ISCRETE SEMICONDUCTORS

Small-signal Transistors and Diodes

Data Handbook SC10
1999

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Small Signal Transistors and Diodes

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

PREFACE

Dear Customer

We are pleased to issue Philips Semiconductors' 'Small-Signal Transistors and Diodes' handbook SC10.

Features of this new fully-revised handbook:

- ONE book for small-signal transistors **and** diodes (SC10 supersedes SC01 and SC04)
- Small-signal transistors and diodes at a glance in ONE list, such as in the index, selection guide and conversion list
- Extra information such as a package cross-reference guide, replacement list and packing quantities per package
- Survey of new products and packages, see following pages
- CD-ROM version available with additional information, e.g. SPICE parameters

PRODUCT RANGE

We give range to your ideas through our broad product portfolio of small-signal transistors and diodes, which includes:

- General purpose amplification and switching transistors
- Switching transistors
- High-amplification Darlington transistors
- Medium-frequency transistors
- High-voltage transistors
- Resistor-equipped transistors
- High-speed, switching and general purpose diodes
- Schottky-barrier diodes
- Low-leakage-current diodes
- Zener diode family

plus

- General purpose transistor arrays
- Resistor-equipped transistor arrays
- Switching diode arrays
- Zener diode arrays

The products listed in this book are of excellent quality and performance; many are preferred types in market segments such as:

- Audio/video
- Multimedia
- Communications
- Automotive

NEW PRODUCTS

Breakthrough in small-signal transistors

Philips has recently introduced a new technology for bipolar small-signal transistors which provides an extremely low collector-emitter saturation voltage (V_{CEsat}) and high current capability.

This new technology has already been proven with the following released types:

SOT23

PMMT491A (npn)

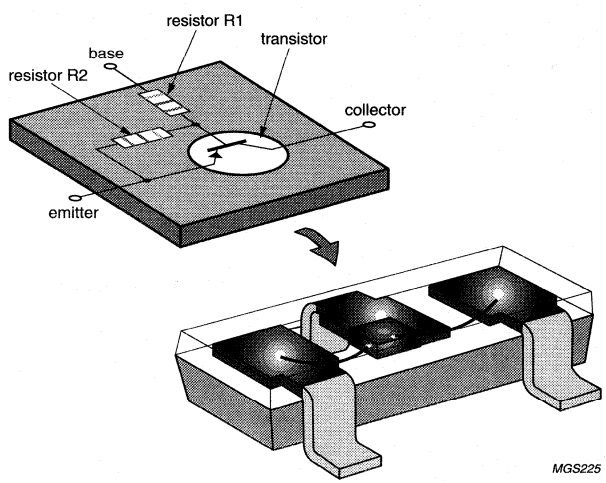
PMMT591A (pnp)

SOT223

PBSS5540Z (pnp)

PBSS4540Z (npn)

Enlarged range of resistor-equipped transistors



NEW TYPES

SC-89/SOT49

Resistors: 10, 10 kΩ	PDTA114EEF (pnp)
	PDTC114EEF (npn)
Resistors: 47, 47 kΩ	PDTA144EEF (pnp)
	PDTC144EEF (npn)
Resistors: 2.2, 47 kΩ	PDTA123JEF (pnp)
	PDTC123JEF (npn)
Resistors: 22, 47 kΩ	PDTA124XEF (pnp)
	PDTC124XEF (npn)

SC-88/SOT363

Resistors: 47, 47 kΩ	PUMB2 (pnp)
	PUMD12 (npn/pnp)
Resistors: 4.7, open kΩ	PUMD6 (npn/pnp)

Low-noise Zener diodes

The benefit of these new diodes is their low noise at low currents (I_Z = 50 μA). These products are ideal for battery powered applications, where low power consumption is important.

Available types with voltage ranges at I_Z = 50 μA:

SOT23

BZX99-C: C4V7 up to C6V8

SOD323

BZX399-C: C1V8 up to C43

Low V_F Schottky diode for longer battery lifetime

The BAT754 sets a new standard: V_F = 600 mV at 100 mA. This type is also available as a double diode.

Small-signal diodes in small packages

Switching diodes

SOD323/SC-76

BAS316

BAS321

SOD523/SC-79

BAS516

SOT416/SC-75

BAS16T

BAV70T

BAW56T

Zener diodes

SOD323/SC-76

PDZ series

Schottky diodes

SOD323/SC-76

IPS76SB70

IPS76SB40

IPS76SB10

IPS76SB21

SOD523/SC-79

IPS79SB70

IPS79SB40

IPS79SB10

SOT416/SC-75.

IPS75SB45

New double Zener diodes in SC-59

PZM-NA series

Low voltage regulator zener diodes: PLVAxxx series

Advantages:

- Low dynamic impedance at low currents (I_Z = 250 mA): approx. $1/20$ of conventional series
- Low noise effect (similar to the BZX(3)99 types)
- Total max. power dissipation: 400 mW/250 mW
- Working voltage range: V_Z = 5.0 to 6.8 V

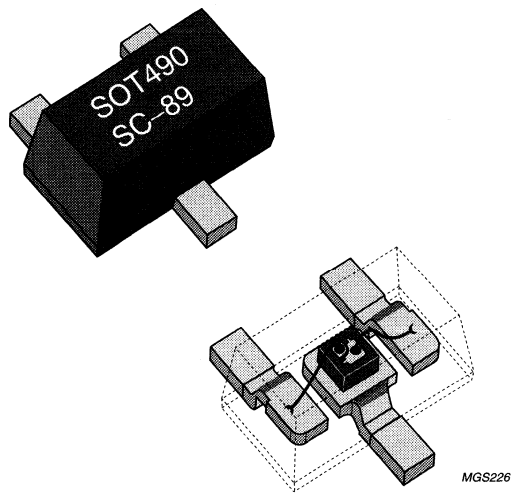
PLVA4xx series: Single diodes in the SOD27 glass package

PLVA6xx series: Single diodes in the SOT23 plastic package

PLVA26xx series: Double diodes in the SOT23 plastic package

NEW PACKAGES

SC-89/SOT490 – the super-small surface-mount package for transistors and diodes



This package is a flat-pack version of SC-75 and it features:

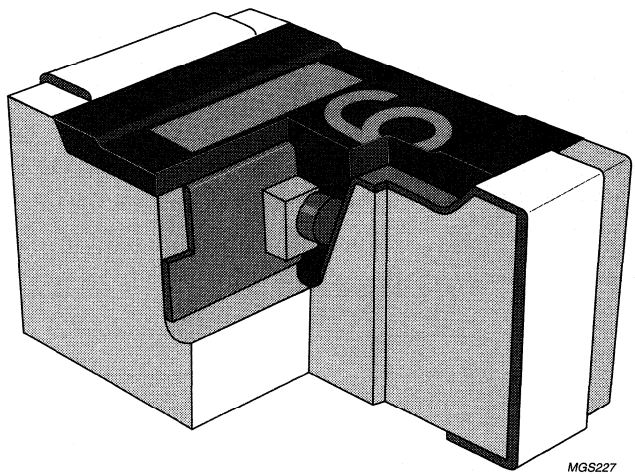
- Reduced package height: 0.70 mm
- Better solderability due to flat leads
- Higher power dissipation

The main application fields for this package are the technology-driven market segments, e.g. communications and multimedia.

SC-89 products in this book include:

	npn	pnp
Standard transistors	BC847F	BC857F
	2PC4617J	2PA1774J
Resistor-equipped transistors	PDTC114EEF	PDTA114EEF
	PDTC123JEF	PDTA123JEF
	PDTC124XEF	PDTA124XEF
	PDTC144EEF	PDTA144EEF
Double Schottky diodes	1PS89SB14 – series connected	
	1PS89SB15 – common cathode	
	1PS89SB16 – common anode	
Double switching diodes	1PS89SS04 – series connected	
	1PS89SS05 – common cathode	
	1PS89SS06 – common anode	

SOD110 - the ceramic package



The SOD110 ceramic package features:

- Smaller PCB area needed through the absence of leads
- High power dissipation capability (the stress-free ceramic package provides thermal performance comparable to MELF glass diodes)
- High surge current capability
- Easy handling in PCB mass-production processes
- Environment-friendly production processes and products

The following types are available:

Switching diodes

BAS216

BAS221

Schottky diodes

BAT254

Zener diodes

BZX284-C..

BZX284-B...

Band-switching diode.

BA792

(see our website for datasheet)

FOR MORE INFORMATION

Although the information in this databook is up-to-date at the time of going to press, for the latest information, contact your local Philips organisation (see the back page of this databook), or visit our Internet home page at:

http://www.semiconductors.philips.com

You can find Philips small-signal transistors and diodes at this location in the product category 'Discretes'.

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PRLL5817	697
PRLL5818	697
PRLL5819	697
PUMB4	1686
PUMD2	1689
PUMD3	1694
PUMD6	1699
PUMD9	1703
PUMD10	1708
PUMD12	1713
PUMD48	1717
PUMH1	1722
PUMH2	1)
PUMH4	1726
PUMH7	1729
PUMH11	1733
PUMT1	1735
PUMX1	1737

TYPE NUMBER	PAGE
PUMZ1	1739
PXT2222A	1555
PXT2907A	1558
PXT3904	1561
PXT3906	1564
PXT4401	1567
PXT4403	1570
PXTA14	1573
PXTA42	1576
PXTA92	1578
PZM-N series	704
PZM-NA series	710
PZT2222A	1580
PZT2907A	1583
PZT3904	1586
PZT3906	1589
PZT4401	1592
PZT4403	1595
PZTA14	1598
PZTA42	1601
PZTA44	1603
PZTA92	1605
PZTM1101	715
PZTM1102	719

1) Data sheet available on Internet only

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HIGH-SPEED, SWITCHING AND GENERAL-PURPOSE DIODES

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	I_{FRM} max.	I_{FSM} max.	V_F @ I_F max.		C_d max.	t_{rr} max.		
		(V)	(mA)	(mA)	(A)	(V)	(mA)	(pF)	(ns)		
Leaded types											
1N914	SOD27 (DO-35)	75	75	225	4	1	10	4	4	no	161
1N4148		75	200	450	4	1	10	4	4	no	166
1N4150		50	300	600	4	1	200	2.5	6	no	171
1N4151		50	200	450	4	1	50	2	4	no	171
1N4448		75	200	450	4	1	100	4	4	no	166
BAV10		60	300	600	9	1	200	2.5	6	no	451
BAV20		150	250	625	9	1	100	5	50	no	456
BAV21		200	250	625	9	1	100	5	50	no	456
BAW62		75	200	450	4	1	100	2	4	no	554
BAX12[1]		90	400	800	55	1	200	35	50	no	563
BAX18		75	500	2000	55	1	300	35	50	no	569
1N4531	SOD68 (DO-34)	75	200	450	4	1	10	4	4	no	176
1N4532		75	200	450	4	1	10	2	2	no	176
Surface-mount types											
BAL74	SOT23	50	215	500	4	1	50	2	4	no	275
BAL99		70	215	500	4	1	50	1.5	4	no	286
BAS16		75	215	500	4	1	50	1.5	4	no	296
BAS19		100	200	625	9	1	100	5	50	no	313
BAS20		150	200	625	9	1	100	5	50	no	313
BAS21		200	200	625	9	1	100	5	50	no	313
BAS29[1]		90	250	500	10	1	200	35	50	no	324
BAS31[1]		90	250	500	10	1	200	35	50	yes[4]	324
BAS35[1]		90	250	500	10	1	200	35	50	yes[2]	324
BAV23S		200	225	625	9	1	100	5	50	yes[4]	467
BAV70		70	215	450	4	1	50	1.5	4	yes[3]	471
BAV74		50	215	450	4	1	100	1.5	4	yes[3]	491
BAV99		75	215	450	4	1	50	1.5	4	yes[4]	496
BAW56		75	215	450	4	1	50	2	4	yes[2]	534
PMBD914		70	215	500	4	1	50	1.5	4	no	660
PMBD6050		70	215	500	4	1	50	1.5	4	no	665
PMBD6100		70	215	450	4	1	50	1.5	4	yes[3]	670
PMBD7000		100	215	450	4	1	50	1.5	4	yes[4]	675

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	I_{FRM} max.	I_{FSM} max.	V_F @ I_F max.		C_d max.	t_{rr} max.		
		(V)	(mA)	(mA)	(A)	(V)	(mA)	(pF)	(ns)		
BAS28	SOT143	75	215	500	4	1	50	1.5	4	yes	319
BAS56		60	200	600	9	1	200	2.5	6	yes	348
BAV23		200	225	625	9	1	100	5	50	yes	462
BAL74W	SOT323 (SC-70)	75	175	500	4	1	50	1.5	4	no	281
BAL99W		75	150	500	4	1	50	1.5	4	no	291
BAS16W		75	175	500	4	1	50	1.5	4	no	306
BAV70W		70	175	500	4	1	50	1.5	4	yes(3)	486
BAV99W		75	150	500	4	1	50	1.5	4	yes(4)	501
BAW56W		75	150	500	4	1	50	2	4	yes(2)	549
1PS300		80	200	500	4	1	50	2	4	yes(2)	263
1PS301		80	250	500	4	1	50	1.5	4	yes(3)	267
1PS302		80	200	500	4	1	50	1.5	4	yes(4)	271
1PS181	SOT346 (SC-59)	80	215	500	4	1	50	2	4	yes(2)	247
1PS184		80	215	500	4	1	50	1.5	4	yes(3)	251
1PS193		80	215	500	4	1	50	1.5	4	no	255
1PS226		80	215	500	4	1	50	1.5	4	yes(4)	259
BAS16T	SOT416 (SC-75)	75	155	500	4	1	50	1.5	4	no	301
BAV70T		75	150	500	4	1	50	1.5	4	yes(3)	481
BAW56T		75	150	500	4	1	50	2	4	yes(2)	544
1PS89SS04	SOT490 (SC-89)	80	200	500	4	1	50	1.5	4	yes(4)	242
1PS89SS05		80	200	500	4	1	50	1.5	4	yes(3)	242
1PS89SS06		80	200	500	4	1	50	2	4	yes(2)	242
BAS32L	SOD80C	75	200	450	4	0.93	100	2	4	no	329
BAV100		50	250	625	9	1	100	5	50	no	506
BAV101		100	250	625	9	1	100	5	50	no	506
BAV102		150	250	625	9	1	100	5	50	no	506
BAV103		200	250	625	9	1	100	5	50	no	506
BAV105		60	300	600	9	1	200	2.5	6	no	512
PMLL4148		75	200	450	4	1	10	4	4	no	685
PMLL4150		50	300	450	4	1	200	2.5	6	no	690
PMLL4151		50	200	450	4	1	50	2	4	no	690
PMLL4153		50	200	450	4	0.88	50	2	4	no	690
PMLL4448		75	200	450	4	1	100	4	4	no	685

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	I_{FRM} max.	I_{FSM} max.	V_F @ I_F max.		C_d max.	t_{rr} max.		
		(V)	(mA)	(mA)	(A)	(V)	(mA)	(pF)	(ns)		
BAS216	SOD110	75	250	500	4	1	50	1.5	4	no	377
BAS221	SOD110	200	300	1000	20	1.4	300	2	50	no	383
BAS316	SOD323 (SC-76)	75	250	500	4	1	50	1.5	4	no	387
BAS516	SOD523 (SC-79)	75	250	500	4	1	50	1	4	no	397

Notes

1. Controlled avalanche diode; I_{RRM} = 600 mA.
2. Common anode.
3. Common cathode.
4. Series connected.

SMALL-SIGNAL SCHOTTKY-BARRIER DIODES

TYPE NUMBER	PACKAGE	RATINGS		CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	V_F @ I_F max.		C_d @ V_R max.			
		(V)	(mA)	(mV)	(mA)	(pF)	(V)		
Leaded types									
BAT81	SOD68 (DO-34)	40	30	410	1	1.6	1	no	421
BAT82		50	30	410	1	1.6	1	no	421
BAT83		60	30	410	1	1.6	1	no	421
BAT85		30	200	320	1	10	1	no	424
BAT86		50	200	380	1	8	1	no	424
Surface-mount types									
BAS40	SOT23	40	120	380	1	5	0	no	334
BAS40-04		40	120	380	1	5	0	yes(1)	334
BAS40-05		40	120	380	1	5	0	yes(2)	334
BAS40-06		40	120	380	1	5	0	yes(3)	334
BAS70		70	70	410	1	2	0	no	354
BAS70-04		70	70	410	1	2	0	yes(1)	354
BAS70-05		70	70	410	1	2	0	yes(2)	354
BAS70-06		70	70	410	1	2	0	yes(3)	354
BAT17		4	30	450	1	1	0	no	402
BAT54		30	200	320	1	10	1	no	405
BAT54A		30	200	320	1	10	1	yes(3)	405
BAT54C		30	200	320	1	10	1	yes(2)	405
BAT54S		30	200	320	1	10	1	yes(1)	405
BAT720		40	500	550	500	90	0	no	445
BAT721		40	200	300	10	50	0	yes	448
BAT721A		40	200	300	10	50	0	yes(3)	448
BAT721C		40	200	300	10	50	0	yes(2)	448
BAT721S		40	200	300	10	50	0	yes(1)	448
PMBD353		4	30	450	1	1	0	yes(1)	657
BAS70-07	SOT143	70	70	410	1	2	0	yes	354
BAT74		30	200	320	1	10	1	yes	411
BAS40-07		40	120	380	1	5	0	yes	334

TYPE NUMBER	PACKAGE	RATINGS		CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	V_F @ I_F max.		C_d @ V_R max.			
		(V)	(mA)	(mV)	(mA)	(pF)	(V)		
BAS40W	SOT323 (SC-70)	40	120	380	1	5	0	no	337
BAS40-04W		40	120	380	1	5	0	yes(1)	337
BAS40-05W		40	120	380	1	5	0	yes(2)	337
BAS40-06W		40	120	380	1	5	0	yes(3)	337
BAS70W		70	70	410	1	2	0	no	360
BAS70-04W		70	70	410	1	2	0	yes(1)	360
BAS70-05W		70	70	410	1	2	0	yes(2)	360
BAS70-06W		70	70	410	1	2	0	yes(3)	360
BAT54W		30	200	320	1	10	1	no	408
BAT54AW		30	200	320	1	10	1	yes(3)	408
BAT54CW		30	200	320	1	10	1	yes(2)	408
BAT54SW		30	200	320	1	10	1	yes(1)	408
1PS70SB10		30	200	320	1	10	1	yes	201
1PS70SB14		30	200	320	1	10	1	yes(1)	201
1PS70SB15		30	200	320	1	10	1	yes(2)	201
1PS70SB16		30	200	320	1	10	1	yes(3)	201
1PS70SB40		40	120	380	1	5	0	no	204
1PS70SB44		40	120	380	1	5	0	yes(1)	204
1PS70SB45		40	120	380	1	5	0	yes(2)	204
1PS70SB46		40	120	380	1	5	0	yes(3)	204
1PS59SB10	SOT346 (SC-59)	30	200	320	1	10	1	no	192
1PS59SB14		30	200	320	1	10	1	yes(1)	192
1PS59SB15		30	200	320	1	10	1	yes(2)	192
1PS59SB16		30	200	320	1	10	1	yes(3)	192
1PS59SB20		40	500	550	500	90	0	no	195
1PS59SB21		40	200	300	10	50	0	no	198
1PS88SB48	SOT363 (SC-88)	40	120	380	1	5	0	yes(4)	236
BAS70-07S		70	70	410	1	2	0	yes(5)	357
BAT74S		30	200	320	1	10	1	yes(5)	416
1PS75SB45	SOT416 (SC75)	40	120	380	1	5	0	yes(2)	210
1PS74SB23	SOT457 (SC74)	25	1000	300	100	100	4	no	207
1PS89SB14	SOT490 (SC-89)	30	200	320	1	10	1	yes(1)	239
1PS89SB15		30	200	320	1	10	1	yes(2)	239
1PS89SB16		30	200	320	1	10	1	yes(3)	239

TYPE NUMBER	PACKAGE	RATINGS		CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_R max.	I_F max.	V_F @ I_F max.		C_d @ V_R max.			
		(V)	(mA)	(mV)	(mA)	(pF)	(V)		
BAS81	SOD80C	40	30	410	1	1.6	1	no	363
BAS82		50	30	410	1	1.6	1	no	363
BAS83		60	30	410	1	1.6	1	no	363
BAS85		30	200	320	1	10	1	no	366
BAS86		50	200	380	1	8	1	no	369
BAT254	SOD110	30	200	320	1	10	1	no	441
1PS76SB10	SOD323 (SC-76)	30	200	320	1	10	1	no	213
1PS76SB17		4	30	450	1	1	0	no	216
1PS76SB21		40	200	550	200	50	0	no	218
1PS76SB40		40	120	380	1	5	0	no	221
1PS76SB70		70	70	410	1	2	0	no	224
1PS79SB10	SOD523 (SC-79)	30	200	320	1	10	1	no	227
1PS79SB40		40	120	380	1	5	0	no	230
1PS79SB70		70	70	410	1	2	0	no	233

Notes

1. Series connected.
2. Common cathode.
3. Common anode.
4. Dual diodes with common cathode.
5. Separate diodes.

MEDIUM-POWER SCHOTTKY-BARRIER DIODES

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS				DOUBLE DIODE	PAGE
		V_{RRM} max.	V_R max.	$I_{F(AV)}$ max.	I_{FSM} max.	C_d @ V_R max.		V_F @ I_F max.			
		(V)	(V)	(A)	(A)	(pF)	(V)	(mV)	(A)		
Leaded types											
1N5817	SOD81	20	20	1	25	80(1)	4	450	1	no	185
1N5818		30	30	1	25	50(1)	4	550	1	no	185
1N5819		40	40	1	25	50(1)	4	600	1	no	185
BYV10-20		20	–	1	–	220(1)	0	550	1	no	574
BYV10-30		30	–	1	–	220(1)	0	550	1	no	574
BYV10-40		40	–	1	–	220(1)	0	550	1	no	574
Surface-mount types											
PRLL5817	SOD87	20	20	1	25	70(1)	4	450	1	no	697
PRLL5818		30	30	1	25	50(1)	4	550	1	no	697
PRLL5819		40	40	1	25	50(1)	4	600	1	no	697
BAT120A	SOT223	25	25	1	10	100	4	450	1	yes(3)	432
BAT120C		25	25	1	10	100	4	450	1	yes(2)	432
BAT120S		25	25	1	10	100	4	450	1	yes(4)	432
BAT140A		40	40	1	10	80	4	500	1	yes(3)	435
BAT140C		40	40	1	10	80	4	500	1	yes(2)	435
BAT140S		40	40	1	10	80	4	500	1	yes(4)	435
BAT160A		60	60	1	10	60	4	650	1	yes(3)	438
BAT160C		60	60	1	10	60	4	650	1	yes(2)	438
BAT160S		60	60	1	10	60	4	650	1	yes(4)	438
PBYR2100CT		100	100	1	10	100	4	790	1	yes(2)	637
PBYR2150CT		150	150	1	10	100	4	850	1	yes(2)	640

Notes

1. Typical values.
2. Common cathode.
3. Common anode.
4. Series connected.

MEDIUM-POWER TRANSISTOR/SCHOTTKY-DIODE MODULES

Transistor section

TYPE NUMBER	PACKAGE	RATINGS		CHARACTERISTICS					NPN OR PNP MODULE	PAGE
		V_{CES} max.	I_C max.	h_{FE} @ I_C min.		f_T min.	t_{on}/t_{off} @ I_C max.			
		(V)	(mA)		(mA)	(MHz)	(ns)	(mA)		
PZTM1101	SOT223	40	200	100	10	300	36/410	50	NPN	715
PZTM1102		−40	−200	100	−10	250	30/460	50	PNP	719

Schottky-barrier diode section

TYPE NUMBER	RATINGS		CHARACTERISTICS				PAGE
	V_R max.	$I_{F(AV)}$ max.	C_d @ V_R max.		V_F @ I_F max.		
	(V)	(A)	(pF)	(V)	(mV)	(A)	
PZTM1101	40	1	250	0	560	1	715
PZTM1102	40	1	250	0	560	1	719

LOW-LEAKAGE CURRENT DIODES

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS						DOUBLE DIODE	PAGE
		V_R max.	I_F max.	I_{FRM} max.	I_{FSM} max.	V_F @ I_F max.		I_R @ V_R max.		C_d max.	t_{rr} max.		
		(V)	(mA)	(mA)	(A)	(V)	(mA)	(nA)	(V)	(pF)	(μs)		
Leaded types													
BAS45A	SOD68 (DO-34)	125	250	625	4	1	100	1	125	4	1.5[1]	no	340
Surface-mount types													
BAS45AL	SOD80C	125	250	625	4	1	100	1	125	4	1.5[1]	no	344
BAS116	SOT23	75	215	500	4	1	10	5	75	2[1]	3	no	373
BAV170		75	215	500	4	1	10	5	75	2[1]	3	yes[2]	517
BAV199		75	160	500	4	1	10	5	75	2[1]	3	yes[3]	521
BAW156		75	160	500	4	1	10	5	75	3[1]	3	yes[4]	559
BAV199W	SOT323 (SC-70)	75	135	500	4	1	10	5	75	2[1]	3	yes[3]	525

Notes

1. Typical value.
2. Common cathode.
3. Series connected.
4. Common anode.

ZENER DIODES

TYPE NUMBER	PACKAGE	RATINGS						CHARACTERISTICS		DOUBLE DIODE	PAGE
		I_F	P_{tot} @ T_{tp}/T_{amb}		P_{ZSM} @ T_j and t_p			V_Z nom.			
		max.	max.		max.			E24 range	tol.		
		(mA)	(mW)	(°C)	(W)	(°C)	(ms)	(V)	(±%)		
Leaded types											
BZX79 series	SOD27 (DO-35)	250	500	50	40	25	0.1	2.4 to 75	1, 2, appr. 5	no	606
PLVA400A ser.		250	400	55	30	150	0.1	5 to 6.8	±0.2 V	no	647
1N4728A to 49A	SOD66 (DO-41)	500	1000	50	–	–	–	3.3 to 24	5	no	181
BZV85 series		500	1300	55	60	25	0.1	3.6 to 75	5	no	
BZV37	SOD68 (DO-34)	50	400	25	40	25	0.1	6.5	5	yes[1]	579
Surface-mount types											
BZV55 series	SOD80C	250	500	50	40	25	0.1	2.4 to 75	2, appr. 5	no	587
BZX284 series	SOD110	250	400	25	–	–	–	2.4 to 75	2, appr. 5	no	625
BZX84 series	SOT23	200	250	25	40	25	0.1	2.4 to 75	1, 2, appr. 5	no	614
BZX99 series		300	300	25	–	–	–	2.4 to 15	5	no	621
PLVA600A ser.		250	250	25	30	150	0.1	5 to 6.8	±0.2 V	no	650
PLVA2600A ser.		250	250	25	30	150	0.1	5 to 6.8	±0.2 V	yes[2]	653
PMBZ5226B to PMBZ5257B		250	250	25	10	55	8.3	3.3 to 33	appr. 5	no	680
BZV49 series	SOT89	250	1000	25	40	25	0.1	2.4 to 75	appr. 5	no	581
BZV90 series	SOT223	400	1500	25	40	25	0.1	2.4 to 75	appr. 5	no	601
PDZ-B series	SOD323 (SC-76)	200	400	25	–	–	–	2.4 to 36[3]	appr. 2	no	643
BZX399 series		250	300	25	–	–	–	1.8 to 43	5	no	631
PZM-N series	SOT346 (SC-59)	250	300	25	–	–	–	2.4 to 75[3]	appr. 3	no	704
PZM-NA series		200	220	25	–	–	–	2.4 to 15[3]	5	yes[2]	710

Notes

1. Bidirectional Zener diode.
2. Common anode.
3. Japanese range.

VOLTAGE REFERENCE DIODES

TYPE NUMBER	PACKAGE	RATINGS	CHARACTERISTICS				PAGE
		I_Z max.	V_{ref} nom.	$\lvert S_Z \rvert$ max.	r_{dif} @ I_Z max.		
		(mA)	(V)	(%/K)	(Ω)	(mA)	
Leaded types							
1N821/1N821A	SOD68 (DO-34)	50	6.2	0.01	15/10	7.5	158
1N823/1N823A		50	6.2	0.005	15/10	7.5	158
1N825/1N825A		50	6.2	0.002	15/10	7.5	158
1N827/1N827A		50	6.2	0.001	15/10	7.5	158
1N829/1N829A		50	6.2	0.0005	15/10	7.5	158
BZV10		50	6.2	0.01	50	2	576
BZV11		50	6.2	0.005	50	2	576
BZV12		50	6.2	0.002	50	2	576
BZV13		50	6.2	0.001	50	2	576
BZV14		50	6.2	0.0005	50	2	576

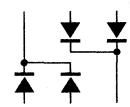
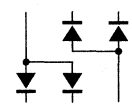
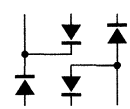
LOW-VOLTAGE STABISTORS

TYPE NUMBER	PACKAGE	RATINGS		CHARACTERISTICS							PAGE
		V_R max.	I_F max.	V_F @ I_F = 5 mA min.	max.	S_F @ I_F typ.		r_{dif} @ I_F and f = 1 kHz max.		C_d max.	
		(V)	(mA)	(mV)	(mV)	(mV/K)	(mA)	(mV/K)	(mA)	(pF)	
Leaded types											
BZV86-1V4	SOD27 (DO-35)	10	200	1300	1500	−3.8	5	10	10	25	598
BZV86-2V0		10	150	1850	2150	−6	5	15	10	25	598
BZV86-2V6		10	125	2350	2800	−8.5	5	17.5	10	25	598
BZV86-3V2		10	100	2850	3450	−11.5	5	20	10	25	598
Surface-mount types											
BAS17	SOT23	5	200	725	805	−1.8	1	80[1]	2	140	311

Note

1. Typical value.

HIGH-SPEED SWITCHING DIODE ARRAYS

TYPE NUMBER	PACKAGE	RATINGS				CHARACTERISTICS				CONFIGURATION	PAGE
		V_R max.	I_F max.	I_{FRM} max.	I_{FSM} max.	V_F @ I_F max.		C_d max.	t_{rr} max.		
		(V)	(mA)	(mA)	(A)	(V)	(mA)	(pF)	(ns)		
Surface-mount types											
BAV70S	SOT363 (SC-88)	75	250	450	4	1	50	1.5	4		1608
BAW56S	SOT363 (SC-88)	75	250	450	4	1	50	2	4		1618
BAV756S	SOT363 (SC-88)	75	250	450	4	1	50	2	4		1613

ZENER DIODE ARRAYS

TYPE NUMBER	PACKAGE	RATINGS					CHARACTERISTICS				NUMBER OF DIODES	PAGE
		I_F max.	I_{FSM} max.	I_{ZSM} max.	P_{ZSM} @ t_p max.		V_Z nom.	r_{dif} max.	S_Z @ I_Z typ.			
		(mA)	(A)	(A)	(W)	(ms)	(V)	(Ω)	(mV/K)	(mA)		
Surface-mount types												
BZA100	SO20	200	4	2.5	27.5	1	6.8	8	3	5	18	1648
BZA109		100	4.5	2.5	25	1	6.8	100	3	5	18	1651
BZA109TS	SSOP20	100	4.5	2.5	25	1	6.8	100	3	5	18	1657
BZA408B	SOT457 (SC-74)	–	–	2	20	1	±5	–	–	–	8	1663
BZA420A		100	3.75	0.7	19.6	1	20	125	16.2	5	4	1668
BZA456A		100	3.75	3	24	1	5.6	400	1.2	5	4	1674
BZA462A		100	3.75	2.66	24	1	6.2	300	1.2	5	4	1680

SURFACE-MOUNT DEVICES

NPN LOW-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BCV27	SOT23	30	500	250	20000	>20000	220 typ.	BCV26	903
BCV47	SOT23	60	500	250	10000	>10000	220 typ.	BCV46	903
PMBTA13	SOT23	30	500	250	5000	>5000	125	–	1487
PMBTA14	SOT23	30	500	250	10000	>10000	125	PMBTA64	1487

PNP LOW-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BCV26	SOT23	30	500	250	20000	>20000	220 typ.	BCV27	900
BCV46	SOT23	60	500	250	10000	>10000	220 typ.	BCV47	900
PMBTA64	SOT23	30	500	250	10000	>10000	125	PMBTA14	1493

NPN MEDIUM-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BCV29	SOT89	30	500	1300	20000	>20000	220 typ.	–	BCV28	909
BCV49	SOT89	60	500	1300	10000	>10000	220 typ.	–	BCV48	909
BSP50	SOT223	45	1000	1250	2000	>2000	200 typ.	1300 typ.	BSP60	1092
BSP51	SOT223	60	1000	1250	2000	>2000	200 typ.	1300 typ.	BSP61	1092
BSP52	SOT223	80	1000	1250	2000	>2000	200 typ.	1300 typ.	BSP62	1092
BST50	SOT89	45	500	1300	2000	>2000	200 typ.	1500 typ.	BST60	1138
BST51	SOT89	60	500	1300	2000	>2000	200 typ.	1500 typ.	BST61	1138
BST52	SOT89	80	500	1300	2000	>2000	200 typ.	1500 typ.	BST62	1138
PXTA14	SOT89	30	500	1300	20000	>20000	125	–	–	1573
PZTA14	SOT223	30	500	1250	10000	>10000	125	–	–	1598

PNP MEDIUM-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
BCV28	SOT89	30	500	1300	20000	>20000	220 typ.	–	BCV29	906
BCV48	SOT89	60	500	1300	10000	>10000	220 typ.	–	BCV49	906
BSP60	SOT223	45	500	1250	2000	>2000	200 typ.	1500 typ.	BSP50	1095
BSP61	SOT223	60	500	1250	2000	>2000	200 typ.	1500 typ.	BSP51	1095
BSP62	SOT223	80	500	1250	2000	>2000	200 typ.	1500 typ.	BSP52	1095
BST60	SOT89	45	500	1300	2000	>2000	200 typ.	700 typ.	BST50	1142
BST61	SOT89	60	500	1300	2000	>2000	200 typ.	700 typ.	BST51	1142
BST62	SOT89	80	500	1300	2000	>2000	200 typ.	700 typ.	BST52	1142

NPN GENERAL PURPOSE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
2PC4081Q	SC-70/SOT323	40	100	200	120	270	100	2PA1576Q	762
2PC4081R	SC-70/SOT323	40	100	200	180	390	100	2PA1576R	762
2PC4081S	SC-70/SOT323	40	100	200	270	560	100	2PA1576S	762
2PC4617Q	SC-75/SOT416	50	100	150	120	270	100	2PA1774Q	764
2PC4617QJ	SC-89/SOT490	50	100	250	120	270	100	2PA1774QJ	764
2PC4617R	SC-75/SOT416	50	100	150	180	390	100	2PA1774R	764
2PC4617RJ	SC-89/SOT490	50	100	250	180	390	100	2PA1774RJ	764
2PC4617S	SC-75/SOT416	50	100	150	270	560	100	2PA1774S	764
2PC4617SJ	SC-89/SOT490	50	100	250	270	560	100	2PA1774SJ	764
2PD601AQ	SC-59/SOT346	50	100	250	160	260	100	2PB709AQ	768
2PD601AR	SC-59/SOT346	50	100	250	210	340	120	2PB709AR	768
2PD601AS	SC-59/SOT346	50	100	250	290	460	140	2PB709AS	768
2PD602AQ	SC-59/SOT346	50	500	250	85	170	140	2PB710AQ	770
2PD602AR	SC-59/SOT346	50	500	250	120	240	160	2PB710AR	770
2PD602AS	SC-59/SOT346	50	500	250	170	340	180	2PB710AS	770
2PD1820AQ	SC-70/SOT323	50	500	200	85	170	150	2PB1219AQ	772
2PD1820AR	SC-70/SOT323	50	500	200	120	240	150	2PB1219AR	772
2PD1820AS	SC-70/SOT323	50	500	200	170	340	150	2PB1219AS	772
BC817	SOT23	45	500	250	100	600	100	BC807	822
BC817W	SC-70/SOT323	45	500	200	100	600	100	BC807W	826
BC817-16	SOT23	45	500	250	100	250	100	BC807-16	822

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BC817-16W	SC-70/SOT323	45	500	200	100	250	100	BC807-16W	826
BC817-25	SOT23	45	500	250	160	400	100	BC807-25	822
BC817-25W	SC-70/SOT323	45	500	200	160	400	100	BC807-25W	826
BC817-40	SOT23	45	500	250	250	600	100	BC807-40	822
BC817-40W	SC-70/SOT323	45	500	200	250	600	100	BC807-40W	826
BC846	SOT23	65	100	250	110	450	100	BC856	830
BC846A	SOT23	65	100	250	110	220	100	BC856A	830
BC846AT	SC-75/SOT416	65	100	150	110	220	100	BC856AT	840
BC846AW	SC-70/SOT323	65	100	200	110	220	100	BC856AW	846
BC846B	SOT23	65	100	250	200	450	100	BC856B	830
BC846BT	SC-75/SOT416	65	100	150	200	450	100	BC856BT	840
BC846BW	SC-70/SOT323	65	100	200	200	450	100	BC856BW	846
BC846W	SC-70/SOT323	65	100	200	110	450	100	BC856W	844
BC847	SOT23	45	100	250	110	800	100	BC857	830
BC847A	SOT23	45	100	250	110	220	100	BC857A	830
BC847AF	SC-89/SOT490	45	100	250	110	220	100	BC857AF	834
BC847AT	SC-75/SOT416	45	100	150	110	220	100	BC857AT	840
BC847AW	SC-70/SOT323	45	100	200	110	220	100	BC857AW	830
BC847B	SOT23	45	100	250	200	450	100	BC857B	830
BC847BF	SC-89/SOT490	45	100	250	200	450	100	BC857BF	834
BC847BT	SC-75/SOT416	45	100	150	200	450	100	BC857BT	830
BC847BW	SC-70/SOT323	45	100	200	200	450	100	BC857BW	830
BC847C	SOT23	45	100	250	420	800	100	BC857C	830
BC847CF	SC-89/SOT490	45	100	250	420	800	100	BC857CF	830
BC847CT	SC-75/SOT416	45	100	150	420	800	100	BC857CT	830
BC847CW	SC-70/SOT323	45	100	200	420	800	100	BC857CW	830
BC847W	SC-70/SOT323	45	100	200	110	800	100	BC857W	846
BC849B	SOT23	30	100	250	200	450	100	BC859B	848
BC849BW	SC-70/SOT323	30	100	200	200	450	100	BC859BW	851
BC849C	SOT23	30	100	250	420	800	100	BC859C	848
BC849CW	SC-70/SOT323	30	100	200	420	800	100	BC859CW	851
BC850B	SOT23	45	100	250	200	450	100	BC860B	848
BC850BW	SC-70/SOT323	45	100	200	200	450	100	BC860BW	851
BC850C	SOT23	45	100	250	420	800	100	BC860C	848
BC850CW	SC-70/SOT323	45	100	200	420	800	100	BC860CW	851
BCF32	SOT23	32	100	250	200	450	100	–	887
BCV71	SOT23	60	100	250	110	220	100	–	887
BCV72	SOT23	60	100	250	200	450	100	–	912
BCW31	SOT23	32	100	250	110	220	100	BCW29	916

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BCW32	SOT23	32	100	250	200	450	100	BCW30	916
BCW33	SOT23	32	100	250	420	800	100	–	916
BCW60B	SOT23	32	100	250	180	310	100	BCW61B	918
BCW60C	SOT23	32	100	250	250	460	100	BCW61C	918
BCW60D	SOT23	32	100	250	380	630	100	BCW61D	918
BCW71	SOT23	45	100	250	110	220	100	BCW69	924
BCW72	SOT23	45	100	250	200	450	100	BCW70	924
BCX19	SOT23	45	500	250	100	600	100	BCX17	930
BCX70G	SOT23	45	100	250	120	220	100	BCX71G	938
BCX70H	SOT23	45	100	250	180	310	100	BCX71H	938
BCX70J	SOT23	45	100	250	250	460	100	BCX71J	938
BCX70K	SOT23	45	100	250	380	630	100	BCX71K	938
PMBS3904	SOT23	40	100	250	100	300	180	PMBS3906	1445
PMBT5088	SOT23	30	100	250	350	>350	–	–	1472
PMBT6428	SOT23	50	100	250	250	650	100	–	1483
PMBT6429	SOT23	45	100	250	500	1250	100	–	1483
PMBTA06	SOT23	80	500	250	50	>50	100	PMBTA56	1485
PMMT491A	SOT23	40	1000	250	300	900	150	PMMT591A	1497
PMST5088	SC-70/SOT323	30	100	200	350	>350	100	–	1528
PMST5089	SC-70/SOT323	25	100	200	450	>450	100	–	1528
PMST6428	SC-70/SOT323	50	100	200	250	650	100	–	1536
PMST6429	SC-70/SOT323	45	100	200	500	1250	100	–	1536
PMSTA05	SC-70/SOT323	60	500	200	50	>50	100	PMSTA55	1538
PMSTA06	SC-70/SOT323	80	500	200	50	>50	100	PMSTA56	1538

PNP GENERAL PURPOSE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
2PA1576Q	SC-70/SOT323	40	100	200	120	270	100	2PC4081Q	744
2PA1576R	SC-70/SOT323	40	100	200	180	390	100	2PC4081R	744
2PA1576S	SC-70/SOT323	40	100	200	270	560	100	2PC4081S	744
2PA1774Q	SC-75/SOT416	40	100	150	120	270	100	2PC4617Q	746
2PA1774QJ	SC-89/SOT490	50	100	250	120	270	100	2PC4617QJ	750
2PA1774R	SC-75/SOT416	40	100	150	180	390	100	2PC4617R	746
2PA1774RJ	SC-89/SOT490	50	100	250	180	390	100	2PC4617RJ	750
2PA1774S	SC-75/SOT416	40	100	150	270	560	100	2PC4617S	746
2PA1774SJ	SC-89/SOT490	50	100	250	270	560	100	2PC4617SJ	750
2PB709AQ	SC-59/SOT346	45	100	250	160	260	60	2PB601AQ	754
2PB709AR	SC-59/SOT346	45	100	250	210	340	70	2PB601AR	754
2PB709AS	SC-59/SOT346	45	100	250	290	460	80	2PB601AS	754
2PB710AQ	SC-59/SOT346	50	500	250	85	170	100	2PD602AQ	756
2PB710AR	SC-59/SOT346	50	500	250	120	240	120	2PD602AR	756
2PB710AS	SC-59/SOT346	50	500	250	170	340	140	2PD602AS	756
2PB1219AQ	SC-70/SOT323	50	500	200	85	170	100	2PD1820AQ	752
2PB1219AR	SC-70/SOT323	50	500	200	120	240	120	2PD1820AR	752
2PB1219AS	SC-70/SOT323	50	500	200	170	340	140	2PD1820AS	752
BC807	SOT23	45	500	250	100	600	80	BC817	814
BC807W	SC-70/SOT323	45	500	200	100	600	80	BC817W	818
BC807-16	SOT23	45	500	250	100	250	80	BC817-16	814
BC807-16W	SC-70/SOT323	45	500	200	100	250	80	BC817-16W	818
BC807-25	SOT23	45	500	250	160	400	80	BC817-25	814
BC807-25W	SC-70/SOT323	45	500	200	160	400	80	BC817-25W	818
BC807-40	SOT23	45	500	250	250	600	80	BC817-40	814
BC807-40W	SC-70/SOT323	45	500	200	250	600	80	BC817-40W	818
BC856	SOT23	65	100	250	125	475	100	BC846	854
BC856A	SOT23	65	100	250	125	250	100	BC846A	854
BC856AT	SC-75/SOT416	65	100	150	125	250	100	BC846AT	861
BC856AW	SC-70/SOT323	65	100	200	125	250	100	BC846AW	865
BC856B	SOT23	65	100	250	220	475	100	BC846B	854
BC856BT	SC-75/SOT416	65	100	150	220	475	100	BC846BT	861
BC856BW	SC-70/SOT323	65	100	200	220	475	100	BC846BW	865
BC856W	SC-70/SOT323	65	100	200	125	475	100	BC846W	865
BC857	SOT23	45	100	250	125	800	100	BC847	854
BC857A	SOT23	45	100	250	125	250	100	BC847AF	854
BC857AF	SC-89/SOT490	45	100	250	125	250	100	BC847A	858
BC857AT	SC-75/SOT416	45	100	150	125	250	100	BC847AT	861

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BC857AW	SC-70/SOT323	45	100	200	125	250	100	BC847AW	865
BC857B	SOT23	45	100	250	220	475	100	BC847B	854
BC857BF	SC-89/SOT490	45	100	250	200	475	100	BC847BF	858
BC857BT	SC-75/SOT416	45	100	150	220	475	100	BC847BT	861
BC857BW	SC-70/SOT323	45	100	200	220	475	100	BC847BW	865
BC857C	SOT23	45	100	250	420	800	100	BC847C	854
BC857CF	SOT23	45	100	250	420	800	100	BC847CF	858
BC857CT	SC-75/SOT416	45	100	150	420	800	100	BC847CT	861
BC857CW	SC-70/SOT323	45	100	200	420	800	100	BC847CW	865
BC857W	SC-70/SOT323	45	100	200	125	800	100	BC847W	865
BC859B	SOT23	30	100	250	220	475	100	BC849B	870
BC859BW	SC-70/SOT323	30	100	200	220	475	100	BC849BW	873
BC859C	SOT23	30	100	250	420	800	100	BC849C	870
BC859CW	SC-70/SOT323	30	100	200	420	800	100	BC849CW	873
BC859W	SC-70/SOT323	30	100	200	125	800	100	–	873
BC860B	SOT23	45	100	250	220	475	100	BC850B	870
BC860BW	SC-70/SOT323	45	100	200	220	475	100	BC850BW	873
BC860C	SOT23	45	100	250	420	800	100	BC850C	870
BC860CW	SC-70/SOT323	45	100	200	420	800	100	BC850CW	873
BC860W	SC-70/SOT323	45	100	200	125	800	100	–	873
BCW29	SOT23	32	100	250	120	260	100	BCW31	914
BCW30	SOT23	32	100	250	215	500	100	BCW32	914
BCW61B	SOT23	32	100	250	180	310	100	BCW60B	920
BCW61C	SOT23	32	100	250	250	460	100	BCW60C	920
BCW61D	SOT23	32	100	250	380	630	100	BCW60D	920
BCW69	SOT23	45	100	250	120	260	100	BCW71	922
BCW70	SOT23	45	100	250	215	500	100	BCW72	922
BCW89	SOT23	60	100	250	120	260	100	–	926
BCX17	SOT23	45	500	250	100	600	80	BCX19	928
BCX18	SOT23	25	500	250	100	600	80	–	928
BCX71G	SOT23	45	100	250	120	220	100	BCX70G	940
BCX71H	SOT23	45	100	250	180	310	100	BCX70H	940
BCX71J	SOT23	45	100	250	250	460	100	BCX70J	940
BCX71K	SOT23	45	100	250	380	630	100	BCX70K	940
PMBS3906	SOT23	40	100	250	100	300	150	PMBS3904	1448
PMBTA56	SOT23	80	500	250	100	>100	50	PMBTA06	1491
PMMT591A	SOT23	40	1000	250	300	900	150	PMMT491A	1499
PMSTA55	SC-70/SOT323	60	500	200	50	>50	50	PMSTA05	1542
PMSTA56	SC-70/SOT323	80	500	200	50	>50	50	PMSTA06	1542

NPN GENERAL PURPOSE TRANSISTOR ARRAYS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL. / REMARKS	PAGE
BC847BS	SC-88/SOT363	45	100	200	200	450	100	BC857BS; matched pair	1626
BCV61	SOT143B	30	100	250	100	>100	100	BCV62; matched pair	1632
BCV61A	SOT143B	30	100	250	110	220	100	BCV62A; matched pair	1632
BCV61B	SOT143B	30	100	250	200	450	100	BCV62B; matched pair	1632
BCV61C	SOT143B	30	100	250	420	800	100	BCV62C; matched pair	1632
BCV63	SOT143B	30	100	250	110	800	100	–	1640
BCV63B	SOT143B	30	100	250	200	450	100	BCV64B	1640
PUMX1	SC-88/SOT363	40	100	200	120	>120	100	PUMT1	1737

PNP GENERAL PURPOSE TRANSISTOR ARRAYS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL./ REMARKS	PAGE
BC857BS	SC-88/SOT363	45	100	200	200	450	100	BC847BS; matched pair	1629
BCV62	SOT143B	30	100	250	100	>100	100	BCV61; matched pair	1636
BCV62A	SOT143B	30	100	250	125	250	100	BCV61A; matched pair	1636
BCV62B	SOT143B	30	100	250	220	475	100	BCV61B; matched pair	1636
BCV62C	SOT143B	30	100	250	420	800	100	BCV61C; matched pair	1636
BCV64B	SOT143B	30	100	250	220	475	100	BCV63B	1643
PUMT1	SC-88/SOT363	40	100	200	120	>120	100	PUMX1	1735

NPN/PNP GENERAL PURPOSE TRANSISTOR ARRAYS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	REMARKS	PAGE
BC847BPN	SC-88/SOT363	45	100	200	200	450	100	matched pair	1623
BCV65	SOT143B	30	100	250	75	800	–	matched pair	1646
PUMZ1	SC-88/SOT363	40	100	200	120	>120	100	–	1739

NPN GENERAL PURPOSE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BC868	SOT89	20	1000	1350	85	375	40	–	BC869	876
BC868-25	SOT89	20	1000	1350	160	>250	40	–	BC869-25	876
BCP54	SOT223	45	1000	1330	40	250	130 typ.	–	BCP51	892
BCP54-16	SOT223	45	1000	1330	100	250	130 typ.	–	BCP51-16	892
BCP55	SOT223	60	1000	1330	40	250	130 typ.	–	–	892
BCP55-10	SOT223	60	1000	1330	63	160	130 typ.	–	–	892
BCP55-16	SOT223	60	1000	1330	100	250	130 typ.	–	BCP52-16	892
BCP56	SOT223	80	1000	1330	40	250	130 typ.	–	BCP53	892
BCP56-10	SOT223	80	1000	1330	63	160	130 typ.	–	BCP53-10	892
BCP56-16	SOT223	80	1000	1330	100	250	130 typ.	–	BCP53-16	892
BCP68	SOT223	20	1000	1370	85	375	40	–	BCP69	894
BCP68-25	SOT223	20	1000	1370	160	>160	40	–	BCP69-25	894
BCX54	SOT89	45	1000	1300	40	250	130 typ.	–	BCX51	932
BCX54-10	SOT89	45	1000	1300	63	160	130 typ.	–	BCX51-10	932
BCX54-16	SOT89	45	1000	1300	100	250	130 typ.	–	BCX51-16	932
BCX55	SOT89	60	1000	1300	40	250	130 typ.	–	BCX52	932
BCX55-10	SOT89	60	1000	1300	63	160	130 typ.	–	BCX52-10	932
BCX55-16	SOT89	60	1000	1300	100	250	130 typ.	–	BCX52-16	932
BCX56	SOT89	80	1000	1300	40	250	130 typ.	–	BCX53	932
BCX56-10	SOT89	80	1000	1300	63	160	130 typ.	–	BCX53-10	932
BCX56-16	SOT89	80	1000	1300	100	250	130 typ.	–	BCX53-16	932
BDL31	SOT223	10	5000	1350	200	>200	100	–	BDL32	972
BDP31	SOT223	45	3000	1350	40	>40	60	–	BDP32	977
BSP41	SOT223	60	1000	1300	100	300	100	–	BSP31	1090
BSP43	SOT223	80	1000	1300	100	300	100	–	BSP33	1090
BSR40	SOT89	60	1000	1350	40	120	100	1000	BSR30	1122
BSR41	SOT89	60	1000	1350	100	300	100	1000	BSR31	1122
BSR42	SOT89	80	1000	1350	40	120	100	1000	–	1122
BSR43	SOT89	80	1000	1350	100	300	100	1000	BSR33	1122

PNP GENERAL PURPOSE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
BC869	SOT89	20	1000	1350	100	375	40	–	BC868	879
BC869-16	SOT89	20	1000	1350	100	250	40	–	–	879
BC869-25	SOT89	20	1000	1350	160	>160	40	–	BC868-25	879
BCP51	SOT223	45	1000	1300	40	250	115 typ.	–	BCP54	889
BCP51-16	SOT223	45	1000	1300	100	250	115 typ.	–	BCP54-16	889
BCP52-16	SOT223	60	1000	1300	100	250	115 typ.	–	BCP55-16	889
BCP53	SOT223	80	1000	1300	40	250	115 typ.	–	BCP56	889
BCP53-10	SOT223	80	1000	1300	63	160	115 typ.	–	BCP56-10	889
BCP53-16	SOT223	80	1000	1300	100	250	115 typ.	–	BCP56-16	889
BCP69	SOT223	20	1000	1350	85	375	40	–	BCP68	897
BCP69-16	SOT223	20	1000	1350	100	250	40	–	–	897
BCP69-25	SOT223	20	1000	1350	160	>160	40	–	BCP68-25	897
BCX51	SOT89	45	1000	1300	40	250	50 typ.	–	BCX54	932
BCX51-10	SOT89	45	1000	1300	63	160	50 typ.	–	BCX54-10	932
BCX51-16	SOT89	45	1000	1300	100	250	50 typ.	–	BCX54-16	932
BCX52	SOT89	60	1000	1300	40	250	50 typ.	–	BCX55	932
BCX52-10	SOT89	60	1000	1300	63	160	50 typ.	–	BCX55-10	932
BCX52-16	SOT89	60	1000	1300	100	250	50 typ.	–	BCX55-16	932
BCX53	SOT89	80	1000	1300	40	250	50 typ.	–	BCX56	932
BCX53-10	SOT89	80	1000	1300	63	160	50 typ.	–	BCX56-10	932
BCX53-16	SOT89	80	1000	1300	100	250	50 typ.	–	BCX56-16	932
BDL32	SOT223	10	5000	1350	180	>180	100	–	BDL31	972
BDP32	SOT223	45	3000	1350	40	>40	60	–	BDP31	977
BSP31	SOT223	60	1000	1300	100	300	100	650	BSP41	1088
BSP32	SOT223	80	1000	1300	40	120	100	650	–	1088
BSP33	SOT223	80	1000	1300	100	300	100	650	BSP43	1088
BSR30	SOT89	60	1000	1350	40	120	100	–	BSR40	1120
BSR31	SOT89	60	1000	1350	100	300	100	–	BSR41	1120
BSR33	SOT89	80	1000	1350	100	300	100	–	BSR43	1120

NPN HIGH-VOLTAGE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BF820	SOT23	300	50	250	50	>50	60	BF821	1039
BF820W	SC-70/SOT323	300	50	200	50	>50	60	–	1041
BF822	SOT23	250	50	250	50	>50	60	BF823	1039
BF822W	SC-70/SOT323	250	50	200	50	>50	60	–	1041
BSR19	SOT23	140	300	250	60	>60	100	BSR20	1112
BSR19A	SOT23	160	300	250	80	>80	100	BSR20A	1112
BSS64	SOT23	80	100	250	20	80	60	BSS63	1132
PMBT5550	SOT23	140	300	250	60	250	100	PMBT5401	1477
PMBT5551	SOT23	160	300	250	80	250	100	PMBT5401	1480
PMBTA42	SOT23	300	100	250	40	>40	50	PMBTA92	1489
PMST5550	SC-70/SOT323	140	300	200	60	250	100	PMST5401	1533
PMST5551	SC-70/SOT323	160	300	200	80	250	100	PMST5401	1533
PMSTA42	SC-70/SOT323	300	500	200	40	>40	50	PMSTA92	1541
PMSTA43	SC-70/SOT323	200	500	200	40	>40	50	PMSTA93	1540

PNP HIGH-VOLTAGE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BF821	SOT23	300	50	250	50	>50	60	BF820	1043
BF823	SOT23	250	50	250	50	>50	60	BF822	1043
BSR20	SOT23	120	300	250	40	180	100	BSR19	1116
BSR20A	SOT23	150	300	250	60	240	100	BSR19A	1116
BSS63	SOT23	100	100	250	30	>30	85 typ.	BSS64	1130
PMBT5401	SOT23	150	300	250	60	240	100	PMBT5550	1474
PMBTA92	SOT23	300	100	250	40	>40	50	PMBTA42	1495
PMST5401	SC-70/SOT323	150	300	200	60	240	100	PMST5550 PMST5551	1530
PMSTA92	SC-70/SOT323	300	500	200	40	>40	50	PMSTA42	1544
PMSTA93	SC-70/SOT323	200	500	200	40	>40	50	PMSTA43	1544

NPN HIGH-VOLTAGE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BF620	SOT89	300	50	1250	50	>50	60	BF621	1029
BF622	SOT89	250	50	1250	50	>50	60	BF623	1029
BF720	SOT223	300	50	1200	50	>50	60	–	1033
BF722	SOT223	250	50	1200	50	>50	60	BF723	1033
BSP19	SOT223	350	50	1200	40	>40	70	–	1086
BSP20	SOT223	250	50	1200	40	>40	70	BSP16	1086
BST39	SOT89	350	100	1300	40	>40	70	BST15	1136
BST40	SOT89	250	100	1300	40	>40	70	BST16	1136
PXTA42	SOT89	300	100	1300	40	>40	50	PXTA92	1576
PZTA42	SOT223	300	100	1200	40	>40	50	PZTA92	1601
PZTA44	SOT223	400	300	1350	40	>40	20	–	1603

PNP HIGH-VOLTAGE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BF621	SOT89	300	50	1250	50	>50	60	BF620	1031
BF623	SOT89	250	50	1250	50	>50	60	BF622	1031
BF723	SOT223	250	50	1200	50	>50	60	BF722	1035
BSP16	SOT223	300	50	1280	30	120	15	BSP20	1084
BST15	SOT89	200	200	1300	30	150	15	BST39	1134
BST16	SOT89	300	200	1300	30	120	15	BST40	1134
PXTA92	SOT89	300	100	1300	40	>40	50	PXTA42	1578
PZTA92	SOT223	300	100	1200	40	>40	50	PZTA42	1605

NPN MEDIUM-FREQUENCY TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PAGE
BF570	SOT23	15	100	250	40	>40	490	1023
BF840	SOT23	40	25	250	76	222	380 typ.	1049
BFS19	SOT23	20	30	250	65	225	260 typ.	1057
BFS20	SOT23	20	25	250	40	>85	450 typ.	1059
BFS20W	SC-70/SOT323	20	25	250	40	>85	450 typ.	1061

PNP MEDIUM-FREQUENCY TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PAGE
BF550	SOT23	40	25	250	50	>50	325 typ.	1021
BF824	SOT23	30	25	250	25	>50	450 typ.	1045
BF824W	SC-70/SOT323	30	25	200	25	>25	400	1047

PROGRAMMABLE UNIJUNCTION TRANSISTORS

TYPE NUMBER	PACKAGE	V_{GA} max. (V)	I_A max. (mA)	I_{ARM} max. (mA)	P_{tot} max. (mW)	dI_A/dt max. (A/μs)	I_P max. (μA)	I_V min. (μA)	t_r max. (ns)	PAGE
BRY61	SOT23	70	175	2500	250	20	0.2	2	80	1074

SILICON CONTROLLED SWITCHES

TYPE NUMBER	PACKAGE	V_{CBO} max. (V)	I_E max. (mA)	I_{ERM} max. (mA)	P_{tot} max. (mW)	V_{AK} max. (V)	I_H max. (mA)	t_{on} max. (μs)	t_{off} max. (μs)	PAGE
BRY62	SOT143B	70	175	2500	250	1.4	1	0.25	15	1078

NPN RESISTOR-EQUIPPED TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_O max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	INPUT RES. (KΩ)	RES. RATIO	PNP COMPL.	PAGE
PDTC114EE	SC-75/SOT416	50	100	150	30	>30	10	1	PDTA114EE	1309
PDTC114EEF	SC-89/SOT490	50	100	250	30	–	10	1	PDTA114EEF	1312
PDTC114EK	SC-59/SOT346	50	100	250	30	>30	10	1	PDTA114EK	1315
PDTC114ET	SOT23	50	100	250	30	>30	10	1	PDTA114ET	1321
PDTC114EU	SC70/SOT323	50	100	200	30	>30	10	1	PDTA114EU	1324
PDTC114TE	SC-75/SOT416	50	100	150	100	600	10	–	–	1327
PDTC114TK	SC-59/SOT346	50	100	250	100	600	10	–	PDTA114TK	1330
PDTC114TT	SOT23	50	100	250	100	600	10	–	PDTA114TT	1336
PDTC114TU	SC70/SOT323	50	100	200	100	600	10	–	PDTA114TU	1338
PDTC114YE	SC-75/SOT416	50	100	150	100	–	10	4.7	–	1340
PDTC114YT	SOT23	50	100	250	100	–	10	4.7	PDTA114YT	1343
PDTC114YU	SC70/SOT323	50	100	200	100	–	10	4.7	–	1346
PDTC123ET	SOT23	50	100	250	30	–	2.2	1	PDTA123ET	1349
PDTC123JE	SC-75/SOT416	50	100	150	100	–	2.2	21	PDTA123JE	1352
PDTC123JEF	SC-89/SOT490	50	100	250	100	–	2.2	21	PDTA123JEF	1355
PDTC123JT	SOT23	50	100	250	100	–	2.2	21	PDTA123JT	1358
PDTC124EE	SC-75/SOT416	50	100	150	56	>56	22	1	PDTA124EE	1361
PDTC124EK	SC-59/SOT346	50	100	250	56	>56	22	1	PDTA124EK	1364
PDTC124ET	SOT23	50	100	250	56	>56	22	1	PDTA124ET	1370
PDTC124EU	SC70/SOT323	50	100	200	56	>56	22	1	PDTA124EU	1373
PDTC124XE	SC-75/SOT416	50	100	150	80	–	22	2.1	PDTA124XE	1376
PDTC124XEF	SC-89/SOT490	50	100	250	80	–	22	2.1	PDTA124XEF	1379
PDTC143EE	SC-75/SOT416	50	100	150	20	>20	4.7	1	PDTA143EE	1382
PDTC143EK	SC-59/SOT346	50	100	250	20	>20	4.7	1	PDTA143EK	1385
PDTC143ET	SOT23	50	100	250	20	>20	4.7	1	PDTA143ET	1391
PDTC143EU	SC70/SOT323	50	100	200	20	>20	4.7	1	PDTA143EU	1394
PDTC143TT	SOT23	50	100	250	100	600	4.7	–	–	1397
PDTC143XE	SC-75/SOT416	50	100	150	50	–	4.7	2.1	PDTA143XE	1400
PDTC143XT	SOT23	50	100	250	50	–	4.7	2.1	PDTA143XT	1403
PDTC143ZK	SC-59/SOT346	50	100	250	100	–	4.7	10	PDTA143ZK	1406
PDTC143ZT	SOT23	50	100	250	100	–	4.7	10	PDTA143ZT	1409
PDTC144EE	SC-75/SOT416	50	100	150	68	>68	47	1	PDTA144EE	1412
PDTC144EEF	SC-89/SOT490	50	100	250	80	–	47	1	PDTA144EEF	1415
PDTC144EK	SC-59/SOT346	50	100	250	68	>68	47	1	PDTA144EK	1418
PDTC144ET	SOT23	50	100	250	68	>68	47	1	PDTA144ET	1424
PDTC144EU	SC70/SOT323	50	100	200	68	>68	47	1	PDTA144EU	1427
PDTC144WT	SOT23	50	100	250	60	–	47	0.47	–	1430
PDTC144WU	SC70/SOT323	50	100	200	60	–	47	0.47	PDTA144WU	1433

PNP RESISTOR-EQUIPPED TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	INPUT RES. (KΩ)	RES. RATIO	NPN COMPL.	PAGE
PDTA114EE	SC-75/SOT416	50	100	150	30	>30	10	1	PDTC114EE	1200
PDTA114EEF	SC-89/SOT490	50	100	250	30	–	10	1	PDTC114EEF	1203
PDTA114EK	SC-59/SOT346	50	100	250	30	>30	10	1	PDTC114EK	1206
PDTA114ET	SOT23	50	100	250	30	>30	10	1	PDTC114ET	1212
PDTA114EU	SC70/SOT323	50	100	200	30	>30	10	1	PDTC114EU	1215
PDTA114TK	SC-59/SOT346	50	100	250	100	600	10	–	PDTC114TK	1218
PDTA114TT	SOT23	50	100	250	100	600	10	–	PDTC114TT	1224
PDTA114TU	SC70/SOT323	50	100	200	100	600	10	–	PDTC114TU	1226
PDTA114YT	SOT23	50	100	250	100	–	10	4.7	PDTC114YT	1228
PDTA123ET	SOT23	50	100	250	30	–	2.2	2.2	PDTC123ET	1231
PDTA123JE	SC-75/SOT416	50	100	150	100	–	2.2	21	PDTC123JE	1234
PDTA123JEF	SC-89/SOT490	50	100	250	100	–	2.2	21	PDTC123JEF	1234
PDTA123JT	SOT23	50	100	250	100	–	2.2	21	PDTC123JT	1237
PDTA124EE	SC-75/SOT416	50	100	150	56	>56	22	1	PDTC124EE	1240
PDTA124EK	SC-59/SOT346	50	100	250	56	>56	22	1	PDTC124EK	1243
PDTA124ET	SOT23	50	100	250	56	>56	22	1	PDTC124ET	1249
PDTA124EU	SC70/SOT323	50	100	200	56	>56	22	1	PDTC124EU	1252
PDTA124XE	SC-75/SOT416	50	100	150	80	–	22	2.1	PDTC124XE	1255
PDTA124XEF	SC-89/SOT490	50	100	250	80	–	22	2.1	PDTC124XEF	1258
PDTA143EE	SC-75/SOT416	50	100	150	20	>20	4.7	1	PDTC143EE	1261
PDTA143EK	SC-59/SOT346	50	100	250	20	>20	4.7	1	PDTC143EK	1264
PDTA143ET	SOT23	50	100	250	20	>20	4.7	1	PDTC143ET	1270
PDTA143EU	SC70/SOT323	50	100	200	20	>20	4.7	1	PDTC143EU	1273
PDTA143XE	SC-75/SOT416	50	100	150	50	–	4.7	2.1	PDTC143XE	1276
PDTA143XT	SOT23	50	100	250	50	–	4.7	2.1	PDTC143XT	1279
PDTA143ZK	SC-59/SOT346	50	100	250	100	–	4.7	10	PDTC143ZK	1282
PDTA143ZT	SOT23	50	100	250	100	–	4.7	10	PDTC143ZT	1285
PDTA144EE	SC-75/SOT416	50	100	150	68	>68	47	1	PDTC144EE	1288
PDTA144EEF	SC-89/SOT490	50	100	250	80	–	47	1	PDTC144EEF	1291
PDTA144EK	SC-59/SOT346	50	100	250	68	>68	47	1	PDTC144EK	1294
PDTA144ET	SOT23	50	100	250	68	>68	47	1	PDTC144ET	1300
PDTA144EU	SC70/SOT323	50	100	200	68	>68	47	1	PDTC144EU	1303
PDTA144WU	SC70/SOT323	50	100	200	60	–	47	0.47	PDTC144WU	1306

NPN, PNP AND NPN/PNP RESISTOR-EQUIPPED TRANSISTOR ARRAYS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	INPUT RES. (KΩ)	RES. RATIO	POLARITY	PAGE
PUMB4	SC-88/SOT363	50	100	200	100	600	10	–	2 x PNP	1686
PUMD2	SC-88/SOT363	50	100	200	56	>56	22	1	NPN/PNP	1689
PUMD3	SC-88/SOT363	50	100	200	30	>30	10	1	NPN/PNP	1694
PUMD6	SC-88/SOT363	50	100	200	100	600	4.7	–	NPN/PNP	1699
PUMD9	SC-88/SOT363	50	100	200	100	–	10	4.7	NPN/PNP	1703
PUMD10	SC-88/SOT363	50	100	200	100	–	2.2	21	NPN/PNP	1708
PUMD12	SC-88/SOT363	50	100	200	80	–	47	1	NPN/PNP	1713
PUMD48	SC-88/SOT363	50	100	200	80/100	–	47/2.2	1/21	NPN/PNP	1717
PUMH1	SC-88/SOT363	50	100	200	60	–	22	1	n double	1722
PUMH4	SC-88/SOT363	50	100	200	200	–	10	–	n double	1726
PUMH7	SC-88/SOT363	50	100	200	100	600	4.7	–	n double	1729
PUMH11	SC-88/SOT363	50	100	200	30	>30	10	1	2 x NPN	1733

NPN LOW-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BSR13	SOT23	30	800	250	30	>30	250	250	BSR15	1098
BSR14	SOT23	40	800	250	40	>40	300	250	BSR16	1098
BSR17A	SOT23	40	100	250	100	300	300	240	BSR18A	1104
BSV52	SOT23	12	100	250	40	120	500 typ.	30	–	1146
PMBT2222	SOT23	30	600	250	100	300	250	250	PMBT2907	1451
PMBT2222A	SOT23	40	600	250	100	300	300	250	PMBS2907A	1451
PMBT2369	SOT23	15	200	250	40	120	500	30	–	1454
PMBT3904	SOT23	40	100	250	100	300	300	240	PMBT3906	1460
PMBT4401	SOT23	40	600	250	100	300	250	250	PMBT4403	1466
PMSS3904	SC70/SOT323	40	100	200	100	300	180	1200	PMSS3906	1501
PMST2222	SC70/SOT323	30	600	200	100	300	250	250	–	1507
PMST2222A	SC70/SOT323	40	600	200	100	300	300	250	PMST2907A	1507
PMST2369	SC70/SOT323	15	200	200	40	120	500	30	–	1510
PMST3904	SC70/SOT323	40	200	200	100	300	300	240	PMST3906	1516
PMST4401	SC70/SOT323	40	600	200	100	300	250	285	PMST4403	1522

PNP LOW-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
BSR15	SOT23	40	600	250	30	>30	200	365	BSR13	1098
BSR16	SOT23	60	600	250	50	>50	200	365	BSR14	1101
BSR18A	SOT23	40	100	250	100	300	250	300	BSR17A	1108
PMBT2907	SOT23	40	600	250	100	300	200	365	PMBT2222	1457
PMBT2907A	SOT23	60	600	250	100	300	200	365	PMBT2222A	1457
PMBT3906	SOT23	40	100	250	100	300	250	300	PMBT3904	1463
PMBT4403	SOT23	40	600	250	100	300	200	350	PMBT4401	1469
PMSS3906	SC70/SOT323	40	100	200	100	300	150	700	PMSS3904	1504
PMST2907A	SC70/SOT323	60	200	200	50	>50	200	300	PMST2222A	1513
PMST3906	SC70/SOT323	40	100	200	100	300	250	300	PMST3904	1519
PMST4403	SC70/SOT323	40	600	200	100	300	200	350	PMST4401	1525

NPN MEDIUM-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
PXT2222A	SOT89	40	600	1250	100	300	300	250	PXT2907A	1555
PXT3904	SOT89	40	100	1200	100	300	300	240	PXT3906	1561
PXT4401	SOT89	40	600	1250	100	300	250	250	PXT4403	1567
PZT2222A	SOT223	40	600	1150	100	300	300	250	PZT2907A	1580
PZT3904	SOT223	40	200	1050	100	300	300	240	PZT3906	1586
PZT4401	SOT223	40	600	1150	100	300	250	250	PZT4403	1592

PNP MEDIUM-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
PXT2907A	SOT89	60	600	1250	100	300	200	365	PXT2222A	1558
PXT3906	SOT89	40	100	1150	100	300	250	300	PXT3904	1564
PXT4403	SOT89	40	600	1250	100	300	200	350	PXT4401	1570
PZT2907A	SOT223	60	600	1150	100	300	200	365	PZT2222A	1583
PZT3906	SOT223	40	100	1050	100	300	250	300	PZT3904	1589
PZT4403	SOT223	40	600	1150	100	300	200	350	PZT4401	1595

LEADED DEVICES

NPN HIGH-VOLTAGE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
2N5550	TO-92	140	300	630	60	>60	100	–	739
2N5551	TO-92	160	300	630	80	>80	100	2N5401	739
BF422L	TO-92	250	50	625	50	>50	60	BF423L	1007
MPSA42	TO-92	300	100	500	40	>40	50	MPSA92	1190
MPSA43	TO-92	200	100	500	40	>40	50	–	1190
MPSA44	TO-92	400	300	625	40	>40	20	–	1192

PNP HIGH-VOLTAGE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
2N5401	TO-92	150	300	630	60	>60	100	2N5551	736
BF421L	TO-92	300	50	625	50	>50	60	–	1005
BF423L	TO-92	250	50	625	50	>50	60	BF422L	1005
MPSA92	TO-92	300	500	625	25	>25	50	MPSA42	1198

NPN HIGH-VOLTAGE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BF420	TO-92	300	50	830	50	>50	60	BF421	1001
BF422	TO-92	250	50	830	50	>50	60	BF423	1001
BF483	TO-92	250	50	830	50	>50	70	BF488	1017
BF485	TO-92	300	50	830	50	>50	70	BF488	1017
BF487	TO-92	350	50	830	50	>50	70	BF488	1017
BFV420	TO-92	100	100	830	150	>150	150	BFV421	1064

PNP HIGH-VOLTAGE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BF421	TO-92	300	50	830	50	>50	60	BF420	1003
BF423	TO-92	250	50	830	50	>50	60	BF422	1003
BF488	TO-92	350	50	830	50	>50	70	BF487	1019
BFV421	TO-92	100	100	830	150	>150	150	BFV420	1066

NPN HIGH-VOLTAGE POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BF419	TO-126	250	300	6000	45 typ.	>45	90	–	999
BF458	TO-126	250	100	6000	26	>26	90 typ.	–	1011
BF459	TO-126	300	100	6000	26	>26	90 typ.	–	1011
BF469	TO-126	250	50	1800	50	>50	60	BF470	1013
BF471	TO-126	300	50	1800	50	>50	60	BF472	1013
BF585	TO-202	300	50	1600	50	>50	70	BF588	1017
BF587	TO-202	350	50	1600	50	>50	70	BF588	1025
BF819	TO-202	250	100	1200	45 typ.	>45	90 typ.	–	1037
BF859	TO-202	300	100	2000	26	>26	90	–	1051
BF869	TO-202	250	50	1600	50	>50	60	BF872	1053
BF871	TO-202	300	50	1600	50	>50	60	BF872	1053
BFV469	TO-126	100	100	2000	150	>150	150	–	1068

PNP HIGH-VOLTAGE POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BF470	TO-126	250	50	1800	50	>50	60	BF469	1015
BF472	TO-126	300	50	1800	50	>50	60	BF471	1015
BF588	TO-202	300	50	1600	50	>50	70	BF587	1027
BF872	TO-202	300	50	1600	50	>50	60	BF871	1055

NPN LOW-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BC517	TO-92	30	500	500	30000	>30000	220 typ.	–	BC516	790
BC618	TO-92	55	800	500	2000	>2000	155	–	–	806
MPSA14	TO-92	30	500	500	10000	>10000	125	–	MPSA64	1185
MPSA26	TO-92	50	500	500	10000	>10000	125	–	–	1187
MPSA27	TO-92	60	500	500	10000	>10000	125	–	–	1187

PNP LOW-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BC516	TO-92	30	500	500	30000	>30000	220 typ.	BC517	788
MPSA64	TO-92	30	500	500	10000	>10000	125	MPSA14	1196

NPN LOW-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
2N3904	TO-92	40	200	500	100	300	300	240	2N3906	724
2N4401	TO-92	40	600	630	150	300	250	250	2N4403	730
MPS3904	TO-92	40	100	500	100	300	180	990	MPS3906	1177
PH2222A	TO-92	40	600	500	75	>75	300	250	PH2907A	1436
PH2369	TO-92	15	200	500	40	120	500	30	–	1439
PN2222A	TO-92	40	600	500	100	300	300	250	PN2907A	1546
PN2369	TO-92	15	200	500	40	120	500	30	–	1549
PN2369A	TO-92	15	600	500	40	120	500	30	–	1549

PNP LOW-POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
2N3906	TO-92	40	200	500	100	300	250	300	2N3904	727
2N4403	TO-92	40	600	630	100	300	200	350	2N4401	733
MPS3906	TO-92	40	100	500	100	300	150	690	MPS3904	1180
PH2907A	TO-92	60	600	500	100	300	200	365	PH2222A	1442
PN2907A	TO-92	60	600	500	100	300	200	365	PN2222A	1552

NPN GENERAL PURPOSE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
2N5088	TO-92	30	100	500	350	>350	50	–	
2PC945P	TO-92	50	100	500	200	400	150	2PA733P	758
2PC1815	TO-92	50	150	500	120	700	80	–	760
2PC1815BL	TO-92	50	150	500	350	700	80	–	760
2PC1815GR	TO-92	50	150	500	200	400	80	2PA1015GR	760
2PC1815Y	TO-92	50	150	500	120	240	80	2PA1015Y	760
BC337	TO-92	45	500	625	100	600	100	BC327	778
BC337-16	TO-92	45	500	625	100	250	100	BC327-16	778
BC337-25	TO-92	45	500	625	160	400	100	BC327-25	778
BC337-40	TO-92	45	500	625	250	600	100	BC327-40	778
BC546	TO-92	65	100	500	110	450	100	BC556	792
BC546A	TO-92	65	100	500	110	220	100	BC556A	792
BC546B	TO-92	65	100	500	200	450	100	BC556B	792
BC547	TO-92	45	100	500	110	800	100	BC557	792
BC547B	TO-92	45	100	500	200	450	100	BC557B	792
BC547C	TO-92	45	100	500	420	800	100	BC557C	792

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BC549C	TO-92	30	100	500	420	800	100	BC559C	796
BC550C	TO-92	45	100	500	420	800	100	–	796
ED1402B	TO-92	20	200	500	150	225	100 max.	–	1149
ED1402C	TO-92	20	200	500	202	318	100 max.	ED1602C	1149
ED1402D	TO-92	20	200	500	290	450	100 max.	ED1602D	1149
ED1402E	TO-92	20	200	500	410	810	100 max.	ED1602E	1149
ED1502B	TO-92	20	25	500	48	75	825 max.	–	1151
ED1502C	TO-92	20	25	500	66	100	825 max.	–	1151
ED1502D	TO-92	20	25	500	84	127	825 max	–	1151
ED1502E	TO-92	20	25	500	105	210	825 max	–	1151
ED1702L	TO-92	25	500	625	132	189	80	ED1802L	1155
ED1702M	TO-92	25	500	625	170	233	80	ED1802M	1155
ED1702N	TO-92	25	500	625	213	300	80	ED1802N	1155
ED1702O	TO-92	25	500	625	263	370	80	ED1802O	1155
ED1702P	TO-92	25	500	625	333	476	80	ED1802P	1155
JC337-25	TO-92	60	500	625	160	400	100	JC327-25	1164
JC501P	TO-92	45	100	500	135	270	130 typ.	JA101P	1166
JC501Q	TO-92	45	100	500	200	400	130 typ.	JA101Q	1166
JC501R	TO-92	45	100	500	300	600	130 typ.	JA101R	1166
JC546B	TO-92	65	100	500	200	290	100	JC556B	1168
JC547A	TO-92	45	100	500	110	220	100	–	1168
JC547B	TO-92	45	100	500	200	450	100	JC557B	1168
JC548B	TO-92	30	100	500	200	450	100	JC558B	1168
MPSA06	TO-92	80	500	625	100	>100	100	MPSA56	1183

PNP GENERAL PURPOSE LOW-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
2PA733	TO-92	50	100	500	135	600	100	–	750
2PA733P	TO-92	50	100	500	200	400	100	2PC945P	750
2PA1015GR	TO-92	50	150	500	200	400	80	2PC1815GR	742
2PA1015Y	TO-92	50	150	500	120	240	80	2PC1815Y	742
BC327	TO-92	45	500	625	100	600	80	BC337	774
BC327-16	TO-92	45	500	625	100	250	80	BC337-16	774
BC327-25	TO-92	45	500	625	160	400	80	BC337-25	774
BC327-40	TO-92	45	500	625	250	600	80	BC337-40	774
BC556	TO-92	65	100	500	125	475	100	BC546	799
BC556A	TO-92	65	100	500	125	250	100	BC546A	799
BC556B	TO-92	65	100	500	200	475	100	BC546B	799
BC557	TO-92	45	100	500	125	800	100	BC547	799
BC557B	TO-92	45	100	500	220	475	100	BC547B	799
BC557C	TO-92	45	100	500	420	800	100	BC547C	799
BC559C	TO-92	30	100	500	420	800	100	BC549C	803
ED1602C	TO-92	20	100	500	125	190	100	ED1402C	1153
ED1602D	TO-92	20	100	500	170	260	100	ED1402D	1153
ED1602E	TO-92	20	100	500	223	475	100	ED1402E	1153
ED1802K	TO-92	25	500	625	106	150	80	–	1157
ED1802L	TO-92	25	500	625	132	189	80	ED1702L	1157
ED1802M	TO-92	25	500	625	170	233	80	ED1702M	1157
ED1802N	TO-92	25	500	625	213	300	80	ED1702N	1157
ED1802P	TO-92	25	500	625	333	476	80	ED1702P	1157
JA101P	TO-92	45	100	500	135	270	100	JC501P	1159
JA101Q	TO-92	45	100	500	200	400	100	JC501Q	1159
JA101R	TO-92	45	100	500	300	600	100	JC501R	1159
JC327-25	TO-92	45	500	625	160	400	80	JC337-25	1162
JC556B	TO-92	65	100	500	220	475	100	JC546B	1171
JC557B	TO-92	45	100	500	220	475	100	JC547B	1171
JC558B	TO-92	30	100	500	220	475	100	JC548B	1171
JC559	TO-92	30	100	500	125	800	100	–	1174
MPSA56	TO-92	80	500	625	100	>100	50	MPSA06	1194

NPN MEDIUM-FREQUENCY TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PAGE
BF199	TO-92	25	25	500	38	>38	550 typ.	991
BF240	TO-92	40	25	300	67	220	150	993
BF370	TO-92	15	100	500	40	>40	490	997

PNP MEDIUM-FREQUENCY TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PAGE
BF324	TO-92	30	25	300	25	>25	450 typ	995
BF450	TO-92	40	25	300	50	>50	350	1009

NPN MEDIUM-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BC875	TO-92	45	1000	830	1000	>1000	200 typ.	1300	BC878	882
BC879	TO-92	80	1000	830	1000	>1000	200 typ.	1300	BC878	882
BSR52	TO-92	80	1000	830	2000	>2000	200 typ.	1300	BSR62	1124

PNP MEDIUM-POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
BC878	TO-92	60	1000	830	1000	>1000	200 typ.	700	BC879	885
BSR62	TO-92	80	1000	830	2000	>2000	200 typ.	–	BSR52	1127

NPN GENERAL PURPOSE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BC368	TO-92	20	1000	830	85	375	40	–	BC369	782
BC635	TO-92	45	1000	830	40	250	100	–	BC636	808
BC635-16	TO-92	45	1000	830	100	250	100	–	BC636-16	808
BC637	TO-92	60	1000	830	40	250	100	–	BC638	808
BC637-16	TO-92	60	1000	830	100	250	100	–	BC638-16	808
BC639	TO-92	80	1000	830	40	250	100	–	BC640	808
BC639-10	TO-92	80	1000	830	63	160	100	–	–	808
BC639-16	TO-92	80	1000	830	100	250	100	–	BC640-16	808

PNP GENERAL PURPOSE MEDIUM-POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BC369	TO-92	20	1000	830	85	375	40	BC368	785
BC369-16	TO-92	20	1000	830	100	250	40	BC368	785
BC369-25	TO-92	20	1000	830	160	>160	40	BC368	785
BC636	TO-92	45	1000	830	40	250	100	BC635	811
BC636-10	TO-92	45	1000	830	63	160	100	–	811
BC636-16	TO-92	45	1000	830	100	250	100	BC635-16	811
BC638	TO-92	60	1000	830	40	250	100	BC637	811
BC638-16	TO-92	60	1000	830	100	250	100	BC637-16	811
BC640	TO-92	80	1000	830	40	250	100	BC639	811
BC640-16	TO-92	80	1000	830	100	250	100	BC639-16	811

NPN POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BDX42	TO-126	45	1000	1250	2000	>2000	200 typ.	–	BDX45	983
BDX43	TO-126	60	1000	1250	2000	>2000	200 typ.	–	–	983
BDX44	TO-126	80	1000	1250	2000	>2000	200 typ.	–	BDX47	983

PNP POWER DARLINGTON TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CES} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	NPN COMPL.	PAGE
BDX45	TO-126	45	1000	1250	2000	>2000	200 typ.	–	BDX42	987
BDX47	TO-126	80	1000	1250	2000	>2000	200 typ.	–	BDX44	987

NPN POWER SWITCHING TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	t_{off} max. (ns)	PNP COMPL.	PAGE
BDX35	TO-126	60	5000	1250	45	450	350 typ.	500	–	980
BDX36	TO-126	60	5000	1250	45	450	350 typ.	500	–	980
BDX37	TO-126	80	5000	1250	45	450	350 typ.	500	–	980

NPN GENERAL PURPOSE POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	PNP COMPL.	PAGE
BD131	TO-126	45	3000	15000	40	>40	60	BD132	942
BD135	TO-126	45	1500	8000	40	250	190 typ.	BD136	948
BD135-10	TO-126	45	1500	8000	63	160	190 typ.	BD136-10	948
BD135-16	TO-126	45	1500	8000	100	250	190 typ.	BD136-16	948
BD137	TO-126	60	1500	8000	40	250	190 typ.	BD138	948
BD137-10	TO-126	60	1500	8000	63	160	190 typ.	BD138-10	948
BD137-16	TO-126	60	1500	8000	100	250	190 typ.	BD138-16	948
BD139	TO-126	80	1500	8000	40	250	190 typ.	BD140	948
BD139-10	TO-126	80	1500	8000	63	160	190 typ.	BD140-10	948
BD139-16	TO-126	80	1500	8000	100	250	190 typ.	BD140-16	948
BD230	TO-126	80	1500	12500	40	250	125 typ.	BD231	954
BD329	TO-126	20	3000	15000	85	375	130 typ.	BD330	960
BD825	TO-202	45	1000	2000	40	250	250 typ.	–	965
BD825-16	TO-202	45	1000	2000	100	250	250 typ.	–	965
BD829	TO-202	80	1000	2000	40	250	250 typ.	BD830	965

PNP GENERAL PURPOSE POWER TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	f_T min. (MHz)	NPN COMPL.	PAGE
BD132	TO-126	45	3000	15000	40	>40	60	BD131	945
BD136	TO-126	45	1500	8000	40	250	160 typ.	BD135	951
BD136-10	TO-126	45	1500	8000	63	160	160 typ.	BD135-10	951
BD136-16	TO-126	45	1500	8000	100	250	160 typ.	BD135-16	951
BD138	TO-126	60	1500	8000	40	250	160 typ.	BD137	951
BD138-10	TO-126	60	1500	8000	63	160	160 typ.	BD137-10	951
BD138-16	TO-126	60	1500	8000	100	250	160 typ.	BD137-16	951
BD140	TO-126	80	1500	8000	40	250	160 typ.	BD139	951
BD140-10	TO-126	80	1500	8000	63	160	160 typ.	BD139-10	951
BD140-16	TO-126	80	1500	8000	100	250	160 typ.	BD139-16	951
BD231	TO-126	80	1500	12500	40	250	50 typ.	BD230	957
BD330	TO-126	20	3000	15000	85	375	100 typ.	BD329	963
BD830	TO-202	80	1000	2000	40	250	75 typ.	BD829	968

PROGRAMMABLE UNIJUNCTION TRANSISTORS

TYPE NUMBER	PACKAGE	V_{GA} max. (V)	I_A max. (mA)	I_{ARM} max. (mA)	P_{tot} max. (mW)	dI_A/dt max. (A/μs)	I_P max. (μA)	I_V min. (μA)	t_r max. (ns)	PAGE
BRY56A	TO-92	70	175	2500	300	20	0.2	2	80	1070

NPN RESISTOR-EQUIPPED TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_O max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	INPUT RES. (KΩ)	RES. RATIO	PNP COMPL.	PAGE
PDTC114ES	TO-92	50	100	500	30	>30	10	1	PDTA114ES	1318
PDTC114TS	TO-92	50	100	500	100	600	10	–	PDTA114TS	1333
PDTC124ES	TO-92	50	100	500	56	>56	22	1	PDTA124ES	1367
PDTC143ES	TO-92	50	100	500	20	>20	4.7	1	PDTA143ES	1388
PDTC144ES	TO-92	50	100	500	68	>68	47	1	PDTA144ES	1421

PNP RESISTOR-EQUIPPED TRANSISTORS

TYPE NUMBER	PACKAGE	V_{CEO} max. (V)	I_C max. (mA)	P_{tot} max. (mW)	h_{FE} min.	h_{FE} max.	INPUT RES. (KΩ)	RES. RATIO	NPN COMPL.	PAGE
PDTA114ES	TO-92	50	100	500	30	>30	10	1	PDTC114ES	1209
PDTA114TS	TO-92	50	100	500	100	600	10	–	PDTC114TS	1221
PDTA124ES	TO-92	50	100	500	56	>56	22	1	PDTC124ES	1246
PDTA143ES	TO-92	50	100	500	20	>20	4.7	1	PDTC143ES	1267
PDTA144ES	TO-92	50	100	500	68	>68	47	1	PDTC144ES	1297

SC10/CATEGORY CROSS REFERENCE PER PACKAGE

General purpose low-power transistors

LEADED	SURFACE-MOUNT						
TO-92 SOT54	SC-59 SOT346	SOT23	SOT143	SC-70 SOT323	SC-88 SOT363	SC-75 SOT416	SC-89 SOT490
General purpose low-power transistors NPN							
2N5088	2PD601A	BC846	BCV61	2PC4081	BC846S	2PC4617	2PC4617J
2PC1815		BC847	BCV63	BC846W	BC847BNP(1)	2PC4617	BC847F
2PC945		BC849	BCV65(1)	BC847W	BC847BS	BC846T	
BC546		BC850		BC849W	PUMX1	BC847T	
BC547		BCF32		BC850W	PUMX1		
BC549		BCV71		PMSS3904	PUMZ1(1)		
BC550		BCV72		PMST5088			
ED1402		BCW31		PMST5089			
ED1702		BCW32		PMST6428			
JC501		BCW33		PMST6429			
JC546		BCW60					
JC547		BCW71					
JC548		BCW72					
MPS3904		BCX70					
		PMBS3904					
		PMBT5088					
		PMBT6428					
		PMBT6429					
General purpose low-power transistors PNP							
2PA1015	2PB709A	BC856	BCV62	2PA1576	BC857BS	2PA1774	2PA1774J
2PA733		BC857	BCV64	BC856W	PUMB4	BC857T	BC857F
BC556		BC859		BC857W	PUMT1		
BC557		BC860		BC859W			
BC559		BCV29		BC860W			
ED1602		BCW30		PMSS3906			
ED1802		BCW69					
JA101		BCW70					
JC556		BCW89					
JC557		BCX71					
JC558		BCXW61					
JC559		PMBS3906					
MPS3906							

Note

1. PNP and NPN transistor.

General purpose medium-power transistors

LEADED	SURFACE-MOUNT		
TO-92 SOT54	**SC-59 SOT346**	**SOT23**	**SC-70 SOT323**
General purpose medium-power transistors NPN			
BC337	2PD602A	BC817	2PD1820A
JC337		BCX19	BC817W
MPSA06		PMBTA06	PMSTA05
		PMMT491A	PMSTA06
General purpose medium-power transistors NPN			
BC327	2PB710A	BC807	2PB1219A
JC327		BCX17	BC807W
MPSA56		BCX18	PMSTA55
		PMBTA56	PMSTA56
JC501		PMMT591A	

Darlington transistors

LEADED	SURFACE-MOUNT			
TO-92 SOT54	**TO-126 SOT32**	**SOT23**	**SOT89**	**SOT223**
Darlington transistors NPN				
BC517	BDX42	BCV27	BCV29	BSP50
BC618	BDX43	BCV47	BCV49	BSP51
BC875	BDX44	PMBTA13	BST50	BSP52
BC879		PMBTA14	BST51	PZTA14
BSR52			BST52	
MPSA14			PXTA14	
MPSA26				
MPSA27				
Darlington transistors PNP				
BC516	BDX45	BCV26	BCV28	BSP60
BC878	BDX47	BCV46	BCV48	BSP61
BSR62		PMBTA64	BST60	BSP62
MPSA63			BST61	
MPSA64			BST62	

Medium power/power transistors

LEADED	SURFACE-MOUNT			
TO-92 SOT54	TO-126 SOT32	TO-202 SOT128	SOT89	SOT223
Medium power/power transistors NPN				
BC635	BD131	BD825	BC868	BCP54
BC637	BD135	BD829	BCX54	BCP55
BC639	BD137		BCX55	BCP56
BC368	BD139		BCX56	BCP68
	BD230		BSR40	BDL31
	BD329		BSR41	BDP31
	BDX35		BSR42	BSP41
	BDX36		BSR43	BSP43
	BDX37			PBSS4540Z
Medium power/power transistors PNP				
BC636	BD132	BD830	BC869	BCP51
BC638	BD136		BCX51	BCP52
BC640	BD138		BCX52	BCP53
BC369	BD140		BCX53	BCP69
	BD231		BSR30	BDL32
	BD330		BSR31	BDP32
			BSR33	BSP31
				BSP32
				BSP33
				PBSS5540Z

Medium frequency transistors

LEADED	SURFACE-MOUNT	
TO-92 SOT54	SOT23	SC-70 SOT323
Medium frequency transistors NPN		
BF199	BF840	BFS20W
BF240	BF570	
BF370	BFS19	
ED1502	BFS20	
Medium frequency transistors PNP		
BF324	BF824	BF824W
BF450	BF550	

Switching transistors

LEADED	SURFACE-MOUNT			
TO-92 SOT54	SOT23	SC-70 SOT323	SOT89	SOT223
Switching transistors NPN				
2N3904	BSR13	PMST2222	PXT2222A	PZT2222A
2N4401	BSR14	PMST2222/A	PXT3904	PZT3904
PH2222A	BSR17A	PMST2369	PXT4401	PZT4401
PH2369	BSV52	PMST3904		
PH2222A	PMBT2222	PMST4401		
PN2369	PMBT2222A			
PN2369A	PMBT2369			
	PMBT3904			
	PMBT4401			
Switching transistors PNP				
2N3906	BSR15	PMST2907A	PXT2907A	PZT2907A
2N4403	BSR16	PMST3906	PXT3906	PZT3906
PH2907A	BSR18A	PMST4403	PXT4403	PZT4403
PN2907A	PMBT2907			
	PMBT2907A			
	PMBT3906			
	PMBT4403			

High voltage transistors

LEADED			SURFACE-MOUNT			
TO-92 SOT54	TO-126 SOT32	TO-202 SOT128	SOT23	SC-70 SOT323	SOT89	SOT223
High voltage transistors NPN						
2N5550	BF419	BF585	BF820	BF820W	BF620	BF720
2N5551	BF458	BF587	BF822	BF822W	BF622	BF722
BF420	BF459	BF819	BSR19	PMST5550	BST39	BSP19
BF422	BF469	BF859	BSR19	PMST5551	BST40	BSP20
BF422L	BF471	BF869	BSS64	PMSTA42	PXTA42	PZTA42
BF483	BFV469	BF871	PMBT5550	PMSTA43		PZTA44
BF485			PMBT5551			
BF487			PMBTA42			
BFV420						
MPSA42						
MPSA43						
MPSA44						

LEADED			SURFACE-MOUNT			
High voltage transistors PNP						
2N5401	BF470	BF588	BF821	PMST5401	BF621	BF723
BF421	BF472	BF872	BF823	PMSTA92	BF623	BSP16
BF421L			BSR20	PMSTA93	BST15	PZTA92
BF423			BSR20A		BST16	
BF423L			BSS63		PXTA92	
BF488			PMBT5401			
BFV421			PMBTA92			
MPSA92						

Resistor equipped transistors

LEADED	SURFACE-MOUNT					
TO-92 SOT54	**SC-59 SOT346**	**SOT23**	**SC-70 SOT323**	**SC-88 SOT363**	**SC-75 SOT416**	**SC-89 SOT490**
Resistor equipped transistors NPN						
PDTC114ES	PDTC114EK	PDTC114ET	PDTC114EU	PUMH1	PDTC114EE	PDTC114EEF
PDTC114TS	PDTC114TK	PDTC114TT	PDTC114TU	PUMH11	PDTC114TE	PDTC123JEF
PDTC124ES	PDTC124EK	PDTC114YT	PDTC114YU	PUMH4	PDTC114YE	PDTC124XEF
PDTC143ES	PDTC143EK	PDTC123ET	PDTC124EU	PUMH7	PDTC123JE	PDTC144EEF
PDTC144ES	PDTC143ZK	PDTC123JT	PDTC143EU		PDTC124EE	
	PDTC144EK	PDTC124ET	PDTC144EU	PUMD2[1]	PDTC124XE	
		PDTC143ET	PDTC144WU	PUMD3[1]	PDTC143EE	
		PDTC143TT		PUMD6[1]	PDTC143XE	
		PDTC143XT		PUMD9[1]	PDTC144EE	
		PDTC143ZT		PUMD10[1]		
		PDTC144ET		PUMD12[1]		
		PDTC144WT		PUMD48[1]		
Resistor equipped transistors PNP						
PDTA114ES	PDTA114EK	PDTA114ET	PDTA114EU	PUMB4	PDTA114EE	PDTA114EEF
PDTA114TS	PDTA114TK	PDTA114TT	PDTA114TU		PDTA123JE	PDTA123JEF
PDTA124ES	PDTA124EK	PDTA114YT	PDTA124EU		PDTA124EE	PDTA124XEF
PDTA143ES	PDTA143EK	PDTA123ET	PDTA143EU		PDTA124XE	PDTA144EEF
PDTA144ES	PDTA143ZK	PDTA123JT	PDTA144EU		PDTA143EE	
	PDTA144EK	PDTA124ET	PDTA144WU		PDTA143XE	
		PDTA143ET			PDTA144EE	
		PDTA143XT				
		PDTA143ZT				
		PDTA144ET				

Note

1. PNP and NPN transistor.

PHILIPS GA DIODES CROSS-REFERENCE

Schottky diodes

COMPETITOR TYPE-NUMBER	PHILIPS TYPE-NUMBER
BAS125	BAT54
BAS125-04	BAT54S
BAS125-04W	BAT54SW
BAS125-05	BAT54C
BAS125-05W	BAT54CW
BAS125-06	BAT54A
BAS125-06W	BAT54AW
BAS125W	BAT54W
BAS140W	1PS76SB40
BAS170W	1PS76SB70
BAS40	BAS40
BAS40-04	BAS40-04
BAS40-04W	BAS40-04W
BAS40-05	BAS40-05
BAS40-05W	BAS40-05W
BAS40-06	BAS40-06
BAS40-06W	BAS40-06W
BAS40-07	BAS40-07
BAS70	BAS70
BAS70-04	BAS70-04
BAS70-04W	BAS70-04W
BAS70-05	BAS70-05
BAS70-05W	BAS70-05W
BAS70-06	BAS70-06

COMPETITOR TYPE-NUMBER	PHILIPS TYPE-NUMBER
BAS70-06W	BAS70-06W
BAS70-07	BAS70-07
BAT17	BAT17
BAT64	BAT54
BAT64-04	BAT54S
BAT64-04W	BAT54SW
BAT64-05	BAT54C
BAT64-05W	BAT54CW
BAT64-06	BAT54A
BAT64-06W	BAT54AW
BAT64-07	BAT74
BAT70-05	PBYR2100CT
RB420D	1PS59SB10
RB421D	1PS59SB21
RB425D	1PS59SB21
RB450F	BAT54W
RB451F	BAT54W
RB495D	1PS59SB15
RB500V-40	1PS76SB40
RB501V-40	1PS76SB10
RB520S-30	1PS79SB21
RB521S-30	1PS79SB10
RB715F	BAS40-05W
RB717F	BAS40-06W

Zener/Switching diodes

COMPETITOR TYPE-NUMBER	PHILIPS TYPE-NUMBER
1N4148	1N4148
1N47XXA (not all types available)	1N47XXA
1N52XXB (not all types available)	1N52XXB
1SS133	BAW62
1SS244(DO34)	BAV20/21 (DO35)
1SS355	BAS316
1SS376 (300V type)	BAS321 (250V type)
1SS400	BAS516
BAS16 /DA114	BAS16/BAS16W
BAS16/BAS16W	BAS16/BAS16W
BAS16-02W	BAS316
BAS16-03W	BAS32L
BAS16-03W	PMLL4148L
BAS16LT1/BAS16WT1	BAS16/BAS16W
BAS21	BAS21
BAS21LT1	BAS21
BAS28	BAS28
BAV70	BAV70/BAV70W
BAV70/BAV70W	BAV70/BAV70W
BAV70LT1/BAV70WT1	BAV70/BAV70W
BAV70S	BAV70S
BAV70W	1PS301
BAV70WT1	1PS301
BAV99	BAV99/BAV99W
BAV99/BAV99W	BAV99/BAV99W
BAV99LT1	BAV99/BAV99W
BAV99W	1PS302
BAV99WT1	1PS302
BAW101 (300 V)	BAV23 (250V)
BAW56	BAW56/BAW56W
BAW56BAW56W	BAW56/BAW56W
BAW56LT1/BAW56WT1	BAW56/BAW56W
BAW56S	BAW56S
BAW56W	1PS300
BAW56WT1	1PS300
BZX84CXXXL (not all types available)	BZX84-C
DAN202K	1PS184
DAN202U	1PS301
DAN212K	1PS193
DAN217	1PS226
DAN222	BAV70T
DAN222	BAV70T
DAP202K	1PS181
DAP202U	1PS300
DAP222	BAW56T
DAP222	BAW56T
MMBD7000LT1	PMBD7000
MMBZ52xxBLT1 (not all types available)	PMBZ52xxB
MMQA20VT1	BZA420A
MMQA5V6T1	BZA456A
MMQA6V2T1	BZA462A
RLS4148 (SOD80)	PMLL4148L (SOD80C)
SMBD7000	PMBD7000
STZ6.2N, STZ6.8N (only 2 devices)	PZMxxx (double diodes)
UDZxxx	PDZxxx
UMN11N	BAV70S
UMP11N	BAW56S

Remark:

In general this list can only give a rough overview of replacing possibilities. Regarding exceeding, close and nearest equivalent therefore this list does not replace a detailed comparison of data sheets.

PHILIPS GA TRANSISTORS CROSS REFERENCE

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
2N2925	ED1402D
2N3903	2N3904
2N3904	2N3904
2N3904	2N3904
2N3905	2N3906
2N3906	2N3906
2N3906	2N3906
2N4123	2N3904
2N4124	2N3904
2N4125	2N3904
2N4400	2N4401
2N4401	2N4401
2N4401	2N4401
2N4402	2N4403
2N4403	2N4403
2N4403	2N4403
2N4410	MPSA06
2N5087	MPS3906
2N5087	MPS3906
2N5088	MPS3904
2N5089	MPS3904
2N5209	BC547B
2N5210	BC547B
2N5232A	BC547B
2N5400	2N5401
2N5401	2N5401
2N5401	2N5401
2N5550	2N5550
2N5551	2N5551
2N5551	2N5551
2N6426	MPSA14
2N6426	MPSA14
2N6427	MPSA14
2N6517	MPSA44
2N6519	MPSA92
2SA1036K	BSR15
2SA1037AK	2PB709AS
2SA1576A	2PA1576S
2SA1579	PMST5401

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
2SA1759	PXTA92
2SA1774	2PA1774Q
2SA1774	2PA1774S
2SA1797	BCX52-16
2SA1900	BCX52-16
2SB1132	BCX51-16
2SB1189	BSR33
2SB1260	BCX53-16
2SB1424	BC869
2SB1561	BSR31
2SB1580	BST62
2SC1651S	BF422L
2SC2062S	BC618
2SC2411K	2PD601AS
2SC2412K	2PD1820AS
2SC2413K	2PD601AQ
2SC4081	2PC4081Q
2SC4097	2PC4081Q
2SC4098	BC847AW
2SC4102	PMST5550
2SC4132	BSR43
2SC4505	PXTA42
2SC4617	2PC4617Q
2SC4618	BC847AT
2SC4672	BCX55-16
2SC4997	BC847CT
2SC4998	PMST6429
2SC5053	BCX55-16
2SD1484K	2PD602AR
2SD1664	BCX54
2SD1757K	2PD602AS
2SD1766	BC868
2SD1767	BCX56-16
2SD1781K	2PD602AR
2SD1782K	2PD602AS
2SD1834	BST51
2SD1898	BCX56-16
2SD1949	2PD1820AS
2SD2098	BC868-25

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
2SD2150	BC868
2SD2153	BC868
2SD2195	BST52
2SD2351	PMST6429
2SD2391	BSR41
BC237	BC547B
BC237A	BC547B
BC237B	BC547B
BC307	BC557B
BC307B	BC557B
BC327	BC327
BC327-16	BC327-16
BC327-25	BC327-25
BC328	BC327
BC328-16	BC327-16
BC328-25	BC327-25
BC337	BC337
BC337-16	BC337-16
BC337-25	BC337-25
BC337-40	BC337-40
BC338	BC337
BC338-16	BC337-16
BC338-25	BC337-25
BC338-40	BC337-40
BC368	BC368
BC369	BC369
BC373	BC618
BC489A	MPSA06
BC490A	MPSA56
BC517	BC517
BC546	BC546
BC546B	BC546B
BC547	BC547
BC547A	BC546A
BC547B	BC547B
BC547C	BC547C
BC548	BC547
BC548A	BC546A
BC548B	BC547B
BC548C	BC547C

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BC549B	BC547B
BC549C	BC549C
BC550B	BC547B
BC550C	BC550C
BC556	BC556
BC556B	BC556B
BC557	BC557
BC557A	BC556A
BC557B	BC557B
BC557C	BC557C
BC558B	BC557B
BC559B	BC556B
BC559C	BC559C
BC560C	BC557C
BC618	BC618
BC635	BC635
BC636	BC636
BC637	BC637
BC638	BC640-16
BC639	BC639
BC640	BC640
BC807-16LT1	BC807-16
BC807-25	BC807-25
BC807-25LT1	BC807-25
BC807-40	BC807-40
BC807-40LT1	BC807-40
BC808-16W	BC807-16W
BC817-16LT1	BC817-16
BC817-25	BC817-25
BC817-25LT1	BC817-25
BC817-40	BC817-40
BC817-40LT1	BC817-40
BC818-16W	BC817-16W
BC818W	BC817W
BC846...850	BC846
BC846ALT1	BC846A
BC846AWT1	BC846AW
BC846BLT1	BC846B
BC846BWT1	BC846BW
BC846W..850W	BC846W

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BC847A	BC847A
BC847ALT1	BC847A
BC847AWT1	BC847AW
BC847B	BC847B
BC847BLT1	BC847B
BC847BW	BC847BW
BC847BWT1	BC847BW
BC847C	BC847C
BC847CLT1	BC847C
BC847CWT1	BC847CW
BC847PN	BC847BPN
BC847S	BC847BS
BC848A	BC847A
BC848ALT1	BC847A
BC848AWT1	BC847AW
BC848B	BC847B
BC848BLT1	BC847B
BC848BWT1	BC847BW
BC848C	BC847C
BC848CLT1	BC847C
BC848CWT1	BC847CW
BC849BLT1	BC849B
BC849CLT1	BC849C
BC850BLT1	BC850B
BC850CLT1	BC850C
BC856...860	BC856
BC856ALT1	BC856A
BC856AWT1	BC856AW
BC856BLT1	BC856B
BC856BWT1	BC856BW
BC856W..860W	BC856W
BC857A	BC857A
BC857ALT1	BC857A
BC857AWT1	BC857AW
BC857B	BC857B
BC857BLT1	BC857B
BC857BWT1	BC857BW
BC857S	BC857BS
BC858ALT1	BC857A
BC858AWT1	BC857AW

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BC858B	BC857B
BC858BLT1	BC857B
BC858BW	BC857BW
BC858BWT1	BC857BW
BC858CLT1	BC857C
BC858CWT1	BC857CW
BCP28	BSP62
BCP29	PZTA14
BCP51...53	BCP51
BCP53T1	BCP53
BCP54...56	BCP54
BCP56-10T1	BCP56-10
BCP56-16T1	BCP56-16
BCP56T1	BCP56
BCP68-10	BCP68
BCP68-16	BCP68
BCP68T1	BCP68
BCP69-10	BCP69
BCP69T1	BCP69
BCR108	PDTC123JT
BCR10PN	PUMD3
BCR112	PDTC143ET
BCR112W	PDTC143EU
BCR116	PDTC143ZT
BCR119	PDTC143TT
BCR119S	PUMH7
BCR133	PDTC114ET
BCR133S	PUMH11
BCR133W	PDTC114EU
BCR135	PDTC114YT
BCR141	PDTC124ET
BCR141S	PUMH1
BCR141W	PDTC124EU
BCR146	PDTC144WT
BCR146W	PDTC144WU
BCR148	PDTC144ET
BCR148W	PDTC144EU
BCR162	PDTA143ET
BCR162W	PDTA143EU
BCR166	PDTA143ZT

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BCR183W	PDTA114EU
BCR191	PDTA124ET
BCR196W	PDTA144WU
BCR198	PDTA144ET
BCR198W	PDTA144EU
BCR22PN	PUMD2
BCR35PN	PUMD9
BCR533	PDTD114ET
BCV26	BCV26
BCV27	BCV27
BCV28	BCV28
BCV29	BCV29
BCV46	BCV46
BCV47	BCV47
BCV48	BCV48
BCV49	BCV49
BCV61/A/B/C	BCV61
BCV62/A/B/C	BCV62
BCW29	BCW29
BCW29LT1	BCW29
BCW30	BCW30
BCW30LT1	BCW30
BCW31	BCW31
BCW32	BCW32
BCW33	BCW33
BCW33LT1	BCW33
BCW60A	BCW60B
BCW60A...FN	BCW60B
BCW60ALT1	BCW60B
BCW60B	BCW60B
BCW60BLT1	BCW60B
BCW60C	BCW60C
BCW60D	BCW60D
BCW60DLT1	BCW60D
BCW61A...FN	BCW61B
BCW61B	BCW61B
BCW61BLT1	BCW61B
BCW61C	BCW61C
BCW61CLT1	BCW61C
BCW61DLT1	BCW61D

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BCW65B	BSR13
BCW67A...C	BSR15
BCW68F	BSR15
BCW68F...H	BSR16
BCW68G	BSR15
BCW69	BCW69
BCW69LT1	BCW69
BCW70	BCW70
BCW70LT1	BCW70
BCW71	BCW71
BCW72	BCW72
BCW72LT1	BCW72
BCX17	BCX17
BCX17LT1	BCX17
BCX18LT1	BCX18
BCX19	BCX19
BCX19LT1	BCX19
BCX20	BCX19
BCX20LT1	BCX19
BCX51/10/16	BCX51
BCX52/10/16	BCX52
BCX53	BCX53
BCX53/10/16	BCX53
BCX54/10/16	BCX54
BCX55/10/16	BCX55
BCX56	BCX56
BCX56/10/16	BCX56
BCX68/10..25	BC868-25
BCX69/10..25	BC869
BCX70G...K	BCX70G
BCX70GLT1	BCX70G
BCX70H	BCX70H
BCX70J	BCX70J
BCX70JLT1	BCX70J
BCX70K	BCX70K
BCX70KLT1	BCX70K
BCX71G	BCX71G
BCX71G...K	BCX71G
BCX71H	BCX71H
BCX71J	BCX71J

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BDB01C	BC639
BDB02C	BC640
BF199	BF199
BF240	BF240
BF393	MPSA44
BF420	BF420
BF421	BF421
BF422	BF422
BF423	BF423
BF622	BF622
BF623	BF623
BF720	BF720
BF720T1	BF720
BF721	BF723
BF721T1	BF723
BF722	BF722
BF723	BF723
BF840	BF840
BF841	BF840
BF844	MPSA44
BF959	BF240
BFN16	BST40
BFN17	BST15
BFN18	BST39
BFN19	BST16
BFN20	BF620
BFN21	BF621
BFN22	BF822
BFN23	BF823
BFN39	PZTA92
BSP16T1	BSP16
BSP19AT1	BSP19
BSP50...52	BSP50
BSP52T1	BSP52
BSP60...62	BSP60
BSP62T1	BSP62
BSR14	BSR14
BSS63	BSS63
BSS63LT1	BSS63
BSS64	BSS64

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
BSS79	BSR14
BSS80	BSR15
BSS81	BSR13
BSS82	BSR16
BSV52LT1	BSS64
BSV52LT1	BSV52
DTA114EE	PDTA114EE
DTA114EKA	PDTA114EK
DTA114ESA	PDTA114ES
DTA114EUA	PDTA114EU
DTA114TKA	PDTA114TK
DTA114TSA	PDTA114TS
DTA114TUA	PDTA114TU
DTA123JE	PDTA123JE
DTA124ECA	PDTA124ET
DTA124EE	PDTA124EE
DTA124EKA	PDTA124EK
DTA124ESA	PDTA124ES
DTA124EUA	PDTA124EU
DTA124XE	PDTA124XE
DTA143ECA	PDTA143ET
DTA143EE	PDTA143EE
DTA143EE	PDTA143EE
DTA143EKA	PDTA143EK
DTA143ESA	PDTA143ES
DTA143EUA	PDTA143EU
DTA143ZKA	PDTA143ZK
DTA144EE	PDTA144EE
DTA144EKA	PDTA144EK
DTA144ESA	PDTA144ES
DTA144EUA	PDTA144EU
DTA144WUA	PDTA144WU
DTC114ECA	PDTC114ET
DTC114EE	PDTC114EE
DTC114EKA	PDTC114EK
DTC114ESA	PDTC114ES
DTC114EUA	PDTC114EU
DTC114TCA	PDTC114TT
DTC114TE	PDTC114TE
DTC114TE	PDTC114TE

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
DTC114TKA	PDTC114TK
DTC114TSA	PDTC114TS
DTC114TUA	PDTC114TU
DTC114YE	PDTC114YE
DTC114YE	PDTC114YE
DTC123JE	PDTC123JE
DTC124ECA	PDTC124ET
DTC124EE	PDTC124EE
DTC124EKA	PDTC124EK
DTC124ESA	PDTC124ES
DTC124EUA	PDTC124EU
DTC124XE	PDTC124XE
DTC143EE	PDTC143EE
DTC143EKA	PDTC143EK
DTC143ESA	PDTC143ES
DTC143EUA	PDTC143EU
DTC143XE	PDTC143XE
DTC143ZCA	PDTC143ZT
DTC143ZKA	PDTC143ZK
DTC144EE	PDTC144EE
DTC144EKA	PDTC144EK
DTC144ESA	PDTC144ES
DTC144EUA	PDTC144EU
DTC144WKA	PDTC144WK
DTC144WUA	PDTC144WU
IMZ2A	BC847BPN
MBT3904DW1T1	PUMX1
MBT3906DW1T1	PUMT1
MBT3946DW1T1	PUMZ1
MMBT2222ALT1	PMBT2222A
MMBT2222AWT1	PMST2222A
MMBT2222LT1	PMBT2222
MMBT2369ALT1	PMBT2369
MMBT2369LT1	PMBT2369
MMBT2484LT1	BC850B
MMBT2907ALT1	PMBT2907A
MMBT2907AWT1	PMST2907A
MMBT2907LT1	PMBT2907
MMBT3904LT1	PMBT3904
MMBT3904WT1	PMST3904

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
MMBT3906LT1	PMBT3906
MMBT3906WT1	PMST3906
MMBT4401LT1	PMBT4401
MMBT4403LT1	PMBT4403
MMBT5087LT1	BC860B
MMBT5088LT1	PMBT5088
MMBT5089LT1	PMBT5088
MMBT5401LT1	PMBT5401
MMBT5550LT1	PMBT5550
MMBT5551LT1	PMBT5551
MMBT6427LT1	PMBTA14
MMBT6428LT1	PMBT6428
MMBT6429LT1	PMBT6429
MMBTA05LT1	PMBTA06
MMBTA06LT1	PMBTA06
MMBTA13LT1	PMBTA13
MMBTA14LT1	PMBTA14
MMBTA42LT1	PMBTA42
MMBTA43LT1	PMBTA42
MMBTA55LT1	PMBTA56
MMBTA56LT1	PMBTA56
MMBTA63LT1	PMBTA64
MMBTA64LT1	PMBTA64
MMBTA92LT1	PMBTA92
MMBTA93LT1	PMBTA92
MMST4126	2PB709AQ
MMST5086	2PB709AQ
MMST5087	2PB709AS
MMST8098	2PD601AQ
MMUN2111LT1	PDTA114ET
MMUN2112LT1	PDTA124ET
MMUN2113LT1	PDTA144ET
MMUN2115LT1	PDTA114TT
MMUN2131LT1	PDTA123ET
MMUN2132LT1	PDTA143ET
MMUN2133LT1	PDTA143ZT
MMUN2211LT1	PDTC114ET
MMUN2212LT1	PDTC124ET
MMUN2213LT1	PDTC144ET
MMUN2214LT1	PDTC114YT

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
MMUN2215LT1	PDTC114TT
MMUN2216LT1	PDTC143TT
MMUN2231LT1	PDTC123ET
MMUN2232LT1	PDTC143ET
MMUN2233LT1	PDTC143ZT
MPS2222	PH2222A
MPS2222A	PH2222A
MPS2369	PH2369
MPS2369A	PH2369
MPS2907	PH2907A
MPS2907A	PH2907A
MPS3563	PH2369
MPS3646	BF370
MPS3904	MPS3904
MPS3906	MPS3906
MPS4124	2N3904
MPS4126	2N3904
MPS6531	PH2222A
MPS6534	BC327-16
MPS6601	BC368
MPS6602	BC635-16
MPS6651	BC369
MPS6652	BC636-10
MPS6717	BC639
MPS8598	MPSA56
MPS8599	MPSA56
MPS918	PH2369
MPSA05	MPSA06
MPSA06	MPSA06
MPSA06	MPSA06
MPSA13	MPSA14
MPSA13	MPSA14
MPSA14	MPSA14
MPSA17	JC501Q
MPSA18	BC550C
MPSA27	MPSA27
MPSA28	MPSA27
MPSA28	MPSA27
MPSA29	MPSA27
MPSA29	MPSA27

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
MPSA42	MPSA42
MPSA43	MPSA43
MPSA44	MPSA44
MPSA55	MPSA56
MPSA56	MPSA56
MPSA56	MPSA56
MPSA62	MPSA64
MPSA63	MPSA64
MPSA63	MPSA64
MPSA64	MPSA64
MPSA64	MPSA64
MPSA70	MPS3906
MPSA70	MPS3906
MPSA75	MPSA64
MPSA92	MPSA92
MPSA93	MPSA92
MPSH81	BF324
MPSL51	2N5401
MPSW01	BC635-16
MPSW01A	BC635-16
MPSW05	MPSA06
MPSW06	MPSA06
MPSW13	MPSA14
MPSW14	MPSA14
MPSW42	MPSA42
MPSW51	BC636-10
MPSW51A	BC636-10
MPSW55	MPSA56
MPSW56	MPSA56
MSB709-RT1	2PB709AR
MSB710-RT1	2PB710AR
MSD1328-RT1	2PD602AS
MSD601-RT1	2PD601AR
MSD601-ST1	2PD601AS
MSD602-RT1	2PD602AR
MUN2111T1	PDTA114EK
MUN2112T1	PDTA124EK
MUN2113T1	PDTA144EK
MUN2115T1	PDTA114TK
MUN2132T1	PDTA143EK

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
MUN2133T1	PDTA143ZK
MUN2211T1	PDTC114EK
MUN2212T1	PDTC124EK
MUN2213T1	PDTC144EK
MUN2215T1	PDTC114TK
MUN2232T1	PDTC143EK
MUN2233T1	PDTC143ZK
MUN5111T1	PDTA114EU
MUN5112T1	PDTA124EU
MUN5113T1	PDTA144EU
MUN5115DW1T1	PUMB4
MUN5115T1	PDTA114TU
MUN5132T1	PDTA143EU
MUN5211DW1T1	PUMH11
MUN5211T1	PDTC114EU
MUN5212DW1T1	PUMH1
MUN5212T1	PDTC124EU
MUN5213T1	PDTC144EU
MUN5215DW1T1	PUMH4
MUN5215T1	PDTC114TU
MUN5216DW1T1	PUMH7
MUN5232T1	PDTC143EU
MUN5311DW1T1	PUMD3
MUN5312DW1T1	PUMD2
MUN5314DW1T1	PUMD9
P2N2222A	PN2222A
P2N2907A	PN2907A
PN2222A	PN2222A
PN2907A	PN2907A
PN918	BF370
PZT2222	PZT2222A
PZT2222A	PZT2222A
PZT2222AT1	PZT2222A
PZT2907A	PZT2907A
PZT2907AT1	PZT2907A
PZT3904	PZT3904
PZT3906	PZT3906
PZT751T1	BSP31
PZTA13	PZTA14
PZTA14	PZTA14

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
PZTA14T1	PZTA14
PZTA42	PZTA42
PZTA42T1	PZTA42
PZTA43	PZTA42
PZTA63	BSP62
PZTA64	BSP62
PZTA64T1	BSP62
PZTA92	PZTA92
PZTA92T1	PZTA92
PZTA93	PZTA92
RXT2222A	PXT2222A
RXT2907A	PXT2907A
RXT3904	PXT3904
RXT3906	PXT3906
RXTA14	PXTA14
RXTA28	BCV49
SMBT2222	PMBT2222
SMBT2222A	PMBT2222A
SMBT2907	PMBT2907
SMBT2907A	PMBT2907A
SMBT3904	PMBT3904
SMBT3906	PMBT3906
SMBT6428	PMBT6428
SMBT6429	PMBT6429
SMBTA05	PMBTA06
SMBTA06	PMBTA06
SMBTA13	PMBTA13
SMBTA14	PMBTA14
SMBTA42	PMBTA42
SMBTA43	PMBTA42
SMBTA55	PMBTA56
SMBTA56	PMBTA56
SMBTA63	PMBTA64
SMBTA64	PMBTA64
SMBTA92	PMBTA92
SMBTA93	PMBTA92
SST2222A	PMBT2222A
SST2907A	PMBT2907A
SST3904	PMBT3904
SST3906	PMBT3906

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
SST4401	PMBT4401
SST4403	PMBT4403
SST6427	PMBTA14
SST6838	BC847
SST6839	BC857
SST8245	PMBT2369
SSTA05	PMBTA06
SSTA06	PMBTA06
SSTA13	PMBTA13
SSTA14	PMBTA14
SSTA28	PMBTA14
SSTA56	PMBTA56
SSTTIS97	BC817-40
SXT2222A	PXT2222A
SXT2907A	PXT2907A
SXT3904	PXT3904
SXT3906	PXT3906
SXTA42	PXTA42
SXTA43	PXTA42
SXTA92	PXTA92
SXTA93	PXTA92

COMPETITOR TYPE NUMBER	PHILIPS-TYPE-No.
UMB4N	PUMB4
UMD2N	PUMD2
UMD3N	PUMD3
UMH11N	PUMH11
UMH1N	PUMH1
UMH3N	PUMH7
UMH4N	PUMH4
UMH7N	PUMH7
UMT1N	BC857BS
UMT2222A	PMST2222A
UMT2907A	PMST2907A
UMT2N	PUMT1
UMT3904	PMST3904
UMT3906	PMST3906
UMT4401	PMST4401
UMT4403	PMST4403
UMX1N	PUMX1
UMX2N	BC847BS
UMX3N	BC847BS
UMZ1N	BC847BPN
UMZ2N	BC847BPN

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
2N1613	Discontinued	
2N1711	Discontinued	
2N1893	Discontinued	
2N2219	Discontinued	
2N2219A	Discontinued	
2N2222/A	Discontinued	
2N2369/A	Discontinued	
2N2484	Discontinued	
2N2905	Discontinued	
2N2905A	Discontinued	
2N2906	Discontinued	
2N2906A	Discontinued	
2N2907/A	Discontinued	
2N3019/01	Discontinued	
2N4031/4033	Discontinued	
2N4036	Discontinued	
2N4124	Replaced by 2N3904	
2N4126	Replaced by 2N3904	
2N5087	Replaced by MPS3906 (similar type)	
2N5400	Replaced by 2N5401	
2N5415/5416	Discontinued	
2N6427	Replaced by MPSA14	
2PA1015BL	Replaced by 2PA1015GR	equivalent type
2PA733K	Replaced by 2PA733P	equivalent type
2PA733Q	Replaced by 2PA733P	equivalent type
2PC945K	Replaced by 2PA733P	equivalent type
2PC945Q	Replaced by 2PA733P	equivalent type
BC107/108/109	Discontinued	
BC140/141	Discontinued	
BC160/161	Discontinued	
BC177/A/B	Discontinued	
BC237	Replaced by BC547B	
BC237B	Replaced by BC547B	
BC307	Replaced by BC557B	
BC307B	Replaced by BC557B	
BC327A	Replaced by BC327	equivalent type
BC328	Replaced by BC327	
BC328-16	Replaced by BC327-16	
BC328-25	Replaced by BC327-25	
BC328-40	BC327-40	

Small-signal Transistors — Replacement list

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
BC337A	BC337	equivalent type
BC338	BC337	
BC338-16	BC337-16	
BC338-25	BC337-25	
BC338-40	BC337-40	
BC368-16	BC635-16	
BC368-25	BC635-16	equivalent type
BC547A	BC546A	
BC548	BC547	
BC548A	BC546A	
BC548B	BC547B	
BC548C	BC547C	
BC549	BC547B	
BC549B	BC547B	
BC550	BC547B	
BC550B	BC547B	
BC557A	BC556A	
BC558	BC557	
BC558A	BC556A	
BC558B	BC557B	
BC558C	BC557C	
BC559	BC557	
BC559A	BC556A	
BC559B	BC556B	
BC560	BC557	
BC560B	BC556B	
BC560C	BC557C	
BC617	BC618	equivalent type
BC635-10	BC635-16	
BC637-10	BC637-16	
BC638	BC640-16	
BC640-10	BC640-16	equivalent type
BC808	BC807	
BC808-16	BC807-16	
BC808-25	BC807-25	
BC808-40	BC807-40	
BC808W	BC807W	
BC808-16W	BC807-16W	
BC808-25W	BC807-25W	
BC808-40W	BC807-40W	
BC818	BC817	

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
BC818-16	BC817-16	
BC818-25	BC817-25	
BC818-40	BC817-40	
BC818W	BC817W	
BC818-16W	BC817-16W	
BC818-25W	BC817-25W	
BC818-40W	BC817-40W	
BC848	BC847	
BC848A	BC847A	
BC848B	BC847B	
BC848C	BC847C	
BC848AT	BC847AT	
BC848BT	BC847BT	
BC848CT	BC847CT	
BC848W	BC847W	
BC848AW	BC847AW	
BC848BW	BC847BW	
BC848CW	BC847CW	
BC849	BC849B	
BC850	BC850B	
BC849W	BC849BW	
BC850W	BC850BW	
BC858	BC857	
BC858A	BC857A	
BC858B	BC857B	
BC858C	BC857C	
BC858T	BC857T	
BC858AT	BC857AT	
BC858BT	BC857BT	
BC858CT	BC857CT	
BC858W	BC857W	
BC858AW	BC857AW	
BC858BW	BC857BW	
BC858CW	BC857CW	
BC859	BC857	
BC859A	BC857A	
BC859AW	BC857AW	
BC860	BC857	
BC860A	BC857A	
BC860AW	BC857AW	
BC868-10	"BC868, BC868-25"	equivalent type

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
BC868-16	"BC868, BC868-25"	equivalent type
BC876	BC878	
BC880	BC878	equivalent type
BC877	BC879	
BCF29	BC857	
BCF30	BC857B	
BCF33	BC847B	
BCF81	BC847C	
BCP51-10	BCP53-10	
BCP52-10	BCP53-10	
BCP52	BCP53	
BCP54-10	BCP55-10	
BCP68-10	"BCP68, BCP68-25"	
BCP68-16	"BCP68, BCP68-25"	
BCP69-10	"BCP69, BCP69-16, BCP69-25"	equivalent type
BCV65B	BCV65	equivalent type
BCW60A	"BCW60B, BCW60C, BCW60D"	equivalent type
BCW61A	"BCW61B, BCW61C, BCW61D"	equivalent type
BCW81	BC847C	
BCX20	BCX19	
BCY58/59	-	package discontinued
BCY70/71	-	package discontinued
BCY78/79	-	package discontinued
BCY87/88/89	-	package discontinued
BD226	BD230	
BD228	BD230	
BD227	BD231	
BD229	BD231	
BD825-10	BD825-16	equivalent type
BD829-10	BD825-16	equivalent type
BD829-16	BD825-16	equivalent type
BD826	BD830	equivalent type
BD826-10	BD830	equivalent type
BD826-16	BD830	equivalent type
BD828	BD830	equivalent type
BD828-10	BD830	equivalent type
BD828-16	BD830	equivalent type
BD830-10	BD830	equivalent type
BD830-16	BD830	equivalent type
BF240B	BF240	equivalent type
BF370R	-	

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
BF420L	BF422L	equivalent type
BF457	BF458	
BF486	BF488	
BF494	BF240	equivalent type
BF494B	BF240	equivalent type
BF495	BF240	equivalent type
BF495B	BF240	equivalent type
BF583	BF585	
BF591	BF859	
BF593	BF859	
BF721	BF723	equivalent type
BF841	BF840	equivalent type
BF857	BF859	
BF858	BF859	
BF870	BF872	equivalent type
BFR54	BF370	
BFT45	-	package discontinued
BFX30, BFX34	-	package discontinued
BFX85	-	package discontinued
BFY50,51,52	-	package discontinued
BRY39	-	package discontinued
BRY56	BRY56A	
BSP15	BSP16	
BSP30	BSP32	
BSP40	BSP43	
BSP42	BSP43	
BSR32	BSR33	equivalent type
BSR50	BSR52	
BSR51	BSR52	
BSR60	BSR62	
BSR61	BSR62	
BSS50/51/52	-	package discontinued
BSS61/62	-	package discontinued
BSV15/16/17-Fam	-	package discontinued
BSV64	-	package discontinued
BSW66A/67A/68A	-	package discontinued
BSX20	-	package discontinued
BSX32	-	package discontinued
BSX45/46/47-Fam.	-	package discontinued
BSX59/61	-	package discontinued
BSX62/63-Fam.	-	package discontinued

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
ED1402A	ED1402B	equivalent type
ED1502A	ED1502B	equivalent type
ED1602A	ED1602C	equivalent type
ED1602B	ED1602C	equivalent type
ED1602F	ED1602E	equivalent type
ED1702K	ED1702L	equivalent type
ED1702Q	ED1702P	equivalent type
ED1802O	ED1802P	equivalent type
ED1802Q	ED1802P	equivalent type
JA101	JA101Q	
JC327A	JC327-25	
JC327-16	JC327-25	
JC327-40	JC327-25	equivalent type
JC328	JC327-25	
JC328-16	JC327-25	
JC328-25	JC327-25	
JC328-40	JC327-25	equivalent type
JC337	JC337-25	
JC337A	JC337-25	
JC337-16	JC337-25	
JC337-40	JC337-25	equivalent type
JC338	JC337-25	
JC338-16	JC337-25	
JC338-25	JC337-25	
JC338-40	JC337-25	equivalent type
JC501	JC501Q	
JC501O	JC501P	
JC546	JC546B	
JC547	JC547B	
JC548A	JC547A	
JC546A	JC546B	
JC547C	JC547B	equivalent type
JC548A	JC548B	
JC549	JC547B	
JC549B	JC547B	
JC549C	JC547B	equivalent type
JC550	JC547B	
JC550B	JC547B	
JC550C	JC547B	equivalent type
JC556	JC556B	
JC557	JC557B	

DISCONTINUED TYPE	REASON FOR DELETION	REMARKS
JC558	JC558B	
JC559A	JC559	equivalent type
JC559B	JC558B	
JC559C	JC558B	equivalent type
JC560	JC557B	
JC560A	JC557B	equivalent type
JC560B	JC557B	
JC560C	JC557B	equivalent type
MPS8098	-	
MPSA05	MPSA06	
MPSA13	MPSA14	
MPSA25	MPSA26	
MPSA45	MPSA44	
MPSA55	MPSA56	
MPSA63	MPSA64	
MPSA93	MPSA92	
PDTA114TE	-	
PDTB114ET	-	
PDTD114ET	-	
PH2222	PH2222A	
PH2369A	PH2369	
PH2907	PH2907A	
PH5416	-	
PMBTA43	PMBTA42	
PMBTA55	PMBTA56	
PMBTA63	PMBTA64	
PMBTA93	PMBTA92	
PN2222	PN2222A	
PN3439	MPSA42	
PN3440	MPSA42	
PXTA27	BCV49	
PXTA43	PXTA42	
PXTA64	BCV48	equivalent type
PXTA93	PXTA92	
PZTA06	BSP43	equivalent type
PZTA43	PZTA42	
PZTA45	PZTA44	
PZTA56	BSP33	equivalent type
PZTA64	BSP62	equivalent type

DIODE TYPE NUMBER TO MARKING CODE

TYPE NUMBER	MARKING CODE	PACKAGE
1N821	1N821	SOD68 (DO34)
1N821A	1N821A	SOD68 (DO34)
1N823	1N823	SOD68 (DO34)
1N823A	1N823A	SOD68 (DO34)
1N825	1N825	SOD68 (DO34)
1N825A	1N825A	SOD68 (DO34)
1N827	1N827	SOD68 (DO34)
1N827A	1N827A	SOD68 (DO34)
1N829	1N829	SOD68 (DO34)
1N829A	1N829A	SOD68 (DO34)
1N914	1N914 PH	SOD27 (DO35)
1N4148	1N4148 PH	SOD27 (DO35)
1N4150	1N4150 PH	SOD27 (DO35)
1N4151	1N4151 PH	SOD27 (DO35)
1N4448	1N4448 PH	SOD27 (DO35)
1N4531	4531PH	SOD68 (DO34)
1N4532	4532PH	SOD68 (DO34)
1N4728A	4728A P	SOD66 (DO41)
1N4729A	4729A P	SOD66 (DO41)
1N4730A	4730A P	SOD66 (DO41)
1N4731A	4731A P	SOD66 (DO41)
1N4732A	4732A P	SOD66 (DO41)
1N4733A	4733A P	SOD66 (DO41)
1N4734A	4734A P	SOD66 (DO41)
1N4735A	4735A P	SOD66 (DO41)
1N4736A	4736A P	SOD66 (DO41)
1N4737A	4737A P	SOD66 (DO41)
1N4738A	4738A P	SOD66 (DO41)
1N4739A	4739A P	SOD66 (DO41)
1N4740A	4740A P	SOD66 (DO41)
1N4741A	4741A P	SOD66 (DO41)
1N4742A	4742A P	SOD66 (DO41)
1N4743A	4743A P	SOD66 (DO41)
1N4744A	4744A P	SOD66 (DO41)
1N4745A	4745A P	SOD66 (DO41)
1N4746A	4746A P	SOD66 (DO41)
1N4747A	4747A P	SOD66 (DO41)
1N4748A	4748A P	SOD66 (DO41)
1N4749A	4749A P	SOD66 (DO41)

TYPE NUMBER	MARKING CODE	PACKAGE
1N5817	1N5817	SOD81
1N5818	1N5818	SOD81
1N5819	1N5819	SOD81
1PS59SB10	10	SC-59/SOT346
1PS59SB14	14	SC-59/SOT346
1PS59SB15	15	SC-59/SOT346
1PS59SB16	16	SC-59/SOT346
1PS59SB20	20	SC-59/SOT346
1PS59SB21	21	SC-59/SOT346
1PS70SB10	7t0; 7-0	SC-70/SOT323
1PS70SB14	7t4; 7-4	SC-70/SOT323
1PS70SB15	7t5; 7-5	SC-70/SOT323
1PS70SB16	7t5; 7-5	SC-70/SOT323
1PS70SB40	6t3; 6-3	SC-70/SOT323
1PS70SB44	6t4; 6-4	SC-70/SOT323
1PS70SB45	6t5; 6-5	SC-70/SOT323
1PS70SB46	6t6; 6-6	SC-70/SOT323
1PS74SB23	P1	SC-74/SOT457
1PS75SB45	45	SC-75/SOT416
1PS76SB10	S0	SC-76/SOD323
1PS76SB17	S7	SC-76/SOD323
1PS76SB21	S1	SC-76/SOD323
1PS76SB40	S4	SC-76/SOD323
1PS76SB70	S2	SC-76/SOD323
1PS79SB10	F	SC-79/SOD523
1PS79SB40	T	SC-79/SOD523
1PS79SB70	G	SC-79/SOD523
1PS88SB48	8t5	SC-88/SOT363
1PS89SB14	44	SC-89/SOT490
1PS89SB15	43	SC-89/SOT490
1PS89SB16	45	SC-89/SOT490
1PS89SS04	S4	SC-89/SOT490
1PS89SS05	S5	SC-89/SOT490
1PS89SS06	S6	SC-89/SOT490
1PS181	A3T	SC-59/SOT346
1PS184	B3T	SC-59/SOT346
1PS193	F3T	SC-59/SOT346
1PS226	C3T	SC-59/SOT346
1PS300	A3	SC-70/SOT323
1PS301	B3	SC-70/SOT323

TYPE NUMBER	MARKING CODE	PACKAGE
1PS302	C3	SC-70/SOT323
BAL74	JCp; JCt	SOT23
BAL74W	JC	SC-70/SOT323
BAL99	JFp; JFt	SOT23
BAL99W	JF	SC-70/SOT323
BAS16	A6p; A6t	SOT23
BAS16T	A6	SC-75/SOT416
BAS16W	A6	SC-70/SOT323
BAS17	A91	SOT23
BAS19	JPp; JPt	SOT23
BAS20	JRp; JRt	SOT23
BAS21	JSp; JSt	SOT23
BAS28	JTp	SOT143B
BAS29	L20	SOT23
BAS31	L21	SOT23
BAS32L	black	SOD80C
BAS35	L22	SOT23
BAS40	43p; 43t	SOT23
BAS40W	63	SC-70/SOT323
BAS40-04	44p; 44t	SOT23
BAS40-04W	64	SC-70/SOT323
BAS40-05	45p; 45t	SOT23
BAS40-05W	65	SC-70/SOT323
BAS40-06	46p; 46t	SOT23
BAS40-06W	66	SC-70/SOT323
BAS40-07	47p	SOT143B
BAS45A	45A PH	SOD68 (DO34)
BAS45AL	black	SOD80C
BAS56	L51	SOT143B
BAS70	73p; 73t	SOT23
BAS70W	73-; 73t	SC-70/SOT323
BAS70-04	74p; 74t	SOT23
BAS70-04W	74-; 74t	SC-70/SOT323
BAS70-05	75p; 75t	SOT23
BAS70-05W	75-; 75t	SC-70/SOT323
BAS70-06	76p; 76t	SOT23
BAS70-06W	76-; 76t	SC-70/SOT323
BAS70-07	77p	SOT143B
BAS70-07S	77	SC-88/SOT363
BAS81	grey	SOD80C

TYPE NUMBER	MARKING CODE	PACKAGE
BAS82	grey	SOD80C
BAS83	grey	SOD80C
BAS85	grey	SOD80C
BAS86	grey	SOD80C
BAS116	JVp; JVt	SOT23
BAS216	A6	SOD110
BAS221	JS	SOD110
BAS316	A6	SC-76/SOD323
BAS321	A7	SC-76/SOD323
BAS516	6	SC-79/SOD523
BAT17	A3p; A3t	SOT23
BAT54	L4p; L4t	SOT23
BAT54A	L42	SOT23
BAT54AW	42	SC-70/SOT323
BAT54C	L43	SOT23
BAT54CW	43	SC-70/SOT323
BAT54S	L44	SOT23
BAT54SW	44	SC-70/SOT323
BAT54W	L4	SC-70/SOT323
BAT74	L41	SOT143B
BAT74S	74	SC-88/SOT363
BAT81	BAT81	SOD68 (DO34)
BAT82	BAT82	SOD68 (DO34)
BAT83	BAT83	SOD68 (DO34)
BAT85	BAT85	SOD68 (DO34)
BAT86	BAT86	SOD68 (DO34)
BAT120A	AT120A	SC-73/SOT223
BAT120C	AT120C	SC-73/SOT223
BAT120S	AT120S	SC-73/SOT223
BAT140A	AT140A	SC-73/SOT223
BAT140C	AT140C	SC-73/SOT223
BAT140S	AT140S	SC-73/SOT223
BAT160A	AT160A	SC-73/SOT223
BAT160C	AT160C	SC-73/SOT223
BAT160S	AT160S	SC-73/SOT223
BAT254	L4	SOD110
BAT720	L6p; L6t	SOT23
BAT721	L7p; L7t	SOT23
BAT721A	L8p; L8t	SOT23
BAT721C	L9p; L9t	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BAT721S	L0p; L0t	SOT23
BAV10	BAV10 PH	SOD27 (DO35)
BAV20	BAV20 PH	SOD27 (DO35)
BAV21	BAV21 PH	SOD27 (DO35)
BAV23	L30	SOT143B
BAV23S	L31	SOT23
BAV70	A4p; A4t	SOT23
BAV70S	A4t	SC-88/SOT363
BAV70T	A4	SC75/SOT416
BAV70W	A4	SC-70/SOT323
BAV74	JAp; JAt	SOT23
BAV99	A7p; A7t	SOT23
BAV99W	A7	SC-70/SOT323
BAV100	green	SOD80C
BAV101	green	SOD80C
BAV102	green	SOD80C
BAV103	green	SOD80C
BAV105	black	SOD80C
BAV170	JXp; JXt	SOT23
BAV199	JYp; JYt	SOT23
BAV199W	JYt; JY-	SC-70/SOT323
BAV756S	A7t	SC-88/SOT363
BAW56	A1p; A1t	SOT23
BAW56S	A1t	SC-88/SOT363
BAW56T	A1	SC-75/SOT416
BAW56W	A1	SC-70/SOT323
BAW62	BAW62 PH	SOD27 (DO35)
BAW156	JZp; JZt	SOT23
BAX12	BAX12 PH	SOD27 (DO35)
BAX18	BAX18 PH	SOD27 (DO35)
BYV10-20	V10-20	SOD81
BYV10-30	V10-30	SOD81
BYV10-40	V10-40	SOD81
BZA100	BZA100	SO20 (SOT163-1)
BZA109	BZA109	SC-73/SOT223
BZA109TS	ZA109TS	SSOP20 (SOT339-1)
BZA408B	Z8	SC-74/SOT457
BZA420A	Z0	SC-74/SOT457

TYPE NUMBER	MARKING CODE	PACKAGE
BZA456A	Z6	SC-74/SOT457
BZA462A	Z2t	SC-74/SOT457
BZV10	BZV10	SOD68 (DO34)
BZV11	BZV11	SOD68 (DO34)
BZV12	BZV12	SOD68 (DO34)
BZV13	BZV13	SOD68 (DO34)
BZV14	BZV14	SOD68 (DO34)
BZV37	BZV37	SOD68 (DO34)
BZV49-C2V4	2Y4	SC-62/SOT89
BZV49-C2V7	2Y7	SC-62/SOT89
BZV49-C3V0	3Y0	SC-62/SOT89
BZV49-C3V3	3Y3	SC-62/SOT89
BZV49-C3V6	3Y6	SC-62/SOT89
BZV49-C3V9	3Y9	SC-62/SOT89
BZV49-C4V3	4Y3	SC-62/SOT89
BZV49-C4V7	4Y7	SC-62/SOT89
BZV49-C5V1	5Y1	SC-62/SOT89
BZV49-C5V6	5Y6	SC-62/SOT89
BZV49-C6V2	6Y2	SC-62/SOT89
BZV49-C6V8	6Y8	SC-62/SOT89
BZV49-C7V5	7Y5	SC-62/SOT89
BZV49-C8V2	8Y2	SC-62/SOT89
BZV49-C9V1	9Y1	SC-62/SOT89
BZV49-C10	10Y	SC-62/SOT89
BZV49-C11	11Y	SC-62/SOT89
BZV49-C12	12Y	SC-62/SOT89
BZV49-C13	13Y	SC-62/SOT89
BZV49-C15	15Y	SC-62/SOT89
BZV49-C16	16Y	SC-62/SOT89
BZV49-C18	18Y	SC-62/SOT89
BZV49-C20	20Y	SC-62/SOT89
BZV49-C22	22Y	SC-62/SOT89
BZV49-C24	24Y	SC-62/SOT89
BZV49-C27	27Y	SC-62/SOT89
BZV49-C30	30Y	SC-62/SOT89
BZV49-C33	33Y	SC-62/SOT89
BZV49-C36	36Y	SC-62/SOT89
BZV49-C39	39Y	SC-62/SOT89
BZV49-C43	43Y	SC-62/SOT89
BZV49-C47	47Y	SC-62/SOT89

TYPE NUMBER	MARKING CODE	PACKAGE
BZV49-C51	51Y	SC-62/SOT89
BZV49-C56	56Y	SC-62/SOT89
BZV49-C62	62Y	SC-62/SOT89
BZV49-C68	68Y	SC-62/SOT89
BZV49-C75	75Y	SC-62/SOT89
BZV55-B2V4	yellow	SOD80C
BZV55-B2V7	yellow	SOD80C
BZV55-B3V0	yellow	SOD80C
BZV55-B3V3	yellow	SOD80C
BZV55-B3V6	yellow	SOD80C
BZV55-B3V9	yellow	SOD80C
BZV55-B4V3	yellow	SOD80C
BZV55-B4V7	yellow	SOD80C
BZV55-B5V1	yellow	SOD80C
BZV55-B5V6	yellow	SOD80C
BZV55-B6V2	yellow	SOD80C
BZV55-B6V8	yellow	SOD80C
BZV55-B7V5	yellow	SOD80C
BZV55-B8V2	yellow	SOD80C
BZV55-B9V1	yellow	SOD80C
BZV55-B10	yellow	SOD80C
BZV55-B11	yellow	SOD80C
BZV55-B12	yellow	SOD80C
BZV55-B13	yellow	SOD80C
BZV55-B15	yellow	SOD80C
BZV55-B16	yellow	SOD80C
BZV55-B18	yellow	SOD80C
BZV55-B20	yellow	SOD80C
BZV55-B22	yellow	SOD80C
BZV55-B24	yellow	SOD80C
BZV55-B27	yellow	SOD80C
BZV55-B30	yellow	SOD80C
BZV55-B33	yellow	SOD80C
BZV55-B36	yellow	SOD80C
BZV55-B39	yellow	SOD80C
BZV55-B43	yellow	SOD80C
BZV55-B47	yellow	SOD80C
BZV55-B51	yellow	SOD80C
BZV55-B56	yellow	SOD80C
BZV55-B62	yellow	SOD80C

TYPE NUMBER	MARKING CODE	PACKAGE
BZV55-B68	yellow	SOD80C
BZV55-B75	yellow	SOD80C
BZV55-C2V4	yellow	SOD80C
BZV55-C2V7	yellow	SOD80C
BZV55-C3V0	yellow	SOD80C
BZV55-C3V3	yellow	SOD80C
BZV55-C3V6	yellow	SOD80C
BZV55-C3V9	yellow	SOD80C
BZV55-C4V3	yellow	SOD80C
BZV55-C4V7	yellow	SOD80C
BZV55-C5V1	yellow	SOD80C
BZV55-C5V6	yellow	SOD80C
BZV55-C6V2	yellow	SOD80C
BZV55-C6V8	yellow	SOD80C
BZV55-C7V5	yellow	SOD80C
BZV55-C8V2	yellow	SOD80C
BZV55-C9V1	yellow	SOD80C
BZV55-C10	yellow	SOD80C
BZV55-C11	yellow	SOD80C
BZV55-C12	yellow	SOD80C
BZV55-C13	yellow	SOD80C
BZV55-C15	yellow	SOD80C
BZV55-C16	yellow	SOD80C
BZV55-C18	yellow	SOD80C
BZV55-C20	yellow	SOD80C
BZV55-C22	yellow	SOD80C
BZV55-C24	yellow	SOD80C
BZV55-C27	yellow	SOD80C
BZV55-C30	yellow	SOD80C
BZV55-C33	yellow	SOD80C
BZV55-C36	yellow	SOD80C
BZV55-C39	yellow	SOD80C
BZV55-C43	yellow	SOD80C
BZV55-C47	yellow	SOD80C
BZV55-C51	yellow	SOD80C
BZV55-C56	yellow	SOD80C
BZV55-C62	yellow	SOD80C
BZV55-C68	yellow	SOD80C
BZV55-C75	yellow	SOD80C
BZV85-C3V6	C3V6 PH	SOD66 (DO41)

TYPE NUMBER	MARKING CODE	PACKAGE
BZV85-C3V9	C3V9 PH	SOD66 (DO41)
BZV85-C4V3	C4V3 PH	SOD66 (DO41)
BZV85-C4V7	C4V7 PH	SOD66 (DO41)
BZV85-C5V1	C5V1 PH	SOD66 (DO41)
BZV85-C5V6	C5V6 PH	SOD66 (DO41)
BZV85-C6V2	C6V2 PH	SOD66 (DO41)
BZV85-C6V8	C6V8 PH	SOD66 (DO41)
BZV85-C7V5	C7V5 PH	SOD66 (DO41)
BZV85-C8V2	C8V2 PH	SOD66 (DO41)
BZV85-C9V1	C9V1 PH	SOD66 (DO41)
BZV85-C10	C10 PH	SOD66 (DO41)
BZV85-C11	C11 PH	SOD66 (DO41)
BZV85-C12	C12 PH	SOD66 (DO41)
BZV85-C13	C13 PH	SOD66 (DO41)
BZV85-C15	C15 PH	SOD66 (DO41)
BZV85-C16	C16 PH	SOD66 (DO41)
BZV85-C18	C18 PH	SOD66 (DO41)
BZV85-C20	C20 PH	SOD66 (DO41)
BZV85-C22	C22 PH	SOD66 (DO41)
BZV85-C24	C24 PH	SOD66 (DO41)
BZV85-C27	C27 PH	SOD66 (DO41)
BZV85-C30	C30 PH	SOD66 (DO41)
BZV85-C33	C33 PH	SOD66 (DO41)
BZV85-C36	C36 PH	SOD66 (DO41)
BZV85-C39	C39 PH	SOD66 (DO41)
BZV85-C43	C43 PH	SOD66 (DO41)
BZV85-C47	C47 PH	SOD66 (DO41)
BZV85-C51	C51 PH	SOD66 (DO41)
BZV85-C56	C56 PH	SOD66 (DO41)
BZV85-C62	C62 PH	SOD66 (DO41)
BZV85-C68	C68 PH	SOD66 (DO41)
BZV85-C75	C75 PH	SOD66 (DO41)
BZV86-1V4	BZV86 1V4 PH	SOD27 (DO35)
BZV86-2V0	BZV86 2V0 PH	SOD27 (DO35)
BZV86-2V6	BZV86 2V6 PH	SOD27 (DO35)
BZV86-3V2	BZV86 3V2 PH	SOD27 (DO35)
BZV90-C2V4	BZV90C2V4	SC-73/SOT223
BZV90-C2V7	BZV90C2V7	SC-73/SOT223
BZV90-C3V0	BZV90C3V0	SC-73/SOT223
BZV90-C3V3	BZV90C3V3	SC-73/SOT223

TYPE NUMBER	MARKING CODE	PACKAGE
BZV90-C3V6	BZV90C3V6	SC-73/SOT223
BZV90-C3V9	BZV90C3V9	SC-73/SOT223
BZV90-C4V3	BZV90C4V3	SC-73/SOT223
BZV90-C4V7	BZV90C4V7	SC-73/SOT223
BZV90-C5V1	BZV90C5V1	SC-73/SOT223
BZV90-C5V6	BZV90C5V6	SC-73/SOT223
BZV90-C6V2	BZV90C6V2	SC-73/SOT223
BZV90-C6V8	BZV90C6V8	SC-73/SOT223
BZV90-C7V5	BZV90C7V5	SC-73/SOT223
BZV90-C8V2	BZV90C8V2	SC-73/SOT223
BZV90-C9V1	BZV90C9V1	SC-73/SOT223
BZV90-C10	BZV90C10	SC-73/SOT223
BZV90-C11	BZV90C11	SC-73/SOT223
BZV90-C12	BZV90C12	SC-73/SOT223
BZV90-C13	BZV90C13	SC-73/SOT223
BZV90-C15	BZV90C15	SC-73/SOT223
BZV90-C16	BZV90C16	SC-73/SOT223
BZV90-C18	BZV90C18	SC-73/SOT223
BZV90-C20	BZV90C20	SC-73/SOT223
BZV90-C22	BZV90C22	SC-73/SOT223
BZV90-C24	BZV90C24	SC-73/SOT223
BZV90-C27	BZV90C27	SC-73/SOT223
BZV90-C30	BZV90C30	SC-73/SOT223
BZV90-C33	BZV90C33	SC-73/SOT223
BZV90-C36	BZV90C36	SC-73/SOT223
BZV90-C39	BZV90C39	SC-73/SOT223
BZV90-C43	BZV90C43	SC-73/SOT223
BZV90-C47	BZV90C47	SC-73/SOT223
BZV90-C51	BZV90C51	SC-73/SOT223
BZV90-C56	BZV90C56	SC-73/SOT223
BZV90-C62	BZV90C62	SC-73/SOT223
BZV90-C68	BZV90C68	SC-73/SOT223
BZV90-C75	BZV90C75	SC-73/SOT223
BZX79-A2V4	A2V4 PH	SOD27 (DO35)
BZX79-A2V7	A2V7 PH	SOD27 (DO35)
BZX79-A3V0	A3V0 PH	SOD27 (DO35)
BZX79-A3V3	A3V3 PH	SOD27 (DO35)
BZX79-A3V6	A3V6 PH	SOD27 (DO35)
BZX79-A3V9	A3V9 PH	SOD27 (DO35)
BZX79-A4V3	A4V3 PH	SOD27 (DO35)

TYPE NUMBER	MARKING CODE	PACKAGE
BZX79-A4V7	A4V7 PH	SOD27 (DO35)
BZX79-A5V1	A5V1 PH	SOD27 (DO35)
BZX79-A5V6	A5V6 PH	SOD27 (DO35)
BZX79-A6V2	A6V2 PH	SOD27 (DO35)
BZX79-A6V8	A6V8 PH	SOD27 (DO35)
BZX79-A7V5	A7V5 PH	SOD27 (DO35)
BZX79-A8V2	A8V2 PH	SOD27 (DO35)
BZX79-A9V1	A9V1 PH	SOD27 (DO35)
BZX79-A10	A10 PH	SOD27 (DO35)
BZX79-A11	A11 PH	SOD27 (DO35)
BZX79-A12	A12 PH	SOD27 (DO35)
BZX79-A13	A13 PH	SOD27 (DO35)
BZX79-A15	A15 PH	SOD27 (DO35)
BZX79-A16	A16 PH	SOD27 (DO35)
BZX79-A18	A18 PH	SOD27 (DO35)
BZX79-A20	A20 PH	SOD27 (DO35)
BZX79-A22	A22 PH	SOD27 (DO35)
BZX79-A24	A24 PH	SOD27 (DO35)
BZX79-A27	A27 PH	SOD27 (DO35)
BZX79-A30	A30 PH	SOD27 (DO35)
BZX79-A33	A33 PH	SOD27 (DO35)
BZX79-A36	A36 PH	SOD27 (DO35)
BZX79-A39	A39 PH	SOD27 (DO35)
BZX79-A43	A43 PH	SOD27 (DO35)
BZX79-A47	A47 PH	SOD27 (DO35)
BZX79-A51	A51 PH	SOD27 (DO35)
BZX79-A56	A56 PH	SOD27 (DO35)
BZX79-A62	A62 PH	SOD27 (DO35)
BZX79-A68	A68 PH	SOD27 (DO35)
BZX79-A75	A75 PH	SOD27 (DO35)
BZX79-B2V4	B2V4 PH	SOD27 (DO35)
BZX79-B2V7	B2V7 PH	SOD27 (DO35)
BZX79-B3V0	B3V0 PH	SOD27 (DO35)
BZX79-B3V3	B3V3 PH	SOD27 (DO35)
BZX79-B3V6	B3V6 PH	SOD27 (DO35)
BZX79-B3V9	B3V9 PH	SOD27 (DO35)
BZX79-B4V3	B4V3 PH	SOD27 (DO35)
BZX79-B4V7	B4V7 PH	SOD27 (DO35)
BZX79-B5V1	B5V1 PH	SOD27 (DO35)
BZX79-B5V6	B5V6 PH	SOD27 (DO35)

TYPE NUMBER	MARKING CODE	PACKAGE
BZX79-B6V2	B6V2 PH	SOD27 (DO35)
BZX79-B6V8	B6V8 PH	SOD27 (DO35)
BZX79-B7V5	B7V5 PH	SOD27 (DO35)
BZX79-B8V2	B8V2 PH	SOD27 (DO35)
BZX79-B9V1	B9V1 PH	SOD27 (DO35)
BZX79-B10	B10 PH	SOD27 (DO35)
BZX79-B11	B11 PH	SOD27 (DO35)
BZX79-B12	B12 PH	SOD27 (DO35)
BZX79-B13	B13 PH	SOD27 (DO35)
BZX79-B15	B15 PH	SOD27 (DO35)
BZX79-B16	B16 PH	SOD27 (DO35)
BZX79-B18	B18 PH	SOD27 (DO35)
BZX79-B20	B20 PH	SOD27 (DO35)
BZX79-B22	B22 PH	SOD27 (DO35)
BZX79-B24	B24 PH	SOD27 (DO35)
BZX79-B27	B27 PH	SOD27 (DO35)
BZX79-B30	B30 PH	SOD27 (DO35)
BZX79-B33	B33 PH	SOD27 (DO35)
BZX79-B36	B36 PH	SOD27 (DO35)
BZX79-B39	B39 PH	SOD27 (DO35)
BZX79-B43	B43 PH	SOD27 (DO35)
BZX79-B47	B47 PH	SOD27 (DO35)
BZX79-B51	B51 PH	SOD27 (DO35)
BZX79-B56	B56 PH	SOD27 (DO35)
BZX79-B62	B62 PH	SOD27 (DO35)
BZX79-B68	B68 PH	SOD27 (DO35)
BZX79-B75	B75 PH	SOD27 (DO35)
BZX79-C2V4	C2V4 PH	SOD27 (DO35)
BZX79-C2V7	C2V7 PH	SOD27 (DO35)
BZX79-C3V0	C3V0 PH	SOD27 (DO35)
BZX79-C3V3	C3V3 PH	SOD27 (DO35)
BZX79-C3V6	C3V6 PH	SOD27 (DO35)
BZX79-C3V9	C3V9 PH	SOD27 (DO35)
BZX79-C4V3	C4V3 PH	SOD27 (DO35)
BZX79-C4V7	C4V7 PH	SOD27 (DO35)
BZX79-C5V1	C5V1 PH	SOD27 (DO35)
BZX79-C5V6	C5V6 PH	SOD27 (DO35)
BZX79-C6V2	C6V2 PH	SOD27 (DO35)
BZX79-C6V8	C6V8 PH	SOD27 (DO35)
BZX79-C7V5	C7V5 PH	SOD27 (DO35)

TYPE NUMBER	MARKING CODE	PACKAGE
BZX79-C8V2	C8V2 PH	SOD27 (DO35)
BZX79-C9V1	C9V1 PH	SOD27 (DO35)
BZX79-C10	C10 PH	SOD27 (DO35)
BZX79-C11	C11 PH	SOD27 (DO35)
BZX79-C12	C12 PH	SOD27 (DO35)
BZX79-C13	C13 PH	SOD27 (DO35)
BZX79-C15	C15 PH	SOD27 (DO35)
BZX79-C16	C16 PH	SOD27 (DO35)
BZX79-C18	C18 PH	SOD27 (DO35)
BZX79-C20	C20 PH	SOD27 (DO35)
BZX79-C22	C22 PH	SOD27 (DO35)
BZX79-C24	C24 PH	SOD27 (DO35)
BZX79-C27	C27 PH	SOD27 (DO35)
BZX79-C30	C30 PH	SOD27 (DO35)
BZX79-C33	C33 PH	SOD27 (DO35)
BZX79-C36	C36 PH	SOD27 (DO35)
BZX79-C39	C39 PH	SOD27 (DO35)
BZX79-C43	C43 PH	SOD27 (DO35)
BZX79-C47	C47 PH	SOD27 (DO35)
BZX79-C51	C51 PH	SOD27 (DO35)
BZX79-C56	C56 PH	SOD27 (DO35)
BZX79-C62	C62 PH	SOD27 (DO35)
BZX79-C68	C68 PH	SOD27 (DO35)
BZX79-C75	C75 PH	SOD27 (DO35)
BZX84-A2V4	Y50	SOT23
BZX84-A2V7	Y51	SOT23
BZX84-A3V0	Y52	SOT23
BZX84-A3V3	Y53	SOT23
BZX84-A3V6	Y54	SOT23
BZX84-A3V9	Y55	SOT23
BZX84-A4V3	Y56	SOT23
BZX84-A4V7	Y57	SOT23
BZX84-A5V1	Y58	SOT23
BZX84-A5V6	Y59	SOT23
BZX84-A6V2	Y60	SOT23
BZX84-A6V8	Y61	SOT23
BZX84-A7V5	Y62	SOT23
BZX84-A8V2	Y63	SOT23
BZX84-A9V1	Y64	SOT23
BZX84-A10	Y65	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BZX84-A11	Y66	SOT23
BZX84-A12	Y67	SOT23
BZX84-A13	Y68	SOT23
BZX84-A15	Y69	SOT23
BZX84-A16	Y70	SOT23
BZX84-A18	Y71	SOT23
BZX84-A20	Y72	SOT23
BZX84-A22	Y73	SOT23
BZX84-A24	Y74	SOT23
BZX84-A27	Y75	SOT23
BZX84-A30	Y76	SOT23
BZX84-A33	Y77	SOT23
BZX84-A36	Y78	SOT23
BZX84-A39	Y79	SOT23
BZX84-A43	Y80	SOT23
BZX84-A47	Y81	SOT23
BZX84-A51	Y82	SOT23
BZX84-A56	Y83	SOT23
BZX84-A62	Y84	SOT23
BZX84-A68	Y85	SOT23
BZX84-A75	Y86	SOT23
BZX84-B2V4	Z50	SOT23
BZX84-B2V7	Z51	SOT23
BZX84-B3V0	Z52	SOT23
BZX84-B3V3	Z53	SOT23
BZX84-B3V6	Z54	SOT23
BZX84-B3V9	Z55	SOT23
BZX84-B4V3	Z56	SOT23
BZX84-B4V7	Z57	SOT23
BZX84-B5V1	Z58	SOT23
BZX84-B5V6	Z59	SOT23
BZX84-B6V2	Z60	SOT23
BZX84-B6V8	Z61	SOT23
BZX84-B7V5	Z62	SOT23
BZX84-B8V2	Z63	SOT23
BZX84-B9V1	Z64	SOT23
BZX84-B10	Z65	SOT23
BZX84-B11	Z66	SOT23
BZX84-B12	Z67	SOT23
BZX84-B13	Z68	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BZX84-B15	Z69	SOT23
BZX84-B16	Z70	SOT23
BZX84-B18	Z71	SOT23
BZX84-B20	Z72	SOT23
BZX84-B22	Z73	SOT23
BZX84-B24	Z74	SOT23
BZX84-B27	Z75	SOT23
BZX84-B30	Z76	SOT23
BZX84-B33	Z77	SOT23
BZX84-B36	Z78	SOT23
BZX84-B39	Z79	SOT23
BZX84-B43	Z80	SOT23
BZX84-B47	Z81	SOT23
BZX84-B51	Z82	SOT23
BZX84-B56	Z83	SOT23
BZX84-B62	Z84	SOT23
BZX84-B68	Z85	SOT23
BZX84-B75	Z86	SOT23
BZX84-C2V4	Z11	SOT23
BZX84-C2V7	Z12	SOT23
BZX84-C3V0	Z13	SOT23
BZX84-C3V3	Z14	SOT23
BZX84-C3V6	Z15	SOT23
BZX84-C3V9	Z16	SOT23
BZX84-C4V3	Z17	SOT23
BZX84-C4V7	Z1p; Z1t	SOT23
BZX84-C5V1	Z2p; Z2t	SOT23
BZX84-C5V6	Z3p; Z3t	SOT23
BZX84-C6V2	Z4p; Z4t	SOT23
BZX84-C6V8	Z5p; Z5t	SOT23
BZX84-C7V5	Z6p; Z6t	SOT23
BZX84-C8V2	Z7p; Z7t	SOT23
BZX84-C9V1	Z8p; Z8t	SOT23
BZX84-C10	Z9p; Z9t	SOT23
BZX84-C11	Y1p; Y1t	SOT23
BZX84-C12	Y2p; Y2t	SOT23
BZX84-C13	Y3p; Y3t	SOT23
BZX84-C15	Y4p; Y4t	SOT23
BZX84-C16	Y5p; Y5t	SOT23
BZX84-C18	Y6p; Y6t	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BZX84-C20	Y7p; Y7t	SOT23
BZX84-C22	Y8p; Y8t	SOT23
BZX84-C24	Y9p; Y9t	SOT23
BZX84-C27	Y10	SOT23
BZX84-C30	Y11	SOT23
BZX84-C33	Y12	SOT23
BZX84-C36	Y13	SOT23
BZX84-C39	Y14	SOT23
BZX84-C43	Y15	SOT23
BZX84-C47	Y16	SOT23
BZX84-C51	Y17	SOT23
BZX84-C56	Y18	SOT23
BZX84-C62	Y19	SOT23
BZX84-C68	Y20	SOT23
BZX84-C75	Y21	SOT23
BZX99-C2V4	XL	SOT23
BZX99-C2V7	XM	SOT23
BZX99-C3V0	XN	SOT23
BZX99-C3V3	XP	SOT23
BZX99-C3V6	XR	SOT23
BZX99-C3V9	XS	SOT23
BZX99-C4V3	XT	SOT23
BZX99-C4V7	XA	SOT23
BZX99-C5V1	XB	SOT23
BZX99-C5V6	XC	SOT23
BZX99-C6V2	XD	SOT23
BZX99-C6V8	XE	SOT23
BZX99-C7V5	XU	SOT23
BZX99-C8V2	XV	SOT23
BZX99-C9V1	XW	SOT23
BZX99-C10	XX	SOT23
BZX99-C11	XY	SOT23
BZX99-C12	XZ	SOT23
BZX99-C13	X2	SOT23
BZX99-C15	X3	SOT23
BZX284-B2V4	WO	SOD110
BZX284-B2V7	WP	SOD110
BZX284-B3V0	WQ	SOD110
BZX284-B3V3	WR	SOD110
BZX284-B3V6	WS	SOD110

TYPE NUMBER	MARKING CODE	PACKAGE
BZX284-B3V9	WT	SOD110
BZX284-B4V3	WU	SOD110
BZX284-B4V7	WV	SOD110
BZX284-B5V1	WW	SOD110
BZX284-B5V6	WX	SOD110
BZX284-B6V2	WY	SOD110
BZX284-B6V8	WZ	SOD110
BZX284-B7V5	XA	SOD110
BZX284-B8V2	XB	SOD110
BZX284-B9V1	XC	SOD110
BZX284-B10	XD	SOD110
BZX284-B11	XE	SOD110
BZX284-B12	XF	SOD110
BZX284-B13	XG	SOD110
BZX284-B15	XH	SOD110
BZX284-B16	XI	SOD110
BZX284-B18	XJ	SOD110
BZX284-B20	XK	SOD110
BZX284-B22	XL	SOD110
BZX284-B24	XM	SOD110
BZX284-B27	XN	SOD110
BZX284-B30	XO	SOD110
BZX284-B33	XP	SOD110
BZX284-B36	XQ	SOD110
BZX284-B39	XR	SOD110
BZX284-B43	XS	SOD110
BZX284-B47	XT	SOD110
BZX284-B51	XU	SOD110
BZX284-B56	XV	SOD110
BZX284-B62	XW	SOD110
BZX284-B68	XX	SOD110
BZX284-B75	XY	SOD110
BZX284-C2V4	YO	SOD110
BZX284-C2V7	YP	SOD110
BZX284-C3V0	YQ	SOD110
BZX284-C3V3	YR	SOD110
BZX284-C3V6	YS	SOD110
BZX284-C3V9	YT	SOD110
BZX284-C4V3	YU	SOD110
BZX284-C4V7	YV	SOD110

TYPE NUMBER	MARKING CODE	PACKAGE
BZX284-C5V1	YW	SOD110
BZX284-C5V6	YX	SOD110
BZX284-C6V2	YY	SOD110
BZX284-C6V8	YZ	SOD110
BZX284-C7V5	ZA	SOD110
BZX284-C8V2	ZB	SOD110
BZX284-C9V1	ZC	SOD110
BZX284-C10	ZD	SOD110
BZX284-C11	ZE	SOD110
BZX284-C12	ZF	SOD110
BZX284-C13	ZG	SOD110
BZX284-C15	ZH	SOD110
BZX284-C16	ZI	SOD110
BZX284-C18	ZJ	SOD110
BZX284-C20	ZK	SOD110
BZX284-C22	ZL	SOD110
BZX284-C24	ZM	SOD110
BZX284-C27	ZN	SOD110
BZX284-C30	ZO	SOD110
BZX284-C33	ZP	SOD110
BZX284-C36	ZQ	SOD110
BZX284-C39	ZR	SOD110
BZX284-C43	ZS	SOD110
BZX284-C47	ZT	SOD110
BZX284-C51	ZU	SOD110
BZX284-C56	ZV	SOD110
BZX284-C62	ZW	SOD110
BZX284-C68	ZX	SOD110
BZX284-C75	ZY	SOD110
BZX399-C1V8	B1	SC-76/SOD323
BZX399-C2V0	B2	SC-76/SOD323
BZX399-C2V2	B3	SC-76/SOD323
BZX399-C2V4	B4	SC-76/SOD323
BZX399-C2V7	B5	SC-76/SOD323
BZX399-C3V0	B6	SC-76/SOD323
BZX399-C3V3	B7	SC-76/SOD323
BZX399-C3V6	B8	SC-76/SOD323
BZX399-C3V9	B9	SC-76/SOD323
BZX399-C4V3	B0	SC-76/SOD323
BZX399-C4V7	BA	SC-76/SOD323

TYPE NUMBER	MARKING CODE	PACKAGE
BZX399-C5V1	BB	SC-76/SOD323
BZX399-C5V6	BC	SC-76/SOD323
BZX399-C6V2	BD	SC-76/SOD323
BZX399-C6V8	BE	SC-76/SOD323
BZX399-C7V5	BF	SC-76/SOD323
BZX399-C8V2	BG	SC-76/SOD323
BZX399-C9V1	BH	SC-76/SOD323
BZX399-C10	BJ	SC-76/SOD323
BZX399-C11	BK	SC-76/SOD323
BZX399-C12	BL	SC-76/SOD323
BZX399-C13	BM	SC-76/SOD323
BZX399-C15	BN	SC-76/SOD323
BZX399-C16	BP	SC-76/SOD323
BZX399-C18	BQ	SC-76/SOD323
BZX399-C20	BR	SC-76/SOD323
BZX399-C22	BS	SC-76/SOD323
BZX399-C24	BT	SC-76/SOD323
BZX399-C27	BU	SC-76/SOD323
BZX399-C30	BV	SC-76/SOD323
BZX399-C33	BW	SC-76/SOD323
BZX399-C36	BX	SC-76/SOD323
BZX399-C39	BY	SC-76/SOD323
BZX399-C43	BZ	SC-76/SOD323
PBYR2100CT	BYR210	SC-73/SOT223
PBYR2150CT	BYR215	SC-73/SOT223
PDZ2.4B	Z0	SC-76/SOD323
PDZ2.7B	Z1	SC-76/SOD323
PDZ3.0B	Z2	SC-76/SOD323
PDZ3.3B	Z3	SC-76/SOD323
PDZ3.6B	Z4	SC-76/SOD323
PDZ3.9B	Z5	SC-76/SOD323
PDZ4.3B	Z6	SC-76/SOD323
PDZ4.7B	Z7	SC-76/SOD323
PDZ5.1B	Z8	SC-76/SOD323
PDZ5.6B	Z9	SC-76/SOD323
PDZ6.2B	ZA	SC-76/SOD323
PDZ6.8B	ZB	SC-76/SOD323
PDZ7.5B	ZC	SC-76/SOD323
PDZ8.2B	ZD	SC-76/SOD323
PDZ9.1B	ZE	SC-76/SOD323

TYPE NUMBER	MARKING CODE	PACKAGE
PDZ10B	ZF	SC-76/SOD323
PDZ11B	ZG	SC-76/SOD323
PDZ12B	ZH	SC-76/SOD323
PDZ13B	ZJ	SC-76/SOD323
PDZ15B	ZK	SC-76/SOD323
PDZ16B	ZL	SC-76/SOD323
PDZ18B	ZM	SC-76/SOD323
PDZ20B	ZN	SC-76/SOD323
PDZ22B	ZP	SC-76/SOD323
PDZ24B	ZQ	SC-76/SOD323
PDZ27B	ZR	SC-76/SOD323
PDZ30B	ZS	SC-76/SOD323
PDZ33B	ZT	SC-76/SOD323
PDZ36B	ZU	SC-76/SOD323
PLVA450A	450A PH	SOD27 (DO35)
PLVA453A	453A PH	SOD27 (DO35)
PLVA456A	456A PH	SOD27 (DO35)
PLVA459A	459A PH	SOD27 (DO35)
PLVA462A	462A PH	SOD27 (DO35)
PLVA465A	465A PH	SOD27 (DO35)
PLVA468A	468A PH	SOD27 (DO35)
PLVA650A	p9A; t9A	SOT23
PLVA653A	p9B; t9B	SOT23
PLVA656A	p9C; t9C	SOT23
PLVA659A	p9D; t9D	SOT23
PLVA662A	p9E; t9E	SOT23
PLVA665A	p9F; t9F	SOT23
PLVA668A	p9G; t9G	SOT23
PLVA2650A	p9J; t9J	SOT23
PLVA2653A	p9K; t9K	SOT23
PLVA2656A	p9L; t9L	SOT23
PLVA2659A	p9M; t9M	SOT23
PLVA2662A	p9N; t9N	SOT23
PLVA2665A	p9O; t9O	SOT23
PLVA2668A	p9P; t9P	SOT23
PMBD353	p4f; t4f	SOT23
PMBD914	p5D; t5D	SOT23
PMBD6050	p5A; t5A	SOT23
PMBD6100	p5B; t5B	SOT23
PMBD7000	p5C; t5C	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
PMBZ5226B	p8A; t8A	SOT23
PMBZ5227B	p8B; t8B	SOT23
PMBZ5228B	p8C; t8C	SOT23
PMBZ5229B	p8D; t8D	SOT23
PMBZ5230B	p8E; t8E	SOT23
PMBZ5231B	p8F; t8F	SOT23
PMBZ5232B	p8G; t8G	SOT23
PMBZ5233B	p8H; t8H	SOT23
PMBZ5234B	p8J; t8J	SOT23
PMBZ5235B	p8K; t8K	SOT23
PMBZ5236B	p8L; t8L	SOT23
PMBZ5237B	p8M; t8M	SOT23
PMBZ5238B	p8N; t8N	SOT23
PMBZ5239B	p8P; t8P	SOT23
PMBZ5240B	p8Q; t8Q	SOT23
PMBZ5241B	p8R; t8R	SOT23
PMBZ5242B	p8S; t8S	SOT23
PMBZ5243B	p8T; t8T	SOT23
PMBZ5244B	p8U; t8U	SOT23
PMBZ5245B	p8V; t8V	SOT23
PMBZ5246B	p8W; t8W	SOT23
PMBZ5247B	p8X; t8X	SOT23
PMBZ5248B	p8Y; t8Y	SOT23
PMBZ5249B	p8Z; t8Z	SOT23
PMBZ5250B	81A	SOT23
PMBZ5251B	81B	SOT23
PMBZ5252B	81C	SOT23
PMBZ5253B	81D	SOT23
PMBZ5254B	81E	SOT23
PMBZ5255B	81F	SOT23
PMBZ5256B	81G	SOT23
PMBZ5257B	81H	SOT23
PMLL4148	black	SOD80C
PMLL4150	black	SOD80C
PMLL4151	black	SOD80C
PMLL4153	black	SOD80C
PMLL4448	black	SOD80C
PRLL5817	9	SOD87
PRLL5818	9	SOD87
PRLL5819	9	SOD87

TYPE NUMBER	MARKING CODE	PACKAGE
PZM2.4NB	2V4	SC-59/SOT346
PZM2.4NBA	2A4	SC-59/SOT346
PZM2.7NB	2V7	SC-59/SOT346
PZM2.7NB1	271	SC-59/SOT346
PZM2.7NB2	272	SC-59/SOT346
PZM2.7NB2A	2A7	SC-59/SOT346
PZM3.0NB	3V0	SC-59/SOT346
PZM3.0NB1	301	SC-59/SOT346
PZM3.0NB2	302	SC-59/SOT346
PZM3.0NB2A	3A0	SC-59/SOT346
PZM3.3NB	3V3	SC-59/SOT346
PZM3.3NB1	331	SC-59/SOT346
PZM3.3NB2	332	SC-59/SOT346
PZM3.3NB2A	3A3	SC-59/SOT346
PZM3.6NB	3V6	SC-59/SOT346
PZM3.6NB1	361	SC-59/SOT346
PZM3.6NB2	362	SC-59/SOT346
PZM3.6NB2A	3A6	SC-59/SOT346
PZM3.9NB	3V9	SC-59/SOT346
PZM3.9NB1	391	SC-59/SOT346
PZM3.9NB2	392	SC-59/SOT346
PZM3.9NB2A	3A9	SC-59/SOT346
PZM4.3NB	4V3	SC-59/SOT346
PZM4.3NB1	431	SC-59/SOT346
PZM4.3NB2	432	SC-59/SOT346
PZM4.3NB2A	4A3	SC-59/SOT346
PZM4.3NB3	433	SC-59/SOT346
PZM4.7NB	4V7	SC-59/SOT346
PZM4.7NB1	471	SC-59/SOT346
PZM4.7NB2	472	SC-59/SOT346
PZM4.7NB2A	4A7	SC-59/SOT346
PZM4.7NB3	473	SC-59/SOT346
PZM5.1NB	5V1	SC-59/SOT346
PZM5.1NB1	511	SC-59/SOT346
PZM5.1NB2	512	SC-59/SOT346
PZM5.1NB2A	5A1	SC-59/SOT346
PZM5.1NB3	513	SC-59/SOT346
PZM5.6NB	5V6	SC-59/SOT346
PZM5.6NB1	561	SC-59/SOT346
PZM5.6NB2	562	SC-59/SOT346

TYPE NUMBER	MARKING CODE	PACKAGE
PZM5.6NB2A	5A6	SC-59/SOT346
PZM5.6NB3	563	SC-59/SOT346
PZM6.2NB	6V2	SC-59/SOT346
PZM6.2NB1	621	SC-59/SOT346
PZM6.2NB2	622	SC-59/SOT346
PZM6.2NB2A	6A2	SC-59/SOT346
PZM6.2NB3	623	SC-59/SOT346
PZM6.8NB	6V8	SC-59/SOT346
PZM6.8NB1	681	SC-59/SOT346
PZM6.8NB2	682	SC-59/SOT346
PZM6.8NB2A	6A8	SC-59/SOT346
PZM6.8NB3	683	SC-59/SOT346
PZM7.5NB	7V5	SC-59/SOT346
PZM7.5NB1	751	SC-59/SOT346
PZM7.5NB2	752	SC-59/SOT346
PZM7.5NB2A	7A5	SC-59/SOT346
PZM7.5NB3	753	SC-59/SOT346
PZM8.2NB	8V2	SC-59/SOT346
PZM8.2NB1	821	SC-59/SOT346
PZM8.2NB2	822	SC-59/SOT346
PZM8.2NB2A	8A2	SC-59/SOT346
PZM8.2NB3	823	SC-59/SOT346
PZM9.1NB	9V1	SC-59/SOT346
PZM9.1NB1	911	SC-59/SOT346
PZM9.1NB2	912	SC-59/SOT346
PZM9.1NB2A	9A1	SC-59/SOT346
PZM9.1NB3	913	SC-59/SOT346
PZM10NB	10V	SC-59/SOT346
PZM10NB1	101	SC-59/SOT346
PZM10NB2	102	SC-59/SOT346
PZM10NB2A	10A	SC-59/SOT346
PZM10NB3	103	SC-59/SOT346
PZM11NB	11V	SC-59/SOT346
PZM11NB1	111	SC-59/SOT346
PZM11NB2	112	SC-59/SOT346
PZM11NB2A	11A	SC-59/SOT346
PZM11NB3	113	SC-59/SOT346
PZM12NB	12V	SC-59/SOT346
PZM12NB1	121	SC-59/SOT346
PZM12NB2	122	SC-59/SOT346

TYPE NUMBER	MARKING CODE	PACKAGE
PZM12NB2A	12A	SC-59/SOT346
PZM12NB3	123	SC-59/SOT346
PZM13NB	13V	SC-59/SOT346
PZM13NB1	131	SC-59/SOT346
PZM13NB2	132	SC-59/SOT346
PZM13NB2A	13A	SC-59/SOT346
PZM13NB3	133	SC-59/SOT346
PZM15NB	15V	SC-59/SOT346
PZM15NB1	151	SC-59/SOT346
PZM15NB2	152	SC-59/SOT346
PZM15NB2A	15A	SC-59/SOT346
PZM15NB3	153	SC-59/SOT346
PZM16NB	16V	SC-59/SOT346
PZM16NB1	161	SC-59/SOT346
PZM16NB2	162	SC-59/SOT346
PZM16NB3	163	SC-59/SOT346
PZM18NB	18V	SC-59/SOT346
PZM18NB1	181	SC-59/SOT346
PZM18NB2	182	SC-59/SOT346
PZM18NB3	183	SC-59/SOT346
PZM20NB	20V	SC-59/SOT346
PZM20NB1	201	SC-59/SOT346
PZM20NB2	202	SC-59/SOT346
PZM20NB3	203	SC-59/SOT346
PZM22NB	22V	SC-59/SOT346
PZM22NB1	221	SC-59/SOT346
PZM22NB2	222	SC-59/SOT346
PZM22NB3	223	SC-59/SOT346
PZM24NB	24V	SC-59/SOT346
PZM24NB1	241	SC-59/SOT346
PZM24NB2	242	SC-59/SOT346
PZM24NB3	243	SC-59/SOT346
PZM27NB	27V	SC-59/SOT346
PZM30NB	30V	SC-59/SOT346
PZM33NB	33V	SC-59/SOT346
PZM36NB	36V	SC-59/SOT346
PZM39NB	39V	SC-59/SOT346
PZM43NB	43V	SC-59/SOT346
PZM47NB	47V	SC-59/SOT346
PZM51NB	51V	SC-59/SOT346

TYPE NUMBER	MARKING CODE	PACKAGE
PZM56NB	56V	SC-59/SOT346
PZM62NB	62V	SC-59/SOT346
PZM68NB	68V	SC-59/SOT346
PZM75NB	75V	SC-59/SOT346
PZTM1101	TM1101	SC-73/SOT223
PZTM1102	TM1102	SC-73/SOT223

DIODE MARKING CODE TO TYPE NUMBER

MARKING CODE	TYPE NUMBER	PACKAGE
10	1PS59SB10	SC-59/SOT346
101	PZM10NB1	SC-59/SOT346
102	PZM10NB2	SC-59/SOT346
103	PZM10NB3	SC-59/SOT346
10A	PZM10NB2A	SC-59/SOT346
10V	PZM10NB	SC-59/SOT346
10Y	BZV49-C10	SC-62/SOT89
111	PZM11NB1	SC-59/SOT346
112	PZM11NB2	SC-59/SOT346
113	PZM11NB3	SC-59/SOT346
11A	PZM11NB2A	SC-59/SOT346
11V	PZM11NB	SC-59/SOT346
11Y	BZV49-C11	SC-62/SOT89
121	PZM12NB1	SC-59/SOT346
122	PZM12NB2	SC-59/SOT346
123	PZM12NB3	SC-59/SOT346
12A	PZM12NB2A	SC-59/SOT346
12V	PZM12NB	SC-59/SOT346
12Y	BZV49-C12	SC-62/SOT89
131	PZM13NB1	SC-59/SOT346
132	PZM13NB2	SC-59/SOT346
133	PZM13NB3	SC-59/SOT346
13A	PZM13NB2A	SC-59/SOT346
13V	PZM13NB	SC-59/SOT346
13Y	BZV49-C13	SC-62/SOT89
14	1PS59SB14	SC-59/SOT346
15	1PS59SB15	SC-59/SOT346
151	PZM15NB1	SC-59/SOT346
152	PZM15NB2	SC-59/SOT346
153	PZM15NB3	SC-59/SOT346
15A	PZM15NB2A	SC-59/SOT346
15V	PZM15NB	SC-59/SOT346
15Y	BZV49-C15	SC-62/SOT89
16	1PS59SB16	SC-59/SOT346
161	PZM16NB1	SC-59/SOT346
162	PZM16NB2	SC-59/SOT346
163	PZM16NB3	SC-59/SOT346
16V	PZM16NB	SC-59/SOT346
16Y	BZV49-C16	SC-62/SOT89
181	PZM18NB1	SC-59/SOT346
182	PZM18NB2	SC-59/SOT346
183	PZM18NB3	SC-59/SOT346
18V	PZM18NB	SC-59/SOT346
18Y	BZV49-C18	SC-62/SOT89
1N4148 PH	1N4148	SOD27 (DO35)
1N4150 PH	1N4150	SOD27 (DO35)
1N4151 PH	1N4151	SOD27 (DO35)
1N4448 PH	1N4448	SOD27 (DO35)
1N5817	1N5817	SOD81
1N5818	1N5818	SOD81
1N5819	1N5819	SOD81
1N821	1N821	SOD68 (DO34)
1N821A	1N821A	SOD68 (DO34)
1N823	1N823	SOD68 (DO34)
1N823A	1N823A	SOD68 (DO34)
1N825	1N825	SOD68 (DO34)
1N825A	1N825A	SOD68 (DO34)
1N827	1N827	SOD68 (DO34)
1N827A	1N827A	SOD68 (DO34)
1N829	1N829	SOD68 (DO34)
1N829A	1N829A	SOD68 (DO34)
1N914 PH	1N914	SOD27 (DO35)
201	PZM20NB1	SC-59/SOT346
202	PZM20NB2	SC-59/SOT346
203	PZM20NB3	SC-59/SOT346
20V	PZM20NB	SC-59/SOT346
20Y	BZV49-C20	SC-62/SOT89
221	PZM22NB1	SC-59/SOT346
222	PZM22NB2	SC-59/SOT346
223	PZM22NB3	SC-59/SOT346

MARKING CODE	TYPE NUMBER	PACKAGE
22V	PZM22NB	SC-59/SOT346
22Y	BZV49-C22	SC-62/SOT89
241	PZM24NB1	SC-59/SOT346
242	PZM24NB2	SC-59/SOT346
243	PZM24NB3	SC-59/SOT346
24V	PZM24NB	SC-59/SOT346
24Y	BZV49-C24	SC-62/SOT89
271	PZM2.7NB1	SC-59/SOT346
272	PZM2.7NB2	SC-59/SOT346
27V	PZM27NB	SC-59/SOT346
27Y	BZV49-C27	SC-62/SOT89
2A4	PZM2.4NBA	SC-59/SOT346
2A7	PZM2.7NB2A	SC-59/SOT346
2V4	PZM2.4NB	SC-59/SOT346
2V7	PZM2.7NB	SC-59/SOT346
2Y4	BZV49-C2V4	SC-62/SOT89
2Y7	BZV49-C2V7	SC-62/SOT89
301	PZM3.0NB1	SC-59/SOT346
302	PZM3.0NB2	SC-59/SOT346
30V	PZM30NB	SC-59/SOT346
30Y	BZV49-C30	SC-62/SOT89
33V	PZM33NB	SC-59/SOT346
33Y	BZV49-C33	SC-62/SOT89
331	PZM3.3NB1	SC-59/SOT346
332	PZM3.3NB2	SC-59/SOT346
361	PZM3.6NB1	SC-59/SOT346
362	PZM3.6NB2	SC-59/SOT346
36V	PZM36NB	SC-59/SOT346
36Y	BZV49-C36	SC-62/SOT89
391	PZM3.9NB1	SC-59/SOT346
392	PZM3.9NB2	SC-59/SOT346
39V	PZM39NB	SC-59/SOT346
39Y	BZV49-C39	SC-62/SOT89
3A0	PZM3.0NB2A	SC-59/SOT346
3A3	PZM3.3NB2A	SC-59/SOT346
3A6	PZM3.6NB2A	SC-59/SOT346
3A9	PZM3.9NB2A	SC-59/SOT346
3V0	PZM3.0NB	SC-59/SOT346
3V3	PZM3.3NB	SC-59/SOT346
3V6	PZM3.6NB	SC-59/SOT346

MARKING CODE	TYPE NUMBER	PACKAGE
3V9	PZM3.9NB	SC-59/SOT346
3Y0	BZV49-C3V0	SC-62/SOT89
3Y3	BZV49-C3V3	SC-62/SOT89
3Y6	BZV49-C3V6	SC-62/SOT89
3Y9	BZV49-C3V9	SC-62/SOT89
4001	PRLL4001	SOD87
4002	PRLL4002	SOD87
42	BAT54AW	SC-70/SOT323
43	1PS89SB15	SC-89/SOT490
43	BAT54CW	SC-70/SOT323
431	PZM4.3NB1	SC-59/SOT346
432	PZM4.3NB2	SC-59/SOT346
433	PZM4.3NB3	SC-59/SOT346
43V	PZM43NB	SC-59/SOT346
43Y	BZV49-C43	SC-62/SOT89
43p	BAS40	SOT23
43t	BAS40	SOT23
44	1PS89SB14	SC-89/SOT490
44	BAT54SW	SC-70/SOT323
44p	BAS40-04	SOT23
44t	BAS40-04	SOT23
45	1PS89SB16	SC-89/SOT490
45	1PS75SB45	SC-75/SOT416
450A PH	PLVA450A	SOD27 (DO35)
4531PH	1N4531	SOD68 (DO34)
4532PH	1N4532	SOD68 (DO34)
453A PH	PLVA453A	SOD27 (DO35)
456A PH	PLVA456A	SOD27 (DO35)
459A PH	PLVA459A	SOD27 (DO35)
45A PH	BAS45A	SOD68 (DO34)
45p	BAS40-05	SOT23
45t	BAS40-05	SOT23
462A PH	PLVA462A	SOD27 (DO35)
465A PH	PLVA465A	SOD27 (DO35)
468A PH	PLVA468A	SOD27 (DO35)
46p	BAS40-06	SOT23
46t	BAS40-06	SOT23
471	PZM4.7NB1	SC-59/SOT346
472	PZM4.7NB2	SC-59/SOT346
473	PZM4.7NB3	SC-59/SOT346

MARKING CODE	TYPE NUMBER	PACKAGE
4728A P	1N4728A	SOD66 (DO41)
4729A P	1N4729A	SOD66 (DO41)
4730A P	1N4730A	SOD66 (DO41)
4731A P	1N4731A	SOD66 (DO41)
4732A P	1N4732A	SOD66 (DO41)
4733A P	1N4733A	SOD66 (DO41)
4734A P	1N4734A	SOD66 (DO41)
4735A P	1N4735A	SOD66 (DO41)
4736A P	1N4736A	SOD66 (DO41)
4737A P	1N4737A	SOD66 (DO41)
4738A P	1N4738A	SOD66 (DO41)
4739A P	1N4739A	SOD66 (DO41)
4740A P	1N4740A	SOD66 (DO41)
4741A P	1N4741A	SOD66 (DO41)
4742A P	1N4742A	SOD66 (DO41)
4743A P	1N4743A	SOD66 (DO41)
4744A P	1N4744A	SOD66 (DO41)
4745A P	1N4745A	SOD66 (DO41)
4746A P	1N4746A	SOD66 (DO41)
4747A P	1N4747A	SOD66 (DO41)
4748A P	1N4748A	SOD66 (DO41)
4749A P	1N4749A	SOD66 (DO41)
47V	PZM47NB	SC-59/SOT346
47Y	BZV49-C47	SC-62/SOT89
47p	BAS40-07	SOT143B
4A3	PZM4.3NB2A	SC-59/SOT346
4A7	PZM4.7NB2A	SC-59/SOT346
4V3	PZM4.3NB	SC-59/SOT346
4V7	PZM4.7NB	SC-59/SOT346
4Y3	BZV49-C4V3	SC-62/SOT89
4Y7	BZV49-C4V7	SC-62/SOT89
511	PZM5.1NB1	SC-59/SOT346
512	PZM5.1NB2	SC-59/SOT346
513	PZM5.1NB3	SC-59/SOT346
561	PZM5.6NB1	SC-59/SOT346
562	PZM5.6NB2	SC-59/SOT346
563	PZM5.6NB3	SC-59/SOT346
51V	PZM51NB	SC-59/SOT346
51Y	BZV49-C51	SC-62/SOT89
56V	PZM56NB	SC-59/SOT346

MARKING CODE	TYPE NUMBER	PACKAGE
56Y	BZV49-C56	SC-62/SOT89
5A1	PZM5.1NB2A	SC-59/SOT346
5A6	PZM5.6NB2A	SC-59/SOT346
5V1	PZM5.1NB	SC-59/SOT346
5V6	PZM5.6NB	SC-59/SOT346
5Y1	BZV49-C5V1	SC-62/SOT89
5Y6	BZV49-C5V6	SC-62/SOT89
6	BAS516	SC-79/SOD523
621	PZM6.2NB1	SC-59/SOT346
622	PZM6.2NB2	SC-59/SOT346
623	PZM6.2NB3	SC-59/SOT346
62V	PZM62NB	SC-59/SOT346
62Y	BZV49-C62	SC-62/SOT89
63	BAS40W	SC-70/SOT323
64	BAS40-04W	SC-70/SOT323
65	BAS40-05W	SC-70/SOT323
66	BAS40-06W	SC-70/SOT323
681	PZM6.8NB1	SC-59/SOT346
682	PZM6.8NB2	SC-59/SOT346
683	PZM6.8NB3	SC-59/SOT346
68V	PZM68NB	SC-59/SOT346
68Y	BZV49-C68	SC-62/SOT89
6A2	PZM6.2NB2A	SC-59/SOT346
6A8	PZM6.8NB2A	SC-59/SOT346
6V2	PZM6.2NB	SC-59/SOT346
6V8	PZM6.8NB	SC-59/SOT346
6Y2	BZV49-C6V2	SC-62/SOT89
6Y8	BZV49-C6V8	SC-62/SOT89
6t3	1PS70SB40	SC-70/SOT323
6t4	1PS70SB44	SC-70/SOT323
6t5	1PS70SB45	SC-70/SOT323
6t6	1PS70SB46	SC-70/SOT323
6-3	1PS70SB40	SC-70/SOT323
6-4	1PS70SB44	SC-70/SOT323
6-5	1PS70SB45	SC-70/SOT323
6-6	1PS70SB46	SC-70/SOT323
73p	BAS70	SOT23
73t	BAS70	SOT23
73-	BAS70W	SC-70/SOT323
73t	BAS70W	SC-70/SOT323

MARKING CODE	TYPE NUMBER	PACKAGE
74	BAT74S	SC-88/SOT363
74p	BAS70-04	SOT23
74t	BAS70-04	SOT23
74-	BAS70-04W	SC-70/SOT323
74t	BAS70-04W	SC-70/SOT323
751	PZM7.5NB1	SC-59/SOT346
752	PZM7.5NB2	SC-59/SOT346
753	PZM7.5NB3	SC-59/SOT346
75V	PZM75NB	SC-59/SOT346
75Y	BZV49-C75	SC-62/SOT89
75p	BAS70-05	SOT23
75t	BAS70-05	SOT23
75-	BAS70-05W	SC-70/SOT323
75t	BAS70-05W	SC-70/SOT323
76p	BAS70-06	SOT23
76t	BAS70-06	SOT23
76-	BAS70-06W	SC-70/SOT323
76t	BAS70-06W	SC-70/SOT323
77	BAS70-07S	SC-88/SOT363
77p	BAS70-07	SOT143B
7A5	PZM7.5NB2A	SC-59/SOT346
7V5	PZM7.5NB	SC-59/SOT346
7Y5	BZV49-C7V5	SC-62/SOT89
7t0	1PS79SB10	SC-70/SOT323
7t4	1PS79SB14	SC-70/SOT323
7t5	1PS79SB15	SC-70/SOT323
7t6	1PS79SB16	SC-70/SOT323
7-0	1PS79SB10	SC-70/SOT323
7-4	1PS79SB14	SC-70/SOT323
7-5	1PS79SB15	SC-70/SOT323
7-6	1PS79SB16	SC-70/SOT323
81A	PMBZ5250B	SOT23
81B	PMBZ5251B	SOT23
81C	PMBZ5252B	SOT23
81D	PMBZ5253B	SOT23
81E	PMBZ5254B	SOT23
81F	PMBZ5255B	SOT23
81G	PMBZ5256B	SOT23
81H	PMBZ5257B	SOT23
821	PZM8.2NB1	SC-59/SOT346

MARKING CODE	TYPE NUMBER	PACKAGE
822	PZM8.2NB2	SC-59/SOT346
823	PZM8.2NB3	SC-59/SOT346
8A2	PZM8.2NB2A	SC-59/SOT346
8V2	PZM8.2NB	SC-59/SOT346
8Y2	BZV49-C8V2	SC-62/SOT89
8t5	1PS88SB48	SC-88/SOT363
9	PRLL5817	SOD87
9	PRLL5818	SOD87
9	PRLL5819	SOD87
911	PZM9.1NB1	SC-59/SOT346
912	PZM9.1NB2	SC-59/SOT346
913	PZM9.1NB3	SC-59/SOT346
9A1	PZM9.1NB2A	SC-59/SOT346
9V1	PZM9.1NB	SC-59/SOT346
9Y1	BZV49-C9V1	SC-62/SOT89
A1	BAW56W	SC-70/SOT323
A1	BAW56T	SC-75/SOT416
A10 PH	BZX79-A10	SOD27 (DO35)
A11 PH	BZX79-A11	SOD27 (DO35)
A12 PH	BZX79-A12	SOD27 (DO35)
A13 PH	BZX79-A13	SOD27 (DO35)
A15 PH	BZX79-A15	SOD27 (DO35)
A16 PH	BZX79-A16	SOD27 (DO35)
A18 PH	BZX79-A18	SOD27 (DO35)
A1p	BAW56	SOT23
A1t	BAW56	SOT23
A1t	BAW56S	SC-88/SOT363
A20 PH	BZX79-A20	SOD27 (DO35)
A22 PH	BZX79-A22	SOD27 (DO35)
A24 PH	BZX79-A24	SOD27 (DO35)
A27 PH	BZX79-A27	SOD27 (DO35)
A2V4 PH	BZX79-A2V4	SOD27 (DO35)
A2V7 PH	BZX79-A2V7	SOD27 (DO35)
A3	1PS300	SC-70/SOT323
A30 PH	BZX79-A30	SOD27 (DO35)
A33 PH	BZX79-A33	SOD27 (DO35)
A36 PH	BZX79-A36	SOD27 (DO35)
A39 PH	BZX79-A39	SOD27 (DO35)
A3T	1PS181	SC-59/SOT346
A3V0 PH	BZX79-A3V0	SOD27 (DO35)

MARKING CODE	TYPE NUMBER	PACKAGE
A3V3 PH	BZX79-A3V3	SOD27 (DO35)
A3V6 PH	BZX79-A3V6	SOD27 (DO35)
A3V9 PH	BZX79-A3V9	SOD27 (DO35)
A3p	BAT17	SOT23
A3t	BAT17	SOT23
A4	BAV70T	SC-75/SOT416
A4	BAV70W	SC-70/SOT323
A43 PH	BZX79-A43	SOD27 (DO35)
A47 PH	BZX79-A47	SOD27 (DO35)
A4V3 PH	BZX79-A4V3	SOD27 (DO35)
A4V7 PH	BZX79-A4V7	SOD27 (DO35)
A4p	BAV70	SOT23
A4t	BAV70	SOT23
A4t	BAV70S	SC-88/SOT363
A51 PH	BZX79-A51	SOD27 (DO35)
A56 PH	BZX79-A56	SOD27 (DO35)
A5V1 PH	BZX79-A5V1	SOD27 (DO35)
A5V6 PH	BZX79-A5V6	SOD27 (DO35)
A6	BAS16T	SC-75/SOT416
A6	BAS16W	SC-70/SOT323
A6	BAS216	SOD110
A6	BAS316	SC-76/SOD323
A62 PH	BZX79-A62	SOD27 (DO35)
A68 PH	BZX79-A68	SOD27 (DO35)
A6V2 PH	BZX79-A6V2	SOD27 (DO35)
A6V8 PH	BZX79-A6V8	SOD27 (DO35)
A6p	BAS16	SOT23
A6t	BAS16	SOT23
A7	BAS321	SC-76/SOD323
A7	BAV99W	SC-70/SOT323
A75 PH	BZX79-A75	SOD27 (DO35)
A7V5 PH	BZX79-A7V5	SOD27 (DO35)
A7p	BAV99	SOT23
A7t	BAV99	SOT23
A7t	BAV756S	SC-88/SOT363
A8V2 PH	BZX79-A8V2	SOD27 (DO35)
A91	BAS17	SOT23
A9V1 PH	BZX79-A9V1	SOD27 (DO35)
AT120A	BAT120A	SC-73/SOT223
AT120C	BAT120C	SC-73/SOT223

MARKING CODE	TYPE NUMBER	PACKAGE
AT120S	BAT120S	SC-73/SOT223
AT140A	BAT140A	SC-73/SOT223
AT140C	BAT140C	SC-73/SOT223
AT140S	BAT140S	SC-73/SOT223
AT160A	BAT160A	SC-73/SOT223
AT160C	BAT160C	SC-73/SOT223
AT160S	BAT160S	SC-73/SOT223
B1	BZX399-C1V8	SC-76/SOD323
B2	BZX399-C2V0	SC-76/SOD323
B3	BZX399-C2V2	SC-76/SOD323
B4	BZX399-C2V4	SC-76/SOD323
B5	BZX399-C2V7	SC-76/SOD323
B6	BZX399-C3V0	SC-76/SOD323
B7	BZX399-C3V3	SC-76/SOD323
B8	BZX399-C3V6	SC-76/SOD323
B9	BZX399-C3V9	SC-76/SOD323
B0	BZX399-C4V3	SC-76/SOD323
BA	BZX399-C4V7	SC-76/SOD323
BB	BZX399-C5V1	SC-76/SOD323
BC	BZX399-C5V6	SC-76/SOD323
BD	BZX399-C6V2	SC-76/SOD323
BE	BZX399-C6V8	SC-76/SOD323
BF	BZX399-C7V5	SC-76/SOD323
BG	BZX399-C8V2	SC-76/SOD323
BH	BZX399-C9V1	SC-76/SOD323
BJ	BZX399-C10	SC-76/SOD323
BK	BZX399-C11	SC-76/SOD323
BL	BZX399-C12	SC-76/SOD323
BM	BZX399-C13	SC-76/SOD323
BN	BZX399-C15	SC-76/SOD323
BP	BZX399-C16	SC-76/SOD323
BQ	BZX399-C18	SC-76/SOD323
BR	BZX399-C20	SC-76/SOD323
BS	BZX399-C22	SC-76/SOD323
BT	BZX399-C24	SC-76/SOD323
BU	BZX399-C27	SC-76/SOD323
BV	BZX399-C30	SC-76/SOD323
BW	BZX399-C33	SC-76/SOD323
BX	BZX399-C36	SC-76/SOD323
BY	BZX399-C39	SC-76/SOD323

MARKING CODE	TYPE NUMBER	PACKAGE
BZ	BZX399-C43	SC-76/SOD323
B10 PH	BZX79-B10	SOD27 (DO35)
B11 PH	BZX79-B11	SOD27 (DO35)
B12 PH	BZX79-B12	SOD27 (DO35)
B13 PH	BZX79-B13	SOD27 (DO35)
B15 PH	BZX79-B15	SOD27 (DO35)
B16 PH	BZX79-B16	SOD27 (DO35)
B18 PH	BZX79-B18	SOD27 (DO35)
B20 PH	BZX79-B20	SOD27 (DO35)
B22 PH	BZX79-B22	SOD27 (DO35)
B24 PH	BZX79-B24	SOD27 (DO35)
B27 PH	BZX79-B27	SOD27 (DO35)
B2V4 PH	BZX79-B2V4	SOD27 (DO35)
B2V7 PH	BZX79-B2V7	SOD27 (DO35)
B3	1PS301	SC-70/SOT323
B30 PH	BZX79-B30	SOD27 (DO35)
B33 PH	BZX79-B33	SOD27 (DO35)
B36 PH	BZX79-B36	SOD27 (DO35)
B39 PH	BZX79-B39	SOD27 (DO35)
B3T	1PS184	SC-59/SOT346
B3V0 PH	BZX79-B3V0	SOD27 (DO35)
B3V3 PH	BZX79-B3V3	SOD27 (DO35)
B3V6 PH	BZX79-B3V6	SOD27 (DO35)
B3V9 PH	BZX79-B3V9	SOD27 (DO35)
B43 PH	BZX79-B43	SOD27 (DO35)
B47 PH	BZX79-B47	SOD27 (DO35)
B4V3 PH	BZX79-B4V3	SOD27 (DO35)
B4V7 PH	BZX79-B4V7	SOD27 (DO35)
B51 PH	BZX79-B51	SOD27 (DO35)
B56 PH	BZX79-B56	SOD27 (DO35)
B5V1 PH	BZX79-B5V1	SOD27 (DO35)
B5V6 PH	BZX79-B5V6	SOD27 (DO35)
B62 PH	BZX79-B62	SOD27 (DO35)
B68 PH	BZX79-B68	SOD27 (DO35)
B6V2 PH	BZX79-B6V2	SOD27 (DO35)
B6V8 PH	BZX79-B6V8	SOD27 (DO35)
B75 PH	BZX79-B75	SOD27 (DO35)
B7V5 PH	BZX79-B7V5	SOD27 (DO35)
B8V2 PH	BZX79-B8V2	SOD27 (DO35)
B9V1 PH	BZX79-B9V1	SOD27 (DO35)

MARKING CODE	TYPE NUMBER	PACKAGE
BAT81	BAT81	SOD68 (DO34)
BAT82	BAT82	SOD68 (DO34)
BAT83	BAT83	SOD68 (DO34)
BAT85	BAT85	SOD68 (DO34)
BAT86	BAT86	SOD68 (DO34)
BAV10 PH	BAV10	SOD27 (DO35)
BAV20 PH	BAV20	SOD27 (DO35)
BAV21 PH	BAV21	SOD27 (DO35)
BAW62 PH	BAW62	SOD27 (DO35)
BAX12 PH	BAX12	SOD27 (DO35)
BAX18 PH	BAX18	SOD27 (DO35)
BYR210	PBYR2100CT	SC-73/SOT223
BYR215	PBYR2150CT	SC-73/SOT223
BZA100	BZA100	SO20 (SOT163-1)
BZA109	BZA109	SC-73/SOT223
BZV10	BZV10	SOD68 (DO34)
BZV11	BZV11	SOD68 (DO34)
BZV12	BZV12	SOD68 (DO34)
BZV13	BZV13	SOD68 (DO34)
BZV14	BZV14	SOD68 (DO34)
BZV37	BZV37	SOD68 (DO34)
BZV86 1V4 PH	BZV86-1V4	SOD27 (DO35)
BZV86 2V0 PH	BZV86-2V0	SOD27 (DO35)
BZV86 2V6 PH	BZV86-2V6	SOD27 (DO35)
BZV86 3V2 PH	BZV86-3V2	SOD27 (DO35)
BZV90C10	BZV90-C10	SC-73/SOT223
BZV90C11	BZV90-C11	SC-73/SOT223
BZV90C12	BZV90-C12	SC-73/SOT223
BZV90C13	BZV90-C13	SC-73/SOT223
BZV90C15	BZV90-C15	SC-73/SOT223
BZV90C16	BZV90-C16	SC-73/SOT223
BZV90C18	BZV90-C18	SC-73/SOT223
BZV90C20	BZV90-C20	SC-73/SOT223
BZV90C22	BZV90-C22	SC-73/SOT223
BZV90C24	BZV90-C24	SC-73/SOT223
BZV90C27	BZV90-C27	SC-73/SOT223
BZV90C2V4	BZV90-C2V4	SC-73/SOT223
BZV90C2V7	BZV90-C2V7	SC-73/SOT223
BZV90C30	BZV90-C30	SC-73/SOT223

MARKING CODE	TYPE NUMBER	PACKAGE
BZV90C33	BZV90-C33	SC-73/SOT223
BZV90C36	BZV90-C36	SC-73/SOT223
BZV90C39	BZV90-C39	SC-73/SOT223
BZV90C3V0	BZV90-C3V0	SC-73/SOT223
BZV90C3V3	BZV90-C3V3	SC-73/SOT223
BZV90C3V6	BZV90-C3V6	SC-73/SOT223
BZV90C3V9	BZV90-C3V9	SC-73/SOT223
BZV90C43	BZV90-C43	SC-73/SOT223
BZV90C47	BZV90-C47	SC-73/SOT223
BZV90C4V3	BZV90-C4V3	SC-73/SOT223
BZV90C4V7	BZV90-C4V7	SC-73/SOT223
BZV90C51	BZV90-C51	SC-73/SOT223
BZV90C56	BZV90-C56	SC-73/SOT223
BZV90C5V1	BZV90-C5V1	SC-73/SOT223
BZV90C5V6	BZV90-C5V6	SC-73/SOT223
BZV90C62	BZV90-C62	SC-73/SOT223
BZV90C68	BZV90-C68	SC-73/SOT223
BZV90C6V2	BZV90-C6V2	SC-73/SOT223
BZV90C6V8	BZV90-C6V8	SC-73/SOT223
BZV90C75	BZV90-C75	SC-73/SOT223
BZV90C7V5	BZV90-C7V5	SC-73/SOT223
BZV90C8V2	BZV90-C8V2	SC-73/SOT223
BZV90C9V1	BZV90-C9V1	SC-73/SOT223
C10 PH	BZV85-C10	SOD66 (DO41)
C10 PH	BZX79-C10	SOD27 (DO35)
C11 PH	BZV85-C11	SOD66 (DO41)
C11 PH	BZX79-C11	SOD27 (DO35)
C12 PH	BZV85-C12	SOD66 (DO41)
C12 PH	BZX79-C12	SOD27 (DO35)
C13 PH	BZV85-C13	SOD66 (DO41)
C13 PH	BZX79-C13	SOD27 (DO35)
C15 PH	BZV85-C15	SOD66 (DO41)
C15 PH	BZX79-C15	SOD27 (DO35)
C16 PH	BZV85-C16	SOD66 (DO41)
C16 PH	BZX79-C16	SOD27 (DO35)
C18 PH	BZV85-C18	SOD66 (DO41)
C18 PH	BZX79-C18	SOD27 (DO35)
C20 PH	BZV85-C20	SOD66 (DO41)
C20 PH	BZX79-C20	SOD27 (DO35)
C22 PH	BZV85-C22	SOD66 (DO41)

MARKING CODE	TYPE NUMBER	PACKAGE
C22 PH	BZX79-C22	SOD27 (DO35)
C24 PH	BZV85-C24	SOD66 (DO41)
C24 PH	BZX79-C24	SOD27 (DO35)
C27 PH	BZV85-C27	SOD66 (DO41)
C27 PH	BZX79-C27	SOD27 (DO35)
C2V4 PH	BZX79-C2V4	SOD27 (DO35)
C2V7 PH	BZX79-C2V7	SOD27 (DO35)
C3	1PS302	SC-70/SOT323
C30 PH	BZV85-C30	SOD66 (DO41)
C30 PH	BZX79-C30	SOD27 (DO35)
C33 PH	BZV85-C33	SOD66 (DO41)
C33 PH	BZX79-C33	SOD27 (DO35)
C36 PH	BZV85-C36	SOD66 (DO41)
C36 PH	BZX79-C36	SOD27 (DO35)
C39 PH	BZV85-C39	SOD66 (DO41)
C39 PH	BZX79-C39	SOD27 (DO35)
C3T	1PS226	SC-59/SOT346
C3V0 PH	BZX79-C3V0	SOD27 (DO35)
C3V3 PH	BZX79-C3V3	SOD27 (DO35)
C3V6 PH	BZV85-C3V6	SOD66 (DO41)
C3V6 PH	BZX79-C3V6	SOD27 (DO35)
C3V9 PH	BZV85-C3V9	SOD66 (DO41)
C3V9 PH	BZX79-C3V9	SOD27 (DO35)
C43 PH	BZV85-C43	SOD66 (DO41)
C43 PH	BZX79-C43	SOD27 (DO35)
C47 PH	BZV85-C47	SOD66 (DO41)
C47 PH	BZX79-C47	SOD27 (DO35)
C4V3 PH	BZV85-C4V3	SOD66 (DO41)
C4V3 PH	BZX79-C4V3	SOD27 (DO35)
C4V7 PH	BZV85-C4V7	SOD66 (DO41)
C4V7 PH	BZX79-C4V7	SOD27 (DO35)
C51 PH	BZV85-C51	SOD66 (DO41)
C51 PH	BZX79-C51	SOD27 (DO35)
C56 PH	BZV85-C56	SOD66 (DO41)
C56 PH	BZX79-C56	SOD27 (DO35)
C5V1 PH	BZV85-C5V1	SOD66 (DO41)
C5V1 PH	BZX79-C5V1	SOD27 (DO35)
C5V6 PH	BZV85-C5V6	SOD66 (DO41)
C5V6 PH	BZX79-C5V6	SOD27 (DO35)
C62 PH	BZV85-C62	SOD66 (DO41)

MARKING CODE	TYPE NUMBER	PACKAGE
C62 PH	BZX79-C62	SOD27 (DO35)
C68 PH	BZV85-C68	SOD66 (DO41)
C68 PH	BZX79-C68	SOD27 (DO35)
C6V2 PH	BZV85-C6V2	SOD66 (DO41)
C6V2 PH	BZX79-C6V2	SOD27 (DO35)
C6V8 PH	BZV85-C6V8	SOD66 (DO41)
C6V8 PH	BZX79-C6V8	SOD27 (DO35)
C75 PH	BZV85-C75	SOD66 (DO41)
C75 PH	BZX79-C75	SOD27 (DO35)
C7V5 PH	BZV85-C7V5	SOD66 (DO41)
C7V5 PH	BZX79-C7V5	SOD27 (DO35)
C8V2 PH	BZV85-C8V2	SOD66 (DO41)
C8V2 PH	BZX79-C8V2	SOD27 (DO35)
C9V1 PH	BZV85-C9V1	SOD66 (DO41)
C9V1 PH	BZX79-C9V1	SOD27 (DO35)
F	1PS79SB10	SC-79/SOD523
F3T	1PS193	SC-59/SOT346
G	1PS79SB70	SC-79/SOD523
JAp	BAV74	SOT23
JAt	BAV74	SOT23
JC	BAL74W	SC-70/SOT323
JCp	BAL74	SOT23
JCt	BAL74	SOT23
JF	BAL99W	SC-70/SOT323
JFp	BAL99	SOT23
JFt	BAL99	SOT23
JPp	BAS19	SOT23
JPt	BAS19	SOT23
JRp	BAS20	SOT23
JRt	BAS20	SOT23
JS	BAS221	SOT23
JSp	BAS21	SOT23
JSt	BAS21	SOT23
JTp	BAS28	SOT143B
JVp	BAS116	SOT23
JVt	BAS116	SOT23
JXp	BAV170	SOT23
JXt	BAV170	SOT23
JYp	BAV199	SOT23
JYt	BAV199	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
JYt	BAV199W	SC-70/SOT323
JY-	BAV199W	SC-70/SOT323
JZp	BAW156	SOT23
JZt	BAW156	SOT23
L20	BAS29	SOT23
L21	BAS31	SOT23
L22	BAS35	SOT23
L30	BAV23	SOT143B
L31	BAV23S	SOT23
L4	BAT54W	SC-70/SOT323
L4	BAT254	SOD110
L41	BAT74	SOT143B
L42	BAT54A	SOT23
L43	BAT54C	SOT23
L44	BAT54S	SOT23
L4p	BAT54	SOT23
L4t	BAT54	SOT23
L51	BAS56	SOT143B
L6p	BAT720	SOT23
L6t	BAT720	SOT23
L7p	BAT721	SOT23
L7t	BAT721	SOT23
L8p	BAT721A	SOT23
L8t	BAT721A	SOT23
L9p	BAT721C	SOT23
L9t	BAT721C	SOT23
L0p	BAT721S	SOT23
L0t	BAT721S	SOT23
P1	1PS74SB23	SC-74/SOT457
S0	1PS76SB10	SC-76/SOD323
S1	1PS76SB21	SC-76/SOD323
S2	1PS76SB70	SC-76/SOD323
S4	1PS76SB40	SC-76/SOD323
S4	1PS89SS04	SC-89/SOT490
S5	1PS89SS05	SC-89/SOT490
S6	1PS89SS06	SC-89/SOT490
S7	1PS76SB17	SC-76/SOD323
T	1PS79SB40	SC-79/SOD523
TM1101	PZTM1101	SC-73/SOT223
TM1102	PZTM1102	SC-73/SOT223

MARKING CODE	TYPE NUMBER	PACKAGE
V10-20	BYV10-20	SOD81
V10-30	BYV10-30	SOD81
V10-40	BYV10-40	SOD81
WO	BZX284-B2V4	SOD110
WP	BZX284-B2V7	SOD110
WQ	BZX284-B3V0	SOD110
WR	BZX284-B3V3	SOD110
WS	BZX284-B3V6	SOD110
WT	BZX284-B3V9	SOD110
WU	BZX284-B4V3	SOD110
WV	BZX284-B4V7	SOD110
WW	BZX284-B5V1	SOD110
WX	BZX284-B5V6	SOD110
WY	BZX284-B6V2	SOD110
WZ	BZX284-B6V8	SOD110
XA	BZX99-C4V7	SOT23
XA	BZX284-B7V5	SOD110
XB	BZX99-C5V1	SOT23
XB	BZX284-B8V2	SOD110
XC	BZX99-C5V6	SOT23
XC	BZX284-B9V1	SOD110
XD	BZX99-C6V2	SOT23
XD	BZX284-B10	SOD110
XE	BZX99-C6V8	SOT23
XE	BZX284-B11	SOD110
XF	BZX284-B12	SOD110
XG	BZX284-B13	SOD110
XH	BZX284-B15	SOD110
XI	BZX284-B16	SOD110
XJ	BZX284-B18	SOD110
XK	BZX284-B20	SOD110
XL	BZX99-C2V4	SOT23
XL	BZX284-B22	SOD110
XM	BZX99-C2V7	SOT23
XM	BZX284-B24	SOD110
XN	BZX99-C3V0	SOT23
XN	BZX284-B27	SOD110
XO	BZX284-B30	SOD110
XP	BZX99-C3V3	SOT23
XP	BZX284-B33	SOD110
XQ	BZX284-B36	SOD110
XR	BZX99-C3V6	SOT23
XR	BZX284-B39	SOD110
XS	BZX99-C3V9	SOT23
XS	BZX284-B43	SOD110
XT	BZX99-C4V3	SOT23
XT	BZX284-B47	SOD110
XU	BZX99-C7V5	SOT23
XU	BZX284-B51	SOD110
XV	BZX99-C8V2	SOT23
XV	BZX284-B56	SOD110
XW	BZX99-C9V1	SOT23
XW	BZX284-B62	SOD110
XX	BZX99-C10	SOT23
XX	BZX284-B68	SOD110
XY	BZX99-C11	SOT23
XY	BZX284-B75	SOD110
XZ	BZX99-C12	SOT23
X2	BZX99-C13	SOT23
X3	BZX99-C15	SOT23
Y10	BZX84-C27	SOT23
Y11	BZX84-C30	SOT23
Y12	BZX84-C33	SOT23
Y13	BZX84-C36	SOT23
Y14	BZX84-C39	SOT23
Y15	BZX84-C43	SOT23
Y16	BZX84-C47	SOT23
Y17	BZX84-C51	SOT23
Y18	BZX84-C56	SOT23
Y19	BZX84-C62	SOT23
Y1p	BZX84-C11	SOT23
Y1t	BZX84-C11	SOT23
Y20	BZX84-C68	SOT23
Y21	BZX84-C75	SOT23
Y2p	BZX84-C12	SOT23
Y2t	BZX84-C12	SOT23
Y3p	BZX84-C13	SOT23
Y3t	BZX84-C13	SOT23
Y4p	BZX84-C15	SOT23
Y4t	BZX84-C15	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
Y50	BZX84-A2V4	SOT23
Y51	BZX84-A2V7	SOT23
Y52	BZX84-A3V0	SOT23
Y53	BZX84-A3V3	SOT23
Y54	BZX84-A3V6	SOT23
Y55	BZX84-A3V9	SOT23
Y56	BZX84-A4V3	SOT23
Y57	BZX84-A4V7	SOT23
Y58	BZX84-A5V1	SOT23
Y59	BZX84-A5V6	SOT23
Y5p	BZX84-C16	SOT23
Y5t	BZX84-C16	SOT23
Y60	BZX84-A6V2	SOT23
Y61	BZX84-A6V8	SOT23
Y62	BZX84-A7V5	SOT23
Y63	BZX84-A8V2	SOT23
Y64	BZX84-A9V1	SOT23
Y65	BZX84-A10	SOT23
Y66	BZX84-A11	SOT23
Y67	BZX84-A12	SOT23
Y68	BZX84-A13	SOT23
Y69	BZX84-A15	SOT23
Y6p	BZX84-C18	SOT23
Y6t	BZX84-C18	SOT23
Y70	BZX84-A16	SOT23
Y71	BZX84-A18	SOT23
Y72	BZX84-A20	SOT23
Y73	BZX84-A22	SOT23
Y74	BZX84-A24	SOT23
Y75	BZX84-A27	SOT23
Y76	BZX84-A30	SOT23
Y77	BZX84-A33	SOT23
Y78	BZX84-A36	SOT23
Y79	BZX84-A39	SOT23
Y7p	BZX84-C20	SOT23
Y7t	BZX84-C20	SOT23
Y80	BZX84-A43	SOT23
Y81	BZX84-A47	SOT23
Y82	BZX84-A51	SOT23
Y83	BZX84-A56	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
Y84	BZX84-A62	SOT23
Y85	BZX84-A68	SOT23
Y86	BZX84-A75	SOT23
Y8p	BZX84-C22	SOT23
Y8t	BZX84-C22	SOT23
Y9p	BZX84-C24	SOT23
Y9t	BZX84-C24	SOT23
YO	BZX284-C2V4	SOD110
YP	BZX284-C2V7	SOD110
YQ	BZX284-C3V0	SOD110
YR	BZX284-C3V3	SOD110
YS	BZX284-C3V6	SOD110
YT	BZX284-C3V9	SOD110
YU	BZX284-C4V3	SOD110
YV	BZX284-C4V7	SOD110
YW	BZX284-C5V1	SOD110
YX	BZX284-C5V6	SOD110
YY	BZX284-C6V2	SOD110
YZ	BZX284-C6V8	SOD110
Z0	BZA420A	SC-74/SOT457
Z0	PDZ2.4B	SC-76/SOD323
Z1	PDZ2.7B	SC-76/SOD323
Z2	PDZ3.0B	SC-76/SOD323
Z3	PDZ3.3B	SC-76/SOD323
Z4	PDZ3.6B	SC-76/SOD323
Z5	PDZ3.9B	SC-76/SOD323
Z6	BZA456A	SC-74/SOT457
Z6	PDZ4.3B	SC-76/SOD323
Z7	PDZ4.7B	SC-76/SOD323
Z8	BZA408B	SC-74/SOT457
Z8	PDZ5.1B	SC-76/SOD323
Z9	PDZ5.6B	SC-76/SOD323
Z11	BZX84-C2V4	SOT23
Z12	BZX84-C2V7	SOT23
Z13	BZX84-C3V0	SOT23
Z14	BZX84-C3V3	SOT23
Z15	BZX84-C3V6	SOT23
Z16	BZX84-C3V9	SOT23
Z17	BZX84-C4V3	SOT23
Z1p	BZX84-C4V7	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
Z1t	BZX84-C4V7	SOT23
Z2p	BZX84-C5V1	SOT23
Z2t	BZX84-C5V1	SOT23
Z2t	BZA462A	SC-74/SOT457
Z3p	BZX84-C5V6	SOT23
Z3t	BZX84-C5V6	SOT23
Z4p	BZX84-C6V2	SOT23
Z4t	BZX84-C6V2	SOT23
Z50	BZX84-B2V4	SOT23
Z51	BZX84-B2V7	SOT23
Z52	BZX84-B3V0	SOT23
Z53	BZX84-B3V3	SOT23
Z54	BZX84-B3V6	SOT23
Z55	BZX84-B3V9	SOT23
Z56	BZX84-B4V3	SOT23
Z57	BZX84-B4V7	SOT23
Z58	BZX84-B5V1	SOT23
Z59	BZX84-B5V6	SOT23
Z5p	BZX84-C6V8	SOT23
Z5t	BZX84-C6V8	SOT23
Z60	BZX84-B6V2	SOT23
Z61	BZX84-B6V8	SOT23
Z62	BZX84-B7V5	SOT23
Z63	BZX84-B8V2	SOT23
Z64	BZX84-B9V1	SOT23
Z65	BZX84-B10	SOT23
Z66	BZX84-B11	SOT23
Z67	BZX84-B12	SOT23
Z68	BZX84-B13	SOT23
Z69	BZX84-B15	SOT23
Z6p	BZX84-C7V5	SOT23
Z6t	BZX84-C7V5	SOT23
Z70	BZX84-B16	SOT23
Z71	BZX84-B18	SOT23
Z72	BZX84-B20	SOT23
Z73	BZX84-B22	SOT23
Z74	BZX84-B24	SOT23
Z75	BZX84-B27	SOT23
Z76	BZX84-B30	SOT23
Z77	BZX84-B33	SOT23
Z78	BZX84-B36	SOT23
Z79	BZX84-B39	SOT23
Z7p	BZX84-C8V2	SOT23
Z7t	BZX84-C8V2	SOT23
Z80	BZX84-B43	SOT23
Z81	BZX84-B47	SOT23
Z82	BZX84-B51	SOT23
Z83	BZX84-B56	SOT23
Z84	BZX84-B62	SOT23
Z85	BZX84-B68	SOT23
Z86	BZX84-B75	SOT23
Z8p	BZX84-C9V1	SOT23
Z8t	BZX84-C9V1	SOT23
Z9p	BZX84-C10	SOT23
Z9t	BZX84-C10	SOT23
ZA	BZX284-C7V5	SOD110
ZA	PDZ6.2B	SC-76/SOD323
ZA109TS	BZA109TS	SSOP20 (SOT339-1)
ZB	BZX284-C8V2	SOD110
ZB	PDZ6.8B	SC-76/SOD323
ZC	BZX284-C9V1	SOD110
ZC	PDZ7.5B	SC-76/SOD323
ZD	BZX284-C10	SOD110
ZD	PDZ8.2B	SC-76/SOD323
ZE	BZX284-C11	SOD110
ZE	PDZ9.1B	SC-76/SOD323
ZF	BZX284-C12	SOD110
ZF	PDZ10B	SC-76/SOD323
ZG	BZX284-C13	SOD110
ZG	PDZ11B	SC-76/SOD323
ZH	BZX284-C15	SOD110
ZH	PDZ12B	SC-76/SOD323
ZI	BZX284-C16	SOD110
ZJ	BZX284-C18	SOD110
ZJ	PDZ13B	SC-76/SOD323
ZK	BZX284-C20	SOD110
ZK	PDZ15B	SC-76/SOD323
ZL	BZX284-C22	SOD110
ZL	PDZ16B	SC-76/SOD323

MARKING CODE	TYPE NUMBER	PACKAGE
ZM	BZX284-C24	SOD110
ZM	PDZ18B	SC-76/SOD323
ZN	BZX284-C27	SOD110
ZN	PDZ20B	SC-76/SOD323
ZO	BZX284-C30	SOD110
ZP	BZX284-C33	SOD110
ZP	PDZ22B	SC-76/SOD323
ZQ	BZX284-C36	SOD110
ZQ	PDZ24B	SC-76/SOD323
ZR	BZX284-C39	SOD110
ZR	PDZ27B	SC-76/SOD323
ZS	BZX284-C43	SOD110
ZS	PDZ30B	SC-76/SOD323
ZT	BZX284-C47	SOD110
ZT	PDZ33B	SC-76/SOD323
ZU	BZX284-C51	SOD110
ZU	PDZ36B	SC-76/SOD323
ZV	BZX284-C56	SOD110
ZW	BZX284-C62	SOD110
ZX	BZX284-C68	SOD110
ZY	BZX284-C75	SOD110
black	BAS32L	SOD80C
black	BAS45AL	SOD80C
black	BAV105	SOD80C
black	PMLL4148	SOD80C
black	PMLL4150	SOD80C
black	PMLL4151	SOD80C
black	PMLL4153	SOD80C
black	PMLL4448	SOD80C
green	BAV100	SOD80C
green	BAV101	SOD80C
green	BAV102	SOD80C
green	BAV103	SOD80C
grey	BAS81	SOD80C
grey	BAS82	SOD80C
grey	BAS83	SOD80C
grey	BAS85	SOD80C
grey	BAS86	SOD80C
p4f	PMBD353	SOT23
p5A	PMBD6050	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
p5B	PMBD6100	SOT23
p5C	PMBD7000	SOT23
p5D	PMBD914	SOT23
p8A	PMBZ5226B	SOT23
p8B	PMBZ5227B	SOT23
p8C	PMBZ5228B	SOT23
p8D	PMBZ5229B	SOT23
p8E	PMBZ5230B	SOT23
p8F	PMBZ5231B	SOT23
p8G	PMBZ5232B	SOT23
p8H	PMBZ5233B	SOT23
p8J	PMBZ5234B	SOT23
p8K	PMBZ5235B	SOT23
p8L	PMBZ5236B	SOT23
p8M	PMBZ5237B	SOT23
p8N	PMBZ5238B	SOT23
p8P	PMBZ5239B	SOT23
p8Q	PMBZ5240B	SOT23
p8R	PMBZ5241B	SOT23
p8S	PMBZ5242B	SOT23
p8T	PMBZ5243B	SOT23
p8U	PMBZ5244B	SOT23
p8V	PMBZ5245B	SOT23
p8W	PMBZ5246B	SOT23
p8X	PMBZ5247B	SOT23
p8Y	PMBZ5248B	SOT23
p8Z	PMBZ5249B	SOT23
p9A	PLVA650A	SOT23
p9B	PLVA653A	SOT23
p9C	PLVA656A	SOT23
p9D	PLVA659A	SOT23
p9E	PLVA662A	SOT23
p9F	PLVA665A	SOT23
p9G	PLVA668A	SOT23
p9J	PLVA2650A	SOT23
p9K	PLVA2653A	SOT23
p9L	PLVA2656A	SOT23
p9M	PLVA2659A	SOT23
p9N	PLVA2662A	SOT23
p9O	PLVA2665A	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
p9P	PLVA2668A	SOT23
t4f	PMBD353	SOT23
t5A	PMBD6050	SOT23
t5B	PMBD6100	SOT23
t5C	PMBD7000	SOT23
t5D	PMBD914	SOT23
t8A	PMBZ5226B	SOT23
t8B	PMBZ5227B	SOT23
t8C	PMBZ5228B	SOT23
t8D	PMBZ5229B	SOT23
t8E	PMBZ5230B	SOT23
t8F	PMBZ5231B	SOT23
t8G	PMBZ5232B	SOT23
t8H	PMBZ5233B	SOT23
t8J	PMBZ5234B	SOT23
t8K	PMBZ5235B	SOT23
t8L	PMBZ5236B	SOT23
t8M	PMBZ5237B	SOT23
t8N	PMBZ5238B	SOT23
t8P	PMBZ5239B	SOT23
t8Q	PMBZ5240B	SOT23
t8R	PMBZ5241B	SOT23
t8S	PMBZ5242B	SOT23
t8T	PMBZ5243B	SOT23
t8U	PMBZ5244B	SOT23
t8V	PMBZ5245B	SOT23
t8W	PMBZ5246B	SOT23
t8X	PMBZ5247B	SOT23
t8Y	PMBZ5248B	SOT23
t8Z	PMBZ5249B	SOT23
t9A	PLVA650A	SOT23
t9B	PLVA653A	SOT23
t9C	PLVA656A	SOT23
t9D	PLVA659A	SOT23
t9E	PLVA662A	SOT23
t9F	PLVA665A	SOT23
t9G	PLVA668A	SOT23
t9J	PLVA2650A	SOT23
t9K	PLVA2653A	SOT23
t9L	PLVA2656A	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
t9M	PLVA2659A	SOT23
t9N	PLVA2662A	SOT23
t9O	PLVA2665A	SOT23
t9P	PLVA2668A	SOT23
yellow	BZV55-B2V4	SOD80C
yellow	BZV55-B2V7	SOD80C
yellow	BZV55-B3V0	SOD80C
yellow	BZV55-B3V3	SOD80C
yellow	BZV55-B3V6	SOD80C
yellow	BZV55-B3V9	SOD80C
yellow	BZV55-B4V3	SOD80C
yellow	BZV55-B4V7	SOD80C
yellow	BZV55-B5V1	SOD80C
yellow	BZV55-B5V6	SOD80C
yellow	BZV55-B6V2	SOD80C
yellow	BZV55-B6V8	SOD80C
yellow	BZV55-B7V5	SOD80C
yellow	BZV55-B8V2	SOD80C
yellow	BZV55-B9V1	SOD80C
yellow	BZV55-B10	SOD80C
yellow	BZV55-B11	SOD80C
yellow	BZV55-B12	SOD80C
yellow	BZV55-B13	SOD80C
yellow	BZV55-B15	SOD80C
yellow	BZV55-B16	SOD80C
yellow	BZV55-B18	SOD80C
yellow	BZV55-B20	SOD80C
yellow	BZV55-B22	SOD80C
yellow	BZV55-B24	SOD80C
yellow	BZV55-B27	SOD80C
yellow	BZV55-B30	SOD80C
yellow	BZV55-B33	SOD80C
yellow	BZV55-B36	SOD80C
yellow	BZV55-B39	SOD80C
yellow	BZV55-B43	SOD80C
yellow	BZV55-B47	SOD80C
yellow	BZV55-B51	SOD80C
yellow	BZV55-B56	SOD80C
yellow	BZV55-B62	SOD80C
yellow	BZV55-B68	SOD80C

MARKING CODE	TYPE NUMBER	PACKAGE
yellow	BZV55-B75	SOD80C
yellow	BZV55-C2V4	SOD80C
yellow	BZV55-C2V7	SOD80C
yellow	BZV55-C3V0	SOD80C
yellow	BZV55-C3V3	SOD80C
yellow	BZV55-C3V6	SOD80C
yellow	BZV55-C3V9	SOD80C
yellow	BZV55-C4V3	SOD80C
yellow	BZV55-C4V7	SOD80C
yellow	BZV55-C5V1	SOD80C
yellow	BZV55-C5V6	SOD80C
yellow	BZV55-C6V2	SOD80C
yellow	BZV55-C6V8	SOD80C
yellow	BZV55-C7V5	SOD80C
yellow	BZV55-C8V2	SOD80C
yellow	BZV55-C9V1	SOD80C
yellow	BZV55-C10	SOD80C
yellow	BZV55-C11	SOD80C
yellow	BZV55-C12	SOD80C
yellow	BZV55-C13	SOD80C
yellow	BZV55-C15	SOD80C
yellow	BZV55-C16	SOD80C
yellow	BZV55-C18	SOD80C
yellow	BZV55-C20	SOD80C
yellow	BZV55-C22	SOD80C
yellow	BZV55-C24	SOD80C
yellow	BZV55-C27	SOD80C
yellow	BZV55-C30	SOD80C
yellow	BZV55-C33	SOD80C
yellow	BZV55-C36	SOD80C
yellow	BZV55-C39	SOD80C
yellow	BZV55-C43	SOD80C
yellow	BZV55-C47	SOD80C
yellow	BZV55-C51	SOD80C
yellow	BZV55-C56	SOD80C
yellow	BZV55-C62	SOD80C
yellow	BZV55-C68	SOD80C
yellow	BZV55-C75	SOD80C

TRANSISTOR TYPE NUMBER TO MARKING CODE

TYPE NUMBER	MARKING CODE	PACKAGE
2PA1576Q	FtQ; F-Q	SC-70/SOT323
2PA1576R	FtR; F-R	SC-70/SOT323
2PA1576S	FtS; F-S	SC-70/SOT323
2PA1774JQ	YQ	SC-89/SOT490
2PA1774JR	YR	SC-89/SOT490
2PA1774JS	YS	SC-89/SOT490
2PA1774Q	YQ	SC-75/SOT416
2PA1774R	YR	SC-75/SOT416
2PA1774S	YS	SC-75/SOT416
2PB1219AQ	DtQ; D-Q	SC-70/SOT323
2PB1219AR	DtR; D-R	SC-70/SOT323
2PB1219AS	DtS; D-S	SC-70/SOT323
2PB709AQ	BQ	SC-59/SOT346
2PB709AR	BR	SC-59/SOT346
2PB709AS	BS	SC-59/SOT346
2PB710AQ	DQ	SC-59/SOT346
2PB710AR	DR	SC-59/SOT346
2PB710AS	DS	SC-59/SOT346
2PC4081Q	ZtQ; Z-Q	SC-70/SOT323
2PC4081R	ZtR; Z-R	SC-70/SOT323
2PC4081S	ZtS; Z-S	SC-70/SOT323
2PC4617JQ	ZQ	SC-89/SOT490
2PC4617JR	ZR	SC-89/SOT490
2PC4617JS	ZS	SC-89/SOT490
2PC4617Q	ZQ	SC-75/SOT416
2PC4617R	ZR	SC-75/SOT416
2PC4617S	ZS	SC-75/SOT416
2PD1820AQ	AtQ; A-Q	SC-70/SOT323
2PD1820AR	AtR; A-R	SC-70/SOT323
2PD1820AS	AtS; A-S	SC-70/SOT323
2PD601AQ	ZQ	SC-59/SOT346
2PD601AR	ZR	SC-59/SOT346
2PD601AS	ZS	SC-59/SOT346
2PD602AQ	XQ	SC-59/SOT346
2PD602AR	XR	SC-59/SOT346
2PD602AS	XS	SC-59/SOT346
BC807	5Dp; 5Dt	SOT23
BC807W	5Dt; 5D-	SC-70/SOT323
BC807-16	5Ap; 5At	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BC807-16W	5At; 5A-	SC-70/SOT323
BC807-25	5Bp; 5Bt	SOT23
BC807-25W	5Bt; 5B-	SC-70/SOT323
BC807-40	5Cp; 5Ct	SOT23
BC807-40W	5Ct; 5C-	SC-70/SOT323
BC817	6Dp; 6Dt	SOT23
BC817W	6Dt; 6D-	SC-70/SOT323
BC817-16	6Ap; 6At	SOT23
BC817-16W	6At; 6A-	SC-70/SOT323
BC817-25	6Bp; 6Bt	SOT23
BC817-25W	6Bt; 6B-	SC-70/SOT323
BC817-40	6Cp; 6Bt	SOT23
BC817-40W	6Ct; 6C-	SC-70/SOT323
BC846	1Dp; 1Dt	SOT23
BC846A	1Ap; 1At	SOT23
BC846AT	1A	SC-75/SOT416
BC846AW	1At; 1A-	SC-70/SOT323
BC846B	1Bp; 1Bt	SOT23
BC846BT	1B	SC-75/SOT416
BC846BW	1Bt; 1B-	SC-70/SOT323
BC846W	1Dt; 1D-	SC-70/SOT323
BC847	1Hp; 1Ht	SOT23
BC847A	1Ep; 1Et	SOT23
BC847AT	1E	SC-75/SOT416
BC847AW	1Et; 1E-	SC-70/SOT323
BC847B	1Fp; 1Ft	SOT23
BC847BPN	13t	SC-88/SOT363
BC847BS	1Ft	SC-88/SOT363
BC847BT	1F	SC-75/SOT416
BC847BW	1Ft; 1F-	SC-70/SOT323
BC847C	1Gp; 1Gt	SOT23
BC847CT	1G	SC-75/SOT416
BC847CW	1Gt; 1G-	SC-70/SOT323
BC847W	1Ht; 1H-	SC-70/SOT323
BC849B	2Bp; 2Bt	SOT23
BC849BW	2Bt; 2B-	SC-70/SOT323
BC849C	2Cp; 2Ct	SOT23
BC849CW	2Ct; 2C-	SC-70/SOT323
BC850B	2Fp; 2Ft	SOT23
BC850BW	2Ft; 2F-	SC-70/SOT323

TYPE NUMBER	MARKING CODE	PACKAGE
BC850C	2Gp; 2Gt	SOT23
BC850CW	2Gt; 2G-	SC-70/SOT323
BC856	3Dp; 3Dt	SOT23
BC856A	3Ap; 3At	SOT23
BC856AT	3A	SC-75/SOT416
BC856AW	3At; 3A-	SC-70/SOT323
BC856B	3Bp; 3Bt	SOT23
BC856BT	3B	SC-75/SOT416
BC856BW	3Bt; 3B-	SC-70/SOT323
BC856W	3Dt; 3D-	SC-70/SOT323
BC857	3Hp; 3Ht	SOT23
BC857A	3Ep; 3Et	SOT23
BC857AT	3E	SC-75/SOT416
BC857AW	3Et; 3E-	SC-70/SOT323
BC857B	3Fp; 3Ft	SOT23
BC857BS	3Ft	SC-88/SOT363
BC857BT	3F	SC-75/SOT416
BC857BW	3Ft; 3F-	SC-70/SOT323
BC857C	3Gp; 3Gt	SOT23
BC857CT	3G	SC-75/SOT416
BC857CW	3Gt; 3G-	SC-70/SOT323
BC857W	3Ht; 3H-	SC-70/SOT323
BC859B	4Bp; 4Bt	SOT23
BC859BW	4Bt; 4B-	SC-70/SOT323
BC859C	4Cp; 4Ct	SOT23
BC859CW	4Ct; 4C-	SC-70/SOT323
BC859W	4Dt; 4D-	SC-70/SOT323
BC860B	4Fp; 4Ft	SOT23
BC860BW	4Ft; 4F-	SC-70/SOT323
BC860C	4Gp; 4Gt	SOT23
BC860CW	4Gt; 4G-	SC-70/SOT323
BC860W	4Ht; 4H-	SC-70/SOT323
BC868	CAC	SC-62/SOT89
BC868-25	CDC	SC-62/SOT89
BC869	CEC	SC-62/SOT89
BC869-16	CGC	SC-62/SOT89
BC869-25	CHC	SC-62/SOT89
BCF32	D7p; D7t	SOT23
BCP51	BCP51	SC-73/SOT223
BCP51-16	BCP51/16	SC-73/SOT223

TYPE NUMBER	MARKING CODE	PACKAGE
BCP52-16	BCP52/16	SC-73/SOT223
BCP53	BCP53	SC-73/SOT223
BCP53-10	BCP53/10	SC-73/SOT223
BCP53-16	BCP53/16	SC-73/SOT223
BCP54	BCP54	SC-73/SOT223
BCP54-16	BCP54/16	SC-73/SOT223
BCP55	BCP55	SC-73/SOT223
BCP55-10	BCP55/10	SC-73/SOT223
BCP55-16	BCP55/16	SC-73/SOT223
BCP56	BCP56	SC-73/SOT223
BCP56-10	BCP56/10	SC-73/SOT223
BCP56-16	BCP56/16	SC-73/SOT223
BCP68	BCP68	SC-73/SOT223
BCP68-25	BCP68/25	SC-73/SOT223
BCP69	BCP69	SC-73/SOT223
BCP69-16	BCP/16	SC-73/SOT223
BCP69-25	BCP/25	SC-73/SOT223
BCV26	FDp; FDt	SOT23
BCV27	FFp; FFt	SOT23
BCV28	ED	SC-62/SOT89
BCV29	EF	SC-62/SOT89
BCV46	FEp; FEt	SOT23
BCV47	FGp; FGt	SOT23
BCV48	EE	SC-62/SOT89
BCV49	EG	SC-62/SOT89
BCV61	1Mp	SOT143B
BCV61A	1Jp	SOT143B
BCV61B	1Kp	SOT143B
BCV61C	1Lp	SOT143B
BCV62	3Mp	SOT143B
BCV62A	3Jp	SOT143B
BCV62B	3Kp	SOT143B
BCV62C	3Lp	SOT143B
BCV63	D95	SOT143B
BCV63B	D96	SOT143B
BCV64B	C96	SOT143B
BCV65	97p	SOT143B
BCV71	K7p; K7t	SOT23
BCV72	K8p; K8t	SOT23
BCW29	C1p; C1t	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BCW30	C2p; C2t	SOT23
BCW31	D1p; D1t	SOT23
BCW32	D2p; D2t	SOT23
BCW33	D3p; D3t	SOT23
BCW60B	ABp; ABt	SOT23
BCW60C	ACp; ACt	SOT23
BCW60D	ADp; ADt	SOT23
BCW61B	BBp; BBt	SOT23
BCW61C	BCp; BCt	SOT23
BCW61D	BDp; BDt	SOT23
BCW69	H1p; H1t	SOT23
BCW70	H2p; H2t	SOT23
BCW71	K1p; K1t	SOT23
BCW72	K2p; K2t	SOT23
BCW89	H3p; H3t	SOT23
BCX17	T1p; T1t	SOT23
BCX18	T2p; T2t	SOT23
BCX19	U1p; U1t	SOT23
BCX51	AA	SC-62/SOT89
BCX51-10	AC	SC-62/SOT89
BCX51-16	AD	SC-62/SOT89
BCX52	AE	SC-62/SOT89
BCX52-10	AG	SC-62/SOT89
BCX52-16	AM	SC-62/SOT89
BCX53	AH	SC-62/SOT89
BCX53-10	AK	SC-62/SOT89
BCX53-16	AL	SC-62/SOT89
BCX54	BA	SC-62/SOT89
BCX54-10	BC	SC-62/SOT89
BCX54-16	BD	SC-62/SOT89
BCX55	BE	SC-62/SOT89
BCX55-10	BG	SC-62/SOT89
BCX55-16	BM	SC-62/SOT89
BCX56	BH	SC-62/SOT89
BCX56-10	BK	SC-62/SOT89
BCX56-16	BL	SC-62/SOT89
BCX70G	AGp; AGt	SOT23
BCX70H	AHp; AHt	SOT23
BCX70J	AJp; AJt	SOT23
BCX70K	AKp; AKt	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
BCX71G	BGp; BGt	SOT23
BCX71H	BHp; BHt	SOT23
BCX71J	BJp; BJt	SOT23
BCX71K	BKp; BKt	SOT23
BDL31	BDL31	SC-73/SOT223
BDL32	BDL32	SC-73/SOT223
BDP31	BDP31	SC-73/SOT223
BDP32	BDP32	SC-73/SOT223
BF550	LAp; LAt	SOT23
BF570	B26	SOT23
BF620	DC	SC-62/SOT89
BF621	DF	SC-62/SOT89
BF622	DA	SC-62/SOT89
BF623	DB	SC-62/SOT89
BF720	BF720	SC-73/SOT223
BF722	BF722	SC-73/SOT223
BF723	BF723	SC-73/SOT223
BF820	1Vp; 1Vt	SOT23
BF820W	1Vt; 1V-	SC-70/SOT323
BF821	1Wp; 1Wt	SOT23
BF822	1Xp; 1Xt	SOT23
BF822W	1Wt; 1W-	SC-70/SOT323
BF823	1Yp; 1Yt	SOT23
BF824	F8p; F8t	SOT23
BF824W	F8t; F8-	SC-70/SOT323
BF840	NCp; NCt	SOT23
BFS19	F2p; F2t	SOT23
BFS20	G1p; G1t	SOT23
BFS20W	N1t; N1-	SC-70/SOT323
BRY61	A5p; A5t	SOT23
BRY62	A51	SOT143B
BSP16	BSP16	SC-73/SOT223
BSP19	BSP19	SC-73/SOT223
BSP20	BSP20	SC-73/SOT223
BSP31	BSP31	SC-73/SOT223
BSP32	BSP32	SC-73/SOT223
BSP33	BSP33	SC-73/SOT223
BSP41	BSP41	SC-73/SOT223
BSP43	BSP43	SC-73/SOT223
BSP50	BSP50	SC-73/SOT223

TYPE NUMBER	MARKING CODE	PACKAGE
BSP51	BSP51	SC-73/SOT223
BSP52	BSP52	SC-73/SOT223
BSP60	BSP60	SC-73/SOT223
BSP61	BSP61	SC-73/SOT223
BSP62	BSP62	SC-73/SOT223
BSR13	U7p; U7t	SOT23
BSR14	U8p; U8t	SOT23
BSR15	T7p; T7t	SOT23
BSR16	T8p; T8t	SOT23
BSR17A	U92	SOT23
BSR18A	T92	SOT23
BSR19	U35	SOT23
BSR19A	U36	SOT23
BSR20	T35	SOT23
BSR20A	T36	SOT23
BSR30	BR1	SC-62/SOT89
BSR31	BR2	SC-62/SOT89
BSR33	BR4	SC-62/SOT89
BSR40	AR1	SC-62/SOT89
BSR41	AR2	SC-62/SOT89
BSR42	AR3	SC-62/SOT89
BSR43	AR4	SC-62/SOT89
BSS63	BMp; BMt	SOT23
BSS64	AMp; AMt	SOT23
BST15	BT1	SC-62/SOT89
BST16	BT2	SC-62/SOT89
BST39	AT1	SC-62/SOT89
BST40	AT2	SC-62/SOT89
BST50	AS1	SC-62/SOT89
BST51	AS2	SC-62/SOT89
BST52	AS3	SC-62/SOT89
BST60	BS1	SC-62/SOT89
BST61	BS2	SC-62/SOT89
BST62	BS3	SC-62/SOT89
BSV52	B2p; B2t	SOT23
PDTA114EE	03	SC-75/SOT416
PDTA114EEF	03	SC-89/SOT490
PDTA114EK	03	SC-59/SOT346
PDTA114ET	p03; t03	SOT23
PDTA114EU	t03; -03	SC-70/SOT323

TYPE NUMBER	MARKING CODE	PACKAGE
PDTA114TK	23	SC-59/SOT346
PDTA114TT	p11; t11	SOT23
PDTA114TU	t23; -23	SC-70/SOT323
PDTA114YT	p29; t29	SOT23
PDTA123ET	p21; t21	SOT23
PDTA123JEF	27	SC-89/SOT490
PDTA123JT	p23; t23	SOT23
PDTA124EE	05	SC-75/SOT416
PDTA124EK	05	SC-59/SOT346
PDTA124ET	p05; t05	SOT23
PDTA124EU	t05; -05	SC-70/SOT323
PDTA124XE	31	SC-75/SOT416
PDTA124XEF	31	SC-89/SOT490
PDTA143EE	01	SC-75/SOT416
PDTA143EK	01	SC-59/SOT346
PDTA143ET	p01; t01	SOT23
PDTA143EU	01t; 01-	SC-70/SOT323
PDTA143XE	35	SC-75/SOT416
PDTA143XT	p31; t31	SOT23
PDTA143ZK	19	SC-59/SOT346
PDTA143ZT	p19; t19	SOT23
PDTA144EE	07	SC-75/SOT416
PDTA144EEF	07	SC-89/SOT490
PDTA144EK	07	SC-59/SOT346
PDTA144ET	p07; t07	SOT23
PDTA144EU	t07; -07	SC-70/SOT323
PDTA144WU	t28; -28	SC-70/SOT323
PDTC114EE	09	SC-75/SOT416
PDTC114EK	04	SC-59/SOT346
PDTC114ET	p16; t16	SOT23
PDTC114EU	t09; -09	SC-70/SOT323
PDTC114TE	24	SC-75/SOT416
PDTC114TK	24	SC-59/SOT346
PDTC114TT	p12; t12	SOT23
PDTC114TU	t24; -24	SC-70/SOT323
PDTC114YE	33	SC-75/SOT416
PDTC114YT	p27; t27	SOT23
PDTC114YU	t30; -30	SC-70/SOT323
PDTC123ET	p26; t26	SOT23
PDTC123JE	28	SC-75/SOT416

TYPE NUMBER	MARKING CODE	PACKAGE
PDTC123JEF	28	SC-89/SOT490
PDTC123JT	p25; t25	SOT23
PDTC124EE	06	SC-75/SOT416
PDTC124EK	06	SC-59/SOT346
PDTC124ET	p17; t17	SOT23
PDTC124EU	t06; -06	SC-70/SOT323
PDTC124XE	32	SC-75/SOT416
PDTC124XEF	32	SC-89/SOT490
PDTC143EE	02	SC-75/SOT416
PDTC143EK	02	SC-59/SOT346
PDTC143ET	p02; t02	SOT23
PDTC143EU	t02; -02	SC-70/SOT323
PDTC143TT	p33; t33	SOT23
PDTC143XE	34	SC-75/SOT416
PDTC143XT	p32; t32	SOT23
PDTC143ZK	18	SC-59/SOT346
PDTC143ZT	p18; t18	SOT23
PDTC144EE	08	SC-75/SOT416
PDTC144EEF	08	SC-89/SOT490
PDTC144EK	08	SC-59/SOT346
PDTC144ET	p08; t08	SOT23
PDTC144EU	t08; -08	SC-70/SOT323
PDTC144WT	p20; t20	SOT23
PDTC144WU	t20; -20	SC-70/SOT323
PMBS3904	pO4; t04	SOT23
PMBS3906	pO6; t06	SOT23
PMBT2222	p1B; t1B	SOT23
PMBT2222A	p1P; t1P	SOT23
PMBT2369	p1J; t1J	SOT23
PMBT2907	p2B; t2B	SOT23
PMBT2907A	p2F; t2F	SOT23
PMBT3904	p1A; t1A	SOT23
PMBT3906	p2A; t2A	SOT23
PMBT4401	p2X; t2X	SOT23
PMBT4403	p2T; t2T	SOT23
PMBT5088	p1Q; t1Q	SOT23
PMBT5401	p2L; t2L	SOT23
PMBT5550	p1F; t1F	SOT23
PMBT5551	pG1; tG1	SOT23
PMBT6428	p1K; t1K	SOT23

TYPE NUMBER	MARKING CODE	PACKAGE
PMBT6429	p1L; t1L	SOT23
PMBTA06	p1G; t1G	SOT23
PMBTA13	p1M; t1M	SOT23
PMBTA14	p1N; t1N	SOT23
PMBTA42	p1D; t1D	SOT23
PMBTA56	p2G; t2G	SOT23
PMBTA64	p2V; t2V	SOT23
PMBTA92	p2D; t2D	SOT23
PMMT491A	9Ap; 9At	SOT23
PMMT591A	9Bp; 9Bt	SOT23
PMSS3904	t04; -04	SC-70/SOT323
PMSS3906	t06; -06	SC-70/SOT323
PMST2222	t1B; -1B	SC-70/SOT323
PMST2222A	t1P; -1P	SC-70/SOT323
PMST2369	t1J; -1J	SC-70/SOT323
PMST2907A	t2F; -2F	SC-70/SOT323
PMST3904	t1A; -1A	SC-70/SOT323
PMST3906	t2A; -2A	SC-70/SOT323
PMST4401	t2X; -2X	SC-70/SOT323
PMST4403	t2T; -2T	SC-70/SOT323
PMST5088	t1Q; -1Q	SC-70/SOT323
PMST5089	t1R; -1R	SC-70/SOT323
PMST5401	t2L; -2L	SC-70/SOT323
PMST5550	t1F; -1F	SC-70/SOT323
PMST5551	tG3; -G3	SC-70/SOT323
PMST6428	t1K; -1K	SC-70/SOT323
PMST6429	t1L; -1L	SC-70/SOT323
PMSTA05	t1H; -1H	SC-70/SOT323
PMSTA06	t1G; -1G	SC-70/SOT323
PMSTA42	t1D; -1D	SC-70/SOT323
PMSTA43	t1E; -1E	SC-70/SOT323
PMSTA55	t2H; -2H	SC-70/SOT323
PMSTA56	t2G; -2G	SC-70/SOT323
PMSTA92	t2D; -2D	SC-70/SOT323
PMSTA93	t2E; -2E	SC-70/SOT323
PUMB4	Bt4	SC-88/SOT363
PUMD2	Dt2	SC-88/SOT363
PUMD3	Dt3	SC-88/SOT363
PUMD6	Dt6	SC-88/SOT363
PUMD9	Dt9	SC-88/SOT363

TYPE NUMBER	MARKING CODE	PACKAGE
PUMD10	Dt0	SC-88/SOT363
PUMD12	Dt1	SC-88/SOT363
PUMD48	4t8	SC-88/SOT363
PUMH1	Ht2	SC-88/SOT363
PUMH4	Ht4	SC-88/SOT363
PUMH7	Ht7	SC-88/SOT363
PUMH11	Ht1	SC-88/SOT363
PUMT1	FtF	SC-88/SOT363
PUMX1	ZtZ	SC-88/SOT363
PUMZ1	FtZ	SC-88/SOT363
PXT2222A	p1P	SC-62/SOT89
PXT2907A	p2F	SC-62/SOT89
PXT3904	p1A	SC-62/SOT89
PXT3906	p2A	SC-62/SOT89
PXT4401	p2X	SC-62/SOT89
PXT4403	p2T	SC-62/SOT89
PXTA14	p1N	SC-62/SOT89
PXTA42	p1D	SC-62/SOT89
PXTA92	p2D	SC-62/SOT89
PZT2222A	ZT2222A	SC-73/SOT223
PZT2907A	ZT2907A	SC-73/SOT223
PZT3904	ZT3904	SC-73/SOT223
PZT3906	ZT3906	SC-73/SOT223
PZT4401	ZT4401	SC-73/SOT223
PZT4403	ZT4403	SC-73/SOT223
PZTA14	PZTA14	SC-73/SOT223
PZTA42	ZTA42	SC-73/SOT223
PZTA44	PZTA44	SC-73/SOT223
PZTA92	PZTA92	SC-73/SOT223

TRANSISTOR MARKING CODE TO TYPE NUMBER

MARKING CODE	TYPE NUMBER	PACKAGE
01	PDTA143EE	SC-75/ SOT416
01	PDTA143EK	SC-59/SOT346
01t	PDTA143EU	SC-70/SOT323
01-	PDTA143EU	SC-70/SOT323
02	PDTC143EE	SC-75/ SOT416
02	PDTC143EK	SC-59/SOT346
03	PDTA114EE	SC-75/ SOT416

MARKING CODE	TYPE NUMBER	PACKAGE
03	PDTA114EK	SC-59/SOT346
03	PDTA114EEF	SC-89/SOT490
04	PDTC114EK	SC-59/SOT346
05	PDTA124EE	SC-75/ SOT416
05	PDTA124EK	SC-59/SOT346
06	PDTC124EE	SC-75/ SOT416
06	PDTC124EK	SC-59/SOT346
07	PDTA144EE	SC-75/ SOT416
07	PDTA144EEF	SC-89/SOT490
07	PDTA144EK	SC-59/SOT346
08	PDTC144EE	SC-75/ SOT416
08	PDTC144EEF	SC-89/SOT490
08	PDTC144EK	SC-59/SOT346
09	PDTC114EE	SC-75/ SOT416
11	PDTA114TE	SC-75/ SOT416
13t	BC847BPN	SC-88/SOT363
18	PDTC143ZK	SC-59/SOT346
19	PDTA143ZK	SC-59/SOT346
1A	BC846AT	SC-75/ SOT416
1Ap	BC846A	SOT23
1At	BC846A	SOT23
1At	BC846AW	SC-70/SOT323
1A-	BC846AW	SC-70/SOT323
1B	BC846BT	SC-75/ SOT416
1Bp	BC846B	SOT23
1Bt	BC846B	SOT23
1Bt	BC846BW	SC-70/SOT323
1B-	BC846BW	SC-70/SOT323
1Dp	BC846	SOT23
1Dt	BC846	SOT23
1Dt	BC846W	SC-70/SOT323
1D-	BC846W	SC-70/SOT323
1E	BC847AT	SC-75/ SOT416
1Ep	BC847A	SOT23
1Et	BC847A	SOT23
1Et	BC847AW	SC-70/SOT323
1E-	BC847AW	SC-70/SOT323
1F	BC847BT	SC-75/ SOT416
1Fp	BC847B	SOT23
1Ft	BC847B	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
1Ft	BC847BS	SC-88/SOT363
1Ft	BC847BW	SC-70/SOT323
1F-	BC847BW	SC-70/SOT323
1G	BC847CT	SC-75/ SOT416
1Gp	BC847C	SOT23
1Gt	BC847C	SOT23
1Gt	BC847CW	SC-70/SOT323
1G-	BC847CW	SC-70/SOT323
1Hp	BC847	SOT23
1Ht	BC847	SOT23
1Ht	BC847W	SC-70/SOT323
1H-	BC847W	SC-70/SOT323
1Kp	BCV61B	SOT143B
1Lp	BCV61C	SOT143B
1Mp	BCV61	SOT143B
1Vp	BF820	SOT23
1Vt	BF820	SOT23
1Vt	BF820W	SC-70/SOT323
1V-	BF820W	SC-70/SOT323
1Wp	BF821	SOT23
1Wt	BF821	SOT23
1Wt	BF822W	SC-70/SOT323
1W-	BF822W	SC-70/SOT323
1Xp	BF822	SOT23
1Xt	BF822	SOT23
1Yp	BF823	SOT23
1Yt	BF823	SOT23
23	PDTA114TK	SC-59/SOT346
24	PDTC114TE	SC-75/SOT416
24	PDTC114TK	SC-59/SOT346
27	PDTA123JEF	SC-89/SOT490
28	PDTC123JE	SC-75/SOT416
28	PDTC123JEF	SC-89/SOT490
2Bp	BC849B	SOT23
2Bt	BC849B	SOT23
2Bt	BC849BW	SC-70/SOT323
2B-	BC849BW	SC-70/SOT323
2Cp	BC849C	SOT23
2Ct	BC849C	SOT23
2Ct	BC849CW	SC-70/SOT323

MARKING CODE	TYPE NUMBER	PACKAGE
2C-	BC849CW	SC-70/SOT323
2Fp	BC850B	SOT23
2Ft	BC850B	SOT23
2Ft	BC850BW	SC-70/SOT323
2F-	BC850BW	SC-70/SOT323
2Gp	BC850C	SOT23
2Gt	BC850C	SOT23
2Gt	BC850CW	SC-70/SOT323
2G-	BC850CW	SC-70/SOT323
31	PDTA124XE	SC-75/SOT416
31	PDTA124XEF	SC-89/SOT490
32	PDTC124XE	SC-75/SOT416
32	PDTC124XEF	SC-89/SOT490
33	PDTC114YE	SC-75/SOT416
34	PDTC143XE	SC-75/SOT416
35	PDTA143XE	SC-75/SOT416
3A	BC856AT	SC-75/SOT416
3Ap	BC856A	SOT23
3At	BC856A	SOT23
3At	BC856AW	SC-70/SOT323
3A-	BC856AW	SC-70/SOT323
3B	BC856BT	SC-75/SOT416
3Bp	BC856B	SOT23
3Bt	BC856B	SOT23
3Bt	BC856BW	SC-70/SOT323
3B-	BC856BW	SC-70/SOT323
3Dp	BC856	SOT23
3Dt	BC856	SOT23
3Dt	BC856W	SC-70/SOT323
3D-	BC856W	SC-70/SOT323
3E	BC857AT	SC-75/SOT416
3Ep	BC857A	SOT23
3Et	BC857A	SOT23
3Et	BC857AW	SC-70/SOT323
3E-	BC857AW	SC-70/SOT323
3F	BC857BT	SC-75/SOT416
3Fp	BC857B	SOT23
3Ft	BC857B	SOT23
3Ft	BC857BS	SC-88/SOT363
3Ft	BC857BW	SC-70/SOT323

MARKING CODE	TYPE NUMBER	PACKAGE
3F-	BC857BW	SC-70/SOT323
3G	BC857CT	SC-75/SOT416
3Gp	BC857C	SOT23
3Gt	BC857C	SOT23
3Gt	BC857CW	SC-70/SOT323
3G-	BC857CW	SC-70/SOT323
3Hp	BC857	SOT23
3Ht	BC857	SOT23
3Ht	BC857W	SC-70/SOT323
3H-	BC857W	SC-70/SOT323
3Jp	BCV62A	SOT143B
3Kp	BCV62B	SOT143B
3Lp	BCV62C	SOT143B
3Mp	BCV62	SOT143B
4Bp	BC859B	SOT23
4Bt	BC859B	SOT23
4Bt	BC859BW	SC-70/SOT323
4B-	BC859BW	SC-70/SOT323
4Cp	BC859C	SOT23
4Ct	BC859C	SOT23
4Ct	BC859CW	SC-70/SOT323
4C-	BC859CW	SC-70/SOT323
4Dt	BC859W	SC-70/SOT323
4D-	BC859W	SC-70/SOT323
4Fp	BC860B	SOT23
4Ft	BC860B	SOT23
4Ft	BC860BW	SC-70/SOT323
4F-	BC860BW	SC-70/SOT323
4Gp	BC860C	SOT23
4Gt	BC860C	SOT23
4Gt	BC860CW	SC-70/SOT323
4G-	BC860CW	SC-70/SOT323
4Ht	BC860W	SC-70/SOT323
4H-	BC860W	SC-70/SOT323
4t8	PUMD48	SC-88/SOT363
5Ap	BC807-16	SOT23
5At	BC807-16	SOT23
5At	BC807-16W	SC-70/SOT323
5A-	BC807-16W	SC-70/SOT323
5Bp	BC807-25	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
5Bt	BC807-25	SOT23
5Bt	BC807-25W	SC-70/SOT323
5B-	BC807-25W	SC-70/SOT323
5Cp	BC807-40	SOT23
5Ct	BC807-40	SOT23
5Ct	BC807-40W	SC-70/SOT323
5C-	BC807-40W	SC-70/SOT323
5Dp	BC807	SOT23
5Dt	BC807	SOT23
5Dt	BC807W	SC-70/SOT323
5D-	BC807W	SC-70/SOT323
6Ap	BC817-16	SOT23
6At	BC817-16	SOT23
6At	BC817-16W	SC-70/SOT323
6A-	BC817-16W	SC-70/SOT323
6Bp	BC817-25	SOT23
6Bt	BC817-25	SOT23
6Bt	BC817-25W	SC-70/SOT323
6B-	BC817-25W	SC-70/SOT323
6Cp	BC817-40	SOT23
6Ct	BC817-40	SOT23
6Ct	BC817-40W	SC-70/SOT323
6C-	BC817-40W	SC-70/SOT323
6Dp	BC817	SOT23
6Dt	BC817	SOT23
6Dt	BC817W	SC-70/SOT323
6D-	BC817W	SC-70/SOT323
9Ap	PMMT491A	SOT23
9At	PMMT491A	SOT23
9Bp	PMMT591A	SOT23
9Bt	PMMT591A	SOT23
97p	BCV65	SOT143B
A51	BRY62	SOT143B
A5p	BRY61	SOT23
A5t	BRY61	SOT23
AA	BCX51	SC-62/SOT89
ABp	BCW60B	SOT23
ABt	BCW60B	SOT23
AC	BCX51-10	SC-62/SOT89
ACp	BCW60C	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
ACt	BCW60C	SOT23
AD	BCX51-16	SC-62/SOT89
ADp	BCW60D	SOT23
ADt	BCW60D	SOT23
AE	BCX52	SC-62/SOT89
AG	BCX52-10	SC-62/SOT89
AGp	BCX70G	SOT23
AGt	BCX70G	SOT23
AH	BCX53	SC-62/SOT89
AHp	BCX70H	SOT23
AHt	BCX70H	SOT23
AJp	BCX70J	SOT23
AJt	BCX70J	SOT23
AK	BCX53-10	SC-62/SOT89
AKp	BCX70K	SOT23
AKt	BCX70K	SOT23
AL	BCX53-16	SC-62/SOT89
AM	BCX52-16	SC-62/SOT89
AMp	BSS64	SOT23
AMt	BSS64	SOT23
AR1	BSR40	SC-62/SOT89
AR2	BSR41	SC-62/SOT89
AR3	BSR42	SC-62/SOT89
AR4	BSR43	SC-62/SOT89
AS1	BST50	SC-62/SOT89
AS2	BST51	SC-62/SOT89
AS3	BST52	SC-62/SOT89
AT1	BST39	SC-62/SOT89
AT2	BST40	SC-62/SOT89
AtQ	2PD1820AQ	SC-70/SOT323
AtR	2PD1820AR	SC-70/SOT323
AtS	2PD1820AS	SC-70/SOT323
A-Q	2PD1820AQ	SC-70/SOT323
A-R	2PD1820AR	SC-70/SOT323
A-S	2PD1820AS	SC-70/SOT323
B26	BF570	SOT23
B2p	BSV52	SOT23
B2t	BSV52	SOT23
BA	BCX54	SC-62/SOT89
BAp	BCW61A	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
BAt	BCW61A	SOT23
BBp	BCW61B	SOT23
BBt	BCW61B	SOT23
BC	BCX54-10	SC-62/SOT89
BCP51	BCP51	SC-73/SOT223
BCP51/16	BCP51-16	SC-73/SOT223
BCP52/16	BCP52-16	SC-73/SOT223
BCP53	BCP53	SC-73/SOT223
BCP53/10	BCP53-10	SC-73/SOT223
BCP53/16	BCP53-16	SC-73/SOT223
BCP54	BCP54	SC-73/SOT223
BCP54/16	BCP54-16	SC-73/SOT223
BCP55	BCP55	SC-73/SOT223
BCP55/10	BCP55-10	SC-73/SOT223
BCP55/16	BCP55-16	SC-73/SOT223
BCP56	BCP56	SC-73/SOT223
BCP56/10	BCP56-10	SC-73/SOT223
BCP56/16	BCP56-16	SC-73/SOT223
BCP68	BCP68	SC-73/SOT223
BCP68/25	BCP68-25	SC-73/SOT223
BCP69	BCP69	SC-73/SOT223
BCP/16	BCP69-16	SC-73/SOT223
BCP/25	BCP69-25	SC-73/SOT223
BCp	BCW61C	SOT23
BCt	BCW61C	SOT23
BD	BCX54-16	SC-62/SOT89
BDL31	BDL31	SC-73/SOT223
BDL32	BDL32	SC-73/SOT223
BDP31	BDP31	SC-73/SOT223
BDP32	BDP32	SC-73/SOT223
BDp	BCW61D	SOT23
BDt	BCW61D	SOT23
BE	BCX55	SC-62/SOT89
BF720	BF720	SC-73/SOT223
BF722	BF722	SC-73/SOT223
BF723	BF723	SC-73/SOT223
BG	BCX55-10	SC-62/SOT89
BGp	BCX71G	SOT23
BGt	BCX71G	SOT23
BH	BCX56	SC-62/SOT89

MARKING CODE	TYPE NUMBER	PACKAGE
BHp	BCX71H	SOT23
BHt	BCX71H	SOT23
BJp	BCX71J	SOT23
BJt	BCX71J	SOT23
BK	BCX56-10	SC-62/SOT89
BKp	BCX71K	SOT23
BKt	BCX71K	SOT23
BL	BCX56-16	SC-62/SOT89
BM	BCX55-16	SC-62/SOT89
BMp	BSS63	SOT23
BMt	BSS63	SOT23
BQ	2PB709AQ	SC-59/SOT346
BR	2PB709AR	SC-59/SOT346
BR1	BSR30	SC-62/SOT89
BR2	BSR31	SC-62/SOT89
BR4	BSR33	SC-62/SOT89
BS	2PB709AS	SC-59/SOT346
BS1	BST60	SC-62/SOT89
BS2	BST61	SC-62/SOT89
BS3	BST62	SC-62/SOT89
BSP16	BSP16	SC-73/SOT223
BSP19	BSP19	SC-73/SOT223
BSP20	BSP20	SC-73/SOT223
BSP31	BSP31	SC-73/SOT223
BSP32	BSP32	SC-73/SOT223
BSP33	BSP33	SC-73/SOT223
BSP41	BSP41	SC-73/SOT223
BSP43	BSP43	SC-73/SOT223
BSP50	BSP50	SC-73/SOT223
BSP51	BSP51	SC-73/SOT223
BSP52	BSP52	SC-73/SOT223
BSP60	BSP60	SC-73/SOT223
BSP61	BSP61	SC-73/SOT223
BSP62	BSP62	SC-73/SOT223
BT1	BST15	SC-62/SOT89
BT2	BST16	SC-62/SOT89
Bt4	PUMB4	SC-88/SOT363
C1p	BCW29	SOT23
C1t	BCW29	SOT23
C2p	BCW30	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
C2t	BCW30	SOT23
C96	BCV64B	SOT143B
CAC	BC868	SC-62/SOT89
CDC	BC868-25	SC-62/SOT89
CEC	BC869	SC-62/SOT89
CGC	BC869-16	SC-62/SOT89
CHC	BC869-25	SC-62/SOT89
D1p	BCW31	SOT23
D1t	BCW31	SOT23
D2p	BCW32	SOT23
D2t	BCW32	SOT23
D3p	BCW33	SOT23
D3t	BCW33	SOT23
D7p	BCF32	SOT23
D7t	BCF32	SOT23
D95	BCV63	SOT143B
D96	BCV63B	SOT143B
DA	BF622	SC-62/SOT89
DB	BF623	SC-62/SOT89
DC	BF620	SC-62/SOT89
DF	BF621	SC-62/SOT89
DQ	2PB710AQ	SC-59/SOT346
DR	2PB710AR	SC-59/SOT346
DS	2PB710AS	SC-59/SOT346
Dt0	PUMD10	SC-88/SOT363
Dt1	PUMD12	SC-88/SOT363
Dt2	PUMD2	SC-88/SOT363
Dt3	PUMD3	SC-88/SOT363
Dt6	PUMD6	SC-88/SOT363
Dt9	PUMD9	SC-88/SOT363
DtQ	2PB1219AQ	SC-70/SOT323
DtR	2PB1219AR	SC-70/SOT323
DtS	2PB1219AS	SC-70/SOT323
D-Q	2PB1219AQ	SC-70/SOT323
D-R	2PB1219AR	SC-70/SOT323
D-S	2PB1219AS	SC-70/SOT323
ED	BCV28	SOT89
EE	BCV48	SOT89
EF	BCV29	SOT89
EG	BCV49	SOT89

MARKING CODE	TYPE NUMBER	PACKAGE
F2p	BFS19	SOT23
F2t	BFS19	SOT23
F8p	BF824	SOT23
F8t	BF824	SOT23
F8t	BF824W	SC-70/SOT323
FDp	BCV26	SOT23
FDt	BCV26	SOT23
FEp	BCV46	SOT23
FEt	BCV46	SOT23
FFp	BCV27	SOT23
FFt	BCV27	SOT23
FGp	BCV47	SOT23
FGt	BCV47	SOT23
FtF	PUMT1	SC-88/SOT363
FtQ	2PA1576Q	SC-70/SOT323
FtR	2PA1576R	SC-70/SOT323
FtS	2PA1576S	SC-70/SOT323
F-Q	2PA1576Q	SC-70/SOT323
F-R	2PA1576R	SC-70/SOT323
F-S	2PA1576S	SC-70/SOT323
FtZ	PUMZ1	SC-88/SOT363
G1p	BFS20	SOT23
G1t	BFS20	SOT23
H1p	BCW69	SOT23
H1t	BCW69	SOT23
H2p	BCW70	SOT23
H2t	BCW70	SOT23
H3p	BCW89	SOT23
H3t	BCW89	SOT23
Ht1	PUMH11	SC-88/SOT363
Ht2	PUMH1	SC-88/SOT363
Ht4	PUMH4	SC-88/SOT363
Ht7	PUMH7	SC-88/SOT363
K1p	BCW71	SOT23
K1t	BCW71	SOT23
K2p	BCW72	SOT23
K2t	BCW72	SOT23
K3t	BCW81	SOT23
K7p	BCV71	SOT23
K7t	BCV71	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
K8p	BCV72	SOT23
K8t	BCV72	SOT23
LAp	BF550	SOT23
LAt	BF550	SOT23
N1t	BFS20W	SC-70/SOT323
N1-	BFS20W	SC-70/SOT323
NCp	BF840	SOT23
NCt	BF840	SOT23
PZTA14	PZTA14	SC-73/SOT223
PZTA44	PZTA44	SC-73/SOT223
PZTA92	PZTA92	SC-73/SOT223
T1p	BCX17	SOT23
T1t	BCX17	SOT23
T2p	BCX18	SOT23
T2t	BCX18	SOT23
T35	BSR20	SOT23
T36	BSR20A	SOT23
T7p	BSR15	SOT23
T7t	BSR15	SOT23
T8p	BSR16	SOT23
T8t	BSR16	SOT23
T92	BSR18A	SOT23
U1p	BCX19	SOT23
U1t	BCX19	SOT23
U2t	BCX20	SOT23
U35	BSR19	SOT23
U36	BSR19A	SOT23
U7p	BSR13	SOT23
U7t	BSR13	SOT23
U8p	BSR14	SOT23
U8t	BSR14	SOT23
U92	BSR17A	SOT23
XQ	2PD602AQ	SC-59/SOT346
XR	2PD602AR	SC-59/SOT346
XS	2PD602AS	SC-59/SOT346
YQ	2PA1774JQ	SC-89/SOT490
YQ	2PA1774Q	SC-75/SOT416
YR	2PA1774JR	SC-89/SOT490
YR	2PA1774R	SC-75/SOT416
YS	2PA1774JS	SC-89/SOT490

MARKING CODE	TYPE NUMBER	PACKAGE
YS	2PA1774S	SC-75/SOT416
ZQ	2PC4617JQ	SC-89/SOT490
ZQ	2PC4617Q	SC-75/SOT416
ZQ	2PD601AQ	SC-59/SOT346
ZR	2PC4617JR	SC-89/SOT490
ZR	2PC4617R	SC-75/SOT416
ZR	2PD601AR	SC-59/SOT346
ZS	2PC4617JS	SC-89/SOT490
ZS	2PC4617S	SC-75/SOT416
ZS	2PD601AS	SC-59/SOT346
ZT2222A	PZT2222A	SC-73/SOT223
ZT2907A	PZT2907A	SC-73/SOT223
ZT3904	PZT3904	SC-73/SOT223
ZT3906	PZT3906	SC-73/SOT223
ZT4401	PZT4401	SC-73/SOT223
ZT4403	PZT4403	SC-73/SOT223
ZTA42	PZTA42	SC-73/SOT223
ZtQ	2PC4081Q	SC-70/SOT323
ZtR	2PC4081R	SC-70/SOT323
ZtS	2PC4081S	SC-70/SOT323
Z-Q	2PC4081Q	SC-70/SOT323
Z-R	2PC4081R	SC-70/SOT323
Z-S	2PC4081S	SC-70/SOT323
ZtZ	PUMX1	SC-88/SOT363
p01	PDTA143ET	SOT23
p02	PDTC143ET	SOT23
p03	PDTA114ET	SOT23
p05	PDTA124ET	SOT23
p07	PDTA144ET	SOT23
p08	PDTC144ET	SOT23
p11	PDTA114TT	SOT23
p12	PDTC114TT	SOT23
p16	PDTC114ET	SOT23
p17	PDTC124ET	SOT23
p18	PDTC143ZT	SOT23
p19	PDTA143ZT	SOT23
p20	PDTC144WT	SOT23
p21	PDTA123ET	SOT23
p23	PDTA123JT	SOT23
p25	PDTC123JT	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
p26	PDTC123ET	SOT23
p27	PDTC114YT	SOT23
p29	PDTA114YT	SOT23
p31	PDTA143XT	SOT23
p32	PDTC143XT	SOT23
p33	PDTC143TT	SOT23
p1A	PMBT3904	SOT23
p1A	PXT3904	SC-62/SOT89
p1B	PMBT2222	SOT23
p1D	PMBTA42	SOT23
p1D	PXTA42	SC-62/SOT89
p1F	PMBT5550	SOT23
p1G	PMBTA06	SOT23
p1J	PMBT2369	SOT23
p1K	PMBT6428	SOT23
p1L	PMBT6429	SOT23
p1M	PMBTA13	SOT23
p1N	PMBTA14	SOT23
p1N	PXTA14	SC-62/SOT89
p1P	PMBT2222A	SOT23
p1P	PXT2222A	SC-62/SOT89
p1Q	PMBT5088	SOT23
p2A	PMBT3906	SOT23
p2A	PXT3906	SC-62/SOT89
p2B	PMBT2907	SOT23
p2D	PMBTA92	SOT23
p2D	PXTA92	SC-62/SOT89
p2F	PMBT2907A	SOT23
p2F	PXT2907A	SC-62/SOT89
p2G	PMBTA56	SOT23
p2L	PMBT5401	SOT23
p2T	PMBT4403	SOT23
p2T	PXT4403	SC-62/SOT89
p2V	PXTA64	SC-62/SOT89
p2X	PMBT4401	SOT23
p2X	PXT4401	SC-62/SOT89
pG1	PMBT5551	SOT23
pO4	PMBS3904	SOT23
pO6	PMBS3906	SOT23
t01	PDTA143ET	SOT23
t02	PDTC143ET	SOT23
t02	PDTC143EU	SC-70/SOT323
t03	PDTA114ET	SOT23
t03	PDTA114EU	SC-70/SOT323
t04	PMSS3904	SC-70/SOT323
t05	PDTA124ET	SOT23
t05	PDTA124EU	SC-70/SOT323
t06	PDTC124EU	SC-70/SOT323
t06	PMSS3906	SC-70/SOT323
t07	PDTA144ET	SOT23
t07	PDTA144EU	SC-70/SOT323
t08	PDTC144ET	SOT23
t08	PDTC144EU	SC-70/SOT323
t09	PDTB114ET	SOT23
t09	PDTC114EU	SC-70/SOT323
t10	PDTD114ET	SOT23
t11	PDTA114TT	SOT23
t12	PDTC114TT	SOT23
t16	PDTC114ET	SOT23
t17	PDTC124ET	SOT23
t18	PDTC143ZT	SOT23
t19	PDTA143ZT	SOT23
t20	PDTC144WT	SOT23
t20	PDTC144WU	SC-70/SOT323
t21	PDTA123ET	SOT23
t23	PDTA123JT	SOT23
t23	PDTA114TU	SC-70/SOT323
t24	PDTC114TU	SC-70/SOT323
t25	PDTC123JT	SOT23
t26	PDTC123ET	SOT23
t27	PDTC114YT	SOT23
t28	PDTA144WU	SC-70/SOT323
t29	PDTA114YT	SOT23
t30	PDTC114YU	SC-70/SOT323
t31	PDTA143XT	SOT23
t32	PDTC143XT	SOT23
t33	PDTC143TT	SOT23
t1A	PMBT3904	SOT23
t1A	PMST3904	SC-70/SOT323
t1B	PMBT2222	SOT23

MARKING CODE	TYPE NUMBER	PACKAGE
t1B	PMST2222	SC-70/SOT323
t1D	PMBTA42	SOT23
t1D	PMSTA42	SC-70/SOT323
t1E	PMBTA43	SOT23
t1E	PMSTA43	SC-70/SOT323
t1F	PMBT5550	SOT23
t1F	PMST5550	SC-70/SOT323
t1G	PMBTA06	SOT23
t1G	PMSTA06	SC-70/SOT323
t1H	PMSTA05	SC-70/SOT323
t1J	PMBT2369	SOT23
t1J	PMST2369	SC-70/SOT323
t1K	PMBT6428	SOT23
t1K	PMST6428	SC-70/SOT323
t1L	PMBT6429	SOT23
t1L	PMST6429	SC-70/SOT323
t1M	PMBTA13	SOT23
t1N	PMBTA14	SOT23
t1P	PMBT2222A	SOT23
t1P	PMST2222A	SC-70/SOT323
t1Q	PMBT5088	SOT23
t1Q	PMST5088	SC-70/SOT323
t1R	PMST5089	SC-70/SOT323
t2A	PMBT3906	SOT23
t2A	PMST3906	SC-70/SOT323
t2B	PMBT2907	SOT23
t2D	PMBTA92	SOT23
t2D	PMSTA92	SC-70/SOT323
t2E	PMBTA93	SOT23
t2E	PMSTA93	SC-70/SOT323
t2F	PMBT2907A	SOT23
t2F	PMST2907A	SC-70/SOT323
t2G	PMBTA56	SOT23
t2G	PMSTA56	SC-70/SOT323
t2H	PMBTA55	SOT23
t2H	PMSTA55	SC-70/SOT323
t2L	PMBT5401	SOT23
t2L	PMST5401	SC-70/SOT323
t2T	PMBT4403	SOT23
t2T	PMST4403	SC-70/SOT323

MARKING CODE	TYPE NUMBER	PACKAGE
t2U	PMBTA63	SOT23
t2V	PMBTA64	SOT23
t2X	PMBT4401	SOT23
t2X	PMST4401	SC-70/SOT323
tG1	PMBT5551	SOT23
tG3	PMST5551	SC-70/SOT323
tO4	PMBS3904	SOT23
tO6	PMBS3906	SOT23
-02	PDTC143EU	SC-70/SOT323
-03	PDTA114EU	SC-70/SOT323
-04	PMSS3904	SC-70/SOT323
-05	PDTA124EU	SC-70/SOT323
-06	PDTC124EU	SC-70/SOT323
-06	PMSS3906	SC-70/SOT323
-07	PDTA144EU	SC-70/SOT323
-09	PDTC114EU	SC-70/SOT323
-1A	PMST3904	SC-70/SOT323
-1B	PMST2222	SC-70/SOT323
-20	PDTC144WU	SC-70/SOT323
-28	PDTA144WU	SC-70/SOT323
-30	PDTC114YU	SC-70/SOT323

GENERAL

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QUALITY

Total Quality Management

Philips Semiconductors is a Quality Company, aiming towards one ultimate standard, that of Business Excellence. The tool we use in striving towards this goal is our Total Quality Management (TQM) system. The TQM is described in our Quality manuals, and is summarized in the following paragraphs. The Philips Business Excellence Programme as part of TQM follows the European Foundation for Quality Management (EFQM) model. The EFQM award is on the level of the Malcolm Baldridge award.

QUALITY ASSURANCE

Quality Assurance (QA) is based on ISO 9000 standards and customer standards such as QS-9000. Our factories are certified to ISO 9000 and QS-9000 by external inspectorates. Sales organizations and headquarters are also certified to ISO 9000. The products of Philips Semiconductors are in conformance with the requirements of international standards.

PARTNERSHIPS WITH CUSTOMERS

Partnerships with customers include Process Quality measurement co-operation (using PPM), design-in agreements, ship-to-stock, just-in-time, sharing technology roadmaps, a change notification programme, self-qualification programmes and application support.

PARTNERSHIPS WITH SUPPLIERS

Our suppliers are certified to ISO 9000 and participate in ship-to-stock programmes. Key-suppliers receive support and feedback through our Supplier Quality System (SQS) audits.

CONTINUOUS IMPROVEMENT PROGRAMME

The continuous improvement programme incorporates continuous process and system improvement, design improvement, complete use of statistical process control, and logistics improvement, driven by key performance indicators. To encourage improvement in teamwork a very popular Quality Improvement Competition is held yearly. With a large number of improvement teams participating, opportunities arise for the sharing of successful improvement ideas.

Advanced quality planning

During the design and development of new products and processes, quality is built-in by advanced quality planning. By means of failure-mode-and-effect analysis the critical parameters of a process are identified. Procedures are then laid down to ensure the highest level of performance for these parameters. The capability of process steps is also planned in this phase in preparation for production under statistical process control.

Quality network

Product quality is the responsibility of the Business Lines, with their Quality and Reliability (Q&R) departments operating in a supportive and controlling manner. The sales organization has Quality Managers who respond to any quality matters raised by customers. Customer complaints are then handled by direct contact between Sales Quality and the relevant Q&R department. General quality requirements are covered by a divisional Quality department.

Product conformance

The assurance of product conformance is an integral part of our Quality Assurance practice. This is achieved by:

- In-line Quality Assurance to monitor process reproducibility during manufacture. Equipment performance and process steps are under statistical process control.
- Acceptance tests on finished products to verify conformance with the device specification. The test results are used for Quality feedback and corrective actions. Periodic sample inspections to monitor and measure the conformance of products are increasingly being replaced by continuous in-line monitoring.
- Qualification tests.

The inspection and test requirements are detailed in the General Quality Specifications in the SNW-FQ-611 series.

Product reliability

Highly accelerated tests are implemented to evaluate and monitor product reliability. Rejects from reliability tests are subjected to failure analysis, so that improvements may be made. This analysis also extends to product related customer complaints.

Customer response

Our quality improvement depends on working together with our customer. We need our customer's input, and we therefore invite constructive comments on all aspects of our performance. For all such matters, please contact your local Philips Semiconductors sales representative.

RATING SYSTEMS

The rating systems described are those recommended by the IEC in its publication number 60134.

Remark: It is common practice to use the Absolute Maximum Rating System in published semiconductor data sheets.

Definitions of terms used

ELECTRONIC DEVICE

An electronic tube or valve, transistor or other semiconductor device.

Remark: This definition excludes inductors, capacitors, resistors and similar components.

CHARACTERISTIC

A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

BOGEY ELECTRONIC DEVICE

An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics that are directly related to the application.

RATING

A value that establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Remark: Limiting conditions may be either maxima or minima.

RATING SYSTEM

The set of principles upon which ratings are established and which determine their interpretation.

Remark: The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type, as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout the life of the device, no absolute maximum value for the intended service is exceeded with any device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Design maximum rating system

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout the life of the device, no design-maximum value for the intended service is exceeded with a bogey electronic device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design centre rating system

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

TRANSISTOR RATINGS

Voltage ratings

COLLECTOR TO BASE

V_{CBmax} The maximum permissible instantaneous voltage between collector and base terminals. The collector voltage is negative with respect to base in PNP transistors and positive with respect to base in NPN types.

V_{CBmax} ($I_E = 0$) The maximum permissible instantaneous voltage between collector and base terminals when the emitter terminal is open-circuit.

EMITTER TO BASE

V_{EBmax} The maximum permissible instantaneous voltage between emitter and base terminals. The emitter voltage is negative with respect to base in PNP transistors and positive with respect to base in NPN types.

V_{EBmax} ($I_C = 0$) The maximum permissible instantaneous voltage between emitter and base terminals when the collector terminal is open-circuit.

COLLECTOR TO EMITTER

V_{CEmax} The maximum permissible instantaneous voltage between collector and emitter terminals. The collector voltage is negative with respect to emitter in PNP transistors and positive with respect to emitter in NPN types. This rating is very dependent on circuit conditions and collector current, and it is necessary to refer to the curve of V_{CE} versus I_C for the appropriate circuit condition in order to obtain the correct rating.

V_{CEmax} (Cut-off) The maximum permissible instantaneous voltage between collector and emitter terminals when the emitter current is reduced to zero by means of a reverse emitter base voltage, i.e. the base voltage is normally positive with respect to emitter for PNP transistors and negative with respect to emitter for NPN types. The term '(Cut-off)' is sometimes replaced by $V_{BE} > x$ V, or $R_B/R_E \leq y$, which are equivalent conditions under which the transistor may be cut off.

V_{CEmax} (I_C = x mA) The maximum permissible instantaneous voltage between collector and emitter terminals when the collector current is at a high value, often the maximum rated value.

V_{CEmax} ($I_B = 0$) The maximum permissible instantaneous voltage between collector and emitter terminals when the base terminal is open-circuit or when a very high resistance is in series with the base terminal. Special care must be taken to ensure that thermal runaway due to excessive collector leakage current does not occur in this condition.

Due to the current dependency of V_{CE} it is usual to present this information as a voltage rating chart, a curve of collector current as a function of collector-to-emitter voltage (see Fig.1). The permissible area of operation under all conditions of base drive (provided the dissipation rating is not exceeded) is shown as area 1 and operation under certain specified conditions is shown as area 2.

To assist in determining the rating in area 2, further curves can relate the voltage rating to external circuit conditions, for example: R_B/R_E, R_B, Z_{Bg}, V_{BE}, I_B or V_{BB}/R_B. An example of this type of curve is given in Fig.2 with V_{CE} as a function of R_B/R_E for two values of collector current.

It should be noted that when R_E is shunted by a capacitor, during switching, the collector voltage V_{CE} must be restricted to a value that does not rely on the effect of R_E.

In the case of an inductive load, when an energy rating is given, it may be safe to operate outside the rated area provided the specified energy rating is not exceeded.

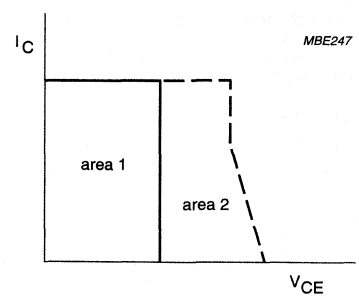


Fig.1 Graph of permissible operating areas.

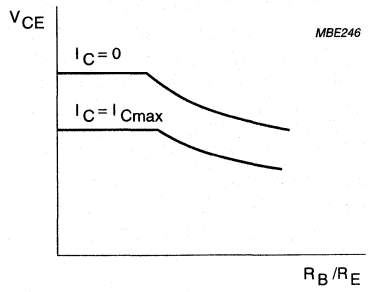


Fig.2 Graph showing effect of collector current on permissible operating areas.

Current ratings

COLLECTOR

I_{Cmax} The maximum permissible collector current. Without further qualification, the DC value is implied.

$I_{C(AV)max}$ The maximum permissible average value of the total collector current.

I_{CM} The maximum permissible instantaneous value of the total collector current.

Emitter

I_{Emax} The maximum permissible emitter current. Without further qualification, the DC value is implied.

$I_{E(AV)max}$ The maximum permissible average value of the total emitter current.

$I_{ER(AV)max}$ The maximum permissible average value of the total emitter current when operating in the reverse emitter-base breakdown region.

I_{EM} The maximum permissible instantaneous value of the total emitter current.

I_{ERM} The maximum permissible instantaneous value of the total emitter current when operating in the reverse breakdown region.

BASE

I_{Bmax} The maximum permissible base current. Without further qualification, the DC value is implied.

$I_{B(AV)max}$ The maximum permissible average value of the total base current.

$I_{BR(AV)max}$ The maximum permissible average value of the total base current when operating in the reverse breakdown region.

I_{BM} The maximum permissible instantaneous value of the total base current. The rating also includes the switch-off current.

I_{BRM} The maximum permissible instantaneous value of the total reverse current allowable in the reverse breakdown region.

Power ratings

The total maximum permissible continuous power dissipation in the transistor, $P_{tot\ max}$, includes collector-base dissipation and emitter-base dissipation. Under steady state conditions, the total power is given as:

$P_{tot} = V_{CE} \times I_C + V_{BE} \times I_B$.

In order to distinguish between 'steady state' and 'pulse' conditions, the terms 'steady state power (P_S)' and 'pulse power (P_P)' can be used. The permissible total power dissipation is dependent on temperature; this relationship is shown in Fig.3.

The temperature may be the ambient, the case or the mounting base temperature. Where a cooling clip or heatsink is attached to the device, the allowable power dissipation is also dependent on the efficiency of the heatsink.

The efficiency of this clip or heatsink is measured in terms of its thermal resistance ($R_{th\ h}$) normally expressed in degrees Kelvin per Watt (K/W). For mounting-base rated devices, the added effect of the contact resistance ($R_{th\ i}$) must be taken into account.

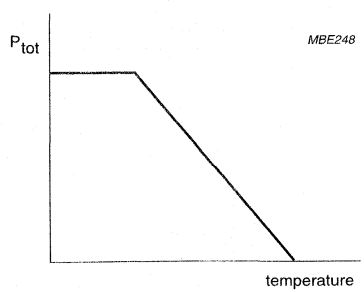


Fig.3 Permissible total power dissipation.

The effect of heatsinks of various thermal and contact resistance is often included in the graph of permissible total power dissipation.

The relationship between maximum power dissipation, ambient temperature and thermal heatsink resistance is given by:

$$P_{tot} = \frac{T_j - T_{amb}}{R_{th\,j-a}}$$

where $R_{th\,j\text{-}a}$ is the thermal resistance from the transistor junction to the ambient. For case rated or mounting-base rated devices, the thermal resistance $R_{th\,j}$ is made up of the thermal resistance junction to case or mounting-base ($R_{th\,j\text{-}mb}$), the contact thermal resistance ($R_{th\,i}$) and the heatsink thermal resistance ($R_{th\,h}$).

For the calculation of pulse power operation, the maximum pulse power is obtained using a graph as shown in Fig.4

The general expression from which the maximum pulse power dissipation can be calculated is:

$$P_p = \frac{T_j - T_{amb} - P_S \times R_{th\,j-a}}{Z_{th\,t} + d\,(R_{th\,c-a})}$$

where $Z_{th\,t}$ and δ are given in Fig.4 and $R_{th\,c-a}$ is the thermal resistance between case and ambient for a case rated device. For a mounting-base rated device, it is equal to $R_{th\,h} + R_{th\,i}$ and is zero for a free-air rated device because the effect of the temperature rise of the case over the ambient for a pulse train is already included in $Z_{th\,t}$.

Temperature ratings

$T_{j\,max}$ The maximum permissible junction temperature which is used as the basis for the calculation of power ratings. Unless otherwise stated, the continuous value is implied.

$T_{j\,max}$ (continuous operation): indicates the maximum permissible continuous value.

$T_{j\,max}$ (intermittent operation): indicates the maximum permissible instantaneous junction temperature usually allowed for a total duration of 200 hours.

T_{mb} The temperature of the surface in contact with the heatsink. This is confined to devices where a flange or stud for fixing onto a heatsink forms an integral part of the package.

T_{case} The temperature of the package. This is confined to devices that may have a clip-on cooling fin attachment.

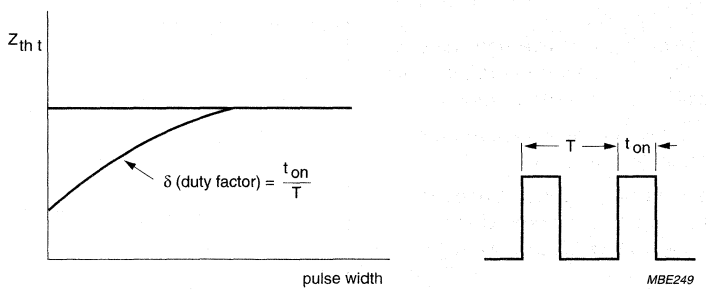


Fig.4 Pulse power operation.

LETTER SYMBOLS

The letter symbols for transistors detailed in this section are based on IEC publication number 148.

Letter symbols for currents, voltages and powers

BASIC LETTERS

I, i current

V, v voltage

P, p power.

Upper-case letter symbols are used to represent all values except instantaneous values that vary with time, these are represented by lower-case letters.

SUBSCRIPTS

A, a	anode terminal
(AV), (av)	average value
B, b	base terminal
C, c	collector terminal
D, d	drain terminal
E, e	emitter terminal
F, f	forward
G, g	gate terminal
K, k	cathode terminal
M, m	peak value
O, o	as third subscript: the terminal not mentioned is open-circuit
R, r	as first subscript: reverse. As second subscript: repetitive. As third subscript: with a specified resistance between the terminal not mentioned and the reference terminal
(RMS), (rms)	root-mean-square value
S, s	as first or second subscript: source terminal (FETs only). As second subscript: non-repetitive (not FETs). As third subscript: short circuit between the terminal not mentioned and the reference terminal
X, x	specified circuit
Z, z	replaces R to indicate the actual working voltage, current or power of voltage reference and voltage reference diodes.

No additional subscript is used for DC values.

Upper-case subscripts are used for the indication of:

- Continuous (DC) values (without signal), e.g. I_B
- Instantaneous total values, e.g. i_B
- Average total values, e.g. $I_{B(AV)}$
- Peak total values, e.g. I_{BM}
- Root-mean-square total values, e.g. $I_{B(RMS)}$.

Lower-case subscripts are used for the indication of values applying to the varying component alone:

- Instantaneous values, e.g. i_b
- Root-mean-square values, e.g. $I_{b(rms)}$
- Peak values, e.g. I_{bm}
- Average values, e.g. $I_{b(av)}$.

If more than one subscript is used, the subscript for which both styles exist are either all upper-case or all lower-case.

ADDITIONAL RULES FOR SUBSCRIPTS

Transistor currents

If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}.

Transistor voltages

If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}.

Supply voltages or currents

Supply voltages or supply currents are indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}.

If it is necessary to indicate a reference terminal, this should be done by a third subscript.

Example: V_{CCE}.

Subscripts for devices with more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal, followed by a number. In the case of multiple subscripts, hyphens may be necessary to avoid confusion.

Examples:

I_{B2} continuous (DC) current flowing into the second base terminal

V_{B2-E} continuous (DC) voltage between the terminals of second base and emitter terminals.

Subscripts for multiple devices

For multiple unit devices, the subscripts are modified by a number preceding the letter subscript. In the case of multiple subscripts, hyphens may be necessary to avoid confusion.

Examples:

I_{2C} continuous (DC) current flowing into the collector terminal of the second unit

V_{1C-2C} continuous (DC) voltage between the collector terminals of the first and second units.

Application of the rules

Figure 1 represents a transistor collector current as a function of time. It comprises a continuous (DC) current and a varying component.

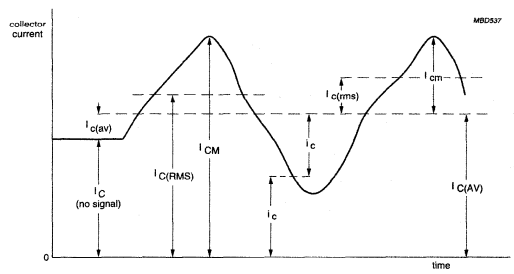


Fig.1 Collector current as a function of time.

Letter symbols for electrical parameters

DEFINITION

For the purpose of this publication, the term 'electrical parameter' applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

BASIC LETTERS

The following list comprises the most important basic letters used for electrical parameters of semiconductor devices.

B, b susceptance (imaginary part of an admittance)
C capacitance
G, g conductance (real part of an admittance)
H, h hybrid parameter
L inductance
R, r resistance (real part of an impedance)
X, x reactance (imaginary part of an impedance)
Y, y admittance
Z, z impedance.

Upper-case letters are used for the representation of:

- Electrical parameters of external circuits and of circuits in which the device forms only a part
- All inductances and capacitances.

Lower-case letters are used for the representation of electrical parameters inherent in the device, with the exception of inductances and capacitances.

SUBSCRIPTS

General subscripts

The following list comprises the most important general subscripts used for electrical parameters of semiconductor devices.

F, f forward (forward transfer)
I, i (or 1) input
L, l load
O, o (or 2) output
R, r reverse (reverse transfer)
S, s source.

Examples: Z_s, h_f, h_F.

The upper-case variant of a subscript is used for the designation of static (DC) values.

Examples:

h_{FE} static value of forward current transfer ratio in common-emitter configuration (DC current gain)

R_E DC value of the external emitter resistance.

The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript is used for the designation of small-signal values.

Examples:

h_{fe}	small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$Z_e = R_e + jX_e$	small-signal value of the external impedance.

If more than one subscript is used, subscripts for which both styles exist are either all upper-case or all lower-case.

Examples: h_{FE}, y_{RE}, h_{fe}.

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer.

Examples: h_i (or h_{11}), h_o (or h_{22}), h_f (or h_{21}), h_r (or h_{12}).

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E}).

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$, $y_{fe} = g_{fe} + jb_{fe}$.

If such symbols do not exist, or if they are not suitable, the following notation is used:

Examples:

Re (h_{ib}) etc. for the real part of h_{ib}

Im (h_{ib}) etc. for the imaginary part of h_{ib}.

THERMAL CONSIDERATIONS - DIODES

Thermal resistance

Circuit performance and long-term reliability are affected by the temperature of the die. Normally, both are improved by keeping the die temperature (junction temperature) low.

Electrical power dissipated in any semiconductor device is a source of heat. This increases the temperature of the die about some reference point, normally an ambient temperature of 25 °C in still air. The extent of increase in temperature depends on the amount of power dissipated in the device and the net thermal resistance between the heat source and the reference point. This can be expressed with the following formula:

$\Delta T_j = P_{tot} \times R_{th(j\text{-}a)}$

where:

ΔT_j is the increase in junction temperature

P_{tot} is the total power generated in the device

$R_{th(j\text{-}a)}$ is the thermal resistance from junction to ambient.

Surface mount devices

Heat transfer can occur by radiation, conduction and convection. Surface mount devices lose most of their heat by conduction when mounted on a substrate. Referring to Fig.1, heat conducts from its source (the junction) via the package leads and soldered connections to the substrate. Some heat radiates from the package into the surrounding air, where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The thermal resistance for surface mounted devices therefore, can be expressed as:

$R_{th(j\text{-}a)} = R_{th(j\text{-}tp)} + R_{th(tp\text{-}a)}$ (see Fig.2)

where:

$R_{th(j\text{-}a)}$ is the thermal resistance from junction to ambient

$R_{th(j\text{-}tp)}$ is the thermal resistance from junction to tie-point

$R_{th(tp\text{-}a)}$ is the thermal resistance from tie-point to ambient.

The $R_{th(j\text{-}tp)}$ value is essentially independent of external mounting method and cooling air, but is sensitive to the materials used in the package construction, the die bonding method and the die area, all of which are fixed.

The $R_{th(tp\text{-}a)}$ value depends on the shape and material of the tracks and substrate. For all package types these values are given in Table 1 for mounting on (FR4) printed-circuit board with small pad area. For other pad areas and printed-circuit board configurations see Fig.3.

The maximum power handling capability ($P_{tot(max)}$) is given by:

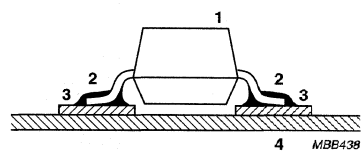
$$P_{tot(max)} = \frac{(T_{j(max)} - T_{amb})}{R_{th(j\text{-}a)}}$$

where:

$T_{j(max)}$ is the maximum junction temperature

T_{amb} is the ambient temperature.

Calculating this maximum power handling capability we have to take into account the maximum junction temperature of the particular device, the maximum temperature of the solder joints (110 °C for long time reliability) and the ambient temperature. Dependent on the ratio of the component parts of the thermal resistance, it will be possible that the junction temperature or the temperature of the solder joints (T_{tp}) will be the limiting factor. This can be shown in the following examples for SOT23 and SOD87 packages mounted on FR4 printed-circuit board.



Heat radiates from the package (1) to ambient.
Heat conducts via leads (2), solder joints (3) to the substrate (4).

Fig.1 Heat losses.

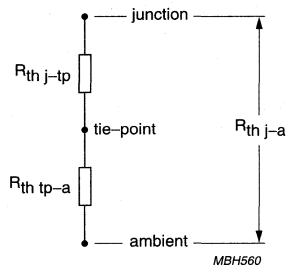


Fig.2 Representation of thermal resistance paths for a surface mounted diode.

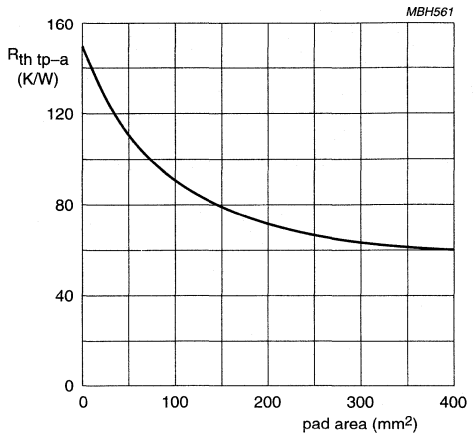


Fig.3 Thermal resistance ($R_{th(tp-a)}$) as a function of FR4 printed-circuit board pad area.

Table 1 Thermal resistance values and maximum power handling capability of surface mount packages

PACKAGE	$R_{th(j-a)}$ (K/W)	$R_{th(j-tp)}$ (K/W)	$R_{th(tp-a)}$ (K/W)	$P_{tot(max)}$ (W)
SC-59 (SOT346)	500	350	150	0.25
SC-70 (SOT323)	500	350	150	0.25
SOD80(C)	320 to 600	170 to 450	150	0.21 to 0.47
SOD87	150	30	120	0.71
SOD106	150	25	125	0.68
SOD110	315	165	150	0.40
SOD323	625	475	150	0.20
SOT23	500	350	150	0.25
SOT143	500	350	150	0.25
SOT323	625	475	150	0.20

EXAMPLE FOR THE SOT23 PACKAGE

$$P_{tot(max)} = \frac{(T_{j(max)} - T_{amb})}{R_{th(j-a)}}$$

$$= \frac{(150\,°C - 25\,°C)}{500\ K/W} = 0.25\ W$$

$$T_{tp} = T_{amb} + P_{tot(max)} \times R_{th(tp-a)}$$

$$= 25\,°C + 0.25\ W \times 150\ K/W = 62.5\,°C$$

This is below 110 °C, so $T_{j\,max}$ is the limiting factor.

EXAMPLE FOR THE SOD87 PACKAGE

$$P_{tot(max)} = \frac{(T_{j(max)} - T_{amb})}{R_{th(j-a)}}$$

$$= \frac{(175\,°C - 25\,°C)}{150\ K/W} = 1\ W$$

$$T_{tp} = T_{amb} + P_{tot(max)} \times R_{th(tp-a)}$$

$$= 25\,°C + 1\ W \times 120\ K/W = 145\,°C$$

This is above 110 °C, so the $P_{tot(max)}$ will be limited by T_{tp}, therefore:

$$P_{tot(max)} = \frac{(T_{tp} - T_{amb})}{R_{th(tp-a)}}$$

$$= \frac{(110\,°C - 25\,°C)}{120\ K/W} = 0.71\ W$$

The $P_{tot(max)}$ values given in Table 1 are based on:

T_{amb} = 25 °C; $T_j = T_{j(max)}$; $T_{tp} \leq 110$ °C.

Leaded devices

Figure 4 illustrates the various components of thermal resistance for an axial leaded diode mounted with symmetrical, equal length leads. The thermal resistance from junction to ambient ($R_{th(j-a)}$) comprises the following thermal resistances:

$R_{th(j-p)}$ is the thermal resistance from junction to package

$R_{th(p-tp)}$ is the thermal resistance from package to tie-point

$R_{th(tp-a)}$ is the thermal resistance from tie-point to ambient

$R_{th(p-a)}$ is the thermal resistance from package to ambient.

The values of the thermal components depend on the diode package type, the lead length and the mounting method used.

Using the model in Fig.4 and referring to Table 2, values for the thermal resistance from junction to ambient can be calculated using the formula:

$$R_{th(j-a)} = R_{th(j-p)} + \frac{R_{th(p-a)}\,(R_{th(p-tp)} + R_{th(tp-a)})}{R_{th(p-a)} + R_{th(p-tp)} + R_{th(tp-a)}}$$

The maximum power handling capability ($P_{tot(max)}$) is given by:

$$P_{tot(max)} = \frac{(T_{j(max)} - T_{(amb)})}{R_{th(j-a)}}$$

where:

$T_{j(max)}$ is the maximum junction temperature and

T_{amb} is the ambient temperature.

Calculating this maximum power handling capability we have to take into account the maximum junction temperature of the particular device, the maximum temperature of the solder joints (110 °C for long time reliability) and the ambient temperature. Dependent on the ratio of the component parts of the thermal resistance it is possible that the junction temperature or the temperature of the solder joints (T_{tp}) will be the limiting factor. This can be shown in the following examples for a SOD57 device mounted on an FR4 printed-circuit board, as shown in Fig.5.

$$R_{th(j-a)} = 14\ K/W + \frac{429\ K/W\,(38\ K/W + 70\ K/W)}{429\ K/W + 38\ K/W + 70\ K/W}$$

$$= 100\ K/W$$

and

$$P_{tot(max)} = \frac{(T_{j(max)} - T_{amb})}{R_{th(j-a)}}$$

$$= \frac{(175\,°C - 60\,°C)}{100\ K/W} = 1.15\ W$$

$$T_{tp} = T_{amb} + \frac{R_{th(p-a)} \times R_{th(tp-a)}}{R_{th(p-a)} + R_{th(p-tp)} + R_{th(tp-a)}} \times P_{tot}$$

Using values in Table 2:

$$T_{tp} = T_{amb} + \frac{429\ K/W \times 70\ K/W}{429\ K/W + 38\ K/W + 70\ K/W} \times P_{tot}$$

is simplified to:

$$T_{tp} = T_{amb} + 56\ K/W \times P_{tot}$$

Using $T_{tp} = 110\ °C$ and $T_{amb} = 60\ °C$ the equation becomes:

$$P_{tot} = \frac{(T_{tp} - T_{amb})}{56\ K/W}$$

$$= \frac{(110\ °C - 60\ °C)}{56\ K/W} = 0.89\ W$$

This is lower than $P_{tot(max)} = 1.15\ W$ (for $T_{j(max)} = 175\ °C$), so in this particular case $T_{tp} = 110\ °C$ is limiting the $P_{tot(max)}$.

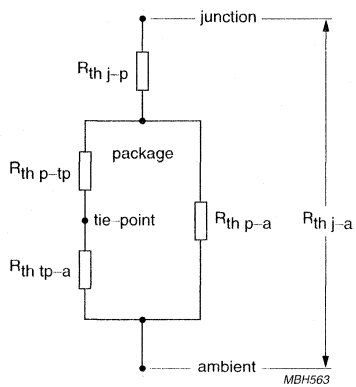


Fig.4 Representation of thermal resistance paths for a leaded device.

Table 2 Thermal resistance values for leaded packages

All values expressed in K/W, unless otherwise specified.

THERMAL RESISTANCE	CONDITIONS	SOD27	SOD57	SOD64	SOD66	SOD68	SOD81	SOD91
$R_{th(j-p)}$		125	14	10	95	150[1]	28	60
$R_{th(p-tp)}$	lead length = 5 mm	121	19	7	19	121	19	48
	lead length = 10 mm	242	38	14	38	242	38	96
	lead length = 15 mm	363	57	21	57	363	57	144
	lead length = 20 mm	484	76	28	76	484	76	192
	lead length = 25 mm	605	95	35	95	605	95	240
$R_{th(p-a)}$	lead length = 5 mm	1050	586	417	673	1343	787	1261
	lead length = 10 mm	744	429	293	473	879	527	843
	lead length = 15 mm	576	338	225	365	654	396	633
	lead length = 20 mm	469	279	183	297	520	317	507
	lead length = 25 mm	396	237	154	250	432	264	423
$R_{th(tp-a)}$	notes 2 and 3	100	–	–	–	100	–	–
	notes 2 and 4	–	70	70	70	–	70	70
	notes 2 and 5	–	55	55	55	–	55	55
	notes 2 and 6	–	45	45	45	–	45	45

Notes

1. For Schottky diodes in SOD68 package $R_{th(j-p)}$ = 125 K/W.
2. Device mounted on a 1.5 mm thick epoxy-glass printed-circuit board with a copper thickness ≥ 40 μm.
3. Mounted as in Fig.6.
4. Mounted as in Fig.5.
5. Mounted with copper laminate per lead of 1 cm^2.
6. Mounted with copper laminate per lead of 2.25 cm^2.

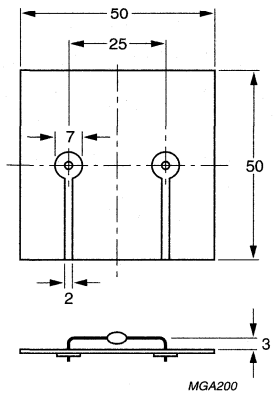


Fig.5 Leaded device mounted on printed-circuit board 50 × 50 mm.

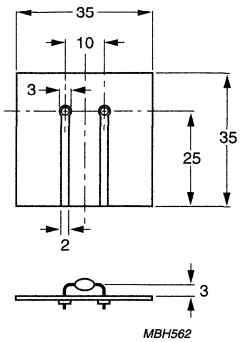


Fig.6 Leaded device mounted on printed-circuit board 35 × 35 mm.

THERMAL CONSIDERATIONS - TRANSISTORS

Thermal resistance

Circuit performance and long-term reliability are affected by the temperature of the transistor die. Normally, both are improved by keeping the die temperature (junction temperature) low.

Electrical power dissipated in any semiconductor device is a source of heat. This increases the temperature of the die about some reference point, normally an ambient temperature of 25 °C in still air. The extent of increase in temperature depends on the amount of power dissipated in the circuit and the net thermal resistance between the heat source and the reference point.

Devices lose most of their heat by conduction when mounted on a printed-circuit board, a substrate or heatsink. Referring to Fig.1 (for surface mounted devices mounted on a substrate), heat conducts from its source (the junction) via the package leads and soldered connections to the substrate. Some heat radiates from the package into the surrounding air where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The elements of thermal resistance shown in Fig.2 are defined as follows:

$R_{th(j-mb)}$ thermal resistance from junction to mounting base

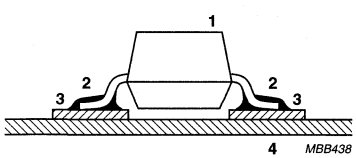
$R_{th(j-c)}$ thermal resistance from junction to case ($R_{th(j-mb)}$ and $R_{th(j-c)}$ are the same for most packages

$R_{th(j-s)}$ thermal resistance from junction to soldering point

$R_{th(s-a)}$ thermal resistance from soldering point to ambient

$R_{th(c-a)}$ thermal resistance from case to ambient ($R_{th(s-a)}$ and $R_{th(c-a)}$ are the same for most packages)

$R_{th(j-a)}$ thermal resistance from junction to ambient.



Heat radiates from the package (1) to ambient.
Heat conducts via leads (2), solder joints (3) to the substrate (4).

Fig.1 Heat losses.

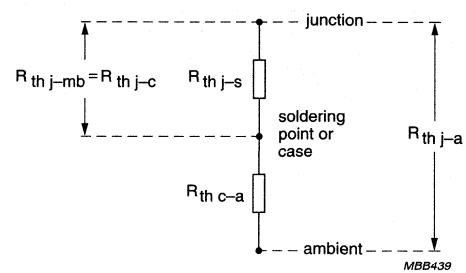


Fig.2 Representation of thermal resistance paths of a device mounted on a substrate or printed-circuit board.

The temperature at the junction depends on the ability of the package and its mounting to transfer heat from the junction region to the ambient environment. The basic relationship between junction temperature and power dissipation is:

$T_{j(max)} = T_{amb} + P_{tot(max)} (R_{th(j-s)} + R_{th(s-a)})$
$= T_{amb} + P_{tot(max)} (R_{th(j-a)})$

where

$T_{j(max)}$ is the maximum junction temperature

T_{amb} is the ambient temperature

$P_{tot(max)}$ is the maximum power handling capability of the device, including the effects of external loads when applicable.

In the expression for $T_{j(max)}$, only T_{amb} and $R_{th(s-a)}$ can be varied by the user. The package mounting technique and the flow of cooling air are factors that affect $R_{th(s-a)}$. The device power dissipation can be controlled to a limited extent but under recommended usage, the supply voltage and circuit loading dictate a fixed power maximum. The $R_{th(j-s)}$ value is essentially independent of external mounting method and cooling air; but is sensitive to the materials used in the package construction, the die bonding method and the die area, all of which are fixed.

Values of $T_{j(max)}$ and $R_{th(j-s)}$, or $R_{th(j-c)}$ or $R_{th(j-a)}$ are given in the device data sheets. For applications where the temperature of the case is stabilized by a large or temperature-controlled heatsink, the junction temperature can be calculated from:

$T_j = T_{case} + P_{tot} \times R_{th(j-c)}$ or, using the soldering point definition, from $T_j = T_{solder} + P_{tot} \times R_{th(j-s)}$.

$R_{th\ s-a}$ for SMDs

The thermal resistance $R_{th(s-a)}$ for SMDs mounted on a ceramic substrate (Al_2O_3) is a function of the substrate area as shown in Fig.3.

The thermal resistance $R_{th(s-a)}$ for SMDs mounted on a FR4 printed-circuit board is a function of the board type (single-sided or double-sided), track area and plated or unplated tracks as shown in Fig.4.

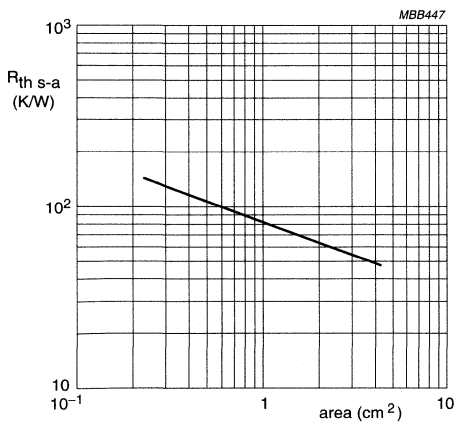
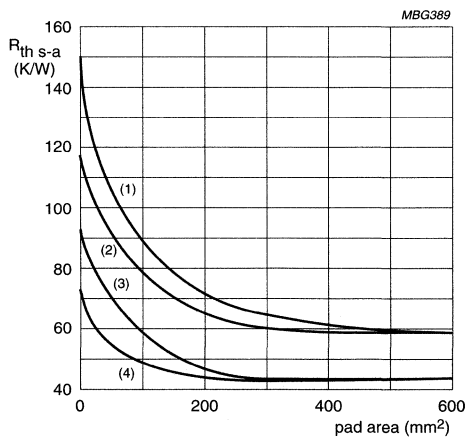


Fig.3 Thermal resistance ($R_{th\ s-a}$) as a function of area of ceramic substrate.



(1) Single-sided, unplated.
(2) Single-sided, plated.
(3) Double-sided, unplated.
(4) Double-sided, plated.

Fig.4 Thermal resistance ($R_{th(s-a)}$) as a function of pad area on different configurations of FR4 printed-circuit board.

Temperature calculation under pulsed conditions

In pulsed power conditions, the peak temperature of the die depends on the pulse time and duty factor as well as the ability of the package and its mounting to disperse heat.

When power is applied in repetitive square-wave pulses with a certain duty factor (δ), the variation in junction temperature has a sawtooth characteristic.

The average steady-state junction temperature is:

$$T_{j(av)} = T_{ref} + \delta \times P_d \times R_{th(j\text{-}ref)}$$

The peak junction temperature, however, is the most relevant to performance reliability. This can be calculated by heating and cooling step functions that result in heating and cooling curves shifted in time as shown in Fig.5.

The peak value of T_j is reached at the end of a power pulse and the minimum value immediately before the next power pulse. The thermal ripple is the difference between $T_{j(peak)}$ and $T_{j(min)}$.

Calculation of $T_{j(peak)}$ after n pulses:

$$T_{j(peak)} = T_{ref} + P_d \times \sum_{a=0}^{a=n-1} [Z_{th(at+w)} - Z_{th(at)}]$$

where 'a' is an integer number.

Approximation method of finding $T_{j(peak)}$

With this method it is assumed that the average load is immediately followed by two square power pulses as shown in Fig.6. This two-pulse approximation method is accurate enough for finding $T_{j(peak)}$.

The junction temperature at the end of the second pulse is:

$$T_{j(peak)} = T_{ref} + P_d \times [\delta \times R_{th(j\text{-}ref)} + (1 - \delta) \times Z_{th(t+w)} + Z_{th(w)} - Z_{th(t)}]$$

The junction temperature immediately before the second power pulse is:

$$T_{j(min)} = T_{ref} + P_d \times [\delta \times R_{th(j\text{-}ref)} + (1 - \delta) \times Z_{th(t)} - Z_{th(t-w)}]$$

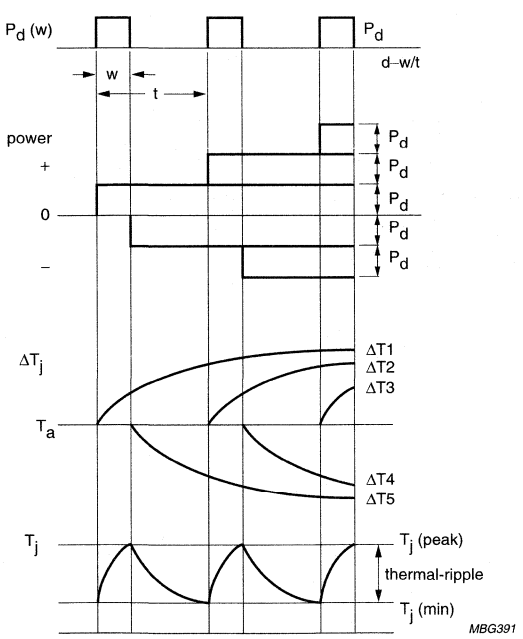


Fig.5 Heating effect of three identical power pulses after thermal stabilization.

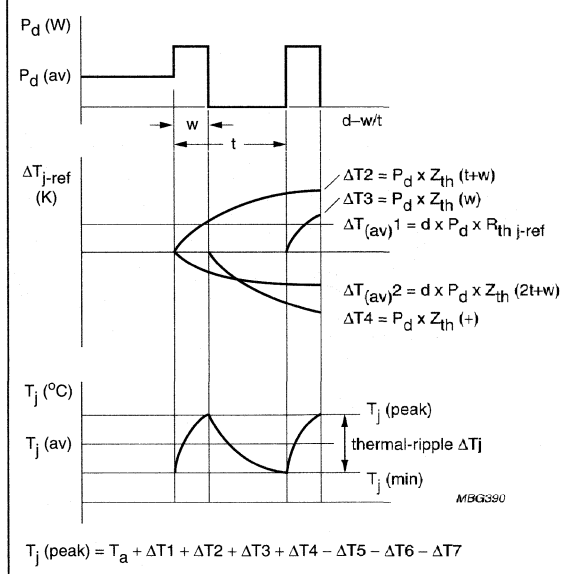


Fig.6 Two-pulse approximation method of finding peak steady-state junction temperature ($T_{j(peak)}$).

The thermal ripple is:

$\Delta T_j = T_{j(peak)} - T_{j(min)}$

$\Delta T_j = P_d \times [\delta \times (Z_{th(t)} - Z_{th(t+w)} - 2 \times Z_{th(t)} + Z_{th(w)} + Z_{th(t-w)}]$

Reducing calculation time

To be able to point out the junction peak temperature at a certain pulse time and duty cycle, a graph similar to that shown in Fig.7 is included in relevant data sheets. In this example, the curves have been derived using the formula $T_{j(peak)} = T_{ref} + P_d \times [\delta \times R_{th(j-ref)} + (1 - \delta) \times Z_{th(t+w)} + Z_{th(w)} - Z_{th(t)}]$, with typical values inserted.

The pulse width along the X-axis meets a particular duty cycle curve, indicating the Z_{th} value in K/W along the Y-axis.

$T_{j(peak)} = P_{d(peak)} \times Z_{th(j-s)} + P_{d(av)} \times R_{th(s-a)} + T_{amb}$ (°C)

Soldering point temperature provides a better reference point than ambient temperature as this is subject to many uncontrolled variables. Therefore, the thermal resistance from junction to soldering point [$R_{th(j-s)}$] is becoming a more relevant measurement path.

For transistors in small SMD packages which are usually mounted on FR4 epoxy fibre-glass printed-circuit boards, only the thermal resistance from junction to ambient [$R_{th(j-a)}$] is published. In this case, the junction temperature can be calculated by:

$T_{j(peak)} = P_{d(peak)} \times Z_{th(j-a)} + T_{amb}$ (°C)

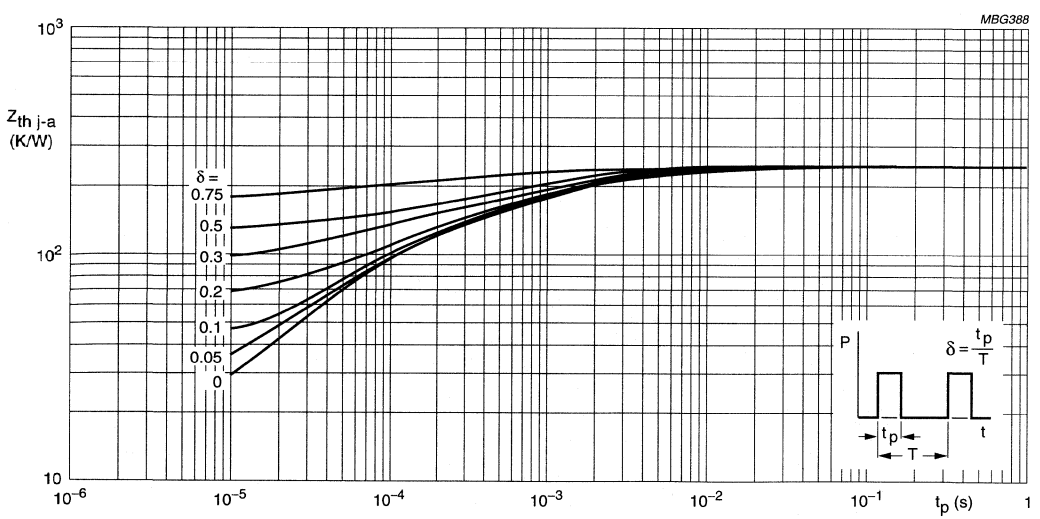
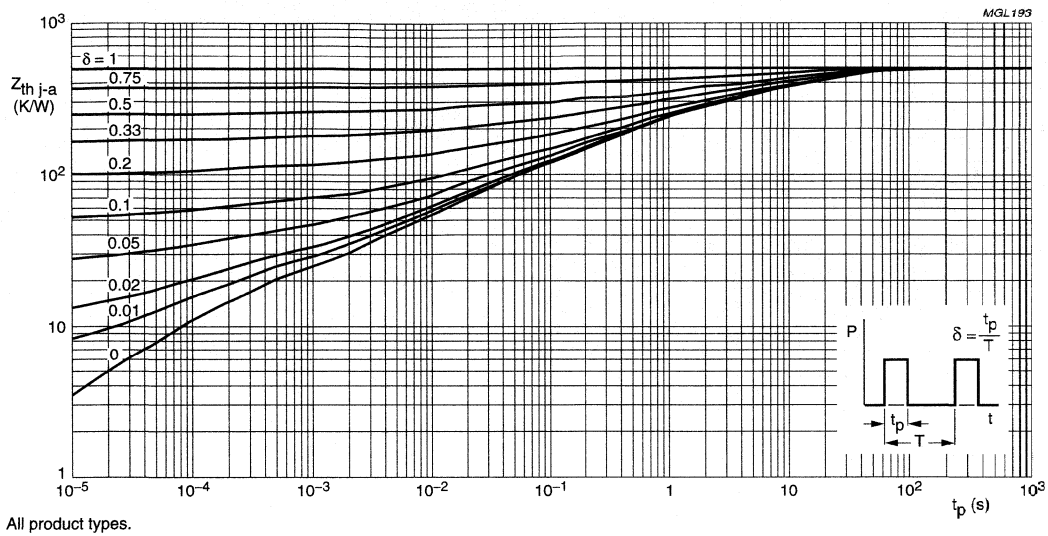


Fig.7 Direct reading of thermal impedance from junction to soldering point for calculation of junction temperature at pulsed power conditions.

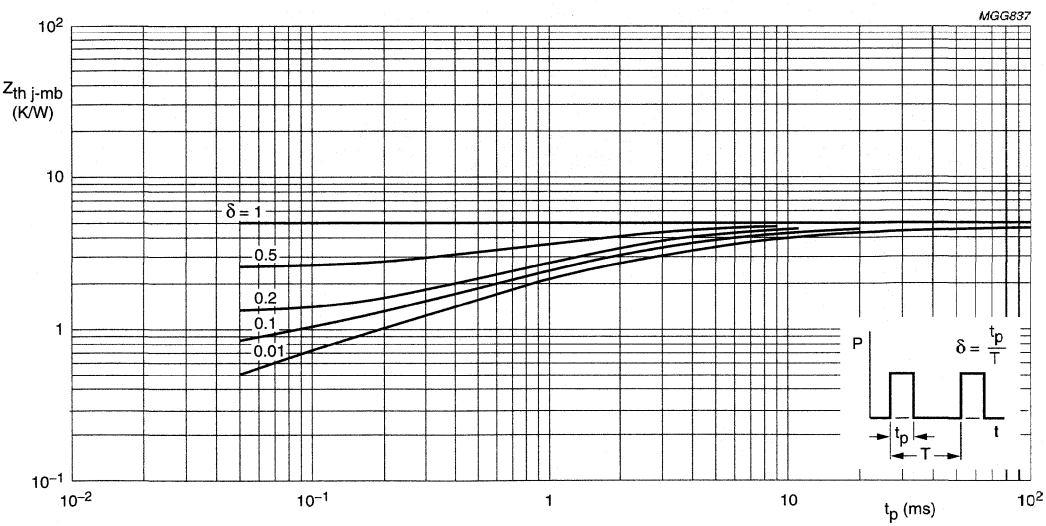
THERMAL IMPEDANCE CURVES

Transistor thermal impedance curves for various packages and duty cycles are shown in Figures 1 to 23 inclusive.



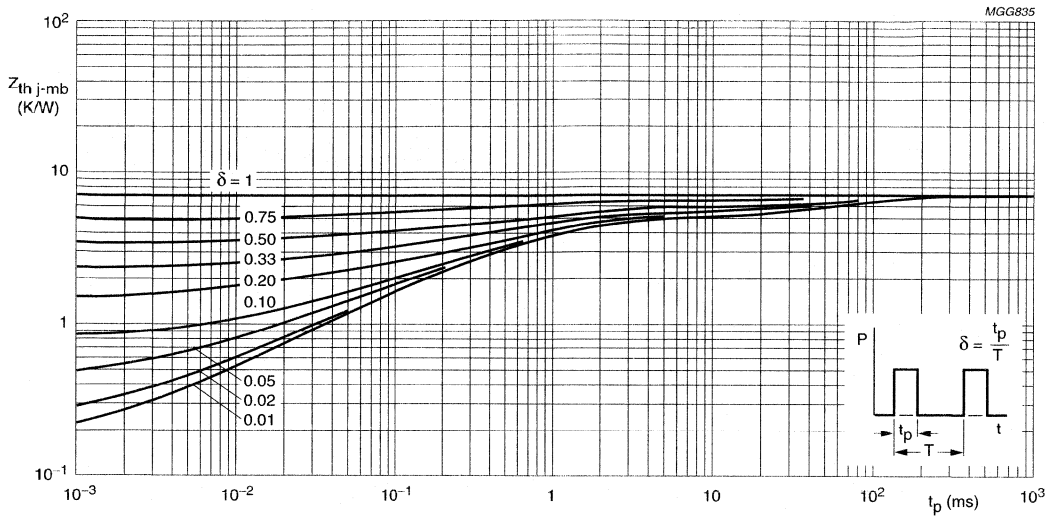
All product types.

Fig.1 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT23.



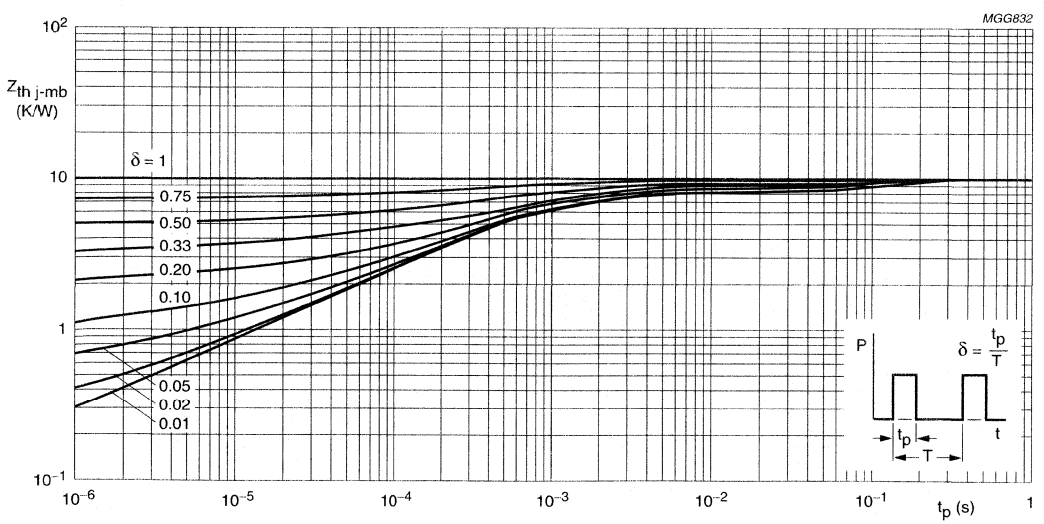
Device example: **BDX35**.

Fig.2 Thermal impedance curves (junction to mounting-base) for transistors mounted on a printed-circuit board: SOT32 (TO-126).



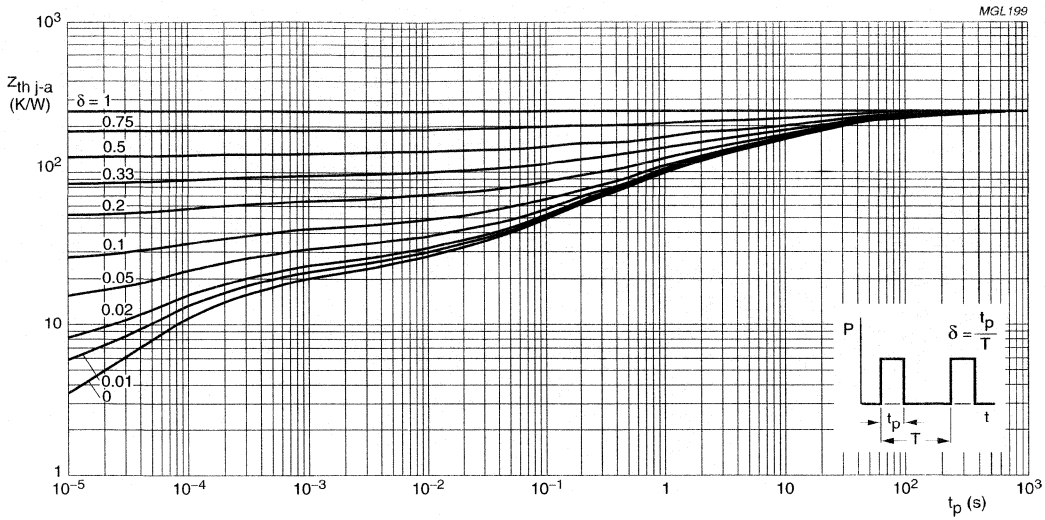
Device example: **BD226**.

Fig.3 Thermal impedance curves (junction to mounting-base) for transistors mounted on a printed-circuit board: SOT32 (TO-126).



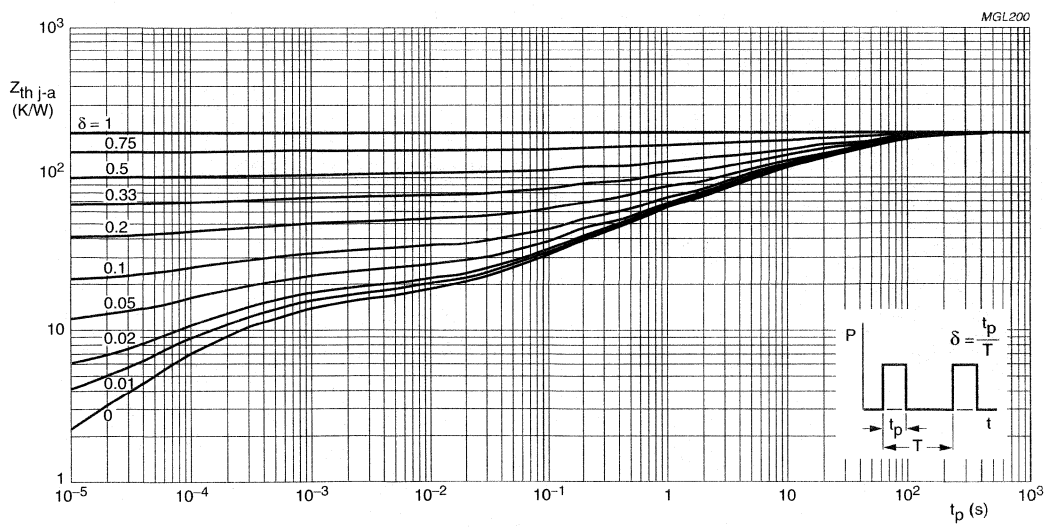
Device example: **BD136**.

Fig.4 Thermal impedance curves (junction to mounting-base) for transistors mounted on a printed-circuit board: SOT32 (TO-126).



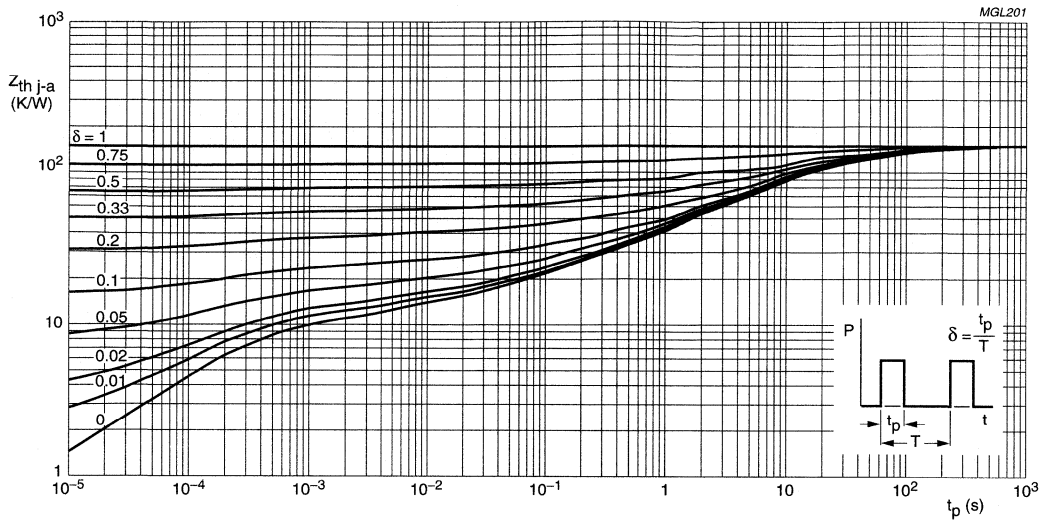
Curves are for devices with P_{tot} = **500 mW**.

Fig.5 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT54.



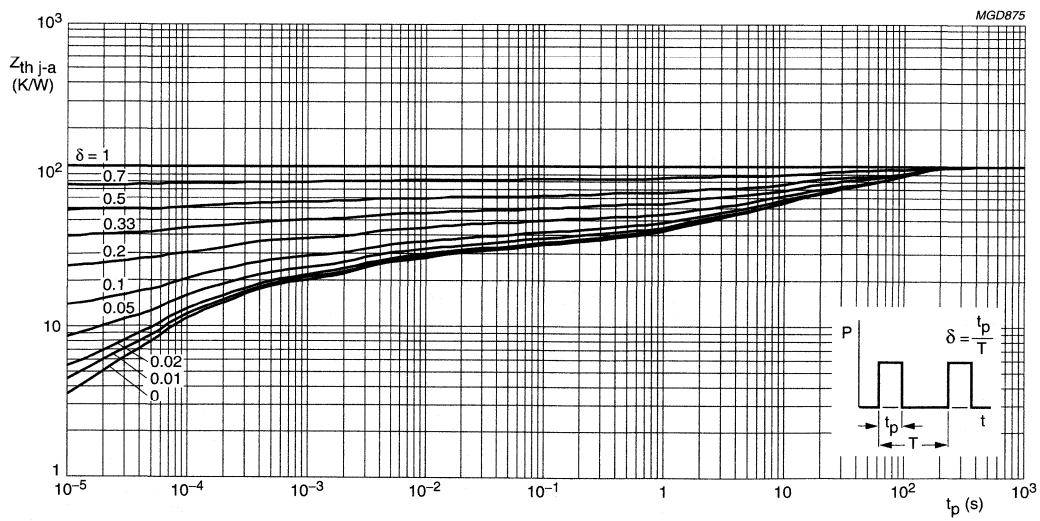
Curves are for devices with P_{tot} = **625 mW**.

Fig.6 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT54.



Curves are for devices with P_{tot} = **830 mW**.

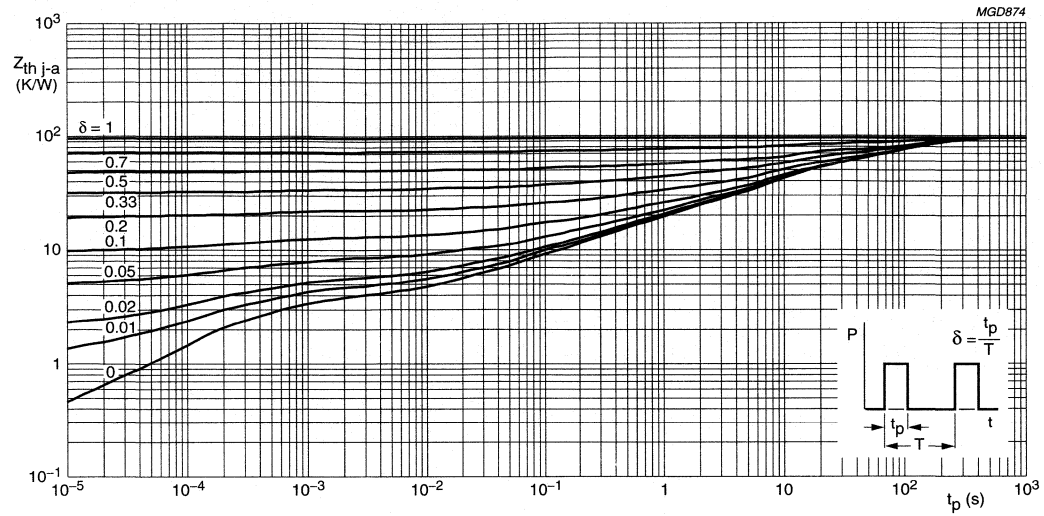
Fig.7 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT54.



Printed-circuit board, single-sided, unplated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 25 K/W, $R_{th(j\text{-}a)}$ = 113 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (1)"*.

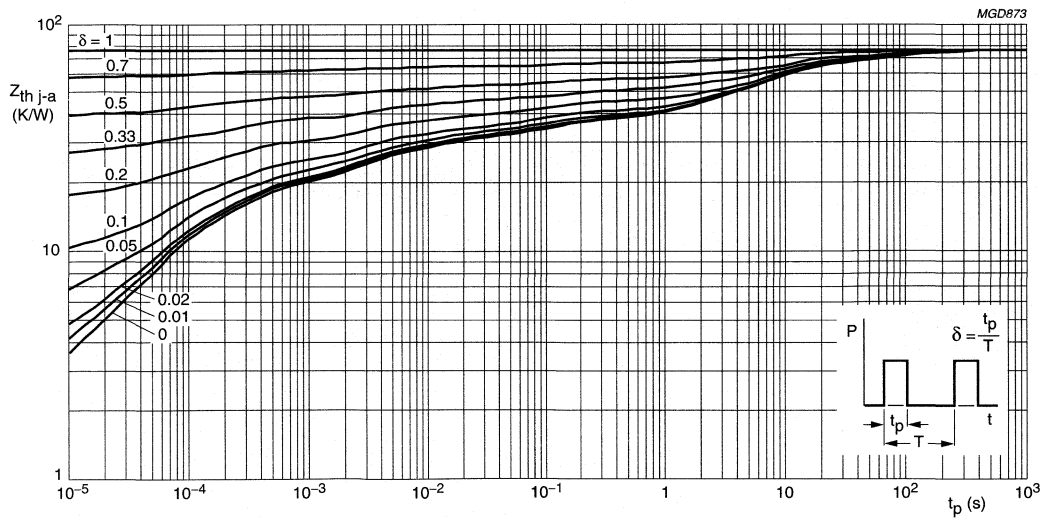
Fig.8 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT89.

Thermal Impedance Curves



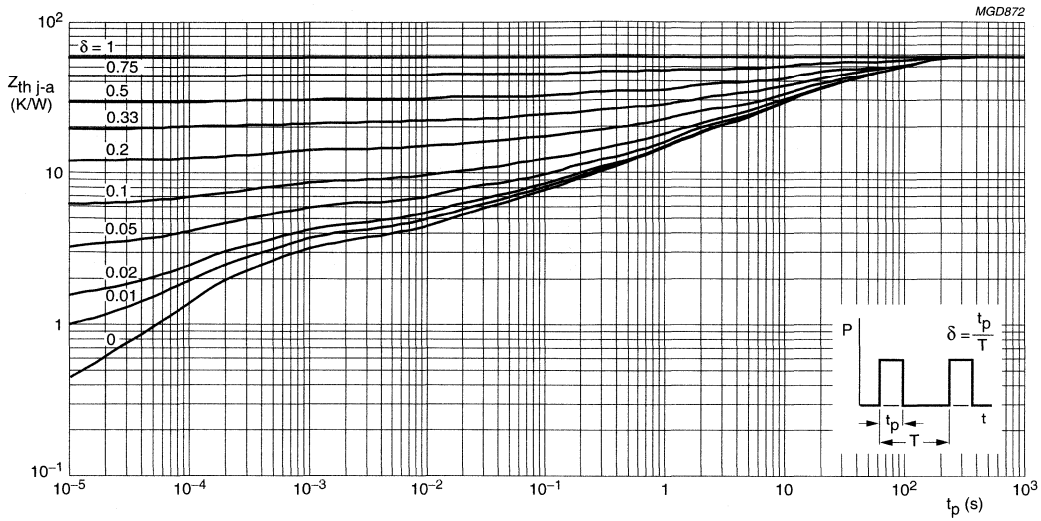
Printed-circuit board, single-sided, unplated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 7 K/W, $R_{th(j\text{-}a)}$ = 95 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (1)"*.

Fig.9 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT89.



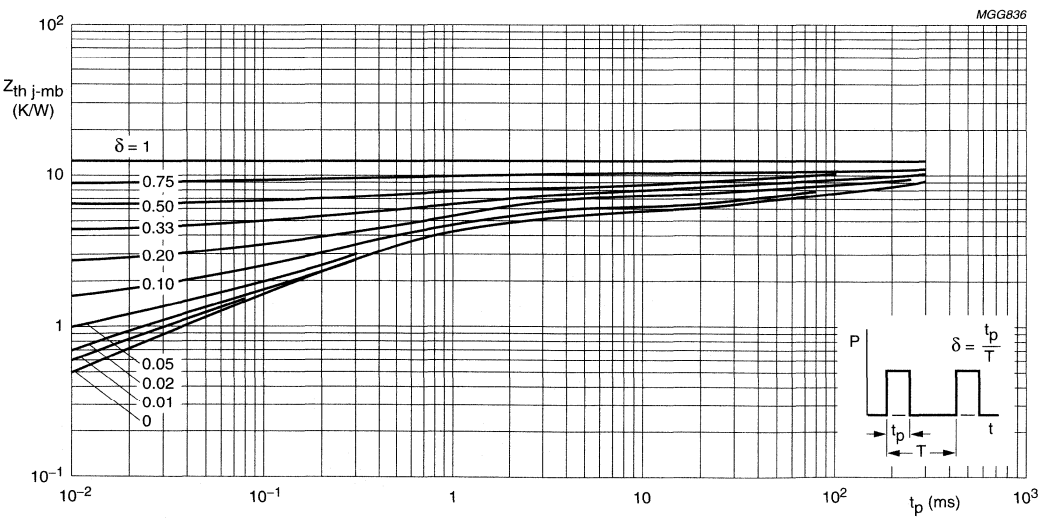
Printed-circuit board, double-sided, plated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 25 K/W, $R_{th(j\text{-}a)}$ = 76 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (4)"*.

Fig.10 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT89.



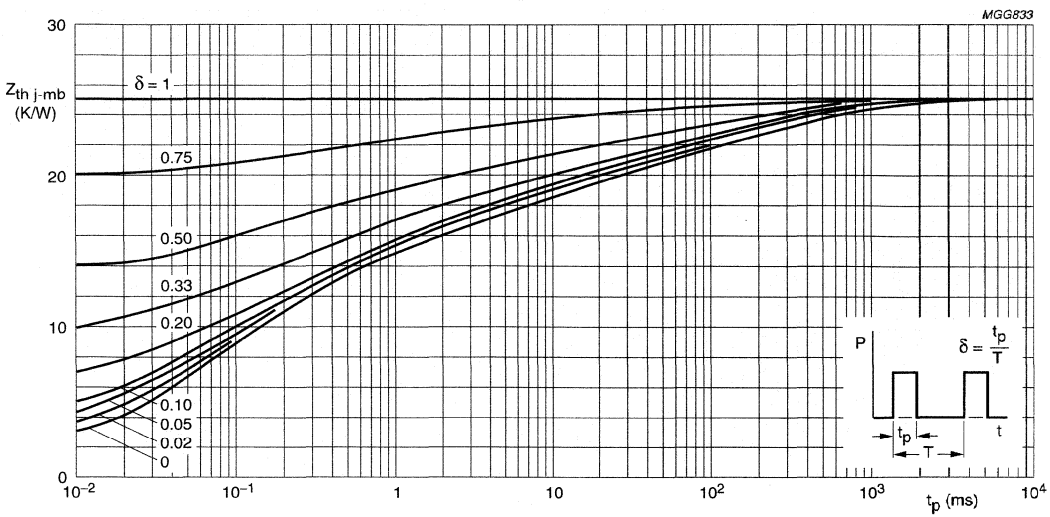
Printed-circuit board, double-sided, plated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 7 K/W, $R_{th(j\text{-}a)}$ = 58 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (4)"*.

Fig.11 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT89.



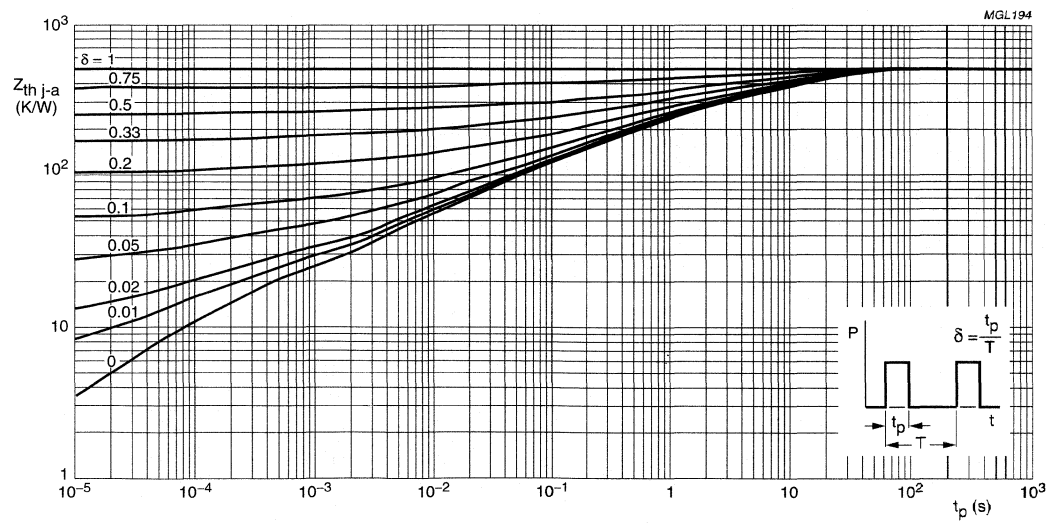
Device example: **BD829**.

Fig.12 Thermal impedance curves (junction to mounting-base) for transistors mounted on a printed-circuit board: SOT128 (TO-202).



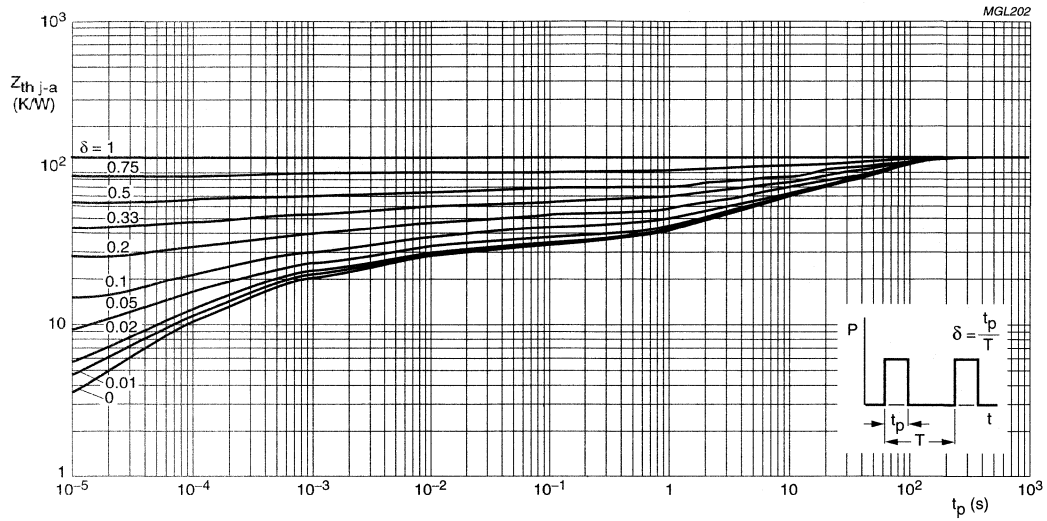
Device example: **BF869**.

Fig.13 Thermal impedance curves (junction to mounting-base) for transistors mounted on a printed-circuit board: SOT128 (TO-202).



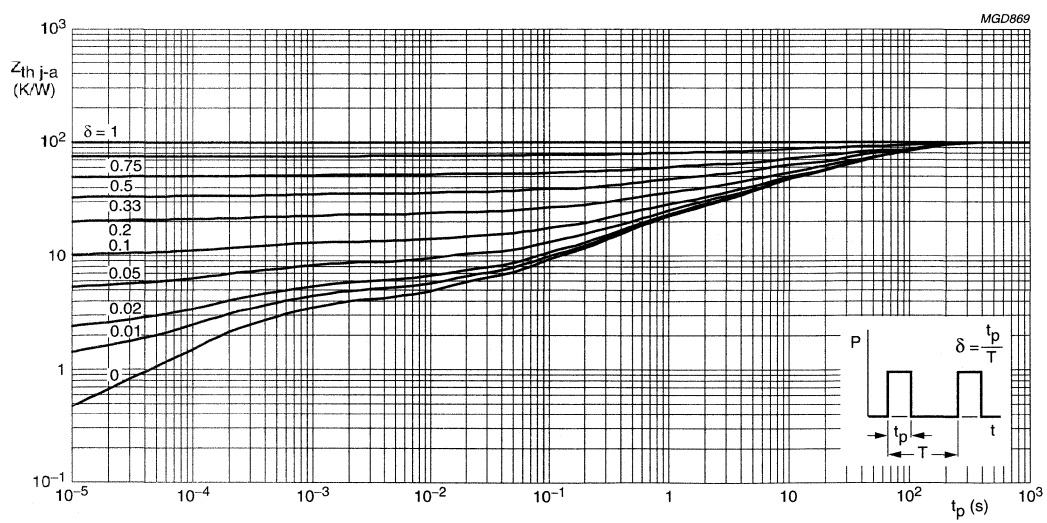
All product types.

Fig.14 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT143.



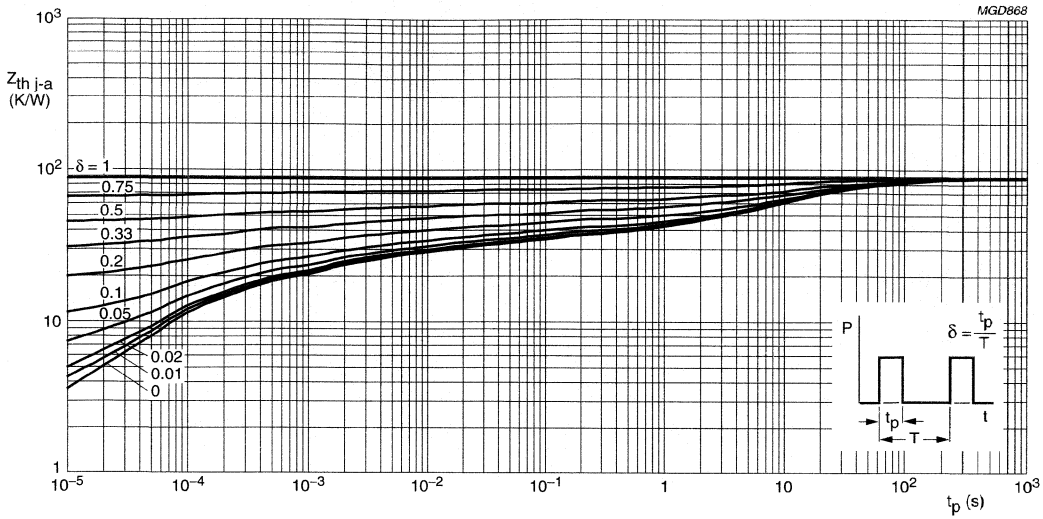
Printed-circuit board, single-sided, unplated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 36 K/W, $R_{th(j\text{-}a)}$ = 124 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (1)"*.

Fig.15 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT223.



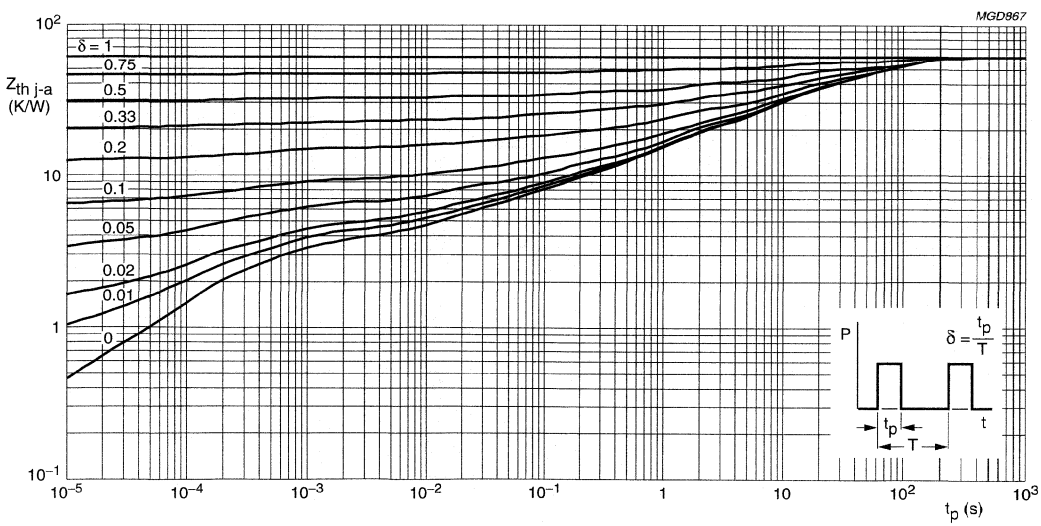
Printed-circuit board, single-sided, unplated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 10 K/W, $R_{th(j\text{-}a)}$ = 98 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (1)"*.

Fig.16 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT223.



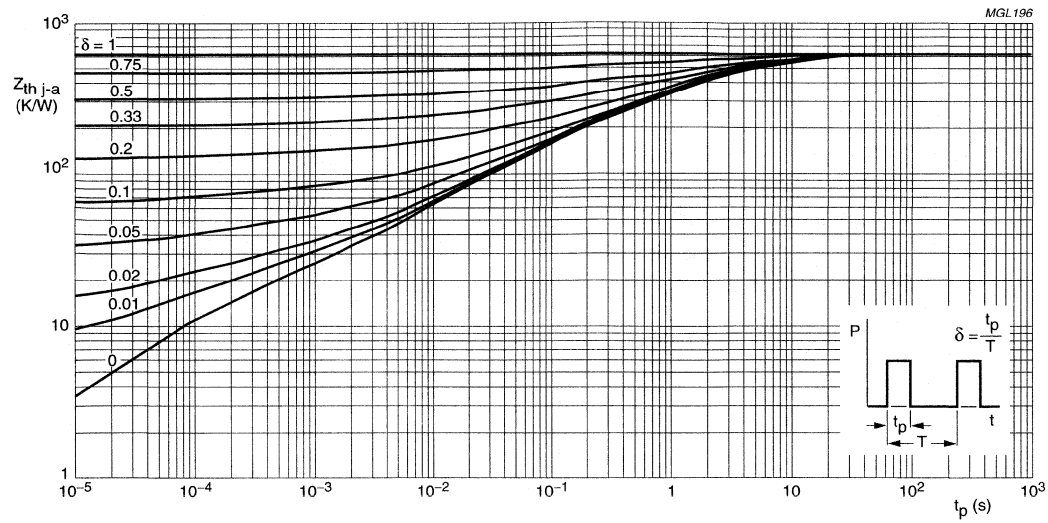
Printed-circuit board, double-sided, plated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 36 K/W, $R_{th(j\text{-}a)}$ = 87 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (4)"*.

Fig.17 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT223.



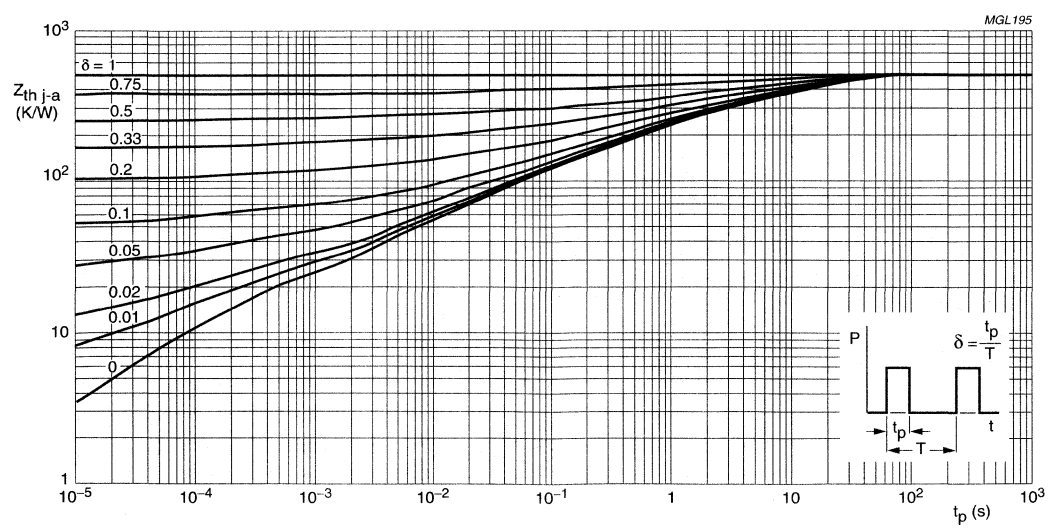
Printed-circuit board, double-sided, plated, 1 cm^2 collector pad, $R_{th(j\text{-}s)}$ = 10 K/W, $R_{th(j\text{-}a)}$ = 61 K/W.
See also Chapter *"Thermal Considerations - Transistors, Fig.4 curve (4)"*.

Fig.18 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT223.



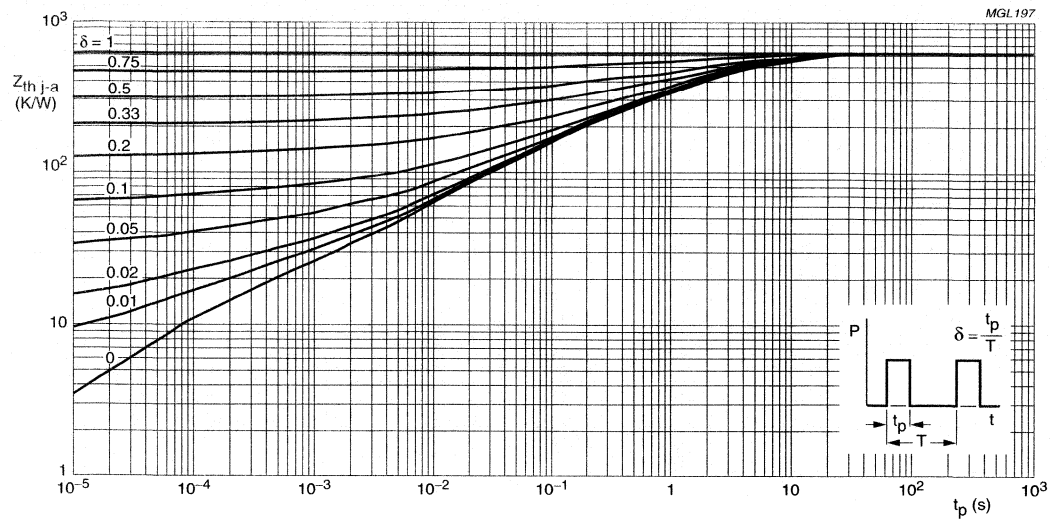
All product types.

Fig.19 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT323 (SC-70).



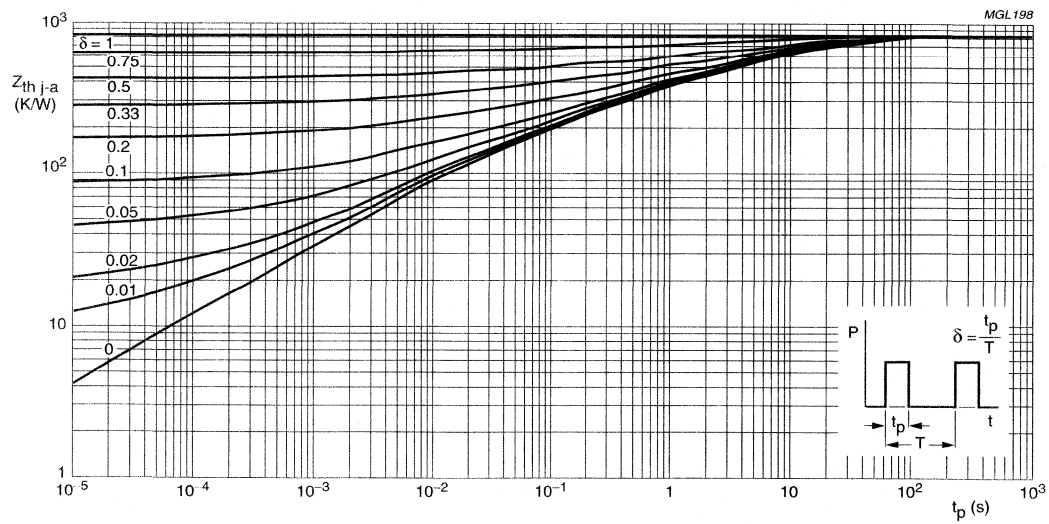
All product types.

Fig.20 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT346 (SC-59).



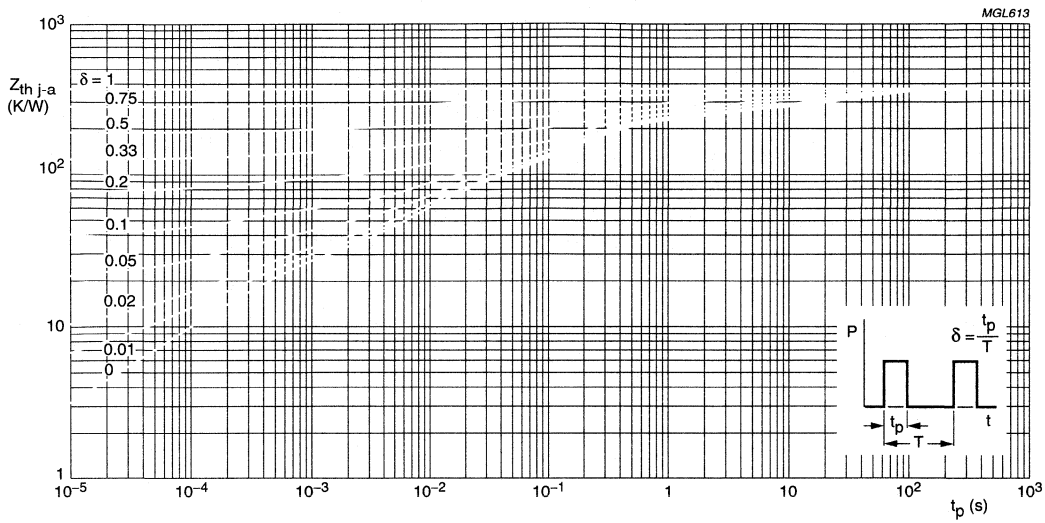
All product types.

Fig.21 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT363 (SC-88).



All product types.

Fig.22 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT416 (SC-75).

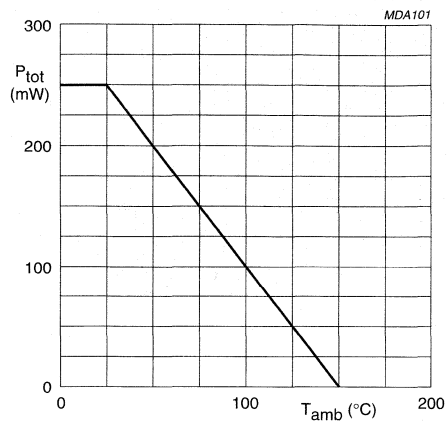


All product types.

Fig.23 Thermal impedance curves (junction to ambient) for transistors mounted on a printed-circuit board: SOT490 (SC-89).

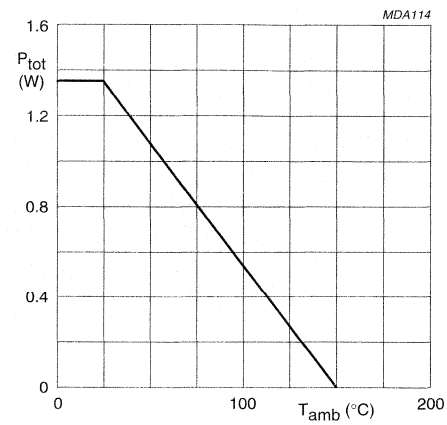
POWER DERATING CURVES FOR SMDs

Figures 1 through 17 on the following pages show the power derating curves (P_{tot} versus T_{amb}) for transistors in SMD packages.



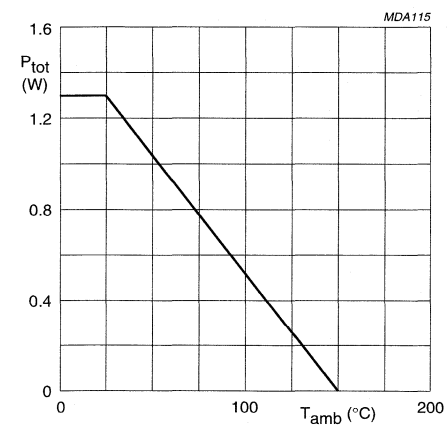
All product types.

Fig.1 Power derating curve for SOT23.



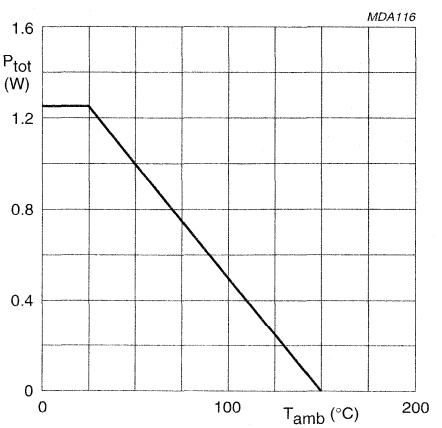
Device families:
BC868, BC869, BSR30, BSR40.

Fig.2 Power derating curve for SOT89.



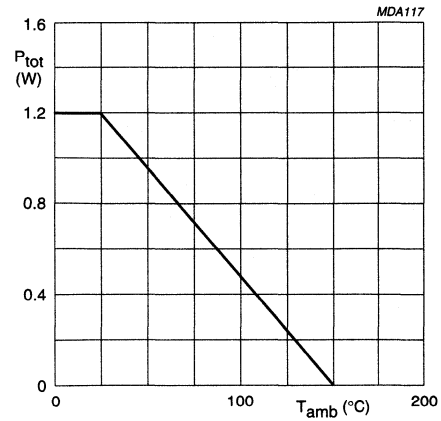
Device families:
BCV28/48, BCV29/49, BCX51, BCX54, BST15, BST39, BST50, BST60, PXTA14, PXTA42, PXTA92, PXT2907A, PXT4403.

Fig.3 Power derating curve for SOT89.



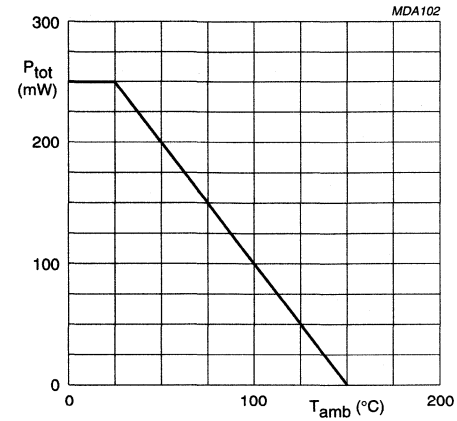
Device families:
BF620, BF621, PXT2222A, PXT4401.

Fig.4 Power derating curve for SOT89.



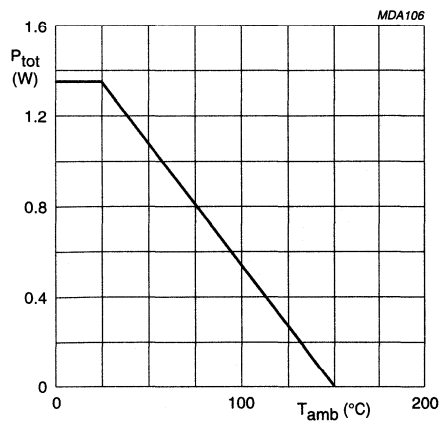
Device families:
PXT3904, PXT3906.

Fig.5 Power derating curve for SOT89.



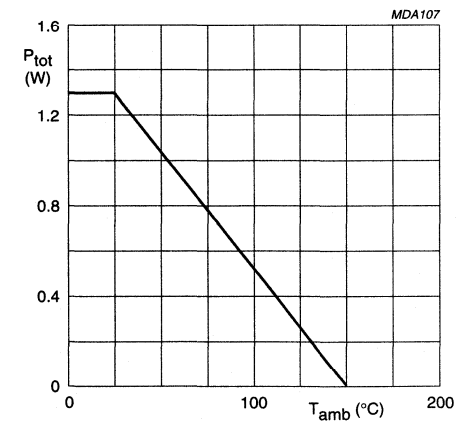
All product types.

Fig.6 Power derating curve for SOT143.



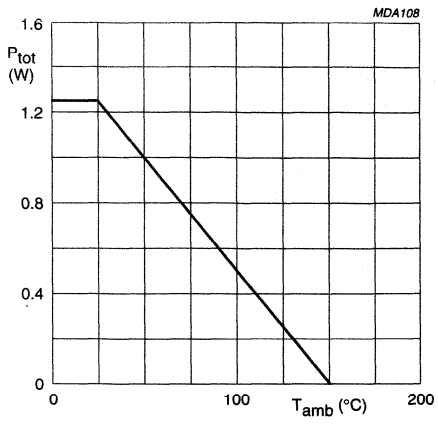
Device families:
BCP68, BCP69, BDL31, BDL32, BDP31, BDP32, PZTA44.

Fig.7 Power derating curve for SOT223.



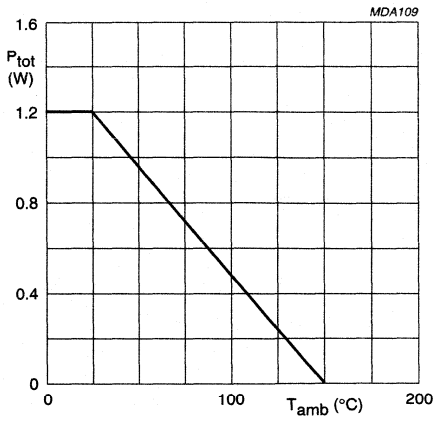
Device families:
BSP30, BSP40, BCP51, BCP54, BSP15.

Fig.8 Power derating curve for SOT223.



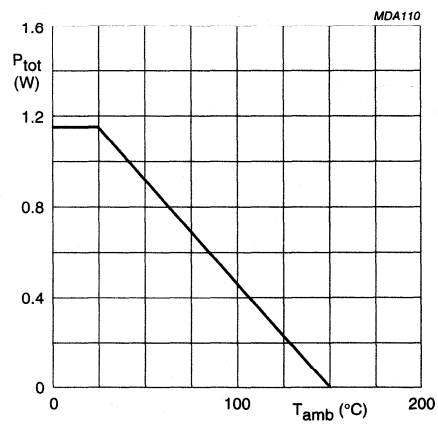
Device families:
BSP50, BSP60, PZTA14.

Fig.9 Power derating curve for SOT223.



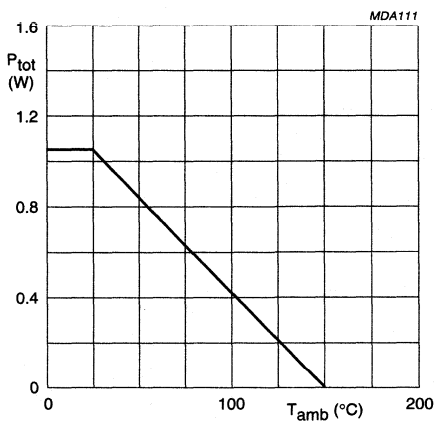
Device families:
BF720, BF723, BSP19, PZTA42, PZTA92.

Fig.10 Power derating curve for SOT223.



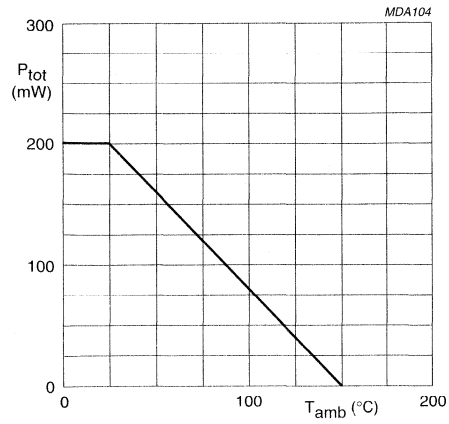
Device families:
PZTA2907A, PZT4403, PZT2222A, PZT4401.

Fig.11 Power derating curve for SOT223.



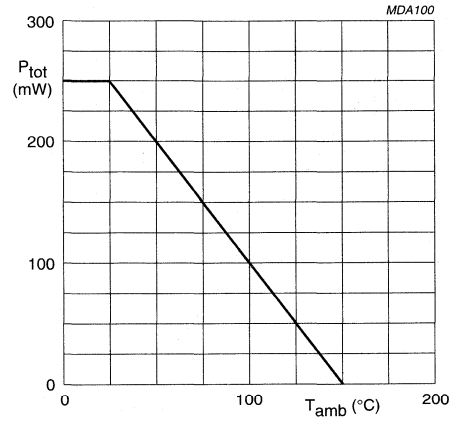
Device families:
PZT3904, PZT3906.

Fig.12 Power derating curve for SOT223.



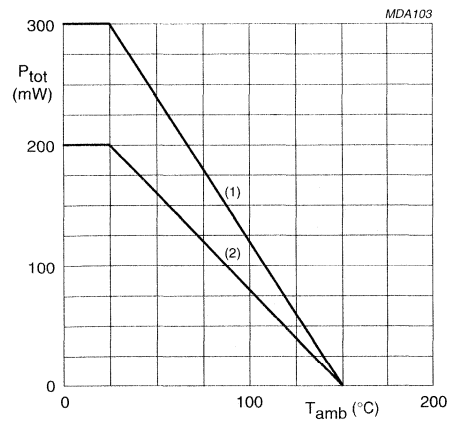
All product types.

Fig.13 Power derating curve for SOT323 (SC-70).



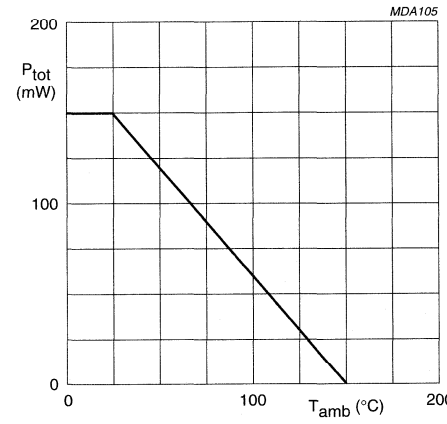
All product types.

Fig.14 Power derating curve for SOT346 (SC-59).



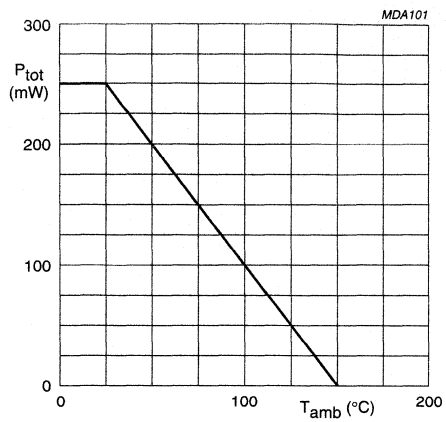
(1) Both transistors used.
(2) One transistor used.

Fig.15 Power derating curves for SOT363 (SC-88).



All product types.

Fig.16 Power derating curve for SOT416 (SC-75).



All product types.

Fig.17 Power derating curve for SOT490 (SC-89).

DEVICE DATA DIODES

In alphanumeric sequence

Voltage reference diodes

1N821 to 1N829
1N821A to 1N829A

FEATURES

- Temperature compensated
- Reference voltage range: 5.89 to 6.51 V (typ. 6.20 V)
- Low temperature coefficient range: max. 0.0005 to 0.01 %/K.

APPLICATION

- Voltage reference sources in measuring instruments such as digital voltmeters.

DESCRIPTION

Voltage reference diode in a hermetically-sealed SOD68 (DO-34) glass package.

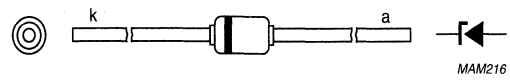


Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_Z	working current		–	50	mA
P_{tot}	total power dissipation	T_{amb} = 50 °C	–	400	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{amb}	operating ambient temperature		–55	+100	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{ref}	reference voltage	I_Z =7.5 mA	5.89	6.20	6.51	V
$\lvert\Delta V_{ref}\rvert$	reference voltage excursion	I_Z =7.5 mA; test points for T_{amb}: −55; +25; +75; +100 °C; see Fig.2; notes 1 and 2				
	1N821; 1N821A		–	–	96	mV
	1N823; 1N823A		–	–	48	mV
	1N825; 1N825A		–	–	19	mV
	1N827; 1N827A		–	–	9	mV
	1N829; 1N829A		–	–	5	mV
$\lvert S_Z\rvert$	temperature coefficient	I_Z = 7.5 mA: see Fig.3; notes 1 and 2				
	1N821; 1N821A		–	–	0.01	%/K
	1N823; 1N823A		–	–	0.005	%/K
	1N825; 1N825A		–	–	0.002	%/K
	1N827; 1N827A		–	–	0.001	%/K
	1N829; 1N829A		–	–	0.0005	%/K
r_{dif}	differential resistance	I_Z = 7.5 mA; see Fig.4				
	1N821 to 1N829		–	–	15	Ω
	1N821A to 1N829A		–	–	10	Ω

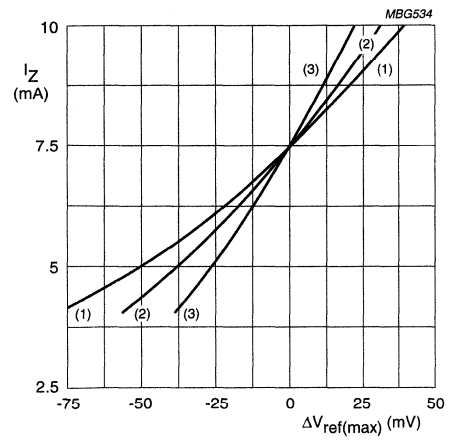
Notes

1. The quoted values of ΔV_{ref} are based on a constant current I_Z. Two factors can cause ΔV_{ref} to change, namely the differential resistance r_{dif} and the temperature coefficient S_Z.
   a) As the max. r_{dif} of the device can be 15 Ω, a change of 0.01 mA in the current through the reference diode will result in a ΔV_{ref} of 0.01 mA × 15 Ω = 0.15 mV. This level of ΔV_{ref} is not significant on a 1N821 (ΔV_{ref} < 96 mV), it is however very significant on a 1N829 (ΔV_{ref} < 5 mV).
   b) The temperature coefficient of the reference voltage S_Z is a function of I_Z. Reference diodes are classified at the specified test current and the S_Z of the reference diode will be different at different levels of I_Z. The absolute value of I_Z is important, however, the stability of I_Z, once the level has been set, is far more significant. This applies particularly to the 1N829. The effect of the stability of I_Z on S_Z is shown in Fig.3.
2. All reference diodes are characterized by the 'box method'. This guarantees a maximum voltage excursion (ΔV_{ref}) over the specified temperature range, at the specified test current (I_Z), verified by tests at indicated temperature points within the range. V_Z is measured and recorded at each temperature specified. The ΔV_{ref} between the highest and lowest values must not exceed the maximum ΔV_{ref} given. Therefore the temperature coefficient is only given as a reference. It may be derived from: $S_Z = \frac{V_{ref1} - V_{ref2}}{T_{amb2} - T_{amb1}} \times \frac{100}{V_{ref\ nom}}$ %/K

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	8 mm from the body	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm	375	K/W

GRAPHICAL DATA



Referenced to I_Z = 7.5 mA.
(1) T_j = 100 °C.
(2) T_j = 25 °C.
(3) T_j = −55 °C.

Fig.2 Working current as a function of the maximum reference voltage excursion.

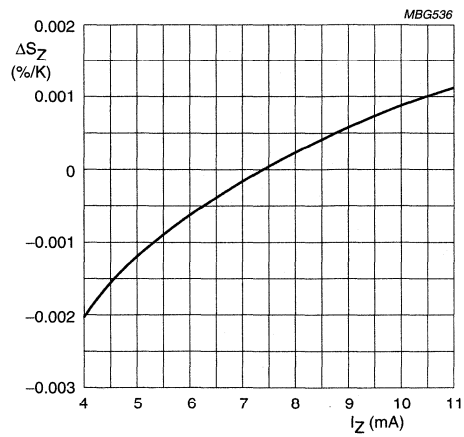
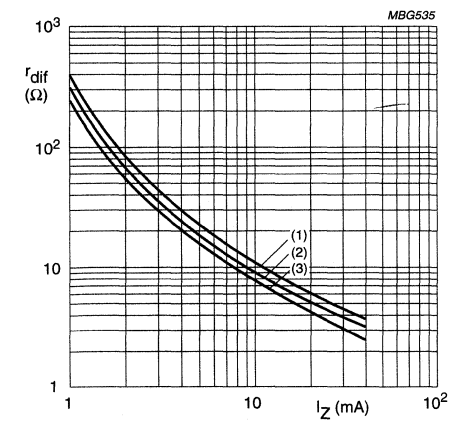


Fig.3 Temperature coefficient change as a function of working current; typical values.



(1) T_j = 100 °C.
(2) T_j = 25 °C.
(3) T_j = −55 °C.

Fig.4 Differential resistance as a function of working current; typical values.

High-speed diode 1N914

FEATURES

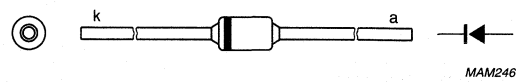
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 100 V
- Repetitive peak forward current: max. 225 mA.

APPLICATIONS

- High-speed switching.

DESCRIPTION

The 1N914 is a high-speed switching diode fabricated in planar technology, and encapsulated in a hermetically sealed leaded glass SOD27 (DO-35) package.



The diode is type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	100	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	75	mA
I_{FRM}	repetitive peak forward current		–	225	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.3	1	V
I_R	reverse current	see Fig.5		
		V_R = 20 V	25	nA
		V_R = 75 V	5	µA
		V_R = 20 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	8	ns
		when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	2.5	V

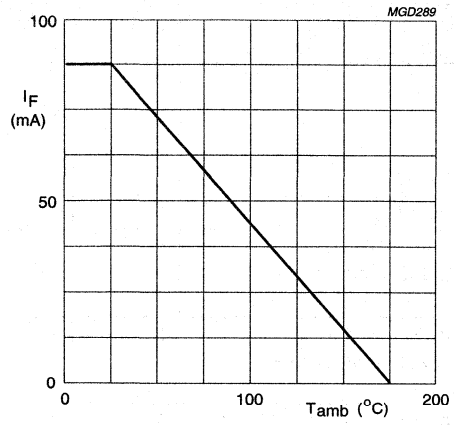
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	500	K/W

Note

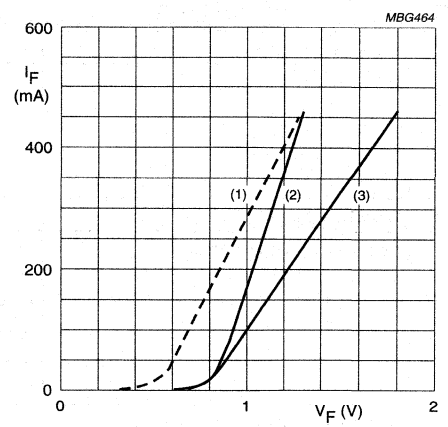
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



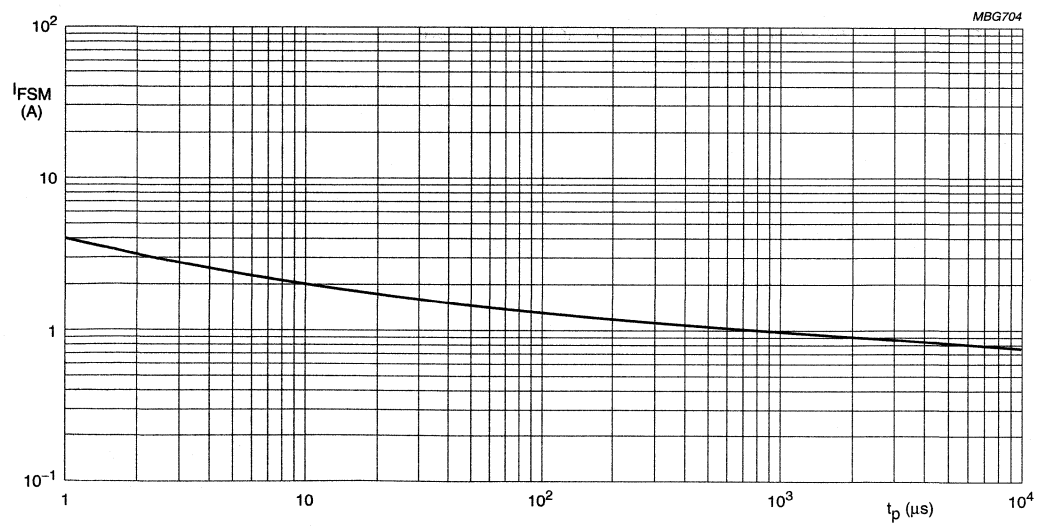
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



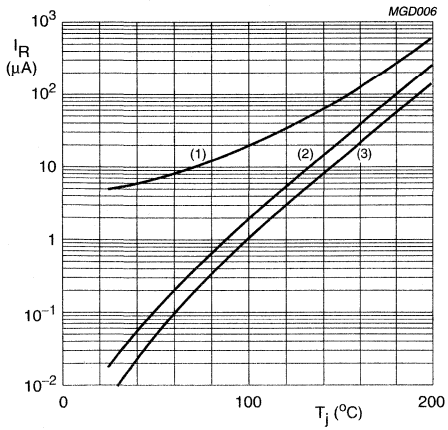
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



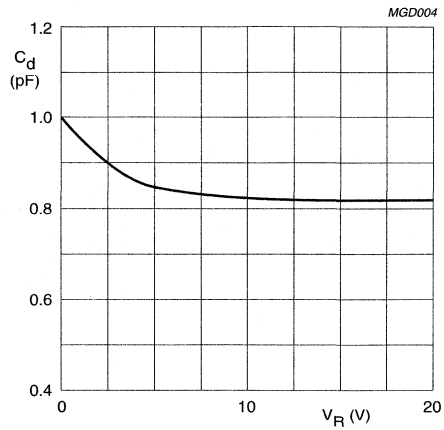
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



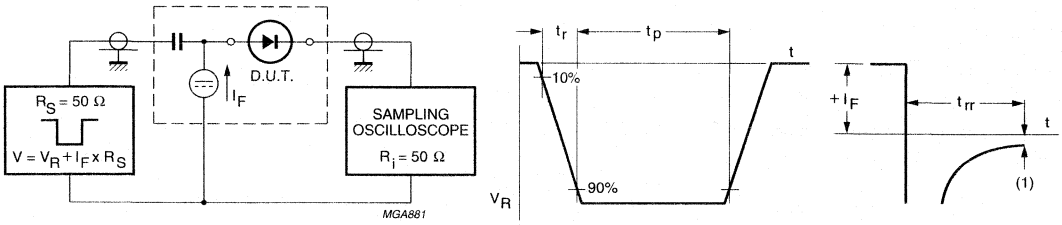
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

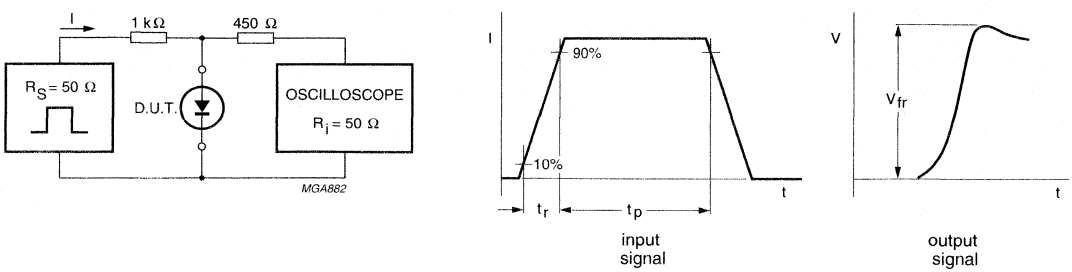


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diodes 1N4148; 1N4448

FEATURES

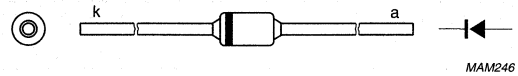
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 4 ns
- General application
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

- High-speed switching.

DESCRIPTION

The 1N4148 and 1N4448 are high-speed switching diodes fabricated in planar technology, and encapsulated in hermetically sealed leaded glass SOD27 (DO-35) packages.



The diodes are type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	200	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
	1N4148	I_F = 10 mA	–	1	V
	1N4448	I_F = 5 mA	0.62	0.72	V
		I_F = 100 mA	–	1	V
I_R	reverse current	V_R = 20 V; see Fig.5		25	nA
		V_R = 20 V; T_j = 150 °C; see Fig.5	–	50	µA
I_R	reverse current; 1N4448	V_R = 20 V; T_j = 100 °C; see Fig.5	–	3	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6		4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7		4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	–	2.5	V

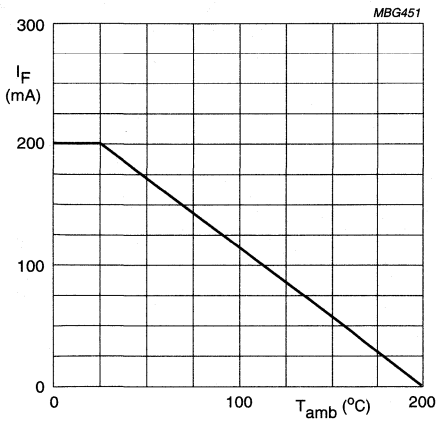
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	350	K/W

Note

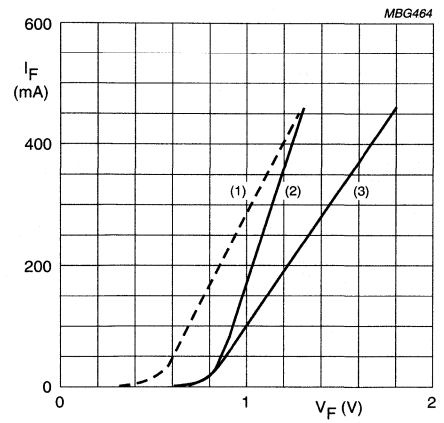
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



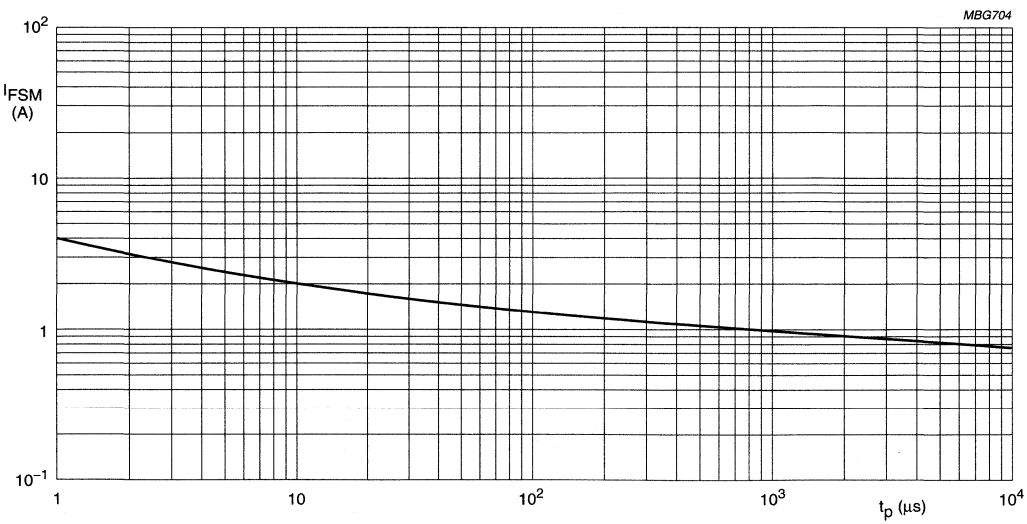
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



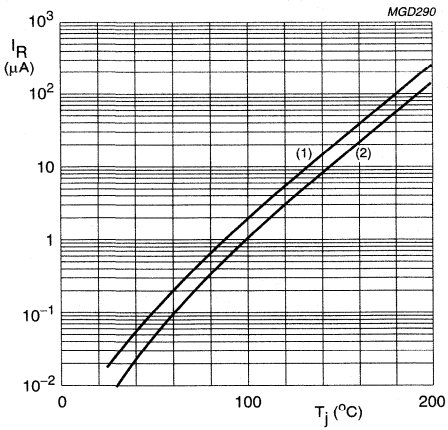
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



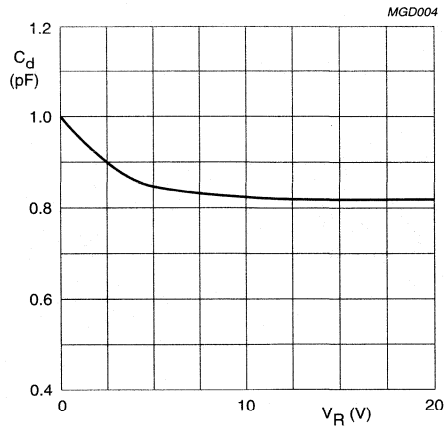
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



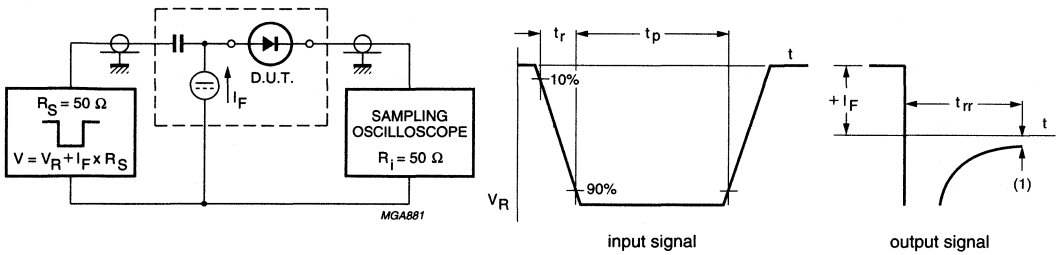
(1) V_R = 75 V; typical values.
(2) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

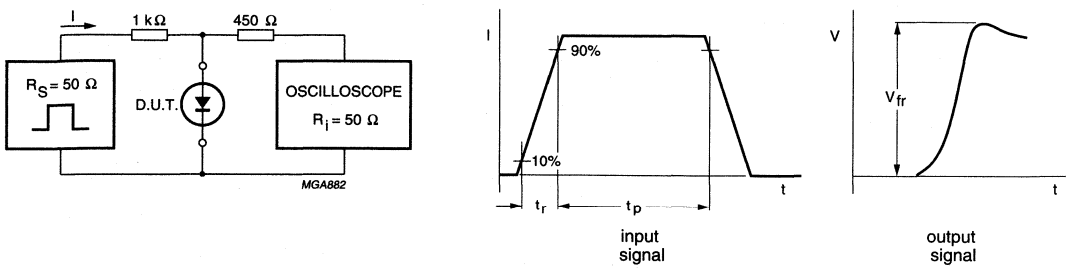


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diodes 1N4150; 1N4151

FEATURES

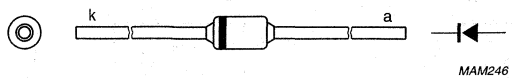
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 4 ns
- General application
- Continuous reverse voltage: max. 50 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 600 mA and 450 mA respectively.

APPLICATIONS

- High-speed switching
- 1N4150: general purpose use in computer and industrial applications
- 1N4151: military and industrial applications.

DESCRIPTION

The 1N4150 and 1N4151 are high-speed switching diodes fabricated in planar technology, and encapsulated in hermetically sealed leaded glass SOD27 (DO-35) packages.



The marking band indicates the cathode.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current	see Fig.2; note 1			
	1N4150		–	300	mA
	1N4151		–	200	mA
I_{FRM}	repetitive peak forward current				
	1N4150		–	600	mA
	1N4151		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed-circuit board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
	1N4150	I_F = 1 mA	540	620	mV
		I_F = 10 mA	660	740	mV
		I_F = 50 mA	760	860	mV
		I_F = 100 mA	820	920	mV
		I_F = 200 mA	870	1000	mV
	1N4151	I_F = 50 mA	–	1000	mV
I_R	reverse current	V_R = 50 V; see Fig.5			
	1N4150		–	0.1	μA
	1N4151		–	0.05	μA
I_R	reverse current	V_R = 50 V; T_j = 150 °C; see Fig.5			
	1N4150		–	100	μA
	1N4151		–	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6			
	1N4150		–	2.5	pF
	1N4151		–	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 1 mA; R_L = 100 Ω; measured at I_R = 0.1 mA; see Fig.7			
	1N4150		–	6	ns
		when switched from I_F = 10 mA to 200 mA to I_R = 10 mA to 200 mA; R_L = 100 Ω; measured at $I_R = 0.1 \times I_F$; see Fig.7	–	4	ns
		when switched from I_F = 200 mA to 400 mA to I_R = 200 mA to 400 mA; R_L = 100 Ω; measured at $I_R = 0.1 \times I_F$; see Fig.7	–	6	ns
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7			
	1N4151		–	4	ns
		when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	2	ns
t_{fr}	forward recovery time	when switched to I_F = 200 mA; t_r = 0.4 ns; measured at V_F = 1 V; see Fig.8	–	10	ns

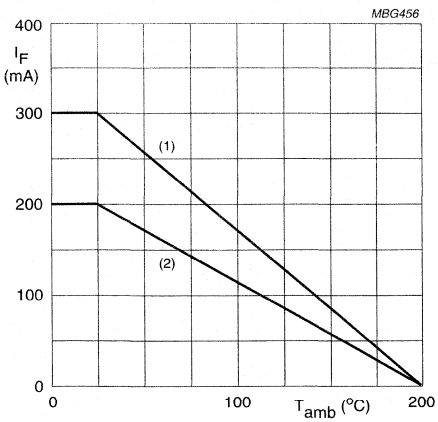
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	350	K/W

Note

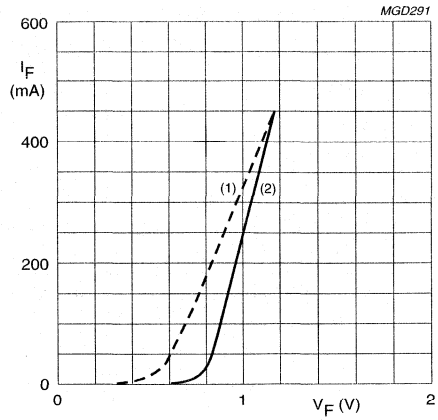
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



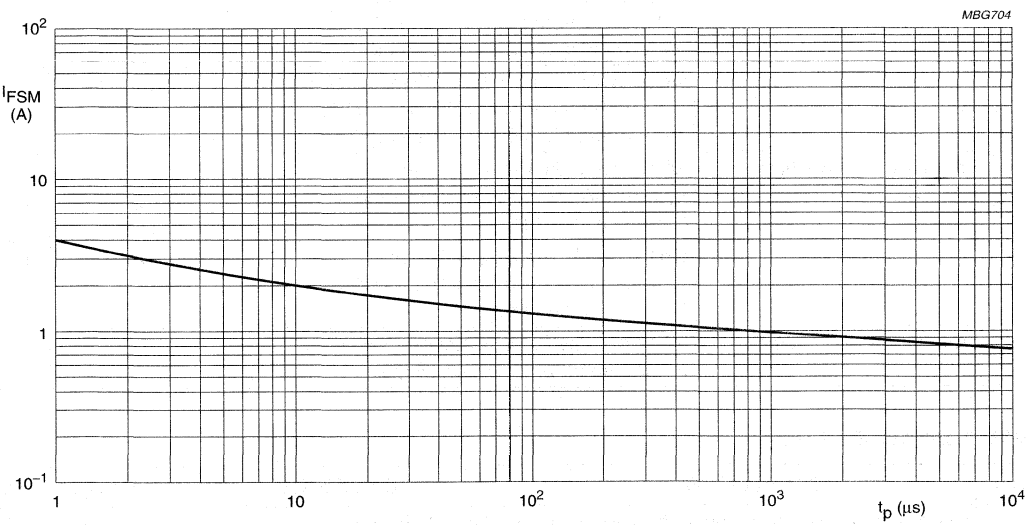
Device mounted on an FR4 printed-circuit board; lead length 10 mm.
(1) 1N4150. (2) 1N4151.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



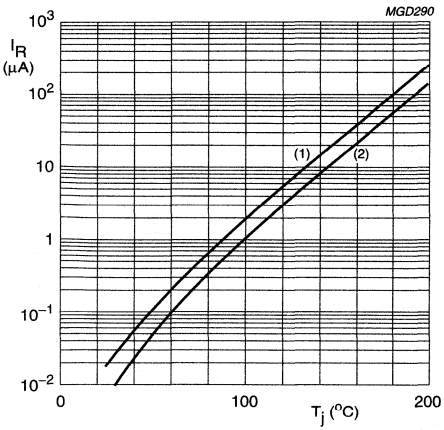
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.

Fig.3 Forward current as a function of forward voltage.



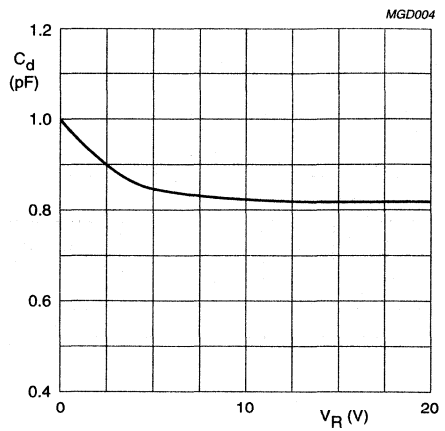
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



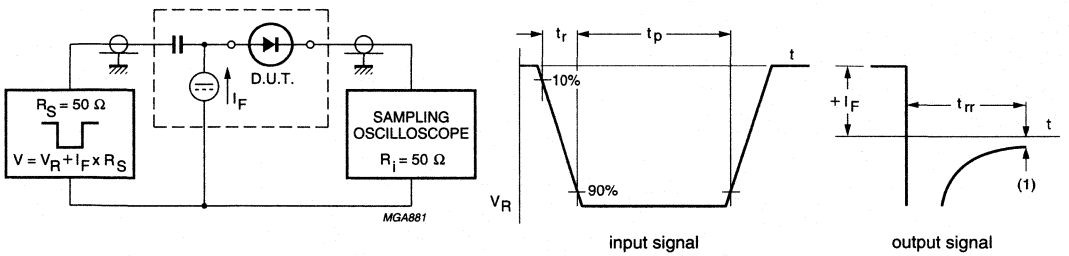
(1) V_R = 75 V; typical values.
(2) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



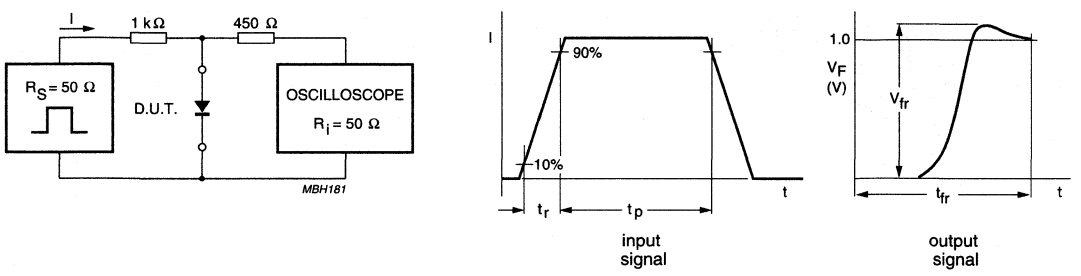
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) The value of I_R is dependent on product type.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 0.4 ns; forward pulse duration t_p = 100 ns; duty factor δ = 0.01.

Fig.8 Forward recovery time test circuit and waveforms.

High-speed diodes 1N4531; 1N4532

FEATURES

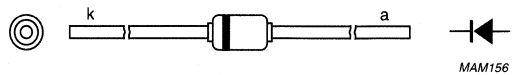
- Hermetically sealed leaded glass SOD68 (DO-34) package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

- High-speed switching
- Protection diodes in reed relays.

DESCRIPTION

The 1N4531, 1N4532 are high-speed switching diodes fabricated in planar technology, and encapsulated in hermetically sealed leaded glass SOD68 (DO-34) packages.



The diodes are type branded.

Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2	–	200	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	500	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.3	–	1000	mV
I_R	reverse current	see Fig.5			
	IN4531	V_R = 20 V	–	25	nA
		V_R = 20 V; T_j = 150 °C	–	50	µA
	IN4532	V_R = 50 V	–	100	nA
		V_R = 50 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6			
	IN4531		–	4	pF
	IN4532		–	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7			
	IN4531		–	4	ns
	IN4532		–	2	ns
	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7			
	IN4532		–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 100 mA; $t_r \leq$ 30 ns; see Fig.8	–	3	V

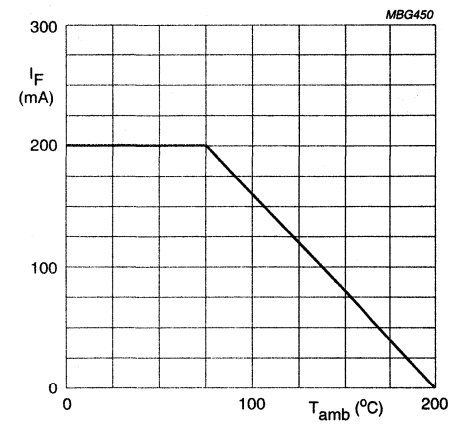
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 5 mm	120	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 5 mm; note 1	350	K/W

Note

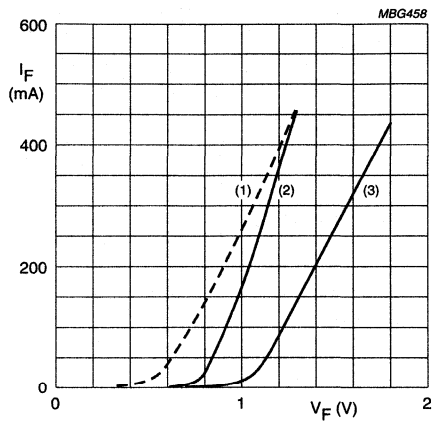
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



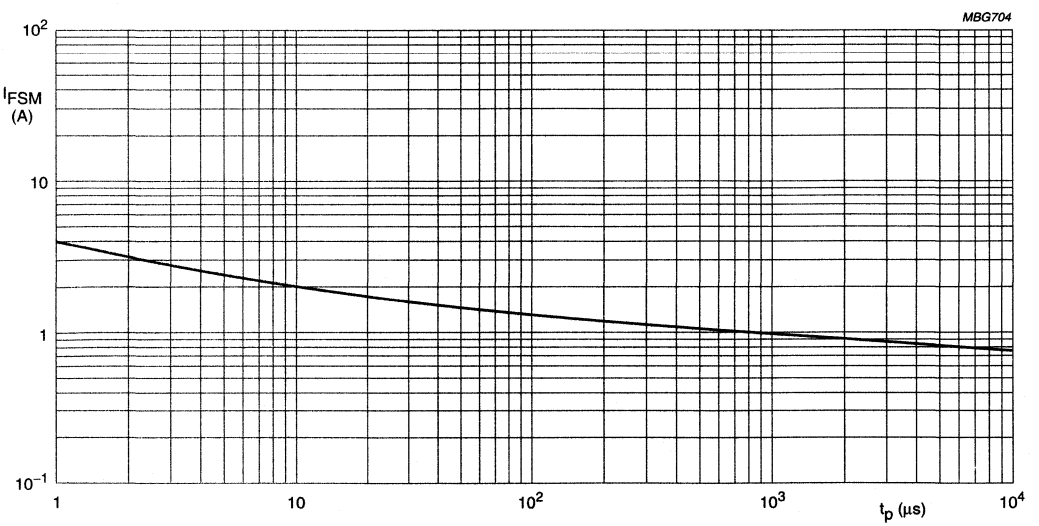
Lead length 5 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



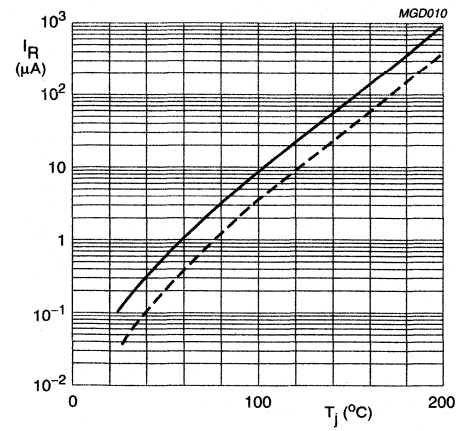
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



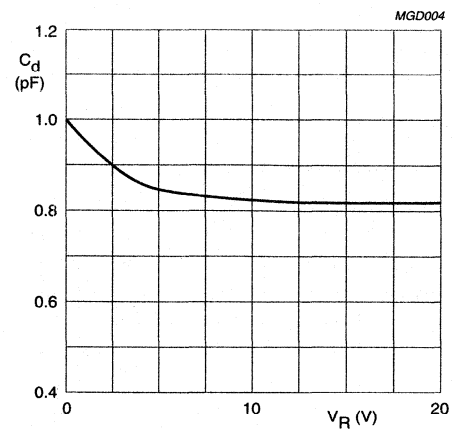
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



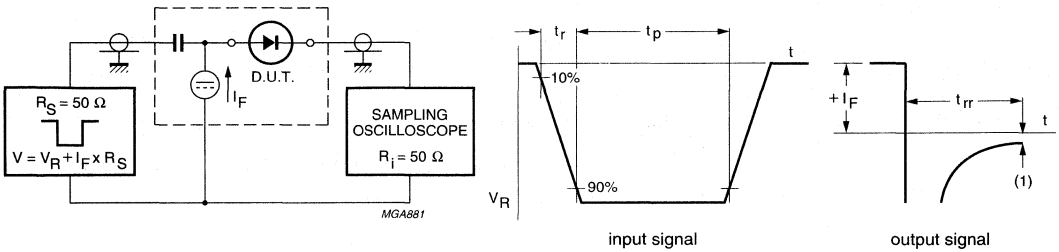
V_R = 50 V
Solid line; maximum values.
Dotted line; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

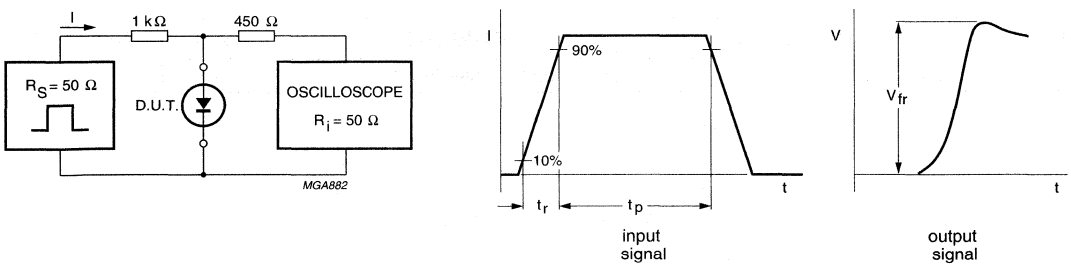


Fig.8 Forward recovery voltage test circuit and waveforms.

Voltage regulator diodes 1N4728A to 1N4749A

FEATURES

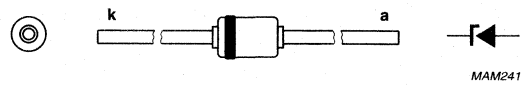
- Total power dissipation: max. 1000 mW
- Tolerance series: ±5%
- Working voltage range: nom. 3.3 to 24 V.

APPLICATIONS

- Low voltage stabilizers.

DESCRIPTION

Low voltage regulator diodes in hermetically sealed SOD66 (DO-41) packages. The series consists of 22 types with nominal working voltages from 3.3 to 24 V.



The diodes are type branded.

Fig.1 Simplified outline (SOD66; DO-41) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	500	mA
I_{ZM}	working current		see Table "Per type"		
I_{ZSM}	non-repetitive peak reverse current		see Table "Per type"		
P_{tot}	total power dissipation	T_{amb} = 50 °C	–	1000	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		−65	+200	°C

ELECTRICAL CHARACTERISTICS

Total series

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	I_F = 200 mA; see Fig.3	–	1.2	V

Per type

T_j = 25 °C; unless otherwise specified.

TYPE No.	WORKING VOLTAGE V_Z (V)(1) at I_{Ztest}	TEST CURRENT I_{Ztest} (mA)	DIFFERENTIAL RESISTANCE			REVERSE CURRENT at REVERSE VOLTAGE		WORKING CURRENT I_{ZM} (mA)	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (mA)(2)
			r_{dif} (Ω) at I_{Ztest}	r_{dif} (Ω) at I_Z	I_Z (mA)	I_R (μA)	V_R (V)		
	NOM.		MAX.	MAX.		MAX.		MAX.	MAX.
1N4728A	3.3	76	10	400	1	100	1	276	1380
1N4729A	3.6	69	10	400	1	100	1	252	1260
1N4730A	3.9	64	9	400	1	50	1	234	1190
1N4731A	4.3	58	9	400	1	10	1	217	1070
1N4732A	4.7	53	8	500	1	10	1	193	970
1N4733A	5.1	49	7	550	1	10	1	178	890
1N4734A	5.6	45	5	600	1	10	2	162	810
1N4735A	6.2	41	2	700	1	10	3	146	730
1N4736A	6.8	37	3.5	700	1	10	4	133	660
1N4737A	7.5	34	4	700	0.5	10	5	121	605
1N4738A	8.2	31	4.5	700	0.5	10	6	110	550
1N4739A	9.1	28	5	700	0.5	10	7	100	500
1N4740A	10	25	7	700	0.25	10	7.6	91	454
1N4741A	11	23	8	700	0.25	5	8.4	83	414
1N4742A	12	21	9	700	0.25	5	9.1	76	380
1N4743A	13	19	10	700	0.25	5	9.9	69	344
1N4744A	15	17	14	700	0.25	5	11.4	61	304
1N4745A	16	15.5	16	700	0.25	5	12.2	57	285
1N4746A	18	14	20	750	0.25	5	13.7	50	250
1N4747A	20	12.5	22	750	0.25	5	15.2	45	225
1N4748A	22	11.5	23	750	0.25	5	16.7	41	205
1N4749A	24	10.5	25	750	0.25	5	18.2	38	190

Notes

1. V_Z is measured with device at thermal equilibrium while held in clips at 10 mm from body in still air at 25 °C.
2. Half square wave or equivalent sinewave pulse $^1/_{120}$ second duration superimposed on I_{Ztest}.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 4 mm; see Fig.2	110	K/W

GRAPHICAL DATA

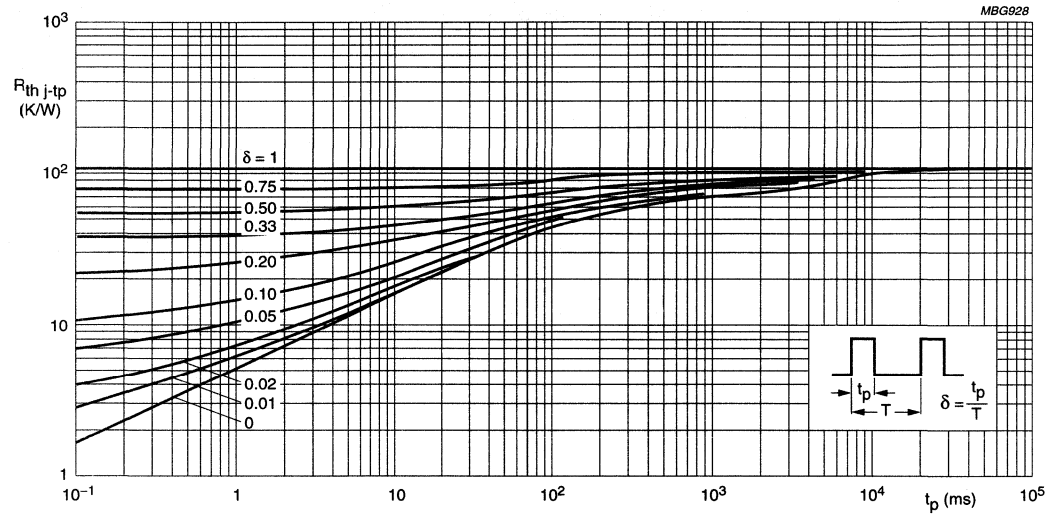
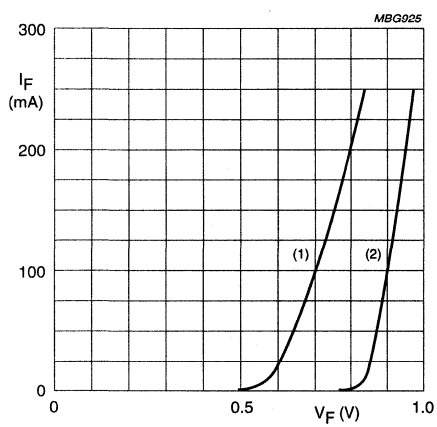


Fig.2 Thermal resistance from junction to tie-point; lead length 4 mm.



(1) T_j = 200 °C; typical values.
(2) T_j = 25 °C; typical values.

Fig.3 Forward current as a function of forward voltage.

Schottky barrier diodes 1N5817; 1N5818; 1N5819

FEATURES

- Low switching losses
- Fast recovery time
- Guard ring protected
- Hermetically sealed leaded glass package.

APPLICATIONS

- Low power, switched-mode power supplies
- Rectifying
- Polarity protection.

DESCRIPTION

The 1N5817 to 1N5819 types are Schottky barrier diodes fabricated in planar technology, and encapsulated in SOD81 hermetically sealed glass packages incorporating Implotec™(1) technology.

(1) Implotec is a trademark of Philips.

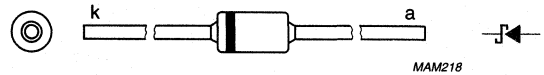


Fig.1 Simplified outline (SOD81) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	1N5817		–	20	V
	1N5818		–	30	V
	1N5819		–	40	V
V_{RSM}	non-repetitive peak reverse voltage				
	1N5817		–	24	V
	1N5818		–	36	V
	1N5819		–	48	V
V_{RRM}	repetitive peak reverse voltage				
	1N5817		–	20	V
	1N5818		–	30	V
	1N5819		–	40	V
V_{RWM}	crest working reverse voltage				
	1N5817		–	20	V
	1N5818		–	30	V
	1N5819		–	40	V
$I_{F(AV)}$	average forward current	T_{amb} = 55 °C; $R_{th\ j\text{-}a}$ = 100 K/W; note 1; $V_{R(equiv)}$ = 0.2 V; note 2	–	1	A
I_{FSM}	non-repetitive peak forward current	t = 8.3 ms half sine wave; JEDEC method; $T_j = T_{j\ max}$ prior to surge: V_R = 0	–	25	A
T_{stg}	storage temperature		–65	+175	°C
T_j	junction temperature		–	125	°C

Notes

1. Refer to SOD81 standard mounting conditions.
2. For Schottky barrier diodes thermal run-away has to be considered, as in some applications, the reverse power losses P_R are a significant part of the total power losses. Nomograms for determination of the reverse power losses P_R and $I_{F(AV)}$ rating will be available on request.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.2				
	1N5817	I_F = 0.1 A	–	–	320	mV
		I_F = 1 A	–	–	450	mV
		I_F = 3 A	–	–	750	mV
V_F	forward voltage	see Fig.2				
	1N5818	I_F = 0.1 A	–	–	330	mV
		I_F = 1 A	–	–	550	mV
		I_F = 3 A	–	–	875	mV
V_F	forward voltage	see Fig.2				
	1N5819	I_F = 0.1 A	–	–	340	mV
		I_F = 1 A	–	–	600	mV
		I_F = 3 A	–	–	900	mV
I_R	reverse current	$V_R = V_{RRMmax}$; note 1	–	–	1	mA
		$V_R = V_{RRMmax}$; T_j = 100 °C	–	–	10	mA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz				
	1N5817		–	80	–	pF
	1N5818		–	50	–	pF
	1N5819		–	50	–	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W

Note

1. Refer to SOD81 standard mounting conditions.

GRAPHICAL DATA

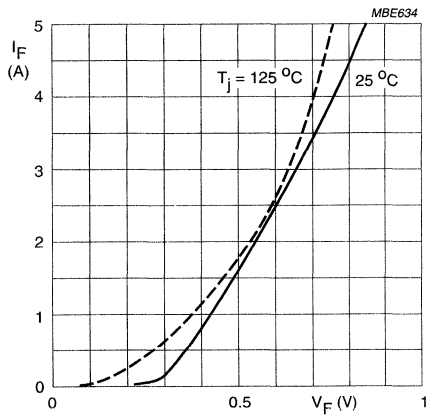


Fig.2 Typical forward voltage.

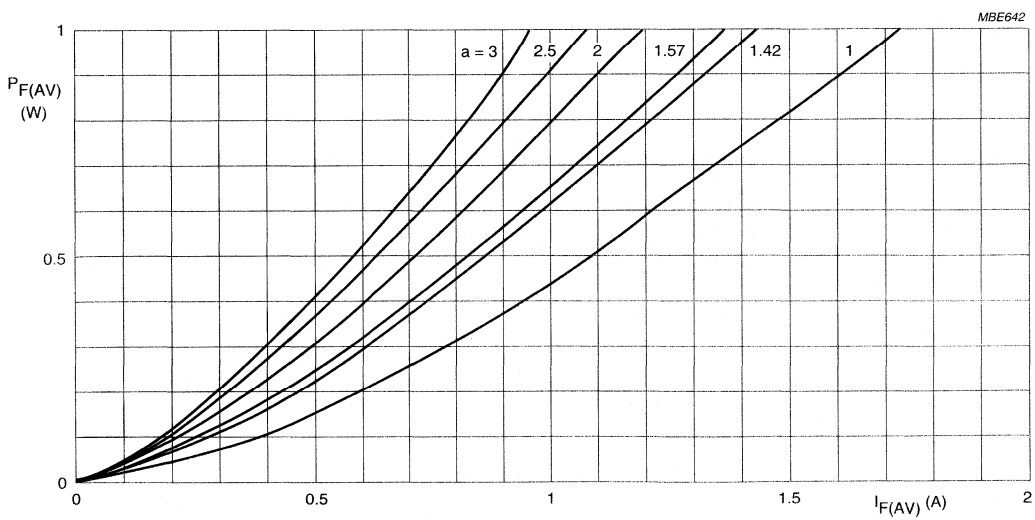


Fig.3 1N817. Maximum values steady state forward power dissipation as a function of the average forward current; a = $I_{F(RMS)}/I_{F(AV)}$.

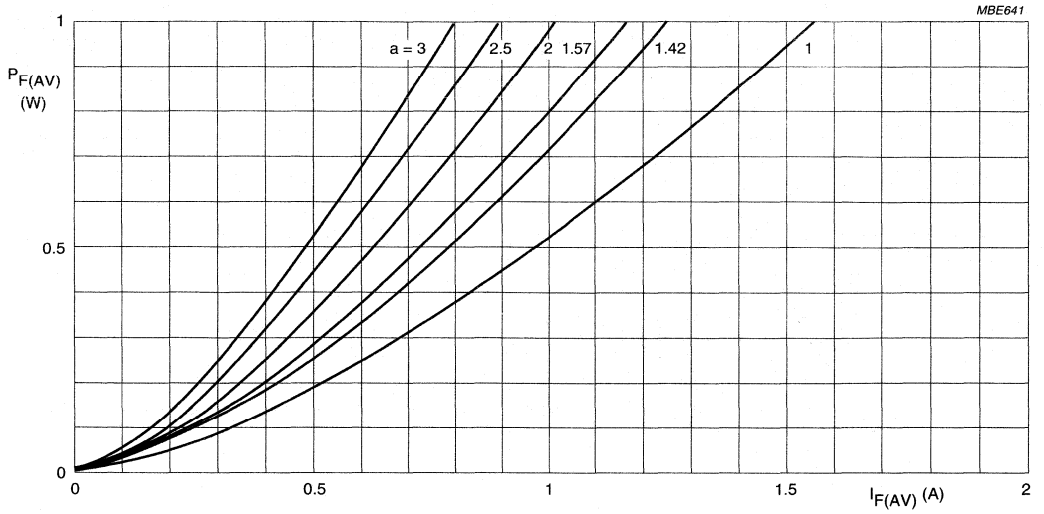


Fig.4 1N5818. Maximum values steady state forward power dissipation as a function of the average forward current; $a = I_{F(RMS)}/I_{F(AV)}$.

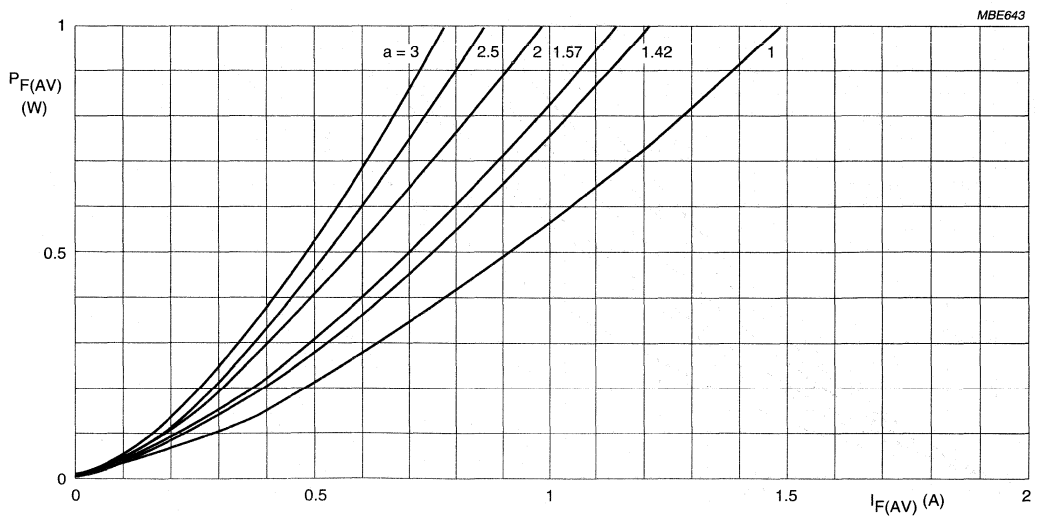


Fig.5 1N5819. Maximum values steady state forward power dissipation as a function of the average forward current; $a = I_{F(RMS)}/I_{F(AV)}$.

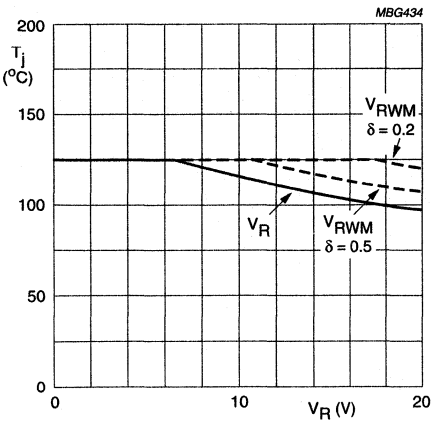


Fig.6 1N5817. Maximum permissible junction temperature as a function of reverse voltage; $R_{th\ j\text{-}a}$ = 100 K/W.

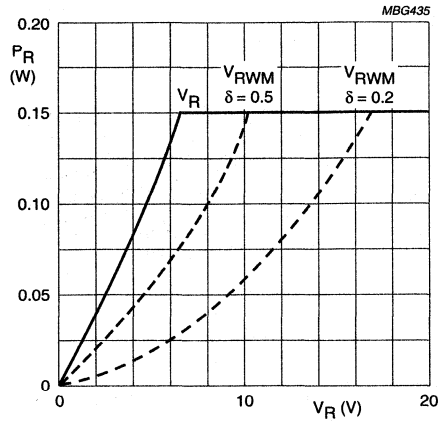


Fig.7 1N5817. Reverse power dissipation as a function of reverse voltage (max. values); $R_{th\ j\text{-}a}$ = 100 K/W.

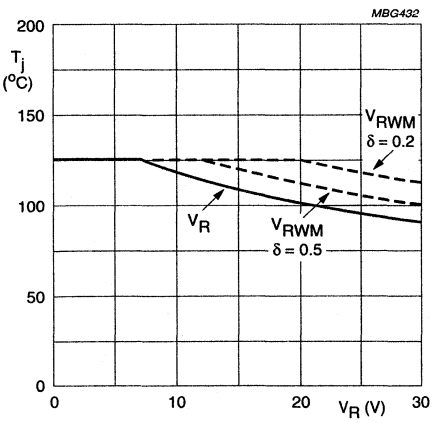


Fig.8 1N5818. Maximum permissible junction temperature as a function of reverse voltage; $R_{th\ j\text{-}a}$ = 100 K/W.

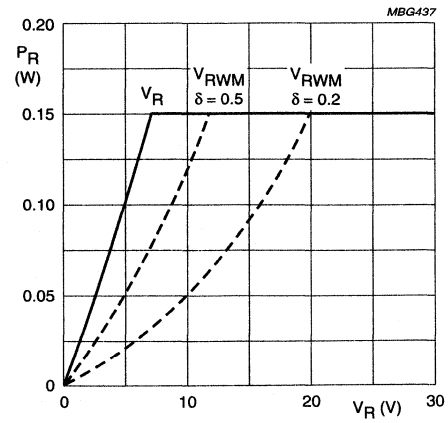


Fig.9 1N5818. Reverse power dissipation as a function of reverse voltage (max. values); $R_{th\ j\text{-}a}$ = 100 K/W.

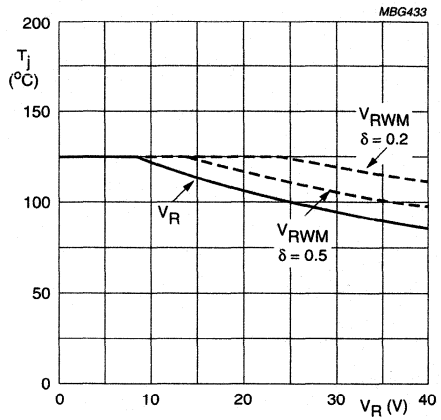


Fig.10 1N5819. Maximum permissible junction temperature as a function of reverse voltage; $R_{th\ j\text{-}a}$ = 100 K/W.

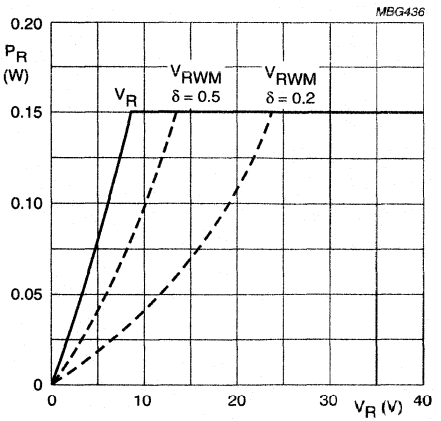


Fig.11 1N5819. Reverse power dissipation as a function of reverse voltage (max. values); $R_{th\ j\text{-}a}$ = 100 K/W.

Schottky barrier (double) diodes 1PS59SB10 series

FEATURES

- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes encapsulated in a SC59 small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE
1PS59SB10	10
1PS59SB14	14
1PS59SB15	15
1PS59SB16	16

PINNING

PIN	1PS59SB. .			
	10	14	15	16
1	a	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k	k_1, a_2	k_1, k_2	a_1, a_2

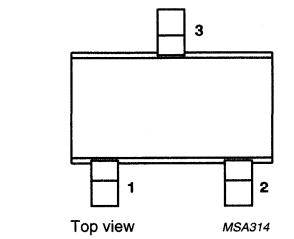


Fig.1 Simplified outline (SC59) and pin configuration.

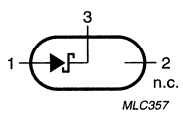


Fig.2 1PS59SB10 single diode configuration (symbol).

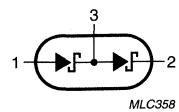


Fig.3 1PS59SB14 diode configuration (symbol).

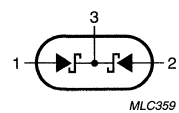


Fig.4 1PS59SB15 diode configuration (symbol).

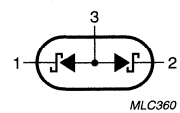


Fig.5 1PS59SB16 diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.6		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; see Fig.7	2	µA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.9	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.8	10	pF

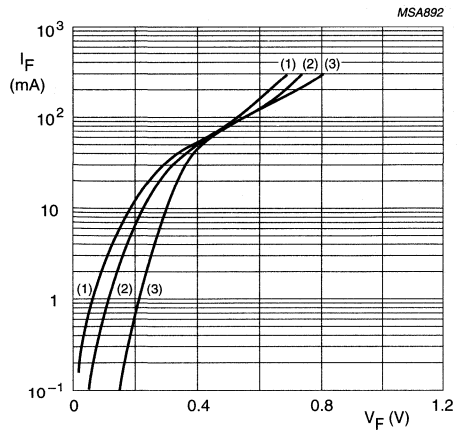
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

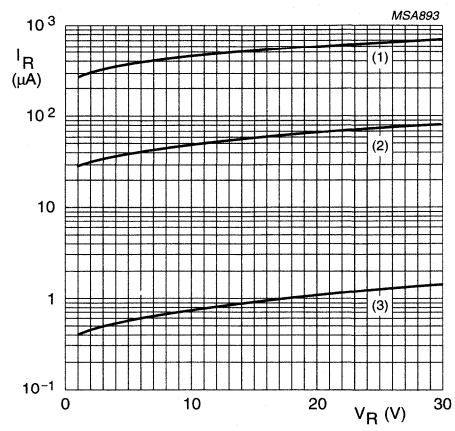
1. Refer to SC59 standard mounting conditions.

GRAPHICAL DATA



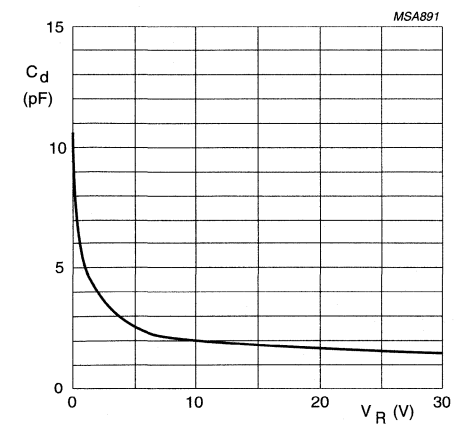
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

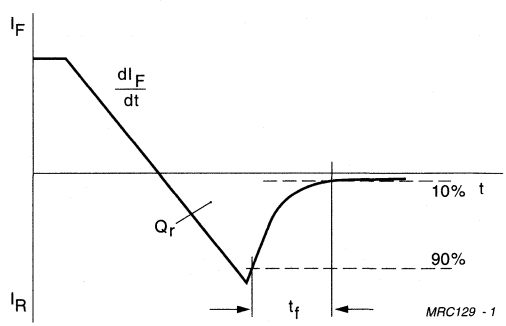


Fig.9 Reverse recovery definitions.

Schottky barrier diode 1PS59SB20

FEATURES

- Ultra fast switching speed
- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

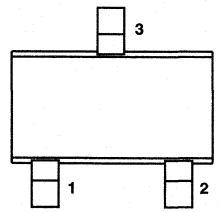
- High-speed switching
- Voltage clamping
- Protection circuits.

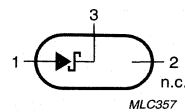
PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

DESCRIPTION

Planar Schottky barrier diode with an integrated guard ring for stress protection in an SC-59 small SMD plastic package.





Marking code: 20.

Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_R	continuous reverse voltage	–	40	V
I_F	continuous forward current	–	500	mA
I_{FSM}	non-repetitive peak forward current	–	2	A
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	–	125	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	I_F = 500 mA; see Fig.2	–	550	mV
I_R	reverse current	V_R = 35 V; see Fig.3	–	100	μA
		V_R = 35 V; T_j = 100 °C; see Fig.3	–	10	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	60	90	pF

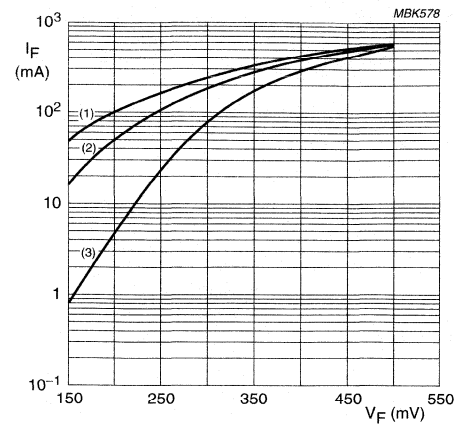
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

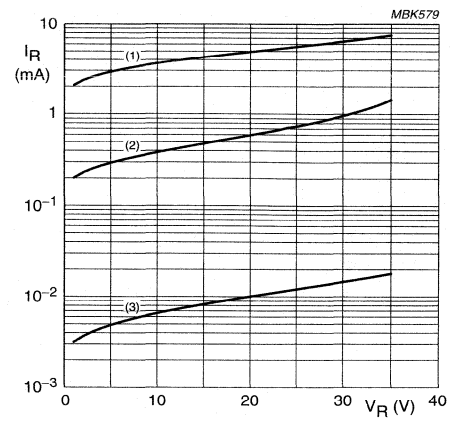
1. Refer to SC-59 standard mounting conditions.

GRAPHICAL DATA



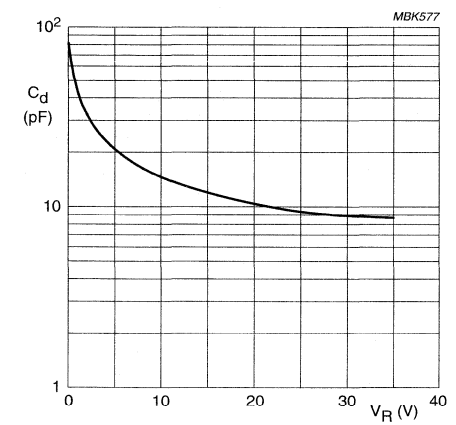
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_j = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS59SB21

FEATURES

- Ultra fast switching speed
- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

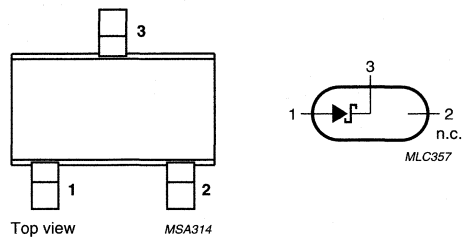
- High-speed switching
- Voltage clamping
- Protection circuits.

DESCRIPTION

Planar Schottky barrier diode with an integrated guard ring for stress protection in an SC-59 small plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: 21.

Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_R	continuous reverse voltage	–	40	V
I_F	continuous forward current	–	200	mA
I_{FSM}	non-repetitive peak forward current	–	1	A
T_{stg}	storage temperature	−65	+150	°C
T_j	junction temperature	–	125	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.2			
		I_F = 10 mA	–	300	mV
		I_F = 100 mA	–	420	mV
		I_F = 200 mA	–	550	mV
I_R	reverse current	V_R = 30 V; note 1; see Fig.3	–	15	μA
		V_R = 30 V; T_j = 100 °C; note 1; see Fig.3	–	3	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	40	50	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

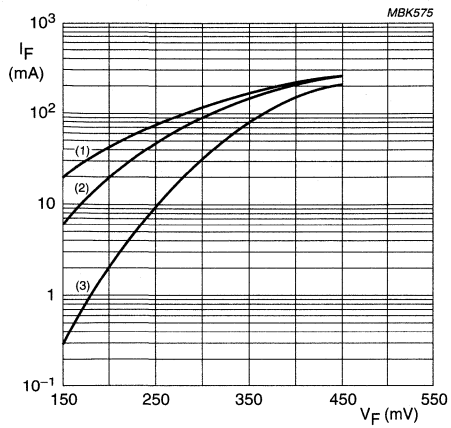
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

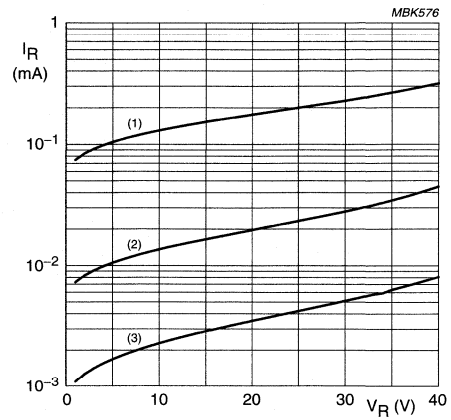
1. Refer to SC-59 standard mounting conditions.

GRAPHICAL DATA



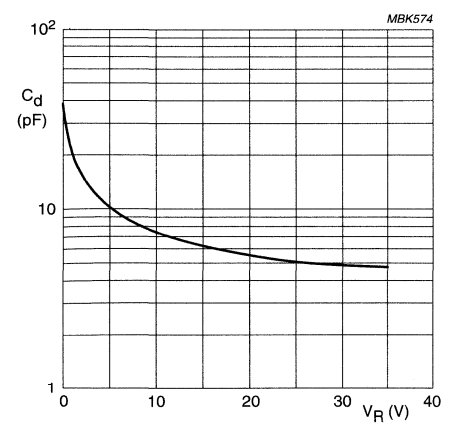
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_j = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes

1PS70SB10; 1PS70SB14; 1PS70SB15; 1PS70SB16

FEATURES

- Low forward voltage
- Guard ring protected
- Very small plastic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes encapsulated in a SOT323 very small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE (1)
1PS70SB10	7∗0
1PS70SB14	7∗4
1PS70SB15	7∗5
1PS70SB16	7∗6

Note

1. ∗ = -: Made in Hong Kong.
   ∗ = t: Made in Malaysia.

PINNING

PIN	1PS70SB..			
	10	14	15	16
1	a_1	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2

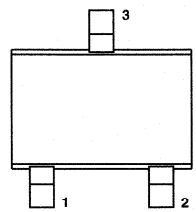


Fig.1 Simplified outline SOT323 (SC-70) and pin configuration.

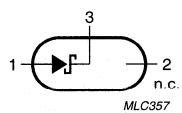


Fig.2 1PS70SB10 single diode configuration (symbol).

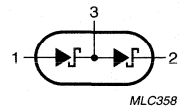


Fig.3 1PS70SB14 diode configuration (symbol).

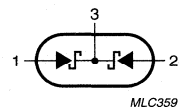


Fig.4 1PS70SB15 diode configuration (symbol).

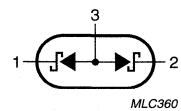


Fig.5 1PS70SB16 diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
P_{tot}	total power dissipation (per package)	$T_{amb} < 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	continuous forward voltage	see Fig.6		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	continuous reverse current	V_R = 25 V; note 1; see Fig.7	2	µA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz; see Fig.8	10	pF

Note

1. Pulse test: t_p = 300 µs; δ = 0.02.

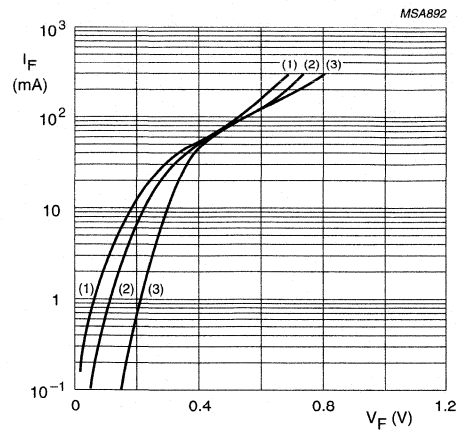
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

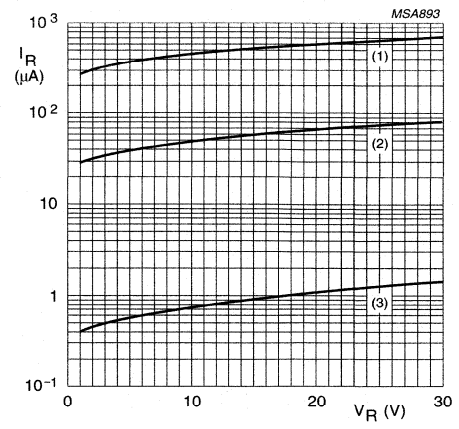
1. Refer to SOT323 (SC70) standard mounting conditions.

GRAPHICAL DATA



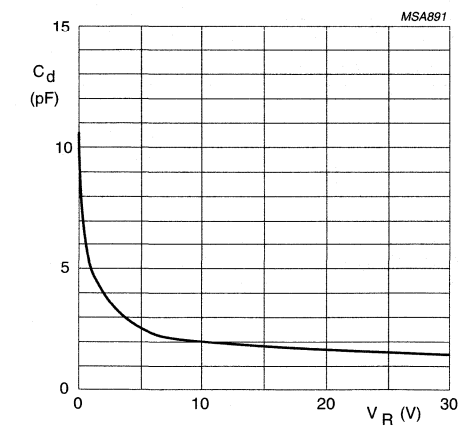
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes 1PS70SB40 series

FEATURES

- Low forward voltage
- Guard ring protected
- Very small SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes encapsulated in an SC-70 very small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE (1)
1PS70SB40	6*3
1PS70SB44	6*4
1PS70SB45	6*5
1PS70SB46	6*6

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	1PS70SB..			
	40	44	45	46
1	a_1	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2

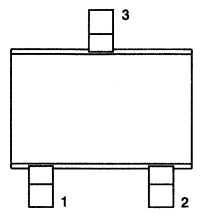


Fig.1 Simplified outline (SC-70) and pin configuration.

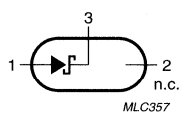


Fig.2 1PS70SB40 single diode configuration (symbol).

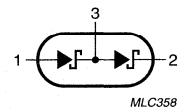


Fig.3 1PS70SB44 diode configuration (symbol).

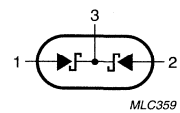


Fig.4 1PS70SB45 diode configuration (symbol).

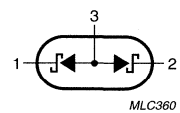


Fig.5 1PS70SB46 diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	continuous forward voltage	see Fig.6		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.7	1	µA
		V_R = 40 V; note 1; see Fig.7	10	µA
τ	charge carrier life time	I_F = 5 mA; Krakauer method	100	ps
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.9	5	pF

Note

1. Pulse test: t_p = 300 µs; δ = 0.02.

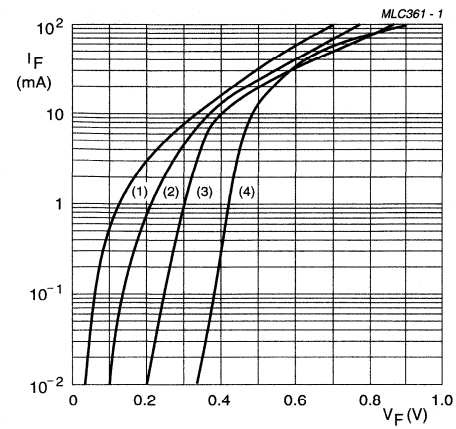
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

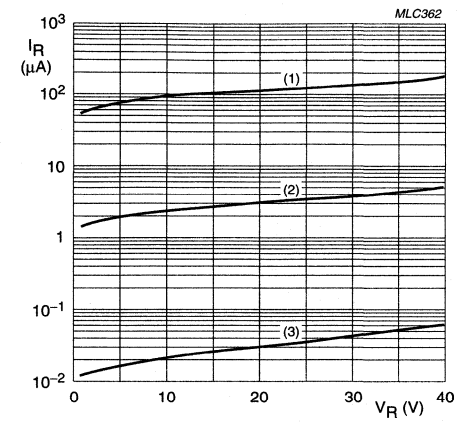
1. Refer to SC70 standard mounting conditions.

GRAPHICAL DATA



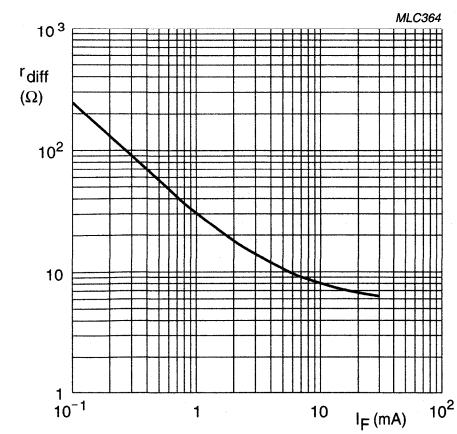
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



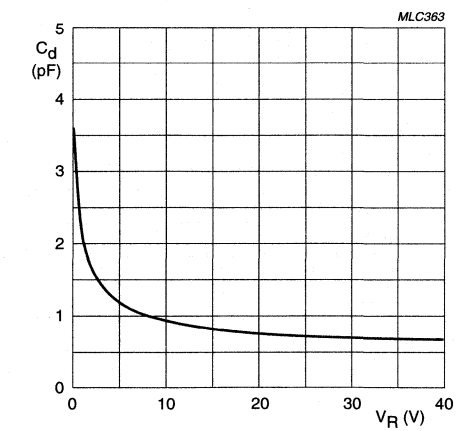
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 10 KHz.

Fig.8 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.9 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS74SB23

FEATURES

- Ultra fast switching speed
- Low forward voltage
- Fast recovery time
- Guard ring protected
- Small plastic SMD package
- Capability of absorbing very high surge current.

APPLICATIONS

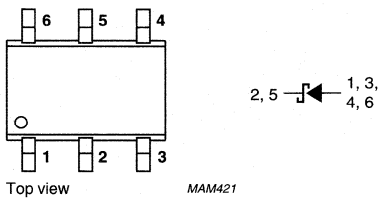
- Rectification
- Circuit protection
- Polarity protection
- Switched-mode power supplies.

DESCRIPTION

Planar Schottky barrier diode encapsulated in an SC-74 (SOT457) small plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	anode
4	anode
5	cathode
6	anode



Marking code: P1.

Fig.1 Simplified outline SC-74 (SOT457) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	25	V
I_F	continuous forward current		–	1	A
I_{FSM}	non-repetitive peak forward current	t_p = 8.3 ms; half sinewave; JEDEC method; note 1	–	25	A
I_{RSM}	non-repetitive peak reverse current	t_p = 100 µs	–	0.5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

Note

1. Pins 1, 3, 4 and 6 are connected in parallel; pins 2 and 5 are connected in parallel.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 100 mA	260	300	mV
		I_F = 1 A	400	450	mV
I_R	reverse current	V_R = 20 V; note 1; see Fig.3	80	500	μA
		V_R = 25 V; note 1; see Fig.3	–	1	mA
C_d	diode capacitance	f = 1 MHz; V_R = 4 V; see Fig.4	100	–	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

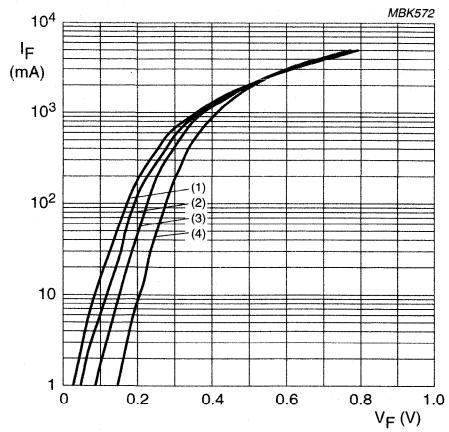
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

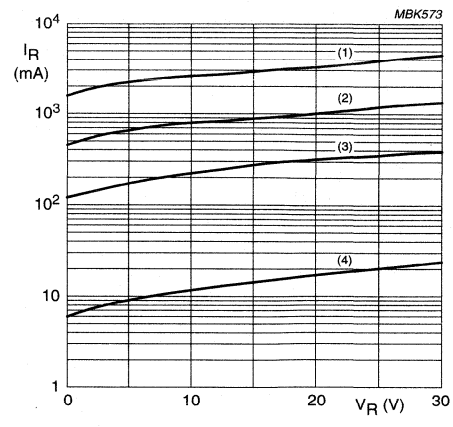
1. Refer to SC-74 (SOT457) standard mounting conditions.

GRAPHICAL DATA



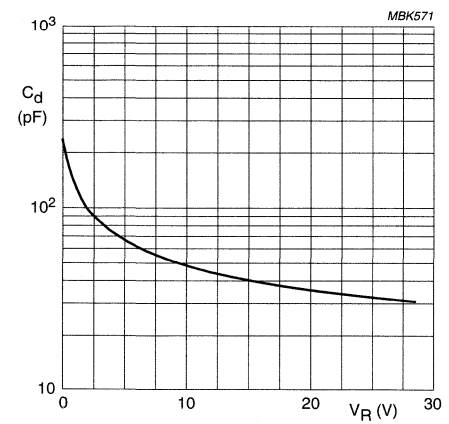
(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diode 1PS75SB45

FEATURES

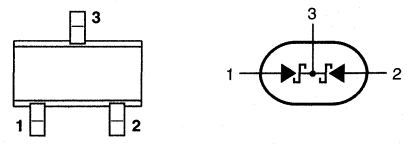
- Low forward voltage
- Guard ring protected
- Ultra small plastic SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier double diode encapsulated in a SOT416 (SC75) ultra small plastic SMD package.



Marking code: 45.

Fig.1 Simplified outline SOT416; (SC75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	continuous forward voltage	see Fig.2		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.3	1	μA
		V_R = 40 V; note 1; see Fig.3	10	μA
τ	charge carrier life time	I_F = 5 mA; Krakauer method	100	ps
C_d	diode capacitance	V_R = 0 ; f = 1 MHz; see Fig.5	5	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

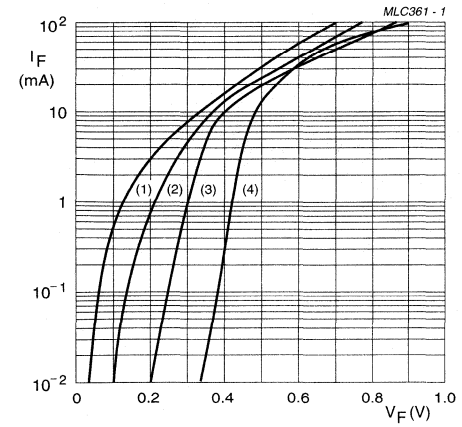
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

Note

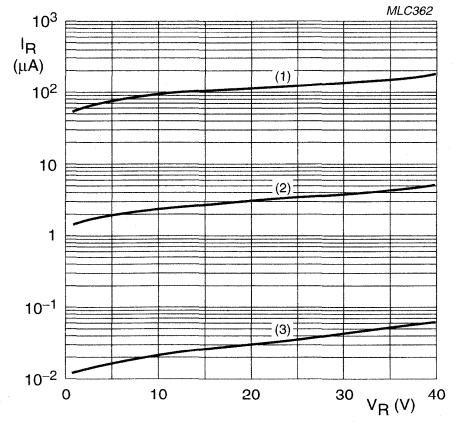
1. Refer to SC75 standard mounting conditions.

GRAPHICAL DATA



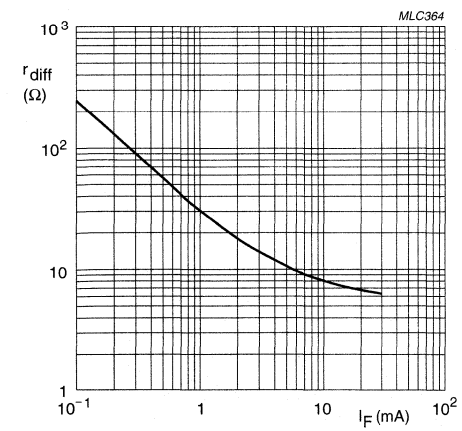
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



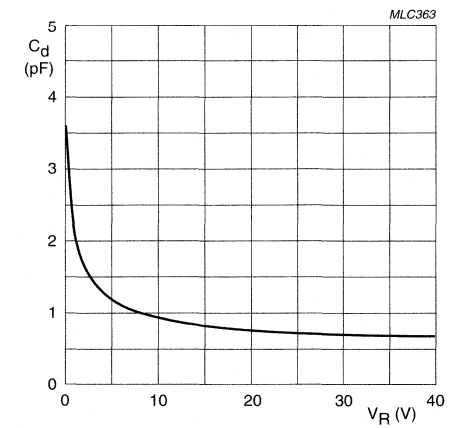
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS76SB10

FEATURES

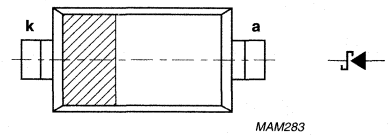
- Low forward voltage
- Guard ring protected
- Very small plastic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD323 very small plastic SMD package.



Marking code: S0.
The marking bar indicates the cathode.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.3	2	μA
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.4	10	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

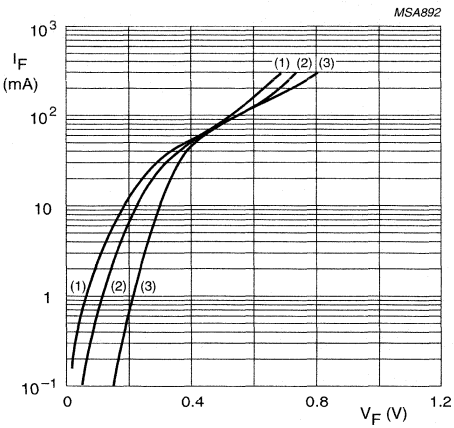
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

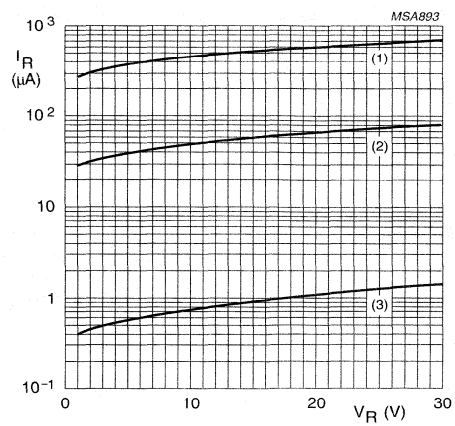
1. Refer to SOD323 standard mounting conditions.

GRAPHICAL DATA



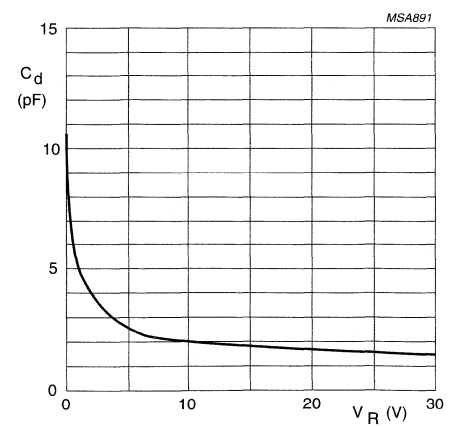
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS76SB17

FEATURES

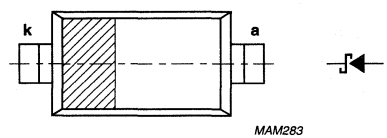
- Low forward voltage
- Low diode capacitance
- ESD > 500 V; Human body model
- Very small plastic SMD package.

APPLICATIONS

- UHF mixers
- Sampling circuits
- Modulators
- Phase detectors.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD323 very small plastic SMD package.



Marking code: S7.
The marking bar indicates the cathode.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_R	continuous reverse voltage	–	4	V
I_F	continuous forward current	–	30	mA
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	–	100	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.2			
		I_F = 0.1 mA	–	300	mV
		I_F = 1 mA	360	450	mV
		I_F = 10 mA	470	600	mV
I_R	reverse current	V_R = 3 V; see Fig.3	0.15	0.25	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; see Fig.4	0.8	1	pF
		f = 1 MHz; V_R = 0.5 V; see Fig.4	0.65	–	pF

THERMAL CHARACTERISTICS

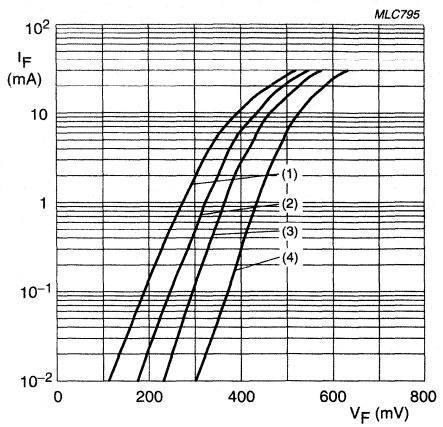
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

1. Refer to SOD323 standard mounting conditions.

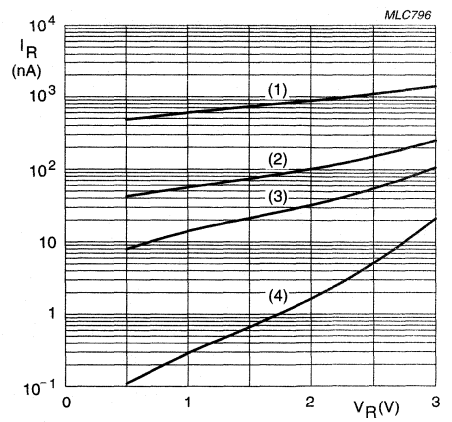
PRELIMINARY
See Philips Semiconductors for design-in information

GRAPHICAL DATA



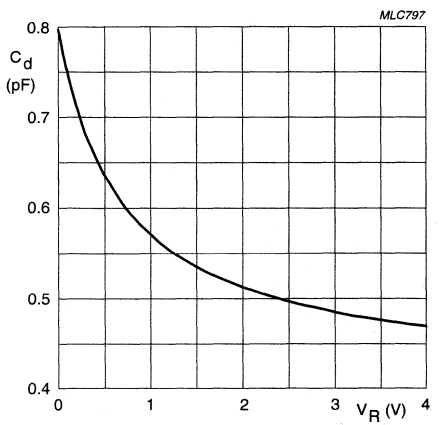
(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS76SB21

FEATURES

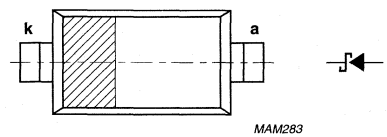
- Ultra fast switching speed
- Low forward voltage
- Guard ring protected
- Very small plastic SMD package.

APPLICATIONS

- High-speed switching
- Voltage clamping
- Protection circuits.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD323 very small plastic SMD package.



Marking code: S1.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	200	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	1	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.2			
		I_F = 10 mA	–	300	mV
		I_F = 100 mA	–	420	mV
		I_F = 200 mA	–	550	mV
I_R	reverse current	V_R = 30 V; note 1; see Fig.3	–	15	μA
		V_R = 30 V; T_j = 100 °C; note 1; see Fig.3	–	3	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	40	50	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

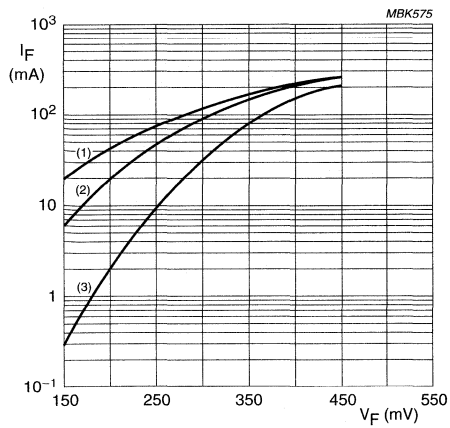
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

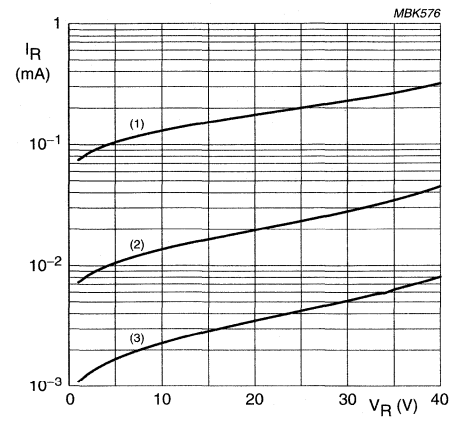
1. Refer to SOD323 standard mounting conditions.

GRAPHICAL DATA



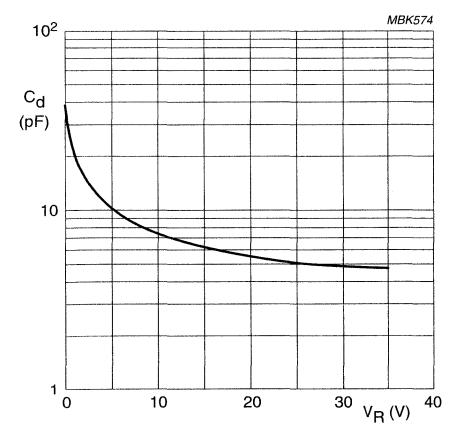
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_j = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS76SB40

FEATURES

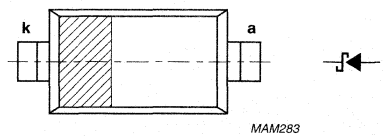
- Low forward voltage
- Guard ring protected
- Very small plastic SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD323 very small plastic SMD package.



Marking code: S4.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	continuous forward voltage	see Fig.2		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.3	1	μA
		V_R = 40 V; note 1; see Fig.3	10	μA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz; see Fig.5	5	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

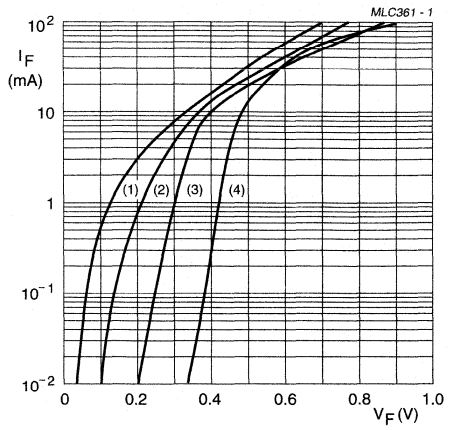
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

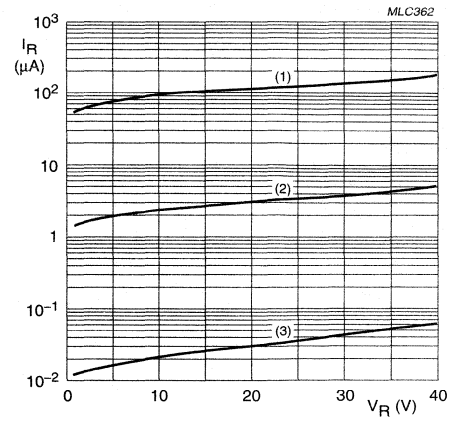
1. Refer to SOD323 standard mounting conditions.

GRAPHICAL DATA



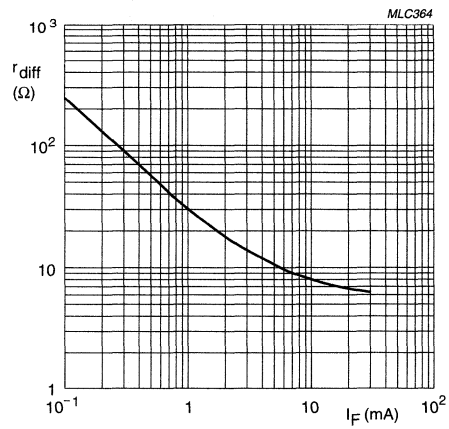
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



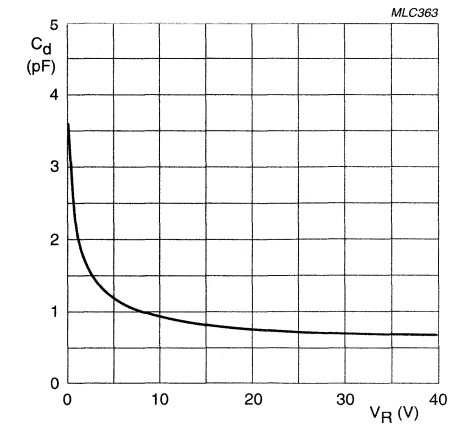
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS76SB70

FEATURES

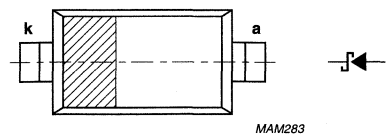
- Low forward voltage
- Guard ring protected
- Very small plastic SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD323 very small plastic SMD package.



Marking code: S2.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	continuous forward voltage	see Fig.2		
		I_F = 1 mA	410	mV
		I_F = 10 mA	750	mV
		I_F = 15 mA	1	V
I_R	continuous reverse current	V_R = 50 V; note 1; see Fig.3	100	nA
		V_R = 70 V; note 1; see Fig.3	10	µA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz; see Fig.5	2	pF

Note

1. Pulsed test: t_p = 300 µs; δ = 0.02.

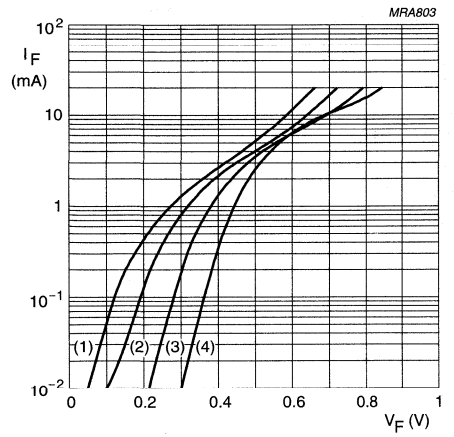
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

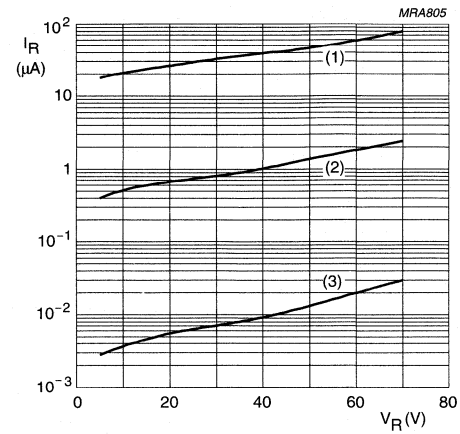
1. Refer to SOD323 standard mounting conditions.

GRAPHICAL DATA



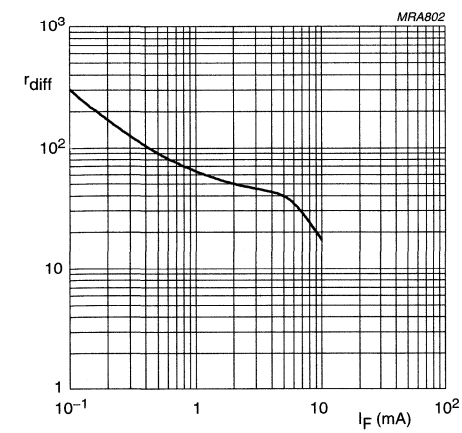
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



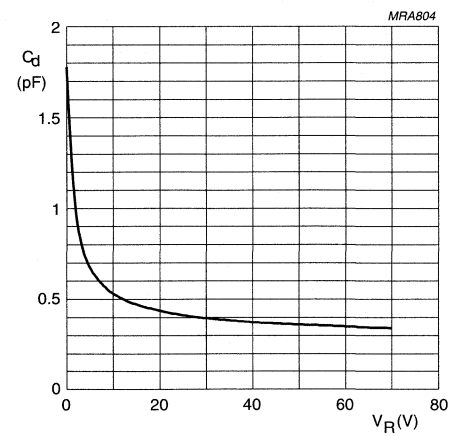
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS79SB10

FEATURES

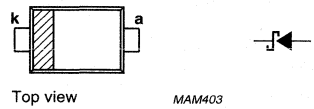
- Low forward voltage
- Guard ring protected
- Ultra small plastic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SC-79 ultra small plastic SMD package.



Marking code: F.

Fig.1 Simplified outline (SC-79) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	continuous forward voltage	see Fig.2		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	continuous reverse current	V_R = 25 V; note 1; see Fig.3	2	µA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz; see Fig.4	10	pF

Note

1. Pulsed test: t_p = 300 µs; δ = 0.02.

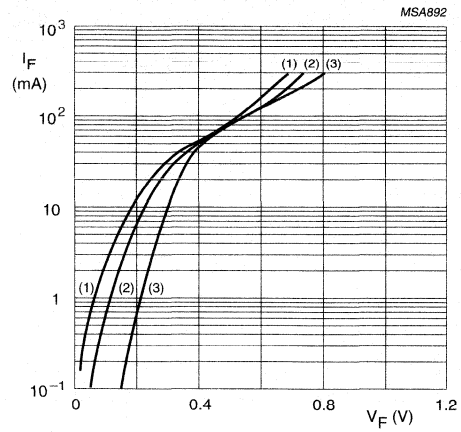
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

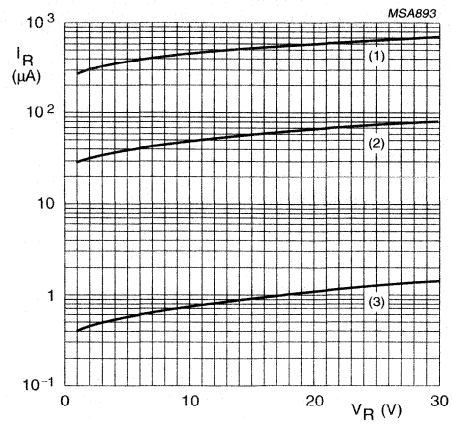
1. Refer to SC-79 standard mounting conditions.

GRAPHICAL DATA



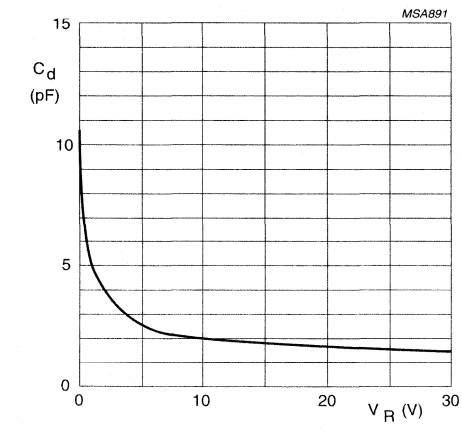
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS79SB40

FEATURES

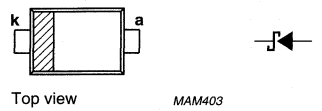
- Low forward voltage
- Guard ring protected
- Ultra small SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in an SC-79 (SOD523) ultra small plastic SMD package.



Marking code: T.
The marking bar indicates the cathode.

Fig.1 Simplified outline SC-79 (SOD523) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	continuous forward voltage	see Fig.2		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.3	1	μA
		V_R = 40 V; note 1; see Fig.3	10	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.5	5	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

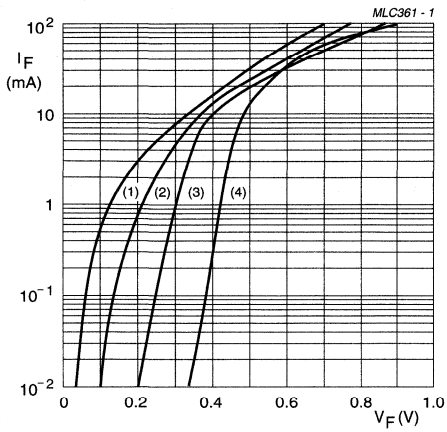
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

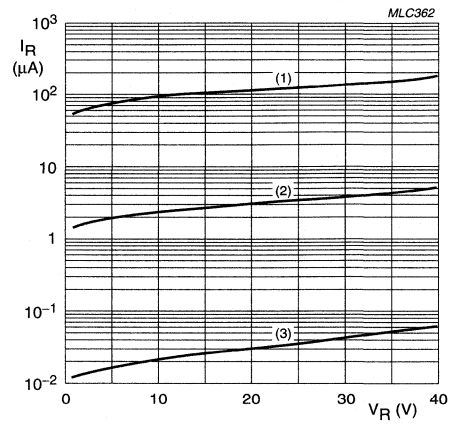
1. Refer to SC-79 (SOD523) standard mounting conditions.

GRAPHICAL DATA



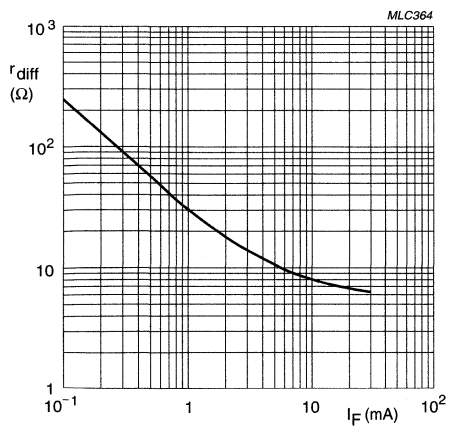
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



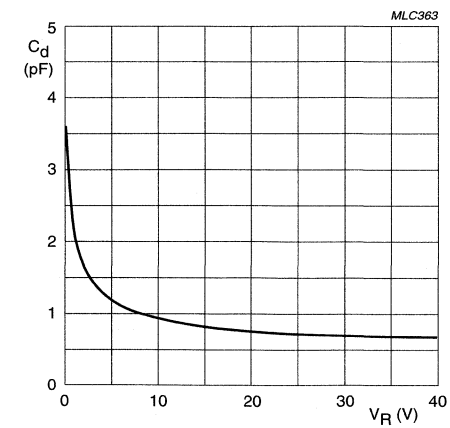
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 KHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode 1PS79SB70

FEATURES

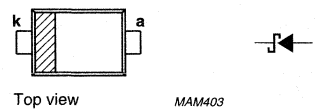
- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Ultra small plastic SMD package
- Low capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SC-79 ultra small plastic SMD package.



Marking code: G.

Fig.1 Simplified outline (SC-79) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 1 mA	410	mV
		I_F = 10 mA	750	mV
		I_F = 15 mA	1	V
I_R	reverse current	V_R = 50 V; note 1; see Fig.3	100	nA
		V_R = 70 V; note 1; see Fig.3	10	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	2	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

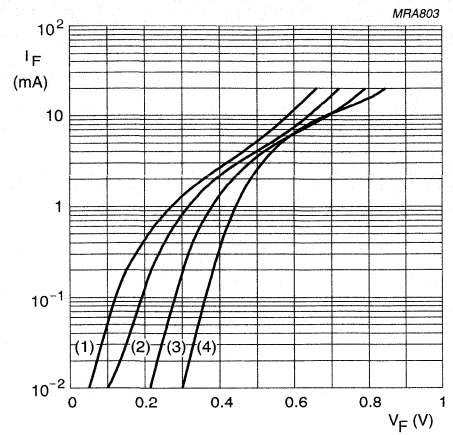
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	450	K/W

Note

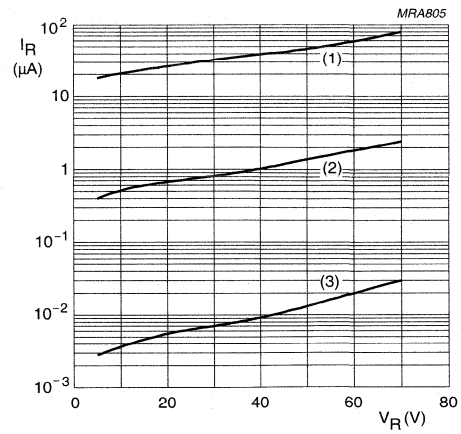
1. Refer to SC-79 standard mounting conditions.

GRAPHICAL DATA



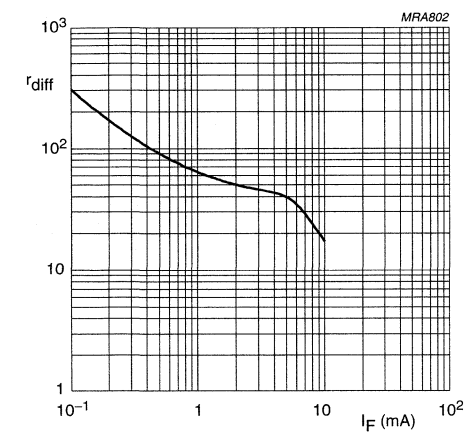
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



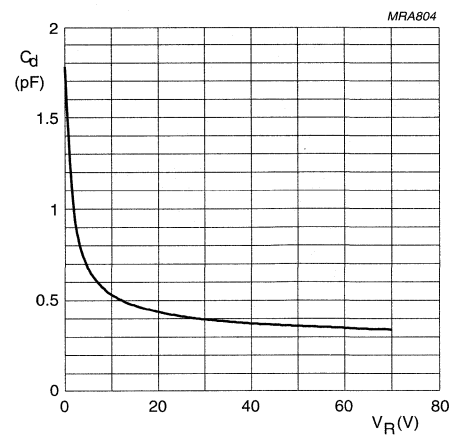
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diodes 1PS88SB48

FEATURES

- Ultra fast switching speed
- Low forward voltage
- Small SMD package
- Guard ring protected
- Absorbs very high surge pulse
- Low capacitance.

APPLICATIONS

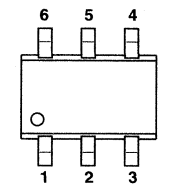
- High speed switching
- Circuit protection
- Voltage clamping.

DESCRIPTION

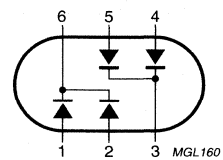
The 1PS88SB48 consists of two dual high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SMD SC-88 plastic package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode (k1)
4	anode (a3)
5	anode (a4)
6	common cathode (k2)



Top view



Marking code: 8t5.

Fig.1 Simplified outline (SC-88) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	continuous forward voltage	see Fig.2		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.3	1	μA
		V_R = 40 V; note 1; see Fig.3	10	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.5	5	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

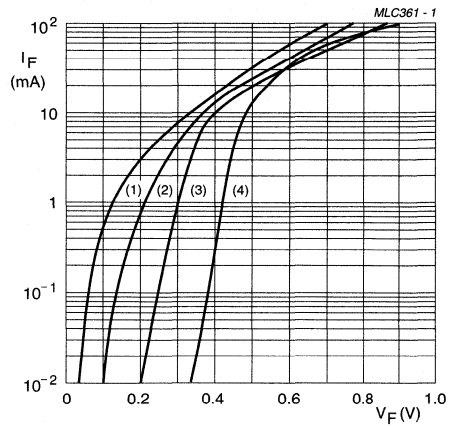
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

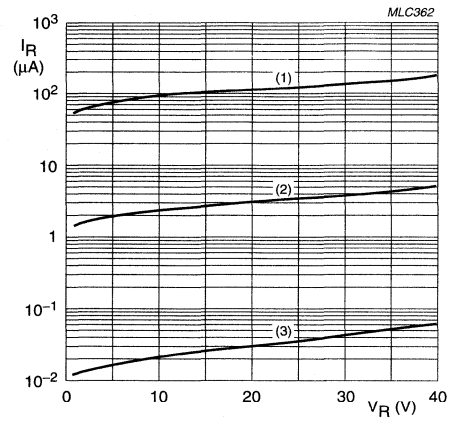
1. Refer to SC-88 standard mounting conditions.

GRAPHICAL DATA



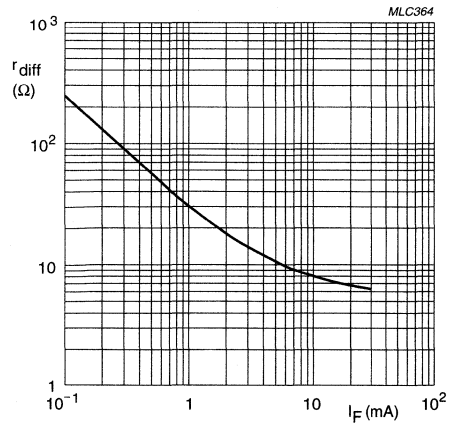
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



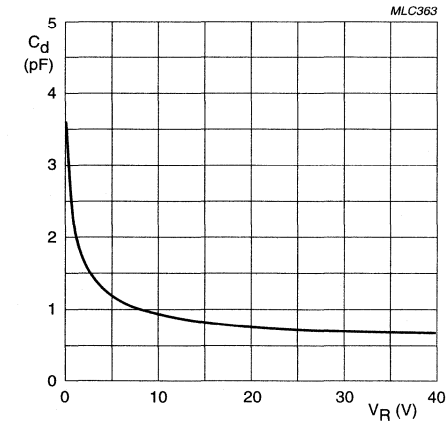
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 KHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diodes

1PS89SB14; 1PS89SB15; 1PS89SB16

FEATURES

- Power dissipation comparable to SOT23
- Low forward voltage
- Guard ring protected
- Ultra small SMD package.

APPLICATIONS

- Ultra high speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier double diodes encapsulated in an ultra small plastic SMD SC-89 (SOT490) package.

MARKING

TYPE NUMBER	MARKING CODE
1PS89SB14	44
1PS89SB15	43
1PS89SB15	45

PINNING

PIN	1PS89SB..		
	14	15	16
1	a_1	a_1	k_1
2	k_2	a_2	k_2
3	k_1, a_2	k_1, k_2	a_1, a_2

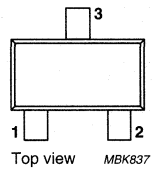


Fig.1 Simplified outline (SC-89; SOT490) and pin configuration.

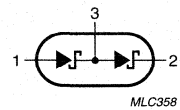


Fig.2 1PS89SB14 diode configuration (symbol).

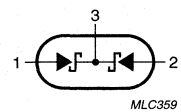


Fig.3 1PS89SB15 diode configuration (symbol).

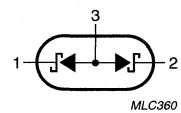


Fig.4 1PS89SB16 diode configuration (symbol).

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode unless otherwise specified					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode unless otherwise specified				
V_F	forward voltage	see Fig.5		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.6	2	µA
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.7	10	pF

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

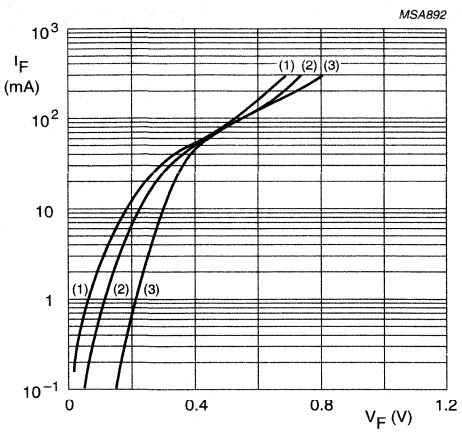
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

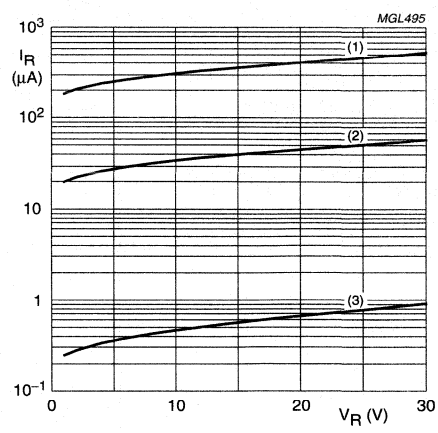
1. Refer to SC-89 (SOT490) standard mounting conditions.

GRAPHICAL DATA



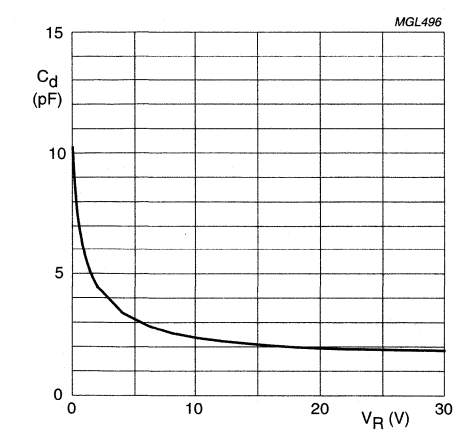
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.7 Diode capacitance as a function of reverse voltage; typical values.

High-speed double diodes

1PS89SS04; 1PS89SS05; 1PS89SS06

FEATURES

- Power dissipation comparable to SOT23
- Ultra small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

- High speed switching in e.g. surface mounted circuits.

DESCRIPTION

Two high-speed switching diodes in planar technology, with different configurations, in an ultra small SC-89 (SOT490) plastic SMD package.

PINNING

PIN	1PS89SS..		
	04	05	06
1	a_1	a_1	k_1
2	k_2	a_2	k_2
3	k_1, a_2	k_1, k_2	a_1, a_2

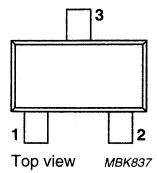


Fig.1 Simplified outline (SC-89; SOT490) and pin configuration.

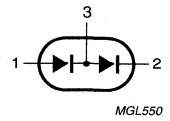


Fig.2 1PS89SS04 diode configuration (symbol).

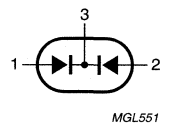


Fig.3 1PS89SS05 diode configuration (symbol).

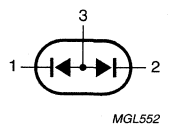


Fig.4 1PS89SS06 diode configuration (symbol).

MARKING

TYPE NUMBER	MARKING CODE
1PS89SS04	S4
1PS89SS05	S5
1PS89SS06	S6

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode unless otherwise specified					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	T_{amb} = 25 °C; note 1; see Fig.5			
		single diode loaded	–	200	mA
		both diodes loaded	–	125	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.7			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A

PRELIMINARY
Philips Semiconductors reserve the right to change specifications without notice.
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.6			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.8			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.9			
	1PS89SS04		–	1.5	pF
	1PS89SS05		–	1.5	pF
	1PS89SS06		–	2	pF
t_{rr}	reverse recovery time	switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.10	–	4	ns
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_r = 20 ns; see Fig.11	–	1.75	V

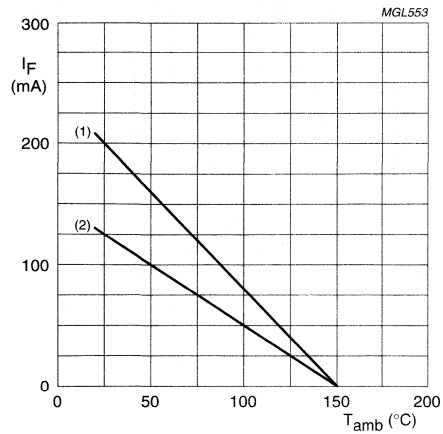
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	both diodes loaded		
	1PS89SS04		55	K/W
	1PS89SS05		70	K/W
	1PS89SS06		70	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

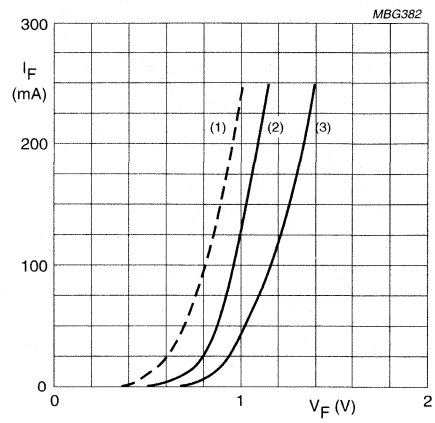
1. Refer to SC-89 (SOT490) standard mounting conditions.

GRAPHICAL DATA



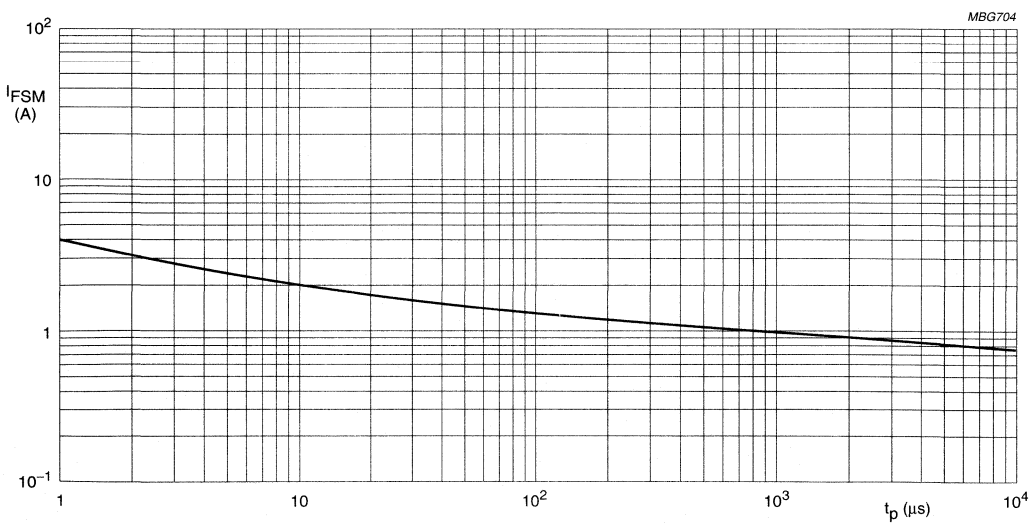
(1) One diode loaded.
(2) Both diodes loaded.

Fig.5 Maximum permissible continuous forward current as a function of the ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.6 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.7 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

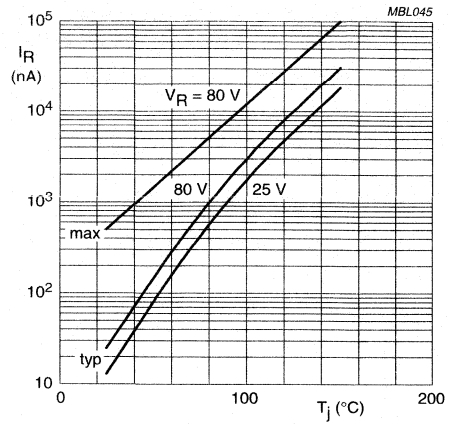
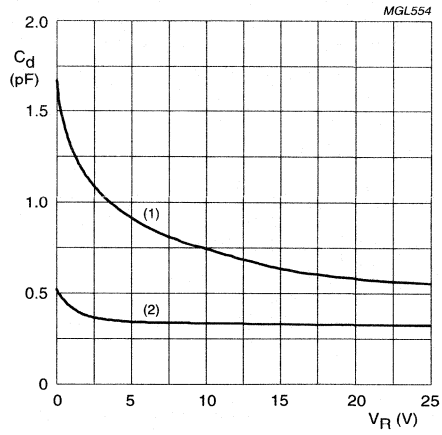
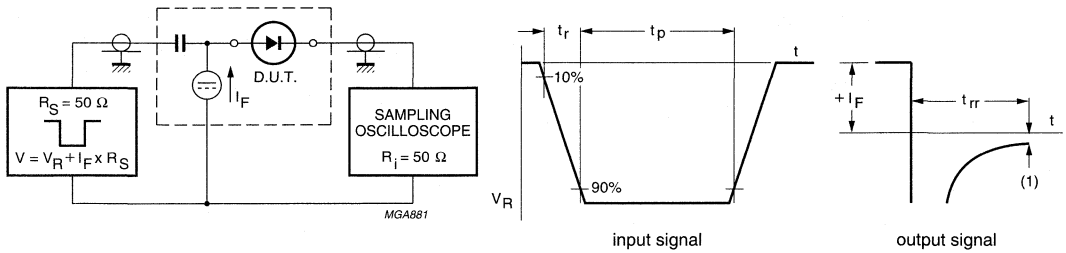


Fig.8 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.
(1) 1PS89SS06.
(2) 1PS89SS04 and 1PS89SS05.

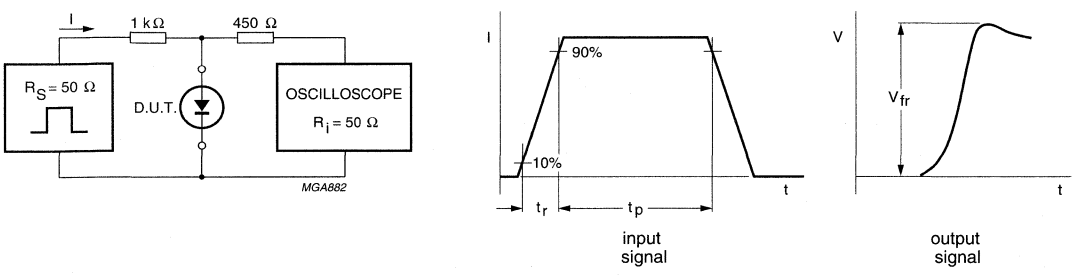
Fig.9 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05;
Oscilloscope: rise time t_r = 0.35 ns.

Fig.10 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.11 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS181

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

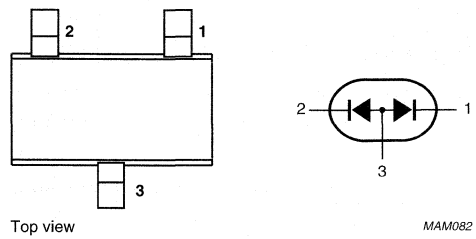
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS181 consists of two high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the small plastic SMD SC59 package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode



Marking code: A3T.

Fig.1 Simplified outline (SC59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	215	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	2.0	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

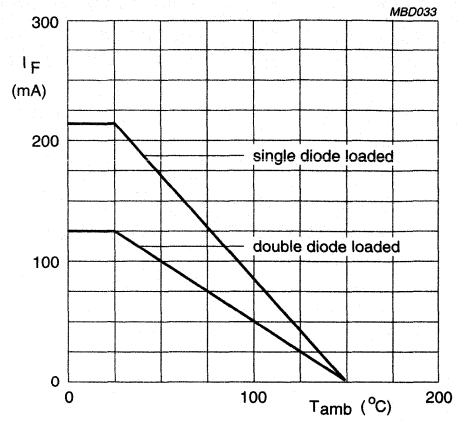
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		250	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

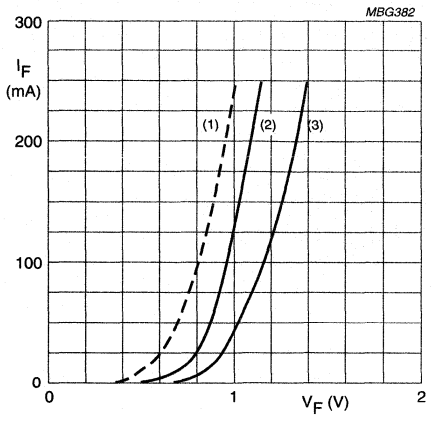
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



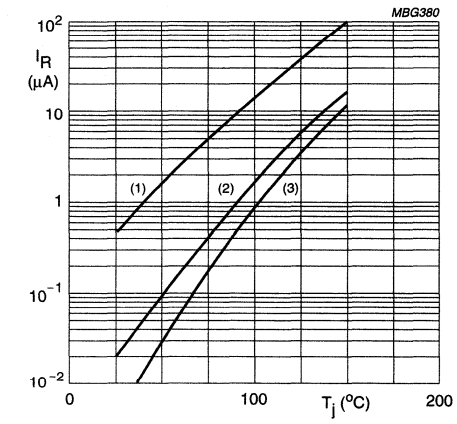
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



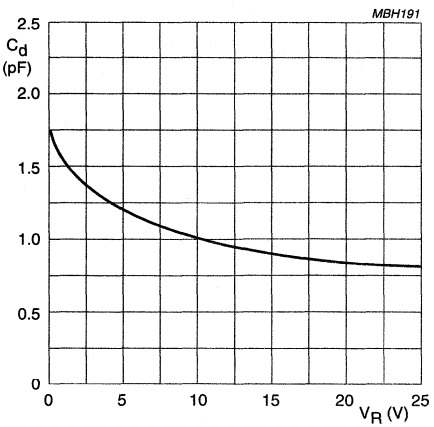
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



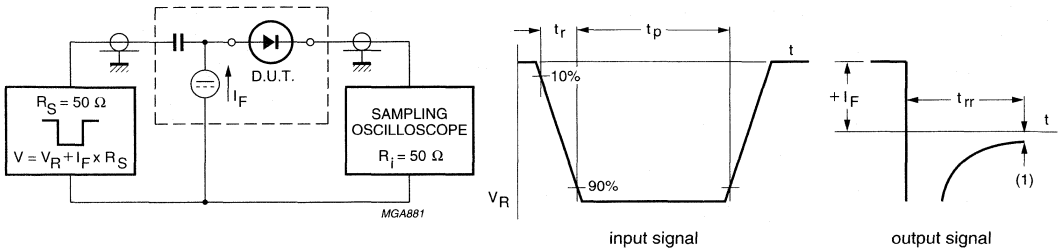
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

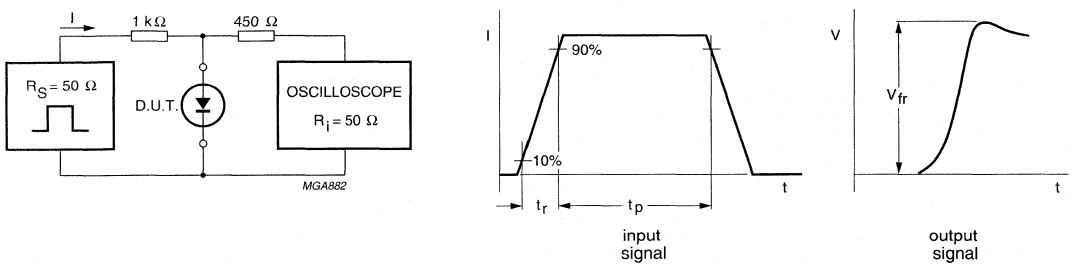


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS184

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

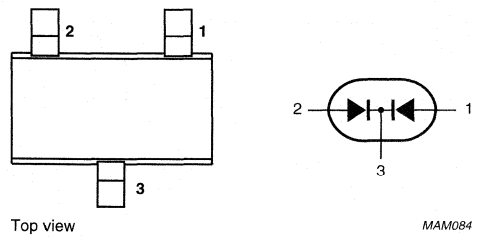
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS184 consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small plastic SMD SC59 package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode



Marking code: B3T.

Fig.1 Simplified outline (SC59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	215	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

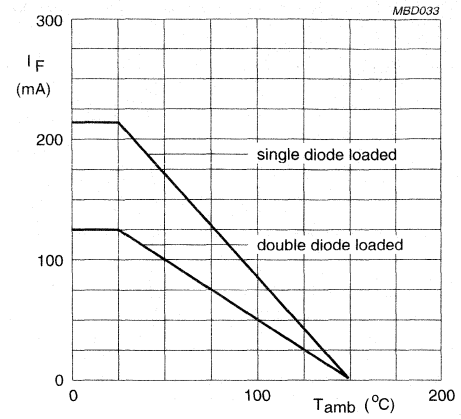
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		250	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

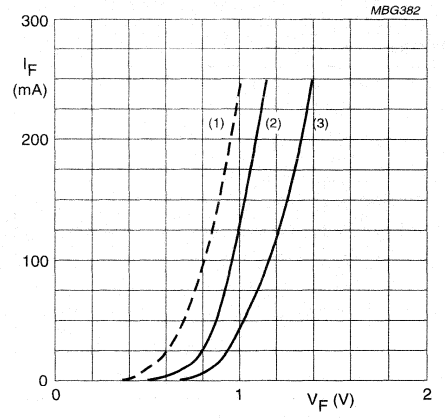
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



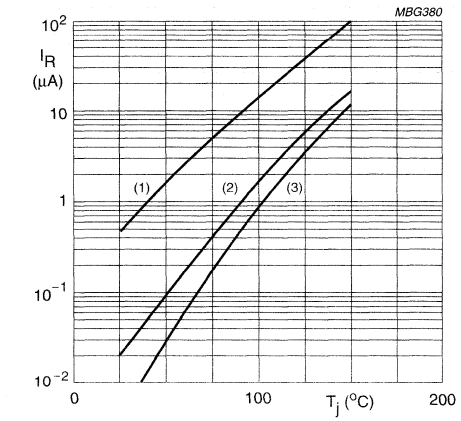
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



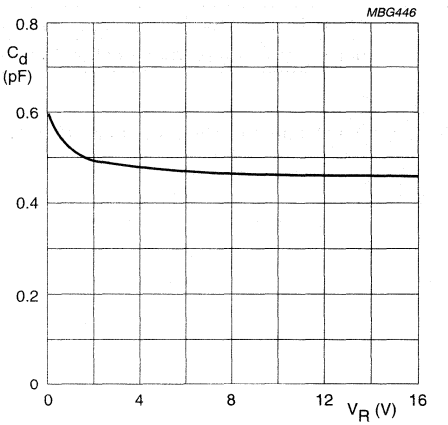
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



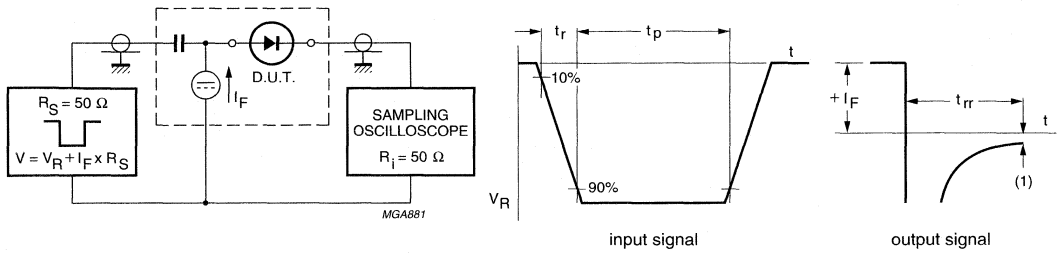
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

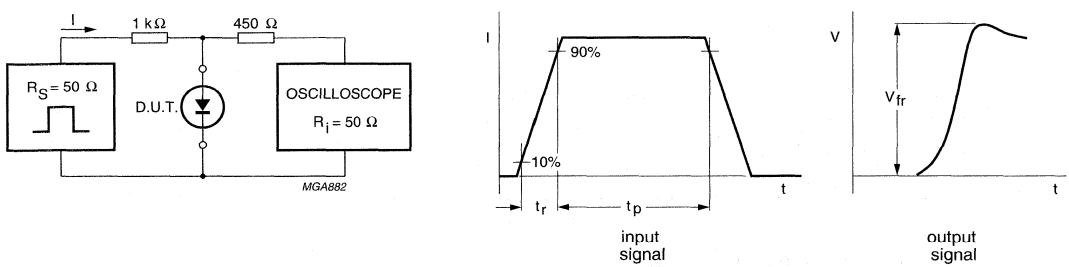


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed diode 1PS193

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

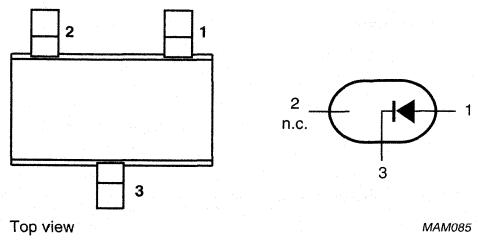
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS193 is a high-speed switching diode, fabricated in planar technology, and encapsulated in the small plastic SMD SC59 package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: F3T.

Fig.1 Simplified outline (SC59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C;	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_p = 20 ns; see Fig.7	–	1.75	V

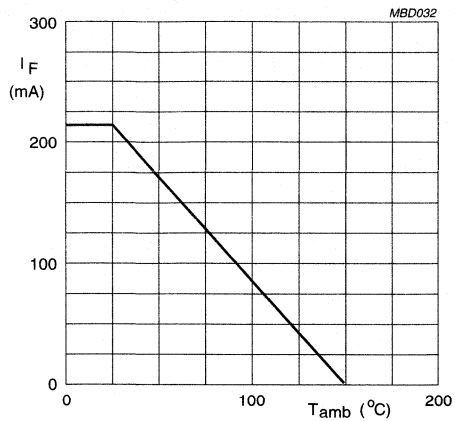
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		250	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

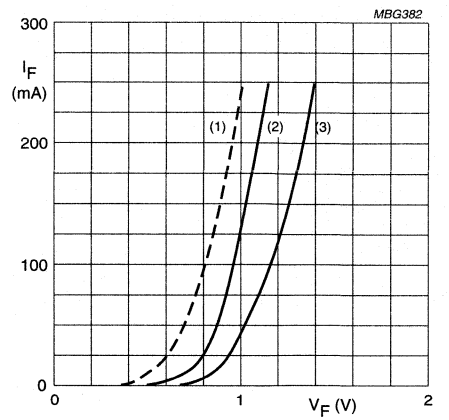
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



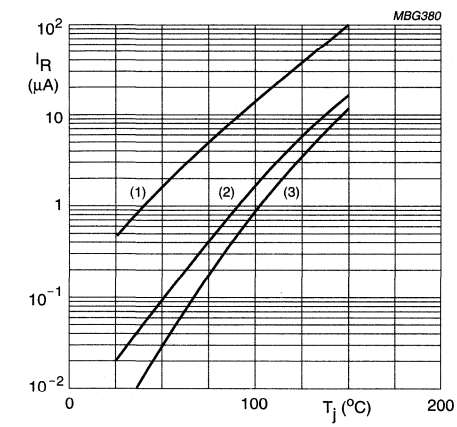
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



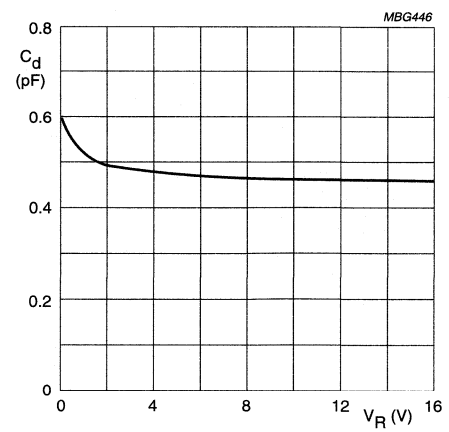
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



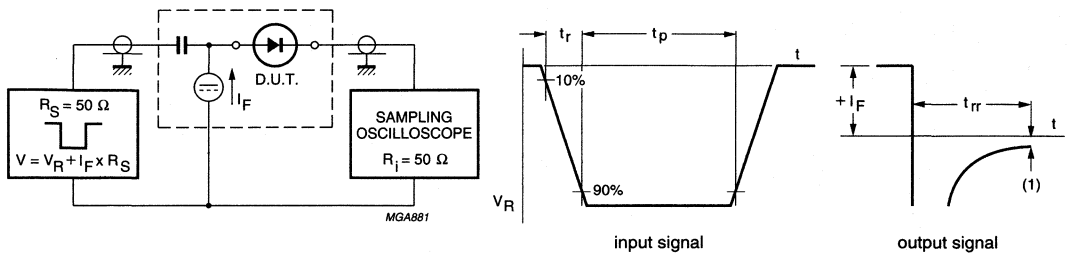
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

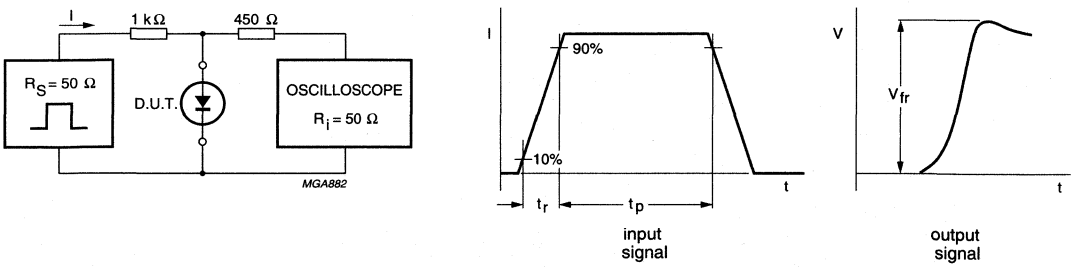


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS226

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

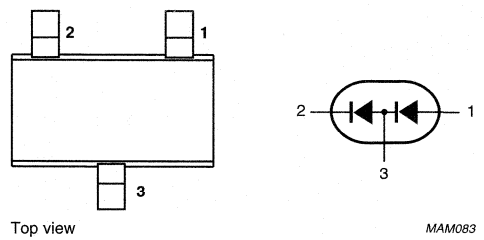
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS226 consists of two high-speed switching diodes connected in series, fabricated in planar technology, and encapsulated in the small plastic SMD SC59 package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: C3T.

Fig.1 Simplified outline (SC59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	215	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	μA
		V_R = 25 V; T_j = 150 °C	–	30	μA
		V_R = 80 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

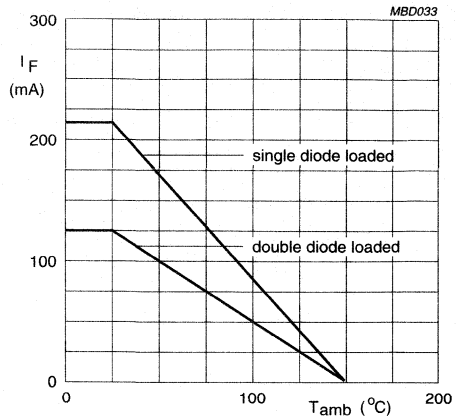
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		250	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

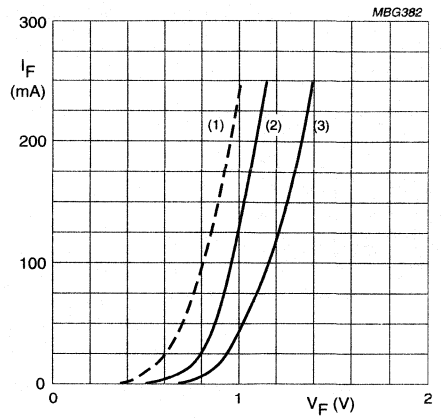
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



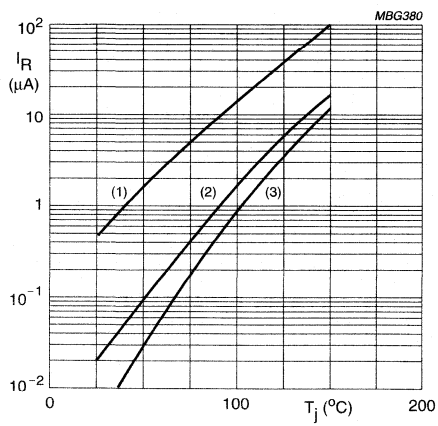
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



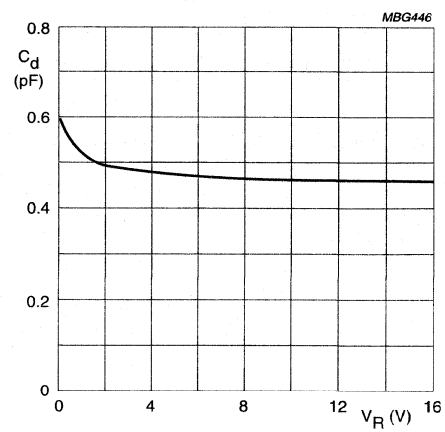
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



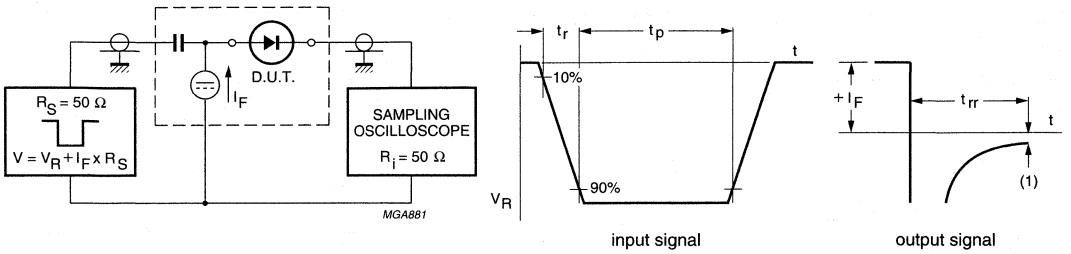
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

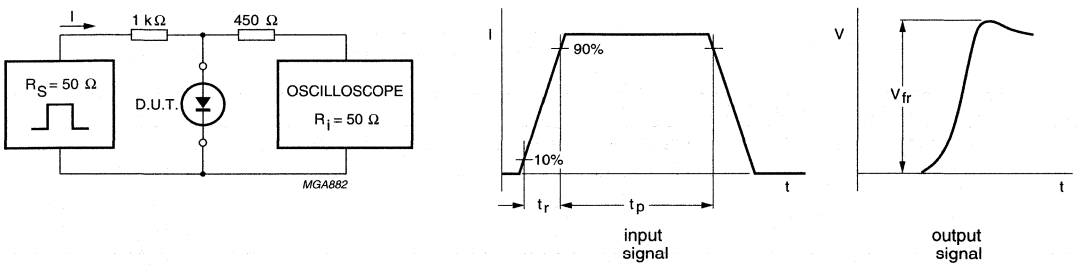


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS300

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

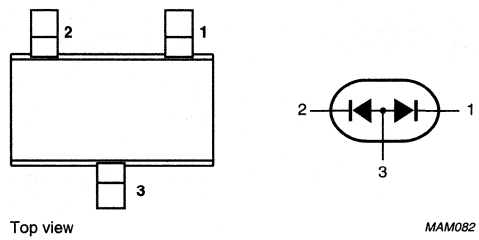
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS300 consists of two high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the very small rectangular SOT323 (SC-70) plastic SMD package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode



Marking code: A3.

Fig.1 Simplified outline SOT323 (SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	200	mA
		double diode loaded; see Fig.2; note 1	–	170	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

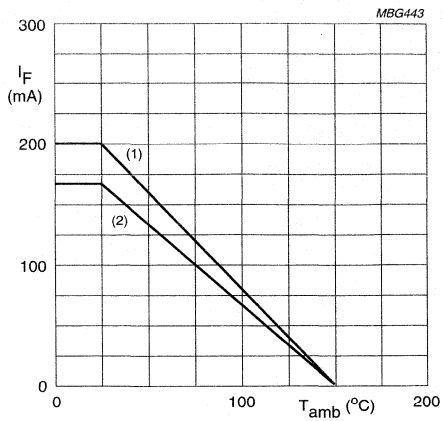
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		200	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	415	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA

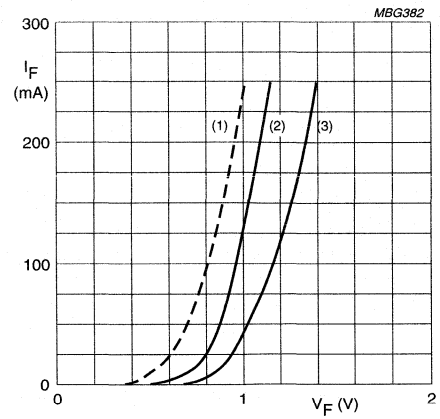


Device mounted on an FR4 printed-circuit board.

(1) Single diode loaded.

(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.

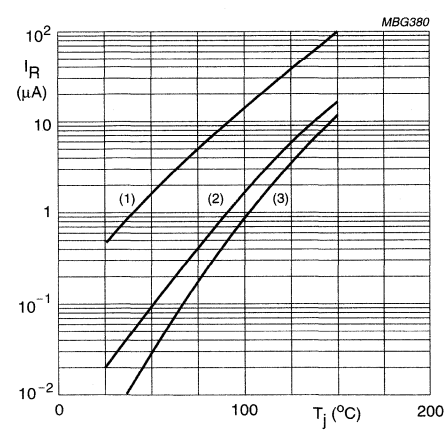


(1) T_j = 150 °C; typical values.

(2) T_j = 25 °C; typical values.

(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.

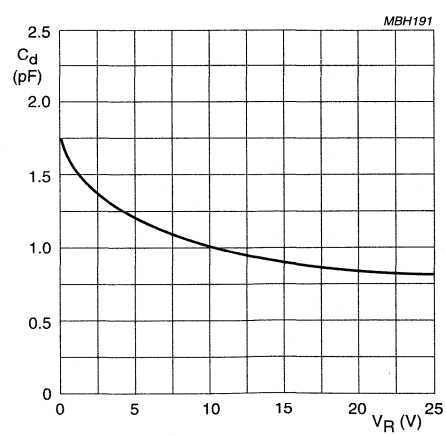


(1) V_R = 80 V; maximum values.

(2) V_R = 80 V; typical values.

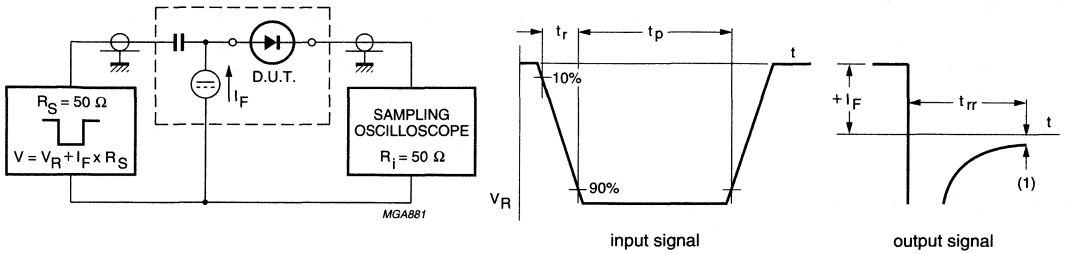
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

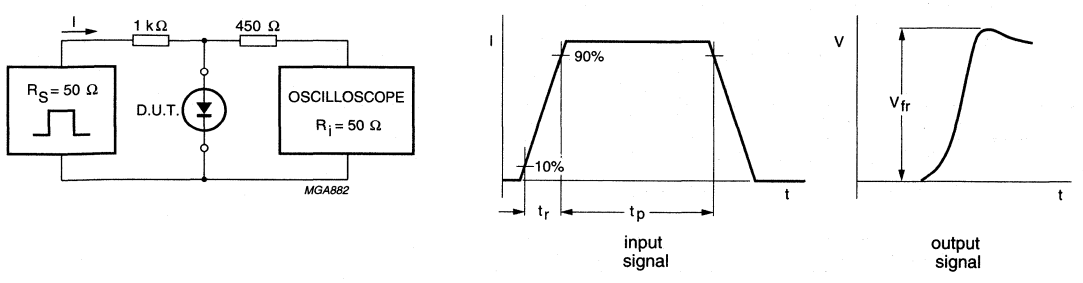


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS301

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

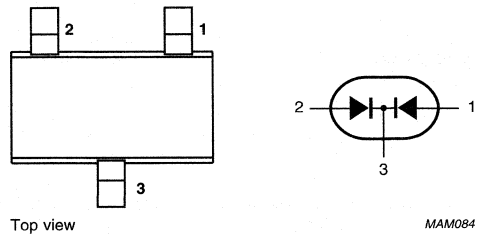
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS301 consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the very small rectangular plastic SMD SC70-3 package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode



Marking code: B3.

Fig.1 Simplified outline (SOT323; SC70-3) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	250	mA
		double diode loaded; note 1; see Fig.2	–	160	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 80 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

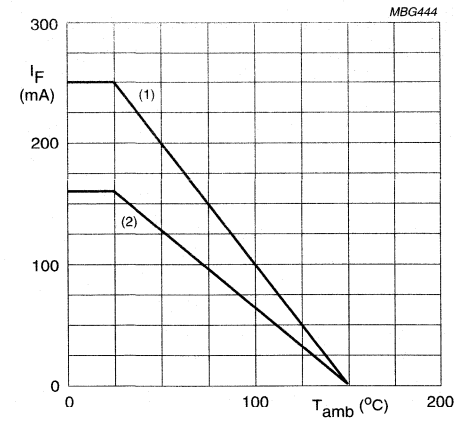
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		200	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	415	K/W

Note

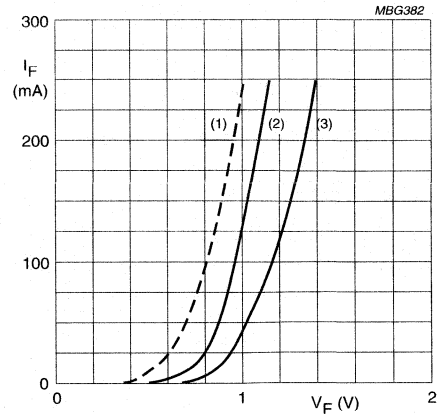
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



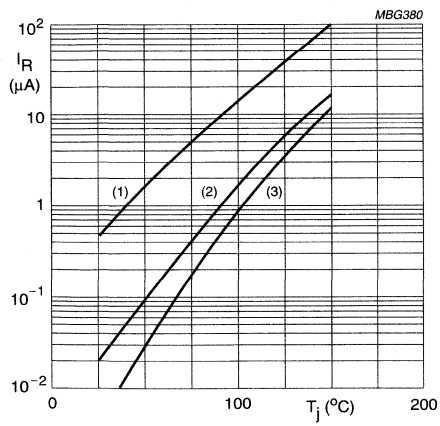
Device mounted on an FR4 printed-circuit board.
(1) Single diode loaded.
(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



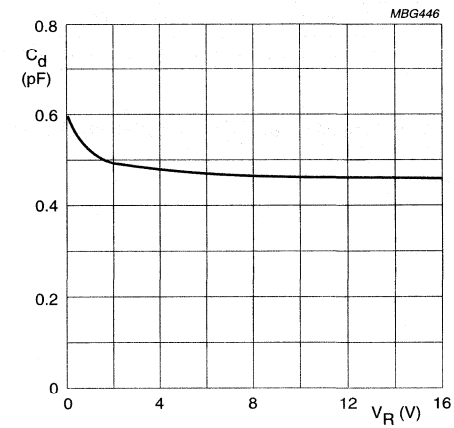
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



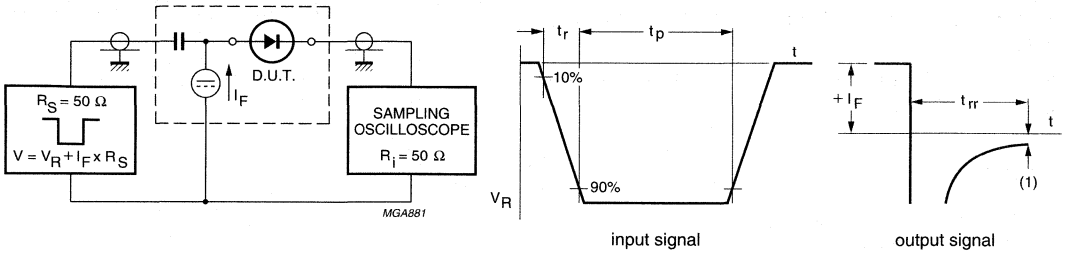
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

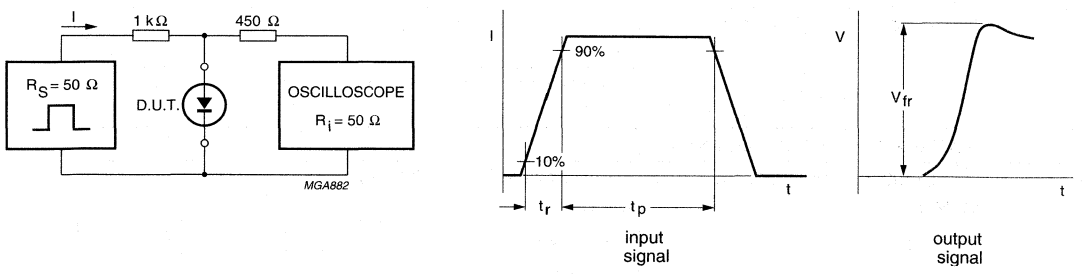


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode 1PS302

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 80 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

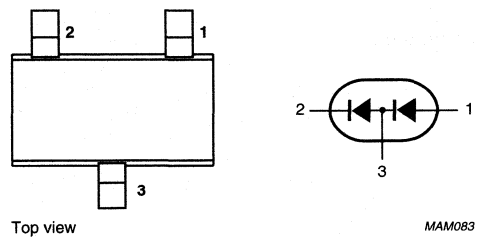
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The 1PS302 consists of two high-speed switching diodes connected in series, fabricated in planar technology, and encapsulated in the very small rectangular plastic SMD SC70-3 package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: C3.

Fig.1 Simplified outline (SOT323; SC70-3) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	80	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	200	mA
		double diode loaded; note 1; see Fig.2	–	170	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge			
		t = 1 μs	–	4	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	610	–	mV
		I_F = 10 mA	740	–	mV
		I_F = 50 mA	–	1.0	V
		I_F = 100 mA	–	1.2	V
I_R	reverse current	see Fig.4			
		V_R = 25 V	–	30	nA
		V_R = 80 V	–	0.5	μA
		V_R = 25 V; T_j = 150 °C	–	30	μA
		V_R = 80 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	–	1.75	V

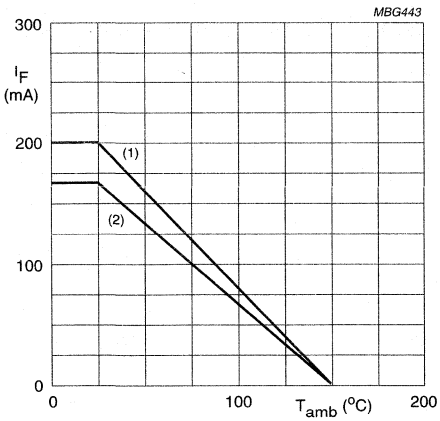
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		200	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	415	K/W

Note

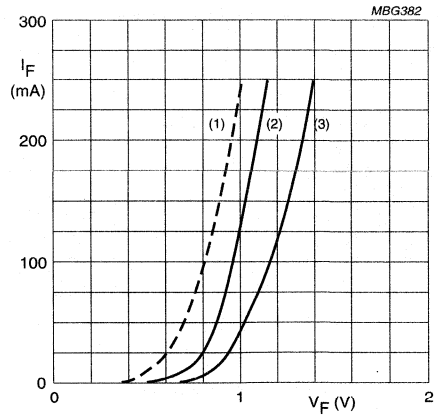
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



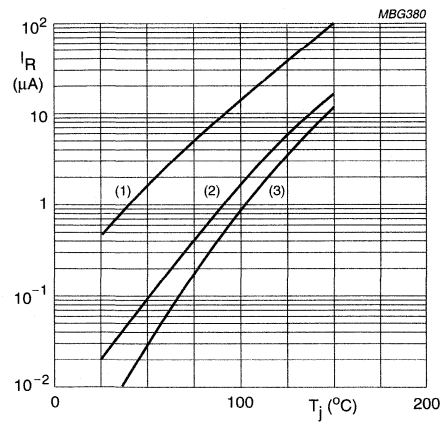
Device mounted on an FR4 printed-circuit board.
(1) Single diode loaded.
(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



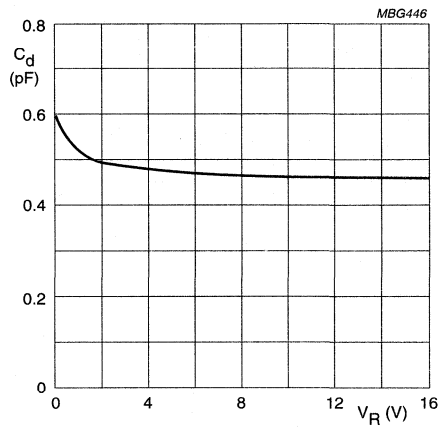
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



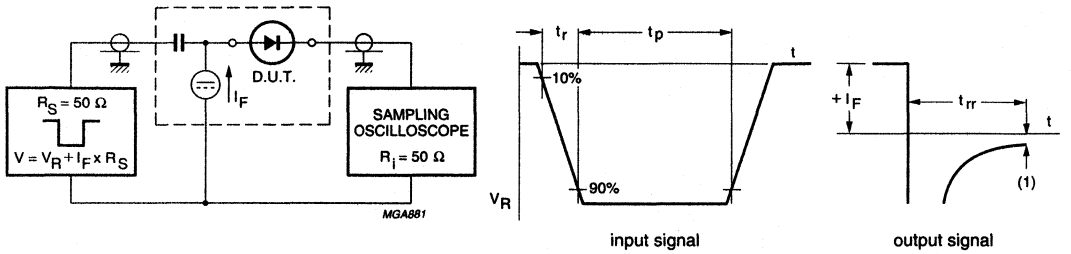
(1) V_R = 80 V; maximum values.
(2) V_R = 80 V; typical values.
(3) V_R = 25 V; typical values.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.6 Reverse recovery voltage test circuit and waveforms.

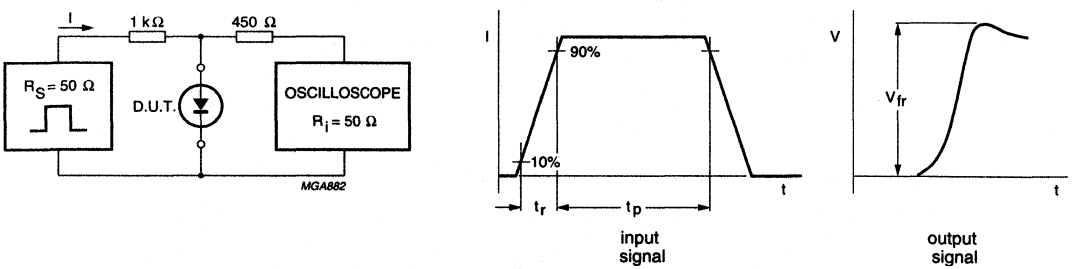


Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed diode BAL74

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 50 V
- Repetitive peak reverse voltage: max. 50 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

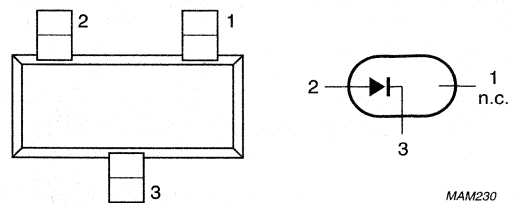
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAL74 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode



Marking code: JCp = made in Hong Kong; JCt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	50	V
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 50 V	0.1	µA
		V_R = 50 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

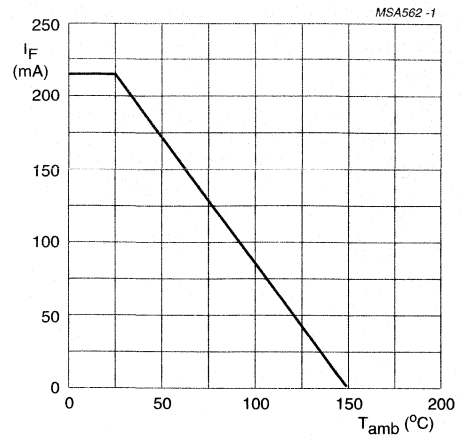
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

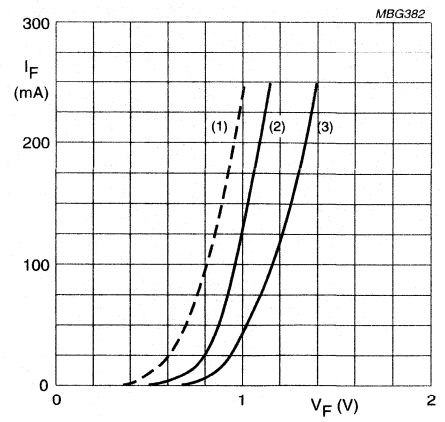
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



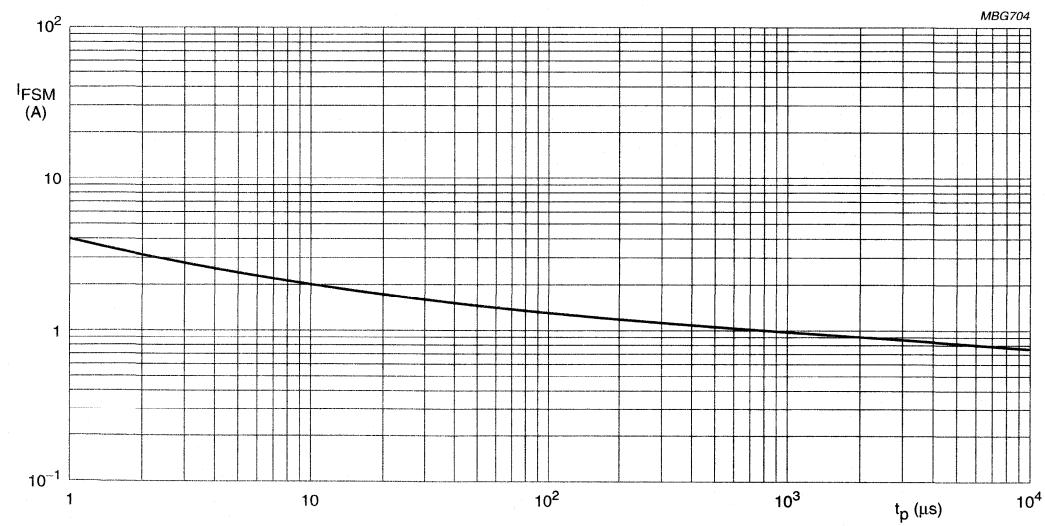
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



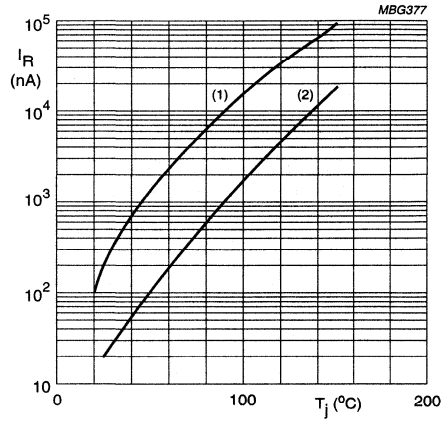
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



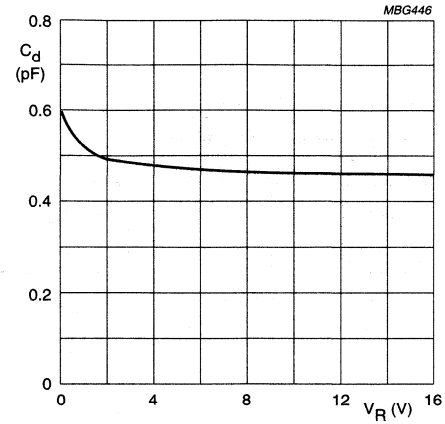
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



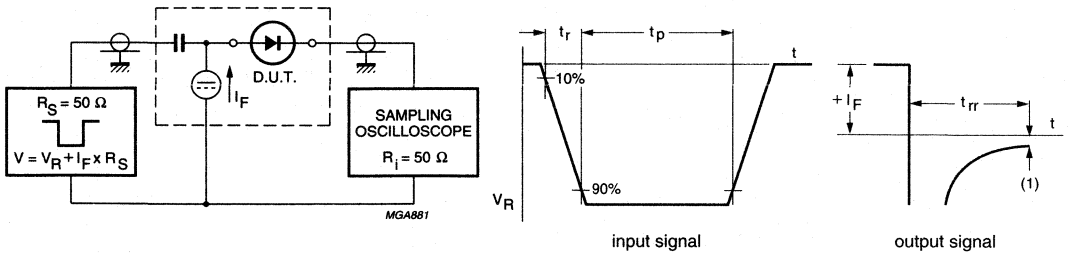
(1) V_R = 50 V; maximum values.
(2) V_R = 50 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

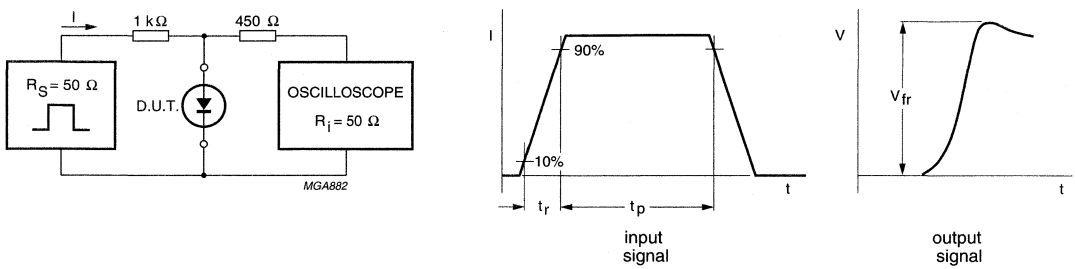


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAL74W

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

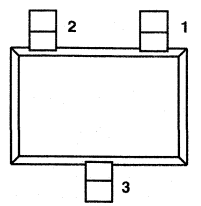
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

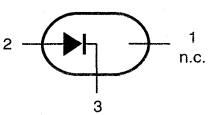
The BAL74W is a high-speed switching diode fabricated in planar technology, and encapsulated in the very small plastic SMD SOT323 package.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode



Top view



MAM081

Marking code: JC.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	175	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

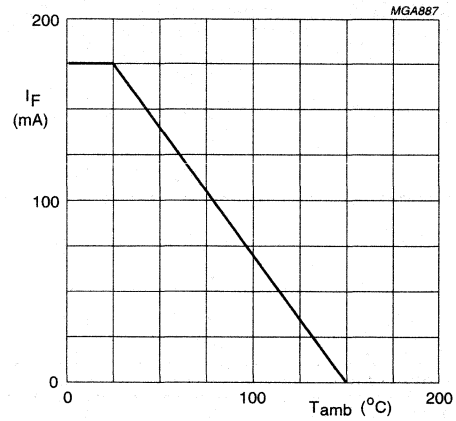
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

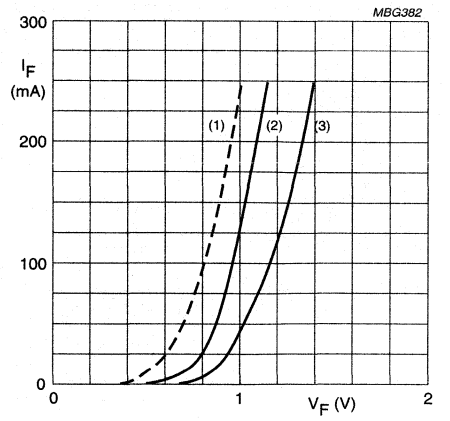
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



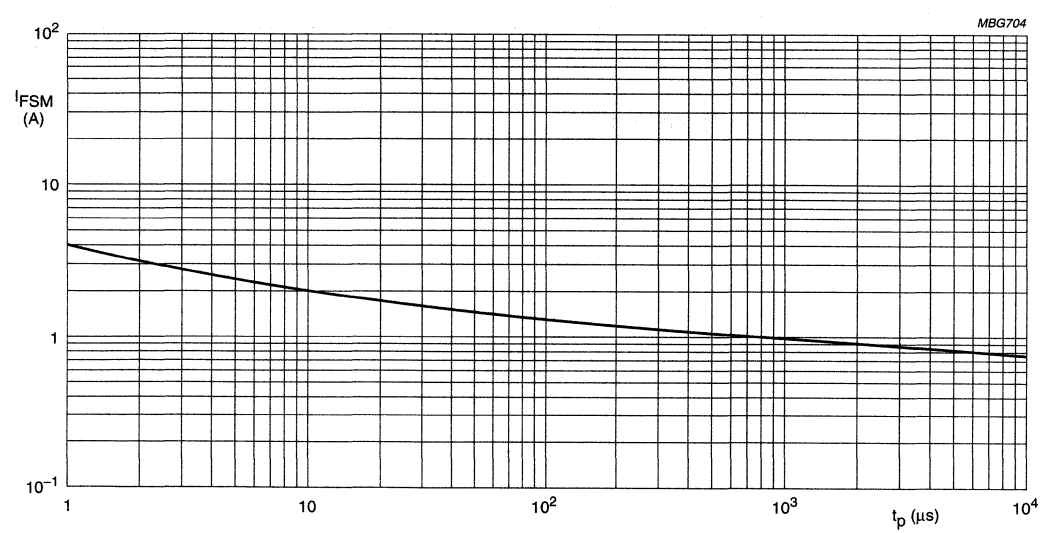
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

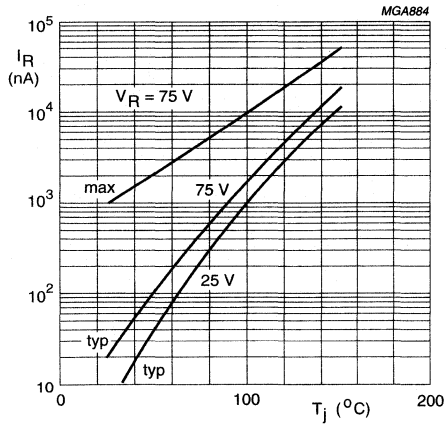
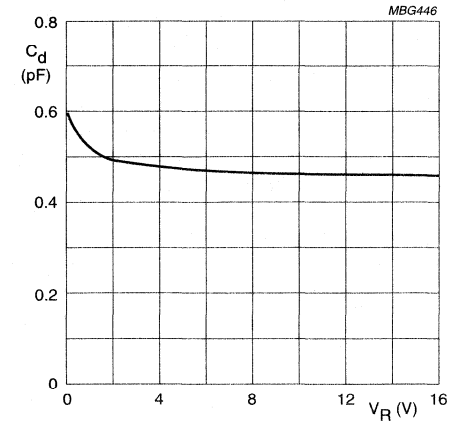
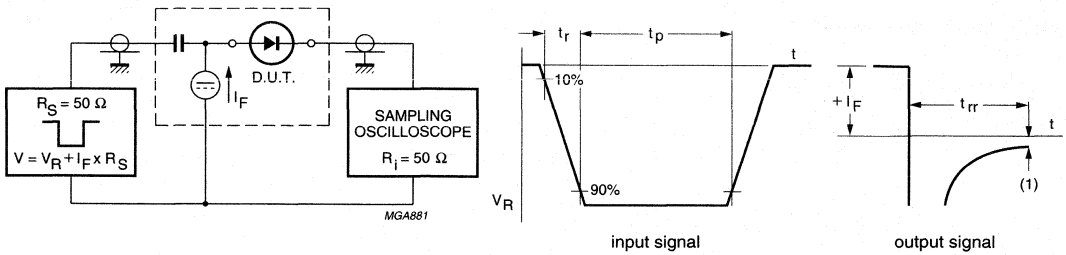


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

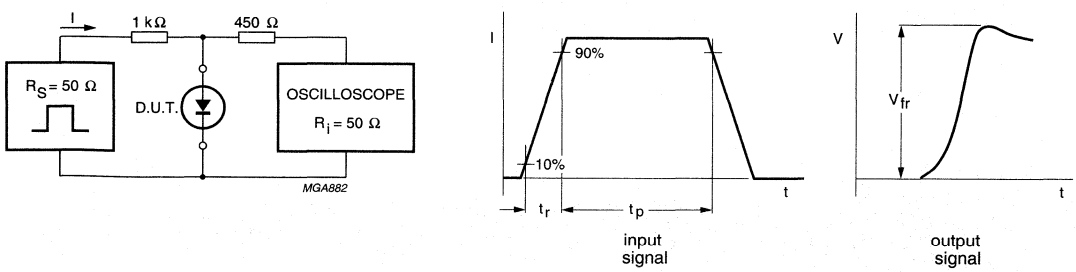


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAL99

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 70 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

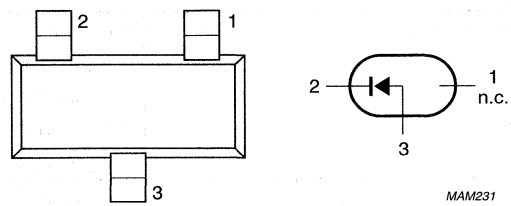
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAL99 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	not connected
2	cathode
3	anode



Marking code: JFp = made in Hong Kong; JFt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	70	V
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 70 V	1	μA
		V_R = 25 V; T_j = 150 °C	30	μA
		V_R = 70 V; T_j = 150 °C;	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

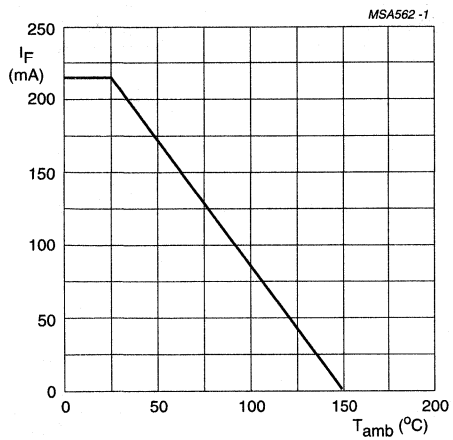
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

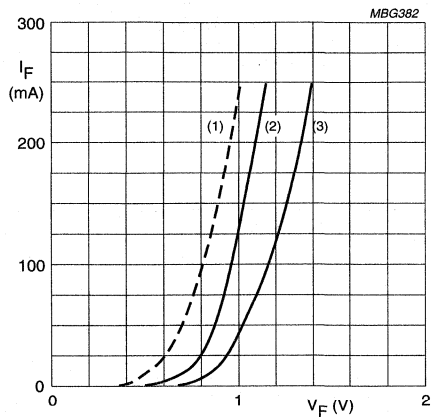
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



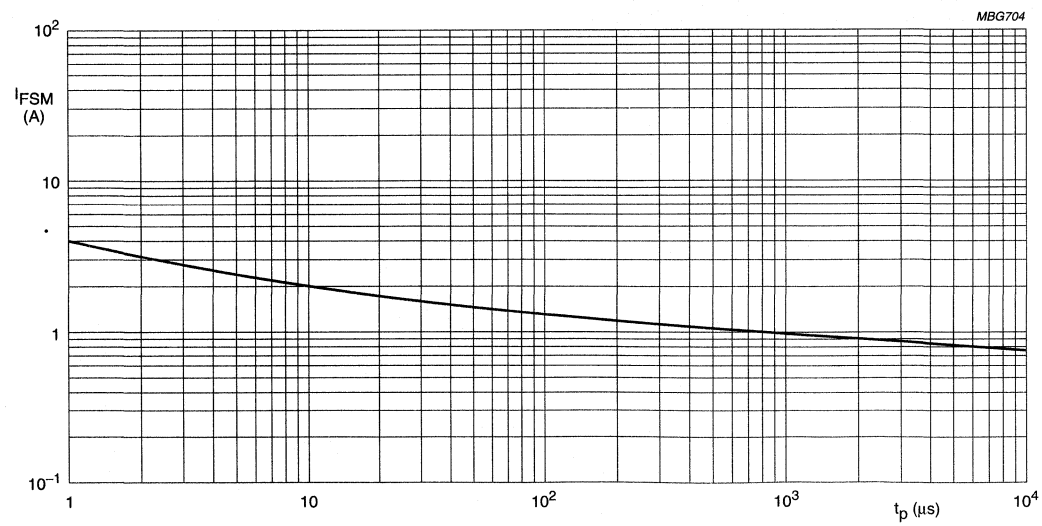
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



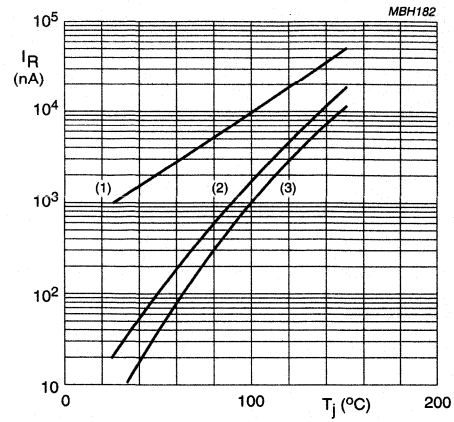
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



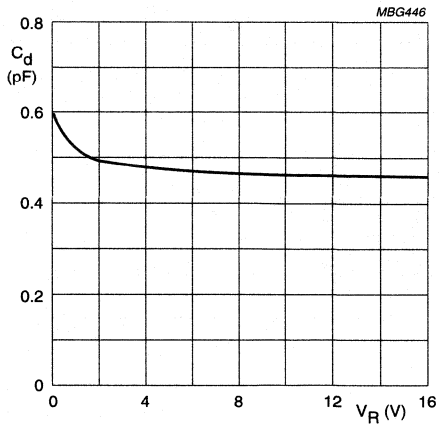
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



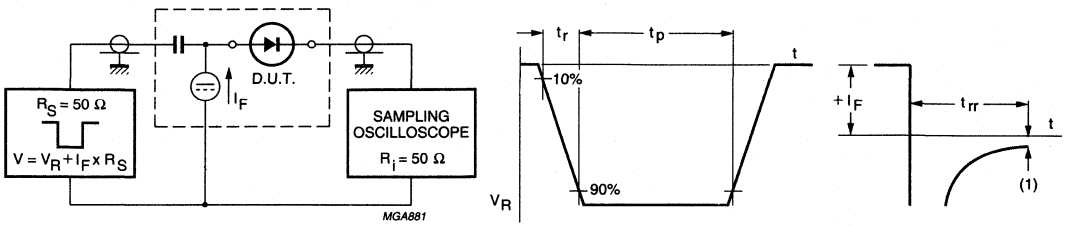
(1) V_R = 70 V; maximum values.
(2) V_R = 70 V; typical values.
(3) V_R = 25 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

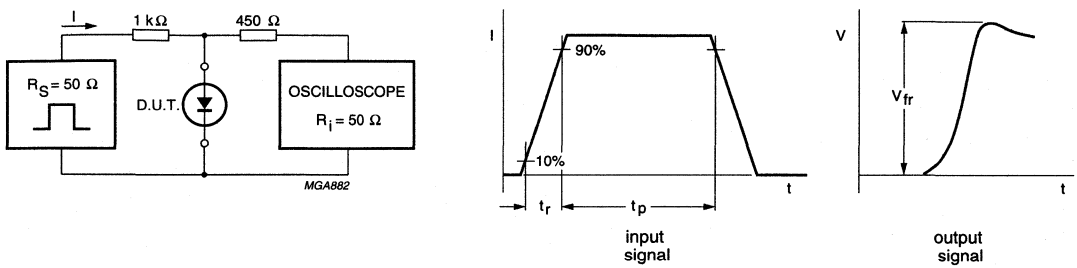


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAL99W

FEATURES

- Very small plastic SMD envelope
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

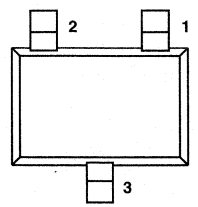
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

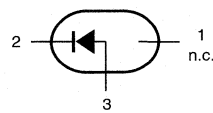
The BAL99W is a high-speed switching diode fabricated in planar technology, and encapsulated in the very small plastic SMD SOT323 package.

PINNING

PIN	DESCRIPTION
1	not connected
2	cathode
3	anode



Top view



MAM080

Marking code: JF.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	150	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

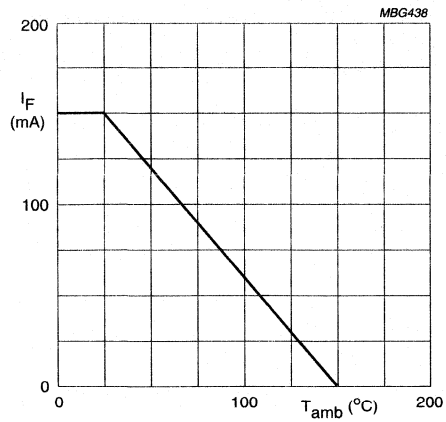
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

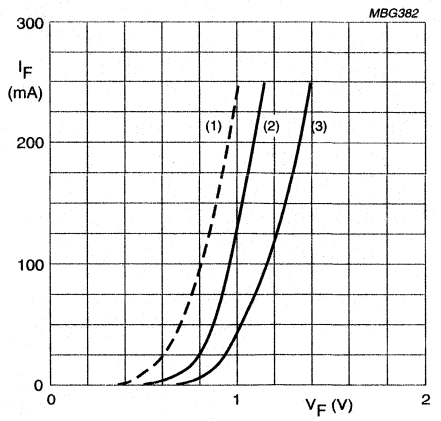
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



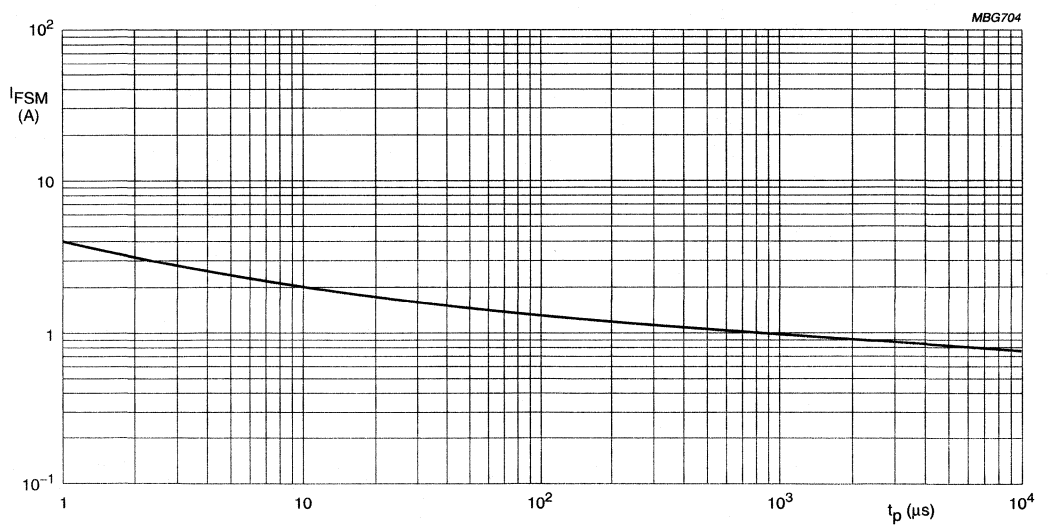
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

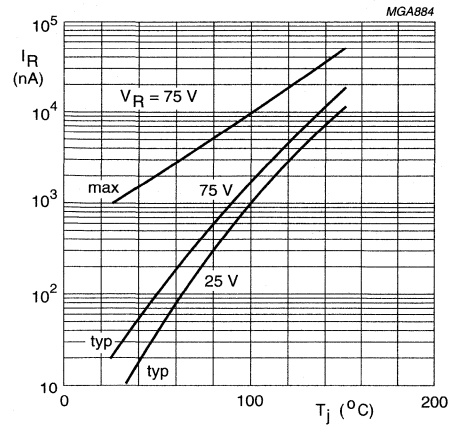
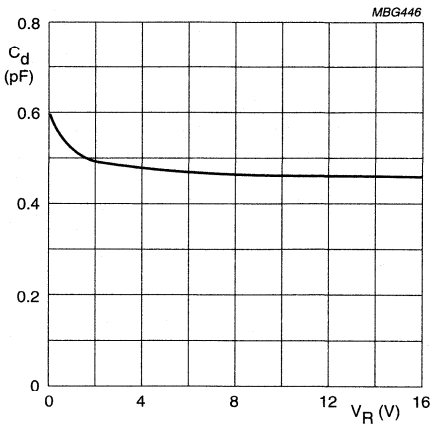
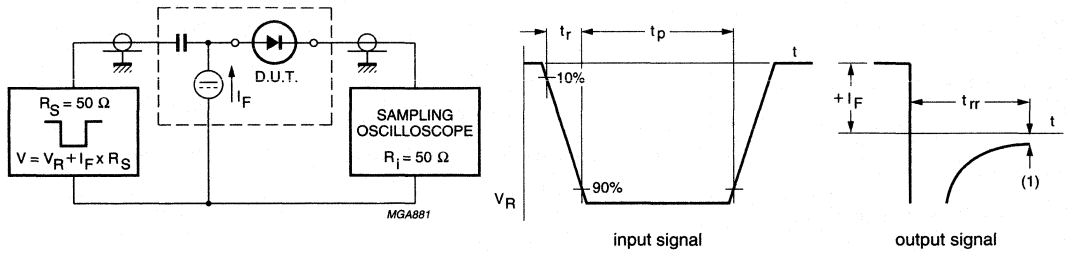


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

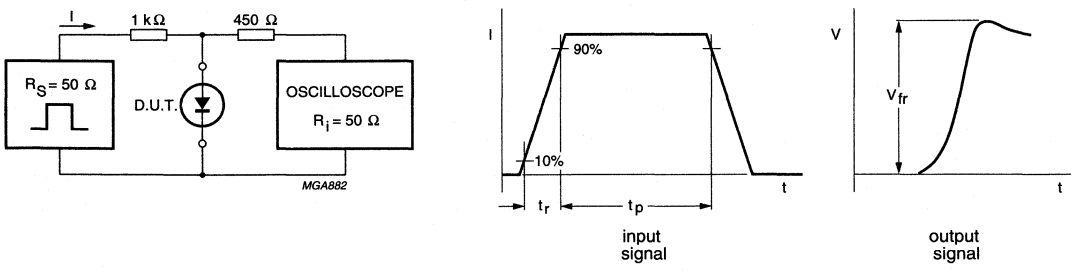


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAS16

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

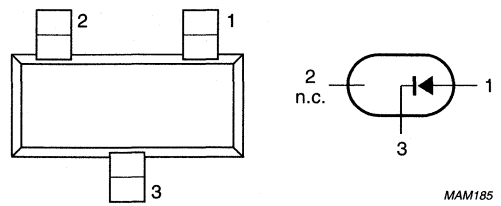
- High-speed switching in hybrid thick and thin-film circuits.

DESCRIPTION

The BAS16 is a high-speed switching diode fabricated in planar technology, and encapsulated in a small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: A6p = made in Hong Kong; A6t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	μA
		V_R = 25 V; T_j = 150 °C	30	μA
		V_R = 75 V; T_j = 150 °C	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

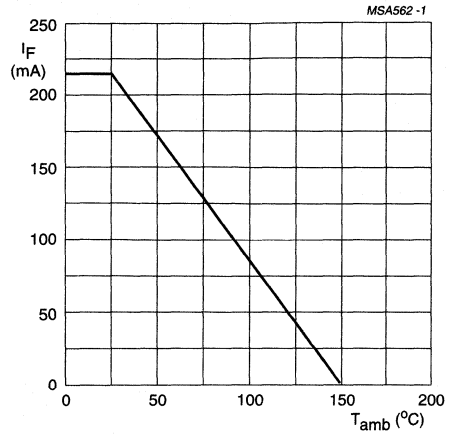
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

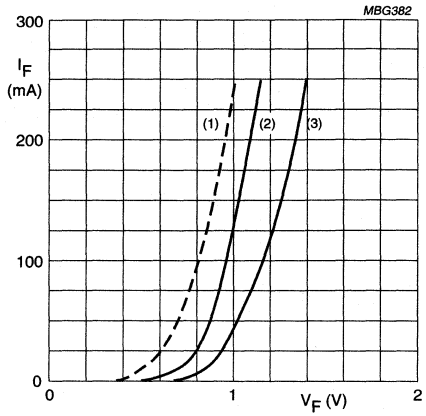
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



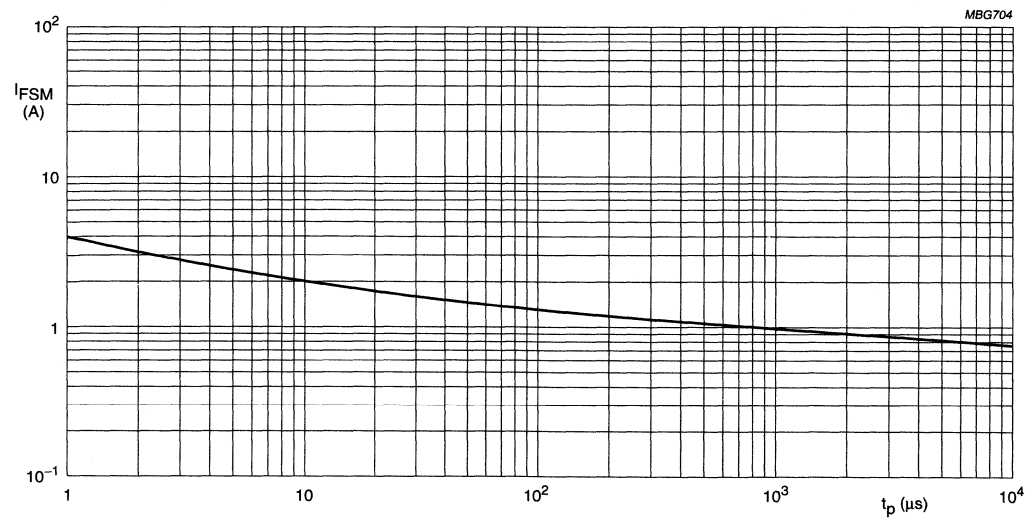
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

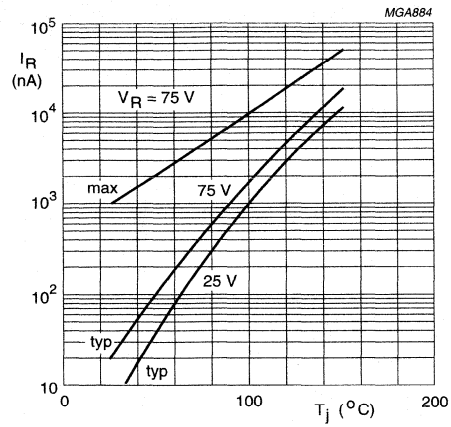
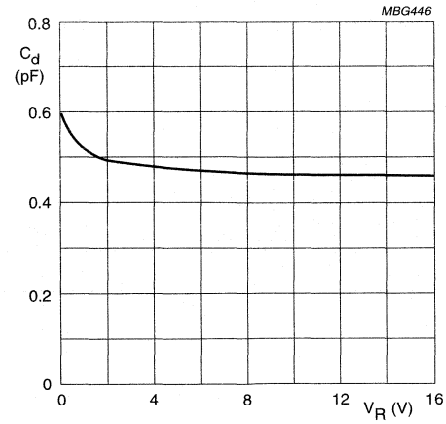
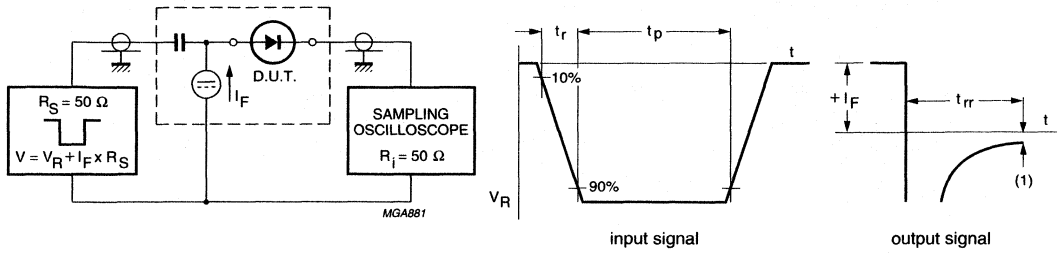


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

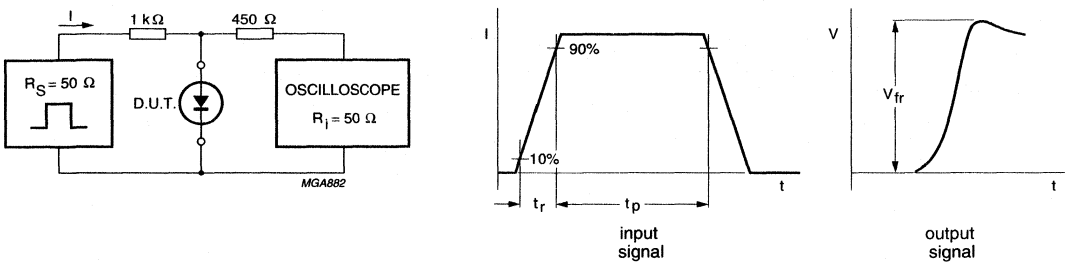


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAS16T

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

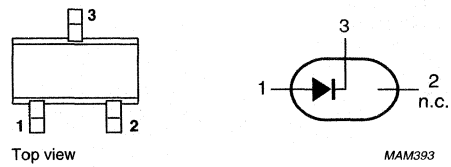
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS16T is a high-speed switching diode fabricated in planar technology, and encapsulated in the very small plastic SMD SOT416 (SC-75) package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: A6.

Fig.1 Simplified outline (SOT416; SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	T_s = 90 °C; see Fig.2	–	155	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square pulse; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 90 °C	–	170	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	μA
		V_R = 25 V; T_j = 150 °C	30	μA
		V_R = 75 V; T_j = 150 °C	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	T_S = 90 °C	350	K/W

GRAPHICAL DATA

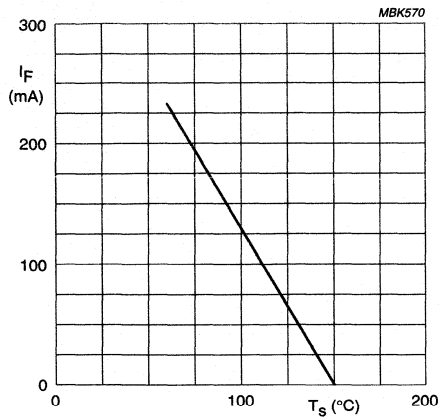
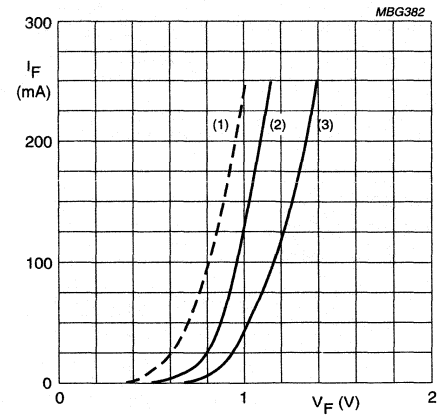
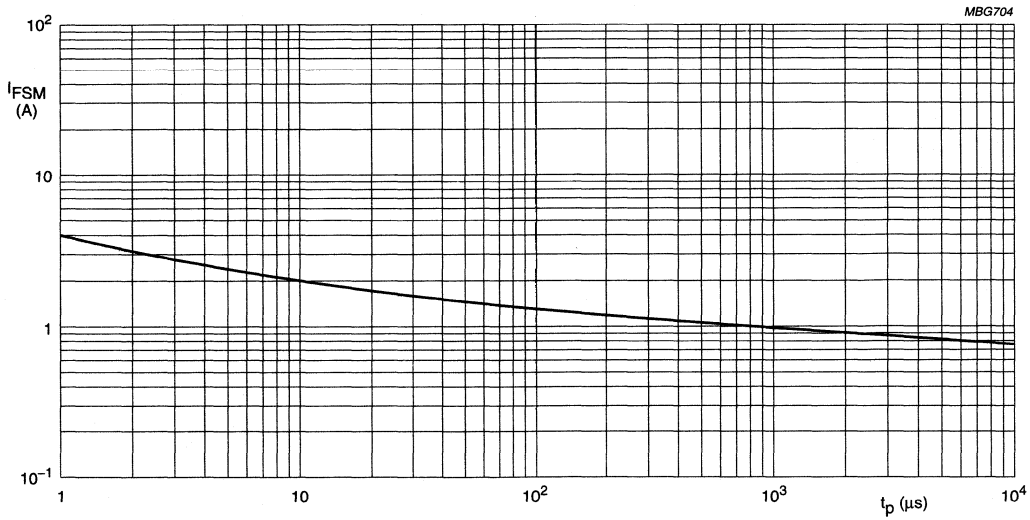


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

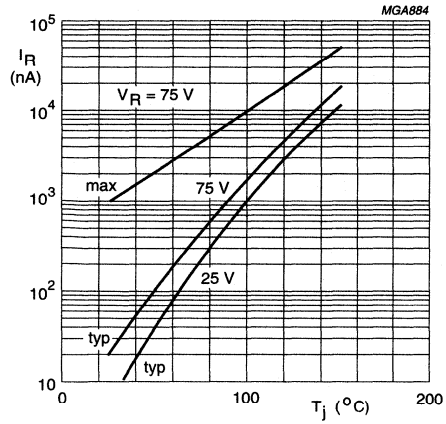
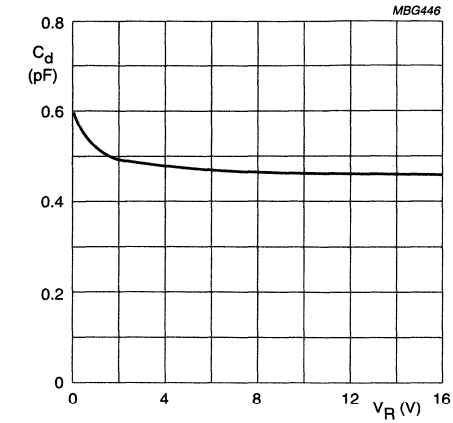
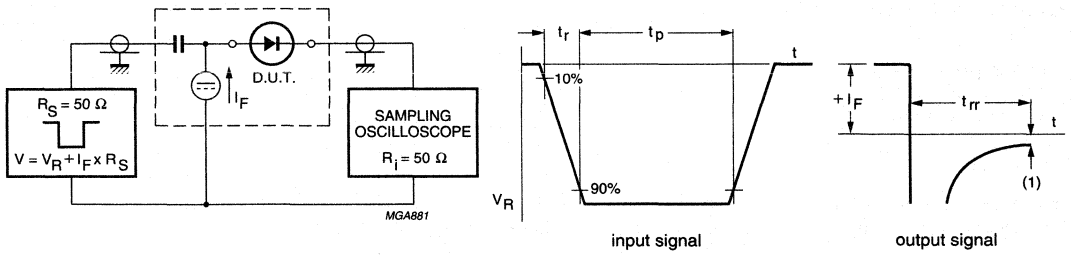


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

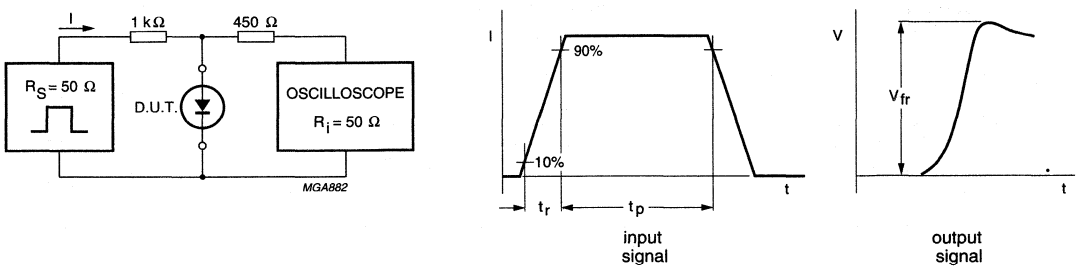
Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$; Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAS16W

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

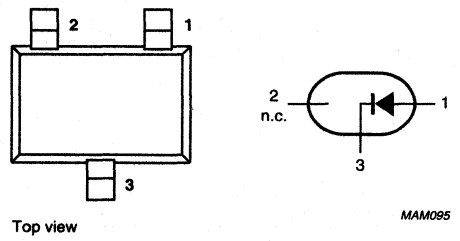
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS16W is a high-speed switching diode fabricated in planar technology, and encapsulated in the very small plastic SMD SOT323 package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: A6.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	175	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	mA
		V_R = 25 V; T_j = 150 °C	30	mA
		V_R = 75 V; T_j = 150 °C;	50	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

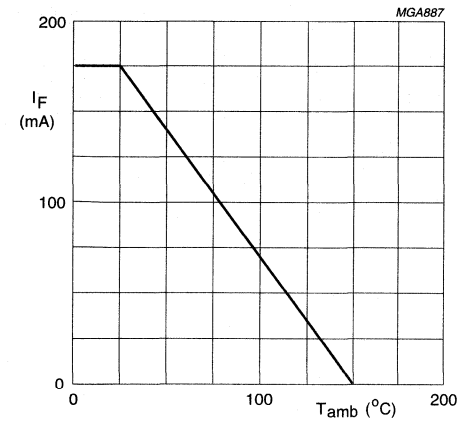
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

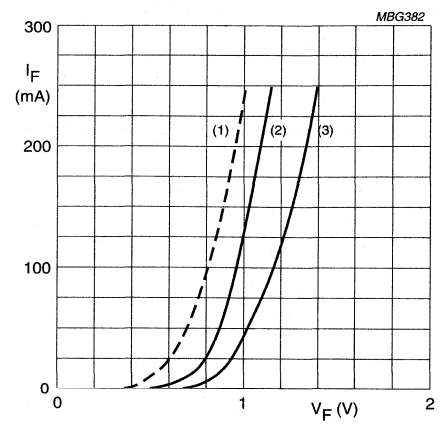
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



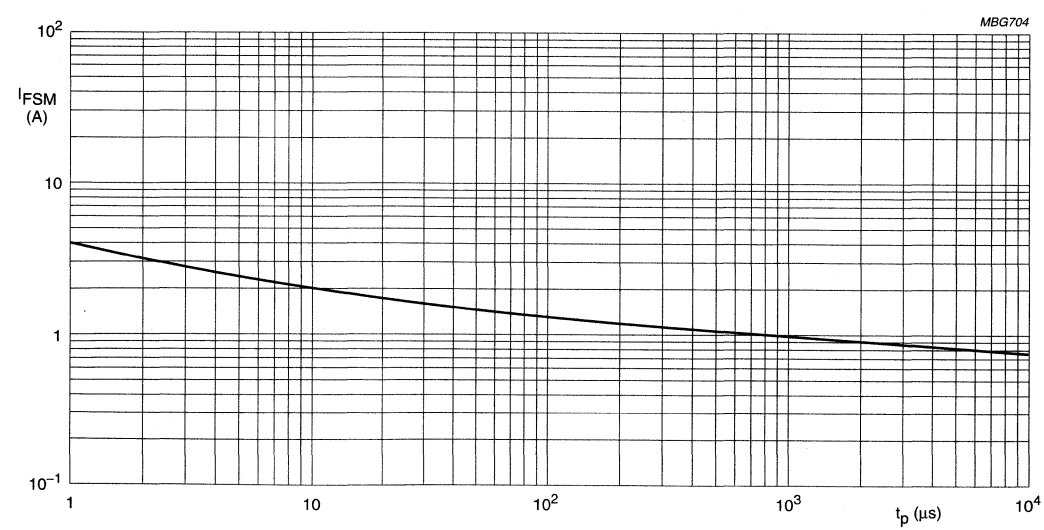
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

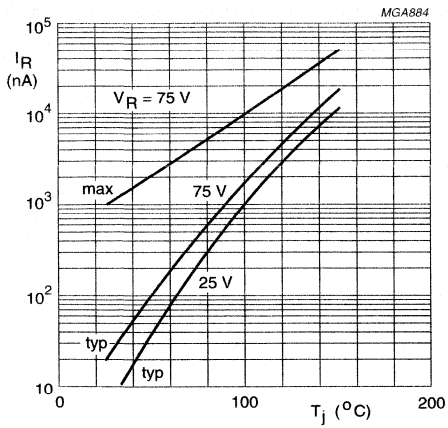
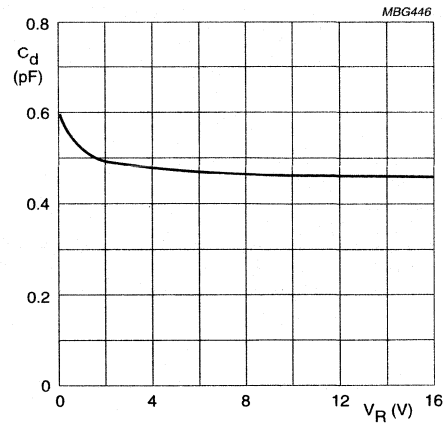
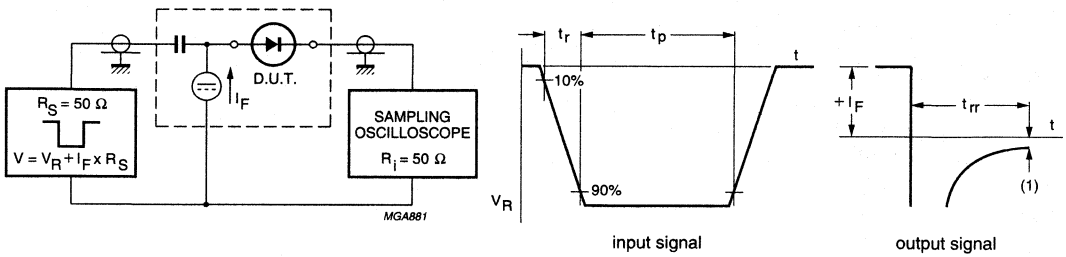


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

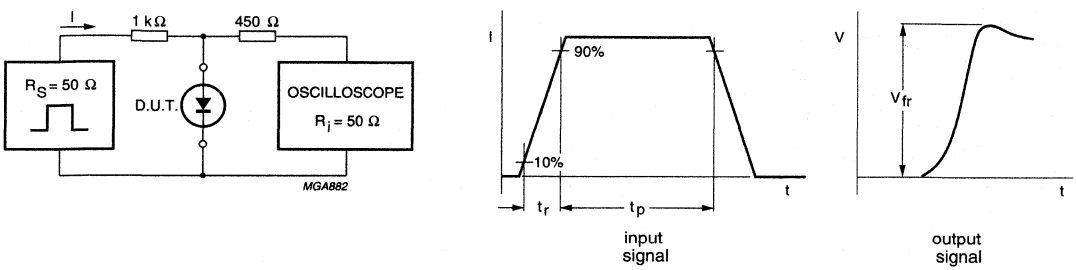


Fig.8 Forward recovery voltage test circuit and waveforms.

Low-voltage stabistor BAS17

FEATURES

- Low-voltage stabilization
- Forward voltage range: 580 to 960 mV
- Total power dissipation: max. 250 mW.

APPLICATIONS

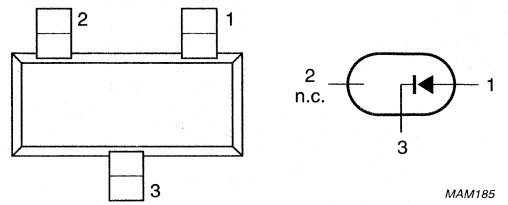
- Low-voltage stabilization e.g.
  - Bias stabilizer in class-B output stages
  - Clipping
  - Clamping
  - Meter protection.

DESCRIPTION

Low-voltage stabilization diode in a small SOT23 plastic package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: A91.

Fig.1 Simplified outline (SOT23), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	5	V
I_F	continuous forward current		–	200	mA
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.2				
		I_F = 0.1 mA	580	–	660	mV
		I_F = 1 mA	665	–	745	mV
		I_F = 5 mA	725	–	805	mV
		I_F = 10 mA	750	–	830	mV
		I_F = 100 mA	870	–	960	mV
I_R	reverse current	V_R = 4 V	–	–	5	μA
r_{dif}	differential resistance	I_F = 0.5 mA	–	120	–	Ω
		I_F = 2 mA	–	80	–	Ω
S_F	temperature coefficient	I_F = 1 mA	–	−1.8	–	mV/K
C_d	diode capacitance	V_R = 0 V; f = 1 MHz	–	–	140	pF

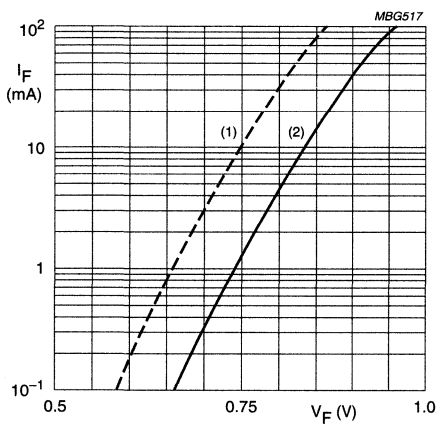
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA



T_j = 25 °C.
(1) Minimum values.
(2) Maximum values.

Fig.2 Forward current as a function of forward voltage.

General purpose diodes BAS19; BAS20; BAS21

FEATURES

- Small plastic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 100 V; 150 V; 200 V
- Repetitive peak reverse voltage: max. 120 V; 200 V; 250 V
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS19, BAS20, BAS21 are general purpose diodes fabricated in planar technology, and encapsulated in small SOT23 plastic SMD packages.

MARKING

TYPE NUMBER	MARKING CODE (1)
BAS19	JP*
BAS20	JR*
BAS21	JS*

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

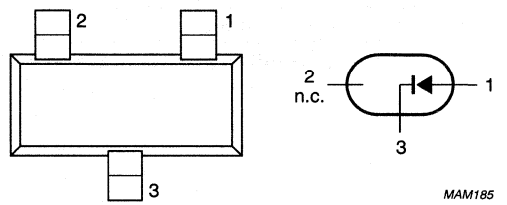


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage				
	BAS19		–	120	V
	BAS20		–	200	V
	BAS21		–	250	V
V_R	continuous reverse voltage				
	BAS19		–	100	V
	BAS20		–	150	V
	BAS21		–	200	V
I_F	continuous forward current	see Fig.2; note 1	–	200	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 10 ms	–	1.7	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 100 mA	1	V
		I_F = 200 mA	1.25	V
I_R	reverse current	see Fig.5		
	BAS19	V_R = 100 V	100	nA
		V_R = 100 V; T_j = 150 °C	100	μA
	BAS20	V_R = 150 V	100	nA
		V_R = 150 V; T_j = 150 °C	100	μA
	BAS21	V_R = 200 V	100	nA
		V_R = 200 V; T_j = 150 °C	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.8	50	ns

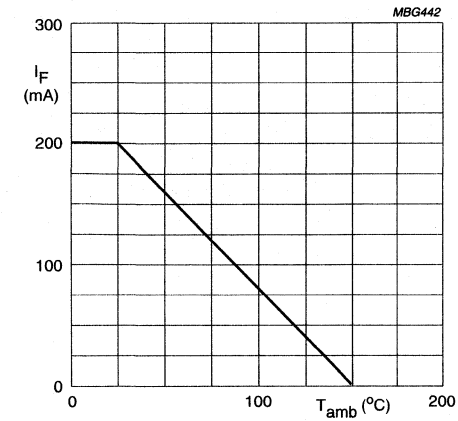
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

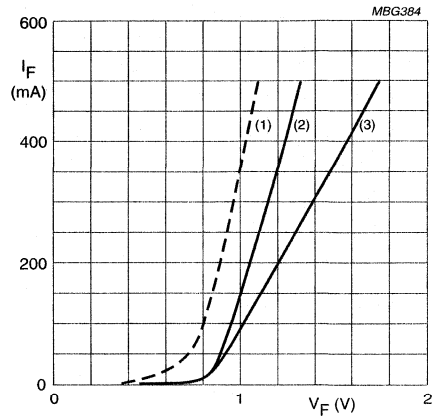
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



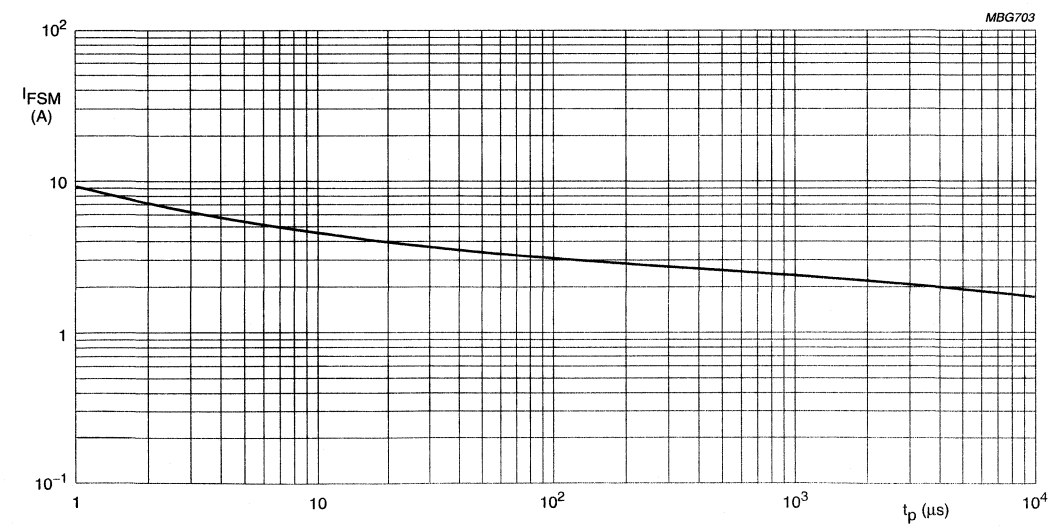
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



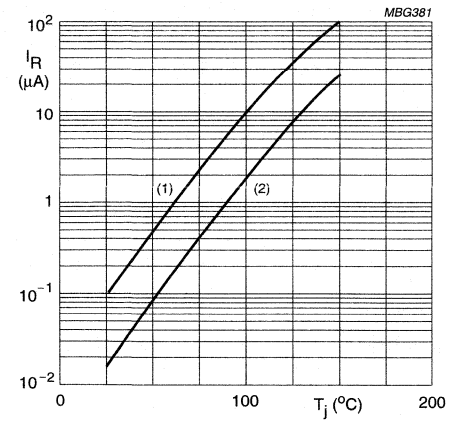
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



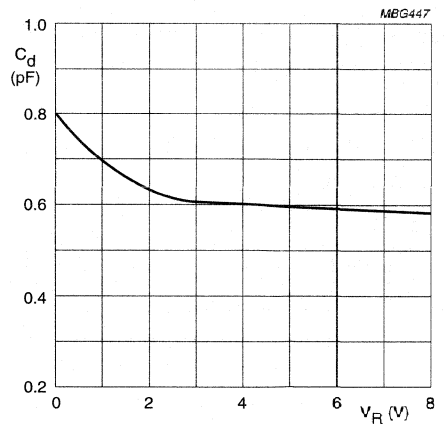
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



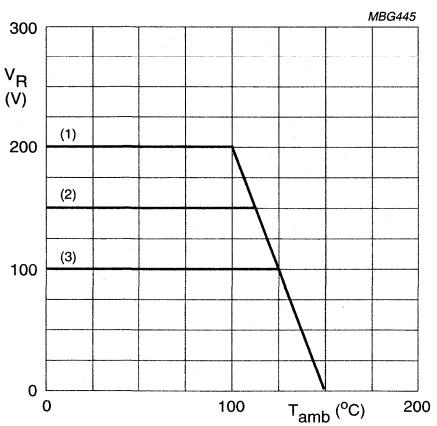
(1) $V_R = V_{Rmax}$; maximum values.
(2) $V_R = V_{Rmax}$; typical values.

Fig.5 Reverse current as a function of junction temperature.



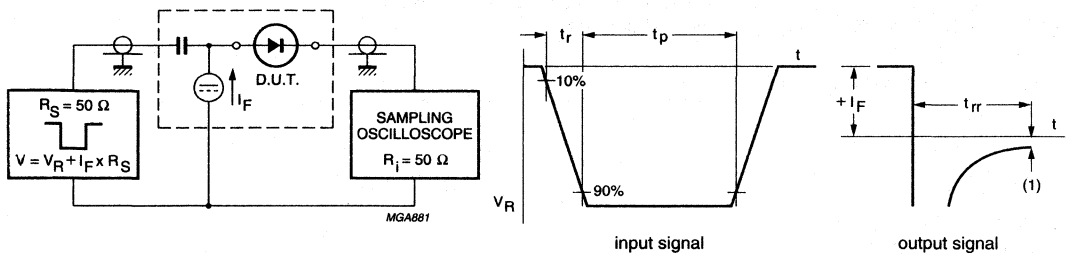
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) BAS21.
(2) BAS20.
(3) BAS19.

Fig.7 Maximum permissible continuous reverse voltage as a function of the ambient temperature.



(1) $I_R = 3$ mA.

Fig.8 Reverse recovery voltage test circuit and waveforms.

High-speed double diode BAS28

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA .

APPLICATIONS

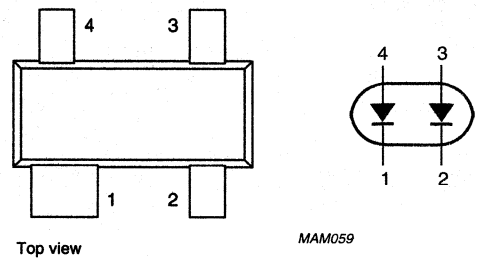
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS28 consists of two high-speed switching diodes, fabricated in planar technology, and encapsulated in the small plastic SMD SOT143 package. The diodes are not connected.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	anode (a2)
4	anode (a1)



Marking code: JTp.

Fig.1 Simplified outline (SOT143) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	715	mV
		I_F = 10 mA	–	855	mV
		I_F = 50 mA	–	1	V
		I_F = 150 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		V_R = 25 V	–	30	nA
		V_R = 75 V	–	1	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 75 V; T_j = 150 °C	–	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	–	1.75	V

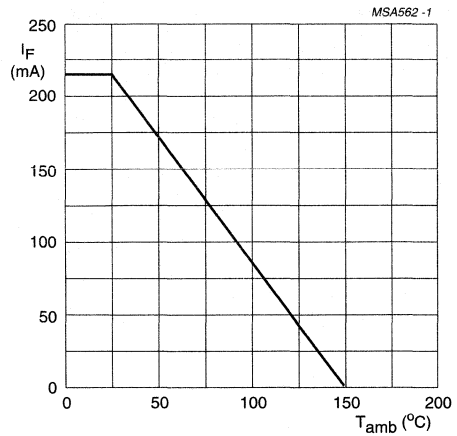
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

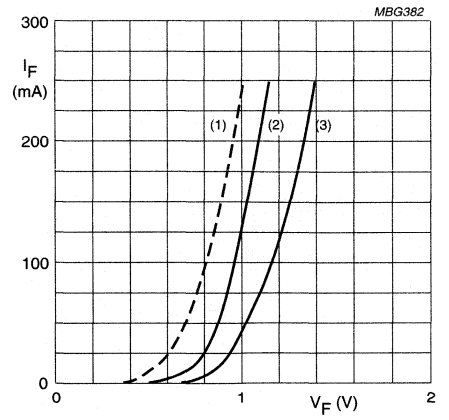
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



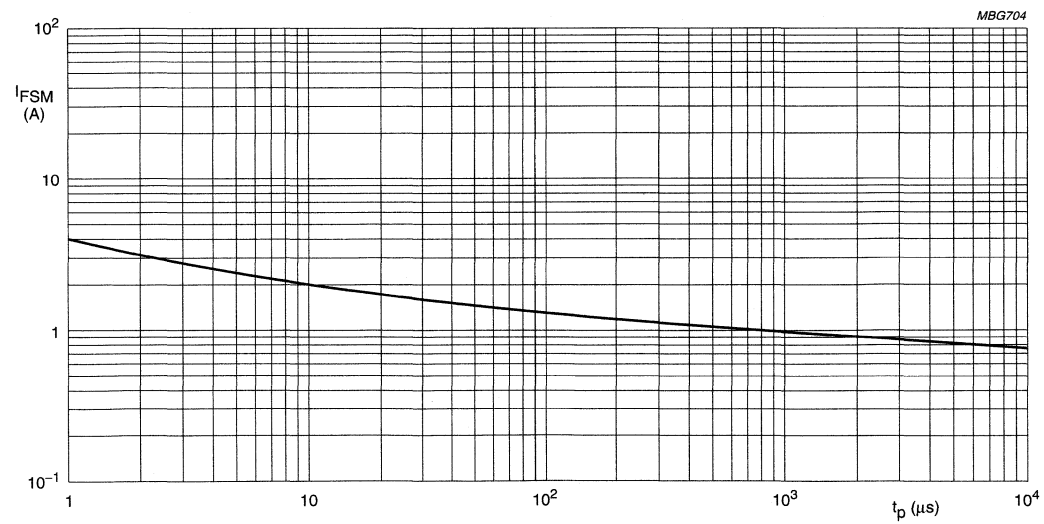
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

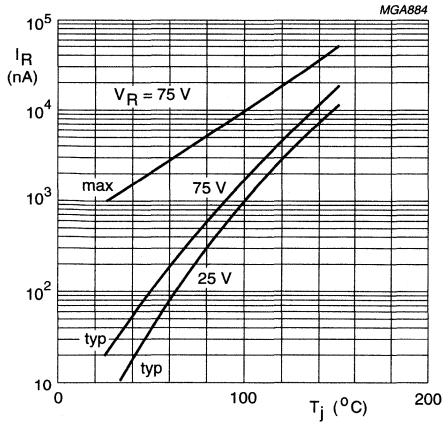
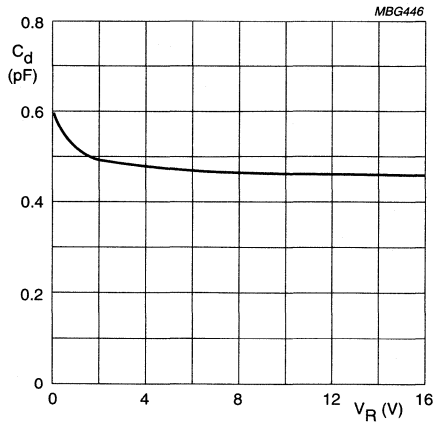
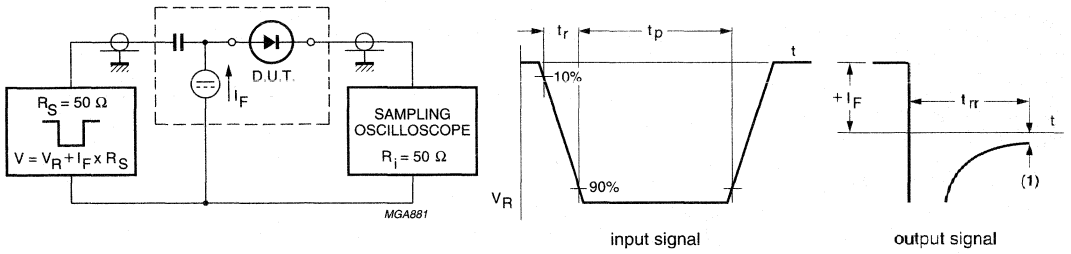


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

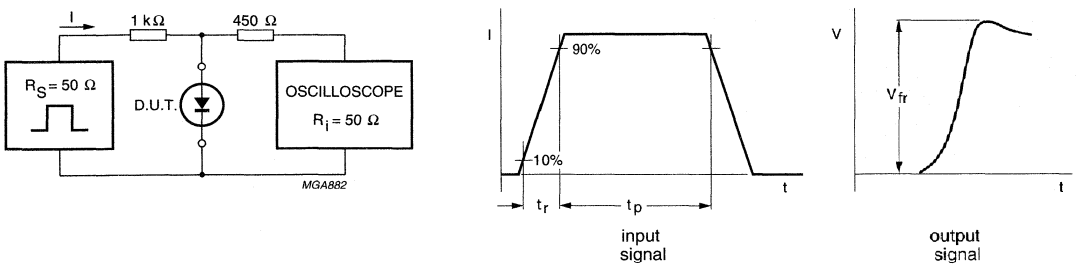


Fig.8 Forward recovery voltage test circuit and waveforms.

General purpose controlled avalanche (double) diodes

BAS29; BAS31; BAS35

FEATURES

- Small plastic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 90 V
- Repetitive peak reverse voltage: max. 110 V
- Repetitive peak forward current: max. 600 mA
- Repetitive peak reverse current: max. 600 mA.

APPLICATIONS

- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

General purpose switching diodes fabricated in planar technology, and encapsulated in small rectangular plastic SMD SOT23 packages.
The BAS29 consists of a single diode.
The BAS31 has two diodes in series.
The BAS35 has two diodes with a common anode.

MARKING

TYPE NUMBER	MARKING CODE
BAS29	L20
BAS31	L21
BAS35	L22

PINNING

PIN	DESCRIPTION		
	BAS29	BAS31	BAS35
1	anode	anode	cathode (k1)
2	not connected	cathode	cathode (k2)
3	cathode	common connection	common anode

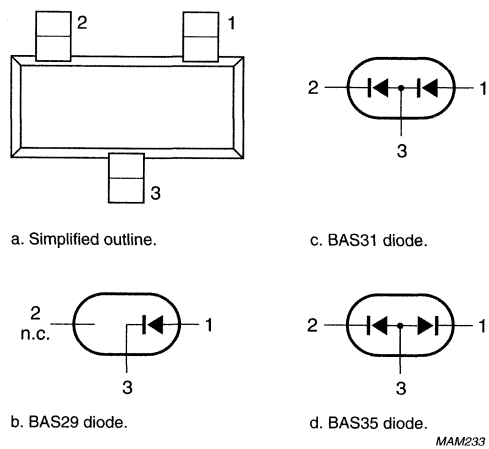


Fig.1 Simplified outline (SOT23) and symbols.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	110	V
V_R	continuous reverse voltage		–	90	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	250	mA
		double diode loaded; see Fig.2; note 1	–	150	mA
I_{FRM}	repetitive peak forward current		–	600	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	10	A
		t = 100 μs	–	4	A
		t = 1 s	–	0.75	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
I_{RRM}	repetitive peak reverse current		–	600	mA
E_{RRM}	repetitive peak reverse energy	$t_p \geq 50$ μs; $f \leq 20$ Hz; T_j = 25 °C	–	5	mJ
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 10 mA	–	750	mV
		I_F = 50 mA	–	840	mV
		I_F = 100 mA	–	900	mV
		I_F = 200 mA	–	1	V
		I_F = 400 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		V_R = 90 V	–	100	nA
		V_R = 90 V; T_j = 150 °C	–	100	µA
$V_{(BR)R}$	reverse avalanche breakdown voltage	I_R = 1 mA	120	170	V
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	35	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.7	–	50	ns

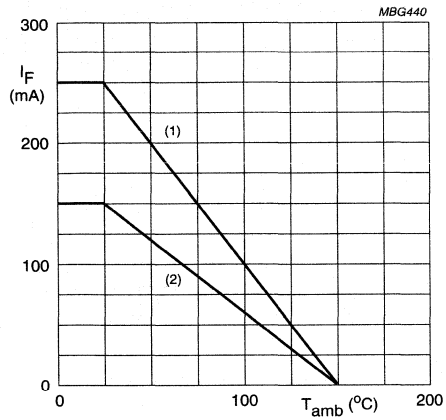
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

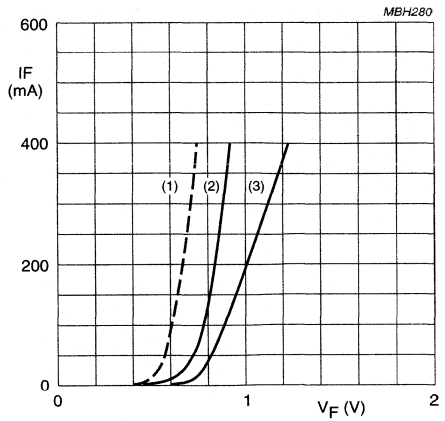
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



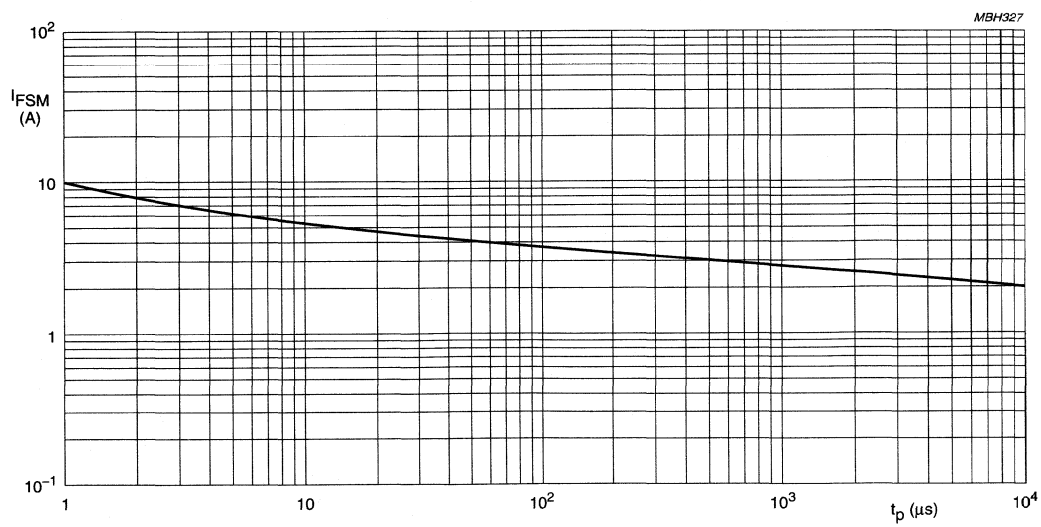
Device mounted on an FR4 printed-circuit board.
(1) Single diode loaded.
(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



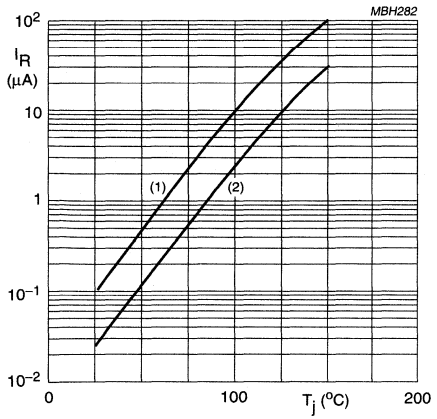
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



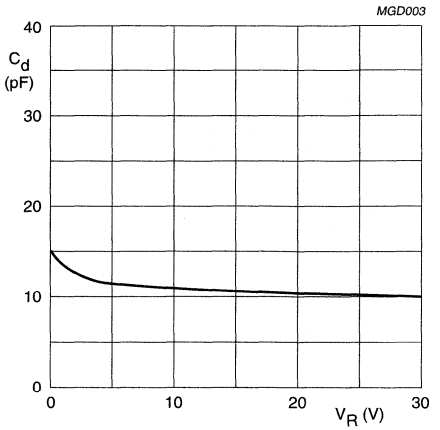
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



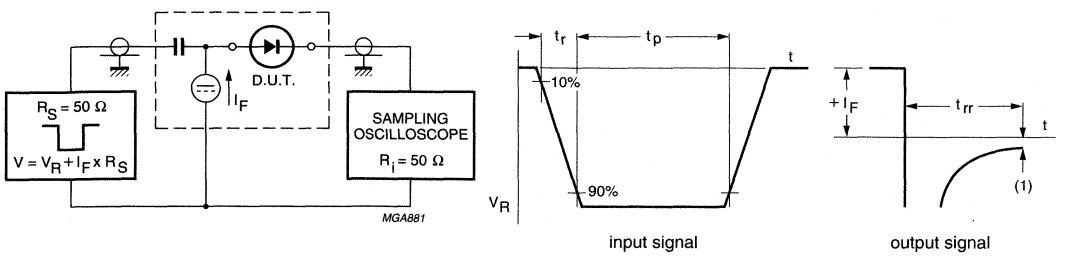
(1) V_R = 90 V; maximum values.
(2) V_R = 90 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 3 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

High-speed diode BAS32L

FEATURES

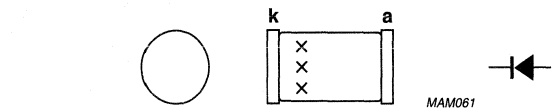
- Small hermetically sealed glass SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

- High-speed switching
- Fast logic applications.

DESCRIPTION

The BAS32L is a high-speed switching diode fabricated in planar technology, and encapsulated in the small hermetically sealed glass SOD80C SMD package.



Cathode indicated by black band.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	200	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 5 mA	620	750	mV
		I_F = 100 mA	–	1000	mV
		I_F = 100 mA; T_j = 100 °C	–	930	mV
I_R	reverse current	see Fig.5			
		V_R = 20 V	–	25	nA
		V_R = 75 V	–	5	µA
		V_R = 20 V; T_j = 150 °C	–	50	µA
		V_R = 75 V; T_j = 150 °C	–	100	µA
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 µA	100	–	V
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6		2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7		4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	–	2.5	V

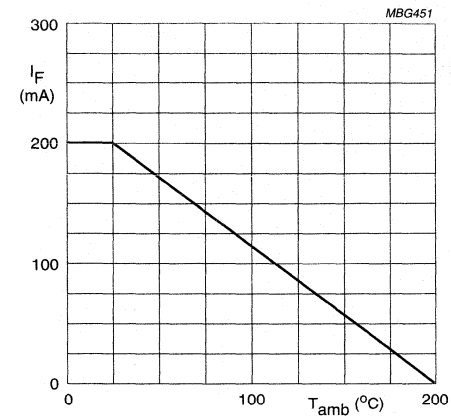
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	350	K/W

Note

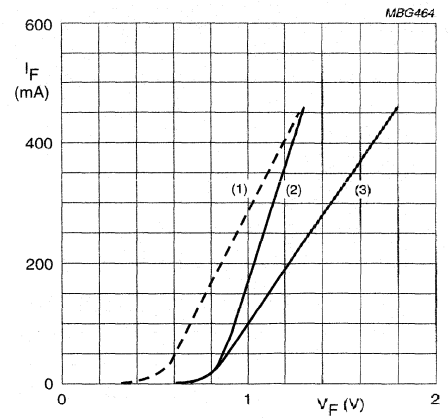
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



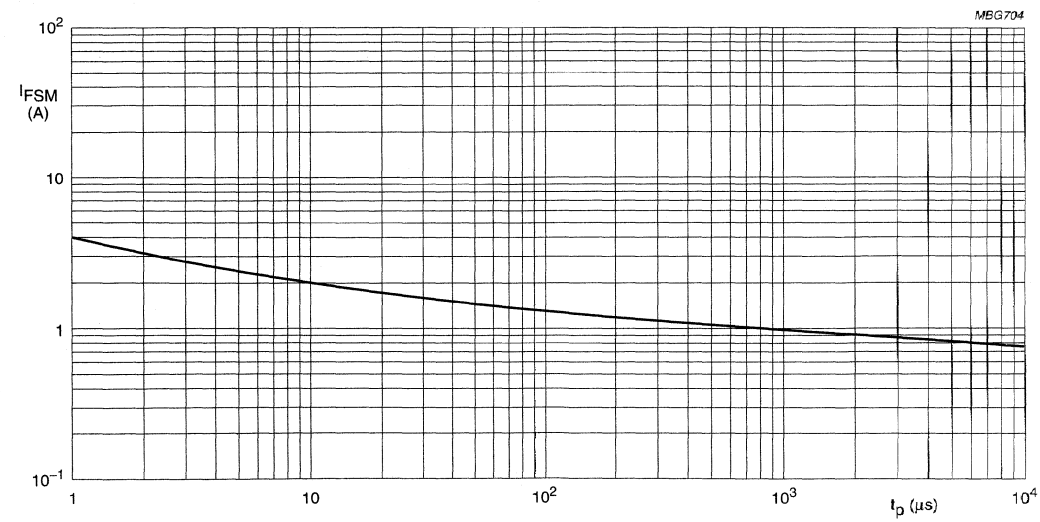
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



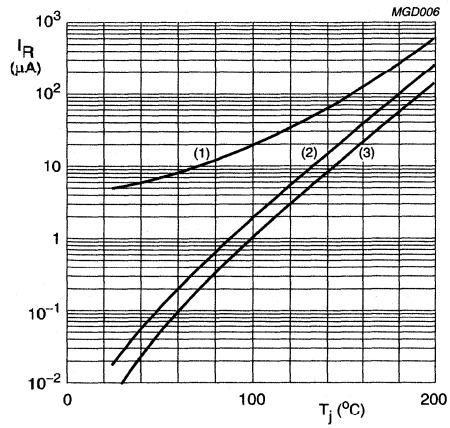
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



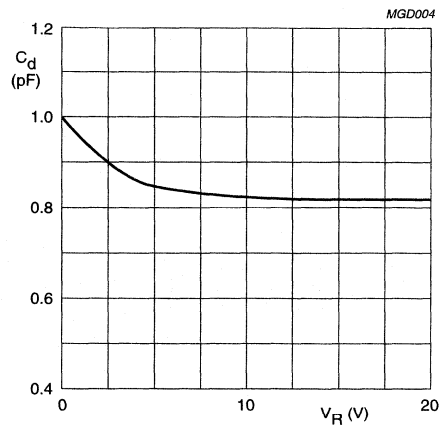
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



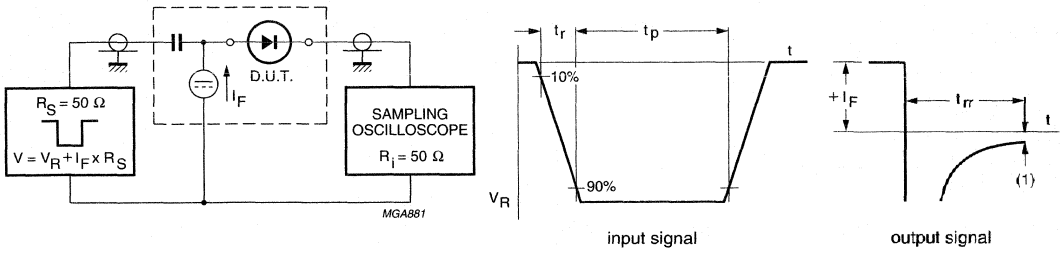
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

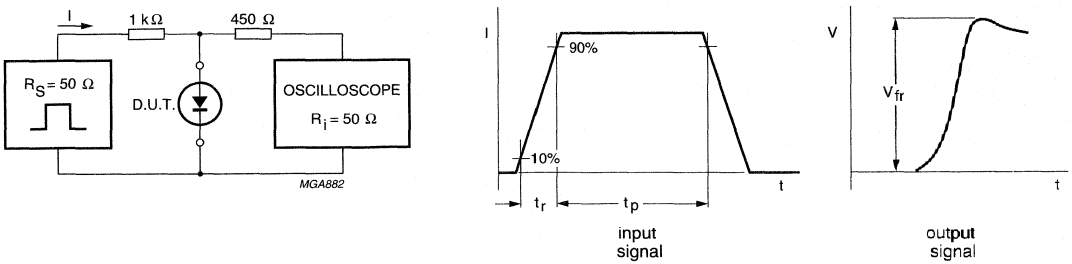


Fig.8 Forward recovery voltage test circuit and waveforms.

Schottky barrier (double) diodes BAS40 series

FEATURES

- Low forward voltage
- Guard ring protected
- Small plastic SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes with an integrated guard ring for stress protection. Single diodes and double diodes with different pinning are available. The diodes BAS40, BAS40-04, BAS40-05 and BAS40-06 are encapsulated in a SOT23 small plastic SMD package. The BAS40-07 is encapsulated in a SOT143B small plastic SMD package

MARKING

TYPE NUMBER	MARKING CODE (1)
BAS40	43*
BAS40-04	44*
BAS40-05	45*
BAS40-06	46*
BAS40-07	47p

Note

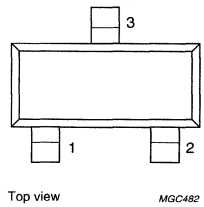
1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING SOT143B (see Fig.2)

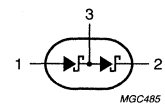
PIN	DESCRIPTION
BAS40-07	
1	k_1
2	k_2
3	a_2
4	a_1

PINNING SOT23 (see Fig.1a)

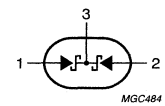
PIN	DESCRIPTION			
	BAS40 (see Fig.1b)	BAS40-04 (see Fig.1c)	BAS40-05 (see Fig.1d)	BAS40-06 (see Fig.1e)
1	a_1	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2



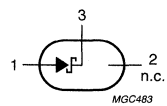
a. Simplified outline SOT23.



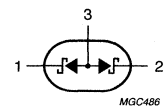
c. BAS40-04



d. BAS40-05.

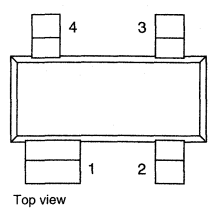


b. BAS40 single diode.



e. BAS40-06.

Fig.1 Simplified outline (SOT23) and symbols.



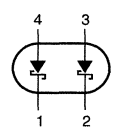


Fig.2 Simplified outline (SOT143B) BAS40-07 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	reverse current	V_R = 30 V; note 1; see Fig.4	1	µA
		V_R = 40 V; note 1; see Fig.4	10	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0 ; see Fig.6	5	pF

Note

1. Pulse test: t_p = 300 µs; δ = 0.02.

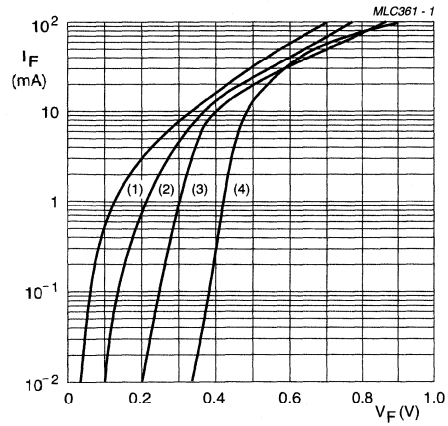
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

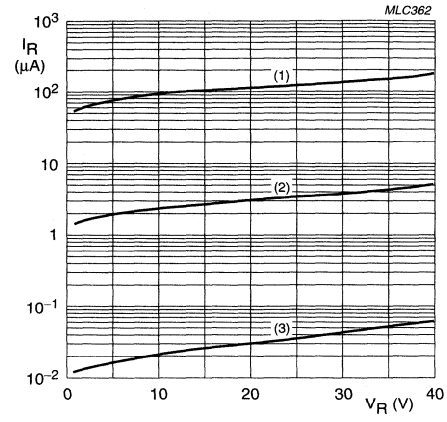
1. Refer to SOT23 or SOT143B standard mounting conditions.

GRAPHICAL DATA



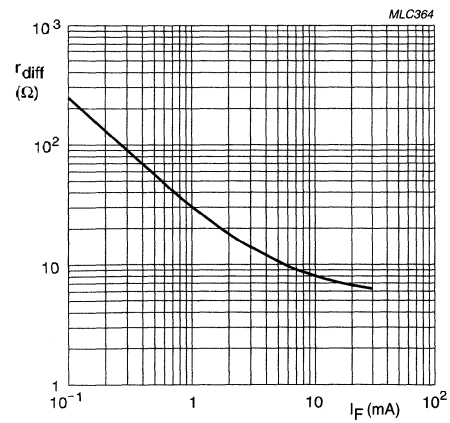
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



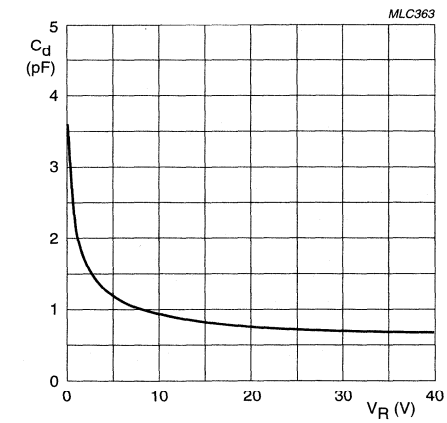
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.5 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz T_{amb} = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes BAS40W series

FEATURES

- Low forward voltage
- Guard ring protected
- Very small SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

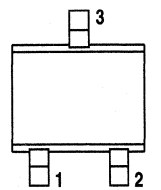
Planar Schottky barrier diodes encapsulated in a SOT323 very small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE
BAS40W	63
BAS40-04W	64
BAS40-05W	65
BAS40-06W	66

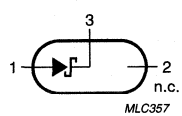
PINNING

PIN	BAS40			
	W	-04W	-05W	-06W
1	a_1	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2



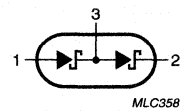
Top view MBC870

Fig.1 Simplified outline (SOT323) and pin configuration.



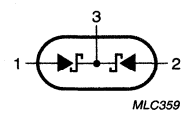
MLC357

Fig.2 BAS40W single diode configuration (symbol).



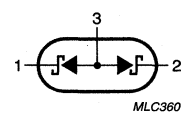
MLC358

Fig.3 BAS40-04W diode configuration (symbol).



MLC359

Fig.4 BAS40-05W diode configuration (symbol).



MLC360

Fig.5 BAS40-06W diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	120	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	120	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	200	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	continuous forward voltage	see Fig.6		
		I_F = 1 mA	380	mV
		I_F = 10 mA	500	mV
		I_F = 40 mA	1	V
I_R	continuous reverse current	V_R = 30 V; note 1; see Fig.7	1	µA
		V_R = 40 V; note 1; see Fig.7	10	µA
τ	charge carrier life time	I_F = 5 mA; Krakauer method	100	ps
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.9	5	pF

Note

1. Pulse test: t_p = 300 µs; δ = 0.02.

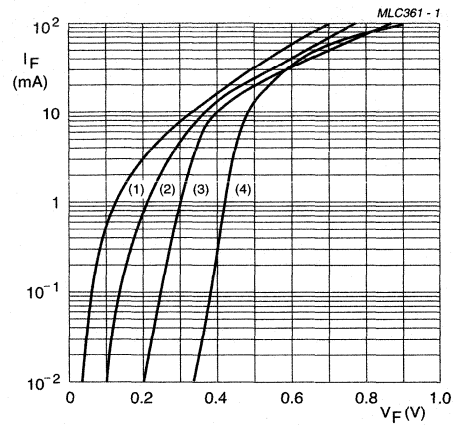
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

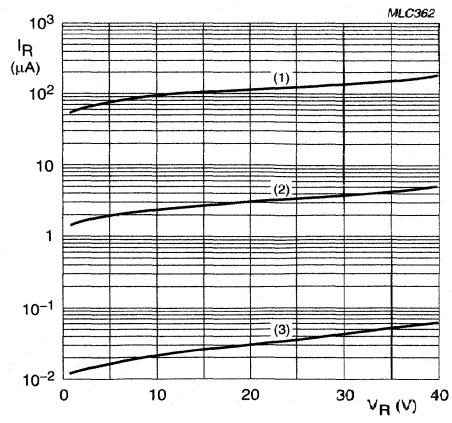
1. Refer to SOT323 standard mounting conditions.

GRAPHICAL DATA



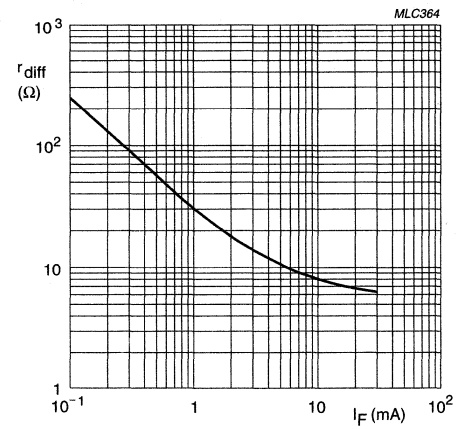
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



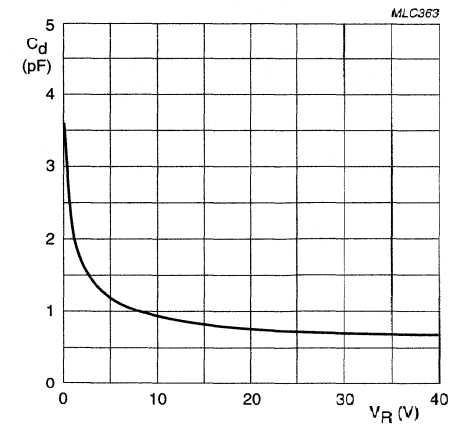
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 10 KHz.

Fig.8 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.9 Diode capacitance as a function of reverse voltage; typical values.

Low-leakage diode BAS45A

FEATURES

- Continuous reverse voltage: max. 125 V
- Repetitive peak forward current: max. 625 mA
- Low reverse current: max. 1 nA
- Switching time: typ. 1.5 μs.

APPLICATION

- Low leakage current applications.

DESCRIPTION

Epitaxial medium-speed switching diode with a low leakage current in a hermetically-sealed glass SOD68 (DO-34) package.

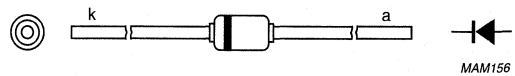


Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	125	V
V_R	continuous reverse voltage		–	125	V
I_F	continuous forward current	see Fig.2; note 1	–	250	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 μs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	300	mW
T_{stg}	storage temperature		−65	+175	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on a printed-circuit board without metallization pad.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	780	mV
		I_F = 10 mA	–	860	mV
		I_F = 100 mA	–	1000	mV
I_R	reverse current	see Fig.5			
		V_R = 125 V; E_{max} = 100 lx	–	1	nA
		V_R = 30 V; T_j = 125 °C; E_{max} = 100 lx	–	300	nA
		V_R = 125 V; T_j = 125 °C; E_{max} = 100 lx	–	500	nA
		V_R = 125 V; T_j = 150 °C; E_{max} = 100 lx	–	2	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	1.5	–	µs

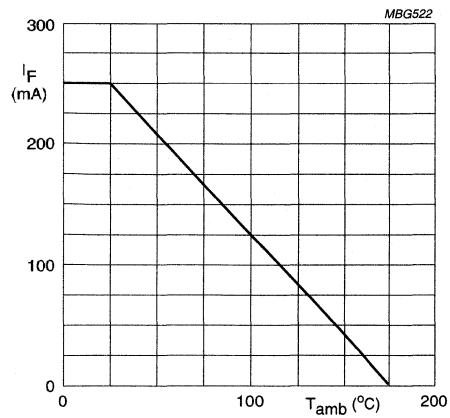
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	8 mm from the body	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	500	K/W

Note

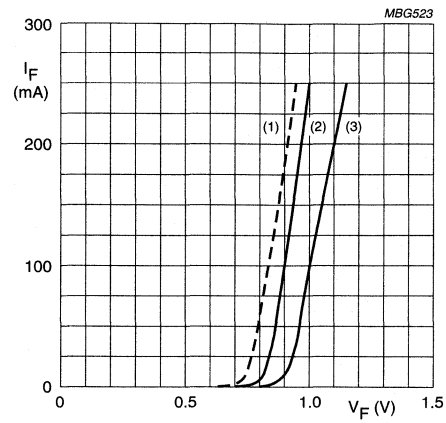
1. Device mounted on a printed-circuit board without metallization pad.

GRAPHICAL DATA



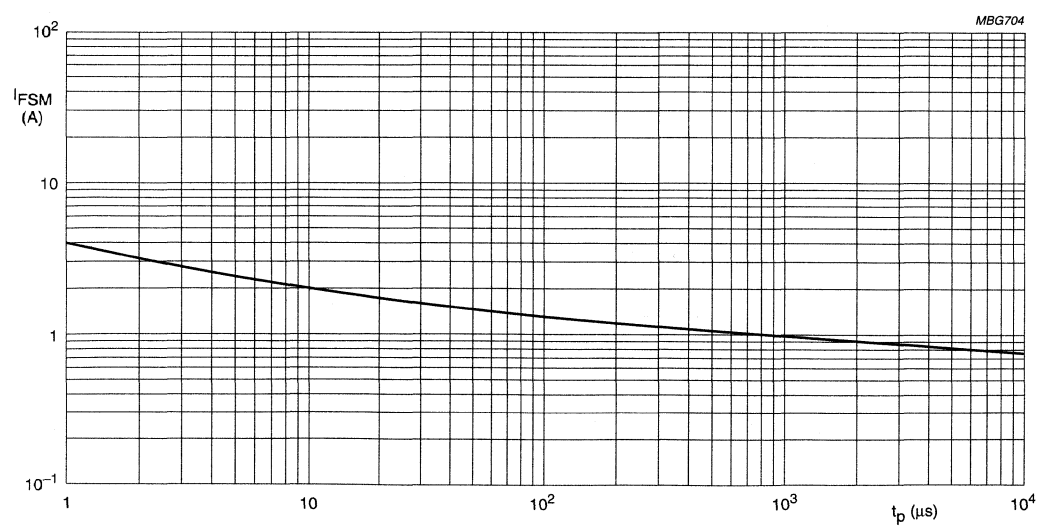
Device mounted on a printed-circuit board without metallization pad.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



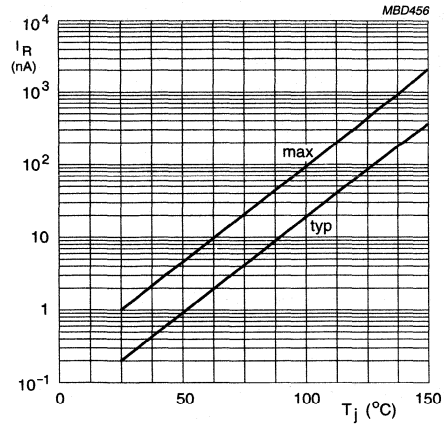
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



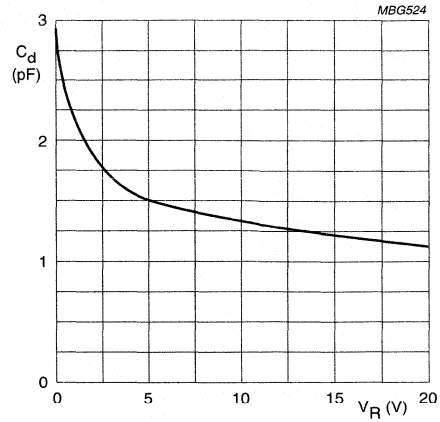
Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



V_R = 125 V.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

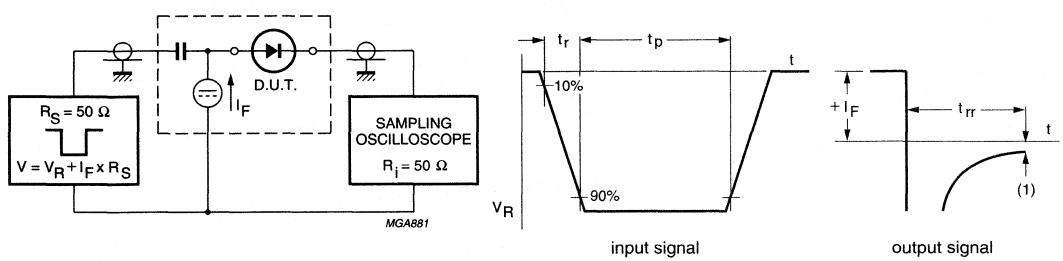


Fig.7 Reverse recovery time test circuit and waveforms.

Low-leakage diode BAS45AL

FEATURES

- Continuous reverse voltage: max. 125 V
- Repetitive peak forward current: max. 625 mA
- Low reverse current: max. 1 nA
- Switching time: typ. 1.5 µs.

APPLICATION

- Low leakage current applications.

DESCRIPTION

Epitaxial medium-speed switching diode with a low leakage current in a small SOD80C glass SMD package.

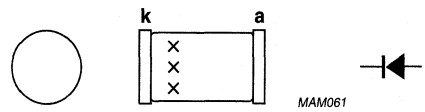


Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	125	V
V_R	continuous reverse voltage		–	125	V
I_F	continuous forward current	note 1; see Fig.2	–	250	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 µs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	400	mW
T_{stg}	storage temperature		−65	+175	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on a FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	780	mV
		I_F = 10 mA	–	860	mV
		I_F = 100 mA	–	1000	mV
I_R	reverse current	see Fig.5			
		V_R = 125 V; E_{max} = 100 lx	–	1	nA
		V_R = 30 V; T_j = 125 °C; E_{max} = 100 lx	–	300	nA
		V_R = 125 V; T_j = 125 °C; E_{max} = 100 lx	–	500	nA
		V_R = 125 V; T_j = 150 °C; E_{max} = 100 lx	–	2	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	1.5	–	µs

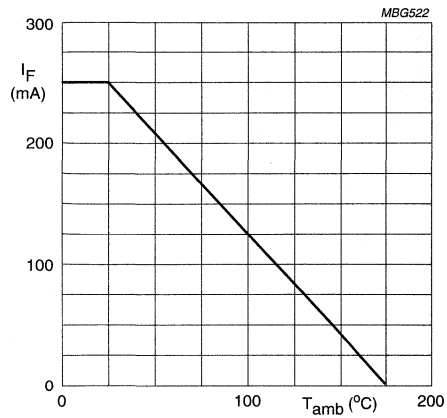
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	375	K/W

Note

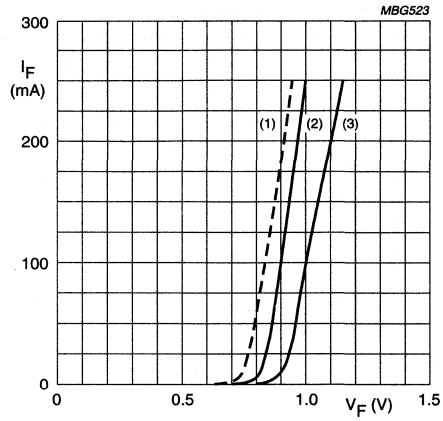
1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA



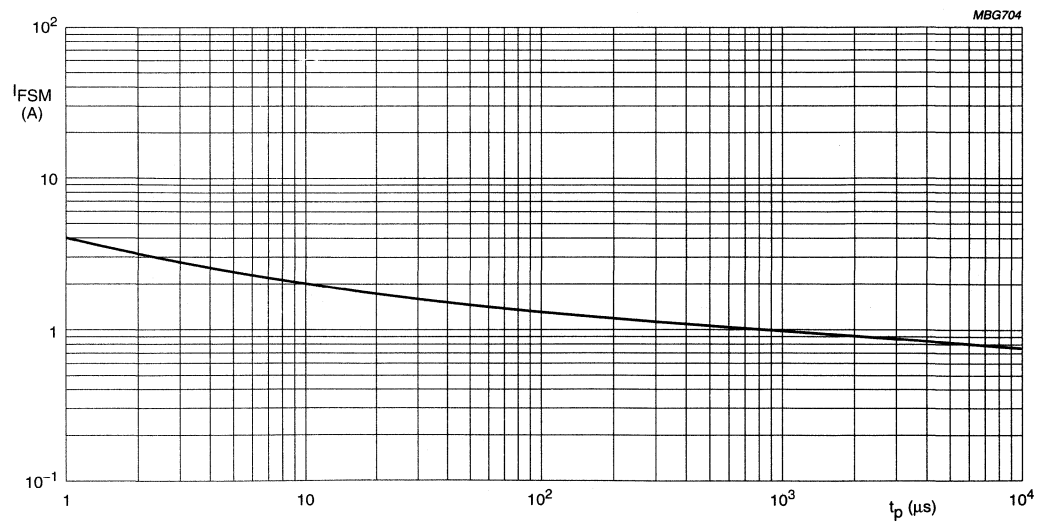
Device mounted on a FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



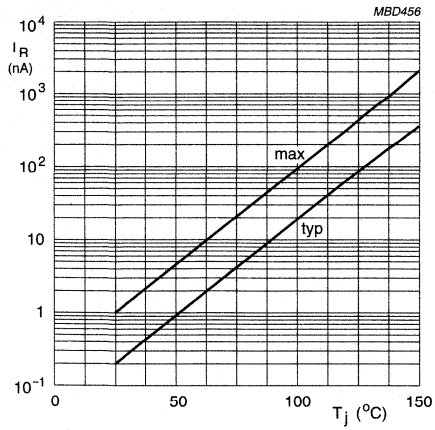
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage; typical values.



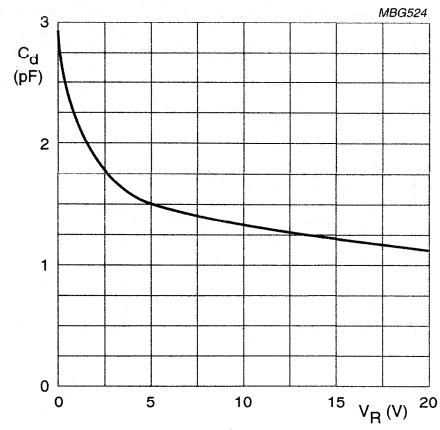
Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



V_R = 125 V.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

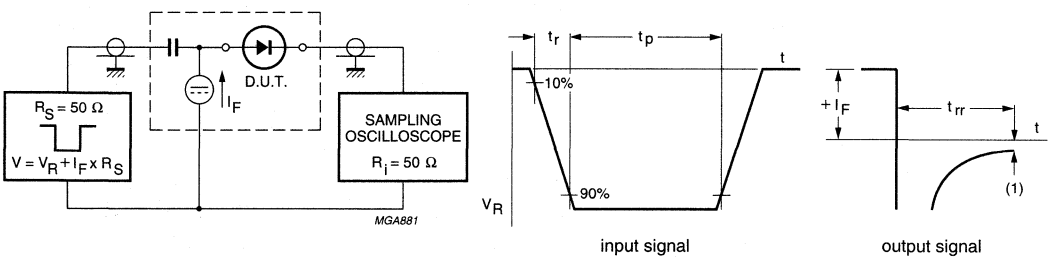


Fig.7 Reverse recovery time test circuit and waveforms.

High-speed double diode BAS56

FEATURES

- Small plastic SMD package
- High switching speed: max. 6 ns
- Continuous reverse voltage: max. 60 V
- Repetitive peak reverse voltage: max. 60 V
- Repetitive peak forward current: max. 600 mA.

APPLICATIONS

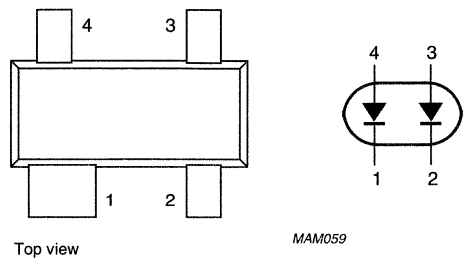
- High speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS56 consists of two high-speed switching diodes fabricated in planar technology, and encapsulated in the small rectangular plastic SMD SOT143 package. The diodes are not connected.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	anode (a2)
4	anode (a1)



Top view

Marking code: L51.

Fig.1 Simplified outline (SOT143) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	60	V
V_{RRM}	repetitive peak reverse voltage	series connection		120	V
V_R	continuous reverse voltage		–	60	V
V_R	continuous reverse voltage	series connection	–	120	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	200	mA
		double diode loaded; see Fig.2; note 1	–	150	mA
I_{FRM}	repetitive peak forward current	single diode loaded	–	600	mA
		double diode loaded	–	430	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 10 ms	–	1.7	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3; I_F = 200 mA; DC value; note 1	–	1.0	V
I_R	reverse current	see Fig.5			
		V_R = 60 V	–	100	nA
		V_R = 60 V; T_j = 150 °C	–	100	μA
I_R	reverse current	series connection	–		
		V_R = 120 V	–	100	nA
		V_R = 120 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	2.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA; see Fig.7	–	6	ns
V_{fr}	forward recovery voltage	when switched from I_F = 400 mA; t_r = 30 ns; see Fig.8	–	2.0	V
		when switched from I_F = 400 mA; t_r = 100 ns; see Fig.8	–	1.5	V

Note

1. T_{amb} = 25 °C; device has reached the thermal equilibrium when mounted on an FR4 printed-circuit board.

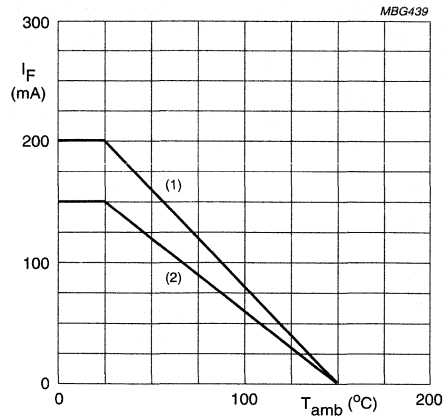
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

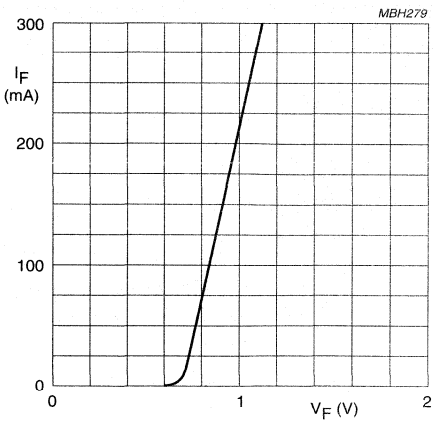
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



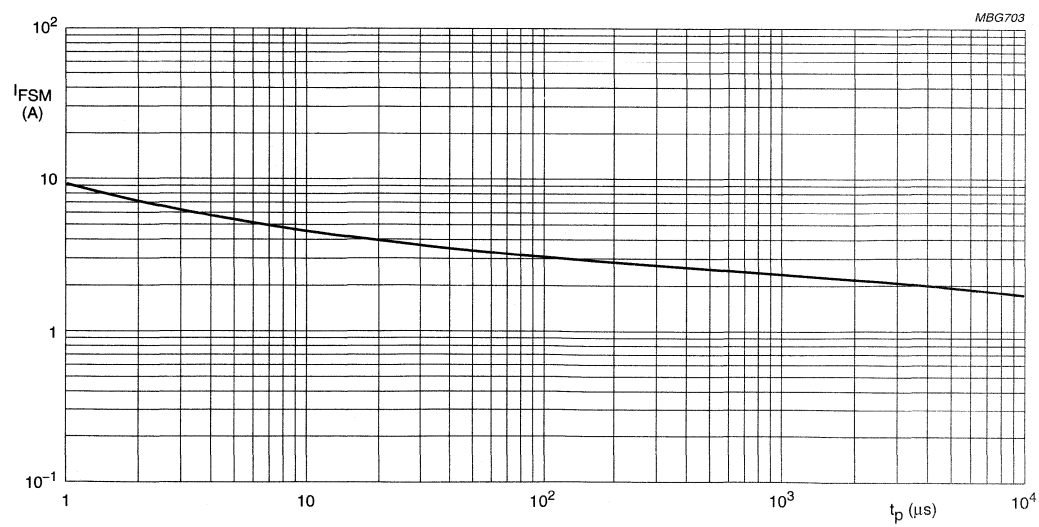
Device mounted on a FR4 printed-circuit board.
(1) Single diode loaded.
(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



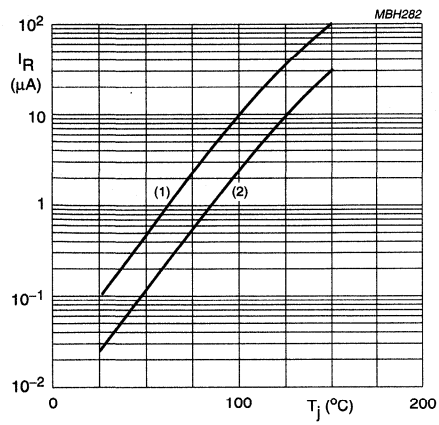
T_j = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



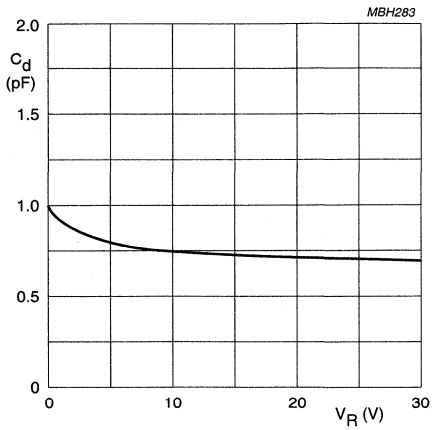
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



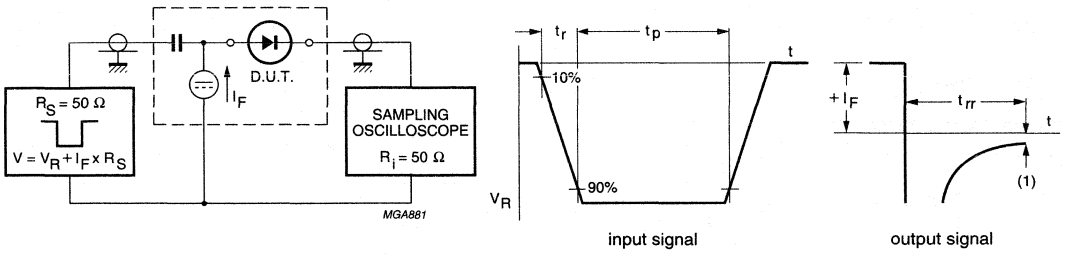
(1) V_R = 60 V; maximum values.
(2) V_R = 60 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



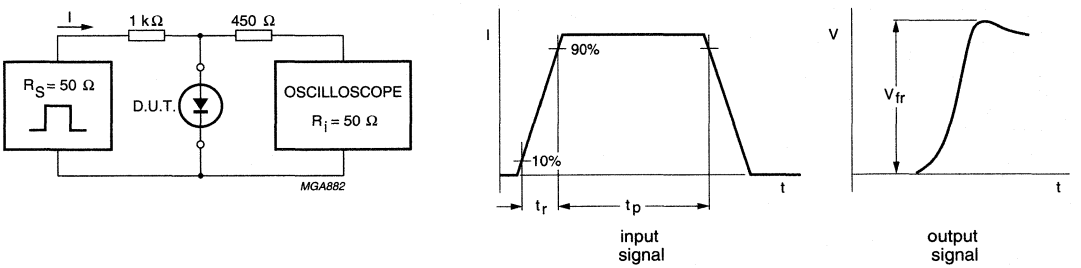
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 40$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse duration $t_p = 300$ ns; duty factor $\delta = 0.01$.

Fig.8 Forward recovery voltage test circuit and waveforms.

Schottky barrier (double) diodes BAS70 series

FEATURES

- Low forward current
- High breakdown voltage
- Guard ring protected
- Small plastic SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits.

DESCRIPTION

Planar Schottky barrier diodes with an integrated guard ring for stress protection. Single diodes and double diodes with different pinning are available.

The diodes BAS70, BAS70-04, BAS70-05 and BAS70-06 are encapsulated in a SOT23 small plastic SMD package. The BAS70-07 is encapsulated in a SOT143B small plastic SMD package.

MARKING

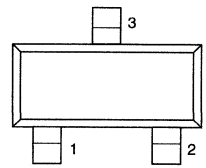
TYPE NUMBER	MARKING CODE(1)
BAS70	73p*
BAS70-04	74p*
BAS70-05	75p*
BAS70-06	76p*
BAS70-07	77p

Note

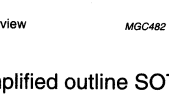
1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

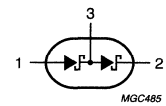
PIN	DESCRIPTION				
	SOT23				SOT143B
	BAS70 (see Fig.1b)	BAS70-04 (see Fig.1c)	BAS70-05 (see Fig.1d)	BAS70-06 (see Fig.1e)	BAS70-07 (see Fig.2)
1	a_1	a_1	a_1	k_1	k_1
2	n.c.	k_2	a_2	k_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2	a_2
4	–	–	–	–	a_1



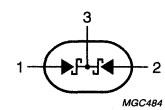
a. Simplified outline SOT23.



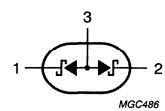
b. BAS70 single diode.



c. BAS70-04

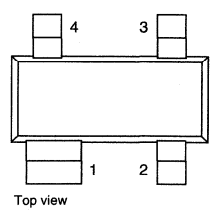


d. BAS70-05.



e. BAS70-06.

Fig.1 Simplified outline (SOT23) and symbols.



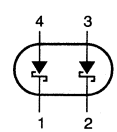


Fig.2 Simplified outline (SOT143B) BAS70-07 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	410	mV
		I_F = 10 mA	750	mV
		I_F = 15 mA	1	V
I_R	reverse current	V_R = 50 V; note 1; see Fig.4	100	nA
		V_R = 70 V; note 1; see Fig.4	10	μA
τ	charge carrier life time (Krakauer method)	I_F = 5 mA	100	ps
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

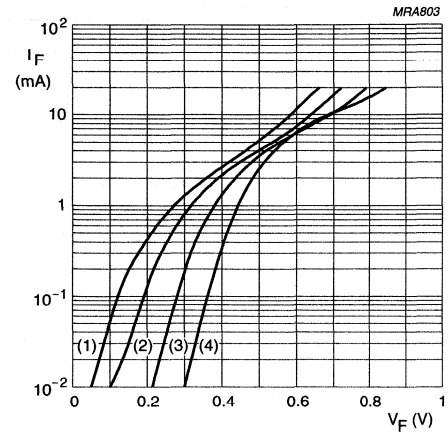
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

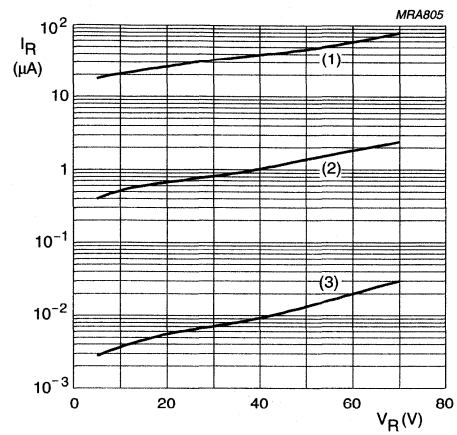
1. Refer to SOT23 or SOT143B standard mounting conditions.

GRAPHICAL DATA



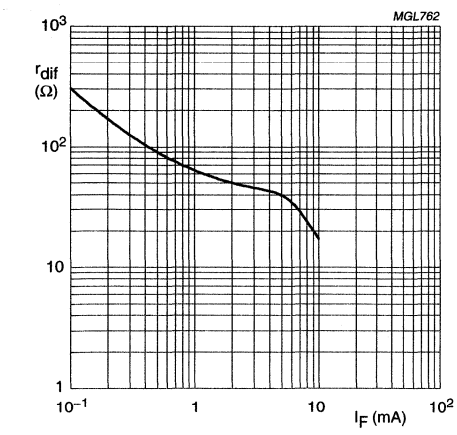
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



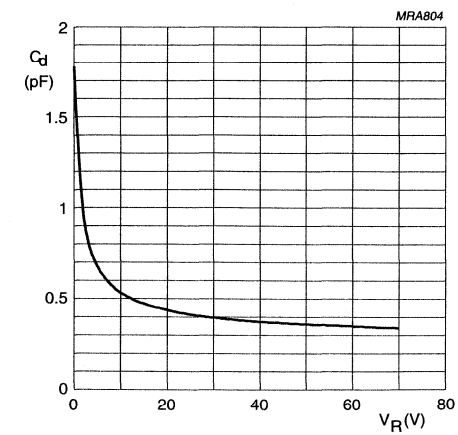
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.5 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diode BAS70-07S

FEATURES

- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

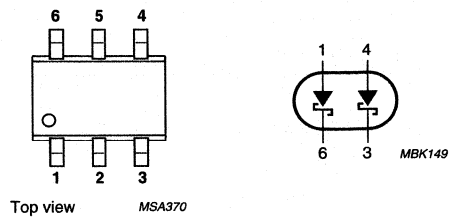
DESCRIPTION

Planar Schottky barrier double diode with an integrated guard ring for stress protection.

Two separate dies are encapsulated in a SOT363 small SMD plastic package.

PINNING

PIN	DESCRIPTION
1	anode (a_1)
2,5	not connected
3	cathode (k_2)
4	anode (a_2)
6	cathode (k_1)



Marking code: 77.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.2		
		I_F = 1 mA	410	mV
		I_F = 10 mA	750	mV
		I_F = 15 mA	1	V
I_R	reverse current	V_R = 50 V; note 1; see Fig.3	100	nA
		V_R = 70 V; note 1; see Fig.3	10	µA
τ	charge carrier life time (Krakauer method)	I_F = 5 mA	100	ps
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.5	2	pF

Note

1. Pulsed test: t_p = 300 µs; δ = 0.02.

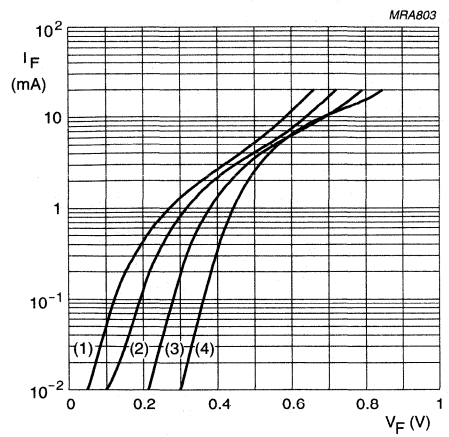
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

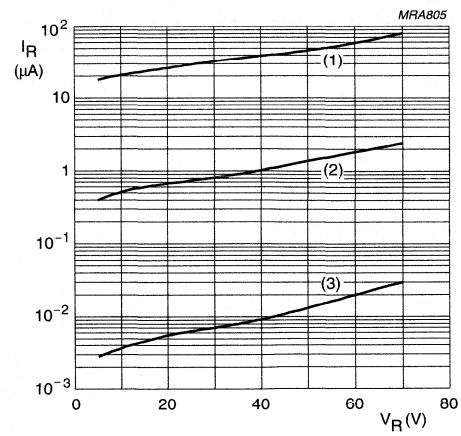
1. Refer to SOT363 standard mounting conditions.

GRAPHICAL DATA



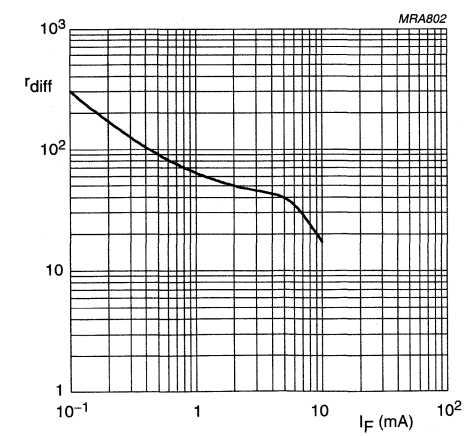
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



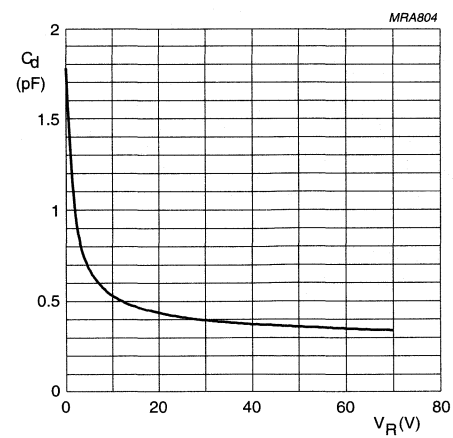
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.4 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes BAS70W series

FEATURES

- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Very small SMD package
- Low capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes. Single diodes (BAS70W) and double diodes with different pinning (BAS70-04W; -05W; -06W) are available.

The diodes are encapsulated in a SOT323 very small plastic SMD package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BAS70W	73*
BAS70-04W	74*
BAS70-05W	75*
BAS70-06W	76*

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	BAS70			
	W	-04W	-05W	-06W
1	a_1	a_1	a_1	k_1
2	n.c.	k_2	a_2	k_2
3	k_1	k_1, a_2	k_1, k_2	a_1, a_2

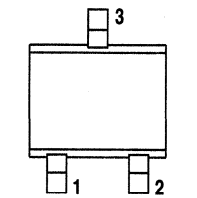


Fig.1 Simplified outline (SOT323) and pin configuration.

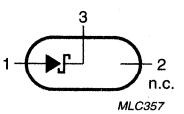


Fig.2 BAS70W single diode configuration (symbol).

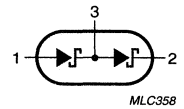


Fig.3 BAS70-04W diode configuration (symbol).

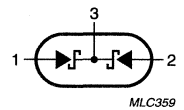


Fig.4 BAS70-05W diode configuration (symbol).

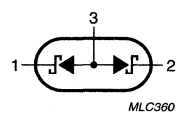


Fig.5 BAS70-06W diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.6		
		I_F = 1 mA	410	mV
		I_F = 10 mA	750	mV
		I_F = 15 mA	1	V
I_R	reverse current	V_R = 50 V; note 1; see Fig.7	100	nA
		V_R = 70 V; note 1; see Fig.7	10	μA
τ	charge carrier life time (Krakauer method)	I_F = 5 mA	100	ps
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.9	2	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

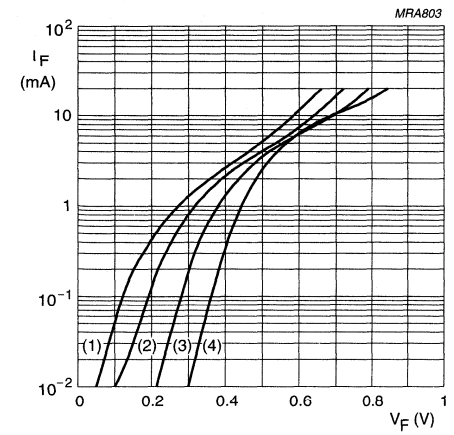
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

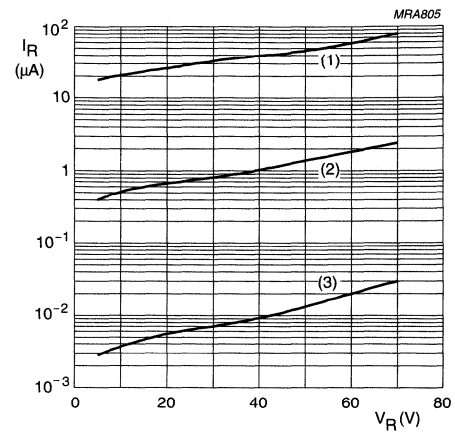
1. Refer to SOT323 standard mounting conditions.

GRAPHICAL DATA



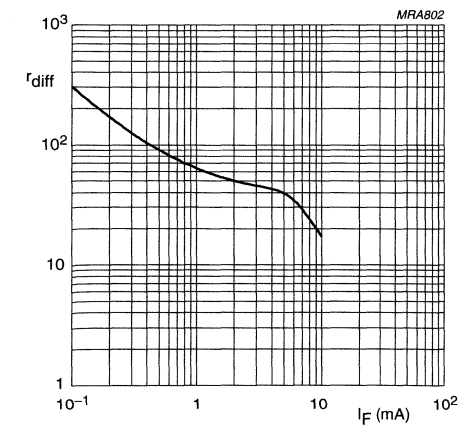
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



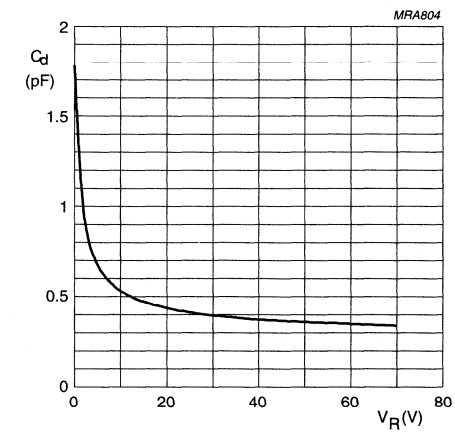
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 10 kHz.

Fig.8 Differential forward resistance as a function of forward current; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.9 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diodes BAS81; BAS82; BAS83

FEATURES

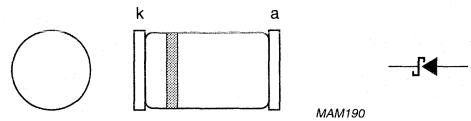
- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Hermetically-sealed small SMD package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges. This surface mounted diode is encapsulated in a hermetically sealed SOD80C glass SMD package with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.



Cathode indicated by a grey band.

Fig.1 Simplified outline (SOD80C), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	BAS81		–	40	V
	BAS82		–	50	V
	BAS83		–	60	V
I_F	continuous forward current		–	30	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	150	mA
I_{FSM}	non-repetitive peak forward current	$t_p = 1$ s	–	500	mA
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	330	mV
		I_F = 1 mA	410	mV
		I_F = 15 mA	1	V
I_R	reverse current	$V_R = V_{Rmax}$; see Fig.3	200	nA
C_d	diode capacitance	f = 1 MHz; V_R = 2 V; see Fig.4	1.6	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

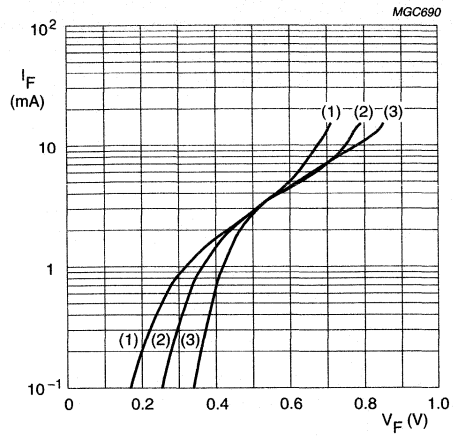
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

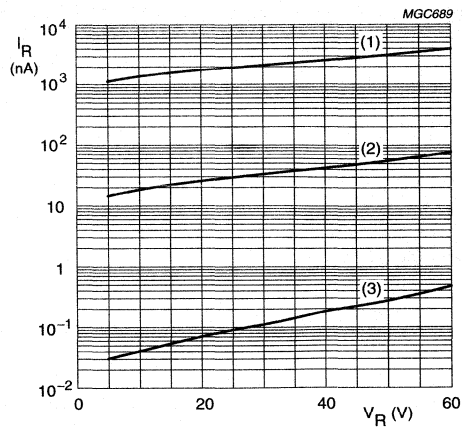
1. Refer to SOD80 standard mounting conditions.

GRAPHICAL DATA



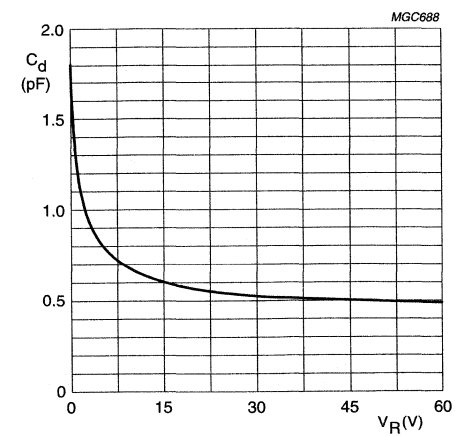
(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode BAS85

FEATURES

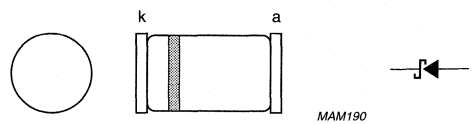
- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Hermetically-sealed small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges.
This surface mounted diode is encapsulated in a hermetically sealed SOD80C glass SMD package with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.



Cathode indicated by a grey band.

Fig.1 Simplified outline (SOD80C), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
$I_{F(AV)}$	average forward current	V_{RWM} = 25 V; a = 1.57; δ = 0.5; note 1; Fig.2	–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms	–	5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

Note

1. Refer to SOD80 standard mounting conditions.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.4	2.3	μA
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	10	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

1. Refer to SOD80 standard mounting conditions.

GRAPHICAL DATA

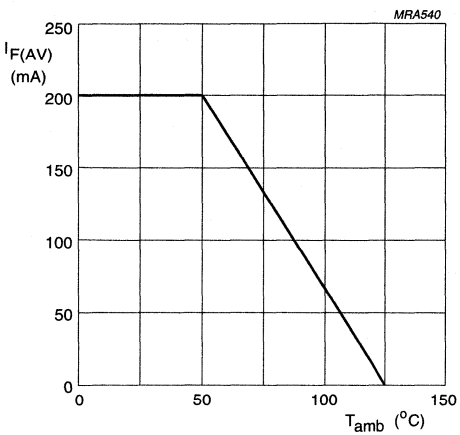
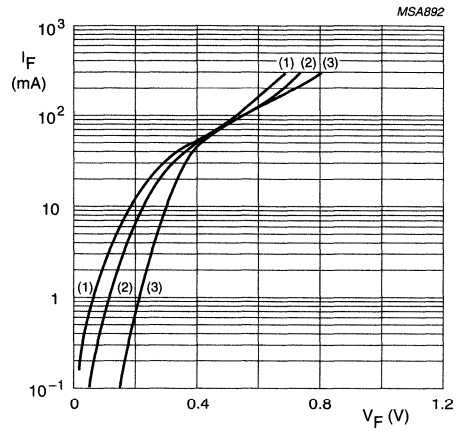
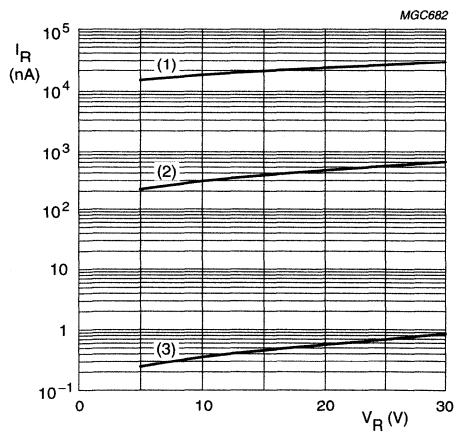


Fig.2 Derating curve.



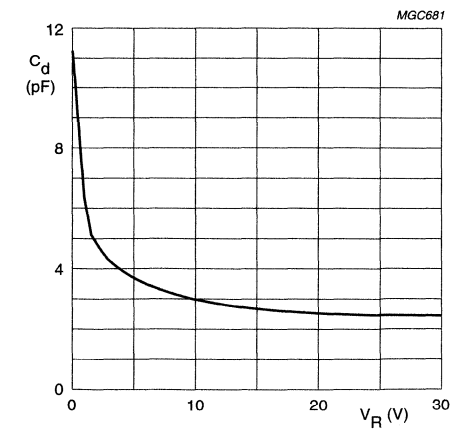
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode BAS86

FEATURES

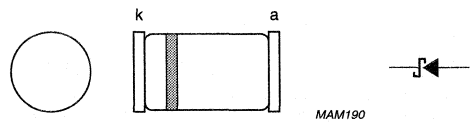
- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Hermetically-sealed small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges.
This surface mounted diode is encapsulated in a hermetically sealed SOD80C glass SMD package with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.



Cathode indicated by a grey band.

Fig.1 Simplified outline (SOD80C), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current		–	200	mA
$I_{F(AV)}$	average forward current	see Fig.2	–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ sec.; $\delta \leq 0.5$	–	500	mA
I_{FSM}	non-repetitive peak forward current	$t_p = 10$ ms		5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	300	mV
		I_F = 1 mA	380	mV
		I_F = 10 mA	450	mV
		I_F = 30 mA	600	mV
		I_F = 100 mA	900	mV
I_R	reverse current	V_R = 40 V; see Fig.4; note 1	5	μA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	4	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	8	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

1. Refer to SOD80 standard mounting conditions.

GRAPHICAL DATA

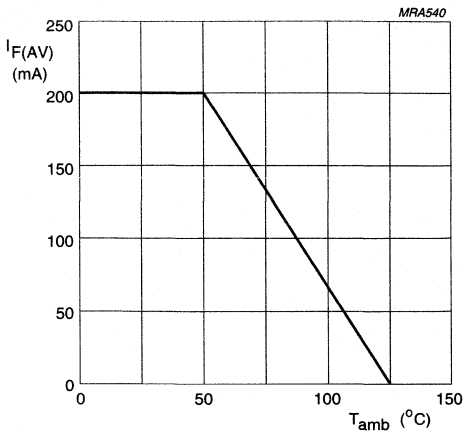
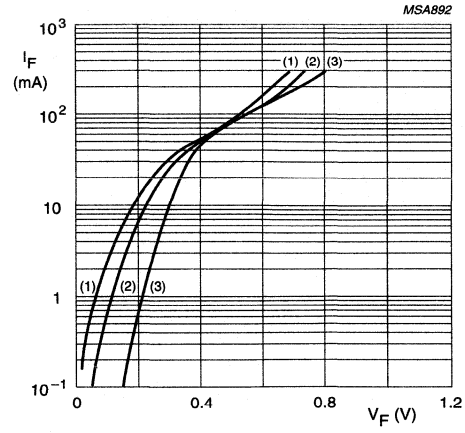
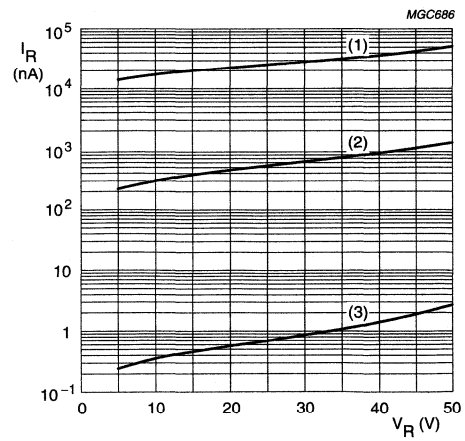


Fig.2 Derating curve.



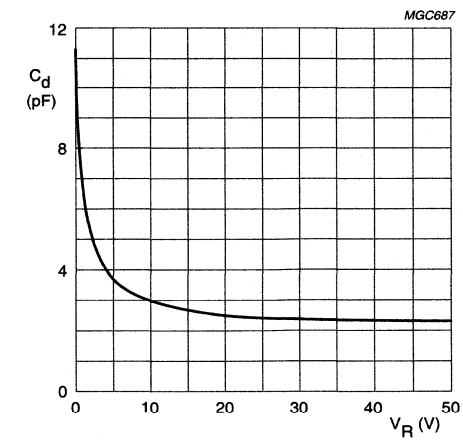
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

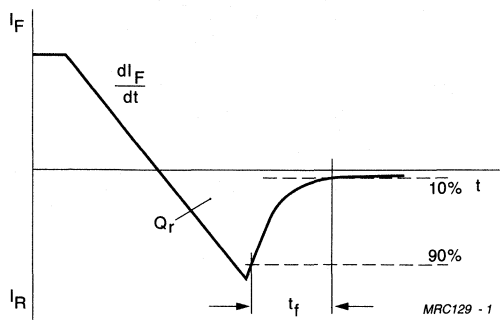


Fig.6 Reverse recovery definitions.

Low-leakage diode BAS116

FEATURES

- Plastic SMD package
- Low leakage current: typ. 3 pA
- Switching time: typ. 0.8 µs
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATION

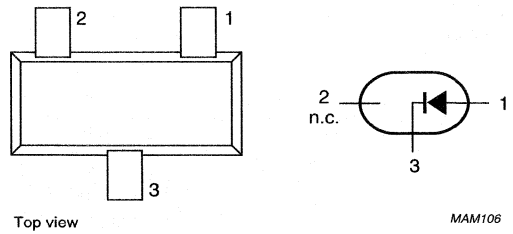
- Low leakage current applications in surface mounted circuits.

DESCRIPTION

Epitaxial medium-speed switching diode with a low leakage current in a small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: JVp = made in Hong Kong; JVt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 µs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	0.9	V
		I_F = 10 mA	–	1	V
		I_F = 50 mA	–	1.1	V
		I_F = 150 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		V_R = 75 V	0.003	5	nA
		V_R = 75 V; T_j = 150 °C	3	80	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	–	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	0.8	3	µs

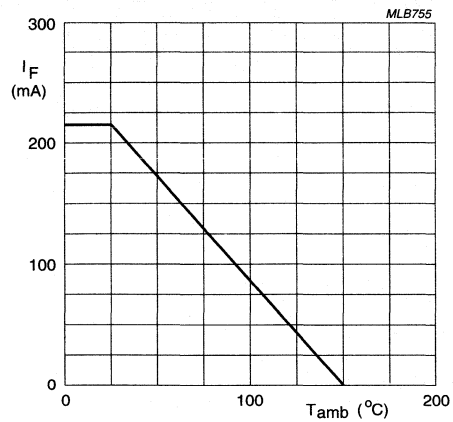
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

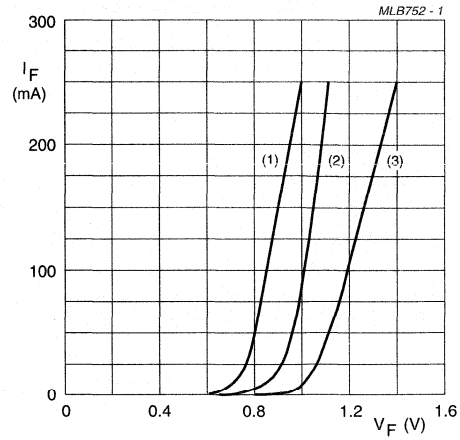
1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA



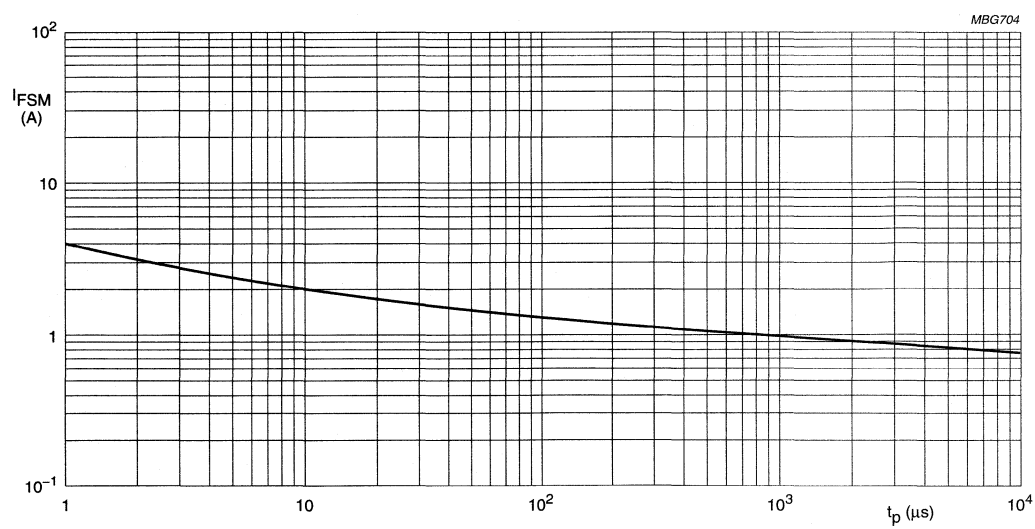
Device mounted on a FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



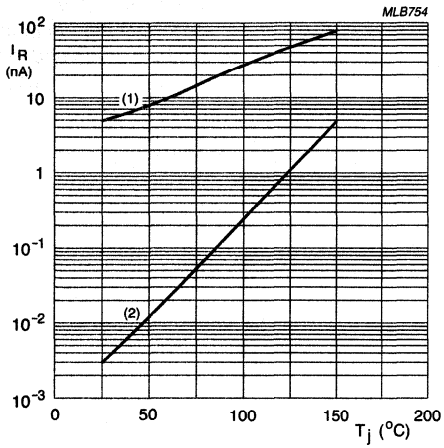
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



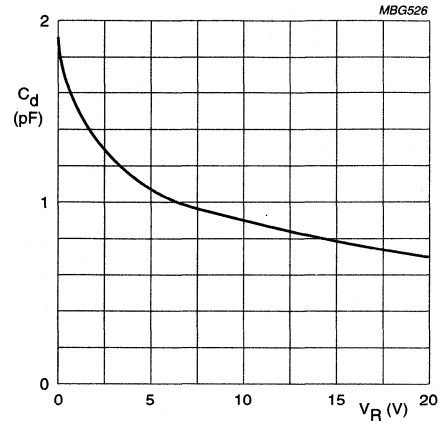
Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



V_R = 75 V.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

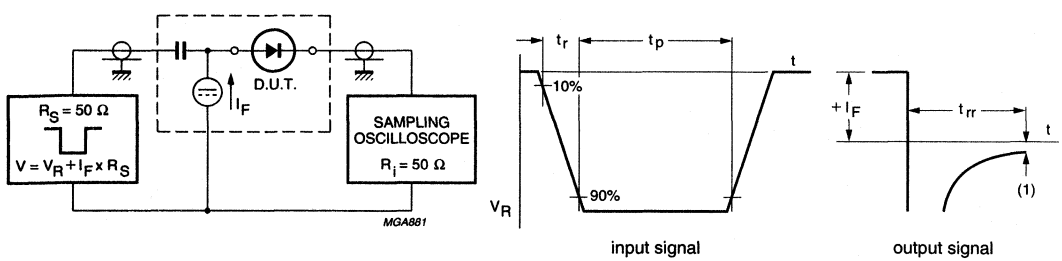


Fig.7 Reverse recovery time test circuit and waveforms.

High-speed switching diode BAS216

FEATURES

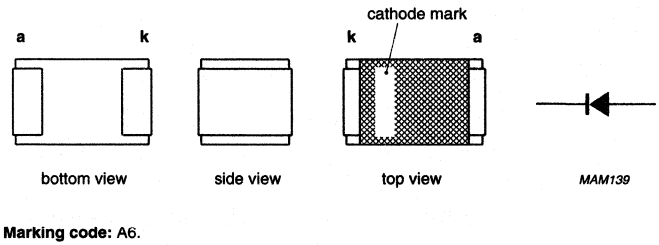
- Small ceramic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS216 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small rectangular ceramic SMD SOD110 package.



Marking code: A6.

Fig.1 Simplified outline (SOD110) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	note 1	–	250	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; see Fig.2; note 1	–	400	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	715	mV
		I_F = 10 mA	–	855	mV
		I_F = 50 mA	–	1	V
		I_F = 150 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		V_R = 25 V	–	30	nA
		V_R = 75 V	–	1	µA
		V_R = 25 V; T_j = 150 °C	–	30	µA
		V_R = 75 V; T_j = 150 °C	–	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	–	1.75	V

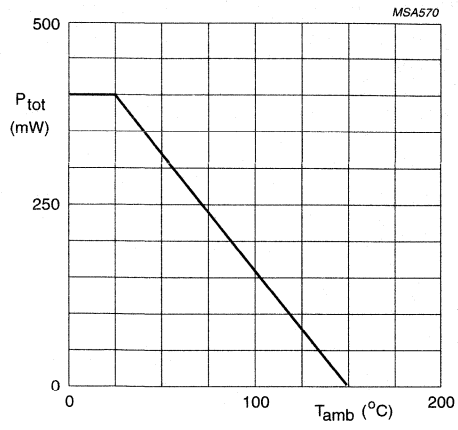
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		200	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	315	K/W

Note

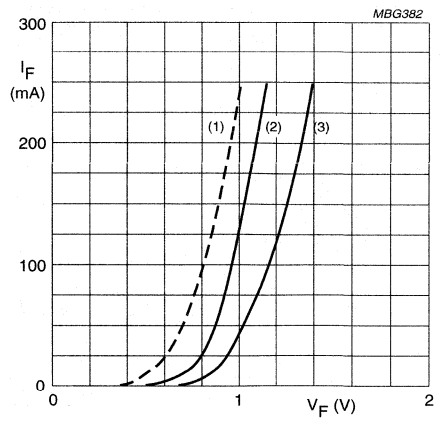
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



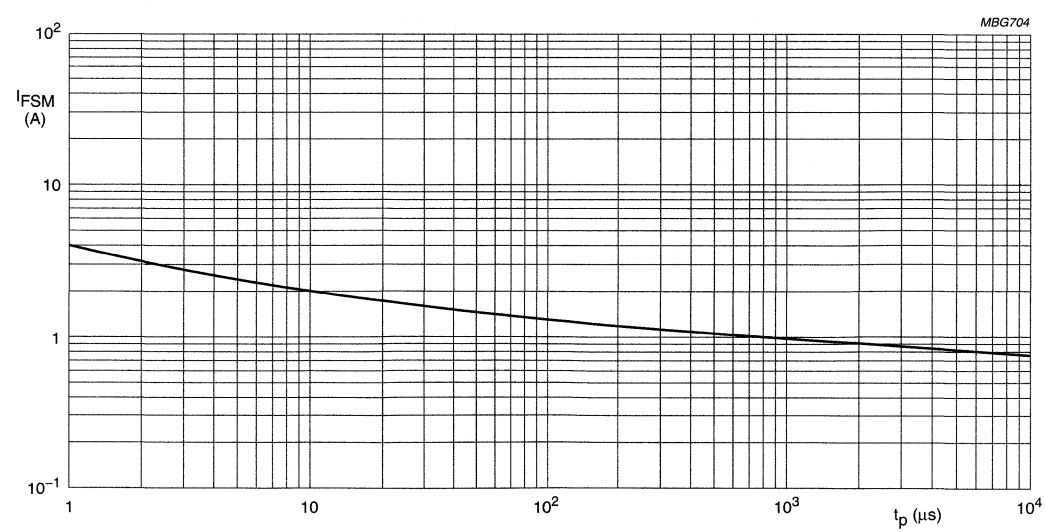
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible total power dissipation as a function of ambient temperature.



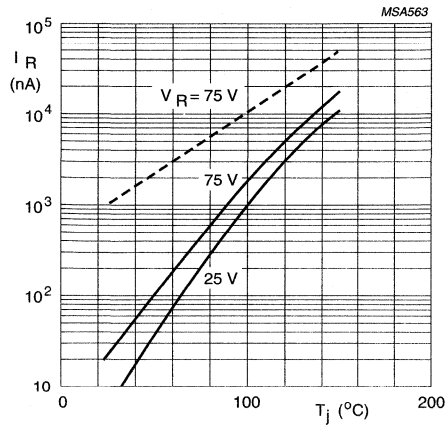
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



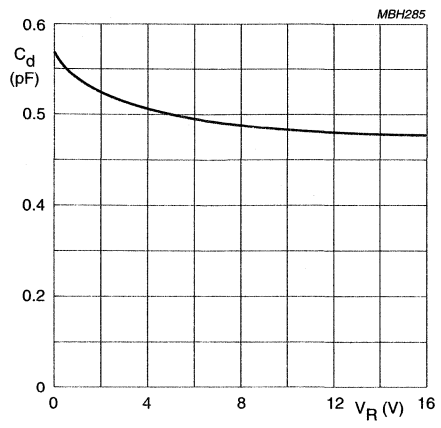
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



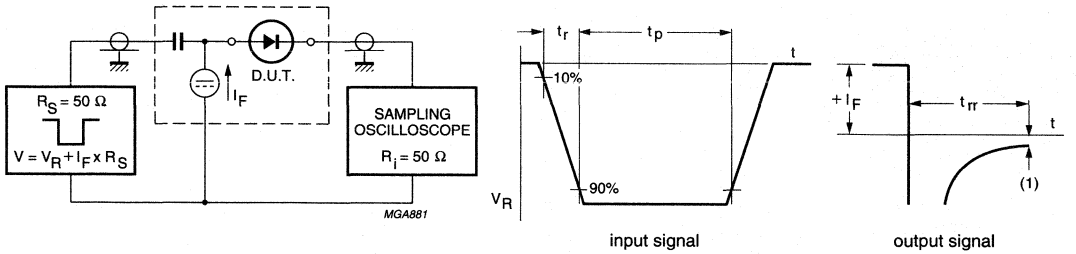
Dotted line: maximum values.
Solid line: typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

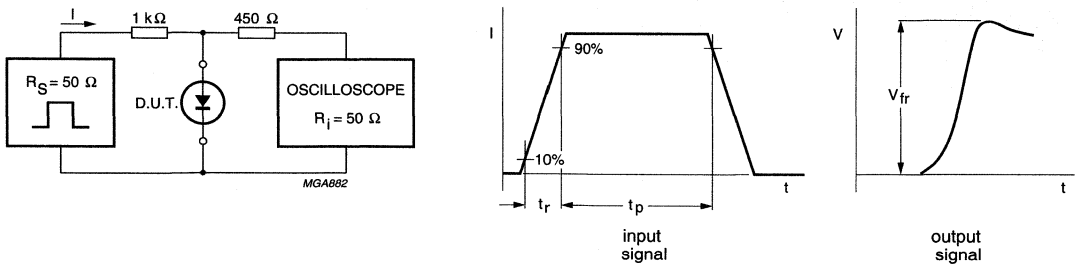
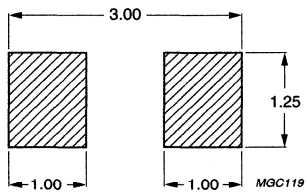


Fig.8 Forward recovery voltage test circuit and waveforms.

MOUNTING

Reflow soldering

Follow standard reflow soldering techniques to ensure correct application of solder paste and placement of the SOD110 package (see Fig.9).

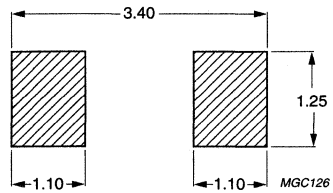


Dimensions in mm.

Fig.9 SOD110 reflow soldering pattern.

Wave soldering

Before wave soldering, attach SOD110 packages to the printed-circuit boards using a small dot of thermo-setting epoxy or UV-curing adhesive centred between the soldering lands (see Fig.10).



Dimensions in mm.

Fig.10 SOD110 wave soldering pattern.

General purpose diode BAS221

FEATURES

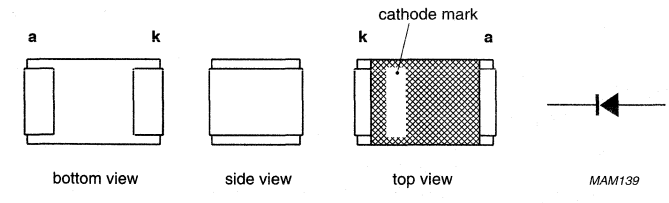
- Small ceramic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 200 V
- Repetitive peak reverse voltage: max. 250 V
- Repetitive peak forward current: max. 1 A.

APPLICATIONS

- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS221 is a general purpose diode fabricated in planar technology, and encapsulated in the ceramic SOD110 package.



Marking code: JS.

Fig.1 Simplified outline (SOD110) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	250	V
V_R	continuous reverse voltage		–	200	V
I_F	continuous forward current	note 1; see Fig.2	–	300	mA
I_{FRM}	repetitive peak forward current	$t_p < 0.5$ ms; $\delta \leq 0.25$	–	1	A
I_{FSM}	non-repetitive peak forward current	square wave; $T_j = 25$ °C prior to surge; see Fig.4			
		$t = 1$ µs	–	20	A
		$t = 100$ µs	–	7	A
		$t = 10$ ms	–	2	A
P_{tot}	total power dissipation	$T_{amb} = 25$ °C; note 1	–	400	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		200	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	315	K/W

Note

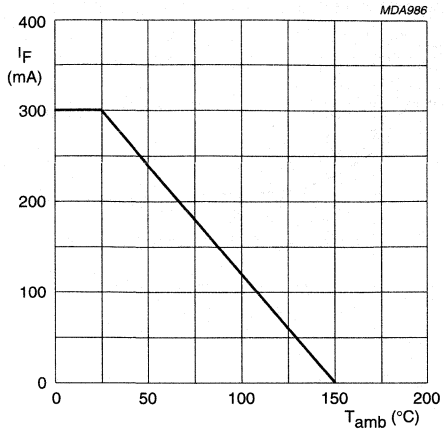
1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

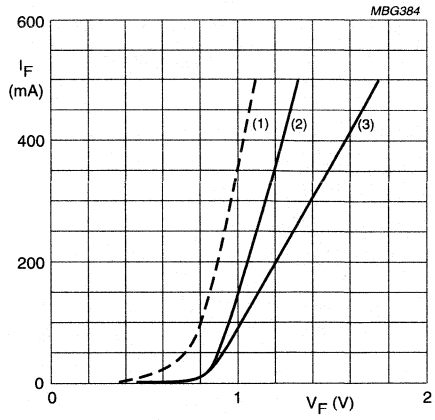
SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 100 mA	1	V
		I_F = 200 mA	1.25	V
		I_F = 300 mA	1.4	V
I_R	reverse current	see Fig.5		
		V_R = 200 V	100	nA
		V_R = 200 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.7	50	ns

GRAPHICAL DATA



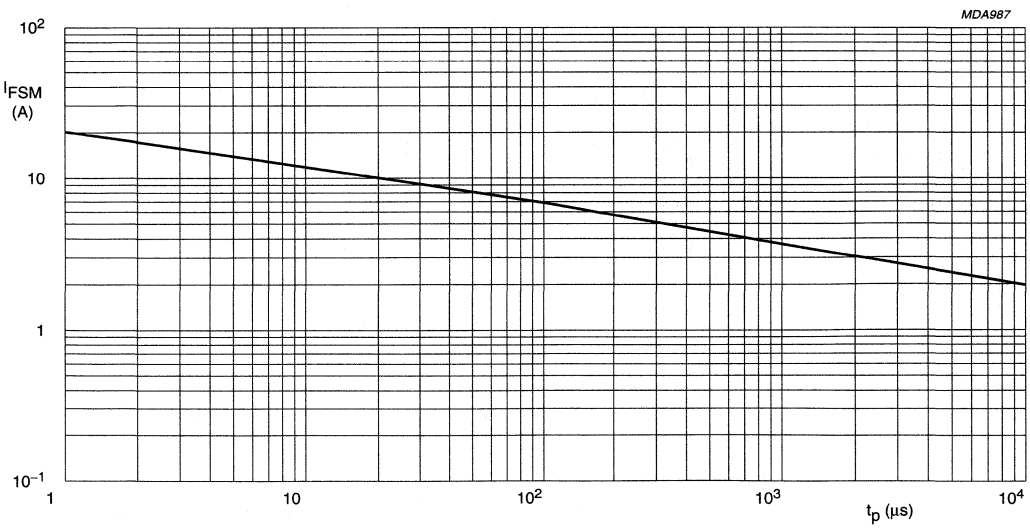
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



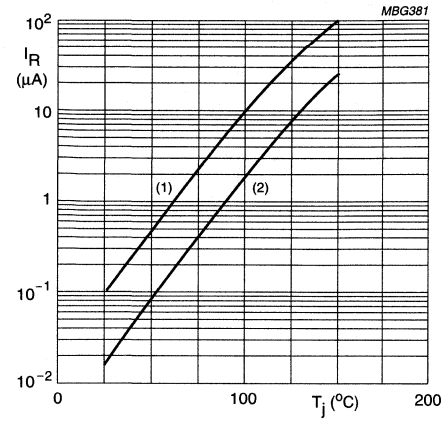
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



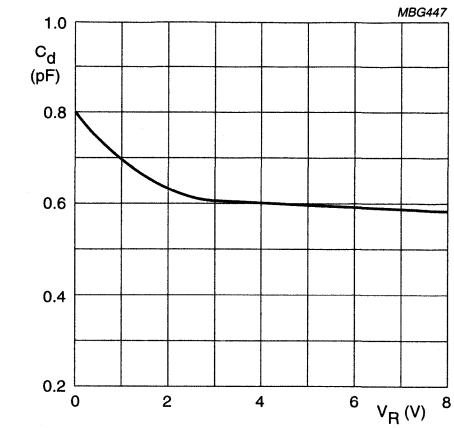
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



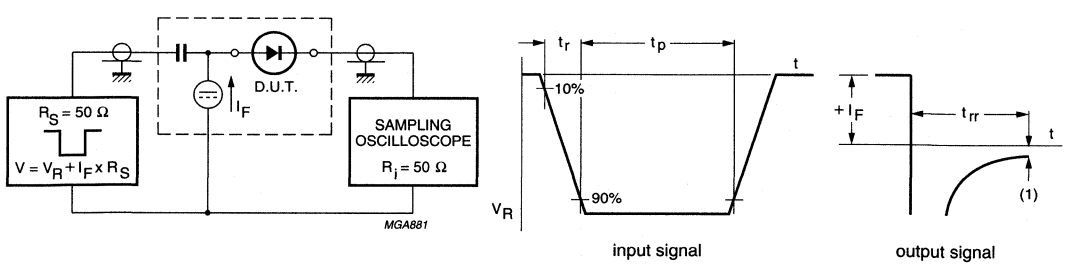
(1) $V_R = V_{Rmax}$; maximum values.
(2) $V_R = V_{Rmax}$; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 3 mA.
Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance C ≤ 1 pF (oscilloscope input + parasitic capacitance).

Fig.7 Reverse recovery time and waveforms.

High-speed diode BAS316

FEATURES

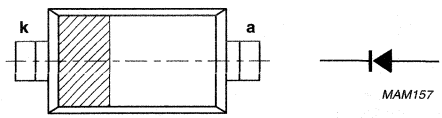
- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS316 is a high-speed switching diode fabricated in planar technology, and encapsulated in the SOD323 SMD plastic package.



Marking code: A6.
Cathode side indicated by a bar.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	T_s = 90 °C; note 1; see Fig.2	–	250	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 90 °C; note 1	–	400	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the cathode tab.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C;	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	150	K/W

Note

1. Soldering point of the cathode tab.

GRAPHICAL DATA

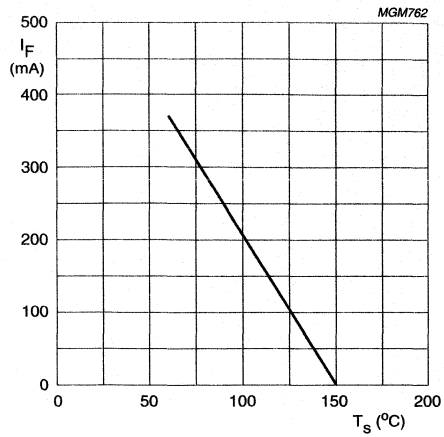
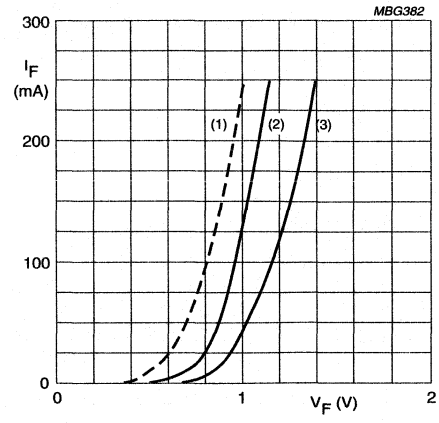
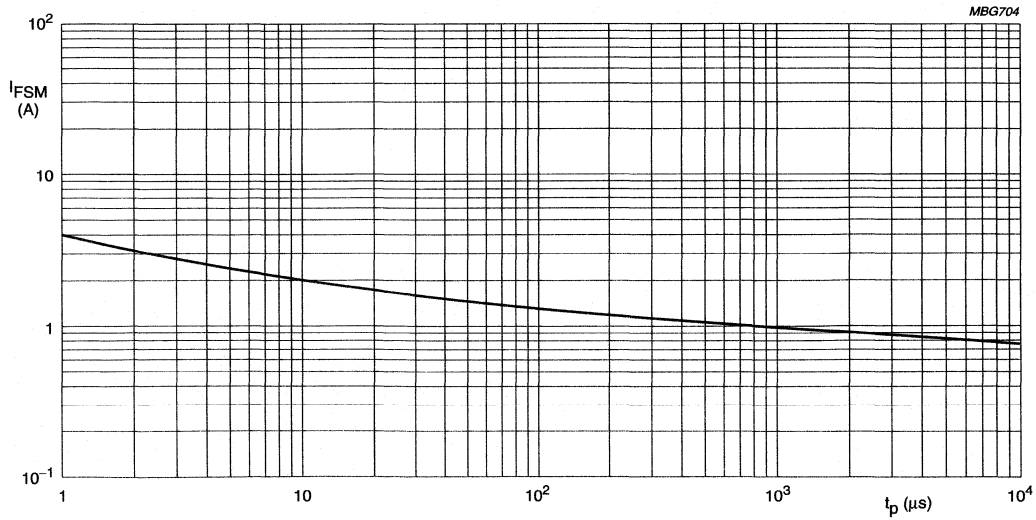


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

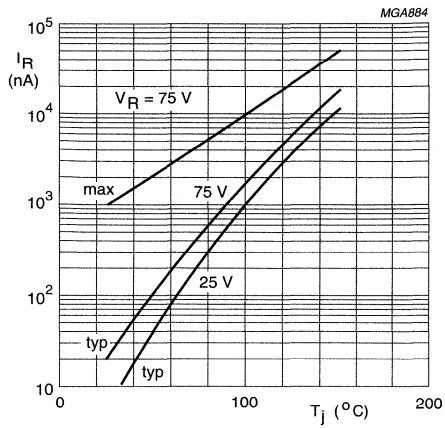
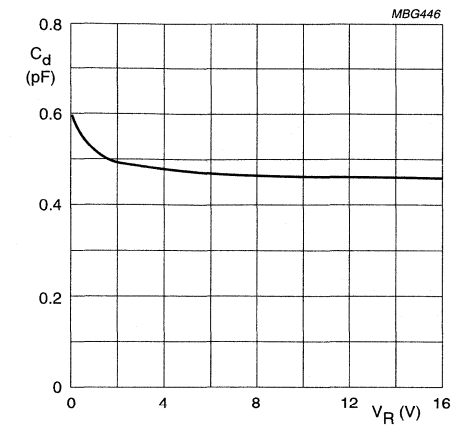
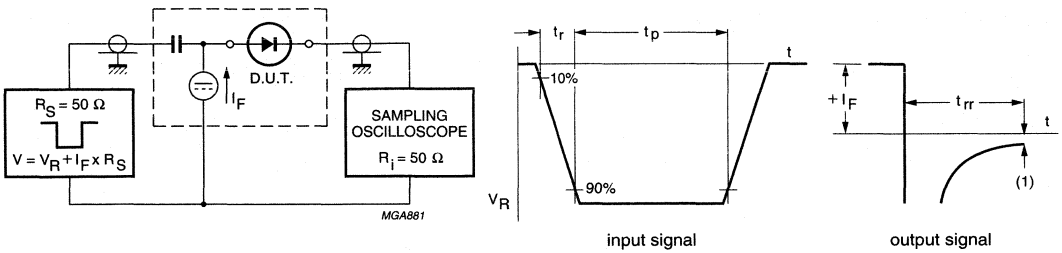


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

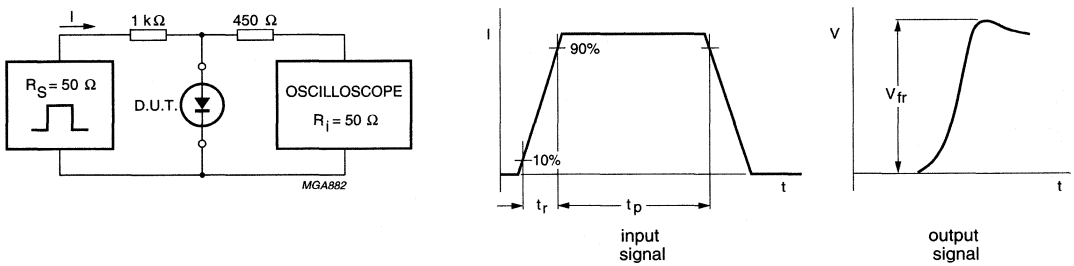
Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$;
Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

General purpose diode BAS321

FEATURES

- Small plastic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 200 V
- Repetitive peak reverse voltage: max. 250 V
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

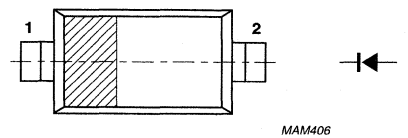
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS321 is a general purpose diode fabricated in planar technology and encapsulated in a plastic SOD323 package.

PINNING

PIN	DESCRIPTION
1	cathode
2	anode



Marking code: A7

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	250	V
V_R	continuous reverse voltage		–	200	V
I_F	continuous forward current	see Fig. 2; note 1	–	250	mA
I_{FRM}	repetitive peak forward current	$t_p < 0.5$ ms; $\delta \leq 0.25$	–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; $T_j = 25$ °C prior to surge; see Fig. 4			
		$t = 1$ μs	–	9	A
		$t = 100$ μs	–	3	A
		$t = 10$ ms	–	1.7	A
P_{tot}	total power dissipation	$T_{amb} = 25$ °C; note 1	–	300	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig. 3		
		I_F = 100 mA	1	V
		I_F = 200 mA	1.25	V
I_R	reverse current	see Fig. 5		
		V_R = 200 V	100	nA
		V_R = 200 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig. 6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.8	50	ns

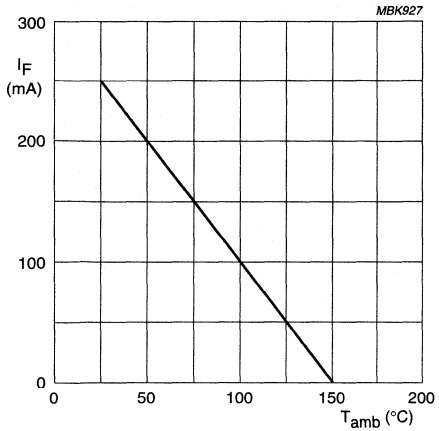
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	T_s = 90°C; note 1	130	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 2	366	K/W

Notes

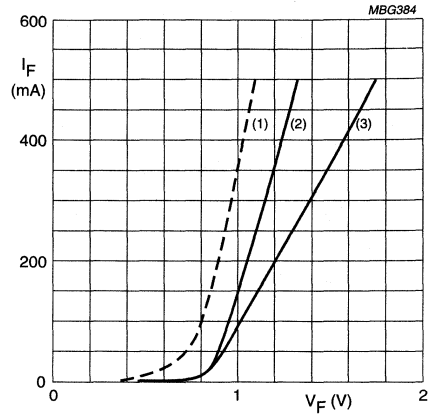
1. Soldering point of cathode tab.
2. Device mounted on an FR4 printed circuit board.

GRAPHICAL DATA



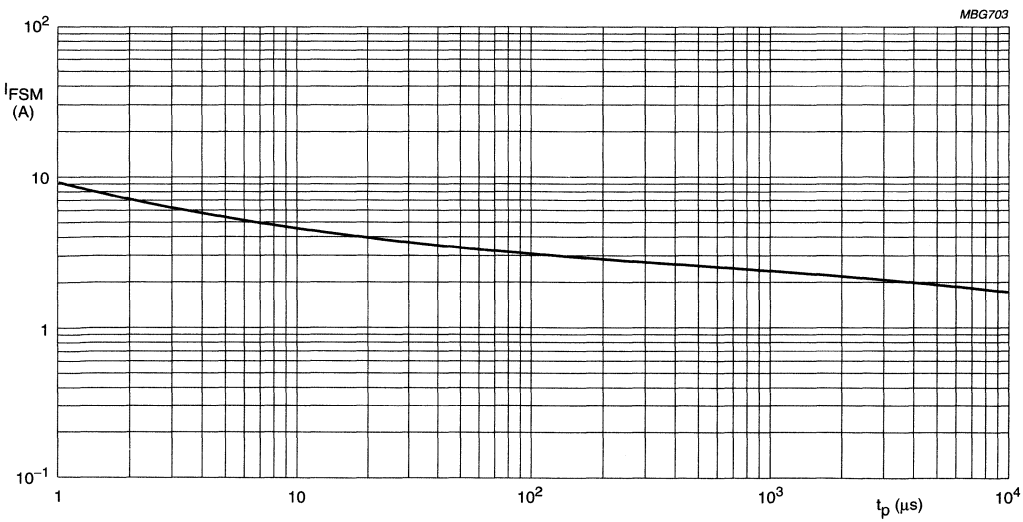
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



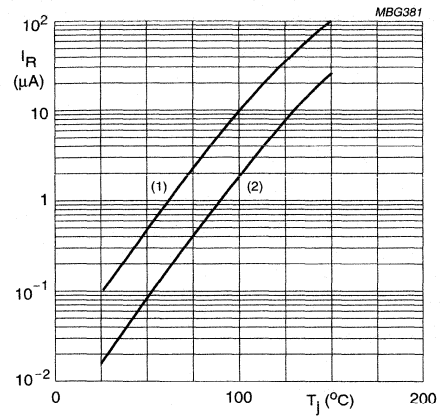
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



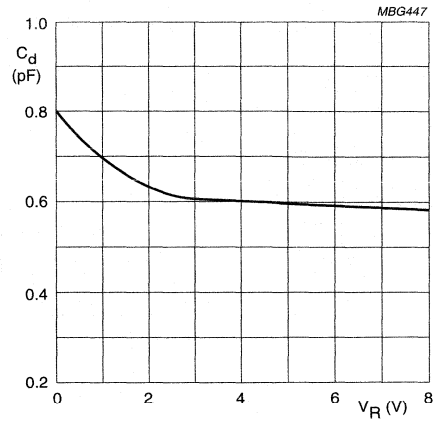
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



(1) $V_R = V_{Rmax}$; maximum values.
(2) $V_R = V_{Rmax}$; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

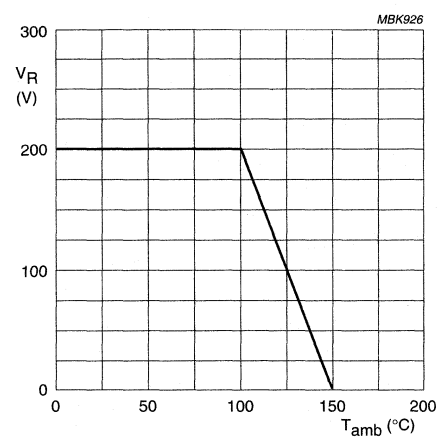
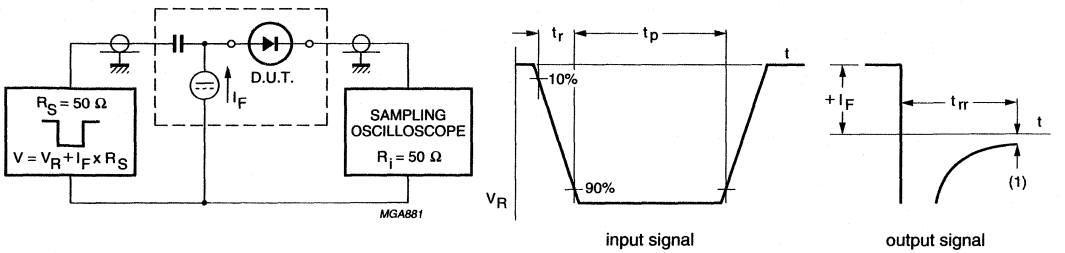


Fig.7 Maximum permissible continuous reverse voltage as a function of the ambient temperature.



(1) I_R = 3 mA

Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05;
Oscilloscope: rise time t_r = 0.35 ns;
Circuit capacitance C ≤ 1 pF (oscilloscope input + parasitic capacitance)

Fig.8 Reverse recovery time and waveforms.

High-speed diode BAS516

FEATURES

- Ultra small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

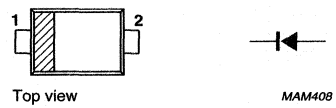
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAS516 is a high-speed switching diode fabricated in planar technology, and encapsulated in the SOD523 (SC79) SMD plastic package.

PINNING

PIN	DESCRIPTION
1	cathode
2	anode



Marking code: 6.

Fig.1 Simplified outline (SOD523) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	T_s = 90 °C; note 1; see Fig.2	–	250	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 90 °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the cathode tab.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C;	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	120	K/W

Note

1. Soldering point of the cathode tab.

GRAPHICAL DATA

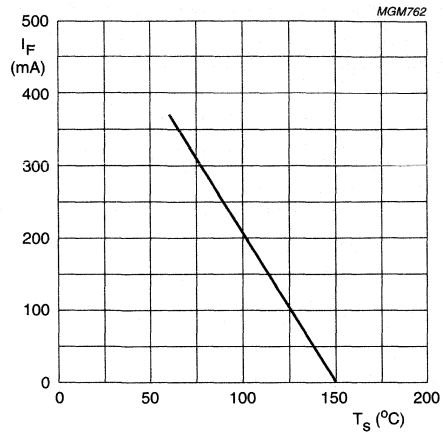
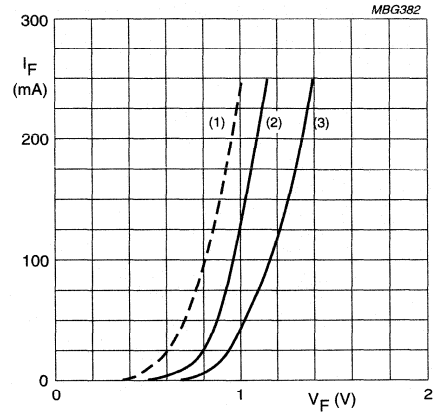
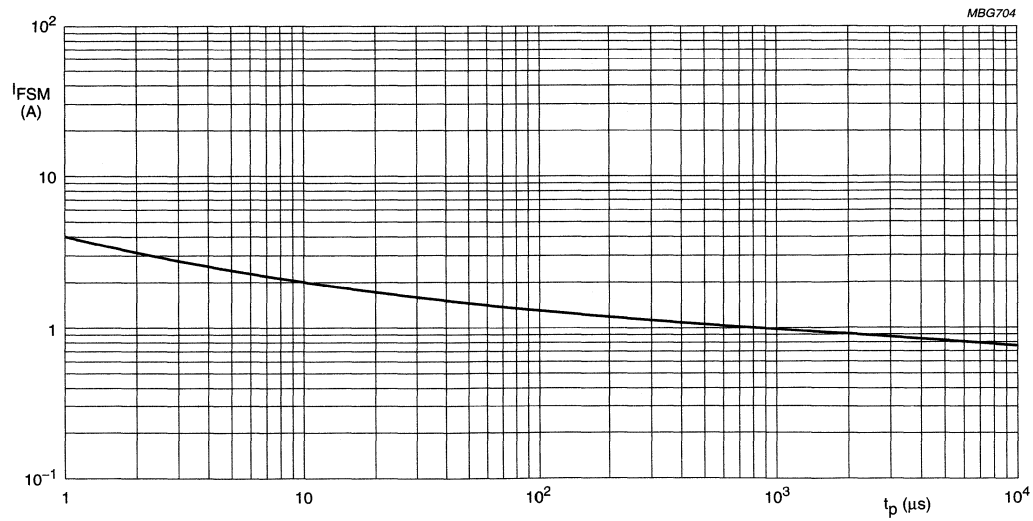


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

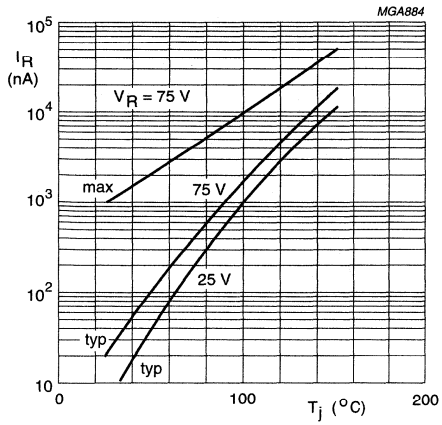
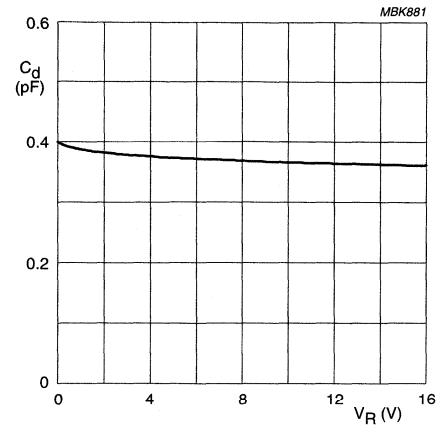
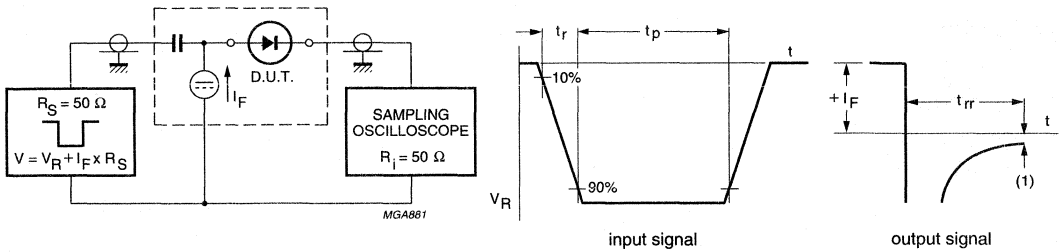


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

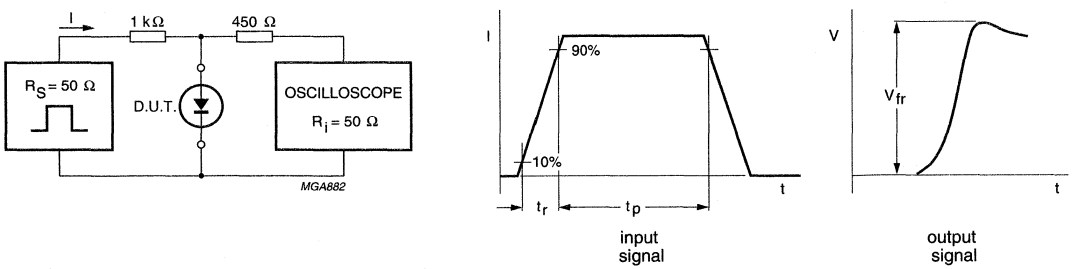
Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05;
Oscilloscope: rise time t_r = 0.35 ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

Schottky barrier diode BAT17

FEATURES

- Low forward voltage
- Small SMD package
- Low capacitance.

APPLICATIONS

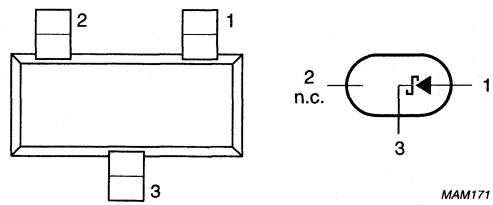
- UHF mixer
- Sampling circuits
- Modulators
- Phase detection.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

DESCRIPTION

Planar Schottky barrier diode in a small SOT23 plastic SMD package.



Marking code: A3p = made in Hong Kong; A3t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_R	continuous reverse voltage	–	4	V
I_F	continuous forward current	–	30	mA
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	–	100	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	350	mV
		I_F = 1 mA	450	mV
		I_F = 10 mA	600	mV
I_R	reverse current	V_R = 3 V; see Fig.3	0.25	μA
		V_R = 3 V; T_{amb} = 60 °C; see Fig.3	1.25	μA
r_D	diode forward resistance	f = 1 kHz; I_F = 5 mA	15	Ω
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	1	pF
F	noise figure	f = 900 MHz; note 1	8	dB

Note

1. The local oscillator is adjusted for a diode current of 2 mA. IF amplifier noise F_{if} = 1.5 dB; f = 35 MHz.

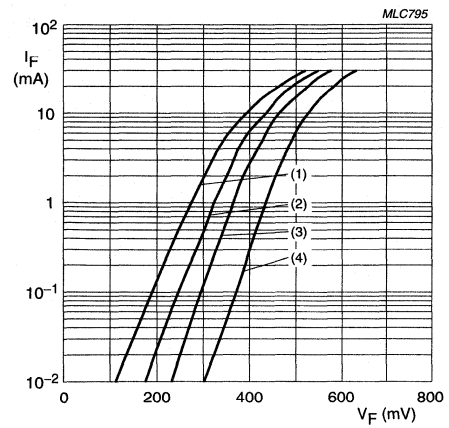
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

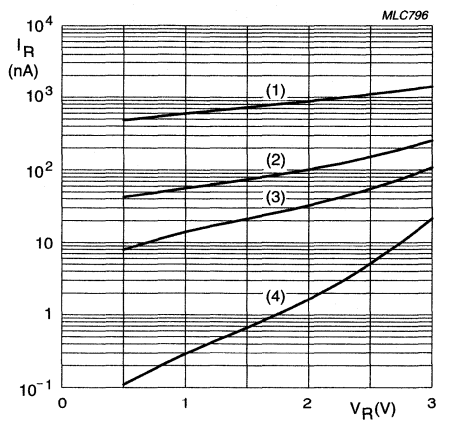
1. Refer to SOT23 standard mounting conditions.

GRAPHICAL DATA



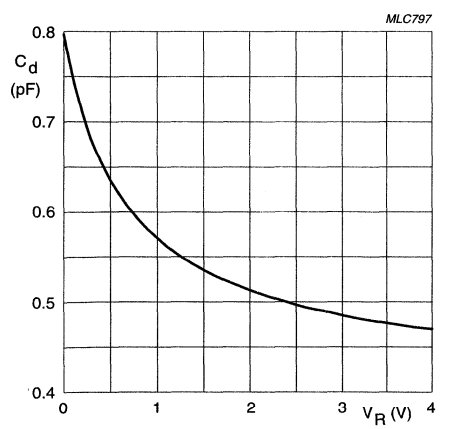
(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes BAT54 series

FEATURES

- Low forward voltage
- Guard ring protected
- Small plastic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diodes encapsulated in a SOT23 small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

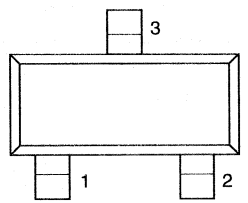
TYPE NUMBER	MARKING CODE(1)
BAT54	L4*
BAT54A	L42
BAT54C	L43
BAT54S	L44

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

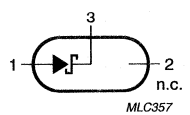
PINNING

PIN	BAT54			
		A	C	S
1	a	k_1	a_1	a_1
2	n.c.	k_2	a_2	k_2
3	k	a_1, a_2	k_1, k_2	k_1, a_2



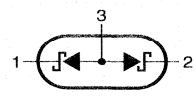
Top view MGC421

Fig.1 Simplified outline (SOT23) and pin configuration.



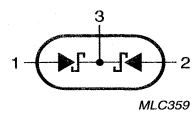
MLC357

Fig.2 BAT54 single diode configuration (symbol).



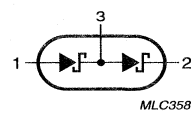
MLC360

Fig.3 BAT54A diode configuration (symbol).



MLC359

Fig.4 BAT54C diode configuration (symbol).



MLC358

Fig.5 BAT54S diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C	–	230	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.6		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; see Fig.7	2	µA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.9	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.8	10	pF

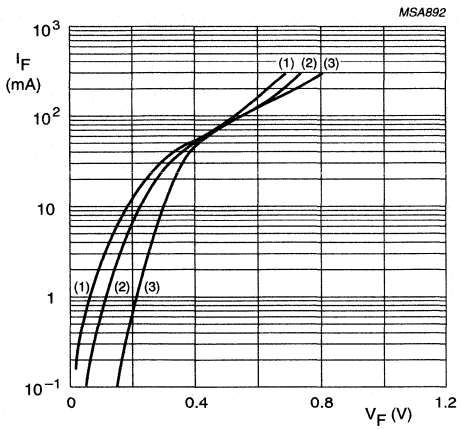
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

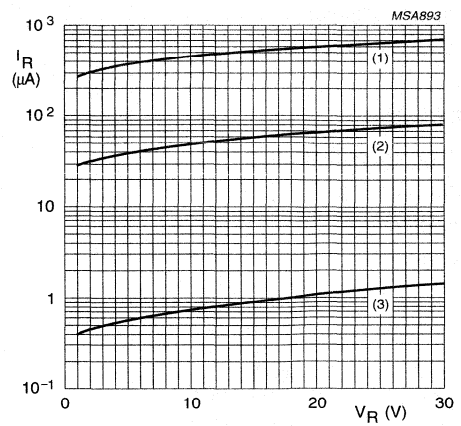
1. Refer to SOT23 standard mounting conditions.

GRAPHICAL DATA



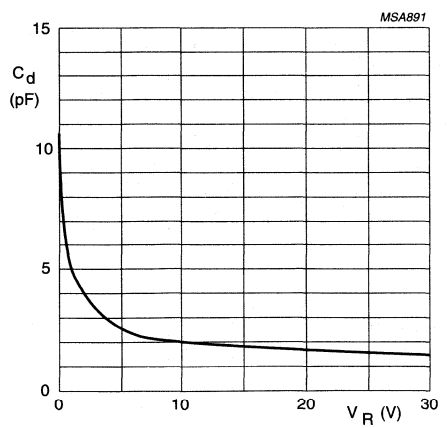
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

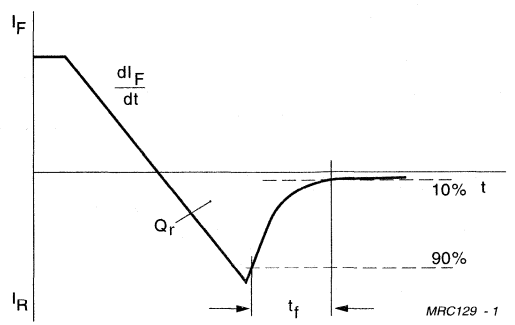


Fig.9 Reverse recovery definitions.

Schottky barrier (double) diodes BAT54W series

FEATURES

- Low forward voltage
- Guard ring protected
- Very small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

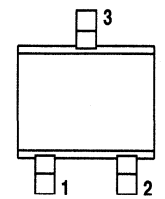
Planar Schottky barrier diodes encapsulated in a SOT323 very small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE
BAT54W	L4
BAT54AW	42
BAT54CW	43
BAT54SW	44

PINNING

PIN	BAT54			
	W	AW	CW	SW
1	a	k_1	a_1	a_1
2	n.c.	k_2	a_2	k_2
3	k	a_1, a_2	k_1, k_2	k_1, a_2



Top view MBC870

Fig.1 Simplified outline (SOT323) and pin configuration.

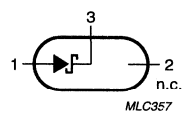


Fig.2 BAT54W single diode configuration (symbol).

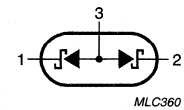


Fig.3 BAT54AW diode configuration (symbol).

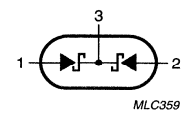


Fig.4 BAT54CW diode configuration (symbol).

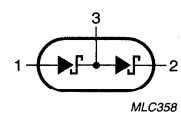


Fig.5 BAT54SW diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.6		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.7	2	μA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA: see Fig.9	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.8	10	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

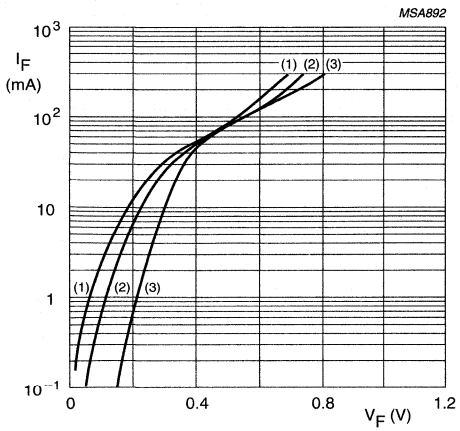
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

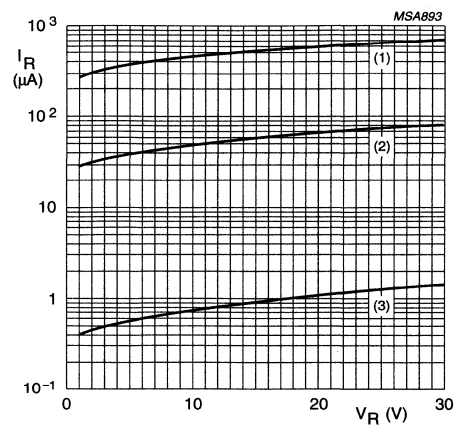
1. Refer to SOT323 standard mounting conditions.

GRAPHICAL DATA



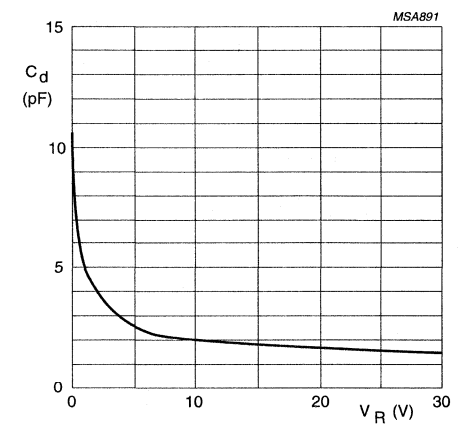
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

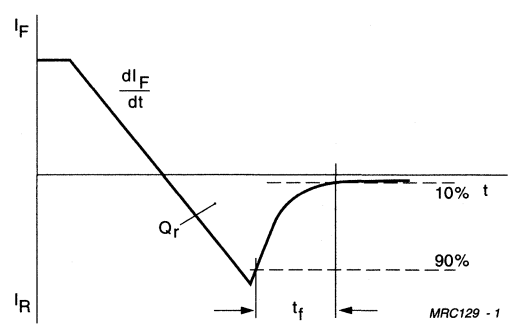


Fig.9 Reverse recovery definitions.

Schottky barrier double diode BAT74

FEATURES

- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

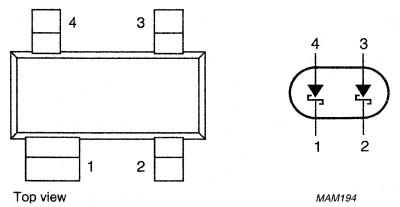
- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier double diode. Two separate dies encapsulated in a SOT143 small plastic SMD package.

PINNING

PIN	DESCRIPTION
1	cathode (k_1)
2	cathode (k_2)
3	anode (a_2)
4	anode (a_1)



Marking code: L41.

Fig.1 Simplified outline (SOT143), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms		600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; see Fig.2	–	230	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C
Double diode operation					
V_R	continuous reverse voltage		–	30	V
		series connection	–	60	V
I_F	continuous forward current		–	110[1]	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	200	mA

Note

1. If both diodes are in forward operation at the same moment, total device current is max. 110 mA. If one diode is in reverse and the other in forward operation at the same moment, total device current is max. 200 mA.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA; note 1	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 2; see Fig.4	2	µA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	10	pF

Note

1. Temperature coefficient of forward voltage –0.6%/K.
2. Pulsed test: t_p = 300µs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Refer to SOT143 standard mounting conditions .

GRAPHICAL DATA

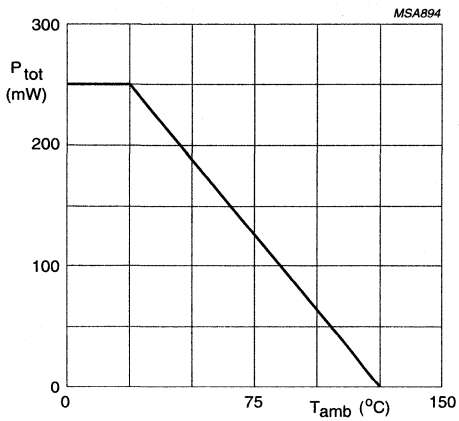
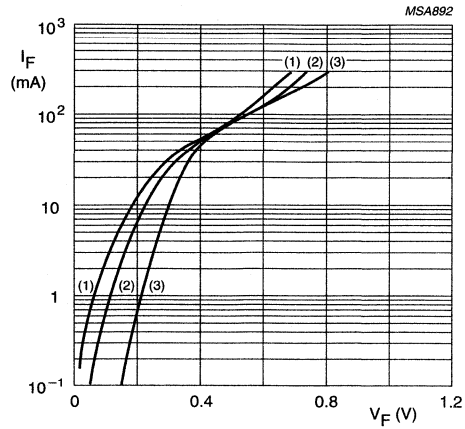
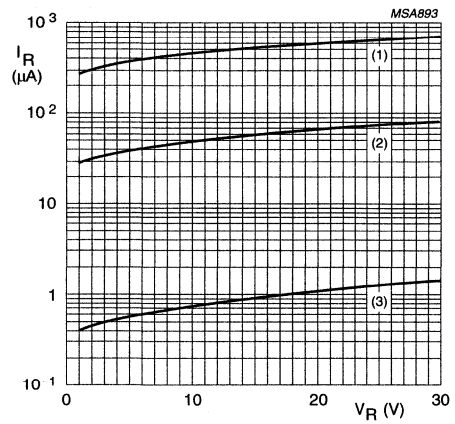


Fig.2 Power derating curve.



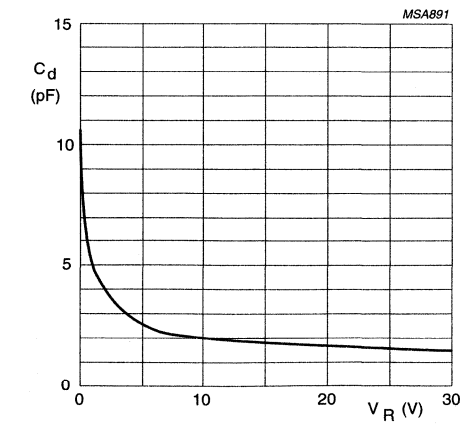
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

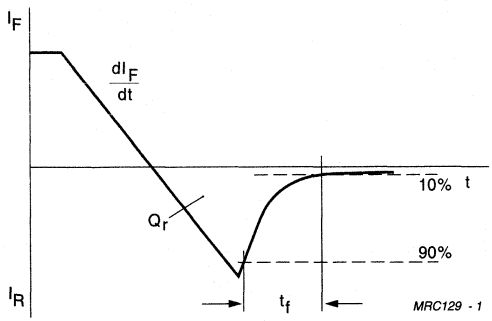


Fig.6 Reverse recovery definitions.

Schottky barrier double diode BAT74S

FEATURES

- Low forward voltage
- Guard ring protected
- Small SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

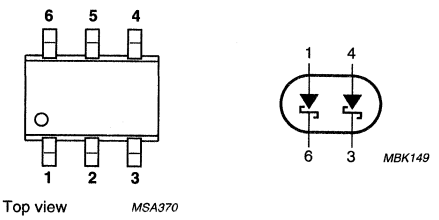
DESCRIPTION

Planar Schottky barrier double diode with an integrated guard ring for stress protection.

Two separate dies are encapsulated in a SOT363 small SMD plastic package.

PINNING

PIN	DESCRIPTION
1	anode (a_1)
2,5	not connected
3	cathode (k_2)
4	anode (a_2)
6	cathode (k_1)



Marking code: 74.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms		600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; see Fig.2	–	230	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C
Double diode operation					
V_R	continuous reverse voltage		–	30	V
V_R	continuous reverse voltage	series connection	–	60	V
I_F	continuous forward current		–	110[1]	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	200	mA

Note

1. If both diodes are in forward operation at the same moment, total device current is max. 110 mA. If one diode is in reverse and the other in forward operation at the same moment, total device current is max. 200 mA.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.4	2	µA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	10	pF

Note

1. Pulsed test: t_p = 300 µs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Refer to SOT363 standard mounting conditions.

GRAPHICAL DATA

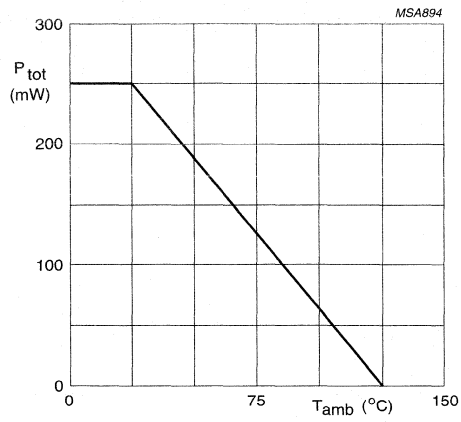
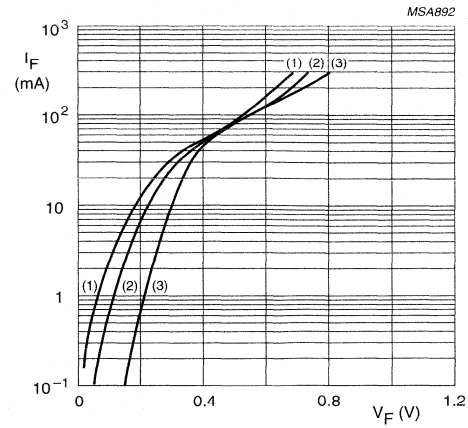
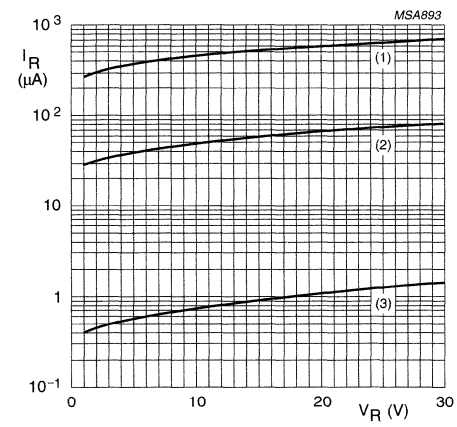


Fig.2 Power derating curve.



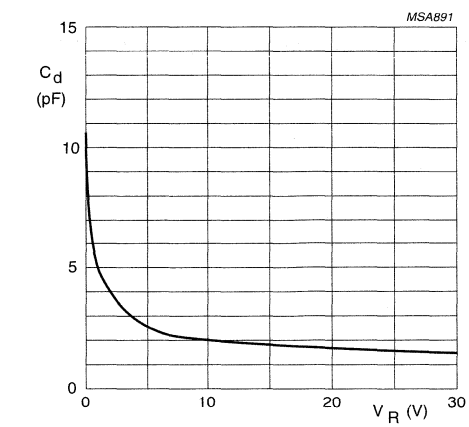
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

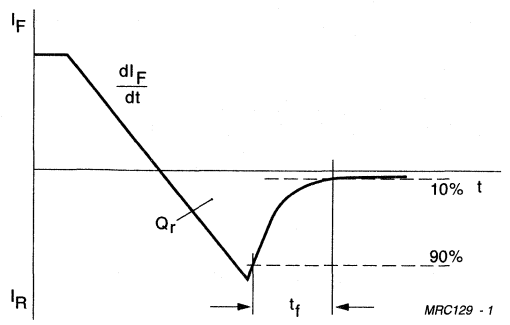


Fig.6 Reverse recovery definitions.

Schottky barrier diodes BAT81; BAT82; BAT83

FEATURES

- Low forward voltage
- High breakdown voltage
- Guard ring protected
- Hermetically-sealed leaded glass package
- Low diode capacitance.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges, encapsulated in a hermetically-sealed subminiature SOD68 (DO-34) package. The diode is suitable for mounting on a 2 E (5.08 mm) pitch.

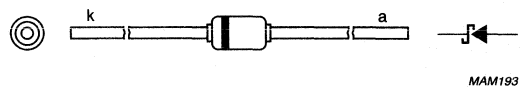


Fig.1 Simplified outline (SOD68; DO-34), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	BAT81		–	40	V
	BAT82		–	50	V
	BAT83		–	60	V
I_F	continuous forward current		–	30	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	150	mA
I_{FSM}	non-repetitive peak forward current	$t_p \leq 10$ ms	–	500	mA
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	330	mV
		I_F = 1 mA	410	mV
		I_F = 15 mA	1	V
I_R	reverse current	$V_R = V_{Rmax}$; see Fig.3	200	nA
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.4	1.6	pF

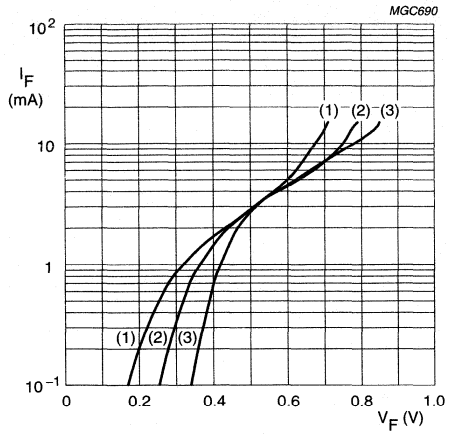
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

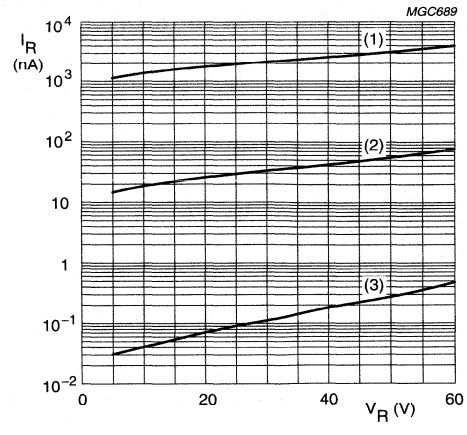
1. Refer to SOD68 standard mounting conditions.

GRAPHICAL DATA



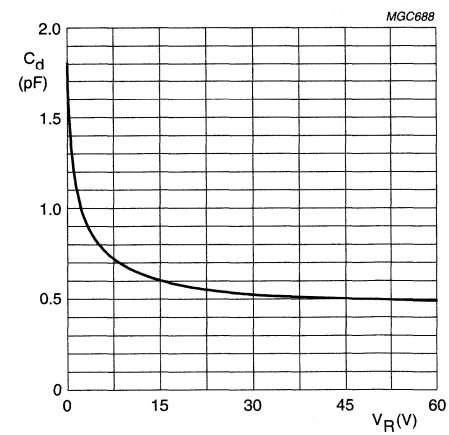
(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode BAT85

FEATURES

- Low forward voltage
- Guard ring protected
- Hermetically-sealed leaded glass package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges, encapsulated in a hermetically-sealed subminiature SOD68 (DO-34) package. The diode is suitable for mounting on a 2 E (5.08 mm) pitch.

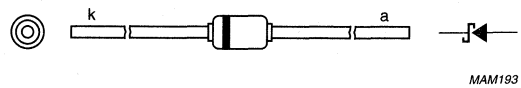


Fig.1 Simplified outline (SOD68; DO-34), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
$I_{F(AV)}$	average forward current	PCB mounting, lead length = 4 mm; V_{RWM} = 25 V; a = 1.57; δ = 0.5; T_{amb} = 50 °C; see Fig.2	–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; δ 0.5	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p \leq 10$ ms	–	5	A
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		−65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; see Fig.4	2	μA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	4	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	10	pF

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

1. Refer to SOD68 standard mounting conditions.

GRAPHICAL DATA

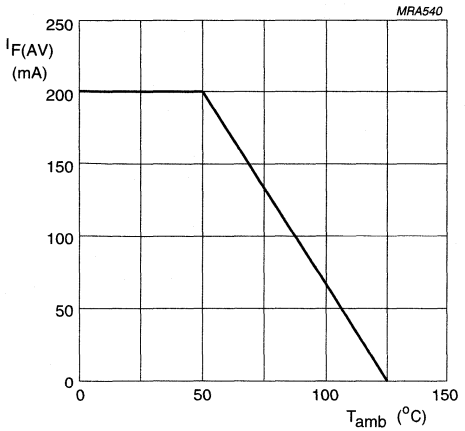
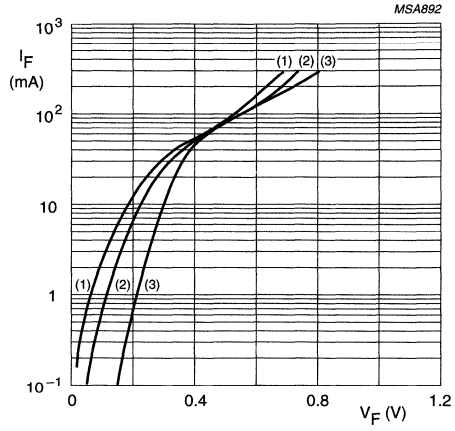
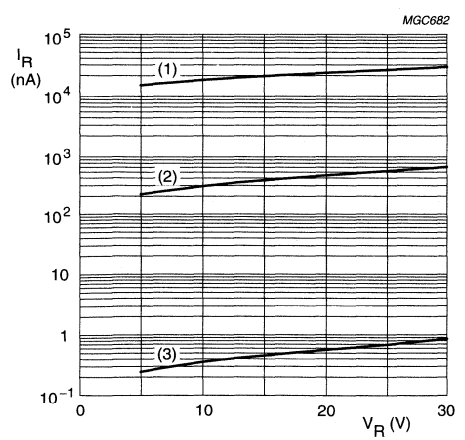


Fig.2 Derating curve.



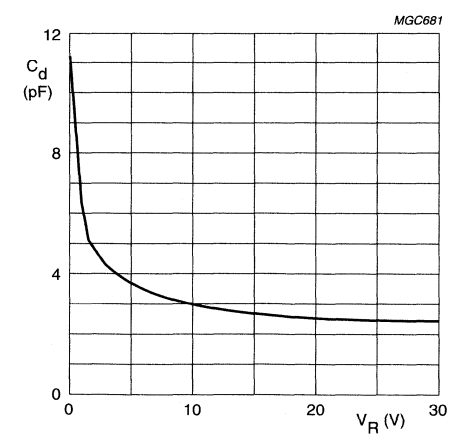
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

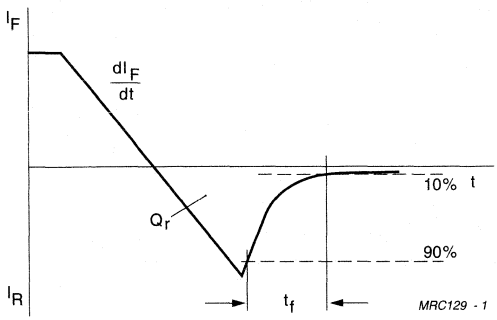


Fig.6 Reverse recovery definitions.

Schottky barrier diode BAT86

FEATURES

- Low forward voltage
- Guard ring protected
- Hermetically-sealed leaded glass package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode with an integrated protection ring against static discharges, encapsulated in a hermetically-sealed subminiature SOD68 (DO-34) package. The diode is suitable for mounting on a 2 E (5.08 mm) pitch.

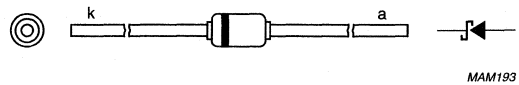


Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current		–	200	mA
$I_{F(AV)}$	average forward current	PCB mounting, lead length = 4 mm; V_{RWM} = 25 V; a = 1.57; δ = 0.5; T_{amb} = 50 °C; see Fig.2	–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	500	mA
I_{FSM}	non-repetitive peak forward current	$t_p \leq 10$ ms	–	5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 0.1 mA	300	mV
		I_F = 1 mA	380	mV
		I_F = 10 mA	450	mV
		I_F = 30 mA	600	mV
		I_F = 100 mA	900	mV
I_R	reverse current	V_R = 40V; see Fig.4; note 1	5	μA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	4	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.5	8	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	320	K/W

Note

1. Refer to SOD68 standard mounting conditions.

GRAPHICAL DATA

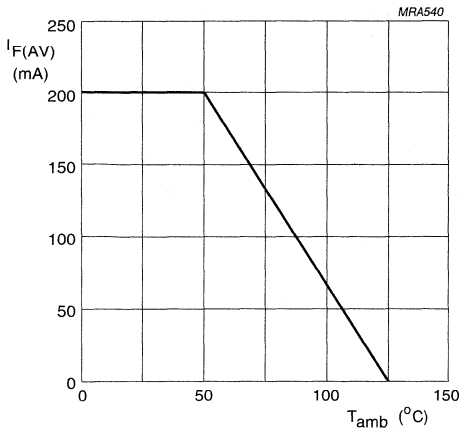
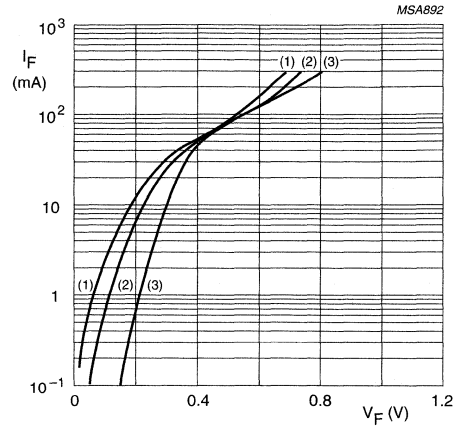
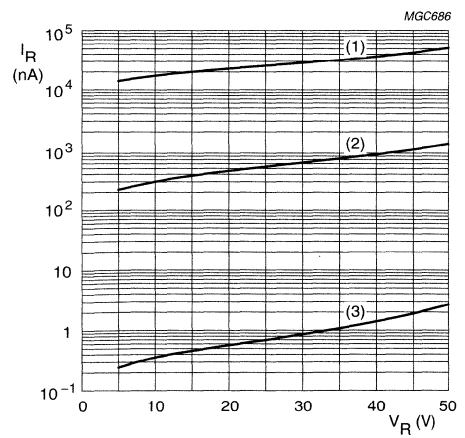


Fig.2 Derating curve.



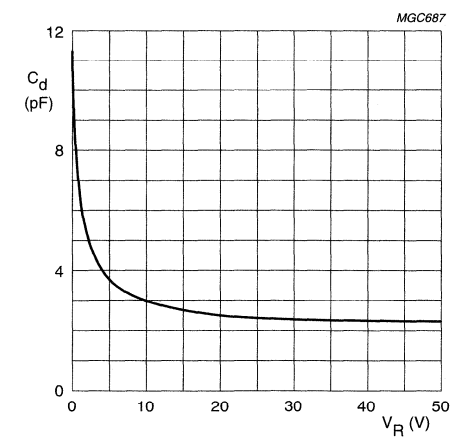
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 85 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

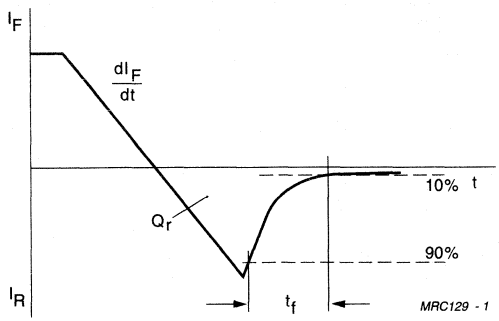


Fig.6 Reverse recovery definitions.

Schottky barrier double diodes BAT120 series

FEATURES

- Low switching losses
- Capability of absorbing very high surge current
- Fast recovery time
- Guard ring protected
- Plastic SMD package.

APPLICATIONS

- Low power switched-mode power supplies
- Rectification
- Polarity protection.

DESCRIPTION

Planar Schottky barrier double diodes encapsulated in a SOT223 plastic SMD package

MARKING

TYPE NUMBER	MARKING CODE
BAT120A	AT120A
BAT120C	AT120C
BAT120S	AT120S

PINNING

PIN	BAT120		
	A	C	S
1	k_1	a_1	a_1
2	n.c.	n.c.	n.c.
3	k_2	a_2	k_2
4	a_1, a_2	k_1, k_2	k_1, a_2

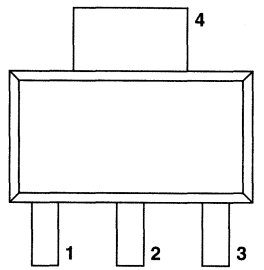


Fig.1 Simplified outline (SOT223) and pin configuration.

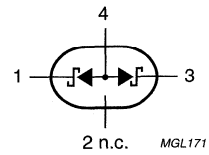


Fig.2 BAT120A diode configuration (symbol).

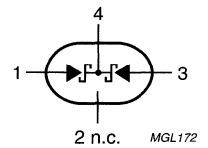


Fig.3 BAT120C diode configuration (symbol).

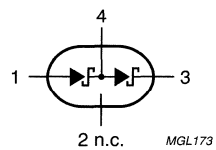


Fig.4 BAT120S diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	25	V
I_F	continuous forward current		–	1	A
I_{FSM}	non-repetitive peak forward current	t_p < 10 ms; half sinewave; JEDEC method	–	10	A
I_{RSM}	non-repetitive peak reverse current	t_p = 100 μs	–	0.5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.5			
		I_F = 100 mA	260	300	mV
		I_F = 1 A	400	450	mV
I_R	reverse current	V_R = 20 V; note 1; see Fig.6	80	500	μA
		V_R = 25 V; note 1; see Fig.6	–	1	mA
		V_R = 20 V; T_j = 100 °C; note 1	–	10	mA
C_d	diode capacitance	f = 1 MHz; V_R = 4 V; see Fig.7	100	–	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

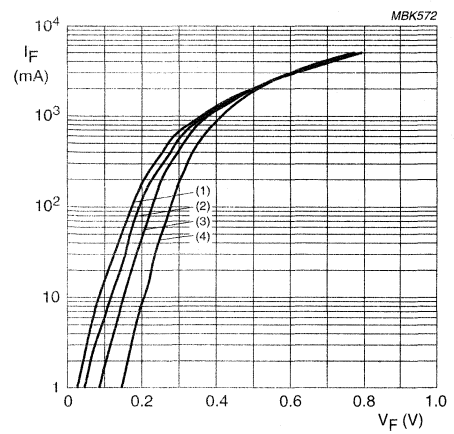
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W

Note

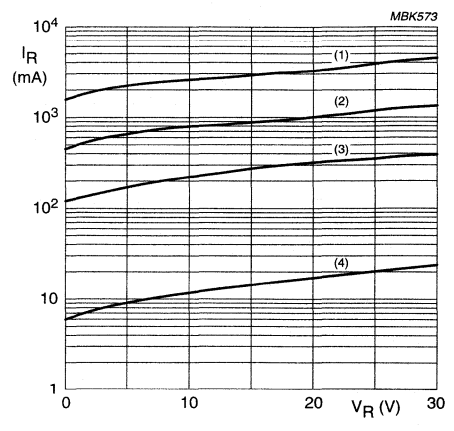
1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA



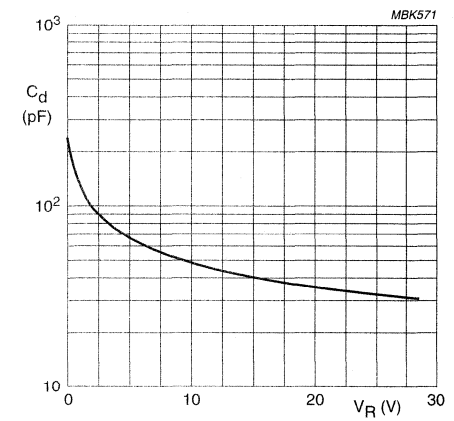
(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.6 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.7 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diodes BAT140 series

FEATURES

- Low switching losses
- Capability of absorbing very high surge current
- Fast recovery time
- Guard ring protected
- Plastic SMD package.

APPLICATIONS

- Low power switched-mode power supplies
- Rectification
- Polarity protection.

DESCRIPTION

Planar Schottky barrier double diodes encapsulated in a SOT223 plastic SMD package.

MARKING

TYPE NUMBER	MARKING CODE
BAT140A	AT140A
BAT140C	AT140C
BAT140S	AT140S

PINNING

PIN	BAT140		
	A	C	S
1	k_1	a_1	a_1
2	n.c.	n.c.	n.c.
3	k_2	a_2	k_2
4	a_1, a_2	k_1, k_2	k_1, a_2

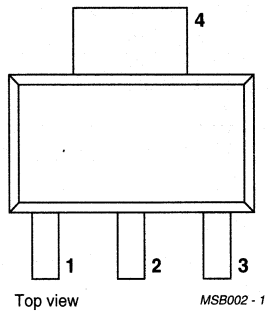


Fig.1 Simplified outline (SOT223) and pin configuration.

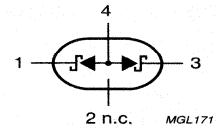


Fig.2 BAT140A diode configuration (symbol).

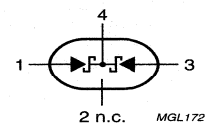


Fig.3 BAT140C diode configuration (symbol).

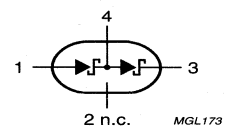


Fig.4 BAT140S diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	1	A
$I_{F(AV)}$	average forward current	T_{amb} = 65 °C; $R_{th\ j\text{-}a}$ = 80 K/W; note 1; $V_{R(equiv)}$ = 0.2 V; note 2	–	1	A
I_{FSM}	non-repetitive peak forward current	t = 8.3 μs half sinewave; JEDEC method	–	10	A
I_{RSM}	non-repetitive peak reverse current	t_p = 100 μs	–	0.5	A
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	125	°C

Notes

1. Refer to SOT223 standard mounting conditions.
2. For Schottky barrier diodes thermal run-away has to be considered, as in some applications, the reverse power losses P_R are a significant part of the total power losses. Nomograms for determination of the reverse power losses P_R and $I_{F(AV)}$ rating will be available on request.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.5			
		I_F = 100 mA; note 1	280	330	mV
		I_F = 1 A; note 1	460	500	mV
I_R	reverse current	V_R = 10 V; note 1; see Fig.6	15	40	μA
		V_R = 40 V; note 1; see Fig.6	60	300	μA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz; see Fig.7	65	80	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

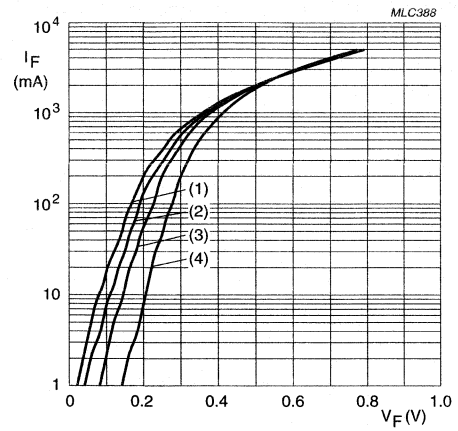
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W

Note

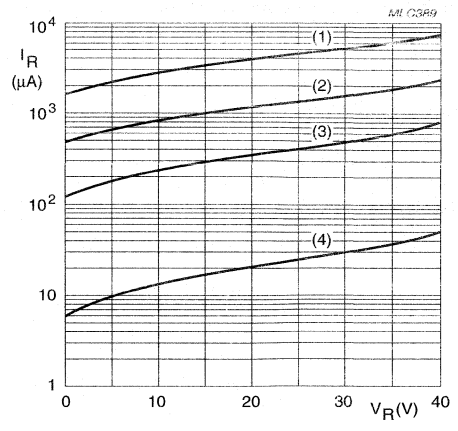
1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA



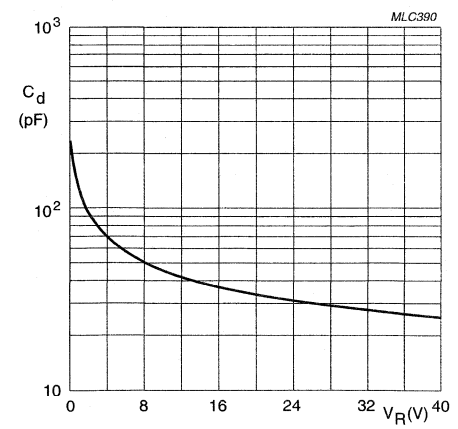
(1) T_{amb} = 125 °C. (3) T_{amb} = 75 °C.
(2) T_{amb} = 100 °C. (4) T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C. (3) T_{amb} = 75 °C.
(2) T_{amb} = 100 °C. (4) T_{amb} = 25 °C.

Fig.6 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.7 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diodes BAT160 series

FEATURES

- Low switching losses
- Capability of absorbing very high surge current
- Fast recovery time
- Guard ring protected
- Plastic SMD package.

APPLICATIONS

- Low power switched-mode power supplies
- Rectification
- Polarity protection.

DESCRIPTION

Planar Schottky barrier double diodes encapsulated in a SOT223 plastic SMD package.

MARKING

TYPE NUMBER	MARKING CODE
BAT160A	AT160A
BAT160C	AT160C
BAT160S	AT160S

PINNING

PIN	BAT160		
	A	C	S
1	k_1	a_1	a_1
2	n.c.	n.c.	n.c.
3	k_2	a_2	k_2
4	a_1, a_2	k_1, k_2	k_1, a_2

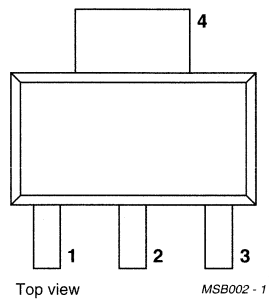


Fig.1 Simplified outline (SOT223) and pin configuration.

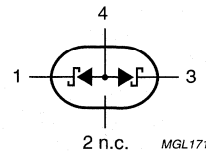


Fig.2 BAT160A diode configuration (symbol).

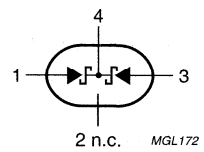


Fig.3 BAT160C diode configuration (symbol).

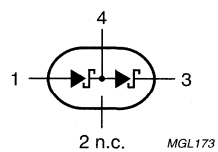


Fig.4 BAT160S diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	60	V
I_F	continuous forward current		–	1	A
I_{FSM}	non-repetitive peak forward current	t_p = 8.3 ms; half sinewave; JEDEC method	–	10	A
I_{RSM}	non-repetitive peak reverse current	t_p = 100 μs	–	0.5	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.5		
		I_F = 100 mA	400	mV
		I_F = 1 A	650	mV
		I_F = 2 A	850	mV
I_R	reverse current	V_R = 60 V; note 1; see Fig.6	350	μA
		V_R = 60 V; T_j = 100 °C; note 1; see Fig.6	8	mA
C_d	diode capacitance	f = 1 MHz; V_R = 4 V; see Fig.7	60	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

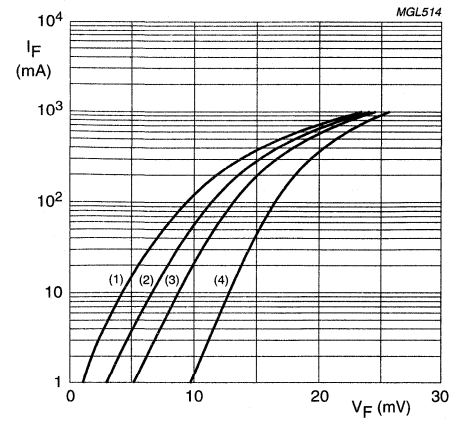
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W

Note

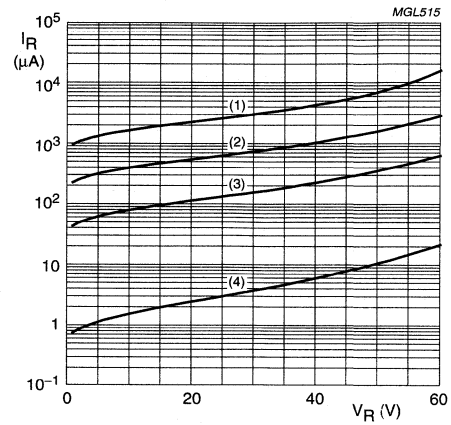
1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA



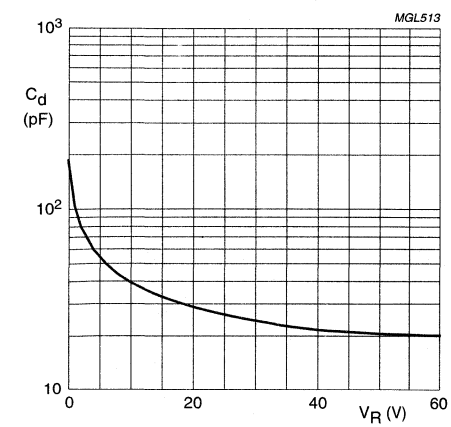
(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 100 °C.
(3) T_{amb} = 75 °C.
(4) T_{amb} = 25 °C.

Fig.6 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.7 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier diode BAT254

FEATURES

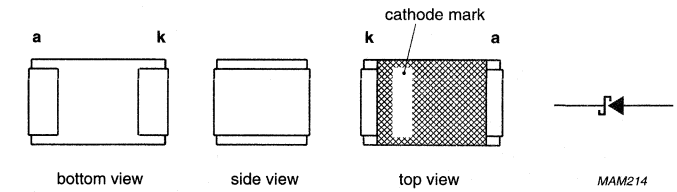
- Low forward voltage
- Guard ring protected
- Very small ceramic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits
- Blocking diodes.

DESCRIPTION

Planar Schottky barrier diode encapsulated in a SOD110 very small ceramic SMD package.



Marking code: L4.

Fig.1 Simplified outline (SOD110) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature		–65	+125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V; note 1; see Fig.3	2	μA
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA: see Fig.5	5	ns
C_d	diode capacitance	f = 1 MHz; V_R = 1 V; see Fig.4	10	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

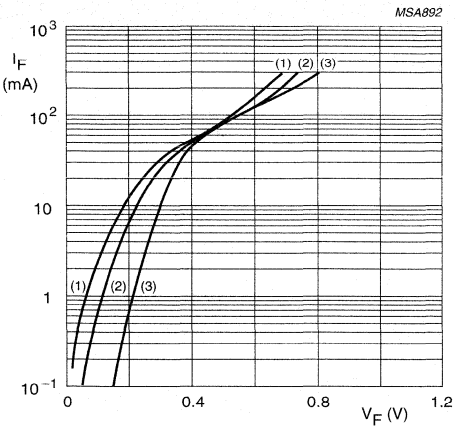
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	315	K/W

Note

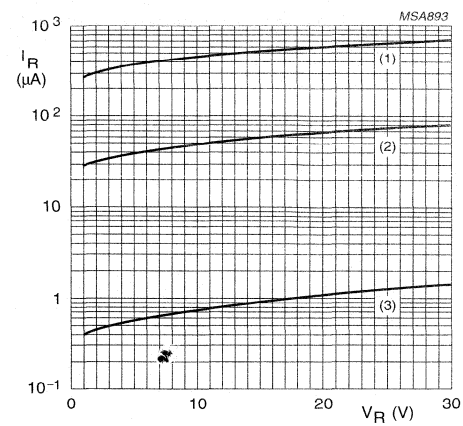
1. Refer to SOD110 standard mounting conditions.

GRAPHICAL DATA



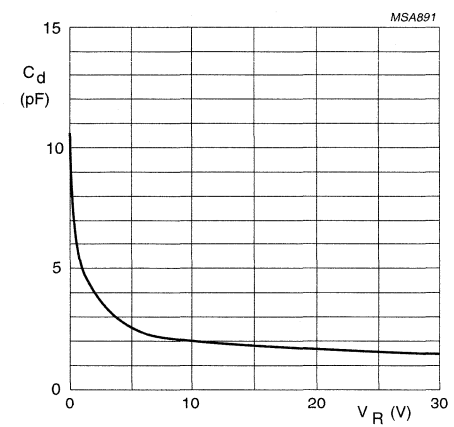
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

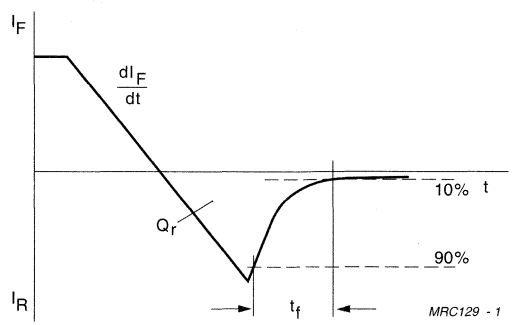
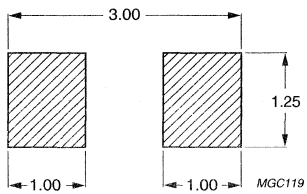


Fig.5 Reverse recovery definitions.

MOUNTING

Reflow soldering

Follow standard reflow soldering techniques to ensure correct application of solder paste and placement of the SOD110 package (see Fig.6).

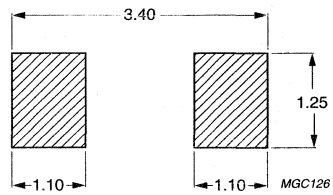


Dimensions in mm.

Fig.6 SOD110 reflow soldering pattern.

Wave soldering

Before wave soldering, attach SOD110 packages to the printed-circuit boards using a small dot of thermo-setting epoxy or UV-curing adhesive centred between the soldering lands (see Fig.7).



Dimensions in mm.

Fig.7 SOD110 wave soldering pattern.

Schottky barrier diode BAT720

FEATURES

- Ultra high switching speed
- Low forward voltage
- Guard ring protected
- Small plastic SMD package.

APPLICATIONS

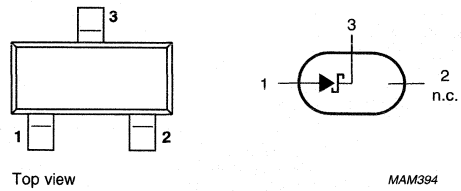
- Ultra high-speed switching
- Voltage clamping
- Protection circuits.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

DESCRIPTION

Planar Schottky barrier diode with an integrated guard ring for stress protection in a small SOT23 plastic SMD package.



Marking code: L6p = made in Hong Kong; L6t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	2	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	I_F = 500 mA; see Fig.2	–	550	mV
I_R	reverse current	V_R = 35 V; see Fig.3	–	100	μA
		V_R = 35 V; T_j = 100 °C; see Fig.3	–	10	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	60	90	pF

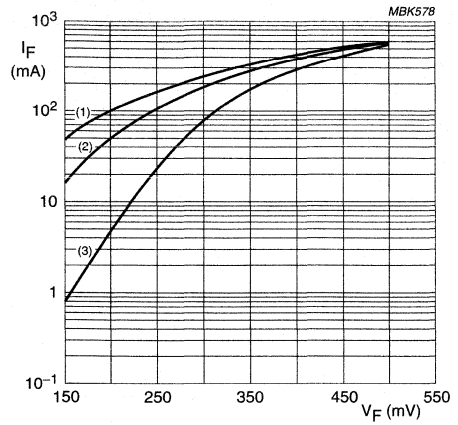
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

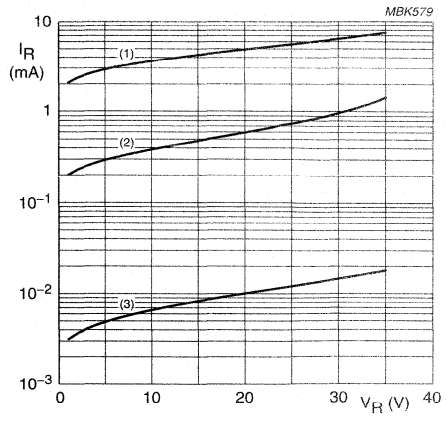
1. Refer to SOT23 standard mounting conditions.

GRAPHICAL DATA



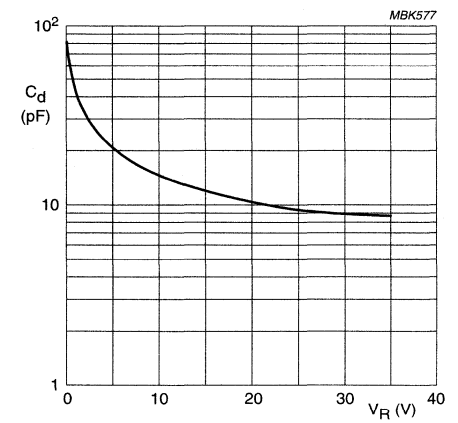
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_j = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier (double) diodes BAT721 series

FEATURES

- Ultra high switching speed
- Low forward voltage
- Guard ring protected
- Small plastic SMD package.

APPLICATIONS

- Ultra high-speed switching
- Voltage clamping
- Protection circuits.

DESCRIPTION

Planar Schottky barrier diodes encapsulated in a SOT23 small plastic SMD package. Single diodes and double diodes with different pinning are available.

MARKING

TYPE NUMBER	MARKING CODE[1]
BAT721	L7*
BAT721A	L8*
BAT721C	L9*
BAT721S	L0*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	BAT721			
		A	C	S
1	a	k_1	a_1	a_1
2	n.c.	k_2	a_2	k_2
3	k	a_1, a_2	k_1, k_2	k_1, a_2

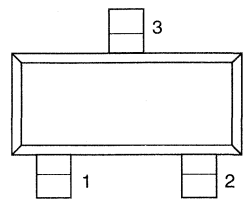


Fig.1 Simplified outline (SOT23) and pin configuration.

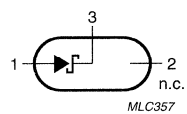


Fig.2 BAT721 single diode configuration (symbol).

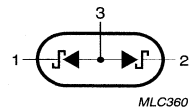


Fig.3 BAT721A diode configuration (symbol).

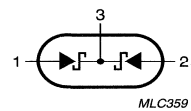


Fig.4 BAT721C diode configuration (symbol).

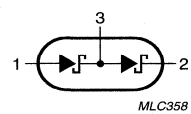


Fig.5 BAT721S diode configuration (symbol).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	40	V
I_F	continuous forward current		–	200	mA
I_{FSM}	non-repetitive peak forward current	t_p = 8.3 ms half sinewave; JEDEC method	–	1	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	continuous forward voltage	see Fig.6			
		I_F = 10 mA	–	300	mV
		I_F = 100 mA	–	420	mV
		I_F = 200 mA	–	550	mV
I_R	continuous reverse current	V_R = 30 V; see Fig.7	–	15	µA
		V_R = 30 V; T_j = 100 °C; see Fig.7	–	3	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.8	40	50	pF

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

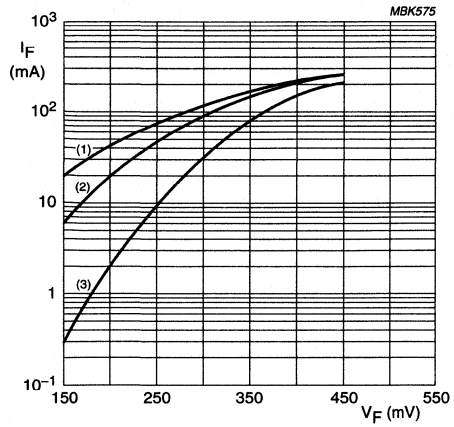
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

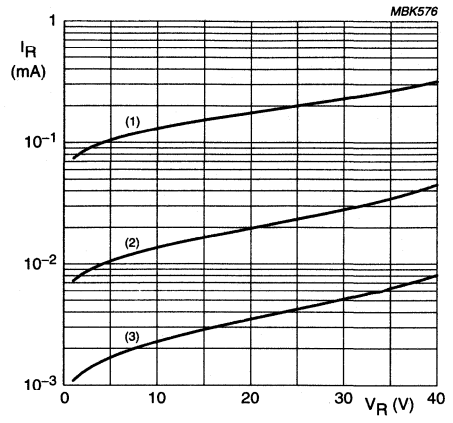
1. Refer to SOT23 standard mounting conditions.

GRAPHICAL DATA



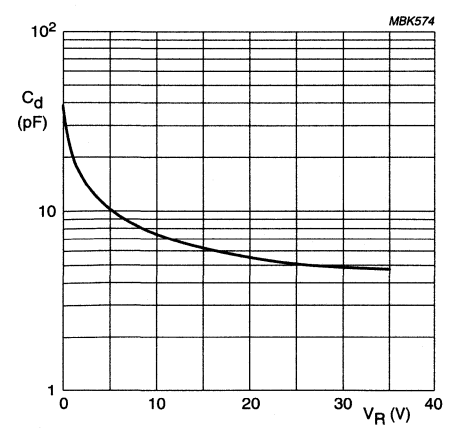
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_j = 25 °C.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

High-speed diode BAV10

FEATURES

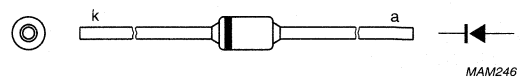
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 6 ns
- General application
- Continuous reverse voltage: max. 60 V
- Repetitive peak reverse voltage: max. 60 V
- Repetitive peak forward current: max. 600 mA.

APPLICATIONS

- High-speed switching.

DESCRIPTION

The BAV10 is a high-speed switching diode fabricated in planar technology, and encapsulated in the hermetically sealed leaded glass SOD27 (DO-35) package.



The diode is type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	60	V
V_R	continuous reverse voltage		–	60	V
I_F	continuous forward current	see Fig.2; note 1	–	300	mA
I_{FRM}	repetitive peak forward current		–	600	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	350	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 10 mA	–	750	mV
		I_F = 200 mA	–	1.0	V
		I_F = 500 mA	–	1.25	V
		I_F = 200 mA; T_j = 100 °C	–	950	mV
I_R	reverse current	see Fig.5			
		V_R = 60 V	–	100	nA
		V_R = 60 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	2.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA; see Fig.7	–	6	ns
V_{fr}	forward recovery voltage	when switched from I_F = 400 mA; t_r = 30 ns; see Fig.8	–	2	V
		when switched from I_F = 400 mA; t_r = 10 ns; see Fig.8	–	1.5	V

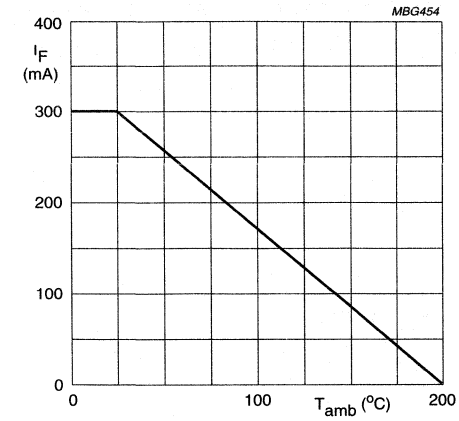
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	500	K/W

Note

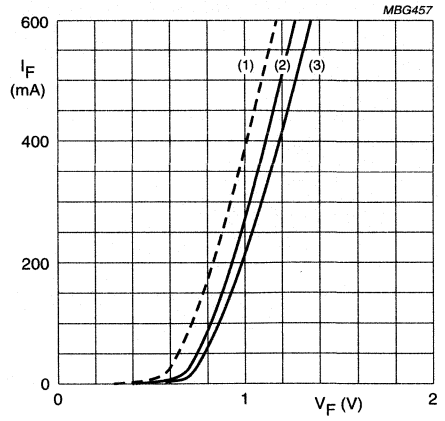
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



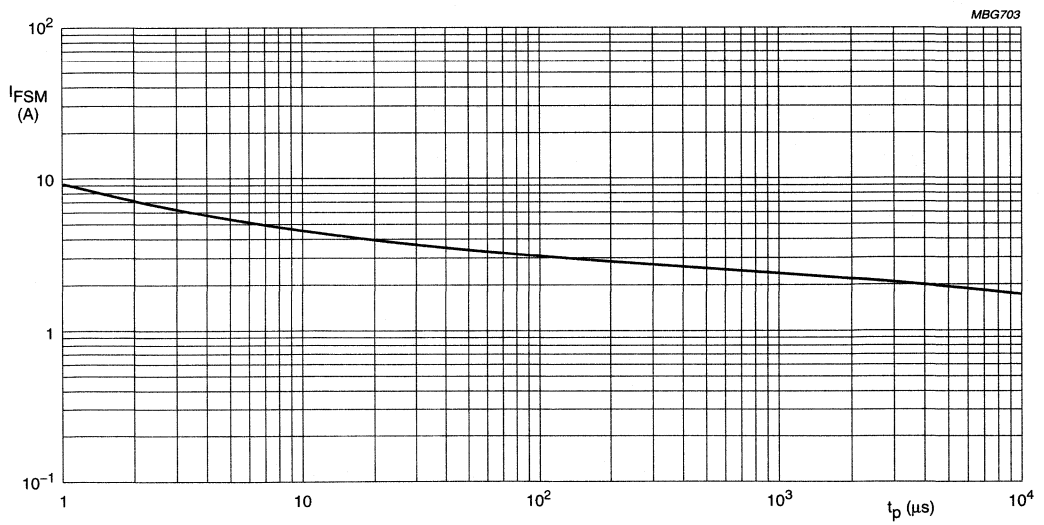
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



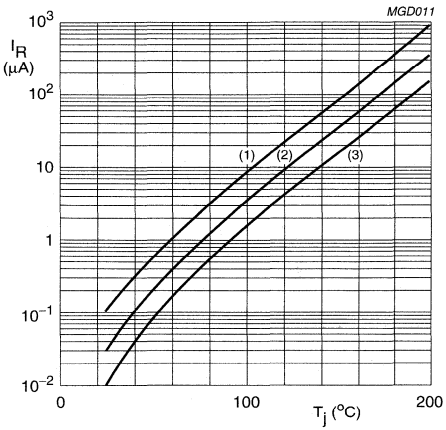
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



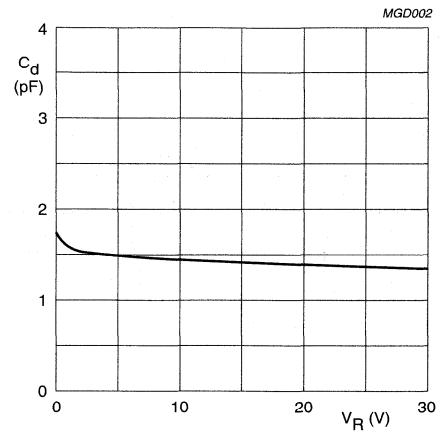
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



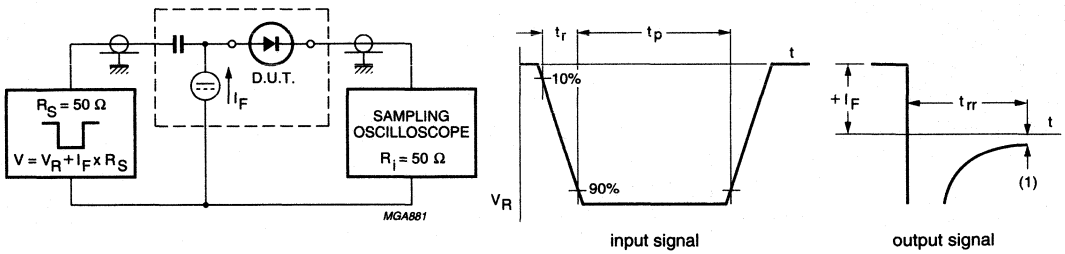
(1) V_R = 60 V; maximum values.
(2) V_R = 60 V; typical values.
(3) V_R = 30 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



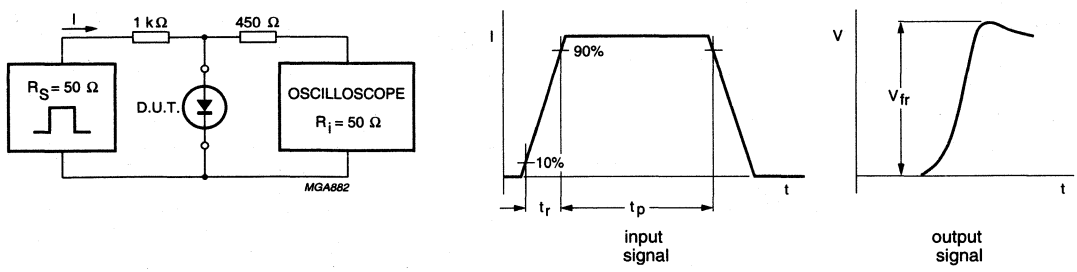
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 40 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse duration t_p = 300 ns; duty factor δ = 0.01.

Fig.8 Forward recovery voltage test circuit and waveforms.

General purpose diodes BAV20; BAV21

FEATURES

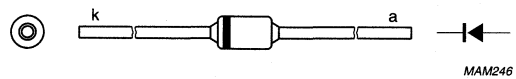
- Hermetically sealed leaded glass SOD27 (DO-35) package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 150 V, 200 V
- Repetitive peak reverse voltage: max. 200 V, 250 V
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

- General purposes in industrial equipment e.g. oscilloscopes, digital voltmeters and video output stages in colour television.

DESCRIPTION

The BAV20 and BAV21 are switching diodes fabricated in planar technology, and encapsulated in hermetically sealed leaded glass SOD27 (DO-35) packages.



The diodes are type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage				
	BAV20		–	200	V
	BAV21		–	250	V
V_R	continuous peak reverse voltage				
	BAV20		–	150	V
	BAV21		–	200	V
I_F	continuous forward current	see Fig.2; note 1	–	250	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	400	mW
T_{stg}	storage temperature		−65	+175	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 100 mA	–	1.0	V
		I_F = 200 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		$V_R = V_{Rmax}$	–	100	nA
		$V_R = V_{Rmax}$; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.8	–	50	ns

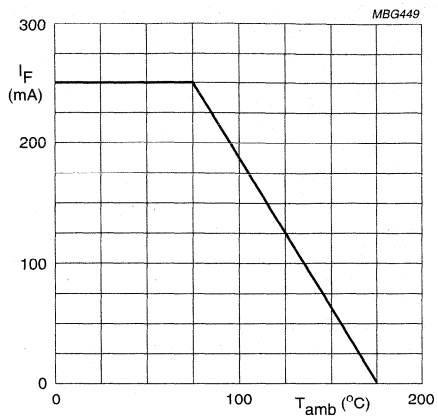
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	375	K/W

Note

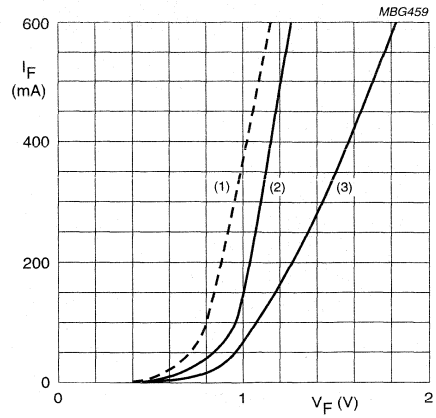
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



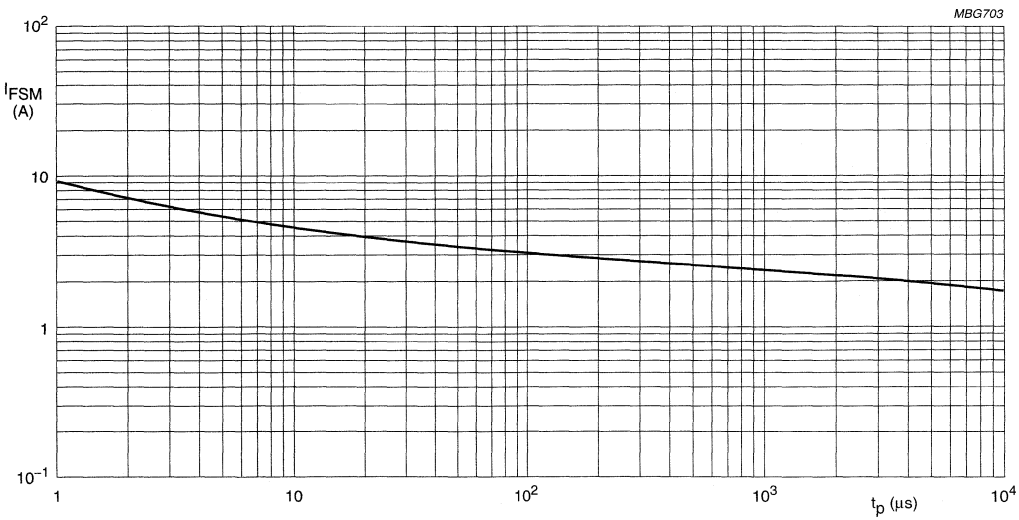
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



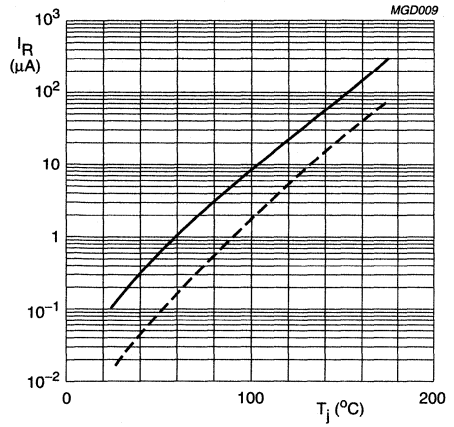
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



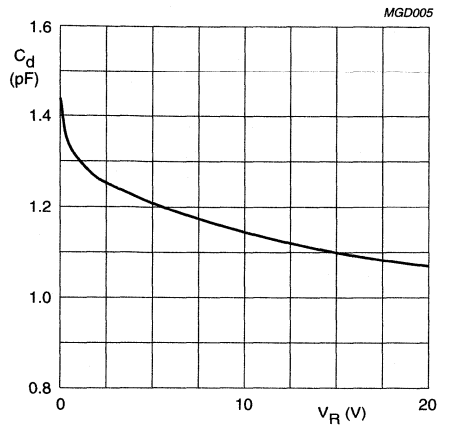
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



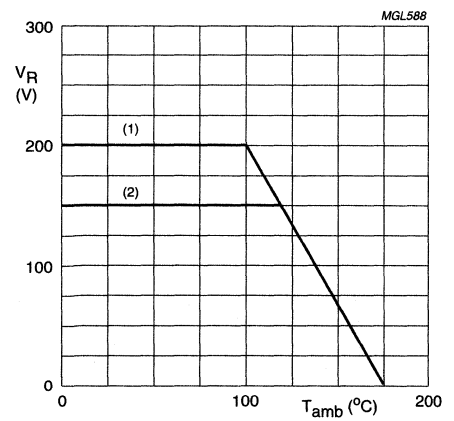
$V_R = V_{Rmax}$.
Solid line; maximum values.
Dotted line; typical values.

Fig.5 Reverse current as a function of junction temperature.



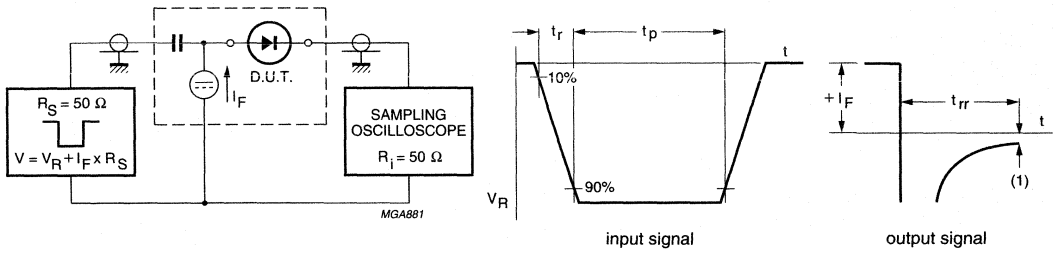
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) BAV21.
(2) BAV20.

Fig.7 Maximum permissible continuous reverse voltage as a function of ambient temperature.



(1) I_R = 3 mA.

Fig.8 Reverse recovery voltage test circuit and waveforms.

General purpose double diode BAV23

FEATURES

- Small plastic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 200 V
- Repetitive peak reverse voltage: max. 250 V
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

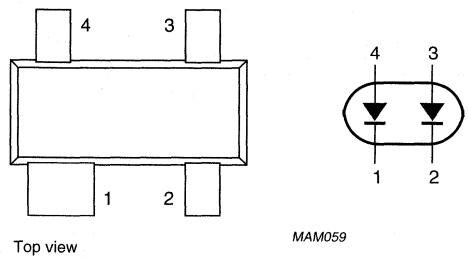
- General purpose where high breakdown voltages are required.

DESCRIPTION

The BAV23 consists of two general purpose diodes fabricated in planar technology, and encapsulated in the small plastic SMD SOT143 package. The diodes are not connected.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	anode (a2)
4	anode (a1)



Marking code: L30.

Fig.1 Simplified outline (SOT143) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	250	V
V_{RRM}	repetitive peak reverse voltage	series connection		500	V
V_R	continuous reverse voltage		–	200	V
V_R	continuous reverse voltage	series connection	–	400	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	225	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 10 ms	–	1.7	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 100 mA	–	1.0	V
		I_F = 200 mA	–	1.25	V
V_F	forward voltage	series connection; see Fig.3			
		I_F = 100 mA	–	2.0	V
		I_F = 200 mA	–	2.5	V
I_R	reverse current	see Fig.5			
		V_R = 200 V	–	100	nA
		V_R = 200 V; T_j = 150 °C	–	100	µA
I_R	reverse current	series connection	–		
		V_R = 400 V	–	100	nA
		V_R = 400 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	5	pF
		series connection; f = 1 MHz; V_R = 0; see Fig.6	–	2.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.7	–	50	ns

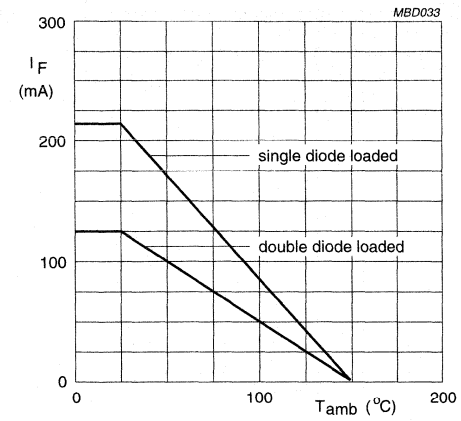
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

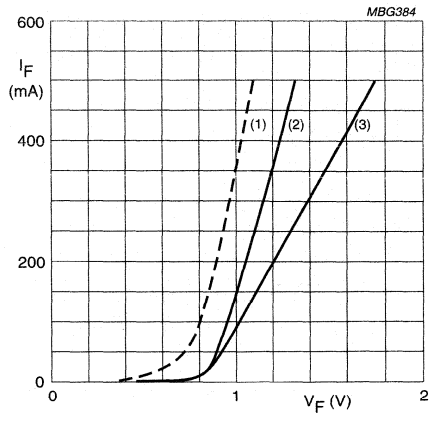
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



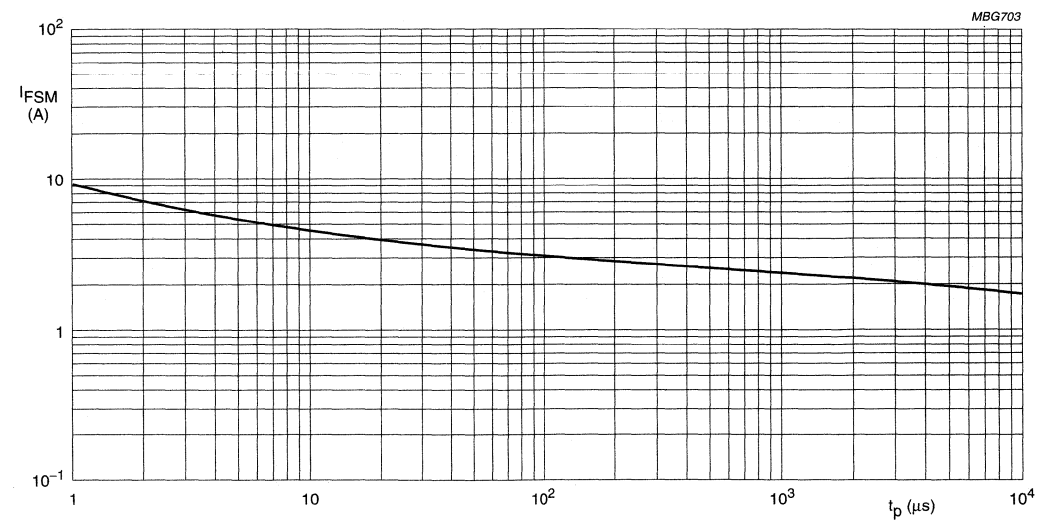
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



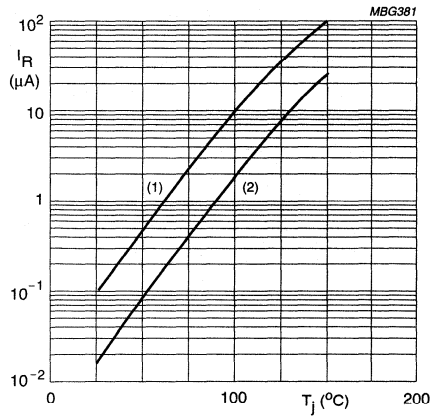
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



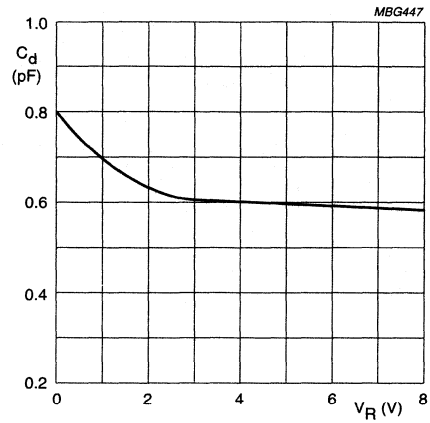
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



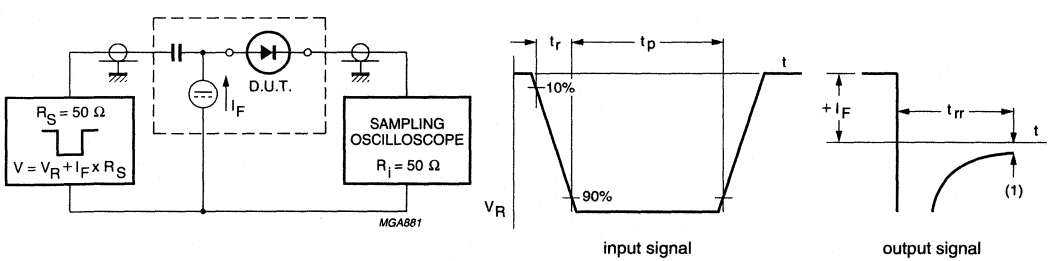
(1) V_R = 200 V; maximum values.
(2) V_R = 200 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 3 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

General purpose double diode BAV23S

FEATURES

- Small plastic SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 200 V
- Repetitive peak reverse voltage: max. 250 V
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

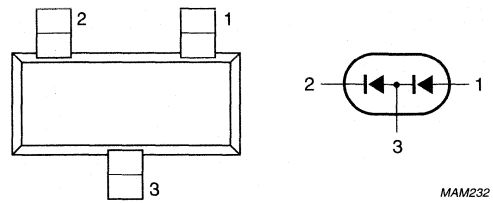
- General purpose where high breakdown voltages are required.

DESCRIPTION

The BAV23S consists of two general purpose diodes connected in series fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: L31.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	250	V
V_{RRM}	repetitive peak reverse voltage	series connection	–	500	V
V_R	continuous reverse voltage		–	200	V
V_R	continuous reverse voltage	series connection	–	400	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	225	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 10 ms	–	1.7	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 100 mA	1.0	V
		I_F = 200 mA	1.25	V
V_F	forward voltage	series connection; see Fig.3		
		I_F = 100 mA	2.0	V
		I_F = 200 mA	2.5	V
I_R	reverse current	see Fig.5		
		V_R = 200 V	100	nA
		V_R = 200 V; T_j = 150 °C	100	mA
I_R	reverse current	series connection		
		V_R = 400 V	100	nA
		V_R = 400 V; T_j = 150 °C	100	mA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.7	50	ns

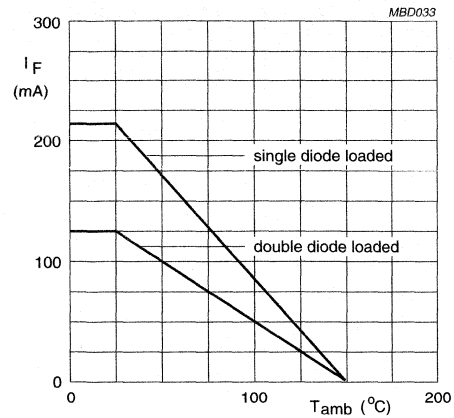
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

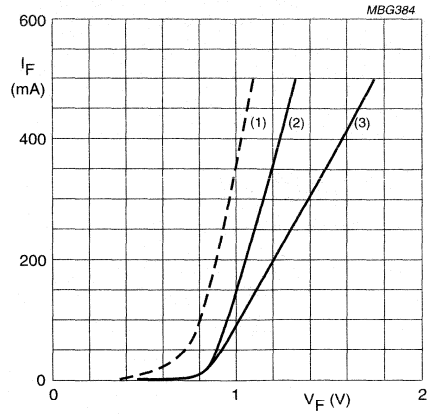
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



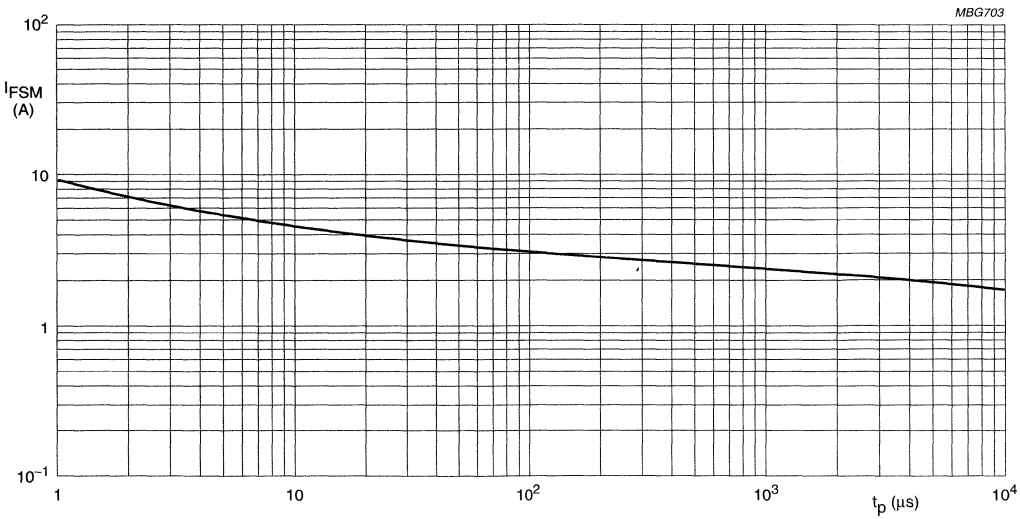
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



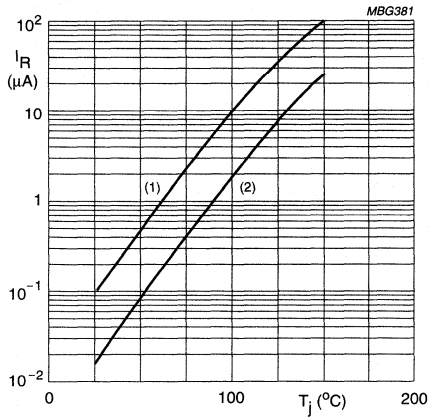
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



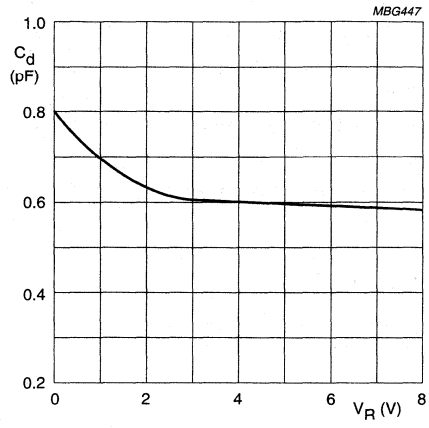
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



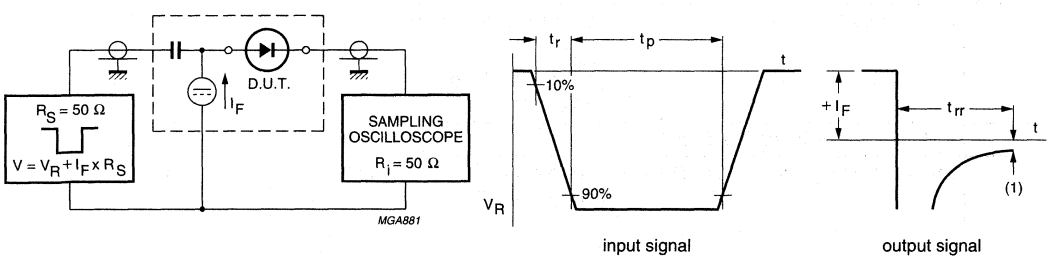
(1) V_R = 200 V; maximum values.
(2) V_R = 200 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 3 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

High-speed double diode BAV70

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

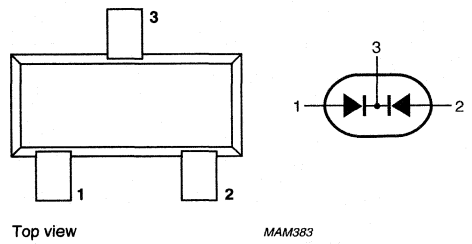
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The BAV70 consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode



Marking code: A4p = made in Hong Kong. A4t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	215	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	µA
		V_R = 25 V; T_j = 150 °C	60	µA
		V_R = 75 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

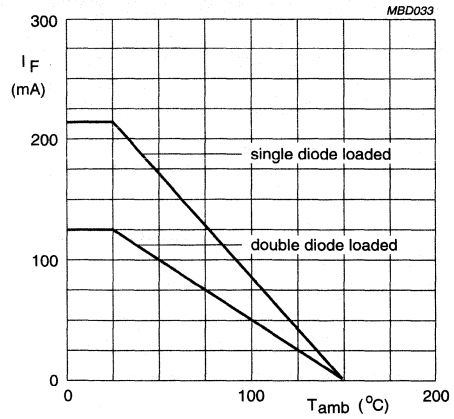
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

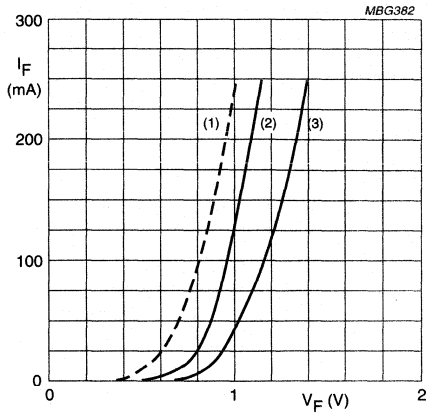
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



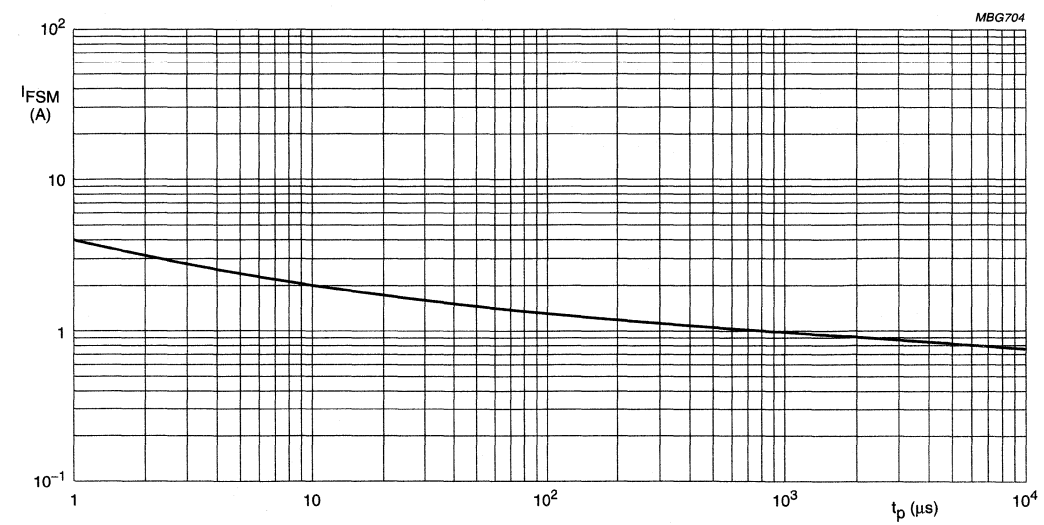
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

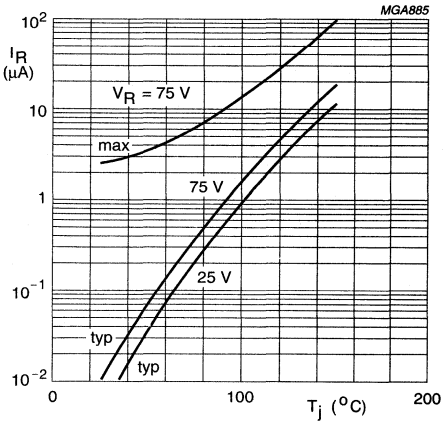
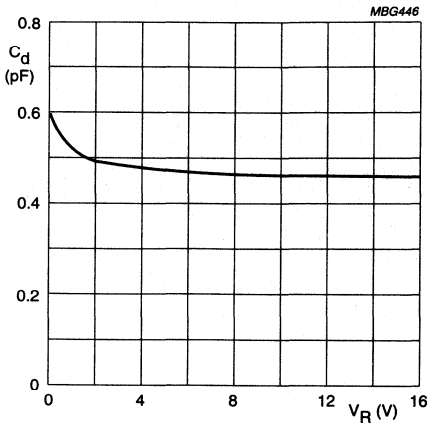
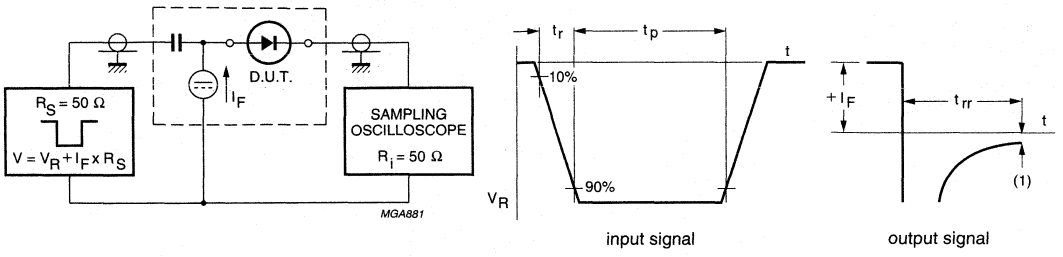


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

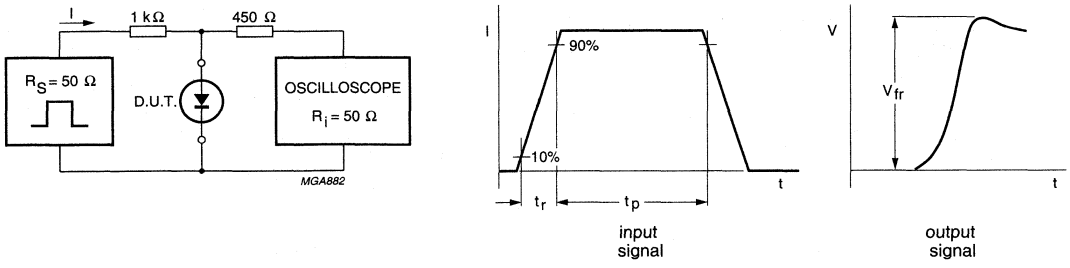


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode array BAV70S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

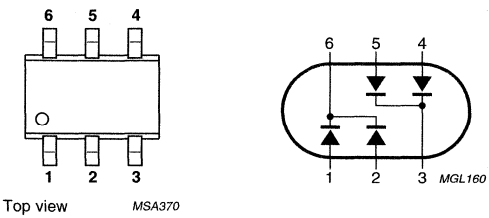
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV70S consists of two dual high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode (k1)
4	anode (a3)
5	anode (a4)
6	common cathode (k2)



Marking code: A4t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	μA
		V_R = 25 V; T_j = 150 °C	60	μA
		V_R = 75 V; T_j = 150 °C	100	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

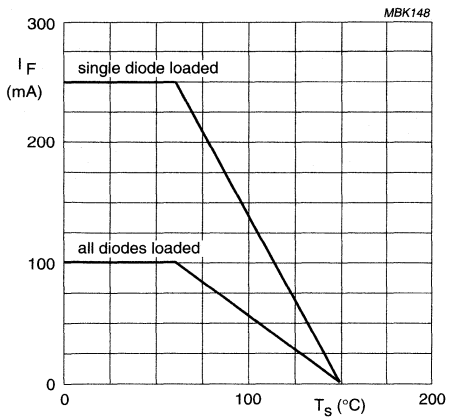
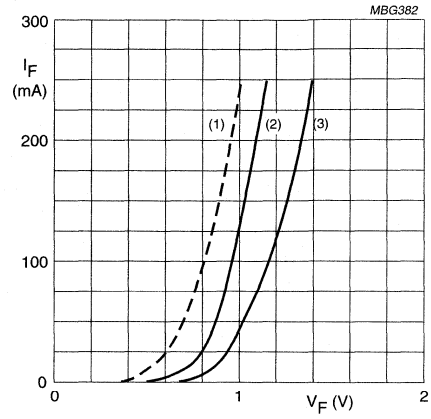
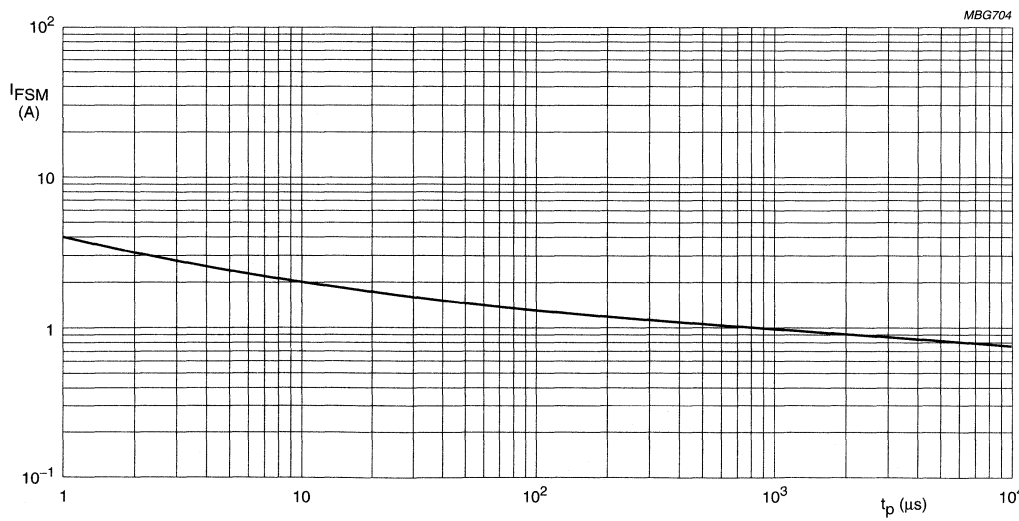


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

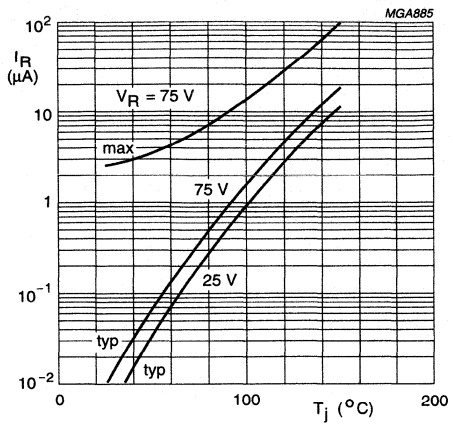
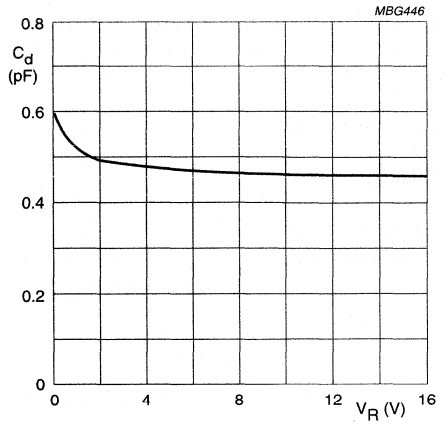
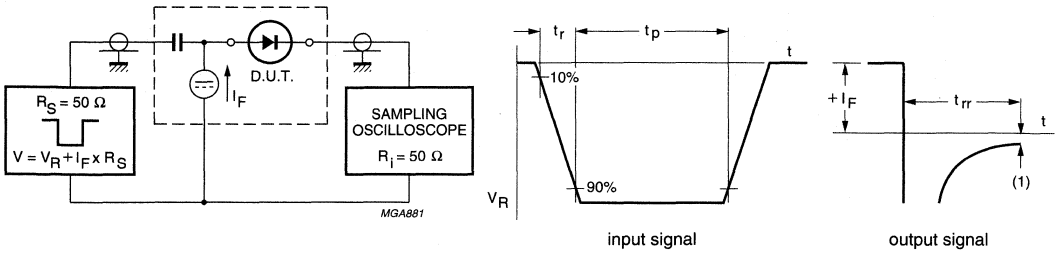


Fig.5 Reverse current as a function of junction temperature.



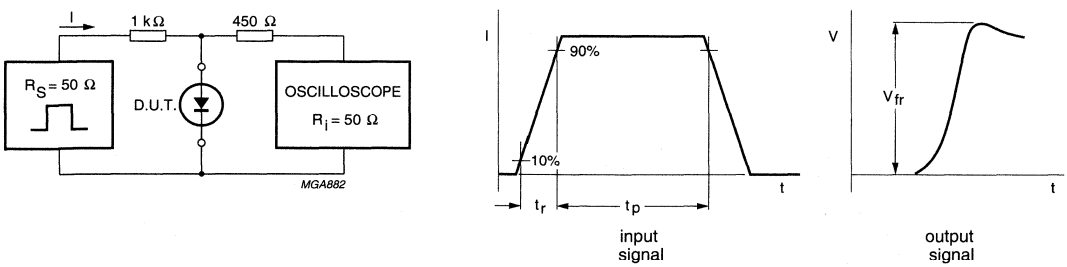
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.
Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq$ 100 ns; duty factor $\delta \leq$ 0.005.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAV70T

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

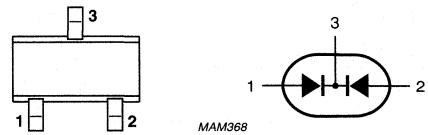
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

Two high-speed switching diodes in a common cathode configuration, fabricated in planar technology, in a very small rectangular SMD SOT416 (SC-75) package.

PINNING

PIN	DESCRIPTION
1	anode 1
2	anode 2
3	common cathode



Marking code: A4.

Fig.1 Simplified outline (SOT416; SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode (unless otherwise specified)					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	T_s = 90 °C; see Fig.2			
		single diode loaded	–	150	mA
		both diodes loaded	–	75	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 90 °C; one diode loaded	–	170	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	+150	°C

ELECTRICAL CHARACTERISTICS

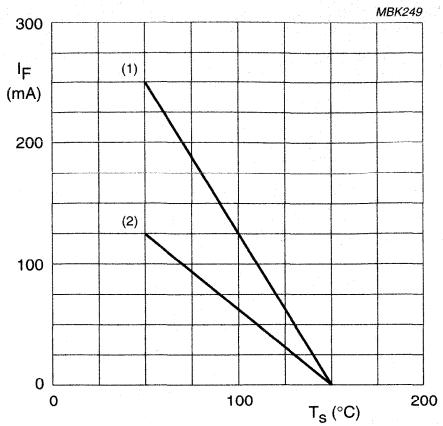
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	0.715	V
		I_F = 10 mA	0.855	V
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2	μA
		V_R = 25 V; T_j = 150 °C	60	μA
		V_R = 75 V; T_j = 150 °C	100	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

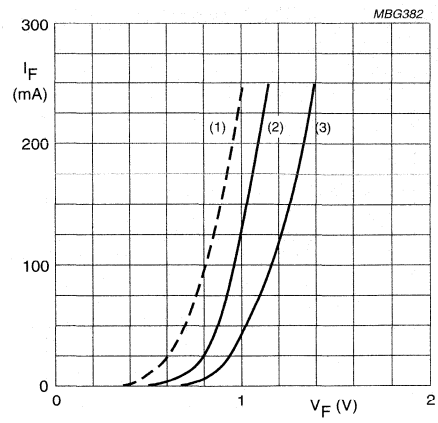
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one diode loaded	350	K/W

GRAPHICAL DATA



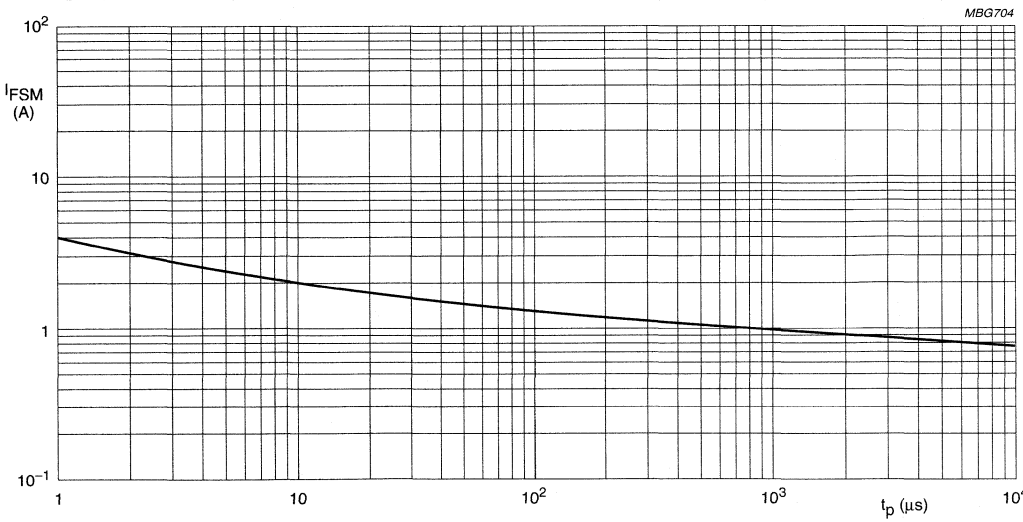
(1) One diode loaded.
(2) Both diodes loaded.

Fig.2 Maximum permissible continuous forward current per diode as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

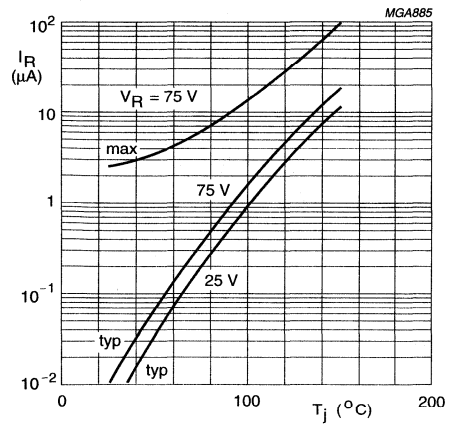
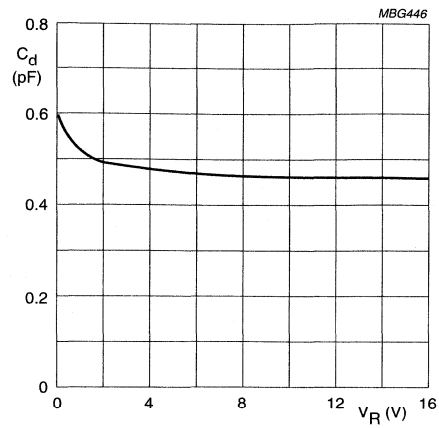
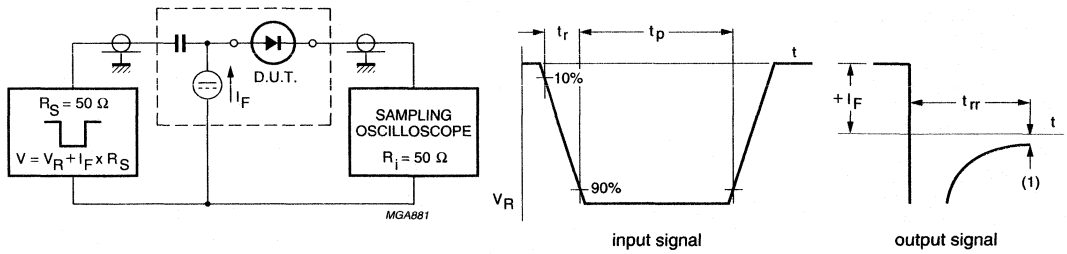


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

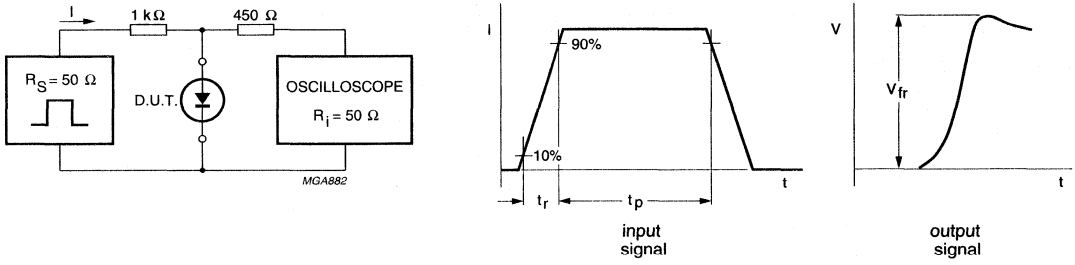


(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$.

Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAV70W

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

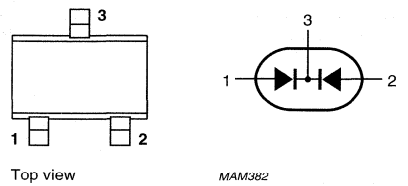
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV70W consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the very small SOT323 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode



Marking code: A4.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	175	mA
		double diode loaded; note 1; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	µA
		V_R = 25 V; T_j = 150 °C	60	µA
		V_R = 75 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

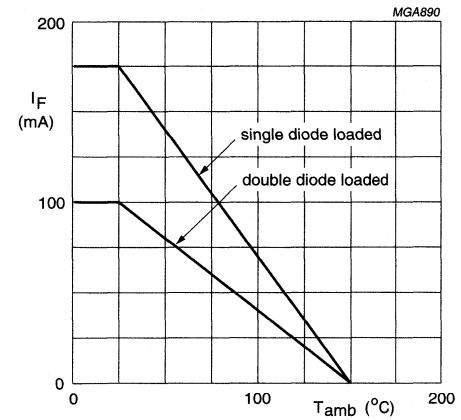
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

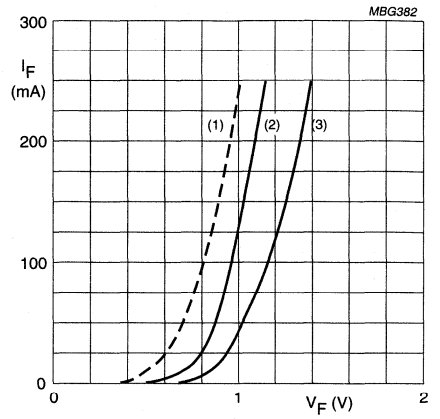
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



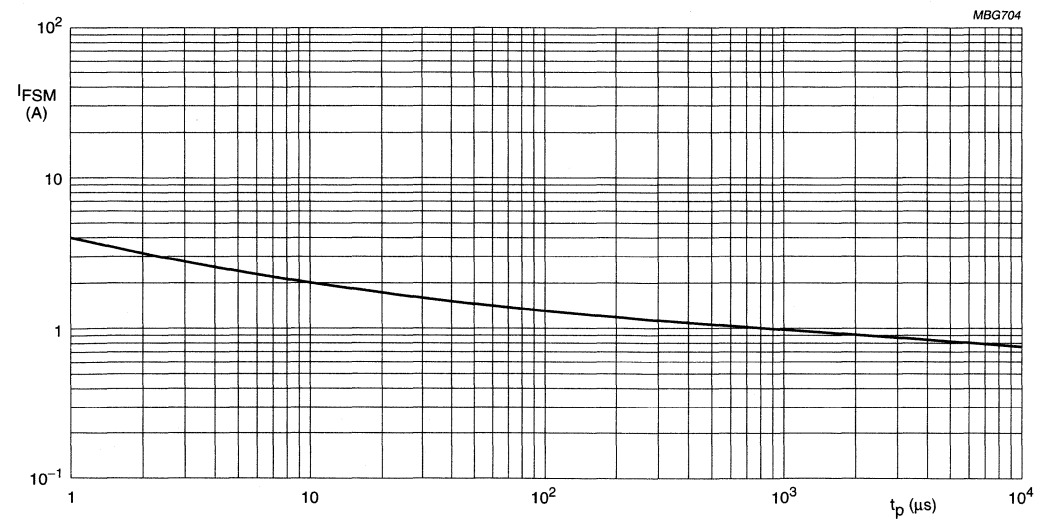
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

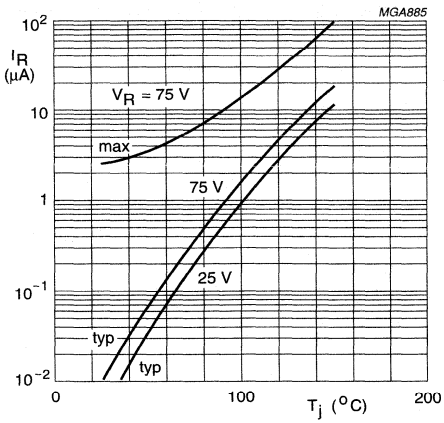
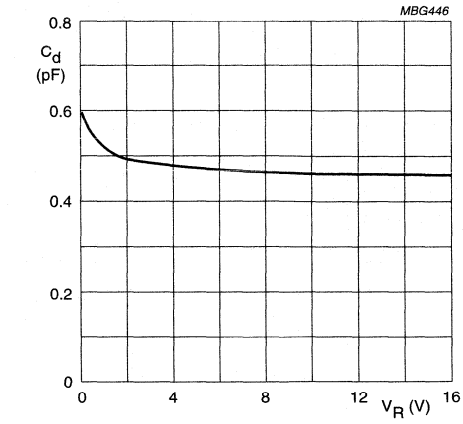
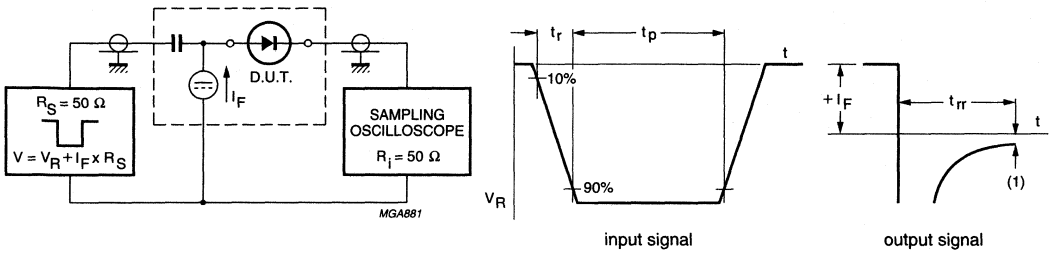


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

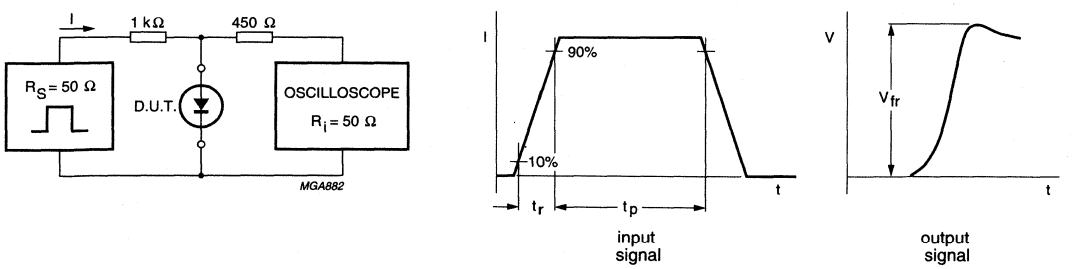


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAV74

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 50 V
- Repetitive peak reverse voltage: max. 60 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

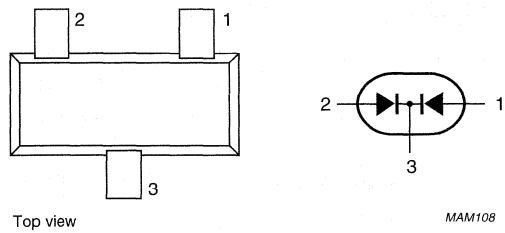
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The BAV74 consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	cathode



Marking code: JAp = made in Hong Kong; JAt= made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	60	V
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	215	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 100 mA	1.0	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 50 V	0.1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 50 V; T_j = 150 °C	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

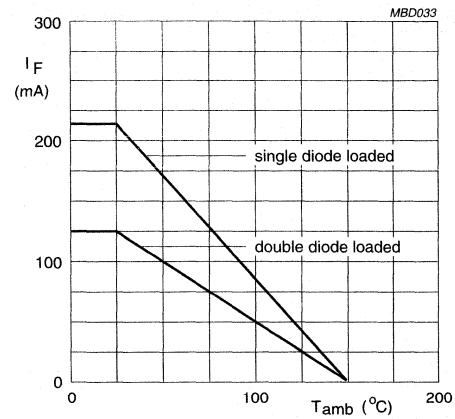
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

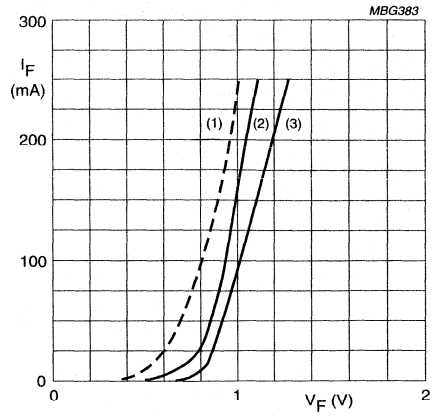
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



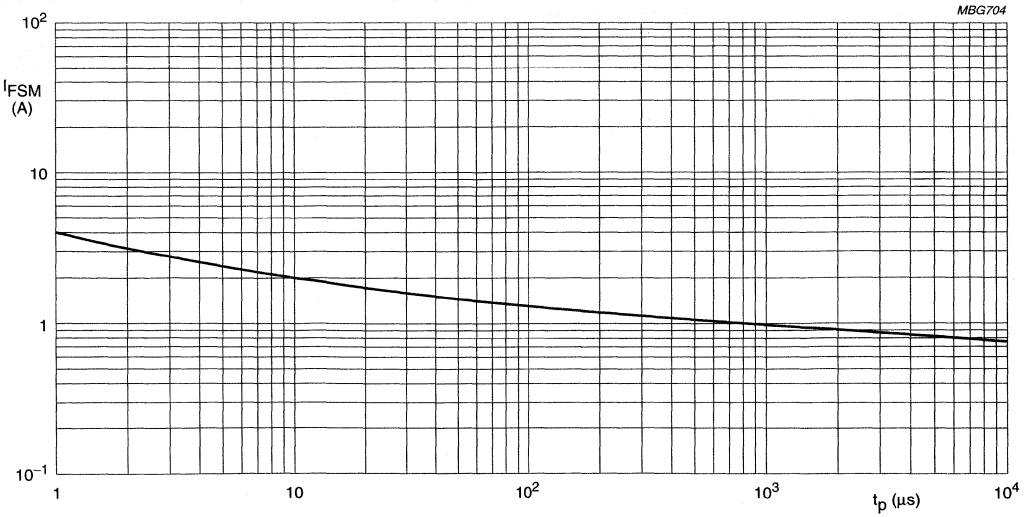
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



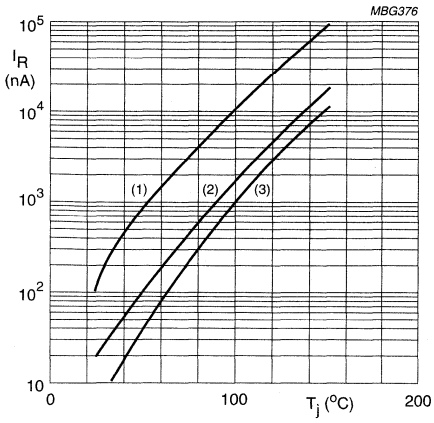
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



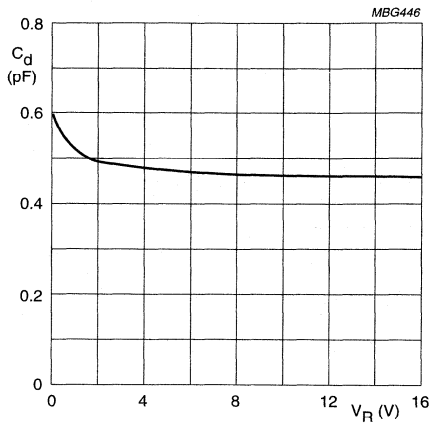
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



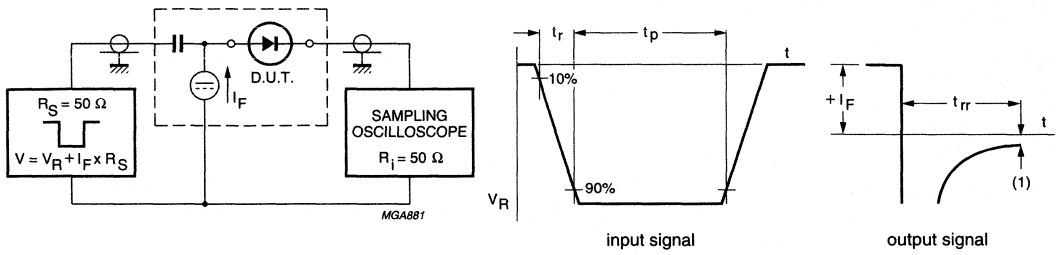
(1) V_R = 50 V; maximum values.
(2) V_R = 50 V; typical values.
(3) V_R = 25 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

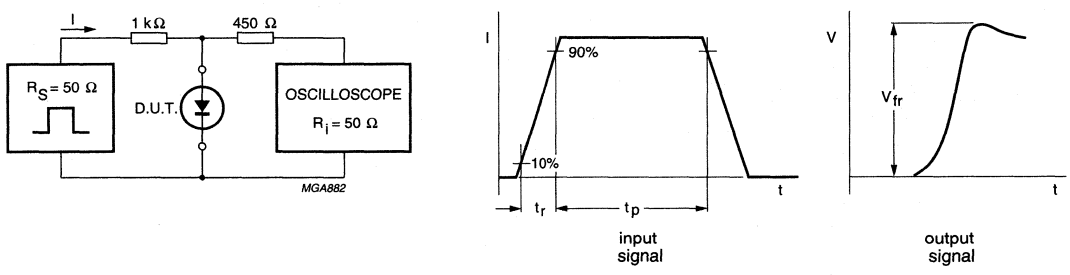


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAV99

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

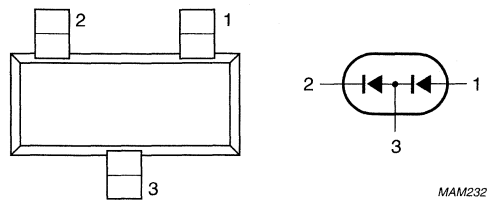
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The BAV99 consists of two high-speed switching diodes connected in series, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: A7p = made in Hong Kong; A7t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	215	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	μA
		V_R = 25 V; T_j = 150 °C	30	μA
		V_R = 75 V; T_j = 150 °C	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

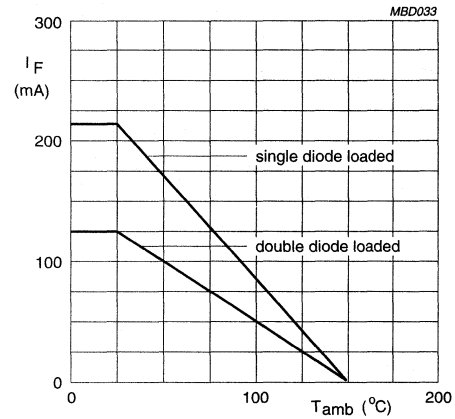
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

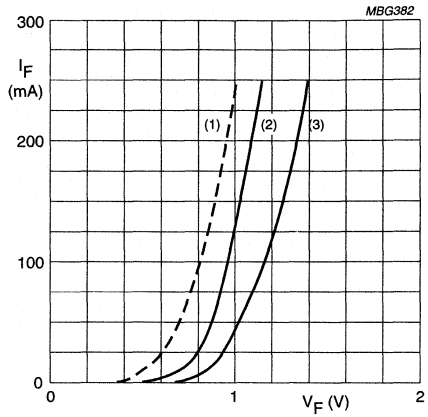
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



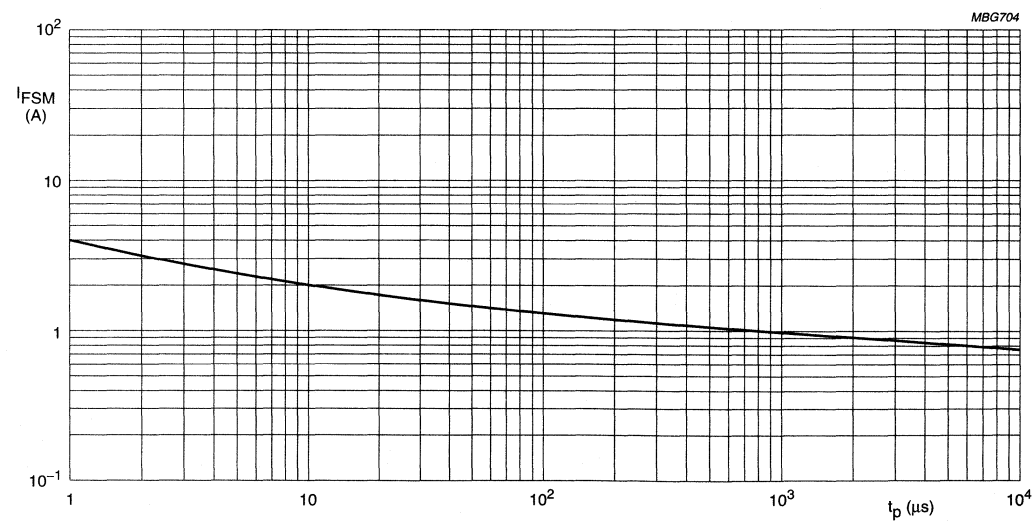
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

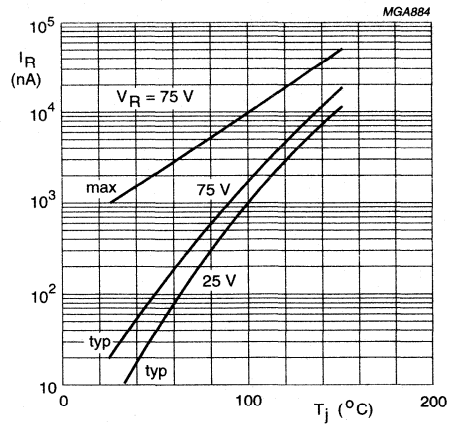
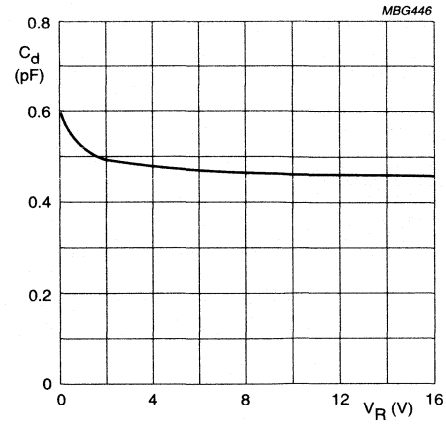
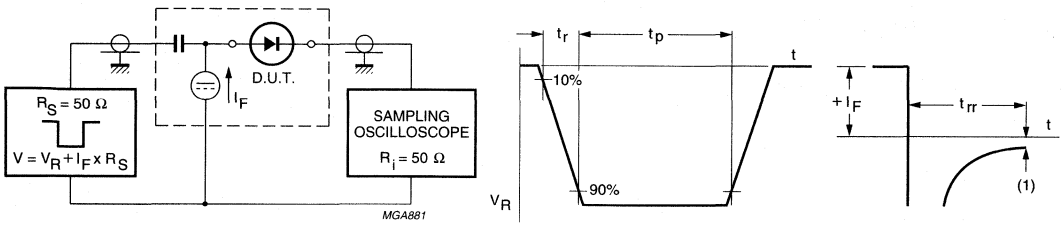


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

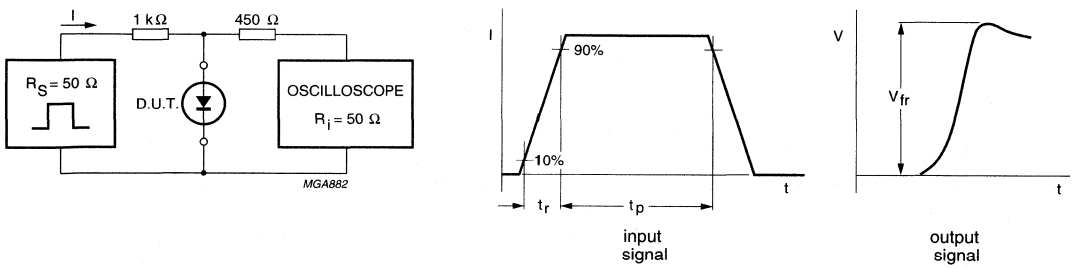


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAV99W

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

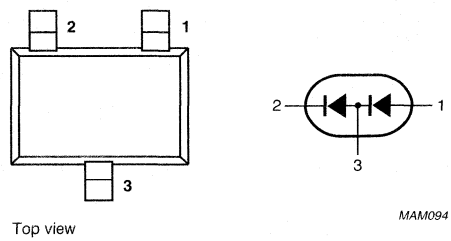
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV99W consists of two high-speed switching diodes connected in series, fabricated in planar technology, and encapsulated in the very small SOT323 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: A7.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	150	mA
		double diode loaded; note 1; see Fig.2	–	130	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

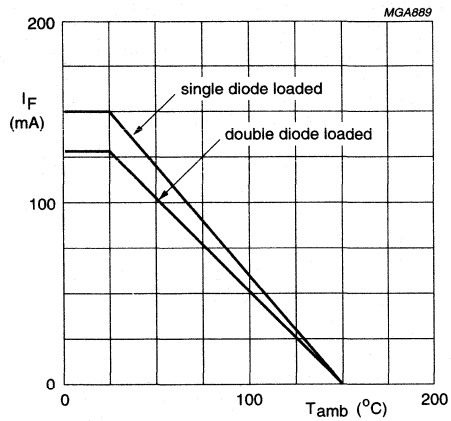
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

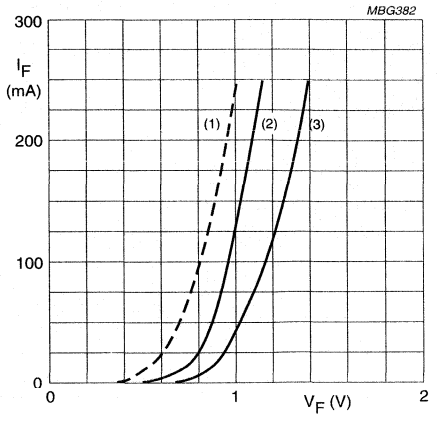
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



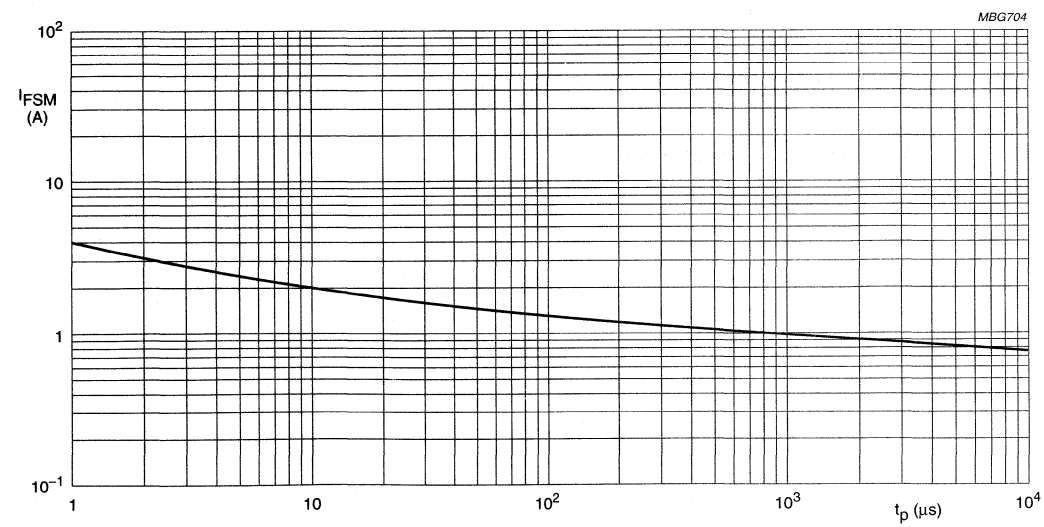
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

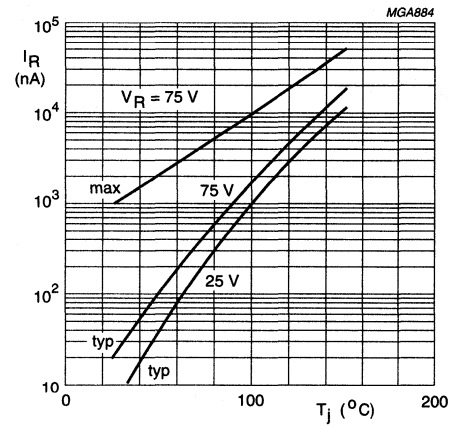
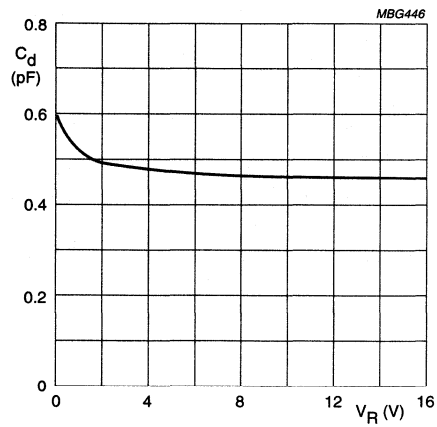
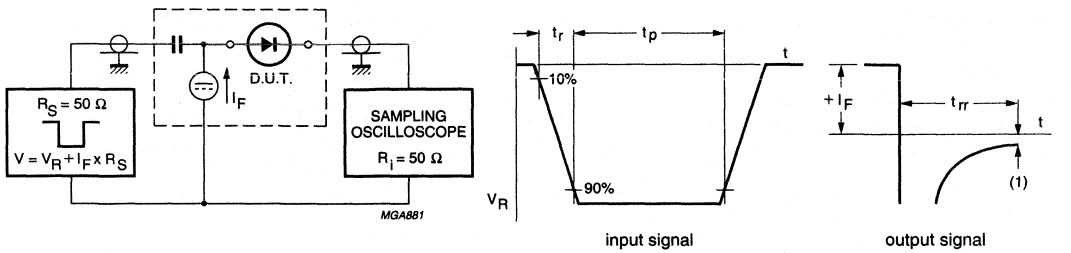


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

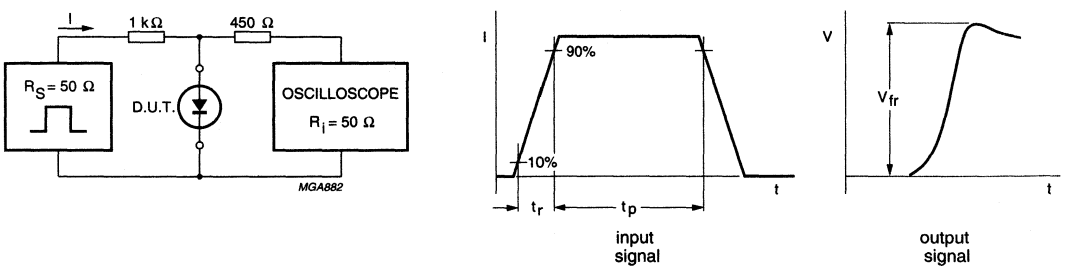


Fig.8 Forward recovery voltage test circuit and waveforms.

General purpose diodes BAV100 to BAV103

FEATURES

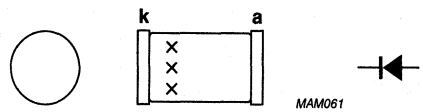
- Small hermetically sealed glass SMD package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 50 V, 100 V, 150 V and 200 V respectively
- Repetitive peak reverse voltage: max. 60 V, 120 V, 200 V and 250 V respectively
- Repetitive peak forward current: max. 625 mA.

APPLICATIONS

- Switching in industrial equipment e.g. oscilloscopes, digital voltmeters and video output stages in colour television.

DESCRIPTION

The BAV100 to BAV103 are switching diodes fabricated in planar technology, and encapsulated in small hermetically sealed glass SOD80C SMD packages.



Cathode indicated by green band.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage				
	BAV100		–	60	V
	BAV101		–	120	V
	BAV102		–	200	V
	BAV103		–	250	V
V_R	continuous reverse voltage				
	BAV100		–	50	V
	BAV101		–	100	V
	BAV102		–	150	V
	BAV103		–	200	V
I_F	continuous forward current	see Fig.2; note 1	–	250	mA
I_{FRM}	repetitive peak forward current		–	625	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	400	mW
T_{stg}	storage temperature		–65	+175	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 100 mA	–	1.0	V
		I_F = 200 mA	–	1.25	V
I_R	reverse current	see Fig.5			
	BAV100	V_R = 50 V	–	100	nA
		V_R = 50 V; T_j = 150 °C	–	100	µA
	BAV101	V_R = 100 V	–	100	nA
		V_R = 100 V; T_j = 150 °C	–	100	µA
	BAV102	V_R = 150 V	–	100	nA
		V_R = 150 V; T_j = 150 °C	–	100	µA
	BAV103	V_R = 200 V	–	100	nA
		V_R = 200 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.8	–	50	ns

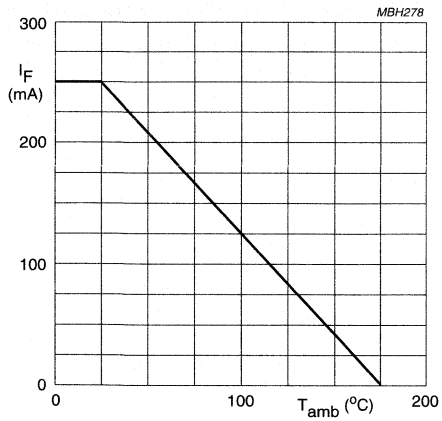
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	375	K/W

Note

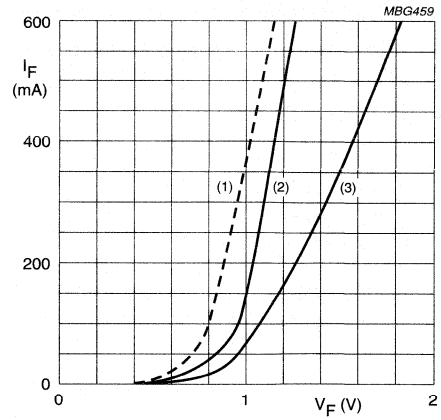
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



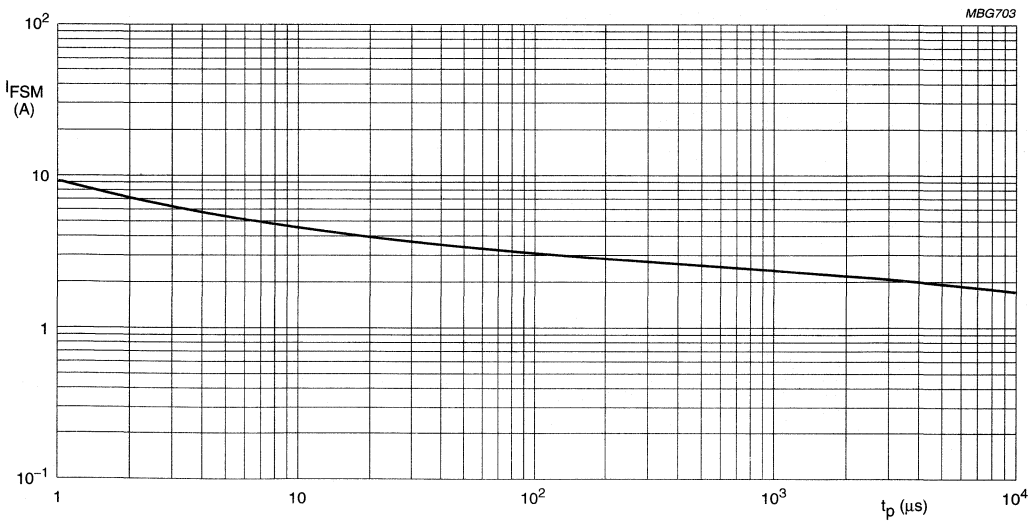
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



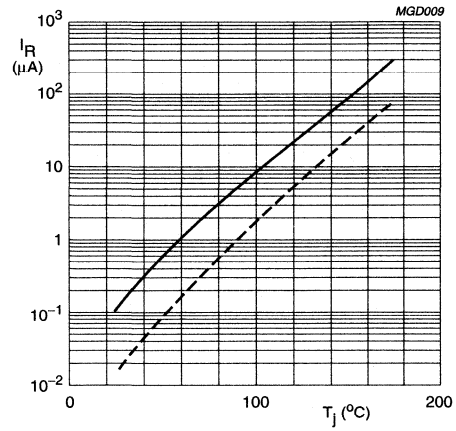
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



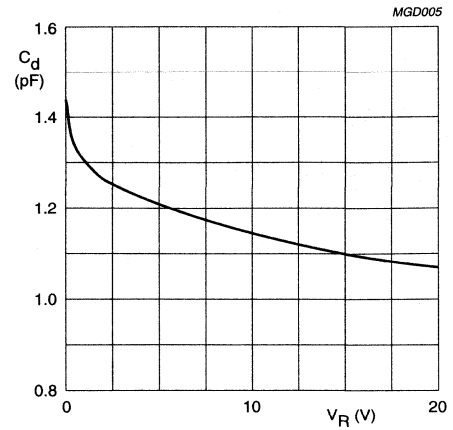
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



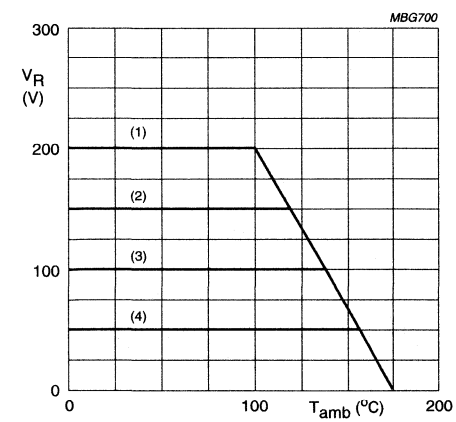
$V_R = V_{Rmax}$.
Solid line; maximum values.
Dotted line; typical values.

Fig.5 Reverse current as a function of junction temperature.



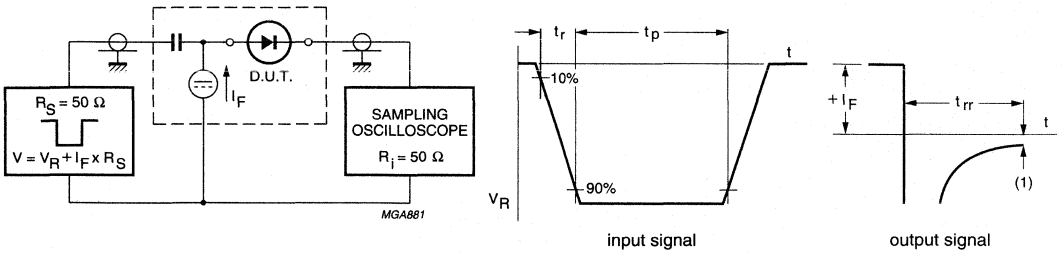
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) BAV103.
(2) BAV102.
(3) BAV101.
(4) BAV100.

Fig.7 Maximum permissible continuous reverse voltage as a function of ambient temperature.



(1) I_R = 1 mA.

Fig.8 Reverse recovery voltage test circuit and waveforms.

High-speed diode BAV105

FEATURES

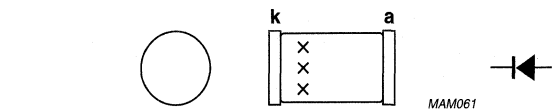
- Small hermetically sealed glass SMD package
- High switching speed: max. 6 ns
- General application
- Continuous reverse voltage: max. 60 V
- Repetitive peak reverse voltage: max. 60 V
- Repetitive peak forward current: max. 600 mA.

APPLICATIONS

- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV105 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small hermetically sealed glass SOD80C SMD package.



Cathode indicated by black band.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	60	V
V_R	continuous reverse voltage		–	60	V
I_F	continuous forward current	see Fig.2; note 1	–	300	mA
I_{FRM}	repetitive peak forward current		–	600	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	9	A
		t = 100 μs	–	3	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 10 mA	–	750	mV
		I_F = 200 mA	–	1000	mV
		I_F = 500 mA	–	1.25	V
		I_F = 200 mA; T_j = 100 °C	–	950	mV
I_R	reverse current	see Fig.5			
		V_R = 60 V	–	100	nA
		V_R = 60 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	2.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA; see Fig.7	–	6	ns
V_{fr}	forward recovery voltage	when switched from I_F = 400 mA; t_{r1} = 30 ns; see Fig.8	–	2	V
		when switched from I_F = 400 mA; t_{r2} = 100 ns; see Fig.8	–	1.5	V

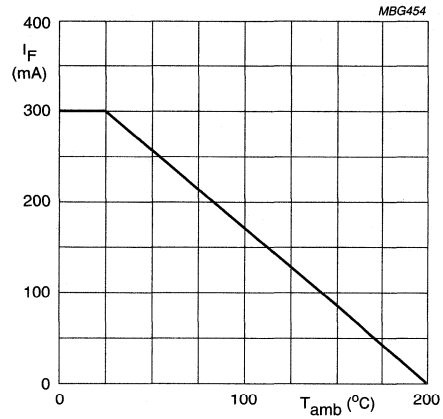
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	350	K/W

Note

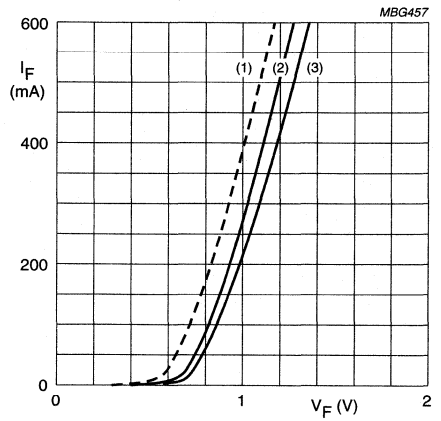
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



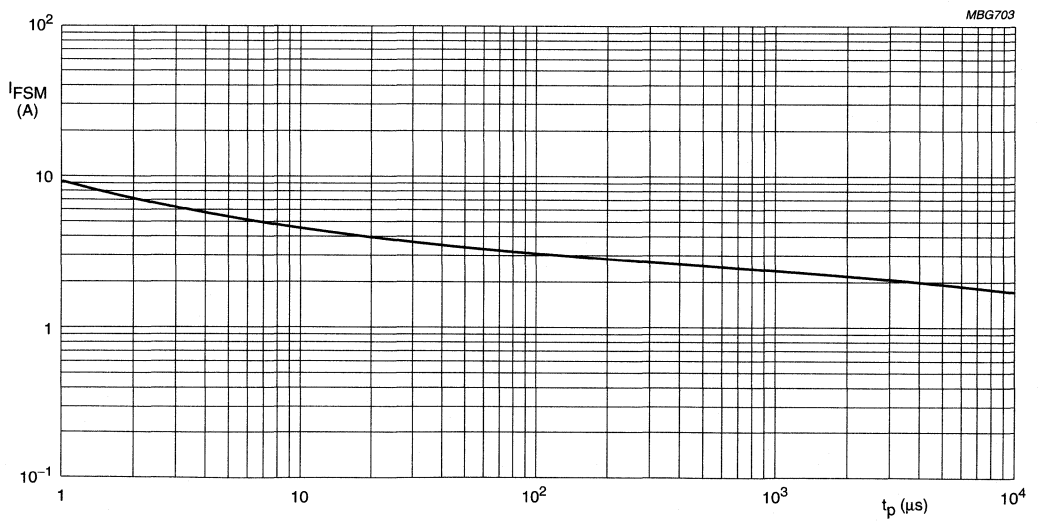
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



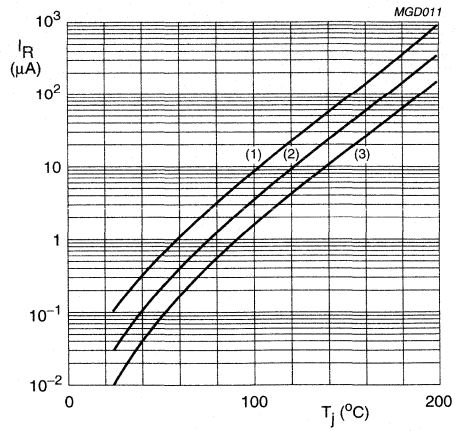
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



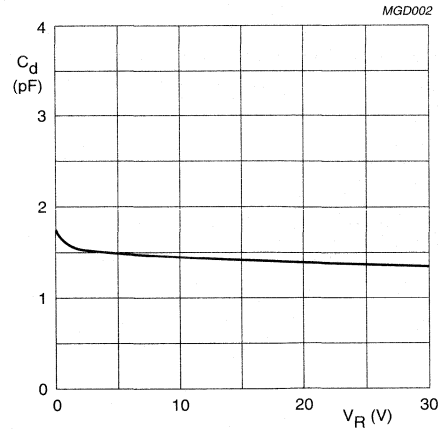
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



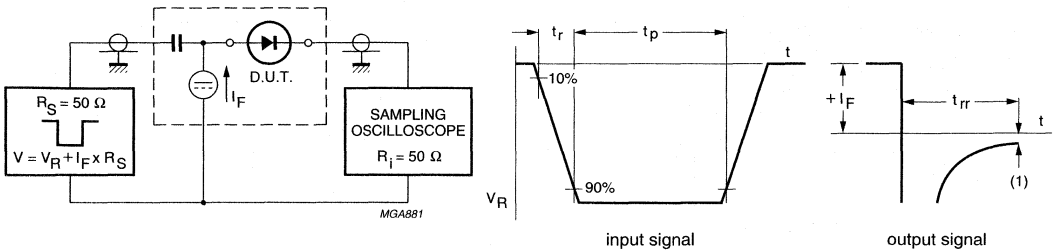
(1) V_R = 60 V; maximum values.
(2) V_R = 60 V; typical values.
(3) V_R = 30 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



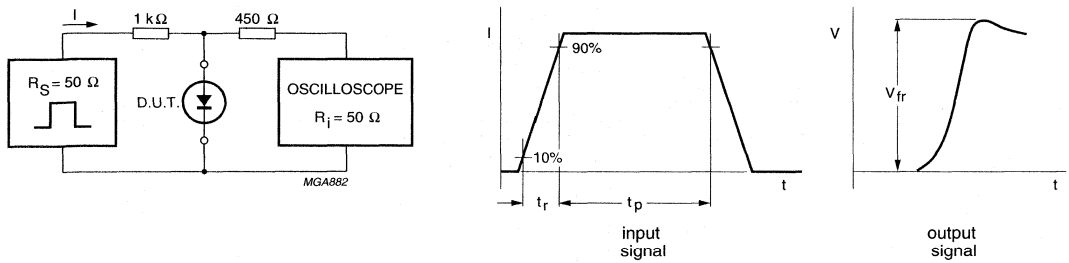
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 40$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse duration $t_p = 300$ ns; duty factor $\delta = 0.01$.

Fig.8 Forward recovery voltage test circuit and waveforms.

Low-leakage double diode | BAV170

FEATURES

- Plastic SMD package
- Low leakage current: typ. 3 pA
- Switching time: typ. 0.8 μs
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATION

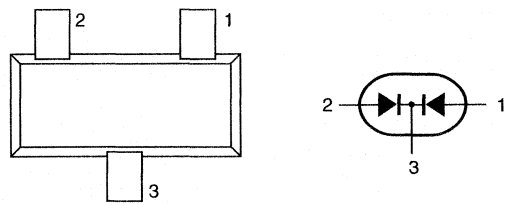
- Low-leakage current applications in surface mounted circuits.

DESCRIPTION

Epitaxial, medium-speed switching, double diode in a small SOT23 plastic SMD package. The diodes are in common cathode configuration.

PINNING

PIN	DESCRIPTION
1	anode
2	anode
3	common cathode



Marking code: JXp = made in Hong Kong; JXt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	215	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 μs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	900	mV
		I_F = 10 mA	–	1000	mV
		I_F = 50 mA	–	1100	mV
		I_F = 150 mA	–	1250	mV
I_R	reverse current	see Fig.5			
		V_R = 75 V	0.003	5	nA
		V_R = 75 V; T_j = 150 °C	3	80	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	–	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	0.8	3	µs

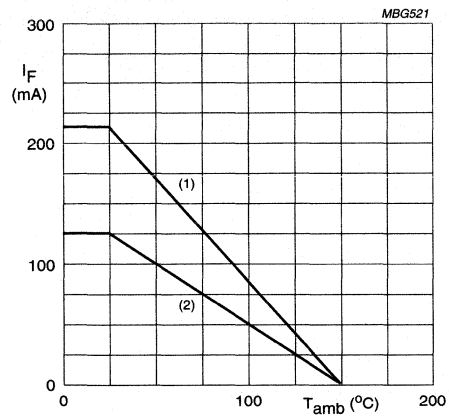
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA

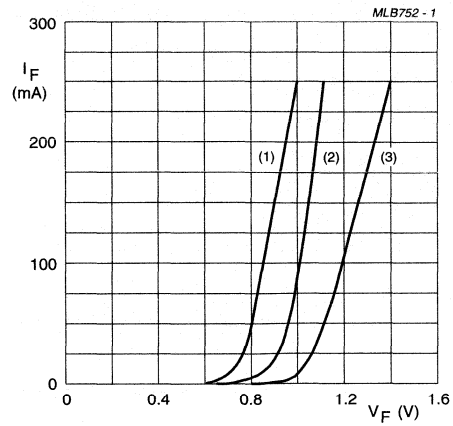


Device mounted on a FR4 printed-circuit board.

(1) Single diode loaded.

(2) Double diode loaded.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.

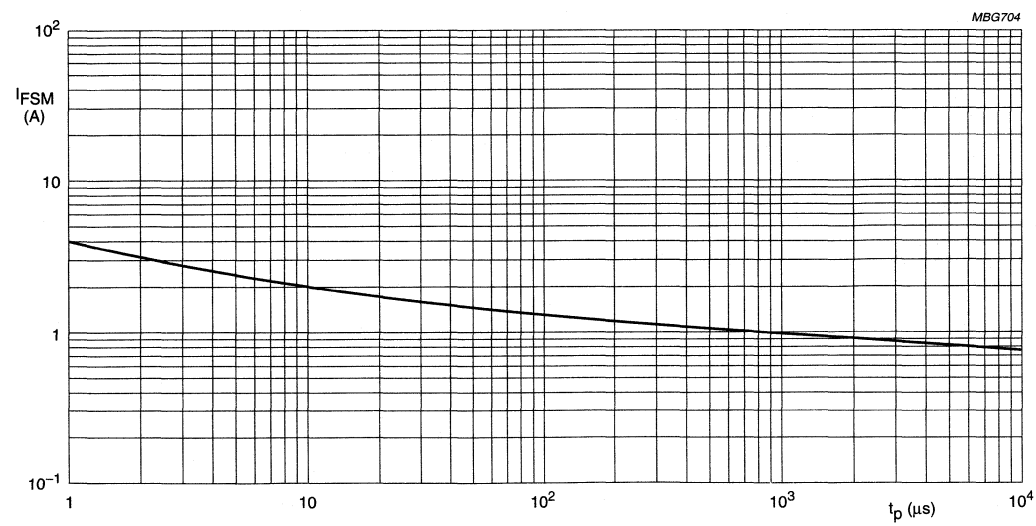


(1) T_j = 150 °C; typical values.

(2) T_j = 25 °C; typical values.

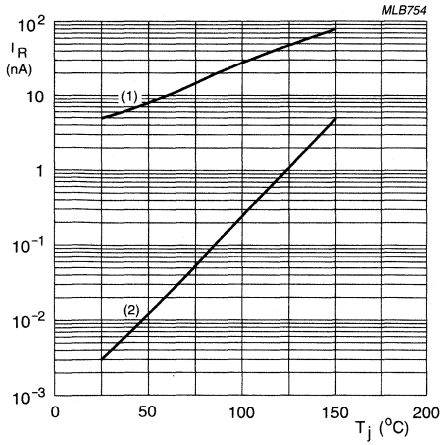
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage; per diode.



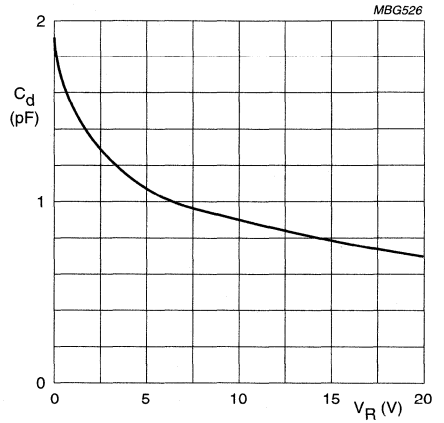
Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration per diode.



V_R = 75 V.
(1) Maximum values.
(2) Typical values.

Fig.5 Reverse current as a function of junction temperature; per diode.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; per diode; typical values.

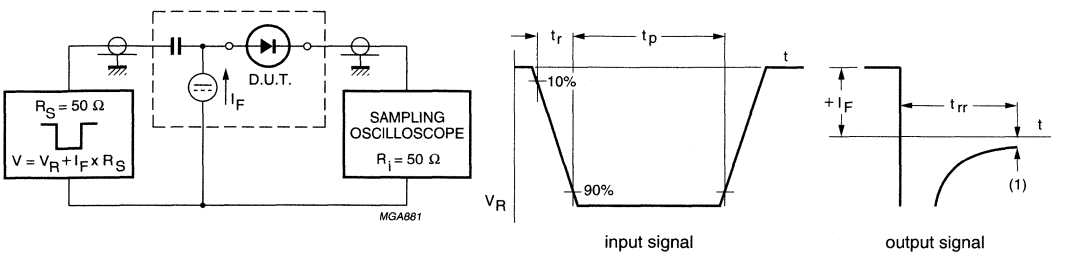


Fig.7 Reverse recovery time test circuit and waveforms.

Low-leakage double diode BAV199

FEATURES

- Plastic SMD package
- Low leakage current: typ. 3 pA
- Switching time: typ. 0.8 µs
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATION

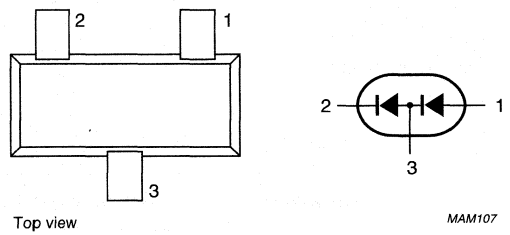
- Low-leakage current applications in surface mounted circuits.

DESCRIPTION

Epitaxial, medium-speed switching, double diode in a small SOT23 plastic SMD package. The diodes are connected in series.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	anode; cathode



Marking code: JYp = made in Hong Kong; JYt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	160	mA
		double diode loaded; note 1; see Fig.2	–	140	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 µs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	900	mV
		I_F = 10 mA	–	1000	mV
		I_F = 50 mA	–	1100	mV
		I_F = 150 mA	–	1250	mV
I_R	reverse current	see Fig.5			
		V_R = 75 V	0.003	5	nA
		V_R = 75 V; T_j = 150 °C	3	80	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	–	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	0.8	3	µs

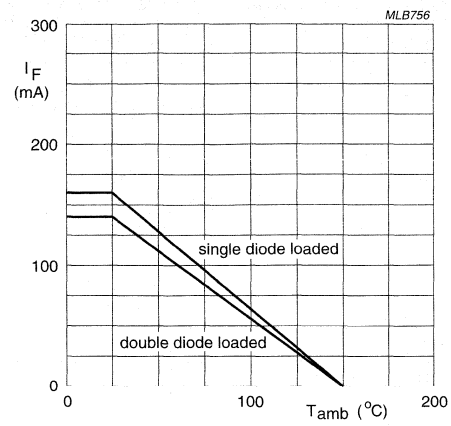
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

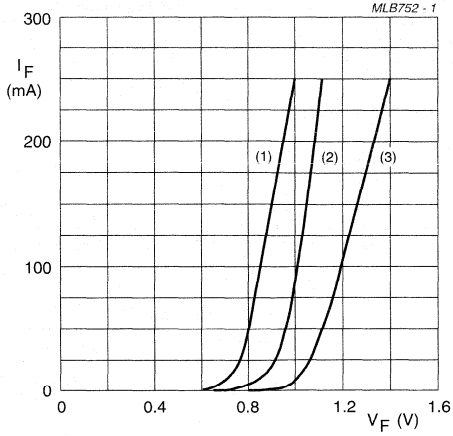
1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA



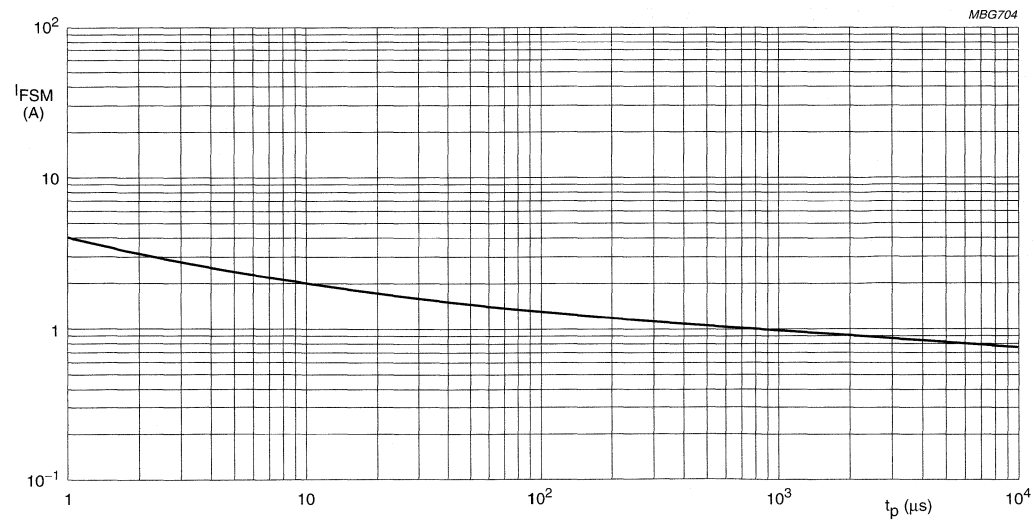
Device mounted on a FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



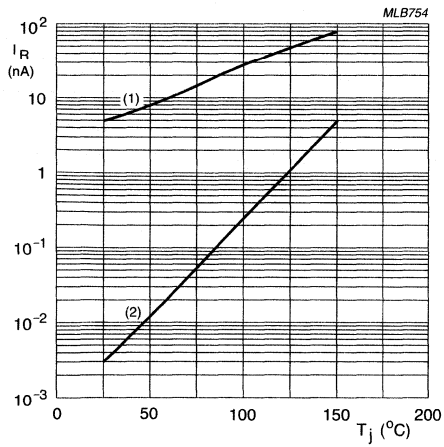
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage; per diode.



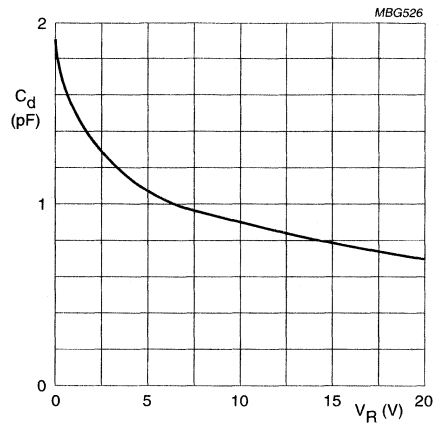
Based on square wave currents; T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration per diode.



V_R = 75 V.
(1) Maximum values.
(2) Typical values.

Fig.5 Reverse current as a function of junction temperature; per diode.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; per diode; typical values.

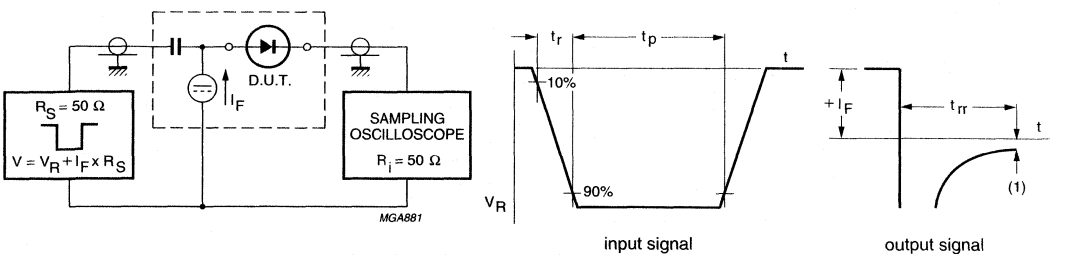


Fig.7 Reverse recovery time test circuit and waveforms.

Low-leakage double diode BAV199W

FEATURES

- Small plastic SMD package
- Low leakage current: typ. 3 pA
- Switching time: typ. 0.8 μs
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

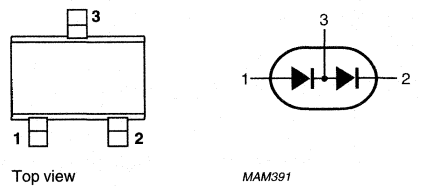
- Low-leakage current applications in surface mounted circuits.

DESCRIPTION

Epitaxial, medium-speed switching, double diode in a small plastic SOT323 (SC-70) SMD package. The diodes are connected in series.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	cathode; anode



Marking code: JY- = made in Hong Kong; JYt = made in Malaysia.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode unless otherwise specified					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; T_s = 90 °C; see Fig.2	–	135	mA
		double diode loaded; T_s = 90 °C; see Fig.2	–	110	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 μs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	single diode loaded; T_s = 90 °C	–	150	mW
		double diode loaded; T_s = 90 °C	–	240	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

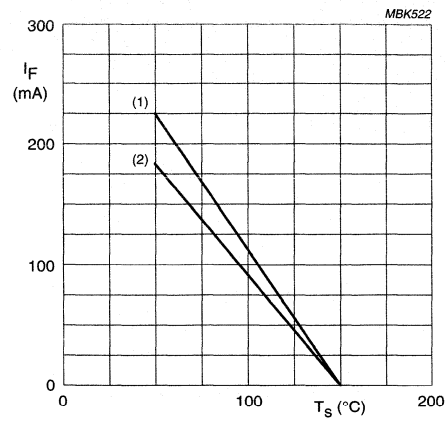
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	900	mV
		I_F = 10 mA	–	1000	mV
		I_F = 50 mA	–	1100	mV
		I_F = 150 mA	–	1250	mV
I_R	reverse current	see Fig.5			
		V_R = 75 V	0.003	5	nA
		V_R = 75 V; T_j = 150 °C	3	80	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	–	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	0.8	3	µs

THERMAL CHARACTERISTICS

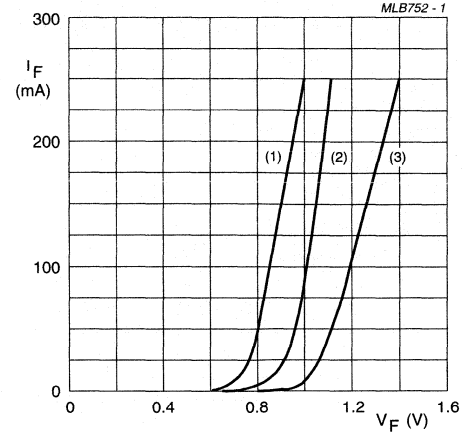
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	T_s = 90 °C	400	K/W

GRAPHICAL DATA



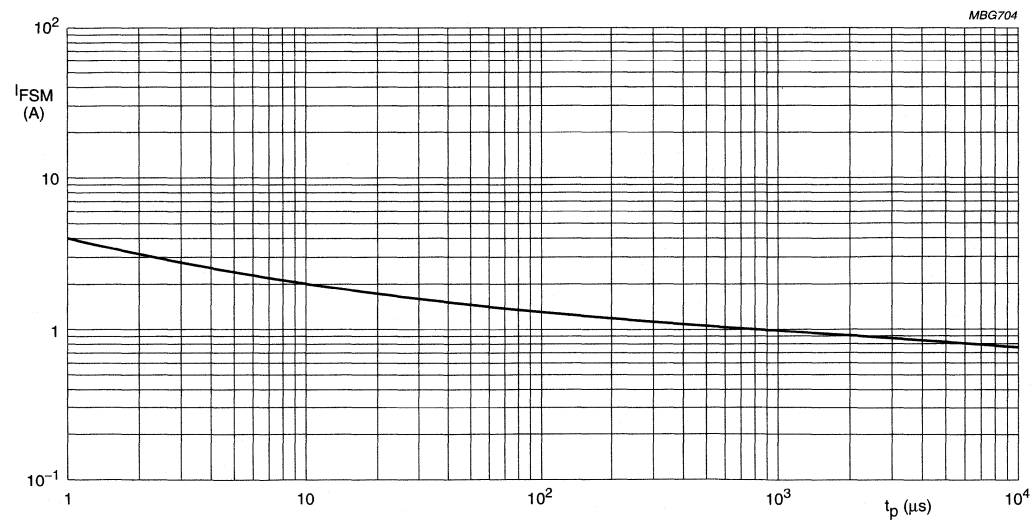
(1) Single diode loaded.
(2) Double diodes loaded.

Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature; per diode.



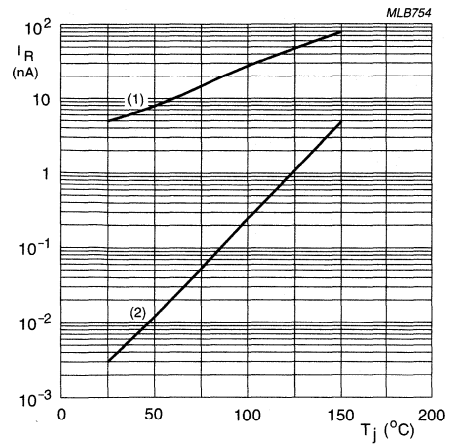
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage; per diode.



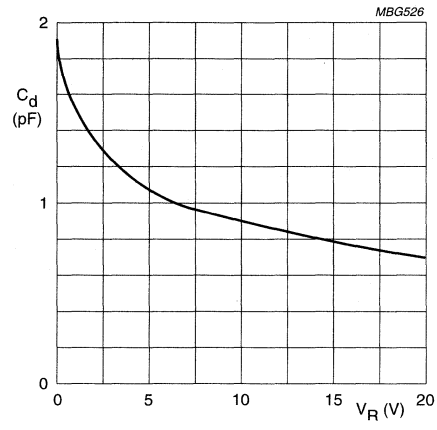
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration per diode.



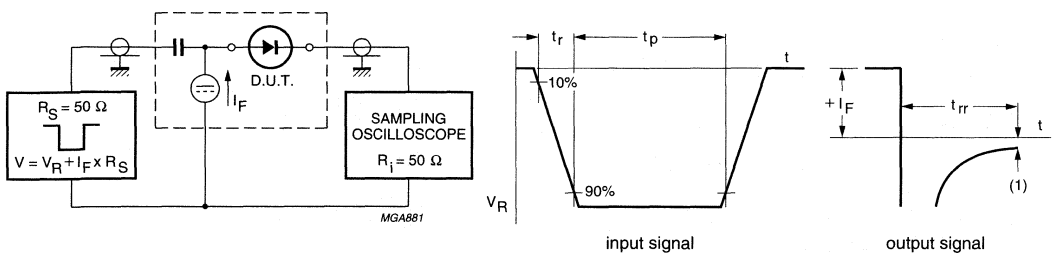
V_R = 75 V.
(1) Maximum values.
(2) Typical values.

Fig.5 Reverse current as a function of junction temperature; per diode.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; per diode; typical values.



(1) I_R = 1 mA.
Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 5 μs; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.

Fig.7 Reverse recovery time test circuit and waveforms.

High-speed switching diode array BAV756S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

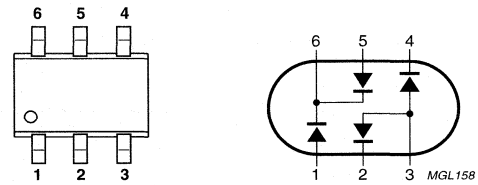
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV756S consists of four high-speed switching diodes fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package. One pair of diodes has a common cathode; the other pair has a common anode.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	cathode (k1)
3	common anode
4	cathode (k2)
5	anode (a2)
6	common cathode



Marking code: A7t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.11		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	µA
		V_R = 25 V; T_j = 150 °C	60	µA
		V_R = 75 V; T_j = 150 °C	100	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

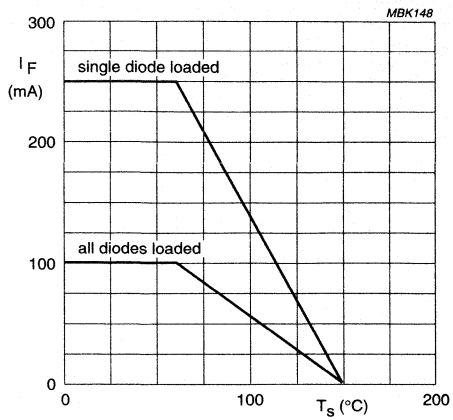
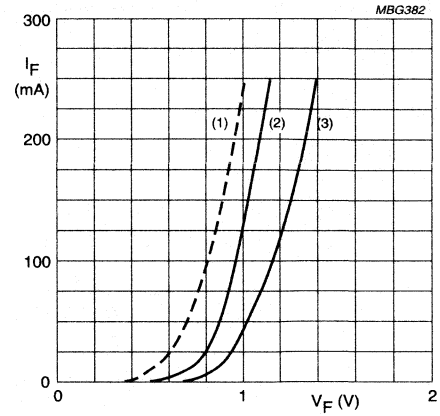
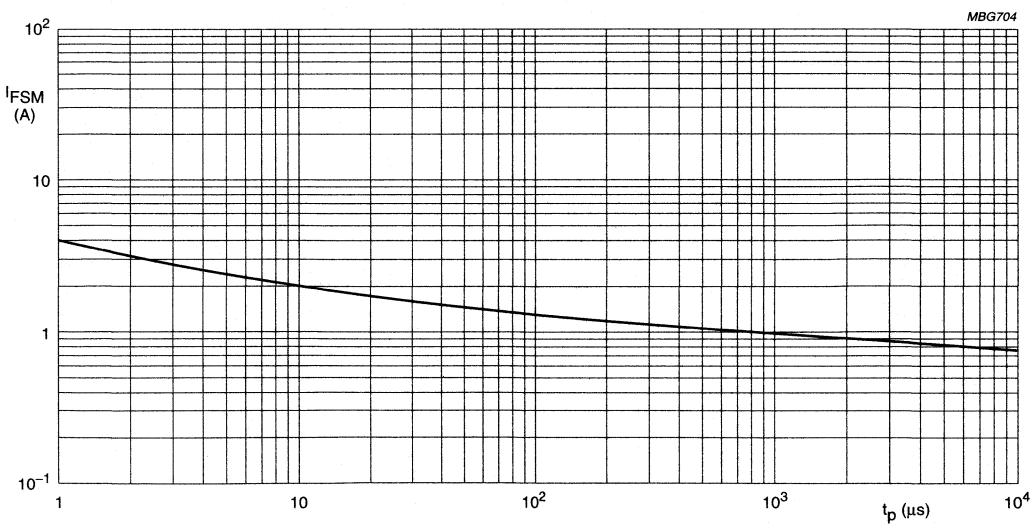


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.11 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

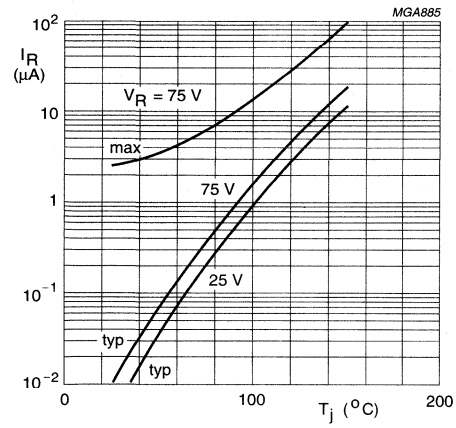
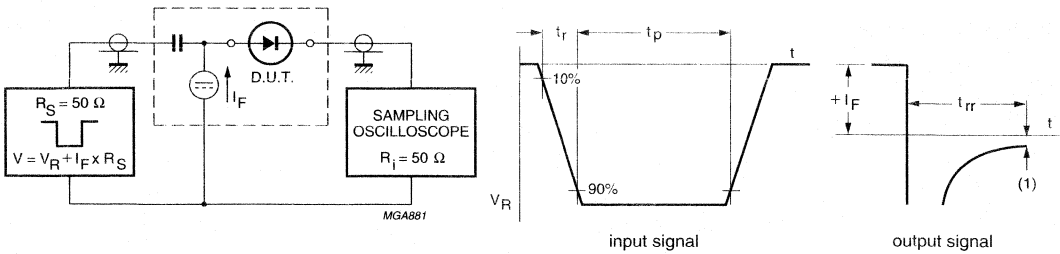


Fig.5 Reverse current as a function of junction temperature.

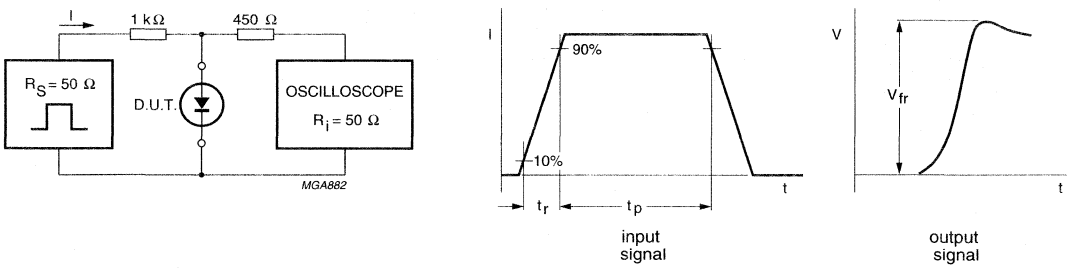


(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$.

Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.6 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAW56

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

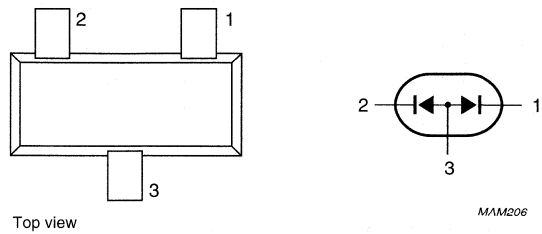
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The BAW56 consists of two high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode



Marking code: A1p = made in Hong Kong; A1t = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	215	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	μA
		V_R = 25 V; T_j = 150 °C	30	μA
		V_R = 75 V; T_j = 150 °C	50	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

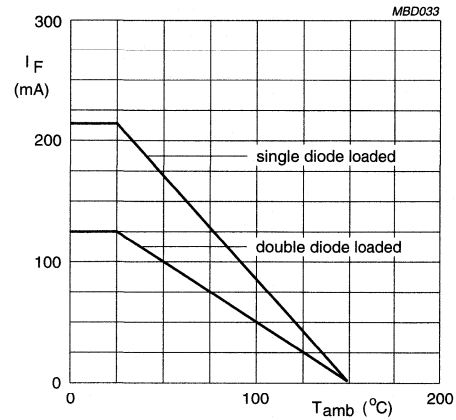
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

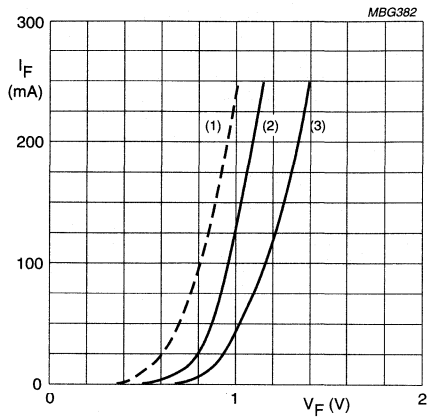
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



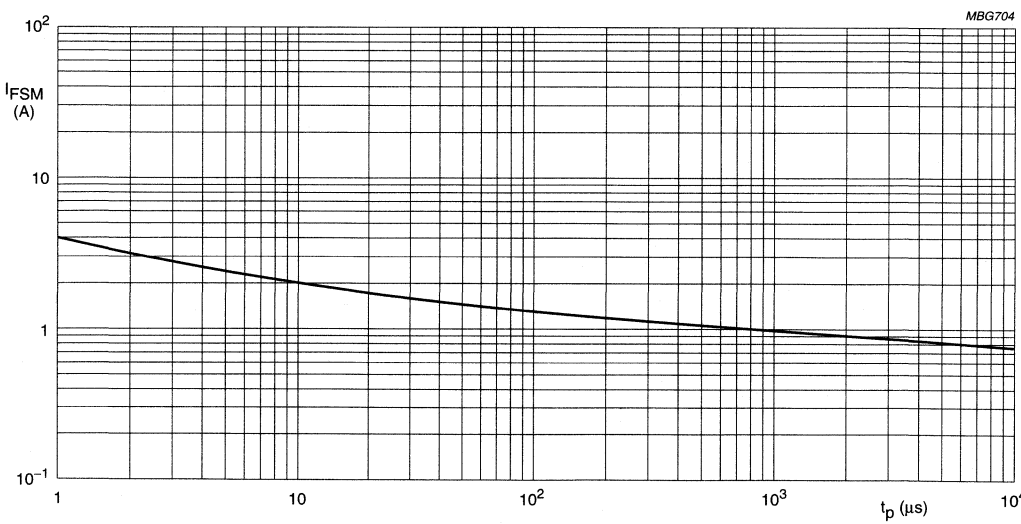
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

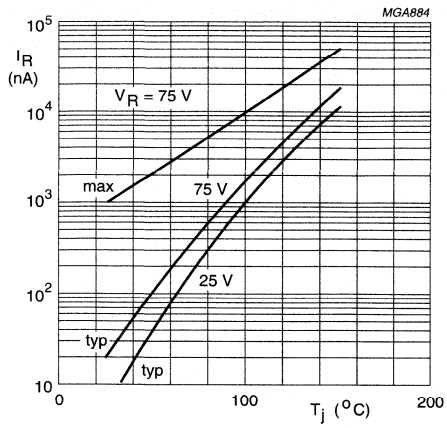
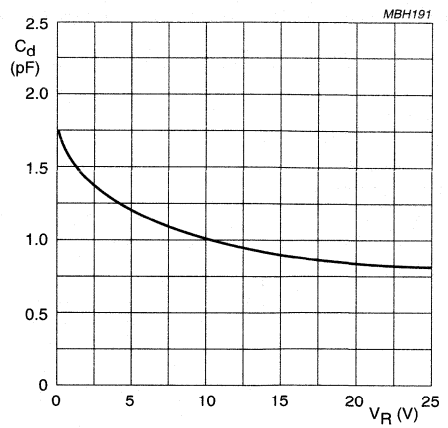
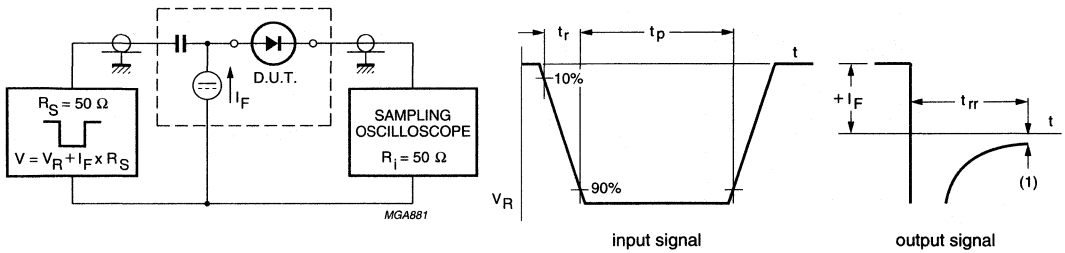


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

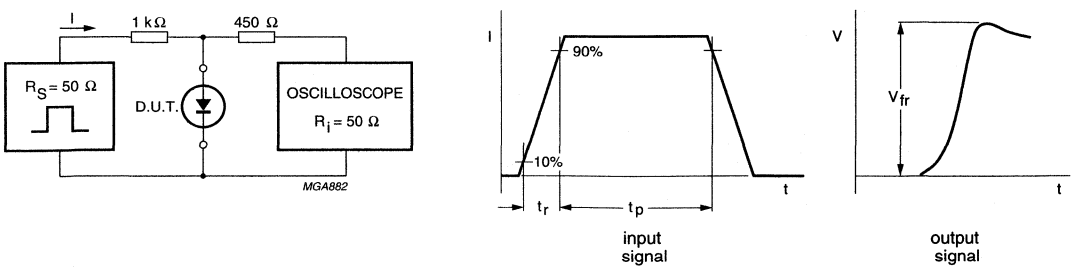


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode array BAW56S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

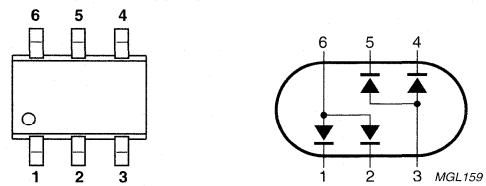
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAW56S consists of two dual high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode (a1)
4	cathode (k3)
5	cathode (k4)
6	common anode (a2)



Marking code: A1t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.18		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

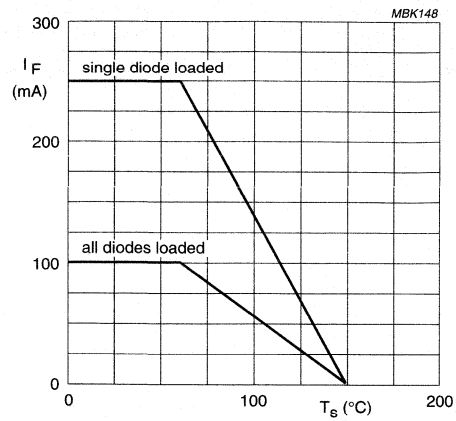
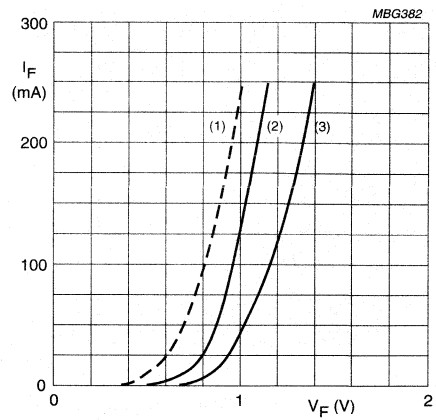
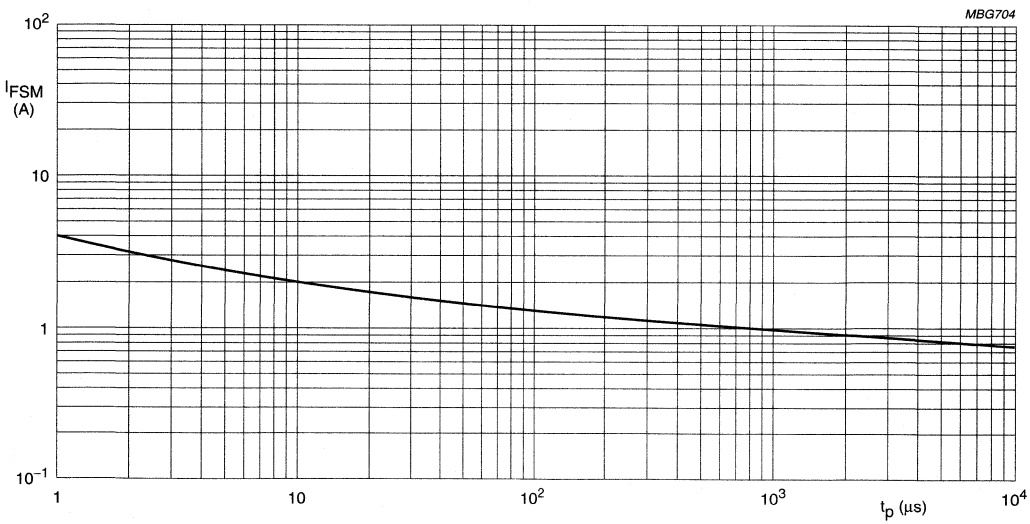


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.18 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

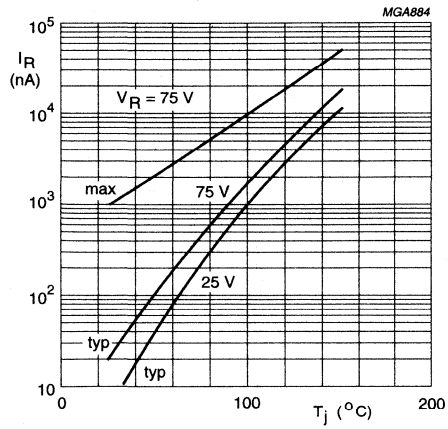
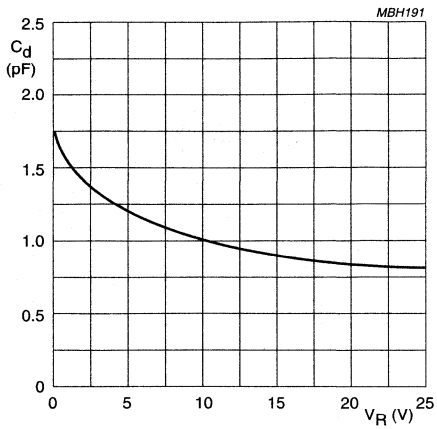
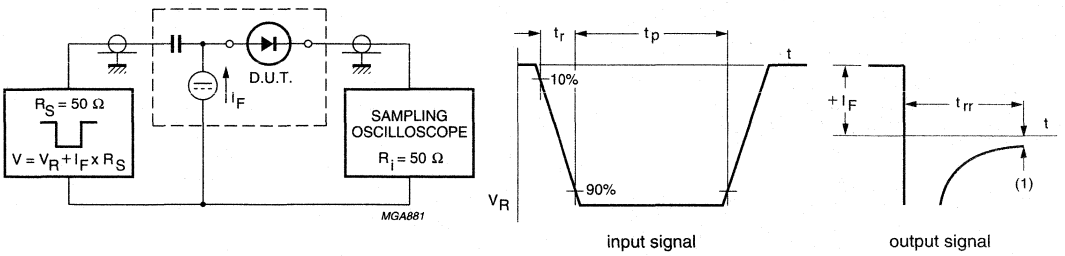


Fig.5 Reverse current as a function of junction temperature.



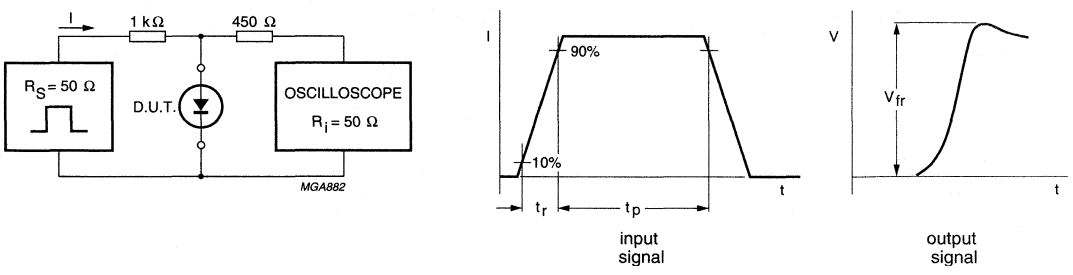
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.
Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAW56T

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

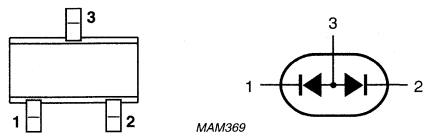
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

Two high-speed switching diodes in a common anode configuration, fabricated in planar technology, in a very small rectangular SMD SOT416 (SC-75) package.

PINNING

PIN	DESCRIPTION
1	cathode 1
2	cathode 2
3	common anode



Marking code: A1.

Fig.1 Simplified outline (SOT416; SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode (unless otherwise specified)					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	T_s = 90 °C; see Fig.2			
		single diode loaded	–	150	mA
		both diodes loaded	–	75	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 90 °C; one diode loaded	–	170	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

ELECTRICAL CHARACTERISTICS

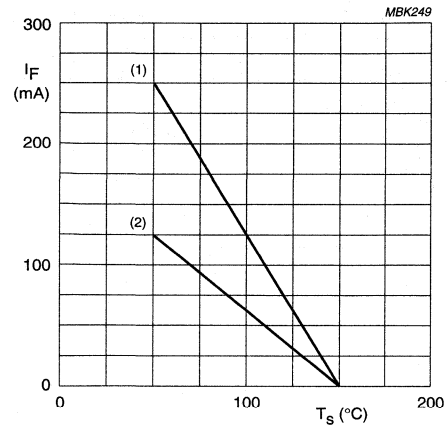
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	0.715	V
		I_F = 10 mA	0.855	V
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	2	pF
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

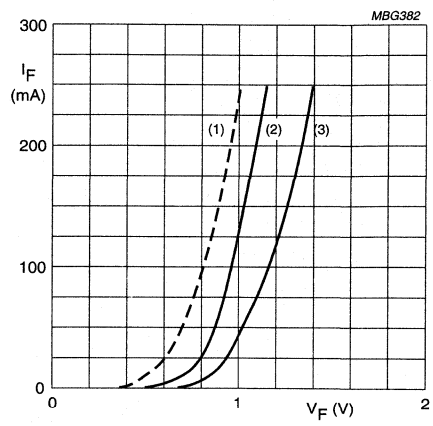
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one diode loaded	350	K/W

GRAPHICAL DATA



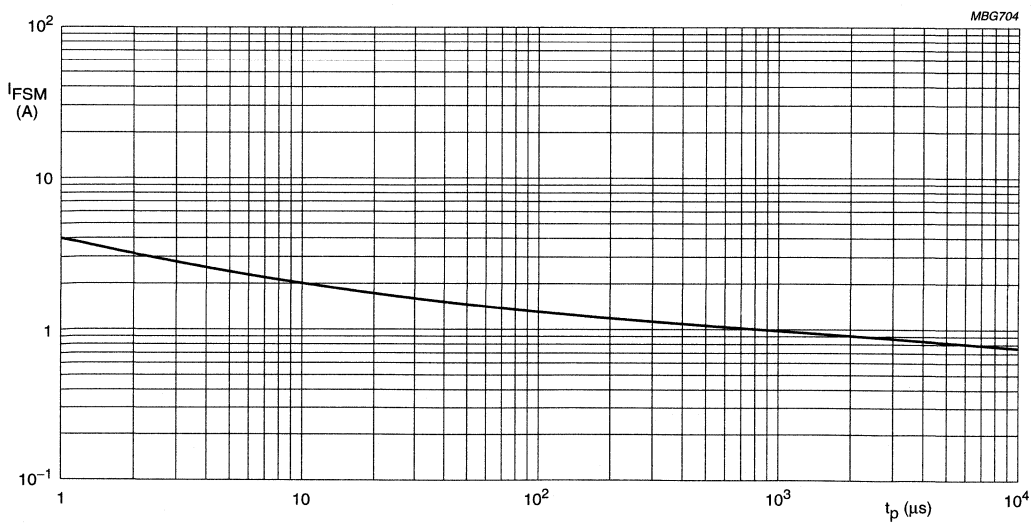
(1) One diode loaded.
(2) Both diodes loaded.

Fig.2 Maximum permissible continuous forward current per diode as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

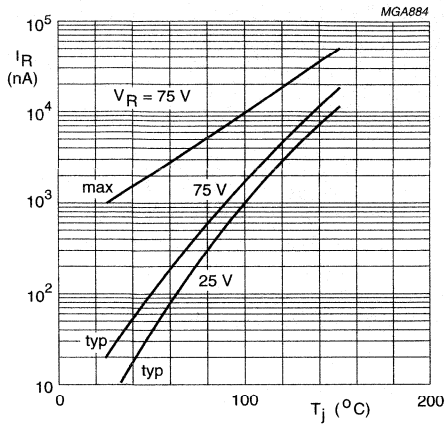
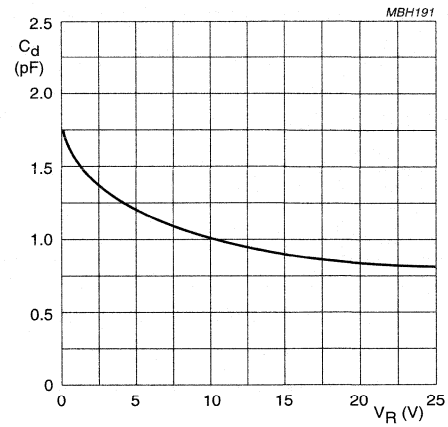
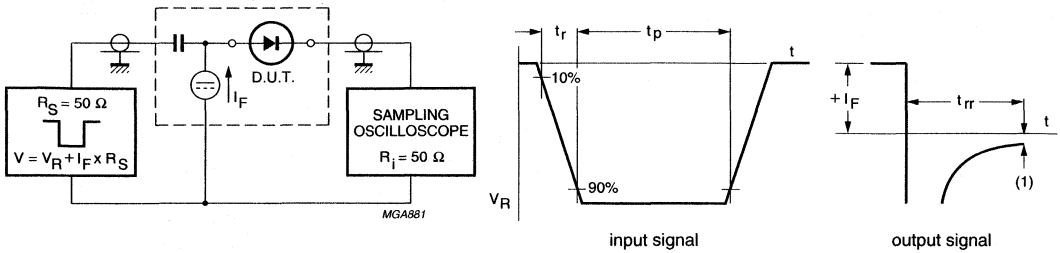


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

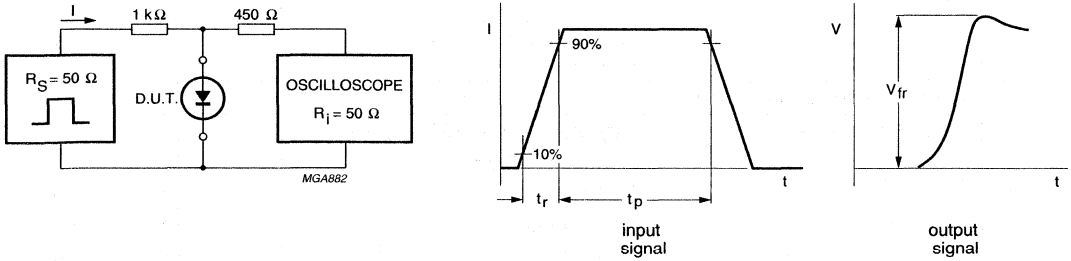


(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$.

Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode BAW56W

FEATURES

- Very small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

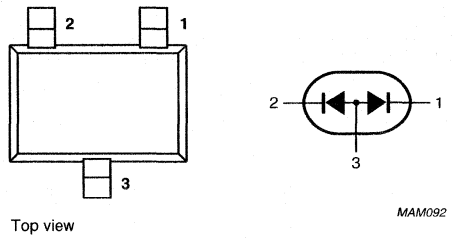
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The BAW56W consists of two high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the very small SOT323 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode



Top view

Marking code: A1.

Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	150	mA
		double diode loaded; note 1; see Fig.2	–	130	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

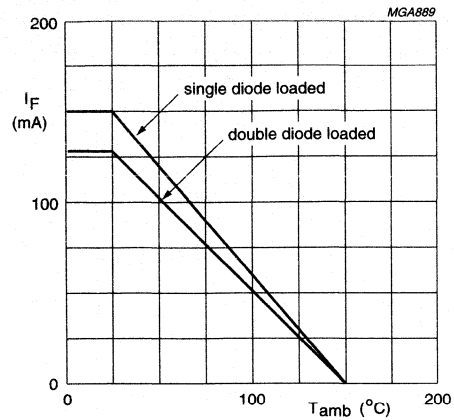
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

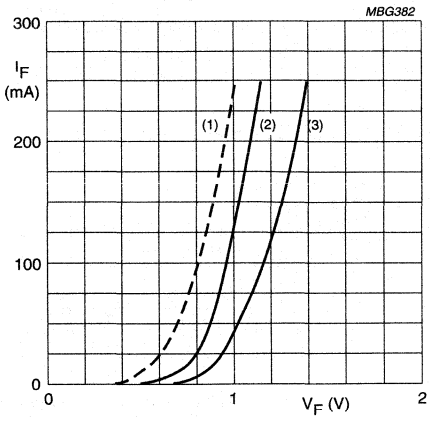
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



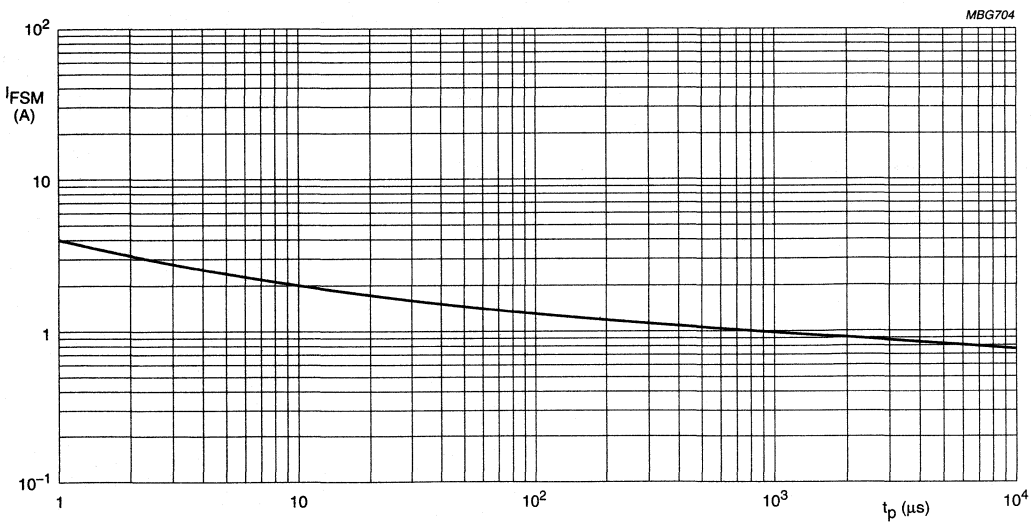
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

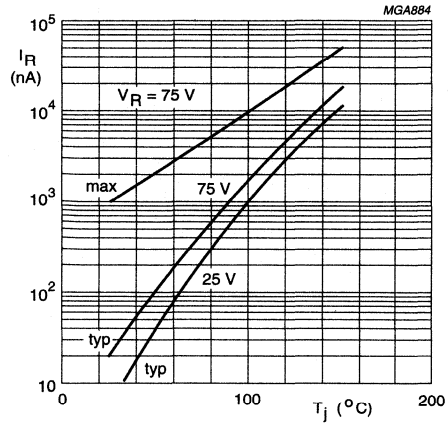
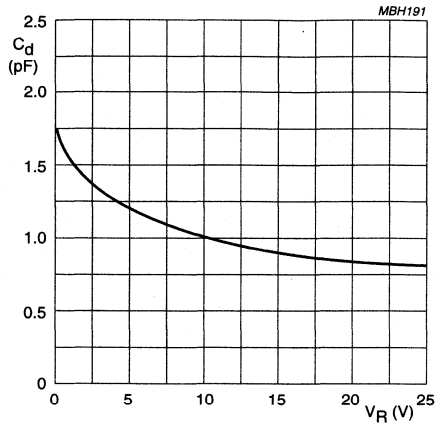
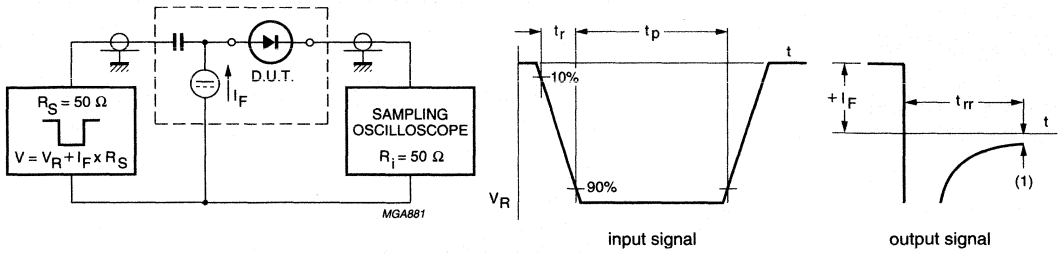


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

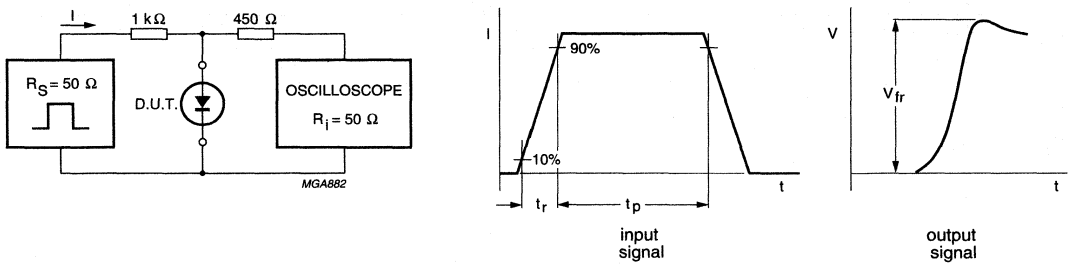


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode BAW62

FEATURES

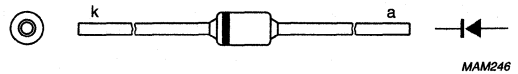
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

- High-speed switching
- Fast logic applications.

DESCRIPTION

The BAW62 is a high-speed switching diode fabricated in planar technology, and encapsulated in the hermetically sealed leaded glass SOD27 (DO-35) package.



The diode is type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	250	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	350	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 5 mA	620	750	mV
		I_F = 100 mA	–	1000	mV
		I_F = 100 mA; T_j = 100 °C	–	930	mV
I_R	reverse current	see Fig.5			
		V_R = 20 V	–	25	nA
		V_R = 50 V	–	200	nA
		V_R = 75 V	–	5	µA
		V_R = 20 V; T_j = 150 °C	–	50	µA
		V_R = 75 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	–	2.5	V

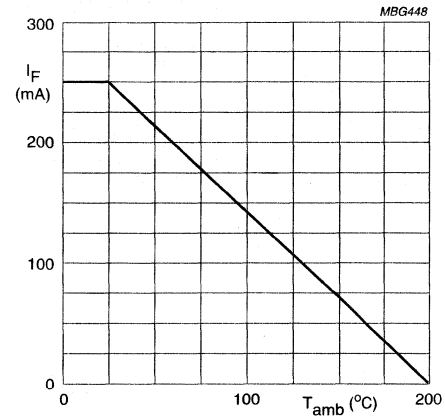
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	500	K/W

Note

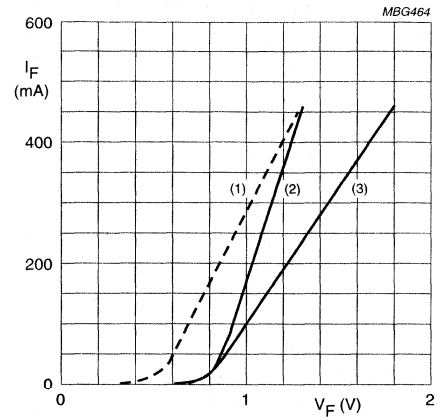
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



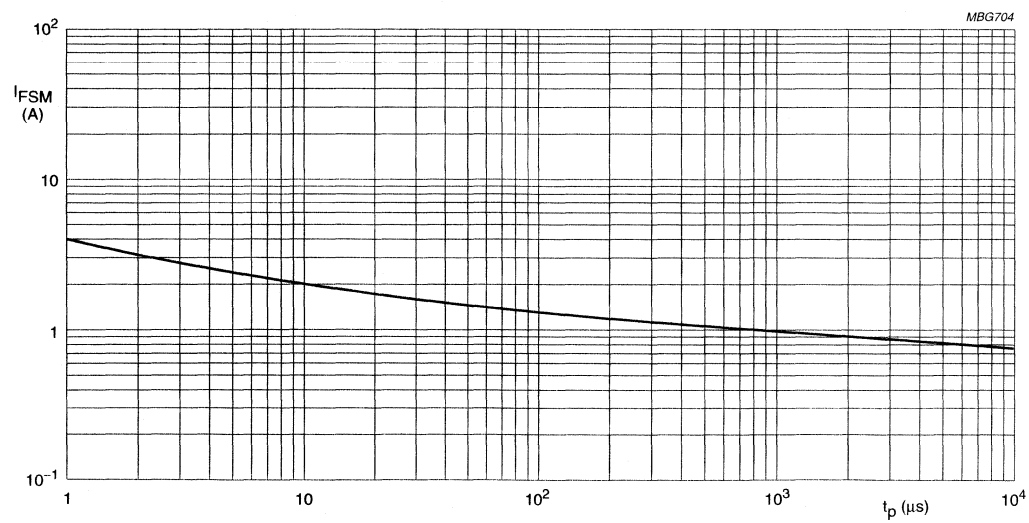
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



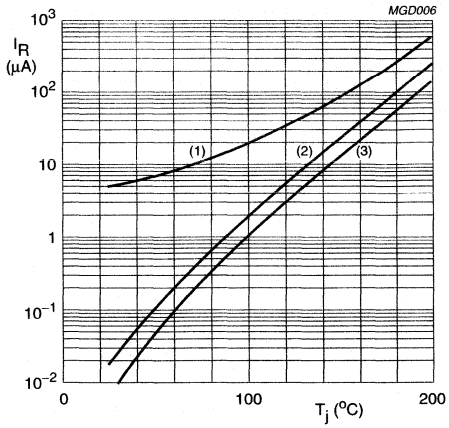
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



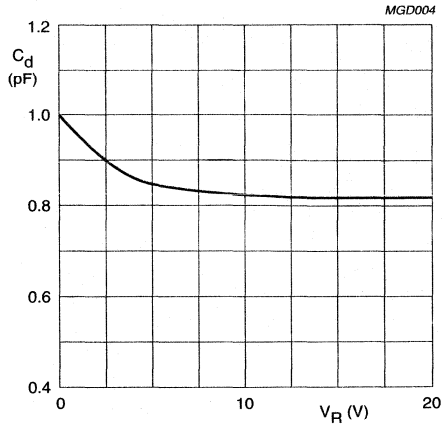
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



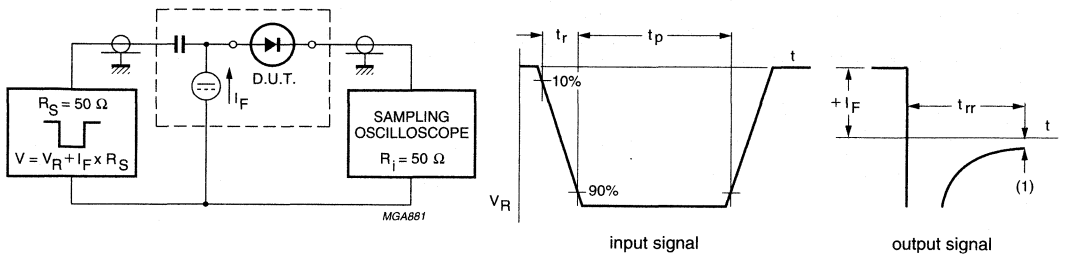
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

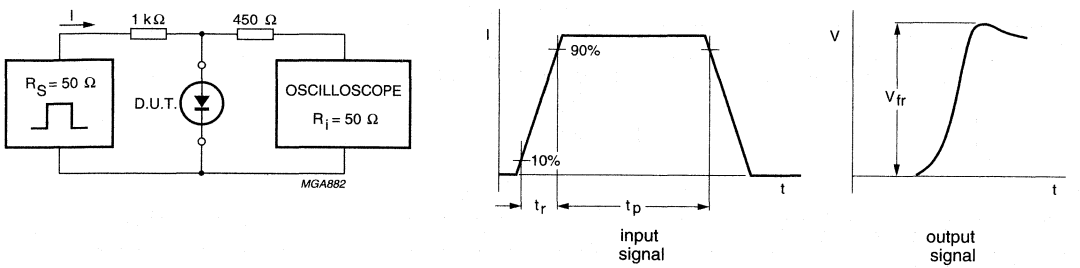


Fig.8 Forward recovery voltage test circuit and waveforms.

Low-leakage double diode BAW156

FEATURES

- Plastic SMD package
- Low leakage current: typ. 3 pA
- Switching time: typ. 0.8 μs
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATION

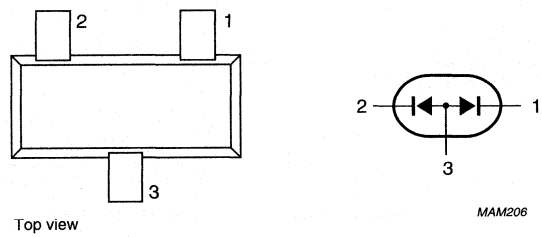
- Low-leakage current applications in surface mounted circuits.

DESCRIPTION

Epitaxial, medium-speed switching, double diode in a small SOT23 plastic SMD package. The diodes are in common anode configuration.

PINNING

PIN	DESCRIPTION
1	cathode
2	cathode
3	common anode



Marking code: JZp = made in Hong Kong; JZt = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	160	mA
		double diode loaded; note 1; see Fig.2	–	140	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t_p = 1 μs	–	4	A
		t_p = 1 ms	–	1	A
		t_p = 1 s	–	0.5	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	–	900	mV
		I_F = 10 mA	–	1000	mV
		I_F = 50 mA	–	1100	mV
		I_F = 150 mA	–	1250	mV
I_R	reverse current	see Fig.5			
		V_R = 75 V	0.003	5	nA
		V_R = 75 V; T_j = 150 °C	3	80	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	3	–	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	0.8	3	µs

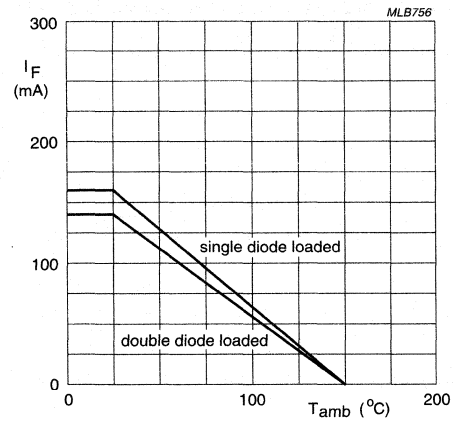
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

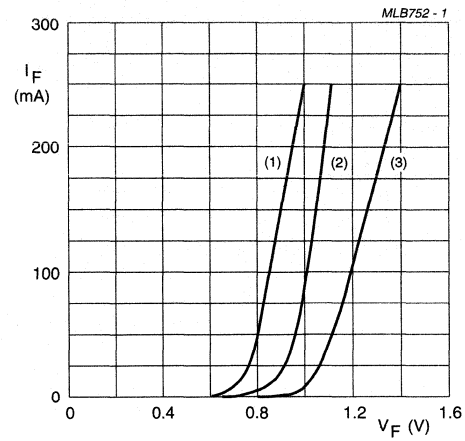
1. Device mounted on a FR4 printed-circuit board.

GRAPHICAL DATA



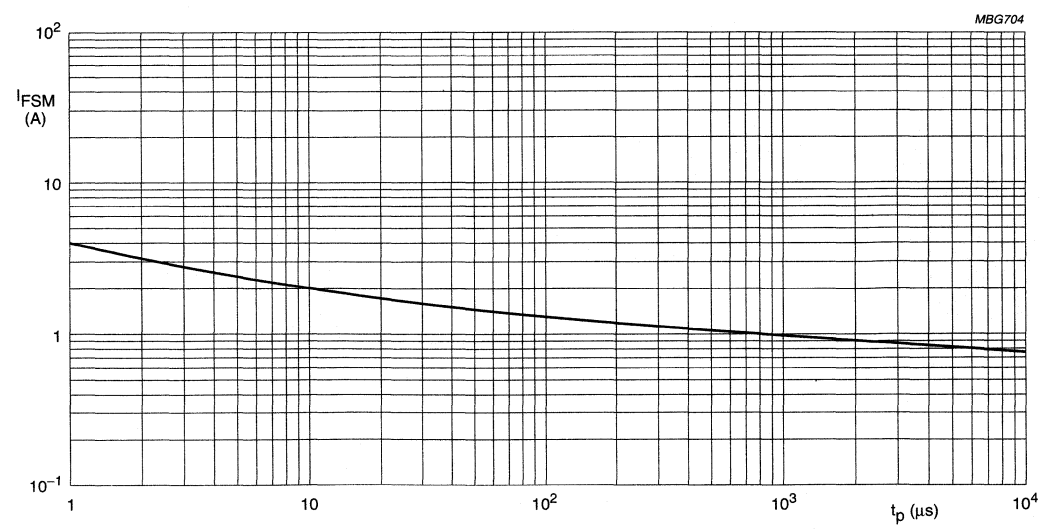
Device mounted on a FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



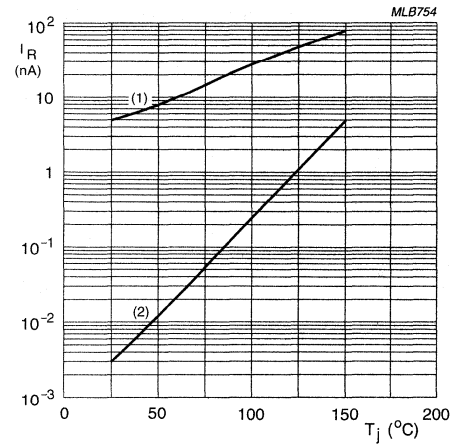
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage; per diode.



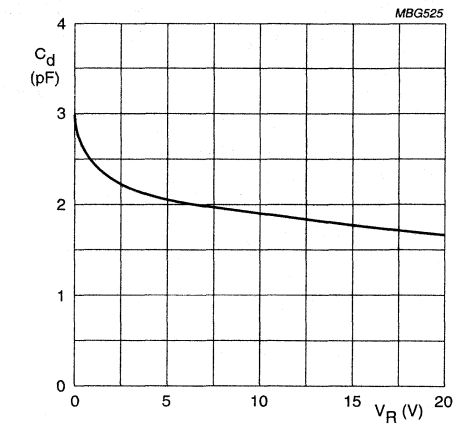
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration per diode.



V_R = 75 V.

Fig.5 Reverse current as a function of junction temperature; per diode.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; per diode; typical values.

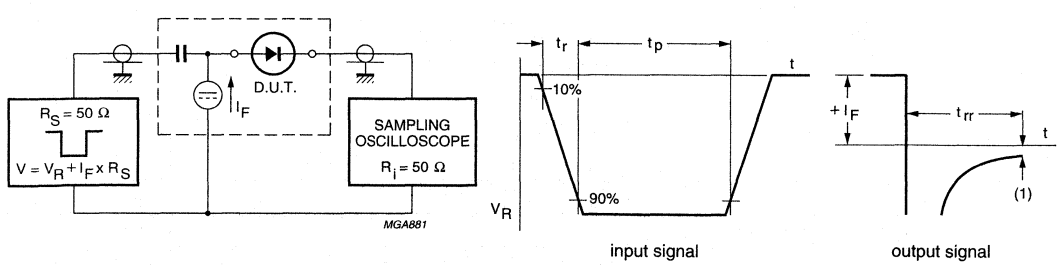


Fig.7 Reverse recovery time test circuit and waveforms.

Controlled avalanche diode BAX12

FEATURES

- Hermetically sealed leaded glass SOD27 (DO-35) package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 90 V
- Repetitive peak reverse voltage: max. 90 V
- Repetitive peak forward current: max. 800 mA
- Repetitive peak reverse current: max. 600 mA
- Capable of absorbing transients repetitively.

APPLICATIONS

- Switching of inductive loads in semi-electronic telephone exchanges.

DESCRIPTION

The BAX12 is a controlled avalanche diode fabricated in planar technology, and encapsulated in the hermetically sealed leaded glass SOD27 (DO-35) package.

Marking code: BAX12.

Fig.1 Simplified outline (SOD27; DO35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage	note 1	–	90	V
V_R	continuous reverse voltage	note 1	–	90	V
I_F	continuous forward current	see Fig.2; note 2	–	400	mA
I_{FRM}	repetitive peak forward current		–	800	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	55	A
		t = 100 μs	–	15	A
		t = 10 ms	–	9	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 2	–	450	mW
I_{RRM}	repetitive peak reverse current		–	600	mA
E_{RRM}	repetitive peak reverse energy	$t_p \geq 50$ μs; $f \leq 20$ Hz; T_j = 25 °C	–	5.0	mJ
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Notes

1. It is allowed to exceed this value; see Figs 8 and 9. Care should be taken not to exceed the I_{RRM} rating.
2. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 10 mA	–	750	mV
		I_F = 50 mA	–	840	mV
		I_F = 100 mA	–	900	mV
		I_F = 200 mA	–	1.0	V
		I_F = 400 mA	–	1.25	V
I_R	reverse current	see Fig.5			
		V_R = 90 V	–	100	nA
		V_R = 90 V; T_j = 150 °C	–	100	µA
$V_{(BR)R}$	reverse avalanche breakdown voltage	I_R = 1 mA	120	170	V
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	35	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.10	–	50	ns

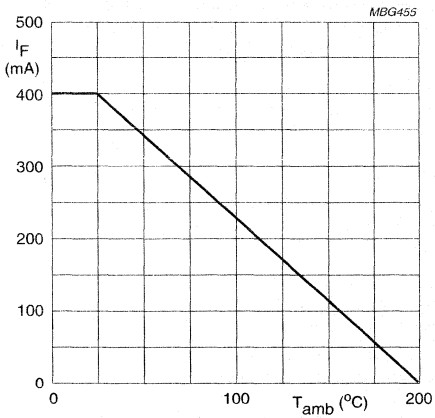
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	375	K/W

Note

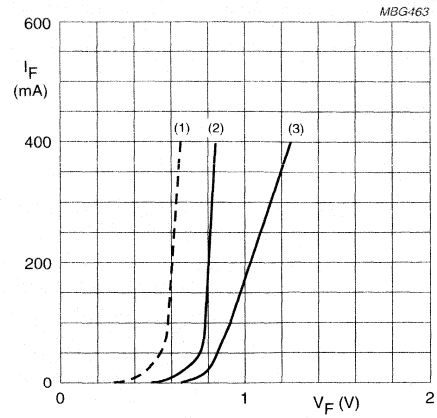
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



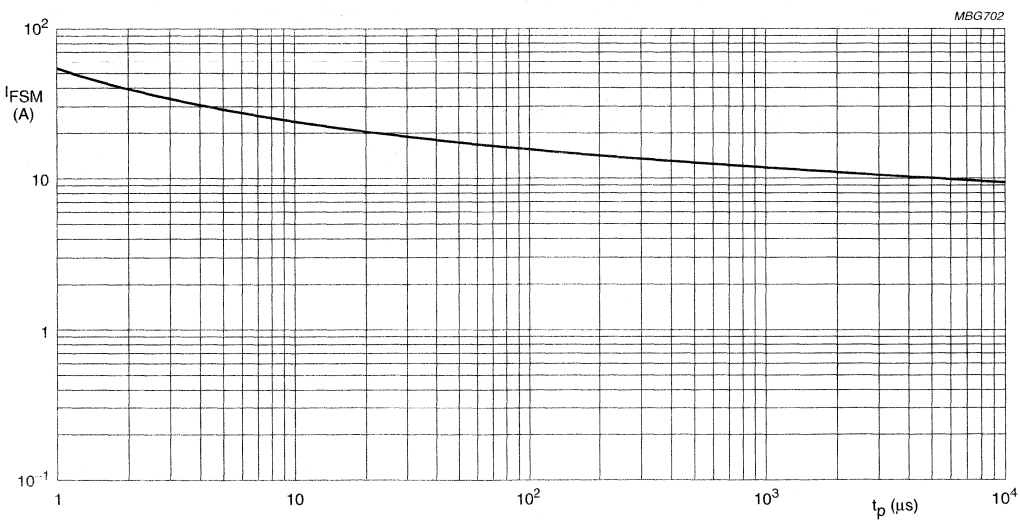
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



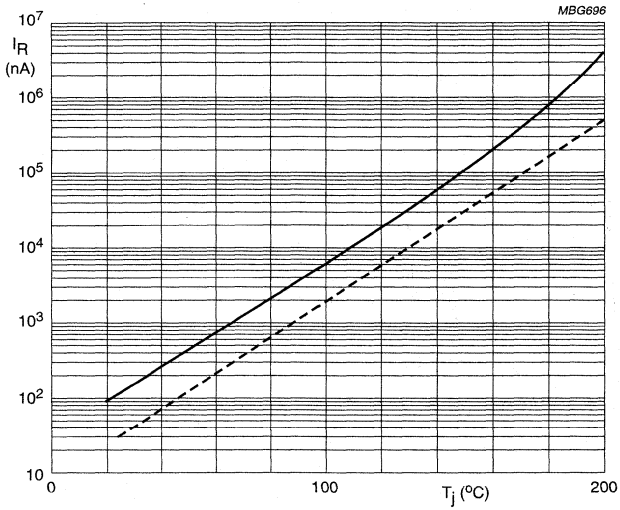
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



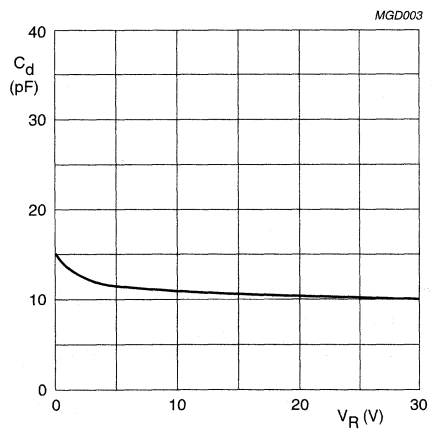
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



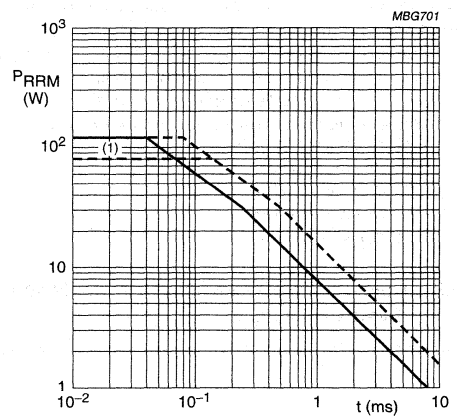
V_R = 90 V.
Solid line; maximum values. Dotted line; typical values.

Fig.5 Reverse current as a function of junction temperature.



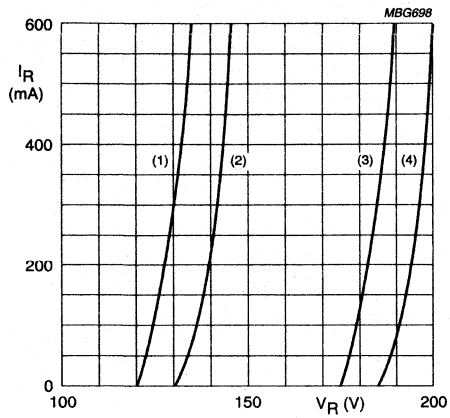
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



Solid line; rectangular waveform; $\delta \leq 0.01$.
Dotted line; triangular waveform; $\delta \leq 0.02$.
(1) Limited by I_{RMM} = 600 mA.

Fig.7 Maximum permissible repetitive peak reverse power as a function of the pulse duration T ≥ 50 ms; T_j = 25 °C.



Reverse voltages higher than the V_R ratings are allowed, provided:

a. The transient energy ≤ 7.5 mJ at P_{RRM} ≤30 W; T_j = 25 °C;
the transient energy ≤ 5 mJ at P_{RRM} = 120 W; T_j = 25 °C (see Fig.7).

b. T ≥ 50 ms; δ ≤0.01 (rectangular waveform) (see Fig.9).
δ ≤0.02 (triangular waveform) (see Fig.9).

With increasing temperature, the maximum permissible transient energy must be decreased by 0.03 mJ/K.

(1) T_j = 25 °C; minimum values.
(2) T_j = 175 °C; minimum values.
(3) T_j = 25 °C; maximum values.
(4) T_j = 175 °C; maximum values.

Fig.8 Reverse current as a function of continuous reverse voltage.

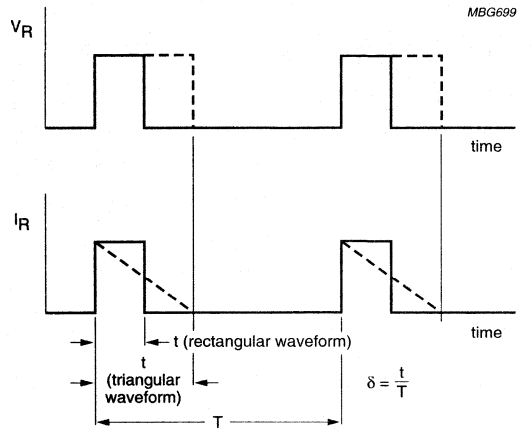
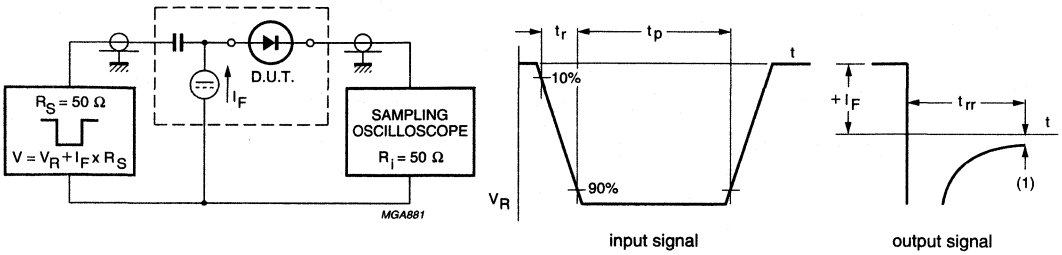


Fig.9 Peak reverse voltage and current test pulses.



Input signal: reverse pulse rise time t_r = 0.6 ns; reverse pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤ 1 pF (oscilloscope input capacitance + parasitic capacitance).
(1) I_R = 3 mA.

Fig.10 Reverse recovery voltage test circuit and waveforms.

General purpose diode BAX18

FEATURES

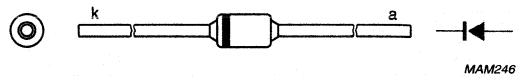
- Hermetically sealed leaded glass SOD27 (DO-35) package
- Switching speed: max. 50 ns
- General application
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 2 A.

APPLICATIONS

- Rectifier applications.

DESCRIPTION

The BAX18 is a general purpose diode fabricated in planar technology, and encapsulated in the hermetically sealed leaded glass SOD27 (DO-35) package.



The diode is type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	500	mA
I_{FRM}	repetitive peak forward current		–	2000	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	55	A
		t = 100 μs	–	15	A
		t = 10 ms	–	9	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	450	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
		I_F = 300 mA	–	1.0	V
		I_F = 2 A; T_j = 150 °C	–	1.5	V
I_R	reverse current	see Fig.5			
		V_R = 75 V	–	5	μA
		V_R = 75 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	35	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA; see Fig.7	–	50	ns

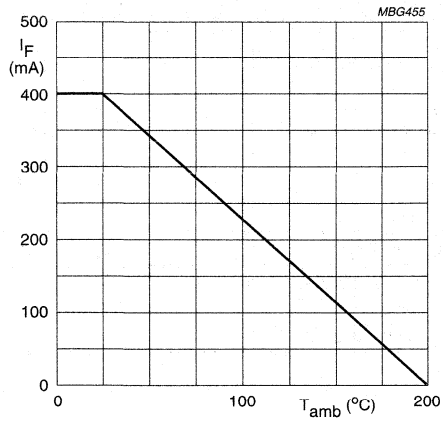
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	375	K/W

Note

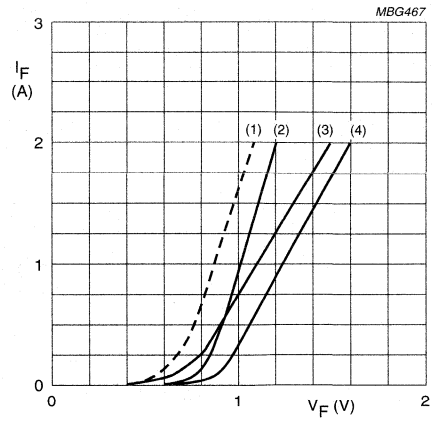
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



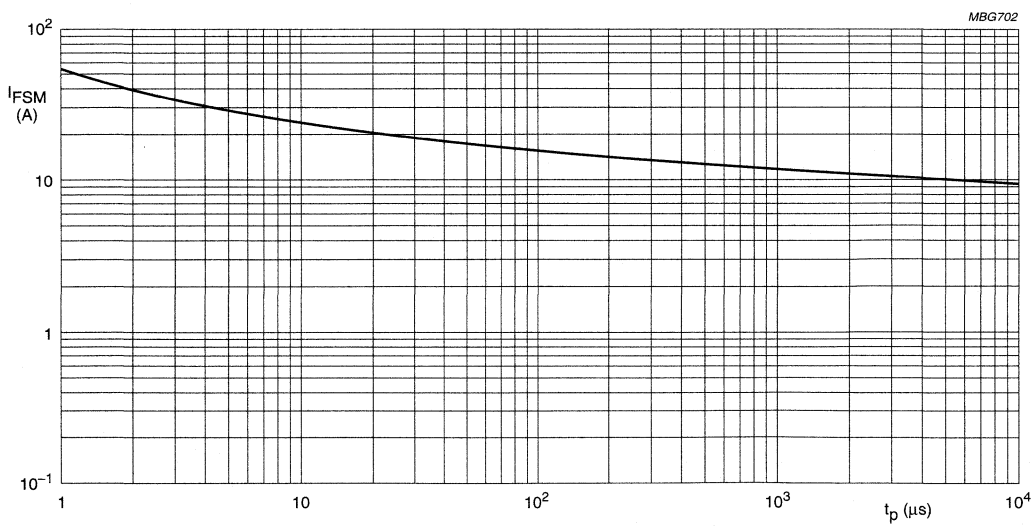
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



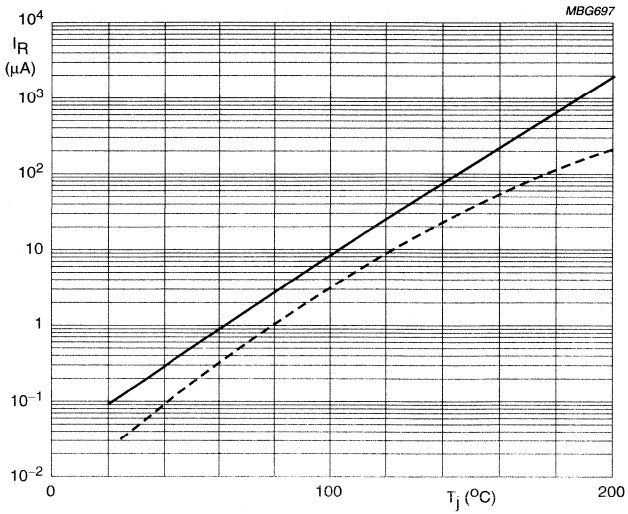
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 150 °C; maximum values.
(4) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



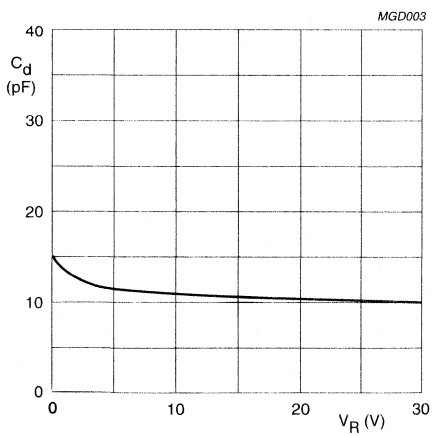
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



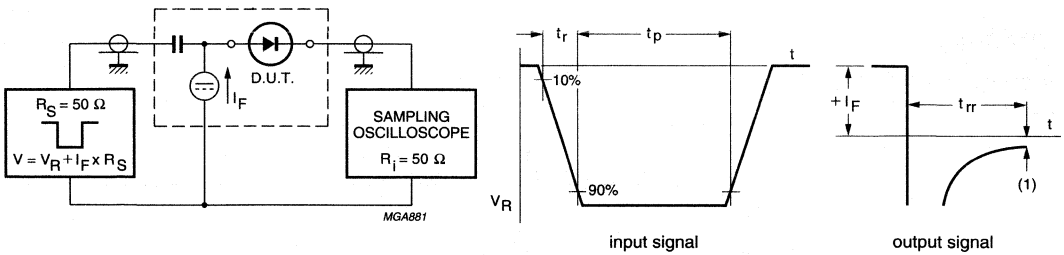
V_R = 75 V.
Solid line; maximum values. Dotted line; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 3$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

Schottky barrier diodes BYV10 series

FEATURES

- Low switching losses
- Fast recovery time
- Guard ring protected
- Hermetically sealed leaded glass package.

APPLICATIONS

- Low power, switched-mode power supplies
- Rectifying
- Polarity protection.

DESCRIPTION

The BYV10-20 to BYV10-40 types are Schottky barrier diodes fabricated in planar technology, and encapsulated in SOD81 hermetically sealed glass packages incorporating Implotec™(1) technology.

(1) Implotec is a trademark of Philips.

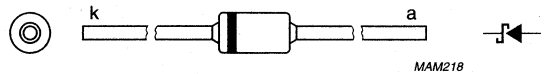


Fig.1 Simplified outline (SOD81) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage				
	BYV10-20		–	20	V
	BYV10-30		–	30	V
	BYV10-40		–	40	V
$I_{F(AV)}$	average forward current	note 1	–	1	A
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	125	°C

Note

1. Refer to SOD81 standard mounting conditions.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 0.1 A	–	–	390	mV
		I_F = 1 A	–	–	550	mV
		I_F = 3 A	–	–	850	mV
I_R	reverse current	$V_R = V_{RRMmax}$; note 1	–	–	1	mA
C_d	diode capacitance	V_R = 0 V; f = 1 MHz	–	220	–	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W

Note

1. Refer to SOD81 standard mounting conditions.

Voltage reference diodes BZV10 to BZV14

FEATURES

- Temperature compensated
- Reference voltage range: 5.9 to 6.5 V (typ. 6.2 V)
- Low temperature coefficient range: max. 0.0005 to 0.01 %/K.

APPLICATION

- Voltage reference sources in measuring instruments such as digital voltmeters.

DESCRIPTION

Voltage reference diode in a hermetically-sealed SOD68 (DO-34) glass package.

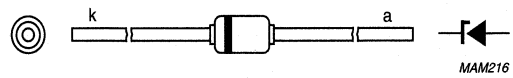


Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_Z	working current		–	50	mA
P_{tot}	total power dissipation	T_{amb} = 50 °C	–	400	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{amb}	operating ambient temperature		0	+70	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{ref}	reference voltage	I_Z =2 mA	5.9	6.2	6.5	V
$\lvert\Delta V_{ref}\rvert$	reference voltage excursion	I_Z =2 mA; test points for T_{amb}: 0; +25; +70 °C; notes 1 and 2				
	BZV10		–	–	46	mV
	BZV11		–	–	23	mV
	BZV12		–	–	9	mV
	BZV13		–	–	4.6	mV
	BZV14		–	–	2.3	mV
$\lvert S_Z\rvert$	temperature coefficient	I_Z = 2 mA: see Fig.2; notes 1 and 2				
	BZV10		–	–	0.01	%/K
	BZV11		–	–	0.005	%/K
	BZV12		–	–	0.002	%/K
	BZV13		–	–	0.001	%/K
	BZV14		–	–	0.0005	%/K
r_{dif}	differential resistance	I_Z = 2 mA; see Fig.3	–	20	50	Ω

Notes

1. The quoted values of ΔV_{ref} are based on a constant current I_Z. Two factors can cause ΔV_{ref} to change, namely the differential resistance r_{dif} and the temperature coefficient S_Z.
   a) As the max. r_{dif} of the device can be 50 Ω, a change of 0.01 mA in the current through the reference diode will result in a ΔV_{ref} of 0.01 mA × 50 Ω = 0.5 mV. This level of ΔV_{ref} is not significant on a BZV10 (ΔV_{ref} < 46 mV), it is however very significant on a BZV14 (ΔV_{ref} < 2.3 mV).
   b) The temperature coefficient of the reference voltage S_Z is a function of I_Z. Reference diodes are classified at the specified test current, and the S_Z of the reference diode will be different at different levels of I_Z. The absolute value of I_Z is important, however, the stability of I_Z, once the level has been set, is far more significant. This applies particularly to the BZV13 and BZV14. The effect of the stability of I_Z on S_Z is shown in Fig.2.
2. All reference diodes are characterized by the 'box method'. This guarantees a maximum voltage excursion (ΔV_{ref}) over the specified temperature range, at the specified test current (I_Z), verified by tests at indicated temperature points within the range. V_Z is measured and recorded at each temperature specified. The ΔV_{ref} between the highest and lowest values must not exceed the maximum ΔV_{ref} given. Therefore the temperature coefficient is only given as a reference. It may be derived from: $S_Z = \frac{V_{ref1} - V_{ref2}}{T_{amb2} - T_{amb1}} \times \frac{100}{V_{ref\ nom}}$ %/K

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	8 mm from the body	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm	375	K/W

GRAPHICAL DATA

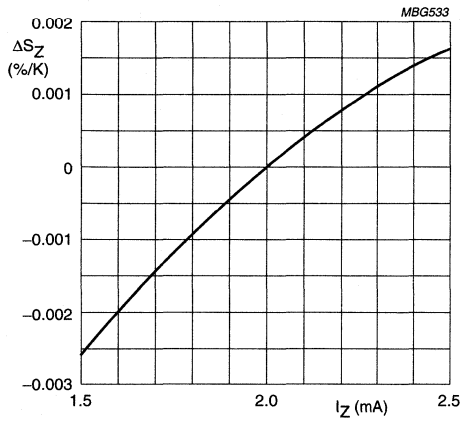


Fig.2 Temperature coefficient change as a function of working current; typical values.

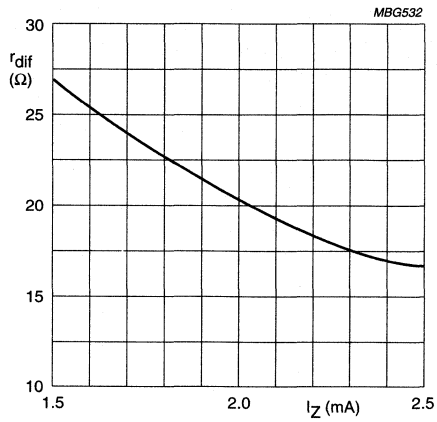


Fig.3 Differential resistance as a function of working current; typical values.

Bidirectional voltage regulator diode BZV37

FEATURES

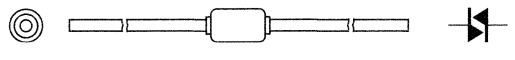
- Low total power dissipation: max. 400 mW
- Working voltage: nom. 6.5 V
- Non-repetitive peak reverse power dissipation: max. 40 W
- Bidirectional.

APPLICATIONS

- Voltage stabilizer and transient protection element.

DESCRIPTION

Low-power voltage regulator diode in an hermetically sealed leaded glass SOD68 (DO-34) package.



MAM247

The diode is type branded.

Fig.1 Simplified outline (SOD68; DO-34) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_Z	continuous working current		–	50	mA
I_{ZSM}	non-repetitive peak reverse current	$t = 30$ s; $t_1 = 8$ µs; $t_2 = 20$ µs; $T_j = 25$ °C prior to surge; see Fig.3	–	7	A
		$t = 30$ s; $t_1 = 10$ µs; $t_2 = 1000$ µs; $T_j = 25$ °C prior to surge; see Fig.3	–	2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	400	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	$t_p = 100$ µs square wave; $T_j = 25$ °C prior to surge; see Fig.2	–	40	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

ELECTRICAL CHARACTERISTICS

$T_j = 25$ °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	NOM.	MAX.	UNIT
V_Z	working voltage	$I_{Ztest} = 5$ mA	6.2	6.5	6.8	V
$V_{(CL)R}$	clamping voltage	$I_{ZSM} = 7$ A; $t_1 = 8$ µs; $t_2 = 20$ µs	–	–	25	V
		$I_{ZSM} = 2$ A; $t_1 = 10$ µs; $t_2 = 1000$ µs	–	–	15	V
r_{diff}	differential resistance	$I_{Ztest} = 5$ mA	–	–	20	Ω
S_Z	temperature coefficient	$I_{Ztest} = 5$ mA	–	–	0.1	%/K
C_d	diode capacitance	$V_R = 0$ V	–	–	150	pF
I_R	reverse current	$V_R = 4$ V	–	–	10	µA
		$V_R = 4$ V; $T_j = 150$ °C	–	–	30	µA
		$V_R = 2$ V	–	–	3	µA

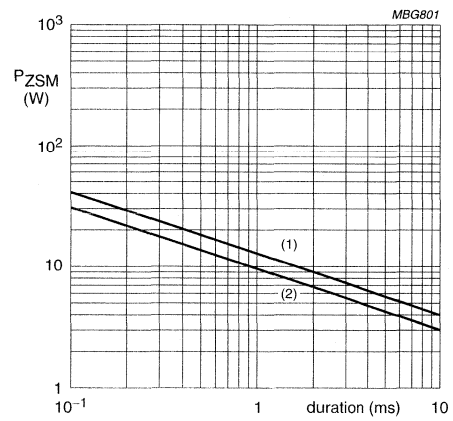
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 8 mm	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length max.; note 1	380	K/W

Note

1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.2 Maximum permissible non-repetitive peak reverse power dissipation versus duration.

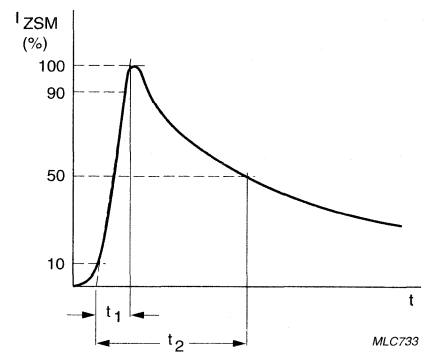


Fig.3 Current pulse according to IEC 60-2, Section 6.

Voltage regulator diodes BZV49 series

FEATURES

- Total power dissipation: max. 1 W
- Tolerance series: approx. ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- General regulation functions.

DESCRIPTION

Medium-power voltage regulator diodes in a SOT89 plastic SMD package.

The diodes are available in the normalized E24 approx. ±5% tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V (BZV49-C2V4 to BZV49-C75).

PINNING

PIN	DESCRIPTION
1	anode
2	anode
3	cathode

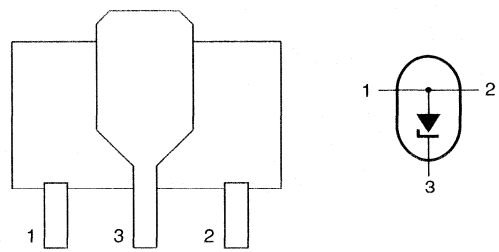


Fig.1 Simplified outline (SOT89) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BZV49-C2V4	2Y4	BZV49-C6V2	6Y2	BZV49-C16	16Y	BZV49-C43	43Y
BZV49-C2V7	2Y7	BZV49-C6V8	6Y8	BZV49-C18	18Y	BZV49-C47	47Y
BZV49-C3V0	3Y0	BZV49-C7V5	7Y5	BZV49-C20	20Y	BZV49-C51	51Y
BZV49-C3Y3	3Y3	BZV49-C8V2	8Y2	BZV49-C22	22Y	BZV49-C56	56Y
BZV49-C3V6	3Y6	BZV49-C9V1	9Y1	BZV49-C24	24Y	BZV49-C62	62Y
BZV49-C3V9	3Y9	BZV49-C10	10Y	BZV49-C27	27Y	BZV49-C68	68Y
BZV49-C4V3	4Y3	BZV49-C11	11Y	BZV49-C30	30Y	BZV49-C75	75Y
BZV49-C4V7	4Y7	BZV49-C12	12Y	BZV49-C33	33Y	–	–
BZV49-C5V1	5Y1	BZV49-C13	13Y	BZV49-C36	36Y	–	–
BZV49-C5V6	5Y6	BZV49-C15	15Y	BZV49-C39	39Y	–	–

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 μs; square wave; T_j = 25 °C prior to surge	see Table "Per type"		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	1	W
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 μs; square wave; T_j = 25 °C prior to surge; see Fig.2	–	40	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

ELECTRICAL CHARACTERISTICS

Total series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 50 mA; see Fig.3	1	V

Per type

T_j = 25 °C unless otherwise specified.

BZV49-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}		TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 4 and 5			TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
										I_R (μA)	V_R (V)	
	MIN.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.		MAX.	MAX.		MAX.
2V4	2.2	2.6	70	100	−3.5	−1.6	0	5	450	50	1.0	6.0
2V7	2.5	2.9	75	100	−3.5	−2.0	0	5	450	20	1.0	6.0
3V0	2.8	3.2	80	95	−3.5	−2.1	0	5	450	10	1.0	6.0
3V3	3.1	3.5	85	95	−3.5	−2.4	0	5	450	5	1.0	6.0
3V6	3.4	3.8	85	90	−3.5	−2.4	0	5	450	5	1.0	6.0
3V9	3.7	4.1	85	90	−3.5	−2.5	0	5	450	3	1.0	6.0
4V3	4.0	4.6	80	90	−3.5	−2.5	0	5	450	3	1.0	6.0
4V7	4.4	5.0	50	80	−3.5	−1.4	+0.2	5	300	3	2.0	6.0
5V1	4.8	5.4	40	60	−2.7	−0.8	+1.2	5	300	2	2.0	6.0
5V6	5.2	6.0	15	40	−2.0	+1.2	+2.5	5	300	1	2.0	6.0
6V2	5.8	6.6	6	10	0.4	2.3	3.7	5	200	3	4.0	6.0
6V8	6.4	7.2	6	15	1.2	3.0	4.5	5	200	2	4.0	6.0
7V5	7.0	7.9	6	15	2.5	4.0	5.3	5	150	1	5.0	4.0
8V2	7.7	8.7	6	15	3.2	4.6	6.2	5	150	0.7	5.0	4.0
9V1	8.5	9.6	6	15	3.8	5.5	7.0	5	150	0.5	6.0	3.0
10	9.4	10.6	8	20	4.5	6.4	8.0	5	90	0.2	7.0	3.0
11	10.4	11.6	10	20	5.4	7.4	9.0	5	85	0.1	8.0	2.5
12	11.4	12.7	10	25	6.0	8.4	10.0	5	85	0.1	8.0	2.5
13	12.4	14.1	10	30	7.0	9.4	11.0	5	80	0.1	8.0	2.5
15	13.8	15.6	10	30	9.2	11.4	13.0	5	75	0.05	10.5	2.0
16	15.3	17.1	10	40	10.4	12.4	14.0	5	75	0.05	11.2	1.5
18	16.8	19.1	10	45	12.4	14.4	16.0	5	70	0.05	12.6	1.5
20	18.8	21.2	15	55	14.4	16.4	18.0	5	60	0.05	14.0	1.5

BZV49-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}		TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 4 and 5			TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
										I_R (μA)	V_R (V)	
	MIN.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.		MAX.	MAX.		MAX.
22	20.8	23.3	20	55	16.4	18.4	20.0	5	60	0.05	15.4	1.25
24	22.8	25.6	25	70	18.4	20.4	22.0	5	55	0.05	16.8	1.25
27	25.1	28.9	25	80	21.4	23.4	25.3	2	50	0.05	18.9	1.0
30	28.0	32.0	30	80	24.4	26.6	29.4	2	50	0.05	21.0	1.0
33	31.0	35.0	35	80	27.4	29.7	33.4	2	45	0.05	23.1	0.9
36	34.0	38.0	35	90	30.4	33.0	37.4	2	45	0.05	25.2	0.8
39	37.0	41.0	40	130	33.4	36.4	41.2	2	45	0.05	27.3	0.7
43	40.0	46.0	45	150	37.6	41.2	46.6	2	40	0.05	30.1	0.6
47	44.0	50.0	50	170	42.0	46.1	51.8	2	40	0.05	32.9	0.5
51	48.0	54.0	60	180	46.6	51.0	57.2	2	40	0.05	35.7	0.4
56	52.0	60.0	70	200	52.2	57.0	63.8	2	40	0.05	39.2	0.3
62	58.0	66.0	80	215	58.8	64.4	71.6	2	35	0.05	43.4	0.3
68	64.0	72.0	90	240	65.6	71.7	79.8	2	35	0.05	47.6	0.25
75	70.0	79.0	95	255	73.4	80.2	88.6	2	35	0.05	52.5	0.2

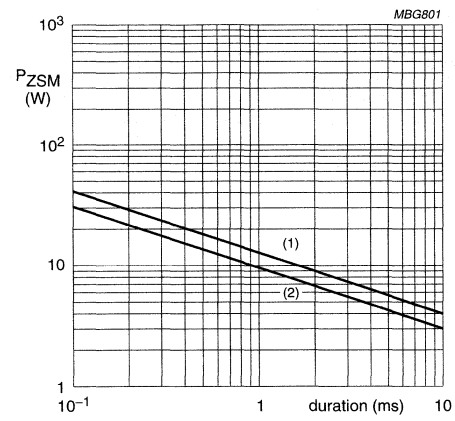
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		15	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	125	K/W

Note

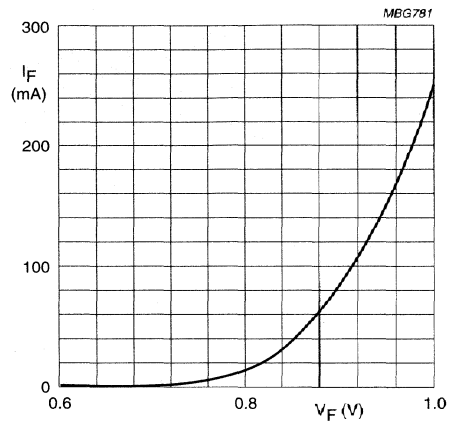
1. Device mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

GRAPHICAL DATA



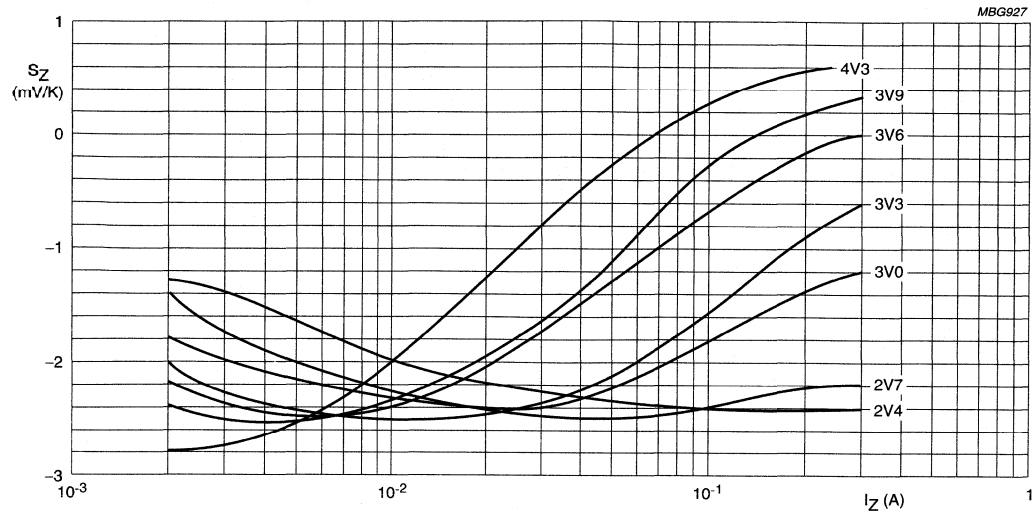
(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.2 Maximum permissible non-repetitive peak reverse power dissipation versus duration.



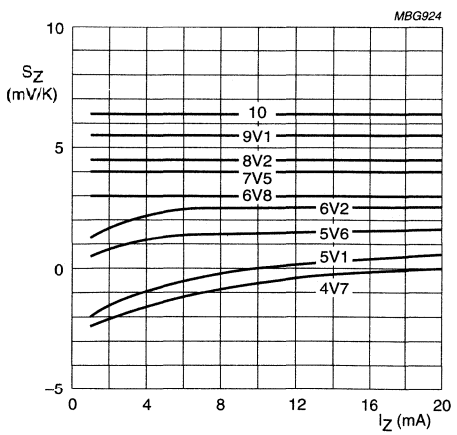
T_j = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



BZV49-C2V4 to C4V3.
T_j = 25 to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.



BZV49-C4V7 to C10.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZV55 series

FEATURES

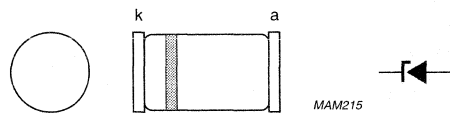
- Total power dissipation: max. 500 mW
- Two tolerance series: ±2% and approx. ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- Low-power voltage stabilizers or voltage references.

DESCRIPTION

Low-power voltage regulator diodes in small hermetically sealed glass SOD80C SMD packages. The diodes are available in the normalized E24 ±2% (BZV55-B) and approx. ±5% (BZV55-C) tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V.



The cathode is indicated by a yellow band.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_j = 25 °C prior to surge	see Tables 1 and 2		
P_{tot}	total power dissipation	T_{amb} ≤50 °C; note 1	–	400	mW
		tie-point ≤50 °C; note 1	–	500	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 µs; square wave; T_j = 25 °C prior to surge; see Fig.3	–	40	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		−65	+200	°C

Note

1. Device mounted on a ceramic substrate of 10 × 10 × 0.6 mm.

ELECTRICAL CHARACTERISTICS

Total BZV55-B and C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.4	0.9	V
I_R	reverse current			
	BZV55-B/C2V4	V_R = 1 V	50	µA
	BZV55-B/C2V7	V_R = 1 V	20	µA
	BZV55-B/C3V0	V_R = 1 V	10	µA
	BZV55-B/C3V3	V_R = 1 V	5	µA
	BZV55-B/C3V6	V_R = 1 V	5	µA
	BZV55-B/C3V9	V_R = 1 V	3	µA
	BZV55-B/C4V3	V_R = 1 V	3	µA
	BZV55-B/C4V7	V_R = 2 V	3	µA
	BZV55-B/C5V1	V_R = 2 V	2	µA
	BZV55-B/C5V6	V_R = 2 V	1	µA
	BZV55-B/C6V2	V_R = 4 V	3	µA
	BZV55-B/C6V8	V_R = 4 V	2	µA
	BZV55-B/C7V5	V_R = 5 V	1	µA
	BZV55-B/C8V2	V_R = 5 V	700	nA
	BZV55-B/C9V1	V_R = 6 V	500	nA
	BZV55-B/C10	V_R = 7 V	200	nA
	BZV55-B/C11	V_R = 8 V	100	nA
	BZV55-B/C12	V_R = 8 V	100	nA
	BZV55-B/C13	V_R = 8 V	100	nA
	BZV55-B/C15 to 75	$V_R = 0.7V_{Znom}$	50	nA

Table 1 Per type BZV55-**B/C2V4** to **B/C24**

T_j = 25 °C unless otherwise specified.

BZV55-B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 5 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 5 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±2% (B)		Tol. approx. ±5% (C)		at I_{Ztest} = 1 mA		at I_{Ztest} = 5 mA						
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
2V4	2.35	2.45	2.2	2.6	275	600	70	100	−3.5	−1.6	0	450	6.0
2V7	2.65	2.75	2.5	2.9	300	600	75	100	−3.5	−2.0	0	450	6.0
3V0	2.94	3.06	2.8	3.2	325	600	80	95	−3.5	−2.1	0	450	6.0
3V3	3.23	3.37	3.1	3.5	350	600	85	95	−3.5	−2.4	0	450	6.0
3V6	3.53	3.67	3.4	3.8	375	600	85	90	−3.5	−2.4	0	450	6.0
3V9	3.82	3.98	3.7	4.1	400	600	85	90	−3.5	−2.5	0	450	6.0
4V3	4.21	4.39	4.0	4.6	410	600	80	90	−3.5	−2.5	0	450	6.0
4V7	4.61	4.79	4.4	5.0	425	500	50	80	−3.5	−1.4	0.2	300	6.0
5V1	5.00	5.20	4.8	5.4	400	480	40	60	−2.7	−0.8	1.2	300	6.0
5V6	5.49	5.71	5.2	6.0	80	400	15	40	−2.0	1.2	2.5	300	6.0
6V2	6.08	6.32	5.8	6.6	40	150	6	10	0.4	2.3	3.7	200	6.0
6V8	6.66	6.94	6.4	7.2	30	80	6	15	1.2	3.0	4.5	200	6.0
7V5	7.35	7.65	7.0	7.9	30	80	6	15	2.5	4.0	5.3	150	4.0
8V2	8.04	8.36	7.7	8.7	40	80	6	15	3.2	4.6	6.2	150	4.0
9V1	8.92	9.28	8.5	9.6	40	100	6	15	3.8	5.5	7.0	150	3.0
10	9.80	10.20	9.4	10.6	50	150	8	20	4.5	6.4	8.0	90	3.0
11	10.80	11.20	10.4	11.6	50	150	10	20	5.4	7.4	9.0	85	2.5
12	11.80	12.20	11.4	12.7	50	150	10	25	6.0	8.4	10.0	85	2.5
13	12.70	13.30	12.4	14.1	50	170	10	30	7.0	9.4	11.0	80	2.5
15	14.70	15.30	13.8	15.6	50	200	10	30	9.2	11.4	13.0	75	2.0
16	15.70	16.30	15.3	17.1	50	200	10	40	10.4	12.4	14.0	75	1.5
18	17.60	18.40	16.8	19.1	50	225	10	45	12.4	14.4	16.0	70	1.5
20	19.60	20.40	18.8	21.2	60	225	15	55	14.4	16.4	18.0	60	1.5
22	21.60	22.40	20.8	23.3	60	250	20	55	16.4	18.4	20.0	60	1.25
24	23.50	24.50	22.8	25.6	60	250	25	70	18.4	20.4	22.0	55	1.25

Table 2 Per type BZV55-**B/C27** to **B/C75**

T_j = 25 °C unless otherwise specified.

BZV55-B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 2 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 2 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±2% (B)		Tol. approx. ±5% (C)		at I_{Ztest} = 0.5 mA		at I_{Ztest} = 2 mA						
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
27	26.50	27.50	25.1	28.9	65	300	25	80	21.4	23.4	25.3	50	1.0
30	29.40	30.60	28.0	32.0	70	300	30	80	24.4	26.6	29.4	50	1.0
33	32.30	33.70	31.0	35.0	75	325	35	80	27.4	29.7	33.4	45	0.9
36	35.30	36.70	34.0	38.0	80	350	35	90	30.4	33.0	37.4	45	0.8
39	38.20	39.80	37.0	41.0	80	350	40	130	33.4	36.4	41.2	45	0.7
43	42.10	43.90	40.0	46.0	85	375	45	150	37.6	41.2	46.6	40	0.6
47	46.10	47.90	44.0	50.0	85	375	50	170	42.0	46.1	51.8	40	0.5
51	50.00	52.00	48.0	54.0	90	400	60	180	46.6	51.0	57.2	40	0.4
56	54.90	57.10	52.0	60.0	100	425	70	200	52.2	57.0	63.8	40	0.3
62	60.80	63.20	58.0	66.0	120	450	80	215	58.8	64.4	71.6	35	0.3
68	66.60	69.40	64.0	72.0	150	475	90	240	65.6	71.7	79.8	35	0.25
75	73.50	76.50	70.0	79.0	170	500	95	255	73.4	80.2	88.6	35	0.2

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	see Fig.2 and note 1	380	K/W

Note

1. Device mounted on a ceramic substrate of $10 \times 10 \times 0.6$ mm.

GRAPHICAL DATA

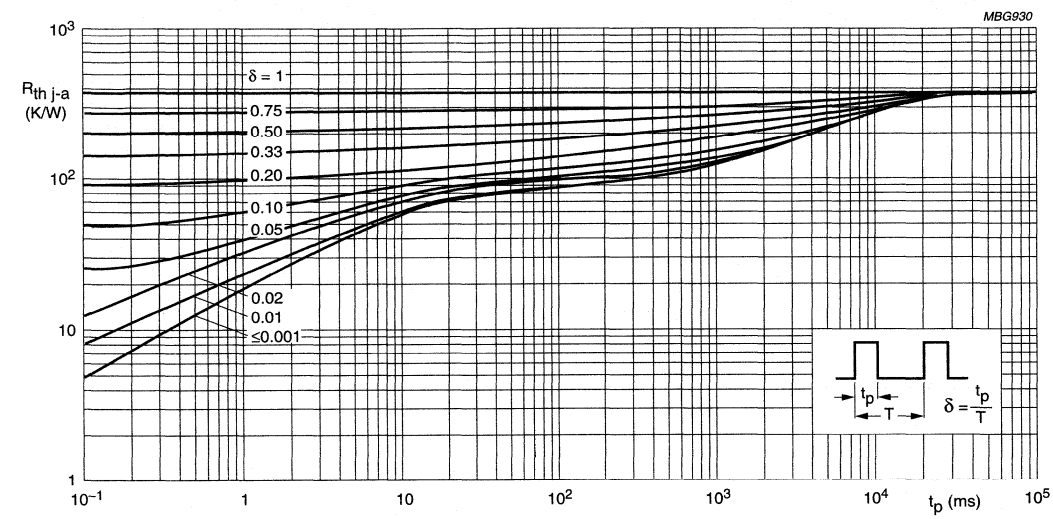
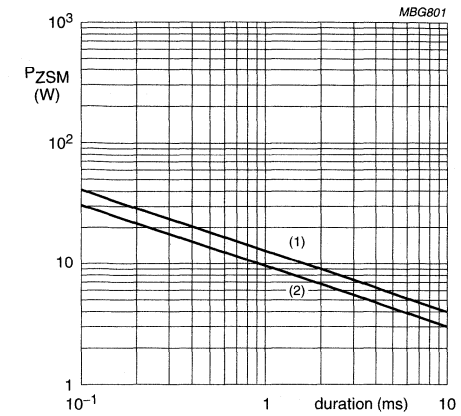
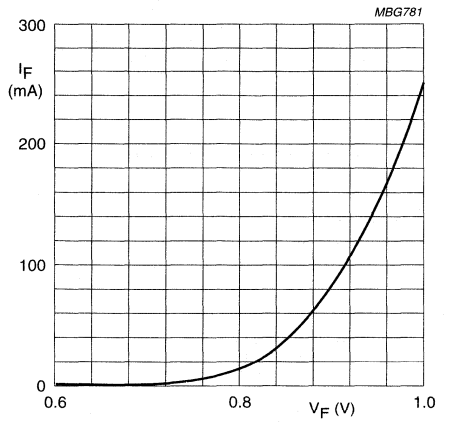


Fig.2 Thermal resistance from junction to ambient as a function of pulse duration.



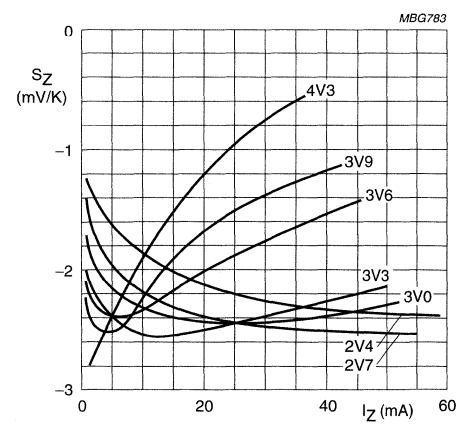
(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.3 Maximum permissible non-repetitive peak reverse power dissipation versus duration.



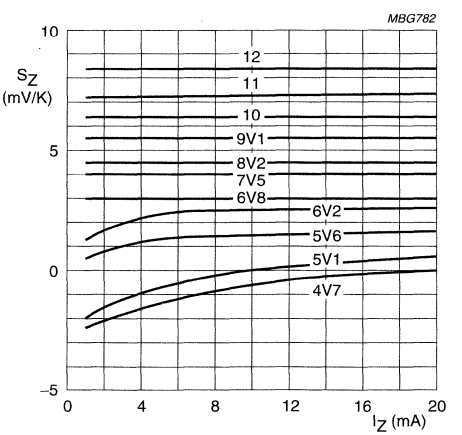
T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.



BZV55-B/C2V4 to B/C4V3.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.



BZV55-B/C4V7 to B/C12.
T_j = 25 to 150 °C.

Fig.6 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZV85 series

FEATURES

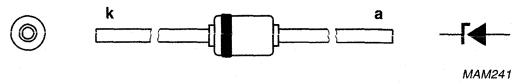
- Total power dissipation: max. 1.3 W
- Tolerance series: approx. ±5%
- Working voltage range: nom. 3.6 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 60 W.

APPLICATIONS

- Stabilization purposes.

DESCRIPTION

Medium-power voltage regulator diodes in hermetically sealed leaded glass SOD66 (DO-41) packages. The diodes are available in the normalized E24 approx. ±5% tolerance range. The series consists of 33 types with nominal working voltages from 3.6 to 75 V (BZV85-C3V6 to BZV85-C75).



The diodes are type branded.

Fig.1 Simplified outline (SOD66; DO-41) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	500	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_j = 25 °C prior to surge; see Fig.3	see Table "Per type"		
		t_p = 10 ms; half sinewave; T_j = 25 °C prior to surge	see Table "Per type"		
P_{tot}	total power dissipation	T_{amb} = 25 °C; lead length 10 mm; note 1	–	1	W
		note 2	–	1.3	W
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 µs; square wave; T_j = 25 °C prior to surge	–	60	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Notes

1. Device mounted on a printed circuit-board with 1 cm^2 copper area per lead.
2. If the leads are kept at T_{tp} = 55 °C at 4 mm from body.

ELECTRICAL CHARACTERISTICS

Total series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 50 mA; see Fig.4	1	V

Per type

T_j = 25 °C unless otherwise specified.

BZV85-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}	TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 5 and 6		TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM}	
								I_R (μA)	V_R (V)	at t_p = 100 μs; T_{amb} = 25 °C	at t_p = 10 ms; T_{amb} = 25 °C
	MIN.	MAX.	MAX.	MIN.	MAX.		MAX.	MAX.		MAX. (A)	MAX. (mA)
3V6	3.4	3.8	15	−3.5	−1.0	60	450	50	1.0	8.0	2000
3V9	3.7	4.1	15	−3.5	−1.0	60	450	10	1.0	8.0	1950
4V3	4.0	4.6	13	−2.7	0	50	450	5	1.0	8.0	1850
4V7	4.4	5.0	13	−2.0	+0.7	45	300	3	1.0	8.0	1800
5V1	4.8	5.4	10	−0.5	+2.2	45	300	3	2.0	8.0	1750
5V6	5.2	6.0	7	0	2.7	45	300	2	2.0	8.0	1700
6V2	5.8	6.6	4	0.6	3.6	35	200	2	3.0	7.0	1620
6V8	6.4	7.2	3.5	1.3	4.3	35	200	2	4.0	7.0	1550
7V5	7.0	7.9	3	2.5	5.5	35	150	1	4.5	5.0	1500
8V2	7.7	8.7	5	3.1	6.1	25	150	0.7	5.0	5.0	1400
9V1	8.5	9.6	5	3.8	7.2	25	150	0.7	6.5	4.0	1340
10	9.4	10.6	8	4.7	8.5	25	90	0.2	7.0	4.0	1200
11	10.4	11.6	10	5.3	9.3	20	85	0.2	7.7	3.0	1100
12	11.4	12.7	10	6.3	10.8	20	85	0.2	8.4	3.0	1000
13	12.4	14.1	10	7.4	12.0	20	80	0.2	9.1	3.0	900
15	13.8	15.6	15	8.9	13.6	15	75	0.05	10.5	2.5	760
16	15.3	17.1	15	10.7	15.4	15	75	0.05	11.0	1.75	700
18	16.8	19.1	20	11.8	17.1	15	70	0.05	12.5	1.75	600
20	18.8	21.2	24	13.6	19.1	10	60	0.05	14.0	1.75	540
22	20.8	23.3	25	16.6	22.1	10	60	0.05	15.5	1.5	500
24	22.8	25.6	30	18.3	24.3	10	55	0.05	17	1.5	450
27	25.1	28.9	40	20.1	27.5	8	50	0.05	19	1.2	400
30	28.0	32.0	45	22.4	32.0	8	50	0.05	21	1.2	380

BZV85-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}	TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 5 and 6		TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM}	
								I_R (μA)	V_R (V)	at t_p = 100 μs; T_{amb} = 25 °C	at t_p = 10 ms; T_{amb} = 25 °C
	MIN.	MAX.	MAX.	MIN.	MAX.		MAX.	MAX.		MAX. (A)	MAX. (mA)
33	31.0	35.0	45	24.8	35.0	8	45	0.05	23	1.0	350
36	34.0	38.0	50	27.2	39.9	8	45	0.05	25	0.9	320
39	37.0	41.0	60	29.6	43.0	6	45	0.05	27	0.8	296
43	40.0	46.0	75	34.0	48.3	6	40	0.05	30	0.7	270
47	44.0	50.0	100	37.4	52.5	4	40	0.05	33	0.6	246
51	48.0	54.0	125	40.8	56.5	4	40	0.05	36	0.5	226
56	52.0	60.0	150	46.8	63.0	4	40	0.05	39	0.4	208
62	58.0	66.0	175	52.2	72.5	4	35	0.05	43	0.4	186
68	64.0	72.0	200	60.5	81.0	4	35	0.05	48	0.35	171
75	70.0	80.0	225	66.5	88.0	4	35	0.05	53	0.3	161

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 4 mm; see Fig.2	110	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length10 mm; note 1	175	K/W

Note

1. Device mounted on a printed circuit-board with 1 cm^2 copper area per lead.

GRAPHICAL DATA

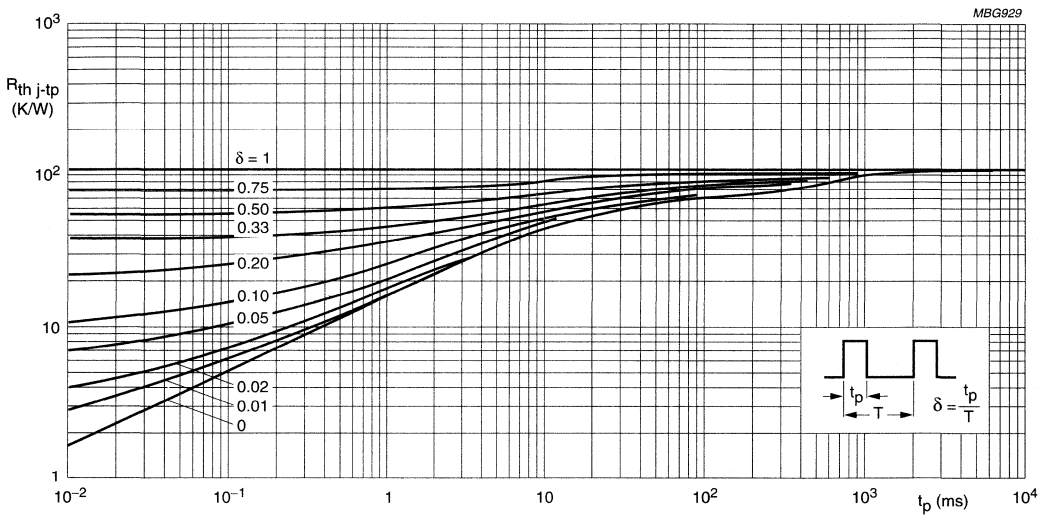
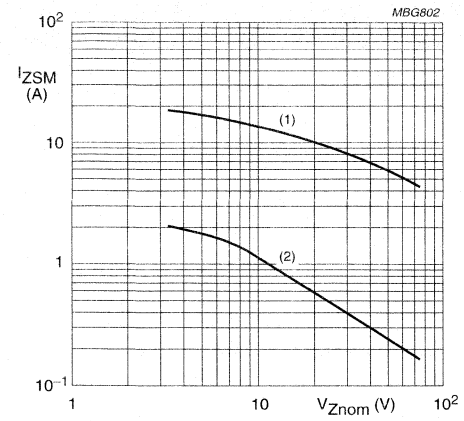
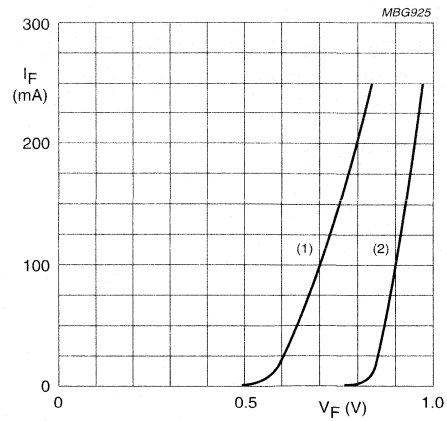


Fig.2 Thermal resistance from junction to tie-point with a lead length of 4 mm.



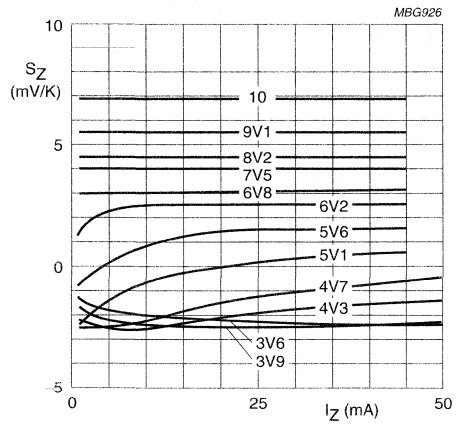
(1) t_p = 10 µs; half sinewave; T_{amb} = 25 °C.
(2) t_p = 10 ms; half sinewave; T_{amb} = 25 °C.

Fig.3 Non-repetitive peak reverse current as a function of the nominal working voltage.



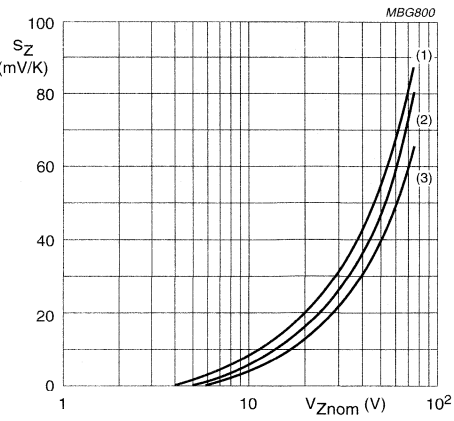
(1) T_j = 200 °C.
(2) T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.



BZV85-C3V6 to C10.
T_j = 25 to 150 °C.
For types above 7.5 V the temperature coefficient is independent of current; see Table "Per type".

Fig.5 Temperature coefficient as a function of working current; typical values.



$I_Z = I_{Ztest}$; T_j = 25 to 150 °C.
(1) Maximum values.
(2) Typical values.
(3) Minimum values.

Fig.6 Temperature coefficient as a function of nominal working voltage.

Low-voltage stabistors BZV86 series

FEATURES

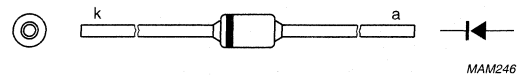
- Low-voltage stabilization
- Forward voltage range: 1.4 to 3.2 V
- Total power dissipation: max. 330 mW
- Differential resistance range: max. 20 to 35 Ω.

APPLICATIONS

- Power clipping
- Level shifting
- Low-voltage regulation
- Temperature stabilization.

DESCRIPTION

Low-voltage stabilization diode in a hermetically-sealed SOD27 (DO-35) glass package. The series consists of four types: BZV86-1V4 to BZV86-3V2.



The diodes are type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	10	V
I_F	continuous forward current				
	BZV86-1V4		–	200	mA
	BZV86-2V0		–	150	mA
	BZV86-2V6		–	125	mA
	BZV86-3V2		–	100	mA
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	330	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

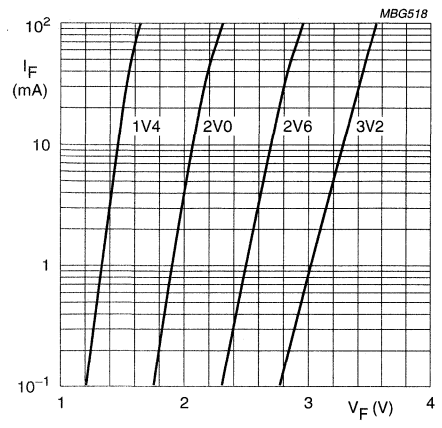
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 5 mA; see Fig.2				
	BZV86-1V4		1.30	–	1.50	V
	BZV86-2V0		1.85	–	2.15	V
	BZV86-2V6		2.35	–	2.80	V
	BZV86-3V2		2.85	–	3.45	V
I_R	reverse current	V_R = 5 V	–	–	200	nA
r_{dif}	differential resistance	I_F = 1 mA; f = 1 kHz				
	BZV86-1V4		–	55	–	Ω
	BZV86-2V0		–	80	–	Ω
	BZV86-2V6		–	90	–	Ω
	BZV86-3V2		–	100	–	Ω
r_{dif}	differential resistance	I_F = 5 mA; f = 1 kHz				
	BZV86-1V4		–	10	20	Ω
	BZV86-2V0		–	15	30	Ω
	BZV86-2V6		–	18	32.5	Ω
	BZV86-3V2		–	20	35	Ω
r_{dif}	differential resistance	I_F = 10 mA; f = 1 kHz				
	BZV86-1V4		–	6	10	Ω
	BZV86-2V0		–	8	15	Ω
	BZV86-2V6		–	9	17.5	Ω
	BZV86-3V2		–	10	20	Ω
S_F	temperature coefficient	I_F = 5 mA				
	BZV86-1V4		–	−3.8	–	mV/K
	BZV86-2V0		–	−6.0	–	mV/K
	BZV86-2V6		–	−8.5	–	mV/K
	BZV86-3V2		–	−11.5	–	mV/K
C_d	diode capacitance	V_R = 0 V; f = 1 MHz	–	15	25	pF

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	8 mm from the body	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm	380	K/W

GRAPHICAL DATA



T_j = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.

Voltage regulator diodes BZV90 series

FEATURES

- Total power dissipation: max. 1500 mW
- Tolerance series: approx. ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- General regulation functions.

DESCRIPTION

Medium-power voltage regulator diodes in SOT223 plastic SMD packages.

The diodes are available in the normalized E24 approx. ±5% tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V (BZV90-C2V4 to C75).

PINNING

PIN	DESCRIPTION
1	anode
2, 4	cathode
3	anode

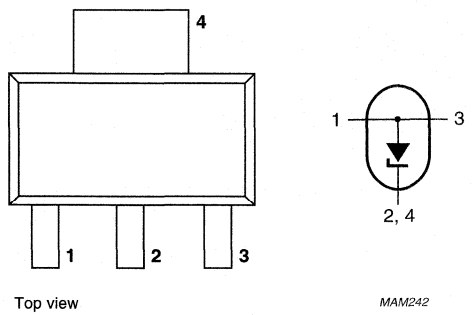


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	400	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 μs; square wave; T_j = 25 °C prior to surge	see Table "Per type"		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	1500	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 μs; square wave; T_j = 25 °C prior to surge; see Fig.2	–	40	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 double-sided copper-clad printed circuit-board; copper area = 2 cm^2.

ELECTRICAL CHARACTERISTICS

Total series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	I_F = 50 mA; see Fig.3	–	1.0	V

Per type

T_j = 25 °C unless otherwise specified.

BZV90-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}		TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 4 and 5			TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
										I_R (μA)	V_R (V)	
	MIN.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.		MAX.	MAX.		MAX.
2V4	2.2	2.6	70	100	−3.5	−1.6	0	5	450	50	1.0	6.0
2V7	2.5	2.9	75	100	−3.5	−2.0	0	5	450	20	1.0	6.0
3V0	2.8	3.2	80	95	−3.5	−2.1	0	5	450	10	1.0	6.0
3V3	3.1	3.5	85	95	−3.5	−2.4	0	5	450	5	1.0	6.0
3V6	3.4	3.8	85	90	−3.5	−2.4	0	5	450	5	1.0	6.0
3V9	3.7	4.1	85	90	−3.5	−2.5	0	5	450	3	1.0	6.0
4V3	4.0	4.6	80	90	−3.5	−2.5	0	5	450	3	1.0	6.0
4V7	4.4	5.0	50	80	−3.5	−1.4	0.2	5	300	3	2.0	6.0
5V1	4.8	5.4	40	60	−2.7	−0.8	1.2	5	300	2	2.0	6.0
5V6	5.2	6.0	15	40	−2.0	1.2	2.5	5	300	1	2.0	6.0
6V2	5.8	6.6	6	10	0.4	2.3	3.7	5	200	3	4.0	6.0
6V8	6.4	7.2	6	15	1.2	3.0	4.5	5	200	2	4.0	6.0
7V5	7.0	7.9	6	15	2.5	4.0	5.3	5	150	1	5.0	4.0
8V2	7.7	8.7	6	15	3.2	4.6	6.2	5	150	0.7	5.0	4.0
9V1	8.5	9.6	6	15	3.8	5.5	7.0	5	150	0.5	6.0	3.0
10	9.4	10.6	8	20	4.5	6.4	8.0	5	90	0.2	7.0	3.0
11	10.4	11.6	10	20	5.4	7.4	9.0	5	85	0.1	8.0	2.5
12	11.4	12.7	10	25	6.0	8.4	10.0	5	85	0.1	8.0	2.5
13	12.4	14.1	10	30	7.0	9.4	11.0	5	80	0.1	8.0	2.5
15	13.8	15.6	10	30	9.2	11.4	13.0	5	75	0.05	10.5	2.0
16	15.3	17.1	10	40	10.4	12.4	14.0	5	75	0.05	11.2	1.5
18	16.8	19.1	10	45	12.4	14.4	16.0	5	70	0.05	12.6	1.5
20	18.8	21.2	15	55	14.4	16.4	18.0	5	60	0.05	14.0	1.5

BZV90-CXXX	WORKING VOLTAGE V_Z (V) at I_{Ztest}		DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_{Ztest}		TEMP. COEFF. S_Z (mV/K) at I_{Ztest} see Figs 4 and 5			TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
										I_R (μA)	V_R (V)	
	MIN.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.		MAX.	MAX.		MAX.
22	20.8	23.3	20	55	16.4	18.4	20.0	5	60	0.05	15.4	1.25
24	22.8	25.6	25	70	18.4	20.4	22.0	5	55	0.05	16.8	1.25
27	25.0	28.9	25	80	21.4	23.4	25.3	2	50	0.05	18.9	1.0
30	28.0	32.0	30	80	24.4	26.6	29.4	2	50	0.05	21.0	1.0
33	31.0	35.0	35	80	27.4	29.7	33.4	2	45	0.05	23.1	0.9
36	34.0	38.0	35	90	30.4	33.0	37.4	2	45	0.05	25.2	0.8
39	37.0	41.0	40	130	33.4	36.4	41.2	2	45	0.05	27.3	0.7
43	40.0	46.0	45	150	37.6	41.2	46.6	2	40	0.05	30.1	0.6
47	44.0	50.0	50	170	42.0	46.1	51.8	2	40	0.05	32.9	0.5
51	48.0	54.0	60	180	46.6	51.0	57.2	2	40	0.05	35.7	0.4
56	52.0	60.0	70	200	52.2	57.0	63.8	2	40	0.05	39.2	0.3
62	58.0	66.0	80	215	58.8	64.4	71.6	2	35	0.05	43.4	0.3
68	64.0	72.0	90	240	65.6	71.7	79.8	2	35	0.05	47.6	0.25
75	70.0	79.0	95	255	73.4	80.2	88.6	2	35	0.05	52.5	0.2

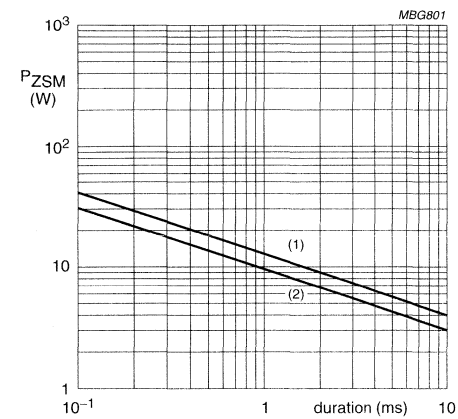
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length max.; note 1	83.3	K/W

Note

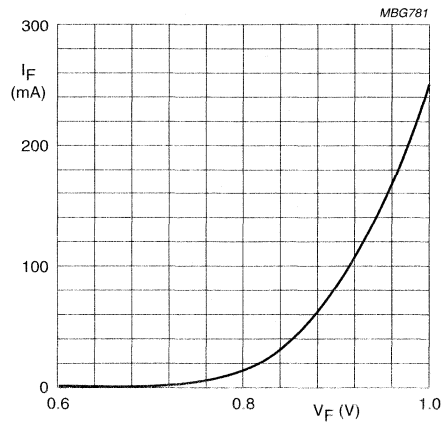
1. Device mounted on an FR4 double-sided copper-clad printed circuit-board; copper area = 2 cm^2.

GRAPHICAL DATA



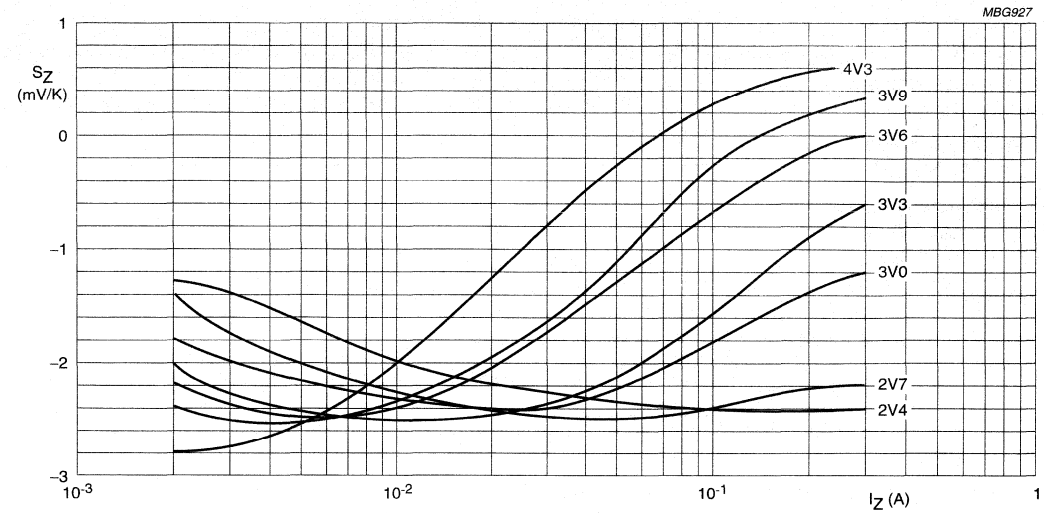
(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.2 Maximum permissible non-repetitive peak reverse power dissipation versus duration.



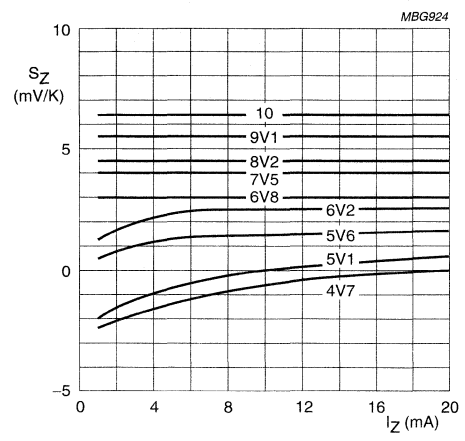
T_j = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



BZV90-C2V4 to C4V3.
T_j = 25 to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.



BZV90-C4V7 to C10.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZX79 series

FEATURES

- Total power dissipation: max. 500 mW
- Three tolerance series: ±1%, ±2%, and approx. ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- Low voltage stabilizers or voltage references.

DESCRIPTION

Low-power voltage regulator diodes in hermetically sealed leaded glass SOD27 (DO-35) packages. The diodes are available in the normalized E24 ±1% (BZX79-A), ±2% (BZX79-B), and approx. ±5% (BZX79-C) tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V.

The diodes are type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_j = 25 °C prior to surge	see Tables 1, 2, 3 and 4		
P_{tot}	total power dissipation	T_{amb} = 50 °C; note 1	–	400	mW
		T_{amb} = 50 °C; note 2	–	500	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 µs; square wave; T_j = 25 °C prior to surge; see Fig.3	–	40	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		−65	+200	°C

Notes

1. Device mounted on a printed circuit-board without metallization pad; lead length max.
2. Tie-point temperature ≤ 50 °C; max. lead length 8 mm.

ELECTRICAL CHARACTERISTICS

Total BZX79-A, B and C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.4	0.9	V
I_R	reverse current			
	BZX79-A/B/C2V4	V_R = 1 V	50	µA
	BZX79-A/B/C2V7	V_R = 1 V	20	µA
	BZX79-A/B/C3V0	V_R = 1 V	10	µA
	BZX79-A/B/C3V3	V_R = 1 V	5	µA
	BZX79-A/B/C3V6	V_R = 1 V	5	µA
	BZX79-A/B/C3V9	V_R = 1 V	3	µA
	BZX79-A/B/C4V3	V_R = 1 V	3	µA
	BZX79-A/B/C4V7	V_R = 2 V	3	µA
	BZX79-A/B/C5V1	V_R = 2 V	2	µA
	BZX79-A/B/C5V6	V_R = 2 V	1	µA
	BZX79-A/B/C6V2	V_R = 4 V	3	µA
	BZX79-A/B/C6V8	V_R = 4 V	2	µA
	BZX79-A/B/C7V5	V_R = 5 V	1	µA
	BZX79-A/B/C8V2	V_R = 5 V	700	nA
	BZX79-A/B/C9V1	V_R = 6 V	500	nA
	BZX79-A/B/C10	V_R = 7 V	200	nA
	BZX79-A/B/C11	V_R = 8 V	100	nA
	BZX79-A/B/C12	V_R = 8 V	100	nA
	BZX79-A/B/C13	V_R = 8 V	100	nA
	BZX79-A/B/C15 to 75	$V_R = 0.7V_{Znom}$	50	nA

Table 1 Per type BZX79-**A/B2V4** to **A/B24**

T_j = 25 °C unless otherwise specified.

BZX79-A or B XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 5 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 5 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±1% (A)		Tol. ±2% (B)		at I_{Ztest} = 1 mA		at I_{Ztest} = 5 mA						
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
2V4	2.37	2.43	2.35	2.45	275	600	70	100	−3.5	−1.6	0	450	6.0
2V7	2.67	2.73	2.65	2.75	300	600	75	100	−3.5	−2.0	0	450	6.0
3V0	2.97	3.03	2.94	3.06	325	600	80	95	−3.5	−2.1	0	450	6.0
3V3	3.26	3.34	3.23	3.37	350	600	85	95	−3.5	−2.4	0	450	6.0
3V6	3.56	3.64	3.53	3.67	375	600	85	90	−3.5	−2.4	0	450	6.0
3V9	3.86	3.94	3.82	3.98	400	600	85	90	−3.5	−2.5	0	450	6.0
4V3	4.25	4.35	4.21	4.39	410	600	80	90	−3.5	−2.5	0	450	6.0
4V7	4.65	4.75	4.61	4.79	425	500	50	80	−3.5	−1.4	0.2	300	6.0
5V1	5.04	5.16	5.00	5.20	400	480	40	60	−2.7	−0.8	1.2	300	6.0
5V6	5.54	5.66	5.49	5.71	80	400	15	40	−2.0	1.2	2.5	300	6.0
6V2	6.13	6.27	6.08	6.32	40	150	6	10	0.4	2.3	3.7	200	6.0
6V8	6.73	6.87	6.66	6.94	30	80	6	15	1.2	3.0	4.5	200	6.0
7V5	7.42	7.58	7.35	7.65	30	80	6	15	2.5	4.0	5.3	150	4.0
8V2	8.11	8.29	8.04	8.36	40	80	6	15	3.2	4.6	6.2	150	4.0
9V1	9.00	9.20	8.92	9.28	40	100	6	15	3.8	5.5	7.0	150	3.0
10	9.90	10.10	9.80	10.20	50	150	8	20	4.5	6.4	8.0	90	3.0
11	10.89	11.11	10.80	11.20	50	150	10	20	5.4	7.4	9.0	85	2.5
12	11.88	12.12	11.80	12.20	50	150	10	25	6.0	8.4	10.0	85	2.5
13	12.87	13.13	12.70	13.30	50	170	10	30	7.0	9.4	11.0	80	2.5
15	14.85	15.15	14.70	15.30	50	200	10	30	9.2	11.4	13.0	75	2.0
16	15.84	16.16	15.70	16.30	50	200	10	40	10.4	12.4	14.0	75	1.5
18	17.82	18.18	17.60	18.40	50	225	10	45	12.4	14.4	16.0	70	1.5
20	19.80	20.20	19.60	20.40	60	225	15	55	14.4	16.4	18.0	60	1.5
22	21.78	22.22	21.60	22.40	60	250	20	55	16.4	18.4	20.0	60	1.25
24	23.76	24.24	23.50	24.50	60	250	25	70	18.4	20.4	22.0	55	1.25

Table 2 Per type BZX79-**A/B27** to **A/B75**

T_j = 25 °C unless otherwise specified.

BZX79-A or B XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 2 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 2 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±1% (A)		Tol. ±2% (B)		at I_{Ztest} = 0.5 mA		at I_{Ztest} = 2 mA						
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
27	26.73	27.27	26.50	27.50	65	300	25	80	21.4	23.4	25.3	50	1.0
30	29.70	30.30	29.40	30.60	70	300	30	80	24.4	26.6	29.4	50	1.0
33	32.67	33.33	32.30	33.70	75	325	35	80	27.4	29.7	33.4	45	0.9
36	35.64	36.36	35.30	36.70	80	350	35	90	30.4	33.0	37.4	45	0.8
39	38.61	39.39	38.20	39.80	80	350	40	130	33.4	36.4	41.2	45	0.7
43	42.57	43.43	42.10	43.90	85	375	45	150	37.6	41.2	46.6	40	0.6
47	46.53	47.47	46.10	47.90	85	375	50	170	42.0	46.1	51.8	40	0.5
51	50.49	51.51	50.00	52.00	90	400	60	180	46.6	51.0	57.2	40	0.4
56	55.44	56.56	54.90	57.10	100	425	70	200	52.2	57.0	63.8	40	0.3
62	61.38	62.62	60.80	63.20	120	450	80	215	58.8	64.4	71.6	35	0.3
68	67.32	68.68	66.60	69.40	150	475	90	240	65.6	71.7	79.8	35	0.25
75	74.25	75.75	73.50	76.50	170	500	95	255	73.4	80.2	88.6	35	0.2

Table 3 Per type BZX79-**C2V4** to **C24**

T_j = 25 °C unless otherwise specified.

BZX79 - C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 5 mA		DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 5 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. approx. ±5% (C)		at I_{Ztest} = 1 mA		at I_{Ztest} = 5 mA						
	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
2V4	2.2	2.6	275	600	70	100	−3.5	−1.6	0	450	6.0
2V7	2.5	2.9	300	600	75	100	−3.5	−2.0	0	450	6.0
3V0	2.8	3.2	325	600	80	95	−3.5	−2.1	0	450	6.0
3V3	3.1	3.5	350	600	85	95	−3.5	−2.4	0	450	6.0
3V6	3.4	3.8	375	600	85	90	−3.5	−2.4	0	450	6.0
3V9	3.7	4.1	400	600	85	90	−3.5	−2.5	0	450	6.0
4V3	4.0	4.6	410	600	80	90	−3.5	−2.5	0	450	6.0
4V7	4.4	5.0	425	500	50	80	−3.5	−1.4	0.2	300	6.0
5V1	4.8	5.4	400	480	40	60	−2.7	−0.8	1.2	300	6.0
5V6	5.2	6.0	80	400	15	40	−2.0	1.2	2.5	300	6.0
6V2	5.8	6.6	40	150	6	10	0.4	2.3	3.7	200	6.0
6V8	6.4	7.2	30	80	6	15	1.2	3.0	4.5	200	6.0
7V5	7.0	7.9	30	80	6	15	2.5	4.0	5.3	150	4.0
8V2	7.7	8.7	40	80	6	15	3.2	4.6	6.2	150	4.0
9V1	8.5	9.6	40	100	6	15	3.8	5.5	7.0	150	3.0
10	9.4	10.6	50	150	8	20	4.5	6.4	8.0	90	3.0
11	10.4	11.6	50	150	10	20	5.4	7.4	9.0	85	2.5
12	11.4	12.7	50	150	10	25	6.0	8.4	10.0	85	2.5
13	12.4	14.1	50	170	10	30	7.0	9.4	11.0	80	2.5
15	13.8	15.6	50	200	10	30	9.2	11.4	13.0	75	2.0
16	15.3	17.1	50	200	10	40	10.4	12.4	14.0	75	1.5
18	16.8	19.1	50	225	10	45	12.4	14.4	16.0	70	1.5
20	18.8	21.2	60	225	15	55	14.4	16.4	18.0	60	1.5
22	20.8	23.3	60	250	20	55	16.4	18.4	20.0	60	1.25
24	22.8	25.6	60	250	25	70	18.4	20.4	22.0	55	1.25

Table 4 Per type BZX79-**C27** to **C75**

T_j = 25 °C unless otherwise specified.

BZX79 - C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 2 mA		DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 2 mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol.approx. ±5% (C)		at I_{Ztest} = 0.5 mA		at I_{Ztest} = 2 mA						
	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
27	25.1	28.9	65	300	25	80	21.4	23.4	25.3	50	1.0
30	28.0	32.0	70	300	30	80	24.4	26.6	29.4	50	1.0
33	31.0	35.0	75	325	35	80	27.4	29.7	33.4	45	0.9
36	34.0	38.0	80	350	35	90	30.4	33.0	37.4	45	0.8
39	37.0	41.0	80	350	40	130	33.4	36.4	41.2	45	0.7
43	40.0	46.0	85	375	45	150	37.6	41.2	46.6	40	0.6
47	44.0	50.0	85	375	50	170	42.0	46.1	51.8	40	0.5
51	48.0	54.0	90	400	60	180	46.6	51.0	57.2	40	0.4
56	52.0	60.0	100	425	70	200	52.2	57.0	63.8	40	0.3
62	58.0	66.0	120	450	80	215	58.8	64.4	71.6	35	0.3
68	64.0	72.0	150	475	90	240	65.6	71.7	79.8	35	0.25
75	70.0	79.0	170	500	95	255	73.4	80.2	88.6	35	0.2

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 8 mm.	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length max.; see Fig.2 and note 1	380	K/W

Note

1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA

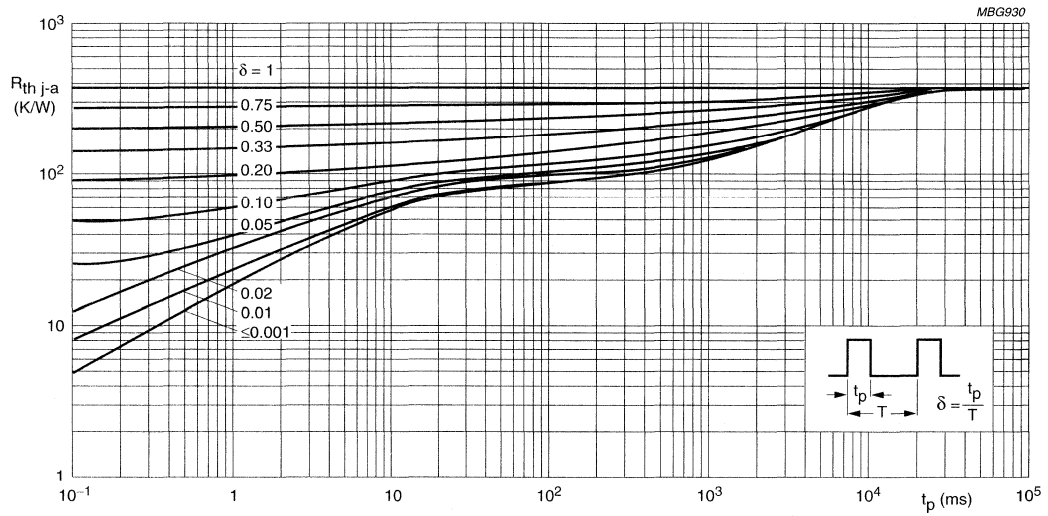
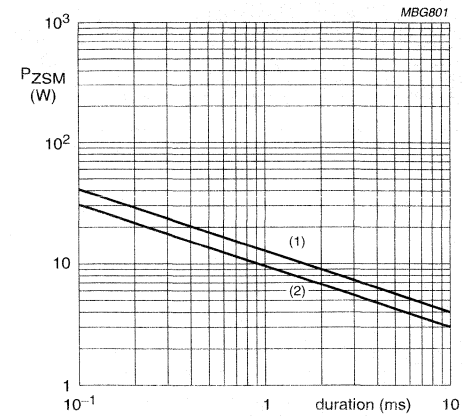
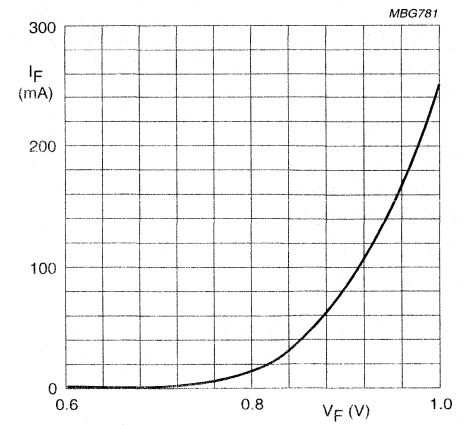


Fig.2 Thermal resistance from junction to ambient as a function of pulse duration.



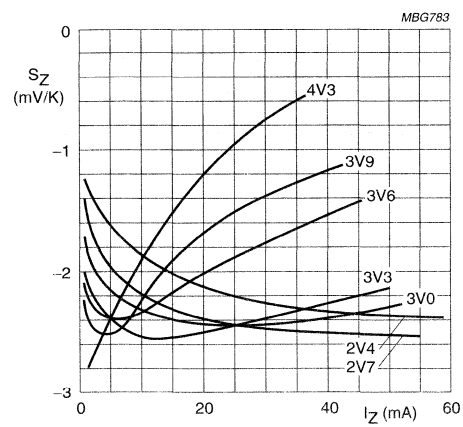
(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.3 Maximum permissible non-repetitive peak reverse power dissipation versus duration.



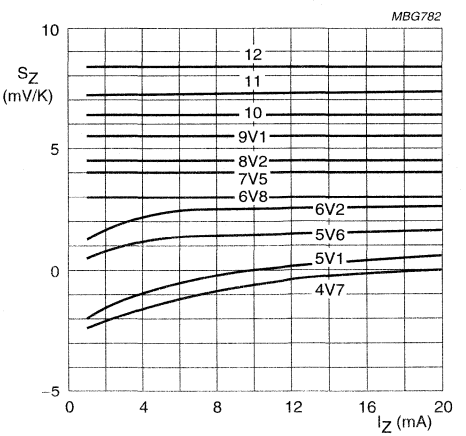
T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.



BZX79-A/B/C2V4 to A/B/C4V3.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.



BZX79-A/B/C4V7 to A/B/C12.
T_j = 25 to 150 °C.

Fig.6 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZX84 series

FEATURES

- Total power dissipation: max. 250 mW
- Three tolerance series: ±1%, ±2% and approx. ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range)
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- General regulation functions.

DESCRIPTION

Low-power voltage regulator diodes in small SOT23 plastic SMD packages.

The diodes are available in the normalized E24 ±1% (BZX84-A), ±2% (BZX84-B) and approx. ±5% (BZX84-C) tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

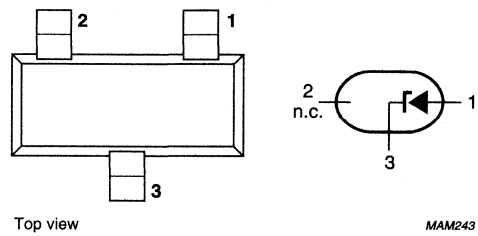


Fig.1 Simplified outline (SOT23) and symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE
Marking codes for BZX84-C2V4 to BZX84-C75							
BZX84-C2V4	Z11	BZX84-C6V2	Z4*	BZX84-C16	Y5*	BZX84-C43	Y15
BZX84-C2V7	Z12	BZX84-C6V8	Z5*	BZX84-C18	Y6*	BZX84-C47	Y16
BZX84-C3V0	Z13	BZX84-C7V5	Z6*	BZX84-C20	Y7*	BZX84-C51	Y17
BZX84-C3V3	Z14	BZX84-C8V2	Z7*	BZX84-C22	Y8*	BZX84-C56	Y18
BZX84-C3V6	Z15	BZX84-C9V1	Z8*	BZX84-C24	Y9*	BZX84-C62	Y19
BZX84-C3V9	Z16	BZX84-C10	Z9*	BZX84-C27	Y10	BZX84-C68	Y20
BZX84-C4V3	Z17	BZX84-C11	Y1*	BZX84-C30	Y11	BZX84-C75	Y21
BZX84-C4V7	Z1*	BZX84-C12	Y2*	BZX84-C33	Y12	–	–
BZX84-C5V1	Z2*	BZX84-C13	Y3*	BZX84-C36	Y13	–	–
BZX84-C5V6	Z3*	BZX84-C15	Y4*	BZX84-C39	Y14	–	–
Marking codes for BZX84-B2V4 to BZX84-B75							
BZX84-B2V4	Z50	BZX84-B6V2	Z60	BZX84--B16	Z70	BZX84-B43	Z80
BZX84-B2V7	Z51	BZX84-B6V8	Z61	BZX84-B18	Z71	BZX84-B47	Z81
BZX84-B3V0	Z52	BZX84-B7V5	Z62	BZX84-B20	Z72	BZX84-B51	Z82
BZX84-B3V3	Z53	BZX84-B8V2	Z63	BZX84-B22	Z73	BZX84-B56	Z83
BZX84-B3V6	Z54	BZX84-B9V1	Z64	BZX84-B24	Z74	BZX84-B62	Z84
BZX84-B3V9	Z55	BZX84-B10	Z65	BZX84-B27	Z75	BZX84-B68	Z85
BZX84-B4V3	Z56	BZX84-B11	Z66	BZX84-B30	Z76	BZX84-B75	Z86
BZX84-B4V7	Z57	BZX84-B12	Z67	BZX84-B33	Z77	–	–
BZX84-B5V1	Z58	BZX84-B13	Z68	BZX84-B36	Z78	–	–
BZX84-B5V6	Z59	BZX84-B15	Z69	BZX84-B39	Z79	–	–
Marking codes for BZX84-A2V4 to BZX84-A75							
BZX84-A2V4	Y50	BZX84-A6V2	Y60	BZX84-A16	Y70	BZX84-A43	Y80
BZX84-A2V7	Y51	BZX84-A6V8	Y61	BZX84-A18	Y71	BZX84-A47	Y81
BZX84-A3V0	Y52	BZX84-A7V5	Y62	BZX84-A20	Y72	BZX84-A51	Y82
BZX84-A3V3	Y53	BZX84-A8V2	Y63	BZX84-A22	Y73	BZX84-A56	Y83
BZX84-A3V6	Y54	BZX84-A9V1	Y64	BZX84-A24	Y74	BZX84-A62	Y84
BZX84-A3V9	Y55	BZX84-A10	Y65	BZX84-A27	Y75	BZX84-A68	Y85
BZX84-A4V3	Y56	BZX84-A11	Y66	BZX84-A30	Y76	BZX84-A75	Y86
BZX84-A4V7	Y57	BZX84-A12	Y67	BZX84-A33	Y77	–	–
BZX84-A5V1	Y58	BZX84-A13	Y68	BZX84-A36	Y78	–	–
BZX84-A5V6	Y59	BZX84-A15	Y69	BZX84-A39	Y79	–	–

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	200	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_j = 25 °C prior to surge	see Tables 1 and 2		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 µs; square wave; T_j = 25 °C prior to surge; see Fig.2	–	40	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

Note

1. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

Total BZX84-A and B and C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.3	0.9	V
I_R	reverse current			
	BZX84-A/B/C2V4	V_R = 1 V	50	µA
	BZX84-A/B/C2V7	V_R = 1 V	20	µA
	BZX84-A/B/C3V0	V_R = 1 V	10	µA
	BZX84-A/B/C3V3	V_R = 1 V	5	µA
	BZX84-A/B/C3V6	V_R = 1 V	5	µA
	BZX84-A/B/C3V9	V_R = 1 V	3	µA
	BZX84-A/B/C4V3	V_R = 1 V	3	µA
	BZX84-A/B/C4V7	V_R = 2 V	3	µA
	BZX84-A/B/C5V1	V_R = 2 V	2	µA
	BZX84-A/B/C5V6	V_R = 2 V	1	µA
	BZX84-A/B/C6V2	V_R = 4 V	3	µA
	BZX84-A/B/C6V8	V_R = 4 V	2	µA
	BZX84-A/B/C7V5	V_R = 5 V	1	µA
	BZX84-A/B/C8V2	V_R = 5 V	700	nA
	BZX84-A/B/C9V1	V_R = 6 V	500	nA
	BZX84-A/B/C10	V_R = 7 V	200	nA
	BZX84-A/B/C11	V_R = 8 V	100	nA
	BZX84-A/B/C12	V_R = 8 V	100	nA
	BZX84-A/B/C13	V_R = 8 V	100	nA
	BZX84-A/B/C15 to 75	$V_R = 0.7V_{Znom}$	50	nA

Table 1 Per type BZX84-**A/B/C2V4** to **A/B/C24**

T_j = 25 °C unless otherwise specified.

BZX84-A or B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 5 mA						DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 5 mA (see Figs 4 and 5)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±1% (A)		Tol. ±2% (B)		Tol. approx. ±5% (C)		at I_{Ztest} = 1 mA		at I_{Ztest} = 5 mA						
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
2V4	2.37	2.43	2.35	2.45	2.2	2.6	275	600	70	100	−3.5	−1.6	0	450	6.0
2V7	2.67	2.73	2.65	2.75	2.5	2.9	300	600	75	100	−3.5	−2.0	0	450	6.0
3V0	2.97	3.03	2.94	3.06	2.8	3.2	325	600	80	95	−3.5	−2.1	0	450	6.0
3V3	3.26	3.34	3.23	3.37	3.1	3.5	350	600	85	95	−3.5	−2.4	0	450	6.0
3V6	3.56	3.64	3.53	3.67	3.4	3.8	375	600	85	90	−3.5	−2.4	0	450	6.0
3V9	3.86	3.94	3.82	3.98	3.7	4.1	400	600	85	90	−3.5	−2.5	0	450	6.0
4V3	4.25	4.35	4.21	4.39	4.0	4.6	410	600	80	90	−3.5	−2.5	0	450	6.0
4V7	4.65	4.75	4.61	4.79	4.4	5.0	425	500	50	80	−3.5	−1.4	0.2	300	6.0
5V1	5.04	5.16	5.00	5.20	4.8	5.4	400	480	40	60	−2.7	−0.8	1.2	300	6.0
5V6	5.54	5.66	5.49	5.71	5.2	6.0	80	400	15	40	−2.0	1.2	2.5	300	6.0
6V2	6.13	6.27	6.08	6.32	5.8	6.6	40	150	6	10	0.4	2.3	3.7	200	6.0
6V8	6.73	6.87	6.66	6.94	6.4	7.2	30	80	6	15	1.2	3.0	4.5	200	6.0
7V5	7.42	7.58	7.35	7.65	7.0	7.9	30	80	6	15	2.5	4.0	5.3	150	4.0
8V2	8.11	8.29	8.04	8.36	7.7	8.7	40	80	6	15	3.2	4.6	6.2	150	4.0
9V1	9.00	9.20	8.92	9.28	8.5	9.6	40	100	6	15	3.8	5.5	7.0	150	3.0
10	9.90	10.10	9.80	10.20	9.4	10.6	50	150	8	20	4.5	6.4	8.0	90	3.0
11	10.80	11.11	10.80	11.20	10.4	11.6	50	150	10	20	5.4	7.4	9.0	85	2.5
12	11.88	12.12	11.80	12.20	11.4	12.7	50	150	10	25	6.0	8.4	10.0	85	2.5
13	12.87	13.13	12.70	13.30	12.4	14.1	50	170	10	30	7.0	9.4	11.0	80	2.5
15	14.85	15.15	14.70	15.30	13.8	15.6	50	200	10	30	9.2	11.4	13.0	75	2.0
16	15.84	16.16	15.70	16.30	15.3	17.1	50	200	10	40	10.4	12.4	14.0	75	1.5
18	17.82	18.18	17.60	18.40	16.8	19.1	50	225	10	45	12.4	14.4	16.0	70	1.5
20	19.80	20.20	19.60	20.40	18.8	21.2	60	225	15	55	14.4	16.4	18.0	60	1.5
22	21.78	22.22	21.60	22.40	20.8	23.3	60	250	20	55	16.4	18.4	20.0	60	1.25
24	23.76	24.24	23.50	24.50	22.8	25.6	60	250	25	70	18.4	20.4	22.0	55	1.25

Table 2 Per type BZX84-**A/B/C27** to **A/B/C75**

T_j = 25 °C unless otherwise specified.

BZX84-A or B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 2 mA						DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 2 mA (see Figs 4 and 5)			DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μ; T_{amb} = 25 °C
	Tol. ±1% (A)		Tol. ±2% (B)		Tol. approx. ±5% (C)		at I_{Ztest} = 0.5 m A		at I_{Ztest} = 2 mA						
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	MIN.	TYP.	MAX.	MAX.	MAX.
27	26.73	27.27	26.50	27.50	25.1	28.9	65	300	25	80	21.4	23.4	25.3	50	1.0
30	29.70	30.30	29.40	30.60	28.0	32.0	70	300	30	80	24.4	26.6	29.4	50	1.0
33	32.67	33.33	32.30	33.70	31.0	35.0	75	325	35	80	27.4	29.7	33.4	45	0.9
36	35.64	36.36	35.30	36.70	34.0	38.0	80	350	35	90	30.4	33.0	37.4	45	0.8
39	38.61	39.39	38.20	39.80	37.0	41.0	80	350	40	130	33.4	36.4	41.2	45	0.7
43	42.57	43.43	42.10	43.90	40.0	46.0	85	375	45	150	37.6	41.2	46.6	40	0.6
47	46.53	47.47	46.10	47.90	44.0	50.0	85	375	50	170	42.0	46.1	51.8	40	0.5
51	50.49	51.51	50.00	52.00	48.0	54.0	90	400	60	180	46.6	51.0	57.2	40	0.4
56	55.44	56.56	54.90	57.10	52.0	60.0	100	425	70	200	52.2	57.0	63.8	40	0.3
62	61.38	62.62	60.80	63.20	58.0	66.0	120	450	80	215	58.8	64.4	71.6	35	0.3
68	67.32	68.68	66.60	69.40	64.0	72.0	150	475	90	240	65.6	71.7	79.8	35	0.25
75	74.25	75.75	73.50	76.50	70.0	79.0	170	500	95	255	73.4	80.2	88.6	35	0.2

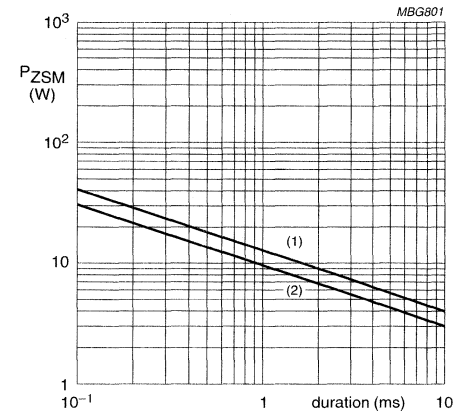
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

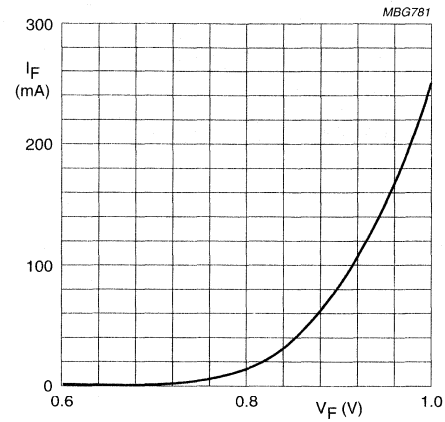
1. Device mounted on an FR4 printed circuit-board.

GRAPHICAL DATA



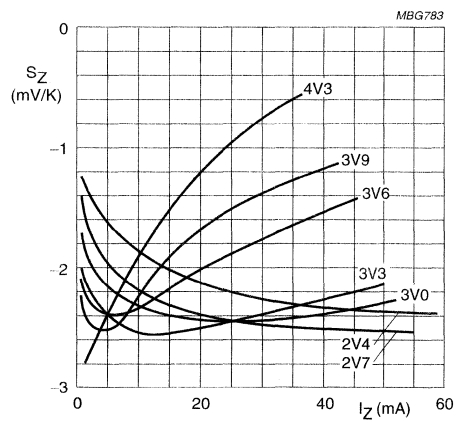
(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.2 Maximum permissible non-repetitive peak reverse power dissipation versus duration.



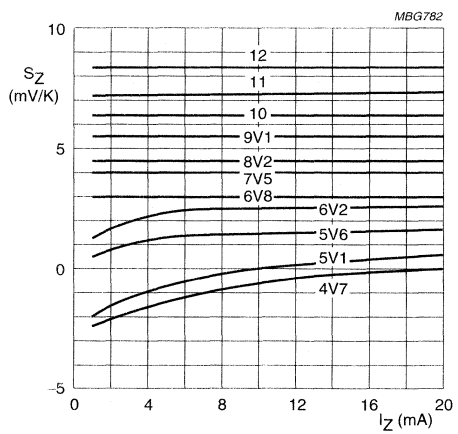
T_j = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



BZX84-A/B/C2V4 to A/B/C4V3.
T_j = 25 to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.



BZX84-A/B/C4V7 to A/B/C12.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZX99 series

FEATURES

- Total power dissipation: max. 300 mW
- Tolerance: ±5%
- Working voltage range: nom. 2.4 to 15 V (E24 range)
- Improved I_Z/V_Z characteristics at low currents (I_Z = 50 µA). This results in a noise free and sharp breakdown knee.

APPLICATIONS

- General regulation functions, where low noise at low currents is required
- Low-power consumption applications (e.g. hand-held applications).

DESCRIPTION

Low-power low noise voltage regulator diodes in small SOT23 plastic SMD packages.

The diodes are available in the normalized E24 ±5% tolerance range. The series consists of 20 types with nominal working voltages from 2.4 to 15 V.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

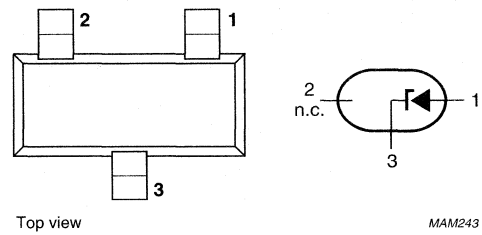


Fig.1 Simplified outline (SOT23) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BZX99-C2V4	XL	BZX99-C3V9	XS	BZX99-C6V2	XD	BZX99-C10	XX
BZX99-C2V7	XM	BZX99-C4V3	XT	BZX99-C6V8	XE	BZX99-C11	XY
BZX99-C3V0	XN	BZX99-C4V7	XA	BZX99-C7V5	XU	BZX99-C12	XZ
BZX99-C3V3	XP	BZX99-C5V1	XB	BZX99-C8V2	XV	BZX99-C13	X2
BZX99-C3V6	XR	BZX99-C5V6	XC	BZX99-C9V1	XW	BZX99-C15	X3

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	300	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 μs; square wave; T_{amb} = 25 °C prior to surge	see Table 1		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

Total BZX99-C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.4	0.9	V
		I_F = 100 mA; see Fig.4	1	V
I_R	reverse current			
	BZX99-A/B/C2V4	V_R = 1 V	0.2	μA
	BZX99-A/B/C2V7	V_R = 1 V	0.05	μA
	BZX99-A/B/C3V0	V_R = 1 V	0.02	μA
	BZX99-A/B/C3V3	V_R = 2 V	2	μA
	BZX99-A/B/C3V6	V_R = 2 V	1	μA
	BZX99-A/B/C3V9	V_R = 2 V	0.5	μA
	BZX99-A/B/C4V3	V_R = 2 V	0.1	μA
	BZX99-A/B/C4V7	V_R = 3 V	2	μA
	BZX99-A/B/C5V1	V_R = 3 V	1	μA
	BZX99-A/B/C5V6	V_R = 4 V	1	μA
	BZX99-A/B/C6V2	V_R = 5 V	0.1	μA
	BZX99-A/B/C6V8	V_R = 5 V	0.01	μA
	BZX99-A/B/C7V5	V_R = 5 V	0.1	μA
	BZX99-A/B/C8V2	V_R = 6 V	0.2	μA
	BZX99-A/B/C9V1	V_R = 7 V	0.1	μA
	BZX99-A/B/C10	V_R = 7 V	0.1	μA
	BZX99-A/B/C11	V_R = 8 V	0.05	μA
	BZX99-A/B/C12	V_R = 9 V	0.05	μA
	BZX99-A/B/C13	V_R = 10 V	0.05	μA
	BZX99-A/B/C15	V_R = 10.5 V	0.01	μA

Table 1 Per type BZX99-C2V4 to C15

T_j = 25 °C unless otherwise specified.

BZX99-C XXX	WORKING VOLTAGE V_Z (V) at I_Z = 50 μA Tol. ±5%		VOLTAGE CHANGE ΔV_Z(V)(1)	TEMP. COEFF. S_Z (mV/K) I_{Ztest} = 50 μA (see Figs 2 and 3)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	MIN.	MAX.	MAX.	TYP.	MAX.	MAX.
2V4	2.28	2.52	0.80	−1.15	370	6.0
2V7	2.57	2.84	0.85	−1.35	350	6.0
3V0	2.85	3.15	0.90	−1.50	325	6.0
3V3	3.14	3.47	0.93	−1.65	310	6.0
3V6	3.42	3.78	0.95	−1.80	300	6.0
3V9	3.71	4.10	0.97	−1.95	290	6.0
4V3	4.09	4.52	0.99	−2.05	280	6.0
4V7	4.47	4.94	0.97	−1.90	275	6.0
5V1	4.85	5.36	0.60	−0.15	300	5.0
5V6	5.32	5.88	0.20	1.75	275	4.0
6V2	5.89	6.51	0.10	2.35	250	3.0
6V8	6.46	7.14	0.10	3.00	215	3.0
7V5	7.13	7.88	0.15	3.60	170	3.0
8V2	7.79	8.61	0.15	4.25	150	3.0
9V1	8.65	9.56	0.10	5.00	120	3.0
10	9.50	10.50	0.10	5.80	110	3.0
11	10.45	11.55	0.11	6.70	110	2.5
12	11.40	12.60	0.12	7.65	105	2.5
13	12.35	13.65	0.13	8.60	105	2.5
15	14.25	15.75	0.15	10.50	100	2.0

Note

1. $\Delta V_Z = V_Z$ at 100 μA minus V_Z at 10 μA

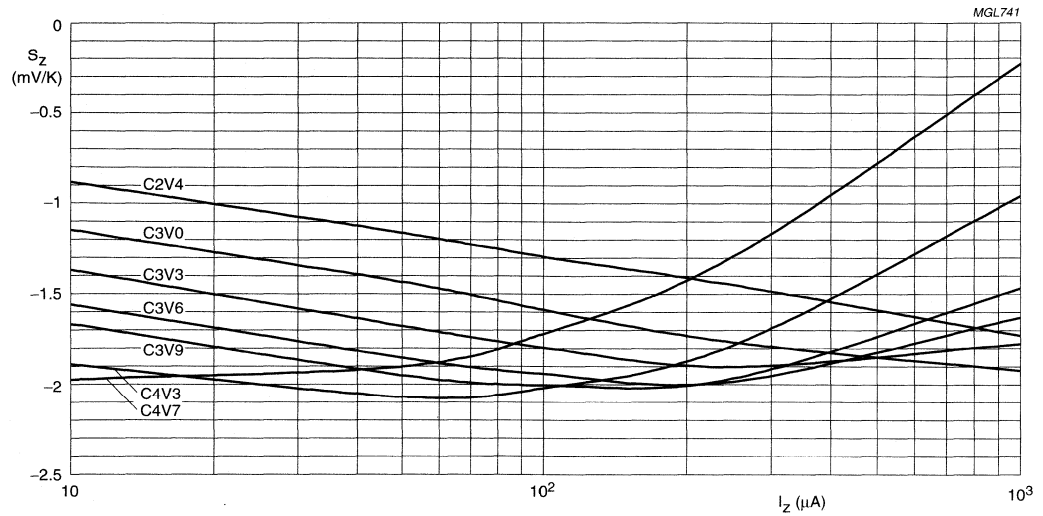
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	415	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to solderpoint	note 2	195	K/W

Notes

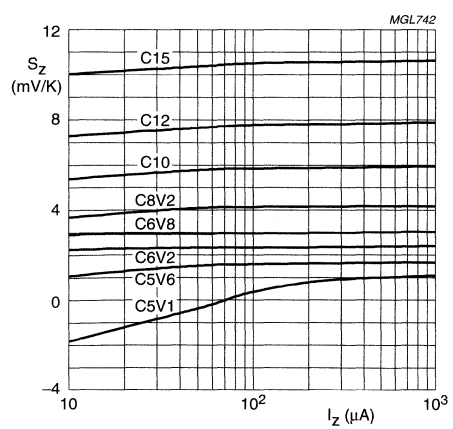
1. Device mounted on an FR4 printed circuit-board.
2. Solderpoint of cathode tab.

GRAPHICAL DATA



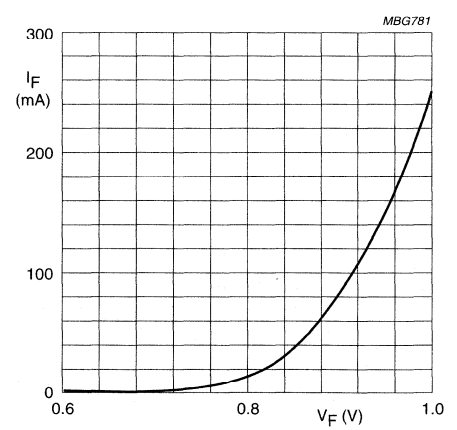
T_j = 25 to 150 °C.

Fig.2 Temperature coefficient as a function of working current; typical values.



T_j = 25 to 150 °C.

Fig.3 Temperature coefficient as a function of working current; typical values.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.

Voltage regulator diodes BZX284 series

FEATURES

- Total power dissipation: max. 400 mW
- Two tolerance series: ±2% and ±5%
- Working voltage range: nom. 2.4 to 75 V (E24 range).

APPLICATIONS

- General regulation functions.

DESCRIPTION

Low-power voltage regulator diodes in a small ceramic SMD SOD110 package. The diodes are available in the normalized E24 ±2% (BZX284-B) and ±5% (BZX284-C) tolerance range. The series consists of 37 types with nominal working voltages from 2.4 to 75 V.

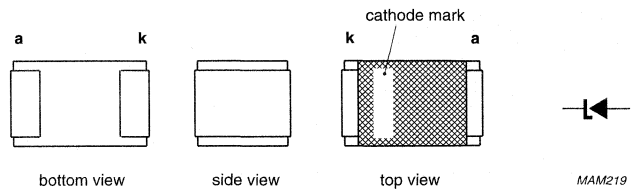


Fig.1 Simplified outline (SOD110) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BZX284-B2V4	WO	BZX284-B15	XH	BZX284-C2V4	YO	BZX284-C15	ZH
BZX284-B2V7	WP	BZX284-B16	XI	BZX284-C2V7	YP	BZX284-C16	ZI
BZX284-B3V0	WQ	BZX284-B18	XJ	BZX284-C3V0	YQ	BZX284-C18	ZJ
BZX284-B3V3	WR	BZX284-B20	XK	BZX284-C3V3	YR	BZX284-C20	ZK
BZX284-B3V6	WS	BZX284-B22	XL	BZX284-C3V6	YS	BZX284-C22	ZL
BZX284-B3V9	WT	BZX284-B24	XM	BZX284-C3V9	YT	BZX284-C24	ZM
BZX284-B4V3	WU	BZX284-B27	XN	BZX284-C4V3	YU	BZX284-C27	ZN
BZX284-B4V7	WV	BZX284-B30	XO	BZX284-C4V7	YV	BZX284-C30	ZO
BZX284-B5V1	WW	BZX284-B33	XP	BZX284-C5V1	YW	BZX284-C33	ZP
BZX284-B5V6	WX	BZX284-B36	XQ	BZX284-C5V6	YX	BZX284-C36	ZQ
BZX284-B6V2	WY	BZX284-B39	XR	BZX284-C6V2	YY	BZX284-C39	ZR
BZX284-B6V8	WZ	BZX284-B43	XS	BZX284-C6V8	YZ	BZX284-C43	ZS
BZX284-B7V5	XA	BZX284-B47	XT	BZX284-C7V5	ZA	BZX284-C47	ZT
BZX284-B8V2	XB	BZX284-B51	XU	BZX284-C8V2	ZB	BZX284-C51	ZU
BZX284-B9V1	XC	BZX284-B56	XV	BZX284-C9V1	ZC	BZX284-C56	ZV
BZX284-B10	XD	BZX284-B62	XW	BZX284-C10	ZD	BZX284-C62	ZW
BZX284-B11	XE	BZX284-B68	XX	BZX284-C11	ZE	BZX284-C68	ZX
BZX284-B12	XF	BZX284-B75	XY	BZX284-C12	ZF	BZX284-C75	ZY
BZX284-B13	XG	–	–	BZX284-C13	ZG	–	–

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_{amb} = 25 °C prior to surge	see Tables 1 and 2		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	400	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a printed-circuit board: 11 × 25 × 1.6 mm.

ELECTRICAL CHARACTERISTICS

Total BZX284-B and C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.4	0.9	V
		I_F = 100 mA; see Fig.4	1.1	V
I_R	reverse current			
	BZX284-B/C2V4	V_R = 1 V	50	µA
	BZX284-B/C2V7	V_R = 1 V	20	µA
	BZX284-B/C3V0	V_R = 1 V	10	µA
	BZX284-B/C3V3	V_R = 1 V	5	µA
	BZX284-B/C3V6	V_R = 1 V	5	µA
	BZX284-B/C3V9	V_R = 1 V	3	µA
	BZX284-B/C4V3	V_R = 1 V	3	µA
	BZX284-B/C4V7	V_R = 2 V	3	µA
	BZX284-B/C5V1	V_R = 2 V	2	µA
	BZX284-B/C5V6	V_R = 2 V	1	µA
	BZX284-B/C6V2	V_R = 4 V	3	µA
	BZX284-B/C6V8	V_R = 4 V	2	µA
	BZX284-B/C7V5	V_R = 5 V	1	µA
	BZX284-B/C8V2	V_R = 5 V	700	nA
	BZX284-B/C9V1	V_R = 6 V	500	nA
	BZX284-B/C10	V_R = 7 V	200	nA
	BZX284-B/C11	V_R = 8 V	100	nA
	BZX284-B/C12	V_R = 8 V	100	nA
	BZX284-B/C13	V_R = 8 V	100	nA
	BZX284-B/C15 to 75	$V_R = 0.7V_{Znom}$	50	nA

Table 1 Per type BZX284-**B/C2V4** to **B/C24**

T_j = 25 °C unless otherwise specified.

BZX284-B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 5 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 5 mA (see Figs 5 and 6)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±2% (B)		Tol. ±5% (C)		at I_{Ztest} = 1 mA		at I_{Ztest} = 5 mA				
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.	MAX.
2V4	2.35	2.45	2.2	2.6	275	400	70	100	−1.6	450	12.0
2V7	2.65	2.75	2.5	2.9	300	450	75	100	−2.0	440	12.0
3V0	2.94	3.06	2.8	3.2	325	500	80	95	−2.1	425	12.0
3V3	3.23	3.37	3.1	3.5	350	500	85	95	−2.4	410	12.0
3V6	3.53	3.67	3.4	3.8	375	500	85	90	−2.4	390	12.0
3V9	3.82	3.98	3.7	4.1	400	500	85	90	−2.5	370	12.0
4V3	4.21	4.39	4.0	4.6	410	600	80	90	−2.5	350	12.0
4V7	4.61	4.79	4.4	5.0	425	500	50	80	−1.4	325	12.0
5V1	5.00	5.20	4.8	5.4	400	480	40	60	−0.8	300	12.0
5V6	5.49	5.71	5.2	6.0	80	400	15	40	1.2	275	12.0
6V2	6.08	6.32	5.8	6.6	40	150	6	10	2.3	250	12.0
6V8	6.66	6.94	6.4	7.2	30	80	6	15	3.0	215	12.0
7V5	7.35	7.65	7.0	7.9	15	80	2	10	4.0	170	4.0
8V2	8.04	8.36	7.7	8.7	20	80	2	10	4.6	150	4.0
9V1	8.92	9.28	8.5	9.6	20	100	2	10	5.5	120	3.0
10	9.80	10.20	9.4	10.6	20	150	2	10	6.4	110	3.0
11	10.80	11.20	10.4	11.6	25	150	2	10	7.4	108	2.5
12	11.80	12.20	11.4	12.7	25	150	2	10	8.4	105	2.5
13	12.70	13.30	12.4	14.1	25	170	2	10	9.4	103	2.5
15	14.70	15.30	13.8	15.6	25	200	3	15	11.4	99	2.0
16	15.70	16.30	15.3	17.1	25	200	4	20	12.4	97	1.5
18	17.60	18.40	16.8	19.1	25	225	4	20	14.4	93	1.5
20	19.60	20.40	18.8	21.2	30	225	4	20	16.4	88	1.5
22	21.60	22.40	20.8	23.3	30	250	5	25	18.4	84	1.25
24	23.50	24.50	22.8	25.6	30	250	6	30	20.4	80	1.25

Table 2 Per type BZX284-**B/C27** to **B/C75**

T_j = 25 °C unless otherwise specified.

BZX284-B or C XXX	WORKING VOLTAGE V_Z (V) at I_{Ztest} = 2 mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_{Ztest} = 2 mA	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±2% (B)		Tol. ±5% (C)		at I_{Ztest} = 0.5 mA		at I_{Ztest} = 2 mA				
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.	MAX.
27	26.50	27.50	25.1	28.9	35	250	8	40	23.4	73	1.0
30	29.40	30.60	28.0	32.0	35	250	10	40	26.6	66	1.0
33	32.30	33.70	31.0	35.0	40	275	11	40	29.7	60	0.9
36	35.30	36.70	34.0	38.0	40	300	15	60	33.0	59	0.8
39	38.20	39.80	37.0	41.0	40	300	25	75	36.4	58	0.7
43	42.10	43.90	40.0	46.0	45	325	30	80	41.2	56	0.6
47	46.10	47.90	44.0	50.0	45	325	30	90	46.1	55	0.5
51	50.00	52.00	48.0	54.0	45	350	35	110	51.0	52	0.4
56	54.90	57.10	52.0	60.0	50	375	40	120	57.0	49	0.3
62	60.80	63.20	58.0	66.0	60	400	50	140	64.4	44	0.3
68	66.60	69.40	64.0	72.0	75	400	55	160	71.7	40	0.25
75	73.50	76.50	70.0	79.0	85	400	70	175	80.2	35	0.2

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	315	K/W

Note

1. Device mounted on a printed-circuit board: 11 × 25 × 1.6 mm.

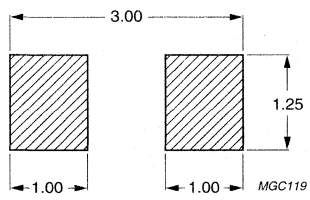
MOUNTING

Reflow soldering

Follow standard reflow soldering techniques to ensure correct application of solder paste and placement of the SOD110 package (see Fig.2).

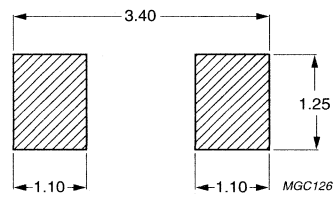
Wave soldering

Before wave soldering, attach SOD110 packages to the printed-circuit boards using a small dot of thermo-setting epoxy or UV-curing adhesive centred between the soldering lands (see Fig.3).



Dimensions in mm.

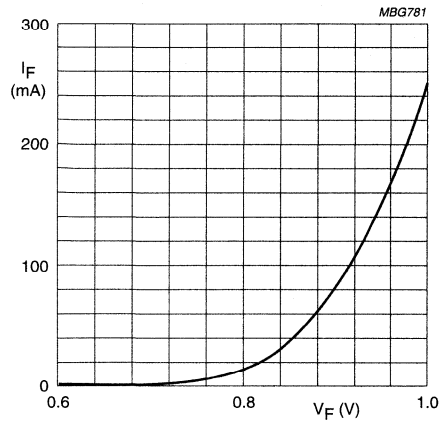
Fig.2 SOD110 reflow soldering pattern.



Dimensions in mm.

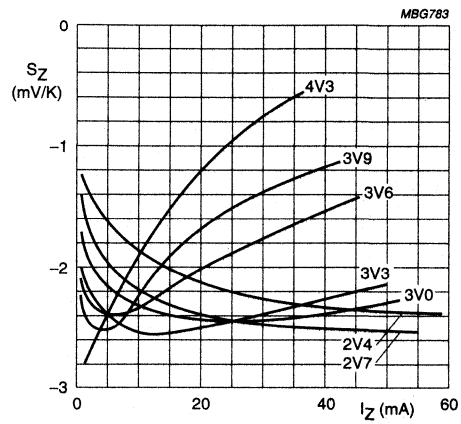
Fig.3 SOD110 wave soldering pattern.

GRAPHICAL DATA



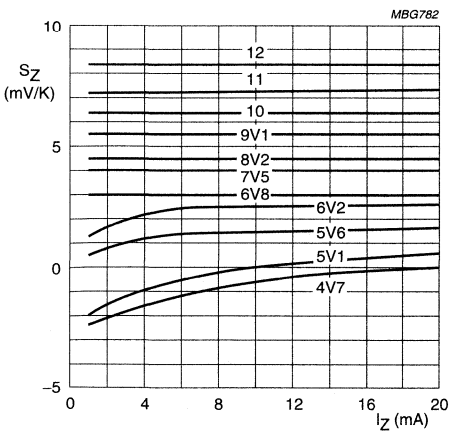
T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.



BZX284-B/C2V4 to B/C4V3.
T_j = 25 to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.



BZX284-B/C4V7 to B/C12.
T_j = 25 to 150 °C.

Fig.6 Temperature coefficient as a function of working current; typical values.

Voltage regulator diodes BZX399 series

FEATURES

- Total power dissipation: max. 300 mW
- Tolerance: ±5%
- Working voltage range: nom. 1.8 to 43 V (E24 range)
- Improved I_Z/V_Z characteristic at low currents (I_Z = 50 μA). This results in a noise free and sharp breakdown knee.

APPLICATIONS

- General regulation functions, where low noise at low currents is required
- Low power consumption applications (e.g. hand-held applications).

DESCRIPTION

Low-power low noise voltage regulator diodes in SOD323 plastic SMD package.

The diodes are available in the normalized E24 ±5% tolerance range. The series consists of 34 types with nominal working voltages from 1.8 to 43 V.

PINNING

PIN	DESCRIPTION
1	cathode
2	anode

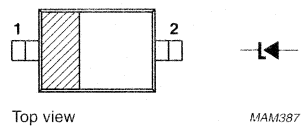


Fig.1 Simplified outline (SOD323) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BZX399-C1V8	B1	BZX399-C4V3	B0	BZX399-C10	BJ	BZX399-C24	BT
BZX399-C2V0	B2	BZX399-C4V7	BA	BZX399-C11	BK	BZX399-C27	BU
BZX399-C2V2	B3	BZX399-C5V1	BB	BZX399-C12	BL	BZX399-C30	BV
BZX399-C2V4	B4	BZX399-C5V6	BC	BZX399-C13	BM	BZX399-C33	BW
BZX399-C2V7	B5	BZX399-C6V2	BD	BZX399-C15	BN	BZX399-C36	BX
BZX399-C3V0	B6	BZX399-C6V8	BE	BZX399-C16	BP	BZX399-C39	BY
BZX399-C3V3	B7	BZX399-C7V5	BF	BZX399-C18	BQ	BZX399-C43	BZ
BZX399-C3V6	B8	BZX399-C8V2	BG	BZX399-C20	BR		
BZX399-C3V9	B9	BZX399-C9V1	BH	BZX399-C22	BS		

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 µs; square wave; T_{amb} = 25 °C prior to surge	see Tables 1 and 2		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

Total BZX399-C series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.5	0.9	V
		I_F = 100 mA; see Fig.5	1.0	V
I_R	reverse current			
	BZX399-C1V8	V_R = 1 V	2	µA
	BZX399-C2V0	V_R = 1 V	1	µA
	BZX399-C2V2	V_R = 1 V	0.5	µA
	BZX399-C2V4	V_R = 1 V	0.2	µA
	BZX399-C2V7	V_R = 1 V	0.05	µA
	BZX399-C3V0	V_R = 1 V	0.02	µA
	BZX399-C3V3	V_R = 2 V	2	µA
	BZX399-C3V6	V_R = 2 V	1	µA
	BZX399-C3V9	V_R = 2 V	0.5	µA
	BZX399-C4V3	V_R = 2 V	0.1	µA
	BZX399-C4V7	V_R = 3 V	2	µA
	BZX399-C5V1	V_R = 3 V	1	µA
	BZX399-C5V6	V_R = 4 V	1	µA
	BZX399-C6V2	V_R = 5 V	0.1	µA
	BZX399-C6V8	V_R = 5 V	0.01	µA
	BZX399-C7V5	V_R = 5 V	0.1	µA
	BZX399-C8V2	V_R = 6 V	0.2	µA
	BZX399-C9V1	V_R = 7 V	0.1	µA
	BZX399-C10	V_R = 7 V	0.1	µA
	BZX399-C11	V_R = 8 V	0.05	µA
	BZX399-C12	V_R = 9 V	0.05	µA
	BZX399-C13	V_R = 10 V	0.05	µA
	BZX399-C15 to 43	$V_R = 0.7V_{Znom}$	0.01	µA

Table 1 Per type BZX399-**C1V8** to **C15**

T_j = 25 °C unless otherwise specified.

BZX399-C XXX	WORKING VOLTAGE V_Z (V) I_Z = 50 μA		VOLTAGE CHANGE ΔV_Z(V) (note 1)	TEMP. COEFF. S_Z (mV/K) I_Z = 50 μA (see Figs 2, 3 and 4)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±5%					
	MIN.	MAX.	MAX.	TYP.	MAX.	MAX.
1V8	1.71	1.89	0.65	−0.85	425	6.0
2V0	1.90	2.10	0.70	−0.95	410	6.0
2V2	2.09	2.31	0.75	−1.05	390	6.0
2V4	2.28	2.52	0.80	−1.15	370	6.0
2V7	2.57	2.84	0.85	−1.35	350	6.0
3V0	2.85	3.15	0.90	−1.50	325	6.0
3V3	3.14	3.47	0.93	−1.65	310	6.0
3V6	3.42	3.78	0.95	−1.80	300	6.0
3V9	3.71	4.10	0.97	−1.95	290	6.0
4V3	4.09	4.52	0.99	−2.05	280	6.0
4V7	4.47	4.94	0.97	−1.90	275	6.0
5V1	4.85	5.36	0.60	0.15	300	5.0
5V6	5.32	5.88	0.20	1.75	275	4.0
6V2	5.89	6.51	0.10	2.35	250	3.0
6V8	6.46	7.14	0.10	3.00	215	3.0
7V5	7.13	7.88	0.15	3.60	170	3.0
8V2	7.79	8.61	0.15	4.25	150	3.0
9V1	8.65	9.56	0.10	5.00	120	3.0
10	9.50	10.50	0.10	5.80	110	3.0
11	10.45	11.55	0.11	6.70	110	2.5
12	11.40	12.60	0.12	7.65	105	2.5
13	12.35	13.65	0.13	8.60	105	2.5
15	14.25	15.75	0.15	10.50	100	2.0

Note

1. $\Delta V_Z = V_Z$ at 100 μA minus V_Z at 10 μA.

Table 2 Per type BZX399-**C16** to **C43**

T_j = 25 °C unless otherwise specified.

BZX399- C XXX	WORKING VOLTAGE V_Z (V) I_Z = 50 μA		VOLTAGE CHANGE ΔV_Z(V) (note 1)	TEMP. COEFF. S_Z (mV/K) I_Z = 50 μA (see Fig.4)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0 V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	Tol. ±5%					
	MIN.	MAX.	MAX.	TYP.	MAX.	MAX.
16	15.20	16.80	0.16	11.4	95	1.5
18	17.10	18.90	0.18	13.3	95	1.5
20	19.00	21.00	0.20	15.3	90	1.5
22	20.90	23.10	0.22	17.2	85	1.25
24	22.80	25.20	0.24	19.2	80	1.25
27	25.65	28.35	0.27	22.0	75	1.0
30	28.50	31.50	0.30	25.2	65	1.0
33	31.35	34.65	0.30	28.5	60	0.9
36	34.20	37.80	0.30	32.0	60	0.8
39	37.05	40.95	0.30	35.1	60	0.7
43	40.85	45.15	0.30	39.4	55	0.6

Note

1. $\Delta V_Z = V_Z$ at 100 μA minus V_Z at 10 μA.

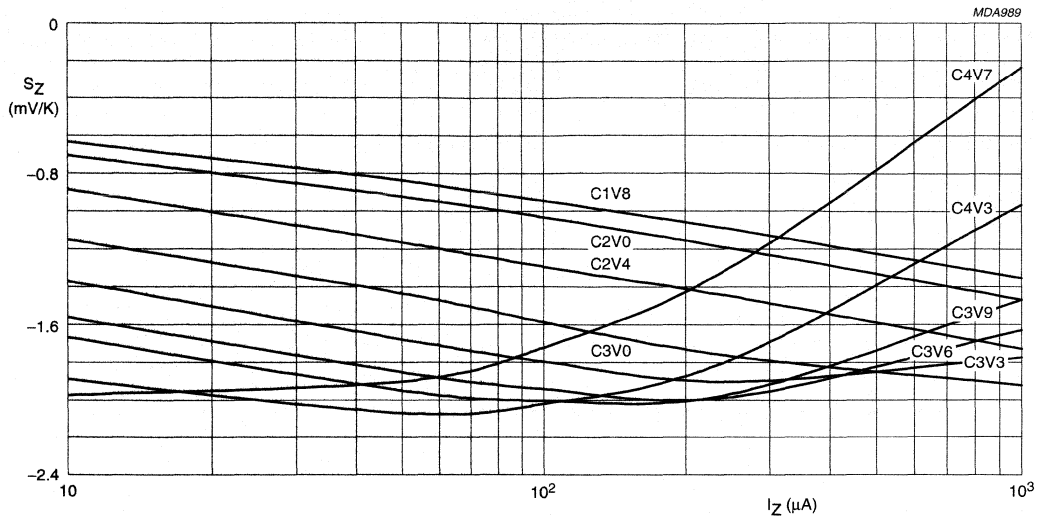
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	415	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 2	110	K/W

Notes

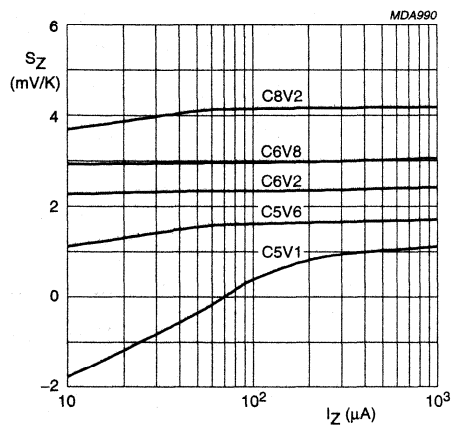
1. Device mounted on a FR4 printed circuit-board.
2. Soldering point of the cathode tab.

GRAPHICAL DATA



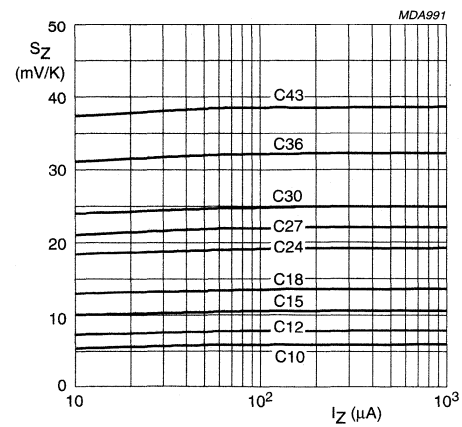
T_j = 25 to 150 °C.

Fig.2 Temperature coefficient as a function of working current; typical values.



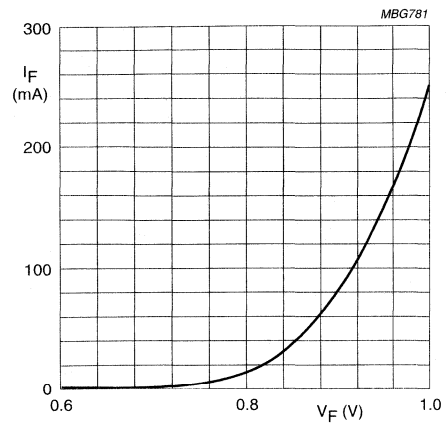
T_j = 25 to 150 °C.

Fig.3 Temperature coefficient as a function of working current; typical values.



T_j = 25 to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.



T_j = 25 °C.

Fig.5 Forward current as a function of forward voltage; typical values.

Schottky barrier double diode PBYR2100CT

FEATURES

- Low switching losses
- High breakdown voltage
- Fast recovery time
- Guard ring protected
- Plastic SMD package.

APPLICATIONS

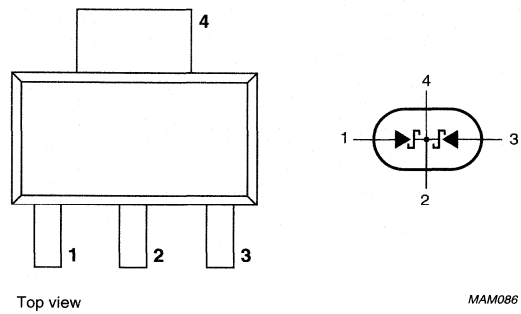
- Low power, switched-mode power supplies
- Rectification
- Polarity protection.

DESCRIPTION

Schottky barrier double diode fabricated in planar technology, and encapsulated in a SOT223 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode (a_1)
2	common cathode
3	anode (a_2)
4	common cathode



Marking code: BYR210.

Fig.1 Simplified outline (SOT223), pin configuration and symbol.

Schottky barrier double diode PBYR2100CT

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	100	V
V_{RRM}	repetitive peak reverse voltage		–	100	V
V_{RWM}	crest working reverse voltage		–	100	V
$I_{F(AV)}$	average forward current	T_{amb} = 85 °C; see Fig.2; $R_{th\ j\text{-}a}$ = 70 K/W; note 1; $V_{R(equiv)}$ = 0.2 V; note 2	–	1	A
I_{FSM}	non-repetitive peak forward current	t = 8.3 ms half sine wave; JEDEC method	–	10	A
I_{RSM}	non-repetitive peak reverse current	t_p = 100 μs	–	0.5	A
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C
T_{amb}	operating ambient temperature		–	85	°C

Notes

1. Refer to SOT223 standard mounting conditions.
2. For Schottky barrier diodes thermal run-away has to be considered, as in some applications, the reverse power losses P_R are a significant part of the total power losses. Nomograms for determination of the reverse power losses P_R and $I_{F(AV)}$ rating will be available on request.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	I_F = 1 A; note 1; see Fig.3	790	mV
		I_F = 1 A; T_j = 100 °C; note 1; see Fig.3	690	mV
I_R	reverse current	$V_R = V_{RRMmax}$; note 1; see Fig.4	0.5	mA
		$V_R = V_{RRMmax}$; T_j = 100 °C; note 1; see Fig.4	5	mA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz; see Fig.5	100	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	70	K/W

Note

1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA

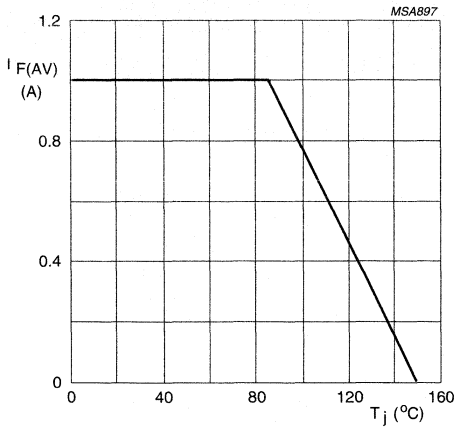
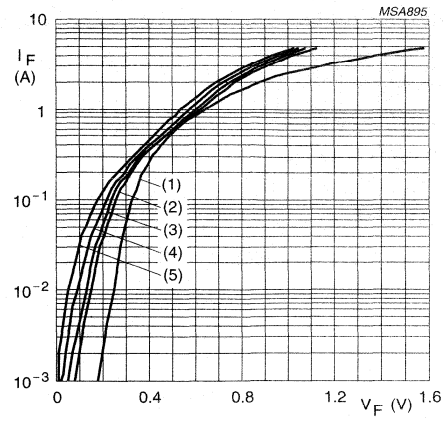


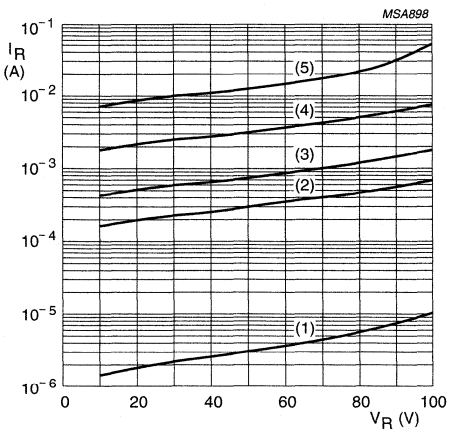
Fig.2 Average forward current derating curve.



(1) T_{amb} = 25 °C. (2) T_{amb} = 85 °C.

(3) T_{amb} = 100 °C. (4) T_{amb} = 125 °C. (5) T_{amb} = 150 °C.

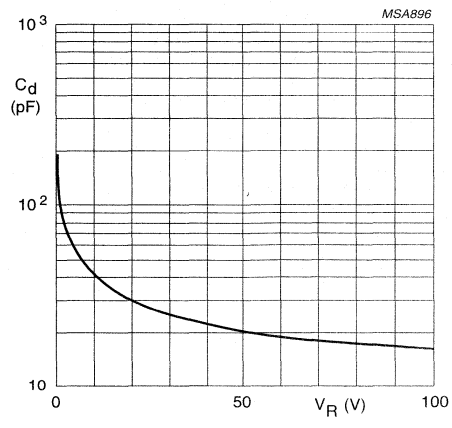
Fig.3 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 25 °C. (2) T_{amb} = 85 °C.

(3) T_{amb} = 100 °C. (4) T_{amb} = 125 °C. (5) T_{amb} = 150 °C.

Fig.4 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

Schottky barrier double diode PBYR2150CT

FEATURES

- Low switching losses
- Low forward voltage
- High breakdown voltage
- Fast recovery time
- Guard ring protected
- Plastic SMD package.

APPLICATIONS

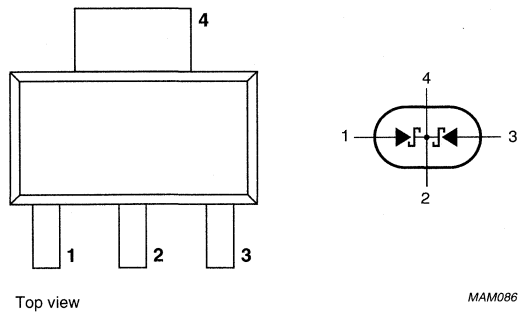
- Low power, switched-mode power supplies
- Rectification
- Polarity protection.

PINNING

PIN	DESCRIPTION
1	anode (a_1)
2	common cathode
3	anode (a_2)
4	common cathode

DESCRIPTION

The PBYR2150CT is a Schottky barrier double diode, fabricated in planar technology, and encapsulated in a SOT223 plastic SMD package.



Marking code: BYR215.

Fig.1 Simplified outline (SOT223), pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	150	V
V_{RRM}	repetitive peak reverse voltage		–	150	V
V_{RWM}	crest working reverse voltage		–	150	V
$I_{F(AV)}$	average forward current	T_{amb} = 85 °C; $R_{th\ j\text{-}a}$ = 70 K/W; note 1; $V_{R(equiv)}$ = 0.2 V; note 2	–	1	A
I_{FSM}	non-repetitive peak forward current	t = 8.3 ms half sinewave; JEDEC method	–	10	A

PRELIMINARY
See Philips Semiconductors for Design-in information

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C
T_{amb}	operating ambient temperature		–	80	°C

Notes

1. Refer to SOT223 standard mounting conditions.
2. For Schottky barrier diodes thermal run-away has to be considered, as in some applications, the reverse power losses P_R are a significant part of the total power losses. Nomograms for determination of the reverse power losses P_R and $I_{F(AV)}$ rating will be available on request.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.2		
		I_F = 0.1 A; note 1	400	mV
		I_F = 0.5 A; note 1	650	mV
		I_F = 1 A; note 1	850	mV
		I_F = 1 A; T_j = 100 °C; note 1	690	mV
I_R	reverse current	$V_R = V_{RRMmax}$; note 1; see Fig.3	1	mA
		$V_R = V_{RRMmax}$; T_j = 100 °C; note 1; see Fig.3	10	mA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz; see Fig.4	100	pF

Note

1. Pulsed test: t_p = 300 μs; δ = 0.02.

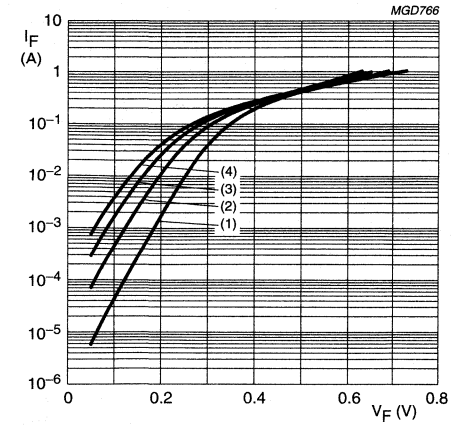
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	70	K/W

Note

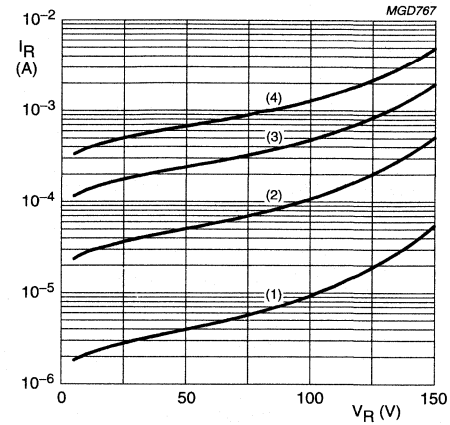
1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA



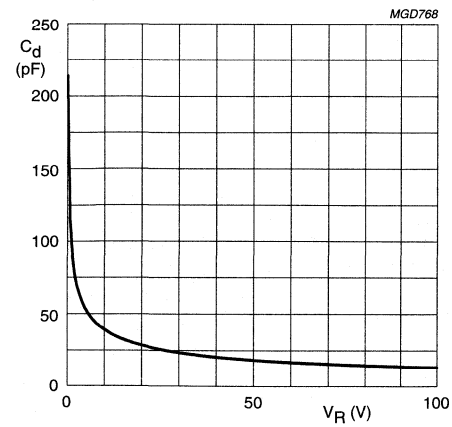
(1) T_{amb} = 25 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 80 °C.
(4) T_{amb} = 100 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 25 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 80 °C.
(4) T_{amb} = 100 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

Voltage regulator diodes PDZ-B series

FEATURES

- Total power dissipation: max. 400 mW
- Small plastic package suitable for surface mounted design
- Wide variety of voltage ranges: nom. 2.4 to 36 V (E24 range).

APPLICATIONS

- General voltage regulation.

DESCRIPTION

Low-power general purpose voltage regulator diodes in a small plastic SMD SOD323 package.

PINNING

PIN	DESCRIPTION
1	cathode
2	anode

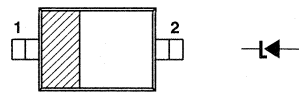


Fig.1 Simplified outline (SOD323) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
PDZ2.4B	Z0	PDZ5.1B	Z8	PDZ11B	ZG	PDZ24B	ZQ
PDZ2.7B	Z1	PDZ5.6B	Z9	PDZ12B	ZH	PDZ27B	ZR
PDZ3.0B	Z2	PDZ6.2B	ZA	PDZ13B	ZJ	PDZ30B	ZS
PDZ3.3B	Z3	PDZ6.8B	ZB	PDZ15B	ZK	PDZ33B	ZT
PDZ3.6B	Z4	PDZ7.5B	ZC	PDZ16B	ZL	PDZ36B	ZU
PDZ3.9B	Z5	PDZ8.2B	ZD	PDZ18B	ZM		
PDZ4.3B	Z6	PDZ9.1B	ZE	PDZ20B	ZN		
PDZ4.7B	Z7	PDZ10B	ZF	PDZ22B	ZP		

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	200	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 μs; square wave; T_{amb} = 25 °C prior to surge	see Table 2		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1; see Fig.2	–	400	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on a printed-circuit board measuring 11 × 25 × 1.6 mm.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		130	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	340	K/W

Note

1. Device mounted on a printed-circuit board measuring 11 × 25 × 1.6 mm.

ELECTRICAL CHARACTERISTICS

Table 1 Total series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.3	0.9	V
		I_F = 100 mA; see Fig.3	1.1	V
I_R	reverse current			
	PDZ2.4B	V_R = 1 V	50	µA
	PDZ2.7B	V_R = 1 V	20	µA
	PDZ3.0B	V_R = 1 V	10	µA
	PDZ3.3B	V_R = 1 V	5	µA
	PDZ3.6B	V_R = 1 V	5	µA
	PDZ3.9B	V_R = 1 V	3	µA
	PDZ4.3B	V_R = 1 V	3	µA
	PDZ4.7B	V_R = 1 V	2	µA
	PDZ5.1B	V_R = 1.5 V	2	µA
	PDZ5.6B	V_R = 2.5 V	1	µA
	PDZ6.2B	V_R = 3 V	500	nA
	PDZ6.8B	V_R = 3.5 V	500	nA
	PDZ7.5B	V_R = 4 V	500	nA
	PDZ8.2B	V_R = 5 V	500	nA
	PDZ9.1B	V_R = 6 V	500	nA
	PDZ10B	V_R = 7 V	100	nA
	PDZ11B	V_R = 8 V	100	nA
	PDZ12B	V_R = 9 V	100	nA
	PDZ13B	V_R = 10 V	100	nA
	PDZ15B	V_R = 11 V	50	nA
	PDZ16B	V_R = 12 V	50	nA
	PDZ18B	V_R = 13 V	50	nA
	PDZ20B	V_R = 15 V	50	nA
	PDZ22B	V_R = 17 V	50	nA
	PDZ24B	V_R = 19 V	50	nA
	PDZ27B	V_R = 21 V	50	nA
	PDZ30B	V_R = 23 V	50	nA
	PDZ33B	V_R = 25 V	50	nA
	PDZ36B	V_R = 27 V	50	nA

Table 2 Per type

T_j = 25 °C unless otherwise specified.

TYPE NUMBER	WORKING VOLTAGE V_Z (V) at I_Z = 5 mA		DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_Z = 5 mA (see Figs 4 and 5)	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	MIN.	MAX.	MAX.	at I_Z (mA)	MAX.	at I_Z (mA)	TYP.	MAX.	MAX.
PDZ2.4B	2.43	2.63	1000	0.5	100	5	−1.6	450	8.0
PDZ2.7B	2.69	2.91	1000	0.5	100	5	−2.0	440	8.0
PDZ3.0B	2.85	3.07	1000	0.5	95	5	−2.1	425	8.0
PDZ3.3B	3.32	3.53	1000	0.5	95	5	−2.4	410	8.0
PDZ3.6B	3.60	3.85	500	1.0	90	5	−2.4	390	8.0
PDZ3.9B	3.89	4.16	500	1.0	90	5	−2.5	370	8.0
PDZ4.3B	4.17	4.48	600	1.0	90	5	−2.5	350	8.0
PDZ4.7B	4.55	4.75	600	1.0	90	5	−1.4	325	8.0
PDZ5.1B	4.96	5.20	250	0.5	60	5	0.3	300	5.5
PDZ5.6B	5.48	5.73	100	0.5	50	5	1.9	275	5.5
PDZ6.2B	6.06	6.33	80	0.5	50	5	2.7	250	5.5
PDZ6.8B	6.65	6.93	60	0.5	40	5	3.4	215	5.5
PDZ7.5B	7.28	7.60	60	0.5	10	5	4.0	170	3.5
PDZ8.2B	8.02	8.36	60	0.5	10	5	4.6	150	3.5
PDZ9.1B	8.85	9.23	60	0.5	10	5	5.5	120	3.5
PDZ10B	9.77	10.21	60	0.5	10	5	6.4	110	3.5
PDZ11B	10.78	11.22	60	0.5	10	5	7.4	108	3.0
PDZ12B	11.74	12.24	80	0.5	10	5	8.4	105	3.0
PDZ13B	12.91	13.49	80	0.5	10	5	9.4	103	2.5
PDZ15B	14.34	14.98	80	0.5	15	5	11.4	99	2.0
PDZ16B	15.85	16.51	80	0.5	20	5	12.4	97	1.5
PDZ18B	17.56	18.35	80	0.5	20	5	14.4	93	1.5
PDZ20B	19.52	20.39	100	0.5	20	5	16.4	88	1.5
PDZ22B	21.54	22.47	100	0.5	25	5	18.4	84	1.3
PDZ24B	23.72	24.78	120	0.5	30	5	20.4	80	1.3
PDZ27B	26.19	27.53	150	0.5	40	5	23.4	73	1.0
PDZ30B	29.19	30.69	200	0.5	40	5	26.6	66	1.0
PDZ33B	32.15	33.79	250	0.5	40	5	29.7	60	0.9
PDZ36B	35.07	36.87	300	0.5	60	5	33.0	59	0.8

GRAPHICAL DATA

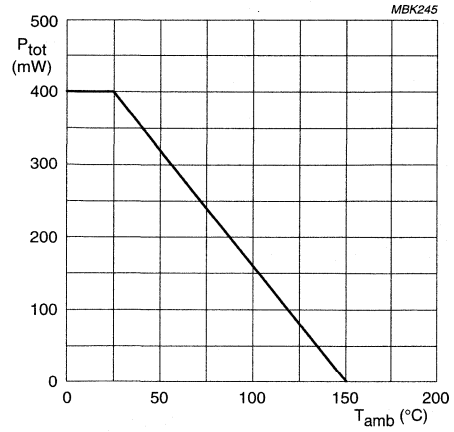
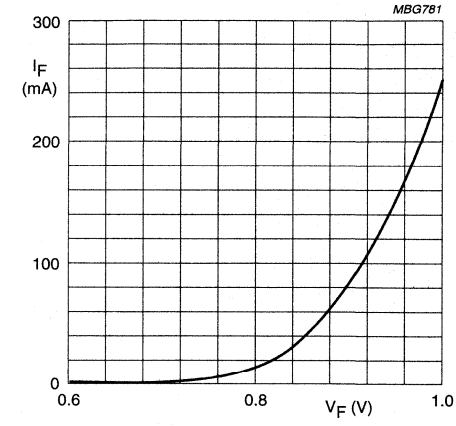
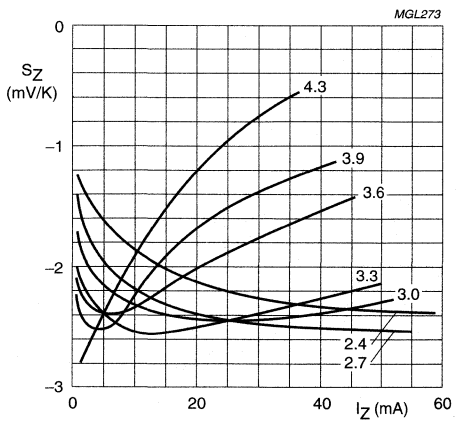


Fig.2 Power derating curve.



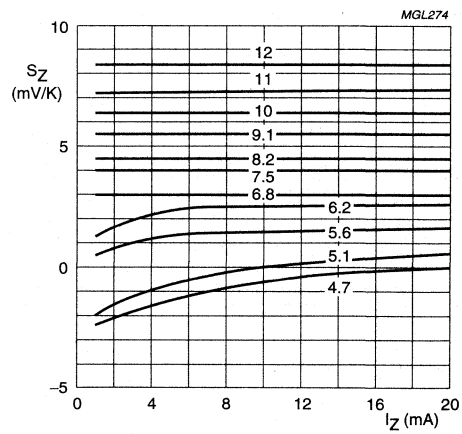
T_j = 25 °C.

Fig.3 Forward current as a function of forward voltage; typical values.



PDZ2.4B to PDZ4.3B.
T_j = 25 °C to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.



PDZ4.7B to PDZ12B.
T_j = 25 °C to 150 °C.

Fig.5 Temperature coefficient as a function of working current; typical values.

Low-voltage avalanche regulator diodes PLVA400A series

FEATURES

- Very low dynamic impedance at low currents: approximately $1/20$ of conventional series
- Hard breakdown knee
- Low noise: approximately $1/10$ of conventional series
- Total power dissipation: max. 400 mW
- Small tolerances of V_Z
- Working voltage range: nom. 5.0 to 6.8 V
- Non-repetitive peak reverse power dissipation: max. 30 W.

APPLICATIONS

- Low current, low power, low noise applications
- CMOS RAM back-up circuits
- Voltage stabilizers
- Voltage limiters
- Smoke detector relays.

DESCRIPTION

High performance voltage regulator diodes in hermetically sealed leaded glass SOD27 (DO-35) packages.

The series consists of PLVA450A to PLVA468A.

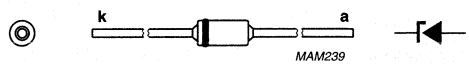


Fig.1 Simplified outline (SOD27; DO-35) and symbol.

MARKING

TYPE NUMBER	MARKING CODE
PLVA450A	450APH
PLVA453A	453APH
PLVA456A	456APH
PLVA459A	459APH
PLVA462A	462APH
PLVA465A	465APH
PLVA468A	468APH

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZRM}	repetitive peak working current	t_p = 100 μs; δ = 10%		250	mA
P_{tot}	total power dissipation	$T_{tp} \leq 55$ °C; note 1	–	400	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 μs; T_j = 150 °C		30	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	175	°C

Note

1. Lead length 8 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA	–	–	0.9	V
V_Z	working voltage	I_Z = 250 μA				
	PLVA450A		4.80	5.00	5.20	V
	PLVA453A		5.10	5.30	5.50	V
	PLVA456A		5.40	5.60	5.80	V
	PLVA459A		5.70	5.90	6.10	V
	PLVA462A		6.00	6.20	6.40	V
	PLVA465A		6.30	6.50	6.70	V
	PLVA468A		6.60	6.80	7.00	V
V_Z	working voltage	I_Z = 10 μA				
	PLVA450A		–	4.30	–	V
	PLVA453A		–	5.20	–	V
	PLVA456A		–	5.51	–	V
	PLVA459A		–	5.85	–	V
	PLVA462A		–	6.19	–	V
	PLVA465A		–	6.49	–	V
	PLVA468A		–	6.80	–	V
R_Z	dynamic resistance	1 kHz superimposed;				
	PLVA450A	I_{ZAC} is 10% of I_{ZDC}; I_Z = 250 μA	–	–	700	Ω
	PLVA453A		–	–	250	Ω
	PLVA456A to PLVA468A		–	–	100	Ω
S_Z	temperature coefficient	I_Z = 250 μA				
	PLVA450A		–	0.20	–	mV/K
	PLVA453A		–	1.60	–	mV/K
	PLVA456A		–	1.90	–	mV/K
	PLVA459A		–	2.40	–	mV/K
	PLVA462A		–	2.65	–	mV/K
	PLVA465A		–	2.90	–	mV/K
	PLVA468A		–	3.40	–	mV/K
I_R	reverse current	V_R = 80% V_Z nominal				
	PLVA450A		–	–	20000	nA
	PLVA453A		–	–	5000	nA
	PLVA456A		–	–	1000	nA
	PLVA459A		–	–	500	nA
	PLVA462A		–	–	100	nA
	PLVA465A		–	–	50	nA
	PLVA468A		–	–	10	nA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_R	reverse current	V_R = 50% V_Z nominal				
	PLVA450A		–	34	–	nA
	PLVA453A		–	22	–	nA
	PLVA456A		–	1.1	–	nA
	PLVA459A		–	0.9	–	nA
	PLVA462A		–	0.9	–	nA
	PLVA465A		–	0.9	–	nA
	PLVA468A		–	0.8	–	nA
I_R	reverse current	V_R = 90% V_Z nominal				
	PLVA450A		–	21	–	μA
	PLVA453A		–	3.5	–	μA
	PLVA456A		–	1.3	–	μA
	PLVA459A		–	1.0	–	μA
	PLVA462A		–	0.05	–	μA
	PLVA465A		–	0.04	–	μA
	PLVA468A		–	0.006	–	μA
ΔV_Z	line regulation					
	PLVA459A to PLVA468A	I_{LO} = 10 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA456A	I_{LO} = 50 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA450A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.4	V
	PLVA453A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.2	V
V_n	noise voltage density	f = 1 kHz; B = 1 kHz; I_Z = 250 μA	–	–	1.0	$\frac{\mu V}{\sqrt{Hz}}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 8 mm.	300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length max.	380	K/W

Low-voltage avalanche regulator diodes PLVA600A series

FEATURES

- Very low dynamic impedance at low currents: approximately $1/20$ of conventional series
- Hard breakdown knee
- Low noise: approximately $1/10$ of conventional series
- Total power dissipation: max. 250 mW
- Small tolerances of V_Z
- Working voltage range: nom. 5.0 to 6.8 V
- Non-repetitive peak reverse power dissipation: max. 30 W.

APPLICATIONS

- Low current, low power, low noise applications
- CMOS RAM back-up circuits
- Voltage stabilizers
- Voltage limiters
- Smoke detector relays.

DESCRIPTION

High performance voltage regulator diodes in small SOT23 plastic SMD packages.

The series consists of PLVA650A to PLVA668A.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

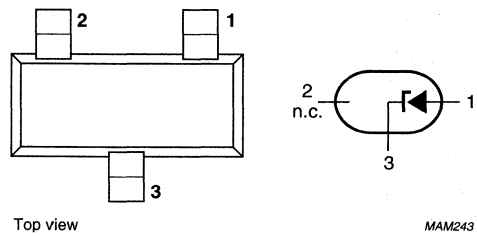


Fig.1 Simplified outline (SOT23) and symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PLVA650A	*9A
PLVA653A	*9B
PLVA656A	*9C
PLVA659A	*9D
PLVA662A	*9E
PLVA665A	*9F
PLVA668A	*9G

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZRM}	repetitive peak working current	t_p = 100 µs; δ = 10%		250	mA
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 µs; T_j = 150 °C		30	W
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA	–	–	0.9	V
V_Z	working voltage	I_Z = 250 μA				
	PLVA650A		4.80	5.00	5.20	V
	PLVA653A		5.10	5.30	5.50	V
	PLVA656A		5.40	5.60	5.80	V
	PLVA659A		5.70	5.90	6.10	V
	PLVA662A		6.00	6.20	6.40	V
	PLVA665A		6.30	6.50	6.70	V
	PLVA668A		6.60	6.80	7.00	V
V_Z	working voltage	I_Z = 10 μA				
	PLVA650A		–	4.30	–	V
	PLVA653A		–	5.20	–	V
	PLVA656A		–	5.51	–	V
	PLVA659A		–	5.85	–	V
	PLVA662A		–	6.19	–	V
	PLVA665A		–	6.49	–	V
	PLVA668A		–	6.80	–	V
R_Z	dynamic resistance	1 kHz superimposed;				
	PLVA650A	I_{ZAC} is 10% of I_{ZDC}; I_Z = 250 μA	–	–	700	Ω
	PLVA653A		–	–	250	Ω
	PLVA656A to PLVA668A		–	–	100	Ω
S_Z	temperature coefficient	I_Z = 250 μA				
	PLVA650A		–	0.20	–	mV/K
	PLVA653A		–	1.60	–	mV/K
	PLVA656A		–	1.90	–	mV/K
	PLVA659A		–	2.40	–	mV/K
	PLVA662A		–	2.65	–	mV/K
	PLVA665A		–	2.90	–	mV/K
	PLVA668A		–	3.40	–	mV/K
I_R	reverse current	V_R = 80% V_Z nominal				
	PLVA650A		–	–	20000	nA
	PLVA653A		–	–	5000	nA
	PLVA656A		–	–	1000	nA
	PLVA659A		–	–	500	nA
	PLVA662A		–	–	100	nA
	PLVA665A		–	–	50	nA
	PLVA668A		–	–	10	nA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_R	reverse current	V_R = 50% V_Z nominal				
	PLVA650A		–	34	–	nA
	PLVA653A		–	22	–	nA
	PLVA656A		–	1.1	–	nA
	PLVA659A		–	0.9	–	nA
	PLVA662A		–	0.9	–	nA
	PLVA665A		–	0.9	–	nA
	PLVA668A		–	0.8	–	nA
I_R	reverse current	V_R = 90% V_Z nominal				
	PLVA650A		–	21	–	μA
	PLVA653A		–	3.5	–	μA
	PLVA656A		–	1.3	–	μA
	PLVA659A		–	1.0	–	μA
	PLVA662A		–	0.05	–	μA
	PLVA665A		–	0.04	–	μA
	PLVA668A		–	0.006	–	μA
ΔV_Z	line regulation					
	PLVA659A to PLVA668A	I_{LO} = 10 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA656A	I_{LO} = 50 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA650A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.4	V
	PLVA653A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.2	V
V_n	noise voltage density	f = 1 kHz; B = 1 kHz; I_Z = 250 μA	–	–	1.0	$\frac{\mu V}{\sqrt{Hz}}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on an FR4 printed circuit-board.

Low-voltage avalanche regulator double diodes

PLVA2600A series

FEATURES

- Very low dynamic impedance at low currents: approximately $1/20$ of conventional series
- Hard breakdown knee
- Low noise: approximately $1/10$ of conventional series
- Total power dissipation: max. 250 mW
- Small tolerances of V_Z
- Working voltage range: nom. 5.0 to 6.8 V
- Non-repetitive peak reverse power dissipation: max. 30 W.

APPLICATIONS

- Low current, low power, low noise applications
- CMOS RAM back-up circuits
- Voltage stabilizers
- Voltage limiters
- Smoke detector relays.

DESCRIPTION

The PLVA2600A series consists of two high performance voltage regulator diodes with common anodes, in small SOT23 plastic SMD packages.

The series consists of PLVA2650A to PLVA2668A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PLVA2650A	*9J
PLVA2653A	*9K
PLVA2656A	*9L
PLVA2659A	*9M
PLVA2662A	*9N
PLVA2665A	*9O
PLVA2668A	*9P

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode

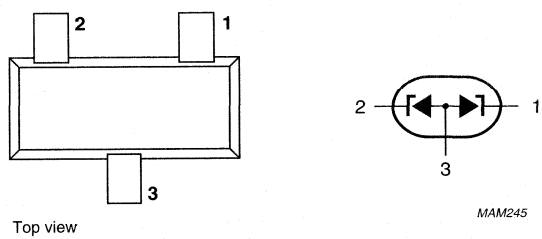


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZRM}	repetitive peak working current	t_p = 100 μs; δ = 10%	–	250	mA
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 μs; T_j = 150 °C	–	30	W
P_{tot}	total power dissipation	single diode loaded; T_{amb} = 25 °C; note 1	–	250	mW
		double diode loaded; T_{amb} = 25 °C; note 1	–	180	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA	–	–	0.9	V
V_Z	working voltage	I_Z = 250 µA				
	PLVA2650A		4.80	5.00	5.20	V
	PLVA2653A		5.10	5.30	5.50	V
	PLVA2656A		5.40	5.60	5.80	V
	PLVA2659A		5.70	5.90	6.10	V
	PLVA2662A		6.00	6.20	6.40	V
	PLVA2665A		6.30	6.50	6.70	V
	PLVA2668A		6.60	6.80	7.00	V
	working voltage	I_Z = 10 µA				
	PLVA2650A		–	4.30	–	V
	PLVA2653A		–	5.20	–	V
	PLVA2656A		–	5.51	–	V
	PLVA2659A		–	5.85	–	V
	PLVA2662A		–	6.19	–	V
	PLVA2665A		–	6.49	–	V
	PLVA2668A		–	6.80	–	V
R_Z	dynamic resistance	1 kHz superimposed;				
	PLVA2650A	I_{ZAC} is 10% of I_{ZDC}; I_Z = 250 µA	–	–	700	Ω
	PLVA2653A		–	–	250	Ω
	PLVA2656A to PLVA2668A		–	–	100	Ω
S_Z	temperature coefficient	I_Z = 250 µA				
	PLVA2650A		–	0.20	–	mV/K
	PLVA2653A		–	1.60	–	mV/K
	PLVA2656A		–	1.90	–	mV/K
	PLVA2659A		–	2.40	–	mV/K
	PLVA2662A		–	2.65	–	mV/K
	PLVA2665A		–	2.90	–	mV/K
	PLVA2668A		–	3.40	–	mV/K
I_R	reverse current	V_R = 80%; V_Z nominal				
	PLVA2650A		–	–	20000	nA
	PLVA2653A		–	–	5000	nA
	PLVA2656A		–	–	1000	nA
	PLVA2659A		–	–	500	nA
	PLVA2662A		–	–	100	nA
	PLVA2665A		–	–	50	nA
	PLVA2668A		–	–	10	nA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_R	reverse current	V_R = 50%; V_Z nominal				
	PLVA2650A		–	34	–	nA
	PLVA2653A		–	22	–	nA
	PLVA2656A		–	1.1	–	nA
	PLVA2659A		–	0.9	–	nA
	PLVA2662A		–	0.9	–	nA
	PLVA2665A		–	0.9	–	nA
	PLVA2668A		–	0.8	–	nA
	reverse current	V_R = 90%; V_Z nominal				
	PLVA2650A		–	21	–	μA
	PLVA2653A		–	3.5	–	μA
	PLVA2656A		–	1.3	–	μA
	PLVA2659A		–	1.0	–	μA
	PLVA2662A		–	0.05	–	μA
	PLVA2665A		–	0.04	–	μA
	PLVA2668A		–	0.006	–	μA
ΔV_Z	line regulation					
	PLVA2659A to PLVA2668A	I_{LO} = 10 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA2656A	I_{LO} = 50 μA; I_{Hi} = 1 mA	–	–	0.1	V
	PLVA2650A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.4	V
	PLVA2653A	I_{LO} = 100 μA; I_{Hi} = 1 mA	–	–	0.2	V
V_n	noise voltage density	f = 1 kHz; B = 1 kHz; I_Z = 250 μA	–	–	1.0	$\frac{\mu V}{\sqrt{Hz}}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on an FR4 printed circuit-board.

Schottky barrier double diode PMBD353

FEATURES

- Low forward voltage
- Small SMD package
- Low capacitance.

APPLICATIONS

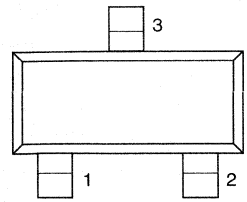
- UHF mixer
- Sampling circuits
- Modulators
- Phase detection.

PINNING

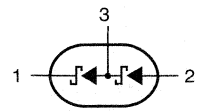
PIN	DESCRIPTION
1	k_1
2	a_2
3	a_1, k_2

DESCRIPTION

Planar Schottky barrier double diode in a SOT23 small plastic SMD package.



Top view MGC421



Marking code: A6p = made in Hong Kong; A6t = made in Malaysia.

Fig.1 Simplified outline (SOT23) pin configuration and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
Per diode				
V_R	continuous reverse voltage	–	4	V
I_F	continuous forward current	–	30	mA
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	–	100	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.2		
		I_F = 0.1 mA	350	mV
		I_F = 1 mA	450	mV
		I_F = 10 mA	600	mV
I_R	reverse current	V_R = 3 V; note 1; see Fig.3	0.25	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.4	1	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

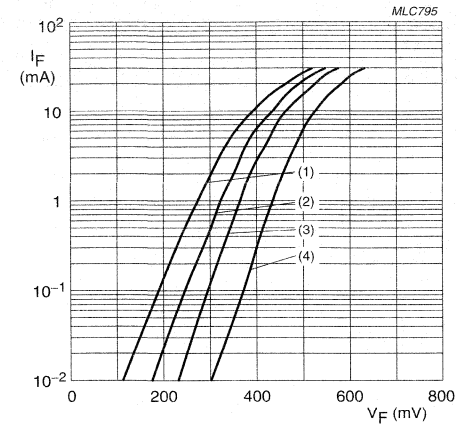
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

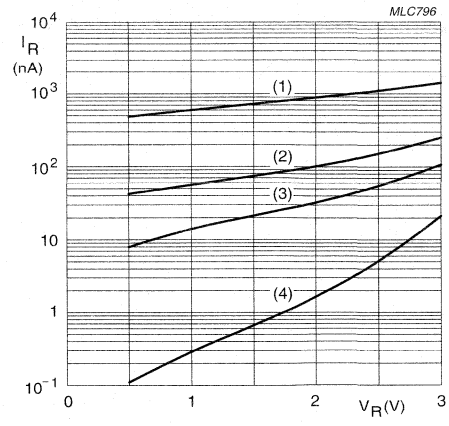
1. Refer to SOT23 standard mounting conditions.

GRAPHICAL DATA



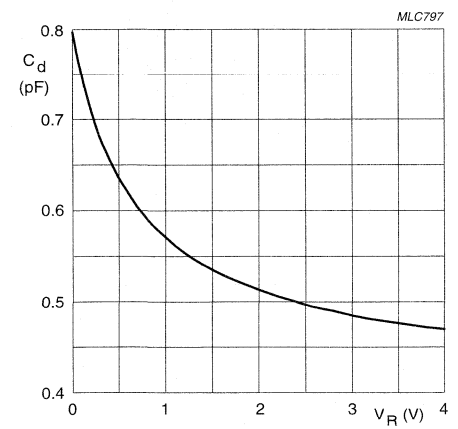
(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



(1) T_{amb} = 100 °C.
(2) T_{amb} = 60 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.3 Reverse current as a function of reverse voltage; typical values.



f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage; typical values.

High-speed diode PMBD914

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA
- Reverse recovery time: max. 4 ns.

APPLICATIONS

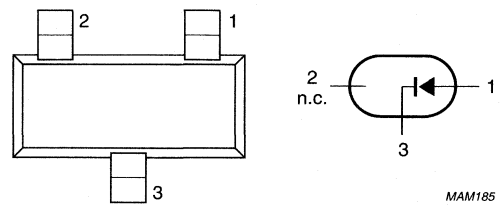
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The PMBD914 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: p5D = made in Hong Kong; t5D = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current	note 1; see Fig.2	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	25	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

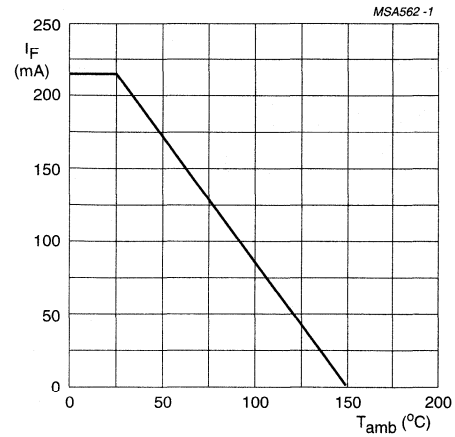
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

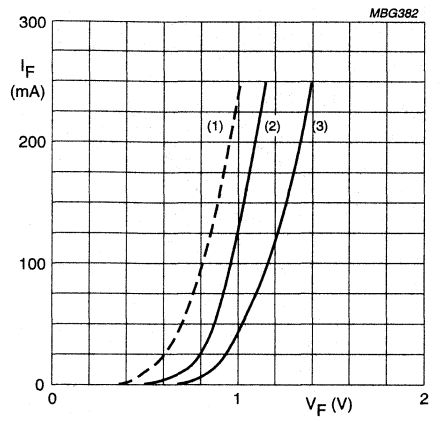
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



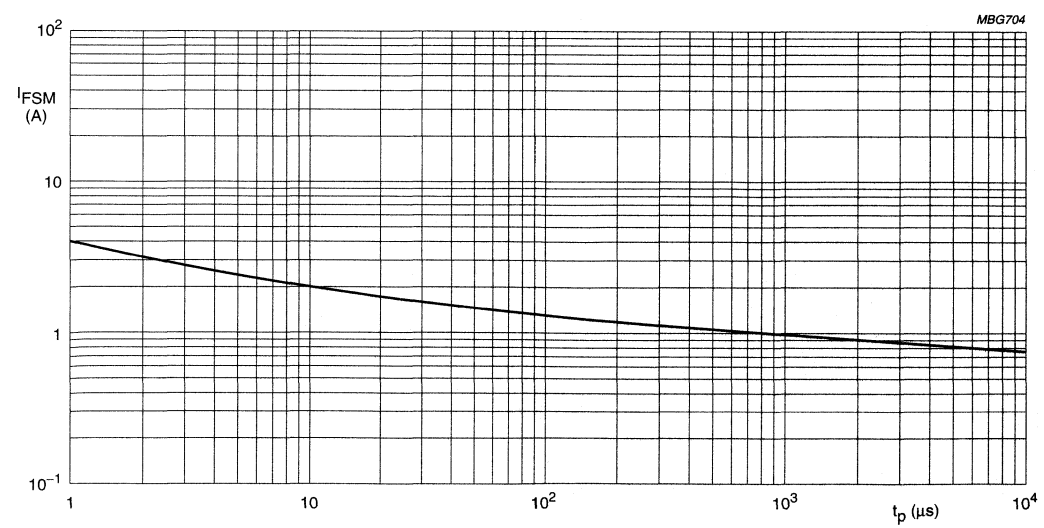
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

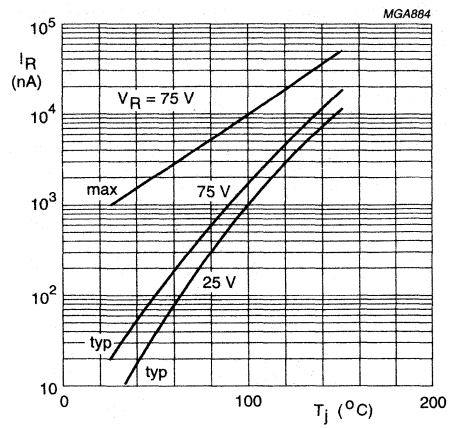
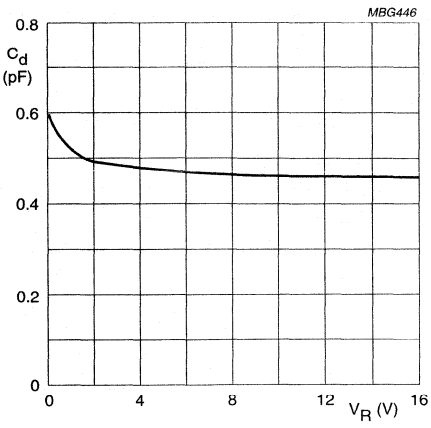
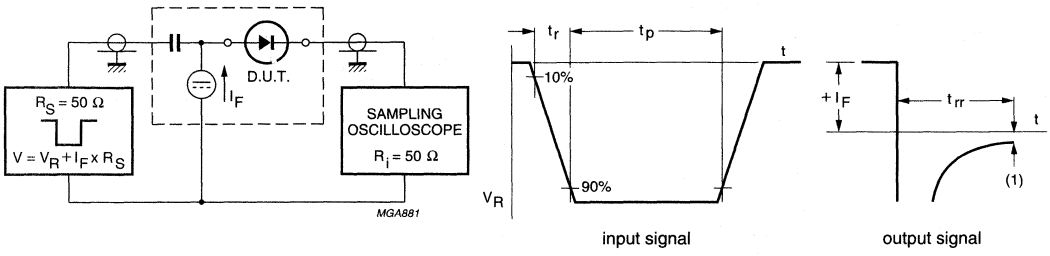


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

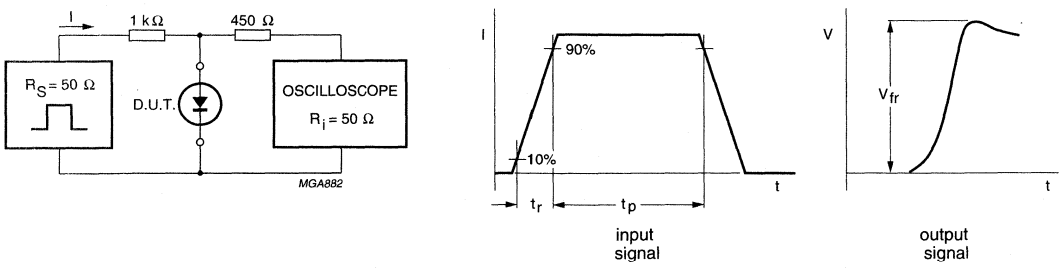


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diode PMBD6050

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 500 mA.

APPLICATIONS

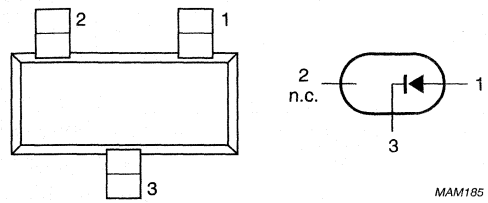
- High-speed switching in thick and thin-film circuits.

DESCRIPTION

The PMBD6050 is a high-speed switching diode fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode



Marking code: p5A = made in Hong Kong; t5A = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current	note 1; see Fig.2	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 50 V	100	nA
		V_R = 50 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

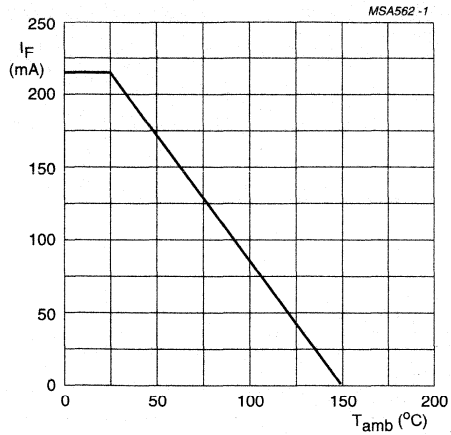
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

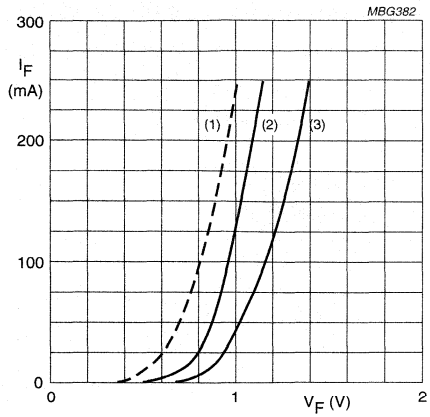
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



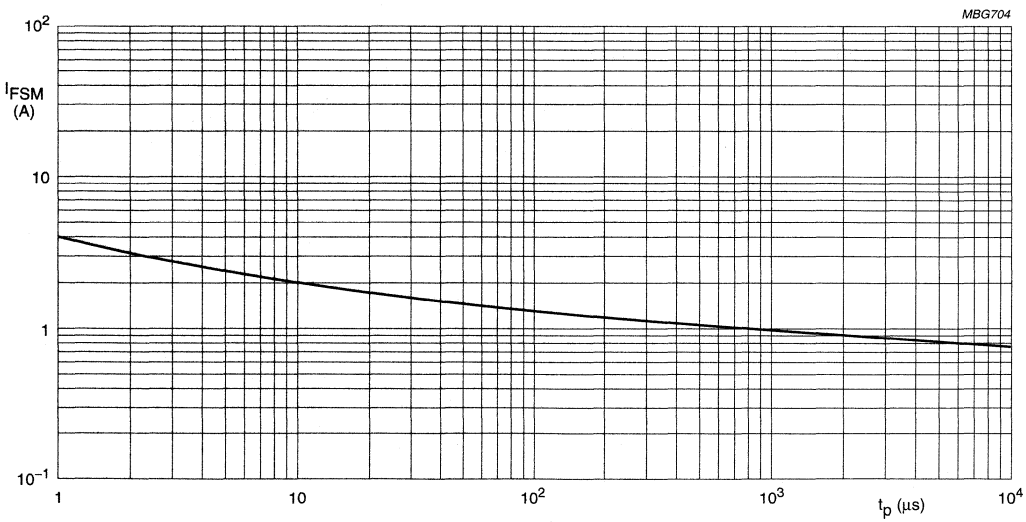
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



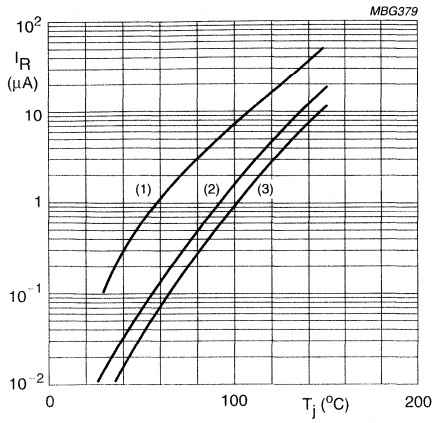
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



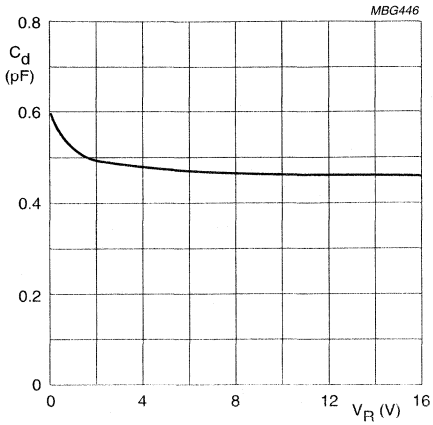
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



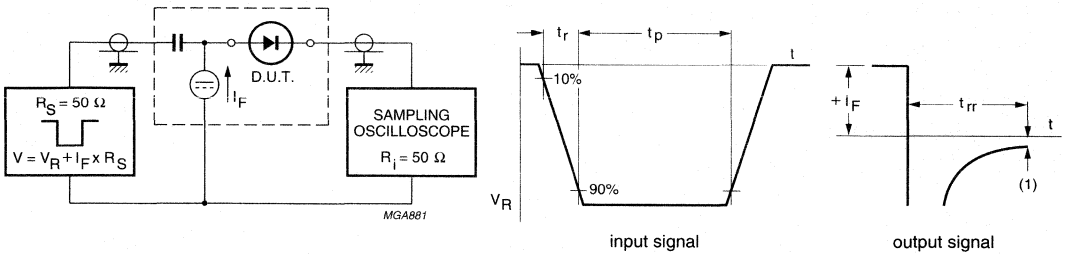
(1) V_R = 50 V; maximum values.
(2) V_R = 50 V; typical values.
(3) V_R = 30 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

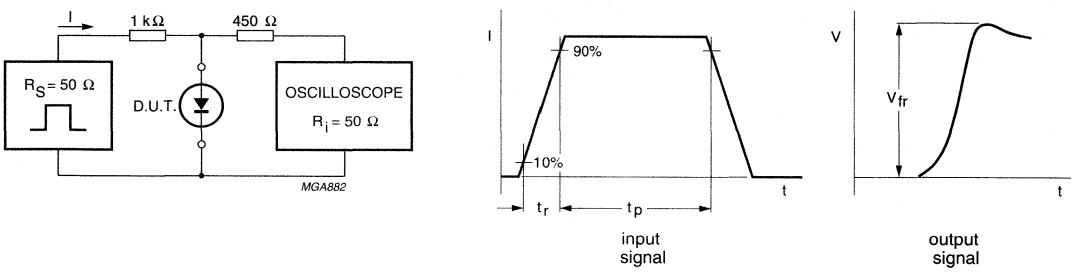


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode PMBD6100

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- General application
- Continuous reverse voltage: max. 70 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

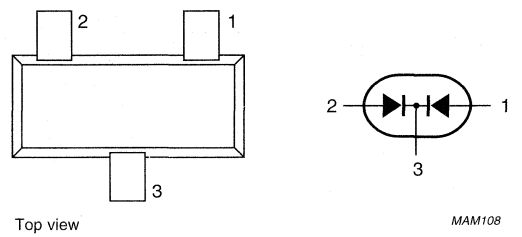
- High-speed switching in surface mounted circuits.

DESCRIPTION

The PMBD6100 consists of two high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode



Marking code: p5B = made in Hong Kong; t5B = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current	single diode loaded; note 1; see Fig.2	–	215	mA
		double diode loaded; note 1; see Fig.2	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	550	700	mV
		I_F = 10 mA	–	855	mV
		I_F = 50 mA	–	1	V
		I_F = 100 mA	0.85	1.1	V
I_R	reverse current	see Fig.5			
		V_R = 50 V	–	100	nA
		V_R = 50 V; T_j = 150 °C	–	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	–	1.75	V

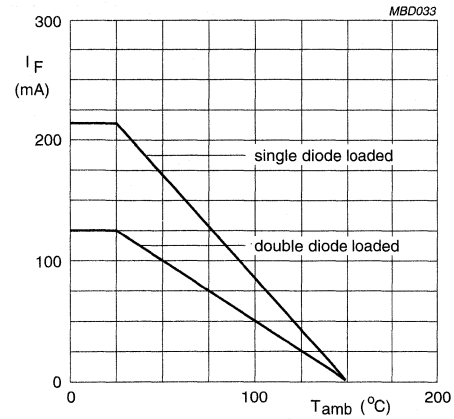
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

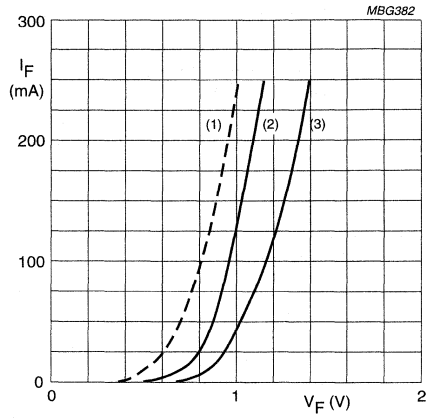
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



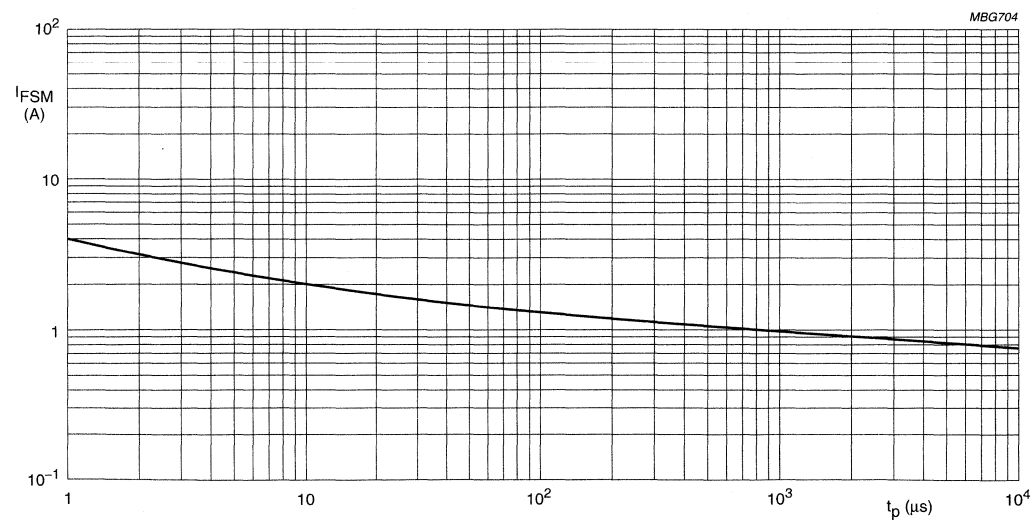
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



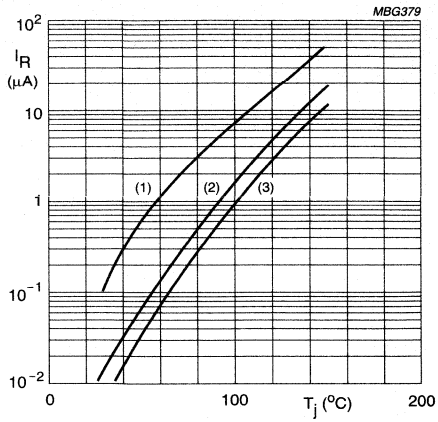
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



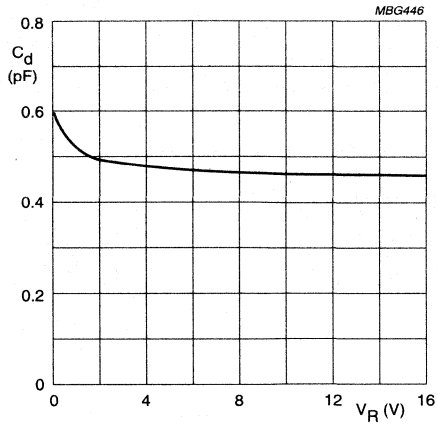
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



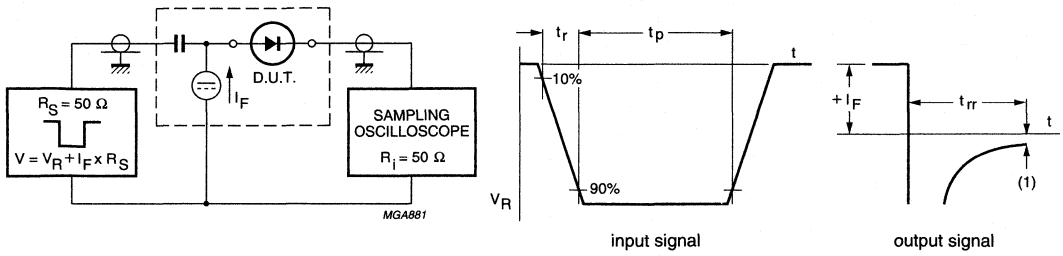
(1) V_R = 50 V; maximum values.
(2) V_R = 50 V; typical values.
(3) V_R = 30 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

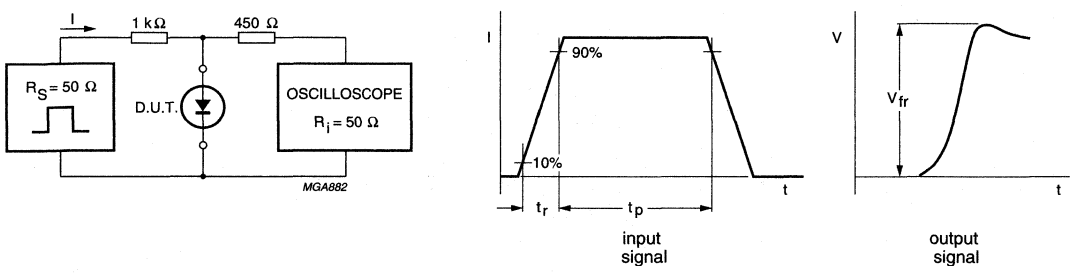


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed double diode PMBD7000

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 100 V
- Repetitive peak reverse voltage: max. 100 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

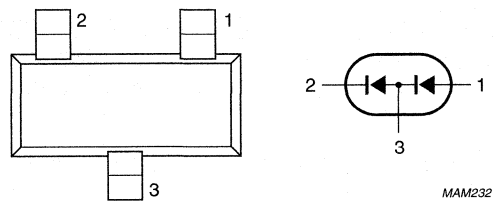
- High-speed switching in e.g. surface mounted circuits.

DESCRIPTION

The PMBD7000 consists of two high-speed switching diodes connected in series, fabricated in planar technology, and encapsulated in the small SOT23 plastic SMD package.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	common connection



Marking code: p5C = made in Hong Kong; t5C = made in Malaysia.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	100	V
V_R	continuous reverse voltage		–	100	V
I_F	continuous forward current	single diode loaded; see Fig.2; note 1	–	215	mA
		double diode loaded; see Fig.2; note 1	–	125	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_F	forward voltage	see Fig.3			
		I_F = 1 mA	550	700	mV
		I_F = 10 mA	670	820	mV
		I_F = 50 mA	–	1	V
		I_F = 100 mA	0.75	1.1	V
		I_F = 150 mA	–	1.25	mV
I_R	reverse current	see Fig.5			
		V_R = 50 V	–	300	nA
		V_R = 100 V	–	500	nA
		V_R = 50 V; T_j = 150 °C	–	100	μA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	–	1.75	V

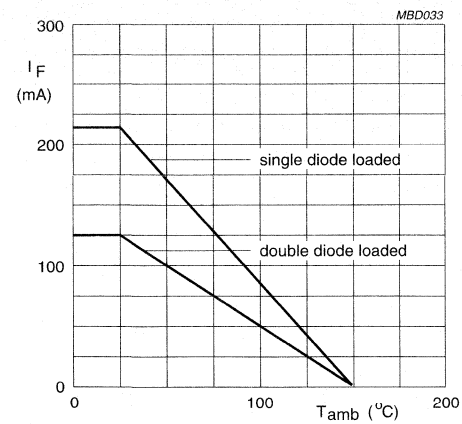
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		360	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

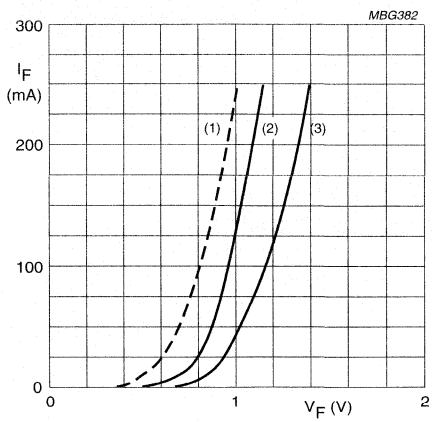
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



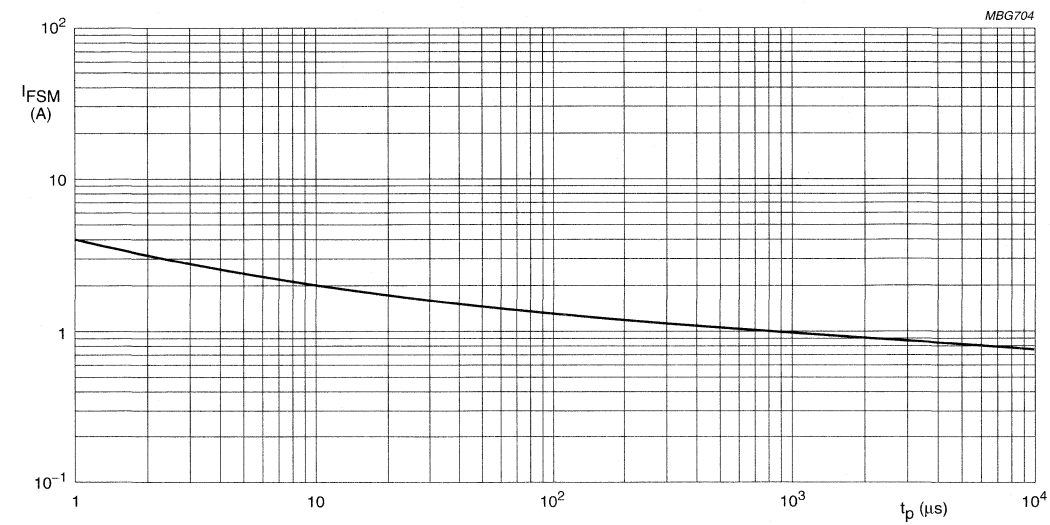
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



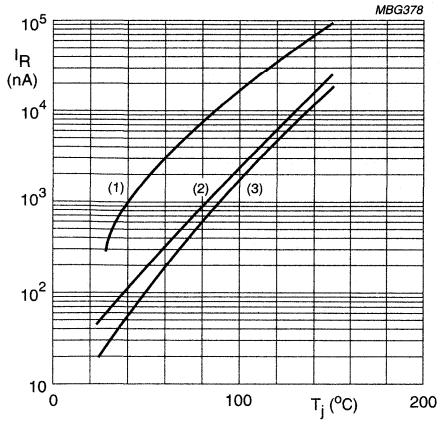
(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



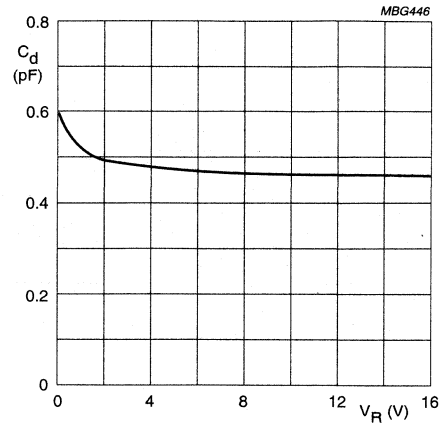
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



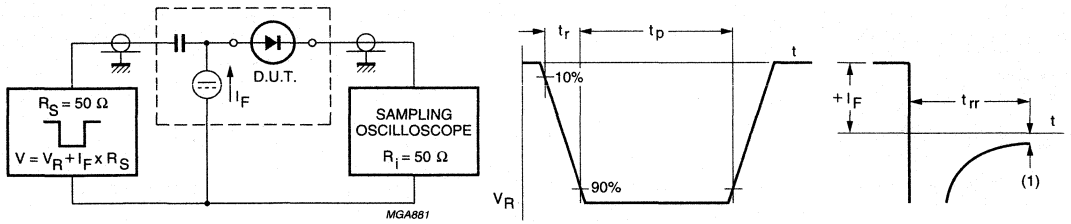
(1) V_R = 50 V; maximum values.
(2) V_R = 30 V; typical values.
(3) V_R = 50 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) $I_R = 1$ mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

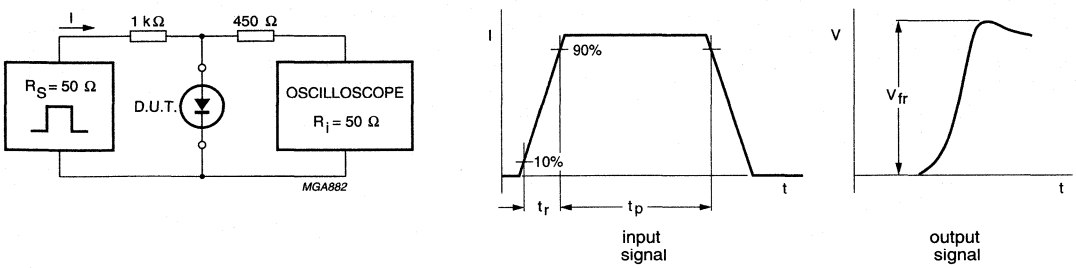


Fig.8 Forward recovery voltage test circuit and waveforms.

Voltage regulator diodes PMBZ5226B to PMBZ5257B

FEATURES

- Total power dissipation: max. 250 mW
- Tolerance series: ±5%
- Working voltage range: nom. 3.3 to 75 V
- Non-repetitive peak reverse power dissipation: max. 40 W.

APPLICATIONS

- General regulation functions.

DESCRIPTION

Low-power voltage regulator diodes in small SOT23 plastic SMD packages.

The series consists of 32 types with nominal working voltages from 3.3 to 75 V.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

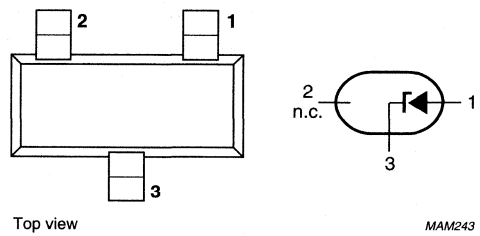


Fig.1 Simplified outline (SOT23) and symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE
PMBZ5226B	*8A	PMBZ5234B	*8J	PMBZ5242B	*8S	PMBZ5250B	81A
PMBZ5227B	*8B	PMBZ5235B	*8K	PMBZ5243B	*8T	PMBZ5251B	81B
PMBZ5228B	*8C	PMBZ5236B	*8L	PMBZ5244B	*8U	PMBZ5252B	81C
PMBZ5229B	*8D	PMBZ5237B	*8M	PMBZ5245B	*8V	PMBZ5253B	81D
PMBZ5230B	*8E	PMBZ5238B	*8N	PMBZ5246B	*8W	PMBZ5254B	81E
PMBZ5231B	*8F	PMBZ5239B	*8P	PMBZ5247B	*8X	PMBZ5255B	81F
PMBZ5232B	*8G	PMBZ5240B	*8Q	PMBZ5248B	*8Y	PMBZ5256B	81G
PMBZ5233B	*8H	PMBZ5241B	*8R	PMBZ5249B	*8Z	PMBZ5257B	81H

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	200	mA
I_{ZSM}	non-repetitive peak reverse current	t_p = 100 μs; square wave; T_j = 25 °C prior to surge	see Table "Per type"		
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	300	mW
		T_{amb} = 25 °C; note 2	–	250	mW
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 100 μs; square wave; T_j = 25 °C prior to surge; see Fig.2	–	40	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. Device mounted on a ceramic substrate of 8 × 10 × 0.7 mm.
2. Device mounted on an FR4 printed circuit-board.

ELECTRICAL CHARACTERISTICS

Total series

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 200 mA; see Fig.3	1.1	V

Per type

T_j = 25 °C unless otherwise specified.

TYPE No.	WORKING VOLTAGE V_Z (V)(1) at I_{Ztest}	DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_Z = 0.25 mA	TEMP. COEFF. S_Z (%/K) at I_Z(2)	TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
						I_R (μA)	V_R (V)	
	NOM.	MAX.	TYP.		MAX.	MAX.		MAX.
PMBZ5226B	3.3	1600	−0.064	20	450	25	1.0	6.0
PMBZ5227B	3.6	1700	−0.065	20	450	15	1.0	6.0
PMBZ5228B	3.9	1900	−0.063	20	450	10	1.0	6.0
PMBZ5229B	4.3	2000	−0.058	20	450	5	1.0	6.0
PMBZ5230B	4.7	2000	−0.047	20	450	5	1.0	6.0
PMBZ5231B	5.1	2000	−0.013	20	300	5	2.0	6.0
PMBZ5232B	5.6	1600	+0.023	20	300	5	3.0	6.0
PMBZ5233B	6.0	1600	+0.023	20	300	5	3.5	6.0
PMBZ5234B	6.2	1000	+0.039	20	200	5	4.0	6.0
PMBZ5235B	6.8	750	+0.040	20	200	3	5.0	6.0
PMBZ5236B	7.5	500	+0.047	20	150	3	6.0	4.0
PMBZ5237B	8.2	500	+0.052	20	150	3	6.5	4.0
PMBZ5238B	8.7	600	+0.053	20	150	3	6.5	3.5
PMBZ5239B	9.1	600	+0.055	20	150	3	7.0	3.0
PMBZ5240B	10	600	+0.055	20	90	3	8.0	3.0
PMBZ5241B	11	600	+0.058	20	85	2	8.4	2.5
PMBZ5242B	12	600	+0.062	20	85	1	9.1	2.5
PMBZ5243B	13	600	+0.065	9.5	80	0.5	9.9	2.5
PMBZ5244B	14	600	+0.067	9.0	80	0.1	10	2.0
PMBZ5245B	15	600	+0.073	8.5	75	0.1	11	2.0
PMBZ5246B	16	600	+0.073	7.8	75	0.1	12	1.5
PMBZ5247B	17	600	+0.073	7.4	75	0.1	13	1.5
PMBZ5248B	18	600	+0.078	7.0	70	0.1	14	1.5
PMBZ5249B	19	600	+0.078	6.6	70	0.1	14	1.5
PMBZ5250B	20	600	+0.080	6.2	60	0.1	15	1.5
PMBZ5251B	22	600	+0.080	5.6	60	0.1	17	1.25

TYPE No.	WORKING VOLTAGE V_Z (V)[1] at I_{Ztest}	DIFFERENTIAL RESISTANCE r_{dif} (Ω) at I_Z = 0.25 mA	TEMP. COEFF. S_Z (%/K) at I_Z[2]	TEST CURRENT I_{Ztest} (mA)	DIODE CAP. C_d (pF) at f = 1 MHz; at V_R = 0 V	REVERSE CURRENT at REVERSE VOLTAGE		NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
						I_R (μA)	V_R (V)	
	NOM.	MAX.	TYP.		MAX.	MAX.		MAX.
PMBZ5252B	24	600	+0.081	5.2	55	0.1	18	1.25
PMBZ5253B	25	600	+0.082	5.0	55	0.1	19	1.25
PMBZ5254B	27	600	+0.085	4.6	50	0.1	21	1.0
PMBZ5255B	28	600	+0.085	4.5	50	0.1	21	1.0
PMBZ5256B	30	600	+0.085	4.2	50	0.1	23	1.0
PMBZ5257B	33	700	+0.085	3.8	45	0.1	25	0.9

Notes

1. V_Z is measured with device at thermal equilibrium while mounted on a ceramic substrate of 8 × 10 × 0.7 mm.
2. For types PMBZ5226B to PMBZ5242B the I_Z current is 7.5 mA; for PMBZ5243B and higher $I_Z = I_{Ztest}$. S_Z values valid between 25 °C and 125 °C.

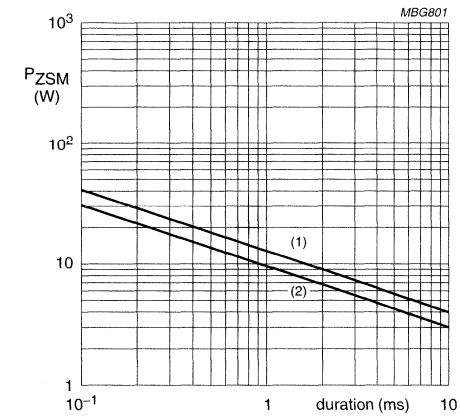
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		330	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on a printed-circuit board.

GRAPHICAL DATA



(1) T_j = 25 °C (prior to surge).
(2) T_j = 150 °C (prior to surge).

Fig.2 Maximum permissible non-repetitive peak reverse power dissipation versus duration.

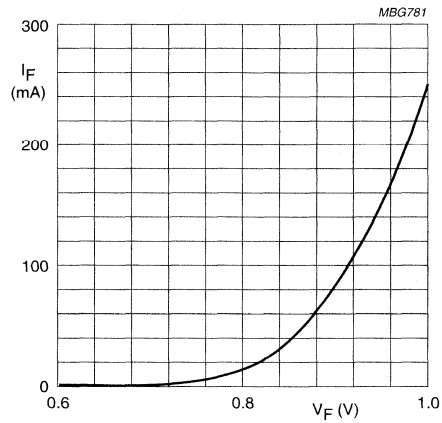


Fig.3 Forward current as a function of forward voltage; typical values.

High-speed diodes PMLL4148; PMLL4448

FEATURES

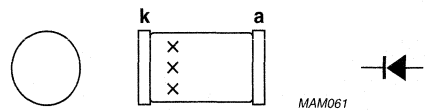
- Small hermetically sealed glass SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

- High-speed switching
- Fast logic applications.

DESCRIPTION

The PMLL4148 and PMLL4448 are high-speed switching diodes fabricated in planar technology, and encapsulated in small hermetically sealed glass SOD80C SMD packages.



The marking band indicates the cathode.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	75	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	200	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
	PMLL4148	I_F = 10 mA	–	1	V
	PMLL4448	I_F = 5 mA	620	720	mV
		I_F = 100 mA	–	1	V
I_R	reverse current	V_R = 20 V; see Fig.5		25	nA
		V_R = 20 V; T_j = 150 °C; see Fig.5	–	50	µA
I_R	reverse current; PMLL4448	V_R = 20 V; T_j = 100 °C; see Fig.5	–	3	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6		4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7		4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	–	2.5	V

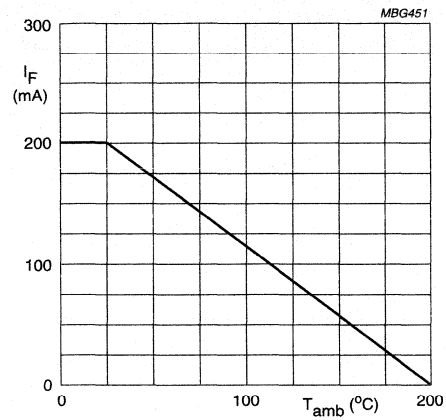
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	350	K/W

Note

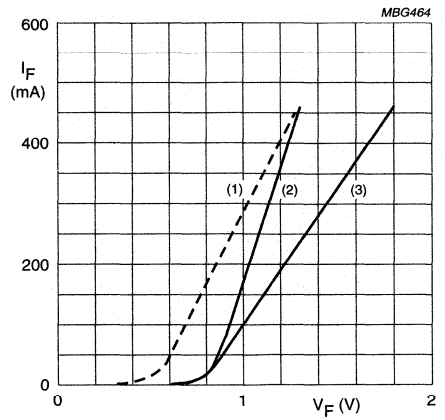
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



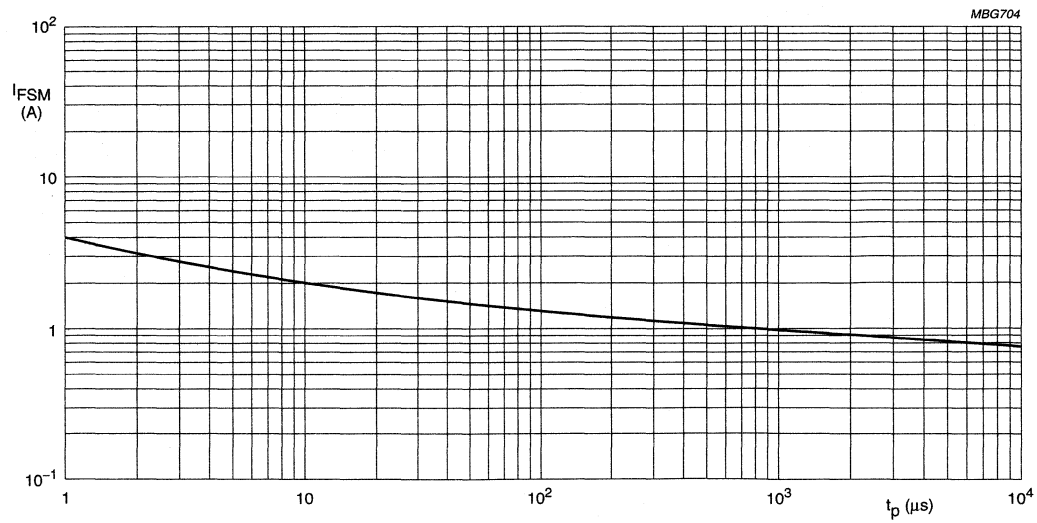
Device mounted on an FR4 printed-circuit board.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



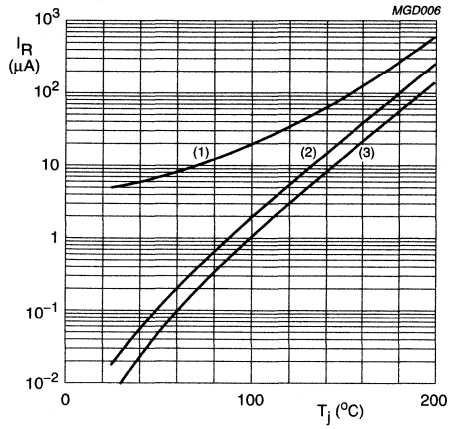
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



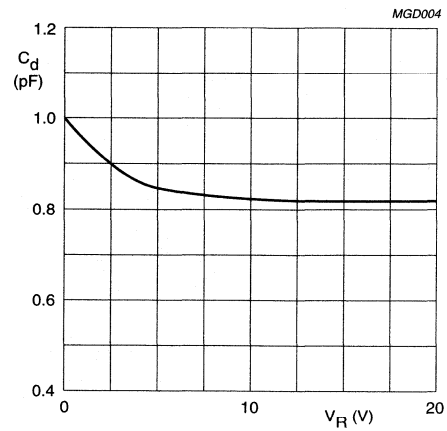
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



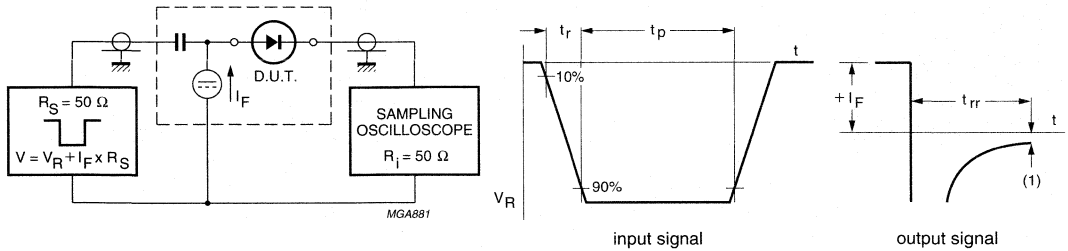
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

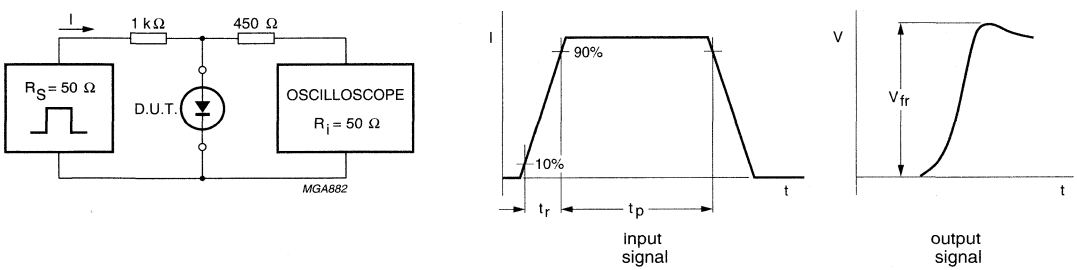


Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed diodes PMLL4150; PMLL4151; PMLL4153

FEATURES

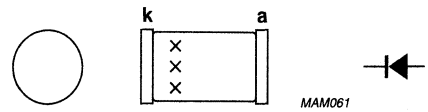
- Small hermetically sealed glass SMD package
- High switching speed: max. 4 ns
- General application
- Continuous reverse voltage: max. 50 V
- Repetitive peak reverse voltage: max. 75 V
- Repetitive peak forward current: max. 600 mA and 450 mA respectively.

APPLICATIONS

- High-speed switching
- The PMLL4150 is primarily intended for general purpose use in computer and industrial applications.
- The PMLL4151 and PMLL4153 are intended for military and industrial applications.

DESCRIPTION

The PMLL4150, PMLL4151, PMLL4153 are high-speed switching diodes fabricated in planar technology, and encapsulated in small hermetically sealed glass SOD80C SMD packages.



Cathode indicated by black band.

Fig.1 Simplified outline (SOD80C) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage				
	PMLL4151		–	75	V
	PMLL4153		–	75	V
V_R	continuous reverse voltage		–	50	V
I_F	continuous forward current	see Fig.2; note 1			
	PMLL4150		–	300	mA
	PMLL4151		–	200	mA
	PMLL4153		–	200	mA
I_{FRM}	repetitive peak forward current				
	PMLL4150		–	600	mA
	PMLL4151		–	450	mA
	PMLL4153		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C

Note

1. Device mounted on an FR4 printed-circuit board.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	see Fig.3			
	PMLL4150	I_F = 1 mA	540	620	mV
		I_F = 10 mA	660	740	mV
		I_F = 50 mA	760	860	mV
		I_F = 100 mA	820	920	mV
		I_F = 200 mA	870	1000	mV
	PMLL4151	I_F = 50 mA	–	1000	mV
	PMLL4153	I_F = 0.1 mA	490	550	mV
		I_F = 0.25 mA	530	590	mV
		I_F = 1 mA	590	670	mV
		I_F = 2 mA	620	700	mV
		I_F = 10 mA	700	810	mV
		I_F = 50 mA	740	880	mV
I_R	reverse current	V_R = 50 V; see Fig.5			
	PMLL4150		–	0.1	µA
	PMLL4151		–	0.05	µA
	PMLL4153		–	0.05	µA
I_R	reverse current	V_R = 50 V; T_j = 150 °C; see Fig.5			
	PMLL4150		–	100	µA
	PMLL4151		–	50	µA
	PMLL4153		–	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6			
	PMLL4150		–	2.5	pF
	PMLL4151		–	2	pF
	PMLL4153			2	pF

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
t_{rr}	reverse recovery time PMLL4150	when switched from I_F = 10 mA to I_R = 1 mA; R_L = 100 Ω; measured at I_R = 0.1 mA; see Fig.7	–	6	ns
		when switched from I_F = 10 mA to 200 mA to I_R = 10 mA to 200 mA; R_L = 100 Ω; measured at $I_R = 0.1 \times I_F$; see Fig.7	–	4	ns
		when switched from I_F = 200 mA to 400 mA to I_R = 200 mA to 400 mA; R_L = 100 Ω; measured at $I_R = 0.1 \times I_F$; see Fig.7	–	6	ns
t_{rr}	reverse recovery time PMLL4151	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
		when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	2	ns
t_{rr}	reverse recovery time PMLL4153	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	4	ns
		when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	–	2	ns
t_{fr}	forward recovery time	when switched to I_F = 200 mA; t_r = 0.4 ns; measured at V_F = 1 V; see Fig.8	–	10	ns

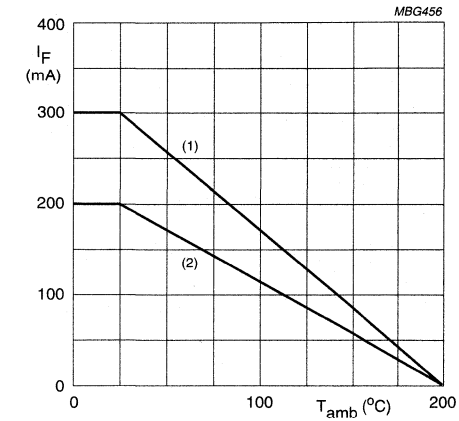
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point		300	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	350	K/W

Note

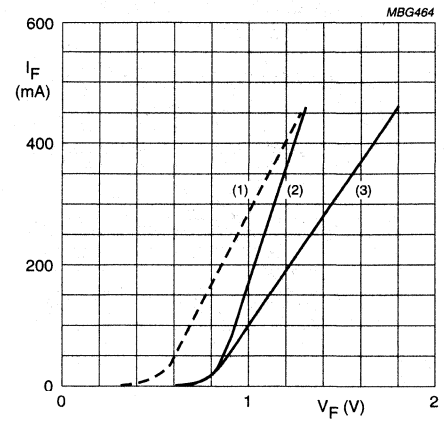
1. Device mounted on an FR4 printed-circuit board.

GRAPHICAL DATA



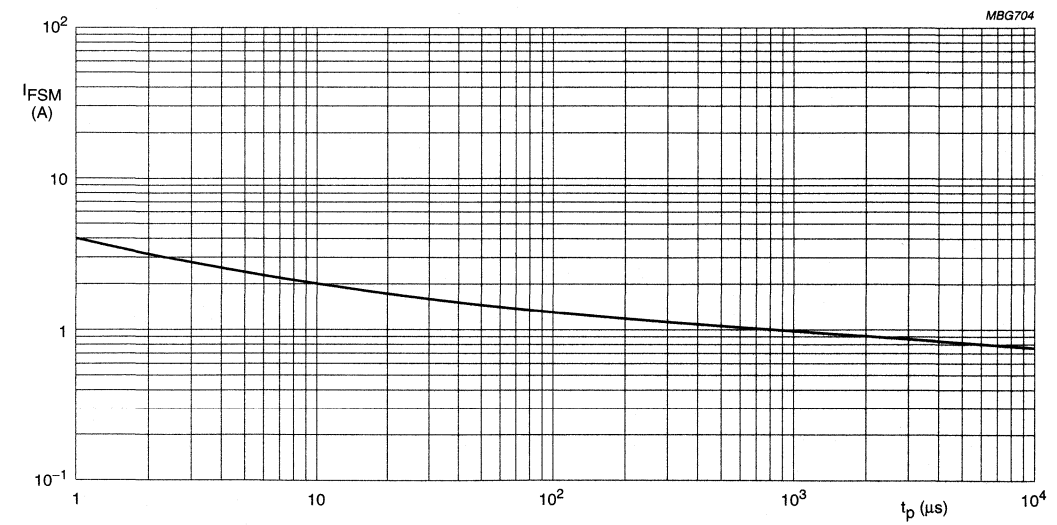
Device mounted on an FR4 printed-circuit board.
(1) PMLL4150.
(2) PMLL4151; PMLL4153.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



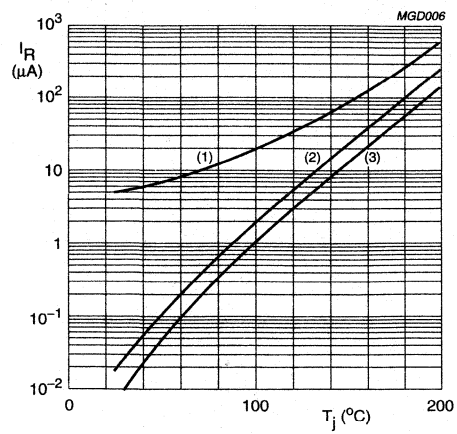
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



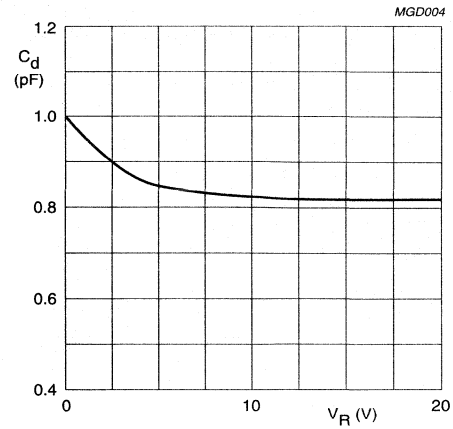
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



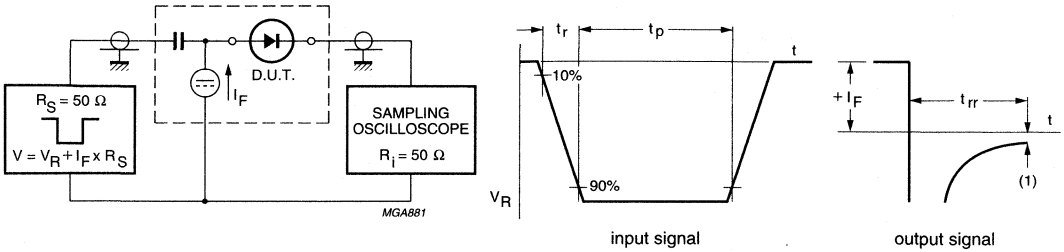
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



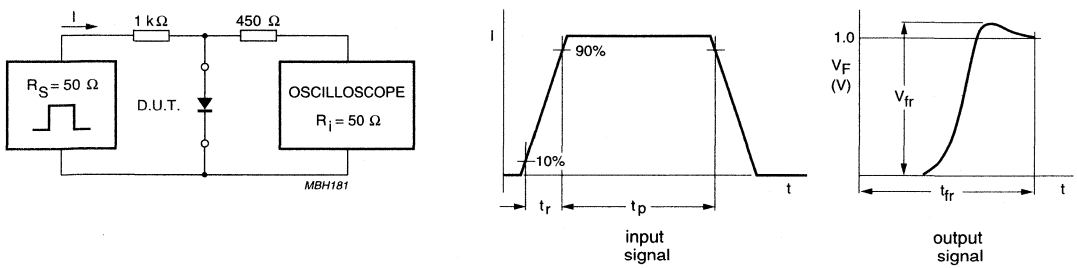
f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) The value of I_R is dependent on product type.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 0.4 ns; forward pulse duration t_p = 100 ns; duty factor δ = 0.01.

Fig.8 Forward recovery time test circuit and waveforms.

Schottky barrier diodes PRLL5817; PRLL5818; PRLL5819

FEATURES

- Low switching losses
- Fast recovery time
- Guard ring protected
- Hermetically sealed glass SMD package.

APPLICATIONS

- Low power, switched-mode power supplies
- Rectifying
- Polarity protection.

DESCRIPTION

The PRLL5817 to PRLL5819 types are Schottky barrier diodes fabricated in planar technology, and encapsulated in SOD87 hermetically sealed glass SMD packages incorporating Implotec™(1) technology.

(1) Implotec is a trademark of Philips.

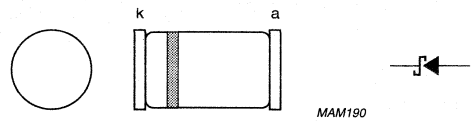


Fig.1 Simplified outline (SOD87) and symbol.

MARKING

TYPE NUMBER	MARKING CODE
PRLL5817	9
PRLL5818	9
PRLL5819	9

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	PRLL5817		–	20	V
	PRLL5818		–	30	V
	PRLL5819		–	40	V
V_{RSM}	non-repetitive peak reverse voltage				
	PRLL5817		–	24	V
	PRLL5818		–	36	V
	PRLL5819		–	48	V
V_{RRM}	repetitive peak reverse voltage				
	PRLL5817		–	20	V
	PRLL5818		–	30	V
	PRLL5819		–	40	V
V_{RWM}	crest working reverse voltage				
	PRLL5817		–	20	V
	PRLL5818		–	30	V
	PRLL5819		–	40	V
$I_{F(AV)}$	average forward current	T_{amb} = 60 °C	–	1	A
I_{FSM}	non-repetitive peak forward current	t = 10 ms half sine wave; $T_j = T_{j\,max}$ prior to surge: $V_R = 0$	–	25	A
T_{stg}	storage temperature		–65	+175	°C
T_j	junction temperature		–	125	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_F	forward voltage	see Fig.2				
	PRLL5817	I_F = 0.1 A	–	–	320	mV
		I_F = 1 A	–	–	450	mV
		I_F = 3 A	–	–	750	mV
V_F	forward voltage	see Fig.2				
	PRLL5818	I_F = 0.1 A	–	–	330	mV
		I_F = 1 A	–	–	550	mV
		I_F = 3 A	–	–	875	mV
V_F	forward voltage	see Fig.2				
	PRLL5819	I_F = 0.1 A	–	–	340	mV
		I_F = 1 A	–	–	600	mV
		I_F = 3 A	–	–	900	mV
I_R	reverse current	$V_R = V_{RRMmax}$; note 1	–	0.5	1	mA
		$V_R = V_{RRMmax}$; T_j = 100 °C	–	5	10	mA
C_d	diode capacitance	V_R = 4 V; f = 1 MHz				
	PRLL5817		–	70	–	pF
	PRLL5818		–	50	–	pF
	PRLL5819		–	50	–	pF

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Refer to SOD87 standard mounting conditions.

GRAPHICAL DATA

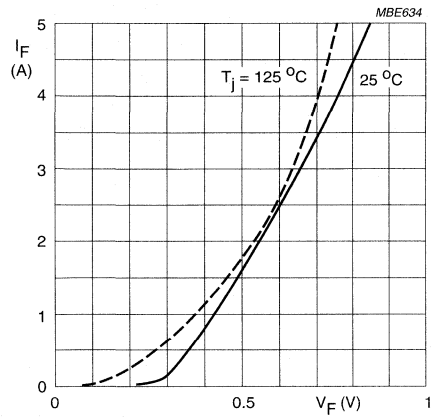


Fig.2 Typical forward voltage.

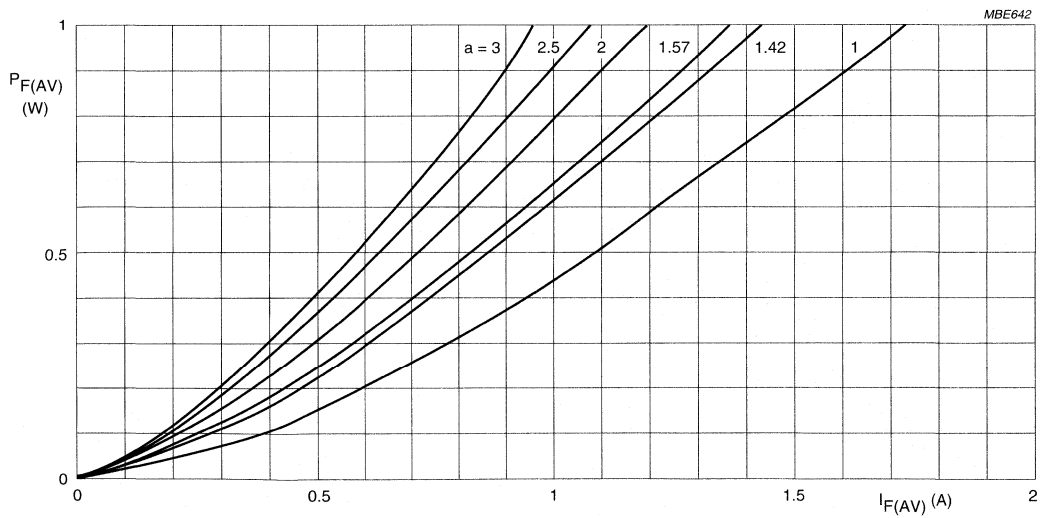


Fig.3 PRLL817. Maximum values steady state forward power dissipation as a function of the average forward current; $a = I_{F(RMS)}/I_{F(AV)}$.

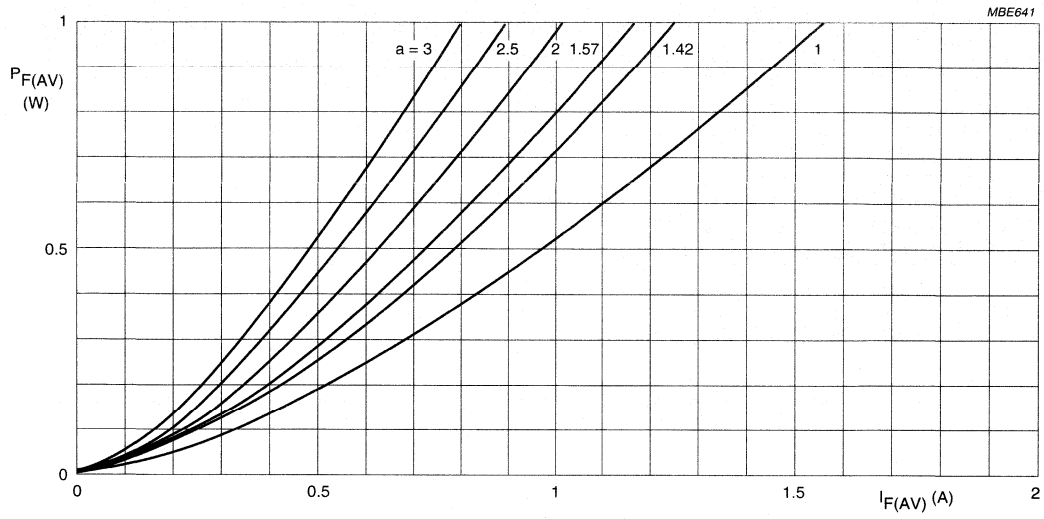


Fig.4 PRLL5818. Maximum values steady state forward power dissipation as a function of the average forward current; $a = I_{F(RMS)}/I_{F(AV)}$.

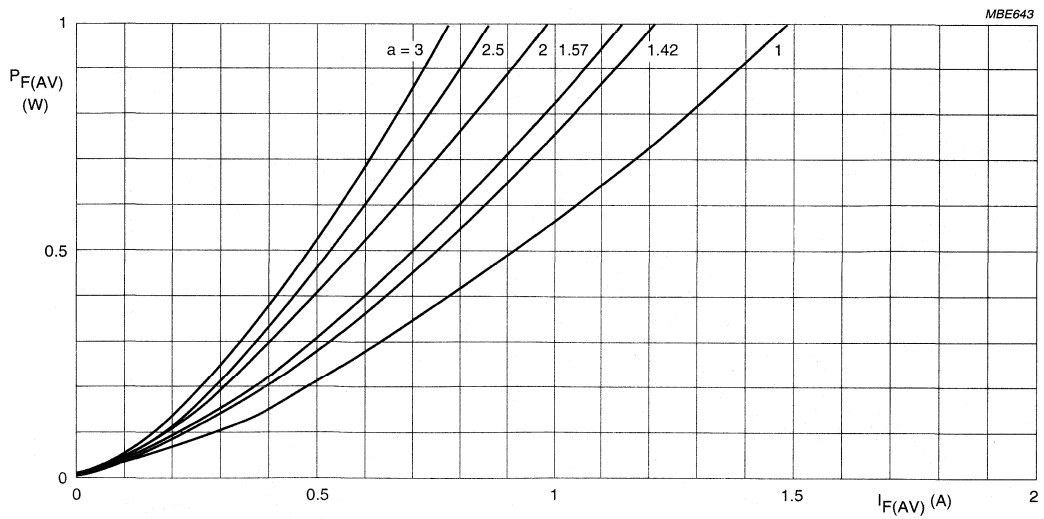


Fig.5 PRLL5819. Maximum values steady state forward power dissipation as a function of the average forward current; $a = I_{F(RMS)}/I_{F(AV)}$.

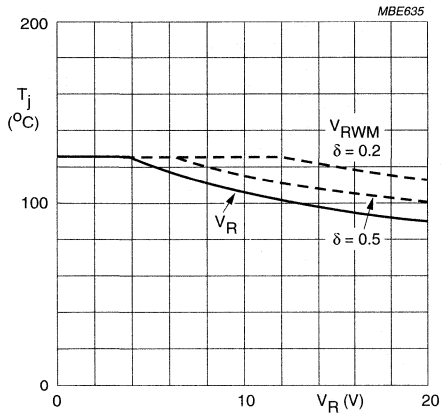


Fig.6 PRLL5817. Maximum permissible junction temperature as a function of reverse voltage; device mounted; refer to SOD87 standard mounting conditions.

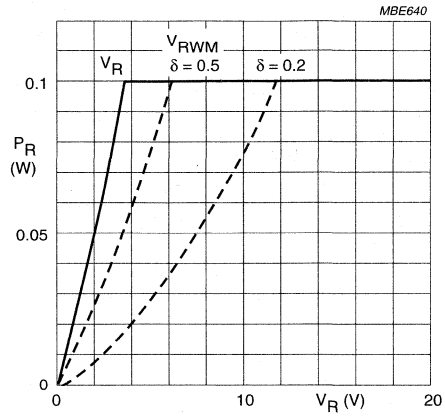


Fig.7 PRLL5817. Reverse power dissipation as a function of reverse voltage (max. values); device mounted; refer to SOD87 standard mounting conditions.

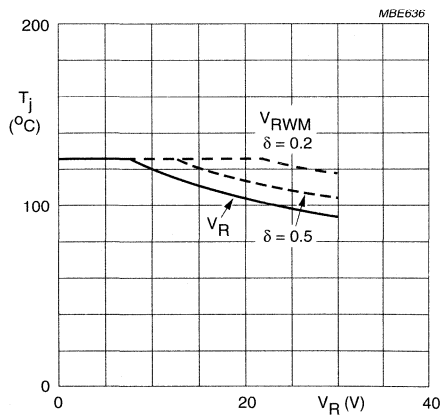


Fig.8 PRLL5818. Maximum permissible junction temperature as a function of reverse voltage; device mounted; refer to SOD87 standard mounting conditions.

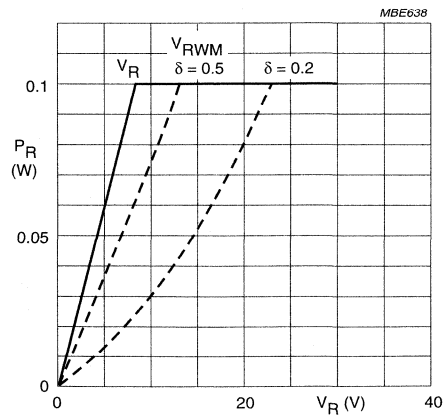


Fig.9 PRLL5818. Reverse power dissipation as a function of reverse voltage (max. values), device mounted; refer to SOD87 standard mounting conditions.

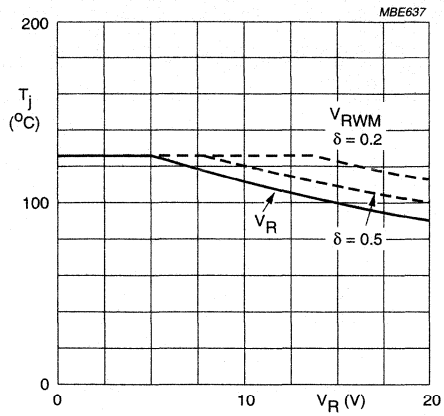


Fig.10 PRLL5819. Maximum permissible junction temperature as a function of reverse voltage; device mounted; refer to SOD87 standard mounting conditions.

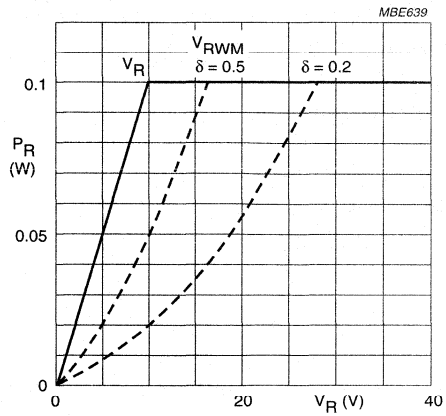


Fig.11 PRLL5819. Reverse power dissipation as a function of reverse voltage (max. values); device mounted; refer to SOD87 standard mounting conditions.

Voltage regulator diodes PZM-N series

FEATURES

- Total power dissipation: max. 300 mW
- Small plastic package suitable for surface mounted design
- Wide working voltage range: nom. 2.4 to 75 V (E24 range).

APPLICATIONS

- General regulation functions.

DESCRIPTION

Low power general purpose voltage regulator diode in a SOT346 (SC59) plastic package, suitable for surface mounted design.

PINNING

PIN	DESCRIPTION
1	anode
2	not connected
3	cathode

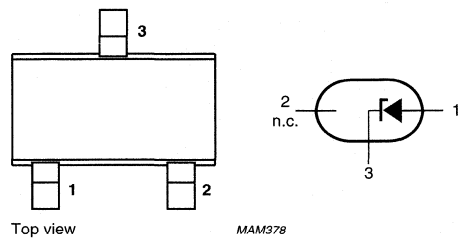


Fig.1 Simplified outline (SOT346; SC59) and symbol.

MARKING

TYPE NUMBER	MARKING CODE				TYPE NUMBER	MARKING CODE			
	B	B1	B2	B3		B	B1	B2	B3
PZM2.4N	2V4	–	–	–	PZM15N	15V	151	152	153
PZM2.7N	2V7	271	272	–	PZM16N	16V	161	162	163
PZM3.0N	3V0	301	302	–	PZM18N	18V	181	182	183
PZM3.3N	3V3	331	332	–	PZM20N	20V	201	202	203
PZM3.6N	3V6	361	362	–	PZM22N	22V	221	222	223
PZM3.9N	3V9	391	392	–	PZM24N	24V	241	242	243
PZM4.3N	4V3	431	432	433	PZM27N	27V	–	–	–
PZM4.7N	4V7	471	472	473	PZM30N	30V	–	–	–
PZM5.1N	5V1	511	512	513	PZM33N	33V	–	–	–
PZM5.6N	5V6	561	562	563	PZM36N	36V	–	–	–
PZM6.2N	6V2	621	622	623	PZM39N	39V	–	–	–
PZM6.8N	6V8	681	682	683	PZM43N	43V	–	–	–
PZM7.5N	7V5	751	752	753	PZM47N	47V	–	–	–
PZM8.2N	8V2	821	822	823	PZM51N	51V	–	–	–
PZM9.1N	9V1	911	912	913	PZM56N	56V	–	–	–
PZM10N	10V	101	102	103	PZM62N	62V	–	–	–
PZM11N	11V	111	112	113	PZM68N	68V	–	–	–
PZM12N	12V	121	122	123	PZM75N	75V	–	–	–
PZM13N	13V	131	132	133	–	–	–	–	–

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_F	continuous forward current		–	250	mA
I_{ZSM}	non-repetitive peak current	t_p = 100 µs; square wave; T_{amb} = 25 °C prior to surge	see Tables 1 and 2		
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	T_s = 60 °C	300	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.2	0.9	V
		I_F = 100 mA; see Fig.2	1.1	V
I_R	reverse current			
	PZM2.4N	V_R = 1 V	50	µA
	PZM2.7N	V_R = 1 V	20	µA
	PZM3.0N	V_R = 1 V	10	µA
	PZM3.3N	V_R = 1 V	5	µA
	PZM3.6N	V_R = 1 V	5	µA
	PZM3.9N	V_R = 1 V	3	µA
	PZM4.3N	V_R = 1 V	3	µA
	PZM4.7N	V_R = 1 V	3	µA
	PZM5.1N	V_R = 1.5 V	3	µA
	PZM5.6N	V_R = 2.5 V	2	µA
	PZM6.2N	V_R = 3.0 V	2	µA
	PZM6.8N	V_R = 3.5 V	2	µA
	PZM7.5N	V_R = 4.0 V	1	µA
	PZM8.2N	V_R = 5.0 V	700	nA
	PZM9.1N	V_R = 6.0 V	500	nA
	PZM10N	V_R = 7.0 V	200	nA
	PZM11N	V_R = 8.0 V	100	nA
	PZM12N	V_R = 9.0 V	100	nA
	PZM13N	V_R = 10.0 V	100	nA
	PZM15N	V_R = 11.0 V	70	nA
	PZM16N	V_R = 12.0 V	70	nA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_R	reverse current			
	PZM18N	V_R = 13.0 V	70	nA
	PZM20N	V_R = 15.0 V	70	nA
	PZM22N	V_R = 17.0 V	70	nA
	PZM24N	V_R = 19.0 V	70	nA
	PZM27N	V_R = 21.0 V	70	nA
	PZM30N	V_R = 23.0 V	70	nA
	PZM33N	V_R = 25.0 V	70	nA
	PZM36N	V_R = 27.0 V	70	nA
	PZM39N	V_R = 0.7 V_{Znom}	50	nA
	PZM43N	V_R = 0.7 V_{Znom}	50	nA
	PZM47N	V_R = 0.7 V_{Znom}	50	nA
	PZM51N	V_R = 0.7 V_{Znom}	50	nA
	PZM56N	V_R = 0.7 V_{Znom}	50	nA
	PZM62N	V_R = 0.7 V_{Znom}	50	nA
	PZM68N	V_R = 0.7 V_{Znom}	50	nA
	PZM75N	V_R = 0.7 V_{Znom}	50	nA

Table 1 Per type; PZM2.4N to PZM24N

T_j = 25 °C unless otherwise specified.

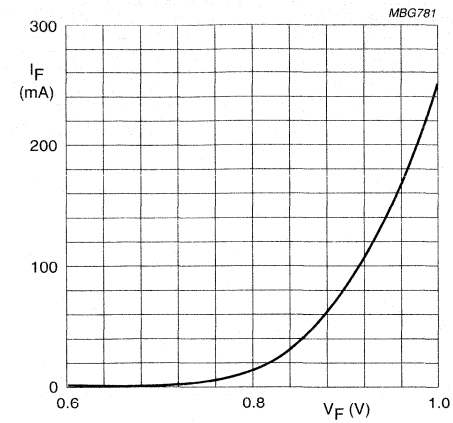
PZM -XXX	WORKING VOLTAGE V_Z (V) at I_Z = 5 mA; t_m = 40 ms								DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_Z = 5 mA	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	B		B1		B2		B3		I_Z = 1 mA		I_Z = 5 mA				
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.	MAX.
2.4N	2.30	2.60	–	–	–	–	–	–	275	400	70	100	−1.6	450	8.00
2.7N	2.50	2.90	2.50	2.75	2.65	2.90	–	–	300	450	75	100	−2.0	440	8.00
3.0N	2.80	3.20	2.80	3.05	2.95	3.20	–	–	325	500	80	95	−2.1	425	8.00
3.3N	3.10	3.50	3.10	3.35	3.25	3.50	–	–	350	500	85	95	−2.4	410	8.00
3.6N	3.40	3.80	3.40	3.65	3.55	3.80	–	–	375	500	85	90	−2.4	390	8.00
3.9N	3.70	4.10	3.70	3.97	3.87	4.10	–	–	400	500	85	90	−2.5	370	8.00
4.3N	4.01	4.48	4.01	4.21	4.15	4.34	4.28	4.48	410	600	80	90	−2.5	350	8.00
4.7N	4.42	4.90	4.42	4.61	4.55	4.75	4.69	4.90	425	500	50	80	−1.4	325	8.00
5.1N	4.84	5.37	4.84	5.04	4.98	5.20	5.14	5.37	400	480	40	60	−0.8	300	8.00
5.6N	5.31	5.92	5.31	5.55	5.49	5.73	5.67	5.92	80	400	15	40	1.2	275	8.00
6.2N	5.86	6.53	5.86	6.12	6.06	6.33	6.26	6.53	40	150	6	10	2.3	250	8.00
6.8N	6.47	7.14	6.47	6.73	6.65	6.93	6.86	7.14	30	80	6	15	3.0	215	8.00
7.5N	7.06	7.84	7.06	7.36	7.28	7.60	7.52	7.84	15	80	2	10	4.0	170	3.50
8.2N	7.76	8.64	7.76	8.10	8.02	8.36	8.28	8.64	20	80	2	10	4.6	150	3.50
9.1N	8.56	9.55	8.56	8.93	8.85	9.23	9.15	9.55	20	100	2	10	5.5	120	3.50
10N	9.45	10.55	9.45	9.87	9.77	10.21	10.11	10.55	20	150	2	10	6.4	110	3.50
11N	10.44	11.56	10.44	10.88	10.76	11.22	11.10	11.56	25	150	2	10	7.4	108	3.00
12N	11.42	12.60	11.42	11.90	11.74	12.24	12.08	12.60	25	150	2	10	8.4	105	3.00
13N	12.47	13.96	12.47	13.03	12.91	13.49	13.37	13.96	25	170	2	10	9.4	103	2.50
15N	13.84	15.52	13.84	14.46	14.34	14.98	14.85	15.52	25	200	3	15	11.4	99	2.00
16N	15.37	17.09	15.37	16.01	15.85	16.51	16.35	17.09	25	200	4	20	12.4	97	1.50
18N	16.94	19.03	16.94	17.70	17.56	18.35	18.21	19.03	25	225	4	20	14.4	93	1.50
20N	18.86	21.08	18.86	19.70	19.52	20.39	20.21	21.08	30	225	4	20	16.4	88	1.50
22N	20.88	23.17	20.88	21.77	21.54	22.47	22.23	23.17	30	250	5	25	18.4	84	1.25
24N	22.93	25.57	22.93	23.96	23.72	24.78	24.54	25.57	30	250	6	30	20.4	80	1.25

Table 2 Per type; PZM27N to PZM75N

T_j = 25 °C unless otherwise specified.

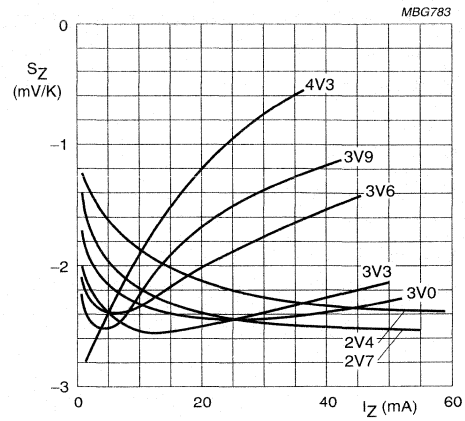
PZM -XXX	WORKING VOLTAGE V_Z (V) at I_Z = 2 mA; t_m = 40 ms								DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_Z = 2 mA	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs; T_{amb} = 25 °C
	B		B1		B2		B3		I_Z = 0.5 mA		I_Z = 2 mA				
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.	MAX.
27N	25.10	28.90	–	–	–	–	–	–	35	250	8	40	23.4	73	1.00
30N	28.00	32.00	–	–	–	–	–	–	35	250	10	40	26.6	66	1.00
33N	31.00	35.00	–	–	–	–	–	–	40	275	11	40	29.7	60	0.90
36N	34.00	38.00	–	–	–	–	–	–	40	300	15	60	33.0	59	0.80
39N	37.00	41.00	–	–	–	–	–	–	40	300	25	75	36.4	58	0.70
43N	40.00	46.00	–	–	–	–	–	–	45	325	30	80	41.2	56	0.60
47N	44.00	50.00	–	–	–	–	–	–	45	325	30	90	46.1	55	0.50
51N	48.00	54.00	–	–	–	–	–	–	45	350	35	110	51.0	52	0.40
56N	52.00	60.00	–	–	–	–	–	–	50	375	40	120	57.0	49	0.30
62N	58.00	66.00	–	–	–	–	–	–	60	400	50	140	64.4	44	0.30
68N	64.00	72.00	–	–	–	–	–	–	75	400	55	160	71.7	40	0.25
75N	70.00	79.00	–	–	–	–	–	–	85	400	70	175	80.2	35	0.20

GRAPHICAL DATA



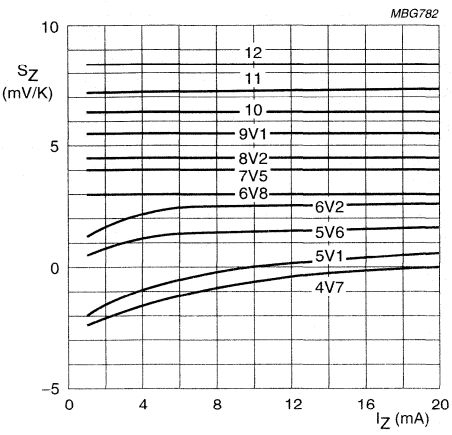
T_j = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



PZM2.4N to PZM4.3N.
T_j = 25 °C to 150 °C.

Fig.3 Temperature coefficient as a function of working current; typical values.



PZM4.7N to PZM12N.
T_j = 25 °C to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.

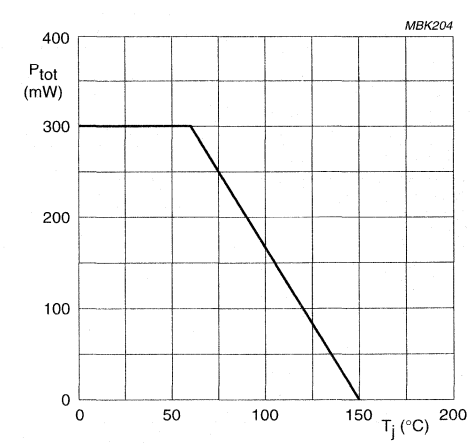


Fig.5 Power derating curve.

Voltage regulator double diodes PZM-NA series

FEATURES

- Total power dissipation: max. 220 mW per diode
- Small plastic package suitable for surface mounted design
- Working voltage: nom. 2.4 V and 15 V (E24 range).

APPLICATIONS

- General regulation functions.

DESCRIPTION

Low power general purpose voltage regulator double diodes in a SOT346 (SC59) plastic package, suitable for surface mounted design.

PINNING

PIN	DESCRIPTION
1	cathode
2	cathode
3	anode

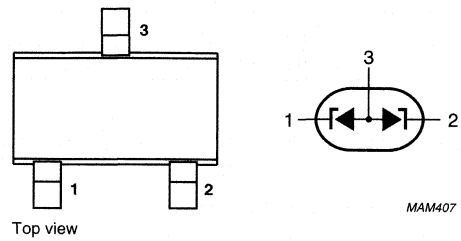


Fig.1 Simplified outline (SOT346; SC59) and symbol.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
PZM2.4NBA	2A4	PZM6.2NB2A	6A2
PZM2.7NB2A	2A7	PZM6.8NB2A	6A8
PZM3.0NB2A	3A0	PZM7.5NB2A	7A5
PZM3.3NB2A	3A3	PZM8.2NB2A	8A2
PZM3.6NB2A	3A6	PZM9.1NB2A	9A1
PZM3.9NB2A	3A9	PZM10NB2A	10A
PZM4.3NB2A	4A3	PZM11NB2A	11A
PZM4.7NB2A	4A7	PZM12NB2A	12A
PZM5.1NB2A	5A1	PZM13NB2A	13A
PZM5.6NB2A	5A6	PZM15NB2A	15A

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_F	continuous forward current		–	200	mA
I_{ZSM}	non-repetitive peak current	t_p = 100 μs; square wave	see Table 1		
P	power dissipation; see note 1	T_{amb} = 25 °C	–	220	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

1. Device mounted on an FR4 printed circuit board with Cu clad 5 × 5 mm.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one diode loaded; note 1	350	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	one diode loaded; note 2	560	K/W

Notes

1. Solderpoint of cathode tab.
2. Device mounted on an FR4 printed circuit board with Cu clad 5 × 5 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

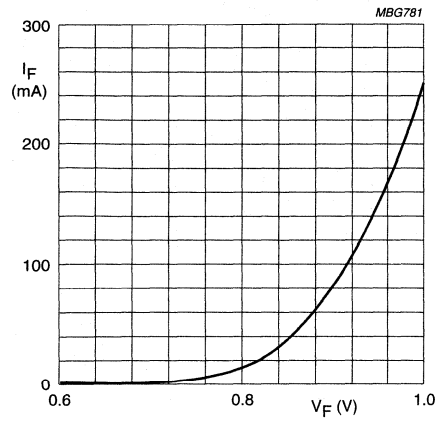
SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.2	0.9	V
		I_F = 100 mA; see Fig.2	1.1	V
I_R	reverse current			
	PZM2.4NBA	V_R = 1 V	50	µA
	PZM2.7NB2A	V_R = 1 V	20	µA
	PZM3.0NB2A	V_R = 1 V	10	µA
	PZM3.3NB2A	V_R = 1 V	5	µA
	PZM3.6NB2A	V_R = 1 V	5	µA
	PZM3.9NB2A	V_R = 1 V	3	µA
	PZM4.3NB2A	V_R = 1 V	3	µA
	PZM4.7NB2A	V_R = 1 V	3	µA
	PZM5.1NB2A	V_R = 1.5 V	3	µA
	PZM5.6NB2A	V_R = 2.5 V	2	µA
	PZM6.2NB2A	V_R = 3.0 V	2	µA
	PZM6.8NB2A	V_R = 3.5 V	2	µA
	PZM7.5NB2A	V_R = 4.0 V	1	µA
	PZM8.2NB2A	V_R = 5.0 V	700	nA
	PZM9.1NB2A	V_R = 6.0 V	500	nA
	PZM10NB2A	V_R = 7.0 V	200	nA
	PZM11NB2A	V_R = 8.0 V	100	nA
	PZM12NB2A	V_R = 9.0 V	100	nA
	PZM13NB2A	V_R = 10.0 V	100	nA
	PZM15NB2A	V_R = 11.0 V	70	nA

Table 1 Per type; PZM2.4N to PZM24N

T_j = 25 °C unless otherwise specified.

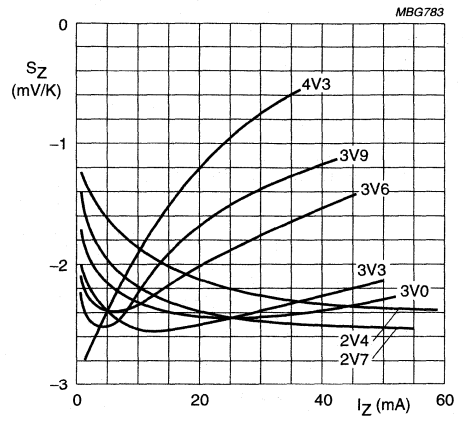
PZM -XXX	WORKING VOLTAGE V_Z (V) at I_Z = 5 mA; t_m = 40 ms; T_{amb} = 25 °C		DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at I_Z = 5 mA	DIODE CAP. C_d (pF) at f = 1 MHz; V_R = 0	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at t_p = 100 μs
			I_Z = 1 mA		I_Z = 5 mA				
	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.	MAX.
2.4NBA	2.30	2.60	275	400	70	100	−1.6	450	8.00
2.7NB2A	2.65	2.90	300	450	75	100	−2.0	440	8.00
3.0NB2A	2.95	3.20	325	500	80	95	−2.1	425	8.00
3.3NB2A	3.25	3.50	350	500	85	95	−2.4	410	8.00
3.6NB2A	3.55	3.80	375	500	85	90	−2.4	390	8.00
3.9NB2A	3.87	4.10	400	500	85	90	−2.5	370	8.00
4.3NB2A	4.15	4.34	410	600	80	90	−2.5	350	8.00
4.7NB2A	4.55	4.75	425	500	50	80	−1.4	325	8.00
5.1NB2A	4.98	5.20	400	480	40	60	−0.8	300	8.00
5.6NB2A	5.49	5.73	80	400	15	40	1.2	275	8.00
6.2NB2A	6.06	6.33	40	150	6	10	2.3	250	8.00
6.8NB2A	6.65	6.93	30	80	6	15	3.0	215	8.00
7.5NB2A	7.28	7.60	15	80	2	10	4.0	170	3.50
8.2NB2A	8.02	8.36	20	80	2	10	4.6	150	3.50
9.1NB2A	8.85	9.23	20	100	2	10	5.5	120	3.50
10NB2A	9.77	10.21	20	150	2	10	6.4	110	3.50
11NB2A	10.76	11.22	25	150	2	10	7.4	110	3.00
12NB2A	11.74	12.24	25	150	2	10	8.4	105	3.00
13NB2A	12.91	13.49	25	170	2	10	9.4	105	2.50
15NB2A	14.34	14.98	25	200	3	15	11.4	100	2.00

GRAPHICAL DATA



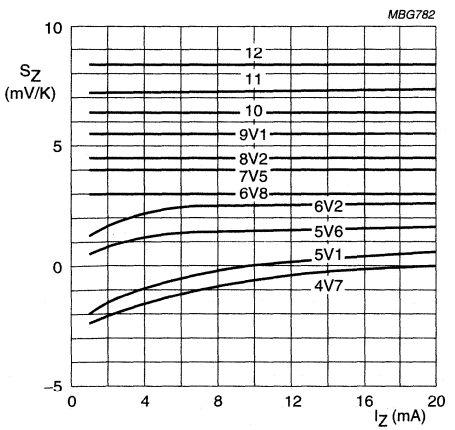
T_j = 25 °C.

Fig.2 Forward current as a function of forward voltage; typical values.



PZM2.4NBA to PZM4.3NB2A.
T_j = 25 °C to 150 °C.

Fig.3 Temperature coefficient as a function of working current; typical values.



PZM4.7NB2A to PZM12NB2A.
T_j = 25 °C to 150 °C.

Fig.4 Temperature coefficient as a function of working current; typical values.

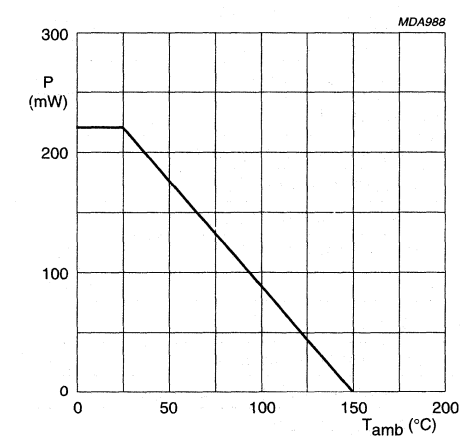


Fig.5 Power derating curve per diode.

NPN transistor/Schottky-diode module PZTM1101

FEATURES

- Low output capacitance
- Fast switching time
- Integrated Schottky protection diode.

APPLICATIONS

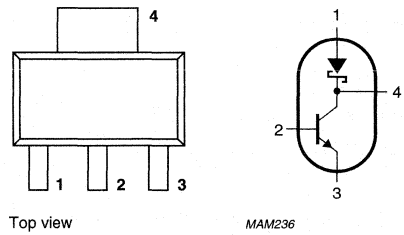
- High-speed switching for industrial applications.

PINNING

PIN	DESCRIPTION
1	anode Schottky
2	base
3	emitter
4	collector, cathode Schottky

DESCRIPTION

Combination of an NPN transistor and a Schottky barrier diode in a plastic SOT223 package. PNP complement: PZTM1102.



Marking code: TM1101.

Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
Schottky barrier diode					
V_R	continuous reverse voltage		–	40	V
I_F	forward current (DC)		–	1	A
$I_{F(AV)}$	average forward current		–	1	A
T_j	junction temperature	reverse current applied	–	125	°C
		forward current applied	–	150	°C
Combined device					
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C	–	1.2	W
T_{amb}	operating ambient temperature		–55	+150	°C
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 μA; I_E = 0; T_{amb} = −55 to +150 °C; note 1	60	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; V_{BE} = 0; T_{amb} = −55 to +150 °C; note 1	40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 μA; I_C = 0; T_{amb} = −55 to +150 °C; note 1	6	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = 20 V; V_{BE} = 0	–	100	nA
		V_{CE} = 20 V; V_{BE} = 0; T_{amb} = −55 to +150 °C	–	50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 6 V; I_C = 0	–	50	nA
		V_{EB} = 6 V; I_C = 0; T_{amb} = −55 to +150 °C	–	10	μA
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 3.2 mA	–	300	mV
V_{CEsat}	collector-emitter saturation voltage	T_{amb} = −55 to +150 °C; note 1			
		I_C = 10 mA; I_B = 1 mA	–	250	mV
		I_C = 50 mA; I_B = 3.2 mA	–	350	mV
V_{BEsat}	base-emitter saturation voltage	note 1			
		I_C = 10 mA; I_B = 1 mA	–	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
V_{BEsat}	base-emitter saturation voltage	T_{amb} = −55 to +150 °C; note 1			
		I_C = 10 mA; I_B = 1 mA	–	1000	mV
		I_C = 50 mA; I_B = 5 mA	–	1100	mV
C_{ob}	output capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_{ib}	input capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
h_{FE}	DC current gain	V_{CE} = 1 V; note 1			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 100 mA	30	–	
h_{FE}	DC current gain	V_{CE} = 1 V; T_{amb} = −55 to +150 °C; note 1			
		I_C = 10 mA	60	500	
		I_C = 100 mA	15	–	
SWITCHING TIMES (see Figs 2 and 3)					
t_d	delay time	V_{CC} = 5 V	1	5	ns
t_r	rise time	I_C = 50 mA	16	31	ns
t_s	storage time	V_i = 0 to 5 V	110	310	ns
t_f	fall time		70	100	ns

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Schottky barrier diode					
V_F	forward voltage	I_F = 100 mA; note 1	–	330	mV
		I_F = 100 mA; T_{amb} = −55 to +150 °C; note 1	–	400	mV
		I_F = 1 A; note 1	–	500	mV
		I_F = 1 A; T_{amb} = −55 to +150 °C; note 1	–	560	mV
I_R	reverse current	V_R = 40 V; note 1	–	300	μA
		V_R = 40 V; T_j = 125 °C; T_{amb} = −55 to +150 °C; note 1	–	35(2)	mA
I_R	reverse current	V_R = 10 V; note 1	–	40	μA
		V_R = 10 V; T_j = 125 °C; T_{amb} = −55 to +150 °C; note 1	–	15(2)	mA
C_j	junction capacitance	V_R = 0 V; f = 1 MHz	–	250	pF

Notes

1. Measured under pulsed conditions: $t_p \leq 300$ μs; $\delta \leq 0.01$.
2. Limiting value for T_j = 125 °C; T_j = 150 °C with reverse current applied is not allowed as this may cause thermal runaway leading to thermal destruction of the diode. A peak junction temperature of T_j = 150 °C is only allowed with forward voltage applied.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (combined device)	note 1	100	K/W

Note

1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA

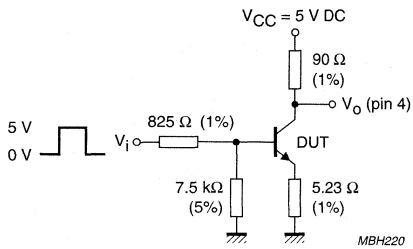
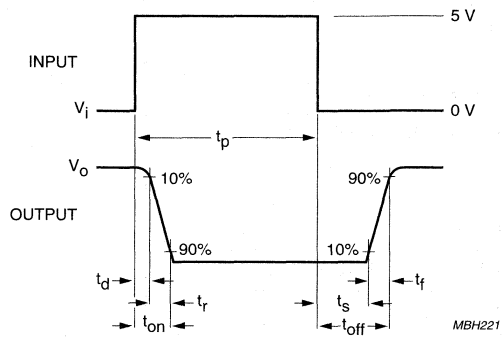


Fig.2 Switching times test circuit.



t_r < 5 ns (10% to 90%); t_p = 1 μs; δ = 0.02; Z_i = 50 Ω.
$t_{on} = t_d + t_r$; $t_{off} = t_s + t_f$.

Fig.3 Input and output waveforms.

PNP transistor/Schottky-diode module PZTM1102

FEATURES

- Low output capacitance
- Fast switching time
- Integrated Schottky protection diode.

APPLICATIONS

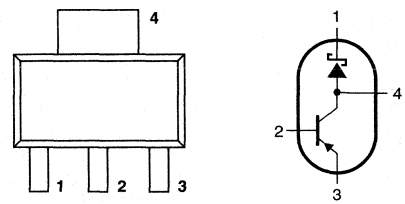
- High-speed switching for industrial applications.

PINNING

PIN	DESCRIPTION
1	cathode Schottky
2	base
3	emitter
4	collector, anode Schottky

DESCRIPTION

Combination of a PNP transistor and a Schottky barrier diode in a plastic SOT223 package. NPN complement: PZTM1101.



Marking code: TM1102.

Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
PNP transistor					
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–200	mA
Schottky barrier diode					
V_R	continuous reverse voltage		–	40	V
I_F	forward current (DC)		–	1	A
$I_{F(AV)}$	average forward current		–	1	A
P	power dissipation	up to T_{amb} = 25 °C; note 1	–	0.5	W
T_j	junction temperature	reverse current applied	–	125	°C
		forward current applied	–	150	°C
Combined device					
P_{tot}	total power dissipation	up to T_{amb} = 25 °C; note 2	–	1.2	W
T_{amb}	operating ambient temperature		–55	+150	°C
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C

Notes

1. An additional copper area of >20 mm^2 is required for pin 1, if power dissipation in the Schottky die is >0.5 W.
2. It is not allowed to dissipate the total power of 1.2 W in the Schottky die only.

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −10 μA; I_E = 0; T_{amb} = −55 to +150 °C; note 1	−40	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	open base; I_C = −1 mA; V_{BE} = 0; T_{amb} = −55 to +150 °C; note 1	−40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −10 μA; I_C = 0; T_{amb} = −55 to +150 °C; note 1	−6	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = −20 V; V_{BE} = 0	–	100	nA
		V_{CE} = −20 V; V_{BE} = 0; T_{amb} = −55 to +150 °C	–	50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = −6 V; I_C = 0	–	50	nA
		V_{EB} = −6 V; I_C = 0; T_{amb} = −55 to +150 °C	–	10	μA
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = −10 mA; I_B = −1 mA	–	−200	mV
		I_C = −50 mA; I_B = −3.2 mA	–	−300	mV
V_{CEsat}	collector-emitter saturation voltage	T_{amb} = −55 to +150 °C; note 1			
		I_C = −10 mA; I_B = −1 mA	–	−250	mV
		I_C = −50 mA; I_B = −3.2 mA	–	−350	mV
V_{BEsat}	base-emitter saturation voltage	note 1			
		I_C = −10 mA; I_B = −1 mA	–	−850	mV
		I_C = −50 mA; I_B = −5 mA	–	−950	mV
V_{BEsat}	base-emitter saturation voltage	T_{amb} = −55 to +150 °C; note 1			
		I_C = −10 mA; I_B = −1 mA	–	−1.0	V
		I_C = −50 mA; I_B = −5 mA	–	−1.1	V
C_{ob}	output capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	4.5	pF
C_{ib}	input capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	250	–	MHz
h_{FE}	DC current gain	V_{CE} = −1 V; note 1			
		I_C = −0.1 mA	40	–	
		I_C = −1 mA	70	–	
		I_C = −10 mA	100	300	
		I_C = −100 mA	30	–	
h_{FE}	DC current gain	V_{CE} = −1 V; T_{amb} = −55 to +150 °C; note 1			
		I_C = −10 mA	60	500	
		I_C = −100 mA	15	–	
SWITCHING TIMES (see Figs 2 and 3)					
t_d	delay time	V_{CC} = 5 V	3	7	ns
t_r	rise time	I_C = 50 mA	13	23	ns
t_s	storage time	V_i = 0 to 5 V	200	380	ns
t_f	fall time		50	80	ns

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Schottky barrier diode					
V_F	forward voltage	I_F = 100 mA; note 1	–	330	mV
		I_F = 100 mA; T_{amb} = –55 to +150 °C; note 1	–	400	mV
		I_F = 1 A; note 1	–	500	mV
		I_F = 1 A; T_{amb} = –55 to +150 °C; note 1	–	560	mV
I_R	reverse current	V_R = 40 V; note 1	–	300	μA
		V_R = 40 V; T_j = 125 °C; T_{amb} = –55 to +150 °C; note 1	–	35(2)	mA
I_R	reverse current	V_R = 10 V; note 1	–	40	μA
		V_R = 10 V; T_j = 125 °C; T_{amb} = –55 to +150 °C; note 1	–	15(2)	mA
C_j	junction capacitance	V_R = 0 V; f = 1 MHz	–	250	pF

Notes

1. Measured under pulsed conditions: $t_p \leq 300$ μs; $\delta \leq 0.01$.
2. Limiting value for T_j = 125 °C; T_j = 150 °C with reverse current applied is not allowed as this may cause thermal runaway leading to thermal destruction of the diode. A peak junction temperature of T_j = 150 °C is only allowed with forward voltage applied.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (for the transistor)	note 1	100	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (for the Schottky diode)	note 1	250	K/W

Note

1. Refer to SOT223 standard mounting conditions.

GRAPHICAL DATA

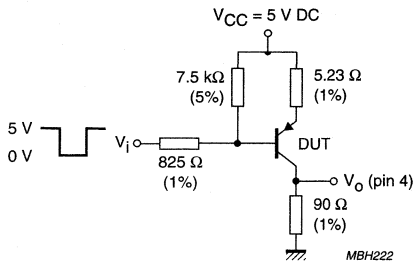
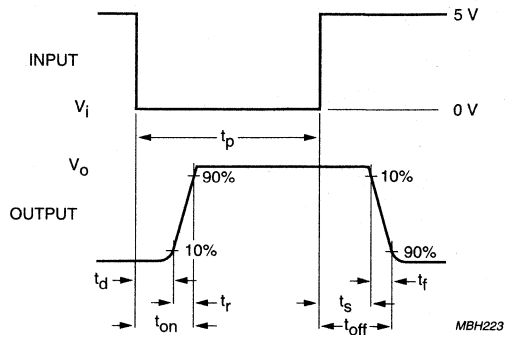


Fig.2 Switching times test circuit.



t_r < 5 ns (10% to 90%); t_p = 1 µs; δ = 0.02; Z_i = 50 Ω.
$t_{on} = t_d + t_r$; $t_{off} = t_s + t_f$.

Fig.3 Input and output waveforms.

DEVICE DATA TRANSISTORS

in alphanumeric sequence

NPN switching transistor 2N3904

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed switching.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package. PNP complement: 2N3906.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

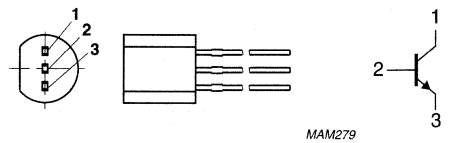


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

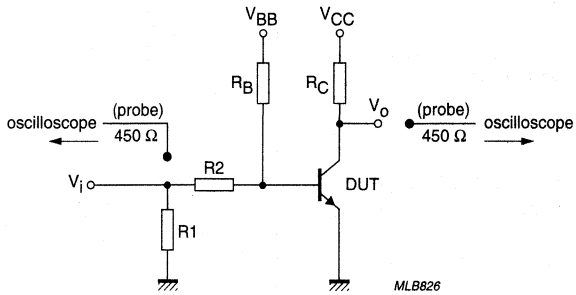
CHARACTERISTICS

T_{amb} = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = 5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = −1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor 2N3906

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed switching in industrial applications.

DESCRIPTION

PNP switching transistor in a TO-92; SOT54 plastic package. NPN complement: 2N3904.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

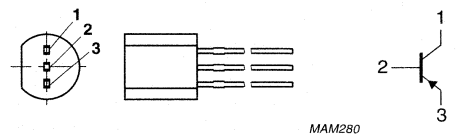


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−40	V
V_{CEO}	collector-emitter voltage	open base	–	−40	V
V_{EBO}	emitter-base voltage	open collector	–	−6	V
I_C	collector current (DC)		–	−200	mA
I_{CM}	peak collector current		–	−300	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

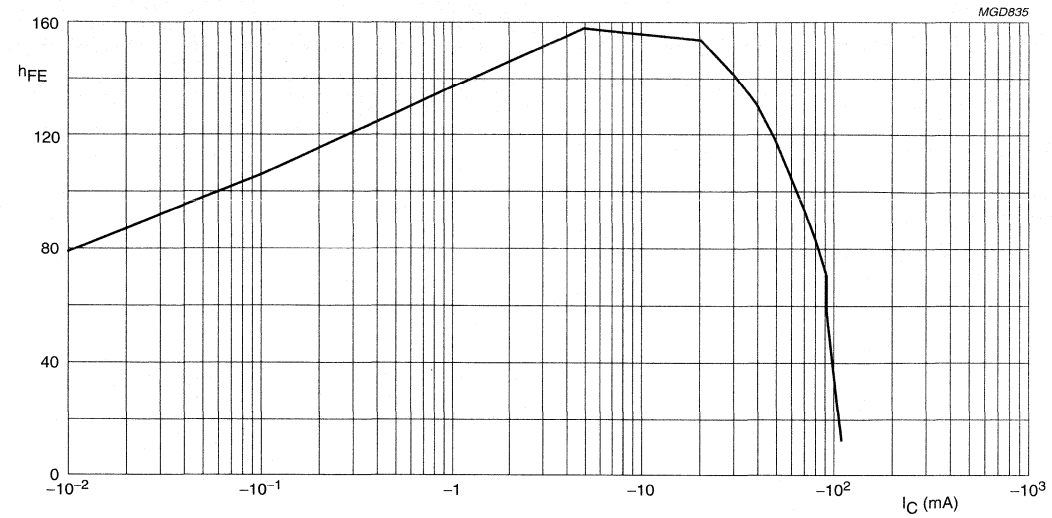
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −6 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; note 1; see Fig.2			
		I_C = −0.1 mA	60	–	
		I_C = −1 mA	80	–	
		I_C = −10 mA	100	300	
		I_C = −50 mA	60	–	
		I_C = −100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	–	−200	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	–	−850	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns

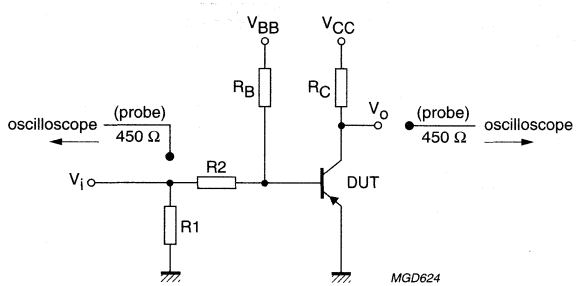
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = −5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; V_{CC} = −3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor 2N4401

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Industrial and consumer switching applications.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package. PNP complement: 2N4403.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

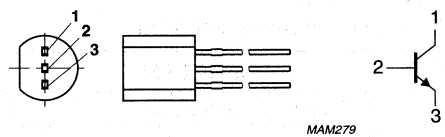


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	630	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; see Fig.2			
		I_C = 0.1 mA	20	–	
		I_C = 1 mA	40	–	
		I_C = 10 mA	80	–	
		I_C = 150 mA; note 1	100	300	
		I_C = 500 mA; V_{CE} = 2 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	950	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB = 5 V; f = 1 MHz	–	6.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	250	–	MHz
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

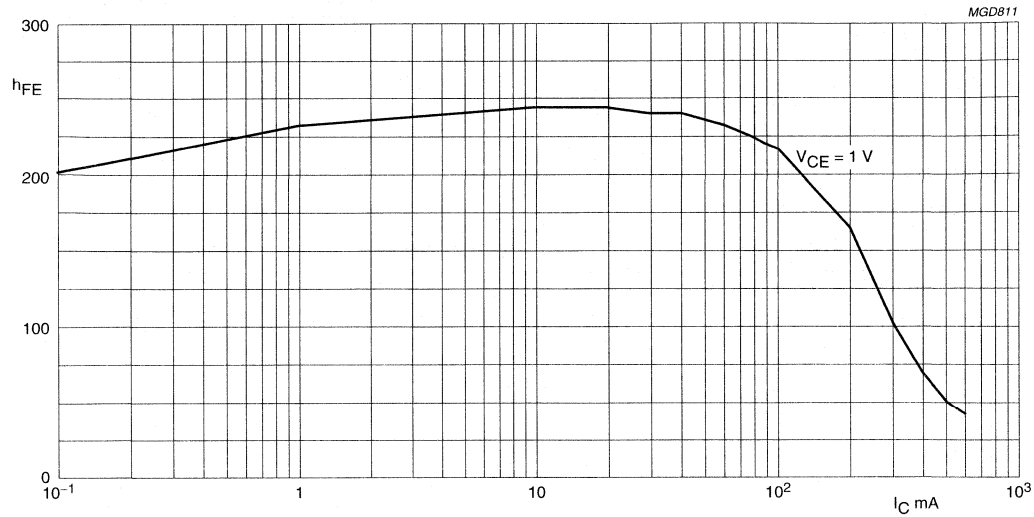
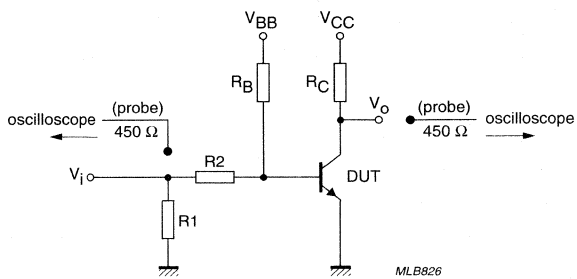


Fig.2 DC current gain; typical values.



V_i = 9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor 2N4403

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Industrial and consumer switching applications.

DESCRIPTION

PNP switching transistor in a TO-92; SOT54 plastic package. NPN complement: 2N4401.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

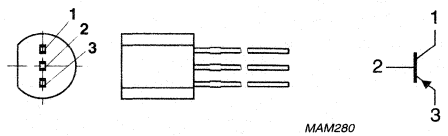


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	630	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

PNP switching transistor 2N4403

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0 mA; V_{CB} = –40 V	–	–50	nA
I_{EBO}	emitter cut-off current	I_C = 0 mA; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V; see Fig.2			
		I_C = –0.1 mA	30	–	
		I_C = –1 mA	60	–	
		I_C = –10 mA	100	–	
		V_{CE} = –2 V			
		I_C = –150 mA	100	300	
		I_C = –500 mA	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA	–	–400	mV
		I_C = –500 mA; I_B = –50 mA	–	–750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA	–	–950	mV
		I_C = –500 mA; I_B = –50 mA	–	–1.3	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	8.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = –20 mA; V_{CE} = –10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	15	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	350	ns
t_s	storage time		–	300	ns
t_f	fall time		–	50	ns

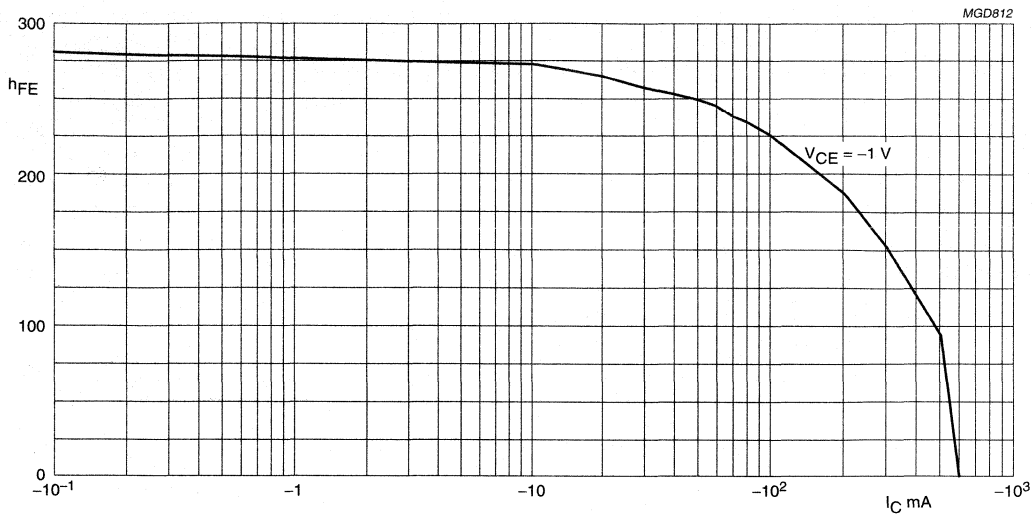
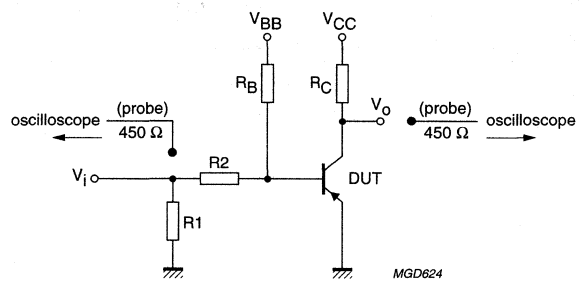


Fig.2 DC current gain; typical values.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP high-voltage transistor 2N5401

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 150 V).

APPLICATIONS

- General purpose switching and amplification
- Telephony applications.

DESCRIPTION

PNP high-voltage transistor in a TO-92; SOT54 plastic package. NPN complement: 2N5551.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

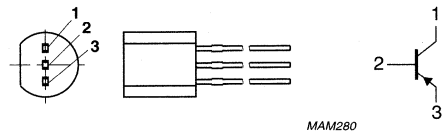


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–160	V
V_{CEO}	collector-emitter voltage	open base	–	–150	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–300	mA
I_{CM}	peak collector current		–	–600	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	630	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

PNP high-voltage transistor 2N5401

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −120 V	–	−50	nA
		I_E = 0; V_{CB} = −120 V; T_{amb} = 100 °C	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	−50	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V; see Fig.2	50	–	
		I_C = −10 mA; V_{CE} = −5 V; see Fig.2	60	240	
		I_C = −50 mA; V_{CE} = −5 V; see Fig.2	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−200	mV
		I_C = −50 mA; I_B = −5 mA	–	−500	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	8	pF

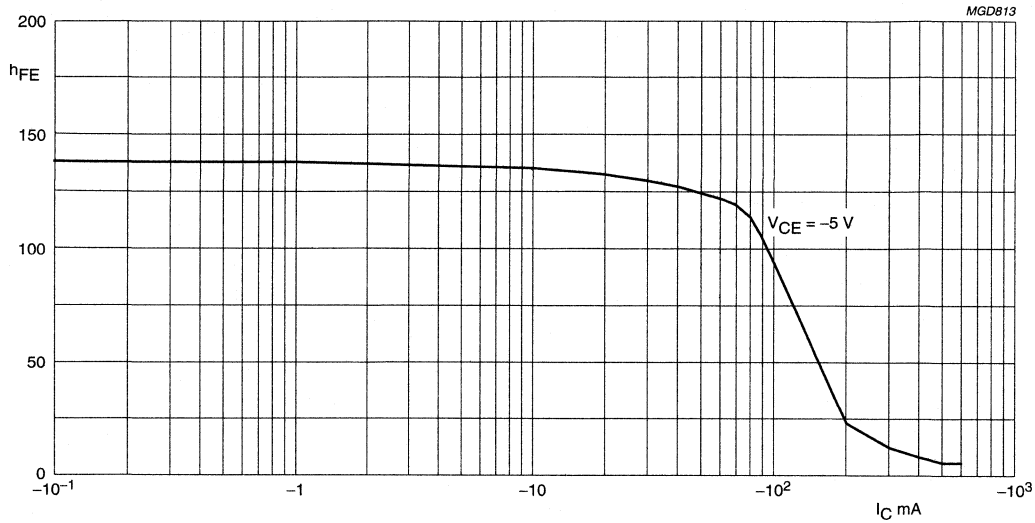


Fig.2 DC current gain; typical values.

NPN high-voltage transistors 2N5550; 2N5551

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 160 V).

APPLICATIONS

- Switching and amplification in high voltage applications such as telephony.

DESCRIPTION

NPN high-voltage transistor in a TO-92; SOT54 plastic package. PNP complements: 2N5400 and 2N5401.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

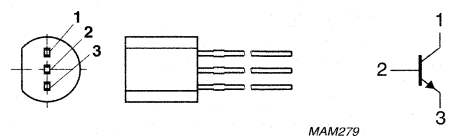


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	2N5550		–	160	V
	2N5551		–	180	V
V_{CEO}	collector-emitter voltage	open base			
	2N5550		–	140	V
	2N5551		–	160	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	630	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	200	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	2N5550	I_E = 0; V_{CB} = 100 V	–	100	nA
		I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	–	100	μA
	collector cut-off current				
	2N5551	I_E = 0; V_{CB} = 120 V	–	50	nA
		I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	50	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V; see Fig.2			
	2N5550		60	–	
	2N5551		80	–	
	DC current gain	I_C = 10 mA; V_{CE} = 5 V; see Fig.2			
	2N5550		60	250	
	2N5551		80	250	
	DC current gain	I_C = 50 mA; V_{CE} = 5 V; see Fig.2			
	2N5550		20	–	
	2N5551		30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	150	mV
	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA			
	2N5550		–	250	mV
	2N5551		–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	1	V
		I_C = 50 mA; I_B = 5 mA	–	1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz			
	2N5550		–	10	dB
	2N5551		–	8	dB

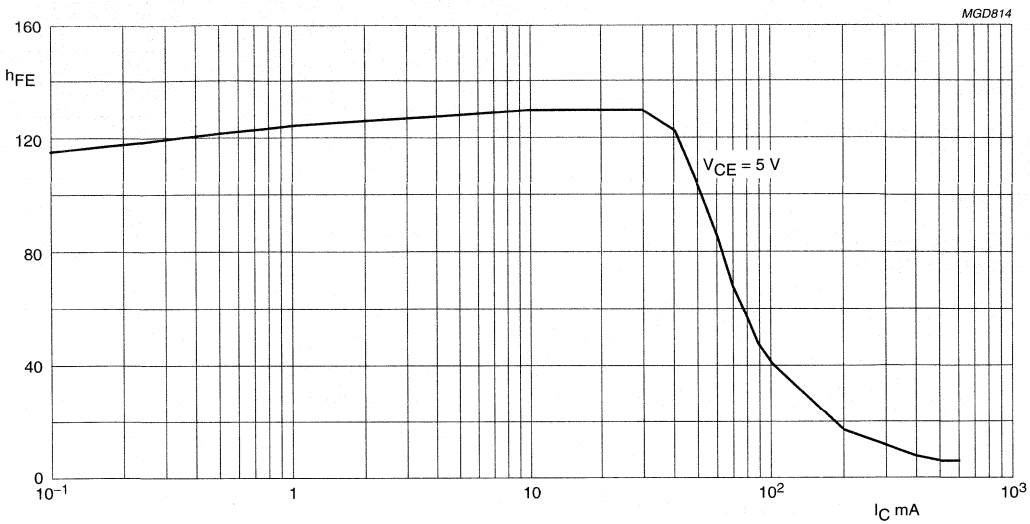


Fig.2 DC current gain; typical values.

PNP general purpose transistor 2PA1015

FEATURES

- Low current (max. 150 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a plastic TO-92; SOT54 package.
NPN complement: 2PC1815.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

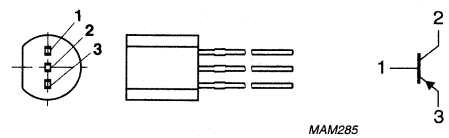


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–150	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistor 2PA1015

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –50 V	–	–	–100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –2 mA; V_{CE} = –6 V				
	2PA1015Y		120	–	240	
	2PA1015GR		200	–	400	
h_{FE}	DC current gain	I_C = –150 mA; V_{CE} = –6 V	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –100 mA; I_B = –10 mA	–	–	–300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –100 mA; I_B = –10 mA	–	–	–1.1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	4	7	pF
f_T	transition frequency	I_C = –1 mA; V_{CB} = –10 V; f = 100 MHz	80	–	–	MHz
F	noise figure	I_C = –200 μA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

PNP general purpose transistor 2PA1576

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V)
- Low collector capacitance (typ. 2.5 pF).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SC-70 (SOT323) plastic package.
NPN complement: 2PC4081.

MARKING

TYPE NUMBER	MARKING CODE (1)
2PA1576Q	F*Q
2PA1576R	F*R
2PA1576S	F*S

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

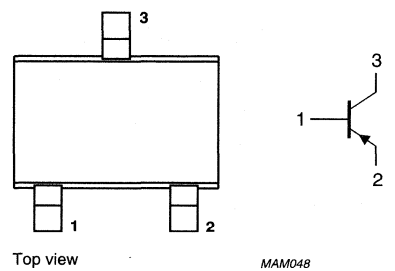


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-70 (SOT323) standard mounting conditions.

PNP general purpose transistor 2PA1576

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Refer to SC-70 (SOT323) standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −6 V				
	2PA1576Q		120	–	270	
	2PA1576R		180	–	390	
	2PA1576S		270	–	560	
V_{CEsat}	saturation voltage	I_C = −50 mA; I_B = −5 mA; note 1	–	–	−500	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −12 V; f = 1 MHz	–	2.5	3.5	pF
f_T	transition frequency	I_C = −2 mA; V_{CE} = −12 V; f = 100 MHz	100	–	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor 2PA1774

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification in communication, electronic data processing (EDP) and consumer applications.

DESCRIPTION

PNP transistor in an SC-75 plastic package.
NPN complement: 2PC4617.

MARKING

TYPE NUMBER	MARKING CODE
2PA1774Q	YQ
2PA1774R	YR
2PA1774S	YS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

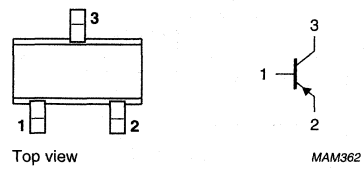


Fig.1 Simplified outline (SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	−	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	−	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −6 V; note 1			
	2PA1774Q		120	270	
	2PA1774R		180	390	
	2PA1774S		270	560	
V_{CEsat}	collector-emitter saturation voltage	I_C = −50 mA; I_B = −5 mA; note 1	−	−200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −12 V; f = 1 MHz	−	2.2	pF
f_T	transition frequency	I_E = −2 mA; V_{CE} = −12 V; f = 100 MHz; note 1	100	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor 2PA1774J

FEATURES

- Power dissipation comparable to SOT23
- Low output capacitance
- Low saturation voltage V_{CEsat}
- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification in miniaturized application areas such as telecom and multimedia.

DESCRIPTION

PNP transistor encapsulated in an ultra small plastic SMD SC-89 (SOT490) package.
NPN complement: 2PC4617J.

MARKING

TYPE NUMBER	MARKING CODE
2PA1774JQ	YQ
2PA1774JR	YR
2PA1774JS	YS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

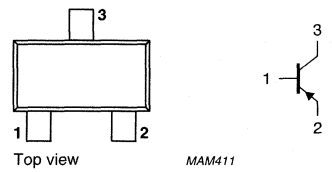


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

PRELIMINARY
Philips Semiconductors for Design-in information
See Philips Semiconductors

PNP general purpose transistor 2PA1774J

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	−	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	−	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −6 V; note 1			
	2PA1774JQ		120	270	
	2PA1774JR		180	390	
	2PA1774JS		270	560	
V_{CEsat}	collector-emitter saturation voltage	I_C = −50 mA; I_B = −5 mA; note 1	−	−200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −12 V; f = 1 MHz	−	2.2	pF
f_T	transition frequency	I_C = −2 mA; V_{CE} = −12 V; f = 100 MHz; note 1	100	−	MHz

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

PNP general purpose transistor 2PA733

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92 (SOT54) plastic package.
NPN complement: 2PC945.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

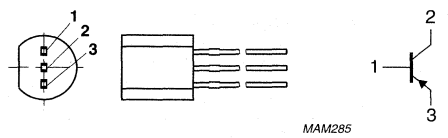


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistor 2PA733

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless other specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –60 V	–	–	–100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain 2PA733P	I_C = –1 mA; V_{CE} = –6 V	 200	 –	 400	
V_{CEsat}	collector-emitter saturation voltage	I_C = –100 mA; I_B = –10 mA	–	–	–300	mV
V_{BE}	base-emitter voltage	I_C = –1 mA; V_{CE} = –6 V	–600	–	–700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	4.5	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –6 V; f = 100 MHz	100	180	–	MHz
F	noise figure	I_C = –200 μA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 100 Hz	–	–	10	dB

PNP general purpose transistor 2PB1219A

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 50 V)
- Low collector-emitter saturation voltage (max. 600 mV).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT323; SC70 plastic package.
NPN complement: 2PD1820A.

MARKING

TYPE NUMBER	MARKING CODE(1)
2PB1219AQ	D*Q
2PB1219AR	D*R
2PB1219AS	D*S

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

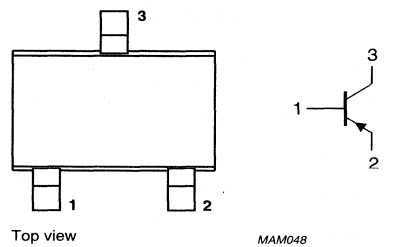


Fig.1 Simplified outline (SOT323; SC70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SOT323; SC70 standard mounting conditions.

PNP general purpose transistor 2PB1219A

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Refer to SOT323; SC70 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	−	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 150 °C	−	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	−	−100	nA
h_{FE}	DC current gain	I_C = −150 mA; V_{CE} = −10 V; note 1			
	2PB1219AQ		85	170	
	2PB1219AR		120	240	
	2PB1219AS		170	340	
h_{FE}	DC current gain	I_C = −500 mA; V_{CE} = −10 V; note 1	40	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −300 mA; I_B = −30 mA; note 1	−	−600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −300 mA; I_B = −30 mA; note 1	−	−1.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	15	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = −10 V;			
	2PB1219AQ	f = 100 MHz; note 1	100	−	MHz
	2PB1219AR		120	−	MHz
	2PB1219AS		140	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor 2PB709A

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in an SC-59 plastic package.
NPN complement: 2PB601A.

MARKING

TYPE NUMBER	MARKING CODE
2PB709AQ	BQ
2PB709AR	BR
2PB709AS	BS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

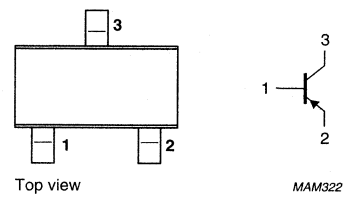


Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−45	V
V_{CEO}	collector-emitter voltage	open base	–	−45	V
V_{EBO}	emitter-base voltage	open collector	–	−6	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −45 V	–	−10	nA
		I_E = 0; V_{CB} = −45 V; T_j = 150 °C	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−10	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −10 V			
	2PB709AQ		160	260	
	2PB709AR		210	340	
	2PB709AS		290	460	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −10 mA; note 1	–	−500	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	5	pF
f_T	transition frequency	I_C = −1 mA; V_{CE} = −10 V; f = 100 MHz			
	2PB709AQ		60	–	MHz
	2PB709AR		70	–	MHz
	2PB709AS		80	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor 2PB710A

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in an SC-59 plastic package.
NPN complement: 2PD602A.

MARKING

TYPE NUMBER	MARKING CODE
2PB710AQ	DQ
2PB710AR	DR
2PB710AS	DS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

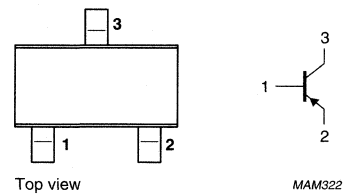


Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistor 2PB710A

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −60 V	−	−10	nA
		I_E = 0; V_{CB} = −60 V; T_j = 150 °C	−	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−10	nA
h_{FE}	DC current gain	I_C = −150 mA; V_{CE} = −10 V; note 1			
	2PB710AQ		85	170	
	2PB710AR		120	240	
	2PB710AS		170	340	
	DC current gain	I_C = −500 mA; V_{CE} = −10 V; note 1	40	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −300 mA; I_B = −30 mA; note 1	−	−600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −300 mA; I_B = −30 mA; note 1	−	−1.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	15	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 100 MHz; note 1			
	2PB710AQ		100	−	MHz
	2PB710AR		120	−	MHz
	2PB710AS		140	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN general purpose transistor 2PC945

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92 (SOT54) plastic package.
PNP complement: 2PA733.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

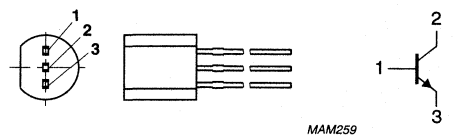


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).s

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

NPN general purpose transistor 2PC945

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 6 V	50	–	–	
h_{FE}	DC current gain 2PC945P	I_C = 1 mA; V_{CE} = 6 V	 200	 –	 400	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	1.1	V
V_{BE}	base-emitter voltage	I_C = 1 mA; V_{CE} = 6 V	600	–	700	mV
C_c	collector capacitance	$I_E = i_e$ =0; V_{CB} = 6 V; f = 1 MHz	–	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 6 V; f = 100 MHz	150	–	450	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ f = 1 kHz, B = 200 Hz	–	–	15	dB

NPN general purpose transistor 2PC1815

FEATURES

- Low current (max. 150 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification, e.g. audio amplifier driver stages.

DESCRIPTION

NPN transistor in a TO-92 (SOT54) plastic package.
PNP complement: 2PA1015.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

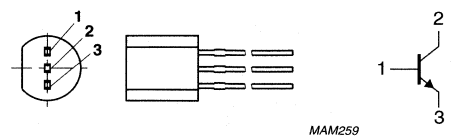


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	150	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

NPN general purpose transistor 2PC1815

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 6 V	25	–	–	
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 6 V				
	2PC1815		120	–	700	
	2PC1815Y		120	–	240	
	2PC1815GR		200	–	400	
	2PC1815BL		350	–	700	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	1.1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	3.5	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 6 V; f = 100 MHz	80	–	–	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz	–	–	10	dB

NPN general purpose transistor 2PC4081

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching
- Small signal amplification.

DESCRIPTION

NPN transistor in an SC-70 plastic package.
PNP complement: 2PA1576.

MARKING

TYPE NUMBER	MARKING CODE (1)
2PC4081Q	Z*Q
2PC4081R	Z*R
2PC4081S	Z*S

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

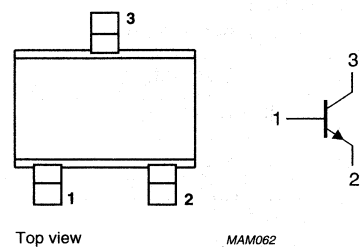


Fig.1 Simplified outline (SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

NPN general purpose transistor 2PC4081

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 6 V				
	2PC4081Q		120	–	270	
	2PC4081R		180	–	390	
	2PC4081S		270	–	560	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1	–	–	400	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 12 V; f = 1 MHz	–	2	3.5	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 12 V; f = 100 MHz	100	–	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN general purpose transistor 2PC4617

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification in communication, electronic data processing (EDP) and consumer applications.

DESCRIPTION

NPN transistor in an SC-75 plastic package.
PNP complement: 2PA1774.

MARKING

TYPE NUMBER	MARKING CODE
2PC4617Q	ZQ
2PC4617R	ZR
2PC4617S	ZS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

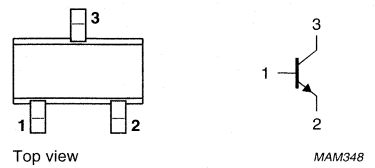


Fig.1 Simplified outline (SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 6 V; note 1			
	2PC4617		120	560	
	2PC4617Q		120	270	
	2PC4617R		180	390	
	2PC4617S		270	560	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 12 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 12 V; f = 100 MHz; note 1	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN general purpose transistor 2PC4617J

FEATURES

- Power dissipation comparable to SOT23
- Low output capacitance
- Low saturation voltage V_{CEsat}
- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification in miniaturized application areas such as telecom and multimedia.

DESCRIPTION

NPN transistor encapsulated in an ultra small plastic SMD SC-89 (SOT490) package.
PNP complement: 2PA1774J.

MARKING

TYPE NUMBER	MARKING CODE
2PC4617JQ	ZQ
2PC4617JR	ZR
2PC4617JS	ZS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

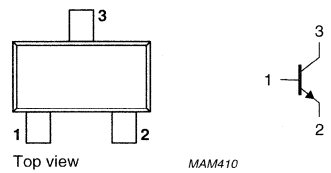


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 6 V; note 1			
	2PC4617JQ		120	270	
	2PC4617JR		180	390	
	2PC4617JS		270	560	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 12 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 12 V; f = 100 MHz; note 1	100	–	MHz

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

NPN general purpose transistor 2PD601A

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in an SC-59 plastic package.
PNP complement: 2PB709A.

MARKING

TYPE NUMBER	MARKING CODE
2PD601AQ	ZQ
2PD601AR	ZR
2PD601AS	ZS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

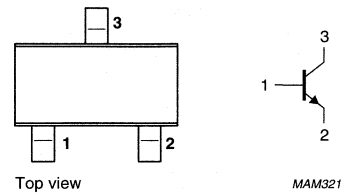


Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	10	nA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 2 V; note 1	90	–	
	DC current gain	I_C = 2 mA; V_{CE} = 10 V; note 1			
	2PD601AQ		160	260	
	2PD601AR		210	340	
	2PD601AS		290	460	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA; note 1	–	500	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	3.5	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 10 V;			
	2PD601AQ	f = 100 MHz	100	–	MHz
	2PD601AR		120	–	MHz
	2PD601AS		140	–	MHz

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

NPN general purpose transistor 2PD602A

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in an SC-59 plastic package.
PNP complement: 2PB710A.

MARKING

TYPE NUMBER	MARKING CODE
2PD602AQ	XQ
2PD602AR	XR
2PD602AS	XS

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

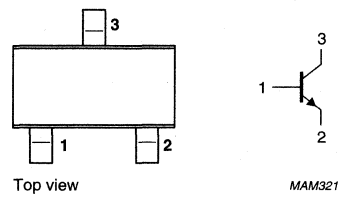


Fig.1 Simplified outline (SC-59) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	10	nA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 10 V; note 1			
	2PD602AQ		85	170	
	2PD602AR		120	240	
	2PD602AS		170	340	
	DC current gain	I_C = 500 mA; V_{CE} = 10 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 300 mA; I_B = 30 mA; note 1	–	600	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	15	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V;			
	2PD602AQ	f = 100 MHz; note 1	140	–	MHz
	2PD602AR		160	–	MHz
	2PD602AS		180	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN general purpose transistor 2PD1820A

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 50 V)
- Low collector-emitter saturation voltage (max. 600 mV).

APPLICATIONS

- General purpose switching and amplification, especially for portable equipment.

DESCRIPTION

NPN transistor in an SC-70; SOT323 plastic package.
PNP complement: 2PB1219A.

MARKING

TYPE NUMBER	MARKING CODE(1)
2PD1820AQ	A*Q
2PD1820AR	A*R
2PD1820AS	A*S

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

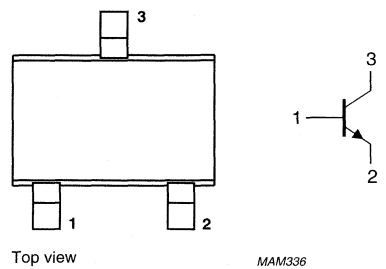


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	10	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	10	nA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 10 V; note 1			
	2PD1820AQ		85	170	
	2PD1820AR		120	240	
	2PD1820AS		170	340	
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 10 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 300 mA; I_B = 30 mA; note 1	–	600	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	15	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz; note 1	150	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor BC327

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification, e.g. driver and output stages of audio amplifiers.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: BC337.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

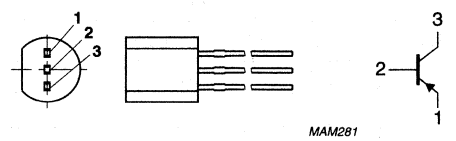


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−50	V
V_{CEO}	collector-emitter voltage	open base	–	−45	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−500	mA
I_{CM}	peak collector current		–	−1	A
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.2	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

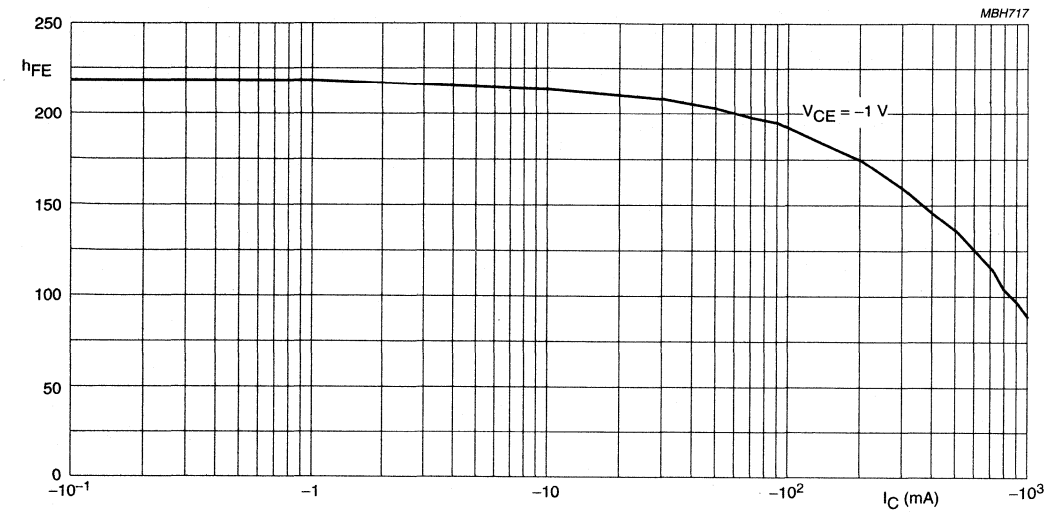
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –20 V	–	–	–100	nA
		I_E = 0; V_{CB} = –20 V; T_j = 150 °C	–	–	–5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –100 mA; V_{CE} = –1 V; see Figs 2, 3 and 4				
	BC327		100	–	600	
	BC327-16		100	–	250	
	BC327-25		160	–	400	
	BC327-40		250	–	600	
h_{FE}	DC current gain	I_C = –500 mA; V_{CE} = –1 V; see Figs 2, 3 and 4	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA	–	–	–700	mV
V_{BE}	base-emitter voltage	I_C = –500 mA; V_{CE} = –1 V; note 1	–	–	–1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	80	–	–	MHz

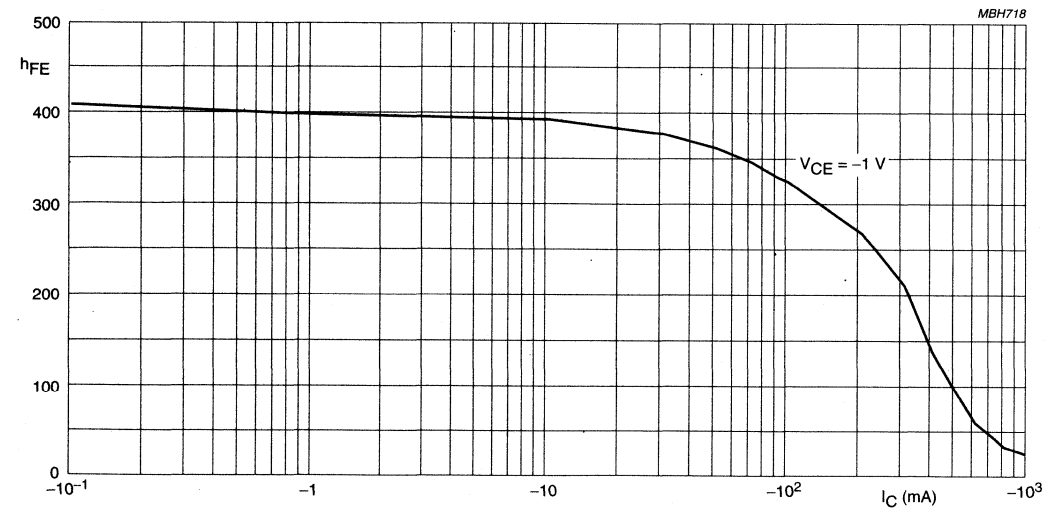
Note

1. V_{BE} decreases by about –2 mV/K with increasing temperature.



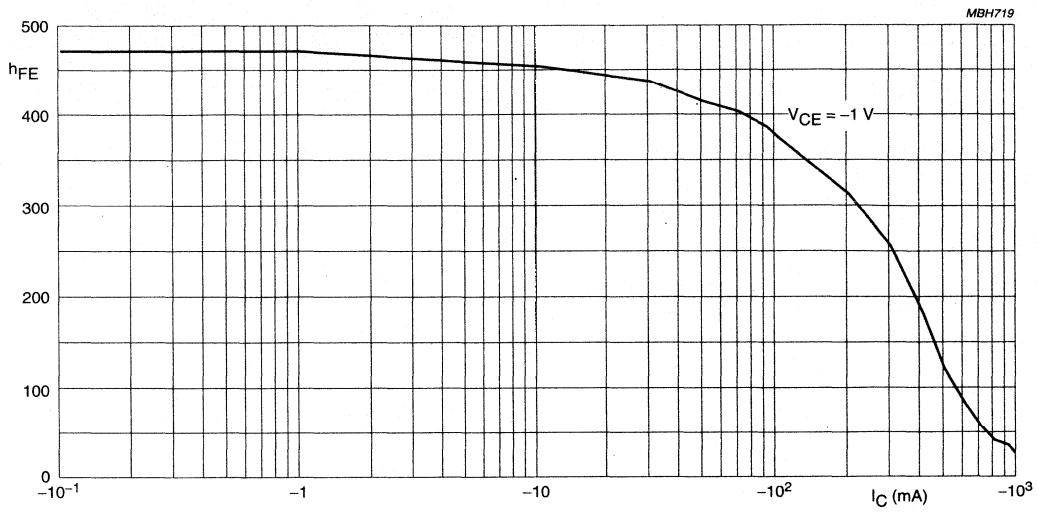
BC327-16.

Fig.2 DC current gain; typical values.



BC327-25.

Fig.3 DC current gain; typical values.



BC327-40.

Fig.4 DC current gain; typical values.

NPN general purpose transistor BC337

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification, e.g. driver and output stages of audio amplifiers.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: BC327.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

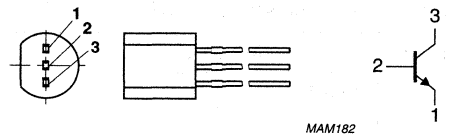


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.2	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

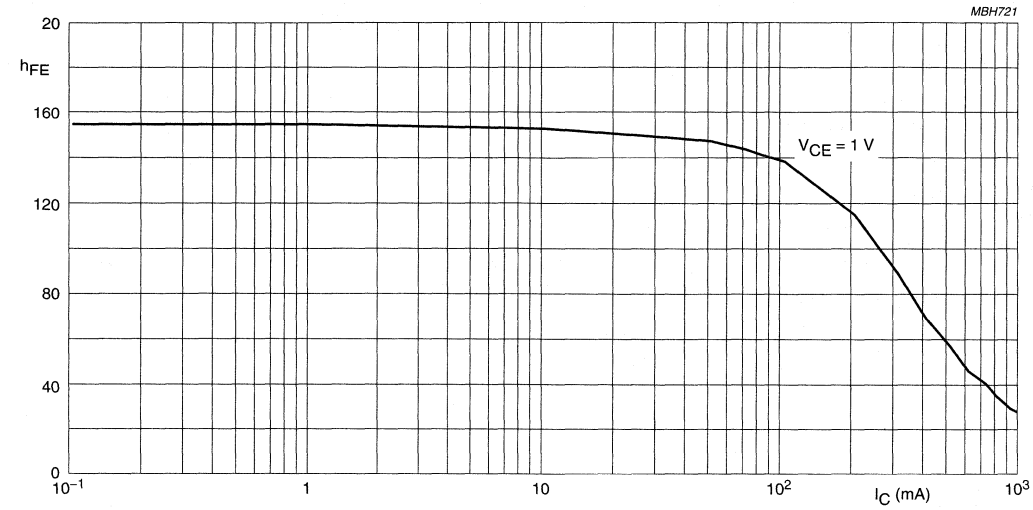
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 1 V; see Figs 2, 3 and 4				
	BC337		100	–	600	
	BC337-16		100	–	250	
	BC337-25		160	–	400	
	BC337-40		250	–	600	
	DC current gain	I_C = 500 mA; V_{CE} = 1 V; see Figs 2, 3 and 4	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	–	–	700	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 1 V; note 1	–	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz

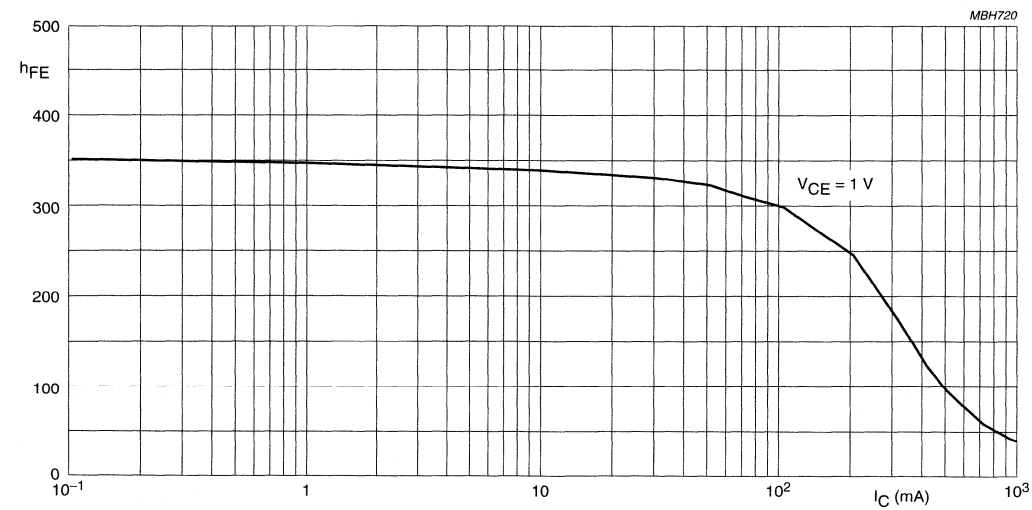
Note

1. V_{BE} decreases by about 2 mV/K with increasing temperature.



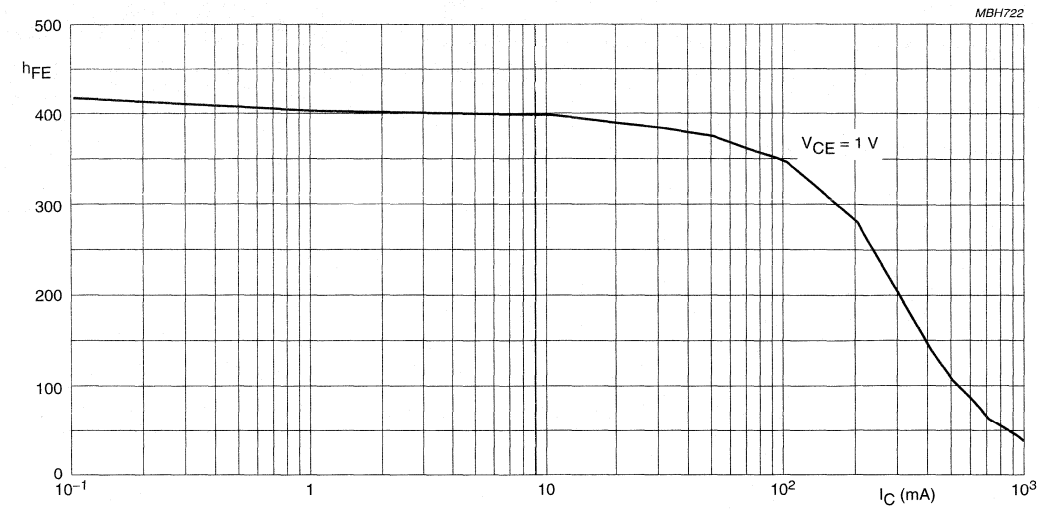
BC337-16.

Fig.2 DC current gain; typical values.



BC337-25.

Fig.3 DC current gain; typical values.



BC337-40.

Fig.4 DC current gain; typical values.

NPN medium power transistor BC368

FEATURES

- High current (1 A)
- Low voltage (20 V).

APPLICATIONS

- General purpose switching and amplification
- Power applications such as audio output stages.

DESCRIPTION

NPN medium power transistor in a TO-92; SOT54 plastic package. PNP complement: BC369.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

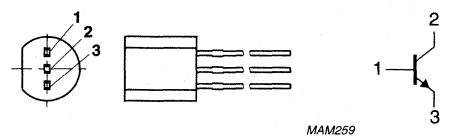


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

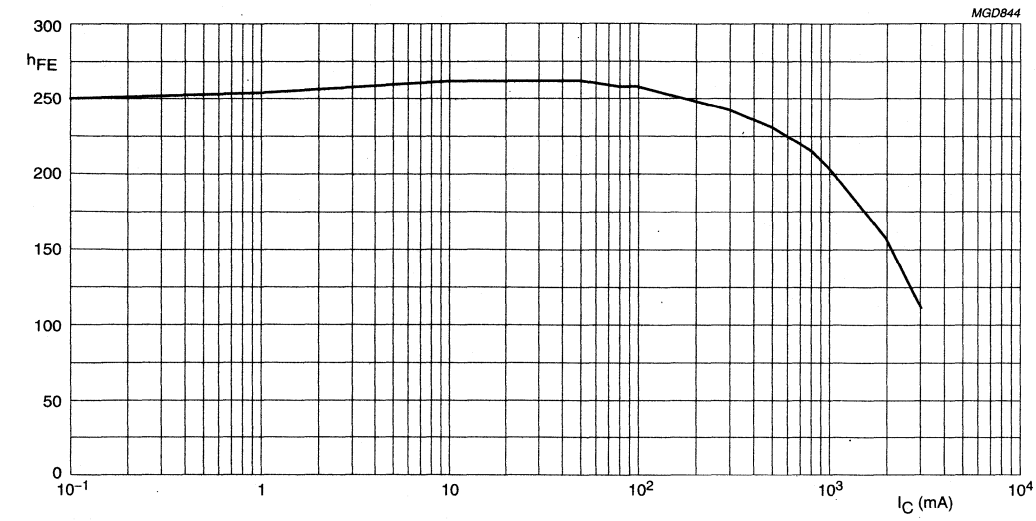
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 25 V	–	100	nA
		I_E = 0; V_{CB} = 25 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	50	–	
		I_C = 500 mA; V_{CE} = 1 V; see Fig.2	85	375	
		I_C = 1 A; V_{CE} = 1 V; see Fig.2	60	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	–	500	mV
V_{BE}	base-emitter voltage	I_C = 5 mA; V_{CE} = 10 V	–	700	mV
		I_C = 1 A; V_{CE} = 1 V	–	1	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	40	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 500 mA; $\lvert V_{CE} \rvert$ = 1 V	–	1.6	



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

PNP medium power transistor BC369

FEATURES

- High current (max. 1 A)
- Low voltage (max. 20 V).

APPLICATIONS

- General purpose switching and amplification
- Power applications such as audio output stages.

DESCRIPTION

NPN medium power transistor in a TO-92; SOT54 plastic package. PNP complement: BC368.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

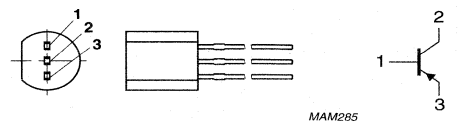


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base	–	–20	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

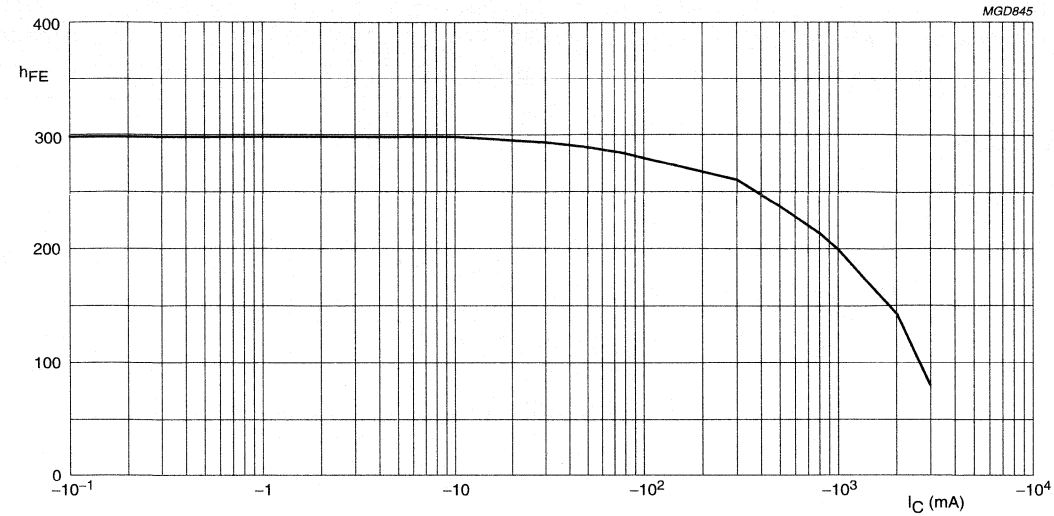
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −25 V	−	−100	nA
		I_E = 0; V_{CB} = −25 V; T_j = 150 °C	−	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−100	nA
h_{FE}	DC current gain	I_C = −5 mA; V_{CE} = −10 V	50	−	
		I_C = −500 mA; V_{CE} = −1 V; see Fig.2	85	375	
		I_C = −1 A; V_{CE} = −1 V; see Fig.2	60	−	
	DC current gain BC369-16 BC369-25	I_C = −500 mA; V_{CE} = −1 V; see Fig.2	 100 160	 250 375	
V_{CEsat}	collector-emitter saturation voltage	I_C = −1 A; I_B = −100 mA	−	−0.5	V
V_{BE}	base-emitter voltage	I_C = −5 mA; V_{CE} = −10 V	−	−0.7	V
		I_C = −1 A; V_{CE} = −1 V	−	−1	V
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	40	−	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 500 mA; $\lvert V_{CE} \rvert$ = 1 V	−	1.6	



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.

PNP Darlington transistor BC516

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- Very high DC current gain (min. 30000).

APPLICATIONS

- Where very high amplification is required.

DESCRIPTION

PNP Darlington transistor in a TO-92; SOT54 plastic package. NPN complement: BC517.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

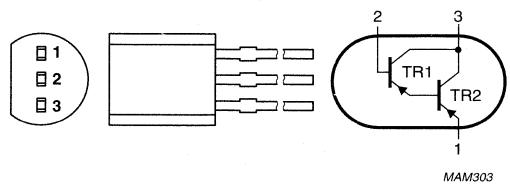


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage (open emitter)	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	V_{BE} = 0	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–800	mA
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

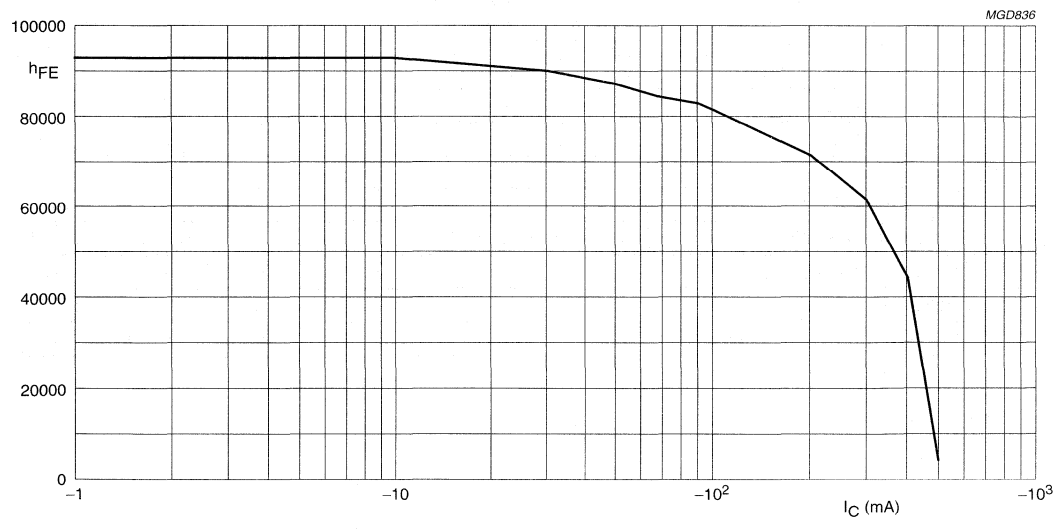
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −10 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −20 mA; V_{CE} = −2 V; see Fig.2	30000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1	V
V_{BEsat}	base-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = −10 mA; V_{CE} = −5 V	–	–	−1.4	V
f_T	transition frequency	I_C = −30 mA; V_{CE} = −5 V; f = 100 MHz	–	220	–	MHz



V_{CE} = −2 V.

Fig.2 DC current gain; typical values.

NPN Darlington transistor BC517

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- Very high DC current gain (min. 30000).

APPLICATIONS

- Where very high amplification is required.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package. PNP complement: BC516.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

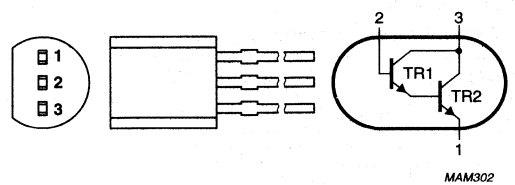


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

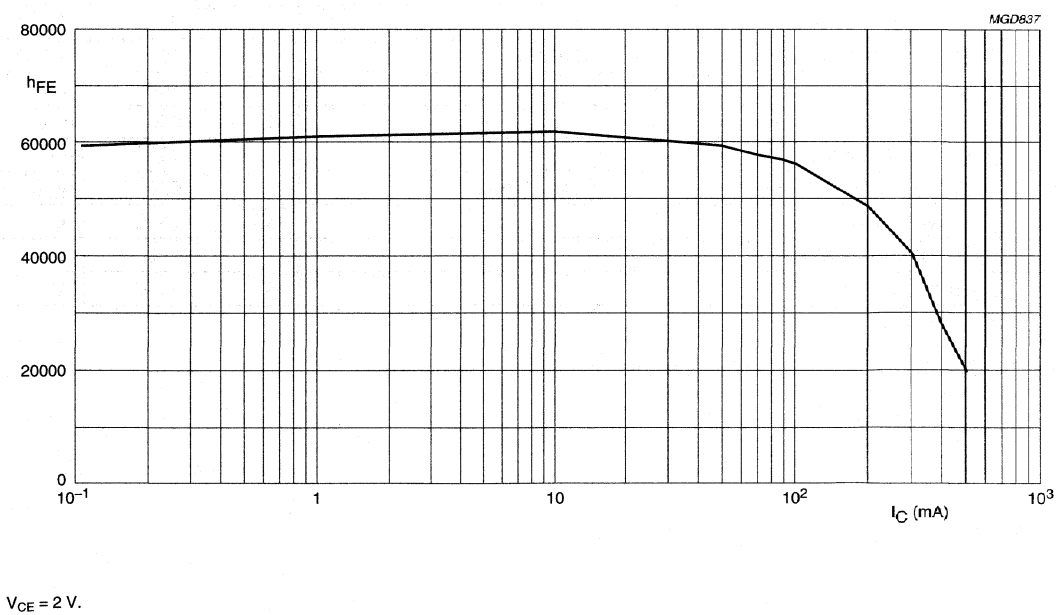
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 2 V; see Fig.2	30000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 10 mA; V_{CE} = 5 V	–	–	1.4	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	–	220	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

NPN general purpose transistors BC546; BC547

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complements: BC556 and BC557.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

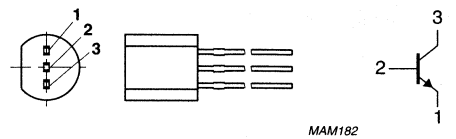


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC546		–	80	V
	BC547		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC546		–	65	V
	BC547		–	45	V
V_{EBO}	emitter-base voltage	open collector			
	BC546		–	6	V
	BC547		–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.25	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

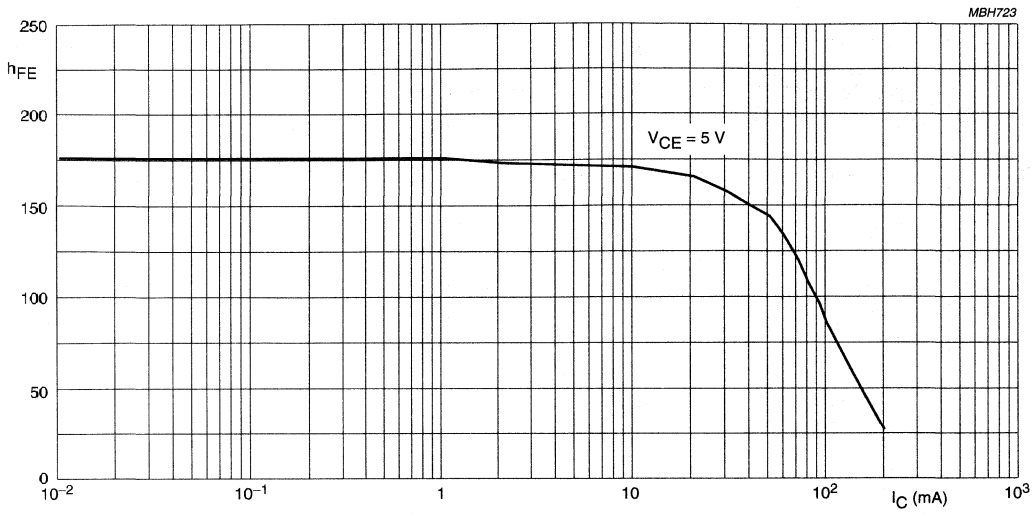
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain BC546A BC546B; BC547B BC547C	I_C = 10 µA; V_{CE} = 5 V; see Figs 2, 3 and 4	 – – –	 90 150 270	 – – –	
	DC current gain BC546A BC546B; BC547B BC547C BC547 BC546	I_C = 2 mA; V_{CE} = 5 V; see Figs 2, 3 and 4	 110 200 420 110 110	 180 290 520 – –	 220 450 800 800 450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	10	dB

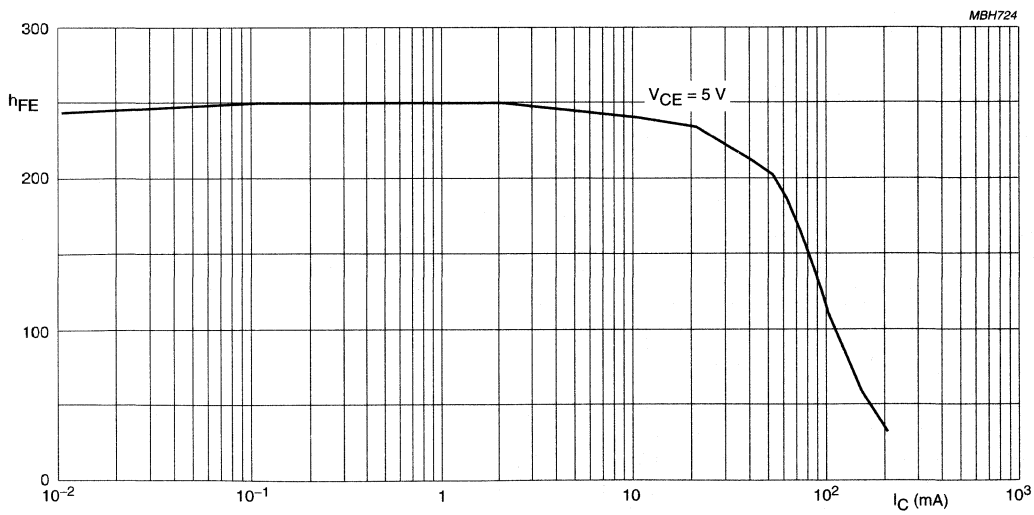
Notes

1. V_{BEsat} decreases by about 1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about 2 mV/K with increasing temperature.



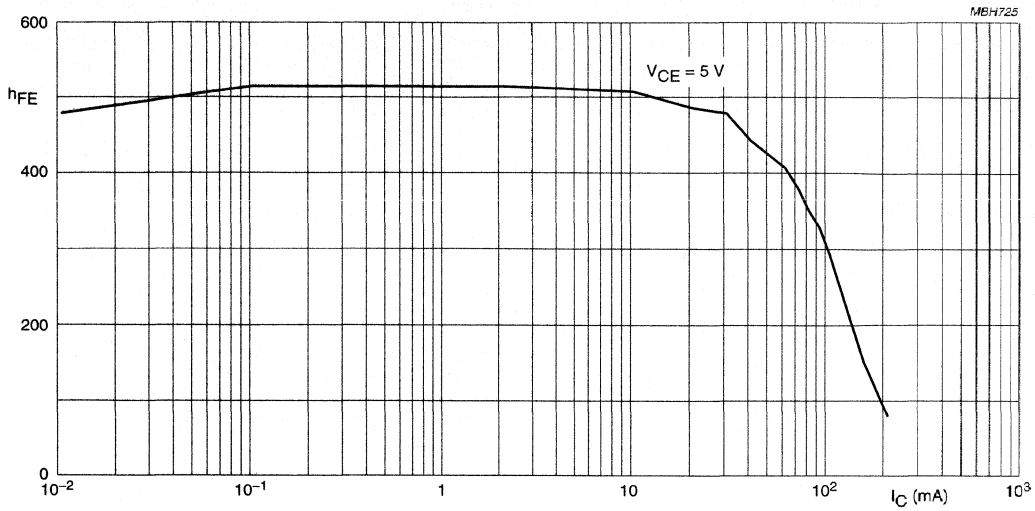
BC546A.

Fig.2 DC current gain; typical values.



BC546B; BC547B.

Fig.3 DC current gain; typical values.



BC547C.

Fig.4 DC current gain; typical values.

NPN general purpose transistors BC549; BC550

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Low noise stages in audio frequency equipment.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complements: BC559 and BC560.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

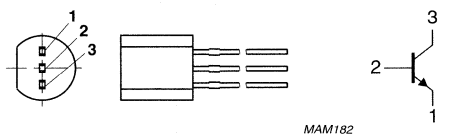


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC549		–	30	V
	BC550		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC549		–	30	V
	BC550		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

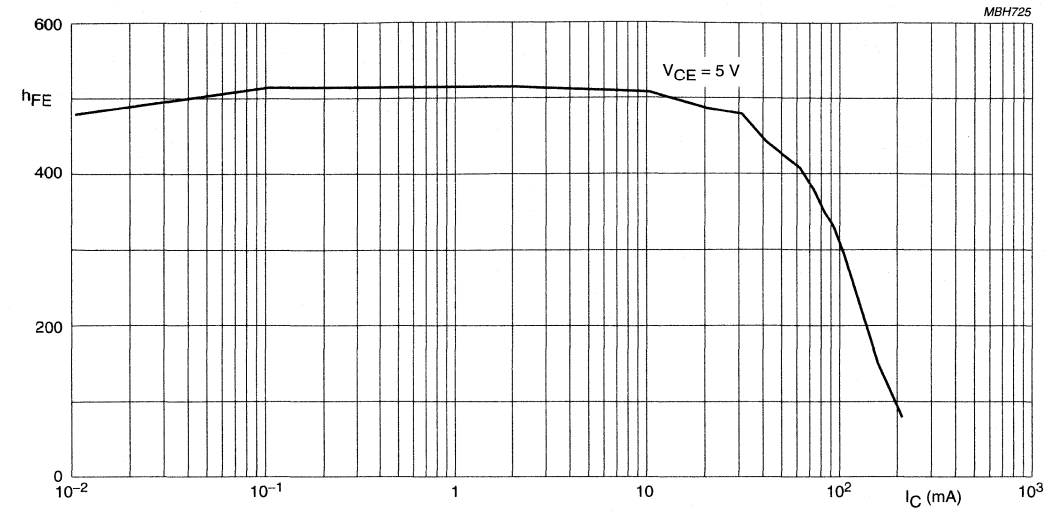
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain BC549C; BC550C	I_C = 10 μA; V_{CE} = 5 V; see Fig.2	–	270		
		I_C = 2 mA; V_{CE} = 5 V; see Fig.2	420	520	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	770	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	–	4	dB
		I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

Notes

1. V_{BEsat} decreases by about 1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about 2 mV/K with increasing temperature.



BC549C; BC550C.

Fig.2 DC current gain; typical values.

PNP general purpose transistors BC556; BC557

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complements: BC546 and BC547.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

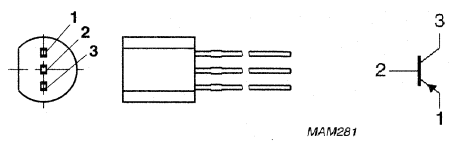


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC556		–	–80	V
	BC557		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC556		–	–65	V
	BC557		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

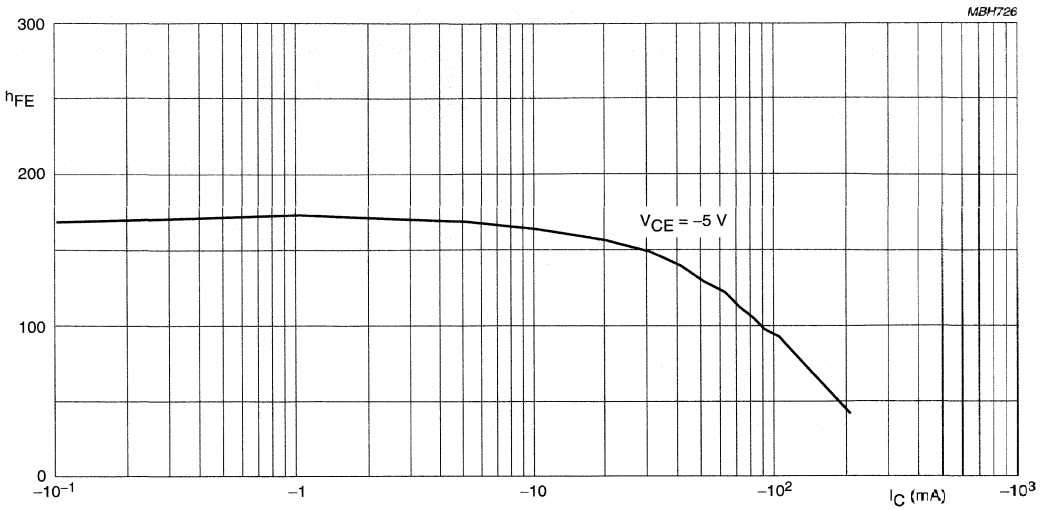
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−1	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V; see Figs 2, 3 and 4				
	BC556		125	–	475	
	BC557		125	–	800	
	BC556A		125	–	250	
	BC556B; BC557B		220	–	475	
	BC557C		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−60	−300	mV
		I_C = −100 mA; I_B = −5 mA	–	−180	−650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 1	–	−750	–	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−930	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V; note 2	−600	−650	−750	mV
		I_C = −10 mA; V_{CE} = −5 V; note 2	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	3	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	10	dB

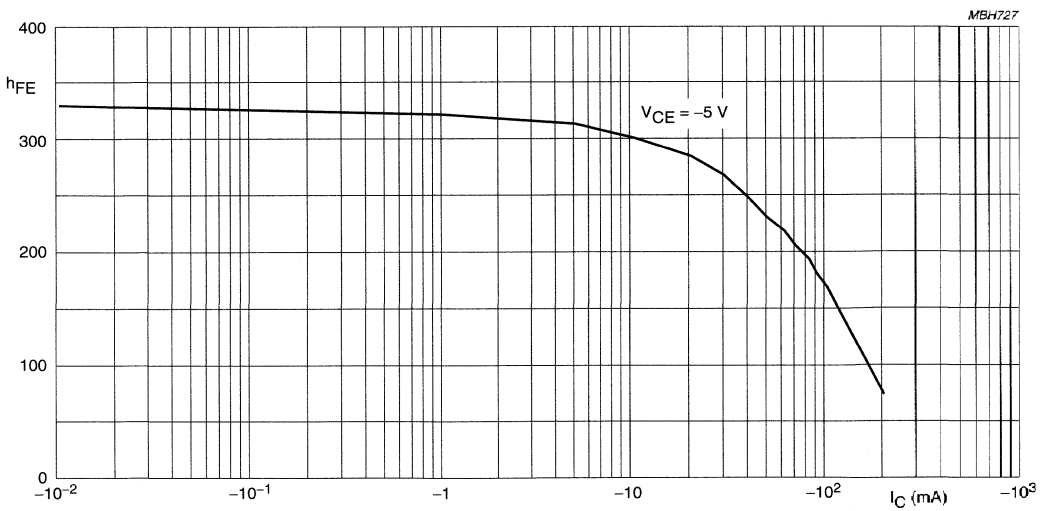
Notes

1. V_{BEsat} decreases by about −1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about −2 mV/K with increasing temperature.



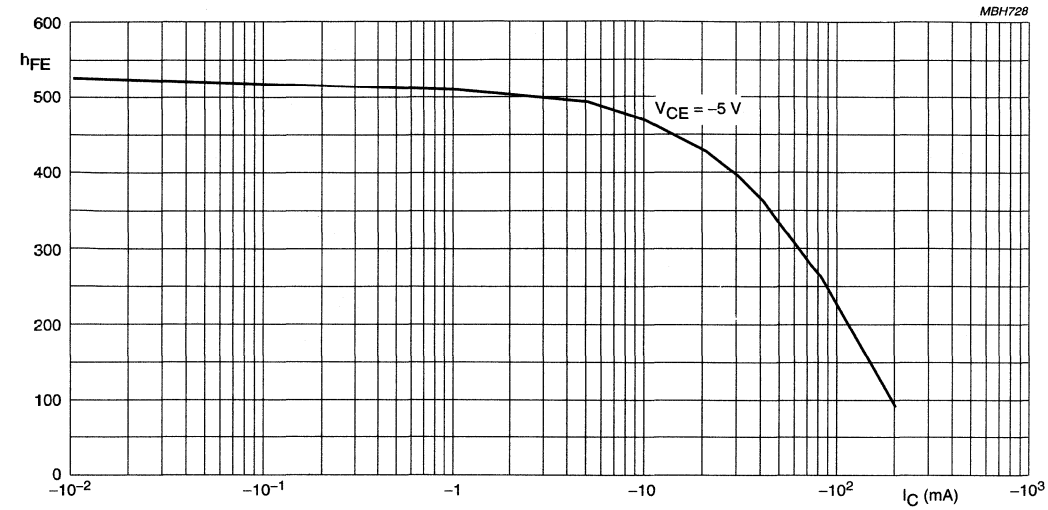
BC556A.

Fig.2 DC current gain; typical values.



BC556B; BC557B.

Fig.3 DC current gain; typical values.



BC557C.

Fig.4 DC current gain; typical values.

PNP general purpose transistor BC559

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92 (SOT54) plastic package.
NPN complement: BC549.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

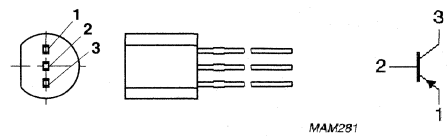


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−30	V
V_{CEO}	collector-emitter voltage	open base	–	−30	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

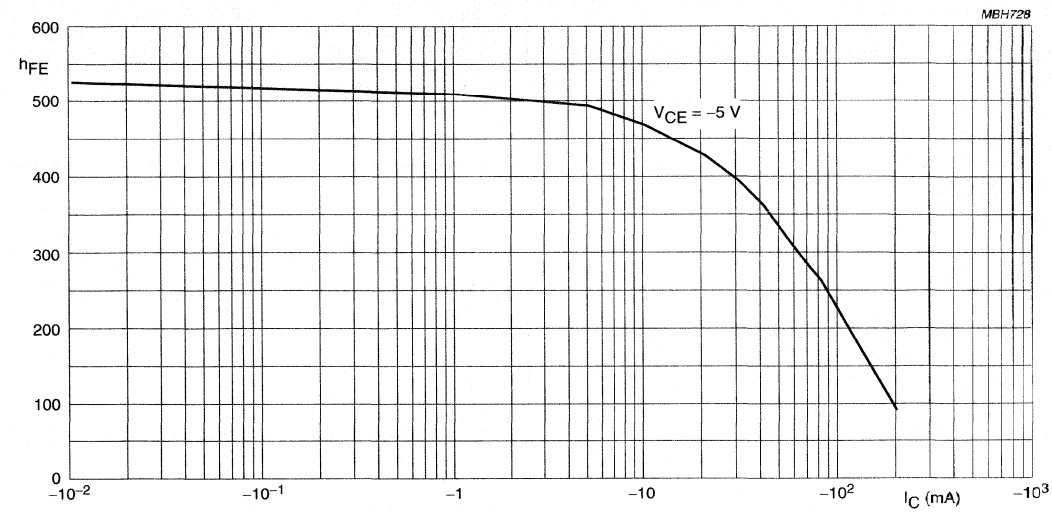
CHARACTERISTICS

$T_j = 25\ °C$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -30$ V	–	–1	–15	nA
		$I_E = 0$; $V_{CB} = -30$ V; $T_j = 150\ °C$	–	–	–4	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–100	nA
h_{FE}	DC current gain; BC559C	$I_C = -2$ mA; $V_{CE} = -5$ V; see Fig.2	420	–	800	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–60	–300	mV
		$I_C = -100$ mA; $I_B = -5$ mA	–	–180	–650	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA; note 1	–	–750	–	mV
		$I_C = -100$ mA; $I_B = -5$ mA; note 1	–	–930	–	mV
V_{BE}	base-emitter voltage	$I_C = -2$ mA; $V_{CE} = -5$ V; note 2	–600	–650	–750	mV
		$I_C = -10$ mA; $V_{CE} = -5$ V; note 2	–	–	–820	mV
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	4	–	pF
f_T	transition frequency	$I_E = -10$ mA; $V_{CB} = -5$ V; f = 100 MHz	100	–	–	MHz
F	noise figure; BC559C	$I_C = -200$ µA; $V_{CE} = -5$ V; $R_S = 2$ kΩ; f = 30 Hz to 15.7 kHz	–	–	4	dB
		$I_C = -200$ µA; $V_{CE} = -5$ V; $R_S = 2$ kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

Notes

1. V_{BEsat} decreases by about –1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about –2 mV/K with increasing temperature.



BC559C.

Fig.2 DC current gain; typical values.

NPN Darlington transistor BC618

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 55 V)
- High DC current gain.

APPLICATIONS

- General purpose low frequency
- Relay drivers.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

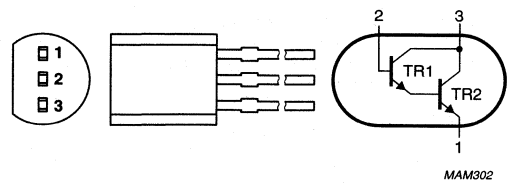


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	80	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	55	V
V_{EBO}	emitter-base voltage	open collector	–	12	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

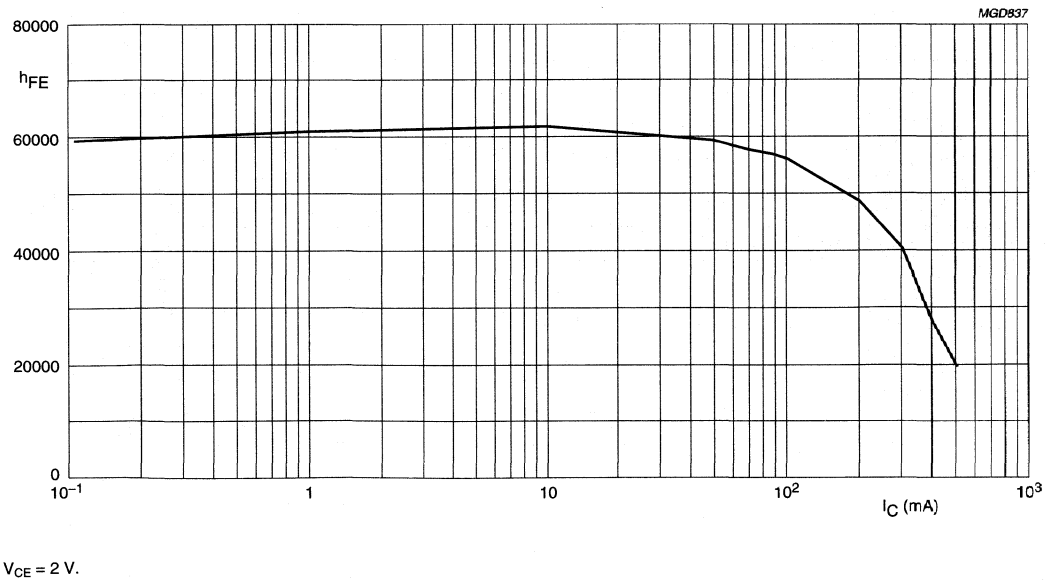
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	–	50	nA
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 60 V	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V; see Fig.2	2000	–	–	
		I_C = 10 mA; V_{CE} = 5 V; see Fig.2	4000	–	–	
		I_C = 200 mA; V_{CE} = 5 V; see Fig.2	10000	–	70000	
V_{CEsat}	collector-emitter saturation voltage	I_C = 200 mA; I_B = 0.2 mA	–	–	1.1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 200 mA; I_B = 0.2 mA	–	–	1.6	V
C_c	collector capacitance	I_E = 0; V_{CB} = 30 V	–	3.5	–	pF
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	155	–	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

NPN medium power transistors BC635; BC637; BC639

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Driver stages of audio/video amplifiers.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complements: BC636, BC638 and BC640.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

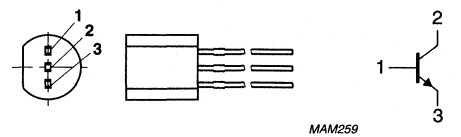


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC635		–	45	V
	BC637		–	60	V
	BC639		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BC635		–	45	V
	BC637		–	60	V
	BC639		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	1.5	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; see Fig.2			
		I_C = 5 mA	40	–	
		I_C = 150 mA	63	250	
		I_C = 500 mA	25	–	
	DC current gain	I_C = 150 mA; V_{CE} = 2 V; see Fig.2			
	BC639-10		63	160	
	BC635-16; BC637-16; BC639-16		100	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	–	500	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 2 V	–	1	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	100	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	1.6	

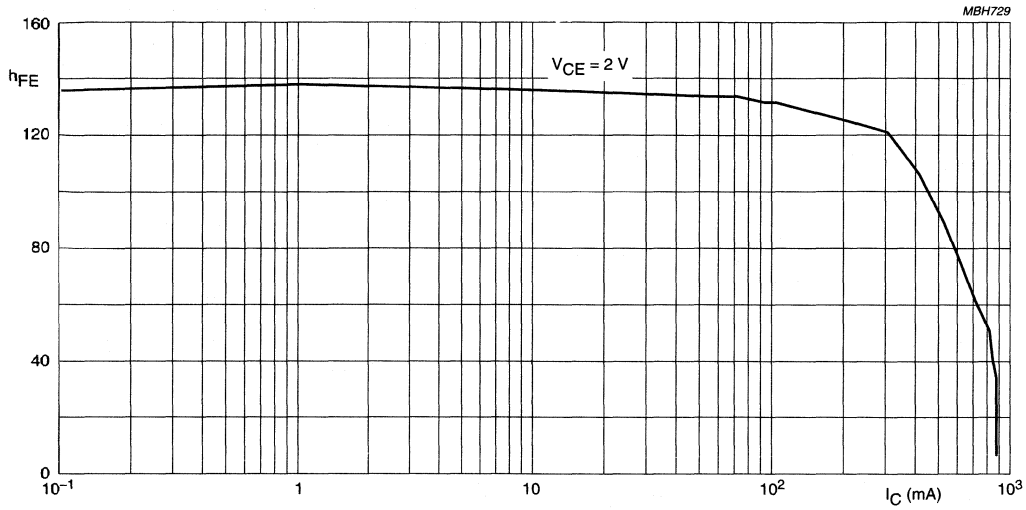


Fig.2 DC current gain; typlcal values.

PNP medium power transistors BC636; BC638; BC640

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Audio and video amplifiers.

DESCRIPTION

PNP medium power transistor in a TO-92; SOT54 plastic package. NP complements: BC635, BC637 and BC639.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

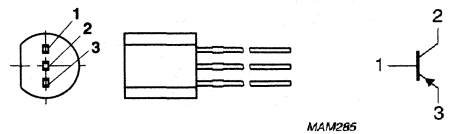


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC636		–	–45	V
	BC638		–	–60	V
	BC640		–	–100	V
V_{CEO}	collector-emitter voltage	open base			
	BC636		–	–45	V
	BC638		–	–60	V
	BC640		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–1.5	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	−	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; see Fig.2			
		I_C = −5 mA	40	−	
		I_C = −150 mA	63	250	
		I_C = −500 mA	25	−	
	DC current gain	I_C = −150 mA; V_{CE} = −2 V; see Fig.2			
	BC636-10		63	160	
	BC636-16; BC638-16; BC640-16		100	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	−	−0.5	V
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −2 V	−	−1	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −5 V; f = 100 MHz	100	−	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	−	1.6	

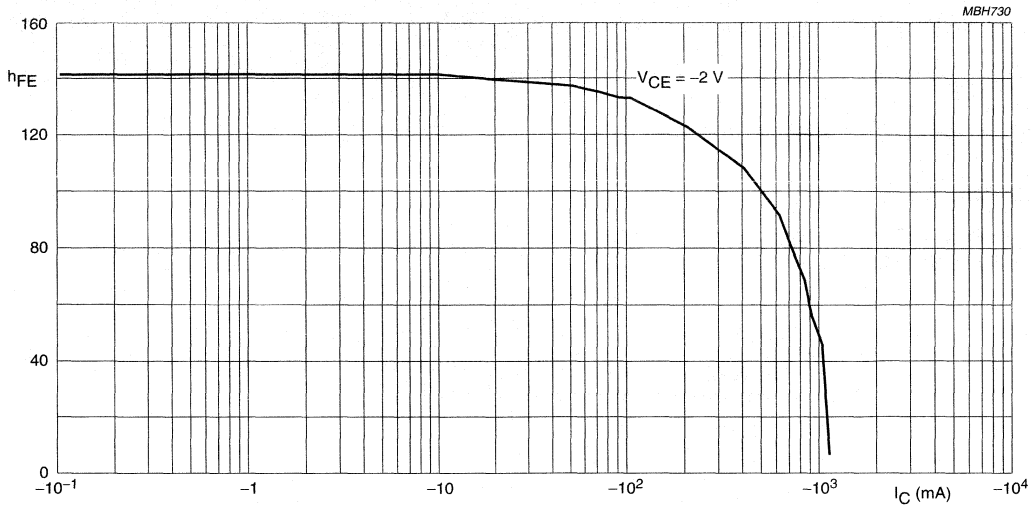


Fig.2 DC current gain; typical values.

PNP general purpose transistor BC807

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BC817.

MARKING

TYPE NUMBER	MARKING CODE (1)
BC807	5D*
BC807-16	5A*
BC807-25	5B*
BC807-40	5C*

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

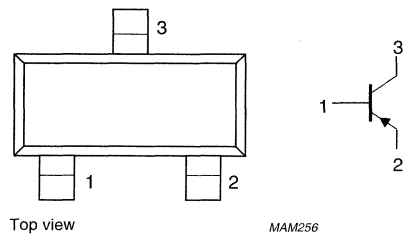


Fig.1 Simplified outline (SOT23) and symbol.

Note

1. * = p: Made in Hong Kong. * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base; I_C = –10 mA	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

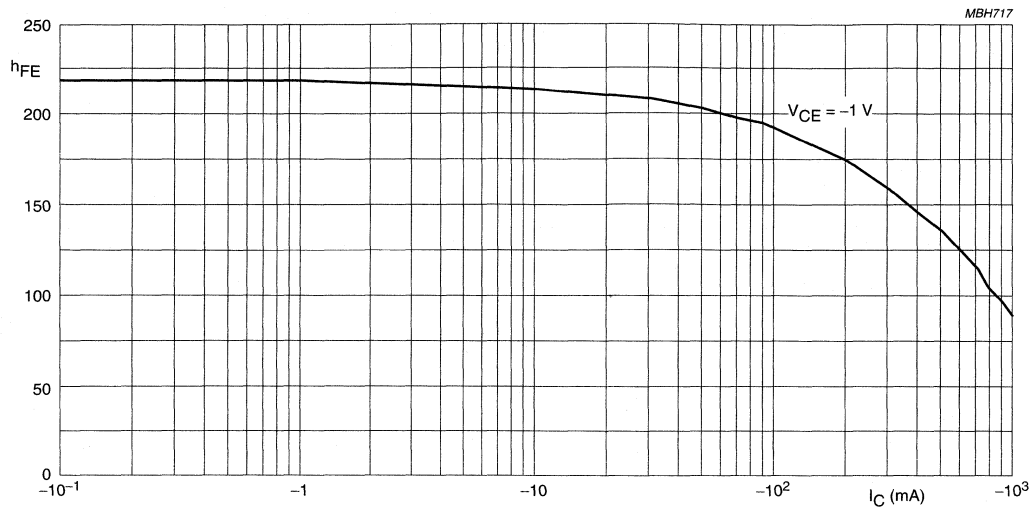
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	–	–	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −100 mA; V_{CE} = −1 V; note 1 see Figs 2, 3 and 4				
	BC807		100	–	600	
	BC807-16		100	–	250	
	BC807-25		160	–	400	
	BC807-40		250	–	600	
h_{FE}	DC current gain	I_C = −500 mA; V_{CE} = −1 V; note 1	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA; note 1	–	–	−700	mV
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −1 V; notes 1 and 2	–	–	−1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	9	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	80	–	–	MHz

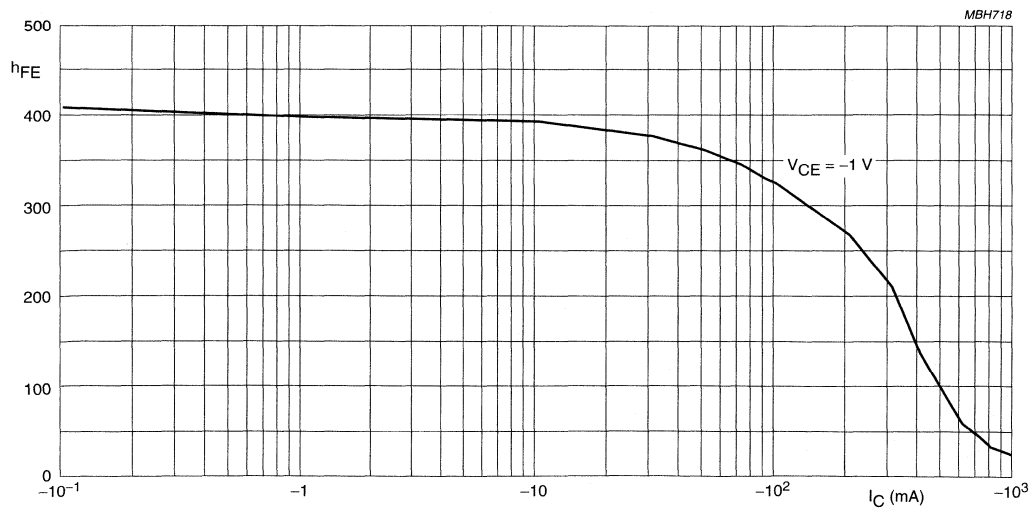
Notes

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.
2. V_{BE} decreases by about −2 mV/K with increasing temperature.



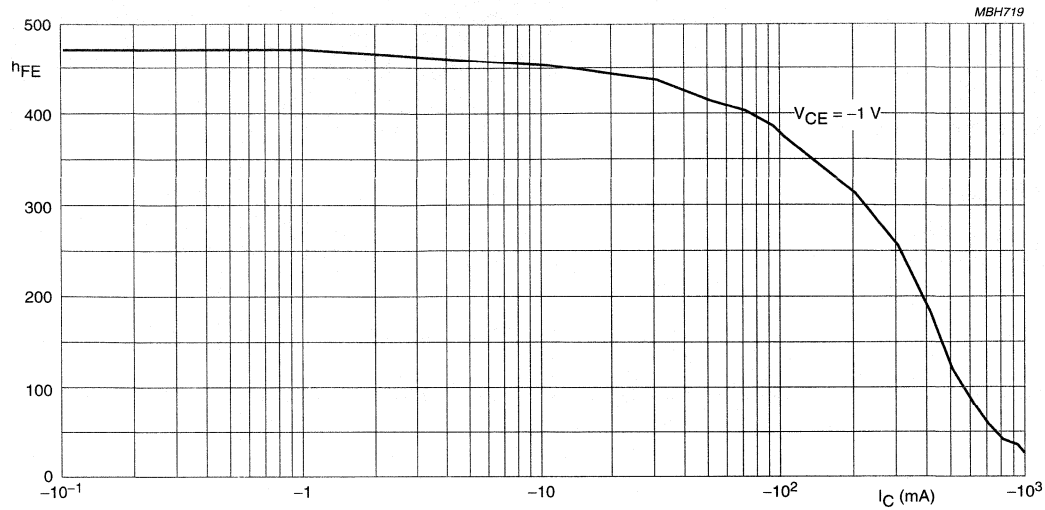
BC807-16.

Fig.2 DC current gain; typical values.



BC807-25.

Fig.3 DC current gain; typical values.



BC807-40.

Fig.4 DC current gain; typical values.

PNP general purpose transistor BC807W

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT323 plastic package.
NPN complement: BC817W.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC807W	5D*	BC807-25W	5B*
BC807-16W	5A*	BC807-40W	5C*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

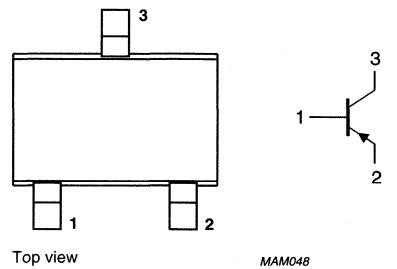


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base; I_C = –10 mA	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

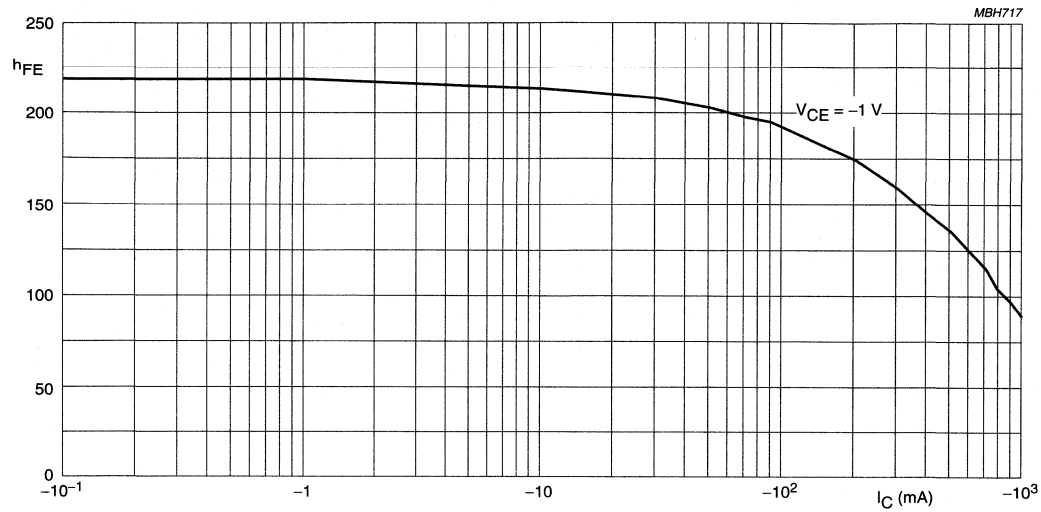
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –20 V	–	–100	nA
		I_E = 0; V_{CB} = –20 V; T_j = 150 °C	–	–5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–100	nA
h_{FE}	DC current gain BC807W BC807-16W BC807-25W BC807-40W	I_C = –100 mA; V_{CE} = –1 V; note 1; see Figs 2, 3 and 4	 100 100 160 250	 600 250 400 600	
	DC current gain	I_C = –500 mA; V_{CE} = –1 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA; note 1	–	–700	mV
V_{BE}	base-emitter voltage	I_C = –500 mA; V_{CE} = –1 V; note 1	–	–1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	80	–	MHz

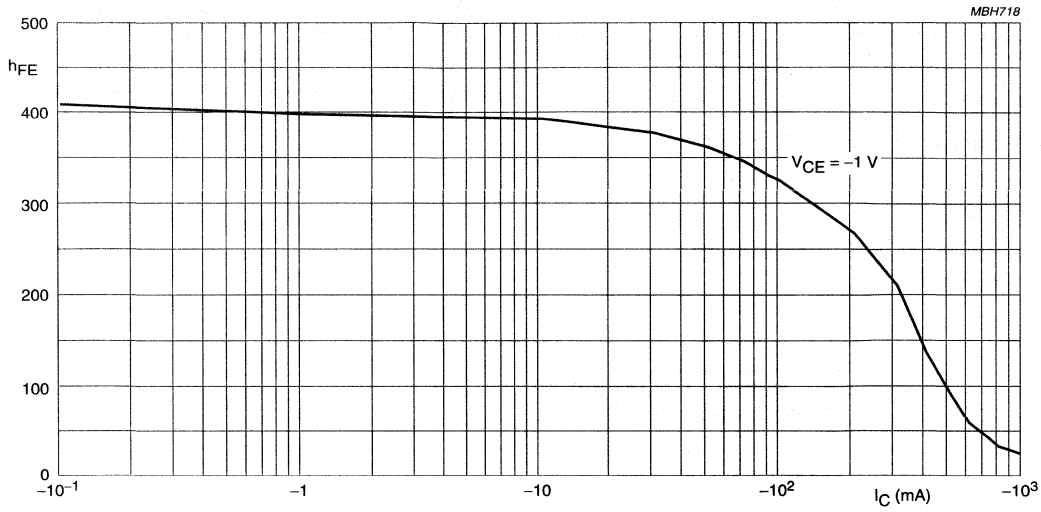
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



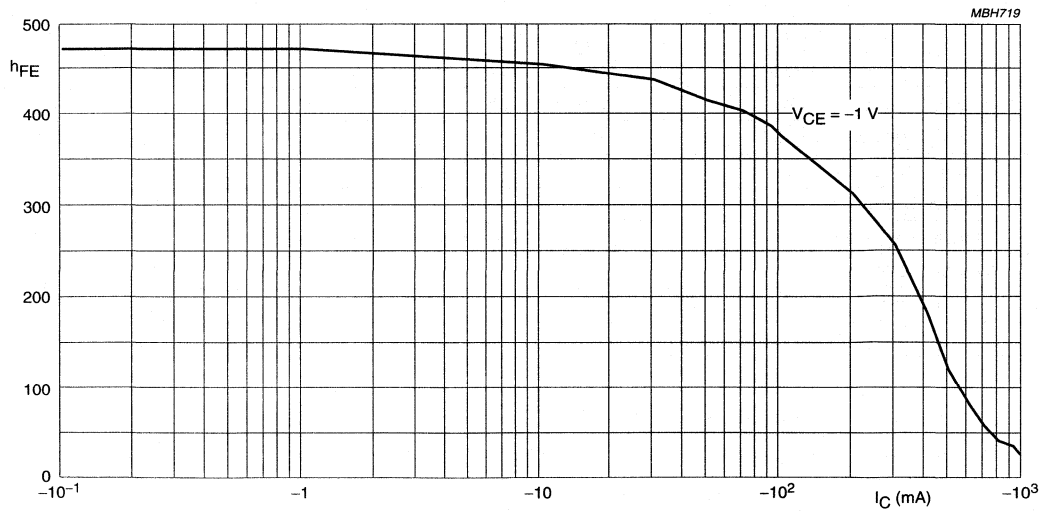
BC807-16W.

Fig.2 DC current gain; typical values.



BC807-25W.

Fig.3 DC current gain; typical values.



BC807-40W.

Fig.4 DC current gain; typical values.

NPN general purpose transistor BC817

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complement: BC807.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC817	6D*	BC817-25	6B*
BC817-16	6A*	BC817-40	6C*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

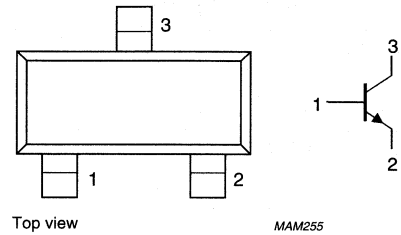


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base; I_C = 10 mA	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

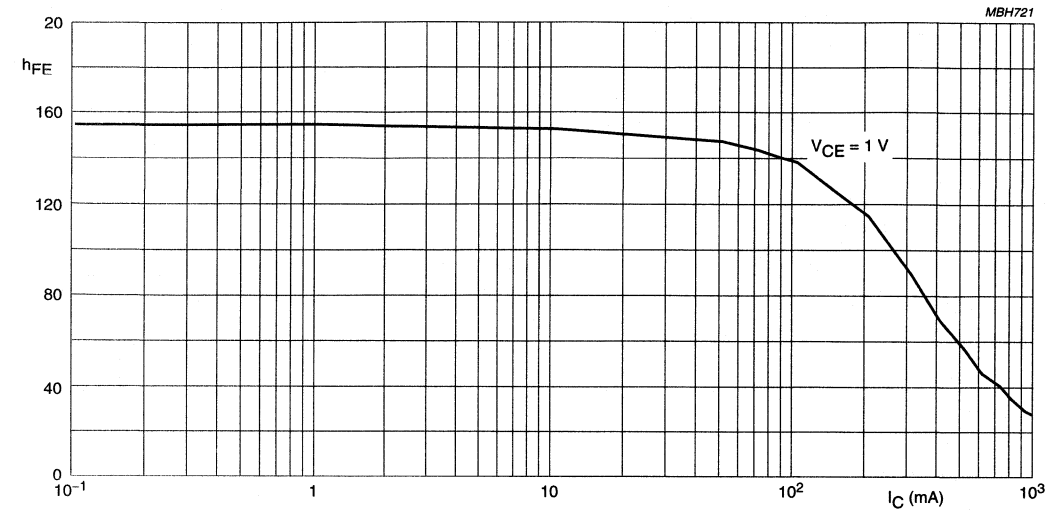
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 1 V; note 1; see Figs 2, 3 and 4				
	BC817		100	–	600	
	BC817-16		100	–	250	
	BC817-25		160	–	400	
	BC817-40		250	–	600	
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 1 V; note 1	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1	–	–	700	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 1 V; note 2	–	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz;	–	5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz;	100	–	–	MHz

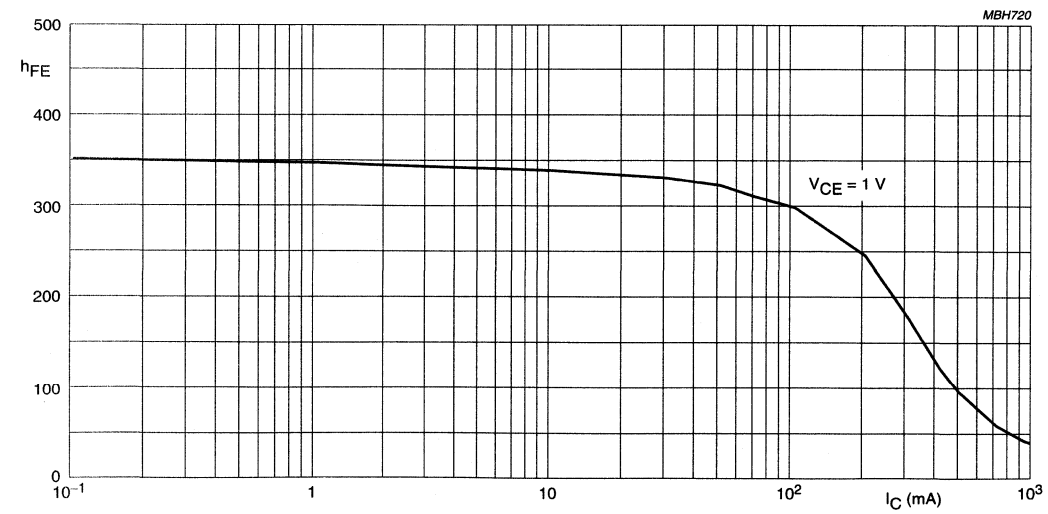
Notes

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.
2. V_{BE} decreases by approx. 2 mV/K with increasing temperature.



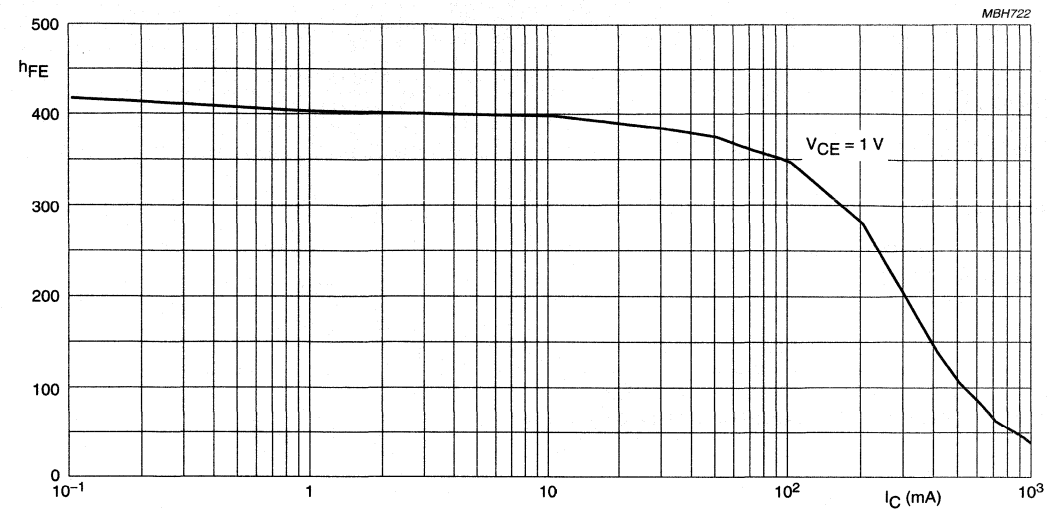
BC817-16.

Fig.2 DC current gain; typical values.



BC817-25.

Fig.3 DC current gain; typical values.



BC817-40.

Fig.4 DC current gain; typical values.

NPN general purpose transistor BC817W

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT323 plastic package.
PNP complement: BC807W.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC817W	6D*	BC818W	6H*
BC817-16W	6A*	BC818-16W	6E*
BC817-25W	6B*	BC818-25W	6F*
BC817-40W	6C*	BC818-40W	6G*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

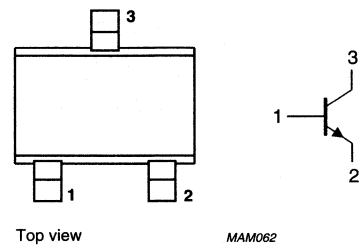


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base; I_C = 10 mA	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

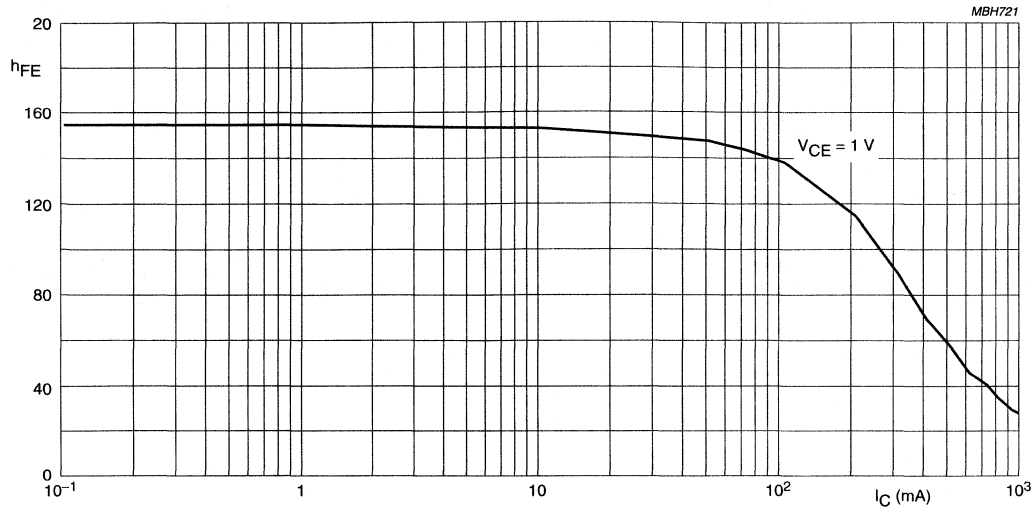
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain BC817W BC817-16W BC817-25W BC817-40W	I_C = 100 mA; V_{CE} = 1 V; note 1; see Figs 2, 3 and 4	 100 100 160 250	 600 250 400 600	
	DC current gain	I_C = 500 mA; V_{CE} = 1 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1	–	700	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 1 V; note 1	–	1.2	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	5	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	MHz

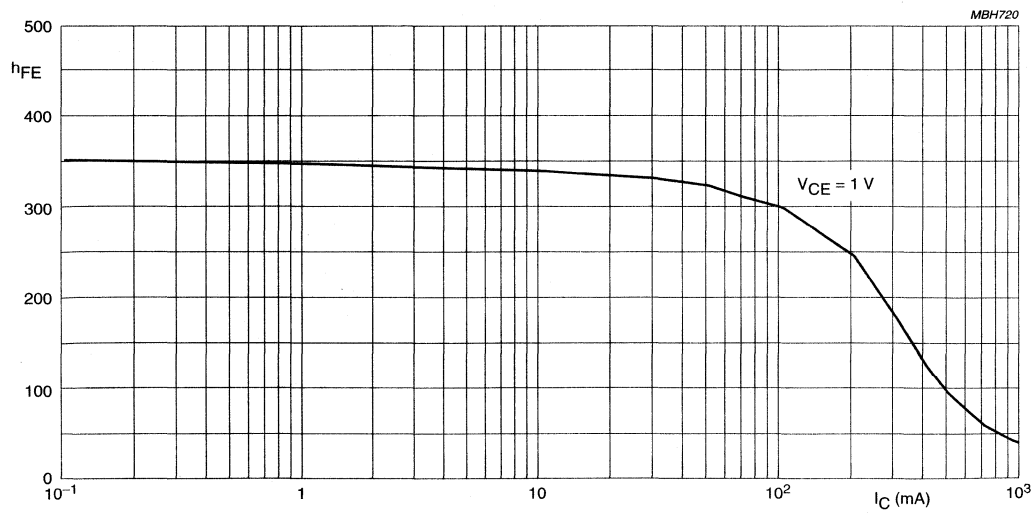
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



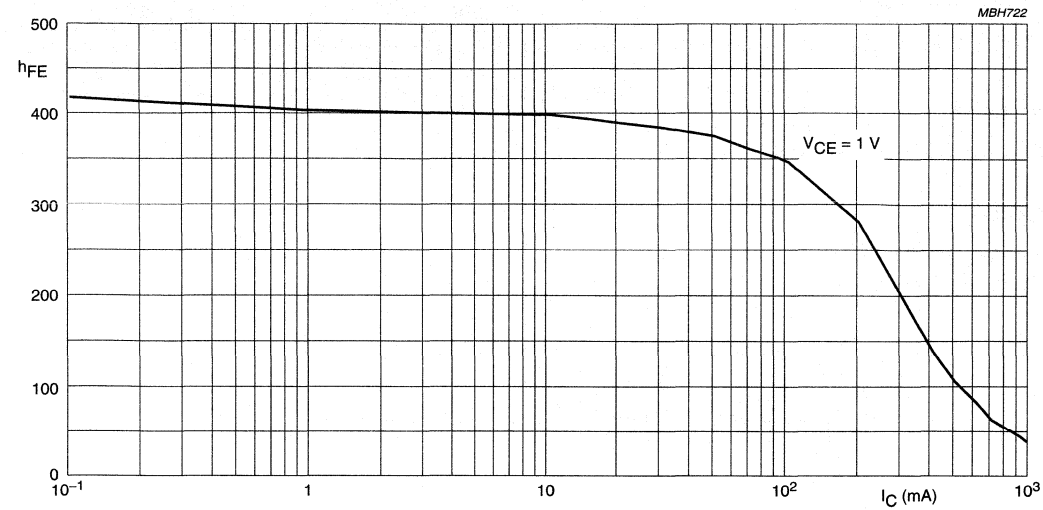
BC817-16W.

Fig.2 DC current gain; typical values.



BC817-25W.

Fig.3 DC current gain; typical values.



BC817-40W.

Fig.4 DC current gain; typical values.

NPN general purpose transistors BC846; BC847

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complements: BC856 and BC857.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE(1)
BC846	1D*	BC847A	1E*
BC846A	1A*	BC847B	1F*
BC846B	1B*	BC847C	1G*
BC847	1H*		

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

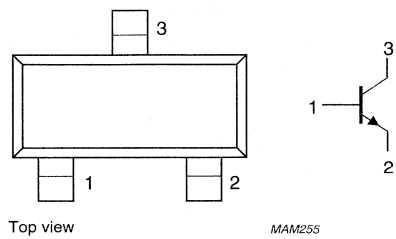


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC846		–	80	V
	BC847		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC846		–	65	V
	BC847		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

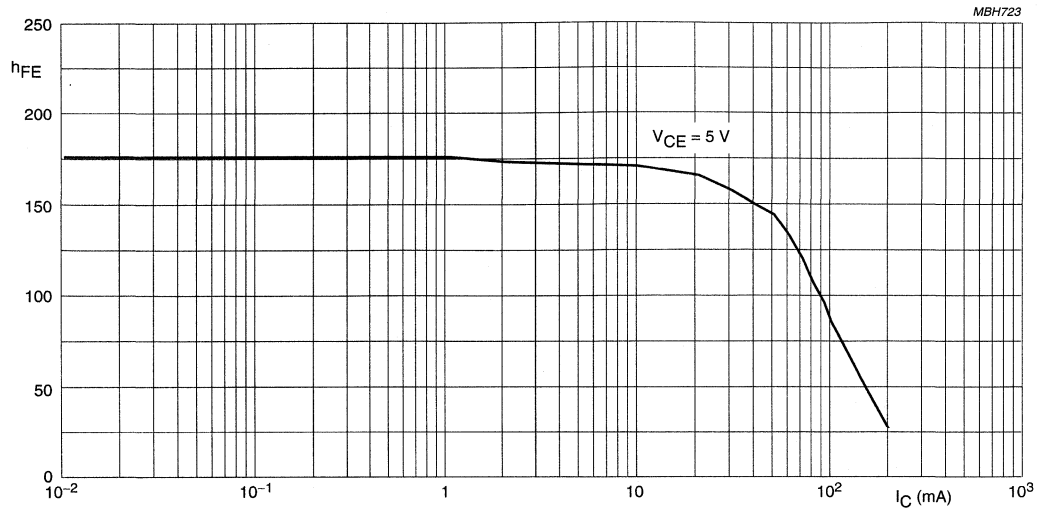
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain BC846A; BC847A BC846B; BC847B BC847C	I_C = 10 µA; V_{CE} = 5 V; see Figs 2, 3 and 4	 – – –	 90 150 270	 – – –	
	DC current gain BC846 BC847 BC846A;BC847A BC846B; BC847B BC847C	I_C = 2 mA; V_{CE} = 5 V; see Figs 2, 3 and 4	 110 110 110 200 420	 – – 180 290 520	 450 800 220 450 800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	770	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz;	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz;	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	10	dB

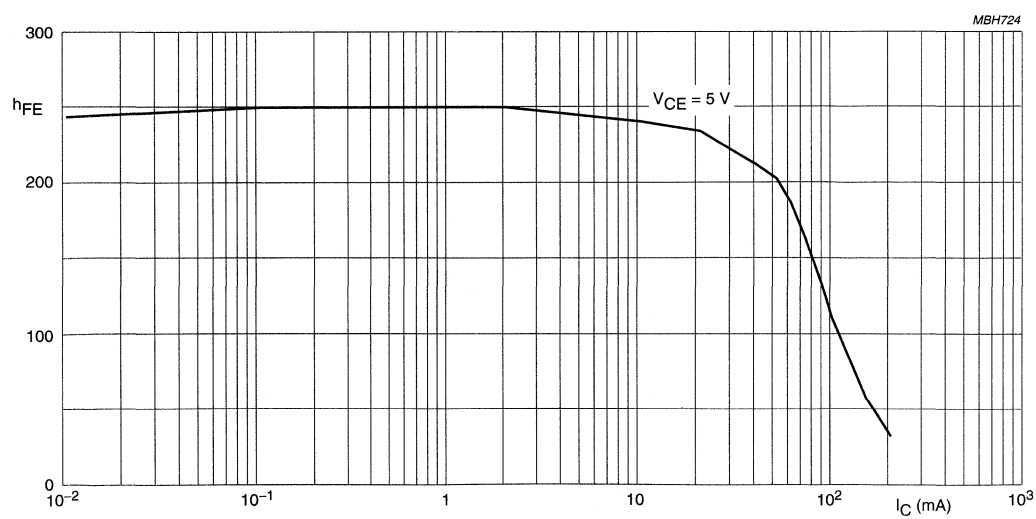
Notes

1. V_{BEsat} decreases by about 1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about 2 mV/K with increasing temperature.



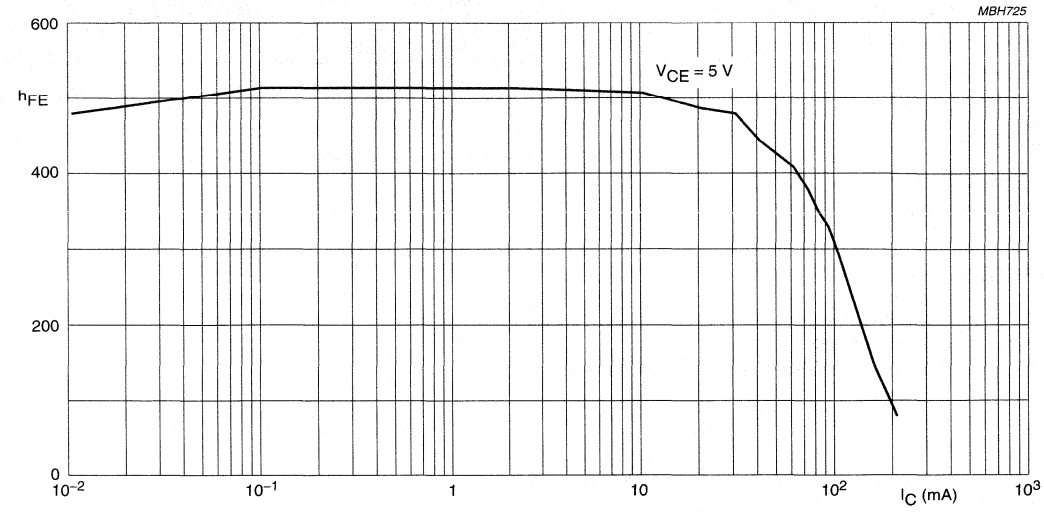
BC846A; BC847A.

Fig.2 DC current gain; typical values.



BC846B; BC847B.

Fig.3 DC current gain; typical values.



BC847C.

Fig.4 DC current gain; typical values.

NPN general purpose transistors BC846F; BC847F; BC848F series

FEATURES

- Power dissipation comparable to SOT23
- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification, especially in portable equipment.

DESCRIPTION

NPN transistor encapsulated in an ultra small SC-89 (SOT490) plastic SMD package.
PNP complements: BC856F, BC857F and BC858F series.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BC846AF	1A	BC847CF	1G
BC846BF	1B	BC848AF	1J
BC847AF	1E	BC848BF	1K
BC847BF	1F	BC848CF	1L

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

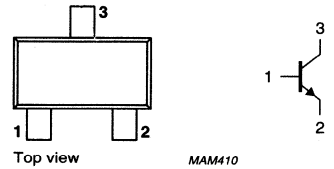


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC846AF; BC846BF		–	80	V
	BC847AF; BC847BF; BC847CF		–	50	V
	BC848AF; BC848BF; BC848CF		–	30	V
V_{CEO}	collector-emitter voltage	open base			
	BC846AF; BC846BF		–	65	V
	BC847AF; BC847BF; BC847CF		–	45	V
	BC848AF; BC848BF; BC848CF		–	30	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V			
	BC846AF; BC847AF; BC848AF		110	220	
	BC846BF; BC847BF; BC848BF		200	450	
	BC847CF; BC848CF		420	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	200	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	400	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	580	700	mV
		I_C = 10 mA; V_{CE} = 5 V	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	10	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

NPN general purpose double transistor BC846S

FEATURES

- Two transistors in one package with SC-88 dimensions
- Reduces number of components and board space
- No mutual interference between the transistors.

APPLICATIONS

- The transistors are intended for general purpose switching and small signal amplification.

DESCRIPTION

NPN double transistor in an SC-88 plastic six lead package.

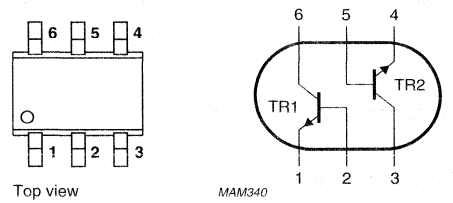


Fig.1 Simplified outline (SC-88) and symbol.

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
BC846S	4Ft

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	80	V
V_{CEO}	collector-emitter voltage	open base	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

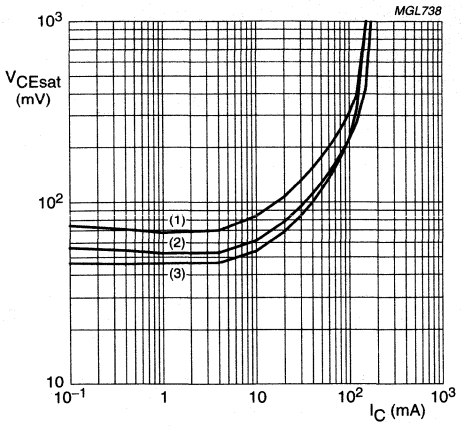
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V	110	220	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	100	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	MHz

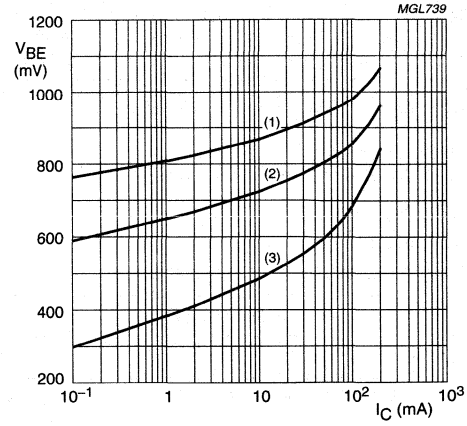
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



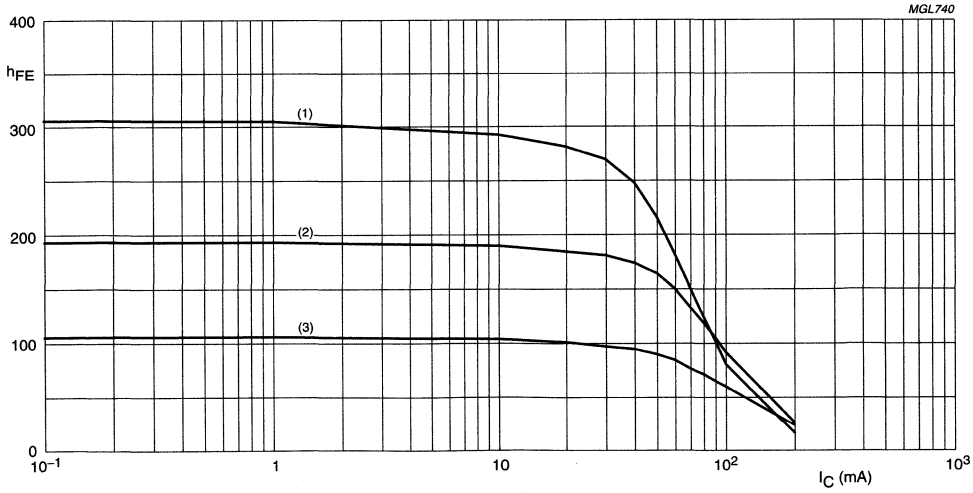
$I_C/I_B = 20$.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -55$ °C.

Fig.2 Collector-emitter saturation voltage as a function of collector current; typical values.



$V_{CE} = 5$ V.
(1) $T_{amb} = -55$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 150$ °C.

Fig.3 Base-emitter voltage as a function of collector current; typical values.



$V_{CE} = 5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -55$ °C.

Fig.4 DC current gain as a function of collector current; typical values.

NPN general purpose transistors | BC846T; BC847T

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification, especially in portable communication equipment
- Electronic data processing (EDP) and consumer applications.

DESCRIPTION

NPN transistor in an SC-75 plastic package.
PNP complements: BC856T and BC857T.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BC846AT	1A	BC847BT	1F
BC846BT	1B	BC847CT	1G
BC847AT	1E		

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

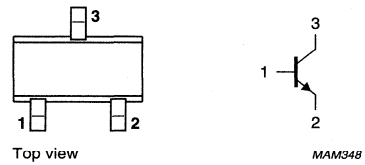


Fig.1 Simplified outline (SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC846AT; BC846BT		–	80	V
	BC847AT; BC847BT; BC847CT		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC846AT; BC846BT		–	65	V
	BC847AT; BC847BT; BC847CT		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

PRELIMINARY
Philips Semiconductors for Design-in Information
See Philips Semiconductors

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

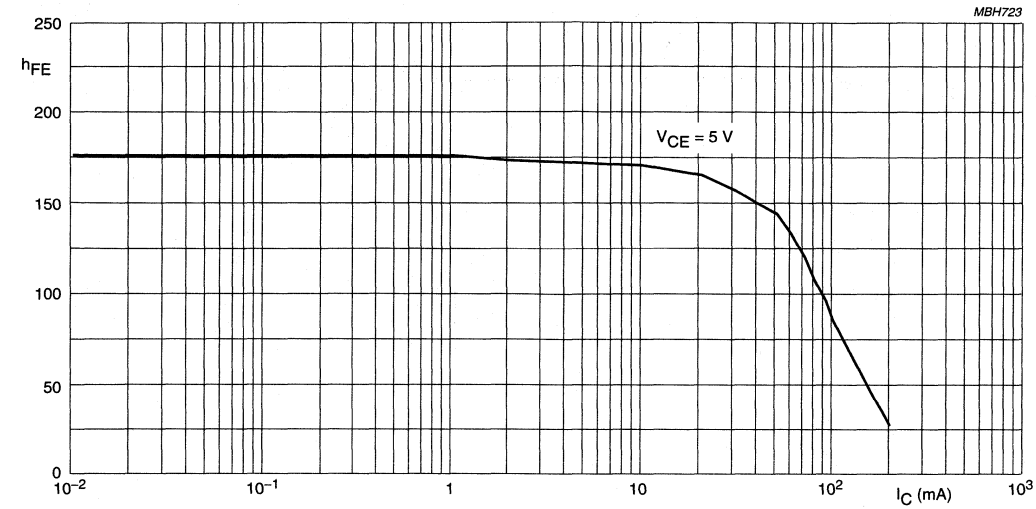
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V				
	BC846AT; BC847AT		110	–	220	
	BC846BT; BC847BT		200	–	450	
	BC847CT		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	200	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	–	400	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	580	–	700	mV
		I_C = 10 mA; V_{CE} = 5 V	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	1.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

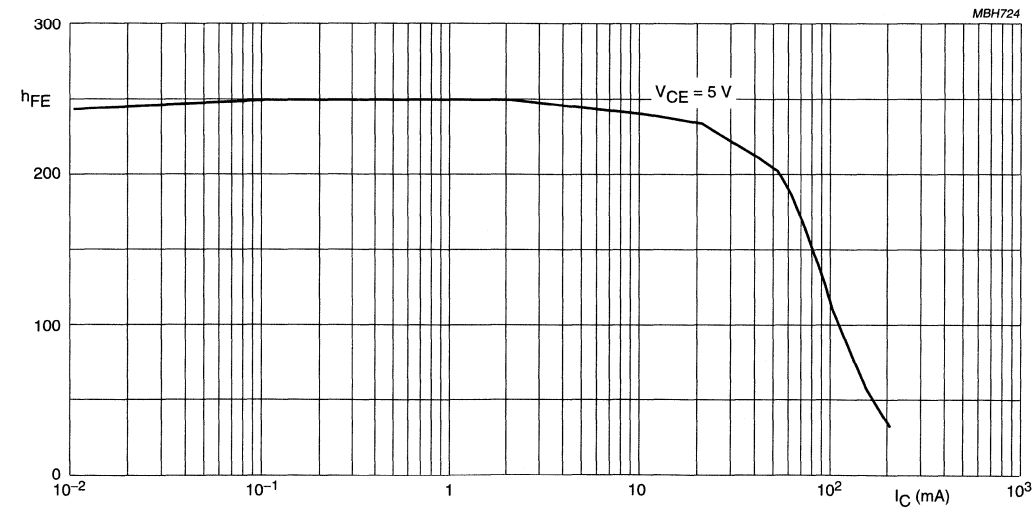
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



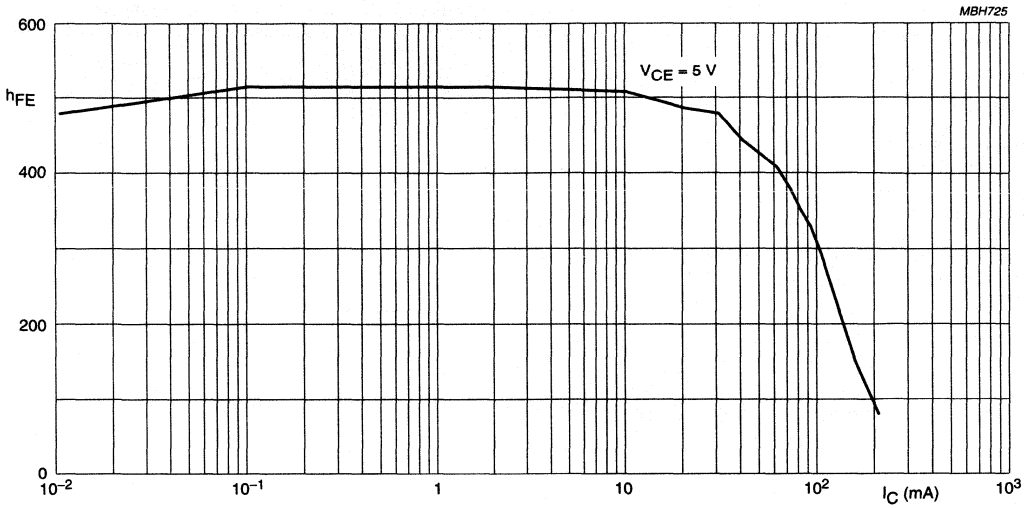
BC846AT; BC847AT.

Fig.2 DC current gain; typical values.



BC846BT; BC847BT.

Fig.3 DC current gain; typical values.



BC847CT.

Fig.4 DC current gain; typical values.

NPN general purpose transistors BC846W; BC847W

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SC70; SOT323 plastic package.
PNP complements: BC856W and BC857W.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC846W	1D*	BC847AW	1E*
BC846AW	1A*	BC847BW	1F*
BC846BW	1B*	BC847CW	1G*
BC847W	1H*		

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

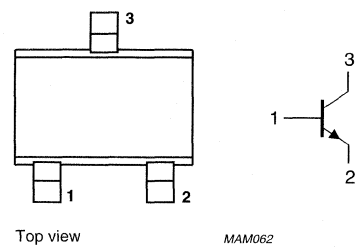


Fig.1 Simplified outline (SC70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC846W		–	80	V
	BC847W		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC846W		–	65	V
	BC847W		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

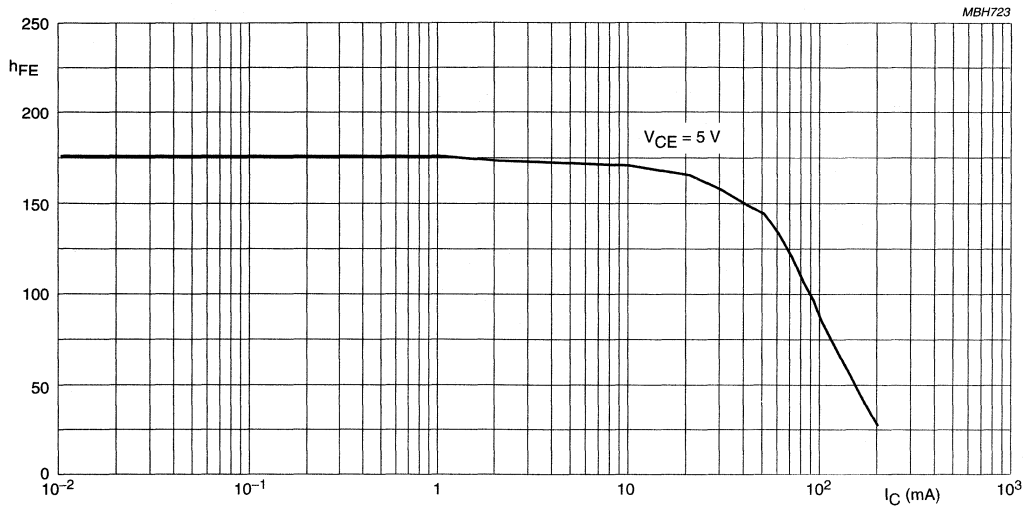
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V; see Figs 2, 3 and 4				
	BC846W		110	–	450	
	BC847W		110	–	800	
	BC846AW; BC847AW		110	–	220	
	BC846BW; BC847BW		200	–	450	
	BC847CW		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	250	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	–	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	580	–	700	mV
		I_C = 10 mA; V_{CE} = 5 V	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	3	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

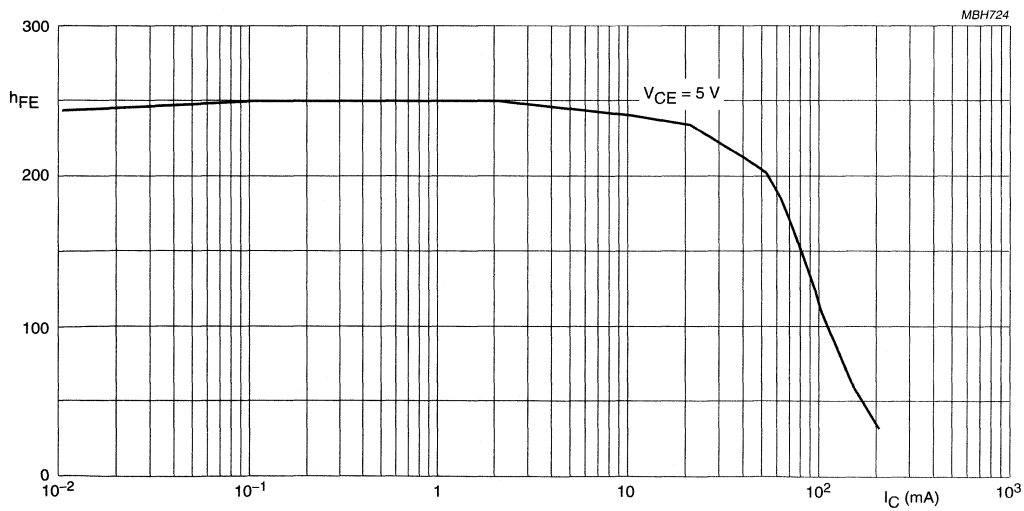
Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



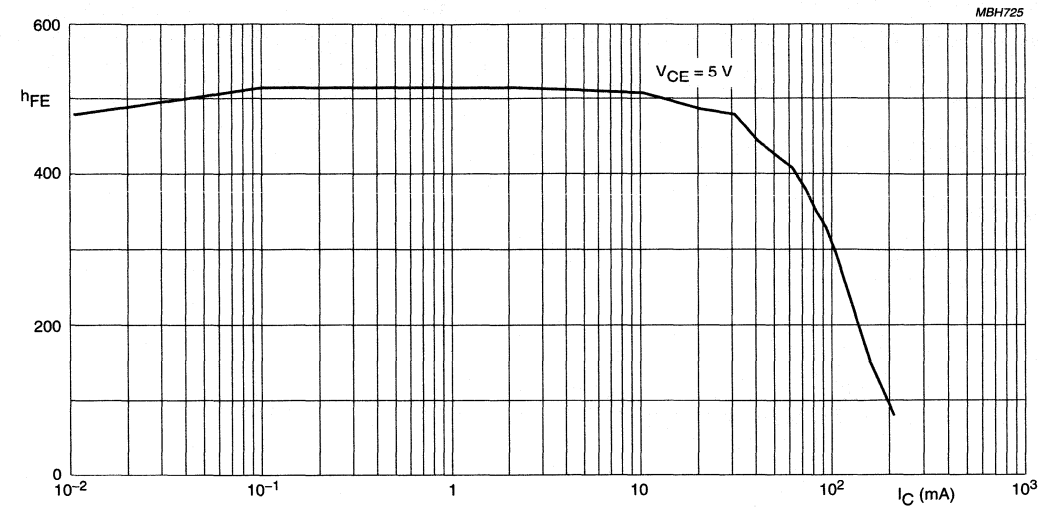
BC846AW; BC847AW.

Fig.2 DC current gain; typical values.



BC846BW; BC847BW.

Fig.3 DC current gain; typical values.



BC847CW.

Fig.4 DC current gain; typical values.

NPN general purpose transistors BC849; BC850

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complements: BC859 and BC860.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC849B	2B*	BC850B	2F*
BC849C	2C*	BC850C	2G*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

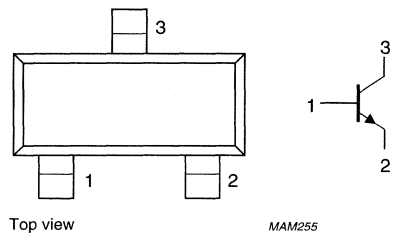


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC849		–	30	V
	BC850		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC849		–	30	V
	BC850		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

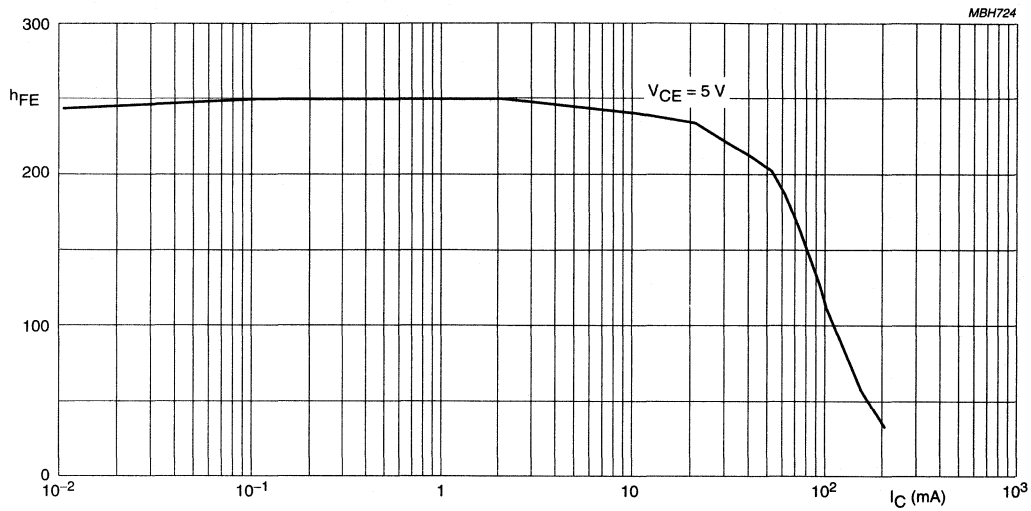
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain BC849B; BC850B BC849C; BC850C	I_C = 10 µA; V_{CE} = 5 V; see Figs 2 and 3	 – –	 240 450	 – –	
	DC current gain BC849B; BC850B BC849C; BC850C	I_C = 2 mA; V_{CE} = 5 V; see Figs 2 and 3	 200 420	 290 520	 450 800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	–	4	dB
		I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

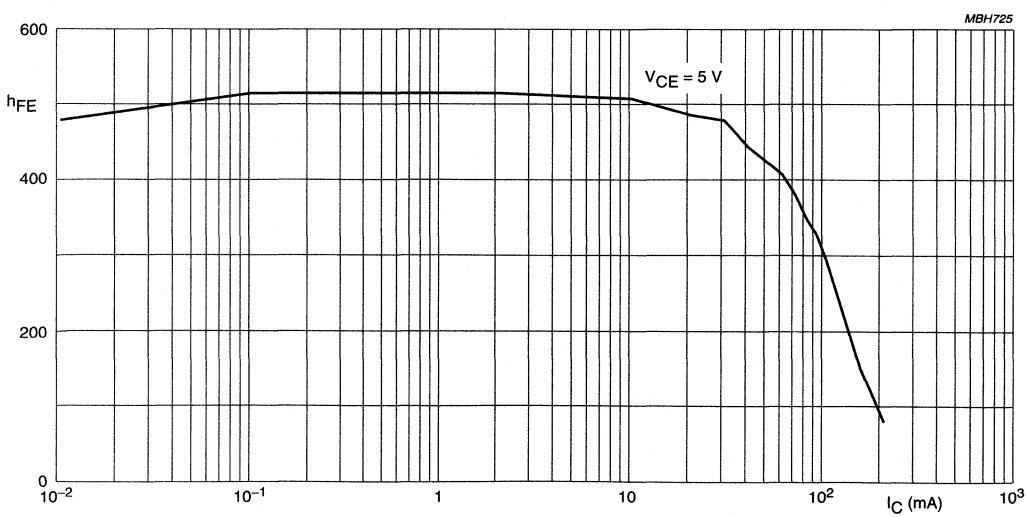
Notes

1. V_{BEsat} decreases by about 1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about 2 mV/K with increasing temperature.



BC849B; BC850B.

Fig.2 DC current gain; typical values.



BC849C; BC850C.

Fig.3 DC current gain; typical values.

NPN general purpose transistors BC849W; BC850W

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Low noise stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment.

DESCRIPTION

NPN transistor in a SOT323 plastic package.
PNP complements: BC859W and BC860W.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC849BW	2B*	BC850BW	2F*
BC849CW	2C*	BC850CW	2G*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

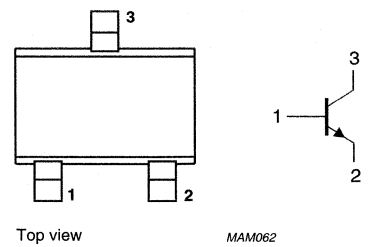


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC849W		–	30	V
	BC850W		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC849W		–	30	V
	BC850W		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

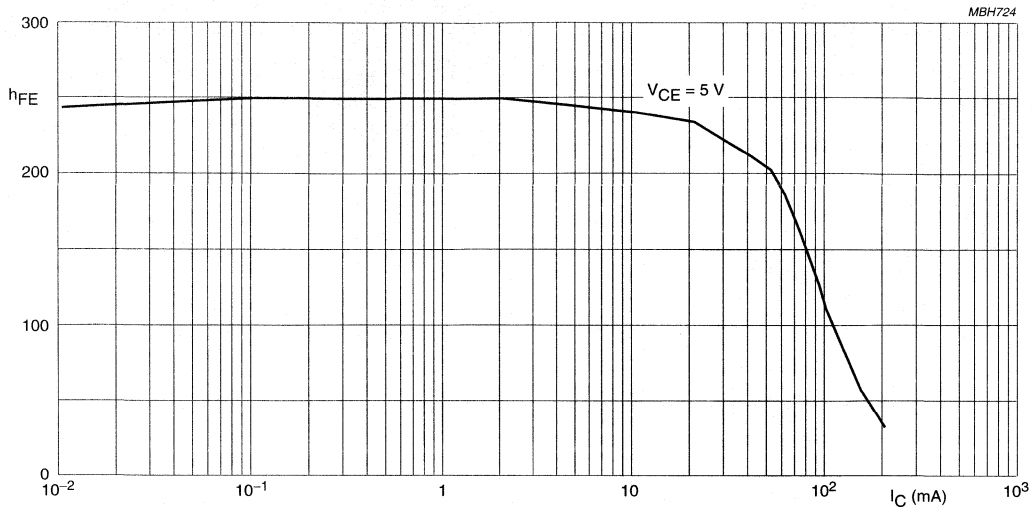
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V; see Figs 2 and 3				
	BC849BW; BC850BW		200	–	450	
	BC849CW; BC850CW		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	250	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	–	600	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	580	–	700	mV
		I_C = 10 mA; V_{CE} = 5 V	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	3	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	–	4	dB
		I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

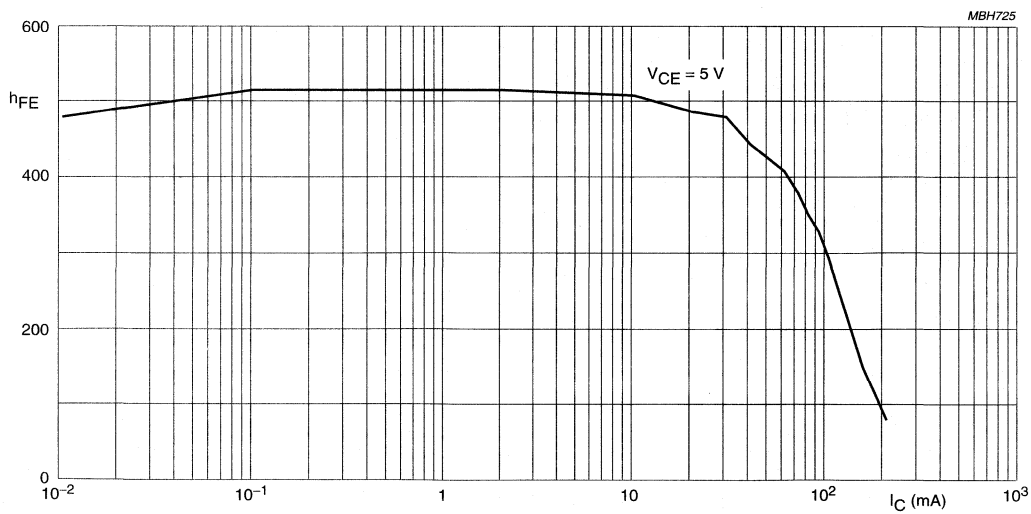
Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



BC849BW; BC850BW.

Fig.2 DC current gain; typical values.



BC849CW; BC850CW.

Fig.3 DC current gain; typical values.

PNP general purpose transistors BC856; BC857

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BC846 and BC847.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC856	3D*	BC857A	3E*
BC856A	3A*	BC857B	3F*
BC856B	3B*	BC857C	3G*
BC857	3H*		

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

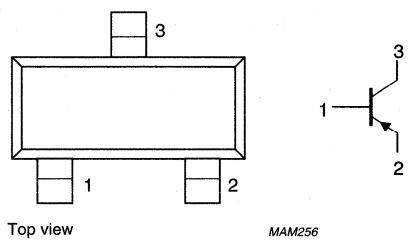


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC856		–	–80	V
	BC857		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC856		–	–65	V
	BC857		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Mounted on an FR4 printed-circuit board.

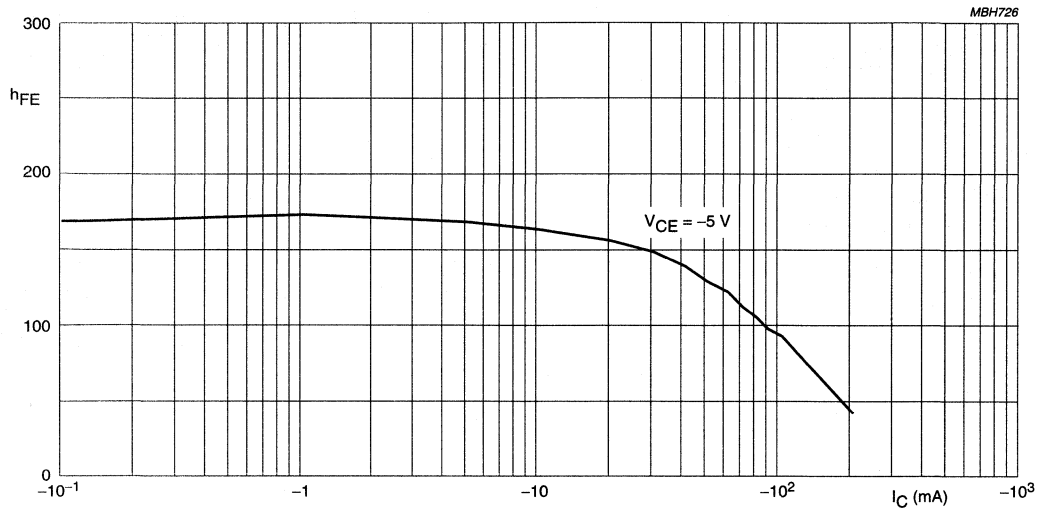
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−1	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V; see Figs 2, 3 and 4				
	BC856		125	–	475	
	BC857		125	–	800	
	BC856A; BC857A		125	–	250	
	BC856B; BC857B		220	–	475	
	BC857C		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−75	−300	mV
		I_C = −100 mA; I_B = −5 mA	–	−250	−650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 1	–	−700	–	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−850	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V; note 2	−600	−650	−750	mV
		I_C = −10 mA; V_{CE} = −5 V; note 2	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	4.5	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	10	dB

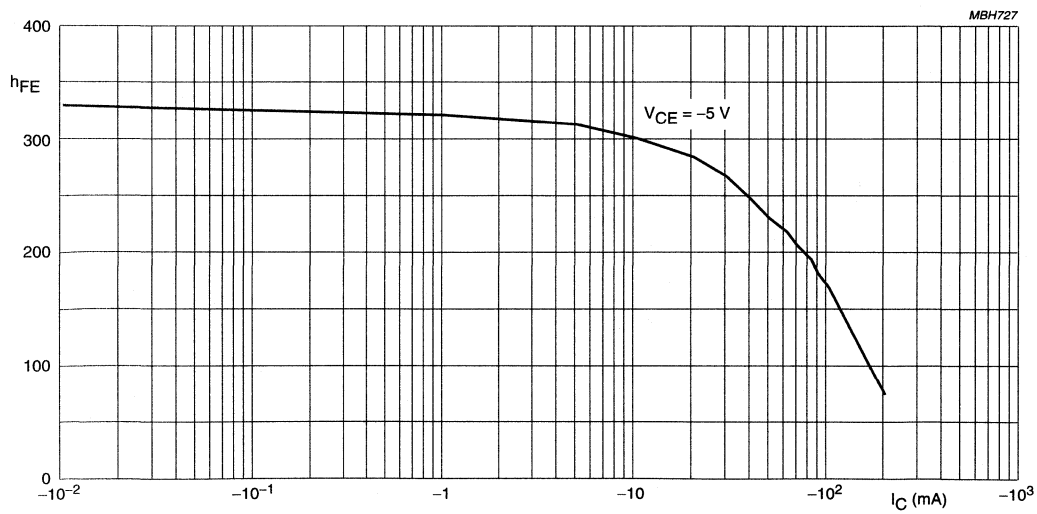
Notes

1. V_{BEsat} decreases by about −1.7 m K/V with increasing temperature.
2. V_{BE} decreases by about −2 mV/K with increasing temperature.



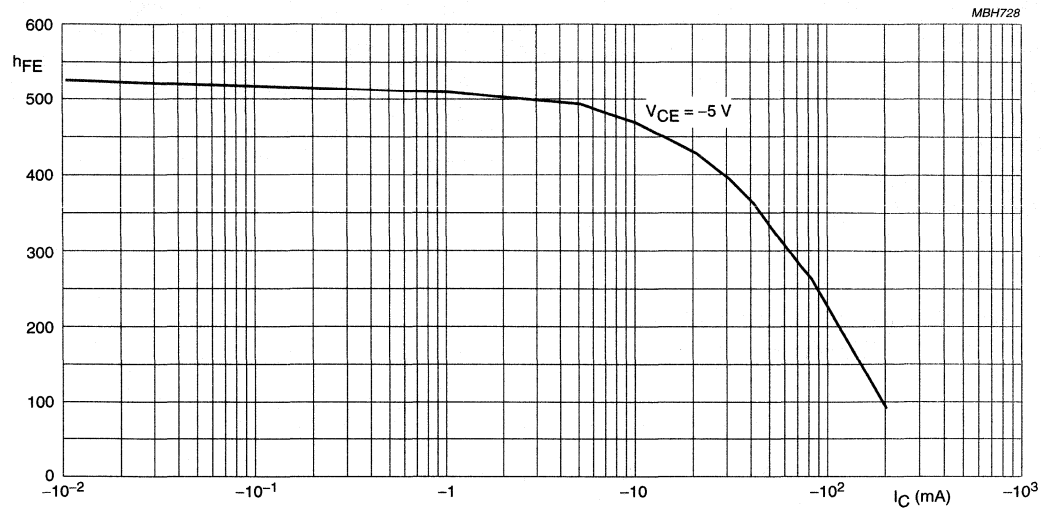
BC856A; BC857A.

Fig.2 DC current gain; typical values.



BC856B; BC857B.

Fig.3 DC current gain; typical values.



BC857C.

Fig.4 DC current gain; typical values.

PNP general purpose transistors BC856F; BC857F; BC858F series

FEATURES

- Power dissipation comparable to SOT23
- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification especially in portable equipment.

DESCRIPTION

PNP transistor encapsulated in an ultra small SC-89 (SOT490) plastic SMD package.
NPN complements: BC846F, BC847F and BC848F series.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BC856AF	3A	BC857CF	3G
BC856BF	3B	BC858AF	3J
BC857AF	3E	BC858BF	3K
BC857BF	3F	BC858CF	3L

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

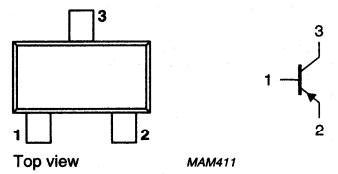


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC856AF; BC856BF		–	–80	V
	BC857AF; BC857BF; BC857CF		–	–50	V
	BC858AF; BC858BF; BC858CF		–	–30	V
V_{CEO}	collector-emitter voltage	open base			
	BC856AF; BC856BF		–	–65	
	BC857AF; BC857BF; BC857CF		–	–45	
	BC858AF; BC858BF; BC858CF		–	–30	
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	−	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V			
	BC856AF; BC857AF; BC858AF		125	250	
	BC856BF; BC857BF; BC858BF		220	475	
	BC857CF; BC858CF		420	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	−	−200	mV
		I_C = −100 mA; I_B = −5 mA; note 1	−	−400	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	−750	mV
		I_C = −10 mA; V_{CE} = −5 V	−	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	2.5	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	−	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 220 Hz	−	10	dB

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistors BC856T; BC857T

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification especially in portable equipment.

DESCRIPTION

PNP transistor in an SC-75 plastic package.
NPN complements: BC846T and BC847T.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BC856AT	3A	BC857BT	3F
BC856BT	3B	BC857CT	3G
BC857AT	3E		

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

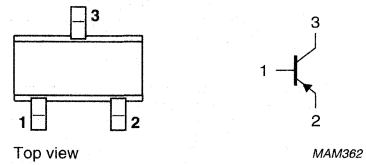


Fig.1 Simplified outline (SC-75) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC856AT; BC856BT		–	–80	V
	BC857AT; BC857BT; BC857CT		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC856AT; BC856BT		–	–65	V
	BC857AT; BC857BT; BC857CT		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

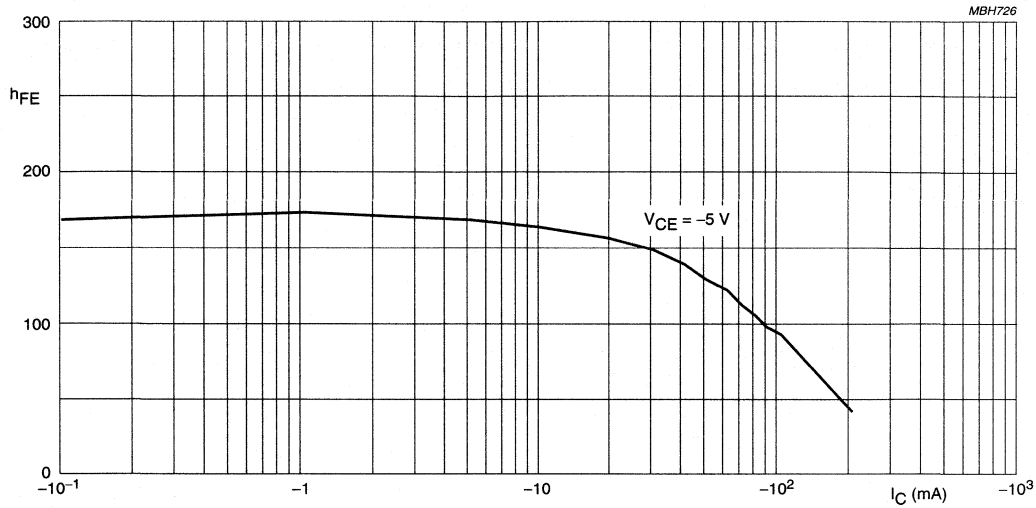
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V				
	BC856AT; BC857AT		125	–	250	
	BC856BT; BC857BT		220	–	475	
	BC857CT		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−200	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	–	−400	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	–	−750	mV
		I_C = −10 mA; V_{CE} = −5 V	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	2.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 220 Hz	–	–	10	dB

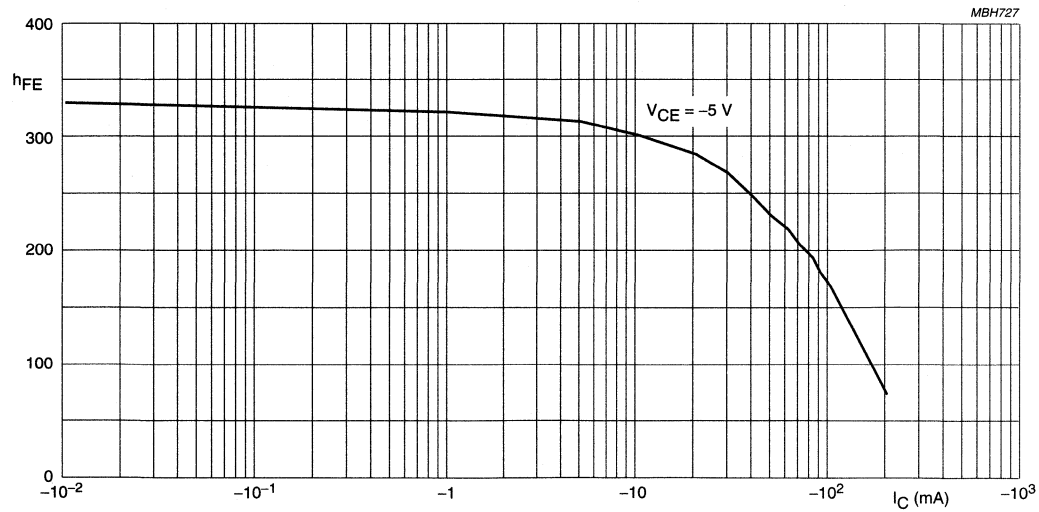
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



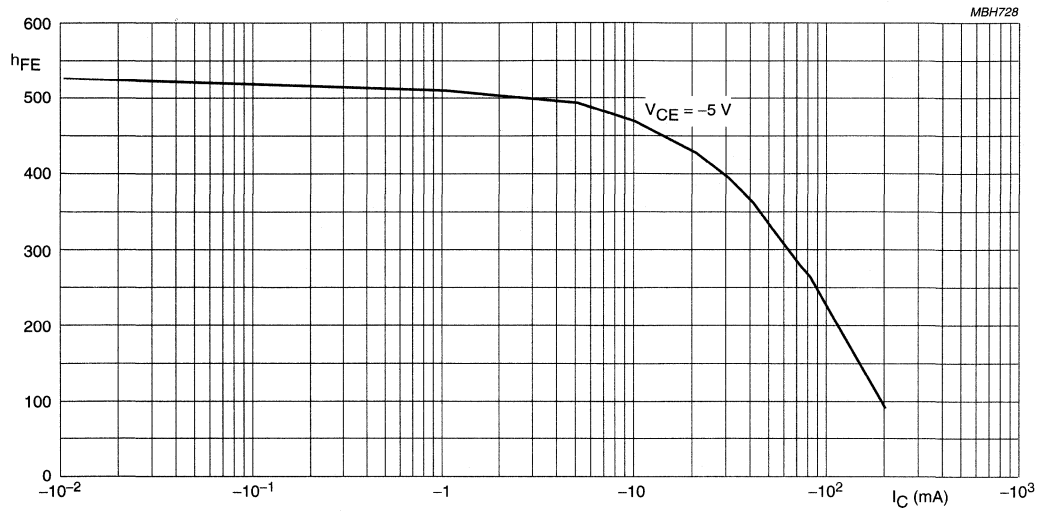
BC856AT; BC857AT.

Fig.2 DC current gain; typical values.



BC856BT; BC857BT.

Fig.3 DC current gain; typical values.



BC857CT.

Fig.4 DC current gain; typical values.

PNP general purpose transistors BC856W; BC857W

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 80)
- S-mini package.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a plastic SOT323 package.
NPN complements: BC846W and BC847W.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC856W	3D*	BC857AW	3E*
BC856AW	3A*	BC857BW	3F*
BC856BW	3B*	BC857CW	3G*
BC857W	3H*		

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

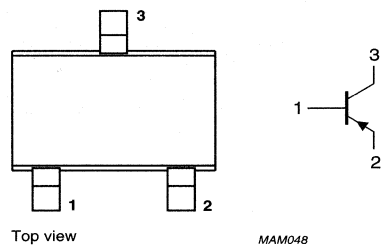


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC856W		–	–80	V
	BC857W		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC856W		–	–65	V
	BC857W		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

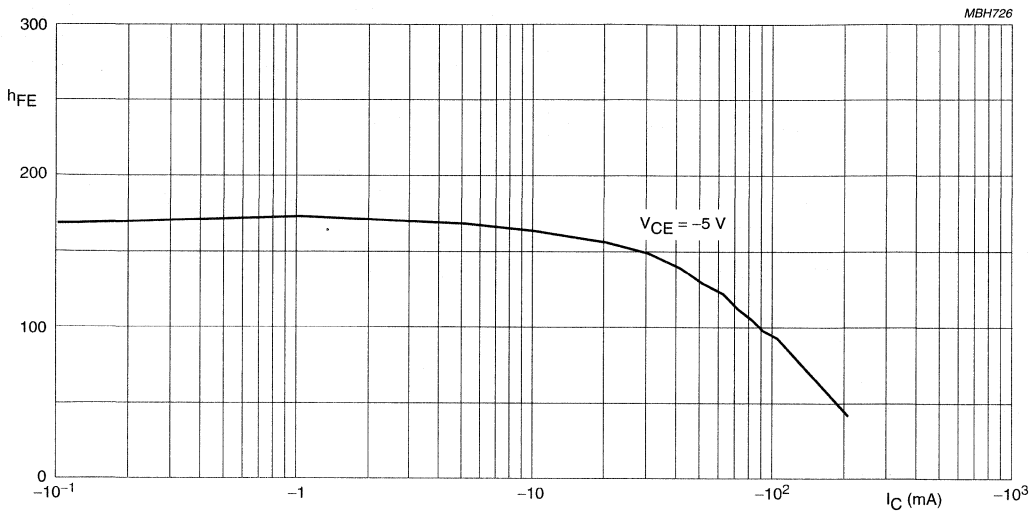
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–15	nA
		I_E = 0; V_{CB} = –30 V; T_j = 150 °C	–	–4	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–100	nA
h_{FE}	DC current gain BC856W BC857W BC856AW; BC857AW BC856BW; BC857BW BC857CW	I_C = –2 mA; V_{CE} = –5 V; see Figs 2, 3 and 4	 125 125 125 220 420	 475 800 250 475 800	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA	–	–300	mV
		I_C = –100 mA; I_B = –5 mA; note 1	–	–650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –100 mA; I_B = –5 mA; note 1	–	–950	mV
V_{BE}	base-emitter voltage	I_C = –2 mA; V_{CE} = –5 V	–600	–750	mV
		I_C = –10 mA; V_{CE} = –5 V	–	–820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	5	pF
C_e	emitter capacitance	$I_C = i_c$ =0; V_{EB} = –0.5 V; f = 1 MHz	–	12	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	100	–	MHz
F	noise figure	I_C = –200 µA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	10	dB

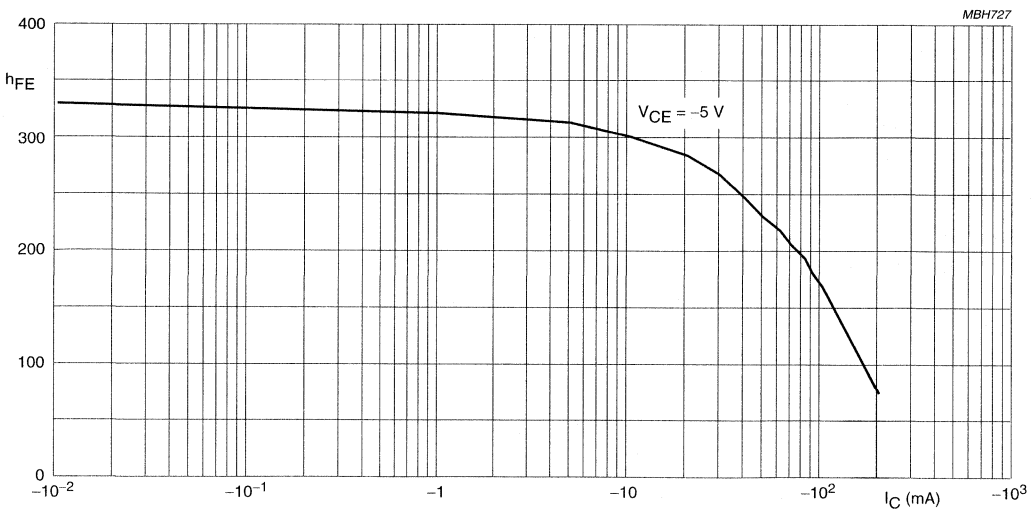
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



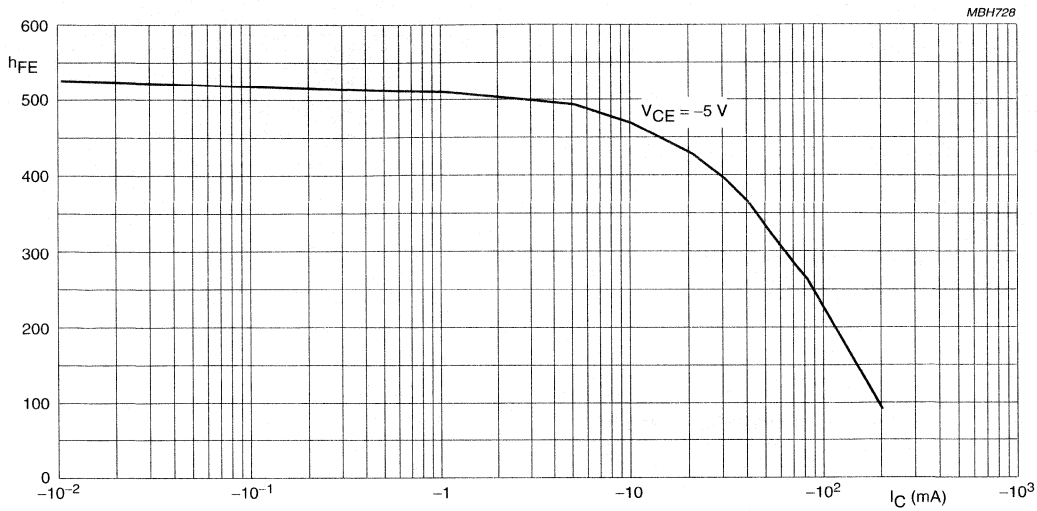
BC856AW; BC857AW.

Fig.2 DC current gain; typical values.



BC856BW; BC857BW.

Fig.3 DC current gain; typical values.



BC857CW.

Fig.4 DC current gain; typical values.

PNP general purpose transistors BC859; BC860

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Low noise input stages of audio frequency equipment.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BC849 and BC850.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BC859B	4B*	BC860B	4F*
BC859C	4C*	BC860C	4G*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

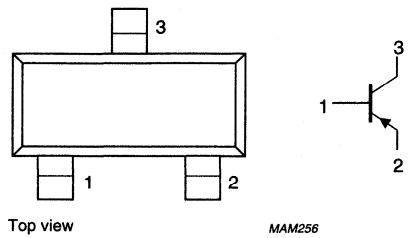


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC859		–	–30	V
	BC860		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC859		–	–30	V
	BC860		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

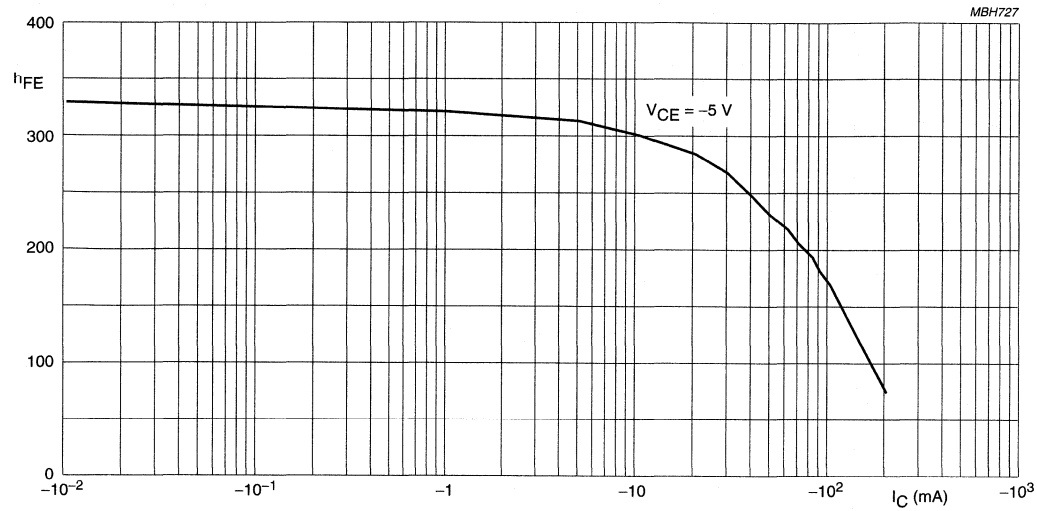
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–1	–15	nA
		I_E = 0; V_{CB} = –30 V; T_j = 150 °C	–	–	–4	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain BC859B; BC860B BC859C; BC860C	I_C = –2 mA; V_{CE} = –5 V; see Figs 2 and 3	 220 420	 – –	 475 800	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA	–	–75	–300	mV
		I_C = –100 mA; I_B = –5 mA	–	–250	–650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA; note 1	–	–700	–	mV
		I_C = –100 mA; I_B = –5 mA; note 1	–	–850	–	mV
V_{BE}	base-emitter voltage	I_C = –2 mA; V_{CE} = –5 V; note 2	–600	–650	–750	mV
		I_C = –10 mA; V_{CE} = –5 V; note 2	–	–	–820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	4.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	100	–	–	MHz
F	noise figure BC859B; BC860B; BC859C; BC860C	I_C = –200 µA; V_{CE} = –5 V; R_S = 2 kΩ; f = 30 Hz to 15 kHz	–	–	4	dB
	noise figure BC859B; BC860B; BC859C; BC860C	I_C = –200 µA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

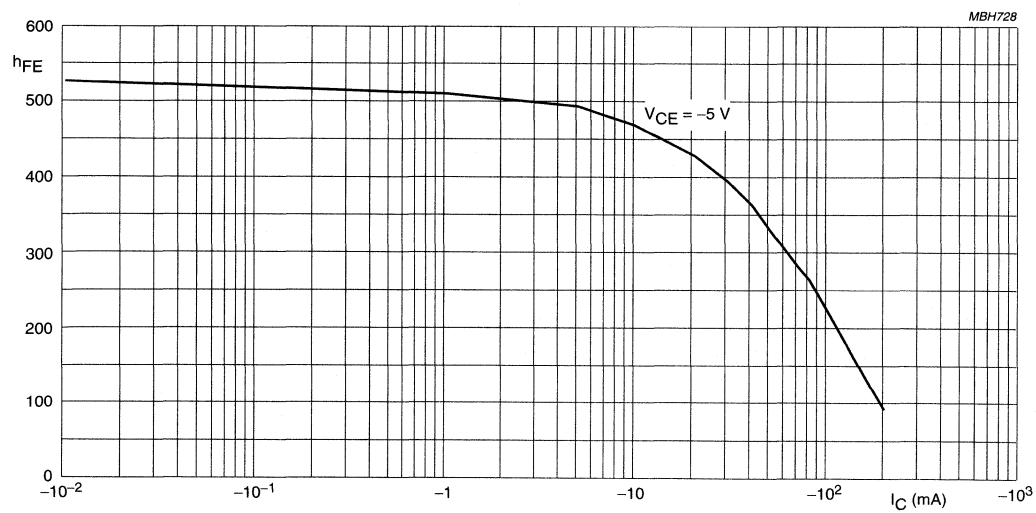
Notes

1. V_{BEsat} decreases by about –1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about –2 mV/K with increasing temperature.



BC859B; BC860B.

Fig.2 DC current gain; typical values.



BC859C; BC860C.

Fig.3 DC current gain; typical values.

PNP general purpose transistors BC859W; BC860W

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Low noise stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment.

DESCRIPTION

PNP transistor in a SOT323 plastic package.
NPN complements: BC849W and BC850W.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BC859W	4D*	BC860W	4H*
BC859BW	4B*	BC860BW	4F*
BC859CW	4C*	BC860CW	4G*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

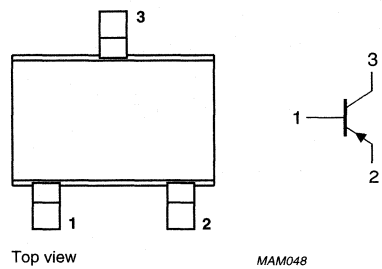


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC859W		–	–30	V
	BC860W		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC859W		–	–30	V
	BC860W		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

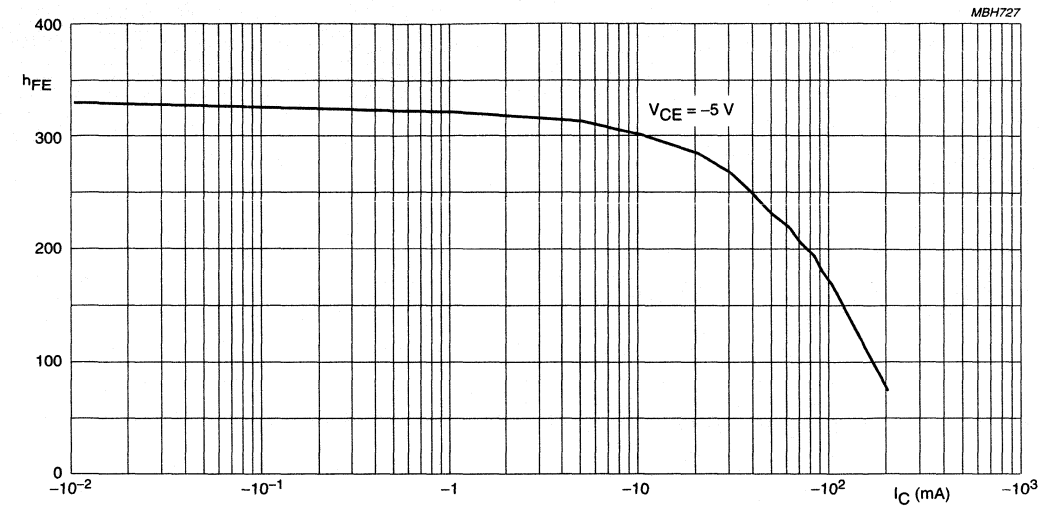
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–	–15	nA
		I_E = 0; V_{CB} = –30 V; T_j = 150 °C	–	–	–4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –2 mA; V_{CE} = –5 V; see Figs 2 and 3				
	BC859W; BC860W		220	–	800	
	BC859BW; BC860BW		220	–	475	
	BC859CW; BC860CW		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA	–	–	–300	mV
		I_C = –100 mA; I_B = –5 mA; note 1	–	–	–650	mV
V_{BE}	base-emitter voltage	I_C = –2 mA; V_{CE} = –5 V	600	–	750	mV
		I_C = –10 mA; V_{CE} = –5 V	–	–	820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	–	5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	100	–	–	MHz
F	noise figure; BC859W; BC860W; BC859BW; BC860BW; BC859CW; BC860CW	I_C = –200 μA; V_{CE} = –5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	–	4	dB
		I_C = –200 μA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

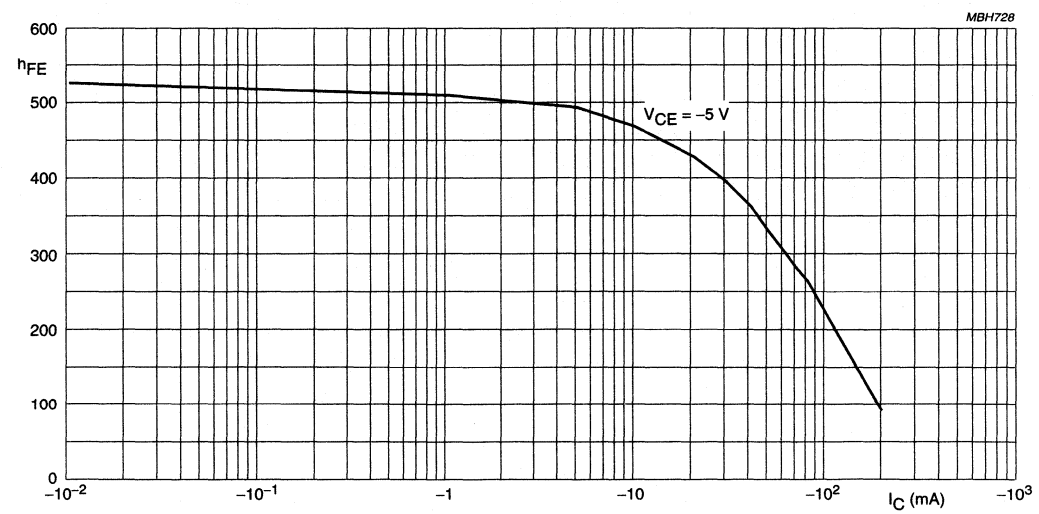
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



BC859BW; BC860BW.

Fig.2 DC current gain; typical values.



BC859CW; BC860CW.

Fig.3 DC current gain; typical values.

NPN medium power transistor BC868

FEATURES

- High current (max. 1 A)
- Low voltage (max. 20 V).

APPLICATIONS

- General purpose switching and amplification
- Power applications such as audio output stages.

DESCRIPTION

NPN medium power transistor in a SOT89 plastic package. PNP complement: BC869.

MARKING

TYPE NUMBER	MARKING CODE
BC868	CAC
BC868-25	CDC

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

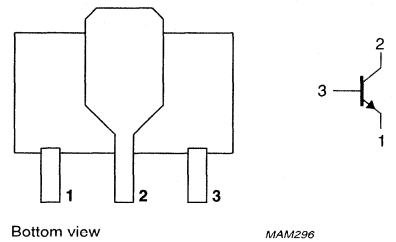


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		13	K/W

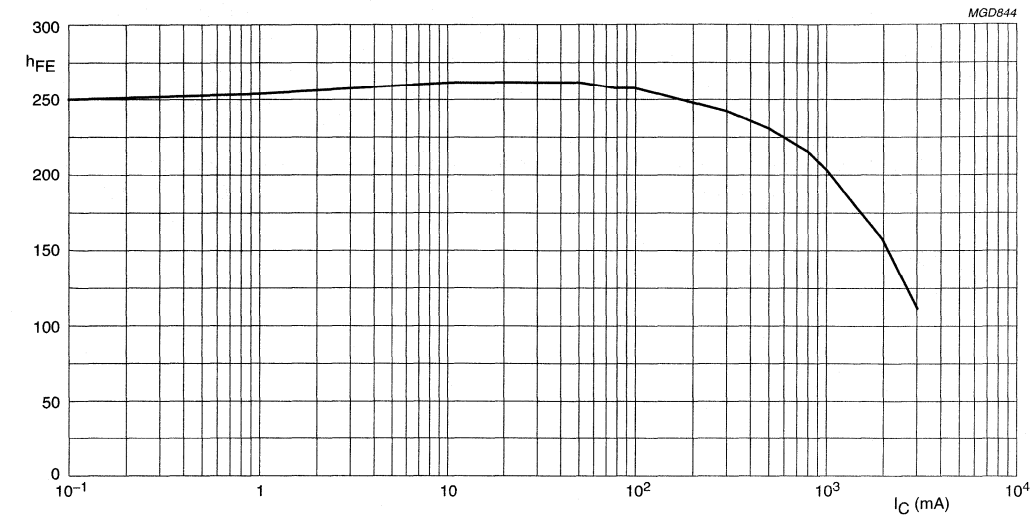
Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 25 V	–	–	100	nA
		I_E = 0; V_{CB} = 25 V; T_j = 150 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	50	–	–	
		I_C = 500 mA; V_{CE} = 1 V; see Fig.2	85	–	375	
		I_C = 1 A; V_{CE} = 1 V; see Fig.2	60	–	–	
	DC current gain BC868-25	I_C = 500 mA; V_{CE} = 1 V; see Fig.2	160	–	375	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	–	–	500	mV
V_{BE}	base-emitter voltage	I_C = 5 mA; V_{CE} = 10 V	–	620	–	mV
		I_C = 1 A; V_{CE} = 1 V	–	–	1	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	40	–	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 0.5 A; $\lvert V_{CE} \rvert$ = 1 V	–	–	1.6	



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

PNP medium power transistor BC869

FEATURES

- High current (max. 1 A)
- Low voltage (max. 20 V).

APPLICATIONS

- Low voltage, high current LF applications.

DESCRIPTION

PNP medium power transistor in a SOT89 plastic package. NPN complement: BC868.

MARKING

TYPE NUMBER	MARKING CODE
BC869	CEC
BC869-16	CGC
BC869-25	CHC

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

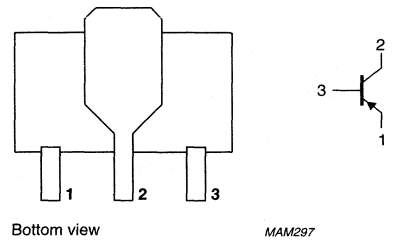


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base	–	–20	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		13	K/W

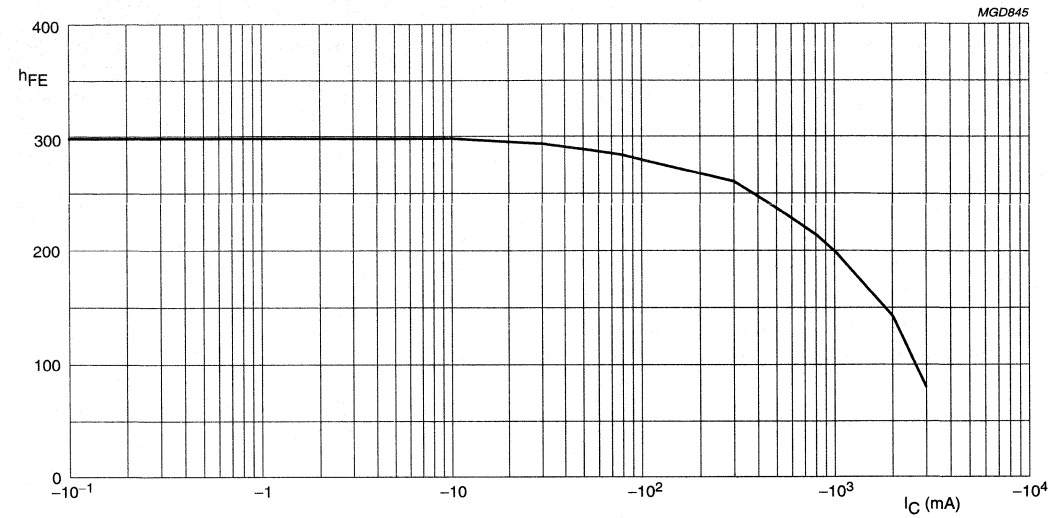
Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –25 V	–	–	–100	nA
		I_E = 0; V_{CB} = –25 V; T_j = 150 °C	–	–	–10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –5 mA; V_{CE} = –10 V; see Fig.2	50	–	–	
		I_C = –500 mA; V_{CE} = –1 V; see Fig.2	100	–	375	
		I_C = –1 A; V_{CE} = –1 V; see Fig.2	60	–	–	
	DC current gain BC869-16 BC869-25	I_C = –500 mA; V_{CE} = –1 V; see Fig.2	 100 160	 – –	 250 375	
V_{CEsat}	collector-emitter saturation voltage	I_C = –1 A; I_B = –100 mA	–	–	–500	mV
V_{BE}	base-emitter voltage	I_C = –5 mA; V_{CE} = –10 V	–	–620	–	mV
		I_C = –1 A; V_{CE} = –1 V	–	–	–1	V
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz	40	–	–	MHz



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.

NPN Darlington transistors BC875; BC879

FEATURES

- High DC current gain (min. 1000)
- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Relay drivers.

DESCRIPTION

NPN Darlington transistor in a TO-92 (SOT54) plastic package. PNP complement: BC878.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

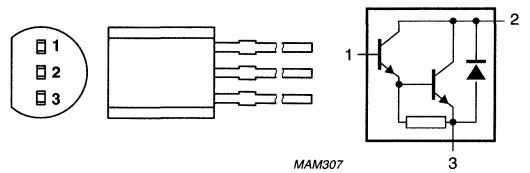


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC875		–	60	V
	BC879		–	100	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BC875		–	45	V
	BC879		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_B	base current (DC)		–	0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

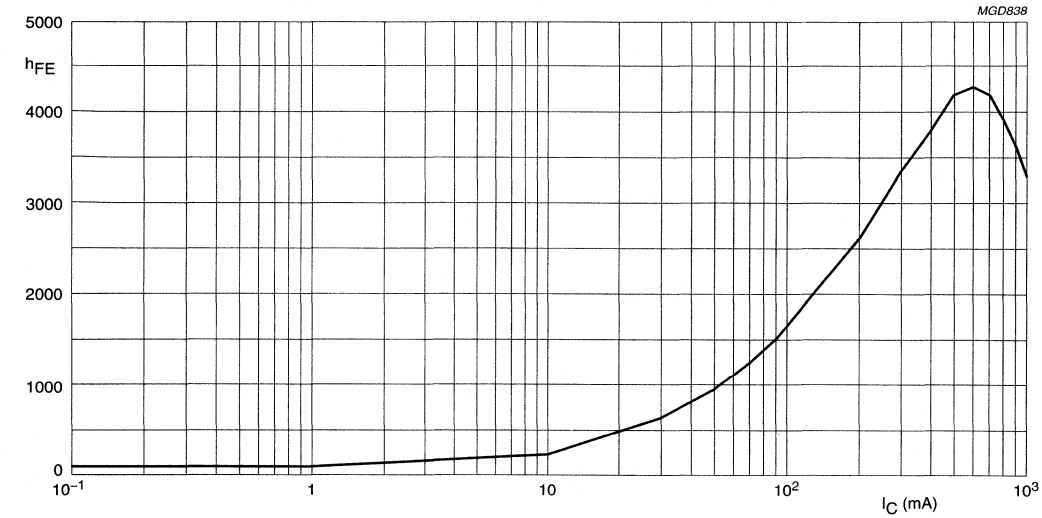
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BC875	V_{BE} = 0; V_{CE} = 45 V	–	–	50	nA
	BC879	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 10 V; see Fig.2	1000	–	–	
		I_C = 0.5 A; V_{CE} = 10 V; see Fig.2	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 0.5 mA	–	–	1.3	V
		I_C = 1 A; I_B = 1 mA	–	–	1.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 1 mA	–	–	2.2	V
f_T	transition frequency	I_C = 0.5 A; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels)						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = −0.5 mA	–	500	–	ns
t_{off}	turn-off time		–	1300	–	ns



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.

PNP Darlington transistor BC878

FEATURES

- High DC current gain (min. 1000)
- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Relay drivers.

DESCRIPTION

PNP Darlington transistor in a TO-92 (SOT54) plastic package. NPN complements: BC875 and BC879.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

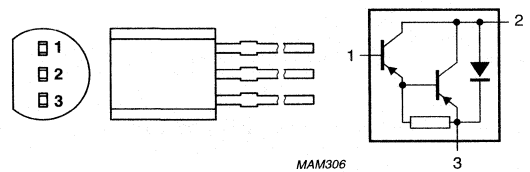


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–80	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_B	base current (DC)		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = −60 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−50	nA
h_{FE}	DC current gain	I_C = −150 mA; V_{CE} = −10 V; see Fig.2	1000	–	–	
		I_C = −0.5 A; V_{CE} = −10 V; see Fig.2	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −0.5 A; I_B = −0.5 mA	–	–	−1.3	V
		I_C = −1 A; I_B = −1 mA	–	–	−1.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = −1 A; I_B = −1 mA	–	–	−2.2	V
f_T	transition frequency	I_C = −0.5 A; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels)						
t_{on}	turn-on time	I_{Con} = −500 mA; I_{Bon} = −0.5 mA; I_{Boff} = 0.5 mA	–	–	500	ns
t_{off}	turn-off time		–	–	700	ns

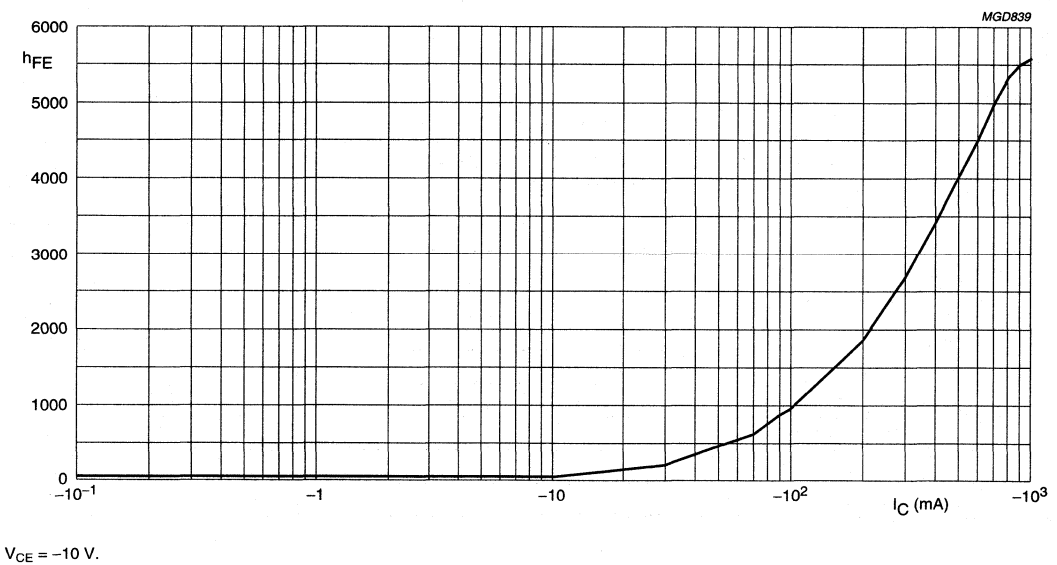


Fig.2 DC current gain; typical values.

NPN general purpose transistor BCF32

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 32 V).

APPLICATIONS

- Low level, low noise general purpose applications in thick and thin-film circuits.

DESCRIPTION

NPN transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCF32	D7*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

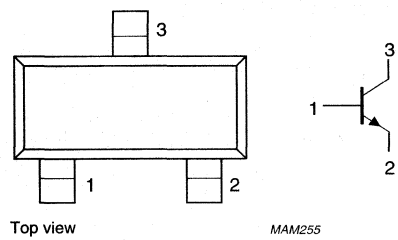


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	32	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 32 V	–	–	100	nA
		I_E = 0; V_{CB} = 32 V; T_j = 100 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 10 μA; V_{CE} = 5 V	–	150	–	
		I_C = 2 mA; V_{CE} = 5 V	200	–	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	120	250	mV
		I_C = 50 mA; I_B = 2.5 mA	–	210	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	750	–	mV
		I_C = 50 mA; I_B = 2.5 mA	–	850	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	550	–	700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	1.2	4	dB

PNP medium power transistors BCP51; BCP52; BCP53

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Medium power (max. 1.3 W).

APPLICATIONS

- Audio, telephony and automotive applications
- Thick and thin-film circuits.

DESCRIPTION

PNP medium power transistor in a SOT223 plastic package. NPN complements: BCP54, BCP55 and BCP56.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

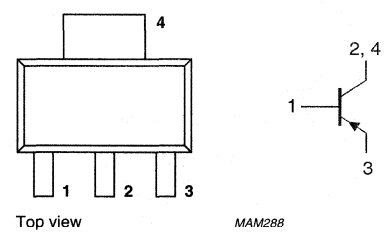


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCP51		–	–45	V
	BCP52		–	–60	V
	BCP53		–	–100	V
V_{CEO}	collector-emitter voltage	open base			
	BCP51		–	–45	V
	BCP52		–	–60	V
	BCP53		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–1.5	A
I_{BM}	peak base current		–	–0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	95	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		14	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 125 °C	−	−	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; see Fig.2				
		I_C = −5 mA	40	−	−	
		I_C = −150 mA	63	−	250	
		I_C = −500 mA	25	−	−	
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = −2 V; see Fig.2				
	BCP53-10		63	−	160	
	BCP51-16; BCP52-16; BCP53-16		100	−	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	−	−	−0.5	V
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −2 V	−	−	−1	V
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	−	115	−	MHz

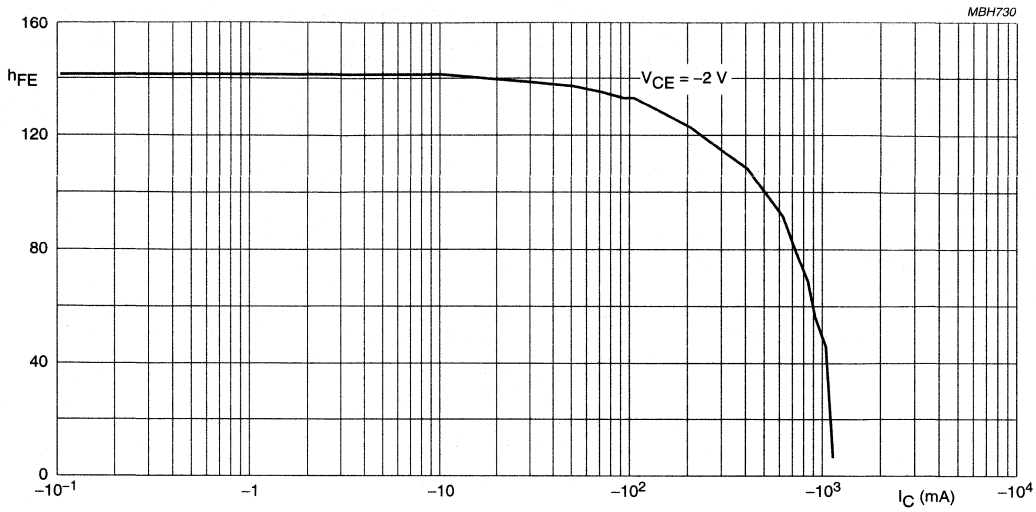


Fig.2 DC current gain; typical values.

NPN medium power transistors BCP54; BCP55; BCP56

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Switching.

DESCRIPTION

NPN medium power transistor in a SOT223 plastic package. PNP complements: BCP51, BCP52 and BCP53.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

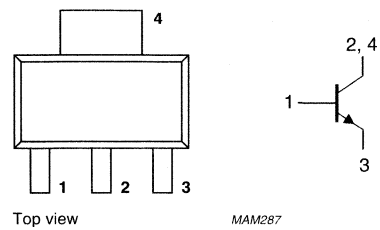


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCP54		–	45	V
	BCP55		–	60	V
	BCP56		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BCP54		–	45	V
	BCP55		–	60	V
	BCP56		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	1.5	A
I_{BM}	peak base current		–	0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.33	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	94	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		13	K/W

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 125 °C	–	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 2 V	25	–	–	
		I_C = 150 mA; V_{CE} = 2 V	63	–	250	
		I_C = 500 mA; V_{CE} = 2 V	25	–	–	
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 2 V		–		
	BCP55-10; 56-10		63	–	160	
	BCP54-16; 55-16; 56-16		100	–	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA	–	–	500	mV
V_{BE}	base-emitter voltage	I_C = 0.5 A; V_{CE} = 2 V	–	–	1	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	–	130	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	–	1.6	

NPN medium power transistor BCP68

FEATURES

- High current (max. 1 A)
- Low voltage (max. 20 V).

APPLICATIONS

- General purpose switching and amplification under high current conditions.

DESCRIPTION

NPN medium power transistor in a SOT223 plastic package. PNP complement: BCP69.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

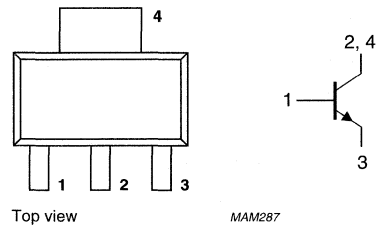


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.37	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	91	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

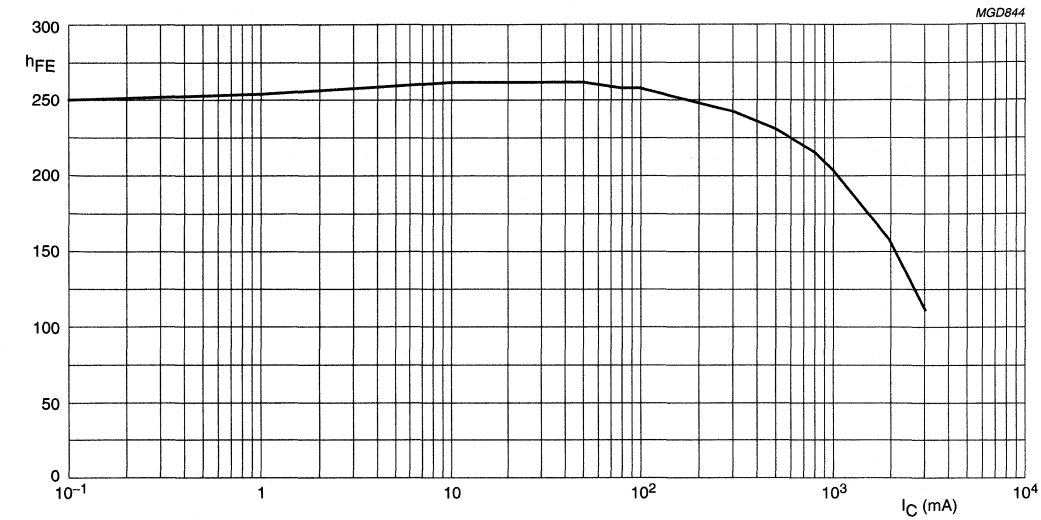
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 25 V	–	–	100	nA
		I_E = 0; V_{CB} = 25 V; T_j = 150 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	50	–	–	
		I_C = 500 mA; V_{CE} = 1 V; see Fig.2	85	–	375	
		I_C = 1 A; V_{CE} = 1 V; see Fig.2	60	–	–	
	DC current gain BCP68-25	I_C = 500 mA; V_{CE} = 1 V; see Fig.2	160	–	375	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	–	–	500	mV
V_{BE}	base-emitter voltage	I_C = 5 mA; V_{CE} = 10 V	–	620	–	mV
		I_C = 1 A; V_{CE} = 1 V	–	–	1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	38	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	40	–	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 0.5 A; $\lvert V_{CE} \rvert$ = 1 V	–	–	1.6	



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

PNP medium power transistor BCP69

FEATURES

- High current (max. 1 A)
- Low voltage (max. 20 V).

APPLICATIONS

- General purpose switching and amplification
- Power applications such as audio output stages.

DESCRIPTION

PNP medium power transistor in a SOT223 plastic package. NPN complement: BCP68.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

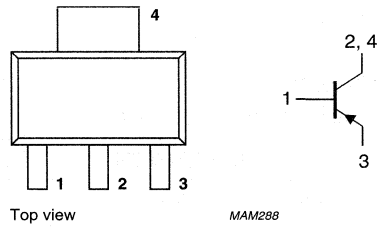


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base	–	–20	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	91	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

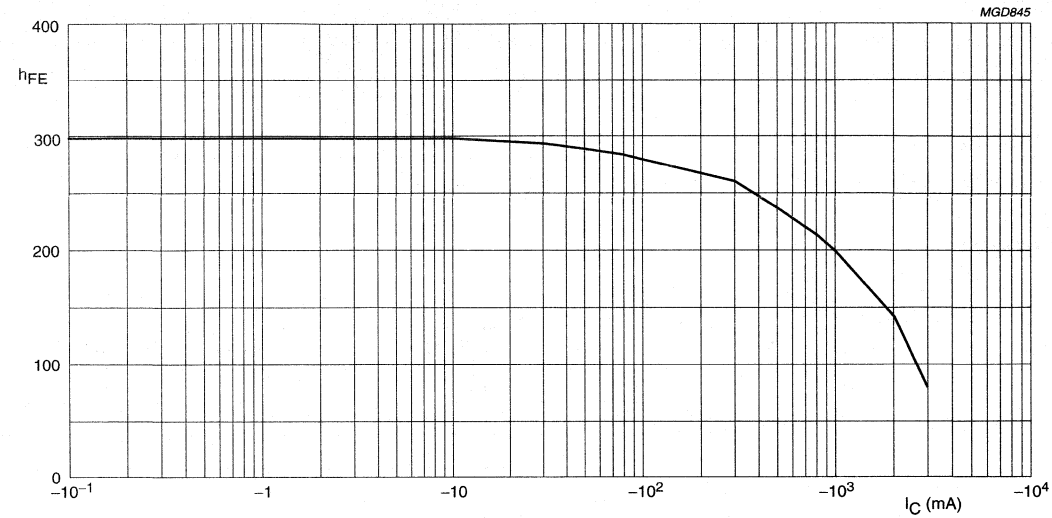
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −25 V	–	–	−100	nA
		I_E = 0; V_{CB} = −25 V; T_j = 150 °C	–	–	−10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −5 mA; V_{CE} = −10 V	50	–	–	
		I_C = −500 mA; V_{CE} = −1 V; see Fig.2	85	–	375	
		I_C = −1 A; V_{CE} = −1 V; see Fig.2	60	–	–	
	DC current gain	I_C = −500 mA; V_{CE} = −1 V; see Fig.2				
	BCP69-16		100	–	250	
	BCP69-25		160	–	375	
V_{CEsat}	collector-emitter saturation voltage	I_C = −1 A; I_B = −100 mA	–	–	−500	mV
V_{BE}	base-emitter voltage	I_C = −5 mA; V_{CE} = −10 V	–	−620	–	mV
		I_C = −1 A; V_{CE} = −1 V	–	–	−1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	48	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	40	–	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 0.5 A; $\lvert V_{CE} \rvert$ = 1 V	–	–	1.6	



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.

PNP Darlington transistors BCV26; BCV46

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 60 V)
- Very high DC current gain (min. 10000).

APPLICATIONS

- Where very high amplification is required.

DESCRIPTION

PNP Darlington transistor in a SOT23 plastic package.
NPN complements: BCV27 and BCV47.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCV26	FD*
BCV46	FE*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

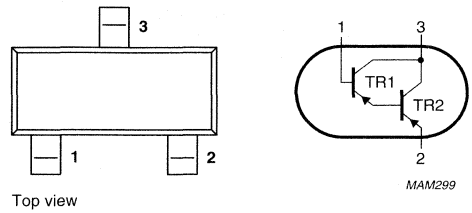


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCV26		–	–40	V
	BCV46		–	–80	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BCV26		–	–30	V
	BCV46		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–800	mA
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

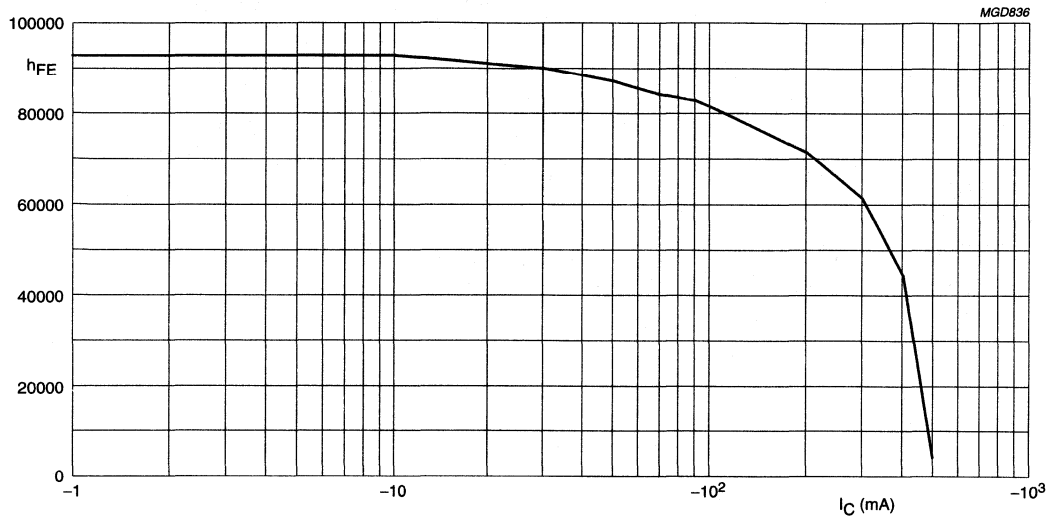
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BCV26	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
	BCV46	I_E = 0; V_{CB} = −60 V	–	–	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −10 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V; (see Fig.2)				
	BCV26		4000	–	–	
	BCV46		2000	–	–	
	DC current gain	I_C = −10 mA; V_{CE} = −5 V; (see Fig.2)				
	BCV26		10000	–	–	
	BCV46		4000	–	–	
	DC current gain	I_C = −100 mA; V_{CE} = −5 V; (see Fig.2)				
	BCV26		20000	–	–	
	BCV46		10000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1	V
V_{BEsat}	base-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = −10 mA; V_{CE} = −5 V	–	–	−1.4	V
f_T	transition frequency	I_C = −30 mA; V_{CE} = −5 V; f = 100 MHz	–	220	–	MHz



$V_{CE} = -2$ V.

Fig.2 DC current gain; typical values.

NPN Darlington transistors BCV27; BCV47

FEATURES

- Medium current (max. 500 mA)
- Low voltage (max. 60 V)
- High DC current gain (min. 20000).

APPLICATIONS

- Preamplifier input applications.

DESCRIPTION

NPN Darlington transistor in a SOT23 plastic package.
PNP complements: BCV26 and BCV46.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCV27	FF*
BCV47	FG*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

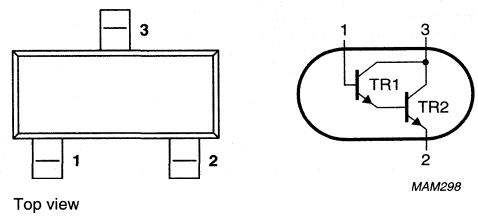


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCV27		–	40	V
	BCV47		–	80	V
V_{CES}	collector-emitter voltage	open base			
	BCV27		–	30	V
	BCV47		–	60	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

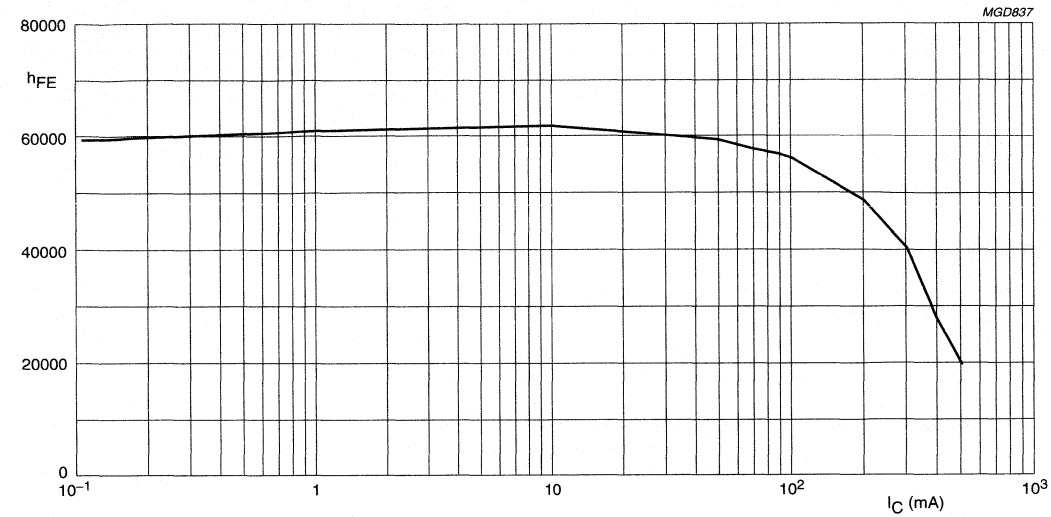
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BCV27	I_E = 0; V_{CBO} = 30 V	–	–	100	nA
	BCV47	I_E = 0; V_{CBO} = 60 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_E = 0; V_{EB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 5 V; (see Fig.2)				
	BCV27	I_C = 1 mA	4000	–	–	
		I_C = 10 mA	10000	–	–	
		I_C = 100 mA	20000	–	–	
	DC current gain	V_{CE} = 5 V; (see Fig.2)				
	BCV47	I_C = 1 mA	2000	–	–	
		I_C = 10 mA	4000	–	–	
		I_C = 100 mA	10000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 10 mA; V_{CE} = 5 V	–	–	1.4	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	–	220	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

PNP Darlington transistors BCV28; BCV48

FEATURES

- Very high DC current gain (min. 10000)
- High current (max. 500 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Where very high amplification is required.

DESCRIPTION

PNP Darlington transistor in a SOT89 plastic package.
NPN complements: BCV29 and BCV49.

MARKING

TYPE NUMBER	MARKING CODE
BCV28	ED
BCV48	EE

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

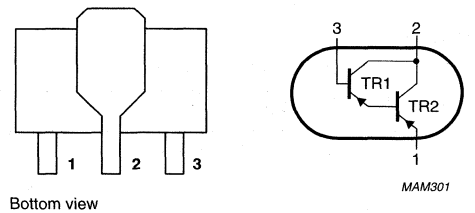


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCV28		–	–40	V
	BCV48		–	–80	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BCV28		–	–30	V
	BCV48		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–800	mA
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

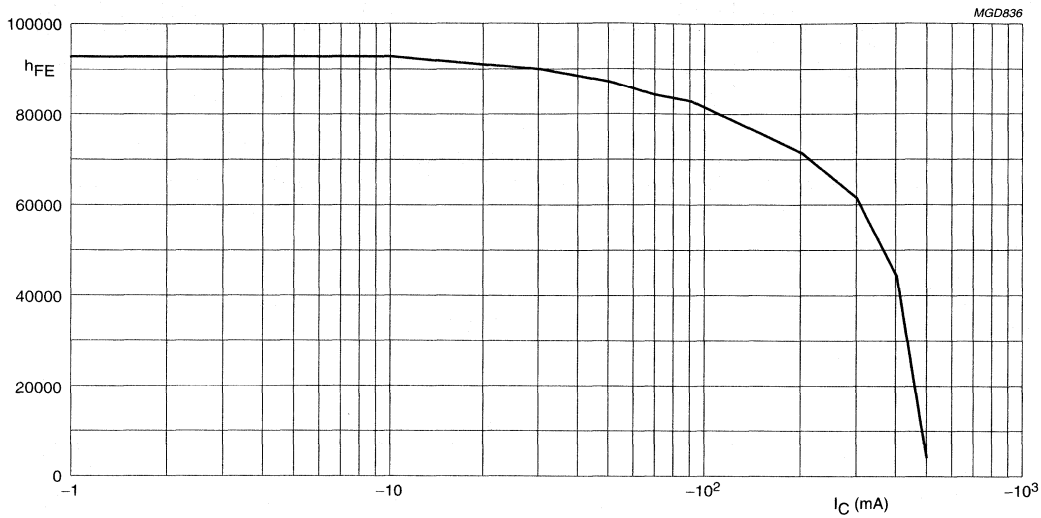
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BCV28	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
	BCV48	I_E = 0; V_{CB} = −60 V	–	–	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = −10 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V; see Fig.2				
	BCV28		4000	–	–	
	BCV48		2000	–	–	
	DC current gain	I_C = −10 mA; V_{CE} = −5 V; see Fig.2				
	BCV28		10000	–	–	
	BCV48		4000	–	–	
	DC current gain	I_C = −100 mA; V_{CE} = −5 V; see Fig.2				
	BCV28		20000	–	–	
	BCV48		10000	–	–	
	DC current gain	I_C = −500 mA; V_{CE} = −5 V; see Fig.2				
	BCV28		4000	–	–	
	BCV48		2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1	V
V_{BEsat}	base-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	–	−1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = −10 mA; I_B = −5 mA	–	–	−1.4	V
f_T	transition frequency	I_C = −30 mA; V_{CE} = −5 V; f = 100 MHz	–	220	–	MHz



$V_{CE} = -5$ V.

Fig.2 DC current gain; typical values.

NPN Darlington transistors BCV29; BCV49

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 60 V)
- High DC current gain (min. 20000).

APPLICATIONS

- Preamplifier input applications.

DESCRIPTION

NPN small-signal Darlington transistor in a surface mount SOT89 plastic package. PNP complements: BCV28 and BCV48.

MARKING

TYPE NUMBER	MARKING CODE
BCV29	EF
BCV49	EG

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

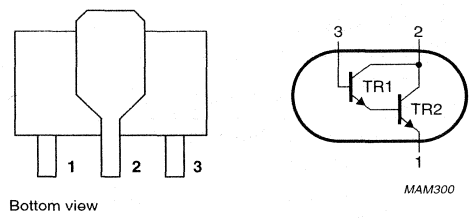


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCV29		–	40	V
	BCV49		–	80	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BCV29		–	30	V
	BCV49		–	60	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

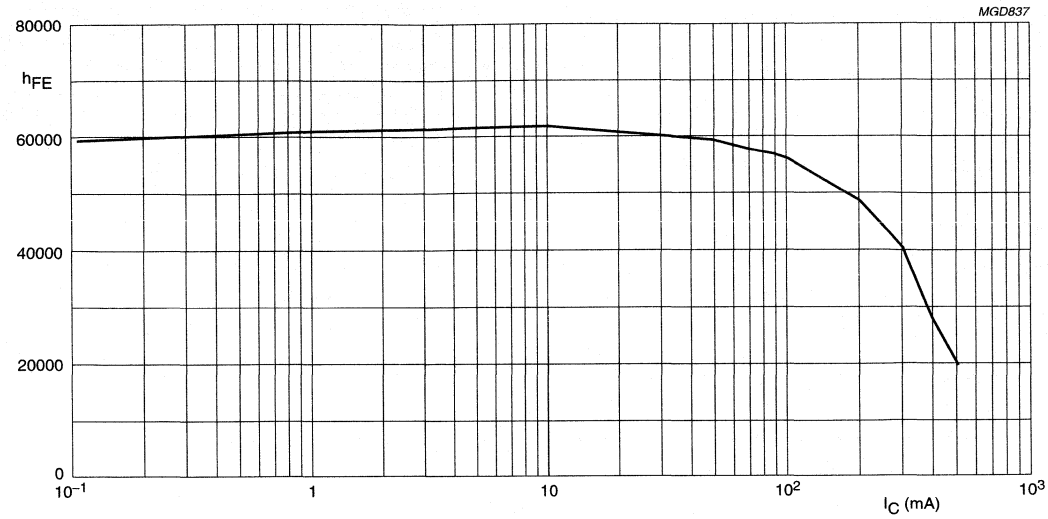
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BCV29	I_E = 0; V_{CB} = 30 V	–	–	100	nA
	BCV49	I_E = 0; V_{CB} = 60 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 5 V; see Fig.2				
	BCV29	I_C = 1 mA	4000	–	–	
		I_C = 10 mA	10000	–	–	
		I_C = 100 mA	20000	–	–	
		I_C = 500 mA	4000	–	–	
	DC current gain	V_{CE} = 5 V; see Fig.2				
	BCV49	I_C = 1 mA	2000	–	–	
		I_C = 10 mA	4000	–	–	
		I_C = 100 mA	10000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 10 mA; V_{CE} = 5 V	–	–	1.4	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	–	220	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

NPN general purpose transistors BCV71; BCV72

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCV71	K7*
BCV72	K8*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

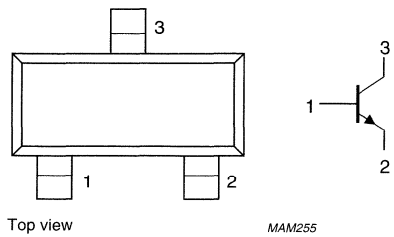


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	80	V
V_{CEO}	collector-emitter voltage	open base; I_C = 2 mA	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 100 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain BCV71 BCV72	I_C = 10 μA; V_{CE} = 5 V	 – –	 90 150	 – –	
	DC current gain BCV71 BCV72	I_C = 2 mA; V_{CE} = 5 V	 110 200	 – –	 220 450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	120	250	mV
		I_C = 50 mA; I_B = 2.5 mA	–	210	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	750	–	mV
		I_C = 50 mA; I_B = 2.5 mA	–	850	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	550	–	700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

PNP general purpose transistors BCW29; BCW30

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 32 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BCW31 and BCW32.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW29	C1*
BCW30	C2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

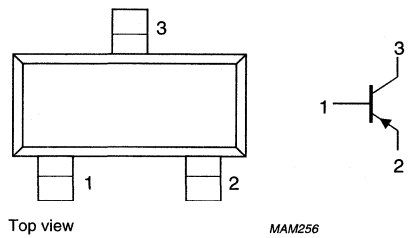


Fig.1 Simplified outline SOT23 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base; I_C = –2 mA	–	–32	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −32 V	–	–	−100	nA
		I_E = 0; V_{CB} = −32 V; T_j = 100 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain BCW29 BCW30	I_C = −10 μA; V_{CE} = −5 V	 – –	 90 150	 – –	
	DC current gain BCW29 BCW30	I_C = −2 mA; V_{CE} = −5 V	 120 215	 – –	 260 500	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−80	−300	mV
		I_C = −50 mA; I_B = −2.5 mA	–	−150	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−720	–	mV
		I_C = −50 mA; I_B = −2.5 mA	–	−810	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	–	−750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	4.5	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

NPN general purpose transistors BCW31; BCW32; BCW33

FEATURES

- Low current (100 mA)
- Low voltage (32 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistors in a plastic SOT23 package.
PNP complements: BCW29 and BCW30.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW31	D1*
BCW32	D2*
BCW33	D3*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

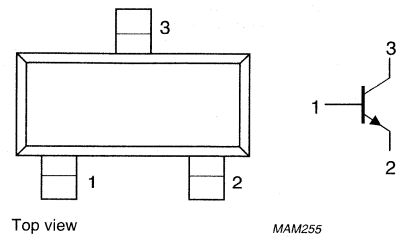


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base; I_C = 2 mA	–	32	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 32 V	–	–	100	nA
		I_E = 0; V_{CB} = 32 V; T_j = 100 °C	–	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 10 µA; V_{CE} = 5 V				
	BCW31		–	90	–	
	BCW32		–	150	–	
	BCW33		–	270	–	
	DC current gain	I_C = 2 mA; V_{CE} = 5 V				
	BCW31		110	–	220	
	BCW32		200	–	450	
	BCW33		420	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	120	250	mV
		I_C = 50 mA; I_B = 2.5 mA	–	210	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	750	–	mV
		I_C = 50 mA; I_B = 2.5 mA	–	850	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	550	–	700	mV
C_c	collector capacitance	I_E = I_e = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

NPN general purpose transistors BCW60 series

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 32 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complements: BCW61 series.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW60B	AB*
BCW60C	AC*
BCW60D	AD*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

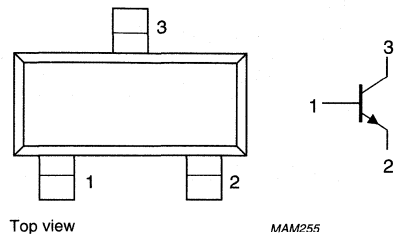


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	32	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 32 V	–	–	20	nA
		I_E = 0; V_{CB} = 32 V; T_{amb} = 150 °C	–	–	20	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	20	nA
h_{FE}	DC current gain	I_C = 10 µA; V_{CE} = 5 V				
	BCW60B		20	–	–	
	BCW60C		40	–	–	
	BCW60D		100	–	–	
	DC current gain	I_C = 2 mA; V_{CE} = 5 V				
	BCW60B		180	–	310	
	BCW60C		250	–	460	
	BCW60D		380	–	630	
	DC current gain	I_C = 50 mA; V_{CE} = 1 V				
	BCW60B		70	–	–	
	BCW60C		90	–	–	
	BCW60D		100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.25 mA	50	–	350	mV
		I_C = 50 mA; I_B = 1.25 mA	100	–	550	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.25 mA	600	–	850	mV
		I_C = 50 mA; I_B = 1.25 mA	0.7	–	1.05	V
V_{BE}	base-emitter voltage	I_C = 10 µA; V_{CE} = 5 V	–	520	–	mV
		I_C = 2 mA; V_{CE} = 5 V	550	650	750	mV
		I_C = 50 mA; V_{CE} = 1 V	–	780	–	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz; note 1	100	250	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	6	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

PNP general purpose transistors BCW61 series

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 32 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complement: BCW60.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW61B	BB*
BCW61C	BC*
BCW61D	BD*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

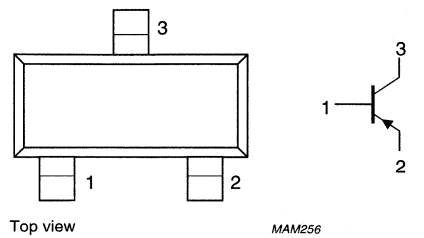


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base	–	–32	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –32 V	–	–	–20	nA
		I_E = 0; V_{CB} = –32 V; T_{amb} = 150 °C	–	–	–20	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –4 V	–	–	–20	nA
h_{FE}	DC current gain	I_C = –10 µA; V_{CE} = –5 V				
	BCW61B		30	–	–	
	BCW61C		40	–	–	
	BCW61D		100	–	–	
	DC current gain	I_C = –2 mA; V_{CE} = –5 V				
	BCW61B		180	–	310	
	BCW61C		250	–	460	
	BCW61D		380	–	630	
	DC current gain	I_C = –50 mA; V_{CE} = –1 V				
	BCW61B		80	–	–	
	BCW61C		100	–	–	
	BCW61D		110	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.25 mA	–60	–	–250	mV
		I_C = –50 mA; I_B = –1.25 mA	–120	–	–550	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –0.25 mA	–600	–	–850	mV
		I_C = –50 mA; I_B = –1.25 mA	–0.68	–	–1.05	V
V_{BE}	base-emitter voltage	I_C = –2 mA; V_{CE} = –5 V	–600	–650	–750	mV
		I_C = –10 µA; V_{CE} = –5 V	–	–550	–	mV
		I_C = –50 mA; V_{CE} = –1 V	–	–720	–	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	4.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; f = 100 MHz; note 1	100	–	–	MHz
F	noise figure	I_C = –200 µA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	6	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

PNP general purpose transistors BCW69; BCW70

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BCW71 and BCW72.

MARKING

TYPE NUMBER	MARKING CODE[1]
BCW69	H1*
BCW70	H2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

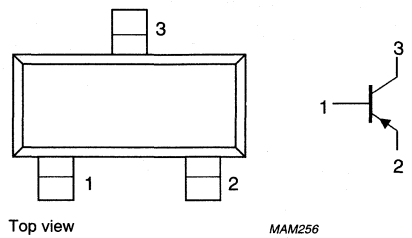


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base; I_C = –2 mA	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -20$ V	–	–	−100	nA
		$I_E = 0$; $V_{CB} = -20$ V; $T_j = 100$ °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	−100	nA
h_{FE}	DC current gain	$I_C = -10$ μA; $V_{CE} = -5$ V				
	BCW69		–	90	–	
	BCW70		–	150	–	
	DC current gain	$I_C = -2$ mA; $V_{CE} = -5$ V				
	BCW69		120	–	260	
	BCW70		215	–	500	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	−80	−300	mV
		$I_C = -50$ mA; $I_B = -2.5$ mA; note 1	–	−150	–	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	−720	–	mV
		$I_C = -50$ mA; $I_B = -2.5$ mA; note 1	–	−810	–	mV
V_{BE}	base-emitter voltage	$I_C = -2$ mA; $V_{CE} = -5$ V	−600	–	−750	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	4.5	–	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 100 MHz	100	–	–	MHz
F	noise figure	$I_C = -200$ μA; $V_{CE} = -5$ V; $R_S = 2$ kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

NPN general purpose transistors BCW71; BCW72

FEATURES

- Low current (100 mA)
- Low voltage (45 V)
- Low noise.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complements: BCW69 and BCW70.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW71	K1*
BCW72	K2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

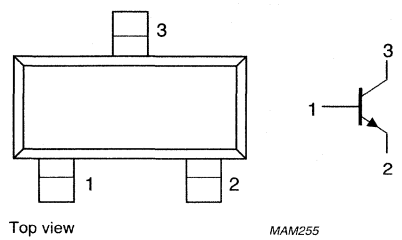


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base; I_C = 2 mA	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 100 °C	–	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	µA
h_{FE}	DC current gain BCW71 BCW72	I_C = 10 µA; V_{CE} = 5 V	 – –	 90 150	 – –	
	DC current gain BCW71 BCW72	I_C = 2 mA; V_{CE} = 5 V	 110 200	 – –	 220 450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	120	250	mV
		I_C = 50 mA; I_B = 2.5 mA	–	210	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	750	–	mV
		I_C = 50 mA; I_B = 2.5 mA	–	850	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	550	–	700	mV
C_c	collector capacitance	$I_E = I_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

PNP general purpose transistor BCW89

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCW89	H3*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

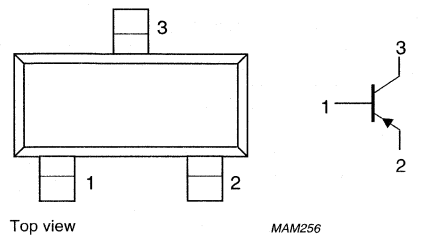


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–80	V
V_{CEO}	collector-emitter voltage	open base; I_C = –2 mA	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	–	–	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 100 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −10 μA; V_{CE} = −5 V	–	90	–	
		I_C = −2 mA; V_{CE} = −5 V	120	–	260	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−80	−300	mV
		I_C = −50 mA; I_B = −2.5 mA	–	−150	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−720	–	mV
		I_C = −50 mA; I_B = −2.5 mA	–	−810	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	–	−750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	4.5	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	–	150	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

PNP general purpose transistors BCX17; BCX18

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Saturated switching and driver applications e.g. for industrial service
- Thick and thin-film circuits.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complement: BCX19.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCX17	T1*
BCX18	T2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

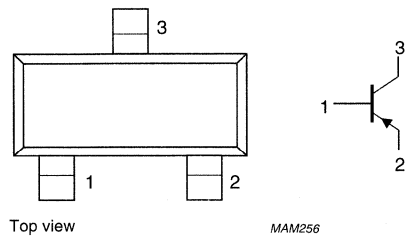


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCX17		–	–50	V
	BCX18		–	–30	V
V_{CEO}	collector-emitter voltage	open base			
	BCX17		–	–45	V
	BCX18		–	–25	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	–	–	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −100 mA; V_{CE} = −1 V	100	–	600	
		I_C = −300 mA; V_{CE} = −1 V	70	–	–	
		I_C = −500 mA; V_{CE} = −1 V	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	–	–	−620	mV
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −1 V; note 1	–	–	−1.2	V
C_c	collector capacitance	$I_E = I_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	9	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	80	–	–	MHz

Note

1. V_{BE} decreases by approximately −2 mV/°C with increasing temperature.

NPN general purpose transistor BCX19

FEATURES

- High current (500 mA)
- Low voltage (45 V).

APPLICATIONS

- General purpose amplification
- Saturated switching and driver applications.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complement: BCX17.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCX19	U8*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

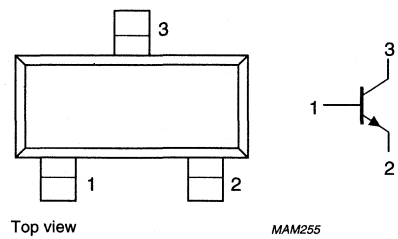


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base; I_C = 10 mA	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1				
		I_C = 100 mA	100	–	600	
		I_C = 300 mA	70	–	–	
		I_C = 500 mA	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 2	–	–	620	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 1 V; notes 1 and 2	–	–	1.2	V
C_c	collector capacitance	$I_E = I_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz

Notes

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.
2. V_{BE} decreases by approximately –2 mV/°C with increasing temperature.

PNP medium power transistors BCX51; BCX52; BCX53

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Medium power general purposes
- Driver stages of audio amplifiers.

DESCRIPTION

PNP medium power transistor in a SOT89 plastic package. NPN complements: BCX54, BCX55 and BCX56.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BCX51	AA	BCX52-16	AM
BCX51-10	AC	BCX53	AH
BCX51-16	AD	BCX53-10	AK
BCX52	AE	BCX53-16	AL
BCX52-10	AG		

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

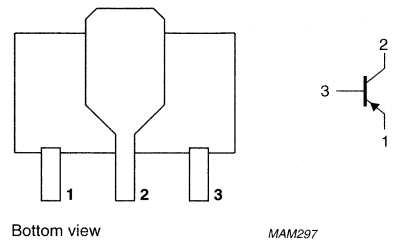


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCX51		–	–45	V
	BCX52		–	–60	V
	BCX53		–	–100	V
V_{CEO}	collector-emitter voltage	open base			
	BCX51		–	–45	V
	BCX52		–	–60	V
	BCX53		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–1.5	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	94	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	14	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 125 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; see Fig.2				
		I_C = −5 mA	40	–	–	
		I_C = −150 mA	63	–	250	
		I_C = −500 mA	25	–	–	
	DC current gain	I_C = −150 mA; V_{CE} = −2 V; see Fig.2				
	BCX51-10; BCX52-10; BCX53-10		63	–	160	
	BCX51-16; BCX52-16; BCX53-16		100	–	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	–	–	−500	mV
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −2 V	–	–	−1	V
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	–	50	–	MHz

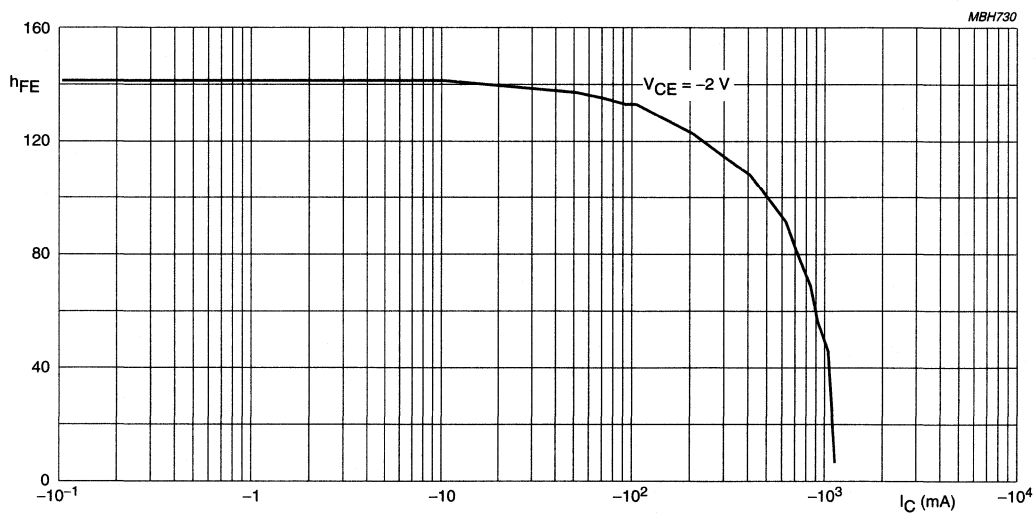


Fig.2 DC current gain; typical values.

NPN medium power transistors BCX54; BCX55; BCX56

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Driver stages of audio and video amplifiers.

DESCRIPTION

NPN medium power transistor in a SOT89 plastic package. PNP complements: BCX51, BCX52 and BCX53.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BCX54	BA	BCX55-16	BM
BCX54-10	BC	BCX56	BH
BCX54-16	BD	BCX56-10	BK
BCX55	BE	BCX56-16	BL
BCX55-10	BG		

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

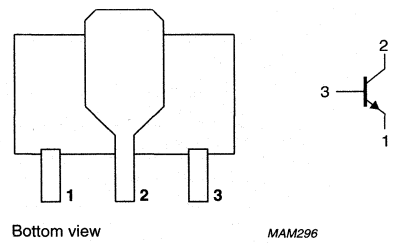


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BCX54		–	45	V
	BCX55		–	60	V
	BCX56		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BCX54		–	45	V
	BCX55		–	60	V
	BCX56		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	1.5	A
I_{BM}	peak base current		–	0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	94	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		14	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 125 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; (see Fig.2)				
		I_C = 5 mA	40	–	–	
		I_C = 150 mA	63	–	250	
		I_C = 500 mA	25	–	–	
	DC current gain	I_C = 150 mA; V_{CE} = 2 V; (see Fig.2)				
	BCX54-10; 55-10; 56-10		63	–	160	
	BCX54-16; 55-16; 56-16		100	–	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	–	–	0.5	V
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 2 V	–	–	1	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	–	130	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	1.3	1.6	

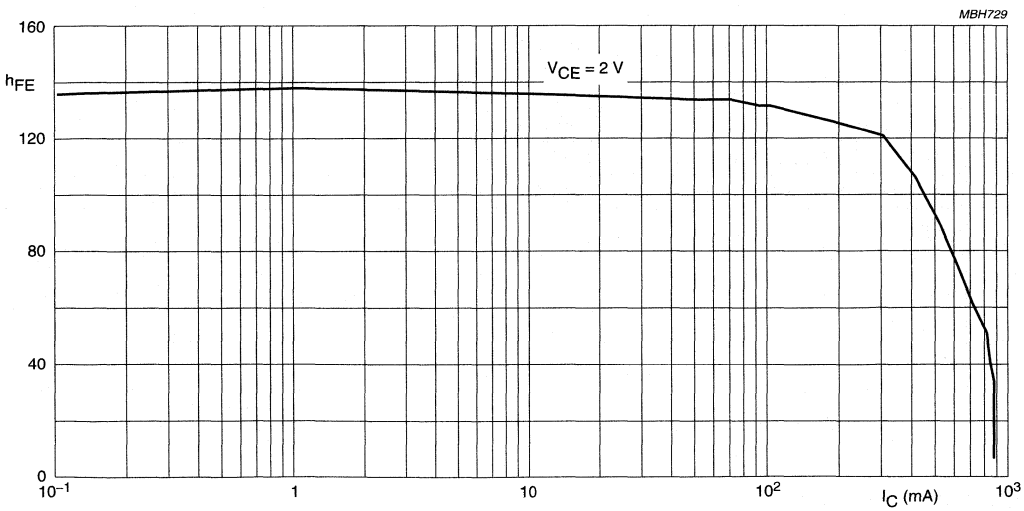


Fig.2 DC current gain; typical values.

NPN general purpose transistors BCX70 series

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complements: BCX71 series.

MARKING

TYPE NUMBER	MARKING CODE(1)
BCX70G	AG*
BCX70H	AH*
BCX70J	AJ*
BCX70K	AK*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

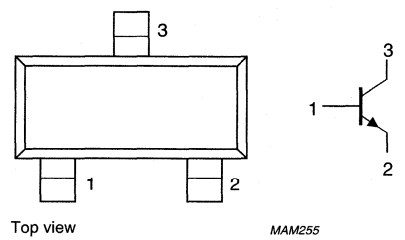


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 45 V	–	–	20	nA
		I_E = 0; V_{CB} = 45 V; T_{amb} = 150 °C	–	–	20	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	20	nA
h_{FE}	DC current gain	I_C = 10 µA; V_{CE} = 5 V				
	BCX70G		–	–	–	
	BCX70H		40	–	–	
	BCX70J		30	–	–	
	BCX70K		100	–	–	
	DC current gain	I_C = 2 mA; V_{CE} = 5 V				
	BCX70G		120	–	220	
	BCX70H		180	–	310	
	BCX70J		250	–	460	
	BCX70K		380	–	630	
	DC current gain	I_C = 50 mA; V_{CE} = 1 V				
	BCX70G		50	–	–	
	BCX70H		70	–	–	
	BCX70J		90	–	–	
	BCX70K		100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.25 mA	50	–	350	mV
		I_C = 50 mA; I_B = 1.25 mA	100	–	550	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.25 mA	600	–	850	mV
		I_C = 50 mA; I_B = 1.25 mA	700	–	1050	mV
V_{BE}	base-emitter voltage	I_C = 10 µA; V_{CE} = 5 V	–	520	–	mV
		I_C = 2 mA; V_{CE} = 5 V	550	650	750	mV
		I_C = 50 mA; V_{CE} = 1 V	–	780	–	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz; note 1	100	250	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	6	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

PNP general purpose transistors BCX71 series

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V)
- Low noise.

APPLICATIONS

- Low level, low noise, low frequency applications in hybrid circuits
- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a plastic SOT23 package.
NPN complements: BCX70 series.

MARKING

TYPE NUMBER	MARKING CODE(1)	TYPE NUMBER	MARKING CODE(1)
BCX71G	BG*	BCX71J	BJ*
BCX71H	BH*	BCX71K	BK*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

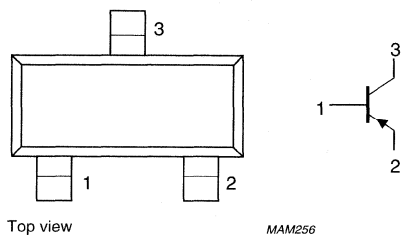


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–45	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −45 V	–	–	−20	nA
		I_E = 0; V_{CB} = −45 V; T_{amb} = 150 °C	–	–	−20	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−20	nA
h_{FE}	DC current gain	I_C = −10 µA; V_{CE} = −5 V				
	BCX71G		–	–	–	
	BCX71H		30	–	–	
	BCX71J		40	–	–	
	BCX71K		100	–	–	
	DC current gain	I_C = −2 mA; V_{CE} = −5 V				
	BCX71G		120	–	220	
	BCX71H		180	–	310	
	BCX71J		250	–	460	
	BCX71K		380	–	630	
	DC current gain	I_C = −50 mA; V_{CE} = −1 V; note 1				
	BCX71G		60	–	–	
	BCX71H		80	–	–	
	BCX71J		100	–	–	
	BCX71K		110	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.25 mA	−60	–	−250	mV
		I_C = −50 mA; I_B = −1.25 mA; note 1	−120	–	−550	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.25 mA	−600	–	−850	mV
		I_C = −50 mA; I_B = −1.25 mA; note 1	−680	–	−1050	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	−650	−750	mV
		I_C = −10 µA; V_{CE} = −5 V	–	−550	–	mV
		I_C = −50 mA; V_{CE} = −1 V; note 1	–	−720	–	mV
C_c	collector capacitance	$I_E = I_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	4.5	–	pF
C_e	emitter capacitance	$I_C = I_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 µA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	6	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

NPN power transistor BD131

FEATURES

- High current (max. 3 A)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose power applications.

DESCRIPTION

NPN power transistor in a TO-126; SOT32 plastic package. PNP complement: BD132.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

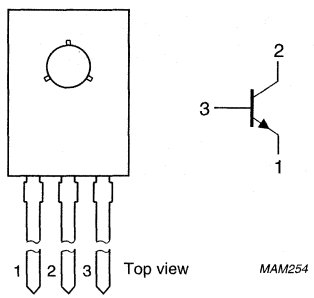


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	3	A
I_{CM}	peak collector current		–	6	A
I_{BM}	peak base current		–	0.5	A
P_{tot}	total power dissipation	$T_{mb} \leq 60$ °C	–	15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		6	K/W

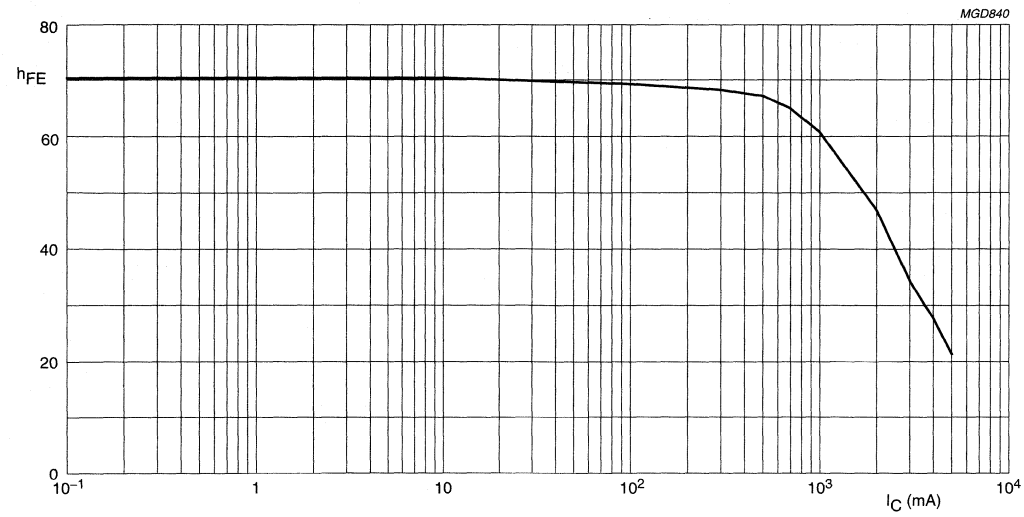
Note

1. Refer to TO-126; SOT32 standard mounting conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	50	nA
		I_E = 0; V_{CB} = 50 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 12 V; (see Fig.2)	40	–	
		I_C = 2 A; V_{CE} = 1 V; (see Fig.2)	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA	–	300	mV
		I_C = 2 A; I_B = 200 mA	–	700	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA	–	1.2	V
		I_C = 2 A; I_B = 200 mA	–	1.5	V
f_T	transition frequency	I_C = 0.25 A; V_{CE} = 5 V; f = 100 MHz; T_{amb} = 25 °C	60	–	MHz



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

PNP power transistor BD132

FEATURES

- High current (max. 3 A)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose power applications.

DESCRIPTION

PNP power transistor in a TO-126; SOT32 plastic package. NPN complement: BD131.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

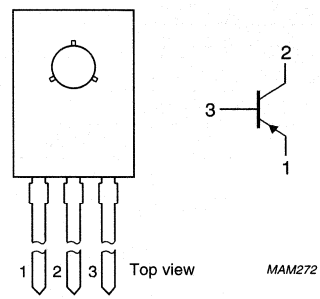


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–45	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
I_{CM}	peak collector current		–	–6	A
P_{tot}	total power dissipation	$T_{mb} \leq 60$ °C	–	15	W
h_{FE}	DC current gain	$I_C = -0.5$ A; $V_{CE} = -12$ V	40	–	
f_T	transition frequency	$I_C = -0.25$ A; $V_{CE} = -5$ V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–45	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–3	A
I_{CM}	peak collector current		–	–6	A
I_{BM}	peak base current		–	–0.5	A
P_{tot}	total power dissipation	$T_{mb} \leq 60$ °C	–	15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		6	K/W

Note

1. Refer to TO-126; SOT32 standard mounting conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −40 V	–	−50	nA
		I_E = 0; V_{CB} = −40 V; T_j = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −3 V	–	−50	nA
h_{FE}	DC current gain	I_C = −0.5 A; V_{CE} = −12 V	40	–	
		I_C = −2 A; V_{CE} = −1 V; see Fig.2	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −0.5 A; I_B = −50 mA	–	−300	mV
		I_C = −2 A; I_B = −200 mA	–	−700	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −0.5 A; I_B = −50 mA	–	−1.2	V
		I_C = −2 A; I_B = −200 mA	–	−1.5	V
f_T	transition frequency	I_C = −0.25 A; V_{CE} = −5 V; f = 100 MHz; T_{amb} = 25 °C	60	–	MHz

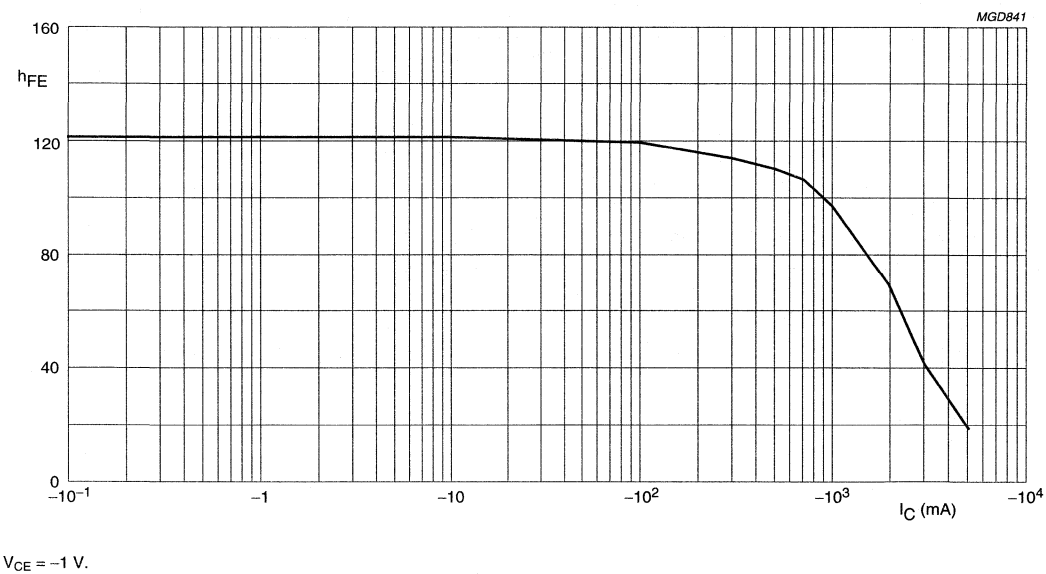


Fig.2 DC current gain; typical values.

NPN power transistors BD135; BD137; BD139

FEATURES

- High current (max. 1.5 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Driver stages in hi-fi amplifiers and television circuits.

DESCRIPTION

NPN power transistor in a TO-126; SOT32 plastic package. PNP complements: BD136, BD138 and BD140.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

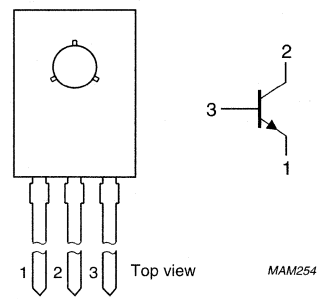


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BD135		–	45	V
	BD137		–	60	V
	BD139		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BD135		–	45	V
	BD137		–	60	V
	BD139		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1.5	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{mb} \leq 70$ °C	–	8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		10	K/W

Note

1. Refer to TO-126; SOT32 standard mounting conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 125 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; (see Fig.2)				
		I_C = 5 mA	40	–	–	
		I_C = 150 mA	63	–	250	
		I_C = 500 mA	25	–	–	
	DC current gain	I_C = 150 mA; V_{CE} = 2 V; (see Fig.2)				
	BD135-10; BD137-10; BD139-10		63	–	160	
	BD135-16; BD137-16; BD139-16		100	–	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	–	–	0.5	V
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 2 V	–	–	1	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	–	190	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	1.3	1.6	

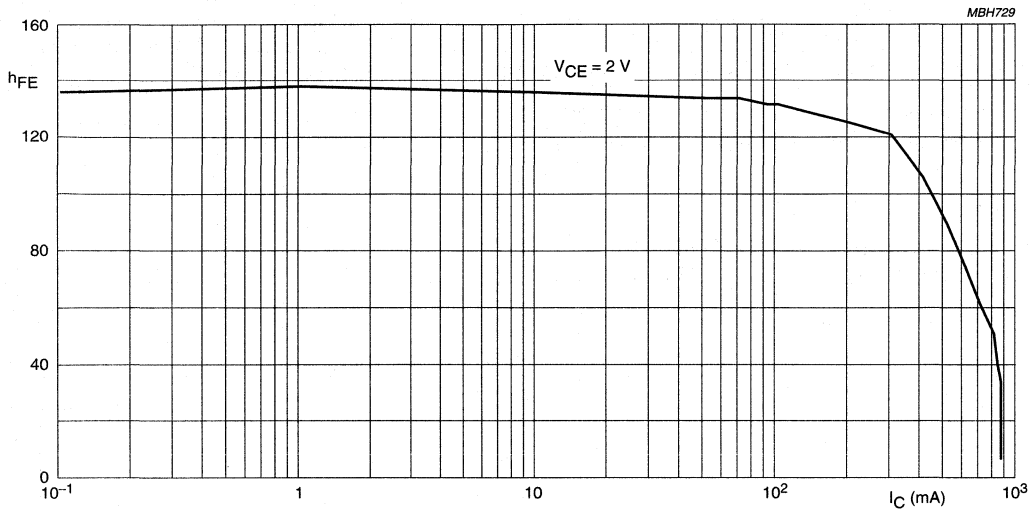


Fig.2 DC current gain; typical values.

PNP power transistors BD136; BD138; BD140

FEATURES

- High current (max. 1.5 A)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose power applications, e.g. driver stages in hi-fi amplifiers and television circuits.

DESCRIPTION

PNP power transistor in a TO-126; SOT32 plastic package. NPN complements: BD135, BD137 and BD139.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

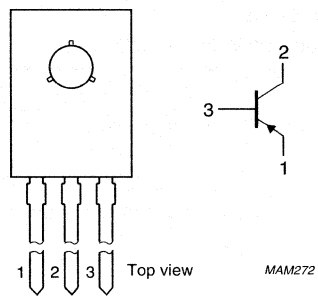


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BD136		–	–45	V
	BD138		–	–60	V
	BD140		–	–100	V
V_{CEO}	collector-emitter voltage	open base			
	BD136		–	–45	V
	BD138		–	–60	V
	BD140		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1.5	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–1	A
P_{tot}	total power dissipation	$T_{mb} \leq 70$ °C	–	8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		10	K/W

Note

1. Refer to TO-126 (SOT32) standard mounting conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 125 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; (see Fig.2)				
		I_C = −5 mA	40	–	–	
		I_C = −150 mA	63	–	250	
		I_C = −500 mA	25	–	–	
	DC current gain	I_C = −150 mA; V_{CE} = −2 V;				
	BD136-10; BD138-10; BD140-10	(see Fig.2)	63	–	160	
	BD136-16; BD138-16; BD140-16		100	–	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	–	–	−0.5	V
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −2 V	–	–	−1	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −5 V; f = 100 MHz	–	160	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	1.3	1.6	

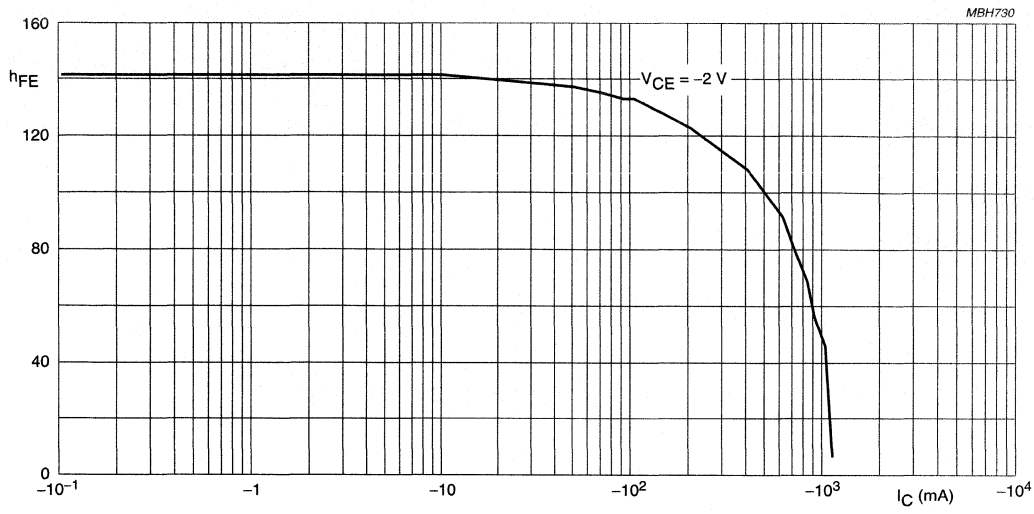


Fig.2 DC current gain; typical values.

NPN power transistor BD230

FEATURES

- High current (max. 1.5 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Driver stages in television circuits.

DESCRIPTION

NPN power transistor in a TO-126; SOT32 plastic package. PNP complement: BD231.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

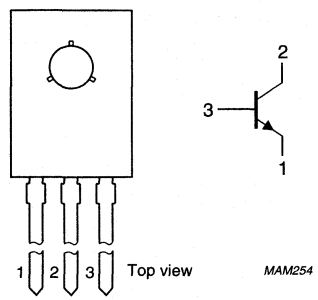


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	100	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1.5	A
I_{CM}	peak collector current		–	3	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{mb} \leq 62$ °C	–	12.5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		7	K/W

Note

1. Refer to TO-126; SOT32 standard mounting conditions.

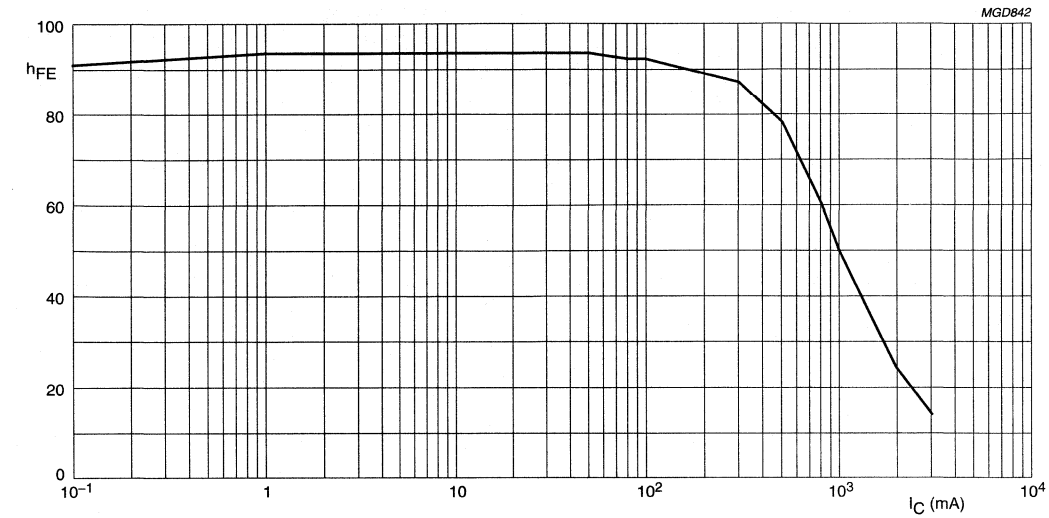
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 125 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; see Fig.2				
		I_C = 5 mA	40	–	–	
		I_C = 150 mA	40	–	250	
		I_C = 1 A	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 0.1 A	–	–	0.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 0.1 A	–	–	1.2	V
V_{BE}	base-emitter voltage	I_C = 1 A; V_{CE} = 2 V; note 1	–	–	1.3	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	–	125	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 150 mA; $\lvert V_{CE} \rvert$ = 2 V	–	1.3	1.6	

Note

1. V_{BE} decreases by about 2.3 mV/K with increasing temperature.



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

PNP power transistor BD231

FEATURES

- High current (max. 1.5 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Driver stages in television circuits.

DESCRIPTION

PNP power transistor in a TO-126; SOT32 plastic package. NPN complement: BD230.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

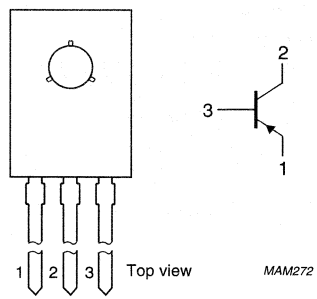


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−100	V
V_{CEO}	collector-emitter voltage	open base	–	−80	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−1.5	A
I_{CM}	peak collector current		–	−3	A
I_{BM}	peak base current		–	−1	A
P_{tot}	total power dissipation	$T_{mb} \leq 62$ °C	–	12.5	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		7	K/W

Note

1. Refer to TO-126; SOT32 standard mounting conditions.

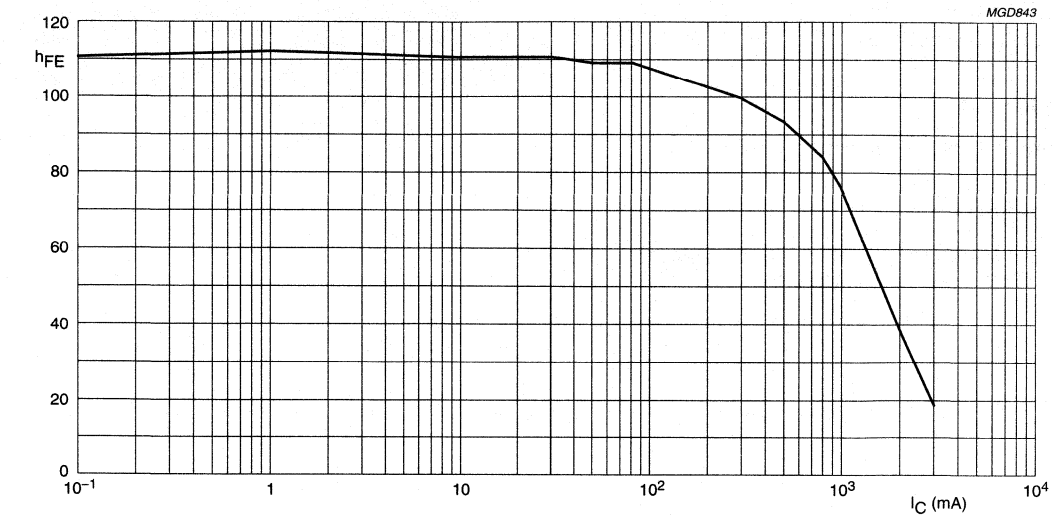
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 125 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; see Fig.2				
		I_C = −5 mA	40	–	–	
		I_C = −150 mA	40	–	250	
		I_C = −1 A	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −1 A; I_B = −0.1 A	–	–	−0.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = −1 A; I_B = −0.1 A	–	–	−1.1	V
V_{BE}	base-emitter voltage	I_C = −1 A; V_{CE} = −2 V; note 1	–	–	−1.3	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −5 V; f = 100 MHz	–	50	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = −150 mA; $\lvert V_{CE} \rvert$ = −2 V	–	1.3	1.6	

Note

1. V_{BE} decreases by about −2.3 mV/K with increasing temperature.



$V_{CE} = -2$ V.

Fig.2 DC current gain; typical values.

NPN power transistor BD329

FEATURES

- High current (max. 3 A)
- Low voltage (max. 20 V).

APPLICATIONS

- Especially for battery equipped applications.

DESCRIPTION

NPN power transistor in a TO-126; SOT32 plastic package. PNP complement: BD330.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

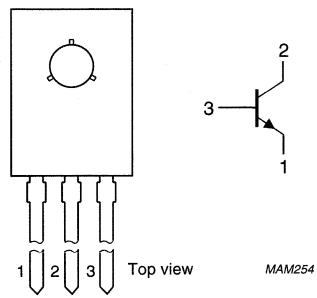


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
I_{CM}	peak collector current		–	–	3	A
P_{tot}	total power dissipation	$T_{mb} \leq 45$ °C	–	–	15	W
h_{FE}	DC current gain	$I_C = 0.5$ A; $V_{CE} = 1$ V	85	–	375	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 5$ V; f = 100 MHz	–	130	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	3	A
I_{CM}	peak collector current		–	3	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{mb} \leq 45$ °C	–	15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		7	K/W

Note

1. Refer to TO-126; SOT32 standard mounting conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 32 V	–	–	100	nA
		I_E = 0; V_{CB} = 32 V; T_j = 150 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 1 V; see Fig.2	85	–	375	
		I_C = 2 A; V_{CE} = 1 V; see Fig.2	40	–	–	
		I_C = 5 mA; V_{CE} = 10 V	50	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 2 A; I_B = 0.2 A	–	–	0.5	V
V_{BE}	base-emitter voltage	I_C = 5 mA; V_{CE} = 10 V	–	0.6	–	V
		I_C = 2 A; V_{CE} = 1 V	–	–	1.2	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	–	130	–	MHz
$\frac{h_{FE1}}{h_{FE2}}$	DC current gain ratio of the complementary pairs	$\lvert I_C \rvert$ = 0.5 A; $\lvert V_{CE} \rvert$ = 1 V	–	–	1.6	

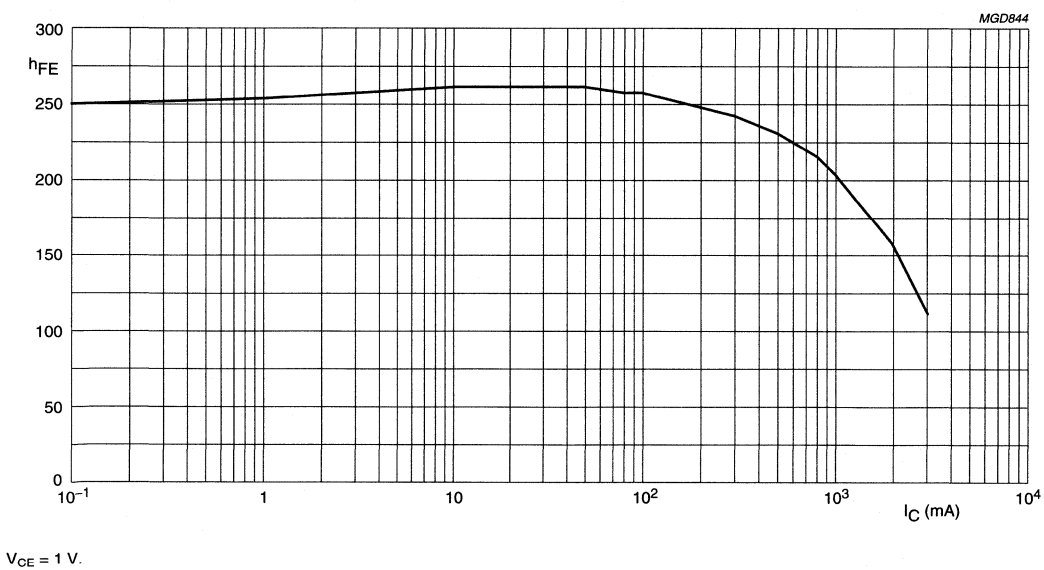


Fig.2 DC current gain; typical values.

PNP power transistor BD330

FEATURES

- High current (max. 3 A)
- Low voltage (max. 20 V).

APPLICATIONS

- Power switching and amplification, especially in portable equipment or e.g. car radio output stages.

DESCRIPTION

PNP power transistor in a TO-126; SOT32 plastic package. NPN complement: BD329.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

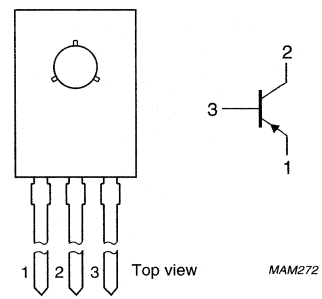


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–32	V
V_{CEO}	collector-emitter voltage	open base	–	–20	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–3	A
I_{CM}	peak collector current		–	–3	A
I_{BM}	peak base current		–	–1	A
P_{tot}	total power dissipation	$T_{mb} \leq 45$ °C	–	15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		7	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −32 V	–	–	−100	nA
		I_E = 0; V_{CB} = −32 V; T_j = 150 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −5 mA; V_{CE} = −10 V	50	–	–	
		I_C = −0.5 A; V_{CE} = −1 V; see Fig.2	85	–	375	
		I_C = −2 A; V_{CE} = −1 V; see Fig.2	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −2 A; I_B = −0.2 A	–	–	−0.5	V
V_{BE}	base-emitter voltage	I_C = −5 mA; V_{CE} = −10 V	–	−600	–	mV
		I_C = −2 A; V_{CE} = −1 V	–	–	−1.2	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −5 V; f = 100 MHz	–	100	–	MHz

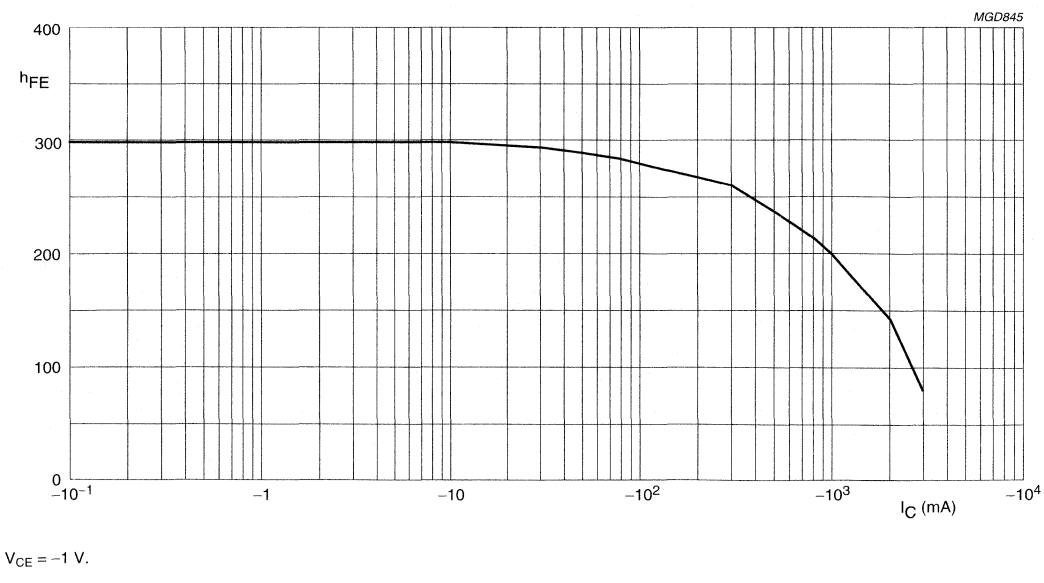


Fig.2 DC current gain; typical values.

NPN power transistors BD825; BD829

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose
- Driver stages in hi-fi amplifiers and television circuits.

DESCRIPTION

NPN power transistor in a TO-202; SOT128B plastic package. PNP complements: BD826 and BD830.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

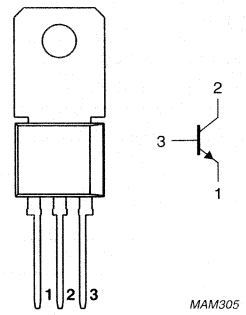


Fig.1 Simplified outline (TO-202; SOT128B) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BD825		–	–	45	V
	BD829		–	–	100	V
V_{CEO}	collector-emitter voltage	open base				
	BD825		–	–	45	V
	BD829		–	–	80	V
I_{CM}	peak collector current		–	–	1.5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	2	W
		$T_{mb} \leq 50$ °C	–	–	8	W
h_{FE}	DC current gain	$I_C = 150$ mA; $V_{CE} = 2$ V	95	–	165	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 5$ V; f = 100 MHz	–	250	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BD825		–	45	V
	BD829		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BD825		–	45	V
	BD829		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	1.5	A
I_{BM}	peak base current		–	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	2	W
		$T_{mb} \leq 50$ °C	–	8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	62.5	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		12.5	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 125 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; see Fig.2				
		I_C = 5 mA	40	–	–	
		I_C = 150 mA	95	–	165	
		I_C = 500 mA	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA	–	–	500	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 2 V	–	–	1	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	–	250	–	MHz

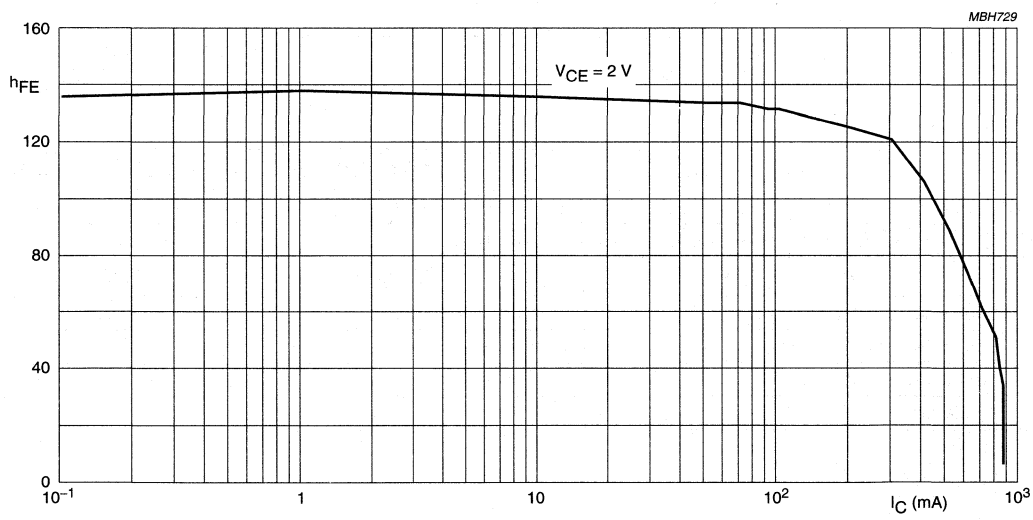


Fig.2 DC current gain; typical values.

PNP power transistor BD830

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose
- Driver stages in hi-fi amplifiers and television circuits.

DESCRIPTION

PNP power transistor in a TO-202; SOT128B plastic package. NPN complement: BD829.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

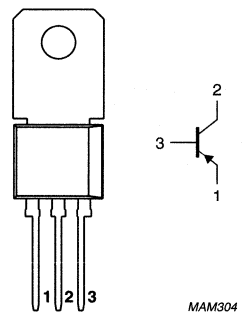


Fig.1 Simplified outline (TO-202; SOT128B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–100	V
V_{CEO}	collector-emitter voltage	open base	–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–1.5	A
I_{BM}	peak base current		–	–500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	2	W
		$T_{mb} \leq 50$ °C	–	8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

PNP power transistor BD830

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	62.5	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		12.5	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−100	nA
		I_E = 0; V_{CB} = −30 V; T_j = 125 °C	–	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	V_{CE} = −2 V; see Fig.2				
		I_C = −5 mA	40	–	–	
		I_C = −150 mA	63	–	250	
		I_C = −500 mA	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	–	–	−500	mV
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −2 V	–	–	−1	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −5 V; f = 100 MHz	–	75	–	MHz

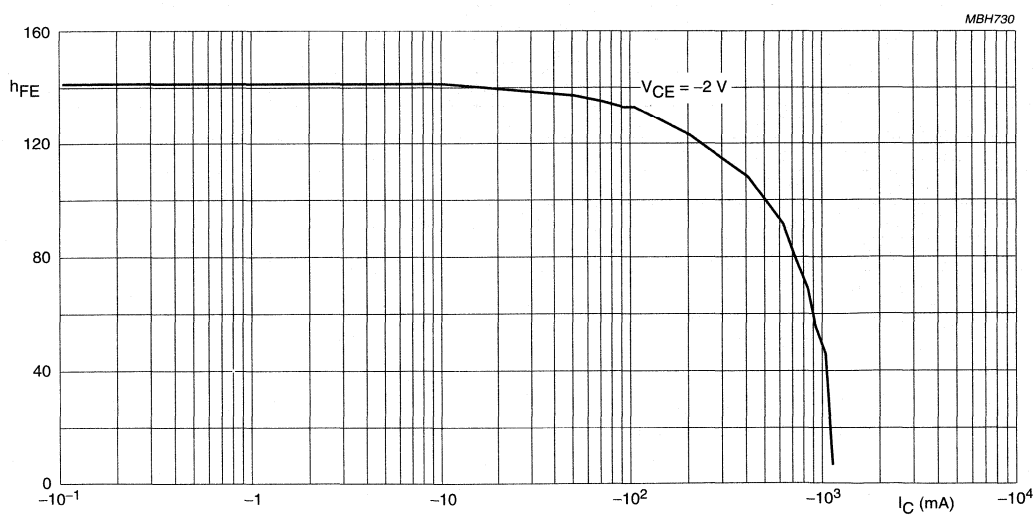


Fig.2 DC current gain; typical values.

NPN BISS-transistor BDL31

FEATURES

- High current (max. 5 A)
- Low voltage (max. 10 V)
- Low collector-emitter saturation voltage ensures reduced power consumption.

APPLICATIONS

- Battery powered units where high current and low power consumption are important.

DESCRIPTION

NPN BISS (Breakthrough In Small Signal) transistor in a SOT223 plastic package. PNP complement: BDL32.

PINNING

PIN	DESCRIPTION
1	base
2	not connected
3	emitter
4	collector

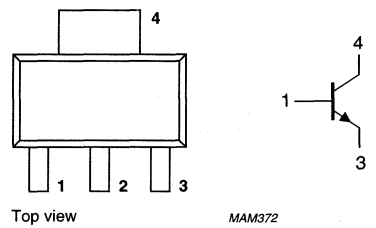


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	5	A
I_{CM}	peak collector current		–	10	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	92	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 2 V; note 1			
		I_C = 0.5 A	200	–	
		I_C = 1 A	200	–	
		I_C = 3 A	150	–	
		I_C = 5 A	100	–	
		V_{CE} = 1 V; I_C = 2 A; note 1	180	–	
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = 1 A; I_B = 20 mA	–	180	mV
		I_C = 2 A; I_B = 200 mA	–	350	mV
		I_C = 3 A; I_B = 60 mA	–	450	mV
		I_C = 5 A; I_B = 100 mA	–	800	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	130	pF
f_T	transition frequency	I_C = 500 mA; V_{CE} = 10 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP BISS-transistor BDL32

FEATURES

- High current (max. 5 A)
- Low voltage (max. 10 V)
- Low collector-emitter saturation voltage ensures reduced power consumption.

APPLICATIONS

- Battery powered units where high current and low power consumption are important.

DESCRIPTION

PNP BISS (Breakthrough In Small Signal) transistor in a SOT223 plastic package. NPN complement: BDL31.

PINNING

PIN	DESCRIPTION
1	base
2	not connected
3	emitter
4	collector

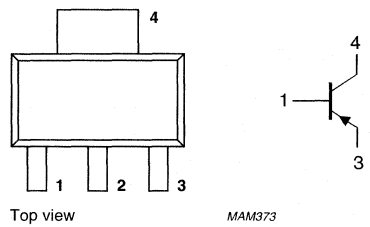


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–15	V
V_{CEO}	collector-emitter voltage	open base	–	–10	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–5	A
I_{CM}	peak collector current		–	–10	A
I_{BM}	peak base current		–	–1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	92	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	−50	nA
		I_E = 0; V_{CB} = −10 V; T_j = 150 °C	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −2 V; note 1			
		I_C = −0.5 A	200	–	
		I_C = −1 A	180	–	
		I_C = −3 A	120	–	
		I_C = −5 A	50	–	
		V_{CE} = −1 V; I_C = −2 A; note 1	120	–	
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = −1 A; I_B = −20 mA	–	−250	mV
		I_C = −2 A; I_B = −200 mA	–	−400	mV
		I_C = −3 A; I_B = −60 mA	–	−600	mV
		I_C = −5 A; I_B = −100 mA	–	−1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	150	pF
f_T	transition frequency	I_C = −500 mA; V_{CE} = −10 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN medium power transistor BDP31

FEATURES

- High current (max. 3 A)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose medium power applications.

DESCRIPTION

NPN medium power transistor in a SOT223 plastic package. PNP complement: BDP32.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

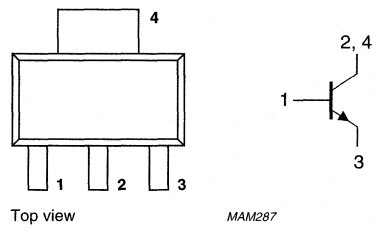


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	3	A
I_{CM}	peak collector current		–	6	A
I_{BM}	peak base current		–	0.5	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	91	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

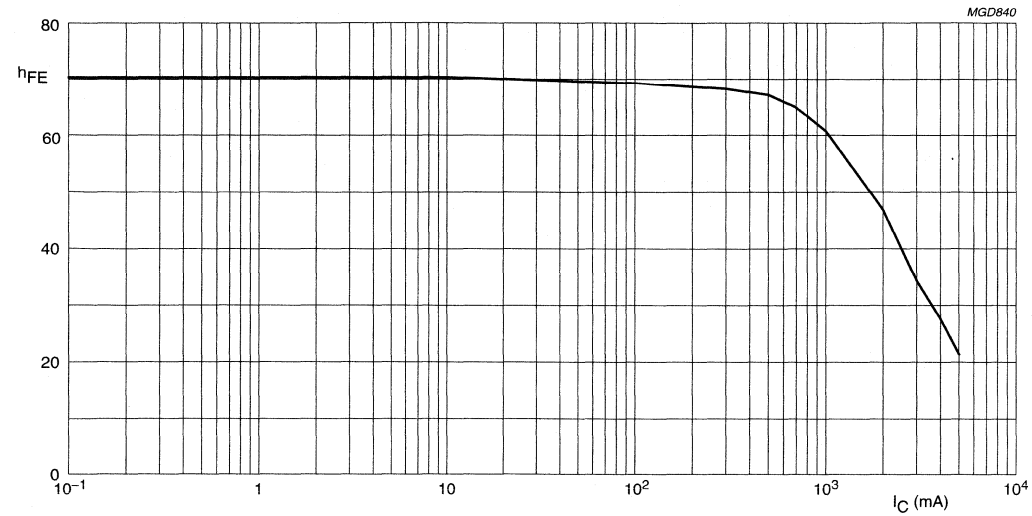
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V;	–	50	nA
		I_E = 0; V_{CB} = 50 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V;	–	50	nA
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 12 V; note 1; see Fig.2	40	–	
		I_C = 2 A; V_{CE} = 1 V; note 1; see Fig.2	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1	–	300	mV
		I_C = 2 A; I_B = 200 mA; note 1	–	700	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
		I_C = 2 A; I_B = 200 mA; note 1	–	1.5	V
f_T	transition frequency	I_C = 250 mA; V_{CE} = 5 V; f = 100 MHz	60	–	MHz

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

PNP medium power transistor BDP32

FEATURES

- High current (max. 3 A)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose medium power applications.

DESCRIPTION

PNP medium power transistor in a SOT223 plastic package. NPN complement: BDP31.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

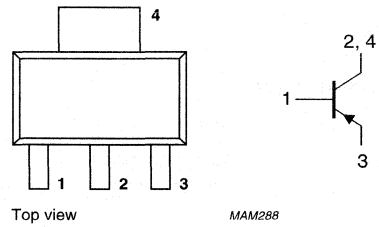


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–45	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–3	A
I_{CM}	peak collector current		–	–6	A
I_{BM}	peak base current		–	–0.5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	91	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

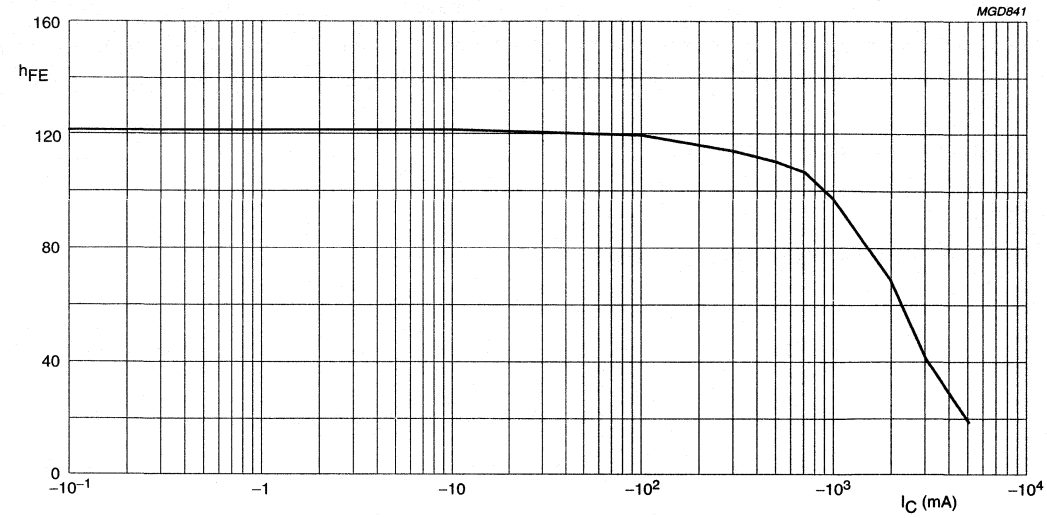
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –40 V	–	–50	nA
		I_E = 0; V_{CB} = –40 V; T_j = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	I_C = –0.5 A; V_{CE} = –12 V; note 1; see Fig.2	40	–	
		I_C = –2 A; V_{CE} = –1 V; note 1; see Fig.2	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA; note 1	–	–300	mV
		I_C = –2 A; I_B = –200 mA; note 1	–	–700	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –500 mA; I_B = –50 mA; note 1	–	–1.2	V
		I_C = –2 A; I_B = –200 mA; note 1	–	–1.5	V
f_T	transition frequency	V_{CE} = –5 V; I_C = –250 mA; f = 100 MHz	60	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.

NPN switching transistors BDX35; BDX36; BDX37

FEATURES

- High current (max. 5 A)
- Low voltage (max. 75 V).

APPLICATIONS

- High-current switching in power applications.

DESCRIPTION

NPN switching transistor in a TO-126; SOT32 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to the metal part of the mounting surface
3	base

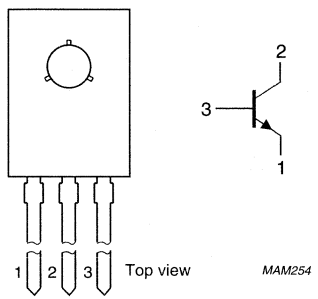


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BDX35		–	–	100	V
	BDX36; BDX37		–	–	120	V
V_{CEO}	collector-emitter voltage	open base				
	BDX35; BDX36		–	–	60	V
	BDX37		–	–	75	V
I_C	collector current (DC)		–	–	5	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	–	15	W
h_{FE}	DC current gain	$I_C = 0.5$ A; $V_{CE} = 10$ V	45	–	450	
f_T	transition frequency	$I_C = 0.5$ A; $V_{CE} = 5$ V; f = 100 MHz	–	100	–	MHz
t_{off}	turn-off time	$I_{Con} = 5$ A; $I_{Bon} = 0.5$ A; $I_{Boff} = -0.5$ A	–	350	500	ns

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDX35		–	100	V
	BDX36; BDX37		–	120	V
V_{CEO}	collector-emitter voltage	open base			
	BDX35; BDX36		–	60	V
	BDX37		–	75	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	5	A
I_{CM}	peak collector current		–	10	A
I_{BM}	peak base current		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	15	W
		$T_{amb} \leq 25$ °C	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

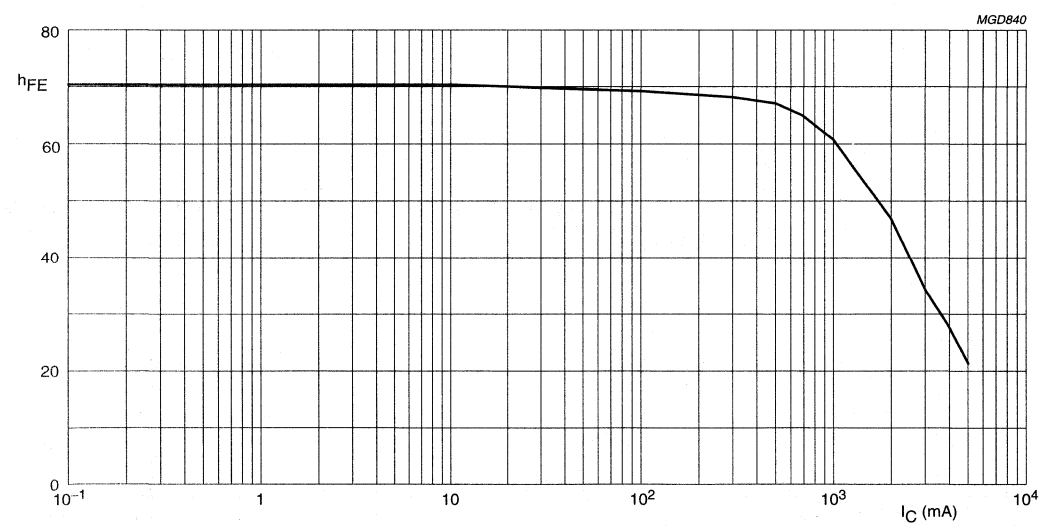
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		5	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BDX35	$I_E = 0$; $V_{CB} = 80$ V	–	–	100	nA
		$I_E = 0$; $V_{CB} = 80$ V; $T_j = 100$ °C	–	–	10	μA
I_{CBO}	collector cut-off current					
	BDX36; BDX37	$I_E = 0$; $V_{CB} = 100$ V	–	–	100	nA
		$I_E = 0$; $V_{CB} = 100$ V; $T_j = 100$ °C	–	–	10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 0.5$ A; $V_{CE} = 10$ V; see Fig.2				
	BDX35; BDX36		45	130	450	
	BDX37		45	80	450	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ A; $I_B = 0.5$ A	–	–	900	mV
V_{CEsat}	collector-emitter saturation voltage					
	BDX35; BDX37	$I_C = 7$ A; $I_B = 0.7$ A	–	–	1.2	V
	BDX36	$I_C = 10$ A; $I_B = 1$ A	–	–	2	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{BEsat}	base-emitter saturation voltage	I_C = 5 A; I_B = 0.5 A	–	–	1.7	V
V_{BEsat}	base-emitter saturation voltage					
	BDX35; BDX37	I_C = 7 A; I_B = 0.7 A	–	–	2	V
	BDX36	I_C = 10 A; I_B = 1 A	–	–	2.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	40	60	pF
f_T	transition frequency	I_C = 0.5 A; V_{CE} = 5 V; f = 100 MHz	–	100	–	MHz
Switching times (between 10% and 90% levels)						
t_{on}	turn-on time	I_{Con} = 1 A; I_{Bon} = 0.1 A; I_{Boff} = −0.1 A	–	60	100	ns
		I_{Con} = 2 A; I_{Bon} = 0.2 A; I_{Boff} = −0.2 A	–	–	80	ns
		I_{Con} = 5 A; I_{Bon} = 0.5 A; I_{Boff} = −0.5 A	–	180	300	ns
t_{off}	turn-off time	I_{Con} = 1 A; I_{Bon} = 0.1 A; I_{Boff} = −0.1 A	–	600	800	ns
		I_{Con} = 2 A; I_{Bon} = 0.2 A; I_{Boff} = −0.2 A	–	450	700	ns
		I_{Con} = 5 A; I_{Bon} = 0.5 A; I_{Boff} = −0.5 A	–	350	500	ns



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.

NPN Darlington transistors BDX42; BDX43; BDX44

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial switching applications such as:
  - print hammers
  - solenoids
  - relay and lamp drivers.

DESCRIPTION

NPN Darlington transistor in a TO-126; SOT32 plastic package. PNP complements: BDX45 and BDX47.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

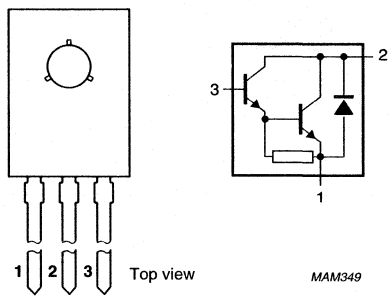


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BDX42		–	–	60	V
	BDX43		–	–	80	V
	BDX44		–	–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0				
	BDX42		–	–	45	V
	BDX43		–	–	60	V
	BDX44		–	–	80	V
I_C	collector current (DC)		–	–	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	1.25	W
		$T_{mb} \leq 100$ °C	–	–	5	W
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 10 V	1000	–	–	
		I_C = 500 mA; V_{CE} = 10 V	2000	–	–	
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDX42		–	60	V
	BDX43		–	80	V
	BDX44		–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BDX42		–	45	V
	BDX43		–	60	V
	BDX44		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.25	W
		$T_{mb} \leq 100$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

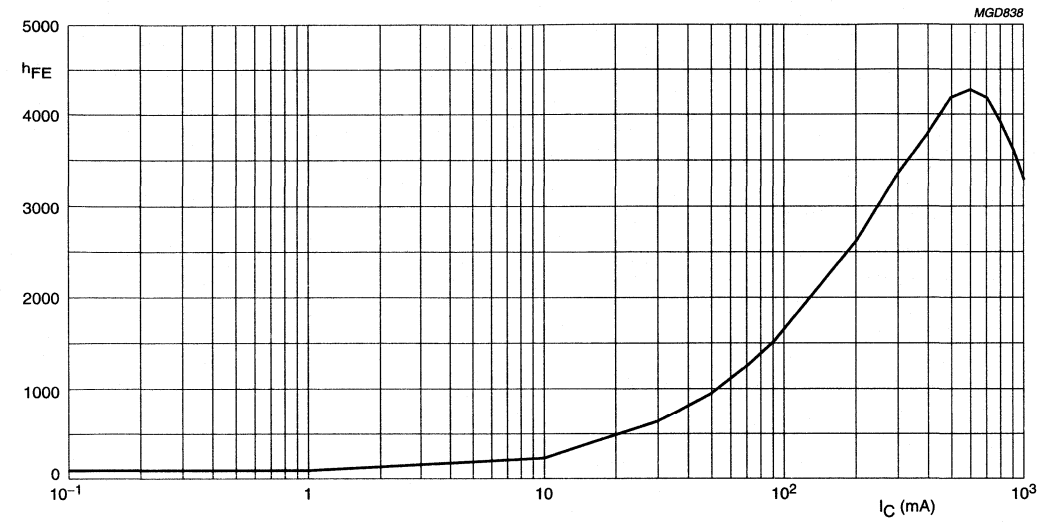
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		10	K/W

CHARACTERISTICS

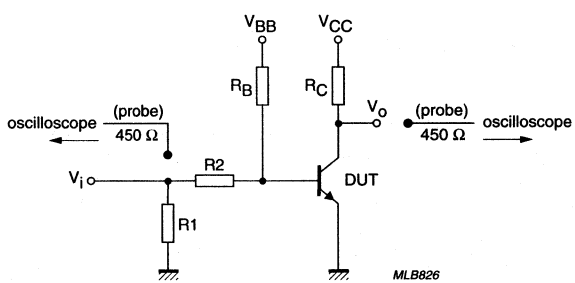
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BDX42	I_E = 0; V_{CB} = 60 V	–	–	100	nA
	BDX43	I_E = 0; V_{CB} = 80 V	–	–	100	nA
	BDX44	I_E = 0; V_{CB} = 100 V	–	–	100	nA
I_{CES}	collector cut-off current					
	BDX42	V_{BE} = 0; V_{CE} = 45 V	–	–	50	nA
	BDX43	V_{BE} = 0; V_{CE} = 60 V	–	–	50	nA
	BDX44	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 10 V; see Fig. 2				
		I_C = 150 mA	1000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.3	V
		I_C = 500 mA; I_B = 0.5 mA; T_j = 150 °C	–	–	1.3	V
V_{CEsat}	collector-emitter saturation voltage					
	BDX42; BDX44	I_C = 1 A; I_B = 4 mA	–	–	1.6	V
		I_C = 1 A; I_B = 4 mA; T_j = 150 °C	–	–	1.6	V
V_{CEsat}	collector-emitter saturation voltage					
	BDX43	I_C = 1 A; I_B = 1 mA	–	–	1.6	V
		I_C = 1 A; I_B = 1 mA; T_j = 150 °C	–	–	1.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.9	V
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 4 mA				
	BDX42; BDX44		–	–	2.2	V
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 1 mA				
	BDX43		–	–	2.2	V
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = −0.5 mA	–	–	500	ns
t_d	delay time		–	–	200	ns
t_r	rise time		–	–	300	ns
t_{off}	turn-off time		–	–	1300	ns
t_s	storage time		–	–	950	ns
t_f	fall time		–	–	350	ns



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.



V_i = 10 V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = −1.8 V; V_{CC} = 10.7 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP Darlington transistors BDX45; BDX47

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial switching applications such as:
  - print hammers
  - solenoids
  - relay and lamp drivers.

DESCRIPTION

PNP Darlington transistor in a TO-126; SOT32 plastic package. NPN complements: BDX42 and BDX44.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to metal part of mounting surface
3	base

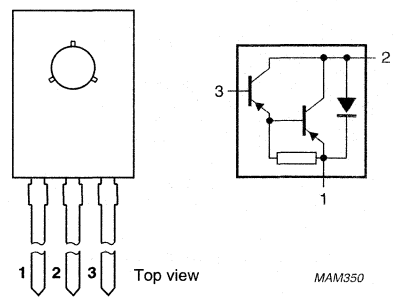


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BDX45		–	–	−60	V
	BDX47		–	–	−90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0				
	BDX45		–	–	−45	V
	BDX47		–	–	−80	V
I_C	collector current (DC)		–	–	−1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	1.25	W
		$T_{mb} \leq 100$ °C	–	–	5	W
h_{FE}	DC current gain	I_C = −150 mA; V_{CE} = −10 V	1000	–	–	
		I_C = −500 mA; V_{CE} = −10 V	2000	–	–	
f_T	transition frequency	I_C = −500 mA; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDX45		–	–60	V
	BDX47		–	–90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BDX45		–	–45	V
	BDX47		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.25	W
		$T_{mb} \leq 100$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

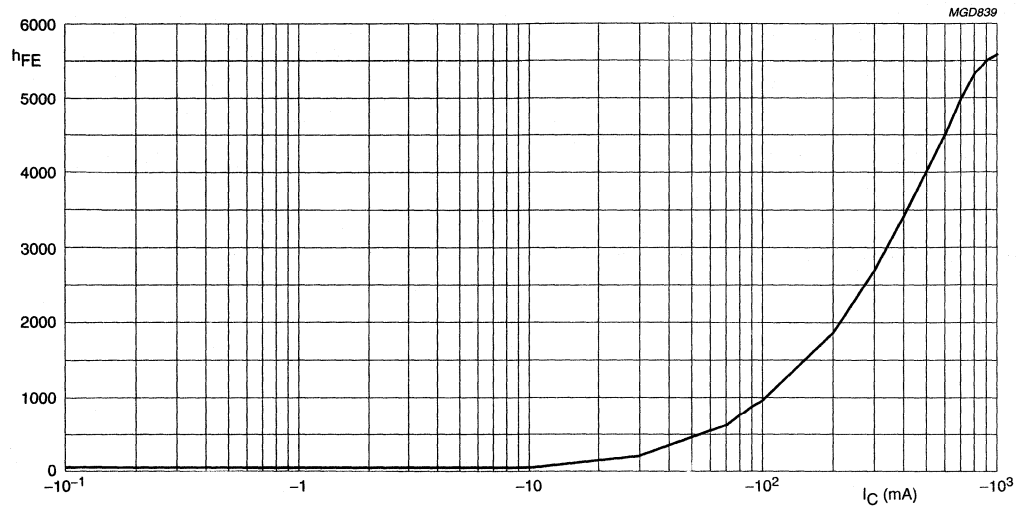
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		10	K/W

CHARACTERISTICS

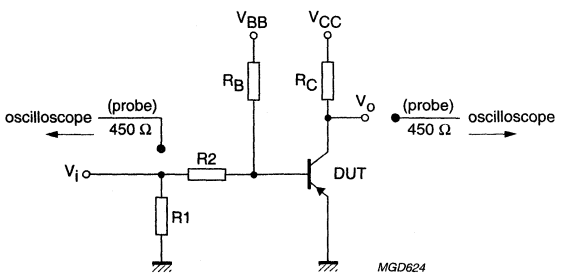
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current					
	BDX45	I_E = 0; V_{CB} = −60 V	–	–	−100	nA
	BDX47	I_E = 0; V_{CB} = −90 V	–	–	−100	nA
I_{CES}	collector cut-off current					
	BDX45	V_{BE} = 0; V_{CE} = −45 V	–	–	−50	nA
	BDX47	V_{BE} = 0; V_{CE} = −80 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −10 V; see Fig. 2				
		I_C = −150 mA	1000	–	–	
		I_C = −500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.3	V
		I_C = −500 mA; I_B = −0.5 mA; T_j = 150 °C	–	–	−1.3	V
		I_C = −1 A; I_B = −4 mA	–	–	−1.6	V
		I_C = −1 A; I_B = −4 mA; T_j = 150 °C	–	–	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.9	V
		I_C = −1 A; I_B = −4 mA	–	–	−2.2	V
f_T	transition frequency	I_C = −500 mA; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = −500 mA; I_{Bon} = −0.5 mA; I_{Boff} = 0.5 mA	–	–	500	ns
t_d	delay time		–	–	200	ns
t_r	rise time		–	–	300	ns
t_{off}	turn-off time		–	–	700	ns
t_s	storage time		–	–	550	ns
t_f	fall time		–	–	150	ns



$V_{CE} = -10$ V.

Fig.2 DC current gain; typical values.



$V_i = -10$ V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
$V_{BB} = 1.8$ V; $V_{CC} = -10.7$ V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN medium frequency transistor BF199

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 25 V).

APPLICATIONS

- Output stage of a vision IF amplifier.

DESCRIPTION

NPN medium frequency transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

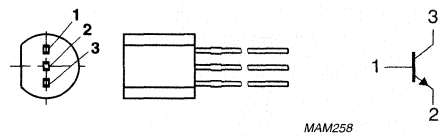


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	–	25	V
I_{CM}	peak collector current		–	–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 7$ mA; $V_{CE} = 10$ V	38	–	–	
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 10$ V; f = 100 MHz	–	550	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 40$ V	–	–	100	nA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 4$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 7$ mA; $V_{CE} = 10$ V	38	–	–	
V_{BE}	base-emitter voltage	$I_C = 7$ mA; $V_{CE} = 10$ V	–	775	925	mV
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	0.5	pF
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 10$ V; f = 100 MHz	–	550	–	MHz

NPN medium frequency transistor BF240

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- AM mixers
- IF amplifiers in AM/FM receivers.

DESCRIPTION

NPN medium frequency transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

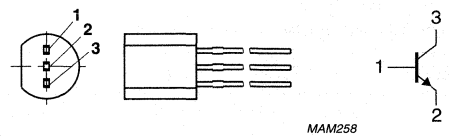


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	420	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_{amb} = 150 °C	–	–	4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	67	–	220	
V_{BE}	base-emitter voltage	I_C = 1 mA; V_{CE} = 10 V	675	725	775	mV
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	–	0.5	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	150	–	–	MHz

PNP medium frequency transistor BF324

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- RF stages in FM front-ends in common base configuration.

DESCRIPTION

PNP medium frequency transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

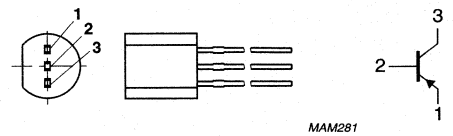


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	–30	V
V_{CEO}	collector-emitter voltage	open base	–	–	–30	V
I_{CM}	peak collector current		–	–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	300	mW
h_{FE}	DC current gain	$I_C = -4$ mA; $V_{CE} = -10$ V	25	–	–	
f_T	transition frequency	$I_C = -4$ mA; $V_{CE} = -10$ V; f = 100 MHz	–	450	–	MHz

PNP medium frequency transistor BF324

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CEO}	collector-emitter voltage	open base	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–25	mA
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	420	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -30$ V	–	–	–50	nA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -4$ V	–	–	–100	nA
h_{FE}	DC current gain	$V_{CE} = -10$ V				
		$I_C = -1$ mA	–	45	–	
		$I_C = -4$ mA	25	–	–	
V_{BE}	base-emitter voltage	$I_C = -4$ mA; $V_{CE} = -10$ V	–	760	–	mV
C_{rb}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	–	0.3	pF
f_T	transition frequency	$V_{CE} = -10$ V; f = 100 MHz				
		$I_C = -1$ mA	–	350	–	MHz
		$I_C = -4$ mA	400	450	–	MHz
		$I_C = -8$ mA	–	440	–	MHz

NPN medium frequency transistor BF370

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- IF pre-amplifiers of television receivers.

DESCRIPTION

NPN medium frequency transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

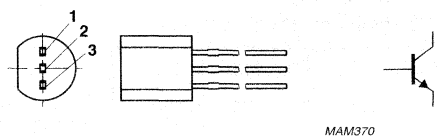


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_j = 125 °C	–	–	30	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 2 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.2	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 1 V; f = 1 MHz	–	–	4.5	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1.6	–	pF
f_T	transition frequency	V_{CE} = 10 V; f = 100 MHz				
		I_C = 10 mA	500	–	–	MHz
		I_C = 40 mA	490	–	–	MHz

NPN high-voltage transistor BF419

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 250 V).

APPLICATIONS

- Driver for line output transistors in colour television receivers.

DESCRIPTION

NPN high-voltage transistor in a TO-126; SOT32 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector connected to mounting base
3	base

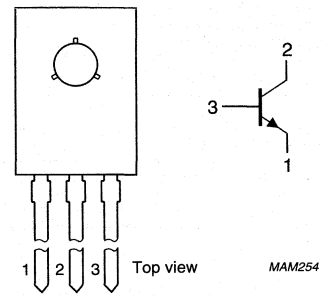


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	250	V
I_{CM}	peak collector current		–	300	mA
P_{tot}	total power dissipation	$T_{mb} \leq 90$ °C	–	6	W
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 10 V	45	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 30 V; f = 1 MHz	–	3.5	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	90	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current	note 1	–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{mb} \leq 90$ °C	–	6	W
		$T_{amb} \leq 70$ °C	–	800	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Precautions should be taken during switch-on of the BF419 where an overshoot of current is likely to occur. The amplitude of the overshoot depends on the relative magnitude of stray external capacities to the transistor collector capacity. It is desirable to keep the stray capacities to a minimum by short lead lengths etc. so as to minimize the area of the switching path.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	10	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 250$ V	–	50	nA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 3$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 10$ V	45	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 200$ mA; $I_B = 20$ mA; note 1	–	6	V
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 30$ V; f = 1 MHz	–	4.5	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 30$ V; f = 1 MHz	–	3.5	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 100 MHz	90	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN high-voltage transistors BF420; BF422

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Class-B video output stages in colour television and professional monitor equipment.

DESCRIPTION

NPN transistors in a TO-92 plastic package.
PNP complements: BF421 and BF423.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

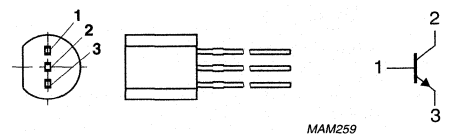


Fig.1 Simplified outline (TO-92) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF420		–	300	V
	BF422		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF420		–	300	V
	BF422		–	250	V
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	830	mW
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF420		–	300	V
	BF422		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF420		–	300	V
	BF422		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	830	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
		$I_E = 0$; $V_{CB} = 200$ V	–	10	nA
		$I_E = 0$; $V_{CB} = 200$ V; $T_j = 150$ °C	–	10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 25$ mA; $V_{CE} = 20$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 30$ mA; $I_B = 5$ mA	–	0.6	V
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 30$ V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	60	–	MHz

PNP high-voltage transistors BF421; BF423

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Class-B video output stages in colour television and professional monitor equipment.

DESCRIPTION

PNP transistors in a TO-92 plastic package.
NPN complements: BF420 and BF422.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

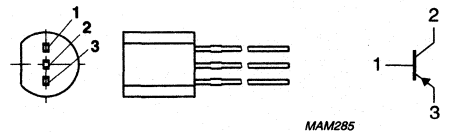


Fig.1 Simplified outline (TO-92) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF421		–	–300	V
	BF423		–	–250	V
V_{CEO}	collector-emitter voltage	open base			
	BF421		–	–300	V
	BF423		–	–250	V
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	830	mW
h_{FE}	DC current gain	$I_C = -25$ mA; $V_{CE} = -20$ V	50	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = -30$ V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF421		–	–300	V
	BF423		–	–250	V
V_{CEO}	collector-emitter voltage	open base			
	BF421		–	–300	V
	BF423		–	–250	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	830	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -200$ V	–	–10	nA
		$I_E = 0$; $V_{CB} = -200$ V; $T_j = 150$ °C	–	–10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–50	nA
h_{FE}	DC current gain	$I_C = -25$ mA; $V_{CE} = -20$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -30$ mA; $I_B = -5$ mA	–	–0.6	V
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = -30$ V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 100 MHz	60	–	MHz

PNP high-voltage transistors BF421L; BF423L

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V)
- Available with a higher power rating (830 mW) under type numbers: BF423.

APPLICATIONS

- Primarily intended for telephony applications.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: BF422L.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

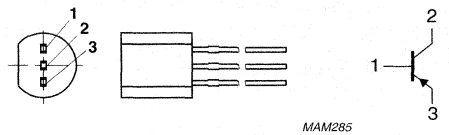


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF421L		–	–300	V
	BF423L		–	–250	V
V_{CEO}	collector-emitter voltage	open base			
	BF421L		–	–300	V
	BF423L		–	–250	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	625	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–10	nA
		I_E = 0; V_{CB} = –200 V; T_j = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–10	μA
h_{FE}	DC current gain	I_C = –25 mA; V_{CE} = –20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –30 mA; I_B = –5 mA; note 1	–	–600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = –30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –10 V; f = 100 MHz	60	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN high-voltage transistor BF422L

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony.

DESCRIPTION

NPN high-voltage transistor in a TO-92; SOT54 plastic package. PNP complements: BF421L and BF423L.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

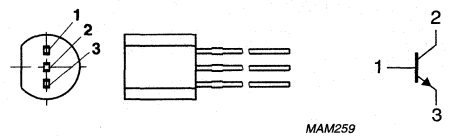


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	250	V
V_{CEO}	collector-emitter voltage	open base	–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	10	nA
		I_E = 0; V_{CB} = 200 V; T_{amb} = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA; note 1	–	600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

PNP medium frequency transistor BF450

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- HF and IF stages in radio receivers
- Mixer stages in AM receivers.

DESCRIPTION

PNP medium frequency transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

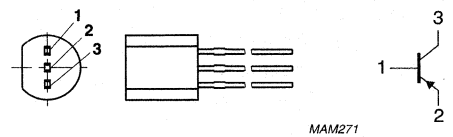


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -10$ V	50	–	
f_T	transition frequency	$I_C = -1$ mA; $V_{CE} = -10$ V; f = 100 MHz	350	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–25	mA
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	420	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -30$ V	–	–50	nA
		$I_E = 0$; $V_{CB} = -30$ V; $T_{amb} = 150$ °C	–	–4	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -3$ V	–	–100	nA
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -10$ V	50	–	
V_{BE}	base-emitter voltage	$I_C = -1$ mA; $V_{CE} = -10$ V	–680	–780	mV
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	0.55	pF
f_T	transition frequency	$I_C = -1$ mA; $V_{CE} = -10$ V; f = 100 MHz	350	–	MHz

NPN high-voltage transistors BF458; BF459

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Intended for video output stages in black-and-white and in colour television receivers.

DESCRIPTION

NPN transistors in a TO-126; SOT32 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

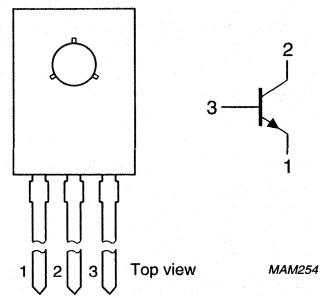


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF458		–	250	V
	BF459		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BF458		–	250	V
	BF459		–	300	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{mb} \leq 90$ °C	–	6	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	104	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	10	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current BF458	I_E = 0; V_{CB} = 200 V	–	–	50	nA
		I_E = 0; V_{CB} = 200 V; T_j = 150 °C	–	–	5	μA
I_{CBO}	collector cut-off current BF459	I_E = 0; V_{CB} = 250 V	–	–	50	nA
		I_E = 0; V_{CB} = 250 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 10 V	26	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 6 mA	–	–	1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 30 V; f = 1 MHz	–	–	4.5	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CE} = 30 V; f = 1 MHz	–	–	3.5	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	–	90	–	MHz

NPN high-voltage transistors BF469; BF471

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Intended for class-B video output stages in television receivers and for high-voltage IF output stages.

DESCRIPTION

NPN transistors in a TO-126; SOT32 plastic package.
PNP complements: BF470 and BF472.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

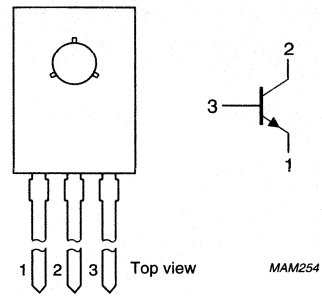


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF469		–	250	V
	BF471		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BF469		–	250	V
	BF471		–	300	V
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{mb} \leq 114$ °C	–	1.8	W
h_{FE}	DC current gain	$I_C = 25$ mA; $V_{CE} = 20$ V	50	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 30$ V; f = 1 MHz	–	1.8	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF469		–	250	V
	BF471		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BF469		–	250	V
	BF471		–	300	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{mb} \leq 114$ °C	–	1.8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		20	K/W

Note

1. Transistor mounted on a printed-circuit board, maximum lead length 4 mm, mounting pad for collector lead minimum 10 × 10 mm.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 200$ V	–	10	nA
		$I_E = 0$; $V_{CB} = 200$ V; $T_j = 150$ °C	–	10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 25$ mA; $V_{CE} = 20$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 30$ mA; $I_B = 5$ mA	–	0.6	V
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 30$ V; f = 1 MHz	–	1.8	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	60	–	MHz

PNP high-voltage transistors BF470; BF472

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Class-B video output stages in television receivers and for high-voltage IF output stages.

DESCRIPTION

PNP transistors in a TO-126; SOT32 plastic package.
NPN complements: BF469 and BF471.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

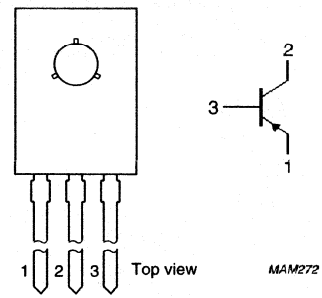


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF470		–	–250	V
	BF472		–	–300	V
V_{CEO}	collector-emitter voltage	open base			
	BF470		–	–250	V
	BF472		–	–300	V
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{mb} \leq 114$ °C	–	1.8	W
h_{FE}	DC current gain	$I_C = -25$ mA; $V_{CE} = -20$ V	50	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = -30$ V; f = 1 MHz	–	1.8	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF470		–	–250	V
	BF472		–	–300	V
V_{CEO}	collector-emitter voltage	open base			
	BF470		–	–250	V
	BF472		–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–50	mA
P_{tot}	total power dissipation	$T_{mb} \leq 114$ °C	–	1.8	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		20	K/W

Note

1. Transistor mounted on a printed-circuit board, maximum lead length 4 mm; mounting pad for collector lead minimum 10 × 10 mm.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -200$ V	–	–10	nA
		$I_E = 0$; $V_{CB} = -200$ V; $T_j = 150$ °C	–	–10	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–50	nA
h_{FE}	DC current gain	$I_C = -25$ mA; $V_{CE} = -20$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -30$ mA; $I_B = -5$ mA	–	–600	mV
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = -30$ V; f = 1 MHz	–	1.8	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 100 MHz	60	–	MHz

NPN high-voltage transistors BF483; BF485; BF487

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Intended for use in video output stages in black-and-white and in colour television receivers.

DESCRIPTION

NPN transistors in a TO-92 plastic package.
PNP complement: BF488

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

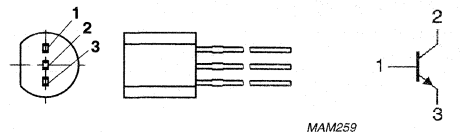


Fig.1 Simplified outline (TO-92) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF483		–	300	V
	BF485		–	350	V
	BF487		–	400	V
V_{CEO}	collector-emitter voltage	open base			
	BF483		–	250	V
	BF485		–	300	V
	BF487		–	350	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	830	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 300 V	–	20	nA
		I_E = 0; V_{CB} = 250 V; T_j = 150 °C	–	20	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
		I_C = 40 mA; V_{CE} = 20 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 30 V; f = 1 MHz	–	1.4	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = 10 V; f = 100 MHz	70	110	MHz

PNP high-voltage transistor BF488

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Intended for use in video output stages of black and white and colour television receivers.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complements: BF483, BF485 and BF487.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

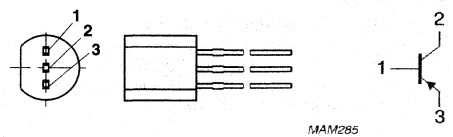


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−350	V
V_{CEO}	collector-emitter voltage	open base	–	−350	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	830	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

PNP high-voltage transistor BF488

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −300 V	–	−20	nA
		I_E = 0; V_{CB} = −200 V; T_j = 150 °C	–	−20	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−100	nA
h_{FE}	DC current gain	I_C = −25 mA; V_{CE} = −20 V	50	–	
		I_C = −40 mA; V_{CE} = −20 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −20 mA; I_B = −2 mA	–	−0.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −20 V; f = 1 MHz	–	4	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CE} = −30 V; f = 1 MHz	–	2.5	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	70	110	MHz

PNP medium frequency transistor BF550

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Medium frequency applications in thick and thin film circuits.

DESCRIPTION

PNP medium frequency transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF550	LA*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

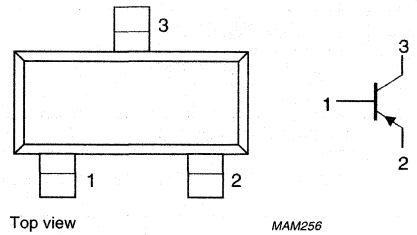


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–25	mA
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −3 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −10 V	50	–	–	
V_{BE}	base-emitter voltage	I_C = −1 mA; V_{CE} = −10 V	–	750	–	mV
C_{re}	feedback capacitance	I_C = −1 mA; V_{CB} = −10 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = −1 mA; V_{CE} = −10 V; f = 100 MHz	–	325	–	MHz

NPN medium frequency transistor BF570

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 15 V)
- Low feedback capacitance (max. 2.2 pF).

APPLICATIONS

- Monitors
- Battery equipped applications.

DESCRIPTION

NPN transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
BF570	B26

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

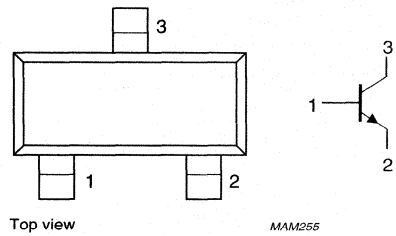


Fig.1 Simplified outline (SOT23) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_{CM}	peak collector current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	–	
f_T	transition frequency	I_C = 40 mA; V_{CE} = 10 V; f = 100 MHz	490	–	MHz

NPN medium frequency transistor BF570

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 20$ V	–	–	400	nA
		$I_E = 0$; $V_{CB} = 20$ V; $T_j = 125$ °C	–	–	30	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 2$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 1$ V	40	–	–	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1.6	2.2	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	500	–	–	MHz
		$I_C = 40$ mA; $V_{CE} = 10$ V; f = 100 MHz	490	–	–	MHz

NPN high-voltage transistors BF585; BF587

FEATURES

- Low feedback capacitance.

APPLICATIONS

- For use in video output stages of black and white and colour television receivers.

DESCRIPTION

NPN transistors in a TO-202; SOT128B plastic package.
PNP complement: BF588.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

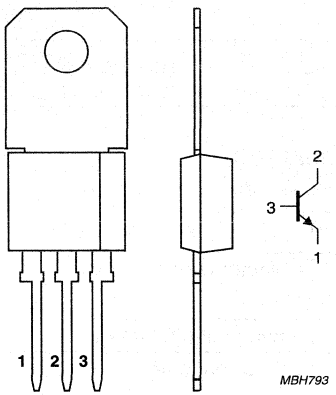


Fig.1 Simplified outline (TO-202; SOT128B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF585		–	350	V
	BF587		–	400	V
V_{CEO}	collector-emitter voltage	open base			
	BF585		–	300	V
	BF587		–	350	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	in free air; $T_{amb} \leq 25$ °C	–	1.6	W
		in free air; $T_{mb} \leq 25$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	78	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	25	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 300 V	–	20	nA
		I_E = 0; V_{CB} = 250 V; T_j = 150 °C	–	20	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
		I_C = 40 mA; V_{CE} = 20 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	600	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 30 V; f = 1 MHz	–	2.5	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CE} = 30 V; f = 1 MHz	–	1.8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V	70	110	MHz

PNP high-voltage transistor BF588

FEATURES

- Low feedback capacitance.

APPLICATIONS

- For use in video output stages of black and white and colour television receivers.

DESCRIPTION

PNP transistor in a TO-202 plastic package.
NPN complements: BF585 and BF587.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

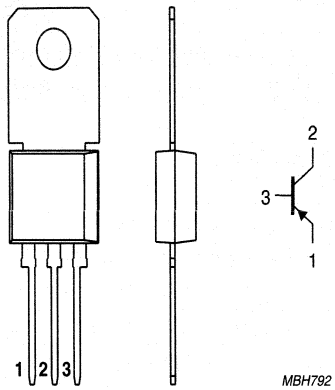


Fig.1 Simplified outline (TO-202) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–350	V
V_{CEO}	collector-emitter voltage	open base	–	–350	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.6	W
		$T_{mb} \leq 25$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	78	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	25	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –300 V	–	–20	nA
		I_E = 0; V_{CB} = –200 V; T_j = 150 °C	–	–20	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–100	nA
h_{FE}	DC current gain	I_C = –25 mA; V_{CE} = –20 V	50	–	
		I_C = –40 mA; V_{CE} = –20 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA	–	–0.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –30 V; f = 1 MHz	–	3	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CE} = –30 V; f = 1 MHz	–	2.2	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –10 V; f = 100 MHz	70	110	MHz

NPN high-voltage transistors BF620; BF622

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Video output stages.

DESCRIPTION

NPN high-voltage transistor in a SOT89 plastic package.
PNP complements: BF621 and BF623.

MARKING

TYPE NUMBER	MARKING CODE
BF620	DC
BF622	DA

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

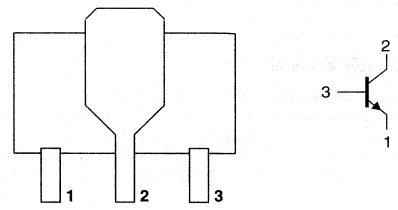


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF620		–	300	V
	BF622		–	250	V
V_{CEO}	collector-emitter voltage	open-base			
	BF620		–	300	V
	BF622		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		20	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	10	nA
		I_E = 0; V_{CB} = 200 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

PNP high-voltage transistors BF621; BF623

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Video output stages.

DESCRIPTION

PNP high-voltage transistor in a SOT89 plastic package.
NPN complements: BF620 and BF622.

MARKING

TYPE NUMBER	MARKING CODE
BF621	DF
BF623	DB

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

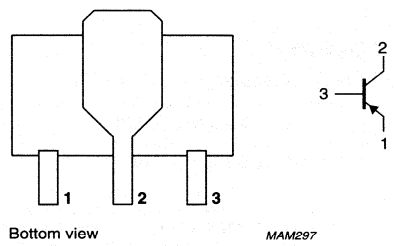


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF621		–	–300	V
	BF623		–	–250	V
V_{CEO}	collector-emitter voltage	open base			
	BF621		–	–300	V
	BF623		–	–250	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		20	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–10	nA
		I_E = 0; V_{CB} = –200 V; T_j = 150 °C	–	–10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	I_C = –25 mA; V_{CE} = –20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –30 mA; I_B = –5 mA	–	–800	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = –30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –10 V; f = 100 MHz	60	–	MHz

NPN high-voltage transistors BF720; BF722

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Class-B video output stages of colour television receivers
- General purpose high voltage circuits.

DESCRIPTION

NPN transistors in a SOT223 plastic package.
PNP complement: BF723.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

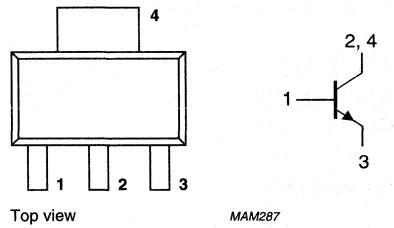


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF720		–	300	V
	BF722		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF720		–	300	V
	BF722		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2.For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	106	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	25	K/W

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	10	nA
		I_E = 0; V_{CB} = 200 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	0.6	V
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

PNP high-voltage transistor BF723

FEATURES

- Low feedback capacitance.

APPLICATIONS

- Class-B video output stages of colour television receivers
- General purpose high voltage circuits.

DESCRIPTION

PNP transistor in a SOT223 plastic package.
NPN complement: BF722.

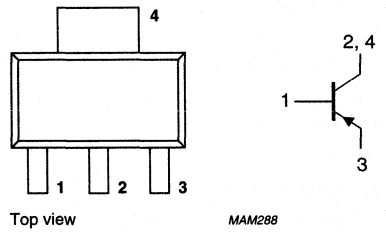


Fig.1 Simplified outline (SOT223) and symbol.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−250	V
V_{CEO}	collector-emitter voltage	open base	–	−250	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	106	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	25	K/W

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −200 V	–	−10	nA
		I_E = 0; V_{CB} = −200 V; T_j = 150 °C	–	−10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −25 mA; V_{CE} = −20 V	−50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −30 mA; I_B = −5 mA	–	−0.6	V
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = −30 V; f = 1 MHz	–	2.5	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	60	–	MHz

NPN high-voltage transistor BF819

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 250 V).

APPLICATIONS

- Driver for a line output transistor in colour television receivers.

DESCRIPTION

NPN high-voltage transistor in a TO-202; SOT128B plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

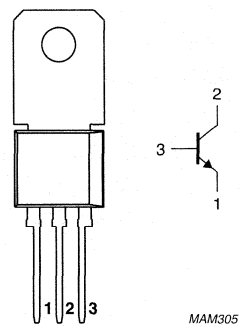


Fig.1 Simplified outline (TO-202; SOT128B) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	250	V
I_{CM}	peak collector current		–	300	mA
P_{tot}	total power dissipation	$T_{amb} \leq 75$ °C	–	6	W
h_{FE}	DC current gain	I_C = 20 mA, V_{CE} = 10 V	45	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 30 V; f = 1 MHz	–	3.5	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	90	–	MHz

NPN high-voltage transistor BF819

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 75$ °C	–	1.2	W
		$T_{mb} \leq 75$ °C	–	6	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	62.5	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		12.5	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 250$ V	–	50	nA
		$I_E = 0$; $V_{CB} = 250$ V; $T_j = 150$ °C	–	5	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	100	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 10$ V	45	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 200$ mA; $I_B = 20$ mA	–	11	V
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 30$ V; f = 1 MHz	–	4.5	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 30$ V; f = 1 MHz	–	3.5	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 100 MHz	90	–	MHz

NPN high-voltage transistors | BF820; BF822

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a SOT23 plastic package.
PNP complements: BF821; BF823.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF820	1V*
BF822	1X*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

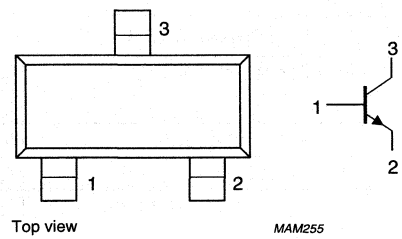


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF820		–	300	V
	BF822		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF820		–	300	V
	BF822		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	10	nA
		I_E = 0; V_{CB} = 200 V; T_j =150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

NPN high-voltage transistors BF820W; BF822W

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a SOT323 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
BF820W	1Vt
BF822W	1Wt

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

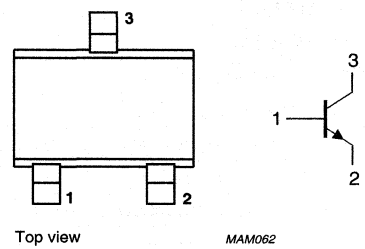


Fig.1 Simplified outline (SOT323) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF820W		–	300	V
	BF822W		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF820W		–	300	V
	BF822W		–	250	V
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 30 V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF820W		–	300	V
	BF822W		–	250	V
V_{CEO}	collector-emitter voltage	open base			
	BF820W		–	300	V
	BF822W		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 200$ V	–	10	nA
		$I_E = 0$; $V_{CB} = 200$ V; $T_j = 150$ °C	–	10	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 25$ mA; $V_{CE} = 20$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 30$ mA; $I_B = 5$mA; note 1	–	600	mV
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 30$ V; f = 1 MHz	–	1.6	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	60	–	MHz

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

PNP high-voltage transistors BF821; BF823

FEATURES

- Low current (max. 50 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BF820, BF822.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF821	1W*
BF823	1Y*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

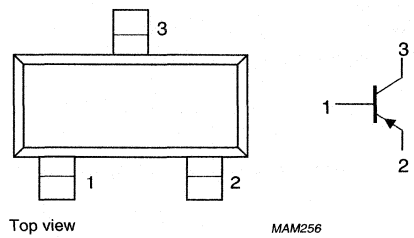


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF821		–	–300	V
	BF823		–	–250	V
V_{CEO}	collector-emitter voltage	open base			
	BF821		–	–300	V
	BF823		–	–250	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −200 V	−	−10	nA
		I_E = 0; V_{CB} = −200 V; T_j = 150 °C	−	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−50	nA
h_{FE}	DC current gain	I_C = −25 mA; V_{CE} = −20 V	50	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −30 mA; I_B = −5 mA	−	−800	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = −30 V; f = 1 MHz	−	1.6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	60	−	MHz

PNP medium frequency transistor BF824

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- RF stages in FM front-ends in common base configuration.

DESCRIPTION

PNP medium frequency transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF824	F8*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

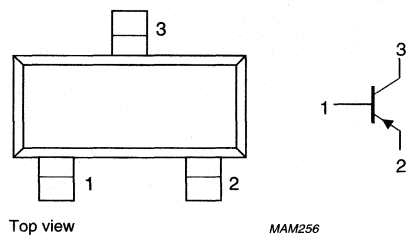


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CEO}	collector-emitter voltage	open base	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–25	mA
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −10 V	25	45	–	
		I_C = −4 mA; V_{CE} = −10 V	25	50	–	
V_{BE}	base-emitter voltage	I_C = −4 mA; V_{CE} = −10 V	–	–	−900	mV
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	–	0.3	pF
f_T	transition frequency	V_{CE} = −10 V; f = 100 MHz				
		I_C = −1 mA	250	350	–	MHz
		I_C = −4 mA	400	450	–	MHz
		I_C = −8 mA	390	440	–	MHz

PNP medium frequency transistor BF824W

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- RF stages in FM front-ends in common base configuration.

DESCRIPTION

PNP medium frequency transistor in a SOT323 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF824W	F8*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

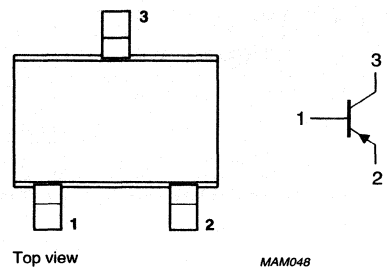


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CEO}	collector-emitter voltage	open base	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–25	mA
I_{CM}	peak collector current		–	–25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −10 V	25	–	
		I_C = −4 mA; V_{CE} = −10 V	25	–	
V_{BE}	base-emitter voltage	I_C = −4 mA; V_{CE} = −10 V	–	−900	mV
C_{rb}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	0.3	pF
f_T	transition frequency	V_{CE} = −10 V; f = 100 MHz; note 1			
		I_C = −1 mA	250	–	MHz
		I_C = −4 mA	400	–	MHz
		I_C = −8 mA	390	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN medium frequency transistor BF840

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- AM mixers
- IF amplifiers in AM/FM receivers.

DESCRIPTION

NPN medium frequency transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BF840	NC*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

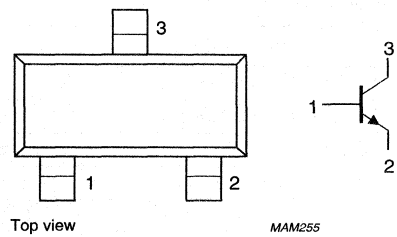


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	67	–	222	
V_{BE}	base-emitter voltage	I_C = 1 mA; V_{CE} = 10 V	675	725	775	mV
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	–	380	–	MHz

NPN high-voltage transistor BF859

DESCRIPTION

NPN transistor in a TO-202 plastic package.

An A-version with e-b-c pinning instead of e-c-b is available on request.

APPLICATIONS

- For use in video output stages of black and white and colour television receivers.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

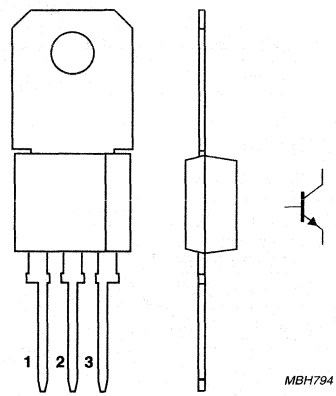


Fig.1 Simplified outline (TO-202) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	300	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	2	W
		$T_{mb} \leq 75$ °C	–	6	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	62.5	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	12.5	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 250 V	–	0.1	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 10 V	26	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 6 mA	–	1	V
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 30 V; f = 1 MHz	–	3	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	90	–	MHz

NPN high-voltage transistors BF869; BF871

FEATURES

- Low feedback capacitance.

APPLICATIONS

- For use in class-B video output stages in colour television receivers.

DESCRIPTION

NPN transistors in a TO-202 plastic package.
PNP complement: BF872.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

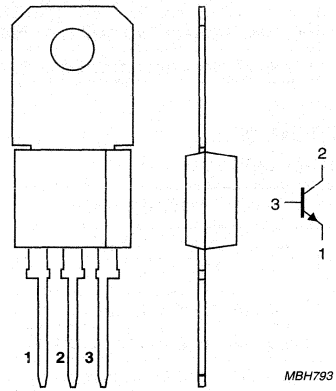


Fig.1 Simplified outline (TO-202) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BF869		–	250	V
	BF871		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BF869		–	250	V
	BF871		–	300	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	50	mA
I_{CM}	peak collector current	peak value	–	100	mA
I_{BM}	peak base current		–	50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.6	W
		$T_{mb} \leq 25$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	78	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	25	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	10	nA
		I_E = 0; V_{CB} = 200 V; T_j = 150 °C		10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 30 V; f = 1 MHz	–	2	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	60	–	MHz

PNP high-voltage transistor BF872

FEATURES

- Low feedback capacitance.

APPLICATIONS

- For use in class-B video output stages of colour television receivers.

DESCRIPTION

PNP transistors in a TO-202 plastic package.
NPN complement: BF871.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector, connected to mounting base
3	base

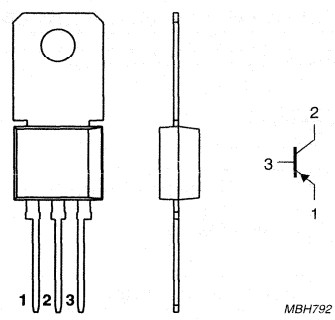


Fig.1 Simplified outline (TO-202) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–300	V
V_{CEO}	collector-emitter voltage	open base	–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–50	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–50	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.6	W
		$T_{mb} \leq 25$ °C	–	5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	78	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	25	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–10	nA
		I_E = 0; V_{CB} = –200 V; T_j = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	I_C = –25 mA; V_{CE} = –20 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –30 mA; I_B = –5 mA	–	–600	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = –30 V; f = 1MHz	–	2.2	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –10 V; f = 100 MHz	60	–	MHz

NPN medium frequency transistor BFS19

FEATURES

- Low current (max. 30 mA)
- Low voltage (max. 20 V).

APPLICATIONS

- Medium frequency applications in thick and thin-film circuits.

DESCRIPTION

NPN medium frequency transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BFS19	F2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

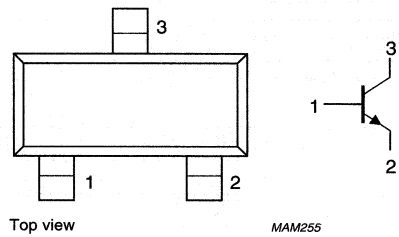


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	30	mA
I_{CM}	peak collector current		–	30	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 100 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	65	–	225	
V_{BE}	base-emitter voltage	I_C = 1 mA; V_{CE} = 10 V	650	–	740	mV
C_c	collector capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	I_C = 0 mA; V_{CB} = 10 V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	–	260	–	MHz

NPN medium frequency transistor BFS20

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 20 V)
- Very low feedback capacitance (typ. 350 fF).

APPLICATIONS

- IF and VHF applications in thick and thin-film circuits.

DESCRIPTION

NPN medium frequency transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BFS20	G1*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

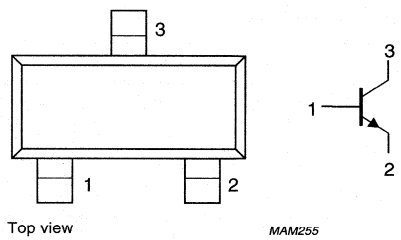


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 100 °C	–	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 7 mA; V_{CE} = 10 V	40	85	–	
V_{BE}	base-emitter voltage	I_C = 7 mA; V_{CE} = 10 V	–	740	900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	350	–	fF
f_T	transition frequency	I_C = 5 mA; V_{CE} = 10 V; f = 100 MHz	275	450	–	MHz

NPN medium frequency transistor BFS20W

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 20 V).
- Very low feedback capacitance (typ. 350 fF).

APPLICATIONS

- IF and VHF applications in thick and thin-film circuits.

DESCRIPTION

NPN medium frequency transistor in a SOT323 (SC-70) plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BFS20W	N1*

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

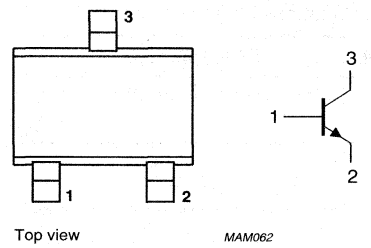


Fig.1 Simplified outline (SOT323; SC-70) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SOT323 (SC-70) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

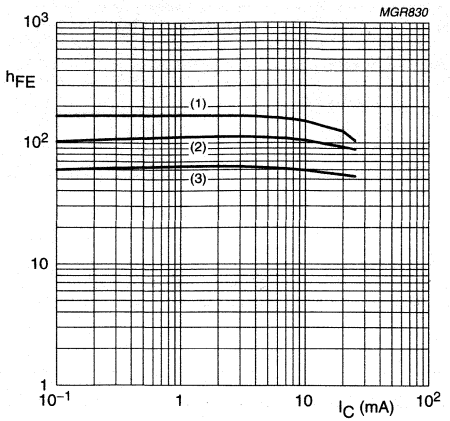
Note

1. Refer to SOT323 (SC-70) standard mounting conditions.

CHARACTERISTICS

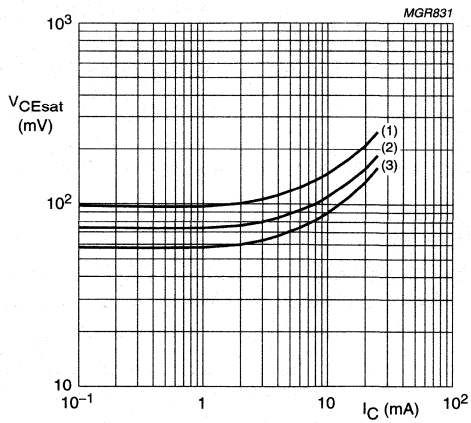
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 20$ V	–	–	100	nA
		$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100$ °C	–	–	10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 4$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 7$ mA; $V_{CE} = 10$ V	40	85	–	
V_{BE}	base-emitter voltage	$I_C = 7$ mA; $V_{CE} = 10$ V	–	740	900	mV
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	350	–	fF
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 10$ V; f = 100 MHz	360	470	–	MHz



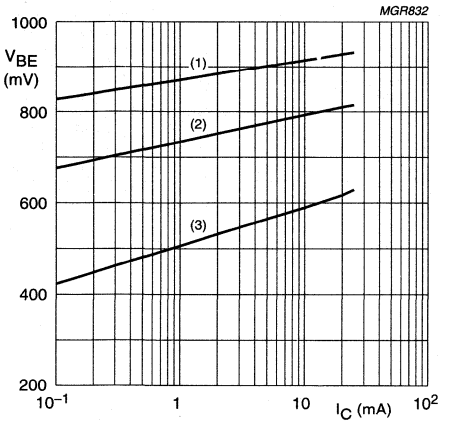
V_{CE} = 10 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −55 °C.

Fig.2 DC current gain as a function of collector current; typical values.



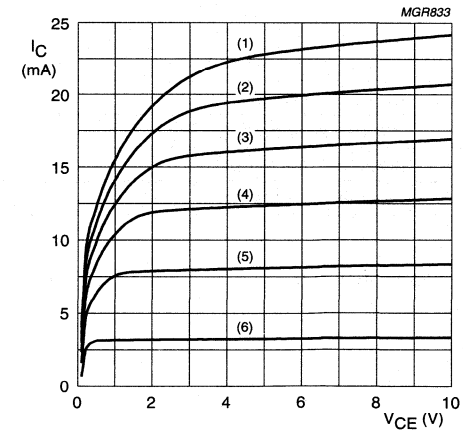
I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −55 °C.

Fig.3 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 10 V.
(1) T_{amb} = −100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 150 °C.

Fig.4 Base-emitter voltage as a function of collector current; typical values.



T_{amb} = 25 °C.
(1) I_B = 280 μA.
(2) I_B = 230 μA.
(3) I_B = 180 μA.
(4) I_B = 130 μA.
(5) I_B = 80 μA.
(6) I_B = 30 μA.

Fig.5 Collector current as a function of collector-emitter voltage; typical values.

NPN high-voltage transistor BFV420

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 100 V).

APPLICATIONS

- Primarily intended for video applications (monitors).

DESCRIPTION

NPN high-voltage transistor in a TO-92; SOT54 plastic package. PNP complement: BFV421.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

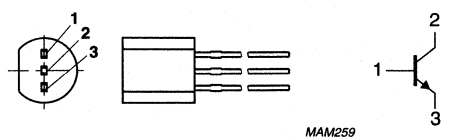


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	140	V
V_{CEO}	collector-emitter voltage	open base	–	100	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	830	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 100 V	–	100	nA
		I_E = 0; V_{CB} = 100 V; T_{amb} = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 10 V	150	–	
		I_C = 50 mA; V_{CE} = 10 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	200	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CE} = 25 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz	150	–	MHz

PNP high-voltage transistor BFV421

FEATURES

- High voltage
- High transition frequency
- Low output capacitance.

APPLICATIONS

- Primarily intended for video applications (monitors).

DESCRIPTION

PNP transistor in a plastic TO-92; SOT54 package.
NPN complement: BFV420.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

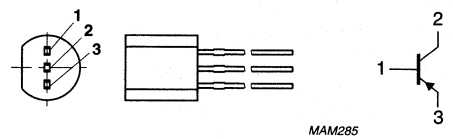


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–140	V
V_{CEO}	collector-emitter voltage	open base	–	–100	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	830	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	150	K/W

Note

1. Transistor mounted on a printed-circuit board; maximum lead length 4 mm; mounting pad for collector lead minimum 10×10 mm.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -100$ V	–	−100	nA
		$I_E = 0$; $V_{CB} = -100$ V; $T_{amb} = 150$ °C	–	−10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -4$ V	–	−100	nA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -10$ V	150	–	
		$I_C = -50$ mA; $V_{CE} = -10$ V	20	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -30$ mA; $I_B = -5$ mA	–	−200	mV
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = -25$ V; f = 1 MHz	–	2.3	pF
f_T	transition frequency	$I_C = -20$ mA; $V_{CE} = -20$ V; f = 100 MHz	150	–	MHz

NPN high-voltage transistor BFV469

FEATURES

- High transition frequency
- Low feedback capacitance.

APPLICATIONS

- Buffer transistor in monitors.

DESCRIPTION

NPN high-voltage transistor in a TO-126; SOT32 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

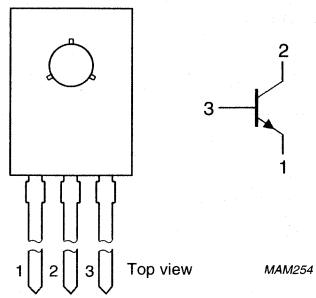


Fig.1 Simplified outline (TO-126; SOT32) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	140	V
V_{CEO}	collector-emitter voltage	open base	–	100	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		10	K/W

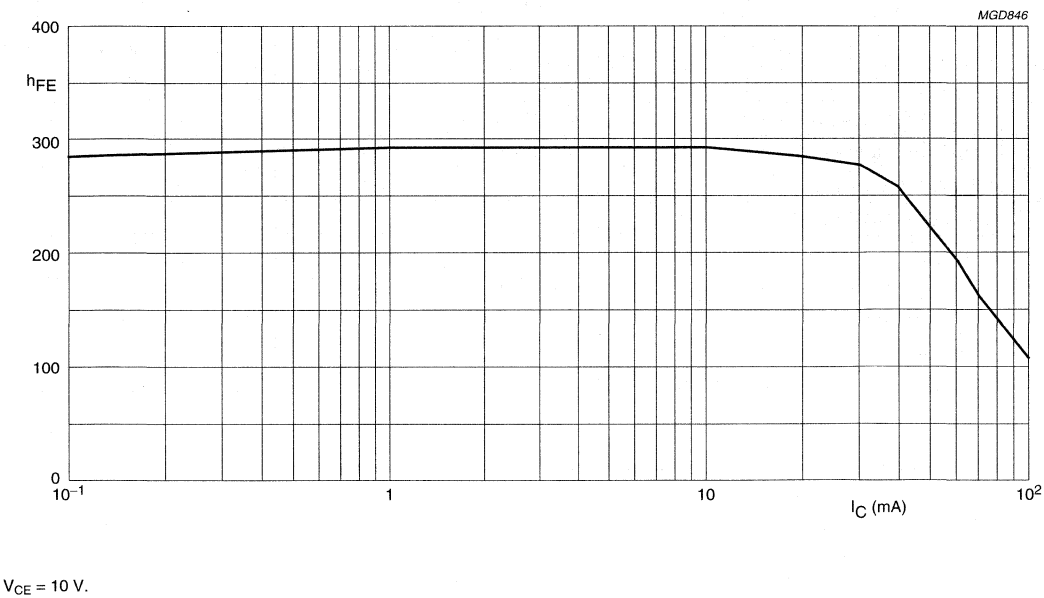
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 100 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; see Fig.2			
		I_C = 10 mA	150	–	
		I_C = 50 mA	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 30 mA; I_B = 5 mA	–	200	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 25 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz	150	–	MHz



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.

Programmable unijunction transistor BRY56A

DESCRIPTION

Planar PNPN trigger device in a TO-92; SOT54 plastic package.

APPLICATIONS

- Switching applications such as:
  - Motor control
  - Oscillators
  - Relay replacement
  - Timers
  - Pulse shapers, etc.

PINNING

PIN	DESCRIPTION
1	gate
2	anode
3	cathode

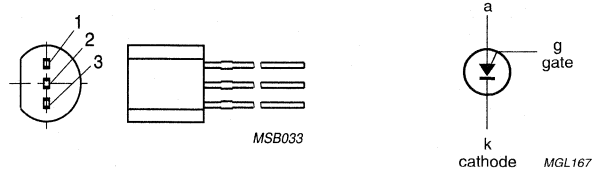


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{GA}	gate-anode voltage		–	70	V
$I_{A(AV)}$	average anode current		–	175	mA
I_{ARM}	repetitive peak anode current	t_p = 10 μs; δ = 0.01	–	2.5	A
I_{ASM}	non-repetitive peak anode current	t_p = 10 μs	–	3	A
dI_A/dt	rate of rise of anode current	$I_A \leq 2.5$ A	–	20	A/μs
P_{tot}	total power dissipation	$T_{amb} \leq 75$ °C	–	300	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Programmable unijunction transistor BRY56A

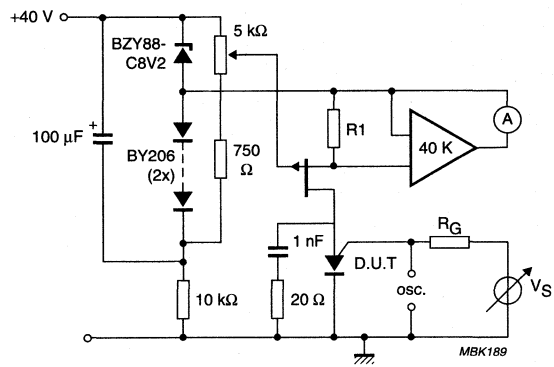
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	250	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_P	peak point current	V_S = 10 V; R_G = 10 kΩ; see Fig.7	–	–	200	nA
		V_S = 10 V; R_G = 100 kΩ; see Fig.7	–	–	60	nA
I_V	valley point current	V_S = 10 V; R_G = 10 kΩ; see Fig.7	2	–	–	μA
		V_S = 10 V; R_G = 100 kΩ; see Fig.7	1	–	–	μA
V_{offset}	offset voltage	typical curve; I_A = 0; see Fig.7	–	$V_P - V_S$	–	V
I_{GAO}	gate-anode leakage current	I_K = 0; V_{GA} = 70 V; see Fig.5	–	–	10	nA
I_{GKS}	gate-cathode leakage current	V_{AK} = 0; V_{KG} = 70 V; see Fig.6	–	–	100	nA
V_{AK}	anode-cathode voltage	I_A = 100 mA	–	–	1.4	V
V_{OM}	peak output voltage	V_{AA} = 20 V; C = 10 nF; see Figs 8 and 9	6	–	–	V
t_r	rise time	V_{AA} = 20 V; C = 10 nF; see Fig.9	–	–	80	ns



I_P and I_V determined by value of R1.

$R1 = \frac{1}{I_A}$; i.e. maximum voltage drop over R1 = 1 V.

Internal resistance of oscilloscope = 10 MΩ.

Fig.2 Measuring circuit for peak and valley point currents.

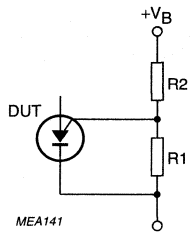


Fig.3 BRY56A with 'program' resistors R1 and R2.

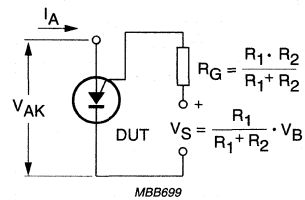


Fig.4 Equivalent test circuit for characteristics testing.

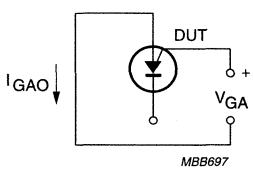


Fig.5 Equivalent test circuit for gate-anode leakage current.

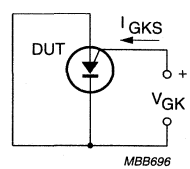


Fig.6 Equivalent test circuit for gate-cathode leakage current.

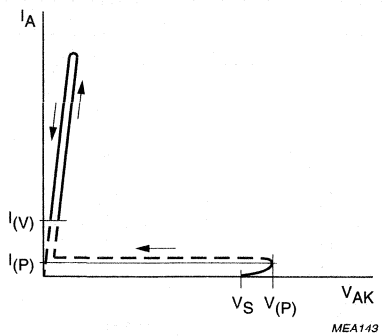


Fig.7 Offset voltage.

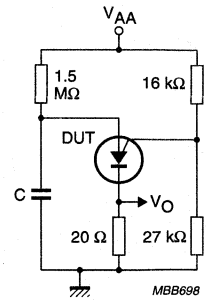


Fig.8 Test circuit for peak output voltage.

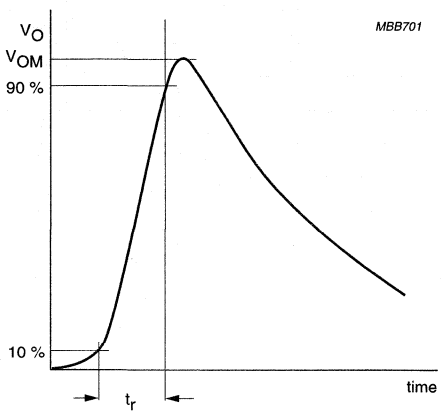


Fig.9 Peak output voltage.

Programmable unijunction transistor BRY61

DESCRIPTION

Planar PNPN trigger device in a SOT23 plastic package.

APPLICATIONS

- Switching applications such as:
  - Motor control
  - Oscillators
  - Relay replacement
  - Timers
  - Pulse shapers, etc.

MARKING

TYPE NUMBER	MARKING CODE(1)
BRY61	A5*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	gate

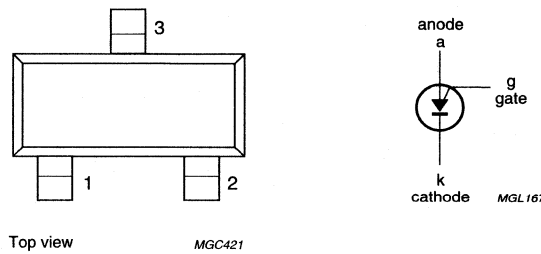


Fig.1 Simplified outline SOT23 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{GA}	gate-anode voltage		–	70	V
$I_{A(AV)}$	average anode current		–	175	mA
I_{ARM}	repetitive peak anode current	t_p = 10 μs; δ = 0.01	–	2.5	A
I_{ASM}	non-repetitive peak anode current	t_p = 10 μs	–	3	A
dI_A/dt	rate of rise of anode current	$1_A \leq 2.5$ A	–	20	A/μs
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Programmable unijunction transistor BRY61

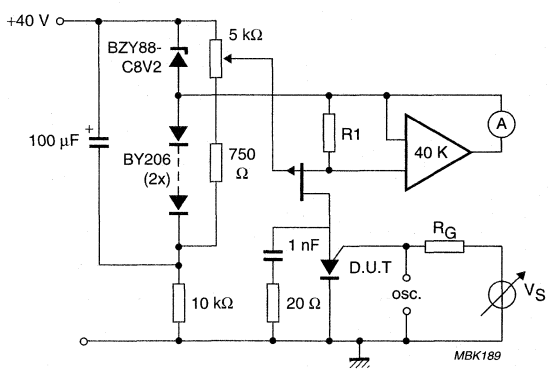
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_P	peak point current	V_S = 10 V; R_G = 10 kΩ; (see Fig.7)	–	–	0.2	μA
		V_S = 10 V; R_G = 100 kΩ; (see Fig.7)	–	–	0.06	μA
I_V	valley point current	V_S = 10 V; R_G = 10 kΩ; (see Fig.7)	2	–	–	μA
		V_S = 10 V; R_G = 100 kΩ; (see Fig.7)	1	–	–	μA
V_{offset}	offset voltage	typical curve; I_A = 0; (see Fig.7)	–	$V_P - V_S$	–	V
I_{GAO}	gate-anode leakage current	I_K = 0; V_{GA} = 70 V; (see Fig.5)	–	–	10	nA
I_{GKS}	gate-cathode leakage current	V_{AK} = 0; V_{KG} = 70 V; (see Fig.6)	–	–	100	nA
V_{AK}	anode-cathode voltage	I_A = 100 mA	–	–	1.4	V
V_{OM}	peak output voltage	V_{AA} = 20 V; C = 10 nF; (see Figs 8 and 9)	6	–	–	V
t_r	rise time	V_{AA} = 20 V; C = 10 nF; (see Fig.9)	–	–	80	ns



I_P and I_V determined by value of R1.

$R1 = \frac{1}{I_A}$; i.e. maximum voltage drop over R1 = 1 V.

Internal resistance of oscilloscope = 10 MΩ.

Fig.2 Measuring circuit for peak and valley point currents.

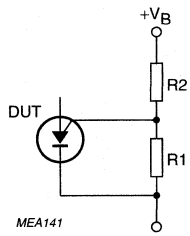


Fig.3 BRY61 with 'program' resistors R1 and R2.

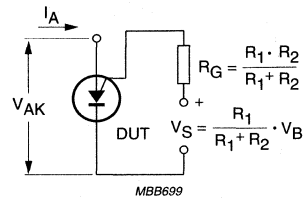


Fig.4 Equivalent test circuit for characteristics testing.

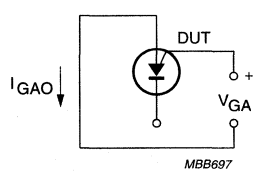


Fig.5 Equivalent test circuit for gate-anode leakage current.

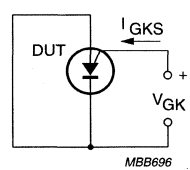


Fig.6 Equivalent test circuit for gate-cathode leakage current.

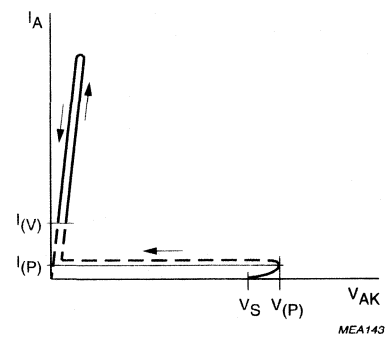


Fig.7 Offset voltage.

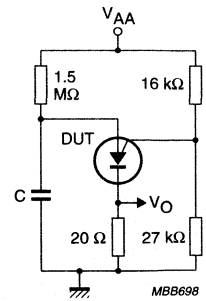


Fig.8 Test circuit for peak output voltage.

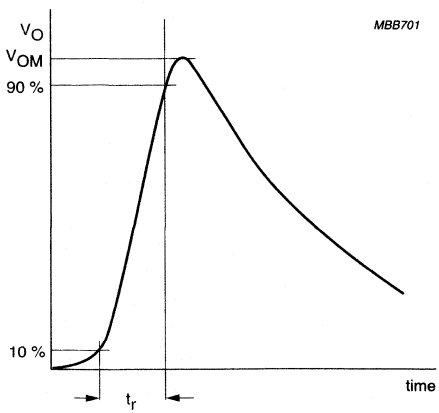


Fig.9 Peak output voltage.

Silicon controlled switch BRY62

DESCRIPTION

Silicon planar PNPN switch in a SOT143B plastic package. It is an integrated PNP/NPN transistor pair, with all electrodes accessible.

APPLICATIONS

- Switching applications.

MARKING

TYPE NUMBER	MARKING CODE
BRY62	A51

PINNING

PIN	DESCRIPTION
1	anode gate
2	anode
3	cathode
4	cathode gate

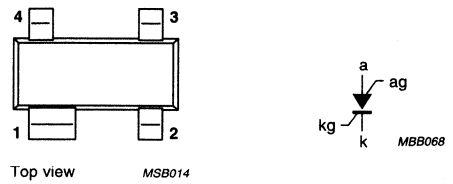


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CER}	collector-emitter voltage	R_{BE} = 10 kΩ	–	70	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)	note 1	–	175	mA
I_{CM}	peak collector current	note 2	–	175	mA
I_E	emitter current (DC)		–	–175	mA
I_{ERM}	repetitive peak emitter current	t_p = 10 μs; δ = 0.01	–	–2.5	A
PNP transistor					
V_{CBO}	collector-base voltage	open emitter	–	–70	V
V_{CEO}	collector-emitter voltage	open base	–	–70	V
V_{EBO}	emitter-base voltage	open collector	–	–70	V
I_E	emitter current (DC)		–	175	mA
I_{ERM}	repetitive peak emitter current	t_p = 10 μs; δ = 0.01	–	2.5	A

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Combined device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.14	−65	+150	°C

Notes

1. Provided the I_E rating is not exceeded.
2. During switching on, the device can withstand the discharge of a capacitor of a maximum value of 500 pF. This capacitor is charged when the transistor is in cut-off condition, with a collector supply voltage of 160 V and a series resistance of 100 kΩ.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
NPN transistor					
I_{CER}	collector cut-off current	V_{CE} = 70 V; R_{BE} = 10 kΩ	–	100	nA
		V_{CE} = 70 V; R_{BE} = 10 kΩ; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V; T_j = 150 °C	–	10	μA
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	900	mV
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 2 V	50	–	
f_T	transition frequency	I_C = 10 mA; V_{CE} = 2 V; f = 100 MHz	100	–	MHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz	–	5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 1 V; f = 1 MHz	–	25	pF
PNP transistor					
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −70 V; T_j = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −70 V; T_j = 150 °C	–	−10	μA
h_{FE}	DC current gain	I_E = 1 mA; V_{CB} = −5 V	3	15	
Combined device					
V_{AK}	forward on-state voltage	$R_{KG\text{-}K}$ = 10 kΩ			
		I_A = 50 mA; I_{AG} = 0	–	1.4	V
		I_A = 50 mA; I_{AG} = 0; T_j = − 55 °C	–	1.9	V
		I_A = 1 mA; I_{AG} = 10 mA	–	1.2	V
I_H	holding current	$R_{KG\text{-}K}$ = 10 kΩ; I_{AG} = 10 mA; V_{BB} = −2 V; (see Fig.5)	–	1	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Switching times					
t_{on}	turn-on time	V_{KG-K} = −0.5 to 4.5 V; R_{KG-K} = 1 kΩ; see Figs 6 and 7	–	0.25	μs
		V_{KG-K} = −0.5 to 0.5 V; R_{KG-K} = 10 kΩ	–	1.5	μs
t_{off}	turn-off time	R_{KG-K} = 10 kΩ; see Figs 8 and 9	–	15	μs

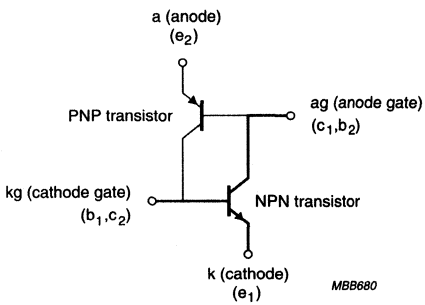


Fig.2 Two transistor equivalent circuit.

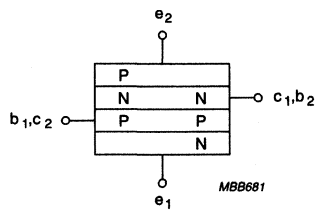


Fig.3 PNPN silicon controlled switch structure.

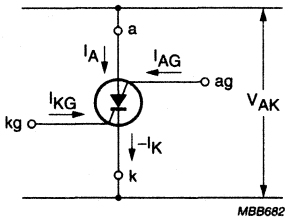


Fig.4 Silicon controlled switch symbol.

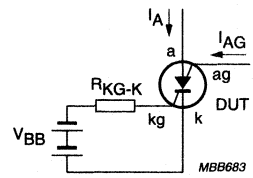


Fig.5 Equivalent test circuit for holding current.

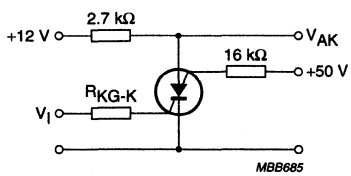


Fig.6 Test circuit for turn-on time.

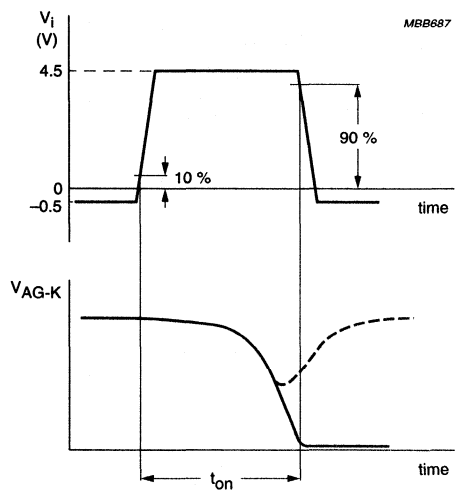


Fig.7 Pulse duration increased until dashed curve disappears.

Silicon controlled switch BRY62

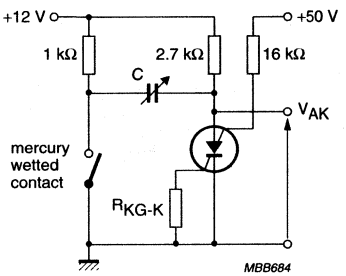


Fig.8 Test circuit for turn-off time.

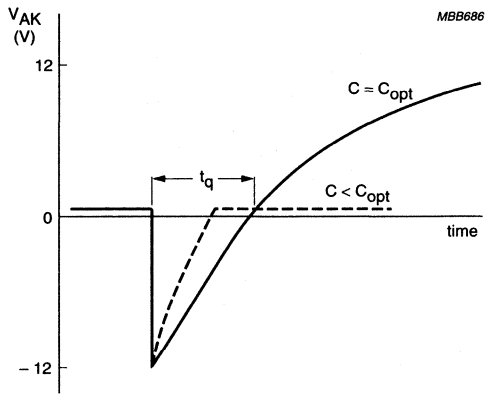
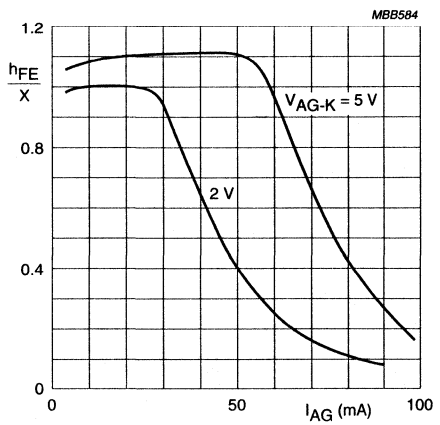
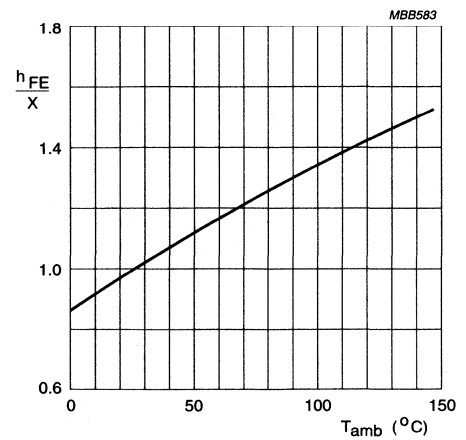


Fig.9 Capacitance increased until C = C_{opt} dashed curve disappears.



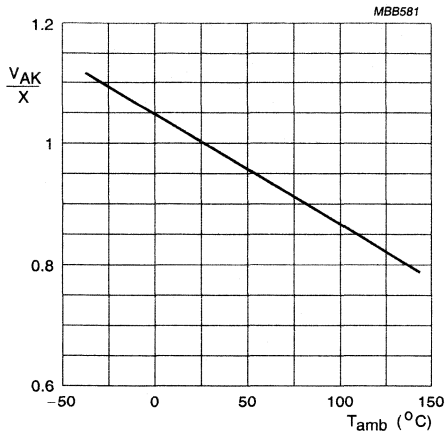
X is the value of h_{FE} at I_C = 10 mA; V_{AG-K} = 2 V; T_{amb} = 25 °C.

Fig.10 Normalized DC current gain as a function of anode gate current.



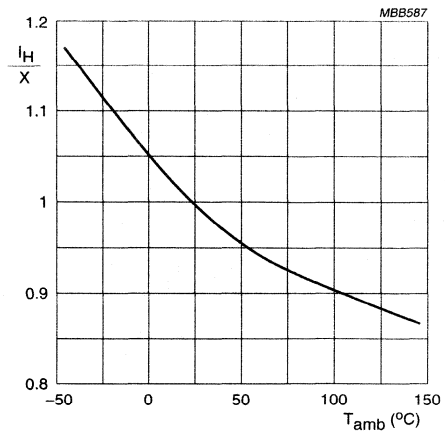
X is the value of h_{FE} at I_{AG} = 10 mA; V_{AG-K} = 2 V; T_{amb} = 25 °C.

Fig.11 Normalized DC current gain as a function of ambient temperature.



X is the value of V_{AK} at I_C = 10 mA; I_{AG} = 10 mA; I_A = 1 mA; V_{BB} = −2 V; R_{KG-K} = 10 kΩ; T_{amb} = 25 °C.

Fig.12 Normalized anode-cathode voltage as a function of ambient temperature.



X is the value of I_H at I_C = 10 mA; I_{AG} = 10 mA; V_{BB} = −2 V; R_{kg-K} = 10 kΩ; T_{amb} = 25 °C.

Fig.13 Normalized holding current as a function of ambient temperature.

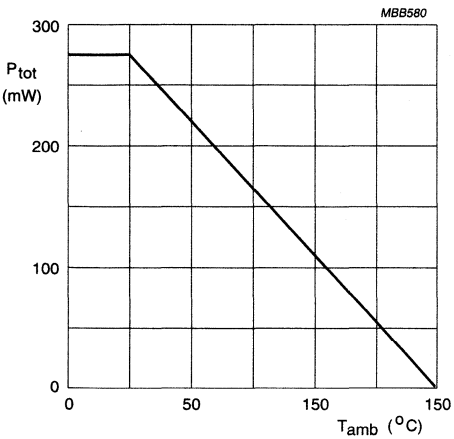


Fig.14 Power derating curve.

PNP high-voltage transistor BSP16

FEATURES

- High voltage (max. 350 V).

APPLICATIONS

- Switching and amplification
- Especially used in telephony and automotive applications.

DESCRIPTION

PNP high-voltage transistor in a SOT223 plastic package.
NPN complements: BSP19 and BSP20.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

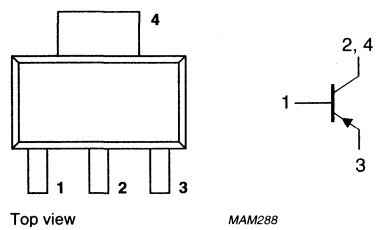


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–350	V
V_{CEO}	collector-emitter voltage	open base	–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–200	mA
I_B	base current (DC)		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.28	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	97	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −280 V	–	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −6 V	–	−100	nA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V	30	120	
V_{CEsat}	collector-emitter saturation voltage	I_C = −50 mA; I_B = −5 mA	–	−2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	15	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	15	–	MHz

NPN high-voltage transistors BSP19; BSP20

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 350 V).

APPLICATIONS

- Switching and amplification
- Especially used in telephony and automotive applications.

DESCRIPTION

NPN transistor in a SOT223 plastic package.
PNP complement: BSP16.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

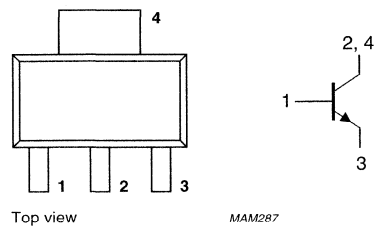


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSP19		–	400	V
	BSP20		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BSP19		–	350	V
	BSP20		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	104	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		23	K/W

Note

1. Device mounted on printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CE} = 300 V	–	20	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 20 mA	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 4 mA	–	0.5	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 10 mA; f = 100 MHz	70	–	MHz

PNP medium power transistors BSP31; BSP32; BSP33

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Telephony and general industrial applications.

DESCRIPTION

PNP medium power transistor in a SOT223 plastic package. NPN complements: BSP41 and BSP43.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

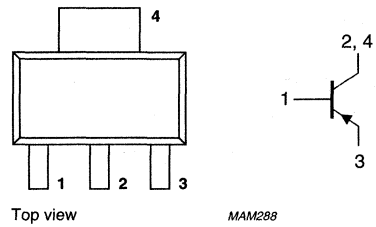


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSP31		–	–70	V
	BSP32; BSP33		–	–90	V
V_{CEO}	collector-emitter voltage	open base			
	BSP31		–	–60	V
	BSP32; BSP33		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		12	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –60 V	–	–100	nA
		I_E = 0; V_{CB} = –60 V; T_j = 150 °C	–	–50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–100	nA
h_{FE}	DC current gain				
	BSP32	I_C = –100 μA; V_{CE} = –5 V; note 1	10	–	
		I_C = –100 mA; V_{CE} = –5 V; note 1	40	120	
		I_C = –500 mA; V_{CE} = –5 V; note 1	30	–	
	DC current gain				
	BSP31; BSP33	I_C = –100 μA; V_{CE} = –5 V; note 1	30	–	
		I_C = –100 mA; V_{CE} = –5 V; note 1	100	300	
		I_C = –500 mA; V_{CE} = –5 V; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–250	mV
		I_C = –500 mA; I_B = –50 mA; note 1	–	–500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–1	V
		I_C = –500 mA; I_B = –50 mA; note 1	–	–1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	20	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	120	pF
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 100 MHz	100	–	MHz
Switching times (between 10% and 90% levels)					
t_{on}	turn-on time	I_{Con} = –100 mA; I_{Bon} = –5 mA; I_{Boff} = 5 mA	–	500	ns
t_{off}	turn-off time		–	650	ns

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.01$.

NPN medium power transistors BSP41; BSP43

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Telephony and general industrial applications
- Thick and thin-film circuits.

DESCRIPTION

NPN medium power transistor in a SOT223 plastic package. PNP complements: BSP31; BSP32 and BSP33.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

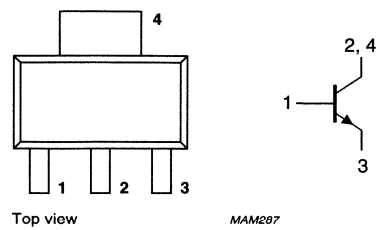


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSP41		–	70	V
	BSP43		–	90	V
V_{CEO}	collector-emitter voltage	open base			
	BSP41		–	60	V
	BSP43		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		12	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	100	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 100 μA; V_{CE} = 5 V; note 1	30	–	
		I_C = 100 mA; V_{CE} = 5 V; note 1	100	300	
		I_C = 500 mA; V_{CE} = 5 V; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	0.25	V
		I_C = 500 mA; I_B = 50 mA; note 1	–	0.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	1	V
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.01$.

NPN Darlington transistors BSP50; BSP51; BSP52

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial high gain amplification.

DESCRIPTION

NPN Darlington transistor in a SOT223 plastic package.
PNP complements: BSP60, BSP61 and BSP62.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

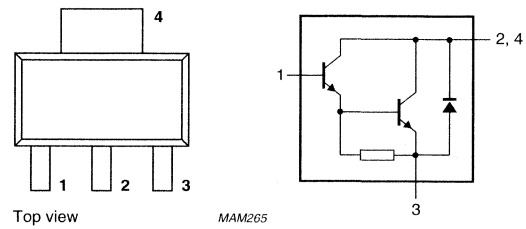


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSP50		–	60	V
	BSP51		–	80	V
	BSP52		–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BSP50		–	45	V
	BSP51		–	60	V
	BSP52		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to solder point		17	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

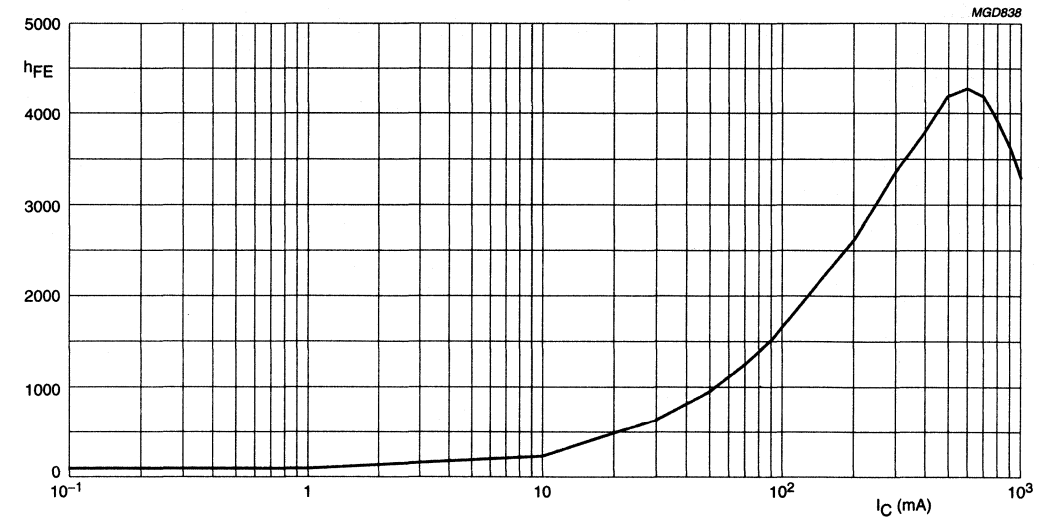
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BSP50	V_{BE} = 0; V_{CE} = 45 V	–	–	50	nA
	BSP51	V_{BE} = 0; V_{CE} = 60 V	–	–	50	nA
	BSP52	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 10 V; note 1; see Fig.2				
		I_C = 150 mA	1000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.3	V
		I_C = 500 mA; I_B = 0.5 mA; T_j = 150 °C	–	–	1.3	V
V_{BEsat}	base-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.9	V
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = −0.5 mA	–	500	–	ns
t_{off}	turn-off time		–	1300	–	ns

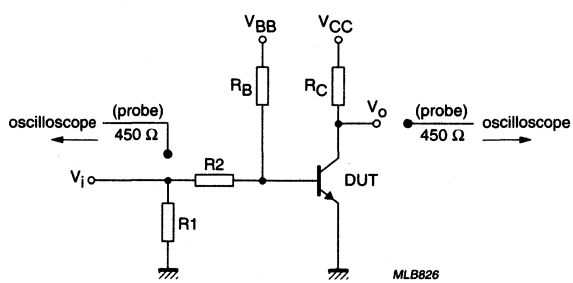
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.



V_i = 10 V; T = 200 μs; t_p = 6 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = −1.8 V; V_{CC} = 10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP Darlington transistors BSP60; BSP61; BSP62

FEATURES

- High current (max. 0.5 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial switching applications such as:
  - Print hammer
  - Solenoid
  - Relay and lamp drivers.

DESCRIPTION

PNP Darlington transistor in a SOT223 plastic package.
NPN complements: BSP50, BSP51 and BSP52.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

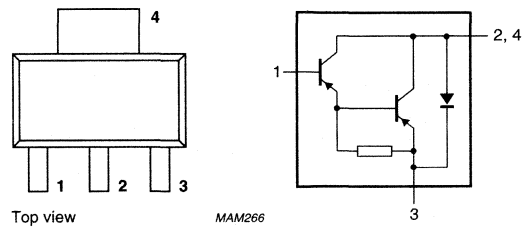


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSP60		–	–60	V
	BSP61		–	–80	V
	BSP62		–	–90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BSP60		–	–45	V
	BSP61		–	–60	V
	BSP62		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–0.5	A
I_{CM}	peak collector current		–	–1.5	A
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	98	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to solder point		17	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT223 in the General Part of associated Handbook"*.

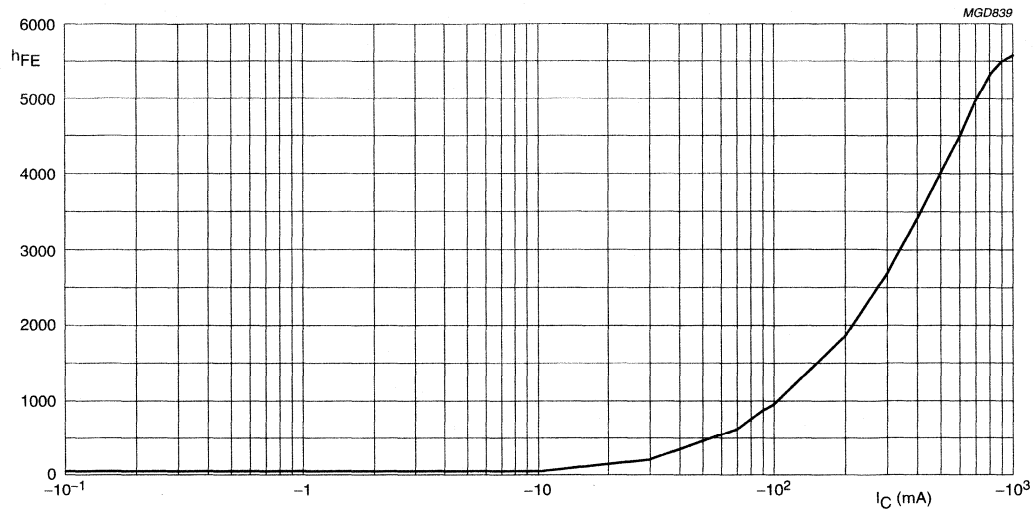
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BSP60	V_{BE} = 0; V_{CE} = −45 V	–	–	−50	nA
	BSP61	V_{BE} = 0; V_{CE} = −60 V	–	–	−50	nA
	BSP62	V_{BE} = 0; V_{CE} = −80 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −10 V; note 1; see Fig.2				
		I_C = −150 mA	1000	–	–	
		I_C = −500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.3	V
		I_C = −500 mA; I_B = −0.5 mA; T_j = 150 °C	–	–	−1.3	V
V_{BEsat}	base-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.9	V
f_T	transition frequency	I_C = −500 mA; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = −500 mA; I_{Bon} = −0.5 mA; I_{Boff} = 0.5 mA	–	400	–	ns
t_{off}	turn-off time		–	1500	–	ns

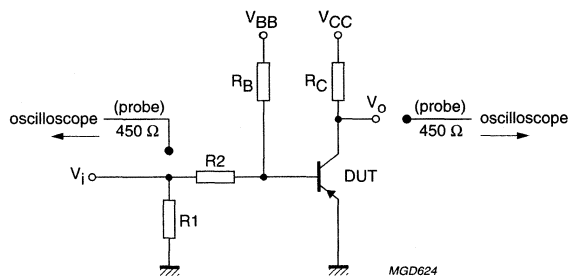
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = −10 V.

Fig.2 DC current gain; typical values.



V_i = −10 V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = 1.8 V; V_{CC} = −10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistors BSR13; BSR14

FEATURES

- High current (max. 800 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear applications.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complements: BSR15 and BSR16.

MARKING

TYPE NUMBER	MARKING CODE(1)
BSR13	U7*
BSR14	U8*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

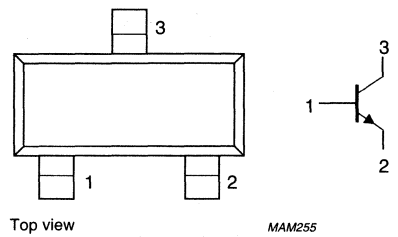


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR13		–	60	V
	BSR14		–	75	V
V_{CEO}	collector-emitter voltage	open base			
	BSR13		–	30	V
	BSR14		–	40	V
V_{EBO}	emitter-base voltage	open collector			
	BSR13		–	5	V
	BSR14		–	6	V
I_C	collector current (DC)		–	800	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

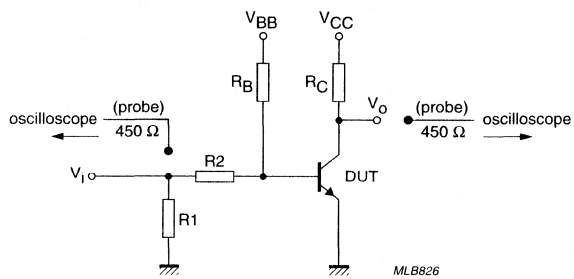
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BSR13	I_E = 0; V_{CB} = 50 V	–	30	nA
		I_E = 0; V_{CB} = 50 V; T_j = 150 °C	–	10	µA
	collector cut-off current				
	BSR14	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V			
	BSR13		–	30	nA
	BSR14		–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V; note 1	35	–	
		I_C = 1 mA; V_{CE} = 10 V; note 1	50	–	
		I_C = 10 mA; V_{CE} = 10 V; note 1	75	–	
		I_C = 150 mA; V_{CE} = 10 V; note 1	100	300	
		I_C = 150 mA; V_{CE} = 1 V; note 1	50	–	
	DC current gain	I_C = 500 mA; V_{CE} = 10 V; note 1			
	BSR13		30	–	
	BSR14		40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA			
	BSR13		–	400	mV
	BSR14		–	300	mV
	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA			
	BSR13		–	1.6	V
	BSR14		–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA			
	BSR13		–	1.3	V
	BSR14		0.6	1.2	V
	base-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA			
	BSR13		–	2.6	V
	BSR14		–	2	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	8	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 20$ V; f = 100 MHz			
	BSR13		250	–	MHz
	BSR14		300	–	MHz
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	$I_{Con} = 150$ mA; $I_{Bon} = 15$ mA; $I_{Boff} = -15$ mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



$V_i = 9.5$ V; T = 500 μs; $t_p = 10$ μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; $R_B = 325$ Ω; $R_C = 160$ Ω.
$V_{BB} = -3.5$ V; $V_{CC} = 29.5$ V.
Oscilloscope: input impedance $Z_i = \geq 100$ Ω.

Fig.2 Test circuit for switching times.

PNP switching transistors BSR15; BSR16

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Medium power switching.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complements: BSR13 and BSR14.

MARKING

TYPE NUMBER	MARKING CODE(1)
BSR15	T7*
BSR16	T8*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

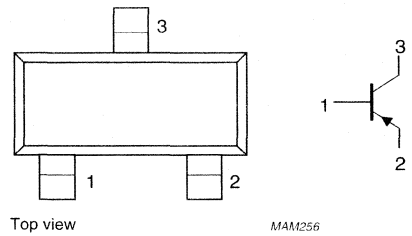


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	BSR15		–	–40	V
	BSR16		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

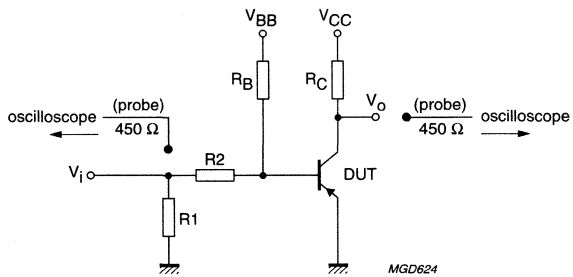
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BSR15	I_E = 0; V_{CB} = −50 V	−	−20	nA
		I_E = 0; V_{CB} = −50 V; T_j = 150 °C	−	−20	μA
	collector cut-off current				
	BSR16	I_E = 0; V_{CB} = −50 V	−	−10	nA
		I_E = 0; V_{CB} = −50 V; T_j = 150 °C	−	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −10 V			
	BSR15		35	−	
	BSR16		75	−	
	DC current gain	I_C = −1 mA; V_{CE} = −10 V			
	BSR15		50	−	
	BSR16		100	−	
	DC current gain	I_C = −10 mA; V_{CE} = −10 V			
	BSR15		75	−	
	BSR16		100	−	
	DC current gain	I_C = −150 mA; V_{CE} = −10 V; note 1	100	300	
	DC current gain	I_C = −500 mA; V_{CE} = −10 V; note 1			
	BSR15		30	−	
	BSR16		50	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	−	−400	mV
		I_C = −500 mA; I_B = −50 mA	−	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	−	−1.3	V
		I_C = −500 mA; I_B = −50 mA	−	−2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −2 V; f = 1 MHz	−	30	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −20 V; f = 100 MHz	200	−	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor BSR17A

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complement: BSR18A.

MARKING

TYPE NUMBER	MARKING CODE
BSR17A	U92

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

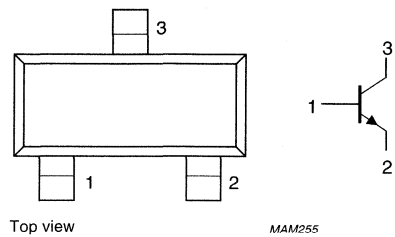


Fig.1 Simplified outline (SOT23) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
I_C	collector current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	100	300	
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
t_{off}	turn-off time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	240	ns

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

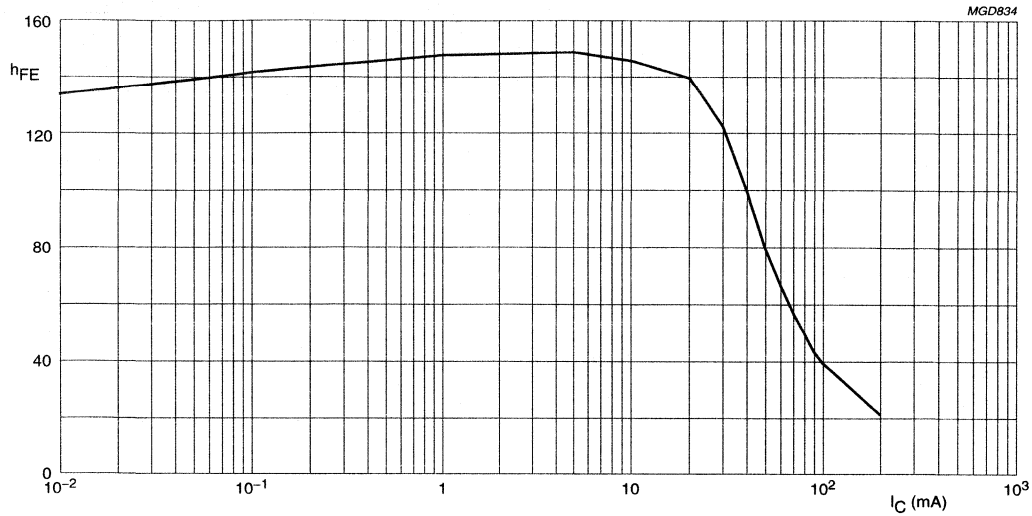
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1; see Fig.2			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	650	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns

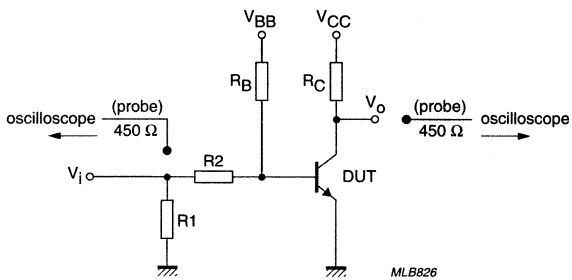
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 µs; t_p = 10 µs; t_r = t_f ≤ 3 ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = −1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor BSR18A

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed saturated switching.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complement: BSR17A.

MARKING

TYPE NUMBER	MARKING CODE
BSR18A	T92

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

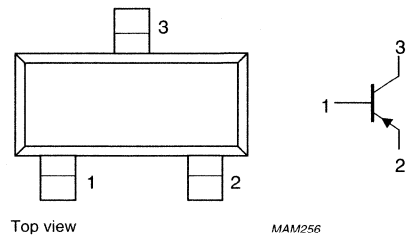


Fig.1 Simplified outline (SOT23) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
I_C	collector current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -1$ V	100	300	
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -20$ V; f = 100 MHz	250	–	MHz
t_{off}	turn-off time	$I_{Con} = -10$ mA; $I_{Bon} = -1$ mA; $I_{Boff} = 1$ mA	–	300	ns

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

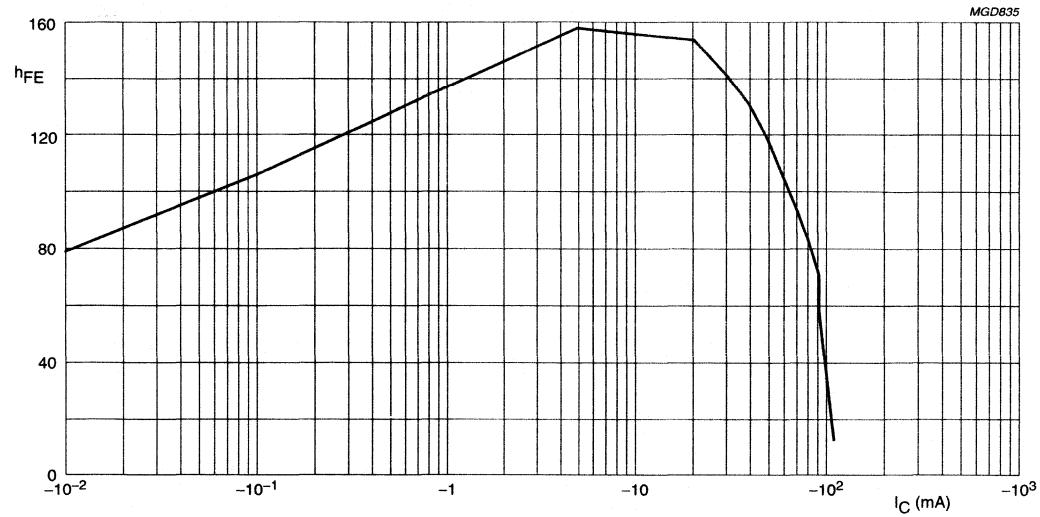
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –6 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V; note 1; see Fig.2			
		I_C = –0.1 mA	60	–	
		I_C = –1 mA	80	–	
		I_C = –10 mA	100	300	
		I_C = –50 mA	60	–	
		I_C = –100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA; note 1	–	–200	mV
		I_C = –50 mA; I_B = –5 mA; note 1	–	–200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA; note 1	–650	–850	mV
		I_C = –50 mA; I_B = –5 mA; note 1	–	–950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = –100 μA; V_{CE} = –5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = –10 mA; I_{Bon} = –1 mA; I_{Boff} = 1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns

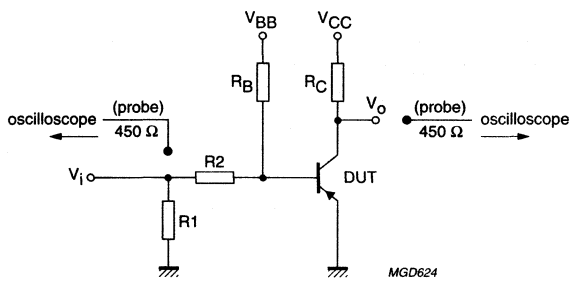
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.01$.



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical value.



$V_i = -5$ V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
$V_{BB} = 1.9$ V; $V_{CC} = -3$ V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN high-voltage transistors BSR19; BSR19A

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 160 V).

APPLICATIONS

- General purpose switching and amplification
- Especially used for telephony applications.

DESCRIPTION

NPN high-voltage transistor in a SOT23 plastic package.
PNP complements: BSR20 and BSR20A.

MARKING

TYPE NUMBER	MARKING CODE
BSR19	U35
BSR19A	U36

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

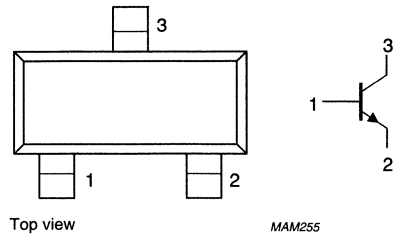


Fig.1 Simplified outline (SOT23) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR19		–	160	V
	BSR19A		–	180	V
V_{CEO}	collector-emitter voltage	open base			
	BSR19		–	140	V
	BSR19A		–	160	V
I_{CM}	peak collector current		–	600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V			
	BSR19		60	–	
	BSR19A		80	–	
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 100 MHz	100	300	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR19		–	160	V
	BSR19A		–	180	V
V_{CEO}	collector-emitter voltage	open base			
	BSR19		–	140	V
	BSR19A		–	160	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BSR19	I_E = 0; V_{CB} = 100 V	–	100	nA
		I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	–	100	μA
I_{CBO}	collector cut-off current				
	BSR19A	I_E = 0; V_{CB} = 120 V	–	50	nA
		I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	50	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V			
	BSR19		60	–	
	BSR19A		80	–	
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V			
	BSR19		60	250	
	BSR19A		80	250	
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V			
	BSR19		20	–	
	BSR19A		30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	150	mV
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA			
	BSR19		–	250	mV
	BSR19A		–	200	mV
C_c	collector capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	100	300	MHz

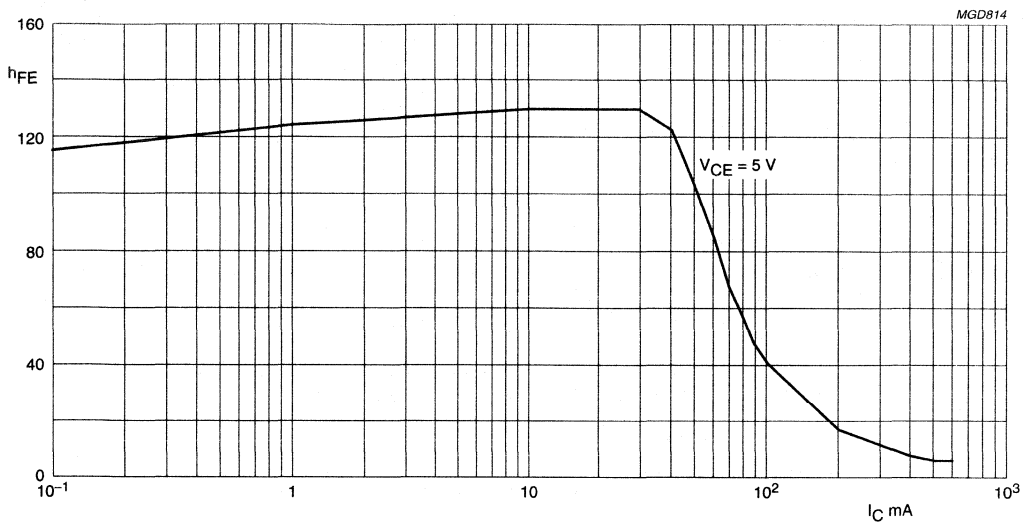


Fig.2 DC current gain; typical values.

PNP high-voltage transistors BSR20; BSR20A

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 150 V).

APPLICATIONS

- General purpose switching and amplification
- Telephony applications.

DESCRIPTION

PNP high-voltage transistor in a SOT23 plastic package.
NPN complements: BSR19 and BSR19A.

MARKING

TYPE NUMBER	MARKING CODE
BSR20	T35
BSR20A	T36

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

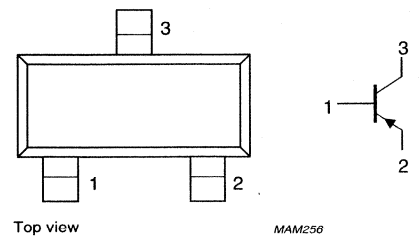


Fig.1 Simplified outline (SOT23) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR20		–	–130	V
	BSR20A		–	–160	V
V_{CEO}	collector-emitter voltage	open base			
	BSR20		–	–120	V
	BSR20A		–	–150	V
I_{CM}	peak collector current		–	–600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V			
	BSR20		40	180	
	BSR20A		60	240	
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 100 MHz	100	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR20		–	–130	V
	BSR20A		–	–160	V
V_{CEO}	collector-emitter voltage	open base			
	BSR20		–	–120	V
	BSR20A		–	–150	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–300	mA
I_{CM}	peak collector current		–	–600	mA
I_B	base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BSR20	I_E = 0; V_{CB} = −100 V	−	−100	nA
		I_E = 0; V_{CB} = −100 V; T_{amb} = 100 °C	−	−100	µA
I_{CBO}	collector cut-off current				
	BSR20A	I_E = 0; V_{CB} = −120 V	−	−50	nA
		I_E = 0; V_{CB} = −120 V; T_{amb} = 100 °C	−	−50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	−	−50	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V			
	BSR20		30	−	
	BSR20A		50	−	
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V			
	BSR20		40	180	
	BSR20A		60	240	
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −5 V			
	BSR20		40	−	
	BSR20A		50	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	−	−200	mV
		I_C = −50 mA; I_B = −5 mA	−	−500	mV
C_c	collector capacitance	I_E = 0; V_{CB} = −10 V; f = 1 MHz	−	6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz			
	BSR20		100	400	MHz
	BSR20A		100	300	MHz

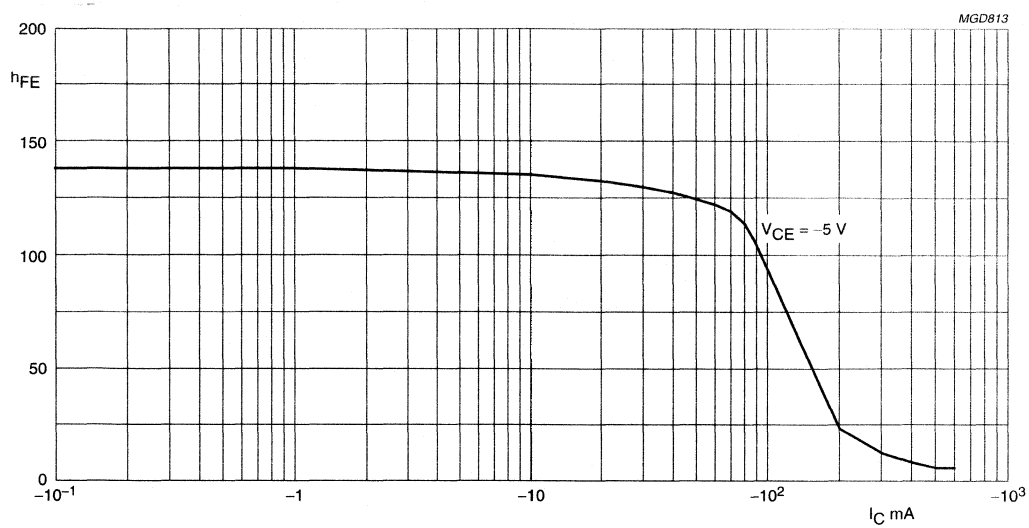


Fig.2 DC current gain; typical values.

PNP medium power transistors BSR30; BSR31; BSR33

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Telephony and general industrial applications
- Thick and thin-film circuits.

DESCRIPTION

PNP medium power transistor in a SOT89 plastic package. NPN complements: BSR40; BSR41 and BSR43.

MARKING

TYPE NUMBER	MARKING CODE
BSR30	BR1
BSR31	BR2
BSR33	BR4

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

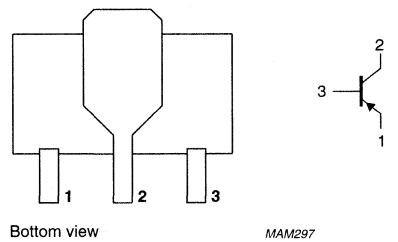


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR30; BSR31		–	–70	V
	BSR33		–	–90	V
V_{CEO}	collector-emitter voltage	open base			
	BSR30; BSR31		–	–60	V
	BSR33		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		13	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −60 V	−	−100	nA
		I_E = 0; V_{CB} = −60 V; T_j = 150 °C	−	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−100	nA
h_{FE}	DC current gain BSR30 BSR31; BSR33	I_C = −100 μA; V_{CE} = −5 V; note 1	 10 30	 − −	
	DC current gain BSR30 BSR31; BSR33	I_C = −100 mA; V_{CE} = −5 V; note 1	 40 100	 120 300	
	DC current gain BSR30 BSR31; BSR33	I_C = −500 mA; V_{CE} = −5 V; note 1	 30 50	 − −	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	−	−0.25	V
		I_C = −500 mA; I_B = −50 mA; note 1	−	−0.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	−	−1	V
		I_C = −500 mA; I_B = −50 mA; note 1	−	−1.2	V
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 100 MHz	100	−	MHz

Note

1. Pulse test: t_p = 300 μs; δ < 0.01.

NPN medium power transistors BSR40; BSR41; BSR42; BSR43

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Thick and thin-film circuits
- Telephony and general industrial applications.

DESCRIPTION

NPN medium power transistor in a SOT89 plastic package. PNP complements: BSR30; BSR3 and BSR33.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BSR40	AR1	BSR42	AR3
BSR41	AR2	BSR43	AR4

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

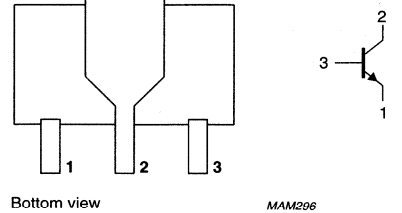


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BSR40; BSR41		–	70	V
	BSR42; BSR43		–	90	V
V_{CEO}	collector-emitter voltage	open base			
	BSR40; BSR41		–	60	V
	BSR42; BSR43		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	93	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		13	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	100	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 100 µA; V_{CE} = 5 V; note 1			
	BSR40; BSR42		10	–	
	BSR41; BSR43		30	–	
	DC current gain	I_C = 100 mA; V_{CE} = 5 V; note 1			
	BSR40; BSR42		40	120	
	BSR41; BSR43		100	300	
	DC current gain	I_C = 500 mA; V_{CE} = 5 V; note 1			
	BSR40; BSR42		30	–	
	BSR41; BSR43		50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	250	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	1	V
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	12	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	90	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	100	–	MHz
Switching times (between 10% and 90% levels)					
t_{on}	turn-on time	I_{Con} = 100 mA; I_{Bon} = 5 mA; I_{Boff} = −5 mA	–	250	ns
t_{off}	turn-off time		–	1	µs

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.01$.

NPN Darlington transistor BSR52

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial high gain amplification.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package. PNP complement: BSR62.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

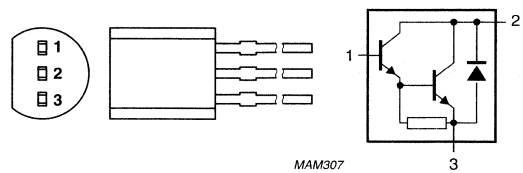


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

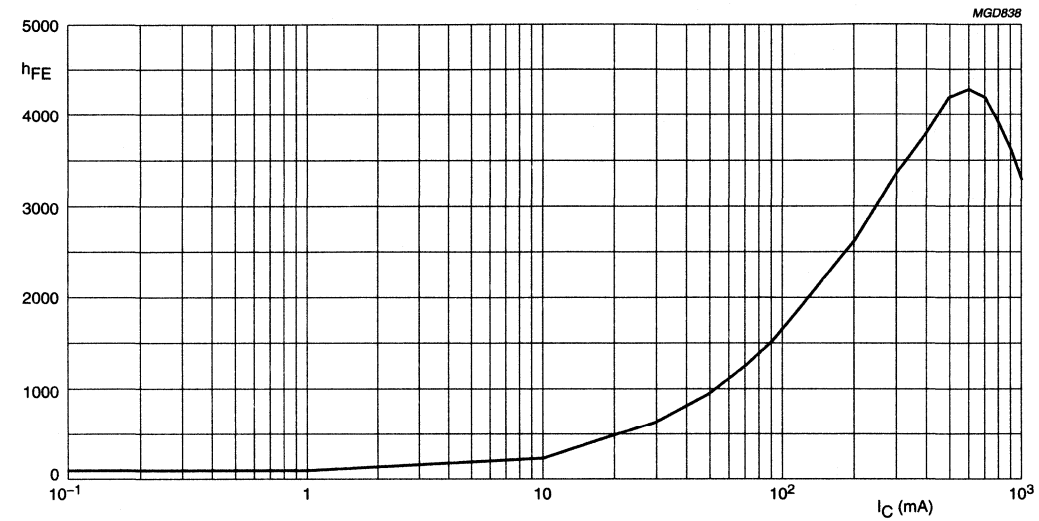
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

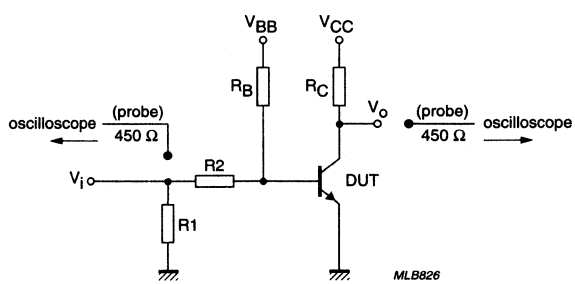
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 10 V; see Fig.2				
		I_C = 150 mA	1000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 0.5 mA	–	–	1.3	V
		I_C = 1 A; I_B = 4 mA	–	–	1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = 0.5 A; I_B = 0.5 mA	–	–	1.9	V
		I_C = 1 A; I_B = 4 mA	–	–	2.2	V
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = −0.5 mA	–	–	500	ns
t_{off}	turn-off time		–	–	1300	ns



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.



V_i = 10 V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = −1.8 V; V_{CC} = 10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP Darlington transistor BSR62

FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial applications such as:
  - Print hammer
  - Solenoid
  - Relay and lamp driving.

DESCRIPTION

PNP Darlington transistor in a TO-92; SOT54 plastic package. NPN complement: BSR52.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

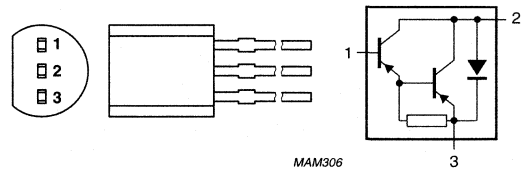


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_B	base current (DC)		–	–0.2	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	0.83	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	150	K/W

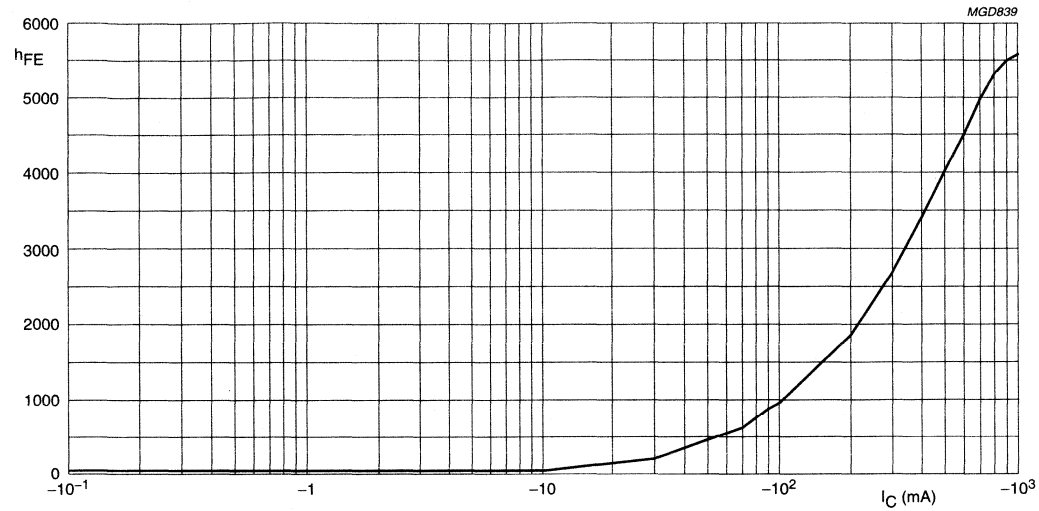
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

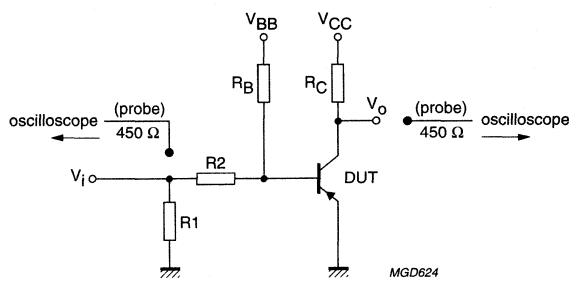
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = −80 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −10 V; see Fig.2				
		I_C = −150 mA	1000	–	–	
		I_C = −500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −0.5 A; I_B = −0.5 mA	–	–	−1.4	V
		I_C = −1 A; I_B = −4 mA	–	–	−1.8	V
V_{BEsat}	base-emitter saturation voltage	I_C = −0.5 A; I_B = −0.5 mA	–	–	−2	V
		I_C = −1 A; I_B = −4 mA	–	–	−2.4	V
f_T	transition frequency	I_C = −500 mA; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = −500 mA; I_{Bon} = −0.5 mA; I_{Boff} = 0.5 mA	–	–	0.5	µs
t_{off}	turn-off time		–	–	0.7	µs



$V_{CE} = -10$ V.

Fig.2 DC current gain; typical values.



$V_i = -10$ V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = 1.8 V; $V_{CC} = -10.7$ V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP high-voltage transistor BSS63

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 100 V).

APPLICATIONS

- High-voltage general purpose
- Switching applications.

DESCRIPTION

PNP high-voltage transistor in a SOT23 plastic package.
NPN complement: BSS64.

MARKING

TYPE NUMBER	MARKING CODE(1)
BSS63	BM*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

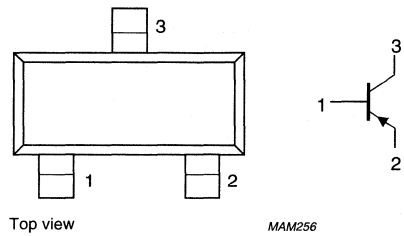


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−110	V
V_{CEO}	collector-emitter voltage	open base	–	−100	V
V_{EBO}	emitter-base voltage	open collector	–	−6	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−100	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –90 V	–	–	–100	nA
		I_E = 0; V_{CB} = –90 V; T_j = 150 °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –6 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –10 mA; V_{CE} = –1 V	30	–	–	
		I_C = –25 mA; V_{CE} = –1 V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –25 mA; I_B = –2.5 mA	–	–	–250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –25 mA; I_B = –2.5 mA	–	–	–900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	3	–	pF
f_T	transition frequency	I_C = –25 mA; V_{CE} = –5 V; f = 100 MHz	50	85	–	MHz

NPN high-voltage transistor BSS64

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 80 V).

APPLICATIONS

- High-voltage general purpose and switching applications
- Intended for application in thick and thin-film circuits.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complement: BSS63.

MARKING

TYPE NUMBER	MARKING CODE[1]
BSS64	AM*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

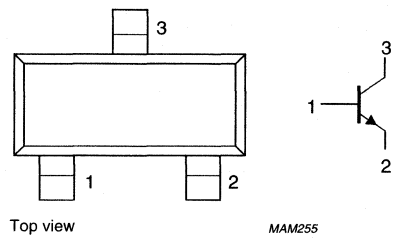


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	120	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	250	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 90 V	–	–	100	nA
		I_E = 0; V_{CB} = 90 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	0.5	200	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 1 V	–	60	–	
		I_C = 10 mA; V_{CE} = 1 V	20	80	–	
		I_C = 20 mA; V_{CE} = 1 V	–	55	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 4 mA; I_B = 400 µA	–	–	150	mV
		I_C = 50 mA; I_B = 15 mA	–	–	200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	3	–	pF
f_T	transition frequency	I_C = 4 mA; V_{CE} = 10 V; f = 100 MHz	60	100	–	MHz

PNP high-voltage transistors BST15; BST16

FEATURES

- Low current (max. 200 mA)
- High voltage (max. 300 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP high-voltage transistor in a SOT89 plastic package.
NPN complements: BST39 and BST40.

MARKING

TYPE NUMBER	MARKING CODE
BST15	BT1
BST16	BT2

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

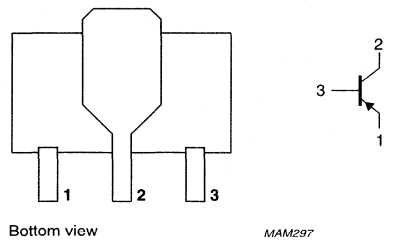


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BST15		–	–200	V
	BST16		–	–350	V
V_{CEO}	collector-emitter voltage	open base			
	BST15		–	–200	V
	BST16		–	–300	V
V_{EBO}	emitter-base voltage	open collector			
	BST15		–	–4	V
	BST16		–	–6	V
I_C	collector current (DC)		–	–200	mA
I_{CM}	peak collector current		–	–400	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	95	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		15	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	BST15	I_E = 0; V_{CB} = −175 V	−	−100	nA
	BST16	I_E = 0; V_{CB} = −280 V	−	−100	nA
I_{EBO}	emitter cut-off current				
	BST15	I_C = 0; V_{EB} = −4 V	−	−100	nA
	BST16	I_C = 0; V_{EB} = −6 V	−	−100	nA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V			
	BST15		30	150	
	BST16		30	120	
V_{CEsat}	collector-emitter saturation voltage	I_C = −50 mA; I_B = −5 mA	−	750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	15	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	15	−	MHz

NPN high-voltage transistors BST39; BST40

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 350 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN high-voltage transistor in a SOT89 plastic package.
PNP complements: BST15 and BST16.

MARKING

TYPE NUMBER	MARKING CODE
BST39	AT1
BST40	AT2

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

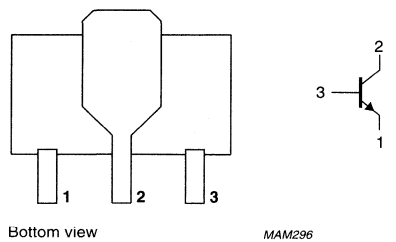


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BST39		–	400	V
	BST40		–	300	V
V_{CEO}	collector-emitter voltage	open base			
	BST39		–	350	V
	BST40		–	250	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 300 V	–	20	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 10 V	–	40	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 4 mA	–	500	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	70	–	MHz

NPN Darlington transistors BST50; BST51; BST52

FEATURES

- High current (max. 0.5 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial switching applications such as:
  - Print hammer
  - Solenoid
  - Relay and lamp driving.

DESCRIPTION

NPN Darlington transistor in a SOT89 plastic package.
PNP complements: BST60, BST61 and BST62.

MARKING

TYPE NUMBER	MARKING CODE
BST50	AS1
BST51	AS2
BST52	AS3

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

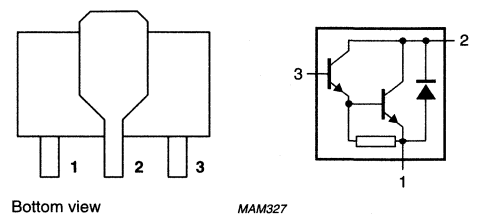


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BST50		–	60	V
	BST51		–	80	V
	BST52		–	90	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BST50		–	45	V
	BST51		–	60	V
	BST52		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	0.5	A
I_{CM}	peak collector current		–	1.5	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

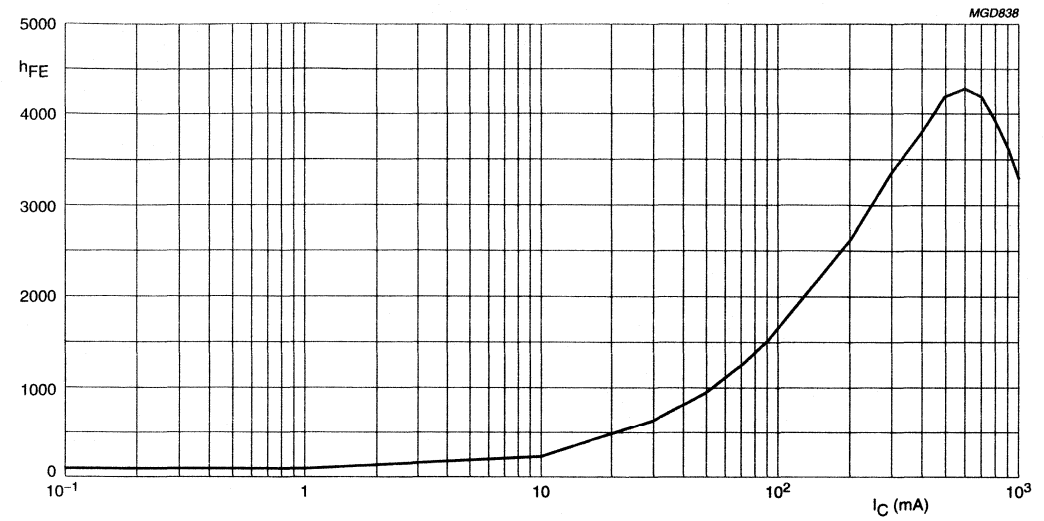
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BST50	V_{BE} = 0; V_{CE} = 45 V	–	–	50	nA
	BST51	V_{BE} = 0; V_{CE} = 60 V	–	–	50	nA
	BST52	V_{BE} = 0; V_{CE} = 80 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 10 V; note 1; (see Fig.2)				
		I_C = 150 mA	1000	–	–	
		I_C = 500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.3	V
		I_C = 500 mA; I_B = 0.5 mA; T_j = 150 °C	–	–	1.3	V
V_{BEsat}	base-emitter saturation voltage	I_C = 500 mA; I_B = 0.5 mA	–	–	1.9	V
f_T	transition frequency	I_C = 500 mA; V_{CE} = 5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)						
t_{on}	turn-on time	I_{Con} = 500 mA; I_{Bon} = 0.5 mA; I_{Boff} = −0.5 mA	–	400	–	ns
t_{off}	turn-off time		–	1500	–	ns

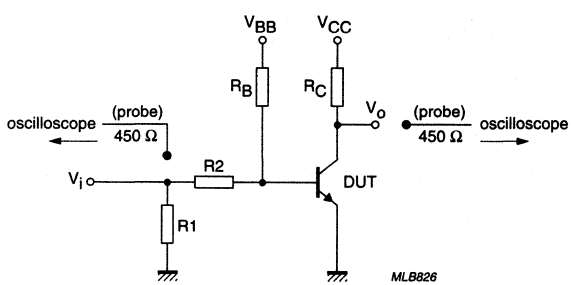
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = 10 V.

Fig.2 DC current gain; typical values.



V_i = 10 V; T = 200 μs; t_p = 6 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = −1.8 V; V_{CC} = 10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP Darlington transistors BST60; BST61; BST62

FEATURES

- High current (max. 0.5 A)
- Low voltage (max. 80 V)
- Integrated diode and resistor.

APPLICATIONS

- Industrial switching applications such as:
  - Print hammer
  - Solenoid
  - Relay and lamp driving.

DESCRIPTION

PNP Darlington transistor in a SOT89 plastic package.
NPN complements: BST50, BST51 and BST52.

MARKING

TYPE NUMBER	MARKING CODE
BST60	BS1
BST61	BS2
BST62	BS3

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

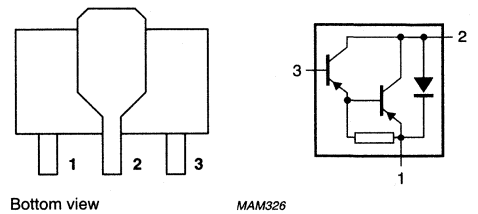


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BST60		–	–60	V
	BST61		–	–80	V
	BST62		–	–90	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	BST60		–	–45	V
	BST61		–	–60	V
	BST62		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–0.5	A
I_{CM}	peak collector current		–	–1.5	A
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

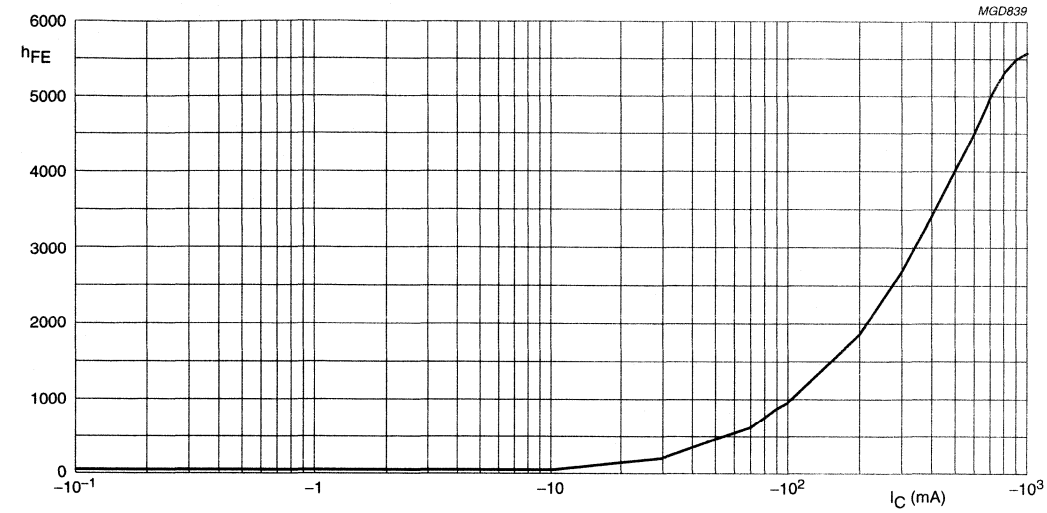
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current					
	BST60	V_{BE} = 0; V_{CE} = −45 V	–	–	−50	nA
	BST61	V_{BE} = 0; V_{CE} = −60 V	–	–	−50	nA
	BST62	V_{BE} = 0; V_{CE} = −80 V	–	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −10 V; note 1; see Fig.2				
		I_C = −150 mA	1000	–	–	
		I_C = −500 mA	2000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.3	V
		I_C = −500 mA; I_B = −0.5 mA; T_j = 150 °C	–	–	−1.3	V
V_{BEsat}	base-emitter saturation voltage	I_C = −500 mA; I_B = −0.5 mA	–	–	−1.9	V
f_T	transition frequency	I_C = −500 mA; V_{CE} = −5 V; f = 100 MHz	–	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3						
t_{on}	turn-on time	I_{Con} = −500 mA; I_{Bon} = −0.5 mA; I_{Boff} = 0.5 mA	–	500	–	ns
t_{off}	turn-off time		–	700	–	ns

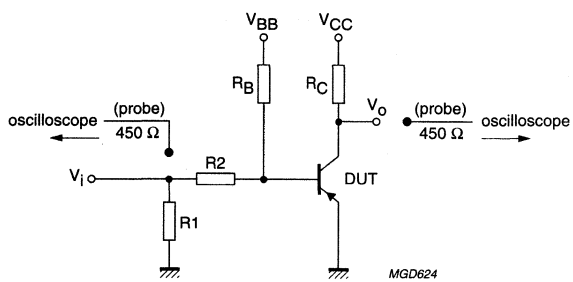
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = −10 V.

Fig.2 DC current gain; typical values.



V_i = −10 V; T = 200 µs; t_p = 6 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 10 kΩ; R_B = 10 kΩ; R_C = 18 Ω.
V_{BB} = 1.8 V; V_{CC} = −10.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor BSV52

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 12 V).

APPLICATIONS

- High speed saturated switching applications, especially in portable equipment.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
BSV52	B2*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

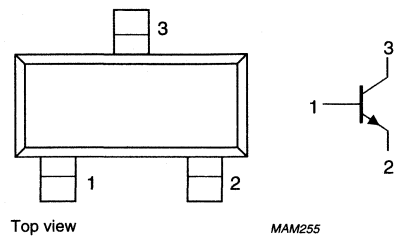


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

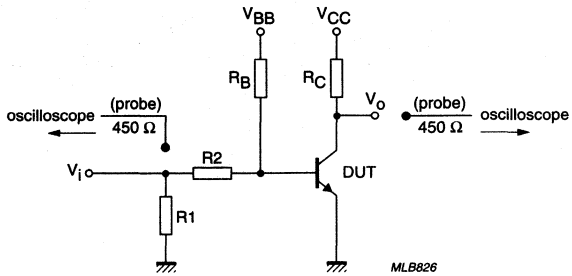
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_j = 125 °C	–	–	30	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain	V_{CE} = 1 V				
		I_C = 1 mA	25	–	–	
		I_C = 10 mA	40	–	120	
		I_C = 50 mA	25	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 300 μA	–	–	300	mV
		I_C = 10 mA; I_B = 1 mA	–	–	250	mV
		I_C = 50 mA; I_B = 5 mA	–	–	400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	700	–	850	mV
		I_C = 50 mA; I_B = 5 mA	–	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 1 V; f = 1 MHz	–	–	4.5	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	400	500	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)						
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = −1.5 mA	–	–	10	ns
t_d	delay time		–	–	4	ns
t_r	rise time		–	–	6	ns
t_{off}	turn-off time		–	–	20	ns
t_s	storage time		–	–	10	ns
t_f	fall time		–	–	10	ns



V_i = 0.5 V to 4.2 V; T = 500 µs; t_p = 10 µs; $t_r = t_s \leq 3$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN general purpose transistor ED1402

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 20 V)
- High gain.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a plastic TO-92; SOT54 package.
PNP complement: ED1602.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

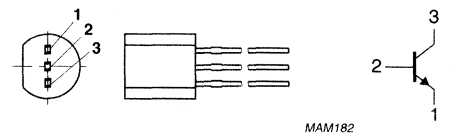


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	28	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to TO-92; SOT54 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Refer to TO-92; SOT54 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V			
	ED1402B		150	225	
	ED1402C		202	318	
	ED1402D		290	450	
	ED1402E		410	810	
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 1	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	5	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

NPN general purpose transistor ED1502

FEATURES

- Low current (max. 25 mA)
- Low voltage (max. 20 V)
- High gain.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a plastic TO-92; SOT54 package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

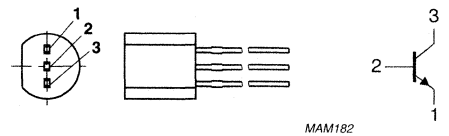


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	25	mA
I_{CM}	peak collector current		–	25	mA
I_{BM}	peak base current		–	25	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to TO-92; SOT54 standard mounting conditions.

NPN general purpose transistor ED1502

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Refer to TO-92; SOT54 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 40 V	–	–	10	μA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	10	μA
h_{FE}	DC current gain	I_C = 7 mA; V_{CE} = 10 V				
	ED1502B		48	–	75	
	ED1502C		66	–	100	
	ED1502D		84	–	127	
	ED1502E		105	–	210	
V_{BE}	base-emitter voltage	I_C = 7 mA; V_{CE} = 10 V; note 1	–	–	925	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 10 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	361	–	825	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor ED1602

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 20 V).

APPLICATIONS

- Audio pre-amplifiers and driver stages
- FM multiplex stereo decoders
- Small-signal circuits in television receivers
- Medium speed switching.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: ED1402.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

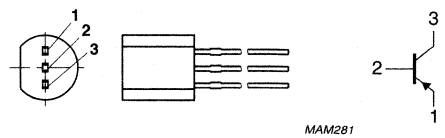


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−25	V
V_{CEO}	collector-emitter voltage	open base	–	−20	V
V_{EBO}	emitter-base voltage	open collector	–	−4	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistor ED1602

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –20 V	–	–15	nA
		I_E = 0; V_{CB} = –10 V; T_j = 150 °C	–	–20	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –4 V	–	–100	nA
h_{FE}	DC current gain	I_C = –2 mA; V_{CE} = –5 V			
	ED1602C		125	190	
	ED1602D		170	260	
	ED1602E		223	475	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –0.5 mA	–	–300	mV
		I_C = –100 mA; I_B = –5 mA	–	–650	mV
V_{BE}	base-emitter voltage	I_C = –2 mA; V_{CE} = –5 V	–500	–750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10V; f = 1 MHz	–	5	pF
f_T	transition frequency	I_C = –5 mA; V_{CE} = –5 V; f = 100 MHz	100	–	MHz
F	noise figure	I_C = –0.2 mA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	4	dB

NPN general purpose transistor ED1702

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 25 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: ED1802.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

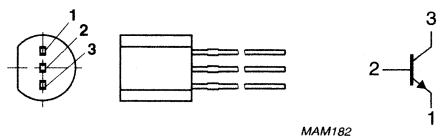


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	500	nA
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 1 V	40	–	
		I_C = 100 mA; V_{CE} = 1 V	132	476	
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 1 V			
	ED1702L		132	189	
	ED1702M		170	233	
	ED1702N		213	300	
	ED1702O		263	370	
	ED1702P		333	476	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1	–	700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	80	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor ED1802

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 25 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: ED1702.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

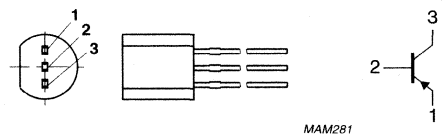


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−30	V
V_{CEO}	collector-emitter voltage	open base	–	−25	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−500	mA
I_{CM}	peak collector current		–	−1	A
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	–	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 150 °C	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−500	nA
h_{FE}	DC current gain	I_C = −500 mA; V_{CE} = −1 V	40	–	
		I_C = −100 mA; V_{CE} = −1 V	106	476	
h_{FE}	DC current gain	I_C = −100 mA; V_{CE} = −1 V			
	ED1802K		106	150	
	ED1802L		132	189	
	ED1802M		170	233	
	ED1802N		213	300	
	ED1802P		333	476	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA; note 1	–	−700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	15	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	80	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor JA101

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: JC501.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

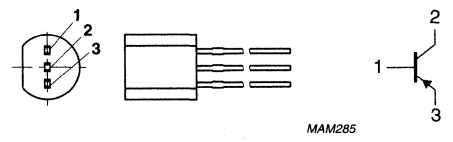


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
I_{CM}	peak collector current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	135	600	
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 100 MHz	100	–	MHz

PNP general purpose transistor JA101

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −45 V	–	–	−15	nA
		I_E = 0; V_{CB} = −45 V; T_j = 125 °C	–	–	−4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V				
	JA101		135	–	600	
	JA101P		135	–	270	
	JA101Q		200	–	400	
	JA101R		300	–	600	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−300	mV
		I_C = −100 mA; I_B = −5 mA	–	−500	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−700	–	mV
		I_C = −100 mA; I_B = −5 mA	–	−850	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−550	–	−700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	12	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	130	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

PNP general purpose transistor JC327

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification, e.g. driver and output stages of audio amplifiers.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: JC337.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

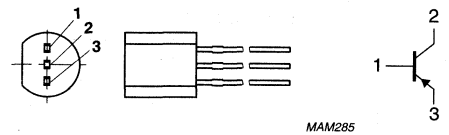


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base; I_C = –10 mA	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit-board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.2	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit-board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −20 V	–	–	−100	nA
		I_E = 0; V_{CB} = −20 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain JC327-25	I_C = −100 mA; V_{CE} = −1 V	 160	 –	 400	
h_{FE}	DC current gain	I_C = −500 mA; V_{CE} = −1 V	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −500 mA; I_B = −50 mA	–	–	−700	mV
V_{BE}	base-emitter voltage	I_C = −500 mA; V_{CE} = −1 V; note 1	–	–	−1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	80	–	–	MHz

Note

1. V_{BE} decreases by about −2 mV/K with increasing temperature.

NPN general purpose transistor JC337

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification, e.g. driver and output stages of audio amplifiers.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: JC327.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

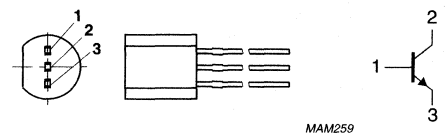


Fig.1 Simplified outline TO-92; SOT54 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	
V_{CEO}	collector-emitter voltage	open base	–	45	
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.2	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	100	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain JC337-25	I_C = 100 mA; V_{CE} = 1 V	 160	 –	 400	
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 1 V	40	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	–	–	700	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 1 V; note 1	–	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz

Note

1. V_{BE} decreases by about 2 mV/K with increasing temperature.

NPN general purpose transistor JC501

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: JA101.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

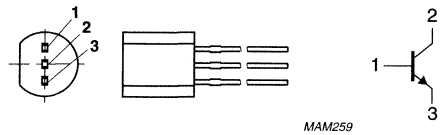


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 45 V	–	–	15	nA
		I_E = 0; V_{CB} = 45 V; T_j = 125 °C	–	–	4	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	135	–	600	
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V				
	JC501P		135	–	270	
	JC501Q		200	–	400	
	JC501R		300	–	600	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	200	mV
		I_C = 100 mA; I_B = 5 mA	–	–	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	830	mV
		I_C = 100 mA; I_B = 5 mA	–	–	1.06	V
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	550	–	700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	–	130	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

NPN general purpose transistors JC546; JC547; JC548

FEATURES

- Low current max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification, e.g. driver and output stages of audio amplifiers.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complements: JC556, JC557 and JC558.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

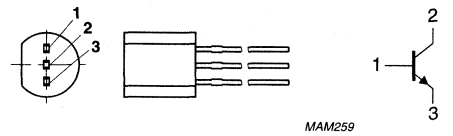


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	JC546		–	80	V
	JC547		–	50	V
	JC548		–	30	V
V_{CEO}	collector-emitter voltage	open-base			
	JC546		–	65	V
	JC547		–	45	V
	JC548		–	30	V
V_{EBO}	emitter-base voltage	open collector			
	JC546; JC547		–	6	V
	JC548		–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	0.25	K/mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

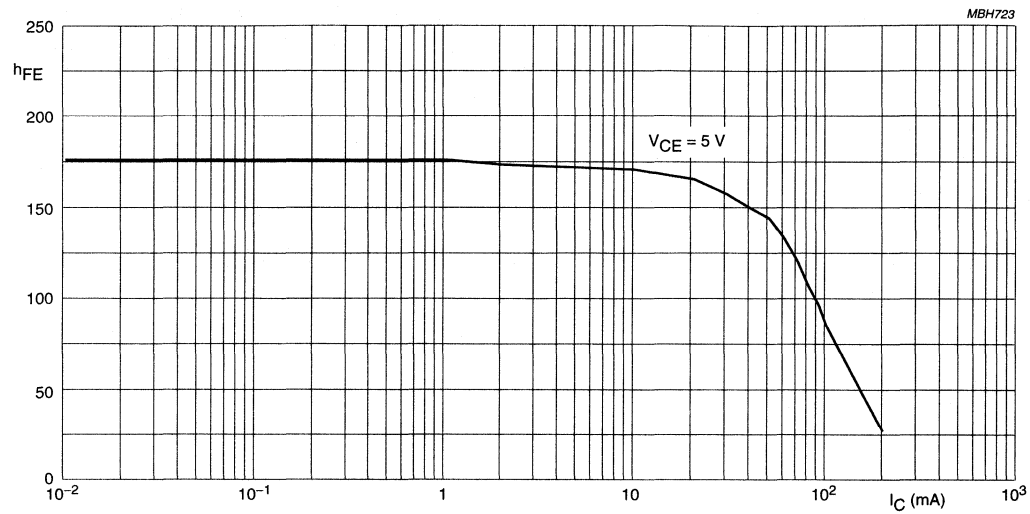
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain JC547A JC546B; JC547B; JC548B	I_C = 10 µA; V_{CE} = 5 V; see Figs 2 and 3	 – –	 90 150	 – –	
	DC current gain JC547A JC546B; JC547B; JC548B	I_C = 2 mA; V_{CE} = 5 V; see Figs 2 and 3	 110 200	 180 290	 220 450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	2	10	dB

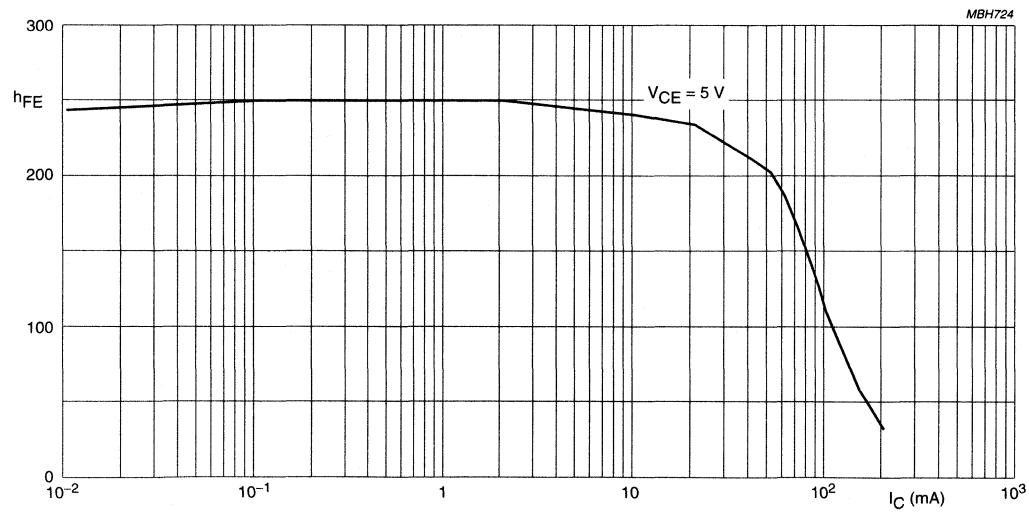
Notes

1. V_{BEsat} decreases by about 1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about 2 mV/K with increasing temperature.



JC547A.

Fig.2 DC current gain; typical values.



JC546B; JC547B; JC548B.

Fig.3 DC current gain; typical values.

PNP general purpose transistors JC556; JC557; JC558

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 65 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complements: JC546, JC547 and JC548.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

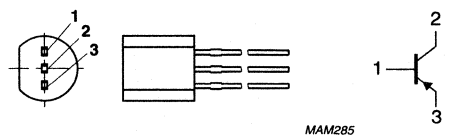


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	JC556		–	–80	V
	JC557		–	–50	V
	JC558		–	–30	V
V_{CEO}	collector-emitter voltage	open base			
	JC556		–	–65	V
	JC557		–	–45	V
	JC558		–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

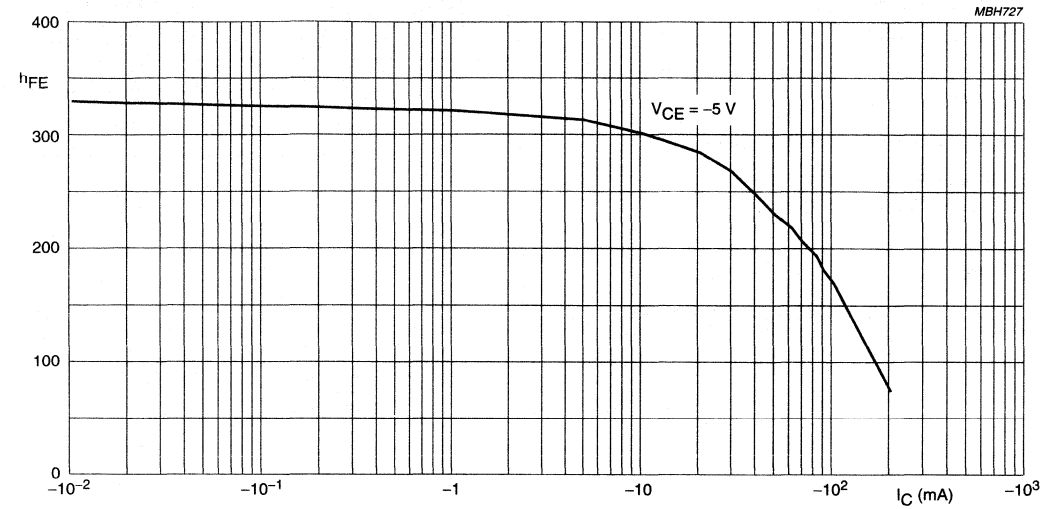
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−1	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	100	nA
h_{FE}	DC current gain JC556B; JC557B; JC558B	I_C = −2 mA; V_{CE} = −5 V; see Fig.2	220	–	475	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−60	−300	mV
		I_C = −100 mA; I_B = −5 mA	–	−180	−650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 1	–	−750	–	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−930	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V; note 2	−600	−650	−750	mV
		I_C = −10 mA; V_{CE} = −5 V; note 2	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CE} = −10 V; f = 1 MHz	–	4	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB

Notes

1. V_{BEsat} decreases by about −1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about −2 mV/K with increasing temperature.



JC556B; JC557B; JC558B.

Fig.2 DC current gain; typical values.

PNP general purpose transistor JC559

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- General purpose switching and amplification
- Low-noise input stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

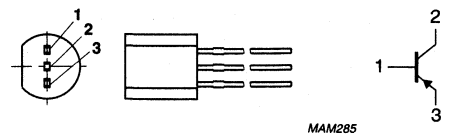


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CEO}	collector-emitter voltage	open base	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistor JC559

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−1	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−4	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V see Fig 2	125	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 1	–	−60	−300	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−180	−650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 1	–	−750	–	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−930	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V; note 2	−600	−650	−750	mV
		I_C = −10 mA; V_{CE} = −5 V; note 2	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	4	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	12	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	–	4	dB
		I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	4	dB

Notes

1. V_{BEsat} decreases by about −1.7 mV/K with increasing temperature.
2. V_{BE} decreases by about −2 mV/K with increasing temperature.

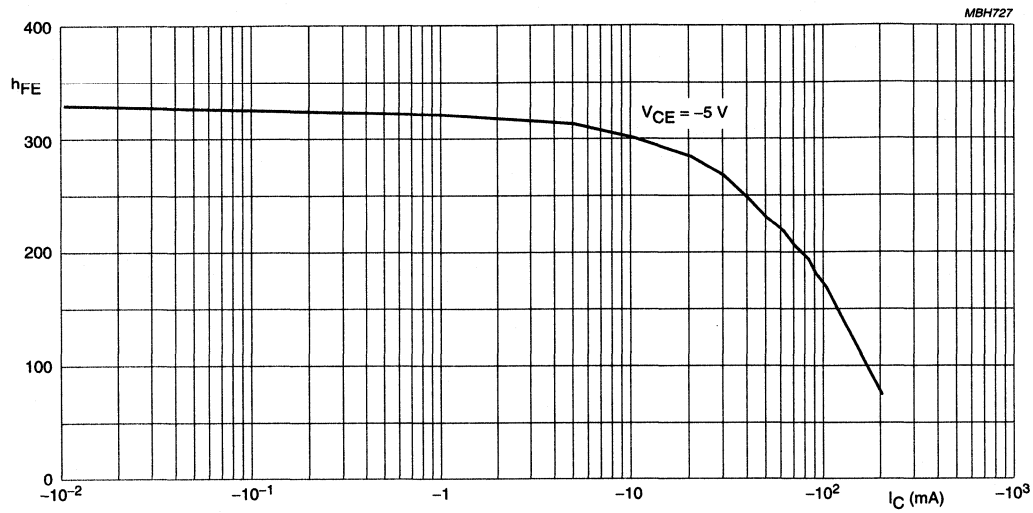


Fig.2 DC current gain; typical values.

NPN switching transistor MPS3904

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: MPS3906.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

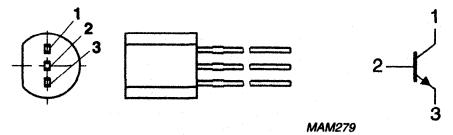


Fig.3 Simplified outline TO-92; SOT54 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

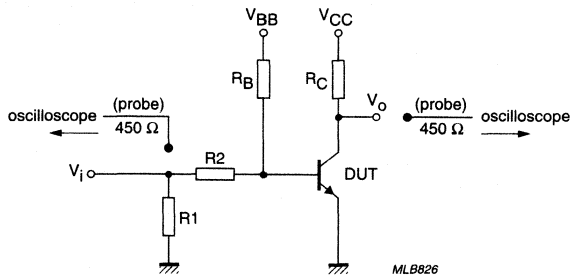
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	650	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; 100 kHz ≤ f ≤ 1 MHz	–	5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; 100 kHz ≤ f ≤ 1 MHz	–	15	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	180	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); (see Fig.4)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA; V_{CC} = 3 V; V_{BB} = −1.9 V	–	110	ns
t_d	delay time		–	50	ns
t_r	rise time		–	60	ns
t_{off}	turn-off time		–	1200	ns
t_s	storage time		–	1000	ns
t_f	fall time		–	200	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta = 0.02$.



V_i = 5 V; $t_p \geq 4$ μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.4 Test circuit for switching times.

PNP switching transistor MPS3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a plastic TO-92; SOT54 package.
NPN complement: MPS3904.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

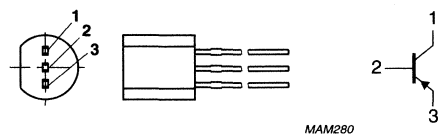


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

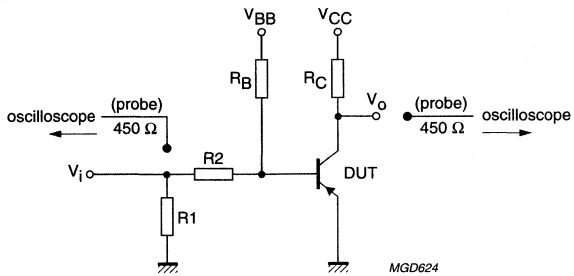
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_E = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; note 1			
		I_C = −0.1 mA	60	–	
		I_C = −1 mA	80	–	
		I_C = −10 mA	100	300	
		I_C = −50 mA	60	–	
		I_C = −100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	–	−250	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	−650	−850	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; 100 kHz ≤ f ≤ 1 MHz	–	5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; 100 kHz ≤ f ≤ 1 MHz	–	15	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	150	–	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA; V_{CC} = −3 V; V_{BB} = 1.9 V	–	100	ns
t_d	delay time		–	50	ns
t_r	rise time		–	50	ns
t_{off}	turn-off time		–	700	ns
t_s	storage time		–	600	ns
t_f	fall time		–	100	ns

Note

1. Pulse test: t_p = 300 μs; δ = 0.02.



V_i = −5 V; $t_p \geq 4$ μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN general purpose transistor MPSA06

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.
PNP complement: MPSA56.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

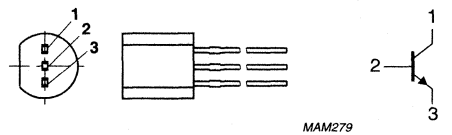


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	80	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 80 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	100	–	
		I_C = 100 mA; V_{CE} = 1 V	100	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	250	mV
V_{BE}	base-emitter voltage	I_C = 100 mA; V_{CE} = 1 V	–	1.2	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 2 V; f = 100 MHz	100	–	MHz

NPN Darlington transistor MPSA14

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- High DC current gain (min. 10000).

APPLICATIONS

- High gain amplification.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package. PNP complement: MPSA64.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

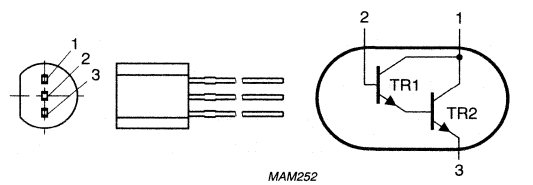


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	50	K/W

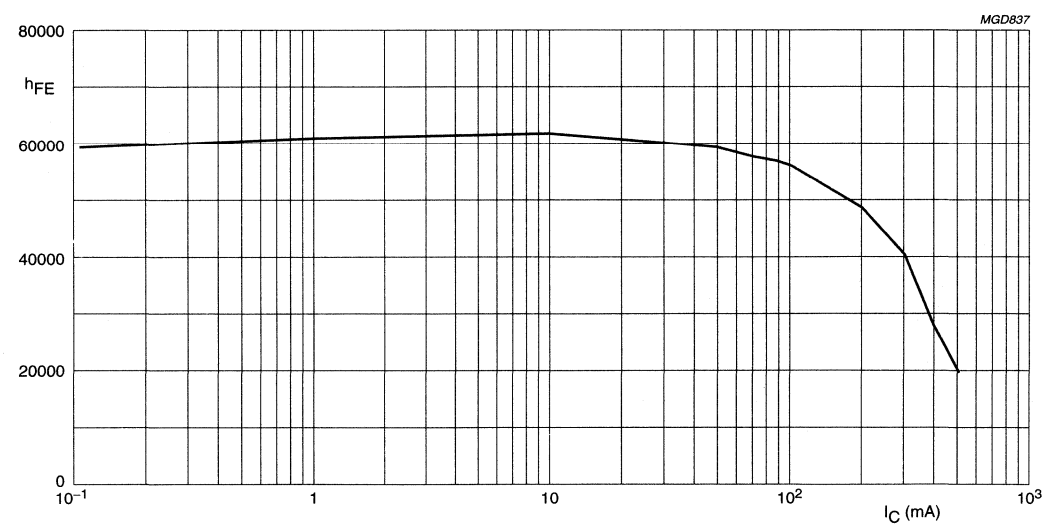
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	0.1	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	0.1	µA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V; see Fig.2	10000	–	
		I_C = 100 mA; V_{CE} = 5 V; see Fig.2	20000	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 100 mA; V_{CE} = 5 V	–	2	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	125	–	MHz



V_{CE} = 5 V.

Fig.2 DC current gain; typical values.

NPN Darlington transistors MPSA26; MPSA27

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 60 V)
- High DC current gain (min. 10000).

APPLICATIONS

- High gain amplification.

DESCRIPTION

NPN Darlington transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

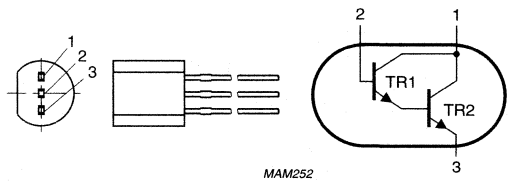


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	MPSA26		–	50	V
	MPSA27		–	60	V
V_{CES}	collector-emitter voltage	V_{BE} = 0			
	MPSA26		–	50	V
	MPSA27		–	60	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

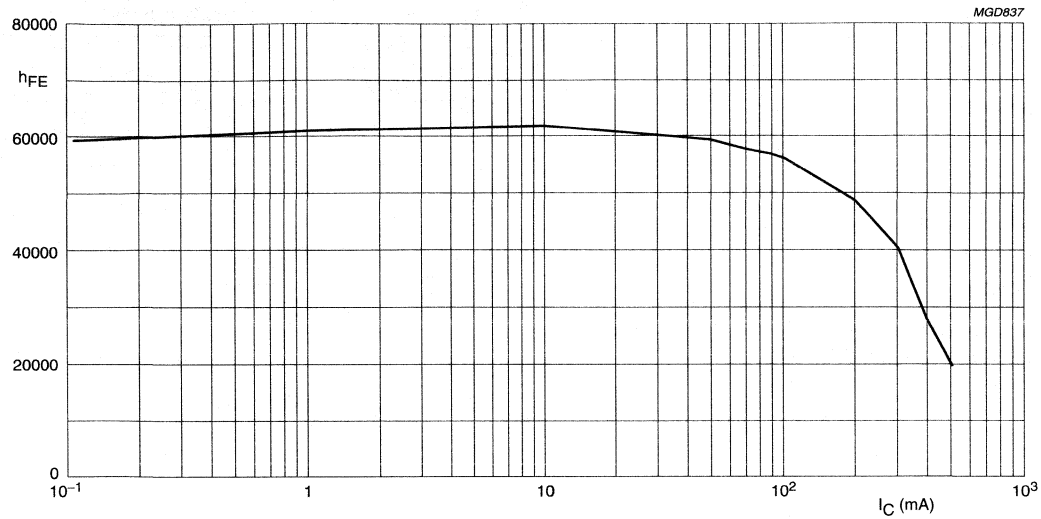
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current MPSA26	I_E = 0; V_{CB} = 40 V	–	–	100	nA
I_{CBO}	collector cut-off current MPSA27	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V; see Fig.2	10000	–	–	
		I_C = 100 mA; V_{CE} = 5 V; see Fig.2	10000	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 100 mA; V_{CE} = 5 V	–	–	2	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	125	220	–	MHz



V_{CE} = 5 V.

Fig.2 DC current gain; typical values.

NPN high-voltage transistors MPSA42; MPSA43

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Video
- Telephony
- Professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a TO-92; SOT54 plastic package. PNP complement: MPSA92.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

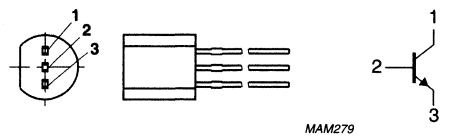


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	MPSA42		–	300	V
	MPSA43		–	200	V
V_{CEO}	collector-emitter voltage	open base			
	MPSA42		–	300	V
	MPSA43		–	200	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	MPSA42	I_E = 0; V_{CB} = 200 V	–	100	nA
	MPSA43	I_E = 0; V_{CB} = 160 V	–	100	nA
I_{EBO}	emitter cut-off current				
	MPSA42	I_C = 0; V_{EB} = 6 V	–	100	nA
	MPSA43	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; note 1			
		I_C = 1 mA	25	–	
		I_C = 10 mA	40	–	
		I_C = 30 mA	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA; note 1	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA; note 1	–	900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz			
	MPSA42		–	3	pF
	MPSA43		–	4	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	50	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN high-voltage transistor MPSA44

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 400 V).

APPLICATIONS

- Telecommunication applications.

DESCRIPTION

NPN high-voltage transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

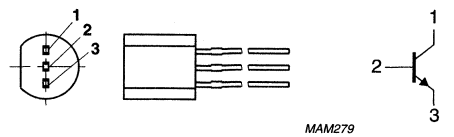


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	500	V
V_{CEO}	collector-emitter voltage	open base	–	400	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

NPN high-voltage transistor MPSA44

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 400 V	–	100	nA
		I_E = 0; V_{CB} = 400 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	40	–	
		I_C = 10 mA; V_{CE} = 10 V	50	200	
		I_C = 50 mA; V_{CE} = 10 V; note 1	45	–	
		I_C = 100 mA; V_{CE} = 10 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 mA; I_B = 0.1 mA	–	400	mV
		I_C = 10 mA; I_B = 1 mA	–	500	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	850	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz	–	7	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	180	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	20	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistor MPSA56

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP transistor in a TO-92; SOT54 plastic package.
NPN complement: MPSA06.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

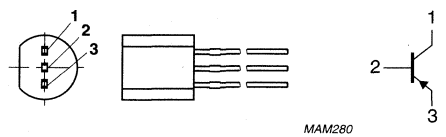


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–80	V
V_{CEO}	collector-emitter voltage	open base	–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	625	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −80 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −1 V	100	–	
		I_C = −100 mA; V_{CE} = −1 V	100	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −10 mA	–	−250	mV
V_{BE}	base-emitter voltage	I_C = −100 mA; V_{CE} = −1 V	–	−1.2	V
f_T	transition frequency	I_C = −100 mA; V_{CE} = −1 V; f = 100 MHz	50	–	MHz

PNP Darlington transistor MPSA64

FEATURES

- Low current (max. 500 mA)
- Low voltage (max. 30 V)
- High DC current gain (min. 10000).

APPLICATIONS

- High gain amplification.

DESCRIPTION

PNP Darlington transistor in a TO-92; SOT54 plastic package. NPN complement: MPSA14.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

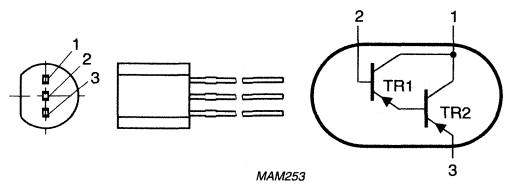


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

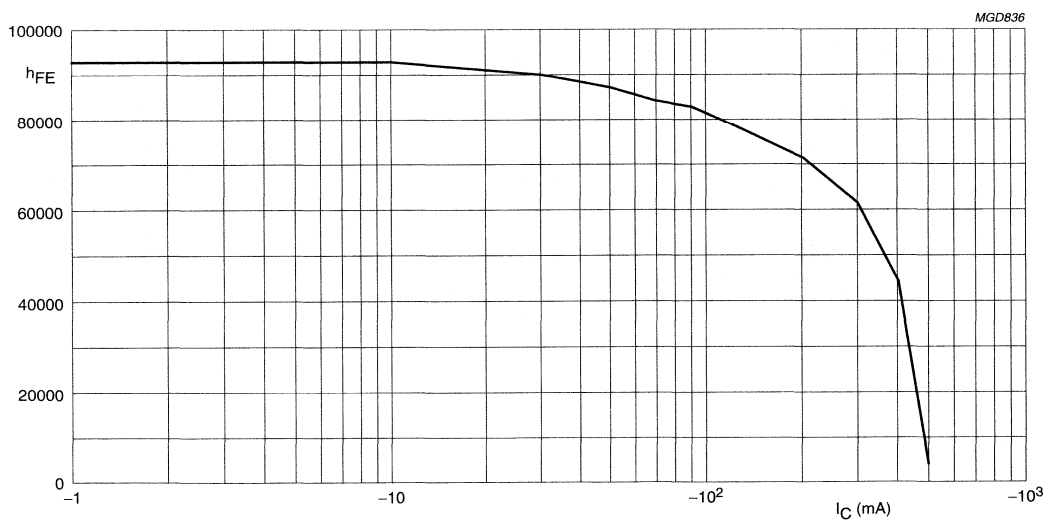
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −10 V	–	−100	nA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V; see Fig.2	10000	–	
		I_C = −100 mA; V_{CE} = −5 V; see Fig.2	20000	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	−1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	–	−1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = −100 mA; V_{CE} = −5 V	–	−2	V
f_T	transition frequency	I_C = −100 mA; V_{CE} = −5 V; f = 100 MHz	125	–	MHz



V_{CE} = −2 V.

Fig.2 DC current gain; typical values.

PNP high-voltage transistor MPSA92

FEATURES

- Low current (max. 500 mA)
- High voltage (max. 300 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP high-voltage transistor in a TO-92; SOT54 plastic package. NPN complement: MPSA42.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

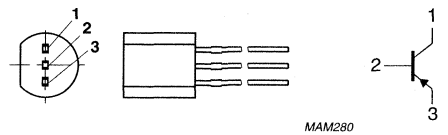


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–300	V
V_{CEO}	collector-emitter voltage	open base	–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	625	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	200	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–250	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = –3 V	–	–100	nA
h_{FE}	DC current gain	V_{CE} = –10 V; note 1			
		I_C = –1 mA	25	–	
		I_C = –10 mA	40	–	
		I_C = –30 mA	25	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA; note 1	–	–500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA; note 1	–	–900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –20 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	50	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP resistor-equipped transistor PDTA114EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

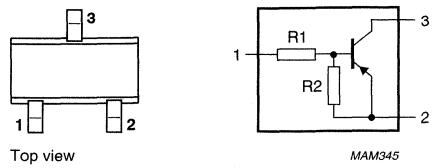


Fig.1 Simplified outline (SC-75) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 plastic package.
NPN complement: PDTC114EE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

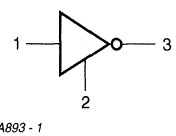


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA114EE	03

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

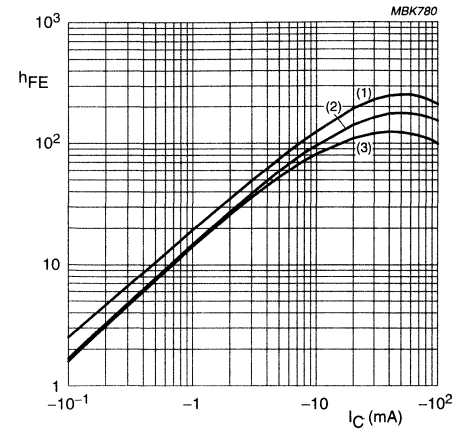
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

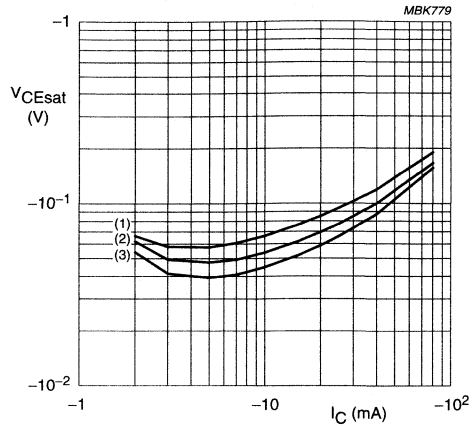
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_C = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1100	–800	mV
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -300$ mV	–2.5	–1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



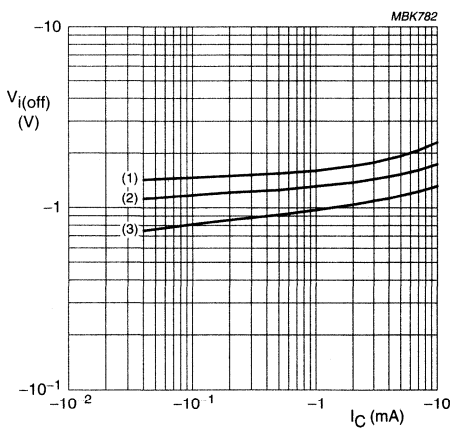
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



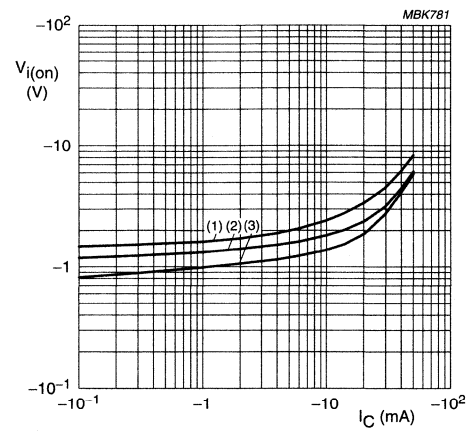
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor | PDTA114EEF

FEATURES

- Power dissipation comparable to SOT23
- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor encapsulated in an ultra small SC-89 (SOT490) plastic SMD package.
NPN complement: PDTC114EEF.

MARKING

TYPE NUMBER	MARKING CODE
PDTA114EEF	03

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

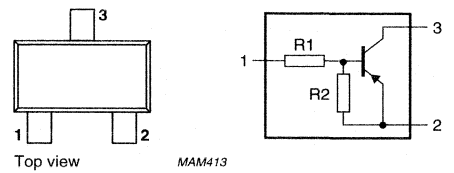


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

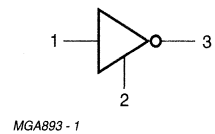


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−50	V
V_{CEO}	collector-emitter voltage	open base	–	−50	V
V_{EBO}	emitter-base voltage	open collector	–	−10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	−40	V
I_O	output current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1		250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

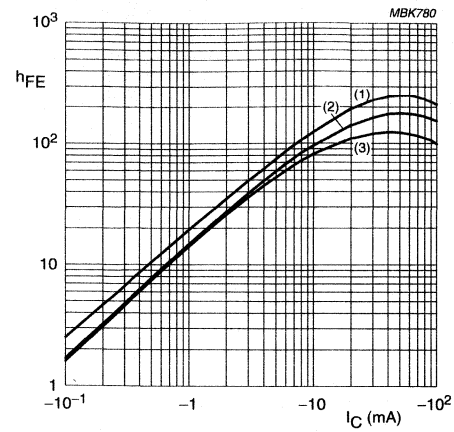
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

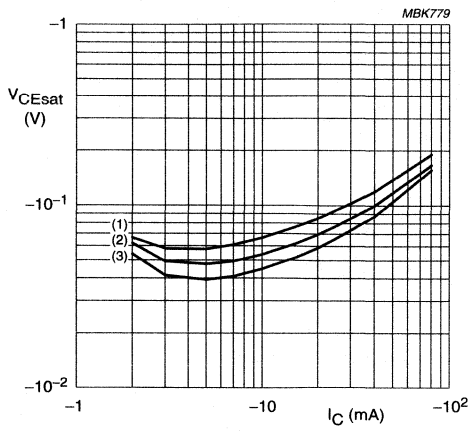
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	−100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	−1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	−50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	−400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	−150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	−1.1	−0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -300$ mV	−2.5	−1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



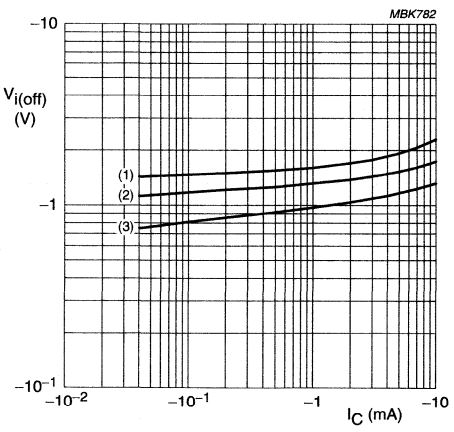
$V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.3 DC current gain as a function of collector current; typical values.



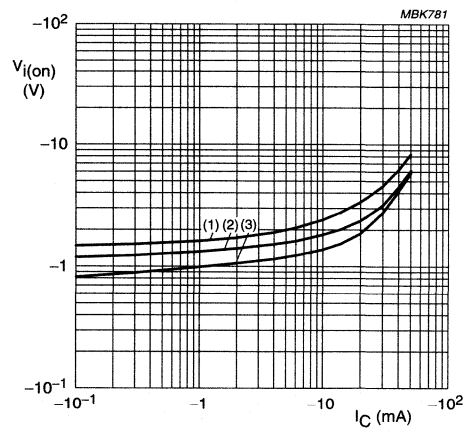
$I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



$V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



$V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in an SC-59 plastic package.
NPN complement: PDTC114EK.

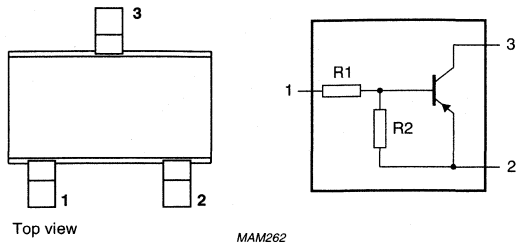


Fig.1 Simplified outline (SC-59) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

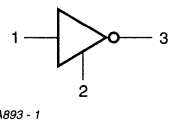


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA114EK	03

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	−50	V
I_O	output current (DC)		–	–	−100	mA
I_{CM}	peak collector current		–	–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

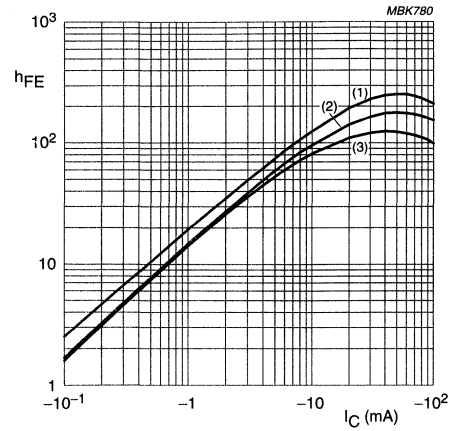
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

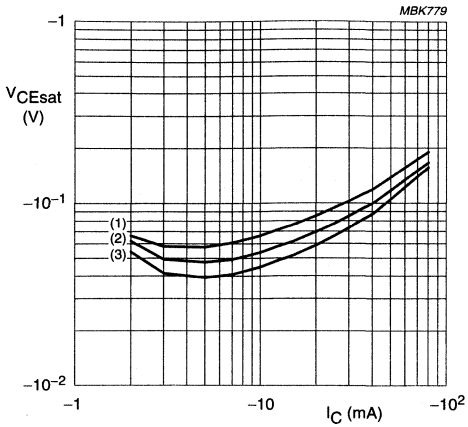
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -0.3$ V	–2.5	–1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



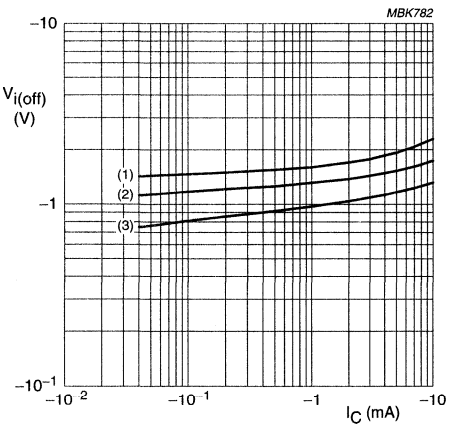
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



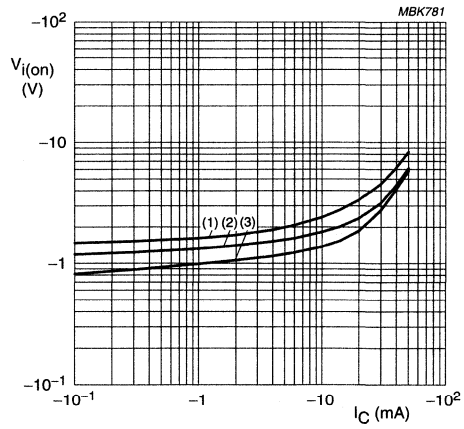
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuit applications
- Inverter circuit configurations without use of external resistors.

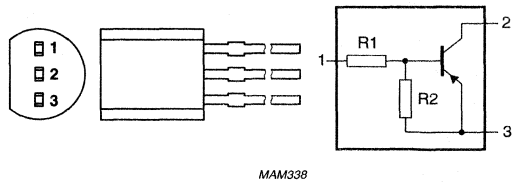


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in a TO-92; SOT54 plastic package.
NPN complement: PDTC114ES.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground (+)

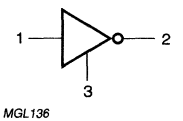


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

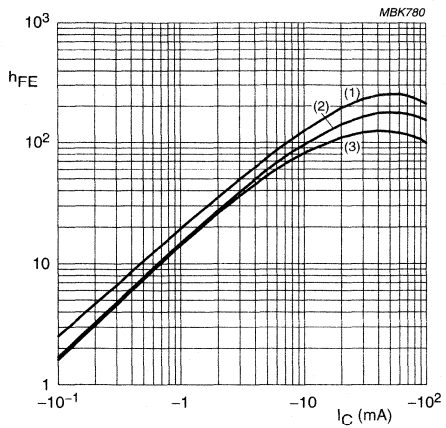
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

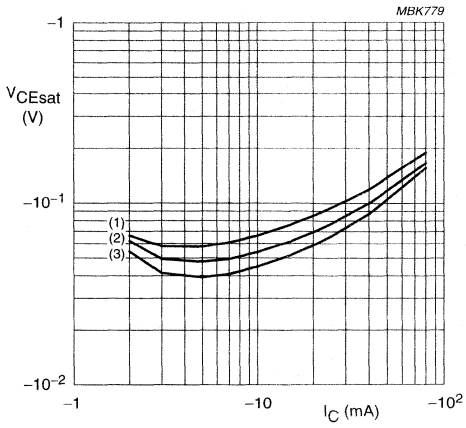
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -0.3$ V	–2.5	–1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



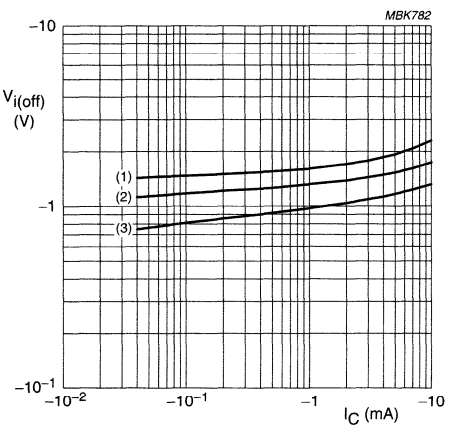
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



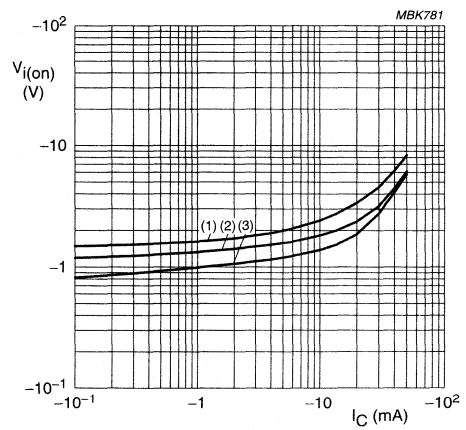
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC114ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

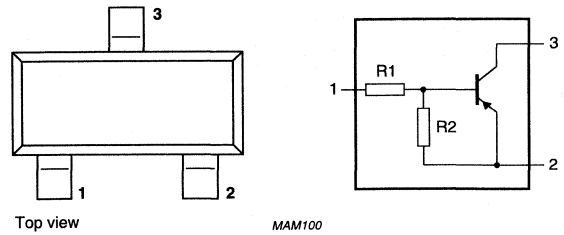


Fig.1 Simplified outline (SOT23) and symbol.

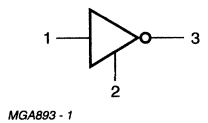


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA114ET	*03

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

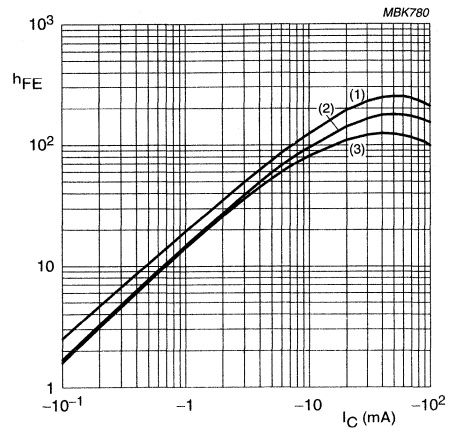
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

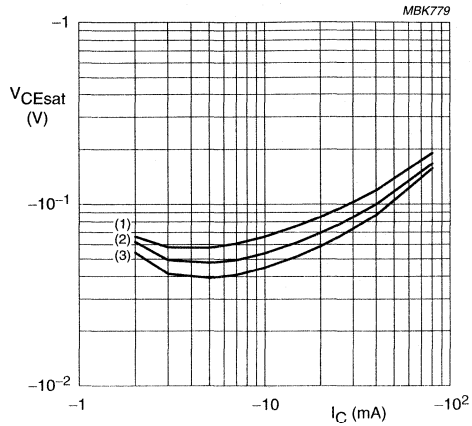
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -0.3$ V	–2.5	–1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



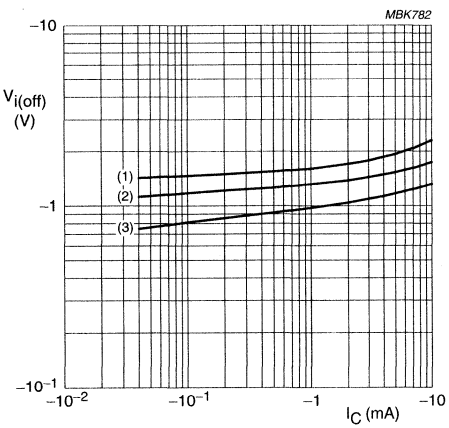
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



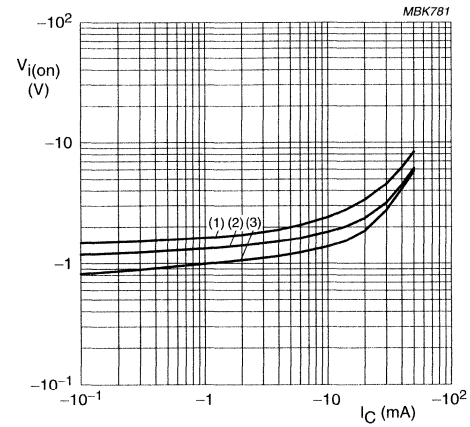
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT323 plastic package.
NPN complement: PDTC114EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

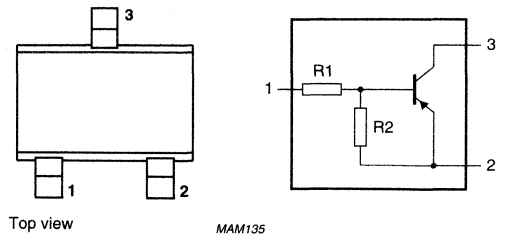


Fig.1 Simplified outline (SOT323) and symbol.

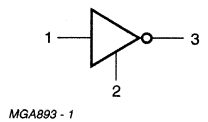


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA114EU	*03

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

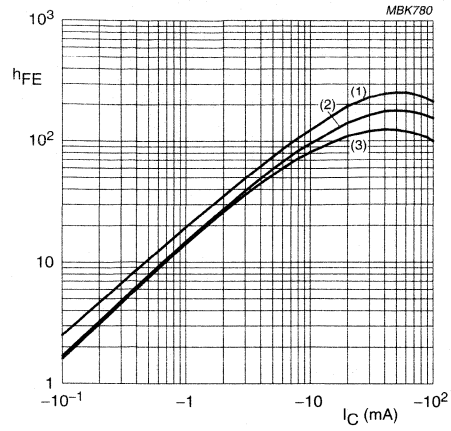
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

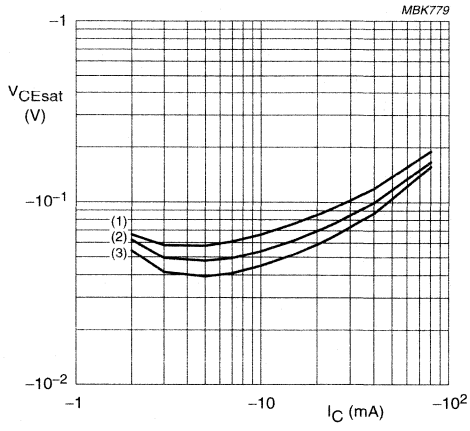
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–400	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -10$ mA; $V_{CE} = -0.3$ V	–2.5	–1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



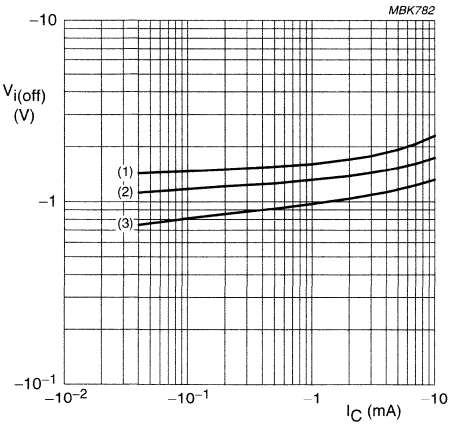
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



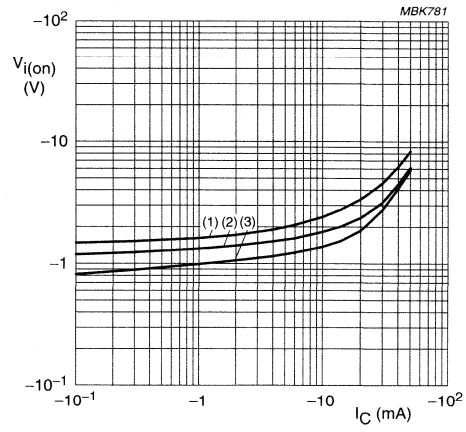
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114TK

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistor.

DESCRIPTION

PNP resistor-equipped transistor in a SC-59 plastic package.
NPN complement: PDTC114TK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

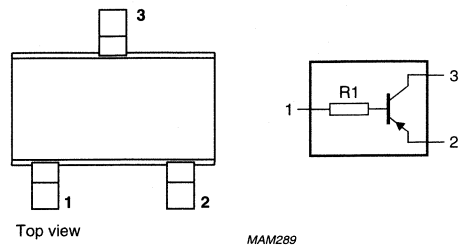


Fig.1 Simplified outline (SC-59) and symbol.

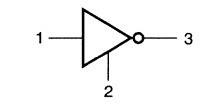


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA114TK	23

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	200	–	–	
R1	input resistor		7	10	13	kΩ

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

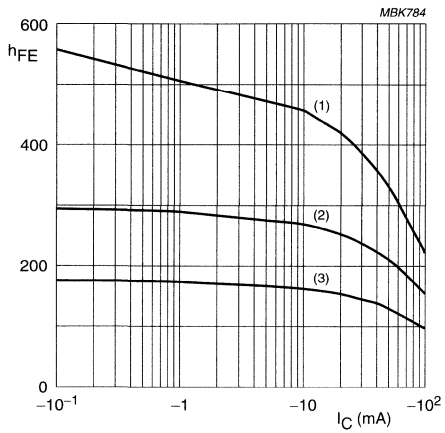
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

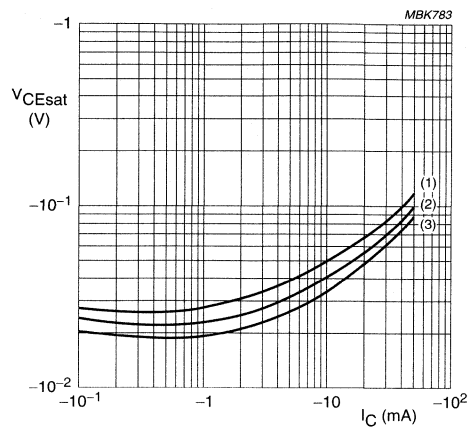
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -4$ V	–	–	–100	nA
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114TS

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

PNP resistor-equipped transistor in a TO-92; SOT54 plastic package.
NPN complement: PDTC114TS.

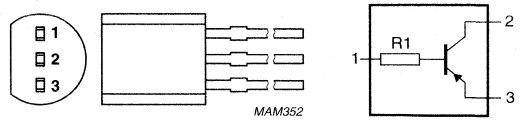


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground (+)

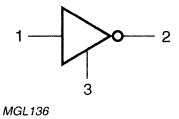


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	200	–	–	
R1	input resistor		7	10	13	kΩ

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

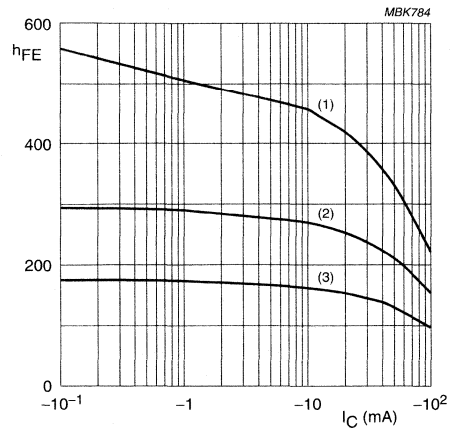
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

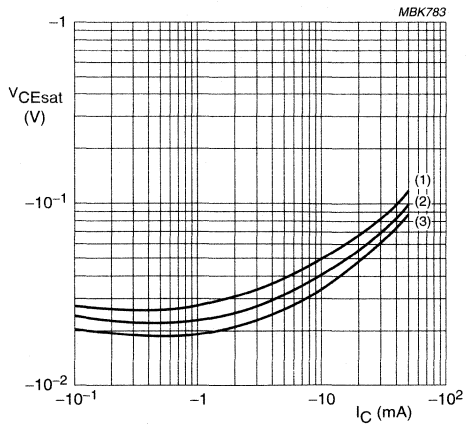
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–100	nA
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114TT

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC114TT.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

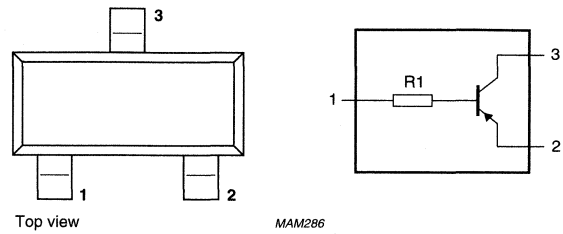


Fig.1 Simplified outline (SOT23) and symbol.

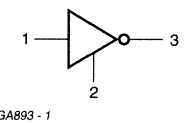


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA114TT	*11

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

OBJECTIVE
See Philips Semiconductors for Design-in Information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

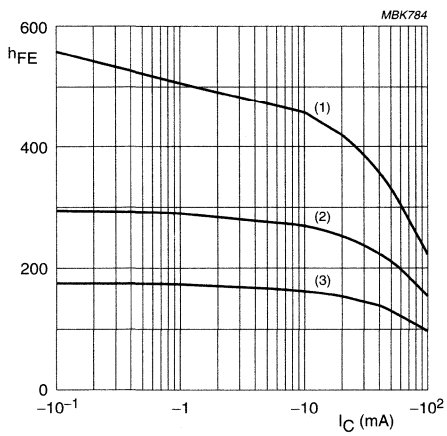
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

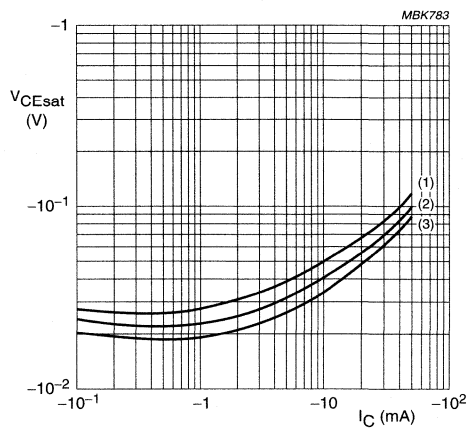
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114TU

FEATURES

- Built-in bias resistor R1(typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

PNP resistor-equipped transistor in a SOT323 plastic package.
NPN complement: PDTC114TU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

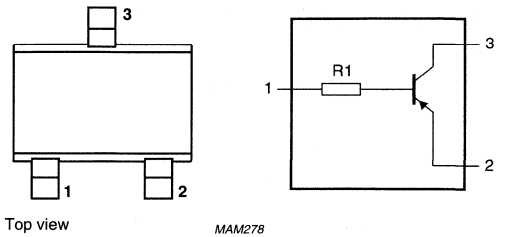


Fig.1 Simplified outline (SOT323) and symbol.

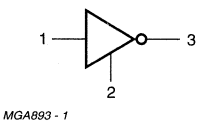


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA114TU	*23

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

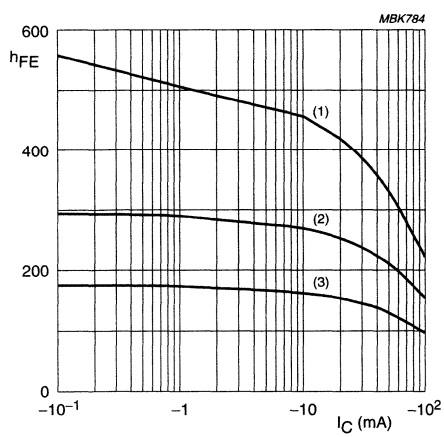
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

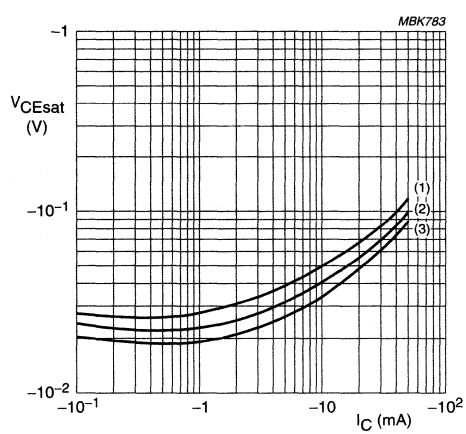
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −1 mA; V_{CE} = −5 V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA114YT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

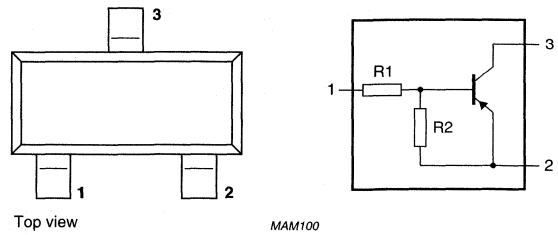


Fig.1 Simplified outline (SOT23) and symbol.

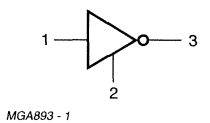


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA114YT	*29

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	6	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SOT23 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

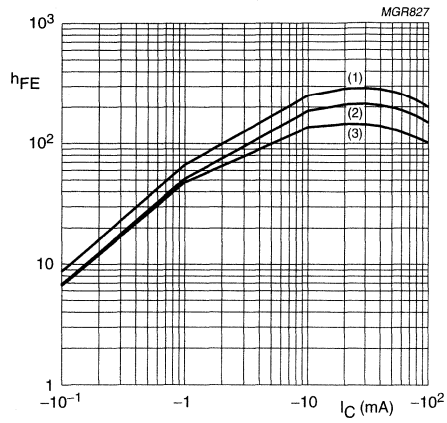
Note

1. Refer to SOT23 standard mounting conditions.

CHARACTERISTICS

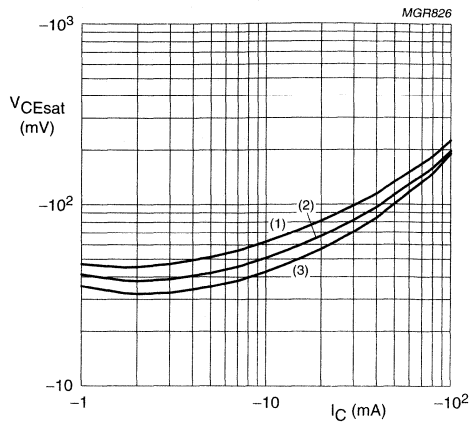
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−150	μA
h_{FE}	DC current gain	I_C = −5 mA; V_{CE} = −5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −5 mA; I_B = −0.25 mA	–	–	−100	mV
$V_{i(off)}$	input-off voltage	I_C = −100 μA; V_{CE} = −5 V	–	−0.7	−0.5	V
$V_{i(on)}$	input-on voltage	I_C = −1 mA; V_{CE} = −0.3 V	−1.4	−0.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		3.7	4.7	5.7	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



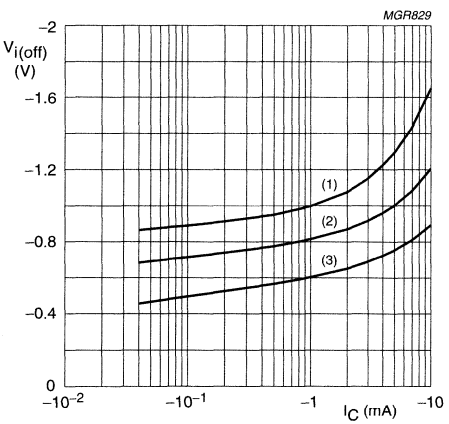
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



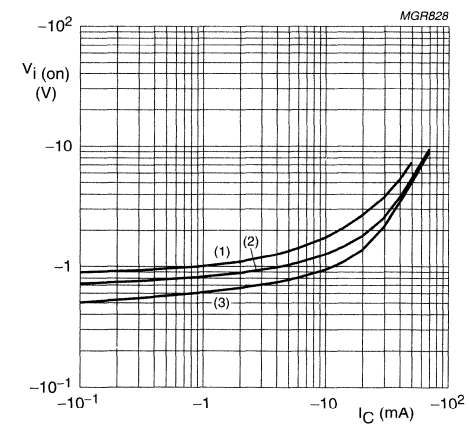
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA123ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package. NPN complement: PDTC123ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA123ET	*21

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

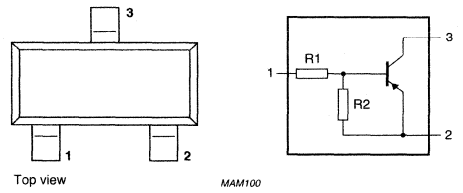


Fig.1 Simplified outline (SOT23) and symbol.

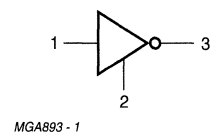


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–12	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

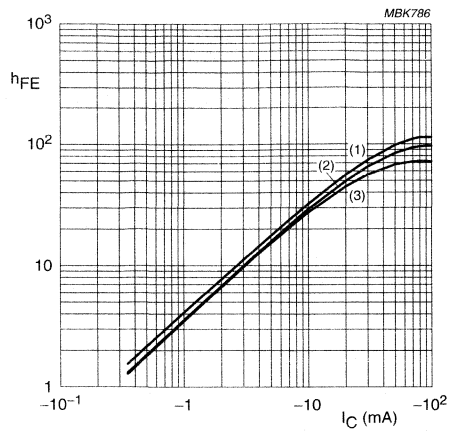
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

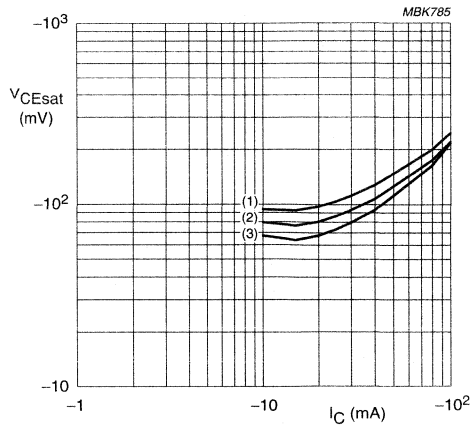
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–2	mA
h_{FE}	DC current gain	$I_C = -20$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -1$ mA; $V_{CE} = -5$ V	–	–1.2	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -0.3$ V	–2	–1.6	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



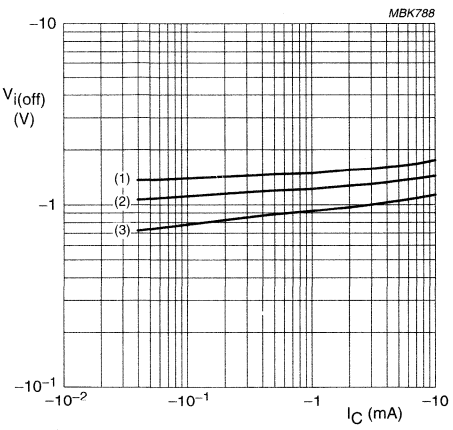
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



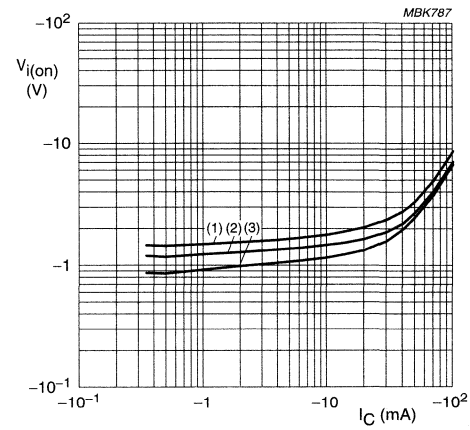
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor | PDTA123JEF

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

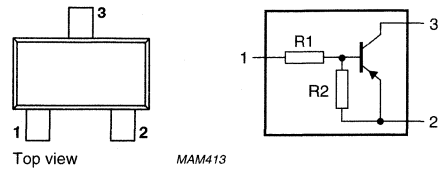


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-89 (SOT490) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

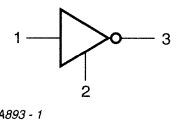


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA123JEF	27

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−50	V
V_{CEO}	collector-emitter voltage	open base	–	−50	V
V_{EBO}	emitter-base voltage	open collector	–	−10	V
V_I	input voltage				
	positive		–	5	V
	negative		–	−12	V
I_O	output current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

PRELIMINARY
Philips Semiconductors for Design-in information
See Philips Semiconductors

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

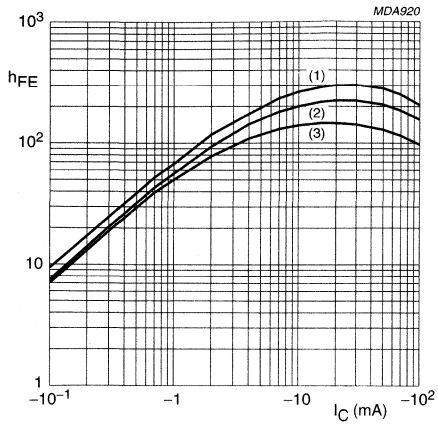
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

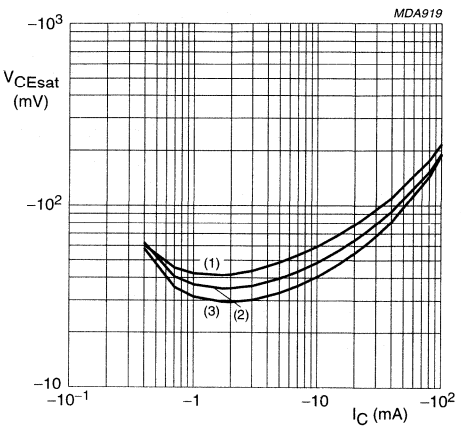
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−180	μA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −5 mA; I_B = −0.25 mA	–	–	−100	mV
$V_{i(off)}$	input-off voltage	I_C = −100 μA; V_{CE} = −5 V	–	−0.6	−0.5	V
$V_{i(on)}$	input-on voltage	I_C = −5 mA; V_{CE} = −0.3 V	−1.1	−0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



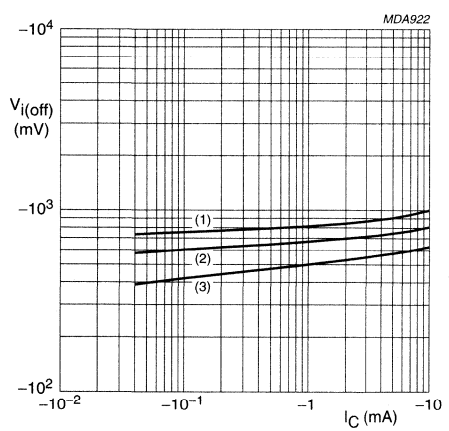
V_{CE} = –5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = –40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



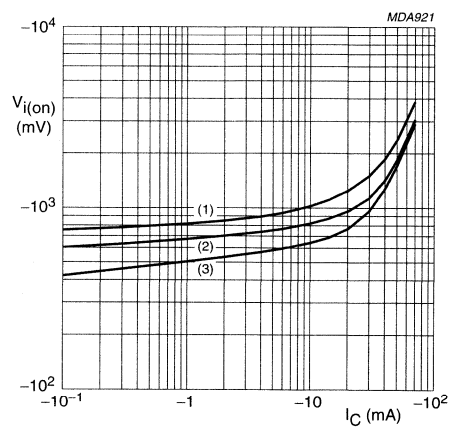
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = –40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = –5 V.
(1) T_{amb} = –40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = –0.3 V.
(1) T_{amb} = –40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA123JT

FEATURES

- Built-in bias resistors (typ 2.2 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

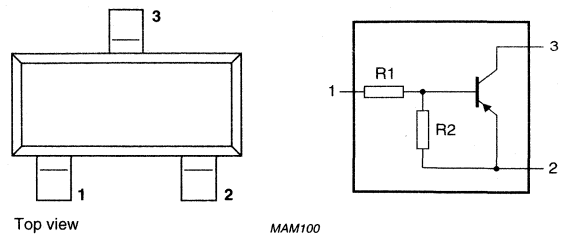


Fig.1 Simplified outline (SOT23) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC123ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

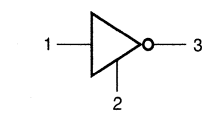


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA123JT	*23

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−50	V
V_{CEO}	collector-emitter voltage	open base	–	−50	V
V_{EBO}	emitter-base voltage	open collector	–	−10	V
V_I	input voltage				
	positive		–	+5	V
	negative		–	−12	V
I_O	output current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Refer to SOT23 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

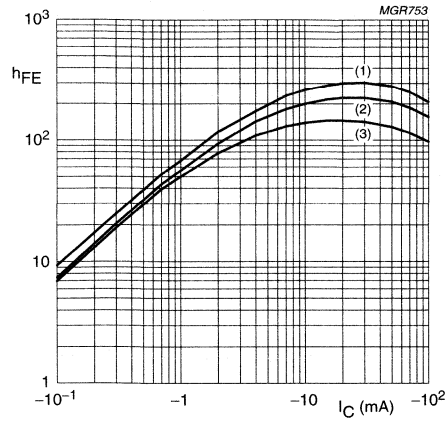
Note

1. Refer to SOT23 standard mounting conditions.

CHARACTERISTICS

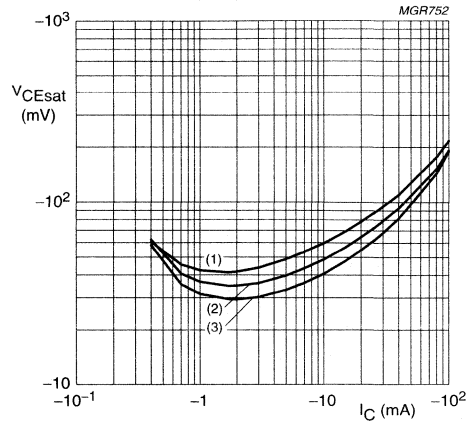
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	µA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−180	µA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −5 mA; I_B = −0.25 mA	–	–	−100	mV
$V_{i(off)}$	input-off voltage	I_C = −100 µA; V_{CE} = −5 V	–	–	−0.5	V
$V_{i(on)}$	input-on voltage	I_C = −5 mA; V_{CE} = −0.3 V	−1.1	−0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



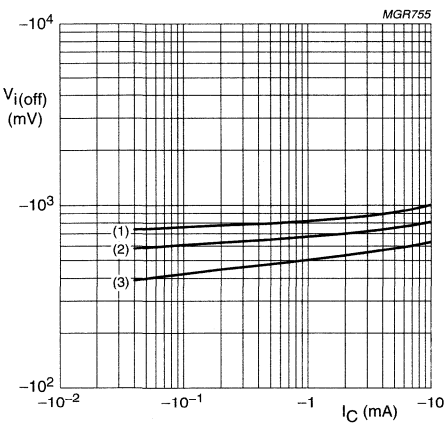
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



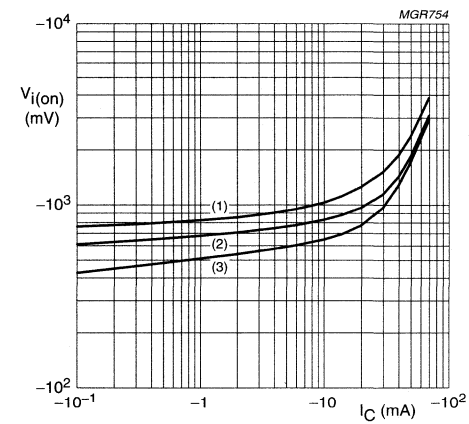
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

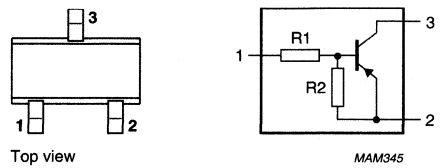


Fig.1 Simplified outline (SC-75) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 plastic package.
NPN complement: PDTC124EE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

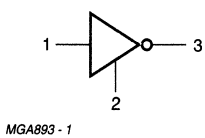


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA124EE	05

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

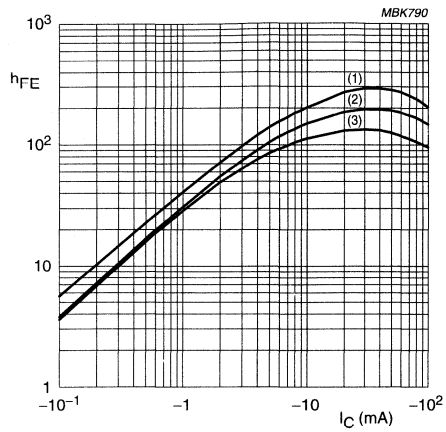
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

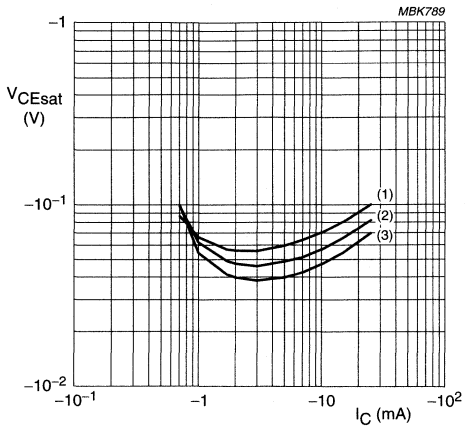
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_C = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–180	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1100	–800	mV
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -300$ mV	–2.5	–1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



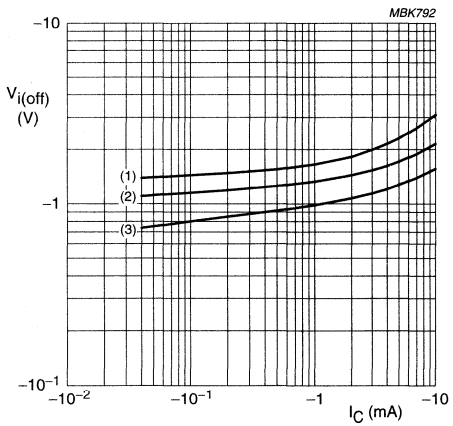
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



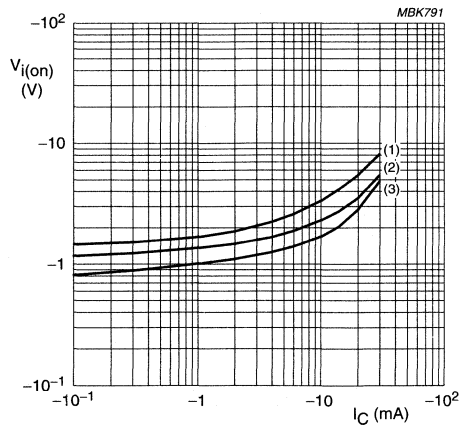
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SC-59 plastic package.
NPN complement: PDTC124EK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

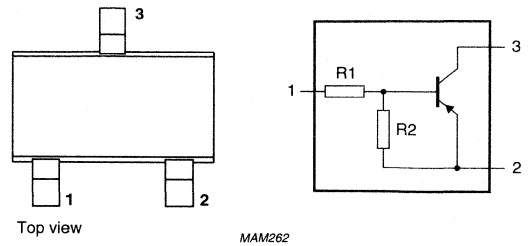


Fig.1 Simplified outline (SC-59) and symbol.

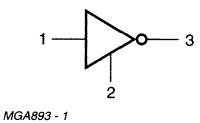


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA124EK	05

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

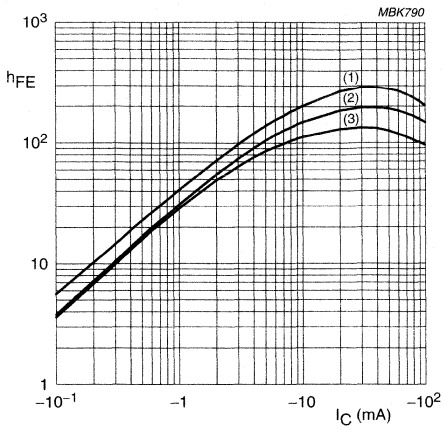
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

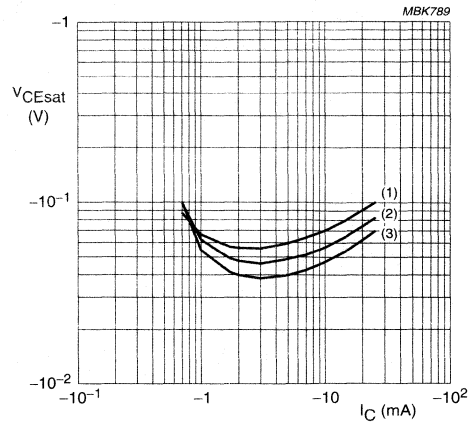
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	μA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–180	μA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ μA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–2.5	–1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



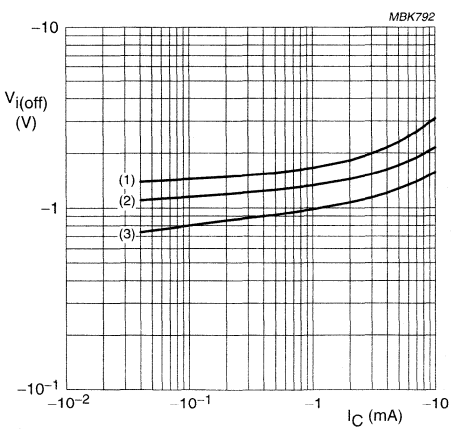
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



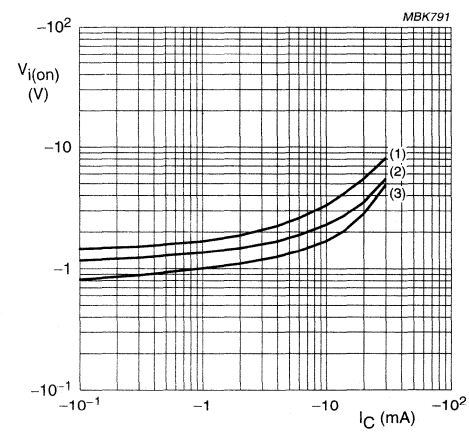
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a TO-92; SOT54 plastic package.
NPN complement: PDTC124ES.

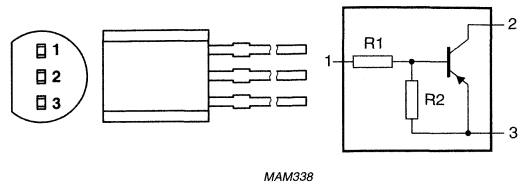


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground (+)

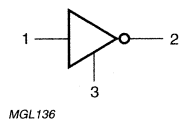


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

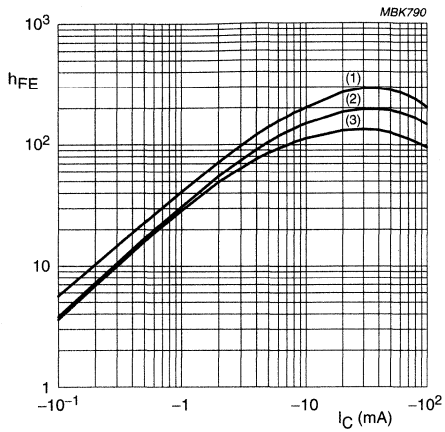
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

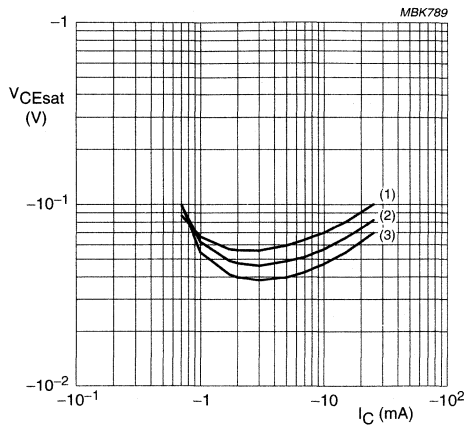
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_C = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–180	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–2.5	–1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



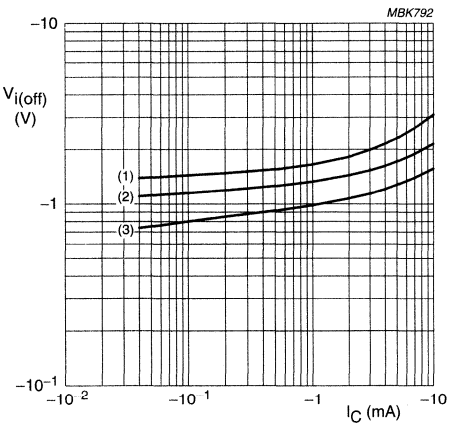
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



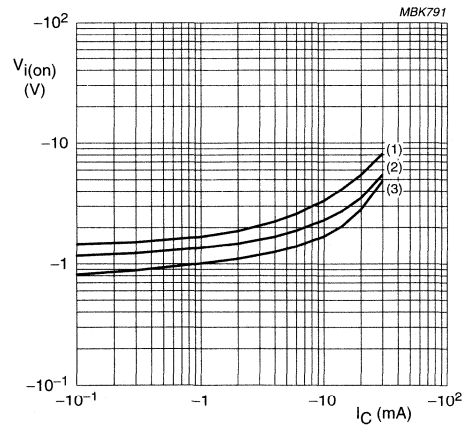
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC124ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

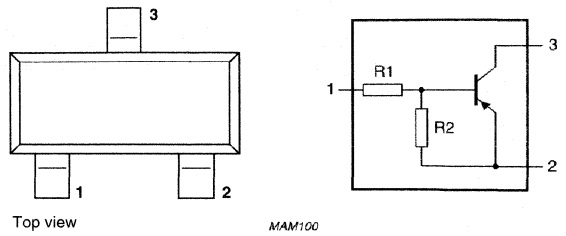


Fig.1 Simplified outline (SOT23) and symbol.

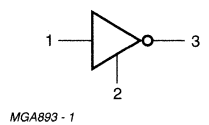


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA124ET	*05

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

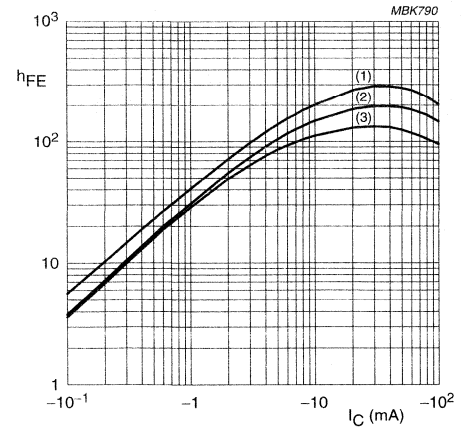
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

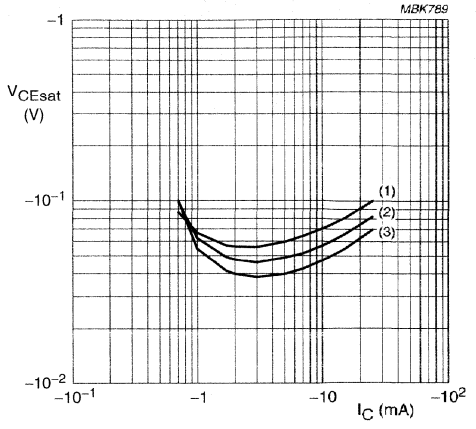
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–180	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–2.5	–1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



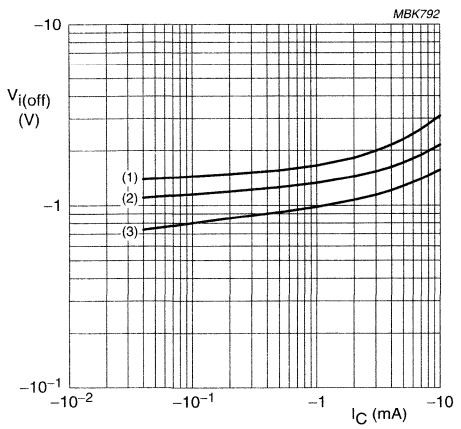
$V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.3 DC current gain as a function of collector current; typical values.



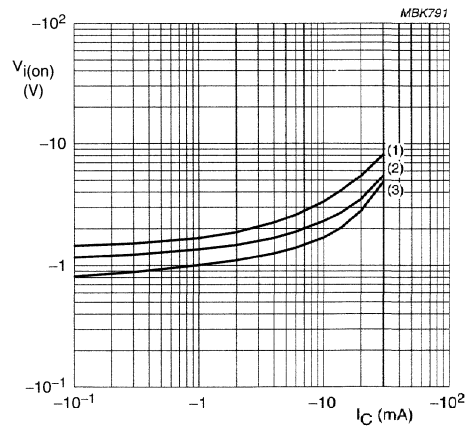
$I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



$V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



$V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT323 plastic package.
NPN complement: PDTC124EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

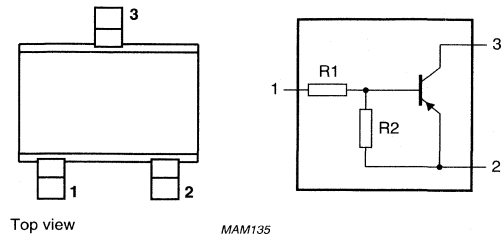


Fig.1 Simplified outline (SOT323) and symbol.

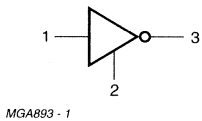


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA124EU	*05

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

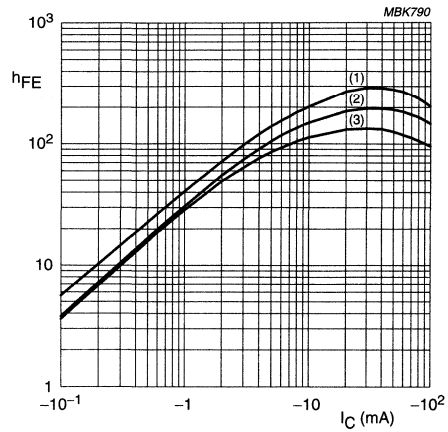
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

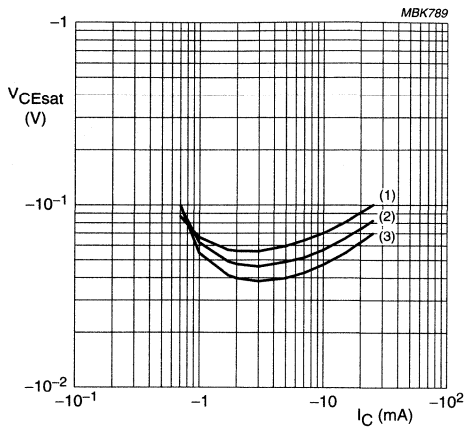
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–180	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–2.5	–1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



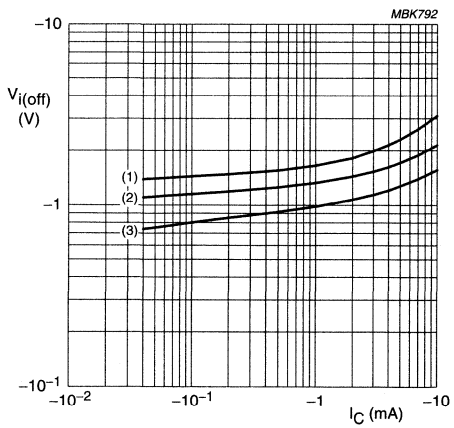
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



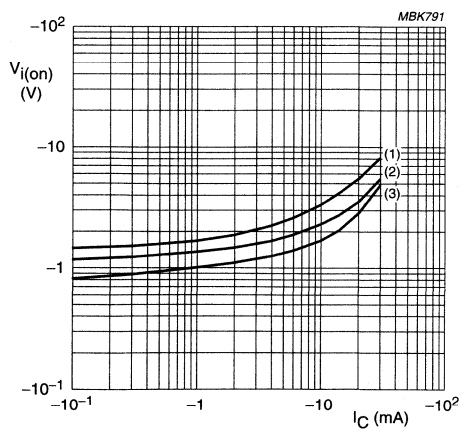
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124XE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 (SOT416) plastic package. NPN complement: PDTC124XE.

MARKING

TYPE NUMBER	MARKING CODE
PDTA124XE	31

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

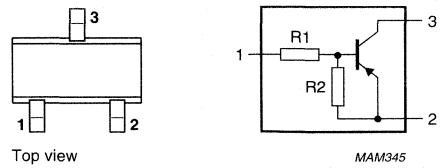


Fig.1 Simplified outline (SC-75) and symbol.

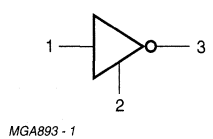


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

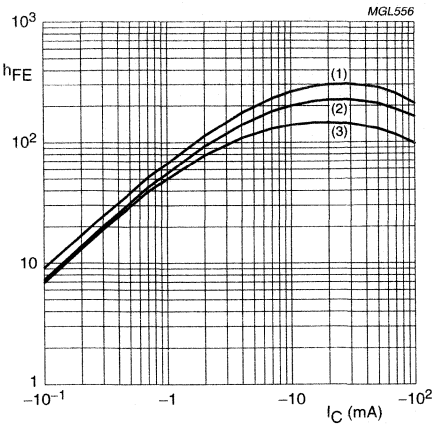
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

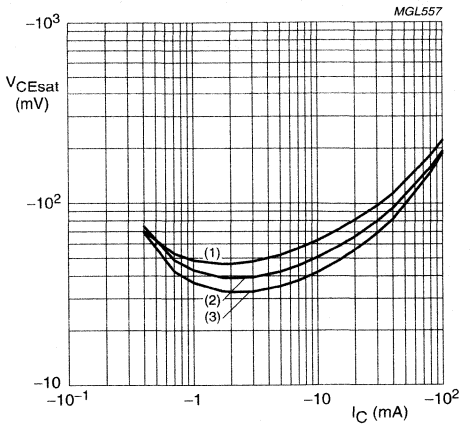
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–120	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–800	–500	mV
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -300$ mV	–2	–1.1	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



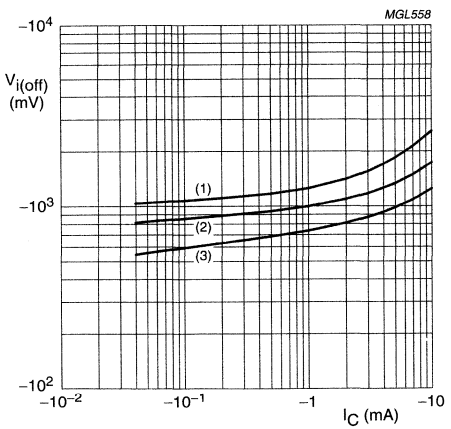
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



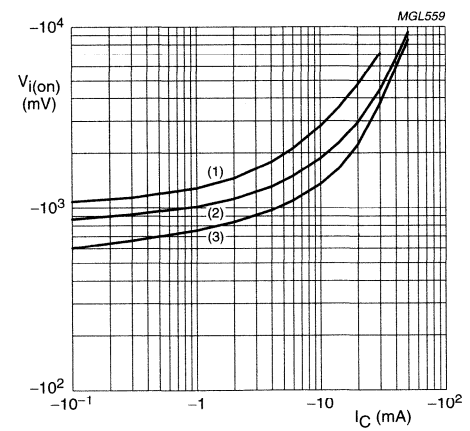
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA124XEF

FEATURES

- Power dissipation comparable to SOT23
- Built-in bias resistors R1 and R2 (typ. 22 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor encapsulated in an ultra small SC-89 (SOT490) plastic SMD package.
NPN complement: PDTC124XEF.

MARKING

TYPE NUMBER	MARKING CODE
PDTA124XEF	31

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

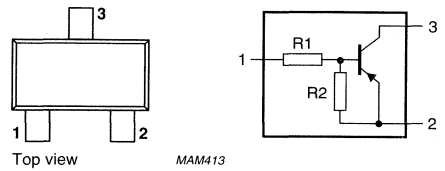


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

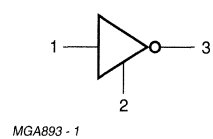


Fig.2 Equivalent inverter symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

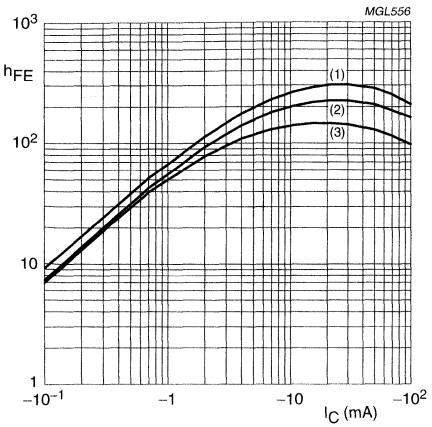
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

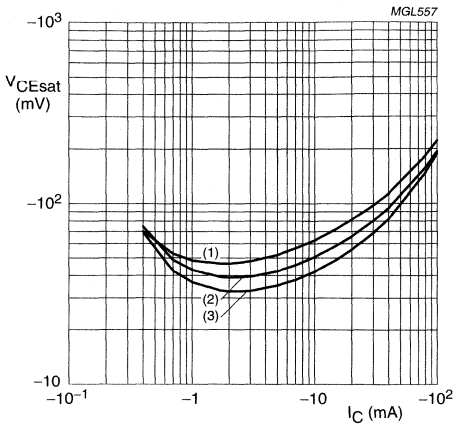
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–120	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–0.8	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -300$ mV	–2	–1.1	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



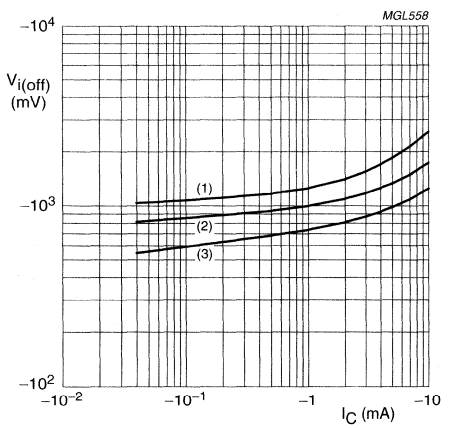
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



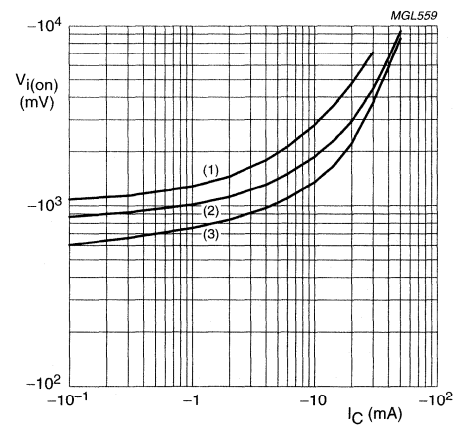
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

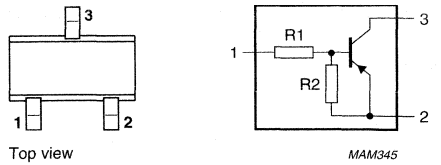


Fig.1 Simplified outline (SC-75) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 plastic package.
NPN complement: PDTC143EE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

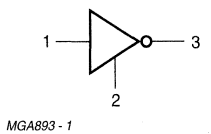


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA143EE	01

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

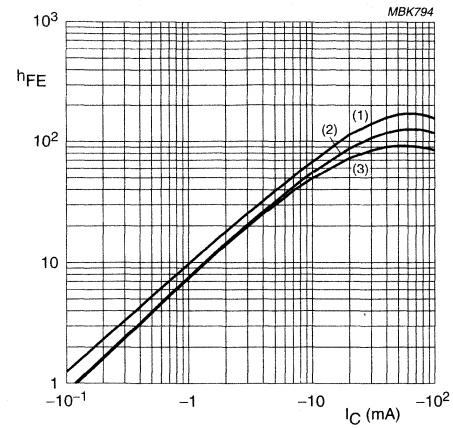
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

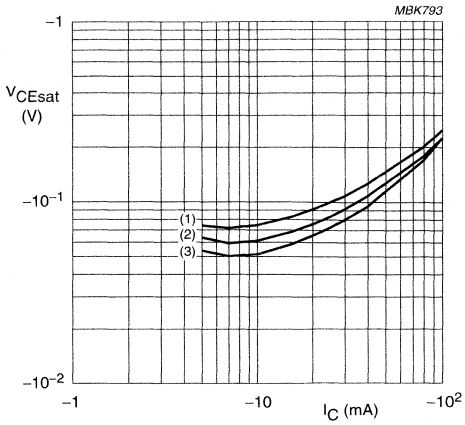
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_C = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–0.9	mA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1100	–500	mV
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -300$ mV	–2.5	–1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



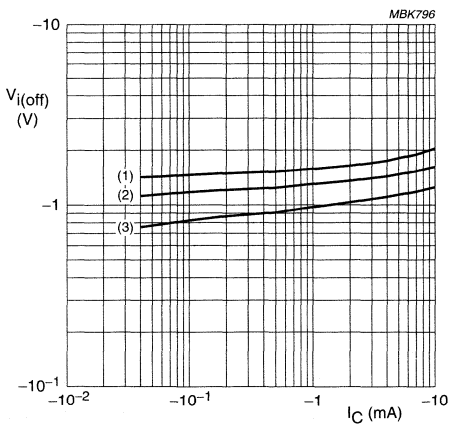
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



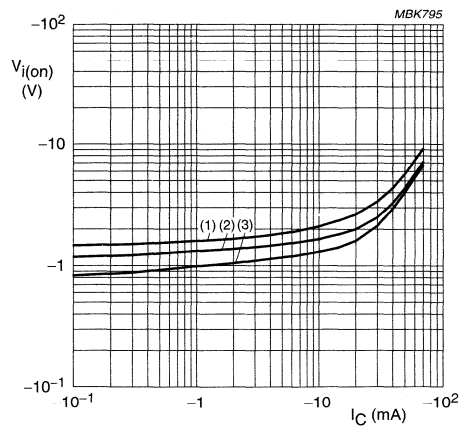
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits.
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a plastic SC-59 package.
NPN complement: PDTC143EK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

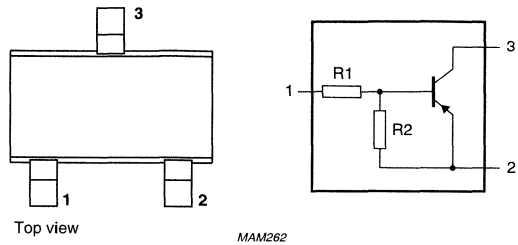


Fig.1 Simplified outline (SC-59) and symbol.

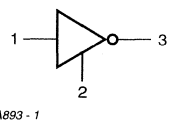


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA143EK	01

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	−50	V
I_O	output current (DC)		–	–	−100	mA
I_{CM}	peak collector current		–	–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

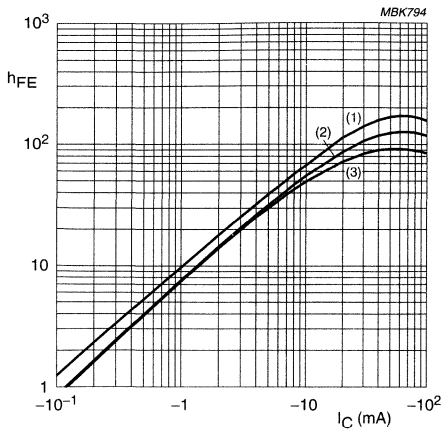
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

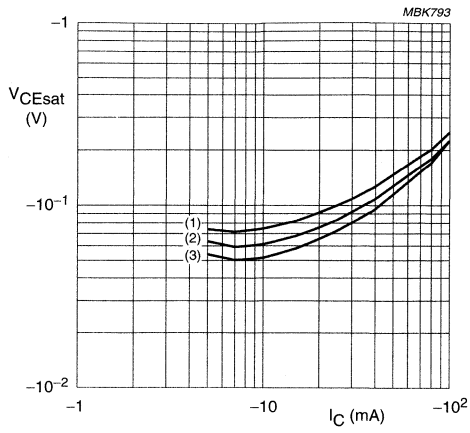
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–0.9	mA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -0.3$ V	–2.5	–1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



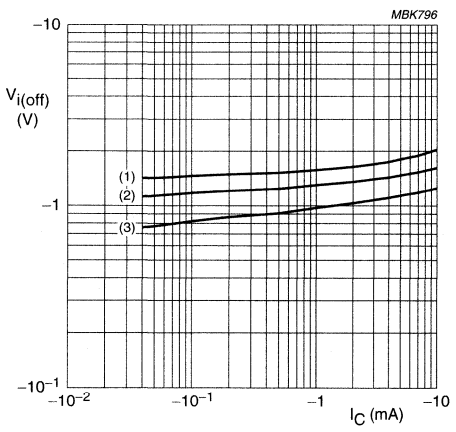
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



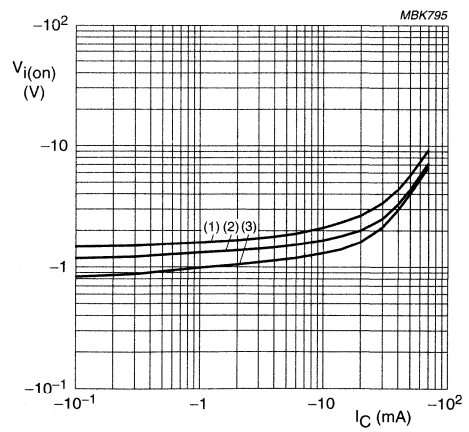
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

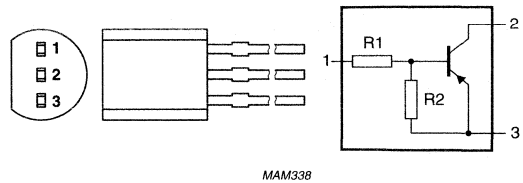


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in a TO-92; SOT54 plastic package.
NPN complement: PDTC143ES.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground (+)

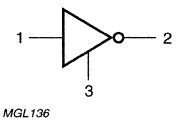


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$V_{CE} = -5$ V; $I_C = -10$ mA	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

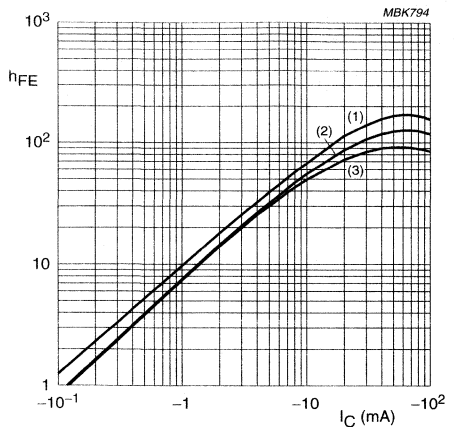
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

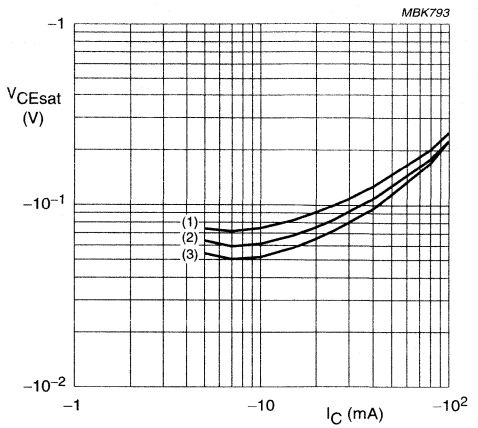
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–0.9	mA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -0.3$ V	–2.5	–1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



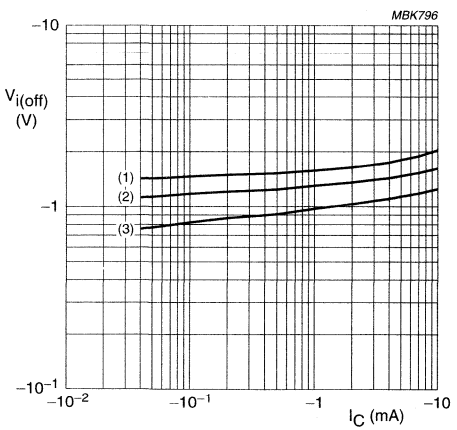
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



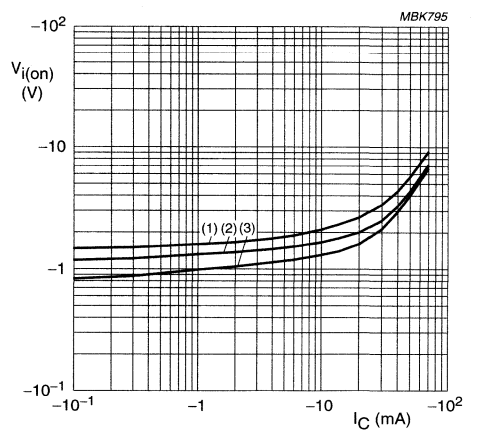
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits.
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC143ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

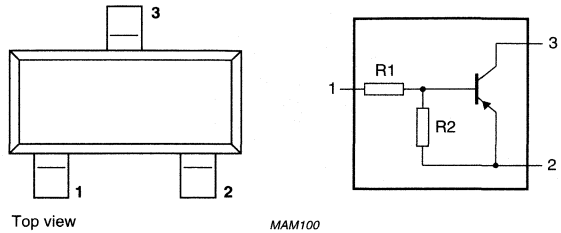


Fig.1 Simplified outline (SOT23) and symbol.

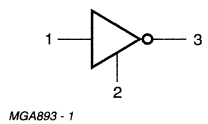


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA143ET	*01

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

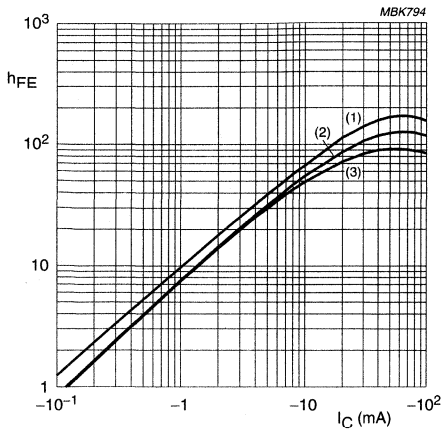
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

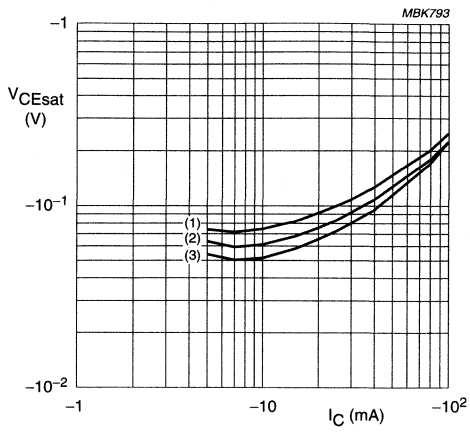
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–0.9	mA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -0.3$ V	–2.5	–1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



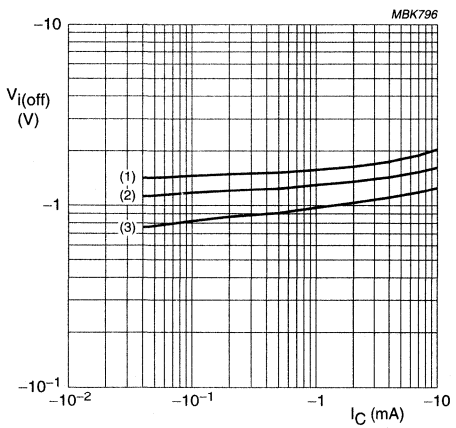
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



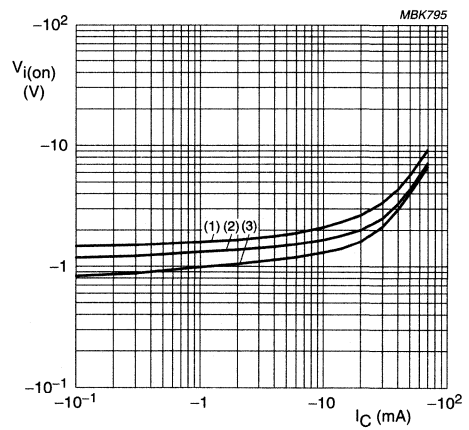
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT323 plastic package.
NPN complement: PDTC143EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

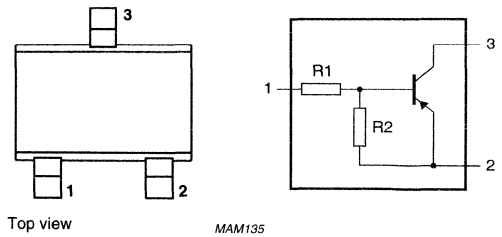


Fig.1 Simplified outline (SOT323) and symbol.

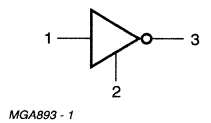


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA143EU	01*

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

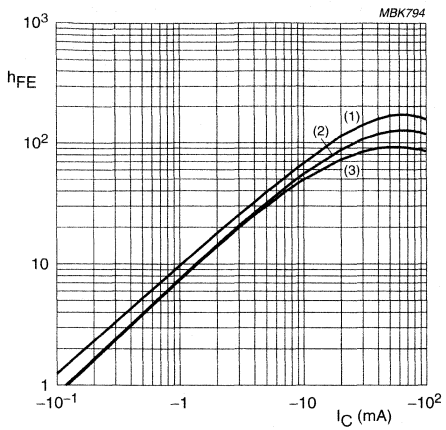
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

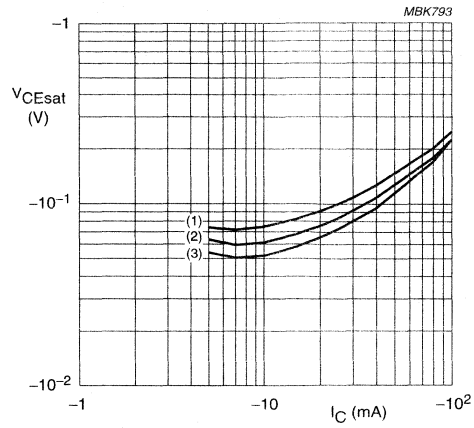
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–0.9	mA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.1	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -20$ mA; $V_{CE} = -0.3$ V	–2.5	–1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



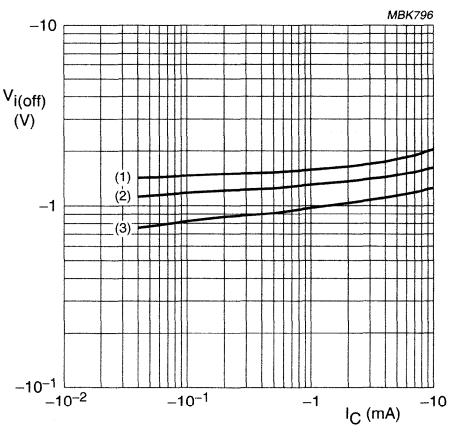
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



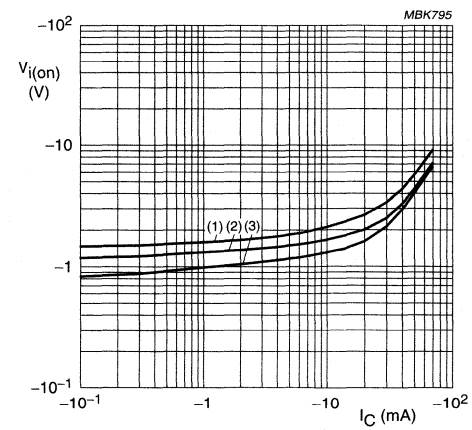
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143XE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 10 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

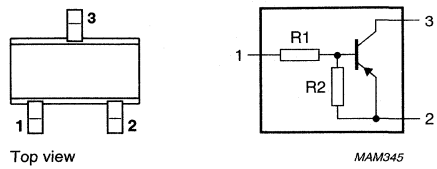


Fig.1 Simplified outline SC-75 (SOT416) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 (SOT416) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

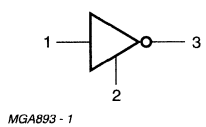


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA143XE	35

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	7	V
	negative		–	–20	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-75 (SOT416) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

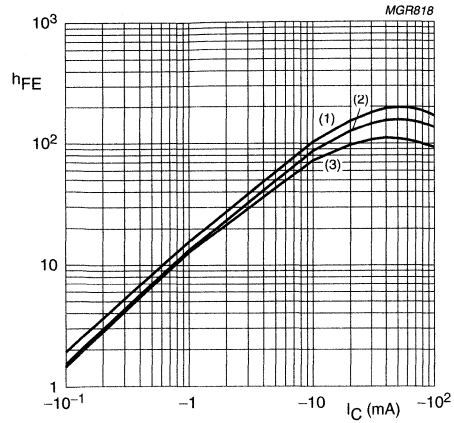
Note

1. Refer to SC-75 (SOT416) standard mounting conditions.

CHARACTERISTICS

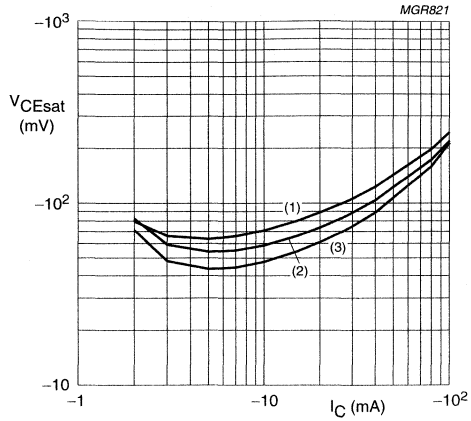
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−0.6	mA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V	50	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−150	mV
$V_{i(off)}$	input-off voltage	I_C = −100 μA; V_{CE} = −5 V	–	–	−0.3	V
$V_{i(on)}$	input-on voltage	I_C = −20 mA; V_{CE} = −0.3 V	−2.5	–	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



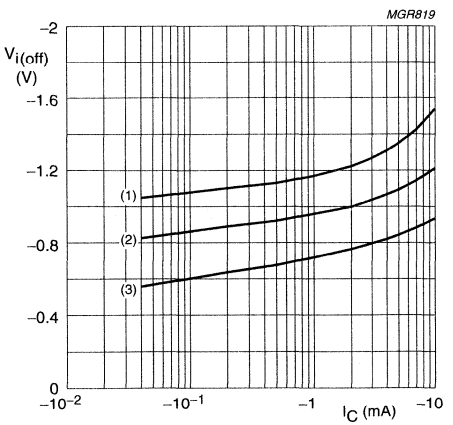
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



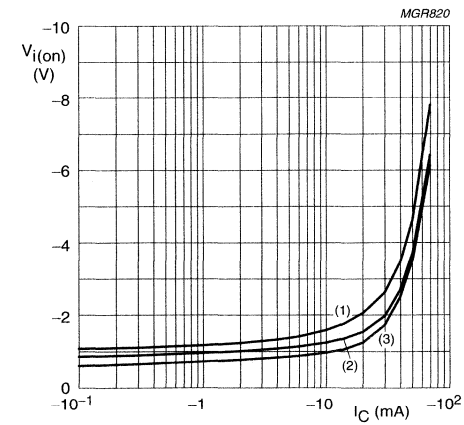
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143XT

FEATURES

- Built-in bias resistors R1 and R2 (typ.4.7 kΩ and 10 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

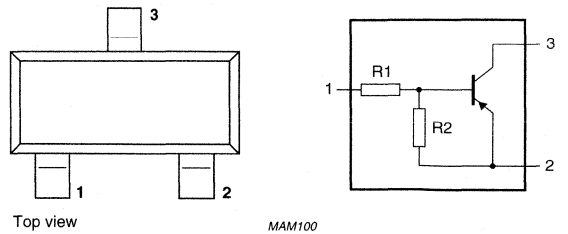


Fig.1 Simplified outline (SOT23) and symbol.

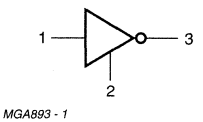


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA143XT	*31

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	7	V
	negative		–	–20	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SOT23 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

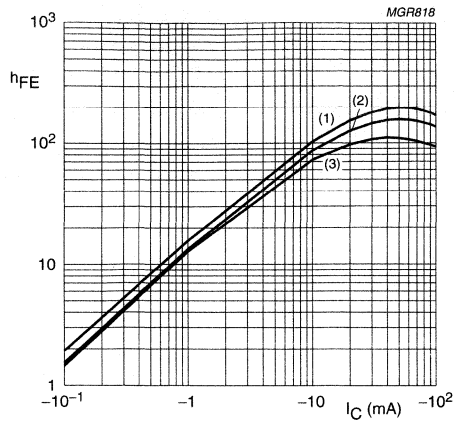
Note

1. Refer to SOT23 standard mounting conditions.

CHARACTERISTICS

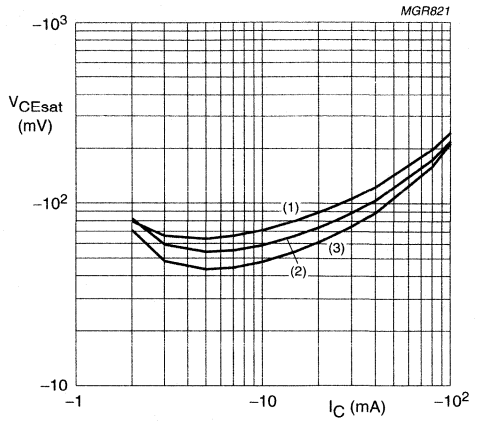
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−0.6	mA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V	50	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−150	mV
$V_{i(off)}$	input-off voltage	I_C = −100 μA; V_{CE} = −5 V	–	–	−0.3	V
$V_{i(on)}$	input-on voltage	I_C = −20 mA; V_{CE} = −0.3 V	−2.5	–	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



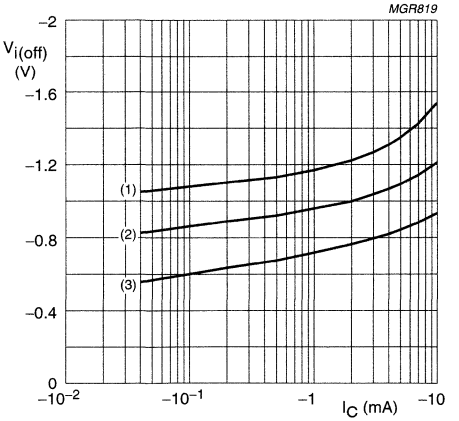
V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



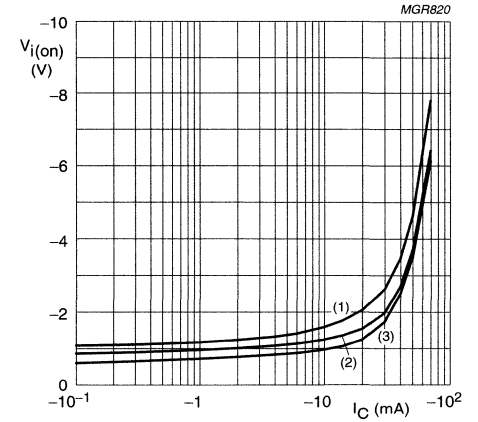
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143ZK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SC-59 (SOT346) plastic package. NPN complement: PDTC143ZK.

MARKING

TYPE NUMBER	MARKING CODE
PDTA143ZK	19

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

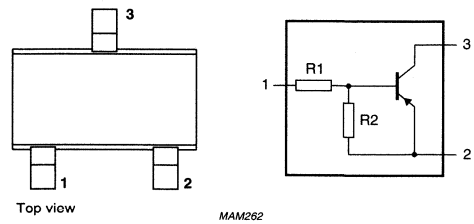


Fig.1 Simplified outline (SC-59; SOT346) and symbol.

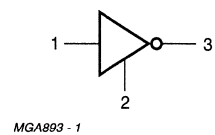


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+5	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

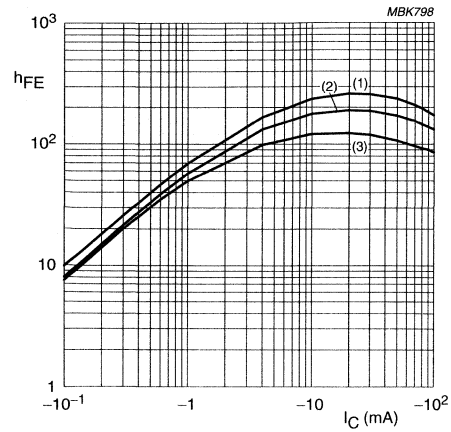
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

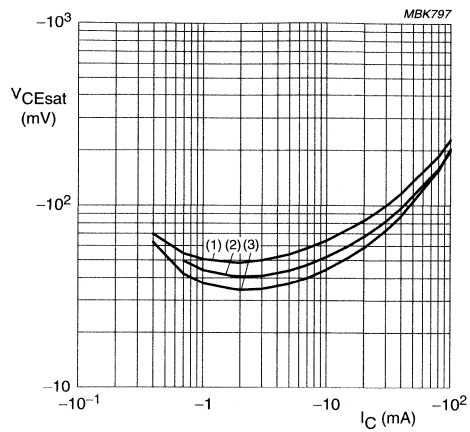
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–170	µA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -5$ mA; $I_B = -0.25$ mA	–	–	–100	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–0.6	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–1.3	–0.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		8	10	12	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



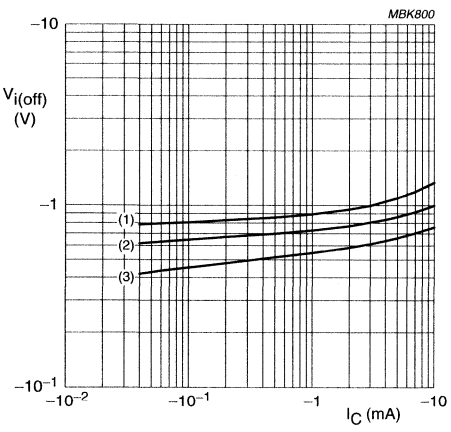
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



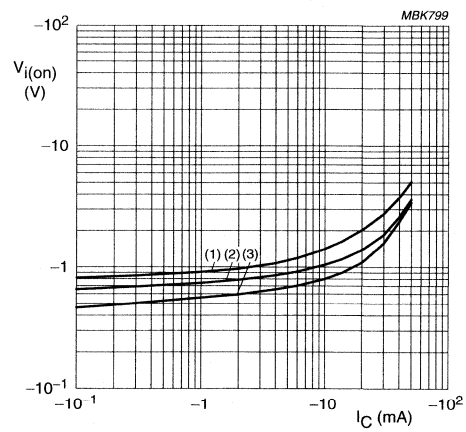
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA143ZT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC143ZT.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA143ZT	*19

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

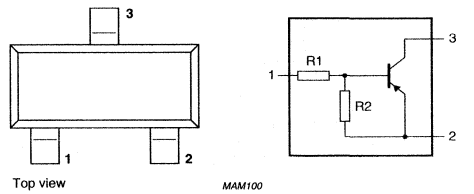


Fig.1 Simplified outline (SOT23) and symbol.

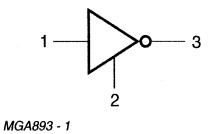


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+5	V
	negative		–	–30	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

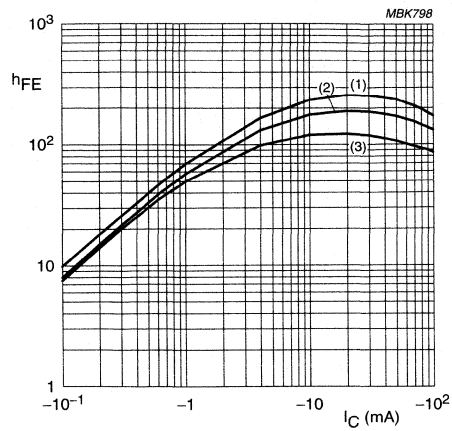
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

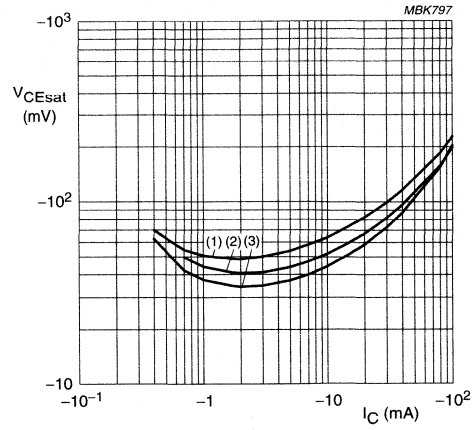
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–170	µA
h_{FE}	DC current gain	$I_C = -10$ mA; $V_{CE} = -5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -5$ mA; $I_B = -0.25$ mA	–	–	–100	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–0.6	–0.5	V
$V_{i(on)}$	input-on voltage	$I_C = -5$ mA; $V_{CE} = -0.3$ V	–1.3	–0.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		8	10	12	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



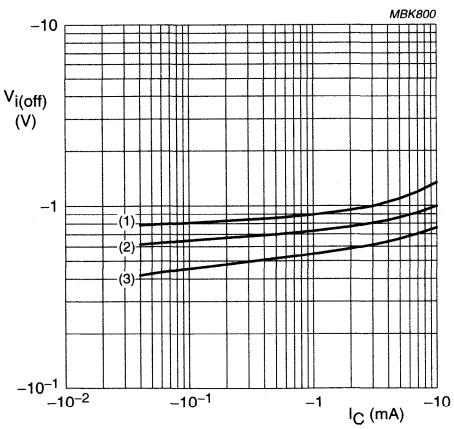
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



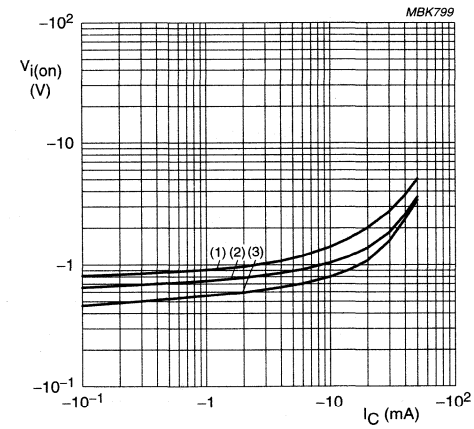
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

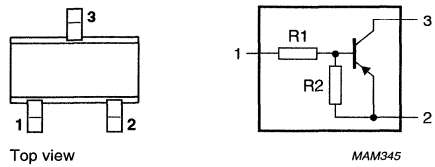


Fig.1 Simplified outline (SC-75) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-75 plastic package.
NPN complement: PDTC144EE.

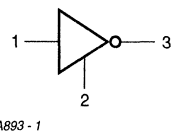


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA144EE	07

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–50	V
I_O	output current (DC)		–	–	–100	mA
I_{CM}	peak collector current		–	–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

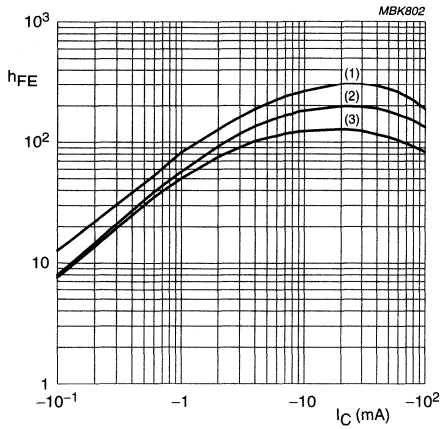
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

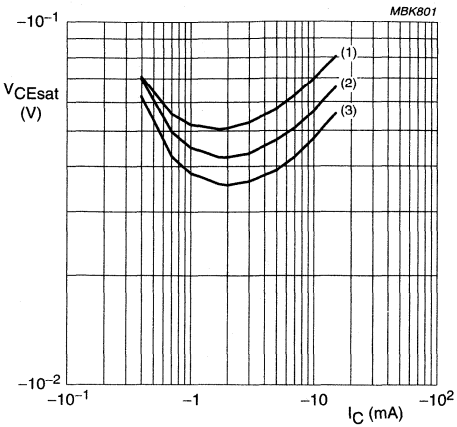
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_C = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–90	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.2	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -300$ mV	–3	–1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



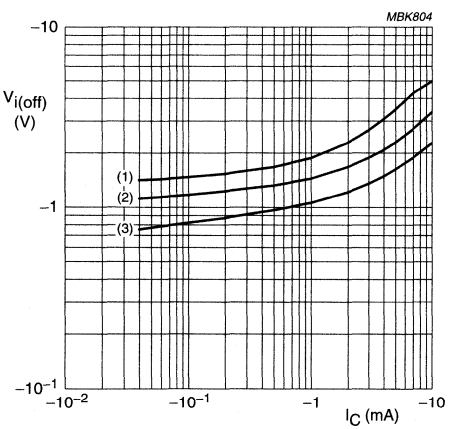
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



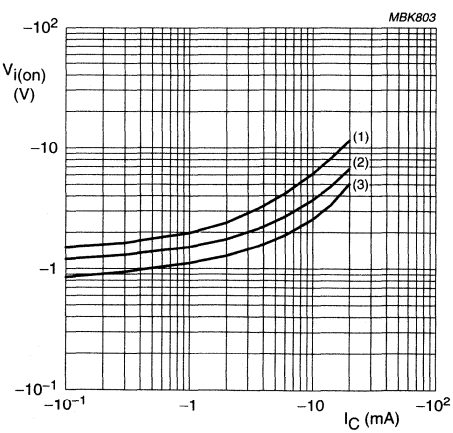
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144EEF

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

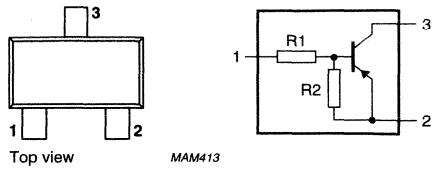


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

DESCRIPTION

PNP resistor-equipped transistor in an SC-89 (SOT490) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

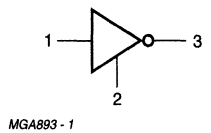


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA144EEF	07

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

PRELIMINARY
Philips Semiconductors for Design-in information
See Philips Semiconductors

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

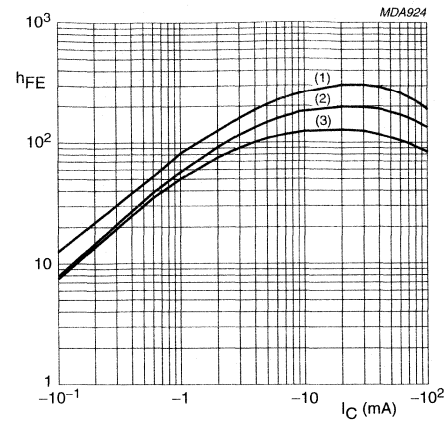
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

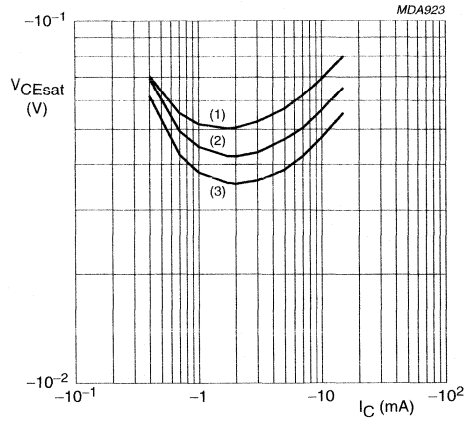
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	–	–	−1	μA
		I_B = 0; V_{CE} = −30 V; T_j = 150 °C	–	–	−50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−90	μA
h_{FE}	DC current gain	I_C = −5 mA; V_{CE} = −5 V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−150	mV
$V_{i(off)}$	input-off voltage	I_C = −100 μA; V_{CE} = −5 V	–	−1.2	−0.8	V
$V_{i(on)}$	input-on voltage	I_C = −2 mA; V_{CE} = −0.3 V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



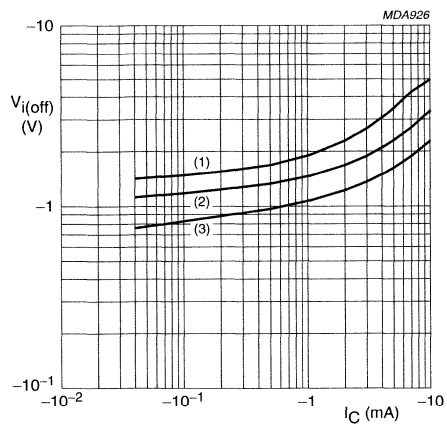
$V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.3 DC current gain as a function of collector current; typical values.



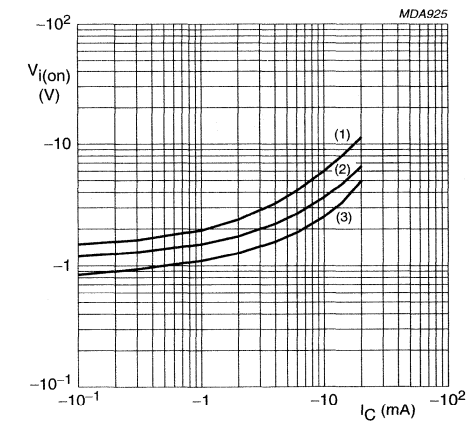
$I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



$V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



$V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in an SC-59 plastic package.
NPN complement: PDTC144EK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

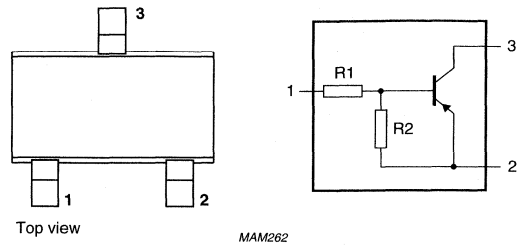


Fig.1 Simplified outline (SC-59) and symbol.

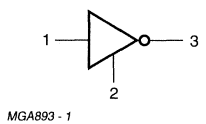


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTA144EK	07

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	−50	V
I_O	output current (DC)		–	–	−100	mA
I_{CM}	peak collector current		–	–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

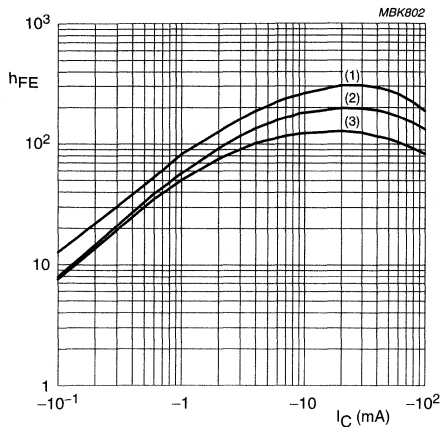
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

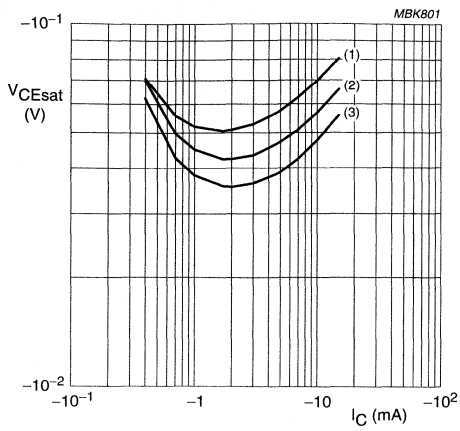
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–90	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.2	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -0.3$ V	–3	–1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



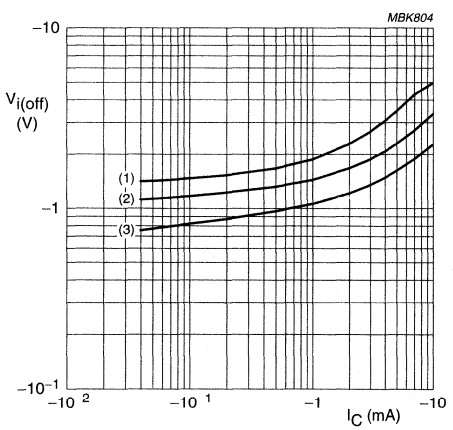
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



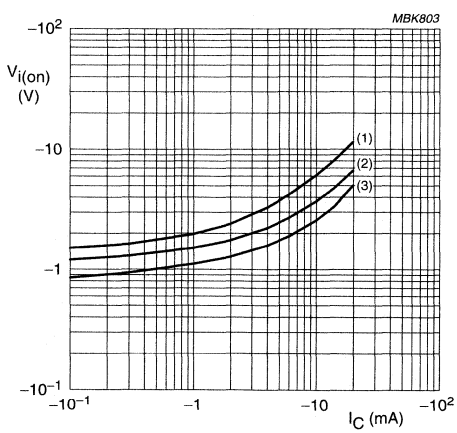
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a TO-92; SOT54 plastic package.
NPN complement: PDTC144ES.

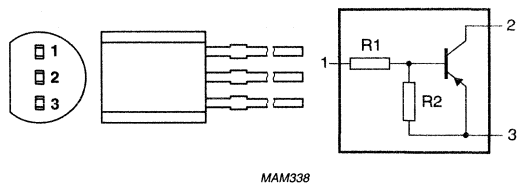


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground (+)

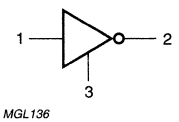


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	−50	V
I_O	output current (DC)		–	–	−100	mA
I_{CM}	peak collector current		–	–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

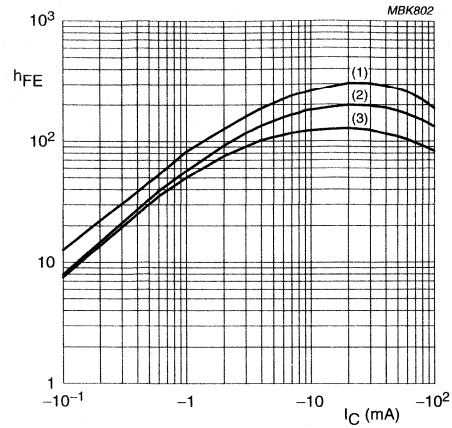
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

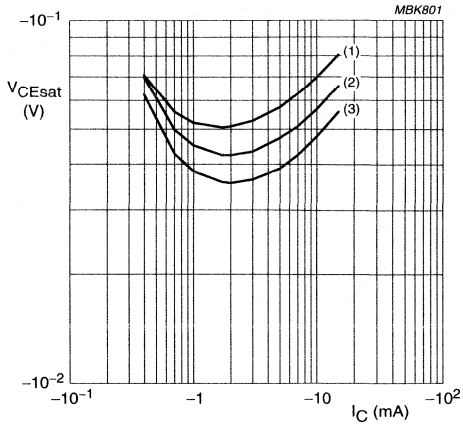
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–90	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.2	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -0.3$ V	–3	–1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



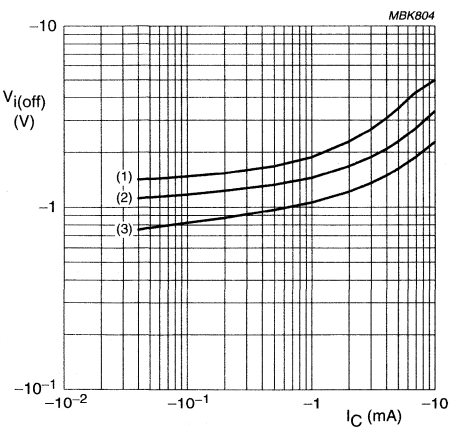
$V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.3 DC current gain as a function of collector current; typical values.



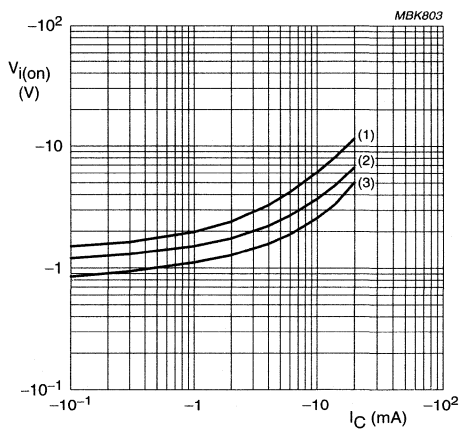
$I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



$V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



$V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT23 plastic package.
NPN complement: PDTC144ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

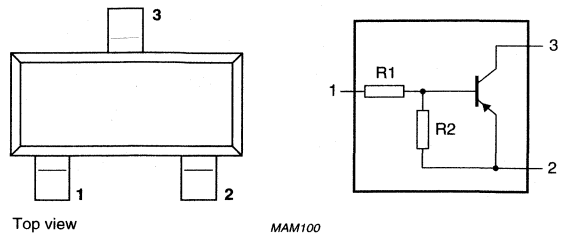


Fig.1 Simplified outline (SOT23) and symbol.

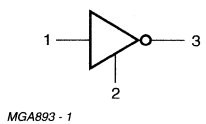


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA144ET	*07

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

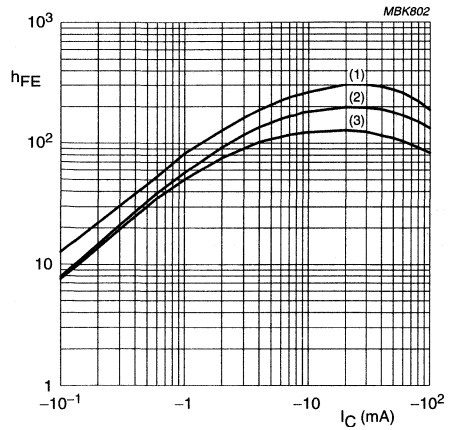
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

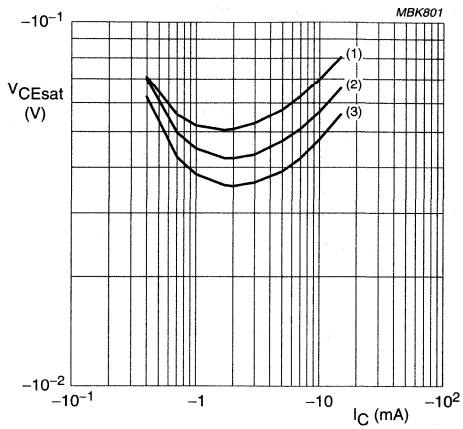
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–90	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.2	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -0.3$ V	–3	–1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



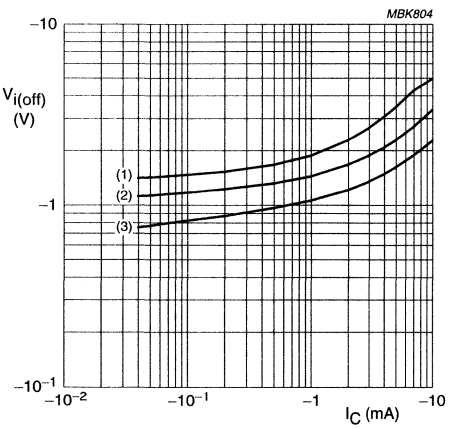
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



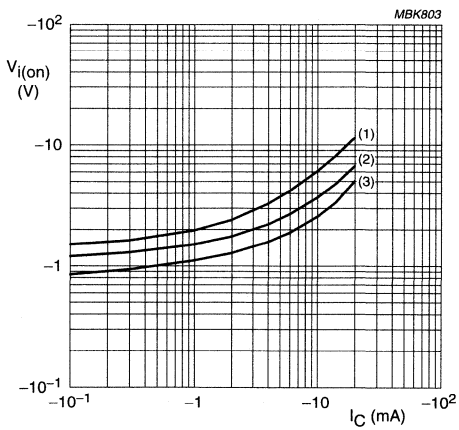
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SOT323 plastic package.
NPN complement: PDTC144EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

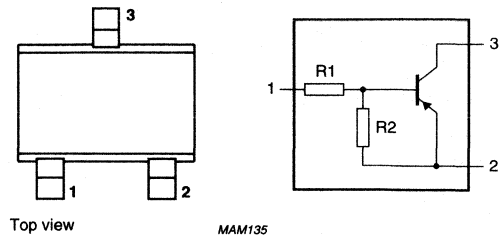


Fig.1 Simplified outline (SOT323) and symbol.

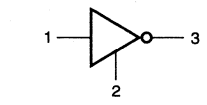


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA144EU	*07

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

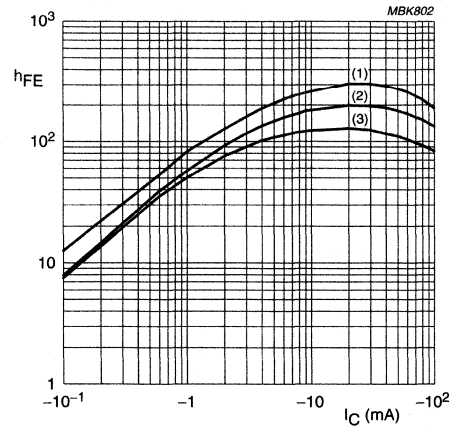
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

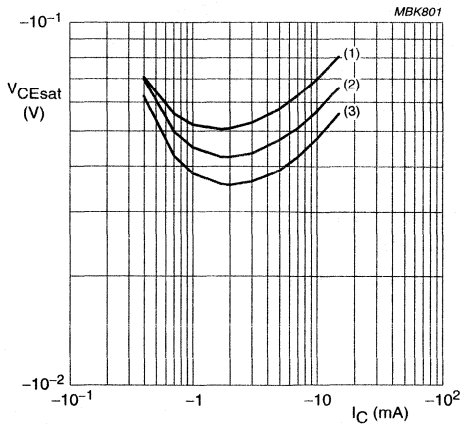
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–90	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.2	–0.8	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -0.3$ V	–3	–1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



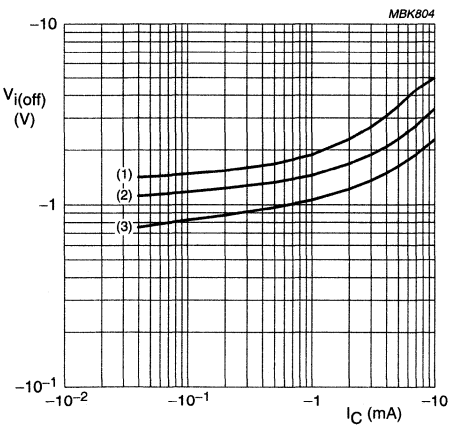
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



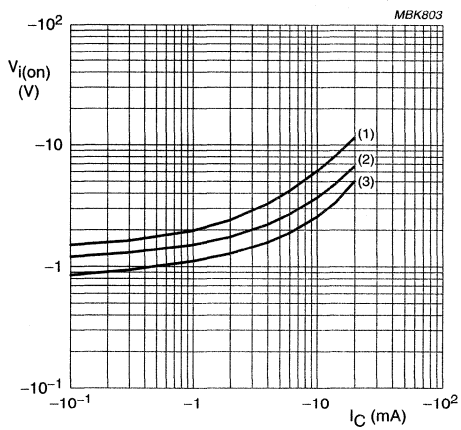
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP resistor-equipped transistor PDTA144WU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ and 22 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped transistor in a SC-70 (SOT323) plastic package.
NPN complement: PDTC144WU.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTA144WU	*28

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground (+)
3	collector/output

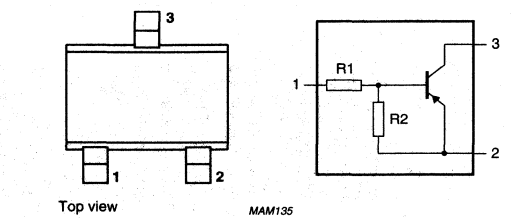


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

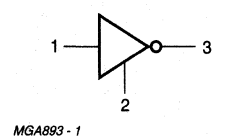


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
V_I	input voltage				
	positive		–	+10	V
	negative		–	–40	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

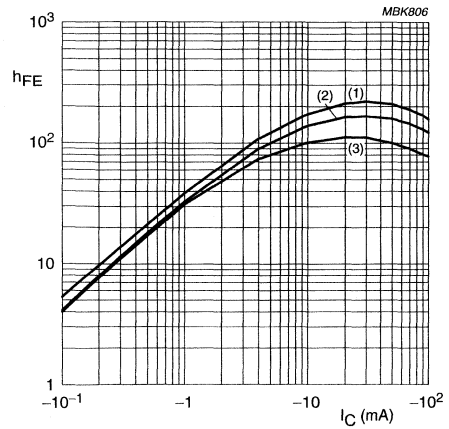
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

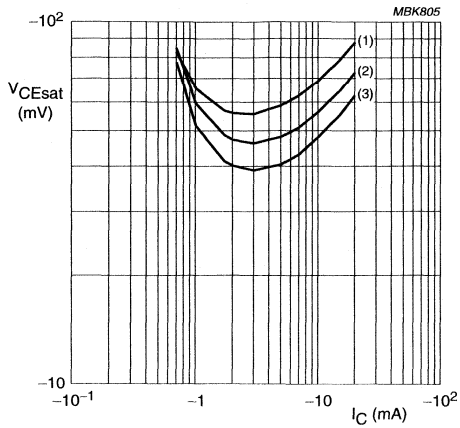
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–110	µA
h_{FE}	DC current gain	$I_C = -5$ mA; $V_{CE} = -5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
$V_{i(off)}$	input-off voltage	$I_C = -100$ µA; $V_{CE} = -5$ V	–	–1.7	–1.2	V
$V_{i(on)}$	input-on voltage	$I_C = -2$ mA; $V_{CE} = -0.3$ V	–4	–2.7	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.37	0.47	0.57	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



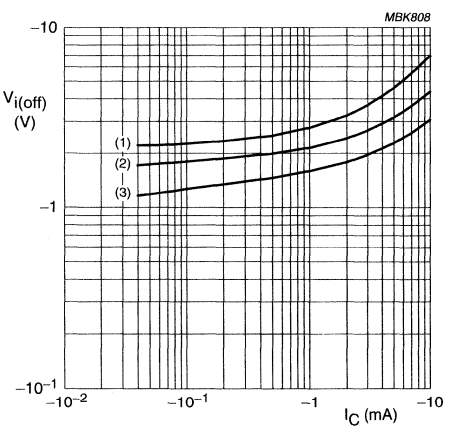
V_{CE} = −5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



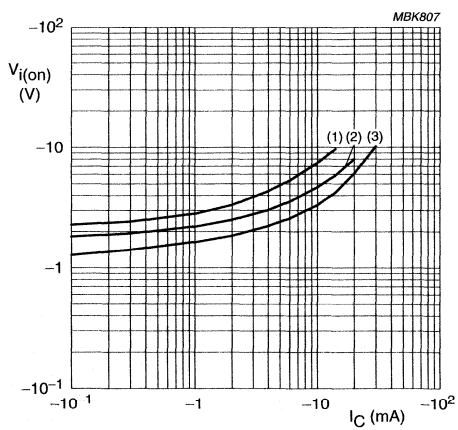
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-75 plastic package. PNP complement: PDTA114EE.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114EE	09

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

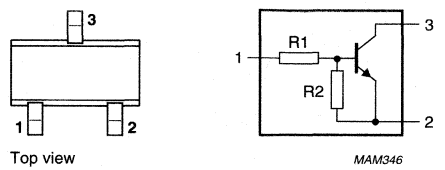


Fig.1 Simplified outline (SC-75) and symbol.

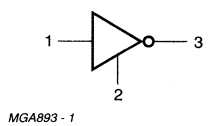


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

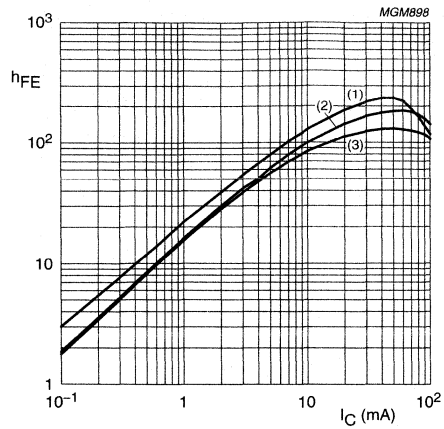
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

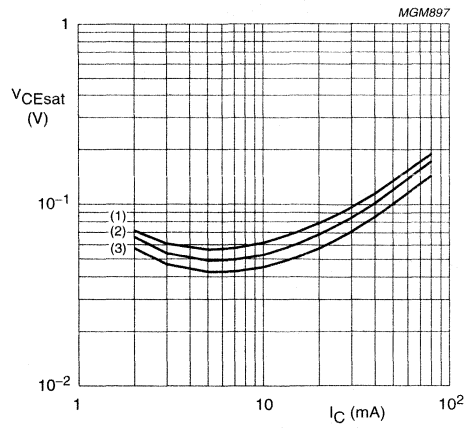
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	400	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 10 mA; V_{CE} = 0.3 V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



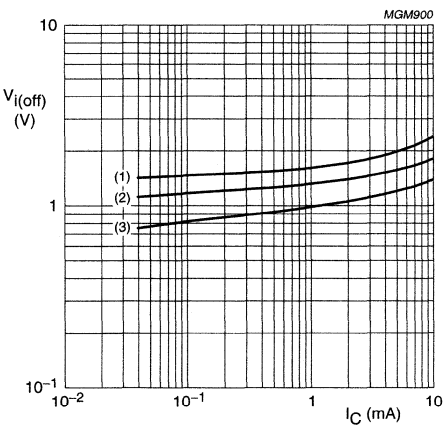
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



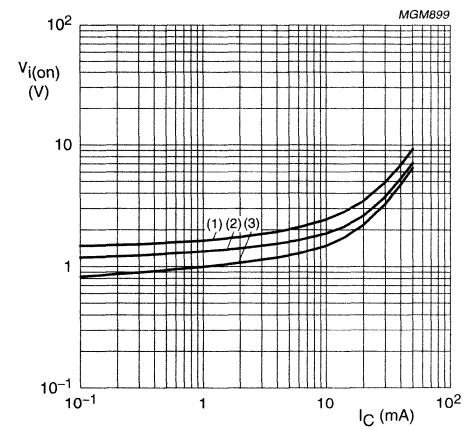
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114EEF

FEATURES

- Power dissipation comparable to SOT23
- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor encapsulated in an ultra small plastic SMD SC-89 (SOT490) package. PNP complement: PDTA114EEF.

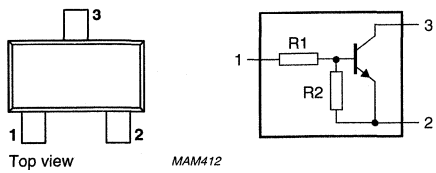


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

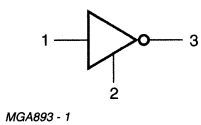


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114EEF	09

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	250	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

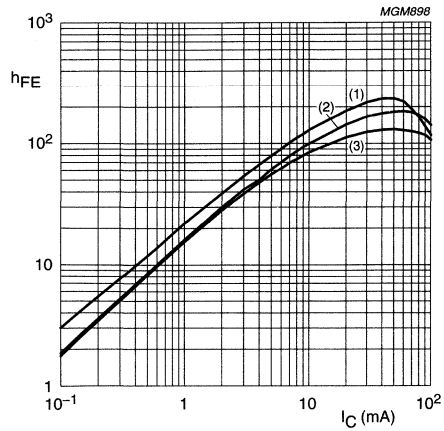
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

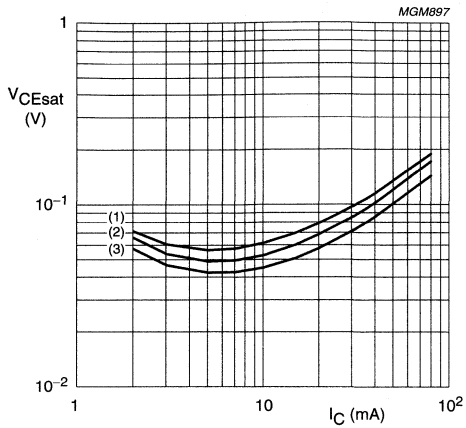
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	400	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 10$ mA; $V_{CE} = 0.3$ V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



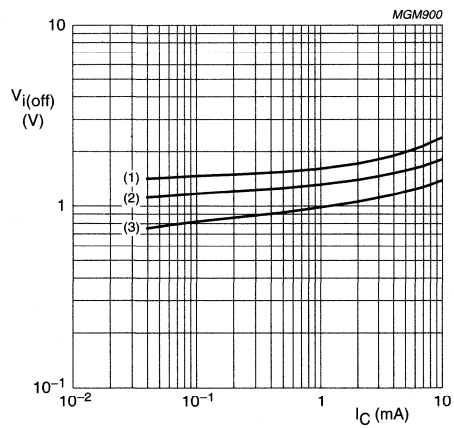
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



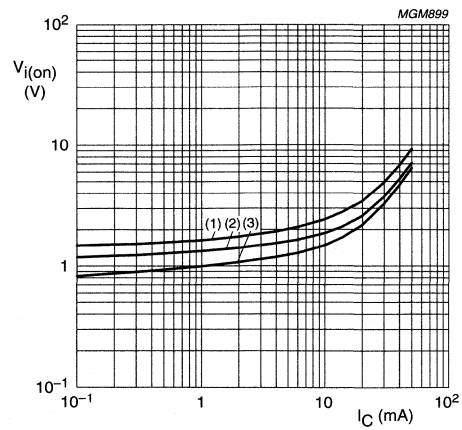
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-59 plastic package.
PNP complement: PDTA114EK.

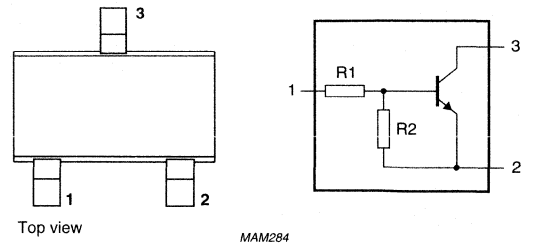


Fig.1 Simplified outline (SC-59) and symbol.

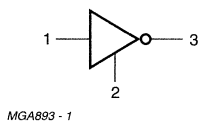


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114EK	04

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

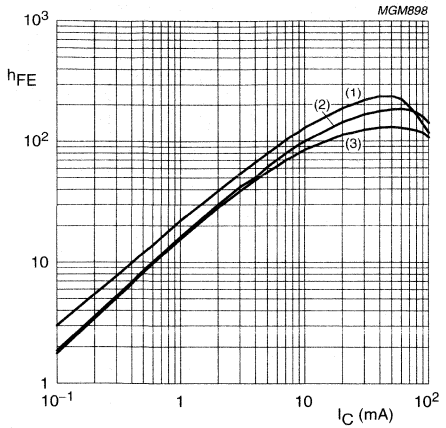
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

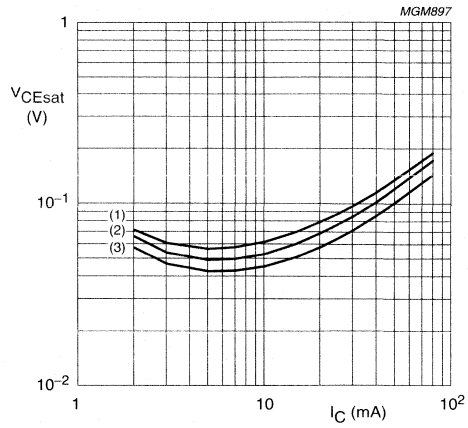
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	400	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 10$ mA; $V_{CE} = 0.3$ V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



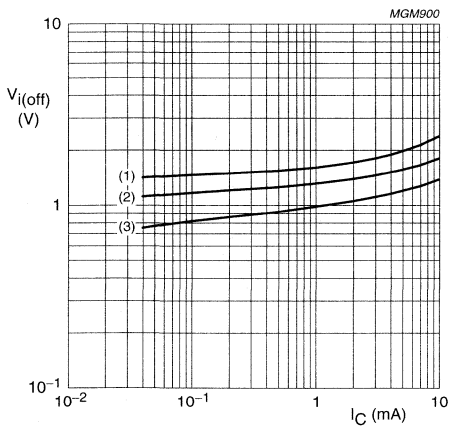
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



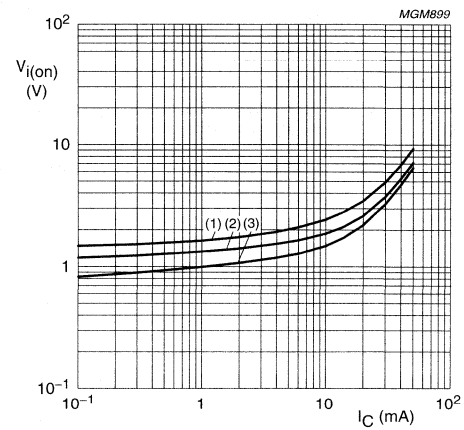
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

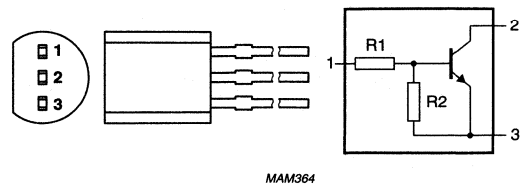


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in a TO-92; SOT54 plastic package.
PNP complement: PDTA114ES.

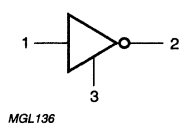


Fig.2 Equivalent inverter symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

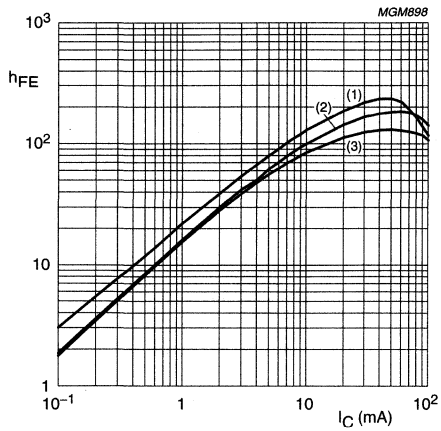
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

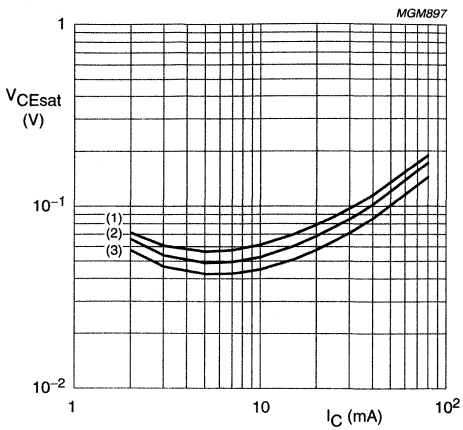
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	400	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 10$ mA; $V_{CE} = 0.3$ V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



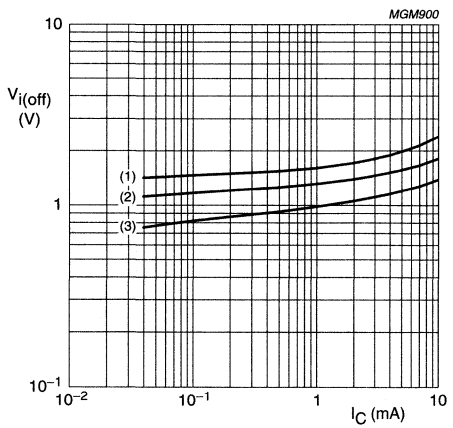
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



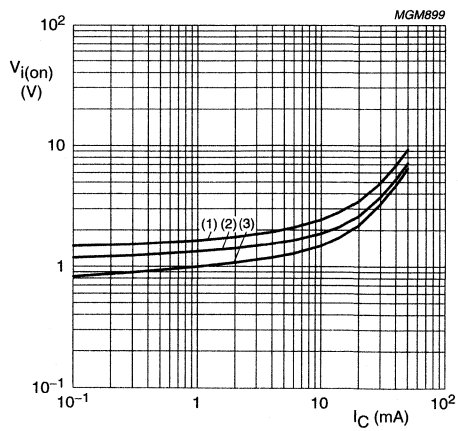
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.
PNP complement: PDTA114ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

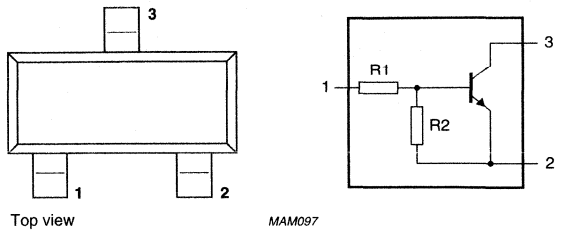


Fig.1 Simplified outline (SOT23) and symbol.

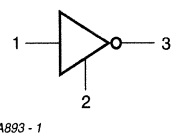


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114ET	*16

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

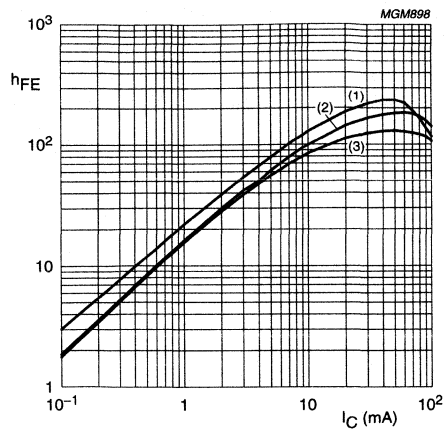
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

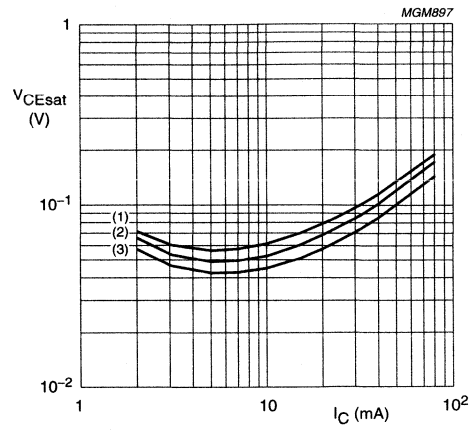
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector-emitter cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter-base cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	400	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input on voltage	$I_C = 10$ mA; $V_{CE} = 0.3$ V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



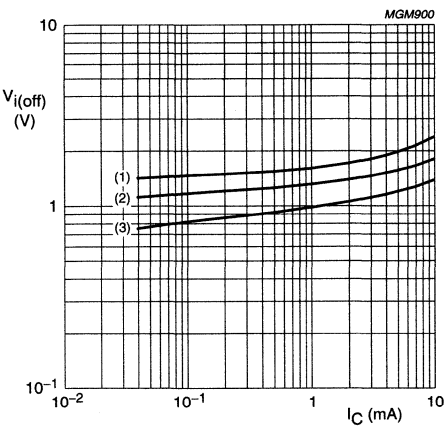
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



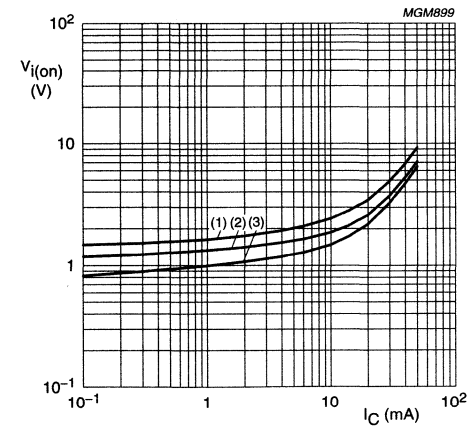
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT323 plastic package.
PNP complement: PDTA114EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

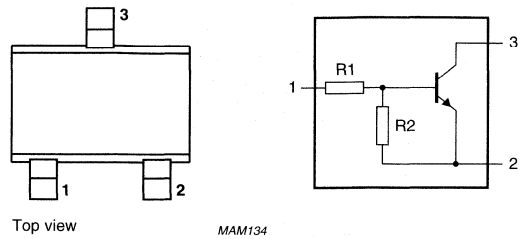


Fig.1 Simplified outline (SOT323) and symbol.

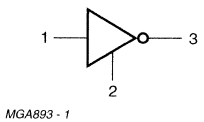


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114EU	*09

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

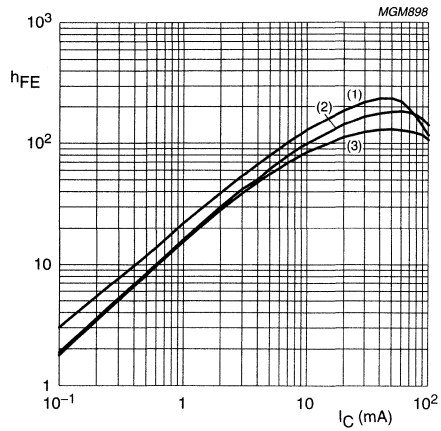
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

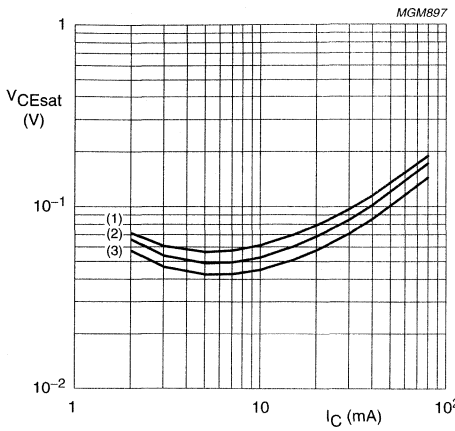
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	400	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 10$ mA; $V_{CE} = 0.3$ V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



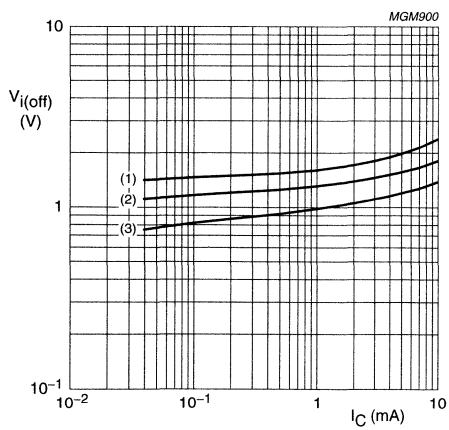
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



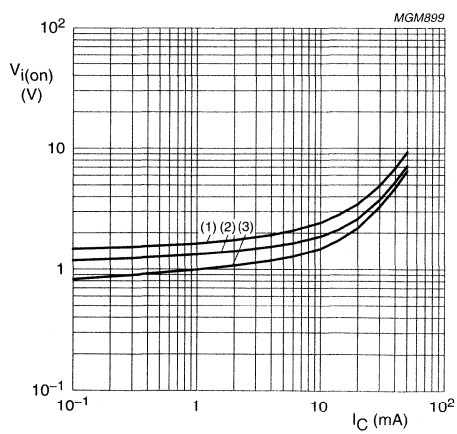
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114TE

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

NPN resistor-equipped transistor in an SC-75; SOT416 plastic package. PNP complement: PDTA114TE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

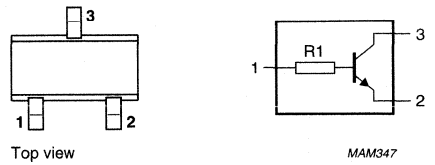


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

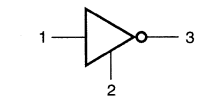


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114TE	24

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
R1	input resistor		7	10	13	kΩ

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

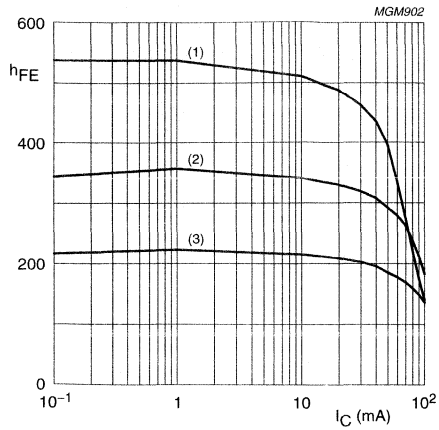
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

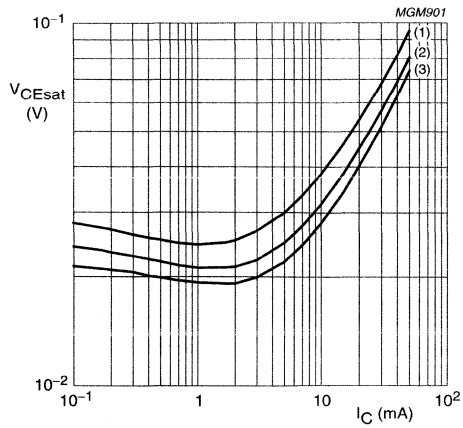
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114TK

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

NPN resistor-equipped transistor in an SC-59 plastic package.
PNP complement: PDTA114TK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

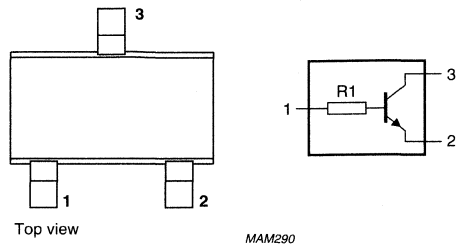


Fig.1 Simplified outline (SC-59) and symbol.

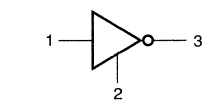


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114TK	24

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
R1	input resistor		7	10	13	kΩ

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

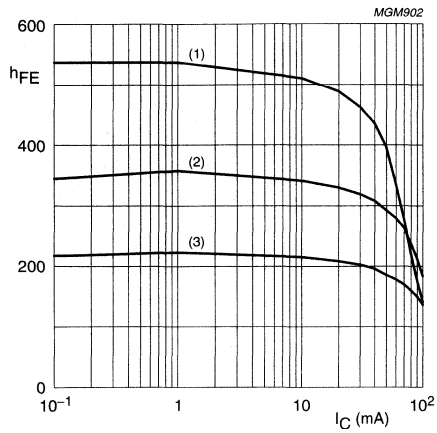
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

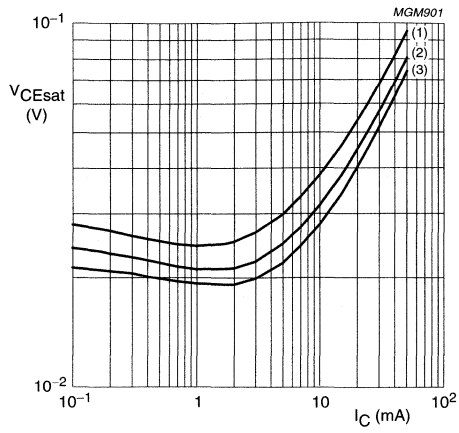
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114TS

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

NPN resistor-equipped transistor in a TO-92; SOT54 plastic package.
PNP complement: PDTA114TS.

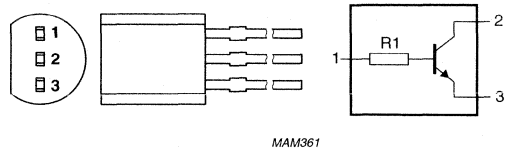


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground

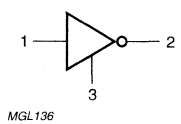


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
R1	input resistor		7	10	13	kΩ

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

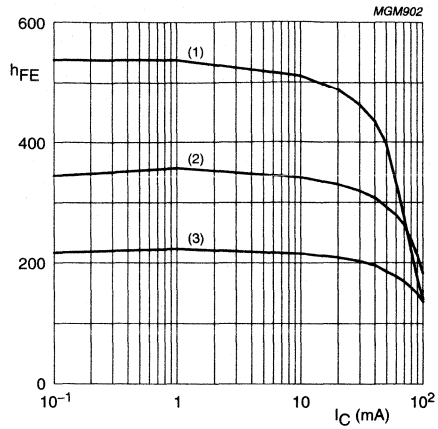
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

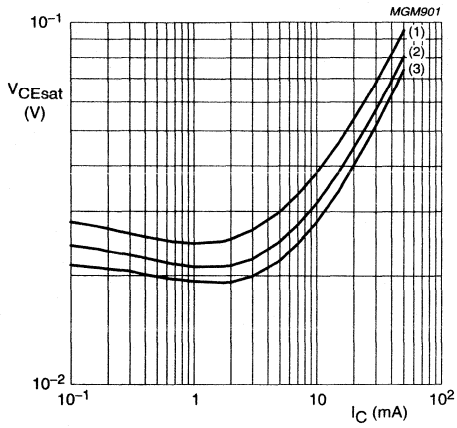
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114TT

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.
PNP complement: PDTA114TT.

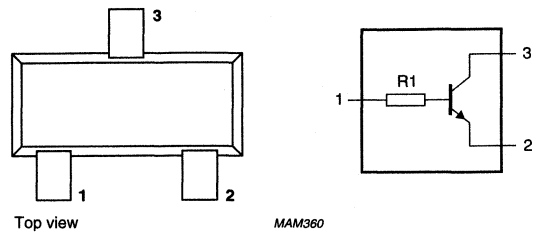


Fig.1 Simplified outline (SOT23) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

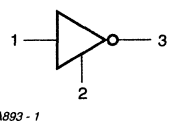


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114TT	*12

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

OBJECTIVE
See Philips Semiconductors for Design-in Information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

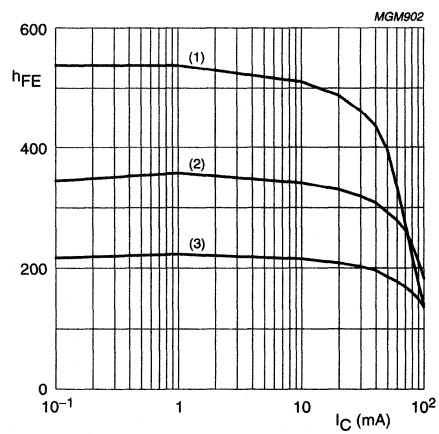
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

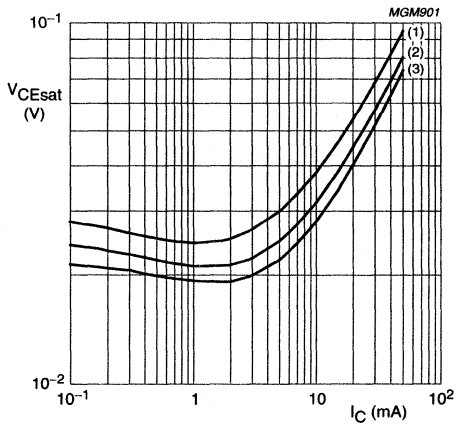
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114TU

FEATURES

- Built-in bias resistor R1 (typ. 10 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

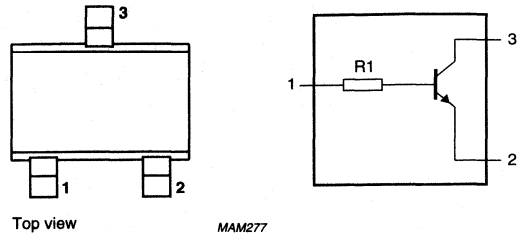


Fig.1 Simplified outline (SOT323) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in a SOT323 plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

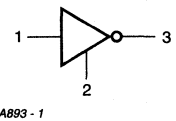


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114TU	*24

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

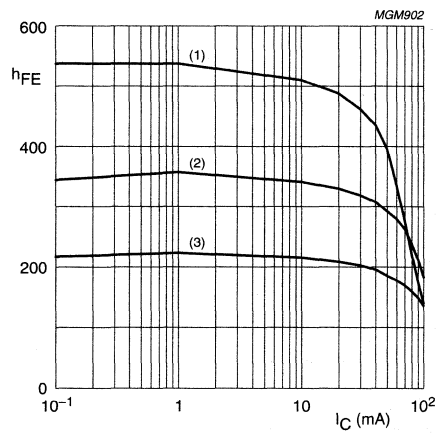
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

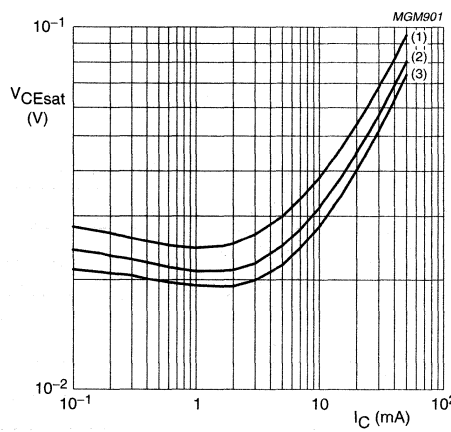
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114YE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-75 (SOT416) plastic package.

MARKING

TYPE NUMBER	MARKING CODE
PDTC114YE	33

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

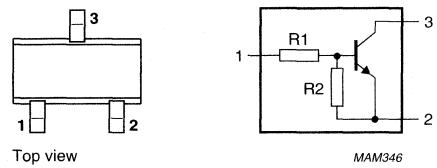


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

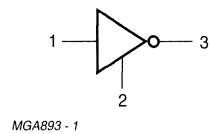


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−6	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

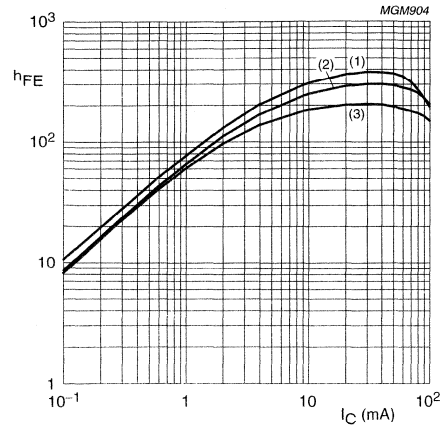
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

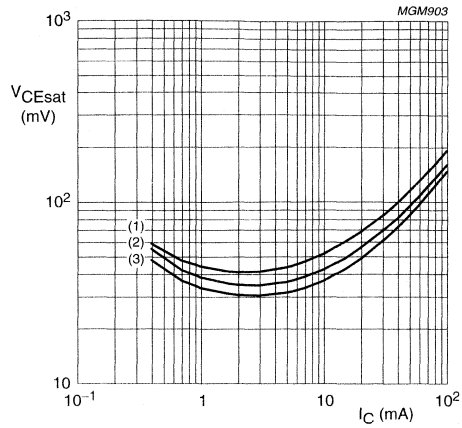
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	150	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	0.7	0.5	V
$V_{i(on)}$	input-on voltage	I_C = 1 mA; V_{CE} = 0.3 V	1.4	0.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		3.7	4.7	5.7	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



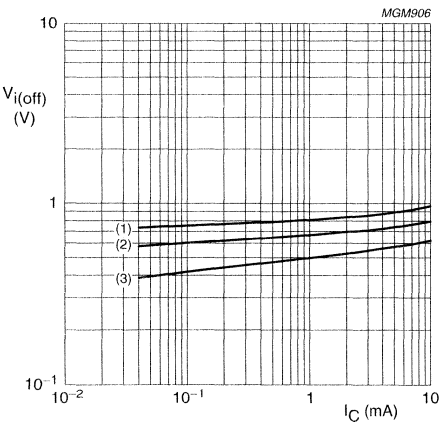
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



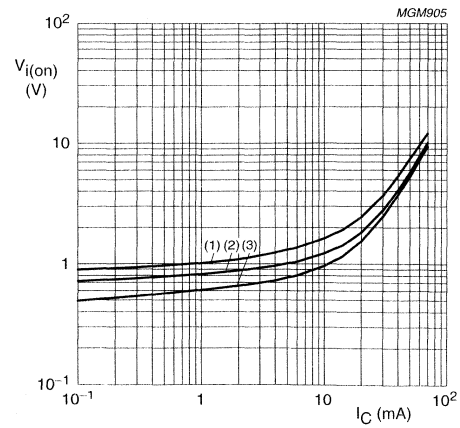
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114YT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.

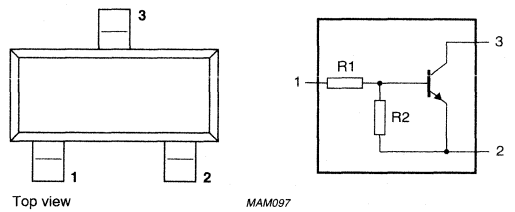


Fig.1 Simplified outline (SOT23) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

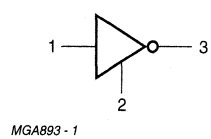


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114YT	*27

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–6	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

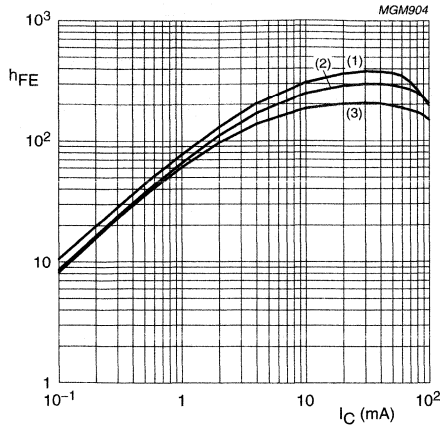
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

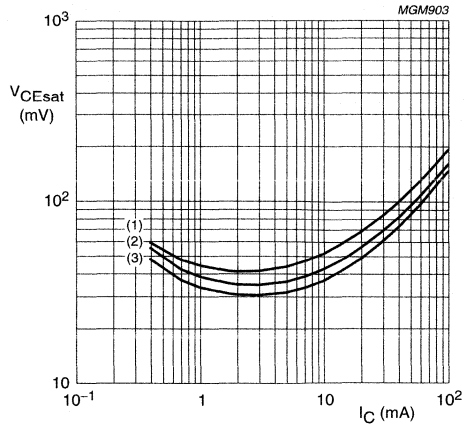
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	150	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	0.7	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 1$ mA; $V_{CE} = 0.3$ V	1.4	0.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		3.7	4.7	5.7	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



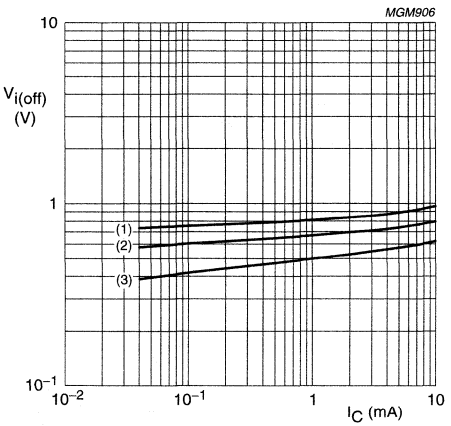
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



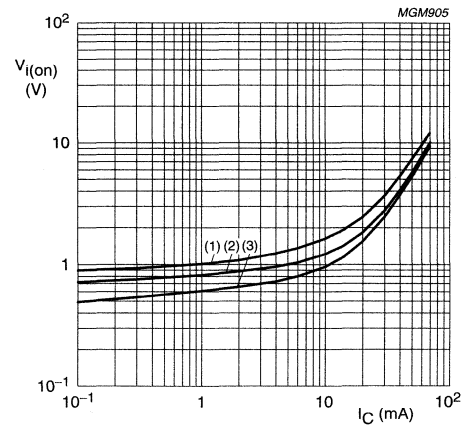
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC114YU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 10 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

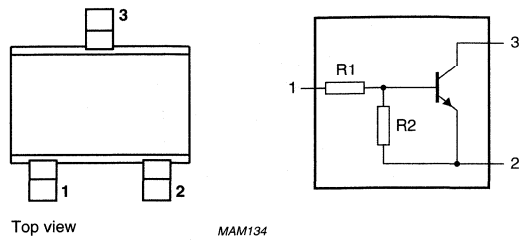


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in an SC-70 (SOT323) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

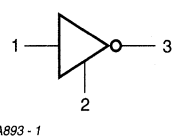


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC114YU	*30

Note

1. * = -: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	40	V
	negative		–	–6	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SC-70 (SOT323) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

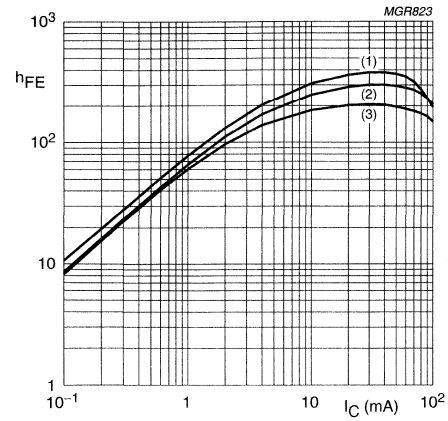
Note

1. Refer to SC-70 (SOT323) standard mounting conditions.

CHARACTERISTICS

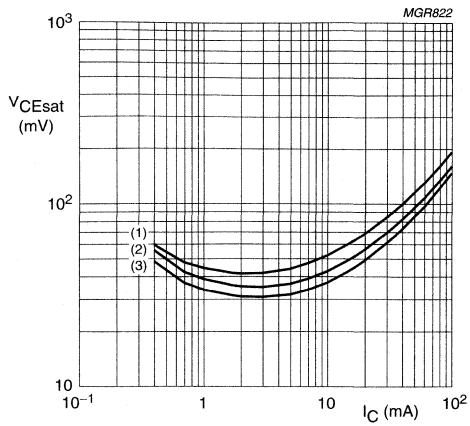
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	150	µA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	0.7	0.5	V
$V_{i(on)}$	input-on voltage	I_C = 1 mA; V_{CE} = 0.3 V	1.4	0.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		3.7	4.7	5.7	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



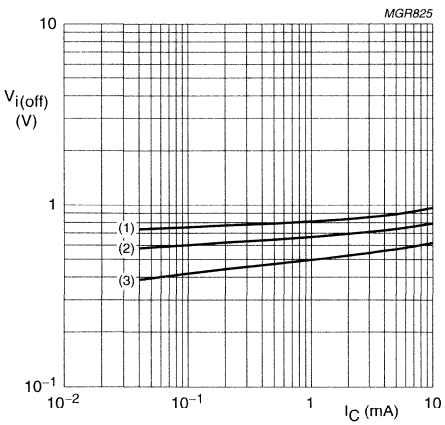
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



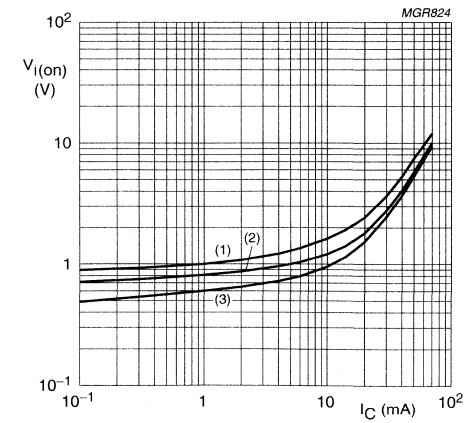
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC123ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package. PNP complement: PDTA123ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC123ET	*26

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

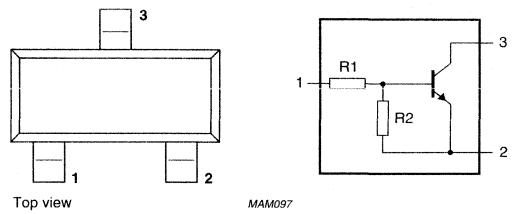


Fig.1 Simplified outline (SOT23) and symbol.

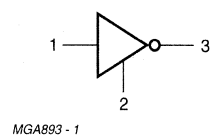


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+12	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

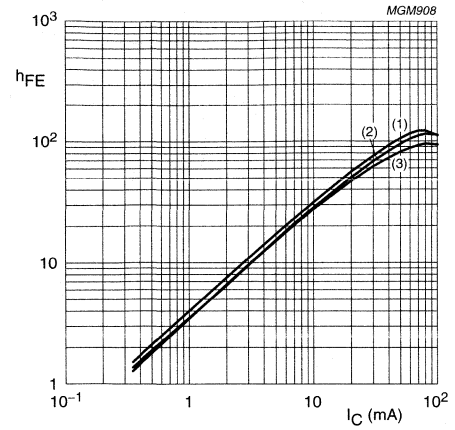
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

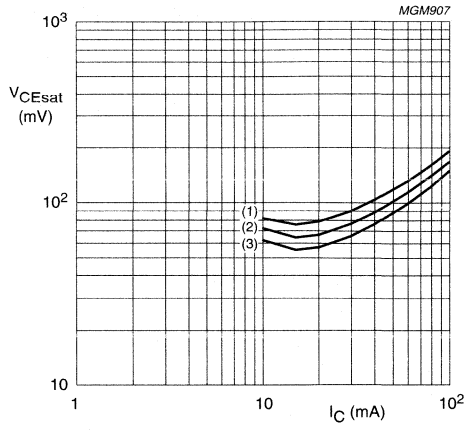
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	2	mA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 1$ mA; $V_{CE} = 5$ V	–	1.2	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2	1.6	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



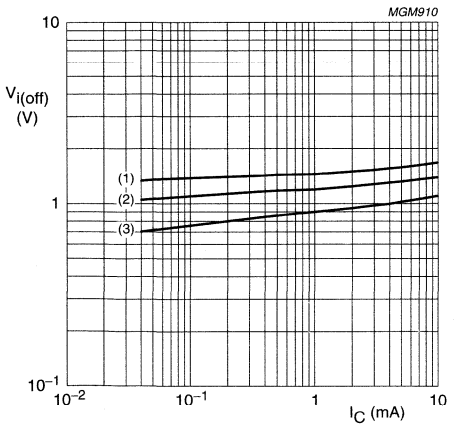
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



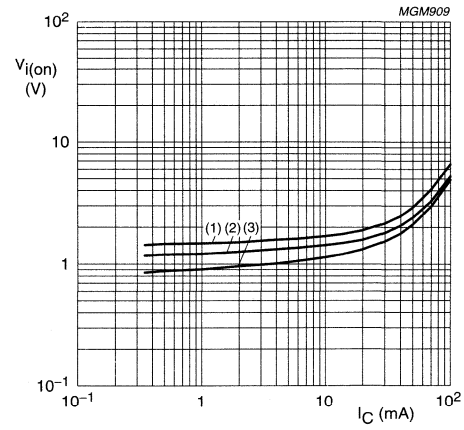
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC123JE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-75 (SOT416) plastic package. PNP complement: PDTA123JE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

MARKING

TYPE NUMBER	MARKING CODE
PDTC123JE	28

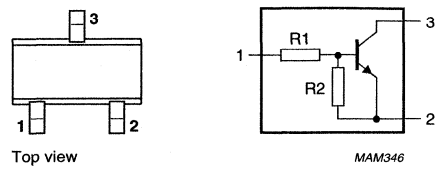


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

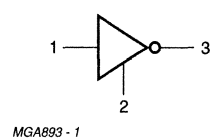


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+12	V
	negative		–	–5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

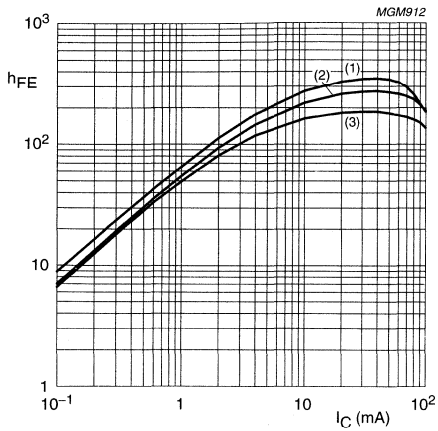
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

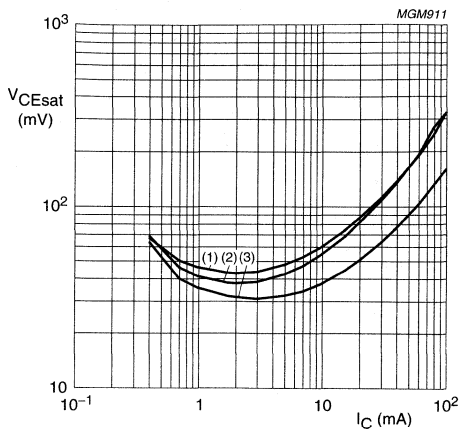
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	600	500	mV
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	1.1	0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



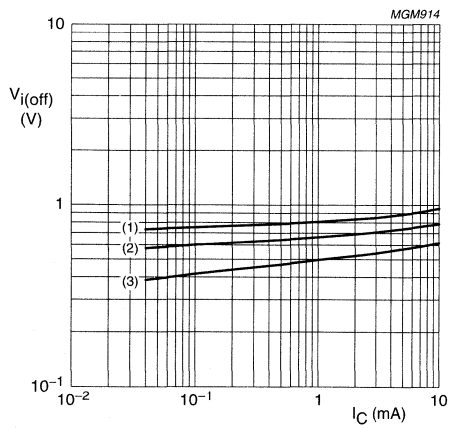
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



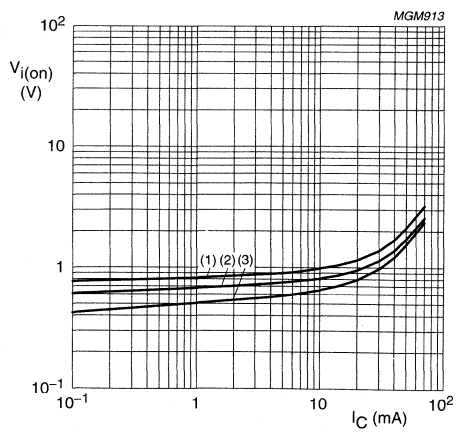
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC123JEF

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-89 (SOT490) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

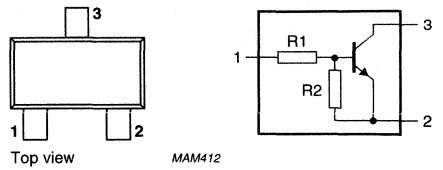


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

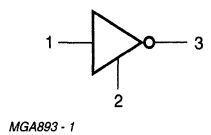


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC123JEF	28

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+12	V
	negative		–	–5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

PRELIMINARY
Philips Semiconductors for Design-in Information
See Philips Semiconductors

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

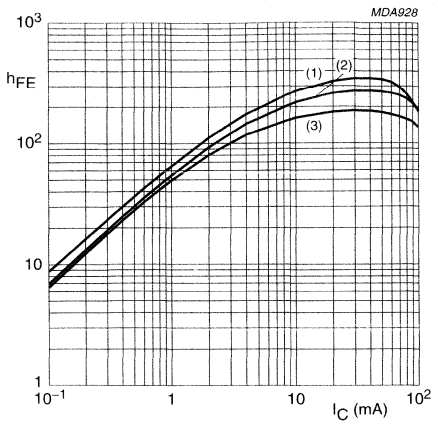
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

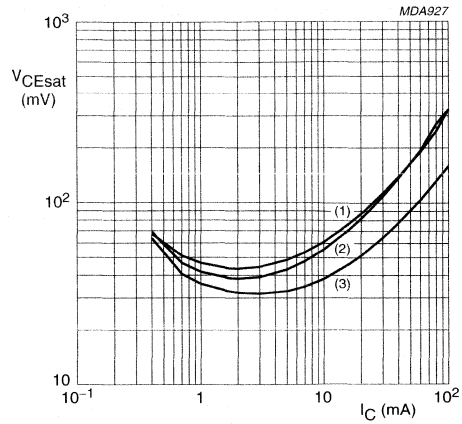
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	180	µA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	0.6	0.5	V
$V_{i(on)}$	input-on voltage	I_C = 5 mA; V_{CE} = 0.3 V	1.1	0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



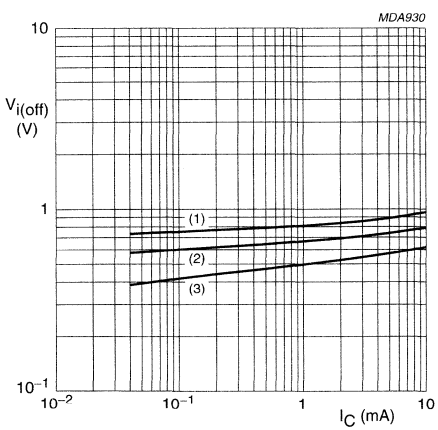
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



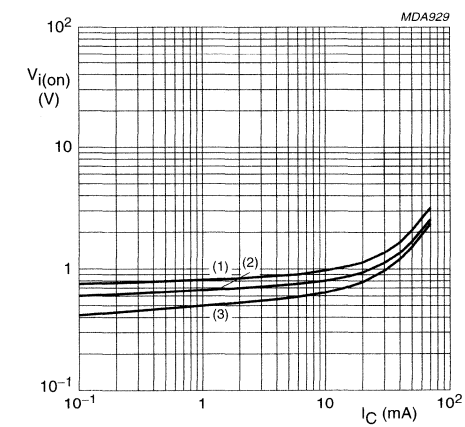
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC123JT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 2.2 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.

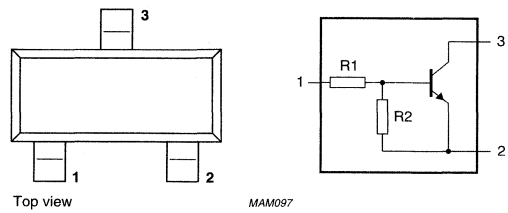


Fig.1 Simplified outline (SOT23) and symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC123JT	*25

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

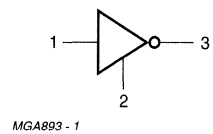


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+12	V
	negative		–	–5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

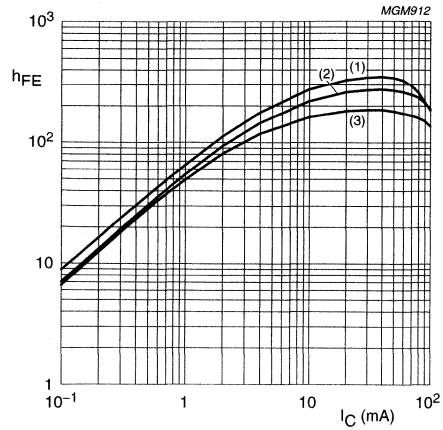
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

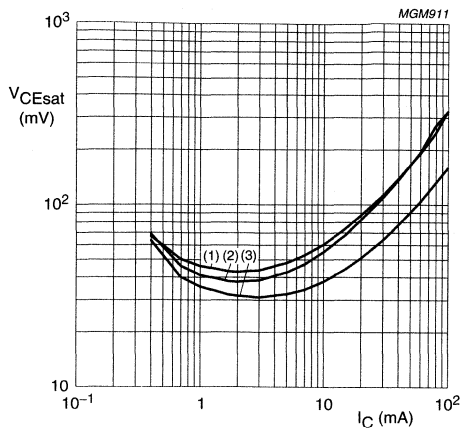
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	600	500	mV
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	1.1	0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



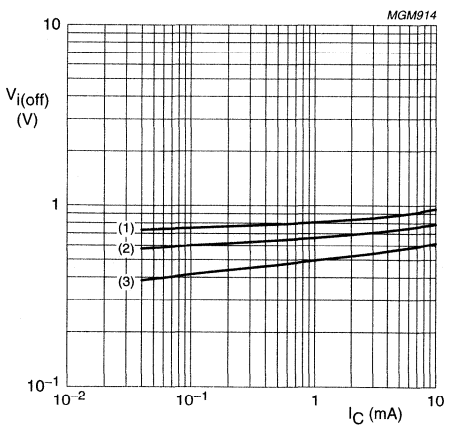
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



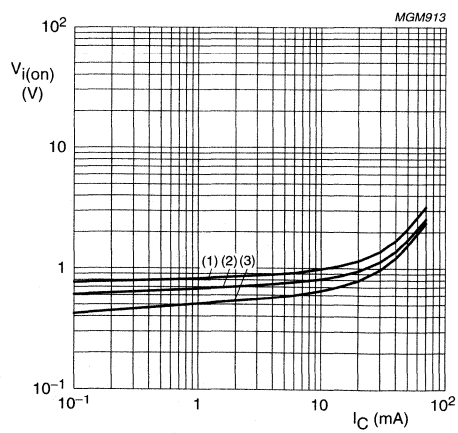
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-75; SOT416 plastic package. PNP complement: PDTA124EE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

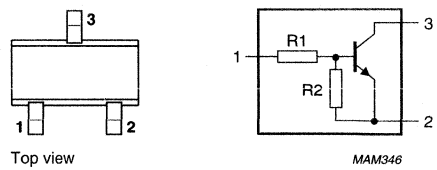


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

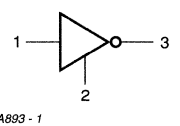


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC124EE	06

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

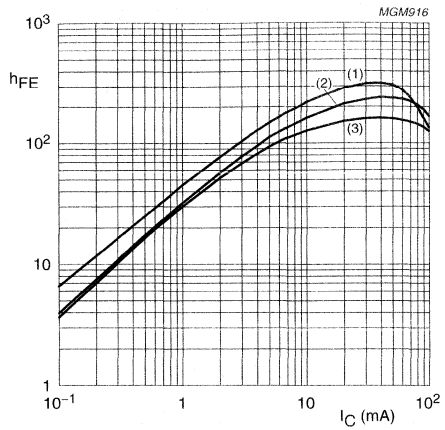
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

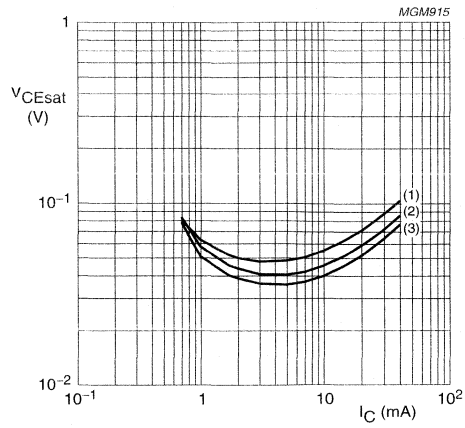
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



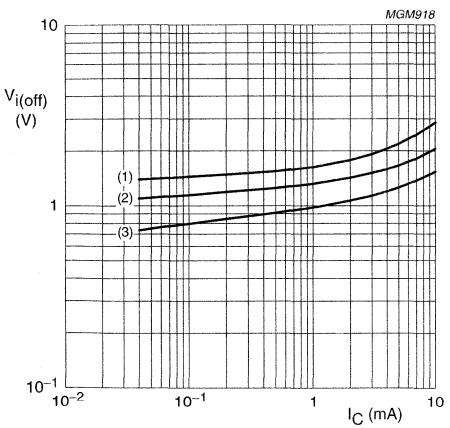
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



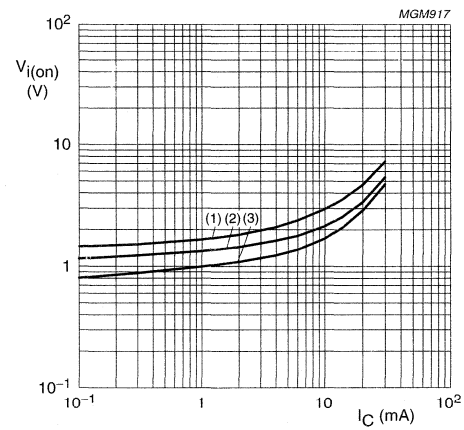
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-59 plastic package.
PNP complement: PDTA124EK.

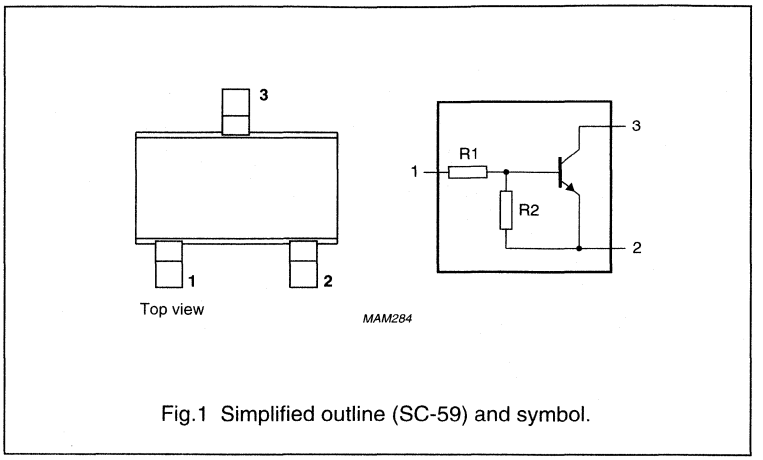


Fig.1 Simplified outline (SC-59) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

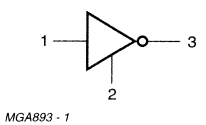


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC124EK	06

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

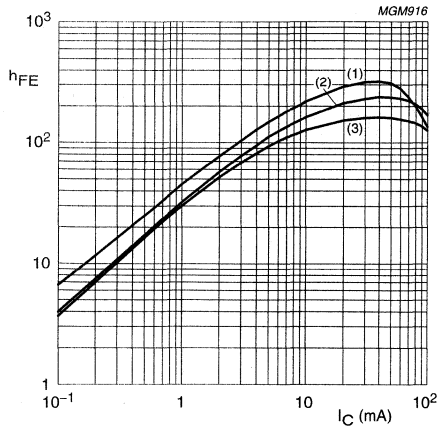
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

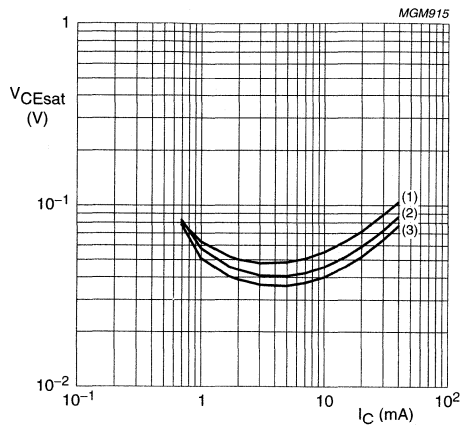
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



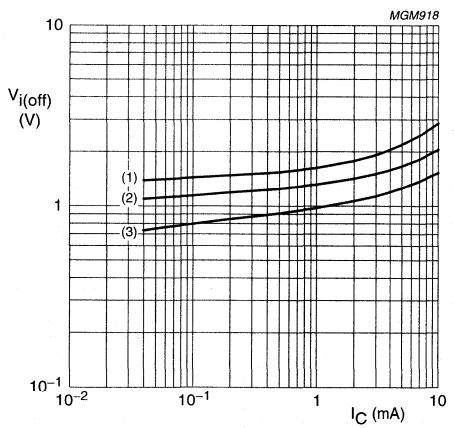
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



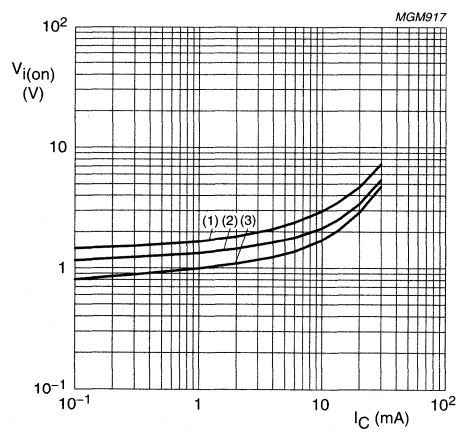
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

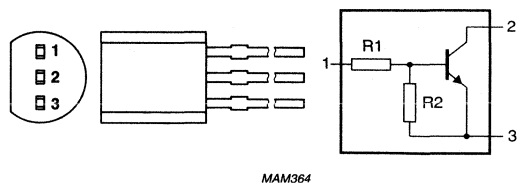


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in a TO-92; SOT54 plastic package.
PNP complement: PDTA124ES.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground

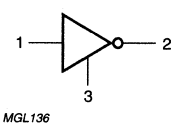


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

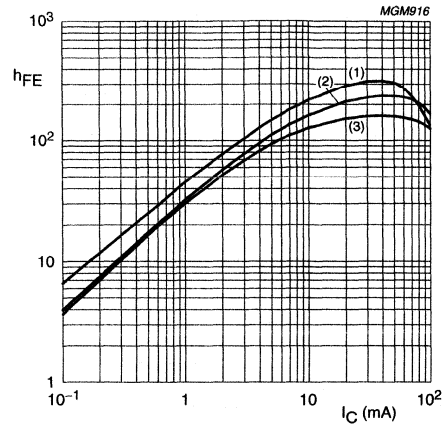
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

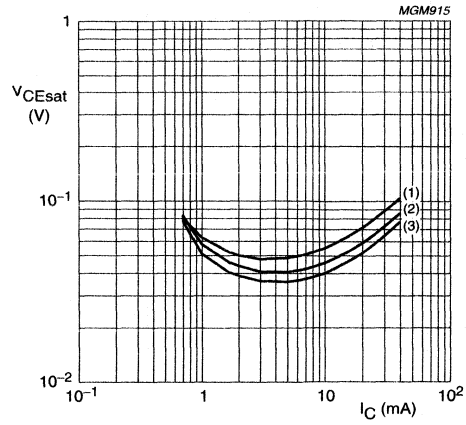
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	μA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ μA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



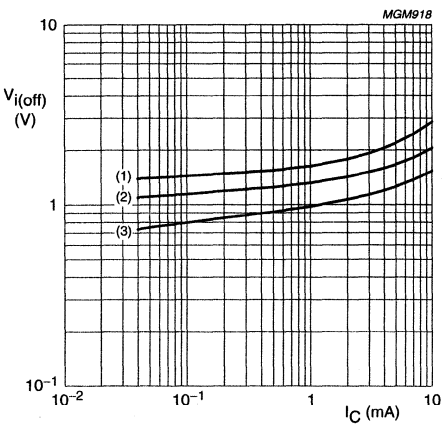
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



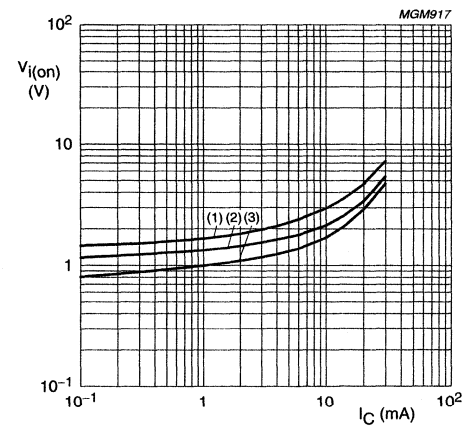
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and boardspace.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.
PNP complement: PDTA124ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

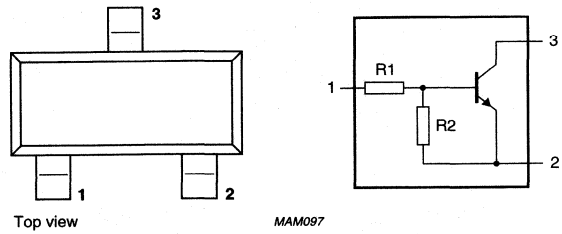


Fig.1 Simplified outline (SOT23) and symbol.

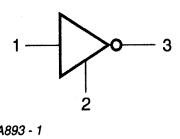


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC124ET	*17

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

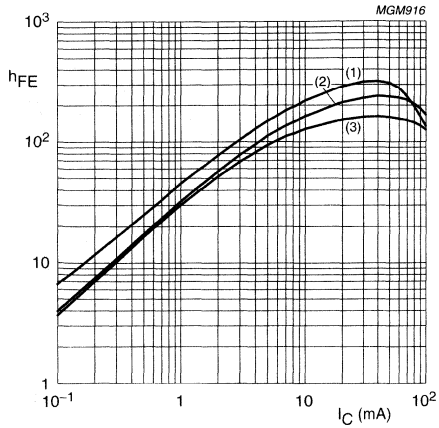
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

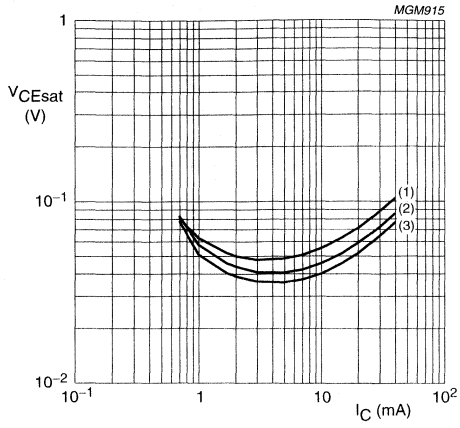
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



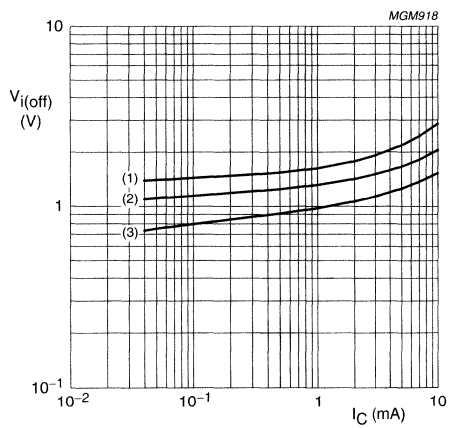
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



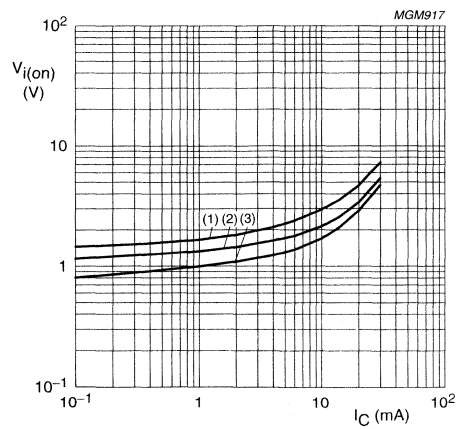
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT323 plastic package.
PNP complement: PDTA124EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

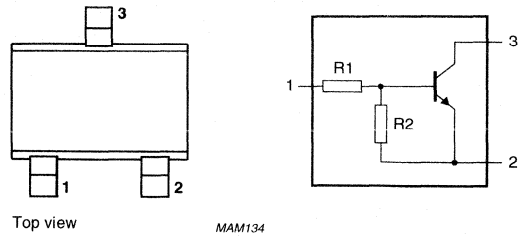


Fig.1 Simplified outline (SOT323) and symbol.

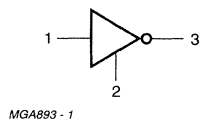


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC124EU	*06

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

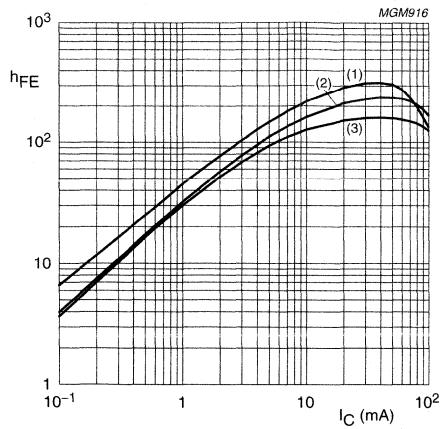
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

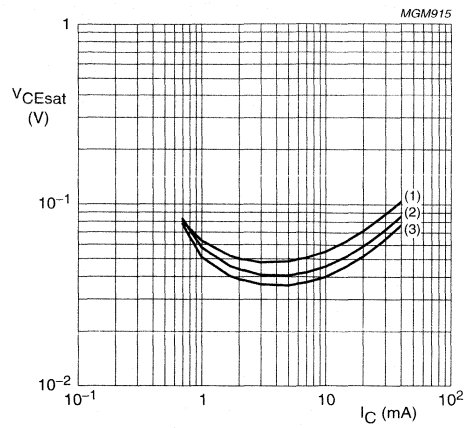
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	180	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



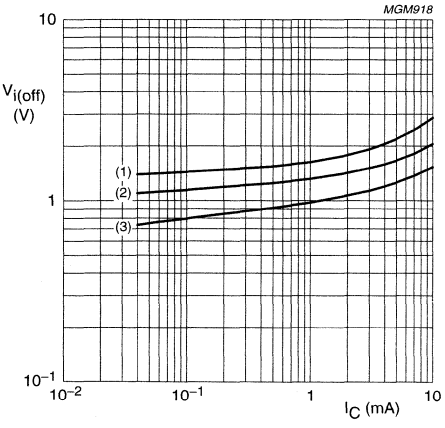
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



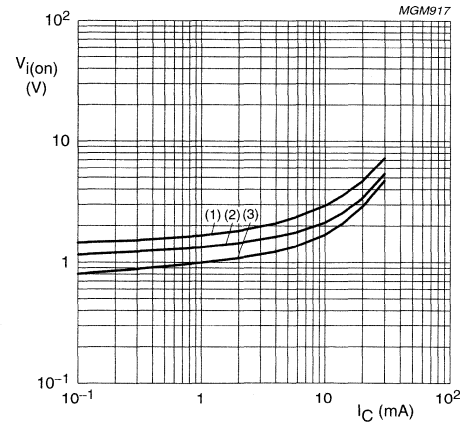
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124XE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 22 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-75 (SOT416) plastic package. PNP complement: PDTA124XE.

MARKING

TYPE NUMBER	MARKING CODE
PDTC124XE	32

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

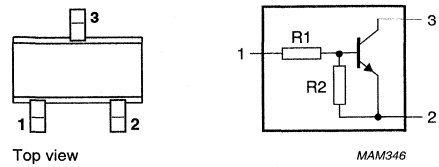


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

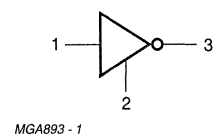


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

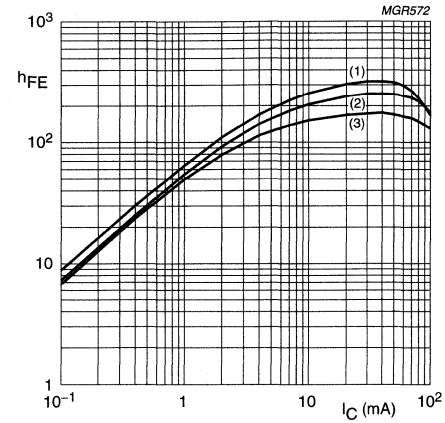
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

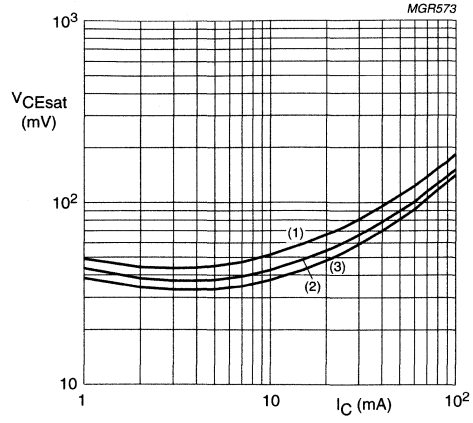
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	120	μA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ μA; $V_{CE} = 5$ V	–	900	500	mV
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 300$ mV	2	1.1	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; $f = 1$ MHz	–	–	2.5	pF



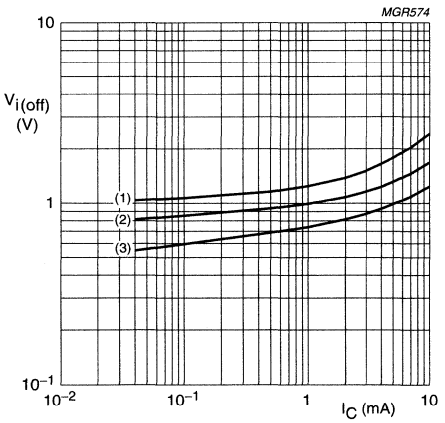
V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



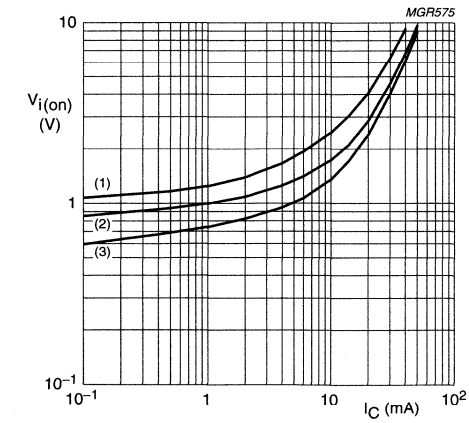
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC124XEF

FEATURES

- Power dissipation comparable to SOT23
- Built-in bias resistors R1 and R2 (typ. 22 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor encapsulated in an ultra small SC-89 (SOT490) plastic SMD package.
PNP complement: PDTA124XEF.

MARKING

TYPE NUMBER	MARKING CODE
PDTC124XEF	32

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

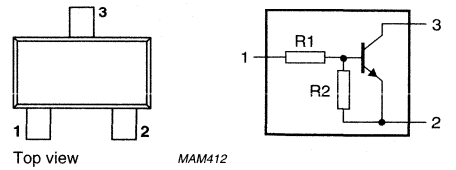


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

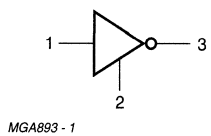


Fig.2 Equivalent inverter symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air; note 1	500	K/W

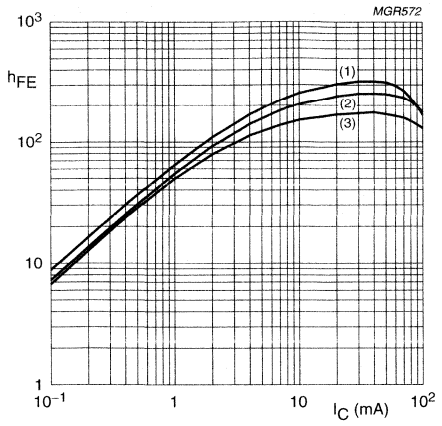
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

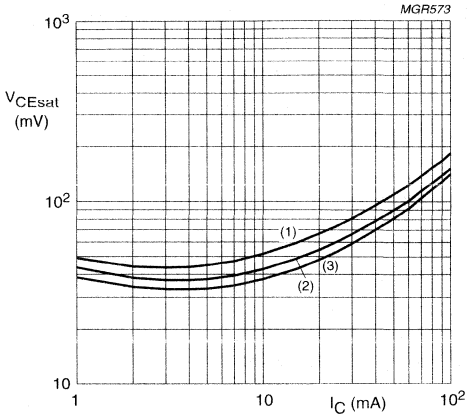
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	120	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	0.9	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 300$ mV	2	1.1	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



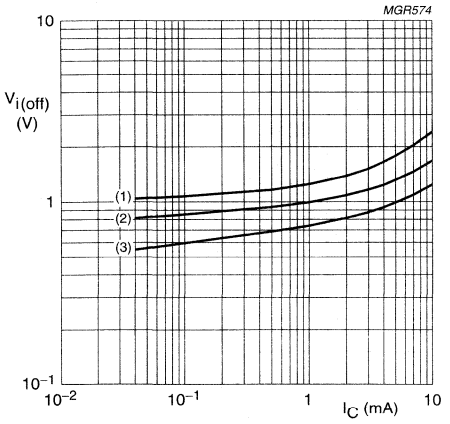
V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



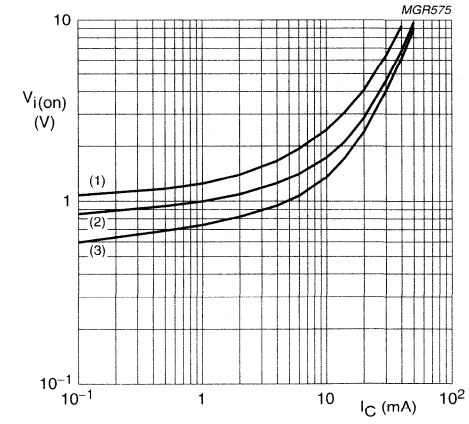
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

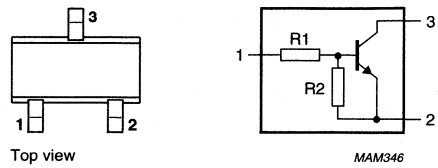


Fig.1 Simplified outline (SC-75) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in an SC-75 plastic package.
PNP complement: PDTA143EE.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

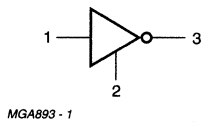


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC143EE	02

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+30	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

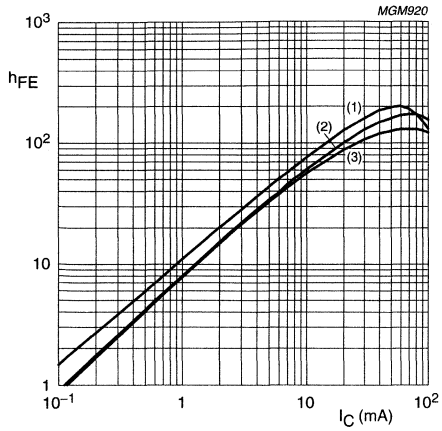
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

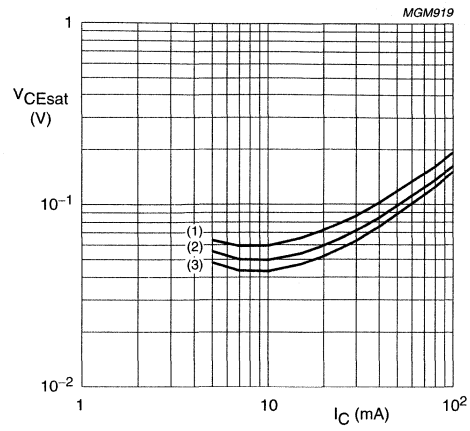
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.9	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2.5	1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



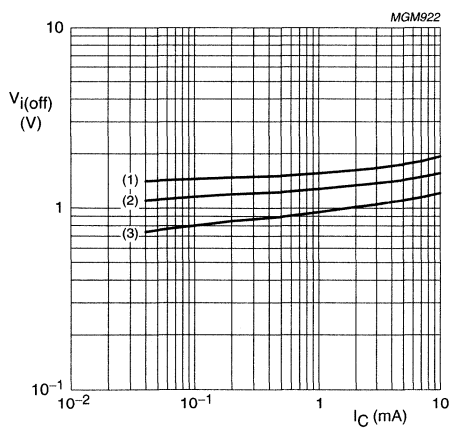
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



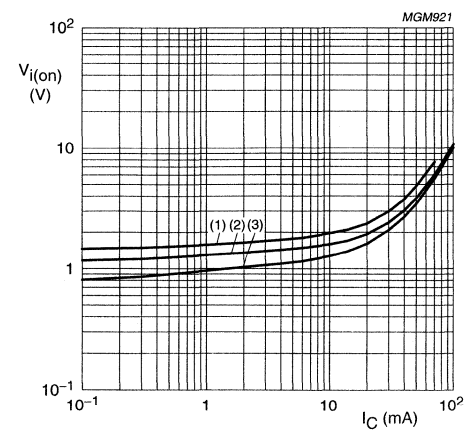
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-59 plastic package.
PNP complement: PDTA143EK.

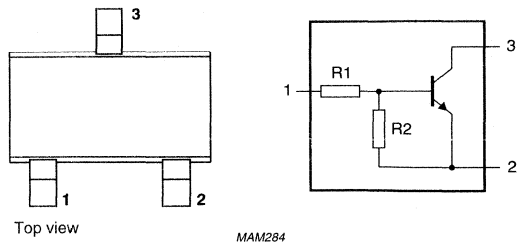


Fig.1 Simplified outline (SC-59) and symbol.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

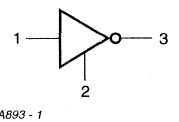


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC143EK	02

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+30	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

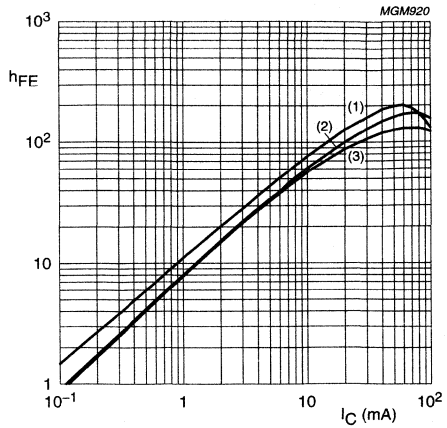
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

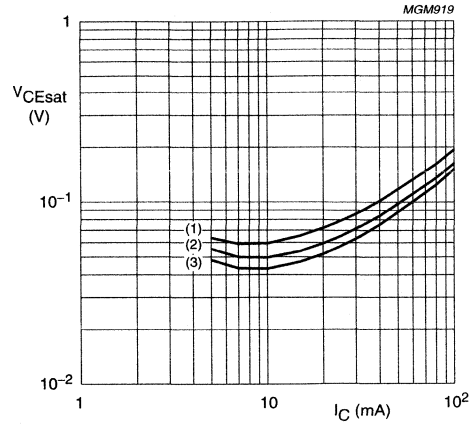
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.9	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2.5	1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



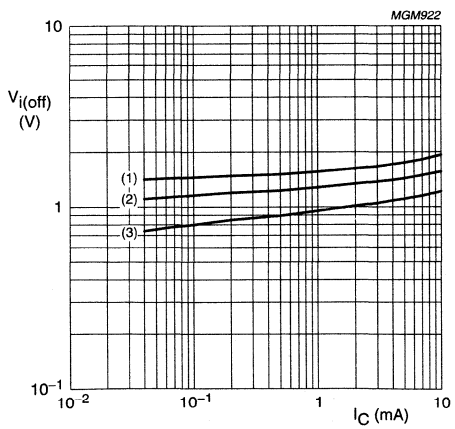
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



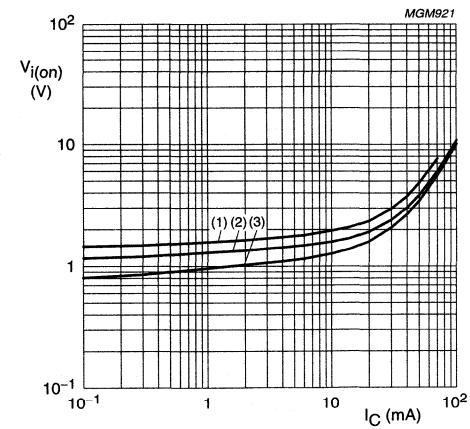
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

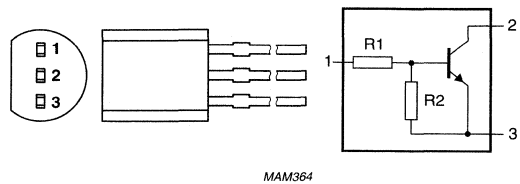


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in a TO-92; SOT54 plastic package.
PNP complement: PDTA143ES.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground

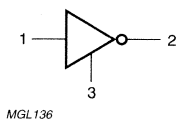


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+30	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

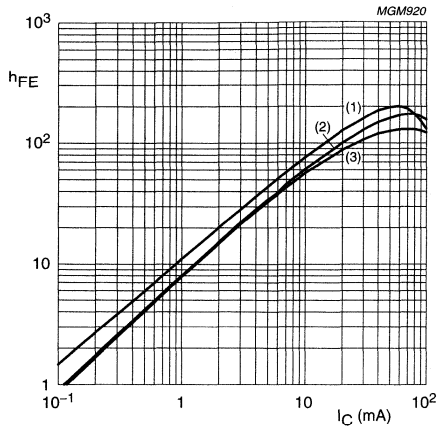
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

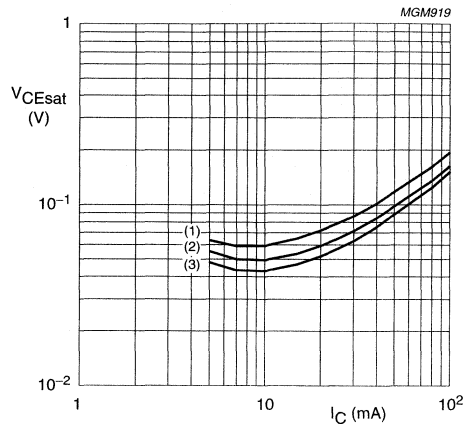
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.9	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ μA; $V_{CE} = 5$ V	–	1.1	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 300$ mV	2.5	1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



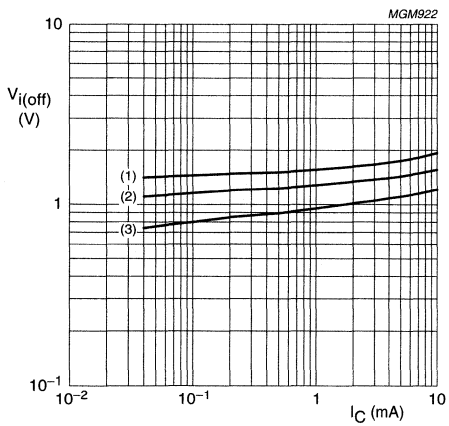
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



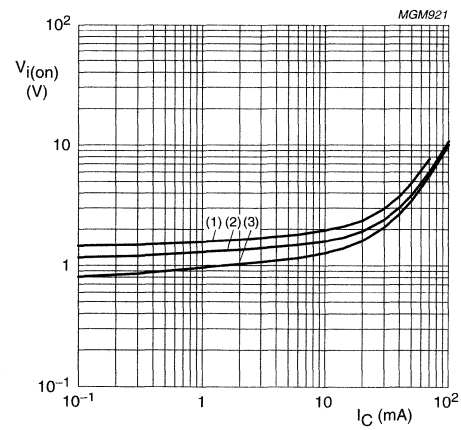
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.
PNP complement: PDTA143ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

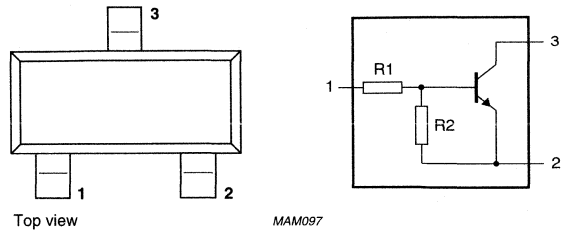


Fig.1 Simplified outline (SOT23) and symbol.

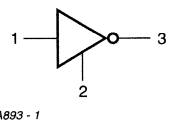


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC143ET	*02

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	30	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

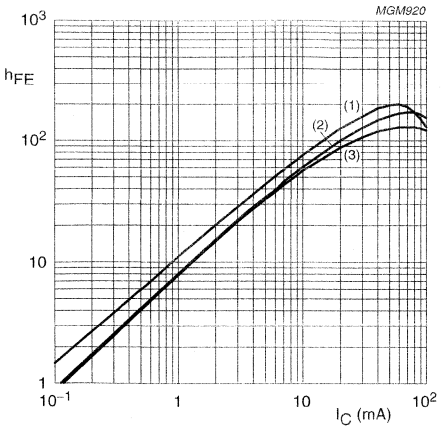
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

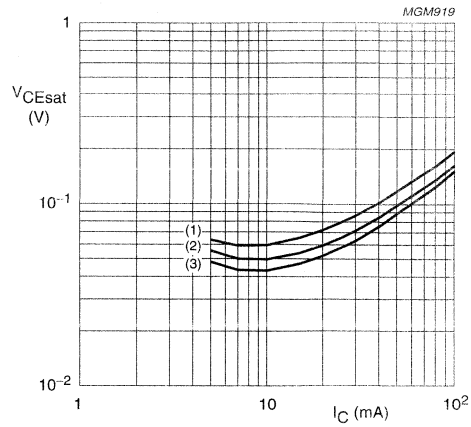
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.9	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2.5	1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



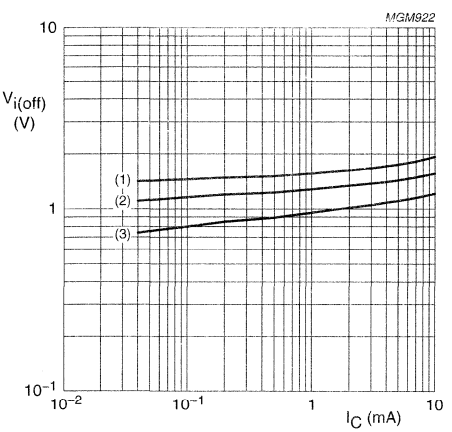
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



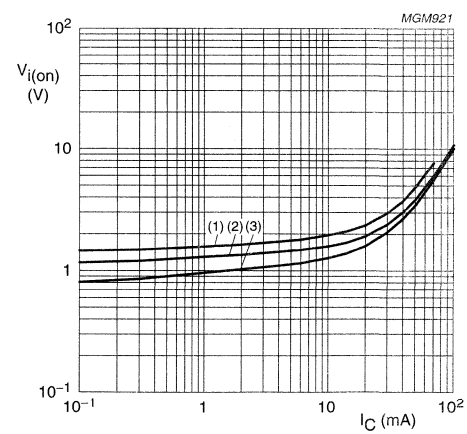
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143EU

FEATURES

- Built-in bias resistors R1 and R2 typ. 4.7 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT323 plastic package.
PNP complement: PDTA143EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

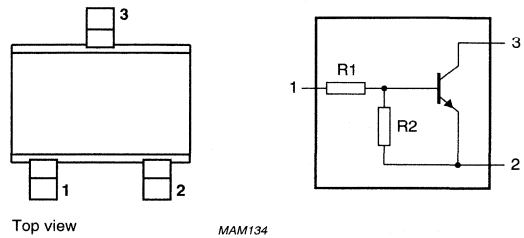


Fig.1 Simplified outline (SOT323) and symbol.

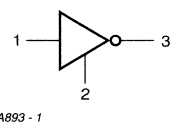


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC143EU	*02

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	30	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

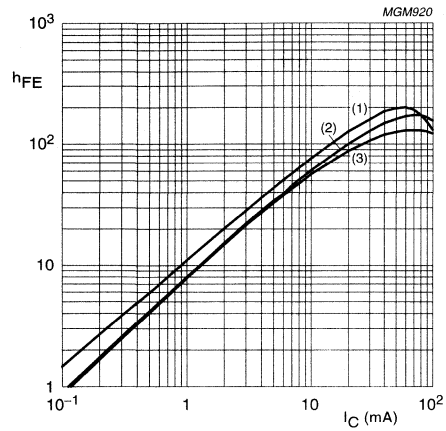
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

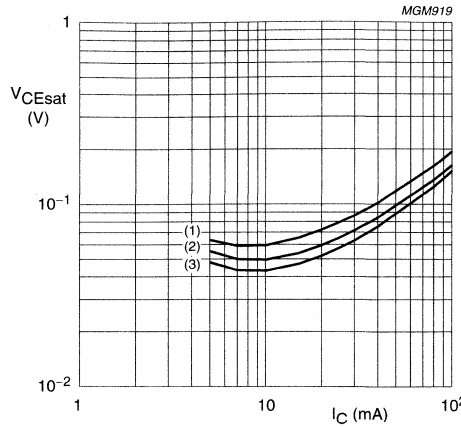
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.9	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.1	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2.5	1.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



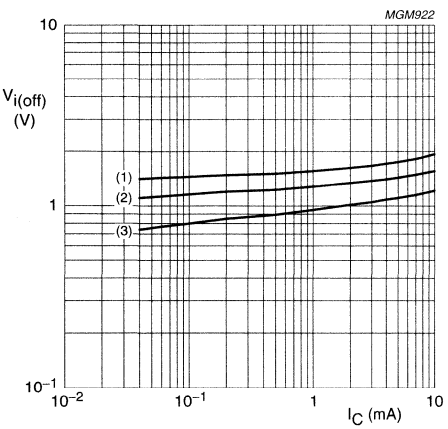
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



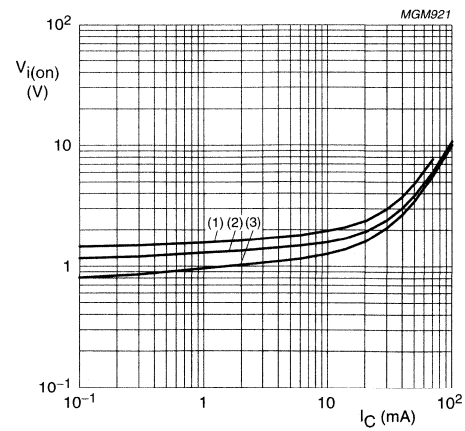
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143TT

FEATURES

- Built-in bias resistor R1 (typ. 4.7 kΩ)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of an external resistor.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC143TT	*33

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

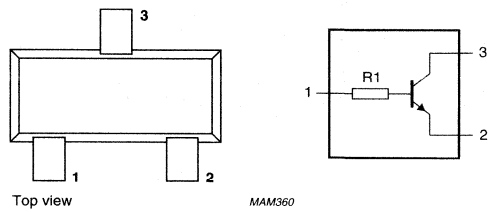


Fig.1 Simplified outline (SOT23) and symbol.

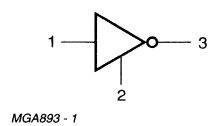


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

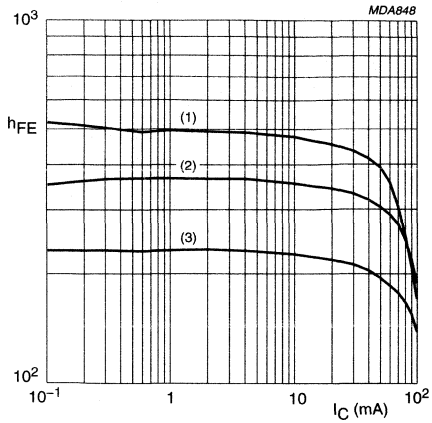
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

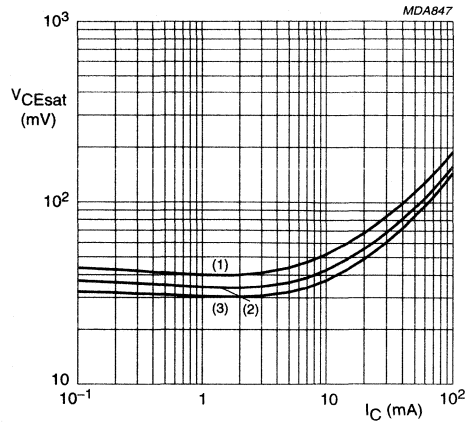
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
R1	input resistor		3.3	4.7	6.1	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143XE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 10 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-75 (SOT416) plastic package. PNP complement: PDTA143XE.

MARKING

TYPE NUMBER	MARKING CODE
PDTC143XE	34

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

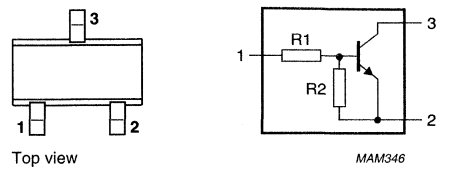


Fig.1 Simplified outline (SC-75; SOT416) and symbol.

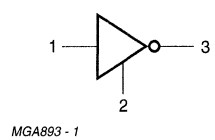


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+20	V
	negative		–	–7	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

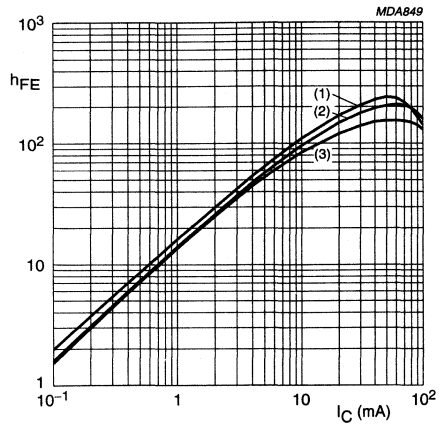
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

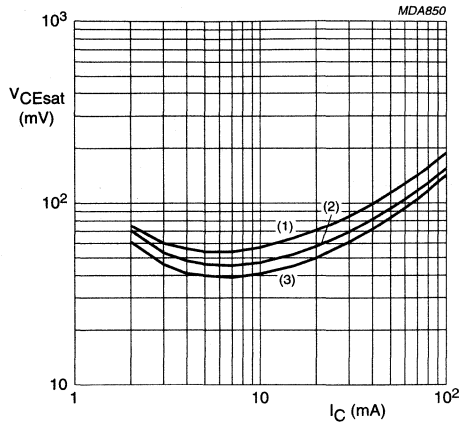
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	0.6	mA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	50	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	–	300	mV
$V_{i(on)}$	input-on voltage	$I_C = 20$ mA; $V_{CE} = 0.3$ V	2.5	–	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



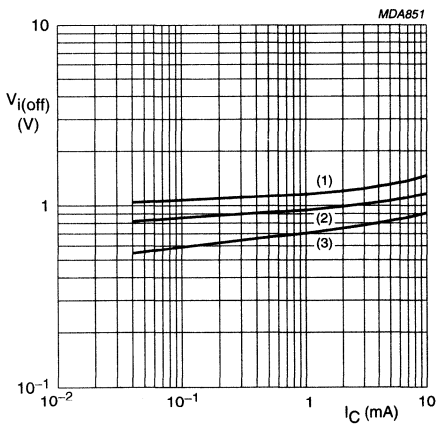
V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



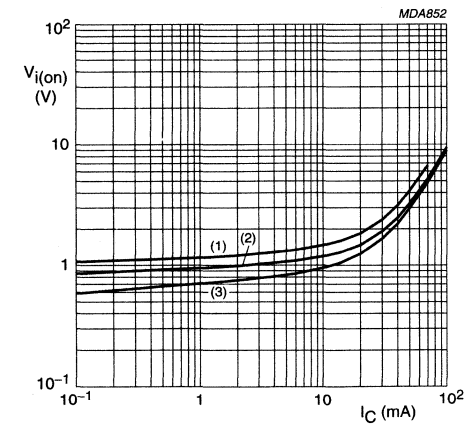
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143XT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 10 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

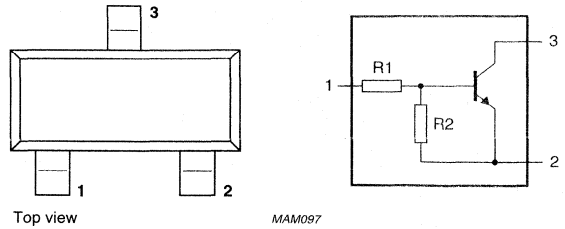


Fig.1 Simplified outline (SOT23) and symbol.

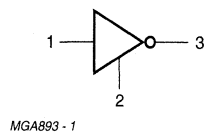


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC143XT	*32

Note

1. * = p: Made in Hong Kong.
   * = t: Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	20	V
	negative		–	–7	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Refer to SOT23 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

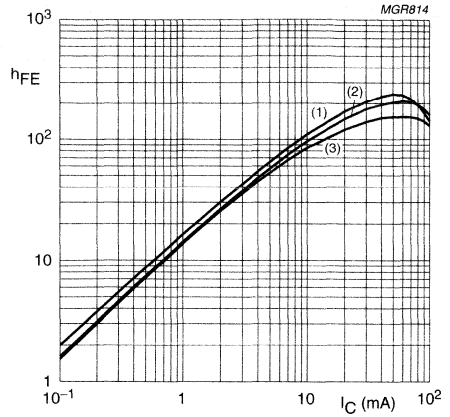
Note

1. Refer to SOT23 standard mounting conditions.

CHARACTERISTICS

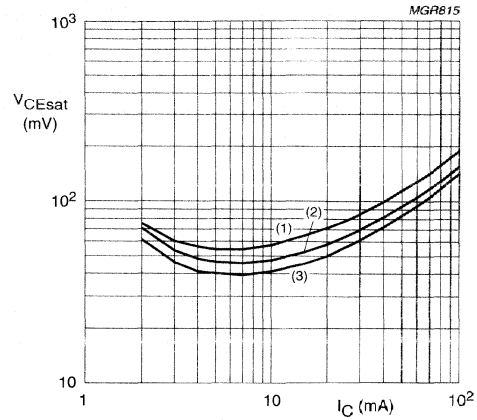
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	600	μA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	50	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	–	0.3	V
$V_{i(on)}$	input-on voltage	I_C = 20 mA; V_{CE} = 0.3 V	2.5	–	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		1.7	2.1	2.6	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



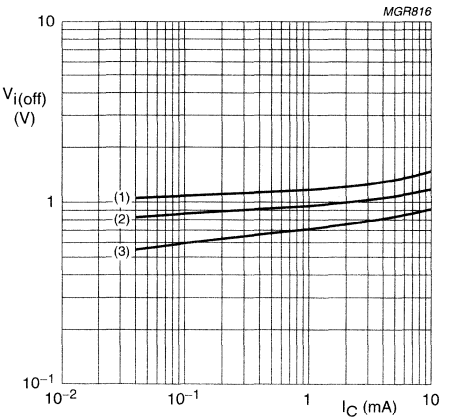
V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



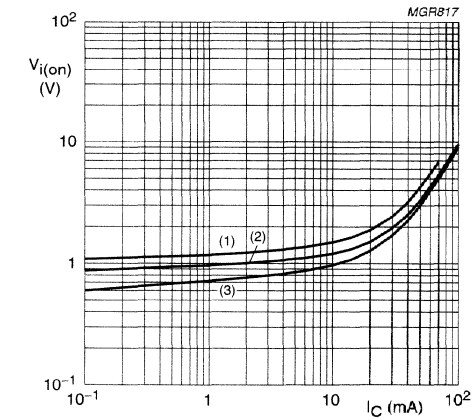
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143ZK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-59 (SOT346) plastic package. PNP complement: PDTA143ZK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

MARKING

TYPE NUMBER	MARKING CODE
PDTC143ZK	18

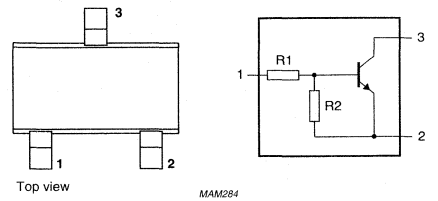


Fig.1 Simplified outline (SC-59; SOT346) and symbol.

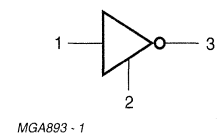


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage positive negative		 – –	 +30 –5	 V V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

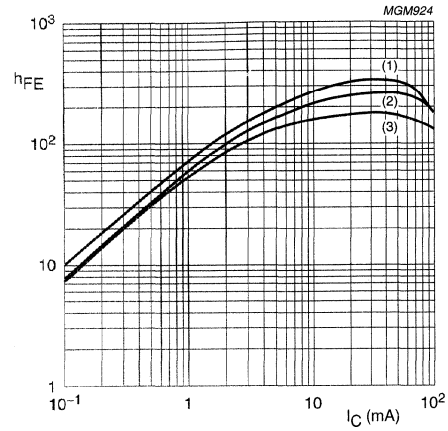
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

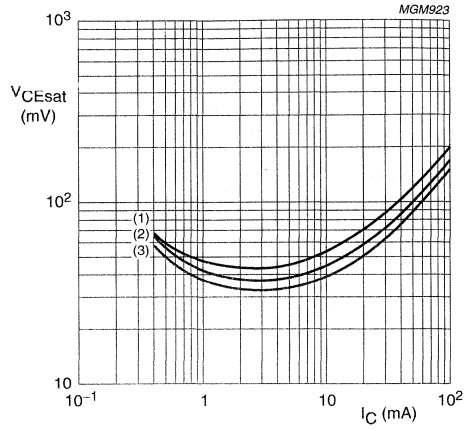
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	170	µA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	0.6	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	1.3	0.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		8	10	12	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



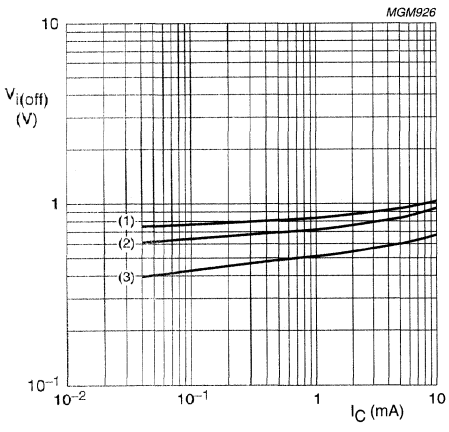
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



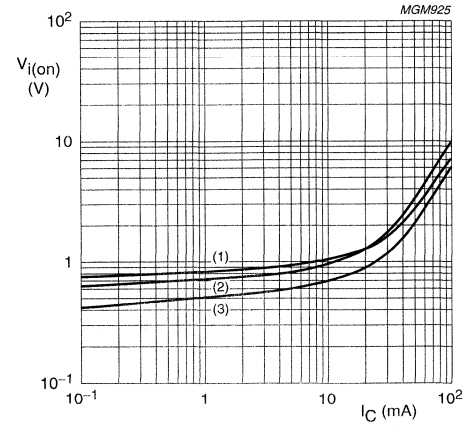
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC143ZT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 4.7 kΩ and 47 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package. PNP complement: PDTA143ZT.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC143ZT	*18

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

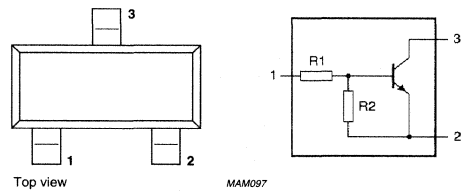


Fig.1 Simplified outline (SOT23) and symbol.

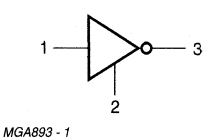


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+30	V
	negative		–	–5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

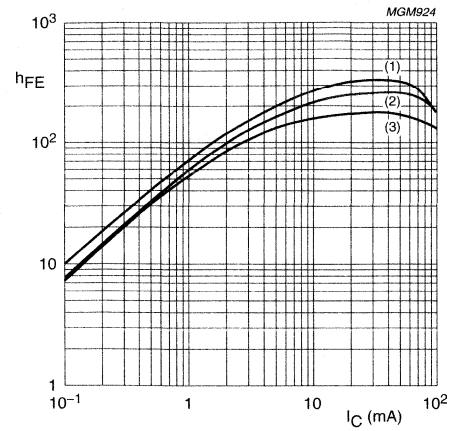
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

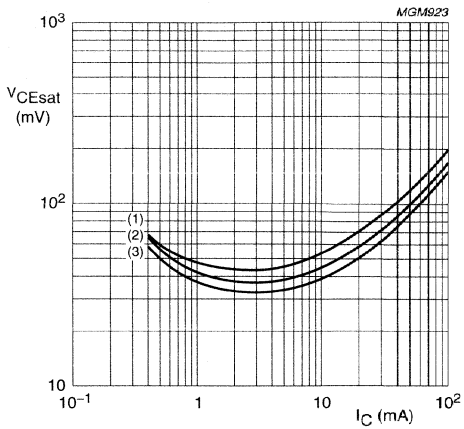
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	170	µA
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 5$ V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	0.6	0.5	V
$V_{i(on)}$	input-on voltage	$I_C = 5$ mA; $V_{CE} = 0.3$ V	1.3	0.9	–	V
R1	input resistor		3.3	4.7	6.1	kΩ
$\frac{R2}{R1}$	resistor ratio		8	10	12	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



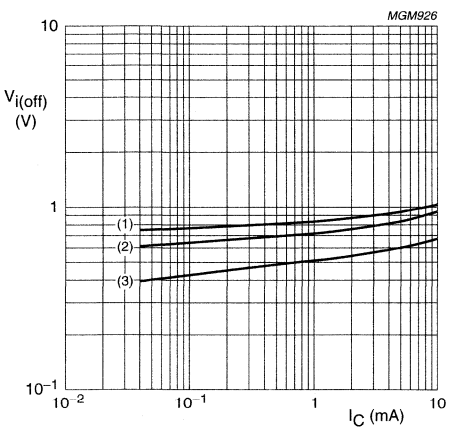
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



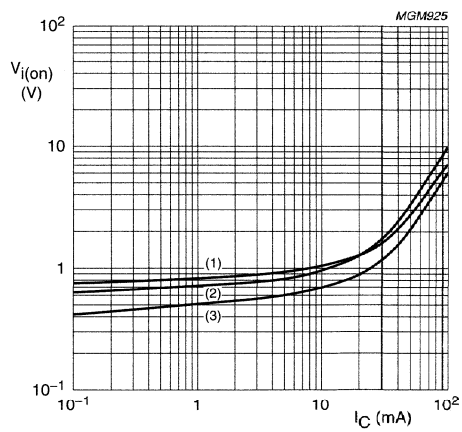
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144EE

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-75 plastic package.
PNP complement: PDTA144EE.

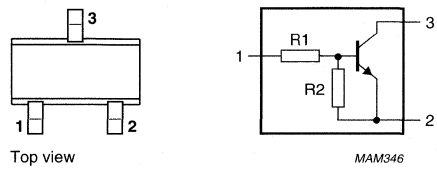


Fig.1 Simplified outline (SC-75) and symbol.

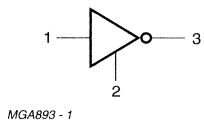


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC144EE	08

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	150	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	833	K/W

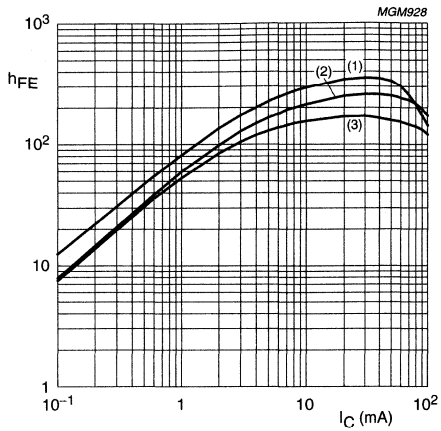
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

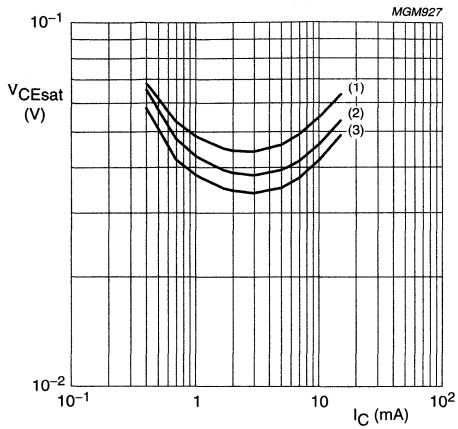
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	90	μA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ μA; $V_{CE} = 5$ V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



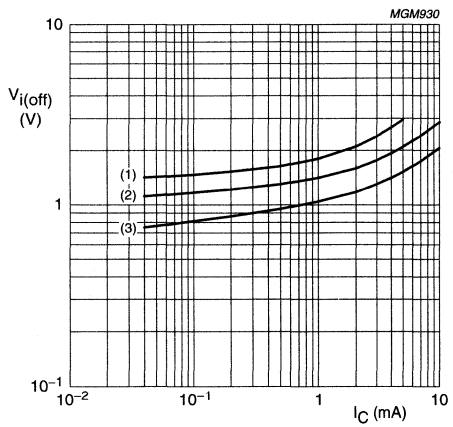
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



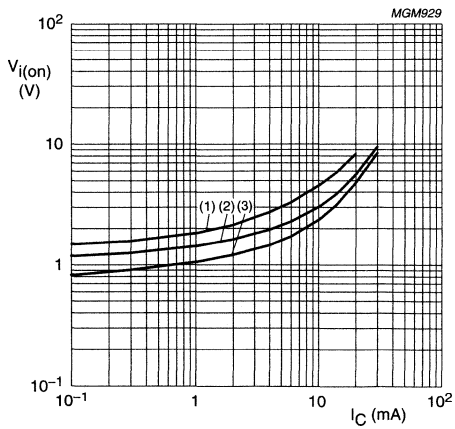
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144EEF

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

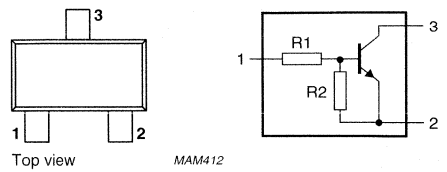


Fig.1 Simplified outline (SC-89; SOT490) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in an SC-89 (SOT490) plastic package.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

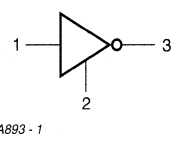


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC144EEF	08

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

PRELIMINARY
Philips Semiconductors for Design-in Information
See Philips Semiconductors

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

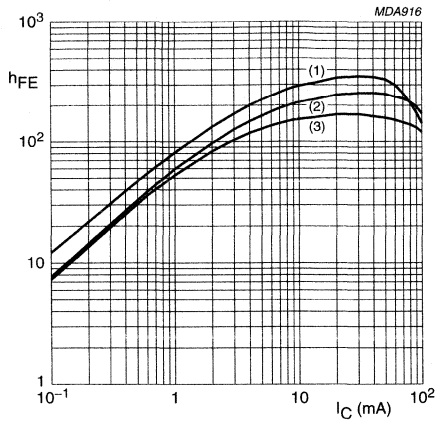
Note

1. Refer to SC-89 (SOT490) standard mounting conditions.

CHARACTERISTICS

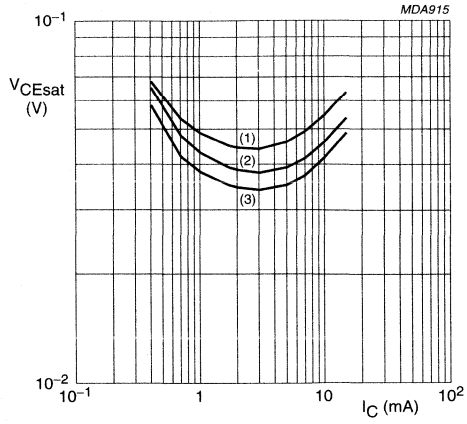
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	90	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 2 mA; V_{CE} = 0.3 V	3	1	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



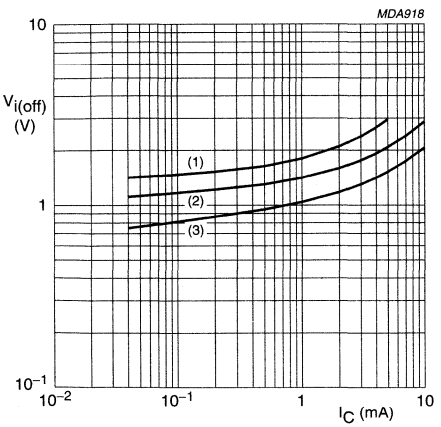
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



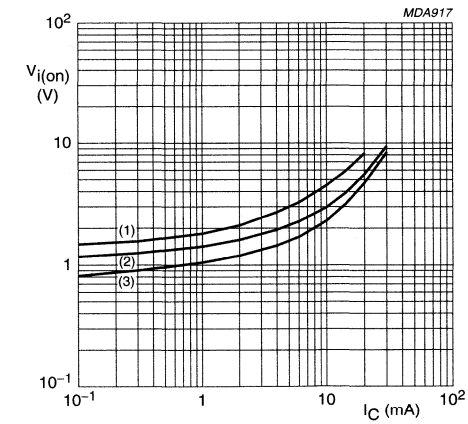
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144EK

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-59 plastic package.
PNP complement: PDTA144EK.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

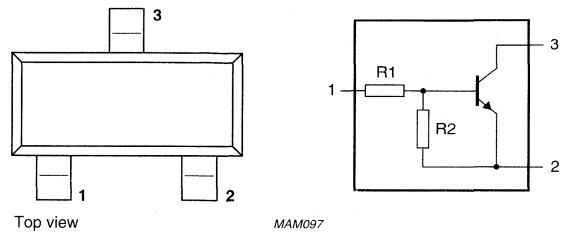


Fig.1 Simplified outline (SC-59) and symbol.

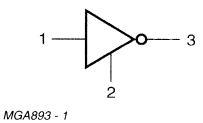


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE
PDTC144EK	08

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	250	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

OBJECTIVE
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage positive negative		 – –	 +40 –10	 V V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

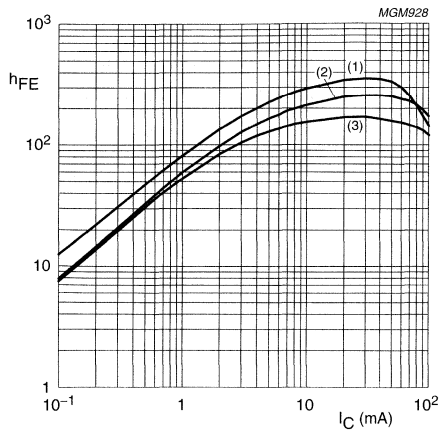
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

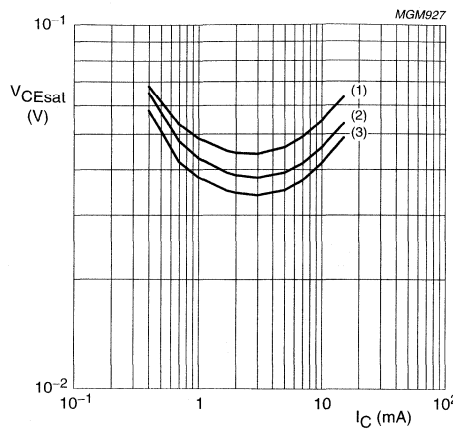
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	90	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 300$ mV	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



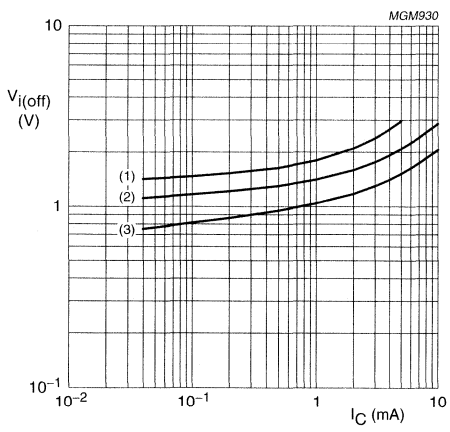
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



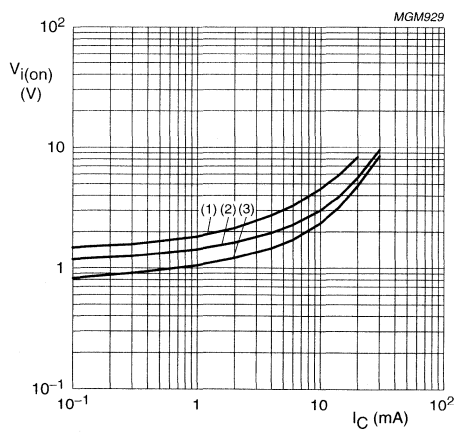
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144ES

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

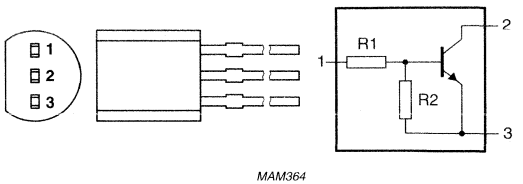


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

DESCRIPTION

NPN resistor-equipped transistor in a TO-92; SOT54 plastic package.
PNP complement: PDTA144ES.

PINNING

PIN	DESCRIPTION
1	base/input
2	collector/output
3	emitter/ground

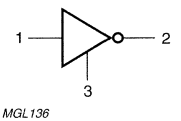


Fig.2 Equivalent inverter symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	50	V
I_O	output current (DC)		–	–	100	mA
I_{CM}	peak collector current		–	–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	–	500	mW
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

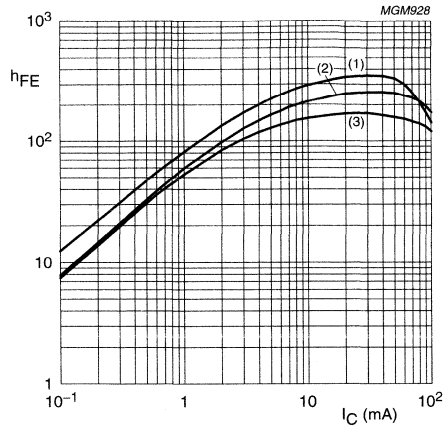
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

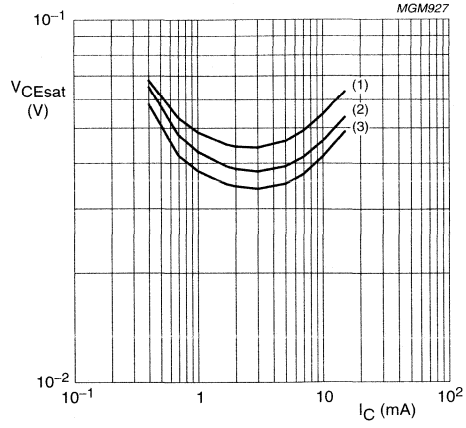
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	90	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



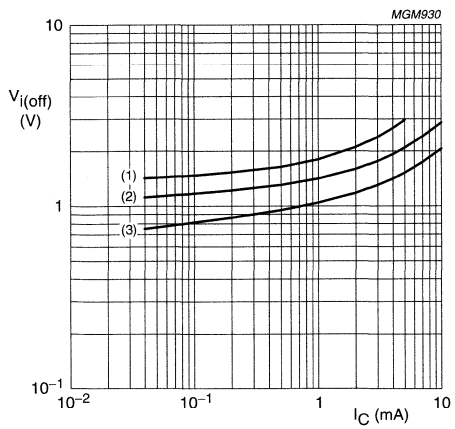
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



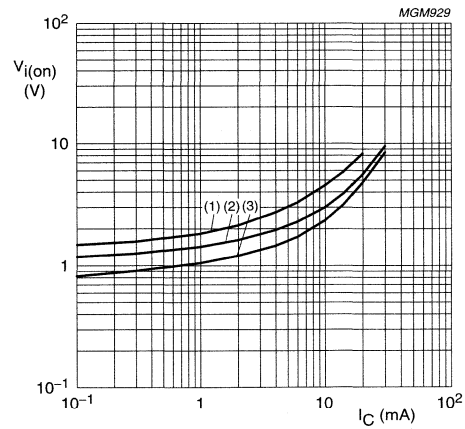
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144ET

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.
PNP complement: PDTA144ET.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

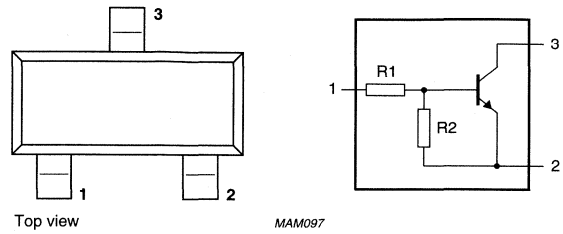


Fig.1 Simplified outline (SOT23) and symbol.

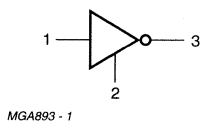


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC144ET	*08

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

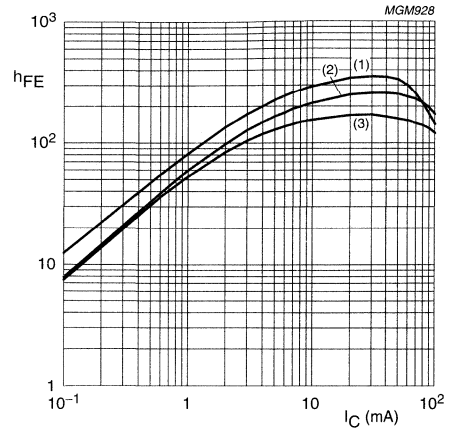
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

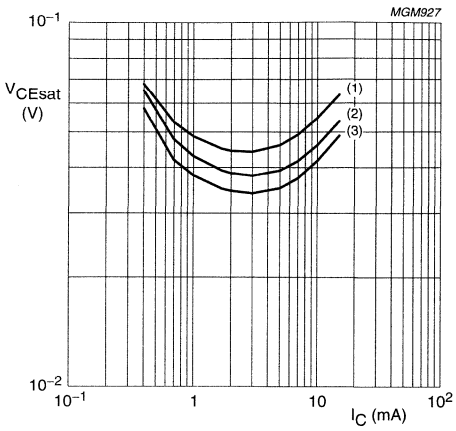
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	90	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



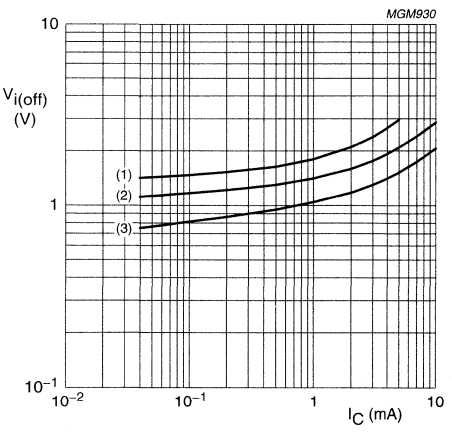
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



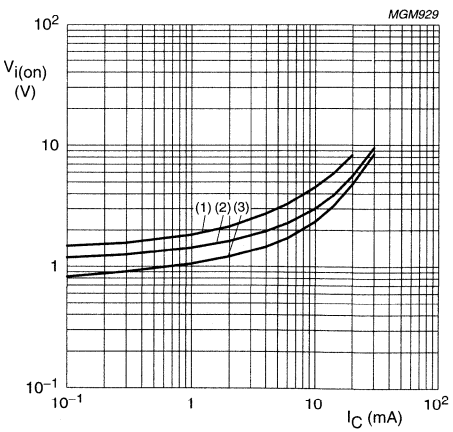
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144EU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in an SC-70; SOT323 plastic package. PNP complement: PDTA144EU.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

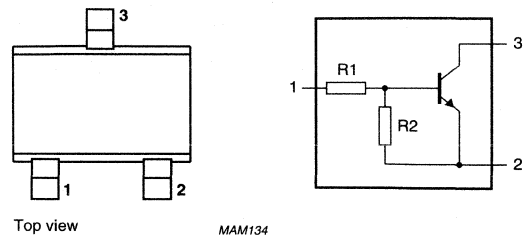


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

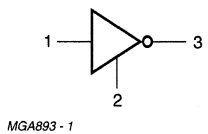


Fig.2 Equivalent inverter symbol.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC144EU	*08

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

OBJECTIVE
See Philips Semiconductors for Design-in information

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

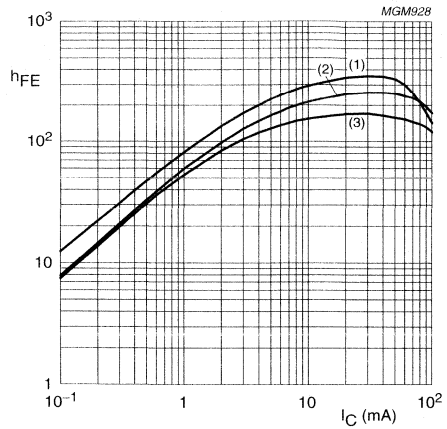
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

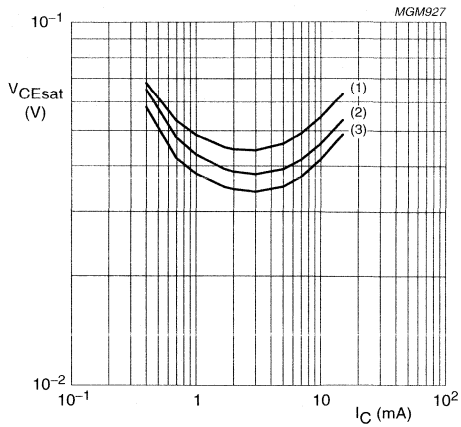
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	90	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



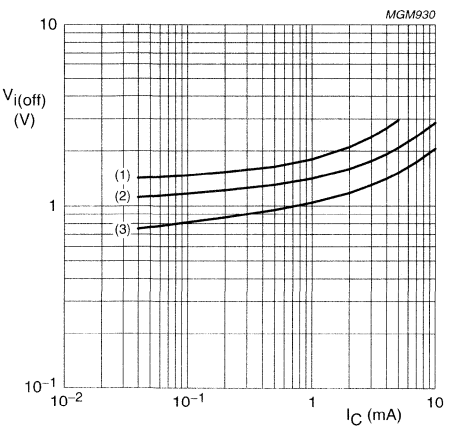
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



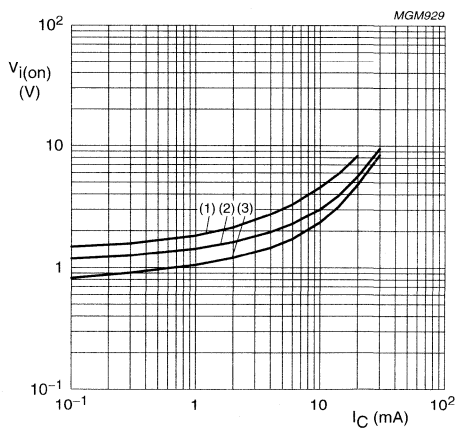
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144WT

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ and 22 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC144WT	*20

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

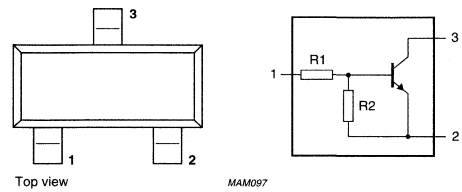


Fig.1 Simplified outline (SOT23) and symbol.

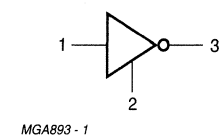


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

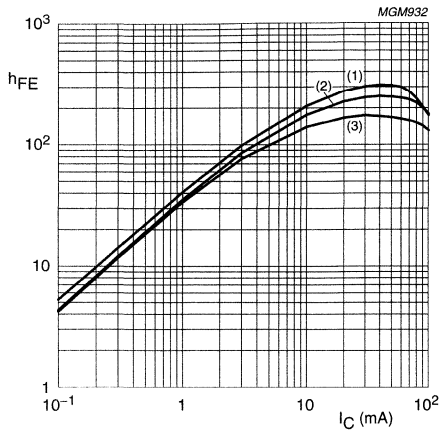
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

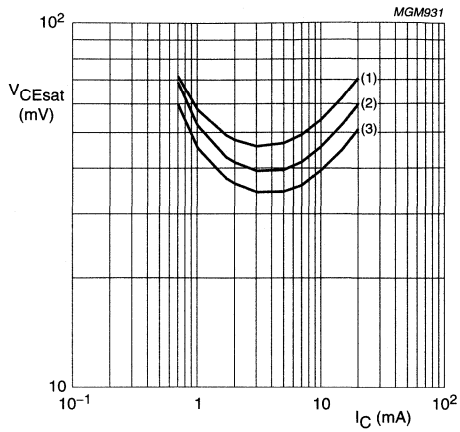
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	110	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.7	1.2	V
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	4	2.7	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.37	0.47	0.57	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



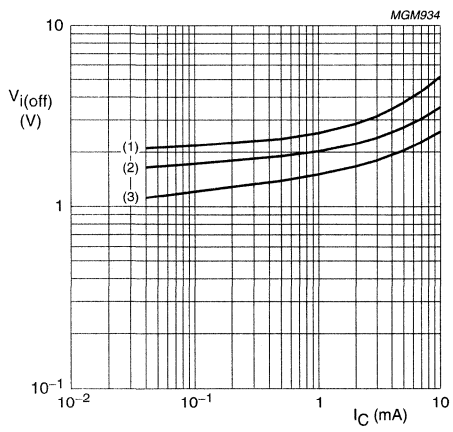
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



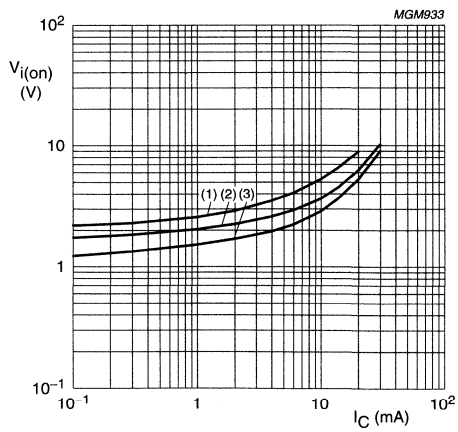
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped transistor PDTC144WU

FEATURES

- Built-in bias resistors R1 and R2 (typ. 47 kΩ and 22 kΩ respectively)
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped transistor in a SC-70 (SOT323) plastic package. PNP complement: PDTA144WU.

MARKING

TYPE NUMBER	MARKING CODE(1)
PDTC144WU	*20

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base/input
2	emitter/ground
3	collector/output

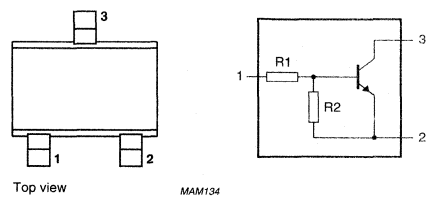


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

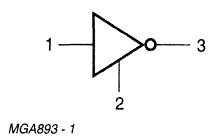


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

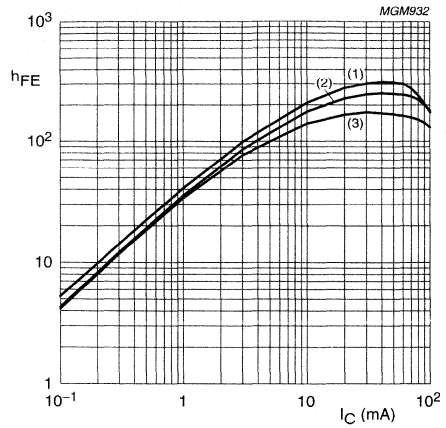
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

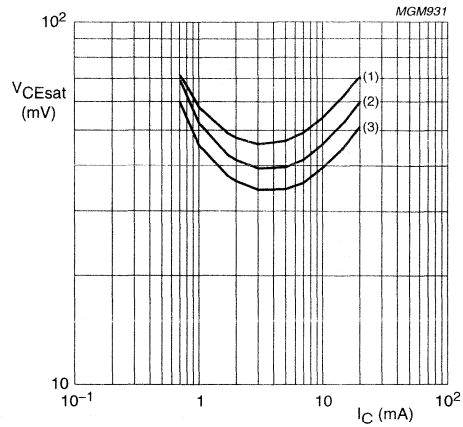
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	µA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	110	µA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	$I_C = 100$ µA; $V_{CE} = 5$ V	–	1.7	1.2	mV
$V_{i(on)}$	input-on voltage	$I_C = 2$ mA; $V_{CE} = 0.3$ V	4	2.7	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.37	0.47	0.57	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



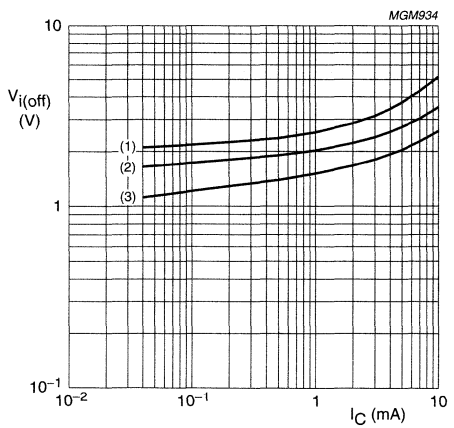
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



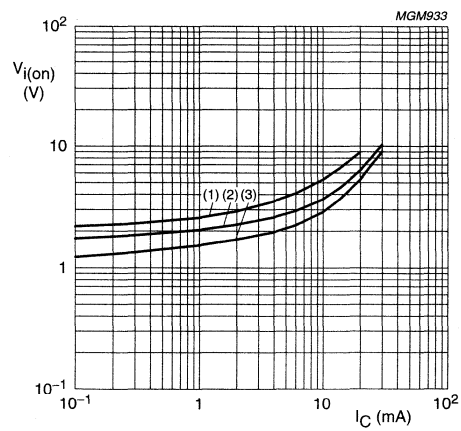
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN switching transistor PH2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package. PNP complement: PH2907A.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

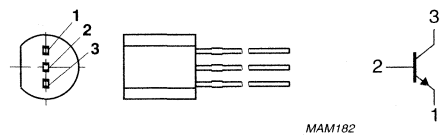


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	75	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

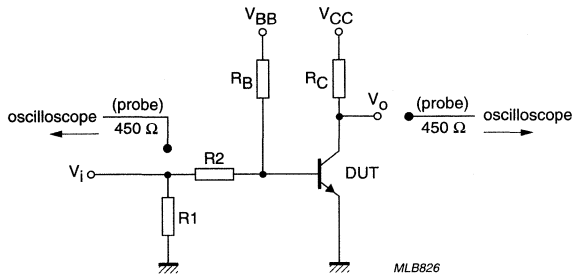
CHARACTERISTICS

$T_j = 25\ °C$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 60$ V	–	10	nA
		$I_E = 0$; $V_{CB} = 60$ V; $T_{amb} = 150\ °C$	–	10	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 3$ V	–	10	nA
h_{FE}	DC current gain	$I_C = 0.1$ mA; $V_{CE} = 10$ V	35	–	
		$I_C = 1$ mA; $V_{CE} = 10$ V	50	–	
		$I_C = 10$ mA; $V_{CE} = 10$ V	75	–	
		$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = -55\ °C$	35	–	
		$I_C = 150$ mA; $V_{CE} = 1$ V; note 1	50	–	
		$I_C = 150$ mA; $V_{CE} = 10$ V; note 1	100	300	
		$I_C = 500$ mA; $V_{CE} = 10$ V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 150$ mA; $I_B = 15$ mA; note 1	–	300	mV
		$I_C = 500$ mA; $I_B = 50$ mA; note 1	–	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 150$ mA; $I_B = 15$ mA; note 1	0.6	1.2	V
		$I_C = 500$ mA; $I_B = 50$ mA; note 1	–	2	V
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; $f = 1$ MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 500$ mV; $f = 1$ MHz	–	25	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 20$ V; $f = 100$ MHz	300	–	MHz
F	noise figure	$I_C = 200$ µA; $V_{CE} = 5$ V; $R_S = 2$ kΩ; $f = 1$ kHz; B = 200 Hz	–	4	db
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	$I_{Con} = 150$ mA; $I_{Bon} = 15$ mA; $I_{Boff} = -15$ mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



V_i = 9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PH2369

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- High-speed switching.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

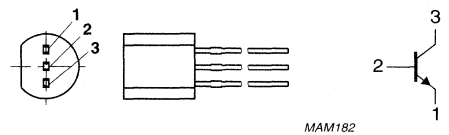


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

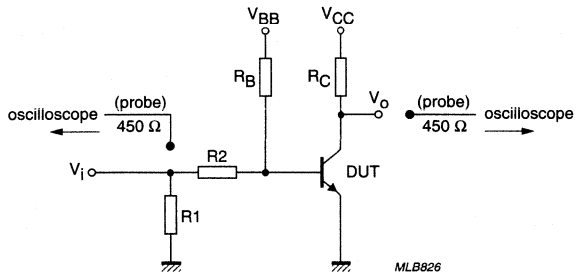
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_j = 125 °C	–	30	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	120	
		I_C = 10 mA; V_{CE} = 1 V; T_{amb} = –55 °C	20	–	
		I_C = 100 mA; V_{CE} = 2 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	700	850	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 1 V; f = 1 MHz	–	4.5	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	500	–	MHz
Switching times (between 10% and 90% levels)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = –1.5 mA; see Fig.2 test conditions A	–	10	ns
t_d	delay time		–	4	ns
t_r	rise time		–	6	ns
t_{off}	turn-off time		–	20	ns
t_s	storage time		–	10	ns
t_f	fall time		–	10	ns
t_{on}	turn-on time	I_{Con} = 100 mA; I_{Bon} = 40 mA; I_{Boff} = –20 mA; see Fig.2 test conditions B	–	13	ns
t_{off}	turn-off time		–	35	ns



Test conditions A.

V_i = 0.5 to 4.2 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Test conditions B.

V_i = 0.5 to 4.52 V; T = 200 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 100 Ω; R2 = 68 Ω; R_B = 390 Ω; R_C = 47 Ω.
V_{BB} = −3 V; V_{CC} = 4.6 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor PH2907A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a TO-92; SOT54 plastic package. NPN complement: PH2222A.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

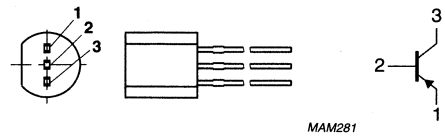


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

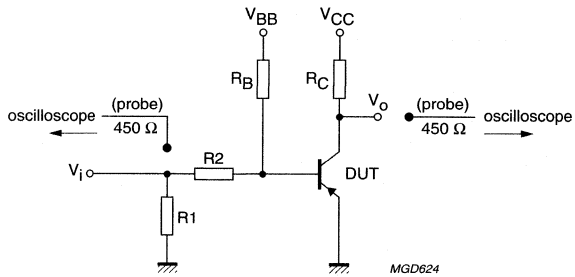
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	−10	nA
		I_E = 0; V_{CB} = −50 V; T_{amb} = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −10 V	75	–	
		I_C = −1 mA; V_{CE} = −10 V	100	–	
		I_C = −10 mA; V_{CE} = −10 V	100	–	
		I_C = −150 mA; V_{CE} = −10 V; note 1	100	300	
		I_C = −500 mA; V_{CE} = −10 V; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	–	−400	mV
		I_C = −500 mA; I_B = −50 mA; note 1	–	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	–	−1.3	V
		I_C = −500 mA; I_B = −50 mA; note 1	–	−2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 100 kHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −2 V; f = 100 kHz	–	30	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −20 V; f = 100 MHz; note 1	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN general purpose transistor PMBS3904

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification, e.g. telephony and professional communication equipment.

DESCRIPTION

NPN transistor in a plastic SOT23 package.
PNP complement: PMBS3906.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBS3904	*O4

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

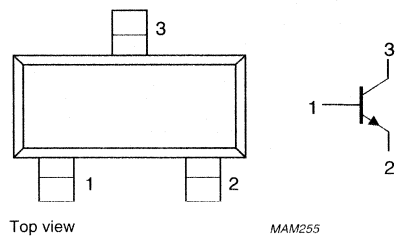


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1; (see Fig.2)			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 5 mA	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	650	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	12	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	180	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = − 1 mA; V_{CC} = 3 V; V_{BB} = −1.9 V	–	110	ns
t_d	delay time		–	50	ns
t_r	rise time		–	60	ns
t_{off}	turn-off time		–	1200	ns
t_s	storage time		–	1000	ns
t_f	fall time		–	200	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

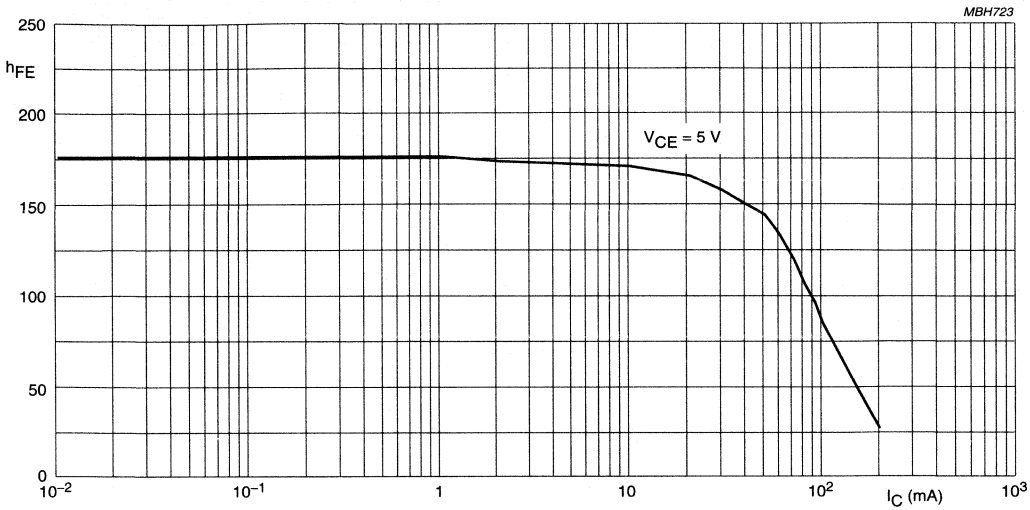
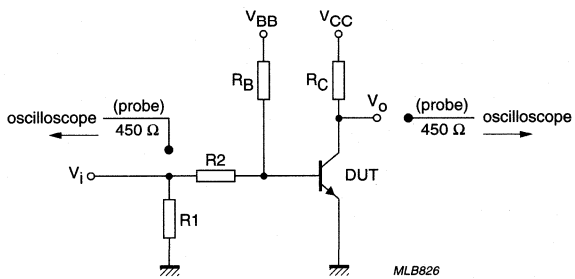


Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP general purpose transistor PMBS3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification, e.g. telephony and professional communication equipment.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complement: PMBS3904.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBS3906	*O6

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

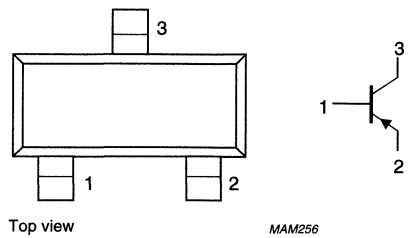


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−40	V
V_{CEO}	collector-emitter voltage	open base	–	−40	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)			
		I_C = −0.1 mA	60	–	
		I_C = −1 mA	80	–	
		I_C = −10 mA	100	300	
		I_C = −50 mA; note 1	60	–	
		I_C = −100 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−250	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−850	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 100 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 100 MHz	–	12	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	150	–	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz;	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA	–	100	ns
t_d	delay time		–	50	ns
t_r	rise time		–	50	ns
t_{off}	turn-off time		–	700	ns
t_s	storage time		–	600	ns
t_f	fall time		–	100	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

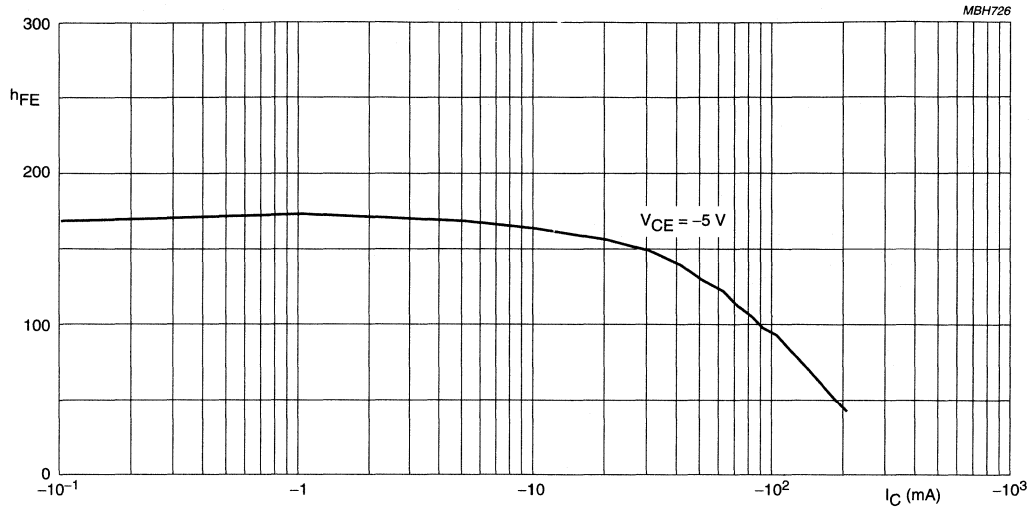
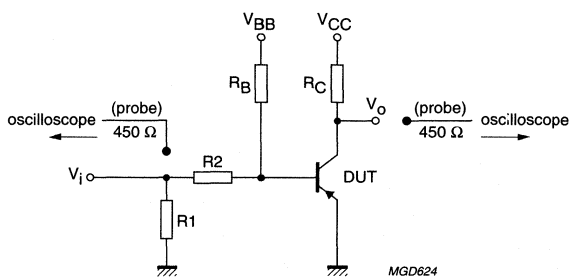


Fig.2 DC current gain; typical values.



V_i = −5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistors PMBT2222; PMBT2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complements: PMBT2907 and PMBT2907A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT2222	*1B
PMBT2222A	*1P

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

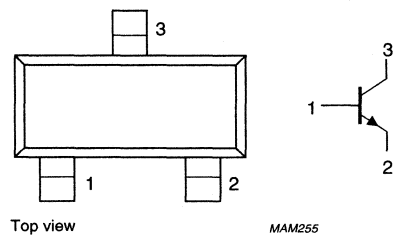


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMBT2222		–	60	V
	PMBT2222A		–	75	V
V_{CEO}	collector-emitter voltage	open base			
	PMBT2222		–	30	V
	PMBT2222A		–	40	V
V_{EBO}	emitter-base voltage	open collector			
	PMBT2222		–	5	V
	PMBT2222A		–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

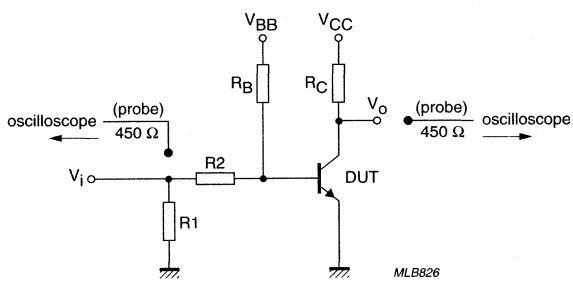
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	PMBT2222	I_E = 0; V_{CB} = 50 V	–	10	nA
		I_E = 0; V_{CB} = 50 V; T_j = 125 °C	–	10	µA
	collector cut-off current				
	PMBT2222A	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_j = 125 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V			
	PMBT2222A		–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V	35	–	
		I_C = 1 mA; V_{CE} = 10 V	50	–	
		I_C = 10 mA; V_{CE} = 10 V	75	–	
		I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	35	–	
		I_C = 150 mA; V_{CE} = 10 V	100	300	
		I_C = 150 mA; V_{CE} = 1 V	50	–	
	DC current gain	I_C = 500 mA; V_{CE} = 10 V			
	PMBT2222		30	–	
	PMBT2222A		40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1			
	PMBT2222		–	400	mV
	PMBT2222A		–	300	mV
	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1			
	PMBT2222		–	1.6	V
	PMBT2222A		–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1			
	PMBT2222		–	1.3	V
	PMBT2222A		0.6	1.2	V
	base-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; note 1			
	PMBT2222		–	2.6	V
	PMBT2222A		–	2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	8	pF

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 500 mV; f = 1 MHz			
	PMBT2222		–	30	
	PMBT2222A		–	25	
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz			
	PMBT2222		250	–	MHz
	PMBT2222A		300	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 1 kHz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PMBT2369

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- High-speed switching, especially in portable equipment.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT2369	*1J

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

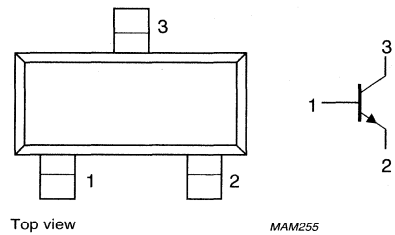


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

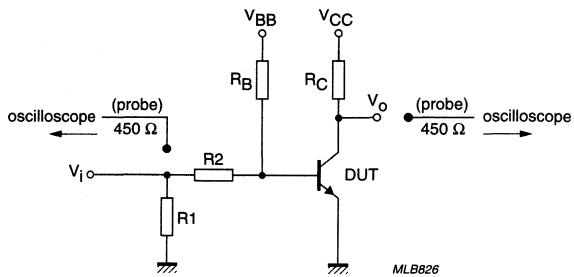
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_j = 125 °C	–	30	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	120	
		I_C = 10 mA; V_{CE} = 1 V; T_{amb} = −55 °C	20	–	
		I_C = 100 mA; V_{CE} = 2 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	700	850	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	500	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = −1.5 mA	–	10	ns
t_d	delay time		–	4	ns
t_r	rise time		–	6	ns
t_{off}	turn-off time		–	20	ns
t_s	storage time		–	10	ns
t_f	fall time		–	10	ns



V_i = 0.5 to 4.2 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistors PMBT2907; PMBT2907A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complements: PMBT2222 and PMBT2222A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT2907	*2B
PMBT2907A	*2F

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

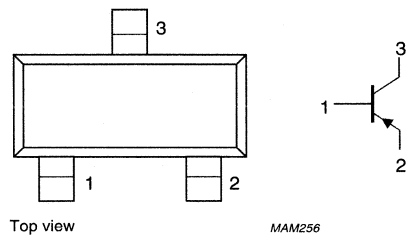


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	PMBT2907		–	–40	V
	PMBT2907A		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

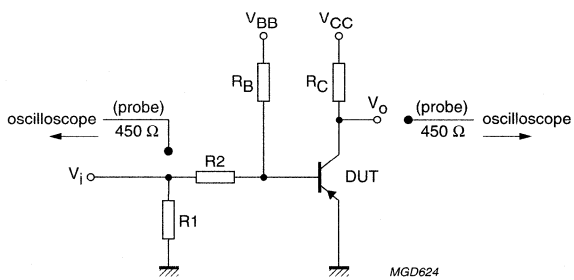
1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V			
	PMBT2907		−	−20	nA
	PMBT2907A		−	−10	nA
	collector cut-off current	I_E = 0; V_{CB} = −50 V; T_j = 125 °C			
	PMBT2907		−	−20	µA
	PMBT2907A		−	−10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −10 V			
	PMBT2907		35	−	
	PMBT2907A		75	−	
	DC current gain	I_C = −1 mA; V_{CE} = −10 V			
	PMBT2907		50	−	
	PMBT2907A		100	−	
	DC current gain	I_C = −10 mA; V_{CE} = −10 V			
	PMBT2907		75	−	
	PMBT2907A		100	−	
	DC current gain	I_C = −150 mA; V_{CE} = −10 V	100	300	
	DC current gain	I_C = −500 mA; V_{CE} = −10 V			
	PMBT2907		30	−	
	PMBT2907A		50	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	−	−400	mV
		I_C = −500 mA; I_B = −50 mA	−	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	−	−1.3	V
		I_C = −500 mA; I_B = −50 mA	−	−2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −2 V; f = 1 MHz	−	30	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −20 V; f = 100 MHz	200	−	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PMBT3904

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complement: PMBT3906.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT3904	*1A

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

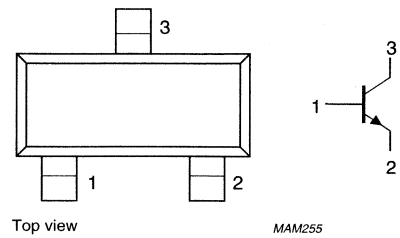


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

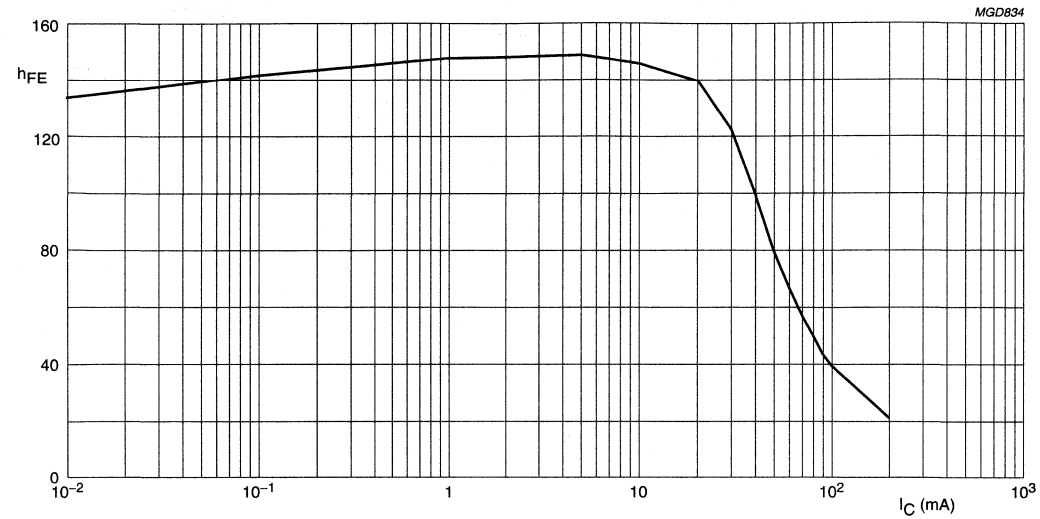
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1; Fig.2			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 5 mA	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	650	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{BE} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 µA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns

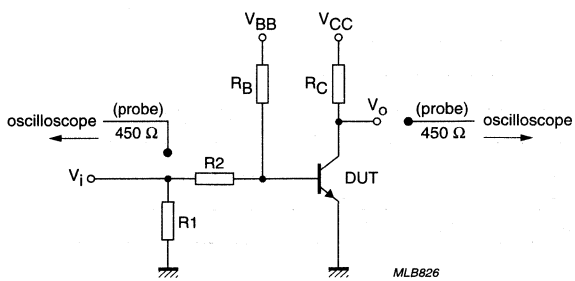
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = −1.9 V; V_{CC} = 3 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PMBT3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complement: PMBT3904.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT3906	*2A

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

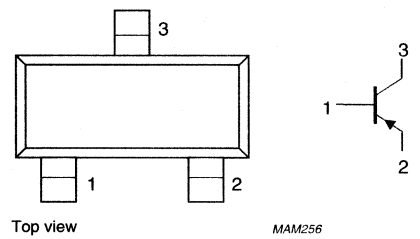


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

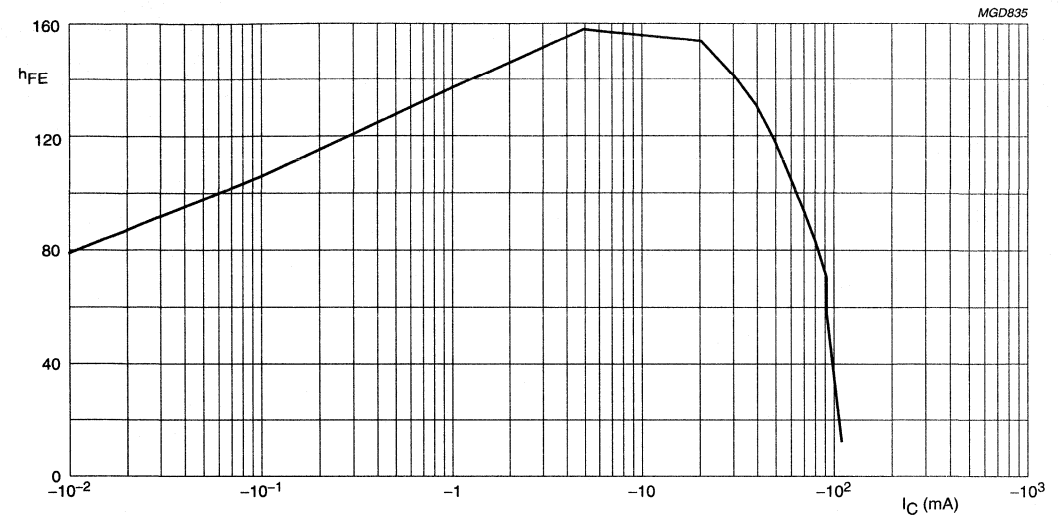
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

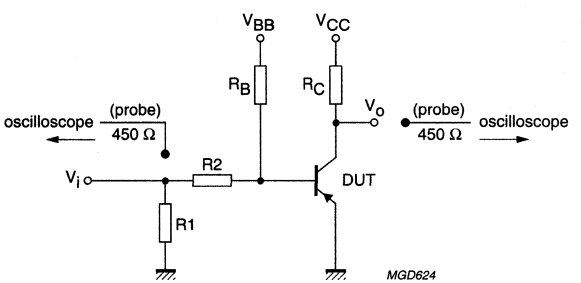
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −6 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)			
		I_C = −0.1 mA	60	–	
		I_C = −1 mA	80	–	
		I_C = −10 mA	100	300	
		I_C = −50 mA	60	–	
		I_C = −100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−200	mV
		I_C = −50 mA; I_B = −5 mA	–	−200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−850	mV
		I_C = −50 mA; I_B = −5 mA	–	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.



$V_i = 5$ V; T = 500 µs; $t_p = 10$ µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; $R_B = 3.9$ kΩ; $R_C = 270$ Ω.
$V_{BB} = 1.9$ V; $V_{CC} = -3$ V.
Oscilloscope: input impedance $Z_i = 50$ Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor PMBT4401

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Industrial and consumer switching applications.

DESCRIPTION

NPN switching transistor in a SOT23 plastic package.
PNP complement: PMBT4403.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT4401	*2X

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

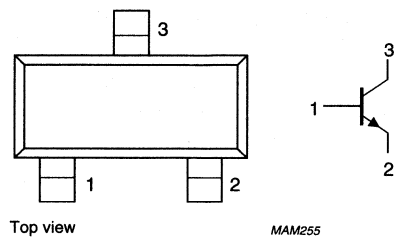


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; (see Fig.2)			
		I_C = 0.1 mA	20	–	
		I_C = 1 mA	40	–	
		I_C = 10 mA	80	–	
		I_C = 150 mA; note 1	100	300	
		I_C = 500 mA; V_{CE} = 2 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	950	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	250	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

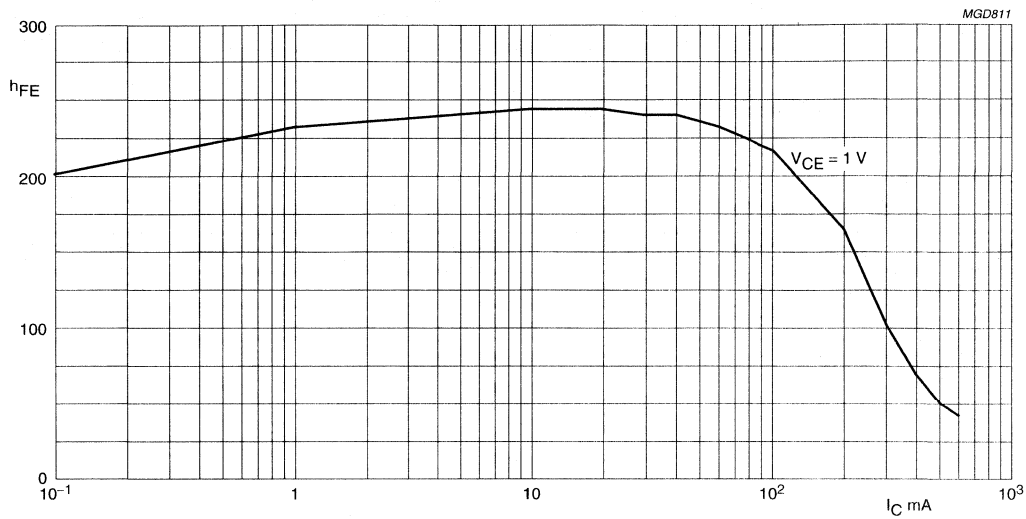
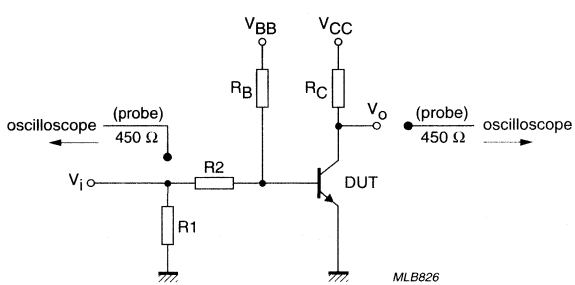


Fig.2 DC current gain; typical values.



V_i = 9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PMBT4403

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Industrial and consumer switching applications.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complement: PMBT4401.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT4403	*2T

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

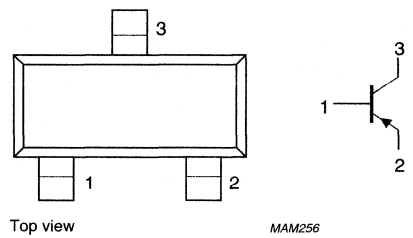


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −40 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)			
		I_C = −0.1 mA	30	–	
		I_C = −1 mA	60	–	
		I_C = −10 mA	100	–	
		V_{CE} = −2 V			
		I_C = −150 mA	100	300	
		I_C = −500 mA	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−400	mV
		I_C = −500 mA; I_B = −50 mA	–	−750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−950	mV
		I_C = −500 mA; I_B = −50 mA	–	−1.3	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	35	pF
f_T	transition frequency	I_C = −20 mA; V_{CE} = −10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	15	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	350	ns
t_s	storage time		–	300	ns
t_f	fall time		–	50	ns

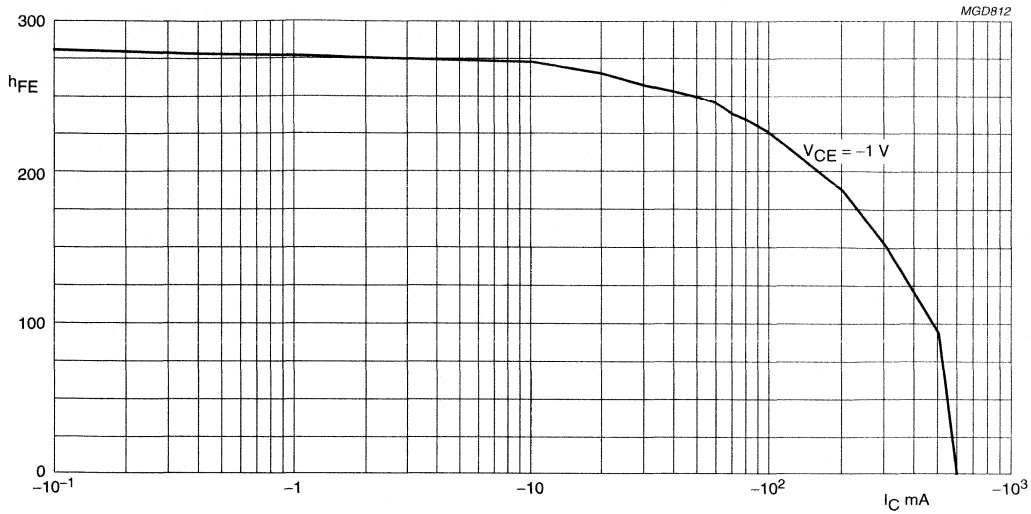
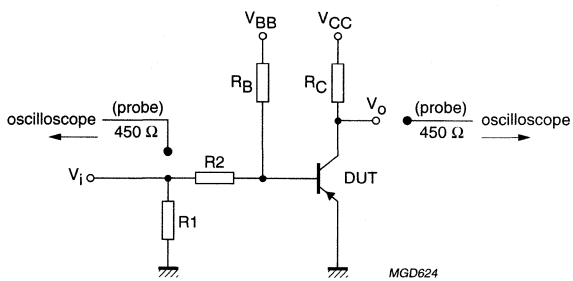


Fig.2 DC current gain; typical values.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; t_r = t_f ≤ 3 ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN general purpose transistor PMBT5088

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- Intended for low-noise input stages in audio equipment.

DESCRIPTION

NPN transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT5088	*1Q

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

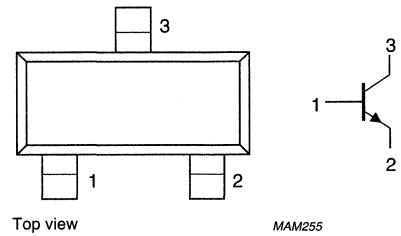


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	35	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 3 V	–	50	nA
h_{FE}	DC current gain	I_C = 100 μA; V_{CE} = 5 V	300	900	
		I_C = 1 mA; V_{CE} = 5 V	350	–	
		I_C = 10 mA; V_{CE} = 5 V	300	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	800	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	10	pF
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	3	dB

PNP high-voltage transistor PMBT5401

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 150 V).

APPLICATIONS

- Switching and amplification in high voltage applications such as telephony.

DESCRIPTION

PNP high-voltage transistor in a SOT23 plastic package.
NPN complement: PMBT5550.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT5401	*2L

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

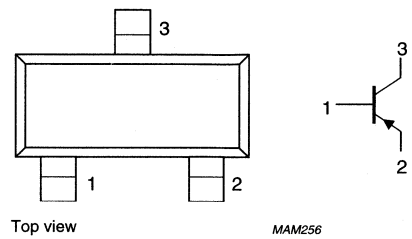


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–160	V
V_{CEO}	collector-emitter voltage	open base	–	–150	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–300	mA
I_{CM}	peak collector current		–	–600	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −120 V	–	−50	nA
		I_E = 0; V_{CB} = −120 V; T_{amb} = 150 °C	–	−50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −5 V; (see Fig.2)			
		I_C = −1 mA	50	–	
		I_C = −10 mA	60	240	
		I_C = −50 mA	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−200	mV
		I_C = −50 mA; I_B = −5 mA	–	−500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−1	V
		I_C = −50 mA; I_B = −5 mA	–	−1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz; T_{amb} = 25 °C	100	300	MHz
F	noise figure	I_C = −200 µA; V_{CE} = −5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz; T_{amb} = 25 °C	–	8	dB

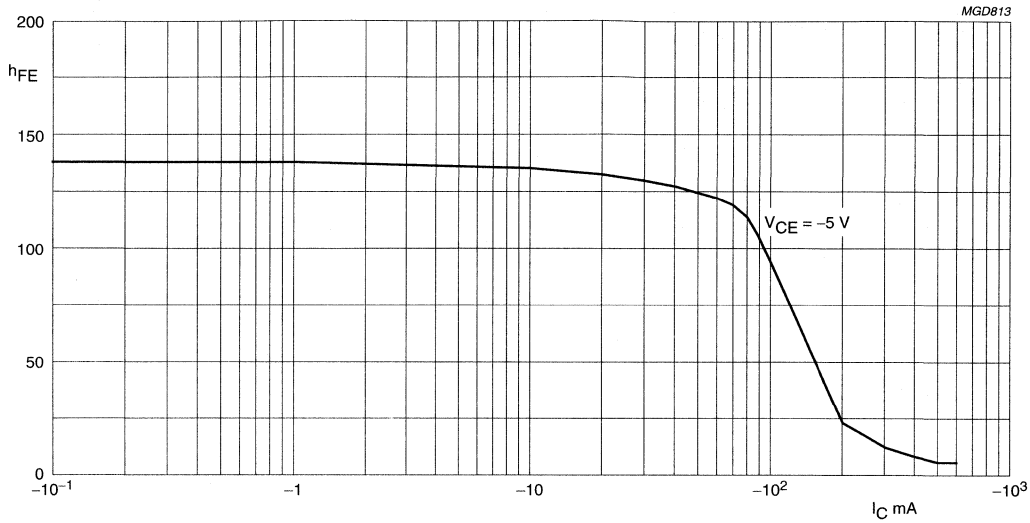


Fig.2 DC current gain; typical values.

NPN high-voltage transistor PMBT5550

FEATURES

- Low current (max. 300 mA)
- Low voltage (max. 140 V).

APPLICATIONS

- Telephony.

DESCRIPTION

NPN high-voltage transistor in a SOT23 plastic package.
PNP complement: PMBT5401.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT5550	*1F

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

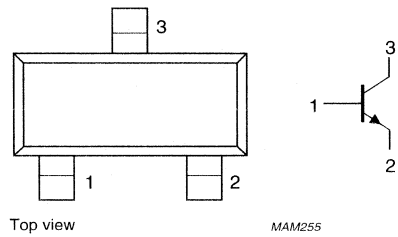


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	160	V
V_{CEO}	collector-emitter voltage	open base	–	140	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 100 V	–	50	nA
		I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 5 V; (see Fig.2)			
		I_C = 1 mA	60	–	
		I_C = 10 mA	60	250	
		I_C = 50 mA	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	150	mV
		I_C = 50 mA; I_B = 5 mA	–	250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	1	V
		I_C = 50 mA; I_B = 5 mA	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	10	dB

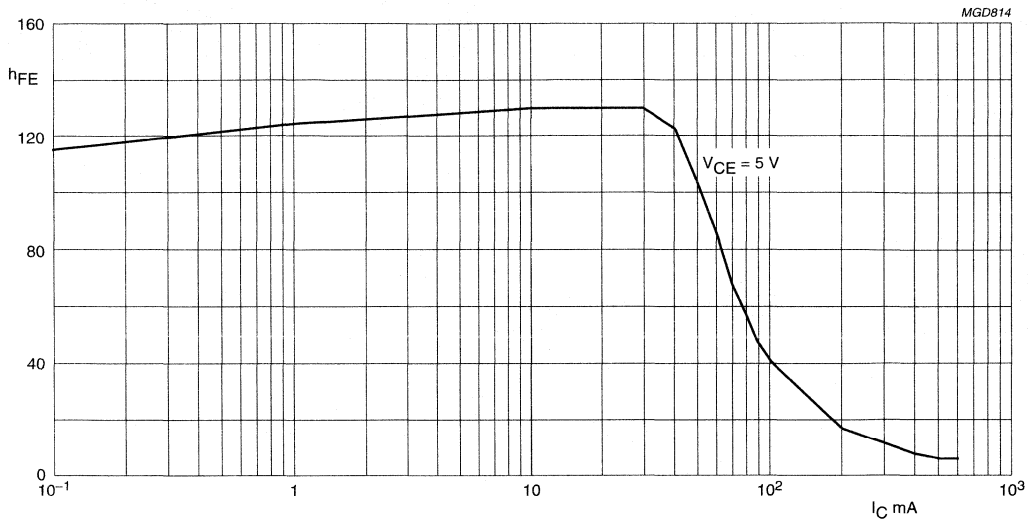


Fig.2 DC current gain; typical values.

NPN high-voltage transistor PMBT5551

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 160 V).

APPLICATIONS

- General purpose
- Telephony.

DESCRIPTION

NPN high-voltage transistor in a SOT23 plastic package.
PNP complement: PMBT5401.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT5551	*G1

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

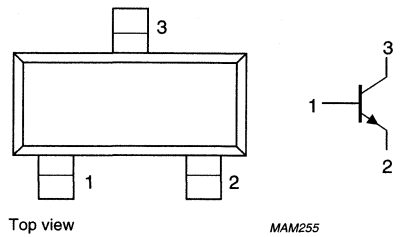


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	180	V
V_{CEO}	collector-emitter voltage	open base	–	160	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 120 V	–	50	nA
		I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 5 V; (see Fig.2)			
		I_C = 1 mA	80	–	
		I_C = 10 mA	80	250	
		I_C = 50 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	150	mV
		I_C = 50 mA; I_B = 5 mA	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	1	V
		I_C = 50 mA; I_B = 5 mA	–	1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 10 Hz to 15.7 kHz	–	8	dB

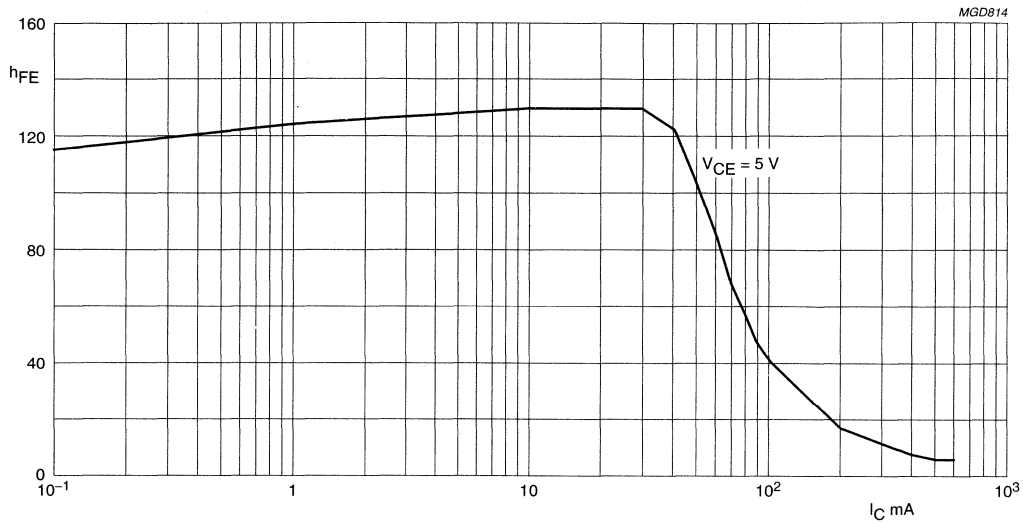


Fig.2 DC current gain; typical values.

NPN general purpose transistors PMBT6428; PMBT6429

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification
- Telephony and professional communication equipment.

DESCRIPTION

NPN transistor in a SOT23 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBT6428	*1K
PMBT6429	*1L

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

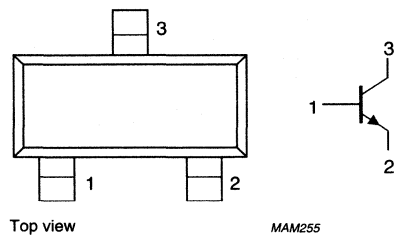


Fig.1 Simplified outline SOT23 and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMBT6428		–	60	V
	PMBT6429		–	55	V
V_{CEO}	collector-emitter voltage	open base			
	PMBT6428		–	50	V
	PMBT6429		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	10	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 5 V			
	PMBT6428		250	650	
	PMBT6429		500	1250	
	DC current gain	I_C = 1 mA; V_{CE} = 5 V			
	PMBT6428		250	–	
	PMBT6429		500	–	
	DC current gain	I_C = 10 mA; V_{CE} = 5 V			
	PMBT6428		250	–	
	PMBT6429		500	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	200	mV
		I_C = 100 mA; I_B = 5 mA	–	600	mV
V_{BE}	base-emitter voltage	I_C = 1 mA; V_{CE} = 5 V	560	660	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	3	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	12	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 5 V; f = 100 MHz	100	700	MHz

NPN general purpose transistor PMBTA06

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose switching and amplification in e.g. telephony and professional communication equipment.

DESCRIPTION

NPN transistor in a SOT23 plastic package.
PNP complement: PMBTA56.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA06	*1G

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

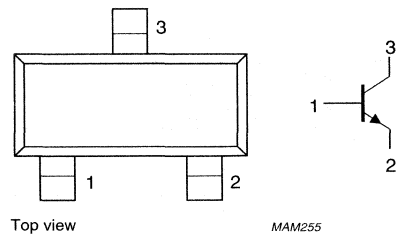


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	80	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 80 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	100	–	
		I_C = 100 mA; V_{CE} = 1 V	100	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	0.25	V
V_{BE}	base-emitter voltage	I_C = 100 mA; V_{CE} = 1 V	–	1.2	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 2 V; f = 100 MHz	100	–	MHz

NPN Darlington transistors PMBTA13; PMBTA14

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- High DC current gain (min. 10000).

APPLICATIONS

- High input impedance preamplifiers.

DESCRIPTION

NPN Darlington transistor in a SOT23 plastic package.
PNP complement: PMBTA64.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA13	*1M
PMBTA14	*1N

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

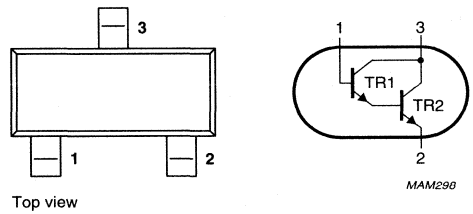


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V; (see Fig.2)			
	PMBTA13		5000	–	
	PMBTA14		10000	–	
	DC current gain	I_C = 100 mA; V_{CE} = 5 V; (see Fig.2)			
	PMBTA13		10000	–	
	PMBTA14		20000	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 100 mA; V_{CE} = 5 V	–	1.4	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	125	–	MHz

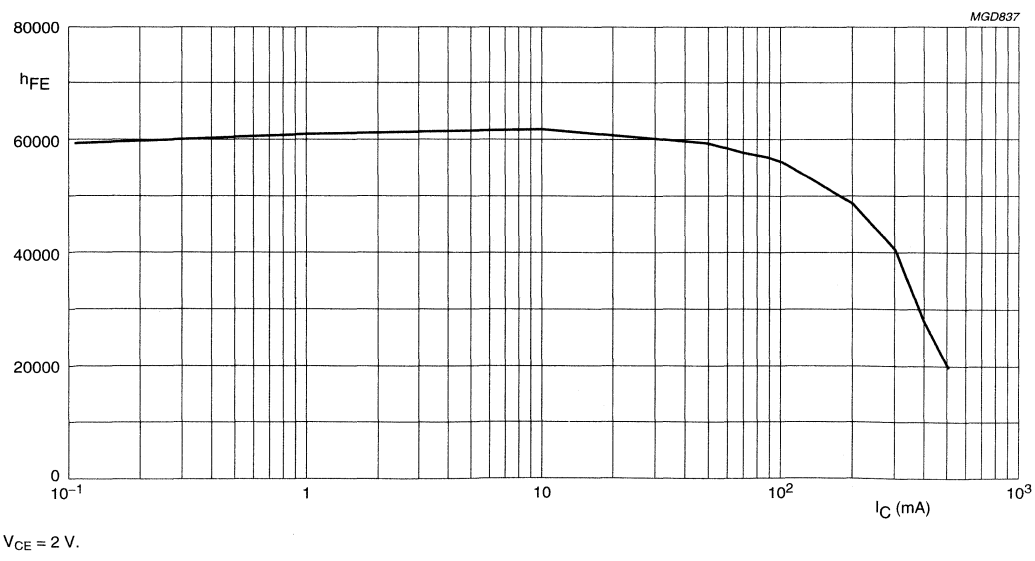


Fig.2 DC current gain; typical values.

NPN high-voltage transistor PMBTA42

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a SOT23 plastic package.
PNP complement: PMBTA92.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA42	*1D

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

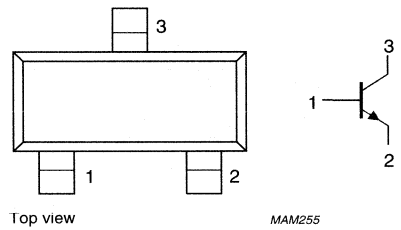


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	300	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V			
		I_C = 1 mA	25	–	
		I_C = 10 mA	40	–	
		I_C = 30 mA	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	900	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 20 V; f = 1 MHz	–	3	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	50	–	MHz

PNP general purpose transistor PMBTA56

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- General purpose switching and amplification, e.g. telephony and professional communication equipment.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complement: PMBTA06.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA56	*2G

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

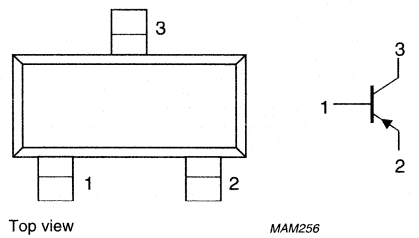


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–80	V
V_{CEO}	collector-emitter voltage	open base	–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −80 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −1 V	100	–	
		I_C = −100 mA; V_{CE} = −1 V	100	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −10 mA	–	−250	mV
V_{BE}	base-emitter voltage	I_C = −100 mA; V_{CE} = −1 V	–	−1.2	V
f_T	transition frequency	I_C = −100 mA; V_{CE} = −1 V; f = 100 MHz	50	–	MHz

PNP Darlington transistor PMBTA64

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V)
- High DC current gain (min. 10000).

APPLICATIONS

- High input impedance preamplifiers.

DESCRIPTION

PNP Darlington transistor in a SOT23 plastic package.
NPN complement: PMBTA14.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA64	*2V

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

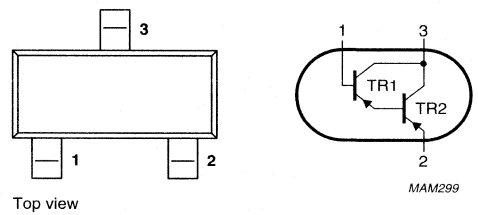


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–30	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–10	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–800	mA
I_B	base current (DC)		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −10 V;	−	−100	nA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −5 V; (see Fig.2)	10000	−	
		I_C = −100 mA; V_{CE} = −5 V; (see Fig.2)	20000	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −0.1 mA	−	−1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = −100 mA; V_{CE} = −5 V	−	−2	V
f_T	transition frequency	I_C = −10 mA; V_{CE} = −50 V; f = 100 MHz	125	−	MHz

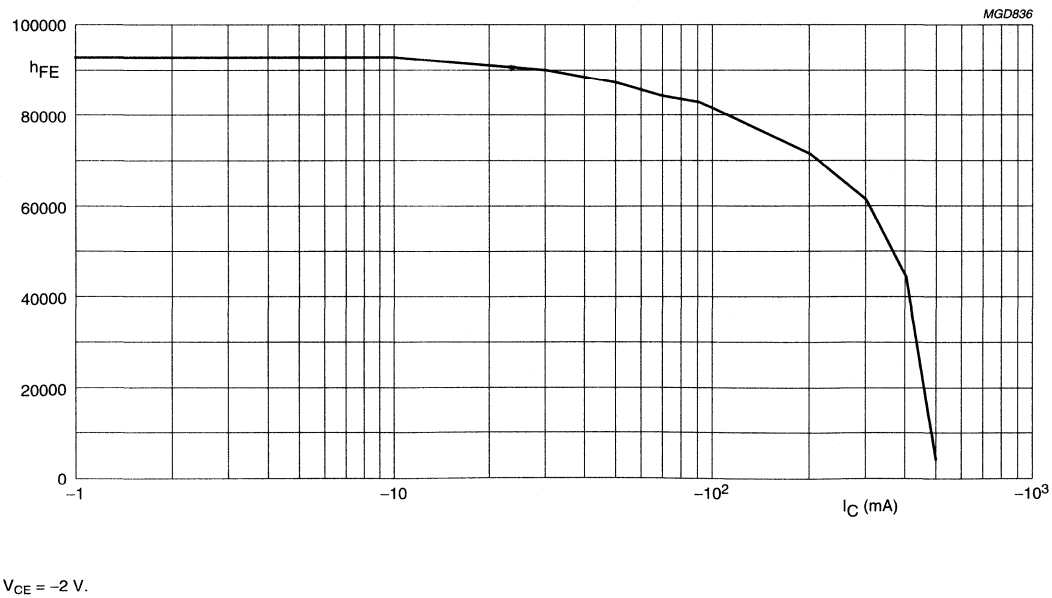


Fig.2 DC gain current; typical values.

PNP high-voltage transistor PMBTA92

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony
- Professional communication equipment.

DESCRIPTION

PNP high-voltage transistor in a SOT23 plastic package.
NPN complement: PMBTA42.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMBTA92	*2D

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

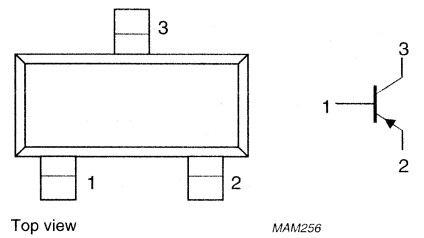


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–300	V
V_{CEO}	collector-emitter voltage	open base	–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −200 V	−	−250	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −3 V	−	−100	nA
h_{FE}	DC current gain	V_{CE} = −10 V; note 1			
		I_C = −1 mA;	25	−	
		I_C = −10 mA	40	−	
		I_C = −30 mA	25	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −20 mA; I_B = −2 mA	−	−500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −20 mA; I_B = −2 mA	−	−900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −20 V; f = 1 MHz	−	6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	50	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN BISS transistor | PMMT491A

FEATURES

- High current (max. 1 A)
- Low collector-emitter saturation voltage ensures reduced power consumption.

APPLICATIONS

- Battery powered units where high current and low power consumption are important.

DESCRIPTION

NPN BISS (Breakthrough In Small Signal) transistor in a SOT23 plastic package. PNP complement: PMMT591A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMMT491A	9A*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

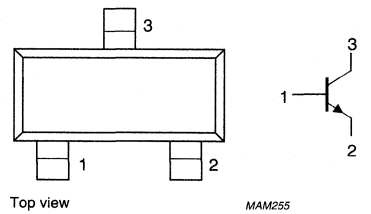


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	2	A
I_{BM}	peak base current		–	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 5 V; note 1			
		I_C = 1 mA	300	–	
		I_C = 500 mA	300	900	
		I_C = 1 A	200	–	
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = 100 mA; I_B = 1 mA	–	200	mV
		I_C = 500 mA; I_B = 50 mA	–	300	mV
		I_C = 1 A; I_B = 100 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 100 mA; note 1	–	1.2	V
V_{BE}	base-emitter voltage	V_{CE} = 5 V; I_C = 1 A; note 1	–	1.1	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	150	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP BISS transistor | PMMT591A

FEATURES

- High current (max. 1 A)
- Low collector-emitter saturation voltage ensures reduced power consumption.

APPLICATIONS

- Battery powered units where high current and low power consumption are important.

DESCRIPTION

PNP BISS (Breakthrough In Small Signal) transistor in a SOT23 plastic package. NPN complement: PMMT491A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMMT591A	9B*

Note

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

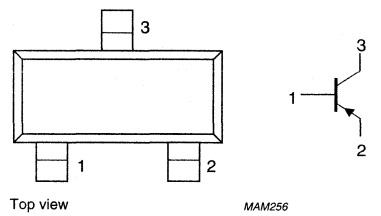


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–1	A
I_{CM}	peak collector current		–	–2	A
I_{BM}	peak base current		–	–1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = −30 V	−	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	−	−100	nA
h_{FE}	DC current gain	V_{CE} = −5 V; note 1			
		I_C = −1 mA	300	−	
		I_C = −100 mA	300	800	
		I_C = −500 mA	250	−	
		I_C = −1 A	160	−	
V_{CEsat}	collector-emitter saturation voltage	note 1			
		I_C = −100 mA; I_B = −1 mA	−	−200	mV
		I_C = −500 mA; I_B = −20 mA	−	−350	mV
		I_C = −1 A; I_B = −100 mA	−	−500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −1 A; I_B = −50 mA; note 1	−	−1.1	V
V_{BE}	base-emitter voltage	V_{CE} = −5 V; I_C = −1 A; note 1	−	−1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	−	12	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 100 MHz	150	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN switching transistor PMSS3904

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and amplification
- Telephony and professional communication equipment.

DESCRIPTION

NPN switching transistor in an SC-70 (SOT323) plastic package. PNP complement: PMSS3906.

MARKING CODE

TYPE NUMBER	MARKING CODE(1)
PMSS3904	*04

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

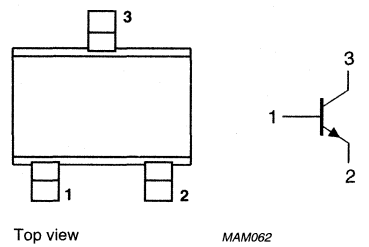


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; see Fig.2			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA; note 1	60	–	
		I_C = 100 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	650	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	12	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	180	–	MHz
F	noise figure	I_C = 100 µA; V_{CE} = 5 V; R_S = 1 kΩ f = 10 Hz to 15.7 KHz	–	5	dB
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = − 1 mA; V_{CC} = 3 V; V_{BB} = −1.9 V	–	110	ns
t_d	delay time		–	50	ns
t_r	rise time		–	60	ns
t_{off}	turn-off time		–	1200	ns
t_s	storage time		–	1000	ns
t_f	fall time		–	200	ns

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

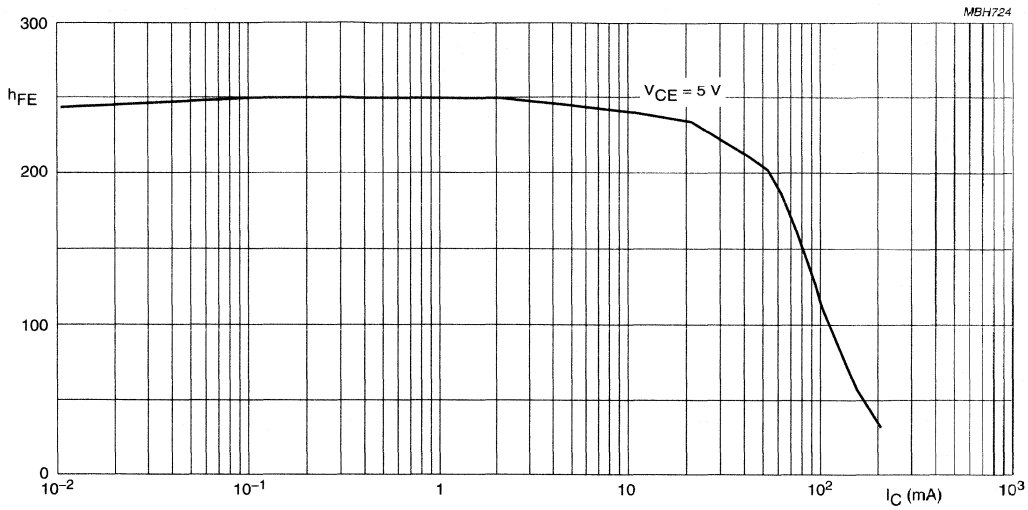
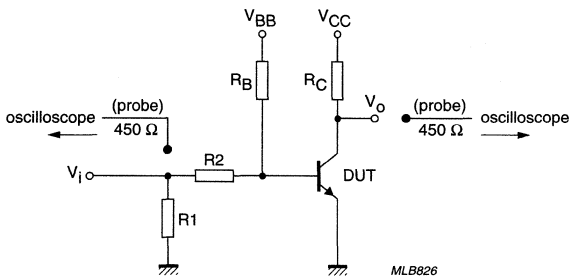


Fig.2 DC gain current; typical values.



V_i = 5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PMSS3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching in e.g. telephony and professional communication equipment.

DESCRIPTION

PNP switching transistor in an SC-70; SOT323 plastic package. NPN complement: PMSS3904.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMSS3906	*06

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

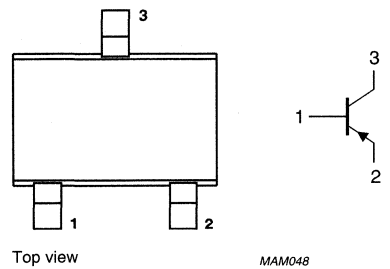


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

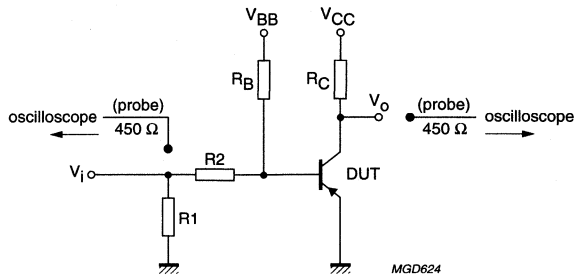
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–50	nA
		I_E = 0; V_{CB} = –30 V; T_j = 150 °C	–	–10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V			
		I_C = –0.1 mA	60	–	
		I_C = –1 mA	80	–	
		I_C = –10 mA	100	300	
		I_C = –50 mA; note 1	60	–	
		I_C = –100 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–	–250	mV
		I_C = –50 mA; I_B = –5 mA; note 1	–	–400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–	–850	mV
		I_C = –50 mA; I_B = –5 mA; note 1	–	–950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	14	pF
f_T	transition frequency	I_E = –10 mA; V_{CB} = –20 V; f = 100 MHz	150	–	MHz
F	noise figure	I_C = –100 µA; V_{CE} = –5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = –10 mA; I_{Bon} = –1 mA; I_{Boff} = 1 mA	–	100	ns
t_d	delay time		–	50	ns
t_r	rise time		–	50	ns
t_{off}	turn-off time		–	700	ns
t_s	storage time		–	600	ns
t_f	fall time		–	100	ns

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



V_i = –5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistors PMST2222; PMST2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed switching and linear amplification.

DESCRIPTION

NPN switching transistor in a SOT323 plastic package.
PNP complement: PMST2907A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST2222	*1B
PMST2222A	*1P

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

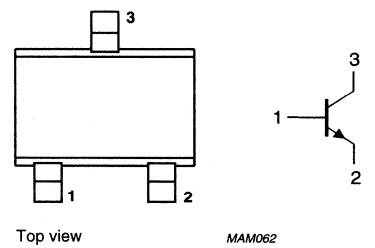


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMST2222		–	60	V
	PMST2222A		–	75	V
V_{CEO}	collector-emitter voltage	open base			
	PMST2222		–	30	V
	PMST2222A		–	40	V
V_{EBO}	emitter-base voltage	open collector			
	PMST2222		–	5	V
	PMST2222A		–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

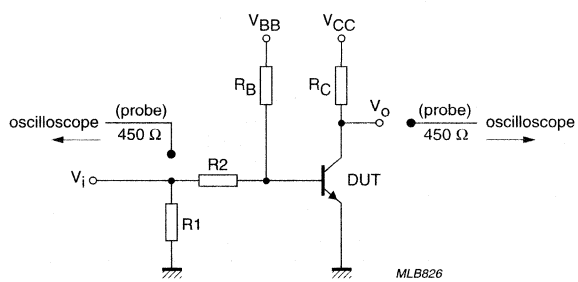
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	10	nA
	PMST2222	I_E = 0; V_{CB} = 50 V; T_j = 125 °C	–	10	μA
	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
	PMST2222A	I_E = 0; V_{CB} = 60 V; T_j = 125 °C	–	10	μA
I_{EBO}	collector cut-off current	I_C = 0; V_{EB} = 3 V	–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V	35	–	
		I_C = 1 mA; V_{CE} = 10 V	50	–	
		I_C = 10 mA; V_{CE} = 10 V	75	–	
		I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	35	–	
		I_C = 150 mA; V_{CE} = 1 V; note 1	50	–	
		I_C = 150 mA; V_{CE} = 10 V; note 1	100	300	
	DC current gain	I_C = 500 mA; V_{CE} = 10 V; note 1			
	PMST2222		30	–	
	PMST2222A		40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
	PMST2222	I_C = 500 mA; I_B = 50 mA; note 1	–	1.6	V
	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	300	mV
	PMST2222A	I_C = 500 mA; I_B = 50 mA; note 1	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	1.3	V
	PMST2222	I_C = 500 mA; I_B = 50 mA; note 1	–	2.6	V
	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	0.6	1.2	V
	PMST2222A	I_C = 500 mA; I_B = 50 mA; note 1	–	2	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz			
	PMST2222		–	30	pF
	PMST2222A		–	25	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz			
	PMST2222		250	–	MHz
	PMST2222A		300	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
F	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PMST2369

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- High-speed switching applications, primarily in portable and consumer equipment.

DESCRIPTION

NPN switching transistor in a SOT323 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST2369	*1J

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

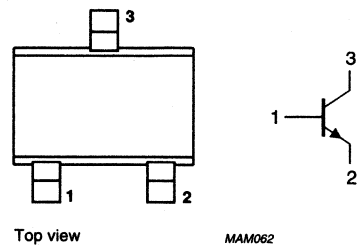


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current	$t_p \leq 10$ μs	–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

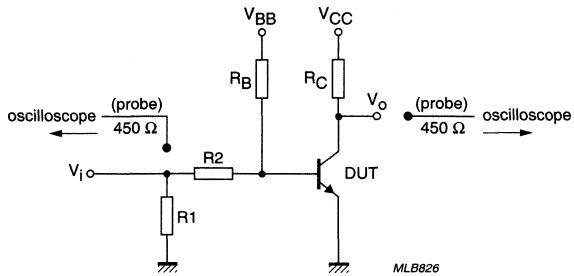
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_j = 125 °C	–	30	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 1 V	40	120	
		I_C = 10 mA; V_{CE} = 1 V; T_{amb} = −55 °C	20	–	
		I_C = 100 mA; V_{CE} = 2 V; note 1	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	700	850	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	500	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = −1.5 mA	–	10	ns
t_d	delay time		–	4	ns
t_r	rise time		–	6	ns
t_{off}	turn-off time		–	20	ns
t_s	storage time		–	10	ns
t_f	fall time		–	10	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = 0.5 V to 4.2 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 1$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor PMST2907A

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Medium power switching
- General purpose amplification.

DESCRIPTION

PNP switching transistor in an SC-70; SOT323 plastic package. NPN complement: PMST2222A.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST2907A	*2F

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

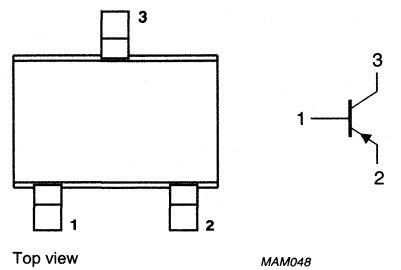


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–200	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

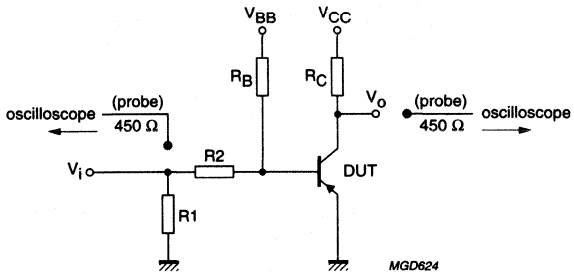
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –50 V	–	–10	nA
		I_E = 0; V_{CB} = –50 V; T_j = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –3 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –10 V			
		I_C = –0.1 mA	75	–	
		I_C = –1 mA	100	–	
		I_C = –10 mA; note 1	100	–	
		I_C = –150 mA; note 1	100	300	
		I_C = –500 mA; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–400	mV
		I_C = –500 mA; I_B = –50 mA; note 1	–	–1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–1.3	V
		I_C = –500 mA; I_B = –50 mA; note 1	–	–2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –2 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = –50 mA; V_{CE} = –20 V; f = 100 MHz; note 1	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	45	ns
t_d	delay time		–	15	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	250	ns
t_f	fall time		–	50	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PMST3904

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Telephony
- Professional communication equipment.

DESCRIPTION

NPN switching transistor in a SOT323 plastic package.
PNP complement: PMST3906.

MARKING

TYPE NUMBER	MARKING CODE[1]
PMST3904	*1A

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

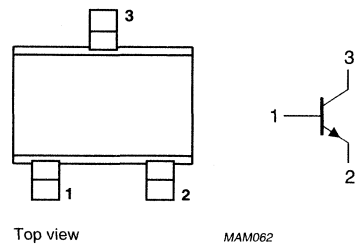


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

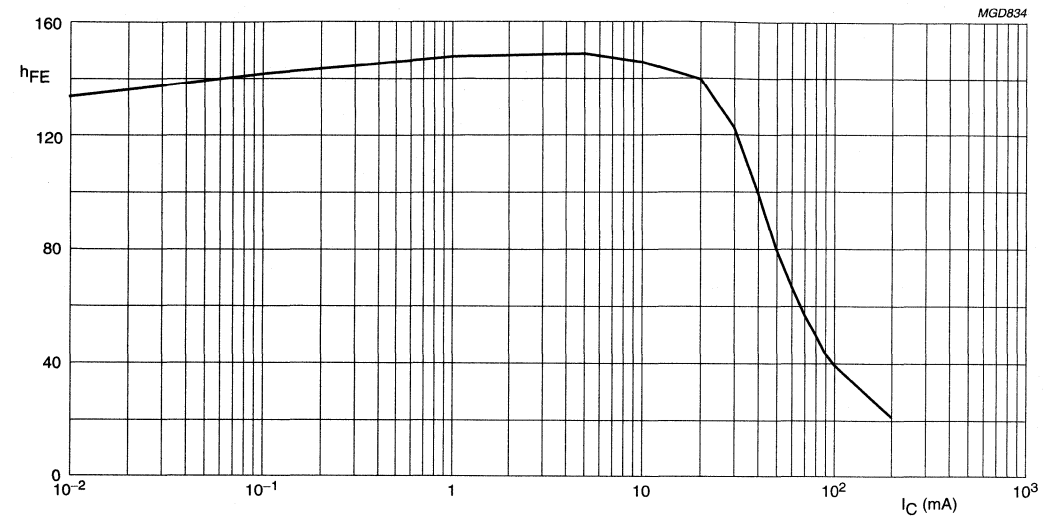
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; see Fig.2			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA; note 1	60	–	
		I_C = 100 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	650	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 µA; V_{CE} = 5 V; R_S = 1 kΩ f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns

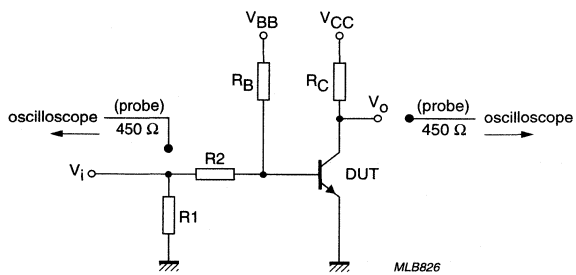
Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = −1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PMST3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching in telephony and professional communication equipment.

DESCRIPTION

PNP switching transistor in a SOT323 plastic package.
NPN complement: PMST3904.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST3906	*2A

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

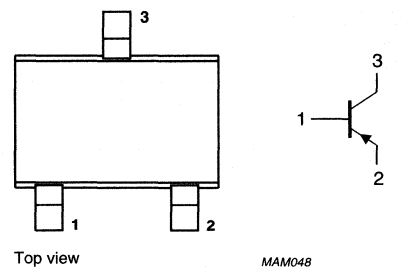


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

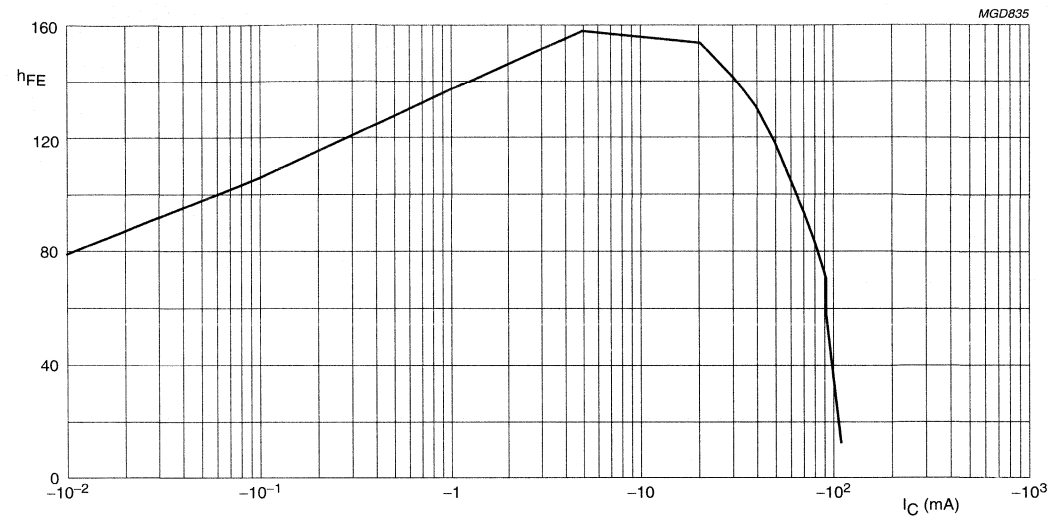
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	−50	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −6 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)			
		I_C = −0.1 mA	60	–	
		I_C = −1 mA	80	–	
		I_C = −10 mA	100	300	
		I_C = −50 mA; note 1	60	–	
		I_C = −100 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	–	−200	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA; note 1	–	−850	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns

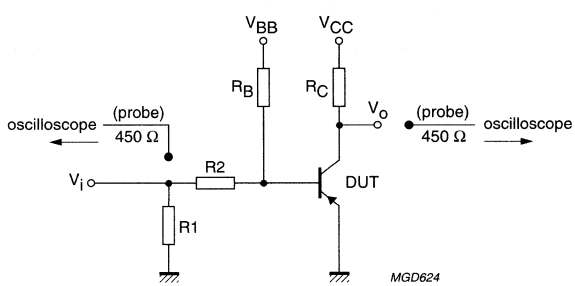
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



$V_{CE} = -1$ V

Fig.2 DC current gain; typical values.



$V_i = -5$ V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; $V_{CC} = -3$ V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor PMST4401

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and linear amplification, especially in portable equipment.

DESCRIPTION

NPN switching transistor in a SOT323 plastic package.
PNP complement: PMST4403.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST4401	*2X

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

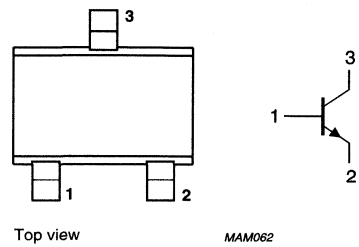


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	50	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; (see Fig.2)			
		I_C = 0.1 mA	20	–	
		I_C = 1 mA	40	–	
		I_C = 10 mA	80	–	
		I_C = 150 mA; note 1	100	300	
	DC current gain	I_C = 500 mA; V_{CE} = 2 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	950	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_E = i_e$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	250	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

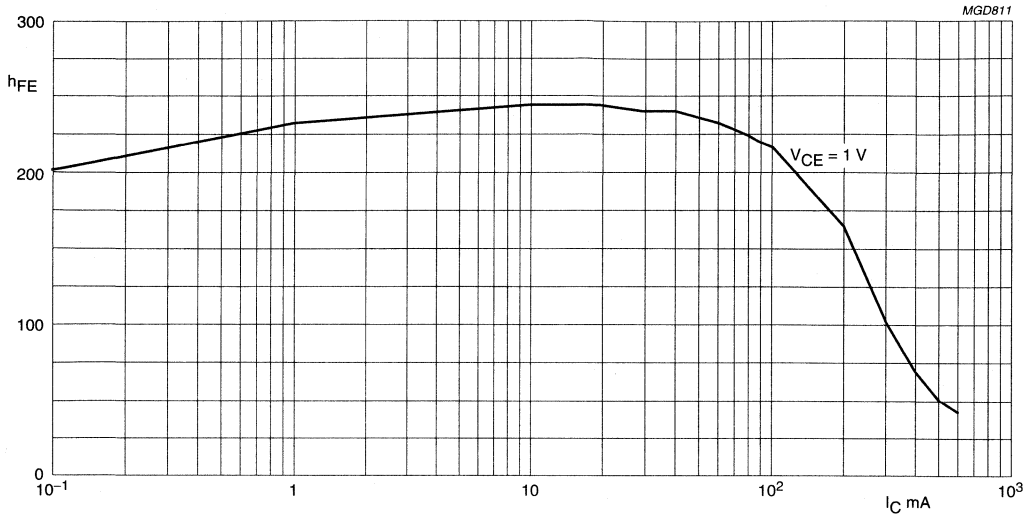
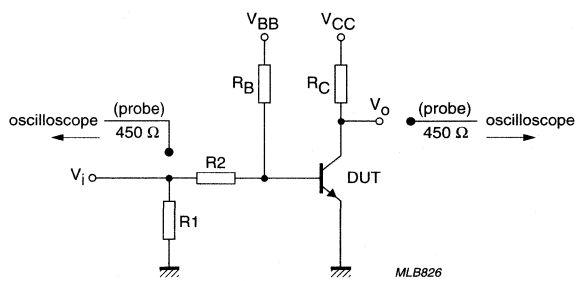


Fig.2 DC current gain; typical values.



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; t_r = t_f ≤ 3 ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PMST4403

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT323 plastic package.
NPN complement: PMST4401.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST4403	*2T

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

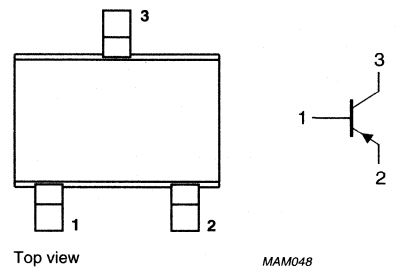


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −40 V	–	−50	nA
		I_E = 0; V_{CB} = −40 V; T_j = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)	–	–	
		I_C = −0.1 mA	30	–	
		I_C = −1 mA	60	–	
		I_C = −10 mA	100	–	
	DC current gain	I_C = −150 mA; V_{CE} = −2 V; note 1	100	300	
		I_C = −500 mA; V_{CE} = −2 V; note 1	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	–	−400	mV
		I_C = −500 mA; I_B = −50 mA; note 1	–	−750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA: I_B = −15 mA; note 1	+750	−950	mV
		I_C = −500 mA; I_B = −50 mA; note 1	–	−1.3	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	35	pF
f_T	transition frequency	I_C = −20 mA; V_{CE} = −10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	15	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	350	ns
t_s	storage time		–	300	ns
t_f	fall time		–	50	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

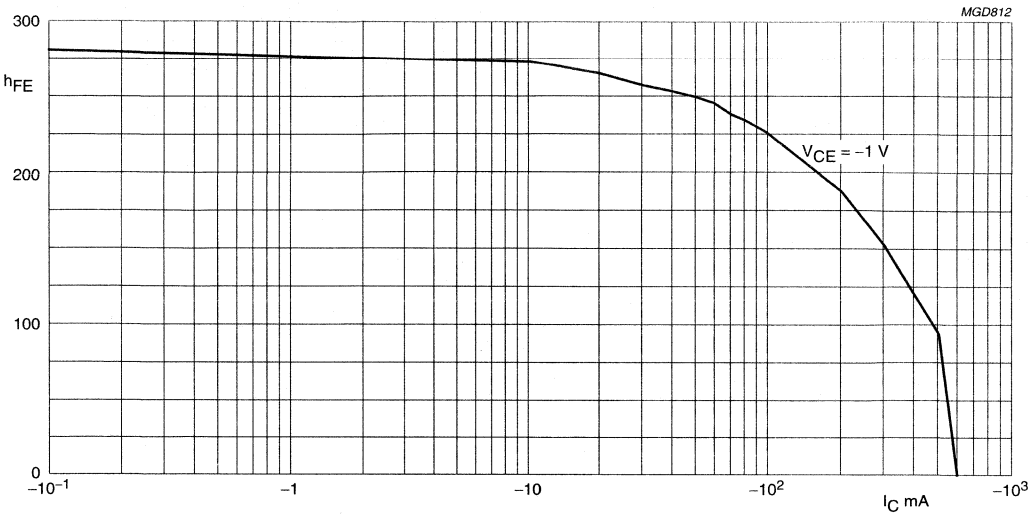
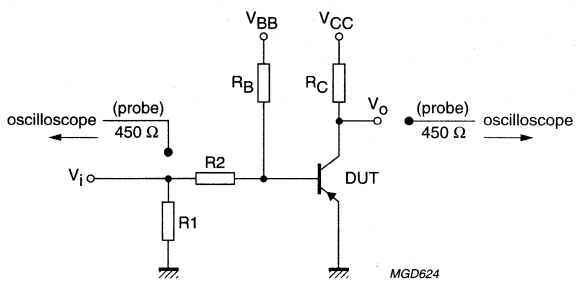


Fig.2 DC current gain; typical values.



V_i = –9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = –29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN general purpose transistors PMST5088; PMST5089

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- Low-noise input stages in audio equipment.

DESCRIPTION

NPN transistor in a SC-70; SOT323 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST5088	*1Q
PMST5089	*1R

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

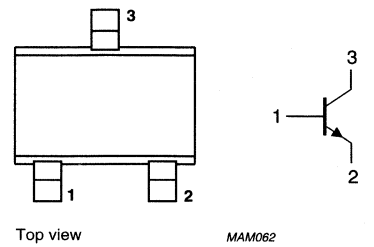


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMST5088		–	35	V
	PMST5089		–	30	V
V_{CEO}	collector-emitter voltage	open base			
	PMST5088		–	30	V
	PMST5089		–	25	V
V_{EBO}	emitter-base voltage	open collector	–	4.5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	50	nA
		I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 3 V	–	50	nA
		I_C = 0; V_{EB} = 4.5 V	–	100	nA
h_{FE}	DC current gain PMST5088	V_{CE} = 5 V			
		I_C = 0.1 mA	300	900	
		I_C = 1 mA	350	–	
		I_C = 10 mA	300	–	
	DC current gain PMST5089	V_{CE} = 5 V			
		I_C = 0.1 mA	400	1200	
		I_C = 1 mA	450	–	
		I_C = 10 mA	400	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	500	mV
V_{BE}	base-emitter voltage	I_C = 10 mA; V_{CE} = 5 V	–	800	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz	–	12	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ f = 10 Hz to 15.7 kHz			
	PMST5088		–	3	dB
	PMST5089		–	2	dB

PNP high-voltage transistor PMST5401

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 150 V).

APPLICATIONS

- General purpose
- Telephony.

DESCRIPTION

PNP high-voltage transistor in a SOT323 plastic package.
NPN complements: PMST5550 and PMST5551.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST5401	*2L

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

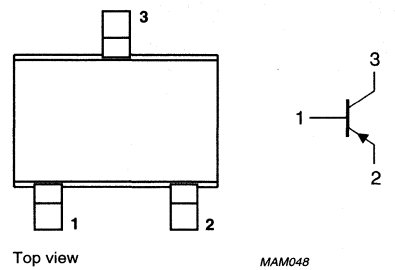


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−160	V
V_{CEO}	collector-emitter voltage	open base	–	−150	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−300	mA
I_{CM}	peak collector current		–	−600	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −120 V	–	−50	nA
		I_E = 0; V_{CB} = −120 V; T_j = 150 °C	–	−50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	–	−50	nA
h_{FE}	DC current gain	V_{CE} = −5 V; (see Fig.2)			
		I_C = −1 mA	50	–	
		I_C = −10 mA	60	240	
		I_C = −50 mA; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−200	mV
		I_C = −50 mA; I_B = −5 mA; note 1	–	−500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	–	−1	V
		I_C = −50 mA; I_B = −5 mA	–	−1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = −200 µA; V_{CE} = −5 V; R_S = 2 kΩ f = 10 Hz to 15.7 kHz	–	8	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

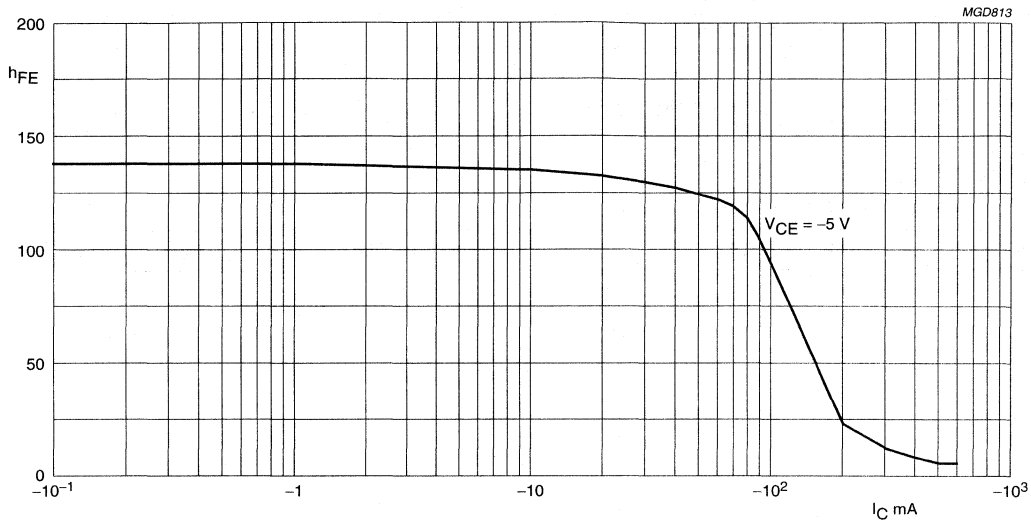


Fig.2 DC current gain; typical values.

NPN high-voltage transistors PMST5550; PMST5551

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 160 V).

APPLICATIONS

- Switching and amplification in high voltage applications such as telephony.

DESCRIPTION

NPN high-voltage transistor in a SOT323 plastic package.
PNP complement: PMST5401.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST5550	*1F
PMST5551	*G3

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

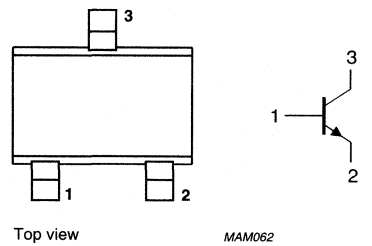


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMST5550		–	160	V
	PMST5551		–	180	V
V_{CEO}	collector-emitter voltage	open base			
	PMST5550		–	140	V
	PMST5551		–	160	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	600	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 100 V	–	100	nA
	PMST5550	I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	–	100	µA
	collector cut-off current	I_E = 0; V_{CB} = 120 V	–	50	nA
	PMST5551	I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 5 V; (see Fig.2)			
	PMST5550	I_C = 1 mA	60	–	
		I_C = 10 mA	60	250	
		I_C = 50 mA; note 1	20	–	
	DC current gain	V_{CE} = 5 V; (see Fig.2)			
	PMST5551	I_C = 1 mA	80	–	
		I_C = 10 mA	80	250	
		I_C = 50 mA; note 1	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	150	mV
	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1			
	PMST5550		–	250	mV
	PMST5551		–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	1	V
	base-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1			
	PMST5550		–	1.2	V
	PMST5551		–	1	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	100	300	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ;			
	PMST5551	f = 10 Hz to 15.7 kHz	–	8	dB

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

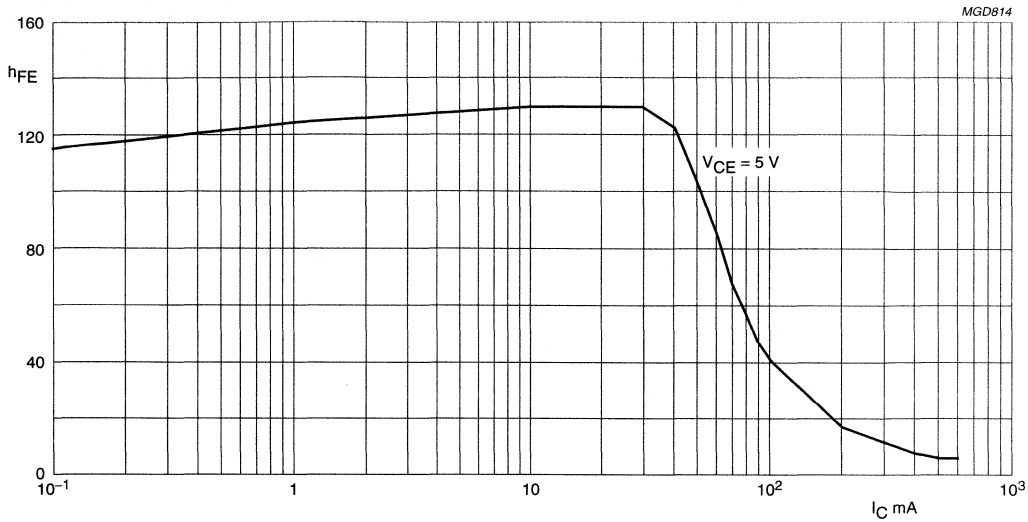


Fig.2 DC current gain; typical values.

NPN general purpose transistors PMST6428; PMST6429

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 50 V).

APPLICATIONS

- General purpose switching and amplification in e.g. telephony and professional communication equipment.

DESCRIPTION

NPN transistor in an SC-70; SOT323 plastic package.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMST6428	*1K
PMST6429	*1L

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

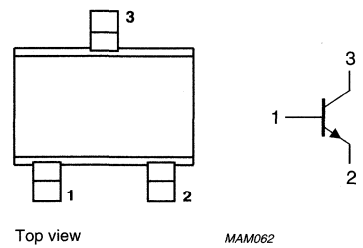


Fig.1 Simplified outline (SC-70; SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMST6428		–	60	V
	PMST6429		–	55	V
V_{CEO}	collector-emitter voltage	open base			
	PMST6428		–	50	V
	PMST6429		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

$T_{amb} \leq 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 30$ V	–	10	nA
		$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	–	10	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	10	nA
h_{FE}	DC current gain PMST6428	$V_{CE} = 5$ V			
		$I_C = 0.01$ mA	250	–	
		$I_C = 0.1$ mA	250	650	
		$I_C = 1$ mA	250	–	
		$I_C = 10$ mA	250	–	
	DC current gain PMST6429	$V_{CE} = 5$ V			
		$I_C = 0.01$ mA	500	–	
		$I_C = 0.1$ mA	500	1250	
		$I_C = 1$ mA	500	–	
		$I_C = 10$ mA	500	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA; note 1	–	200	mV
		$I_C = 100$ mA; $I_B = 5$ mA; note 1	–	600	mV
V_{BE}	base-emitter voltage	$I_C = 1$ mA; $V_{CE} = 5$ V	560	660	mV
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	3	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	12	pF
f_T	transition frequency	$I_C = 1$ mA; $V_{CE} = 5$ V; f = 100 MHz	100	700	MHz

Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

NPN general purpose transistors PMSTA05; PMSTA06

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- Primarily intended for telephony and professional communication equipment.

DESCRIPTION

NPN transistor in a SOT323 plastic package.
PNP complements: PMSTA55 and PMSTA56.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMSTA05	*1H
PMATA06	*1G

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

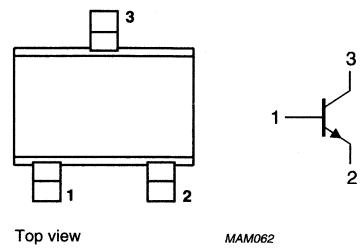


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMSTA05		–	60	V
	PMSTA06		–	80	V
V_{CEO}	collector-emitter voltage	open base			
	PMSTA05		–	60	V
	PMSTA06		–	80	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	500	mA
I_{BM}	peak base current		–	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	PMSTA05	I_E = 0; V_{CB} = 60 V	–	100	nA
	PMSTA06	I_E = 0; V_{CB} = 80 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 3 V	–	500	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 2 V	50	–	
		I_C = 100 mA; V_{CE} = 1 V; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA; note 1	–	250	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA; note 1	–	900	mV
V_{BE}	base-emitter voltage	I_C = 100 mA; V_{CE} = 1 V	–	1.2	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 2 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN high-voltage transistors PMSTA42; PMSTA43

FEATURES

- High current (max. 500 mA)
- High voltage (max. 200 V).

APPLICATIONS

- High-voltage switching in telephony applications.

DESCRIPTION

NPN high-voltage transistor in a SOT323 plastic package.
PNP complements: PMSTA92 and PMSTA93.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMSTA42	*1D
PMSTA43	*1E

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

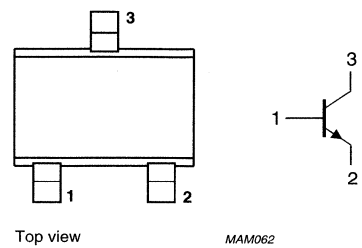


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMSTA42		–	300	V
	PMSTA43		–	200	V
V_{CEO}	collector-emitter voltage	open base			
	PMSTA42		–	300	V
	PMSTA43		–	200	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	PMSTA42	I_E = 0; V_{CB} = 200 V	–	100	nA
	PMSTA43	I_E = 0; V_{CB} = 160 V	–	100	nA
I_{EBO}	emitter cut-off current				
	PMSTA42	I_C = 0; V_{EB} = 6 V	–	100	nA
	PMSTA43	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	25	–	
		I_C = 10 mA; V_{CE} = 10 V	40	–	
		I_C = 30 mA; V_{CE} = 10 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	500	mV
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CB} = 20 V; f = 1 MHz			
	PMSTA42		–	3	pF
	PMSTA43		–	4	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	50	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP general purpose transistors PMSTA55; PMSTA56

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 80 V).

APPLICATIONS

- Intended for telephony and professional communication equipment.

DESCRIPTION

PNP transistor in a SOT323 plastic package.
NPN complements: PMSTA05 and PMSTA06.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMSTA55	*2H
PMATA56	*2G

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

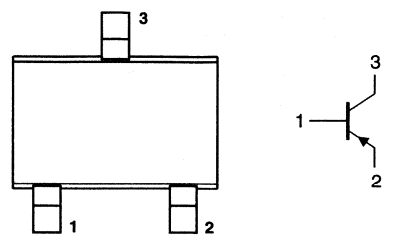


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMSTA55		–	–60	V
	PMSTA56		–	–80	V
V_{CEO}	collector-emitter voltage	open base			
	PMSTA55		–	–60	V
	PMSTA56		–	–80	V
V_{EBO}	emitter-base voltage	open collector	–	–4	V
I_C	collector current (DC)		–	–500	mA
I_{CM}	peak collector current		–	–500	mA
I_{BM}	peak base current		–	–500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	PMSTA55	I_E = 0; V_{CB} = −60 V	−	−100	nA
	PMSTA56	I_E = 0; V_{CB} = −80 V	−	−100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −4 V	−	−500	nA
h_{FE}	DC current gain	I_C = −10 mA; V_{CE} = −1 V	100	−	
		I_C = −100 mA; V_{CE} = −1 V; note 1	100	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −100 mA; I_B = −10 mA	−	−250	mV
V_{BE}	base-emitter voltage	I_C = −100 mA; V_{CE} = −1 V; note 1	−	−1.2	mV
f_T	transition frequency	I_C = −100 mA; V_{CE} = −1 V; f = 100 MHz	50	−	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP high-voltage transistors PMSTA92; PMSTA93

FEATURES

- High voltage.

APPLICATIONS

- High voltage switching in telephony.

DESCRIPTION

PNP transistor in a SOT323 plastic package.
NPN complements: PMSTA42 and PMSTA43.

MARKING

TYPE NUMBER	MARKING CODE(1)
PMSTA92	*2D
PMSTA93	*2E

Note

1. * = - : Made in Hong Kong.
   * = t : Made in Malaysia.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

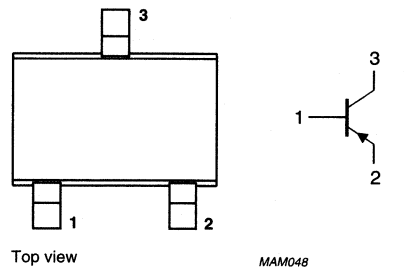


Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	PMSTA92		–	–300	V
	PMSTA93		–	–200	V
V_{CEO}	collector-emitter voltage	open base			
	PMSTA92		–	–300	V
	PMSTA93		–	–200	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	625	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	PMSTA92	I_E = 0; V_{CB} = −200 V	−	−250	nA
	PMSTA93	I_E = 0; V_{CB} = −160 V	−	−250	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −3 V	−	−100	nA
h_{FE}	DC current gain	V_{CE} = −10 V			
		I_C = −1 mA	25	−	
		I_C = −10 mA	40	−	
		I_C = −30 mA	25	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −20 mA; I_B = −2 mA	−	−500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −20 mA; I_B = −2 mA	−	−900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −20 V; f = 1 MHz			
	PMSTA92		−	6	pF
	PMSTA93		−	8	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	50	−	MHz

NPN switching transistor PN2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and linear amplification.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package. PNP complement: PN2907A.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

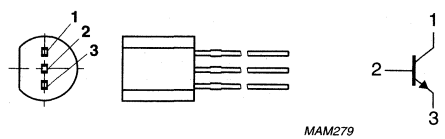


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	75	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

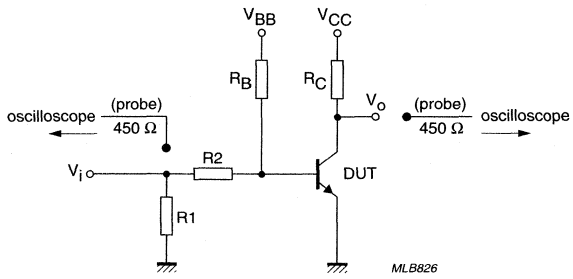
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_{amb} = 125 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 3 V	–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V	35	–	
		I_C = 1 mA; V_{CE} = 10 V	50	–	
		I_C = 10 mA; V_{CE} = 10 V	75	–	
		I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	35	–	
		I_C = 150 mA; V_{CE} = 1 V	50	–	
		I_C = 150 mA; V_{CE} = 10 V	100	300	
		I_C = 500 mA; V_{CE} = 10 V	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	–	300	mV
		I_C = 500 mA; I_B = 50 mA	1	–	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	0.6	1.2	V
		I_C = 500 mA; I_B = 50 mA	–	2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	25	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 μA; V_{CE} = 5 V; R_S = 1 kΩ; f = 1 kHz	–	4	dB
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA; T_{amb} = 25 °C	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistors PN2369; PN2369A

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

APPLICATIONS

- High-speed switching applications.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

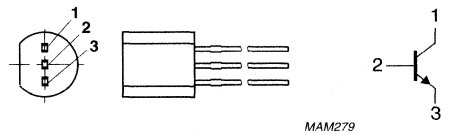


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

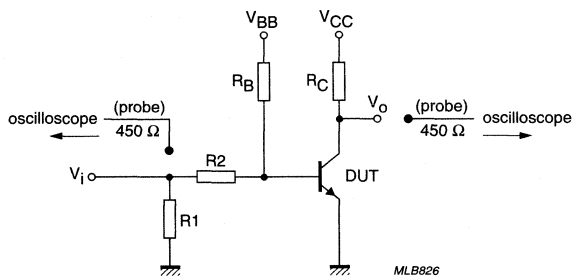
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	400	nA
		I_E = 0; V_{CB} = 20 V; T_{amb} = 125 °C	–	–	30	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	–	100	nA
h_{FE}	DC current gain PN2369	I_C = 10 mA; V_{CE} = 1 V	40	–	120	
		I_C = 10 mA; V_{CE} = 1 V; T_{amb} = –55 °C	20	–	–	
		I_C = 100 mA; V_{CE} = 2 V	20	–	–	
	DC current gain PN2369A	I_C = 10 mA; V_{CE} = 350 mV	40	–	120	
		I_C = 10 mA; V_{CE} = 350 mV; T_{amb} = –55 °C	20	–	–	
		I_C = 30 mA; V_{CE} = 400 mV	30	–	–	
		I_C = 100 mA; V_{CE} = 1 V	20	–	–	
V_{CEsat}	collector-emitter saturation voltage PN2369	I_C = 10 mA; I_B = 1 mA	–	–	250	mV
	collector-emitter saturation voltage PN2369A	I_C = 10 mA; I_B = 1 mA	–	–	200	mV
		I_C = 10 mA; I_B = 10 mA	–	–	300	mV
		I_C = 30 mA; I_B = 3 mA	–	–	250	mV
		I_C = 100 mA; I_B = 10 mA	–	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	700	–	850	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 5 V; f = 1 MHz	–	–	4	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	500	–	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)						
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 3 mA; I_{Boff} = –1.5 mA	–	8	10	ns
t_d	delay time		–	–	4	ns
t_r	rise time		–	–	6	ns
t_{off}	turn-off time		–	10	20	ns
t_s	storage time		–	–	10	ns
t_f	fall time		–	–	10	ns



V_i = 0.5 V to 4.2 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 1$ ns.
R1 = 56 Ω; R2 = 1 kΩ; R_B = 1 kΩ; R_C = 270 Ω.
V_{BB} = 0.2 V; V_{CC} = 2.7 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor PN2907A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a TO-92; SOT54 plastic package. NPN complement: PN2222A.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

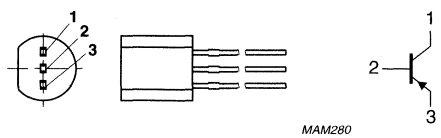


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
I_C	collector current (DC)		–	–600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
h_{FE}	DC current gain	$I_C = -150$ mA; $V_{CE} = -10$ V	100	300	
f_T	transition frequency	$I_C = -50$ mA; $V_{CE} = -20$ V; f = 100 MHz	200	–	MHz
t_{off}	turn-off time	$I_{Con} = -150$ mA; $I_{Bon} = -15$ mA; $I_{Boff} = 15$ mA	–	365	ns

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	250	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

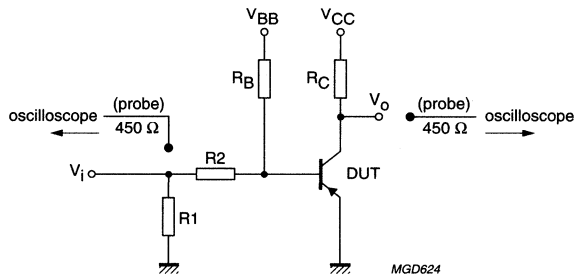
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–10	nA
		$I_E = 0$; $V_{CB} = -50$ V; $T_{amb} = 125$ °C	–	–10	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–50	nA
h_{FE}	DC current gain	$I_C = -0.1$ mA; $V_{CE} = -10$ V	75	–	
		$I_C = -1$ mA; $V_{CE} = -10$ V	100	–	
		$I_C = -10$ mA; $V_{CE} = -10$ V	100	–	
		$I_C = -150$ mA; $V_{CE} = -10$ V	100	300	
		$I_C = -500$ mA; $V_{CE} = -10$ V	50	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -150$ mA; $I_B = -15$ mA	–	–400	mV
		$I_C = -500$ mA; $I_B = -50$ mA	–	–1.6	V
V_{BEsat}	base-emitter saturation voltage	$I_C = -150$ mA; $I_B = -15$ mA	–	–1.3	V
		$I_C = -150$ mA; $I_B = -50$ mA	–	–2.6	V
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -2$ V; f = 1 MHz	–	30	pF
f_T	transition frequency	$I_C = -50$ mA; $V_{CE} = -20$ V; f = 100 MHz	200	–	MHz

PNP switching transistor PN2907A

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns



V_i = −9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PXT2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- General purpose switching and linear amplification.

DESCRIPTION

NPN switching transistor in a SOT89 plastic package.
PNP complement: PXT2907A.

MARKING

TYPE NUMBER	MARKING CODE
PXT2222A	p1P

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

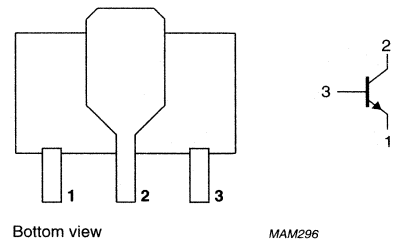


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	75	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		20	K/W

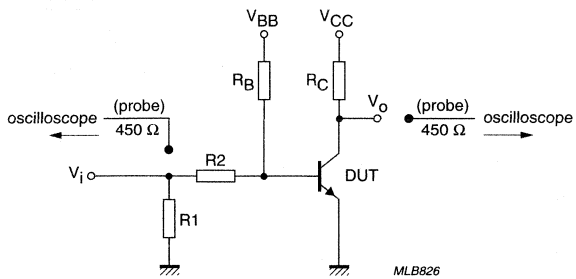
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_{amb} = 125 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = 5 V	–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10V	35	–	
		I_C = 1 mA; V_{CE} = 10 V	50	–	
		I_C = 10 mA; V_{CE} = 10 V	75	–	
		I_C = 10 mA; V_C = 10 V; T_{amb} = −55 °C	35	–	
		I_C = 150 mA; V_{CE} = 1 V	50	–	
		I_C = 150 mA; V_{CE} = 10 V	100	300	
		I_C = 500 mA; V_{CE} = 10 V	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	–	300	mV
		I_C = 500 mA; I_B = 50 mA	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	0.6	1.2	V
		I_C = 500 mA; I_B = 50 mA	–	2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	25	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor PXT2907A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT89 plastic package.
NPN complement: PXT2222A.

MARKING

TYPE NUMBER	MARKING CODE
PXT2907A	p2F

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

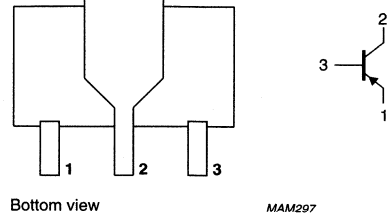


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	97	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		17	K/W

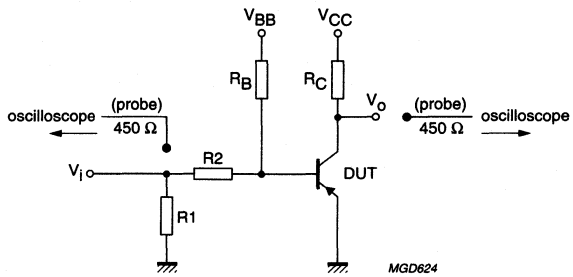
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	−10	nA
		I_E = 0; V_{CB} = −50 V; T_{amb} = 125 °C	–	−10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −1 V	75	–	
		I_C = −1 mA; V_{CE} = −1 V	100	–	
		I_C = −10 mA; V_{CE} = −1 V	100	–	
		I_C = −150 mA; V_{CE} = −2 V	100	300	
		I_C = −500 mA; V_{CE} = −2 V	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−400	mV
		I_C = −500 mA; I_B = −50 mA	–	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−1.3	V
		I_C = −500 mA; I_B = −50 mA	–	−2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	35	pF
f_T	transition frequency	I_C = −20 mA; V_{CE} = −10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor | PXT3904

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed switching.

DESCRIPTION

NPN switching transistor in a SOT89 plastic package.
PNP complement: PXT3906.

MARKING

TYPE NUMBER	MARKING CODE
PXT3904	p1A

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

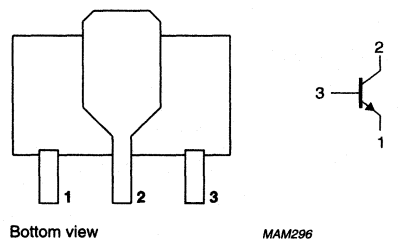


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	105	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		25	K/W

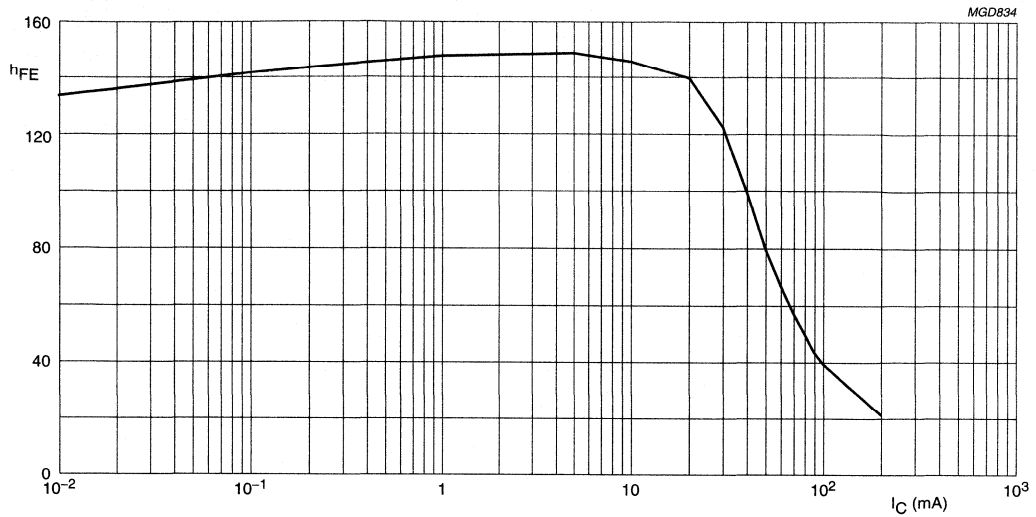
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

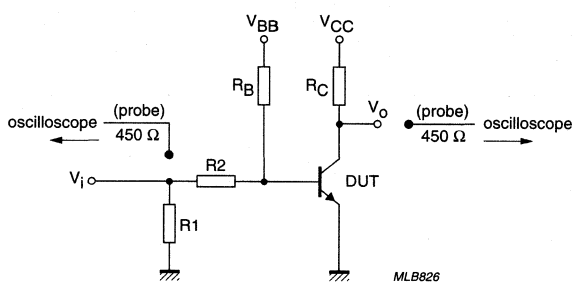
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; (see Fig.2)			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 5 mA	–	200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	650	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 µA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; V_{CC} = −3 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PXT3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed saturated switching applications.

DESCRIPTION

PNP switching transistor in a SOT89 plastic package.
NPN complement: PXT3904.

MARKING

TYPE NUMBER	MARKING CODE
PXT3906	p2A

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

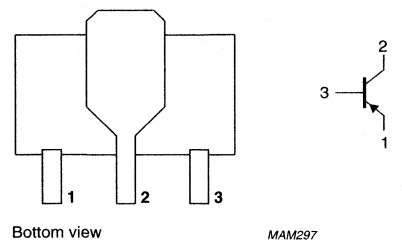


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	104	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		24	K/W

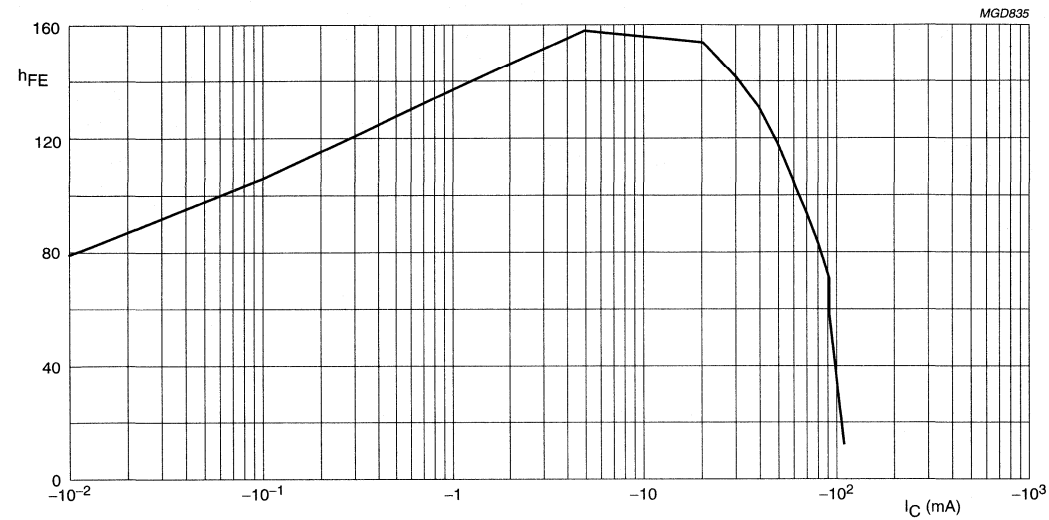
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook".*

CHARACTERISTICS

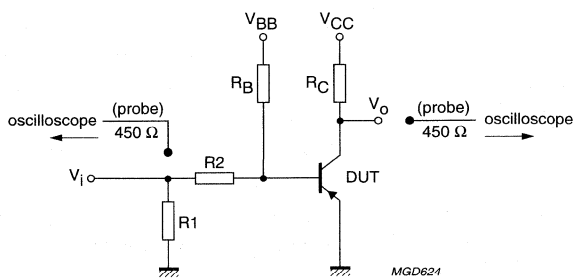
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	−	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −6 V	−	−50	nA
h_{FE}	DC current gain	V_{CE} = −1 V; (see Fig.2)			
		I_C = −0.1 mA	60	−	
		I_C = −1 mA	80	−	
		I_C = −10 mA	100	300	
		I_C = −50 mA	60	−	
		I_C = −100 mA	30	−	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	−	−250	mV
		I_C = −50 mA; I_B = −5 mA	−	−400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −1 mA	−650	−850	mV
		I_C = −50 mA; I_B = −5 mA	−	−950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −5 V; f = 1 MHz	−	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	−	10	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −20 V; f = 100 MHz	250	−	MHz
F	noise figure	I_C = −100 μA; V_{CE} = −5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	−	4	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −10 mA; I_{Bon} = −1 mA; I_{Boff} = 1 mA	−	65	ns
t_d	delay time		−	35	ns
t_r	rise time		−	35	ns
t_{off}	turn-off time		−	300	ns
t_s	storage time		−	225	ns
t_f	fall time		−	75	ns



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.



$V_i = 5$ V; T = 500 µs; $t_p = 10$ µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; $R_B = 3.9$ kΩ; $R_C = 270$ Ω.
$V_{BB} = 1.9$ V; $V_{CC} = -3$ V.
Oscilloscope: input impedance $Z_i = 50$ Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor PXT4401

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification in industrial and consumer applications.

DESCRIPTION

NPN switching transistor in a SOT89 plastic package.
PNP complement: PXT4403.

MARKING

TYPE NUMBER	MARKING CODE
PXT4401	p2X

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

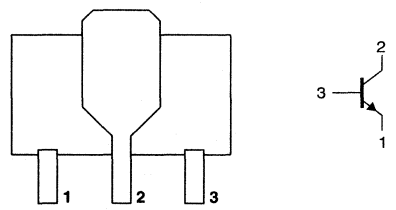


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		20	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; (see Fig.2)	20	–	
		I_C = 0.1 mA	20	–	
		I_C = 1 mA	40	–	
		I_C = 10 mA	80	–	
		I_C = 150 mA; note 1	100	300	
		I_C = 500 mA; V_{CE} = 2 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	950	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	1.2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	250	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

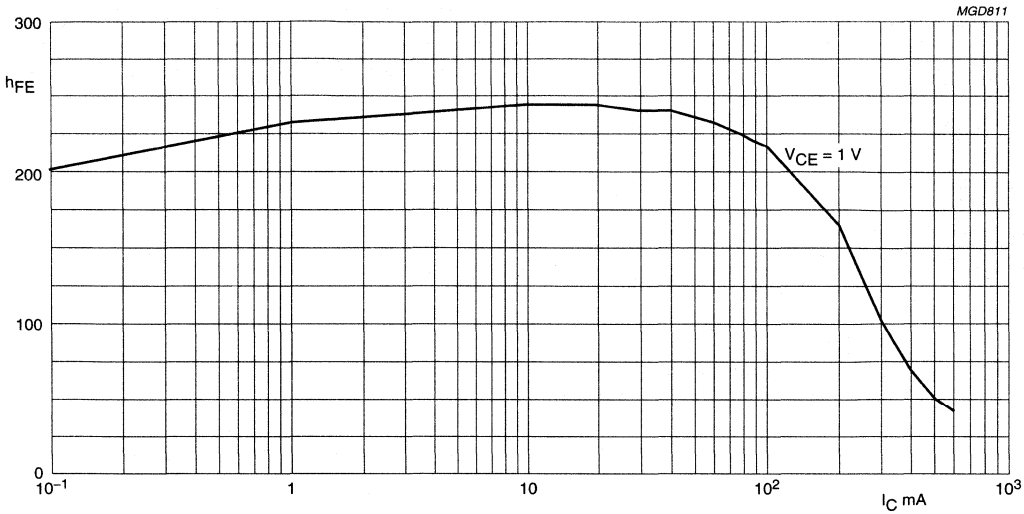
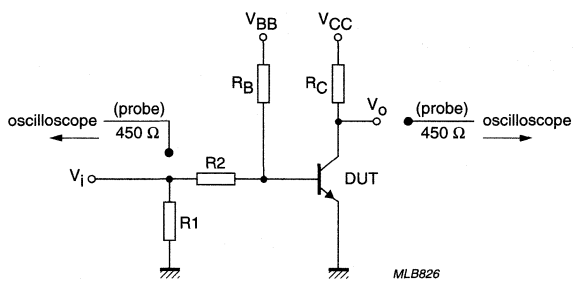


Fig.2 DC current gain; typical values.



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PXT4403

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT89 plastic package.
NPN complement: PXT4401.

MARKING

TYPE NUMBER	MARKING CODE
PXT4403	p2T

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

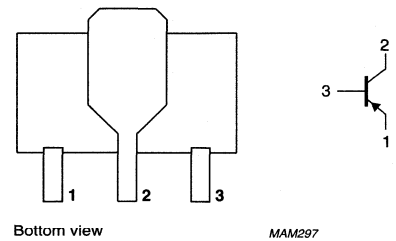


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–55	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	97	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		17	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −40 V	–	−50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −1 V	30	–	
		I_C = −1 mA; V_{CE} = −1 V	60	–	
		I_C = −10 mA; V_{CE} = −1 V	100	–	
		I_C = −150 mA; V_{CE} = −2 V	100	300	
		I_C = −500 mA; V_{CE} = −2 V	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−400	mV
		I_C = −500 mA; I_B = −50 mA	–	−750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA	–	−950	mV
		I_C = −500 mA; I_B = −50 mA	–	−1.3	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	35	pF
f_T	transition frequency	I_C = −20 mA; V_{CE} = −10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	15	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	350	ns
t_s	storage time		–	300	ns
t_f	fall time		–	50	ns

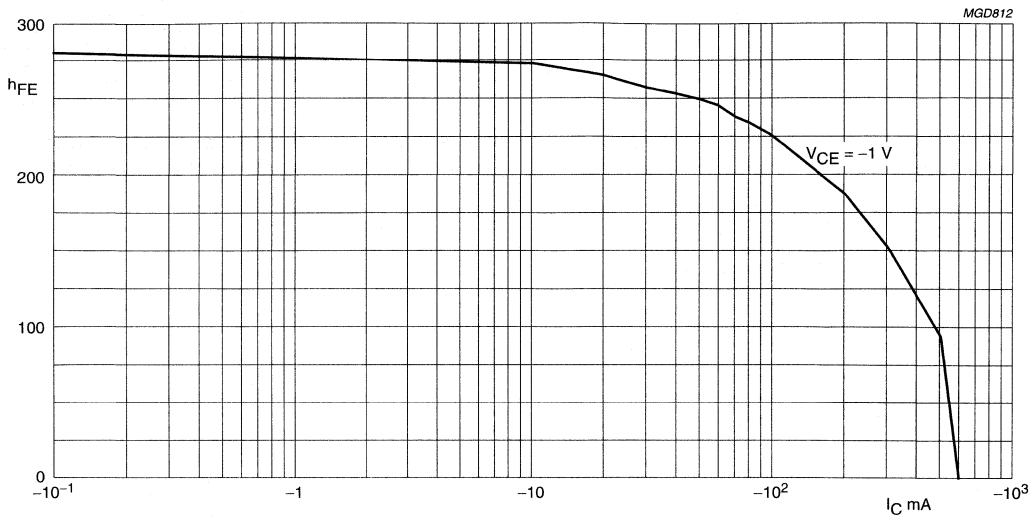
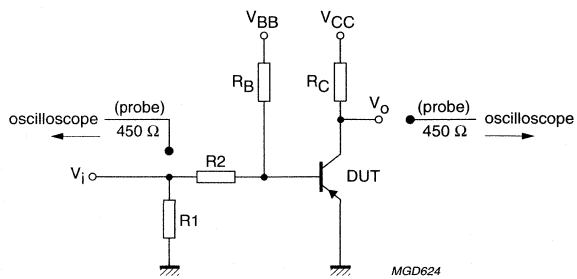


Fig.2 DC current gain; typical values.



V_i = −9.5 V; T = 500 µs; t_p = 10 µs; t_r = t_f ≤ 3 ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN Darlington transistor PXTA14

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- High input impedance preamplifiers.

DESCRIPTION

NPN Darlington transistor in a SOT89 plastic package.
PNP complement: PXTA64.

MARKING

TYPE NUMBER	MARKING CODE
PXTA14	p1N

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

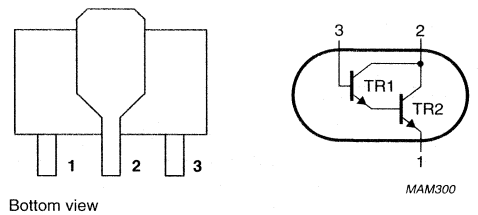


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	1	A
I_B	base current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to solder point		16	K/W

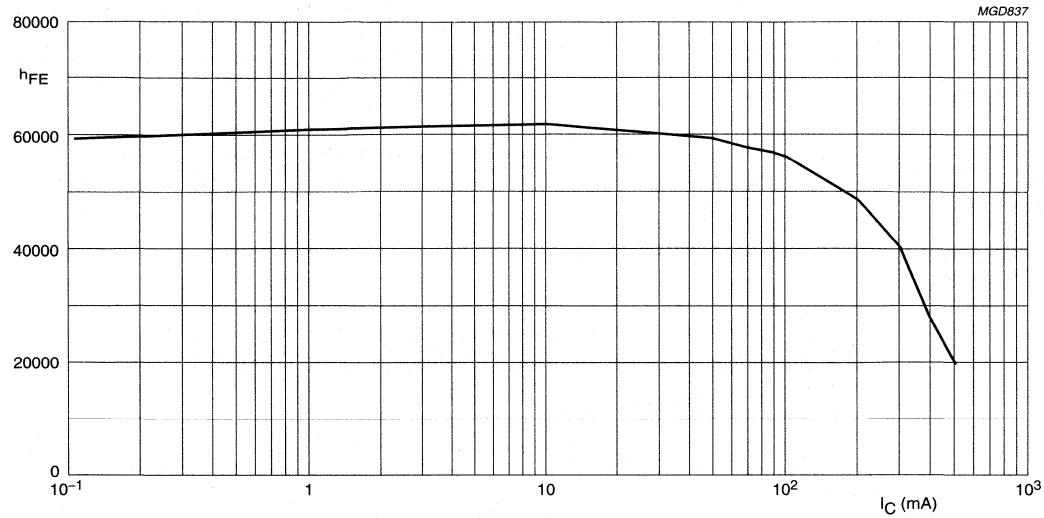
Note

1. Device mounted on a printed-circuit board, single sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for the SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 30 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	100	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V; (see Fig.2)	10000	–	
		I_C = 100 mA; V_{CE} = 5 V; (see Fig.2)	20000	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 100 mA; V_{CE} = 5 V	–	2	V
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 100 MHz	125	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

NPN high-voltage transistor PXTA42

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a SOT89 plastic package.
PNP complement: PXTA92.

MARKING

TYPE NUMBER	MARKING CODE
PXTA42	p1D

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

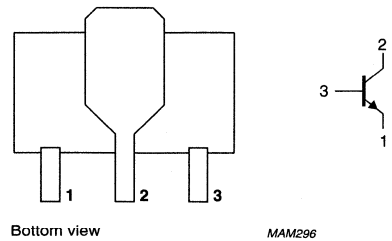


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	300	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = 6 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 10 V	25	–	
		I_C = 10 mA; V_{CE} = 10 V	40	–	
		I_C = 30 mA; V_{CE} = 10 V	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	900	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 20 V; f = 1 MHz	–	3	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	50	–	MHz

PNP high-voltage transistor PXTA92

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

PNP high-voltage transistor in a SOT89 plastic package.
NPN complement: PXTA42.

MARKING

TYPE NUMBER	MARKING CODE
PXTA92	p2D
PXTA93	p2E

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

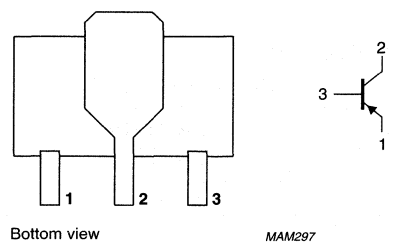


Fig.1 Simplified outline (SOT89) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–300	V
V_{CEO}	collector-emitter voltage	open base	–	–300	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2.
   For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	96	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		16	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 6 cm^2. For other mounting conditions, see *"Thermal considerations for SOT89 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–250	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = –3 V	–	–100	nA
h_{FE}	DC current gain	V_{CE} = –10 V; note 1			
		I_C = –1 mA	25	–	
		I_C = –10 mA	40	–	
		I_C = –30 mA	25	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA	–	–500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA		–900	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –20 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	50	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN switching transistor PZT2222A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

NPN switching transistor in a SOT223 plastic package.
PNP complement: PZT2907A.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

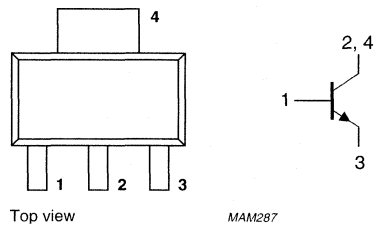


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	75	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	109	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		28	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

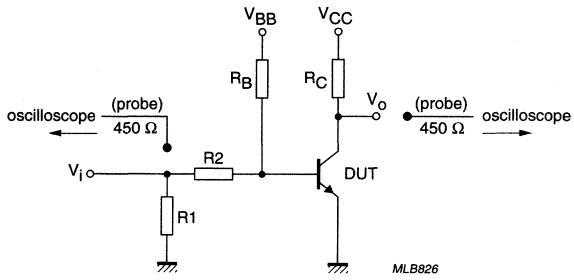
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	nA
		I_E = 0; V_{CB} = 60 V; T_{amb} = 125 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	10	nA
h_{FE}	DC current gain	I_C = 0.1 mA; V_{CE} = 10 V	35	–	
		I_C = 1 mA; V_{CE} = 10 V	50	–	
		I_C = 10 mA; V_{CE} = 10 V	75	–	
		I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	35	–	
		I_C = 150 mA; V_{CE} = 1 V; note 1	50	–	
		I_C = 150 mA; V_{CE} = 10 V; note 1	100	300	
		I_C = 500 mA; V_{CE} = 10 V; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	–	300	mV
		I_C = 500 mA; I_B = 50 mA	–	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA	0.6	1.2	V
		I_C = 500 mA; I_B = 50 mA	–	2	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	25	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA; T_{amb} = 25 °C	–	35	ns
t_d	delay time		–	10	ns
t_r	rise time		–	25	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = 9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PNP switching transistor PZT2907A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT223 plastic package.
NPN complement: PZT2222A.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

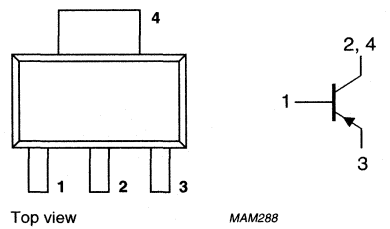


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base	–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	1.15	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	106	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		25	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

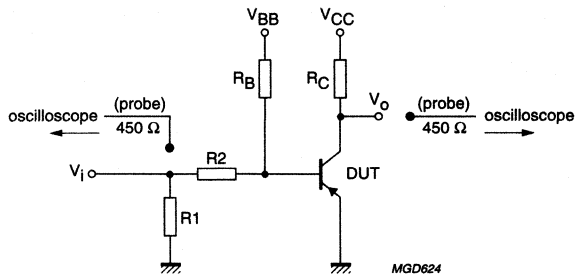
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	−10	nA
		I_E = 0; V_{CB} = −50 V; T_{amb} = 150 °C	–	−10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	−50	nA
h_{FE}	DC current gain	I_C = −0.1 mA; V_{CE} = −10 V	75	–	
		I_C = −1 mA; V_{CE} = −10 V	100	–	
		I_C = −10 mA; V_{CE} = −10 V	100	–	
		I_C = −150 mA; V_{CE} = −10 V; note 1	100	300	
		I_C = −500 mA; V_{CE} = −10 V; note 1	50	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	–	−400	mV
		I_C = −500 mA; I_B = −50 mA; note 1	–	−1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = −150 mA; I_B = −15 mA; note 1	–	−1.3	V
		I_C = −500 mA; I_B = −50 mA; note 1	–	−2.6	V
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −2 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −20 V; f = 100 MHz; note 1	200	–	MHz
Switching times (between 10% and 90% levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = −150 mA; I_{Bon} = −15 mA; I_{Boff} = 15 mA	–	40	ns
t_d	delay time		–	12	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	365	ns
t_s	storage time		–	300	ns
t_f	fall time		–	65	ns

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_i = −9.5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = −29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

NPN switching transistor PZT3904

FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed saturated switching.

DESCRIPTION

NPN switching transistor in a SOT223 plastic package.
PNP complement: PZT3906.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

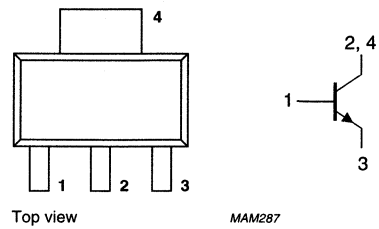


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	200	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.05	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	117	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		36	K/W

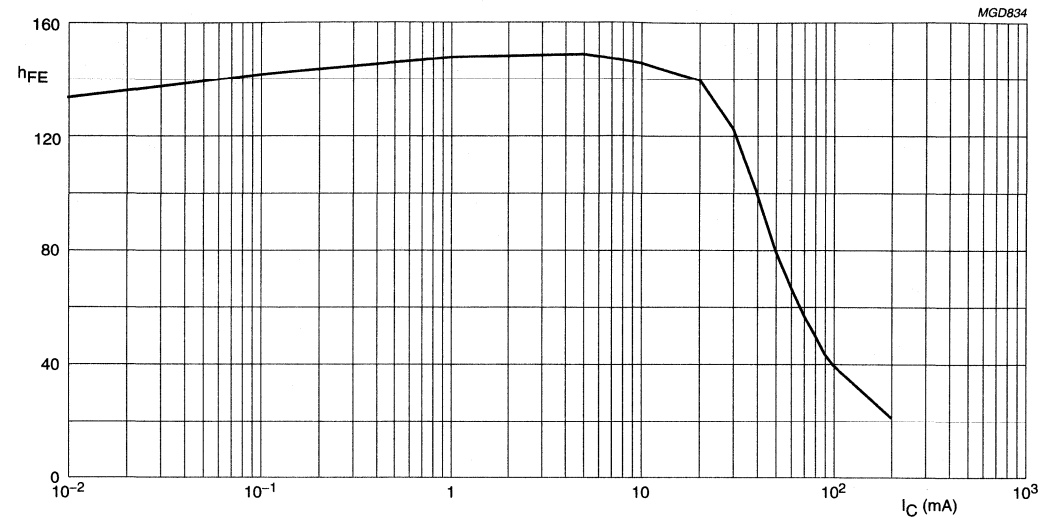
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

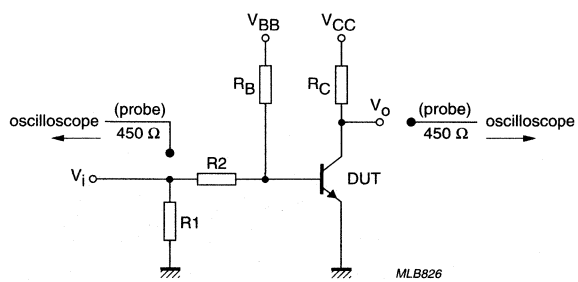
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; (see Fig.2)			
		I_C = 0.1 mA	60	–	
		I_C = 1 mA	80	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	saturation voltage	I_C = 10 mA; I_B = 1 mA	–	200	mV
		I_C = 50 mA; I_B = 5 mA	–	200	mV
V_{BEsat}	saturation voltage	I_C = 10 mA; I_B = 1 mA	–	850	mV
		I_C = 50 mA; I_B = 5 mA	–	950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	8	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	300	–	MHz
F	noise figure	I_C = 100 µA; V_{CE} = 5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	240	ns
t_s	storage time		–	200	ns
t_f	fall time		–	50	ns



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 5 V; T = 500 μs; t_p = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = −1.9 V; V_{CC} = 3 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PZT3906

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

APPLICATIONS

- High-speed switching.

DESCRIPTION

PNP switching transistor in a SOT223 plastic package.
NPN complement: PZT3904.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

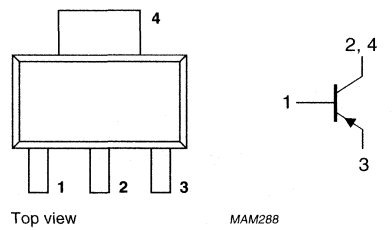


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−40	V
V_{CEO}	collector-emitter voltage	open base	–	−40	V
V_{EBO}	emitter-base voltage	open collector	–	−6	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.05	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	115	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		34	K/W

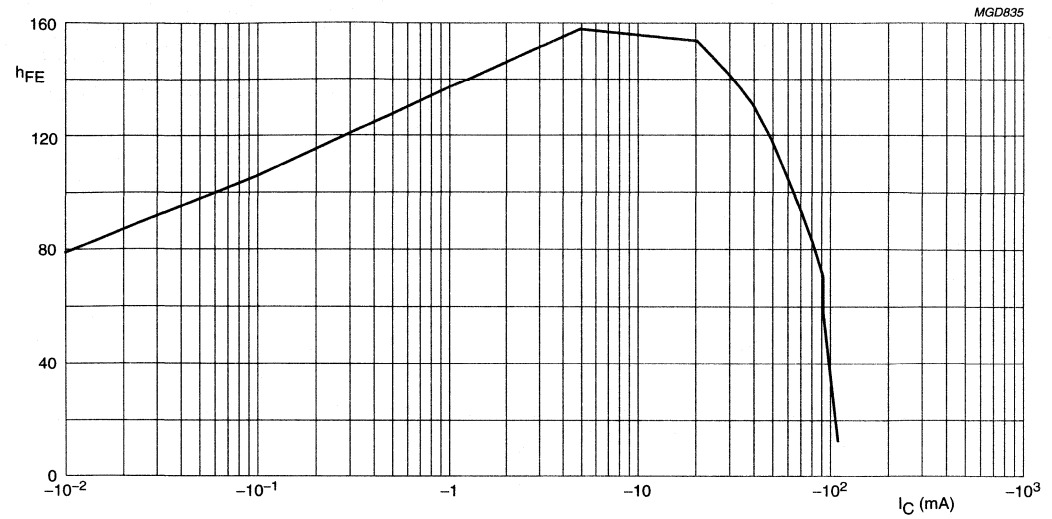
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

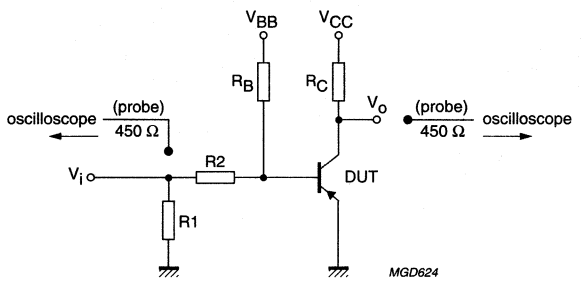
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –6 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V; (see Fig.2)			
		I_C = –0.1 mA	60	–	
		I_C = –1 mA	80	–	
		I_C = –10 mA	100	300	
		I_C = –50 mA	60	–	
		I_C = –100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–	–200	mV
		I_C = –50 mA; I_B = –5 mA	–	–200	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–650	–850	mV
		I_C = –50 mA; I_B = –5 mA	–	–950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = –100 µA; V_{CE} = –5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); (see Fig.3)					
t_{on}	turn-on time	I_{Con} = –10 mA; I_{Bon} = –1 mA; I_{Boff} = 1 mA	–	65	ns
t_d	delay time		–	35	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.



$V_i = -5$ V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
V_{BB} = 1.9 V; $V_{CC} = -3$ V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN switching transistor PZT4401

FEATURES

- High current (max. 600 mA)
- Low voltage.

APPLICATIONS

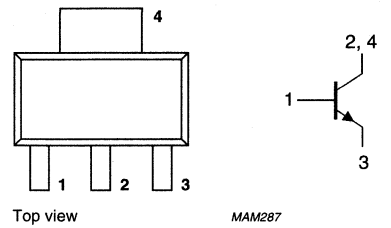
- Switching and linear amplification in industrial and consumer applications.

DESCRIPTION

NPN switching transistor in a SOT223 plastic package. PNP complement: PZT4403.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter



Marking code: ZT4401

Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	600	mA
I_{CM}	peak collector current		–	800	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1150	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	109	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		28	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

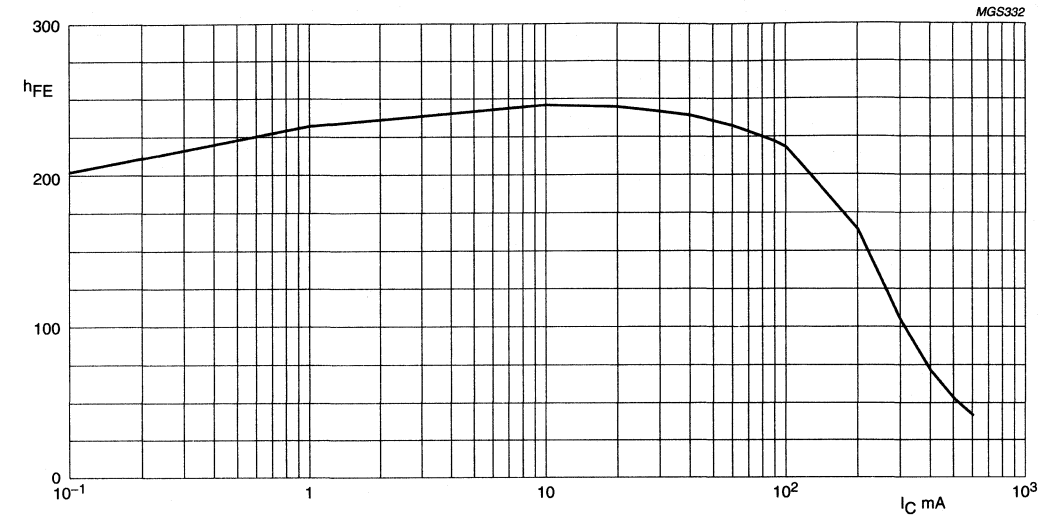
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 6 V	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; see Fig.2			
		I_C = 0.1 mA	20	–	
		I_C = 1 mA	40	–	
		I_C = 10 mA	80	–	
		I_C = 150 mA; note 1	100	300	
		V_{CE} = 2 V; I_C = 500 mA; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	400	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	950	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	1200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; f = 100 MHz	250	–	MHz
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = 150 mA; I_{Bon} = 15 mA; I_{Boff} = −15 mA; V_{BB} = −3.5 V; V_{CC} = 29.5 V	–	35	ns
t_d	delay time		–	15	ns
t_r	rise time		–	20	ns
t_{off}	turn-off time		–	250	ns
t_s	storage time		–	200	ns
t_f	fall time		–	60	ns

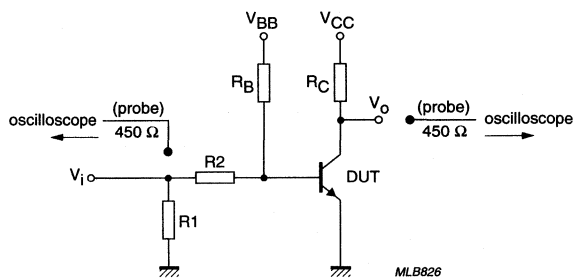
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



V_{CE} = 1 V.

Fig.2 DC current gain; typical values.



V_i = 9.5 V; T = 500 µs; t_p = 10 µs.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = −3.5 V; V_{CC} = 29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

PNP switching transistor PZT4403

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

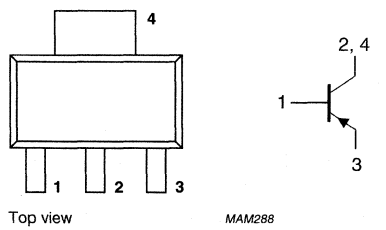
- Switching and linear amplification.

DESCRIPTION

PNP switching transistor in a SOT223 plastic package. NPN complement: PZT4401.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter



Marking code: ZT4403

Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–40	V
V_{CEO}	collector-emitter voltage	open base	–	–40	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–600	mA
I_{CM}	peak collector current		–	–800	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	106	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		25	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

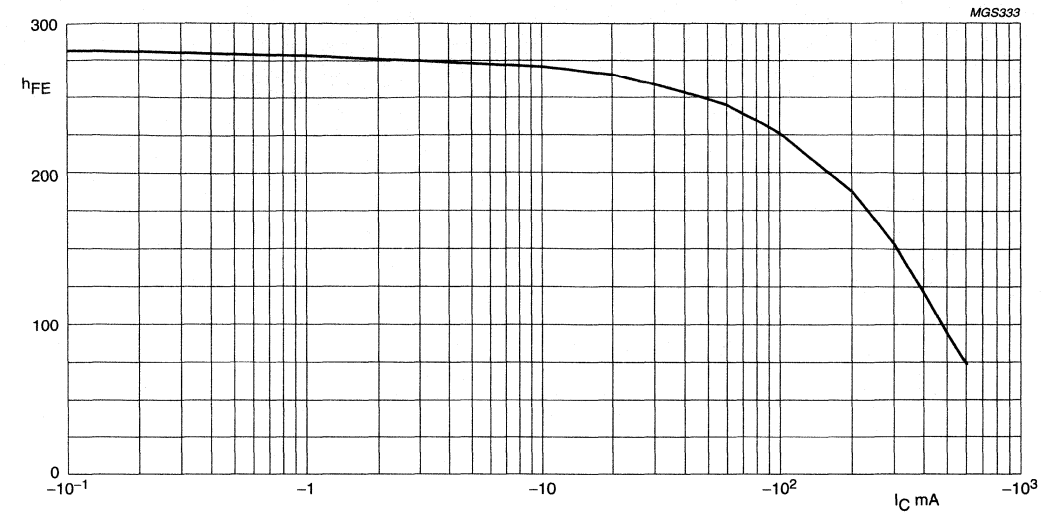
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –40 V	–	–50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V; see Fig.2			
		I_C = –0.1 mA	30	–	
		I_C = –1 mA	60	–	
		I_C = –10 mA	100	–	
		I_C = –150 mA; note 1	100	300	
		V_{CE} = –2 V; I_C = –500 mA; note 1	20	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–400	mV
		I_C = –500 mA; I_B = –50 mA; note 1	–	–750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1	–	–950	mV
		I_C = –500 mA; I_B = –50 mA; note 1	–	–1300	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –5 V; f = 1 MHz	–	8.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	35	pF
f_T	transition frequency	I_C = –20 mA; V_{CE} = –10 V; f = 100 MHz	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.3					
t_{on}	turn-on time	I_{Con} = –150 mA; I_{Bon} = 15 mA; I_{Boff} = –15 mA; V_{BB} = 3.5 V; V_{CC} = –29.5 V	–	40	ns
t_d	delay time		–	15	ns
t_r	rise time		–	30	ns
t_{off}	turn-off time		–	350	ns
t_s	storage time		–	300	ns
t_f	fall time		–	50	ns

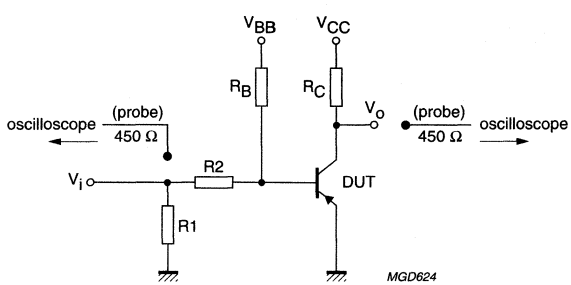
Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.



$V_{CE} = -1$ V.

Fig.2 DC current gain; typical values.



$V_i = -9.5$ V; T = 500 µs; t_p = 10 µs.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
$V_{BB} = 3.5$ V; $V_{CC} = -29.5$ V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.3 Test circuit for switching times.

NPN Darlington transistor PZTA14

FEATURES

- High current (max. 500 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- Pre-amplifiers requiring high input impedance.

DESCRIPTION

NPN Darlington transistor in a SOT223 plastic package.
PNP complement: PZTA64.

PINNING

PIN	DESCRIPTION
1	base/input
2, 4	collector/output
3	emitter/ground

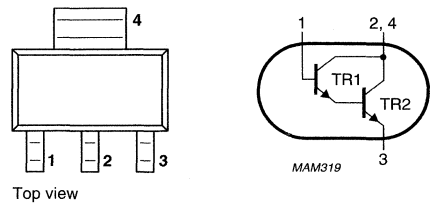


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
I_C	collector current (DC)		–	500	mA
I_{CM}	peak collector current		–	800	mA
I_B	base current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	100	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		19	K/W

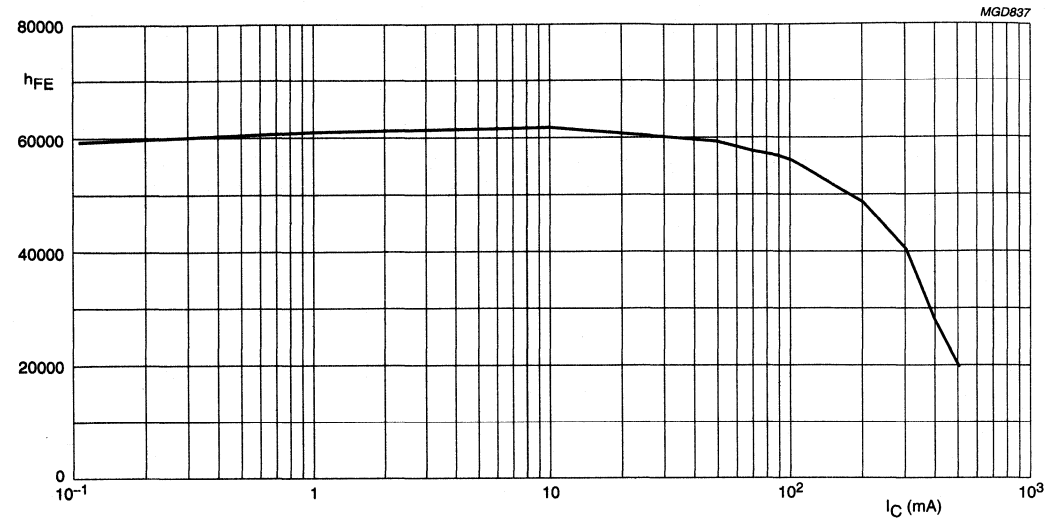
Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 30 V	–	100	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 10 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 5 V; (see Fig.2)			
		I_C = 10 mA	10000	–	
		I_C = 100 mA	20000	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 0.1 mA	–	1.5	V
V_{BEon}	base-emitter on-state voltage	I_C = 100 mA; V_{CE} = 5 V	–	2	V
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	125	–	MHz



V_{CE} = 2 V.

Fig.2 DC current gain; typical values.

NPN high-voltage transistor PZTA42

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Telephony and professional communication equipment.

DESCRIPTION

NPN high-voltage transistor in a SOT223 plastic package.
PNP complement: PZTA92.

PINNING

PIN	DESCRIPTION
1	base
2,4	collector
3	emitter

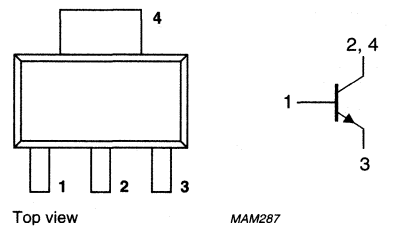


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	300	V
V_{CEO}	collector-emitter voltage	open base	–	300	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

NPN high-voltage transistor PZTA42

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	104	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		23	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 200 V	–	20	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = 6 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V			
		I_C = 1 mA	25	–	
		I_C = 10 mA	40	–	
		I_C = 30 mA	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 20 mA; I_B = 2 mA	–	900	mV
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 20 V; f = 1 MHz	–	3	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 20 V; f = 100 MHz	50	–	MHz

NPN high-voltage transistor PZTA44

FEATURES

- Low current (max. 300 mA)
- High voltage (max. 400 V).

APPLICATIONS

- Telecommunication.

DESCRIPTION

NPN high-voltage transistor in a SOT223 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

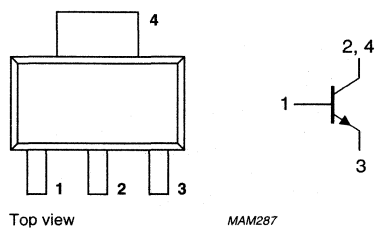


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	500	V
V_{CEO}	collector-emitter voltage	open base	–	400	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	300	mA
I_{CM}	peak collector current		–	300	mA
I_{BM}	peak base current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.35	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	91	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 400 V	–	100	nA
		I_E = 0; V_{CB} = 400 V; T_j = 150 °C	–	10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V			
		I_C = 1 mA	40	–	
		I_C = 10 mA	50	200	
		I_C = 50 mA; note 1	45	–	
		I_C = 100 mA; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 mA; I_B = 0.1 mA	–	400	mV
		I_C = 10 mA; I_B = 1 mA	–	500	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	750	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	850	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz	–	7	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	180	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 10 V; f = 100 MHz	20	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PNP high-voltage transistor PZTA92

FEATURES

- Low current (max. 100 mA)
- High voltage (max. 300 V).

APPLICATIONS

- Video equipment
- Telephony
- Professional communication equipment.

DESCRIPTION

PNP high-voltage transistor in a SOT223 plastic package.
NPN complement: PZTA42.

PINNING

PIN	DESCRIPTION
1	base
2, 4	collector
3	emitter

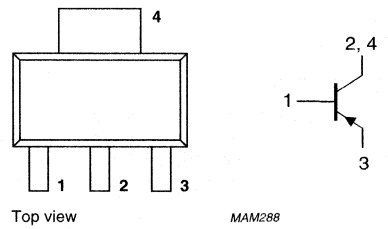


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−300	V
V_{CEO}	collector-emitter voltage	open base	–	−300	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	1.2	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	104	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		23	K/W

Note

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 cm^2. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook"*.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –200 V	–	–20	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{BE} = –5 V	–	–100	nA
h_{FE}	DC current gain	I_C = –1 mA; V_{CE} = –10 V; note 1	25	–	
		I_C = –10 mA; V_{CE} = –10 V; note 1	40	–	
		I_C = –30 mA; V_{CE} = –10 V; note 1	25	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA	–	–500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –20 mA; I_B = –2 mA	–	–900	mV
C_c	collector capacitance	I_E = 0; V_{CB} = –20 V; f = 1 MHz	–	6	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	50	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

DEVICE DATA ARRAYS

In alphanumeric sequence

High-speed double diode array BAV70S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

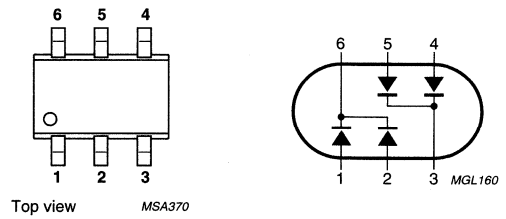
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV70S consists of two dual high-speed switching diodes with common cathodes, fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	anode (a2)
3	common cathode (k1)
4	anode (a3)
5	anode (a4)
6	common cathode (k2)



Marking code: A4t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.3		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	µA
		V_R = 25 V; T_j = 150 °C	60	µA
		V_R = 75 V; T_j = 150 °C	100	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

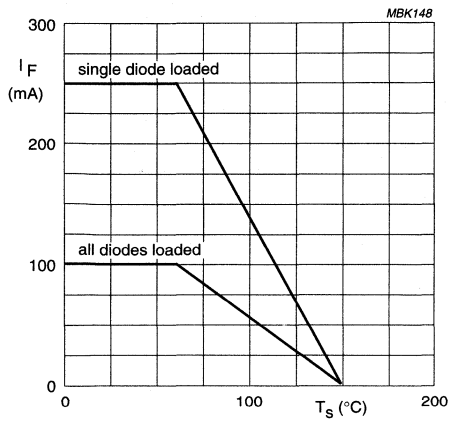
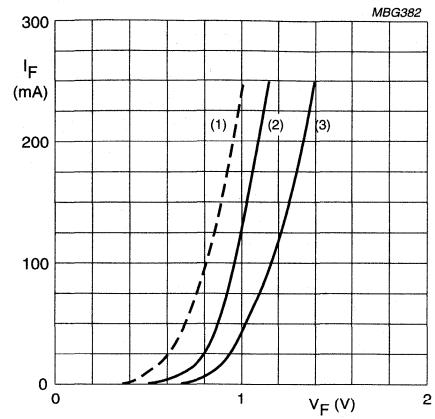
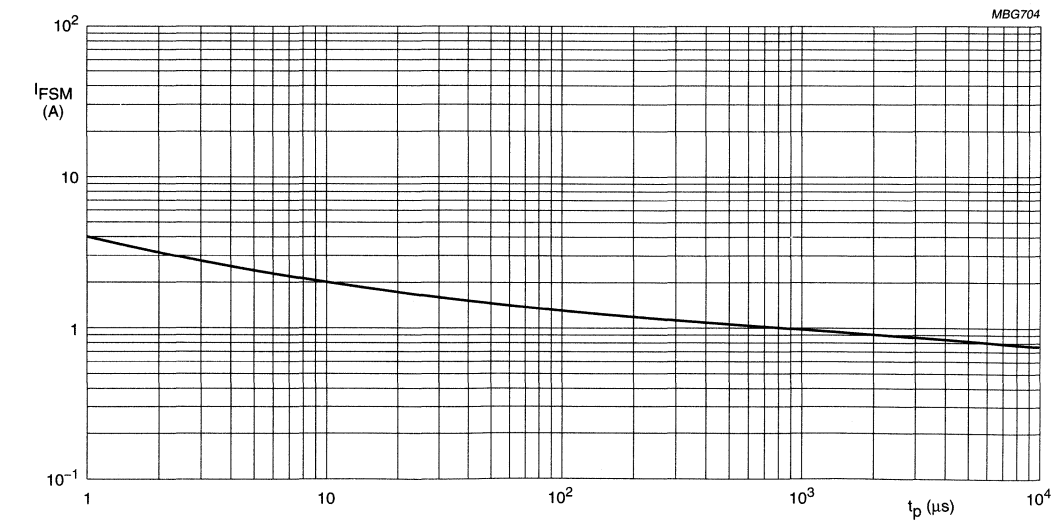


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

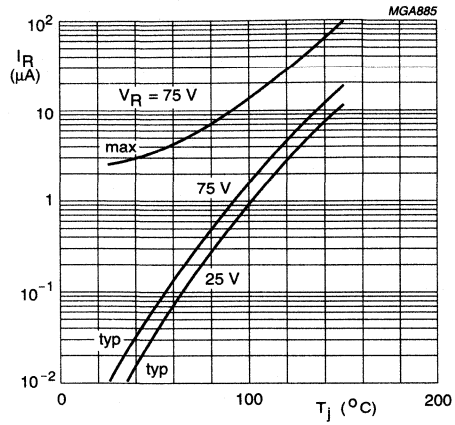
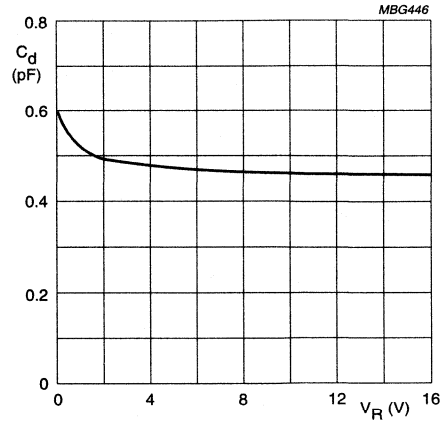
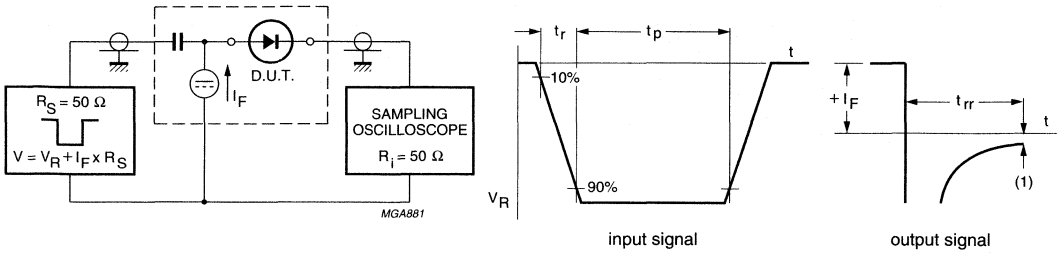


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

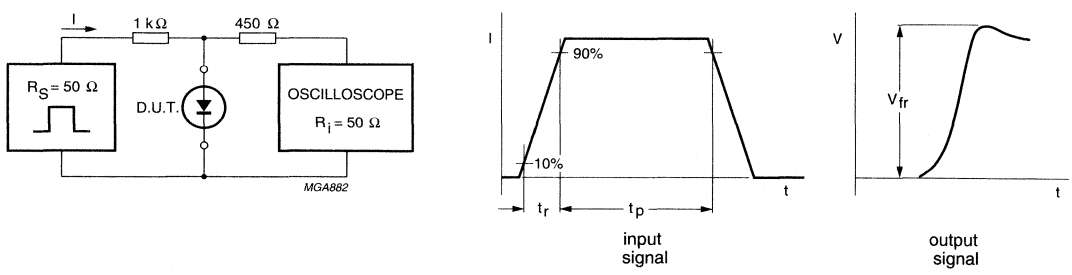


(1) $I_R = 1$ mA.

Input signal: reverse pulse rise time $t_r = 0.6$ ns; reverse voltage pulse duration $t_p = 100$ ns; duty factor $\delta = 0.05$.

Oscilloscope: rise time $t_r = 0.35$ ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time $t_r = 20$ ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

High-speed switching diode array BAV756S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

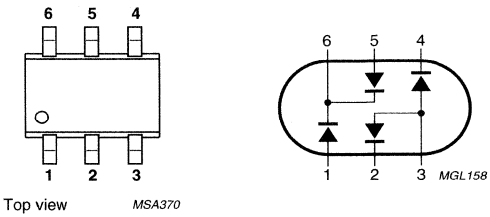
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAV756S consists of four high-speed switching diodes fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package. One pair of diodes has a common cathode; the other pair has a common anode.

PINNING

PIN	DESCRIPTION
1	anode (a1)
2	cathode (k1)
3	common anode
4	cathode (k2)
5	anode (a2)
6	common cathode



Marking code: A7t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.11		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	2.5	µA
		V_R = 25 V; T_j = 150 °C	60	µA
		V_R = 75 V; T_j = 150 °C	100	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.6	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.7	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

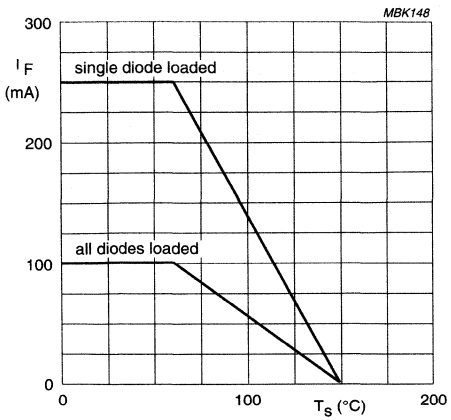
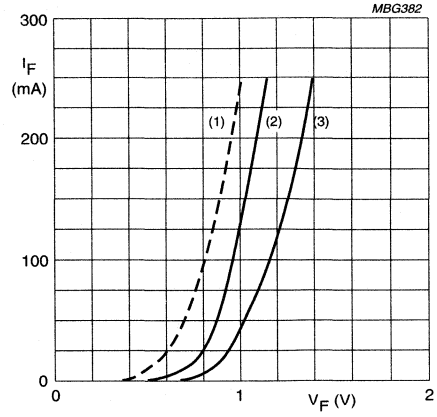
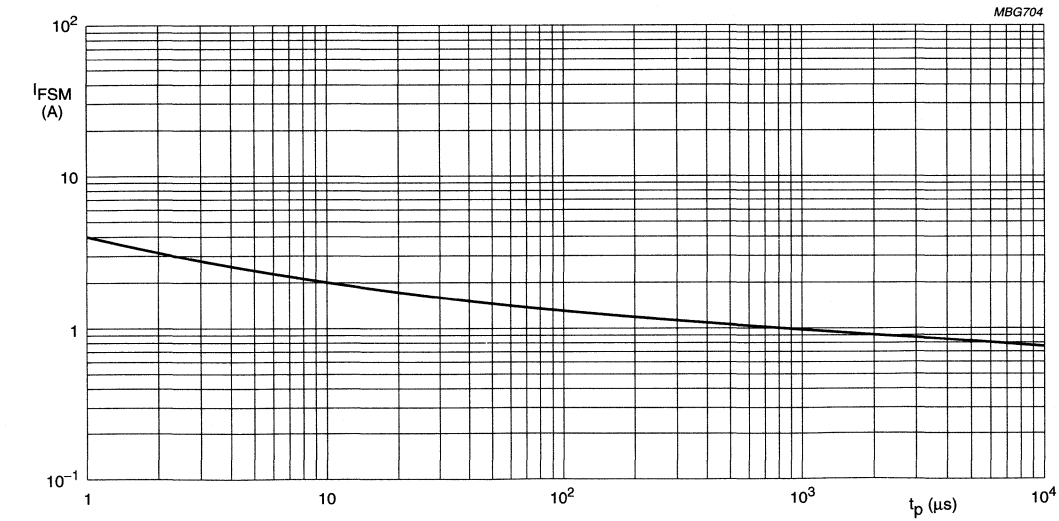


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.11 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

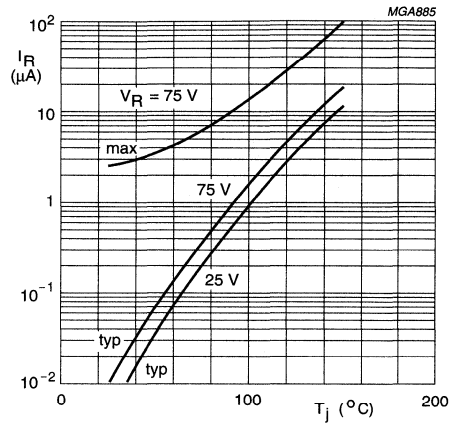
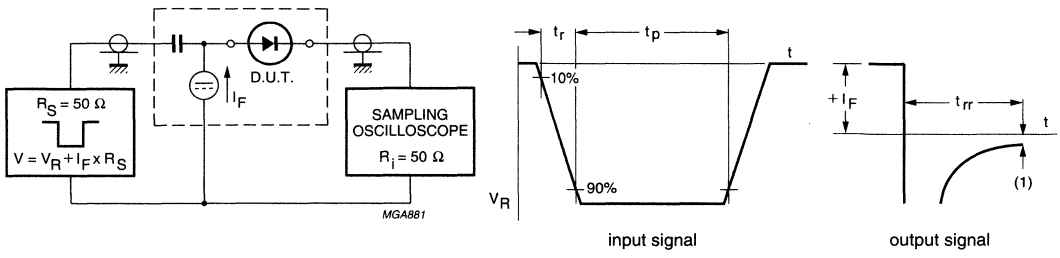


Fig.5 Reverse current as a function of junction temperature.

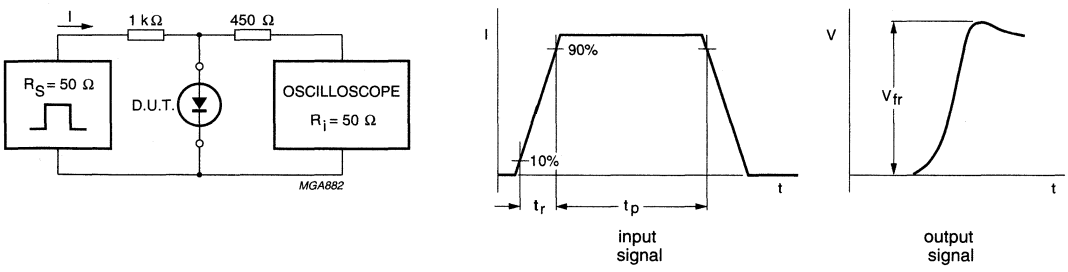


(1) I_R = 1 mA.

Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05.

Oscilloscope: rise time t_r = 0.35 ns.

Fig.6 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.7 Forward recovery voltage test circuit and waveforms.

High-speed double diode array BAW56S

FEATURES

- Small plastic SMD package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 85 V
- Repetitive peak forward current: max. 450 mA.

APPLICATIONS

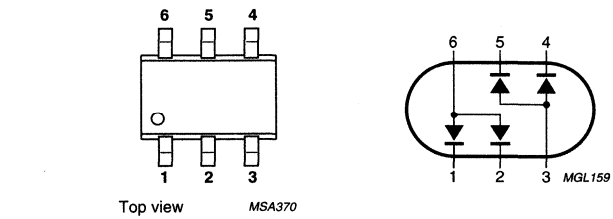
- General purpose switching in e.g. surface mounted circuits.

DESCRIPTION

The BAW56S consists of two dual high-speed switching diodes with common anodes, fabricated in planar technology, and encapsulated in the small SMD SOT363 plastic package.

PINNING

PIN	DESCRIPTION
1	cathode (k1)
2	cathode (k2)
3	common anode (a1)
4	cathode (k3)
5	cathode (k4)
6	common anode (a2)



Marking code: A1t.

Fig.1 Simplified outline (SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_{RRM}	repetitive peak reverse voltage		–	85	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	single diode loaded; see Fig.2	–	250	mA
		all diodes loaded; see Fig.2	–	100	mA
I_{FRM}	repetitive peak forward current		–	450	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	350	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C

Note

1. One or more diodes loaded.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	see Fig.18		
		I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	see Fig.5		
		V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz; see Fig.6	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 10 mA; t_r = 20 ns; see Fig.8	1.75	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	255	K/W

Note

1. One or more diodes loaded.

GRAPHICAL DATA

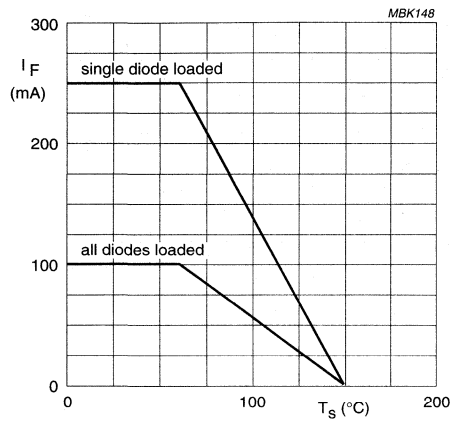
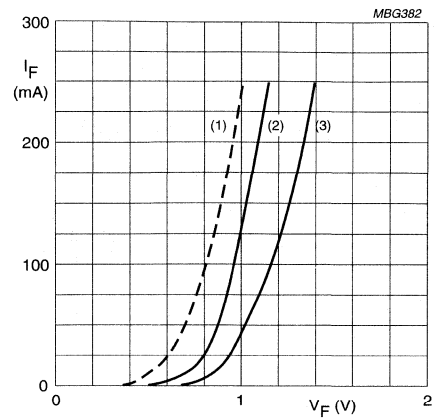
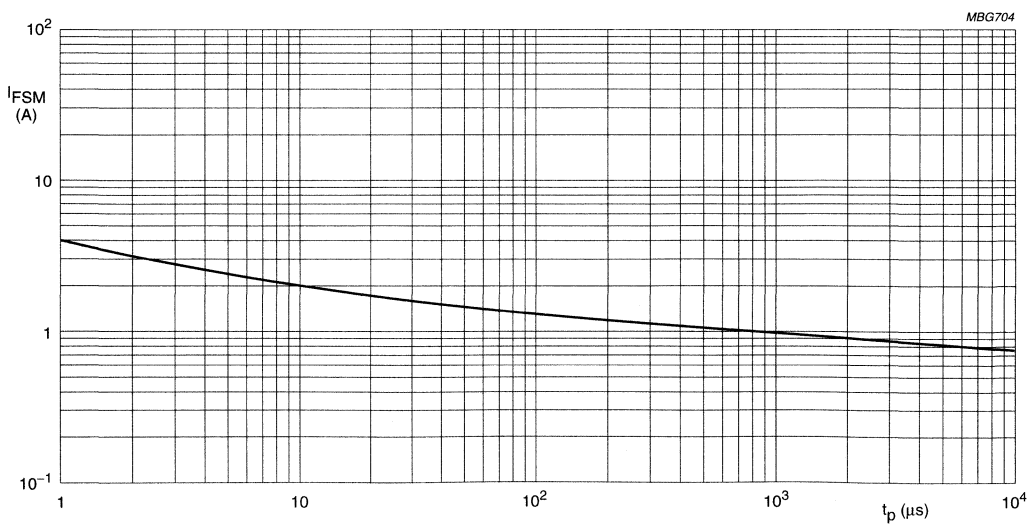


Fig.2 Maximum permissible continuous forward current as a function of soldering point temperature.



(1) T_j = 150 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.18 Forward current as a function of forward voltage.



Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.

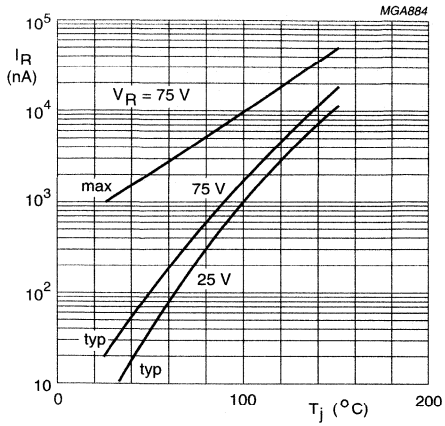
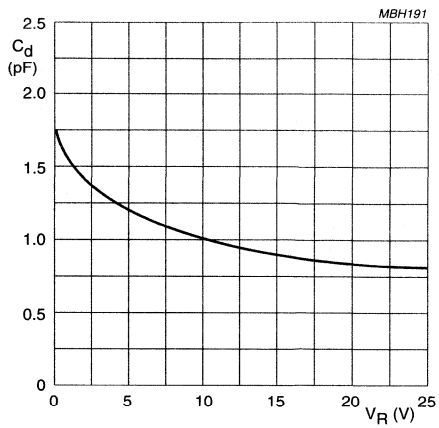
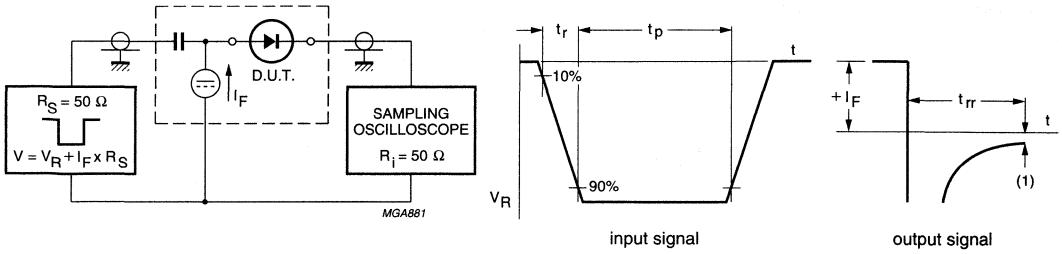


Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.

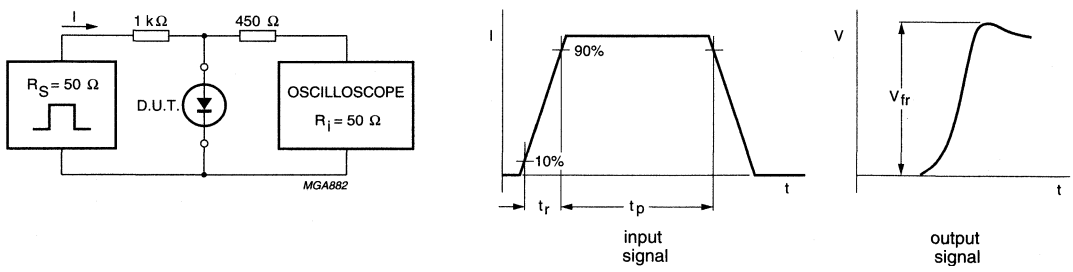


(1) I_R = 1 mA.

Input signal: reverse pulse rise time t_r = 0.6 ns; reverse voltage pulse duration t_p = 100 ns; duty factor δ = 0.05.

Oscilloscope: rise time t_r = 0.35 ns.

Fig.7 Reverse recovery voltage test circuit and waveforms.



Input signal: forward pulse rise time t_r = 20 ns; forward current pulse duration $t_p \geq 100$ ns; duty factor $\delta \leq 0.005$.

Fig.8 Forward recovery voltage test circuit and waveforms.

NPN/PNP general purpose transistor BC847BPN

FEATURES

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and boardspace
- No mutual interference between the transistors.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN/PNP transistor pair in an SC-88; SOT363 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
BC847BPN	13t

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

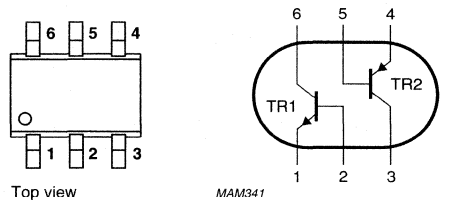


Fig.1 Simplified outline (SC-88; SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

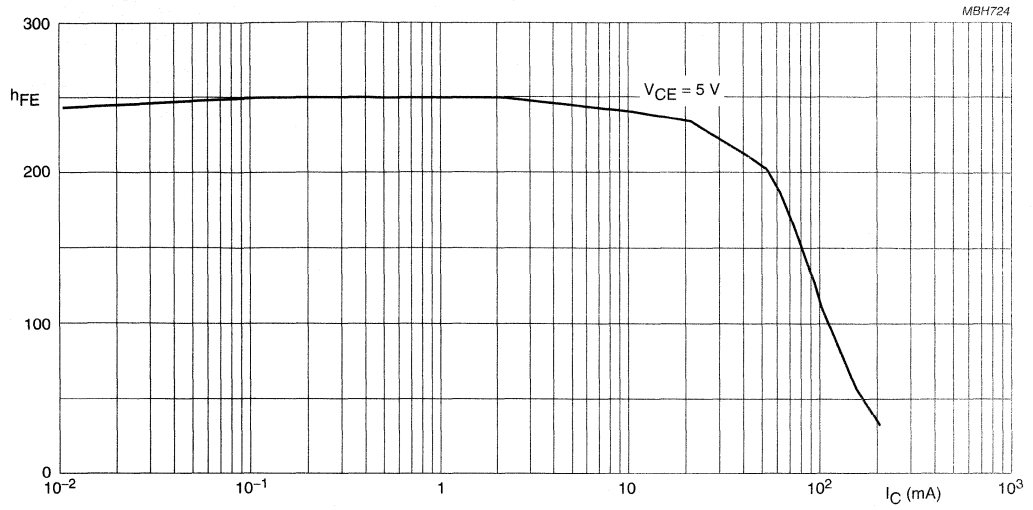
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor unless otherwise specified; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V	200	–	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	100	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	755	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V				
	TR1 NPN		580	655	700	mV
	TR2 PNP		600	655	750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1 NPN		–	–	1.5	pF
	TR2 PNP		–	–	2.2	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz				
	TR1 NPN		–	11	–	pF
	TR2 PNP		–	10	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz

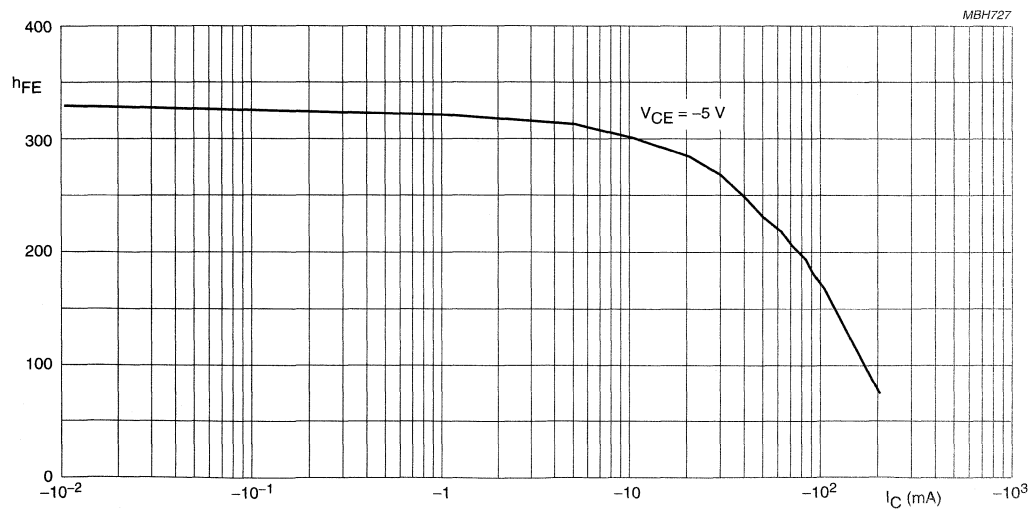
Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



TR1: NPN.

Fig.2 DC current gain; typical values.



TR2: PNP.

Fig.3 DC current gain, typical values.

NPN general purpose double transistor BC847BS

FEATURES

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and board space
- No mutual interference between the transistors.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN double transistor in an SC-88 plastic package.
PNP complement: BC857BS.

MARKING

TYPE NUMBER	MARKING CODE
BC847BS	1Ft

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

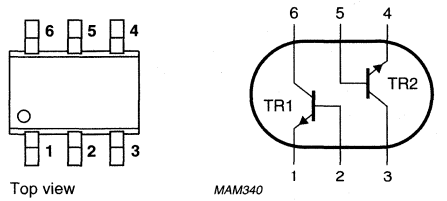


Fig.1 Simplified outline (SC-88) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V	200	–	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	100	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	755	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	580	655	700	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	1.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 500 mV; f = 1 MHz	–	11	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

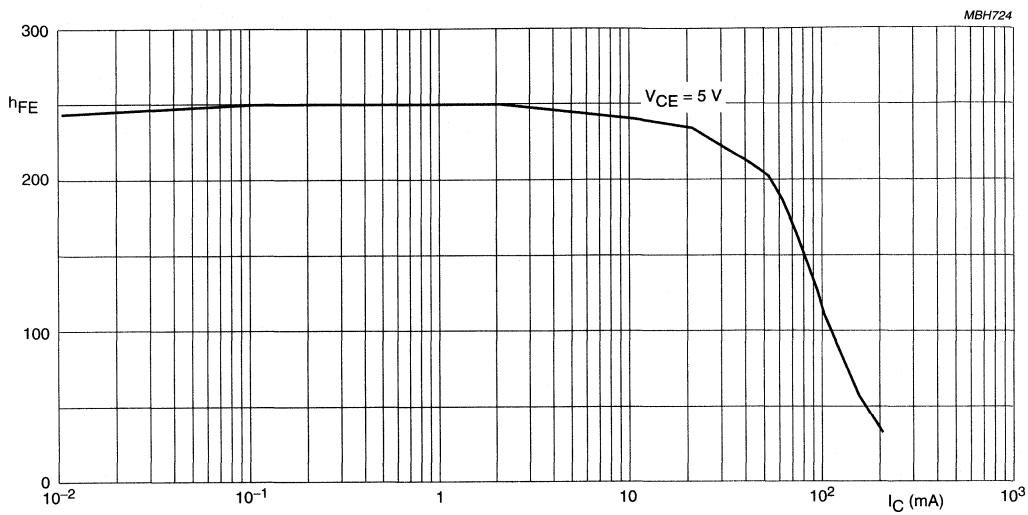


Fig.2 DC current gain; typical values.

PNP general purpose double transistor BC857BS

FEATURES

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and boardspace
- No mutual interference between the transistors.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

PNP double transistor in an SC-88; SOT363 plastic package. NPN complement: BC847BS.

MARKING

TYPE NUMBER	MARKING CODE
BC857BS	3Ft

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

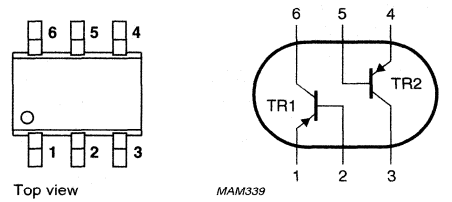


Fig.1 Simplified outline (SC-88; SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V	200	–	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	–	−100	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	–	−400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−755	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V	−600	−655	−750	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	2.2	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −500 mV; f = 1 MHz	–	10	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

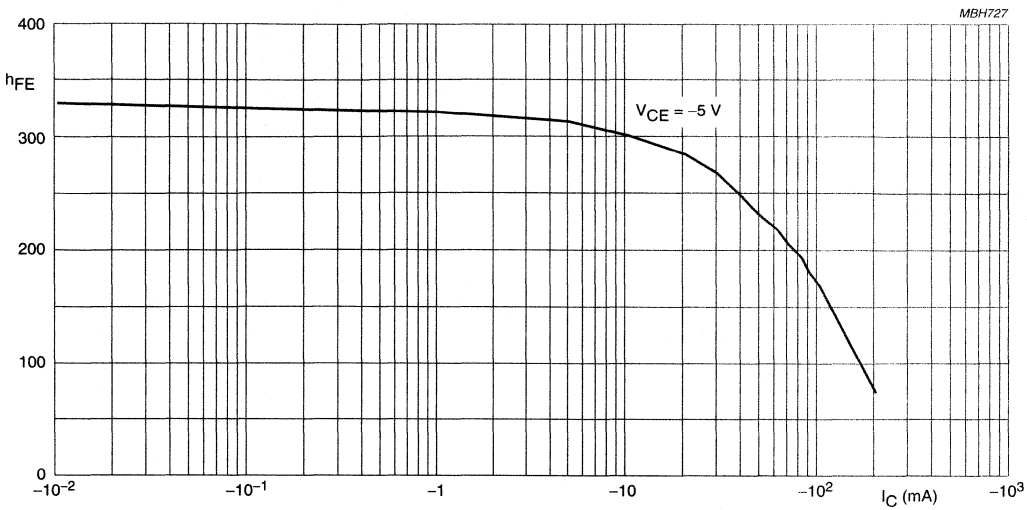


Fig.2 DC current gain; typical values

NPN general purpose double transistor BCV61

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V)
- Matched pairs.

APPLICATIONS

- For use in applications where the working point must be independent of temperature
- Current mirrors.

DESCRIPTION

NPN double transistor in a SOT143B plastic package.
PNP complement: BCV62.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BCV61	1Mp	BCV61B	1Kp
BCV61A	1Jp	BCV61C	1Lp

PINNING

PIN	DESCRIPTION
1	collector TR2; base TR1 and TR2
2	collector TR1
3	emitter TR1
4	emitter TR2

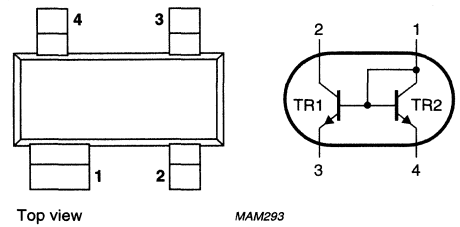


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage TR1	open emitter	–	30	V
V_{CEO}	collector-emitter voltage TR1	open base	–	30	V
V_{EBS}	emitter-base voltage	$V_{CE} = 0$	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current TR1		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

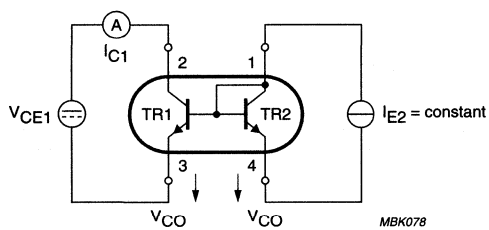
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transistor TR1						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 100 µA; V_{CE} = 5 V	100	–	–	
		I_C = 2 mA; V_{CE} = 5 V	110	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	250	mV
		I_C = 100 mA; I_B = 5 mA	–	200	600	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	770	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB
Transistor TR2						
V_{EBS}	base-emitter forward voltage	V_{CB} = 0; I_E = −250 mA	–	–	−1.8	V
		V_{CB} = 0; I_E = −10 µA	−400	–	–	mV
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V				
	BCV61A		110	–	220	
	BCV61B		200	–	450	
	BCV61C		420	–	800	

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transistors TR1 and TR2						
$\frac{I_{C1}}{I_{E2}}$	current matching of transistors TR1 and TR2	I_{E2} = −0.5 mA; V_{CE1} = 5 V; $T_{amb} \leq 25$ °C	0.7	–	1.3	
		I_{E2} = −0.5 mA; V_{CE1} = 5 V; $T_{amb} \leq 150$ °C	0.7	–	1.3	
I_{E2}	emitter current for thermal stability of I_{C1}	V_{CE1} = 5 V; note 3; (see Fig.2)	–	–	−5	mA

Notes

1. Decreasing 1.7 mV/°C with increasing temperature.
2. Decreasing 2 mV/°C with increasing temperature.
3. Device, without emitter resistors, mounted on an FR4 printed-circuit board.



V_{CE1} = 5 V; device, without emitter resistors, mounted on an FR4 printed-circuit board.

Voltage drop at contacts: $V_{CO} < \frac{2}{3}U_T \triangleq 16$ mV

Fig.2 Test circuit current matching.

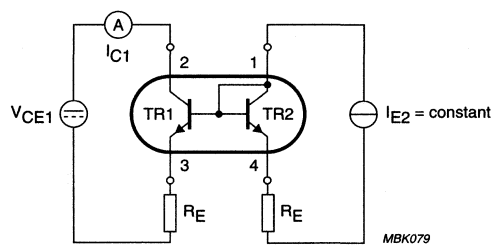
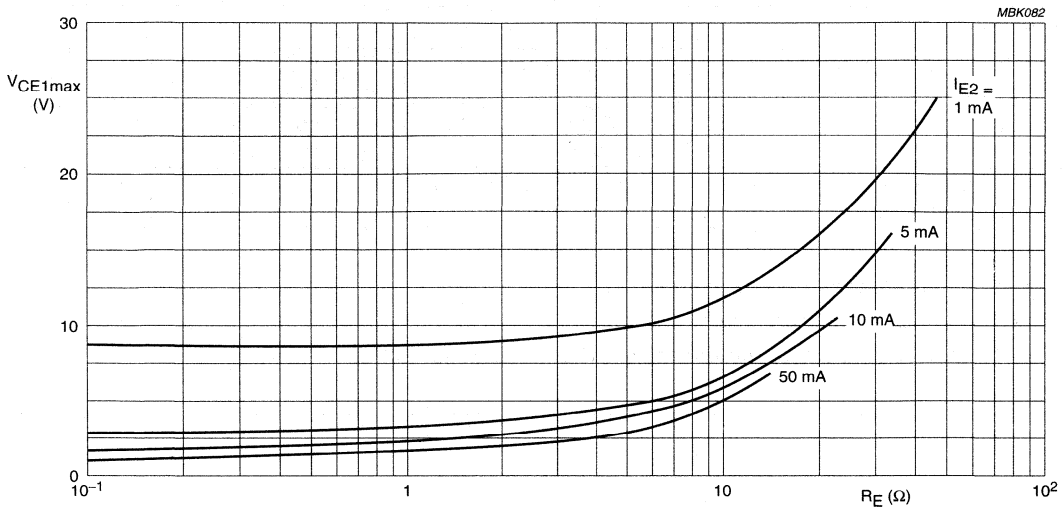


Fig.3 BCV61 with emitter resistors.



$\frac{I_{C1}}{I_{E2}}$ = 1.3 (see Fig.3).

Fig.4 Maximum collector-emitter voltage as a function of emitter resistance.

PNP general purpose double transistor BCV62

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V)
- Matched pair.

APPLICATIONS

- For use in applications where the working point must be independent of temperature
- Current mirrors.

DESCRIPTION

PNP double transistor in a SOT143B plastic package.
NPN complement: BCV61.

MARKING

TYPE NUMBER	MARKING CODE	TYPE NUMBER	MARKING CODE
BCV62	3Mp	BCV62B	3Kp
BCV62A	3Jp	BCV62C	3Lp

PINNING

PIN	DESCRIPTION
1	collector TR2; base TR1 and TR2
2	collector TR1
3	emitter TR1
4	emitter TR2

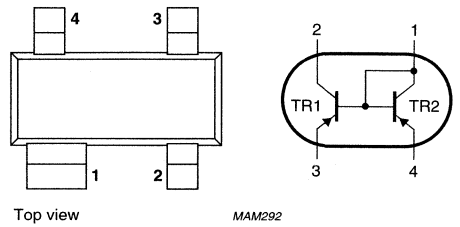


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage TR1	open emitter	–	–30	V
V_{CEO}	collector-emitter voltage TR1	open base	–	–30	V
V_{EBS}	emitter-base voltage	$V_{CE} = 0$	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current TR1		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

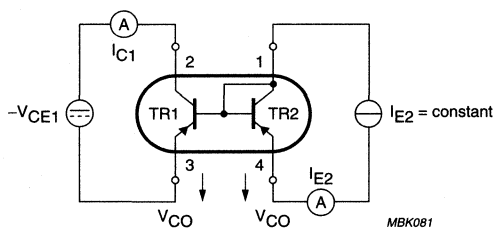
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transistor TR1						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−5	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = −5 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −100 μA; V_{CE} = −5 V	100	–	–	
		I_C = −2 mA; V_{CE} = −5 V	100	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−75	−300	mV
		I_C = −100 mA; I_B = −5 mA	–	−250	−650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = − 0.5 mA; note 1	–	−700	–	mV
		I_C = −100 mA; I_B = −5 mA; note 1	–	−850	–	mV
V_{BE}	base-emitter voltage	I_C = −2 mA; V_{CE} = −5 V; note 1	−600	−650	−750	mV
		I_C = −10 mA; V_{CE} = −5 V; note 2	–	–	−820	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V	–	4.5	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; f = 100 MHz	100	–	–	MHz
F	noise figure	I_C = −200 μA; V_{CE} = −5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	–	10	dB
Transistor TR2						
V_{EBS}	base-emitter forward voltage	I_E = 250 mA; V_{CB} = 0	–	–	1.5	V
		I_E = 10 μA; V_{CB} = 0	400	–	–	mV
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V				
	BCV62A		125	–	250	
	BCV62B		220	–	475	
	BCV62C		420	–	800	

PNP general purpose double transistor BCV62

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transistors TR1 and TR2						
$\frac{I_{C1}}{I_{E2}}$	current matching of transistors TR1 and TR2	I_{E2} = 0.5 mA; V_{CE1} = −5 V; $T_{amb} \leq 25$ °C	0.7	–	1.3	
		I_{E2} = 0.5 mA; V_{CE1} = −5 V; $T_{amb} \leq 150$ °C	0.7	–	1.3	
I_{E2}	emitter current for thermal stability of $-I_{C1}$	V_{CE1} = −5 V; note 3 ; (see Fig.2)	–	–	5	mA

Notes

1. Decreasing −1.7 mV/°C with increasing temperature.
2. Decreasing −2 mV/°C with increasing temperature.
3. Device, without emitter resistors, mounted on an FR4 printed-circuit board.



VCE1 = -5 V; device, without emitter resistors, mounted on an FR4 printed-circuit board.

Voltage drop at contacts: $V_{CO} < \frac{2}{3}U_T \triangleq 16$ mV .

Fig.2 Test circuit current matching.

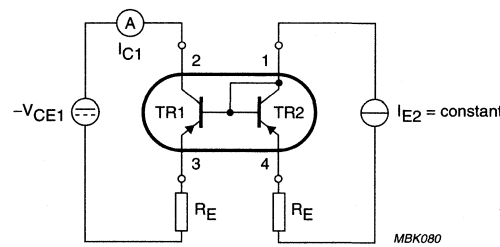
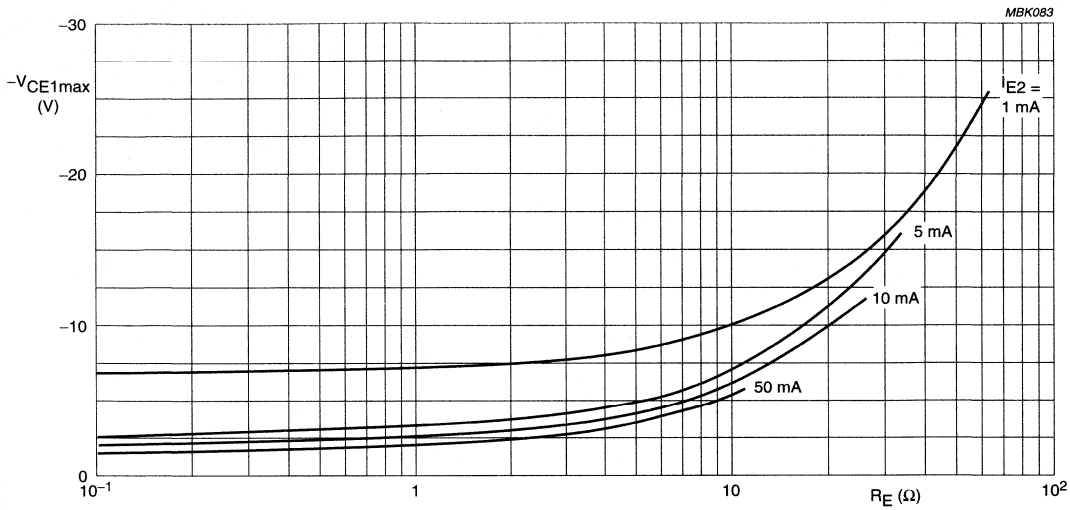


Fig.3 BCV62 with emitter resistors.



$\frac{I_{C1}}{I_{E2}}$ = 1.3 (see Fig.3).

Fig.4 Maximum collector-emitter voltage as a function of emitter resistance.

NPN general purpose double transistors BCV63; BCV63B

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 and 6 V).

APPLICATIONS

- General purpose switching and amplification
- For use in Schmitt-trigger applications.

DESCRIPTION

NPN double transistor in a SOT143B plastic package.
PNP complement: BCV64B.

MARKING

TYPE NUMBER	MARKING CODE
BCV63	D95
BCV63B	D96

PINNING

PIN	DESCRIPTION
1	collector TR2 and base TR1
2	collector TR1
3	emitter TR1 and TR2
4	base TR2

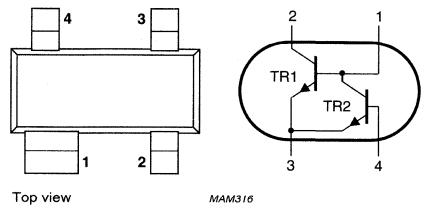


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	TR1		–	30	V
	TR2		–	6	V
V_{CEO}	collector-emitter voltage	open base			
	TR1		–	30	V
	TR2		–	6	V
V_{EBO}	emitter-base voltage	open collector	–	6	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_B	base current (DC)		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	µA
h_{FE}	DC current gain					
	BCV63 TR1	I_C = 2 mA; V_{CE} = 5 V	110	–	800	
	BCV63 TR2	I_C = 2 mA; V_{CE} = 700 mV; note 1	110	–	800	
	BCV63B TR1	I_C = 2 mA; V_{CE} = 5 V	200	–	450	
	BCV63B TR2	I_C = 2 mA; V_{CE} = 700 mV; note 1	200	–	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	75	300	mV
	collector-emitter saturation voltage	I_C = 100 mA; I_B = 5 mA				
	TR1		–	250	650	mV
	TR2		–	250	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 2	–	700	–	mV
	base-emitter saturation voltage	I_C = 100 mA; I_B = 5 mA; note 2				
	TR1		–	–850	–	mV
V_{BE}	base-emitter voltage					
	TR1	I_C = 2 mA; V_{CE} = 5 V; note 3	600	650	750	mV
	TR1	I_C = 10 mA; V_{CE} = 5 V; note 3	–	–	820	mV
	TR2	I_C = 2 mA; V_{CE} = 700 mV; note 3	–	700	–	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1		–	4	–	pF
f_T	transition frequency	I_C = 10 mA; V_{CE} = 5 V; f = 100 MHz				
	TR1		100	–	–	MHz

Notes

1. Group selection will be done on TR1. Due to matched dies, h_{FE} values for TR2 are the same as for TR1.
2. V_{BEsat} decreases by approximately 1.7 mV/K with increasing temperature.
3. V_{BE} decreases by approximately 2 mV/K with increasing temperature.

APPLICATION INFORMATION

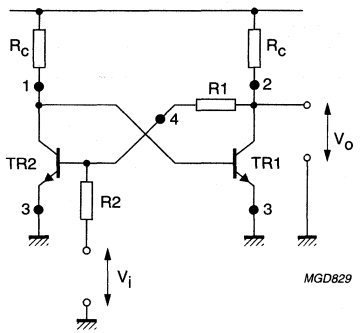


Fig.2 Schmitt-trigger application.

PNP general purpose double transistor BCV64B

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 and 6 V).

APPLICATIONS

- General purpose switching and amplification
- For use in Schmitt-trigger applications.

DESCRIPTION

PNP double transistor in a SOT143B plastic package.
NPN complement: BCV63B.

MARKING

TYPE NUMBER	MARKING CODE
BCV64B	C96

PINNING

PIN	DESCRIPTION
1	collector TR2 and base TR1
2	collector TR1
3	emitter TR1 and TR2
4	base TR2

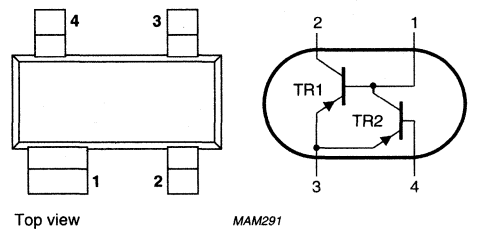


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	TR1		–	–30	V
	TR2		–	–6	V
V_{CEO}	collector-emitter voltage	open base			
	TR1		–	–30	V
	TR2		–	–6	V
V_{EBO}	emitter-base voltage	open collector	–	–6	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_B	base current (DC)		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

1. Transistor mounted on a printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −30 V	–	–	−15	nA
		I_E = 0; V_{CB} = −30 V; T_j = 150 °C	–	–	−5	µA
h_{FE}	DC current gain					
	TR1	I_C = −2 mA; V_{CE} = −5 V	220	–	475	
	TR2	I_C = −2 mA; V_{CE} = −700 mV; note 1	220	–	475	
V_{CEsat}	collector-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA	–	−75	−300	mV
	collector-emitter saturation voltage	I_C = −100 mA; I_B = −5 mA				
	TR1		–	−250	−650	mV
	TR2		–	−250	–	mV
V_{BEsat}	base-emitter saturation voltage	I_C = −10 mA; I_B = −0.5 mA; note 2	–	−700	–	mV
	base-emitter saturation voltage	I_C = −100 mA; I_B = −5 mA; note 2				
	TR1		–	−850	–	mV
V_{BE}	base-emitter voltage					
	TR1	I_C = −2 mA; V_{CE} = −5 V; note 3	−600	−650	−750	mV
	TR1	I_C = −10 mA; V_{CE} = −5 V; note 3	–	–	−820	mV
	TR2	I_C = −2 mA; V_{CE} = −700 mV; note 3	–	−700	–	mV
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = −10 V; f = 1 MHz				
	TR1		–	4	–	pF
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V;				
	TR1	f = 100 MHz	100	–	–	MHz

Notes

1. Group selection will be done on TR1. Due to matched dies, h_{FE} values for TR2 are the same as for TR1.
2. V_{BEsat} decreases by approximately 1.7 mV/K with increasing temperature.
3. V_{BE} decreases by approximately −2 mV/K with increasing temperature.

APPLICATION INFORMATION

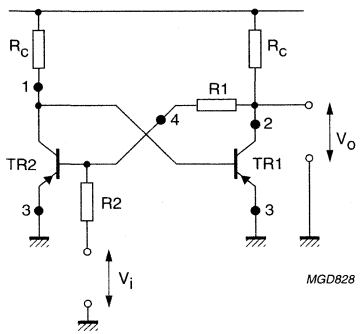


Fig.2 Schmitt-trigger application.

NPN/PNP general purpose transistor BCV65

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 30 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

An NPN/PNP matched pair transistor in a SOT143B plastic package.

MARKING

TYPE NUMBER	MARKING CODE
BCV65	97p

PINNING

PIN	DESCRIPTION
1, 3	collector
2	common base
4	common emitter

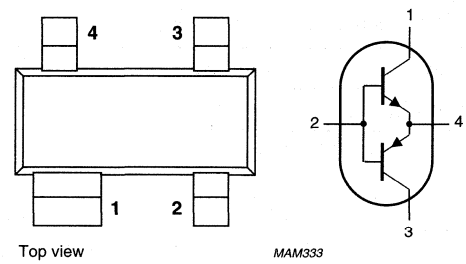


Fig.1 Simplified outline (SOT143B) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation (per device)	$T_{amb} \leq 25$ °C	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	–	15	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	–	5	μA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V	75	–	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	90	300	mV
		I_C = 100 mA; I_B = 5 mA	–	250	650	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; note 1	–	700	–	mV
		I_C = 100 mA; I_B = 5 mA; note 1	–	900	–	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V; note 2	580	650	750	mV
		I_C = 10 mA; V_{CE} = 5 V; note 2	–	–	820	mV

Notes

1. V_{BEsat} decreases by approximately |1.7| mV/K with increasing temperature.
2. V_{BE} decreases by approximately |2| mV/K with increasing temperature.

18-fold ESD transient voltage suppressor BZA100

FEATURES

- SO20 SMD package allows 18 separate voltage regulator diodes in a common anode configuration
- Working voltage: typ. 6.8 V
- Forward voltage: max. 1.3 V
- Maximum reverse peak power dissipation: 27.5 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 11 V at 2.5 A
- Low leakage current: max. 2 μA
- ESD rating >8 kV, according IEC 801-2.

APPLICATIONS

- Where transient overvoltage protection in voltage and ESD sensitive equipment is required such as:
  - Computers
  - Printers
  - Business machines
  - Communication systems
  - Medical equipment.

DESCRIPTION

18-fold monolitic transient voltage suppressor. Its 18-fold junction common anode design protects 18 separate lines using only one package. This device is ideal for situations where board space is a premium.

PINNING

PIN	DESCRIPTION
1 to 5	cathode (k_1 to k_5)
6 and 16	common anode (a_1; a_2)
7 to 15	cathode (k_6 to k_{14})
17 to 20	cathode (k_{15} to k_{18})

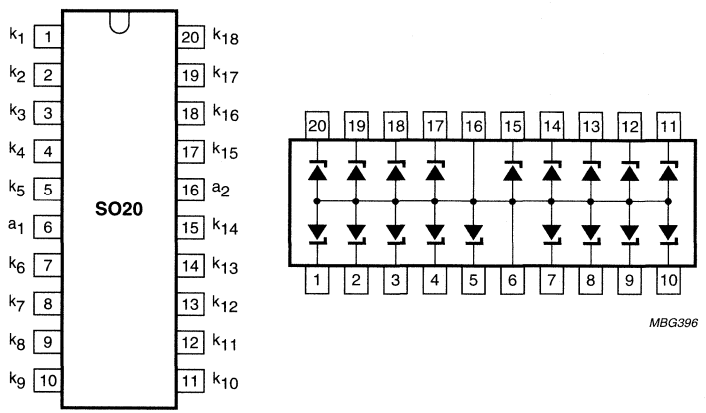


Fig.1 Pin configuration for SO20 (SOT163-1) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_Z	working current		–	note 1	mA
I_F	continuous forward current		–	200	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	4	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	2.5	A
P_{tot}	total power dissipation	see Fig.3			
		up to T_s = 60 °C; note 2	–	1.6	W
		up to T_{amb} = 25 °C; note 3	–	1.25	W
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 1 ms; square pulse; see Fig.4	–	27.5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Notes

1. DC working current limited by $P_{tot\ max}$.
2. One or more diodes loaded; T_s is the temperature at the soldering point.
3. One or more diodes loaded; device mounted on a printed-circuit board with $R_{th\ a\text{-}s}$ = 43.5 K/W.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one or more diodes loaded	56.5	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		100	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 5 mA	6.4	6.8	7.2	V
V_F	forward voltage	I_F = 200 mA	–	–	1.3	V
V_{ZSM}	non-repetitive peak reverse voltage	t_p = 1 ms; I_{ZSM} = 2.5 A	–	–	11	V
I_R	reverse current	V_R = 5.25 V	–	–	2	μA
r_{dif}	differential resistance	I_Z = 1 mA	–	–	40	Ω
		I_Z = 5 mA	–	–	8	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5mA	–	3	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	120	pF
		V_R = 5.25 V; f = 1 MHz	–	–	60	pF

GRAPHICAL DATA

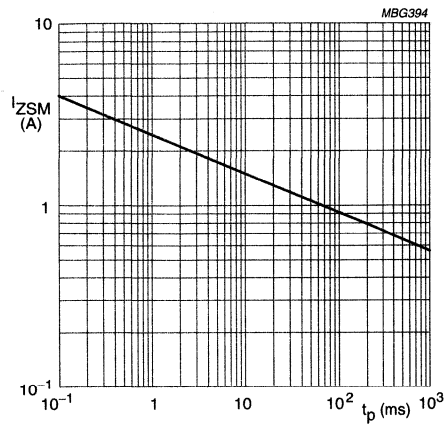
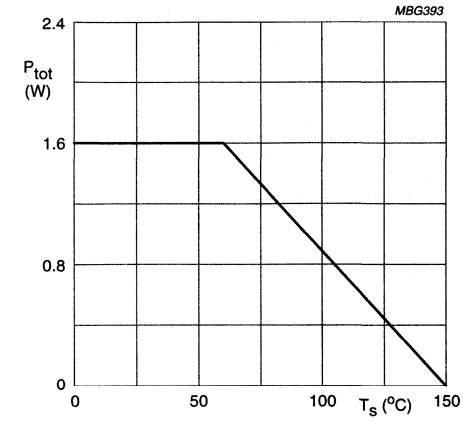
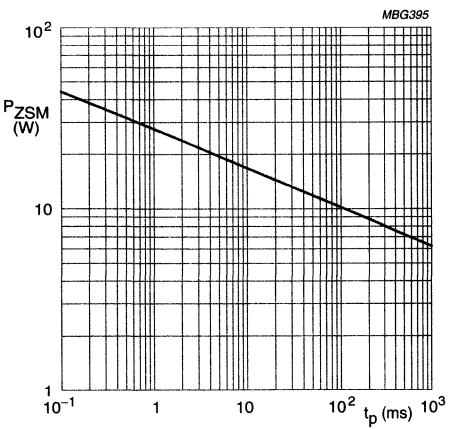


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



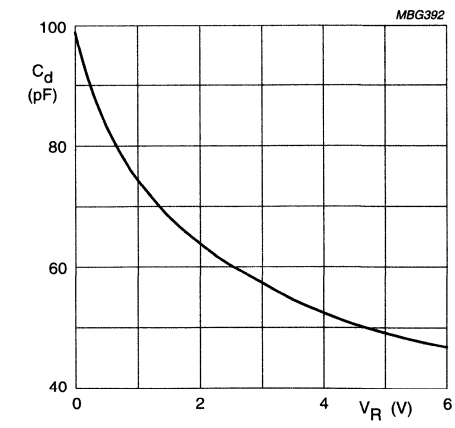
All diodes loaded.

Fig.3 Power derating curve.



$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).



T_j = 25 °C; f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

9-fold ESD transient voltage suppressor BZA109

FEATURES

- ESD rating >8 kV, according to IEC1000-4-2
- SOT163-1 surface mount package
- Common anode configuration
- Non-clamping range 0.5 to 6.8 V
- Maximum non-repetitive peak reverse power dissipation: 25 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 10 V at I_{ZSM} = 2.5 A.

APPLICATIONS

- For 9-bit wide undershoot/ overshoot clamping and fast ESD transient suppression in:
  - Computers and peripherals
  - Audio and video equipment
  - Business machines
  - Communication systems
  - Medical equipment.

DESCRIPTION

9-fold monolithic transient voltage suppressor in an SO20; SOT163-1 surface mount package. The device is ideal in situations where board space is a premium.

PINNING

PIN	DESCRIPTION
1 to 5	input (IN1 to IN5)
6 and 15	common anode (GND)
7 to 10	input (IN6 to IN9)
11 to 14	output (OUT9 to OUT6)
16 to 20	output (OUT5 to OUT1)

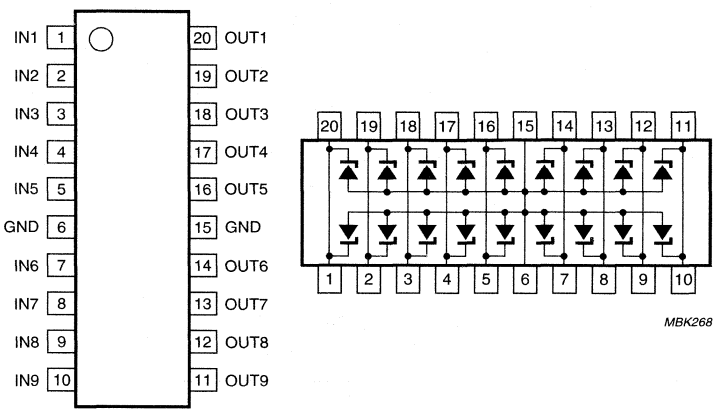


Fig.1 Pin configuration for SO20 (SOT163-1) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_Z	working current	T_{amb} = 25 °C	–	20	mA
I_F	continuous forward current	T_{amb} = 25 °C	–	100	mA
I_{FT}	feed-through current	T_{amb} = 25 °C; note 1	–	100	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	4.5	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	2.5	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C; note 2; see Fig.3	–	1.25	W
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 1 ms; square pulse; see Fig.4	–	25	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		−65	+150	°C

Notes

1. Current is flowing from input to corresponding output.
2. One or more diodes loaded.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	one or more diodes loaded	100	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 250 μA	6.4	6.8	7.2	V
V_F	forward voltage	I_F = 100 mA	–	–	1.1	V
V_{ZSM}	non-repetitive peak reverse voltage	I_{ZSM} = 2.5 A; t_p = 1 ms	–	–	10	V
I_H	input high current	V_{IN} = 5.25 V	–	–	0.5	μA
r_{dif}	differential resistance	I_Z = 250 μA	–	–	100	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5 mA	–	3	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	200	pF
		V_R = 5.25 V; f = 1 MHz	–	–	100	pF

GRAPHICAL DATA

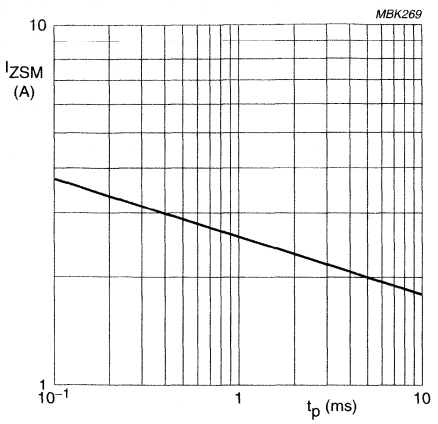
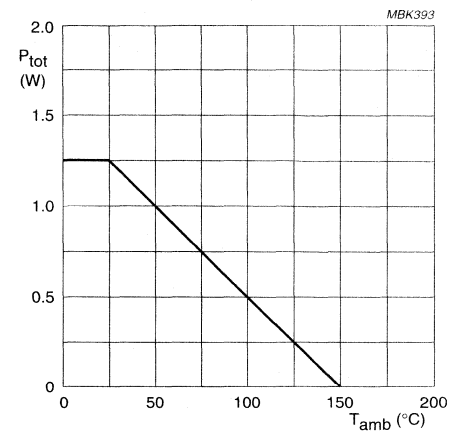
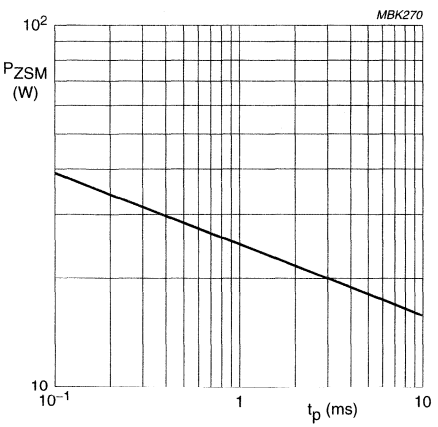


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



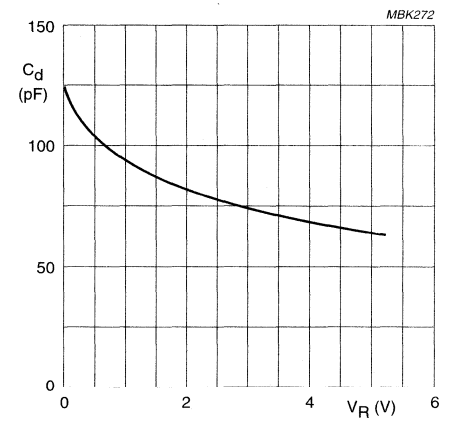
One or more diodes loaded.

Fig.3 Power derating curve.



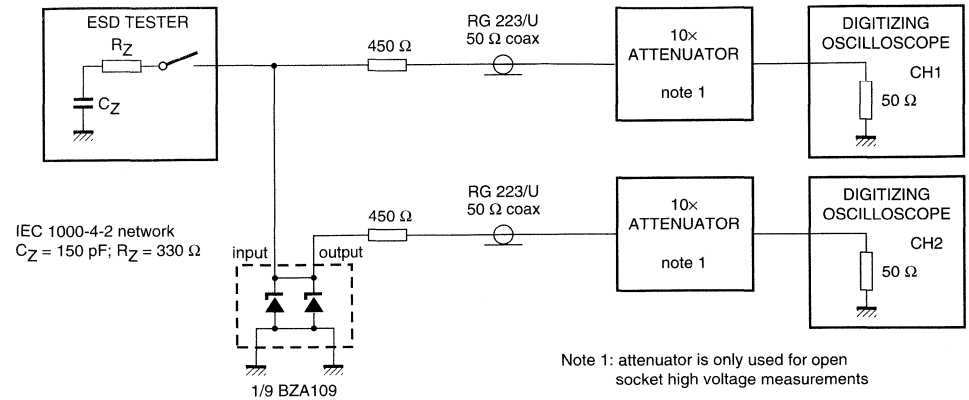
$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).

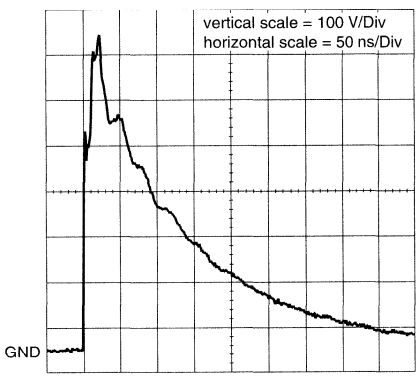


T_j = 25 °C; f = 1 MHz.

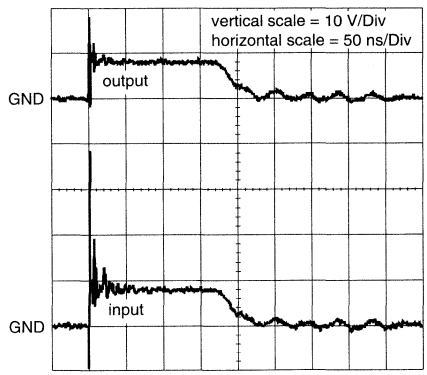
Fig.5 Diode capacitance as a function of reverse voltage; typical values.



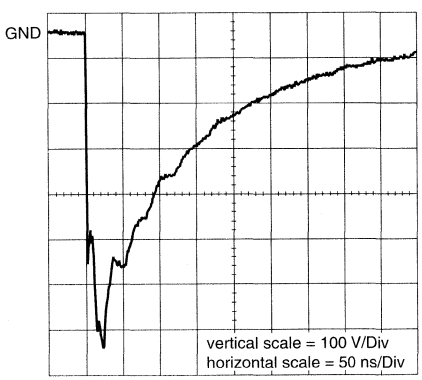
Note 1: attenuator is only used for open socket high voltage measurements



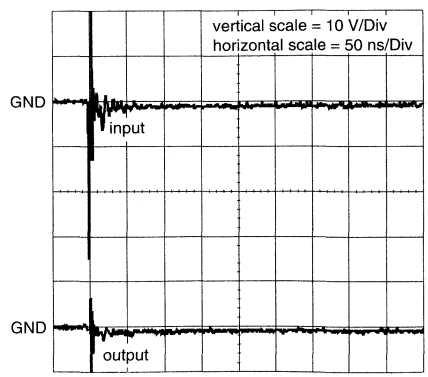
unclamped +1 kV ESD voltage waveform (IEC1000–4–2 network)



clamped +1 kV ESD voltage waveform (IEC1000–4–2 network)



unclamped −1 kV ESD voltage waveform (IEC1000–4–2 network)



clamped −1 kV ESD voltage waveform (IEC1000–4–2 network)

MBK273

Fig.6 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

Typical common anode application

A 9-fold transient suppressor in an SO20; SOT163-1 package makes it possible to protect nine separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.

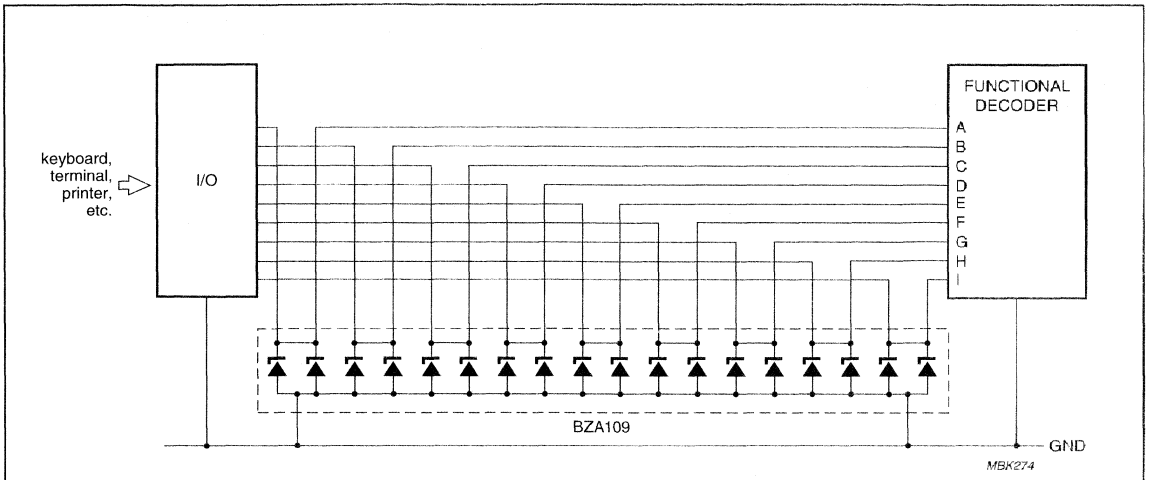


Fig.7 Computer interface protection.

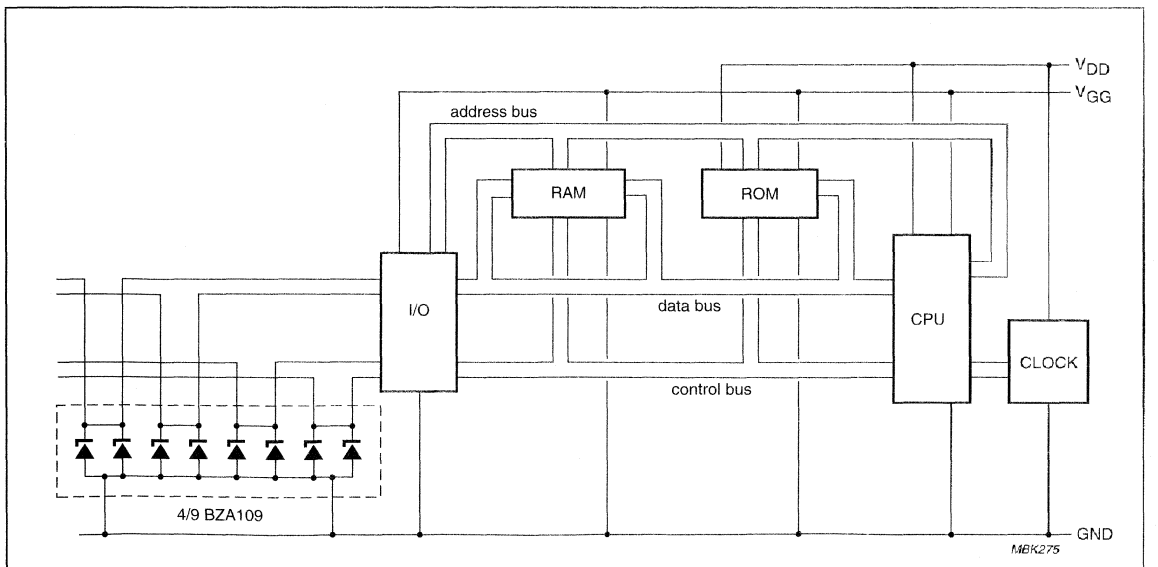


Fig.8 Microprocessor protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA109 is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage (V = L di/dt) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors.
2. Keep parallel signal paths to a minimum.
3. Avoid running protection conductors in parallel with unprotected conductors.
4. Minimize all printed-circuit board loop areas including power and ground loops.
5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

9-fold ESD transient voltage suppressor BZA109TS

FEATURES

- ESD rating >8 kV, according to IEC1000-4-2
- SOT339-1 surface mount package
- Common anode configuration
- Non-clamping range −0.5 to +6.8 V
- Maximum non-repetitive peak reverse power dissipation: 25 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 10 V at I_{ZSM} = 2.5 A.

APPLICATIONS

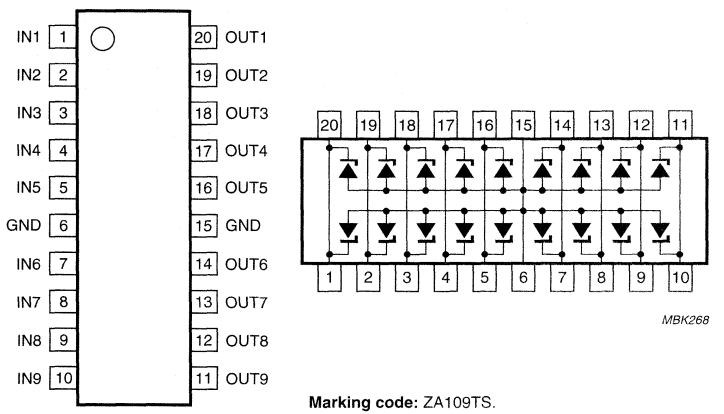
- For 9-bit wide undershoot/ overshoot clamping and fast ESD transient suppression in:
  - Computers and peripherals
  - Audio and video equipment
  - Business machines
  - Communication systems
  - Medical equipment.

DESCRIPTION

9-fold monolithic transient voltage suppressor in an SSOP20; SOT339-1 surface mount package. The device is ideal in situations where board space is a premium.

PINNING

PIN	DESCRIPTION
1 to 5	input (IN1 to IN5)
6 and 15	common anode (GND)
7 to 10	input (IN6 to IN9)
11 to 14	output (OUT9 to OUT6)
16 to 20	output (OUT5 to OUT1)



Marking code: ZA109TS.

Fig.1 Pin configuration for SSOP20 (SOT339-1) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_Z	working current	T_{amb} = 25 °C	–	20	mA
I_F	continuous forward current	T_{amb} = 25 °C	–	100	mA
I_{FT}	feed-through current	T_{amb} = 25 °C; note 1	–	100	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	4.5	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	2.5	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C; note 2; see Fig.3	–	0.95	W
P_{ZSM}	non-repetitive peak reverse power dissipation	t_p = 1 ms; square pulse; see Fig.4	–	25	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		−65	+150	°C

Notes

1. Current is flowing from input to corresponding output.
2. One or more diodes loaded.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	one or more diodes loaded	135	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 250 µA	6.4	6.8	7.2	V
V_F	forward voltage	I_F = 100 mA	–	–	1.1	V
V_{ZSM}	non-repetitive peak reverse voltage	I_{ZSM} = 2.5 A; t_p = 1 ms	–	–	10	V
I_H	input high current	V_{IN} = 5.25 V	–	–	0.5	µA
r_{dif}	differential resistance	I_Z = 250 µA	–	–	100	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5 mA	–	3	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	200	pF
		V_R = 5.25 V; f = 1 MHz	–	–	100	pF

GRAPHICAL DATA

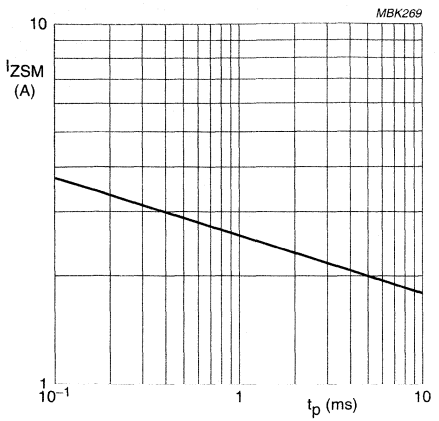
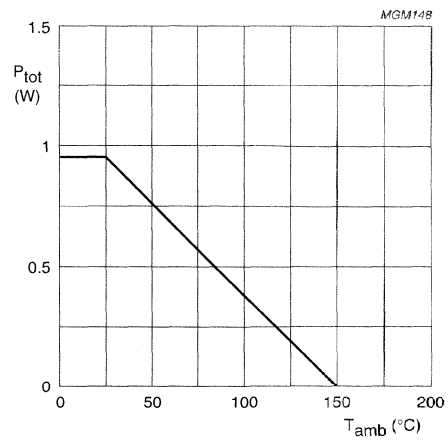
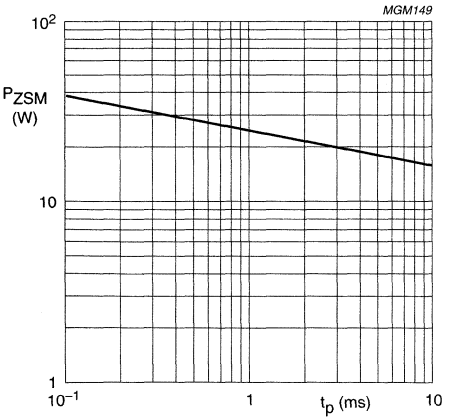


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



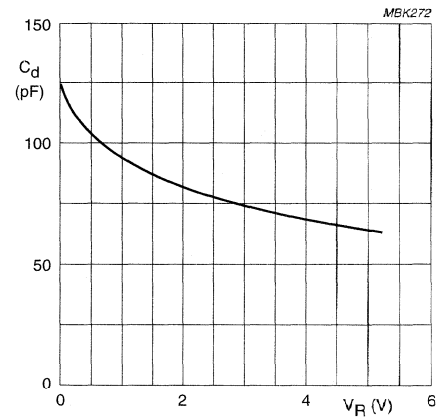
One or more diodes loaded.

Fig.3 Power derating curve.



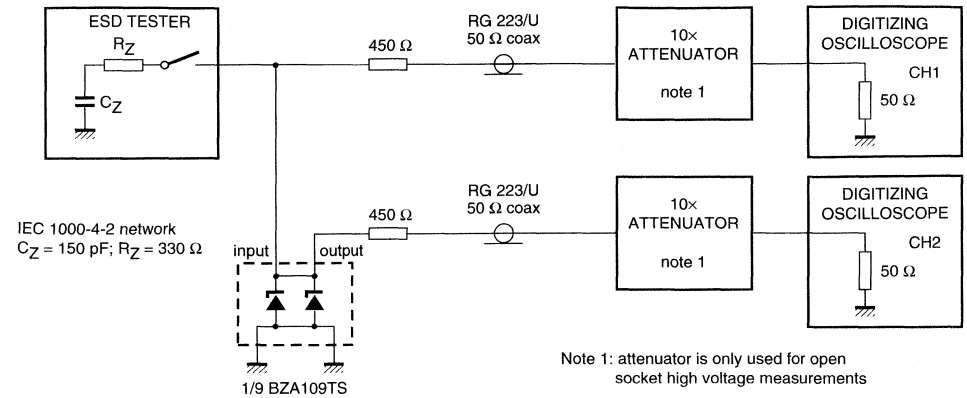
$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).

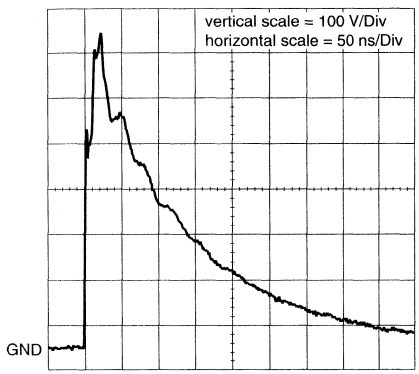


$T_j = 25$ °C; $f = 1$ MHz.

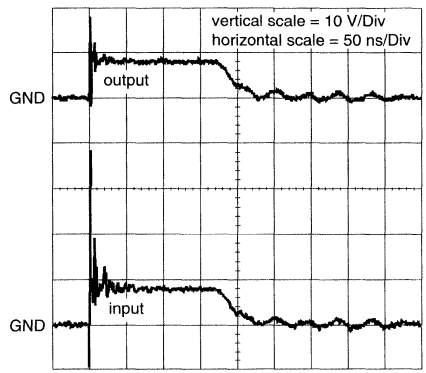
Fig.5 Diode capacitance as a function of reverse voltage; typical values.



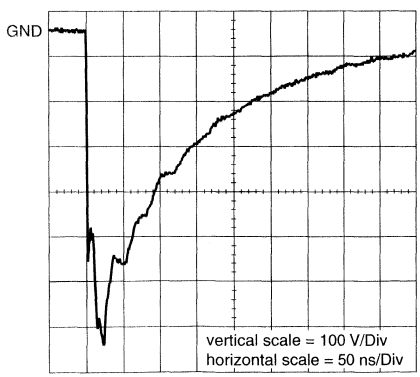
Note 1: attenuator is only used for open socket high voltage measurements



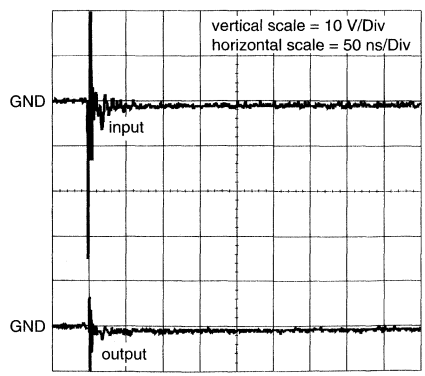
unclamped +1 kV ESD voltage waveform (IEC1000–4–2 network)



clamped +1 kV ESD voltage waveform (IEC1000–4–2 network)



unclamped −1 kV ESD voltage waveform (IEC1000–4–2 network)



clamped −1 kV ESD voltage waveform (IEC1000–4–2 network)

MBK392

Fig.6 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

Typical common anode application

A 9-fold transient suppressor in an SSOP20; SOT339-1 package makes it possible to protect nine separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.

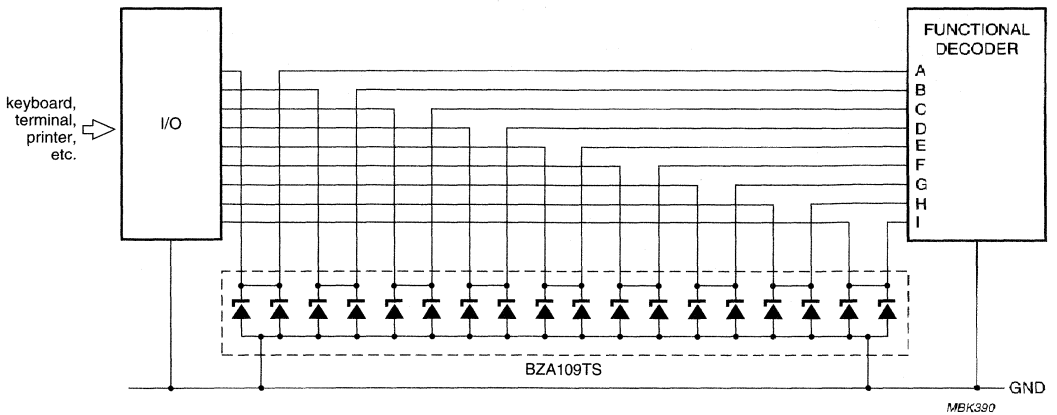


Fig.7 Computer interface protection.

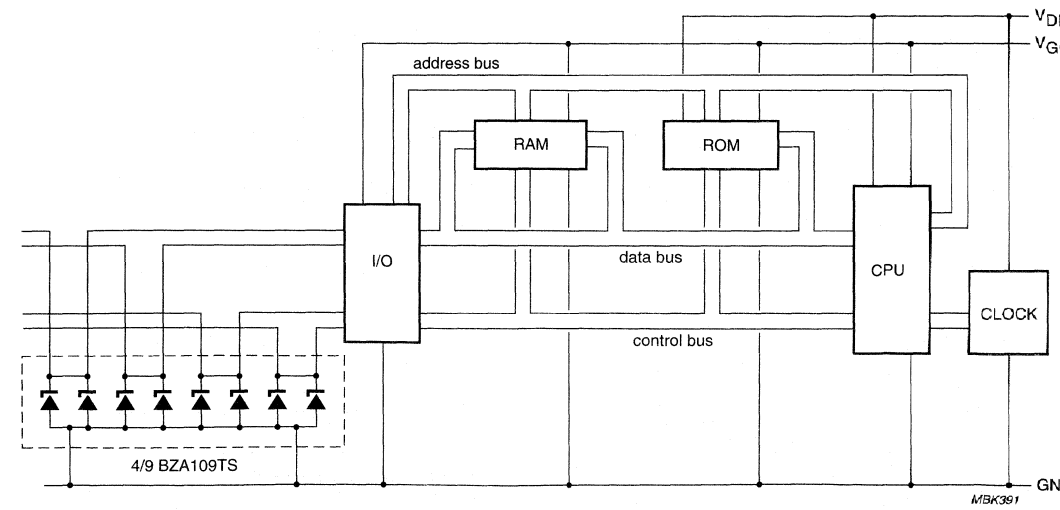


Fig.8 Microprocessor protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA109TS is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage (V = L di/dt) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors.
2. Keep parallel signal paths to a minimum.
3. Avoid running protection conductors in parallel with unprotected conductors.
4. Minimize all printed-circuit board loop areas including power and ground loops.
5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

Quadruple bidirectional ESD transient voltage suppressor

BZA408B

FEATURES

- ESD rating >15 kV, according to IEC1000-4-2
- SOT457 surface mount package
- Non-clamping range: –5 V to +5 V
- Channel separation: >70 dB
- Low reverse current: <100 nA
- Low diode capacitance: <75 pF.

APPLICATIONS

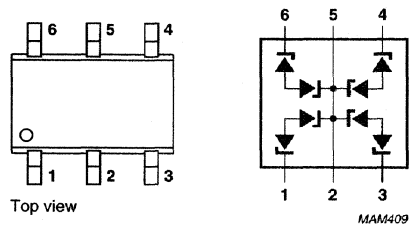
- Protection of equipment, connected to data and transmission lines, against voltage surges caused by electrostatic discharge e.g:
  - Computers and peripherals
  - Audio and video equipment
  - Communication systems
  - Medical equipment
  - Portable electronics.

DESCRIPTION

4-bit wide monolithic bidirectional ESD transient voltage suppressor in a six lead SOT457 (SC-74) package.

PINNING

PIN	DESCRIPTION
1	cathode 1
2, 5	ground
3	cathode 2
4	cathode 3
6	cathode 4



Marking code: Z8.

Fig.1 Simplified outline (SOT457) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode (pin 2 and / or 5 connected to ground)					
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	2	A
P_{ZSM}	non-repetitive peak power	t_p = 1 ms; square pulse	–	20	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one or more diodes loaded	340	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode (pin 2 and / or 5 connected to ground)					
V_{RWM}	working reverse voltage		–	5	V
V_R	reverse voltage	I_{test} = 5 mA	5.5	–	V
V_{ZSM}	non-repetitive peak reverse voltage	t_p = 1 ms; I_{ZSM} = 2 A	–	10	V
I_R	reverse current	$V_R = V_{RWM}$	–	100	nA
C_d	diode capacitance	see Fig.3			
		V_R = 0; f = 1 MHz	–	75	pF
		V_R = 5 V; f = 1 MHz	–	55	pF
$\alpha_{ch\ (p\ to\ p)}$	pin to pin channel separation	note 1; see Fig.4	70	–	dB

Note

1. $\alpha_{ch\ (p\ to\ p)}$ is measured as follows: a –7 dBs sinewave of 400 Hz is connected to e.g. pin 6 and a –7 dBs sinewave of 1 kHz to pin 1. The 1 kHz signal of pin 1 is measured on pin 6 by means of a spectrum analyser with an input impedance of 1 MΩ. So $\alpha_{ch\ (p\ to\ p)}$ equals the 1 kHz level on pin 1 minus the 1 kHz level on pin 6. For the 400 Hz signal the same measurement is done in the opposite way.

GRAPHICAL DATA

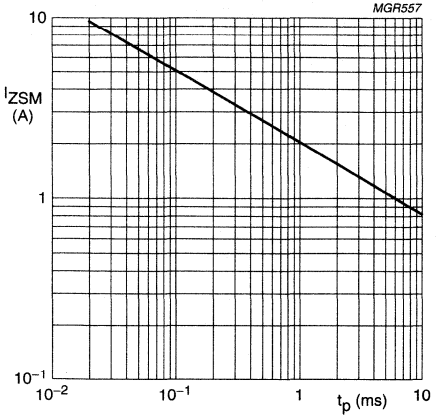
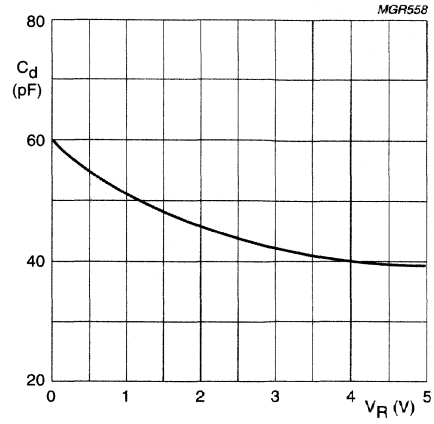


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



T_j = 25 °C; f = 1 MHz.

Fig.3 Diode capacitance as a function of reverse voltage; typical values.

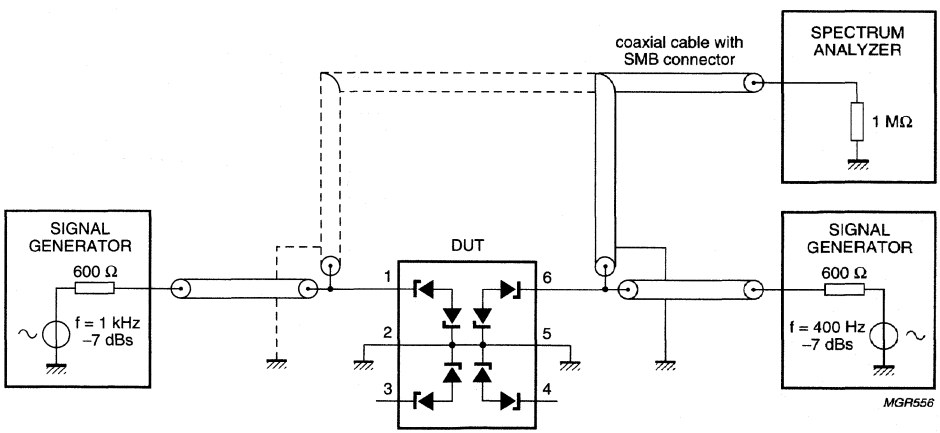
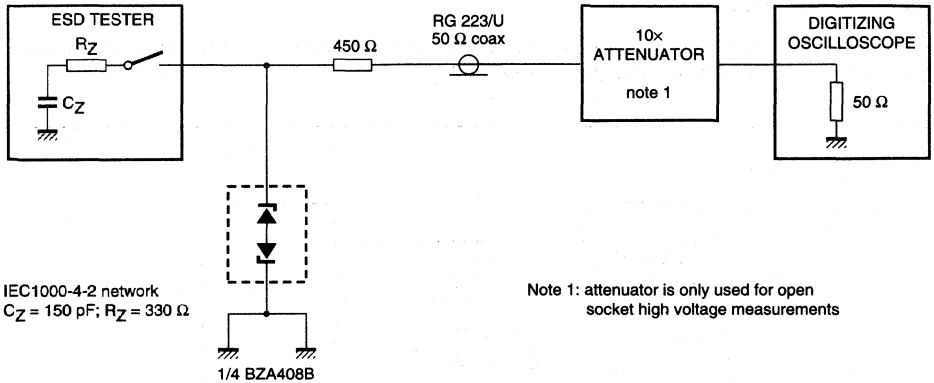
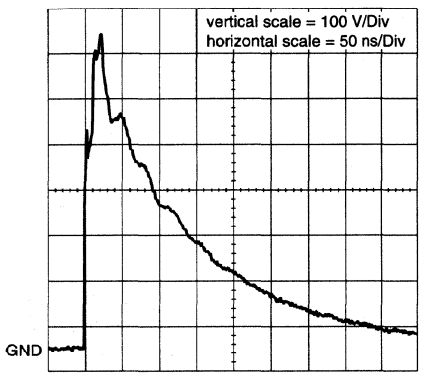
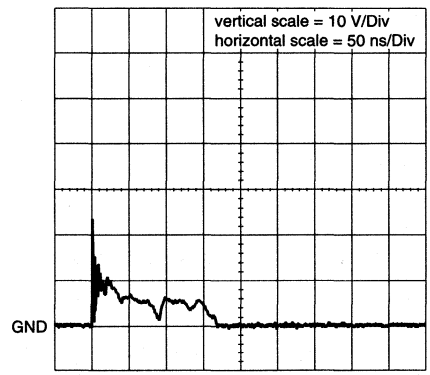


Fig.4 Channel separation measurement setup.

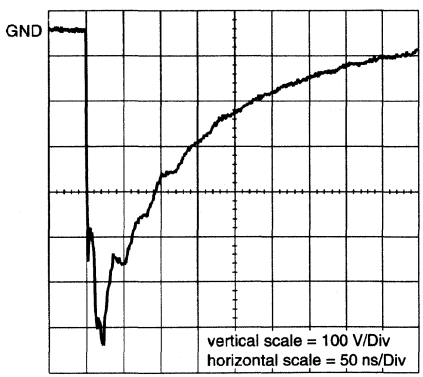




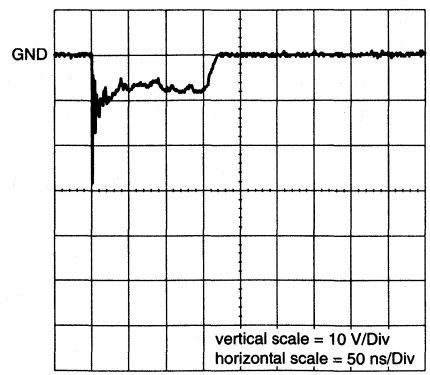
unclamped +1 kV ESD voltage waveform (IEC1000-4-2 network)



clamped +1 kV ESD voltage waveform (IEC1000-4-2 network)



unclamped −1 kV ESD voltage waveform (IEC1000-4-2 network)



clamped −1 kV ESD voltage waveform (IEC1000-4-2 network)

MGR560

Fig.5 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

Typical bidirectional application

A quadruple bidirectional transient suppressor in a SOT457 package makes it possible to protect four separate lines using only one package. One simplified example is shown in Fig.6.

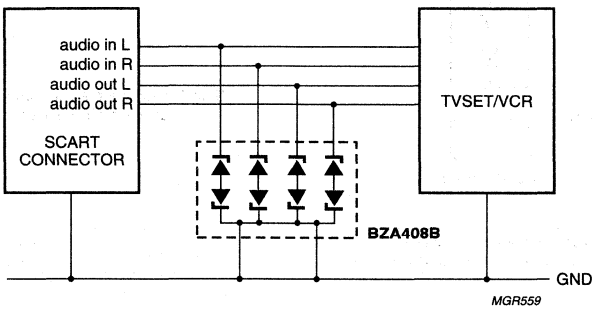


Fig.6 Scart connector protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA408B is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage (V = L di/dt) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors.
2. Keep parallel signal paths to a minimum.
3. Avoid running protection conductors in parallel with unprotected conductors.
4. Minimize all printed-circuit board loop areas including power and ground loops.
5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

Quadruple ESD transient voltage suppressor BZA420A

FEATURES

- ESD rating >8 kV, according to IEC1000-4-2
- SOT457 surface mount package
- Common anode configuration
- Non-clamping range −0.5 to 20 V
- Maximum reverse peak power dissipation: 19.6 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 28 V at I_{ZSM} = 0.7 A.

APPLICATIONS

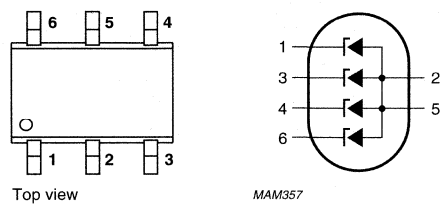
- Computers and peripherals
- Audio and video equipment
- Communication systems
- Medical equipment.

DESCRIPTION

Monolithic transient voltage suppressor diode in a six lead SOT457 (SC-74) package for 4-bit wide ESD transient suppression at 20 V level.

PINNING

PIN	DESCRIPTION
1	cathode 1
2	common
3	cathode 2
4	cathode 3
5	common
6	cathode 4



Marking code: Z0.

Fig.1 Simplified outline (SOT457) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_Z	working current	T_s = 60 °C; note 1	–	note 2	mA
I_F	continuous forward current	T_s = 60 °C	–	100	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	3.75	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	0.7	A
P_{tot}	total power dissipation	T_s = 60 °C; see Fig.3	–	720	mW
P_{ZSM}	non repetitive peak reverse power dissipation	square pulse; t_p = 1 ms; see Fig.4	–	19.6	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		−65	+150	°C

Notes

1. T_s is the temperature at the soldering point of the anode pin.
2. DC working current limited by $P_{tot\ max}$.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one or more diodes loaded	125	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 1 mA	19	20	21	V
V_F	forward voltage	I_F = 200 mA	–	–	1.3	V
V_{ZSM}	non-repetitive peak reverse voltage	I_{ZSM} = 0.7 A; t_p = 1 ms	–	–	28	V
I_R	reverse current	V_R = 15 V	–	–	100	nA
r_{dif}	differential resistance	I_Z = 1 mA	–	–	125	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5 mA	–	16.2	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	48	pF
		V_R = 15 V; f = 1 MHz	–	–	14	pF

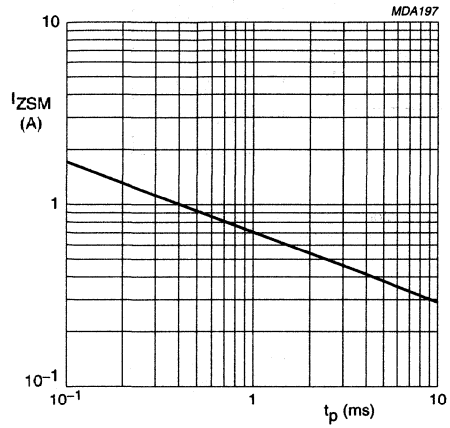
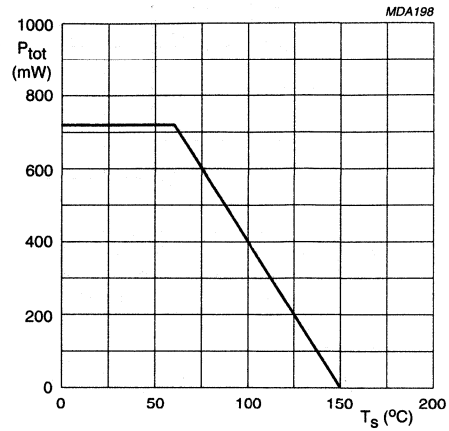
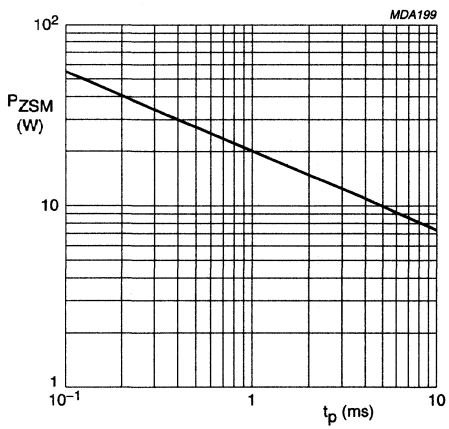


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



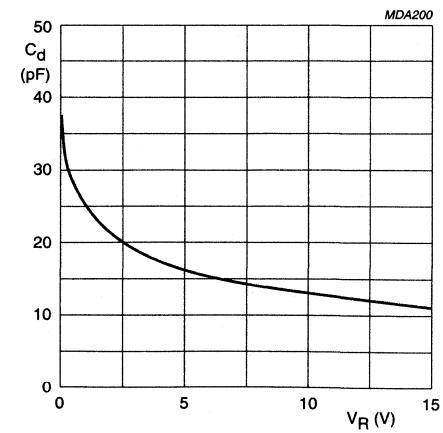
All diodes loaded.

Fig.3 Power derating curve.



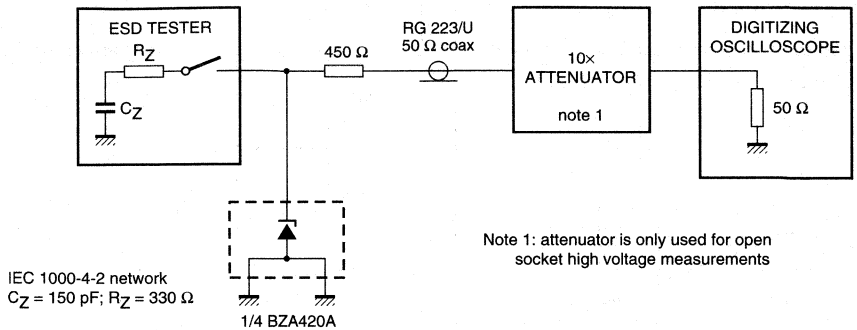
$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

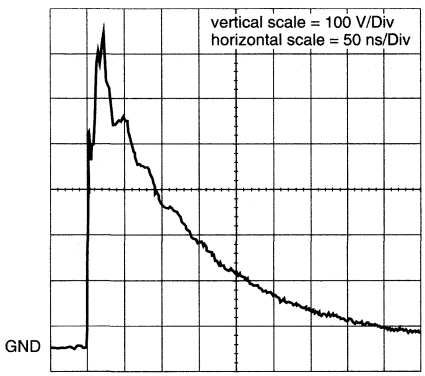
Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).



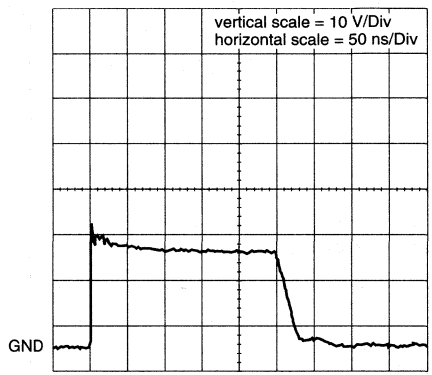
T_j = 25 °C; f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

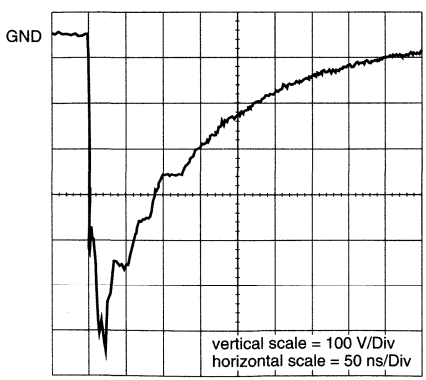




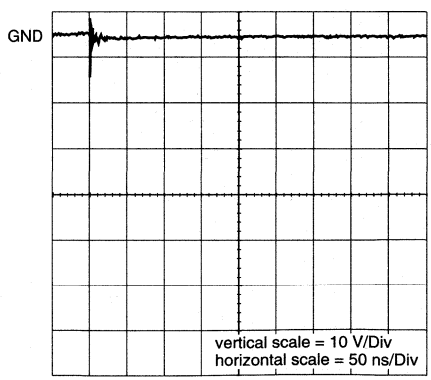
unclamped +1 kV ESD voltage waveform (IEC 1000–4–2 network)



clamped +1 kV ESD voltage waveform (IEC 1000–4–2 network)



unclamped –1 kV ESD voltage waveform (IEC 1000–4–2 network)



clamped –1 kV ESD voltage waveform (IEC 1000–4–2 network)

MBK386

Fig.6 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

Typical common anode application

A quadruple transient suppressor in a SOT457 package makes it possible to protect four separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.

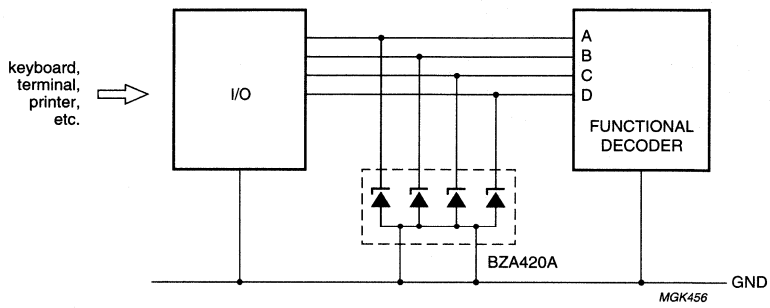


Fig.7 Computer interface protection.

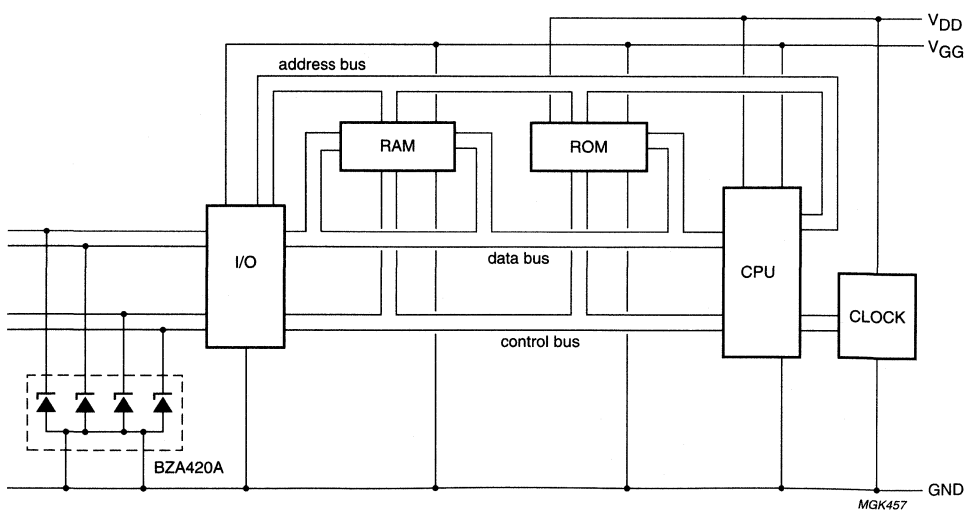


Fig.8 Microprocessor protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA420A is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage ($V = L\ di/dt$) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors
2. Keep parallel signal paths to a minimum
3. Avoid running protection conductors in parallel with unprotected conductors
4. Minimize all printed-circuit board loop areas including power and ground loops
5. Minimize the length of the transient return path to ground
6. Avoid using shared transient return paths to a common ground point.

Quadruple ESD transient voltage suppressor BZA456A

FEATURES

- ESD rating >8 kV, according to IEC1000-4-2
- SOT457 surface mount package
- Common anode configuration
- Non-clamping range –0.5 to 5.6 V
- Maximum reverse peak power dissipation: 24 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 8 V at I_{ZSM} = 3 A.

APPLICATIONS

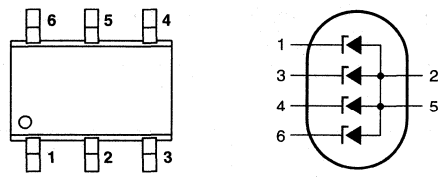
- Computers and peripherals
- Audio and video equipment
- Communication systems
- Medical equipment.

DESCRIPTION

Monolithic transient voltage suppressor diode in a six lead SOT457 (SC-74) package for 4-bit wide ESD transient suppression at 5.6 V level.

PINNING

PIN	DESCRIPTION
1	cathode 1
2	common
3	cathode 2
4	cathode 3
5	common
6	cathode 4



Marking code: Z6.

Fig.1 Simplified outline (SOT457) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_Z	working current	T_s = 60 °C; note 1	–	note 2	mA
I_F	continuous forward current	T_s = 60 °C	–	100	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	3.75	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	3	A
P_{tot}	total power dissipation	T_s = 60 °C; see Fig.3	–	720	mW
P_{ZSM}	non repetitive peak reverse power dissipation	square pulse; t_p = 1 ms; see Fig.4	–	24	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

Notes

1. T_s is the temperature at the soldering point of the anode pin.
2. DC working current limited by $P_{tot\ max}$.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one or more diodes loaded	125	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 1 mA	5.32	5.6	5.88	V
V_F	forward voltage	I_F = 200 mA	–	–	1.3	V
V_{ZSM}	non-repetitive peak reverse voltage	I_{ZSM} = 3 A; t_p = 1 ms	–	–	8	V
I_R	reverse current	V_R = 3 V	–	–	2	μA
r_{dif}	differential resistance	I_Z = 250 μA	–	–	1600	Ω
		I_Z = 1 mA	–	–	400	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5 mA	–	1.2	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	240	pF
		V_R = 3 V; f = 1 MHz	–	–	140	pF

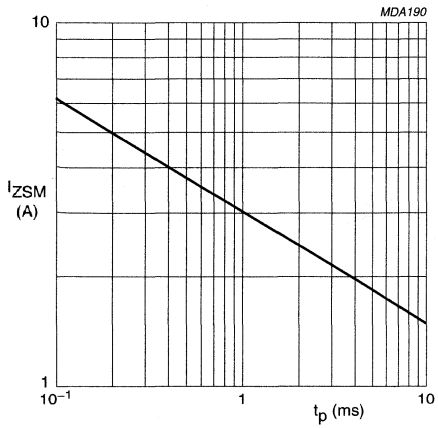
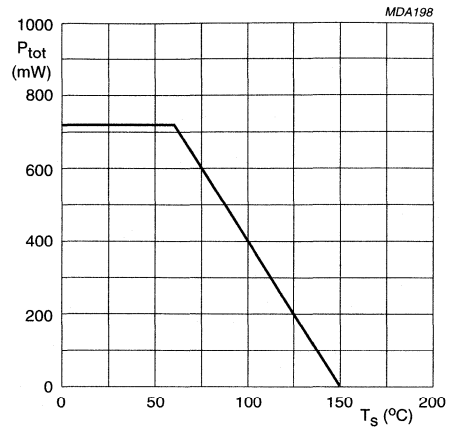
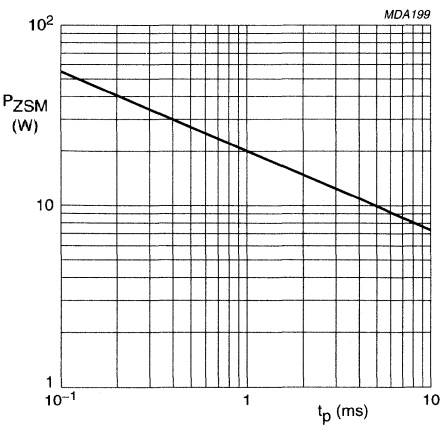


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



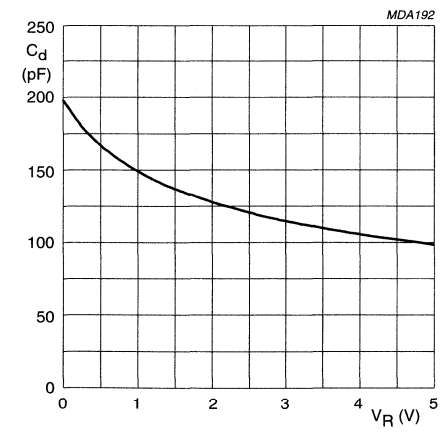
All diodes loaded.

Fig.3 Power derating curve.



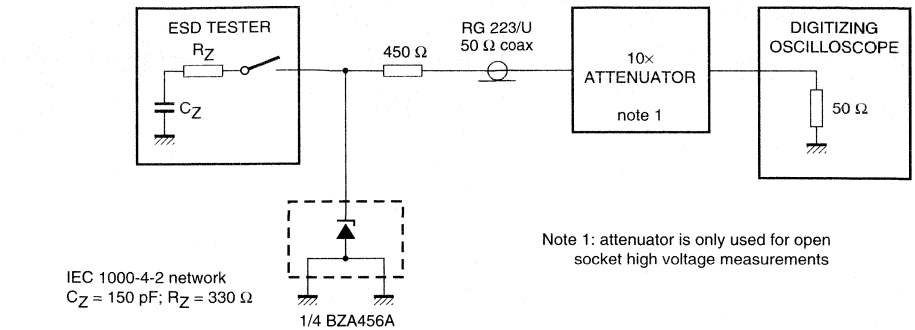
$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

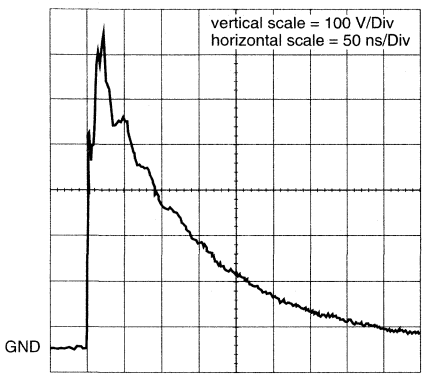
Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).



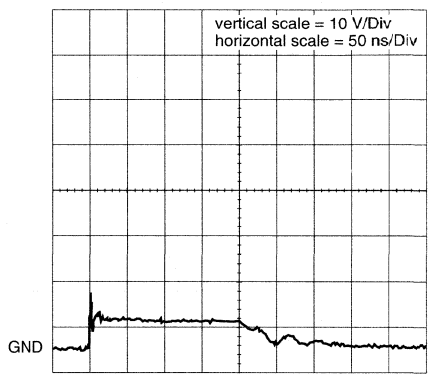
T_j = 25 °C; f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

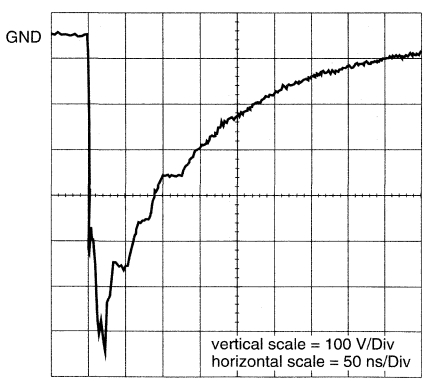




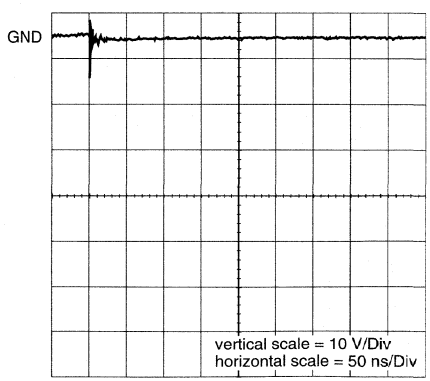
unclamped +1 kV ESD voltage waveform
(IEC 1000–4–2 network)



clamped +1 kV ESD voltage waveform
(IEC 1000–4–2 network)



unclamped −1 kV ESD voltage waveform
(IEC 1000–4–2 network)



clamped −1 kV ESD voltage waveform
(IEC 1000–4–2 network)

MGL247

Fig.6 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

Typical common anode application

A quadruple transient suppressor in a SOT457 package makes it possible to protect four separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.

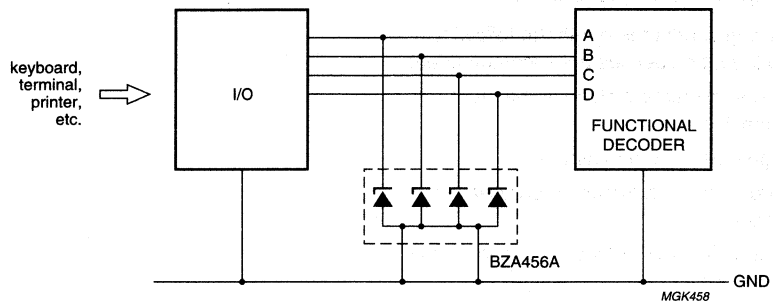


Fig.7 Computer interface protection.

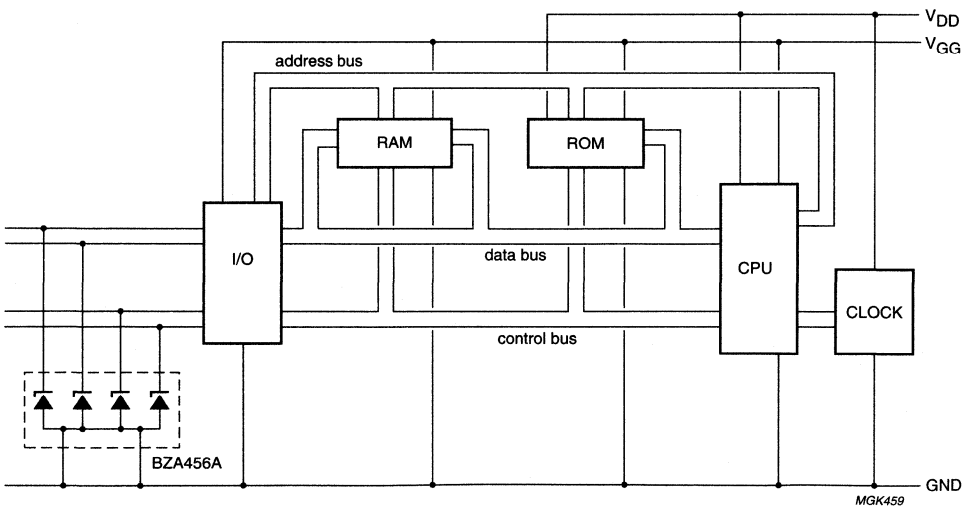


Fig.8 Microprocessor protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA456A is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage ($V = L\ di/dt$) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors.
2. Keep parallel signal paths to a minimum.
3. Avoid running protection conductors in parallel with unprotected conductors.
4. Minimize all printed-circuit board loop areas including power and ground loops.
5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

Quadruple ESD transient voltage suppressor BZA462A

FEATURES

- ESD rating >15 kV, according to IEC1000-4-2
- SOT457 surface mount package
- Common anode configuration
- Non-clamping range –0.5 to 6.2 V
- Maximum reverse peak power dissipation: 24 W at t_p = 1 ms
- Maximum clamping voltage at peak pulse current: 9 V at I_{ZSM} = 2.66 A.

APPLICATIONS

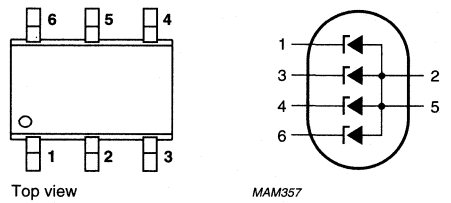
- Computers and peripherals
- Audio and video equipment
- Communication systems
- Medical equipment.

DESCRIPTION

Monolithic transient voltage suppressor diode in a six lead SOT457 (SC-74) package for 4-bit wide ESD transient suppression at 6.2 V level.

PINNING

PIN	DESCRIPTION
1	cathode 1
2	common
3	cathode 2
4	cathode 3
5	common
6	cathode 4



Marking code: Z2t.

Fig.1 Simplified outline (SOT457) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
I_Z	working current	T_s = 60 °C; note 1	–	note 2	mA
I_F	continuous forward current	T_s = 60 °C	–	100	mA
I_{FSM}	non-repetitive peak forward current	t_p = 1 ms; square pulse	–	3.75	A
I_{ZSM}	non-repetitive peak reverse current	t_p = 1 ms; square pulse; see Fig.2	–	2.66	A
P_{tot}	total power dissipation	T_s = 60 °C; see Fig.3	–	720	mW
P_{ZSM}	non repetitive peak reverse power dissipation	square pulse; t_p = 1 ms; see Fig.4	–	24	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–65	+150	°C

Notes

1. T_s is the temperature at the soldering point of the anode pin.
2. DC working current limited by $P_{tot\ max}$.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	one or more diodes loaded	125	K/W

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_Z	working voltage	I_Z = 1 mA	5.89	6.2	6.51	V
V_F	forward voltage	I_F = 200 mA	–	–	1.3	V
V_{ZSM}	non-repetitive peak reverse voltage	I_{ZSM} = 3.5 A; t_p = 1 ms	–	–	9	V
I_R	reverse current	V_R = 4 V	–	–	700	nA
r_{dif}	differential resistance	I_Z = 1 mA	–	–	300	Ω
S_Z	temperature coefficient of working voltage	I_Z = 5 mA	–	1.2	–	mV/K
C_d	diode capacitance	see Fig.5				
		V_R = 0; f = 1 MHz	–	–	200	pF
		V_R = 4 V; f = 1 MHz	–	–	110	pF

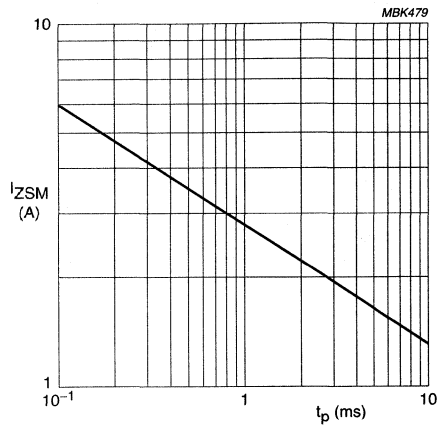
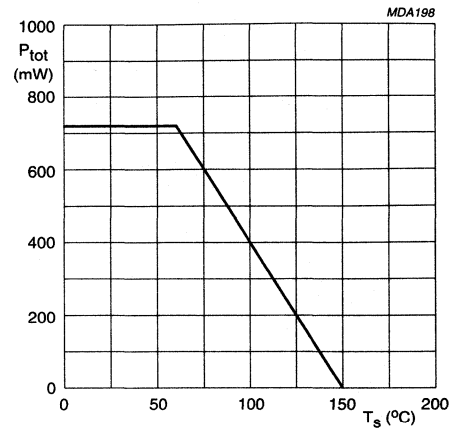
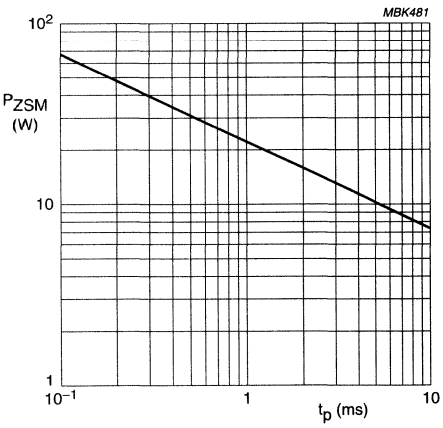


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



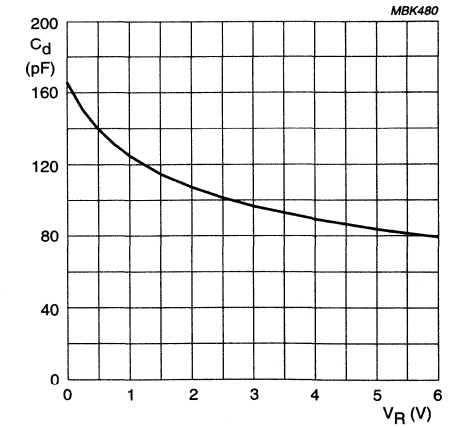
All diodes loaded.

Fig.3 Power derating curve.



$P_{ZSM} = V_{ZSM} \times I_{ZSM}$.
V_{ZSM} is the non-repetitive peak reverse voltage at I_{ZSM}.

Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).



T_j = 25 °C; f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage; typical values.

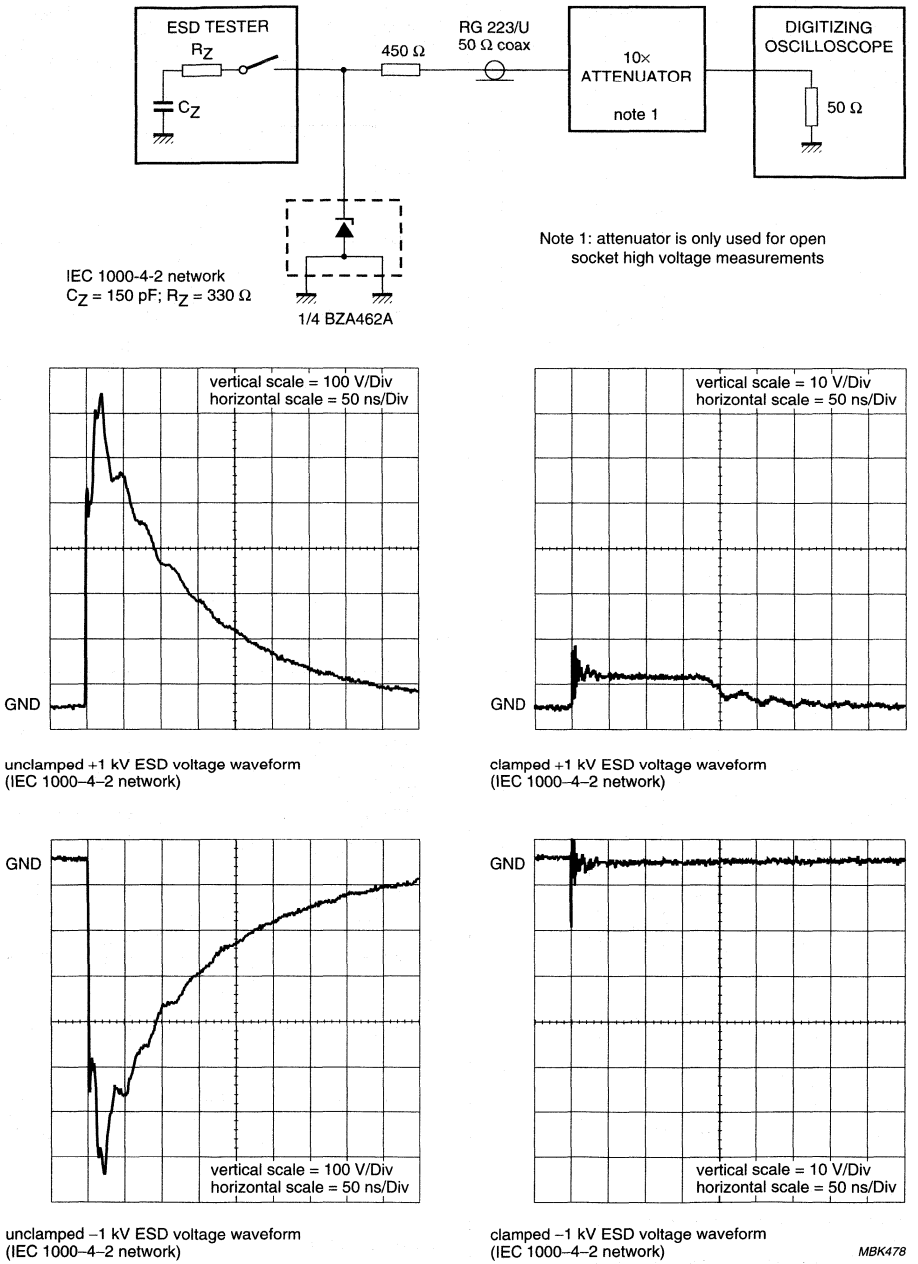


Fig.6 ESD clamping test set-up and waveforms.

APPLICATION INFORMATION

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A quadruple transient suppressor in a SOT457 package makes it possible to protect four separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.

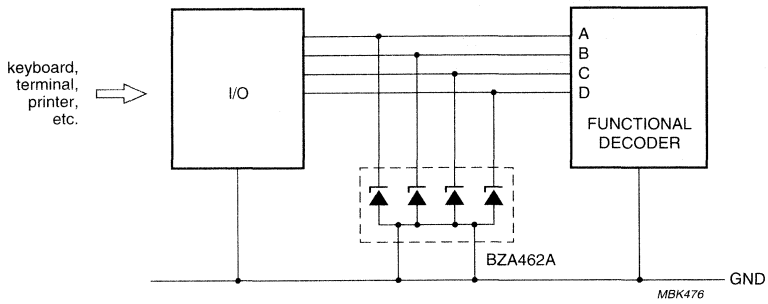

Fig.7 Computer interface protection.

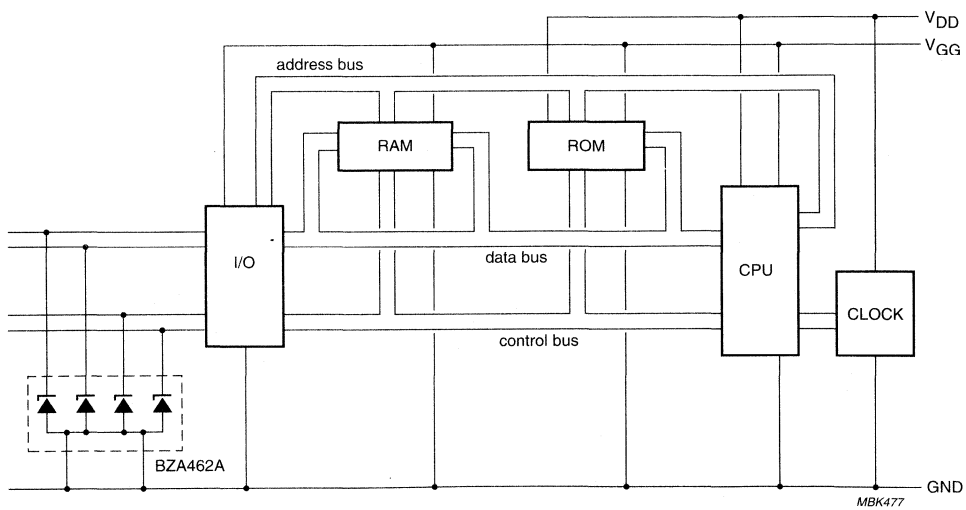

Fig.8 Microprocessor protection.

Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA462A is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage (V = L di/dt) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

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3. Avoid running protection conductors in parallel with unprotected conductors.
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5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

PNP resistor-equipped double transistor PUMB4

FEATURES

- Transistors with built-in bias resistor R1 (typ. 10 kΩ)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

PNP resistor-equipped double transistor in an SC-88 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
PUMB4	Bt4

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

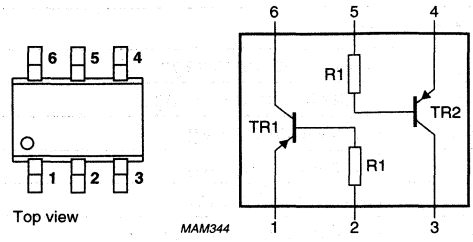


Fig.1 Simplified outline (SC-88) and symbol.

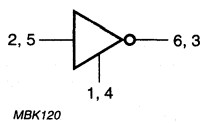


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	–50	V
V_{CEO}	collector-emitter voltage	open base	–	–50	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_O	output current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

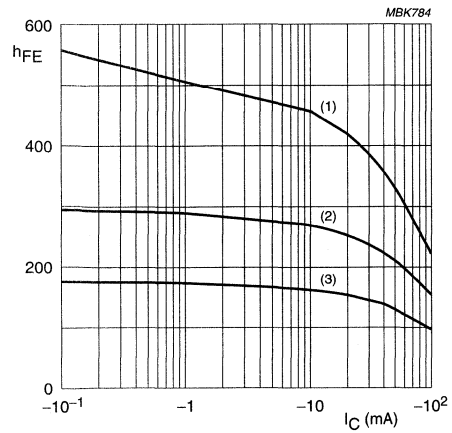
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

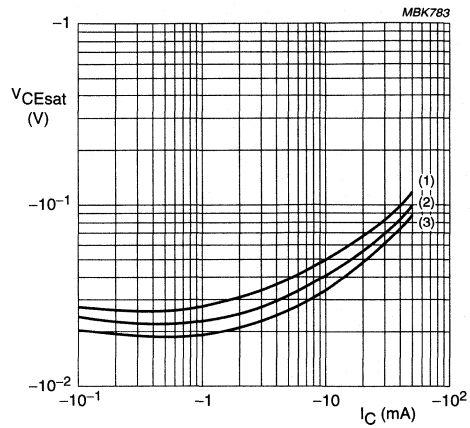
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -50$ V	–	–	–100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = -30$ V	–	–	–1	µA
		$I_B = 0$; $V_{CE} = -30$ V; $T_j = 150$ °C	–	–	–50	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–	–100	nA
h_{FE}	DC current gain	$I_C = -1$ mA; $V_{CE} = -5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	–	–150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	–	3	pF



$V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.3 DC current gain as a function of collector current; typical values.



$I_C/I_B = 10$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistors PUMD2

FEATURES

- Transistors with different polarity and built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 plastic package.

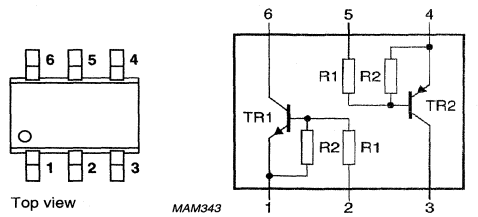


Fig.1 Simplified outline (SC-88) and symbol.

MARKING

TYPE NUMBER	MARKING CODE
PUMD2	Dt2

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

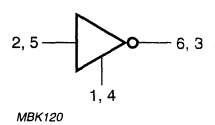


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

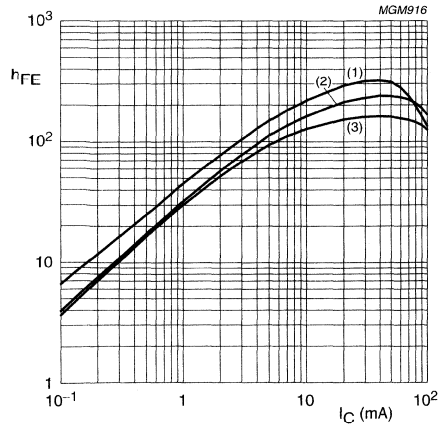
Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

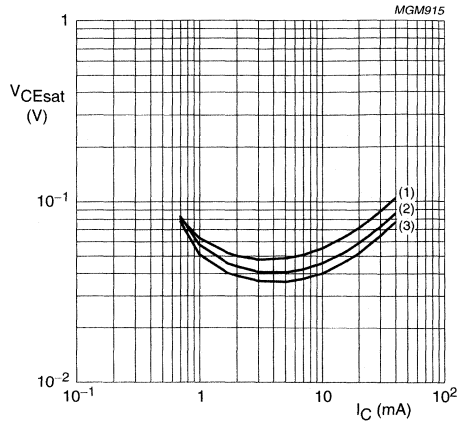
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	180	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 5 mA; V_{CE} = 300 mV	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1 (NPN)		–	–	2.5	pF
	TR2 (PNP)		–	–	3	pF



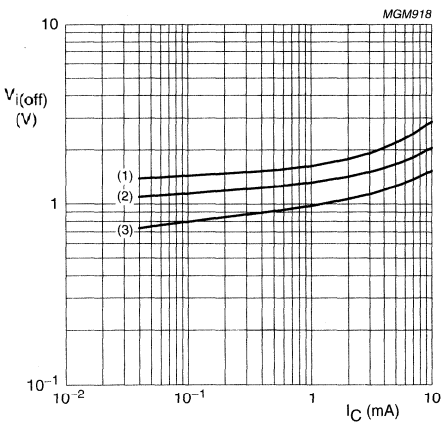
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



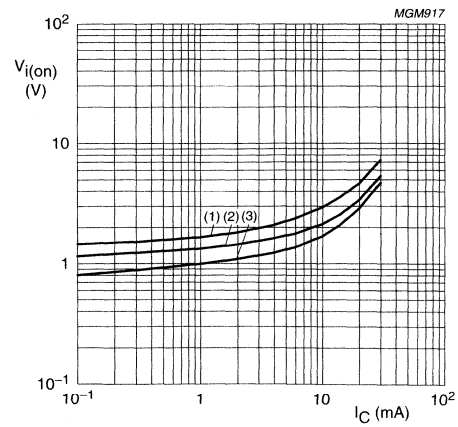
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



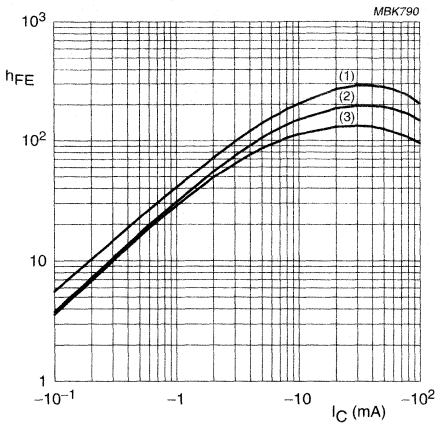
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



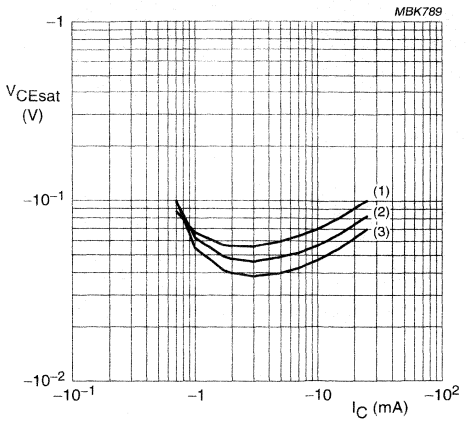
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



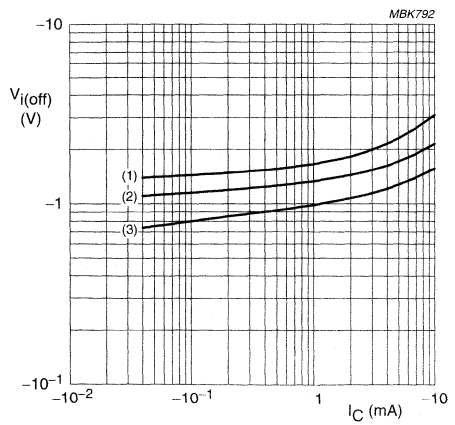
TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.7 DC current gain as a function of collector current; typical values.



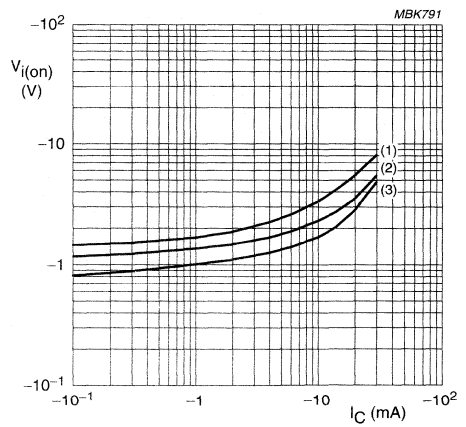
TR2 (PNP); $I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistors PUMD3

FEATURES

- Transistors with different polarity and built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 plastic package.

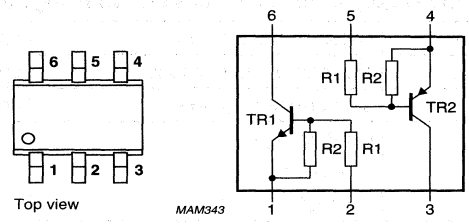


Fig.1 Simplified outline (SC-88) and symbol.

MARKING

TYPE NUMBER	MARKING CODE
PUMD3	Dt3

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

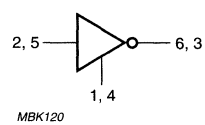


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

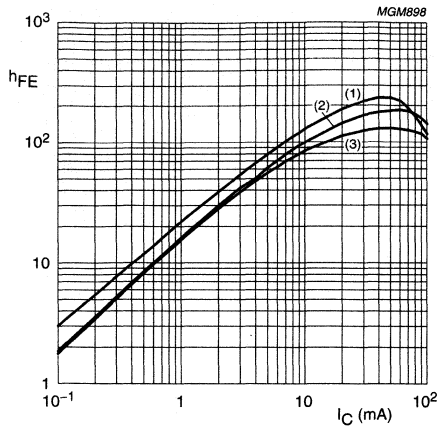
Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

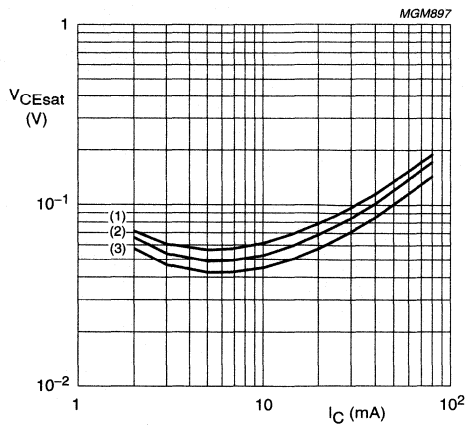
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	400	µA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 10 mA; V_{CE} = 0.3 V				
	TR1 (NPN)		2.5	1.8	–	V
	TR2 (PNP)		2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1 (NPN)		–	–	2.5	pF
	TR2 (PNP)		–	–	3	pF



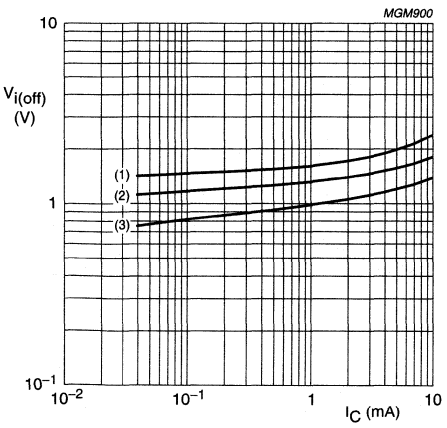
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



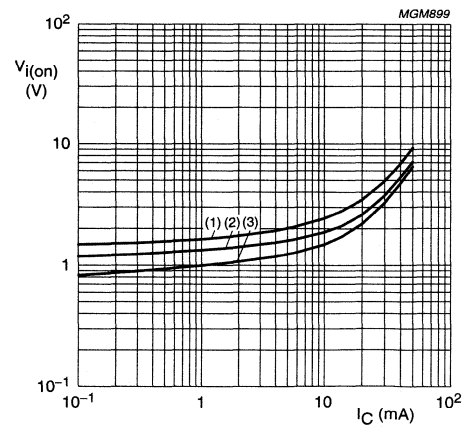
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



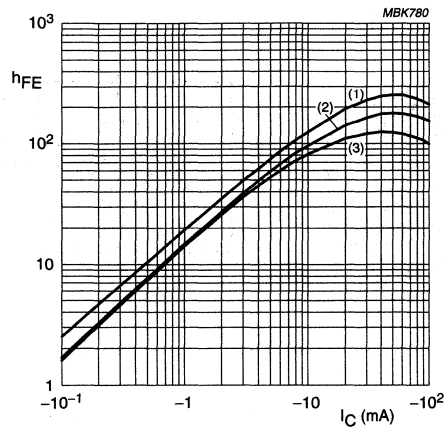
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



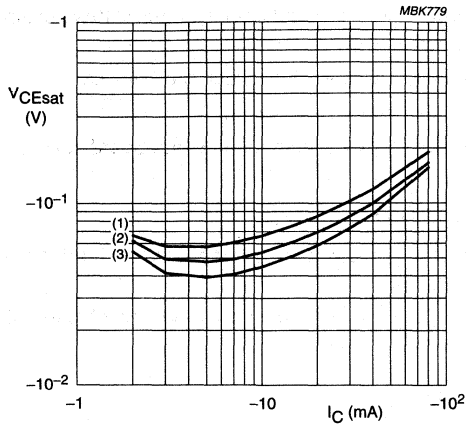
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



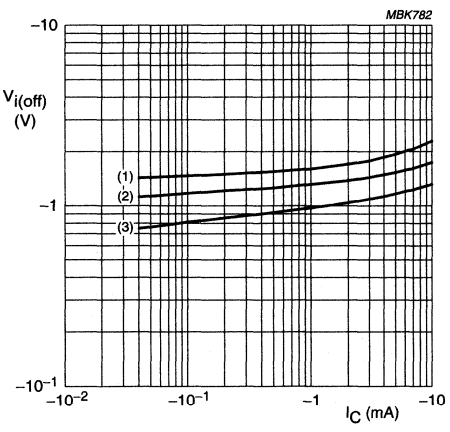
TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.7 DC current gain as a function of collector current; typical values.



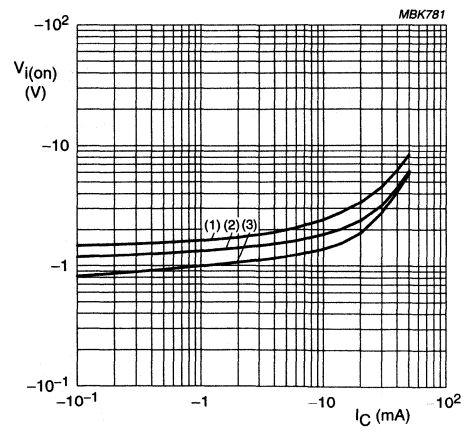
TR2 (PNP); $I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistor PUMD6

FEATURES

- Transistors with different polarity, each with a built-in bias resistor R1 (typ. 4.7 kΩ)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 (SOT363) plastic package.

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMD6	Dt6

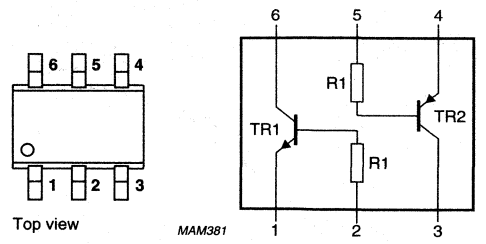


Fig.1 Simplified outline (SC-88; SOT363) and symbol.

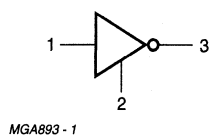


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

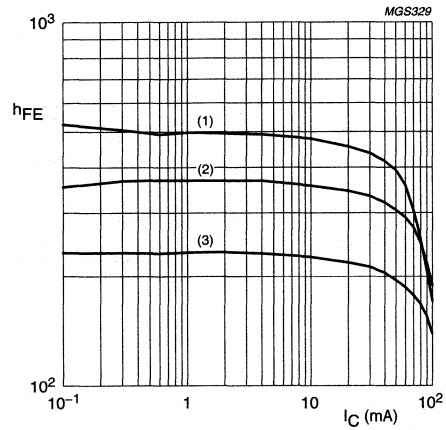
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

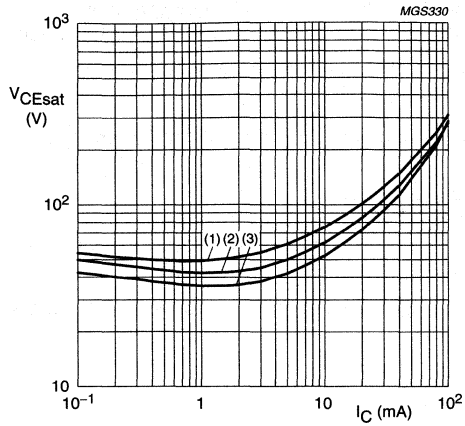
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
R1	input resistor		3.3	4.7	6.1	kΩ
NPN transistor						
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF
PNP transistor						
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	–	3	pF



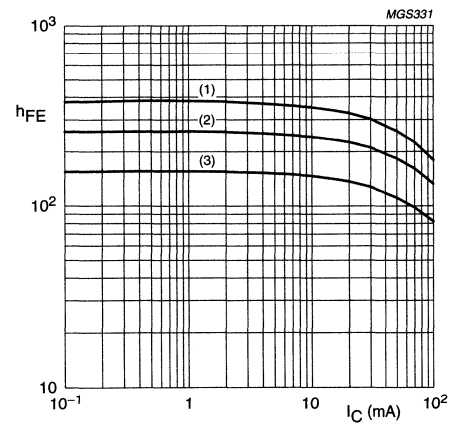
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



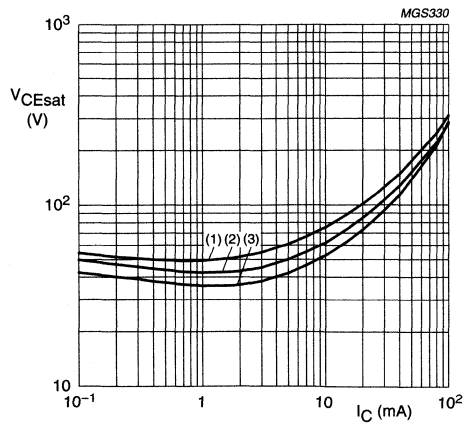
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.5 DC current gain as a function of collector current; typical values.



TR2 (PNP); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.6 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistors PUMD9

FEATURES

- Transistors with different polarity and built-in bias resistors R1 and R2 (typ. 10 kΩ and 47 kΩ respectively)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in portable equipment
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 (SOT363) plastic package.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMD9	Dt9

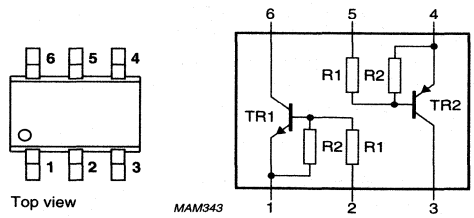


Fig.1 Simplified outline (SC-88) and symbol.

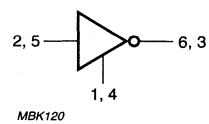


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–6	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Refer to SC-88 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

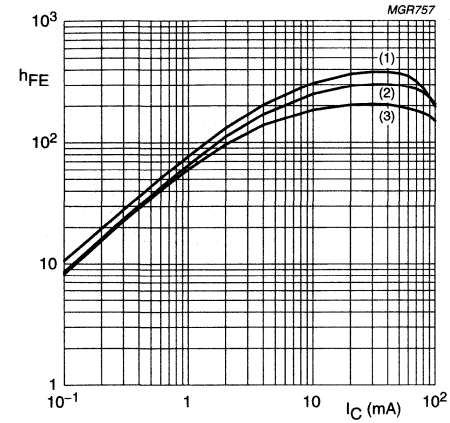
Note

1. Refer to SC-88 standard mounting conditions.

CHARACTERISTICS

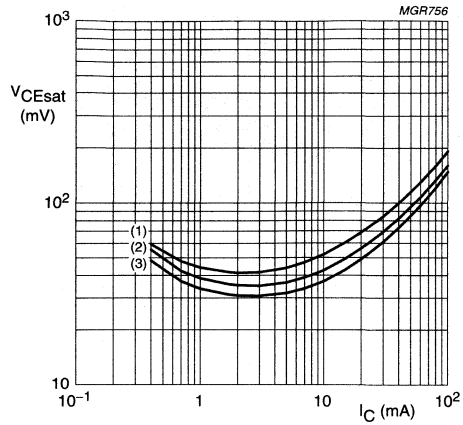
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_C = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	150	µA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	0.7	0.5	V
$V_{i(on)}$	input-on voltage	I_C = 1 mA; V_{CE} = 0.3 V	1.4	0.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		3.7	4.7	5.7	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1 (NPN)		–	–	2.5	pF
	TR2 (PNP)		–	–	3	pF



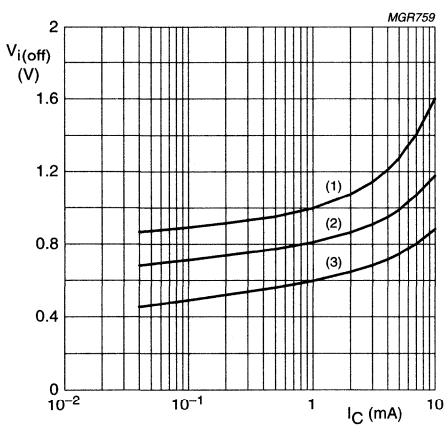
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



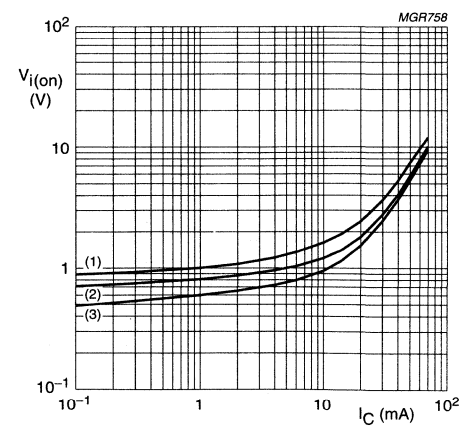
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



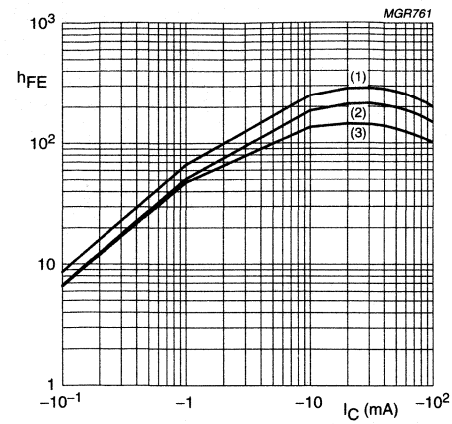
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



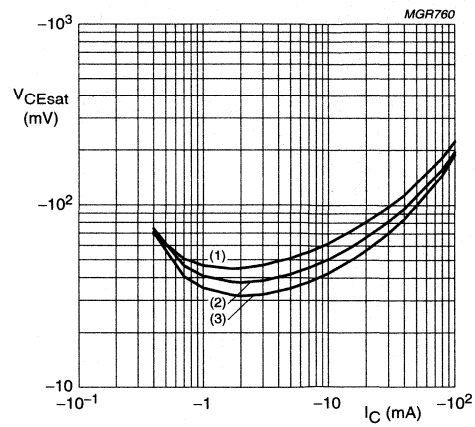
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



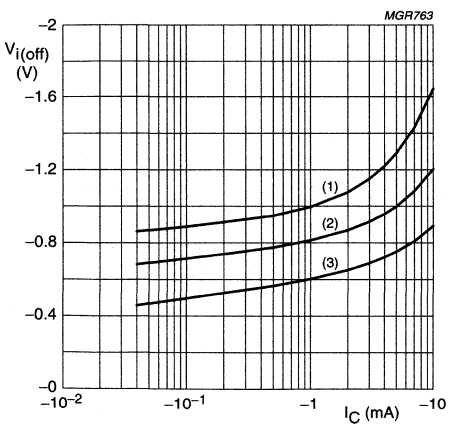
TR2 (PNP); V_{CE} = −5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.7 DC current gain as a function of collector current; typical values.



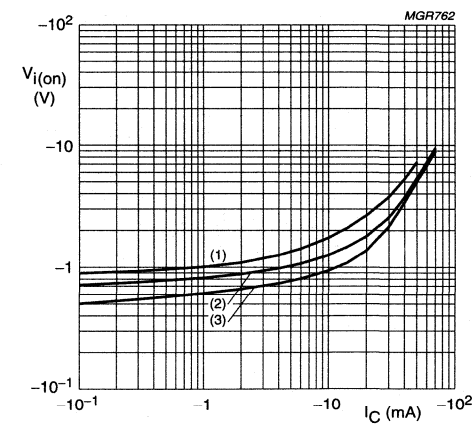
TR2 (PNP); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); V_{CE} = −5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); V_{CE} = −0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistors PUMD10

FEATURES

- Transistors with different polarity and built-in bias resistors R1 and R2 (typ. 2.2 kΩ and 47 kΩ respectively)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in portable equipment
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 (SOT363) plastic package.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMD10	Dt0

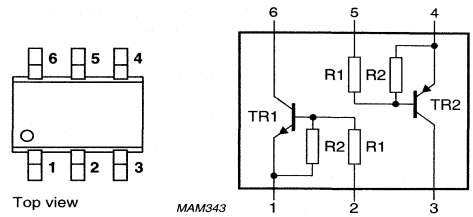


Fig.1 Simplified outline (SC-88) and symbol.

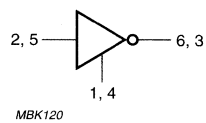


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+12	V
	negative		–	–5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Refer to SC-88 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

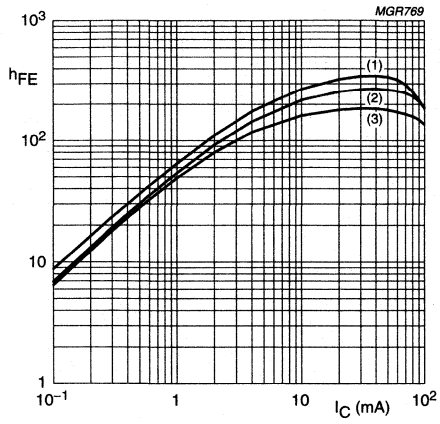
Note

1. Refer to SC-88 standard mounting conditions.

CHARACTERISTICS

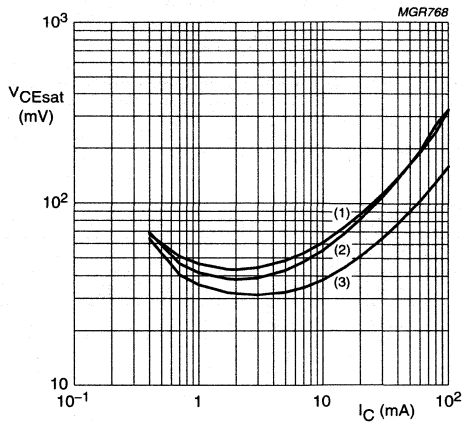
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_C = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	180	μA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	0.6	0.5	V
$V_{i(on)}$	input-on voltage	I_C = 5 mA; V_{CE} = 0.3 V	1.1	0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1 (NPN)		–	–	2.5	pF
	TR2 (PNP)		–	–	3	pF



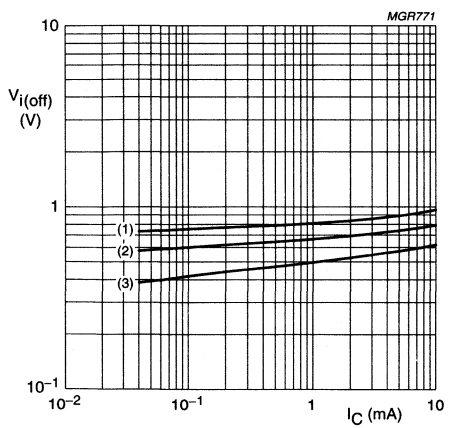
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



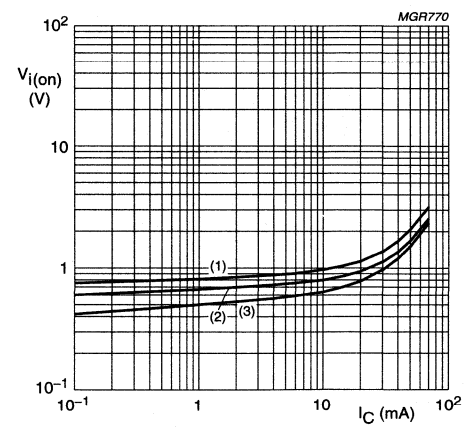
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



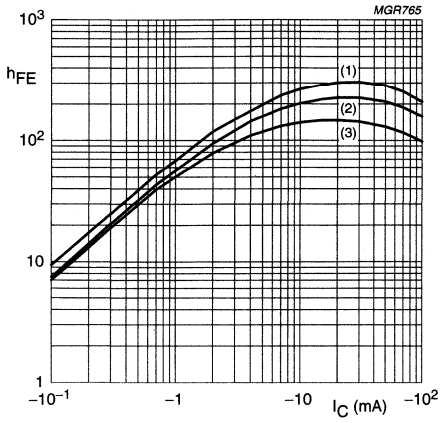
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



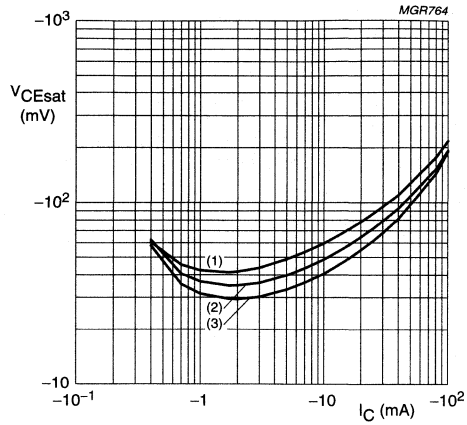
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



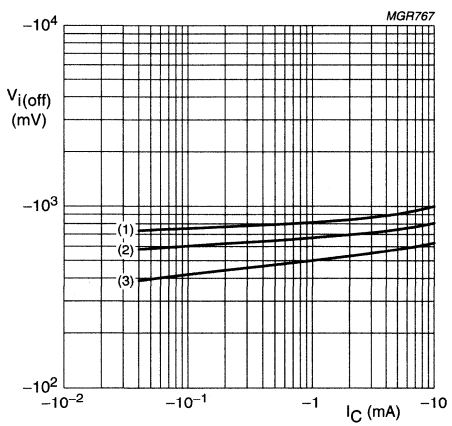
TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.7 DC current gain as a function of collector current; typical values.



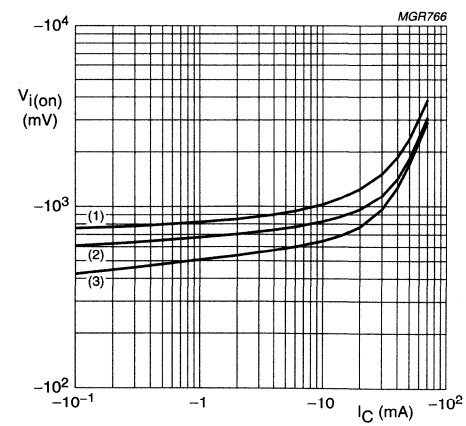
TR2 (PNP); $I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistor — PUMD12

FEATURES

- Transistors with different polarity and built-in bias resistors R1 and R2 (typ. 47 kΩ each)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

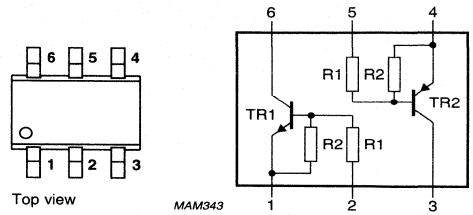


Fig.1 Simplified outline (SC-88) and symbol.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 plastic package.

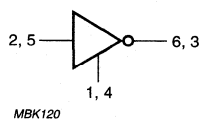


Fig.2 Equivalent inverter symbol.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMD12	Dt1

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Note

1. Refer to SC-88 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

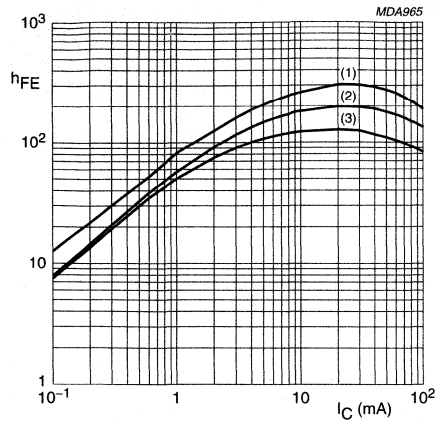
Note

1. Refer to SC-88 standard mounting conditions.

CHARACTERISTICS

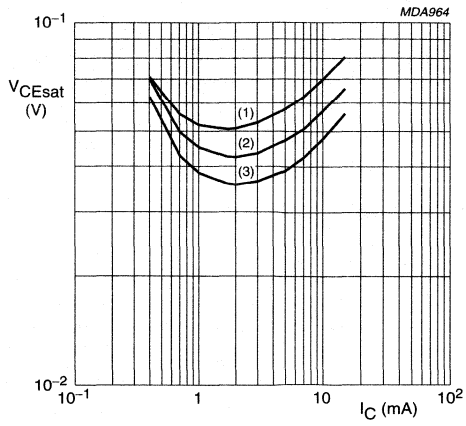
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	90	µA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 2 mA; V_{CE} = 0.3 V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz				
	TR1		–	–	2.5	pF
	TR2		–	–	3	pF



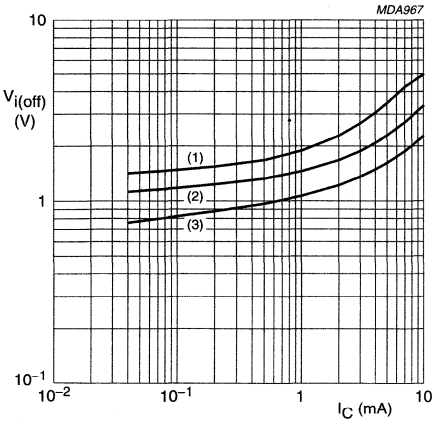
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



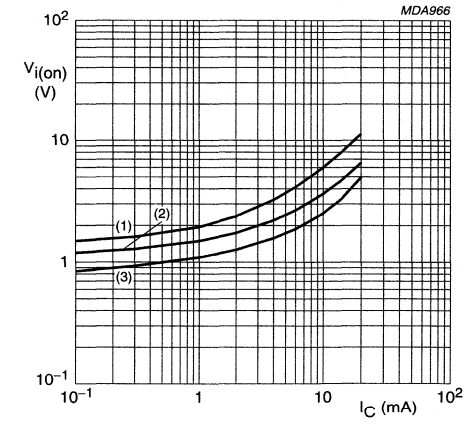
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



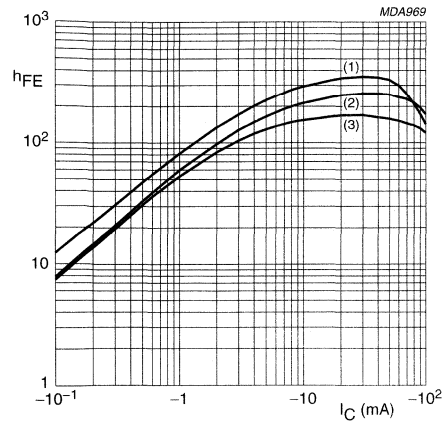
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



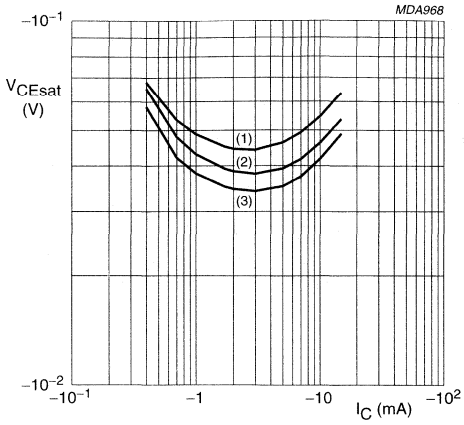
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



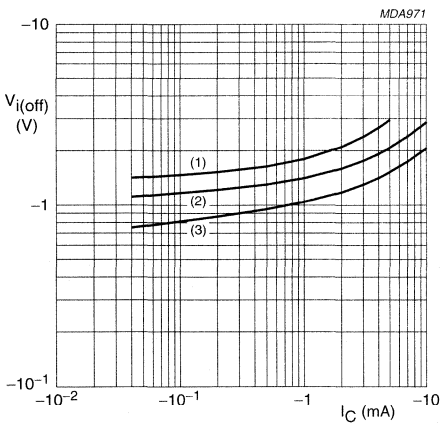
TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = 150$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.7 DC current gain as a function of collector current; typical values.



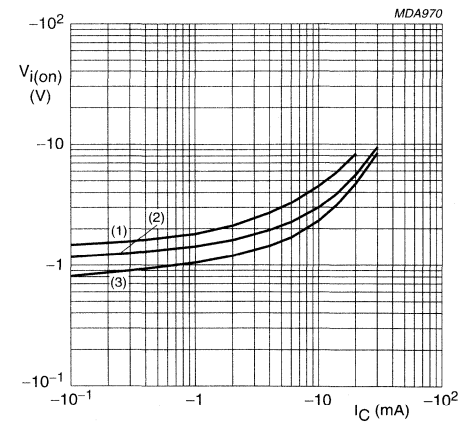
TR2 (PNP); $I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN/PNP resistor-equipped transistors PUMD48

FEATURES

- Transistors with different polarity and built-in bias resistors R1 (typ. 47 and 47 kΩ) and R2 (typ. 2.2 and 47 kΩ)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

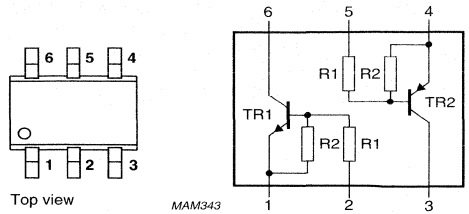


Fig.1 Simplified outline (SC-88) and symbol.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN/PNP resistor-equipped transistors in an SC-88 plastic package.

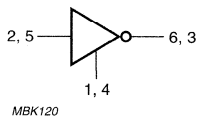


Fig.2 Equivalent inverter symbol.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMD48	4t8

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage TR1				
	positive		–	+40	V
	negative		–	−10	V
	input voltage TR2				
	positive		–	+5	V
	negative		–	−12	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Notes

1. Refer to SC-88 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

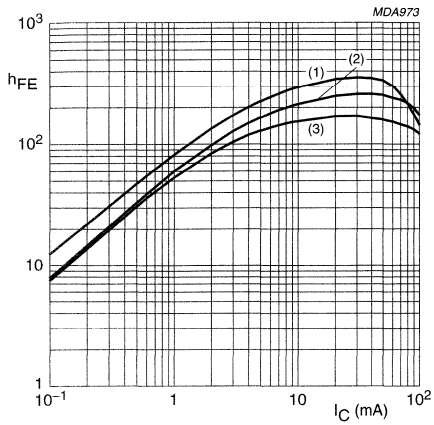
Note

1. Refer to SC-88 standard mounting conditions.

CHARACTERISTICS

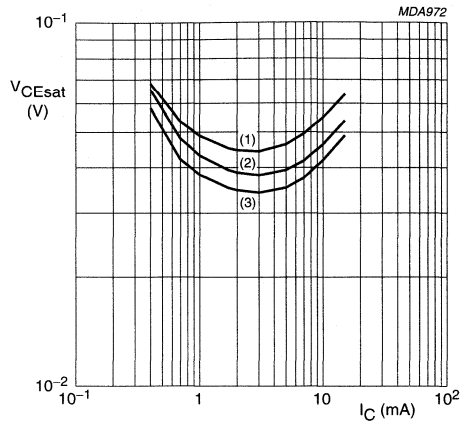
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
Transistor TR1 (NPN)						
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	90	µA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	80	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 µA; V_{CE} = 5 V	–	1.2	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 2 mA; V_{CE} = 0.3 V	3	1.6	–	V
R1	input resistor		33	47	61	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF
Transistor TR2 (PNP)						
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–	180	µA
h_{FE}	DC current gain	I_C = –10 mA; V_{CE} = –5 V	100	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –5 mA; I_B = –0.25 mA	–	–	–100	mV
$V_{i(off)}$	input-off voltage	I_C = –100 µA; V_{CE} = –5 V	–	–0.6	–0.5	V
$V_{i(on)}$	input-on voltage	I_C = –5 mA; V_{CE} = –0.3 V	–1.1	–0.75	–	V
R1	input resistor		1.54	2.2	2.86	kΩ
$\frac{R2}{R1}$	resistor ratio		17	21	26	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	–	3	pF



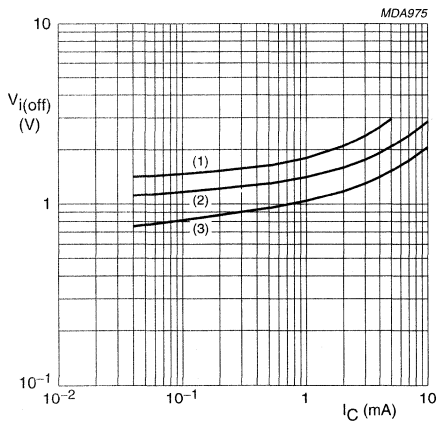
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



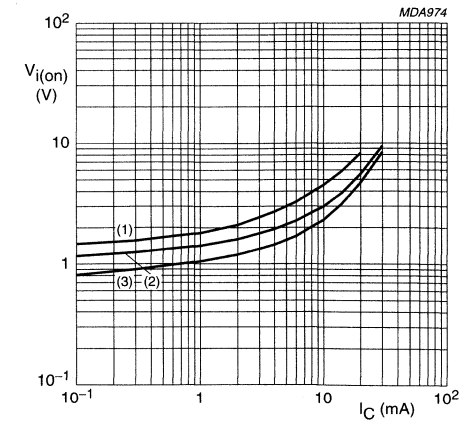
TR1 (NPN); I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



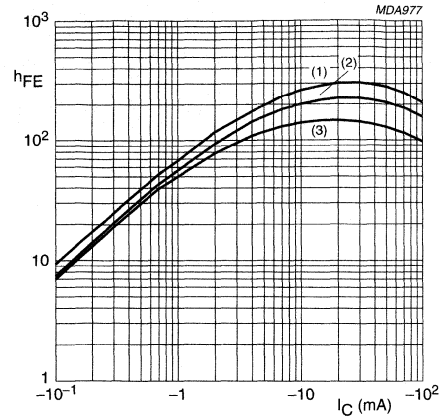
TR1 (NPN); V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



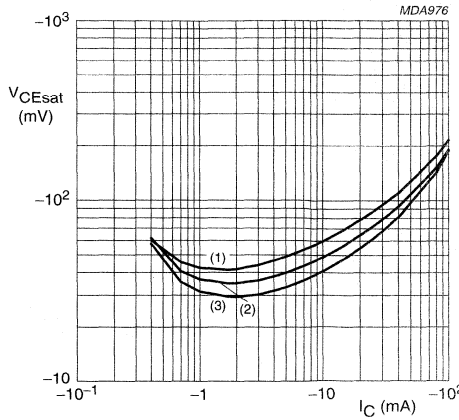
TR1 (NPN); V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.



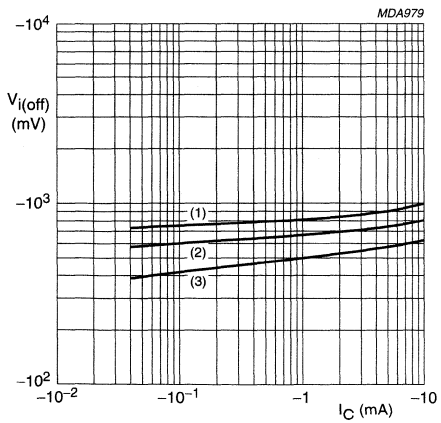
TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.7 DC current gain as a function of collector current; typical values.



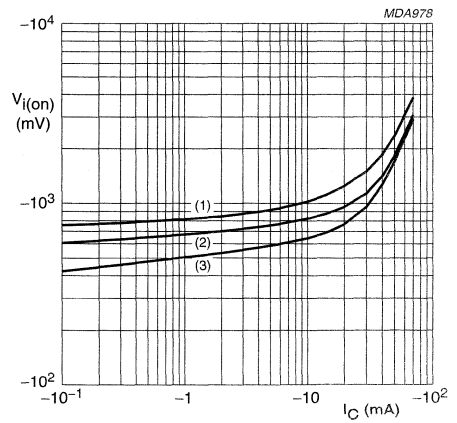
TR2 (PNP); $I_C/I_B = 20$.
(1) $T_{amb} = 100$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = -40$ °C.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -5$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.9 Input-off voltage as a function of collector current; typical values.



TR2 (PNP); $V_{CE} = -0.3$ V.
(1) $T_{amb} = -40$ °C.
(2) $T_{amb} = 25$ °C.
(3) $T_{amb} = 100$ °C.

Fig.10 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped double transistor PUMH1

FEATURES

- Transistors with built-in bias resistors R1 and R2 (typ. 22 kΩ each)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped double transistor in an SC-88 (SOT363) plastic package.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMH1	Ht2

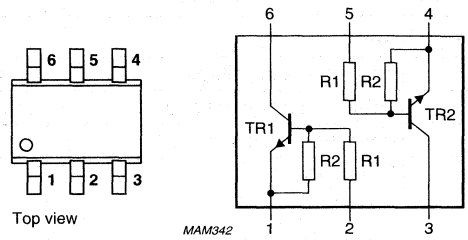


Fig.1 Simplified outline (SC-88) and symbol.

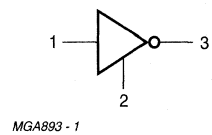


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	−10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

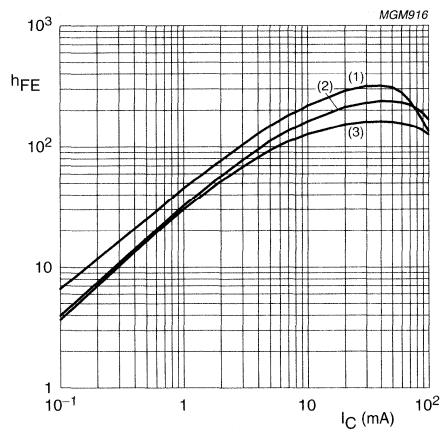
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

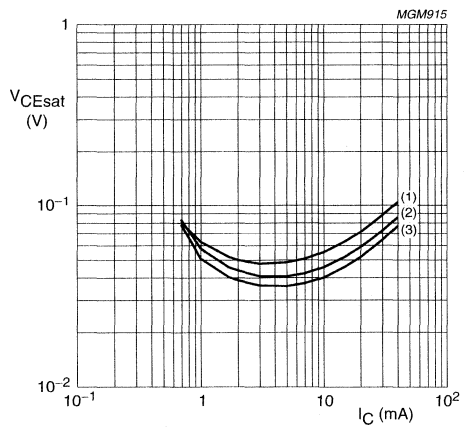
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	180	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	60	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 5 mA; V_{CE} = 200 mV	2.5	1.7	–	V
R1	input resistor		15.4	22	28.6	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



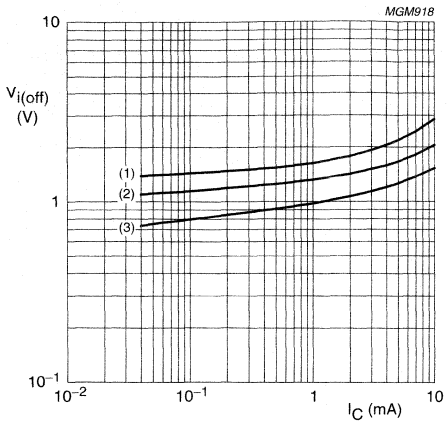
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



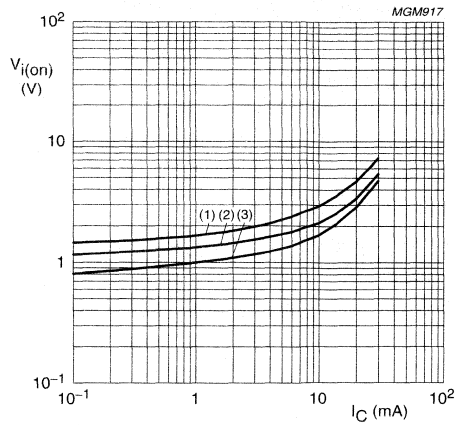
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

NPN resistor-equipped double transistor PUMH4

FEATURES

- Transistors with built-in bias resistor R1 (typ. 10 kΩ)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped double transistor in an SC-88 (SOT363) plastic package.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMH4	Ht4

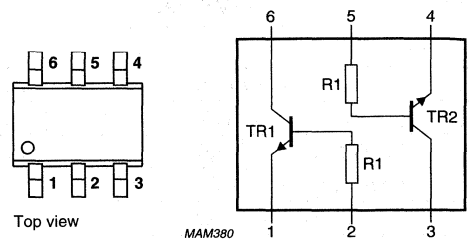


Fig.1 Simplified outline (SC-88) and symbol.

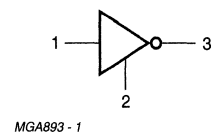


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

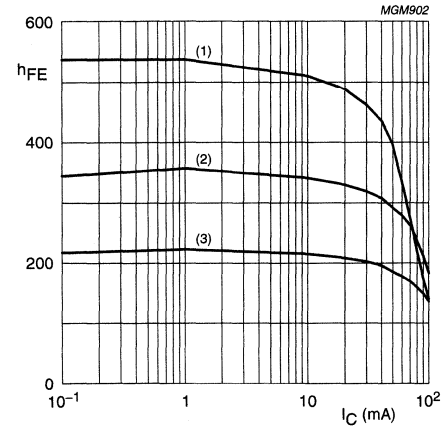
Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

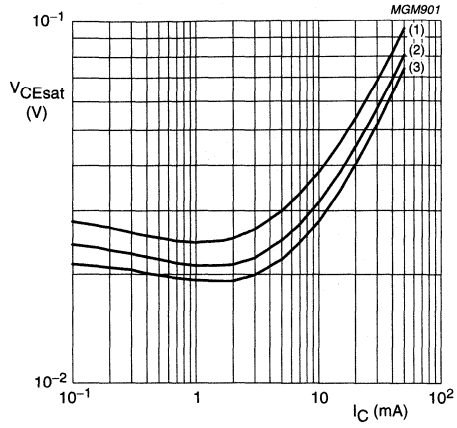
$T_{amb} = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	100	nA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 30$ V	–	–	1	μA
		$I_B = 0$; $V_{CE} = 30$ V; $T_j = 150$ °C	–	–	50	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 1$ mA; $V_{CE} = 5$ V	200	–	–	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 5$ mA; $I_B = 0.25$ mA	–	–	150	mV
R1	input resistor		7	10	13	kΩ
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



I_C/I_B = 10.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.

NPN resistor-equipped double transistor PUMH7

FEATURES

- Transistors with built-in bias resistor R1 (typ. 4.7 kΩ)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped double transistor in an SC-88 (SOT363) plastic package.

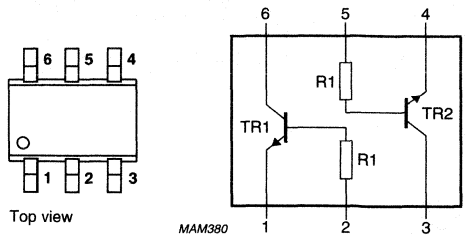


Fig.1 Simplified outline (SC-88; SOT363) and symbol.

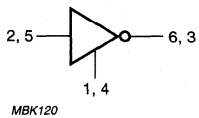


Fig.2 Equivalent inverter symbol.

PINNING

PIN	DESCRIPTION
1, 4	emitter TR1; TR2
2, 5	base TR1; TR2
6, 3	collector TR1; TR2

MARKING

TYPE NUMBER	MARKING CODE
PUMH7	Ht7

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	300	mW

Note

1. Refer to SC-88 standard mounting conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

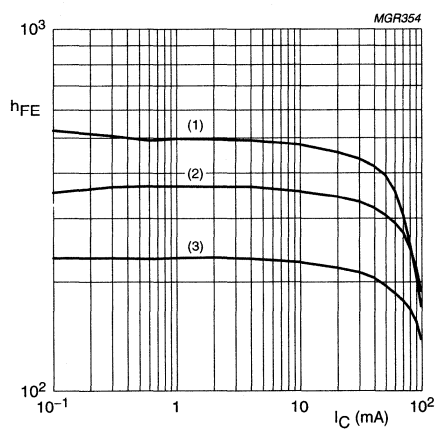
Note

1. Refer to SC-88 standard mounting conditions.

CHARACTERISTICS

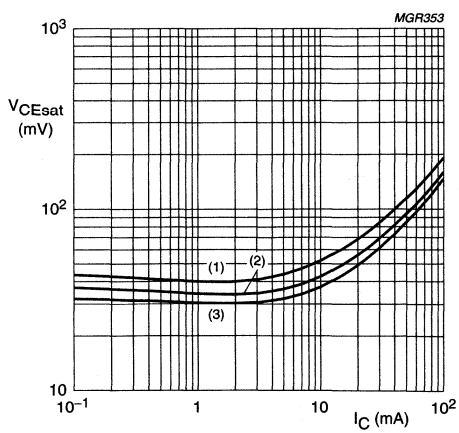
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	µA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V	200	330	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.25 mA	–	–	100	mV
R1	input resistor		3.3	4.7	6.1	kΩ
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



V_{CE} = 5 V.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values; per transistor.



I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values; per transistor.

NPN resistor-equipped double transistor PUMH11

FEATURES

- Transistors with built-in bias resistors R1 and R2 (typ. 10 kΩ each)
- No mutual interference between the transistors
- Simplification of circuit design
- Reduces number of components and board space.

APPLICATIONS

- Especially suitable for space reduction in interface and driver circuits
- Inverter circuit configurations without use of external resistors.

DESCRIPTION

NPN resistor-equipped double transistor in an SC-88 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
PUMH11	Ht1

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
6, 3	collector	TR1; TR2

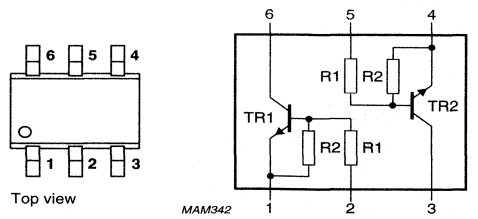


Fig.1 Simplified outline (SC-88) and symbol.

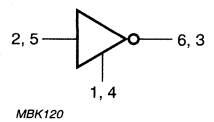


Fig.2 Equivalent inverter symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	10	V
V_I	input voltage				
	positive		–	+40	V
	negative		–	–10	V
I_O	output current (DC)		–	100	mA
I_{CM}	peak collector current		–	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

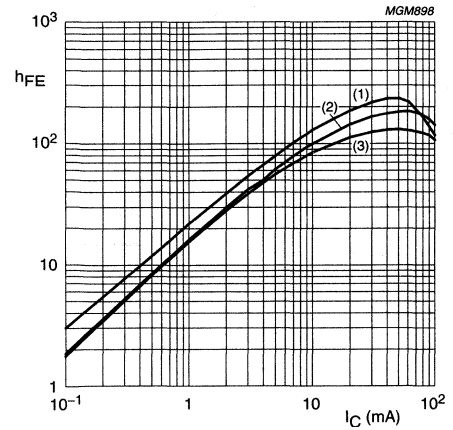
Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

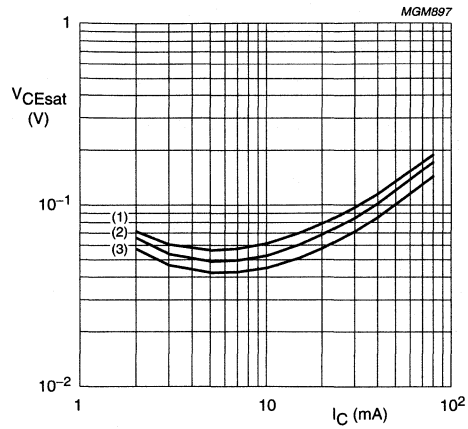
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor						
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	100	nA
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	–	–	1	μA
		I_B = 0; V_{CE} = 30 V; T_j = 150 °C	–	–	50	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	400	μA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V	30	–	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	–	–	150	mV
$V_{i(off)}$	input-off voltage	I_C = 100 μA; V_{CE} = 5 V	–	1.1	0.8	V
$V_{i(on)}$	input-on voltage	I_C = 10 mA; V_{CE} = 0.3 V	2.5	1.8	–	V
R1	input resistor		7	10	13	kΩ
$\frac{R2}{R1}$	resistor ratio		0.8	1	1.2	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	–	2.5	pF



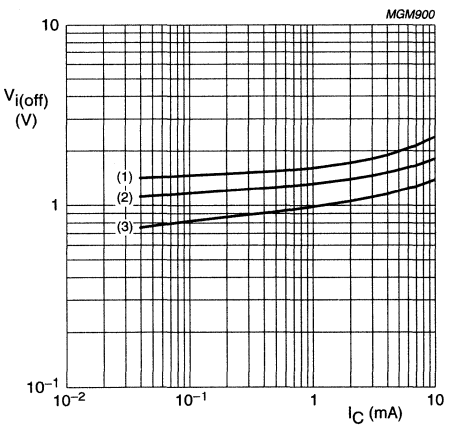
V_{CE} = 5 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.3 DC current gain as a function of collector current; typical values.



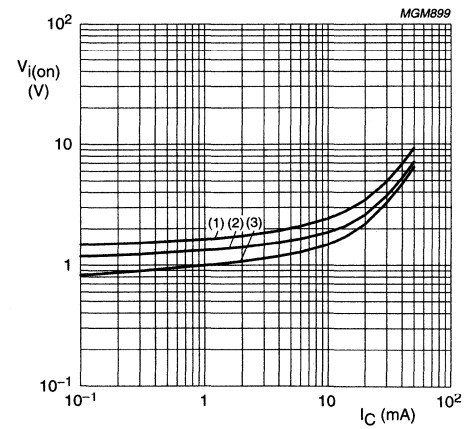
I_C/I_B = 20.
(1) T_{amb} = 100 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = −40 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



V_{CE} = 5 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.5 Input-off voltage as a function of collector current; typical values.



V_{CE} = 0.3 V.
(1) T_{amb} = −40 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 100 °C.

Fig.6 Input-on voltage as a function of collector current; typical values.

PNP general purpose double transistor PUMT1

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V)
- Reduces number of components and boardspace.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

Two independently operating PNP transistors in an SC-88; SOT363 plastic package. NPN complement: PUMX1.

MARKING

TYPE NUMBER	MARKING CODE
PUMT1	FtF

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
3, 6	collector	TR2; TR1

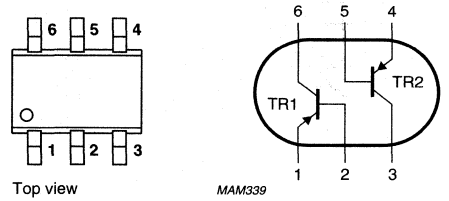


Fig.1 Simplified outline (SC-88; SOT363) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	−50	V
V_{CEO}	collector-emitter voltage	open base	–	−40	V
V_{EBO}	emitter-base voltage	open collector	–	−5	V
I_C	collector current (DC)		–	−100	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–100	nA
		I_E = 0; V_{CB} = –30 V; T_j = 150 °C	–	–10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –4 V	–	–100	nA
h_{FE}	DC current gain	I_C = –1 mA; V_{CE} = –6 V	120	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –50 mA; I_B = –5 mA; note 1	–	–200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –12 V; f = 1 MHz	–	2.2	pF
f_T	transition frequency	I_C = –2 mA; V_{CE} = –12 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN general purpose double transistor PUMX1

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V)
- Reduces number of components and boardspace.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

Two independently operating NPN transistors in an SC-88 plastic package. PNP complement: PUMT1.

MARKING

TYPE NUMBER	MARKING CODE
PUMX1	ZtZ

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR1; TR2
2, 5	base	TR1; TR2
3, 6	collector	TR2; TR1

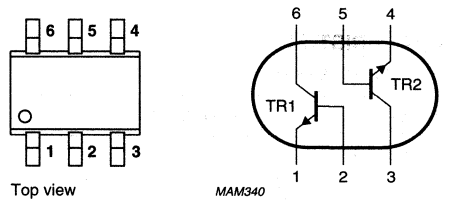


Fig.1 Simplified outline (SC-88) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor					
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 6 V	120	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 12 V; f = 1 MHz	–	1.5	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 12 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

NPN/PNP general purpose transistors PUMZ1

FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V)
- Reduces number of components and boardspace.

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

Two independently operating NPN/PNP transistors in an SC-88 plastic package.

MARKING

TYPE NUMBER	MARKING CODE
PUMZ1	FtZ

PINNING

PIN	DESCRIPTION	
1, 4	emitter	TR2; TR1
2, 5	base	TR2; TR1
3, 6	collector	TR2; TR1

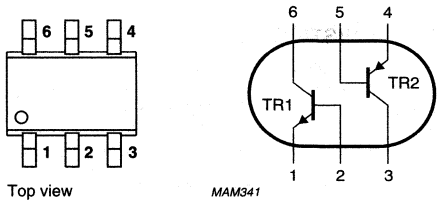


Fig.1 Simplified outline (SC-88) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	collector current (DC)		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	200	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C
Per device					
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	300	mW

Note

1. Device mounted on an FR4 printed-circuit board.

PRELIMINARY
See Philips Semiconductors for Design-in information

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
Per device				
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	416	K/W

Note

1. Device mounted on an FR4 printed-circuit board.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor; for the PNP transistor with negative polarity					
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 30 V	–	100	nA
		I_E = 0; V_{CB} = 30 V; T_j = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 4 V	–	100	nA
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 6 V	120	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 5 mA; note 1	–	200	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 12 V; f = 1 MHz			
	TR1		–	1.5	pF
	TR2		–	2.2	pF
f_T	transition frequency	I_C = 2 mA; V_{CE} = 12 V; f = 100 MHz	100	–	MHz

Note

1. Pulse test: $t_p \leq 300\ \mu s$; $\delta \leq 0.02$.

PACKAGE INFORMATION

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Packing quantities	1743

PACKAGE TITLES

To view the complete range of package outline drawings covering all devices shown in this book refer to either:

- Data handbook SC18, Discrete Semiconductor Packages, ordering code 9397 750 05011
- The SC10 CD-ROM, ordering number 9397 750 06085
- Internet page http://www.semiconductors.philips.com

PHILIPS PACKAGE	EQUIVALENT PACKAGE
SOT23	SST3
SOT32 (TO-126)	TO-126FP
SOT54 (TO-92)	small TO-92: SPT; E-Line
SOT54A	E-Line
SOT54 variant	E-Line
SOT89 (SC-62)	MPT3; UPAK
SOT128 (TO-202)	
SOT143	
SOT223 (SC73)	
SOT323 (SC70)	UMT3; CMPAK
SOT343	CMPAK-4
SOT346 (SC-59)	SMT3; MPAK
SOT353 (SC-88A)	UMT5
SOT363 (SC-88)	UMT6
SOT416 (SC-75)	EMT3; SMPAK
SOT457 (SC-74)	SMT6; TSSOP6
SOT477	
SOT490 (SC-89)	
SOD68	
SOD80	LLDS
SOD81	
SOD87	LLDL
SOD106	PMDS
SOD110	
SOD323 (SC-76)	UMD2; 1-1E1A; URP
SOD523 (SC-79)	SCD79; 1-1G1A; UFP
SO8	
SO16	

Small-signal Transistors and Diodes — Packing Quantities

PACKAGE	PRODUCTS	PACKING QUANTITIES	ORDERING CODE ENDING	PACKING DESCRIPTION	REEL DIAMETER (mm/inch)
SC-59 (SOT346)	Diodes and Transistors	3000	115	8 mm tape and reel, T1	180/7
	Transistors	3000	125	8 mm tape and reel, T2	180/7
	Diodes and Transistors	10000	135	8 mm tape and reel, T1	286/11¼
	Transistors	10000	165	8 mm tape and reel, T2	286/11¼
SC-89 (SOT490)	Diodes and Transistors	4000	115	8 mm tape and reel	180
		8000	315	2 mm pitch	180/7
SOD27 (DO-35)	Diodes	1000	153	53 mm tape, ammopack	138 × 73 × 29
		5000	143	26 mm tape, ammopack	263 × 47 × 72
		5000	136	37 mm radial, tape and reel	356/14
		5000	116	37 mm radial, tape and reel	356/14
		10000	113	53 mm tape and reel	356/14
		10000	133	53 mm tape, ammopack	263 × 73 × 122
SOD66 (DO-41)	Diodes	500	153	53 mm tape, ammopack	138 × 73 × 29
		5000	133	53 mm tape, ammopack	263 × 73 × 122
		5000	113	53 mm tape and reel	356/14
SOD68 (DO-34)	Diodes	1000	153	53 mm tape, ammopack	138 × 73 × 29
		5000	143	26 mm tape, ammopack	263 × 47 × 59
		5000	699	53 mm tape and reel	356/14
		5000	116	37 mm radial, tape and reel	356/14
		10000	113	53 mm tape and reel	356/14
		10000	133	53 mm tape, ammopack	263 × 73 × 102
SOD80C	Diodes	2500	115	8 mm tape and reel	180/7
		10000	135	8 mm tape and reel	330/13
SOD81	Diodes	5000	113	53 mm tape and reel	356/14
		5000	133	53 mm tape, ammopack	263 × 73 × 87
		5000	143	26 mm tape, ammopack	263 × 47 × 87
SOD87	Diodes	2000	115	8 mm tape and reel	180/7
		8000	135	8 mm tape and reel	330/13
SOD110	Diodes	3000	115	8 mm tape and reel	180/7
		11000	135	8 mm tape and reel	330/13
SOD323 (SC-76)	Diodes	3000	115	8 mm tape and reel	180/7
		10000	135	8 mm tape and reel	286/11¼
SOD523	Diodes	3000	115	8 mm tape and reel	180/7
		10000	135	8 mm tape and reel	286/11¼
		8000	315	2 mm pitch	180/7
		24000	335	2 mm pitch	286/11¼
SOT23	Diodes and Transistors	3000	215	8 mm tape and reel	180/7
		10000	235	8 mm tape and reel	286/11¼
	Transistors	15000	245	5 reel box	–

Small-signal Transistors and Diodes — Packing Quantities

PACKAGE	PRODUCTS	PACKING QUANTITIES	ORDERING CODE ENDING	PACKING DESCRIPTION	REEL DIAMETER (mm/inch)
SOT32 (TO-126)	Transistors	1000	127	tube pack	–
SOT54 (TO-92)	Transistors	5000	112	bulk, delta pinning	–
		5000	412	bulk, straight leads	–
		10000	116	tape and reel, wide pitch	380
		10000	126	tape ammopack, wide pitch	–
		10000	699	tape ammopack, reverse	–
SOT89	Diodes and Transistors	1000	115	12 mm tape and reel	180/7
		4000	135	12 mm tape and reel	330/13
SOT128 (TO-202)	Transistors	1000	127	tube pack	–
SOT143	Diodes	3000	215	8 mm tape and reel	180/7
		10000	235	8 mm tape and reel	286/11¼
SOT223	Diodes and Transistors	1000	115	12 mm tape and reel	180/7
		4000	135	12 mm tape and reel	330/13
SOT323 (SC-70)	Diodes and Transistors	3000	115	8 mm tape and reel, T1	180/7
		10000	135	8 mm tape and reel	286/11¼
SOT363 (SC-88)	Transistors	3000	115	8 mm tape and reel, T1	180
		10000	135	8 mm tape and reel, T1	286
SOT416 (SC-75)	Transistors and Diodes	3000	115	8 mm tape and reel, T1	180
		10000	135	8 mm tape and reel	286
		15000	145	8 mm tape and reel	–
SO20[1]	Diodes	2000	118	24 mm tape and reel	330/13
naked dice	Transistors	5 wafer	002	unsawn	–
			005	sawn	–

Note

1. BZA100 only.

DATA HANDBOOK SYSTEM

Data handbook system

DATA HANDBOOK SYSTEM

Philips Semiconductors data handbooks contain all pertinent data available at the time of publication and each is revised and reissued regularly.

Loose data sheets are sent to subscribers to keep them up-to-date on additions or alterations made during the lifetime of a data handbook.

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IC26	Integrated Circuit Packages
IC27	Complex Programmable Logic Devices

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DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC04	Colour Monitor and Multimedia Tubes
DC05	Wire Wound Components

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ACM2	Discrete Ceramics
ACM3 (MA03)	Piezoelectric Ceramics and Specialty Ferrites

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