Surface mounted semiconductors

BOOK SC10 1989

Philips Components

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SURFACE MOUNTED SEMICONDUCTORS

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SELECTION GUIDE

GENERAL PURPOSE TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at V	I_C/I_B mA	f_T typ. MHz	page
NPN										
BC817	45	45	500	310	100/600	100/1	0.7	500/50	200	201
BC818	25	25	500	310						201
BC846	65	65	100	200	220/800	2/5	0.25	10/0.5	300	207
BC847	45	45	100	200						207
BC848	30	30	100	200						207
BC868*	20	20	1000	1000	85/375	500/1	0.5	1000/100	60	247
BCP54▲	45	45	1000	1500	40/250	150/2	0.5	500/50	130	285
BCP55▲	60	60	1000	1500	40/250	150/2	0.5	500/50	130	285
BCP56▲	100	80	1000	1500	40/250	150/2	0.5	500/50	130	285
BCP68▲		20	1000	1500	85/375	500/1	0.5	1000/100	60	289
BCV27	40	30	300	350	> 20000	100/5	1.0	100/0.1	220	303
BCV29*	40	30	500	1000	> 20000	100/5	1.0	100/0.1	220	307
BCV47	80	60	500	300	> 4000	10/5	1.0	100/0.1	220	303
BCV49*	80	60	500	1000	> 10000	100/5	1.0	100/0.1	220	307
BCV71	80	60	100	350	110/220	2/5	0.25	10/0.5	300	327
BCV72					200/450					327
BCW31	32	32	100	350	110/220	2/5	0.25	10/0.5	300	337
BCW32					200/450					337
BCW33					420/800					337
BCW60A	32	32	200	150	120/220	2/5	0.35	10/0.25	250	343
BCW60B					180/310					343
BCW60C					250/460					343
BCW60D					380/630					343
BCW71	50	45	100	350	110/220	2/5	0.25	10/0.5	300	357
BCW72					220/450					357
BCW81					450/800					363
BCX19	50	45	500	425	100/600	100/1	0.62	500/50	200	375
BCX20	30	25								375
BCX54*	45	45	1000	1000	45/250	150/2	0.5	500/50	130	383
BCX55*	60	60			40/160					383
BCX56*	100	80			40/160					383
BCX70G	45	45	200	150	120/220	2/5	0.35	10/0.25	250	387
BCX70H					180/310					387

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

GENERAL PURPOSE TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at V	I_C/I_B mA	f_T typ. MHz	page
NPN										
BCX70J					250/460					387
BCX70K					380/630					387
BSP40**	70	60	1000	1500	40/120	100/5	0.25	150/15	100	629
BSP41**	70	60	1000	1500	100/300	100/5	0.25	150/15	100	629
BSP42**	90	80	1000	1500	40/120	100/5	0.25	150/15	100	629
BSP43**	90	80	1000	1500	100/300	100/5	0.25	150/15	100	629
PMBT4401	60	40	600	300	100/300	150/1	0.75	500/50	250	849
PMBT5550	160	140	600	300	60/250	10/5	0.25	50/5	200	857
PMBT6428	60	50	200	350	250/600		0.2	10/0.5	300	861
PMBT6429	55	45	200	350	500/1250		0.2	10/0.5	300	861
PMBTA05	60	60	500	300	50	10/1	0.25	100/10	100	865
PMBTA06	80	80	500	300	50	10/1	0.25	100/10	100	865
PMBTA13	30	30	300	300	5000	10/5	1.5	100/0.1	125	867
PMBTA14	30	30	300	300	10000	10/5	1.5	100/0.1	125	867
PXT4401*	60	40	600	1000	100/300	150/1	0.75	500/50	250	907
PXTA14*	30	30	300	1000	> 20000	100/5	1.5	100/0.1	125	915
PXTA27*		60	500	1000	> 10000	100/5	1.5	100/0.1	125	917
PZTA13▲	30	30	300	1500	> 5000	10/5	1.5	100/0.1	125	939
PZTA14▲	30	30	300	1500	> 10000	10/5	1.5	100/0.1	125	939
PZTA42▲	300	300	500	1500	> 40	10/10	0.5	20/2	50	941
PZTA43▲	200	200	500	1500	> 40	10/10	0.5	20/2	50	941
PNP										
BC807	45	45	500	310	100/600	100/1	0.7	500/50	100	195
BC808	25	25	500	310						195
BC856	65	65	100	200	75/475	2/5	0.3	10/0.5	150	229
BC857	45	45	100	200	75/475	2/5	0.3	10/0.5	150	229
BC858	30	30	100	200	75/800	2/5	0.3	10/0.5	150	229
BC869*	20	20	1000	1000	85/375	500/1	0.5	1000/100	60	253
BCP51▲	45	45	1000	1500	40/250	150/2	0.5	500/50	50	281
BCP52▲	60	60	1000	1500	40/250	150/2	0.5	500/50	50	281
BCP53▲	100	80	1000	1500	40/250	150/2	0.5	500/50	50	281
BCP69▲	–	25	1000	1500	85/375	500/1	0.5	1000/100	60	295
BCV26	40	30	300	350	> 20000	100/5	1.0	100/0.1	220	301
BCV28*	40	30	500	1000	> 20000	100/5	1.0	100/0.1	220	305
BCV46	80	60	500	300	> 4000	10/5	1.0	100/0.1	220	301
BCV48*	80	60	500	1000	> 10000	100/5	1.0	100/0.1	220	305

* Types in SOT89 package; ** Types in SOT143 package; ▲ Types in SOT223 package.

GENERAL PURPOSE TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at V	I_C/I_B mA	f_T typ. MHz	page
PNP										
BCW29	32	32	100	350	120/260	2/5	0.3	10/0.5	150	331
BCW30	–	–	–	–	215/500					331
BCW61A	32	32	200	150	120/220	2/5	0.25	10/0.25	180	347
BCW61B	–	–	–	–	180/310					347
BCW61C	–	–	–	–	250/460					347
BCW61D	–	–	–	–	380/630					347
BCW69	50	45	100	350	120/260	2/5	0.3	10/0.5	150	351
BCW70					120/500					351
BCW89	80	60			120/260					367
BCX17	50	45	500	425	100/600	100/1	0.62	500/50	100	371
BCX18	30	25								371
BCX51*	45	45	1000	1000	40/250	150/2	0.5	500/50	50	379
BCX52*	60	60			40/160					379
BCX53*	100	80			40/160					379
BCX71G	45	45	200	150	120/220	2/5	0.25	10/0.25	180	391
BCX71H	45	45	200	150	180/310					391
BCX71J	45	45	200	150	250/460					391
BCX71K	45	45	200	150	380/630					391
BSP30**	70	60	1000	1500	40/120	100/5	0.25	150/15	100	625
BSP31**	70	60	1000	1500	100/300	100/5	0.25	150/15	100	625
BSP32**	90	80	1000	1500	40/120	100/5	0.25	150/15	100	625
BSP33**	90	80	1000	1500	100/300	100/5	0.25	150/15	100	625
PMBT4403	40	40	600	300	100/300	150/2	0.75	500/50	200	849
PMBTA55	60	60	500	300	50	10/1	0.25	100/10	50	873
PMBTA56	80	80	500	300	50	10/1	0.25	100/10	50	873
PMBTA63	30	30	500	300	5000	10/5	1.5	100/0.1	125	875
PMBTA64	30	30	500	300	5000	10/5	1.5	100/0.1	125	875
PXT4403*	40	40	600	1000	100/300	150/2	0.4	150/15	200	911
PXTA64*	30	30	300	1000	> 20000	100/5	1.5	100/0.1	125	919
PXTA77*		60	500	1000	> 10000	100/5	1.5	100/0.1	125	921
PZTA63▲	30	30	500	1500	> 10000	100/5	1.5	100/0.1	125	945
PZTA64▲	30	30	500	1500	> 20000	100/5	1.5	100/0.1	125	945
PZTA92▲	300	300	500	1500	> 40	10/10				947
PZTA93▲	200	200	500	1500	> 40	10/10				947

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

HIGH-FREQUENCY TRANSISTORS in SOT23

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	F typ. at f dB	MHz	f_T typ. MHz	C_{re} typ. pF	page
NPN											
BF570	40	15	100	300	> 40	10/1			> 490	1.6	403
BF840	40	40	25	300					380	0.3	443
BF841	40	40	25	300					380	0.3	443
BFS18	30	20	20	250	35/125	1/10	4	100	200	0.85	565
BFS19	30	20	30	250	65/225	1/10	4	100	260	0.85	565
BFS20	30	20	25	250	40/85	7/10			450		571
PNP											
BF550	40	40	25	200	50/–	1/10	2	0.1	325	0.5	399
BF569	40	35	30	200	25/–	3/10	4.5	800	900	0.33	401
BF579	20	20	25	150	20/–	10/10	4.5	800	1350	0.46	407
BF660	40	30	25	200	30/–	3/10	–	–	650	0.65	419
BF824	30	30	25	300	–	–	3	100	450	0.1	437

BROAD-BAND TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	d_{im} typ. at f dB	MHz	f_T typ. GHz	C_{re} typ. pF	page
NPN											
BFG35▲	25	18	150	1000	25/140	100/10	60	793.25	4	1.2	463
BFG67**	20	10	50	300	20/—	15/5			7.5	0.5	467
BFG97▲	20	15	100	1000	25/90	70/10	60	793.25	5.5	1.0	471
BFG135▲	25	15	150	1000	80/120	100/10	60	793.25	7.0	1.2	475
BFG198▲	20	10	100	1000	40/100	50/5	60	793.25	8.0	0.8	479
BFQ17*	40	25	150	1000	25/—	150/6			1.2	1.9	483
BFQ18A	25	15	150	1000	25/—	100/10	60	793.25	3.6	1.2	487
BFQ19*	20	15	75	500	25/—	75/10			5.0	1.3	491
BFQ67	20	10	50	180	100	15/5			7.5	0.5	495
BFR53	18	10	50	250	25/—	50/5	60	217	2.0	0.9	509
BFR92	20	15	25	200	25/—	14/10	60	493.25	5.0	0.7	517
BFR92A	20	15	25	200	40/—	14/10	60	793.25	5.0	0.35	525
BFR93	15	12	35	200	25/—	30/5	60	493.25	5.0	0.8	537
BFR93A	15	12	35	250	40/—	30/5	60	793.25	5.0	0.6	545
BFS17	25	15	25	250	20/150	2/1	45	217	1.3	0.65	559
BFT25	8	5	2.5	50	20/—	1/1			2.3	0.45	577
PNP											
BFT92	20	15	25	200	20/—	14/10	60	493.25	5	0.7	593
BFT93	15	12	35	200	20/—	30/5	60	493.25	5	1.0	599

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

SWITCHING TRANSISTORS in SOT23/SOT89*/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at	I_C/I_B mA/mA	t (max.) on/off at ns	I_C/I_B mA	page
NPN											
BSP50▲	60	45	500	1500	2000/–	500/10	1.3	500/0.5	400/1500	500/0.5	633
BSP51▲	80	60	500	1500	2000/–	500/10	1.3	500/0.5	400/1500	500/0.5	633
BSP52▲	98	80	500	1500	2000/–	500/10	1.3	500/0.5	400/1500	500/0.5	633
BSR13	60	30	800	425	100/300	150/10	1.6	500/50	35/285	150/–	647
BSR14	75	40					1.0				647
BSR17	60	40	200	350	50/150	10/1	0.3	50/5	70/225	10/1	655
BSR17A	60	40	200	350	100/300	10/1	0.3	50/5	70/250	10/1	655
BSR40*	70	60	1000	1000	40/120	100/5	0.5	500/50	250/1000	100/5	675
BSR41*					100/300						675
BSR42*	90	80	1000	1000	40/120	100/5	0.5	500/50	250/1000	100/5	675
BSR43*					100/300						675
BSS64	120	80	100	350	20/80	10/1	0.2	50/15	/1000	15/1	693
BST50*	60	45	500	1000	1000/–	150/10	1.3	500/50	400/1500	500/0.5	709
BST51*	80	60	500	1000							709
BST52*	100	80	500	1000							709
BSV52	20	12	100	250	40/120	10/1	0.2	50/5	12/18	10/3	741
PMBT2222	60	30	600	300	100/300	150/10	0.4	150/15	10/225	150/–	825
PMBT2222A	75	40	600	300	100/300	150/10	0.3	150/15	10/225	150/–	825
PMBT2369	40	40	500	300	40/120	10/1	0.25	10/1	12/18	10/3	829
PMBT3903	60	40	200	300	50/150	10/1	0.3	50/5	35/175	10/1	837
PMBT3904	60	40	200	300	100/300	10/1	0.3	50/5	35/200	10/1	837
PXT2222*	60	30	600	1000	100/300	150/10	0.4	150/15	10/225	150/15	891
PXT2222A*	75	40	600	1000	100/300	150/10	0.4	150/15	10/225	150/15	891
PXT3904*	60	40	200	1000	100/300						899
PZT2222▲	60	30	600	1500	100/300	150/10	0.4	150/15			923
PZT2222A▲	75	40	600	1500	100/300	150/10	0.3	150/10	10/225	150/15	923
PZT3904▲	60	40	200	1500	100/300	10/1	0.3	10/1	35/200	10/1	931

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

SWITCHING TRANSISTORS in SOT23/SOT89*/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at	I_C/I_B V	mA/mA	t (max.) on/off at	I_C/I_B ns	mA	page
PNP													
BSP60	60	45	500	1500	2000/–	500/10	1.3	500/0.5		400/1500	500/0.5		637
BSP61	80	60	500	1500	2000/–	500/10	1.3	500/0.5					637
BSP62	90	80	500	1500	2000/–	500/10	1.3	500/0.5					637
BSR12	15	15	100	250	30/120	50/1	0.45	100/10		20/30	30/3		641
BSR15	60	40	600	425	100/300	150/10	1.6	500/50		45/100	150/15		651
BSR16	60	60											651
BSR18	40	40	200	250	50/150	10/1	0.4	50/5		70/250	10/1		659
BSR18A	40	40	200	250	100/300	10/1	0.4	50/5		70/300	10/1		659
BSR30*	70	60	1000	1000	40/120	100/5	0.5	500/50		500/650	100/5		671
BSR31*	70	60			100/300								671
BSR32*	90	80			40/120								671
BSR33*	90	80			100/300								671
BSS63	110	100	100	350	30/–	25/1	0.25	25/2.5					687
BST60*	60	45	500	1000	1000/–	150/10	1.3	500/0.5		400/1500	500/0.5		713
BST61*	80	60											713
BST62*	100	80											713
PMBT2907	60	40	600	300	30/50	500/10	0.4	150/15		45/100	150/15		833
PMBT2907A	60	60	600	300	30/50	500/10	0.4	150/15		45/100	150/15		833
PMBT3906	40	40	200	300	100/300	10/1	0.25	10/1		35/225	10/1		841
PXT2907*	60	40	600	1000	100/300	150/10	0.4	150/10		45/100	150/15		895
PXT2907A*	60	60	600	1000	100/300	150/10	0.4	150/10		45/100	150/15		895
PXT3906*	40	40	200	1000	100/300	10/1	0.25	10/1		35/225	10/1		903
PZT2907▲	60	40	600	1500	100/300	150/10	0.4	150/15		45/100	150/15		927
PZT2907A▲	60	60	600	1500	100/300	150/10	0.4	150/15		45/100	150/15		927
PZT3906▲	40	40	200	1500	100/300	10/1	0.4	50/5		35/225	10/1		935

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

LOW-NOISE TRANSISTORS in SOT23 ($F < 4$ dB at $f = 1$ kHz; $B = 200$ Hz)

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at I_C/I_B V	mA	f_T typ. MHz	page
NPN										
BC849	30	30	100	200	450/800	2/5	0.25	10/0.5	300	217
BC850	45	45	100	200						217
BCF32	32	32	100	350	200/450	2/5	0.25	10/0.5	300	265
BCF33	32	32	100	350	420/800	2/5	0.25	10/0.5	300	265
BCF81	50	45	100	350	420/800	2/5	0.25	10/0.5	300	277
PMBT5088	35	30	50	300	350/–	1/5	0.5	10/1	200	853
PNP										
BC859	30	30	100	200	125/800	2/5	0.3	10/0.5	150	237
BC860	45	45	100	200	125/800	2/5	0.3	10/0.5	150	237
BCF29	32	32	100	350	120/260	2/5	0.3	10/0.5	150	259
BCF30	32	32	100	350	215/500	2/5	0.3	10/0.5	150	259
BCF70	50	45	100	350	215/500	2/5	0.3	10/0.5	150	271

HIGH-VOLTAGE TRANSISTORS in SOT23/SOT89*/SOT223▲

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at	I_C/I_B mA	f_T min. MHz	page
NPN										
BF620*	300		20	1000	50/–	25/20	0.6	30/5	60	411
BF622*	250	250	20	1000	50/–	25/20	0.6	30/5	60	411
BF720▲	300		50	1500	50/–	25/20	0.6	30/5	60	421
BF722▲	250	250	50	1500	50/–	25/20	0.6	30/5	60	421
BF820	300		50	310	50/–	25/20	0.6	30/5	60	429
BF822	250	250	50	310	50/–	25/20	0.6	30/5	60	429
BSP19▲	400	350	1000	1500	40/–	10/20	1.3	50/4	70	623
BSP20▲	300	250	1000	1500	40/–	10/20	1.3	50/4	70	623
BSR19	160	140	600	350	60/250	10/5	0.25	50/5	100	663
BSR19A	180	160	600	360	80/250	10/5	0.2	50/5	100	663
BST39*	350	300	1000	1000	40/160	20/10	0.5	50/4	70	705
BST40*	350	250	1000	1000	40/160	20/10	0.5	50/4	70	705
PMBT5551	180	160	600	300	80/250	10/5	0.2	50/5	100	859
PMBTA42	300	300	500	310	40/–	30/10	0.5	20/2	50	869
PMBTA43	200	200	500	310	40/–	30/10	0.5	20/2	50	869
PNP										
BF621*	300		20	1000	50/–	25/20	0.8	30/5	60	415
BF623*	250	250	20	1000	50/–	25/20	0.8	30/5	60	415
BF721▲	300		50	1500	50/–	25/20	0.8	30/5	60	425
BF723▲	250	250	50	1500	50/–	25/20	0.8	30/5	60	425
BF821	300		50	310	50/–	25/20	0.8	30/5	60	433
BF823	250	250	50	310	50/–	25/20	0.8	30/5	60	433
BSP15▲	200	200	1000	1500	30/150	10/50	2.5	50/5	15	621
BSP16▲	350	300	1000	1500	30/120	10/50	2.0	50/5	15	621
BSR20	130	120	600	350	40/180	10/5	0.5	50/5	100	667
BSR20A	160	150	600	350	60/240	10/5	0.5	50/5	100	667
BST15*	200	200	1000	1000	30/150	50/10	2.5	50/5	15	701
BST16*	350	300	1000	1000	30/120	50/10	2.0	50/5	15	701
PMBT5401	160	150	500	300	60/240	10/5	0.5	50/5	100	855
PMBTA92	300	300	500	300	40/–	10/10	0.5	20/2	50	877
PMBTA93	200	200	500	300	40/–	10/10	0.5	20/2	50	877

* Types in SOT89 package.
** Types in SOT143 package.
▲ Types in SOT223 package.

FIELD-EFFECT TRANSISTORS in SOT23/SOT89*/SOT143**

type	RATINGS ± V_{DS} V	RATINGS $-V_{GSO}$ V	RATINGS I_D mA	RATINGS P_{tot} mW	$-I_{GSS}$ max. nA	I_{DSS} min./max. mA	$-V_{(P)GS}$ max. V	$\|y_{fs}\|$ min. mS	C_{re} max. pF	V_n max. μV	page
BF510	20		30	300	10	0.7/3	0.8	2.5	0.4		395
BF511						2.5/7.0	1.5	4			395
BF512						6/12	2.2	6			395
BF513						10/18	3	7			395
BF989**	20		20	200	50	2/20	2.7	9.5	0.025		445
BF990A**	18		30	200	25		1.3	18	0.025		447
BF991**	20		20	200	50	4/25	2.5	10	0.020		451
BF992**	20		40	200	25		1.3	20	0.04		453
BF994S**	20		50	300	50	4/20	2.5	15	0.025		455
BF996S**	20		30	300	50	4/20	2.5	15	0.025		457
BF997**	20		30	300	10	2/20	2.5	15	0.025		459
BFR30	25	25	10	250	0.2	4/10	5	1	1.5	0.5	499
BFR31						1/5	2.5	1.5			499
BFR101A**	30	30	10	200	5	0.2/1.5	1.0				557
BFR101B**	30	30	10	200	5	1/5	2.5	2.5			557
BFT46	25	25	10	250	0.2	0.2/1.5	1.2	1.0	1.5	0.5	585
BSD20**	10		50	230	1.0		2.0		0.6		617
BSD22**	20		50	230	1.0		2.0		0.6		617
BSR56	40	40		250	1	50/–	10		5		679
BSR57						20/100	6				679
BSR58						8/80	4				679
BSR174	30				50	20/135	10				683
BSR175	30				50	7/70	6				683
BSR176	30				50	2/35	4				683
BSR177	30				50	1.5/20	2.25				683
BSS83**	10		50	230	10		2		0.6		697
BST80*	80	20	500	1000	100	–/0.01	3.5	300	8		717
BST82	80	20	175	300	100	–/0.001	3.5	150	3		721
BST84*	200	20	250	1000	100	–/0.01	2.8	250	5		725
BST86*	180	20	300	1000	100	–/0.01	2.4	250	6		729
BST120*	60	20	300	1000	100	–/0.01	3.5	200	8		733
BST122*	50	20	250	1000	100	–/0.01	3.5	125	8		737
PMBF4391	40	40		250	1	50/150	10		3.5		817
PMBF4392	40	40		250	1	25/75	5		3.5		817
PMBF4393	40	40		250	1	5/30	3		3.5		817
PMBFJ174	30	30		300	1	20/135	10		4		821
PMBFJ175	30	30		300	1	7/70	6		4		821
PMBFJ176	30	30		300	1	2/35	4		4		821
PMBFJ177	30	30		300	1	1.5/20	2.25		4		821

* Types in SOT89 package. ** Types in SOT143 package.

SPECIAL TRANSISTORS IN SOT143

type	RATINGS V_{CBO} V	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} min./max. at	I_C/V_{CE} mA/V	V_{CEsat} max. at V	I_C/I_B mA	f_T typ. MHz	page
PNP										
BCV62	30	30	100	200	100/800	2/5	0.65	100/5	150	313
BCV64	30	30	100	300	100/900	2/5	0.3	100/0.5	200	321
NPN										
BCV61	30	30	100	200	100/800	2/5	0.6	100/5	300	309
BCV63	30	30	100	300	100/900	2/5	0.65	100/5	200	317
NPN/PNP										
BCV65	30	30	100	300	75/800	2/5	0.3	10/0.5	100	325

TRIGGER DEVICES

PNPN	case	V_{GA} max. V	I_A max. mA	I_P μA	I_V μA	page
BRY61	SOT23	70	175	5/1	30/50	605
BRY62	SOT143	70	175	–	–	611

DIODES in SOT23 unless indicated

type	description	RATINGS V_R V	RATINGS I_F mA	t_{rr} max. ns	V_F max. (mV) at I_F = mA 10/100 – 150	C_d max.	page
BA423L*	band switch	20	50		–/1000	2.5	75
BA682*	band switch	35	100		–/1000	1.5	77
BA683*	band switch	35	100		–/1000	1.5	77
BAS16	high-speed switch	75	250	6	855/– 1250	2	79
BAS17	low-voltage stabilizer		250		830/960	140	83
BAS19	high-speed switch	100	200	50	–/1000	5	87
BAS20	high-speed switch	150	200	50	–/1000	5	87
BAS21	high-speed switch	200	200	50	–/1000	5	87
BAS28**	fast switch double diode	75	250	6	855/– 1250	2	95
BAS29	switch	90	250	50	750/900	35	99
BAS31	two diodes in series	90	250	50	750/900	35	99
BAS32*	high-speed switch	75	200	4	–/1000	2	101
BAS32L*	high-speed switch	75	200	4	–/1000	2	109
BAS35	common diode double diode	90	250	50	750/900	35	99
BAS56**	ultra-high speed switch double diode	60	200	6	750/–	2.5	117
BAS85*	Schottky barrier	30	200	5	500/800	10	121
BAT17	Schottky barrier	4	30		600/–	1	125
BAT18	band switch	35	100		–/1200	1	129
BAT54	Schottky barrier	30	200	5	400/1000	10	133
BAT54A;C;S	Schottky barrier	30	200	5	400/1000	10	137
BAT74**	Schottky barrier double diode	30	200	5	400/1000	10	139
BAV23**	two diodes	200	200	50	–/1000	2.5	143
BAV70	common cathode double diode	70	250	6	855/– 1250	1.5	145
BAV99	two diodes in series	70	250	6	855/– 1250	1.5	149
BAV100*	general purpose	50	250	50	–/1000	5	153
BAV101*	general purpose	100	250	50	–/1000	5	153
BAV102*	general purpose	150	250	50	–/1000	5	153
BAV103*	general purpose	200	250	50	–/1000	5	153
BAV105*	ultra high speed	60	300	6	10/–	2.5	161
BAW56	common anode double diode	70	250	6	855/– 1250	2	169
PMLL4148*	general purpose	75	200	4	1000/–	4	879
PMLL4150*	general purpose	50	300	6	740/920	2.5	883
PMLL4151*	general purpose	50	200	2		2	883
PMLL4153*	general purpose	50	200	2	810/–	2	883
PMLL4446*	general purpose	75	200	4	1000/–	4	879
PMLL4448*	general purpose	70	200	4	1000/–	4	879

* Types in SOD80 package.
** Types in SOT143 package.

VARIABLE CAPACITANCE DIODES SOT23/SOD80*/SOT143**

type	RATINGS		CHARACTERISTICS				page
	V_R	I_F	C_d at V_R		C_d ratio at V_R = 3/25 V at f = 1 MHz	r_D	
	V	mA	pF	V		Ω	
BB215*	30	20	1.8/2.2	28	typ. 8.3	typ. 0.63	173
BB219*	32	20	2.6/3.2	28	12 to 15	typ. 0.7	175
BB240*	32	20	2.4/2.7	28	min. 14	max. 1.0	177
BB241*	32	20	2.5/3.0	28	min. 21	max. 2.0	179
BB804	18	50	42/47.5	2	1.65 to 1.75	typ. 0.2	181
BBY31	28	20	1.8/2.8	25	typ. 5	max. 1.2	183
BBY39	30	20	1.8/2.0	28	typ. 11	max. 0.75	187
BBY40	28	20	4.3/6.0	25	5 to 5.6	max. 0.6	189
BBY62**	28	20	1.6/2.0	28	typ. 9.7	max. 1.2	193

* Types in SOD80 package.
** Types in SOT143 package.

VOLTAGE REGULATOR DIODES

type	case	range (V)	voltage tolerance %	P_{tot} mW	I_{ZRM} mA	I_{FRM} mA	max. V_F at I_F		page
							V	mA	
BZD27	SOD87	7.5 to 510	5	2300	–	–	1.2	200	767
BZV49	SOT89	2.4 to 75	5	1000	*	250	1	50	773
BZV55	SOD80	2.4 to 75	2, 3, 5	500		250	0.9	10	783
BZV80	SOD80	5.89 to 6.51		400	50				797
BZV81	SOD80	5.89 to 6.51		400	50				797
BZX84	SOT23	2.4 to 75	2, 5	350	250	250	0.9	10	799
PMLL5225B to PMLL5267B	SOD80	3.0 to 75	5	500		250	1.1	200	887

TRANSIENT SUPPRESSION DIODES

type	case	V_R V	$V_{(CL)R}$ V	I_{RSM} A	P_{RSM} W	page
BZD27	SOD87	6.2 to 430	11.3 to 707	13.3 to 0.21**	150**	767

* I_{ZRM} limited by P_{ZRM} max.
** Pulse according to IEC 60-2, section 6: 10/1000 μs exponential; T_j = 25 °C prior to the pulse.

RECTIFIER DIODES

type	case	$I_{F(AV)}$ A	V_{RRM} V	V_R V	I_{FRM} A	I_{FSM} A	t_{rr} ns	V_F at I_F V	A	page
BYD17D	SOD87	1.5	200*	200	5.5	20		1.05	1	749
BYD17G	SOD87	1.5	400*	400	5.5	20		1.05	1	749
BYD17J	SOD87	1.5	600*	600	5.5	20		1.05	1	749
BYD17K	SOD87	1.5	800*	800	5.5	20		1.05	1	749
BYD17M	SOD87	1.5	1000*	1000	5.5	20		1.05	1	749
BYD37D	SOD87	1.5	200	200	12	20	250	1.3	1	757
BYD37G	SOD87	1.5	400	400	12	20	250	1.3	1	757
BYD37J	SOD87	1.5	600	600	12	20	250	1.3	1	757
BYD37K	SOD87	1.5	800	800	12	20	300	1.3	1	757
BYD37M	SOD87	1.5	1000	1000	12	20	300	1.3	1	757
BYD77A	SOD87	2.0	50	50	15	25	25	0.95	1	763
BYD77B	SOD87	2.0	100	100	15	25	25	0.95	1	763
BYD77C	SOD87	2.0	150	150	15	25	25	0.95	1	763
BYD77D	SOD87	2.0	200	200	15	25	25	0.95	1	763
BYD77E	SOD87	1.85	250	250	13	25	50	1.05	1	763
BYD77F	SOD87	1.85	300	300	13	25	50	1.05	1	763
BYD77G	SOD87	1.85	400	400	13	25	50	1.05	1	763

TEMPERATURE SENSORS

type	temperature range °C	resistance R . . at T_{amb} and I (R25 or R100) Ω	°C	mA	continuous sensor current mA**	page
KTY85-110	−40 to 125	1000 ± 1%	25	1	10	811
-120	−40 to 125	1000 ± 2%	25	1	10	811
-150	−40 to 125	1000 ± 5%	25	1	10	811

* V_{RWM}.
** T_{amb} = 25 °C.

In this alpha-numeric list we present all surface mounted devices mentioned in this handbook.

type number	SOT23	SOT89	SOT143	SOD80	marking type / reverse type	device type	nearest conventional type(s)	complement	page
BA423L	-	-	-	●		diode			75
BA682	-	-	-	●	red band	diode	BA482		77
BA683	-	-	-	●	red and orange	diode	BA483		77
BAS16	●	-	-	-	A6	diode	BAW62, 1N4148		79
BAS17	●	-	-	-	A91	diode	BA314		83
BAS19	●	-	-	-	JP	diode	BAV19		87
BAS20	●	-	-	-	JR	diode	BAV20		87
BAS21	●	-	-	-	JS	diode	BAV21		87
BAS28	-	-	●	-	JT	2 diodes	1N4148		95
BAS29	●	-	-	-	L20	diode	BAX12		99
BAS31	●	-	-	-	L21	2 diodes	BAX12		99
BAS32	-	-	-	●	black band	diode	1N4148		101
BAS32L	SOD-80C					diode			109
BAS35	●	-	-	-	L22	2 diodes	BAX12		99
BAS56	-	-	●	-	L51	2 diodes	BAV10		117
BAS85	-	-	-	●	grey band	diode			121
BAT17	●	-	-	-	A3	diode	BA480		125
BAT18	●	-	-	-	A2	diode	BA482		129
BAT54	●	-	-	-	L4	diode	BAT85		133
BAT54A	●	-	-	-	L42	2 diodes	BAT85 (double)		137
BAT54C	●	-	-	-	L43	2 diodes	BAT85 (double)		137
BAT54S	●	-	-	-	L44	2 diodes	BAT85 (double)		137
BAT74	-	-	●	-	L41	2 diodes	BAT85		139
BAV23	-	-	●	-	L30	2 diodes	BAV21		143
BAV70	●	-	-	-	A4	2 diodes	BAW62, 1N4148 (double)		145
BAV99	●	-	-	-	A7	2 diodes	BAW62, 1N4148 (double)		149
BAV100	-	-	-	●	green and black	diode	BAV10		153
BAV101	-	-	-	●	green and brown	diode	BAV19		153
BAV102	-	-	-	●	green and red	diode	BAV20		153
BAV103	-	-	-	●	green and orange	diode	BAV21		153
BAV105	-	-	-	●	green band	diode	BAV10		161
BAW56	●	-	-	-	A1	diode	BAW62, 1N4148 (double)		169
BB215	-	-	-	●	white and green	diode	BB405B		173
BB219	-	-	-	●	white	diode	BB909		175
BB240	-	-	-	●	white band	diode			177

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BB241	-	-	-	●	white		diode			179
BB804	-	-	-	●			diode			181
BBY31	●	-	-	-	S1		diode	BB405		183
BBY39	●	-	-	-			2 diodes			187
BBY40	●	-	-	-	S2		diode	BB809		189
BBY62	-	-	●	-			2 diodes			193
BC807-16	●	-	-	-	5A	5AR	PNP	BC327-16	BC817-16	195
BC807-25	●	-	-	-	5B	5BR	PNP	BC327-25	BC817-25	195
BC807-40	●	-	-	-	5C	5CR	PNP	-40	-40	195
BC808-16	●	-	-	-	5E	5ER	PNP	BC328-16	BC818-16	195
BC808-25	●	-	-	-	5F	5FR	PNP	-25	-25	195
BC808-40	●	-	-	-	5G	5GR	PNP	BC328-40	BC818-40	195
BC817-16	●	-	-	-	6A	6AR	NPN	BC337-16	BC807-16	201
BC817-25	●	-	-	-	6B	6BR	NPN	-25	-25	201
BC817-40	●	-	-	-	6C	6CR	NPN	-40	-40	201
BC818-16	●	-	-	-	6E	6ER	NPN	BC328-16	BC808-16	201
BC818-25	●	-	-	-	6F	6FR	NPN	BC328-25	BC808-25	201
BC818-40	●	-	-	-	6G	6GR	NPN	-40	-40	201
BC846A	●	-	-	-	1A	1AR	NPN	BC546A	BC856A	207
BC846B	●	-	-	-	1B	1BR	NPN	BC546B	BC856B	207
BC847A	●	-	-	-	1E	1ER	NPN	BC547A, BC107A	BC857A	207
BC847B	●	-	-	-	1F	1FR	NPN	BC547B, BC107B	BC857B	207
BC847C	●	-	-	-	1G	1GR	NPN	BC547C	BC857C	207
BC848A	●	-	-	-	1J	1JR	NPN	BC548A, BC108A	BC858A	207
BC848B	●	-	-	-	1K	1KR	NPN	BC548B, BC108B	BC858B	207
BC848C	●	-	-	-	1L	1LR	NPN	BC548C, BC108C	BC858C	207
BC849B	●	-	-	-	2B	2BR	NPN	BC549B, BC109B	BC859B	217
BC849C	●	-	-	-	2C	2CR	NPN	BC549C, BC109C	BC859C	217
BC850B	●	-	-	-	2F	2FR	NPN	BC550B, BCY59	BC860B	217
BC850C	●	-	-	-	2G	2GR	NPN	BC550C, BCY59	BC860C	217
BC856A	●	-	-	-	3A	3AR	PNP	BC556A	BC846A	229
BC856B	●	-	-	-	3B	3BR	PNP	BC556B	BC846B	229
BC857A	●	-	-	-	3E	3ER	PNP	BC557A, BC177A	BC847A	229
BC857B	●	-	-	-	3F	3FR	PNP	BC557B, BC177B	BC847B	229
BC857C	●	-	-	-	3G	3GR	PNP	BC557C	BC847C	229
BC858A	●	-	-	-	3J	3JR	PNP	BC558A, BC178A	BC848A	229
BC858B	●	-	-	-	3K	3KR	PNP	BC558B, BC178B	BC848B	229
BC858C	●	-	-	-	3L	3LR	PNP	BC558C	BC848C	229
BC859A	●	-	-	-	4A	4AR	PNP	BC559A, BC179A, BCY78		237
BC859B	●	-	-	-	4B	4BR	PNP	BC559B, BCY79	BC849B	237

type number	SOT23	SOT89	SOT143	SOD80	marking type	marking reverse type	device type	nearest conventional type(s)	complement	page
BC859C	●	-	-	-	4C	4CR	PNP	BC559C, BCY79	BC849C	237
BC860A	●	-	-	-	4E	4ER	PNP	BC560A, BCY79		237
BC860B	●	-	-	-	4F	4FR	PNP	BC560B, BCY79	BC850B	237
BC860C	●	-	-	-	4G	4GR	PNP	BC560C, BCY79	BC850C	237
BC868	-	●	-	-	CAC		NPN	BC368, BD329	BC869	247
BC869	-	●	-	-	CEC		PNP	BC369, BD330	BC868	253
BCF29	●	-	-	-	C7	C77	PNP	BC559A, BCY78, BC179		259
BCF30	●	-	-	-	C8	C9	PNP	BC559B, BCY78	BCF32	259
BCF32	●	-	-	-	D7	D77	NPN	BC549B, BCY58, BC109	BCF30	265
BCF33	●	-	-	-	D8	D81	NPN	BC549C, BCY58		265
BCF70	●	-	-	-	H7	H71	PNP	BC560B, BCY79		271
BCF81	●	-	-	-	K9	K91	NPN	BC550C		277
BCP51		SOT-223			AA		PNP		BCP54	281
BCP51-10		SOT-223			AC		PNP		BCP54-10	281
BCP51-16		SOT-223			AD		PNP		BCP54-16	281
BCP52		SOT-223			AE		PNP		BCP55	281
BCP52-10		SOT-223			AG		PNP		BCP55-10	281
BCP52-16		SOT-223			AM		PNP		BCP55-16	281
BCP53		SOT-223			AH		PNP		BCP56	281
BCP53-10		SOT-223			AK		PNP		BCP56-10	281
BCP53-16		SOT-223			AL		PNP		BCP56-16	281
BCP54		SOT-223			BA		NPN		BCP51	285
BCP54-10		SOT-223			BC		NPN		BCP51-10	285
BCP54-16		SOT-223			BD		NPN		BCP51-16	285
BCP55		SOT-223			BE		NPN		BCP52	285
BCP55-10		SOT-223			BG		NPN		BCP52-10	285
BCP55-16		SOT-223			BM		NPN		BCP52-16	285
BCP56-6		SOT-223			BJ		NPN		BCP53	285
BCP56-10		SOT-223			BK		NPN		BCP53-10	285
BCP56-16		SOT-223			BL		NPN		BCP53-16	285
BCP68		SOT-223			CA		NPN			289
BCP69		SOT-223			CE		PNP			295
BCV26	●	-	-	-	FD		PNP	BC516	BCV27	301
BCV27	●	-	-	-	FF		NPN	BC517	BCV26	303
BCV28	-	●	-	-			PNP		BCV29	305
BCV29	-	●	-	-			NPN		BCV28	307
BCV46	●	-	-	-			PNP		BCV47	301
BCV47	●	-	-	-			NPN		BCV46	303
BCV48	-	●	-	-			PNP		BCV49	305
BCV49	-	●	-	-			NPN		BCV48	307

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BCV61	-	-	●	-	D91		NPN	BC547	BCV62	309
BCV61A	-	-	●	-	D92		NPN			309
BCV61B	-	-	●	-	D93		NPN			309
BCV61C	-	-	●	-	D94		NPN			309
BCV62	-	-	●	-	C91		PNP	BC557	BCV61	313
BCV62A	-	-	●	-	C92		PNP			313
BCV62B	-	-	●	-	C93		PNP			313
BCV62C	-	-	●	-	C94		PNP			313
BCV63	-	-	●	-	D95		NPN		BCV64	317
BCV63B	-	-	●	-	D96		NPN			317
BCV64	-	-	●	-	C95		PNP		BCV63	321
BCV64B	-	-	●	-	C96		PNP			321
BCV65	-	-	●	-	97		PNP			325
BCV65B	-	-	●	-	98		NPN			325
BCV71	●	-	-	-	K7	K71	NPN	BC546A	BCW89	327
BCV72	●	-	-	-	K8	K81	NPN	BC546B		327
BCW29	●	-	-	-	C1	C4	PNP	BC178A, BC558A	BCW31	331
BCW30	●	-	-	-	C2	C5	PNP	BC178B, BC558B	BCW32	331
BCW31	●	-	-	-	D1	D4	NPN	BC108A, BC548A	BCW29	337
BCW32	●	-	-	-	D2	D5	NPN	BC108B, BC548B	BCW30	337
BCW33	●	-	-	-	D3	D6	NPN	BC108C, BC548C		337
BCW60A	●	-	-	-	AA		NPN	BC548A	BCW61A	343
BCW60B	●	-	-	-	AB		NPN	BC548B	BCW61B	343
BCW60C	●	-	-	-	AC		NPN	BC548B	BCW61C	343
BCW60D	●	-	-	-	AD		NPN	BC548C	BCW61D	343
BCW61A	●	-	-	-	BA		PNP	BC558A	BCW60A	347
BCW61B	●	-	-	-	BB		PNP	BC558B	BCW60B	347
BCW61C	●	-	-	-	BC		PNP	BC558B	BCW60C	347
BCW61D	●	-	-	-	BD		PNP	BC558C	BCW60D	347
BCW69	●	-	-	-	H1	H4	PNP	BC557A	BCW71	351
BCW70	●	-	-	-	H2	H5	PNP	BC557B	BCW72	351
BCW71	●	-	-	-	K1	K4	NPN	BC547A	BCW69	357
BCW72	●	-	-	-	K2	K5	NPN	BC547B	BCW70	357
BCW81	●	-	-	-	K3	K31	NPN	BC547C		363
BCW89	●	-	-	-	H3	H31	PNP	BC556A	BCV71	367
BCX17	●	-	-	-	T1	T4	PNP	BC327	BCX19	371
BCX18	●	-	-	-	T2	T5	PNP	BC328	BCX20	371
BCX19	●	-	-	-	U1	U4	NPN	BC337	BCX17	375
BCX20	●	-	-	-	U2	U5	NPN	BC338	BCX18	375
BCX51	-	●	-	-	AA		PNP	BC636, BD136	BCX54	379

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BCX51-10	-	●	-	-	AC		PNP		BCX54-10	379
BCX51-16	-	●	-	-	AD		PNP		BCX54-16	379
BCX52	-	●	-	-	AE		PNP	BC638, BD138	BCX55	379
BCX52-10	-	●	-	-	AG		PNP		BCX55-10	379
BCX52-16	-	●	-	-	AM		PNP		BCX55-16	379
BCX53	-	●	-	-	AH		PNP	BC640, BD140	BCX56	379
BCX53-10	-	●	-	-	AK		PNP		BCX56-10	379
BCX53-16	-	●	-	-	AL		PNP		BCX56-16	379
BCX54	-	●	-	-	BA		NPN	BC635, BD135	BCX51	383
BCX54-10	-	●	-	-	BC		NPN		BCX51-10	383
BCX54-16	-	●	-	-	BD		NPN		BCX51-16	383
BCX55	-	●	-	-	BE		NPN	BC637, BD137	BCX52	383
BCX55-10	-	●	-	-	BG		NPN		BCX52-10	383
BCX55-16	-	●	-	-	BM		NPN		BCX52-16	383
BCX56	-	●	-	-	BH		NPN	BC639, BD139	BCX53	383
BCX56-10	-	●	-	-	BK		NPN		BCX53-10	383
BCX56-16	-	●	-	-	BL		NPN		BCX53-16	383
BCX70G	●	-	-	-	AG		NPN	BC107A, BC547A	BCX71G	387
BCX70H	●	-	-	-	AH		NPN	BC107B, BC547B	BCX71H	387
BCX70J	●	-	-	-	AJ		NPN	BC107B, BC547B	BCX71J	387
BCX70K	●	-	-	-	AK		NPN	BC107C, BC547C	BCX71K	387
BCX71G	●	-	-	-	BG		PNP	BC177A, BC557A	BCX70G	391
BCX71H	●	-	-	-	BH		PNP	BC177B, BC557B	BCX70H	391
BCX71J	●	-	-	-	BJ		PNP	BC177B, BC557B	BCX70J	391
BCX71K	●	-	-	-	BK		PNP	BC557C	BCX70K	391
BF510	●	-	-	-	S6		FET	BF410A		395
BF511	●	-	-	-	S7		FET	BF410B		395
BF512	●	-	-	-	S8		FET	BF410C		395
BF513	●	-	-	-	S9		FET	BF410D		395
BF550	●	-	-	-	LA	G5	PNP	BF450		399
BF569	●	-	-	-	LH		PNP	BF970		401
BF570	●	-	-	-	B26		NPN	BF370		403
BF579	●	-	-	-	LJ		PNP	BF979		407
BF620	-	●	-	-	DC		NPN	BF420, BF471, BF871	BF621	411
BF621	-	●	-	-	DF		PNP	BF421, BF472, BF872	BF620	415
BF622	-	●	-	-	DA		NPN	BF422, BF469, BF869	BF623	411
BF623	-	●	-	-	DB		PNP	BF423, BF470, BF870	BF622	415
BF660	●	-	-	-	LE	G81	PNP	BF606A		419
BF720	SOT-223				DC		NPN			421
BF721	SOT-223				DF		PNP			425

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BF722	SOT-223				DA		NPN			421
BF723	SOT-233				DB		PNP			425
BF820	●	-	-	-	1V		NPN	BF420	BF821	429
BF821	●	-	-	-	1W		PNP	BF421	BF820	433
BF822	●	-	-	-	1X		NPN	BF422	BF823	429
BF823	●	-	-	-	1Y		PNP	BF423	BF822	433
BF824	●	-	-	-	F8		PNP	BF324		437
BF840	●	-	-	-	NC		NPN	BF240		443
BF841	●	-	-	-	ND		NPN	BF241		443
BF989	-	-	●	-	MA		FET	BF960		445
BF990A	-	-	●	-	M86	M50	FET	BF980A		447
BF991	-	-	●	-	M91		FET	BF981		451
BF992	-	-	●	-	M92	M52	FET	BF982		453
BF994S	-	-	●	-	MG		FET	BF964S		455
BF996S	-	-	●	-	MH		FET	BF966S		457
BF997	-	-	●	-	MK		FET	BF965		459
BFG35	SOT-223						NPN	BFQ34T, BFG34		463
BFG67	-	-	●	-	V3		NPN	BFG65		467
BFG97	SOT-223						NPN	BFR96		471
BFG135	SOT-223						NPN	BFQ135		475
BFG198	SOT-223						NPN	BFG195		479
BFQ17	-	●	-	-	FA		NPN	BFW16A		483
BFQ18A	-	●	-	-	FF		NPN	BFQ34		487
BFQ19	-	●	-	-	FB		NPN	BFR96		491
BFQ67	●	-	-	-	V2		NPN	BFQ65		495
BFR30	●	-	-	-	M1		FET	BFW11, BF245		499
BFR31	●	-	-	-	M2		FET	BFW12, BF245		499
BFR53	●	-	-	-	N1	N4	NPN	BFW30, BFW93		509
BFR92	●	-	-	-	P1	P4	NPN	BFR90	BFT92	517
BFR92A	●	-	-	-	P2	P5	NPN	BFR90		525
BFR93	●	-	-	-	R1	R4	NPN	BFR91	BFT93	537
BFR93A	●	-	-	-	R2	R5	NPN	BFR91		545
BFR101A	-	-	●	-	M97		FET	-		557
BFR101B	-	-	●	-	M98		FET	-		557
BFS17	●	-	-	-	E1	E4	NPN	BFY90, BFW92		559
BFS18	●	-	-	-	F1	F4	NPN	BF495		565
BFS19	●	-	-	-	F2	F5	NPN	BF494		565
BFS20	●	-	-	-	G1	G4	NPN	BF199		571
BFT25	●	-	-	-	V1	V4	NPN	BFT24		577
BFT46	●	-	-	-	M3		FET	BFW13, BF245		585

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BFT92	●	-	-	-	W1	W4	PNP	BFQ51; 52	BFR92	593
BFT93	●	-	-	-	X1	X4	PNP	BFQ23; 24	BFR93	599
BRY61	●	-	-	-	A5		PNPN	BRY56, BRY39		605
BRY62	●	-	-	-	A51		PNPN	BRY39		611
BSD20	-	●	-	-	M31		FET	-		617
BSD22	-	●	-	-	M32		FET	-		617
BSP15	SOT-223				BT1		PNP		BSP19	621
BSP16	SOT-223				BT2		PNP		BSP20	621
BSP19	SOT-223				AT1		NPN		BSP15	623
BSP20	SOT-223				AT2		NPN		BSP16	623
BSP30	SOT-223				BR1		PNP			625
BSP31	SOT-223				BR2		PNP			625
BSP32	SOT-223				BR3		PNP			625
BSP33	SOT-223				BR4		PNP			625
BSP40	SOT-223				AR1		NPN			629
BSP41	SOT-223				AR2		NPN			629
BSP42	SOT-223				AR3		NPN			629
BSP43	SOT-223				AR4		NPN			629
BSP50	SOT-223				AS1		NPN		BSP60	633
BSP51	SOT-223				AS2		NPN		BSP61	633
BSP52	SOT-223				AS3		NPN		BSP62	633
BSP60	SOT-223				BS1		PNP		BSP50	637
BSP61	SOT-223				BS2		PNP		BSP51	637
BSP62	SOT-223				BS3		PNP		BSP52	637
BSR12	●	-	-	-	B5	B8	PNP	2N2894A	BSV52	641
BSR13	●	-	-	-	U7	U71	NPN	2N2222, PH2222	BSR15	647
BSR14	●	-	-	-	U8	U81	NPN	2N2222A, PH2222A	BSR16	647
BSR15	●	-	-	-	T7	T71	PNP	2N2907, PH2907	BSR13	651
BSR16	●	-	-	-	T8	T81	PNP	2N2907A, PH2907A	BSR14	651
BSR17	●	-	-	-	U9	U91	NPN	2N3903	BSR18	655
BSR17A	●	-	-	-	U92	U93	NPN	2N3904	BSR18A	655
BSR18	●	-	-	-	T9	T91	PNP	2N3905	BSR17	659
BSR18A	●	-	-	-	T92	T93	PNP	2N3906	BSR17A	659
BSR19	●	-	-	-	U35		NPN	2N5550	BSR20	663
BSR19A	●	-	-	-	U36		NPN	2N5551	BSR20A	663
BSR20	●	-	-	-	T35		PNP	2N5400	BSR19	667
BSR20A	●	-	-	-	T36		PNP	2N5401	BSR19A	667
BSR30	-	●	-	-	BR1		PNP	2N4030	BSR40	671
BSR31	-	●	-	-	BR2		PNP	2N4032	BSR41	671
BSR32	-	●	-	-	BR3		PNP	2N4031	BSR42	671

type number	SOT23	SOT89	SOT143	SOD80	marking type	reverse type	device type	nearest conventional type(s)	complement	page
BSR33	-	●	-	-	BR4		PNP	2N4033	BSR43	671
BSR40	-	●	-	-	AR1		NPN	BSX46-6	BSR30	675
BSR41	-	●	-	-	AR2		NPN	BSX46-16	BSR31	675
BSR42	-	●	-	-	AR3		NPN	2N3020	BSR32	675
BSR43	-	●	-	-	AR4		NPN	2N3019	BSR33	675
BSR56	●	-	-	-	M4		FET	2N4856		679
BSR57	●	-	-	-	M5		FET	2N4857		679
BSR58	●	-	-	-	M6		FET	2N4858		679
BSR174	●	-	-	-	LO		FET			683
BSR175	●	-	-	-	LP		FET			683
BSR176	●	-	-	-	LQ		FET			683
BSR177	●	-	-	-	LR		FET			683
BSS63	●	-	-	-	BM	T6	PNP	BSS68	BSS64	687
BSS64	●	-	-	-	AM	U6	NPN	BSS38	BSS63	693
BSS83	-	-	●	-	M74		FET			697
BST15	-	●	-	-	BT1		PNP	2N5415	BST40	701
BST16	-	●	-	-	BT2		PNP	2N5416	BST39	701
BST39	-	●	-	-	AT1		NPN	2N3439	BST16	705
BST40	-	●	-	-	AT2		NPN	2N3440	BST15	705
BST50	-	●	-	-	AS1		NPN	BSR50, BSS50, BDX42		709
BST51	-	●	-	-	AS2		NPN	BSR51, BSS51, BDX43		709
BST52	-	●	-	-	AS3		NPN	BSR52, BSS52, BDX44		709
BST60	-	●	-	-	BS1		PNP	BSR60, BSS60, BDX45		713
BST61	-	●	-	-	BS2		PNP	BSR61, BSS61, BDX46		713
BST62	-	●	-	-	BS3		PNP	BSR62, BSS62, BDX47		713
BST80	-	●	-	-	KM		FET	BST70A		717
BST82	●	-	-	-	02		FET	BST72A		721
BST84	-	●	-	-	KN		FET	BST74A		725
BST86	-	●	-	-	KO		FET	BST76A		729
BST120	-	●	-	-	LM		FET			733
BST122	-	●	-	-	LN		FET			737
BSV52	●	-	-	-	B2	B3	NPN	PH2369, BSX20	BSR12	741
BYD17D		SOD-87					diode	BYD13D		749
BYD17G		SOD-87					diode	BYD13G		749
BYD17J		SOD-87					diode	BYD13J		749
BYD17K		SOD-87					diode	BYD13K		749
BYD17M		SOD-87					diode	BYD13M		749
BYD37D		SOD-87					diode	BYD33D		757
BYD37G		SOD-87					diode	BYD33G		757
BYD37J		SOD-87					diode	BYD33J		757

type number	SOT23	SOT89	SOT143	SOD80	marking type / reverse type	device type	nearest conventional type(s)	complement	page
BYD37K		SOD-87				diode	BYD33K		757
BYD37M		SOD-87				diode	BYD33M		757
BYD77A		SOD-87				diode	BYD73A		763
BYD77B		SOD-87				diode	BYD73B		763
BYD77C		SOD-87				diode	BYD73C		763
BYD77D		SOD-87				diode	BYD73D		763
BYD77E		SOD-87				diode	BYD73E		763
BYD77F		SOD-87				diode	BYD73F		763
BYD77G		SOD-87				diode	BYD73G		763
BZD27		SOD-87				diode			767
BZV49	–	●	–	–	*	diode	BZV85		773
BZV55	–	–	–	●		diode	BZX79, BZX55		783
BZV80	–	–	–	●		diode			797
BZV81	–	–	–	●		diode			797
BZX84	●	–	–	–	*	diode	BZX79, BZX55		799
KTY85-110	–	–	–	●		sensor			811
KTY85-120	–	–	–	●		sensor			811
KTY85-150	–	–	–	●		sensor			811
PMBF4391	●	–	–	–	M62	FET	2N4391		817
PMBF4392	●	–	–	–	M63	FET	2N4392		817
PMBF4393	●	–	–	–	M64	FET	2N4393		817
PMBFJ174	●	–	–	–	P6V	FET			821
PMBFJ175	●	–	–	–	P6W	FET			821
PMBFJ176	●	–	–	–	P6X	FET			821
PMBFJ177	●	–	–	–	P6Y	FET			821
PMBT2222	●	–	–	–	P1B	NPN	2N2222 PM2222	PMBT2907	825
PMBT2222A	●	–	–	–	P1P	NPN	2N2222A PM2222A	PMBT2907A	825
PMBT2369	●	–	–	–	P1J	NPN			829
PMBT2907	●	–	–	–	P2B	PNP	2N2907 PM2907	PMBT2222	833
PMBT2907A	●	–	–	–	P2F	PNP	2N2907A PM2907A	PMBT2222A	833
PMBT3903	●	–	–	–	P1Y	NPN	2N3903	PMBT3905	837
PMBT3904	●	–	–	–	P1A	NPN	2N3904	PMBT3906	837
PMBT3906	●	–	–	–	P2A	PNP	2N3906	PMBT3904	841
PMBT4401	●	–	–	–	P2X	NPN			845
PMBT4403	●	–	–	–	P2T	PNP			849
PMBT5088	●	–	–	–	P1Q	NPN			853
PMBT5401	●	–	–	–	P2L	PNP			855
PMBT5550	●	–	–	–	P1F	NPN			857
PMBT5551	●	–	–	–		NPN			859
PMBT6428	●	–	–	–	P1K	NPN	2N6428		861

* For marking of these types see page 30

type number	SOT23	SOT89	SOT143	SOD80	marking type reverse type	device type	nearest conventional type(s)	complement	page
PMBT6429	●	–	–	–	P1L	NPN	2N6429		861
PMBTA05	●	–	–	–	P1H	NPN	MPSA05	PMBTA55	865
PMBTA06	●	–	–	–	P1G	NPN	MPSA06	PMBTA56	865
PMBTA13	●	–	–	–	P1M	NPN	MPSA13	PMBTA63	867
PMBTA14	●	–	–	–	P1N	NPN	MPSA14	PMBTA64	867
PMBTA42	●	–	–	–	P1D	NPN	MPSA42	PMBTA94	869
PMBTA43	●	–	–	–	P1E	NPN	MPSA43	PMBTA93	869
PMBTA55	●	–	–	–	P2G	NPN	MPSA55	PMBTA05	873
PMBTA56	●	–	–	–	P2H	NPN	MPSA56	PMBTA06	873
PMBTA63	●	–	–	–	P2U	PNP	MPSA63	PMBTA13	875
PMBTA64	●	–	–	–	P2V	PNP	MPSA63	PMBTA14	875
PMBTA92	●	–	–	–	P2D	PNP	MPSA92	PMBTA42	877
PMBTA93	●	–	–	–	P2E	PNP	MPSA93	PMBTA43	877
PMLL4148	–	–	–	●		diode			879
PMLL4446	–	–	–	●		diode			879
PMLL4448	–	–	–	●		diode			879
PMLL4150	–	–	–	●		diode			883
PMLL4151	–	–	–	●		diode			883
PMLL4153	–	–	–	●		diode			883
PMLL5225B to PMLL5267B	–	–	–	●		diode	1N5225B to 1N5267B		887
PXT2222	–	●	–	–	P1B	NPN		PXT2907	891
PXT2222A	–	●	–	–	P1P	NPN		PXT2907A	891
PXT2907	–	●	–	–	P2B	PNP		PXT2222	895
PXT2907A	–	●	–	–	P2F	PNP		PXT2222A	895
PXT3904	–	●	–	–	P1A	NPN	2N3904	PXT3906	899
PXT3906	–	●	–	–	P2A	PNP	2N3906	PXT3904	903
PXT4401	–	●	–	–	P2X	NPN		PXT4403	907
PXT4403	–	●	–	–	P2T	PNP		PXT4401	911
PXTA14	–	●	–	–	P1N	NPN		PXTA64	915
PXTA27	–	●	–	–		NPN		PXTA77	917
PXTA64	–	●	–	–	P2V	PNP		PXTA14	919
PXTA77	–	●	–	–		PNP		PXTA27	921
PZT2222	SOT-223					NPN		PZT2907	923
PZT2222A	SOT-223					NPN		PZT2907A	923
PZT2907	SOT-223				P2B	PNP		PZT2222	927

type number	SOT23 SOT89 SOT143 SOT80	marking type reverse type	device type	nearest conventional type(s)	complement	page
PZT2907A	SOT-223	P2F	PNP		PZT2222A	927
PZT3904	SOT-223	P1A	NPN			931
PZT3906	SOT-223	P2A	PNP			935
PZTA13	SOT-223	P1M	NPN		PZTA63	939
PZTA14	SOT-223	P1N	NPN		PZTA64	939
PZTA42	SOT-223	P1D	NPN			941
PZTA43	SOT-223	P1E	NPN			941
PZTA63	SOT-223	P2U	PNP		PZTA13	945
PZTA64	SOT-223	P2V	PNP		PZTA14	945
PZTA92	SOT-223	P2D	PNP			947
PZTA93	SOT-223	P2E	PNP			947

type device type nearest conventional type	BZV49- SOT-89 diode BZV85 series	page 773	BZX84- SOT-23 diode BZX79 series	page 799
type number suffix	mark		mark	
C2V4	2Y4		Z11	
C2V7	2Y7		Z12	
C3V0	3Y0		Z13	
C3V3	3Y3		Z14	
C3V6	3Y6		Z15	
C3V9	3Y9		Z16	
C4V3	4Y3		Z17	
C4V7	4Y7		Z1	
C5V1	5Y1		Z2	
C5V6	5Y6		Z3	
C6V2	6Y2		Z4	
C6V8	6Y8		Z5	
C7V5	7Y5		Z6	
C8V2	8Y2		Z7	
C9V1	9Y1		Z8	
C10	10Y		Z9	
C11	11Y		Y1	
C12	12Y		Y2	
C13	13Y		Y3	
C15	15Y		Y4	
C16	16Y		Y5	
C18	18Y		Y6	
C20	20Y		Y7	
C22	22Y		Y8	
C24	24Y		Y9	
C27	27Y		Y10	
C30	30Y		Y11	
C33	33Y		Y12	
C36	36Y		Y13	
C39	39Y		Y14	
C43	43Y		Y15	
C47	47Y		Y16	
C51	51Y		Y17	
C56	56Y		Y18	
C62	62Y		Y19	
C68	68Y		Y20	
C75	75Y		Y21	

CONVERSION LIST

(conversion type number to SMD type number)

conventional type	microminiature type
BA314	BAS17
BA480	BAT17
BA482	BA682
BA483	BA683
BAT85	BAT54
	BAT74
BAV10	BAS56
BAV18	BAV100
BAV19	BAS19
	BAV101
BAV20	BAS20
	BAV102
BAW62	BAS16
	BAS28
	BAS32
	BAV70
	BAV99
	BAW56
BAX12	BAS29
	BAS31
	BAS35
BB405	BBY31
BB809	BBY40
BC107	BC847
	BCW71/72
BC107A	BC847A
	BCW71
BC107B	BC847B
	BCW72
BC108	BC848
	BCW31-33
BC108A	BC848A
	BCW31
BC108B	BC848B
	BCW32
BC109	BC849
	BCF32/33
BC109B	BC849B
	BCF32
BC109C	BC849C
	BCFC33
	BC849B
	BCF32
	BC849B/C
	BCF32/33
	BC849C
	BCF33
	BCW69/70
BC177A	BC857A
	BCW69
BC177B	BC857B
	BCW70
BC178	BC858
	BCW29/30
BC178A	BC858A
	BCW29
BC178B	BC858B
	BCW30
BC179	BC859
	BCF29/30
BC179A	BC859A
	BCF29
BC179B	BC859B
	BCF30
	BC859C
	BCF29
	BC859/C
	BCF29/30
	BC859C
	BCF30
BC327	BC807
	BCX17
BC327-16	BC807-16
BC327-25	BC807-25
BC327-40	BC807-40
BC327A	
BC328	BC808
BC328-16	BC808-16
BC328-25	BC808-25
BC328-40	BC898-40
BC337	BC817
	BCX19
BC337-16	BC817-16
BC337-25	BC817-25
BC337-40	BC817-40
BC338	BC818
	BCX20
BC338-16	BC818-16
BC338-25	BC818-25
BC338-40	BC818-40
BC368	BC868
BC369	BC869
BC516	BCV26
BC517	BCV27
BC546	BC846
	BCV71/72
BC546A	BC846A
	BCV71
BC546B	BC846B
	BCV72
BC547	BC847
	BCW71/71/81
BC547A	BC847A
	BCW71
BC547B	BC847B
	BCW72
BC547C	BC847C
	BCW81
BC548	BC848
	BCW31-33
BC548A	BC848A
	BCW31
BC548B	BC848B
	BCW32
BC548C	BC848C
	BCW33
BC549	BC849
	BCF32/33
BC549B	BC849B
	BCF32
BC549C	BC849C
	BCF33
BC550	BC850
	BCF81
BC550B	BC850B
BC550C	BC850C
BC556	BC856
	BCW89
BC556A	BC856A
	BCW89
BC556B	BC856B

conventional type	microminiature type
BC557	BC857
	BCW69/70
BC557A	BC857A
	BCW69
BC557B	BC857B
	BCW70
BC557C	BC857C
BC558	BC858
	BCW29/30
BC558A	BC858A
	BCW29
BC558B	BC858B
	BCW30
BC558C	BC858C
BC559	BC859
	BCF29/30
BC559A	BC859A
	BCF29
BC559B	BC859B
	BCF30
BC559C	BC859C
BC560	BC860
	BCF70
BC560A	BC860A
BC560B	BC860B
	BCF70
BC560C	BC860C
BC635	BCX54
BC636-6	BCX54-6
BC635-10	BCX54-10
BC635-16	BCX54-16
BC636	BCX51
BC636-6	BCX51-6
BC636-10	BCX51-10
BC636-16	BCX51-16
BC637	BCX55
BC637-6	BCX55-6
BC637-10	BCX55-10
BC637-16	BCX55-16
BC638	BCX52
BC638-6	BCX52-6
BC638-10	BCX52-10
BC638-16	BCX52-16
VC639	BCX56
BC639-6	BCX56-6
BC639-10	BCX56-10
BC639-16	BCX56-16
BC640	BCX53
BC640-6	BCX53-6
BC640-10	BCX53-10
BC640-16	BCX53-16
BCY56	BC850B
	BCF70
BCY57	BC849
	BCF32/33
BCY58	BC849
	BCW60 fam.
BCY58-VII	BCW60A
BCY58-VIII	BC849B
	BCW60B
BCY58 IX	BC849B
	BCW60C
BCY58-X	BC849C
	BCW60D
BCY59	BC850
	BCX70 fam.
BCY59-VII	BCX70G
BCY59-VIII	BC850B
	BCX70H
BCY59-IX	BC850B
	BCX70J
BCY59-X	BC850C
	BCX70K
BCY70	BC860
	BCF70
BCY71	BC860
	BCF70
BCY72	BC859
	BCF29/30
BCY78	BC859
	BCW61 fam.
BCY78-VII	BC859A
	BCW61A
BCY78-VIII	BC859A/B
	BCW61B
BCY78-IX	BC859B
	BCW61C
BCY78-X	BV859C
	BCW61D
BCY79	BC860
	BCX71 fam.
BCY79-VII	BC860A
	BCX71G
BCY79-VIII	BC860A/B
	BCX71H
BCY79-IX	BC860B
	BCX71J
BD135	BCX54
BC135-6	BCX54-6
BD135-10	BCX54-10
BD135-16	BCX54-16
BD136	BCX51
BD136-6	BCX51-6
BD136-10	BCX51-10
BD136-16	BCX51-16
BD137	BCX55
BD137-6	BCX55-6
BD137-10	BCX55-10
BD137-16	BCX55-16
BD138	BCX52
BD138-6	BCX52-6
BD138-10	BCX52-10
BD138-16	BCX52-16
BD139	BCX56
BD139-6	BCX56-6
BD139-10	BCX56-10
BD139-16	BCX56-16
BD140	BCX53
BD140-6	BCX53-6
BD140-10	BCX53-10
BD140-16	BCX53-16
BDX42	BST50
BDX43	BST51
BDX44	BST52
BDX45	BST60
BDX46	BST61
BDX47	BST61
BF198	
BF199	BFS20
BF240	BF840
BF241	BF841
BF324	BF824
BF370	BSV52
	BF570
BF410A	BF510
BF410B	BF511
BF410C	BF512
BF410D	BF513
BF419	BST40
BF420	BF620
	BF820
BF421	BF621
	BF821
BF422	BF622
	BF822
BF423	BF623
	BF823
BF450	BF550
BF451	
BF457	BST40

conventional type	microminiature type
BF458	BST40
BF459	BST39
BF469	BF622
BF470	BF623
BF471	BF620
BF472	BF621
BF494	BFS19
BF494B	BFS19
BF495	BFS18
BF495C	BFS18
BF495D	BFS18
BF606A	BF660
BF819	BST40
BF857	BST40
BF858	BST40
BF859	BST39
BF869	BF622
BF870	BF623
BF871	BF620
BF872	BF621
BF926	BF660
BF936	BF536
BF939	
BF960	BF989
BF964	BF994
	BF994S
BF966	BF996
	BF996S
BF967	BF767
BF970	BF569
BF979	BF579
BF980	BF990
BF981	BF991
BF982	BF992
BFG65	BFG67
BFQ23	BFT93
BFQ24	BFT93
BFQ34	BFQ18A
BFQ34T	BFQ18A
BFQ51	BFT92
BFQ52	BFT92
BFQ65	BFQ67
BFR54	BSV52
BFR90	BFR92A
BFR91	BFR93A
BFR96	BFQ19
BFR96S	BFQ19
BFT24	BFT25

conventional type	microminiature type
BFT44	BST16
BFT45	BST15/16
BFW11	BFR30
BFW12	BFR31
BFW13	BFT46
BFW16A	BFQ17
BFW30	BFR53
BFW92	BFS17
BFW93	BFR53
	BSR16
	BSR16
	BSR40
	BSR41
	BSR41
	BSR16
	BSR15
BFY50	BSR40
BFY51	BSR40
BFY52	BSR40
BFY55	BSR40
BFY90	BFS17
BR101	BRY62
BRY39	BRY62
BRY56	BRY61
BSR50	BST50
BSR51	BST51
BSR52	BST52
BSR60	BST60
BSR61	BST61
BSR62	BST62
BSS38	BSS64
BSS50	BST50
BSS51	BST51
BSS52	BST52
BSS60	BST60
BSS61	BST61
BSS62	BST62
BSS68	BSS63
BSV15	BSR30/31
BSV15-6	BSR30
BSV15-10	BSR30/31
BSV15-16	BSR31
BSV16	BSR30/31
BSV16-6	BSR30
BSV16-10	BSR30/31
BSV16-16	BSR31
BSV17	BSR32/33
BSV17-6	BSR32

conventional type	microminiature type
BSV17-10	BSR32/33
BSX19	BSV52
BSX20	BSV52
BSX45	BSR40/41
BSX45-6	BSR40
BSX45-10	BSR40/41
BSX45-16	BSR41
BSX46	BSR40/41
BSX46-6	BSR40
BSX46-10	BSR40/41
BSX46-16	BSR41
BSX47	BSR42/43
BSX47-6	BSR42
BSX47-10	BSR42/43
BSY95A	BSV52
BZX55	BZX84
BZX79	BZX84
	BZV55
BZV85	BZV49
MPSA05	PMBTA05
MPSA06	PMBTA06
MPSA13	PMBTA13
MPSA14	PMBTA14
MPSA42	PMBTA42
MPSA43	PMBTA43
MPSA55	PMBTA55
MPSA56	PMBTA56
MPSA63	PMBTA63
MPSA92	PMBTA92
MPSA93	PMBTA93
PH2222	BSR13
PH2222A	BSR14
PH2369	BSV52
PH2907	BSR15
PH2907A	BSR16
1N4148	BAS16
	BAV90
	BAV99
	BAW56
1N5225B to 1N5267B	PMLL5225B to PMLL5267B
2N929	BC850
2N930	BC850
	BCF81
2N1613	BSR40
2N1711	BSR41
2N1893	BSR42

conventional type	microminiature type
2N2219	BSR13
2N2219A	BSR14
2N2222	BSR13
	PMBT2222
2N2222A	BSR14
	PMBT2222A
2N2297	BSR40
2N2368	BSV52
2N2369	BSV52
2N2369A	BSV52
2N2483	BC850B
2N2484	BC850B/C
2N894A	BSR12
2N2905	BSR15
2N2905A	BSR16
2N2907	BSR15
	PMBT2907
2N2907A	BSR16
	PMBT2907A
2N3019	BSR43
2N3020	BSR42
2N3053	BSR40/41
2N3903	BSR17
	PMBT3903
2N3904	BSR17A
	PMBT3904
2N3905	BSR18
2N3906	BSR18A
	PMBT3906
2N4030	BSR30
2N4031	BSR32
2N4032	BSR31
2N4033	BSR33
2N4123	BSR17
2N4124	BSR18
2N4856	BSR56
2N4857	BSR57
2N4858	BSR58
2N5415	BST15
2N5416	BST16
2N6428	PMBT6428
2N6429	PMBT6429

MARKING LIST

Types in SOT-23, SOT-89 and SOT-143 envelopes are marked with a code as listed below. The actual type number and data code are on the packing.

An exception to this is the BZV-49 series.
The envelope number is mentioned in those cases where the same marking code appears twice.

mark	type no.
AT1	BST39
AT2	BST40
B1	
B2	BSV52
B3	
B4	BSV52R
B5	BSR12
B6	
B7	
B8	BSR12R
B26	BF570
BA	BCW61A (SOT-23)
BA	BCX54 (SOT-89)
BB	BCW61B (SOT-23)
BB	BCX54-6 (SOT-89)
BC	BCW61C (SOT-23)
BC	BCX54-10 (SOT-89)
BD	BCW61D (SOT-23)
BD	BCX54-16 (SOT-89)
BE	BCX55
BF	BCX55-6
BG	BCX71G (SOT-23)
BG	BCX55-10 (SOT-89)
BH	BCX71H (SOT-23)
BH	BCX56 (SOT-89)
BJ	BCX71J (SOT-23)
BJ	BCX56-6 (SOT-89)
BK	BCX71K (SOT-23)
BK	BCX56-10 (SOT-89)
BL	BCX56-16
BM	BCX55-16
BR1	BSR30
BR2	BSR31
BR3	BSR32
BR4	BSR33
BS1	BST60
BS2	BST61
BS3	BST62
A1	BAW56
A2	BAT18
A3	BAT17
A4	BAV70
A5	BRY61
A51	BRY62
A6	BAS16
A61	BAS28
A7	BAV99
A8	BAS19
A81	BAS20
A82	BAS21
A9	
A91	BAS17
AA	BCW60A (SOT-23)
AA	BCX51 (SOT-89)
AB	BCW60B (SOT-23)
AB	BCX51-6 (SOT-89)
AC	BCW60C (SOT-23)
AC	BCX51-10 (SOT-89)
AD	BCW60D (SOT-23)
AD	BCX51-16 (SOT-89)
AE	BCX52
AF	BCX52-6
AG	BCX70G
AH	BCX70H (SOT-23)
AH	BCX53 (SOT-89)
AJ	BCX70J (SOT-23)
AJ	BCX53-6 (SOT-89)
AK	BCX70K (SOT-23)
AK	BCX53-10 (SOT-89)
AL	BCX53-16
AM	BCX52-16
AR1	BSR40
AR2	BSR41
AR3	BSR42
AR4	BSR43
AS1	BST50
AS2	BST51
AS3	BST52

mark	type no.
BT1	BST15
BT2	BST16
C1	BCW29
C2	BCW30
C3	
C4	BCW29R
C5	BCW30R
C6	
C7	BCF29
C77	BCF29R
C8	BCF30
C9	BCF30R
C91	BCV62
CAC	BC868
CEC	BC869
D1	BCW31
D2	BCW32
D3	BCW33
D4	BCW31R
D5	BCW32R
D6	BCW33R
D7	BCF32
D77	BCF32R
D8	BCF33
D81	BCF33R
D91	BCV61
DA	BF622
DB	BF623
DC	BF620
DF	BF621
E1	BFS17
E2	
E3	
E4	BFS17R
E5	
E6	
E7	
E8	
F1	BFS18
F2	BFS19

mark	type no.
F3	BF840
F31	BF841
F4	BFS18R
F5	BFS19R
F6	
F7	
F8	BF824
F9	
FA	BFQ17
FB	BFQ19
FD	BCV26
FF	BCV27
(SOT-23)	
FF	BFQ18A
(SOT-89)	
G1	BFS20
G2	BF550
G3	BF536
G4	BFS20R
G5	BF550R
G6	BF569
G7	BF579
G8	BF660
G81	BF660R
G9	BF767
H1	BCW69
H2	BCW70
H3	BCW89
H31	BCW89R
H4	BCW69R
H5	BCW70R
H6	
H7	BCF70
H71	BCF70R
H8	
H9	
K1	BCW71
K2	BCW72
K3	BCW81
K31	BCW81R

mark	type no.
K4	BCW71R
K5	BCW72R
K6	
K7	BCV71
K71	BCV71R
K8	BCV72
K81	BCV72R
K9	BCF81
K91	BCF81R
KM	BST80
KN	BST84
KO	BST86
L2	
L20	BAS29
L21	BAS31
L22	BAS35
L3	
L30	BAV23
L4	BAT54
L41	BAT74
L5	
L51	BAS56
LM	BST120
LN	BST122
LO	BSR174
LP	BSR175
LQ	BSR176
LR	BSR177
M1	BFR30
M2	BFR32
M3	BFT46
M31	BSD20
M32	BSD22
M4	BSR56
M5	BSR57
M6	BSR58
M61	
M62	PBMF4391
M63	PBMF4392
M64	PBMF4393

mark	type no.
M74	BSS83
M8	
M83	BF997
M89	BF989
M9	
M90	BF990
M91	BF991
M92	BF992
M93	BF994S
M94	BF994
M95	BF996S
M96	BF996
M97	BFR101A
M98	BFR101B
N1	BFR53
N2	
N3	
N4	BFR53R
N5	
N6	
N7	
N8	
N9	
P1	BFR92
P1A	PMBT3904
P1B	PMBT2222
P1D	PMBTA42
P1E	PMBTA43
P1H	PMBTA05
P1G	PMBTA06
P1K	PMBT6428
P1L	PMBT6429
P1M	PMBTA13
P1N	PMBTA14
P1P	PMBT2222A
P1Y	PMBT3903
P2	BFR92A
P2A	PMBT3906, PXT3906
P2B	PMBT2907, PXT3904
P2D	PMBTA92

mark	type no.	mark	type no.	mark	type no.	mark	type no.
P2E	PMBTA93	T6	BSS63R	X1	BFT93	Z12	-C2V7
P2F	PMBT2907A	T7	BSR15	X2		Z13	-C3V0
P2H	PMBTA55	T71	BSR15R	X3		Z14	-C3V3
P2G	PMBTA56	T8	BSR16	X4	BFT93R	Z15	-C3V6
P2U	PMBTA63	T81	BSR16R	X5		Z16	-C3V9
P2V	PMBTA64	T9	BSR18	X6		Z17	-C4V3
P3		T91	BSR18R	X7		1A	BC846A
P4	BFR92R	T92	BSR18A	X8		1BR	BC846AR
P5	BFR92AR	T93	BSR18AR	X9		1E	BC847A
P6		U1	BCX19	Y1	BZX84-C11	1ER	BC847AR
P6S	PMBFJ176	U2	BCX20	Y2	-C12	1F	BC847B
P6W	PMBFJ175	U3	BSS64	Y3	-C13	1FR	BC847BR
P6X	PMBFJ174	U4	BCX19R	Y4	-C15	1G	BC847C
P6Y	PMBFJ177	U5	BCX20R	Y5	BZX84-C16	1GR	BC847CR
P7		U6	BSS64R	Y6	-C18	1J	BC848A
P8		U7	BSR13	Y7	-C20	1JR	BC848AR
P9		U8	BSR14	Y8	-C22	1K	BC848B
R1	BFR93	U81	BSR14R	Y9	-C24	1KR	BC848BR
R2	BFR93A	U9	BSR17	Y10	BZX84-C27	1L	BC848C
R3		U91	BSR17R	Y11	-C30	1LR	BC848CR
R4	BFR93R	U92	BSR17A	Y12	-C33	1V	BF820
R5	BFR93AR	U93	BSR17AR	Y13	-C36	1W	BF821
R6		V1		Y14	-C39	1X	BF822
R7		V2	BFQ67	Y15	-C43	1Y	BF823
R8		V3	BFG67	Y16	-C47	2B	BC849B
R9		V4	BFT25R	Y17	-C51	2BR	BC849BR
S1	BBY31	V5		Y18	-C56	2C	BC849C
S2	BBY40	V6		Y19	-C62	2CR	BC849CR
S3		V7		Y20	-C68	2F	BC850B
S4		V8		Y21	-C75	2FR	BC850BR
S5		V9		Z1	-C4V7	2G	BC850C
S6	BF510	W1	BFT92	Z2	-C5V1	2GR	BC850CR
S7	BF511	W2		Z3	-C5V6	2Y4	BZV49-C2V4
S8	BF512	W3		Z4	-C6V2	2Y7	BZV49-C2V7
S9	BF513	W4	BFT92R	Z5	-C6V8	3A	BC856A
T1	BCX17	W5		Z6	-C7V5	3AR	BC856AR
T2	BCX18	W6		Z7	-C8V2	3B	BC856B
T3	BSS63	W7		Z8	-C9V1	3BR	BC856BR
T4	BCX17R	W8		Z9	-C10	3E	BC857A
T5	BCX18R	W9		Z11	-C2V4	3ER	BC857AR

mark	type no.	mark	type no.	mark	type no.	mark	type no.
3F	BC857B	5Y1	BZV49-C5V1	75Y	-C75		
3FR	BC857BR	5Y6	BZV49-C5V6				
3J	BC858A	6A	BC917-16				
3JR	BC858AR	6AR	BC817-16R				
3G	BC857C	6B	BC817-25				
3GR	BC857CR	6BR	BC817-25R				
3K	BC858B	6C	BC817-40				
3KR	BC858BR	6CR	BC817-40R				
3L	BC858C	6E	BC818-16				
3LR	BC858CR	6ER	BC818-16R				
3Y0	BZV49-C3V0	6F	BC818-25				
3Y3	BZV49-C3V3	6FR	BC818-25R				
3Y6	BZV49-C3V6	6G	BC818-40				
3Y9	BZV49-C3V9	6GR	BC818-40R				
4A	BC859A	6Y2	BZV49-C6V2				
4AR	BC859AR	6Y8	-C6V8				
4B	BC859B	7Y5	-C7V5				
4BR	BC859BR	8Y2	-C8V2				
4C	BC859C	9Y1	-C9V1				
4CR	BC859CR	10Y	-C10				
4E	BC860A	11Y	-C11				
4ER	BC860AR	12Y	-C12				
4F	BC860B	13Y	-C13				
4FR	BC860BR	15Y	-C15				
4G	BC860C	16Y	-C16				
4GR	BC860CR	18Y	-C18				
4Y3	BZV49-C4V3	20Y	-C20				
4Y7	BZV49-C4V7	22Y	-C22				
5A	BC807-16	24Y	-C24				
5AR	BC807-16R	27Y	-C27				
5B	BC807-25	30Y	-C30				
5BR	BC807-25R	33Y	-C33				
5C	BC807-40	36Y	-C36				
5CR	BC807-40R	39Y	BZV49-C39				
5E	BC808-16	43Y	-C43				
5ER	BC808-16R	47Y	-C47				
5F	BC808-25	51Y	-C51				
5FR	BC808-25R	56Y	-C56				
5G	BC808-40	62Y	-C62				
5GR	BC808-40R	68Y	-C68				

TAPE AND REEL SPECIFICATION

Semiconductors in SOT23 and SOT143 encapsulations can be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.

Separate reel packing for SOT89, SOD87, SOT223 and SOD80 encapsulations are given in Figs 2 to 5 respectively.

The configuration of the reel and flange is given in Fig. 6.

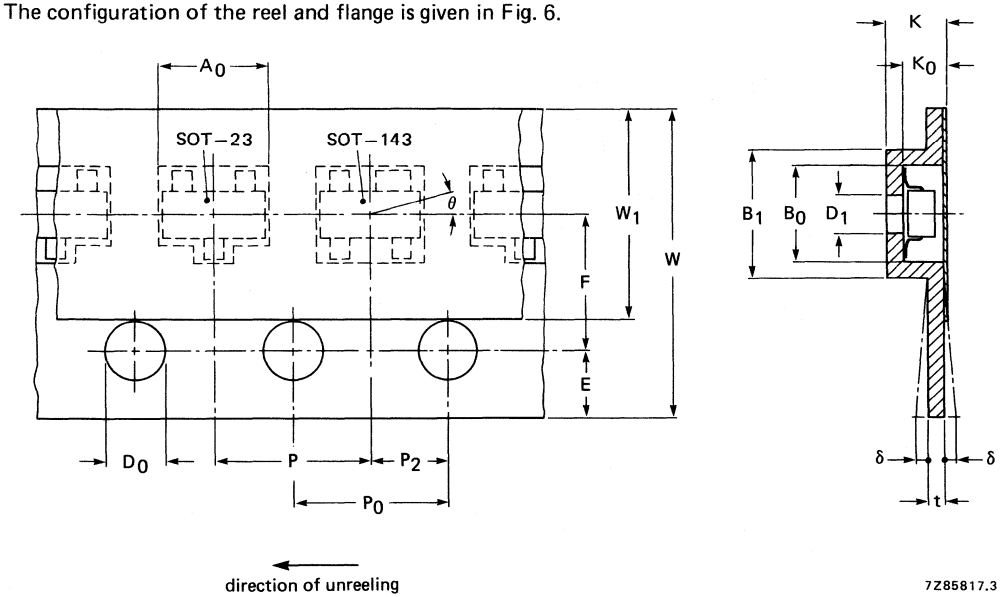
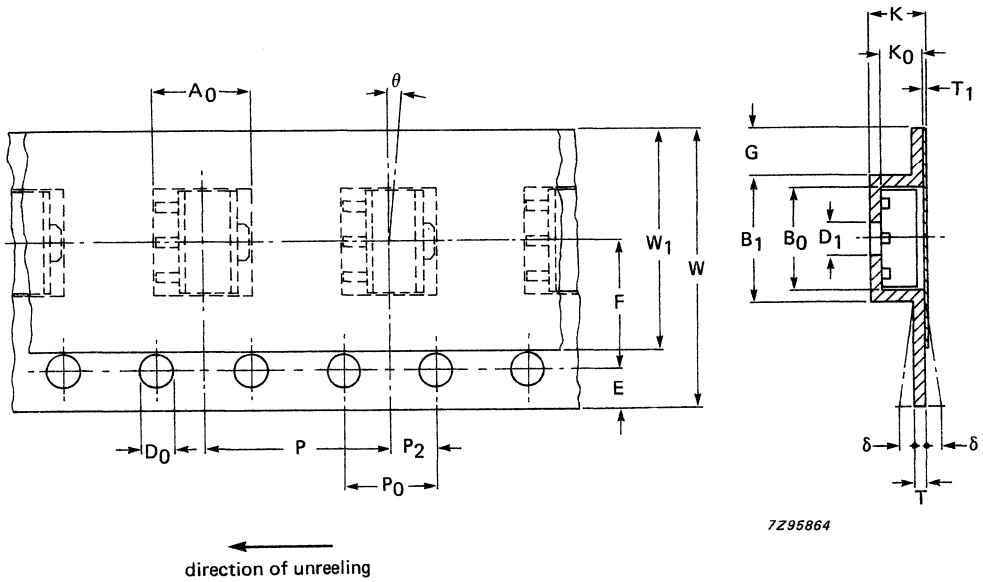


Fig.1 Configuration of bandolier. Dimensions in mm.

Compartment			tol.
length	A_0	component length	+0,2
width	B_0	component width	+0,2
depth	K_0	0,95	+0,2
width outside	B_1	3,3	max.
pitch	P	4,0	±0,1
deviation	Θ	15°	max.
hole diameter	D_1	1	min.
Sprocket hole			
diameter	D_0	1,5	+0,1
pitch	P_0	4,0	±0,1
distance	E	1,75	±0,1
cumulative (10) pitch error		±0,1	

Centre line dimensions			tol.
length direction	P_2	2,0	±0,05
width direction	F	3,5	±0,05
Fixing tape			
width	W_1	5,5	±0,25
thickness	–	0,1	max.
Carrier tape			
width	W	8,0	±0,2
bending	δ	0,3	max.
thickness	t	0,4	max.
Overall thickness	K	1,5	max.

→ Semiconductors in SOT89 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.



→ Fig.2 Configuration of bandolier. Dimensions in mm.

Compartment			tol.
length	A_0	component length	
width	B_0	component width	
depth	K_0	component depth	
width outside	B_1	5,7	max.
pitch	P	8,0	± 0,1
deviation	Θ	± 5°	max.
hole diam.	D_1	1,5	min.
Sprocket hole			
diameter	D_0	1,5	+ 0,1
pitch	P_0	4,0	± 0,1
distance	E	1,75	± 0,1
cumulative (10) pitch error		± 0,1	

Centre line dimensions			tol.
length direction	P_2	2,0	± 0,05
width direction	F	5,5	± 0,1
Fixing tape			
width	W_1	9,5	max.
thickness	T_1	0,1	max.
Carrier tape			
width	W	12	± 0,2
bending	δ	0,3	max.
thickness	T	0,4	max.
Overall thickness	K	2,4	max.
distance	G	1,8	min.

Semiconductors in SOD87 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments. Total number of devices per reel is 2000.

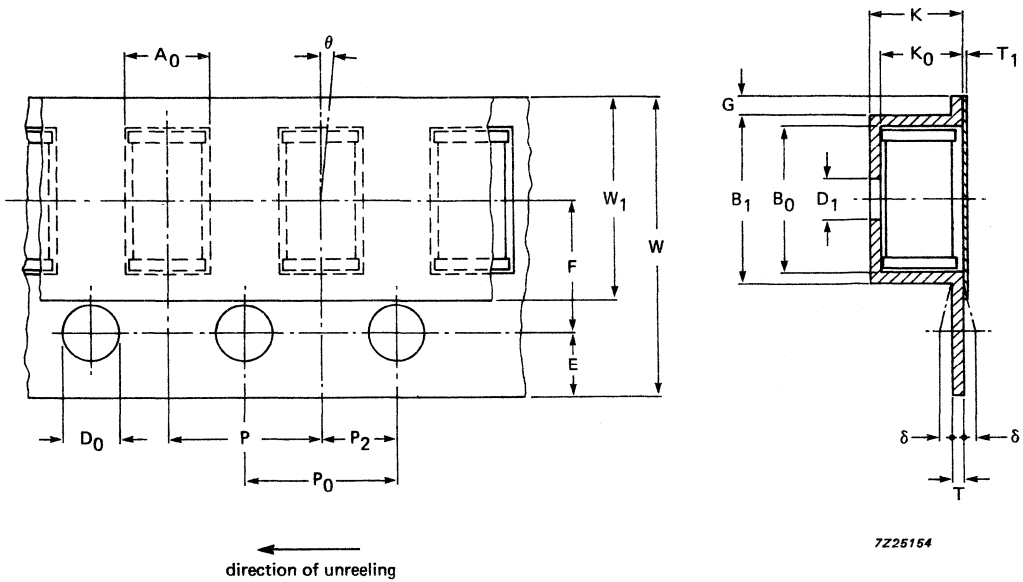


Fig.3 Configuration of bandolier. Dimensions in mm.

Note: Testing of SOD87 devices is not possible in this tape. Total number of devices per reel is 2000.

Compartment			tolerance
length	A_0	2.1	+0.3
width	B_0	3.8	min.
depth	K_0	2.1	+0.3
width outside	B_1	4.5	max.
pitch	P	4.0	± 0.1
deviation	θ	± 5°	max.
hole diameter	D_1	1.0	+0.1
Sprocket hole			
diameter	D_0	1.5	+0.1
pitch	P_0	4.0	±0.1
distance	E	1.75	±0.1
cumulative (10) pitch error		± 0.1	

Centre line dimensions			tolerance
length direction	P_2	2.0	± 0.05
width direction	F	3.5	± 0.1
Fixing tape			
width	W_1	5.5	max.
thickness	T_1	0.1	max
Carrier tape			
width	W	8	± 0.2
bending	δ	0.3	max.
thickness	T	0.4	max.
Overall thickness	K	2.5	max.

Semiconductors in SOT223 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.

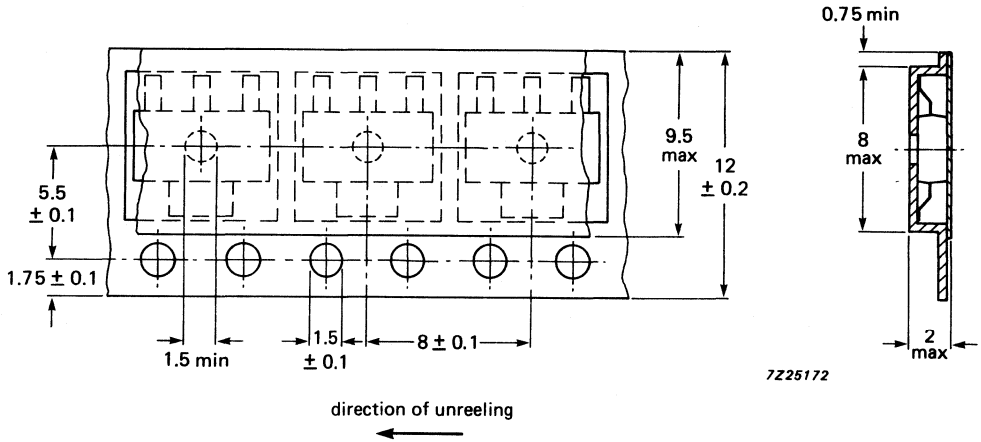


Fig.4 Configuration of bandolier. Dimensions in mm.

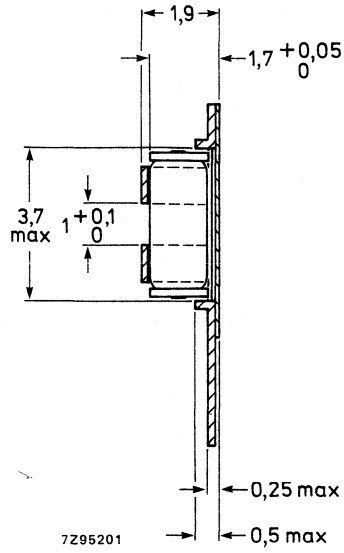


Fig.5 Cross-sectional view of bandolier with **SOD80** devices.

Note: Testing of SOD80 devices is possible in this tape. The cathode is directed towards the sprocket hole. The total number of devices per reel is 2500.

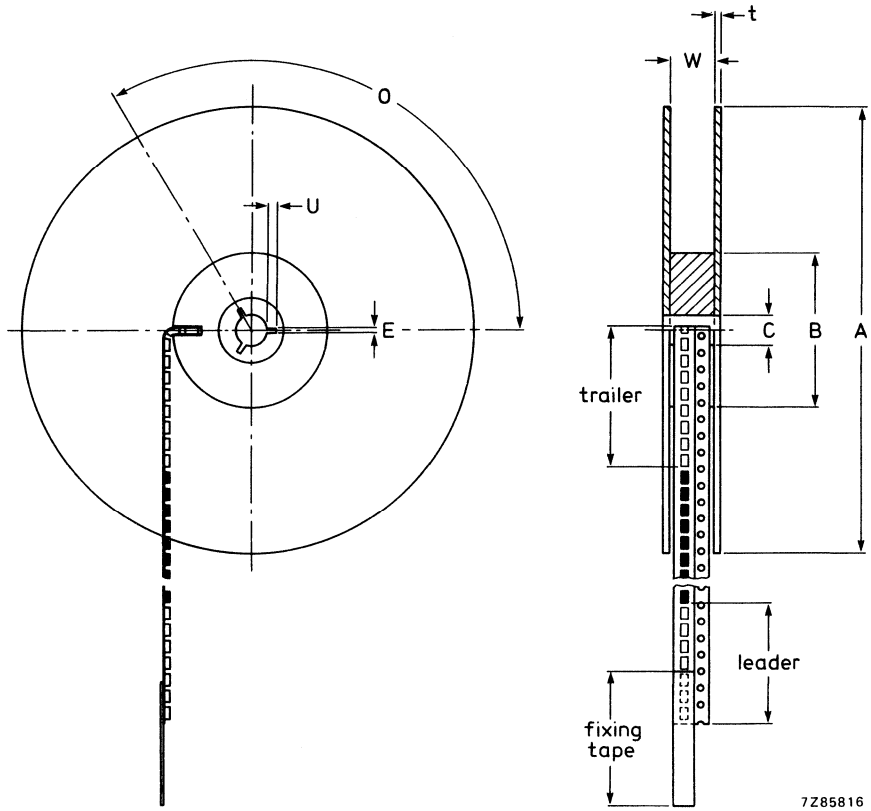


Fig.6 Configuration of reel and flange (dimensions in mm).

Flange			tol.
diameter	A	180	+0 −2
thickness	t	1,5	+0,5 −0,1
space between flanges	W	9,5	± 0,5

Hub			tol.
diameter	B	62	± 1,5
spindle hole	C	12,75	+0,15 −0
key slit			
width	E	2	± 0,5
depth	U	4	± 0,5
location	O	120	degrees

Amount of devices per reel

The bandolier of a 180 mm reel contains at least 3000 devices with no more than 15 empty compartments (0,5%). Three consecutive empty places might be found provided this gap is followed by 6 consecutive devices.

The carrier tape (leader) starts with at least 75 empty positions (equivalent to 300 mm); the covering foil is at least 300 mm. In order to fix the carrier tape a self-adhesive tape of 20 to 50 mm is applied.

At the end of the bandolier (trailer) at least 75 empty positions (equivalent to a length of 300 mm) and 300 mm foil. For fixing onto the reel a self-adhesive tape of 20 to 50 mm is applied.

SOLDERING RECOMMENDATIONS

SMD devices are ideally suited for placement onto thick and thin film substrates and printed boards. ←

To assure reliable and consistent connections particular attention should be paid to:

1. **Flux**

   A non-active flux is recommended. Where active fluxes are employed, great care in subsequent substrate cleaning must be exercised.

2. **Metal-alloy solder or solder paste**

   Correct choice of solder alloy or solder paste to be employed e.g. 62% Sn, 36% Pb, 2% Ag or 60% Sn/40% Pb. Any paste used should contain at least 85% metal dry weight.

3. **Soldering temperature**

   This will vary according to the actual method employed.

REFLOW SOLDERING

The preferred techique for mounting microminiature components on hybrid thick and thin-film is the method of reflow soldering.

The tags of SOT23, SOT143 and SOT89 envelopes are pre-tinned and the best results are obtained if a similar solder is applied to the corresponding soldering areas on the substrate. This can be done by either dipping the substrate in a solder bath or by screen printing a solder paste.
The maximum temperature of the leads or tab during the soldering cycle should not exceed 285 °C.
The most economic method of soldering is a process in which all different components are soldered simultaneously for example SOT23, SOT143 or SOT89 devices, capacitors and resistors.

Having first been fluxed, all components are positioned on the substrate. The slight adhesive force of the flux is sufficient to keep the components in place. Solder paste contains a flux and has therefore good inherent adhesive properties which eases positioning of the components.

With the components in position the substrate is heated to a point where the solder begins to flow. This can be done on a heating plate or on a conveyor belt running through an infrared tunnel. The maximum allowed temperature of the plastic body of a device must be kept below 280 °C during the soldering cycle. For further temperature behaviour during the soldering process see Figs 2 and 3.

The surface tension of the liquid solder tends to draw the tags of the device towards the centre of the soldering area and has thus a correcting affect on slight mispositionings. However, if the layout leaves something to be desired the same effect can result in undesirable shifts; particularly if the soldering areas on the substrate and the components are not concentrally arranged. This problem can be solved using a standard contact pattern, which leaves sufficient scope for the self-positioning effect (see Figs 4 to 9).

After cooling the connections may be visually inspected and, where necessary, repaired with a light soldering iron. Finally any remaining flux must be removed carefully.

WAVE SOLDERING

The normal (dual) wave soldering process can also be applied to SOD80, SOT23, SOD87 and SOT143 envelopes. We do not recommend SOT89 to be used with wave soldering process. ←

IMMERSION SOLDERING

Where a complete substrate or printed circuit board is immersed in solder:

a. The temperature of the soldering bath should not exceed 280 °C.
b. The duration of the soldering cycle should not exceed 10 seconds.
c. Forced cooling may be applied (see Fig. 1).

HAND SOLDERING

It is possible to solder microminiature devices with a light hand-held soldering iron, but this method has obvious drawbacks and should therefore be restricted to laboratory use and/or incidental repairs on production circuits.

1. It is time-consuming and expensive.
2. The device cannot be positioned accurately and therefore the connecting tags may come into contact with the substrate and damage it.
3. There is a great risk of breaking either substrate or even internal connections inside the encapsulation.
4. The envelope may be damaged by the iron.

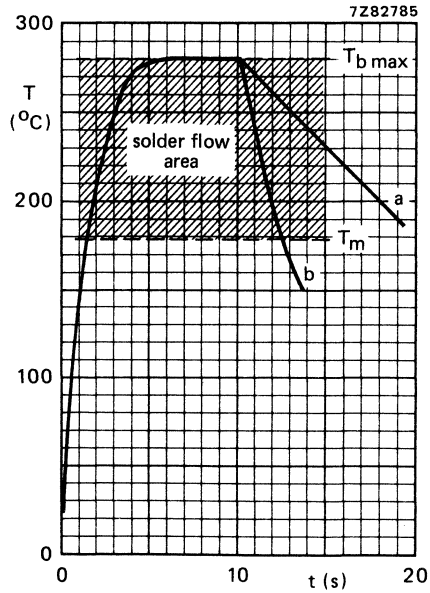
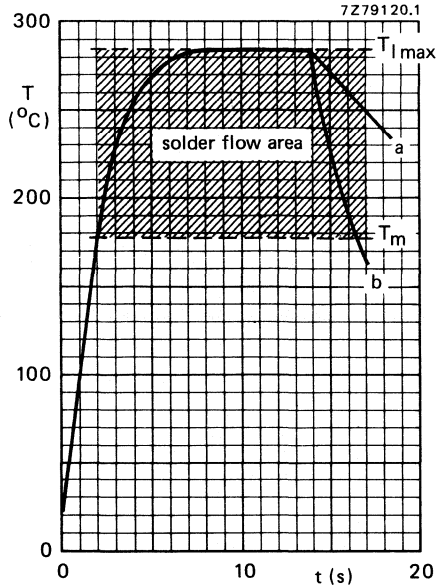


Fig.1 Device temperature during *immersion* soldering.

Maximum time of immersion in soldering bath is 10 seconds at an ambient temperature of 25 °C.

a = free convection cooling; b = forced cooling.
$T_{b\,max}$ = maximum bath temperature (280 °C).
T_m = melting temperature of solder (179 °C).



a = free convection cooling

b = permissible forced cooling

$T_{l\,max}$ = maximum lead or tab temperature = 285 °C

T_m = melting point of the solder is 179 °C

T_{amb} = 25 °C

Time of heat supply:
without preheating max. 14 s
with preheating max. 10 s

Maximum time of preheating 45 s

Fig.2 Reflow soldering without preheating.

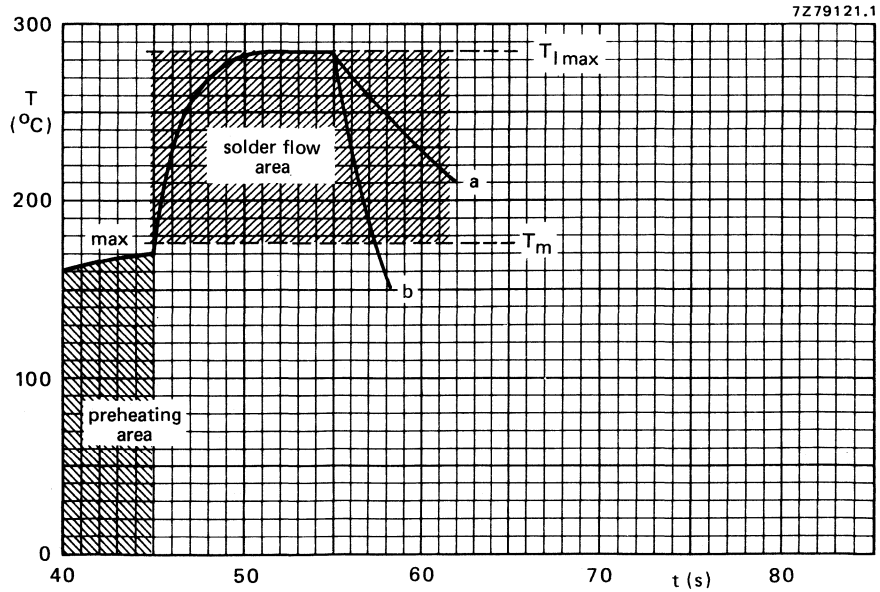


Fig.3 Reflow soldering with preheating.

Minimum required dimensions of metal connection pads on hybrid thick and thin-film substrates.

Dimensions in mm

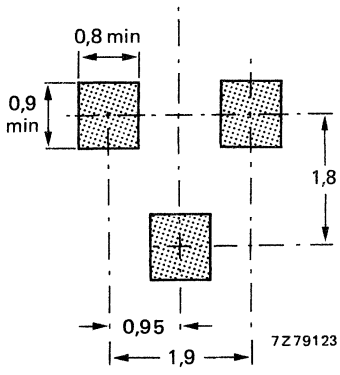


Fig.4 SOT23 pattern.

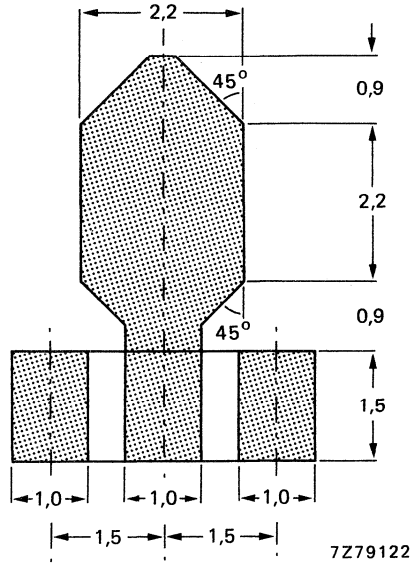


Fig.5 SOT89 pattern.

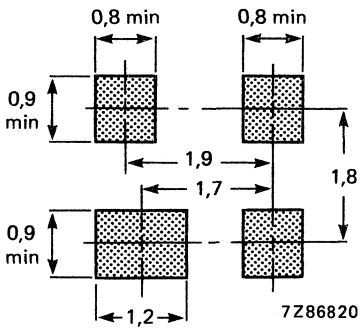


Fig.6 SOT143 pattern.

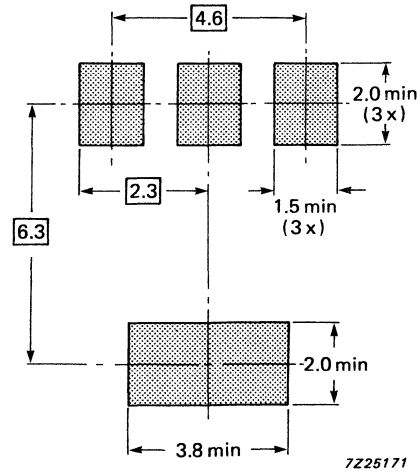


Fig.7 SOT223 pattern.

Minimum required dimensions of metal connection pads on hybrid thick and thin-film substrates.

Dimensions in mm

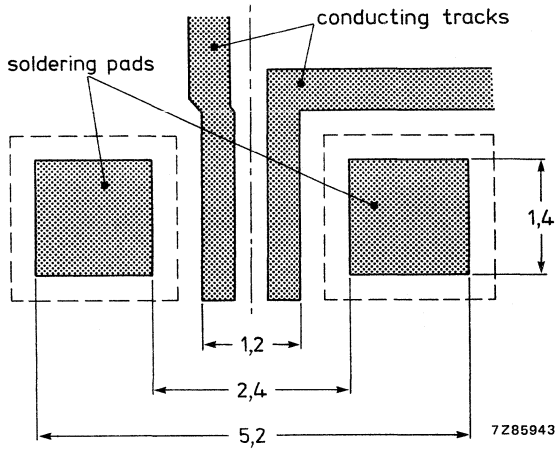


Fig.8 SOD80 pattern.

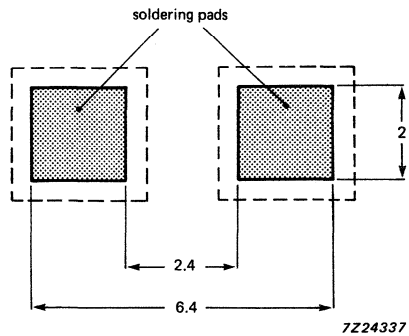


Fig. 9 SOD87 pattern.

THERMAL CHARACTERISTICS

The heat generated in a semiconductor chip normally flows by various paths to the surroundings (ambient).

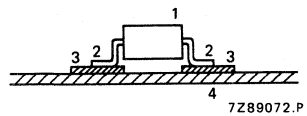


Fig.1.

1. Heat radiation from the envelope to ambient (1).
   This heat transfer can be neglected when the envelope is mounted on a substrate or printed board.
2. Heat transmission via leads (2) soldering points (3) and substrate (4).

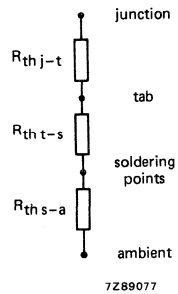


Fig.2 Thermal behaviour of heat flow when the device is mounted on a substrate or printed board.

$R_{th\ j\text{-}t}$ = Thermal resistance from junction to tab.

$R_{th\ t\text{-}s}$ = Thermal resistance from tab to soldering points.

$R_{th\ s\text{-}a}$ = Thermal resistance from soldering points to ambient.

Internal $R_{th} = R_{th\ j\text{-}t} + R_{th\ t\text{-}s}$ = 320 K/W (SOT23/143).

Heat transfer from soldering points to ambient (Fig.3)

This depends on the shape and material of tracks and substrate. In Figures 4 to 8 standard mounting conditions are given to set up the maximum power ratings for SOT23, SOT143, SOT89, SOD87 and SOT223 encapsulations.

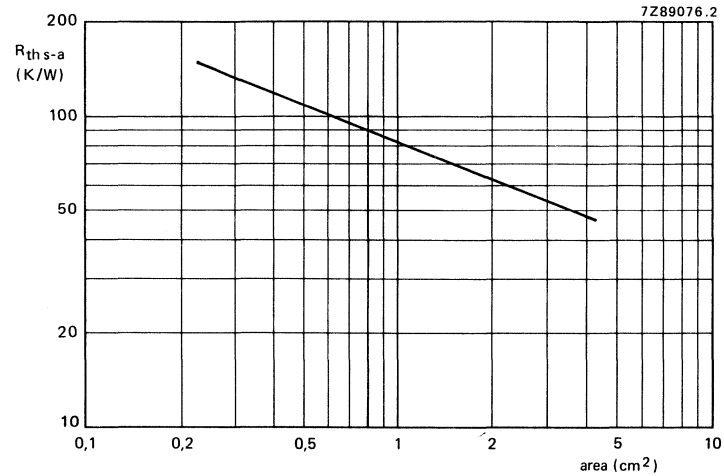


Fig.3 Heat transfer from soldering points to ambient.

Ceramic substrate

The $R_{th\ s\text{-}a}$ depends on the size of the ceramic substrate due to good conductive properties.

Printed board

$R_{th\ s\text{-}a}$ = 150 K/W for SOT23 and SOT143 envelopes mounted on a printed board.
P_{tot} = 250 mW for SOT23 and SOT143 envelopes mounted on a printed board.

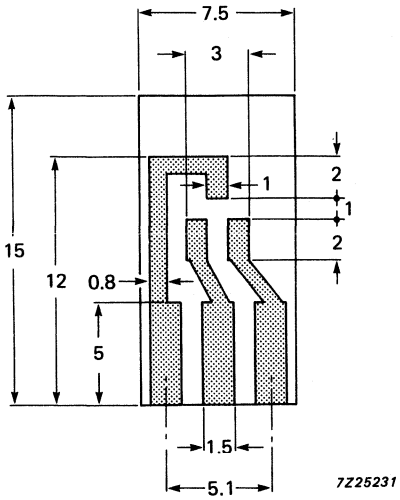


Fig.4 Test circuit for SOT23.

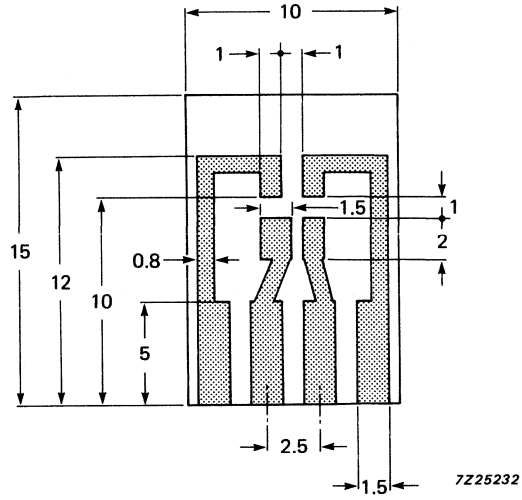


Fig.5 Test circuit for SOT143.

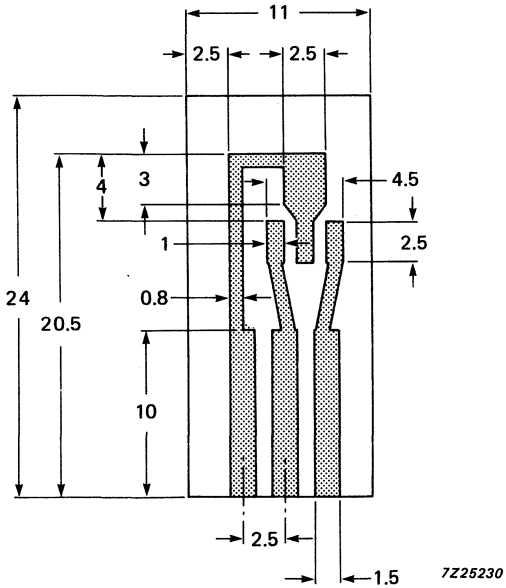


Fig.6 Test circuit for SOT89.

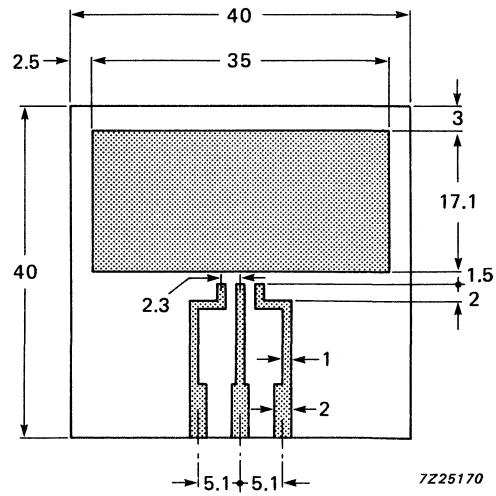


Fig.7 Test circuit for SOT223.

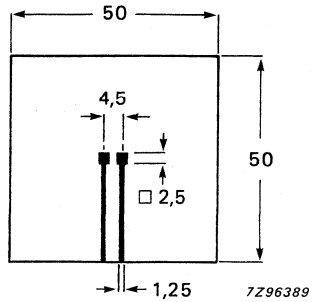


Fig.8 Test circuit for SOD87.

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES — MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter **W**)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current.rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

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

Note
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 which are directly related to the application.

Rating. A value which 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.

Note
Limiting conditions may be either maxima or minima.

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

Note
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 life, 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 life, no design maximum value for the intended service is exceeded with a bogey 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

The ratings are presented as voltage, current, power and temperature ratings. The list of these ratings and their definitions is given as follows:

Transistor voltage ratings

Collector to base voltage ratings

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 circuited.

Emitter to base voltage ratings

V_{EBmax} — The maximum permissible instantaneous reverse voltage between emitter and base terminal. The emitter voltage is negative with respect to base for PNP transistor and positive with respect to base for NPN types.

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

Collector to emitter voltage ratings

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 transistor and negative with respect to emitter for NPN types.

NOTE: The term "cut-off" is sometimes replaced by $V_{BE} > x$ volts, or $\frac{R_B}{R_E}$, $\leqslant y$ which are equivalent conditions under which the device 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 max. rated value.

V_{CEmax} ($I_B = 0$) — The maximum permissible instantaneous voltage between collector and emitter terminals when the base terminal is open circuited 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 which is a curve of collector current versus collector to emitter voltage (see Fig. 1).

This curve is divided into two areas:

A permissible area of operation under all conditions of base drive provided the dissipation rating is not exceeded (area 1) and an area where operation is allowable under certain specified conditions (area 2). To assist in determining the rating in this second area, further curves are provided relating the voltage rating to external circuit conditions, for example:

$$\frac{R_B}{R_E},\ R_B,\ Z_{Bg},\ V_{BE},\ I_B \text{ or } \frac{V_{BB}}{R_B}$$

An example of this type of curve is given in Fig. 2 as V_{CE} versus $\frac{R_B}{R_E}$ for two different values of collector current.

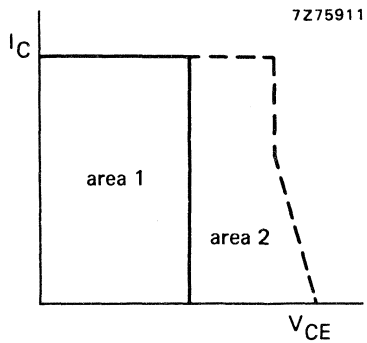


Fig. 1.

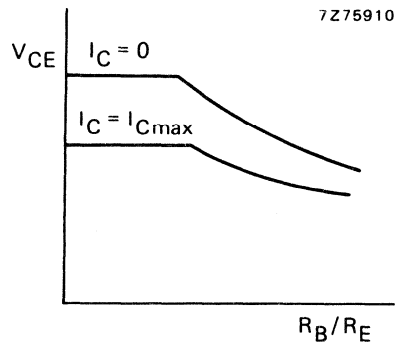


Fig. 2.

It should be noted that when R_E is shunted by a capacitor, the collector voltage V_{CE} during switching must be restricted to a value which does not rely on the effect of R_E.
In the case of an inductive load and when an energy rating is given, it may be permissible to operate outside the rated area provided the spcified energy rating is not exceeded.

Transistor current ratings

Collector current ratings

I_{Cmax}	The maximum permissible collector current. Without further qualification, the d.c. 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 current ratings

I_{Emax}	The maximum permissible emitter current. Without further qualification, the d.c. 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 reverse emitter current allowable in the reverse breakdown region.

Base current ratings

I_{Bmax}	The maximum permissible base current. Without further qualification, the d.c. 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 reverse base current allowable 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.

Transistor power ratings

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

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

In order to distinguish between "steady state" and "pulse" conditions the terms "steady state power (P_S)" and "pulse power (P_P)" are often used. The permissible total power dissipation is dependent upon temperature and its relationship is shown by means of a chart as shown in Fig. 3.

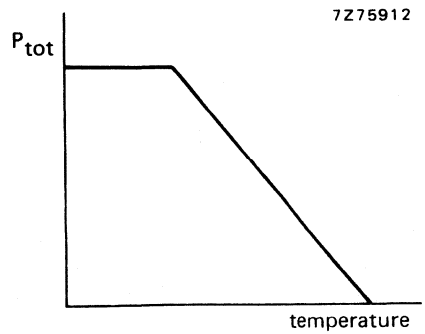


Fig. 3.

The temperature may be ambient, case or mounting base temperatures. Where a cooling clip or a 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.

The effect of heatsinks of various thermal resistance and contact resistance is often included in the above chart.

Thus for any heatsink of known thermal resistance and any given ambient temperature, the maximum permissible power dissipation can be established. Alternatively, knowing the power dissipation which will occur and the ambient temperature, the necessary heatsink thermal resistance can be calculated.

A general expression from which the total permissible steady state power dissipation can be calculated is:

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

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 $R_{th\ j\text{-}a}$ 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 P_p, the maximum pulse power is obtained by the aid of a chart as shown in Fig. 4.

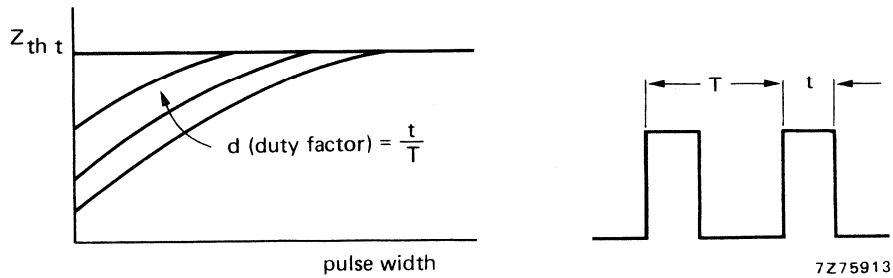


Fig. 4.

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

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

where $Z_{th\ t}$ and d are given in the above chart and $R_{th\ c\text{-}a}$ is the thermal resistance between case and ambient for case rated device. For mounting base rated device, it is equal to $R_{th\ h} + R_{th\ i}$ and is zero for 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_{jmax}	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_{jmax} (continuous operation)	The maximum permissible continuous value.
T_{jmax} (intermittent operation)	The maximum permissible instantaneous junction temperature usually allowed for a total duration of 200 hours.
T_{mb}	The temperature of the surface making contact with a heatsink. This is confined to devices where a flange or stud for fixing onto a heatsink forms an integral part of the envelope.
T_{case}	The temperature of the envelope. This is confined to devices to which may be attached a clip-on cooling fin.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
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 circuited
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 (for FETS only) As second subscript: Non-repetitive (not for 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 regulator diodes.

Note: No additional subscript is used for DC values.

Upper-case subscripts shall be used for the indication of:

a) continuous (DC) values (without signal)
Example I_B

b) instantaneous total values
Example i_B

c) average total values
Example $I_{B(AV)}$

d) peak total values
Example I_{BM}

e) root-mean-square total values
Example $I_{B(RMS)}$

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

a) instantaneous values
Example i_b

b) root-mean-square values
Example $I_{b(rms)}$

c) peak values
Example I_{bm}

d) average values
Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: 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}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: 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}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

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

Examples: V_{CC}, I_{EE}

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

Example : V_{CCE}

Subscripts for devices having 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 misunderstanding.

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

Subscripts for multiple devices

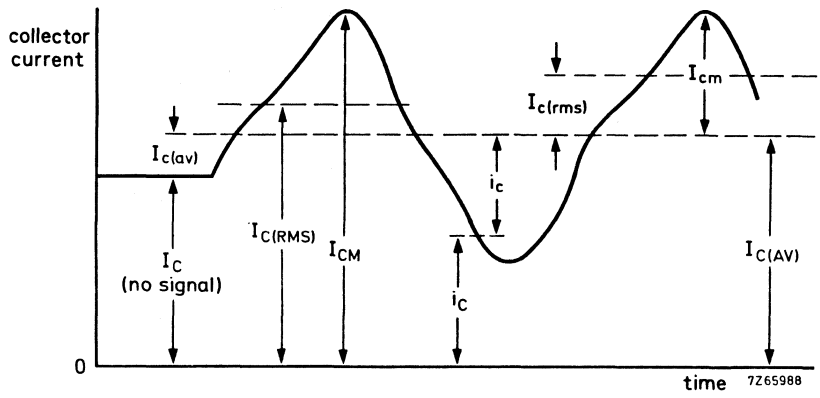
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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 the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (DC) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Defenition

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 is a list of 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 shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward; forward transfer
1, 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 shall be used for the designation of static (d.c.) 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

Note: 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 shall be 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

Note: If more than one subscript is used, subscripts for which both styles exist shall either be 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.

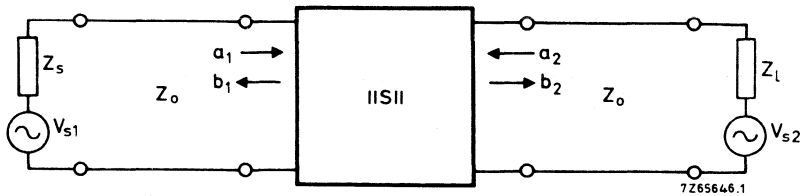
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

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

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad 1)$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$
$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \frac{b_1}{a_1}\bigg|_{a_2 = 0}$$
$$s_r = s_{12} = \frac{b_1}{a_2}\bigg|_{a_1 = 0}$$
$$s_f = s_{21} = \frac{b_2}{a_1}\bigg|_{a_2 = 0}$$
$$s_o = s_{22} = \frac{b_2}{a_2}\bigg|_{a_1 = 0}$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

DEVICE DATA

SILICON AM BAND SWITCHING DIODE FOR SURFACE MOUNTING

The BA423L is a switching diode intended for band switching in AM radio receivers.

This SM diode is a leadless diode in a hermetically sealed SOD-80 envelope with lead/tin plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	20 V
Forward current (DC)	I_F	max.	50 mA
Junction temperature	T_j	max.	100 °C
Diode capacitance at f = 1 MHz V_R = 3 V	C_d	<	2.5 pF
Series resistance at f = 1 MHz I_F = 10 mA	r_s	<	1.2 Ω

MECHANICAL DATA

Dimensions in mm

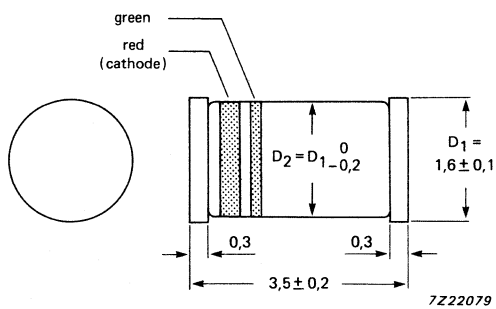


Fig. 1 SOD-80.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	20 V
Forward current (DC)	I_F	max.	50 mA
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient on a ceramic substrate of 8 mm x 10 mm x 0.7 mm (see soldering recommendations SOD-80)	$R_{th\ j\text{-}a}$	max.	400 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage			
I_F = 50 mA	V_F	<	0.9 V
Reverse current			
V_R = 20 V	I_R	<	100 nA
V_R = 20 V; T_j = 125 °C		<	5.0 μA
Diode capacitance at f = 1 MHz			
V_R = 3 V	C_d	<	2.5 pF
Series resistance at f = 1 MHz			
I_F = 10 mA	r_s	<	1.2 Ω

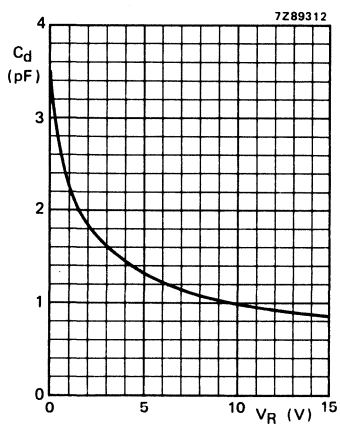


Fig. 2 Diode capacitance as a function of continuous reverse voltage; f = 1 MHz; T_j = 25 °C; typical values.

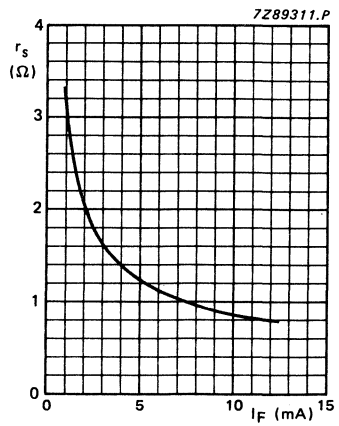


Fig. 3 Series resistance as a function of forward current; f = 1 MHz; T_j = 25 °C; typical values.

BAND-SWITCHING DIODES FOR SURFACE MOUNTING

Switching diodes in a SOD-80 envelope, intended for band switching in v.h.f. television tuners. A special feature of these diodes is their low capacitance.

These SM diodes are leadless diodes in an hermetically sealed micro-miniature glass envelope with tin-plated metal discs at each end. They are suitable for Automatic Placement and as such they can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

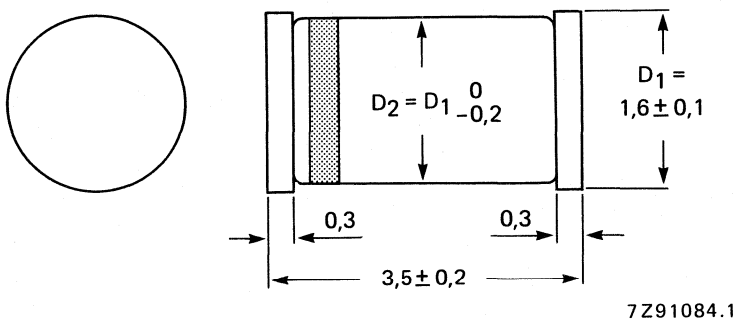
QUICK REFERENCE DATA

			BA682	BA683	
Continuous reverse voltage	V_R	max.	35	35	V
Forward current (d.c.)	I_F	max.	100	100	mA
Junction temperature	T_j	max.	150	150	°C
Diode capacitance V_R = 3 V; f = 1 MHz	C_d	<	1,25	1,2	pF
Series resistance at f = 200 MHz I_F = 3 mA I_F = 10 mA	r_D	< <	0,7 0,5	1,2 0,9	Ω Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a red band.
The BA683 cathode has an additional orange band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	35	V
Forward current (d.c.)	I_F	max.	100	mA
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j		150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage					
I_F = 100 mA	V_F	<	1,0		V
Reverse current					
V_R = 20 V	I_R	<	50		nA
V_R = 20 V; T_{amb} = 75 °C		<	1		μA
			BA682	BA683	
Diode capacitance at f = 1 MHz					
V_R = 1 V	C_d	<	1,5	1,5	pF
V_R = 3 V		<	1,25	1,2	pF
Series resistance at f = 200 MHz					
I_F = 3 mA	r_D	<	0,7	1,2	Ω
I_F = 10 mA		<	0,5	0,9	Ω

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching in hybrid thick and thin-film circuits.

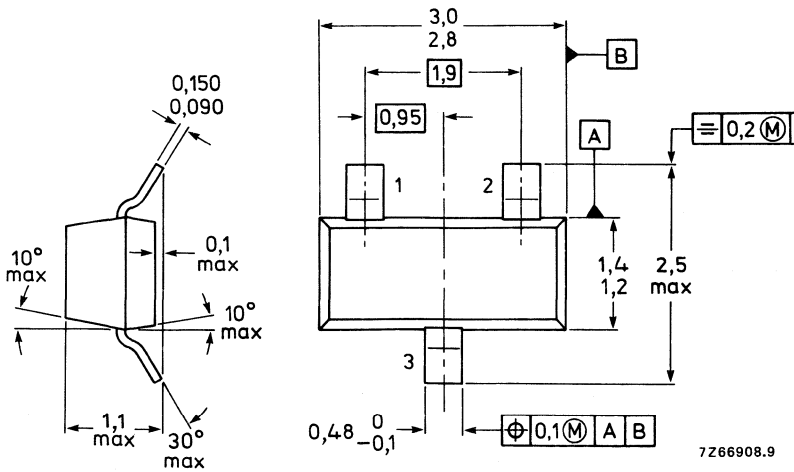
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	250	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
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	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

MECHANICAL DATA

Dimensions in mm

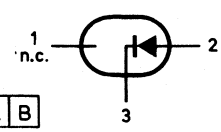
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS16 = A6



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Average rectified forward current* (averaged over any 20 ms period) up to T_{amb} = 25 °C	$I_{F(AV)}$	max.	250	mA
Forward current (DC)	I_F	max.	250	mA
Repetitive peak froward current	I_{FRM}	max.	250	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	2	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}	−65 to+	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	30	μA
V_R = 75 V	I_R	<	1	μA
V_R = 75 V; T_j = 150 °C	I_R	<	50	μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	<	2	pF
Forward recovery voltage (see also Fig. 2) when switched to I_F = 10 mA; t_p = 20 ns	V_{fr}	<	1,75	V
Reverse recovery time (see also Fig. 3) when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge (see also Fig. 4) when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

* Measured under pulse conditions. $t_p \leqslant 0{,}5$ ms. $I_{F(AV)} = 150$ mA, $t_{(AV)} \leqslant 1$ ms, for sinusoidal operation.

** See *Thermal characteristics.*

▲ Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

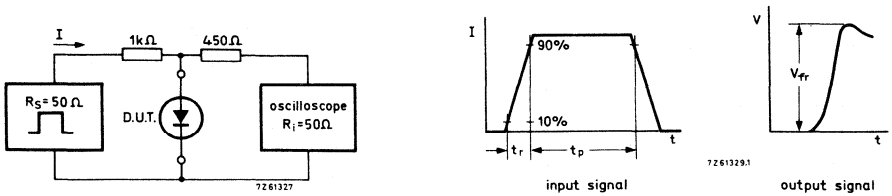


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal: forward pulse rise time = t_r = 20 ns; forward current pulse duration t_p = 120 ns; duty factor = δ = 0,01.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

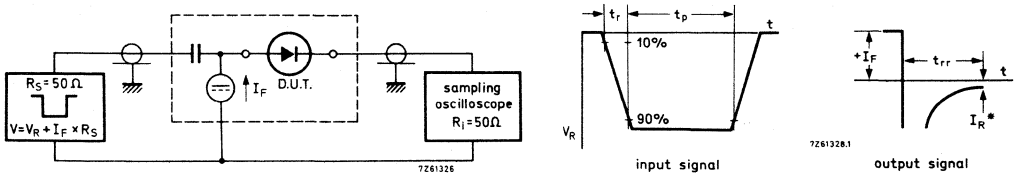


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal: reverse pulse rise time = t_r = 0,6 ns; reverse pulse duration = t_p = 100 ns; duty factor = δ = 0,05.
* t_{rr} up to I_R = 1 mA.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

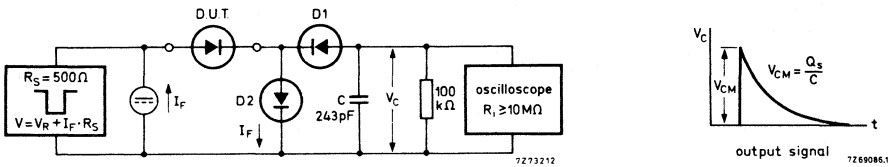


Fig. 4 Recovery charge test circuit and waveform.

D1 = BAW62; D2 = diode with minority carrier life time at 10 mA: < 200 ps
Input signal

Rise time of the reverse pulse	t_r	=	2 ns
Reverse pulse duration	t_p	=	400 ns
Duty factor	δ	=	0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

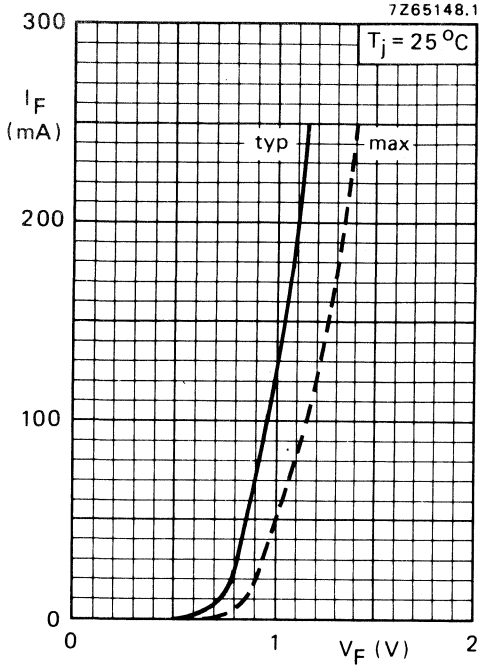


Fig. 5.

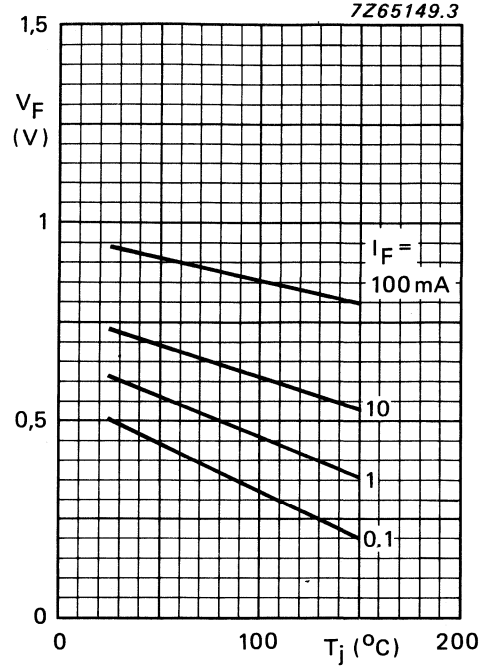


Fig. 6 Typical values.

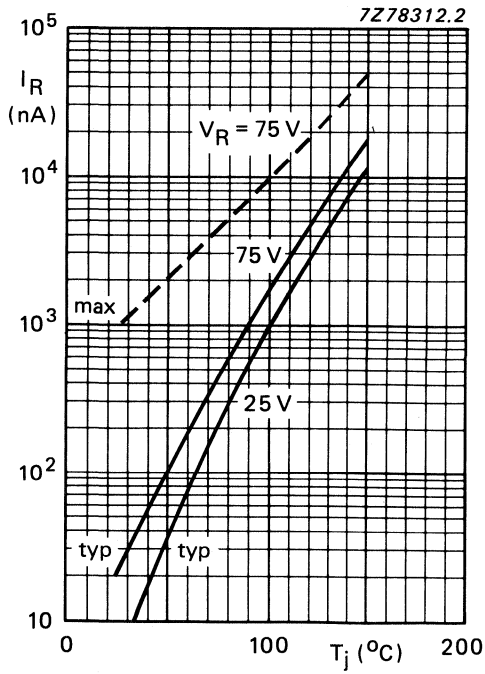


Fig. 7.

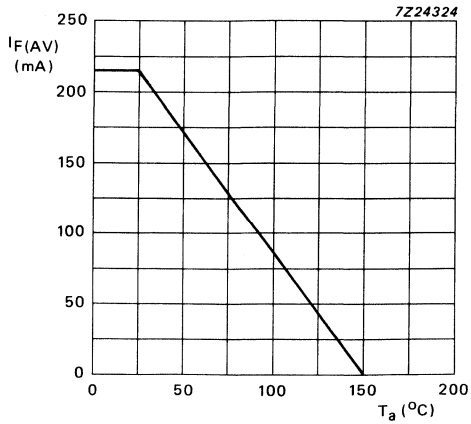


Fig. 8 Current derating curve.

LOW VOLTAGE STABISTOR

Silicon planar epitaxial diode in SOT-23 envelope. This diode is intended for low voltage stabilizing e.g. bias stabilizer in class-B output stages, clipping, clamping and meter protection.

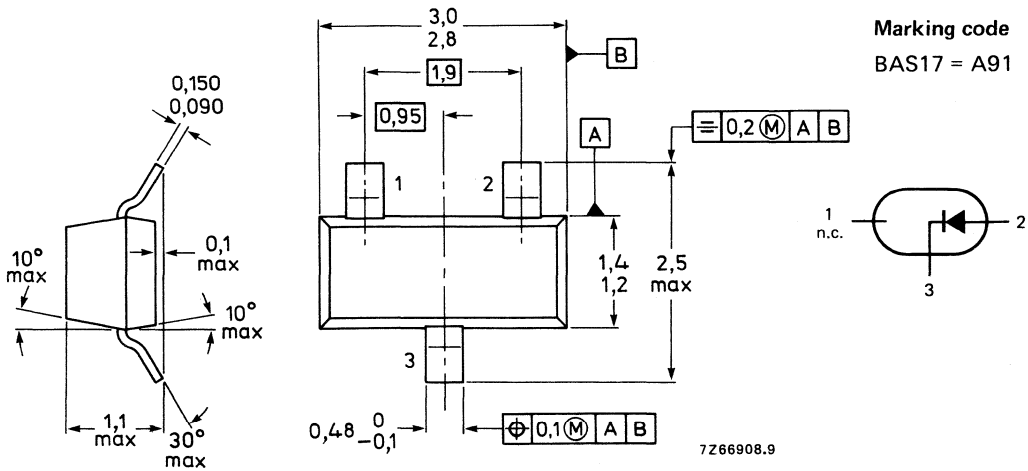
QUICK REFERENCE DATA

Repetitive peak forward current	I_{FRM}	max.	250	mA
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C
Forward voltage				
I_F = 0,1 mA	V_F		580 to 660	mV
I_F = 1,0 mA	V_F		665 to 745	mV
I_F = 10 mA	V_F		750 to 830	mV
I_F = 100 mA	V_F		870 to 960	mV
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	140	pF

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

See also chapter *Soldering Recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak forward current *	I_{FRM}	max.	250	mA
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL CHARACTERISTICS **

From junction to ambient *	$R_{th\ j\text{-}t}$	=	420	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 0,1 mA	V_F		580 to 660	mV
I_F = 1,0 mA	V_F		665 to 745	mV
I_F = 5,0 mA	V_F		725 to 805	mV
I_F = 10 mA	V_F		750 to 830	mV
I_F = 100 mA	V_F		870 to 960	mV
Reverse current				
V_R = 4 V	I_R	<	5	μA
Temperature coefficient				
I_F = 1 mA	S_F	typ.	−1,8	mV/K
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	140	pF

* Mounted on a ceramic substrate of 7 mm x 5 mm x 0,5 mm.

** See *Thermal characteristics.*

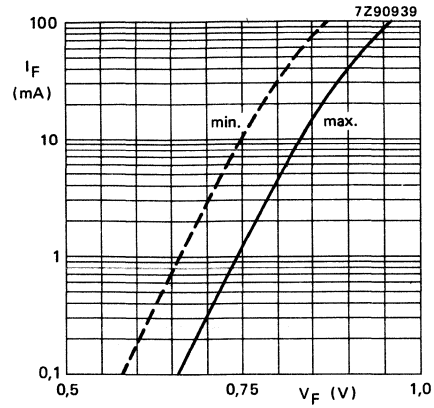


Fig. 2 Forward current as a function of forward voltage.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

Silicon epitaxial high-speed diodes in a microminiature plastic envelope. They are intended for switching and general purposes.

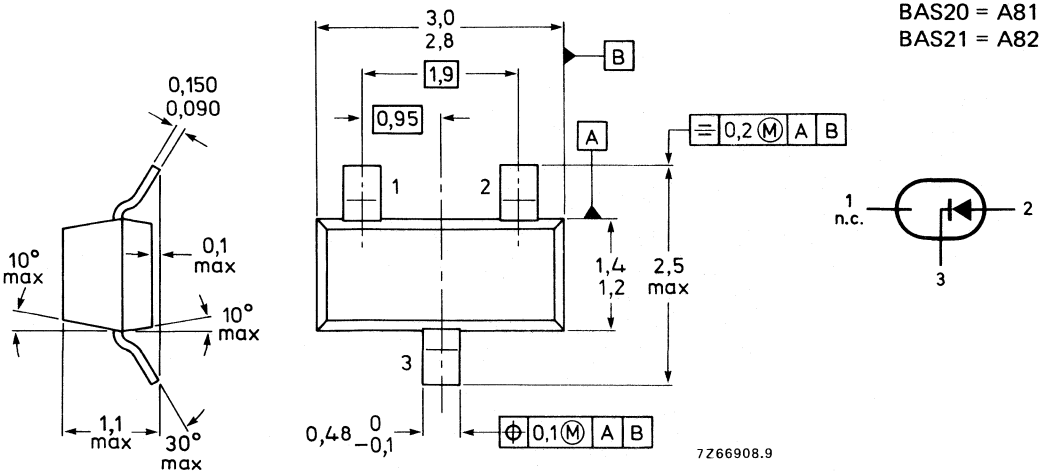
QUICK REFERENCE DATA

			BAS19	BAS20	BAS21	
Continuous reverse voltage	V_R	max.	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	120	200	250	V
Repetitive peak forward current	I_{FRM}	max.		625		mA
Junction temperature	T_j	max.		150		°C
Forward voltage at I_F = 100 mA	V_F	<		1		V
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	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS19 = A8
BAS20 = A81
BAS21 = A82

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BAS19	BAS20	BAS21	
Continuous reverse voltage	V_R	max.	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	120	200	250	V
Non-repetitive peak forward current (per crystal)						
$t = 1\ \mu s$	I_{FSM}	max.		2,5		A
$t = 1\ s$	I_{FSM}	max.		0,5		A
Average rectified forward current (1) (averaged over any 20 ms period)	$I_{F(AV)}$	max.		200		mA
Forward current (DC) up to $T_{amb} = 25\ ^oC$*	I_F	max.		200		mA
Repetitive peak forward current	I_{FRM}	max.		625		mA
Storage temperature range	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.		200		mW

THERMAL RESISTANCE**

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified.

Forward voltage				
$I_F = 100$ mA	V_F	<	1,0	V
$I_F = 200$ mA	V_F	<	1,25	V
Reverse breakdown voltage (1)				
BAS19; $I_R = 100\ \mu A$	$V_{(BR)R}$	>	120	V
BAS20; $I_R = 100\ \mu A$	$V_{(BR)R}$	>	200	V
BAS21; $I_R = 100\ \mu A$ (2)	$V_{(BR)R}$	>	250	V
Reverse current				
$V_R = V_{Rmax}$	I_R	<	100	nA
$V_R = V_{Rmax}$; $T_j = 150\ ^oC$	I_R	<	100	μA
Differential resistance				
$I_F = 10$ mA	r_{diff}	typ.	5	Ω

(1) Measured under pulse conditions; Pulse time = $t_p \leqslant 0{,}3$ ms.
(2) At zero life time, measured under pulse conditions to avoid excessive dissipation and voltage limited to 275 V.

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** See *Thermal characteristics.*

Diode capacitance V_R = 0; f = 1 MHz	C_d	<	5 pF
Reverse recovery time (see Figs 2 and 3) when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	<	50 ns

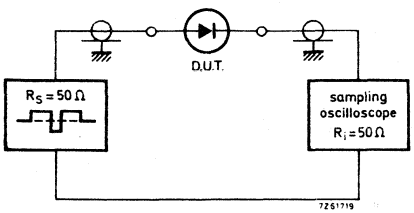


Fig. 2 Test circuit.

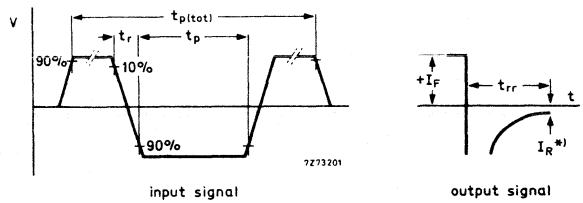


Fig. 3 Waveforms; I_R = 3 mA.

Input signal

total pulse duration	$t_{p(tot)}$	= 2 μs
duty factor	δ	= 0,0025
rise time of reverse pulse	t_r	= 0,6 ns
reverse pulse duration	t_p	= 100 ns

Oscilloscope

rise time	t_r	= 0,35 ns
circuit capacitance*	C	< 1 pF

*C = oscilloscope input capacitance + parasitic capacitance.

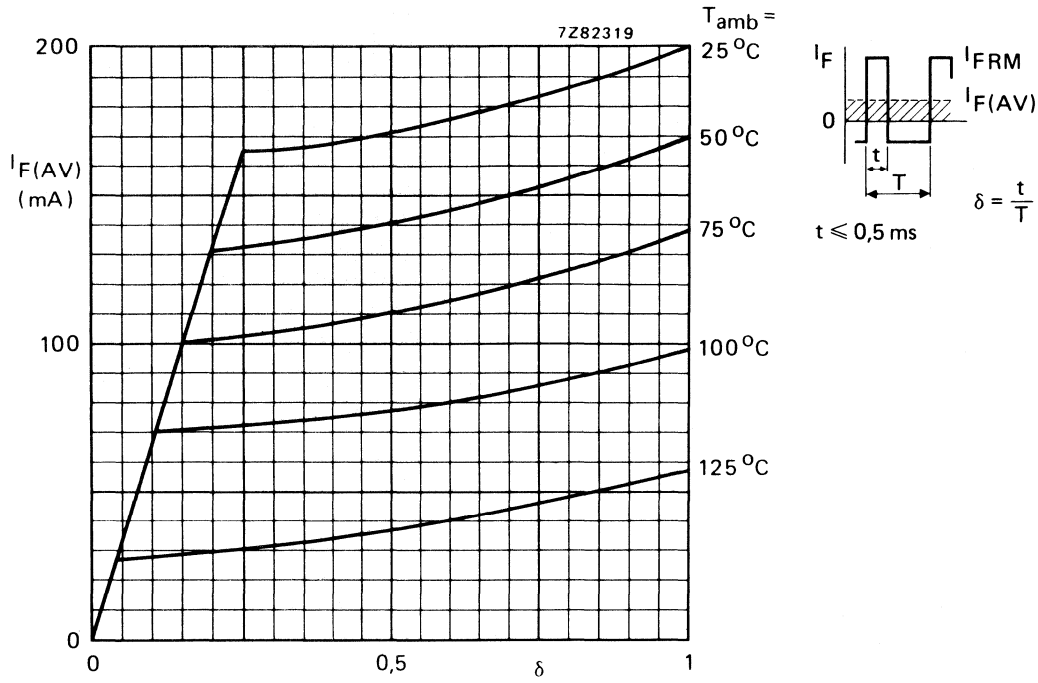


Fig. 4 BAS19; maximum permissible average rectified forward current for pulse operation as a function of the duty factor at V_R = 100 V.

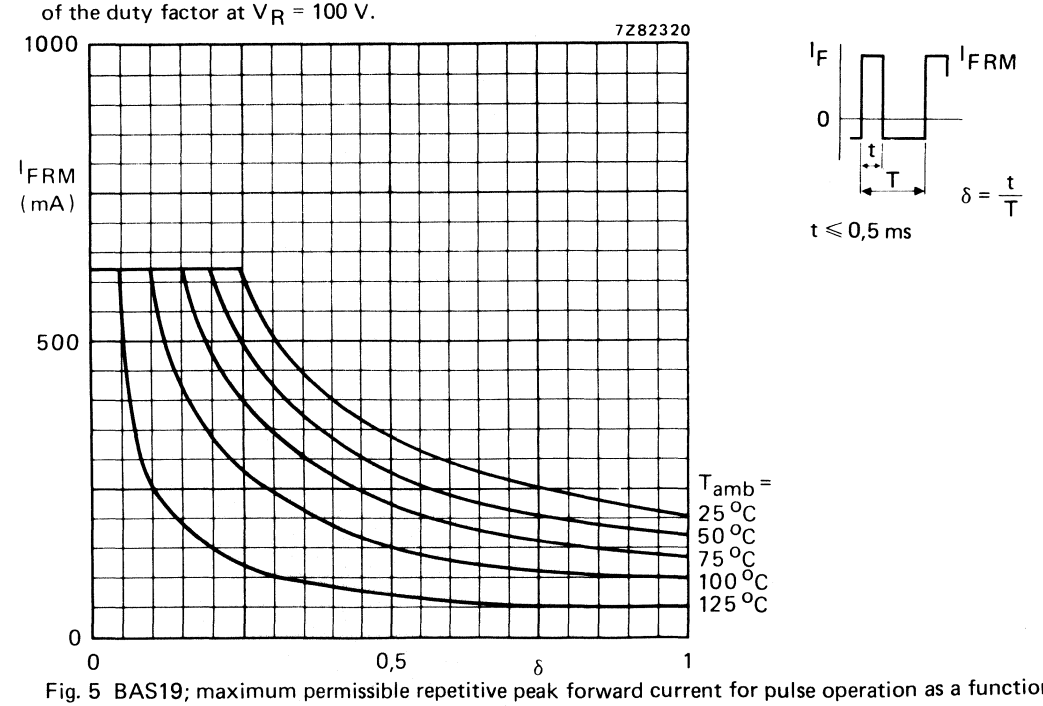


Fig. 5 BAS19; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor at V_R = 100 V.

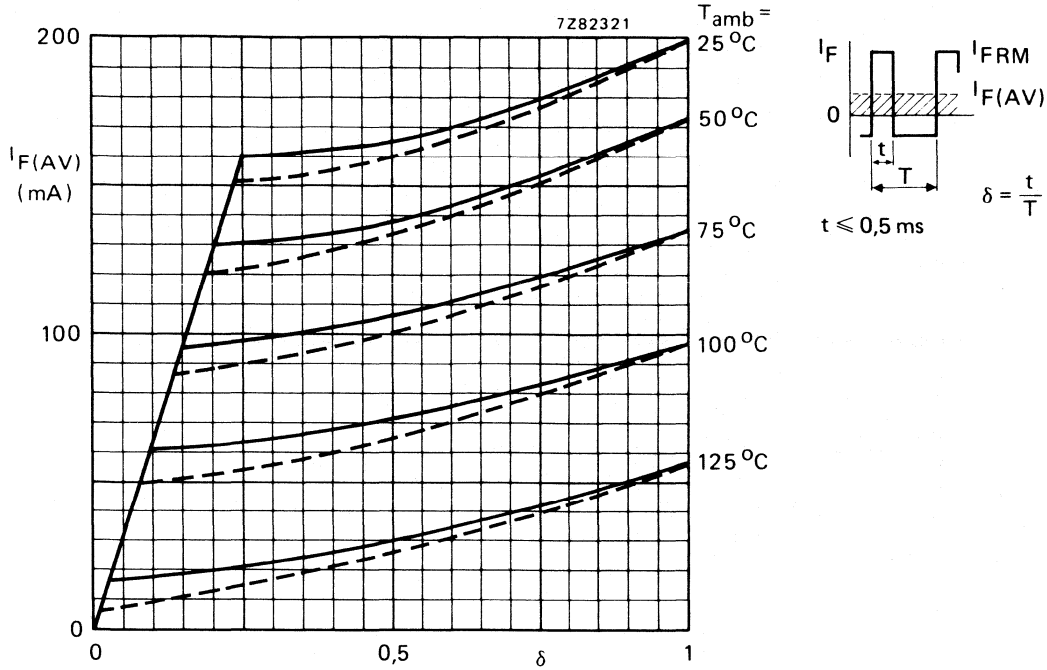


Fig. 6 BAS20/21; maximum permissible average rectified forward current for pulse operation as a function of the duty factor.

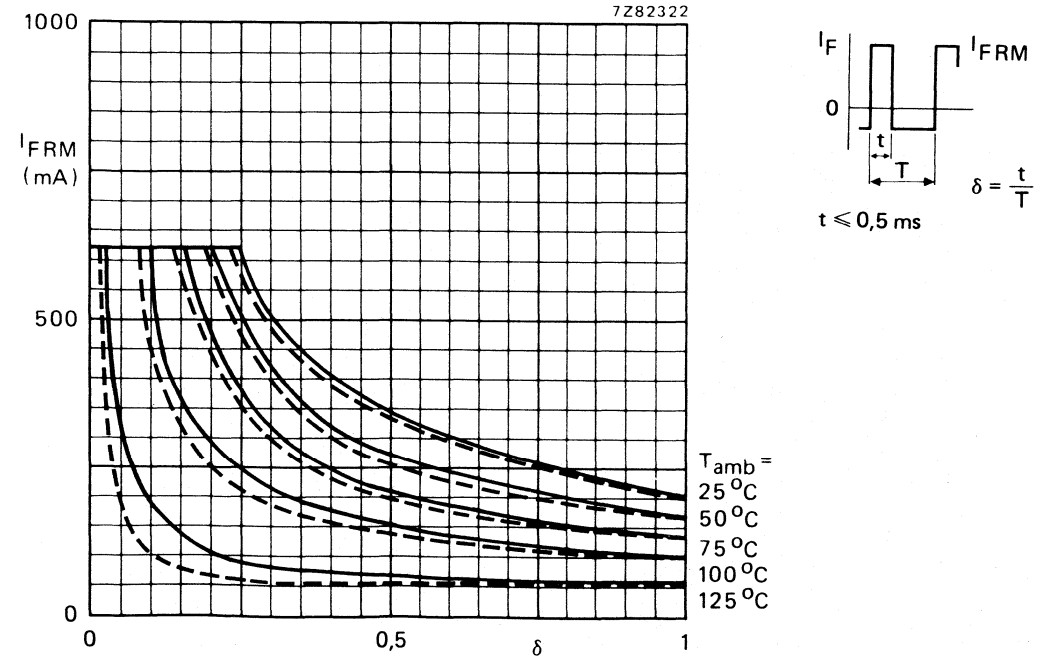


Fig. 7 BAS20/21; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor.

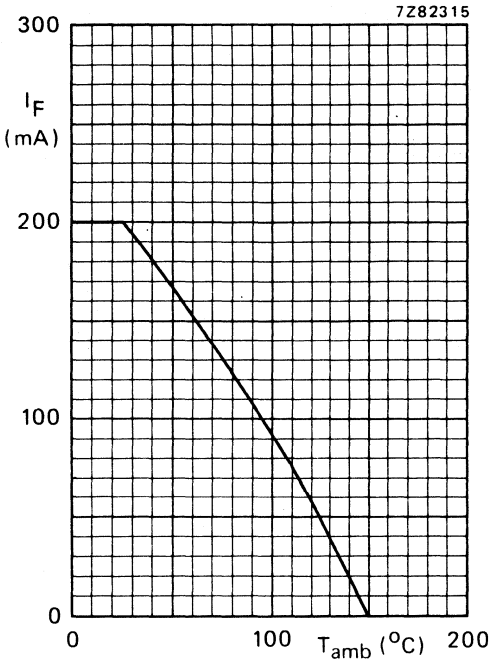


Fig. 8.

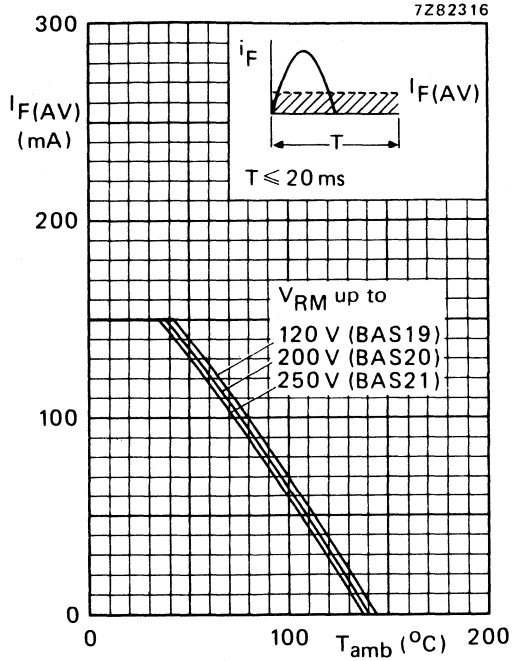


Fig. 9.

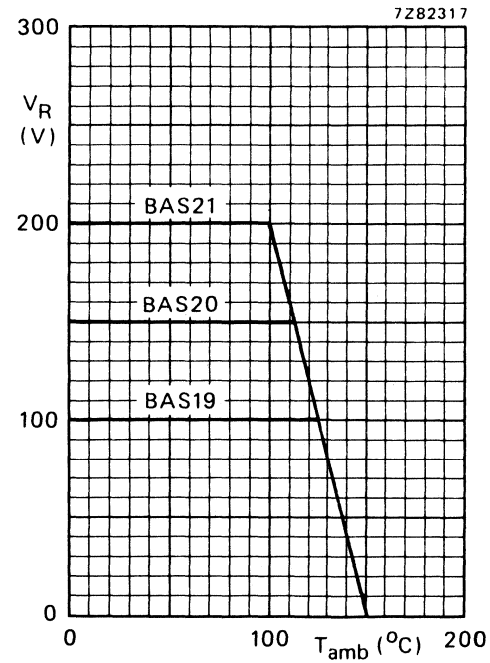


Fig. 10.

Fig. 8 Maximum permissible continuous forward current as a function of the ambient temperature.

Fig. 9 Maximum permissible average rectified forward current as a function of the ambient temperature.

Fig. 10 Maximum permissible continuous reverse voltage as a function of the ambient temperature.

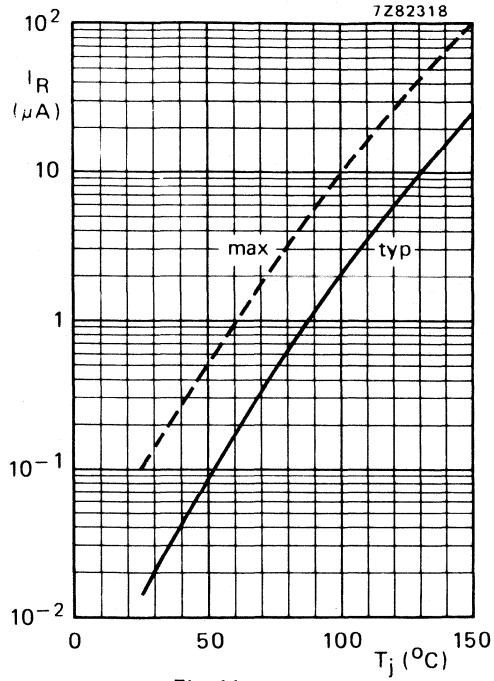


Fig. 11.

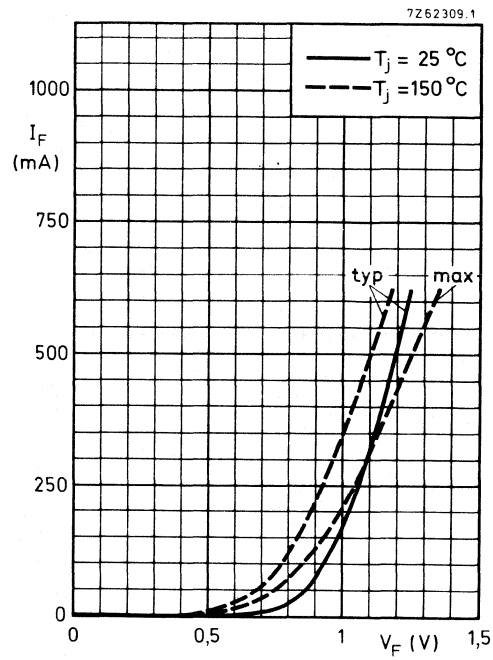


Fig. 12.

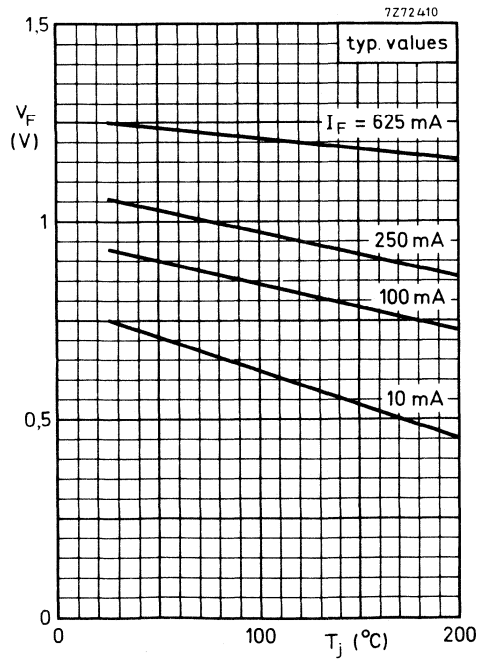


Fig. 13.

Fig. 11 Continuous reverse current as a function of the junction temperature.

Fig. 12 Forward current as a function of forward voltage.

Fig. 13 Forward voltage as a function of the junction temperature.

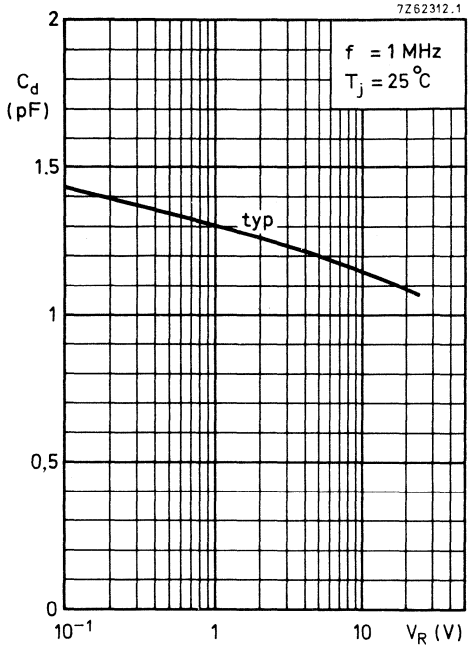

7Z62312.1
f = 1 MHz
T_j = 25 °C
C_d (pF)
2
1.5
1
0,5
0
typ
10^{-1}
1
10
V_R (V)

Fig. 14.

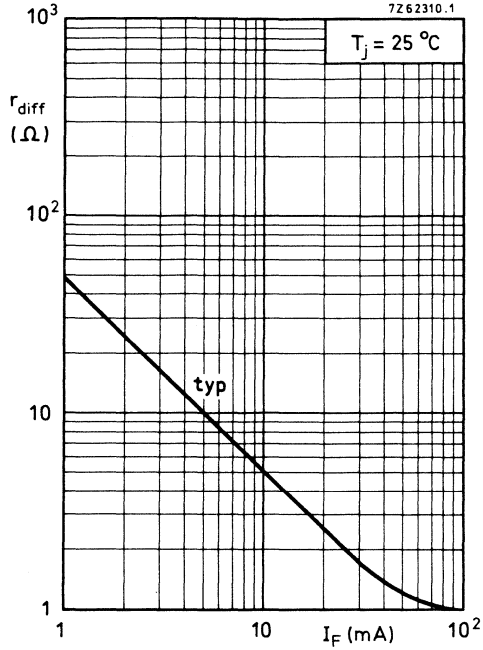

7Z62310.1
T_j = 25 °C
r_{diff} (Ω)
10^3
10^2
10
1
typ
1
10
I_F (mA)
10^2

Fig. 15.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

The BAS28 consists of two separate diodes in one microminiature envelope intended for surface mounting.

It concerns fast-switching general-purpose diodes.

QUICK REFERENCE DATA

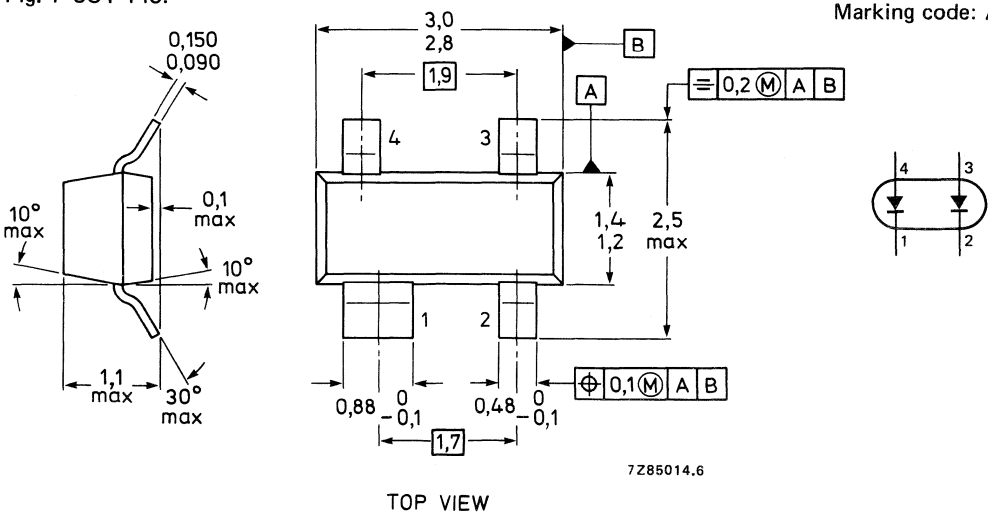
Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	85 V
Repetitive peak forward current	I_{FRM}	max.	250 mA
Junction temperature	T_j	max.	150 °C
Forward voltage at I_F = 50 mA	V_F	<	1,0 V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω, measured at I_R = 1 mA	t_{rr}	<	6 ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code: A61



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	85 V
Average rectified forward current* (averaged over any 20 ms period) up to T_{amb} = 25 °C	$I_{F(AV)}$	max.	250 mA
Forward current (DC)	I_F	max.	250 mA
Repetitive peak forward current	I_{FRM}	max.	250 mA
Non-repetitive peak forward current (per crystal)			
t = 1 μs	I_{FSM}	max.	2 A
t = 1 ms	I_{FSM}	max.	1 A
t = 1 s	I_{FSM}	max.	0,5 A
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 1 mA	V_F	<	715 mV
I_F = 10 mA	V_F	<	855 mV
I_F = 50 mA	V_F	<	1000 mV
I_F = 150 mA	V_F	<	1250 mV
Reverse current			
V_R = 25 V; T_j = 150 °C	I_R	<	30 μA
V_R = 75 V	I_R	<	1 μA
V_R = 75 V; T_j = 150 °C	I_R	<	50 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	2 pF
Forward recovery voltage (see also Fig. 2) when switched to I_F = 10 mA; t_p = 20 ns	V_{fr}	<	1,75 V
Reverse recovery time (see also Fig. 3) when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6 ns
Recovery charge (see also Fig. 4) when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

* Measured under pulse conditions. $t_p \leqslant 0{,}5$ ms. $I_{F(AV)}$ = 150 mA, $t_{(av)} \leqslant 1$ ms, for sinusoidal operation.

** See *Thermal characteristics.*

▲ Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

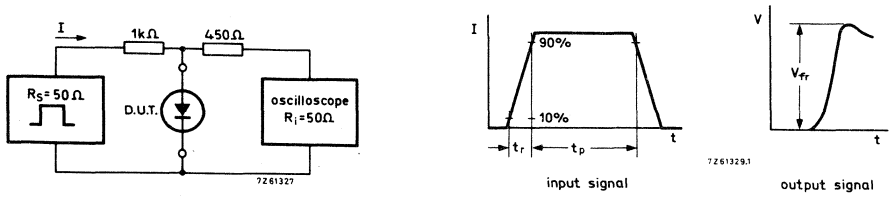


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal: forward pulse rise time = t_r = 20 ns; forward current pulse duration t_p = 120 ns; duty factor = δ = 0,01.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

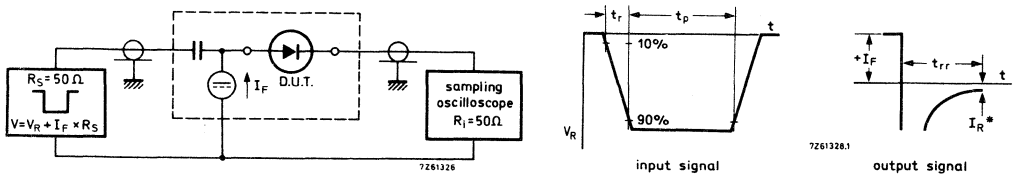


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal: reverse pulse rise time = t_r = 0,6 ns; reverse pulse duration = t_p = 100 ns; duty factor = δ = 0,05. * t_{rr} up to I_R = 1 mA.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

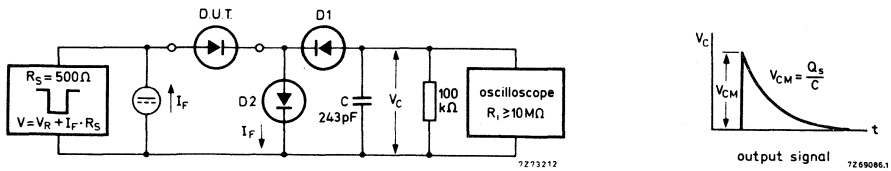


Fig. 4 Recovery charge test circuit and waveform.

D1 = BAW62; D2 = diode with minority carrier life time at 10 mA: < 200 ps
Input signal

Rise time of the reverse pulse	t_r	=	2 ns
Reverse pulse duration	t_p	=	400 ns
Duty factor	δ	=	0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

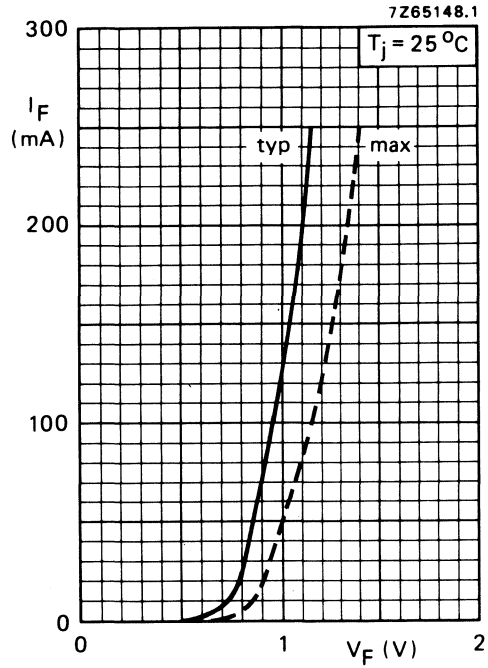


Fig. 5.

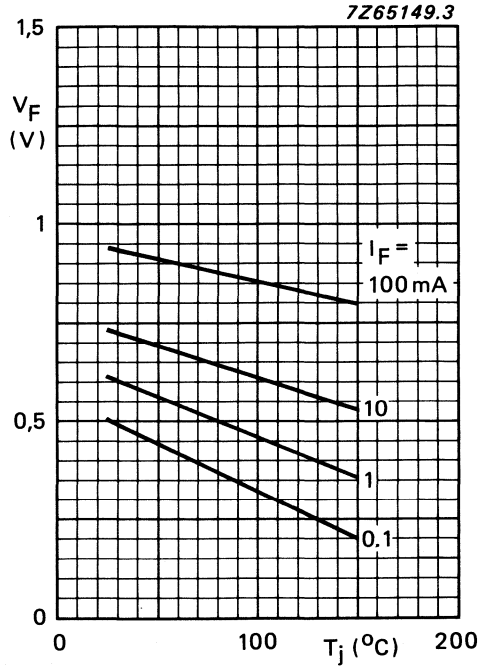


Fig. 6 Typical values.

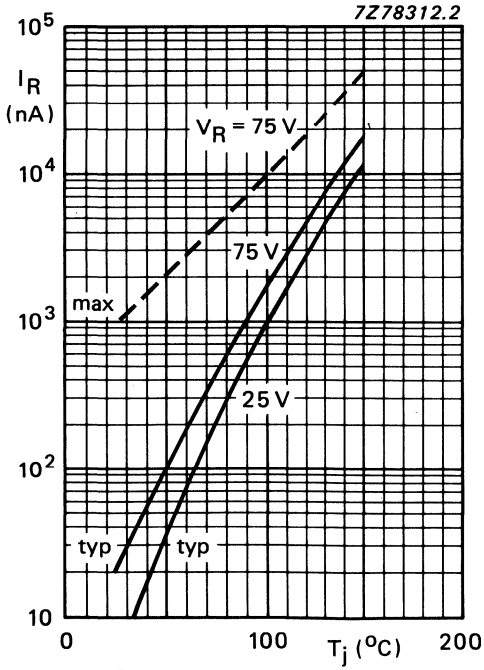


Fig. 7.

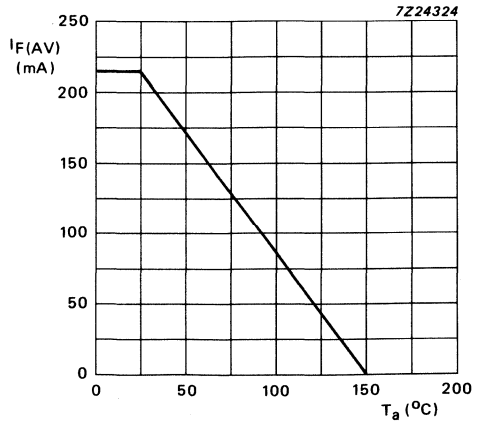


Fig. 8 Current derating curve.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAS29, BAS31 and the BAS35 are silicon planar epitaxial diodes encapsulated in a SOT-23 envelope.

The BAS29 consists of a single diode. The BAS31 has two diodes in series and the BAS35 has two diodes with a common anode. All diodes are designed for switching inductive loads in semi-electronic telephone exchanges.

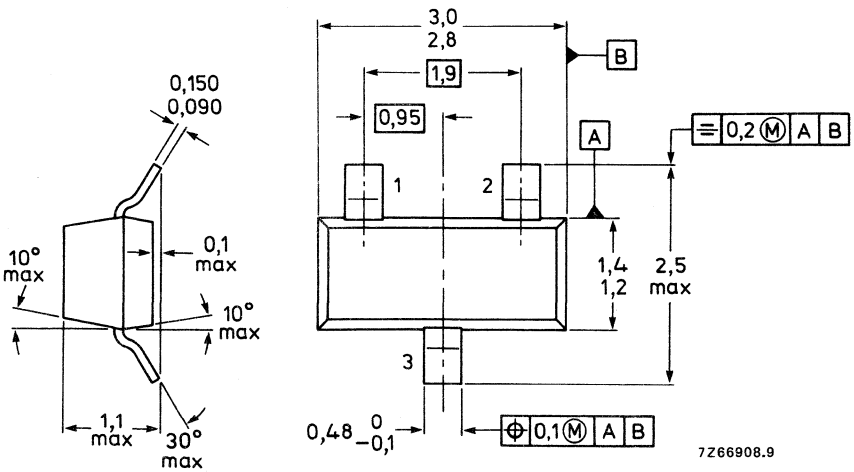
QUICK REFERENCE DATA (per diode)

Continuous reverse voltage	V_R	max.	90 V
Repetitive peak forward current	I_{FRM}	max.	600 mA
Forward current	I_F	max.	250 mA
Junction temperature	T_j	max.	150 °C
Forward voltage at I_F = 50 mA	V_F	<	0,84 V
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	t_{rr}	<	50 ns

MECHANICAL DATA

Fig. 1 SOT-23.

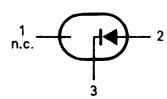
Dimensions in mm



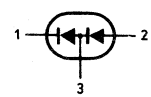
TOP VIEW

Marking code:

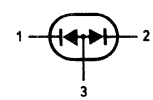
BAS29 = L20
BAS31 = L21
BAS35 = L22



BAS29



BAS31



BAS35

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	90 V
Repetitive peak forward current	I_{FRM}	max.	600 mA
Repetitive peak reverse current	I_{RRM}	max.	600 mA
Average rectified forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	250 mA
Non-repetitive peak forward current			
$t = 1\ \mu s$; $T_j = 25\ ^oC$ prior to surge; per crystal	I_{FSM}	max.	3 A
$t = 1$ s; $T_j = 25\ ^oC$ prior to surge; per crystal			0,75 A
Forward current (DC)	I_F	max.	250 mA
Repetitive peak reverse energy $t_p \geqslant 50\ \mu s$; $f \leqslant 20$ Hz; $T_j = 25\ ^oC$	E_{RRM}	max.	5,0 mJ
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS (per diode)

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	<	0,75 V
I_F = 50 mA	V_F	<	0,84 V
I_F = 100 mA	V_F	<	0,90 V
I_F = 200 mA	V_F	<	1,00 V
I_F = 400 mA	V_F	<	1,25 V
Reverse current			
V_R = 90 V	I_R	<	100 nA
V_R = 90 V; T_j = 150 °C	I_R	<	100 μA
Reverse avalanche breakdown voltage I_R = 1 mA	$V_{(BR)R}$		120 to 175 V
Diode capacitance $V_R = 0$; $f = 1$ MHz	C_d	<	35 pF
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; $R_L = 100\ \Omega$; measured at I_R = 3 mA	t_{rr}	<	50 ns

* See Thermal Characteristics.

** When mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

HIGH-SPEED SILICON DIODE FOR SURFACE MOUNTING

The BAS32 is a planar epitaxial high-speed diode designed for fast logic applications.

This SM diode is a leadless diode in a hermetically sealed SOD-80 envelope with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

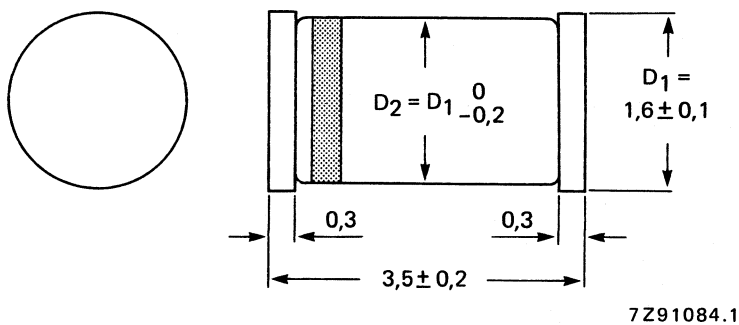
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	75 V
Repetitive peak forward current	I_{FRM}	max.	450 mA
Junction temperature	T_j	max.	200 °C
Forward voltage I_F = 100 mA	V_F	<	1 V
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	t_{rr}	<	4 ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



Cathode indicated by black band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V*
Average rectified forward current	$I_{F(AV)}$	max.	150	mA**
Forward current (d.c.)	I_F	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current				
$t = 1\ \mu s$	I_{FSM}	max.	2000	mA
$t = 1\ s$	I_{FSM}	max.	500	mA
Storage temperature	T_{stg}	−65 to +	200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,6	K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltages				
$I_F = 5$ mA	V_F	0,62 to	0,75	V
$I_F = 100$ mA	V_F	<	1,00	V
$I_F = 100$ mA; $T_j = 100$ °C	V_F	<	0,93	V
Reverse currents				
$V_R = 20$ V	I_R	<	25	nA
$V_R = 20$ V; $T_j = 150$ °C	I_R	<	50	μA
$V_R = 75$ V	I_R	<	5	μA
$V_R = 75$ V; $T_j = 150$ °C	I_R	<	100	μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz	C_d	<	2	pF
Forward recovery voltage when switched to				
$I_F = 50$ mA; $t_r = 20$ ns	V_{fr}	<	2,5	V

* Measured at zero life time at $I_R = 100\ \mu A$; $V_R > 100$ V.

** For sinusoidal operation see Fig. 6. For pulse operation see Figs 4 and 5.

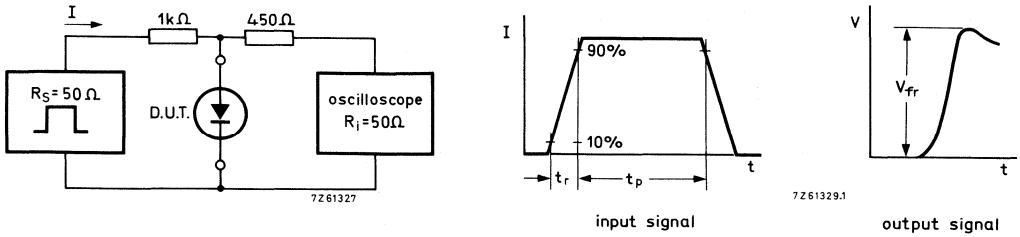


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal : Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns
Duty factor δ = 0,01

Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

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 t_{rr} < 4 ns

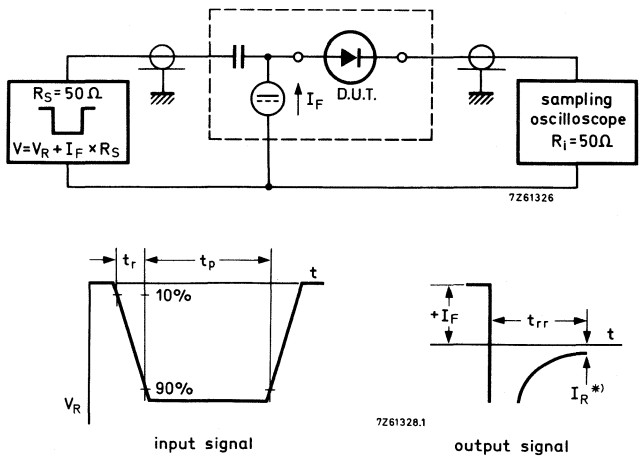


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal : Rise time of the reverse pulse t_r = 0,6 ns
Reverse pulse duration t_p = 100 ns
Duty factor δ = 0,05

* I_R = 1 mA

Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

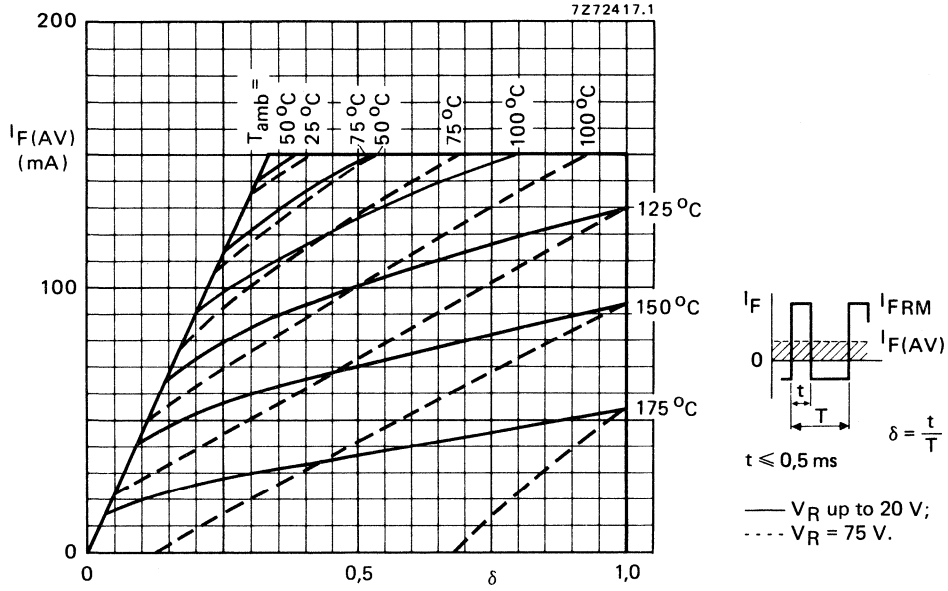


Fig. 4 Maximum permissible average rectified forward current versus duty factor (pulse operated).

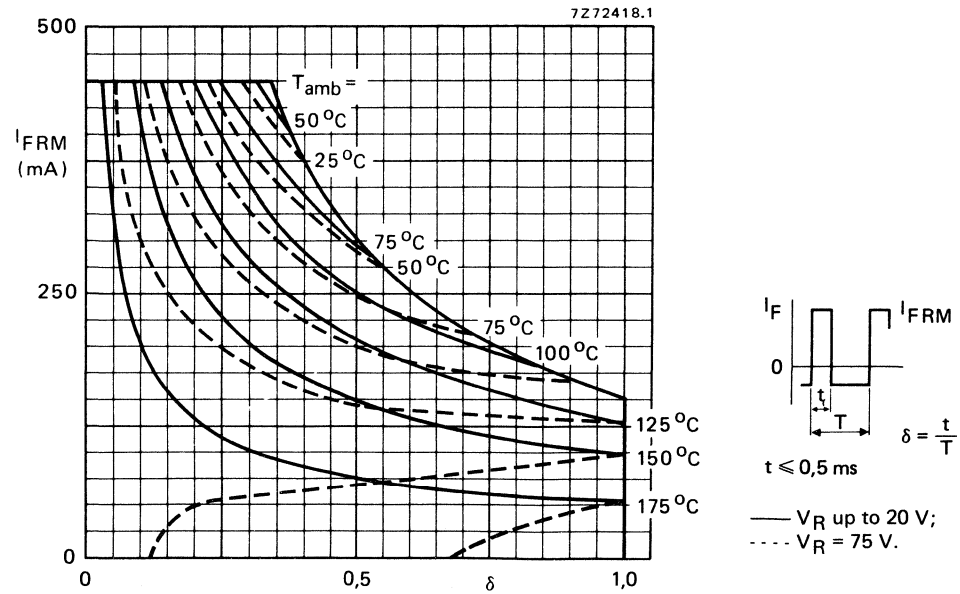


Fig. 5 Maximum permissible repetitive peak forward current versus duty factor (pulse operated).

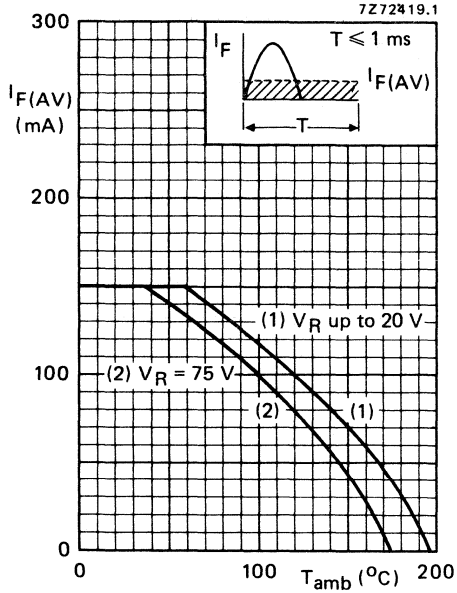


Fig. 6 Maximum permissible average rectified forward current versus ambient temperature.

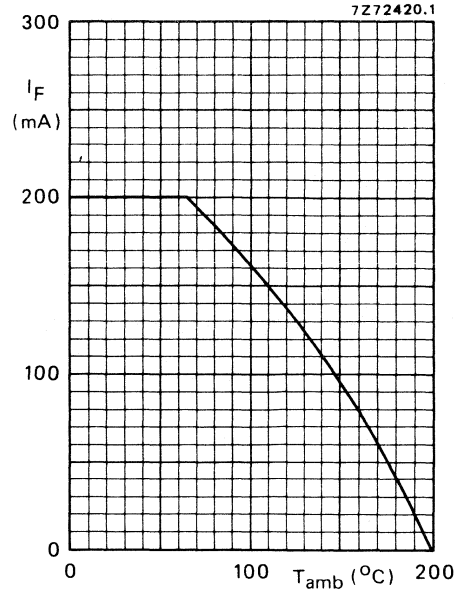


Fig. 7 Maximum permissible continuous forward current versus ambient temperature.

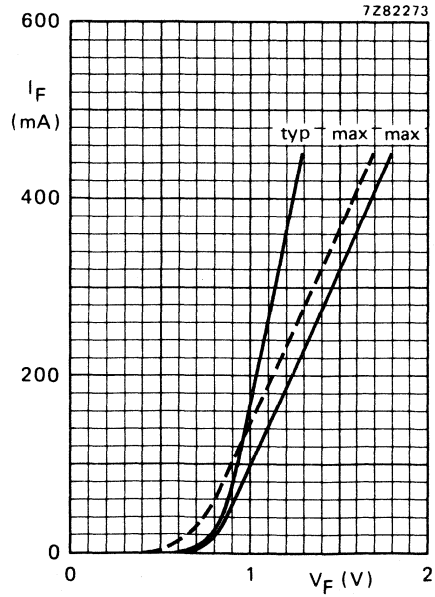


Fig. 8 Forward current versus forward voltage; —— T_j = 25 °C; – – – T_j = 175 °C.

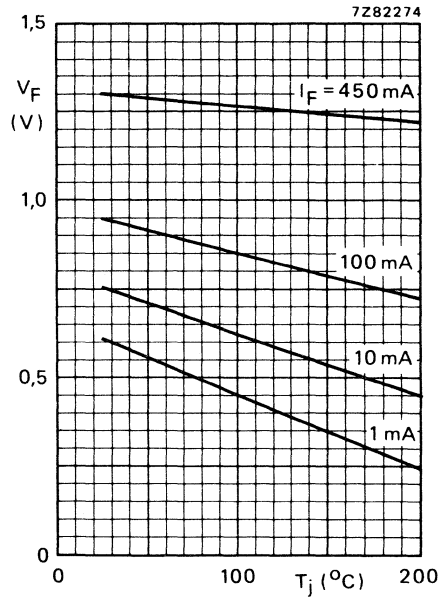


Fig. 9 Forward voltage versus junction temperature; typical values.

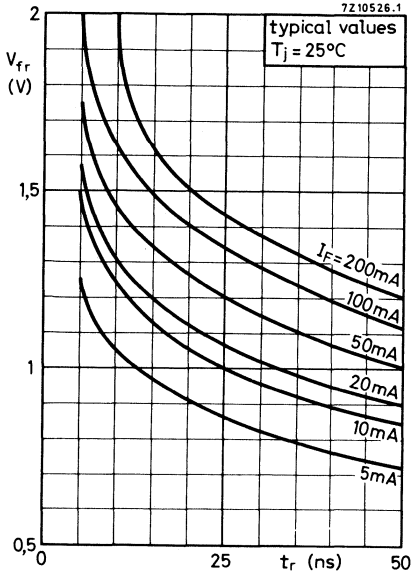


Fig. 10 Forward recovery voltage versus rise time.

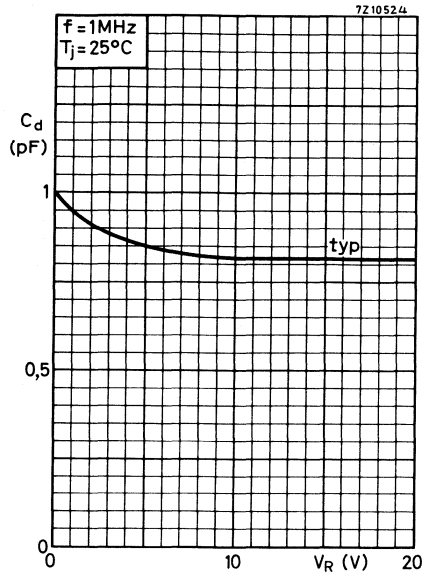


Fig. 11 Diode capacitance versus reverse voltage.

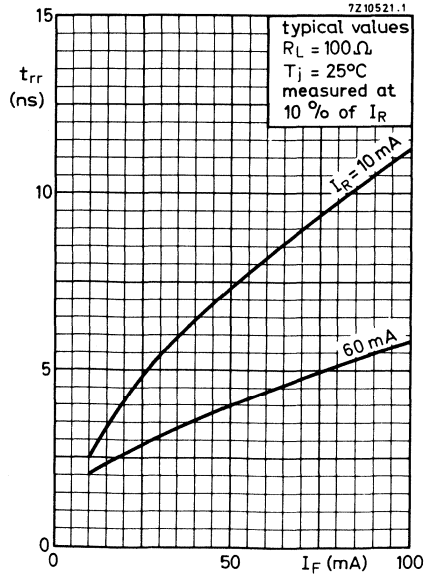


Fig. 12 Reverse recovery time versus forward current.

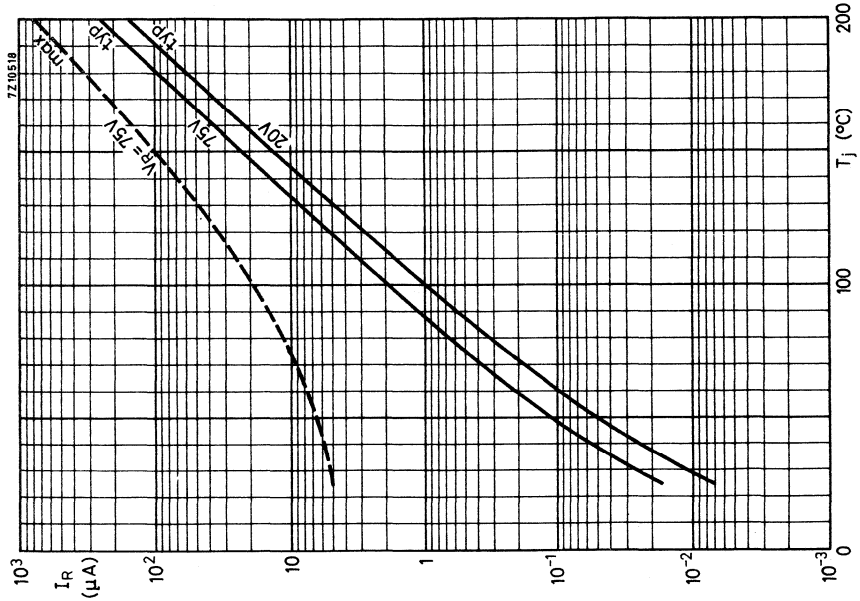


Fig. 14 Reverse current versus junction temperature.

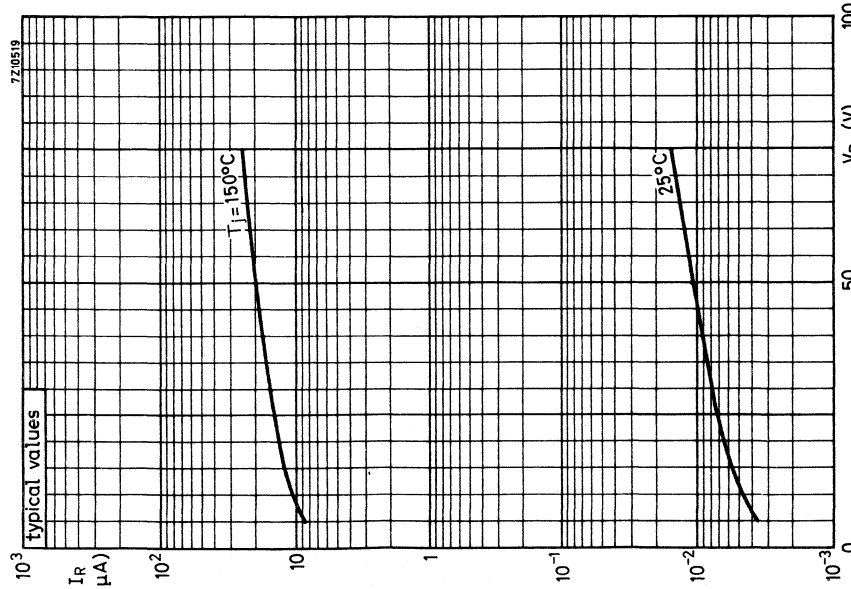


Fig. 13 Reverse current versus reverse voltage.

HIGH-SPEED SILICON DIODE FOR SURFACE MOUNTING

The BAS32L is a planar epitaxial high-speed diode designed for fast logic applications.

This SM diode is a leadless diode in a hermetically sealed SOD-80C glass envelope with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	75 V
Repetitive peak forward current	I_{FRM}	max.	450 mA
Junction temperature	T_j	max.	200 °C
Forward voltage I_F = 100 mA	V_F	<	1.0 V
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	t_{rr}	<	4.0 ns

MECHANICAL DATA

Dimensions in mm

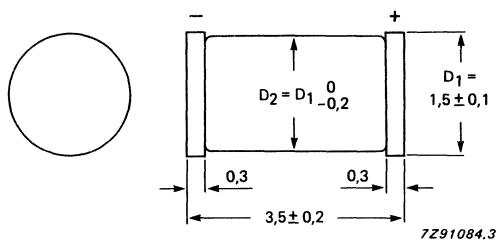


Fig. 1 SOD-80C.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Average rectified forward current *	$I_{F(AV)}$	max.	150	mA
Forward current (DC)	I_F	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current				
$t = 1\ \mu s$	I_{FSM}	max.	2000	mA
$t = 1\ s$	I_{FSM}	max.	500	mA
Storage temperature range	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.6	K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltages				
$I_F = 5$ mA	V_F		0.62 to 0.75	V
$I_F = 100$ mA	V_F	<	1.0	V
$I_F = 100$ mA; $T_j = 100$ °C	V_F	<	0.93	V
Reverse breakdown voltage				
$I_R = 100\ \mu A$	$V_{(BRR)}$	>	100	V
Reverse currents				
$V_R = 20$ V	I_R	<	25	nA
$V_R = 20$ V; $T_j = 150$ °C	I_R	<	50	μA
$V_R = 75$ V	I_R	<	5.0	μA
$V_R = 75$ V; $T_j = 150$ °C	I_R	<	100	μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz	C_d	<	2.0	pF
Forward recovery voltage when switched to				
$I_F = 50$ mA; $t_r = 20$ ns	V_{fr}	<	2.5	V

* For sinusoidal operation see Fig. 6. For pulse operation see Figs 4 and 5.

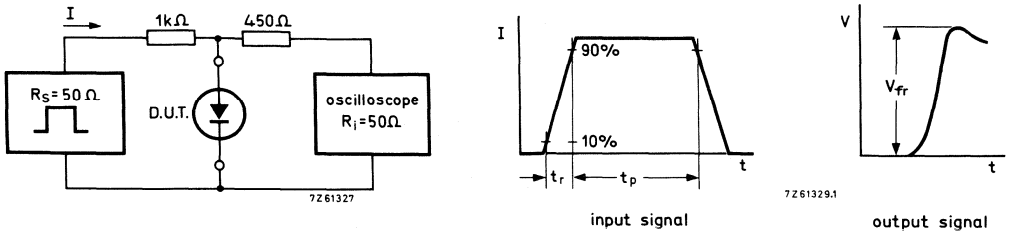


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal : Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns
Duty factor δ = 0.01

Oscilloscope: Rise time t_r = 0.35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

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 t_{rr} < 4 ns

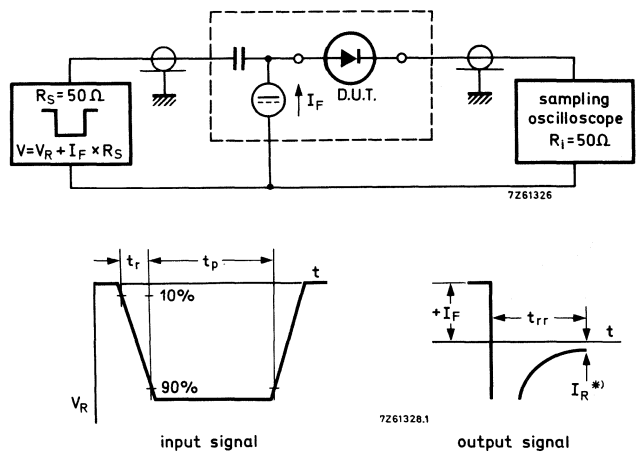


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal : Rise time of the reverse pulse t_r = 0.6 ns
Reverse pulse duration t_p = 100 ns
Duty factor δ = 0.05

* I_R = 1 mA

Oscilloscope: Rise time t_r = 0.35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

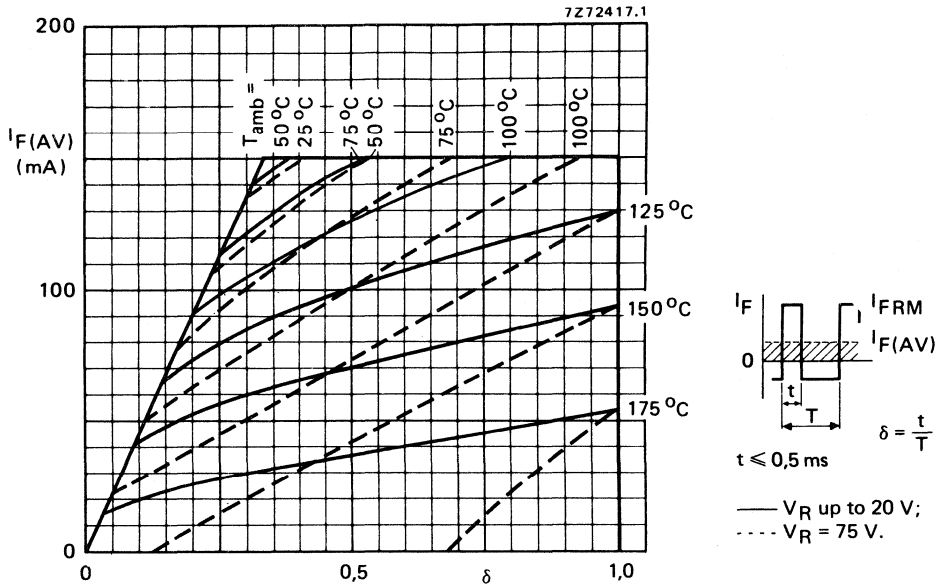


Fig. 4 Maximum permissible average rectified forward current as a function of duty factor (pulse operated).

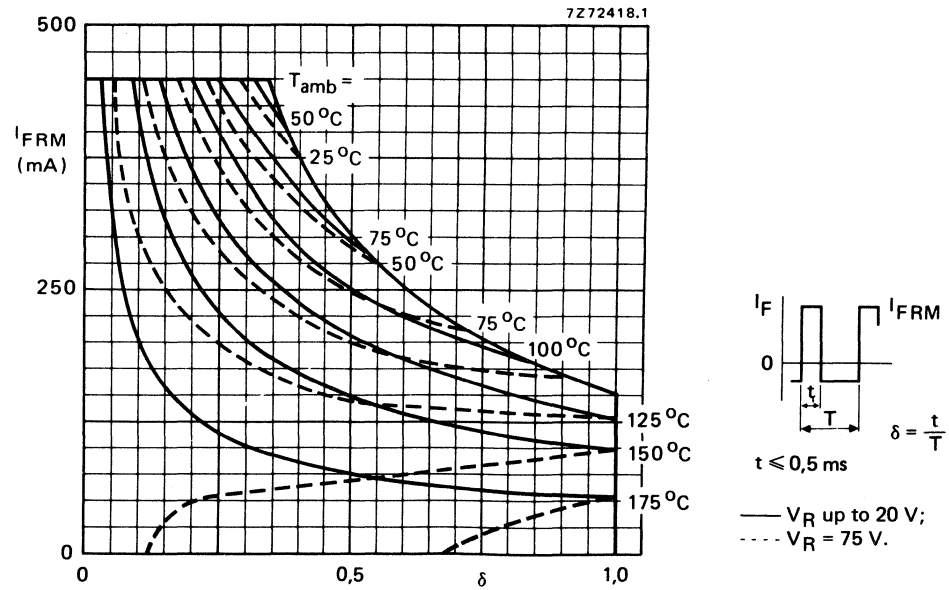


Fig. 5 Maximum permissible repetitive peak forward current as a function of duty factor (pulse operated).

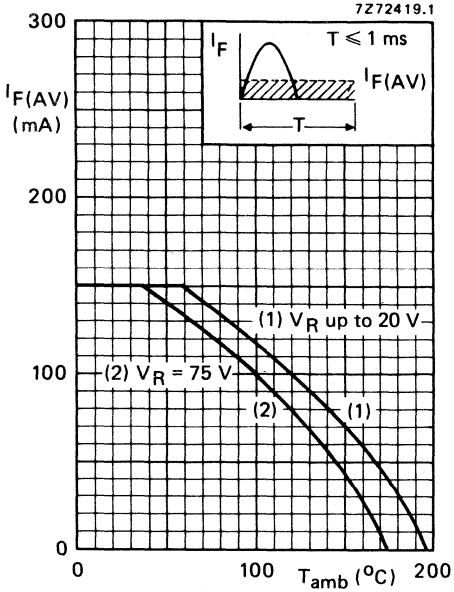


Fig. 6 Maximum permissible average rectified forward current as a function of ambient temperature.

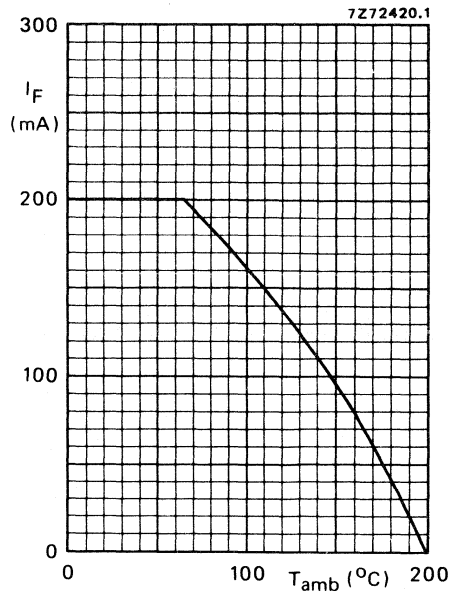


Fig. 7 Maximum permissible continuous forward current as a function of ambient temperature.

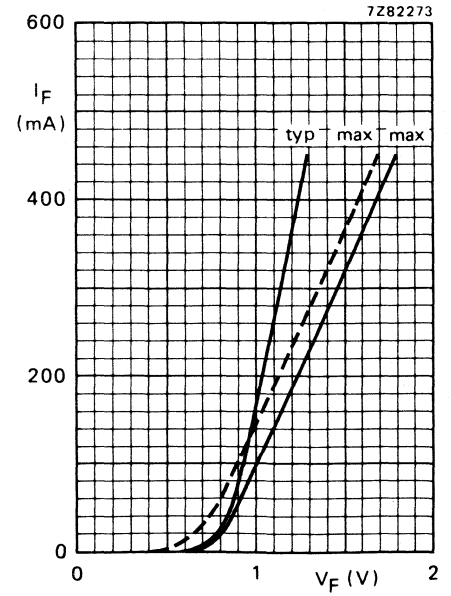


Fig. 8 Forward current as a function of forward voltage; —— T_j = 25 °C; – – – T_j = 175 °C.

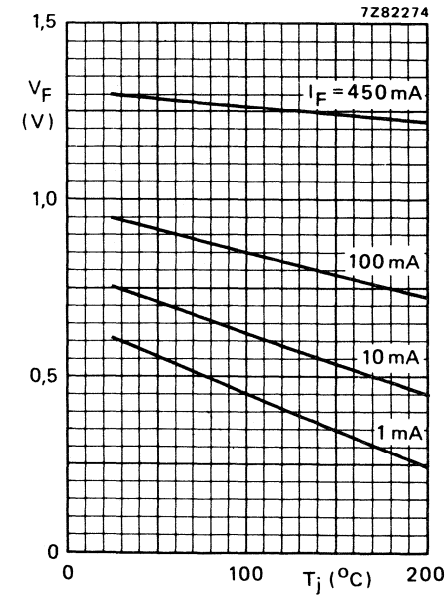


Fig. 9 Forward voltage as a function of junction temperature; typical values.

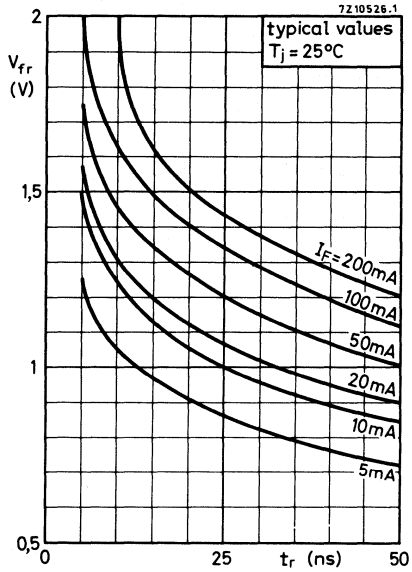


Fig. 10 Forward recovery voltage as a function of rise time.

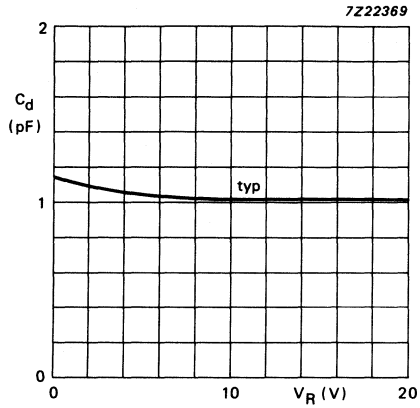


Fig. 11 Diode capacitance as a function of reverse voltage.

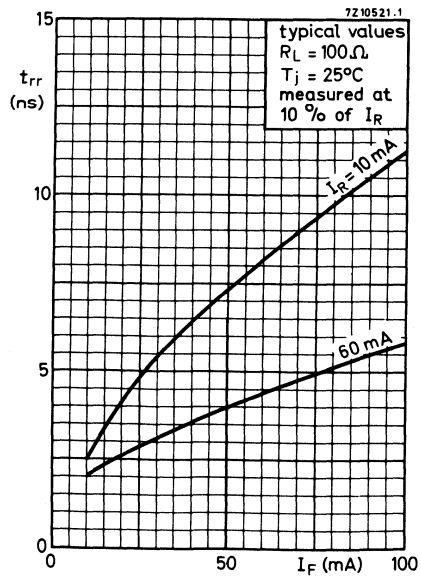


Fig. 12 Reverse recovery time as a function of forward current.

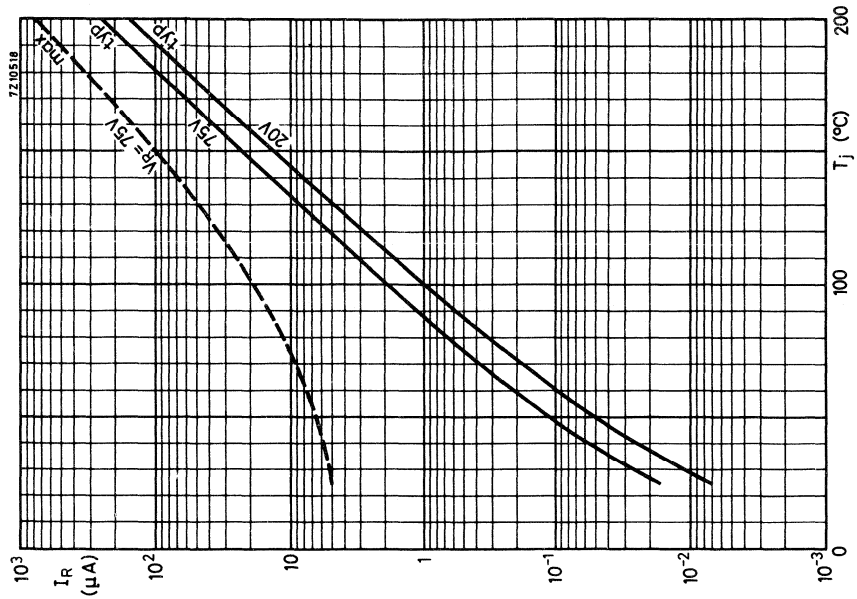


Fig. 14 Reverse current as a function of junction temperature.

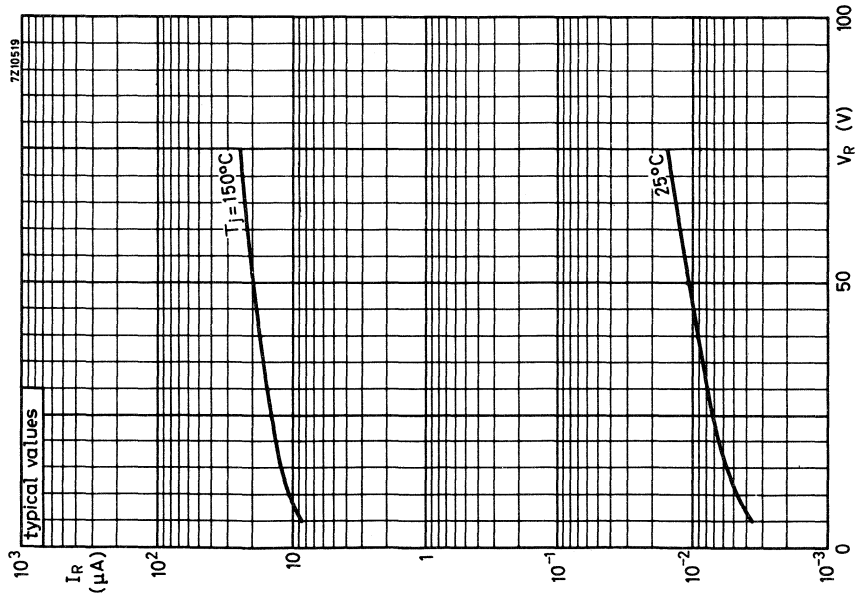


Fig. 13 Reverse current as a function of reverse voltage.

SILICON PLANAR EPITAXIAL ULTRA-HIGH SPEED DIODE

The BAS56 consists of two separate planar epitaxial ultra-high speed, high conductance diodes in one microminiature plastic envelope intended for surface mounting.

The device is primarily intended for core gating in very fast memories using the Surface Mounted Devices (SMD) technology.

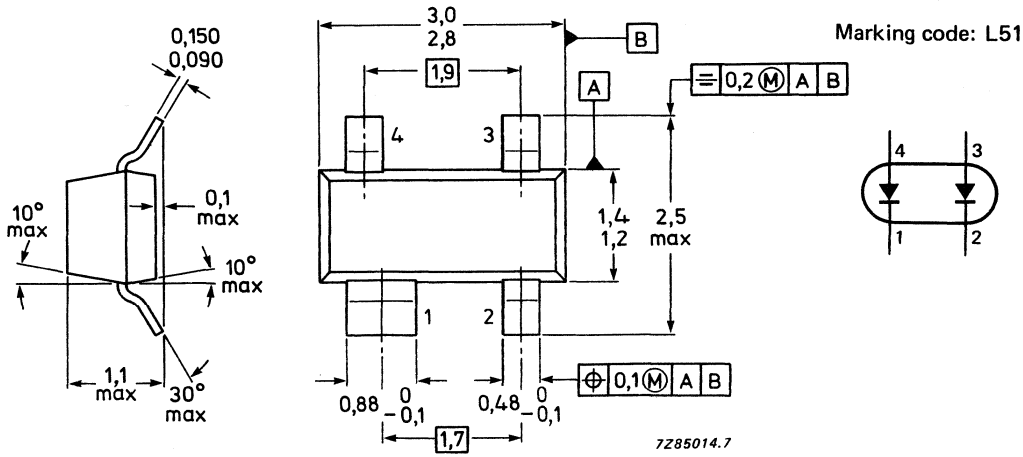
QUICK REFERENCE DATA

			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	V
Forward current	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured a. I_R = 40 mA	t_{rr}	<	6		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage*	V_{RRM}	max.	60	120	V
Forward current	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Non-repetitive peak forward current (per crystal)					
$t = 1\ \mu s$	I_{FSM}	max.	2000		mA
$t = 1\ s$	I_{FSM}	max.	500		mA
Total power dissipation**					
up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300		mW
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS, per diode

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage				
$I_F = 10$ mA	V_F	<	0,75	V
$I_F = 200$ mA	V_F	<	1,00	V
$I_F = 200$ mA; $T_j = 100\ ^oC$	V_F	<	0,95	V
$I_F = 500$ mA	V_F	<	1,25	V
Reverse current				
$V_R = 60$ V	I_R	<	100	nA
$V_R = 60$ V; $T_j = 150\ ^oC$	I_R	<	100	μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz	C_d	<	2,5	pF

* Measured at zero life time at $I_R = 10\ \mu A$; $V_R = 75$ V.

** Mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm.

Forward recovery voltage when switched to

I_F = 400 mA; t_r1 = 30 ns	V_{fr}	<	120	V
I_F = 400 mA; t_r2 = 100 ns	V_{fr}	<	1,5	V

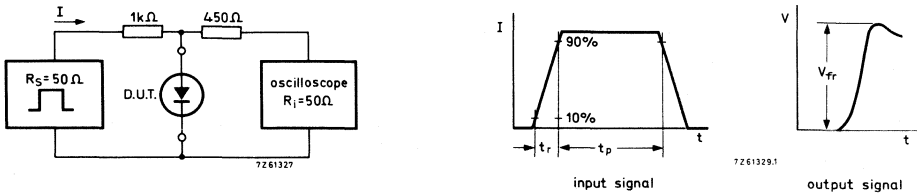


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal:	1st rise time of the forward pulse	t_r1	=	30	ns
	2nd rise time of the forward pulse	t_r2	=	100	ns
	Forward current pulse duration	t_p	=	300	ns
	Duty factor	δ	=	0,01	
Oscilloscope:	Rise time	t_r	=	0,35	ns
	Input capacitance	C_i	≤	1	pF

Circuit capacitance C ≤ 20 pF (C = C_i + parasitic capacitance)

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 t_{rr} < 6 ns

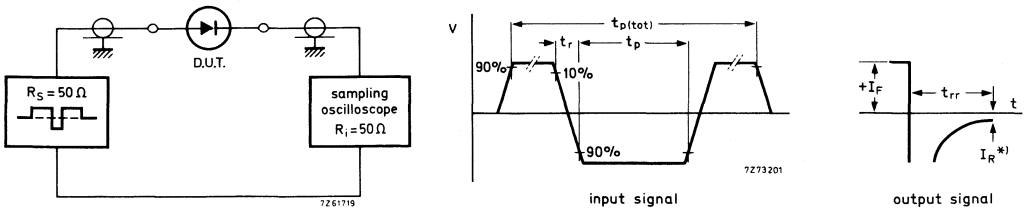


Fig. 3 Test circuits and waveforms; reverse recovery time. *I_R = 40 mA

Input signal:	Total pulse duration	$t_{p(tot)}$	=	0,2	μs
	Duty factor	δ	=	0,0025	
	Rise time of the reverse pulse	t_r	=	0,6	ns
	Reverse pulse duration	t_p	=	30	ns
Oscilloscope:	Rise time	t_r	=	0,35	ns

Circuit capacitance C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	50	pC

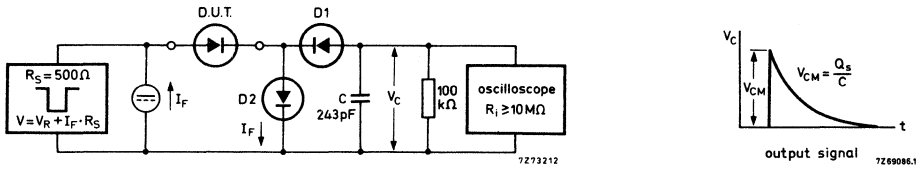


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

D2 = diode with minority carrier life time at 10 mA		<	200	ps
Input signal: Rise time of the reverse pulse	t_r	=	2	ns
Reverse pulse duration	t_p	=	400	ns
Duty factor	δ	=	0,02	

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

SCHOTTKY BARRIER DIODE

Schottky Barrier diode with an integrated protection ring against extremely high static discharges.

This diode, in a SOD-80 envelope, is intended for applications where a very low forward voltage is required.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Forward current (d.c.)	I_F	max.	200 mA
Peak forward current	I_{FM}	max.	300 mA
Junction temperature	T_j	max.	125 °C
Forward voltage I_F = 10 mA	V_F	<	400 mV
Diode capacitance	C_d	<	10 pF

MECHANICAL DATA

Dimensions in mm

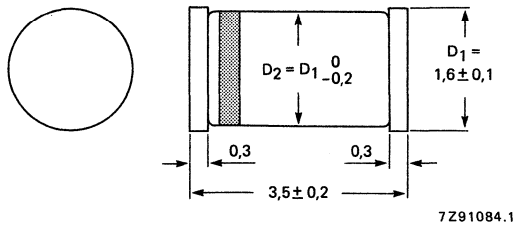


Fig. 1 SOD-80.

The cathode is indicated by a grey band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Forward current			
d.c.	I_F	max.	200 mA
peak value	I_{FM}	max.	300 mA
peak value; $t_p < 1$ s		max.	600 mA
Average rectified forward current (see Fig. 2)	$I_{F(AV)}$	max.	200 mA
Storage temperature	T_{stg}	−65 to + 150	°C
Junction temperature	T_j	max.	125 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage*			
I_F = 0,1 mA	V_F	<	240 mV
I_F = 1 mA		<	320 mV
I_F = 10 mA	V_F	<	400 mV
I_F = 30 mA		<	500 mV
I_F = 100 mA	V_F	typ.	500 mV
		max.	800 mV
Reverse current			
V_R = 25 V	I_R	<	2,0 μA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	>	30 V
Diode capacitance			
V_R = 1 V; f = 1 MHz	C_d	<	10 pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 measured at I_R = 1 mA	t_{rr}	<	5,0 ns

* Temperature coefficient

I_F = 1 mA	S_F	typ.	−0,2 %/K
I_F = 15 mA		typ.	−0,04 %/K

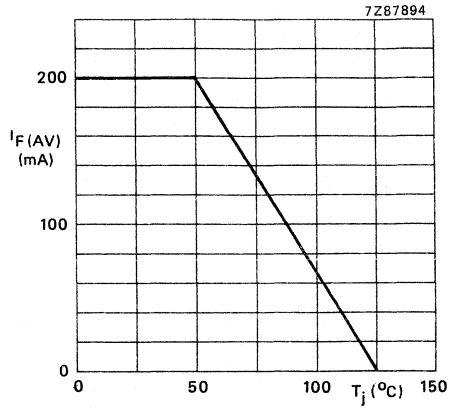


Fig. 2 Power derating curve; typical values.

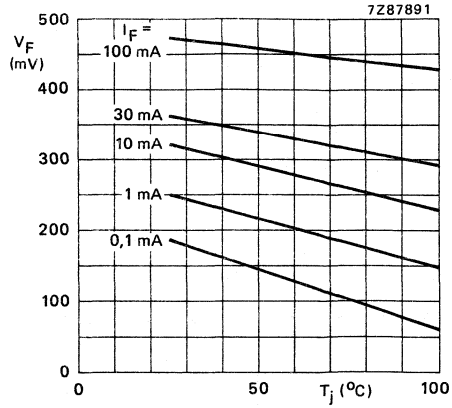


Fig. 3 Forward voltage as a function of temperature; typical values.

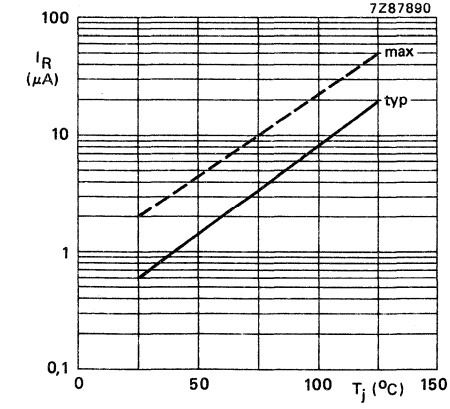


Fig. 4 Reverse current as a function of temperature; V_R = 25 V; typical values.

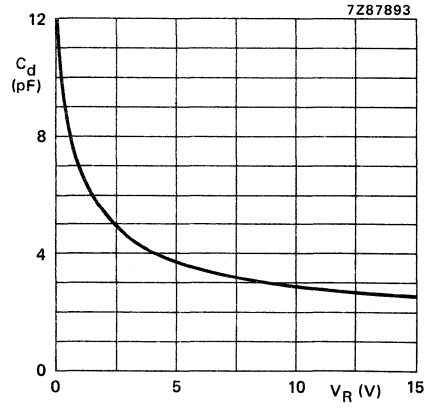


Fig. 5 Diode capacitance as a function of reverse voltage; f = 1 MHz; typical values.

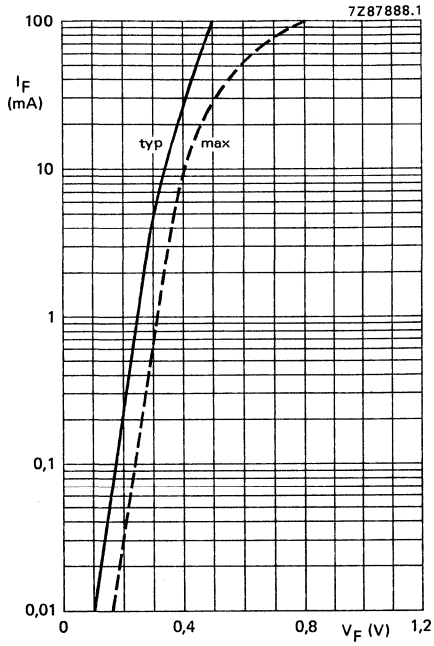


Fig. 6 Forward current as a function of forward voltage.

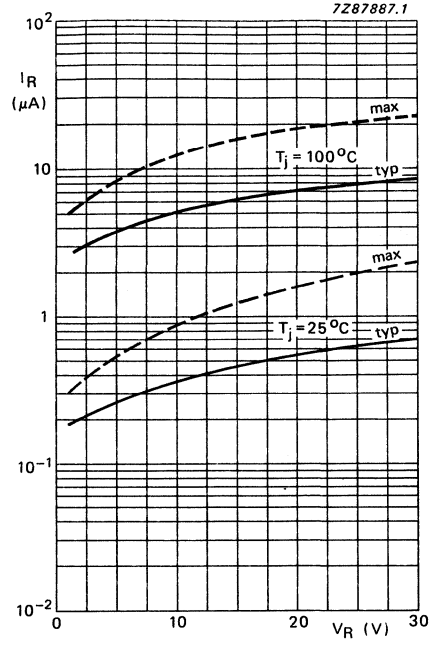


Fig. 7 Reverse current as a function of reverse voltage.

SCHOTTKY BARRIER DIODE

Silicon epitaxial diode in a microminiature plastic envelope. Intended for u.h.f. mixer and fast switching applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	4 V
Forward current (d.c.)	I_F	max.	30 mA
Junction temperature	T_j	max.	100 °C
Forward voltage at I_F = 10 mA	V_F	<	600 mV
Diode capacitance at V_R = 0; f = 1 MHz	C_d	<	1,0 pF
Noise figure at f = 900 MHz	F	<	8,0 dB

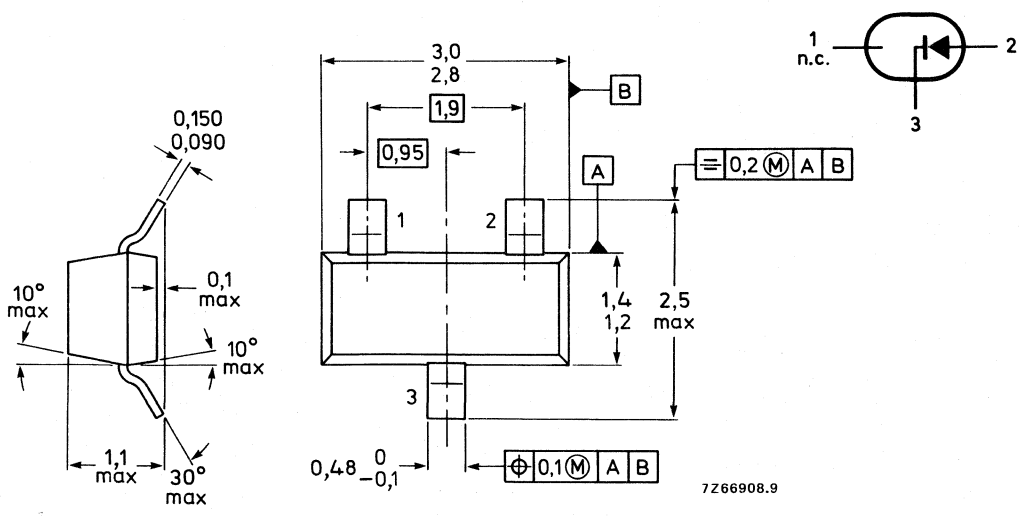
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-23.

Marking code

BAT17 = A3



TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	4 V
Forward current (d.c.) **	I_F	max.	30 mA
Storage temperature	T_{stg}	−65 to +100	°C
Junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 3 V	I_R	<	0,25 μA
V_R = 3 V; T_{amb} = 60 °C	I_R	<	1,25 μA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	>	4 V
Forward voltage			
I_F = 0,1 mA	V_F	<	350 mV
I_F = 1,0 mA	V_F	<	450 mV
I_F = 10 mA	V_F	<	600 mV
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	1,0 pF
Noise figure at f = 900 MHz ▲	F	<	8,0 dB
Series resistance at f = 1 kHz			
I_F = 5 mA	r_D	<	15 Ω

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ The local oscillator is adjusted for a diode current of 2 mA. I.F. amplifier noise F_{if} = 1,5 dB; f = 35 MHz.

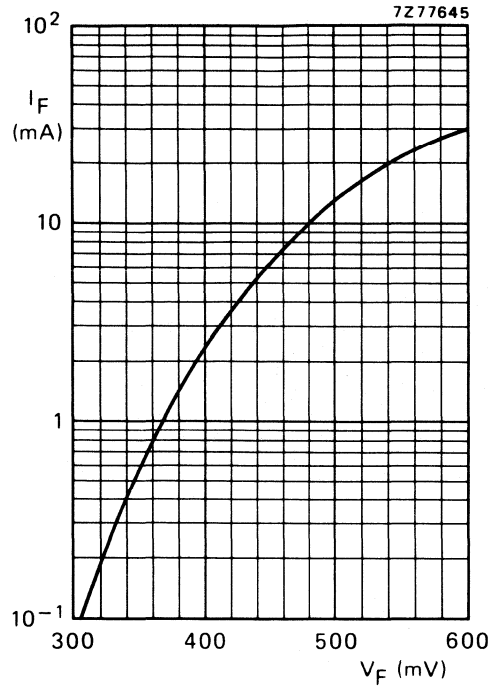


Fig. 2 Typical values.

SILICON PLANAR DIODE

Band switching diode in a microminiature plastic envelope. Intended for thick and thin-film circuits.

QUICK REFERENCE DATA

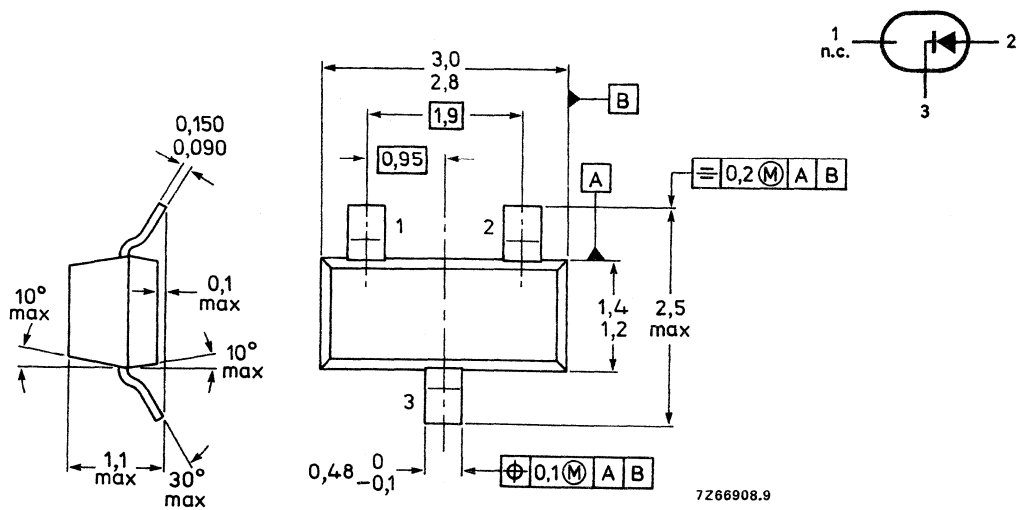
Continuous reverse voltage	V_R	max.	35 V
Forward current (d.c.)	I_F	max.	100 mA
Junction temperature	T_j	max.	100 °C
Diode capacitance at f = 1 MHz V_R = 20 V	C_d	typ. <	0,8 pF 1,0 pF
Series resistance at f = 200 MHz I_F = 5 mA	r_D	typ. <	0,5 Ω 0,7 Ω

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAT18 = A2



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	35 V
Forward current (d.c.)	I_F	max.	100 mA
Storage temperature	T_{stg}	−55 to + 125	°C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage at I_F = 100 mA	V_F	<	1,2 V
Reverse current			
V_R = 20 V	I_R	<	100 nA
V_R = 20 V; T_j = 60 °C	I_R	<	1 μA
Diode capacitance at f = 1 MHz			
V_R = 20 V	C_d	typ. <	0,8 pF 1,0 pF
Series resistance at f = 200 MHz			
I_F = 5 mA	r_D	typ. <	0,5 Ω 0,7 Ω

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

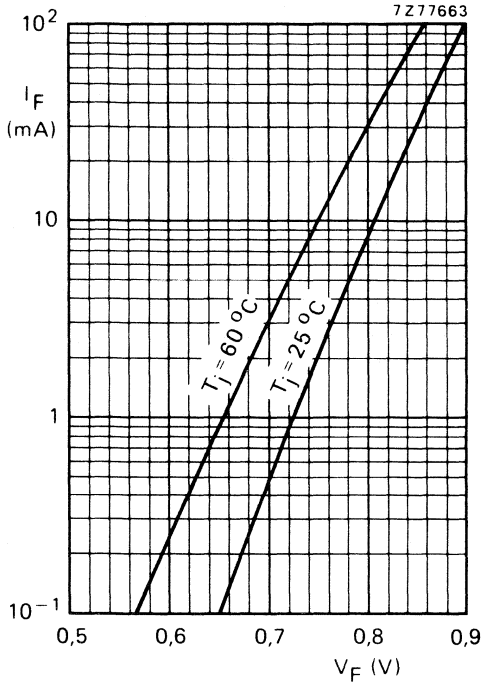


Fig. 2 Typical values.

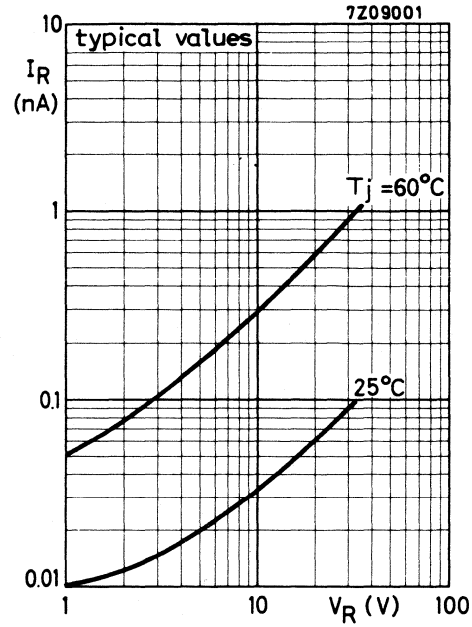


Fig. 3.

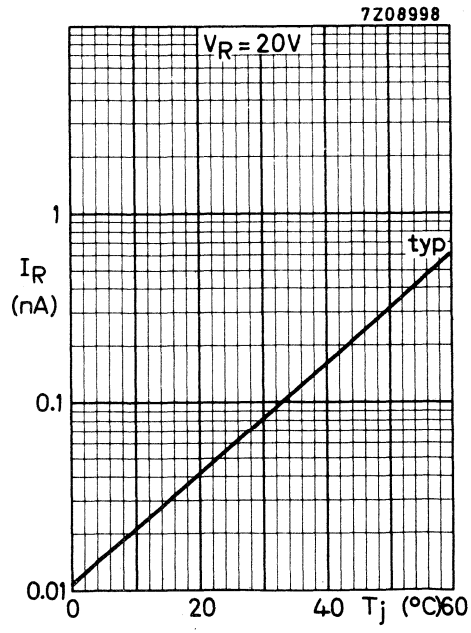


Fig. 4.

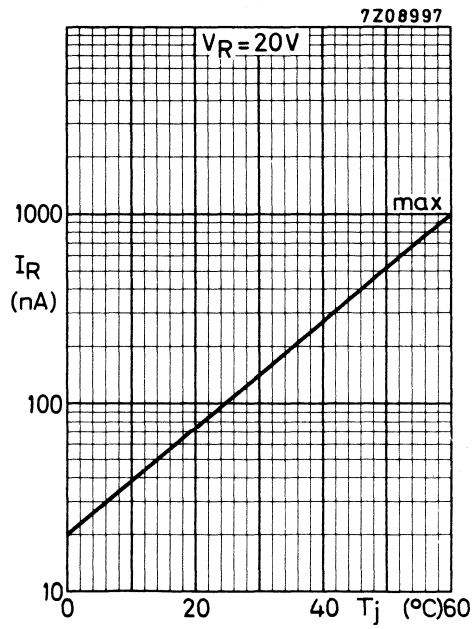


Fig. 5.

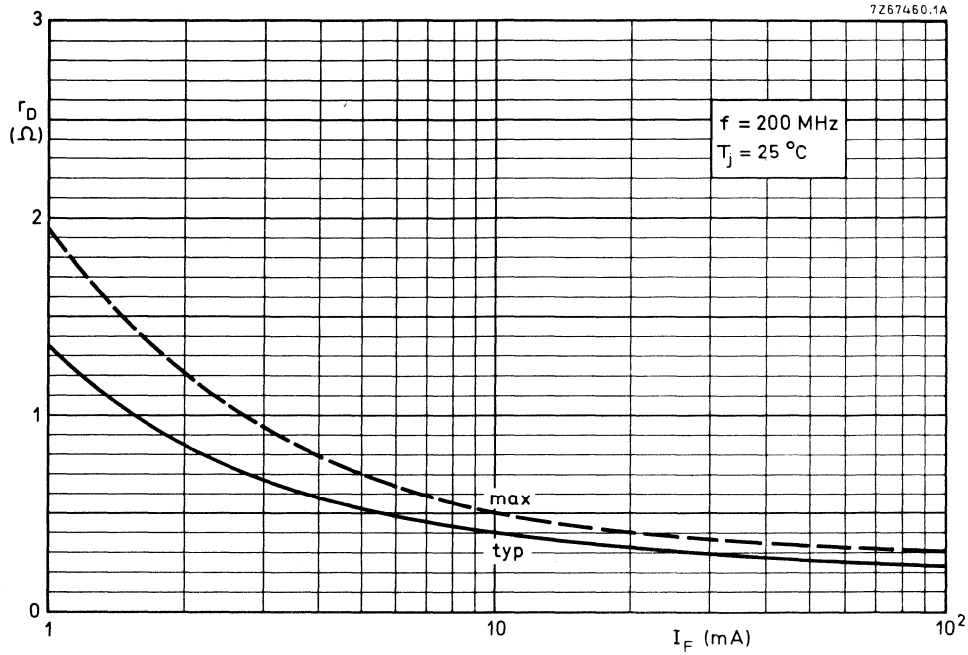


Fig. 6.

SCHOTTKY BARRIER DIODE

Silicon epitaxial Schottky barrier diode with an integrated p-n junction protection ring in a micro-miniature SOT-23 envelope intended for surface mounting.

The diode features especially a low forward voltage.

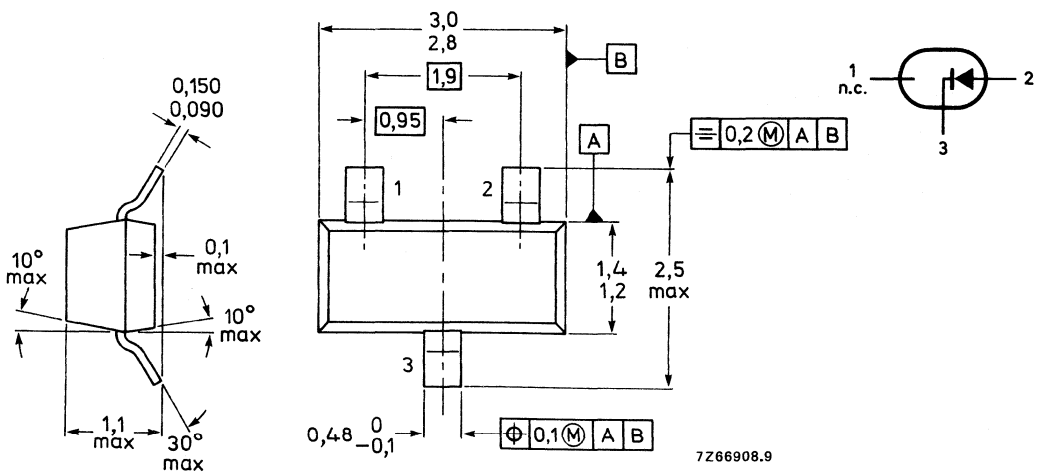
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.)	I_F	max.	200	mA
Forward voltage at I_F = 10 mA	V_F	max.	400	mV
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230	mW
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	t_{rr}	⩽	5	ns
Junction temperature	T_j	max.	125	°C

Fig. 1 SOT-23

Dimensions in mm

Marking code: L4



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.) see Fig. 2	I_F	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	300	mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	230	mW
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Forward voltage				
$I_F = 0{,}1$ mA	V_F	≤	240	mV
$I_F = 1$ mA*	V_F	≤	320	mV
$I_F = 10$ mA	V_F	≤	400	mV
$I_F = 30$ mA*	V_F	≤	500	mV
$I_F = 100$ mA	V_F	=	500	mV
	V_F	<	1000	mV
Reverse current				
$V_R = 25$ V	I_R	≤	2	μA
Reverse breakdown voltage	$V_{(BR)R}$	>	30	V
Diode capacitance				
$V_R = 1$ V; $f = 1$ MHz	C_d	≤	10	pF
Reverse recovery time when switched from $I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	≤	5	ns

* Temperature coefficient of forward voltage:
−0,6 %/K at $I_F = 1$ mA
−0,3 %/K at $I_F = 30$ mA

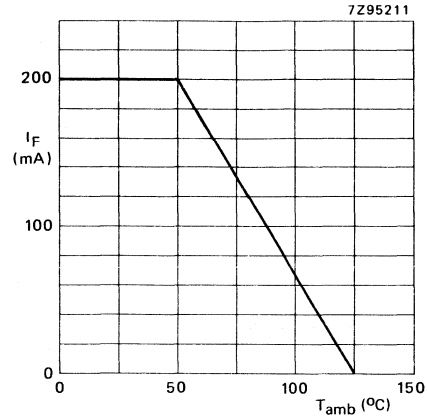


Fig. 2 Derating curve maximum ambient temperature.

SCHOTTKY BARRIER DIODE

Silicon epitaxial Schottky Barrier double diodes with an integrated p-n junction protection ring in a microminiature SOT-23 envelope intended for surface mounting.

The diodes feature an especially low forward voltage.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Forward current (DC)	I_F	max.	200 mA
Forward voltage at I_F = 10 mA	V_F	max.	400 mV
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100; measured at I_R = 1 mA	t_{rr}	<	5 ns
Junction temperature	T_j	max.	125 °C

Dimensions in mm

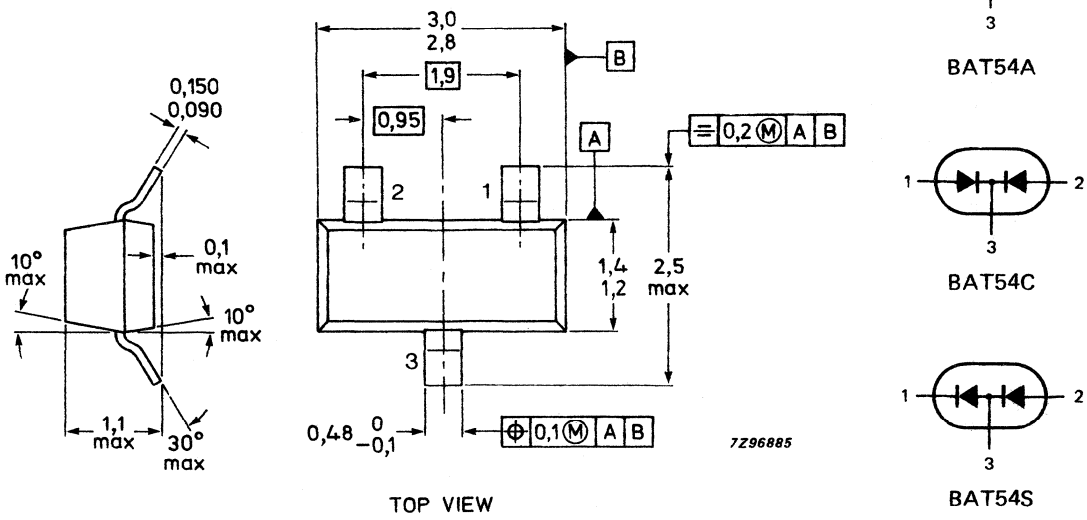


Fig. 1 SOT-23.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak reverse voltage	V_{RRM}	max.	30 V
Forward current (DC)	I_F	max.	200 mA
Repetitive peak forward current	I_{FRM}	max.	300 mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600 mA
Storage temperature	T_{stg}	−50 to + 150	°C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient; mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage			
I_F = 0,1 mA	V_F	max.	240 mV
I_F = 1 mA	V_F	max.	320 mV
I_F = 10 mA	V_F	max.	400 mV
I_F = 30 mA	V_F	max.	500 mV
I_F = 100 mA	V_F	typ. max.	500 mV 1000 mV
Reverse current V_R = 25 V	I_R	<	2 μA
Reverse breakdown voltage	$V_{(BR)R}$	>	30 V
Diode capacitance V_R = 1 V; f = 1 MHz	C_d	<	10 pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100; measured at I_R = 1 mA	t_{rr}	<	5 ns

SCHOTTKY BARRIER DIODE

Two separate silicon epitaxial Schottky barrier diodes with an integrated p-n junction protection ring in one microminiature SOT-143 envelope, intended for surface mounting (SMD technology).

The device features a low forward voltage drop.

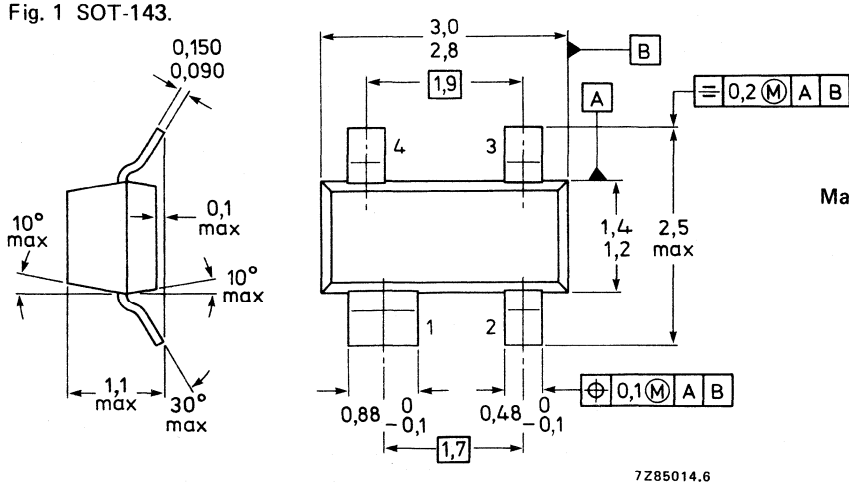
QUICK REFERENCE DATA

			single diode	double-diode operation	
Continuous reverse voltage	V_R	max.	30	30	V
Continuous reverse voltage series connection	V_R	max.	–	60	V
Forward current	I_F	max.	200	110	mA
Repetitive peak forward current	I_{FRM}	max.	300	200	mA
Non-repetitive peak forward current	I_{FSM}	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230		mW
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	t_{rr}	⩽	5		ns

MECHANICAL DATA

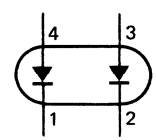
Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

Marking code : L41



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	double-diode operation	
Continuous reverse voltage	V_R	max.	30	30	V
Continuous reverse voltage series connection	V_R	max.	–	60	V
Forward current (see Fig. 2)	I_F	max.	200	110*	mA
Repetitive peak forward current	I_{FRM}	max.	300	200	mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230		mW
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	125		°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\ j\text{-}a}$		430	K/W

CHARACTERISTICS, per diode

T_{amb} = 25 °C unless otherwise specified

Forward voltage				
I_F = 0,1 mA	V_F	$\leqslant$	240	mV
I_F = 1 mA**	V_F	$\leqslant$	320	mV
I_F = 10 mA	V_F	$\leqslant$	400	mV
I_F = 30 mA**	V_F	$\leqslant$	500	mV
I_F = 100 mA	V_F	=	500	mV
	V_F	$<$	1000	mV
Reverse current V_R = 25 V	I_R	$\leqslant$	2	μA
Reverse breakdown voltage	$V_{(BR)R}$	$>$	30	V
Diode capacitance V_R = 1 V; f = 1 MHz	C_d	$\leqslant$	10	pF
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	t_{rr}	$\leqslant$	5	ns

* If both diodes are in forward operation at the same moment, total device current max. 110 mA. If one diode is in reverse and the other in forward operation at the same moment, total device current max. 200 mA.

** Temperature coefficient of forward voltage: –0,6%/K at I_F = 1 mA.

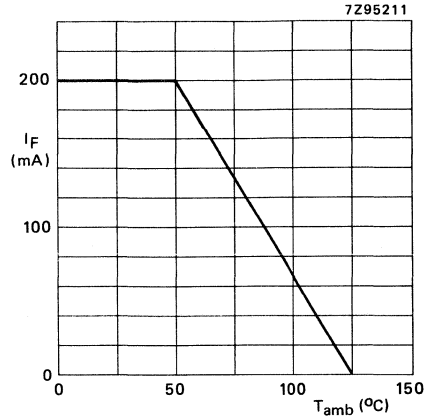


Fig. 2 Derating curve maximum ambient temperature.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

The BAV23 consists of two separate planar epitaxial high-speed diodes in one microminiature plastic envelope intended for surface mounting.

The device is designed for switching and general applications where high breakdown voltages are required.

QUICK REFERENCE DATA

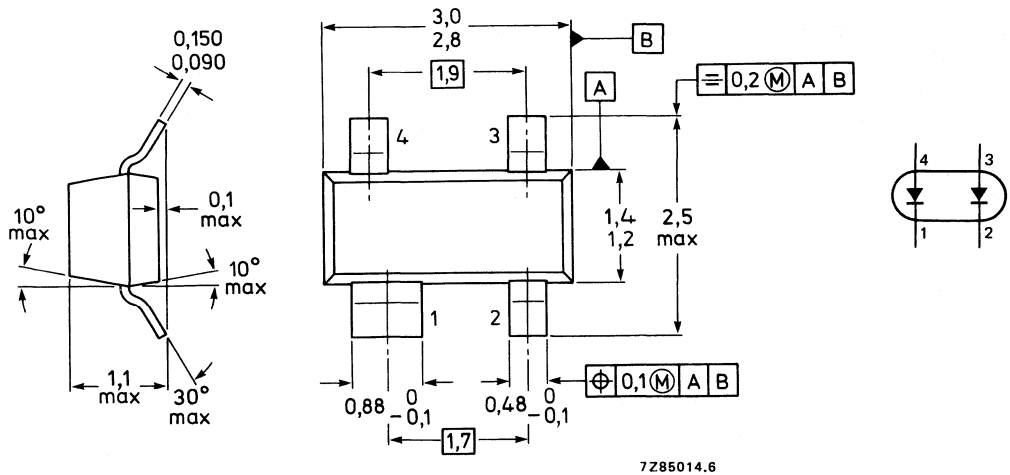
			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak rerverse voltage	V_{RRM}	max.	250	500	V
Average forward current	$I_{F(AV)}$	max.	200	120	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
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	t_{rr}	<	50		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code: L30



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak reverse voltage	V_{RRM}	max.	250	500	V
Average forward current	$I_{F(AV)}$	max.	200	120	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Non-repetitive peak forward current $t = 1\ \mu s$;	I_{FSM}	max.	2,5	1,5	A
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		^oC
Junction temperature	T_j	max.	150		^oC

THERMAL RESISTANCE

From junction to ambient on a ceramic substrate of 8 mm x 10 mm x 0,6 mm	$R_{th\ j\text{-}a}$	430	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

			single diode	series connection	
Forward voltage					
$I_F = 100$ mA	V_F	<	1000	2000	mV
$I_F = 200$ mA		<	1250	2500	mV
Reverse current $V_R = V_{Rmax}$	I_R	<	100	100	nA
Reverse breakdown voltage $I_R = 100\ \mu A$	$V_{(BR)R}$	>	250	500	V
Differential forward resistance $I_F = 10$ mA	r_f	typ.	5	10	Ω
Diode capacitance $V_R = 0$; $f = 1$ MHz	C_d	<	5	2,5	pF
Reverse recovery time when switched from $I_F = 30$ mA to $I_R = 30$ mA; $R_L = 100\ \Omega$; measured at $I_R = 3$ mA	t_{rr}	<	50	50	ns

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAV70 consists of two diodes in a microminiature plastic envelope. The cathodes are commoned and the unit is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA (per diode)

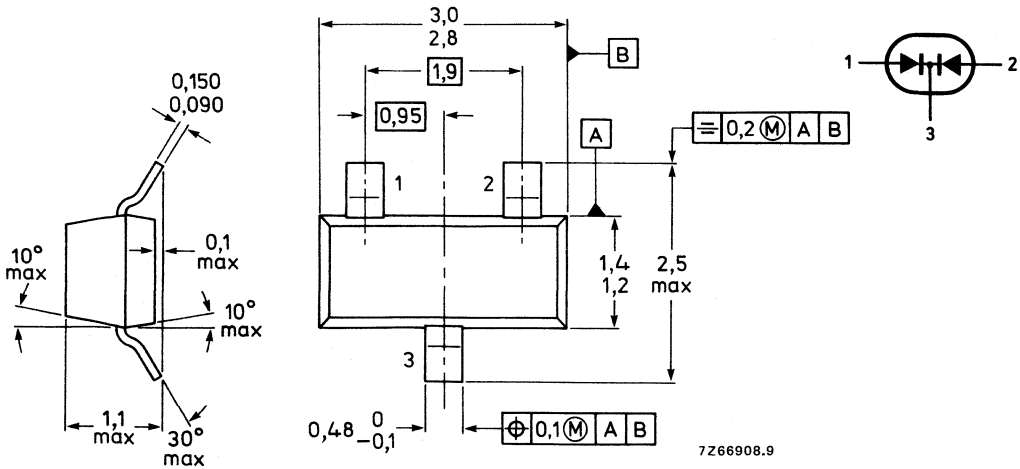
Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Repetitive peak forward current	I_{FRM}	max.	215 mA
Junction temperature	T_j	max.	150 °C
Forward voltage at I_F = 50 mA	V_F	<	1,0 V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6 ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAV70 = A4



TOP VIEW

See also *Soldering recommendations.*

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215	mA
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	215	mA
Non-repetitive peak forward current (per crystal)				
$t = 1\ \mu s$	I_{FSM}	max.	2	A
$t = 1$ ms	I_{FSM}	max.	1	A
$t = 1$ s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS (per diode)

$T_j = 25$ °C unless otherwise specified

Forward voltage				
$I_F =$ 1 mA	V_F	<	715	mV
$I_F =$ 10 mA	V_F	<	855	mV
$I_F =$ 50 mA	V_F	<	1000	mV
$I_F =$ 150 mA	V_F	<	1250	mV
Reverse current				
$V_R = 25$ V; $T_j = 150$ °C	I_R	<	60	μA
$V_R = 70$ V	I_R	<	5	μA
$V_R = 70$ V; $T_j = 150$ °C	I_R	<	100	μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz	C_d	<	1,5	pF
Forward recovery voltage when switched to				
$I_F = 10$ mA; $t_r = 20$ ns see Fig. 2	V_{fr}	<	1,75	V

* Measured under pulse conditions : pulse time $t_p \leqslant 0{,}5$ ms.
For sinusoidal operation $I_{F(AV)} = 150$ mA; averaging time $t_{(AV)} \leqslant 1$ ms.

** See *Thermal characteristics.*

▲ Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

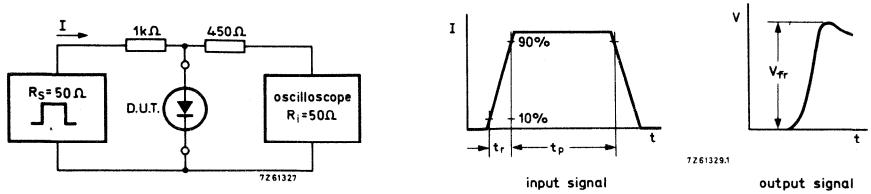


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal : Rise time of the forward pulse t_r = 20 ns; Forward current pulse duration t_p = 120 ns; Duty factor δ = 0,01

Oscilloscope : Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

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. 3 $\quad t_{rr} < 6$ ns

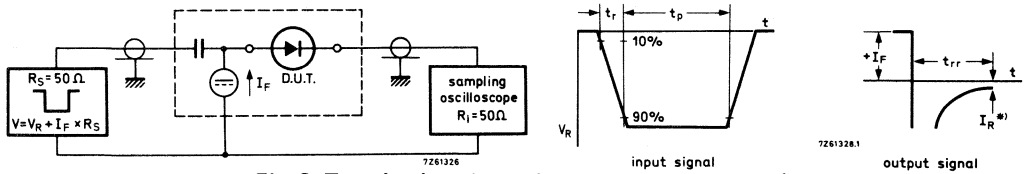


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

Input signal : Rise time of the reverse pulse 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 (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from

I_F = 10 mA to V_R = 5 V; R_L = 500 Ω see Fig. 4 $\quad Q_s < 45$ pC

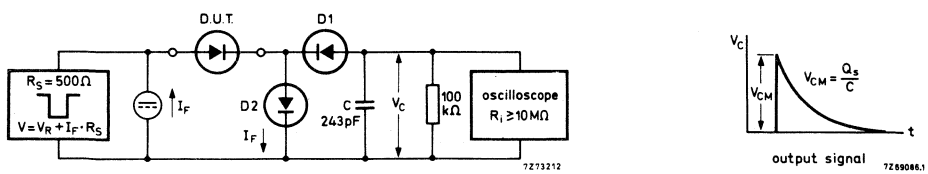


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

D2 = diode with minority carrier life time at 10 mA: < 200 ps

Input signal : Rise time of the reverse pulse = t_r = 2 ns; Reverse pulse duration = t_p = 400 ns; Duty factor = δ = 0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

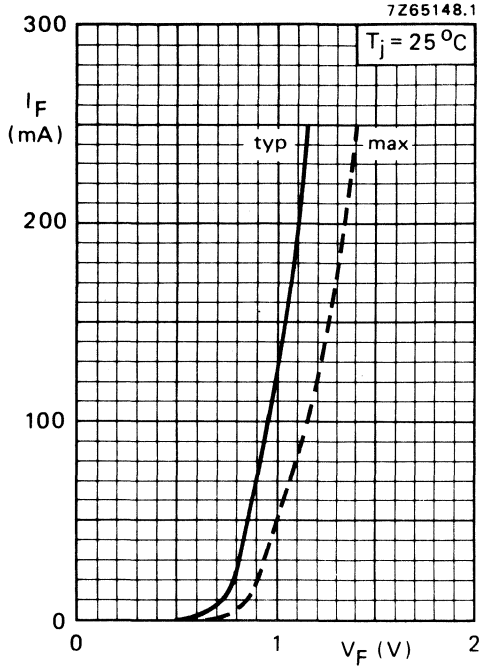


Fig. 5

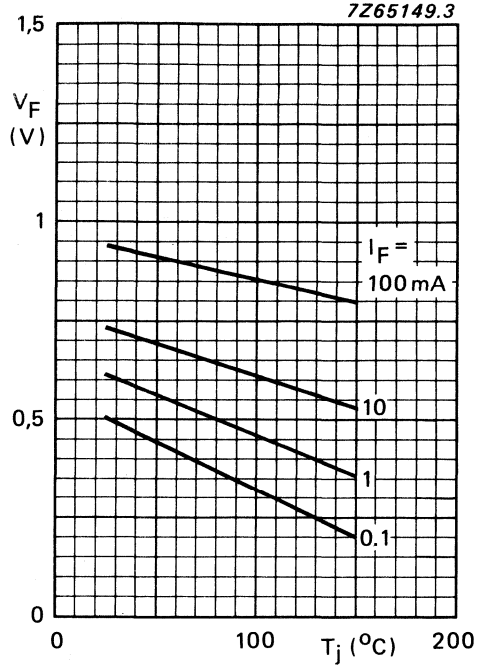


Fig. 6

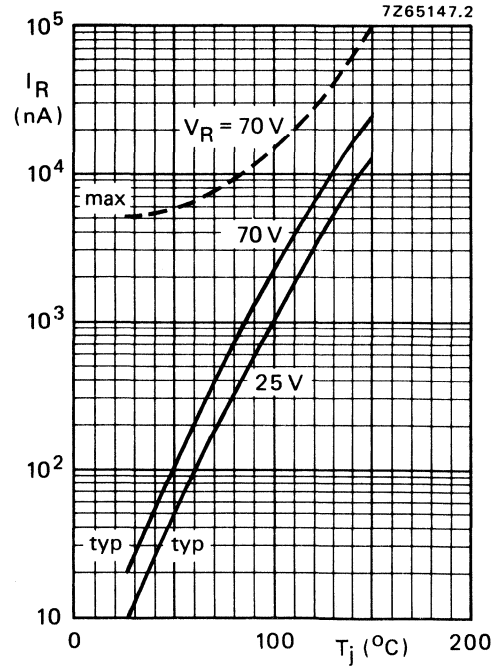


Fig. 7

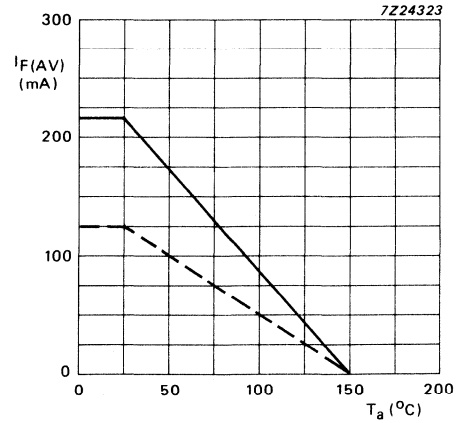


Fig. 8 —— single diode
— — — — double diode, equally loaded.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAV99 consists of two diodes in a microminiature plastic envelope. The diodes are connected in series and the unit is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA (per diode)

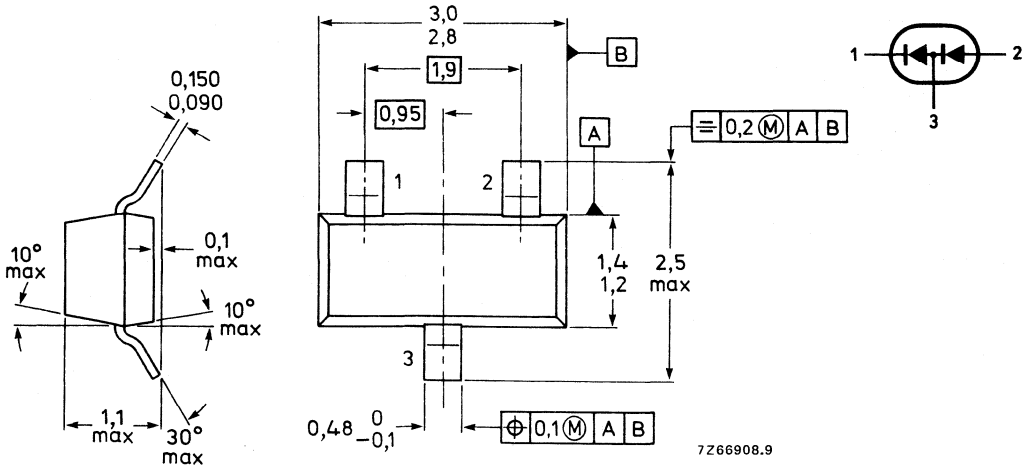
Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Repetitive peak forward current	I_{FRM}	max.	215 mA
Junction temperature	T_j	max.	150 °C
Forward voltage at I_F = 50 mA	V_F	<	1,0 V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6 ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAV99 = A7



TOP VIEW

See also *Soldering recommendations.*

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215 mA
Forward current (d.c.)	I_F	max.	215 mA
Repetitive peak forward current	I_{FRM}	max.	215 mA
Non-repetitive peak forward current (per crystal)			
$t = 1\ \mu s$	I_{FRM}	max.	2 A
$t = 1$ ms	I_{FRM}	max.	1 A
$t = 1$ s	I_{FRM}	max.	0,5 A
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS (per diode)

$T_j = 25$ °C unless otherwise specified

Forward voltage			
$I_F = 1$ mA	V_F	<	715 mV
$I_F = 10$ mA	V_F	<	855 mV
$I_F = 50$ mA	V_F	<	1000 mV
$I_F = 150$ mA	V_F	<	1250 mV
Reverse current			
$V_R = 25$ V; $T_j = 150$ °C	I_R	<	30 μA
$V_R = 70$ V	I_R	<	2,5 μA
$V_R = 70$ V; $T_j = 150$ °C	I_R	<	50 μA
Diode capacitance			
$V_R = 0$; $f = 1$ MHz	C_d	<	1,5 pF
Forward recovery voltage when switched to			
$I_F = 10$ mA; $t_r = 20$ ns	V_{fr}	<	1,75 V

* Measured under pulse conditions: pulse time $t_p \leqslant 0{,}5$ ms.
For sinusoidal operation $I_{F(AV)} = 150$ mA; averaging time $t_{(av)} \leqslant 1$ ms.

** See *Thermal characteristics.*

▲ Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

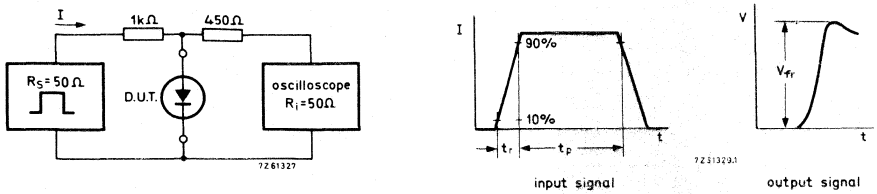


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal: Rise time of the forward pulse t_r = 20 ns;
Forward current pulse duration = t_p = 120 ns. Duty factor = δ = 0,01.
Oscilloscope: Rise time t_r = 0,35 ns.

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

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 $\quad t_{rr} \quad < \quad$ 6 ns

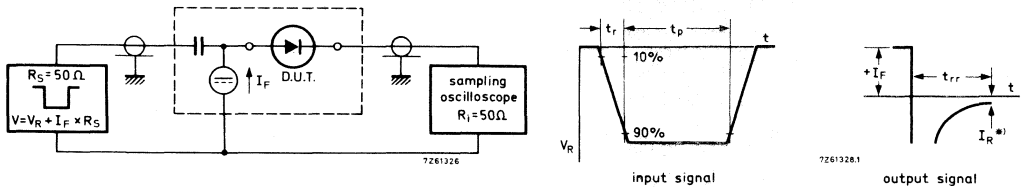


Fig. 3 Test circuit and waveforms; reverse recovery time.

Input signal: Rise time of the reverse pulse t_r = 0,6 ns *) I_R = 1 mA
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 (C = oscilloscope input capacitance + parasitic capacitance).

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω $\quad Q_s \quad < \quad$ 45 pC

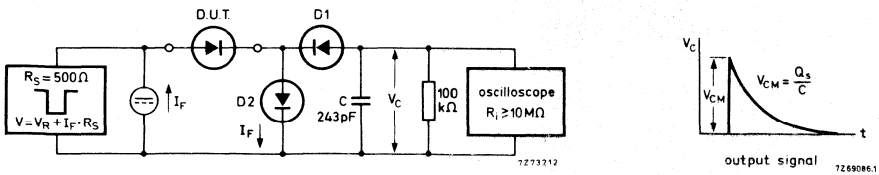


Fig. 4 Test and waveform; recovery charge.

D2 = diode with minority carrier life time at 10 mA: < 200 ps; D1 = BAW62.

Input signal: Rise time of the reverse pulse t_r = 2 ns
Reverse pulse duration t_p = 400 ns. Duty factor δ = 0,02.

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

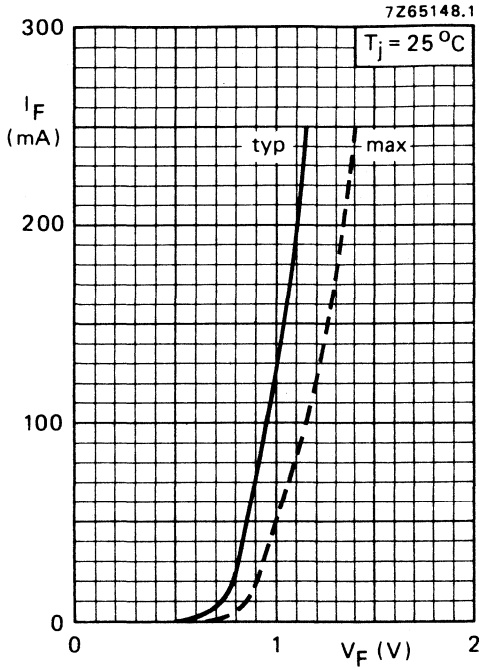


Fig. 5.

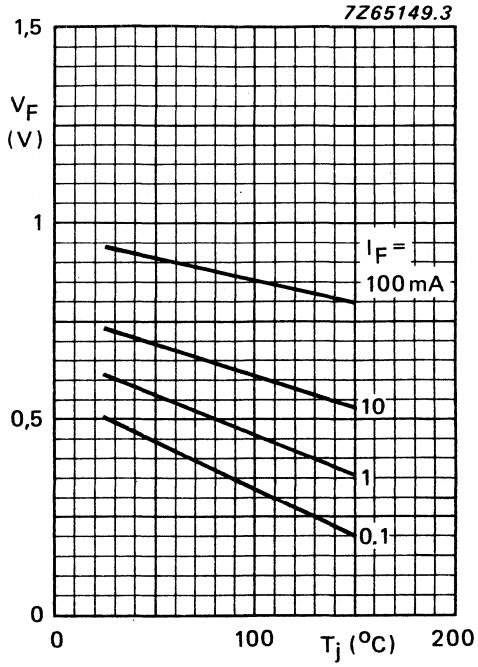


Fig. 6 Typical values.

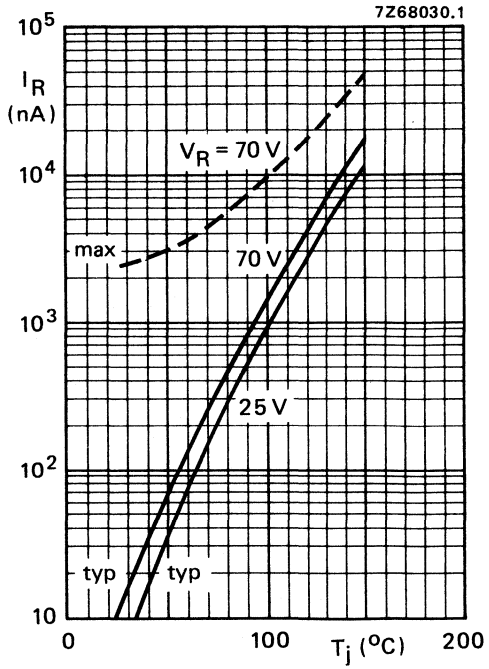


Fig. 7.

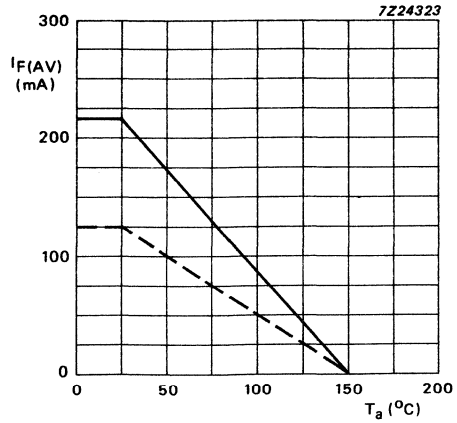


Fig. 8 ——— single diode
– – – – – double diode; equally loaded.

GENERAL PURPOSE DIODES FOR SURFACE MOUNTING

Silicon planar epitaxial diodes; intended for switching and general purposes in industrial equipment e.g. oscilloscopes, digital voltmeters and video output stages in colour television.

The SM DIODE is a leadless diode in an hermetically sealed glass envelope with tin plated metal discs at each end. It is suitable for Automatic Placement and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

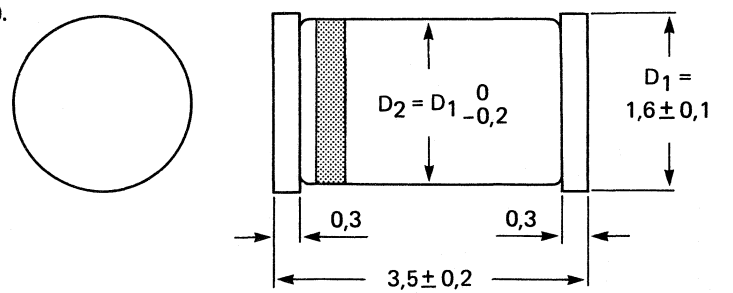
QUICK REFERENCE DATA

			BAV100	BAV101	BAV102	BAV103	
Continuous reverse voltage	V_R	max.	50	100	150	200	V
Forward current (d.c.)	I_F	max.		250			mA
Junction temperature	T_j	max.		175			°C
Thermal resistance from junction to ambient	$R_{th\ j\text{-}a}$	=		0,375			K/mW
Forward voltage at I_F = 100 mA	V_F	<		1,0			V
Reverse current at $V_R = V_{Rmax}$	I_R	<		100			nA
Diode capacitance at V_R = 0; f = 1 MHz	C_d	typ. <		1,5 5,0			pF pF
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	t_{rr}	<		50			ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The BAV100 cathode is indicated by a green and a black band.
The BAV101 cathode is indicated by a green and a brown band.
The BAV102 cathode is indicated by a green and a red band.
The BAV103 cathode is indicated by a green and an orange band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BAV100	BAV101	BAV102	BAV103	
Continuous reverse voltage	V_R	max.	50	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	200	250	V
Average rectified forward current	$I_{F(AV)}$	max.		250			mA[1]
Forward current (d.c.)	I_F	max.		250			mA
Repetitive peak forward current	I_{FRM}	max.		625			mA
Non-repetitive peak forward current							
$t < 1$ s; $T_j = 25$ °C	I_{FSM}	max.		1			A
$t = 1$ μs; $T_j = 25$ °C	I_{FSM}	max.		5			A
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.		400			mW
Storage temperature	T_{stg}			−65 to + 175			°C
Junction temperature	T_j	max.		175			°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,375 K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

			BAV100	BAV101	BAV102	BAV103	
Forward voltage							
$I_F = 100$ mA	V_F	<		1,0			V
$I_F = 200$ mA	V_F	<		1,25			V
Reverse breakdown voltage							
$I_R = 100$ μA	$V_{(BR)R}$	>	60	120	200	250	V[2]
Reverse current							
$V_R = V_{Rmax}$	I_R	<		100			nA
$V_R = V_{Rmax}$; $T_j = 150$ °C	I_R	<		100			μA
Differential resistance							
$I_F = 10$ mA	r_{diff}	typ.		5			Ω
Diode capacitance							
$V_R = 0$; f = 1 MHz	C_d	typ.		1,5			pF
		<		5,0			pF
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	t_{rr}	<		50			ns

[1]) For sinusoidal operation see Figs 7 to 10. For pulse operation see Figs 3 to 6.

[2]) At zero life time, measured under pulse conditions to avoid excessive dissipation and voltage limited at 275 V.

Test circuit and waveforms:

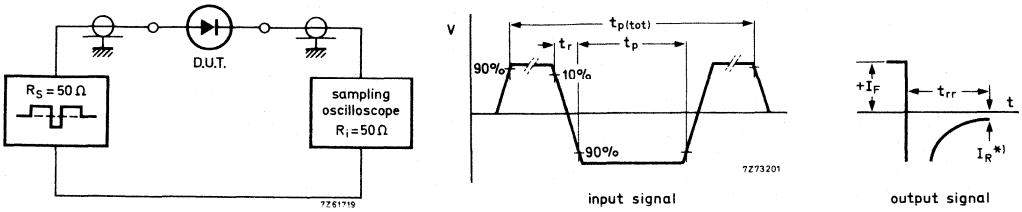


Fig. 2.

*) I_R = 3 mA

Input signal:	Total pulse duration	$t_{p(tot)}$	=	2 μs
	Duty factor	δ	=	0,0025
	Rise time of the reverse pulse	t_r	=	0,6 ns
	Reverse pulse duration	t_p	=	100 ns
Oscilloscope:	Rise time	t_r	=	0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

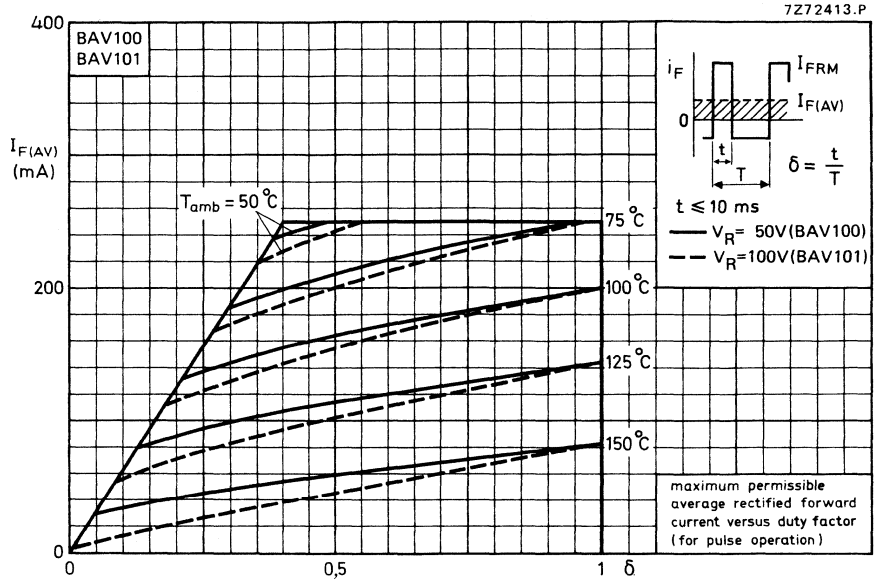

7Z72413.P
400
200
0
BAV100
BAV101
$I_{F(AV)}$ (mA)
T_{amb} = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
$\delta = \frac{t}{T}$
t ≤ 10 ms
V_R= 50V(BAV100)
V_R=100V(BAV101)
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 3.

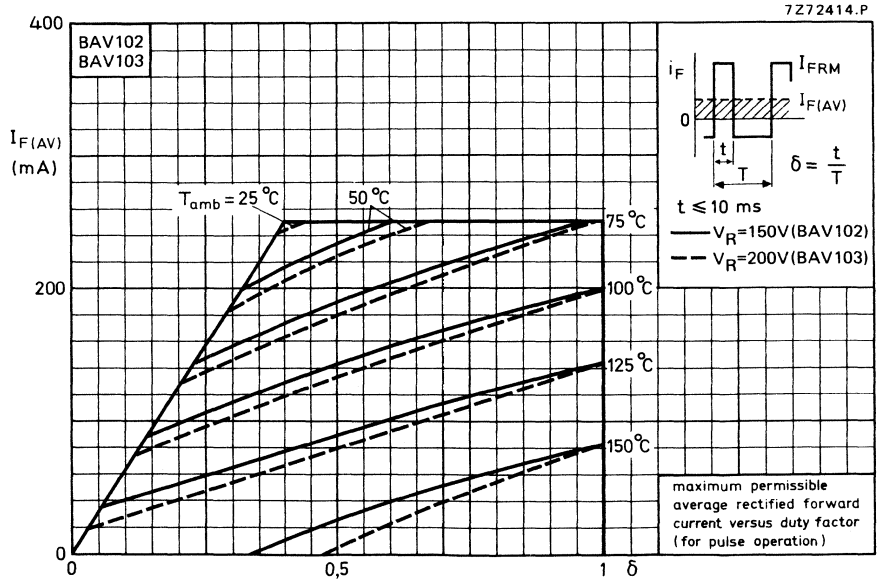

7Z72414.P
400
200
0
BAV102
BAV103
$I_{F(AV)}$ (mA)
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
$\delta = \frac{t}{T}$
t ≤ 10 ms
V_R=150V(BAV102)
V_R=200V(BAV103)
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 4.

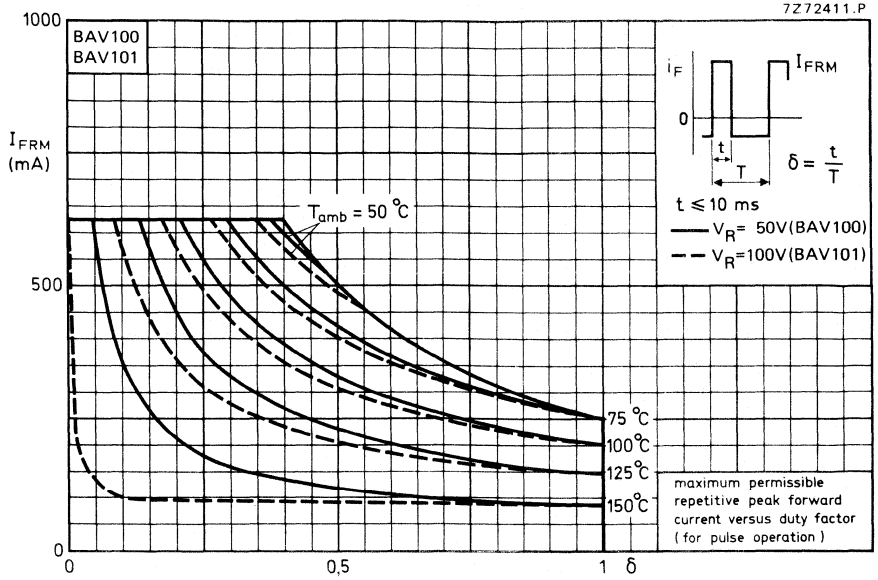

7Z72411.P
1000
500
0
I_{FRM} (mA)
BAV100
BAV101
T_{amb} = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1
δ
i_F
I_{FRM}
0
t
T
δ = t/T
t ≤ 10 ms
V_R = 50V(BAV100)
V_R = 100V(BAV101)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 5.

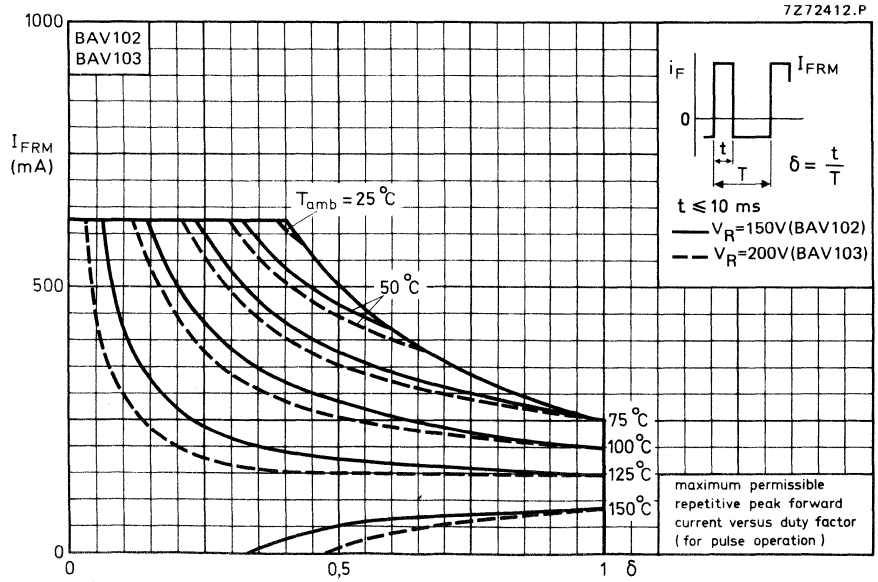

7Z72412.P
1000
500
0
I_{FRM} (mA)
BAV102
BAV103
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1
δ
i_F
I_{FRM}
0
t
T
δ = t/T
t ≤ 10 ms
V_R = 150V(BAV102)
V_R = 200V(BAV103)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 6.

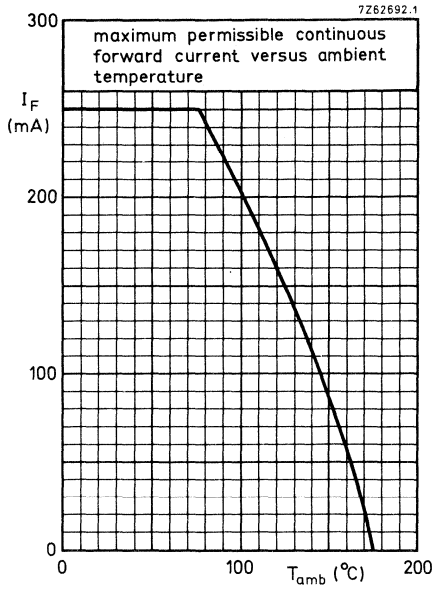


Fig. 7.

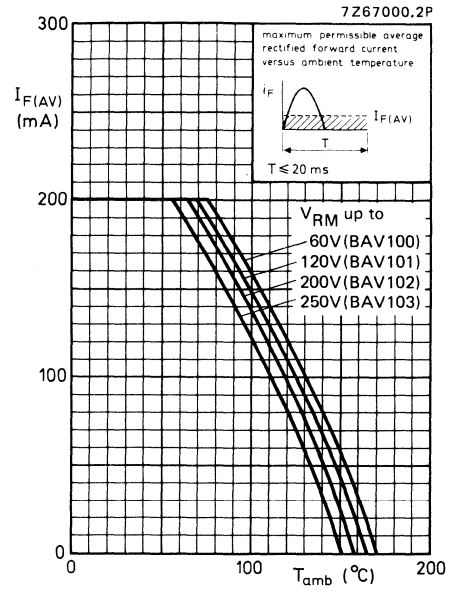


Fig. 8.

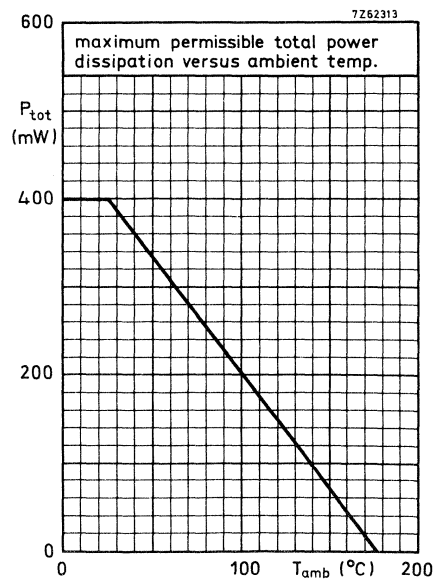


Fig. 9.

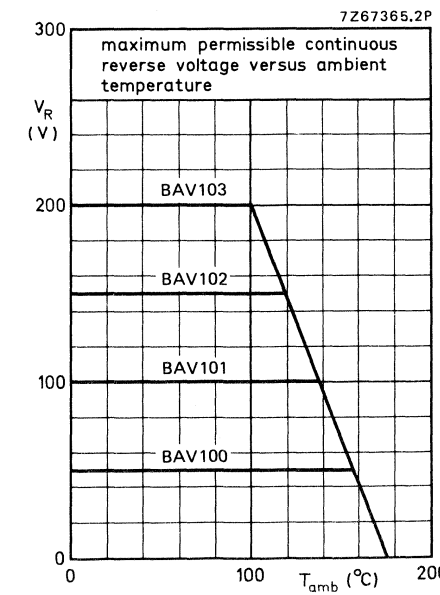


Fig. 10.

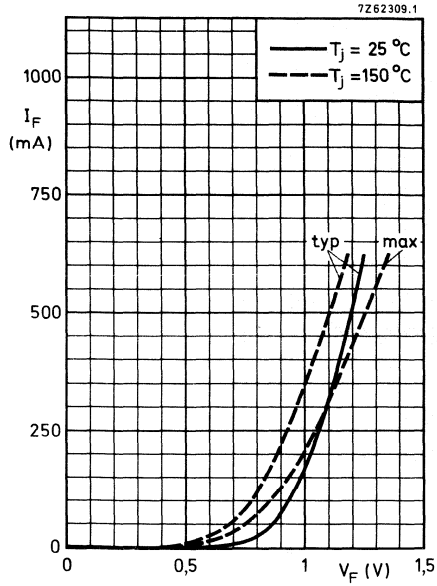


Fig. 11.

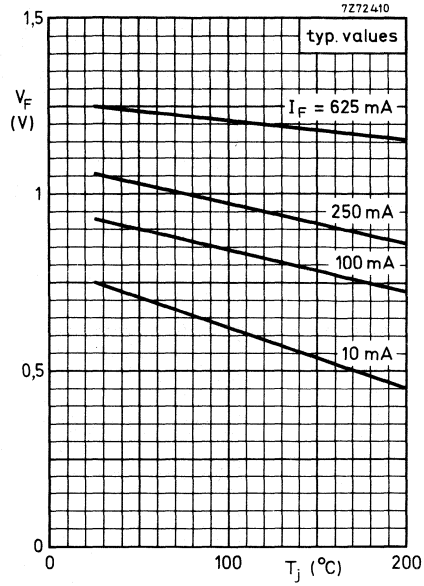


Fig. 12.

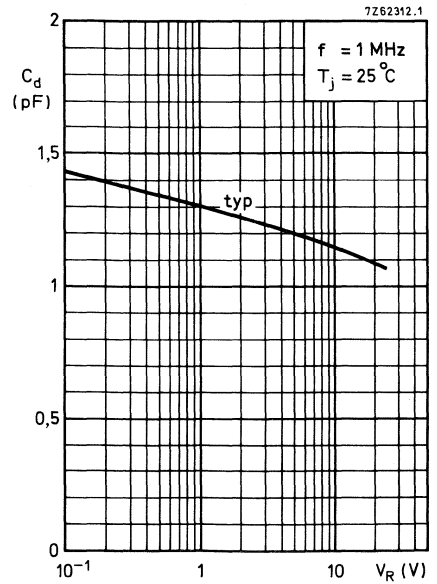


Fig. 13.

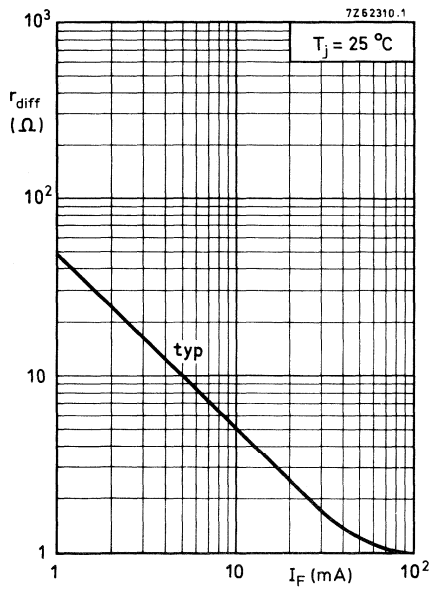


Fig. 14.

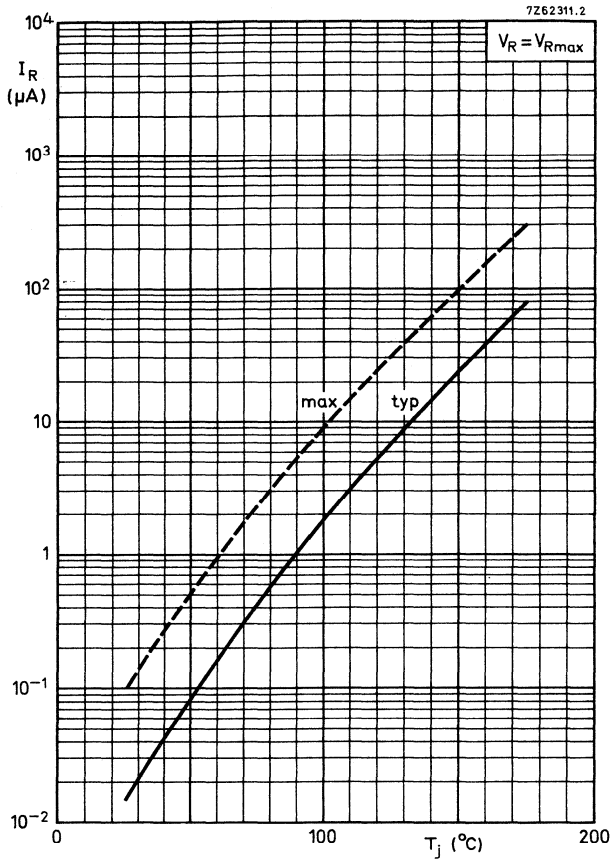

7Z62311.2
$V_R = V_{Rmax}$
I_R (μA)
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
max
typ
0
100
200
T_j (°C)

Fig. 15.

ULTRA HIGH-SPEED DIODE

Silicon planar epitaxial, ultra-high speed, high conductance diode in a SOD-80 envelope.

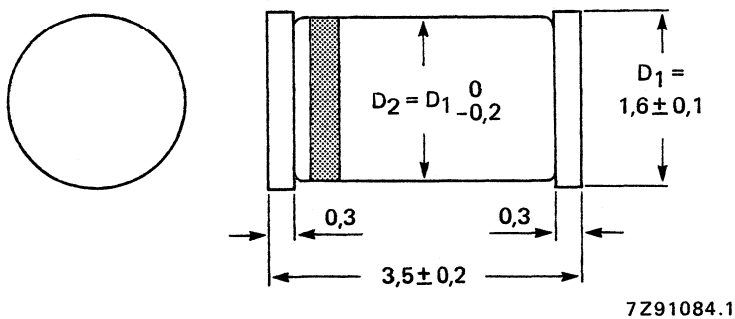
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	60 V
Repetitive peak reverse voltage	V_{RRM}	max.	60 V
Repetitive peak forward current	I_{FRM}	max.	600 mA
Junction temperature	T_j	max.	200 °C
Forward voltage at I_F = 200 mA	V_F	<	1,0 V
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	t_{rr}	<	6 ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	50 pC

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



A green band indicates the cathode side and identifies the type BAV105.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	60	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	V
Average rectified forward current	$I_{F(AV)}$	max.	300	mA
Forward current	I_F	max.	300	mA
Repetitive peak forward current	I_{FRM}	max.	600	mA
Non-repetitive peak forward current				
$t = 1\ \mu s$	I_{FSM}	max.	4000	mA
$t = 1\ s$		max.	1000	mA
Storage temperature	T_{stg}	−65 to +	175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$		375	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltage				
$I_F = 10$ mA	V_F	<	0,75	V
$I_F = 200$ mA		<	1,00	V
$I_F = 200$ mA; $T_j = 100$ °C	V_F	<	0,95	V
$I_F = 500$ mA		<	1,25	V
Reverse current				
$V_R = 60$ V	I_R	<	100	nA
$V_R = 60$ V; $T_j = 100$ °C		<	100	μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz	C_d	<	2,5	pF
Forward recovery voltage when switched to				
$I_F = 400$ mA; $t_r1 = 30$ ns	V_{fr}	<	2,0	V
$I_F = 400$ mA; $t_r2 = 100$ ns		<	1,5	V
(see Fig. 2)				

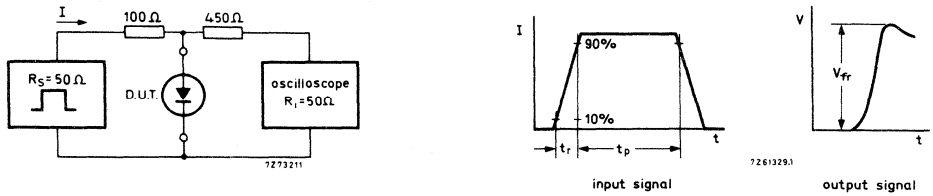
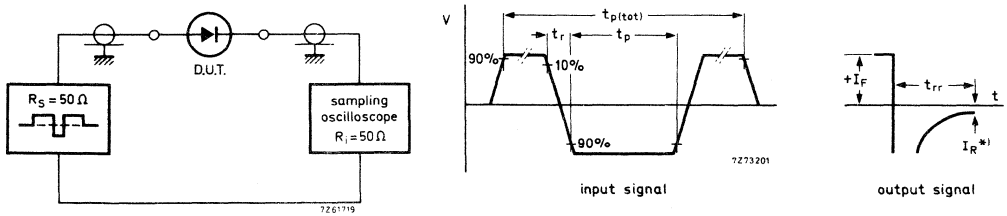


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal:	1st rise time of the forward pulse	t_r1	= 30 ns
	2nd rise time of the forward pulse	t_r2	= 100 ns
	Forward current pulse duration	t_p	= 300 ns
	Duty factor	δ	= 0,01
Oscilloscope:	Rise time	t_r	= 0,35 ns
	Input capacitance	C_i	= 1 pF

Circuit capacitance C ⩽ 20 pF (C = C_i + parasitic capacitance)

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. 3) t_{rr} < 6 ns



*) I_R = 40 mA

Fig. 3 Test circuit and waveforms; reverse recovery time.

Input signal:	Total pulse duration	$t_{p(tot)}$	= 0,2 μs
	Duty factor	δ	= 0,0025
	Rise time of the reverse pulse	t_r	= 0,6 ns
	Reverse pulse duration	t_p	= 30 ns
Oscilloscope:	Rise time	t_r	= 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω $\quad Q_s < 50$ pC
(see Fig. 4)

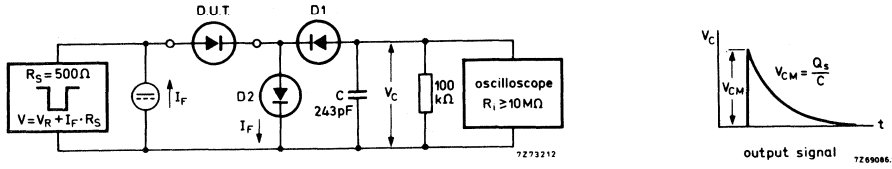


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62
D2 = diode with minority carrier life time at 10 mA: < 200 ps

Input signal: Rise time of the reverse pulse t_r = 2 ns
Reverse pulse duration t_p = 400 ns
Duty factor δ = 0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

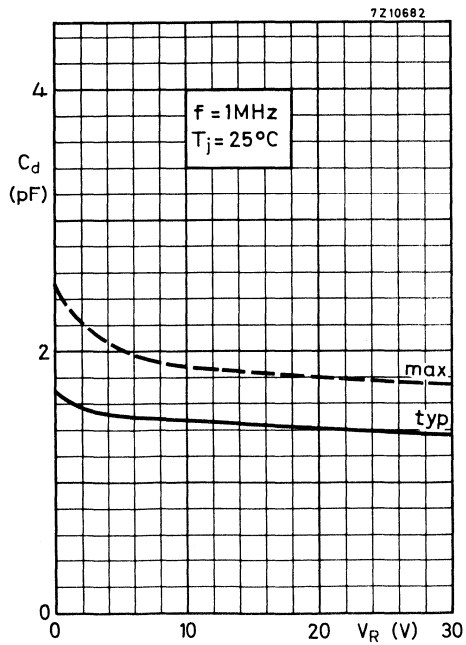


Fig. 5.

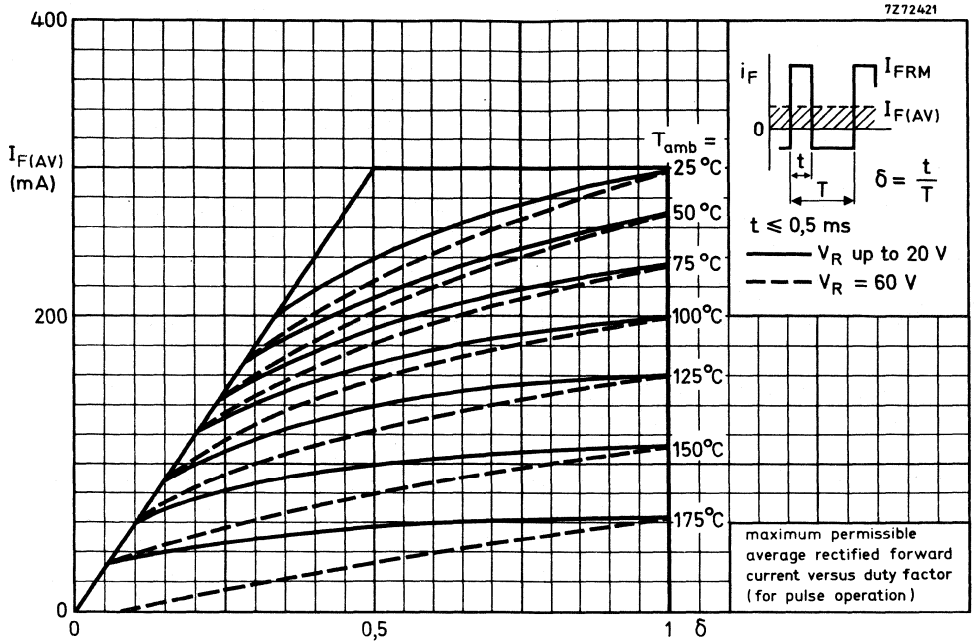

7Z72421
400
200
0
$I_{F(AV)}$ (mA)
0
0,5
1
δ
T_{amb} =
25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
175 °C
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
$\delta = \frac{t}{T}$
t ≤ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 6.

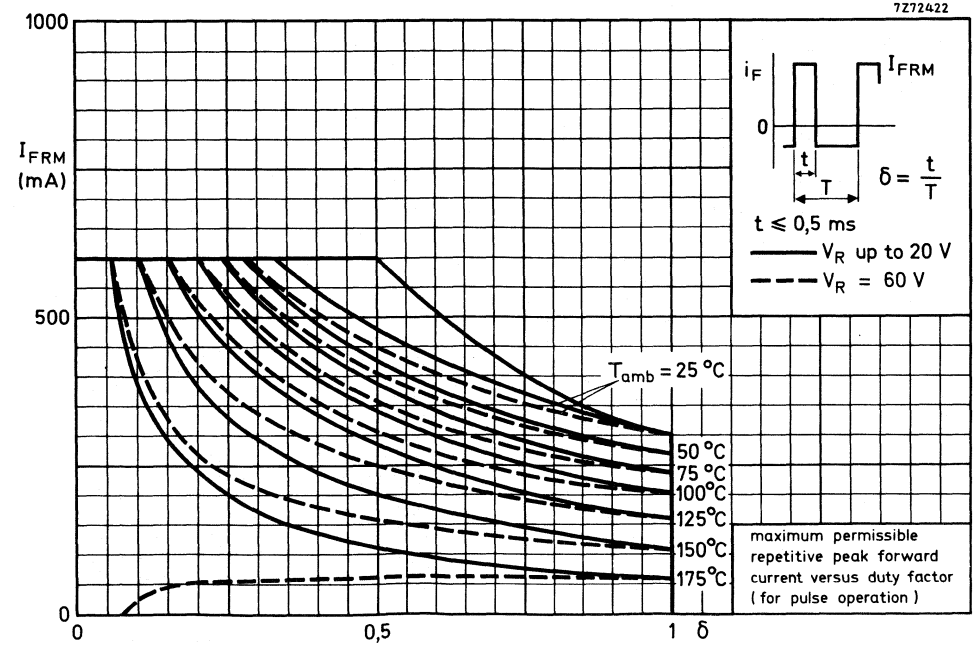

7Z72422
1000
500
0
I_{FRM} (mA)
0
0,5
1
δ
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
175 °C
i_F
I_{FRM}
0
t
T
$\delta = \frac{t}{T}$
t ≤ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 7.

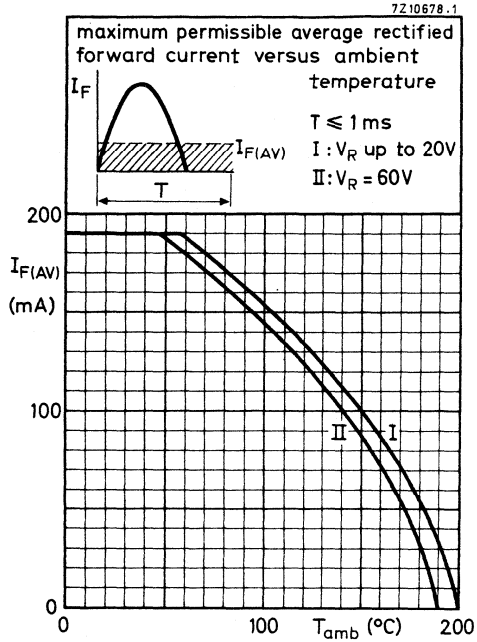


Fig. 8.

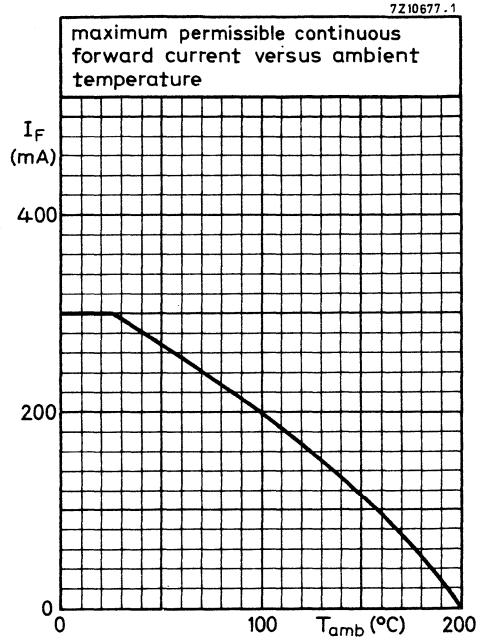


Fig. 9.

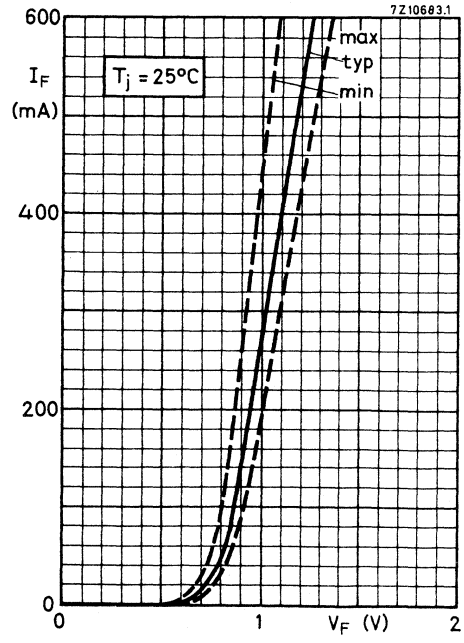


Fig. 10.

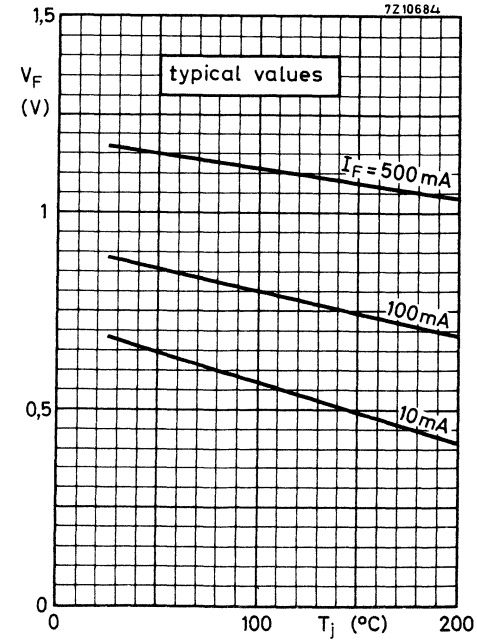


Fig. 11.

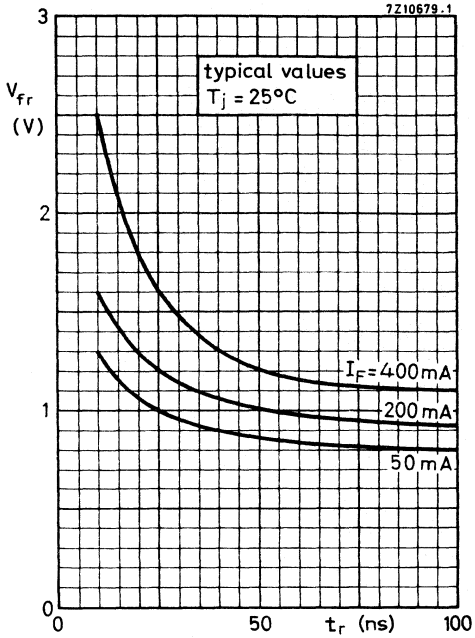


Fig. 12.

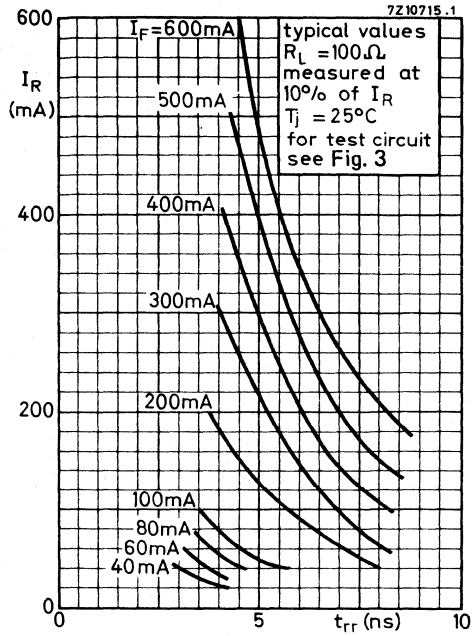


Fig. 13.

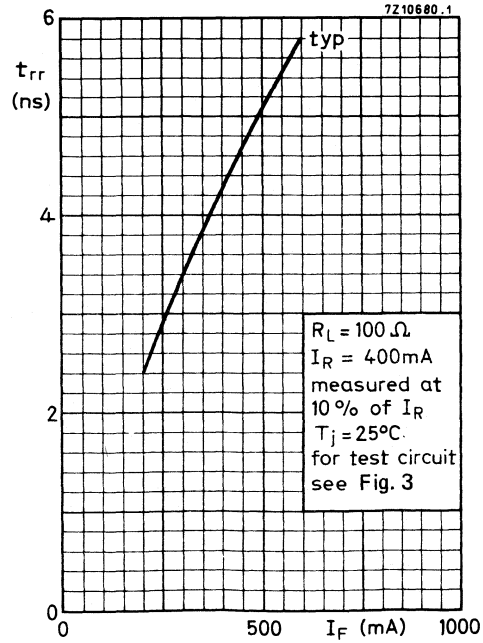


Fig. 14.

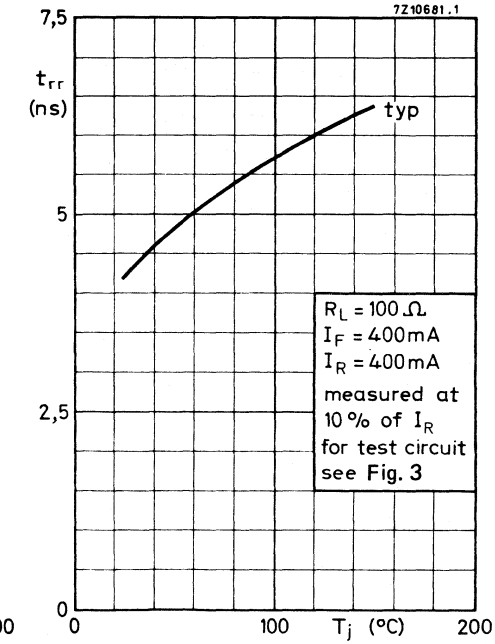


Fig. 15.

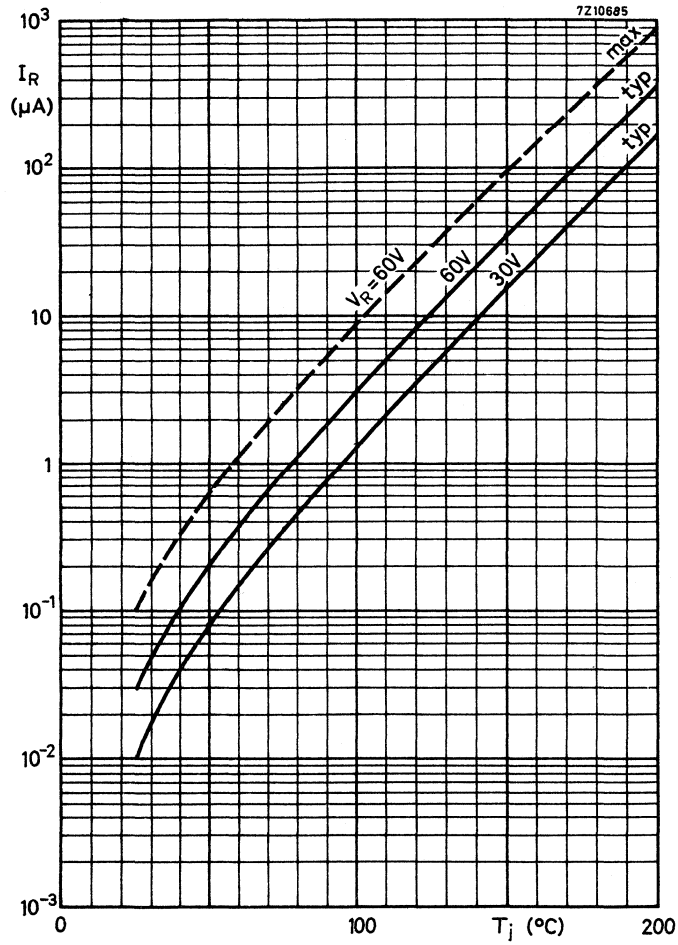

7Z10685
10^3
I_R
(μA)
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
0
100
200
T_j (°C)
max
typ
typ
V_R=60V
60V
30V

Fig. 16.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAW56 consists of two diodes in a microminiature plastic envelope. The anodes are commoned and the unit is intended for high-speed switching in thick and thin-film circuits.

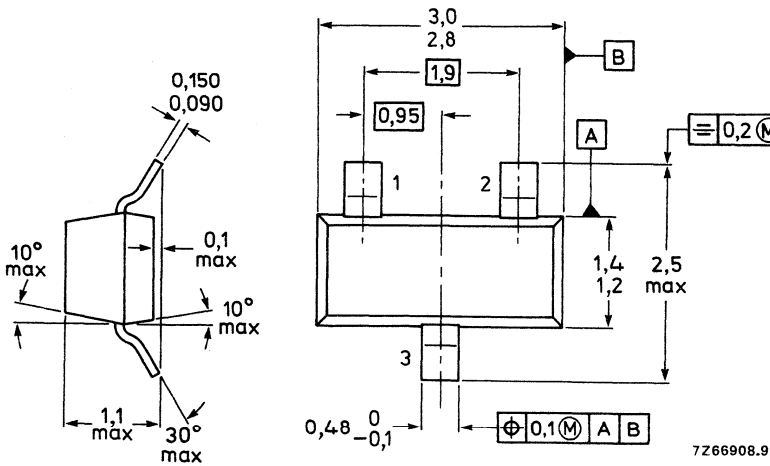
QUICK REFERENCE DATA (per diode)

Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Repetitive peak forward current	I_{FRM}	max.	215 mA
Junction temperature	T_j	max.	150 °C
Forward voltage at I_F = 50 mA	V_F	<	1,0 V
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	t_{rr}	<	6 ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

MECHANICAL DATA

Dimensions in mm

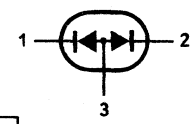
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAW56 = A1



See also *Soldering recommendations.*

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215 mA
Forward current (DC)	I_F	max.	215 mA
Repetitive peak forward current	I_{FRM}	max.	215 mA
Non-repetitive peak forward current (per crystal)			
$t = 1\ \mu s$	I_{FSM}	max.	2 A
$t = 1$ ms	I_{FSM}	max.	1 A
$t = 1$ s	I_{FSM}	max.	0,5 A
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE**

From junction to ambient**	$R_{th\ j\text{-}t}$	=	430 K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	2 x 280 K/W
From soldering points to ambient ▲	$R_{th\ s\text{-}a}$	=	2 x 90 K/W

CHARACTERISTICS (per diode)

$T_j = 25$ °C unless otherwise specified

Forward voltage			
$I_F =$ 1 mA	V_F	<	715 mV
$I_F =$ 10 mA	V_F	<	855 mV
$I_F =$ 50 mA	V_F	<	1000 mV
$I_F =$ 150 mA	V_F	<	1250 mV
Reverse current			
$V_R = 25$ V; $T_j = 150$ °C	I_R	<	30 μA
$V_R = 70$ V	I_R	<	2,5 μA
$V_R = 70$ V; $T_j = 150$ °C	I_R	<	50 μA
Diode capacitance			
$V_R = 0$; $f = 1$ MHz	C_d	<	2 pF
Forward recovery voltage when switched to			
$I_F = 10$ mA; $t_r = 20$ ns see Fig. 2	V_{fr}	<	1,75 V

* Measured under pulse conditions: pulse time $t_p \leqslant 0{,}5$ ms.
For sinusoidal operation $I_{F(AV)} = 150$ mA; averaging time $t_{(AV)} \leqslant 1$ ms.

** See *Thermal characteristics.*

▲ Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

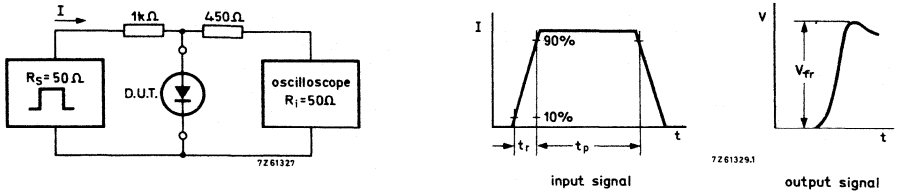


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal: Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns. Duty factor δ = 0,01
Oscilloscope: Rise time t_r = 0,35 ns.

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

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. 3 t_{rr} < 6 ns

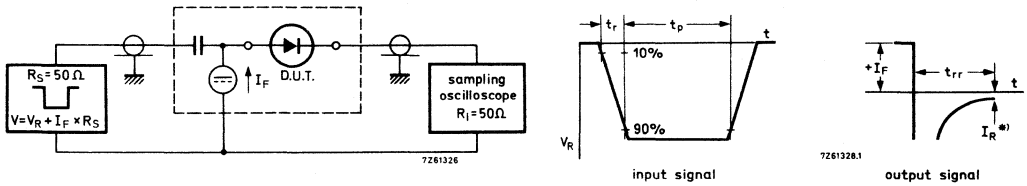


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

Input signal: Rise time of the reverse pulse 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 (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω see Fig. 4 Q_s < 45 pC

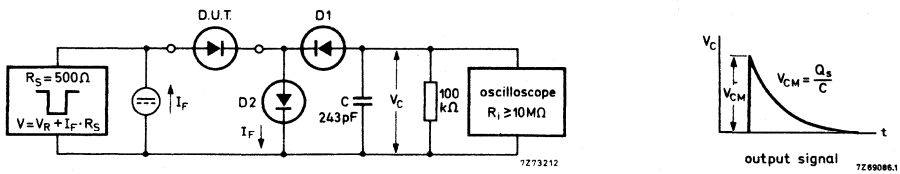


Fig. 4 Test circuit and waveform; recovery charge.

D2 = diode with minority carrier life time at 10 mA: < 200 ps. D1 = BAW62.

Input signal: Rise time of the reverse pulse t_r = 2 ns
Reverse pulse duration t_p = 400 ns. Duty factor δ = 0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

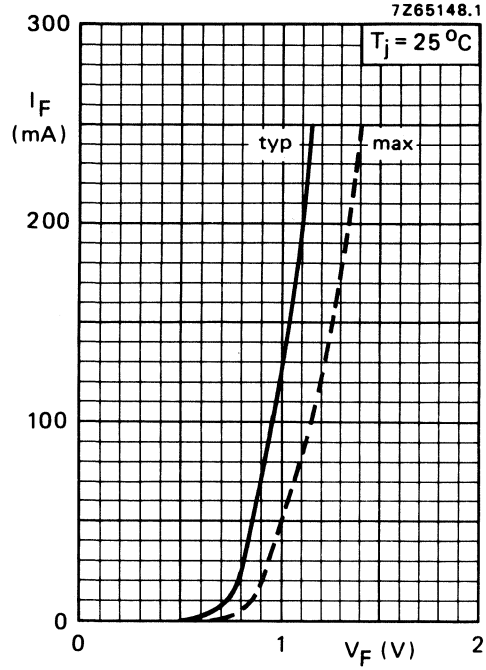


Fig. 5.

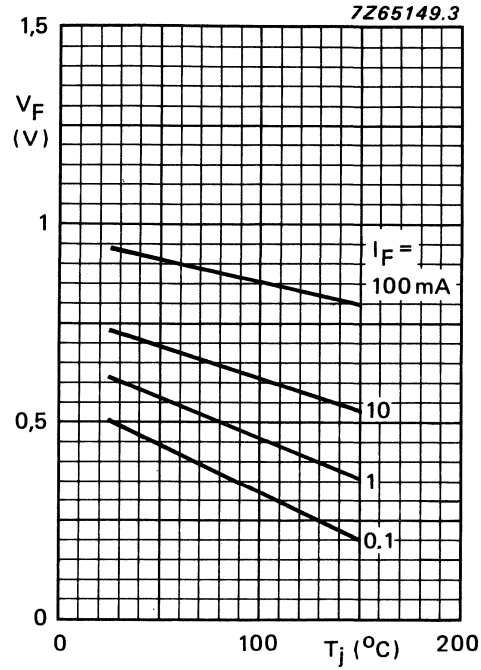


Fig. 6 Typical values.

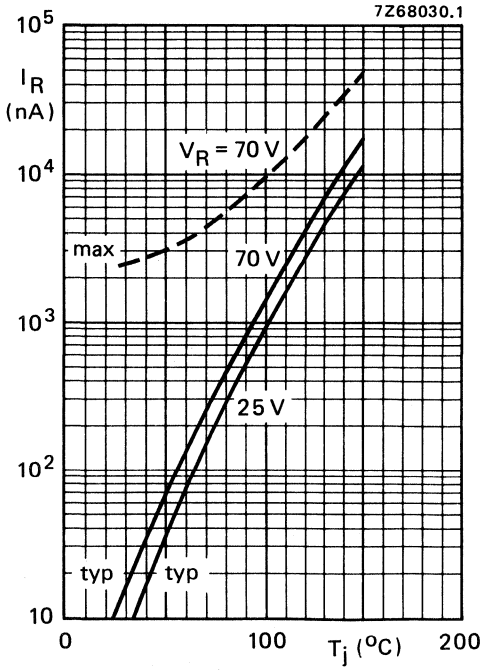


Fig. 7.

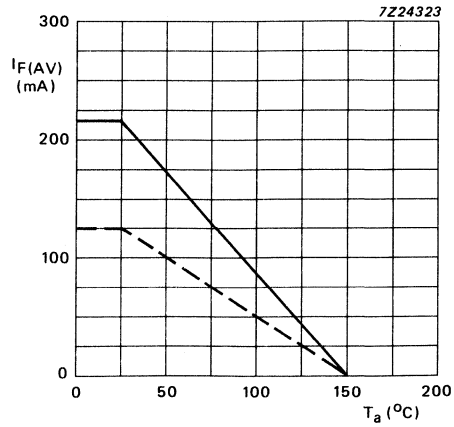


Fig. 8 ——— single diode;
– – – – – double diode, equally loaded.

UHF VARIABLE CAPACITANCE DIODE

The BB215 is a silicon variable capacitance diode in a hermetically sealed glass envelope (SOD-80) and intended for application in UHF tuners. The leadless SOD-80 encapsulation is intended for surface mounting.
The diode features a capacitance characteristic with a good linearity.

Diodes are supplied in matched sets and the capacitance difference between any two diodes in one set is less than 3% over the voltage range from 0,5 V to 28 V.

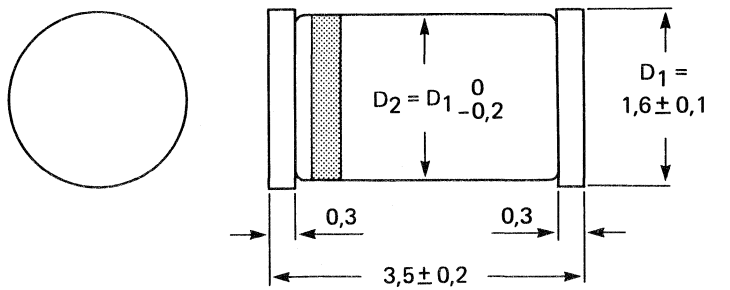
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 500 kHz V_R = 28 V	C_d		1,8 to 2,2 pF
Capacitance ratio at f = 500 kHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	>	7,6
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	0,75 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a white band on the body and a second green band indicates the BB215 type.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature	T_{stg}		−55 to +150	°C
Operating junction temperature	T_j	max.	100	°C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200	nA
Diode capacitance at f = 500 kHz				
V_R = 1 V	C_d	typ.	17	pF
	C_d	<	18	pF
V_R = 28 V	C_d		1,8 to 2,2	pF
Capacitance ratio at f = 500 kHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	>	7,6	
		typ.	8,3	
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	typ.	0,63	Ω

VHF VARIABLE CAPACITANCE DIODE

The BB219 is a silicon variable capacitance diode in a hermetically sealed glass envelope (SOD-80) and intended for electronic tuning in VHF television tuners for C.A.T.V. applications.
The SOD-80 envelope is suitable for surface mounting.

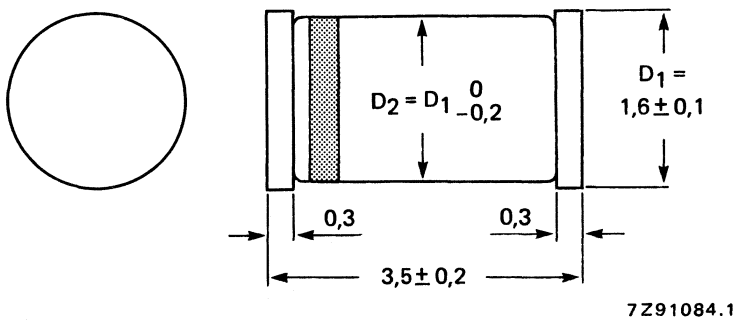
QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	30 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 1 V V_R = 28 V	C_d	> 	31 pF 2,6 to 3,2 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$		12 to 15
Series resistance at f = 100 MHz V_R is that value at which C_d = 30 pF	r_s	typ. <	0,7 Ω 0,9 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a white band on the body.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage, peak value	V_{RM}	max.	30	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature	T_{stg}		−55 to +150	°C
Operating junction temperature	T_j	max.	100	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,6	K/mW

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200	nA
Diode capacitance at f = 0,5 MHz				
V_R = 1 V	C_d	>	31	pF
V_R = 28 V	C_d		2,6 to 3,2	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$		12 to 15	
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	0,7	Ω
	r_s	<	0,9	Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2,5	%

VHF VARIABLE CAPACITANCE DIODE

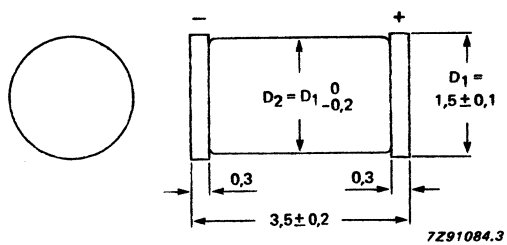
The BB240 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band B up to 460 MHz in all-band tuners.
The diode is encapsulated in the hermetically sealed glass envelope SOD-80 suitable for surface mounting.

QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	32 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 0.5 V V_R = 28 V	C_d	> 2.4 to	38 pF 2.7 pF
Capacitance ratio at f = 1 MHz	C_d (V_R = 0.5 V) C_d (V_R = 28 V)	>	14
Series resistance at f = 100 MHz V_R is that value at which C_d = 40 pF	r_s	<	1.0 Ω

MECHANICAL DATA

Dimensions in mm



The cathode is indicated by a white band on the body.

Fig. 1 SOD-80.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage, peak value	V_{RM}	max.	32	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating junction temperature	T_j	max.	100	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.6	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_{amb} = 85 °C		<	200	nA
Diode capacitance at f = 1 MHz				
V_R = 0.5 V	C_d	>	38	pF
V_R = 28 V			2.4 to 2.7	pF
Capacitance ratio at f = 1 MHz	C_d (V_R = 0.5 V) / C_d (V_R = 28 V)	>	14	
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 40 pF	r_s	<	1.0	Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2.5	%

VHF VARIABLE CAPACITANCE DIODE

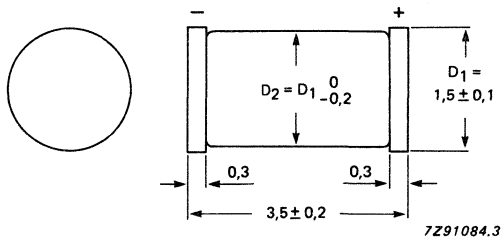
The BB241 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band A up to 160 MHz in all-band tuners.
The diode is encapsulated in the hermetically sealed glass envelope SOD-80 suitable for surface mounting.

QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	32 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 0.5 V V_R = 28 V	C_d	> 	63 pF 2.5 to 3.0 pF
Capacitance ratio at f = 1 MHz	C_d (V_R = 0.5 V) C_d (V_R = 28 V)	>	21
Series resistance at f = 100 MHz V_R is that value at which C_d = 40 pF	r_s	<	2.0 Ω

MECHANICAL DATA

Dimensions in mm



The cathode is indicated by a white band on the body.

Fig. 1 SOD-80.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage, peak value	V_{RM}	max.	32	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating junction temperature	T_j	max.	100	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.6	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200	nA
Diode capacitance at f = 1 MHz				
V_R = 0.5 V	C_d	>	63	pF
V_R = 28 V	C_d		2.5 to 3.0	pF
Capacitance ratio at f = 1 MHz	C_d (V_R = 0.5 V) / C_d (V_R = 28 V)	>	21	
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 40 pF	r_s	<	2.0	Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2.5	%

VHF VARIABLE CAPACITANCE DOUBLE DIODE

The BB804 is a variable capacitance double diode in planar technology with common cathode in a plastic SOT23 envelope. It is intended for FM tuning especially for car radios.

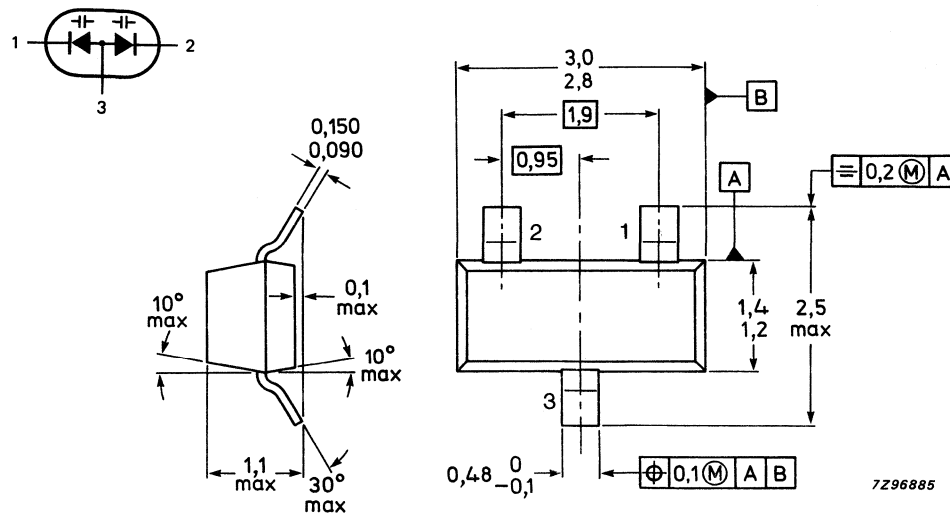
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	18 V
Repetitive peak reverse voltage	V_{RRM}	max.	20 V
Forward current (DC)	I_F	max.	50 mA
Operating junction temperature	T_j	max.	100 °C
Reverse current	I_R	max.	20 nA
Diode capacitance at f = 1 MHz V_R = 2 V	C_d		42 to 47.5 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75
Series resistance at f = 100 MHz V_R is that value at which C_d = 38 pF	r_s	typ.	0.20 Ω

MECHANICAL DATA

Dimensions in mm

Marking S3 x (x = 0 - 4)



TOP VIEW

Fig.1 SOT23.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	18	V
Forward current (DC)	I_F	max.	50	mA
Repetitive peak reverse voltage	V_{RRM}	max.	20	V
Storage temperature range	T_{stg}	−55 to +	100	°C
Operating junction temperature	T_j	max.	100	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Reverse current				
V_R = 16 V	I_R	<	20	nA
V_R = 16 V; T_{amb} = 60 °C	I_R	<	200	nA
Diode capacitance at f = 1.0 MHz				
V_R = 2 V				
red 0	C_d		42 to 43.5	pF
yellow 1	C_d		43 to 44.5	pF
white 2	C_d		44 to 45.5	pF
green 3	C_d		45 to 46.5	pF
blue 4	C_d		46 to 47.5	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75	
Series resistance				
at f = 100 MHz, V_R is that value at which C_d = 38 pF	r_s	typ.	0.20	Ω

VARIABLE CAPACITANCE DIODE

Silicon planar variable capacitance diode in a microminiature envelope. It is intended for electronic tuning applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Reverse voltage	V_R	max.	28 V
Reverse current at V_R = 28 V	I_R	<	50 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz V_R = that value at which C_d = 9 pF	r_D	<	1,2 Ω

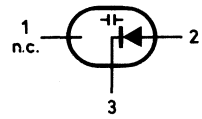
MECHANICAL DATA

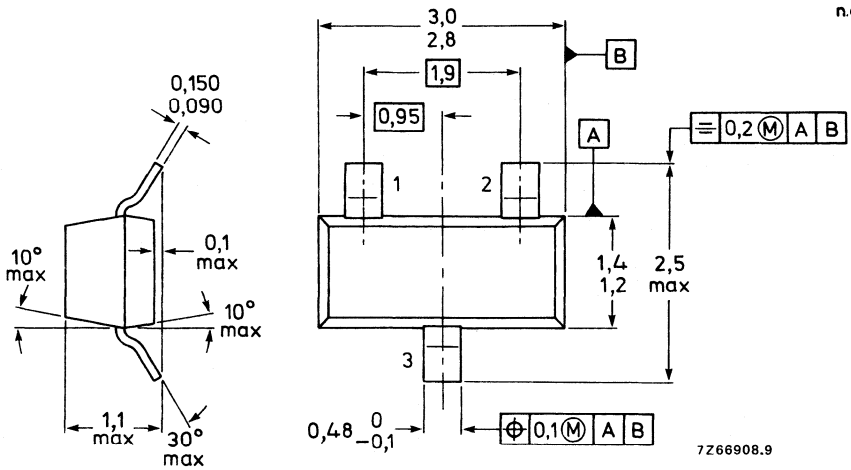
Dimensions in mm

Fig. 1 SOT-23.

Marking code

BBY31 = S1





TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	28	V
Reverse voltage (peak value)	V_{RM}	max.	30	V
Forward current (d.c.)**	I_F	max.	20	mA
Storage temperature	T_{stg}	−65 to +	100	°C
Operating junction temperature	T_j	max.	85	°C

THERMAL RESISTANCE

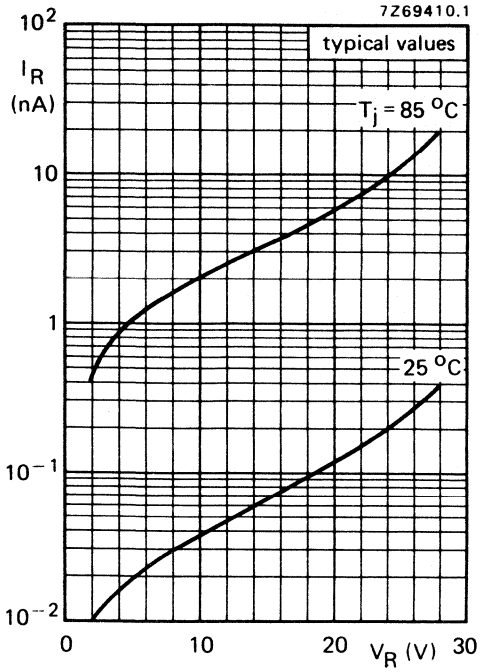
From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

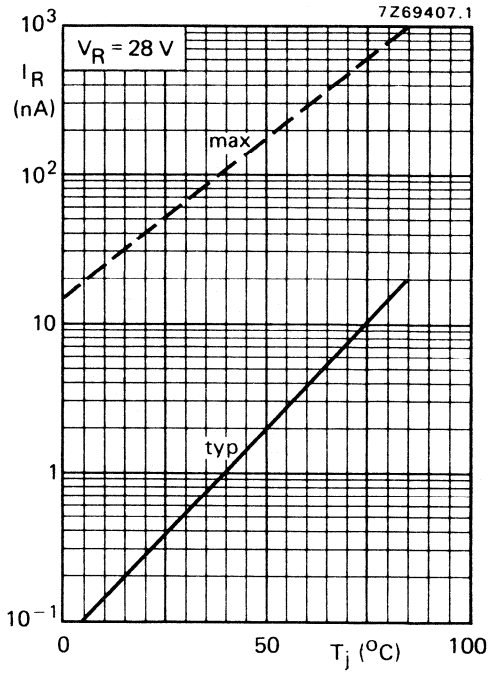
CHARACTERISTICS

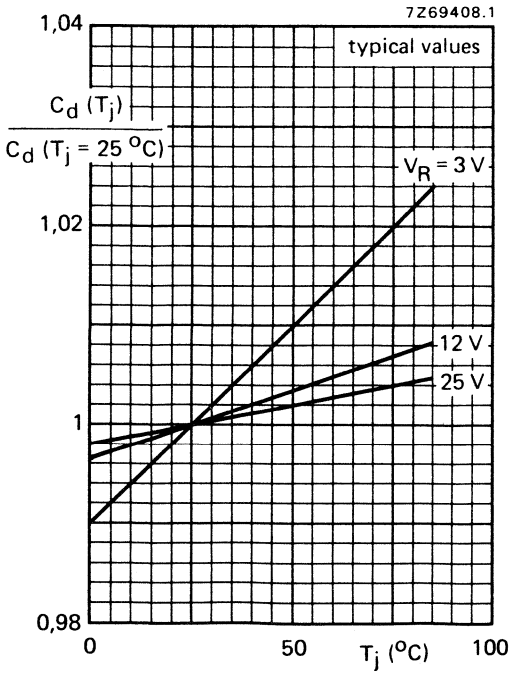
T_j = 25 °C unless otherwise specified

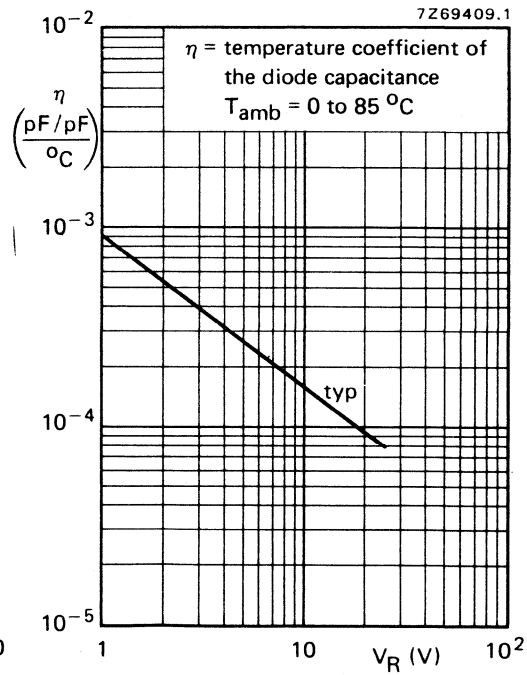
Reverse current				
V_R = 28 V	I_R	<	50	nA
V_R = 28 V; T_j = 85 °C	I_R	<	1000	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d	typ.	17,5	pF
V_R = 28 V	C_d	1,6 to	2,0	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	typ.	9,7	
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_D	<	1,2	Ω

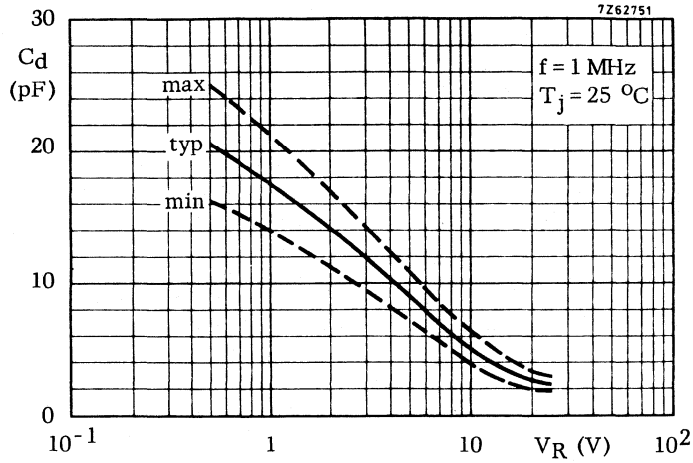
* Mounted on a ceramic substrate of 7 mm x 5 mm x 0,5 mm.


7Z69410.1
typical values
I_R (nA)
T_j = 85 °C
25 °C
10^2
10
1
10^{-1}
10^{-2}
0
10
20
V_R (V)
30


7Z69407.1
V_R = 28 V
I_R (nA)
max
typ
10^3
10^2
10
1
10^{-1}
0
50
T_j (°C)
100


7Z69408.1
typical values
$\frac{C_d(T_j)}{C_d(T_j = 25\ °C)}$
V_R = 3 V
12 V
25 V
1,04
1,02
1
0,98
0
50
T_j (°C)
100


7Z69409.1
η = temperature coefficient of the diode capacitance
T_{amb} = 0 to 85 °C
η $\left(\frac{pF/pF}{°C}\right)$
typ
10^{-2}
10^{-3}
10^{-4}
10^{-5}
1
10
V_R (V)
10^2


7Z62751
30
C_d
(pF)
20
10
0
max
typ
min
f = 1 MHz
T_j = 25 °C
10^{-1}
1
10
V_R (V)
10^2

DOUBLE VARIABLE CAPACITANCE DIODE

The BBY39 is a double variable capacitance diode with a common cathode and mounted in a microminiature envelope (SOT-23), suitable for surface mounting. The two diodes in one envelope are matched.

The device is intended for application in electronic tuners in satellite TV systems.

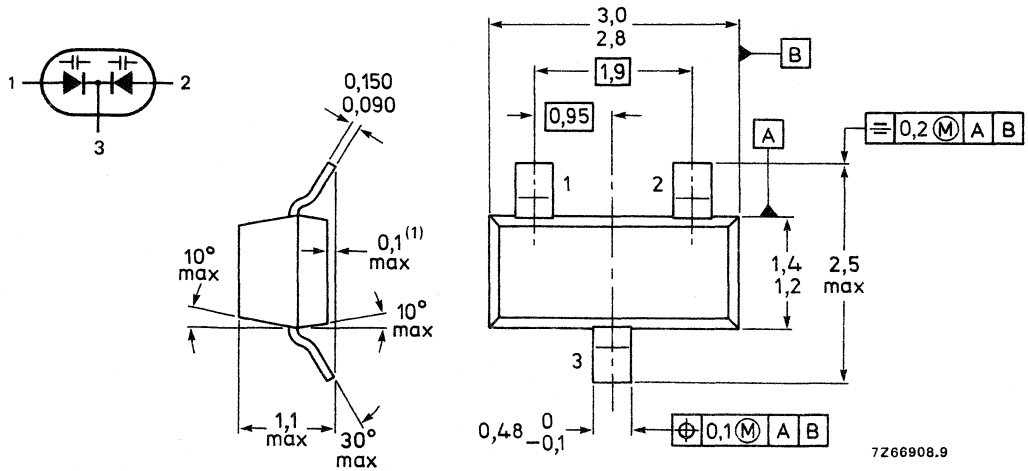
QUICK REFERENCE DATA

For each diode:			
Continuous reverse voltage	V_R	max.	30 V
Operating junction temperature	T_j	max.	85 °C
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	8,0
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	1,2 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

(1) Also available in 0,1 – 0,2 mm version.

RATINGS (for each diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30	V
Reverse voltage (peak value)	V_{RM}	max.	30	V
Forward current (d.c.)	I_F	max.	20	mA
Storage temperature	T_{stg}	−65 to +100		°C
Operating junction temperature	T_j	max.	85	°C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS (for each diode)

T_j = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_j = 85 °C	I_R	<	100	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d	typ.	17,5	pF
V_R = 28 V	C_d		1,8 to 2,0	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	7,6	
Series resistance at f = 470 MHz and that value of V_R at which C_d = 9 pF	r_s	<	0,75	Ω

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR VARIABLE CAPACITANCE DIODE

The BBY40 is a variable capacitance diode in a plastic envelope intended for electronic tuning in VHF television tuners with extended band I (FCC and OIRT-norm).

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	28 V
Reverse current at V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		39 to 46 pF
V_R = 28 V	C_d		3.8 to 4.8 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 12
Series resistance at f = 200 MHz V_R is that value at which C_d = 25 pF	r_S	<	0.7 Ω

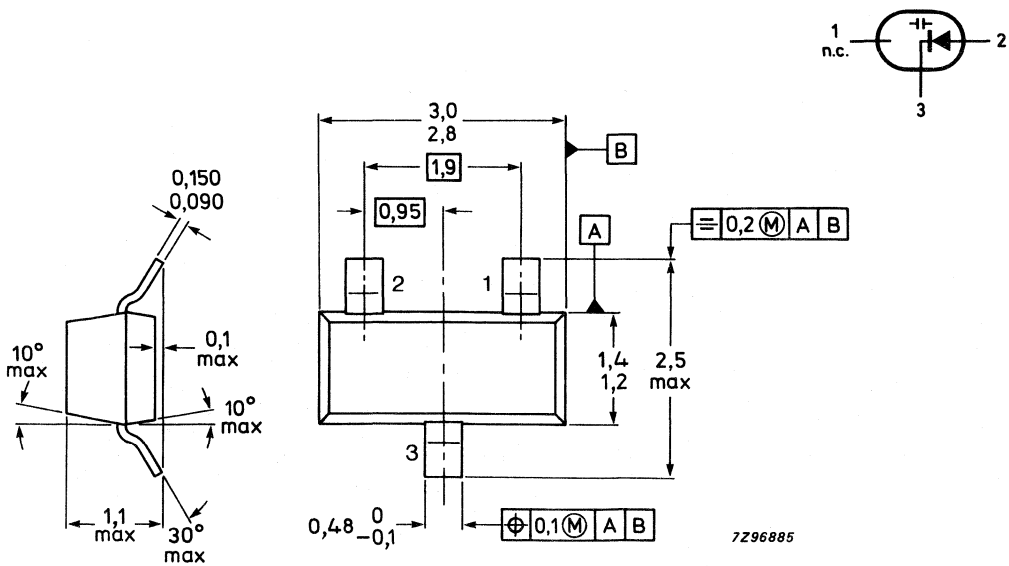
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

BBY40 = S2



TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	28	V
Reverse voltage (repetitive peak value)	V_{RRM}	max.	30	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature	T_{stg}		−55 to + 100	°C
Operating junction temperature	T_j	max.	85	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	typ.	0.1	nA
		<	10	nA
V_R = 28 V; T_{amb} = 60 °C	I_R	<	100	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d		39 to 46	pF
V_R = 3 V	C_d	typ.	29.0	pF
V_R = 28 V	C_d		3.8 to 4.8	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 12	
Series resistance at f = 200 MHz				
V_R is that value at which C_d = 25 pF	r_s	<	0.7	Ω

* Mounted on a ceramic substrate of 7 mm x 5 mm x 0.5 mm.

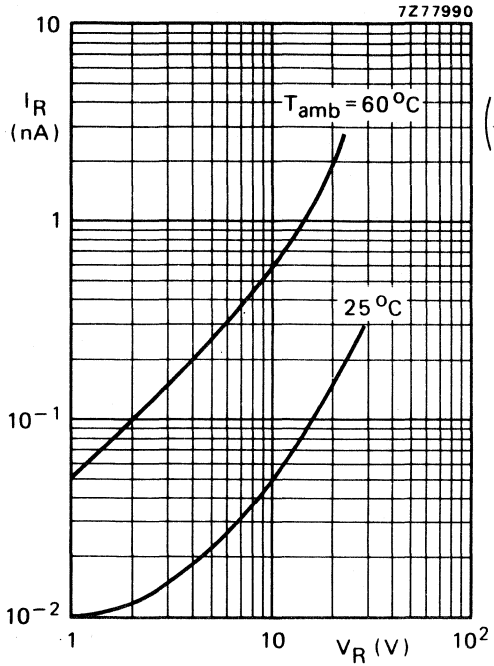


Fig. 2 Typical values

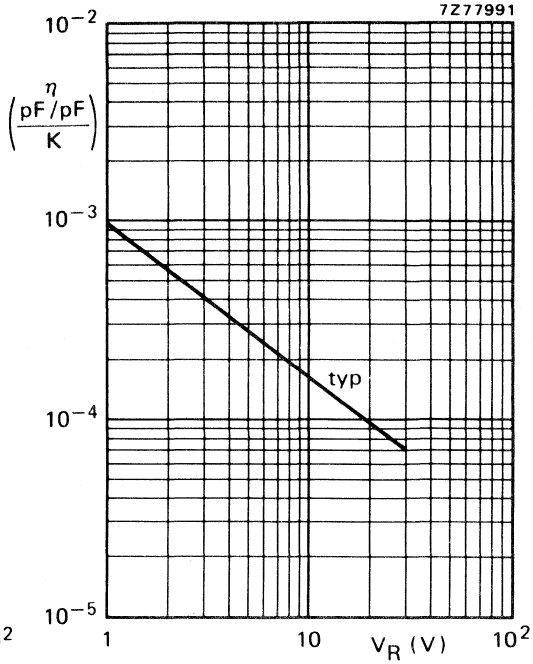


Fig. 3 Temperature coefficient of the diode capacitance; T_{amb} = 0 to 85 °C.

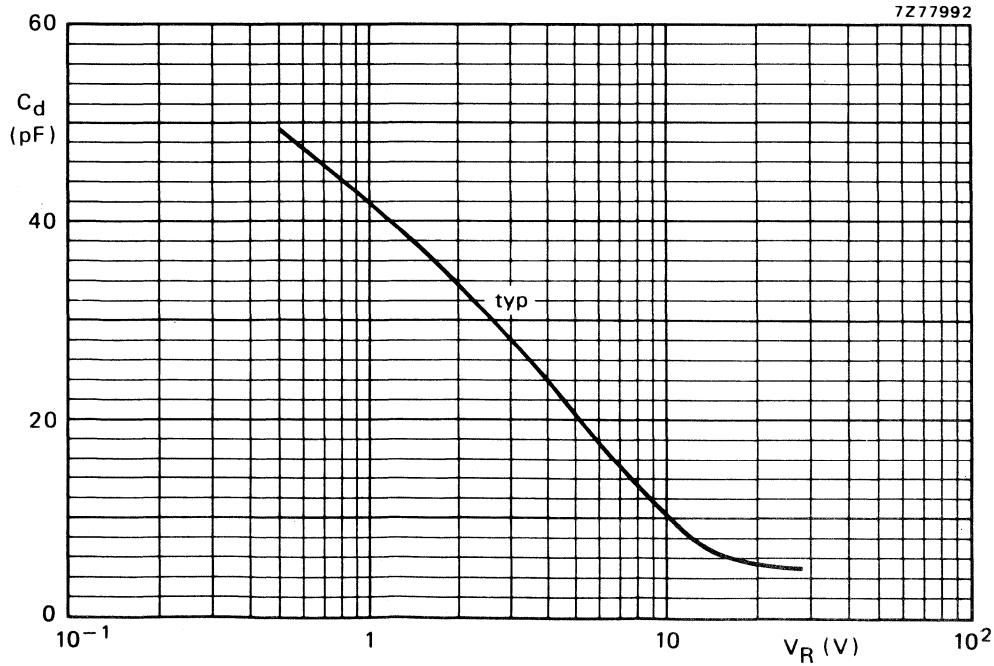


Fig. 4 f = 1 MHz; T_{amb} = 25 °C.

DOUBLE VARIABLE CAPACITANCE DIODE

The BBY62 is a double variable capacitance diode and mounted in a microminiature envelope (SOT-143).

The device is intended for application in electronic tuners using SMD technology.

QUICK REFERENCE DATA

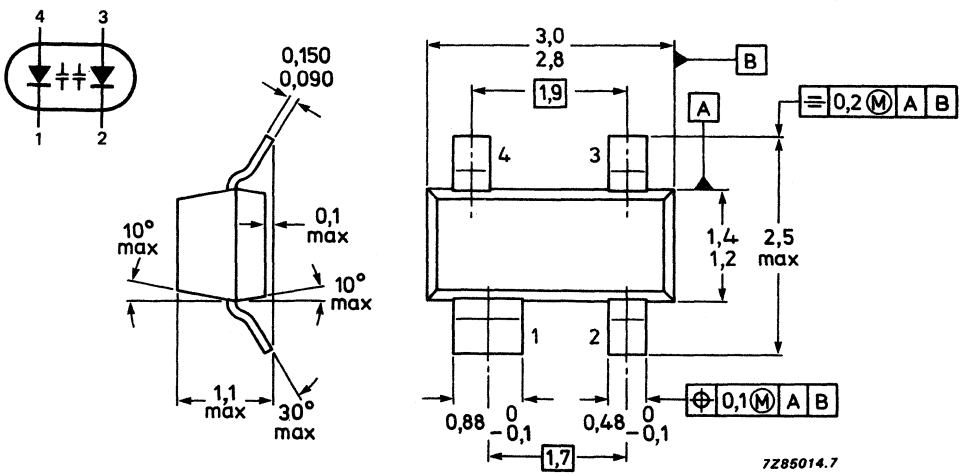
For each diode:			
Continuous reverse voltage	V_R	max.	28 V
Reverse current V_R = 28 V	I_R	<	50 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	1,2 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code: S4



TOP VIEW

RATINGS (for each diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	28 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}		−65 to + 100 °C
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS (for each diode)

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	50 nA
V_R = 28 V; T_j = 85 °C		<	1 μA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d	typ.	17,5 pF
V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	<	1,2 Ω

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film hybrid circuits.

N-P-N complements are BC817; R and BC818; R respectively.

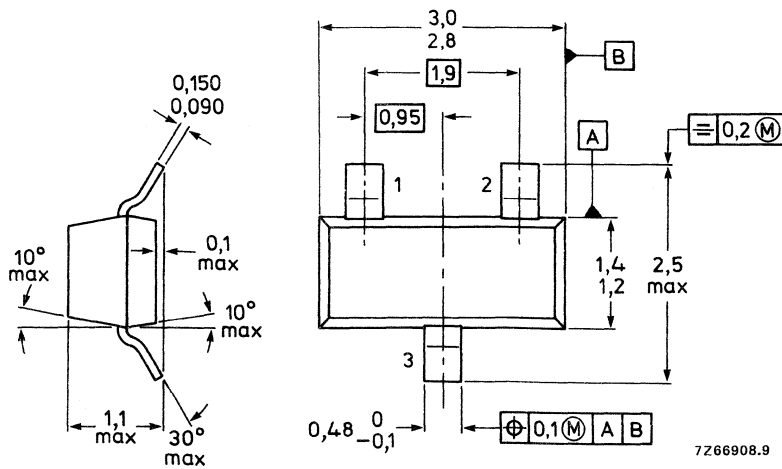
QUICK REFERENCE DATA

			BC807	BC808	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	100		MHz

MECHANICAL DATA

Fig. 1 SOT-23.

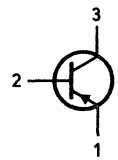
Dimensions in mm



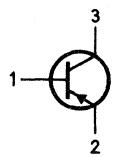
TOP VIEW

Marking code

BC807-16 = 5 A
-25 = 5 B
-40 = 5 C
BC808-16 = 5 E
-25 = 5 F
40 = 5 G



BC807-16R = 5 AR
-25R = 5 BR
-40R = 5 CR
BC808-16R = 5 ER
-25R = 5 FR
-40R = 5 GR



R-types are available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC807	BC808	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base) $-I_C$ = 10 mA	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (DC)	$-I_C$	max.	500		mA
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Emitter current (peak value)	I_{EM}	max.	1000		mA
Base current (DC)	$-I_B$	max.	100		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
→ Total power dissipation at T_{amb} = 25 °C *	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

→ From junction to ambient	$R_{tj\ j\text{-}a}$	=	430	K/W

→ * Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 20 V; T_j = 25 °C	$-I_{CBO}$	max.	100 nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 150 °C	$-I_{CBO}$	max.	5 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 5 V	$-I_{EBO}$	max.	10 μA
Base emitter voltage *			
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	$-V_{BE}$	max.	1,2 V
Saturation voltage			
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	max.	700 mV
D.C. current gain			
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	40
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V; BC807; BC808	h_{FE}		100 to 600
BC807-16 / BC808-16	h_{FE}		100 to 250
BC807-25 / BC808-25	h_{FE}		160 to 400
BC807-40 / BC808-40	h_{FE}		250 to 600
Transition frequency at f = 35 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	100 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	8 pF

* $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

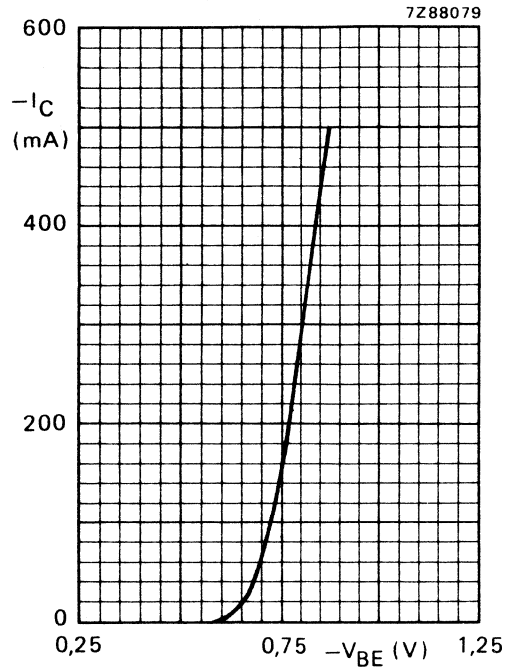


Fig. 2 $-V_{CE}$ = 1 V; T_j = 25 °C.
Typical values.

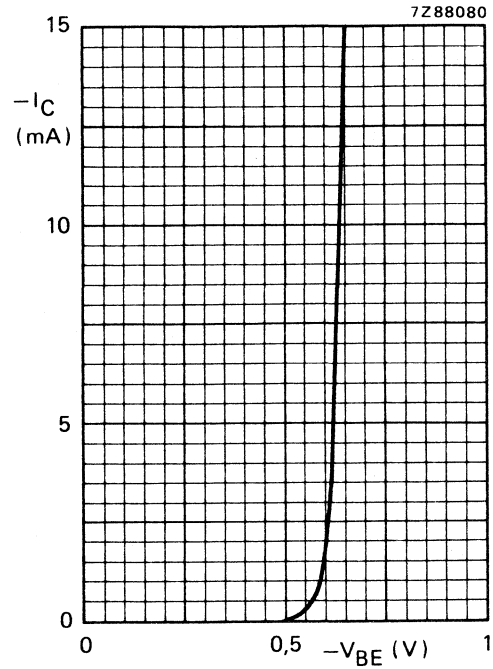


Fig. 3 $-V_{CE}$ = 5 V; T_j = 25 °C.
Typical values.

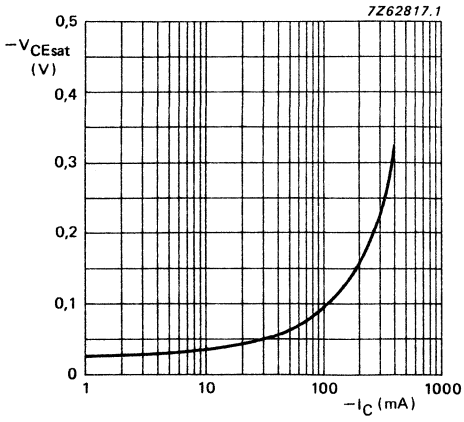


Fig. 4 typical values.

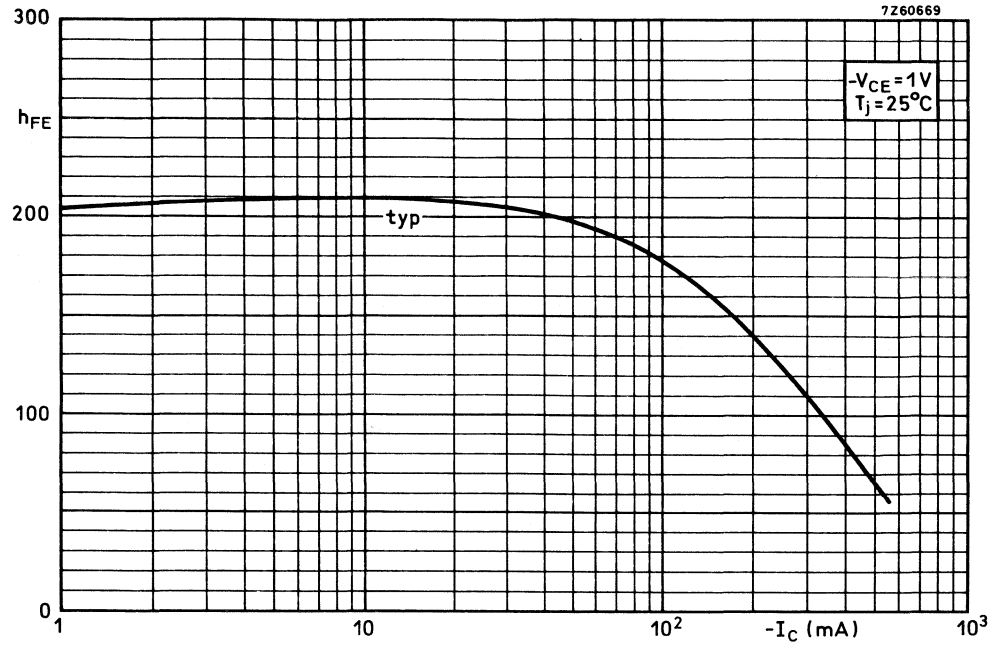


Fig. 5 D.C. current gain.

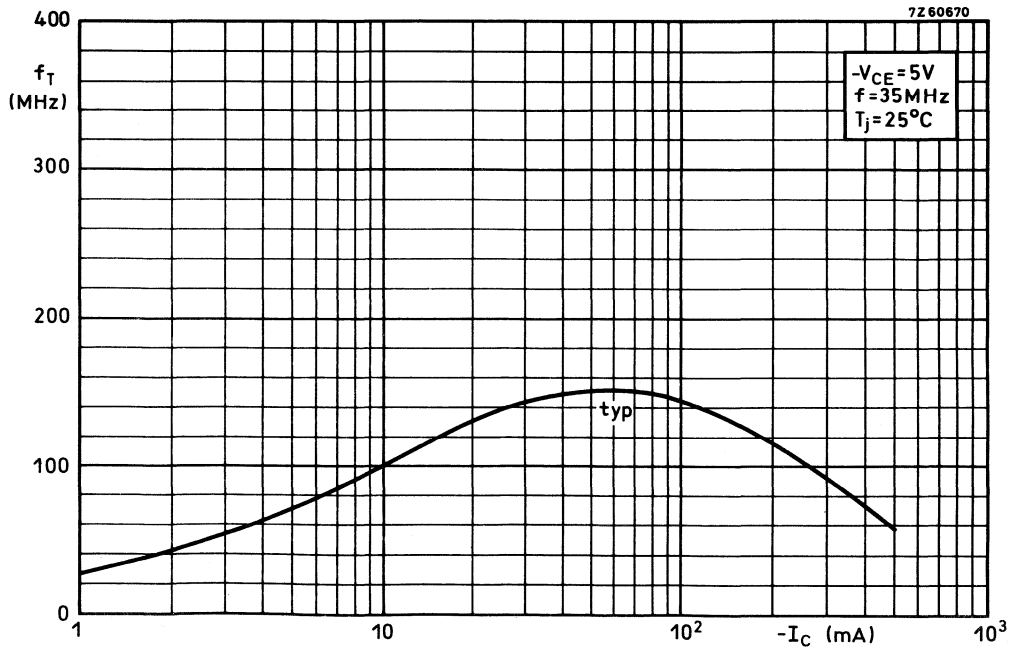


Fig. 6 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film hybrid circuits.

P-N-P complements are BC807; R and BC808; R respectively.

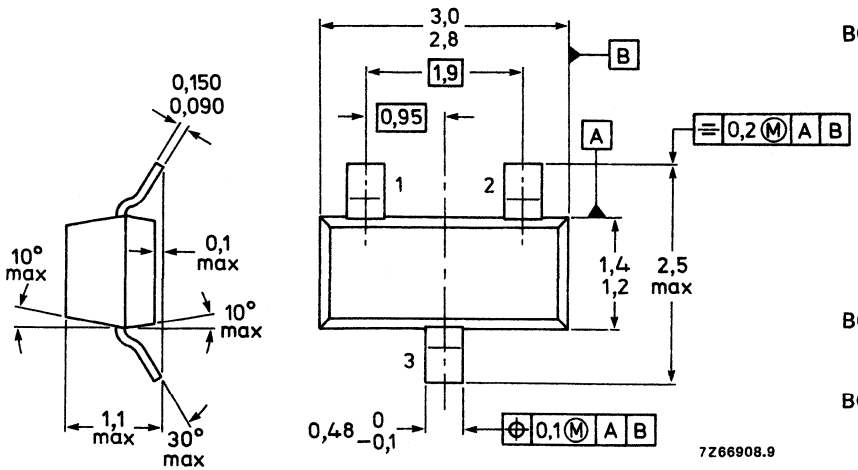
QUICK REFERENCE DATA

			BC817	BC818	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200		MHz

MECHANICAL DATA

Dimensions in mm

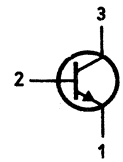
Fig. 1 SOT-23.



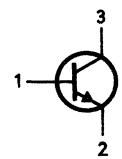
TOP VIEW

Marking code

BC817-16 = 6 A
-25 = 6 B
-40 = 6 C
BC818-16 = 6 E
-25 = 6 F
-40 = 6 G



BC817-16R = 6 AR
-25R = 6 BR
-40R = 6 CR
BC818-16R = 6 ER
-25R = 6 FR
-40R = 6 GR



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC817	BC818	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) I_C = 10 mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

→ **THERMAL RESISTANCE**

From junction to ambient* $R_{th\ j\text{-}a}$ = 430 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V; T_j = 25 °C	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	5 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10 μA
Base emitter voltage *			
I_C = 500 mA; V_{CE} = 1 V	V_{BE}	<	1,2 V
Saturation voltage			
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	700 mV
D.C. current gain			
I_C = 500 mA; V_{CE} = 1 V	h_{FE}	>	40
I_C = 100 mA; V_{CE} = 1 V; BC817; BC818	h_{FE}		100 to 600
BC817-16 | BC818-16	h_{FE}		100 to 250
BC817-25 | BC818-25	h_{FE}		160 to 400
BC817-40 | BC818-40	h_{FE}		250 to 600
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	5 pF

* V_{BE} decreases by about 2 mV/K with increasing temperature.

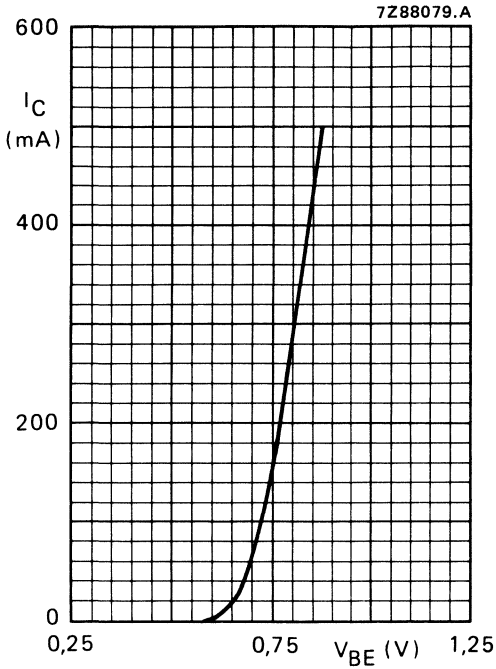


Fig. 2 V_{CE} = 1 V; T_j = 25 °C. Typical values.

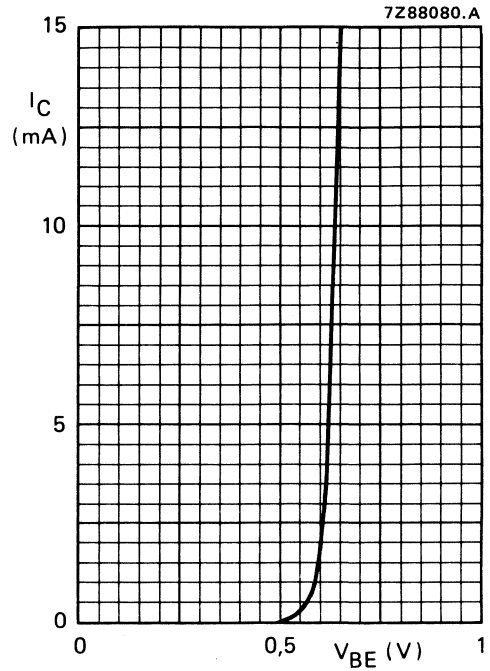


Fig. 3 V_{CE} = 5 V; T_j = 25 °C. Typical values.

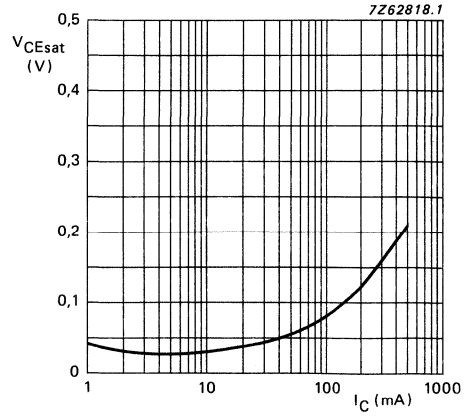


Fig. 4 I_C/I_B = 10; T_j = 25 °C.

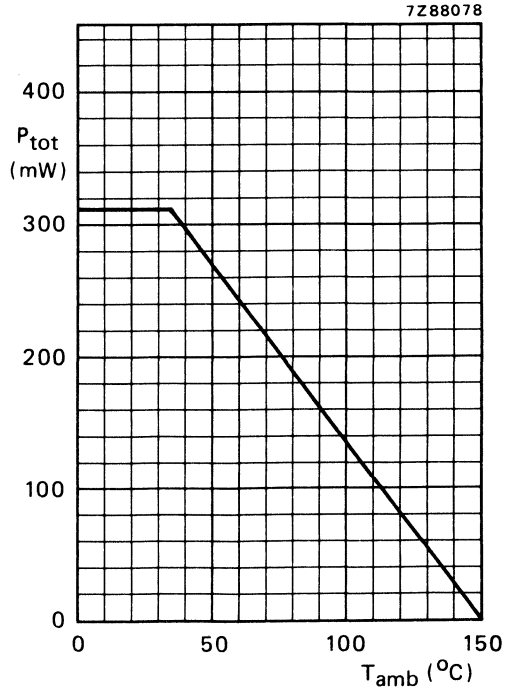


Fig. 5 Power derating curve.

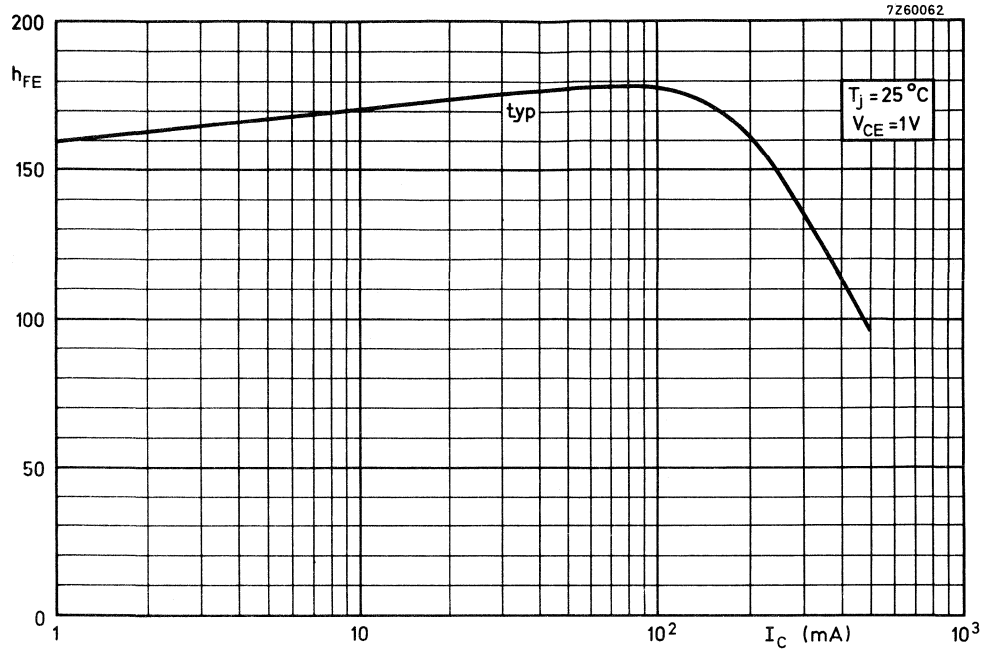


Fig. 6 D.C. current gain.

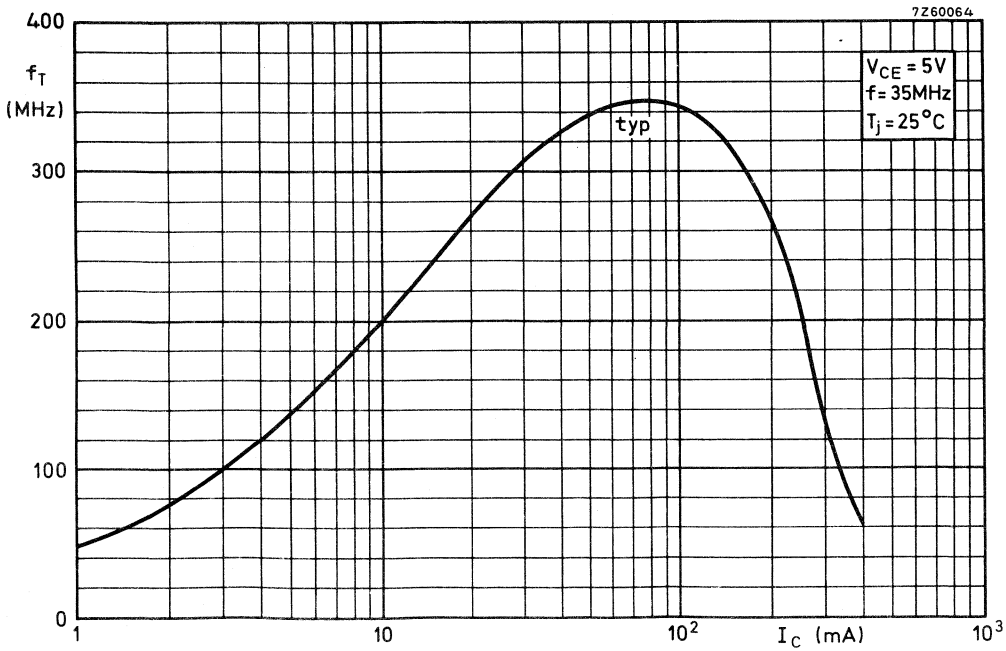


Fig. 7 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

General purpose n-p-n transistors in a plastic SOT-23 variant, especially suitable for use in driver stages of audio amplifiers in thick and thin-film hybrid circuits.

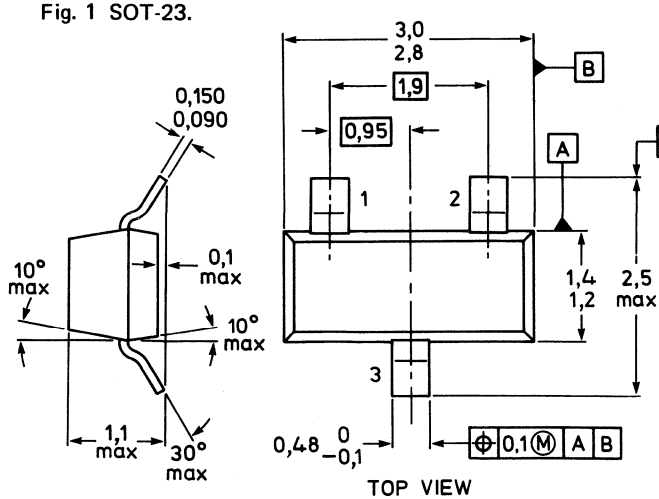
QUICK REFERENCE DATA

			BC846	BC847	BC848	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Collector current (peak value)	I_{CM}	max.	200	200	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	300	300	mW
Junction temperature	T_j	max.	150	150	150	°C
Small-signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	>	125	125	125	
		<	500	900	900	
Transition frequency I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	300	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F	typ.	2	2	2	dB

MECHANICAL DATA

Dimensions in mm

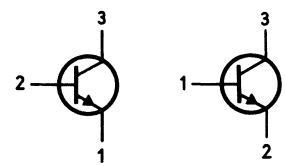
Fig. 1 SOT-23.



Marking code

	type	reverse
BC846A	1A	1AR
B	1B	1BR
BC847A	1E	1ER
B	1F	1FR
C	1G	1GR
BC848A	1J	1JR
B	1K	1KR
C	1L	1LR

type : reverse:



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC846	BC847	BC848	
Collector-base voltage (open emitter)	V_{CBO}	max.	80	50	30	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	6	5	V
Collector current (d.c.)	I_C	max.		100		mA
Collector current (peak value)	I_{CM}	max.		200		mA
Emitter current (peak value)	$-I_{EM}$	max.		200		mA
Base current (peak value)	I_{BM}	max.		200		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.		300		mW
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 430 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15	nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5	μA
Base-emitter voltage*				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660	mV
		580 to	700	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770	mV
Saturation voltage**				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.
** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

			BC846	BC847	BC848	
Small signal current gain at f = 1 kHz						
I_C = 2 mA; V_{CE} = 5 V	h_{fe}	>	125	125	125	
		<	500	900	900	
Noise figure at R_S = 2 kΩ						
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2	2	2	dB
		<	10	10	10	dB
			BC846A BC847A BC848A	BC846B BC847B BC848B	BC847C BC848C	
D.C. current gain						
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	90	150	270	
		>	110	200	420	
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.	180	290	520	
		<	220	450	800	

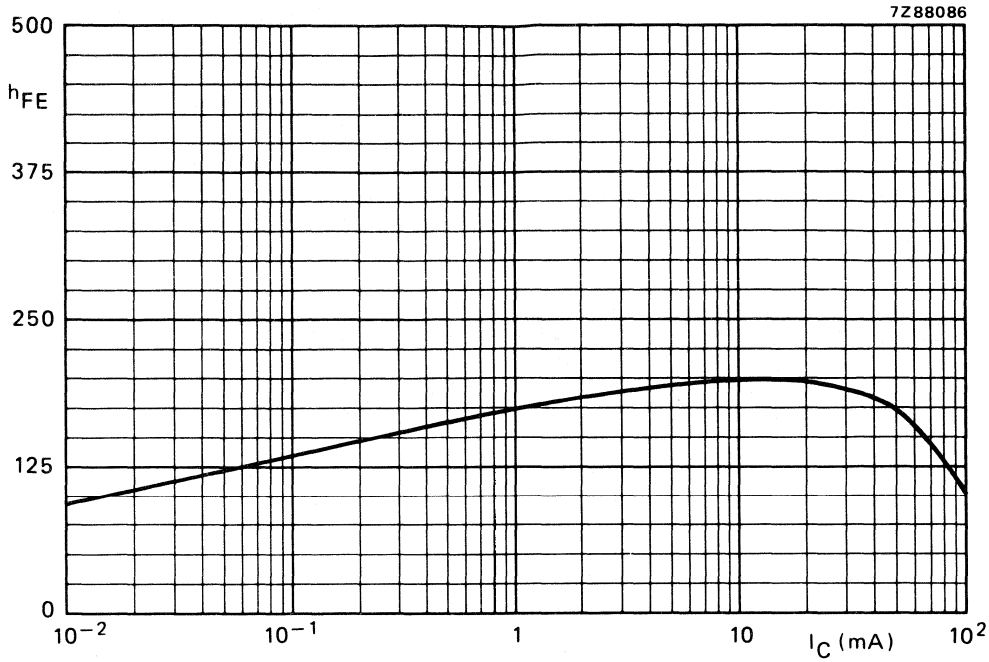


Fig. 3 Typical D.C. current gain for A-selections. V_{CE} = 5 V; T_j = 25 °C.

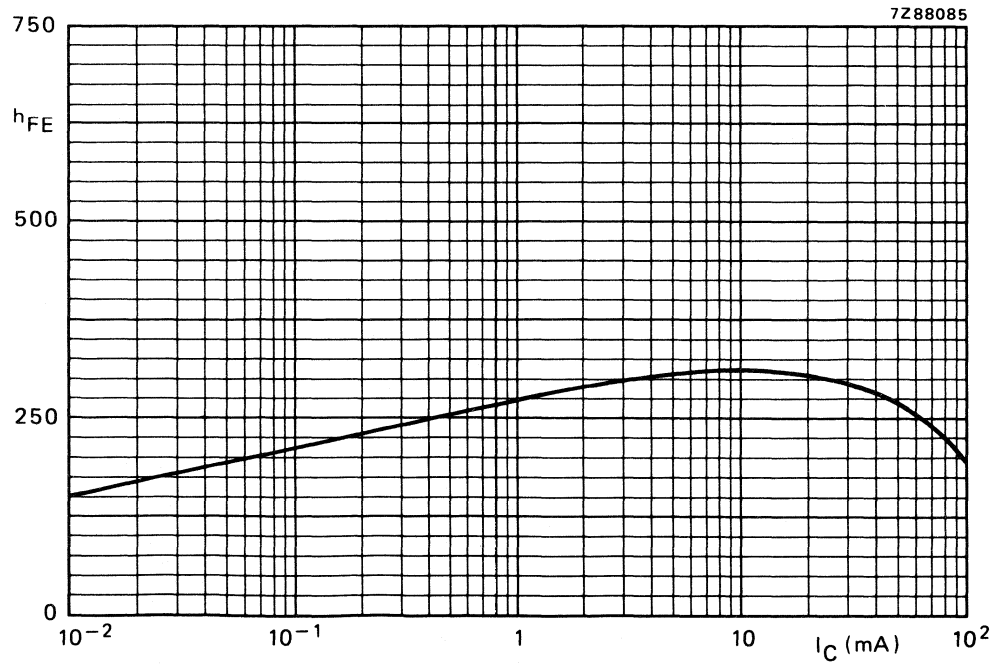


Fig. 4 Typical D.C. current gain for B-selections. V_{CE} = 5 V; T_j = 25 °C.

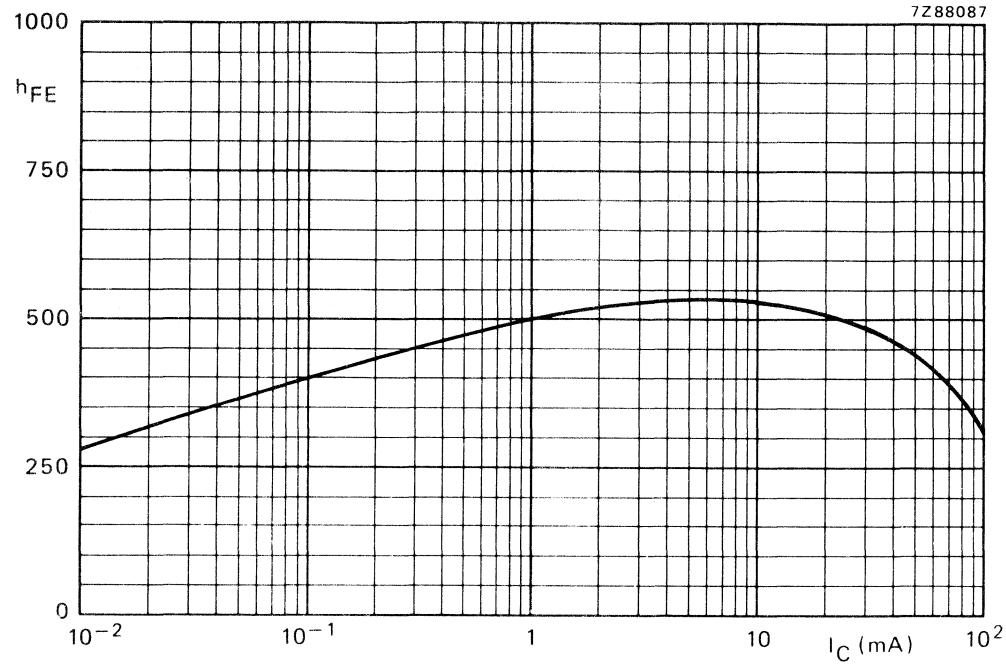


Fig. 5 Typical D.C. current gain for C-selections. V_{CE} = 5 V; T_j = 25 °C.

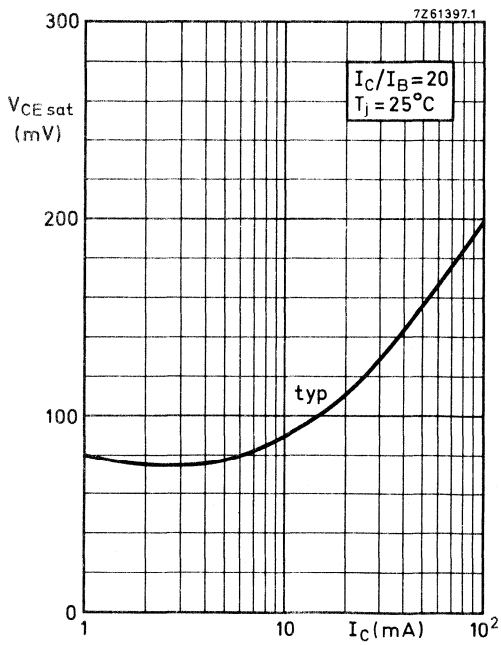


Fig. 6 Typical values.

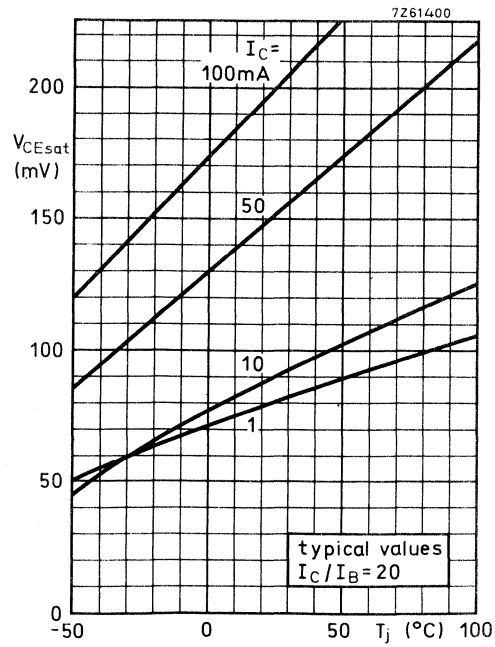


Fig. 7 Typical values.

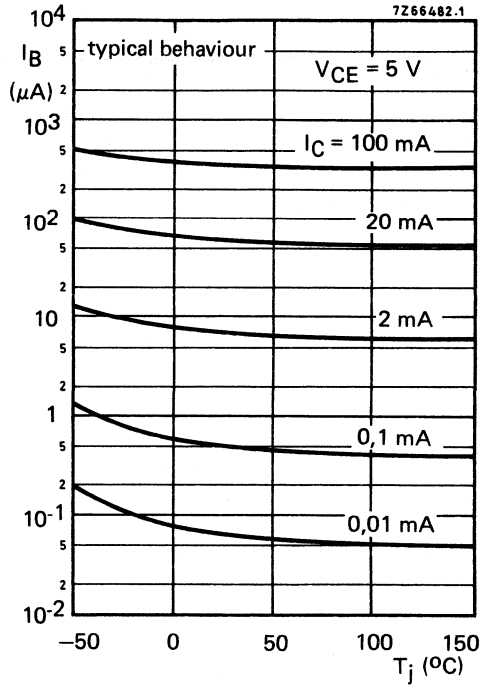


Fig. 8 Typical behaviour of base current versus junction temperature.

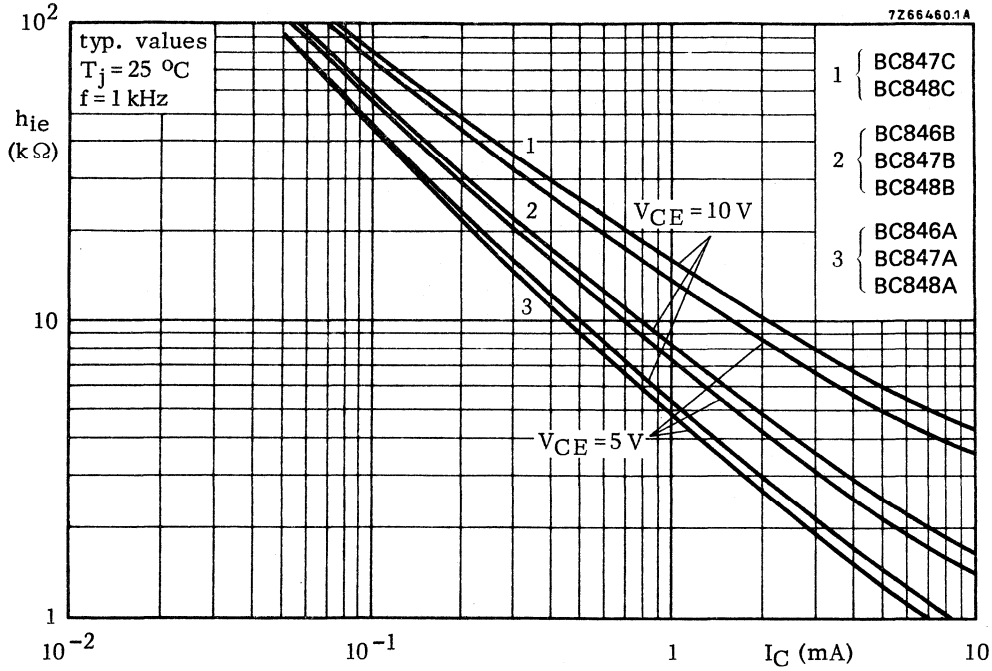


Fig. 9 Input impedance. 1 = C selections; 2 = B selections; 3 = A selections.

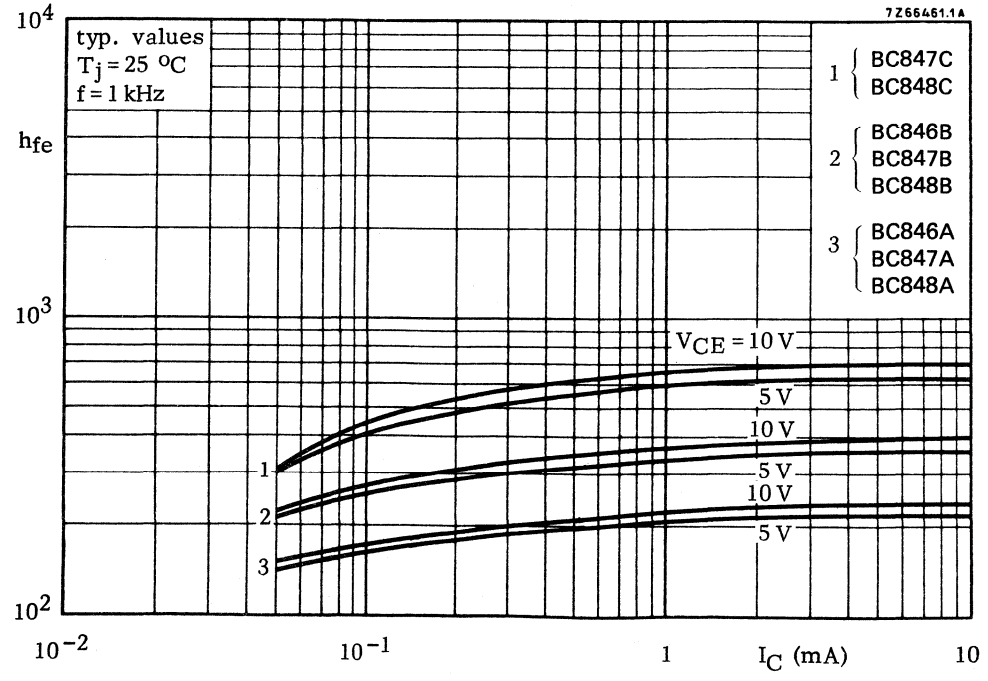


Fig. 10 Small signal current gain. 1 = C-; 2 = B- and 3 = A-selections.

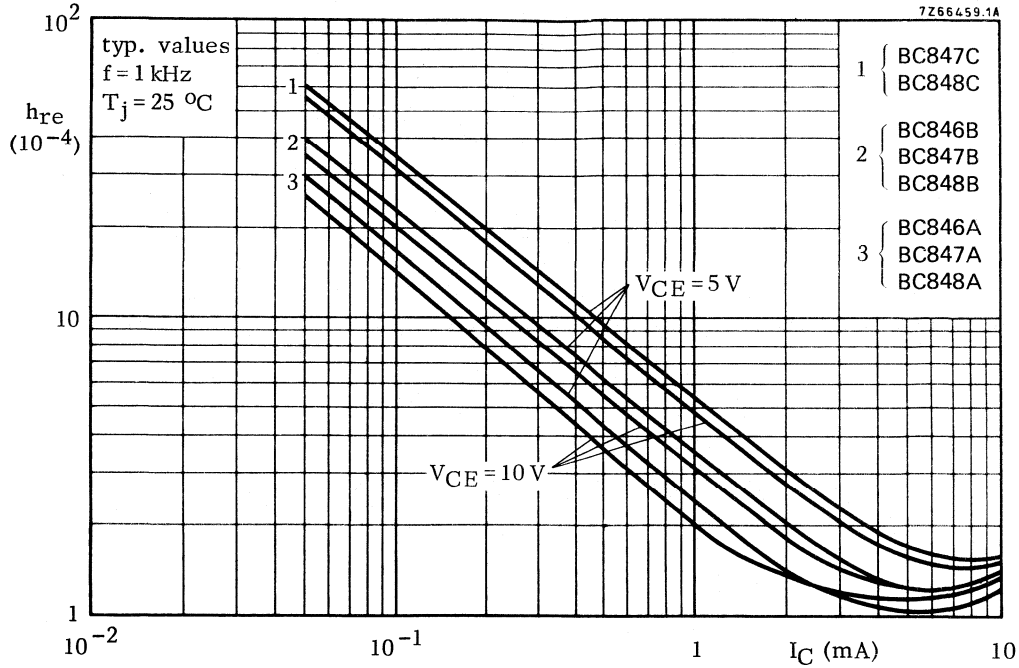


Fig. 11 Reverse voltage transfer ratio. 1 = C-; 2 = B- and 3 = A-selections.

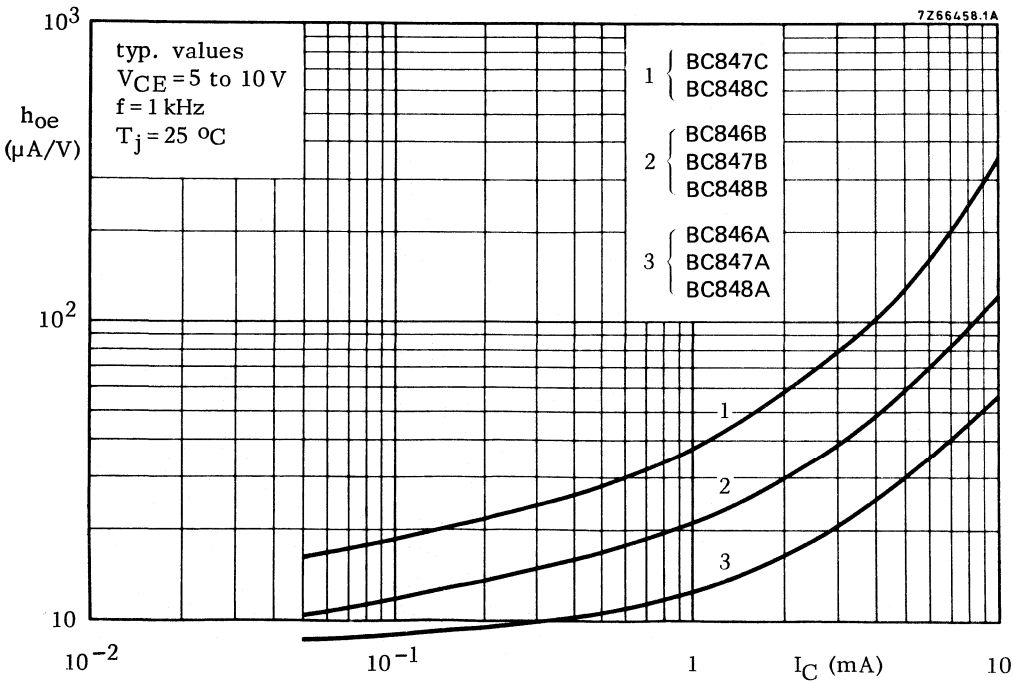


Fig. 12 Output admittance. 1 = C-; 2 = B- and 3 = A-selections.

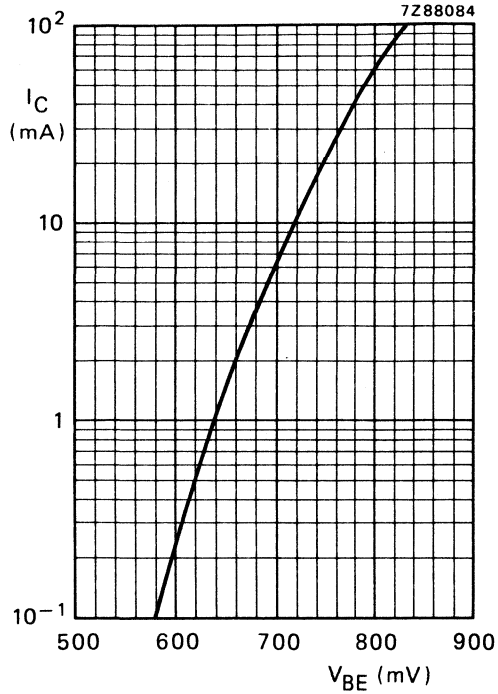


Fig. 13 Typical values at V_{CE} = 5 V; T_j = 25 °C.

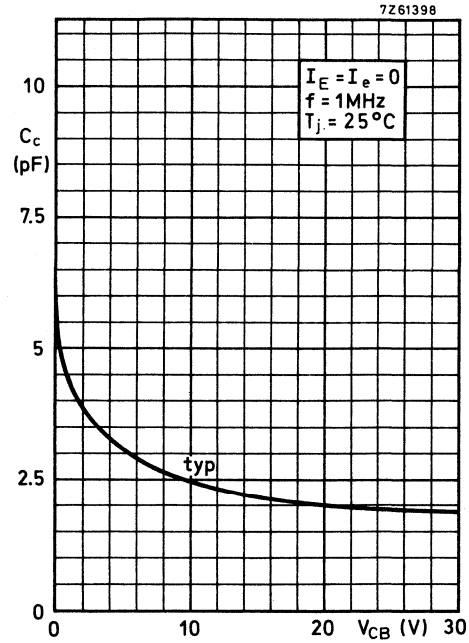


Fig. 14 Typical values.

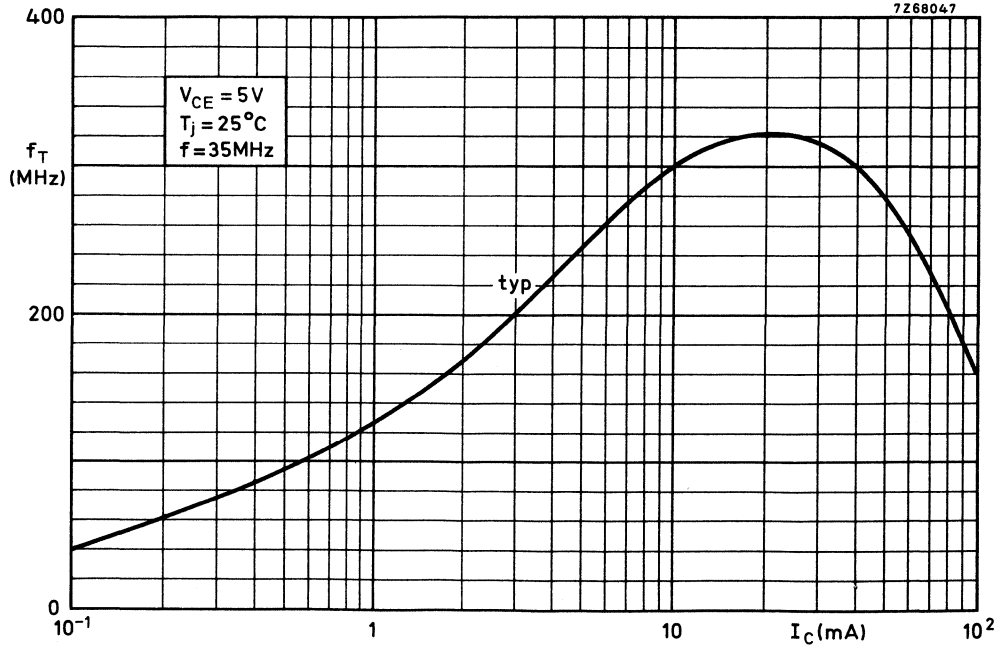


Fig. 15 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a plastic SOT-23 envelope, primarily intended for low-noise input stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment in thick and thin-film hybrid circuits.

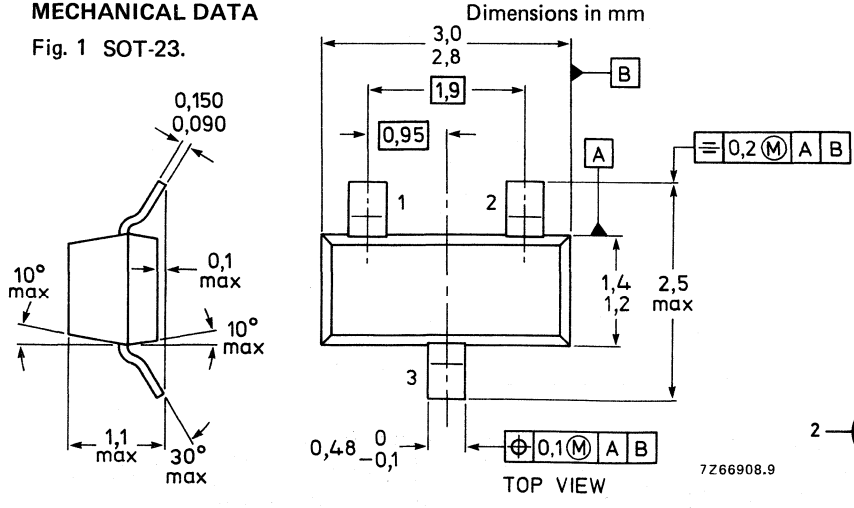
QUICK REFERENCE DATA

			BC849	BC850	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Collector current (peak value)	I_{CM}	max.	200	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	300	mW
Junction temperature	T_j	max.	150	150	°C
Small-signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	> <	240 900	240 900	
Transition frequency I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V					
f = 30 Hz to 15 kHz	F	typ. <	1,4 4	1,4 3	dB dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
f = 10 Hz to 50 Hz (equivalent noise voltage)	V_n	<	–	0,135	μV

MECHANICAL DATA

Fig. 1 SOT-23.

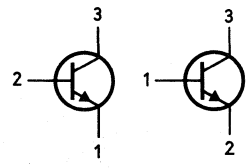
Dimensions in mm



Marking code

BC849B = 2B
BC849C = 2C
BC850B = 2F
BC850C = 2G

BC849BR = 2BR
BC849CR = 2CR
BC850BR = 2FR
BC850CR = 2GR



R-types are available on request

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC849	BC850	
Collector-base voltage (open emitter)	V_{CBO}	max.	30	50	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Emitter current (peak value)	$-I_{EM}$	max.	200		mA
Base current (peak value)	I_{BM}	max.	200		mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

→ THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 430 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15	nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5	μA
Base emitter voltage*				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660	mV
		580 to	700	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770	mV
Saturation voltages**				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.

** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

			BC849	BC850	
Small signal current gain at f = 1 kHz					
I_C = 2 mA; V_{CE} = 5 V	h_{fe}	>	240	240	
		<	900	900	
Noise figure at R_S = 2 kΩ					
I_C = 200 μA; V_{CE} = 5 V					
f = 30 Hz to 15 kHz	F	typ.	1,4	1,4	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
		<	4	4	dB
Equivalent noise voltage at R_S = 2 kΩ					
I_C = 200 μA; V_{CE} = 5 V					
f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	max.	–	0,135	μV

			B-selections	C-selections
D.C. current gain				
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	150	270
		>	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.	290	520
		<	450	800

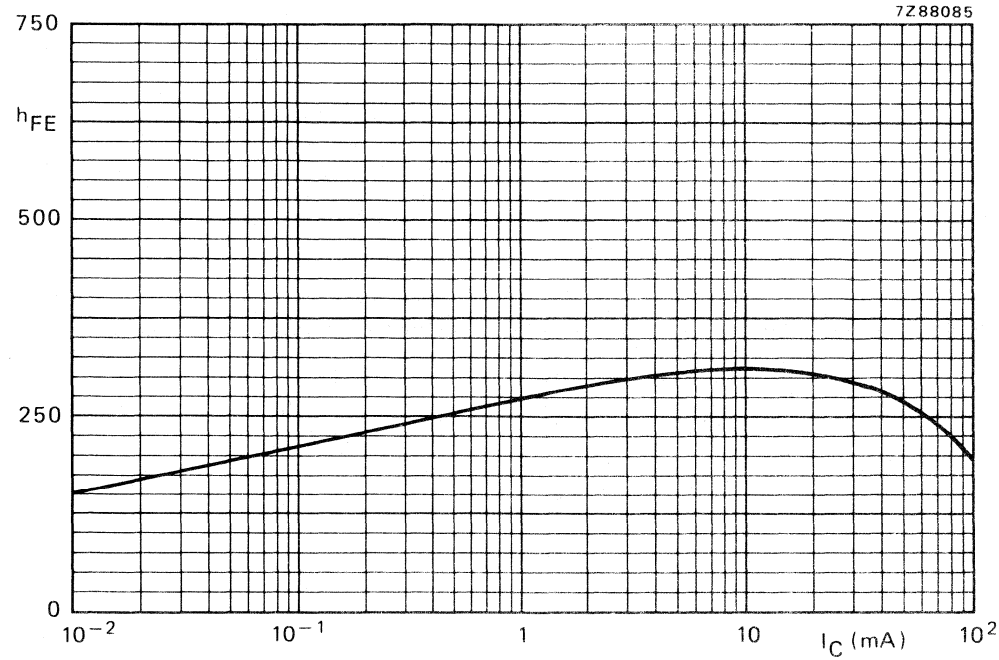


Fig. 3 Typical D.C. current gain B selections. V_{CE} = 5 V; T_j = 25 °C.

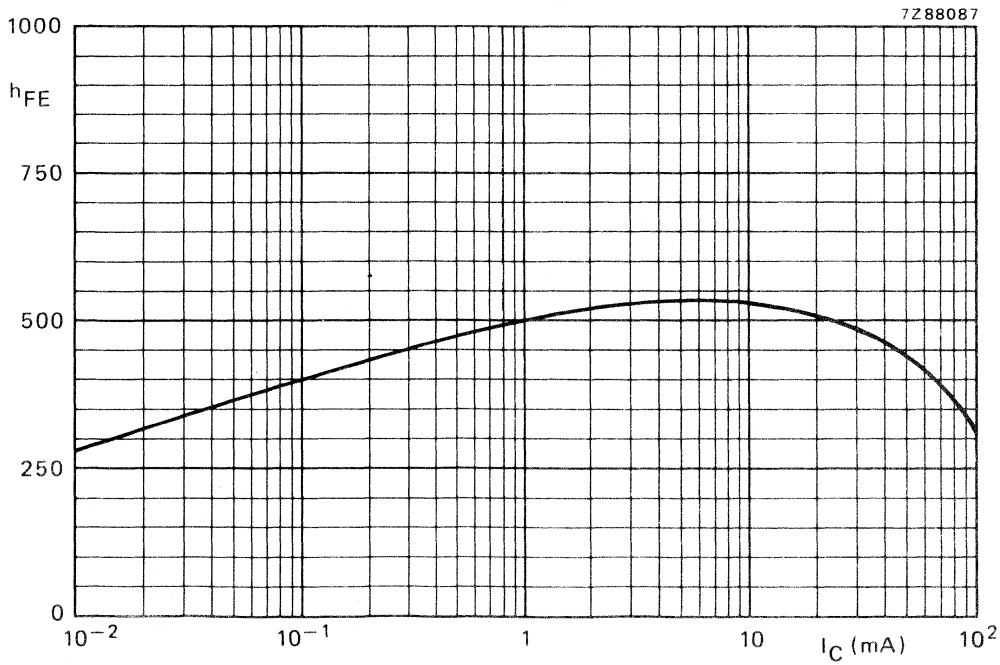


Fig. 4 Typical D.C. current gain C selections. V_{CE} = 5 V; T_j = 25 °C.

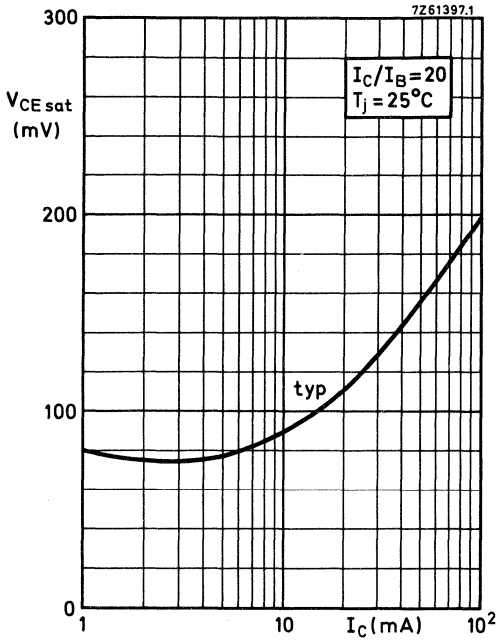


Fig. 5 Typical values.

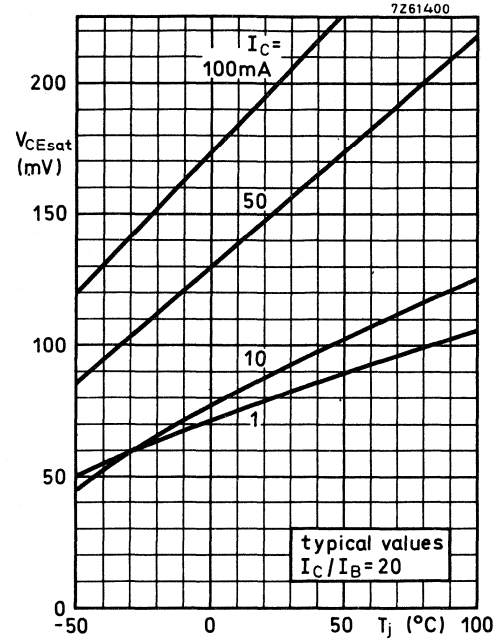


Fig. 6 Typical values; $I_C/I_B = 20$.

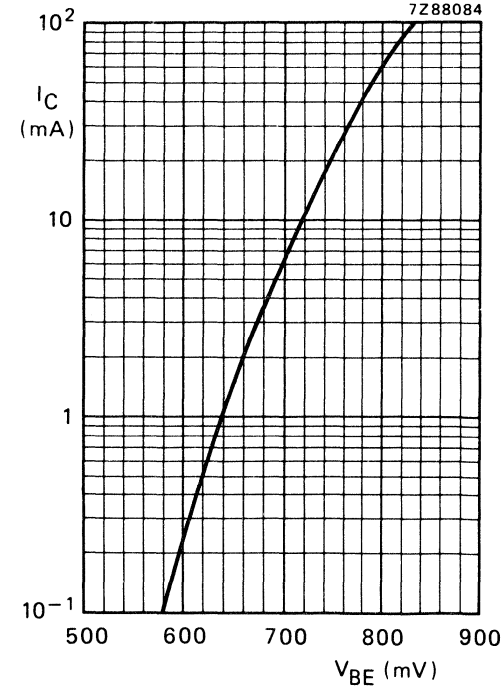


Fig. 7 Typical values V_{BE}. V_{CE} = 5 V; T_j = 25 °C.

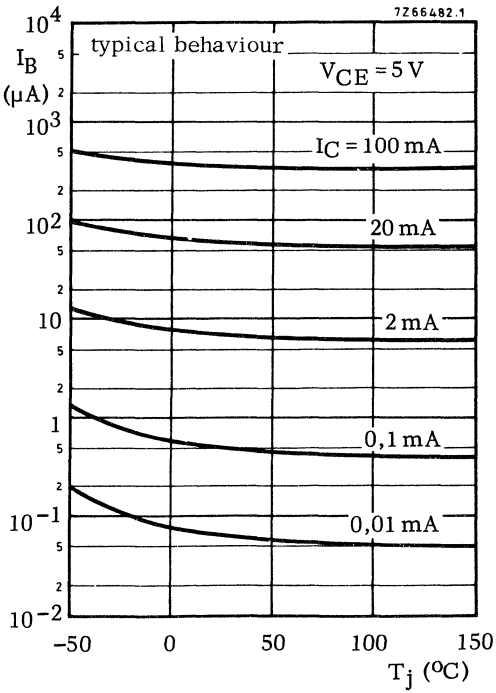


Fig. 8 Typical values.

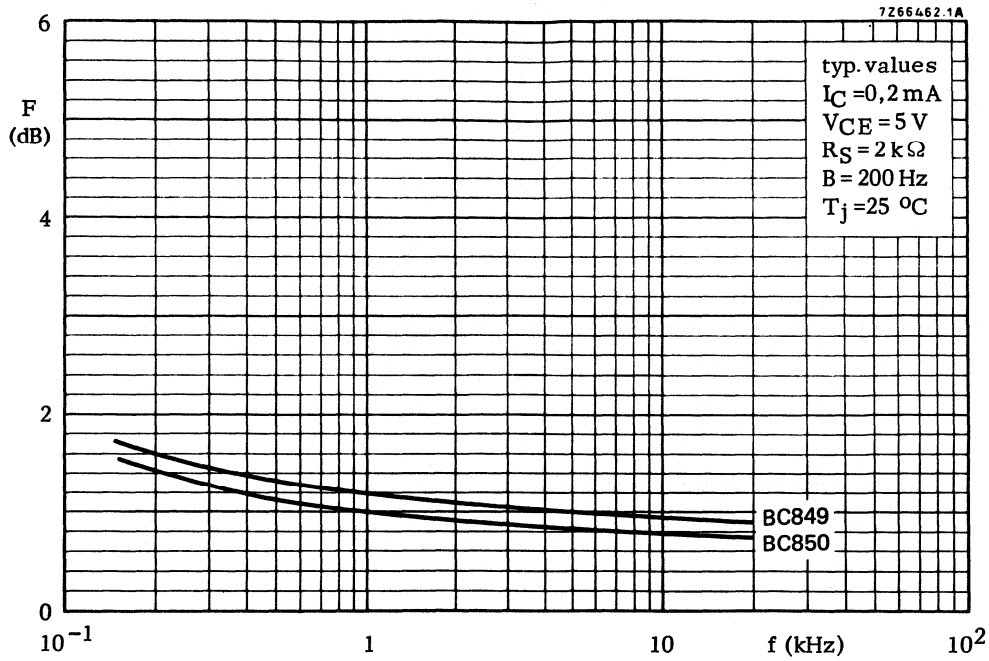

7Z66462.1A
6
F
(dB)
4
2
0
typ. values
I_C =0,2 mA
V_{CE} = 5 V
R_S = 2 kΩ
B = 200 Hz
T_j =25 °C
BC849
BC850
10^{-1}
1
10
f (kHz)
10^2

Fig. 9.

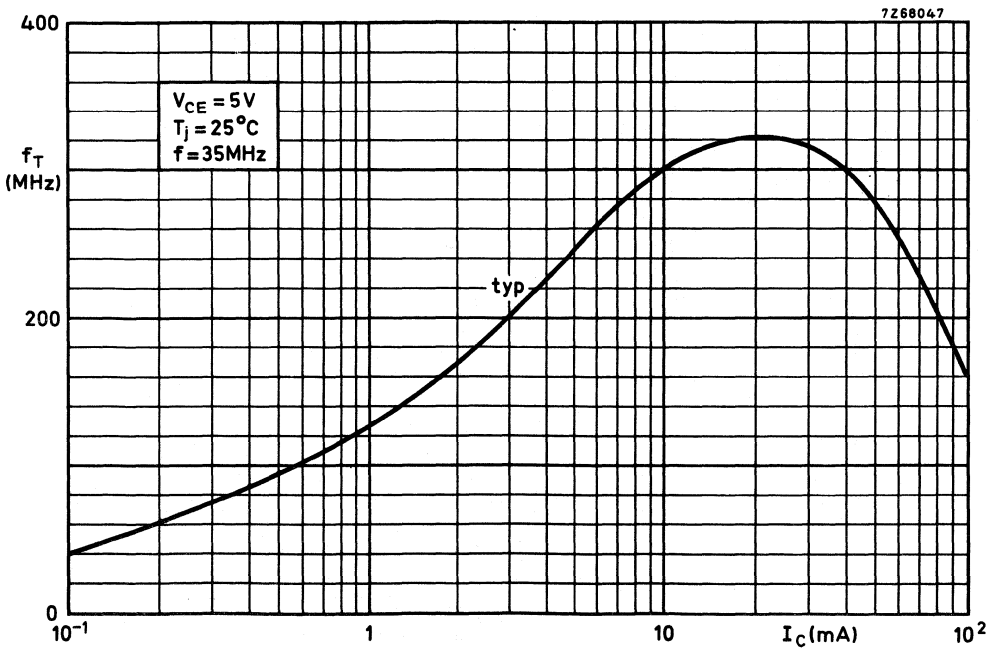

7Z68047
400
f_T
(MHz)
200
0
V_{CE} = 5V
T_j = 25°C
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 10.

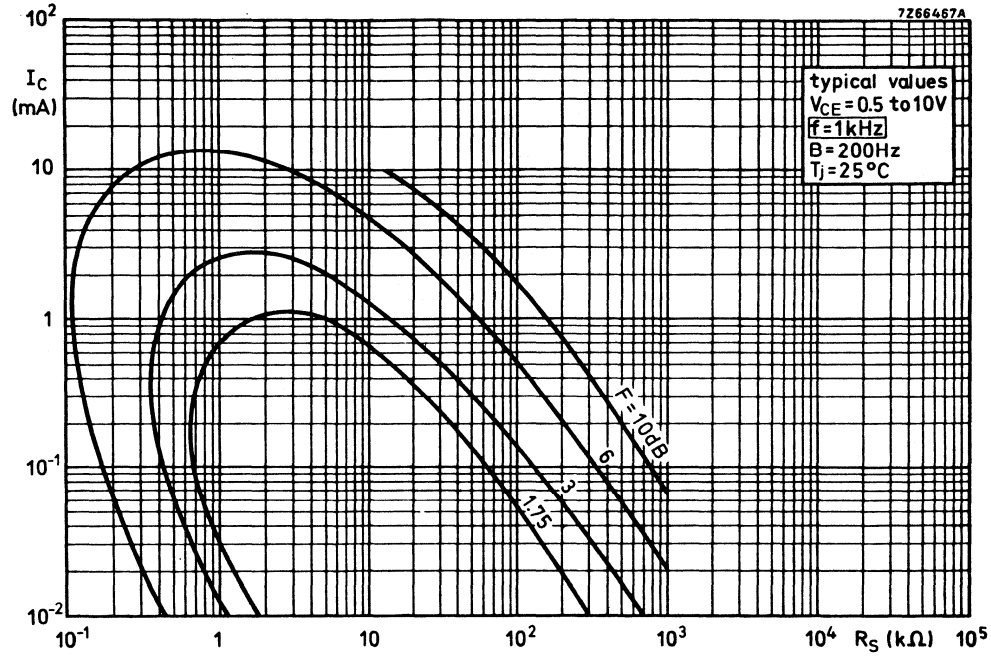


Fig. 11 Curves of constant noise figure for BC849.

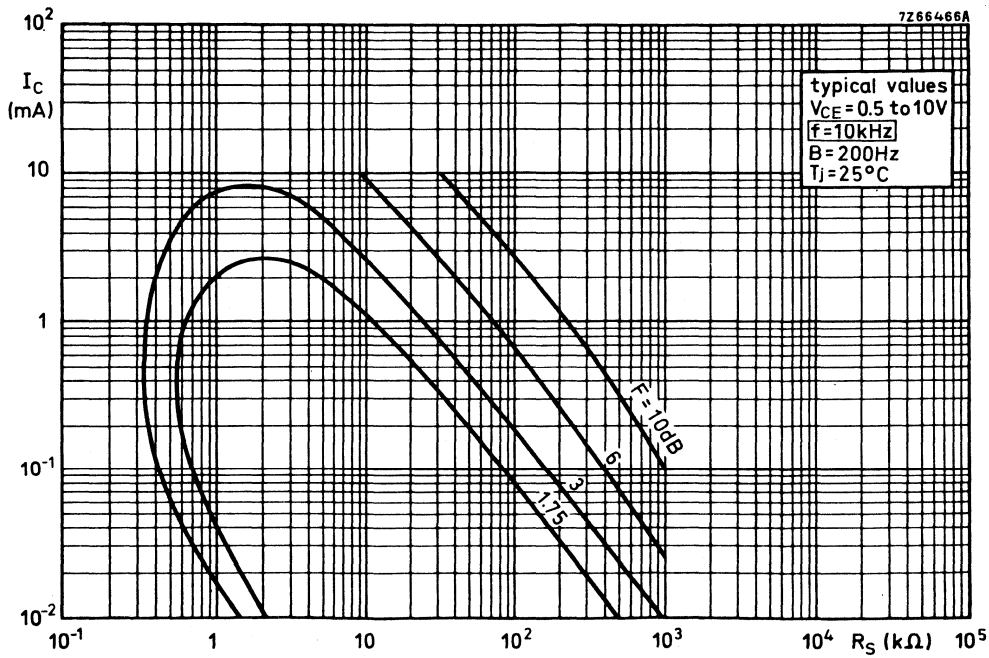


Fig. 12 Curves of constant noise figure for BC849.

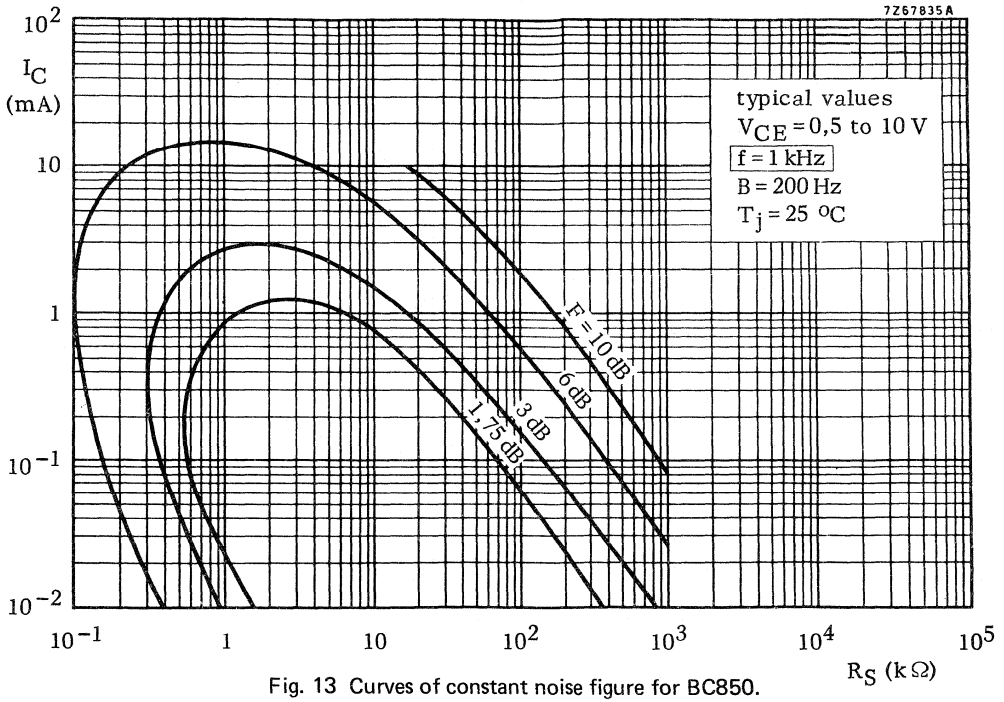


Fig. 13 Curves of constant noise figure for BC850.

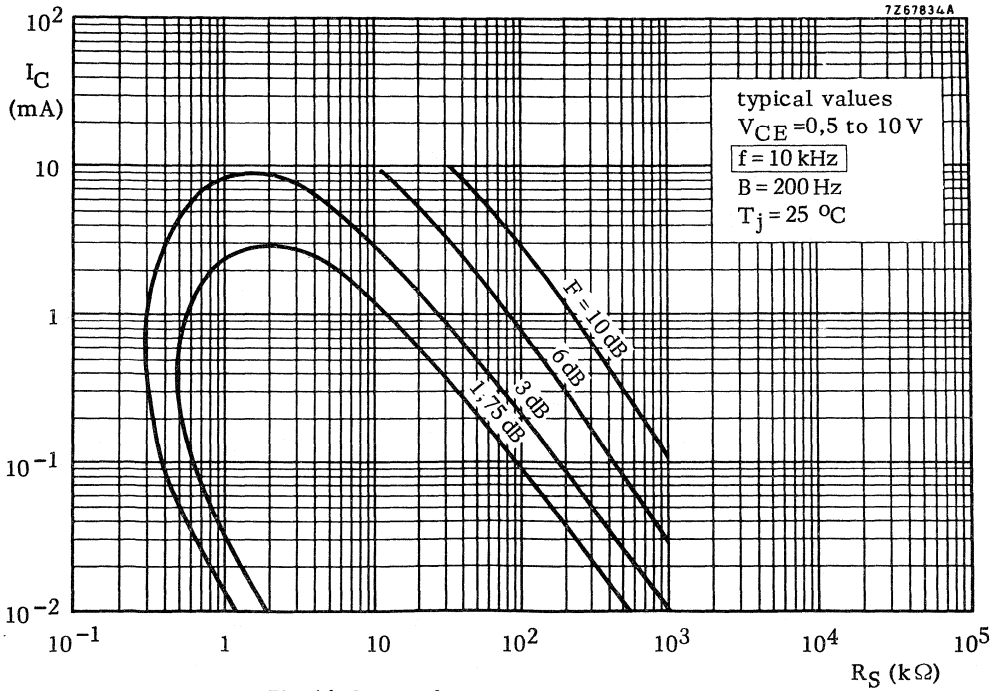


Fig. 14 Curves of constant noise figure for BC850.

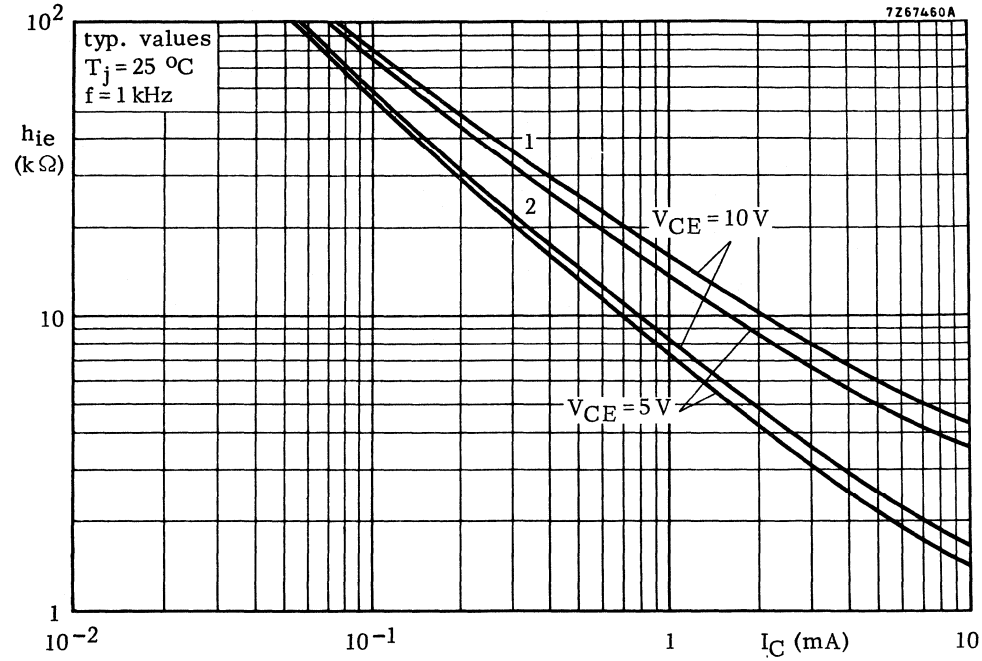


Fig. 15 Typical values. 1 = C selections; 2 = B selections.

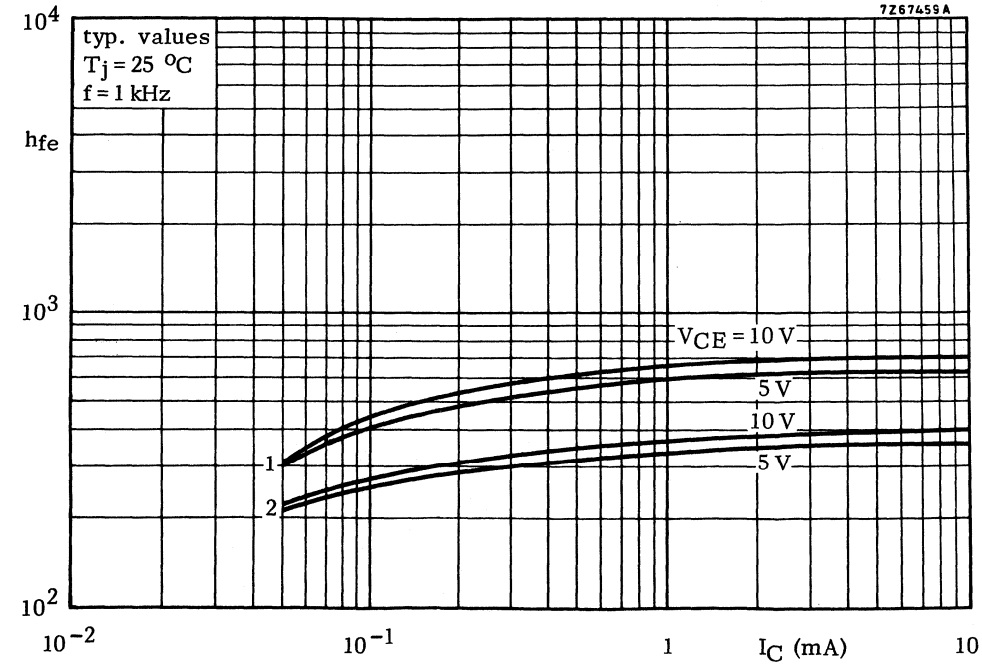


Fig. 16 Typical values. 1 = C selections; 2 = B selections.

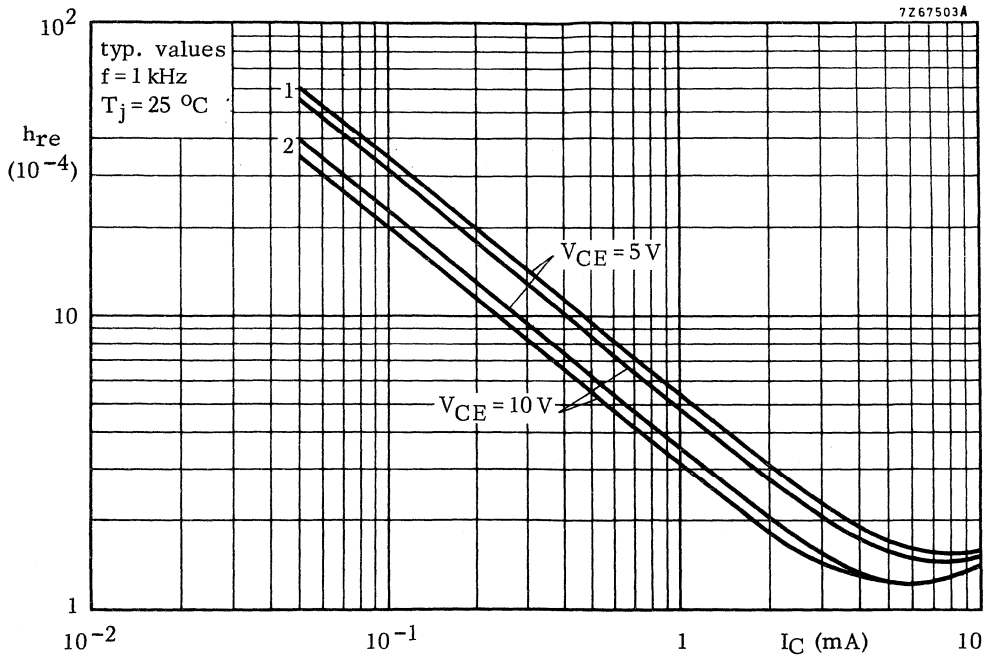


Fig. 17 Typical values. 1 = C selections; 2 = B selections.

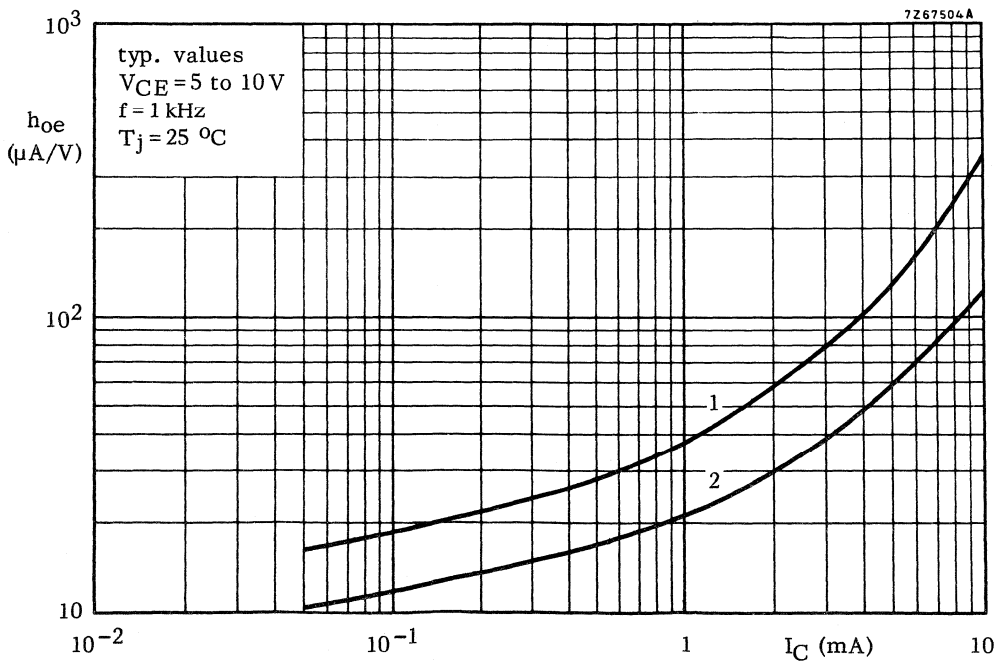


Fig. 18 Typical values. 1 = C selections; 2 = B selections.

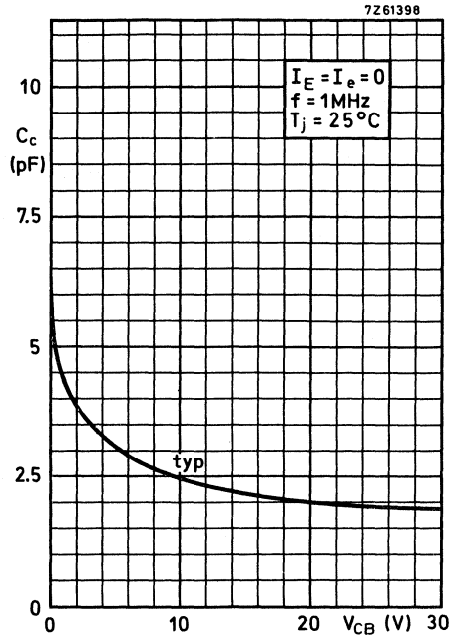


Fig. 19 Typical values.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film circuits.

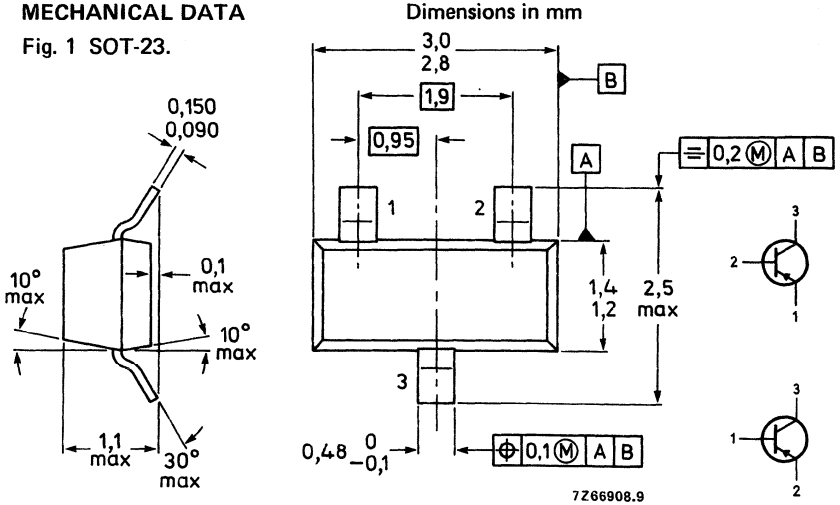
QUICK REFERENCE DATA

			BC856	BC857	BC858	
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.		200		mW
Junction temperature	T_j	max.		150		°C
Small-signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}			75 to 900		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm



TOP VIEW

Marking code

BC856A = 3A
B = 3B
BC857A = 3E
B = 3F
C = 3G
BC858A = 3J
B = 3K
C = 3L

BC856AR = 3AR
BR = 3BR
BC857AR = 3ER
BR = 3FR
CR = 3GR
BC858AR = 3JR
BC = 3KR
CR = 3LR

R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC856	BC857	BC858	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	50	30	V
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		100		mA
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Emitter current (peak value)	I_{EM}	max.		200		mA
Base current (peak value)	$-I_{BM}$	max.		200		mA
Total power dissipation ** up to T_{amb} = 60 °C	P_{tot}	max.		200		mW
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL CHARACTERISTICS*

$T_j = P \times (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\ j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\ s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 30 V; T_j 25 °C	$-I_{CBO}$	typ.	1	nA
	$-I_{CBO}$	<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA
Base-emitter voltage▲				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
			600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Saturation voltages *

$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75 mV
		<	300 mV
	$-V_{BEsat}$	typ.	700 mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250 mV
		<	650 mV
	$-V_{BEsat}$	typ.	850 mV

Knee voltage

$-I_C$ = 10 mA; $-I_B$ = value for which $-I_C$ = 11 mA at $-V_{CE}$ = 1 V	$-V_{CEK}$	typ.	250 mV
		<	600 mV

Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150 MHz
Small-signal current gain at f = 1 kHz $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{fe}		75 to 900
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	typ.	2 dB
		<	10 dB

D.C. current gain

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	BC856/857	h_{FE}	75 to 800 ←
	BC858	h_{FE}	75 to 800
	BC856A/857A/858A	h_{FE}	125 to 250
	BC856B/857B/858B	h_{FE}	220 to 475
	BC857C/858C	h_{FE}	420 to 800

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

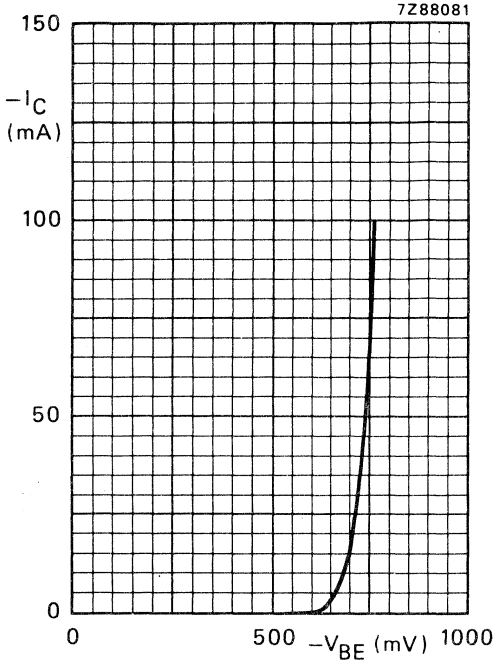


Fig. 3 Typical values. $-V_{CE} = 5$ V; $T_j = 25$ °C.

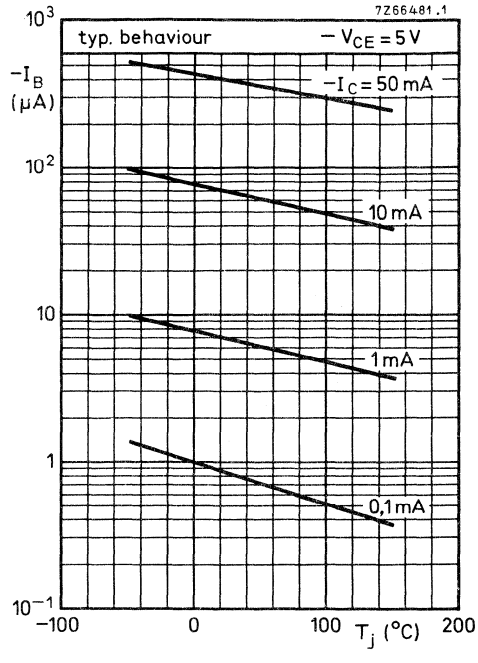


Fig. 4 Typical values.

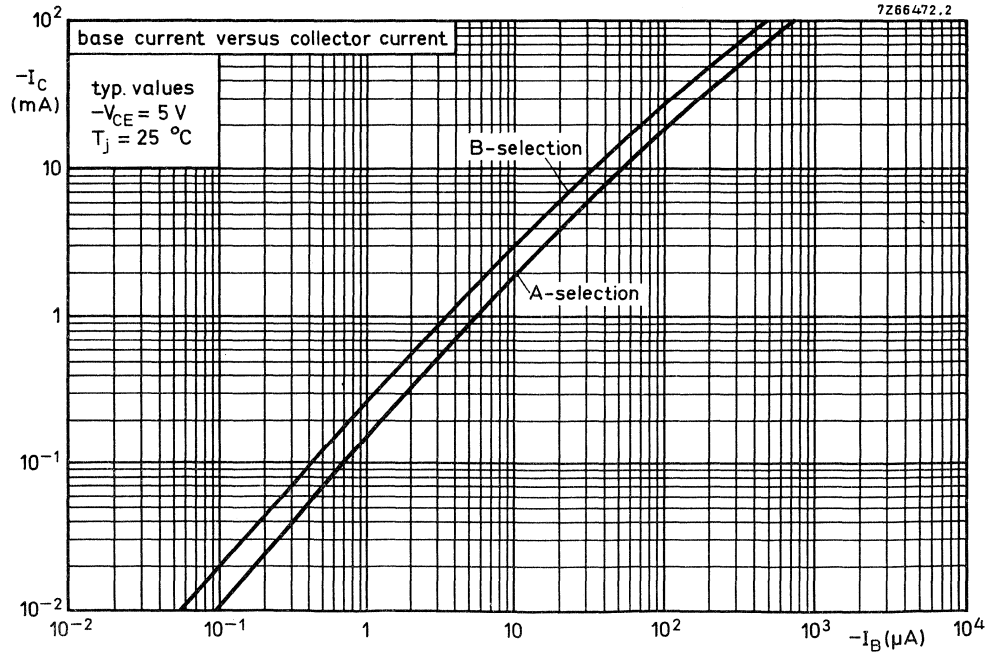


Fig. 5.

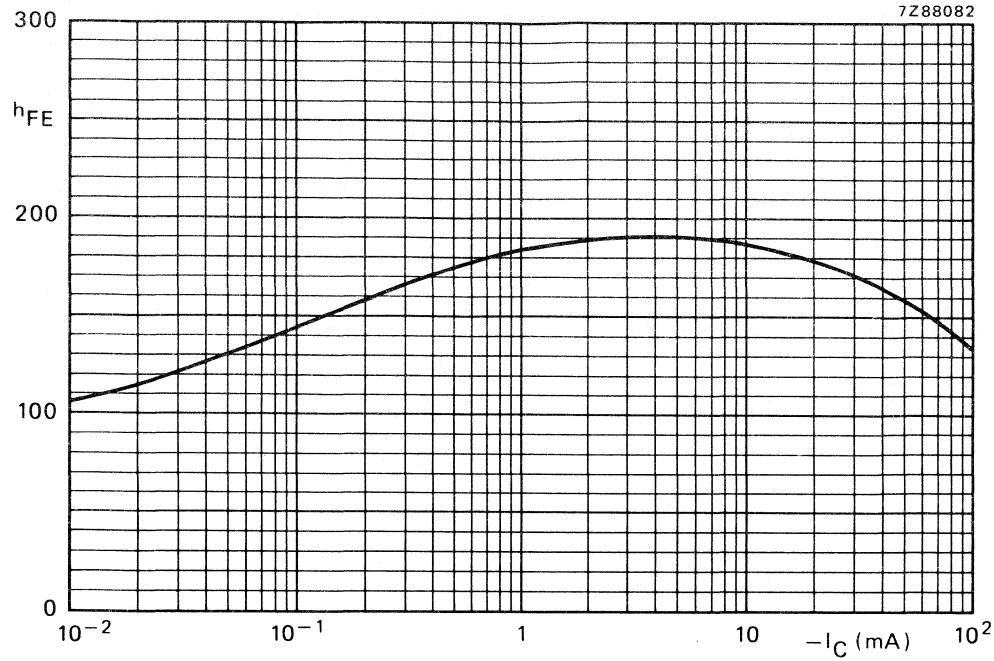


Fig. 6 Typical values D.C. current gain A-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

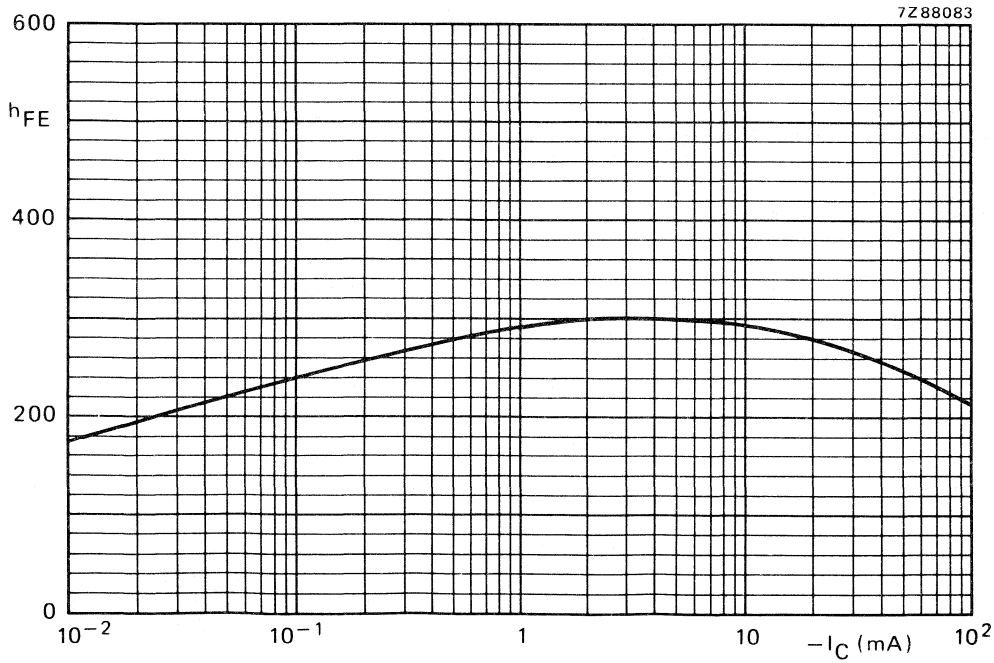


Fig. 7 Typical values D.C. current gain B-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

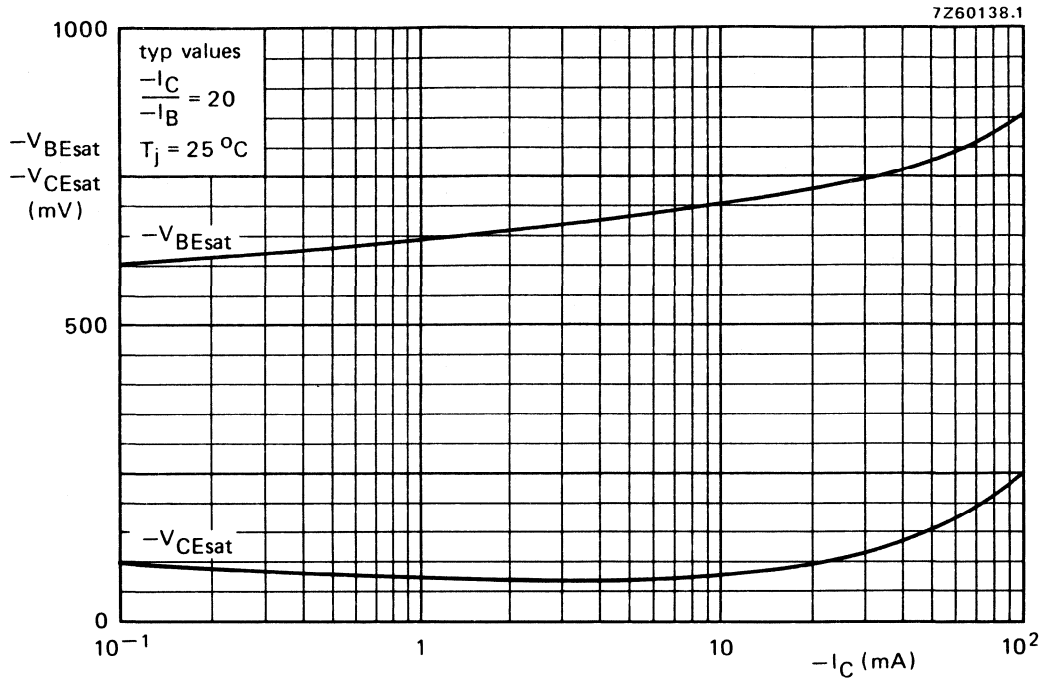


Fig. 8 Typical values base-emitter and collector-emitter saturation voltage.

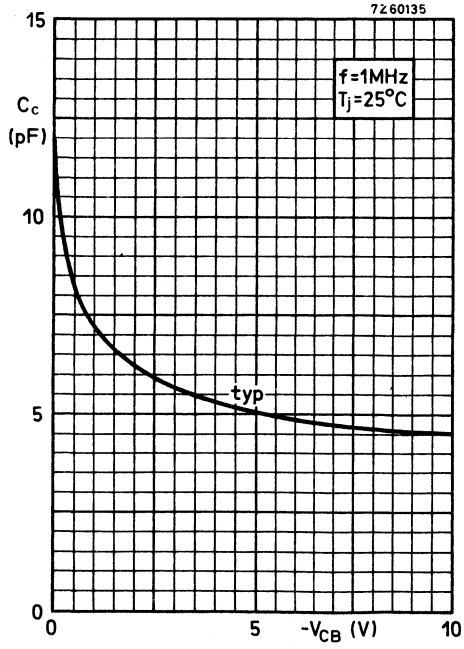


Fig. 9 Typical values.

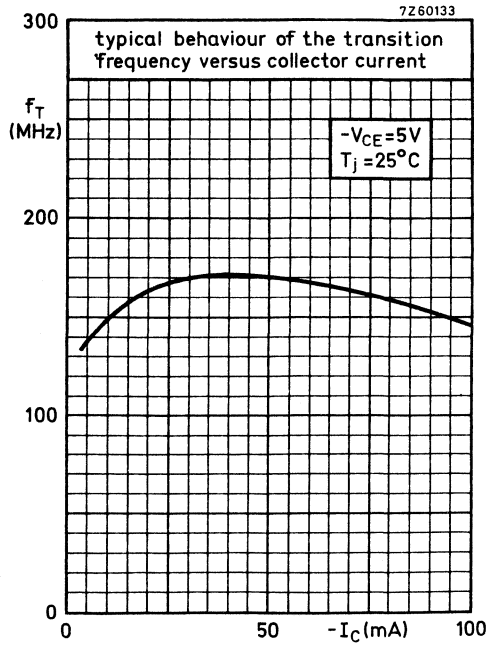


Fig. 10 Typical values. f = 35 MHz.

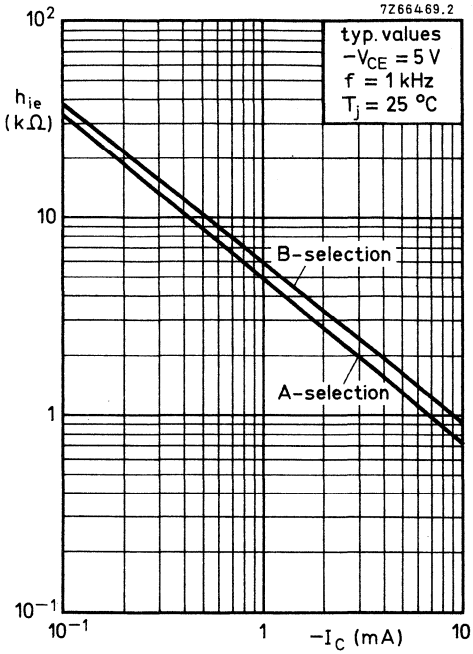


Fig. 11.

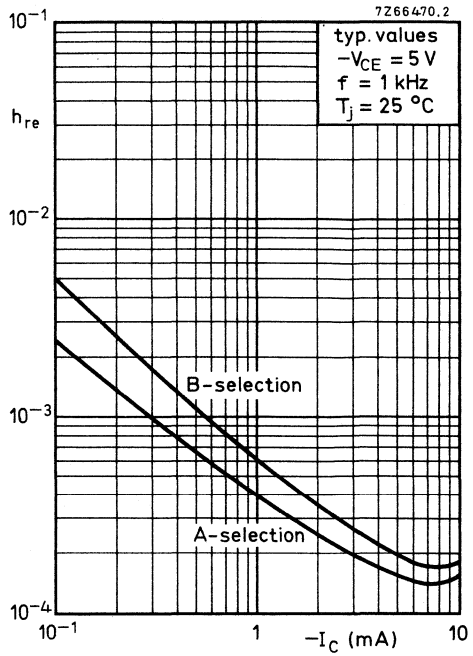


Fig. 12.

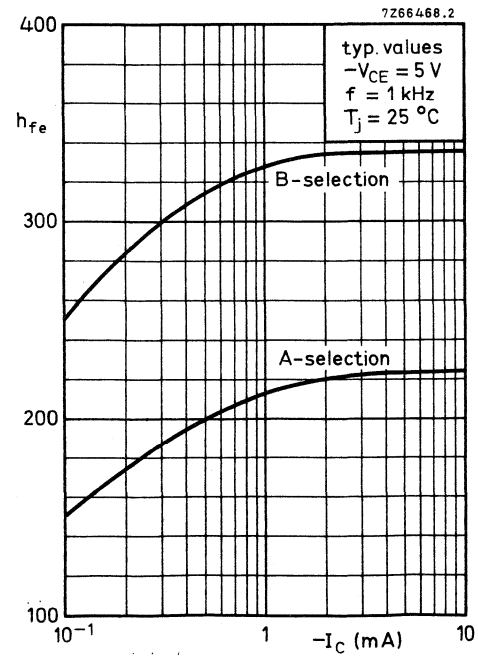


Fig. 13.

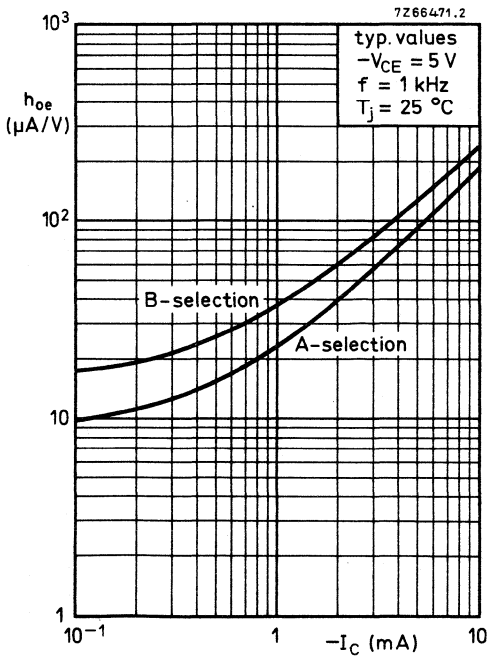


Fig. 14.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in a plastic SOT-23 envelope, primarily intended for low-noise input stages in tape recorders, hi-fi amplifiers and other audio frequency equipment in thick and thin-film hybrid circuits.

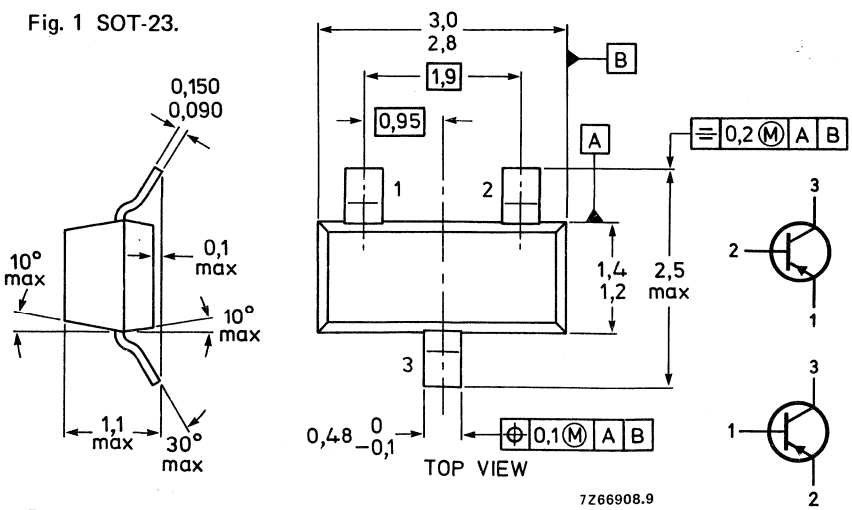
QUICK REFERENCE DATA

			BC859	BC860	
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	200	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	200	mW
Junction temperature	T_j	max.	150	150	°C
Small-signal current gain					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}	>	125	125	
		<	900	900	
Transition frequency					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	150	MHz
Noise figure at R_s = 2 kΩ					
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V					
f = 30 Hz to 15 kHz	F	typ.	1,2	1	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	<	4	4	dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm



Marking code

BC859A = 4A
B = 4B
C = 4C
BC860A = 4E
B = 4F
C = 4G

BC859AR = 4AR
BR = 4BR
CR = 4CR
BC860AR = 4ER
BR = 4FR
CR = 4GR

R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC859	BC860	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	50	V
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Emitter-base voltage (open collector)	$-V_{CBO}$	max.	5	5	V
Collector current (d.c.)	$-I_C$	max.	100		mA
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Emitter current (peak value)	I_{EM}	max.	200		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
Total power dissipation up to T_{amb} = 60 °C**	P_{tot}	max.	200		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS*

$T_j = Px (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\ j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\ s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current

I_E = 0; $-V_{CB}$ = 30 V; T_j = 25 °C	$-I_{CBO}$	typ.	1	nA
	$-I_{CBO}$	<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA

Base-emitter voltage ▲

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
	$-V_{BE}$		600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Saturation voltages*

$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75	mV
		<	300	mV
	$-V_{BEsat}$	typ.	700	mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250	mV
		<	650	mV
	$-V_{BEsat}$	typ.	850	mV

Collector capacitance at f = 1 MHz

$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF

Transition frequency at f = 35 MHz

$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz

Small-signal current gain at f = 1 kHz

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{fe}		125 to 900	

Noise figure at R_S = 2 kΩ

$-I_C$ = 200 μA; $-V_{CE}$ = 5 V			BC859	BC860	
f = 30 Hz to 15 kHz	F	typ.	1,2	1	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1	1	dB
		<	4	4	dB

Equivalent noise voltage at R_S = 2 kΩ

$-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	<	–	0,11	μV

D.C. current gain

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; total range	h_{FE}	125 to 800
A selections	h_{FE}	125 to 250
B selections	h_{FE}	220 to 475
C selections	h_{FE}	420 to 800

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

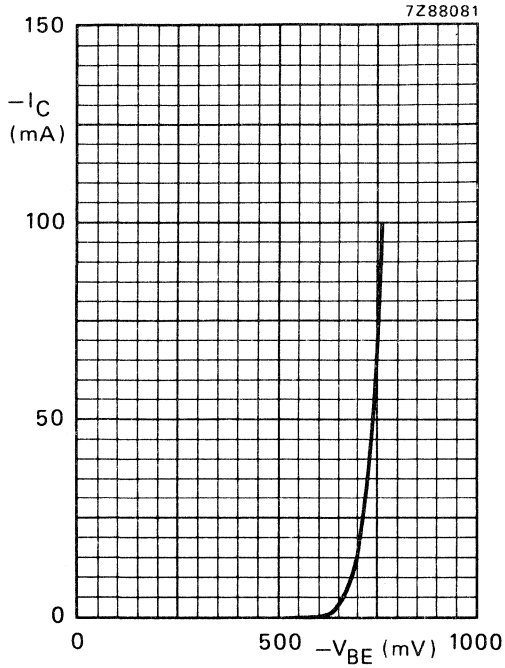


Fig. 3 Typical values. $-V_{CE} = 5$ V; $T_j = 25$ °C.

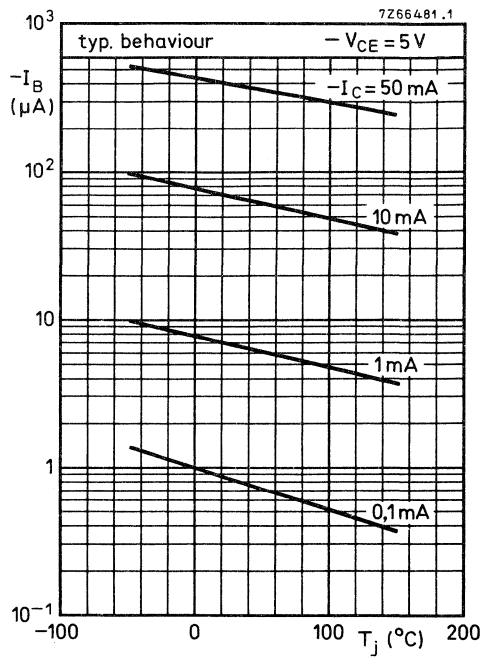


Fig. 4 Typical values.

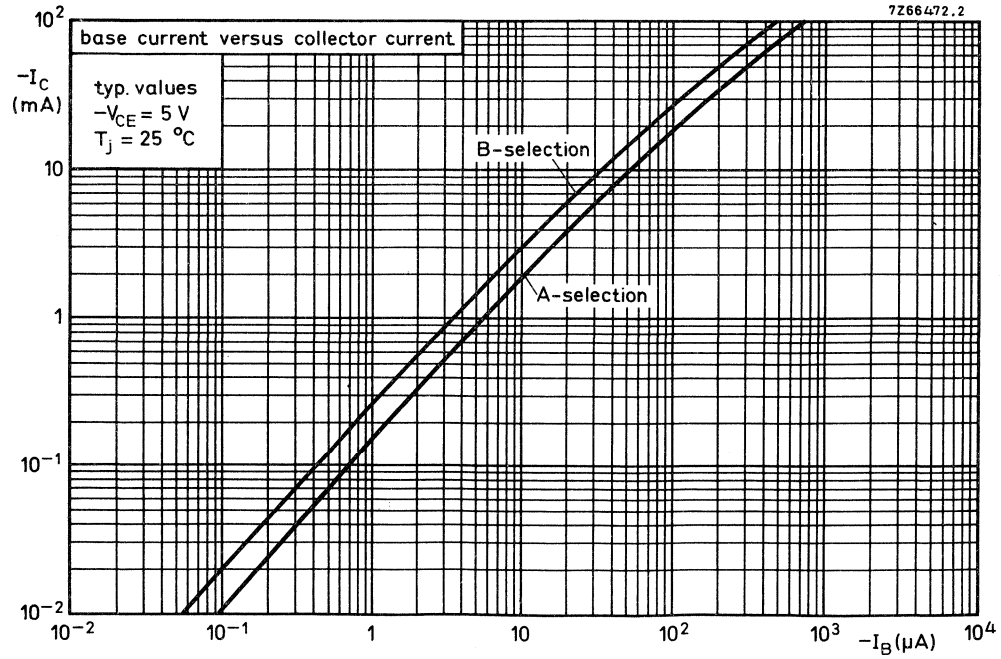


Fig. 5.

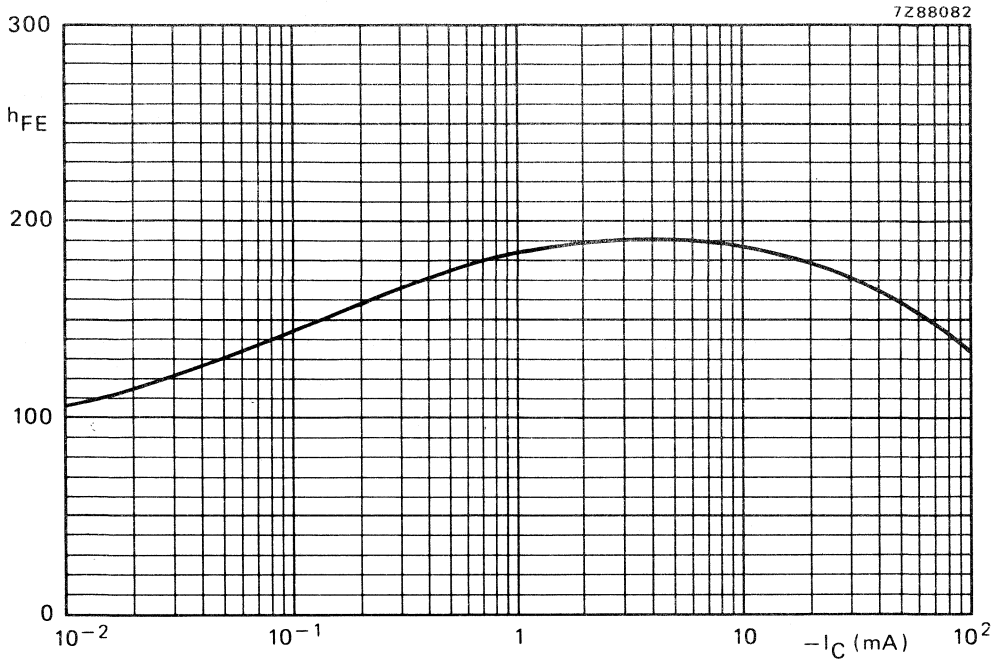


Fig. 6 Typical values. D.C. current gain A-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

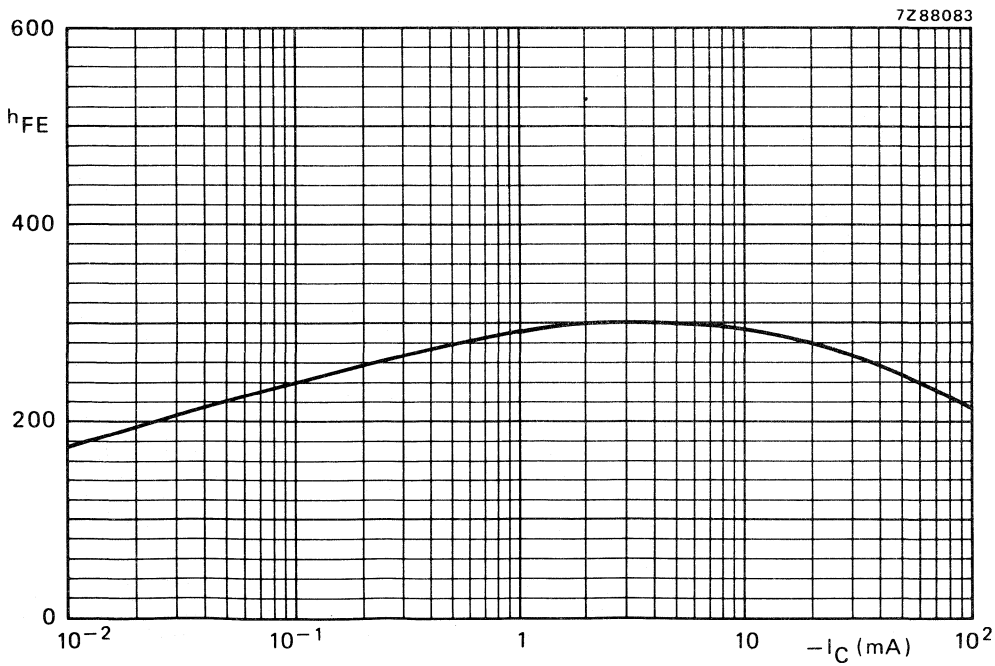


Fig. 7 Typical values. D.C. current gain B-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

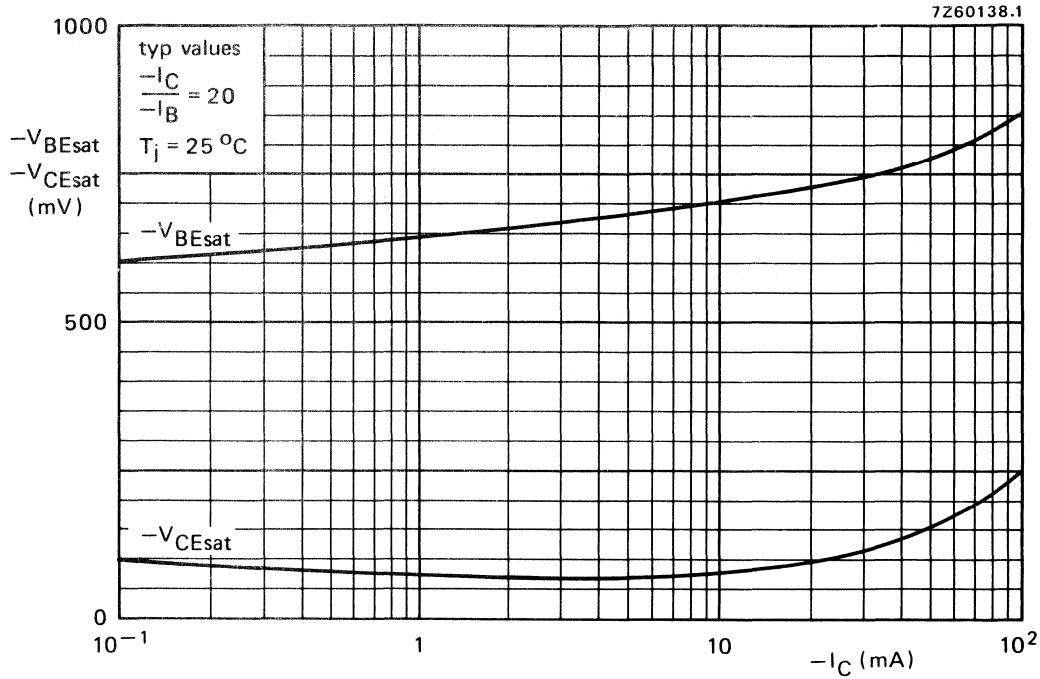


Fig. 8 Typical values base-emitter and collector-emitter saturation voltage.

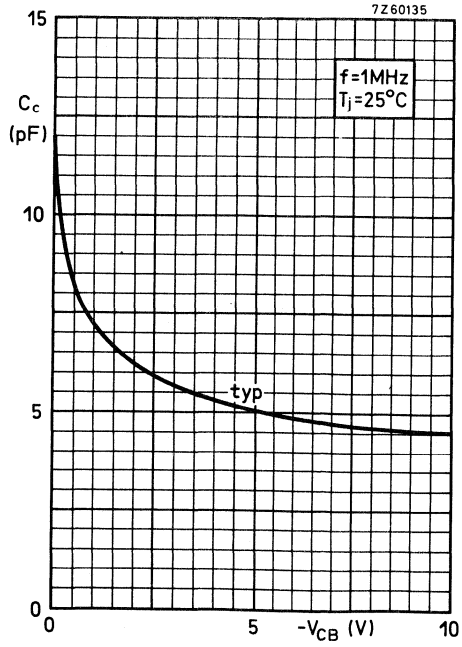


Fig. 9 Typical values.

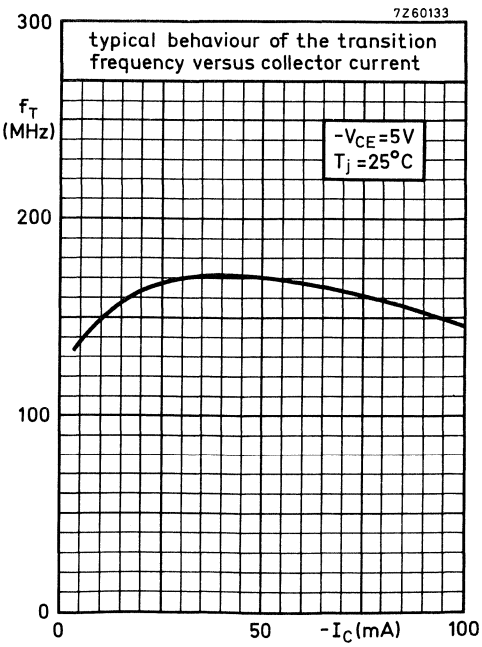


Fig. 10 Typical values. f = 35 MHz.

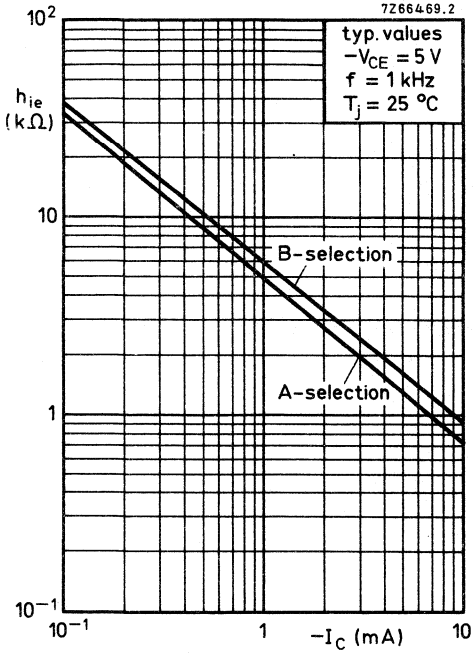


Fig. 11 Typical values.

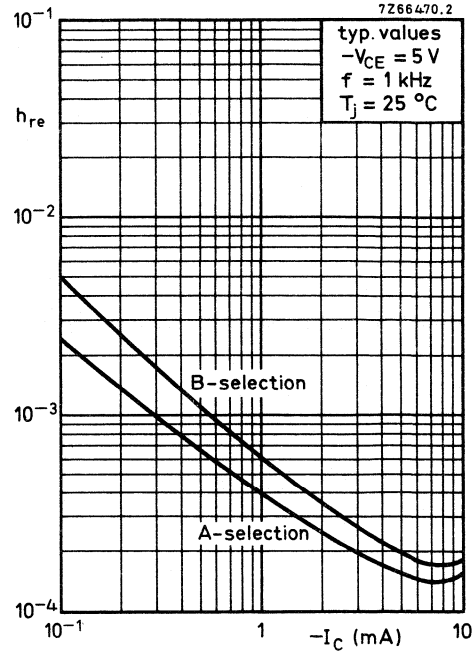


Fig. 12 Typical values.

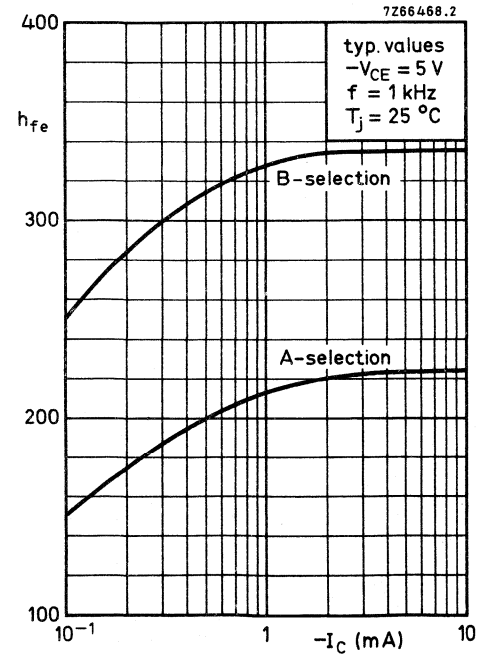


Fig. 13 Typical values.

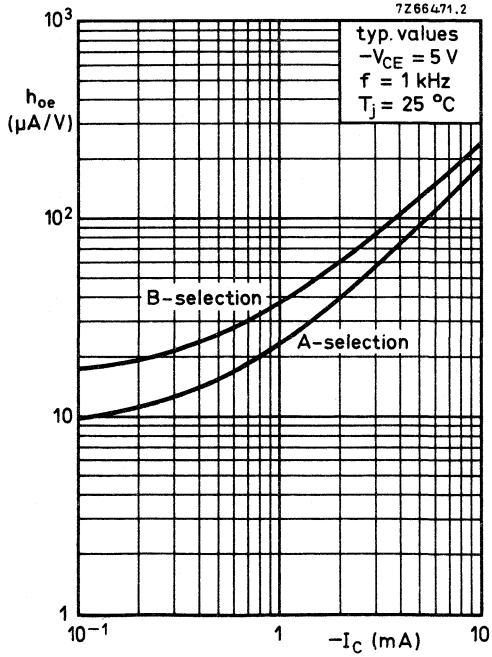


Fig. 14 Typical values.

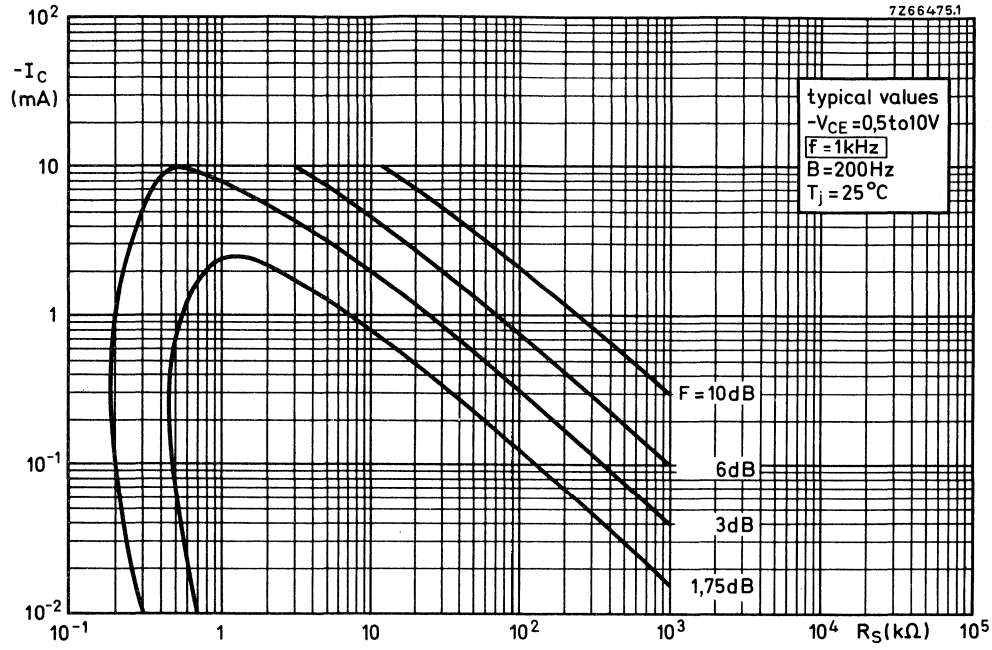


Fig. 15 Curves of constant noise figure at f = 1 kHz.

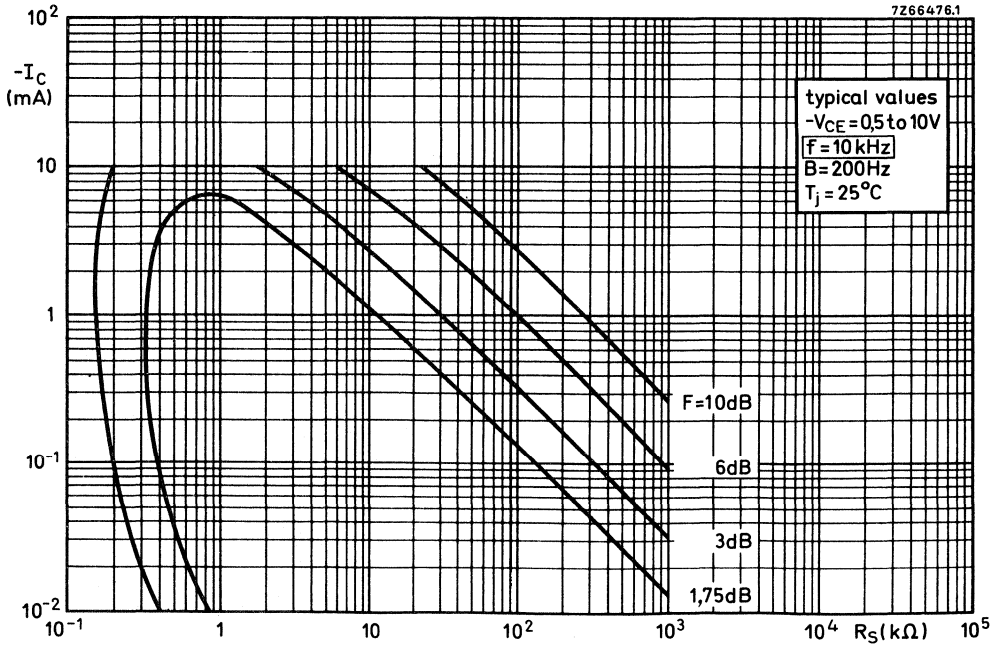


Fig. 16 Curves of constant noise figure at f = 10 kHz.

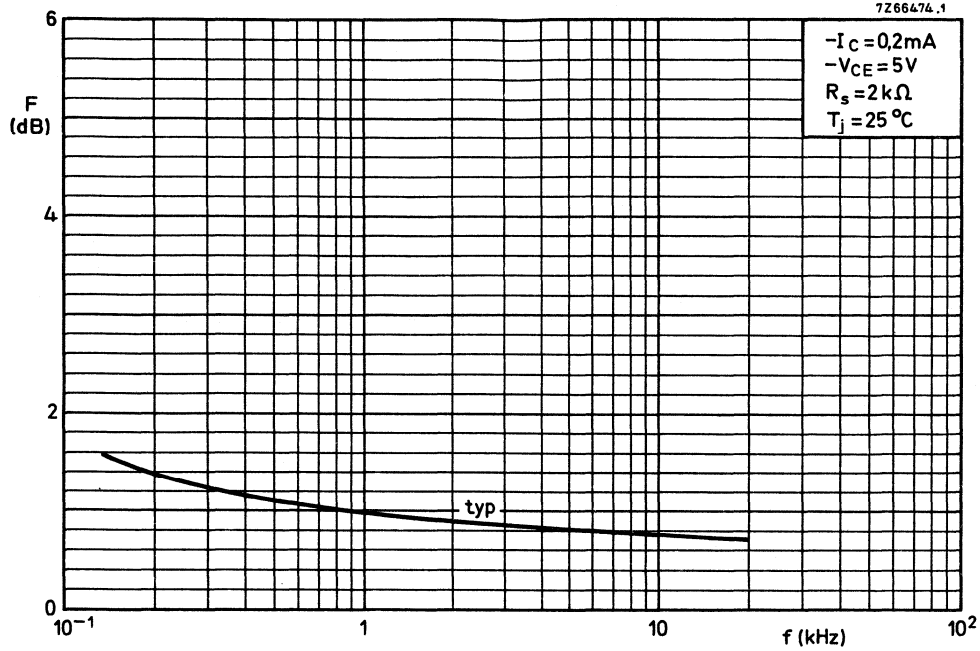


Fig. 17 Typical values noise figure.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a microminiature plastic envelope intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

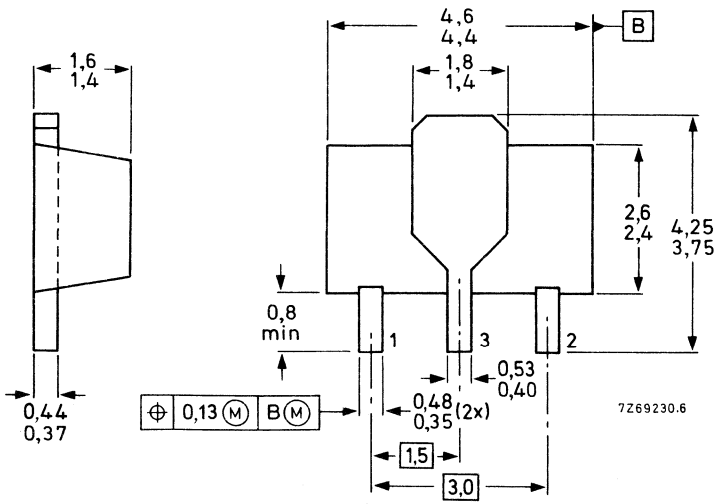
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Collector current (peak value)	I_{CM}	max.	2 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60 MHz

MECHANICAL DATA

Dimensions in mm

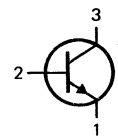
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

CAC
CBC
CCC
CDC



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	1 A
Collector current (peak value)	I_{CM}	max.	2 A
Base current (d.c.)	I_B	max.	100 mA
Base current (peak value)	I_{BM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1 W
Storage temperature	T_{stg}	−65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125 K/W
From junction to tab	$R_{th\ j\text{-}t}$	=	10 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 25 V	I_{CBO}	<	10 μA
I_E = 0; V_{CB} = 25 V; T_j = 150 °C	I_{CBO}	<	1 mA
Emitter cut-off current			
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10 μA
Base-emitter voltage			
I_C = 5 mA; V_{CE} = 10 V	V_{BE}	typ.	0,62 V
I_C = 1 A; V_{CE} = 1 V	V_{BE}	<	1 V
Collector-emitter saturation voltage			
I_C = 1 A; I_B = 100 mA	V_{CEsat}	<	0,5 V
D.C. current gain			
I_C = 5 mA; V_{CE} = 10 V	h_{FE}	>	50
I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375
I_C = 1 A; V_{CE} = 1 V	h_{FE}	>	60
Collector capacitance at f = 450 kHz			
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	typ.	27 pF
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60 MHz

* Mounted on a ceramic substrate, area = 2,5 cm²; thickness = 0,7 mm.

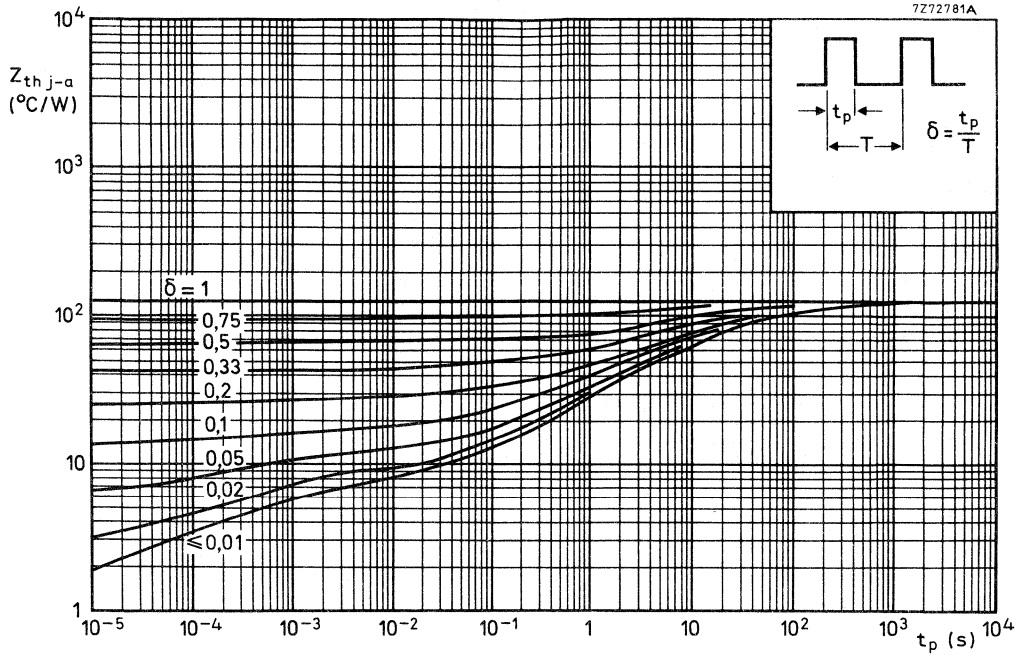


Fig. 2 Pulse power rating chart.

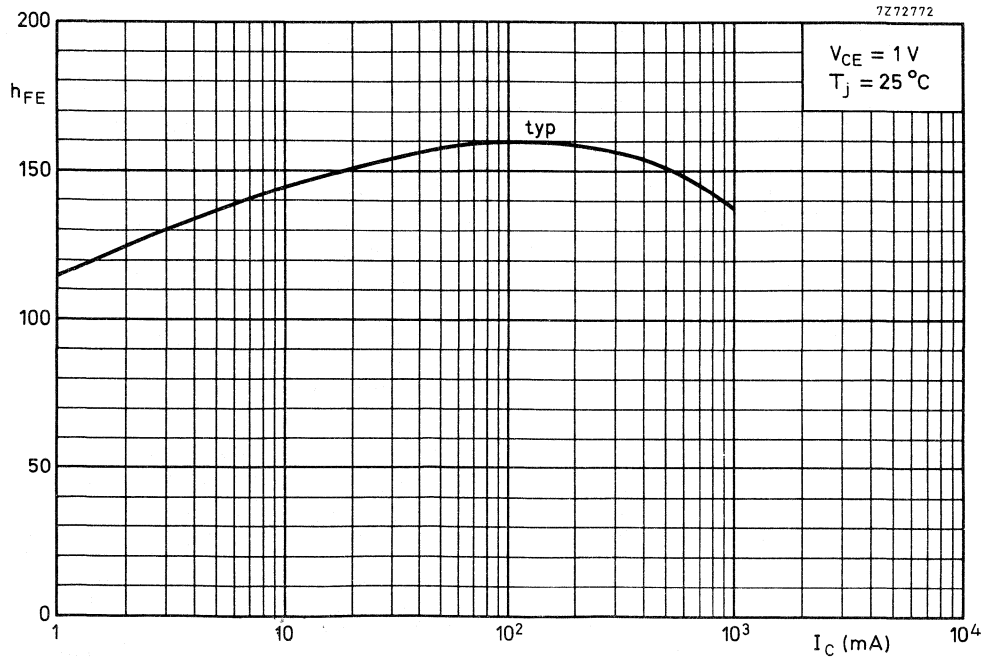


Fig. 3 D.C. current gain.

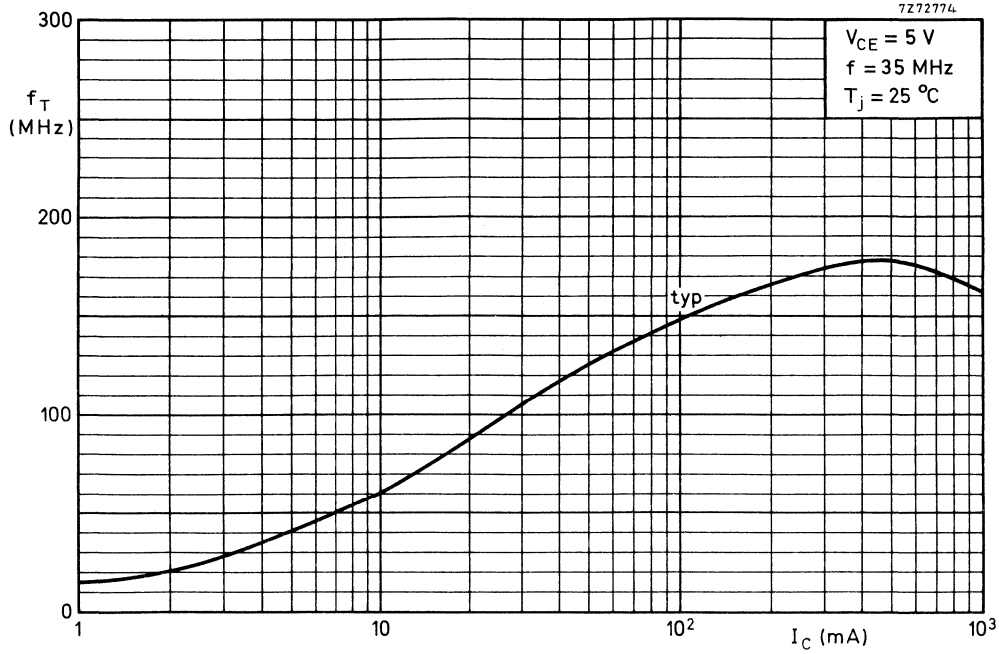


Fig. 4 Typical values transition frequency as a function of collector current.

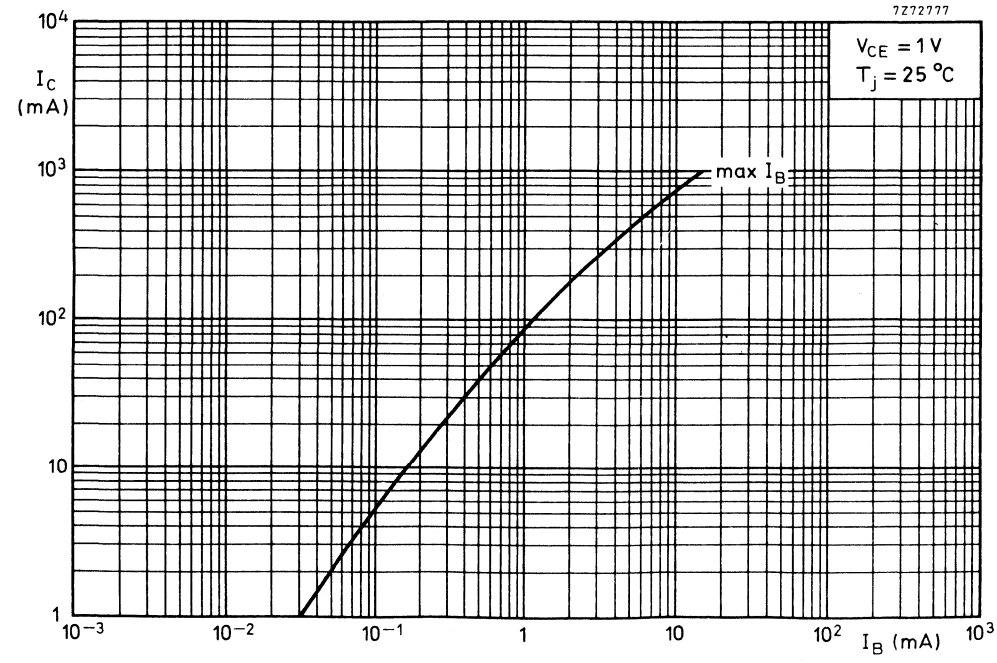


Fig. 5 Typical values collector current as a function of maximum base current.

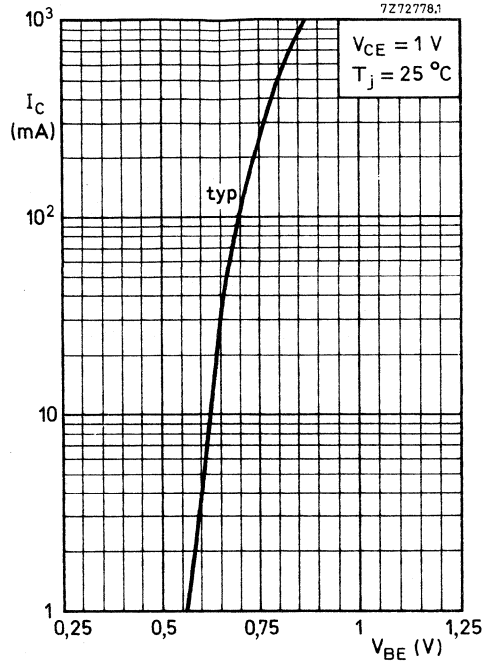


Fig. 6 Typical values collector current as a function of base-emitter voltage.

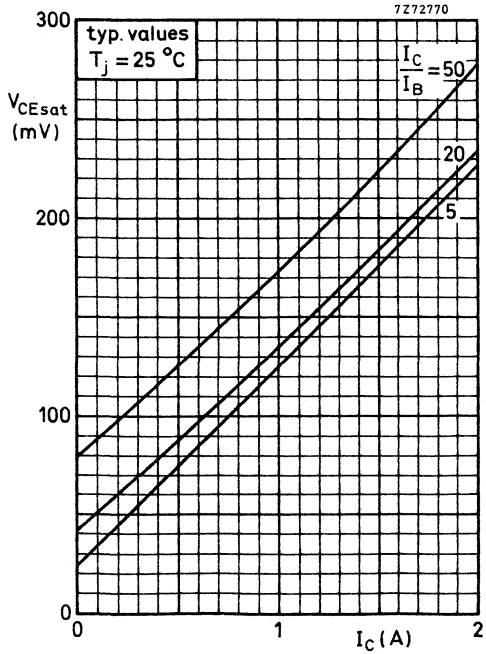


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

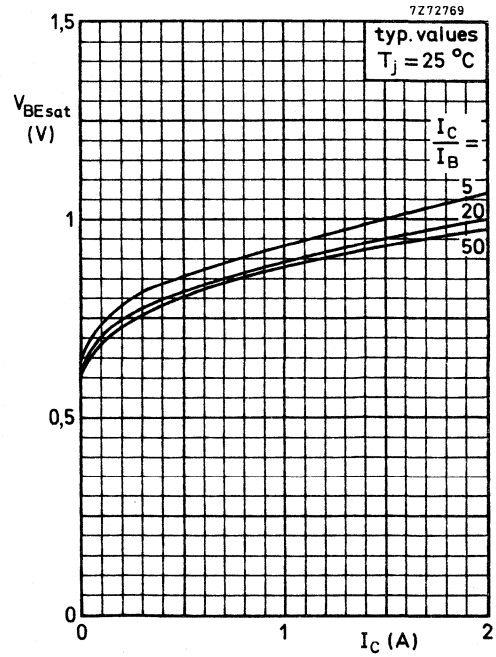


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic microminiature envelope, intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20 V
Collector current (peak value)	$-I_{CM}$	max.	2 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	150 °C
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}	85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60 MHz

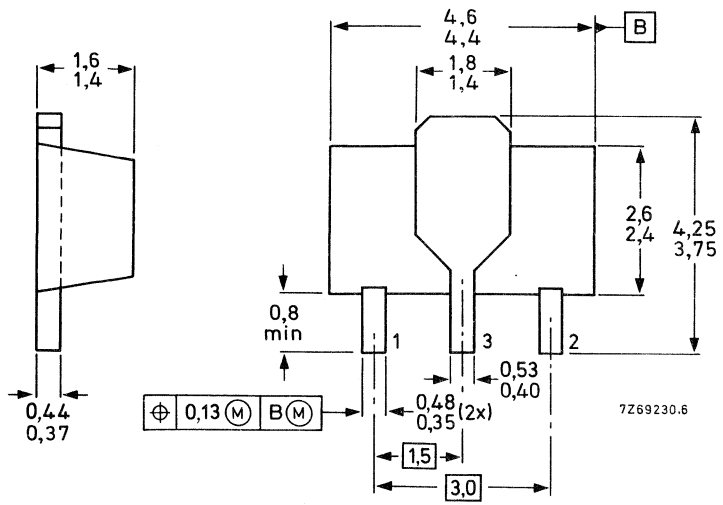
MECHANICAL DATA

Dimensions in mm

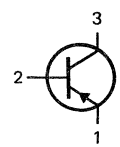
Fig. 1 SOT-89.

Marking code ←

CEC
CGC
CHC



BOTTOM VIEW



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	1	A
Collector current (peak value)	$-I_{CM}$	max.	2	A
Base current (d.c.)	$-I_B$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1	W
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125	K/W
From junction to tab	$R_{th\ j\text{-}t}$	=	10	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 25 V	$-I_{CBO}$	<	10	μA
I_E = 0; $-V_{CB}$ = 25 V; T_j = 150 °C	$-I_{CBO}$	<	1	mA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	$-V_{BE}$	typ.	0,62	V
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	$-V_{BE}$	<	1	V
Collector-emitter saturation voltage				
$-I_C$ = 1 A; $-I_B$ = 100 mA	$-V_{CEsat}$	<	0,5	V
D.C. current gain				
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375	
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	h_{FE}	>	60	
Collector capacitance at f = 450 kHz				
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V	C_c	typ.	45	pF
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60	MHz

* Mounted on a ceramic substrate, area = 2,5 cm²; thickness = 0,7 mm.

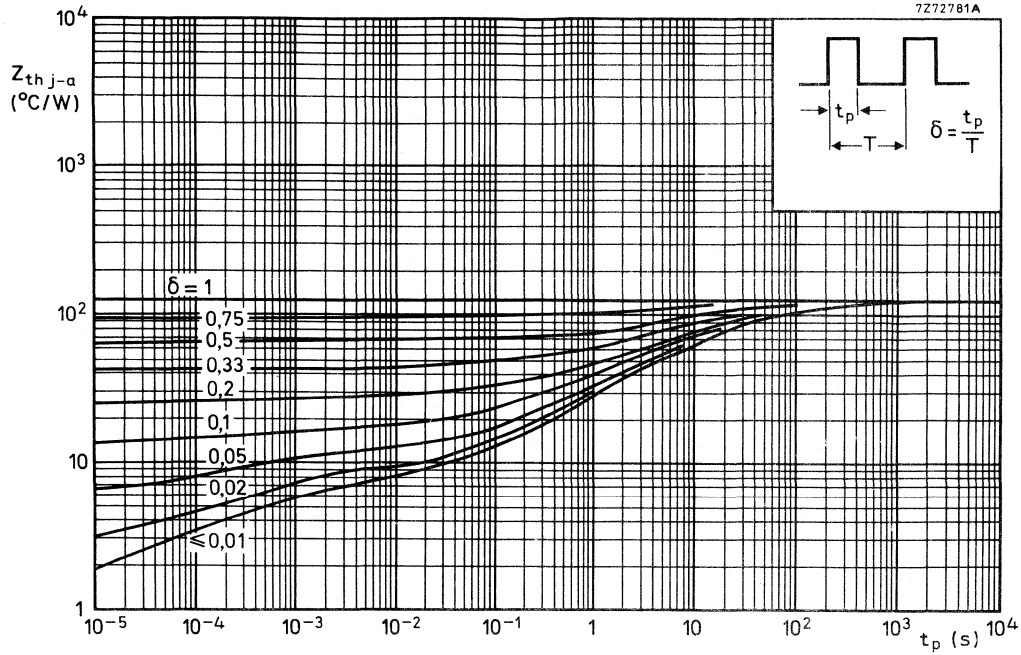


Fig. 2 Pulse power rating chart.

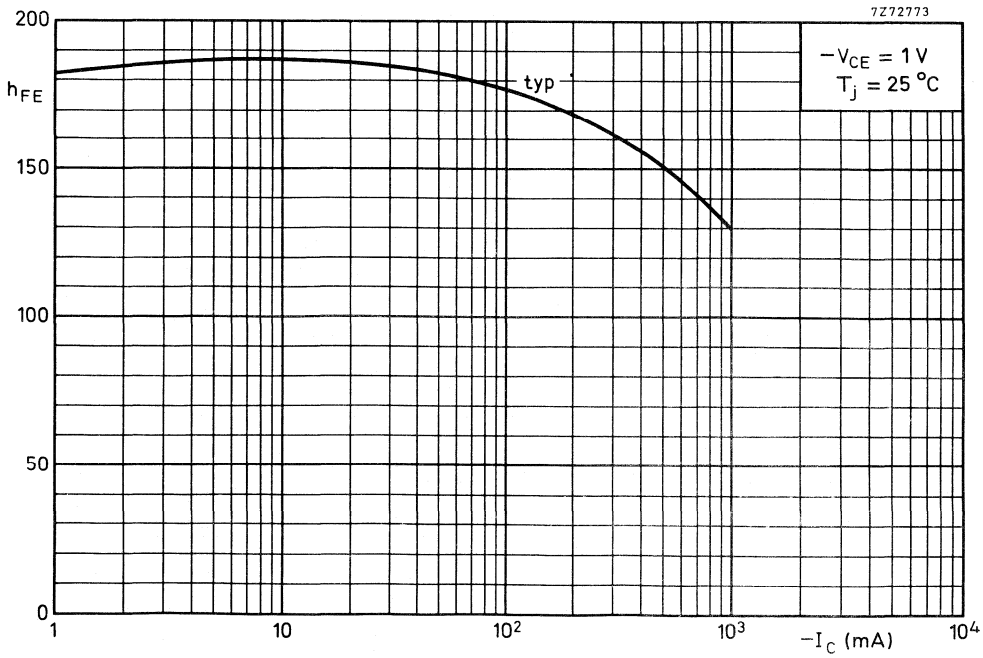


Fig. 3 D.C. current gain.

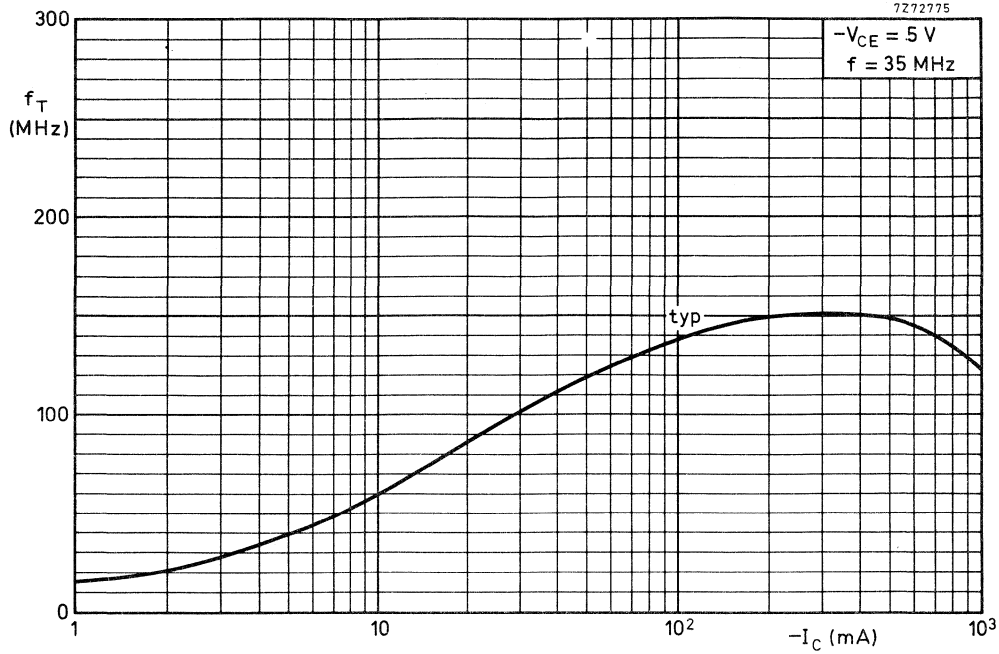


Fig. 4 Typical values transition frequency as a function of collector current.

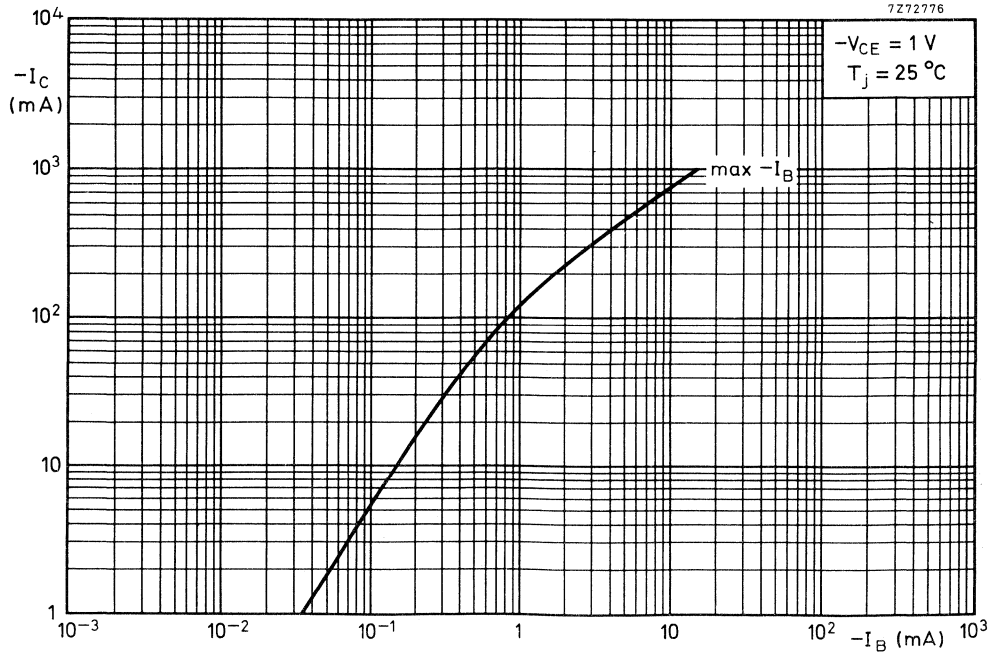


Fig. 5 Typical values collector current as a function of maximum base current.

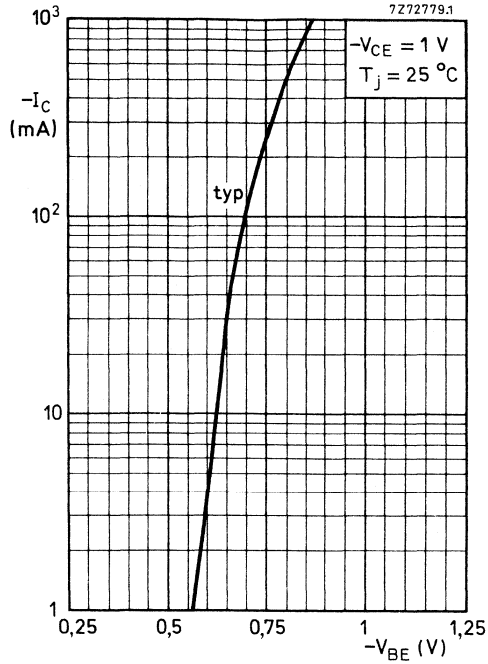


Fig. 6 Typical values collector current as a function of base-emitter voltage.

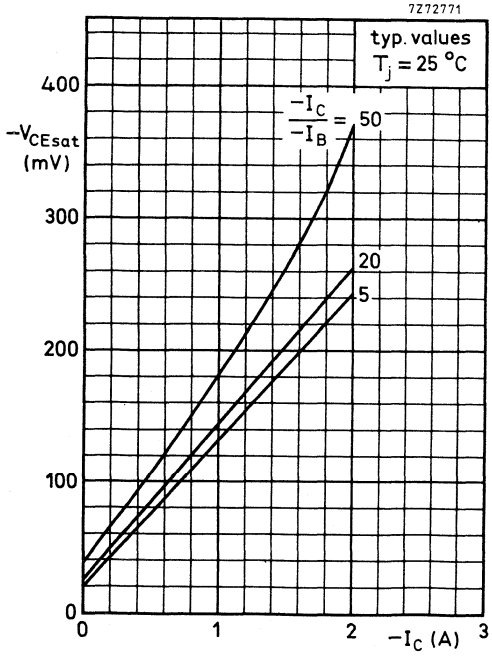


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

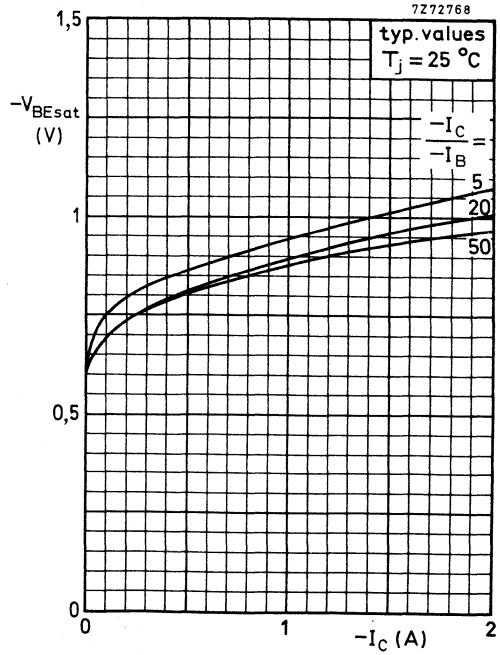


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

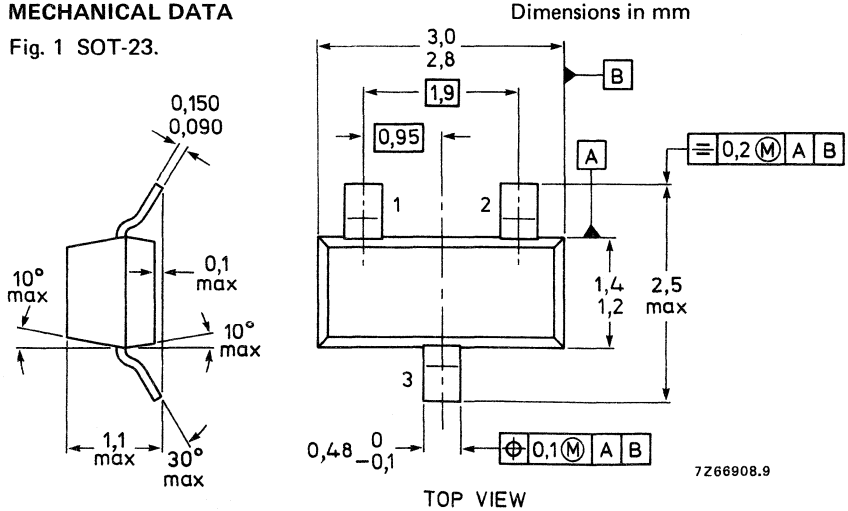
QUICK REFERENCE DATA

			BCF29	BCF30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW ←
Junction temperature	T_j	max.	150		°C ←
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

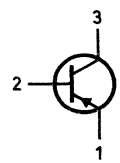


R-types are available on request.

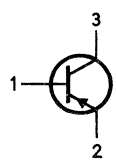
See also *Soldering recommendations*.

Marking code

BCF29 = C7
BCF30 = C8



BCF29R = C77
BCF30R = C9



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C**	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 32 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 32 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mV; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCF29	BCF30	
D.C. current gain					
$-I_C = 10\ \mu A;\ -V_{CE} = 5\ V$	h_{FE}	typ.	90	150	
$-I_C = 2\ mA;\ -V_{CE} = 5\ V$	h_{FE}	>	120	215	
		<	260	500	
Collector capacitance at f = 1 MHz $I_E = I_e = 0;\ -V_{CB} = 10\ V$	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C = 10\ mA;\ -V_{CE} = 5\ V$	f_T	typ.	150		MHz
Noise figure at $R_S = 2\ k\Omega$ $-I_C = 200\ \mu A;\ -V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	<	4		dB
		typ.	1		dB

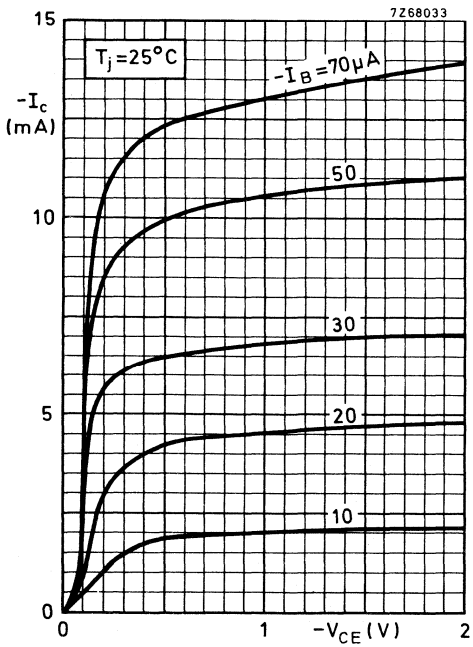


Fig. 2

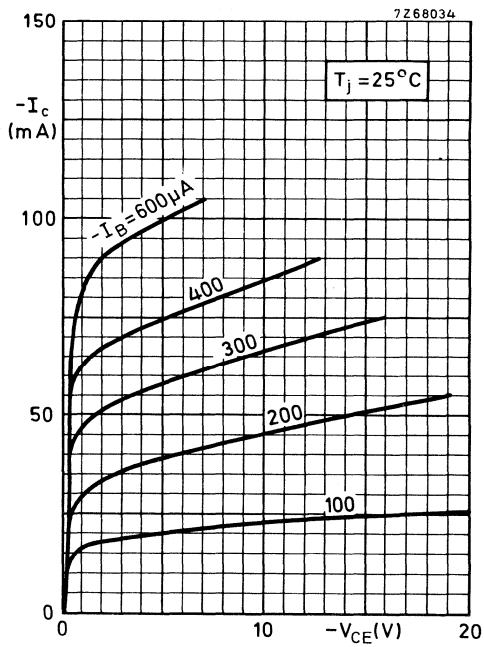


Fig. 3

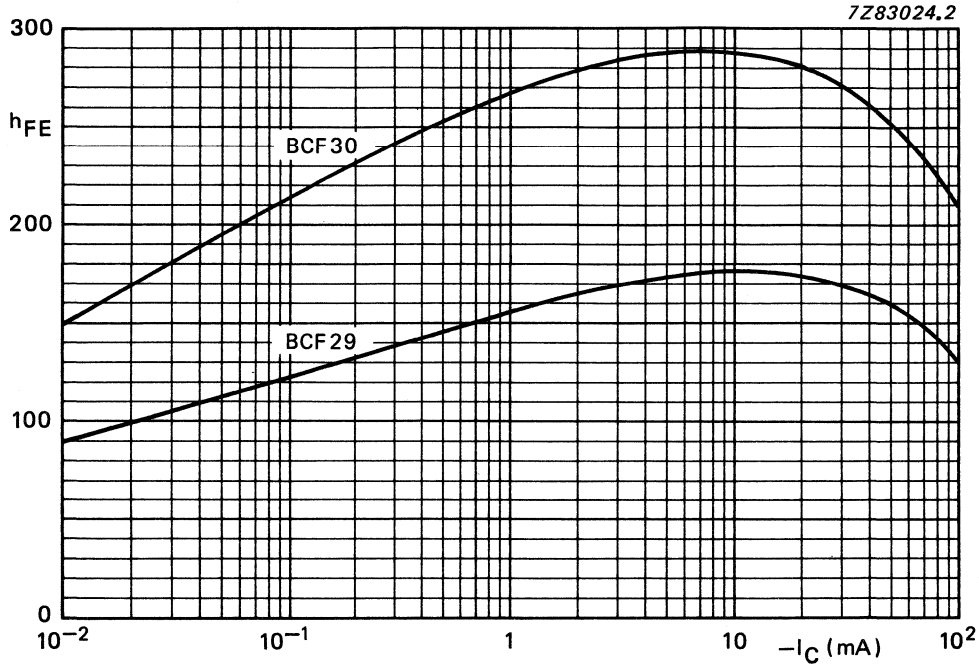


Fig. 4 Typical values of d.c. current gain. $-V_{CE}$ = 5 V; T_j = 25 °C.

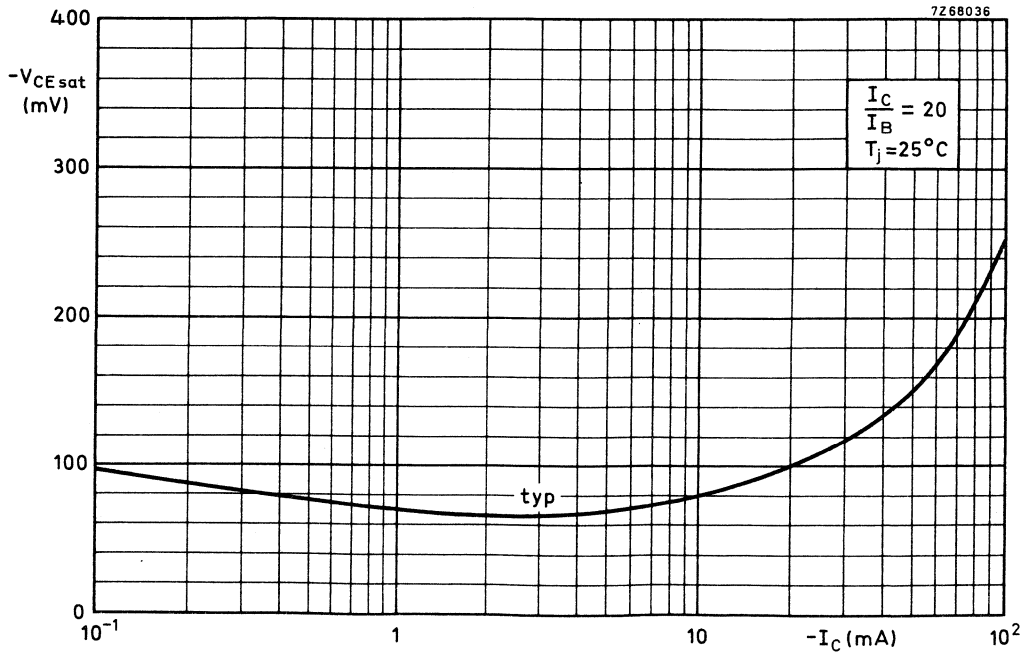


Fig. 5

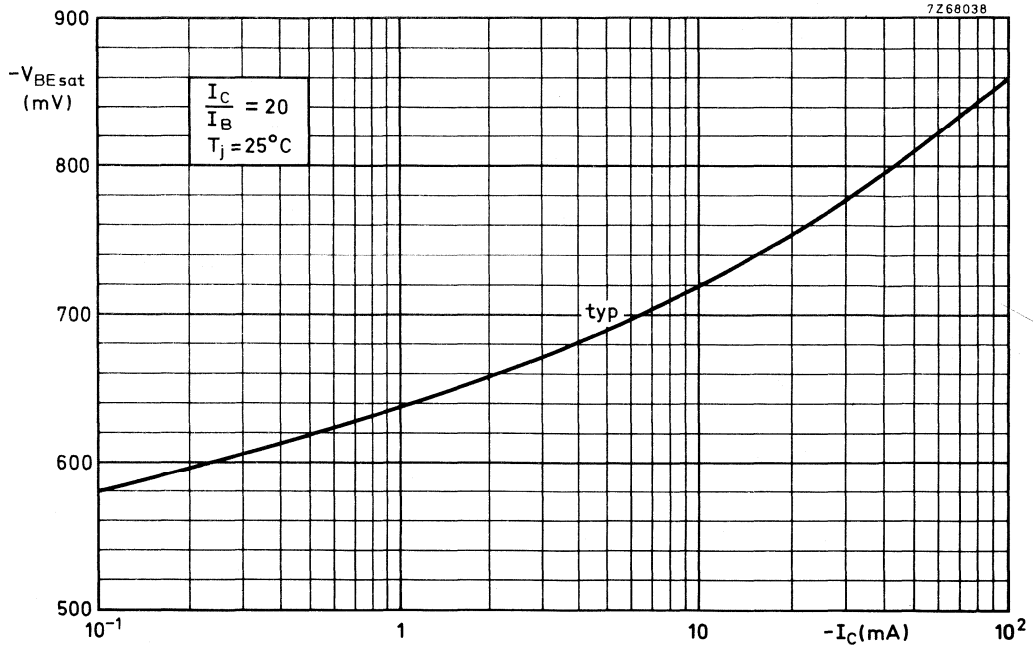

7Z68038
900
800
700
600
500
$-V_{BE\,sat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

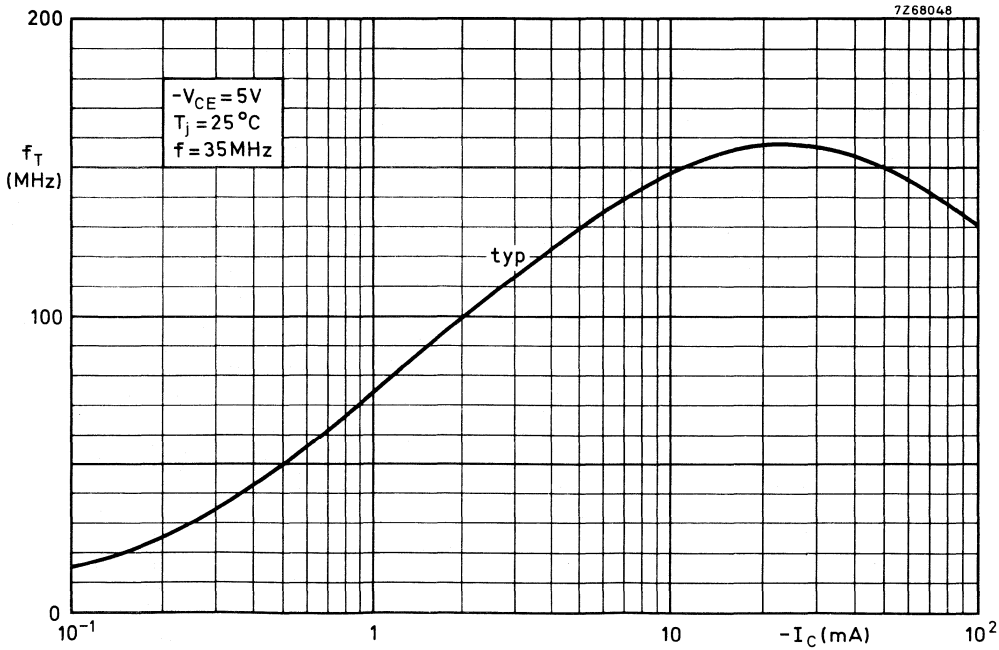

7Z68048
200
100
0
f_T (MHz)
$-V_{CE} = 5V$
$T_j = 25°C$
$f = 35MHz$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

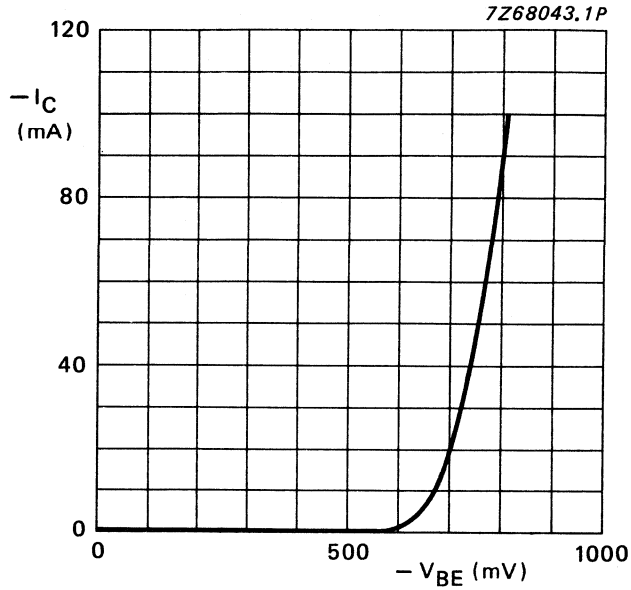


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

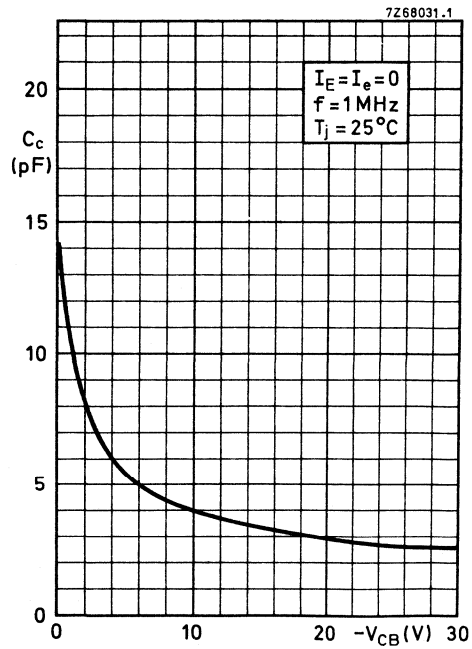


Fig. 9

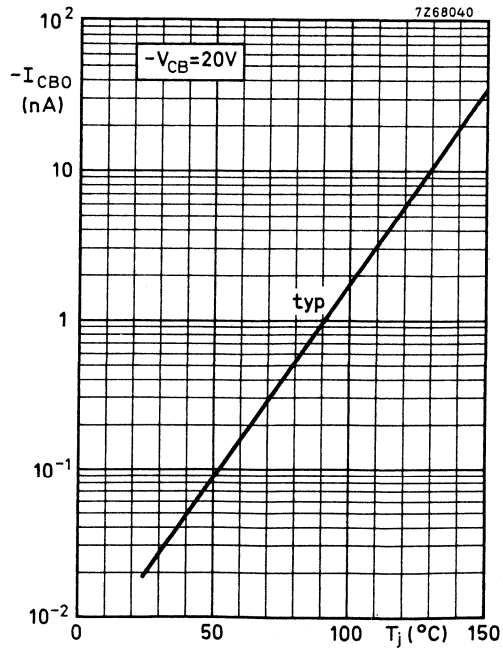


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level, low noise general purpose applications in thick and thin-film circuits.

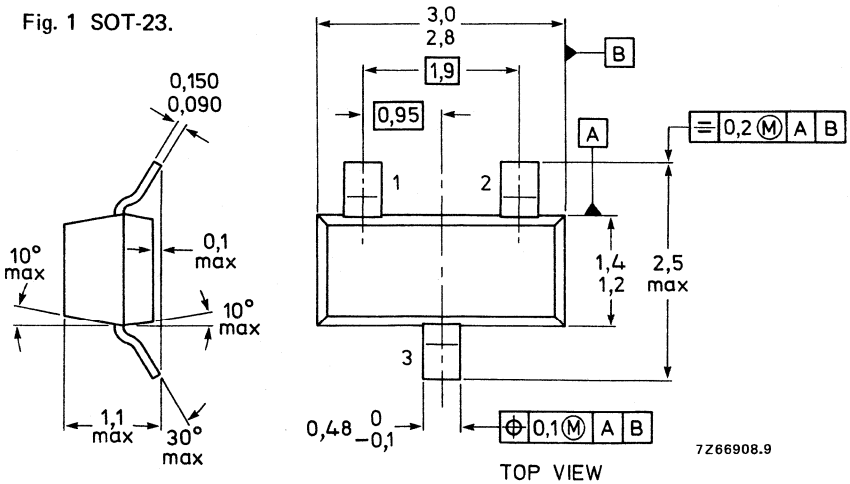
QUICK REFERENCE DATA

			BCF32	BCF33	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	200	420	
		<	450	800	
Collector-base voltage (open emitter)	V_{CBO}	max.	32		V
Collector-emitter voltage (open base)	V_{CEO}	max.	32		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW ←
Junction temperature	T_j	max.	150		°C ←
Transition frequency at f = 35 MHz I_C = 2 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

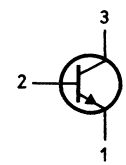


R-types are available on request.

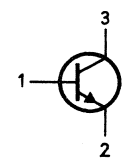
See also *Soldering recommendations*.

Marking code

BCF32 = D7
BCF33 = D8



BCF32R = D77
BCF33R = D81



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base)			
I_C = 2 mA	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C**	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 32 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 32 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base-emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}		550 to 700 mV
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCF32	BCF33
D.C. current gain				
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	150	270
		>	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	<	450	800
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5 pF	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300 MHz	
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V				
f = 1 kHz; B = 200 Hz	F	<	4 dB	
		typ.	1,2 dB	

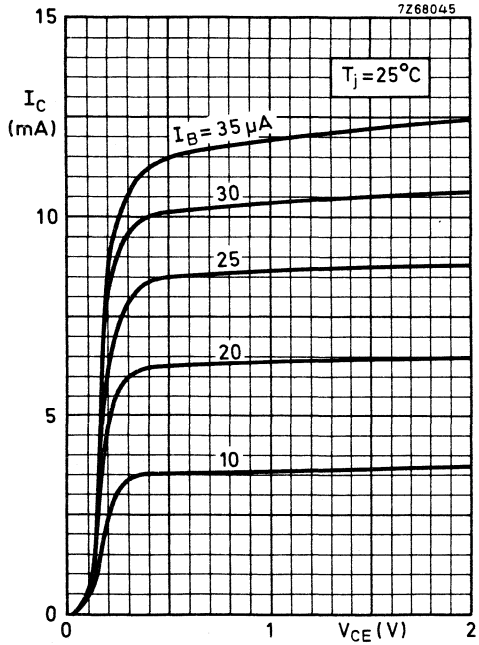


Fig. 2

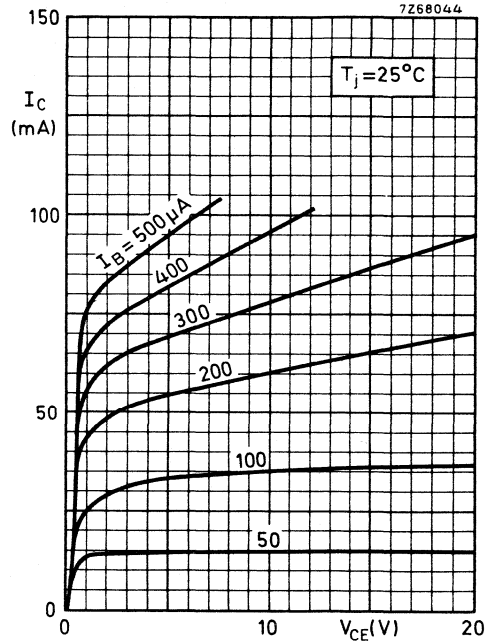


Fig. 3

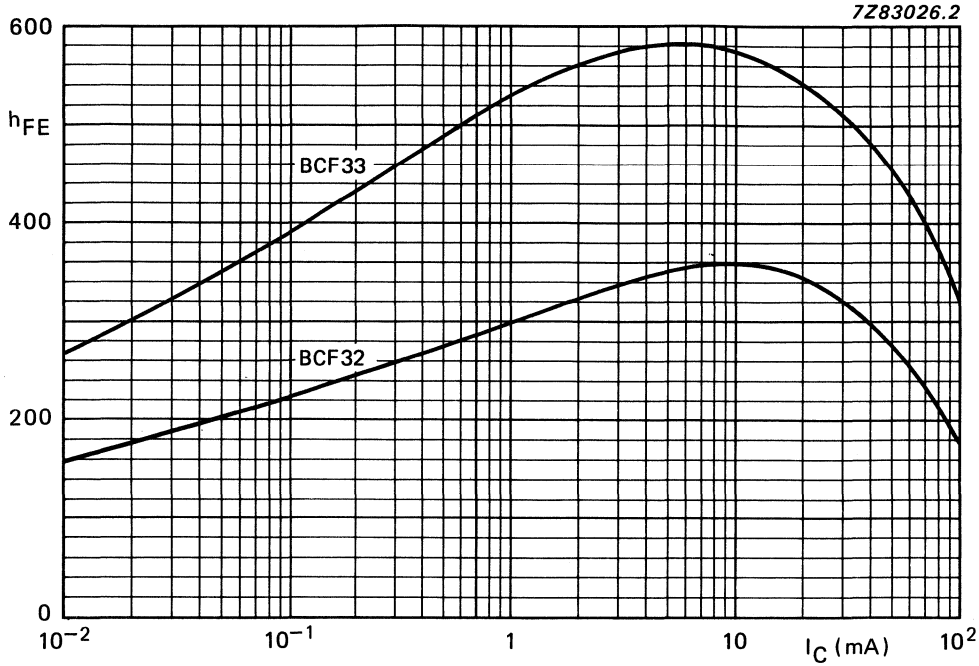


Fig. 4 Typical values d.c. current gain. V_{CE} = 5 V; T_j = 25 °C.

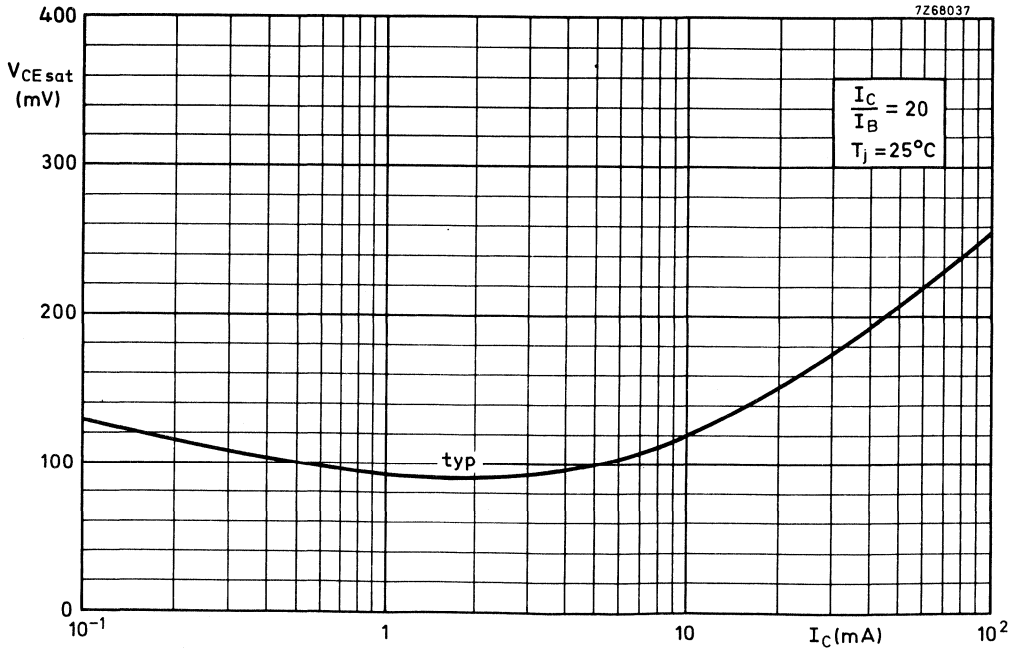


Fig. 5

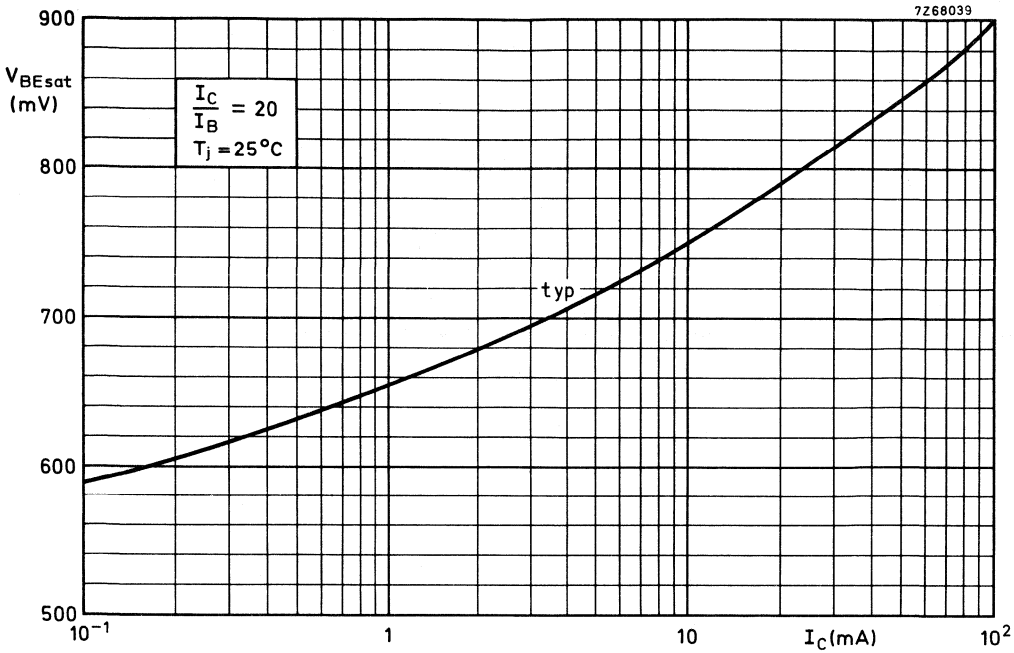

7Z68039
900
800
700
600
500
V_{BEsat} (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

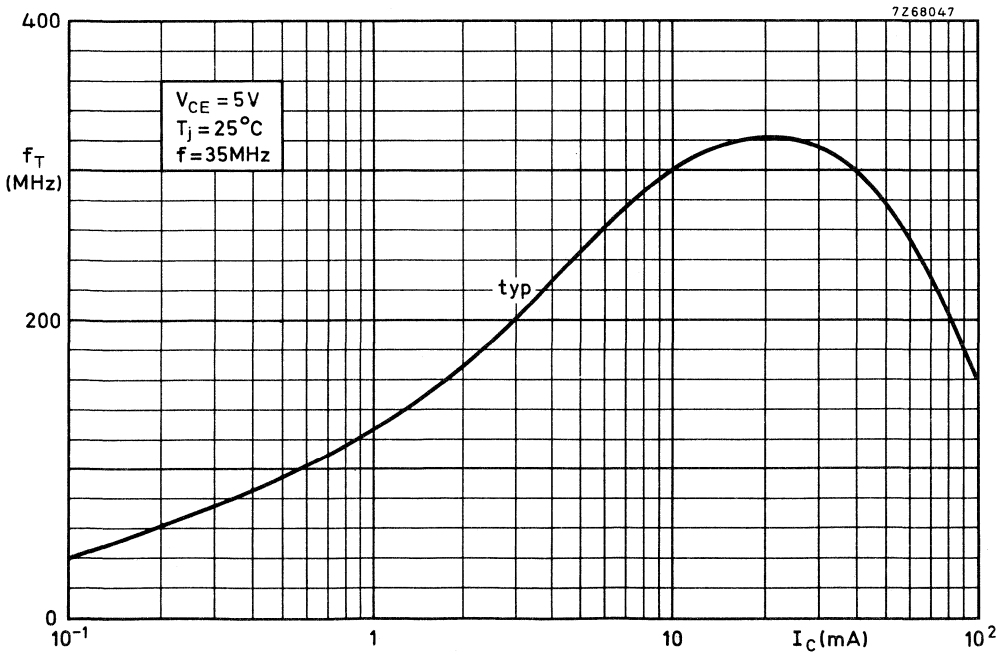

7Z68047
400
200
0
f_T (MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

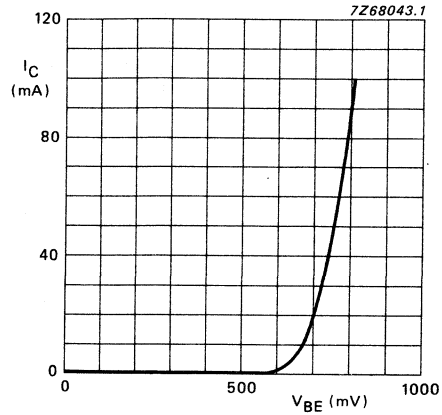


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

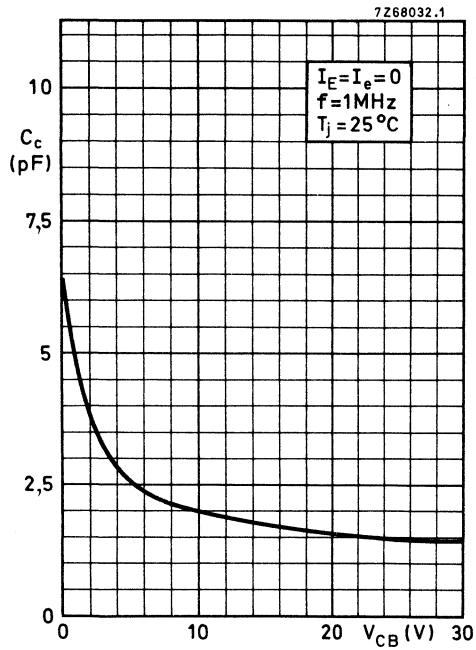


Fig. 9

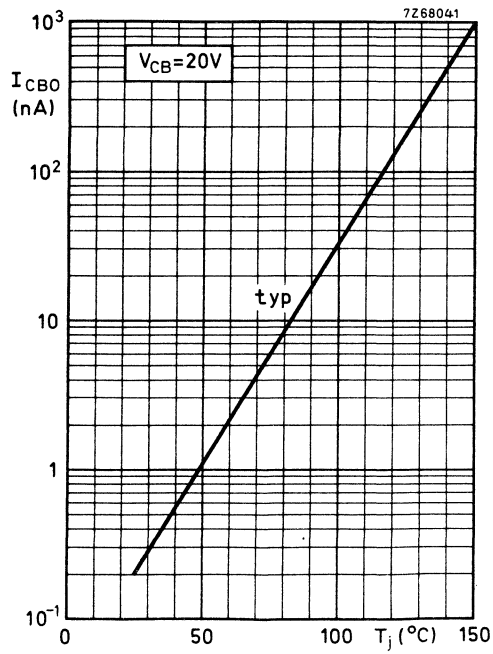


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise applications in thick and thin-film circuits.

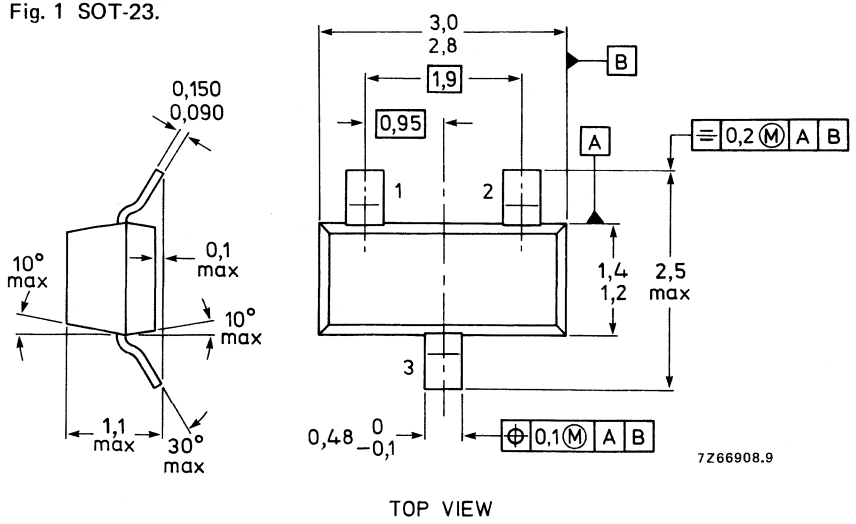
QUICK REFERENCE DATA

D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	215	
		<	500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Fig. 1 SOT-23.

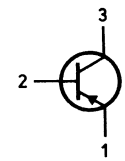
Dimensions in mm



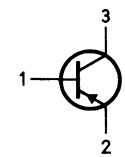
TOP VIEW

Marking code

BCF70 = H7



BCF70R = H71



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50	V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	45	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	200	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

I_E = 0; $-V_{CB}$ = 20 V; T_j = 25 °C	$-I_{CBO}$	<	100	nA
T_j = 100 °C	$-I_{CBO}$	<	10	μA
Base-emitter voltage $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; T_j = 25 °C	$-V_{BE}$	600 to	750	mV
Saturation voltages $-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80	mV
	$-V_{CEsat}$	<	300	mV
	$-V_{BEsat}$	typ.	720	mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150	mV
	$-V_{BEsat}$	typ.	810	mV

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain			
$-I_C = 10\ \mu A;\ -V_{CE} = 5\ V$	h_{FE}	typ.	150
$-I_C = 2\ mA;\ -V_{CE} = 5\ V$	h_{FE}	$>$	215
		$<$	500
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0;\ -V_{CB} = 10\ V$	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz			
$-I_C = 10\ mA;\ -V_{CE} = 5\ V$	f_T	typ.	150 MHz
Noise figure at $R_S = 2\ k\Omega$			
$-I_C = 200\ \mu A;\ -V_{CE} = 5\ V$	F	$<$	4 dB
f = 1 kHz; B = 200 Hz		typ.	1 dB

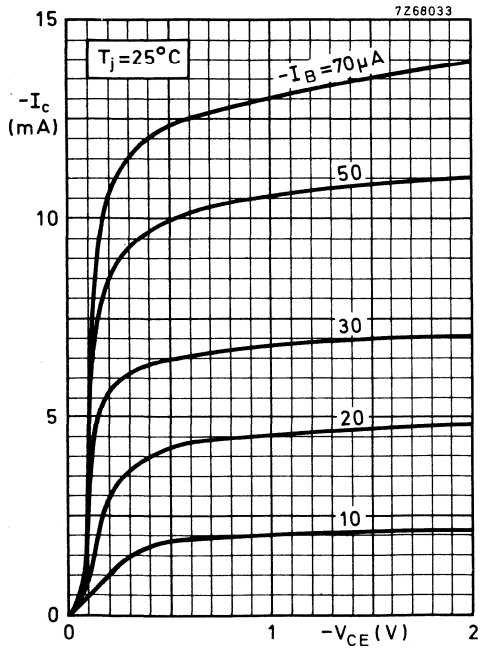


Fig. 2

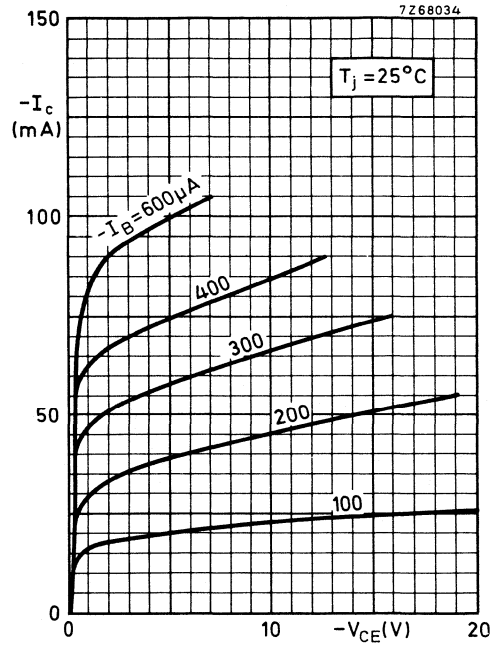


Fig. 3

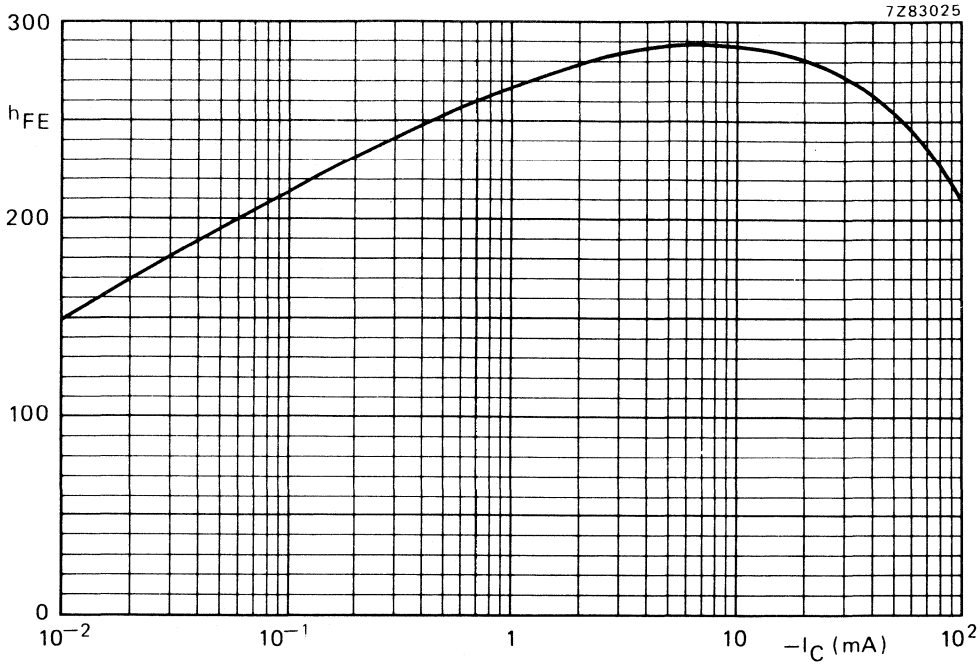


Fig. 4 Typical values of d.c. current gain. $-V_{CE} = 5$ V; $T_j = 25$ °C.

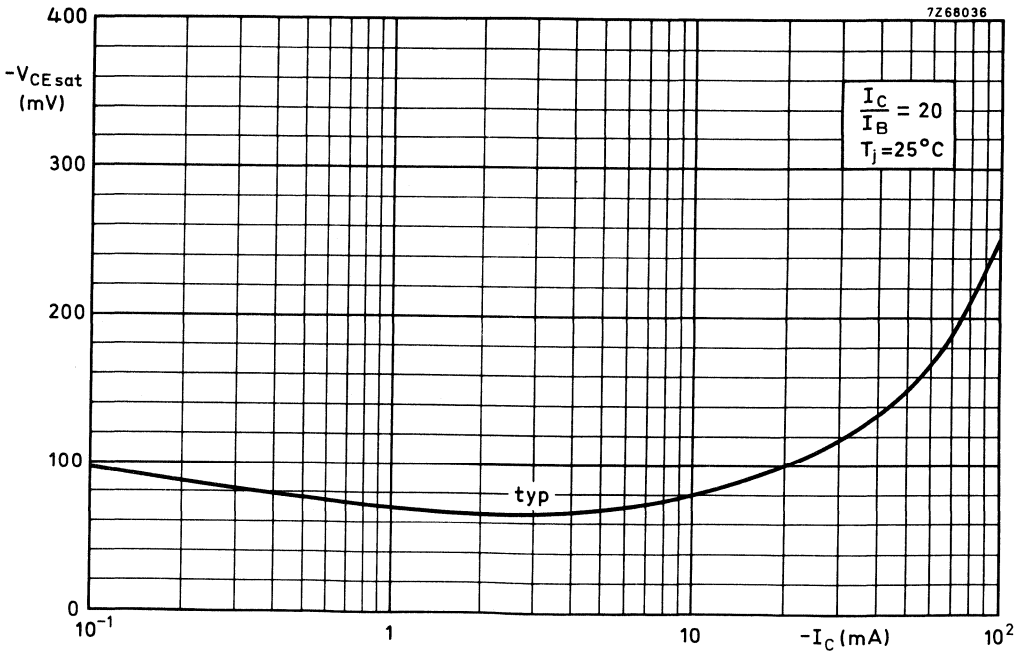


Fig. 5

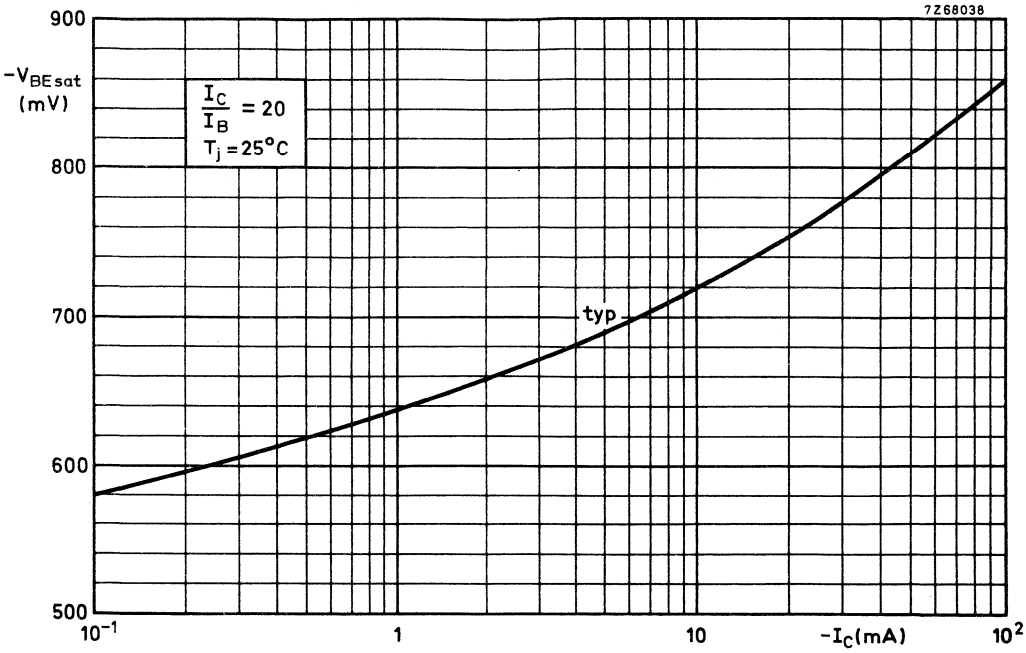

7Z68038
900
800
700
600
500
$-V_{BEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

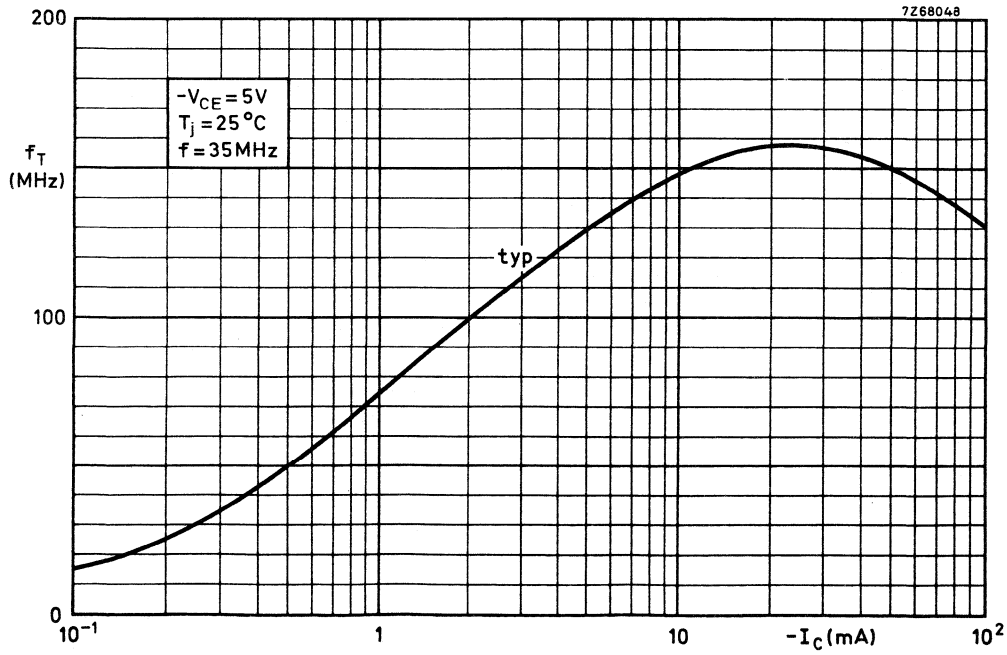

7Z68048
200
100
0
f_T (MHz)
$-V_{CE} = 5V$
$T_j = 25°C$
$f = 35MHz$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

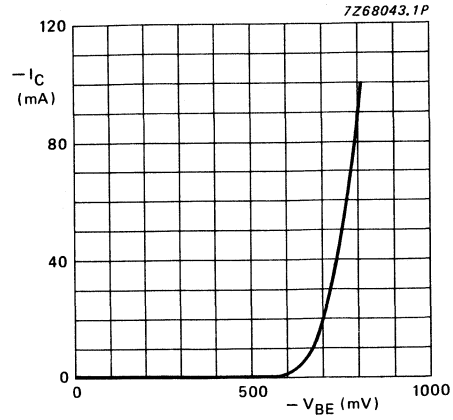


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

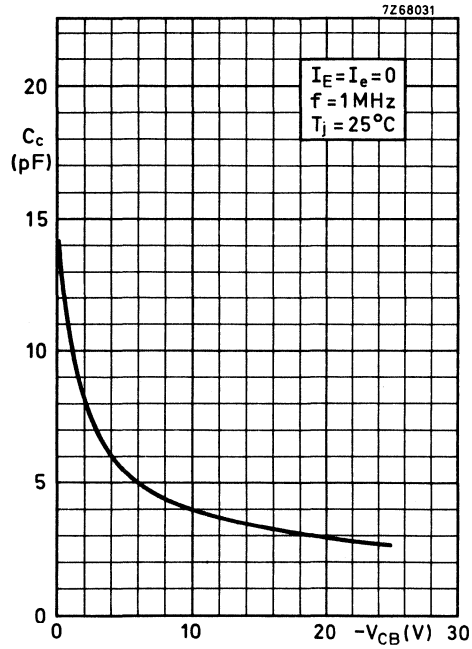


Fig. 9

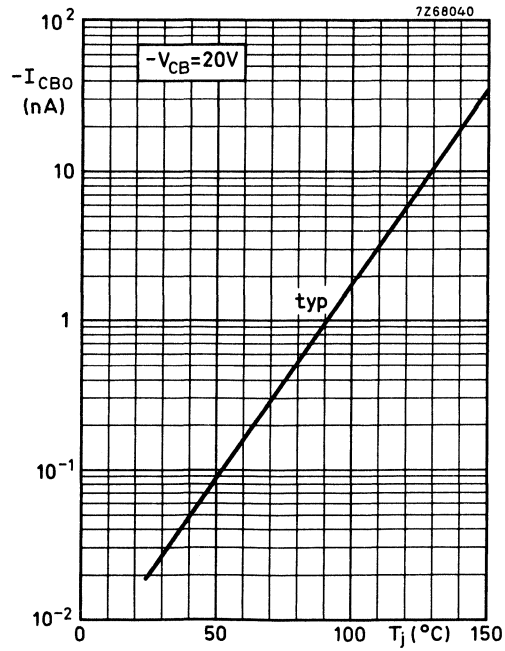


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

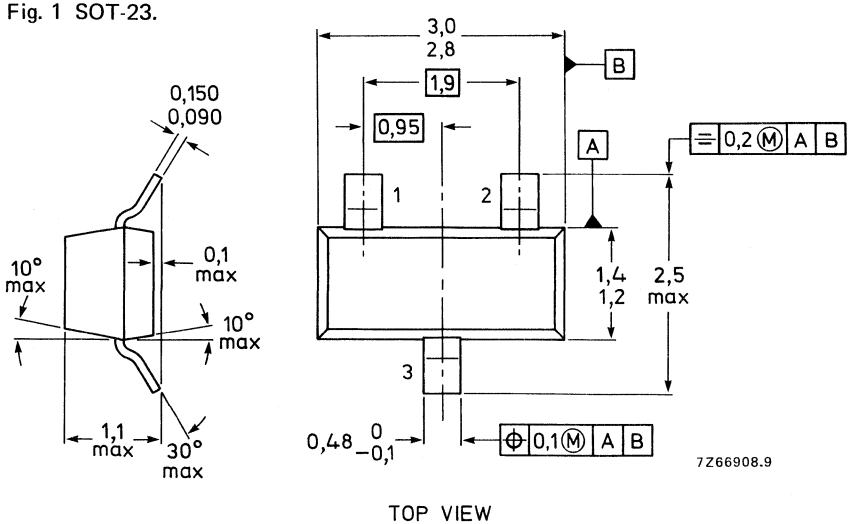
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	420 800	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Fig. 1 SOT-23.

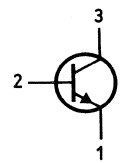
Dimensions in mm



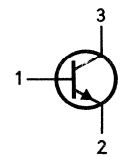
TOP VIEW

Marking code

BCF81 = K9



BCF81R = K91



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50 V
Collector-emitter voltage (open base)			
I_C = 2 mA	V_{CEO}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C**	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}	−65 to +	150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to	700 mV
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain			
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	420
		<	800
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5 pF
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300 MHz
Noise figure at R_S = 2 kΩ			
I_C = 200 μA; V_{CE} = 5 V			
f = 1 kHz; B = 200 Hz	F	<	4 dB
		typ.	1,2 dB

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power pnp transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

NPN complements are BCP54, BCP55 and BCP56 respectively.

QUICK REFERENCE DATA

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

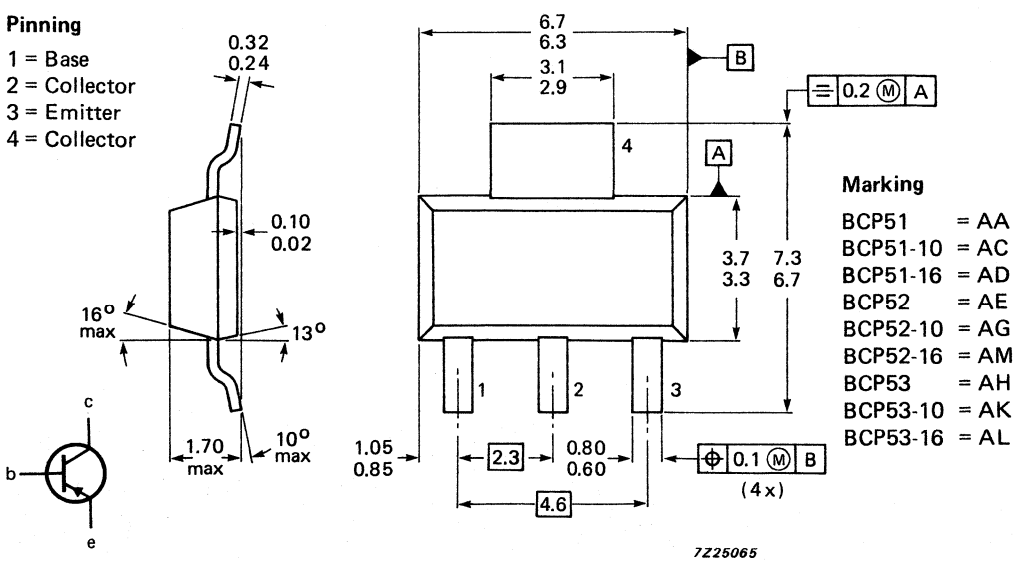
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



Marking

BCP51	= AA
BCP51-10	= AC
BCP51-16	= AD
BCP52	= AE
BCP52-10	= AG
BCP52-16	= AM
BCP53	= AH
BCP53-10	= AK
BCP53-16	= AL

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (DC)	$-I_C$	max.		1,0		A
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Base current (DC)	$-I_B$	max.		0,1		A
Base current (peak value)	$-I_{BM}$	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	100	nA
I_E = 0; $-V_{CB}$ = 30 V; T_j = 125 °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	0,5	V
DC current gain				
$-I_C$ = 5 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		40 to 250	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	50	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

CHARACTERISTICS (continued)

			BCP51-10 52-10 53-10	BCP51-16 52-16 53-16
DC current gain		>	63	100
I_C = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	<	160	250

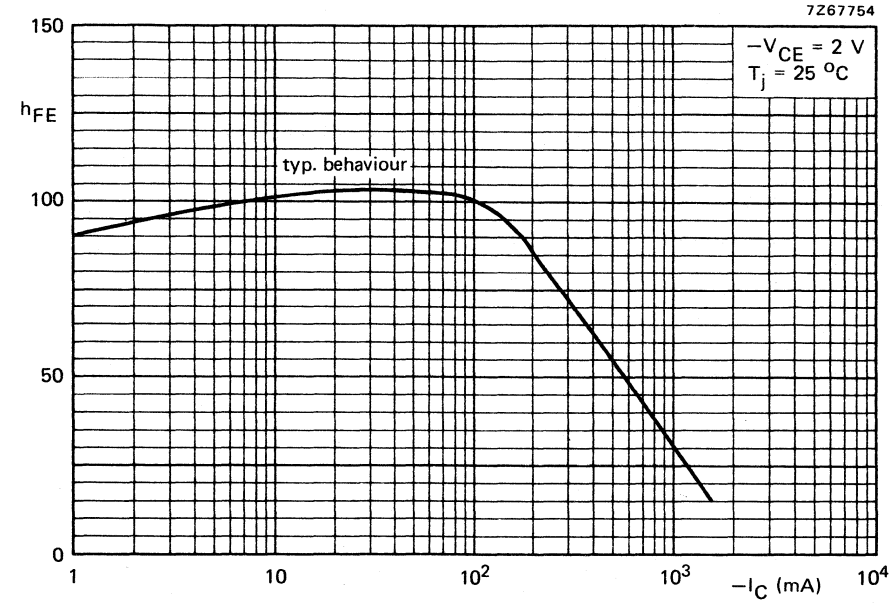


Fig. 2.

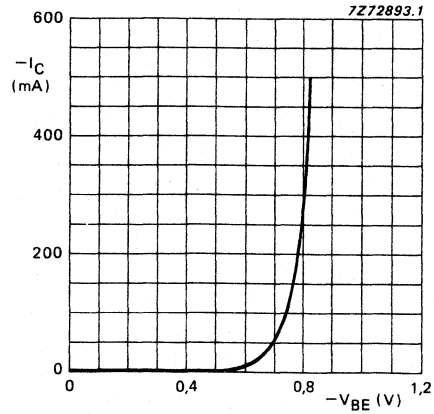


Fig. 3 $-V_{CE}$ = 2 V; T_j = 25 °C; typical values.

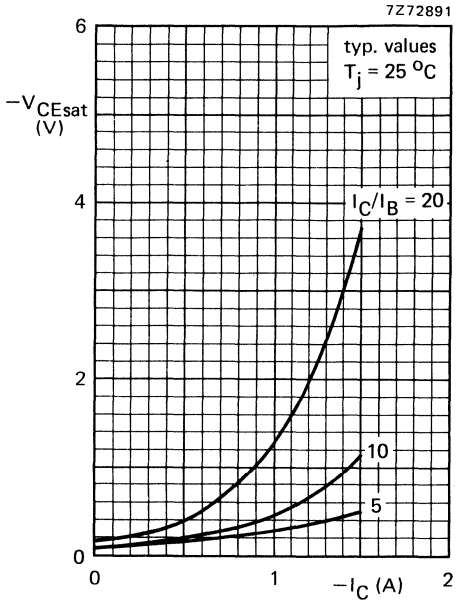


Fig. 4.

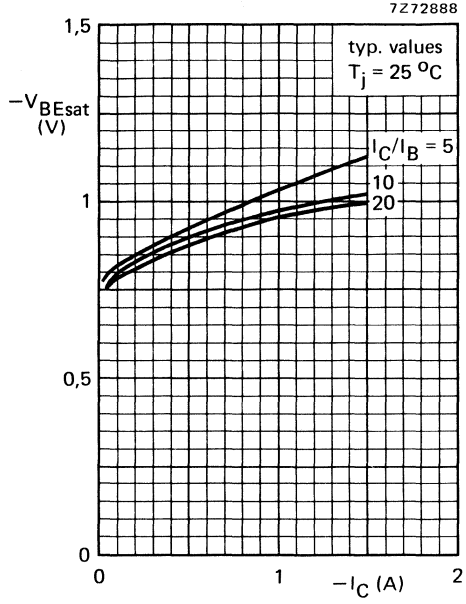


Fig. 5.

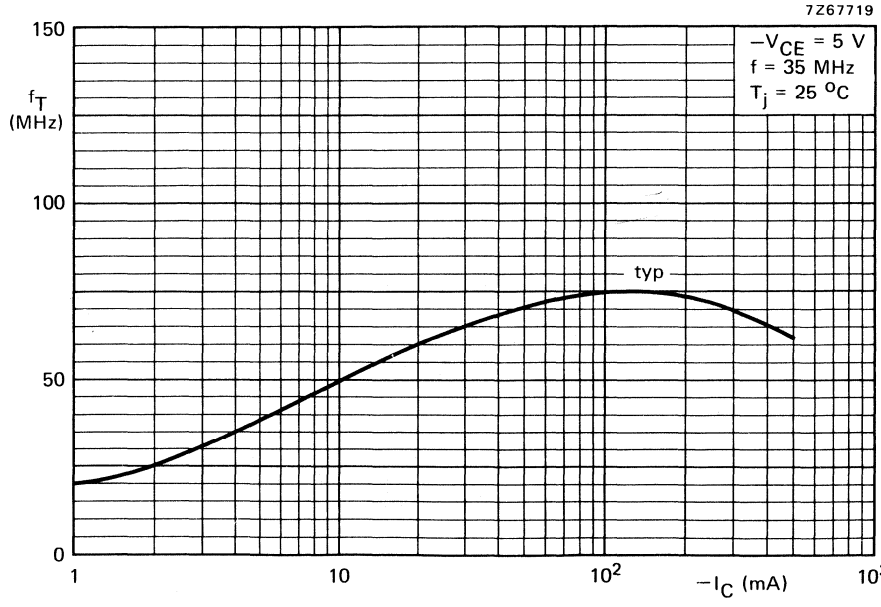


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power npn transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

PNP complements are BCP51, BCP52 and BCP53 respectively.

QUICK REFERENCE DATA

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

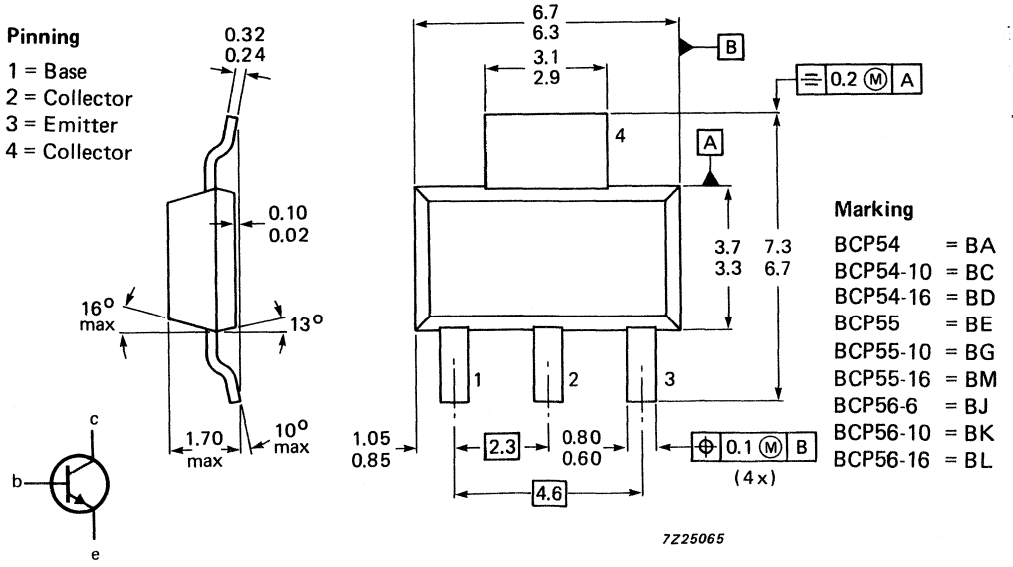
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



Marking

BCP54	= BA
BCP54-10	= BC
BCP54-16	= BD
BCP55	= BE
BCP55-10	= BG
BCP55-16	= BM
BCP56-6	= BJ
BCP56-10	= BK
BCP56-16	= BL

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V
Collector current (DC)	I_C	max.		1,0		A
Collector current (peak value)	I_{CM}	max.		1,5		A
Base current (DC)	I_B	max.		0,1		A
Base current (peak value)	I_{BM}	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 30 V; T_j = 125 °C	I_{CBO}	<	10	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base-emitter voltage				
I_C = 500 mA; V_{CE} = 2 V	V_{BE}	<	1	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	V
DC current gain				
I_C = 5 mA; V_{CE} = 2 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 2 V	h_{FE}		40 to 250	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	130	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

CHARACTERISTICS (continued)

			BCP54-10 55-10 56-10	BCP54-16 55-16 56-16
DC current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}	>	63	100
		<	160	250

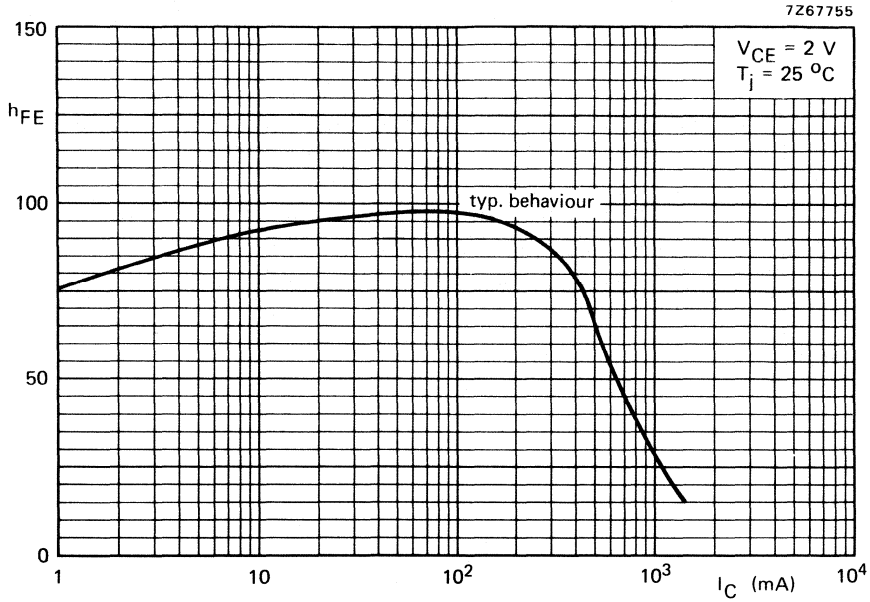


Fig. 2.

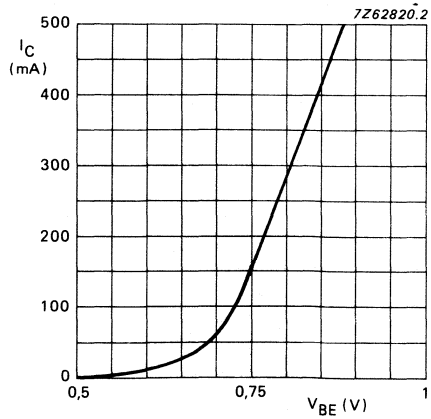


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

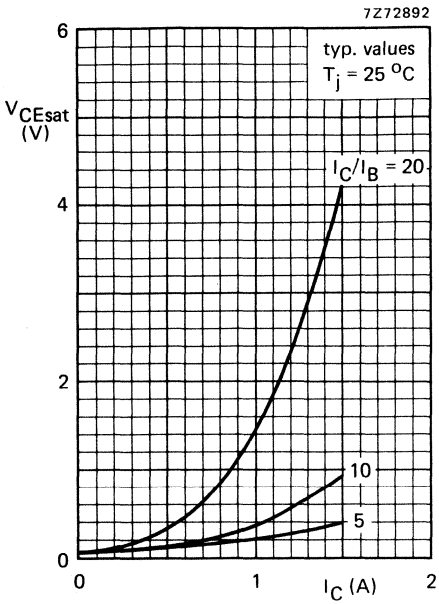


Fig. 4.

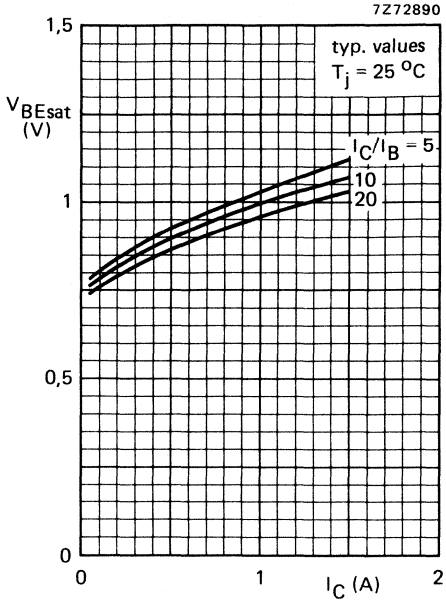


Fig. 5.

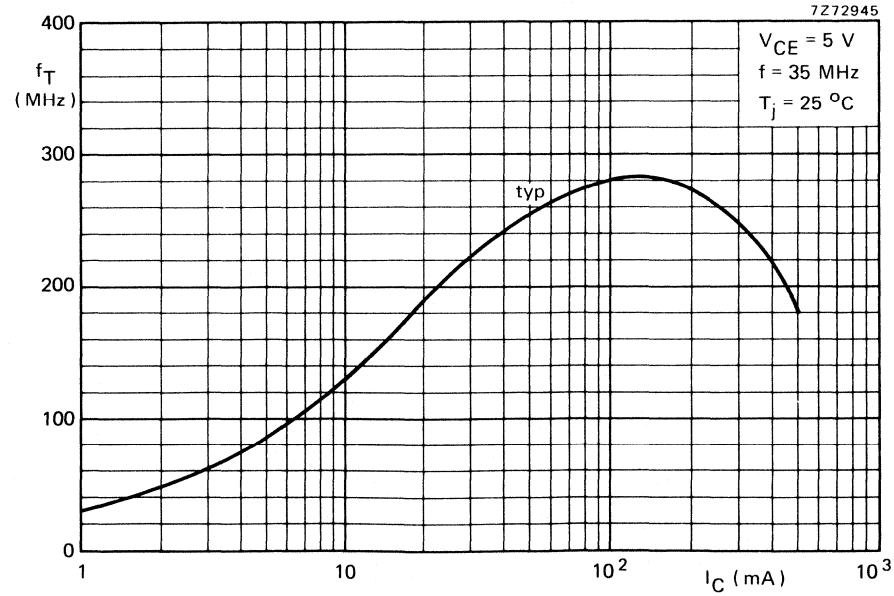


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN transistor in a microminiature plastic envelope intended for low-voltage, high-current LF applications.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Collector current (peak value)	I_{CM}	max.	2 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5 W
Junction temperature	T_j	max.	150 °C
DC current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60 MHz

MECHANICAL DATA Dimensions in mm

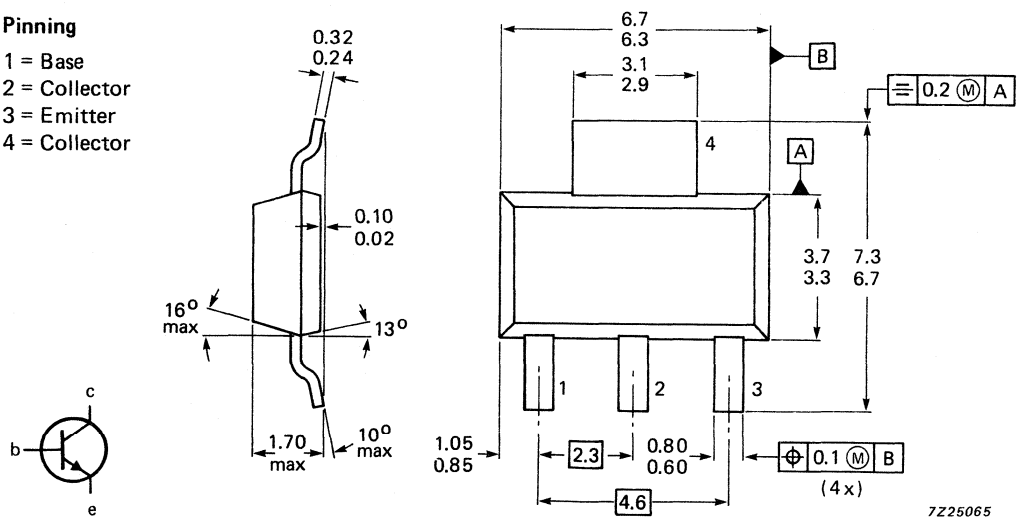
Fig. 1 SOT-223

Mark

CA

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (DC)	I_C	max.	1 A
Collector current (peak value)	I_{CM}	max.	2 A
Base current (DC)	I_B	max.	100 mA
Base current (peak value)	I_{BM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	83,3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 25 V	I_{CBO}	<	10 μA
I_E = 0; V_{CB} = 25 V; T_j = 150 °C	I_{CBO}	<	1 mA
Emitter cut-off current			
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10 μA
Base-emitter voltage			
I_C = 5 mA; V_{CE} = 10 V	V_{BE}	typ.	0,62 V
I_C = 1 A; V_{CE} = 1 V	V_{BE}	<	1 V
Collector-emitter saturation voltage			
I_C = 1 A; I_B = 100 mA	V_{CEsat}	<	0,5 V
DC current gain			
I_C = 5 mA; V_{CE} = 10 V	h_{FE}	>	50
I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375
I_C = 1 A; V_{CE} = 1 V	h_{FE}	>	60
Collector capacitance at f = 450 kHz			
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	typ.	27 pF
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60 MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

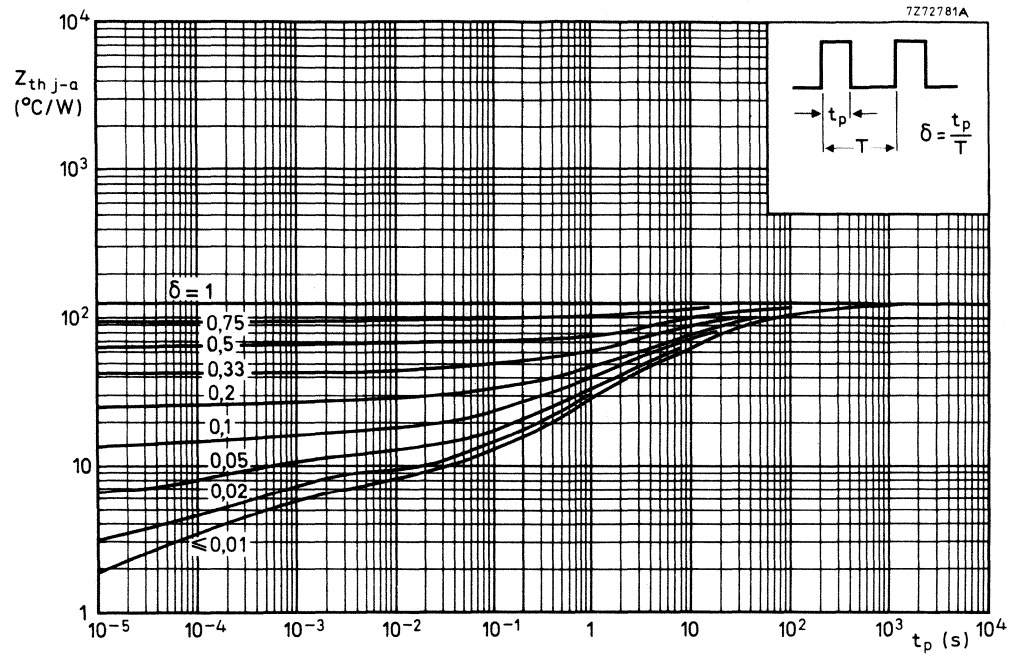


Fig. 2 Pulse power rating chart.

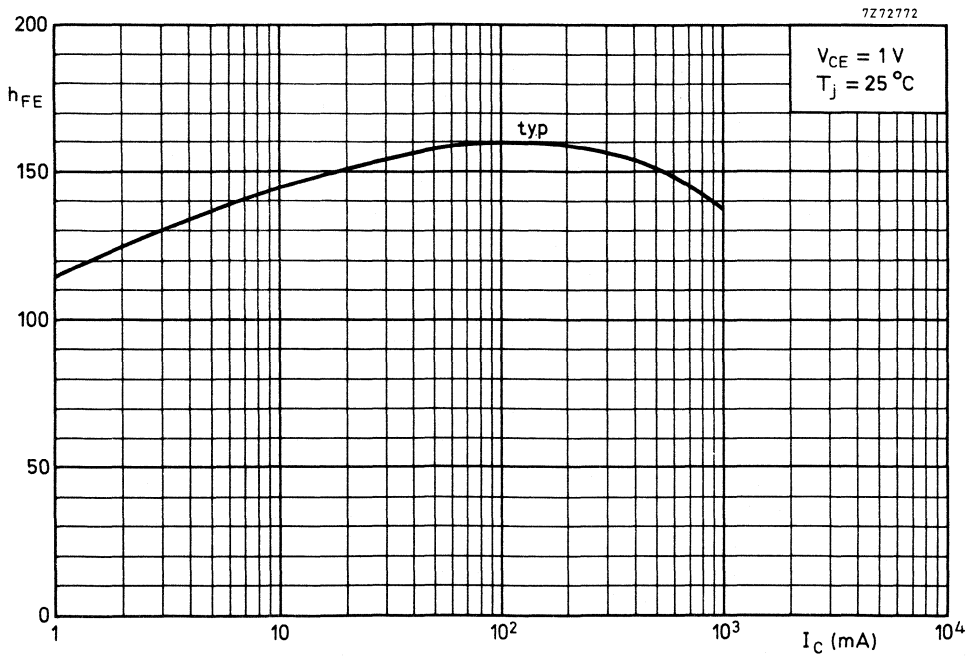


Fig. 3 D.C. current gain.

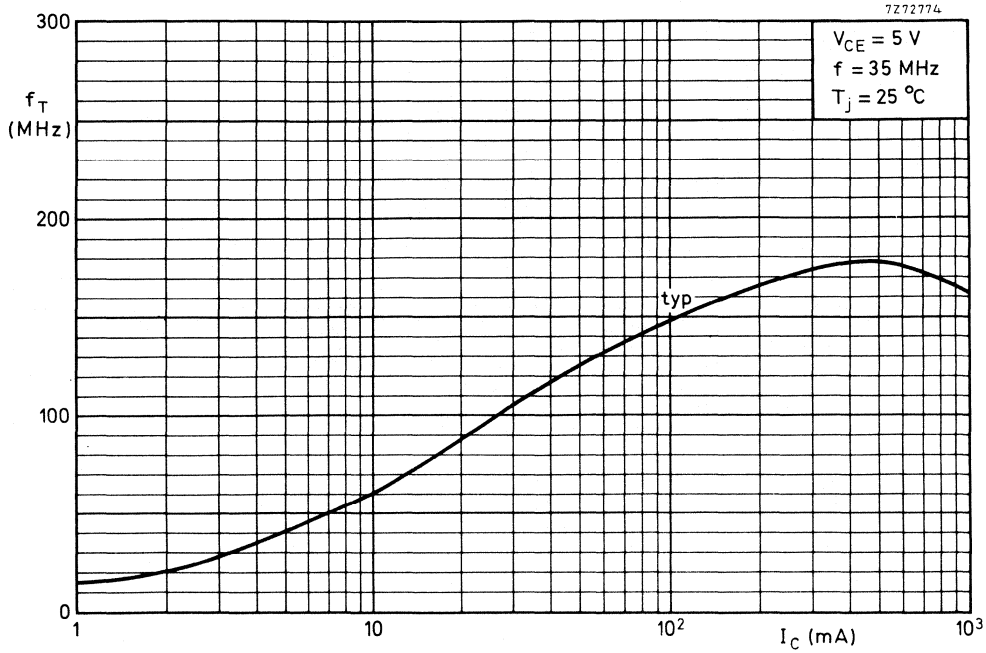


Fig. 4 Typical values transition frequency as a function of collector current.

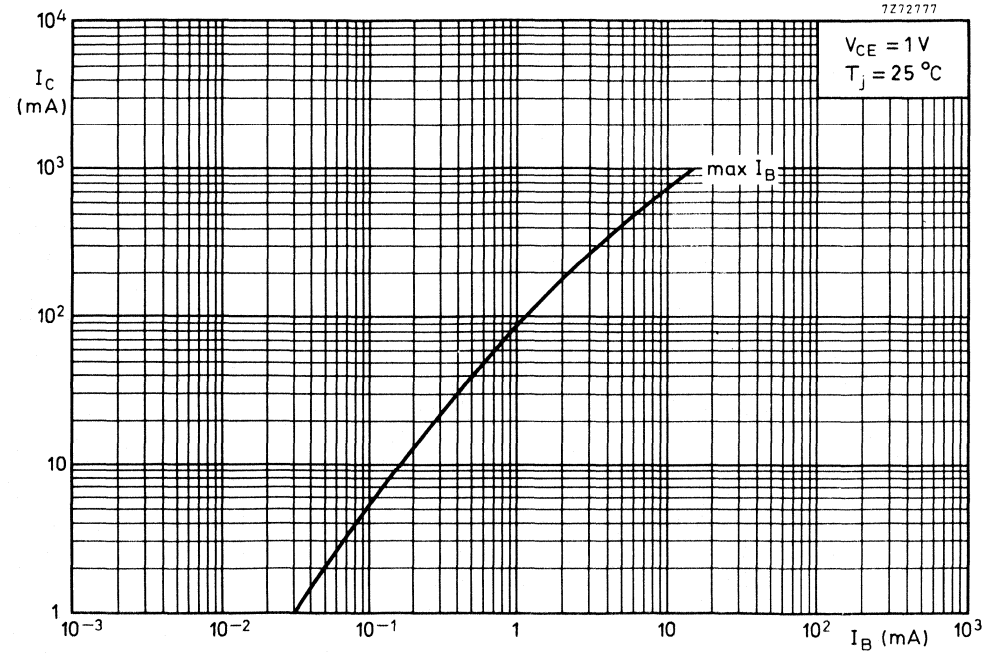


Fig. 5 Typical values collector current as a function of maximum base current.

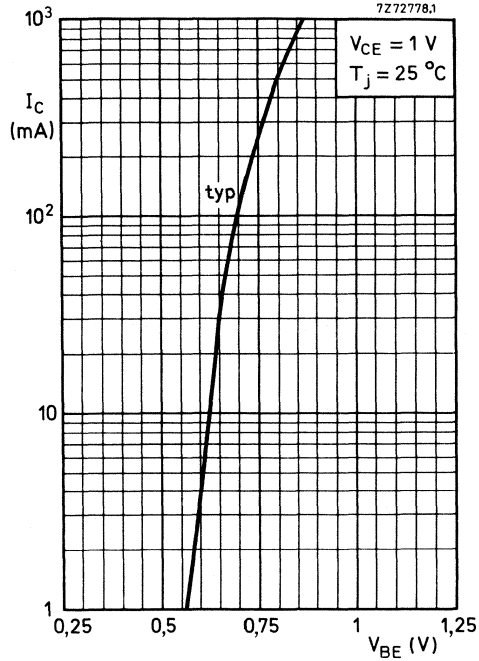


Fig. 6 Typical values collector current as a function of base-emitter voltage.

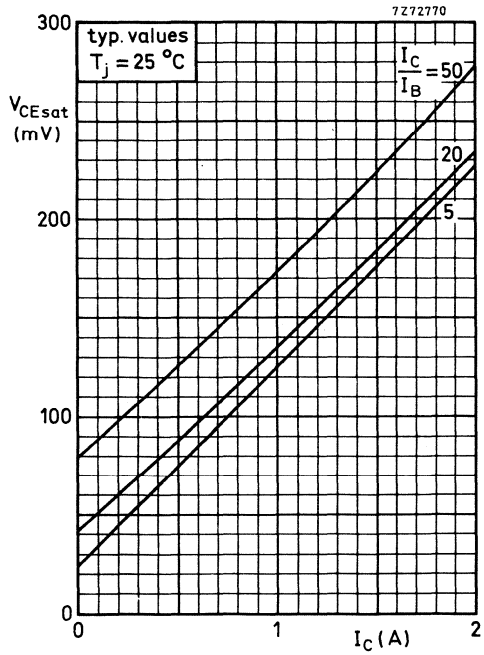


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

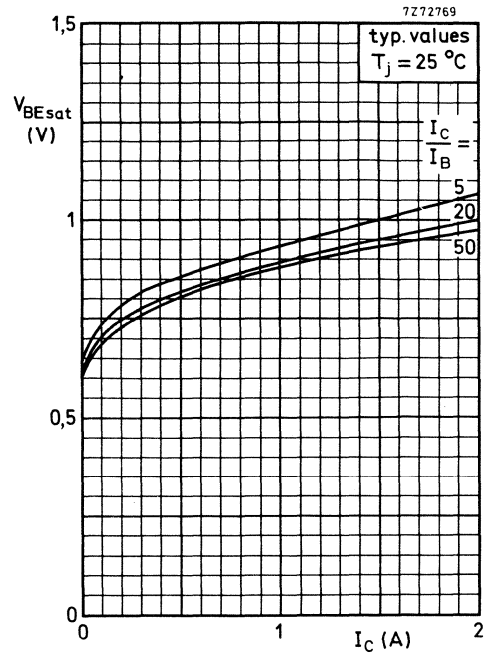


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP transistor in a plastic microminiature envelope, intended for low-voltage, high-current LF applications.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20 V
Collector current (peak value)	$-I_{CM}$	max.	2 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5 W
Junction temperature	T_j	max.	150 °C
DC current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}	85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60 MHz

MECHANICAL DATA

Dimensions in mm

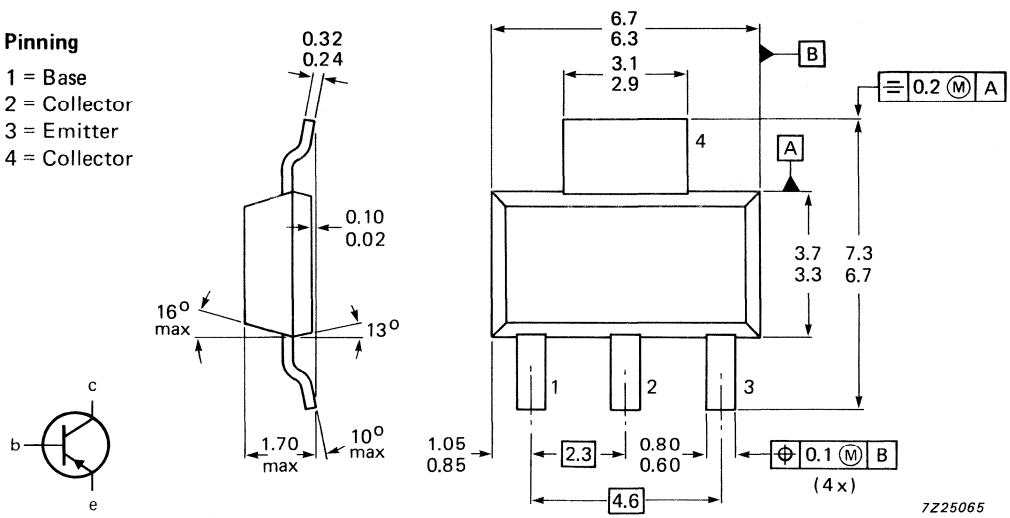
Fig. 1 SOT-223

Mark

CE

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (DC)	$-I_C$	max.	1 A
Collector current (peak value)	$-I_{CM}$	max.	2 A
Base current (DC)	$-I_B$	max.	100 mA
Base current (peak value)	$-I_{BM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5 W
Storage temperature range	T_{stg}	−65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 25 V	$-I_{CBO}$	<	10 μA
I_E = 0; $-V_{CB}$ = 25 V; T_j = 150 °C	$-I_{CBO}$	<	1 mA
Emitter cut-off current			
I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	$-V_{BE}$	typ.	0,62 V
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	$-V_{BE}$	<	1 V
Collector-emitter saturation voltage			
$-I_C$ = 1 A; $-I_B$ = 100 mA	$-V_{CEsat}$	<	0,5 V
DC current gain			
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	h_{FE}	>	60
Collector capacitance at f = 450 kHz			
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V	C_c	typ.	45 pF
Transition frequency at f = 35 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60 MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

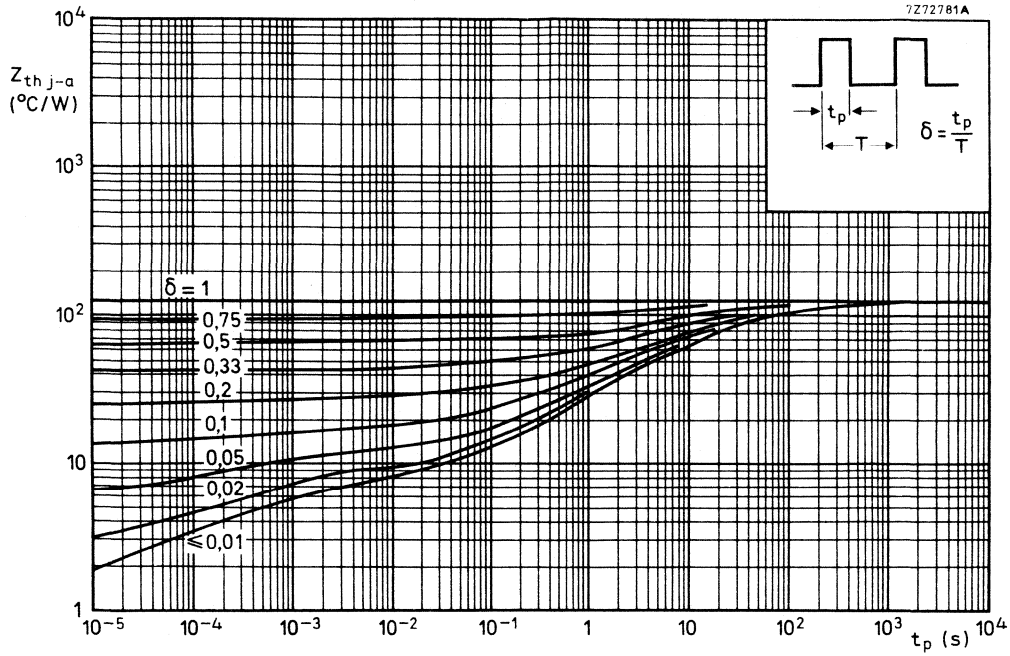


Fig. 2 Pulse power rating chart.

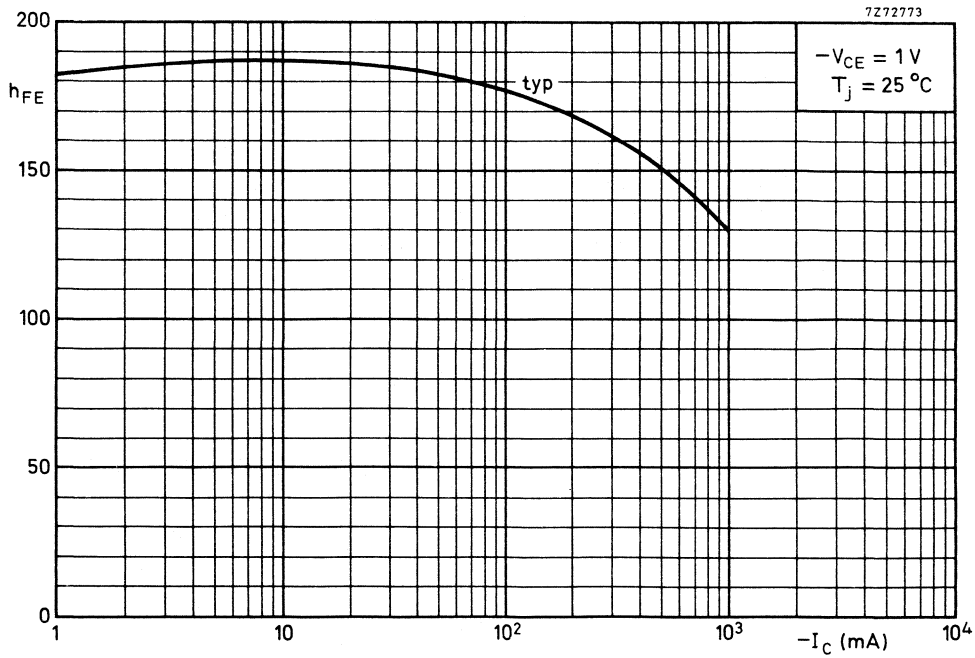


Fig. 3 D.C. current gain.

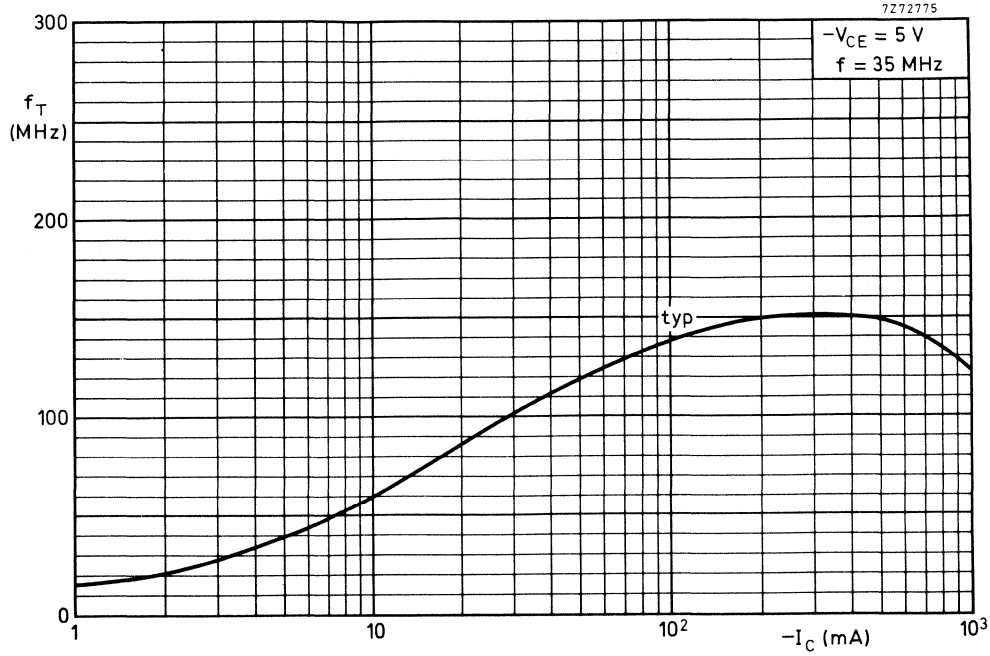


Fig. 4 Typical values transition frequency as a function of collector current.

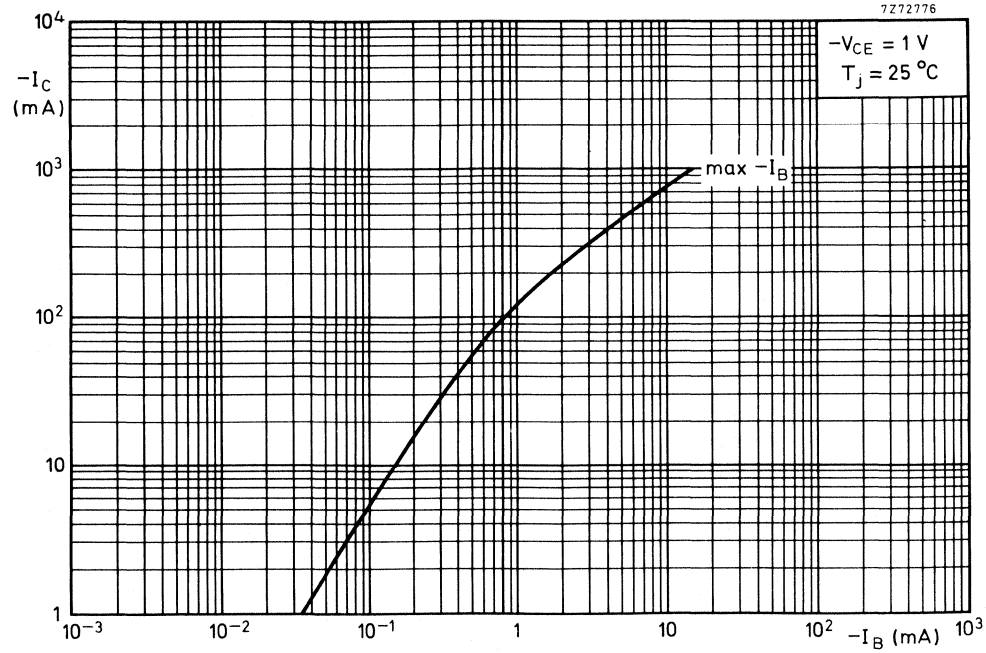


Fig. 5 Typical values collector current as a function of maximum base current.

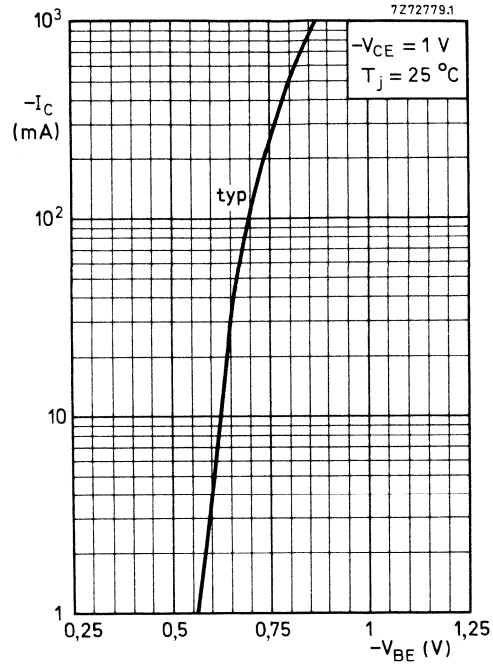


Fig. 6 Typical values collector current as a function of base-emitter voltage.

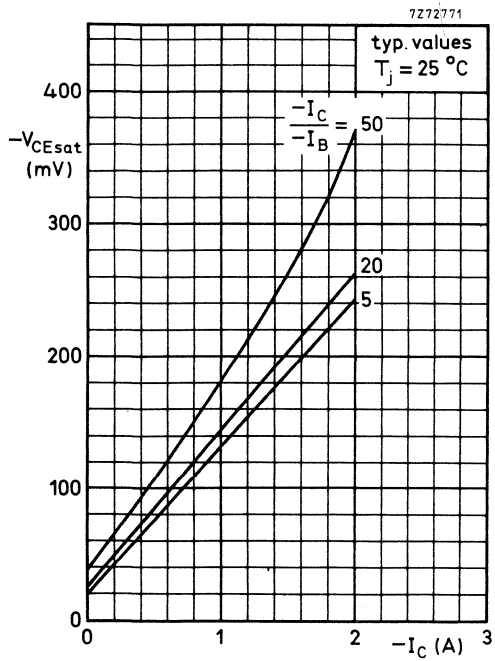


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

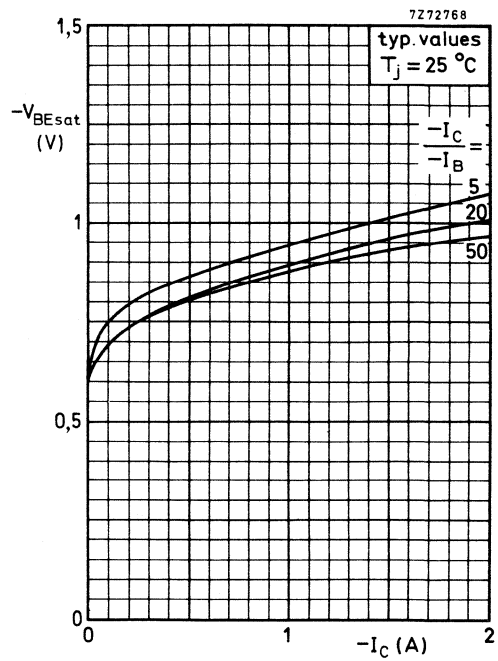


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR DARLINGTON TRANSISTOR

P-N-P silicon planar darlington transistor in a plastic SOT23 envelope.
N-P-N complement is BCV27/47.

QUICK REFERENCE DATA

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Collector current	$-I_C$	max.	300	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	>	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	>	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Collector-emitter saturation voltage					
$-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Transition frequency at f = 100 MHz					
$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

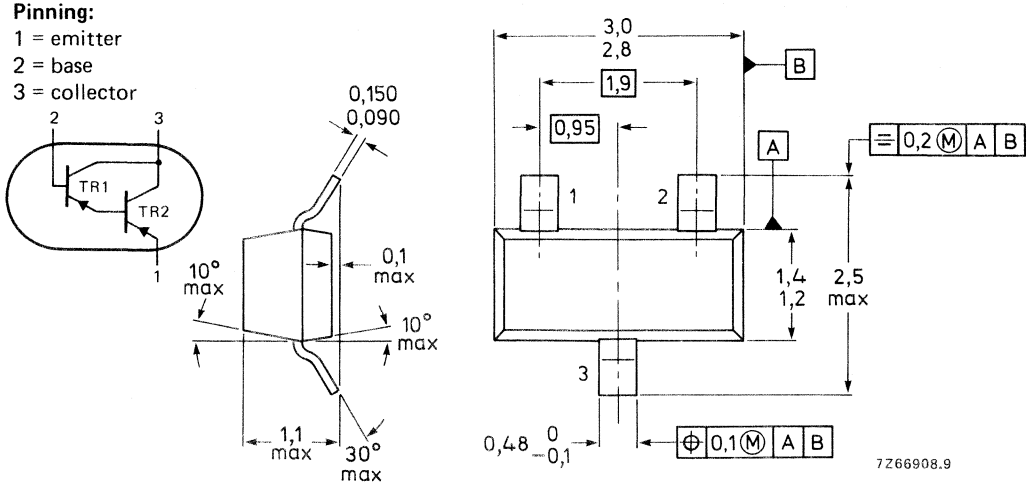
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT23

Marking: FD

Pinning:
1 = emitter
2 = base
3 = collector



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10	10	V
Collector current	$-I_C$	max.	300	500	mA
Collector current (peak value)	$-I_{CM}$	max.	800		mA
Base current	$-I_B$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	430		K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated			BCV26	BCV46	
Collector-base current					
$-V_{CBO}$ = 30 V	$-I_{CBO}$	max.	0.1	0.1	μA
Emitter-base current					
$-V_{EB}$ = 10 V	$-I_{EBO}$	max.	0.1	0.1	μA
Collector-emitter break-down voltage					
$-I_C$ = 10 mA	$-V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage					
I_C = 10 μA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage					
$-I_E$ = 100 nA	$-V_{(BR)EBO}$	min.	10	10	V
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage					
$-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage					
$-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz					
$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz					
I_E = 0; $-V_{CB}$ = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON PLANAR DARLINGTON TRANSISTOR

N-P-N silicon planar darlington transistor in a plastic SOT23 envelope.
P-N-P complement is BCV26/46.

QUICK REFERENCE DATA

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Collector current	I_C	max.	300	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	>	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	>	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Collector-emitter saturation voltage					
I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Transition frequency at f = 100 MHz					
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

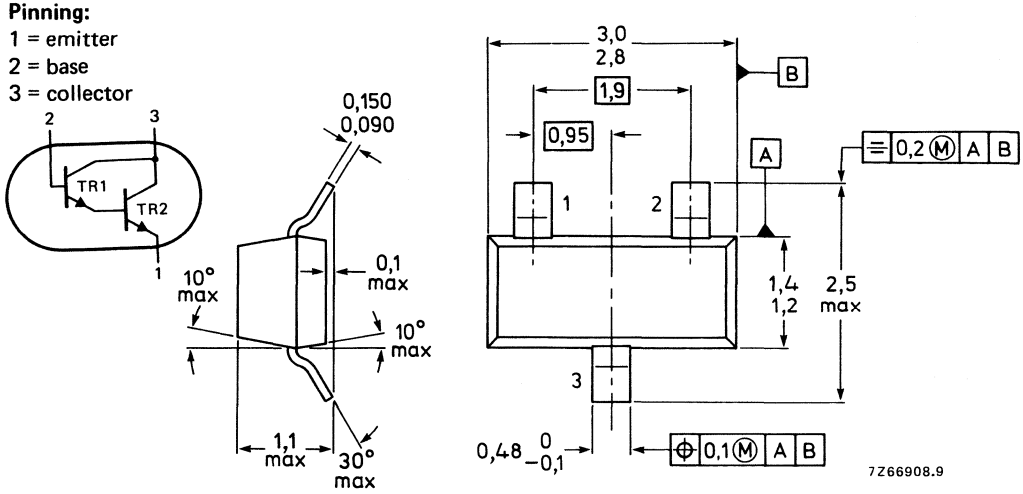
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT23

Marking: FF

Pinning:
1 = emitter
2 = base
3 = collector



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	10	10	V
Collector current	I_C	max.	300	500	mA
Collector current (peak value)	I_{CM}	max.	800		mA
Base current	I_B	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated			BCV27	BCV47	
Collector-base current					
V_{CBO} = 30 V	I_{CBO}	max.	0.1	0.1	μA
Emitter-base current					
V_{EB} = 10 V	I_{EBO}	max.	0.1	0.1	μA
Collector-emitter break-down voltage					
I_C = 10 mA	$V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage					
I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage					
I_E = 100 nA	$V_{(BR)EBO}$	min.	10	10	V
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage					
I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Base-emitter saturation voltage					
I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5		V
Transition frequency at f = 100 MHz					
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

PNP small-signal darlington transistors, housed in a microminiature envelope (SOT89).
NPN complementary types are BCV29/49.

QUICK REFERENCE DATA

			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation					
up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz					
$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

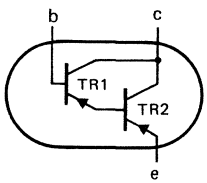
MECHANICAL DATA

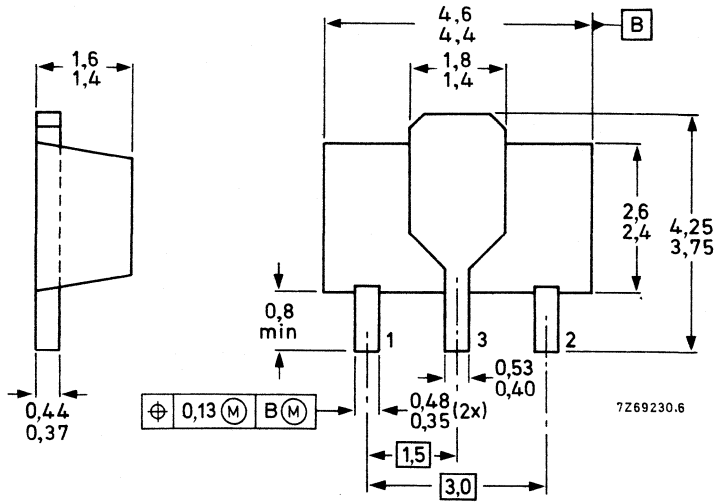
Dimensions in mm

Fig.1 SOT89

Pinning

1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV28	BCV48	
Collector-emitter breakdown voltage $-I_C$ = 10 mA	$-V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage $-I_C$ = 10 μA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage $-I_E$ = 0.1 μA	$-V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current $-V_{BE}$ = 4 V; I_C = 0	$-I_{EBO}$	max.	0.1	0.1	μA
Collector-base cut-off current $-V_{CB}$ = 30/60 V; I_E = 0	$-I_{CBO}$	max.	0.1	0.1	μA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Output capacitance $-V_{CB}$ = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

NPN small-signal darlington transistors, housed in a microminiature envelope (SO89).

PNP complementary types are BCV28/48.

QUICK REFERENCE DATA

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation					
up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz					
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

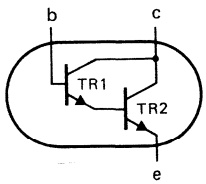
MECHANICAL DATA

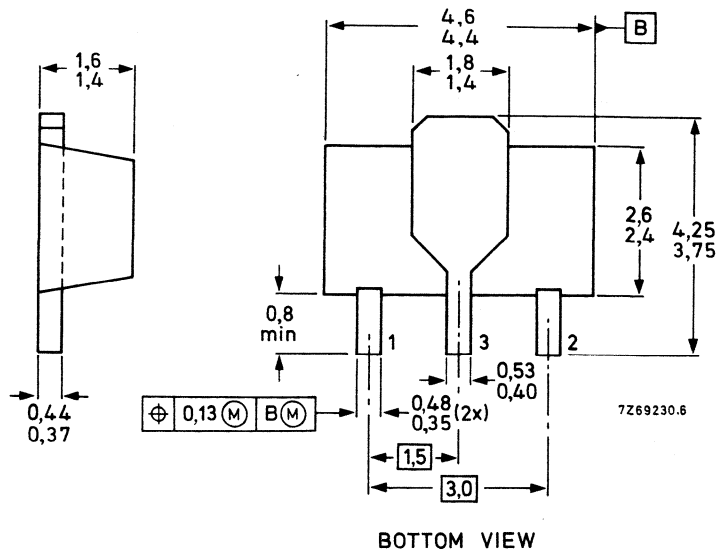
Dimensions in mm

Fig.1 SOT89.

Pinning

1 = emitter
2 = collector
3 = base





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm² ; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV29	BCV49	
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage I_E = 0.1 μA	$V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current V_{BE} = 4 V; I_C = 0	I_{EBO}	max.	0.1	0.1	μA
Collector-base cut-off current V_{CB} = 30/60 V; I_E = 0	I_{CBO}	max.	0.1	0.1	μA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0	1.0	V
Base-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5	1.5	V
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Output capacitance V_{CB} = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double n-p-n transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in p-n-p configuration is the BCV62.

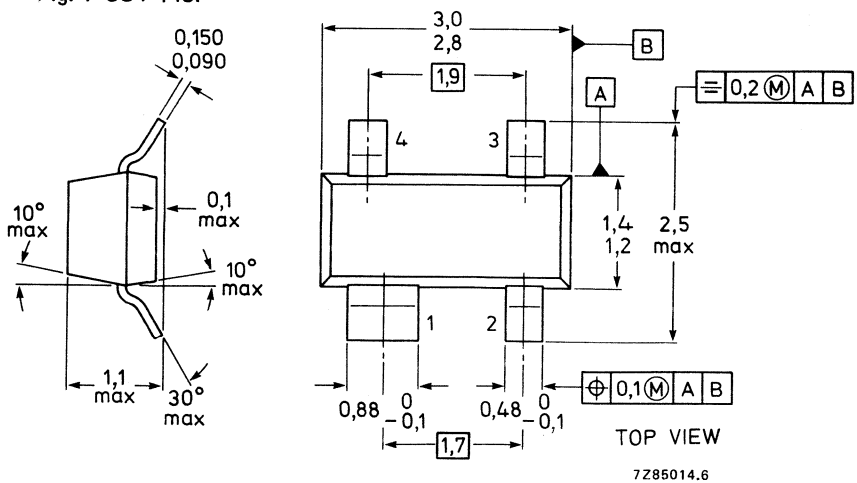
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30 V
Collector current			
d.c.	I_C	max.	100 mA
peak	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

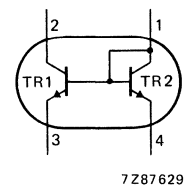
Fig. 1 SOT-143.

Dimensions in mm



Marking code:

BCV61 : D91
BCV61A: D92
BCV61B: D93
BCV61C: D94



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30 V
Base current (transistor T1) peak value	I_{BM1}	max.	200 mA
Emitter-base voltage	V_{EBS}	max.	6 V
Collector current d.c.	I_C	max.	100 mA
peak	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Storage temperature	T_{stg}		−65 to +150 °C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm from junction to ambient	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current			
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15 nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C		<	5 μA
Base-emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660 mV*
			580 to 700 mV*
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770 mV*
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90 mV
		<	250 mV
	V_{BEsat}	typ.	700 mV**
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200 mV
		<	600 mV
	V_{BEsat}	typ.	900 mV**

* Decreasing 2 mV/°C with increasing temperature.

** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V		f_T	typ.	300 MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e = 0$; V_{CB} = 10 V		C_c	typ.	2,5 pF
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V		F	typ.	2 dB
f = 1 kHz; B = 200 Hz			<	10 dB
D.C. current gain				
I_C = 100 μA; V_{CE} = 5 V		h_{FE}	>	100
I_C = 2 mA; V_{CE} = 5 V		h_{FE}	110 to 800	
Input impedance				
I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz		h_{ie}	typ.	5 kΩ
Reverse voltage transfer ratio				
I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz		h_{re}	typ.	2×10^{-4}
Small signal current gain				
I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz		h_{fe}	100 to 900	
Output admittance				
I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz		h_{oe}	typ.	30 μS

Transistor T2

Base-emitter forward voltage				
I_E = 250 mA		V_{BES}	<	1,8 V
I_E = 10 μA			>	400 mV
Matching of transistor T1 and transistor T2				
at I_{E2} = 0,5 mA and V_{CE1} = 5 V				
T_{amb} = 25 °C		I_{C1}/I_{C2}	0,7 to 1,3	
T_{amb} = 150 °C		I_{C1}/I_{C2}	0,7 to 1,3	
Thermal coupling of transistor T1 and Transistor T2*				
T1 : V_{CE} = 5 V				
Maximum current for thermal stability of I_{C1}		I_{E2}	typ.	5 mA
D.C. current gain			min.	110
I_C = 2 mA; V_{CE} = 5 V	BCV61A	h_{FE}	typ.	180
			max.	220
			min.	200
	BCV61B	h_{FE}	typ.	290
			max.	450
			min.	420
	BCV61C	h_{FE}	typ.	520
			max.	800

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (See Fig. 2)

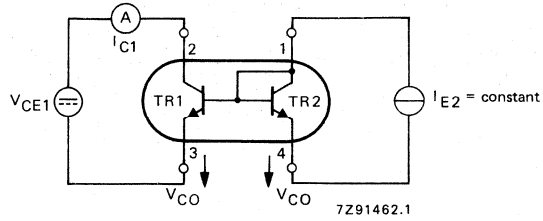


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3} U_T \triangleq 16$ mV.

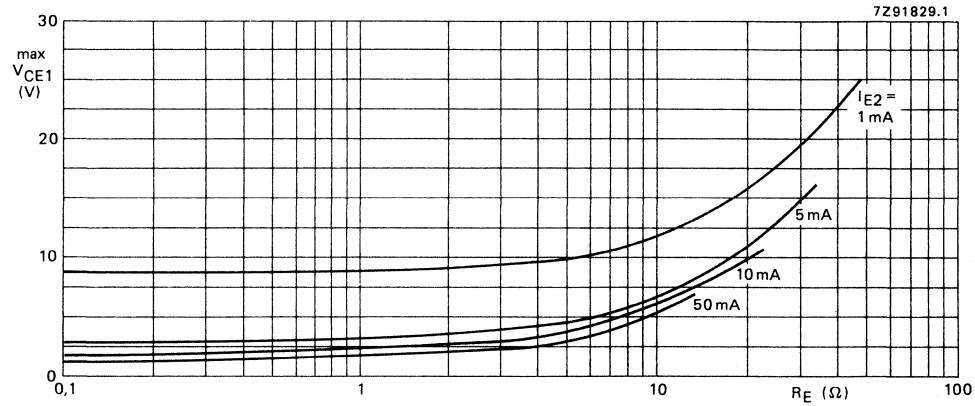


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

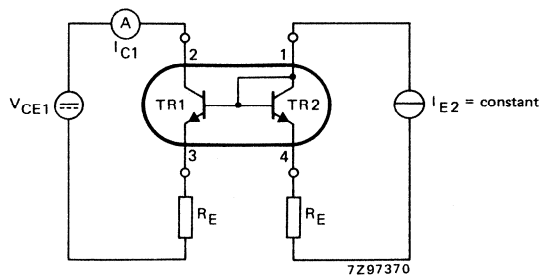


Fig. 4 BCV61 with emitter resistors.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double p-n-p transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in n-p-n configuration is the BCV61.

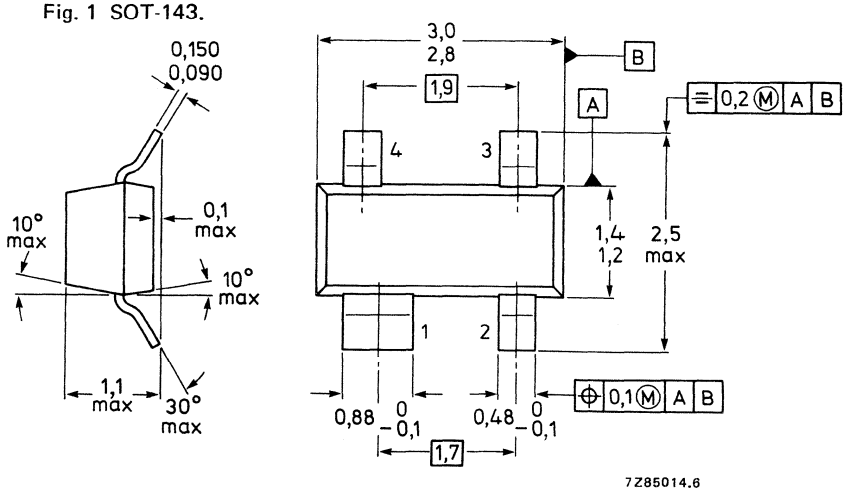
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max	30 V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30 V
Collector current			
d.c.	$-I_C$	max.	100 mA
peak	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

Fig. 1 SOT-143.

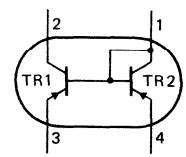
Dimensions in mm



TOP VIEW

Marking code:

BCV62 : C91
BCV62A: C92
BCV62B: C93
BCV62C: C94



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max.	30	V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30	V
Base current (transistor T1) peak value	$-I_{BM1}$	max.	200	mA
Emitter-base voltage	$-V_{EBS}$	max.	6	V
Collector current d.c.	$-I_C$	max.	100	mA
peak	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_{stg}	−65 to +	150	°C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm				
→ from junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current				
$-I_E$ = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	15	nA
$-I_E$ = 0; $-V_{CB}$ = 30 V; T_j = 150 °C		<	5	μA
Base-emitter voltage				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV*
			600 to 750	mV*
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV*
Saturation voltages				
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75	mV
		<	300	mV
	$-V_{BEsat}$	typ.	700	mV**
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250	mV
		<	650	mV
	$-V_{BEsat}$	typ.	850	mV**

* Decreasing 2 mV/°C with increasing temperature.

** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V		f_T	typ.	150	MHz
Collector capacitance at f = 1 MHz					
$I_E = i_e = 0$; $-V_{CB}$ = 10 V		C_c	typ.	4,5	pF
Noise figure at R_S = 2 kΩ					
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V		F	typ.	2	dB
f = 1 kHz; B = 200 Hz			<	10	dB
D.C. current gain					
$-I_C$ = 100 μA; $-V_{CE}$ = 5 V		h_{FE}	>	100	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V		h_{FE}	100 to 800		
Input impedance					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{ie}	typ.	3	kΩ
Reverse voltage transfer ratio					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{re}	typ.	3×10^{-4}	
Small signal current gain					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{fe}	100 to 900		
Output admittance					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{oe}	typ.	50	μS
Transistor T2					
Base-emitter forward voltage					
$-I_E$ = 250 mA		$-V_{BES}$	<	1,5	V
$-I_E$ = 10 μA			>	400	mV
Matching of transistor T1 and transistor T2 at I_{E2} = 0,5 mA and V_{CE1} = 5 V					
T_{amb} = 25 °C		I_{C1}/I_{C2}	0,7 to 1,3		
T_{amb} = 150 °C		I_{C1}/I_{C2}	0,7 to 1,3		
Thermal coupling of transistor T1 and transistor T2*					
T1 : $-V_{CE}$ = 5 V					
Maximum current for thermal stability of $-I_{C1}$		I_{E2}	typ.	5	mA
D.C. current gain			min.	125	
	BCV62A	h_{FE}	typ.	180	
			max.	250	
			min.	220	
	BCV62B	h_{FE}	typ.	290	
			max.	475	
			min.	420	
	BCV62C	h_{FE}	typ.	520	
			max.	800	

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (see Fig. 2)

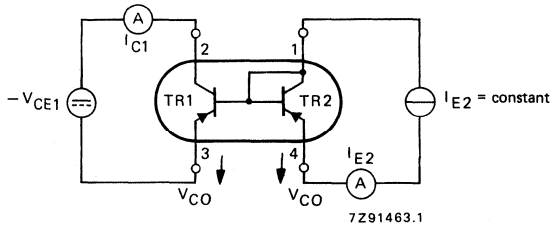


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3} U_T \triangleq 16$ mV.

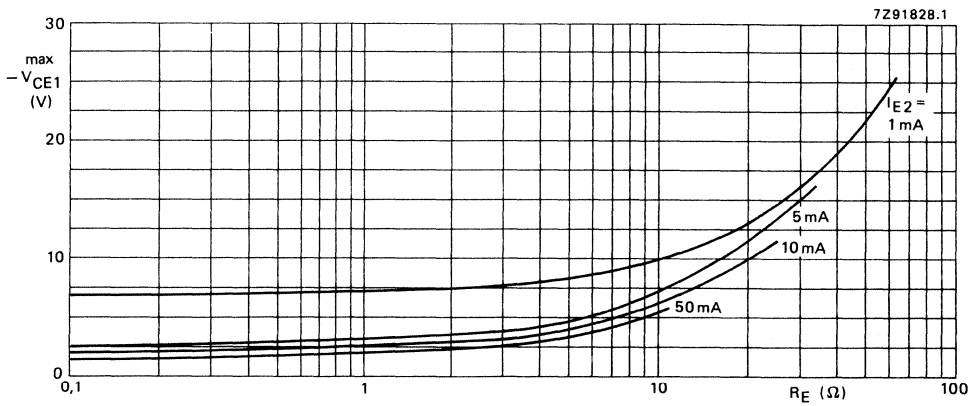


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

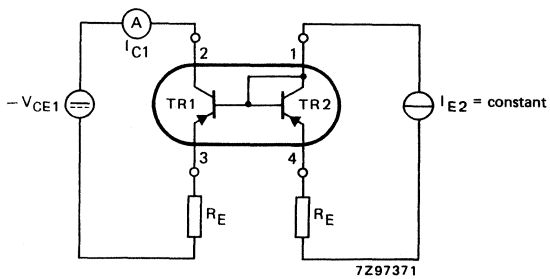


Fig. 4 BCV62 with emitter resistors.

SILICON PLANAR TRANSISTOR

Double N-P-N transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications.
P-N-P complement is the BCV64.

QUICK REFERENCE DATA

	transistor		T1	T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Collector current	I_C	max.	100		mA
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Collector-emitter saturation voltage I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	–	MHz

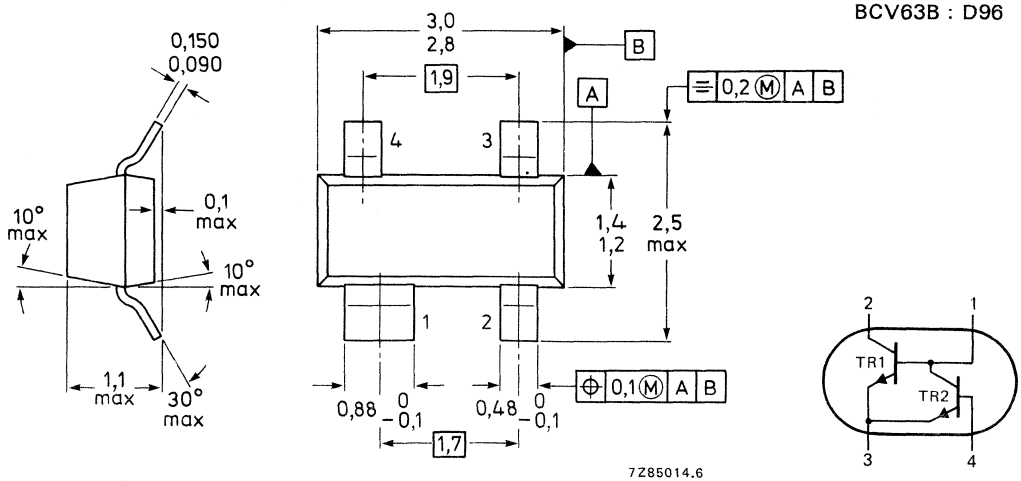
MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm

Marking code

BCV63 : D95
BCV63B : D96



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			transistor T1	transistor T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

			transistor T1	transistor T2	
Collector cut-off current					
I_E = 0; V_{CBO} = 30 V	I_{CBO}	max.	15	15	nA
I_E = 0; V_{CBO} = 30 V; T_j = 150 °C	I_{CBO}	max.	5	5	μA
Saturation voltage**					
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	75	75	mV
	V_{CEsat}	max.	300	300	mV
	V_{BEsat}	typ.	700	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250	250	mV
	V_{CEsat}	max.	650	–	mV
	V_{BEsat}	typ.	850	–	mV
Base-emitter voltage ▲					
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	min.	600	–	mV
	V_{BE}	typ.	650	–	mV
	V_{BE}	max.	750	–	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820	–	mV
I_C = 2 mA; V_{CE} = 700 mV	V_{BE}	typ.		700	mV
Collector capacitance at f = 1 MHz					
$I_E = i_e$ = 0; V_{CE} = 10 V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz I_C = 2 mA; T1 : V_{CE} = 5 V T2 : V_{CE} = 700 mV			h_{fe}	100 to 900
Transistor 1				
D.C. current gain		BCV	63	B
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	min.	110	200
		typ.		290
		max.	800	450
Transistor 2				
D.C. current gain I_C = 2 mA; V_{CE} = 700 mV				Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

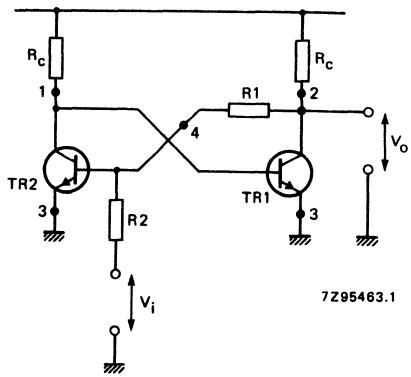


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTOR

Double P-N-P transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications.
N-P-N complement is the BCV63.

QUICK REFERENCE DATA

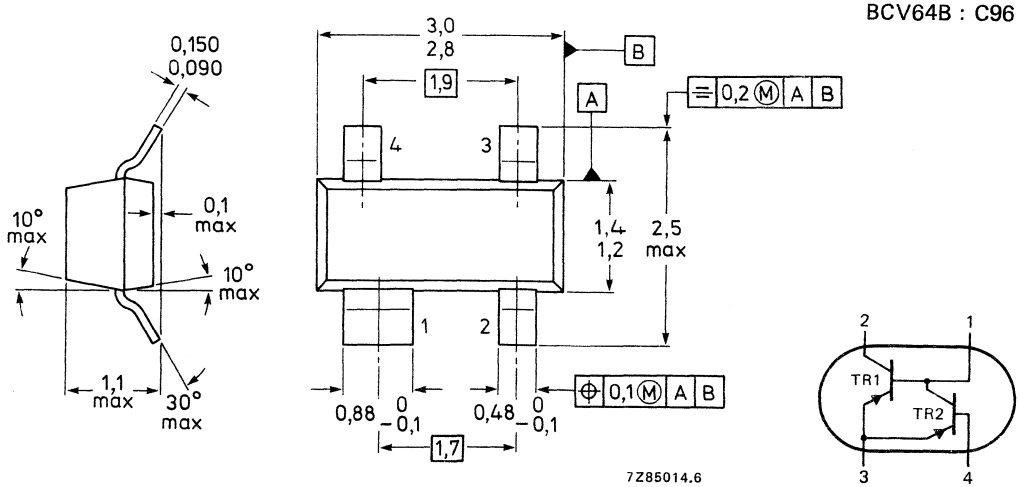
	transistor		T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Collector current	$-I_C$	max.	100		mA
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Collector-emitter saturation voltage $-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	200	–	MHz

MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm

Marking code ←
BCV64 : C95
BCV64B : C96



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

	transistor		T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	6	6	V
Collector current (d.c.)	$-I_C$	max.	6		mA
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

	transistor		T1	T2	
Collector cut-off current					
$-I_E$ = 0; $-V_{CBO}$ = 30 V	$-I_{CBO}$	max.	15	15	nA
$-I_E$ = 0; $-V_{CBO}$ = 30 V; T_j = 150 °C	$-I_{CBO}$	max.	5	5	μA
Saturation voltage**					
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75	75	mV
	$-V_{CEsat}$	max.	300	300	mV
	$-V_{BEsat}$	typ.	700	700	mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250	250	mV
	$-V_{CEsat}$	max.	650	–	mV
	$-V_{BEsat}$	typ.	850	–	mV
Base-emitter voltage ▲					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	–	mV
			600/750	–	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	max.	820	–	mV
$-I_C$ = 2 mA; $-V_{CE}$ = 700 mV	$-V_{BE}$	typ.		700	mV
Collector capacitance at f = 1 MHz					
$-I_E = i_e$ = 0; $-V_{CE}$ = 10 V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz
$-I_C$ = 2 mA; T1 : $-V_{CE}$ = 5 V
T2 : $-V_{CE}$ = 700 mV — h_{fe} — 100 to 900

Transistor 1

D.C. current gain		BCV	64	B
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V		min.	110	220
	h_{FE}	typ.		290
		max.	800	475

Transistor 2

D.C. current gain
$-I_C$ = 2 mA; $-V_{CE}$ = 700 mV

Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

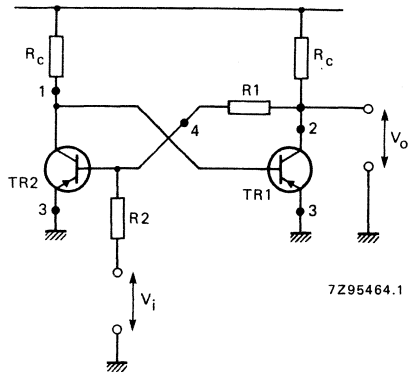


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTORS

A matched pair of P-N-P and N-P-N crystal, based on the BC557 and BC547, in a microminiature SOT-143 envelope.

Complementary crystals give advantages in P.C.B. layout using S.M.D. technology.

QUICK REFERENCE DATA

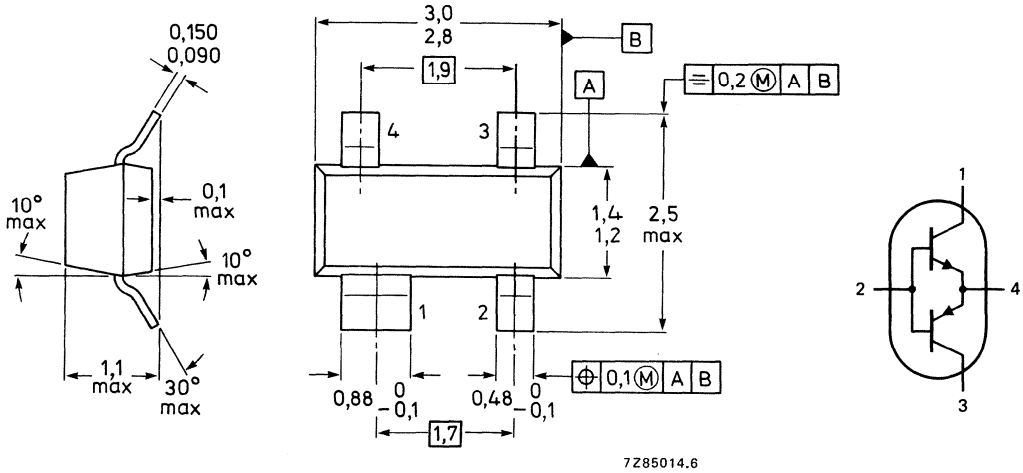
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Collector current (DC)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm

Marking code ←
BCV65: 97
BCV65B: 98



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Per transistor:

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Collector current (DC)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation (per device) up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_s		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	430 K/W

CHARACTERISTICS

Per transistor:

T_j = 25 °C unless otherwise stated

Collector cut-off current			
I_E = 0; V_{CB} = 30 V	I_{CBO}	max.	15 nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	max.	5 μA
Base-emitter voltage**			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	650 mV
			580 to 750 mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820 mV
Saturation voltage▲			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90 mV
		max.	300 mV
	V_{BEsat}	typ.	700 mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250 mV
		max.	650 mV
	V_{BEsat}	typ.	900 mV

D.C. current gain I_C = 2 mA; V_{CE} = 5 V			BCV65	BCV65B
	h_{FE}	min.	75	200
	h_{FE}	typ.	–	290
	h_{FE}	max.	800	475

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

▲ V_{BEsat} decreases by approx. 1,7 mV/K with increasing temperature.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

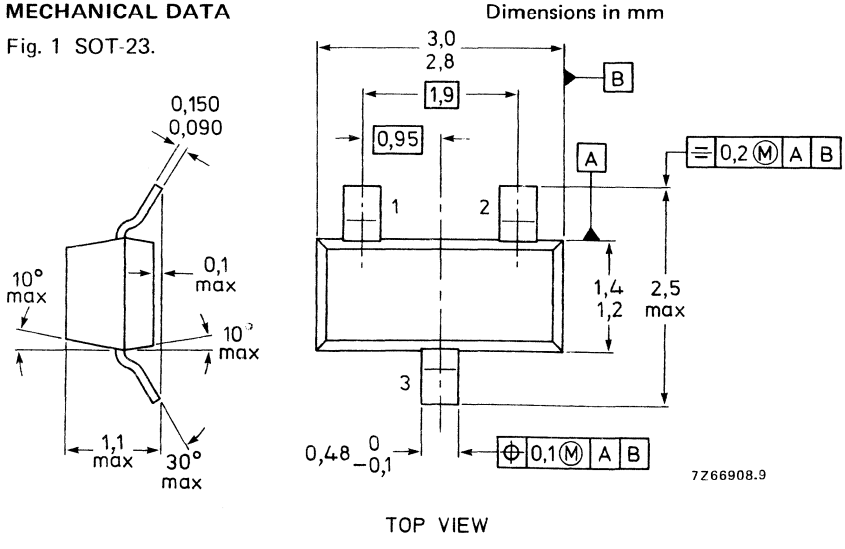
QUICK REFERENCE DATA

			BCV71	BCV72	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	
		<	220	450	
Collector-base voltage (open emitter)	V_{CBO}	max.	80		V
Collector-emitter voltage (open base)	V_{CEO}	max.	60		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

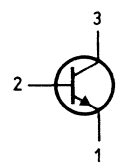
Dimensions in mm



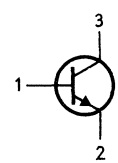
TOP VIEW

Marking code

BCV71 = K7
BCV72 = K8



BCV71R = K71
BCV72R = K81



R-types are available on request

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	80	V
Collector-emitter voltage (open base)				
I_C = 2 mA	V_{CEO}	max.	60	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10	μA
Base emitter voltage				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to	700	mV
Saturation voltages				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCV71	BCV72	
D.C. current gain					
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	90	150	
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz					
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5		pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ					
I_C = 200 μA; V_{CE} = 5 V					
f = 1 kHz; B = 200 Hz	F	<	10		dB

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

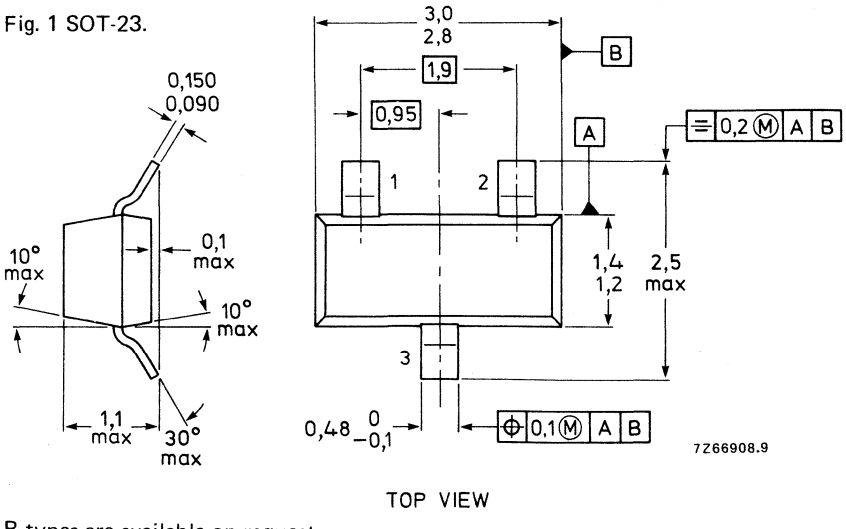
QUICK REFERENCE DATA

			BCW29	BCW30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

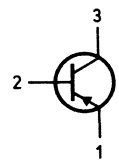


TOP VIEW

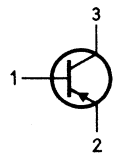
R-types are available on request

Marking code

BCW29 = C1
BCW30 = C2



BCW29R = C4
BCW30R = C5



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to +150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 32 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 32 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

		BCW29	BCW30	
D.C. current gain				
$-I_C = 10\ \mu A;\ -V_{CE} = 5\ V$	h_{FE}	typ. 90	150	
$-I_C = 2\ mA;\ -V_{CE} = 5\ V$	h_{FE}	> 120	215	
		< 260	500	
Collector-capacitance at f = 1 MHz $I_E = I_e = 0;\ -V_{CB} = 10\ V$	C_c	typ.	4,5	pF
Transition frequency at f = 35 MHz $-I_C = 10\ mA;\ -V_{CE} = 5\ V$	f_T	typ.	150	MHz
Noise figure at $R_S = 2\ k\Omega$ $-I_C = 200\ \mu A;\ -V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	<	10	dB

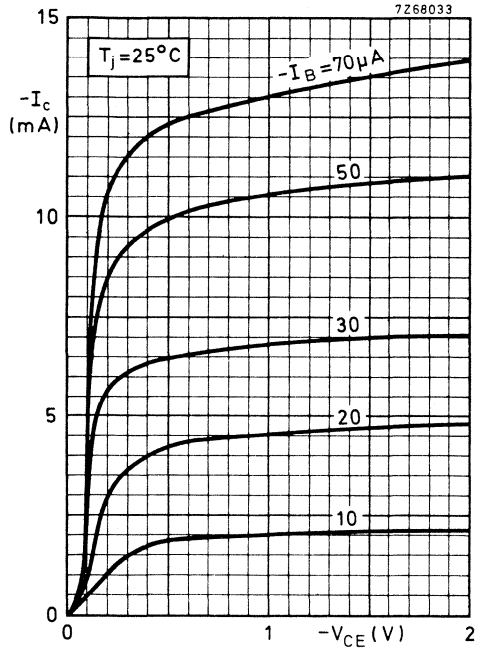


Fig. 2

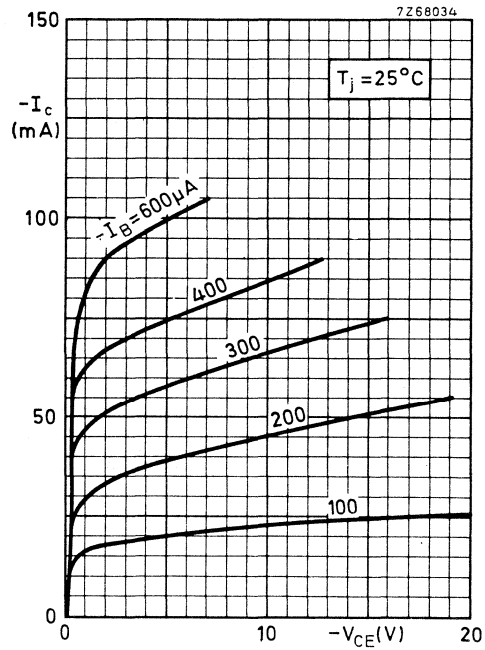


Fig. 3

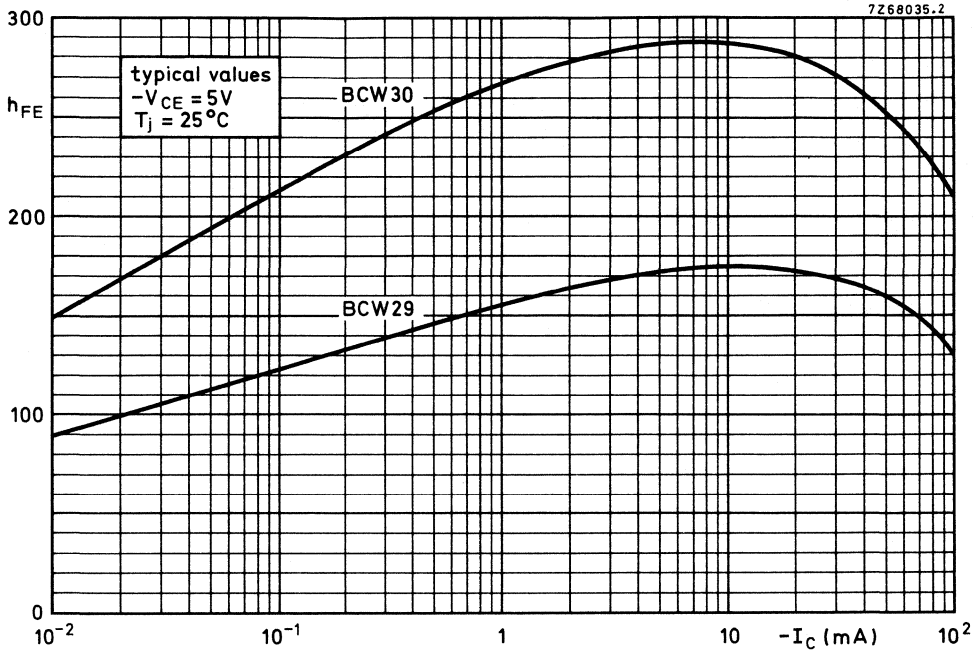

7Z68035.2
300
200
100
0
h_{FE}
typical values
$-V_{CE} = 5V$
$T_j = 25°C$
BCW30
BCW29
10^{-2}
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 4

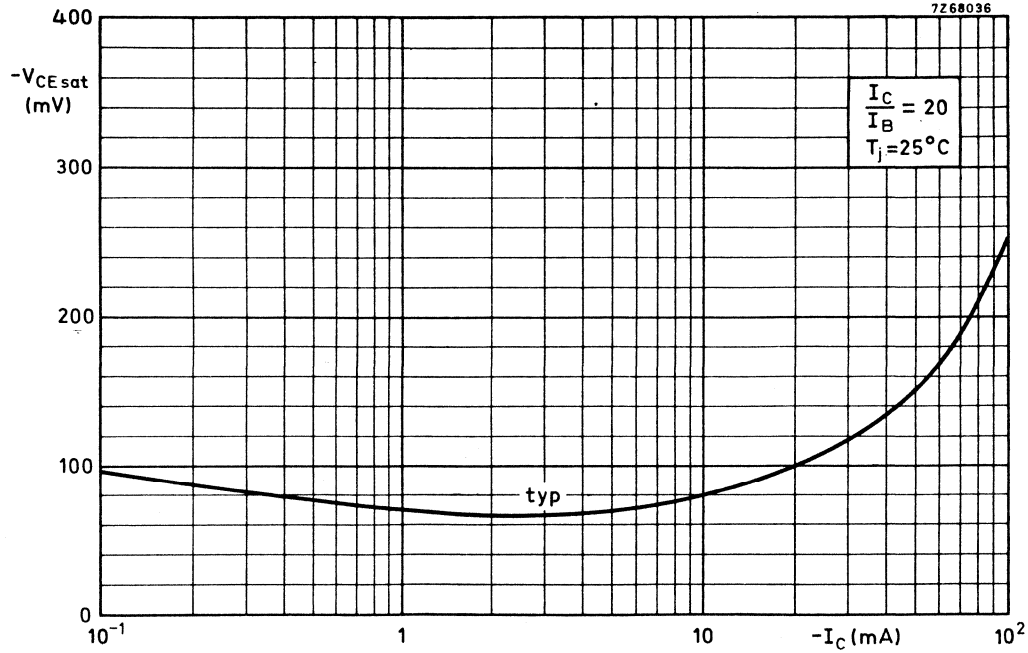

7Z68036
400
300
200
100
0
$-V_{CE\,sat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5

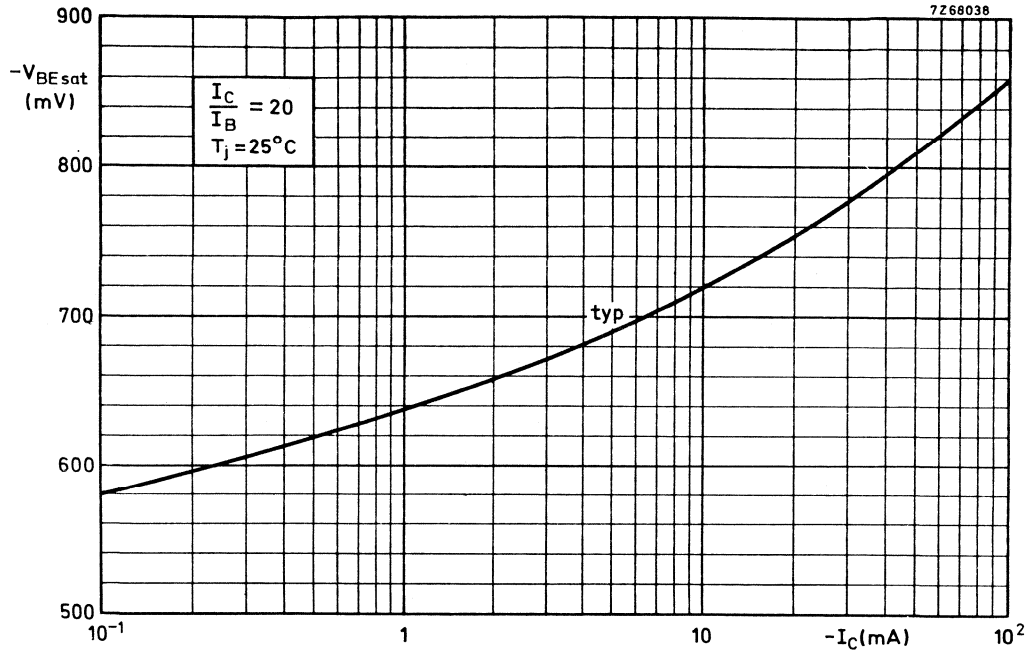

7Z68038
900
800
700
600
500
$-V_{BEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

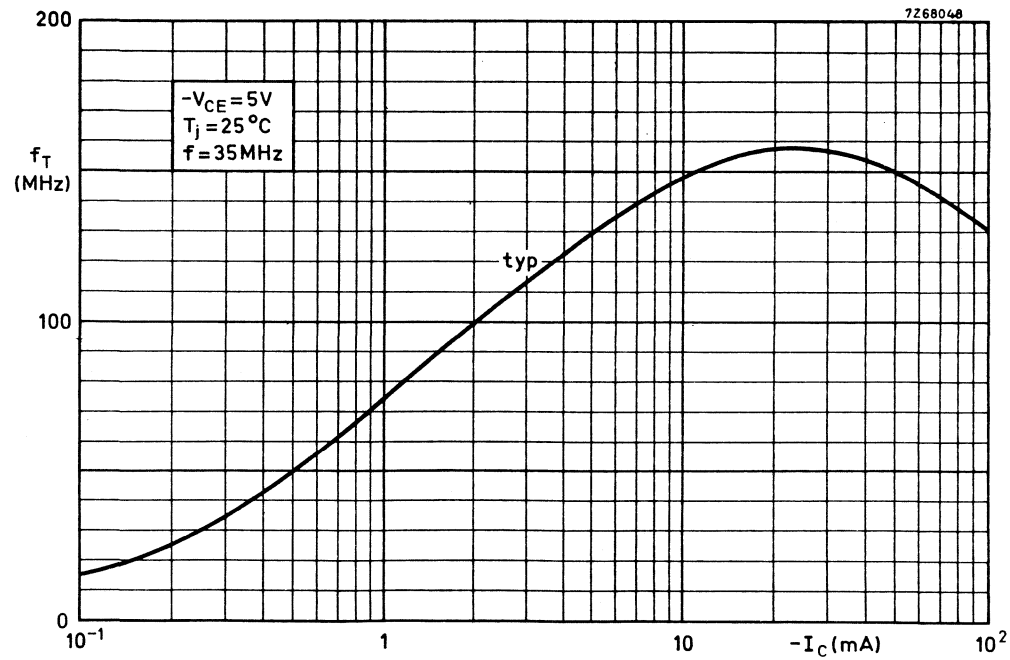

7Z68048
200
100
0
f_T (MHz)
$-V_{CE} = 5V$
$T_j = 25°C$
$f = 35MHz$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

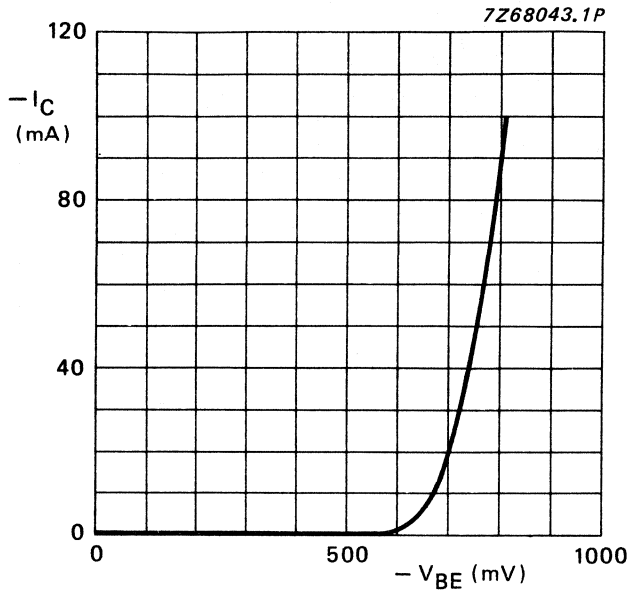


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

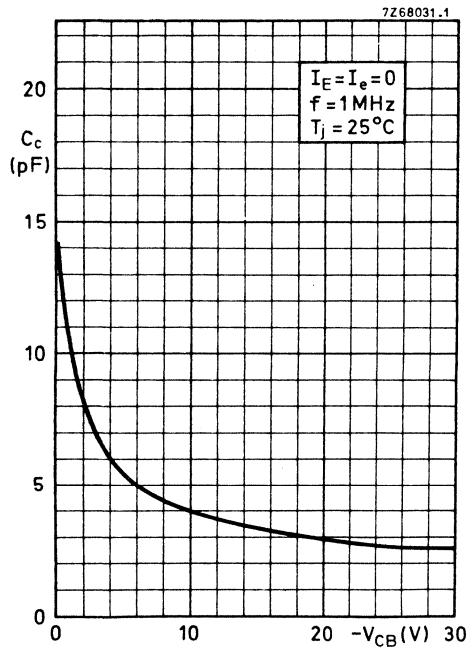


Fig. 9

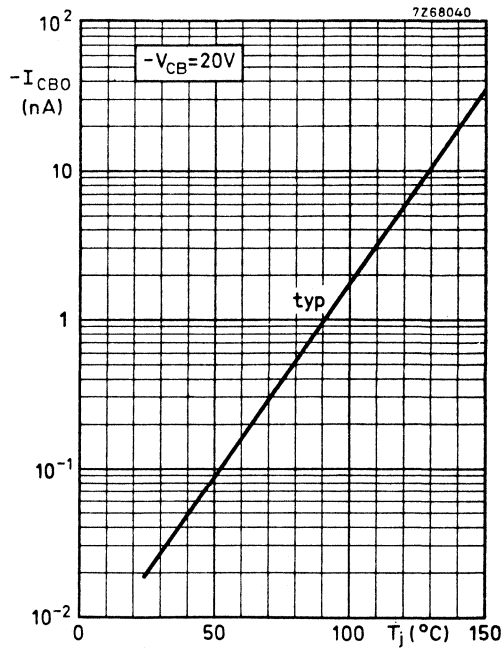


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level general purpose applications in thick and thin-film circuits.

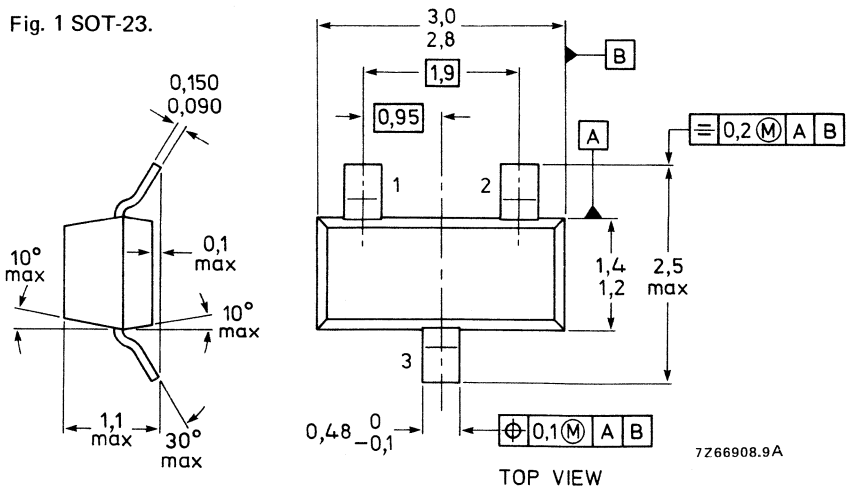
QUICK REFERENCE DATA

			BCW31	BCW32	BCW33	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector-base voltage (open emitter)	V_{CBO}	max.		32		V
Collector-emitter voltage (open base)	V_{CEO}	max.		32		V
Collector current (peak value)	I_{CM}	max.		200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		300		mW ←
Junction temperature	T_j	max.		150		°C ←
Transition frequency at f = 35 MHz I_C = 2 mA; V_{CE} = 5 V	f_T	typ.		300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

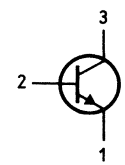


R-types are available on request.

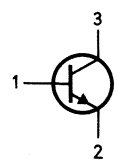
See also *Soldering recommendations.*

Marking code

BCW31 = D1
BCW32 = D2
BCW33 = D3



BCW31R = D4
BCW32R = D5
BCW33R = D6 ←



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base)			
I_C = 2 mA	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to +150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 32 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 32 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base-emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}		550 to 700 mV
Saturation voltages			
I_C 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCW31	BCW32	BCW33	
D.C. current gain						
I_C = 10 μA, V_{CE} = 5 V	h_{FE}	typ.	90	150	270	
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector capacitance at f = 1 MHz						
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c		typ.		2,5	pF
Transition frequency at f = 35 MHz						
I_C = 10 mA; V_{CE} = 5 V	f_T		typ.		300	MHz
Noise figure at R_S = 2 kΩ						
I_C = 200 μA; V_{CE} = 5 V						
f = 1 kHz; B = 200 Hz	F		<		10	dB

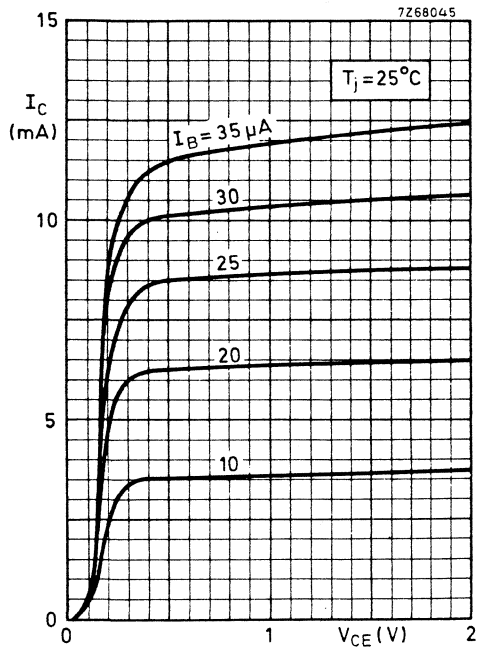


Fig. 2

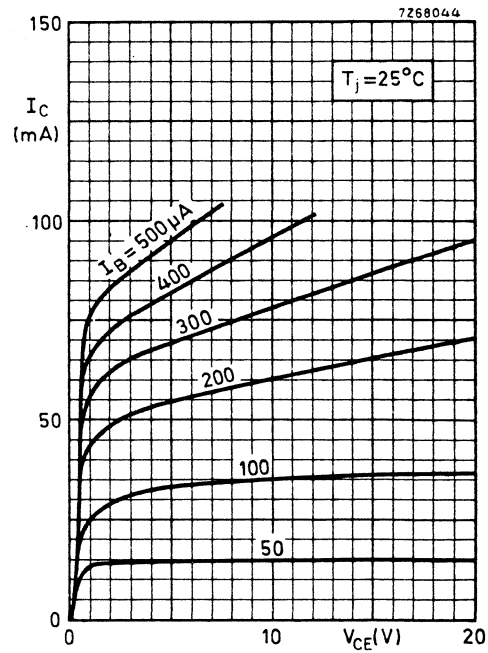


Fig. 3

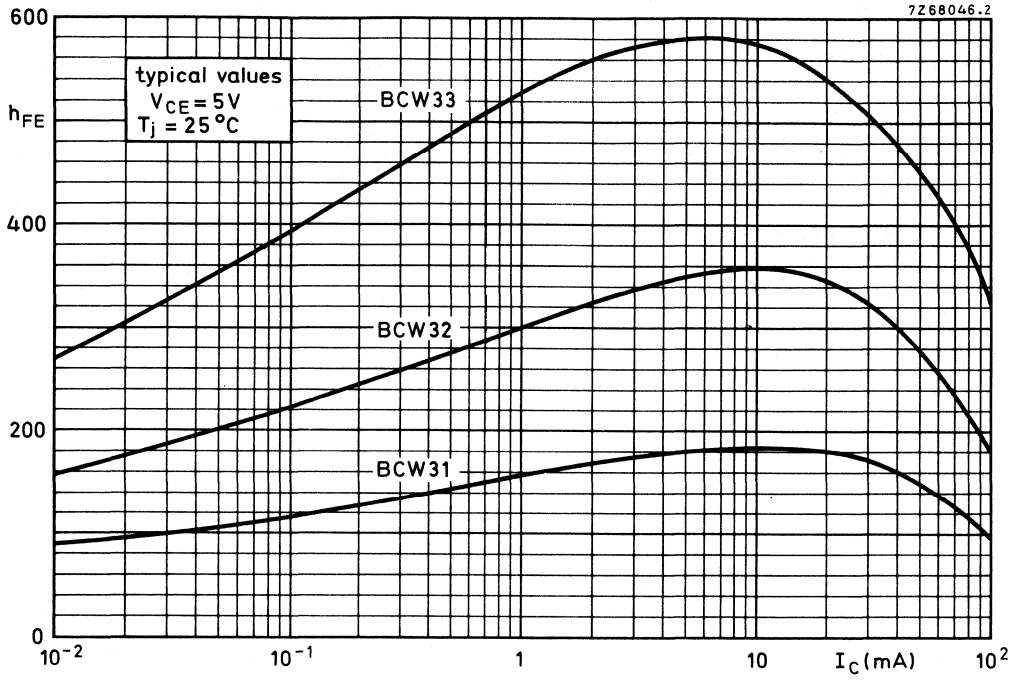

7Z68046.2
600
400
200
0
h_{FE}
typical values
V_{CE} = 5V
T_j = 25 °C
BCW33
BCW32
BCW31
10^{-2}
10^{-1}
1
10
I_C(mA)
10^2

Fig. 4

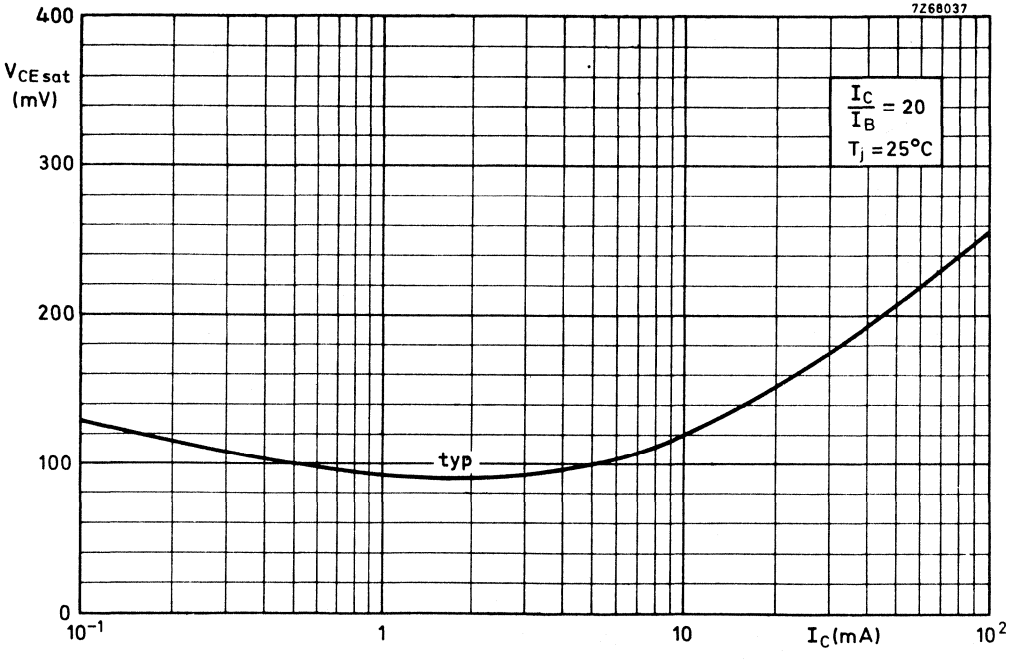

7Z68037
400
300
200
100
0
V_{CEsat} (mV)
$\frac{I_C}{I_B}$ = 20
T_j = 25°C
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 5

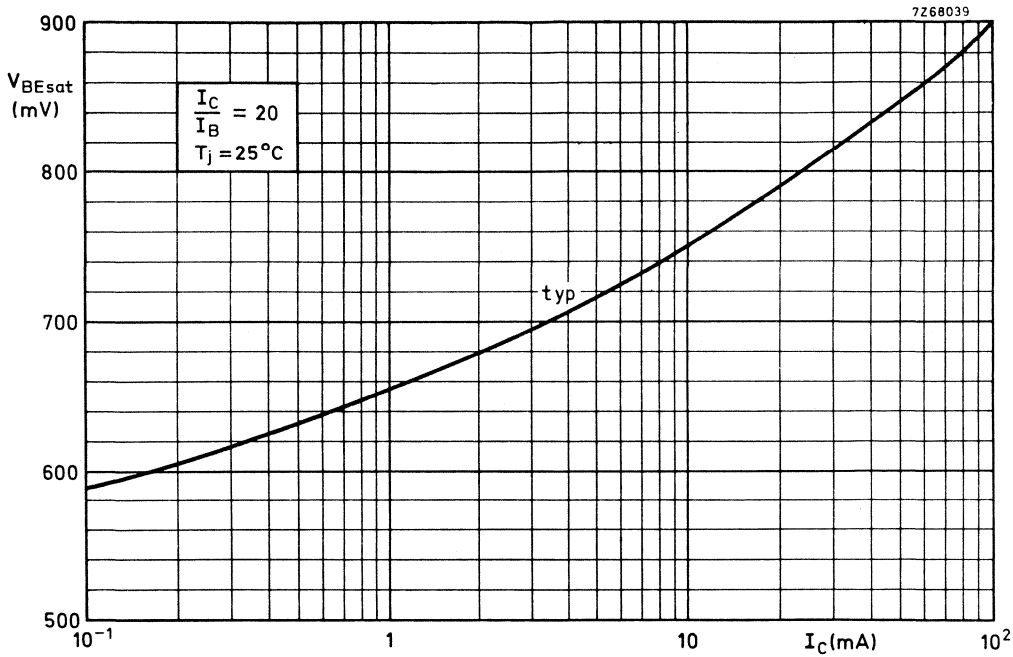

7Z68039
900
800
700
600
500
V_{BEsat} (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

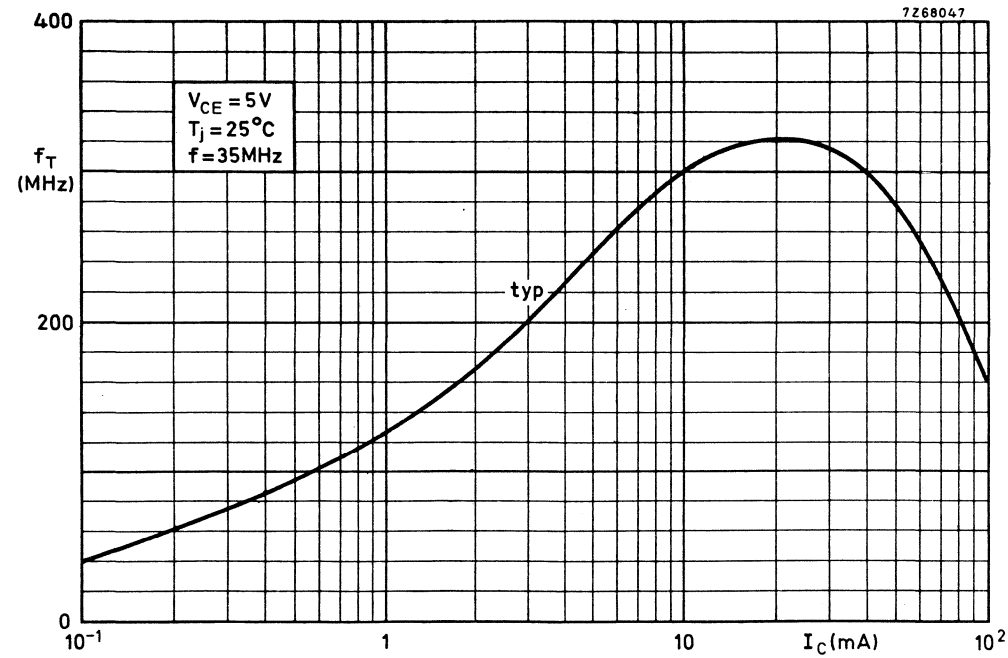

7Z68047
400
200
0
f_T (MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

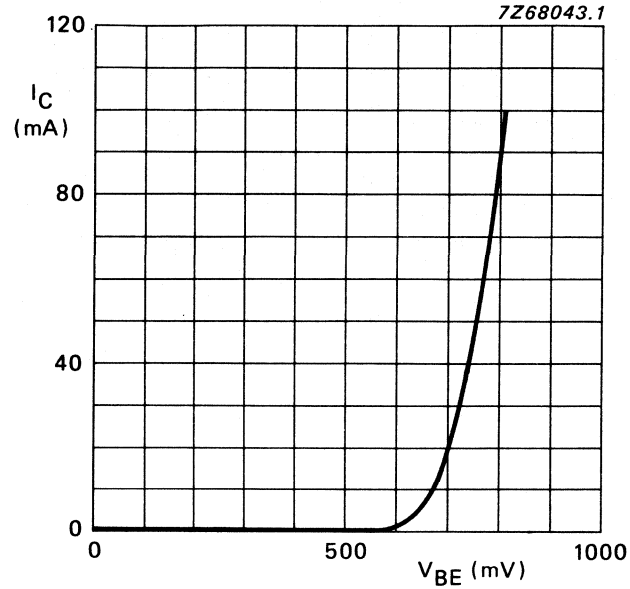


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

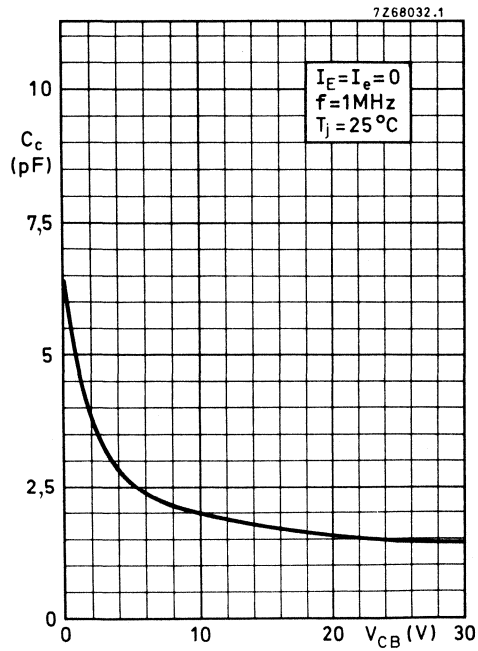


Fig. 9

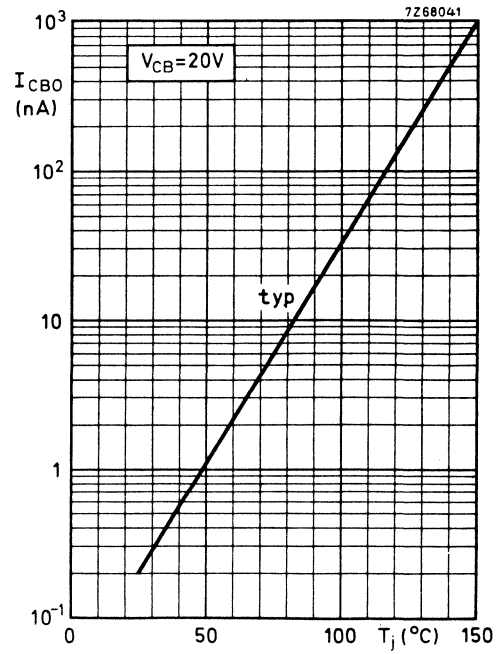


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

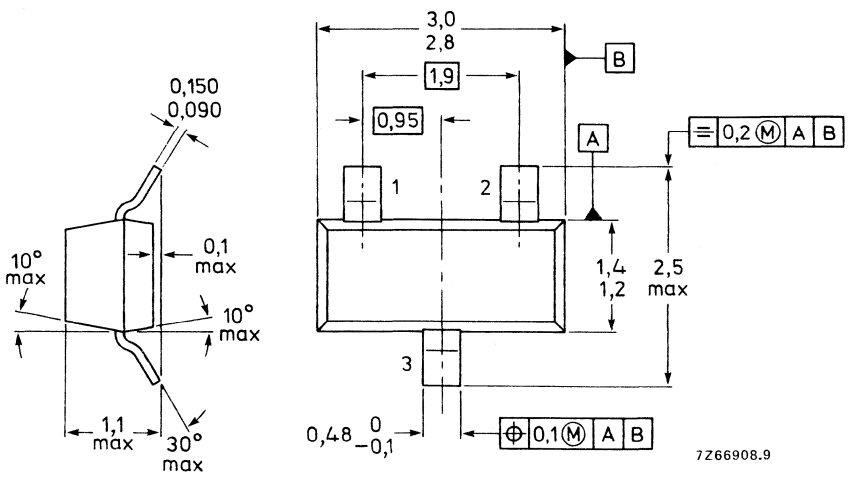
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz V_{CE} = 5 V; I_C = 10 mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz V_{CE} = 5 V; I_C = 200 μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Fig. 1 SOT-23.

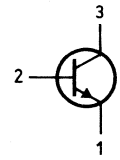
Dimensions in mm



TOP VIEW

Marking code

BCW60A = AA
BCW60B = AB
BCW60C = AC
BCW60D = AD



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	32 V
Collector-emitter voltage (open base)	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	200 mA
Base current	I_B	max.	50 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		− 65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current			
V_{BE} = 0; V_{CE} = 32 V	I_{CES}	<	20 nA
V_{BE} = 0; V_{CE} = 32 V; T_{amb} = 150 °C	I_{CES}	<	20 μA
Emitter-base cut-off current			
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20 nA
Saturation voltages			
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}		0,05 to 0,35 V
	V_{BEsat}		0,6 to 0,85 V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}		0,1 to 0,55 V
	V_{BEsat}		0,7 to 1,05 V
Transition frequency at f = 100 MHz ▲			
I_C = 10 mA; V_{CE} = 5 V	f_T	>	125 MHz
		typ.	250 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	8 pF
Noise figure at R_S = 2 kΩ			
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2 dB
		<	6 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			A	B	C	D	
D.C. current gain							
V_{CE} = 5 V; I_C = 10 μA	h_{FE}	typ.	78	145	220	300	
		>	–	20	40	100	
		>	120	180	250	380	
V_{CE} = 5 V; I_C = 2 mA	h_{FE}	typ.	170	250	350	500	
		<	220	310	460	630	
V_{CE} = 1 V; I_C = 50 mA	h_{FE}	>	50	70	90	100	
Input impedance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μs
Base-emitter voltage							
V_{CE} = 5 V; I_C = 2 mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
V_{CE} = 5 V; I_C = 10 μA	V_{BE}	typ.	0,52				V
V_{CE} = 1 V; I_C = 50 mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; $I_{Bon} = -I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85 ns
		<	150 ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480 ns
		<	800 ns

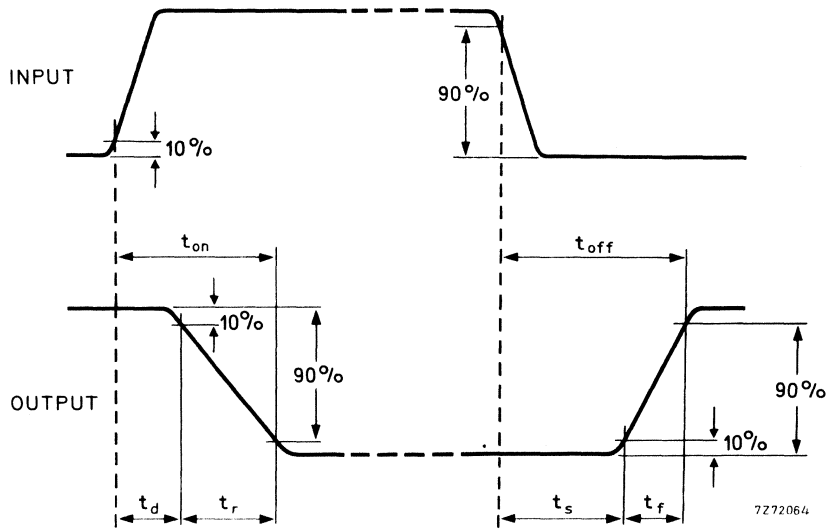


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

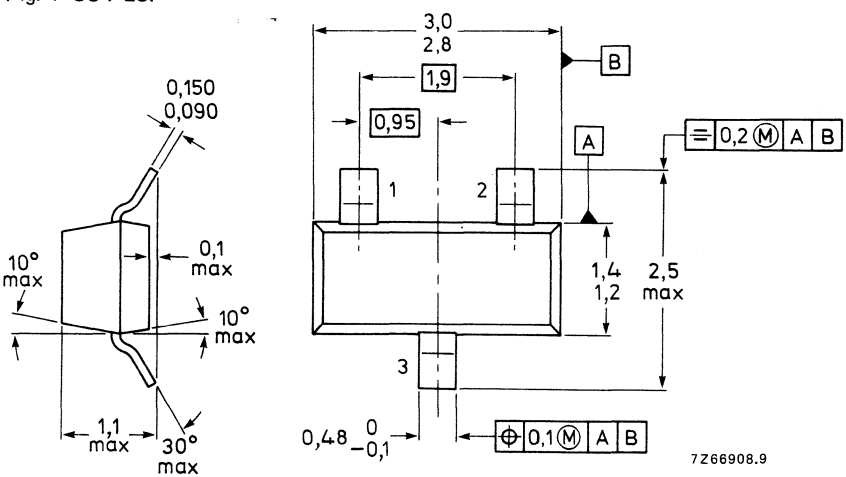
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz $-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180	MHz
Noise figure at f = 1 kHz $-V_{CE}$ = 5 V; $-I_C$ = 200 μA	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

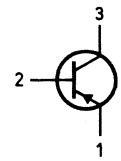
Fig. 1 SOT-23.



TOP VIEW

Marking code

BCW61A = BA
BCW61B = BB
BCW61C = BC
BCW61D = BD



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Base current	$-I_B$	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient *	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{EB} = 0; $-V_{CE}$ = 32 V	$-I_{CES}$	<	20	nA
V_{EB} = 0; $-V_{CE}$ = 32 V; T_{amb} = 150 °C	$-I_{CES}$	<	20	μA
Emitter-base cut-off current				
I_C = 0; $-V_{EB}$ = 4 V	$-I_{EBO}$	<	20	nA
Saturation voltages				
$-I_C$ = 10 mA; $-I_B$ = 0,25 mA	$-V_{CEsat}$	0,06 to 0,25		V
	$-V_{BEsat}$	0,6 to 0,85		V
$-I_C$ = 50 mA; $-I_B$ = 1,25 mA	$-V_{CEsat}$	0,12 to 0,55		V
	$-V_{BEsat}$	0,68 to 1,05		V
Transition frequency at f = 100 MHz ▲				
$-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180	MHz
Collector capacitance at f = 1 MHz				
$-V_{CB}$ = 10 V; $I_E = I_e$ = 0	C_c	typ.	4,5	pF
Emitter capacitance at f = 1 MHz				
$-V_{EB}$ = 0,5 V; $I_C = I_c$ = 0	C_e	typ.	11	pF
Noise figure at R_S = 2 kΩ				
$-V_{CE}$ = 5 V; $-I_C$ = 200 μA; B = 200 Hz	F	typ.	2	dB
		<	6	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			A	B	C	D	
D.C. current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	h_{FE}	typ.	140	200	270	340	
		>	–	30	40	100	
		>	120	180	250	380	
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	h_{FE}	typ.	170	250	350	500	
		<	220	310	460	630	
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	V_{BE}		0,6 to 0,75				V
		typ.	0,65				V
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	V_{BE}	typ.	0,55				V
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	V_{BE}	typ.	0,72				V

Switching times

$-I_{Con}$ = 10 mA; $-I_{Bon} = I_{Boff}$ = 1 mA
$-V_{CC}$ = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85 ns
		<	150 ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480 ns
		<	800 ns

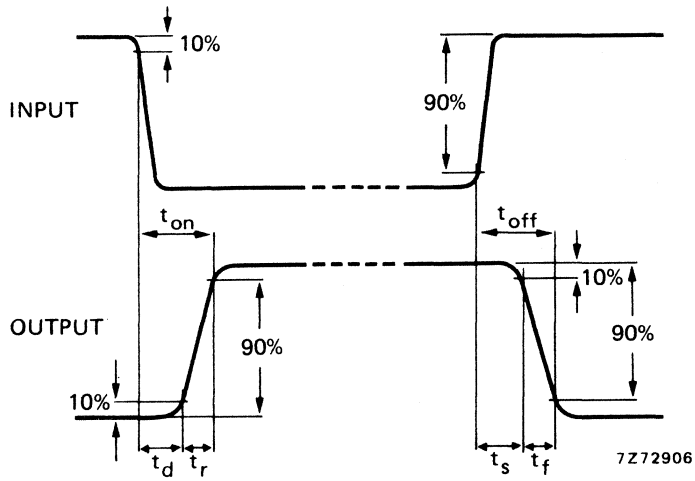


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

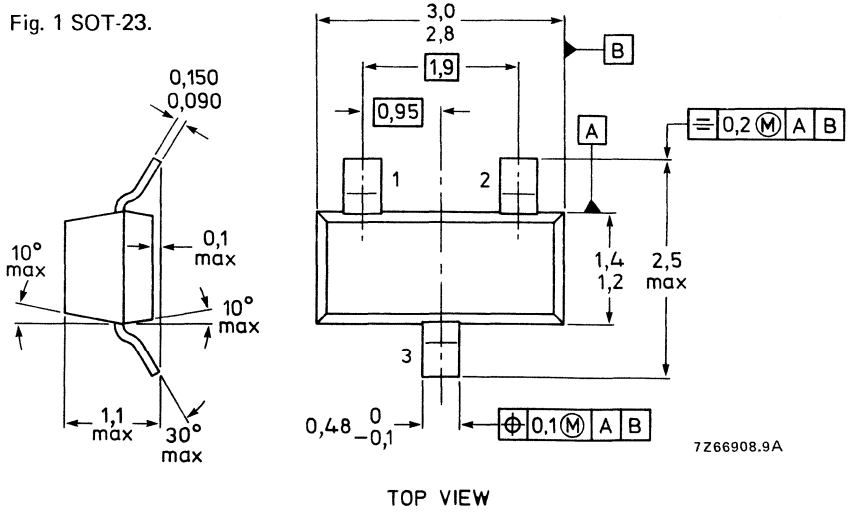
QUICK REFERENCE DATA

			BCW69	BCW70	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

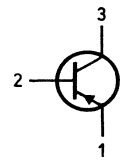


TOP VIEW

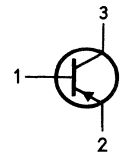
R-types are available on request.

Marking code

BCW69 = H1
BCW70 = H2



BCW69R = H4
BCW70R = H5



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

			BCW69	BCW70
D.C. current gain				
$-I_C$ = 10 μA; $-V_{CE}$ = 5 V	h_{FE}	typ.	90	150
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215
		<	260	500
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ				
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V				
f = 1 kHz; B = 200 Hz	F	<	10	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

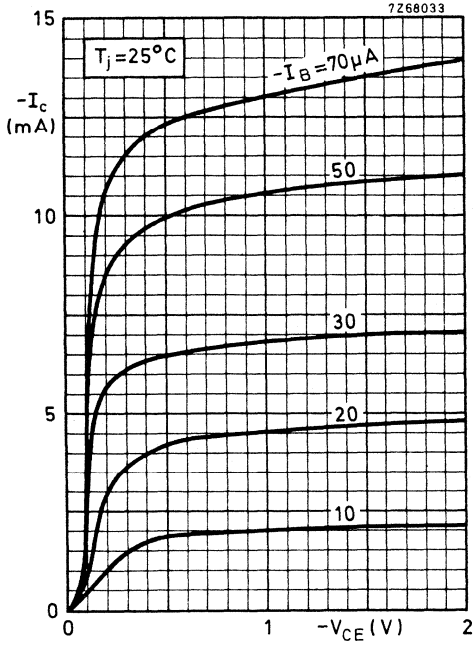


Fig. 2.

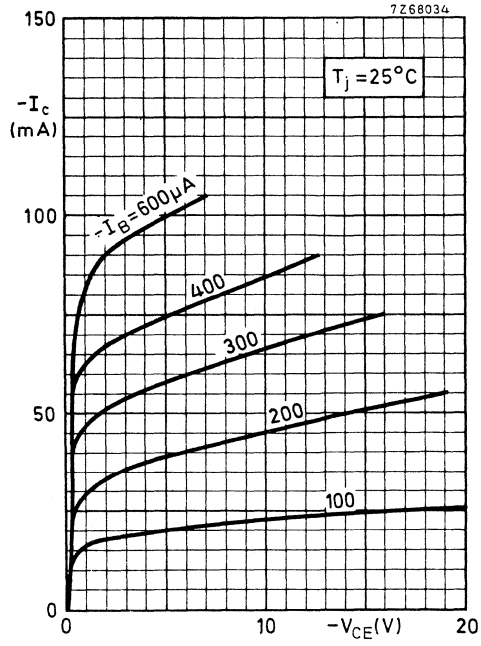


Fig. 3.

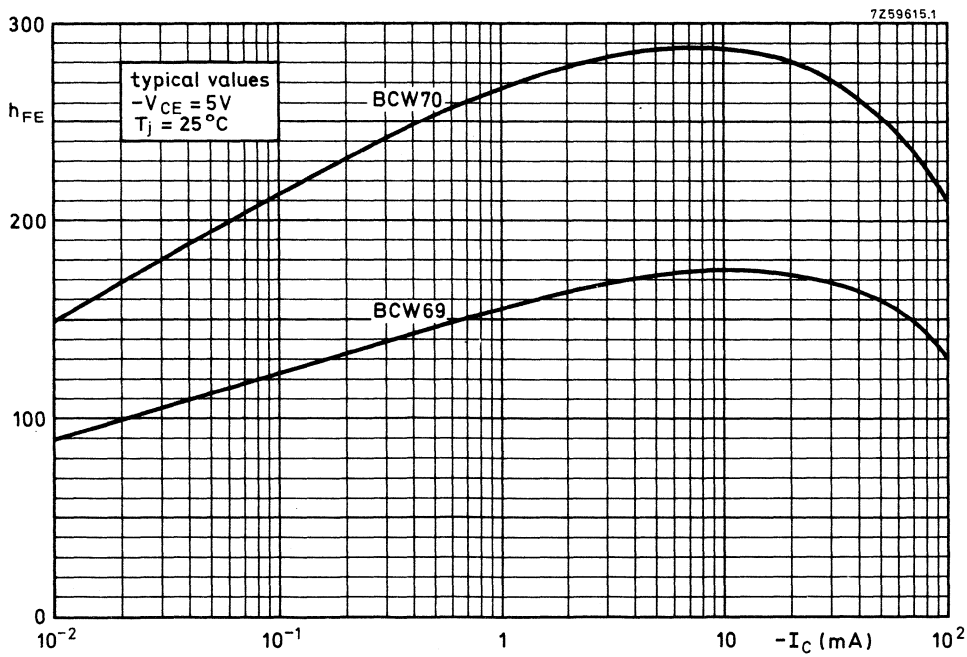


Fig. 4 D.C. current gain.

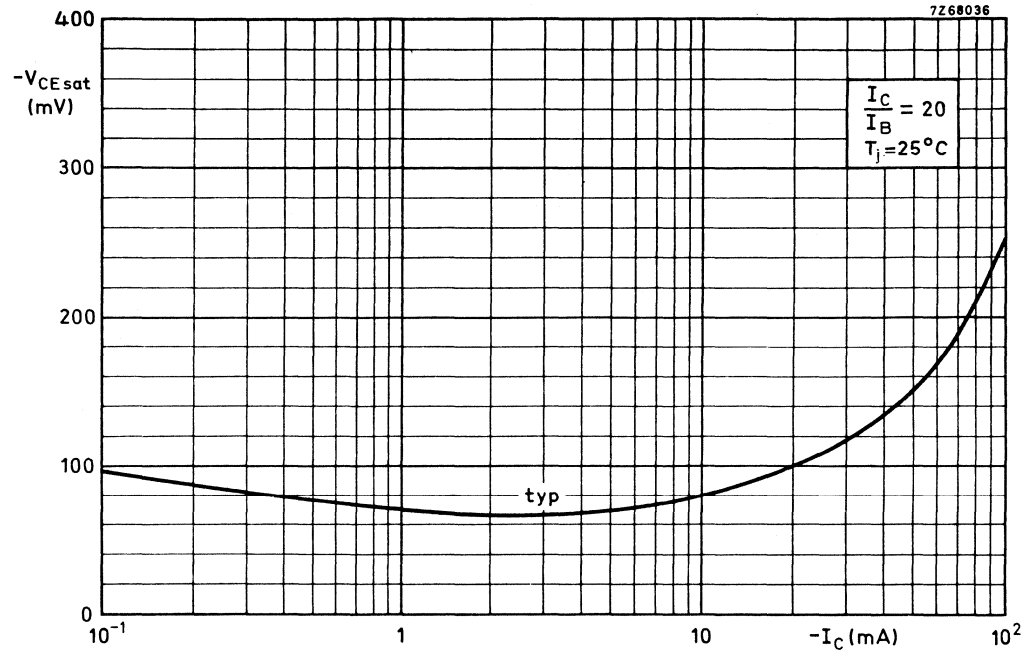

7Z68036
400
300
200
100
0
$-V_{CE\,sat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5.

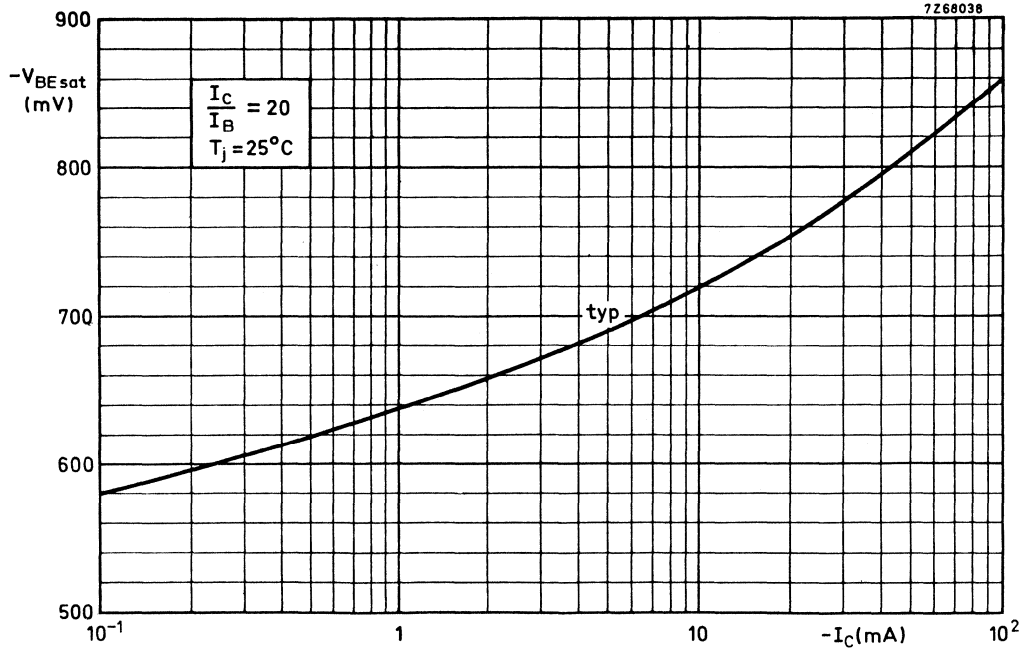

7Z68038
900
800
700
600
500
$-V_{BE\,sat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 6.

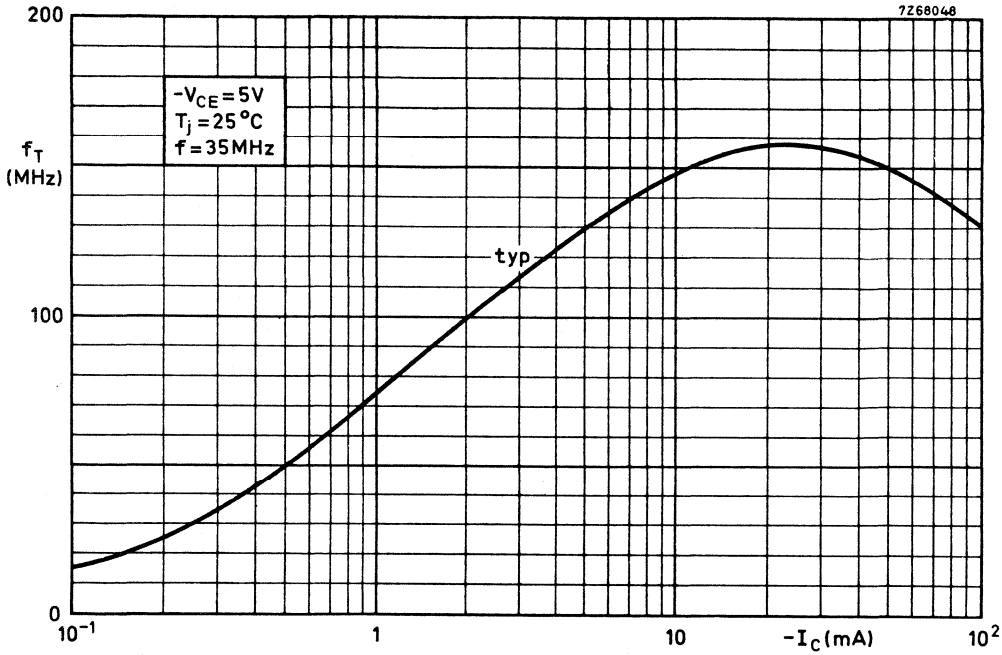


Fig. 7.

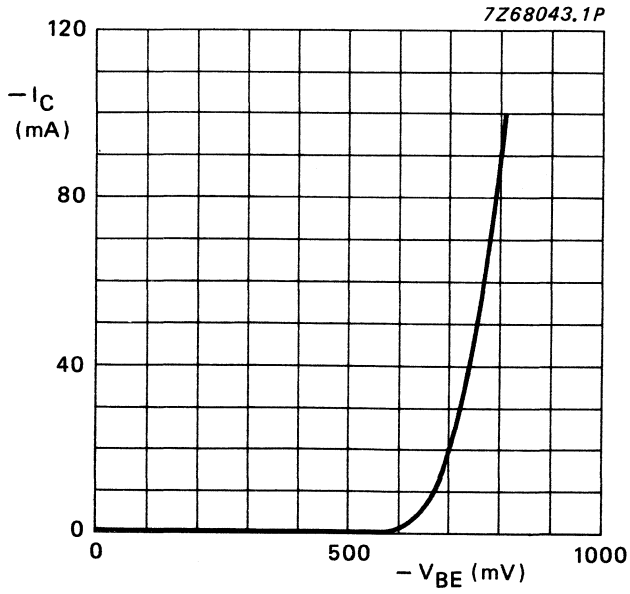


Fig. 8.; $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

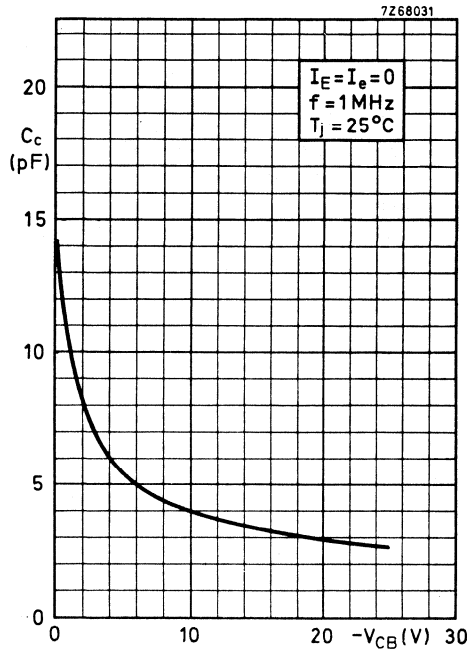

7Z68031
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c (pF)
20
15
10
5
0
0
10
20
$-V_{CB}$ (V)
30

Fig. 9.

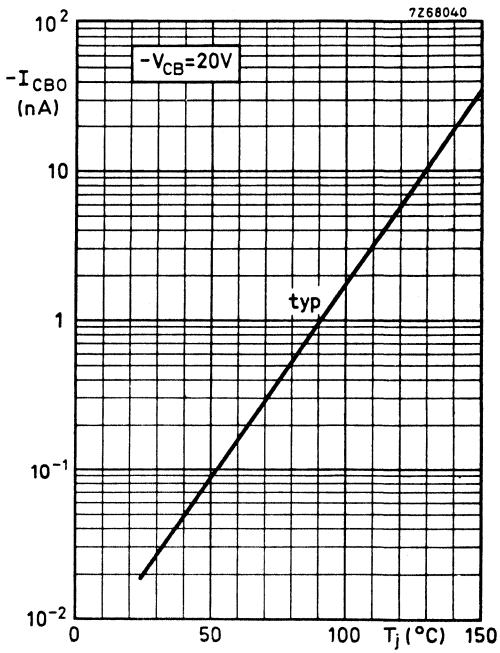

7Z68040
$-V_{CB}$=20V
$-I_{CBO}$ (nA)
10^2
10
1
10^{-1}
10^{-2}
typ
0
50
100
T_j (°C)
150

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

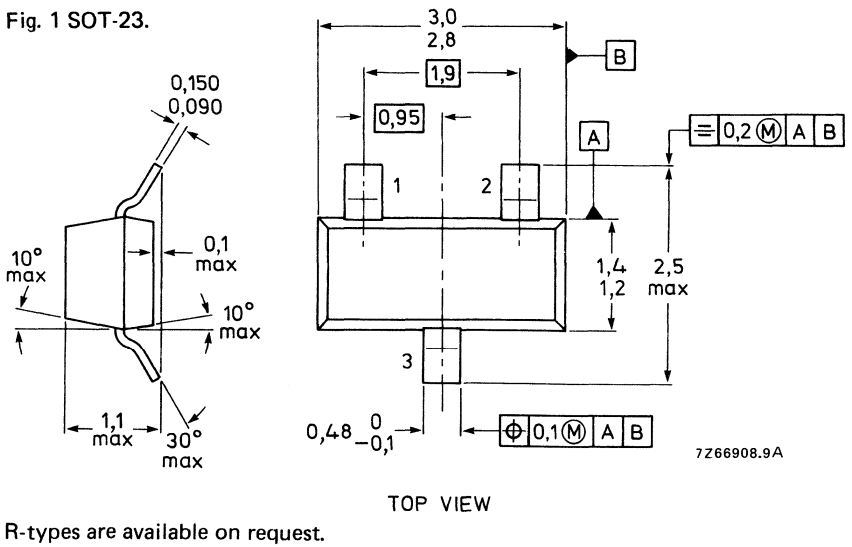
QUICK REFERENCE DATA

			BCW71	BCW72	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	
		<	220	450	
Collector-base voltage (open emitter)	V_{CBO}	max.	50		V
Collector-emitter voltage (open base)	V_{CEO}	max.	45		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

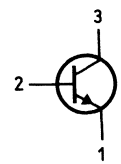


TOP VIEW

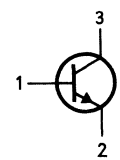
R-types are available on request.

Marking code

BCW71 = K1
BCW72 = K2



BCW71R = K4
BCW72R = K5



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50 V
Collector-emitter voltage (open base)			
I_C = 2 mA	V_{CEO}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to +150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}		550 to 700 mV
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCW71	BCW72	
D.C. current gain					
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	90	150	
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.		2,5	pF
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F	<		10	dB

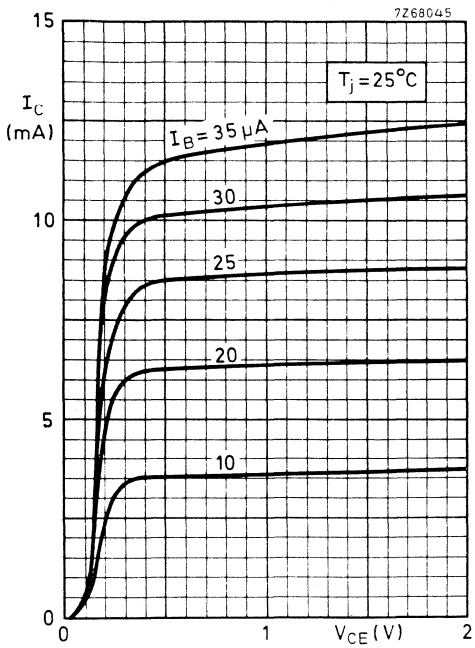


Fig. 2

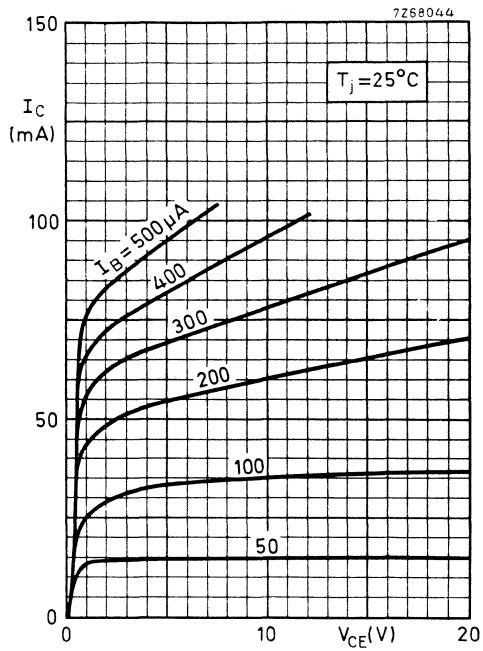


Fig. 3

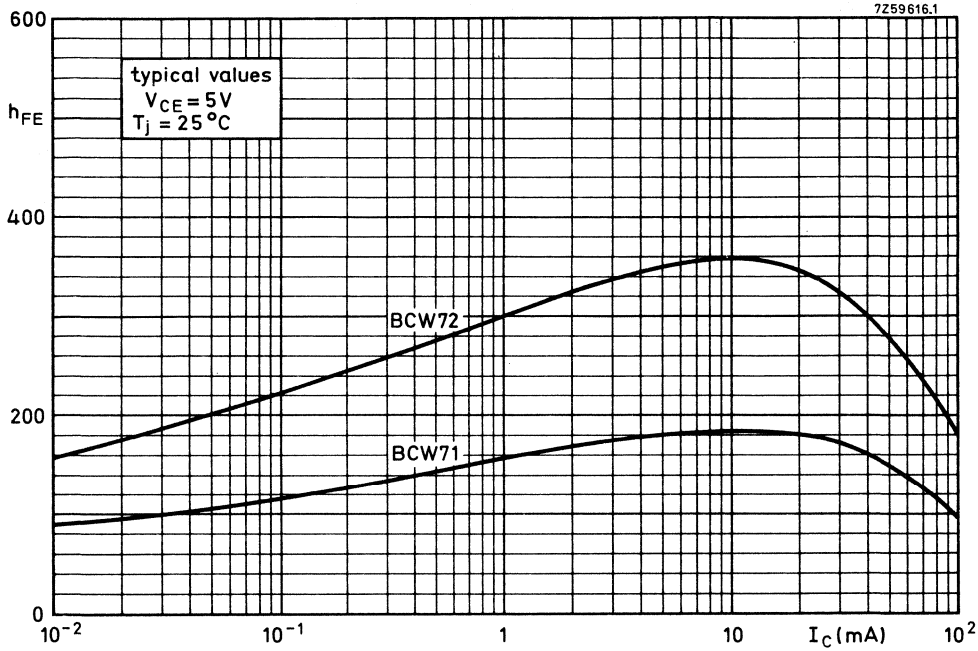


Fig. 4 D.C. current gain.

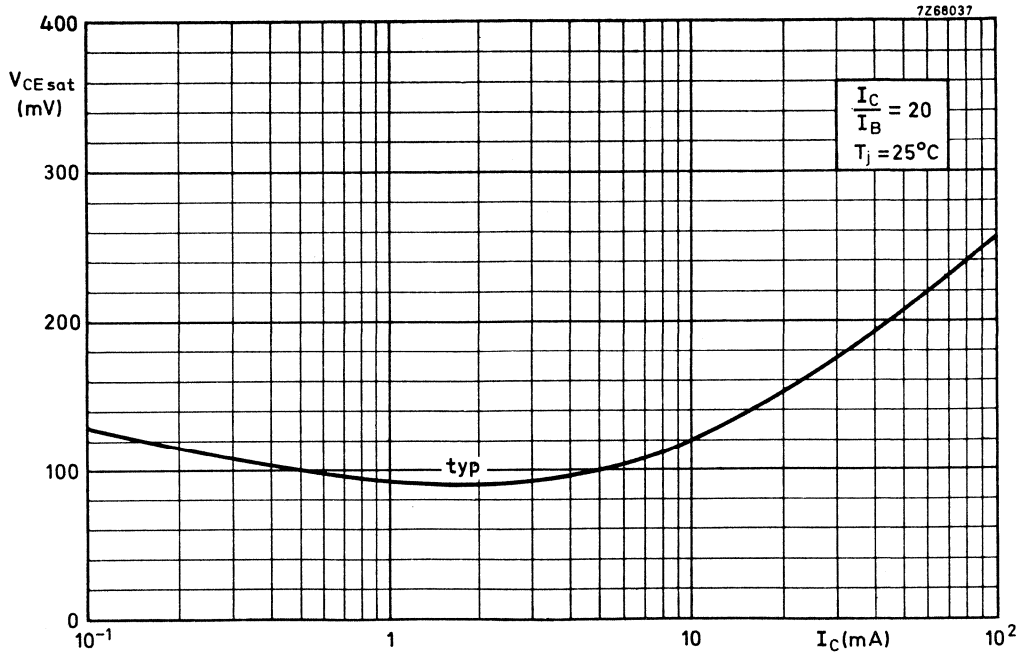


Fig. 5

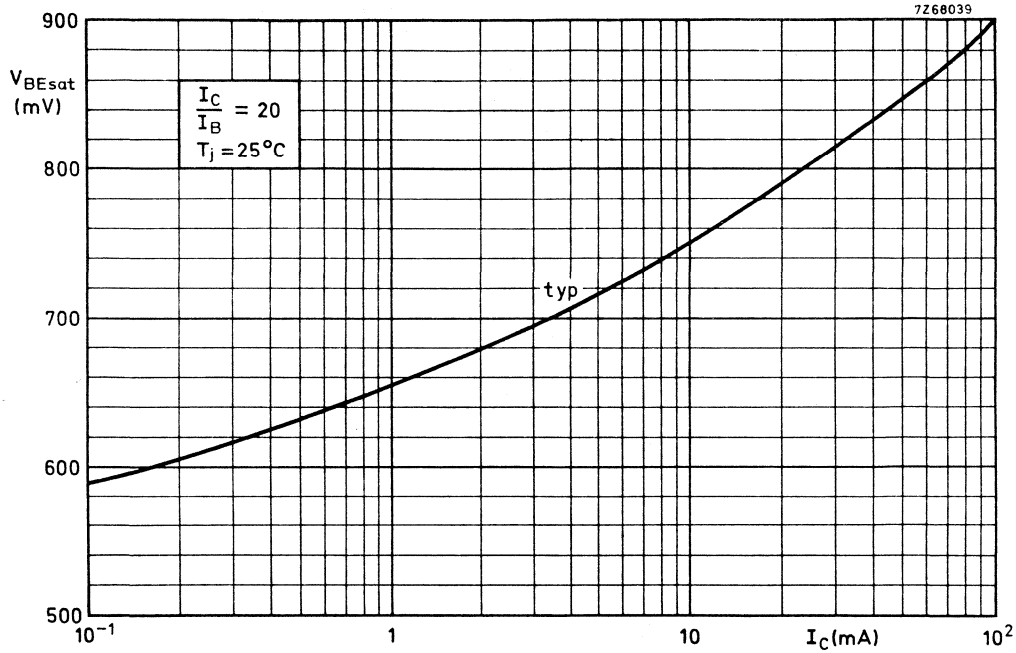

7Z68039
900
800
700
600
500
V_{BEsat} (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

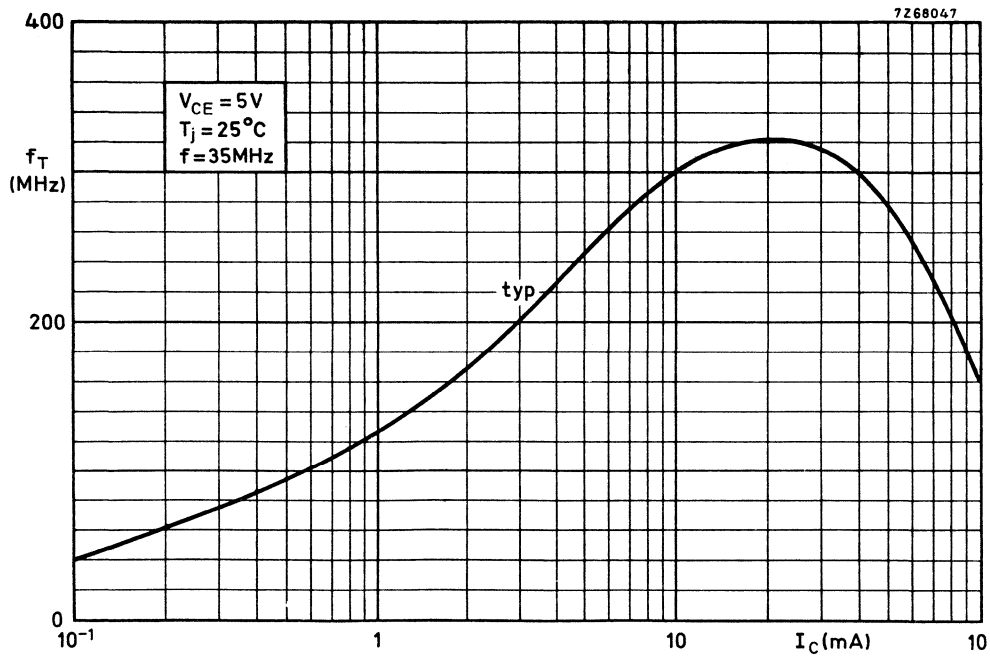

7Z68047
400
200
0
f_T (MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

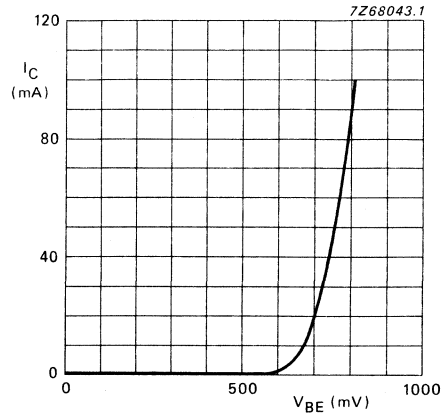


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

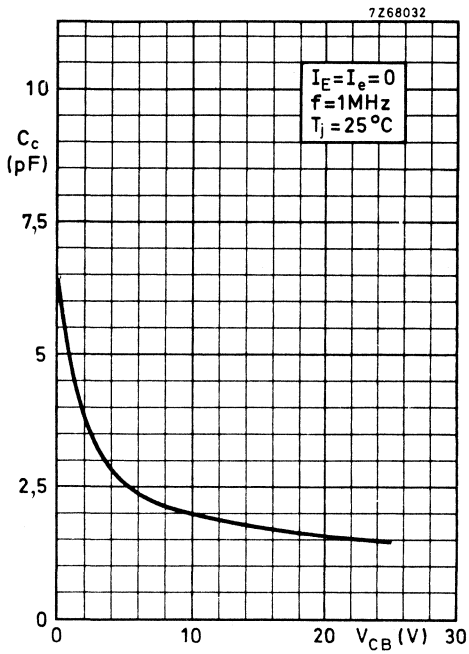


Fig. 9

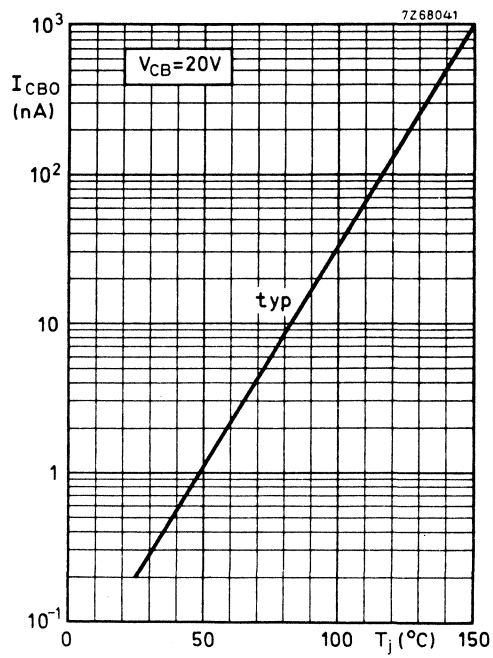


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

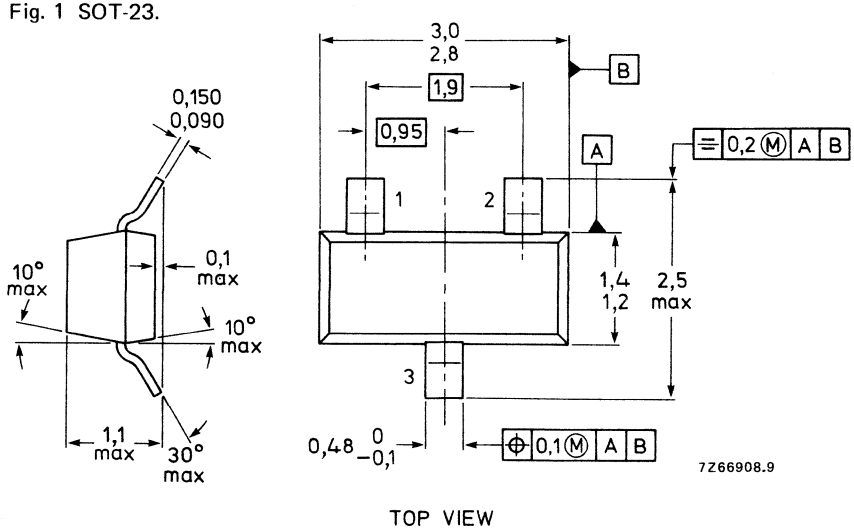
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	420 800	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

MECHANICAL DATA

Fig. 1 SOT-23.

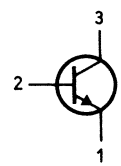
Dimensions in mm



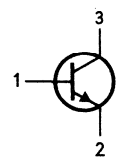
TOP VIEW

Marking code

BCW81 = K3



BCW81R = K31



R-types are available on request

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)				
I_C = 2 mA	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10	μA
Base emitter voltage				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to	700	mV
Saturation voltages				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm

D.C. current gain			
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	420
		<	800
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5 pF
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300 MHz
Noise figure at R_S = 2 kΩ			
I_C = 200 μA; V_{CE} = 5 V			
f = 1 kHz; B = 200 Hz	F	<	10 dB

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

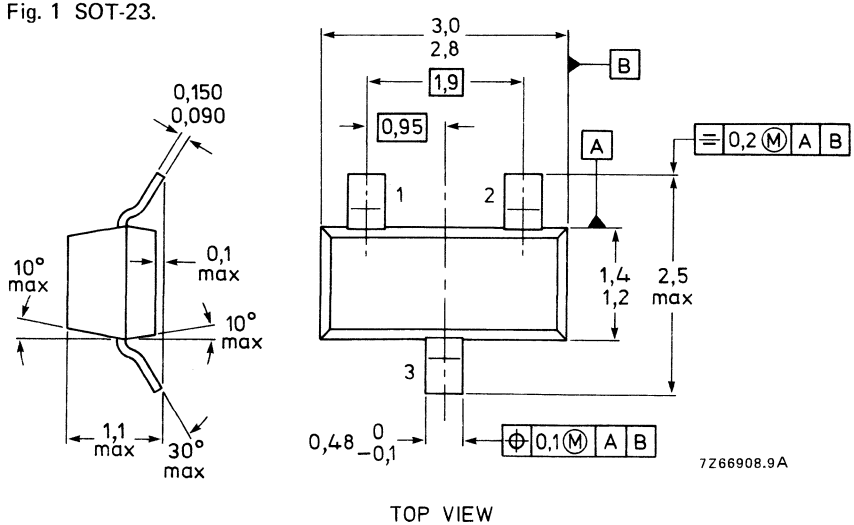
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

MECHANICAL DATA

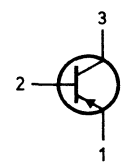
Fig. 1 SOT-23.

Dimensions in mm

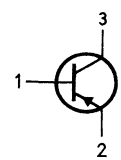


Marking code

BCW89 = H3



BCW89R = H31



R-types are available on request.

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	60 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	60 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; T_j = 25 °C	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain			
$-I_C = 10\ \mu A; -V_{CE} = 5\ V$	h_{FE}	typ.	90
$-I_C = 2\ mA; -V_{CE} = 5\ V$	h_{FE}	$>$	120
		$<$	260
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0; -V_{CB} = 10\ V$	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz			
$-I_C = 10\ mA; -V_{CE} = 5\ V$	f_T	typ.	150 MHz
Noise figure at $R_S = 2\ k\Omega$			
$-I_C = 200\ \mu A; -V_{CE} = 5\ V$			
f = 1 kHz; B = 200 Hz	F	$<$	10 dB

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
N-P-N complements are BCX19 and BCX20 respectively.

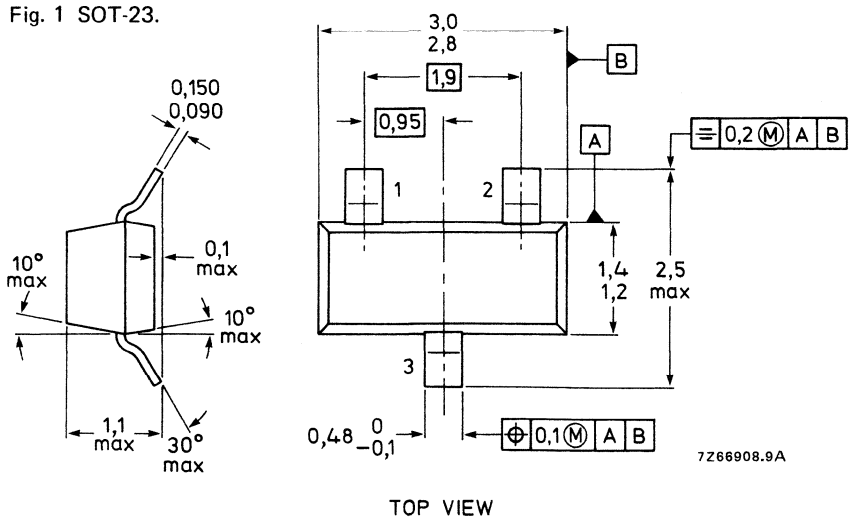
QUICK REFERENCE DATA

			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}		100 to 600		
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 35 MHz	f_T	typ.	100		MHz

MECHANICAL DATA

Fig. 1 SOT-23.

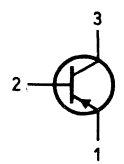
Dimensions in mm



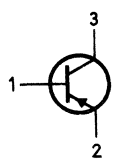
TOP VIEW

Marking code

BCX17 = T1
BCX18 = T2



BCX17R = T4
BCX18R = T5



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage $-I_C$ = 10 mA (see Fig. 2)	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (d.c.)	$-I_C$	max.	500		mA
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Emitter current (peak value)	I_{EM}	max.	1000		mA
Base current (d.c.)	$-I_B$	max.	100		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
→ Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
→ Storage temperature	T_{stg}		−65 to + 150		°C
→ Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

→ From junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100	nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 150 °C	$-I_{CBO}$	<	5	μA
Emitter cut-off current I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage ▲ $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	$-V_{BE}$	<	1,2	V
Saturation voltage $-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	620	mV

→ * Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ $-V_{BE}$ decreases by about 2 mV/°C with increasing temperature.

D.C. current gain			
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	100 to 600	
$-I_C$ = 300 mA; $-V_{CE}$ = 1 V	h_{FE}	> 70	
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}	> 40	
Transition frequency at f = 35 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ. 100	MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ. 8	pF

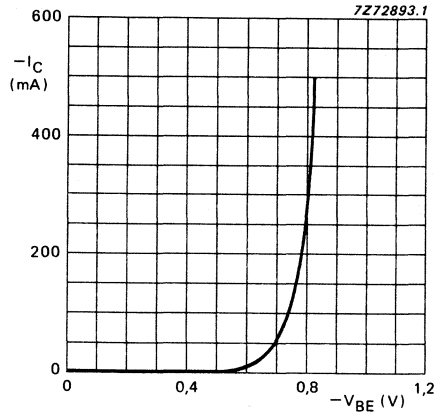


Fig. 2 $-V_{CE}$ = 1 V; T_j = 25 °C; typical values.

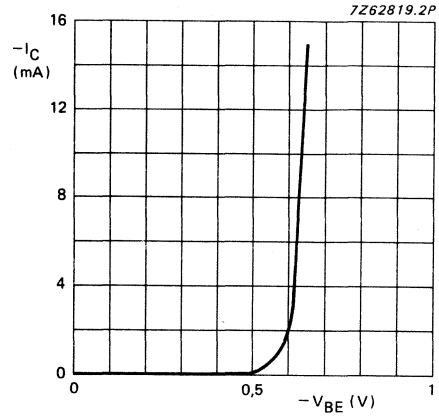


Fig. 3 V_{CE} = 5 V; T_j = 25 °C; typical values.

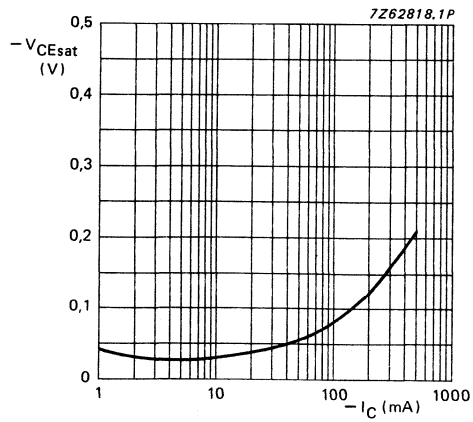


Fig. 4 I_C/I_B = 10; T_j = 25 °C; typical values.

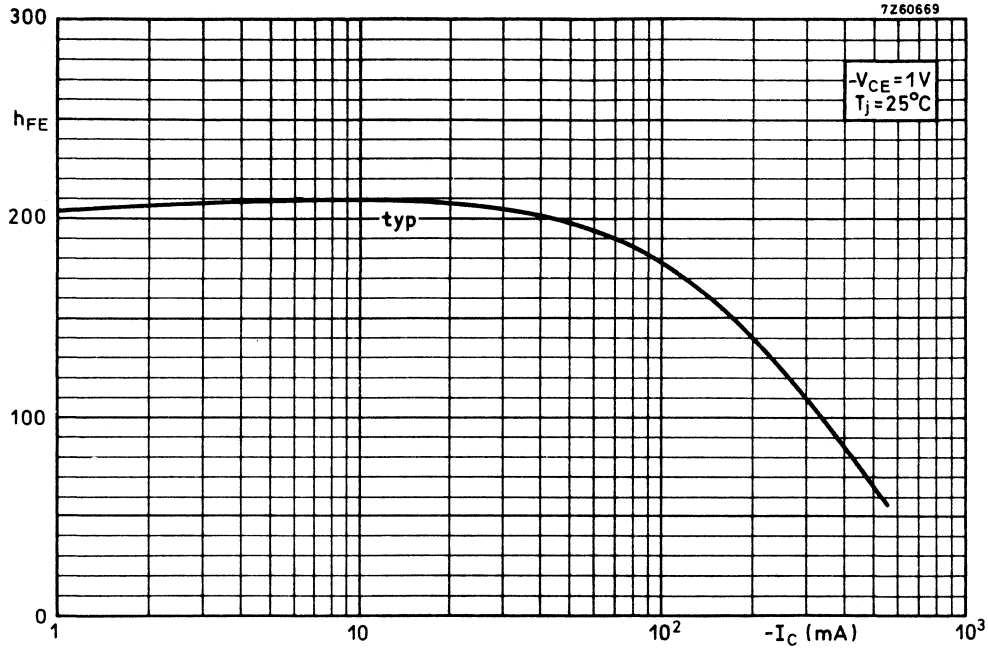

7Z60669
300
h_{FE}
200
100
0
1
10
10^2
10^3
$-I_C$ (mA)
typ
$-V_{CE}$ = 1V
T_j = 25°C

Fig. 5

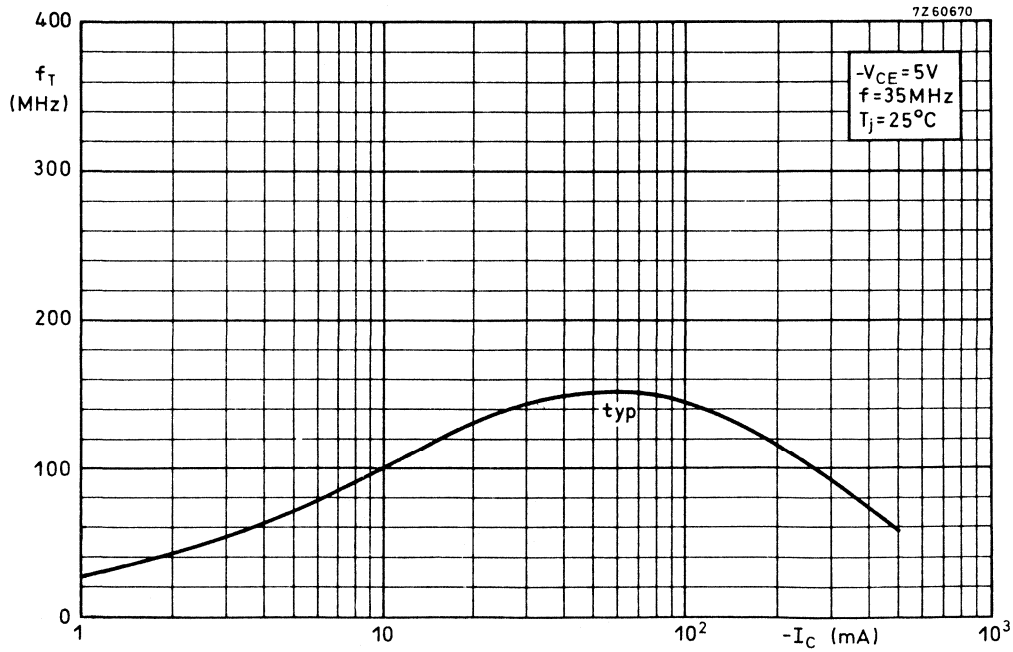

7Z60670
400
f_T
(MHz)
300
200
100
0
1
10
10^2
10^3
$-I_C$ (mA)
typ
$-V_{CE}$ = 5V
f = 35MHz
T_j = 25°C

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
P-N-P complements are BCX17 and BCX18 respectively.

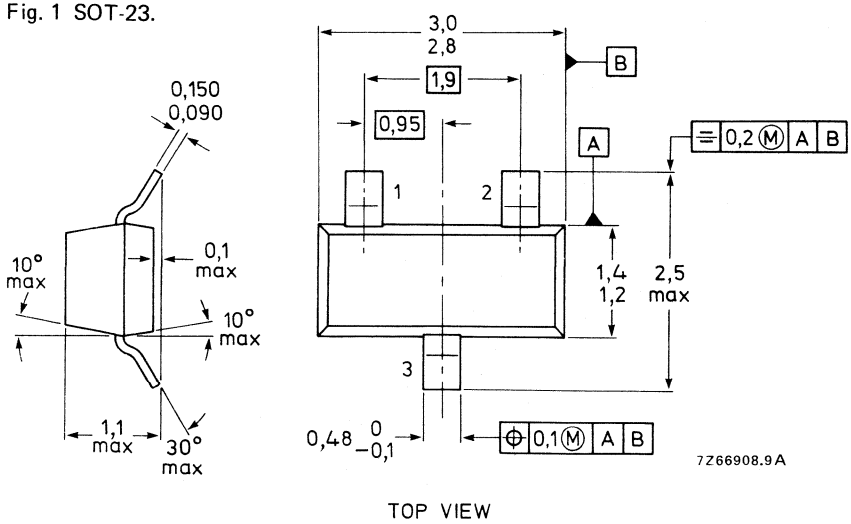
QUICK REFERENCE DATA

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 100 mA; V_{CE} = 1 V	h_{FE}		100 to 600		
Transition frequency I_C = 10 mA; V_{CE} = 5 V; f = 35 MHz	f_T	typ.	200		MHz

MECHANICAL DATA

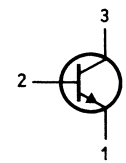
Dimensions in mm

Fig. 1 SOT-23.

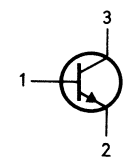


Marking code

BCX19 = U1
BCX20 = U2



BCX19R = U4
BCX20R = U5



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) I_C = 10 mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
→ Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300		mW
→ Storage temperature	T_{stg}		−65 to + 150		°C
→ Junction temperature	T_j	max.	150		°C

→ THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	5	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base emitter voltage ▲				
I_C = 500 mA; V_{CE} = 1 V	V_{BE}	<	1,2	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	620	mV

→ * Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ V_{BE} decreases by about 2 mV/°C with increasing temperature.

D.C. current gain			
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	100 to 600	
I_C = 300 mA; V_{CE} = 1 V	h_{FE}	> 70	
I_C = 500 mA; V_{CE} = 1 V	h_{FE}	> 40	
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ. 200	MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ. 5	pF

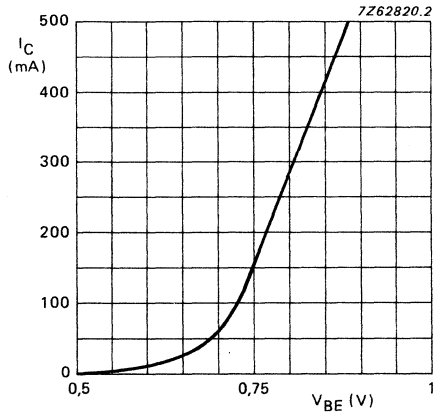


Fig. 2 V_{CE} 1 V; T_j = 25 °C; typical values.

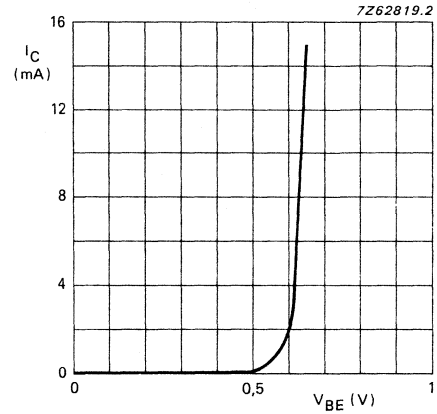


Fig. 3 V_{CE} = 5 V; T_j = 25 °C; typical values.

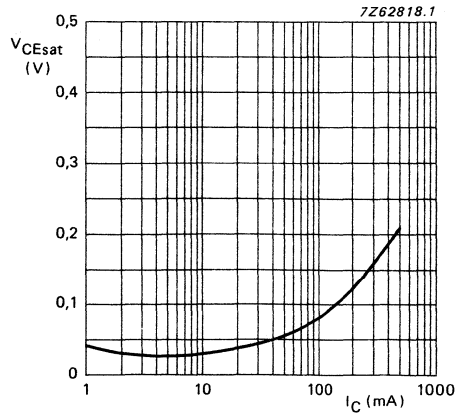


Fig. 4 I_C/I_B = 10; T_j = 25 °C; typical values.

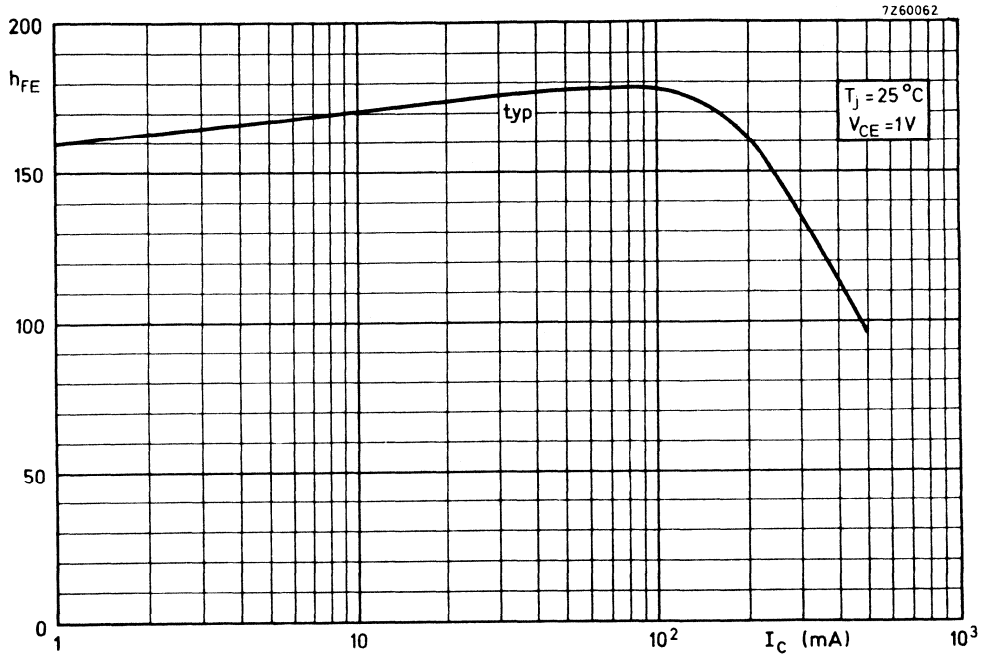

7Z60062
200
h_{FE}
150
100
50
0
typ
T_j = 25 °C
V_{CE} = 1V
1
10
10^2
I_C (mA)
10^3

Fig. 5

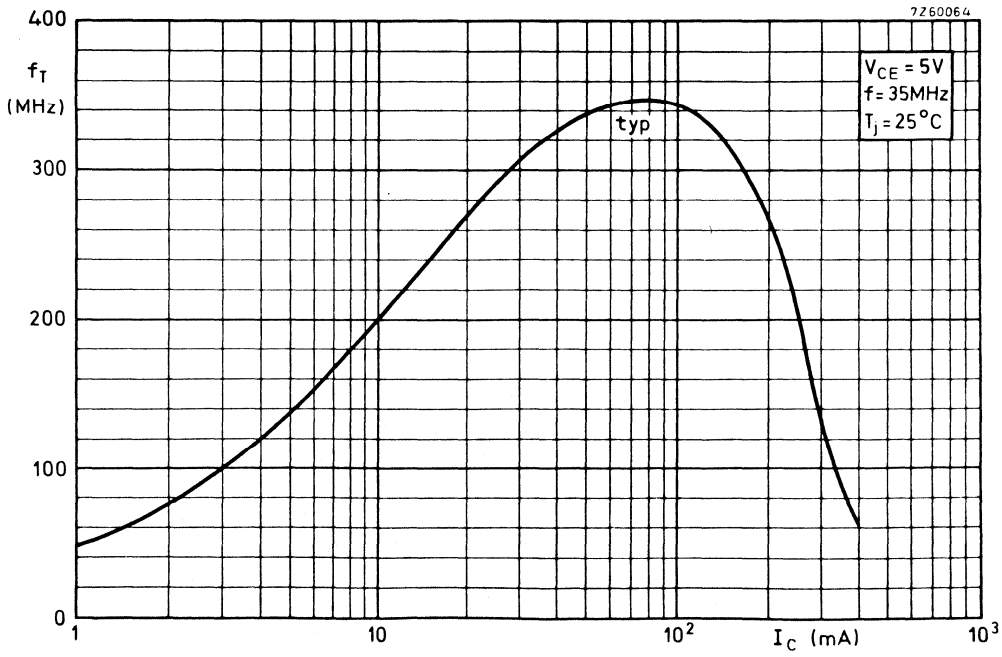

7Z60064
400
f_T
(MHz)
300
200
100
0
typ
V_{CE} = 5V
f = 35MHz
T_j = 25 °C
1
10
10^2
I_C (mA)
10^3

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power p-n-p transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

N-P-N complements are BCX54, BCX55 and BCX56 respectively.

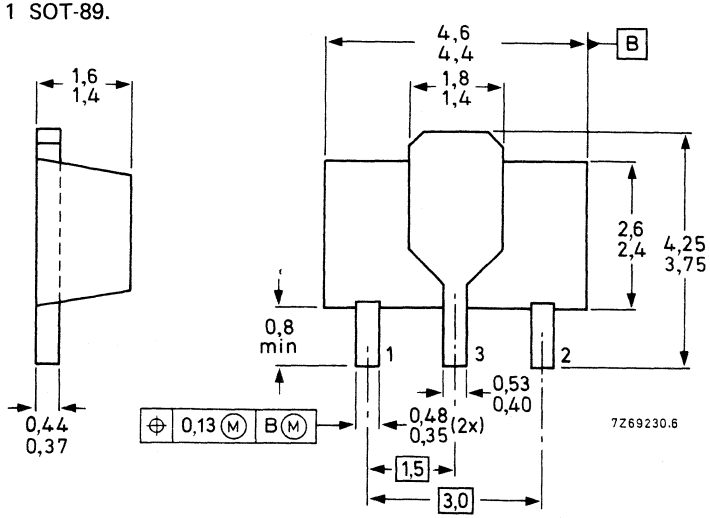
QUICK REFERENCE DATA

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

MECHANICAL DATA

Dimensions in mm

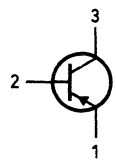
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BCX51	=AA
BCX51-10	=AC
BCX51-16	=AD
BCX52	=AE
BCX52-10	=AG
BCX52-16	=AM
BCX53	=AH
BCX53-10	=AK
BCX53-16	=AL



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		1,0		A
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Base current (d.c.)	$-I_B$	max.		0,1		A
Base current (peak value)	$-I_{BM}$	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.		1,0		W
Storage temperature	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	100	nA
I_E = 0; $-V_{CB}$ = 30 V; T_j = 125 °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	0,5	V
D.C. current gain				
$-I_C$ = 5 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		40 to 250	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	50	MHz

CHARACTERISTICS (continued)

			BCX51-10 52-10 53-10	BCX51-16 52-16 53-16
D.C. current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	$>$ $<$	63 160	100 250

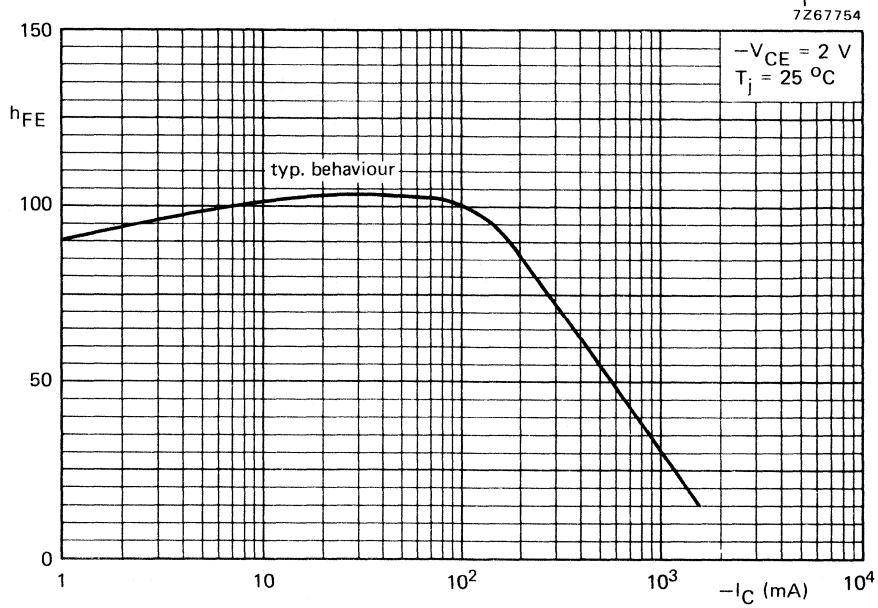


Fig. 2.

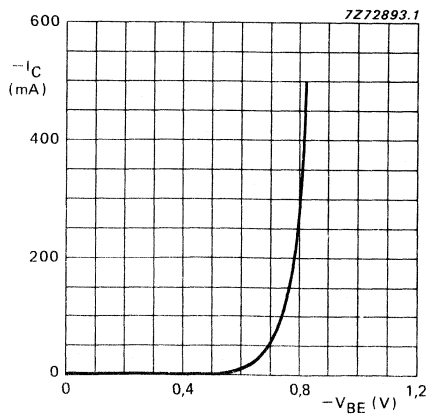


Fig. 3 $-V_{CE}$ = 2 V; T_j = 25 °C; typical values.

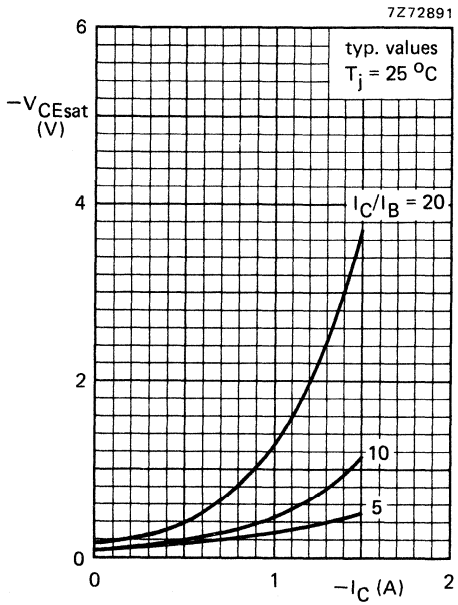


Fig. 4.

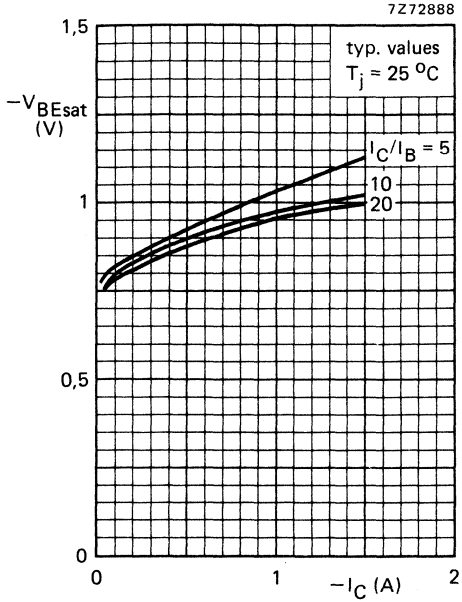


Fig. 5.

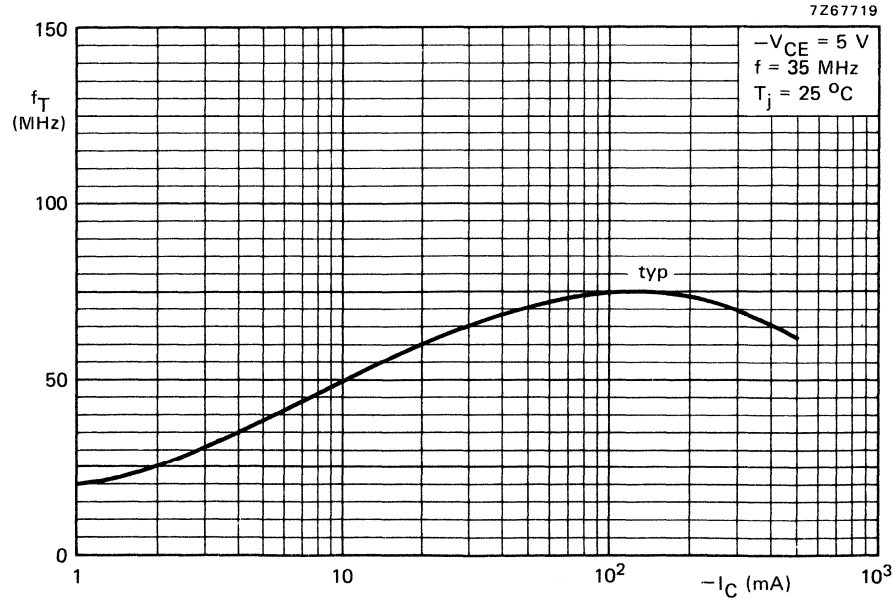


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power n-p-n transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

P-N-P complements are BCX51, BCX52 and BCX53 respectively.

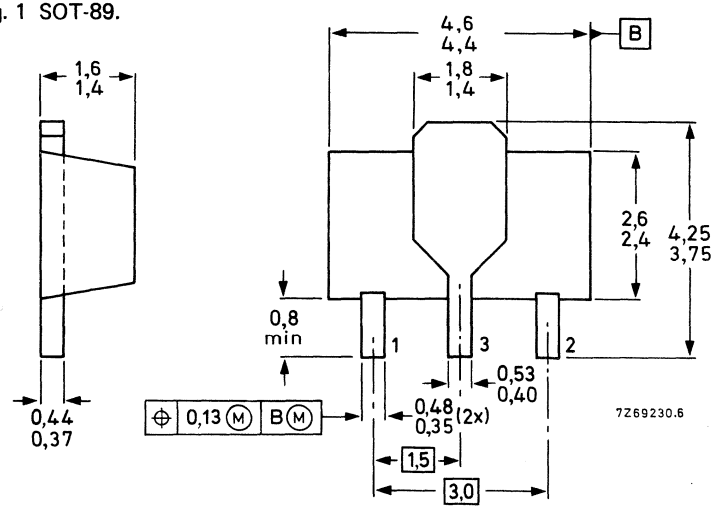
QUICK REFERENCE DATA

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

MECHANICAL DATA

Fig. 1 SOT-89.

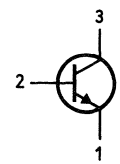
Dimensions in mm



BOTTOM VIEW

Marking code

BCX54	= BA
BCX54-10	= BC
BCX54-16	= BD
BCX55	= BE
BCX55-10	= BG
BCX55-16	= BM
BCX56	= BH
BCX56-10	= BK
BCX56-16	= BL



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V
Collector current (d.c.)	I_C	max.		1,0		A
Collector current (peak value)	I_{CM}	max.		1,5		A
Base current (d.c.)	I_B	max.		0,1		A
Base current (peak value)	I_{BM}	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.		1,0		W
Storage temperature	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 30 V; T_j = 125 °C	I_{CBO}	<	10	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base-emitter voltage				
I_C = 500 mA; V_{CE} = 2 V	V_{BE}	<	1	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	V
D.C. current gain				
I_C = 5 mA; V_{CE} = 2 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 2 V	h_{FE}		40 to 250	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	130	MHz

CHARACTERISTICS (continued)

			BCX54-10 55-10 56-10	BCX54-16 55-16 56-16
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}	>	63	100
		<	160	250

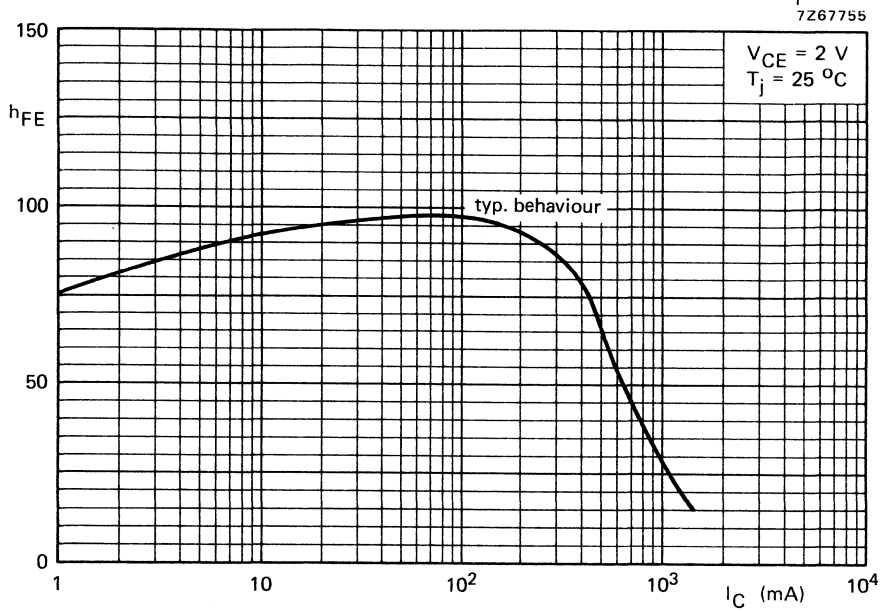


Fig. 2.

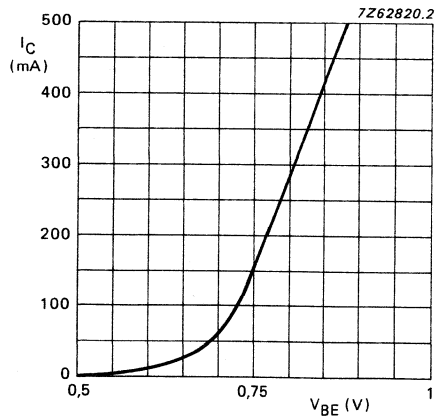


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

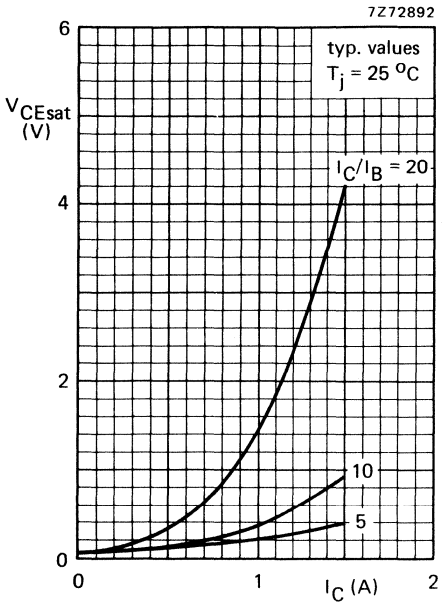


Fig. 4.

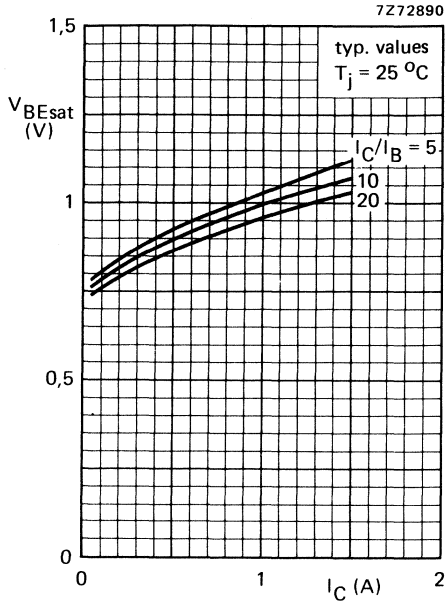


Fig. 5.

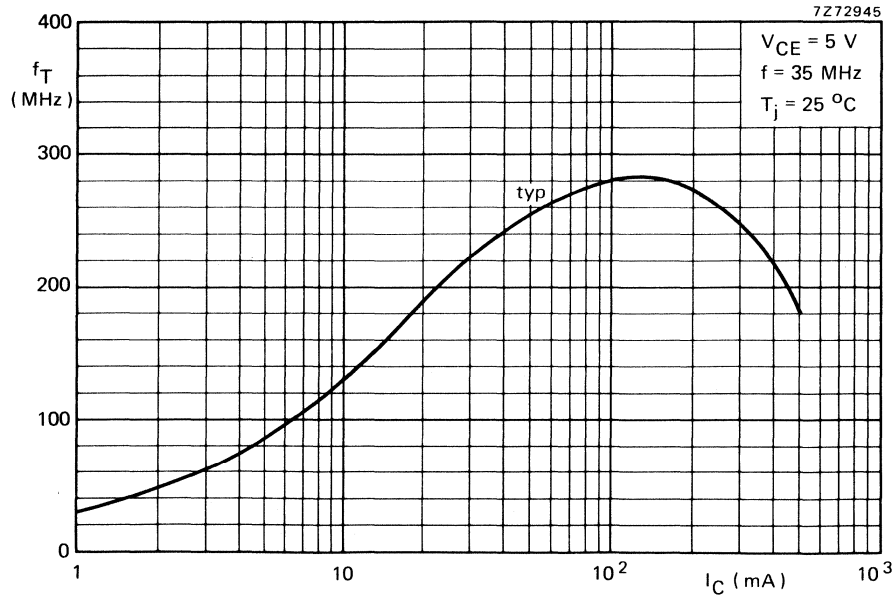


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

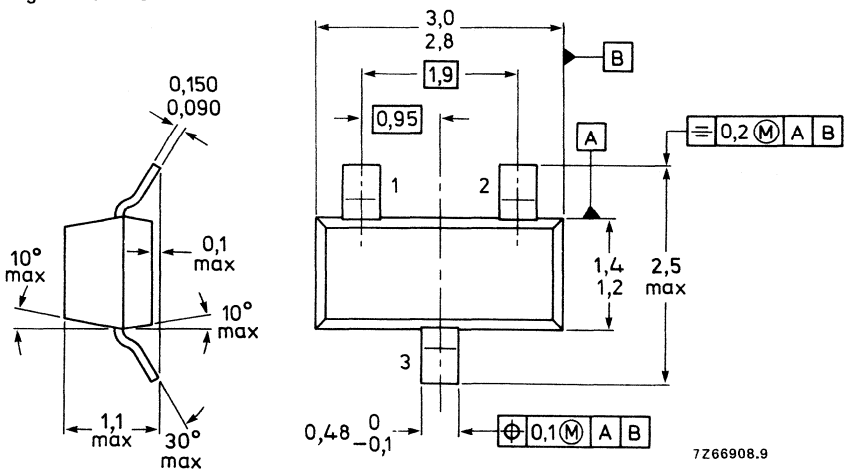
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz V_{CE} = 5 V; I_C = 10 mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz V_{CE} = 5 V; I_C = 200 μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Fig. 1 SOT-23.

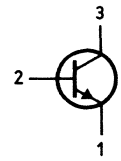
Dimensions in mm



TOP VIEW

Marking code

BCX70G = AG
BCX70H = AH
BCX70J = AJ
BCX70K = AK



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	200	mA
Base current	I_B	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{BE} = 0; V_{CE} = 45 V	I_{CES}	<	20	nA
V_{BE} = 0; V_{CE} = 45 V; T_{amb} = 150 °C	I_{CES}	<	20	μA
Emitter-base cut-off current				
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20	nA
Saturation voltages				
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}	0,05 to	0,35	V
	V_{BEsat}	0,6 to	0,85	V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}	0,1 to	0,55	V
	V_{BEsat}	0,7 to	1,05	V
Transition frequency at f = 100 MHz▲				
I_C = 10 mA; V_{CE} = 5 V	f_T	>	125	MHz
		typ.	250	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	8	pF
Noise figure at R_S = 2 kΩ		typ.	2	dB
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	6	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			G	H	J	K	
D.C. current gain							
V_{CE} = 5 V; I_C = 10 μA	h_{FE}	typ.	78	145	220	300	
		>	–	20	40	100	
		>	120	180	250	380	
V_{CE} = 5 V; I_C = 2 mA	h_{FE}	typ.	170	250	350	500	
		<	220	310	460	630	
V_{CE} = 1 V; I_C = 50 mA	h_{FE}	>	50	70	90	100	
Input impedance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
V_{CE} = 5 V; I_C = 2 mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
V_{CE} = 5 V; I_C = 10 μA	V_{BE}	typ.	0,52				V
V_{CE} = 1 V; I_C = 50 mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; $I_{Bon} = -I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85 ns
		<	150 ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480 ns
		<	800 ns

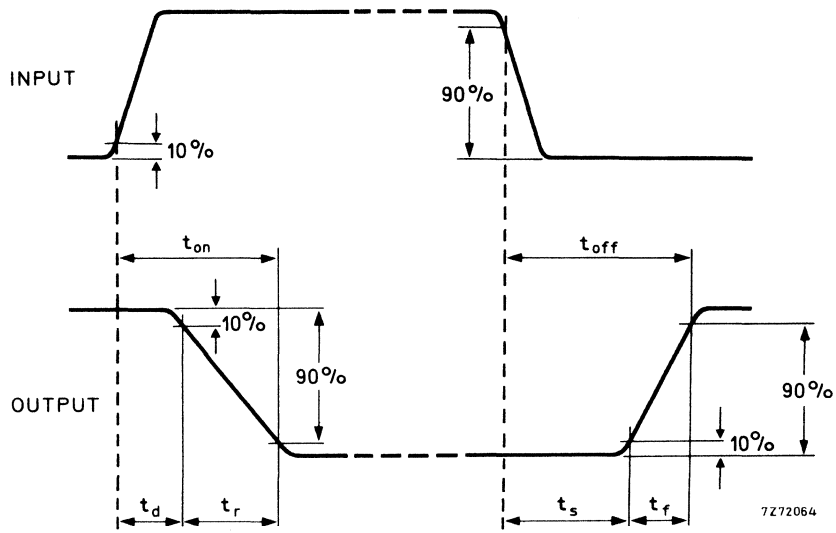


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

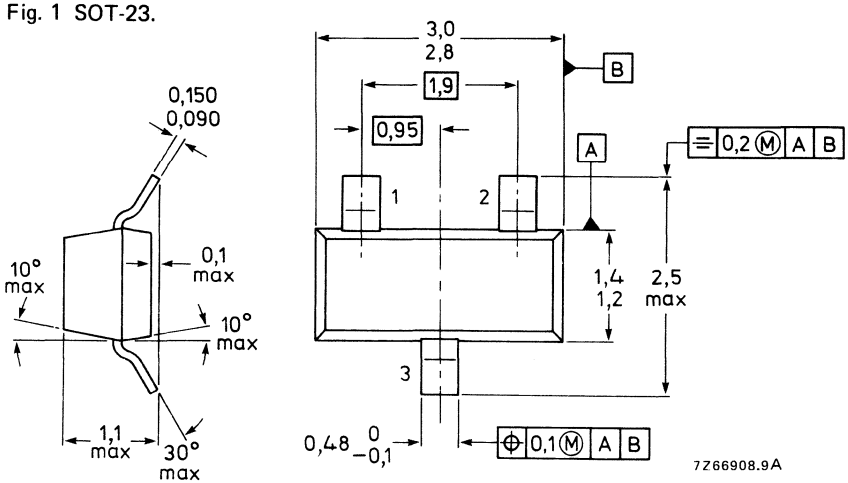
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	45 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Total power dissipation	P_{tot}	max.	300 mW ←
Junction temperature	T_j	max.	150 °C
Transition frequency at f = 100 MHz $-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180 MHz
Noise figure at f = 1 kHz $-V_{CE}$ = 5 V; $-I_C$ = 200 μA	F	typ.	2 dB

MECHANICAL DATA

Fig. 1 SOT-23.

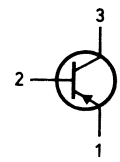
Dimensions in mm



TOP VIEW

Marking code

BCX71G = BG
BCX71H = BH
BCX71J = BJ
BCX71K = BK



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	45 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Base current	$-I_B$	max.	50 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current			
V_{EB} = 0; $-V_{CE}$ = 45 V	$-I_{CES}$	<	20 nA
V_{EB} = 0; $-V_{CE}$ = 45 V; T_{amb} = 150 °C	$-I_{CES}$	<	20 μA
Emitter-base cut-off current			
I_C = 0; $-V_{EB}$ = 4 V	$-I_{EBO}$	<	20 nA
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,25 mA	$-V_{CEsat}$		0,06 to 0,25 V
	$-V_{BEsat}$		0,6 to 0,85 V
$-I_C$ = 50 mA; $-I_B$ = 1,25 mA	$-V_{CEsat}$		0,12 to 0,55 V
	$-V_{BEsat}$		0,68 to 1,05 V
Transition frequency at f = 100 MHz▲			
$-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180 MHz
Collector capacitance at f = 1 MHz			
$-V_{CB}$ = 10 V; I_E = I_e = 0	C_c	typ.	4,5 pF
Emitter capacitance at f = 1 MHz			
$-V_{EB}$ = 0,5 V; I_C = i_c = 0	C_e	typ.	11 pF
Noise figure at R_S = 2 kΩ			
$-V_{CE}$ = 5 V; $-I_C$ = 200 μA; B = 200 Hz	F	typ.	2 dB
		<	6 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			G	H	J	K	
D.C. current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	h_{FE}	typ.	140	200	270	340	
		>	–	30	40	100	
		>	120	180	250	380	
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	h_{FE}	typ.	170	250	350	500	
		<	220	310	460	630	
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	V_{BE}		0,6 to 0,75				V
		typ.		0,65			V
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	V_{BE}	typ.		0,55			V
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	V_{BE}	typ.		0,72			V

Switching times

$-I_{Con}$ = 10 mA; $-I_{Bon} = I_{Boff}$ = 1 mA
$-V_{CC}$ = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

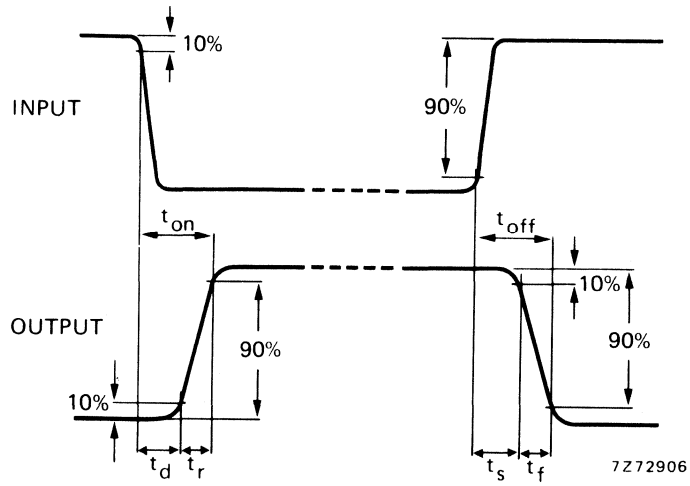


Fig. 2 Switching waveforms.

N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Asymmetrical N-channel planar epitaxial junction field-effect transistors in the miniature plastic envelope intended for applications up to the v.h.f. range in hybrid thick and thin-film circuits. Special features are the low feedback capacitance and the low noise figure. These features make the product very suitable for applications such as the r.f. stages in f.m. portables (BF510), car radios (BF511) and mains radios (BF512) or the mixer stage (BF513).

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.		20		V
Drain current (d.c. or average)	I_D	max.		30		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		300		mW
			BF510	511	512	513	
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0,7	2,5	6	10	mA
		<	3,0	7,0	12	18	mA
Transfer admittance (common source) V_{DS} = 10 V; V_{GS} = 0; f = 1 kHz	$\|y_{fs}\|$	>	2,5	4	6	7	mS
Feedback capacitance V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ.	0,3	0,3	–	–	pF
V_{DS} = 10 V; I_D = 5 mA	C_{rs}	typ.	–	–	0,3	0,3	pF
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz							
V_{DS} = 10 V; V_{GS} = 0	F	typ.	1,5	1,5	–	–	dB
V_{DS} = 10 V; I_D = 5 mA	F	typ.	–	–	1,5	1,5	dB

MECHANICAL DATA

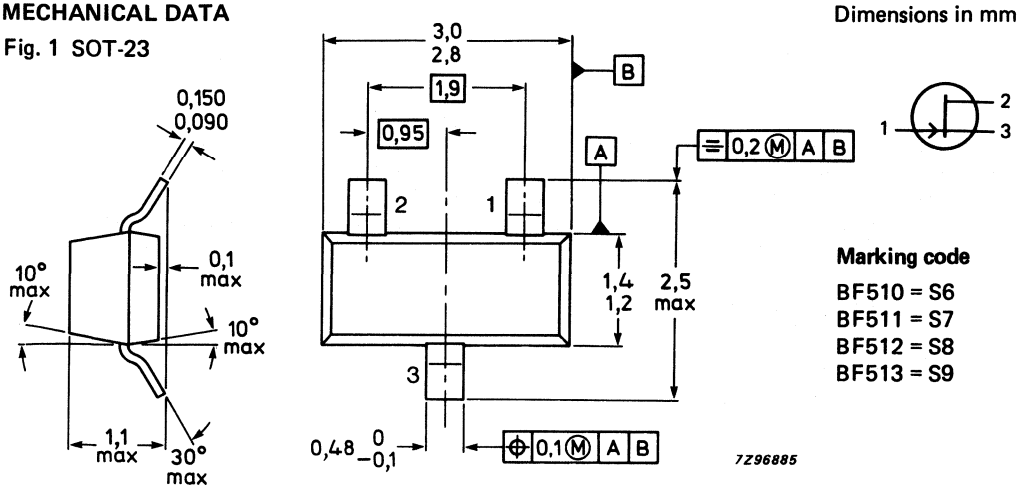
SOT-23.

See also *Soldering recommendations.*

MECHANICAL DATA

Fig. 1 SOT-23

Dimensions in mm



TOP VIEW

Marking code

BF510 = S6
BF511 = S7
BF512 = S8
BF513 = S9

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain-gate voltage (open source)	V_{DGO}	max.	20	V
Drain current (d.c. or average)	I_D	max.	30	mA
Gate current	$\pm I_G$	max.	10	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature range	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

→ THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

STATIC CHARACTERISTICS

T_{amb} = 25 °C

			BF510	511	512	513	
Gate cut-off current							
$-V_{GS}$ = 0,2 V; V_{DS} = 0	$-I_{GSS}$	<	10	10	10	10	nA
Gate-drain breakdown voltage							
I_S = 0; $-I_D$ = 10 μA	$-V_{(BR)GDO}$	>	20	20	20	20	V
Drain current							
V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0,7	2,5	6	10	mA
		<	3,0	7,0	12	18	mA
Gate-source cut-off voltage							
I_D = 10 μA; V_{DS} = 10 V	$-V_{(P)GS}$	typ.	0,8	1,5	2,2	3	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C for BF510 and BF511

V_{DS} = 10 V; I_D = 5 mA; T_{amb} = 25 °C for BF512 and BF513

y-parameters (common source)			BF510	511	512	513	
Input capacitance at f = 1 MHz	C_{is}	<	5	5	5	5	pF
Input conductance at f = 100 MHz	g_{is}	typ.	100	90	60	50	μS
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	0,3	0,3	0,3	0,3	pF
		<	0,4	0,4	0,4	0,4	pF
Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	>	2,5	4,0	4,0	3,5	mS
V_{GS} = 0 instead of I_D = 5 mA	$\|y_{fs}\|$	>	–	–	6,0	7,0	mS
Transfer admittance at f = 100 MHz	$\|y_{fs}\|$	typ.	3,5	5,5	5,0	5,0	mS
Output capacitance at f = 1 MHz	C_{os}	<	3	3	3	3	pF
Output conductance at f = 1 MHz	g_{os}	<	60	80	100	120	μS
Output conductance at f = 100 MHz	g_{os}	typ.	35	55	70	90	μS
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz	F	typ.	1,5	1,5	1,5	1,5	dB

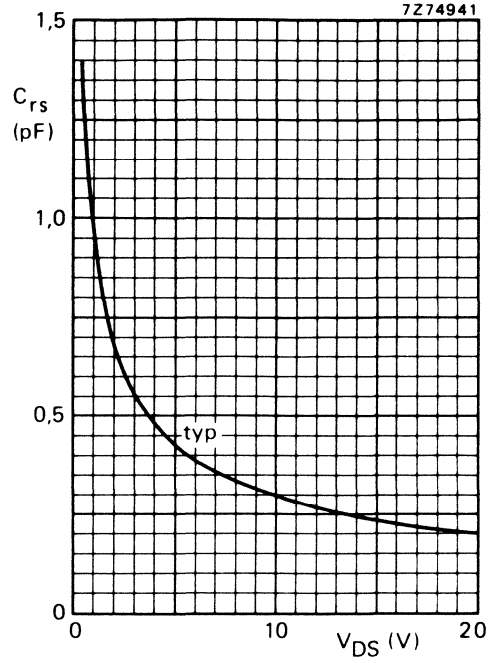


Fig. 2 V_{GS} = 0 for BF510 and BF511; I_D = 5 mA for BF512 and BF513; f = 1 MHz; T_{amb} = 25 °C.

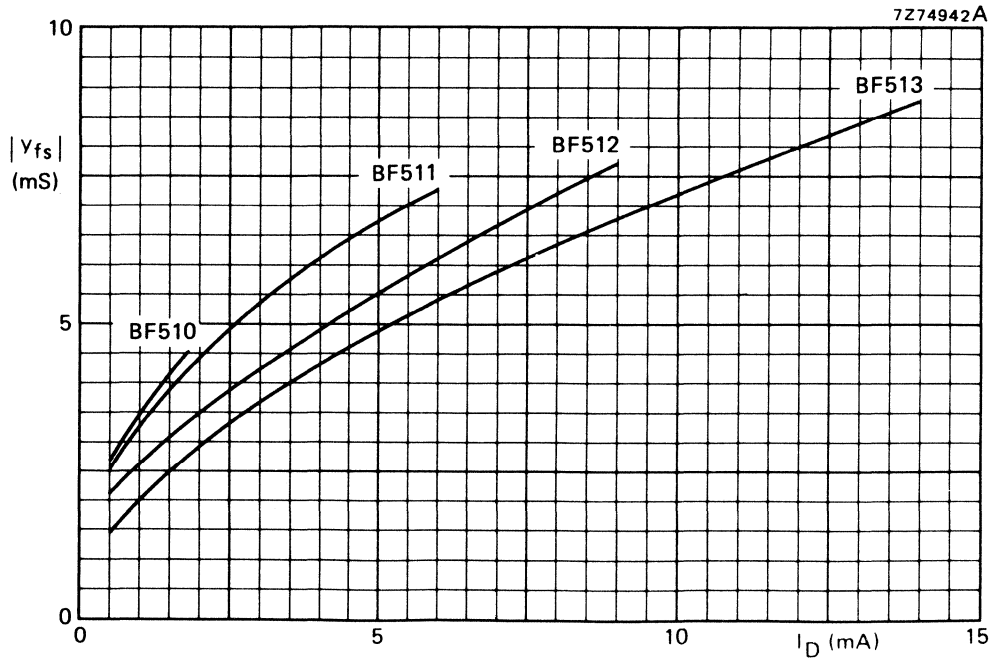


Fig. 3 V_{DS} = 10 V; f = 1 kHz; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope, intended for applications in thick and thin-film circuits. This transistor is primarily intended for use in i.f. detection applications.

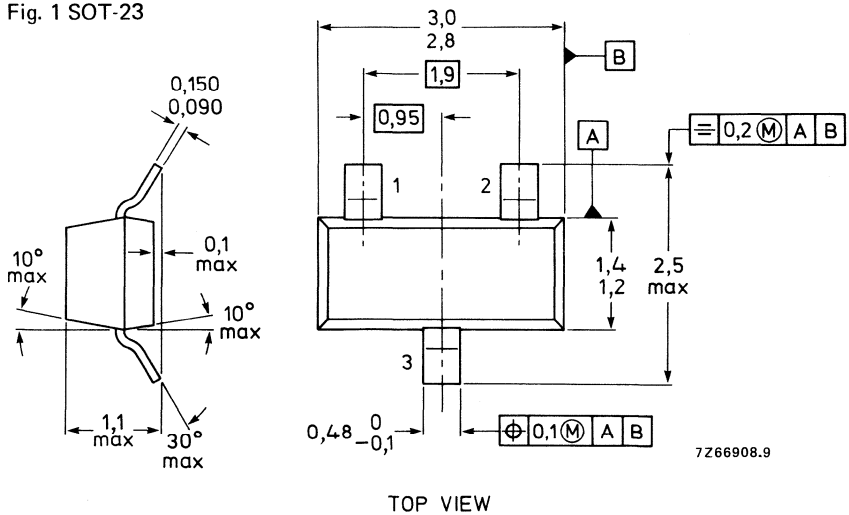
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	
Transition frequency at f = 100 MHz $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	325	MHz
Noise figure at R_S = 300 Ω $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 100 kHz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

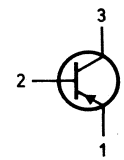
Fig. 1 SOT-23



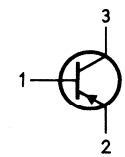
TOP VIEW

Marking code

BF550 = G2



BF550R = G5



See also *Soldering Recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	V
Collector current (d.c.)	$-I_C$	max.	25	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	50	nA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 3 V	$-I_{EBO}$	<	100	μA
Base-emitter voltage				
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	$-V_{BE}$	typ.	750	mV
D.C. current gain				
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	
Transition frequency at f = 100 MHz				
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	325	MHz
Feedback capacitance at f = 1 MHz				
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	C_{re}	typ.	0,5	pF
Noise figure at R_S = 300 Ω				
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 100 kHz	F	typ.	2	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a microminiature plastic envelope, intended for applications in thick and thin-film circuits such as self-oscillating mixer in u.h.f. tuners in conjunction with bipolar transistors or with MOS fets.

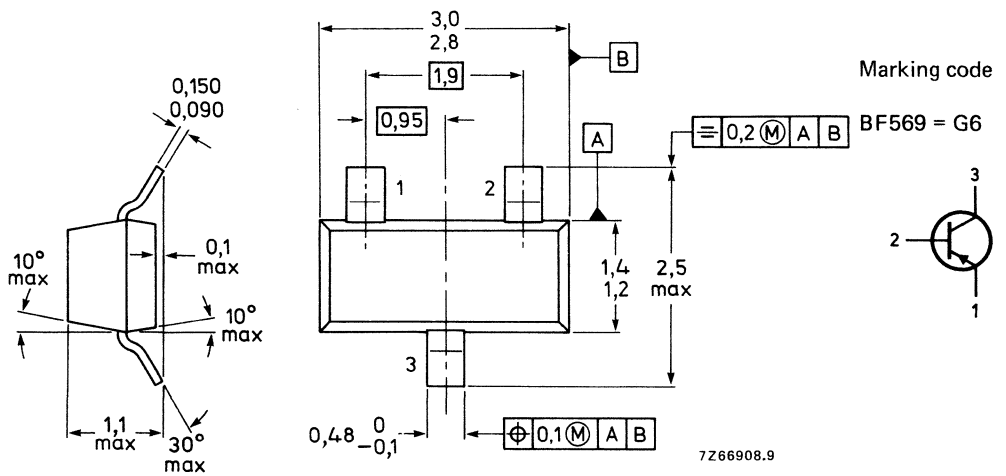
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	35	V
Collector current (d.c)	$-I_C$	max.	30	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 3 mA; $-V_{CB}$ = 10 V	f_T	typ.	900	MHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23



TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	35	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3	V
Collector current (d.c.)	$-I_C$	max.	30	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Collector cut-off current I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100	nA
D.C. current gain I_E = 3 mA; $-V_{CB}$ = 10 V	h_{FE}	> typ.	25 50	
Transition frequency at f = 100 MHz I_E = 3 mA; $-V_{CB}$ = 10 V	f_T	typ.	900	MHz
Feedback capacitance at f = 1 MHz I_E = 1 mA; $-V_{CB}$ = 10 V	C_{re}	typ.	0,33	pF
Noise figure at f = 800 MHz I_E = 3 mA; $-V_{CB}$ = 10 V; R_S = 60 Ω; R_L = 500 Ω	F	typ.	4,5	dB
Power gain at f = 800 MHz I_E = 3 mA; $-V_{CB}$ = 10 V; R_S = 60 Ω; R_L = 500 Ω	G_{pb}	typ.	14,5	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic SOT-23 variant envelope, intended for use in large-signal handling i.f. pre-amplifiers of TV receivers in combination with surface acoustic wave filters.

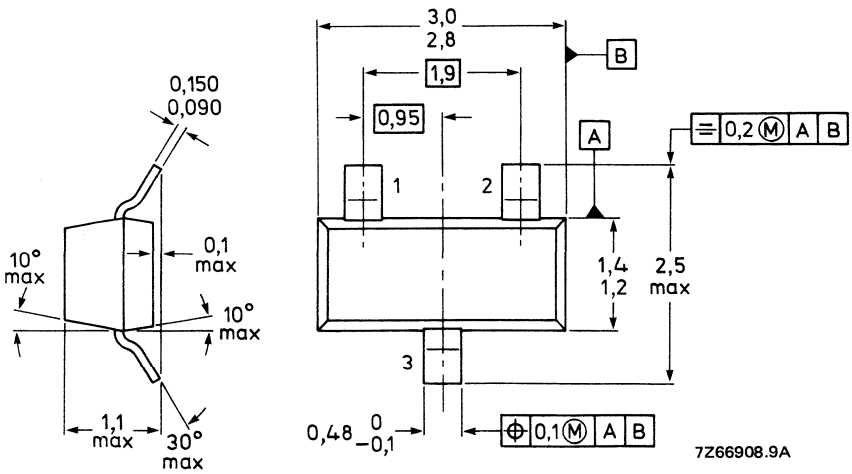
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	40
Transition frequency at f = 100 MHz I_C = 40 mA; V_{CE} = 10 V	f_T	>	490 MHz
Voltage gain at f = 36 MHz (see Fig. 4) I_C = 20 mA; $V_{CE} \approx$ 10,4 V	G_v	typ.	24 dB
Interference voltage for K = 1% (see Fig. 3)	$V_{(int)rms}$	typ.	120 mV

MECHANICAL DATA

Dimensions in mm

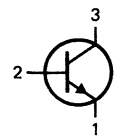
Fig. 1 SOT-23.



TOP VIEW

Marking code

B26



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,5 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−55 to +150	°C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to tab	$R_{th\ j\text{-}t}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	400 nA
I_E = 0; V_{CB} = 20 V; T_j = 125 °C	I_{CBO}	<	30 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 2 V	I_{EBO}	<	100 nA
D.C. current gain			
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	40
Transition frequency at f = 100 MHz			
I_C = 10 mA; V_{CE} = 10 V	f_T	>	500 MHz
I_C = 40 mA; V_{CE} = 10 V	f_T	>	490 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ. <	2,2 pF 3,5 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c$ = 0; V_{EB} = 1 V	C_e	<	4,5 pF
Feedback capacitance at f = 1 MHz			
I_C = 0; V_{CE} = 10 V	C_{re}	typ. <	1,6 pF 2,2 pF

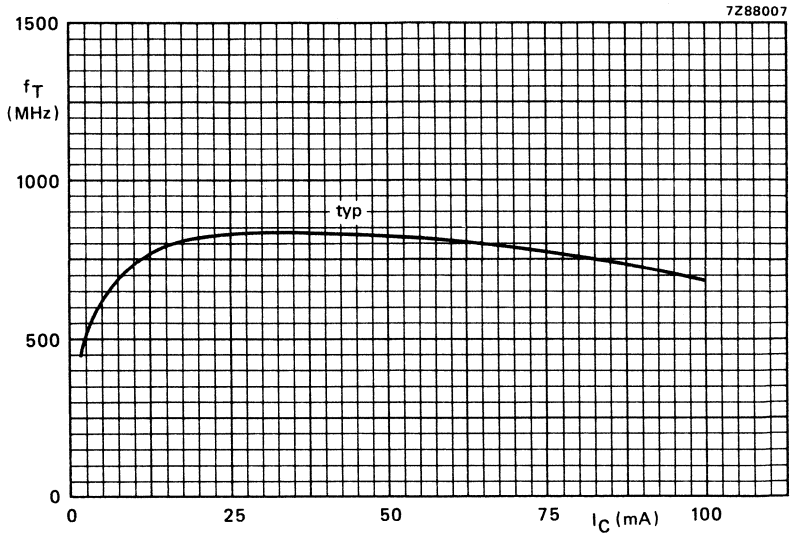
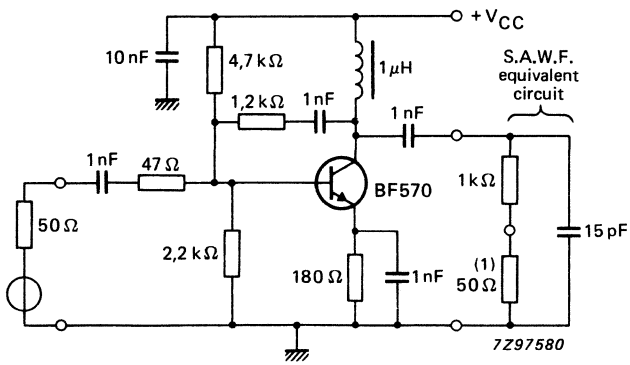


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

APPLICATION INFORMATION



(1) Test instrument load.

Fig. 3 Large-signal handling i.f. preamplifier for surface acoustic wave filter.

Performance

Supply voltage	V_{CC}	=	12	V
Collector current	I_C	=	20	mA
Measuring frequency	f_i	=	36	MHz
Input impedance	Z_i	typ.	50 Ω//1	pF
Output impedance	Z_o	<	100	Ω
Voltage gain G_v (in dB) = 20 log $\frac{V_o}{V_i}$	G_v	typ.	24	dB
Interference voltage for K = 1%*	$V_{(int)rms}$	typ.	120	mV

* Input terminal voltage at 50 Ω internal resistance of signal generator, interference frequency 40 MHz, 80% modulated with 1 kHz.

SILICON PLANAR TRANSISTOR

P-N-P transistor in a microminiature envelope primarily intended for u.h.f. applications in thick and thin-film circuits.

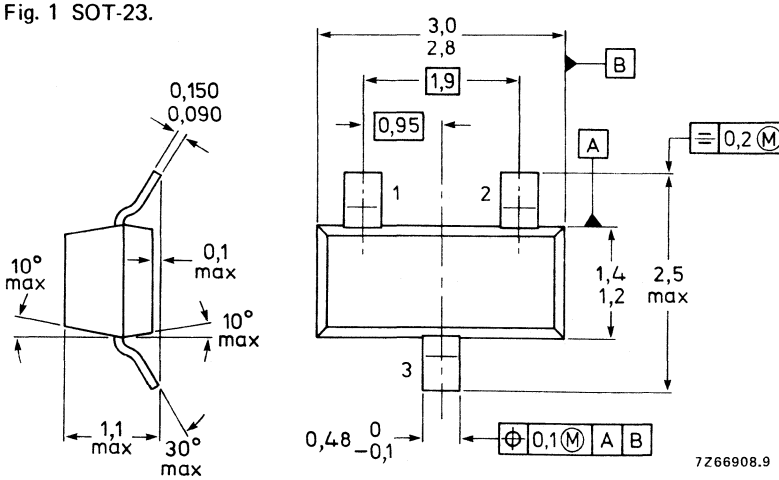
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 10 mA; $-V_{CB}$ = 10 V	f_T	typ.	1350	MHz
Transducer gain (common base) I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz R_S = 60 Ω; R_L = 500 Ω; T_{amb} = 25 °C	G_{tr}	typ.	16	dB
Noise figure (common base) I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz R_S = 60 Ω; R_L = 500 Ω	F	typ.	4,5	dB

MECHANICAL DATA

Fig. 1 SOT-23.

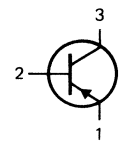
Dimensions in mm



TOP VIEW

Marking code

BF579 = G7



See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) see Fig. 2	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base) see Fig. 2	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector) see Fig. 2	$-V_{EBO}$	max.	3	V
Collector current	$-I_C$	max.	25	mA
Base current (d.c.)	$-I_B$	max.	10	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 15 V	$-I_{CBO}$	<	100	nA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 1 V	$-I_{EBO}$	<	100	nA
D.C. current gain				
I_C = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	>	20	
Transition frequency at f = 100 MHz				
I_E = 10 mA; $-V_{CB}$ = 10 V	f_T	typ.	1350	MHz
Feedback capacitance at f = 500 kHz				
I_E = 7 mA; $-V_{CB}$ = 10 V	C_{re}	typ.	0,46	pF
I_E = 0; $-V_{CB}$ = 10 V	C_{rb}	typ.	160	fF
Transducer gain (common base)				
I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz				
R_S = 60 Ω; R_L = 500 Ω	G_{tr}	typ.	16	dB
Noise figure (common base)				
I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz				
R_S = 60 Ω; R_L = 500 Ω	F	typ.	4,5	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

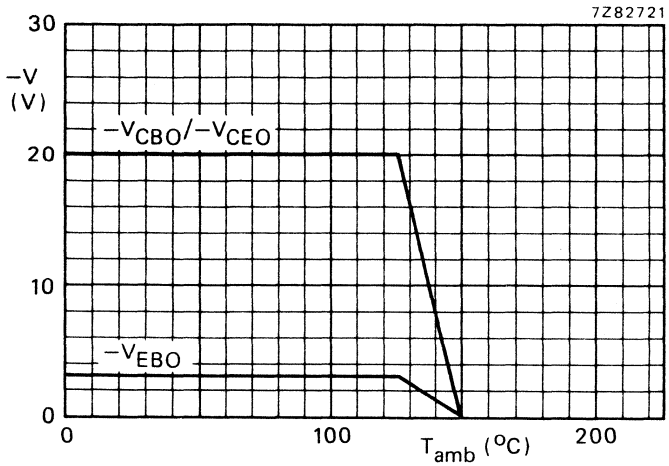


Fig. 2 Voltage derating curves.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

N-P-N transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers.

P-N-P complements are BF621 and BF623 respectively.

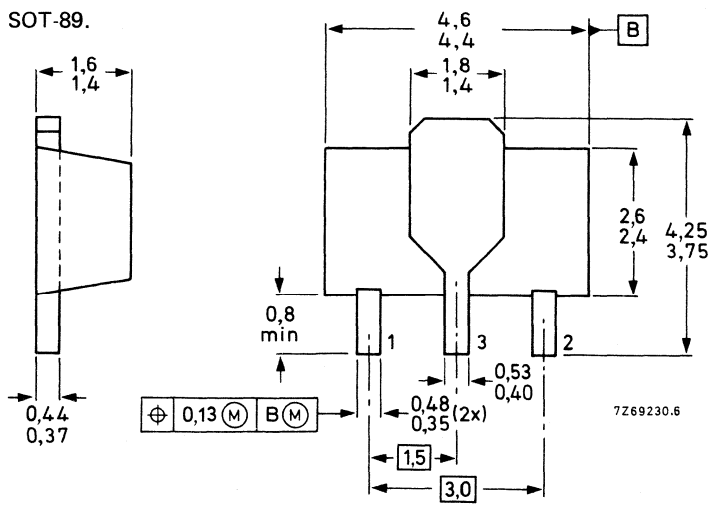
QUICK REFERENCE DATA

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Dimensions in mm

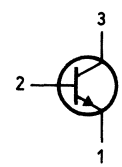
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BF620 = DC
BF622 = DA



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF620	BF622	
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage					
I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
D.C. current gain					
I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

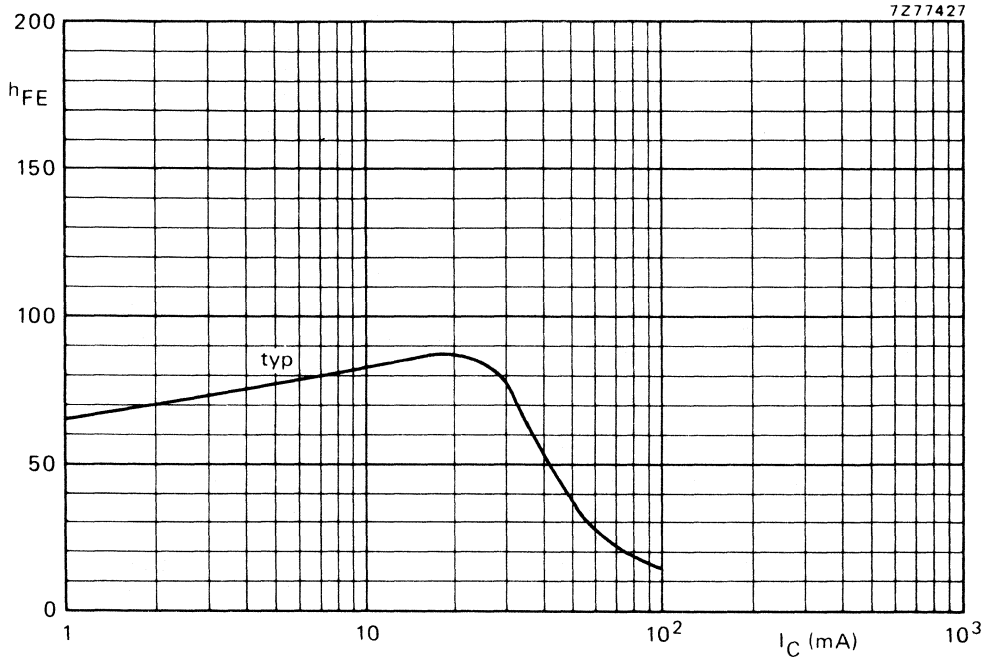


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

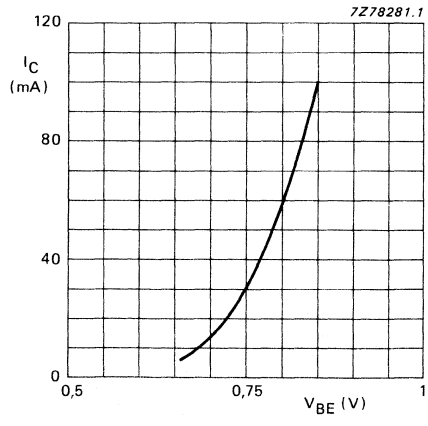


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

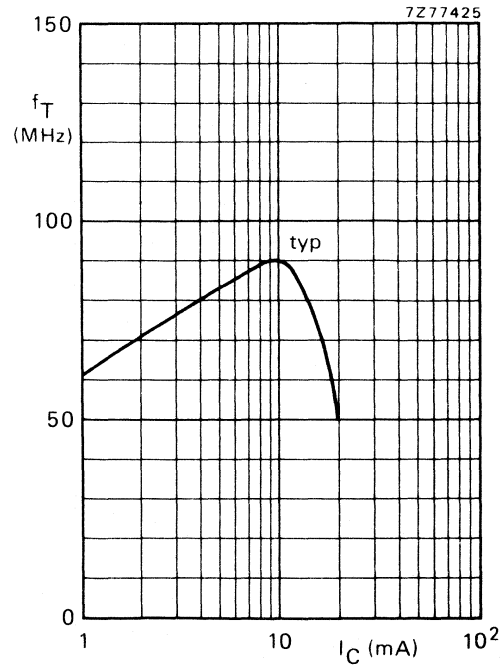


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

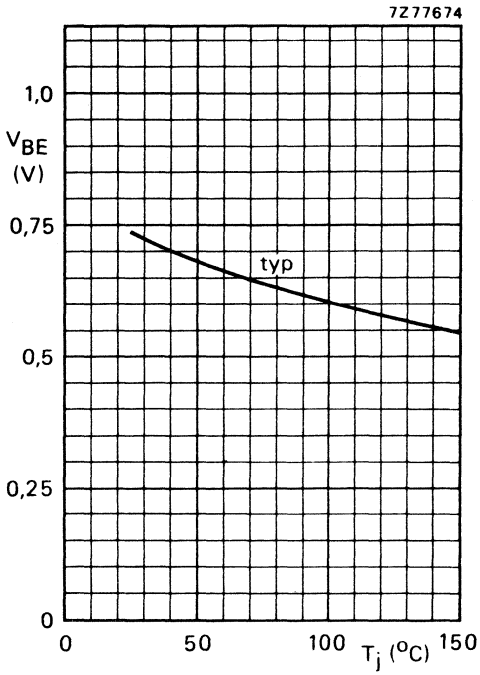


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

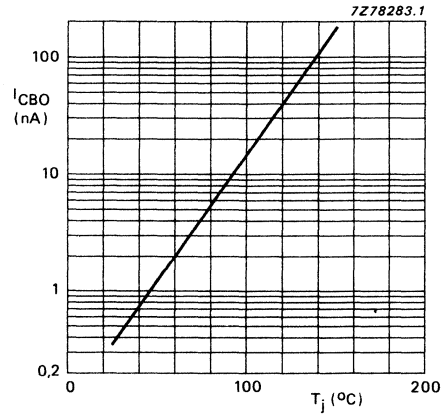


Fig. 6 V_{CB} = 200 V; typical values.

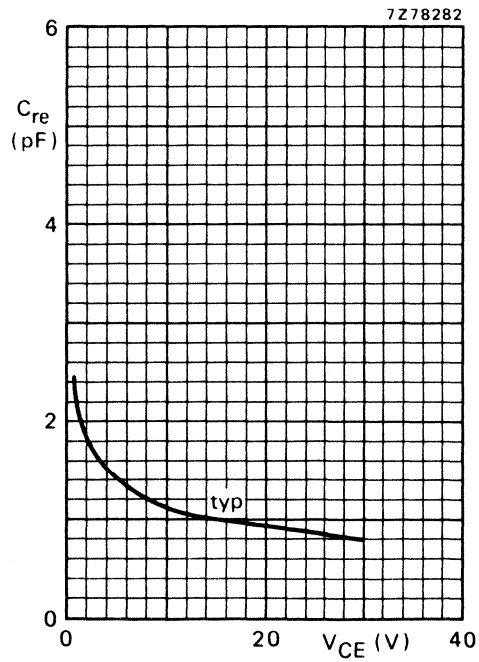


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

P-N-P transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers.

N-P-N complements are BF620 and BF622 respectively.

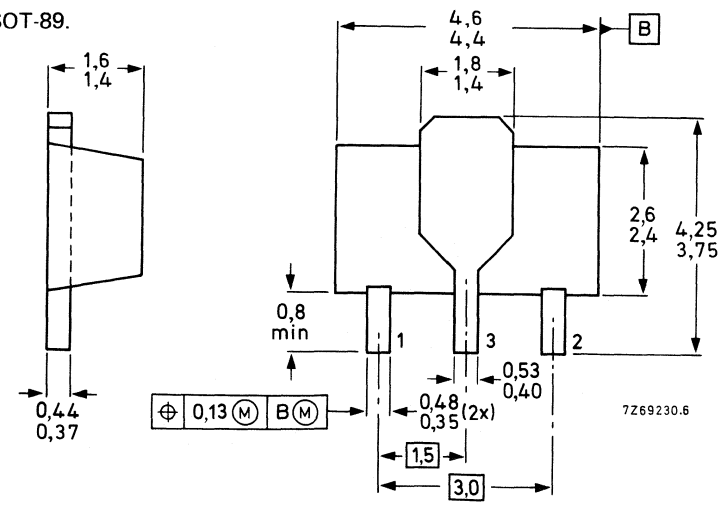
QUICK REFERENCE DATA

			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Fig. 1 SOT-89.

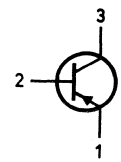
Dimensions in mm



BOTTOM VIEW

Marking code

BF621 = DF
BF623 = DB



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	--	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE *

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF621	BF623	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage					
$-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain					
$-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

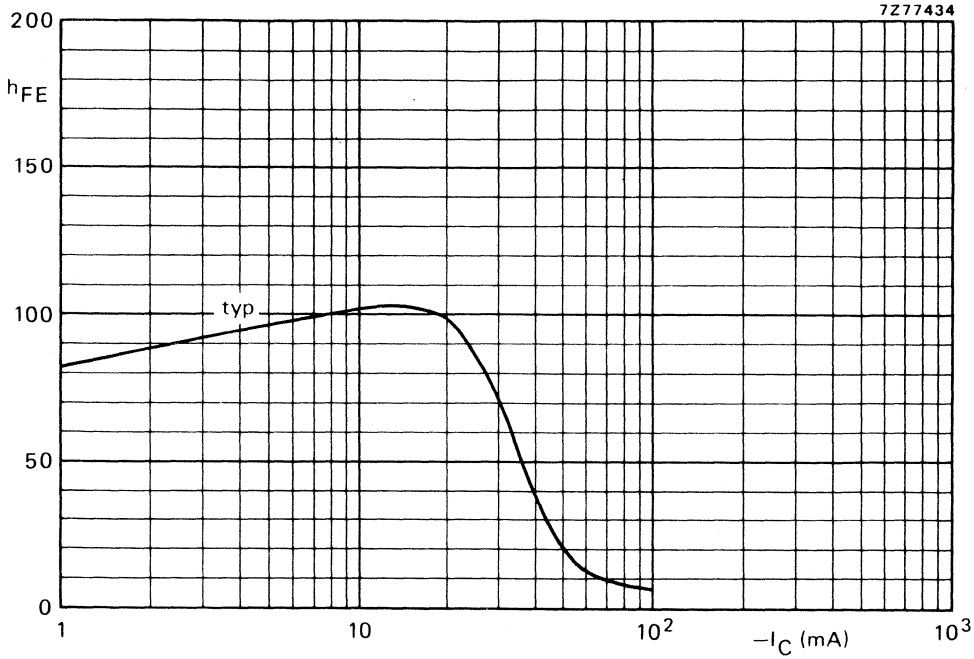


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

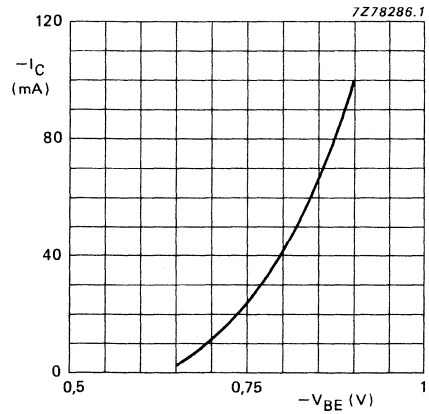


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

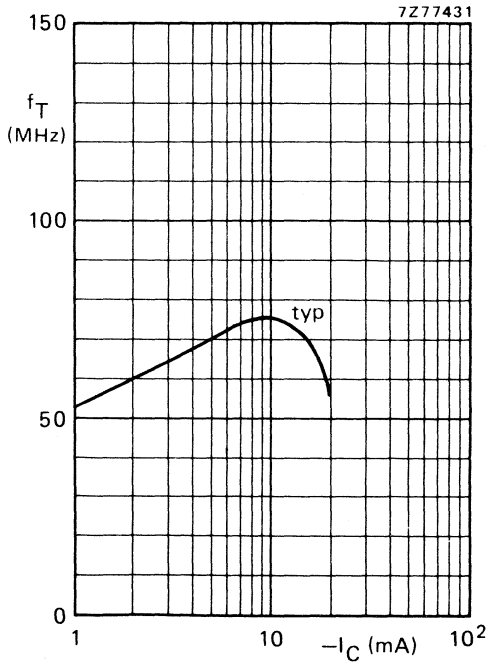


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

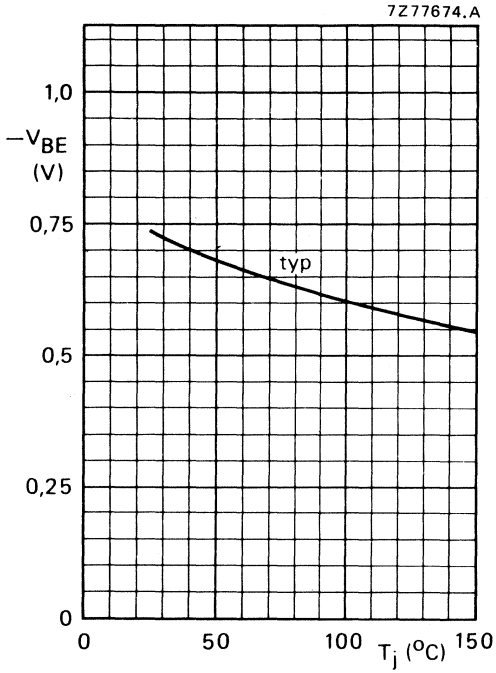


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

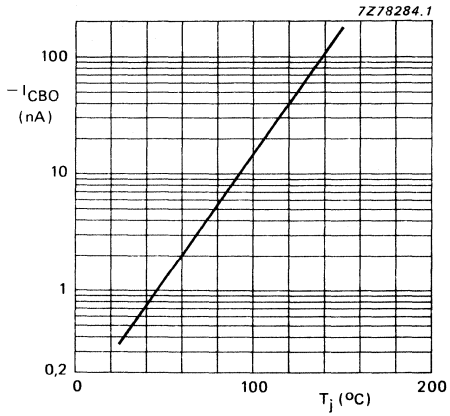


Fig. 6 $-V_{CB}$ = 200 V; typical values.

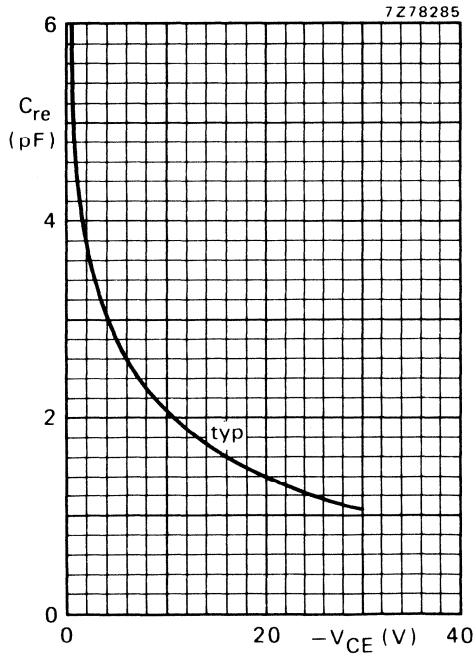


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON PLANAR TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope; intended for use as oscillator in v.h.f. tuners with extended frequency range and/or in conjunction with MOS-FETs in thick and thin-film circuits.

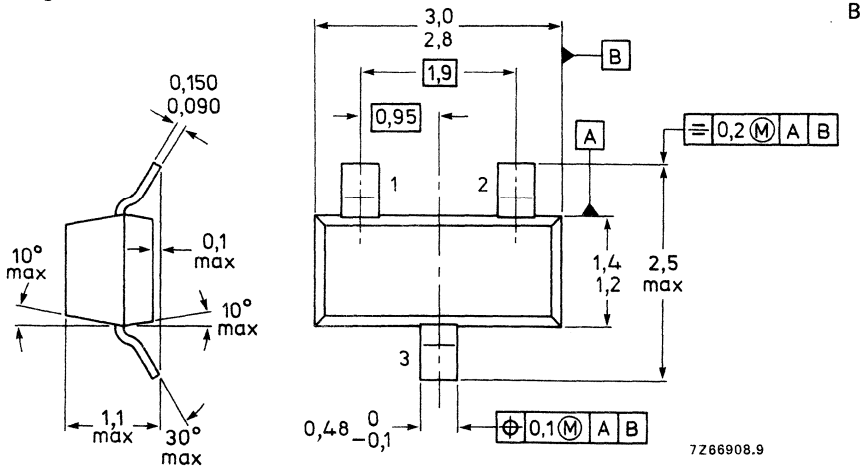
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Collector current (peak value)	$-I_{CM}$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 5 mA; $-V_{CB}$ = 10 V	f_T	typ.	650	MHz

MECHANICAL DATA

Dimensions in mm

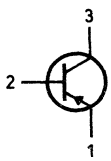
Fig. 1 SOT-23.



TOP VIEW

Marking code

BF660 = G8



See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	V
Collector current (peak value)	$-I_{CM}$	max.	25	mA
Base current (d.c.)	$-I_B$	max.	10	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	50	nA
D.C. current gain				
I_E = 3 mA; $-V_{CE}$ = 10 V	h_{FE}	>	30	
Transition frequency at f = 100 MHz				
I_E = 5 mA; $-V_{CB}$ = 10 V	f_T	typ.	650	MHz
Feedback capacitance at f = 1 MHz				
I_E = 1 mA; $-V_{CB}$ = 10 V	C_{re}	typ.	0,65	pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON EPITAXIAL TRANSISTORS

NPN transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers, and general purpose high voltage circuits.

PNP complements are BF721 and BF723 respectively.

QUICK REFERENCE DATA

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Dimensions in mm

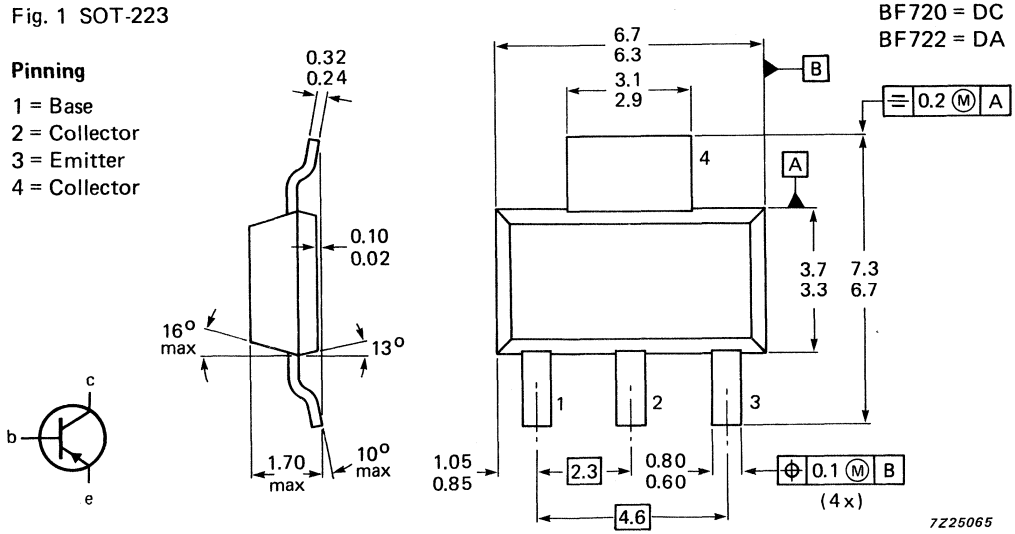
Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector

Marking

BF720 = DC
BF722 = DA



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (DC)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF720	BF722	
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage					
I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
DC current gain					
I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

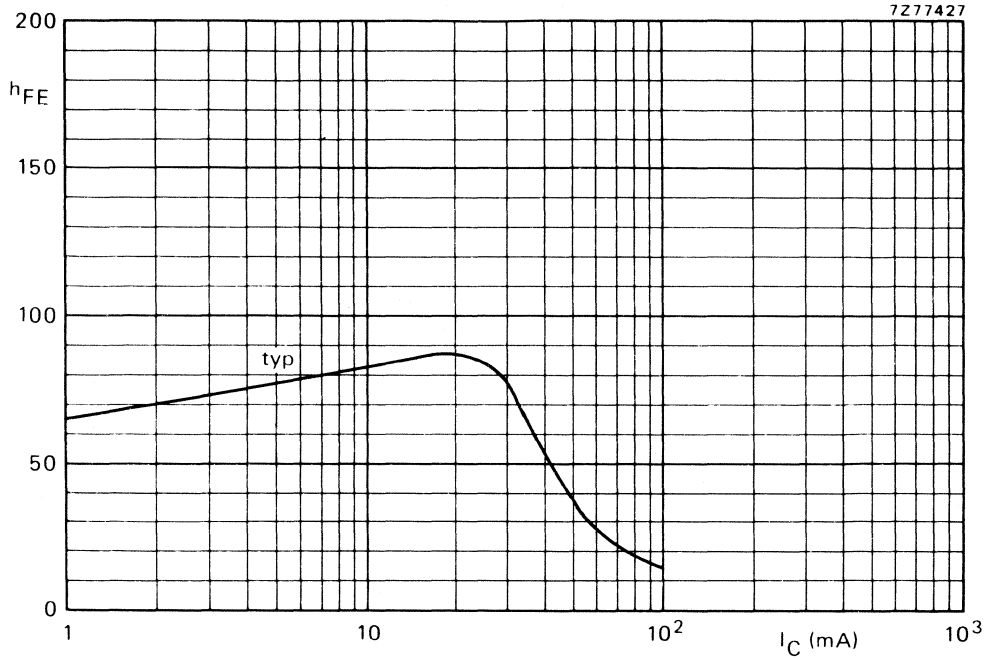


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

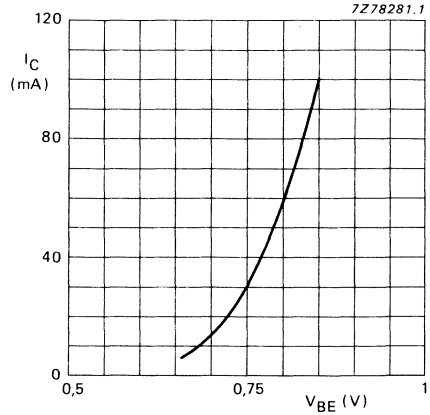


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

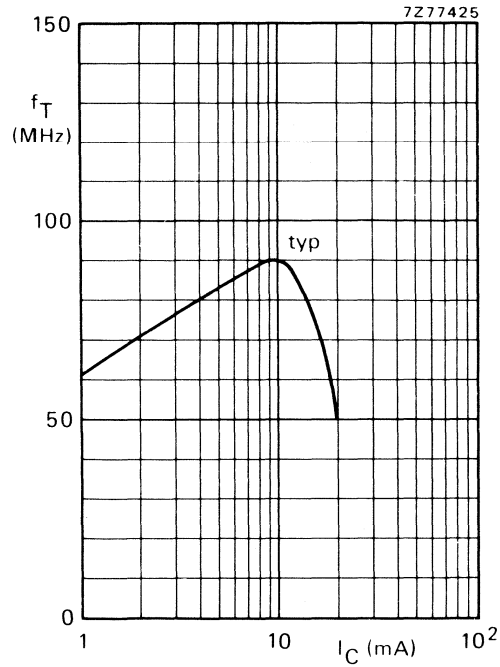


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

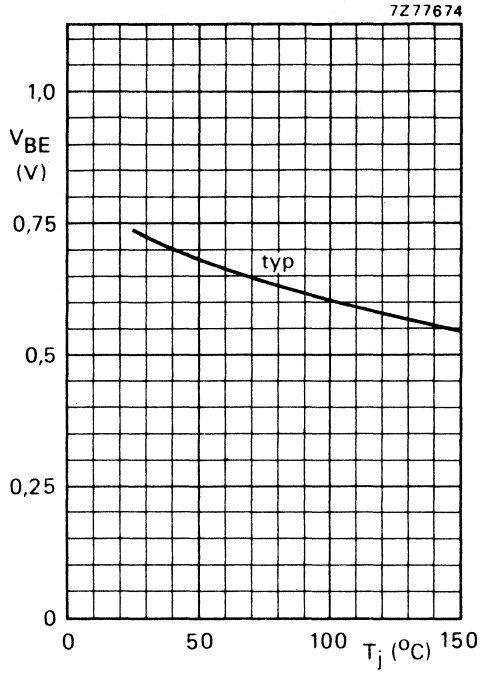


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

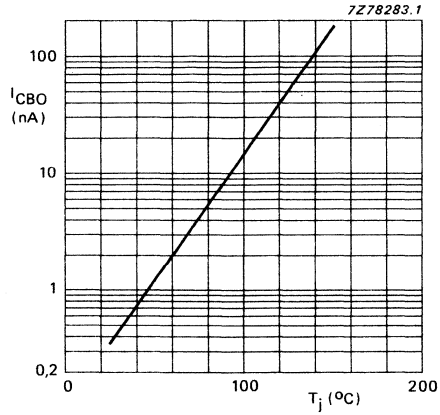


Fig. 6 V_{CB} = 200 V; typical values.

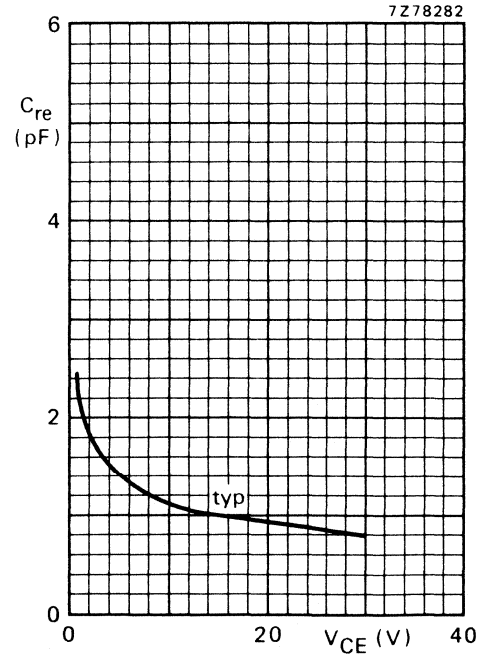


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

PNP transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers, and general purpose high voltage circuits.

NPN complements are BF720 and BF722 respectively.

QUICK REFERENCE DATA

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Fig. 1 SOT-223

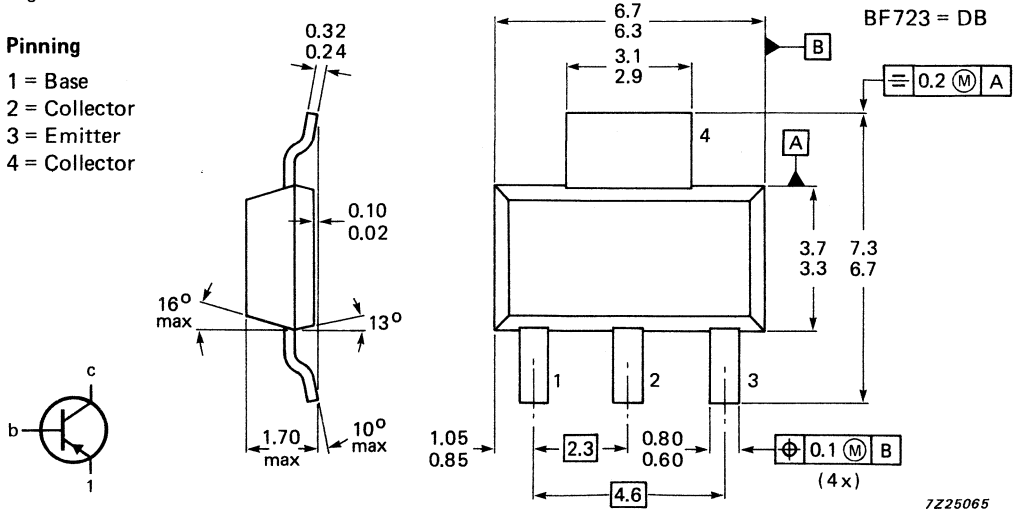
Dimensions in mm

Mark

BF721 = DF
BF723 = DB

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (DC)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF721	BF723	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2.7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage					
$-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
DC current gain					
$-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

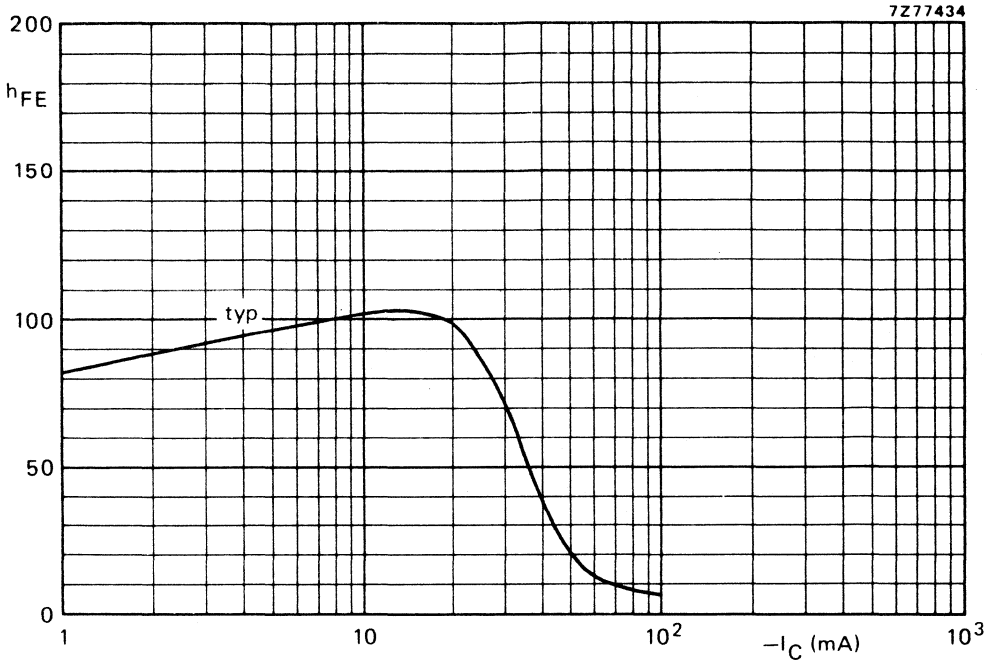


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

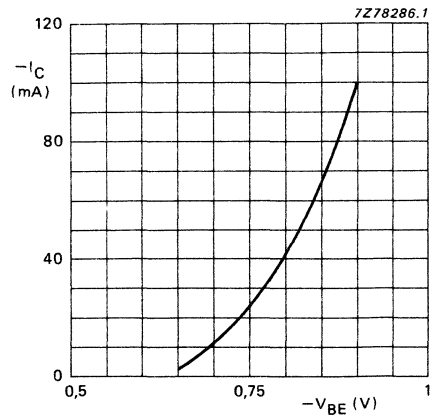


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

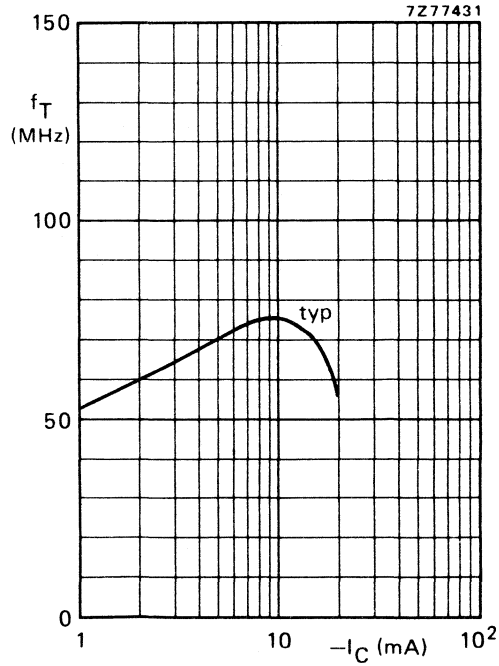


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

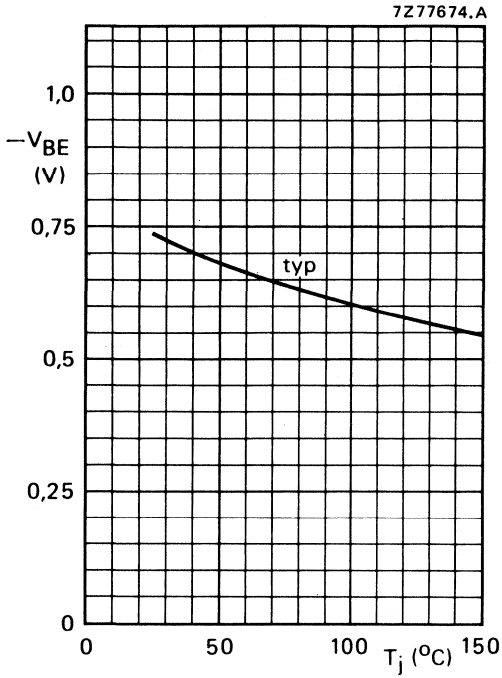


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

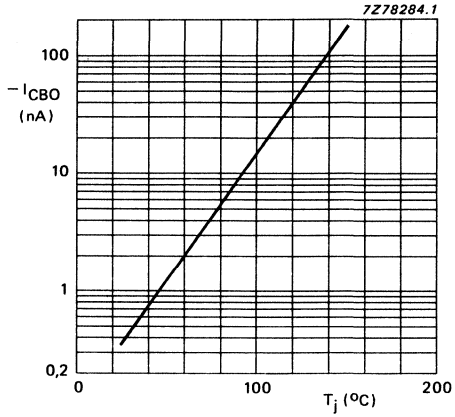


Fig. 6 $-V_{CB}$ = 200 V; typical values.

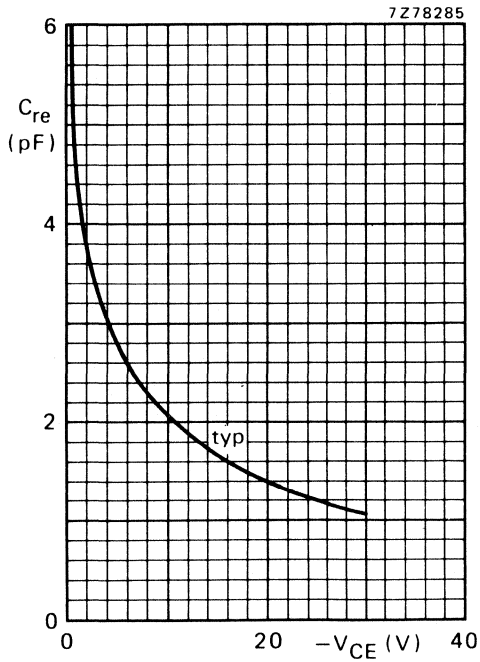


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. P-N-P components are BF821, BF823 respectively.

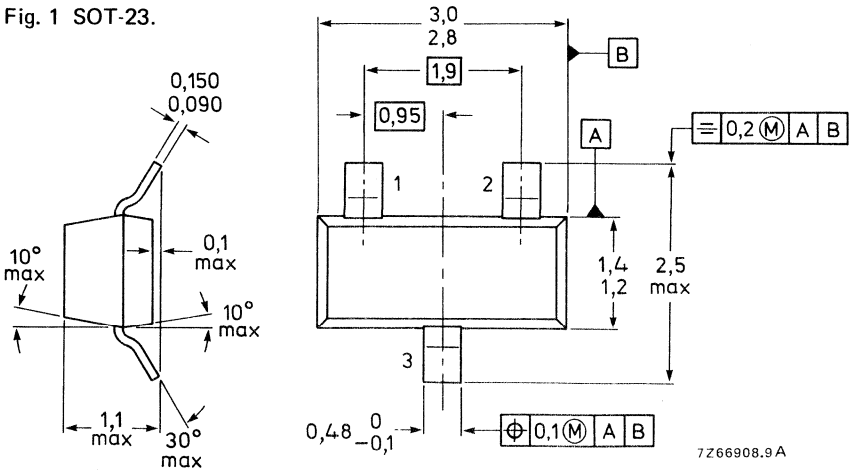
QUICK REFERENCE DATA

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz

MECHANICAL DATA

Fig. 1 SOT-23.

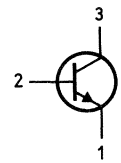
Dimensions in mm



TOP VIEW

Marking code

BF820 = 1 V
BF822 = 1 X



See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF820	BF822	
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	50	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage					
I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
D.C. current gain					
I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm²; thickness = 0,7 mm.

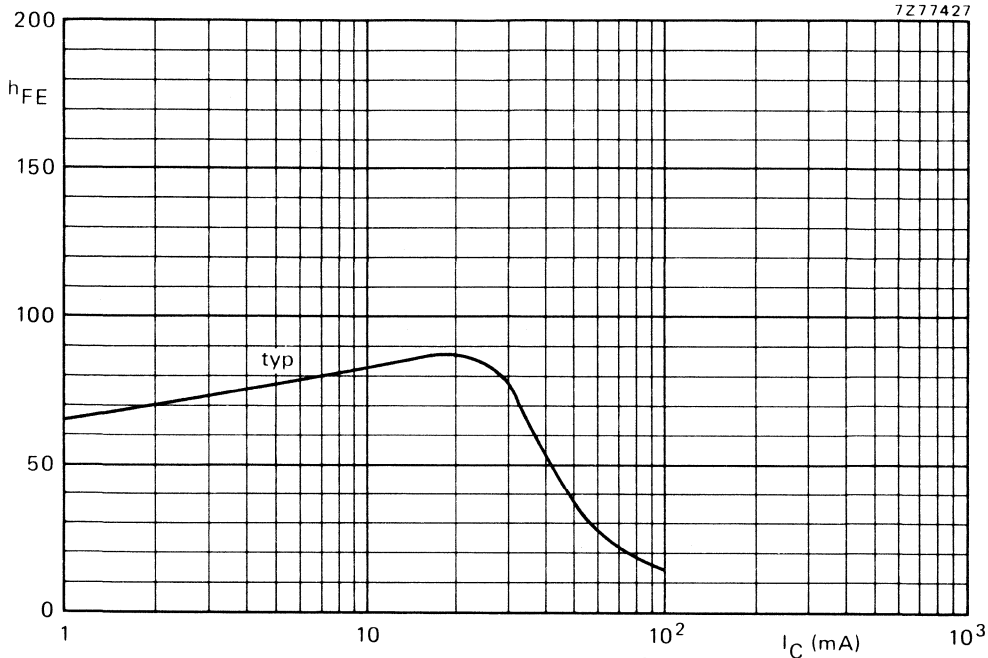


Fig. 2 V_{CE} = 20 V; T_j = 25 °C.

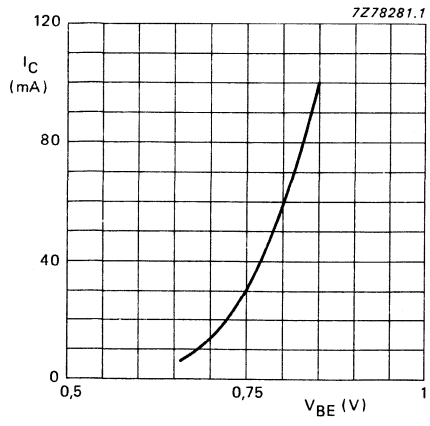


Fig. 3 V_{CE} = 20 V; T_j = 25 °C; typical values.

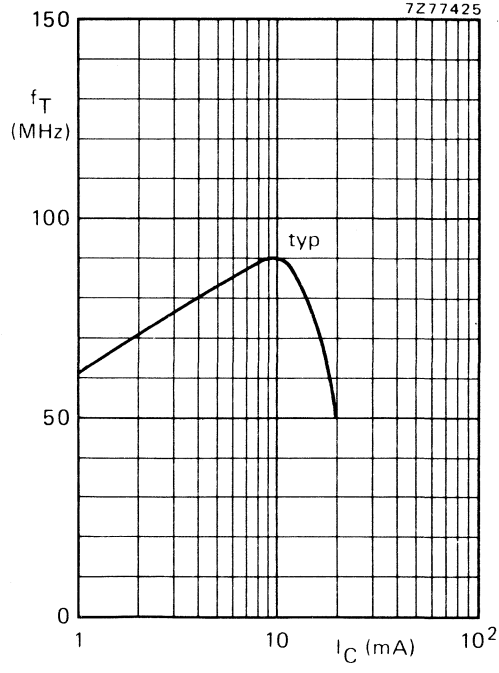


Fig. 4 V_{CE} = 10 V; T_j = 25 °C, f = 35 MHz.

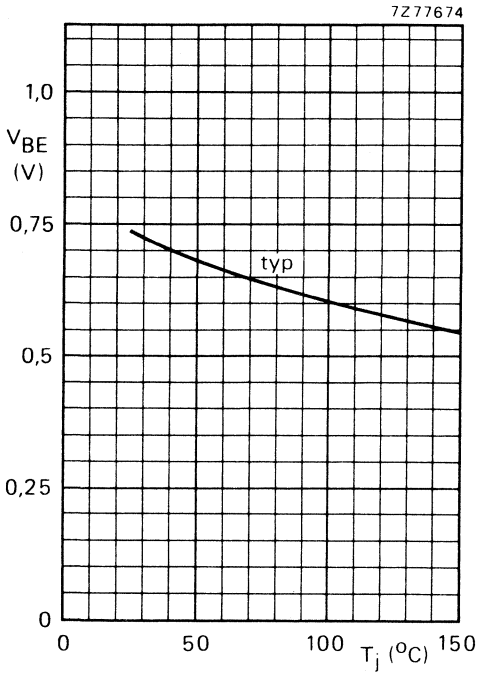


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

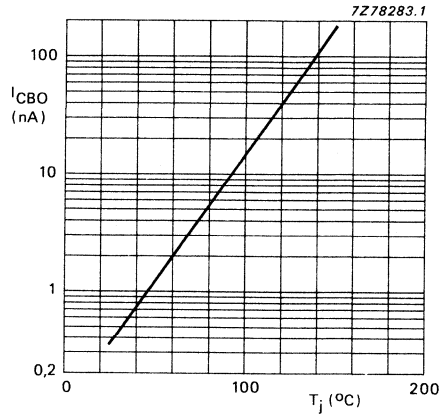


Fig. 6 V_{CB} = 200 V; typical values.

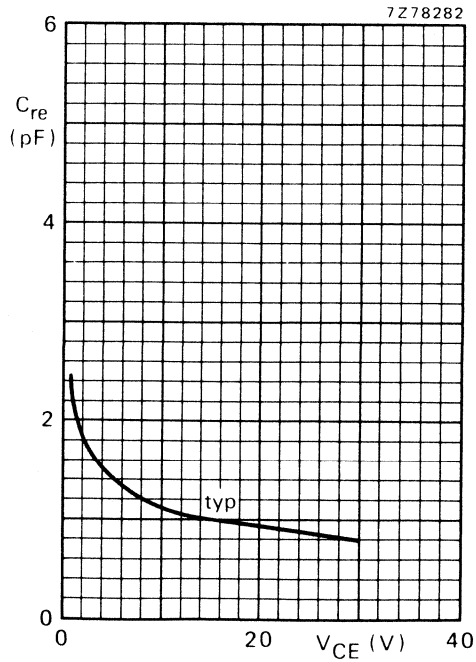


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

P-N-P transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. N-P-N complements are BF820, BF822 respectively.

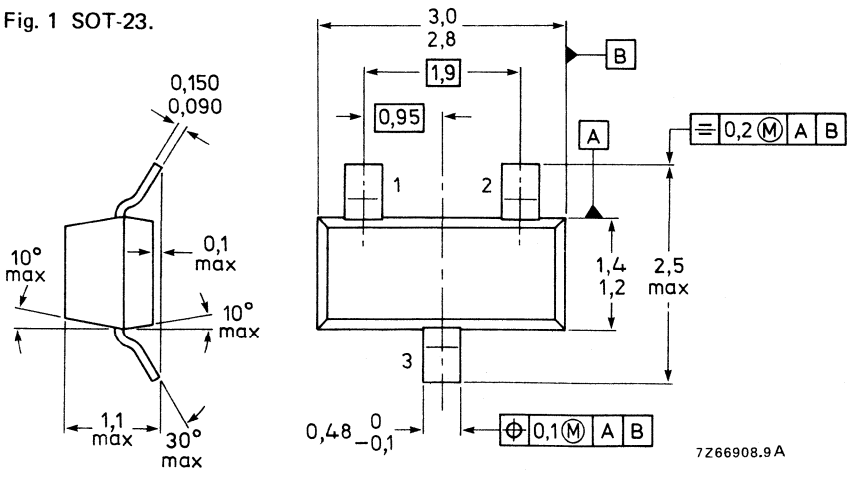
QUICK REFERENCE DATA

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz

MECHANICAL DATA

Fig. 1 SOT-23.

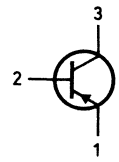
Dimensions in mm



TOP VIEW

Marking code

BF821 = 1W
BF823 = 1Y



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF821	BF823	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	50	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage					
$-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain					
$-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm²; thickness = 0,7 mm.

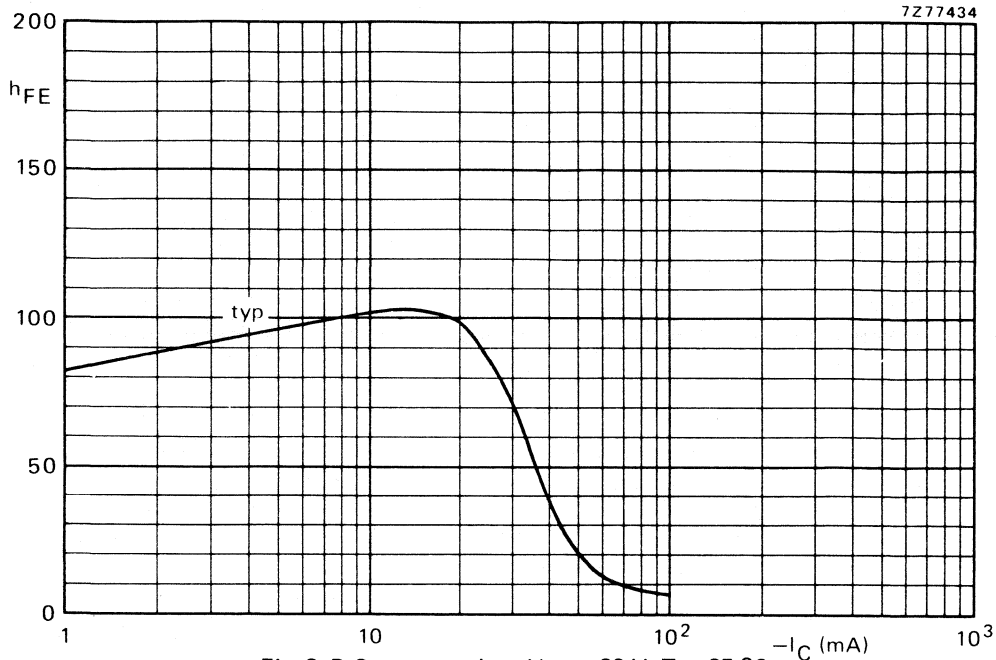


Fig. 2 D.C. current gain. $-V_{CE}$ = 20 V; T_j = 25 °C.

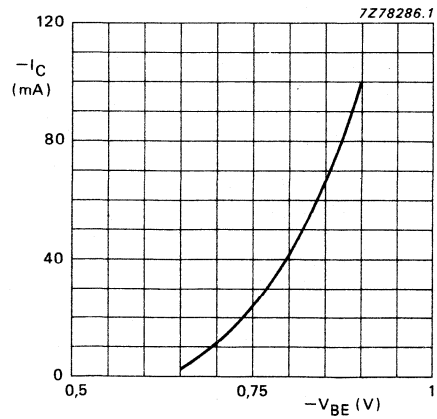


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

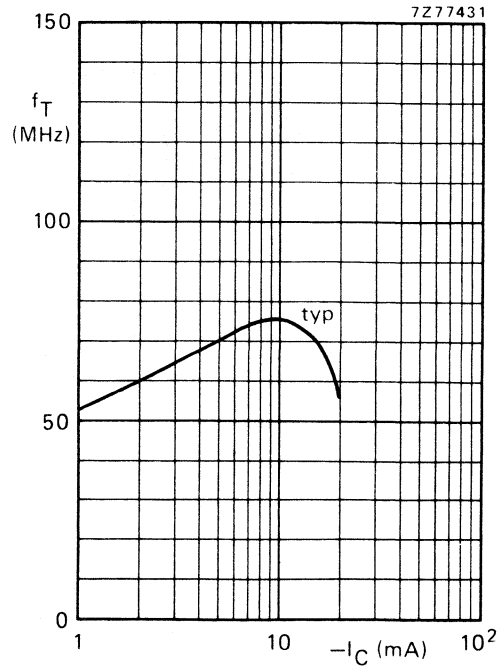


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

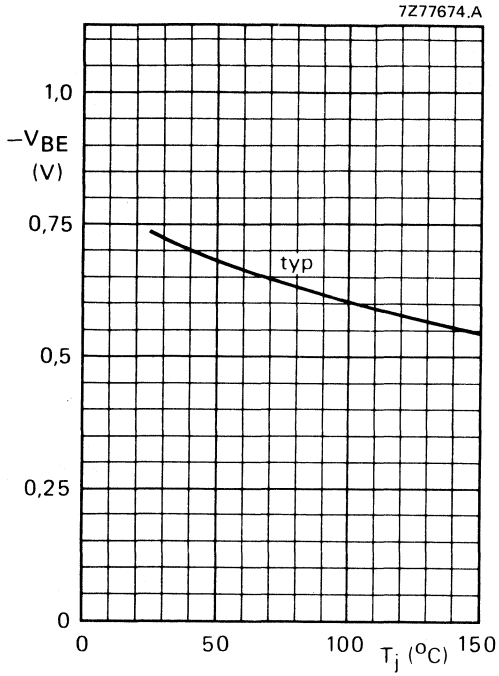


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

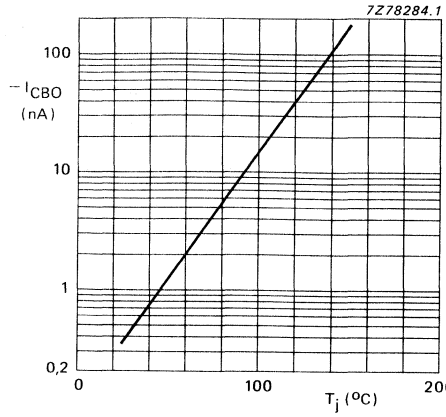


Fig. 6 $-V_{CB}$ = 200 V; typical values.

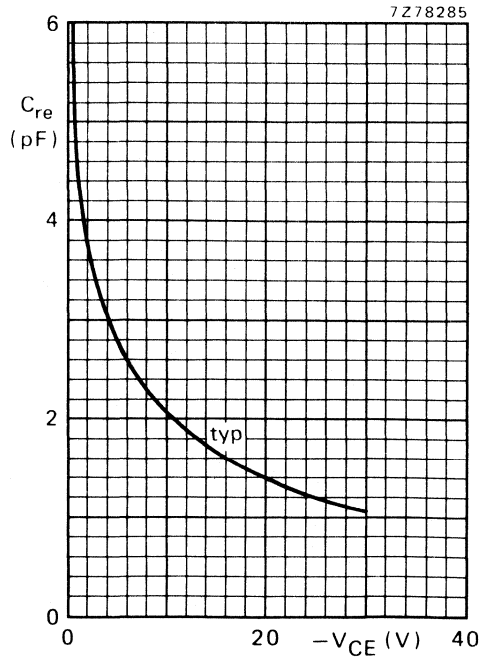


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

H.F. SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic SOT-23 envelope especially intended for r.f. stages in f.m. front-ends in common base configuration for SMD applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Base current $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-I_B$	typ. <	80 μA 160 μA
Transition frequency $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	f_T	typ.	450 MHz
Noise figure at f = 100 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; G_s = 16,7 mS	F	typ.	3 dB
Feedback capacitance at f = 1 MHz V_{EB} = 0; $-V_{CB}$ = 10 V	C_{rb}	typ.	0,1 pF

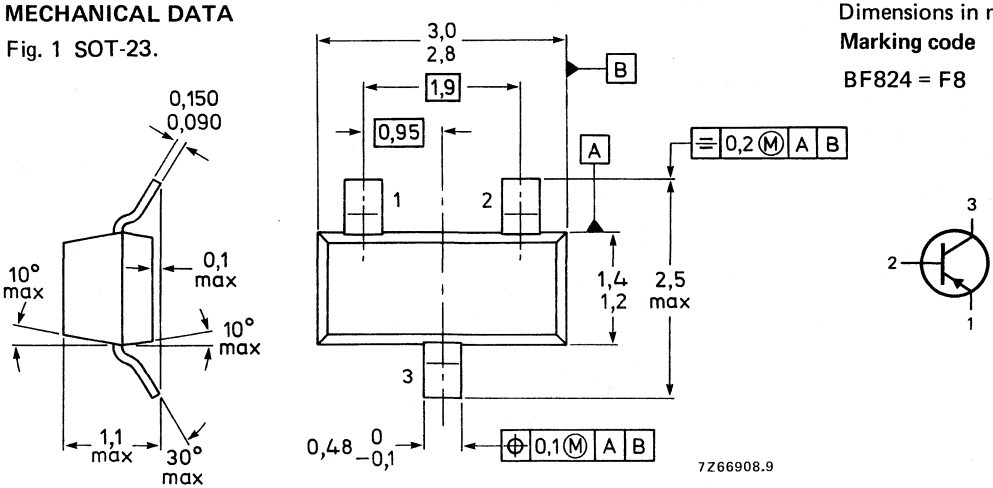
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

BF824 = F8



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−55 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	50 nA
Emitter cut-off current			
I_C = 0; $-V_{EB}$ = 4 V	$-I_{EBO}$	<	10 μA
Base current			
$-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-I_B$	typ.	80 μA
		<	160 μA
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	$-I_B$	typ.	22 μA
Base-emitter voltage			
$-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-V_{BE}$	typ.	0,76 V
Transition frequency at f = 100 MHz			
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	350 MHz
$-I_C$ = 4 mA; $-V_{CE}$ = 10 V	f_T	typ.	450 MHz
$-I_C$ = 8 mA; $-V_{CE}$ = 10 V	f_T	typ.	440 MHz
Feedback capacitance at f = 1 MHz			
V_{EB} = 0; $-V_{CB}$ = 10 V	C_{rb}	typ.	0,1 pF
Noise factor at f = 100 MHz			
$-I_C$ = 2 mA; $-V_{CE}$ = 10 V; G_s = 16,7 mS	F	typ.	3 dB
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V; G_s = 6,7 mS; $-jB_s$ = 5 mS	F	typ.	3,5 dB

* Mounted on ceramic substrate of 8 mm x 10 mm x 0,7 mm.

y-parameters (common base) at f = 100 MHz
$-I_C$ = 4 mA; $-V_{CB}$ = 10 V

Input conductance	g_{ib}	typ.	125 mS
Input capacitance	C_{ib}	typ.	64 pF
Transfer admittance	$\|y_{fb}\|$	typ.	100 mS
Phase angle of transfer admittance	φ_{fb}	typ.	147°
Output conductance	g_{ob}	typ.	40 μS
Output capacitance	C_{ob}	typ.	1,25 pF
Feedback admittance	$\|y_{rb}\|$	typ.	220 μS
Phase angle of feedback admittance	φ_{rb}	typ.	85°

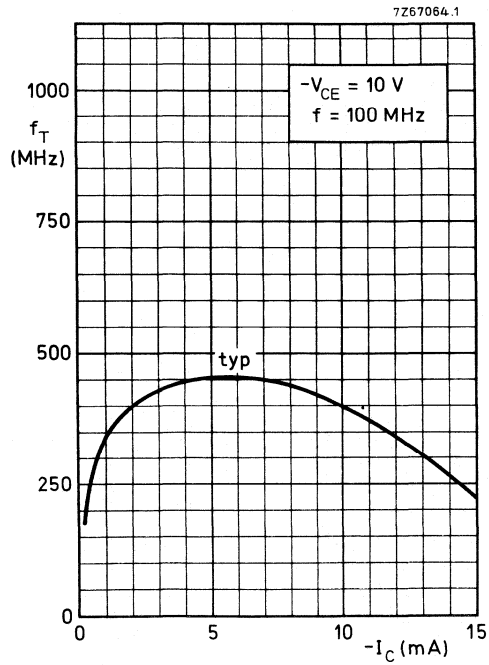


Fig. 2.

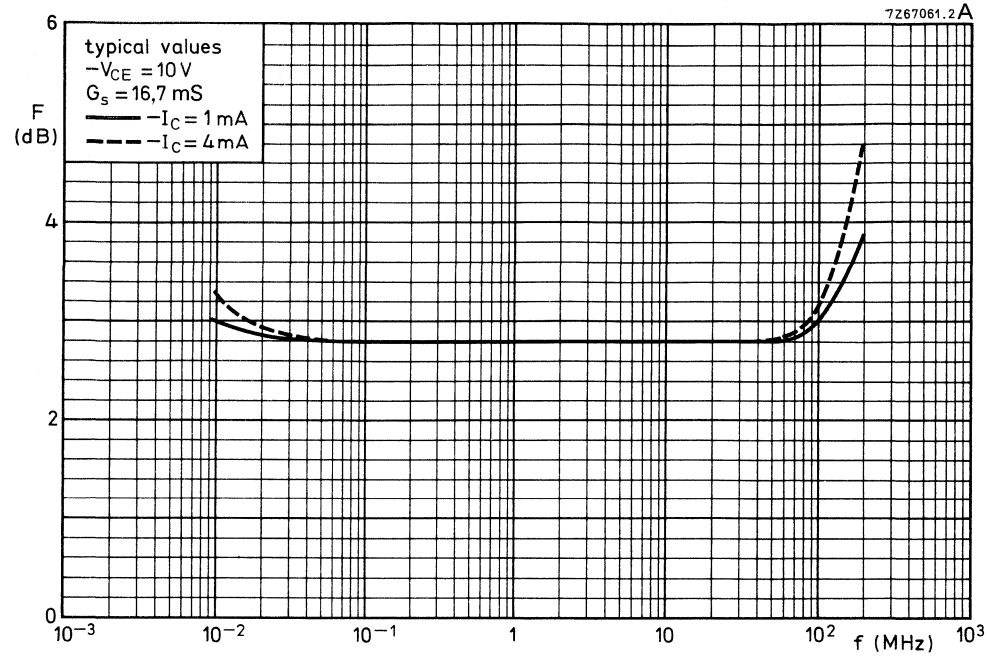


Fig. 3.

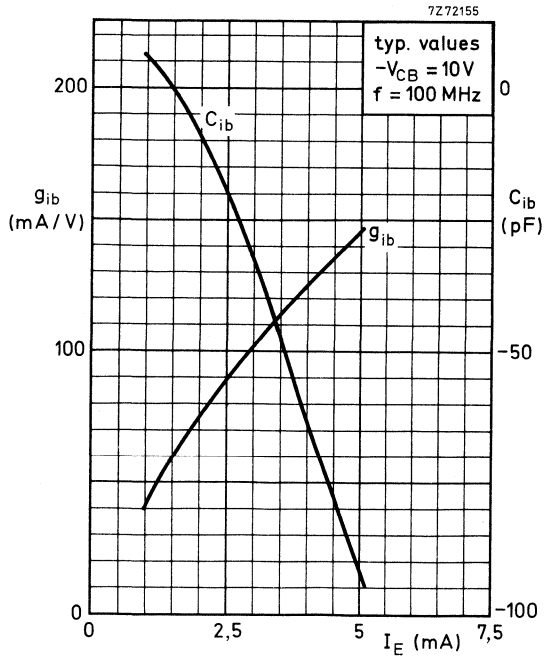


Fig. 4.

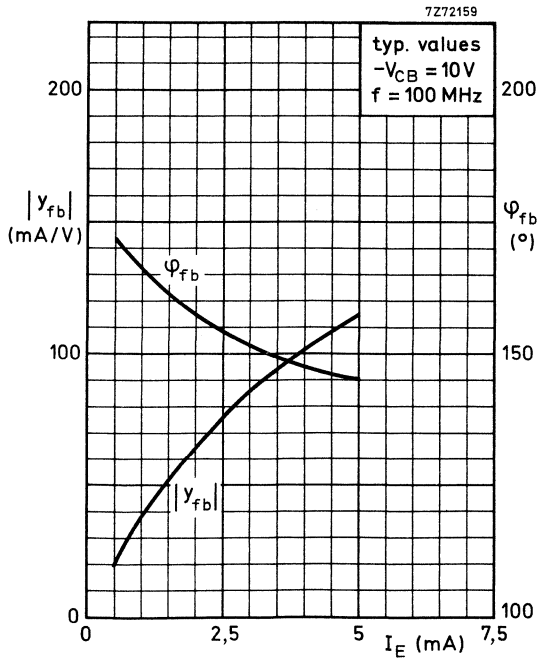


Fig. 5.

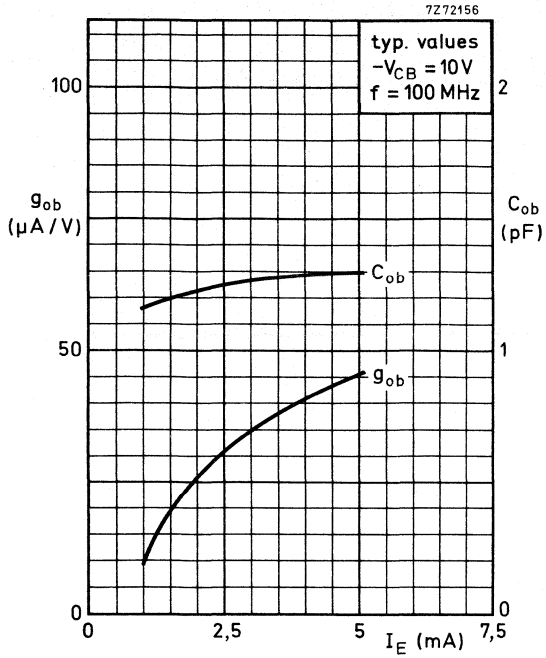


Fig. 6.

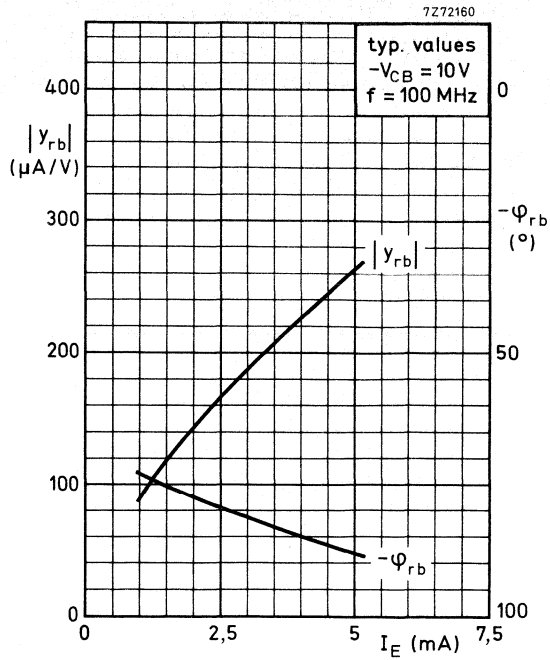


Fig. 7.

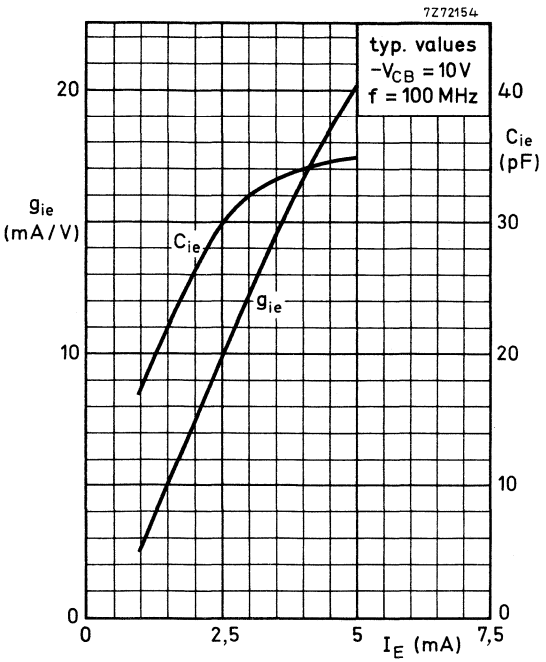


Fig. 8.

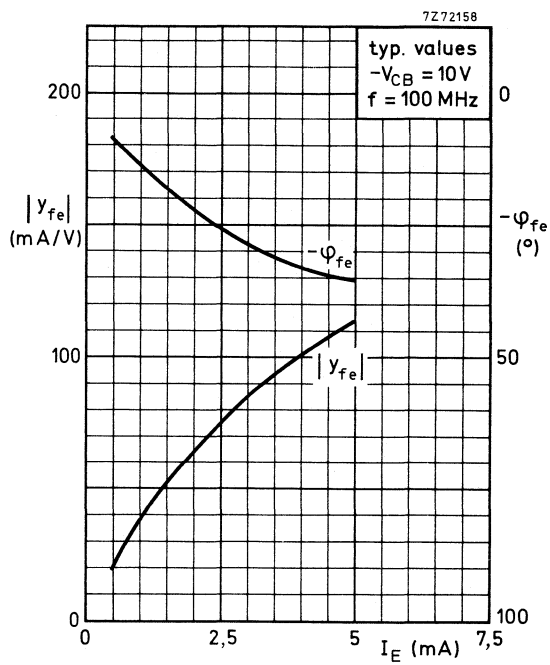


Fig. 9.

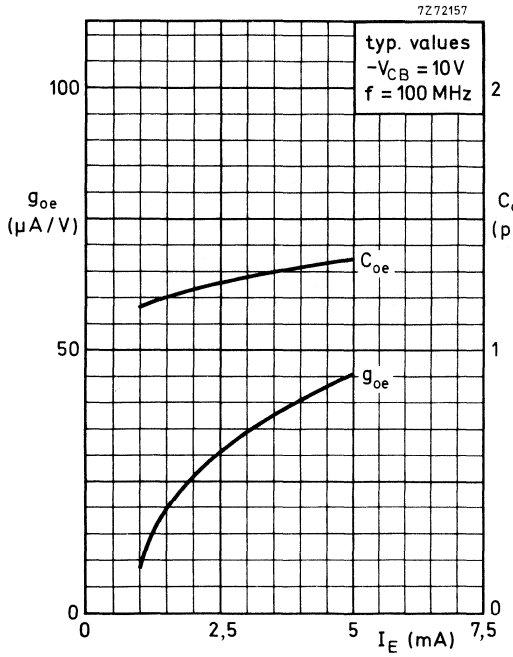

7Z72157
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
g_{oe} (μA/V)
C_{oe} (pF)
C_{oe}
g_{oe}
100
50
0
2
1
0
0
2,5
5
7,5
I_E (mA)

Fig. 10.

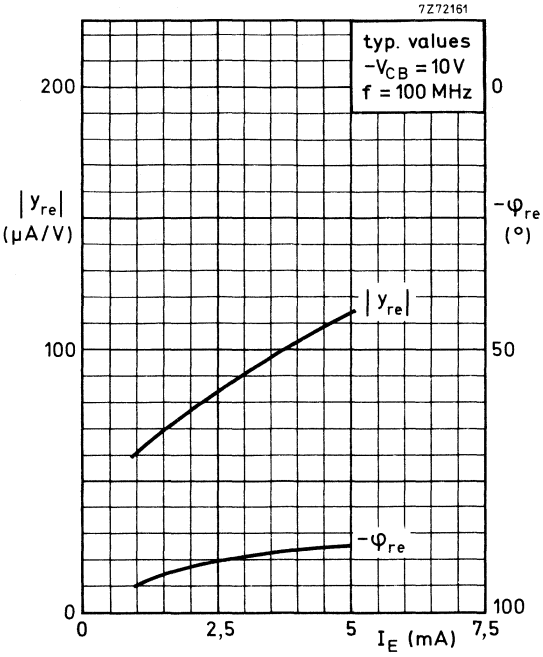

7Z72161
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
$|y_{re}|$ (μA/V)
$-\varphi_{re}$ (°)
$|y_{re}|$
$-\varphi_{re}$
200
100
0
0
50
100
0
2,5
5
7,5
I_E (mA)

Fig. 11.

SILICON PLANAR TRANSISTORS

N-P-N transistors in a plastic SOT-23 envelope.

Primarily intended for a.m. mixers and i.f. amplifiers in a.m./f.m. receivers using SMD technology.

QUICK REFERENCE DATA

			BF840 | BF841	
Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Collector current (d.c.)	I_C	max.	25	mA
Base current I_C = 1 mA; V_{CE} = 10 V	I_B		4,5–15 | 8–28	μA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ.	0,3	pF

MECHANICAL DATA

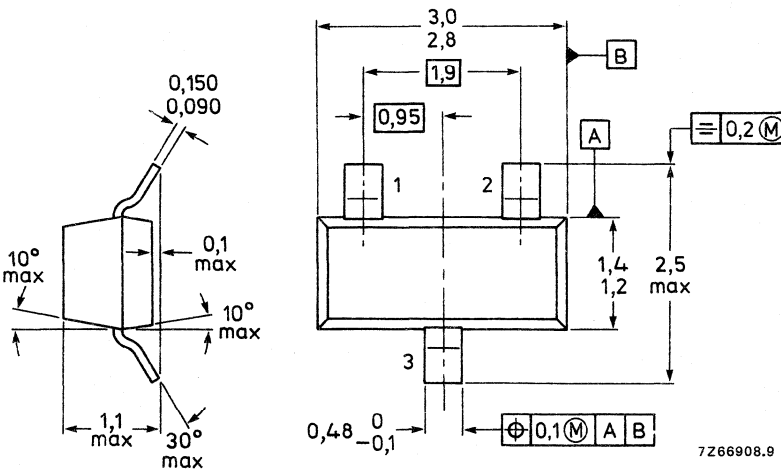
Fig. 1 SOT-23.

Dimensions in mm

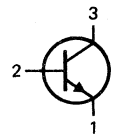
Marking code:

BF840 : F3

BF841 : F31



TOP VIEW



See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 20 V	I_{CBO}	max.	100	nA
Base-emitter voltage I_C = 1 mA; V_{CE} = 10 V	V_{BE}	typ. 650 to 740	700	mV mV

			BF840	BF841	
Base current I_C = 1 mA; V_{CE} = 10 V	I_B		4,5–15	8–28	μA
Transition frequency at f = 100 MHz I_C = 1 mA; V_{CE} = 10 V	f_T	typ.	380	380	MHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ.	0,3	0,3	pF
Noise figure I_C = 1 mA; V_{CE} = 10 V; f = 0,2 MHz; R_S = 200 Ω	F	typ.	1,5	2,0	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT-143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in u.h.f. applications in television tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20 V
Drain current (peak value)	I_{DM}	max.	30 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 7 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$\lvert y_{fs} \rvert$	typ.	12 mS
Feedback capacitance at f = 1 MHz I_D = 7 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 7 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; f = 800 MHz	F	typ.	2,8 dB

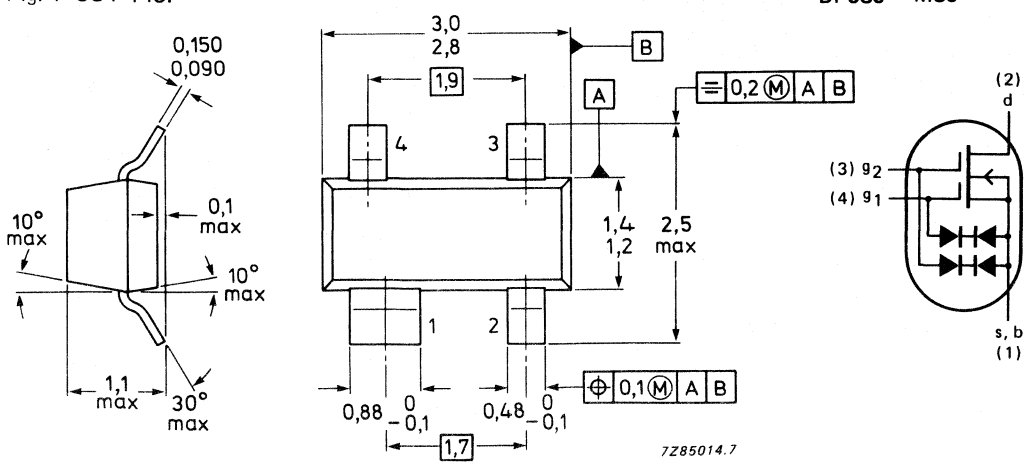
MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm

Marking code

BF989 = M89



TOP VIEW

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (d.c. or average)	I_D	max.	20 mA
Drain current (peak value)	I_{DM}	max.	30 mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C*	P_{tot}	max.	200 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	460 K/W

STATIC CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	50 nA
$\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	50 nA
Drain current			
V_{DS} = 10 V; V_{G1-S} = 0; + V_{G2-S} = 4 V; T_j = 25 °C	I_{DSS}		2 to 20 mA
Gate-source breakdown voltages			
$\pm I_{G1-SS}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$		6 to 20 V
$\pm I_{G2-SS}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$		6 to 20 V
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$-V_{(P)G1-S}$	<	2,7 V
I_D = 20 μA; V_{DS} = 10 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	<	2,7 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 7 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	9,5 mS
		typ.	12 mS
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	1,8 pF
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,0 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0,9 pF
→ Noise figure at G_S = 2 mS; $B_S = B_S$ opt			
f = 200 MHz	F	typ.	1,6 dB
f = 800 MHz	F	typ.	2,8 dB

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic microminiature envelope with source and substrate interconnected, intended for u.h.f. applications, such as u.h.f. television tuners and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

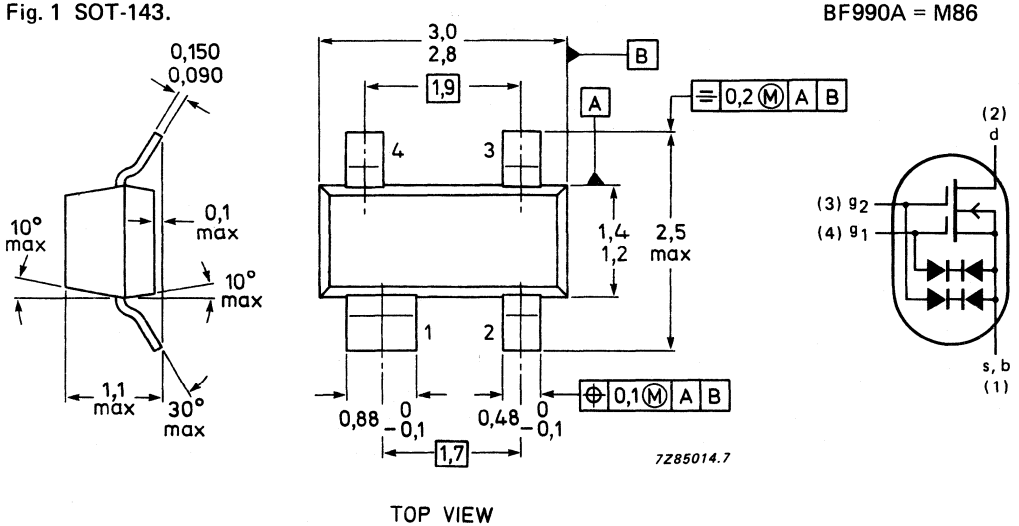
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	18 V
Drain current (average)	$I_{D(AV)}$	max.	30 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs}\rvert$	typ.	19 mS
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	2,0 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

Marking code

BF990A = M86

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	18	V
Drain current (average)	$I_{D(AV)}$	max.	30	mA
Gate 1-source current	$\pm I_{G1-S}$	max.	10	mA
Gate 2-source current	$\pm I_{G2-S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C*	P_{tot}	max.	200	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	460	K/W

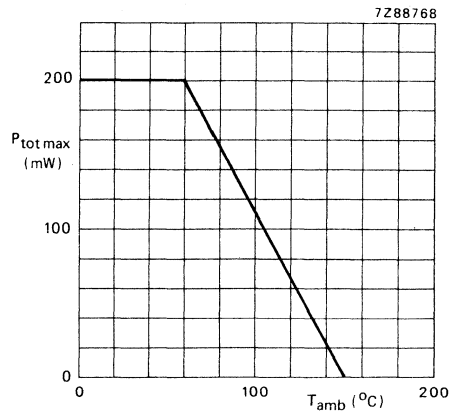


Fig. 2 Power derating curve.

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

STATIC CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate cut-off currents

gate 1; $\pm V_{G1-S}$ = 7 V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	25	nA
gate 2; $\pm V_{G2-S}$ = 7 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	25	nA

Gate-source breakdown voltages

gate 1; $\pm I_{G1-SS}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$	>	8	V
gate 2; $\pm I_{G2-SS}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$	>	8	V

Gate-source cut-off voltages

gate 1; I_D = 20 μA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$-V_{(P)G1-S}$	<	1,3	V
gate 2; I_D = 20 μA; V_{DS} = 10 V; $V_{G1-S} = 0$	$-V_{(P)G2-S}$	<	1,1	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	18	mS	←
		typ.	19	mS	
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	2,6	pF	
		<	3,0	pF	
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,4	pF	
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25	fF	
Output capacitance at f = 1 MHz	C_{os}	typ.	1,2	pF	
Noise figure at f = 800 MHz; G_S = 5 mS; $B_S = B_S$ opt	F	typ.	2,0	dB	←

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT-143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners and f.m. tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

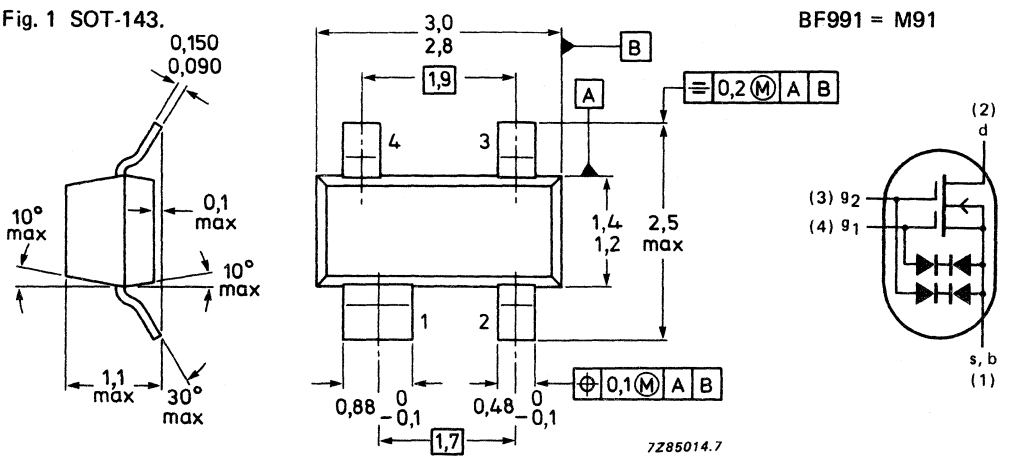
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	20 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$\lvert y_{fs} \rvert$	typ.	14 mS
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V	C_{rs}	typ.	20 fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; f = 200 MHz	F	typ.	0,7 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

Marking code

BF991 = M91

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (d.c. or average)	I_D	max.	20 mA
Drain current (peak value)	I_{DM}	max.	30 mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C*	P_{tot}	max.	200 mW
Storage temperature	T_{stg}	−65 to + 150	°C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	460 K/W

STATIC CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	50 nA
$\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	50 nA
Drain current			
V_{DS} = 10 V; V_{G1-S} = 0; + V_{G2-S} = 4 V; T_j = 25 °C	I_{DSS}		4 to 25 mA
Gate-source breakdown voltages			
$\pm I_{G1-SS}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$	>	6 V
$\pm I_{G2-SS}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$	>	6 V
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$-V_{(P)G1-S}$	<	2,5 V
I_D = 20 μA; V_{DS} = 10 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	<	2,5 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	10 mS
		typ.	14 mS
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	2,1 pF
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,0 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	20 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1,1 pF
Noise figure			
→ f = 100 MHz; G_S = 1 mS; $B_S = B_{S\ opt}$	F	typ.	0,7 dB
		<	1,7 dB
→ f = 200 MHz; G_S = 2 mS; $B_S = B_{S\ opt}$	F	typ.	1,0 dB
		<	2,0 dB
Transducer gain **			
→ f = 100 MHz; G_S = 1 mS; $B_S = B_{S\ opt}$; G_L = 0,5 mS; $B_L = B_{L\ opt}$	G_{tr}	typ.	29 dB
→ f = 200 MHz; G_S = 2 mS; $B_S = B_{S\ opt}$; G_L = 0,5 mS; $B_L = B_{L\ opt}$	G_{tr}	typ.	26 dB

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Crystal mounted in a SOT-103 envelope.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT-143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners, FM tuners with a 12 volt supply voltage. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

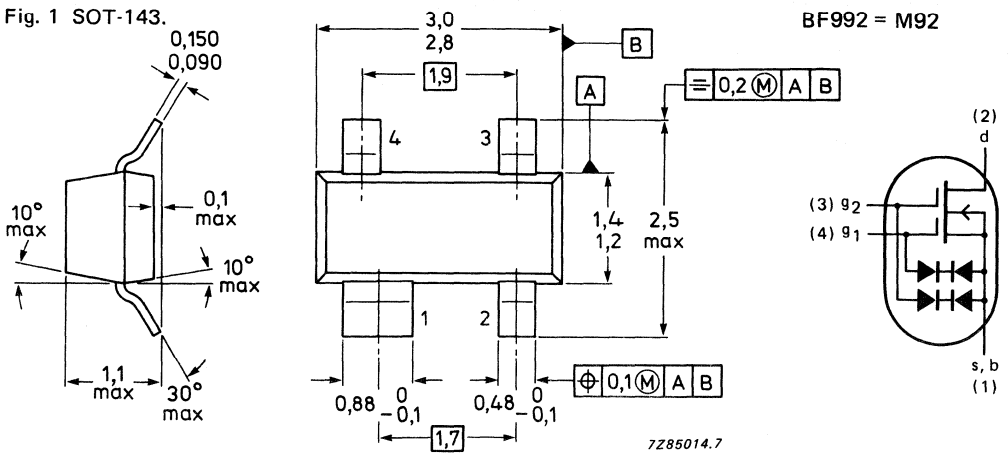
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	40 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	25 mS
Feedback capacitance at f = 1 MHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	30 fF
Noise figure at G_S = 2 mS I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1,2 dB

MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm



Marking code

BF992 = M92

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain current (d.c. or average)	I_D	max.	40	mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C*	P_{tot}	max.	200	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	460	K/W

STATIC CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate cut-off currents				
$\pm V_{G1-S}$ = 7 V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	25	nA
$\pm V_{G2-S}$ = 7 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	25	nA
Gate-source breakdown voltages				
$\pm I_{G1-SS}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$	>	8	V
$\pm I_{G2-SS}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$	>	8	V
Gate-source cut-off voltages				
I_D = 20 μA; V_{DS} = 10 V; + V_{G2-S} = 4 V	$-V_{(P)G1-S}$		0,2 to 1,3	V
I_D = 20 μA; V_{DS} = 10 V; V_{G1-S} = 0	$-V_{(P)G2-S}$		0,2 to 1,1	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 15 mA; V_{DS} = 10 V; + V_{G2-S} = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	20	mS
		typ.	25	mS
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	4	pF
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,7	pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	30	fF
		<	40	fF
Output capacitance at f = 1 MHz	C_{os}	typ.	2	pF
Noise figure at f = 200 MHz; G_S = 2 mS	F	typ.	1,2	dB

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic microminiature envelope (SOT-143) with source and substrate interconnected and intended for v.h.f. applications in television tuners, using SMD* technology. The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

* Surface Mounted Devices.

QUICK REFERENCE DATA

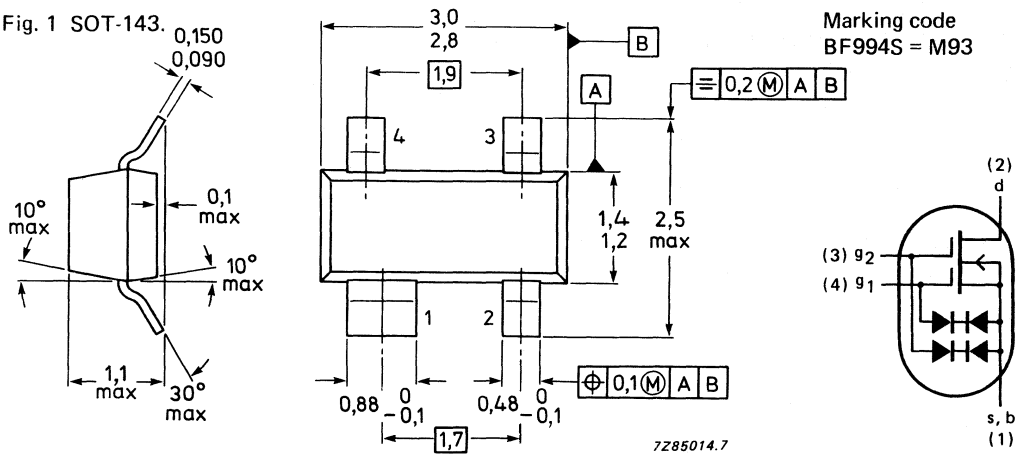
Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	18 mS
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1,0 dB

MECHANICAL DATA

Dimensions in mm

Marking code
BF994S = M93

Fig. 1 SOT-143.



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (d.c. or average)	I_D	max.	50 mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j-a}$	=	430 K/W

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS}$ = 0	$\pm I_{G1-S}$	<	50 nA
$\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS}$ = 0	$\pm I_{G2-S}$	<	50 nA
Gate-source breakdown voltages			
$\pm I_{G1-S}$ = 10 mA; $V_{G2-S} = V_{DS}$ = 0	$\pm V_{(BR)G1-SS}$		6,0 to 20 V
$\pm I_{G2-S}$ = 10 mA; $V_{G1-S} = V_{DS}$ = 0	$\pm V_{(BR)G2-SS}$		6,0 to 20 V
Drain current			
V_{DS} = 15 V; V_{G1-S} = 0; V_{G2-S} = 4 V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V	$-V_{(P)G1-S}$	<	2,5 V
I_D = 20 μA; V_{DS} = 15 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	<	2,0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V; T_{amb} = 25 °C.

Transfer admittance at f = 1 kHz	$\lvert Y_{fs} \rvert$	>	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	C_{ig1-s}	typ.	2,5 pF
		<	3,0 pF
Input capacitance at gate 2: f = 1 MHz	C_{ig2-s}	typ.	1,2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1,0 pF
Noise figure at G_S = 2 mS; $B_S = B_S$ opt; f = 200 MHz	F	typ.	1,0 dB
Power gain at G_S = 2 mS; $B_S = B_S$ opt G_L = 0,5 mS; $B_L = B_L$ opt; f = 200 MHz	G_p	typ.	25 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic microminiature envelope (SOT-143) with source and substrate interconnected and intended for u.h.f. applications in television tuners, using SMD* technology. The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

* Surface Mounted Devices

QUICK REFERENCE DATA

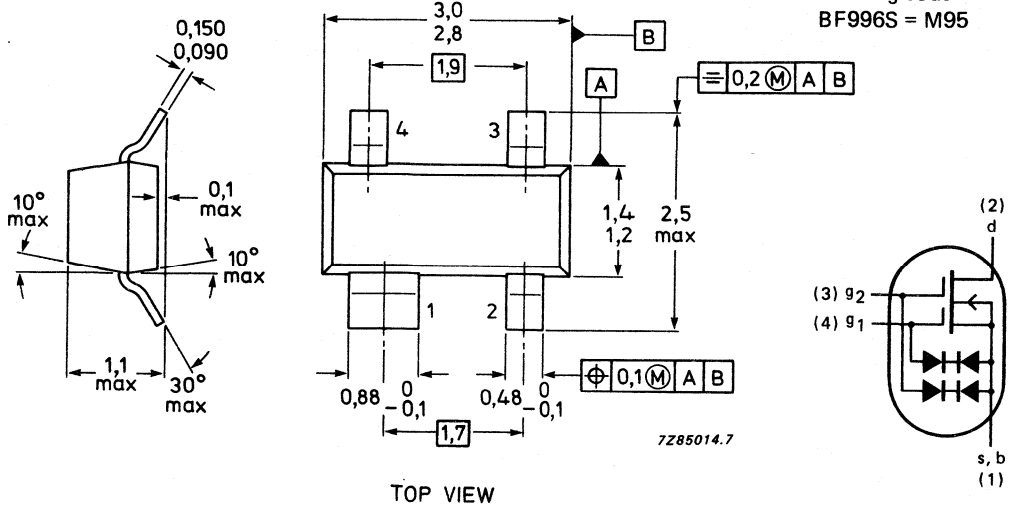
Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	30 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	18 mS
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 3,3 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	1,8 dB

MECHANICAL DATA

Dimensions in mm

Marking code
BF996S = M95

Fig. 1 SOT-143.



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (d.c. or average)	I_D	max.	30 mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j-a}$	=	430 K/W

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S}$ = 5 V, $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-S}$	<	50 nA
$\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-S}$	<	50 nA
Gate-source breakdown voltages			
$\pm I_{G1-S}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$		6,0 to 20 V
$\pm I_{G2-S}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$		6,0 to 20 V
Drain current			
V_{DS} = 15 V; V_{G1-S} = 0; V_{G2-S} = 4 V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V	$-V_{(P)G1-S}$	<	2,5 V
I_D = 20 μA; V_{DS} = 15 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	<	2,0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V; T_{amb} = 25 °C.

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	C_{ig1-s}	typ.	2,3 pF
		<	2,6 pF
Input capacitance at gate 2: f = 1 MHz	C_{ig2-s}	typ.	1,2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0,8 pF
Noise figure			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt	F	typ.	1,0 dB
f = 800 MHz; G_S = 3,3 mS; $B_S = B_S$ opt		typ.	1,8 dB
Power gain			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt; G_L = 0,5 mS; $B_L = B_L$ opt	G_p	typ.	25 dB
f = 800 MHz; G_S = 3,3 mS; $B_S = B_S$ opt; G_L = 1,0 mS; $B_L = B_L$ opt		typ.	18 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic microminiature envelope with source and substrate interconnected, intended for u.h.f. and v.h.f. applications, such as u.h.f./v.h.f. television tuners and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source and has an integrated drain resistance to suppress oscillation in the frequency range higher than 1 GHz.

This device is especially intended for use in pre-amplifiers in CATV tuners with a great tuning range up to 500 MHz.

QUICK REFERENCE DATA

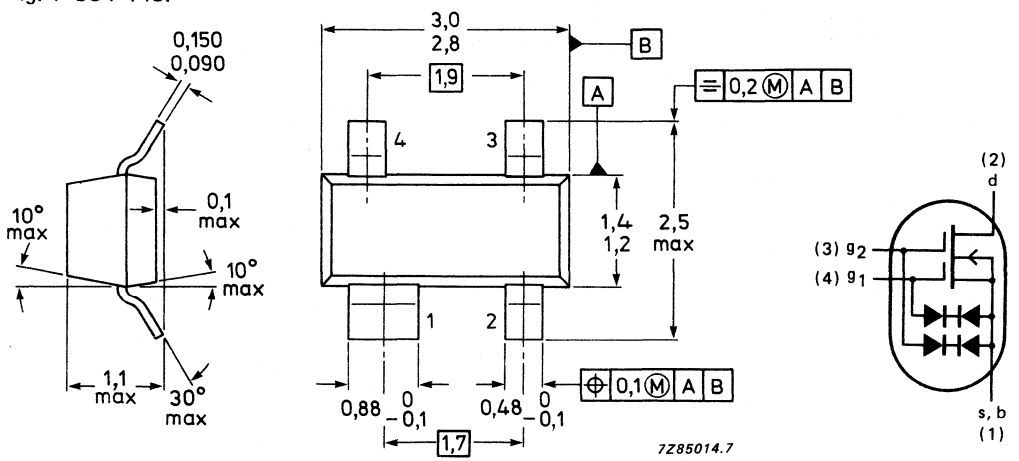
Drain-source voltage	V_{DS}	max.	20 V
Drain current (average)	$I_{D(AV)}$	max.	30 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs}\rvert$	typ.	18 mS
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1,0 dB

MECHANICAL DATA

Dimensions in mm

Marking code: M83

Fig. 1 SOT-143.



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (average)	$I_{D(AV)}$	max.	30 mA
Gate 1 source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	430 K/W

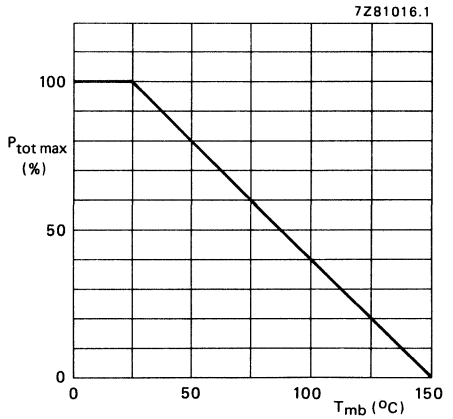


Fig. 2 Power derating curve.

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

STATIC CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate cut-off currents

gate 1; $\pm V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	50	nA
gate 2; $\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	50	nA

Gate-source breakdown voltages

gate 1; $\pm I_{G1-SS}$ = 10 mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$		6 to 20	V
gate 2; $\pm I_{G2-SS}$ = 10 mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$		6 to 20	V

Gate-source cut-off voltages

gate 1; I_D = 20 μA; V_{DS} = 15 V; + V_{G2-S} = 4 V	$-V_{(P)G1-S}$	<	2,5	V
gate 2; I_D = 20 μA; V_{DS} = 15 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	<	2,0	V

Drain-source cut-off voltage

V_{DS} = 15 V; V_{G2-S} = 4 V; V_{G1-S} = 0	I_{DSS}		2 to 20	mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; + V_{G2-S} = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	15	mS
		typ.	18	mS
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	2,5	pF
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,2	pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25	fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1,0	pF
Noise figure at f = 200 MHz; G_S = 2 mS; $B_S = B_{S\ opt}$	F	typ.	1,0	dB
Power gain at G_S = 2 mS; $B_S = B_{S\ opt}$ G_L = 0,5 mS; = $B_L = B_{L\ opt}$; f = 200 MHz	G_p	typ.	25	dB

NPN 1 GHz WIDEBAND TRANSISTOR

NPN transistor in a plastic SOT-223 envelope, primarily designed for VHF, UHF, and microwave wideband amplifiers up to a frequency of 1 GHz.

The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

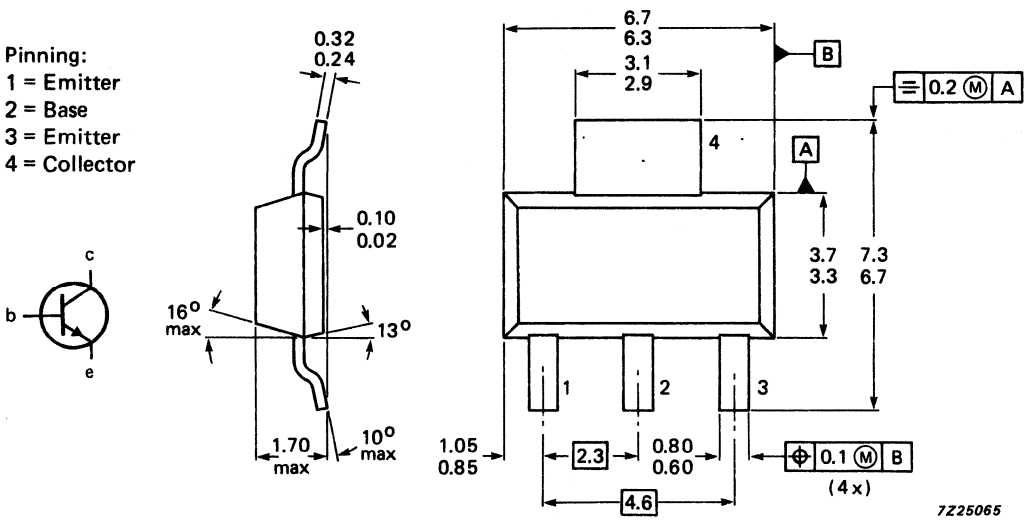
Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Collector current (DC)	I_C	max.	150 mA
Total power dissipation at T_{amb} = 45 °C	P_{tot}	max.	1 W
DC current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 140
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	4.0 GHz
Maximum power gain at f = 800 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	11 dB
Output voltage at d_{im} = −60 dB I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	750 mV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223.

Pinning:
1 = Emitter
2 = Base
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2 V
Collector current (DC)	I_C	max.	150 mA
Total power dissipation at T_{amb} = 45 °C*	P_{tot}	max.	1 W
Storage temperature range	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to case	$R_{th\,j\text{-}c}$	=	35 K/W
From junction to ambient in free air*	$R_{th\,j\text{-}a}$	=	130 K/W

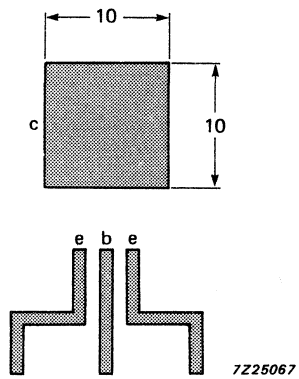


Fig. 2 Single-sided 35 μm Cu-clad epoxy fibreglass printed circuit board; thickness 1.5 mm; tracks fully tin plated; Cu area shown shaded. (Dimensions in mm).

* Mounted on a fibreglass printed circuit board as shown in Fig. 2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 15 V	I_{CBO}	max.	100 μA
DC current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 140
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 10 V	C_c	typ.	2 pF
Emitter capacitance at f = 1 MHz $I_C = i_c$ = 0; V_{EB} = 0.5 V	C_e	typ.	10 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1.2 pF
Maximum power gain at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	15 dB
Maximum power gain at f = 800 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	11 dB
Output voltage at d_{im} = −60 dB (DIN 45004B) I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω $V_p = V_o$ at d_{im} = −60 dB; f_p = 795.25 MHz $V_q = V_o$ − 6 dB; f_q = 803.25 MHz $V_r = V_o$ − 6 dB; f_r = 805.25 MHz measured at $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	750 mV

N-P-N 2 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a four-lead dual-emitter plastic envelope (SOT-143). It is designed for wideband application in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optical systems. The device features a very high transition frequency, high gain and a very low noise figure up to high frequencies.

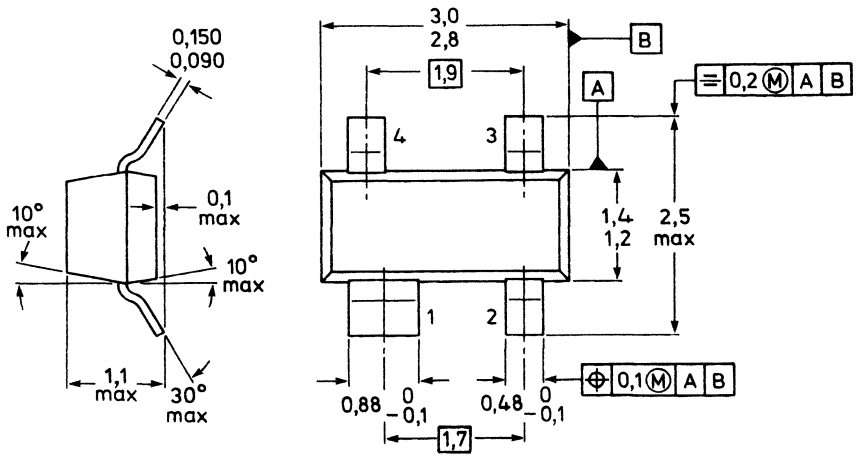
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	10	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	10,0	dB
Noise figure at f = 2 GHz Z_S = 60 Ω; T_{amb} = 25 °C				
I_C = 5 mA; V_{CE} = 8 V	F	typ.	2,5	dB
I_C = 15 mA; V_{CE} = 8 V	F	typ.	3,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	50 nA
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. typ.	60 100
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 8 V	C_c	typ.	0,7 pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	1,3 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 8 V	C_{re}	typ.	0,5 pF
Maximum unilateral power gain (s_{re} assumed to be zero) $G_{UM} = 10 \log \frac{\lvert s_{fe}\rvert^2}{[1-\lvert s_{ie}\rvert^2]\,[1-\lvert s_{oe}\rvert^2]}$ at I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	G_{UM}	typ.	10,0 dB
Noise figures at f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C; V_{CE} = 8 V			
I_C = 5 mA	F	typ.	0,8 dB
I_C = 15 mA	F	typ.	1,5 dB
Noise figures at f = 2 GHz; Z_S = 60 Ω T_{amb} = 25 °C; V_{CE} = 8 V			
I_C = 5 mA	F	typ.	2,5 dB
I_C = 15 mA	F	typ.	3,0 dB

s-parameters (common emitter) at V_{CE} = 8 V; T_{amb} = 25 °C; typical values.

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,96/ −6,8°	5,8/177,8°	0,01/ 84,5°	0,99/ −3,2°	44,1
	100	0,98/ −20,8°	5,6/165,8°	0,03/ 77,5°	1,01/ −10,0°	46,5
	200	0,89/ −40,1°	5,1/153,2°	0,05/ 66,8°	0,91/ −19,0°	28,7
	500	0,81/ −89,3°	4,3/121,5°	0,09/ 43,4°	0,79/ −38,5°	21,5
2	800	0,68/−123,0°	3,3/102,0°	0,11/ 33,8°	0,67/ −50,0°	15,7
	1000	0,64/−139,9°	2,8/ 89,8°	0,11/ 28,0°	0,65/ −54,5°	13,7
	1200	0,60/−157,3°	2,3/ 81,1°	0,11/ 25,8°	0,62/ −61,7°	11,5
	1500	0,59/−173,3°	2,0/ 71,8°	0,11/ 27,4°	0,55/ −69,3°	9,5
	2000	0,57/+161,7°	1,5/ 56,3°	0,10/ 32,2°	0,54/ −85,8°	6,7
	40	0,91/ −10,9°	13,5/174,8°	0,01/ 83,3°	0,98/ −5,9°	44,2
	100	0,91/ −30,3°	12,6/159,5°	0,03/ 72,2°	0,96/ −17,0°	40,9
	200	0,79/ −56,3°	10,6/143,5°	0,04/ 60,3°	0,81/ −29,5°	29,3
	500	0,64/−115,9°	7,4/109,8°	0,07/ 41,4°	0,58/ −50,8°	21,5
5	800	0,55/−145,5°	5,2/ 93,5°	0,08/ 39,9°	0,48/ −59,5°	17,1
	1000	0,53/−161,4°	4,2/ 84,0°	0,08/ 39,1°	0,44/ −62,2°	15,0
	1200	0,52/−176,5°	3,5/ 77,8°	0,08/ 41,2°	0,42/ −67,1°	13,1
	1500	0,51/+172,2°	2,9/ 69,1°	0,09/ 44,6°	0,38/ −75,7°	11,3
	2000	0,50/+149,8°	2,2/ 56,7°	0,11/ 49,8°	0,38/ −89,5°	8,7
	40	0,85/ −16,1°	23,5/170,6°	0,01/ 80,1°	0,96/ −9,7°	43,8
	100	0,81/ −42,6°	21,3/151,8°	0,02/ 67,2°	0,89/ −25,2°	38,0
	200	0,67/ −76,3°	16,6/133,0°	0,04/ 55,5°	0,68/ −40,0°	29,6
	500	0,54/−137,5°	9,5/101,5°	0,05/ 45,7°	0,42/ −60,2°	21,9
10	800	0,49/−161,8°	6,3/ 88,5°	0,07/ 49,2°	0,35/ −67,0°	17,7
	1000	0,49/−175,2°	5,1/ 80,5°	0,07/ 50,6°	0,32/ −68,9°	15,8
	1200	0,49/+171,5°	4,2/ 75,8°	0,08/ 53,4°	0,29/ −72,5°	13,9
	1500	0,47/+163,5°	3,5/ 67,5°	0,09/ 55,3°	0,28/ −82,1°	12,3
	2000	0,47/+142,5°	2,6/ 56,8°	0,12/ 57,7°	0,29/ −94,5°	9,6
	40	0,80/ −20,1°	31,0/167,8°	0,01/ 76,4°	0,94/ −12,2°	43,5
	100	0,74/ −51,8°	26,9/146,8°	0,02/ 64,1°	0,83/ −30,3°	37,2
	200	0,60/ −89,4°	19,9/126,7°	0,03/ 54,0°	0,60/ −45,5°	29,8
	500	0,51/−147,5°	10,3/ 98,0°	0,05/ 49,7°	0,35/ −64,9°	22,1
15	800	0,47/−168,5°	6,7/ 86,5°	0,06/ 54,6°	0,29/ −70,8°	18,1
	1000	0,47/+179,2°	5,4/ 79,3°	0,07/ 55,9°	0,27/ −72,8°	16,1
	1200	0,48/+166,5°	4,4/ 75,0°	0,08/ 58,4°	0,24/ −75,8°	14,3
	1500	0,46/+160,0°	3,7/ 67,0°	0,10/ 59,2°	0,24/ −86,0°	12,5
	2000	0,45/+139,5°	2,7/ 56,8°	0,12/ 60,2°	0,25/ −97,8°	10,0
	40	0,76/ −23,8°	37,2/165,4°	0,01/ 75,6°	0,92/ −14,3°	43,3
	100	0,69/ −60,0°	31,2/142,6°	0,02/ 61,7°	0,78/ −34,3°	36,8
	200	0,55/ −99,6°	21,8/122,5°	0,03/ 53,6°	0,54/ −49,5°	29,8
	500	0,49/−152,5°	10,6/ 96,0°	0,04/ 53,0°	0,31/ −68,0°	22,2
20	800	0,46/−172,9°	7,0/ 85,0°	0,06/ 58,1°	0,26/ −73,3°	18,2
	1000	0,46/+175,9°	5,5/ 78,3°	0,07/ 59,3°	0,24/ −75,3°	16,1
	1200	0,47/+163,5°	4,6/ 74,3°	0,08/ 61,5°	0,21/ −78,3°	14,5
	1500	0,45/+157,9°	3,8/ 66,4°	0,10/ 61,4°	0,22/ −88,9°	12,8
	2000	0,45/+137,8°	2,8/ 56,7°	0,12/ 61,7°	0,22/−100,2°	10,2

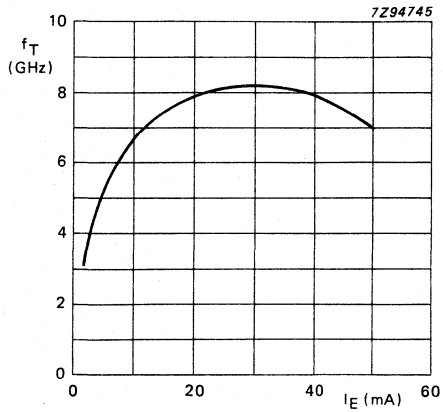


Fig. 2 V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C; typical values.

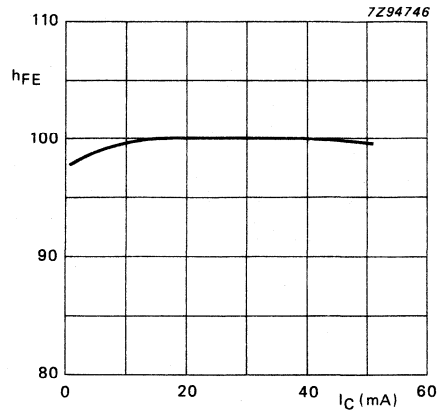


Fig. 3 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

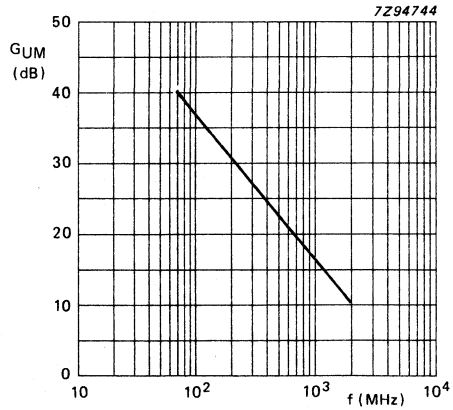


Fig. 4 V_{CE} = 8 V; I_C = 15 mA; T_{amb} = 25 °C; typical values.

NPN 1 GHz WIDEBAND TRANSISTOR

NPN transistor in a plastic SOT-223 envelope, primarily designed for VHF, UHF, and microwave wideband amplifiers up to a frequency of 1 GHz.

The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

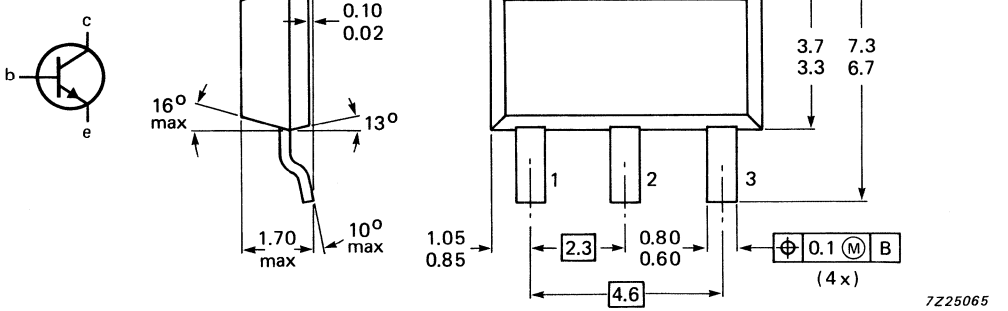
Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (DC)	I_C	max.	100	mA
Total power dissipation at T_{amb} = 30 °C*	P_{tot}	max.	1	W
DC current gain I_C = 70 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 90	
Transition frequency at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	f_T	typ.	5.5	GHz
Maximum power gain at f = 800 MHz I_C = 70 mA; V_{CE} = 10 V	G_{UM}	typ.	12	dB
Output voltage at d_{im} = −60 dB I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	700	mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223.

Pinning:
1 = emitter
2 = base
3 = emitter
4 = collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.0 V
Collector current (DC)	I_C	max.	100 mA
Total power dissipation at T_{amb} = 30 °C*	P_{tot}	max.	1 W
Storage temperature range	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to case	$R_{th\ j\text{-}c}$	=	50 K/W
From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	145 K/W

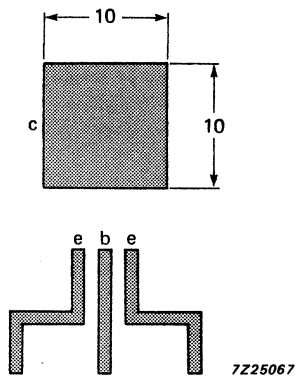


Fig. 2 Single-sided 35 μm Cu-clad epoxy fibreglass printed circuit board; thickness 1.5 mm; tracks fully tin plated; Cu area shown shaded. (Dimensions in mm).

* Mounted on a fibreglass printed circuit board as shown in Fig. 2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	100	nA
DC current gain I_C = 70 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 90	
Transition frequency at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	f_T	typ.	5.5	GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 10 V	C_c	typ.	1.5	pF
Emitter capacitance at f = 1 MHz $I_C = i_c$ = 0; V_{EB} = 0.5 V	C_e	typ.	6.5	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1.0	pF
Maximum power gain at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	G_{UM}	typ.	16	dB
Maximum power gain at f = 800 MHz I_C = 70 mA; V_{CE} = 10 V	G_{UM}	typ.	12	dB
Output voltage at d_{im} = −60 dB (DIN 45004B) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω $V_p = V_o$ at d_{im} = −60 dB; f_p = 795.25 MHz $V_q = V_o$ = 6 dB; f_q = 803.25 MHz $V_r = V_o$ = 6 dB; f_r = 805.25 MHz measured at $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	700	mV

NPN 1 GHz WIDEBAND TRANSISTOR

NPN transistor in a plastic SOT-223 envelope, primarily designed for VHF, UHF, and microwave wideband amplifiers up to a frequency of 1 GHz.

The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

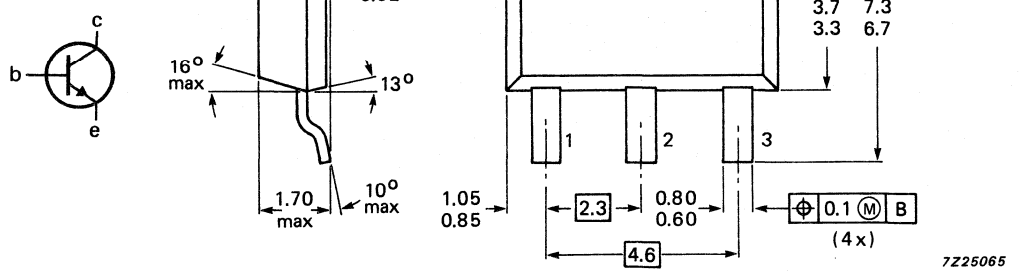
Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (DC)	I_C	max.	150	mA
Total power dissipation at T_{amb} = 60 °C*	P_{tot}	max.	1	W
DC current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min. typ.	80 120	
Transition frequency at f = 1 GHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	7.0	GHz
Maximum power gain at f = 800 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	12	dB
Output voltage at d_{im} = −60 dB I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	850	mV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223.

Pinning:
1 = Emitter
2 = Base
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (DC)	I_C	max.	150	mA
Total power dissipation at T_{amb} = 60 °C*	P_{tot}	max.	1	W
Storage temperature range	T_{stg}		−65 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to case	$R_{th\,j\text{-}c}$	=	20	K/W
From junction to ambient in free air*	$R_{th\,j\text{-}a}$	=	115	K/W

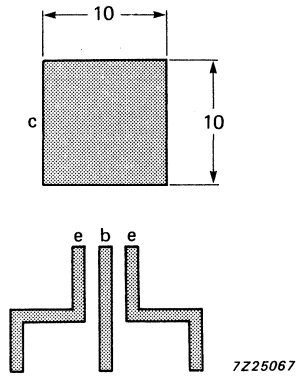


Fig. 2 Single-sided 35 μm Cu-clad epoxy fibreglass printed circuit board; thickness 1.5 mm; tracks fully tin plated; Cu area shown shaded. (Dimensions in mm).

* Mounted on a fibreglass printed circuit board as shown in Fig. 2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	50 μA
DC current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min. typ.	80 120
Transition frequency at f = 1 GHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	7.0 GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 10 V	C_c	typ.	2 pF
Emitter capacitance at f = 1 MHz $I_C = i_c$ = 0; V_{EB} = 0.5 V	C_e	typ.	6.0 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1.2 pF
Maximum power gain at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	16 dB
Maximum power gain at f = 800 MHz I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	12 dB
Output voltage at d_{im} = −60 dB (DIN 45004B) I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω $V_p = V_o$ at d_{im} = −60 dB; f_p = 795.25 MHz $V_q = V_o$ − 6 dB; f_q = 803.25 MHz $V_r = V_o$ − 6 dB; f_r = 805.25 MHz measured at $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	850 mV

NPN 1 GHz WIDEBAND TRANSISTOR

NPN transistor in a plastic SOT-223 envelope, primarily designed for VHF, UHF, and microwave wideband amplifiers up to a frequency of 1 GHz.

The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

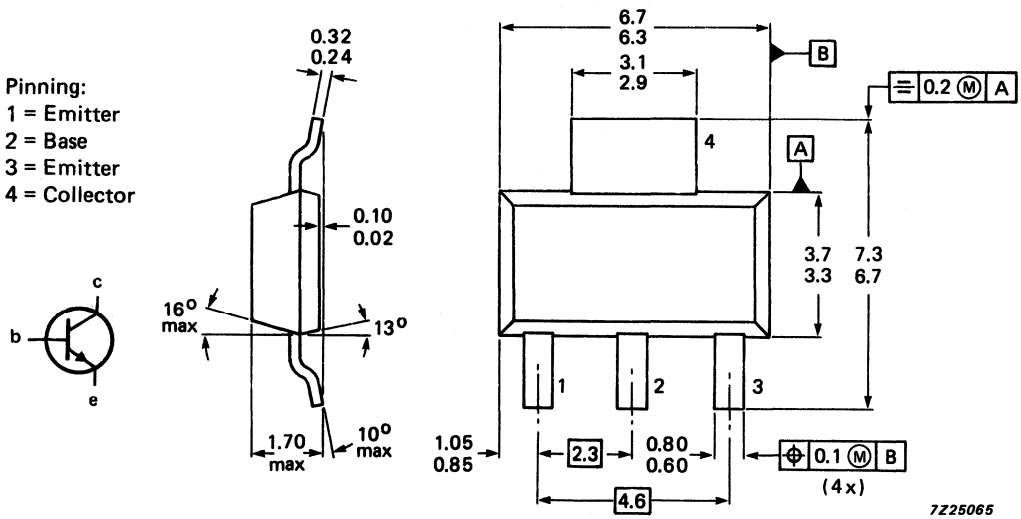
Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (DC)	I_C	max.	100	mA
Total power dissipation at T_{amb} = 50 °C	P_{tot}	max.	1	W
DC current gain I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min. typ.	40 100	
Transition frequency at f = 1 GHz I_C = 50 mA; V_{CE} = 8 V	f_T	typ.	8.0	GHz
Maximum power gain at f = 800 MHz I_C = 50 mA; V_{CE} = 8 V	G_{UM}	typ.	15	dB
Output voltage at d_{im} = −60 dB I_C = 50 mA; V_{CE} = 8 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	700	mV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223

Pinning:
1 = Emitter
2 = Base
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5 V
Collector current (DC)	I_C	max.	100 mA
Total power dissipation at T_{amb} = 45 °C*	P_{tot}	max.	1 W
Storage temperature range	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to case	$R_{th\,j\text{-}c}$	=	40 K/W
From junction to ambient in free air*	$R_{th\,j\text{-}a}$	=	125 K/W

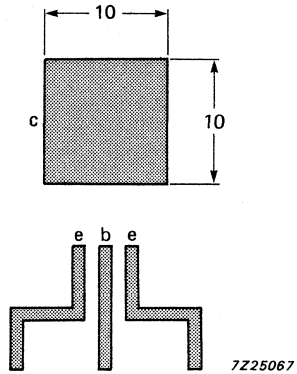


Fig. 2 Single-sided 35 μm Cu-clad epoxy fibreglass printed circuit board; thickness 1.5 mm; tracks fully tin plated; Cu area shown shaded. (Dimensions in mm).

* Mounted on a fibreglass printed circuit board as shown in Fig. 2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 5 V	I_{CBO}	max.	100	nA
DC current gain I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min. typ.	40 100	
Transition frequency at f = 1 GHz I_C = 50 mA; V_{CE} = 8 V	f_T	typ.	8.0	GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 8 V	C_c	typ.	1.5	pF
Emitter capacitance at f = 1 MHz $I_C = i_c$ = 0; V_{EB} = 0.5 V	C_e	typ.	3.0	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 8 V	C_{re}	typ.	0.8	pF
Maximum power gain at f = 500 MHz I_C = 50 mA; V_{CE} = 8 V	G_{UM}	typ.	18	dB
Maximum power gain at f = 800 MHz I_C = 50 mA; V_{CE} = 8 V	G_{UM}	typ.	15	dB
Output voltage at d_{im} = −60 dB (DIN 45004B) I_C = 50 mA; V_{CE} = 8 V; R_L = 75 Ω $V_p = V_o$ at d_{im} = −60 dB; f_p = 795.25 MHz $V_q = V_o$ − 6 dB; f_q = 803.25 MHz $V_r = V_o$ − 6 dB; f_r = 805.25 MHz measured at $f_{(p+q-r)}$ = 793.25 MHz	V_o	typ.	700	mV

N-P-N H.F. WIDEBAND TRANSISTOR

N-P-N multi-emitter transistor in a SOT-89 plastic envelope intended for application in thick and thin-film circuits. The transistor has extremely good intermodulation properties and a high power gain. It is primarily intended for:

- Output and driver stages of channel and band serial amplifiers with high output power for bands I, II, III and IV/V (40–860 MHz).
- Output and driver stages of wideband amplifiers.

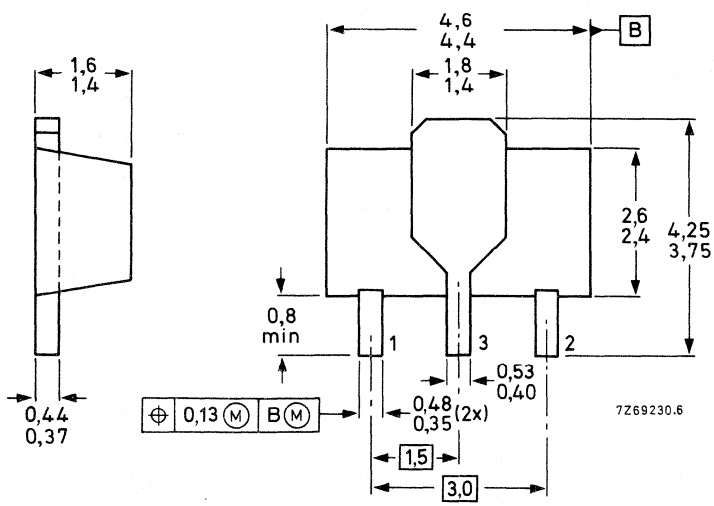
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	25 V
Collector current (peak value; f ≥ 1 MHz)	I_{CM}	max.	300 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	150 °C
Transition frequency at f = 500 MHz I_C = 150 mA; V_{CE} = 15 V	f_T	typ.	1,2 GHz
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V;	C_{re}	typ.	1,9 pF

MECHANICAL DATA

Dimensions in mm

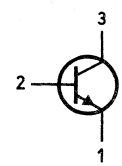
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BFQ17 = FA



See also *Soldering recommendations.*

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V	
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$; peak value)	V_{CERM}	max.	40	V	1)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	1)
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V	
Collector current (d.c.)	I_C	max.	150	mA	
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA	
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	P_{tot}	max.	1	W	
Storage temperature	T_{stg}	−65 to +	150	°C	
Junction temperature	T_j	max.	150	°C	

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j-tab}$	=	30	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	$R_{th\ j-a}$	=	125	K/W

1) I_C = 10 mA.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	max.	20	μA
Saturation voltage				
I_C = 100 mA; I_B = 10 mA	V_{CEsat}	max.	0,5	V
D.C. current gain				
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min.	25	
I_C = 150 mA; V_{CE} = 5 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz [1]				
I_C = 150 mA; V_{CE} = 15 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0 ; V_{CB} = 15 V	C_c	max.	4	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 15 V; T_{amb} = 25 °C	C_{re}	typ.	1,9	pF

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 60 mA; V_{CE} = 15 V; T_{amb} = 25 °C;				
f = 200 MHz	G_{UM}	typ.	16	dB
f = 800 MHz	G_{UM}	typ.	6,5	dB

1) Measured under pulse conditions.

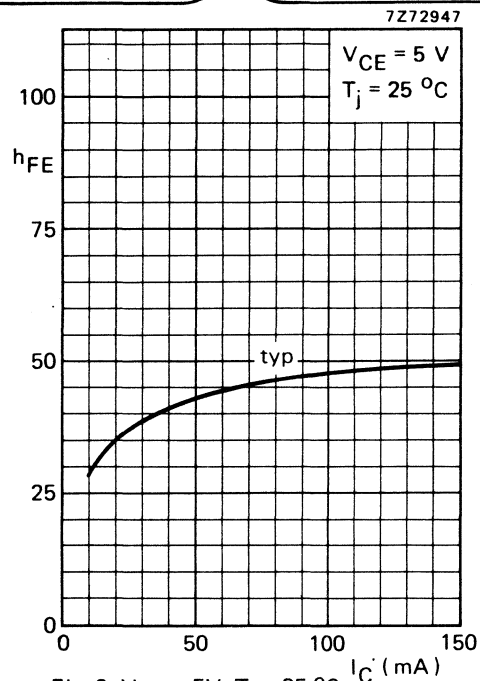


Fig. 2. V_{CE} = 5V; T_j = 25 °C; typical values

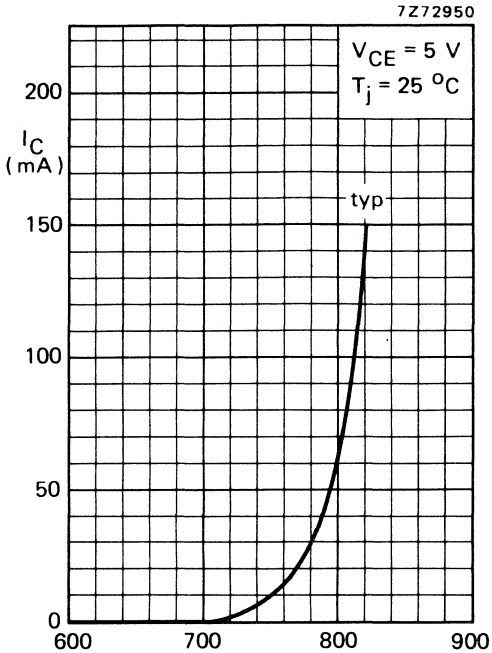


Fig. 3. V_{CE} = 5V; T_j = 25 °C; typical values

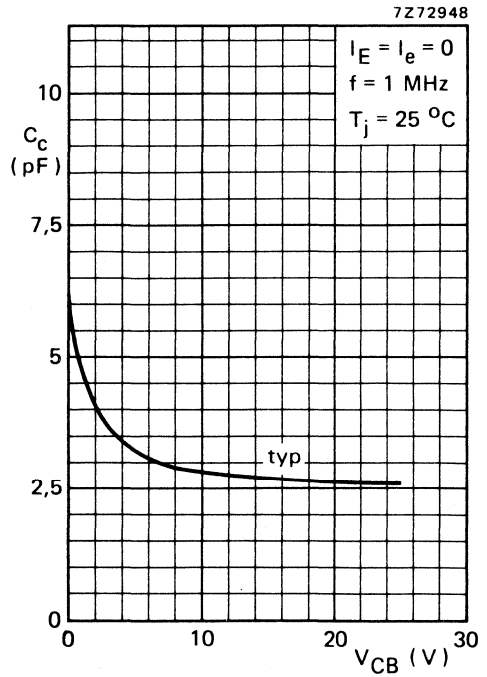


Fig. 4. $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C; typical values

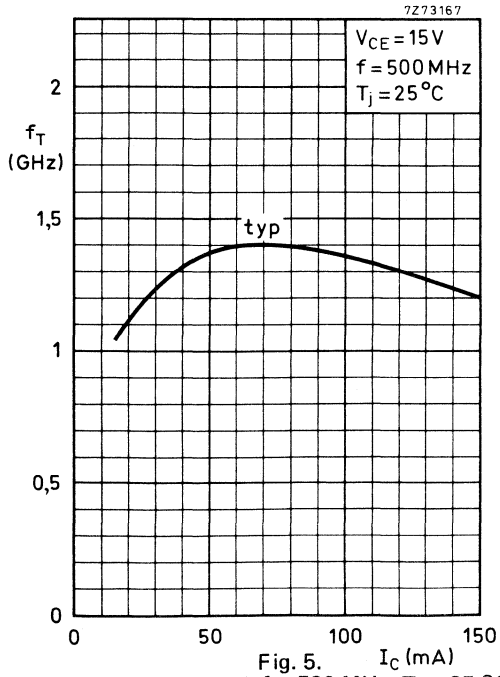


Fig. 5. V_{CE} = 15V; f = 500 MHz; T_j = 25 °C; typical values

N-P-N H.F. WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-89 envelope intended for application in thick and thin-film circuits. It is primarily intended for MATV purposes.

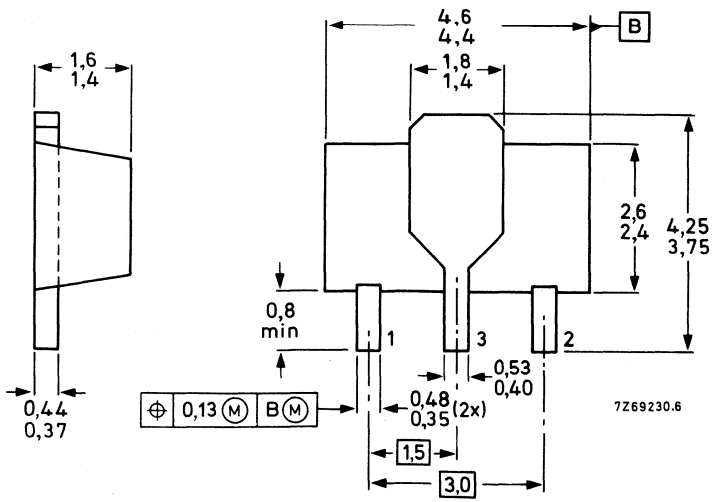
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Collector current (d.c.)	I_C	max.	150 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	150 °C
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,6 GHz
Feedback capacitance at f = 10,7 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1,2 pF
Intermodulation distortion I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω measured at $f_{(p+q-r)}$ = 793,25 MHz	d_{im}	max.	−60 dB

MECHANICAL DATA

Dimensions in mm

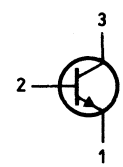
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BFQ18A = FF



See also soldering recommendations

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	1	W
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air *	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

D.C. current gain **				
I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25	
I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz **				
I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	3,2	GHz
I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,0	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	11	pF
Feedback capacitance at f = 10,7 MHz				
I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1,2	pF

* The device mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm.

** Measured under pulse conditions.

Intermodulation distortion (see Fig. 2)

I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω

$V_p = V_o$ = 700 mV at f_p = 795,25 MHz

$V_q = V_o$ –6 dB at f_q = 803,25 MHz

$V_r = V_o$ –6 dB at f_r = 805,25 MHz

Measured at $f_{(p+q-r)}$ = 793,25 MHz d_{im} max. –60 dB

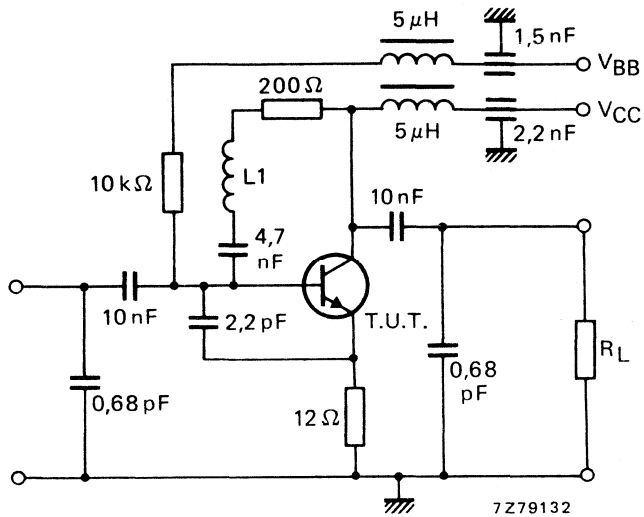


Fig. 2 MATV-test circuit (40–860 MHz).

N-P-N 1 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a **SOT-89** plastic envelope intended for application in thick- and thin-film circuits.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features very low intermodulation distortion and high power gain. Thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

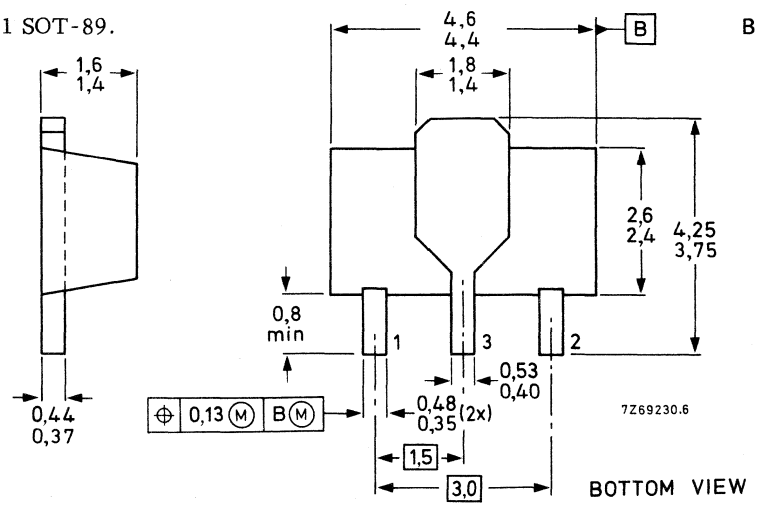
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 87,5 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 10 V;	C_{re}	typ.	1,3	pF
Noise figure at optimum source impedance I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz;	F	typ.	3,3	dB

MECHANICAL DATA

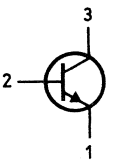
Fig. 1 SOT-89.

Dimensions in mm



Marking code

BFQ19 = FB



See also soldering recommendations

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,3	V
Collector current (d.c.)	I_C	max.	75	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	150	mA
Total power dissipation up to T_{amb} = 87,5 °C mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	P_{tot}	max.	500	mW
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\,j-tab}$	=	40	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	$R_{th\,j-a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	100	nA
D.C. current gain 1)				
I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25	
		typ.	50	
I_C = 75 mA; V_{CE} = 10 V	h_{FE}	min.	25	
		typ.	52	
Transition frequency at f = 500 MHz 1)				
I_C = 50 mA; V_{CE} = 10 V	f_T	min.	4,0	GHz
		typ.	5,0	GHz
I_C = 75 mA; V_{CE} = 10 V	f_T	min.	4,4	GHz
		typ.	5,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0 ; V_{CB} = 10 V	C_c	typ.	1,6	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c$ = 0 ; V_{EB} = 0,5 V	C_e	typ.	5,0	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	1,3	pF
Noise figure at optimum source impedance				
I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,3	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C;				
f = 200 MHz	G_{UM}	typ.	18,5	dB
f = 500 MHz	G_{UM}	typ.	11,5	dB
f = 800 MHz	G_{UM}	typ.	7,5	dB

1) Measured under pulse conditions.

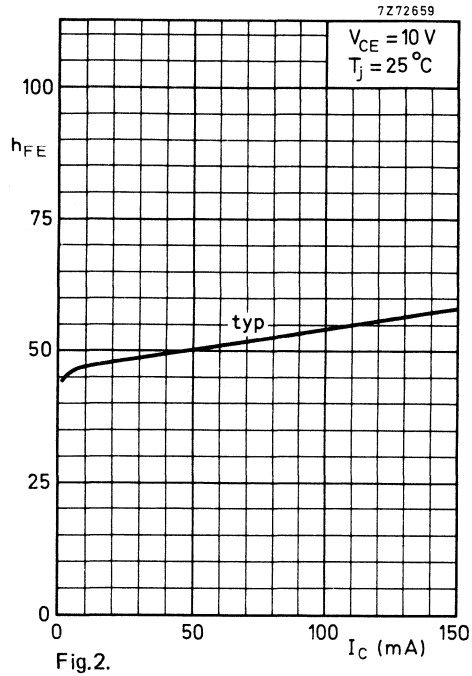


Fig.2.

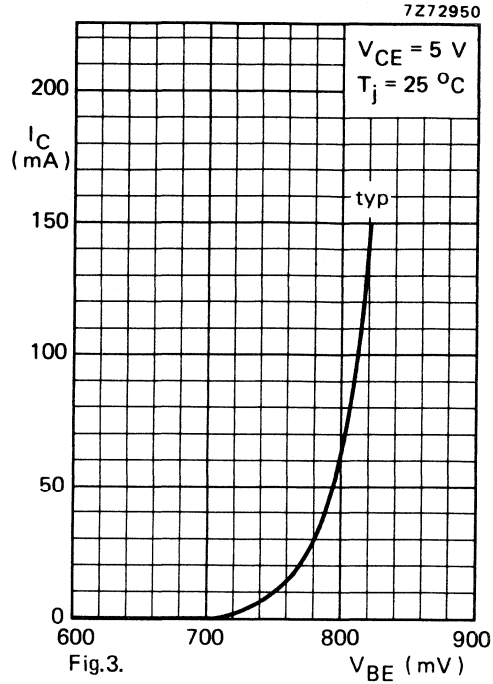


Fig.3.

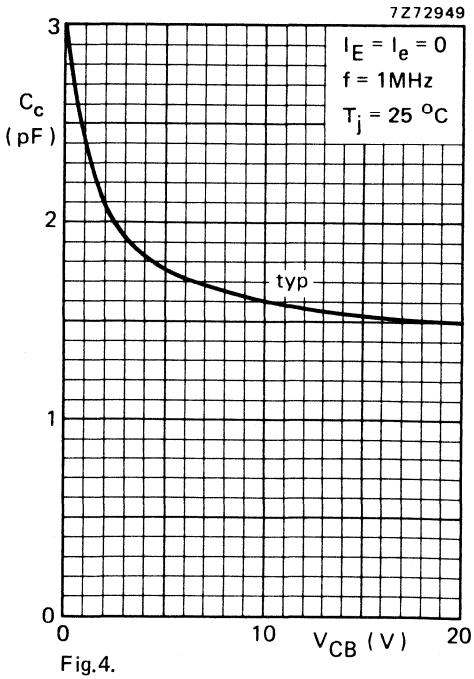


Fig.4.

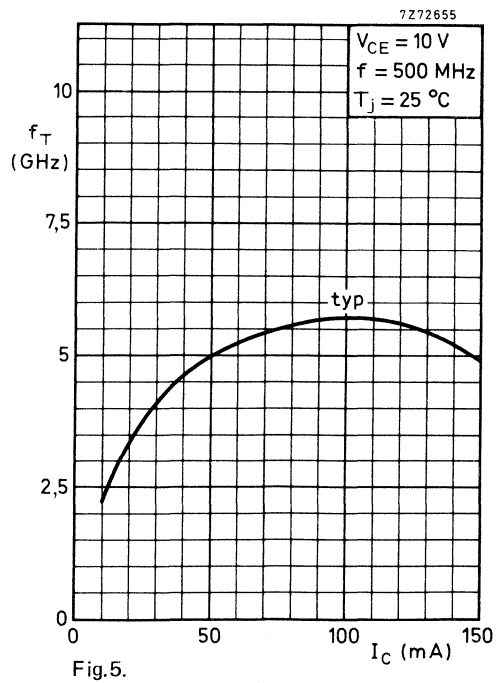


Fig.5.

N-P-N 2 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope. It is designed for wideband application in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optical systems. The device features a very high transition frequency and a very low noise figure up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage, open emitter	V_{CBO}	max.	20	V
Collector-emitter voltage, open base	V_{CEO}	max.	10	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 15 mA; V_{CB} = 5 V	h_{FE}	typ.	100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V	G_{UM}	typ.	8,0	dB

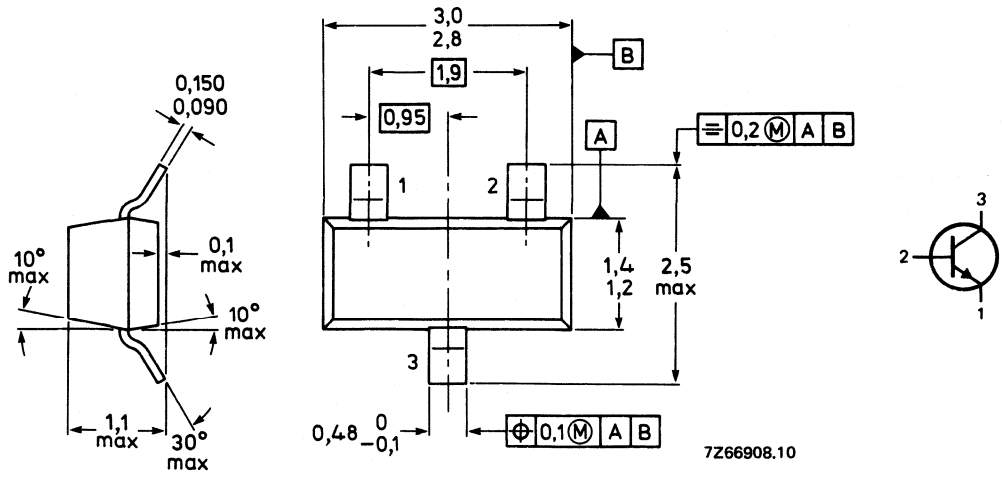
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

BFQ67 = V2



If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 5 V	I_{CBO}	max.	50	nA
D.C. current gain				
I_C = 15 mA; V_{CB} = 5 V	h_{FE}	typ.	100	
Transition frequency at f = 500 mHz				
I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; V_{CB} = 8 V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz				
$I_C = i_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	1,3	pF
Feedback capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 8 V	C_{re}	typ.	0,5	pF
Maximum unilateral power gain (s_{re} assumed to be zero)				
$G_{UM} = 10 \log \frac{\lvert s_{fe}\rvert^2}{[1-\lvert s_{ie}\rvert^2]\,[1-\lvert s_{oe}\rvert^2]}$				
I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	G_{UM}	typ.	8,0	dB
Noise figure at f = 2 GHz; R_S = 60 Ω; T_{amb} = 25 °C				
I_C = 5 mA; V_{CE} = 8 V	F	typ.	2,5	dB
I_C = 15 mA; V_{CE} = 8 V	F	typ.	3,0	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

s-parameters (common emitter) at V_{CE} = 8 V; typical values.

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,93/ −9,5°	7,07/174,6°	0,01/83,2°	1,00/ −4,5°	46,7
	100	0,90/ −22,8°	6,96/163,5°	0,03/76,3°	0,97/−10,4°	36,4
	200	0,84/ −42,1°	6,35/150,4°	0,06/66,4°	0,91/−17,9°	29,2
2	500	0,61/ −90,7°	4,40/117,2°	0,10/45,7°	0,67/−32,6°	17,5
	800	0,55/−118,0°	3,24/102,6°	0,12/42,2°	0,60/−38,2°	13,7
	1000	0,54/−135,5°	2,76/ 93,5°	0,12/41,2°	0,55/−43,6°	11,9
	2000	0,47/ 177,3°	1,57/ 64,5°	0,15/60,0°	0,47/−65,3°	6,1
	40	0,84/ −14,9°	15,47/170,5°	0,01/80,7°	0,99/ −7,9°	44,5
	100	0,78/ −36,1°	14,35/154,8°	0,03/71,1°	0,92/−18,0°	35,4
	200	0,68/ −63,3°	11,97/137,7°	0,05/60,6°	0,79/−29,0°	28,5
5	500	0,45/−119,8°	6,74/106,1°	0,08/49,7°	0,47/−40,1°	18,6
	800	0,42/−143,5°	4,55/ 94,7°	0,09/53,8°	0,41/−41,5°	14,8
	1000	0,43/−155,4°	3,80/ 87,4°	0,10/56,1°	0,37/−46,7°	13,1
	2000	0,35/ 169,2°	2,04/ 63,5°	0,18/69,4°	0,34/−63,3°	7,3
	40	0,74/ −22,8°	25,66/165,6°	0,01/77,5°	0,96/−12,1°	43,0
	100	0,65/ −51,2°	22,19/145,5°	0,03/66,8°	0,84/−26,3°	34,6
	200	0,53/ −85,2°	16,35/126,4°	0,04/58,1°	0,64/−38,4°	28,0
10	500	0,38/−144,4°	8,01/ 99,5°	0,06/58,0°	0,33/−42,8°	19,2
	800	0,36/−161,9°	5,29/ 90,0°	0,09/64,0°	0,30/−41,2°	15,5
	1000	0,38/ 169,9°	4,27/ 84,0°	0,10/66,0°	0,27/−47,0°	13,6
	2000	0,30/ 160,0°	2,29/ 62,8°	0,20/72,6°	0,27/−61,2°	7,9
	40	0,67/ −28,3°	32,67/162,1°	0,01/75,8°	0,94/−14,9°	42,5
	100	0,57/ −62,8°	26,66/139,6°	0,02/64,6°	0,78/−31,4°	34,2
	200	0,46/ −99,5°	18,35/120,6°	0,04/58,7°	0,56/−42,8°	27,9
15	500	0,36/−154,8°	8,49/ 96,8°	0,06/62,9°	0,27/−42,8°	19,5
	800	0,34/ 169,3°	5,55/ 88,4°	0,09/68,4°	0,26/−39,7°	15,7
	1000	0,36/ 176,8°	4,47/ 82,5°	0,10/69,7°	0,23/−46,3°	13,9
	2000	0,29/ 155,7°	2,37/ 62,3°	0,21/73,4°	0,25/−59,8°	8,2
	40	0,63/ −32,5°	37,50/159,4°	0,01/74,2°	0,93/−17,2°	42,0
	100	0,52/ −70,8°	29,23/135,5°	0,02/63,4°	0,73/−34,7°	34,0
	200	0,42/−108,8°	19,22/117,4°	0,03/59,7°	0,50/−45,0°	27,8
20	500	0,35/−162,0°	8,69/ 95,0°	0,06/64,9°	0,23/−41,6°	19,6
	800	0,33/−175,1°	5,62/ 86,9°	0,09/70,7°	0,24/−38,1°	15,7
	1000	0,36/−178,7°	4,57/ 81,7°	0,10/71,6°	0,21/−45,0°	14,0
	2000	0,28/−153,5°	2,40/ 62,0°	0,21/73,8°	0,24/−58,9°	8,2

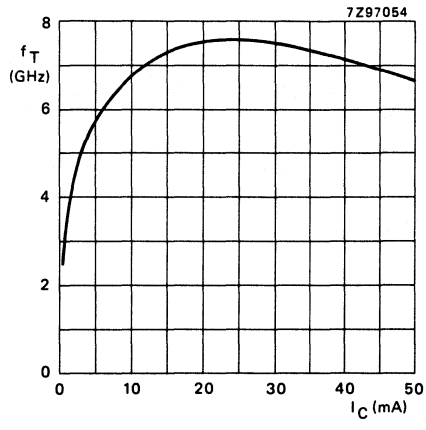


Fig. 2 V_{CE} = 8 V; f = 500 MHz; typical values.

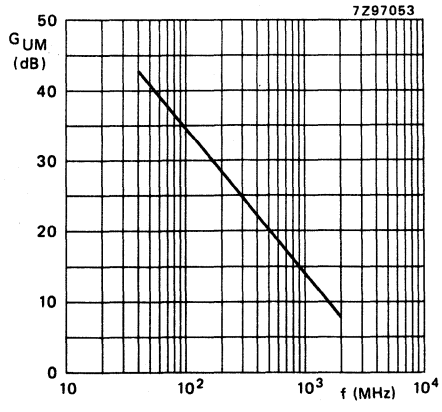


Fig. 3 V_{CE} = 8 V; I_C = 15 mA; T_{amb} = 25 °C; typical values.

N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Planar epitaxial symmetrical junction field effect transistor in a microminiature plastic envelope. It is intended for low level general purpose amplifiers in thick and thin-film circuits.

QUICK REFERENCE DATA

Drain-source voltage	$\pm V_{DS}$	max.	25		V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	25		V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
			BFR30	BFR31	
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	min.	4	1	mA
		max.	10	5	mA
Transfer admittance (common source) I_D = 1 mA; V_{DS} = 10 V; f = 1 kHz	$\|y_{fs}\|$	min.	1,0	1,5	mS
		max.	4,0	4,5	mS

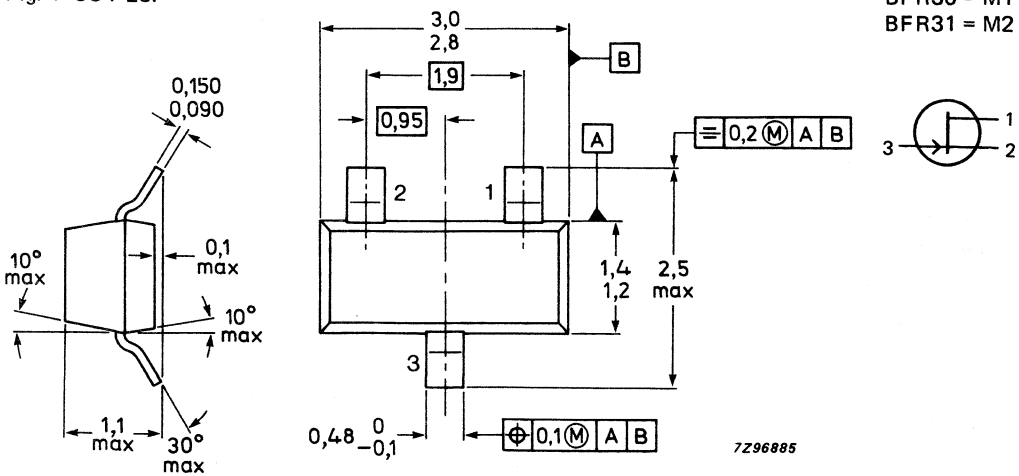
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

BFR30 = M1
BFR31 = M2



TOP VIEW

Note: Drain and source are interchangeable.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	25	V
Drain-gate voltage (open source)	V_{DGO}	max.	25	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	25	V
Drain current	I_D	max.	10	mA
Gate current	I_G	max.	5	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature range	T_{stg}		−65 to + 150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BFR30	BFR31	
Gate cut-off current					
$-V_{GS}$ = 10 V; V_{DS} = 0	$-I_{GSS}$	max.	0,2	0,2	nA
Drain current					
V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	min.	4	1	mA
		max.	10	5	mA
Gate-source voltage					
I_D = 1 mA; V_{DS} = 10 V	$-V_{GS}$	min.	0,7	0	V
		max.	3,0	1,3	V
I_D = 50 μA; V_{DS} = 10 V	$-V_{GS}$	max.	4,0	2,0	V
Gate-source cut-off voltage					
I_D = 0,5 nA; V_{DS} = 10 V	$-V_{(P)GS}$	max.	5	2,5	V
y parameters					
Transfer admittance at f = 1 kHz; T_{amb} = 25 °C					
I_D = 1 mA; V_{DS} = 10 V	$\lvert y_{fs}\rvert$	min.	1,0	1,5	mS
		max.	4,0	4,5	mS
I_D = 200 μA; V_{DS} = 10 V	$\lvert y_{fs}\rvert$	min.	0,5	0,75	mS
Output admittance at f = 1 kHz					
I_D = 1 mA; V_{DS} = 10 V	$\lvert y_{os}\rvert$	max.	40	25	μS
I_D = 200 μA; V_{DS} = 10 V	$\lvert y_{os}\rvert$	max.	20	15	μS

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

y parameters (continued)

			BFR30	BFR31	
Input capacitance at f = 1 MHz					
I_D = 1 mA; V_{DS} = 10 V	C_{is}	max.	4	4	pF
I_D = 200 μA; V_{DS} = 10 V	C_{is}	max.	4	4	pF
Feedback capacitance at f = 1 MHz; T_{amb} = 25 °C					
I_D = 1 mA; V_{DS} = 10 V	C_{rs}	max.	1,5	1,5	pF
I_D = 200 μA; V_{DS} = 10 V	C_{rs}	max.	1,5	1,5	pF
Equivalent noise voltage					
I_D = 200 μA; V_{DS} = 10 V B = 0,6 to 100 Hz	V_n	max.	0,5	0,5	μV

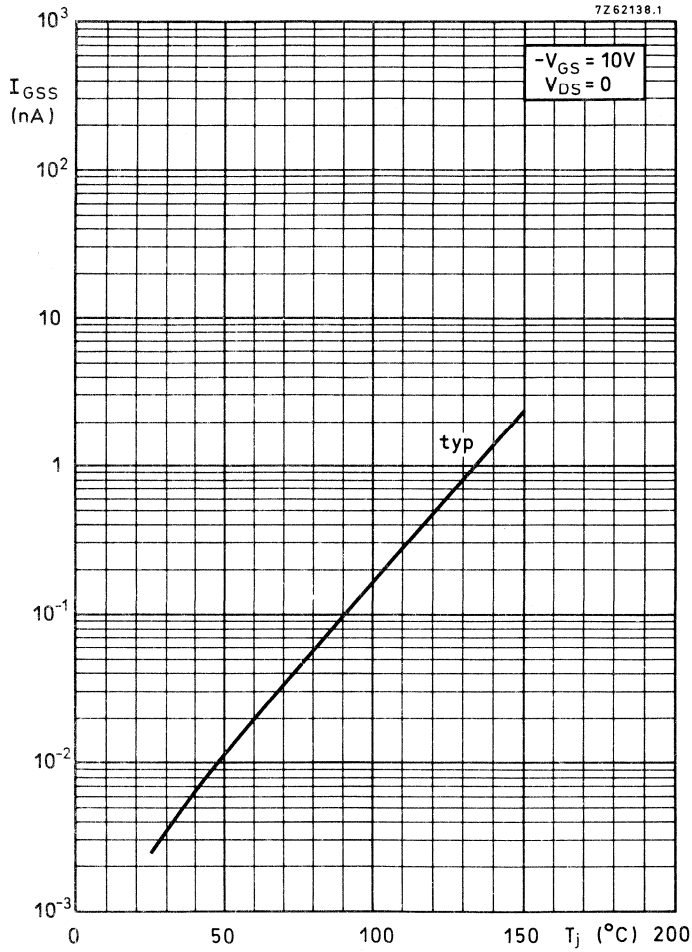

7Z62138.1
10^3
I_{GSS} (nA)
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
$-V_{GS}$ = 10V
V_{DS} = 0
typ
0
50
100
150
T_j (°C)
200

Fig. 2

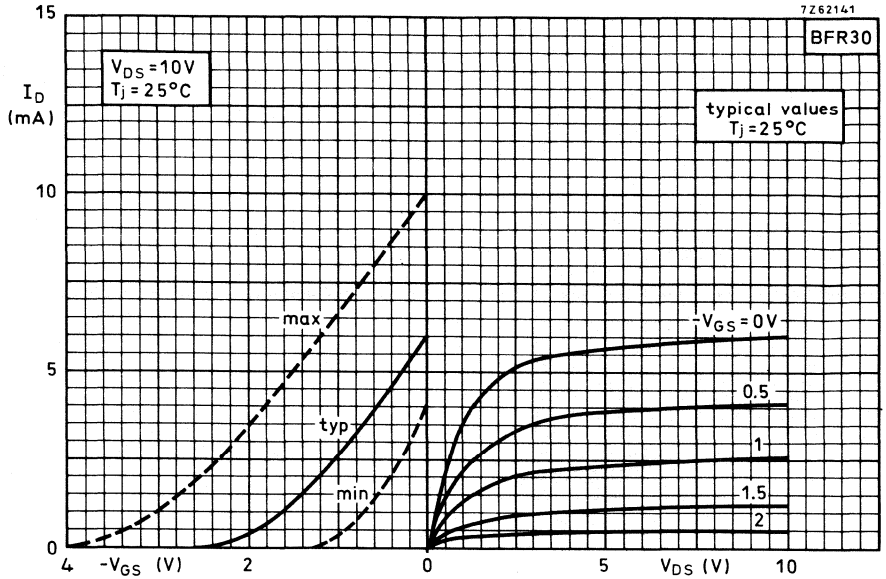

7Z62141
BFR30
V_{DS} = 10 V
T_j = 25 °C
typical values
T_j = 25 °C
I_D (mA)
15
10
5
0
max
typ
min
$-V_{GS}$ = 0 V
0.5
1
1.5
2
4
$-V_{GS}$ (V)
2
0
5
V_{DS} (V)
10

Fig. 3

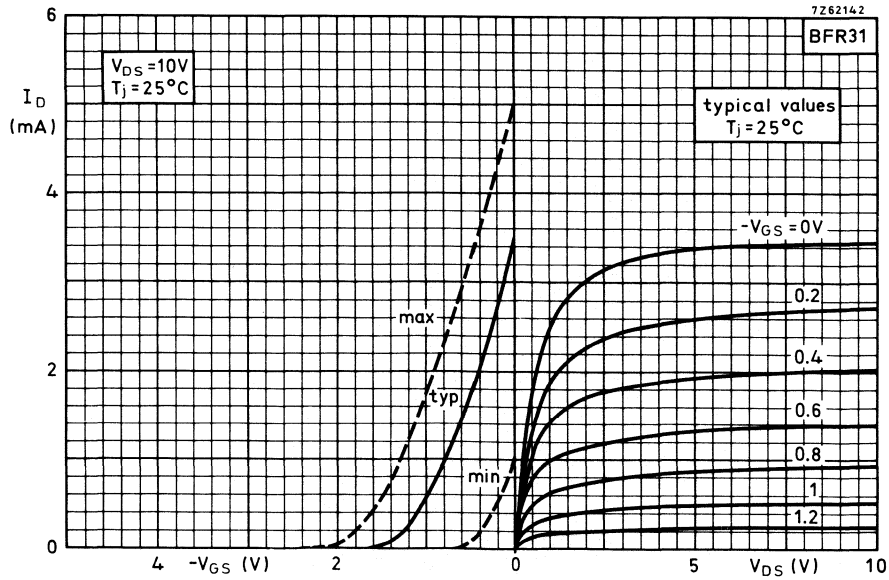

7Z62142
BFR31
V_{DS} = 10 V
T_j = 25 °C
typical values
T_j = 25 °C
I_D (mA)
6
4
2
0
max
typ
min
$-V_{GS}$ = 0 V
0.2
0.4
0.6
0.8
1
1.2
4
$-V_{GS}$ (V)
2
0
5
V_{DS} (V)
10

Fig. 4

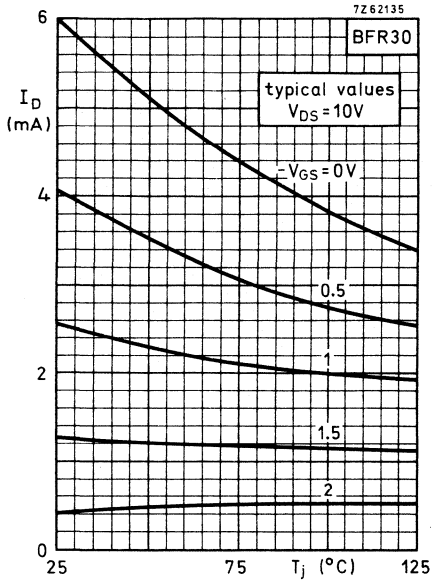


Fig. 5

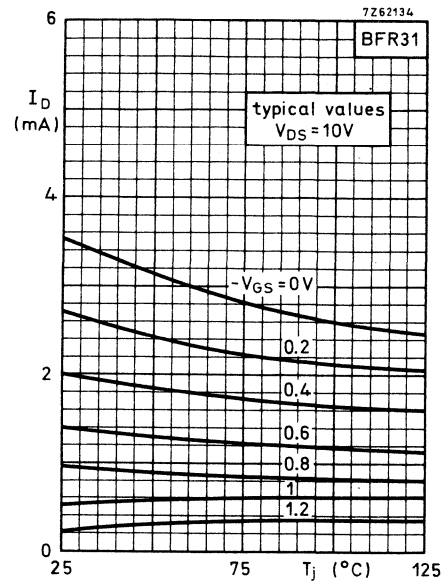


Fig. 6

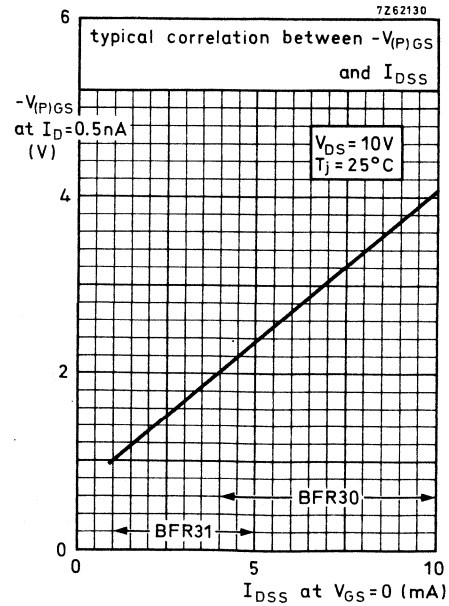


Fig. 7

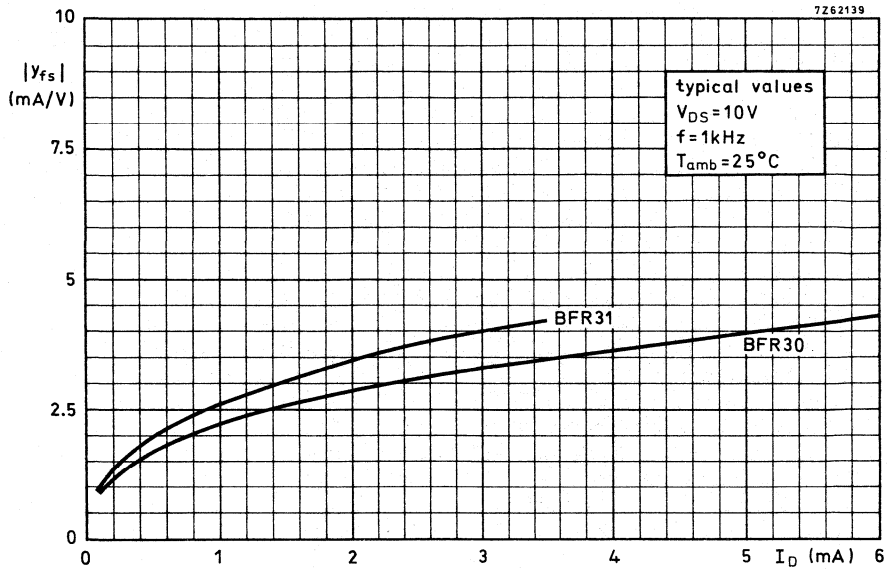

7Z62139
10
|yfs|
(mA/V)
7.5
5
2.5
0
typical values
VDS=10V
f=1kHz
Tamb=25°C
BFR31
BFR30
0
1
2
3
4
5
ID (mA)
6

Fig. 8

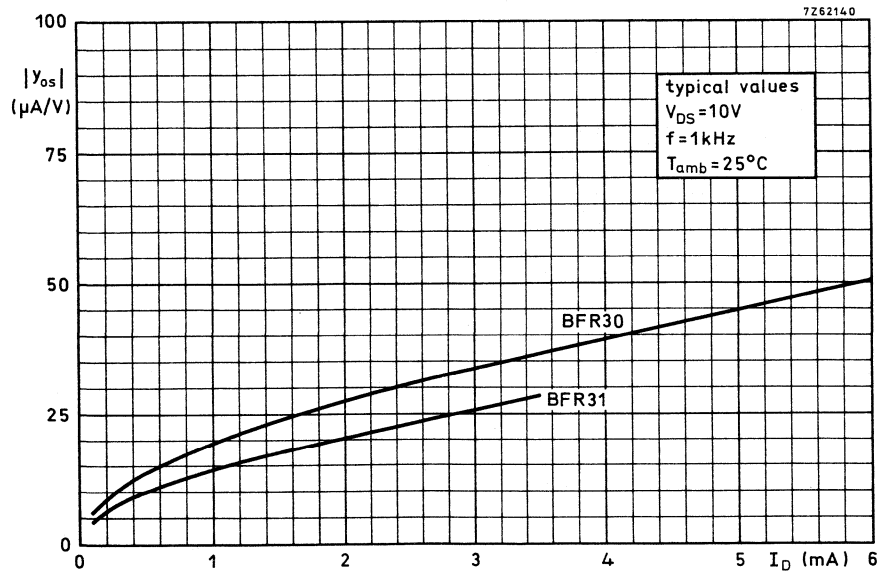

7Z62140
100
|yos|
(μA/V)
75
50
25
0
typical values
VDS=10V
f=1kHz
Tamb=25°C
BFR30
BFR31
0
1
2
3
4
5
ID (mA)
6

Fig. 9

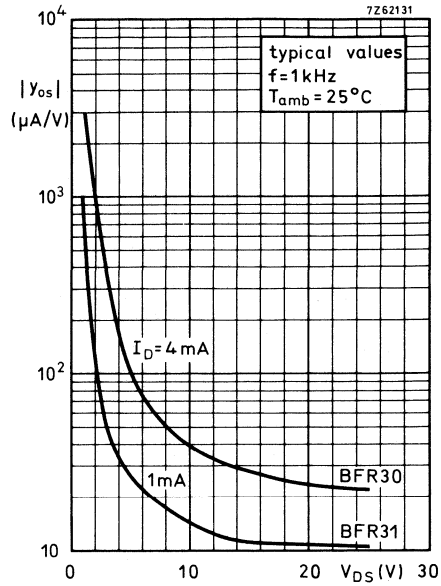


Fig. 10

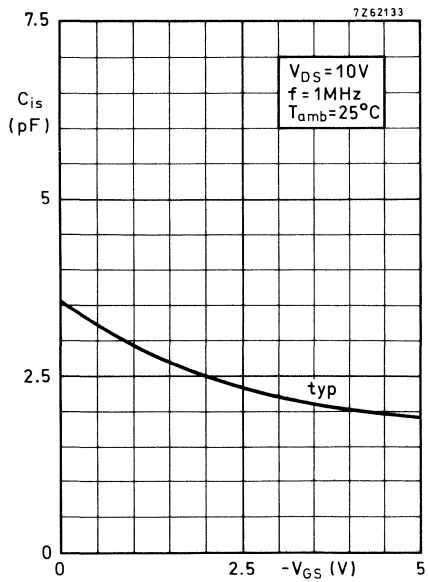


Fig. 11

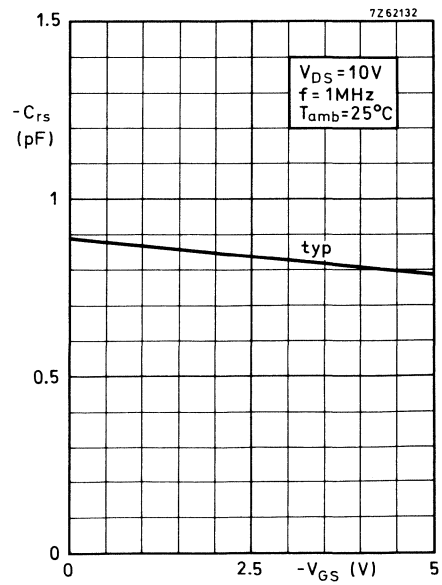


Fig. 12

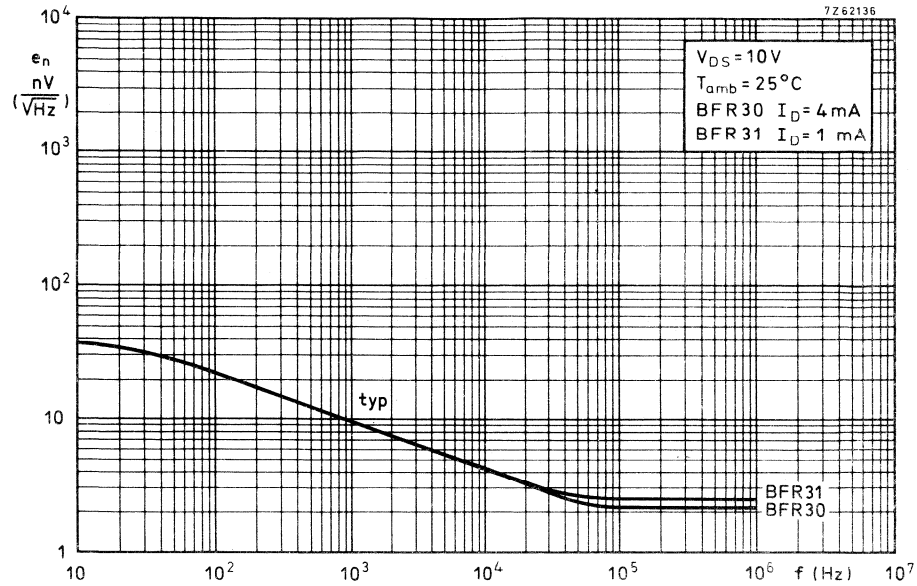

7Z62136
10^4
e_n
nV
$(\frac{}{\sqrt{Hz}})$
10^3
10^2
10
1
V_{DS} = 10V
T_{amb} = 25°C
BFR30 I_D = 4mA
BFR31 I_D = 1 mA
typ
BFR31
BFR30
10
10^2
10^3
10^4
10^5
10^6
f (Hz)
10^7

Fig. 13

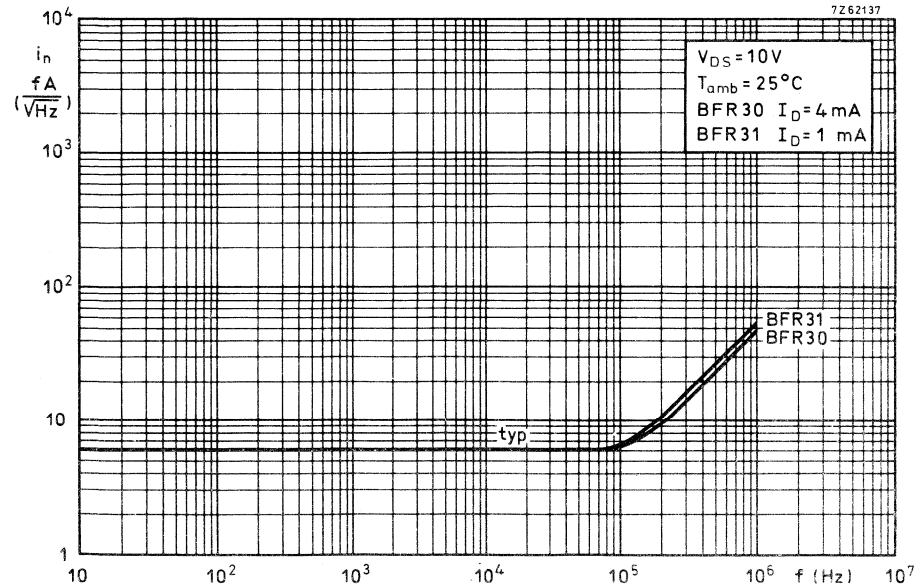

7Z62137
10^4
i_n
fA
$(\frac{}{\sqrt{Hz}})$
10^3
10^2
10
1
V_{DS} = 10V
T_{amb} = 25°C
BFR30 I_D = 4mA
BFR31 I_D = 1 mA
BFR31
BFR30
typ
10
10^2
10^3
10^4
10^5
10^6
f (Hz)
10^7

Fig. 14

N-P-N H.F. WIDEBAND TRANSISTOR

N-P-N multi-emitter transistor in a plastic SOT-23 envelope intended for application in thick and thin-film circuits. The transistor has very low intermodulation distortion and very high power gain. It is primarily intended for:

– Wideband vertical amplifiers in high speed oscilloscopes.
– Television distribution amplifiers.

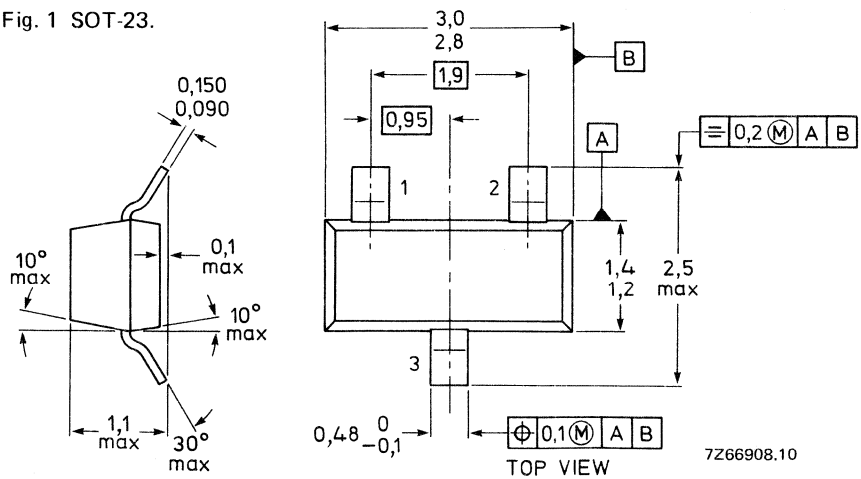
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	100	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at $f = 1$ MHz $I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0,9	pF
Transition frequency at $f = 500$ MHz $I_C = 25$ mA; $V_{CE} = 5$ V	f_T	typ.	2,0	GHz
Max. unilateral power gain				
$I_C = 30$ mA; $V_{CE} = 5$ V; $f = 200$ MHz	G_{UM}	typ.	22	dB
$I_C = 30$ mA; $V_{CE} = 5$ V; $f = 800$ MHz	G_{UM}	typ.	10,5	dB
Intermodulation distortion at $T_{amb} = 25$ °C $I_C = 30$ mA; $V_{CE} = 5$ V; $R_L = 37{,}5\ \Omega$ $V_o = 100$ mV at $f_p = 183$ MHz $V_o = 100$ mV at $f_q = 200$ MHz measured at $f_{(2q-p)} = 217$ MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA

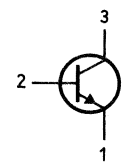
Dimensions in mm

Fig. 1 SOT-23.



Marking code

BFR53 = N1



If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value: $f > 1$ MHz)	I_{CM}	max.	100	mA
→ Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to	+150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	min.	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	min.	25	
Transition frequency at $f = 500$ MHz				
$I_C = 25$ mA; $V_{CE} = 5$ V	f_T	typ.	2,0	GHz
Collector capacitance at $f = 1$ MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,9	pF
Emitter capacitance at $f = 1$ MHz				
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,5	pF
Feedback capacitance at $f = 1$ MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,9	pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Noise figure at f = 500 MHz *

I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C G_S = 20 mS; B_S is tuned	F	max.	5,0 dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

I_C = 30 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	typ.	22 dB
I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	10,5 dB

Intermodulation distortion *

I_C = 30 mA; V_{CE} = 5 V; R_L = 37,5 Ω

V_o = 100 mV at f_p = 183 MHz
V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz

	d_{im}	typ.	−60 dB

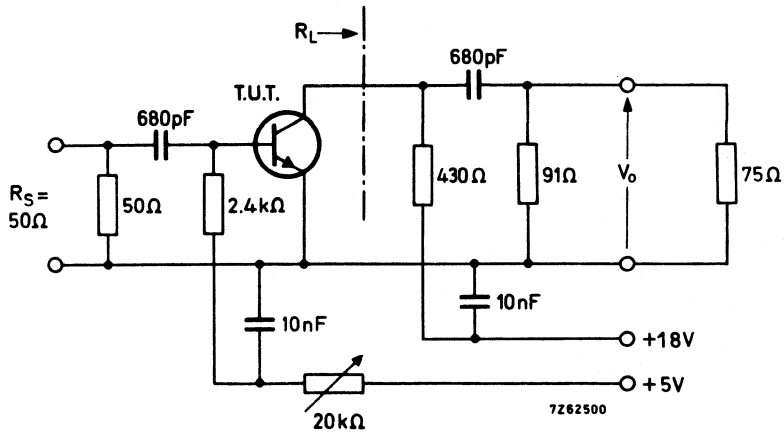


Fig. 2 Test circuit.

* Crystal mounted in a BFW30 envelope.

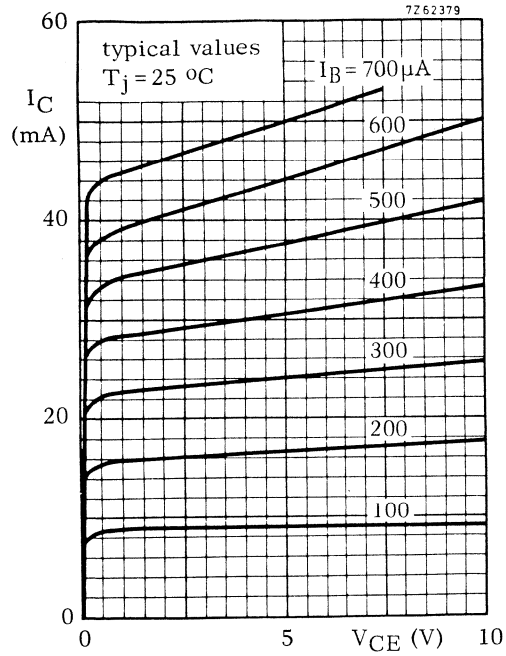


Fig. 3 T_j = 25 °C; typical values.

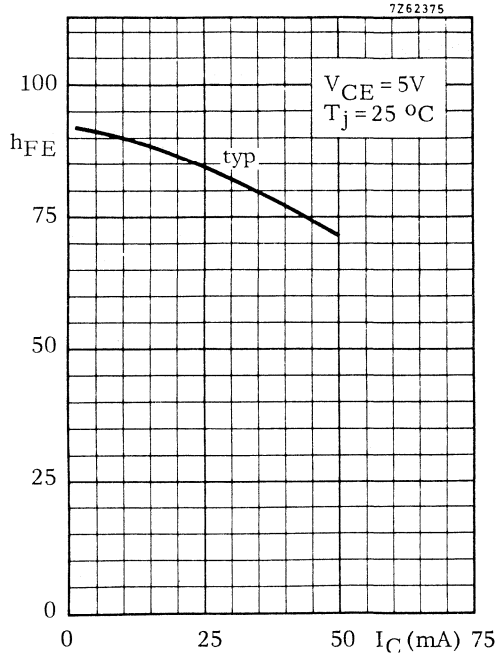


Fig. 4 V_{CE} = 5 V; T_j = 25 °C; typical values.

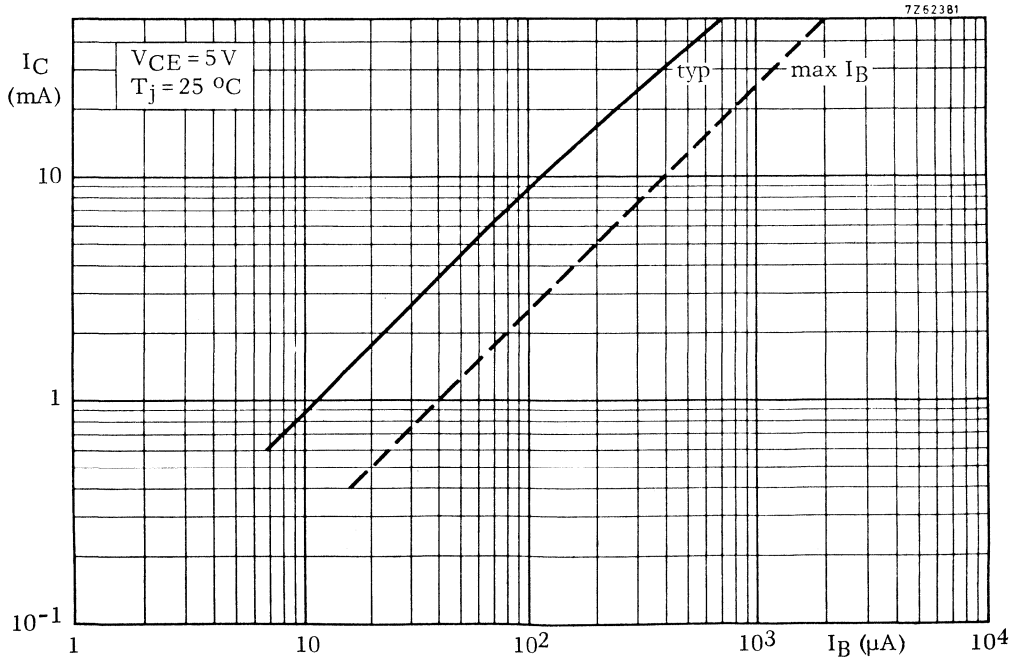


Fig. 5 V_{CE} = 5 V; T_j = 25 °C.

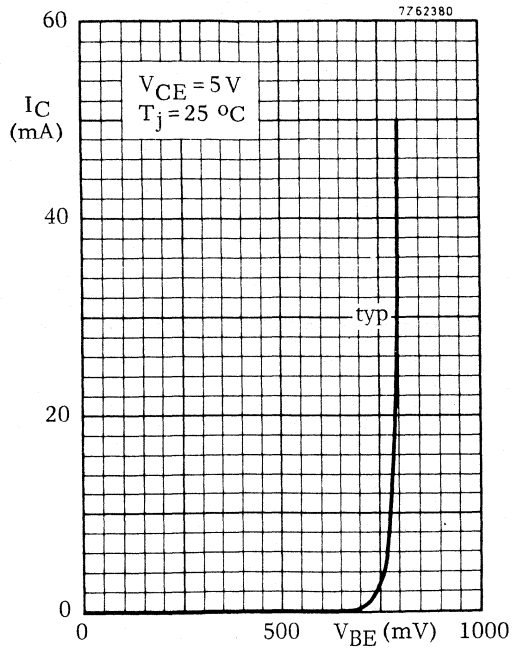


Fig. 6 V_{CE} = 5 V; T_j = 25 °C; typical values.

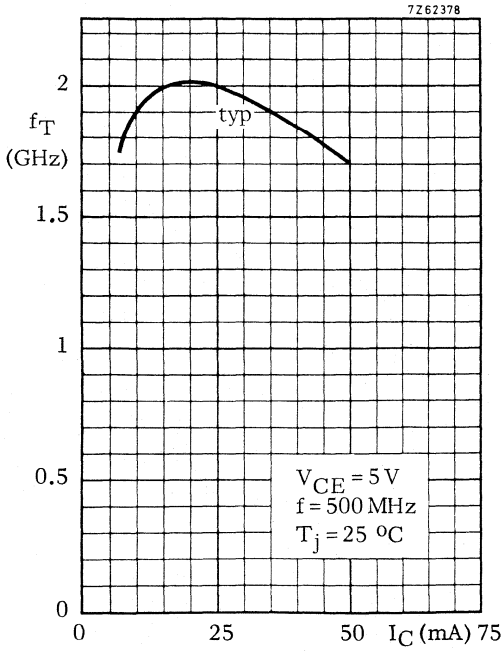


Fig. 7 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; typical values.

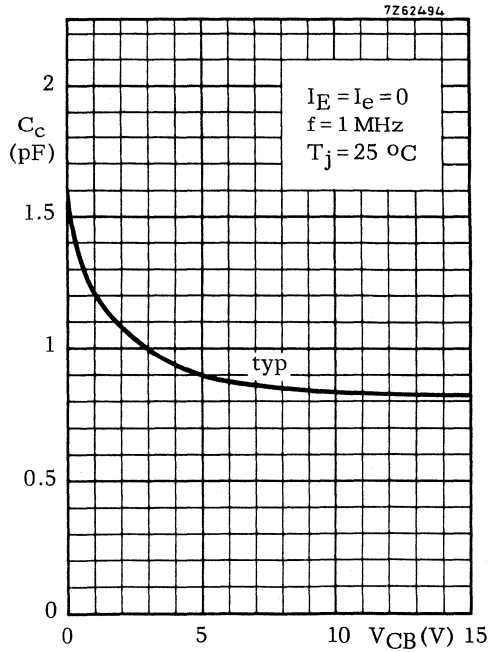


Fig. 8 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C; typical values.

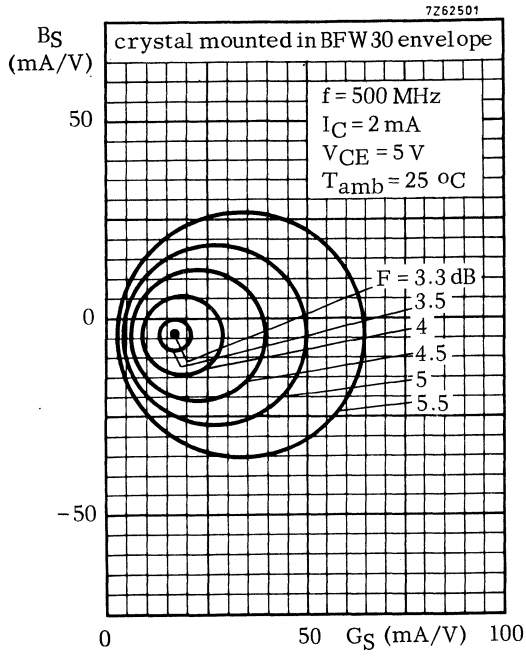


Fig. 9 Circles of constant noise figure; V_{CE} = 5 V; I_C = 2 mA; f = 500 MHz; T_{amb} = 25 °C; typ. values.

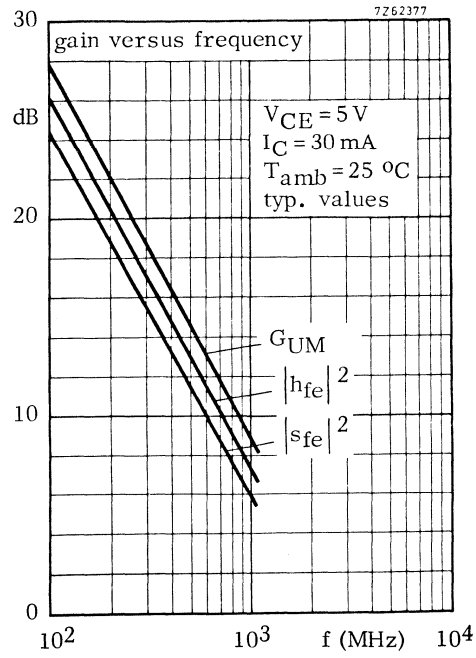


Fig. 10 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values.

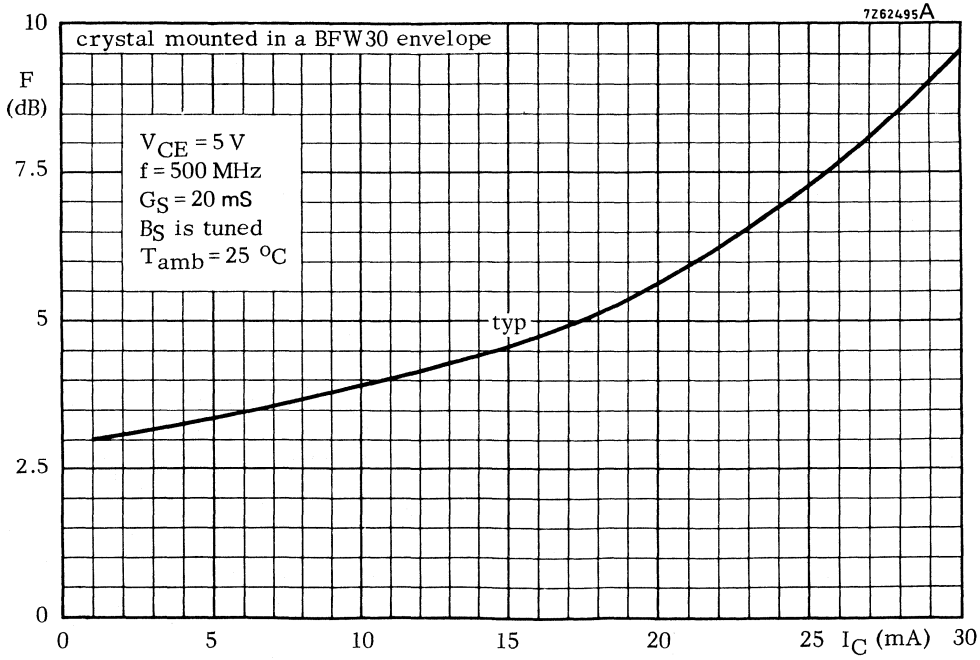


Fig. 11 V_{CE} = 5 V; f = 500 MHz; G_S = 20 mS; B_S = tuned; T_{amb} = 25 °C; typical values.

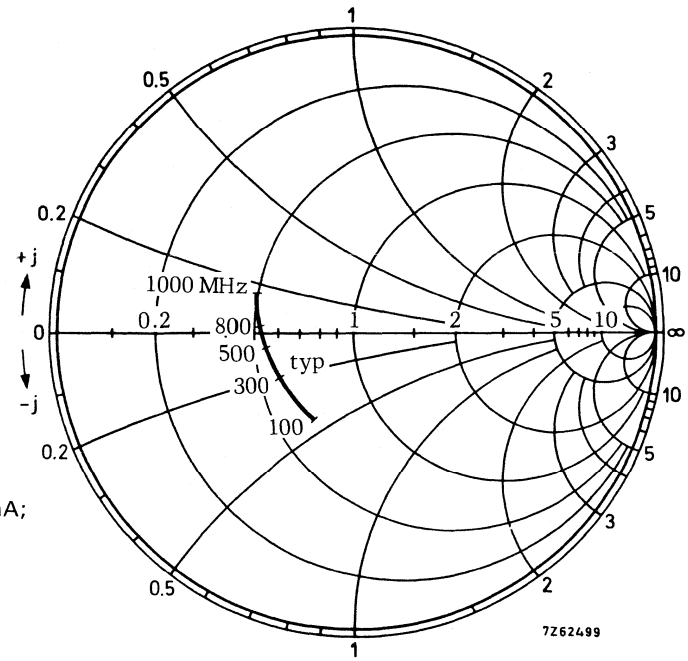


Fig. 12 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values.

Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50.

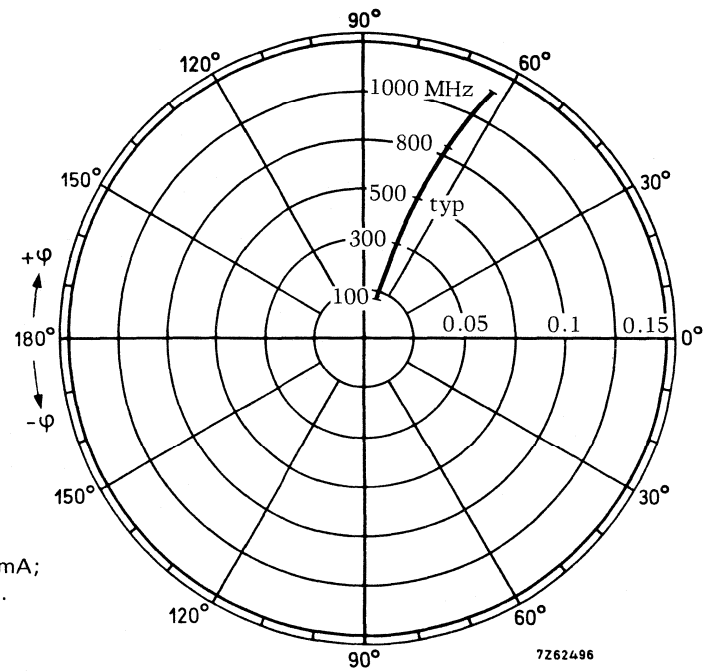


Fig. 13 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values.

Reverse transmission coefficient s_{re}.

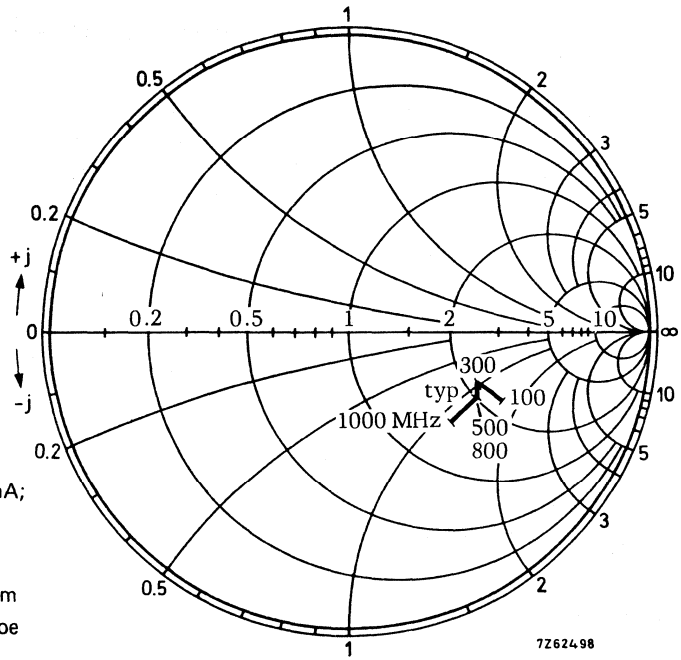


Fig. 14 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values.

Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50.

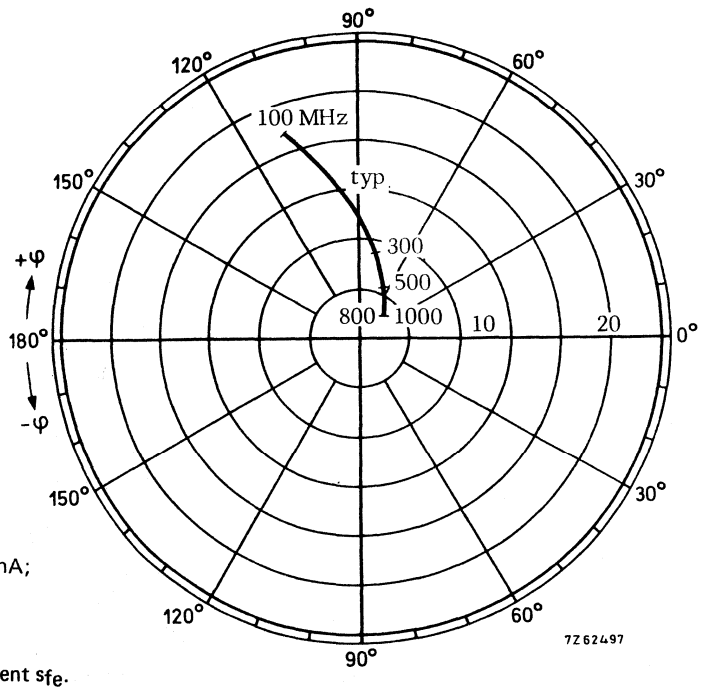


Fig. 15 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values.

Forward transmission coefficient s_{fe}.

N-P-N 1 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope. It is primarily intended for use in u.h.f. and microwave amplifiers in thick and thin-film circuits, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc. The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

P-N-P complement is BFT92.

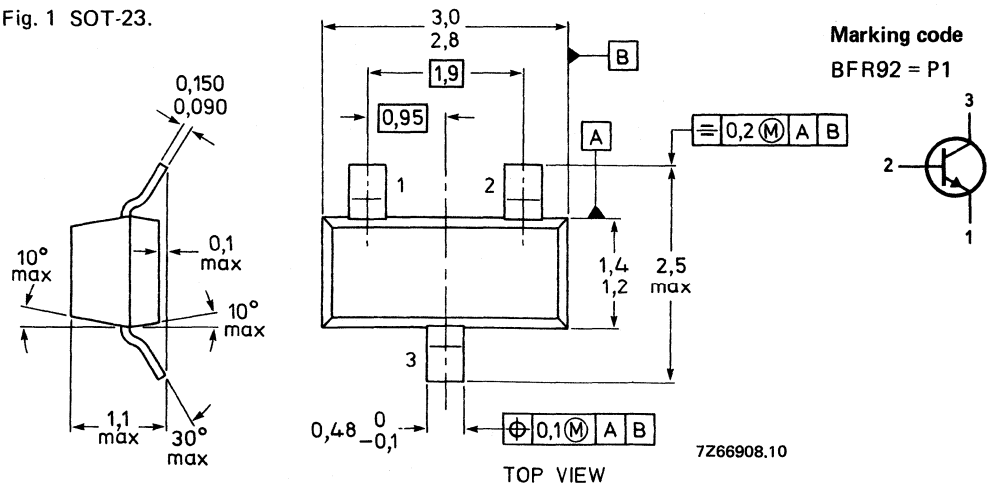
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 10 V	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz	F	typ.	2,4	dB
Max. unilateral power gain I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	G_{UM}	typ.	18,0	dB
Output voltage at d_{im} = −60 dB (see Fig. 2) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 493,25 MHz	V_o	typ.	150	mV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



Marking code

BFR92 = P1

If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	25	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	50	nA
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 50	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	0,75	pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	0,8	pF
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,4	pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Noise figure at optimum source impedance*

I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C — F — typ. — 2,4 dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C — G_{UM} — typ. — 18,0 dB

Output voltage at d_{im} = −60 dB (see Fig. 2)

(DIN 45004B; par. 6.3.: 3-tone)

I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω

$V_p = V_o$ at d_{im} = −60 dB ; f_p = 495,25 MHz

$V_q = V_o$ −6 dB ; f_q = 503,25 MHz

$V_r = V_o$ −6 dB ; f_r = 505,25 MHz

measured at $f_{(p+q-r)}$ = 493,25 MHz — V_o — typ. — 150 mV

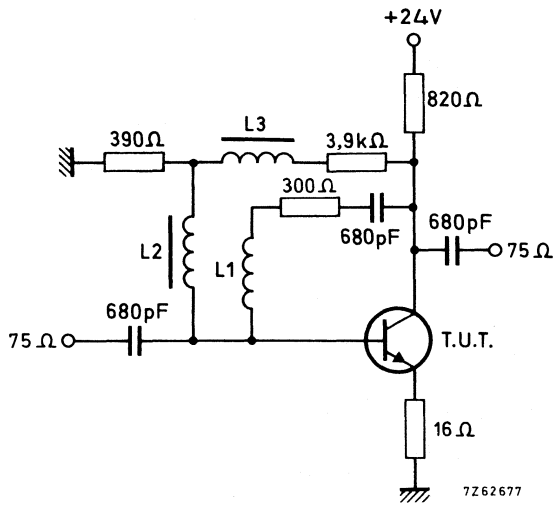


Fig. 2 Intermodulation test circuit.

L1 = 4 turns Cu wire (0,35 mm); winding pitch 1 mm; int. dia. 4 mm

L2 = L3 = 5 μH (code number: 3122 108 20150)

* Crystal mounted in a BFR90 envelope.

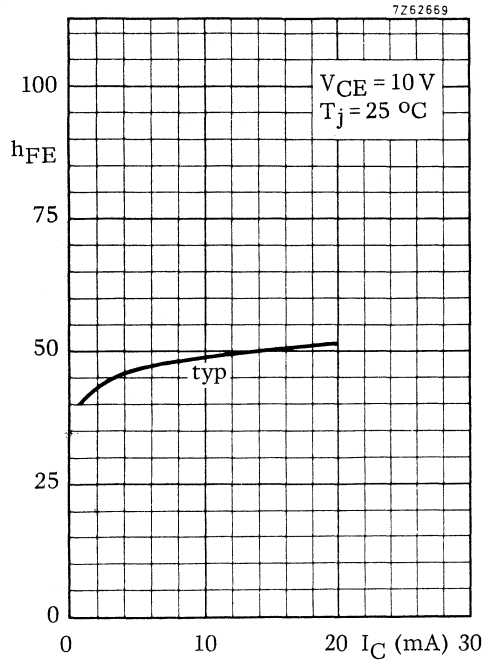


Fig. 3 V_{CE} = 10 V; T_j = 25 °C; typical values.

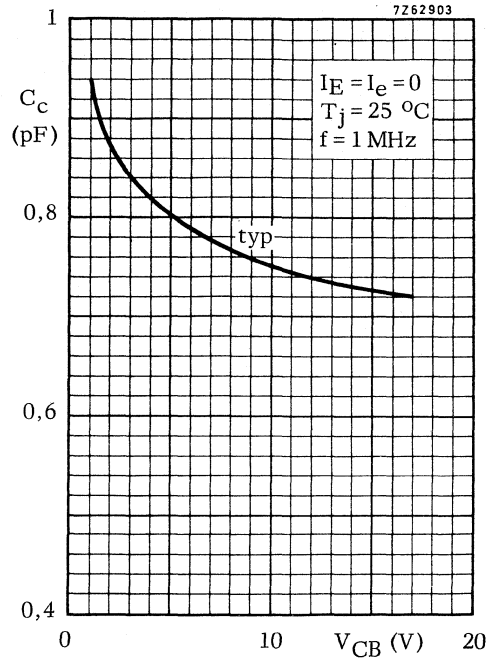


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; typical values.

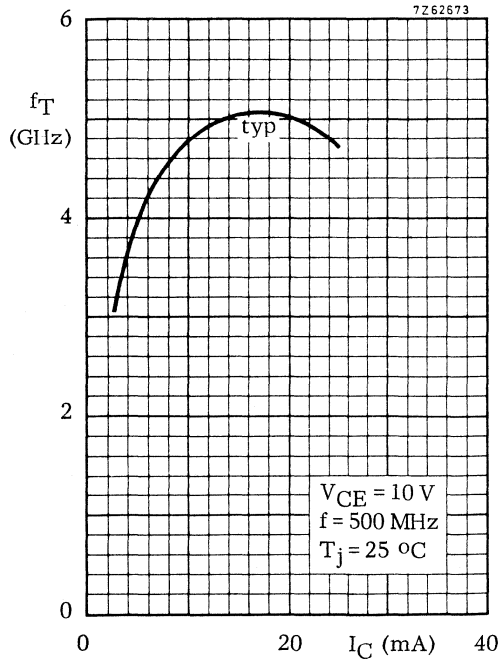


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

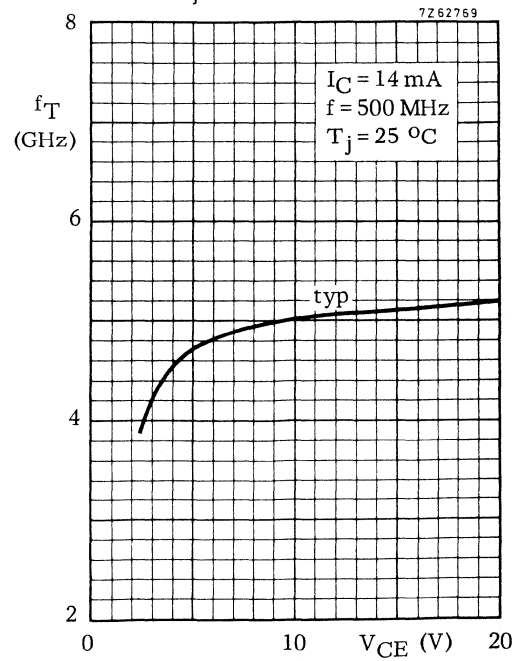


Fig. 6 I_C = 14 mA; f = 500 MHz; T_j = 25 °C; typical values.

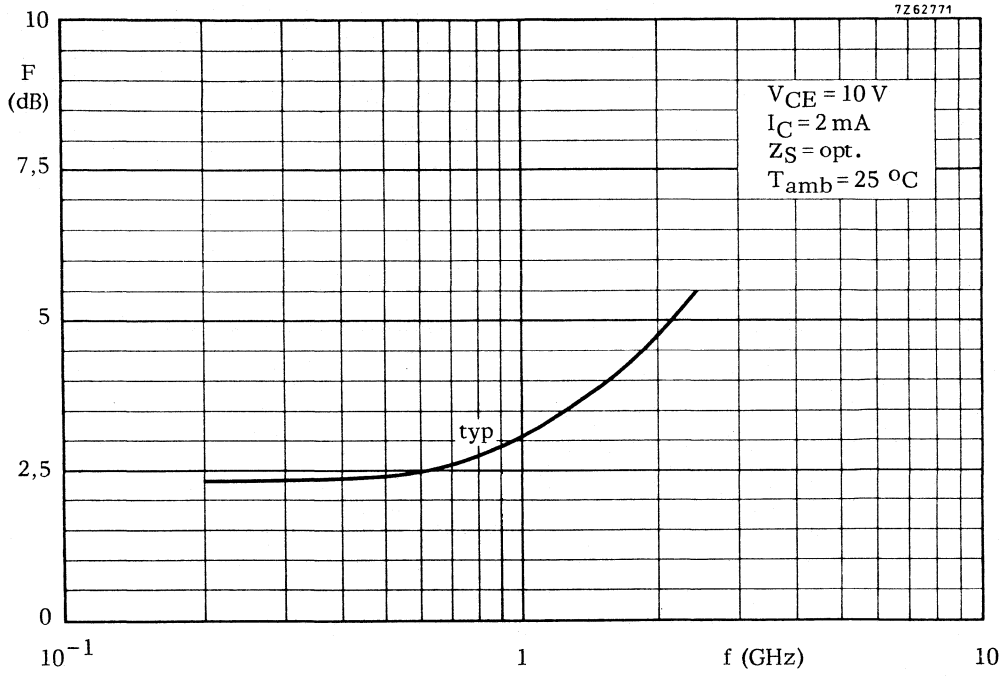


Fig. 7 V_{CE} = 10 V; I_C = 2 mA; Z_S = opt.; T_{amb} = 25 °C; typical values.

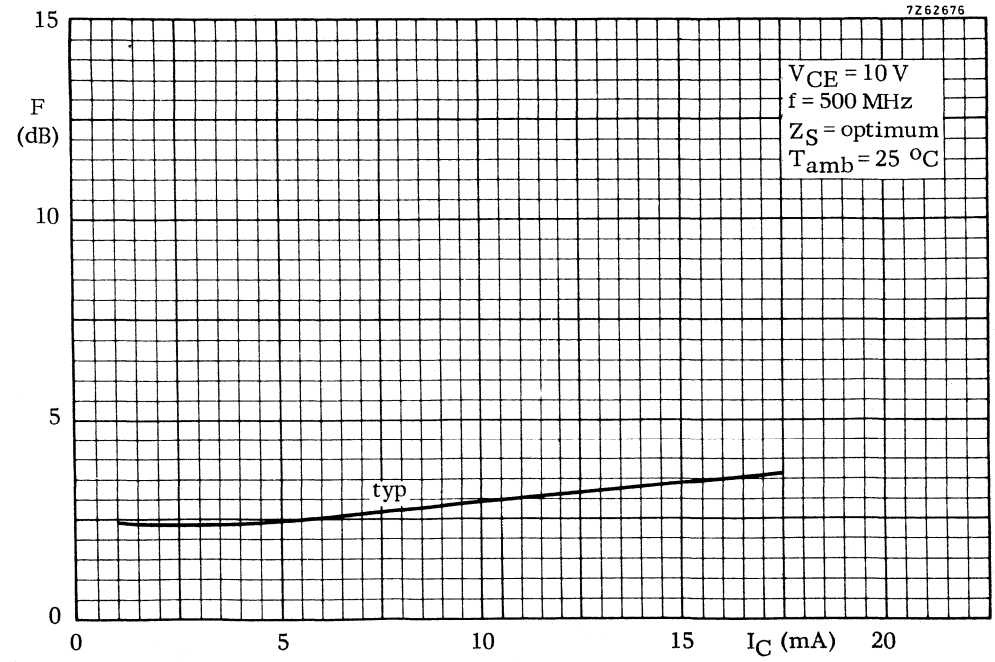


Fig. 8 V_{CE} = 10 V; f = 500 MHz; Z_S = opt.; T_{amb} = 25 °C; typical values.

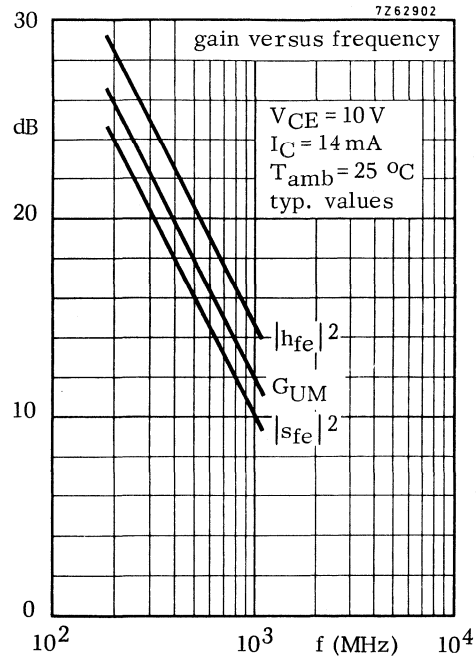


Fig. 9 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

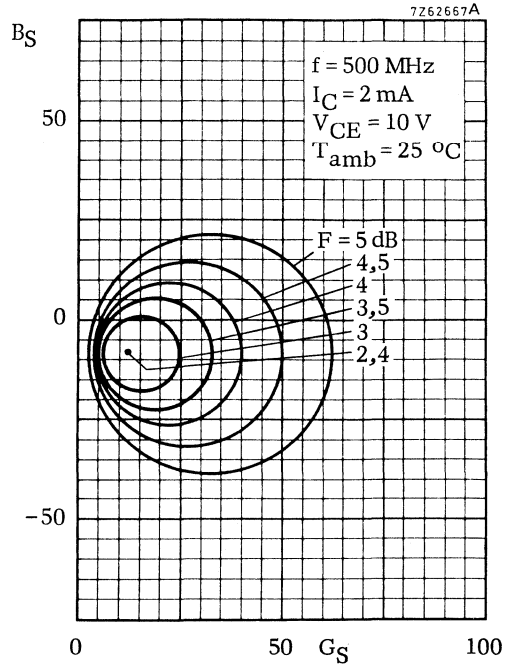


Fig. 10 Circles of constant noise figure; V_{CE} = 10 V; I_C = 2 mA; f = 500 MHz; T_{amb} = 25 °C; typical values.

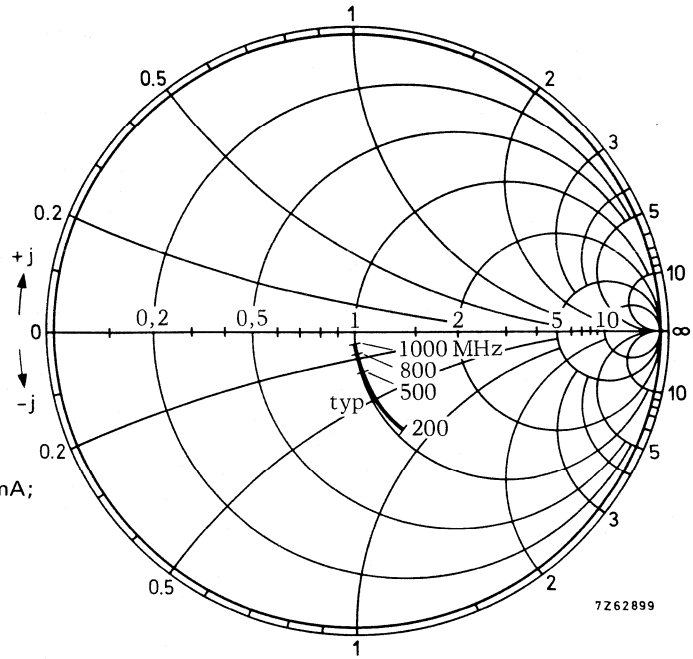


Fig. 11 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

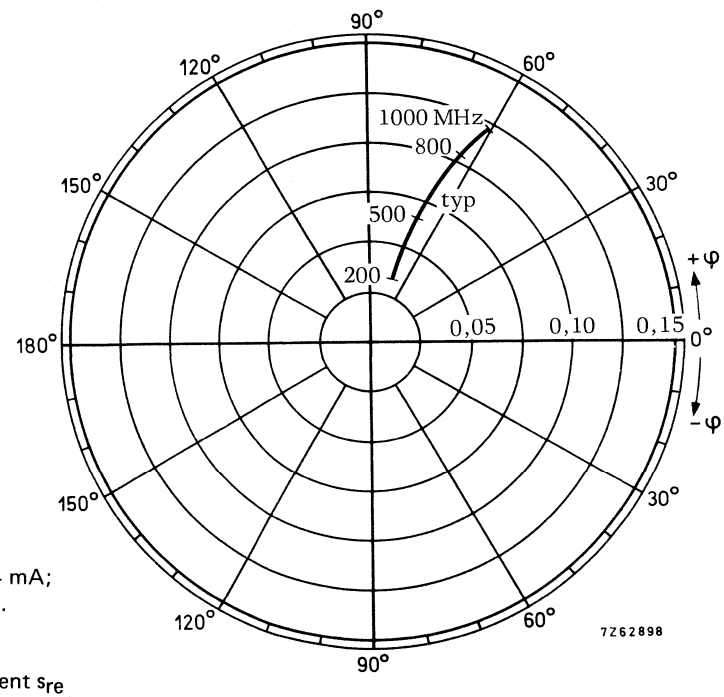


Fig. 12 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

Reverse transmission coefficient s_{re}

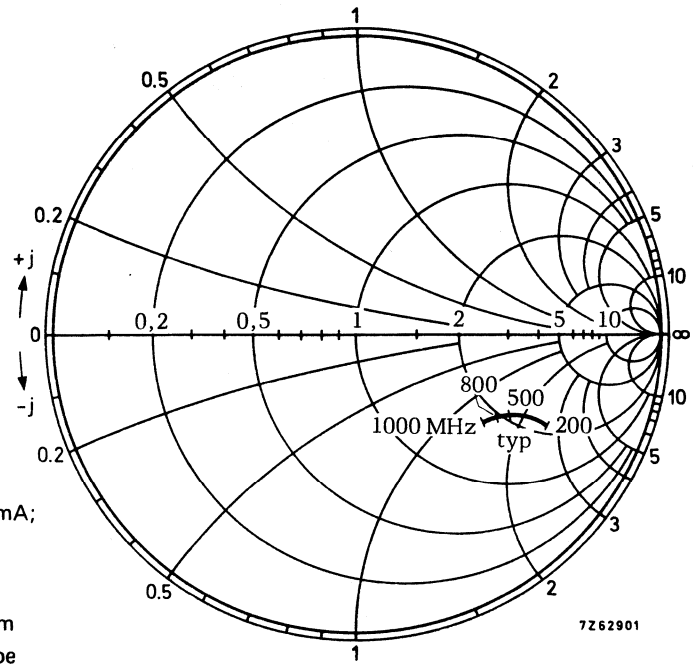


Fig. 13 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

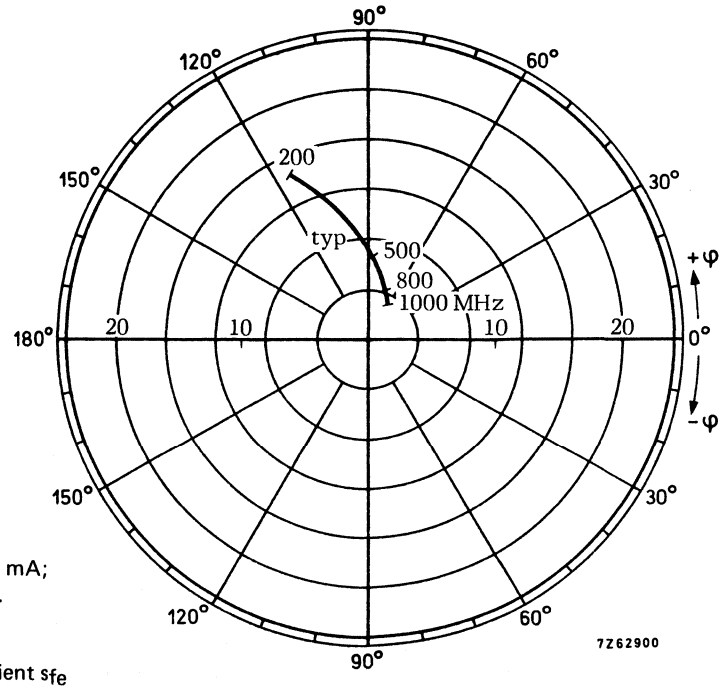


Fig. 14 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

Forward transmission coefficient s_{fe}

N-P-N 1 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope. It is primarily intended for use in v.h.f./u.h.f. broadband amplifiers. The transistor features:

- low noise;
- low intermodulation distortion;
- high power gain.

P-N-P complement is BFT92

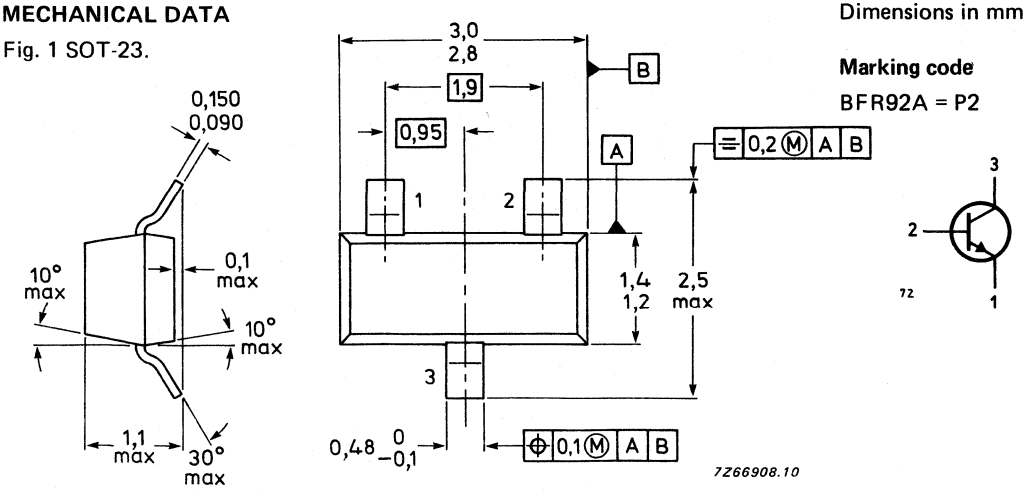
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open-base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	0,35	pF
Noise figure at R_S = 60 Ω I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	1,8	dB
Output voltage at d_{im} = −60 dB I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	150	mV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

Marking code

BFR92A = P2

If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	25	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	60	nA
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	0,6	pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,35	pF
Noise figure at T_{amb} = 25 °C I_C = 4 mA; V_{CE} = 10 V; R_S = 60 Ω; f = 800 MHz	F	typ.	1,8	dB
Maximum unilateral power gain (s_{re} assumed to be zero) $G_{UM} = 10 \log \frac{\lvert s_{fe}\rvert^2}{[1-\lvert s_{ie}\rvert^2]\,[1-\lvert s_{oe}\rvert^2]}$ I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,5	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Output voltage at d_{im} = −60 dB (see Figs 2 and 16)*
(DIN 45004B, par. 6.3: 3-tone)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C

$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz

Measured at $f_{(p+q-r)}$ = 793,25 MHz V_o typ. 150 mV

Second harmonic distortion (see Figs 2 and 18)*
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
V_p = 60 mV at f_p = 250 MHz
V_q = 60 mV at f_q = 560 MHz

measured at $f_{(p+q)}$ = 810 MHz d_2 typ. −50 dB

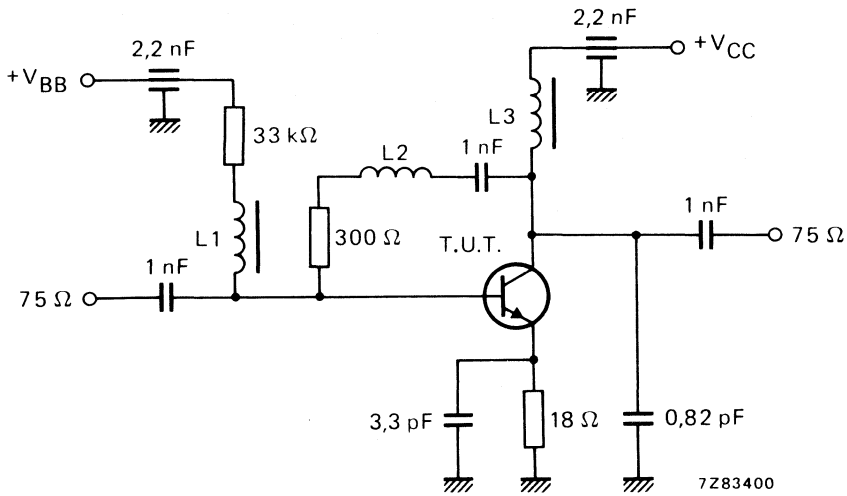


Fig. 2 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

* Measured on same crystal in a SOT-37 envelope (BFR90A).

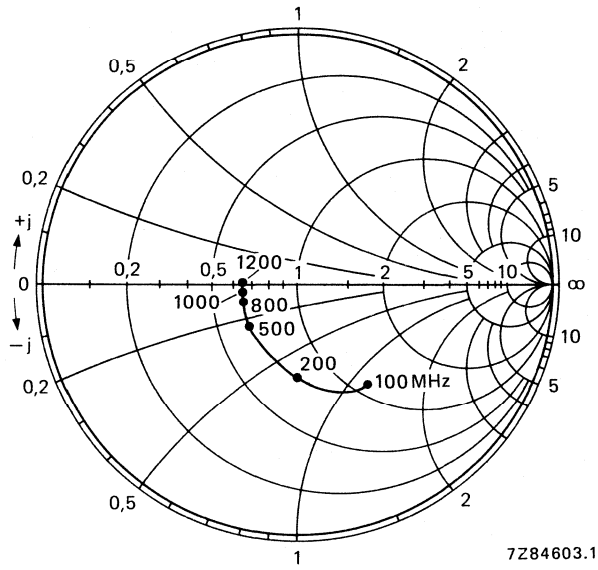


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

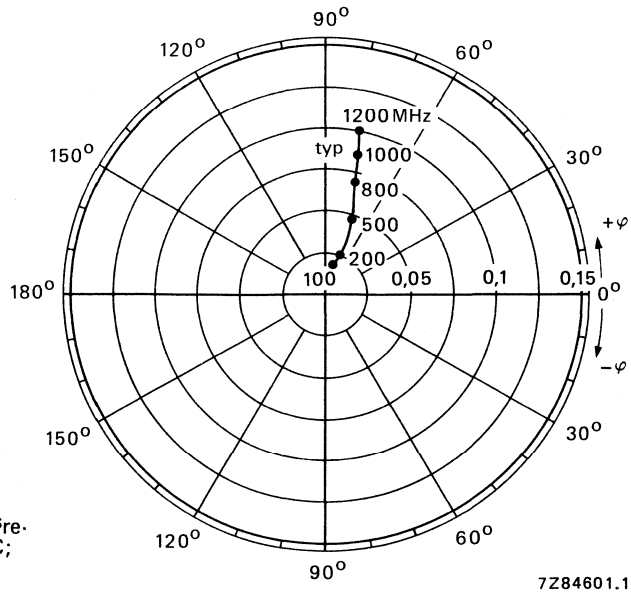


Fig. 4 Reverse transmission coefficient s_{re}.
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

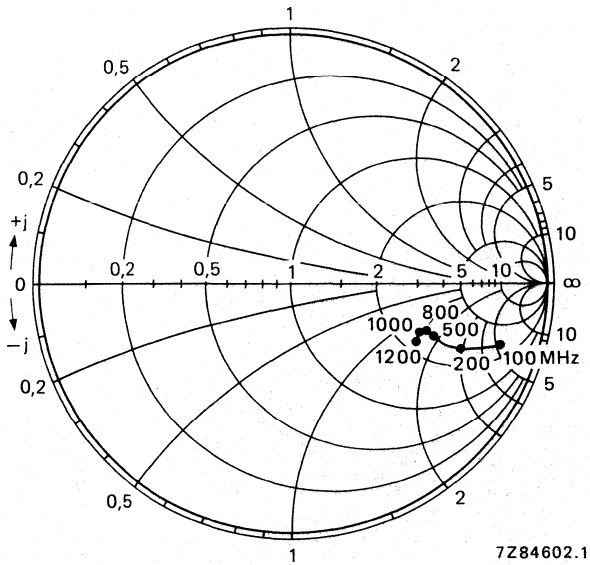


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

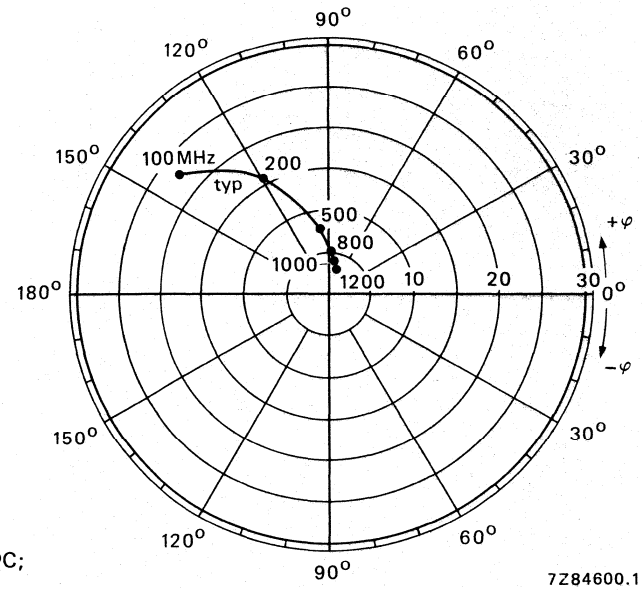


Fig. 6 Forward transmission coefficient s_{fe}.
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

s-parameters (common emitter) at V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,88/ −8,9°	0,009/83,6°	6,7/174,2°	1,00/ −2,7°
	100	0,86/ −21,9°	0,022/78,3°	6,5/164,2°	0,98/ −6,6°
	200	0,80/ −42,2°	0,041/69,0°	6,0/149,2°	0,94/−12,2°
2	500	0,61/ −87,2°	0,073/54,9°	4,2/119,1°	0,81/−20,2°
	800	0,48/−117,4°	0,086/52,7°	3,1/100,5°	0,74/−22,9°
	1000	0,44/−133,8°	0,092/54,2°	2,6/ 91,4°	0,71/−24,2°
	1200	0,41/−147,6°	0,099/57,5°	2,2/ 84,3°	0,70/−25,7°
	40	0,75/ −14,4°	0,008/81,8°	14,4/170,2°	0,99/ −4,9°
	100	0,70/ −34,0°	0,020/74,2°	13,3/155,3°	0,94/−11,2°
	200	0,60/ −61,7°	0,034/65,0°	10,9/135,8°	0,84/−17,9°
5	500	0,40/−111,1°	0,057/61,1°	6,2/106,9°	0,67/−21,9°
	800	0,32/−139,7°	0,074/65,5°	4,2/ 92,4°	0,62/−22,2°
	1000	0,30/−153,2°	0,086/68,2°	3,4/ 85,3°	0,61/−22,8°
	1200	0,29/−166,2°	0,100/70,9°	2,9/ 79,6°	0,60/−24,0°
	40	0,61/ −21,1°	0,008/79,7°	22,9/165,2°	0,97/ −7,3°
	100	0,54/ −48,5°	0,017/71,4°	19,8/145,8°	0,88/−15,5°
	200	0,42/ −82,1°	0,028/65,2°	14,4/124,7°	0,74/−20,8°
10	500	0,30/−132,3°	0,050/69,0°	7,1/ 99,6°	0,59/−20,5°
	800	0,26/−158,0°	0,072/73,7°	4,7/ 87,8°	0,56/−20,3°
	1000	0,25/−168,3°	0,088/75,2°	3,8/ 82,2°	0,56/−20,9°
	1200	0,25/−179,3°	0,104/76,6°	3,2/ 77,5°	0,55/−22,1°
	40	0,53/ −26,0°	0,007/78,6°	27,7/162,4°	0,96/ −8,7°
	100	0,45/ −58,1°	0,016/70,5°	22,6/140,7°	0,85/−17,2°
	200	0,36/ −94,4°	0,025/66,6°	15,6/119,7°	0,70/−21,0°
14	500	0,27/−142,8°	0,049/72,5°	7,3/ 96,9°	0,57/−19,1°
	800	0,25/−166,0°	0,072/76,5°	4,7/ 86,1°	0,55/−19,1°
	1000	0,24/−174,8°	0,088/77,4°	3,8/ 80,5°	0,55/−19,9°
	1200	0,24/ 174,8°	0,105/78,4°	3,2/ 76,2°	0,54/−21,3°
	40	0,45/ −33,1°	0,007/77,0°	32,3/158,8°	0,94/−10,1°
	100	0,38/ −71,8°	0,015/69,5°	24,7/135,0°	0,80/−18,4°
	200	0,31/−110,6°	0,023/68,3°	16,0/114,6°	0,66/−20,1°
20	500	0,26/−154,5°	0,047/75,5°	7,2/ 94,3°	0,56/−17,3°
	800	0,25/−174,2°	0,071/78,7°	4,7/ 84,3°	0,55/−17,8°
	1000	0,25/ 178,5°	0,088/79,3°	3,7/ 79,1°	0,54/−18,9°
	1200	0,26/ 169,9°	0,104/80,0°	3,2/ 74,9°	0,54/−20,5°

s-parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,89/ −8,7°	0,008/83,6°	6,8/174,4°	1,00/ −2,5°
	100	0,86/ −21,2°	0,021/78,5°	6,5/164,6°	0,98/ −6,1°
	200	0,80/ −40,9°	0,038/69,5°	6,0/149,6°	0,94/−11,3°
2	500	0,61/ −85,3°	0,069/55,8°	4,3/119,8°	0,82/−18,7°
	800	0,48/−115,4°	0,081/53,8°	3,1/101,2°	0,75/−21,3°
	1000	0,44/−131,4°	0,086/55,5°	2,6/ 92,1°	0,73/−22,5°
	1200	0,40/−145,6°	0,093/58,9°	2,2/ 85,0°	0,72/−23,9°
	40	0,77/ −13,6°	0,008/81,8°	14,2/170,5°	0,99/ −4,5°
	100	0,73/ −32,3°	0,019/74,7°	13,2/155,8°	0,95/−10,3°
	200	0,62/ −58,8°	0,032/65,6°	11,0/136,8°	0,85/−16,6°
5	500	0,41/−107,2°	0,054/61,4°	6,3/107,7°	0,69/−20,4°
	800	0,32/−135,9°	0,071/65,9°	4,2/ 92,9°	0,64/−20,8°
	1000	0,30/−150,0°	0,082/68,6°	3,5/ 86,1°	0,63/−21,3°
	1200	0,28/−162,9°	0,095/71,5°	2,9/ 80,5°	0,62/−22,4°
	40	0,66/ −19,4°	0,007/80,1°	22,5/165,9°	0,97/ −6,6°
	100	0,58/ −44,7°	0,017/71,8°	19,5/147,0°	0,90/−14,1°
	200	0,45/ −76,2°	0,027/65,4°	14,5/126,0°	0,76/−19,3°
10	500	0,29/−125,1°	0,049/68,7°	7,2/100,6°	0,62/−19,2°
	800	0,24/−151,8°	0,070/73,5°	4,7/ 88,8°	0,59/−19,0°
	1000	0,24/−162,9°	0,084/75,2°	3,8/ 82,6°	0,58/−19,7°
	1200	0,23/−174,8°	0,099/76,8°	3,2/ 78,3°	0,58/−20,9°
	40	0,60/ −23,2°	0,007/78,6°	27,2/163,0°	0,96/ −7,9°
	100	0,51/ −52,5°	0,016/70,6°	22,6/141,8°	0,86/−15,8°
	200	0,38/ −86,2°	0,025/66,4°	15,7/120,7°	0,72/−19,6°
14	500	0,26/−134,3°	0,047/72,0°	7,5/ 97,8°	0,60/−18,0°
	800	0,22/−159,3°	0,069/76,2°	4,8/ 86,8°	0,57/−18,0°
	1000	0,22/−169,0°	0,085/77,3°	3,9/ 81,3°	0,57/−18,7°
	1200	0,22/ 179,8°	0,100/78,5°	3,3/ 76,8°	0,57/−20,1°
	40	0,54/ −28,2°	0,007/77,4°	31,7/159,9°	0,95/ −9,1°
	100	0,45/ −61,7°	0,015/69,5°	24,7/136,8°	0,82/−16,8°
	200	0,33/ −97,5°	0,023/67,5°	16,3/116,2°	0,68/−18,8°
20	500	0,24/−143,7°	0,046/74,4°	7,4/ 95,3°	0,59/−16,4°
	800	0,22/−166,4°	0,069/78,0°	4,8/ 85,2°	0,57/−16,9°
	1000	0,22/−174,7°	0,084/78,7°	3,8/ 80,1°	0,57/−17,8°
	1200	0,22/ 176,3°	0,100/79,7°	3,3/ 76,0°	0,57/−19,4°

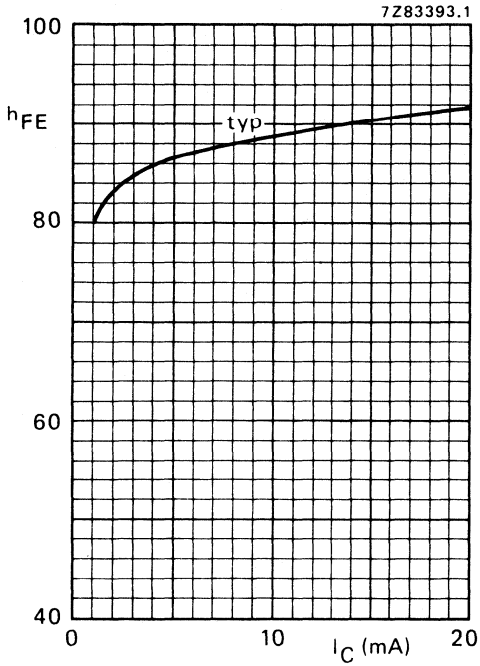


Fig. 7 V_{CE} = 10 V; T_j = 25 °C; typical values.

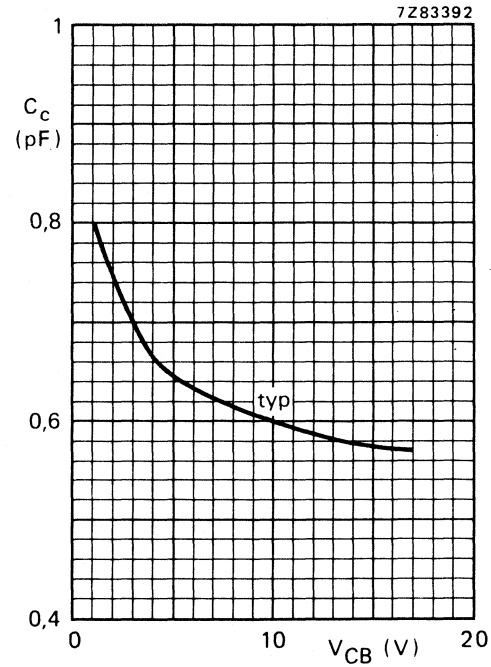


Fig. 8 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; typical values.

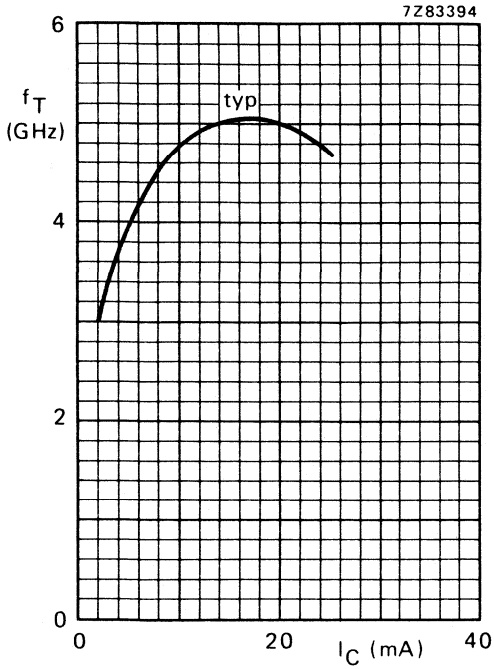


Fig. 9 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

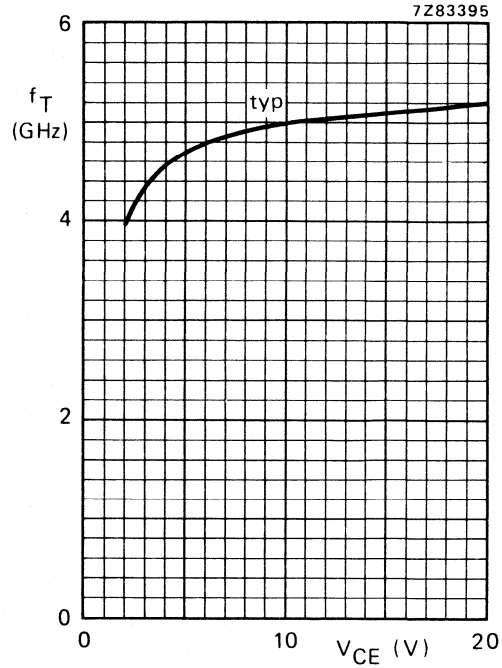


Fig. 10 I_C = 14 mA; f = 500 MHz; T_j = 25 °C; typical values.

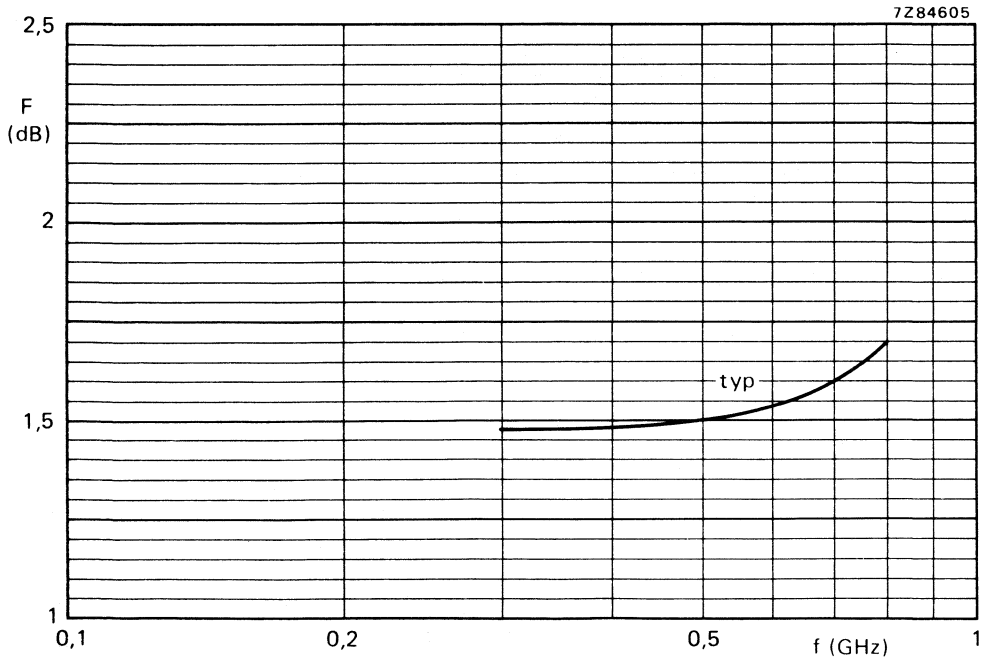


Fig. 11 V_{CE} = 10 V; I_C = 4 mA; Z_S = optimum; T_{amb} = 25 °C; typical values.

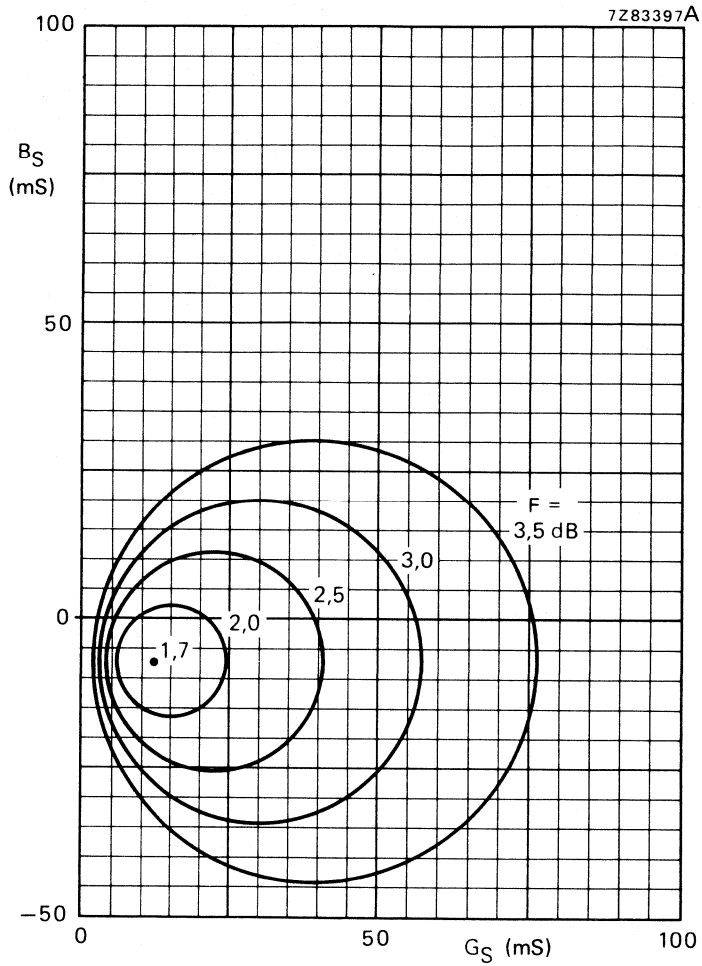


Fig. 12 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz; T_{amb} = 25 °C;
typical values.

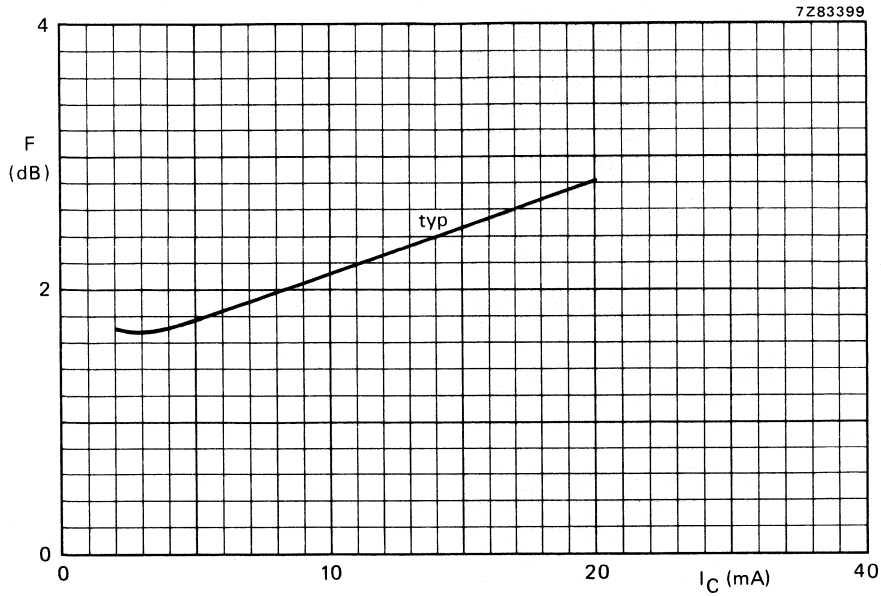


Fig. 13 V_{CE} = 10 V; f = 800 MHz; Z_S = optimum; T_{amb} = 25 °C; typical values.

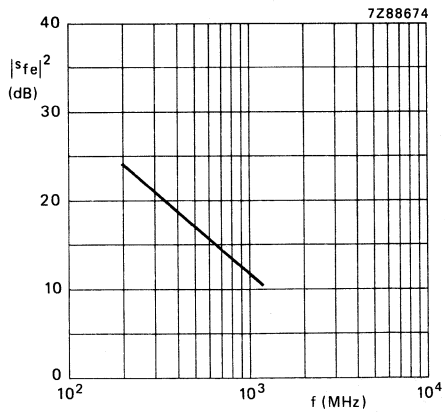


Fig. 14 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

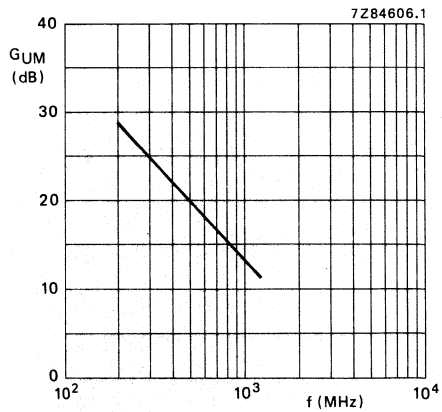


Fig. 15 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C; typical values.

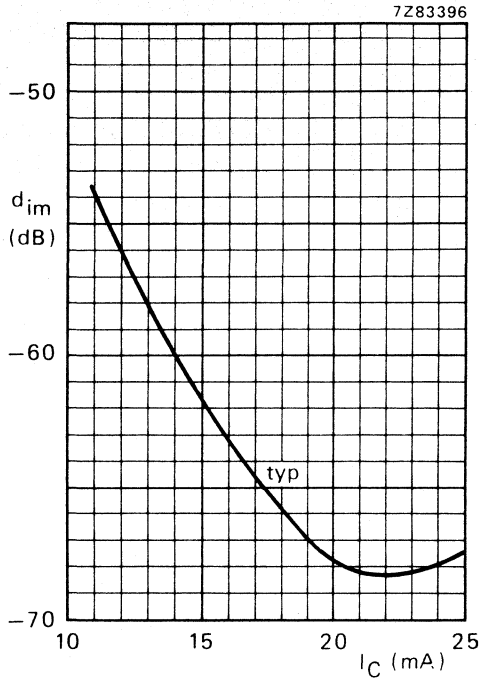


Fig. 16 V_{CE} = 10 V; V_o = 43,5 dBmV = 150 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 2); typical values.

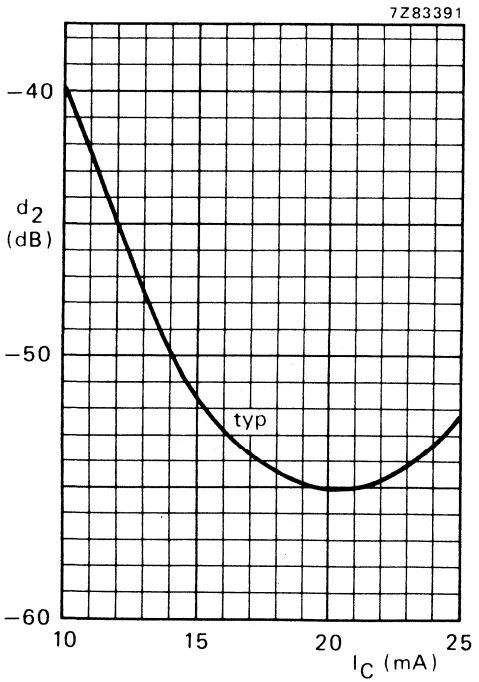


Fig. 17 V_{CE} = 10 V; V_o = 60 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 2); typical values.

N-P-N 1 GHz WIDEBAND TRANSISTOR

N-P-N transistor in a SOT-23 plastic envelope. It is primarily intended for use in u.h.f. and microwave amplifiers in thick and thin-film circuits, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc. The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

P-N-P complement is the BFT93.

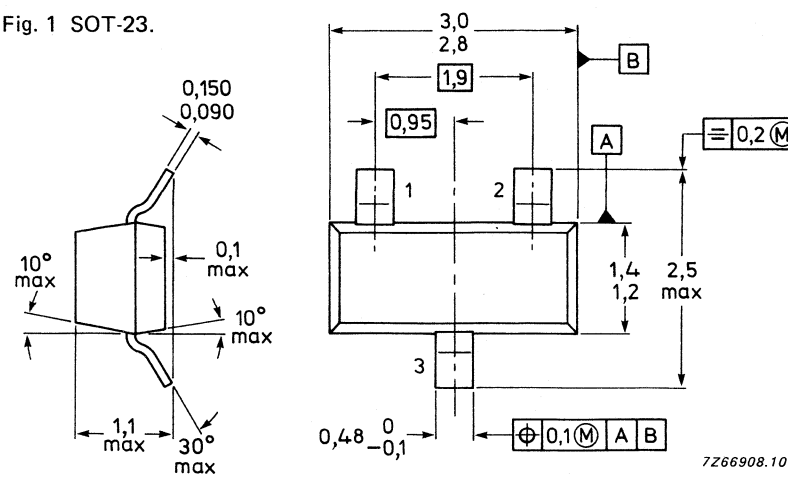
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz;	F	typ.	1,9	dB
Max. unilateral power gain I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz;	G_{UM}	typ.	16,5	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_o = 300 mV $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

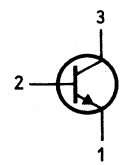


TOP VIEW

If required, the R-version (reverse pinning) is available on request.

Marking code

BFR93 = R1



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	35 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	50 nA
D.C. current gain ** I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min. typ.	25 50
Transition frequency at f = 500 MHz ** I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	0,7 pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	1,8 pF
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8 pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Measured under pulse conditions.

Noise figure at optimum source impedance *

I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C — F — typ. — 1,9 dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C — G_{UM} — typ. — 16,5 dB

Intermodulation distortion at T_{amb} = 25 °C *

I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V.S.W.R. < 2

$V_p = V_o$ = 300 mV at f_p = 495,25 MHz

$V_q = V_o$ – 6 dB at f_q = 503,25 MHz

$V_r = V_o$ – 6 dB at f_r = 505,25 MHz

Measured at $f_{(p+q-r)}$ = 493,25 MHz — d_{im} — typ. — –60 dB

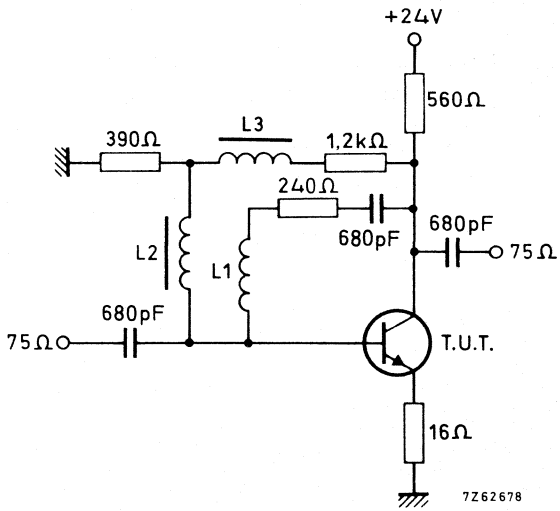


Fig. 2 Intermodulation test circuit.

L1 = 4 turns Cu wire (0,35); winding pitch 1 mm; int. dia. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)

* Crystal mounted in a BFR91 envelope.

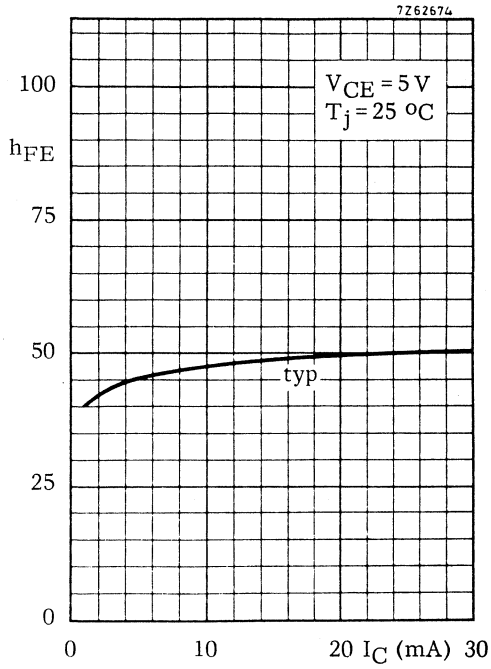


Fig. 3.

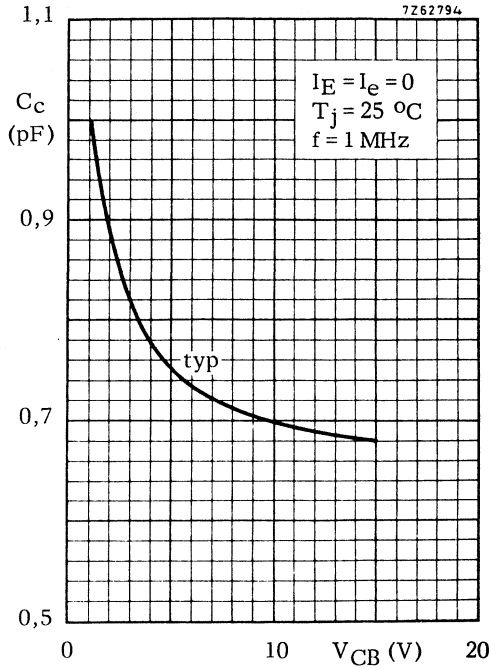


Fig. 4.

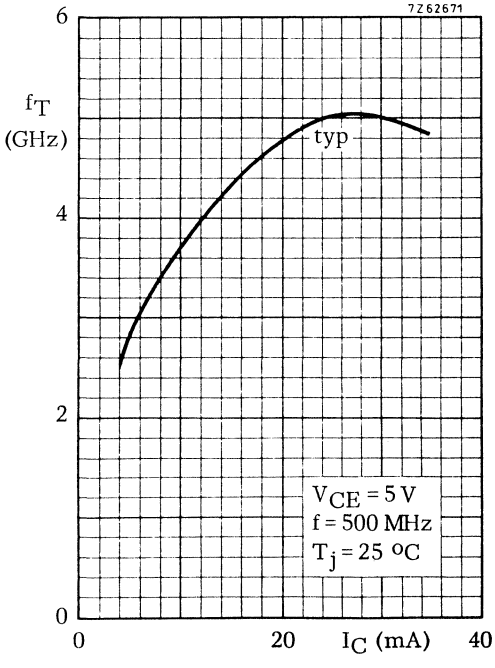


Fig. 5.

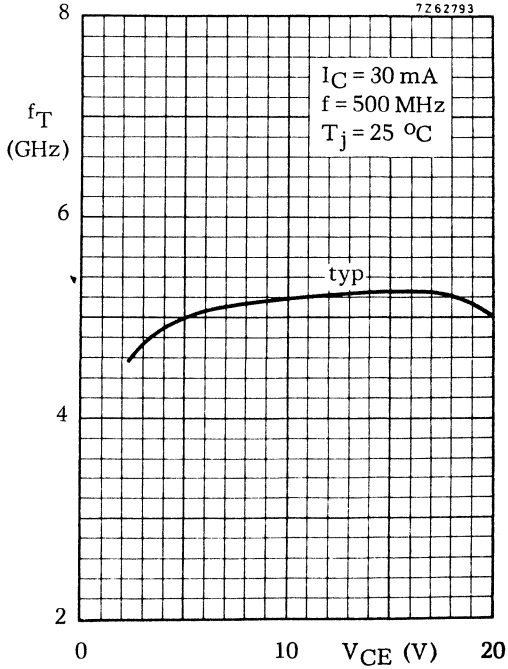


Fig. 6.

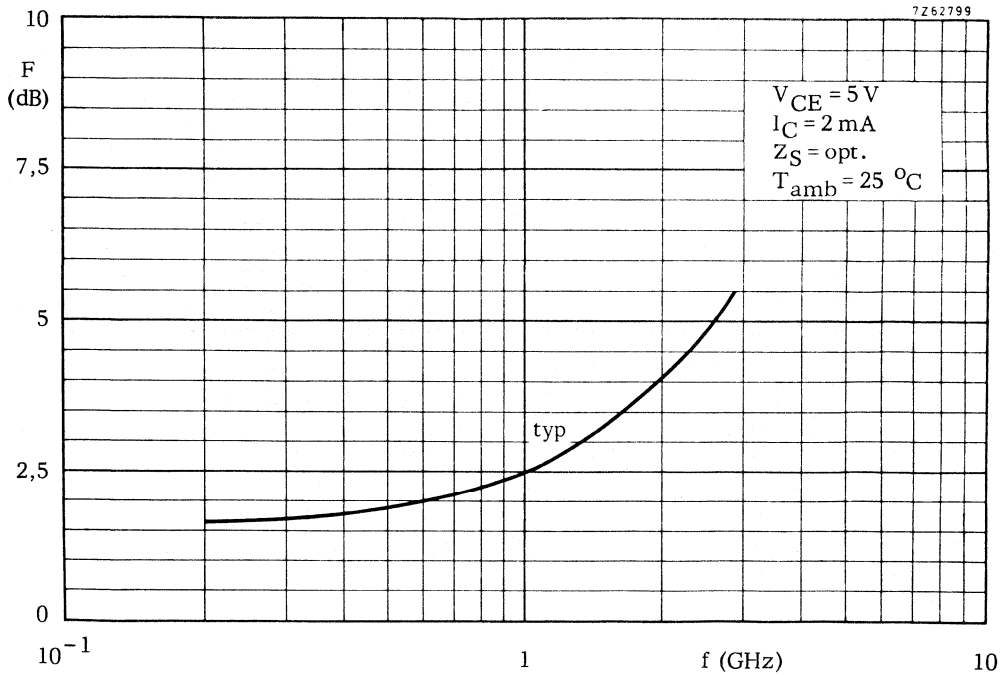

7Z62799
10
F
(dB)
7,5
5
2,5
0
10^{-1}
1
f (GHz)
10
V_{CE} = 5 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ

Fig. 7.

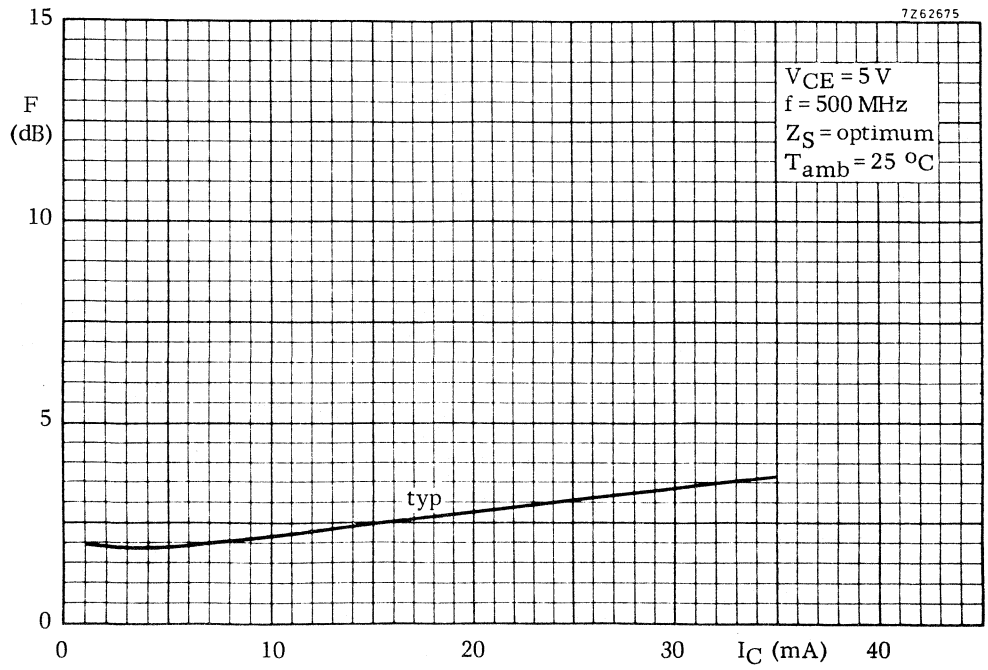

7Z62675
15
F
(dB)
10
5
0
0
10
20
30
I_C (mA)
40
V_{CE} = 5 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ

Fig. 8.

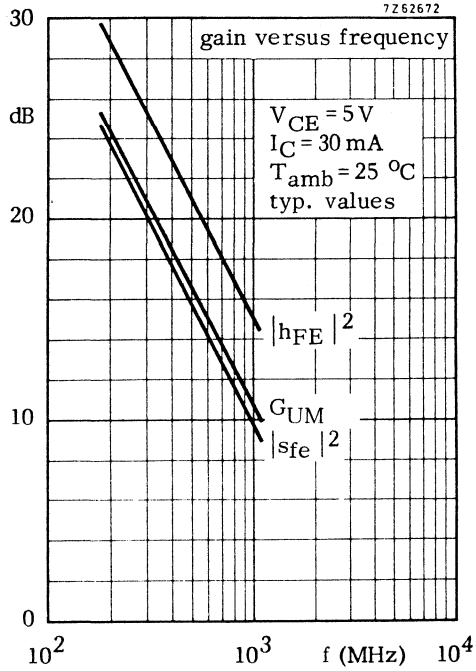

7Z62672
gain versus frequency
V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C
typ. values
$|h_{FE}|^2$
G_{UM}
$|s_{fe}|^2$
30
dB
20
10
0
10^2
10^3
f (MHz)
10^4

Fig. 9.

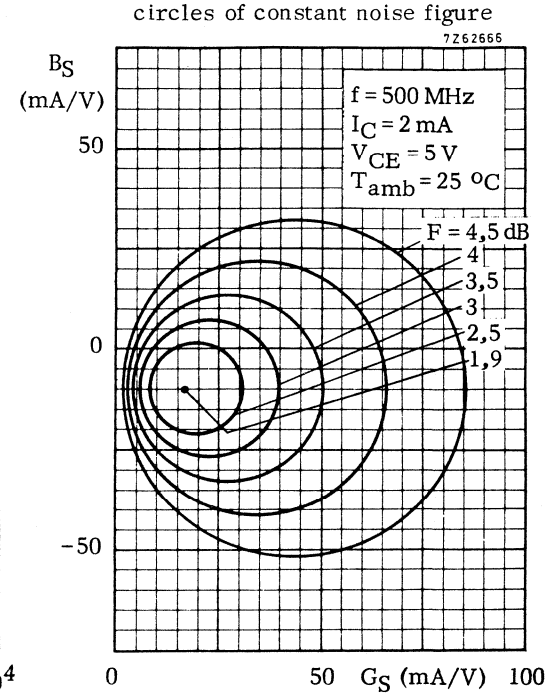

circles of constant noise figure
7Z62665
B_S (mA/V)
f = 500 MHz
I_C = 2 mA
V_{CE} = 5 V
T_{amb} = 25 °C
F = 4,5 dB
4
3,5
3
2,5
1,9
50
0
−50
0
50
G_S (mA/V)
100

Fig. 10.

V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

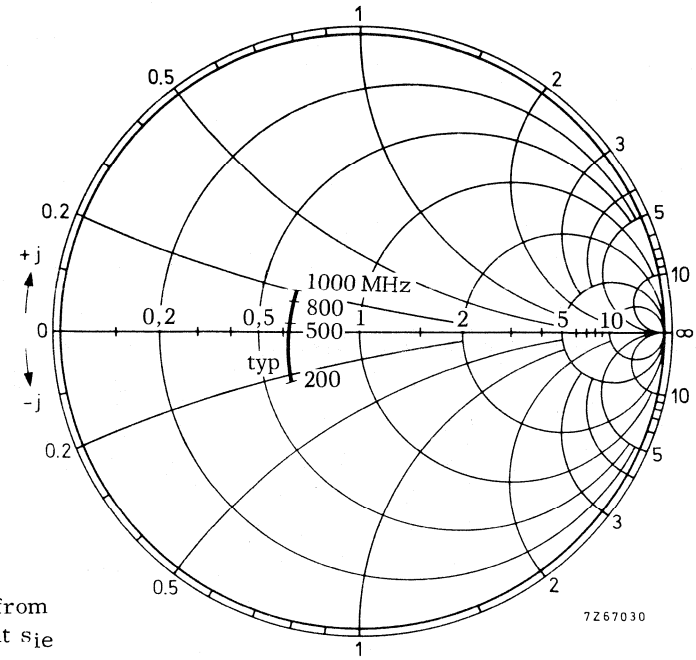


Fig. 11.

Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

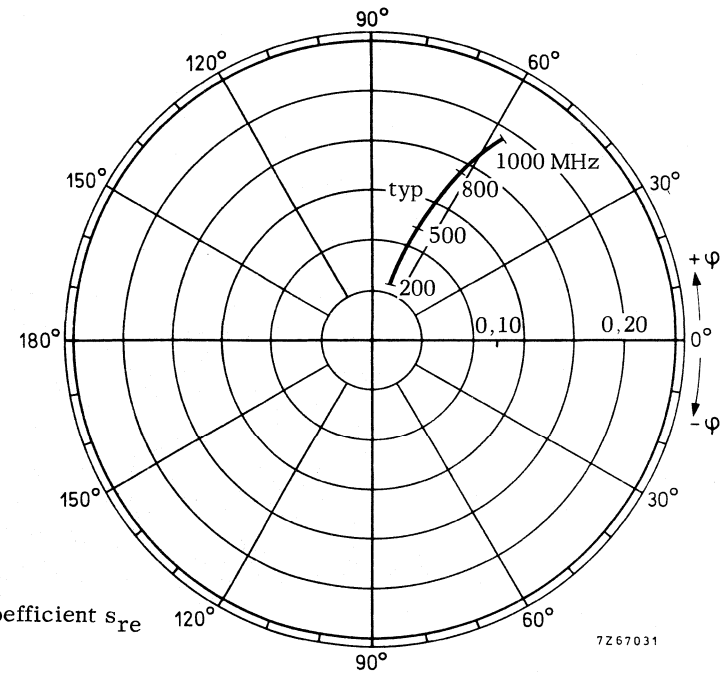


Fig. 12.

Reverse transmission coefficient s_{re}

V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

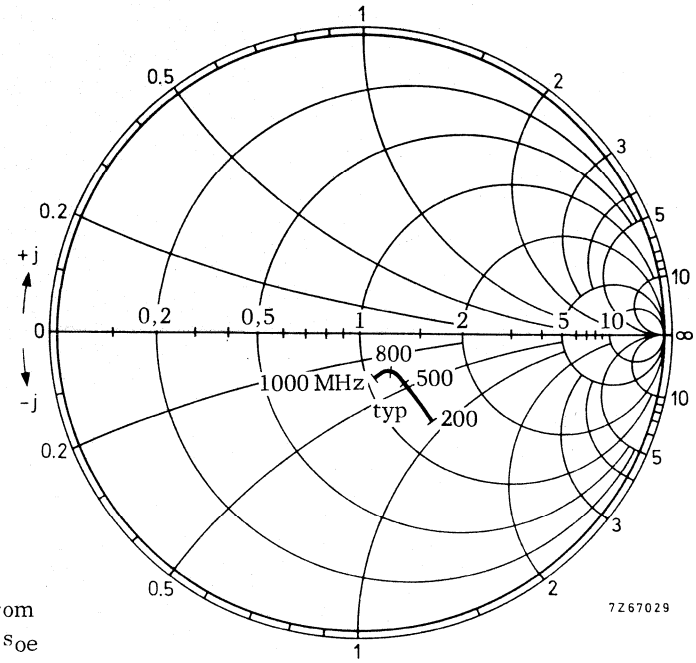


Fig. 13.

Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

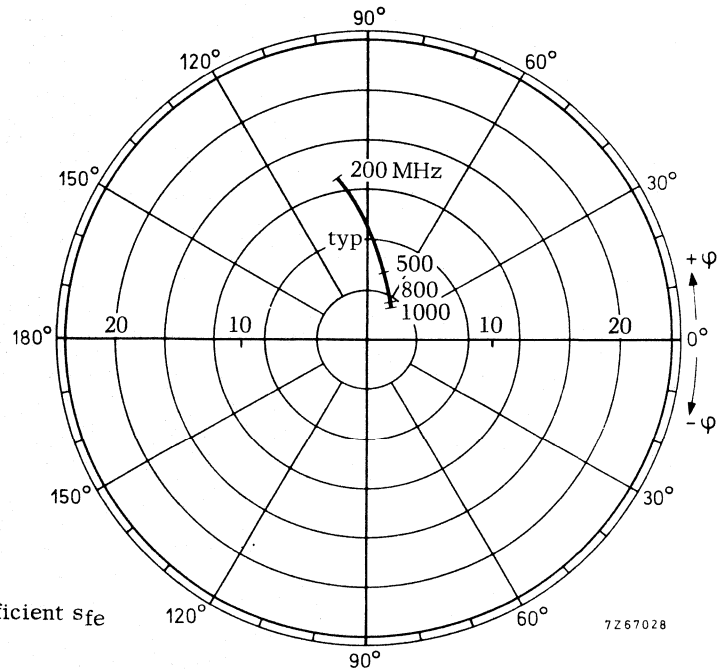


Fig. 14.

Forward transmission coefficient s_{fe}

N-P-N 1 GHz WIDEBAND TRANSISTOR

N-P-N transistors in a SOT-23 plastic envelope. They are primarily intended for use in v.h.f./u.h.f. broadband amplifiers. The transistors feature:

- low noise;
- very low intermodulation distortion;
- high power gain;
- P-N-P complement is the BFT93

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Noise figure at optimum source impedance I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	1,6	dB
Output voltage at d_{im} = −60 dB I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	425	mV

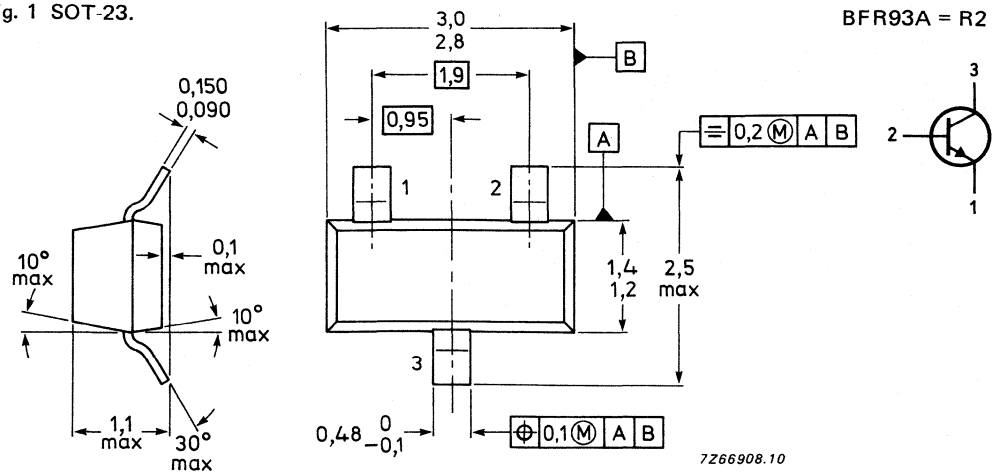
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

BFR93A = R2



TOP VIEW

If required, the R-version (reverse pinning) is available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	35 mA
→ Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 5 V	I_{CBO}	max.	50 nA
D.C. current gain▲			
I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min.	40
		typ.	90
Transition frequency at f = 500 MHz▲			
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	typ.	0,7 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	typ.	1,9 pF
Feedback capacitance at f = 1 MHz			
I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6 pF
Noise figure at optimum source impedance▲			
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	1,6 dB
I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	2,3 dB
Maximum unilateral power gain (s_{re} assumed to be zero)			
See Figs 10 to 15			
$G_{UM}\ (\text{in dB}) = 10 \log \frac{\lvert s_{fe}\rvert^2}{(1-\lvert s_{ie}\rvert^2)(1-\lvert s_{oe}\rvert^2)}$			
I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	14 dB

▲ Measured under pulse conditions.

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Output voltage at d_{im} = −60 dB (see Figs 2 and 15)*
(DIN 45004B, par. 6.3: 3-tone)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz V_o typ. 425 mV

Second harmonic distortion (see Figs 2 and 16)*
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
V_p = 200 mV at f_p = 250 MHz
V_q = 200 mV at f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz d_2 typ. −50 dB

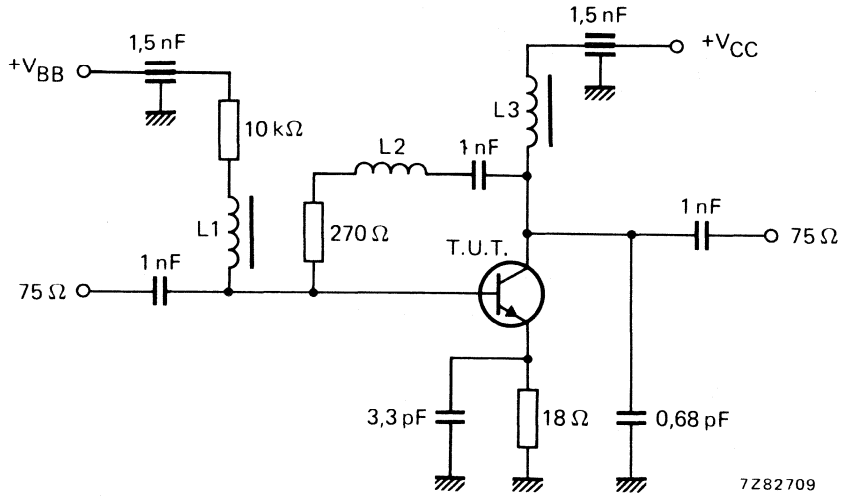


Fig. 2 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm.

* Measured on same crystal in a SOT-37 envelope (BFR91A).

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
		40	0,89/ −12,4°	0,016/82,3°	7,0/171,8°	0,88/ −4,8°
		100	0,87/ −30,1°	0,038/74,2°	6,7/160,1°	0,96/−11,3°
		200	0,80/ −56,3°	0,067/61,8°	6,0/142,3°	0,88/−20,1°
5	2	500	0,64/−109,5°	0,106/44,3°	3,8/110,6°	0,69/−31,9°
		800	0,57/−140,3°	0,116/41,8°	2,7/ 91,5°	0,60/−35,5°
		1000	0,54/−154,5°	0,119/43,9°	2,2/ 82,8°	0,58/−38,0°
		1200	0,53/−166,6°	0,124/48,2°	1,9/ 75,1°	0,56/−40,2°
		40	0,77/ −19,9°	0,015/79,4°	15,1/166,8°	0,97/ −8,8°
		100	0,72/ −46,9°	0,033/68,6°	13,5/149,7°	0,89/−19,6°
		200	0,62/ −81,4°	0,053/57,0°	10,5/128,5°	0,73/−30,3°
5	5	500	0,48/−134,4°	0,079/52,6°	5,5/100,5°	0,51/−37,3°
		800	0,45/−159,8°	0,099/57,8°	3,6/ 85,6°	0,44/−37,9°
		1000	0,44/−170,8°	0,114/61,0°	3,0/ 78,8°	0,42/−39,3°
		1200	0,43/ 179,8°	0,131/64,2°	2,5/ 72,9°	0,41/−40,9°
		40	0,63/ −29,7°	0,013/76,5°	24,4/161,0°	0,95/−13,5°
		100	0,56/ −66,2°	0,028/64,8°	20,0/139,4°	0,80/−17,8°
		200	0,47/−105,4°	0,042/57,8°	13,6/118,0°	0,59/−37,3°
5	10	500	0,41/−152,0°	0,070/62,6°	6,4/ 94,8°	0,39/−39,0°
		800	0,39/−171,7°	0,099/67,6°	4,1/ 82,7°	0,35/−38,2°
		1000	0,39/ 179,6°	0,119/69,1°	3,4/ 76,7°	0,34/−39,1°
		1200	0,39/ 171,6°	0,140/70,5°	2,8/ 71,5°	0,33/−40,7°
		40	0,47/ −44,2°	0,012/73,8°	35,2/154,0°	0,90/−19,2°
		100	0,42/ −90,7°	0,023/63,9°	25,4/129,3°	0,68/−35,0°
		200	0,39/−129,4°	0,034/62,9°	15,6/109,7°	0,47/−41,0°
5	20	500	0,37/−165,1°	0,067/70,5°	6,8/ 90,9°	0,32/−38,4°
		800	0,37/ 179,5°	0,101/73,2°	4,4/ 80,3°	0,29/−37,4°
		1000	0,36/ 173,0°	0,124/73,4°	3,6/ 75,4°	0,29/−38,3°
		1200	0,37/ 166,2°	0,148/73,6°	3,0/ 70,3°	0,28/−40,0°
		40	0,39/ −56,3°	0,011/72,3°	40,8/149,5°	0,86/−22,5°
		100	0,38/−106,8°	0,021/64,5°	27,4/124,0°	0,61/−37,9°
		200	0,37/−141,6°	0,032/66,4°	16,0/105,8°	0,41/−41,1°
5	30	500	0,37/−171,0°	0,067/73,5°	6,9/ 88,9°	0,29/−36,6°
		800	0,37/ 175,9°	0,102/75,2°	4,4/ 79,1°	0,27/−36,0°
		1000	0,36/ 170,0°	0,126/74,8°	3,6/ 74,2°	0,27/−37,1°
		1200	0,37/ 163,9°	0,150/74,6°	3,0/ 69,5°	0,27/−39,0°

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
		40	0,90/ −12,2°	0,015/82,1°	6,9/171,7°	0,99/ −4,8°
		100	0,88/ −29,2°	0,036/74,5°	6,6/160,4°	0,96/−10,8°
		200	0,81/ −54,7°	0,064/62,4°	5,9/143,1°	0,89/−19,2°
8	2	500	0,64/−107,0°	0,103/44,9°	3,8/111,5°	0,71/−30,6°
		800	0,56/−138,1°	0,112/42,1°	2,7/ 92,2°	0,62/−34,1°
		1000	0,54/−152,6°	0,116/44,1°	2,3/ 83,6°	0,60/−36,4°
		1200	0,52/−165,2°	0,120/48,5°	1,9/ 75,9°	0,58/−38,6°
		40	0,78/ −19,2°	0,014/79,4°	14,8/166,9°	0,98/ −8,6°
		100	0,73/ −44,6°	0,032/69,0°	13,5/150,4°	0,90/−18,7°
		200	0,63/ −78,1°	0,051/57,5°	10,5/129,4°	0,75/−28,9°
8	5	500	0,48/−131,2°	0,077/52,5°	5,6/101,3°	0,53/−35,7°
		800	0,44/−157,3°	0,096/57,7°	3,7/ 86,3°	0,46/−36,2°
		1000	0,42/−168,3°	0,110/61,0°	3,0/ 79,5°	0,44/−37,5°
		1200	0,42/−178,3°	0,126/64,3°	2,6/ 73,6°	0,43/−39,0°
		40	0,66/ −27,7°	0,013/76,7°	24,0/161,5°	0,95/−12,9°
		100	0,58/ −62,0°	0,027/65,4°	19,9/140,4°	0,81/−26,3°
		200	0,48/−100,1°	0,041/58,0°	13,8/119,0°	0,61/−35,5°
8	10	500	0,40/−148,2°	0,068/62,2°	6,5/ 95,4°	0,42/−37,0°
		800	0,38/−169,1°	0,096/67,4°	4,2/ 83,0°	0,37/−36,2°
		1000	0,37/−178,3°	0,116/69,0°	3,4/ 77,4°	0,36/−37,0°
		1200	0,37/ 173,6°	0,136/70,5°	2,9/ 72,5°	0,35/−38,5°
		40	0,53/ −39,6°	0,012/73,8°	34,7/154,8°	0,91/−18,1°
		100	0,45/ −83,0°	0,023/63,9°	25,6/130,5°	0,70/−33,2°
		200	0,39/−122,0°	0,034/62,2°	15,9/110,6°	0,49/−39,0°
8	20	500	0,35/−161,3°	0,066/69,7°	7,0/ 91,4°	0,34/−36,2°
		800	0,35/−177,9°	0,098/72,7°	4,5/ 80,7°	0,31/−35,1°
		1000	0,34/ 175,2°	0,121/73,1°	3,7/ 75,8°	0,31/−36,0°
		1200	0,34/ 168,3°	0,143/73,4°	3,1/ 71,2°	0,30/−37,5°
		40	0,47/ −48,0°	0,011/72,2°	40,3/150,8°	0,87/−20,9°
		100	0,41/ −95,5°	0,021/63,8°	27,5/125,4°	0,63/−35,7°
		200	0,36/−132,8°	0,032/64,9°	16,4/106,8°	0,44/−38,9°
8	30	500	0,35/−166,6°	0,065/72,3°	7,1/ 89,6°	0,32/−34,4°
		800	0,34/ 178,8°	0,100/74,4°	4,5/ 79,7°	0,30/−33,6°
		1000	0,34/ 172,7°	0,122/74,4°	3,7/ 74,7°	0,30/−34,7°
		1200	0,34/ 166,0°	0,145/74,3°	3,1/ 70,3°	0,29/−36,5°

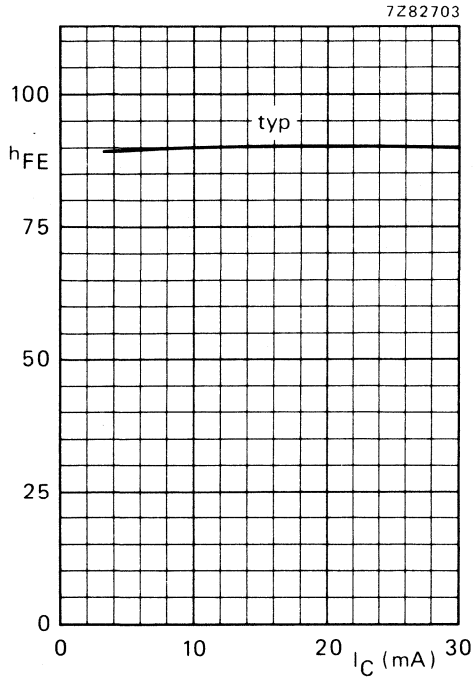


Fig. 3 V_{CE} = 5 V; T_j = 25 °C.

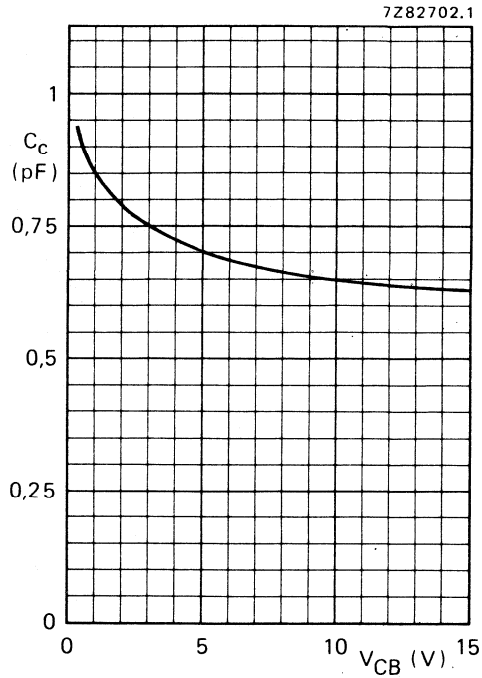


Fig. 4 Typical values collector capacitance $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

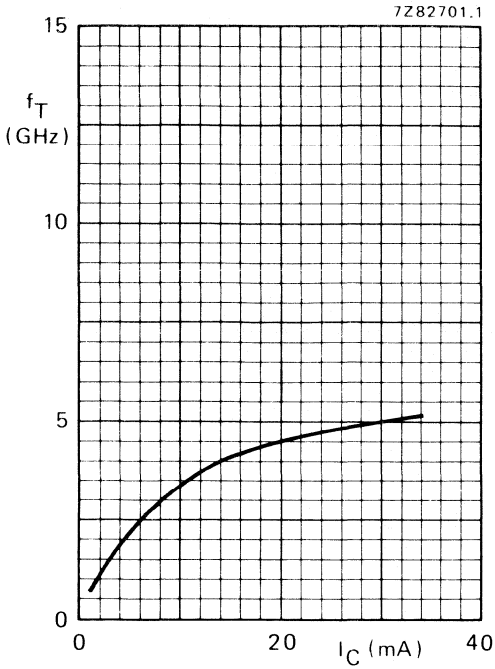


Fig. 5 Typical values transition frequency at V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

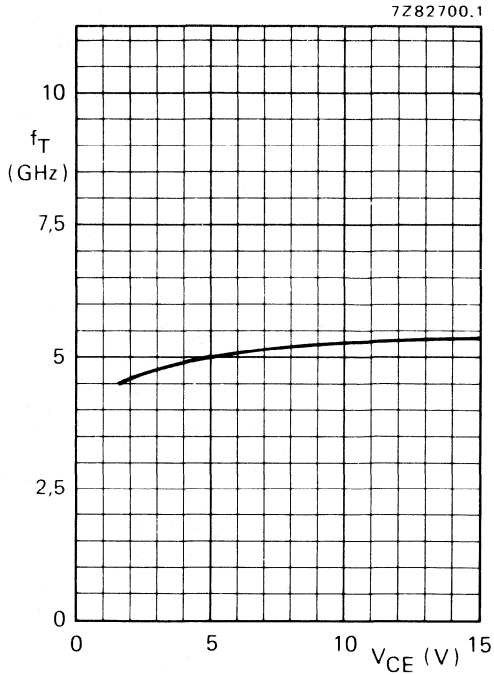


Fig. 6 Typical values transition frequency at I_C = 30 mA; f = 500 MHz; T_j = 25 °C.

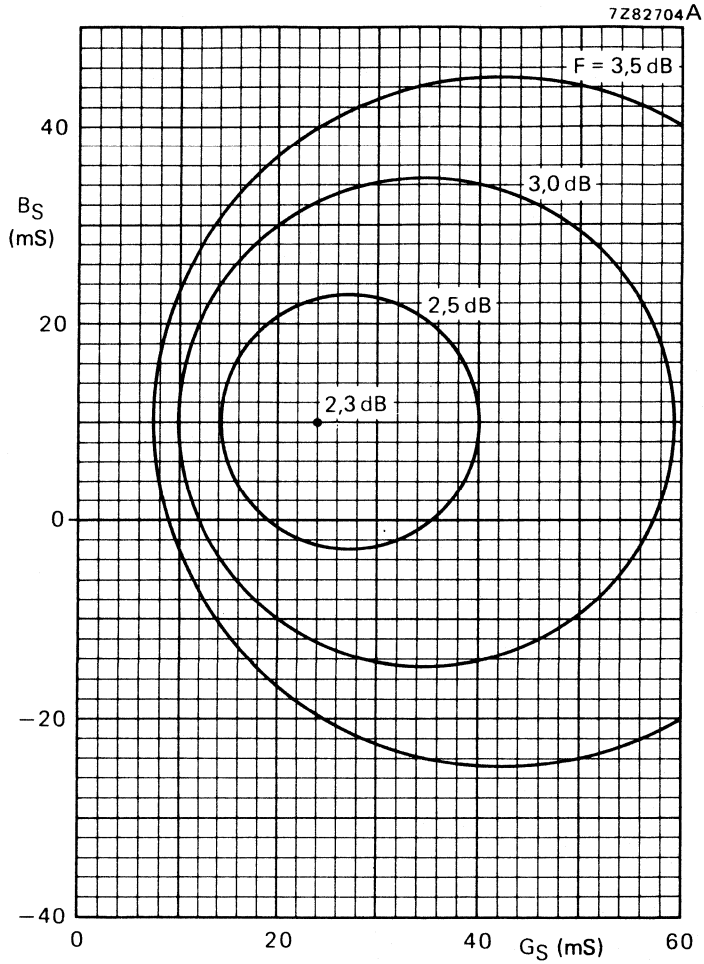


Fig. 7 Circles of constant noise figure.
V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

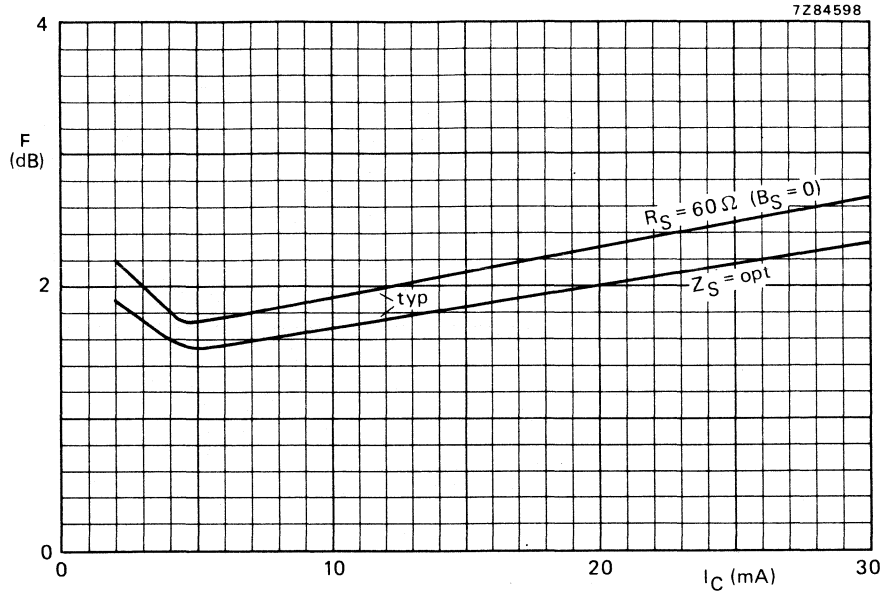


Fig. 8 V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

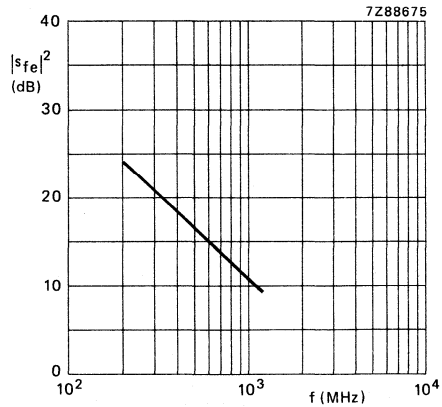


Fig. 9 Typical values forward transmission coefficient as a function of frequency. V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

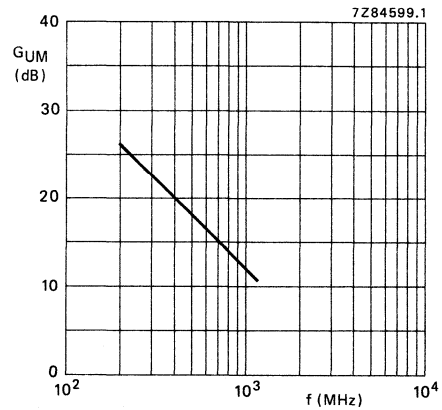


Fig. 10 Typical values unilateral power power gain as a function of frequency. V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

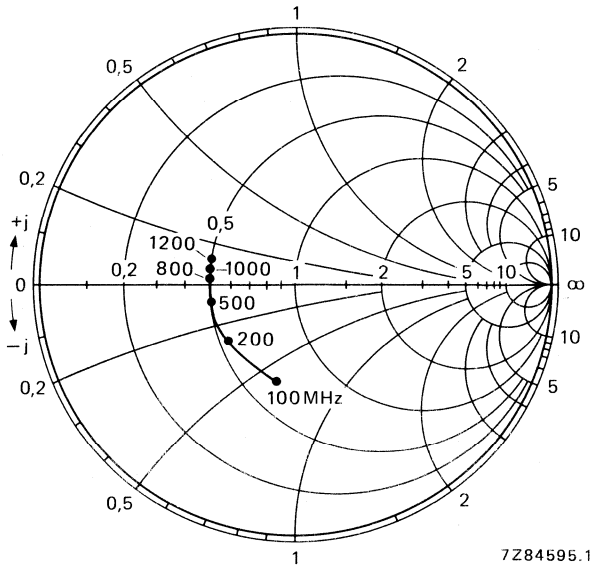


Fig. 11 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

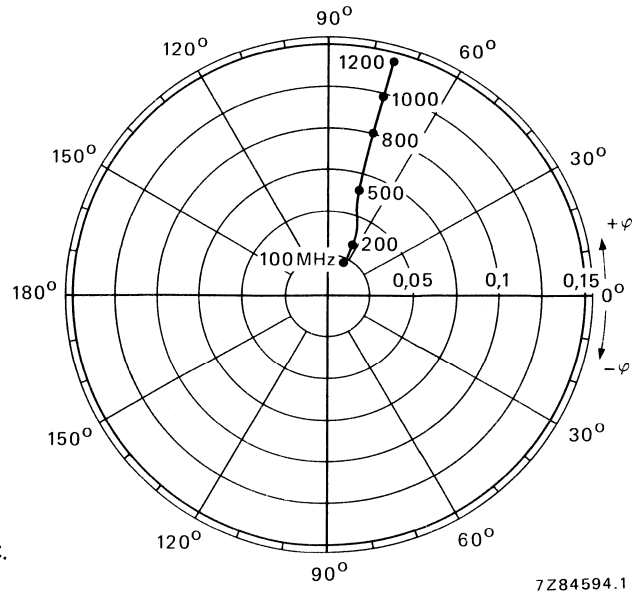


Fig. 12 Reverse transmission coefficient s_{re}.
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

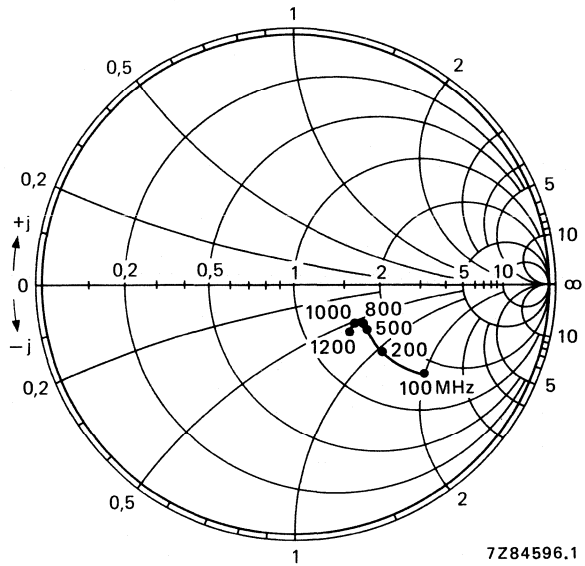


Fig. 13 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

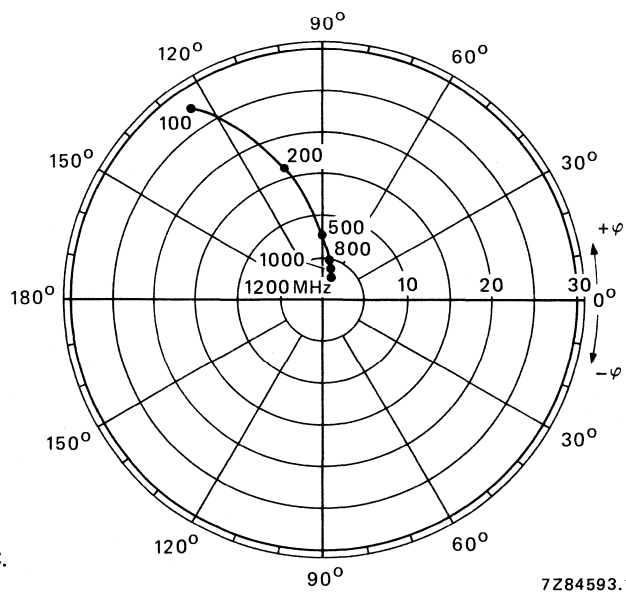


Fig. 14 Forward transmission coefficient s_{fe}.
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

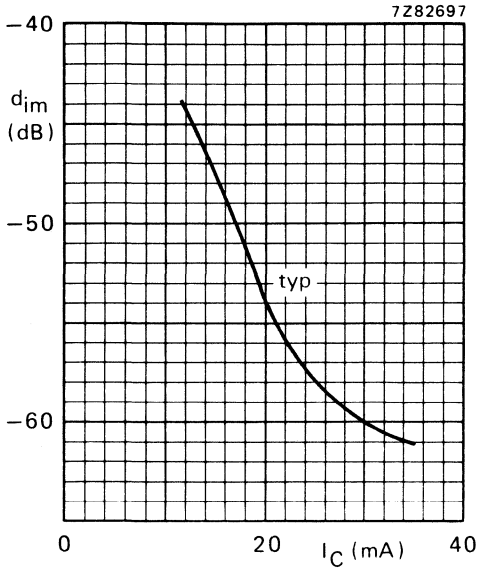


Fig. 15 V_{CE} = 8 V; V_o = 425 mV = 52,6 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 2).

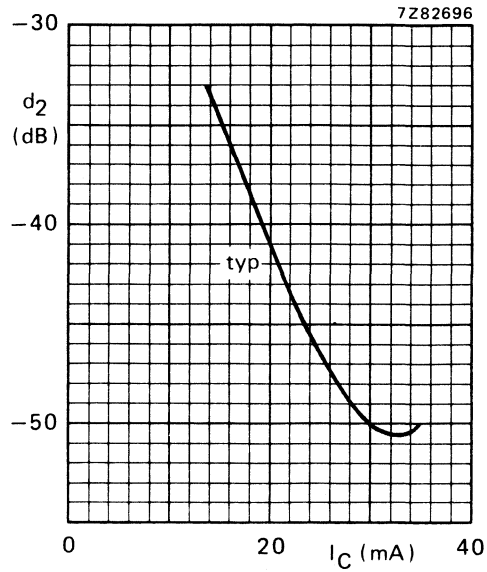


Fig. 16 V_{CE} = 8 V; V_o = 200 mV = 46 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 2).

N-CHANNEL JUNCTION FIELD-EFFECT TRANSISTOR

Symmetrical n-channel silicon junction field-effect transistor, designed primarily for use as a source follower with the input protected against successive voltage surges by a forward and reverse integrated diode.

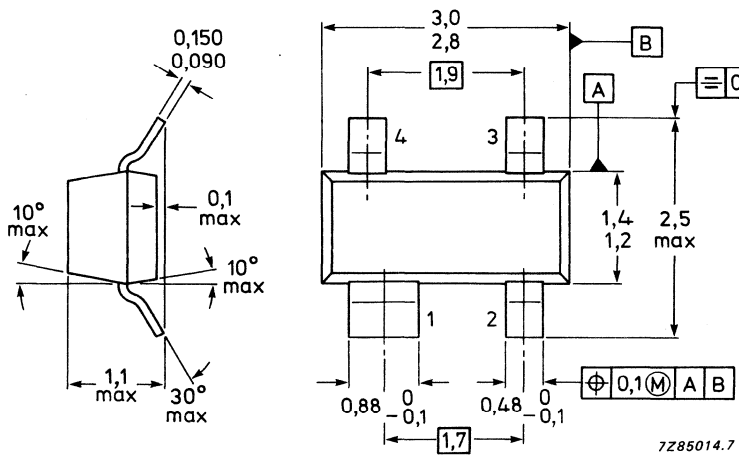
QUICK REFERENCE DATA

Drain-source voltage	$\pm V_{DS}$	max.	30 V
Gate-source voltage (open drain)	$-V_{GS}$	max.	30 V
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Drain current			
V_{DS} = 6 V; V_{GS} = 0: BFR101A	I_{DSS}		0,2 to 1,5 mA
V_{DS} = 6 V; V_{GS} = 0: BFR101B	I_{DSS}		1,0 to 5,0 mA
Transfer admittance (common source)			
V_{DS} = 6 V; V_{GS} = 0; f = 1 kHz: BFR101A	$\lvert y_{fs}\rvert$	>	1,2 mS
V_{DS} = 6 V; V_{GS} = 0; f = 1 kHz: BFR101B	$\lvert y_{fs}\rvert$	>	2,5 mS

MECHANICAL DATA

Fig. 1 SOT-143.

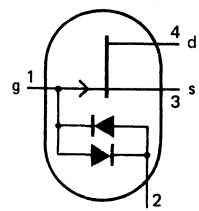
Dimensions in mm



TOP VIEW

Marking code

BFR101A = M97
BFR101B = M98



Note: Drain and source are interchangeable.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	30	V
Drain-gate voltage (open source)	V_{DGO}	max.	30	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	30	V
Drain current (d.c.)	I_D	max.	20	mA
Gate current (d.c.)	I_G	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C*	P_{tot}	max.	200	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	460	K/W

CHARACTERISTICS with source connected to case for all measurements

T_{amb} = 25 °C unless otherwise specified

		BFR101A	BFR101B	
Gate leakage current V_{DS} = 6 V; I_D = 10 μA	$-I_G$	< 5	5	nA
Drain current* V_{DS} = 6 V; V_{GS} = 0	I_{DSS}	0,2 to 1,5	1 to 5	mA
Gate-source cut-off voltage V_{DS} = 6 V; I_D = 1 μA	$-V_{(P)GS}$	0,2 to 1	0,5 to 2,5	V
Small-signal common-source characteristics V_{DS} = 6 V; V_{GS} = 0				
Transfer admittance* f = 1 kHz	$\lvert y_{fs}\rvert$	> 1,2	2,5	mS
Output admittance at f = 1 kHz**	$\lvert y_{os}\rvert$	typ. 10	50	mS
Input capacitance at f = 1 MHz diodes not connected	C_{is}	< 5	5	pF
Diode capacitance V_D = 0; source and drain not connected	C_d	typ. 0,7	0,7	pF
Diode forward voltage $\pm I_F$ = 10 mA	V_F	0,7 to 1,2	0,7 to 1,2	V

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Measured under pulse conditions: t_p = 100 ms; $\delta \leqslant 0{,}1$.

N-P-N H.F. WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope. It is intended for a wide range of v.h.f. and u.h.f. applications in thick and thin-film circuits.

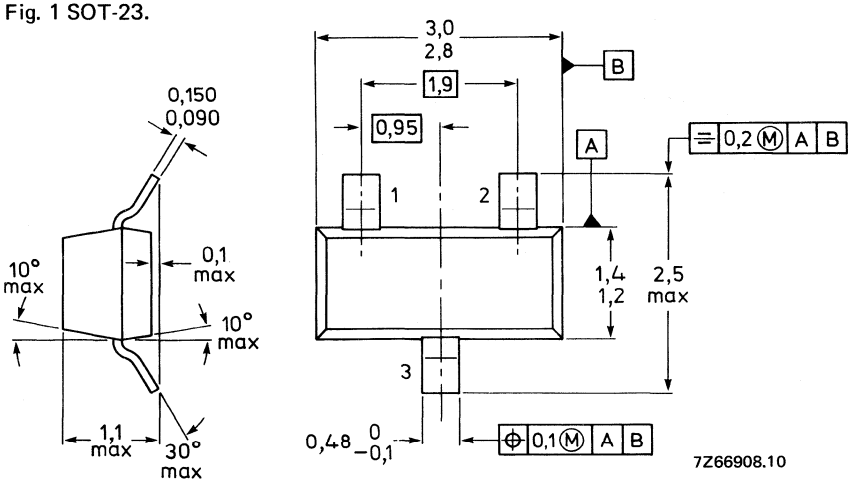
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (peak value)	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 2 mA; V_{CE} = 1 V	h_{FE}	20 to 150		
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,3	GHz
Noise figure I_C = 2 mA; V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz	F	typ.	4,5	dB

MECHANICAL DATA

Fig. 1 SOT-23.

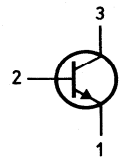
Dimensions in mm



TOP VIEW

Marking code

BFS17 = E1



If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25 V
Collector-emitter voltage (open base)			
I_C = 10 mA	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5 V
Collector current (d.c.)	I_C	max.	25 mA
Collector current (peak value)	I_{CM}	max.	50 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	10 nA
I_E = 0; V_{CB} = 10 V; T_j = 100 °C	I_{CBO}	max.	10 μA
D.C. current gain			
I_C = 2 mA; V_{CE} = 1 V	h_{FE}		20 to 150
I_C = 25 mA; V_{CE} = 1 V	h_{FE}	min.	20
Transition frequency			
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,0 GHz
I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,3 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	max.	1,5 pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	max.	2,0 pF
Feedback capacitance at f = 1 MHz $I_C = 1$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0,65 pF
Noise figure* $I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $R_S = 50\ \Omega$	F	typ.	4,5 dB
Intermodulation distortion $I_C = 10$ mA; $V_{CE} = 6$ V; $R_L = 37{,}5\ \Omega$; $T_{amb} = 25\ ^oC$ $V_o = 100$ mV at $f_p = 183$ MHz $V_o = 100$ mV at $f_q = 200$ MHz measured at $f_{(2q-p)} = 217$ MHz	d_{im}	typ.	−45 dB

* Crystal mounted in a BFY90 envelope.

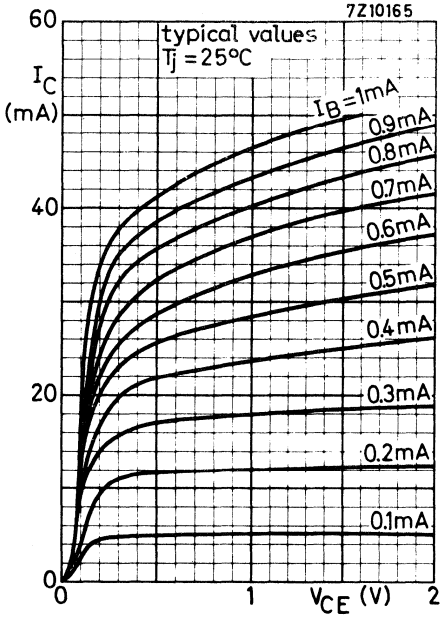


Fig. 2 T_j = 25 °C; typical values.

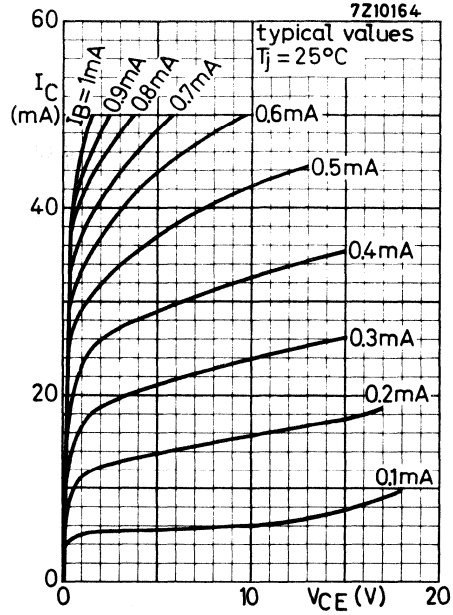


Fig. 3 T_j = 25 °C; typical values.

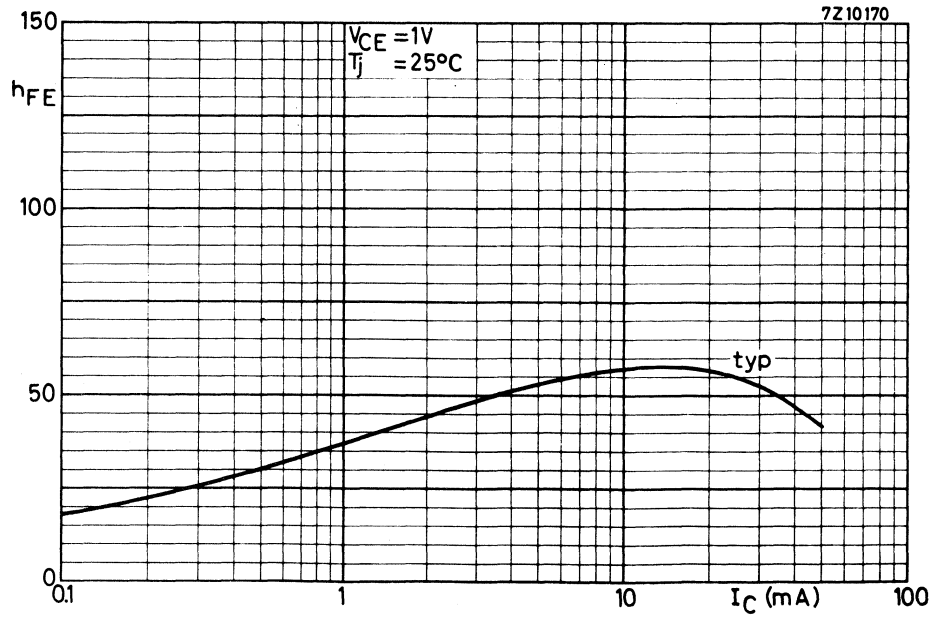


Fig. 4 V_{CE} = 1 V; T_j = 25 °C; typical values.

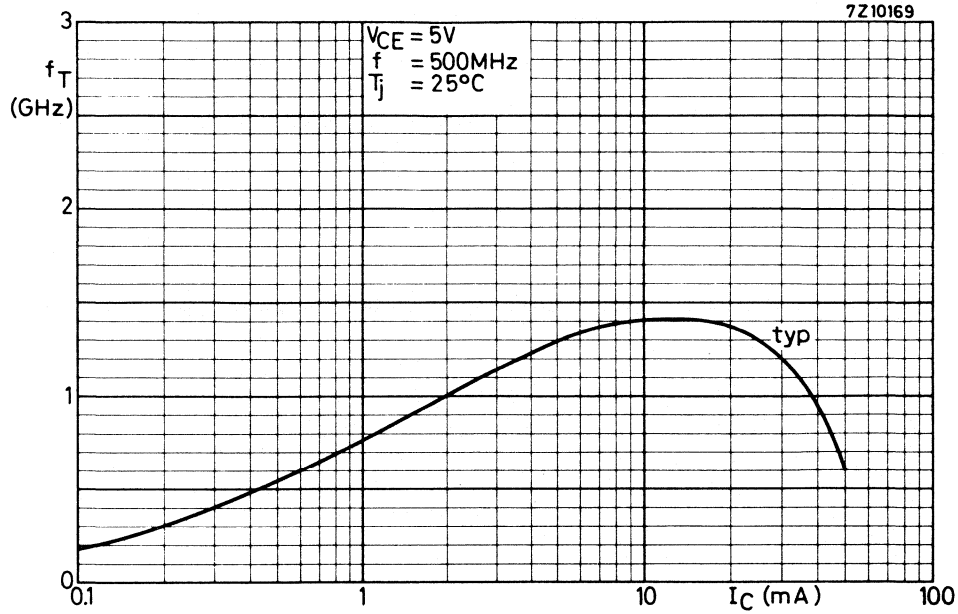


Fig. 5 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; typical values.

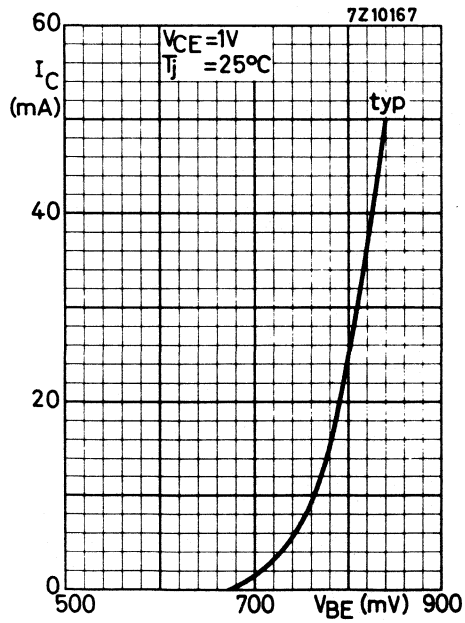


Fig. 6 V_{CE} = 1 V; T_j = 25 °C; typical values.

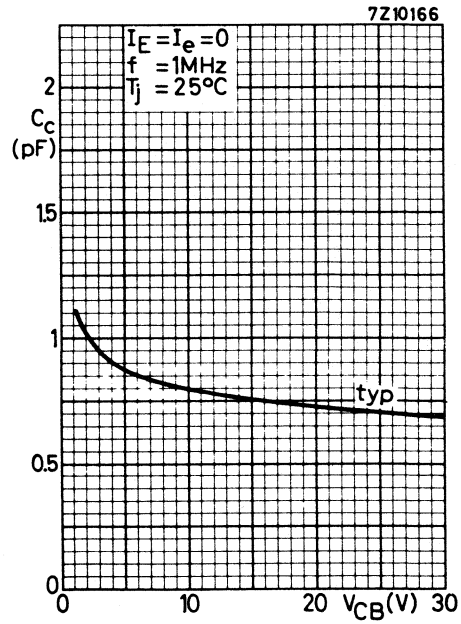


Fig. 7 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C; typical values.

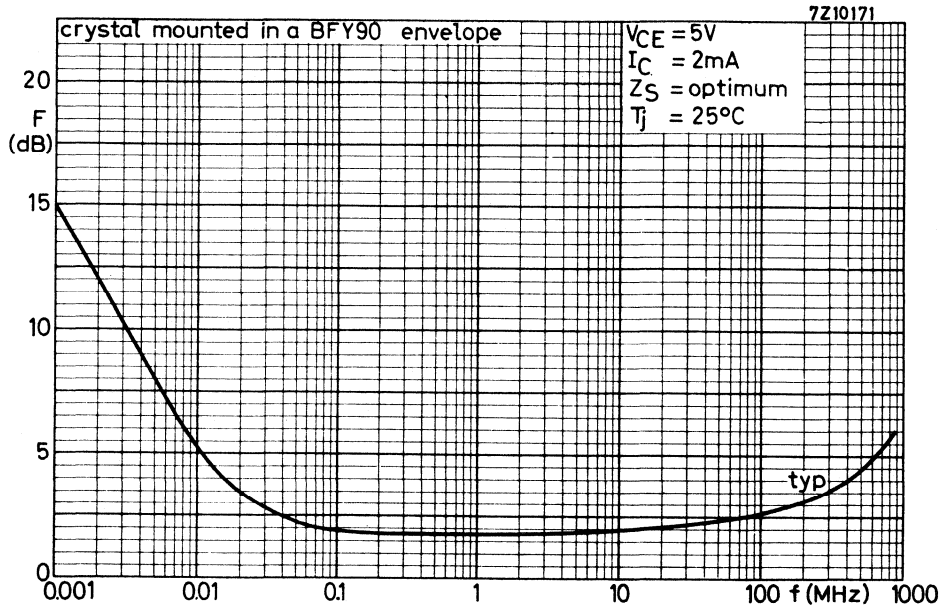


Fig. 8 V_{CE} = 5 V; I_C = 2 mA; Z_S = optimum; T_j = 25 °C; typical values.

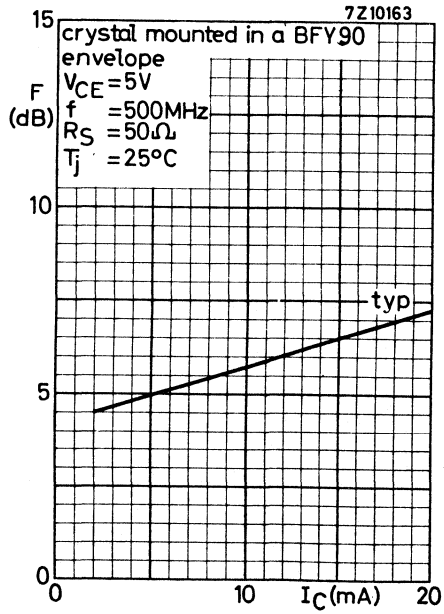


Fig. 9 V_{CE} = 5 V; f = 500 MHz; R_S = 50 Ω; T_j = 25 °C; typical values.

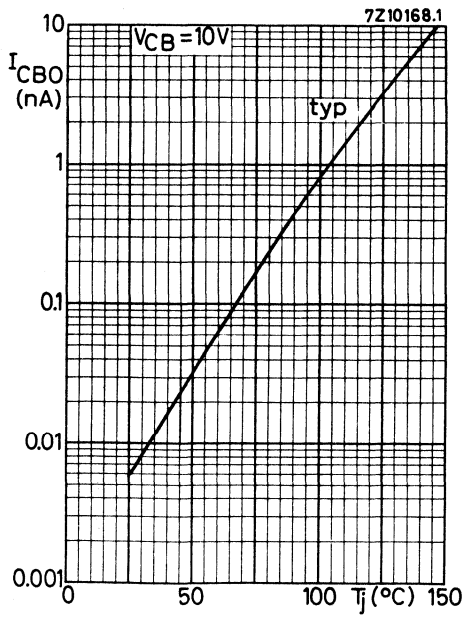


Fig. 10 V_{CB} = 10 V; typical values.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for general purpose and h.f. applications in thick and thin-film circuits.

QUICK REFERENCE DATA

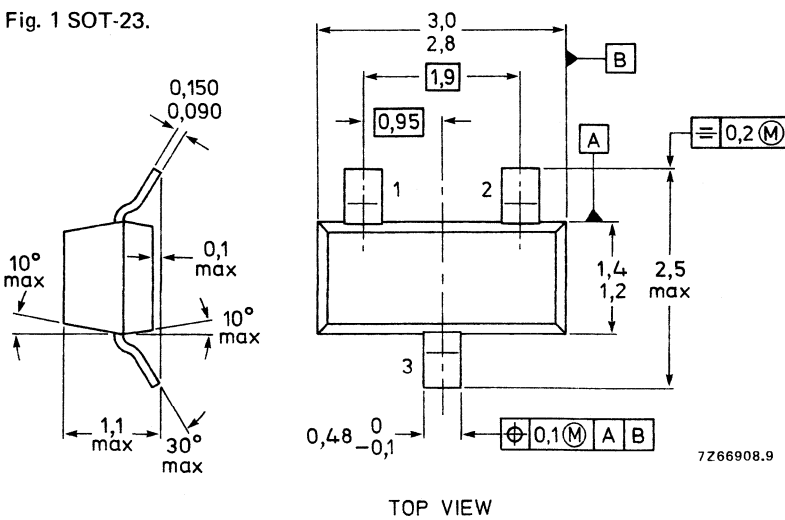
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (d.c.)	I_C	max.	30	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C

			BFS18	BFS19	
D.C. current gain					
I_C = 1 mA; V_{CE} = 10 V	h_{FE}		35 to 125	65 to 225	
Transition frequency at f = 100 MHz					
I_C = 1 mA; V_{CE} = 10 V	f_T	typ.	200	260	MHz
Noise figure at f = 100 MHz					
I_C = 1 mA; V_{CE} = 10 V; G_S = 10 mS	F	typ.	4		dB

MECHANICAL DATA

Dimensions in mm

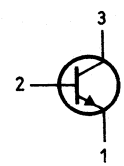
Fig. 1 SOT-23.



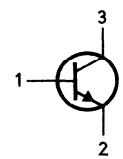
TOP VIEW

Marking code

BFS18 = F1
BFS19 = F2



BFS18R = F4
BFS19R = F5



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)				
I_C = 2 mA	V_{CEO}	max.	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	30	mA
Collector current (peak value)	I_{CM}	max.	30	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100		nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10		μA
Base-emitter voltage					
I_C = 1 mA; V_{CE} = 10 V	V_{BE}		0,65 to 0,74		V
			BFS18	BFS19	
D.C. current gain					
I_C = 1 mA; V_{CE} = 10 V	h_{FE}		35 to 125	65 to 225	
Transition frequency at f = 100 MHz					
I_C = 1 mA; V_{CE} = 10 V	f_T	typ.	200	260	MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	1		pF
Feedback capacitance at f = 1 MHz					
I_C = 1 mA; V_{CE} = 10 V	$-C_{re}$	typ.	0,85		pF
Noise figure**					
I_C = 1 mA; V_{CE} = 10 V; G_S = 10 mS ; f = 100 MHz	F	typ.	4		dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Crystal mounted in a BF115 envelope.

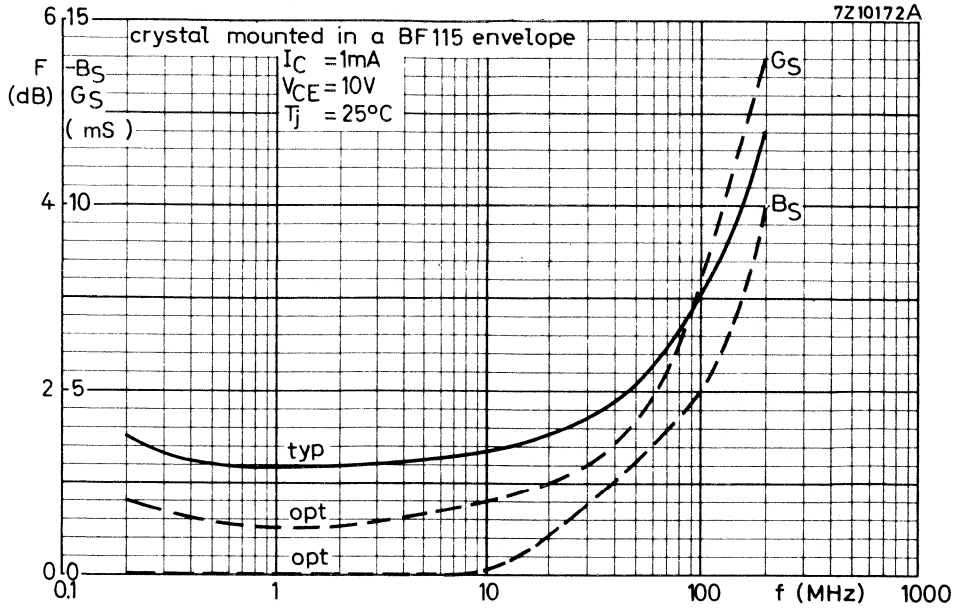


Fig. 2.

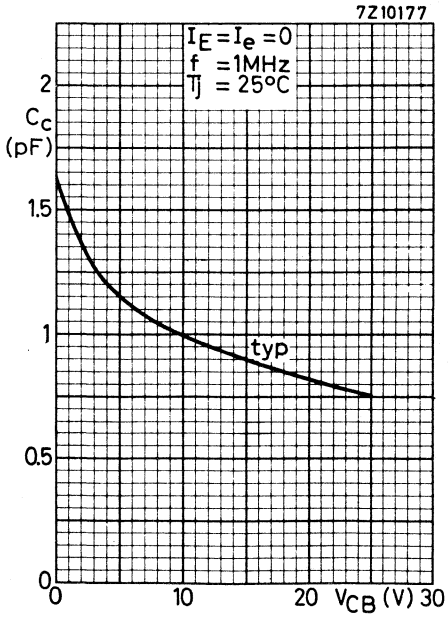


Fig. 3.

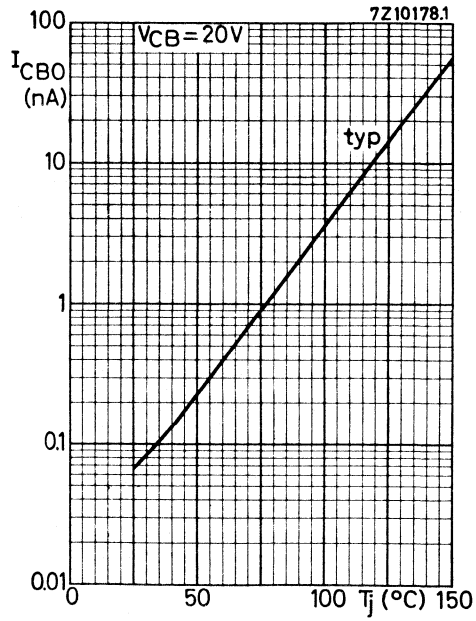


Fig. 4.

Typical behaviour of collector current versus collector-emitter voltage

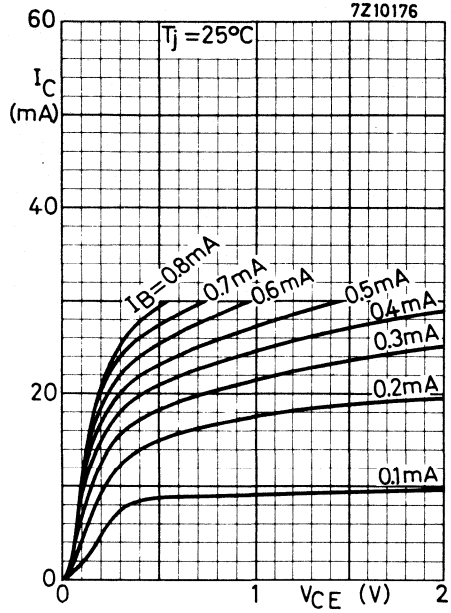


Fig. 5.

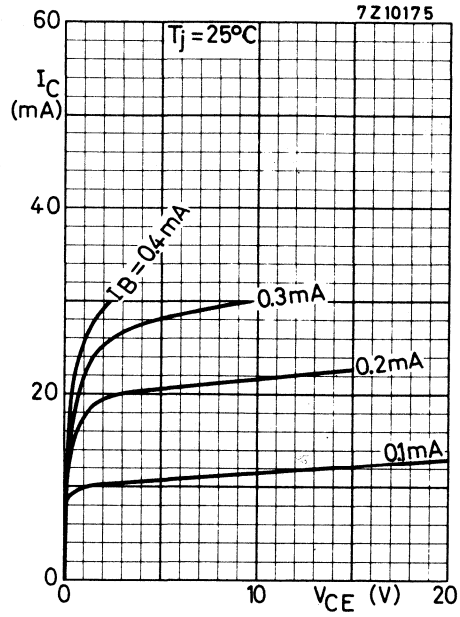


Fig. 6.

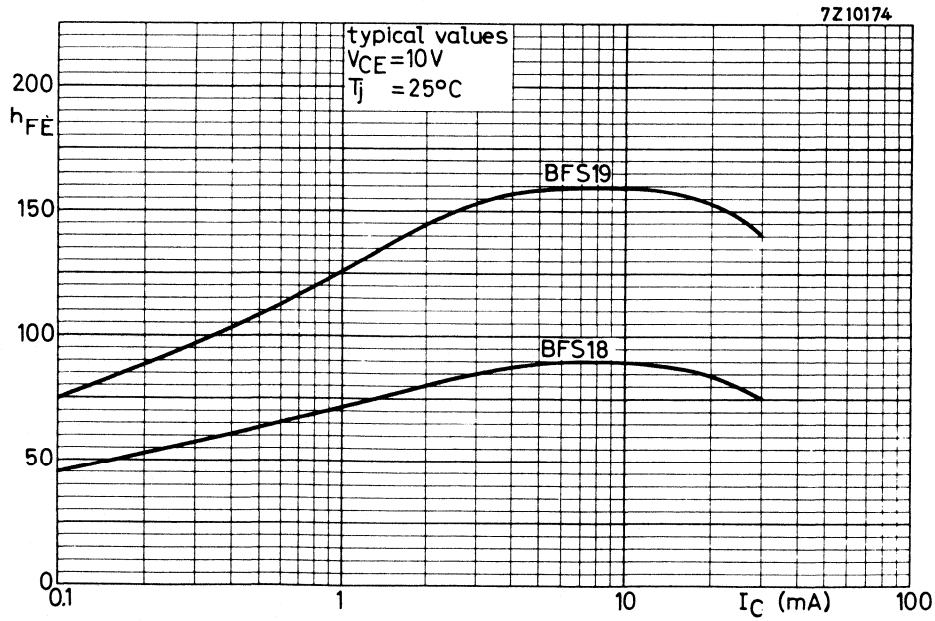


Fig. 7.

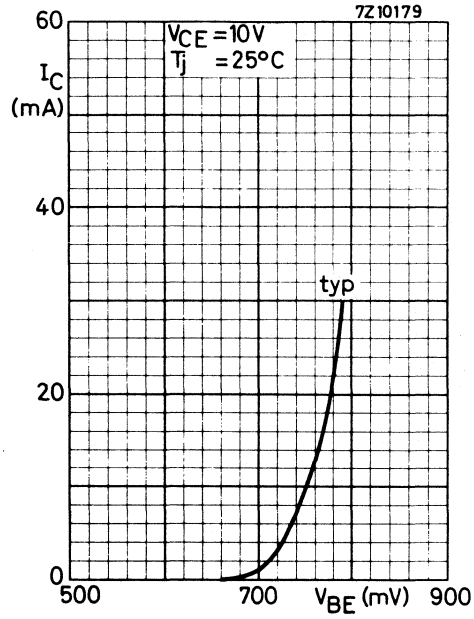

7Z10179
60
I_C
(mA)
40
20
0
V_{CE} = 10V
T_j = 25°C
typ
500
700
V_{BE} (mV)
900

Fig. 8.

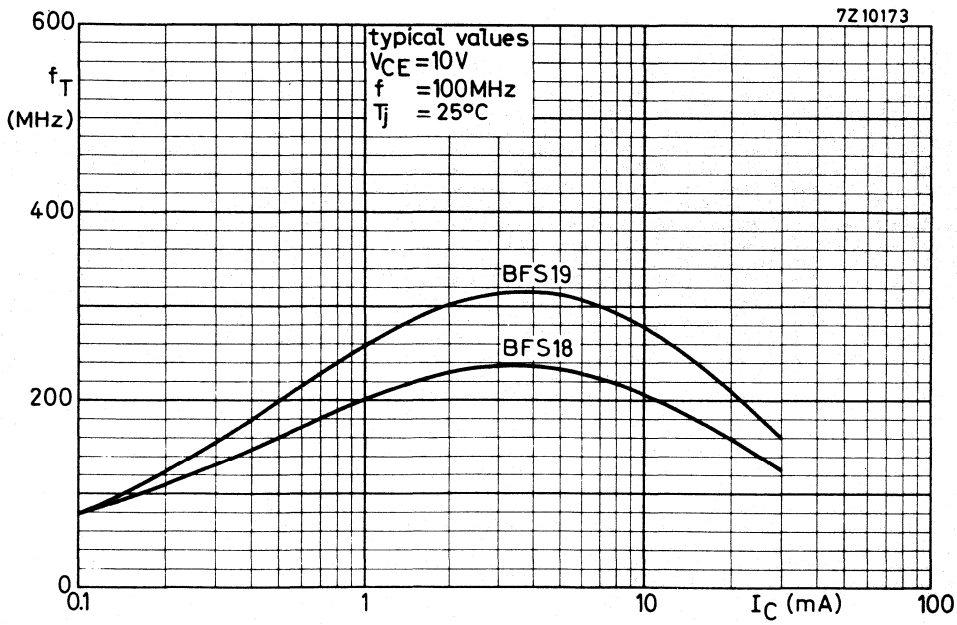

7Z10173
600
f_T
(MHz)
400
200
0
typical values
V_{CE} = 10V
f = 100MHz
T_j = 25°C
BFS19
BFS18
0.1
1
10
I_C (mA)
100

Fig. 9.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistor in a microminiature plastic envelope. It has a very low feedback capacitance and is intended for i.f. and v.h.f. applications in thick and thin-film circuits.

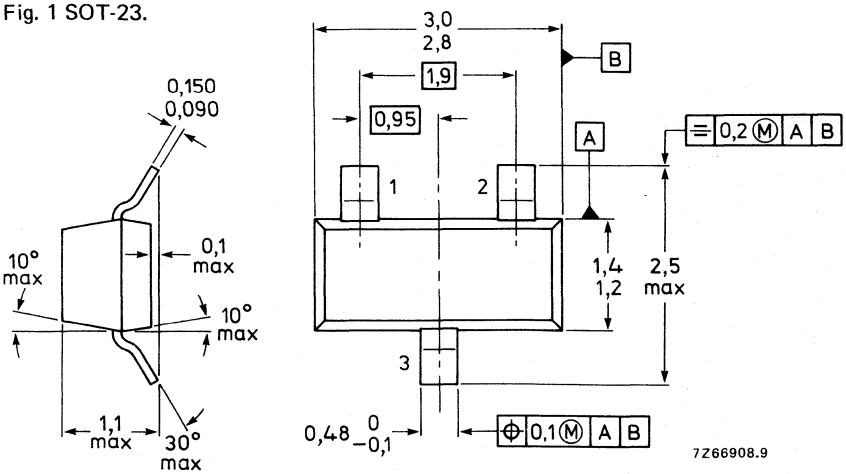
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 7 mA; V_{CE} = 10 V	h_{FE}	>	40	
Transition frequency at f = 100 MHz I_C = 5 mA; V_{CE} = 5 V	f_T	typ.	450	MHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ.	350	fF

MECHANICAL DATA

Fig. 1 SOT-23.

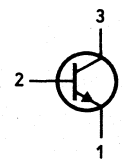
Dimensions in mm



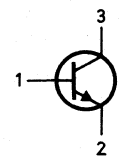
TOP VIEW

Marking code

BFS20 = G1



BFS20R = G4



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) see Fig. 2	V_{CBO}	max.	30 V
Collector-emitter voltage (open base) see Fig. 2			
I_C = 2 mA	V_{CEO}	max.	20 V
Emitter-base voltage (open collector) see Fig. 2	V_{EBO}	max.	4 V
Collector current (d.c.)	I_C	max.	25 mA
Collector current (peak value)	I_{CM}	max.	25 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−65 to	+150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base-emitter voltage			
I_C = 7 mA; V_{CE} = 10 V	V_{BE}	typ. <	740 mV 900 mV
D.C. current gain			
I_C = 7 mA; V_{CE} = 10 V	h_{FE}	> typ.	40 85
Transition frequency at f = 100 MHz			
I_C = 5 mA; V_{CE} = 10 V	f_T	> typ.	275 MHz 450 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	0,8 pF
Feedback capacitance at f = 1 MHz			
I_C = 1 mA; V_{CE} = 10 V	$-C_{re}$	typ.	350 fF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

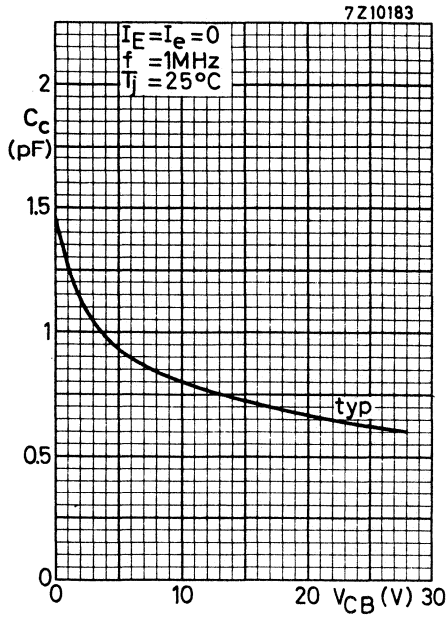

7Z10183
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
C_c (pF)
2
1.5
1
0.5
0
0
10
20
V_{CB} (V)
30
typ

Fig. 2.

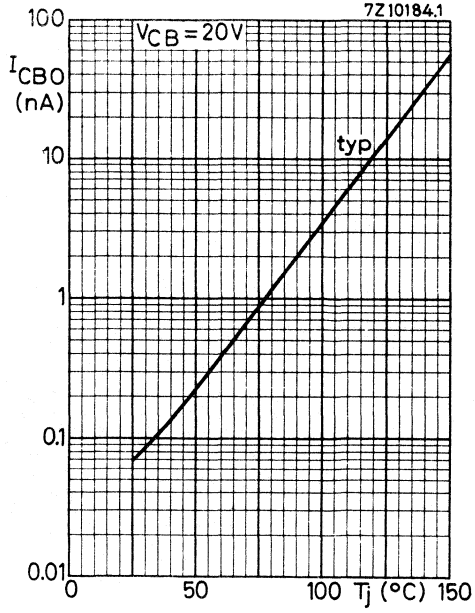

7Z10184.1
V_{CB} = 20V
I_{CBO} (nA)
100
10
1
0.1
0.01
0
50
100
T_j (°C)
150
typ

Fig. 3.

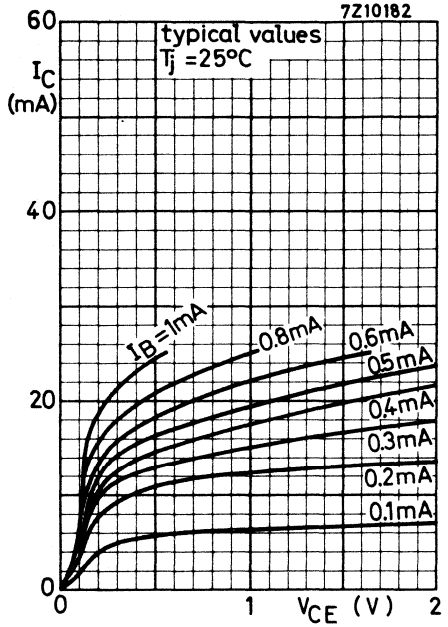


Fig. 4.

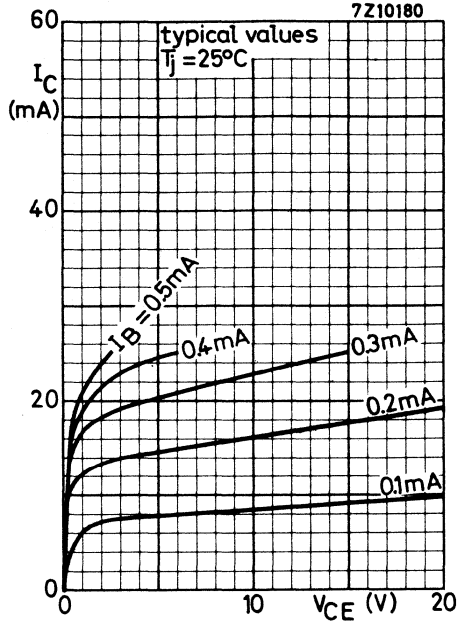


Fig. 5.

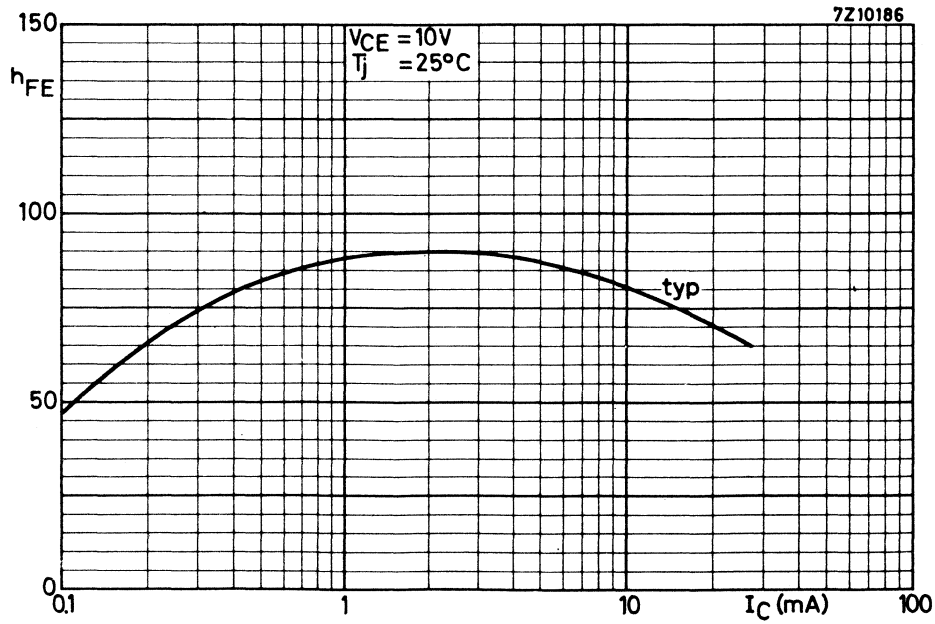


Fig. 6.

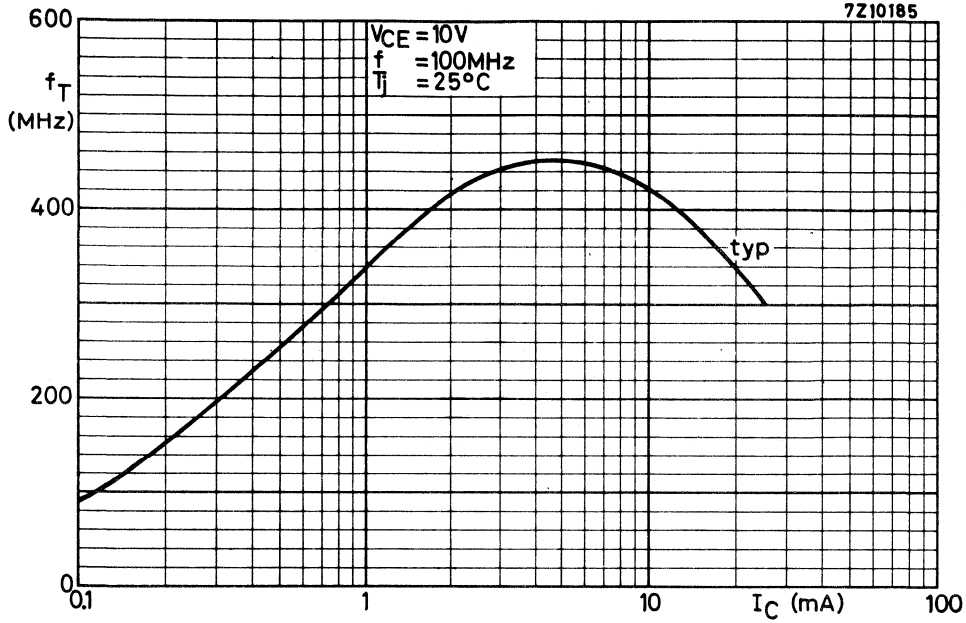

7Z10185
600
f_T
(MHz)
400
200
0
V_{CE} = 10V
f = 100MHz
Tj = 25°C
typ
0.1
1
10
I_C (mA)
100

Fig. 7.

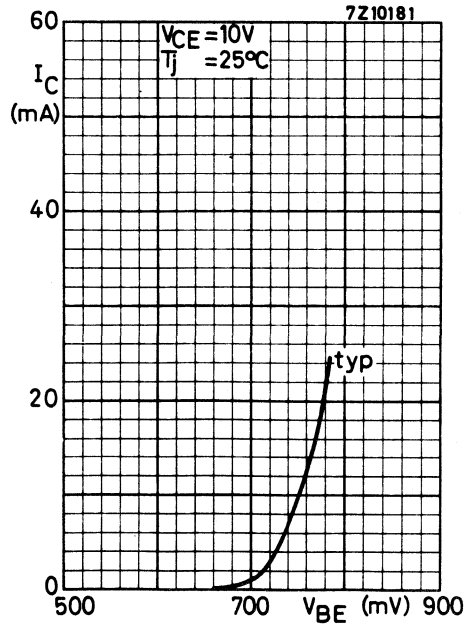

7Z10181
60
I_C
(mA)
40
20
0
V_{CE} = 10V
Tj = 25°C
typ
500
700
V_{BE} (mV)
900

Fig. 8.

N-P-N H.F. WIDEBAND TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope, primarily intended for use in u.h.f. low power amplifiers in thick and thin-film circuits, such as in pocket phones, paging systems, etc. The transistor features low current consumption (100 μA – 1 mA); thanks to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

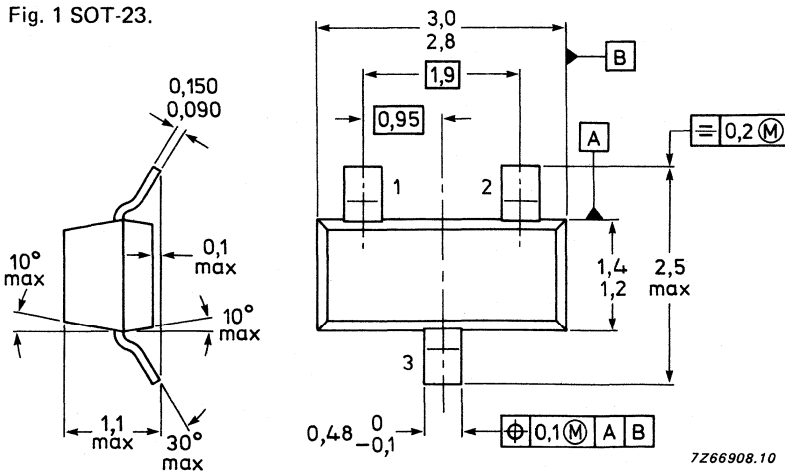
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Collector current (d.c.)	I_C	max.	6,5	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 1 mA; V_{CE} = 1 V	f_T	typ.	2,3	GHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 1 V	C_{re}	max.	0,45	pF
Noise figure at optimum source impedance I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz	F	typ.	3,8	dB
Max. unilateral power gain I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz	G_{UM}	typ.	18	dB

MECHANICAL DATA

Fig. 1 SOT-23.

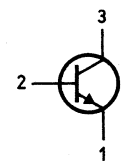
Dimensions in mm



TOP VIEW

Marking code

BFT25 = V1



If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	6,5	mA
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	10	mA
→ Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50	nA
D.C. current gain				
$I_C = 10\ \mu A$; $V_{CE} = 1$ V	h_{FE}	min.	20	
		typ.	30	
$I_C = 1$ mA; $V_{CE} = 1$ V	h_{FE}	min.	20	
		typ.	40	
Saturation voltages				
$I_C = 10\ \mu A$; $I_B = 1\ \mu A$	V_{CEsat}	max.	200	mV
	V_{BEsat}	max.	750	mV
$I_C = 1$ mA; $I_B = 0{,}1$ mA	V_{CEsat}	max.	175	mV
	V_{BEsat}	max.	900	mV
Transition frequency at $f = 500$ MHz				
$I_C = 1$ mA; $V_{CE} = 1$ V	f_T	min.	1,2	GHz
		typ.	2,3	GHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 0{,}5$ V	C_c	max.	0,6 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0$	C_e	max.	0,5 pF
Feedback capacitance at f = 1 MHz $I_C = 1$ mA; $V_{CE} = 1$ V; $T_{amb} = 25$ °C	C_{re}	max.	0,45 pF
Noise figure at optimum source impedance $I_C = 0{,}1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	5,5 dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	3,8 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 1$ mA; $V_{CE} = 1$ V; f = 200 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	25,0 dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	18,0 dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	12,0 dB

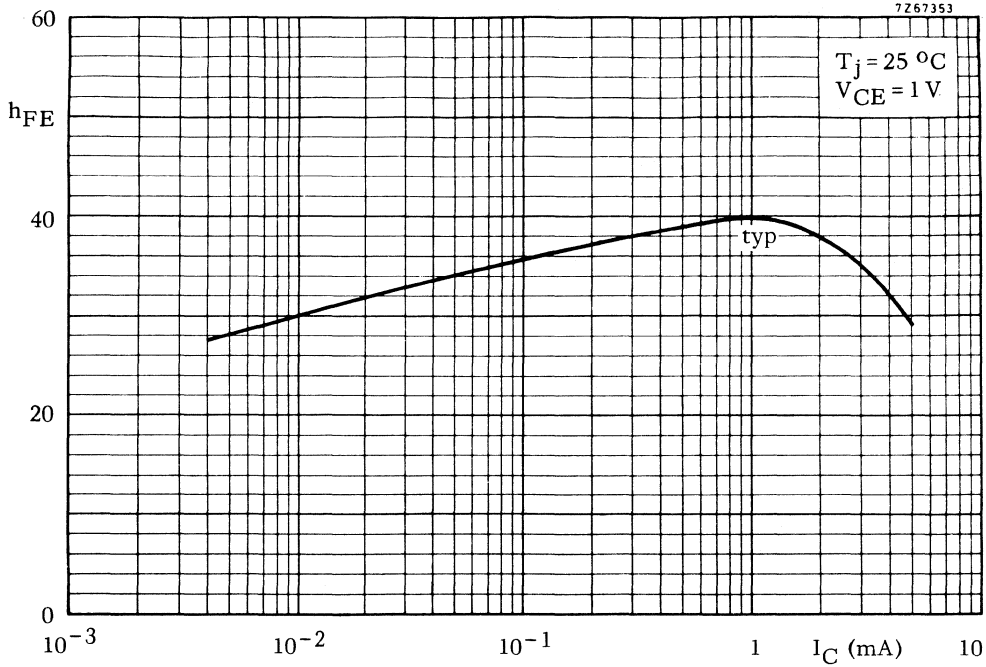


Fig. 2 V_{CE} = 1 V; T_j = 25 °C; typical values.

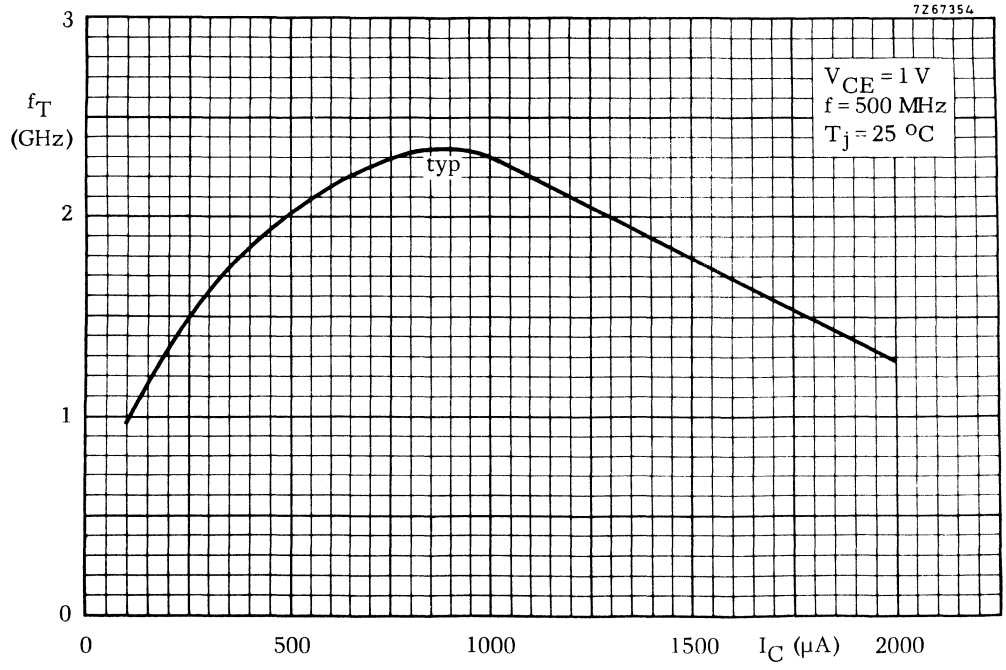


Fig. 3 V_{CE} = 1 V; f = 500 MHz; T_j = 25 °C; typical values.

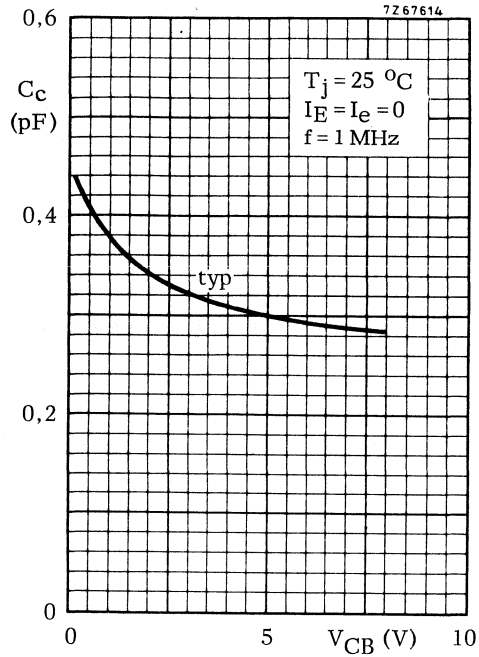


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; typical values.

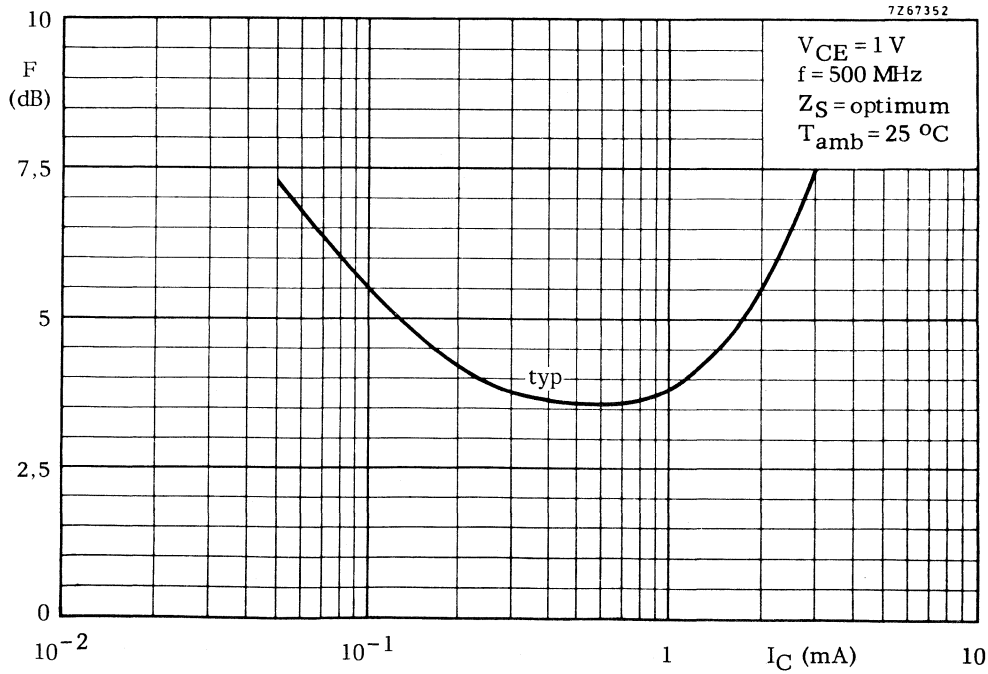


Fig. 5 V_{CE} = 1 V; f = 500 MHz; Z_S = opt.; T_{amb} = 25 °C; typical values.

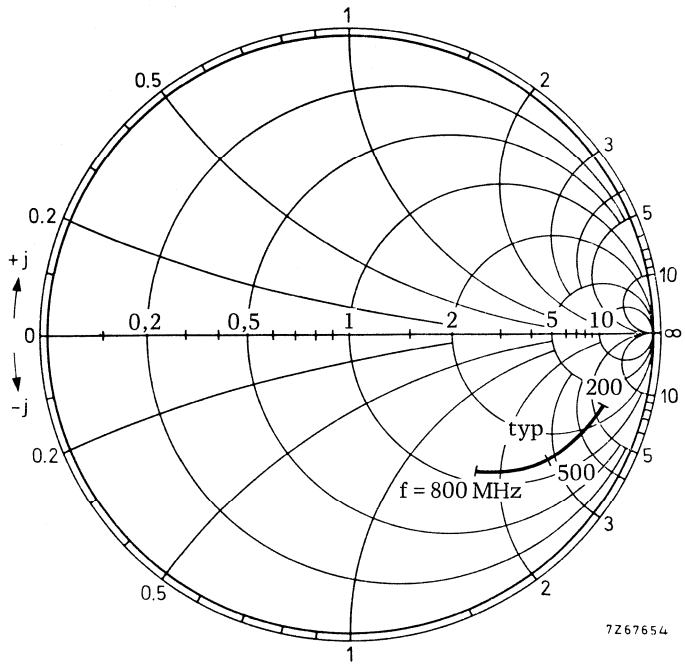


Fig. 6 V_{CE} = 1 V; I_C = 1 mA; T_{amb} = 25 °C; typical values.

Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

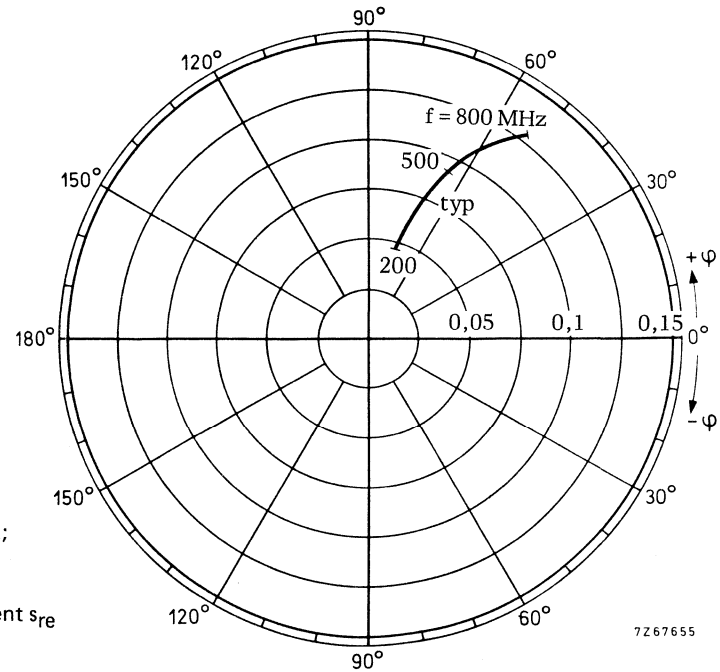


Fig. 7 V_{CE} = 1 V; I_C = 1 mA; T_{amb} = 25 °C; typical values.

Reverse transmission coefficient s_{re}

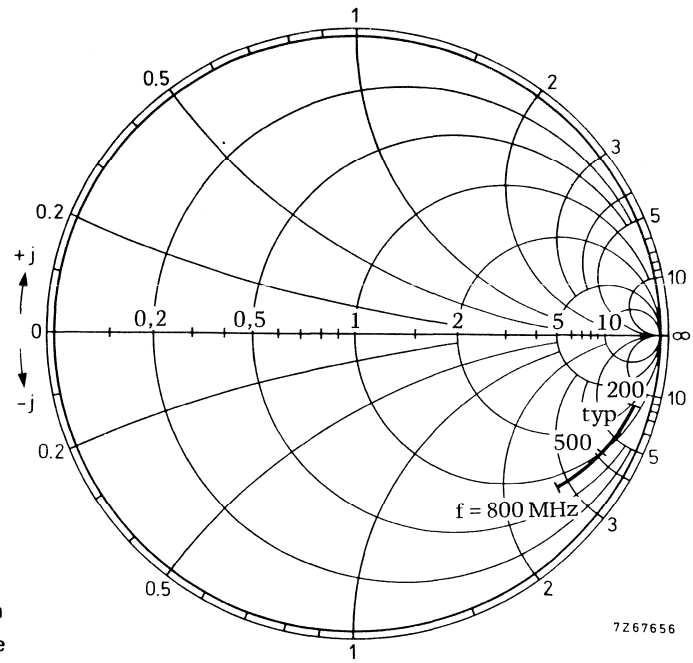


Fig. 8 V_{CE} = 1 V; I_C = 1 mA; T_{amb} = 25 °C; typical values.

Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

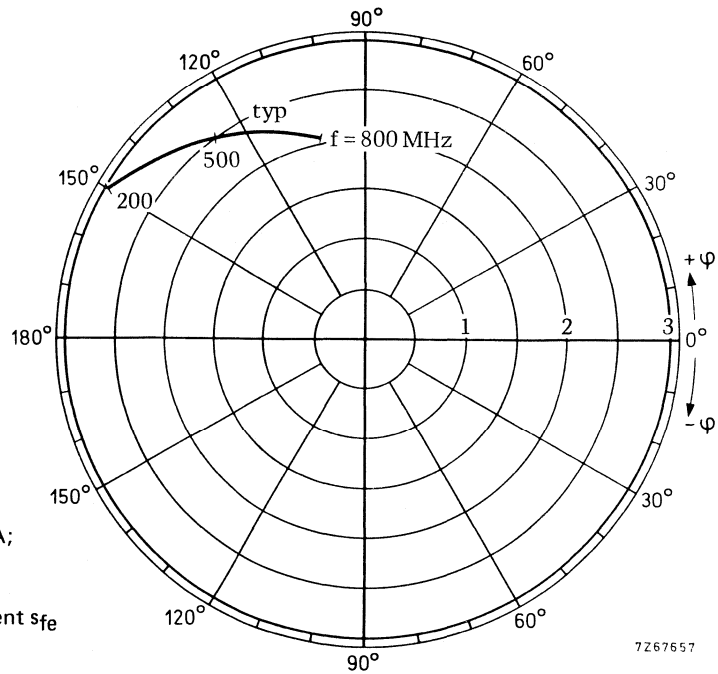


Fig. 9 V_{CE} = 1 V; I_C = 1 mA; T_{amb} = 25 °C; typical values.

Forward transmission coefficient s_{fe}

N-CHANNEL SILICON FET

Symmetrical n-channel silicon epitaxial planar junction field-effect transistor in a microminiature plastic envelope. The transistor is intended for low level general purpose amplifiers in thick and thin-film circuits.

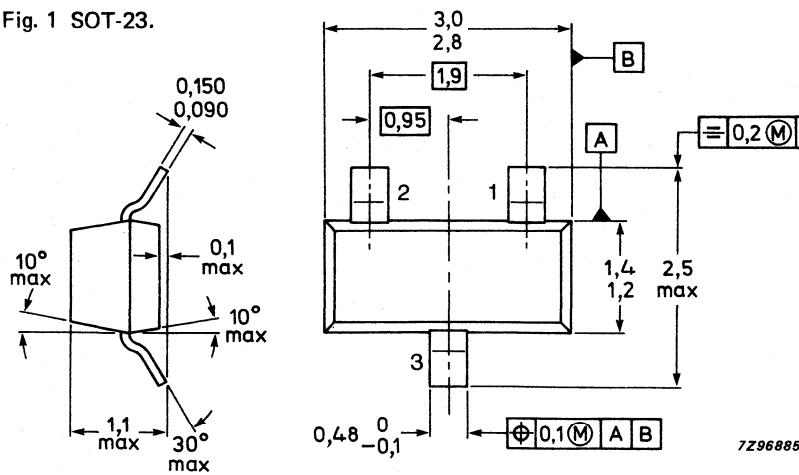
QUICK REFERENCE DATA

Drain-source voltage	$\pm V_{DS}$	max.	25 V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	25 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	> <	0,2 mA 1,5 mA
Transfer admittance (common source) I_D = 0,2 mA; V_{DS} = 10 V; f = 1 kHz	$\lvert y_{fs} \rvert$	>	0,5 mS
Equivalent noise voltage V_{DS} = 10 V; I_D = 200 μA; B = 0,6 to 100 Hz	V_n	<	0,5 μV

MECHANICAL DATA

Dimensions in mm

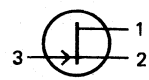
Fig. 1 SOT-23.



TOP VIEW

Marking code

BFT46 = M3



Note : Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	25	V
Drain-gate voltage (open source)	V_{DGO}	max.	25	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	25	V
Drain current	I_D	max.	10	mA
Gate current	I_G	max.	5	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature range	T_{stg}	−65 to +150		°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off current				
$-V_{GS}$ = 10 V; V_{DS} = 0	$-I_{GSS}$	<	0,2	nA
Drain current **				
V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0,2	mA
		<	1,5	mA
Gate-source voltage				
I_D = 50 μA; V_{DS} = 10 V	$-V_{GS}$	>	0,1	V
		<	1,0	V
Gate-source cut-off voltage				
I_D = 0,5 nA; V_{DS} = 10 V	$-V_{(P)GS}$	<	1,2	V
y-parameters at f = 1 kHz;				
V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C				
Transfer admittance	$\lvert y_{fs} \rvert$	>	1,0	mS
Output admittance	$\lvert y_{os} \rvert$	<	10	μS
V_{DS} = 10 V; I_D = 200 μA;				
Transfer admittance	$\lvert y_{fs} \rvert$	>	0,5	mS
Output admittance	$\lvert y_{os} \rvert$	<	5	μS

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Input capacitance at f = 1 MHz; V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C	C_{is}	<	5 pF
Feedback capacitance at f = 1 MHz; V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C	C_{rs}	<	1,5 pF
Equivalent noise voltage V_{DS} = 10 V; I_D = 200 μA; T_{amb} = 25 °C B = 0,6 to 100 Hz	V_n	<	0,5 μV

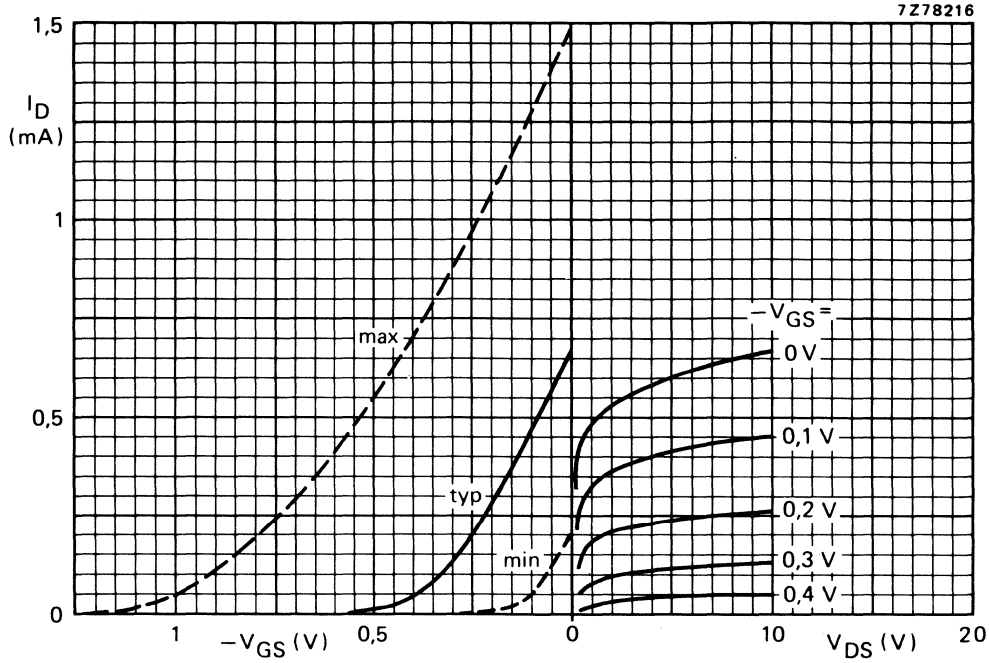


Fig. 2 Typical values. V_{DS} = 10 V; T_j = 25 °C.

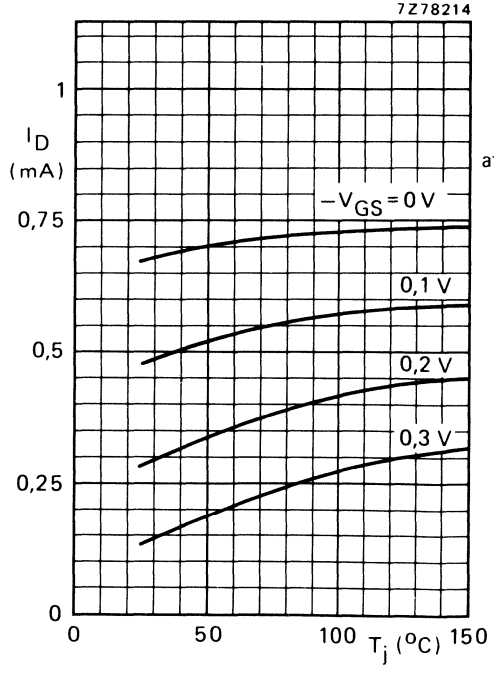


Fig. 3 Typical values. V_{DS} = 10 V.

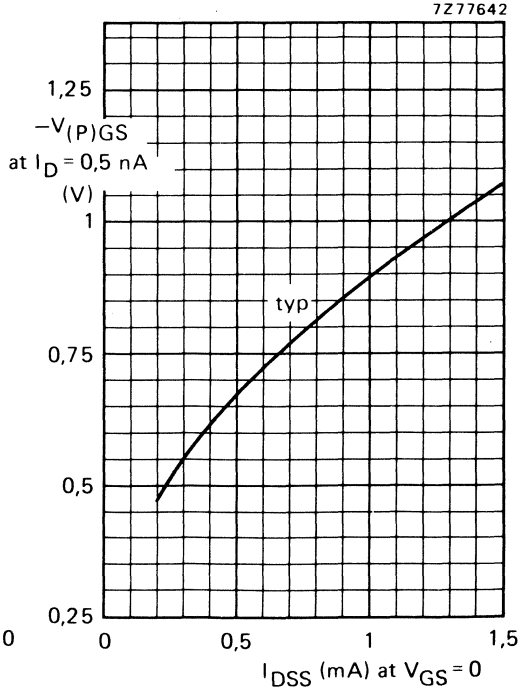


Fig. 4 Correlation between $-V_{(P)GS}$ and I_{DSS}. V_{DS} = 10 V; T_j = 25 °C.

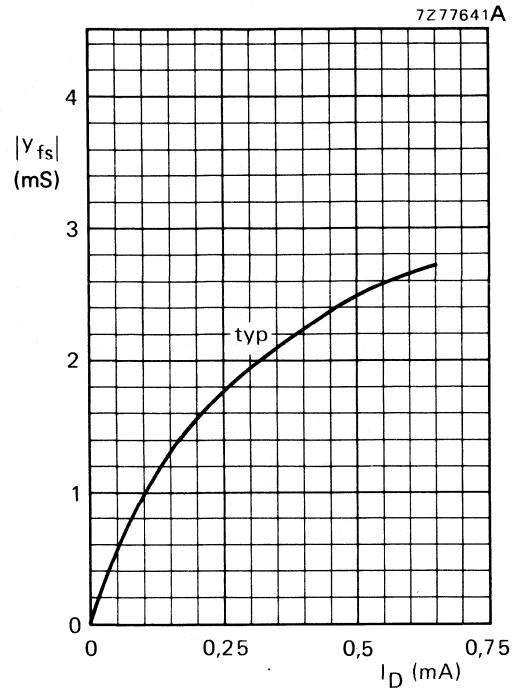


Fig. 5

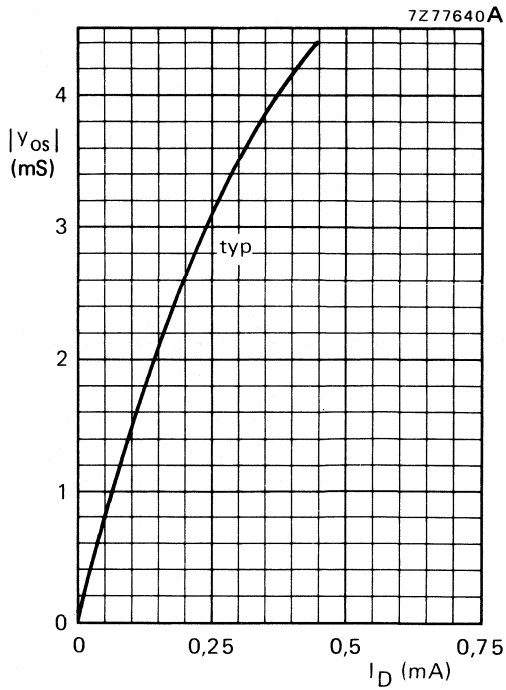


Fig. 6

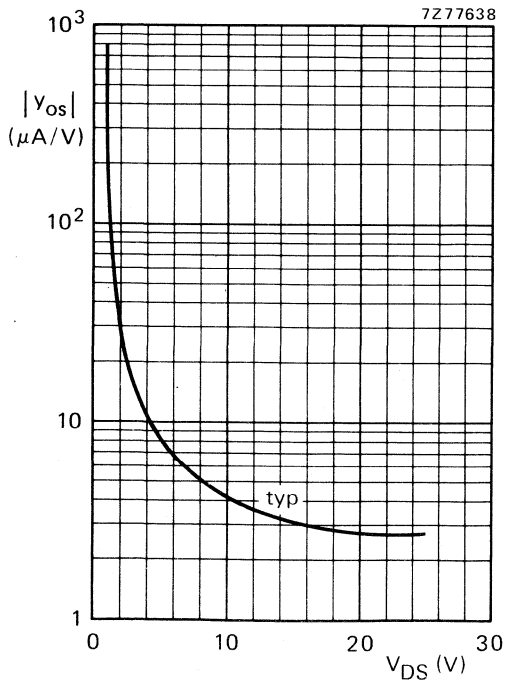


Fig. 7

Fig. 5 $|y_{fs}|$ versus I_D.
V_{DS} = 10 V; f = 1 kHz; T_{amb} = 25 °C.

Fig. 6 $|y_{os}|$ versus I_D.
V_{DS} = 10 V; f = 1 kHz; T_{amb} = 25 °C.

Fig. 7 $|y_{os}|$ versus V_{DS}.
I_D = 0,4 mA; f = 1 kHz; T_{amb} = 25 °C.

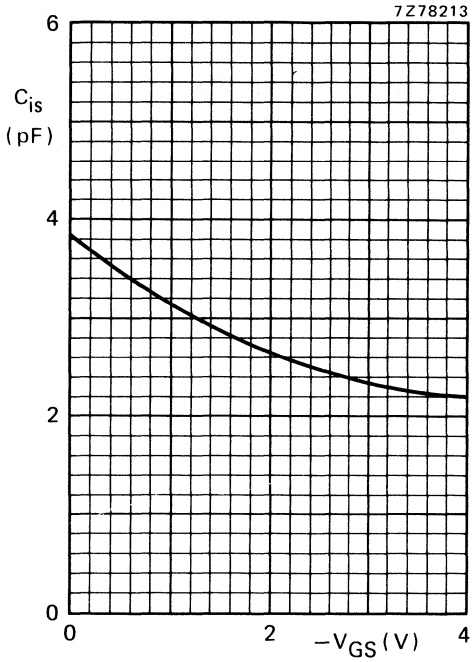


Fig. 8

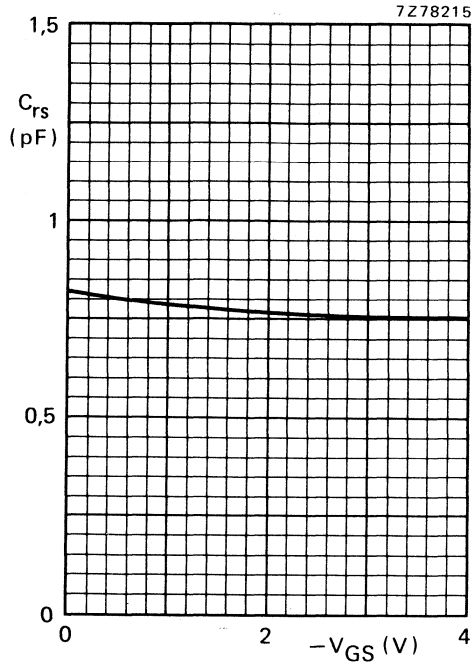


Fig. 9

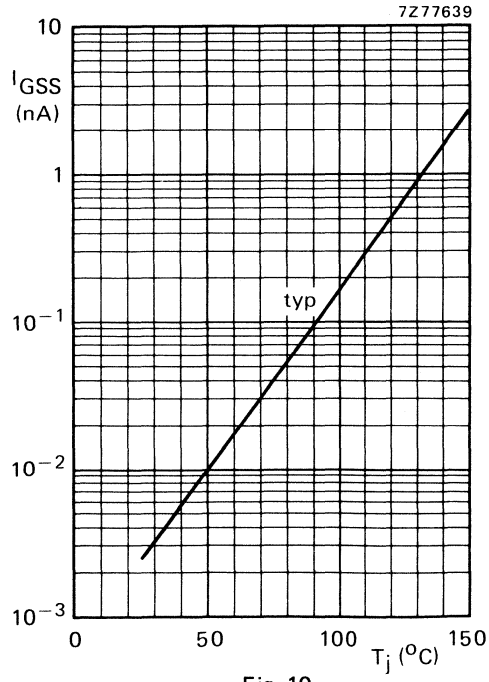


Fig. 10

Fig. 8 Typical values.
V_{DS} = 10 V, T_{amb} = 25 °C.

Fig. 9 Typical values.
V_{DS} = 10 V, T_{amb} = 25 °C.

Fig. 10 I_{GSS} versus T_j.
$-V_{GSS}$ = 10V; V_{DS} = 0.

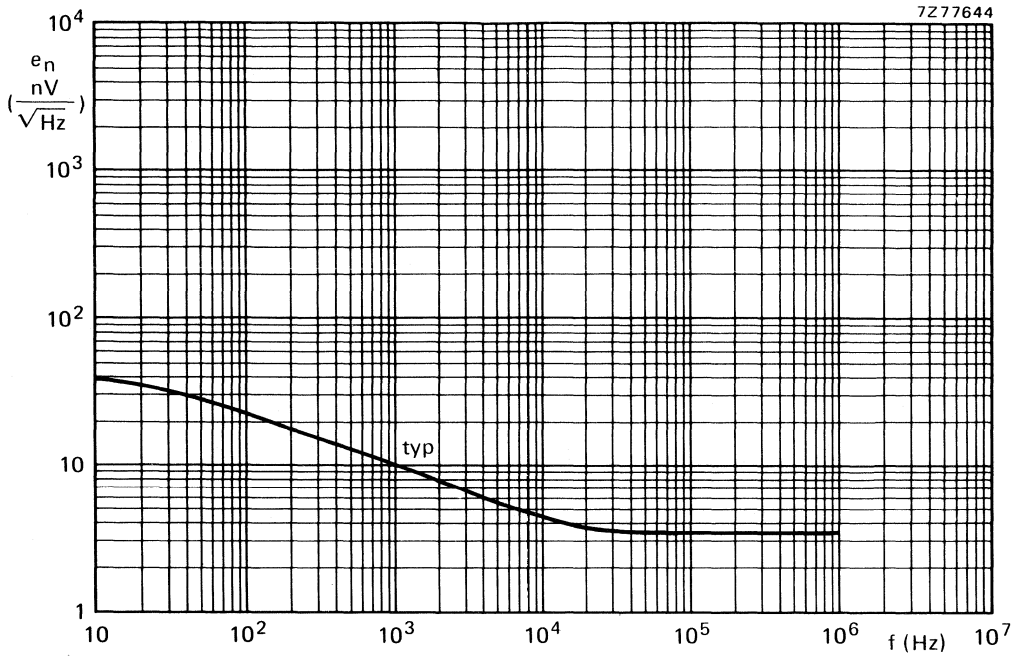


Fig. 11 V_{DS} = 10 V; I_D = 0,2 mA; T_{amb} = 25 °C.

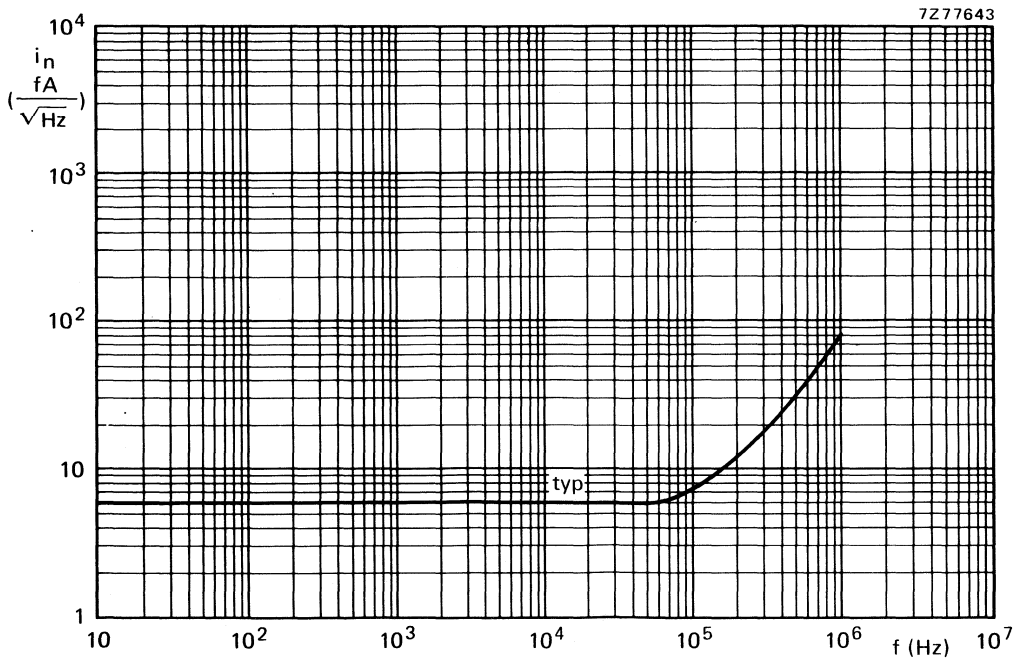


Fig. 12 V_{DS} = 10 V; I_D = 0,2 mA; T_{amb} = 25 °C.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistor in a microminiature plastic envelope. It is primarily intended for use in u.h.f. and microwave amplifiers in thick and thin-film circuits, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.

The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

N-P-N complements are BFR92 and BFR92A.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,7	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB
Max. unilateral power gain $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18	dB
Intermodulation distortion at T_{amb} = 25 °C $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω; V_o = 150 mV $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA

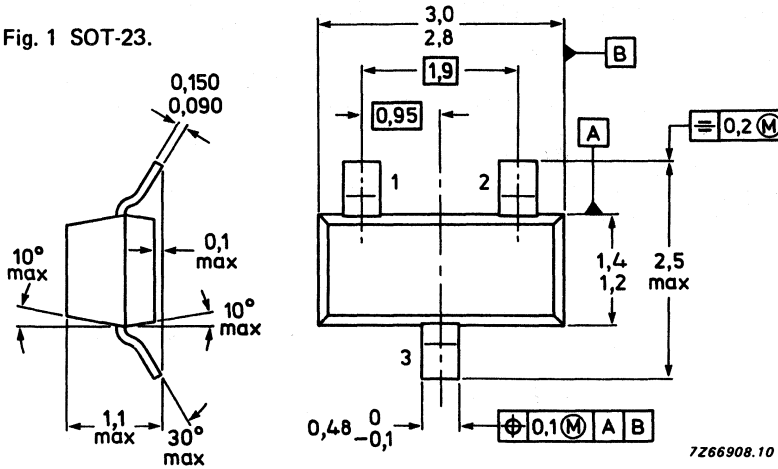
(See next page).

See also *Soldering recommendations.*

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

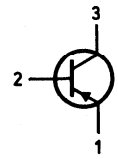


TOP VIEW

If required, the R-version (reverse pinning) is available on request.

Marking code

BFT92 = W1



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value; f > 1 MHz)	$-I_{CM}$	max.	35	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	max.	50	nA
D.C. current gain $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	min. typ.	20 50	
Transition frequency at f = 500 MHz $-I_C = 14$ mA; $-V_{CE} = 10$ V	f_T	typ.	5,0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	0,75	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	0,8	pF
T_{amb} = 25 °C				
Feedback capacitance at f = 1 MHz $-I_C = 2$ mA; $-V_{CE} = 10$ V	C_{re}	typ.	0,7	pF
Noise figure at optimum source impedance * $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz	F	typ.	2,7	dB
Max. unilateral power gain (s_{re} assumed to be zero) $G_{UM} = 10 \log \frac{\lvert s_{fe}\rvert^2}{(1 - \lvert s_{ie}\rvert^2)(1 - \lvert s_{oe}\rvert^2)}$ $-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz	G_{UM}	typ.	18,0	dB
Output voltage at d_{im} = −60 dB (see Fig. 2) (DIN 45004B, par. 6.3.: 3-tone) $-I_C = 14$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$ $V_p = V_o$ at $d_{im} = -60$ dB; f_p = 495,25 MHz $V_q = V_o$ −6 dB ; f_q = 503,25 MHz $R_r = V_o$ −6 dB ; f_r = 505,25 MHz measured at $f_{(p+q-r)}$ = 493,25 MHz	V_o	typ.	150	mV

* Crystal mounted in SOT-37 envelope.

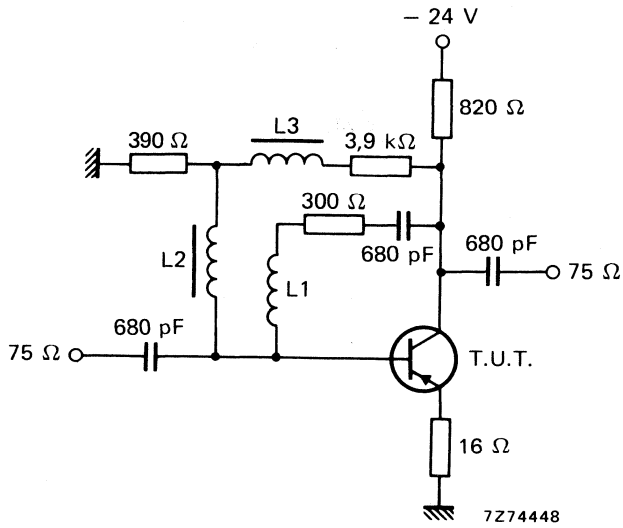


Fig. 2 Intermodulation test circuit.

L1 = 4 turns Cu wire (0,35 mm); winding pitch 1 mm; int. dia. 4 mm.
L2 = L3 = 5 μH (catalogue number: 3122 108 20150).

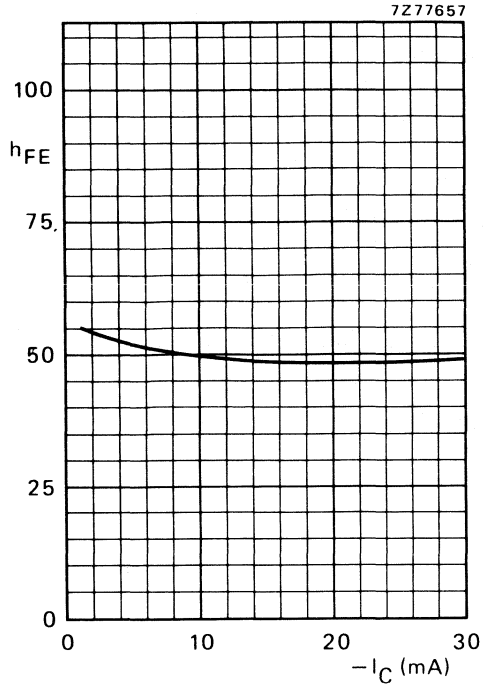


Fig. 3 $-V_{CE}$ = 10 V; T_j = 25 °C; typical values.

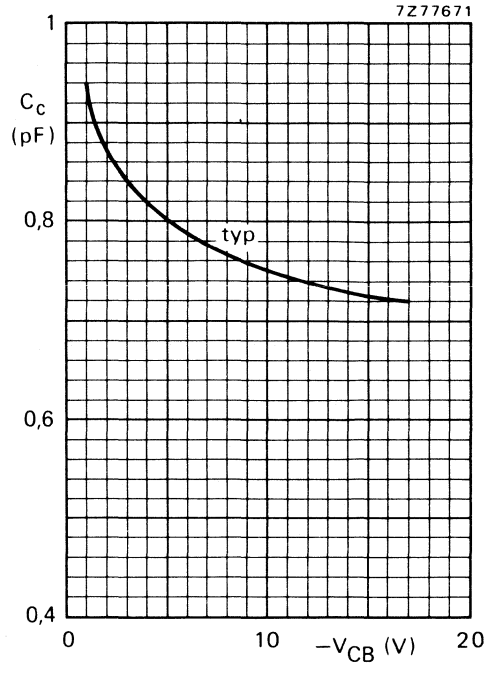


Fig. 4 $I_E = I_e = 0$; T_j = 25 °C; f = 1 MHz; typical values.

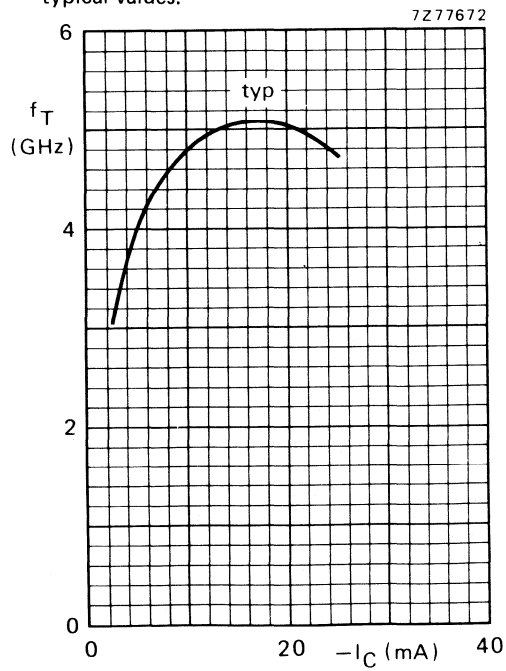


Fig. 5 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

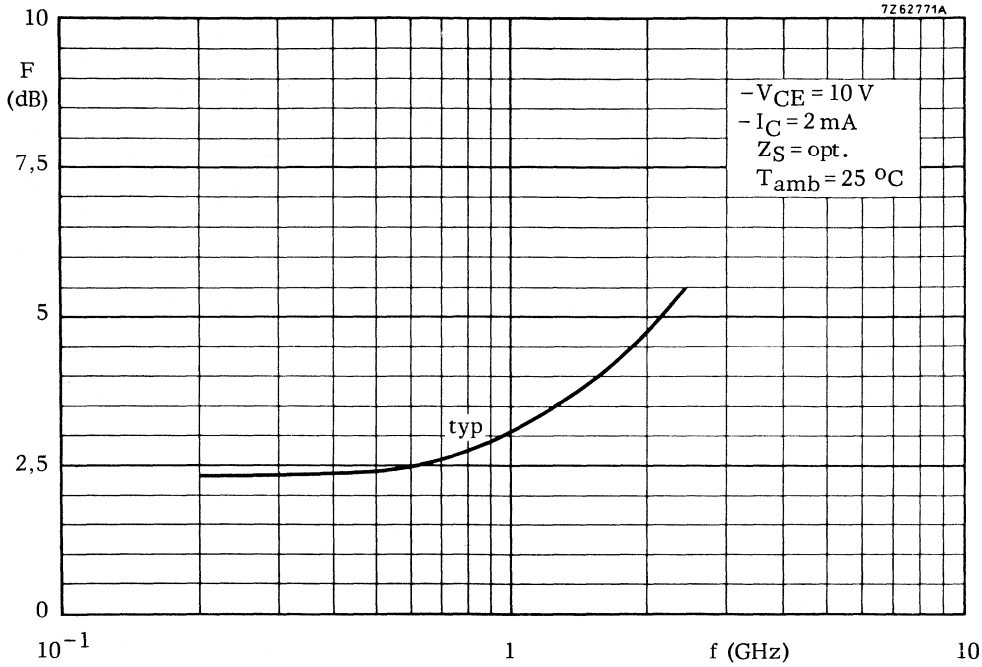


Fig. 6 $-V_{CE}$ = 10 V; $-I_C$ = 2 mA; Z_S = opt.; T_{amb} = 25 °C; typical values.

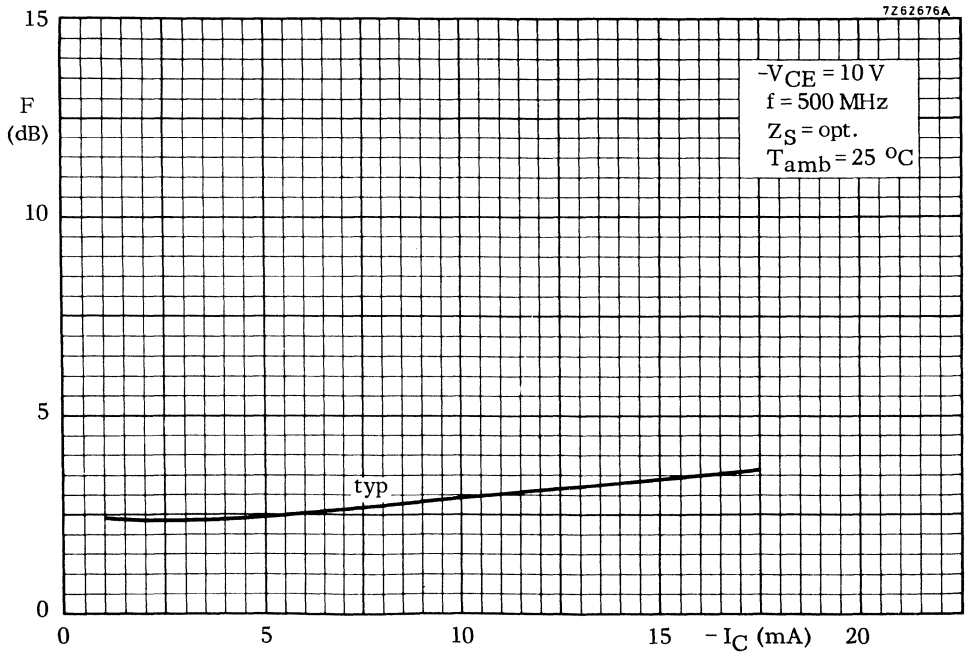


Fig. 7 $-V_{CE}$ = 10 V; f = 500 MHz; Z_S = opt.; T_{amb} = 25 °C; typical values.

P-N-P 1 GHz WIDEBAND TRANSISTOR

P-N-P transistor in a plastic SOT-23 envelope. It is primarily intended for use in u.h.f. and microwave amplifiers in thick and thin-film circuits, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyses, etc.

The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

N-P-N complements are BFR93 and BFR93A.

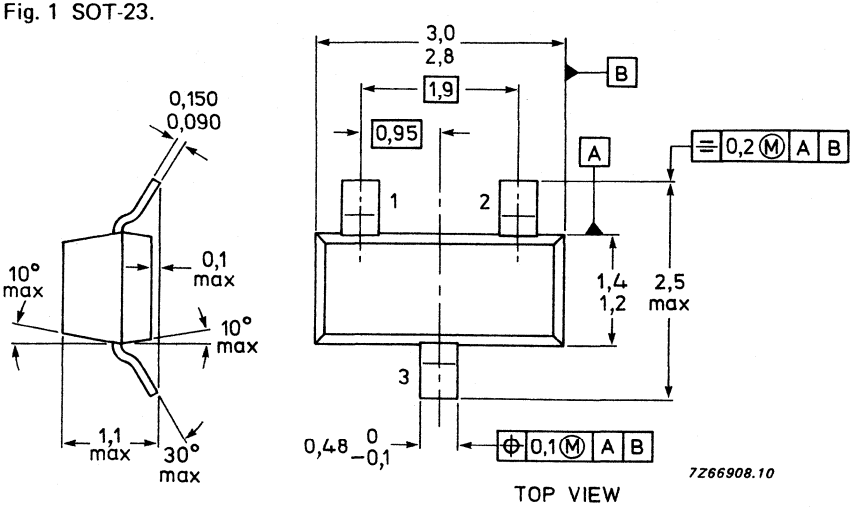
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5,0	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	C_{re}	typ.	1,0	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz	F	typ.	2,4	dB
Max. unilateral power gain $-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz	G_{UM}	typ.	16,5	dB
Output voltage at d_{im} = −60 dB $-I_C$ = 30 mA; $-V_{CE}$ = 5 V; R_L = 75 Ω $f_{(p+q-r)}$ = 493,25 MHz	V_o	typ.	300	mV

MECHANICAL DATA

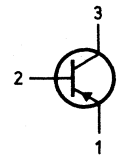
Dimensions in mm

Fig. 1 SOT-23.



Marking code

BFT93 = X1



If required, the R-version (reverse pinning) is available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Collector current (peak value; f > 1 MHz)	$-I_{CM}$	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	max.	50	nA
D.C. current gain $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	min. typ.	20 50	
Transition frequency at f = 500 MHz $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	typ.	5,0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	0,95	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,8	pF
T_{amb} = 25 °C				
Feedback capacitance at f = 1 MHz $-I_C = 2$ mA; $-V_{CE} = 5$ V	C_{re}	typ.	1,0	pF
Noise figure at optimum source impedance * $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz	F	typ.	2,4	dB
Max. unilateral power gain (s_{re} assumed to be zero) $G_{UM} = 10 \log \frac{\lvert s_{fe}\rvert^2}{(1 - \lvert s_{ie}\rvert^2)(1 - \lvert s_{oe}\rvert^2)}$ $-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz	G_{UM}	typ.	16,5	dB
Output voltage at d_{im} = −60 dB (see Fig. 2) $-I_C = 30$ mA; $-V_{CE} = 5$ V; $R_L = 75\ \Omega$ $V_p = V_o$ at d_{im} = −60 dB; f_p = 495,25 MHz $V_q = V_o$ −6 dB ; f_q = 503,25 MHz $V_r = V_o$ −6 dB ; f_r = 505,25 MHz measured at $f_{(p+q-r)}$ = 443,25 MHz	V_o	typ.	300	mV

* Crystal mounted in SOT-37 envelope.

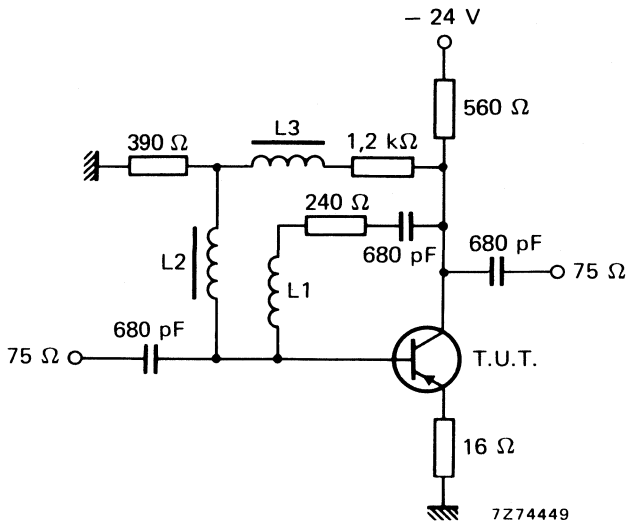


Fig. 2 Intermodulation test circuit.

L1 = 4 turns Cu wire (0,35); winding pitch 1 mm; int. dia. 4 mm.
L2 and L3 = 5 μH (catalogue number: 3122 108 20150).

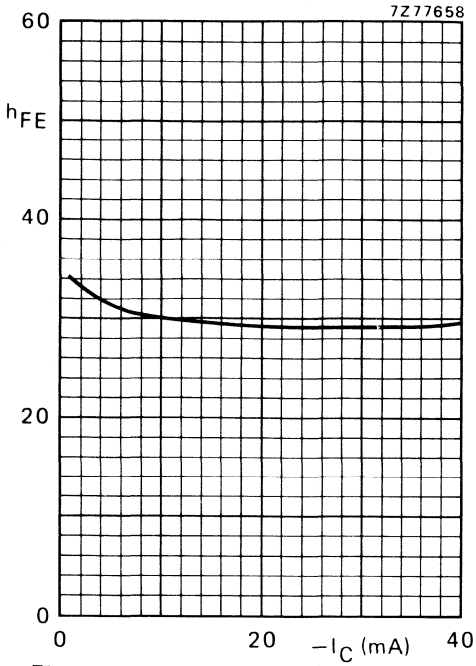


Fig. 3 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

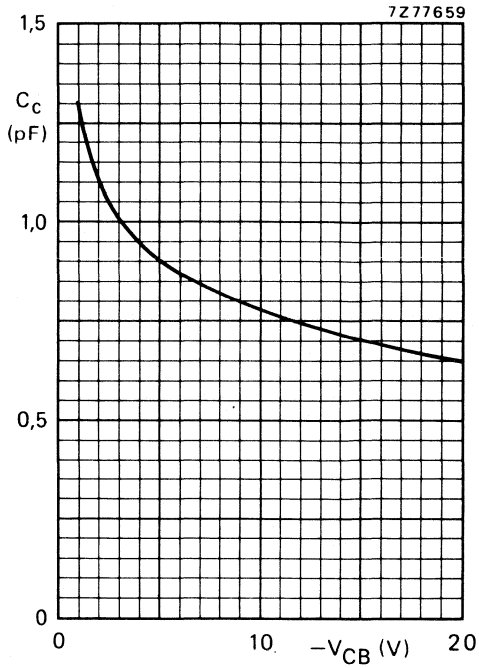


Fig. 4 $I_E = I_e$ = 0; T_j = 25 °C; f = 1 MHz; typical values.

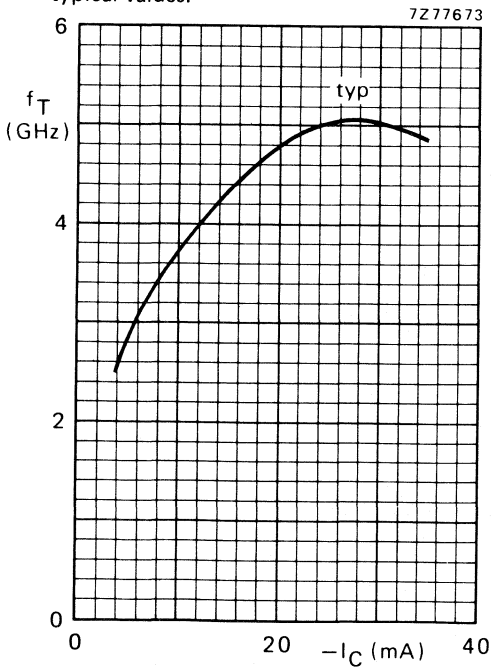


Fig. 5 $-V_{CE}$ = 5 V; T_j = 25 °C; f = 500 MHz; typical values.

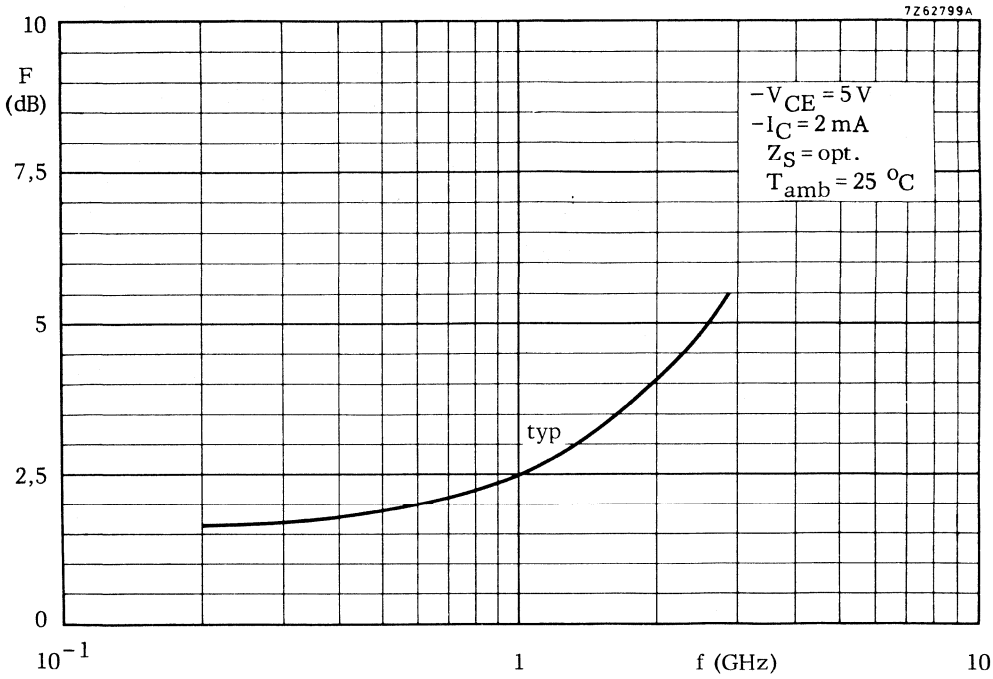


Fig. 6 $-V_{CE}$ = 5 V; $-I_C$ = 2 mA; Z_S = opt.; T_{amb} = 25 °C; typical values.

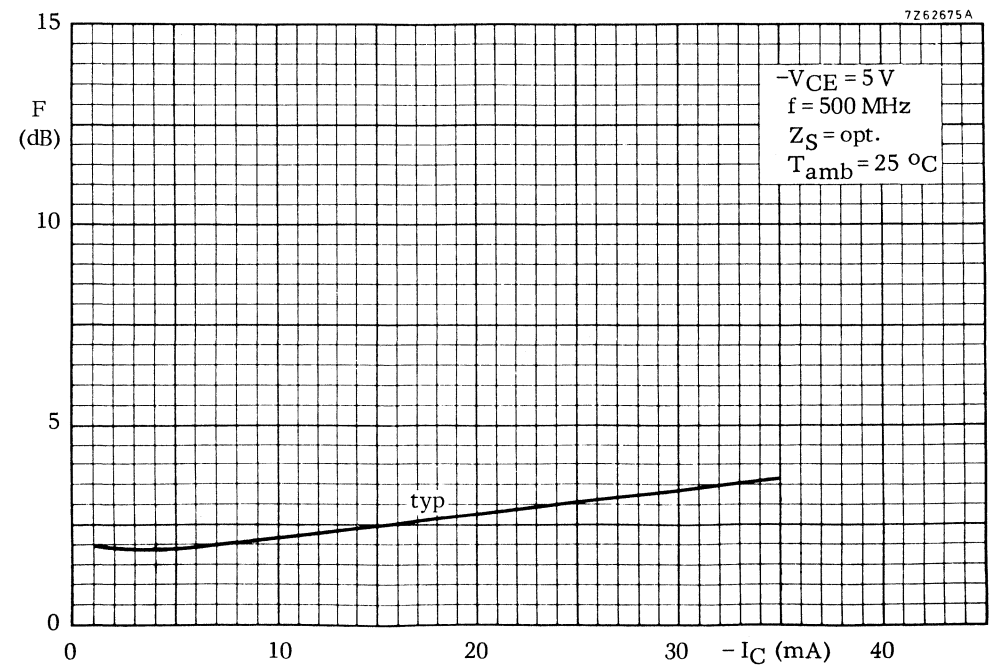


Fig. 7 $-V_{CE}$ = 5 V; f = 500 MHz; Z_S = opt.; T_{amb} = 25 °C; typical values.

PROGRAMMABLE UNIJUNCTION TRANSISTOR

Planar p-n-p-n trigger device in a microminiature plastic envelope intended for applications in thick and thin-film circuits. It is intended for use in switching applications such as motor control, oscillators, relay replacement, timers, pulse shaper, trigger device etc.

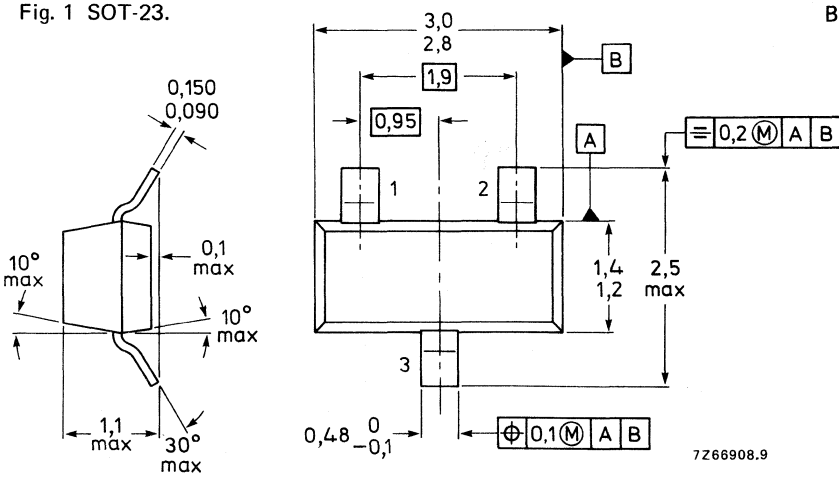
QUICK REFERENCE DATA

Gate-anode voltage	V_{GA}	max.	70 V
Anode current (d.c.) up to T_{amb} = 25 °C	I_A	max.	175 mA
Junction temperature	T_j	max.	150 °C
Peak point current V_S = 10 V; R_G = 10 kΩ	I_P	<	5 μA
Valley point current V_S = 10 V; R_G = 10 kΩ	I_V	>	30 μA

MECHANICAL DATA

Dimensions in mm

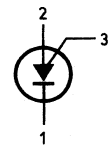
Fig. 1 SOT-23.



TOP VIEW

Marking code

BRY61 = A5



See also *Soldering Recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Gate-anode voltage	V_{GA}	max.	70	V
Anode current (d.c.) up to T_{amb} = 25 °C	I_A	max.	175	mA
Repetitive peak anode current t = 10 μs; δ = 0,01	I_{ARM}	max.	2,5	A
Non-repetitive peak anode current t = 10 μs; T_j = 150 °C	I_{ASM}	max.	3	A
Rate of rise of anode current up to I_A = 2,5 A	$\frac{dI_A}{dt}$	max.	20	A/μs
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Peak point current (see Figs 2, 3 and 4)				
V_S = 10 V; R_G = 10 kΩ	I_P	<	5	μA
V_S = 10 V; R_G = 1 MΩ	I_P	<	1	μA
Valley point current (see also Figs 2, 3 and 4)				
V_S = 10 V; R_G = 10 kΩ	I_V	>	30	μA
V_S = 10 V; R_G = 1 MΩ	I_V	<	50	μA
Offset voltage (see Fig. 12)				
I_A = 0 (for V_P see Fig. 2; for V_S see Fig. 4)	V_{offset}	= $V_P - V_S$		V

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

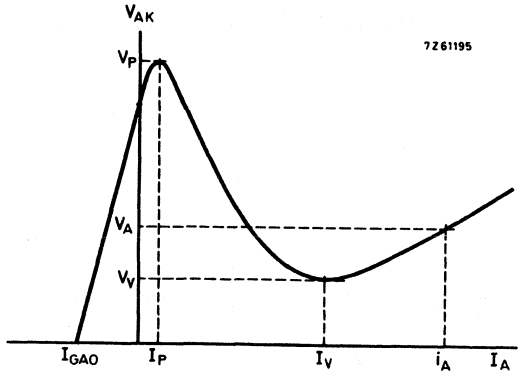


Fig. 2 See also Fig. 11.

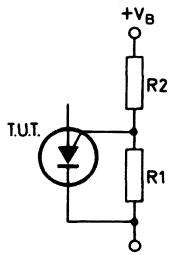


Fig. 3 BRY61 with "program" resistors R1 and R2.

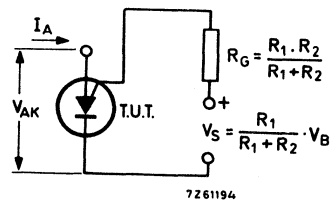


Fig. 4 Equivalent test circuit for characteristics testing.

Gate-anode leakage current (Fig. 5a)
$I_K = 0$; $V_{GA} = 70$ V

Gate-cathode leakage current (Fig. 5b)
$V_{AK} = 0$; $V_{GK} = 70$ V

$I_{GAO} < 10$ nA

$I_{GKS} < 100$ nA

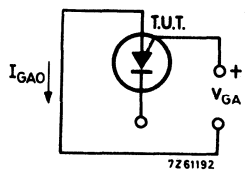


Fig. 5a.

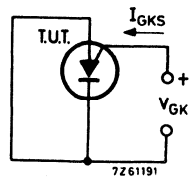


Fig. 5b.

Anode voltage			
I_A = 100 mA	V_A	<	1,4 V
I_A = 180 mA	V_A	<	1,6 V
Peak output voltage			
V_{AA} = 20 V; C = 200 nF (see Fig. 12)	V_{OM}	>	6 V
Rise time			
V_{AA} = 20 V; C = 10 nF (see Fig. 12)	t_r	<	80 ns

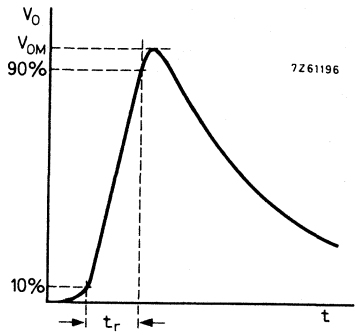


Fig. 6 Output voltage waveform.

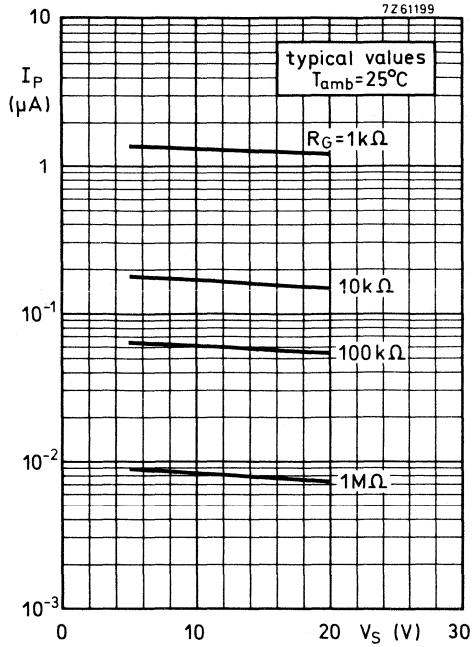


Fig. 7.

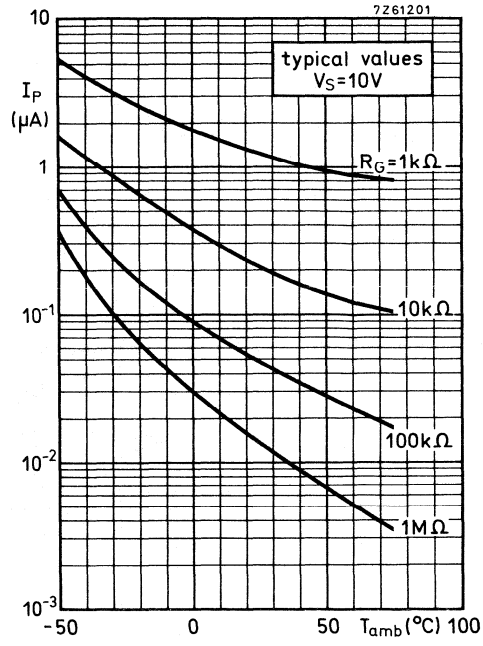


Fig. 8.

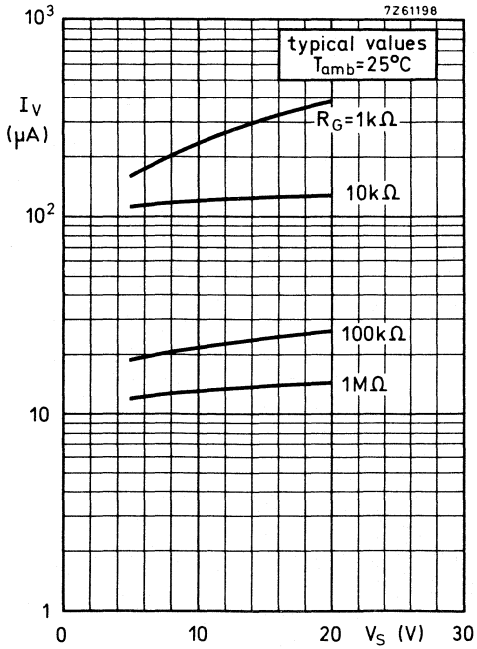


Fig. 9.

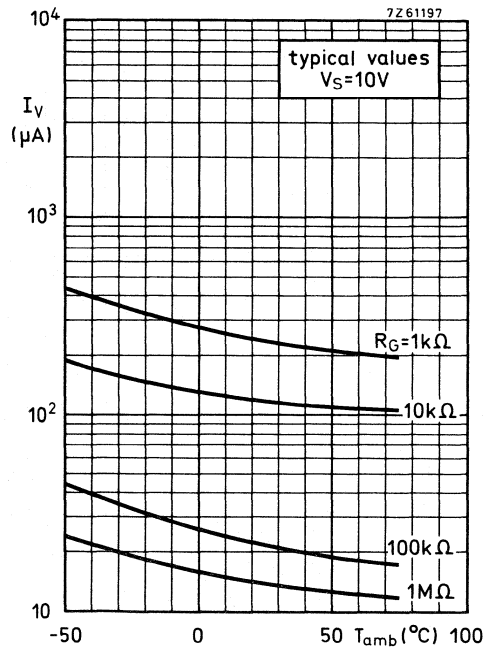


Fig. 10.

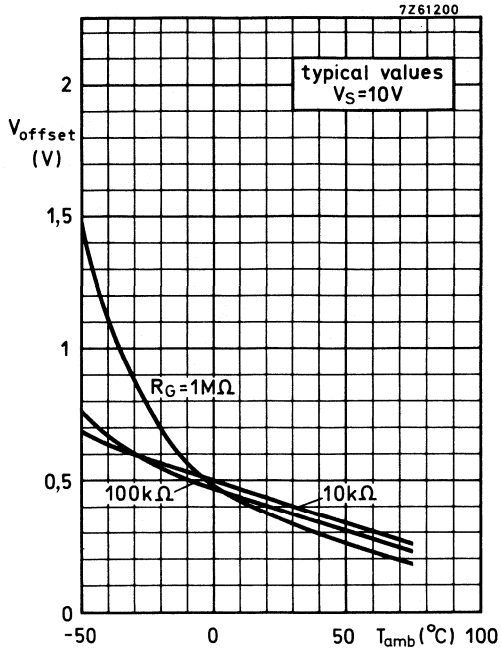

7Z61200
typical values
V_S=10V
V_{offset} (V)
2
1,5
1
0,5
0
R_G=1MΩ
100kΩ
10kΩ
-50
0
50
T_{amb}(°C)
100

Fig. 11.

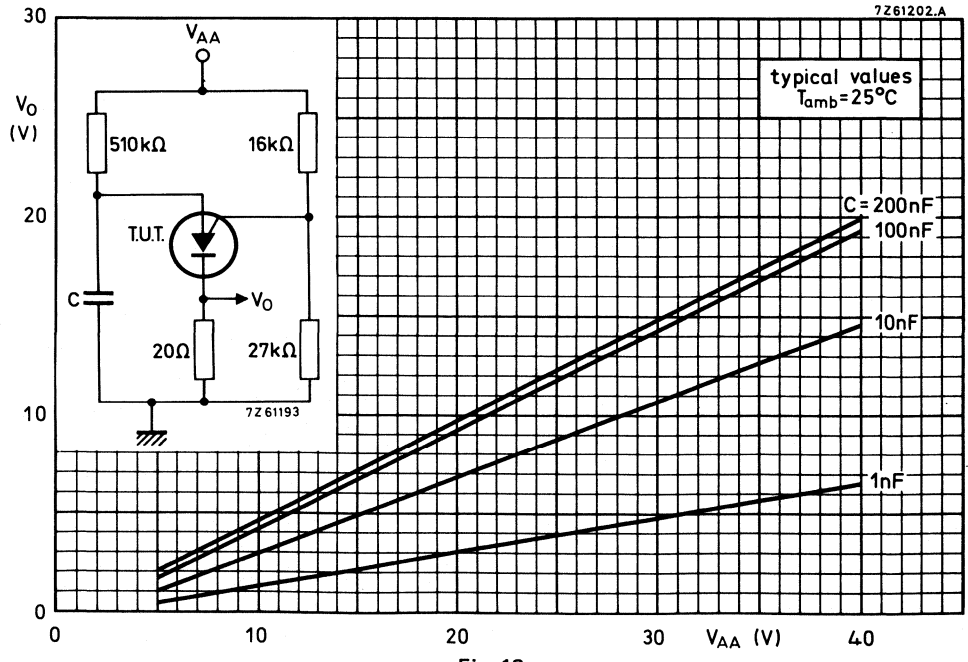

7Z61202.A
typical values
T_{amb}=25°C
V_O (V)
30
20
10
0
V_{AA}
510kΩ
16kΩ
T.U.T.
C
V_O
20Ω
27kΩ
7Z61193
C=200nF
100nF
10nF
1nF
0
10
20
30
V_{AA} (V)
40

Fig. 12.

SILICON P-N-P-N PLANAR TETRODE THYRISTOR

Planar p-n-p-n trigger device in a microminiature plastic envelope. It is intended for use as a programmable trigger device (SCS = silicon controlled switch).

QUICK REFERENCE DATA

Anode gate – cathode voltage	$V_{ga\text{-}kR}$	max.	70	V
Anode gate – anode voltage (open cathode)	$V_{ga\text{-}aO}$	max.	70	V
Average anode current	$I_{A(AV)}$	max.	175	mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Gate-controlled turn-on time $R_{gk\text{-}k}$ = 1 kΩ	t_{gt}	<	0,25	μs
Circuit-commutated turn-off time $R_{gk\text{-}k}$ = 1 kΩ	t_q	<	5	μs

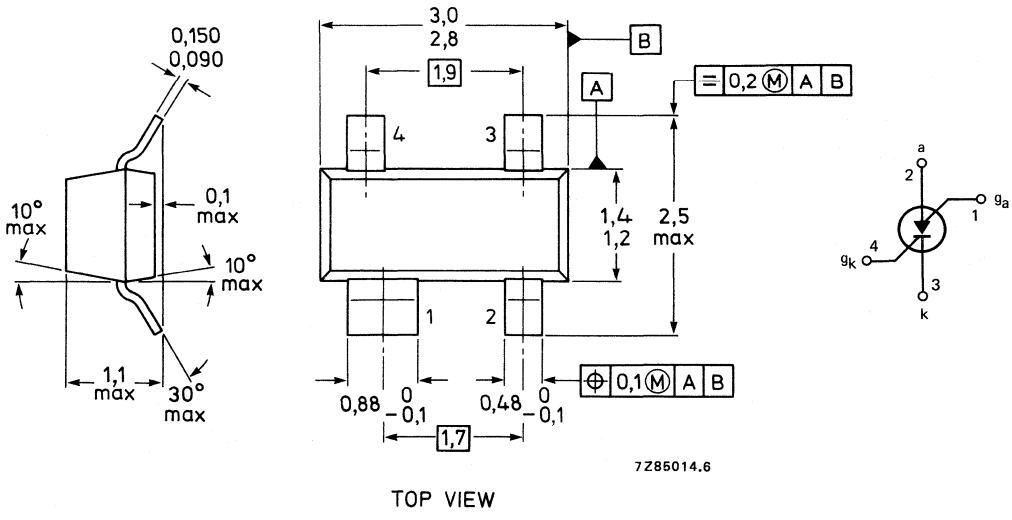
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code

BRY62 = A51



TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Transistor 1 (T1)

Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Collector-emitter voltage (R_{BE} = 10 kΩ)	V_{CEO}	max.	70	V
Emitter-collector voltage (I_{C1} = 0)	V_{EBO}	max.	5	V
Average collector current	$I_{C(AV)}$	max.	175	mA▲
Collector current (peak value)	I_{CM}	max.	175	mA**
Average emitter current	$I_{E(AV)}$	max.	175	mA
Emitter current (peak value) t_p = 10 μs; δ = 1%	I_{EM}	max.	2,5	A

Transistor 2 (T2)

Collector-base voltage (I_{E2} = 0)	$-V_{CBO}$	max.	70	V
Collector-emitter voltage (I_{B2} = 0)	$-V_{CEO}$	max.	70	V
Emitter-base voltage (I_{C2} = 0)	$-V_{EBO}$	max.	70	V
Emitter current (average)	$I_{E(AV)}$	max.	175	mA
Emitter current (peak value) t_p = 10 μs; δ = 1%	I_{EM}	max.	2,5	A
Reverse gate to cathode voltage	$V_{ga\text{-}kR}$	max.	70	V
Gate to anode voltage (open cathode)	$V_{ga\text{-}aO}$	max.	70	V
Gate to cathode voltage (open anode)	$V_{gk\text{-}kO}$	max.	5	V
Average anode current	$I_{A(AV)}$	max.	175	mA
Anode current (peak value) t_p = 10 μs; δ = 1%	I_{AM}	max.	2,5	A
Anode gate current (average)	$I_{GA(AV)}$	max.	175	mA
Anode gate current (peak value)	I_{GAM}	max.	**	
→ Total power dissipation at T_{amb} = 25 °C*	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_{stg}	−65 to +	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

* Device mounted on a ceramic substrate of 15 mm x 15 mm x 0,5 mm.

** During switching on, the device can withstand the discharge of a capacitor of 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.

▲ Provided the I_E rating is not exceeded.

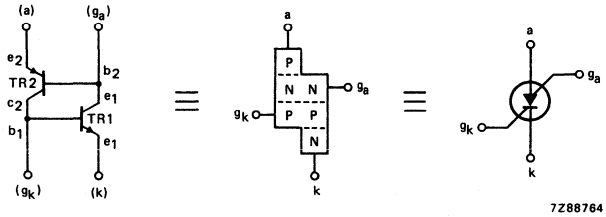


Fig. 2 Circuit diagram.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Transistor 1 (TR1)

Collector-emitter cut-off current			
V_{CE} = 60 V; R_{BE} = 10 kΩ	I_{CER}	<	100 nA
V_{CE} = 70 V; R_{BE} = 10 kΩ; T_j = 150 °C	I_{CER}	<	10 μA
Emitter cut-off current			
V_{EB} = 5 V; I_C = 0; T_j = 150 °C	I_{EBO}	<	10 μA
Saturation voltages			
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	0,5 V
	V_{BEsat}	<	0,9 V
D.C. current gain			
V_{CE} = 2 V; I_C = 10 mA	h_{FE}	>	50
Collector capacitance			
V_{CB} = 20 V; I_E = I_e = 0	C_c	<	5 pF
Emitter capacitance			
V_{EB} = 1 V; I_C = I_c = 0	C_e	<	25 pF
Transition frequency at f = 100 MHz			
V_{CE} = 2 V; I_C = 10 mA	f_T	=	300 MHz

Transistor 2 (TR2)

Collector-emitter cut-off current			
$-V_{CE}$ = 70 V; I_B = 0; T_j = 150 °C	$-I_{CEO}$	<	10 μA
Emitter cut-off current			
$-V_{EB}$ = 70 V; I_C = i_c = 0; T_j = 150 °C	$-I_{EBO}$	<	10 μA
D.C. current gain			
V_{CB} = 0 V; I_E = 1 mA	h_{FE}	0,25 to 2,5	

THYRISTOR

Anode to cathode

On-state voltage

I_A = 50 mA; I_{ga} = 0; $R_{gk\text{-}k}$ = 10 kΩ	V_T	<	1,4 V
I_A = 1 mA; I_{ga} = 10 mA; $R_{gk\text{-}k}$ = 10 kΩ	V_T	<	1,2 V

Holding current

I_{ga} = 10 mA; $-V_{gk}$ = 2 V; $R_{gk\text{-}k}$ = 10 Ω	I_H	<	1 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from V_{gk} = −0,5 V to 4,5 V

at $R_{gk\text{-}k}$ = 1 kΩ	t_{gt}	<	0,25 μs
at $R_{gk\text{-}k}$ = 10 kΩ	t_{gt}	<	1,5 μs

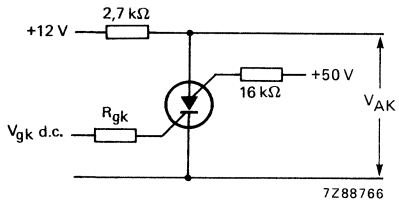


Fig. 3 Switching times test circuit.
The pulse time of V_{gk} can be adjusted in such a way that the broken line in Fig. 4 disappears, which means that the thyristor starts triggering.

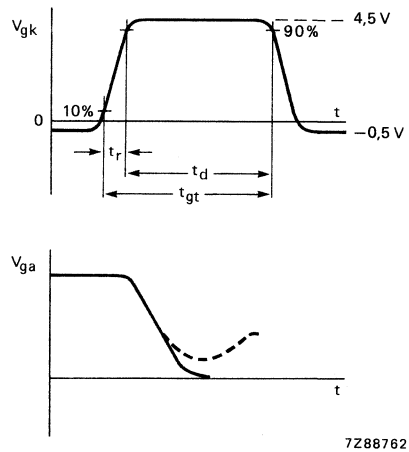


Fig. 4 Switching times waveforms.

Turn-off time (Figs 5 and 6)

R_{gk} = 1 kΩ	t_q	<	5 μs
R_{gk} = 10 kΩ	t_q	<	8 μs
R_{gk} = 10 kΩ; T_j = 125 °C	t_q	<	15 μs

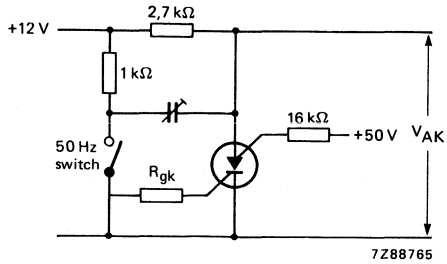


Fig. 5 Switching times test circuit.

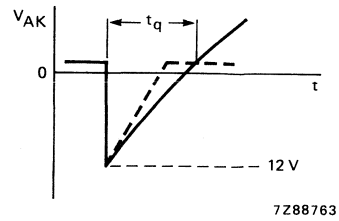


Fig. 6 Switching times waveforms.

The capacitor can be adjusted in such a way that the broken line disappears, which means that the thyristor will not trigger any more.

MOSFET N-CHANNEL DEPLETION SWITCHING TRANSISTORS

Symmetrical insulated-gate silicon MOS field-effect transistors of the N-channel depletion mode type.

The transistor is sealed in a SOT-143 envelope and features a low ON-resistance and low capacitances.

The transistor is protected against excessive input voltages by integrated back-to-back diodes between gate and substrate.

Applications:
- analog and/or digital switch
- switch driver
- convertor
- chopper

QUICK REFERENCE DATA

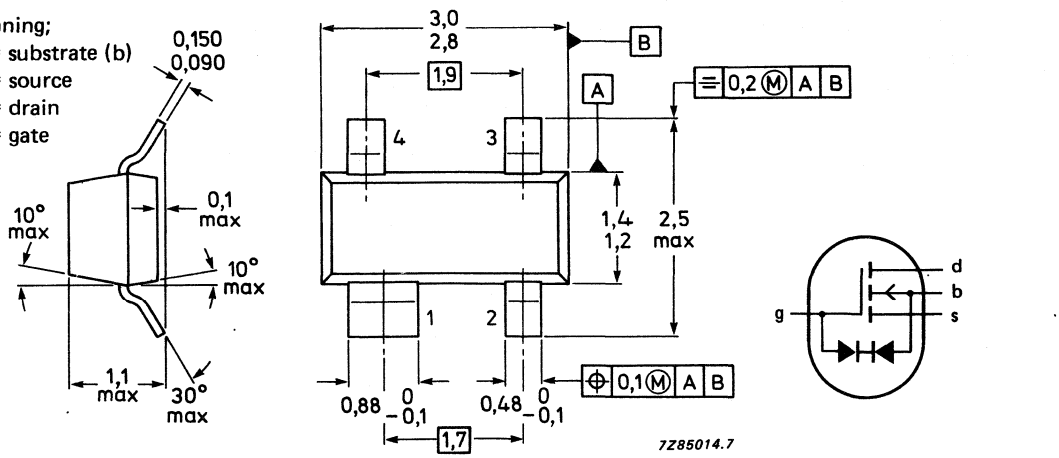
			BSD20	BSD22	
Drain-source voltage	V_{DS}	max.	10	20	V
Gate-source voltage	V_{GS}	max.	+15 −30	+15 −40	V V
Drain current (d.c.)	I_D	max.	50		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230		mW
Junction temperature	T_j	max.	125		°C
Drain-source ON-resistance V_{GS} = 10 V; V_{SB} = 0; I_D = 1 mA	R_{DSon}	<	30		Ω
Feed-back capacitance V_{GS} = V_{BS} = −5 V; V_{DS} = 10 V; f = 1 MHz	C_{rss}	typ.	0,6		pF

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Pinning;
1 = substrate (b)
2 = source
3 = drain
4 = gate



TOP VIEW

Note: Drain and source are interchangeable

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSD20	BSD22	
Drain-source voltage	V_{DS}	max.	10	20	V
Source-drain voltage	V_{SD}	max.	10	20	V
Drain-substrate voltage	V_{DB}	max.	15	25	V
Source-substrate voltage	V_{SB}	max.	15	25	V
Gate-substrate voltage	V_{GB}	max.	± 15	± 25	V
Gate-source voltage	V_{GS}	max.	+ 15 −30	+ 15 −40	V V
Drain current (d.c.)	I_D	max.	50		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	230		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	125		°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BSD20	BSD22	
Drain-source breakdown voltage $V_{GS} = V_{BS} = -5$ V; I_S = 10 nA	$V_{(BR)DSX}$	>	10	20	V
Source-drain breakdown voltage $V_{GD} = V_{BD} = -5$ V; I_D = 10 nA	$V_{(BR)SDX}$	>	10	20	V
Drain-substrate breakdown voltage V_{GB} = 0; I_D = 10 nA; open source	$V_{(BR)DBO}$	>	15	25	V
Source-substrate breakdown voltage V_{GB} = 0; I_S = 10 nA; open drain	$V_{(BR)SBO}$	>	15	25	V
Drain-source leakage current $V_{GS} = V_{BS} = -5$ V; V_{DS} = 10V	I_{DSoff}	typ.	1,0		nA
Source-drain leakage current $V_{GD} = V_{BD}$ = 5 V; V_{SD} = 10V	I_{SDoff}	typ.	1,0		nA
Gate-substrate leakage current → $V_{DB} = V_{SB}$ = 0; V_{GB} = ± 15 V	I_{GBS}	<	10		nA

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Forward transconductance at f = 1 kHz V_{DS} = 10 V; V_{SB} = 0; I_D = 20 mA	g_{fs}	> 10 mS typ. 15 mS	
Gate-source cut-off voltage V_{DS} = 10 V; V_{SB} = 0; I I_D = 10 μA	$-V_{(P)GS}$	< 2,0 V	←
Drain-source ON-resistance I_D = 1 mA; V_{SB} = 0; V_{GS} = 5 V	R_{DSon}	typ. 25 Ω < 50 Ω	
V_{GS} = 10 V	R_{DSon}	typ. 15 Ω < 30 Ω	
Capacitances at f = 1 MHz V_{GS} = V_{BS} = −5V; V_{DS} = 10 V Feed-back capacitance	C_{rss}	typ. 0,6 pF	
Input capacitance	C_{iss}	typ. 1,5 pF	
Output capacitance	C_{oss}	typ. 1,0 pF	
Switching times (see Fig. 3) V_{DD} = 10 V; V_i = −5 V to +5 V	t_{on} t_{off}	typ. 1,0 ns typ. 5,0 ns	←

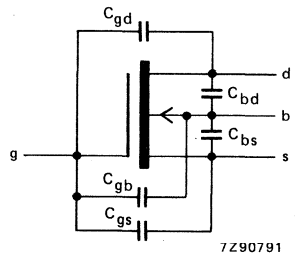
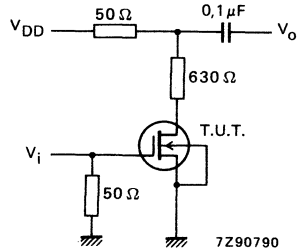


Fig. 2 Capacitances model.
$C_{iss} = C_{gs} + C_{gd} + C_{gb}$
$C_{oss} = C_{gd} + C_{bd}$
$C_{rss} = C_{gd}$ ←



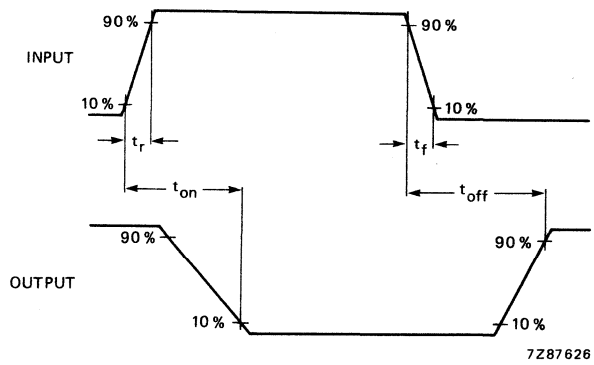


Fig. 3 Switching times and input and output waveforms;
R_i = 50 Ω; t_r < 0,5 ns; t_f < 1,0 ns; t_p = 20 ns; δ < 0,01.

SILICON PLANAR EPITAXIAL TRANSISTORS

PNP transistors in miniature plastic envelopes intended for use in amplifier and switching applications. Complementary types are BSP19/20.

QUICK REFERENCE DATA

			BSP15	BSP16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	200	350	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	200	300	V
Collector current (DC)	$-I_C$	max.	1		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain $-V_{CE}$ = 10 V; $-I_C$ = 50 mA	h_{FE}		30 to 150	30 to 120	
Transition frequency $-V_{CE}$ = 10 V; $-I_C$ = 10 mA	f_T	>	15		MHz

MECHANICAL DATA

Dimensions in mm

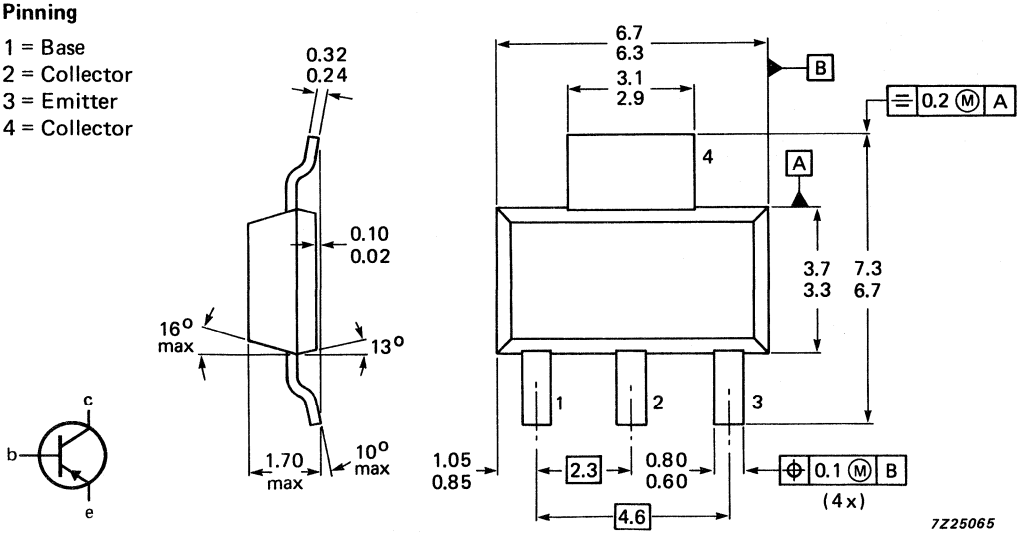
Fig. 1 SOT-223

Marking

BSP15 = BT1
BSP16 = BT2

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP15	BSP16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	200	350	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	200	300	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	6	V
Collector current (DC)	$-I_C$	max.	1		A
Base current	$-I_B$	max.	0,5		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
Storage temperature range	T_{stg}		−65 to 150		°C

THERMAL RESISTANCE

from junction to ambient*	$R_{th\ j\text{-}mb}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BSP15	BSP16	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 175 V	$-I_{CBO}$	<	1	–	μA
I_E = 0; $-V_{CB}$ = 280 V	$-I_{CBO}$	<	–	1	μA
I_B = 0; $-V_{CE}$ = 150 V	$-I_{CEO}$	<	50	–	μA
I_B = 0; $-V_{CE}$ = 250 V	$-I_{CEO}$	<	–	50	μA
Emitter cut-off current					
I_C = 0; $-V_{EB}$ = 4 V	$-I_{EBO}$	<	20	–	μA
I_C = 0; $-V_{EB}$ = 6 V	$-I_{EBO}$	<	–	20	μA
Collector-emitter breakdown voltage					
I_B = 0; $-I_C$ = 50 mA; L = 25 mH	$-V_{(BR)CEO}$	>	200	300	V
Collector-emitter saturation voltage					
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	2,5	2,0	V
DC current gain					
$-V_{CE}$ = 10 V; $-I_C$ = 50 mA	h_{FE}		30 to 150	30 to 120	
Transition frequency at f = 30 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	15		MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	<	15		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

SILICON PLANAR EPITAXIAL TRANSISTORS

NPN transistors in miniature plastic envelopes intended for use in amplifier and switching applications. Complementary pnp types are BSP15/16.

QUICK REFERENCE DATA

			BSP19	BSP20	
Collector-base voltage (open emitter)	V_{CBO}	max.	400	300	V
Collector-emitter voltage (open base)	V_{CEO}	max.	350	250	V
Collector current (DC)	I_C	max.	1		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain V_{CE} = 10 V; I_C = 20 mA	h_{FE}	min.	40		
Transition frequency at f = 5 MHz V_{CE} = 10 V; I_C = 10 mA	f_T	min.	70		MHz

MECHANICAL DATA

Dimensions in mm

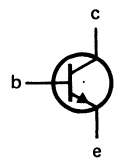
Fig. 1 SOT-223

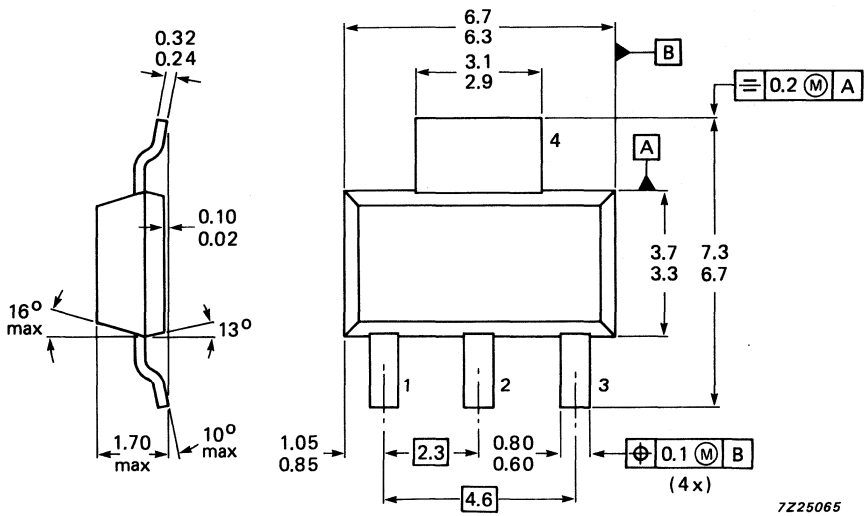
Marking

BSP19 = AT1
BSP20 = AT2

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP19	BSP20	
Collector-base voltage (open emitter)	V_{CBO}	max.	400	300	V
Collector-emitter voltage (open base)	V_{CEO}	max.	350	250	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (DC)	I_C	max.	1		A
Base current	I_B	max.	0,5		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
Storage temperature range	T_{stg}		−65 to 150		°C

THERMAL RESISTANCE

from junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_B = 0; V_{CE} = 300 V	I_{CBO}	⩽	20	nA
Emitter cut-off current I_C = 0; V_{EB} = 5 V	I_{EBO}	⩽	10	μA
Collector-emitter saturation voltage I_C = 50 mA; I_B = 4 mA	V_{CEsat}	⩽	0,5	V
Base-emitter saturation voltage I_C = 50 mA; I_B = 4 mA	V_{BEsat}	⩽	1,3	V
DC current gain V_{CE} = 10 V; I_C = 20 mA	h_{FE}	⩽	40	
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 10 V	C_c	⩽	2	pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 5 V	C_e	⩽	20	pF
Transition frequency at f = 5 MHz V_{CE} = 10 V; I_C = 10 mA	f_T	⩾	70	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

SILICON PLANAR EPITAXIAL TRANSISTORS

PNP transistors in miniature plastic envelopes intended for application in thick and thin-film circuits. They are intended for use in telephony and general industrial applications.

QUICK REFERENCE DATA

			BSP30	BSP31	BSP32	BSP33	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	70	70	90	90	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	60	80	80	V
Collector current (DC)	$-I_C$	max.	1	1	1	1	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5	1,5	1,5	1,5	W
Junction temperature	T_j	max.	150	150	150	150	°C
DC current gain		>	40	100	40	100	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	<	120	300	120	300	
Transition frequency at f = 35 MHz							
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	100	100	100	100	MHz

MECHANICAL DATA

Dimensions in mm

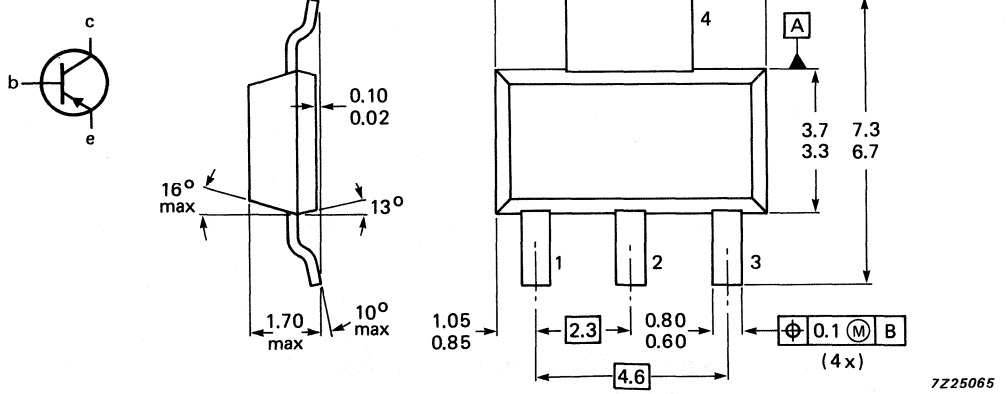
Fig. 1 SOT-223

Marking

BSP30 = BR1
BSP31 = BR2
BSP32 = BR3
BSP33 = BR4

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP30	BSP31	BSP32	BSP33	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	70	70	90	90	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	60	80	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	5	V
Collector current (DC)	$-I_C$	max.		1			A
Base current (DC)	$-I_B$	max.		0,1			A
Total power dissipation up to $T_{amb} = 25\,^{o}C$*	P_{tot}	max.		1,5			W
Storage temperature range	T_{stg}			−65 to +150			^{o}C
Junction temperature	T_j	max.		150			^{o}C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current

I_E = 0; $-V_{CB}$ = 60 V	$-I_{CBO}$	<	100				nA
I_E = 0; $-V_{CB}$ = 60 V; T_j = 150 °C	$-I_{CBO}$	<	50				μA

			BSP30	BSP31	BSP32	BSP33	
Breakdown voltages							
I_B = 0; $-I_C$ = 10 mA	$-V_{(BR)CEO}$	>	60	60	80	80	V
V_{BE} = 0; $-I_C$ = 10 μA	$-V_{(BR)CES}$	>	70	70	90	90	V
I_C = 0; $-I_E$ = 10 μA	$-V_{(BR)EBO}$	>	5	5	5	5	V
Saturation voltages *							
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CEsat}$	<	0,25	0,25	0,25	0,25	V
	$-V_{BEsat}$	<	1,0	1,0	1,0	1,0	V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	0,5	0,5	0,5	0,5	V
	$-V_{BEsat}$	<	1,2	1,2	1,2	1,2	V
DC current gain*							
$-I_C$ = 100 μA; V_{CE} = 5 V	h_{FE}	>	10	30	10	30	
$-I_C$ = 100 mA; V_{CE} = 5 V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
$-I_C$ = 500 mA; V_{CE} = 5 V	h_{FE}	>	30	50	30	50	

Transition frequency at f = 35 MHz

$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	100	MHz

Collector capacitance at f = 1 MHz

$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	<	20	pF

Emitter capacitance at f = 1 MHz

$I_C = I_c$ = 0; $-V_{EB}$ = 0,5 V	C_e	<	120	pF

Switching times see next page.

* Measured under pulse conditions: t_p = 300 μs; δ < 0,01.

CHARACTERISTICS (continued)

$T_{amb} = 25\,^{o}C$

Switching times

$-I_{Con} = 100$ mA; $-I_{Bon} = +I_{Boff} = 5$ mA

Turn-on time	t_{on}	$<$	500 ns
Turn-off time	t_{off}	$<$	650 ns

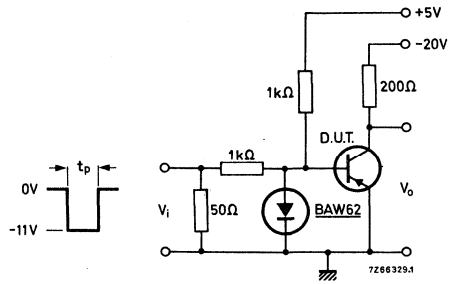


Fig. 2 Switching times test circuit.

Pulse generator:		Oscilloscope:	
Pulse duration	$t_p = 10\ \mu s$	Rise time	$t_r \leqslant 15$ ns
Rise time	$t_r \leqslant 15$ ns	Input impedance	$Z_I \geqslant 100$ kΩ
Fall time	$t_f \leqslant 15$ ns		
Source impedance	$Z_S = 50\ \Omega$		

SILICON PLANAR EPITAXIAL TRANSISTORS

NPN transistors in miniature plastic envelopes intended for application in thick and thin-film circuits. They are intended for use in telephony and general industrial applications.

QUICK REFERENCE DATA

			BSP40	BSP41	BSP42	BSP43	
Collector-base voltage (open emitter)	V_{CBO}	max.	70	70	90	90	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	60	80	80	V
Collector current (DC)	I_C	max.	1	1	1	1	A
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	1,5	1,5	1,5	1,5	W
Junction temperature	T_j	max.	150	150	150	150	^oC
DC current gain							
$I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
Transition frequency at f = 35 MHz							
$I_C = 50$ mA; $V_{CE} = 10$ V	f_T	>	100	100	100	100	MHz

MECHANICAL DATA

Dimensions in mm

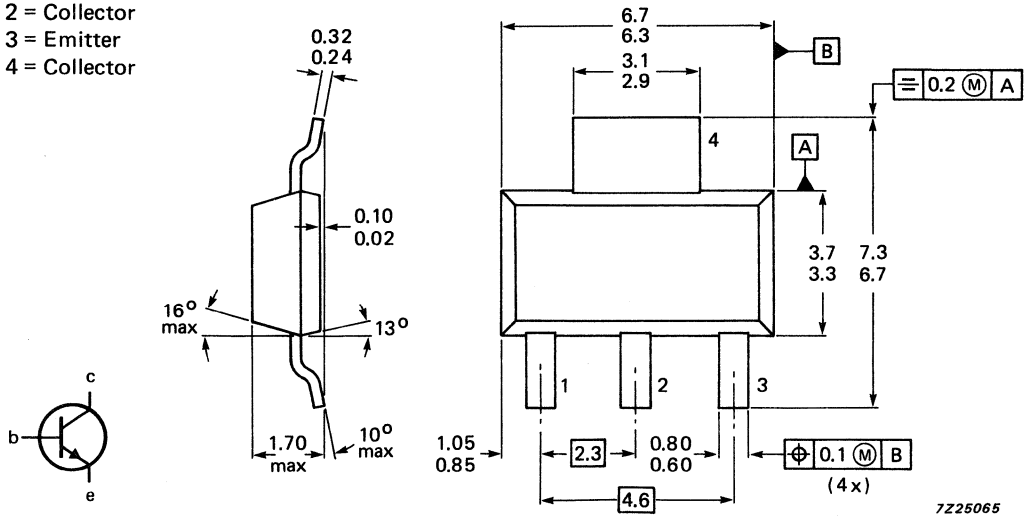
Fig. 1 SOT-223

Mark

BSP40 = AR1
BSP41 = AR2
BSP42 = AR3
BSP43 = AR4

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP40	BSP41	BSP42	BSP43	
Collector-base voltage (open emitter)	V_{CBO}	max.	70	70	90	90	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	60	80	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	5	V
Collector current (DC)	I_C	max.			1		A
Base current (DC)	I_B	max.			0,1		A
Total power dissipation up to $T_{amb} = 25\ ^oC$*	P_{tot}	max.			1,5		W
Storage temperature range	T_{stg}				−65 to +150		^oC
Junction temperature	T_j	max.			150		^oC

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current

I_E = 0; V_{CB} = 60 V	I_{CBO}	<		100			nA
I_E = 0; V_{CB} = 60 V; T_j = 150 °C	I_{CBO}	<		50			μA

Breakdown voltages			BSP40	BSP41	BSP42	BSP43	
I_B = 0; I_C = 10 mA	$V_{(BR)CEO}$	>	60	60	80	80	V
V_{BE} = 0; I_C = 10 μA	$V_{(BR)CES}$	>	70	70	90	90	V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	>	5	5	5	5	V
Saturation voltages *							
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	<	0,25	0,25	0,25	0,25	V
	V_{BEsat}	<	1,0	1,0	1,0	1,0	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	0,5	0,5	0,5	V
	V_{BEsat}	<	1,2	1,2	1,2	1,2	V
DC current gain*							
I_C = 100 μA; V_{CE} = 5 V	h_{FE}	>	10	30	10	30	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	>	30	50	30	50	

Transition frequency at f = 35 MHz

I_C = 50 mA; V_{CE} = 10 V	f_T	>	100		MHz

Collector capacitance at f = 1 MHz

$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	<	12		pF

Emitter capacitance at f = 1 MHz

$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	<	90		pF

Switching times see next page.

* Measured under pulse conditions: t_p = 300 μs; δ < 0,01.

CHARACTERISTICS (continued)

T_{amb} = 25 °C

Switching times

I_{Con} = 100 mA; I_{Bon} = $-I_{Boff}$ = 5 mA

Turn-on time	t_{on}	<	250 ns
Turn-off time	t_{off}	<	1000 ns

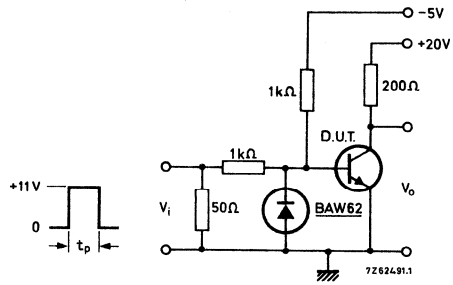


Fig. 2 Switching times test circuit.

Pulse generator:		Oscilloscope:	
Pulse duration	t_p = 10 μs	Rise time	$t_r \leqslant$ 15 ns
Rise time	$t_r \leqslant$ 15 ns	Input impedance	$Z_I \geqslant$ 100 kΩ
Fall time	$t_f \leqslant$ 15 ns		
Source impedance	Z_S = 50 Ω		

NPN SILICON PLANAR DARLINGTON TRANSISTORS

Silicon npn planar Darlington transistors for industrial switching applications, e.g. print hammer, solenoid, relay and lamp driving. Encapsulated in a microminiature SOT-223 envelope.

PNP complements are BSP60, 61, 62 respectively.

QUICK REFERENCE DATA

			BSP50	BSP51	BSP52	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	90	V
Collector-emitter voltage	V_{CER}	max.	45	60	80	V
Collector current	I_C	max.	0,5	0,5	0,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
DC current gain I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>		2000		
Collector-emitter saturation voltage I_C = 500 mA; I_B = 0,5 mA	V_{CEsat}	<		1,3		V
Turn-off time I_C = 500 mA; I_{Bon} = $-I_{Boff}$ = 0,5 mA	t_{off}	typ.		1500		ns

MECHANICAL DATA

Dimensions in mm

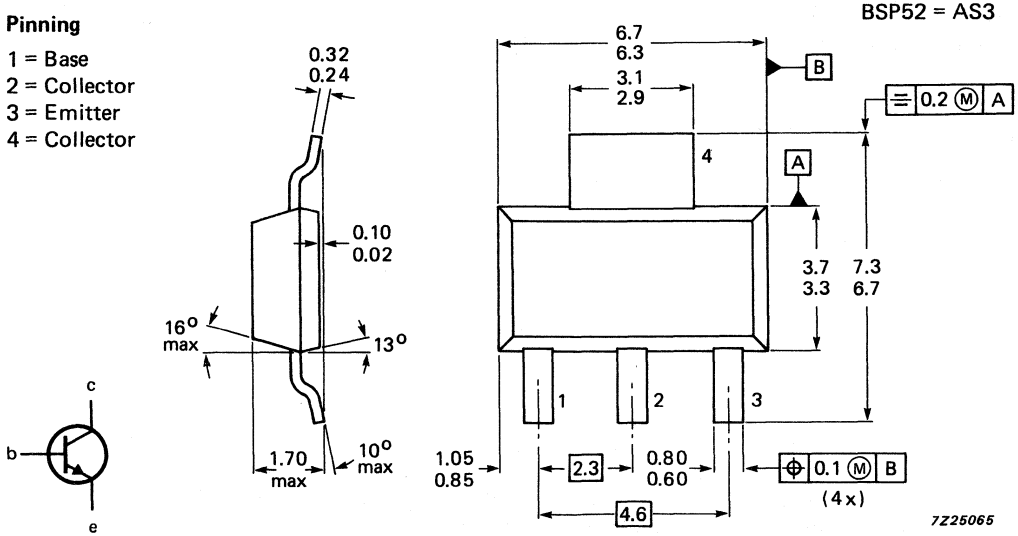
Fig. 1 SOT-223

Mark

BSP50 = AS1
BSP51 = AS2
BSP52 = AS3

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



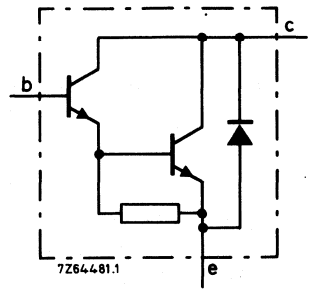


Fig. 2 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP50	BSP51	BSP52	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	90	V
Collector-emitter voltage*	V_{CER}	max.	45	60	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.		5		V
Collector current (DC)	I_C	max.		0,5		A
Collector current (peak)	I_{CM}	max.		1,5		A
Base current (DC)	I_B	max.		0,1		A
Total power dissipation▲ up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to + 150		°C
Junction temperature**	T_j	max.		150		°C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	83,3	K/W

* External R_{BE} not to exceed value shown in Fig. 5.

** Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account.

▲ Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
V_{BE} = 0; V_{CE} = V_{CER}max	I_{CES}	<	10 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	10 μA
DC current gain*			
I_C = 150 mA; V_{CE} = 10 V	h_{FE}	>	1000
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	2000
Collector-emitter saturation voltage			
I_C = 500 mA; I_B = 0,5 mA	V_{CEsat}	<	1,3 V
I_C = 500 mA; I_B = 0,5 mA; T_j = 150 °C	V_{CEsat}	<	1,3 V
Base-emitter saturation voltage			
I_C = 500 mA; I_B = 0,5 mA	V_{BEsat}	<	1,9 V
Switching times (see also Fig. 3 and Fig. 4)			
I_C = 500 mA; I_{Bon} = $-I_{Boff}$ = 0,5 mA			
Turn-on time	t_{on}	typ.	400 ns
Turn-off time	t_{off}	typ.	1500 ns

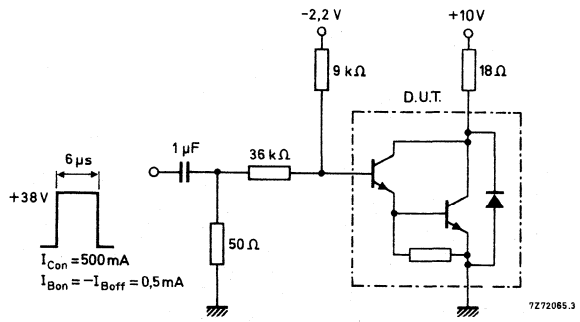


Fig. 3 Switching times test circuit.

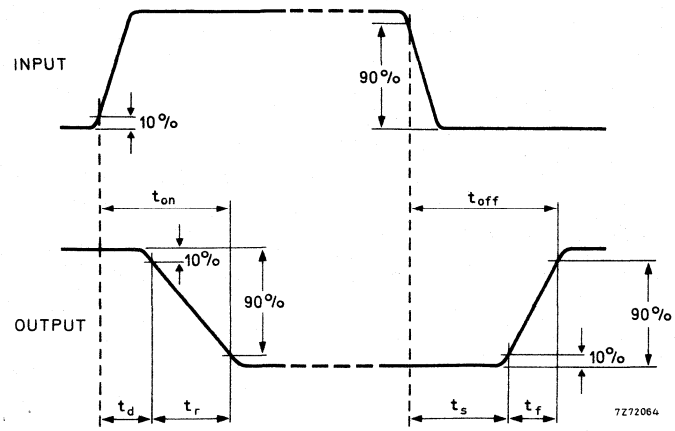


Fig. 4 Switching times waveform.

* Measured under pulsed conditions.

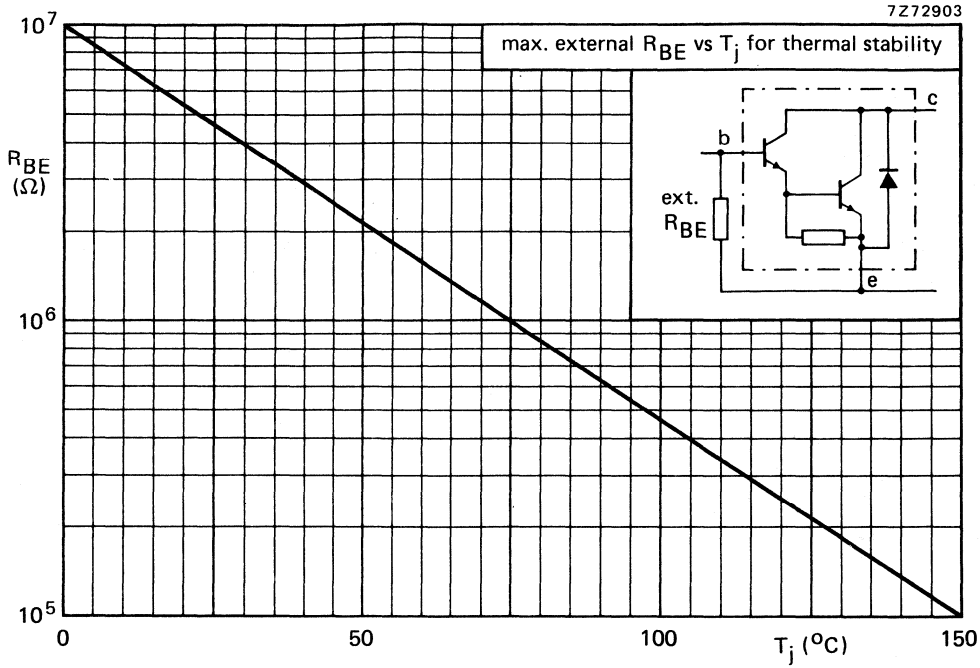


Fig. 5 Maximum values external R_{BE} as a function of junction temperature.

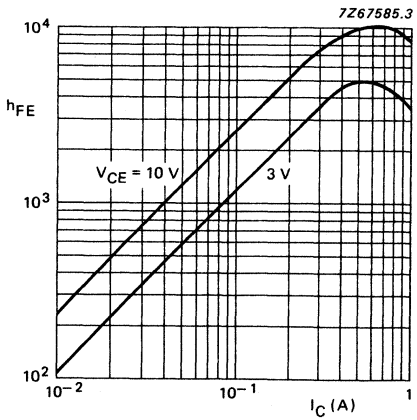


Fig. 6 T_j = 25 °C.

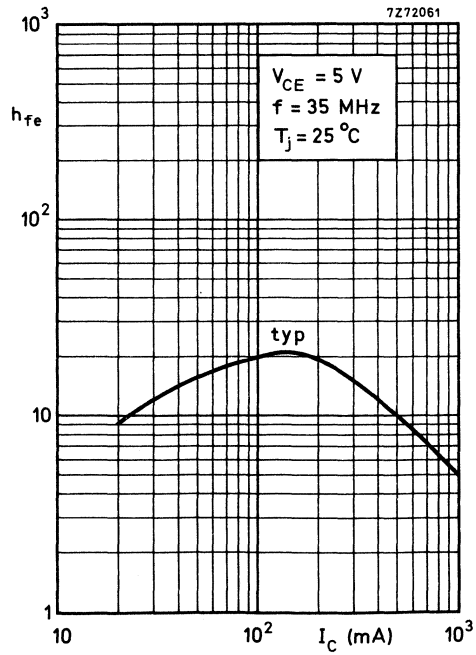


Fig. 7.

SILICON PLANAR DARLINGTON TRANSISTORS

Silicon pnp planar Darlington transistors for industrial switching applications such as print hammer, solenoid, relay and lamp driving. They are encapsulated in a microminiature plastic SOT-223 envelope.

NPN complements are BSP50, BSP51 and BSP52 respectively.

QUICK REFERENCE DATA

			BSP60	BSP61	BSP62	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	90	V
Collector-emitter voltage	$-V_{CER}$	max.	45	60	80	V
Collector current	$-I_C$	max.	0,5	0,5	0,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
DC current gain $-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>		2000		
Collector-emitter saturation voltage $-I_C$ = 0,5 A; $-I_B$ = 0,5 mA	$-V_{CEsat}$	<		1,3		V
Turn-off time $-I_C$ = 500 mA; $-I_{Bon} = I_{Boff}$ = 0,5 mA	t_{off}	typ.		1500		ns

MECHANICAL DATA

Dimensions in mm

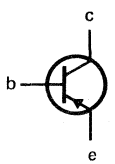
Fig. 1 SOT-223

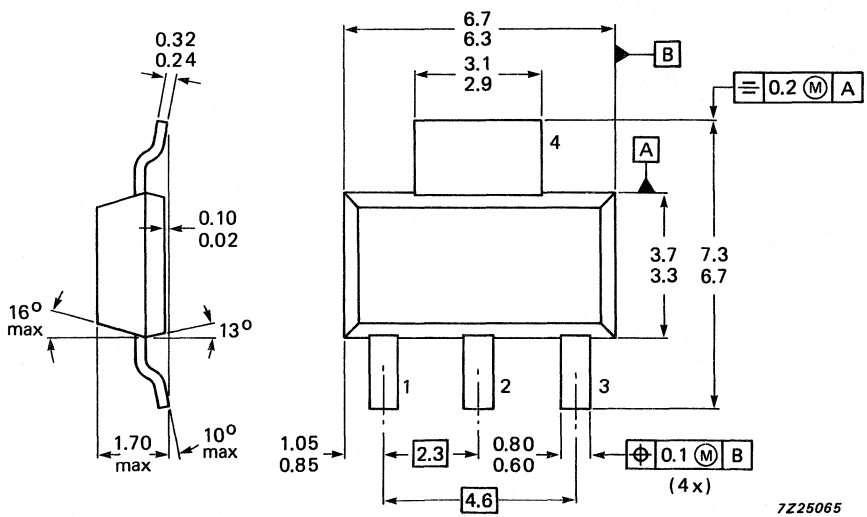
Marking code

BSP60 = BS1
BSP61 = BS2
BSP62 = BS3

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





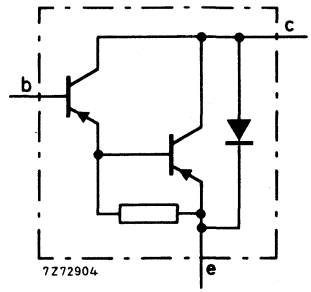


Fig. 2 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSP60	BSP61	BSP62	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	90	V
Collector-emitter voltage*	$-V_{CER}$	max.	45	60	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.		5		V
Collector current (DC)	$-I_C$	max.		0,5		A
Collector current (peak)	$-I_{CM}$	max.		1,5		A
Base current (DC)	$-I_B$	max.		0,1		A
Total power dissipation▲ up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to + 150		°C
Junction temperature**	T_j	max.		150		°C

THERMAL RESISTANCE**

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	83,3	K/W

* External R_{BE} not to exceed value shown in Fig. 5.

** Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account.

▲ Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
V_{BE} = 0; $-V_{CE}$ = $-V_{CER}$max	$-I_{CES}$	<	10 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 4 V	$-I_{EBO}$	<	10 μA
DC current gain*			
$-I_C$ = 150 mA; $-V_{CE}$ = 10 V	h_{FE}	>	1000
$-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	2000
Collector-emitter saturation voltage			
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	<	1,3 V
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA; T_j = 150 °C	$-V_{CEsat}$	<	1,3 V
Base-emitter saturation voltage			
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA	$-V_{BEsat}$	<	1,9 V
Switching times (see also Fig. 3 and Fig. 4)			
$-I_C$ = 500 mA; $-I_{Bon}$ = $-I_{Boff}$ = 0,5 mA			
Turn-on time	t_{on}	typ.	400 ns
Turn-off time	t_{off}	typ.	1500 ns

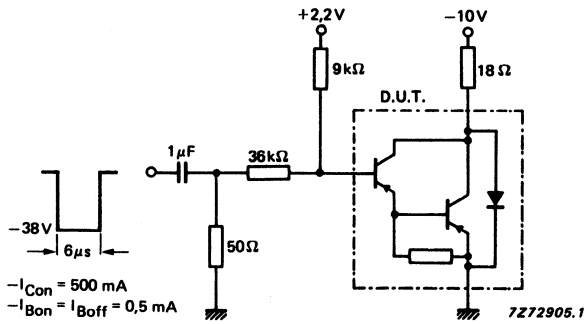


Fig. 3 Switching times test circuit.

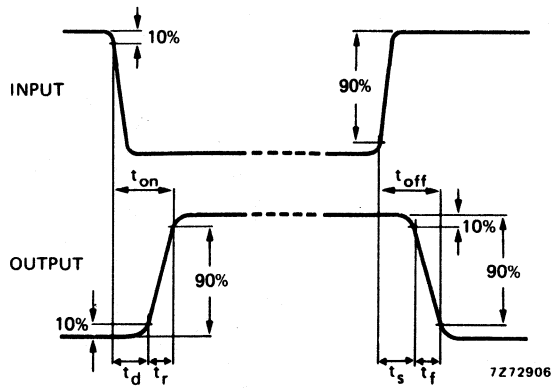


Fig. 4 Switching times waveform.

* Measured under pulsed conditions.

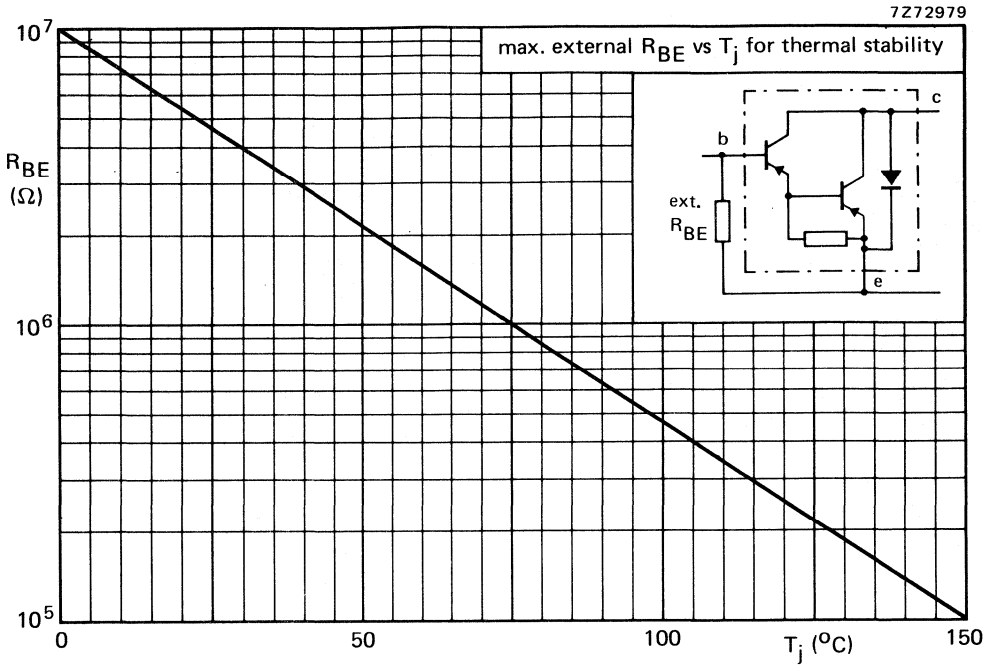


Fig. 5 Maximum values external R_{BE} as a function of junction temperature.

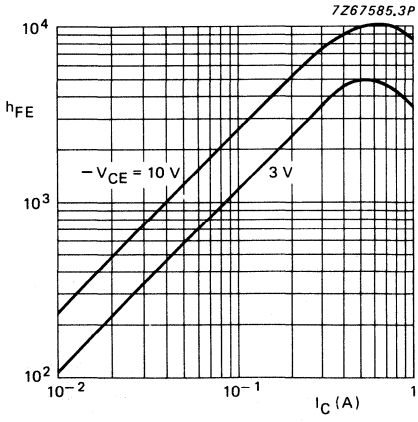


Fig. 6 T_j = 25 °C.

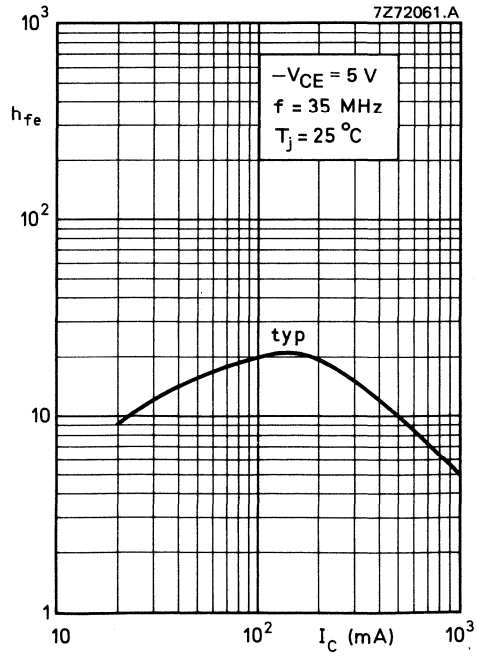


Fig. 7.

SILICON LOW-POWER SWITCHING TRANSISTORS

P-N-P silicon transistor in a microminiature plastic envelope. It is intended for high-speed, saturated switching applications for industrial service in thick and thin-film circuits.

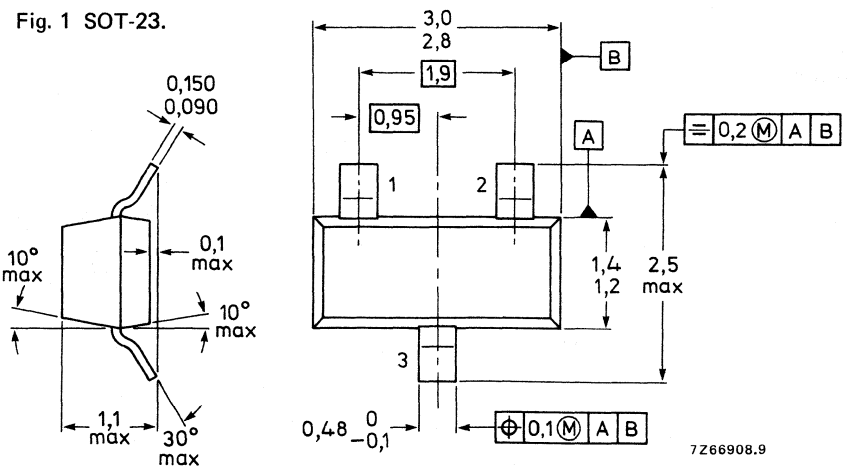
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain				
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	h_{FE}	30 to	120	
Transition frequency at f = 500 MHz				
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	1,5	GHz
Turn-off time				
$-I_{Con}$ = 30 mA; $-I_{Bon}$ = $+I_{Boff}$ = 3,0 mA	t_{off}	<	30	ns

MECHANICAL DATA

Dimensions in mm

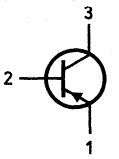
Fig. 1 SOT-23.



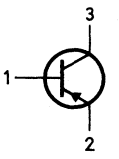
TOP VIEW

Marking code

BSR12 = B5



BSR12R = B8



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 10 V	$-I_{CBO}$	<	50 nA
I_E = 0; $-V_{CB}$ = 10 V; T_{amb} = 125 °C	$-I_{CBO}$	<	5 μA
V_{BE} = 0; $-V_{CE}$ = 10 V	$-I_{CES}$	<	50 nA
Breakdown voltages			
I_E = 0; $-I_C$ = 10 μA	$-V_{(BR)CBO}$	>	15 V
V_{BE} = 0; $-I_C$ = 10 μA	$-V_{(BR)CES}$	>	15 V
I_C = 0; $-I_E$ = 100 μA	$-V_{(BR)EBO}$	>	3 V
Collector-emitter sustaining voltage			
I_B = 0; $-I_C$ = 10 mA	$-V_{CEOsust}$	>	15 V
Saturation voltages**			
$-I_C$ = 10 mA; $-I_B$ = 1 mA	$-V_{CEsat}$	<	130 mV
	$-V_{BEsat}$		725 to 920 mV
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	180 mV
		<	270 mV
	$-V_{BEsat}$		800 to 1150 mV
$-I_C$ = 100 mA; $-I_B$ = 10 mA	$-V_{CEsat}$	<	450 mV
	$-V_{BEsat}$		900 to 1500 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Measured under pulse conditions; t_p = 300 μs; δ = 0,01.

D.C. current gain *				
$-I_C$ = 1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	h_{FE}		30 to 120	
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V; T_{amb} = 55 °C	h_{FE}	>	30	
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	>	20	
Transition frequency at f = 500 MHz				
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	1,5	GHz
Collector capacitance				
$I_E = I_e = 0$; $-V_{CB}$ = 5 V	C_c	<	4,5	pF
Emitter capacitance				
$I_C = I_c = 0$; $-V_{EB}$ = 0,5 V	C_e	<	6,0	pF
Switching times				
Turn-on time	t_{on}	<	20	ns
Turn-off time	t_{off}	<	30	ns

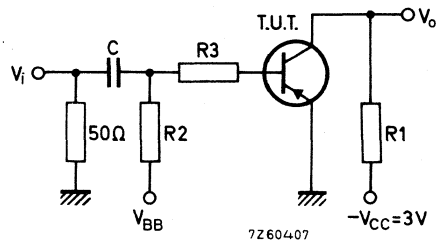


Fig. 2 Test circuit switching times.

Pulse generator			Sampling scope		
Pulse duration	t_p	= 400 ns	Rise time	t_r	< 1 ns
Rise time	t_r	< 1 ns	Input impedance	Z_i	= 100 kΩ
Output impedance	Z_o	= 50 Ω			

	V_i V	V_{BB} V	R1 Ω	R2 kΩ	R3 kΩ	$-I_{Con}$ mA	$-I_{Bon}$ mA	I_{Boff} mA	C µF
t_{on}	−6,85	0	94	1,0	2,0	30	3,0	–	0,1
t_{off}	11,7	−9,85	94	1,0	2,0	30	3,0	3,0	0,1

* Measured under pulse conditions; t_p = 300 µs; δ = 0,01.

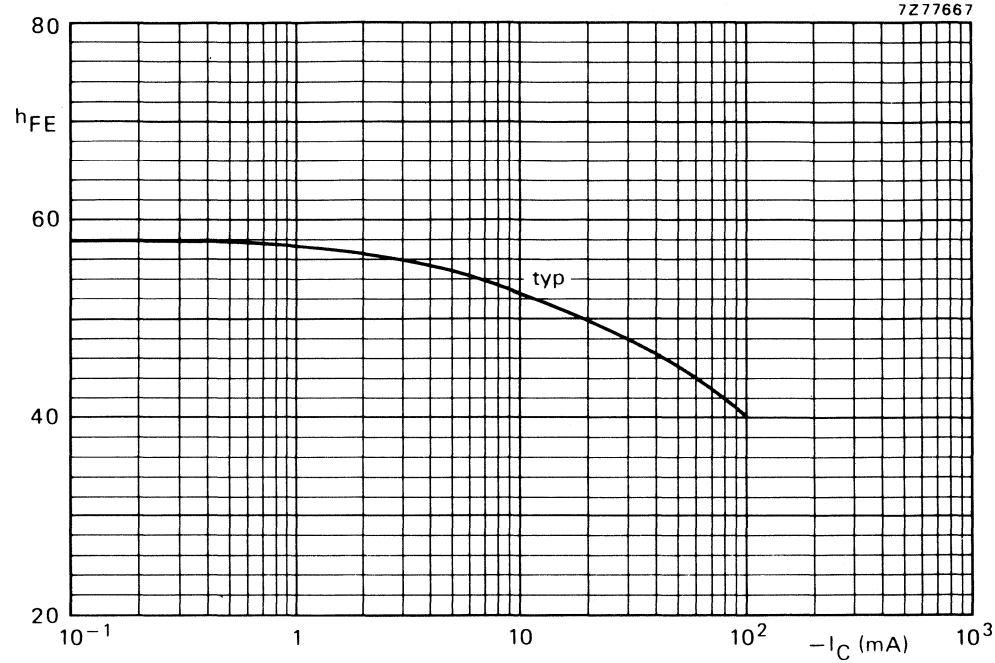


Fig. 3 $-V_{CE}$ = 1 V; T_{amb} = 25 °C.

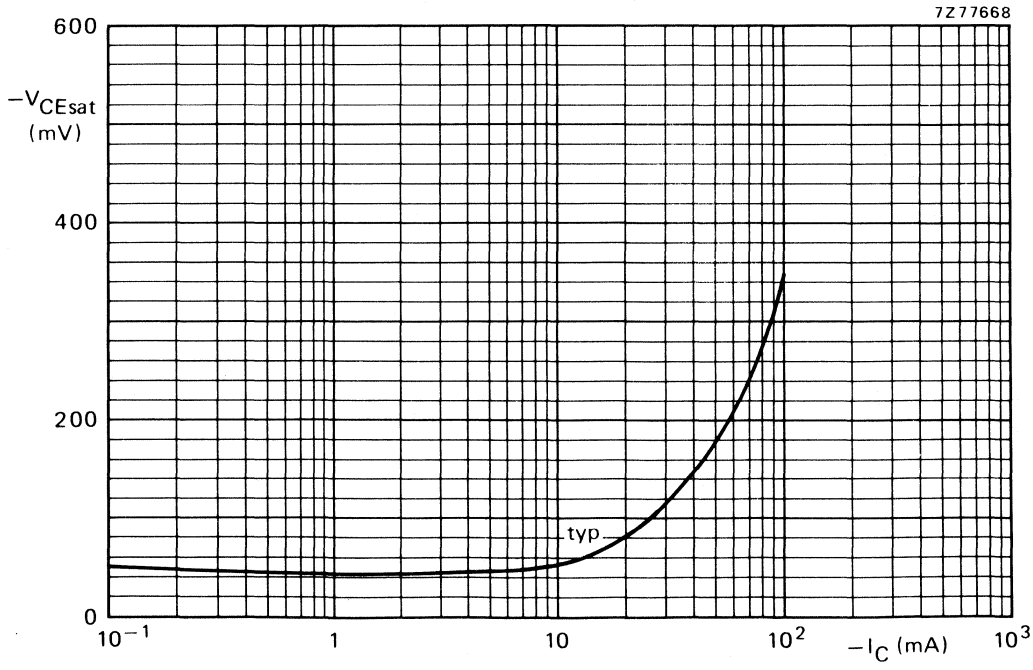


Fig. 4 V_{CEsat} as a function of I_C at I_C/I_B = 10.

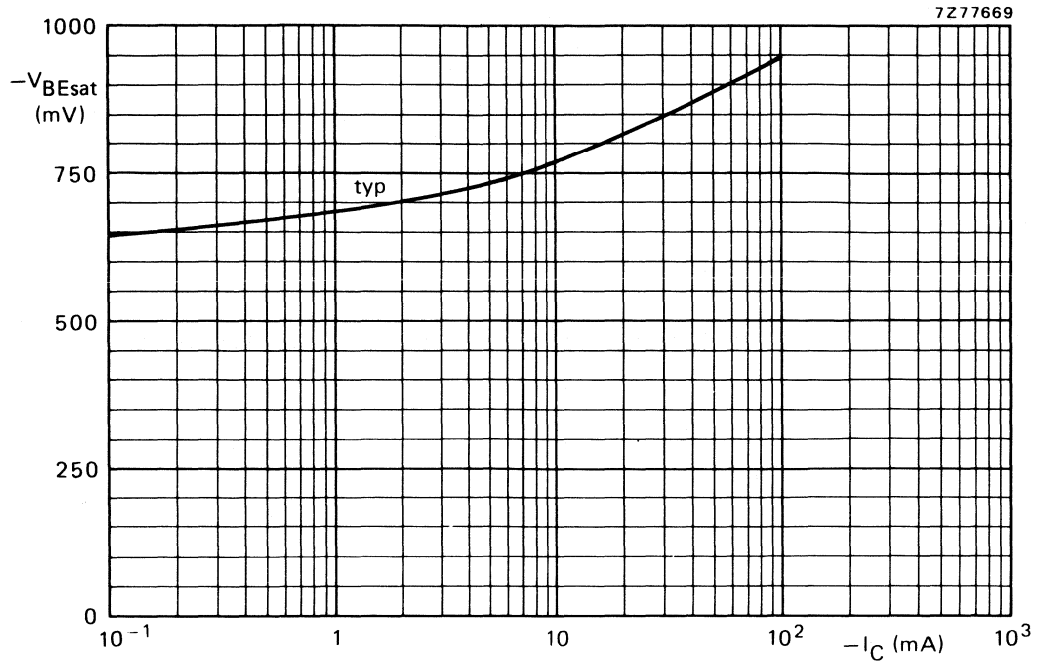


Fig. 5 V_{BEsat} as a function of I_C at $I_C/I_B = 10$.

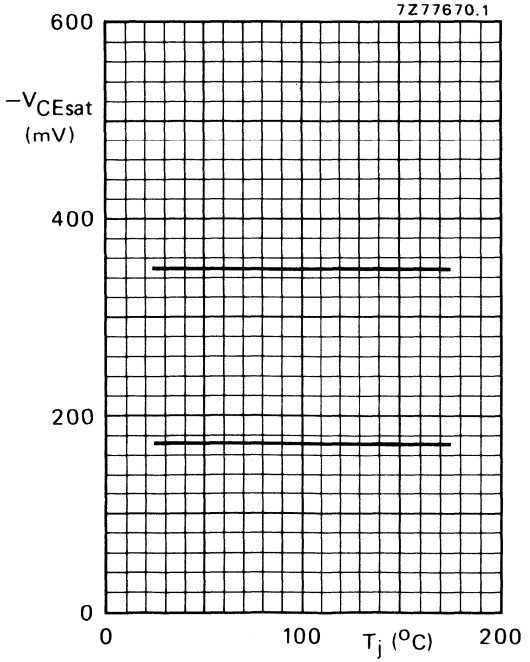


Fig. 6 V_{CEsat} as a function of T_j; typical values.

Upper graph at I_C = 100 mA; I_B = 10 mA. Lower graph at I_C = 50 mA and I_B = 5 mA.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope intended for switching and linear applications in thick and thin-film circuits.

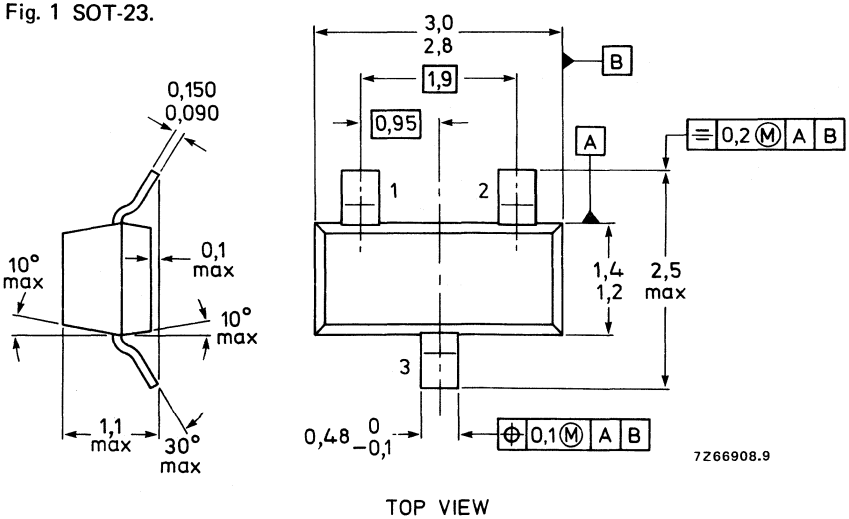
QUICK REFERENCE DATA

			BSR13	BSR14	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	6	V
Collector current (d.c.)	I_C	max.	800		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain					
I_C = 150 mA; V_{CE} = 10 V	h_{FE}		100 to 300		
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	30	40	
Transition frequency at f = 100 MHz					
I_C = 20 mA; V_{CE} = 20 V	f_T	>	250	300	MHz

MECHANICAL DATA

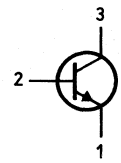
Fig. 1 SOT-23.

Dimensions in mm

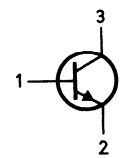


Marking code

BSR13 = U7
BSR14 = U8



BSR13R = U71
BSR14R = U81



R-types are available on request.

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR13	BSR14	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	6	V
Collector current (d.c.)	I_C	max.	800		mA
Total power dissipation					
→ up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
→ Storage temperature	T_{stg}		−65 to + 150		°C
→ Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430		K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BSR13	BSR14	
Collector cut-off current					
I_E = 0; V_{CB} = 50 V	I_{CBO}	<	30	–	nA
I_E = 0; V_{CB} = 60 V	I_{CBO}	<	–	10	nA
I_E = 0; V_{CB} = 50 V; T_j = 150 °C	I_{CBO}	<	10	–	μA
I_E = 0; V_{CB} = 60 V; T_j = 150 °C	I_{CBO}	<	–	10	μA
V_{EB} = 3 V; V_{CE} = 60 V	I_{CEX}	<	–	10	nA
Base current					
with reverse biased emitter junction					
V_{EB} = 3 V; V_{CE} = 60 V	I_{BEX}	<	–	20	nA
Emitter cut-off current					
I_C = 0; V_{EB} = 3 V	I_{EBO}	<	30	15	nA
Saturation voltages					
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	<	400	300	mV
	V_{BEsat}	<	1300	–	mV
	V_{BEsat}		–	0,6 to 1,2	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	1600	1000	mV
	V_{BEsat}	<	2600	2000	mV

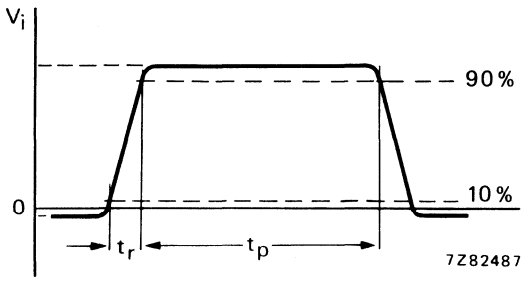
→ * Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gent *			
I_C = 0,1 mA; V_{CE} = 10 V	h_{FE}	> 35	
I_C = 1 mA; V_{CE} = 10 V	h_{FE}	> 50	
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	> 75	
I_C = 150 mA; V_{CE} = 10 V	h_{FE}	100 to 300	
I_C = 150 mA; V_{CE} = 1 V	h_{FE}	> 50	
I_C = 500 mA; V_{CE} = 10 V BSR13; R	h_{FE}	> 30	
I_C = 500 mA; V_{CE} = 10 V BSR14; R	h_{FE}	> 40	
Transition frequency at f = 100 MHz			
I_C = 20 mA; V_{CE} = 20 V BSR13; R	f_T	> 250	MHz
I_C = 20 mA; V_{CE} = 20 V BSR14; R	f_T	> 300	MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	< 8	pF
h parameters (common emitter) at f = 1 kHz			
I_C = 1 mA; V_{CE} = 10 V		BSR14	
input impedance	h_{ie}	2 to 8	kΩ
reverse voltage transfer ratio	h_{re}	< 8.10^{-4}	
small signal current gain	h_{fe}	50 to 300	
output admittance	h_{oe}	5 to 35	μS
I_C = 10 mA; V_{CE} = 10 V			
input impedance	h_{ie}	0,25 to 1,25	kΩ
reverse voltage transfer ratio	h_{re}	< 4.10^{-4}	
small signal current gain	h_{fe}	75 to 375	
output admittance	h_{oe}	25 to 200	μS

* Measured under pulsed conditions to avoid excessive dissipation; pulse duration $t_p \leqslant 300\ \mu s$; duty factor $\delta \leqslant 0{,}02$.

Switching times (between 10% and 90% levels)

		BSR14	
Turn-on time switched to I_C = 150 mA (see Fig. 2)			
delay time	t_d	< 10	ns
rise time	t_r	< 25	ns
Turn-off time switched from I_C = 150 mA (see Fig. 3)			
storage time	t_s	< 225	ns
fall time	t_f	< 60	ns



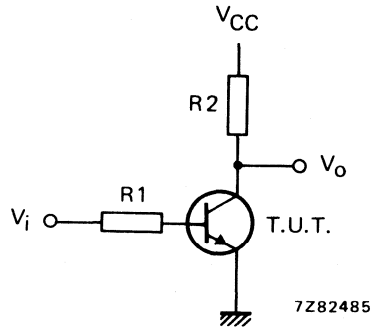
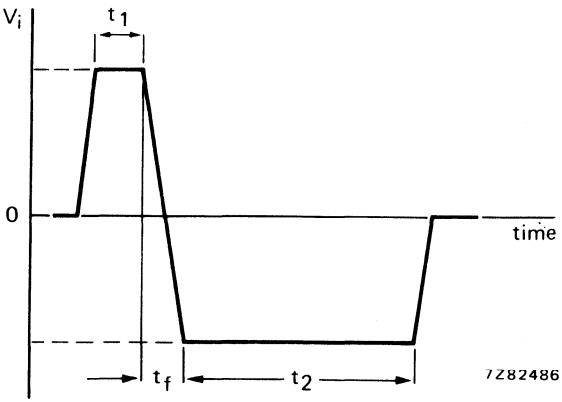


Fig. 2 Waveform and test circuit delay and rise time.

V_i = −0,5 to + 9,9 V; V_{CC} = 30 V; R1 = 619 Ω; R2 = 200 Ω.

Pulse generator:			
pulse duration	t_p	≤	200 ns
rise time	t_r	≤	2 ns
duty factor	δ	=	2 %

Oscilloscope:			
input impedance	Z_i	>	100 kΩ
input capacitance	C_i	<	12 pF
rise time	t_r	<	5 ns



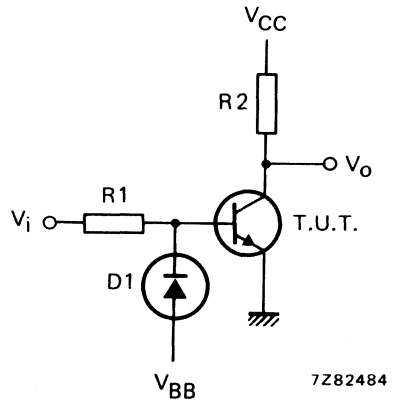


Fig. 3 Waveform and test circuit storage and fall time.

V_i = −13,8 to + 16,2 V; V_{CC} = 30 V; $-V_{BB}$ = 3 V; R1 = 1 kΩ; R2 = 200 Ω.

Pulse generator:			
fall time	t_f	<	5 ns
pulse time	t_1	=	100 μs
	t_2	=	500 μs

Oscilloscope:			
input impedance	Z_i	>	100 kΩ
input capacitance	C_i	<	12 pF
rise time	t_r	<	5 ns

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for medium power switching and general purpose amplifier applications in thick and thin-film circuits.

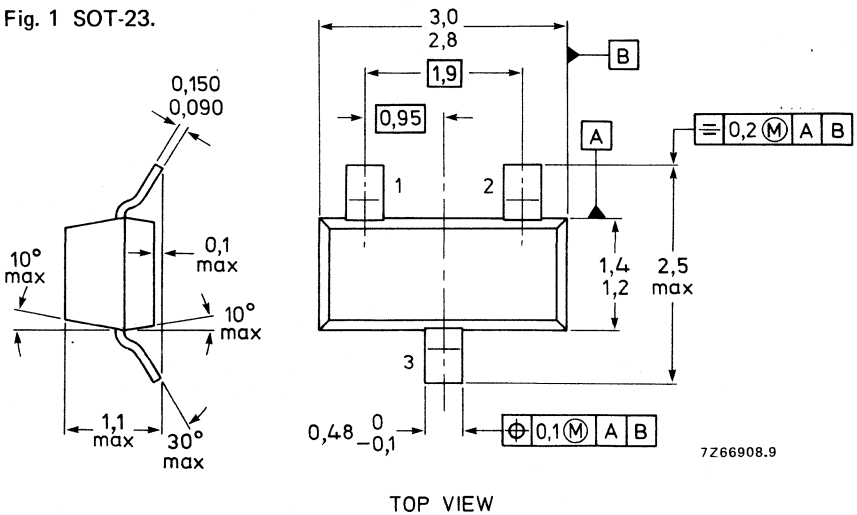
QUICK REFERENCE DATA

			BSR15	BSR16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	60	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	30	50	
Turn-off switching time $-I_{Con}$ = 150 mA; $-I_{Bon}$ = I_{Boff} = 15 mA	t_{off}	>	100		ns
Transition frequency at f = 100 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 20 V	f_T	>	200		MHz

MECHANICAL DATA

Fig. 1 SOT-23.

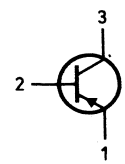
Dimensions in mm



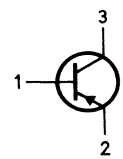
TOP VIEW

Marking code

BSR15 = T7
BSR16 = T8



BSR15R = T71
BSR16R = T81



R-types are available on request.

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR15	BSR16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	60	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (d.c.)	$-I_C$	max.	600		mA
→ Power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
→ Storage temperature	T_{stg}		−65 to +150		°C
→ Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BSR15	BSR16	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 50 V	$-I_{CBO}$	<	20	10	nA
I_E = 0; $-V_{CB}$ = 50 V; T_j = 150 °C	$-I_{CBO}$	<	20	10	μA
$-V_{EB}$ = 0,5 V; $-V_{CE}$ = 30 V	$-I_{CEX}$	<	50		nA
Base current					
with reverse biased emitter junction					
$-V_{EB}$ = 3 V; $-V_{CE}$ = 30 V	$-I_{BEX}$	<	50		nA
Saturation voltages					
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CEsat}$	<	0,4		V
	$-V_{BEsat}$	<	1,3		V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	1,6		V
	$-V_{BEsat}$	<	2,6		V

→ * Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

			BSR15	BSR16	
D.C. current gain *					
$-I_C$ = 0,1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	35	75	
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	100	
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	>	75	100	
$-I_C$ = 150 mA; $-V_{CE}$ = 10 V	h_{FE}		100 to 300		
$-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	30	50	
Transition frequency at f = 100 MHz					
$-I_C$ = 50 mA; $-V_{CE}$ = 20 V; T_{amb} = 25 °C	f_T	>	200		MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	<	8		pF
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; $-V_{EB}$ = 2 V	C_e	<	30		pF
Switching times (between 10% and 90% levels)					
Turn-on time when switched to $-I_C$ = 150 mA; $-I_B$ = 15 mA; (see Fig. 3)					
delay time	t_d	<	10		ns
rise time	t_r	<	40		ns
turn-on time ($t_d + t_r$)	t_{on}	<	45		ns
Turn-off time when switched from $-I_C$ = 150 mA; $-I_B$ = 15 mA to cut-off with + I_{BM} = 15 mA (see Fig. 4)					
storage time	t_s	<	80		ns
fall time	t_f	<	30		ns
turn-off time ($t_s + t_f$)	t_{off}	<	100		ns

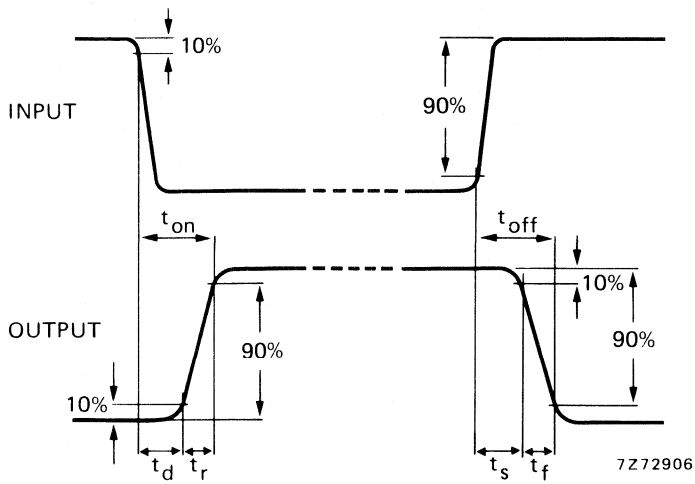


Fig. 2 Switching time waveforms.

* Measured under pulsed conditions to avoid excessive dissipation; pulse duration $t_p \leqslant 300\ \mu s$; duty factor $\delta \leqslant 0{,}02$.

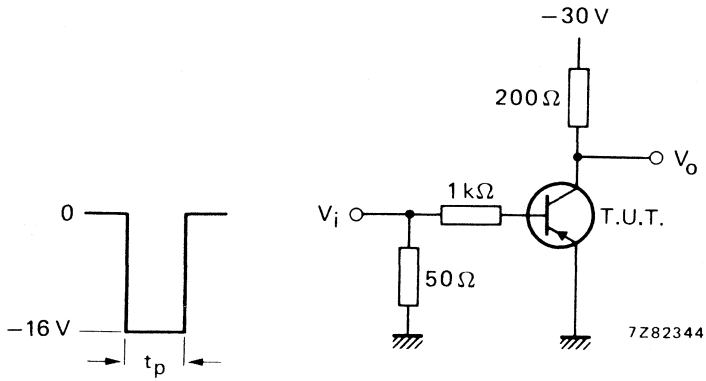


Fig. 3 Turn-on switching time test circuit.

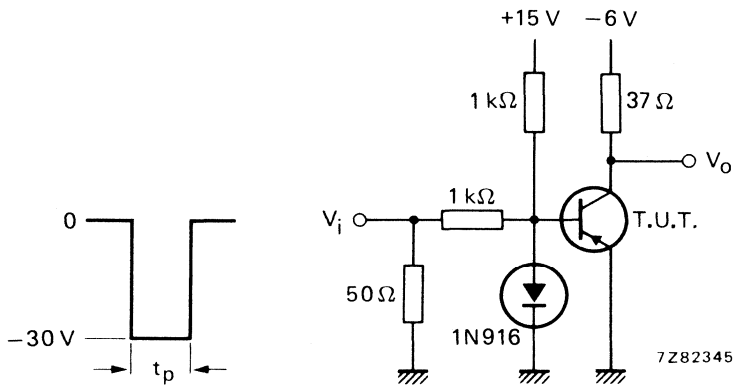


Fig. 4 Turn-off switching time test circuit.

Input pulse generator: Fig. 3 and Fig. 4	frequency	f	=	150	Hz
	pulse duration	t_p	=	200	ns
	rise time	t_r	⩽	2	ns
	output impedance	Z_o	=	50	Ω
Output oscilloscope: Fig. 3 and Fig. 4	rise time	t_r	⩽	5	ns
	input impedance	Z_i	=	10	MΩ

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistor in a microminiature plastic envelope intended for switching and linear applications in thick and thin-film circuits.

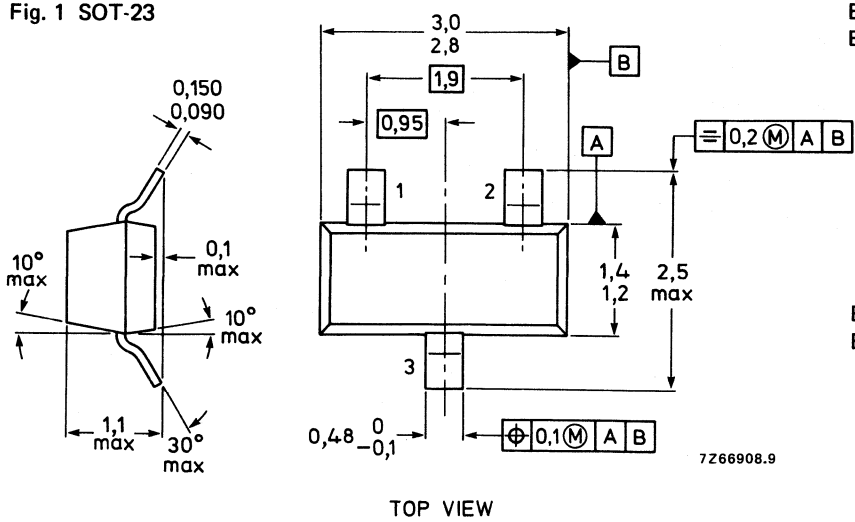
QUICK REFERENCE DATA

Collector-base voltage (open emitter)		V_{CBO}	max.	60	V
Collector-emitter voltage (open base)		V_{CEO}	max.	40	V
Emitter-base voltage (open collector)		V_{EBO}	max.	6	V
Collector current (d.c.)		I_C	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	300	mW
Junction temperature		T_j	max.	150	°C
D.C. current gain					
I_C = 10 mA; V_{CE} = 1 V	BSR17	h_{FE}		50 to 150	
I_C = 10 mA; V_{CE} = 1 V	BSR17A	h_{FE}		100 to 300	
Transition frequency at f = 500 MHz					
I_C = 10 mA; V_{CE} = 20 V	BSR17	f_T	>	250	MHz
I_C = 10 mA; V_{CE} = 20 V	BSR17A	f_T	>	300	MHz

MECHANICAL DATA

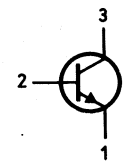
Fig. 1 SOT-23

Dimensions in mm

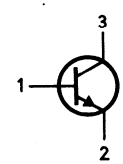


Marking code

BSR17 = U9
BSR17A = U92



BSR17R = U91
BSR17AR = U93



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	60 V
Collector-emitter voltage (open base)	V_{CEO}	max.	40 V
Emitter base voltage (open collector)	V_{EBO}	max.	6 V
Collector current (d.c.)	I_C	max.	200 mA
→ Power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−55 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

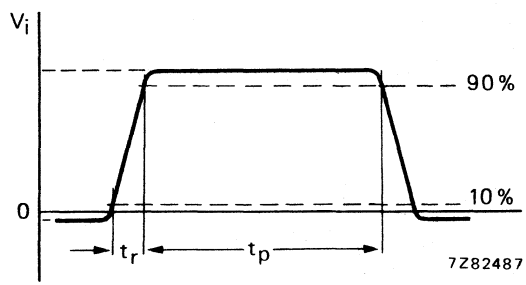
T_j = 25 °C unless otherwise specified.

Collector cut-off current			
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5 μA
V_{EB} = 3 V; V_{CE} = 30 V	I_{CEX}	<	50 nA
Base current			
with reverse biased emitter junction			
V_{EB} = 3 V; V_{CE} = 30 V	I_{BEX}	<	50 nA
Saturation voltages *			
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	200 mV
	V_{BEsat}		650 to 850 mV
I_C = 50 mA; I_B = 5 mA	V_{CEsat}	<	300 mV
	V_{BEsat}	<	950 mV
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	<	4 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	<	8 pF

* Measured under pulsed conditions; pulse duration $t_p \leqslant 300\ \mu s$; duty factor $\delta \leqslant 0{,}02$.

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

		BSR17	BSR17A
D.C. current gain*			
I_C = 0,1 mA; V_{CE} = 1 V	h_{FE}	> 20	40
I_C = 1 mA; V_{CE} = 1 V	h_{FE}	> 35	70
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	> 50 < 150	100 300
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	> 30	60
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	> 15	30
Transition frequency at f = 100 MHz			
I_C = 10 mA; V_{CE} = 20 V	f_T	> 250	300 MHz
h-parameters (common emitter)			
I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz			
Input impedance	h_{ie}	1 to 8	1 to 10 kΩ
Reverse voltage transfer ratio	h_{re}	0,1 to 5	0,5 to 8 10^{-4}
Small-signal current gain	h_{fe}	50 to 200	100 to 400
Output admittance	h_{oe}	1 to 40	1 to 40 μS
Switching times (between 10% and 90% levels)			
Turn on time switched to			
I_C = 10 mA; I_B = 1 mA; V_{EB} = 0,5 V			
delay time	t_d	<	35 ns
rise time	t_r	<	35 ns



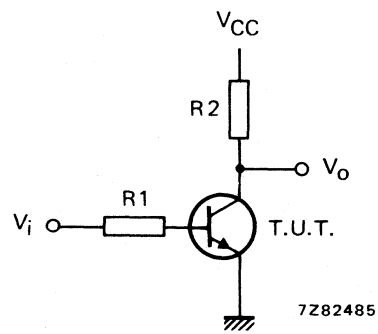
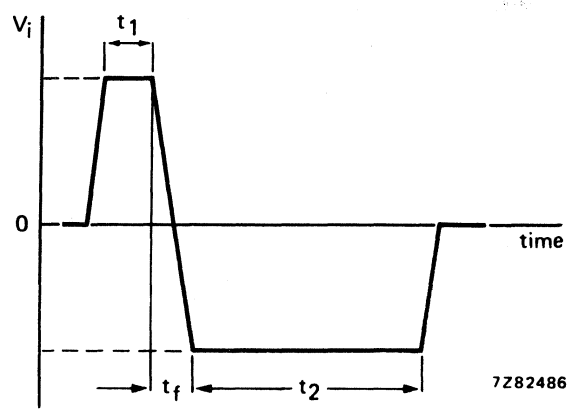


Fig. 2 Delay and rise time equivalent circuit.

V_i = −0,5 to +10,6 V; V_{CC} = 3 V; R1 = 10 kΩ; R2 = 275 Ω;
total shunt capacitance of test jig and connectors = $C_s \leqslant 4$ pF.
Pulse generator: pulse duration 300 ns; fall time < 1 ns; duty factor 2%.

Turn off time switched from
I_C = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA

		BSR17	BSR17A
storage time	t_s	< 175	200 ns
fall time	t_f	< 50	50 ns



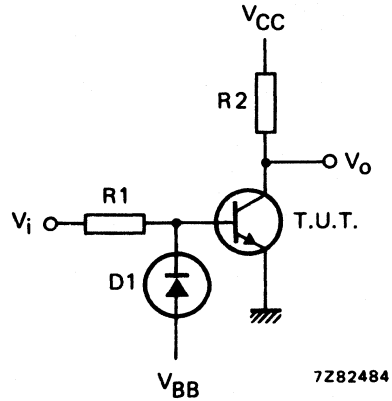


Fig. 3 Storage and fall time equivalent test circuit.

V_i = −9,1 to + 10,9 V; V_{CC} = 3 V; V_{BB} = 0 V (ground); R1 = 10 kΩ; R2 = 275 Ω;
total shunt capacitance of test jig and connectors = $C_s \leqslant 4$ pF.
Pulse generator: pulse duration t_1 = 10 to 500 μs; fall time $t_f < 1$ ns; duty factor δ = 2%.

SILICON LOW-POWER SWITCHING TRANSISTORS

P-N-P silicon transistor in a microminiature plastic envelope, intended for switching and linear applications in thick and thin-film circuits.

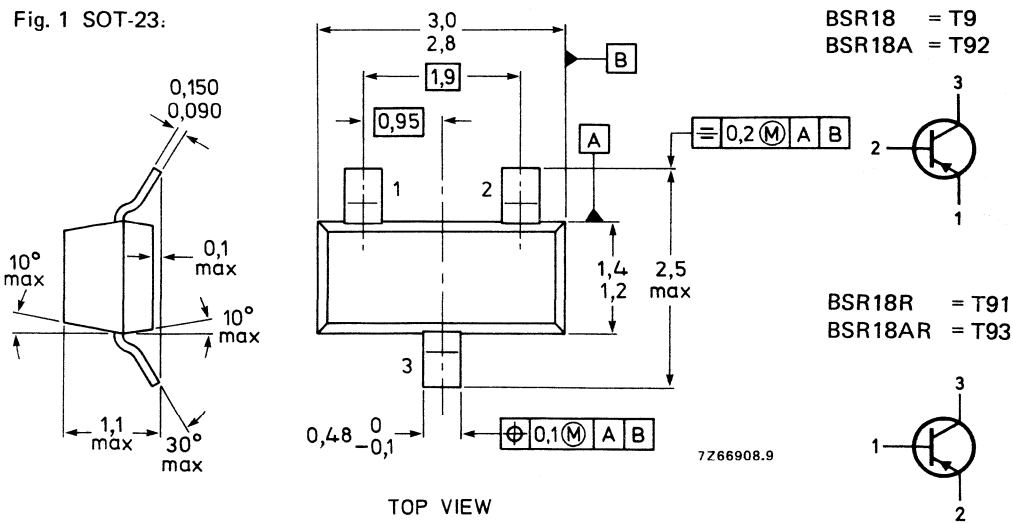
QUICK REFERENCE DATA

Collector-base voltage (open emitter)		$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)		$-V_{CEO}$	max.	40	V
Collector current (d.c.)		$-I_C$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	300	mW
Junction temperature		T_j	max.	150	°C
D.C. current gain					
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	BSR18	h_{FE}		50 to 150	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	BSR18A	h_{FE}		100 to 300	
Transition frequency at f = 500 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 20 V	BSR18	f_T	>	200	MHz
$-I_C$ = 10 mA; $-V_{CE}$ = 20 V	BSR18A	f_T	>	250	MHz

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm



Marking code

BSR18 = T9
BSR18A = T92

BSR18R = T91
BSR18AR = T93

R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−55 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

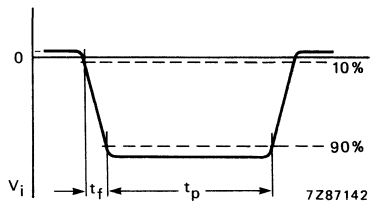
T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	50 nA
Emitter cut-off current			
I_C = 0; $-V_{EB}$ = 3 V	$-I_{EBO}$	<	50 nA
Saturation voltages *			
$-I_C$ = 10 mA; $-I_B$ = 1 mA	$-V_{CEsat}$	<	250 mV
	$-V_{BEsat}$		650 to 850 mV
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	400 mV
	$-V_{BEsat}$	<	950 mV
Collector capacitance at f = 100 kHz			
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V	C_c	<	4,5 pF
Emitter capacitance at f = 100 kHz			
$I_C = I_c$ = 0; $-V_{EB}$ = 0,5 V	C_e	<	10 pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

* Measured under pulse conditions; t_p = 300 μs; δ = 0,01.

		BSR18	BSR18A
D.C. current gain*			
$-I_C$ = 0,1 mA; $-V_{CE}$ = 1 V	h_{FE}	> 30	60
$-I_C$ = 1,0 mA; $-V_{CE}$ = 1 V	h_{FE}	> 40	80
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	50 to 150	100 to 300
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	h_{FE}	> 30	60
$-I_C$ =100 mA; $-V_{CE}$ = 1 V	h_{FE}	> 15	30
Transition frequency at f = 100 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	> 200	250 MHz
Noise figure at R_S = 1 kΩ			
$-I_C$ = 100 μA; $-V_{CE}$ = 5 V			
f = 10 to 15 700 Hz	F	< 5	4 dB
h parameters (common emitter) at f = 1 kHz			
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V			
input impedance	h_{ie}	0,5 to 8	2 to 12 kΩ
reverse voltage transfer ratio	h_{re}	0,1 to 5.10^{-4}	1 to 10.10^{-4}
small signal current gain	h_{fe}	50 to 200	100 to 400
output admittance	h_{oe}	1 to 40	3 to 60 μS
Switching times (between 10% and 90% levels)			
$-I_C$ = 10 mA; $-I_{Bon}$ = $+I_{Boff}$ = 1 mA			
delay time	t_d	<	35 ns
rise time	t_r	<	35 ns



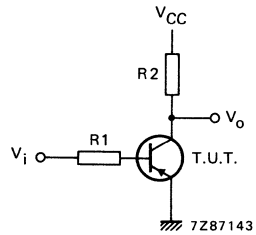
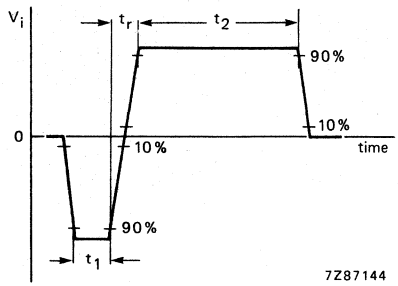


Fig. 2 Waveform and test circuit delay and rise time.
V_i = +0,5 to −10,6 V; $-V_{CC}$ = 3 V; R1 = 10 kΩ; R2 = 275 Ω.
Total shunt capacitance of test jig and connectors = $C_s \leqslant 4$ pF.
Pulse generator: pulse duration 300 ns; fall time < 1 ns; duty factor 2%.

Switching times (between 10% and 90% levels)
$-I_C = 10$ mA, $-I_{Bon} = I_{Boff} = 1$ mA

		BSR18	BSR18A
storage time t_s	$<$	200	225 ns
fall time t_r	$<$	60	75 ns



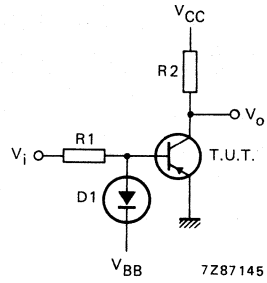


Fig. 3 Waveform and test circuit fall and storage time.
$V_i = -9{,}1$ to $+10{,}9$ V; $V_{CC} = 3$ V; $V_{BB} = 0$ V (ground); R1 = 10 kΩ; R2 = 275 Ω; D1 = 1N916.
Total shunt capacitance of test jig and connectors = $C_s \leqslant 4$ pF.
Pulse generator: pulse duration $t_1 = 10$ to 500 μs; rise time $t_r < 1$ ns; duty factor $\delta = 2\%$.

SILICON N-P-N HIGH-VOLTAGE TRANSISTORS

N-P-N high-voltage small-signal transistors for general purposes and especially telephony applications and encapsulated in a SOT-23 envelope.

P-N-P complements are BSR20 and BSR20A.

QUICK REFERENCE DATA

			BSR19	BSR19A
Collector-base voltage (open emitter)	V_{CBO}	max.	160	180 V
Collector-emitter voltage (open base)	V_{CEO}	max.	140	160 V
Collector current	I_C	max.	600	600 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	300 mW ←
Junction temperature	T_j	max.	150	150 °C
Collector-emitter saturation voltage I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0,25	0,20 V
D.C. current gain I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	60	80

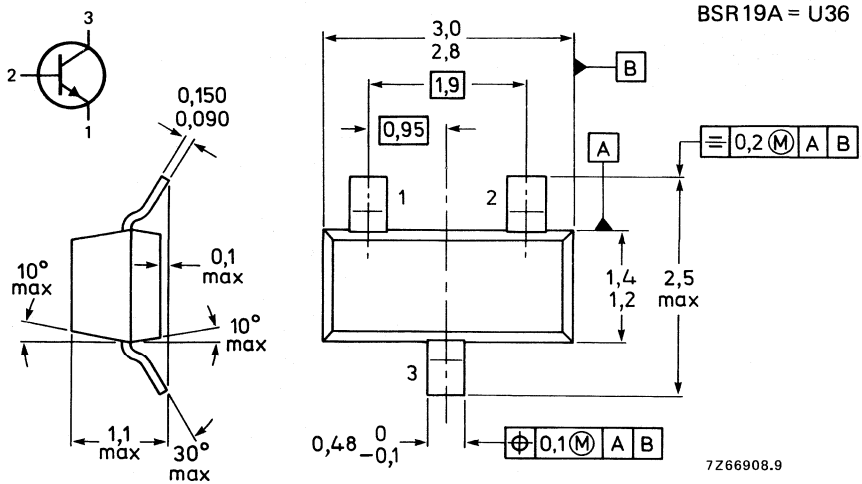
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

BSR19 = U35
BSR19A = U36



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR19	BSR19A	
Collector-base voltage (open emitter)	V_{CBO}	max.	160	180	V
Collector-emitter voltage (open base)	V_{CEO}	max.	140	160	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current	I_C	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Storage temperature	T_{stg}		−65 to + 150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BSR19	BSR19A	
Collector cut-off current					
I_E = 0; V_{CB} = 100 V	I_{CBO}	max.	100		nA
I_E = 0; V_{CB} = 120 V	I_{CBO}	max.		50	nA
I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	I_{CBO}	max.	100		μA
I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	I_{CBO}	max.		50	μA
Emitter cut-off current					
I_C = 0; V_{EB} = 4,0 V	I_{EBO}	max.	50	50	nA
Breakdown voltages					
I_C = 1,0 mA; I_B = 0	$V_{(BR)CEO}$	min.	140	160	V
I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	min.	160	180	V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	min.	6,0	6,0	V
Saturation voltages					
I_C = 10 mA; I_B = 1,0 mA	V_{CEsat}	max.	0,15	0,15	V
	V_{BEsat}	max.	1,0	1,0	V
I_C = 50 mA; I_B = 5,0 mA	V_{CEsat}	max.	0,25	0,20	V
	V_{BEsat}	max.	1,2	1,0	V
D.C. current gain					
I_C = 1,0 mA; V_{CE} = 5 V	h_{FE}	min.	60	80	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	60	80	
		max.	250	250	
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min.	20	30	
Small-signal current gain					
I_C = 1,0 mA; V_{CE} = 10 V; f = 1 kHz	h_{fe}	min.	50	50	
		max.	200	200	
Output capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 10 V	C_o	max.	6	6	pF

* Substrate size 8 mm x 10 mm x 0.7 mm.

			BSR19	BSR19A
Input capacitance at f = 1 MHz				
$I_C = 0$; $V_{EB} = 0{,}5$ V	C_i	max.	30	30 pF
Transition frequency at f = 100 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V	f_T	min.	100	100 MHz
		max.	300	300 MHz
Noise figure at $R_S = 1$ kΩ				
$I_C = 250$ μA; $V_{CE} = 5$ V; f = 10 Hz to 15,7 kHz	F	max.	10	8 dB

SILICON P-N-P HIGH-VOLTAGE TRANSISTORS

P-N-P high-voltage small-signal transistors for general purposes and especially in telephony applications and encapsulated in a SOT-23 envelope.

N-P-N complements are BSR19 and BSR19A.

QUICK REFERENCE DATA

			BSR20	BSR20A
Collector-base boltage (open emitter)	$-V_{CBO}$	max.	130	160 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	120	150 V
Collector current	$-I_C$	max.	600	600 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	300 mW
Junction temperature	T_j	max.	150	150 °C
Collector-emitter saturation voltage I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0,5	0,5 V
D.C. current gain I_C = 10 mA; V_{CE} = −5 V	h_{FE}	min.	40	60

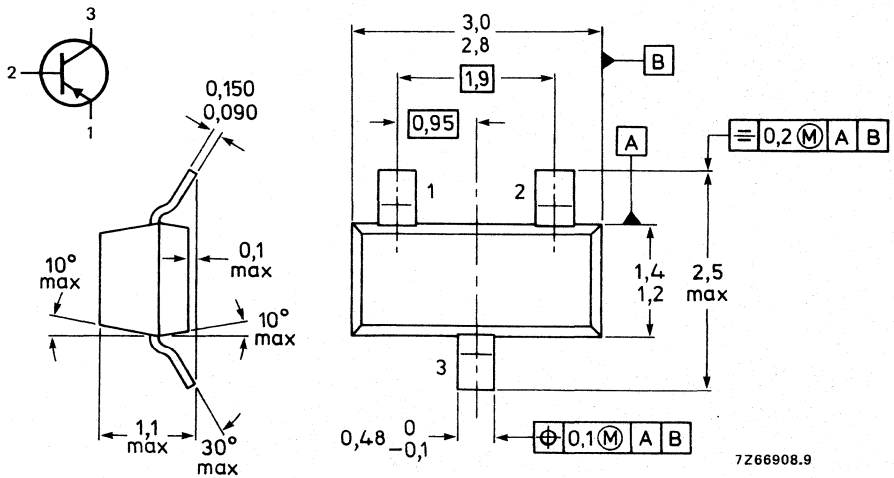
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

BSR20 = T35
BSR20A = T36



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR20	BSR20A	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	130	160	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	120	150	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current	$-I_C$	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
Storage temperature	T_{stg}		−65 to + 150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BSR20	BSR20A	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 100 V	$-I_{CBO}$	max.	100		nA
I_E = 0; $-V_{CB}$ = 120 V	$-I_{CBO}$	max.		50	nA
I_E = 0; $-V_{CB}$ = 100 V; T_{amb} = 100 °C	$-I_{CBO}$	max.	100		μA
I_E = 0; $-V_{CB}$ = 120 V; T_{amb} = 100 °C	$-I_{CBO}$	max.		50	μA
Emitter cut-off current					
I_C = 0; $-V_{EB}$ = 4,0 V	$-I_{EBO}$	max.	50	50	nA
Breakdown voltages					
I_C = 1,0 mA; I_B = 0	$-V_{(BR)CEO}$	min.	120	150	V
I_C = 100 μA; I_E = 0	$-V_{(BR)CBO}$	min.	130	160	V
I_C = 0; I_E = 10 μA	$-V_{(BR)EBO}$	min.	5,0	5,0	V
Saturation voltages					
$-I_C$ = 10 mA; $-I_B$ = 1,0 mA	$-V_{CEsat}$	max.	0,2	0,2	V
	$-V_{BEsat}$	max.	1,0	1,0	V
$-I_C$ = 50 mA; $-I_B$ = 5,0 mA	$-V_{CEsat}$	max.	0,5	0,5	V
	$-V_{BEsat}$	max.	1,0	1,0	V
D.C. current gain					
I_C = 1,0 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	30	50	
I_C = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	40	60	
		max.	180	240	
I_C = 50 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	40	50	
Small-signal current gain					
I_C = 1,0 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{fe}	min.	30	40	
		max.	200	200	
Output capacitance at f = 1 MHz					
I_E = 0; $-V_{CB}$ = 10 V	C_o	max.	6	6	pF

* Substrate size 8 mm x 10 mm x 0.7 mm.

			BSR20	BSR20A
Transition frequency at f = 100 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	min.	100	100 MHz
		max.	400	300 MHz
Noise figure at R_S = 1 kΩ				
I_C = 250 μA; $-V_{CE}$ = 5 V;				
f = 10 Hz to 15,7 kHz	F	max.	8	8 dB

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in miniature plastic envelopes intended for application in thick and thin-film circuits. They are intended for use in telephony and general industrial applications.

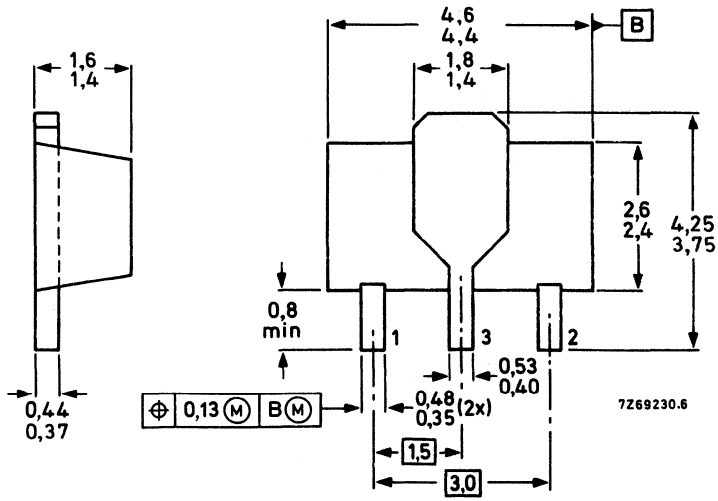
QUICK REFERENCE DATA

			BSR30	BSR31	BSR32	BSR33	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	70	70	90	90	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	60	80	80	V
Collector current (d.c.)	$-I_C$	max.	1	1	1	1	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	1	1	1	W
Junction temperature	T_j	max.	150	150	150	150	°C
D.C. current gain							
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
Transition frequency at f = 35 MHz							
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	100	100	100	100	MHz

MECHANICAL DATA

Dimensions in mm

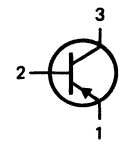
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BSR30 = BR1
BSR31 = BR2
BSR32 = BR3
BSR33 = BR4



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR30	BSR31	BSR32	BSR33	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	70	70	90	90	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	60	80	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		1			A
Base current (d.c.)	$-I_B$	max.		0,1			A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.		1			W
Storage temperature	T_{stg}			−65 to +150			°C
Junction temperature	T_j	max.		150			°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0; -V_{CB} = 60$ V	$-I_{CBO}$	<		100			nA
$I_E = 0; -V_{CB} = 60$ V; $T_j = 150$ °C	$-I_{CBO}$	<		50			μA

			BSR30	BSR31	BSR32	BSR33	
Breakdown voltages							
$I_B = 0; -I_C = 10$ mA	$-V_{(BR)CEO}$	>	60	60	80	80	V
$V_{BE} = 0; -I_C = 10$ μA	$-V_{(BR)CES}$	>	70	70	90	90	V
$I_C = 0; -I_E = 10$ μA	$-V_{(BR)EBO}$	>	5	5	5	5	V
Saturation voltages *							
$-I_C = 150$ mA; $-I_B = 15$ mA	$-V_{CEsat}$	<	0,25	0,25	0,25	0,25	V
	$-V_{BEsat}$	<	1,0	1,0	1,0	1,0	V
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	<	0,5	0,5	0,5	0,5	V
	$-V_{BEsat}$	<	1,2	1,2	1,2	1,2	V
D.C. current gain *							
$-I_C = 100$ μA; $V_{CE} = 5$ V	h_{FE}	>	10	30	10	30	
$-I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
$-I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	30	50	30	50	

Transition frequency at f = 35 MHz					
$-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	>	100		MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0; -V_{CB} = 10$ V	C_c	<	20		pF
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0; -V_{EB} = 0{,}5$ V	C_e	<	120		pF

Switching times see next page.

* Measured under pulse conditions: $t_p = 300$ μs; $\delta < 0{,}01$.

CHARACTERISTICS (continued)

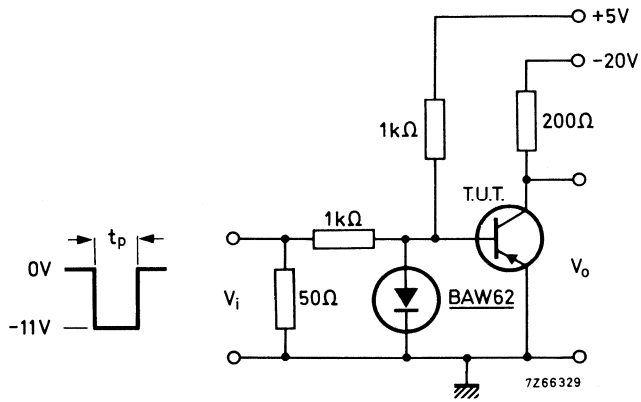
T_{amb} = 25 °C

Switching times

$-I_{Con}$ = 100 mA; $-I_{Bon} = +I_{Boff}$ = 5 mA

Turn-on time	t_{on}	<	500 ns
Turn-off time	t_{off}	<	650 ns

Test circuit



Pulse generator:		Oscilloscope:	
Pulse duration	t_p = 10 μs	Rise time	$t_r \leqslant$ 15 ns
Rise time	$t_r \leqslant$ 15 ns	Input impedance	$Z_I \geqslant$ 100 kΩ
Fall time	$t_f \leqslant$ 15 ns		
Source impedance	Z_S = 50 Ω		

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in miniature plastic envelopes intended for application in thick and thin-film circuits. They are intended for use in telephony and general industrial applications.

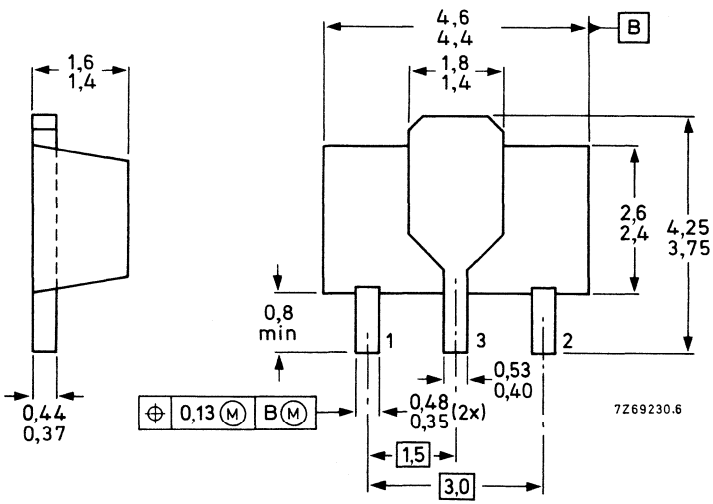
QUICK REFERENCE DATA

			BSR40	BSR41	BSR42	BSR43	
Collector-base voltage (open emitter)	V_{CBO}	max.	70	70	90	90	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	60	80	80	V
Collector current (d.c.)	I_C	max.	1	1	1	1	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	1	1	1	W
Junction temperature	T_j	max.	150	150	150	150	°C
D.C. current gain							
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
Transition frequency at f = 35 MHz							
I_C = 50 mA; V_{CE} = 10 V	f_T	>	100	100	100	100	MHz

MECHANICAL DATA

Dimensions in mm

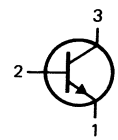
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BSR40 = AR1
BSR41 = AR2
BSR42 = AR3
BSR43 = AR4



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BSR40	BSR41	BSR42	BSR43	
Collector-base voltage (open emitter)	V_{CBO}	max.	70	70	90	90	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	60	80	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	5	V
Collector current (d.c.)	I_C	max.			1		A
Base current (d.c.)	I_B	max.			0,1		A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.			1		W
Storage temperature	T_{stg}				−65 to +150		°C
Junction temperature	T_j	max.			150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 m	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; V_{CB} = 60 V	I_{CBO}	<		100			nA
$I_E = 0$; V_{CB} = 60 V; T_j = 150 °C	I_{CBO}	<		50			μA

Breakdown voltages			BSR40	BSR41	BSR42	BSR43	
$I_B = 0$; I_C = 10 mA	$V_{(BR)CEO}$	>	60	60	80	80	V
$V_{BE} = 0$; I_C = 10 μA	$V_{(BR)CES}$	>	70	70	90	90	V
$I_C = 0$; I_E = 10 μA	$V_{(BR)EBO}$	>	5	5	5	5	V
Saturation voltages *							
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	<	0,25	0,25	0,25	0,25	V
	V_{BEsat}	<	1,0	1,0	1,0	1,0	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	0,5	0,5	0,5	V
	V_{BEsat}	<	1,2	1,2	1,2	1,2	V
D.C. current gain *							
I_C = 100 μA; V_{CE} = 5 V	h_{FE}	>	10	30	10	30	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	40	100	40	100	
		<	120	300	120	300	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	>	30	50	30	50	

Transition frequency at f = 35 MHz					
I_C = 50 mA; V_{CE} = 10 V	f_T	>	100		MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	<	12		pF
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	<	90		pF

Switching times see next page.

* Measured under pulse conditions: t_p = 300 μs; $\delta < 0{,}01$.

CHARACTERISTICS (continued)

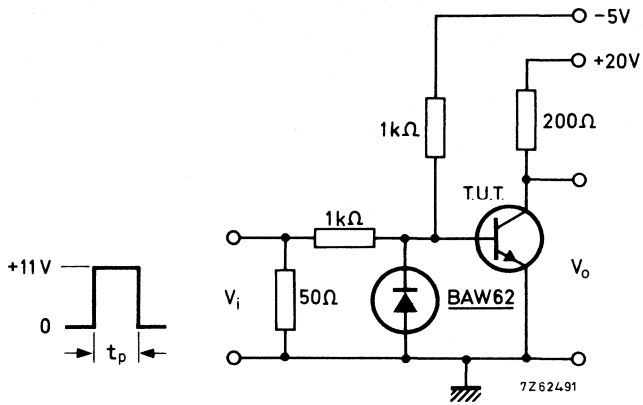
T_{amb} = 25 °C

Switching times

I_{Con} = 100 mA; $I_{Bon} = -I_{Boff}$ = 5 mA

Turn-on time	t_{on}	<	250 ns
Turn-off time	t_{off}	<	1000 ns

Test circuit



Pulse generator:		Oscilloscope:	
Pulse duration	t_p = 10 μs	Rise time	$t_r \leqslant$ 15 ns
Rise time	$t_r \leqslant$ 15 ns	Input impedance	$Z_I \geqslant$ 100 kΩ
Fall time	$t_f \leqslant$ 15 ns		
Source impedance	Z_S = 50 Ω		

N-CHANNEL FETS

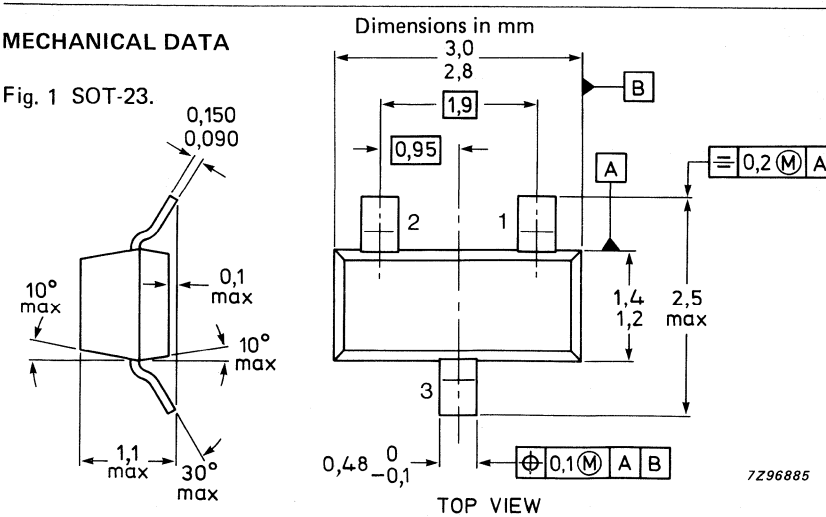
Silicon n-channel depletion type junction field-effect transistors in a plastic microminiature envelope intended for application in thick and thin-film circuits. The transistors are intended for low-power, chopper or switching applications in industrial service.

QUICK REFERENCE DATA

			BSR56	BSR57	BSR58	
Drain-source voltage	$\pm V_{DS}$	max.	40	40	40	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	300	300	mW
Drain current						
V_{DS} = 15 V; V_{GS} = 0	I_{DSS}	>	50	20	8	mA
		<	–	100	80	mA
Gate-source cut-off voltage						
V_{DS} = 15 V; I_D = 0,5 nA	$-V_{(P)GS}$	>	4	2	0,8	V
		<	10	6	4	V
Drain-source resistance (on) at f = 1 kHz						
I_D = 0; V_{GS} = 0	$r_{ds\ on}$	<	25	40	60	Ω
Feedback capacitance at f = 1 MHz						
$-V_{GS}$ = 10 V; V_{DS} = 0	C_{rs}	<	5	5	5	pF
Turn-off time						
V_{DD} = 10 V; V_{GS} = 0						
I_D = 20 mA; $-V_{GSM}$ = 10 V	t_{off}	<	25	–	–	ns
I_D = 10 mA; $-V_{GSM}$ = 6 V	t_{off}	<	–	50	–	ns
I_D = 5 mA; $-V_{GSM}$ = 4 V	t_{off}	<	–	–	100	ns

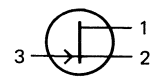
MECHANICAL DATA

Fig. 1 SOT-23.



Marking code

BSR56 = M4
BSR57 = M5
BSR58 = M6



Note: Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	40	V
Drain-gate voltage	V_{DGO}	max.	40	V
Gate-source voltage	$-V_{GSO}$	max.	40	V
Forward gate current	I_{GF}	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature range	T_{stg}		−65 to + 150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Gate-source cut-off current					
V_{DS} = 0 V; $-V_{GS}$ = 20 V	$-I_{GSS}$	<		1	nA
Drain cut-off current					
V_{DS} = 15 V; $-V_{GS}$ = 10 V	I_{DSX}	<		1	nA

			BSR56	BSR57	BSR58	
Drain current *						
V_{DS} = 15 V; V_{GS} = 0	I_{DSS}	>	50	20	8	mA
		<	–	100	80	mA
Gate-source breakdown voltage						
$-I_G$ = 1 μA; V_{DS} = 0	$-V_{(BR)GSS}$	>	40	40	40	V
Gate-source cut-off voltage						
I_D = 0,5 nA; V_{DS} = 15 V	$-V_{(P)GS}$	>	4	2	0,8	V
		<	10	6	4	V
Drain-source voltage (on)						
I_D = 20 mA; V_{GS} = 0	V_{DSon}	<	750	–	–	mV
I_D = 10 mA; V_{GS} = 0	V_{DSon}	<	–	500	–	mV
I_D = 5 mA; V_{GS} = 0	V_{DSon}	<	–	–	400	mV
Drain-source resistance (on) at f = 1 kHz						
I_D = 0; V_{GS} = 0	$r_{ds\ on}$	<	25	40	60	Ω

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

* Measured under pulsed conditions; t_p = 100 ms; $\delta \leqslant 0{,}1$.

Switching times*			BSR56	BSR57	BSR58	
V_{DD} = 10 V; V_{GS} = 0						
Conditions I_D and $-V_{GSM}$	I_D	=	20	10	5	mA
	$-V_{GSM}$	=	10	6	4	V
Delay time	t_d	<	6	6	10	ns
Rise time	t_r	<	3	4	10	ns
Turn-off time	t_{off}	<	25	50	100	ns

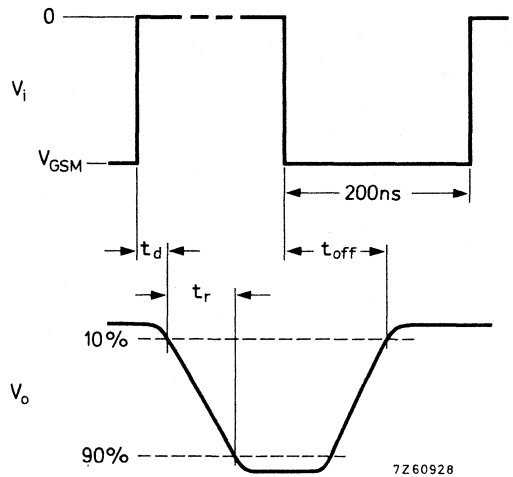


Fig. 2 Switching times waveforms.

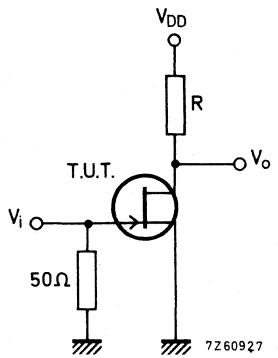


Fig. 3 Test circuit.

BSR56; R = 464 Ω
BSR57; R = 953 Ω
BSR58; R = 1910 Ω

Pulse generator

$t_r = t_f \leqslant 1$ ns
δ = 0,02
Z_o = 50 Ω

Oscilloscope

$t_r \leqslant 0{,}75$ ns
$R_i \geqslant$ 1 MΩ
$C_i \leqslant$ 2,5 pF

* Switching times measured on devices in SOT-18 envelope.

P-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Silicon symmetrical p-channel junction FETs in plastic microminiature SOT-23 envelopes and containing a BSJ174, 175, 176 or 177 crystal.

They are intended for application with analogue switches, choppers, commutators etc. using SMD technology.

A special feature is the interchangeability of the drain and source connections.

QUICK REFERENCE DATA

Drain-source voltage	$\pm V_{DS}$	max.		30			V
Gate-source voltage	V_{GSO}	max.		30			V
Gate current	$-I_G$	max.		50			mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		300			mW
			BSR174	**BSR175**	**BSR176**	**BSR177**	
Drain current $-V_{DS}$ = 15 V; V_{GS} = 0	$-I_{DSS}$	>	20	7	2	1,5	mA
		<	135	70	35	20	mA
Drain-source ON-resistance $-V_{DS}$ = 0,1 V; V_{GS} = 0	$R_{DS\,on}$	<	85	125	250	300	Ω

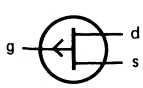
MECHANICAL DATA

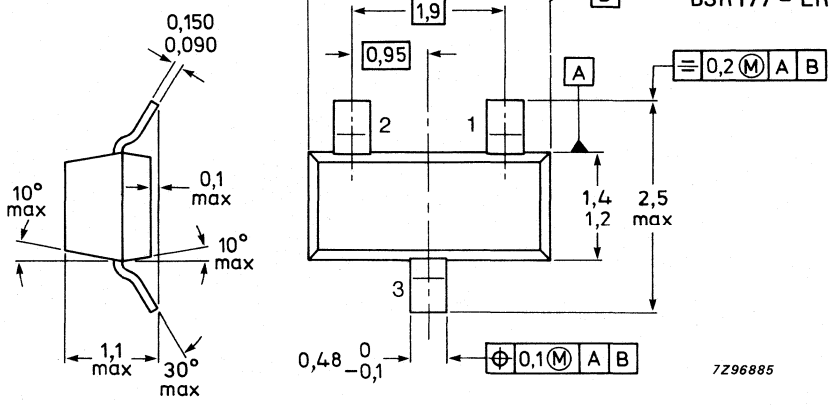
Dimensions in mm

Fig. 1 SOT-23.

Marking codes:
BSR174 = LO
BSR175 = LP
BSR176 = LQ
BSR177 = LR

Pinning:
1 = Drain
2 = Source
3 = Gate





TOP VIEW

Note: Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	30	V
Gate-source voltage	V_{GSO}	max.	30	V
Gate-drain voltage	V_{GDO}	max.	30	V
Gate current (d.c.)	$-I_G$	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	430	K/W

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BSR174	BSR175	BSR176	BSR177	
Gate cut-off current $-V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	<	1	1	1	1	nA
Drain cut-off current $-V_{DS}$ = 15 V; $-V_{GS}$ = 10 V	$-I_{DSX}$	<	1	1	1	1	nA
Drain current $-V_{DS}$ = 15 V; V_{GS} = 0	$-I_{DSS}$	>	20	7	2	1,5	mA
		<	135	70	35	20	mA
Gate-source breakdown voltage I_G = 1 μA; V_{DS} = 0	$V_{(BR)GSS}$	>	30	30	30	30	V
Gate-source cut-off voltage $-I_D$ = 10 nA; V_{DS} = 0	$V_{GS\,off}$	>	5	3	1	0,8	V
		<	10	6	4	2,25	V
Drain-source ON-resistance $-V_{DS}$ = 0,1 V; V_{GS} = 0	$R_{DS\,on}$	<	85	125	250	300	Ω

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

DYNAMIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Input capacitance, f = 1 MHz							
$-V_{GS}$ = 10 V; V_{DS} = 0 V	C_{is}	typ.		8			pF
$-V_{GS}$ = V_{DS} = 0	C_{is}	typ.		30			pF
Feedback capacitance, f = 1 MHz							
$-V_{GS}$ = 10 V; V_{DS} = 0 V	C_{rs}	typ.		4			pF

Switching times (see Fig. 2 + 3)			BSR174	BSR175	BSR176	BSR177	
Delay time	t_d	typ.	2	5	15	20	ns
Rise time	t_r	typ.	5	10	20	25	ns
Turn-on time	t_{on}	typ.	7	15	35	45	ns
Storage temperature	t_s	typ.	5	10	15	20	ns
Fall time	t_f	typ.	10	20	20	25	ns
Turn-off time	t_{off}	typ.	15	30	35	45	ns
Test conditions:	$-V_{DD}$		10	6	6	6	V
	$V_{GS\,off}$		12	8	6	3	V
	R_L		560	1200	2000	2900	Ω
	$V_{GS\,on}$		0	0	0	0	V

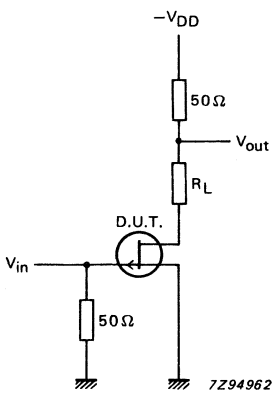


Fig. 2 Switching times test circuit

Rise time input voltage < 1 ns

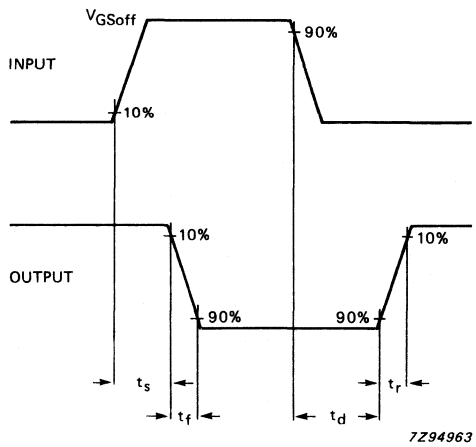


Fig. 3 Input and output waveforms

$t_d + t_r = t_{on}$

$t_s + t_f = t_{off}$

HIGH VOLTAGE P-N-P TRANSISTORS

Silicon planar epitaxial transistor in a microminiature plastic envelope intended for application in thick and thin-film circuits. This transistor is intended for high voltage general purpose and switching applications.

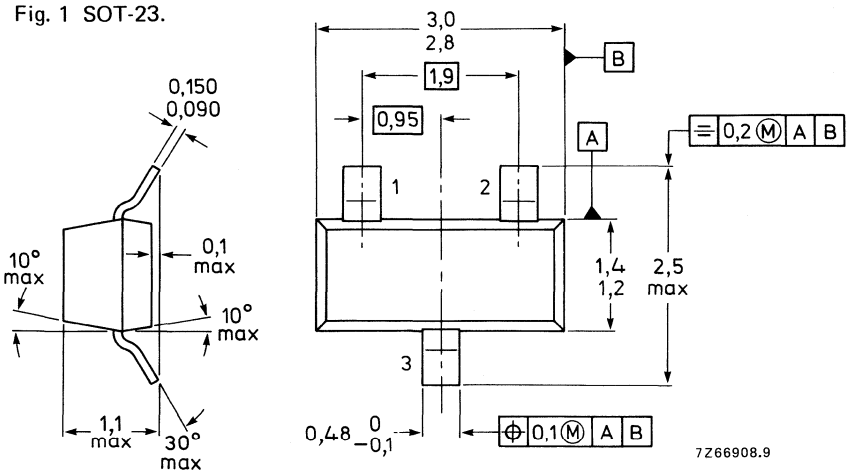
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	110	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	100	V
Collector current (peak value)	$-I_{CM}$	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 25 mA; $-V_{CE}$ = 5 V	h_{FE}	>	30	
Transition frequency at f = 35 MHz $-I_C$ = 25 mA; $-V_{CE}$ = 5 V	f_T	> typ.	50 85	MHz MHz

MECHANICAL DATA

Dimensions in mm

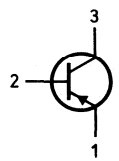
Fig. 1 SOT-23.



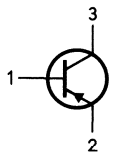
TOP VIEW

Marking code

BSS63 = T3



BSS63R = T6



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) $-I_C = 10\ \mu A$	$-V_{CBO}$	max.	110	V
Collector-emitter voltage (open base) $-I_C = 100\ \mu A$	$-V_{CEO}$	max.	100	V
Emitter-base voltage (open collector) $-I_E = 10\ \mu A$	$-V_{EBO}$	max.	6	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	100	mA
→ Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 90$ V	$-I_{CBO}$	<	100	nA
$I_E = 0; -V_{CB} = 90$ V; $T_j = 150\ ^oC$	$-I_{CBO}$	<	50	μA
Emitter cut-off current $I_C = 0; -V_{EB} = 6$ V	$-I_{EBO}$	<	200	nA
Saturation voltage $-I_C = 25$ mA; $-I_B = 2{,}5$ mA	$-V_{CEsat}$ $-V_{BEsat}$	< <	250 900	mV mV
D.C. current gain $-I_C = 10$ mA; $-V_{CE} = 1$ V $-I_C = 25$ mA; $-V_{CE} = 1$ V	h_{FE} h_{FE}	> >	30 30	
Collector capacitance at f = 1 MHz $I_E = I_e = 0; -V_{CB} = 10$ V	C_c	typ.	3	pF
Transition frequency at f = 35 MHz $-I_C = 25$ mA; $-V_{CE} = 5$ V	f_T	> typ.	50 85	MHz MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

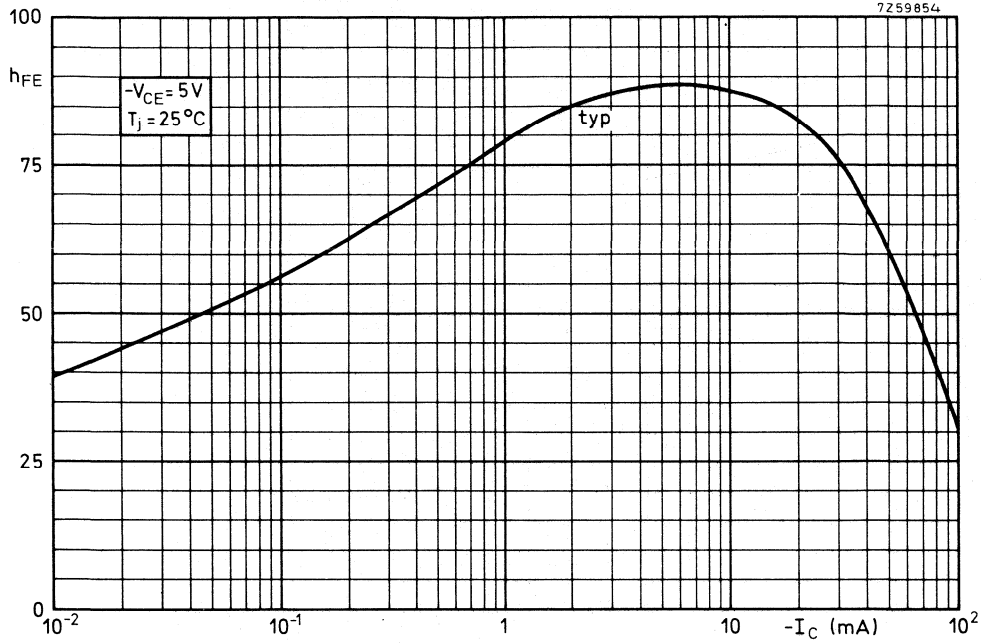

7Z59854
100
h_{FE}
75
50
25
0
$-V_{CE}$ = 5 V
T_j = 25 °C
typ
10^{-2}
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 2.

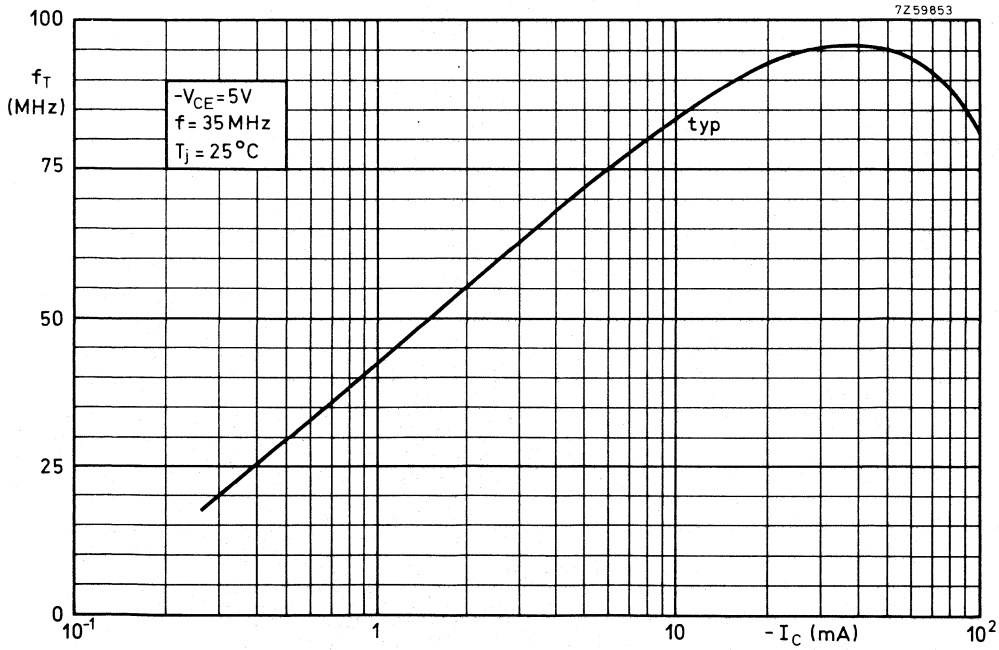

7Z59853
100
f_T
(MHz)
75
50
25
0
$-V_{CE}$ = 5 V
f = 35 MHz
T_j = 25 °C
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 3.

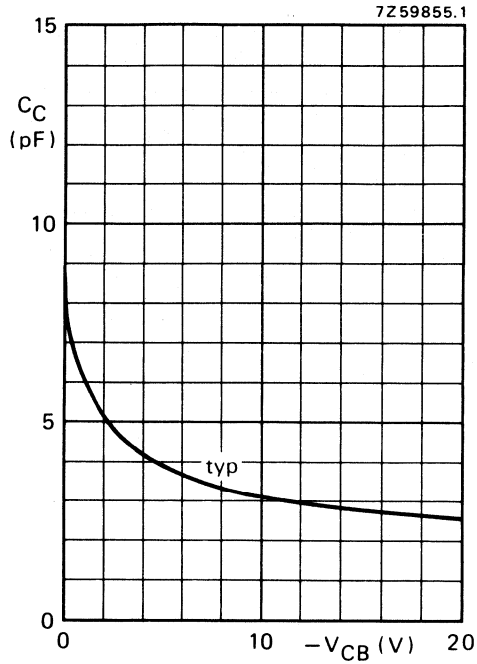


Fig. 4 Typical values collector capacitance as a function of collector-base voltage.
$I_E = I_e = 0$; $T_j = 25\ ^oC$; f = 1 MHz.

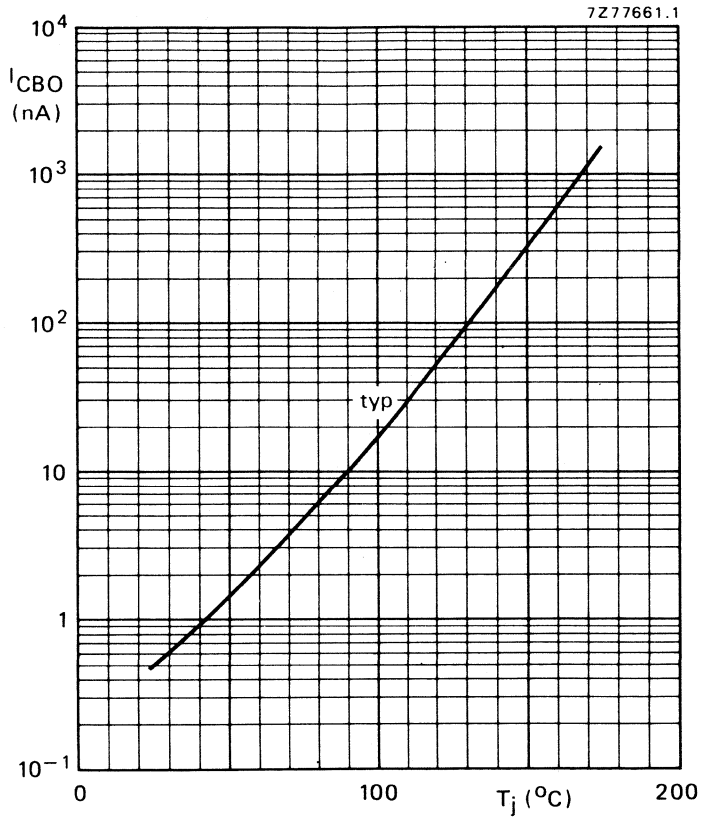


Fig. 5 Typical values collector-base currents as a function of the junction temperature at a collector-base voltage of 90 V.

HIGH VOLTAGE N-P-N TRANSISTORS

Silicon planar epitaxial transistor in a microminiature plastic envelope intended for application in thick and thin-film circuits. This transistor is intended for high-voltage general purpose and switching applications.

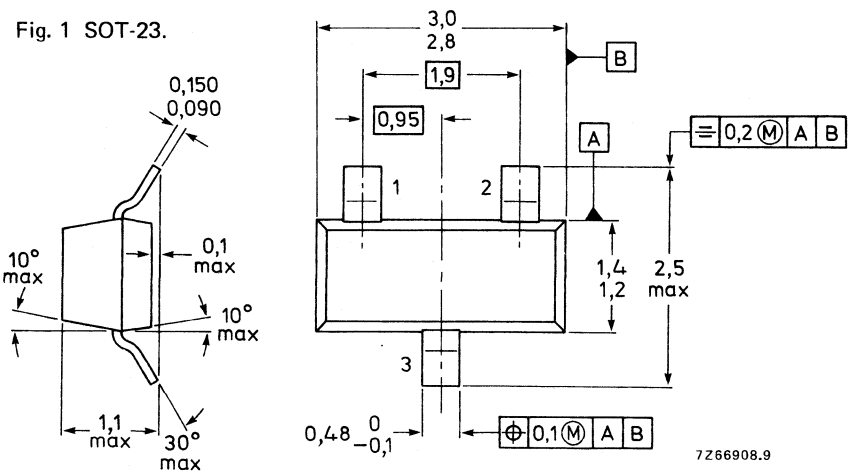
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	120	V
Collector-emitter voltage (open base)	V_{CEO}	max.	80	V
Collector current (peak value)	I_{CM}	max.	250	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain				
I_C = 10 mA; V_{CE} = 1 V; T_j = 25 °C	h_{FE}	>	20	
		typ.	80	
Transition frequency at f = 35 MHz				
I_C = 4 mA; V_{CE} = 10 V	f_T	>	60	MHz
Turn-off time				
I_C = 15 mA; $I_{Bon} = -I_{Boff}$ = 1 mA	t_{off}	<	1	μs

MECHANICAL DATA

Dimensions in mm

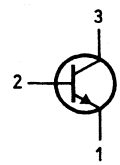
Fig. 1 SOT-23.



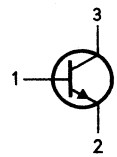
TOP VIEW

Marking code

BSS64 = U3



BSS64R = U6



R-types are available on request

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) I_C = 100 μA	V_{CBO}	max.	120 V
Collector-emitter voltage (open base) I_C = 4 mA	V_{CEO}	max.	80 V
Emitter-base voltage (open collector) I_E = 100 μA	V_{EBO}	max.	5 V
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	250 mA
Base current (peak value)	I_{BM}	max.	100 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}	−65 to	+ 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_E = 0; V_{CB} = 90 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 90 V; T_j = 150 °C	I_{CBO}	<	50 μA
Emitter cut-off current I_C = 0; V_{EB} = 5 V	I_{EBO}	typ. <	0,5 nA 200 nA
Saturation voltages I_C = 4 mA; I_B = 400 μA	V_{CEsat} V_{BEsat}	< <	150 mV 1200 mV
I_C = 50 mA; I_B = 15 mA	V_{CEsat}	<	200 mV
D.C. current gain I_C = 1 mA; V_{CE} = 1 V	h_{FE}	typ.	60
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	> typ.	20 80
I_C = 20 mA; V_{CE} = 1 V	h_{FE}	typ.	55

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Transition frequency at f = 35 MHz I_C = 4 mA; V_{CE} = 10 V	f_T	> typ.	60 MHz 100 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	3 pF ←
Turn-off switching time I_{Con} = 15 mA; $I_{Bon} = -I_{Boff}$ = 1 mA	t_{off}	<	1 μs

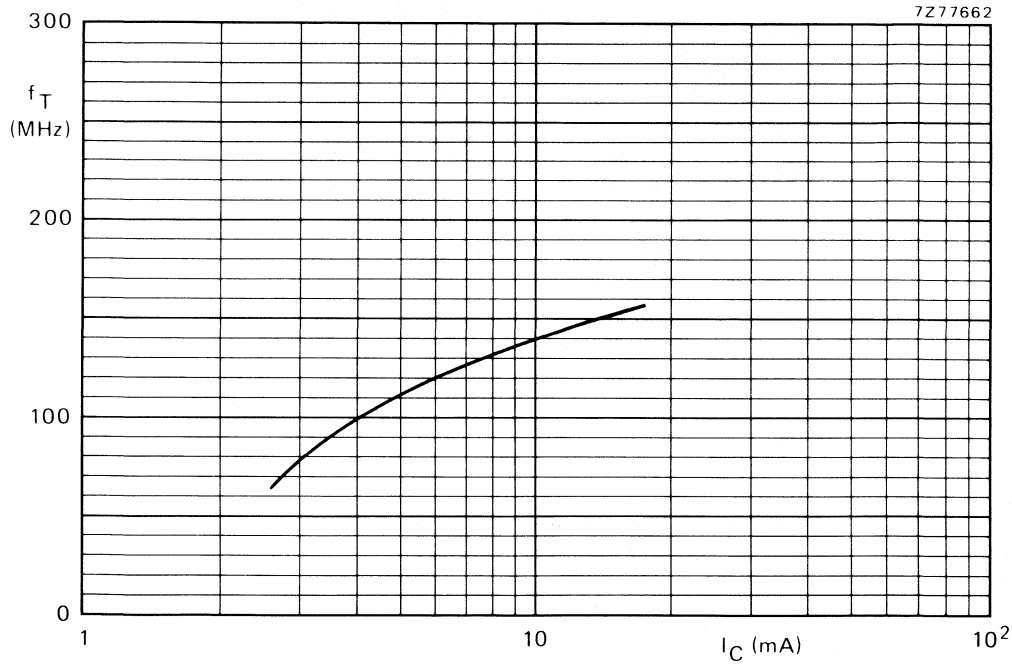


Fig. 2 Typical values transition frequency. V_{CE} = 10 V; f = 35 MHz; T_j = 25 °C.

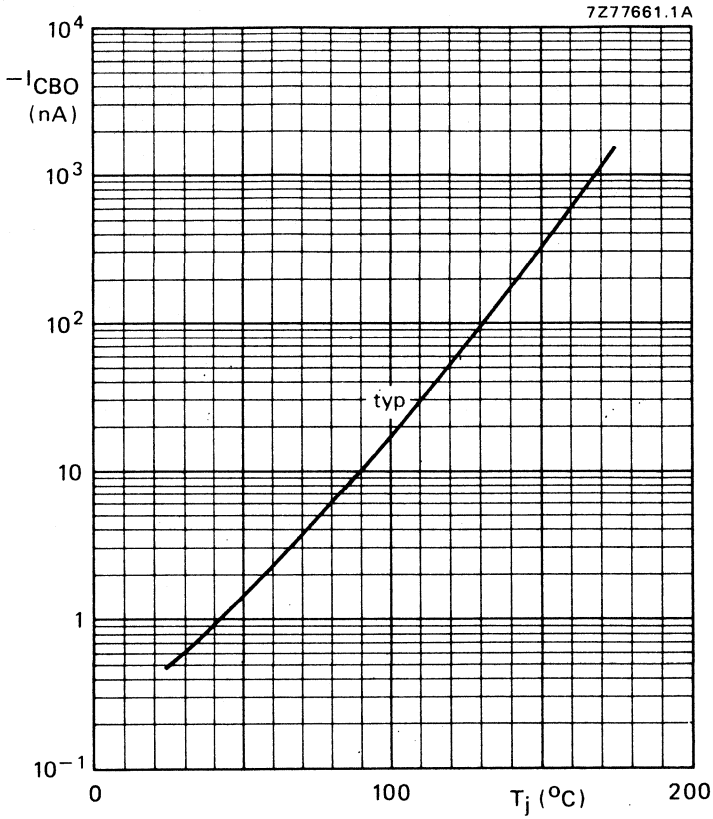


Fig. 3 Typical values collector-base current as a function of the junction temperature at a collector-base voltage of −90 V.

MOSFET N-CHANNEL ENHANCEMENT SWITCHING TRANSISTOR

Symmetrical insulated-gate silicon MOS field-effect transistor of the N-channel enhancement mode type.

The transistor is sealed in a SOT-143 envelope and features a low ON resistance and low capacitances.

The transistor is protected against excessive input voltages by integrated back-to-back diodes between gate and substrate.

Applications:
- analog and/or digital switch
- switch driver

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	10 V
Source-drain voltage	V_{SD}	max.	10 V
Drain-substrate voltage	V_{DB}	max.	15 V
Source-substrate voltage	V_{SB}	max.	15 V
Drain current (d.c.)	I_D	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230 mW
Gate-source cut-off voltage $V_{DS} = V_{GS}$; $V_{SB} = 0$; $I_D = 1\ \mu A$	$V_{(P)GS}$	$>$ $<$	0,1 V 2,0 V
Drain-source ON-resistance V_{GS} = 10 V; V_{SB} = 0; I_D = 0,1 mA	$R_{DS(on)}$	$<$	45 Ω
Feed-back capacitance $V_{GS} = V_{BS} = -15$ V; V_{DS} = 10 V; f = 1 MHz	C_{rss}	typ.	0,6 pF

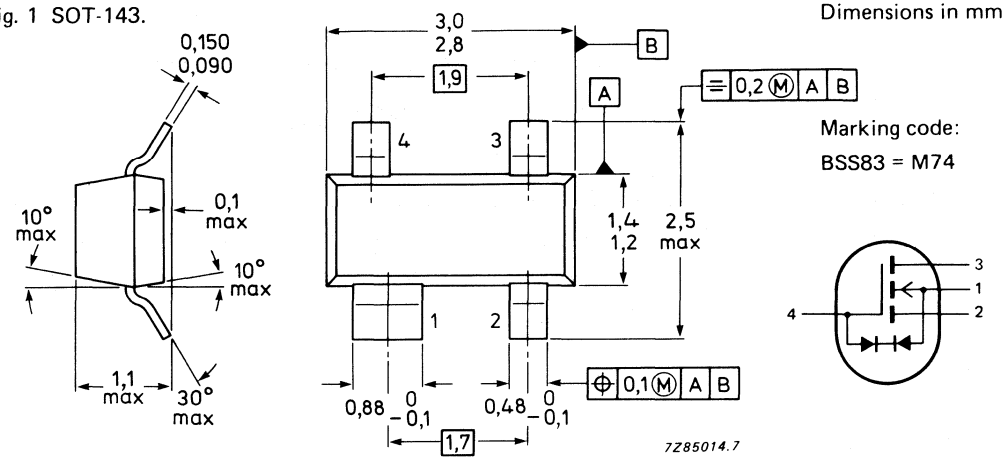
MECHANICAL DATA

SOT-143 (see Fig. 1).

See also *Soldering recommendations*.

Fig. 1 SOT-143.

Dimensions in mm



Note: Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	10 V
Source-drain voltage	V_{SD}	max.	10 V
Drain-substrate voltage	V_{DB}	max.	15 V
Source-substrate voltage	V_{SB}	max.	15 V
Drain current (d.c.)	I_D	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	230 mW*
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	430 K/W*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Drain-source breakdown voltage $V_{GS} = V_{BS} = -5$ V; I_D = 10 nA	$V_{(BR)DSX}$	>	10 V
Source-drain breakdown voltage $V_{GD} = V_{BD} = -5$ V; I_D = 10 nA	$V_{(BR)SDX}$	>	10 V
Drain-substrate breakdown voltage V_{GB} = 0; I_D = 10 nA; open source	$V_{(BR)DBO}$	>	15 V
Source-substrate breakdown voltage V_{GB} = 0; I_D = 10 nA; open drain	$V_{(BR)SBO}$	>	15 V
Drain-source leakage current $V_{GS} = V_{BS} = -2$ V; V_{DS} = 6,6 V	I_{DSoff}	<	10 nA

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Source-drain leakage current			
$V_{GD} = V_{BD} = -2$ V; $V_{SD} = 6{,}6$ V	I_{SDoff}	<	10 nA
Forward transconductance at f = 1 kHz			
$V_{DS} = 10$ V; $V_{SB} = 0$; $I_D = 20$ mA	g_{fs}	>	10 mS
		typ.	15 mS
Gate-source cut-off voltage			
$V_{DS} = V_{GS}$; $V_{SB} = 0$; $I_D = 1\ \mu$A	$V_{(P)GS}$	>	0,1 V
		<	2,0 V
Drain-source ON-resistance			
$I_D = 0{,}1$ mA;			
$V_{GS} = 5$ V; $V_{SB} = 0$	$R_{DS(on)}$	<	70 Ω
$V_{GS} = 10$ V; $V_{SB} = 0$	$R_{DS(on)}$	<	45 Ω
$V_{GS} = 3{,}2$ V; $V_{SB} = 6{,}8$ V (see Fig. 4)	$R_{DS(on)}$	typ.	80 Ω
		<	120 Ω
Gate-substrate zener voltages			
$V_{DB} = V_{SB} = 0$; $-I_C = 10\ \mu$A	$V_{Z(1)}$	>	12,5 V
$V_{DB} = V_{SB} = 0$; $+I_G = 10\ \mu$A	$V_{Z(2)}$	>	12,5 V
Capacitances at f = 1 MHz			
$V_{GS} = V_{BS} = -15$ V; $V_{DS} = 10$ V			
Feed-back capacitance	C_{rss}	typ.	0,6 pF
Input capacitance	C_{iss}	typ.	1,5 pF
Output capacitance	C_{oss}	typ.	1,0 pF
Switching times (see Fig. 2)			
$V_{DD} = 10$ V; $V_i = 5$ V	t_{on}	typ.	1,0 ns
	t_{off}	typ.	5,0 ns

Pulse generator:

R_i = 50 Ω
t_r < 0,5 ns
t_f < 1,0 ns
t_p = 20 ns
δ < 0,01

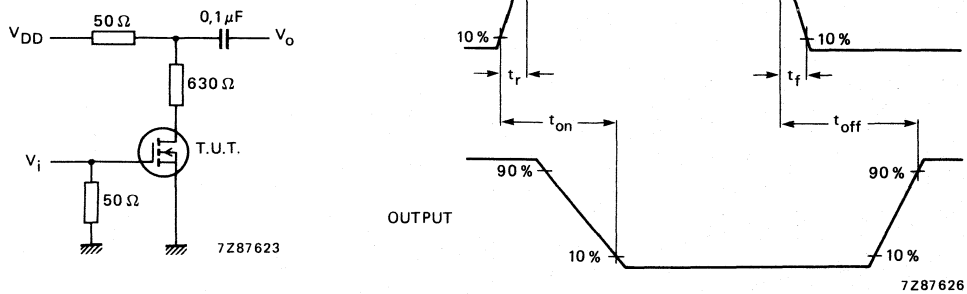


Fig. 2 Switching times test circuit and input and output waveforms.

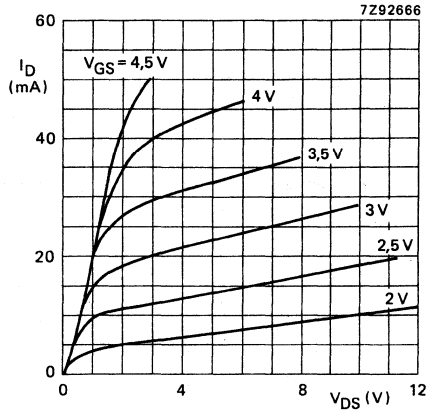


Fig. 3 V_{SB} = 0; typical values.

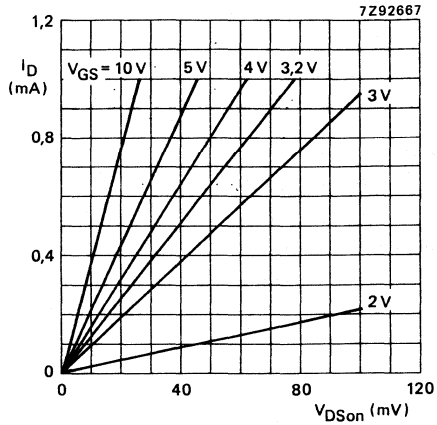


Fig. 4 V_{SB} = 6,8 V; typical values.

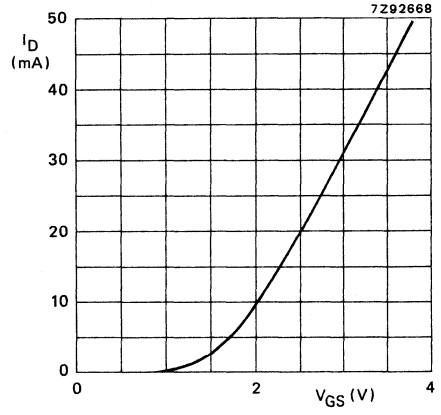


Fig. 5 V_{DS} = 10 V; V_{BS} = 0; typical values.

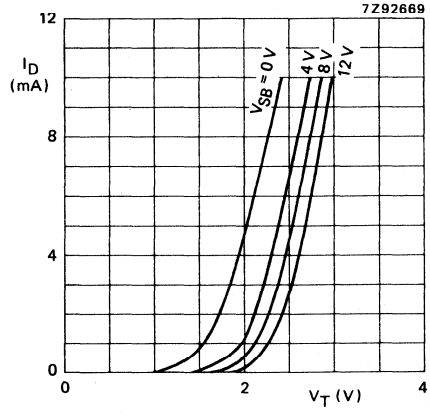


Fig. 6 $V_{DS} = V_{GS} = V_T$.

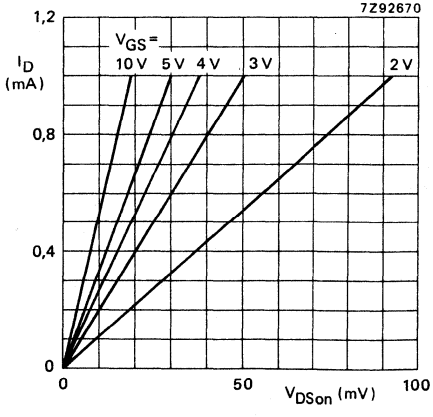


Fig. 7 V_{SB} = 0; typical values.

Conditions for Figs 3, 4, 5, 6 and 7:
T_j = 25 °C.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in miniature plastic envelopes intended for use in amplifier and switching applications. Complementary types are BST39/40.

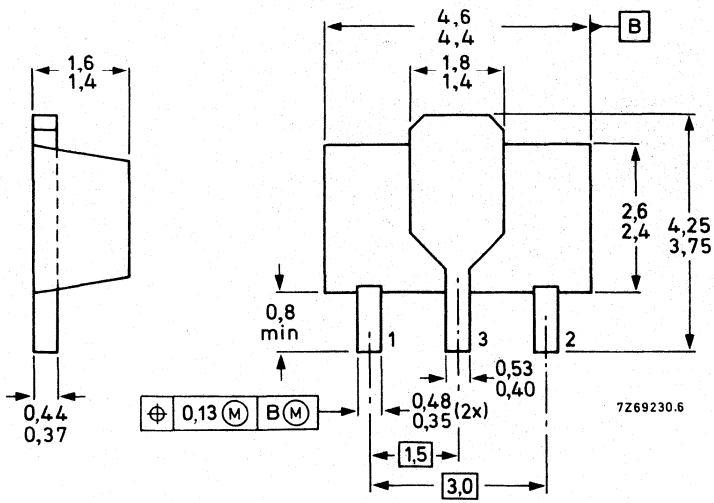
QUICK REFERENCE DATA

			BST15	BST16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	200	350	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	200	300	V
Collector current (d.c.)	$-I_C$	max.	1		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain $-V_{CE}$ = 10 V; $-I_C$ = 50 mA	h_{FE}		30 to 150	30 to 120	
Transition frequency $-V_{CE}$ = 10 V; $-I_C$ = 10 mA	f_T	>	15		MHz

MECHANICAL DATA

Dimensions in mm

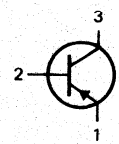
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BST15 = BT1
BST16 = BT2



See also *Soldering Recommendations*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BST15	BST16	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	200	350	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	200	300	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	6	V
Collector current (d.c.)	$-I_C$	max.	1		A
Base current	$-I_B$	max.	0,5		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
Storage temperature	T_{stg}		−65 to 150		°C

THERMAL RESISTANCE

from junction to ambient*	$R_{th\ j\text{-}mb}$	=	125	K/W
from junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BST15	BST16	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 175 V	$-I_{CBO}$	<	1	–	μA
I_E = 0; $-V_{CB}$ = 280 V	$-I_{CBO}$	<	–	1	μA
I_B = 0; $-V_{CE}$ = 150 V	$-I_{CEO}$	<	50	–	μA
I_B = 0; $-V_{CE}$ = 250 V	$-I_{CEO}$	<	–	50	μA
Emitter cut-off current					
I_C = 0; $-V_{EB}$ = 4 V	$-I_{EBO}$	<	20	–	μA
I_C = 0; $-V_{EB}$ = 6 V	$-I_{EBO}$	<	–	20	μA
Collector-emitter breakdown voltage					
I_B = 0; $-I_C$ = 50 mA; L = 25 mH	$-V_{(BR)CEO}$	>	200	300	V
Collector-emitter saturation voltage					
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	2,5	2,0	V
D.C. current gain					
$-V_{CE}$ = 10 V; $-I_C$ = 50 mA	h_{FE}		30 to 150	30 to 120	
Transition frequency at f = 30 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	15		MHz
Collector capacitance at f = 1 MHz					
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	<	15		pF

* Mounted on an area of 2,5 cm² of a ceramic substrate; thickness 0,7 mm.

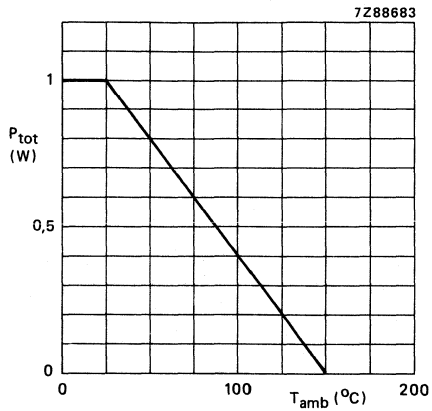


Fig. 2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in miniature plastic envelopes intended for use in amplifier and switching applications. Complementary p-n-p types are BST15/16.

QUICK REFERENCE DATA

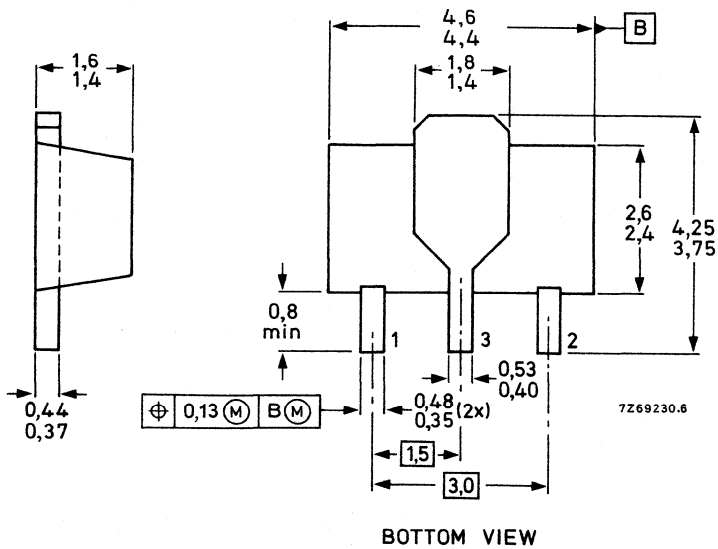
			BST39	BST40	
Collector-base voltage (open emitter)	V_{CBO}	max.	400	300	V
Collector-emitter voltage (open base)	V_{CEO}	max.	350	250	V
Collector current (d.c.)	I_C	max.	1		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain V_{CE} = 10 V; I_C = 20 mA	h_{FE}	min.	40		
Transition frequency at f = 5 MHz V_{CE} = 10 V; I_C = 10 mA	f_T	min.	70		MHz

MECHANICAL DATA

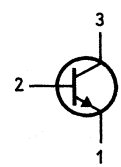
Dimensions in mm

Fig. 1 SOT-89.

Marking code
BST39 = AT1
BST40 = AT2



BOTTOM VIEW



See also *Soldering Recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BST39	BST40	
Collector-base voltage (open emitter)	V_{CBO}	max.	400	300	V
Collector-emitter voltage (open base)	V_{CEO}	max.	350	250	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	1		A
Base current	I_B	max.	0,5		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
Storage temperature	T_{stg}		−65 to 150		°C

THERMAL RESISTANCE

from junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current I_B = 0; V_{CE} = 300 V	I_{CBO}	⩽	20	nA
Emitter cut-off current I_C = 0; V_{EB} = 5 V	I_{EBO}	⩽	10	μA
Collector-emitter saturation voltage I_C = 50 mA; I_B = 4 mA	V_{CEsat}	⩽	0,5	V
Base-emitter saturation voltage I_C = 50 mA; I_B = 4 mA	V_{BEsat}	⩽	1,3	V
D.C. current gain V_{CE} = 10 V; I_C = 20 mA	h_{FE}	⩽	40	
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 10 V	C_c	⩽	2	pF
Emitter capacitance at f = 1 MHz $I_C = I_c$ = 0; V_{EB} = 5 V	C_e	⩽	20	pF
Transition frequency at f = 5 MHz V_{CE} = 10 V; I_C = 10 mA	f_T	⩾	70	MHz

* Mounted on an area of 2,5 cm² of a ceramic substrate; thickness 0,7 mm.

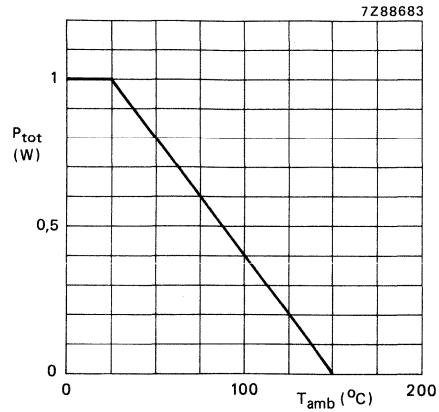


Fig. 2 Power derating curve.

N-P-N SILICON PLANAR DARLINGTON TRANSISTORS

Silicon n-p-n planar Darlington transistors for industrial switching applications, e.g. print hammer, solenoid, relay and lamp driving. Encapsulated in a microminiature SOT-89 envelope.

P-N-P complements are BST60, 61, 62 respectively.

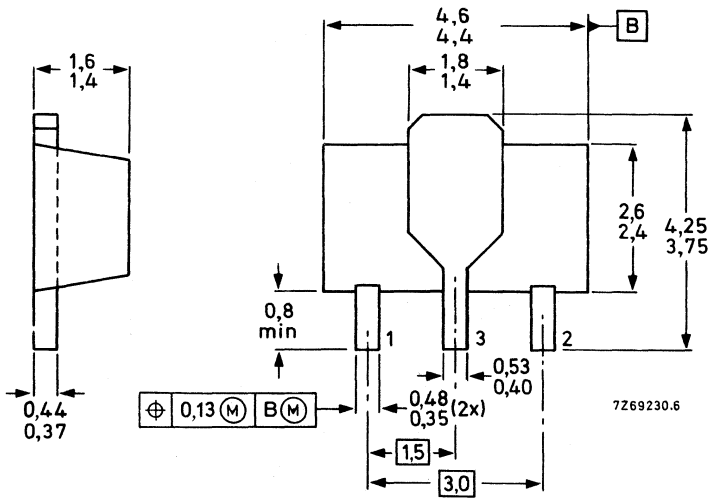
QUICK REFERENCE DATA

			BST50	BST51	BST52	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	90	V
Collector-emitter voltage	V_{CER}	max.	45	60	80	V
Collector current	I_C	max.	0,5	0,5	0,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
D.C. current gain I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>		2000		
Collector-emitter saturation voltage I_C = 500 mA; I_B = 0,5 mA	V_{CEsat}	<		1,3		V
Turn-off time I_C = 500 mA; $I_{Bon} = -I_{Boff}$ = 0,5 mA	t_{off}	typ.		1500		ns

MECHANICAL DATA

Dimensions in mm

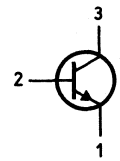
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BST50 = AS1
BST51 = AS2
BST52 = AS3



See also *Soldering recommendations.*

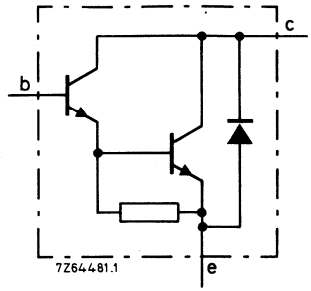


Fig. 2 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BST50	BST51	BST52	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	90	V
Collector-emitter voltage *	V_{CER}	max.	45	60	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.		5		V
Collector current (d.c.)	I_C	max.		0,5		A
Collector current (peak)	I_{CM}	max.		1,5		A
Base current (d.c.)	I_B	max.		0,1		A
Total power dissipation ▲ up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature **	T_j	max.		150		°C

THERMAL RESISTANCE **

From junction to ambient ▲	$R_{th\ j\text{-}a}$	=	125	K/W
From junction to tab	$R_{th\ j\text{-}tab}$	=	10	K/W

* External R_{BE} not to exceed value shown in Fig. 5.

** Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account.

▲ Device mounted on a ceramic substrate; area = 2,5 cm², thickness = 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
V_{BE} = 0; V_{CE} = V_{CER}max	I_{CES}	<	10 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	10 μA
D.C. current gain*			
I_C = 150 mA; V_{CE} = 10 V	h_{FE}	>	1000
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	2000
Collector-emitter saturation voltage			
I_C = 500 mA; I_B = 0,5 mA	V_{CEsat}	<	1,3 V
I_C = 500 mA; I_B = 0,5 mA; T_j = 150 °C	V_{CEsat}	<	1,3 V
Base-emitter saturation voltage			
I_C = 500 mA; I_B = 0,5 mA	V_{BEsat}	<	1,9 V
Switching times (see also Fig. 3 and Fig. 4)			
I_C = 500 mA; I_{Bon} = $-I_{Boff}$ = 0,5 mA			
Turn-on time	t_{on}	typ.	400 ns
Turn-off time	t_{off}	typ.	1500 ns

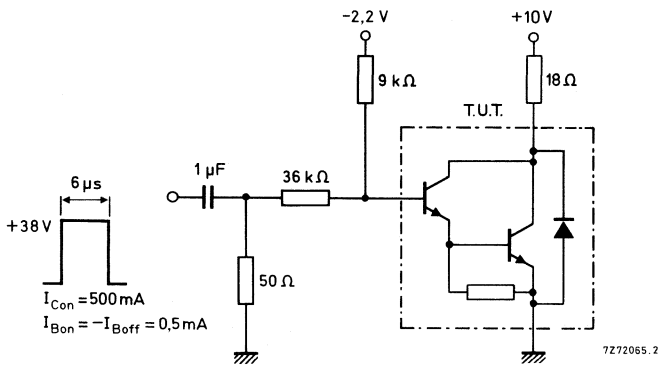


Fig. 3 Switching times test circuit.

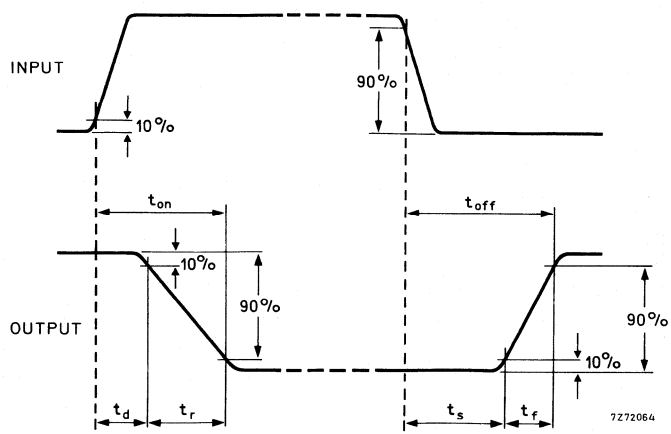


Fig. 4 Switching times waveform.

* Measured under pulsed conditions.

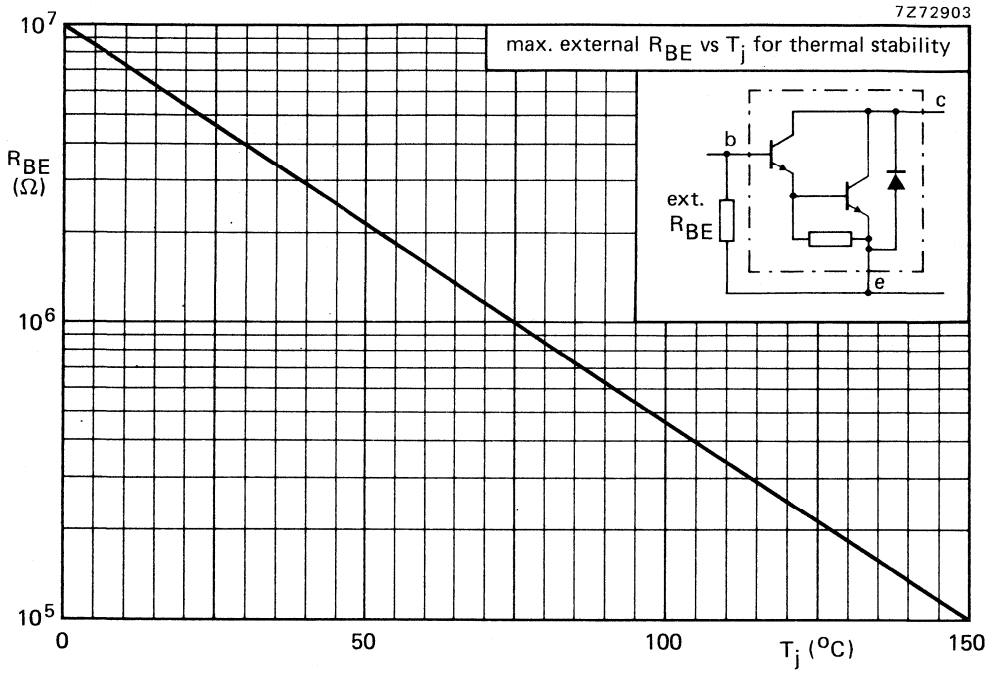


Fig. 5 Maximum values external R_{BE} as a function of junction temperature.

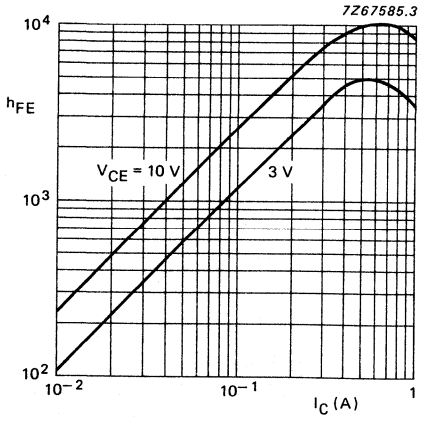


Fig. 6 T_j = 25 °C.

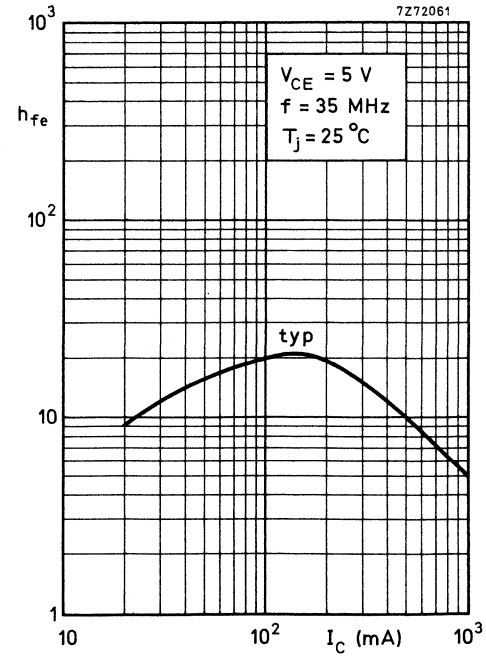


Fig. 7.

P-N-P SILICON PLANAR DARLINGTON TRANSISTORS

Silicon p-n-p planar Darlington transistors for industrial switching applications, e.g. print hammer, solenoid, relay and lamp driving. Encapsulated in a microminiature plastic SOT-89 envelope.

N-P-N complements are BST50, BST51 and BST52 respectively.

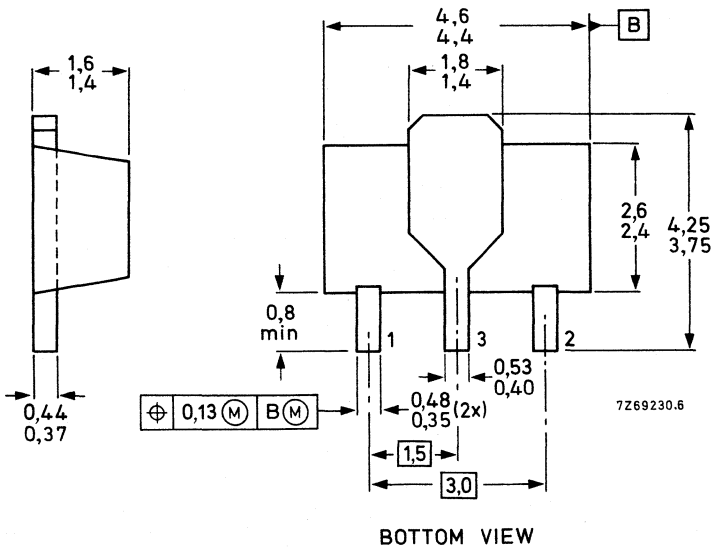
QUICK REFERENCE DATA

			BST60	BST61	BST62	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	90	V
Collector-emitter voltage	$-V_{CER}$	max.	45	60	80	V
Collector current	$-I_C$	max.	0,5	0,5	0,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>		2000		
Collector-emitter saturation voltage $-I_C$ = 0,5 A; $-I_B$ = 0,5 mA	$-V_{CEsat}$	<		1,3		V
Turn-off time $-I_C$ = 500 mA; $-I_{Bon} = I_{Boff}$ = 0,5 mA	t_{off}	typ.		1500		ns

MECHANICAL DATA

Dimensions in mm

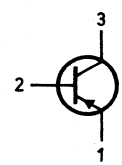
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BST60 = BS1
BST61 = BS2
BST62 = BS3



See also *Soldering recommendations.*

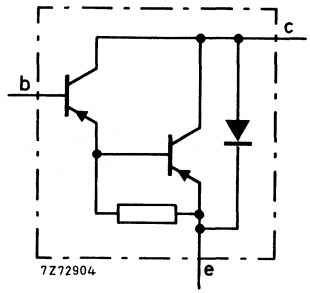


Fig. 2 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BST60	BST61	BST62	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	90	V
Collector-emitter voltage*	$-V_{CER}$	max.	45	60	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.		5		V
Collector current (d.c.)	$-I_C$	max.		0,5		A
Collector current (peak)	$-I_{CM}$	max.		1,5		A
Base current (d.c.)	$-I_B$	max.		0,1		A
Total power dissipation▲ up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature **	T_j	max.		150		°C

THERMAL RESISTANCE **

From junction to ambient ▲	$R_{th\ j\text{-}a}$	=	125	K/W
From junction to tab	$R_{th\ j\text{-}tab}$	=	10	K/W

* External R_{BE} not to exceed value shown in Fig. 5.

** Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account.

▲ Device mounted on a ceramic substrate area 2,5 cm², thickness = 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
V_{BE} = 0; $-V_{CE}$ = $-V_{CER}$max	$-I_{CES}$	<	10 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 4 V	$-I_{EBO}$	<	10 μA
D.C. current gain*			
$-I_C$ = 150 mA; $-V_{CE}$ = 10 V	h_{FE}	>	1000
$-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	2000
Collector-emitter saturation voltage			
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	<	1,3 V
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA; T_j = 150 °C	$-V_{CEsat}$	<	1,3 V
Base-emitter saturation voltage			
$-I_C$ = 500 mA; $-I_B$ = 0,5 mA	$-V_{BEsat}$	<	1,9 V
Switching times (see also Fig. 3 and Fig. 4)			
$-I_C$ = 500 mA; $-I_{Bon}$ = $-I_{Boff}$ = 0,5 mA			
Turn-on time	t_{on}	typ.	400 ns
Turn-off time	t_{off}	typ.	1500 ns

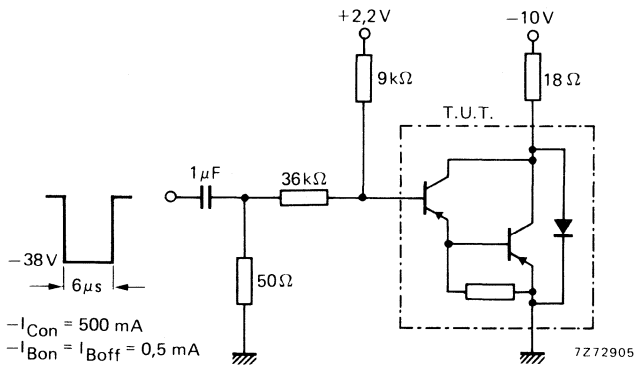


Fig. 3 Switching times test circuit.

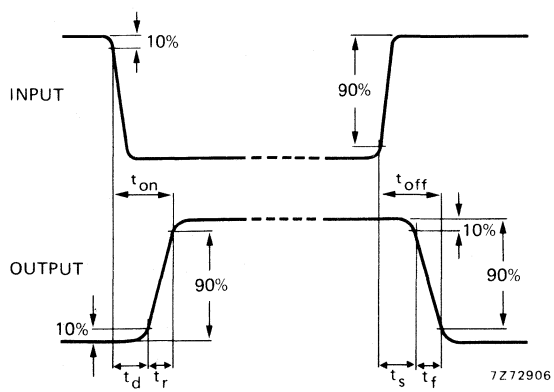


Fig. 4 Switching times waveform.

* Measured under pulsed conditions.

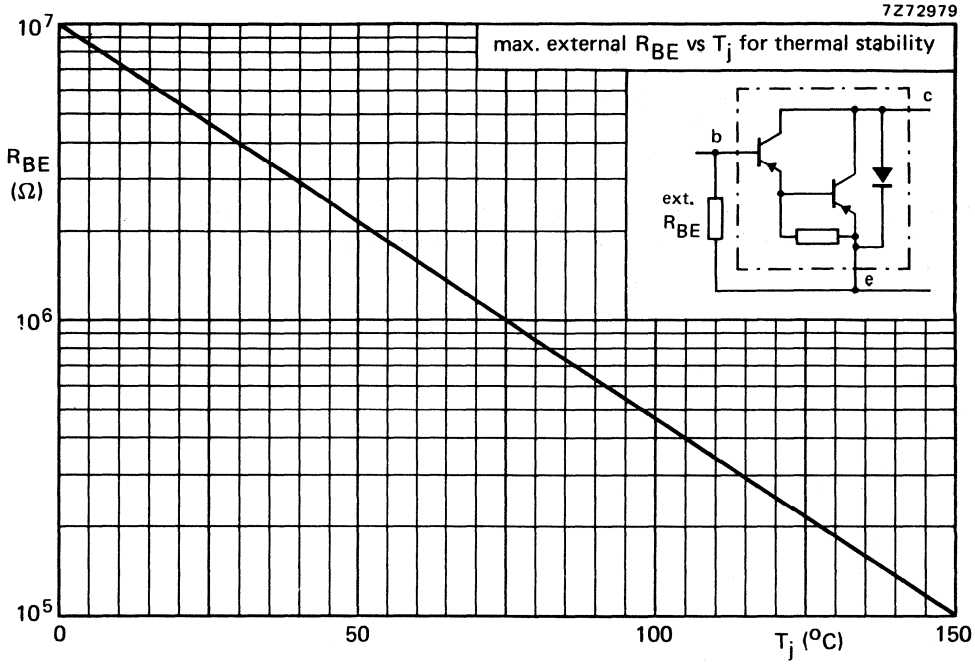


Fig. 5 Maximum values external R_{BE} as a function of junction temperature.

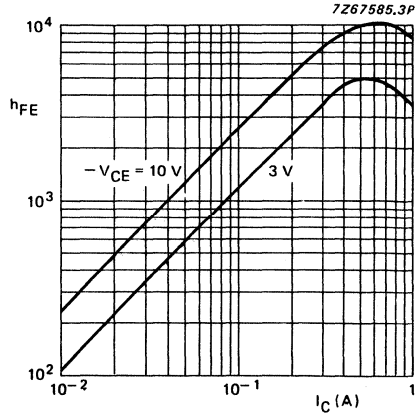


Fig. 6 T_j = 25 °C.

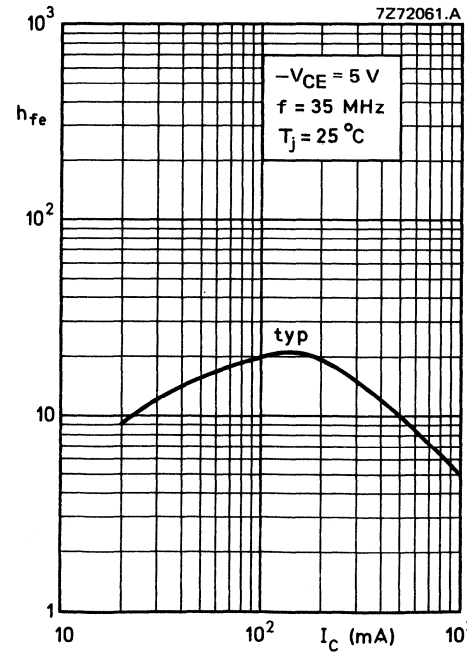


Fig. 7.

N-CHANNEL VERTICAL D-MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor in SOT-89 envelope and designed for use as Surface Mounted Device (SMD) in thin and thick-film circuits for application with relay, high-speed and line-transformer drivers.

Features

- Very low R_{DSon}
- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No second breakdown

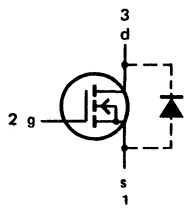
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	80 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	0,5 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Drain-source ON-resistance I_D = 500 mA; V_{GS} = 10 V	R_{DSon}	typ. <	2,0 Ω 4,0 Ω
Transfer admittance I_D = 500 mA; V_{DS} = 15 V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	300 mS

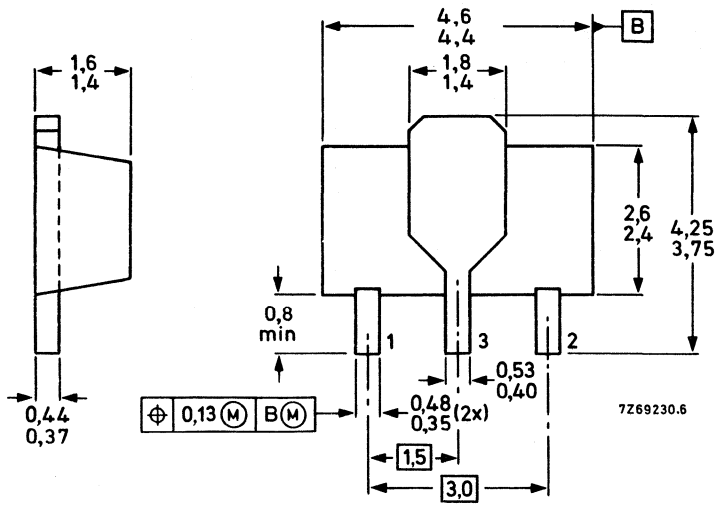
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.



Marking: KM



BOTTOM VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	80 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	0,5 A
Drain current (peak)	I_{DM}	max.	1,0 A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1 W
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$		125 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 μA; V_{GS} = 0	$V_{(BR)DS}$	>	80 V
Drain-source leakage current V_{DS} = 60 V; V_{GS} = 0	I_{DSS}	<	10 μA
Gate-source leakage current V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	100 nA
Gate threshold voltage I_D = 1 mA; V_{DS} = V_{GS}	$V_{GS(th)}$	> <	1,5 V 3,5 V
Drain-source ON-resistance I_D = 500 mA; V_{GS} = 10 V	R_{DSon}	typ. <	2,0 Ω 4,0 Ω
Transfer admittance at f = 1 kHz I_D = 500 mA; V_{DS} = 15 V	$\lvert y_{fs} \rvert$	typ.	300 mS
Input capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{is}	typ. <	45 pF 60 pF
Output capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{os}	typ. <	30 pF 45 pF
Feedback capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ. <	8 pF 12 pF
Switching times (see Figs 2 and 3) I_D = 500 mA; V_{DS} = 50 V; V_{GS} = 0 to 10 V	t_{on} t_{off}	 <	10 ns 15 ns

* Transistors mounted on a substrate with surface area of 2,5 cm^2 and thickness of 0,7 mm.

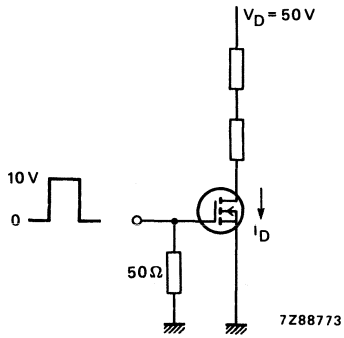


Fig. 2 Switching times test circuit.

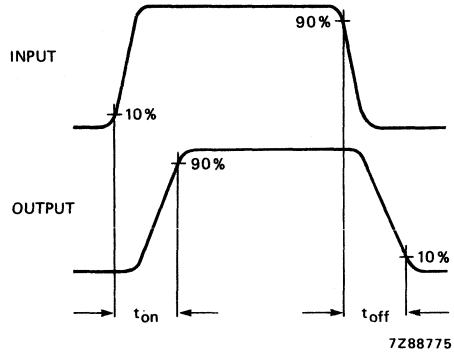


Fig. 3 Input and output waveforms.

N-CHANNEL VERTICAL D-MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor in SOT-23 envelope and designed for use as Surface Mounted Device (SMD) in thin and thick-film circuits for telephone ringer and for application with relay, high-speed and line transformer drivers.

Features

- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No second breakdown

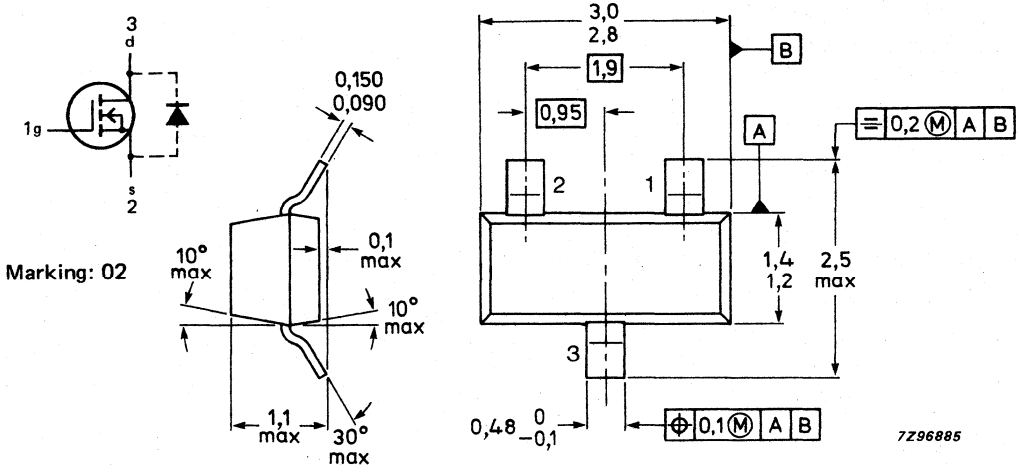
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	80	V
Drain-source voltage (non-repetitive peak; $t_p \leqslant 2$ ms)	$V_{DS(SM)}$	max.	100	V
Gate-source voltage (open drain)	V_{GSO}	max.	20	V
Drain current (d.c.)	I_D	max.	175	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	300	mW
Drain-source ON-resistance $I_D = 150$ mA; $V_{GS} = 5$ V	R_{DSon}	typ. <	7 10	Ω Ω
Transfer admittance $I_D = 175$ mA; $V_{DS} = 5$ V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	150	mS

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	80 V
Drain-source voltage (non-repetitive peak; $t_p \leqslant 2$ ms)	$V_{DS(SM)}$	max.	100 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain surrent (d.c.)	I_D	max.	175 mA
Drain current (peak)	I_{DM}	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW
Storage temperature range	T_{stg}	−65 to +	150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 μA; V_{GS} = 0	$V_{(BR)DS}$	>	80 V
Drain-source leakage current V_{DS} = 60 V; V_{GS} = 0	I_{DSS}	<	1,0 μA
Gate-source leakage current V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	100 nA
Gate-source cut-off voltage I_D = 1 mA; V_{DS} = V_{GS}	$V_{(P)GS}$	> <	1,5 V 3,5 V
Drain-source ON-resistance I_D = 150 mA; V_{GS} = 5 V	R_{DSon}	typ. <	7 Ω 10 Ω
Transfer admittance at f = 1 kHz I_D = 175 mA; V_{DS} = 5 V	$\lvert y_{fs} \rvert$	typ.	150 mS
Input capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{is}	typ. <	15 pF 30 pF
Output capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{os}	typ. <	13 pF 20 pF
Feedback capacitance at f = 1 MHz → V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ. <	3 pF 6 pF
Switching times (see Figs 2 and 3) I_D = 175 mA; V_{DS} = 50 V; V_{GS} = 0 to 10 V	t_{on}	typ. <	4 ns 10 ns
	t_{off}	typ. <	4 ns 10 ns

* Transistors mounted on a ceramic substrate of 7 mm x 5 mm x 0,7 mm.

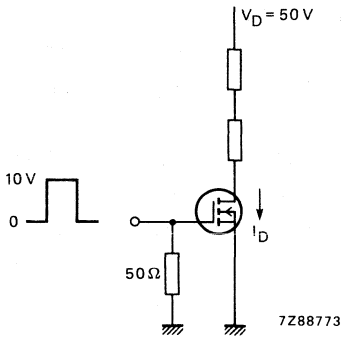


Fig. 2 Switching times test circuit.

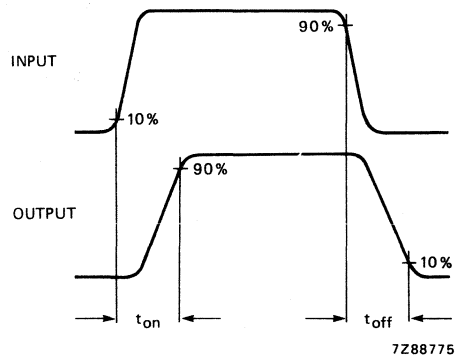


Fig. 3 Input and output waveforms.

N-CHANNEL VERTICAL D-MOS TRANSISTOR

N-channel vertical D-MOS transistor in SOT-89 envelope and designed for use as line current interrupter in telephone sets and for application in relay, high-speed and line-transformer drivers.

Features :

- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No second breakdown

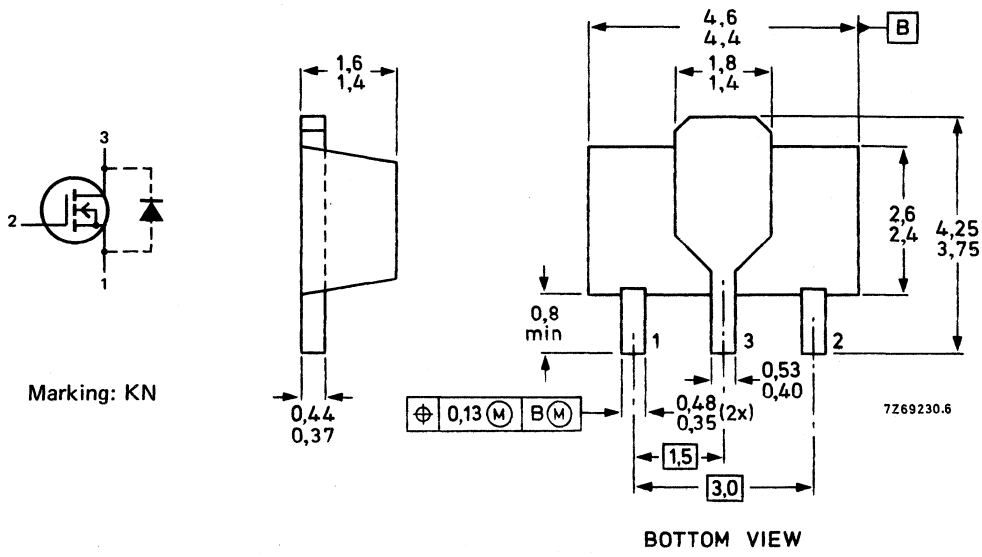
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	200 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	250 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Drain-source ON-resistance I_D= 250 mA; V_{GS} = 10 V	R_{DSon}	typ. <	6 Ω 12 Ω
Transfer admittance I_D= 250 mA; V_{DS} = 15 V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	250 mS

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	200 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	250 mA
Drain current (peak)	I_{DM}	max.	800 mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	1 W
Storage temperature	T_{stg}	−65 to +150	°C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$		125 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 μA; V_{GS} = 0	$V_{(BR)DS}$	>	200 V
Drain-source leakage current V_{DS} = 160 V; V_{GS} = 0	I_{DSS}	<	10 μA
Gate-source leakage current V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	100 nA
Gate threshold voltage I_D = 1 mA; V_{DS} = V_{GS}	$V_{GS(th)}$	> <	0,8 V 2,8 V
Drain-source ON-resistance I_D = 250 mA; V_{GS} = 10 V	R_{DSon}	typ. <	6 Ω 12 Ω
Transfer admittance at f = 1 kHz I_D = 250 mA; V_{DS} = 15 V	$\lvert y_{fs} \rvert$	typ.	250 mS
Input capacitance at f = 1 MHz V_{DS} = 10 V; V_{GS} = 0	C_{is}	typ.	70 pF
Output capacitance at f = 1 MHz V_{DS} = 10 V; V_{GS} = 0	C_{os}	typ.	20 pF
Feedback capacitance at f = 1 MHz V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ.	5 pF
Switching times (see Figs 2 and 3) I_D = 250 mA; V_{DS} = 50 V; V_{GS} = 0 to 10 V	t_{on}	typ. <	4 ns 10 ns
	t_{off}	typ. <	15 ns 25 ns

* Transistor mounted on a ceramic substrate with area of 2,5 cm^2 and thickness of 0,7 mm.

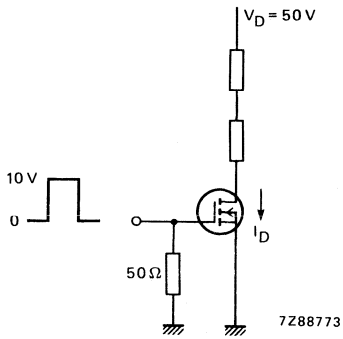


Fig. 2 Switching times test circuit.

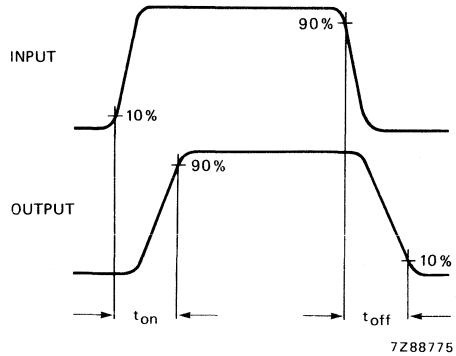


Fig. 3 Input and output waveforms.

N-CHANNEL VERTICAL D-MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor in SOT-89 envelope and designed for use as Surface Mounted Device (SMD) in thin and thick-film circuits for application with relay, high-speed and line-transformer drivers.

Features

- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No second breakdown

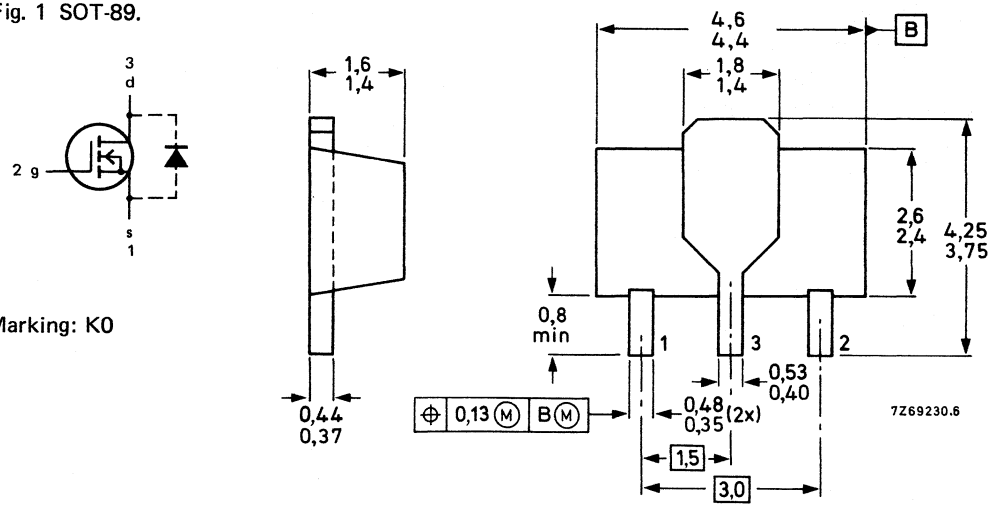
QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	180 V
Drain-source voltage (non-repetitive peak; $t_p \leqslant 2$ ms)	$V_{DS(SM)}$	max.	200 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	300 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	1 W
Drain-source ON-resistance $I_D = 15$ mA; $V_{GS} = 3$ V	R_{DSon}	typ. <	7 Ω 10 Ω
Transfer admittance $I_D = 300$ mA; $V_{DS} = 15$ V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	250 mS

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.



Marking: K0

BOTTOM VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	180 V
Drain-source voltage (non-repetitive peak; $t_p \leqslant 2$ ms)	$V_{DS(SM)}$	max.	200 V
Gate-source voltage (open drain)	V_{GSO}	max.	20 V
Drain current (d.c.)	I_D	max.	300 mA
Drain current (peak)	I_{DM}	max.	800 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1 W
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage			
I_D = 100 μA; V_{GS} = 0	$V_{(BR)DS}$	>	180 V
Drain-source leakage current			
V_{DS} = 120 V; V_{GS} = 0	I_{DSS}	<	10 μA
Gate-source leakage current			
V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	100 nA
Gate threshold voltage			
I_D = 100 μA; V_{DS} = V_{GS}	$V_{GS(th)}$	>	0,7 V
		<	2,7 V
Drain-source ON-resistance			
I_D = 15 mA; V_{GS} = 3 V	R_{DSon}	typ.	7 Ω
		<	10 Ω
I_D = 300 mA; V_{GS} = 10 V	R_{DSon}	typ.	6 Ω
Transfer admittance at f = 1 kHz			
I_D = 300 mA; V_{DS} = 15 V	$\lvert y_{fs} \rvert$	typ.	250 mS
Input capacitance at f = 1 MHz			
→ V_{DS} = 10 V; V_{GS} = 0	C_{is}	typ.	50 pF
		<	65 pF
Output capacitance at f = 1 MHz			
→ V_{DS} = 10 V; V_{GS} = 0	C_{os}	typ.	20 pF
		<	30 pF
Feedback capacitance at f = 1 MHz			
→ V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ.	6 pF
		<	10 pF
Switching times (see Figs 2 and 3)			
I_D = 300 mA; V_D = 50 V; V_{GS} = 0 to 10 V	t_{on}	<	10 ns
	t_{off}	<	15 ns

* Transistors mounted on a ceramic substrate with area of 2,5 cm^2 and thickness of 0,7 mm.

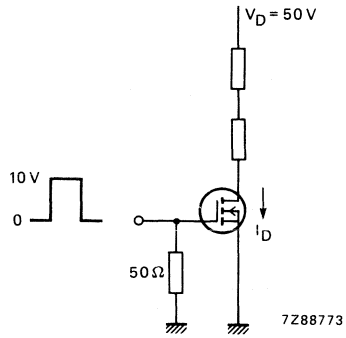


Fig. 2 Switching times test circuit.

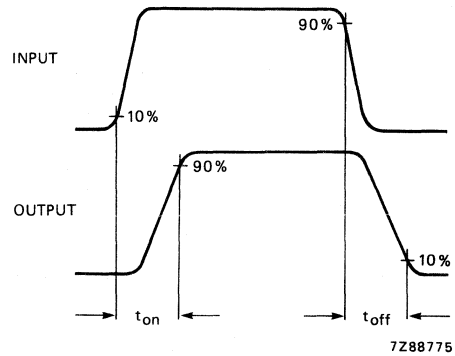


Fig. 3 Input and output waveforms.

P-CHANNEL VERTICAL D-MOS TRANSISTOR

P-channel vertical D-MOS transistor in SOT-89 envelope and intended for use in relay, high-speed and line-transformer drivers, using SMD technology.

Features

- Very low R_{DSon}
- Direct interface to C-MOS
- High-speed switching
- No second breakdown

QUICK REFERENCE DATA

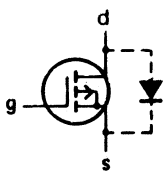
Drain-source voltage	$-V_{DS}$	max.	60 V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	20 V
Drain current (d.c.)	$-I_D$	max.	0,3 A
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	1 W
Drain-source ON-resistance $-I_D = 200$ mA; $-V_{GS} = 10$ V	R_{DSon}	typ. max.	4,5 Ω 6 Ω
Transfer admittance $-I_D = 200$ mA; $-V_{DS} = 15$ V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	200 mS

MECHANICAL DATA

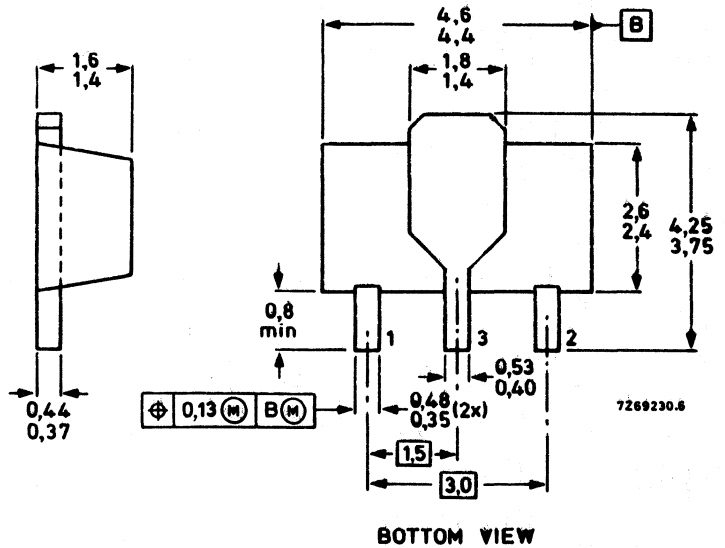
Dimensions in mm

Fig. 1 SOT-89.

Pinning:
1 = source
2 = gate
3 = drain



marking: LM



BOTTOM VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$-V_{DS}$	max.	60	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	20	V
Drain current (d.c.)	$-I_D$	max.	0,3	A
Drain current (peak)	$-I_{DM}$	max.	0,8	A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1	W
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage $-I_D$ = 100 μA; $-V_{GS}$ = 0	$-V_{(BR)DS}$	>	60	V
Drain-source leakage current $-V_{DS}$ = 45 V; V_{GS} = 0	$-I_{DSS}$	<	10	μA
Gate-source leakage current $-V_{GS}$ = 20 V; V_{DS} = 0	$-I_{GSS}$	<	100	nA
Gate threshold voltage $-I_D$ = 1 mA; V_{DS} = V_{GS}	$-V_{GS(th)}$	> <	1,5 3,5	V V
Drain-source ON-resistance $-I_D$ = 200 mA; $-V_{GS}$ = 10 V	R_{DSon}	typ. <	4,5 6	Ω Ω
Transfer admittance at f = 1 kHz $-I_D$ = 200 mA; $-V_{DS}$ = 15 V	$\lvert y_{fs} \rvert$	typ.	200	mS
Input capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{is}	typ. <	55 70	pF pF
Output capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{os}	typ. <	30 45	pF pF
Feedback capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{rs}	typ. <	8 12	pF pF
Switching times (see Figs 2 and 3) → $-I_D$ = 200 mA; $-V_D$ = 50 V; $-V_{GS}$ = 0 to 10 V	t_{on} t_{off}	typ. typ.	4 20	ns ns

* Transistor mounted on a ceramic substrate: area = 2,5 cm^2 and thickness = 0,7 mm.

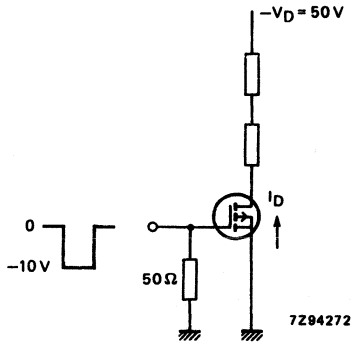


Fig. 2 Switching time test circuit.

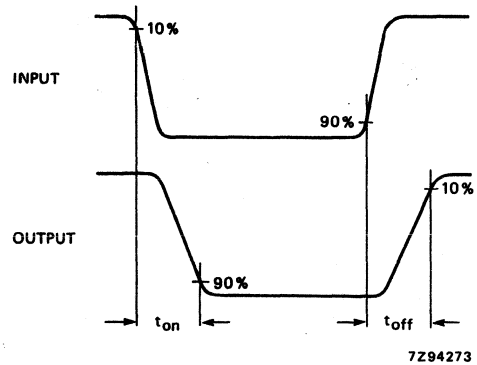


Fig. 3 Input and output waveforms.

P-CHANNEL VERTICAL D-MOS TRANSISTOR

P-channel vertical D-MOS transistor in SOT-89 envelope and intended for use in relay, high-speed and line-transformer drivers, using SMD-technology.

Features

- Very low R_{DSon}
- Direct interface to C-MOS, TTL
- High-speed switching
- No second breakdown

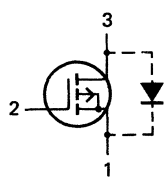
QUICK REFERENCE DATA

Drain-source voltage	$-V_{DS}$	max.	50 V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	20 V
Drain current (d.c.)	$-I_D$	max.	0,25 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Drain-source ON-resistance $-I_D$ = 200 mA; $-V_{GS}$ = 10 V	R_{DSon}	typ. max.	7,5 Ω 10 Ω
Transfer admittance $-I_D$ = 200 mA; $-V_{DS}$ = 15 V; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	125 mS

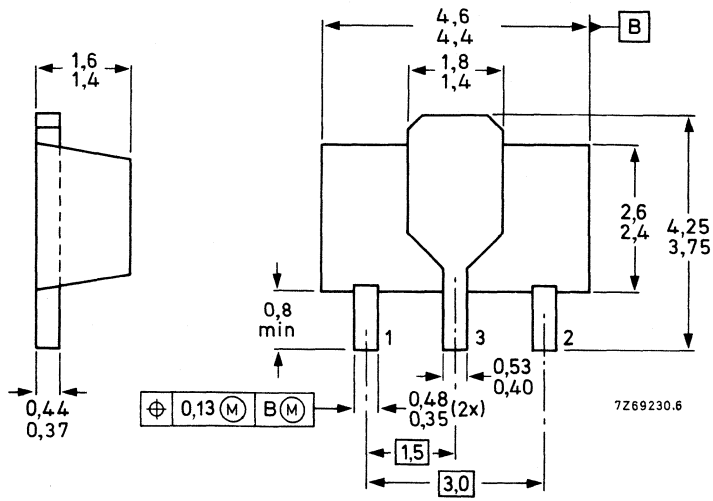
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.



Marking: LN



BOTTOM VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$-V_{DS}$	max.	50	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	20	V
Drain current (d.c.)	$-I_D$	max.	0,25	A
Drain current (peak)	$-I_{DM}$	max.	0,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage $-I_D$ = 100 μA; $-V_{GS}$ = 0	$-V_{(BR)DS}$	>	50	V
Drain-source leakage current $-V_{DS}$ = 1 V; V_{GS} = 0	$-I_{DSS}$	<	10	μA
Gate-source leakage current $-V_{GS}$ = 20 V; V_{DS} = 0	$-I_{GSS}$	<	100	nA
Gate threshold voltage $-I_D$ = 1 mA; V_{DS} = V_{GS}	$-V_{GS(th)}$	> <	1,5 3,5	V V
Drain-source ON-resistance $-I_D$ = 200 mA; $-V_{GS}$ = 10 V	R_{DSon}	typ. <	7,5 10	Ω Ω
Transfer admittance at f = 1 kHz $-I_D$ = 200 mA; $-V_{DS}$ = 15 V	$\lvert y_{fs} \rvert$	typ.	125	mS
Input capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{is}	typ. <	30 45	pF pF
Output capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{os}	typ. <	20 30	pF pF
Feedback capacitance at f = 1 MHz → $-V_{DS}$ = 10 V; V_{GS} = 0	C_{rs}	typ. <	5 10	pF pF
Switching times (see Figs 2 and 3) → $-I_D$ = 200 mA; $-V_D$ = 50 V; $-V_{GS}$ = 0 to 10 V	t_{on} t_{off}	typ. typ.	4 10	ns ns

* Transistor mounted on a ceramic substrate: area = 2,5 cm²; thickness = 0,7 mm.

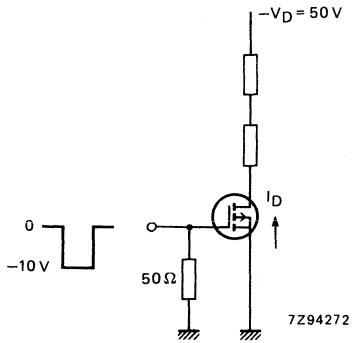


Fig. 2 Switching times test circuit.

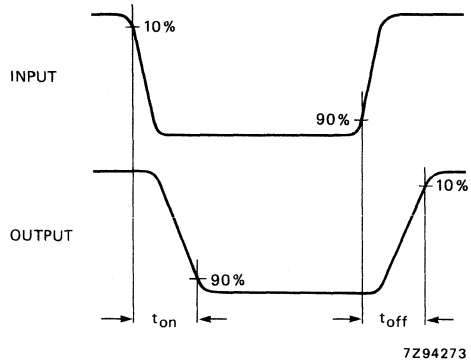


Fig. 3 Input and output waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

- **High-speed switching**

N-P-N transistor in a microminiature plastic envelope. It is intended for very high-speed saturated switching in thick and thin-film circuits.

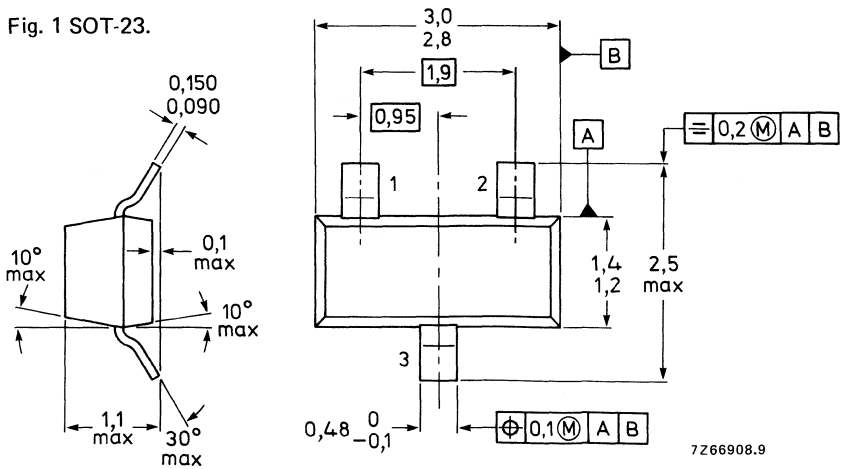
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain				
I_C = 10 mA; V_{CE} = 1 V	h_{FE}		40 to 120	
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	>	25	
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 10 V	f_T	>	400	MHz
		typ.	500	MHz
Storage time				
$I_C = I_B = -I_{BM}$ = 10 mA	t_s	<	13	ns

MECHANICAL DATA

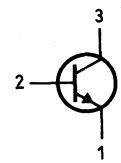
Fig. 1 SOT-23.

Dimensions in mm

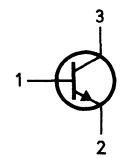


Marking code

BSV52 = B2



BSV52R = B4



R-types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	20 V
Collector-emitter voltage (open base) I_C = 10 mA (see Fig. 4)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
→ Storage temperature	T_{stg}		−65 to + 150 °C
→ Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 10 V	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 10 V; T_j = 125 °C	I_{CBO}	<	5 μA
Saturation voltages			
I_C = 10 mA; I_B = 300 μA	V_{CEsat}	<	300 mV
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	250 mV
	V_{BEsat}		700 to 850 mV
I_C = 50 mA; I_B = 5 mA	V_{CEsat}	<	400 mV
	V_{BEsat}	<	1200 mV
D.C. current gain			
I_C = 1 mA; V_{CE} = 1 V	h_{FE}	>	25
I_C = 10 mA; V_{CE} = 1 V	h_{FE}		40 to 120
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	>	25
Transition frequency at f = 100 MHz			
I_C = 10 mA; V_{CE} = 10 V	f_T	>	400 MHz
		typ.	500 MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	<	4 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 1$ V	C_e	<	4,5 pF
Switching times			
Storage time $I_C = I_B = -I_{BM} = 10$ mA	t_s	<	13 ns
Turn on time when switched from $-V_{BE} = 1{,}5$ V to $I_C = 10$ mA; $I_B = 3$ mA	t_{on}	<	12 ns
Turn off time when switched from $I_C = 10$ mA; $I_B = 3$ mA to cut-off with $-I_{BM} = 1{,}5$ mA	t_{off}	<	18 ns

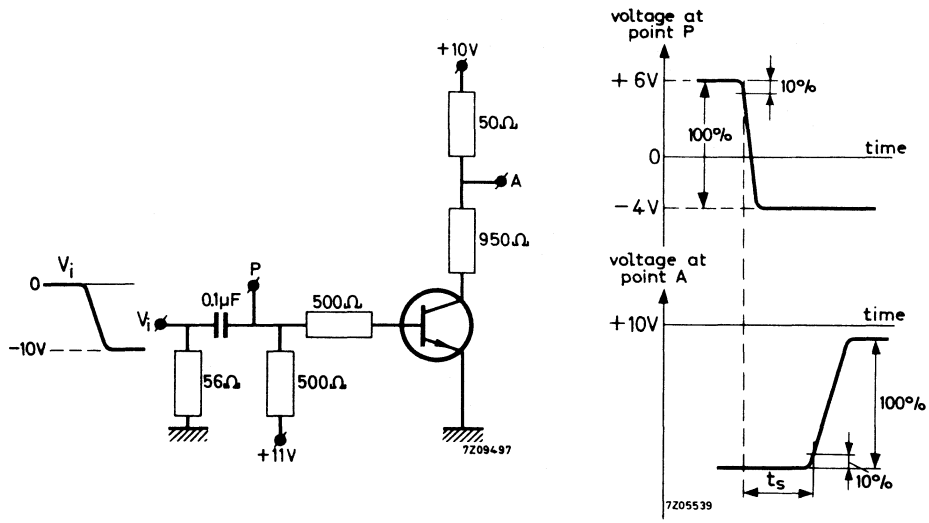


Fig. 2 Test circuit and waveform storage time.

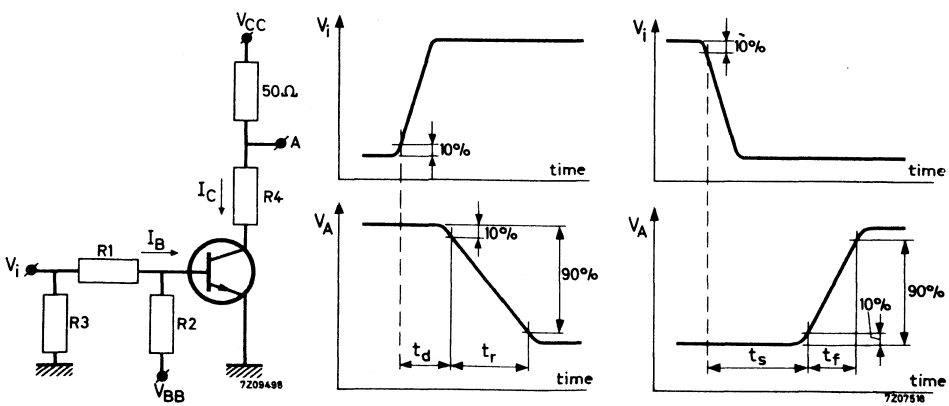


Fig. 3 Test circuit and waveforms turn on and turn off time.

Pulse generator:				Oscilloscope:			
Rise time	t_r	<	1 ns	Input impedance	R_i	=	50 Ω
Pulse duration	t	>	300 ns	Rise time	t_r	<	1 ns
Duty cycle	δ	<	0,02				
Source impedance	R_S	=	50 Ω				

							turn on time			turn off time	
I_C mA	I_B mA	$-I_{BM}$ mA	V_{CC} V	R_1; R_2 kΩ	R_3 Ω	R_4 Ω	$-V_{BB}$ V	$-V_{BE}$ V	V_i V	V_{BB} V	$-V_i$ V
10	3	1,5	3	3,3	50	220	3,0	1,5	15	12,0	15

$-I_{BM}$ is the reverse current that can flow during switching off. The indicated $-I_{BM}$ is determined and limited by the applied cut-off voltage and series resistance.

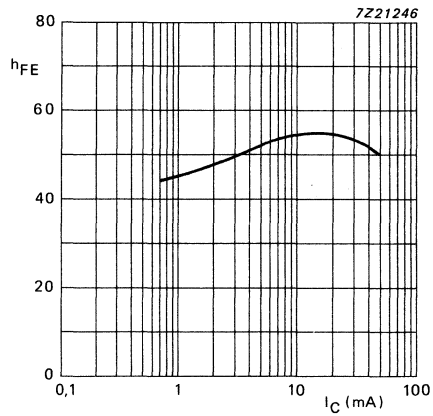


Fig. 4 V_{CE} = 1 V; T_j = 25 °C; typical values.

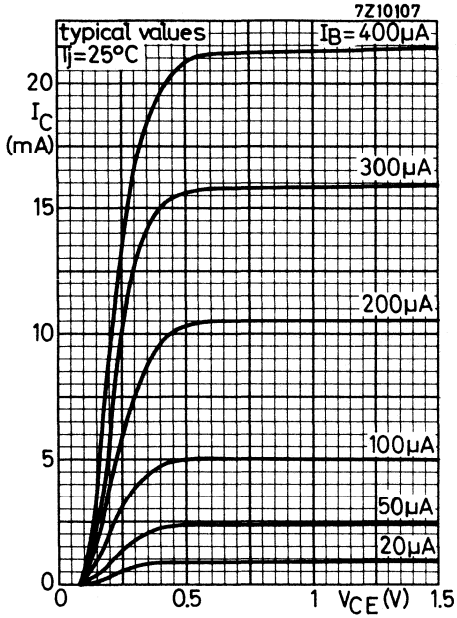

7Z10107
typical values
Tj=25°C
IB=400µA
300µA
200µA
100µA
50µA
20µA
IC (mA)
20
15
10
5
0
0
0.5
1
VCE(V)
1.5

Fig. 5

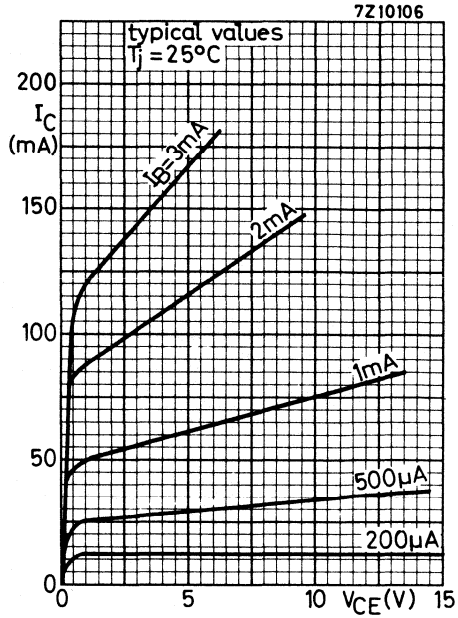

7Z10106
typical values
Tj=25°C
IB=3mA
2mA
1mA
500µA
200µA
IC (mA)
200
150
100
50
0
0
5
10
VCE(V)
15

Fig. 6

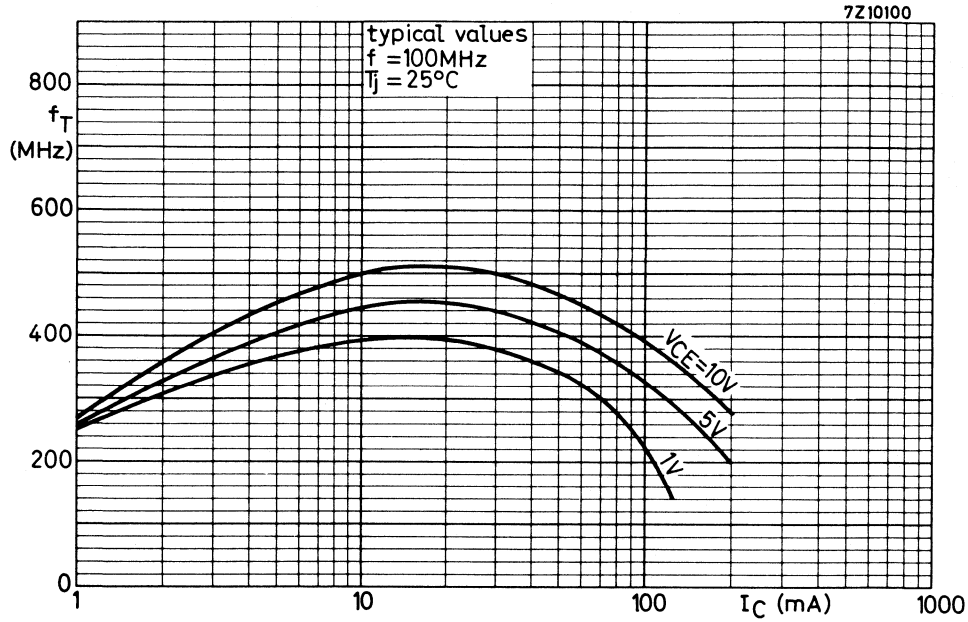

7Z10100
typical values
f =100MHz
Tj =25°C
800
fT
(MHz)
600
400
200
0
1
10
100
IC (mA)
1000
VCE=10V
5V
1V

Fig. 7

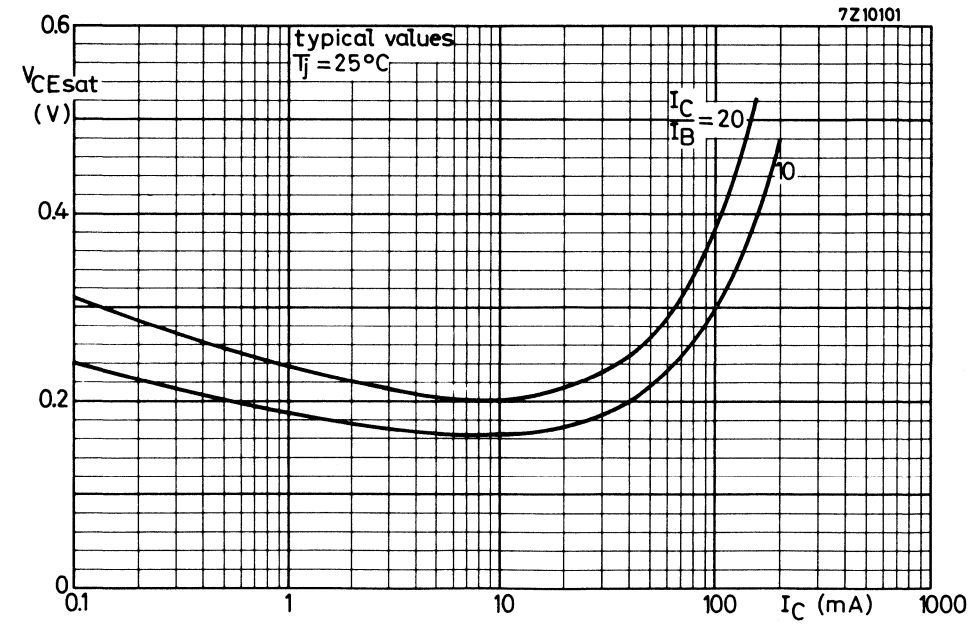

7Z10101
typical values
Tj =25°C
0.6
VCEsat
(V)
0.4
0.2
0
0.1
1
10
100
IC (mA)
1000
IC/IB =20
10

Fig. 8

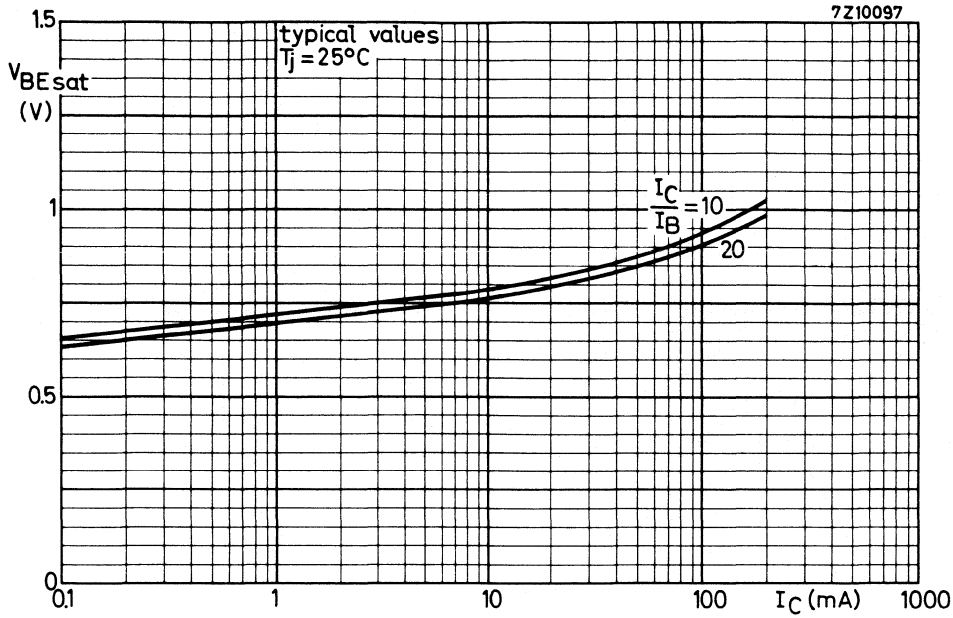


Fig. 9

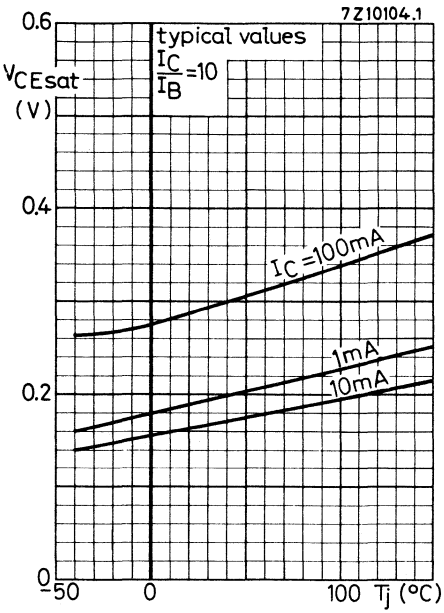


Fig. 10

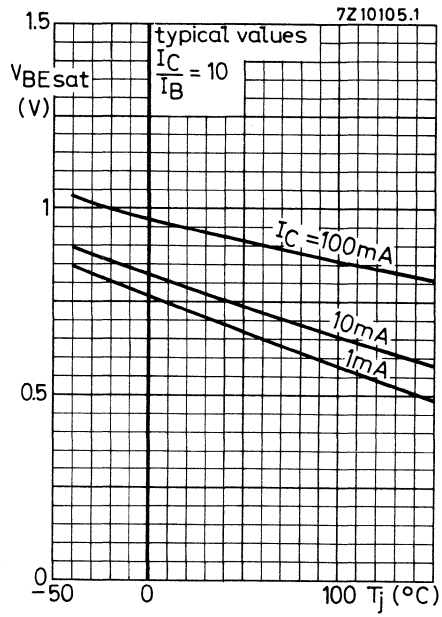


Fig. 11

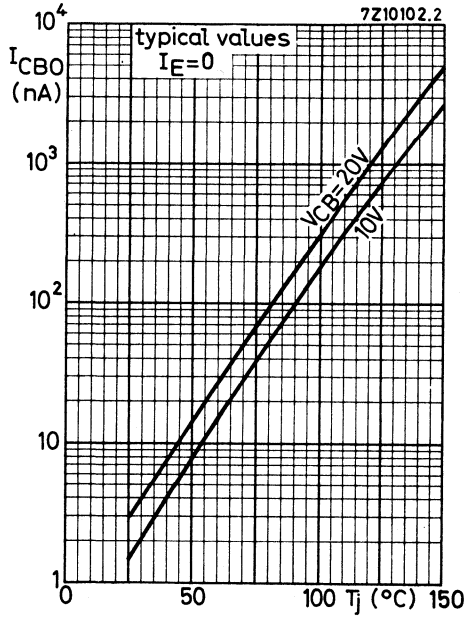

7Z10102.2
typical values
$I_E=0$
I_{CBO} (nA)
10^4
10^3
10^2
10
1
0
50
100
T_j (°C)
150
V_{CB}=20V
10V

Fig. 12

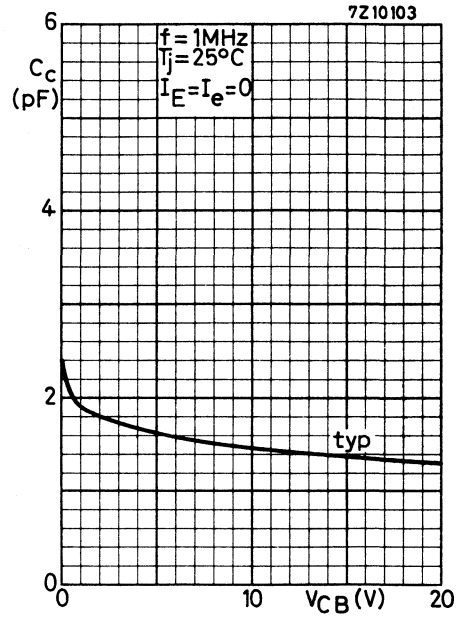

7Z10103
$f=1MHz$
$T_j=25°C$
$I_E=I_e=0$
C_c (pF)
6
4
2
0
typ
0
10
V_{CB} (V)
20

Fig. 13

CONTROLLED AVALANCHE RECTIFIER DIODES

Rectifier diodes in hermetically sealed leadless SMID* envelopes and intended for general purpose rectifier applications.

The device is capable of absorbing reverse transient energy.

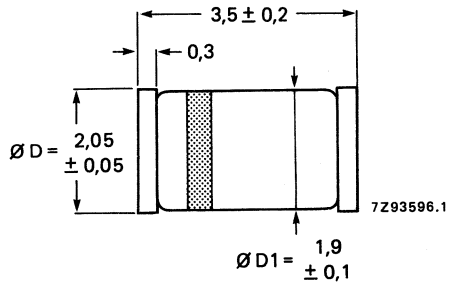
QUICK REFERENCE DATA

			BYD17D	G	J	K	M	
Crest working voltage	V_{RWM}	max.	200	400	600	800	1000	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	225	450	650	900	1100	V
		<	1600	1600	1600	1600	1600	V
Average forward current	$I_{F(AV)}$	max.			1.5			A
Non-repetitive peak forward current	I_{FSM}	max.			20			A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.			0.4			kW
Junction temperature	T_j	max.			175			°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-87.



* Surface-mounted implosion diode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BYD17D	G	J	K	M	
Crest working reverse voltage	V_{RWM}	max.	200	400	600	800	1000	V
Continuous reverse voltage	V_R	max.	200	400	600	800	1000	V
Average forward current (averaged over any 20 ms period								
T_{tp} = 105 °C; lead length 10 mm	$I_{F(AV)}$	max.			1.5			A
T_{amb} = 65 °C; p.c. board mounting	$I_{F(AV)}$	max.			0.6			A
Repetitive peak forward current T_{tp} = 55 °C; f = 50 Hz; a = 3; (inclusive derating for $T_{j\,max}$ at V_{RRM} = 1000 V	I_{FRM}	max.			5.5			A
Non-repetitive peak forward current t = 10 ms, half-sine wave $T_j = T_{j\,max}$ prior to surge $V_R = V_{RWM\,max}$	I_{FSM}	max.			20			A
Non-repetitive peak reverse power dissipation; t = 20 μs (half-sine wave); $T_j = T_{j\,max}$ prior to surge	P_{RSM}	max.			0.4			kW
Non-repetitive peak reverse avalanche energy; I_R = 0.34 A; $T_j = T_{j\,max}$ prior to surge; with inductive load switched off	E_{RSM}	max.			7			mJ
Storage temperature	T_{stg}				−65 to + 175			°C
Junction temperature	T_j	max.			175			°C

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point at a lead length of 10 mm	$R_{th\,j\text{-}tp}$	=	30 K/W
2. Thermal resistance from junction to ambient; device mounted on an 1,5 mm thick epoxy-glass printed circuit board; (see Fig. 2)	$R_{th\,j\text{-}a}$	=	150 K/W

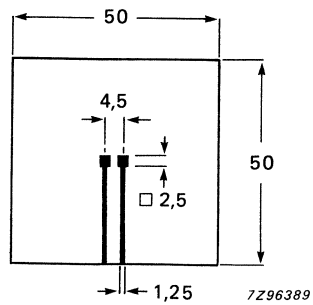


Fig. 2 Mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BYD17D	G	J	K	M	
Forward voltage*								
I_F = 1 A; $T_j = T_{j\,max}$	V_F	<	0,93	0,93	0,93	0,93	0,93	V
I_F = 1 A	V_F	<	1,05	1,05	1,05	1,05	1,05	V
Reverse avalanche breakdown voltage		>	225	450	650	900	1100	V
I_R = 0,1 mA	$V_{(BR)R}$	<	1600	1600	1600	1600	1600	V
Reverse current								
$V_R = V_{RWMmax}$	I_R	<			1			μA
$V_R = V_{RWMmax}$; T_j = 165 °C	I_R	<			100			μA
Diode capacitance								
V_R = 0; f = 1 MHz	C_d	typ.			21			pF

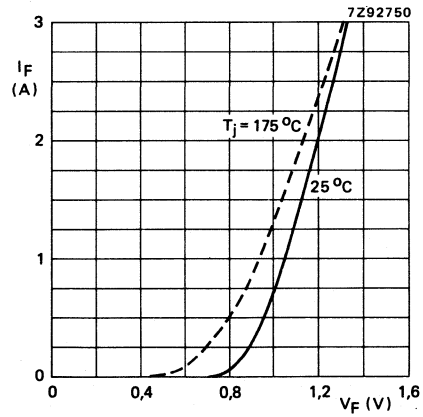


Fig. 3 Maximum forward voltage.

* Measured under pulse conditions to avoid excessive dissipation.

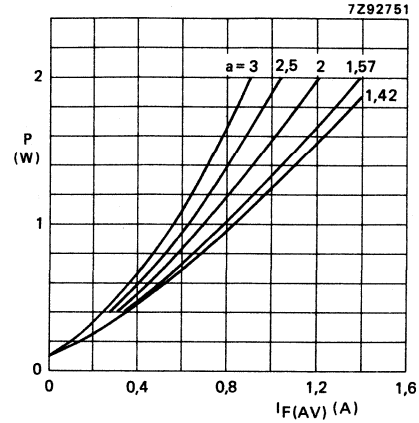


Fig. 4 Maximum values steady power dissipation (forward plus leakage current) as a function of the average (a) forward current. $a = I_{F(RMS)}/I_{F(AV)}$; $V_R = V_{RWMmax}$.

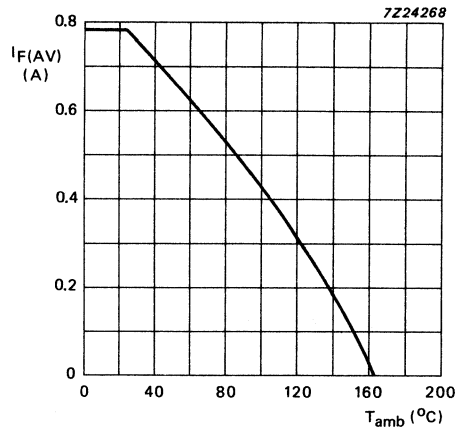


Fig. 5 Maximum average forward current as a function of temperature; the curves include losses due to reverse leakage.

$V_R = V_{RWMmax}$, $\delta = 0.5$; $a = 1.57$.

——— = ambient temperature and device mounted as shown in Fig. 2.

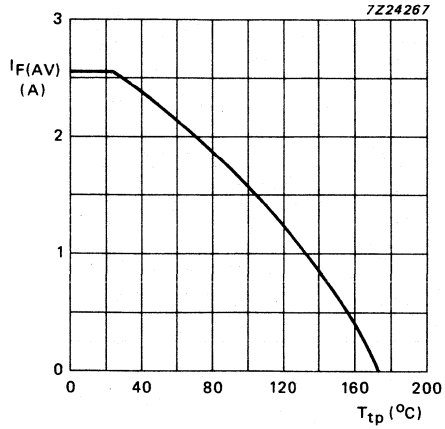


Fig. 6 Maximum average forward current as a function of temperature; the curves include losses due to reverse leakage.
$V_R = V_{RWMmax}$, $\delta = 0.5$; a = 1.57.
——— = tie-point temperature and device mounted as shown in Fig. 2.

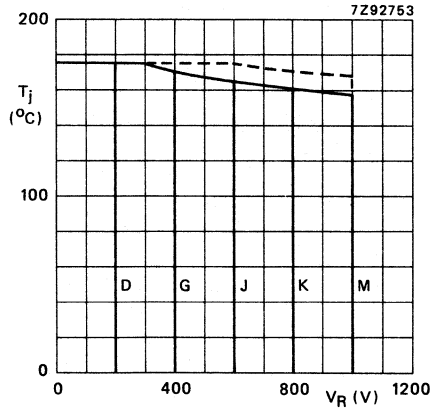


Fig. 7 Maximum permissible junction temperature as a function of reverse voltage;
——— = V_R; – – – – = V_{RWM}, $\delta = 0.5$.

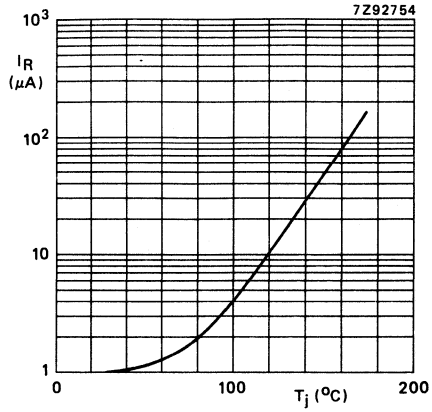


Fig. 8 Maximum values reverse current as a function of junction temperature; $V_R = V_{RWMmax}$.

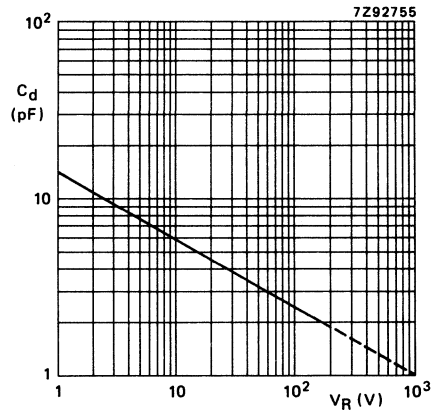
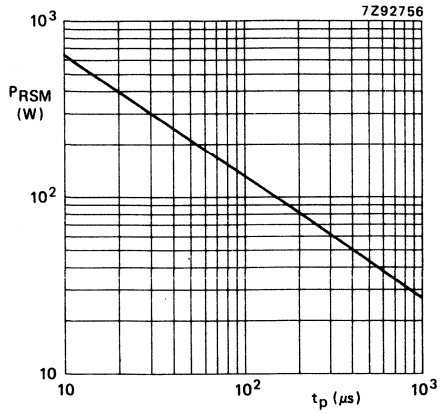


Fig. 9 Capacitance as a function of reverse voltage; f = 1 MHz; T_j = 25 °C; typical values.



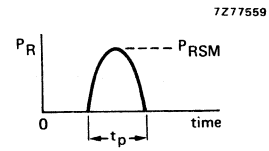


Fig. 10 Maximum permissible non-repetitive peak reverse power dissipation in the avalanche region; $T_j = T_{jmax}$.

AVALANCHE FAST SOFT-RECOVERY RECTIFIER DIODES

Rectifier diodes in hermetically sealed leadless SMID* envelopes. They are intended for television and industrial applications, such as switched-mode power supplies, scan rectifiers in TV receivers and also for use in inverter and converter applications. The devices feature non-snap-off (soft-recovery) switching characteristics and are capable of absorbing reverse transient energy (e.g. during flashover in a picture tube).

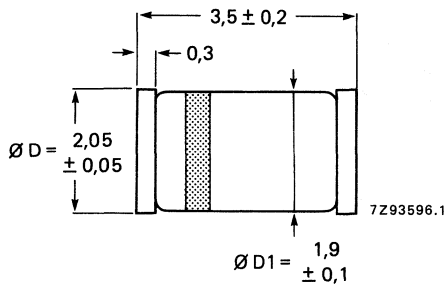
QUICK REFERENCE DATA

			BYD37D	G	J	K	M	
Repetitive peak reverse voltage	V_{RRM}	max.	200	400	600	800	1000	V
Continuous reverse voltage	V_R	max.	200	400	600	600	1000	V
Average forward current	$I_{F(AV)}$	max.		1,5		1,5		A
Non-repetitive peak forward current	I_{FSM}	max.		20		20		A
Non-repetitive peak reverse energy	E_{RSM}	max.		10		7		mJ
Reverse recovery time	t_{rr}	<		250		300		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-87.



* Surface mounted implosion diode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BYD37D	G	J	K	M	
Repetitive peak reverse voltage	V_{RRM}	max.	200	400	600	800	1000	V
Continuous reverse voltage	V_R	max.	200	400	600	800	1000	V
Average forward current (averaged over any 20 ms period)								
T_{tp} = 105 °C	$I_{F(AV)}$	max.		1,5		1,5		A
T_{amb} = 65 °C; p.c. board mounting	$I_{F(AV)}$	max.		0,6		0,6		A
Repetitive peak forward current	I_{FRM}	max.		12		12		A
Non-repetitive peak forward current t = 10 ms, half-sine wave; $T_j = T_{j\ max}$ prior to surge; $V_R = V_{RRMmax}$	I_{FSM}	max.		20		20		A
Non-repetitive peak reverse avalanche energy; I_R = 400 mA; $T_j = T_{j\ max}$, prior to surge; with inductive load switched off	E_{RSM}	max.		10		7		mJ
Storage temperature	T_{stg}				−65 to +175			°C
Junction temperature	T_j	max.			175			°C

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point	$R_{th\ j\text{-}tp}$	=	30	K/W
2. Thermal resistance from junction to ambient; device mounted on a 1,5 mm thick epoxy-glass printed circuit board; (see Fig. 2)	$R_{th\ j\text{-}a}$	=	150	K/W

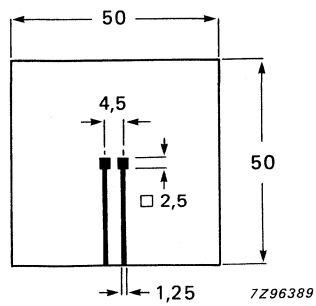


Fig. 2 Mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BYD37D	G	J	K	M	
Forward voltage*								
I_F = 1 A; $T_j = T_{j\,max}$	V_F	<	1,1	1,1	1,1	1,1	1,1	V
I_F = 1 A	V_F	<	1,3	1,3	,1,3	1,3	1,3	V
Reverse avalanche breakdown voltage								
I_R = 0,1 mA	$V_{(BR)R}$	>	300	500	700	900	1100	V
Reverse current								
$V_R = V_{RRMmax}$	I_R	<		1			1	μA
$V_R = V_{RRMmax}$; T_j = 165 °C	I_R	<		100			100	μA
Reverse recovery when switched from I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs								
recovery charge	Q_s	<		250			400	nC
recovery time	t_{rr}	<		250			300	ns
Maximum slope of reverse recovery current when switched from I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 1 A/μs	$\lvert dI_R/dt \rvert$	<		6			5	A/μs

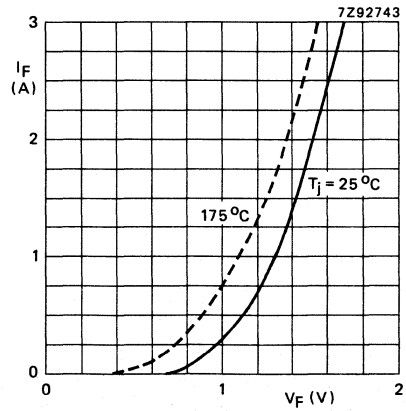


Fig. 3 Maximum forward voltage.

* Measured under pulse conditions to avoid excessive dissipation.

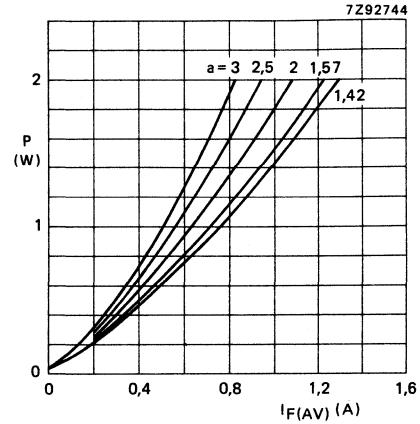


Fig. 4 Maximum values steady state power dissipation (forward plus leakage current) excluding switching losses as a function of the forward current. The graph is for switched-mode application.
$a = I_{F(RMS)}/I_{F(AV)}$; $V_R = V_{RRMmax}$.

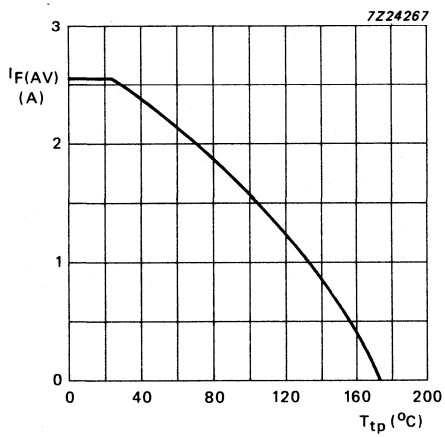


Fig. 5 Maximum average forward current as a function of temperature; the curve includes losses due to reverse leakage.
The graph is for switched-mode application.
$V_R = V_{RRMmax}$, $\delta = 0.5$; $a = 1.42$.
——— = tie-point temperature.

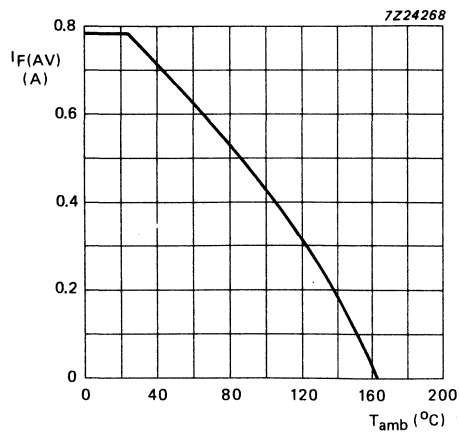


Fig. 6 Maximum average forward current as a function of temperature; the curve includes losses due to reverse leakage.
The graph is for switched-mode application.
$V_R = V_{RRMmax}$, $\delta = 0.5$; $a = 1.42$.
——— = ambient temperature and device mounted as shown in Fig. 2.

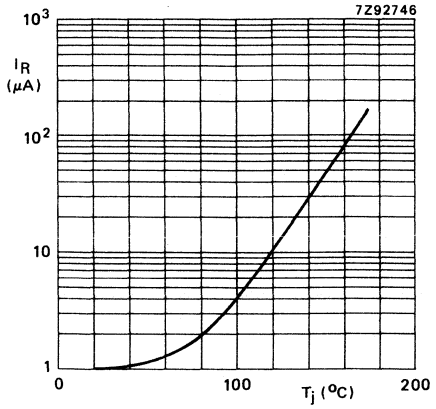


Fig. 7 Maximum values reverse current as a function of junction temperature.
$V_R = V_{RRMmax}$.

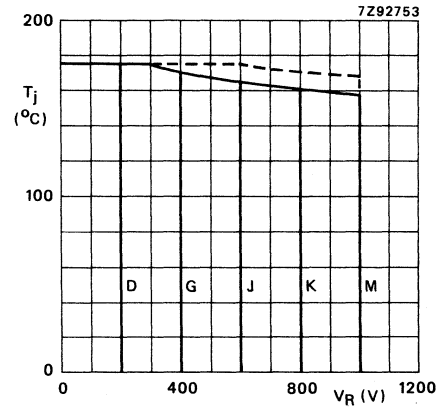


Fig. 8 Maximum permissible junction temperature as a function of reverse voltage.
——— = V_R; – – – = V_{RRM}; $\delta = 0.5$.

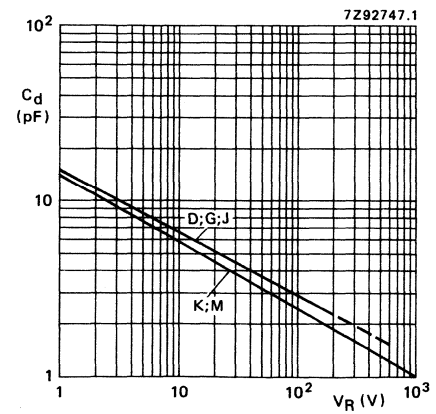


Fig. 9 Capacitance as a function of reverse voltage.
f = 1 MHz; T_j = 25 °C; typical values.

EPITAXIAL AVALANCHE DIODES

Rectifier diodes in hermetically sealed leadless SMID*-envelopes. They feature low forward voltage drop, very fast recovery, very low stored charge, non-snap-off switching characteristics and are capable of absorbing reverse transient energy (e.g. during flashover in a picture tube). These properties make the diodes very suitable for use in switched-mode power supplies and in general high-frequency circuits, where low conduction and switching losses are essential.

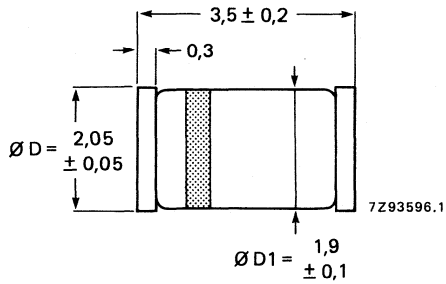
QUICK REFERENCE DATA

		BYD77A		B	C	D	E	F	G	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	250	300	400	V
Continuous reverse voltage	V_R	max.	50	100	150	200	250	300	400	V
Average forward current	$I_{F(AV)}$	max.	2	2	2	2	1,85	1,85	1,85	A
Non-repetitive peak forward current	I_{FSM}	max.	25	25	25	25	25	25	25	A
Non-repetitive peak reverse energy	E_{RSM}	max.	20	20	20	20	20	20	20	mJ
Reverse recovery time	t_{rr}	<	25	25	25	25	50	50	50	ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-87.



* Surface-mounted implosion diode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BYD77A	B	C	D	E	F	G	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	250	300	400	V
Continuous reverse voltage	V_R	max.	50	100	150	200	250	300	400	V
Average forward current square wave; $\delta = 0,5$										
$T_{tp} = 105\ ^oC$	$I_{F(AV)}$	max.	2	2	2	2	1,85	1,85	1,85	A
$T_{amb} = 60\ ^oC$; p.c.b. mounting	$I_{F(AV)}$	max.	0,85	0,85	0,85	0,85	0,8	0,8	0,8	A
Repetitive peak forward current	I_{FRM}	max.	15	15	15	15	13	13	13	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) $T_j = T_{j\,max}$ prior to surge; with reapplied V_{RRM}	I_{FSM}	max.				25				A
Non-repetitive peak reverse avalanche energy; with inductive load switched off:										
$I_R = 600$ mA at $T_j = 25\ ^oC$ prior to surge	E_{RSM}	max.				20				mJ
$I_R = 400$ mA at $T_j = T_{j\,max}$ prior to surge	E_{RSM}	max.				10				mJ
Storage temperature	T_{stg}					−65 to + 175				^oC
Junction temperature	T_j	max.				175				^oC

THERMAL RESISTANCE

Influence of mounting method				
1. Thermal resistance from junction to tie-point	$R_{th\,j\text{-}tp}$	=	30	K/W
2. Thermal resistance from junction to ambient when mounted on a 1,5 mm thick epoxy-glass printed-circuit board; Cu-thickness $\geqslant 40\ \mu m$; Fig 2.	$R_{th\,j\text{-}a}$	=	150	K/W

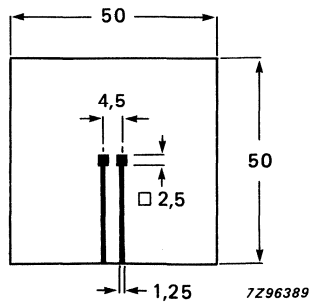


Fig 2. Mounted on a printed-circuit board.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BYD77A	B	C	D	E	F	G	
Reverse avalanche breakdown voltage										
I_R = 0,1 mA	$V_{(BR)R}$	>	55	110	165	220	275	330	440	V
Forward voltage*										
I_F = 1 A; $T_j = T_{j\,max}$	V_F	<	0,74	0,74	0,74	0,74	0,83	0,83	0,83	V
I_F = 1 A	V_F	<	0,95	0,95	0,95	0,95	1,05	1,05	1,05	V
Reverse current										
$V_R = V_{RRMmax}$	I_R	<	1	1	1	1	1	1	1	μA
$V_R = V_{RRMmax}$; T_j = 165 °C	I_R	<	100	100	100	100	100	100	100	μA
Reverse recovery time when switched from I_F = 0,5 A to I_R = 1 A; measured at I_R = 0,25 A	t_{rr}	<	25	25	25	25	50	50	50	ns

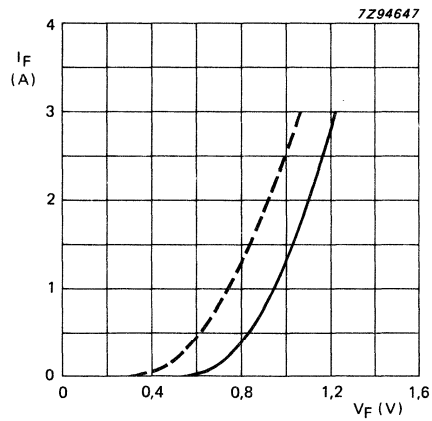


Fig. 3 **BYD77A; B; C; D.**
Maximum forward voltage.
—— T_j = 25 °C; – – – T_j = 175 °C.

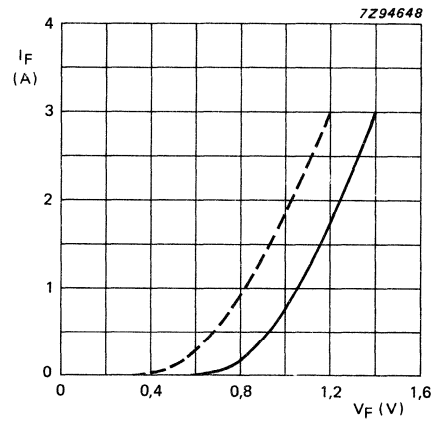


Fig. 4 **BYD77E; F; G.**
Maximum forward voltage.
—— T_j = 25 °C; – – – T_j = 175 °C.

* Measured under pulse conditions to avoid excessive dissipation.

REGULATOR DIODES

Diodes in hermetically sealed leadless SMID* glass envelopes.
They are intended for use as voltage regulator and transient suppressor diodes in medium power regulation and transient suppression circuits.
The series consists of BZD27-C7V5 to BZD27-C510 in the normalized E24 range.

QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage range	V_Z	nom.	7.5 to 270		V
Stand-off voltage	V_R			6.2 to 430	V
Total power dissipation	P_{tot}	max.	2.3		W
Non-repetitive peak reverse power dissipation T_j = 25 °C; t_p = 100 μs	P_{RSM}	max.	300		W

MECHANICAL DATA

Dimensions in mm

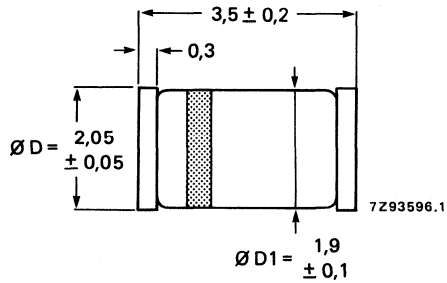


Fig. 1 SOD-87.

* Surface mounted implosion diode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Total power dissipation			
T_{tp} = 105 °C	P_{tot}	max.	2.3 W
T_{amb} = 55 °C; PCB mounting (Fig. 2)	P_{tot}	max.	0.8 W
Non-repetitive peak reverse power dissipation			
t_p = 100 μs, square pulse; T_j = 25 °C (prior to surge) waveforms	P_{RSM}	max.	300 W
waveform 10/1000 exponential pulse (Fig. 3); T_j = 25 °C (prior to surge)	P_{RSM}	max.	150 W
Storage temperature	T_{stg}	−65 to +	175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point	$R_{thj\text{-}tp}$	=	30 K/W
2. Thermal resistance from junction to ambient when mounted on a 1.5 mm thick epoxy glass PCB; Cu-thickness ⩾ 40 μm; Fig. 2.			

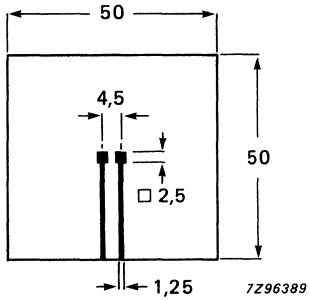


Fig. 2 Mounted on a printed-circuit board.

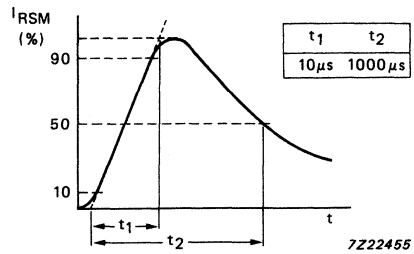


Fig. 3 Current pulse in accordance with IEC 60-2, Section 6.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 0.2 A	V_F	<	1.2 V

	temperature coefficient S_Z %/K		test current I_Z mA	reverse current at reverse voltage		working voltage V_Z V			differential resistance r_{diff} Ω	
	min.	max.		max μA	V	min.	nom.	max.	typ.	max.
C7V5	0	0.07	100	50	3	7.0	7.5	7.9	1	2
C8V2	0.03	0.08	100	10	3	7.7	8.2	8.7	1	2
C9V1	0.03	0.08	50	10	5	8.5	9.1	9.6	2	4
C10	0.05	0.09	50	7	7.5	9.4	10.0	10.6	2	4
C11	0.05	0.10	50	3	8.2	10.4	11.0	11.6	4	7
C12	0.05	0.10	50	2	9.1	11.4	12.0	12.7	4	7
C13	0.05	0.10	50	2	10	12.4	13.0	14.1	5	10
C15	0.05	0.10	50	1	11	13.8	15.0	15.6	5	10
C16	0.06	0.11	25	1	12	15.3	16.0	17.1	6	15
C18	0.06	0.11	25	1	13	16.8	18.0	19.1	6	15
C20	0.06	0.11	25	1	15	18.8	20.0	21.2	6	15
C22	0.06	0.11	25	1	16	20.8	22.0	23.3	6	15
C24	0.06	0.11	25	1	18	22.8	24.0	25.6	7	15
C27	0.06	0.11	25	1	20	25.1	27.0	28.9	7	15
C30	0.06	0.11	25	1	22	28	30	32	8	15
C33	0.06	0.11	25	1	24	31	33	35	8	15
C36	0.06	0.11	10	1	27	34	36	38	21	40
C39	0.06	0.11	10	1	30	37	39	41	21	40
C43	0.07	0.12	10	1	33	40	43	46	24	45
C47	0.07	0.12	10	1	36	44	47	50	24	45
C51	0.07	0.12	10	1	39	48	51	54	25	60
C56	0.07	0.12	10	1	43	52	56	60	25	60
C62	0.08	0.13	10	1	47	58	62	66	25	80
C68	0.08	0.13	10	1	51	64	68	72	25	80
C75	0.08	0.13	10	1	56	70	75	79	30	100
C82	0.08	0.13	10	1	62	77	82	87	30	100
C91	0.09	0.13	5	1	68	85	91	96	60	200
C100	0.09	0.13	5	1	75	94	100	106	60	200
C110	0.09	0.13	5	1	82	104	110	116	80	250
C120	0.09	0.13	5	1	91	114	120	127	80	250
C130	0.09	0.13	5	1	100	124	130	141	110	300
C150	0.09	0.13	5	1	110	138	150	156	130	300
C160	0.09	0.13	5	1	120	153	160	171	150	350
C180	0.09	0.13	5	1	130	168	180	191	180	400
C200	0.09	0.13	5	1	150	188	200	212	200	500
C220	0.09	0.13	2	1	160	208	220	233	350	750
C240	0.09	0.13	2	1	180	228	240	256	400	850
C270	0.09	0.13	2	1	200	251	270	289	450	1000

CHARACTERISTICS when used as transient suppressor diodes; T_j = 25 °C

BZD27	clamping voltage (10/1000 pulse) $V_{(CL)R}$ V	non-repetitive at peak reverse I_{RSM} A	reverse current at recommended stand-off voltage I_R μA	V_R V
	max.		max.	
C7V5	11.3	13.3	1500	6.2
C8V2	12.3	12.2	1200	6.8
C9V1	13.3	11.3	100	7.5
C10	14.8	10.1	20	8.2
C11	15.7	9.6	5	9.1
C12	17.0	8.8	5	10
C13	18.9	7.9	5	11
C15	20.9	7.2	5	12
C16	22.9	6.6	5	13
C18	25.6	5.9	5	15
C20	28.4	5.3	5	16
C22	31.0	4.8	5	18
C24	33.8	4.4	5	20
C27	38.1	3.9	5	22
C30	42.2	3.6	5	24
C33	46.2	3.2	5	27
C36	50.1	3.0	5	30
C39	54.1	2.8	5	33
C43	60.7	2.5	5	36
C47	65.5	2.3	5	39
C51	70.8	2.1	5	43
C56	78.6	1.9	5	47
C62	86.5	1.7	5	51
C68	94.4	1.6	5	56
C75	103.5	1.5	5	62
C82	114.0	1.3	5	68
C91	126	1.2	5	75
C100	139	1.1	5	82
C110	152	1.0	5	91
C120	167	0.90	5	100
C130	185	0.81	5	110
C150	204	0.73	5	120
C160	224	0.67	5	130
C180	249	0.60	5	150
C200	276	0.54	5	160
C220	305	0.50	5	180
C240	336	0.45	5	200
C270	380	0.40	5	220
C300	419	0.36	5	240
C330	459	0.33	5	270
C360	498	0.30	5	300
C390	537	0.28	5	330
C430	603	0.25	5	360
C470	655	0.23	5	390
C510	707	0.21	5	430

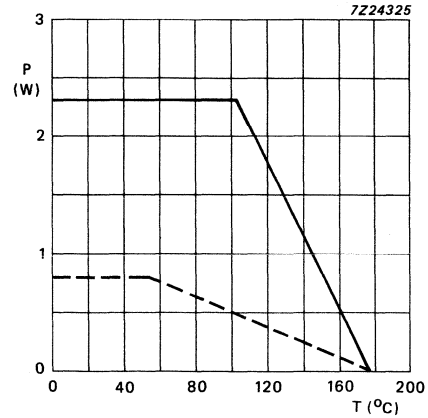


Fig. 4 Maximum total power dissipation as a function of temperature.

——— = tie-point temperature
– – – = ambient temperature and device mounted ans shown in Fig. 2.

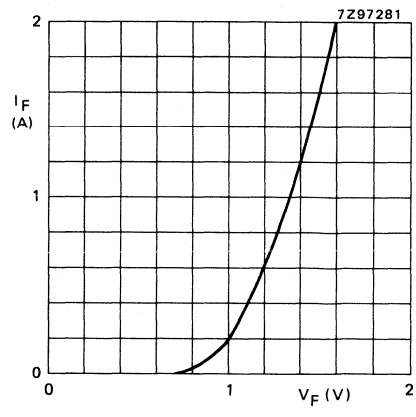


Fig. 5 Forward voltage; T_j = 25 °C; typical values.

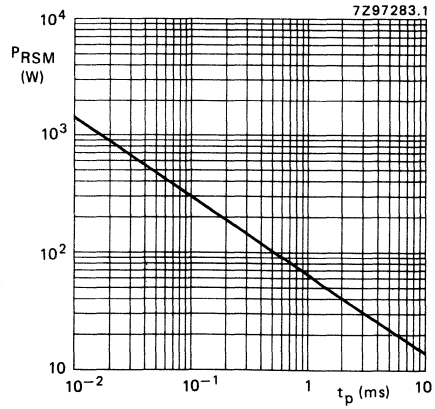


Fig. 6 Maximum non-repetitive peak reverse power dissipation (square pulse); T_j = 25 °C prior to surge.

SILICON PLANAR VOLTAGE REGULATOR DIODES

Silicon planar voltage regulator diodes, in a SOT-89 plastic envelope, intended for stabilization applications in thick and thin-film circuits.

The series covers the normalized range of nominal working voltages from 2,4 V to 75 V with a tolerance of ± 5% (international standard E24 range).

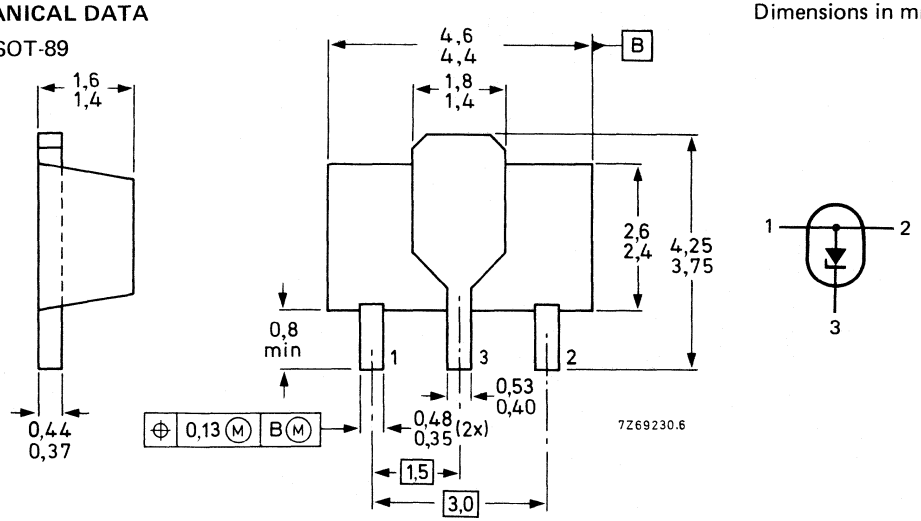
QUICK REFERENCE DATA

Working voltage range	V_Z	nom.	2,4 to 75 V
Working voltage tolerance (E24 range)			±5 %
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89



BOTTOM VIEW

Marking code

BZV49- C2V4 = 2Y4	C5V1 = 5Y1	C12 = 12Y	C33 = 33Y
C2V7 = 2Y7	C5V6 = 5Y6	C13 = 13Y	C36 = 36Y
C3V0 = 3Y0	C6V2 = 6Y2	C15 = 15Y	C39 = 39Y
C3V3 = 3Y3	C6V8 = 6Y8	C16 = 16Y	C43 = 43Y
C3V6 = 3Y6	C7V5 = 7Y5	C18 = 18Y	C47 = 47Y
C3V9 = 3Y9	C8V2 = 8Y2	C20 = 20Y	C51 = 51Y
C4V3 = 4Y3	C9V1 = 9Y1	C22 = 22Y	C56 = 56Y
C4V7 = 4Y7	C10 = 10Y	C24 = 24Y	C62 = 62Y
	C11 = 11Y	C27 = 27Y	C68 = 68Y
		C30 = 30Y	C75 = 75Y

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak forward current	I_{FRM}	max.	250	mA
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	250	mA
Working current (d.c.)	I_Z	limited by P_{tot} max		
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Non-repetitive peak reverse power dissipation * T_j = 25 °C; t_p = 100 μs	P_{ZSM}	max.	40	W
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	15	K/W
From junction to ambient in free air *	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C

Forward voltage I_F = 50 mA		V_F	<	1,0	V
Reverse current					
BZV49- C2V4	V_R = 1 V	I_R	<	50	μA
C2V7	V_R = 1 V	I_R	<	20	μA
C3V0	V_R = 1 V	I_R	<	10	μA
C3V3	V_R = 1 V	I_R	<	5	μA
C3V6	V_R = 1 V	I_R	<	5	μA
C3V9	V_R = 1 V	I_R	<	3	μA
C4V3	V_R = 1 V	I_R	<	3	μA
C4V7	V_R = 2 V	I_R	<	3	μA
C5V1	V_R = 2 V	I_R	<	2	μA
C5V6	V_R = 2 V	I_R	<	1	μA
C6V2	V_R = 4 V	I_R	<	3	μA
C6V8	V_R = 4 V	I_R	<	2	μA
C7V5	V_R = 5 V	I_R	<	1	μA
C8V2	V_R = 5 V	I_R	<	700	nA
C9V1	V_R = 6 V	I_R	<	500	nA
C10	V_R = 7 V	I_R	<	200	nA
C11 to C13	V_R = 8 V	I_R	<	100	nA
C15 to C75	V_R = 0,7 V_{Znom}	I_R	<	50	nA

* Device mounted on a ceramic substrate: area = 2,5 cm²; thickness = 0,7 mm.

T_j = 25 °C

E24 logarithmic range (tolerance ± 5%)

BZV49-...	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			diode capacitance C_d(pF); f = 1 MHz V_R = 0	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
C2V4	2,2	2,6	70	100	−3,5	−1,6	0	375	450
C2V7	2,5	2,9	75	100	−3,5	−2,0	0	350	450
C3V0	2,8	3,2	80	95	−3,5	−2,1	0	350	450
C3V3	3,1	3,5	85	95	−3,5	−2,4	0	325	450
C3V6	3,4	3,8	85	90	−3,5	−2,4	0	300	450
C3V9	3,7	4,1	85	90	−3,5	−2,5	0	300	450
C4V3	4,0	4,6	80	90	−3,5	−2,5	0	275	450
C4V7	4,4	5,0	50	80	−3,5	−1,4	0,2	130	180
C5V1	4,8	5,4	40	60	−2,7	−0,8	1,2	110	160
C5V6	5,2	6,0	15	40	−2,0	1,2	2,5	95	140
C6V2	5,8	6,6	6	10	0,4	2,3	3,7	90	130
C6V8	6,4	7,2	6	15	1,2	3,0	4,5	85	110
C7V5	7,0	7,9	6	15	2,5	4,0	5,3	80	100
C8V2	7,7	8,7	6	15	3,2	4,6	6,2	75	95
C9V1	8,5	9,6	6	15	3,8	5,5	7,0	70	90
C10	9,4	10,6	8	20	4,5	6,4	8,0	70	90
C11	10,4	11,6	10	20	5,4	7,4	9,0	65	85
C12	11,4	12,7	10	25	6,0	8,4	10,0	65	85
C13	12,4	14,1	10	30	7,0	9,4	11,0	60	80
C15	13,8	15,6	10	30	9,2	11,4	13,0	55	75
C16	15,3	17,1	10	40	10,4	12,4	14,0	52	75
C18	16,8	19,1	10	45	12,4	14,4	16,0	47	70
C20	18,8	21,2	15	55	14,4	16,4	18,0	36	60
C22	20,8	23,3	20	55	16,4	18,4	20,0	34	60
C24	22,8	25,6	25	70	18,4	20,4	22,0	33	55
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA				
C27	25,1	28,9	25	80	21,4	23,4	25,3	30	50
C30	28,0	32,0	30	80	24,4	26,6	29,4	27	50
C33	31,0	35,0	35	80	27,4	29,7	33,4	25	45
C36	34,0	38,0	35	90	30,4	33,0	37,4	23	45
C39	37,0	41,0	40	130	33,4	36,4	41,2	21	45
C43	40,0	46,0	45	150	37,6	41,2	46,6	21	40
C47	44,0	50,0	50	170	42,0	46,1	51,8	19	40
C51	48,0	54,0	60	180	46,6	51,0	57,2	19	40
C56	52,0	60,0	70	200	52,2	57,0	63,8	18	40
C62	58,0	66,0	80	215	58,8	64,4	71,6	17	35
C68	64,0	72,0	90	240	65,6	71,7	79,8	17	35
C75	70,0	79,0	95	255	73,4	80,2	88,6	16,5	35

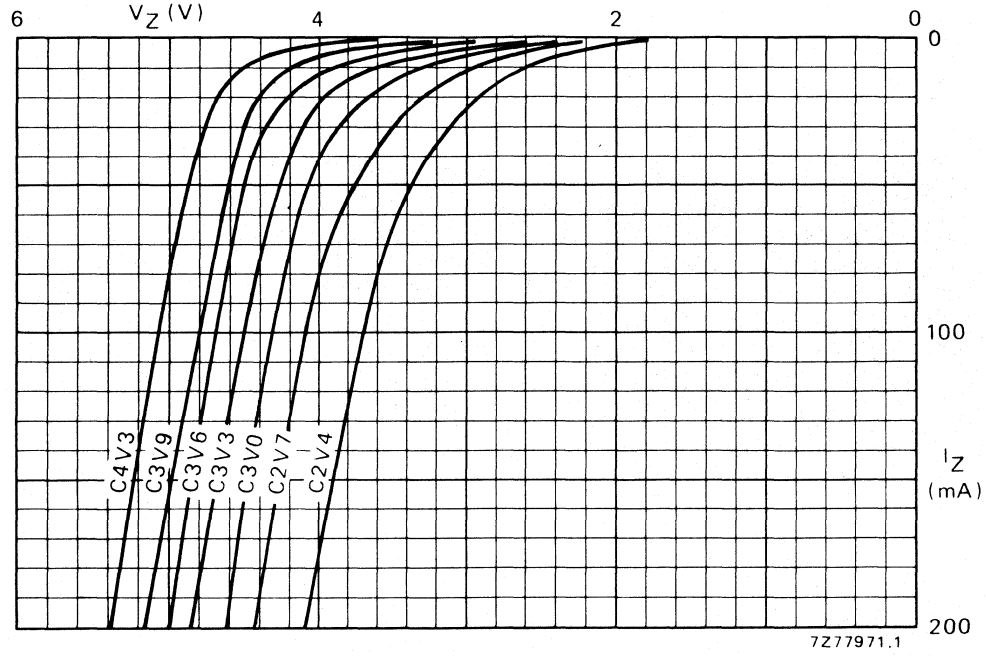


Fig. 2 Dynamic characteristics; typical values; T_j = 25 °C.

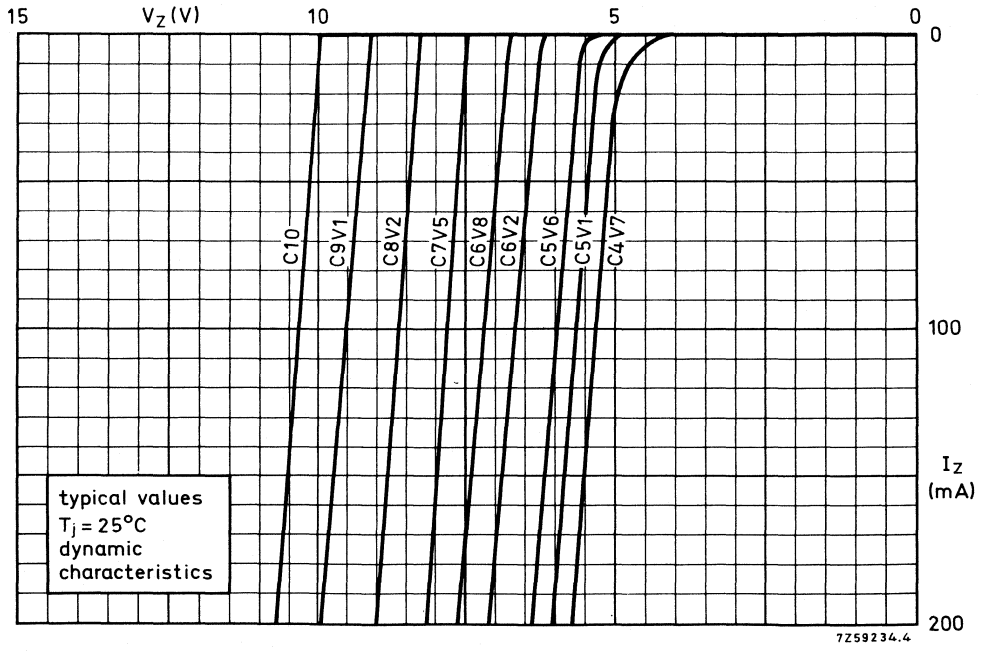


Fig. 3 Dynamic characteristics; typical values at T_j = 25 °C.

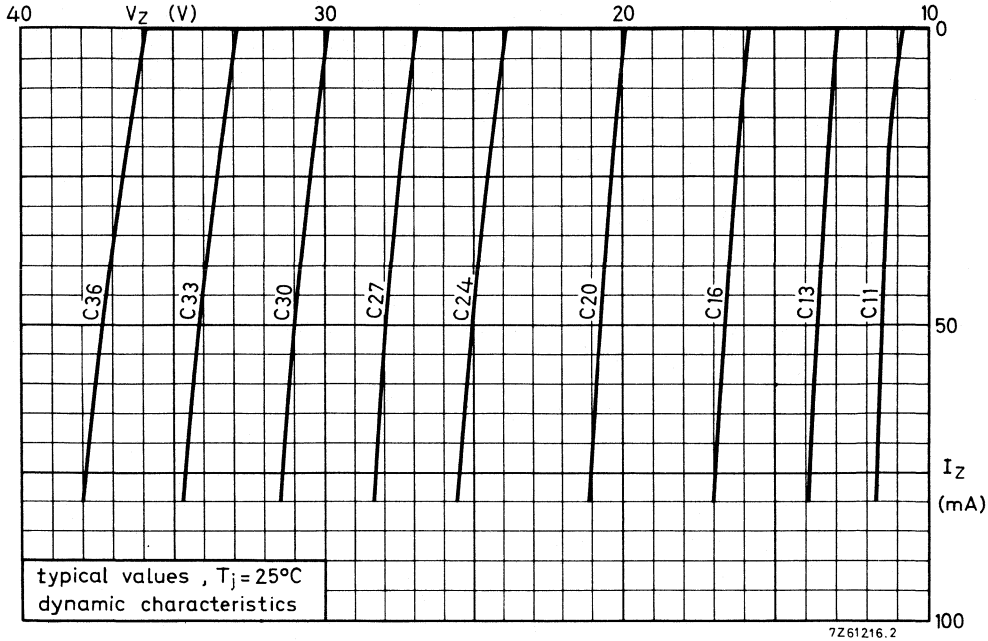


Fig. 4 Dynamic characteristics; typical values; T_j = 25 °C.

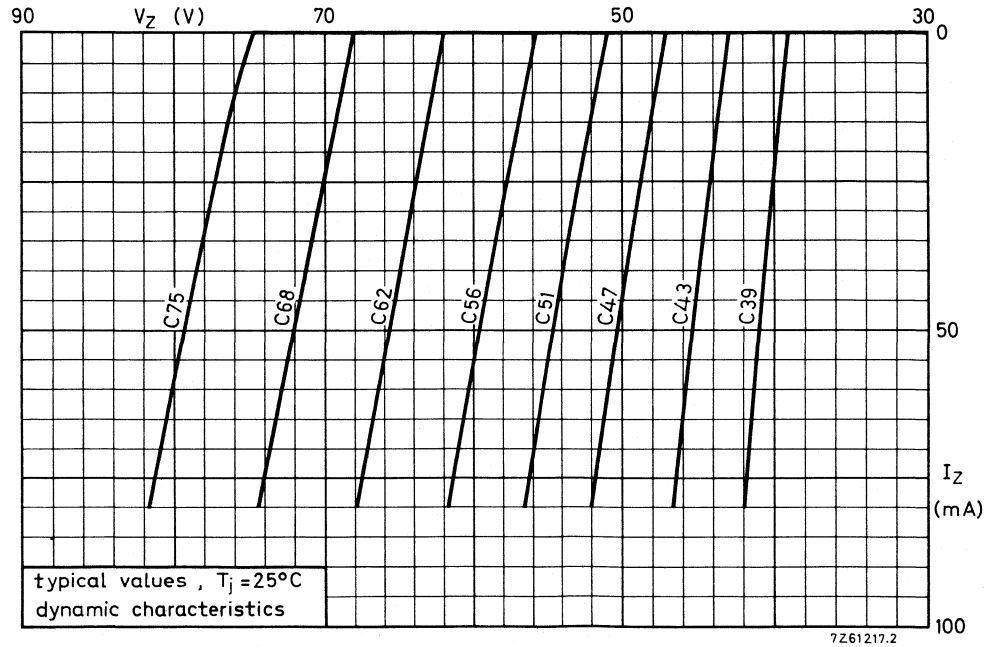


Fig. 5 Dynamic characteristics; typical values at T_j = 25 °C.

Model for calculating the static working voltage ($V_{Z\ stat}$).

This model can be derived from $V_{Z\ stat} = V_{Z\ dyn} + \Delta V_Z$ of which $V_{Z\ dyn}$ is given in the preceding tables and can be derived from the typical dynamic characteristic curves (Figs 2, 3, 4 and 5)
$\Delta V_Z = \Delta T \times S_Z$. For S_Z see tables and graphs S_Z versus T_j.
$\Delta T = P_{tot} \times R_{th\ j\text{-}a} = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a}$.
Following $\Delta V_Z = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$ and the model will be:

$$V_{Z\ stat} = V_{Z\ dyn} + I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$$

Calculating example

BZV49-C24 mounted on a ceramic substrate of 7 x 5 x 0,6 mm; at I_Z = 7 mA.

$$V_{Z\ stat} = 24 + \left(\frac{7}{1000} \times 24 \times \frac{125}{1000} \times 20{,}3\right)$$
$$= 24 + 0{,}4 = 24{,}4\ V.$$

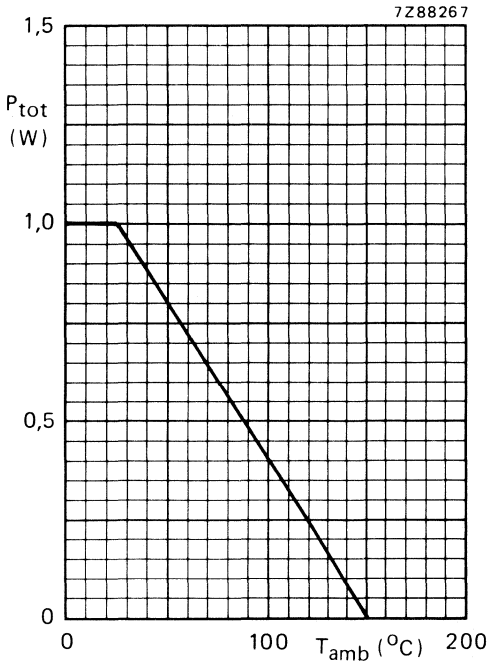


Fig. 6 Power derating curve.

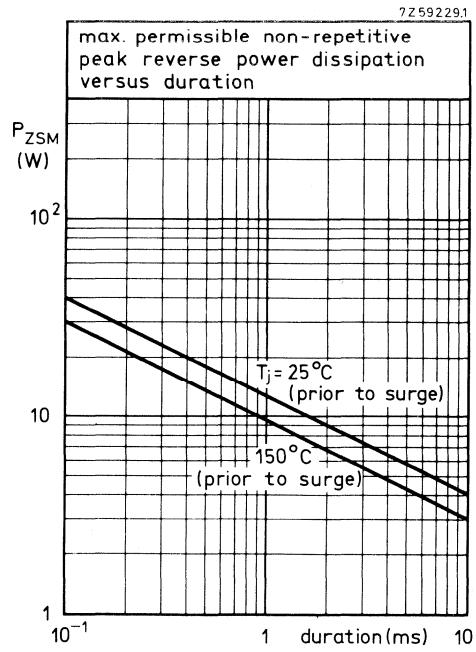


Fig. 7.

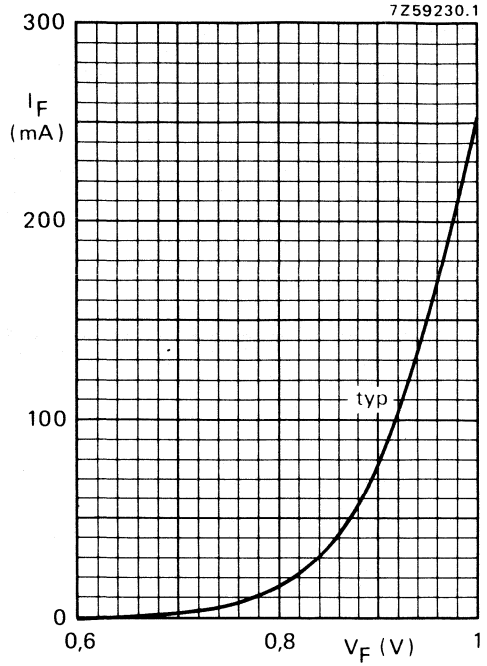


Fig. 8 T_j = 25 °C.

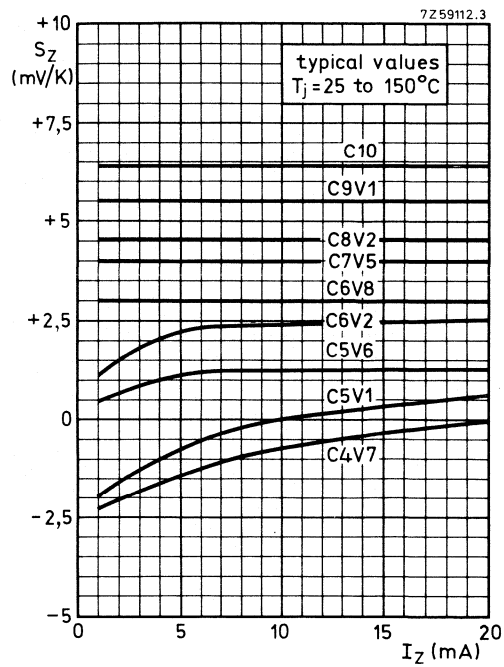


Fig. 9.

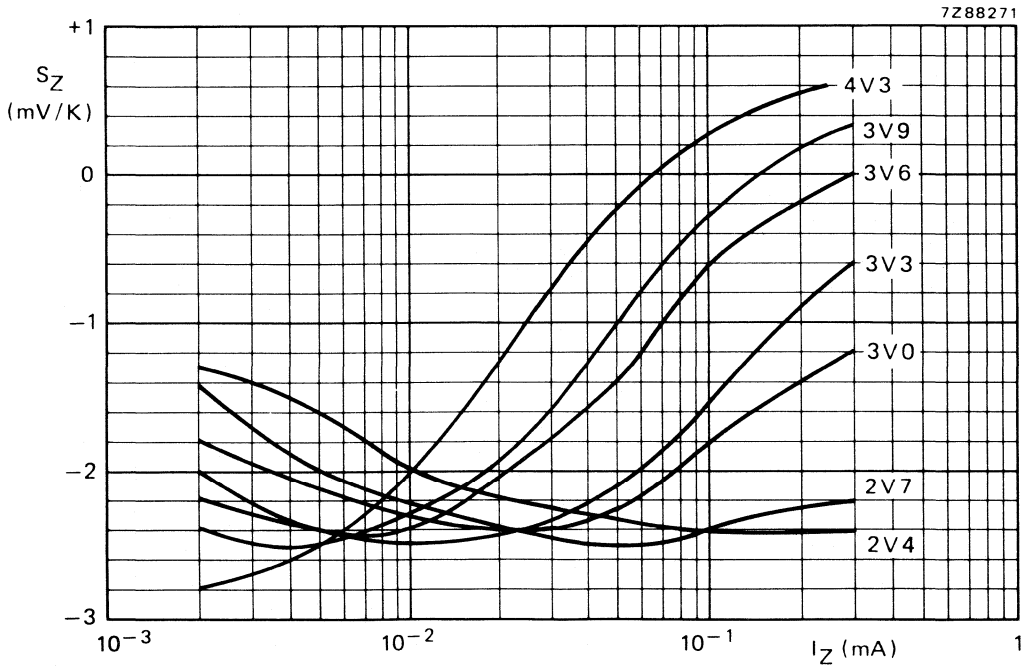


Fig. 10 Typical values temperature coefficient.

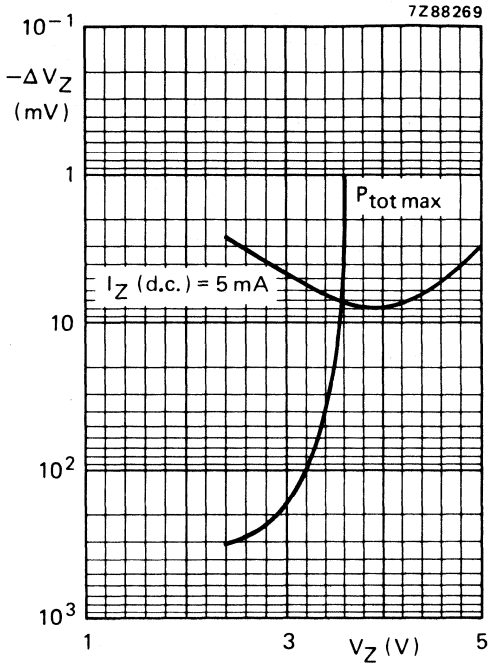


Fig. 11 Typical change of working voltage; T_j = 25 °C.

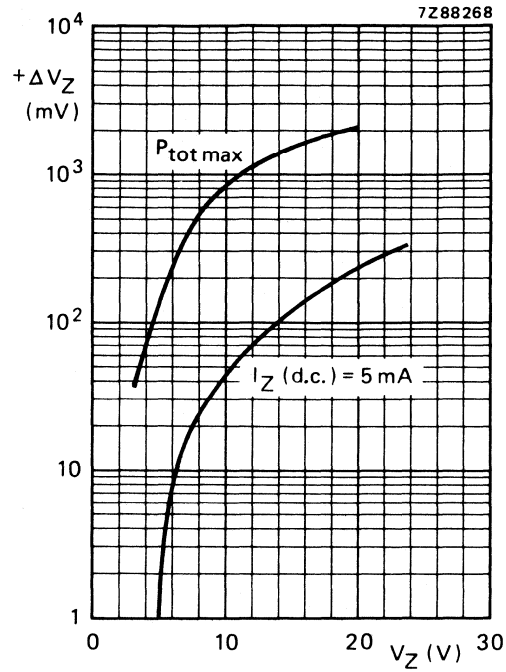


Fig. 12 Typical change of working voltage; T_{amb} = 25 °C.

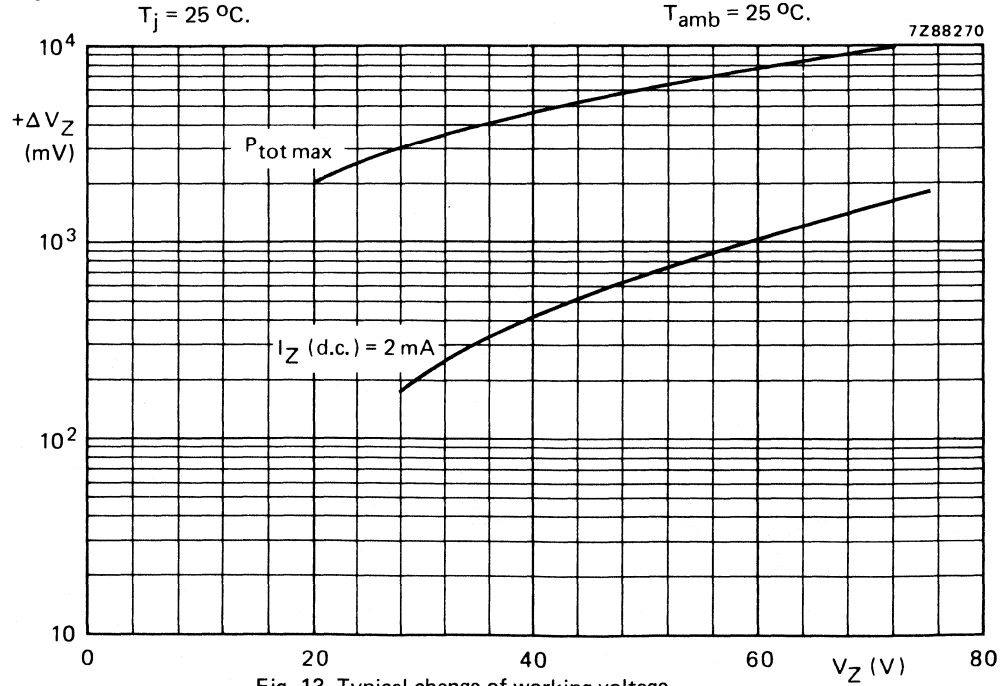


Fig. 13 Typical change of working voltage.

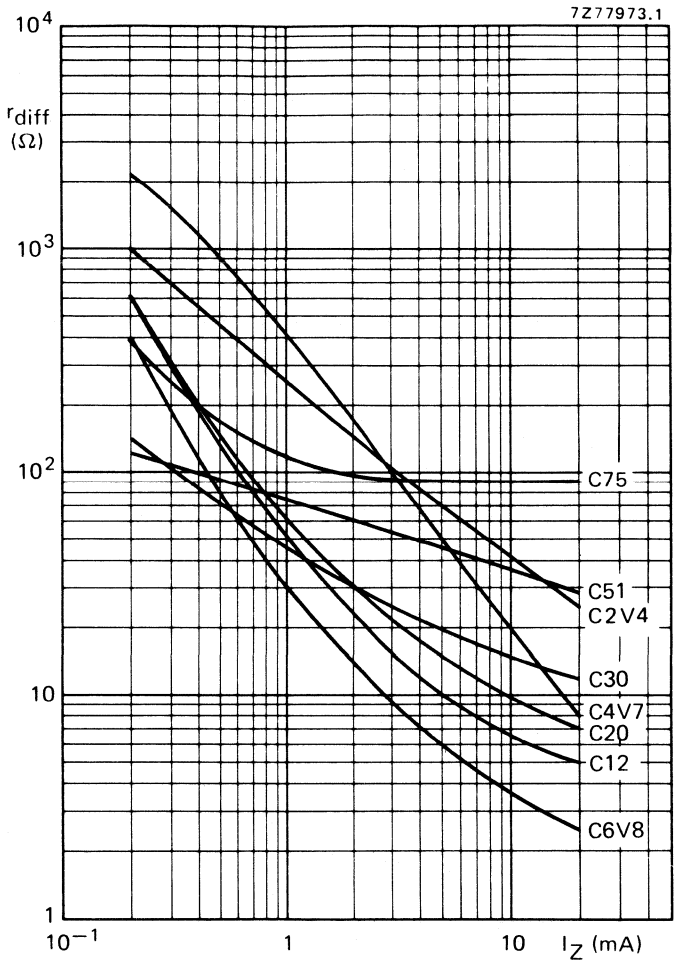


Fig. 14 Typical values; T_j = 25 °C; f = 1 kHz.

VOLTAGE REGULATOR DIODES FOR SURFACE MOUNTING

Silicon planar diodes designed for use as low-voltage stabilizers or voltage references. They are available in the international standardized E24 (± 5%) range, and also in tolerance ranges of 2% and 3%. The series consists of 37 types with nominal working voltages ranging from 2,4 V to 75 V.

The SM diode is a leadless diode in a hermetically sealed glass SOD-80 envelope with tin plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

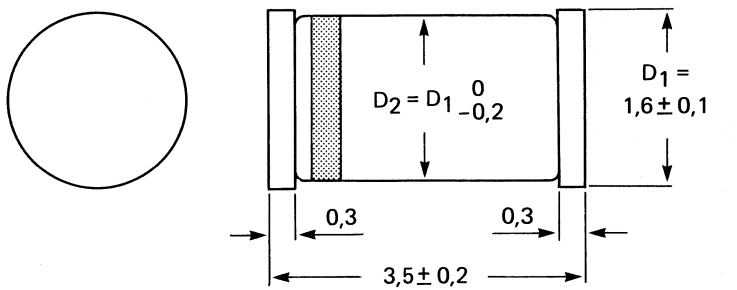
QUICK REFERENCE DATA

Working voltage range	V_Z	nom.	2,4 to 75	V
Total power dissipation up to flange temperature of 50 °C	P_{tot}	max.	500	mW
Non-repetitive peak reverse power dissipation	P_{ZSM}	max.	30	W
Junction temperature	T_j	max.	200	°C
Thermal resistance from junction to tie-point	$R_{th\ j\text{-}tp}$	=	0,30	K/mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The BZV55 cathode is indicated by a yellow band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	250	mA
Repetitive peak forward current	I_{FRM}	max.	250	mA
Total power dissipation up to T_{flange} = 50 °C	P_{tot}	max.	500	mW
up to T_{amb} = 50 °C and mounted on a ceramic substrate of 10 mm x 10 mm x 0,6 mm	P_{tot}	max.	400	mW
Non-repetitive peak reverse power dissipation t = 100 μs; T_j = 150 °C	P_{ZSM}	max.	30	W
Storage temperature	T_{stg}	−65 to	+200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to tie-point (flanges)	$R_{th\ j\text{-}tp}$	=	0,30	K/mW
From junction to ambient when mounted on a ceramic substrate of 10 mm x 10 mm x 0,6 mm	$R_{th\ j\text{-}a}$	=	0,38	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	<	0,9	V
Reverse current					
BZV55-.2V4	V_R = 1 V	I_R	<	50	μA
.2V7	V_R = 1 V	I_R	<	20	μA
.3V0	V_R = 1 V	I_R	<	10	μA
.3V3	V_R = 1 V	I_R	<	5	μA
.3V6	V_R = 1 V	I_R	<	5	μA
.3V9	V_R = 1 V	I_R	<	3	μA
.4V3	V_R = 1 V	I_R	<	3	μA
.4V7	V_R = 2 V	I_R	<	3	μA
.5V1	V_R = 2 V	I_R	<	2	μA
.5V6	V_R = 2 V	I_R	<	1	μA
.6V2	V_R = 4 V	I_R	<	3	μA
.6V8	V_R = 4 V	I_R	<	2	μA
.7V5	V_R = 5 V	I_R	<	1	μA
.8V2	V_R = 5 V	I_R	<	700	nA
.9V1	V_R = 6 V	I_R	<	500	nA
.10	V_R = 7 V	I_R	<	200	nA
.11 to .13	V_R = 8 V	I_R	<	100	nA
.15 to .75	V_R = 0,7 V_{Znom}	I_R	<	50	nA

. = C for E24 (± 5%) tolerance
. = B for ± 2%
. = F for ± 3%.

T_j = 25 °C
± 5% tolerance range

BZV55C	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
C2V4	2,20	2,60	70	100	−3,5	−1,6	0	275	600
C2V7	2,50	2,90	75	100	−3,5	−2,0	0	300	600
C3V0	2,80	3,20	80	95	−3,5	−2,1	0	325	600
C3V3	3,10	3,50	85	95	−3,5	−2,4	0	350	600
C3V6	3,40	3,80	85	90	−3,5	−2,4	0	375	600
C3V9	3,70	4,10	85	90	−3,5	−2,5	0	400	600
C4V3	4,00	4,60	80	90	−3,5	−2,5	0	410	600
C4V7	4,40	5,00	50	80	−3,5	−1,4	0,2	425	500
C5V1	4,80	5,40	40	60	−2,7	−0,8	1,2	400	480
C5V6	5,20	6,00	15	40	−2,0	2,5	2,5	80	400
C6V2	5,80	6,60	6	10	0,4	2,3	3,7	40	150
C6V8	6,40	7,20	6	15	1,2	3,0	4,5	30	80
C7V5	7,00	7,90	6	15	2,5	4,0	5,3	30	80
C8V2	7,70	8,90	6	15	3,2	4,6	6,2	40	80
C9V1	9,50	9,60	6	15	3,8	5,5	7,0	40	100
C10	9,40	10,60	8	20	4,5	6,4	8,0	50	150
C11	10,40	11,60	10	20	5,4	7,4	9,0	50	150
C12	11,40	12,70	10	25	6,0	8,4	10,0	50	150
C13	12,40	14,10	10	30	7,0	9,4	11,0	50	170
C15	13,80	15,60	10	30	9,2	11,4	13,0	50	200
C16	15,30	17,10	10	40	10,4	12,4	14,0	50	200
C18	16,80	19,10	10	45	12,4	14,4	16,0	50	225
C20	18,80	21,20	15	55	14,4	16,4	18,0	60	225
C22	20,80	23,30	20	55	16,4	18,4	20,0	60	250
C24	22,80	25,60	25	70	18,4	20,4	22,0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0,5 mA	
C27	25,10	28,90	25	80	21,4	23,4	25,3	65	300
C30	28,00	32,00	30	80	24,4	26,6	29,4	70	300
C33	31,00	35,00	35	80	27,4	29,7	33,4	75	325
C36	34,00	38,00	35	90	30,4	33,0	37,4	80	350
C39	37,00	41,00	40	130	33,4	36,4	41,2	80	350
C43	40,00	46,00	45	150	37,6	41,2	46,6	85	375
C47	44,00	50,00	50	170	42,0	46,1	51,8	85	375
C51	48,00	54,00	60	180	46,6	51,0	57,2	90	400
C56	52,00	60,00	70	200	52,2	57,0	63,8	100	425
C62	58,00	66,00	80	215	58,8	64,4	71,6	120	450
C68	64,00	72,00	90	240	65,6	71,7	79,8	150	475
C75	70,00	79,00	95	255	73,4	80,02	88,6	170	500

T_j = 25 °C
± 3% tolerance range

BZV55F	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA	leakage current I_R at V_R	
	min.	max.	typ.	max.	typ.	μA	V
F2V	2,33	2,47	70	100	−1,6	50	1
F2V7	2,62	2,78	75	100	−2,0	20	1
F3V0	2,91	3,09	80	100	−2,1	10	1
F3V3	3,20	3,40	85	100	−2,4	5	1
F3V6	3,49	3,71	85	100	−2,4	5	1
F3V9	3,78	4,02	85	100	−2,5	3	1
F4V3	4,17	4,43	80	100	−2,5	3	1
F4V7	4,56	4,84	50	100	−1,4	3	2
F5V1	4,95	5,25	40	80	−0,8	2	2
F5V6	5,43	5,77	15	40	1,2	1	2
F6V2	6,01	6,39	6	30	2,3	3	4
F6V8	6,60	7,00	6	20	3,0	2	4
F7V5	7,28	7,72	6	20	4,0	1	5
F8V2	7,95	8,45	6	20	4,6	0,7	5
F9V1	8,83	9,37	6	20	5,5	0,5	6
F10	9,7	10,30	8	25	6,4	0,2	7
F11	10,67	11,33	10	25	7,4	0,1	8
F12	11,64	12,36	10	25	8,4	0,1	8
F13	12,61	13,39	10	35	9,4	0,1	8
F15	14,55	15,45	10	40	11,4	0,05	10
F16	15,50	16,50	10	45	12,4	0,05	
F18	17,50	18,50	10	50	14,4	0,05	
F20	19,40	20,60	15	60	16,4	0,05	
F22	21,30	22,70	20	70	18,4	0,05	
F24	23,30	24,70	25	80	20,4	0,05	
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA	at I_Z = 0,5 mA	
F27	26,20	27,80	25	80	23,4	0,05	0,7
F30	29,10	30,90	30	100	26,6	0,05	0,7
F33	32,00	34,00	35	120	29,7	0,05	0,7
F36	34,90	37,10	35	140	33,0	0,05	0,7
F39	37,80	40,20	40	150	36,4	0,05	0,7
F43	41,70	44,30	45	160	41,2	0,05	0,7
F47	45,60	48,40	50	170	46,1	0,05	0,7
F51	49,50	52,50	60	180	51,0	0,05	0,7
F56	54,30	57,70	70	200	57,0	0,05	0,7
F62	60,10	63,90	80	220	64,4	0,05	0,7
F68	66,00	70,00	90	240	71,7	0,05	0,7
F75	72,80	77,20	95	255	80,02	0,05	0,7

T_j = 25 °C

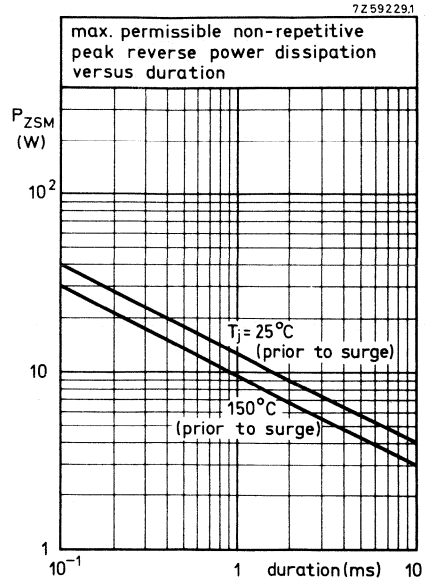

7Z59229.1
max. permissible non-repetitive peak reverse power dissipation versus duration
P_{ZSM} (W)
10^2
10
1
10^{-1}
1
duration (ms)
10
T_j = 25°C (prior to surge)
150°C (prior to surge)

Fig. 2.

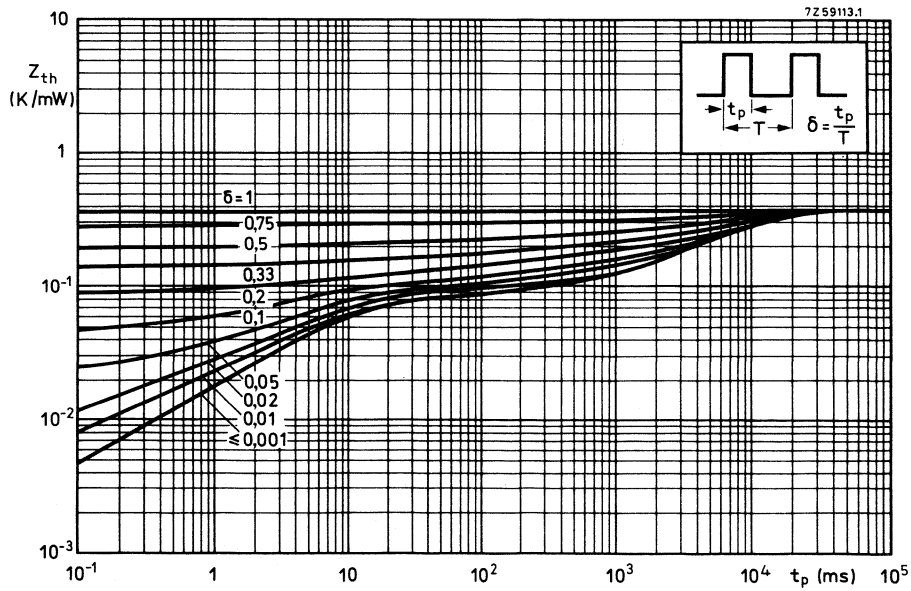

7Z59113.1
Z_{th} (K/mW)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-1}
1
10
10^2
10^3
10^4
t_p (ms)
10^5
δ = 1
0,75
0,5
0,33
0,2
0,1
0,05
0,02
0,01
≤ 0,001
t_p
T
$\delta = \frac{t_p}{T}$

Fig. 3.

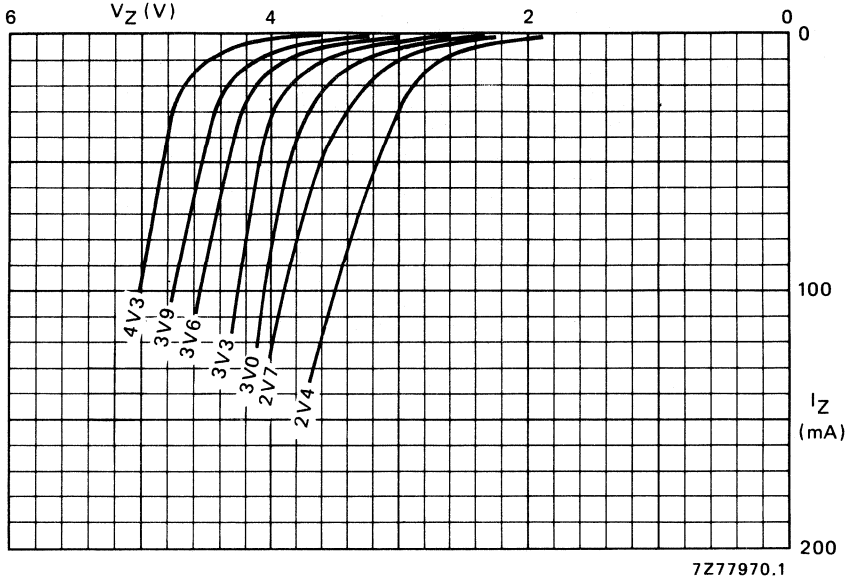


Fig. 4 Static characteristics; typical values; T_{amb} = 25 °C.

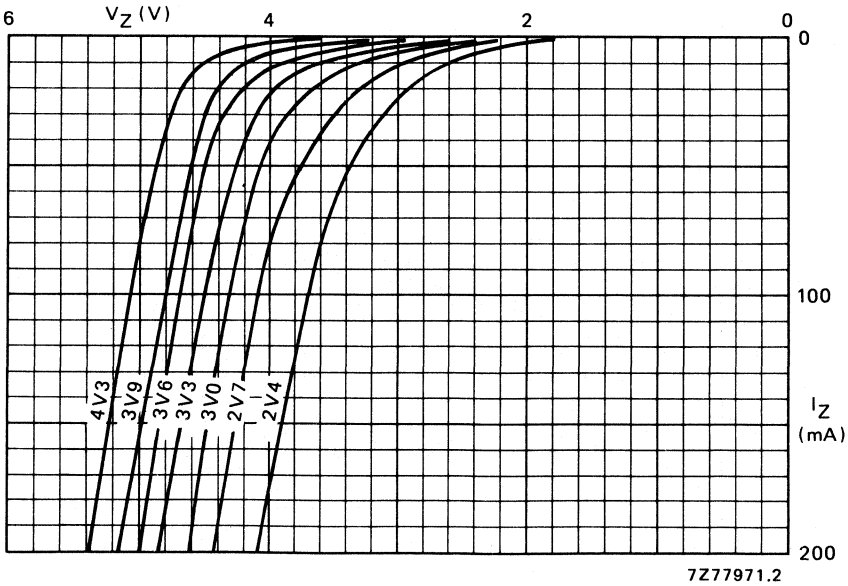


Fig. 5 Dynamic characteristics; typical values; T_j = 25 °C.

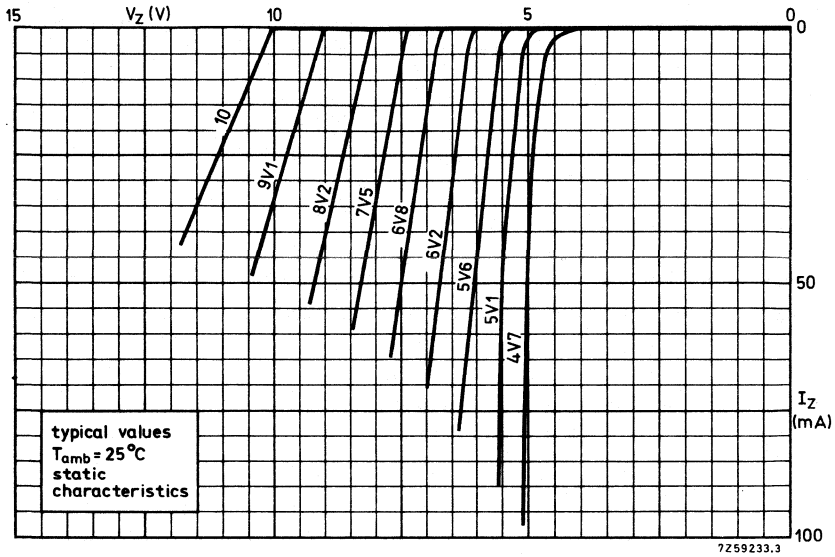

15
V_Z (V)
10
5
0
0
50
100
I_Z (mA)
10
9V1
8V2
7V5
6V8
6V2
5V6
5V1
4V7
typical values
T_{amb} = 25°C
static characteristics
7Z59233.3

Fig. 6.

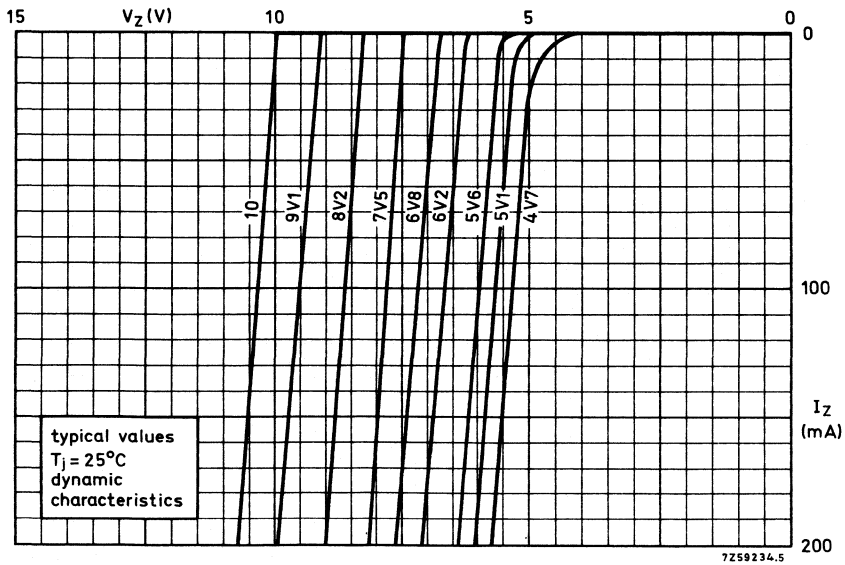

15
V_Z (V)
10
5
0
0
100
200
I_Z (mA)
10
9V1
8V2
7V5
6V8
6V2
5V6
5V1
4V7
typical values
T_j = 25°C
dynamic characteristics
7Z59234.5

Fig. 7.

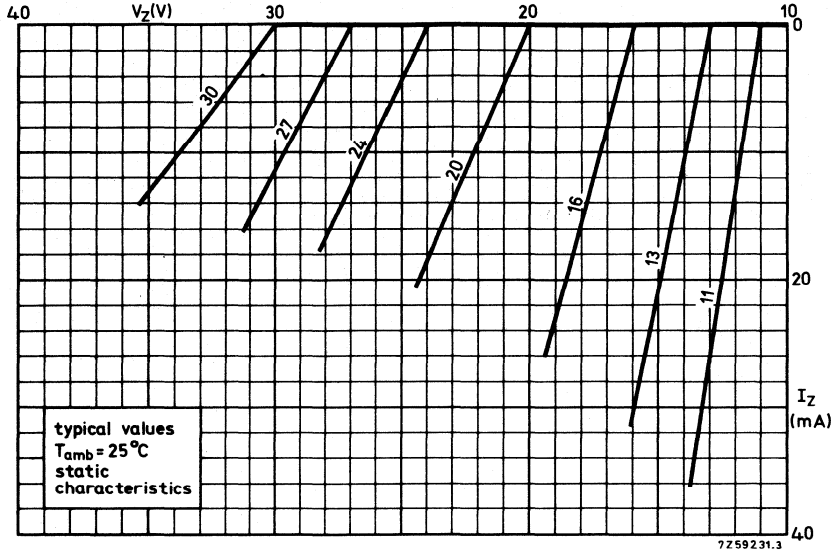

40
V_Z(V)
30
20
10
0
30
27
24
20
16
13
11
20
I_Z
(mA)
40
typical values
T_{amb} = 25°C
static
characteristics
7Z59231.3

Fig. 8.

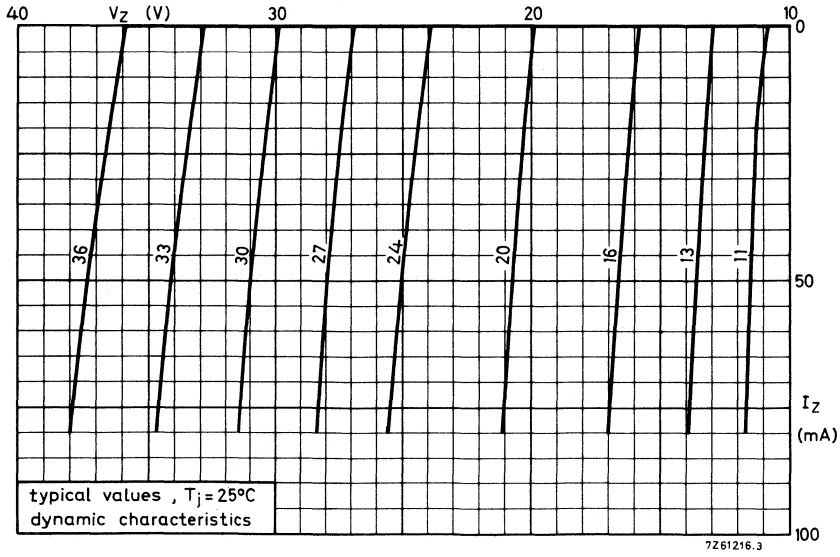

40
V_Z (V)
30
20
10
0
36
33
30
27
24
20
16
13
11
50
I_Z
(mA)
100
typical values , T_j = 25°C
dynamic characteristics
7Z61216.3

Fig. 9.

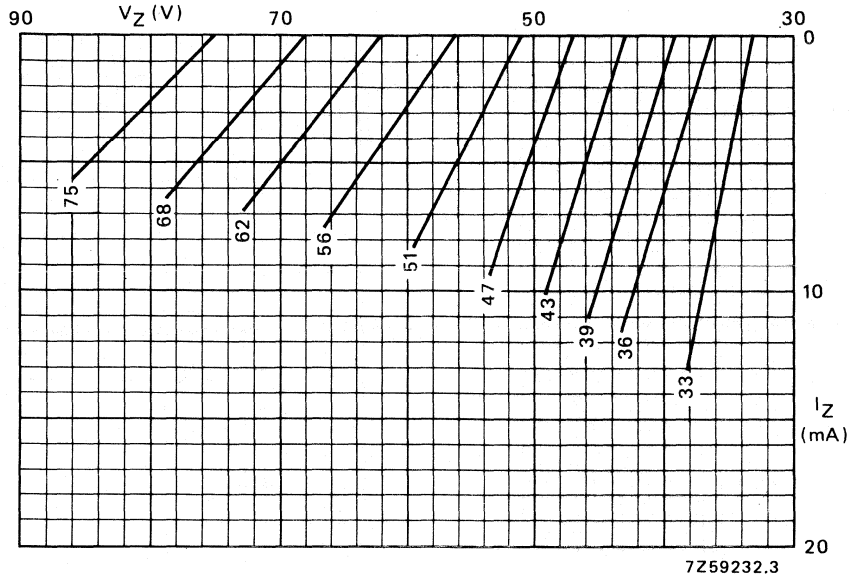


Fig. 10 Static characteristics; typical values; T_{amb} = 25 °C.

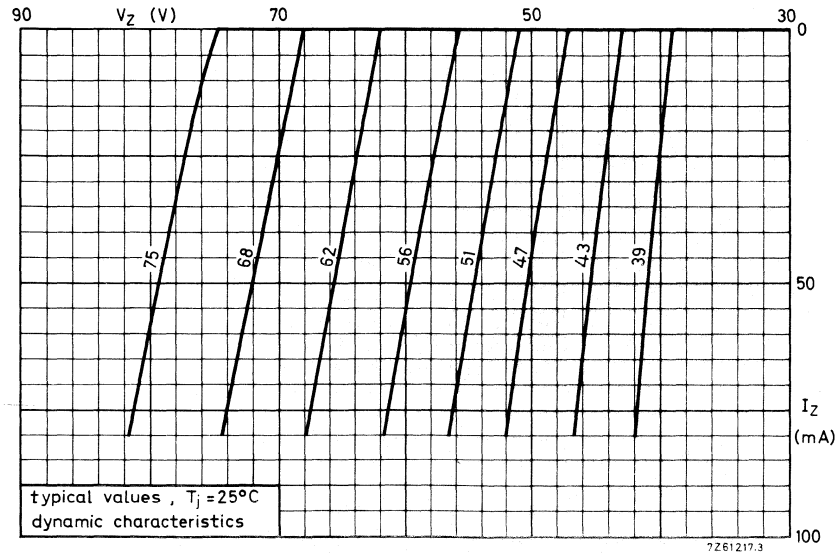


Fig. 11.

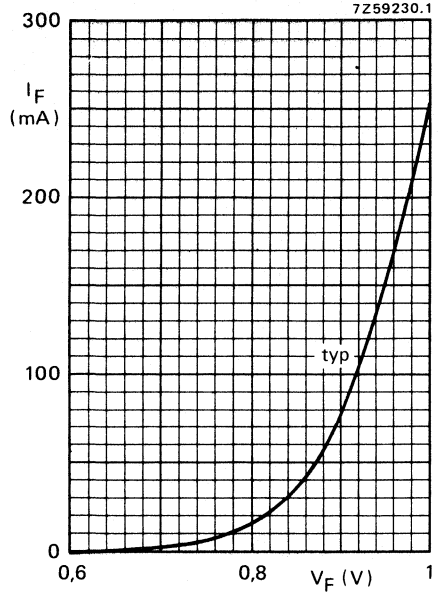


Fig. 12 T_j = 25 °C.

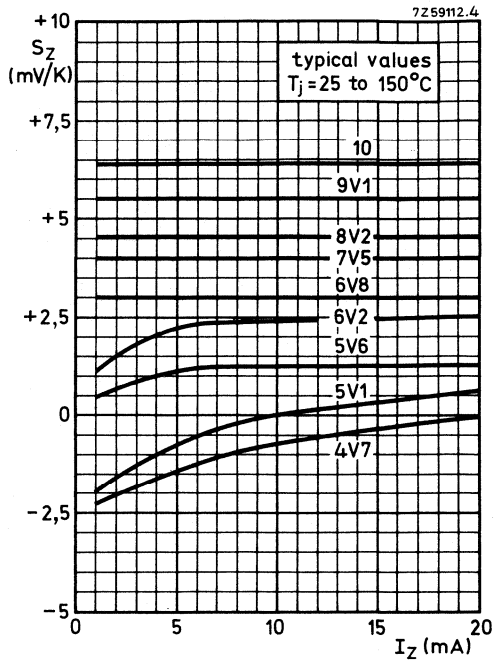


Fig. 13.

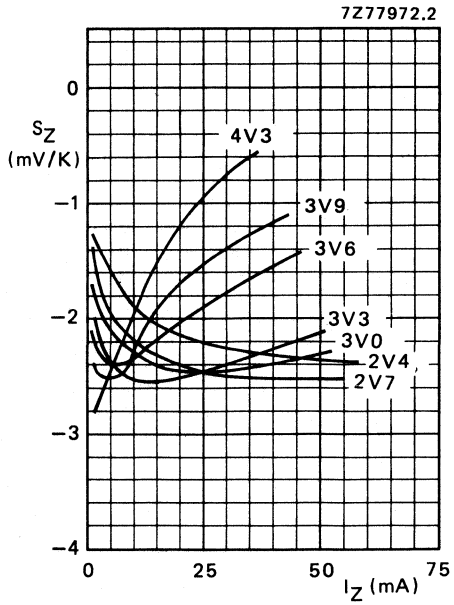


Fig. 14 Typical values; T_j = 25 to 150 °C.

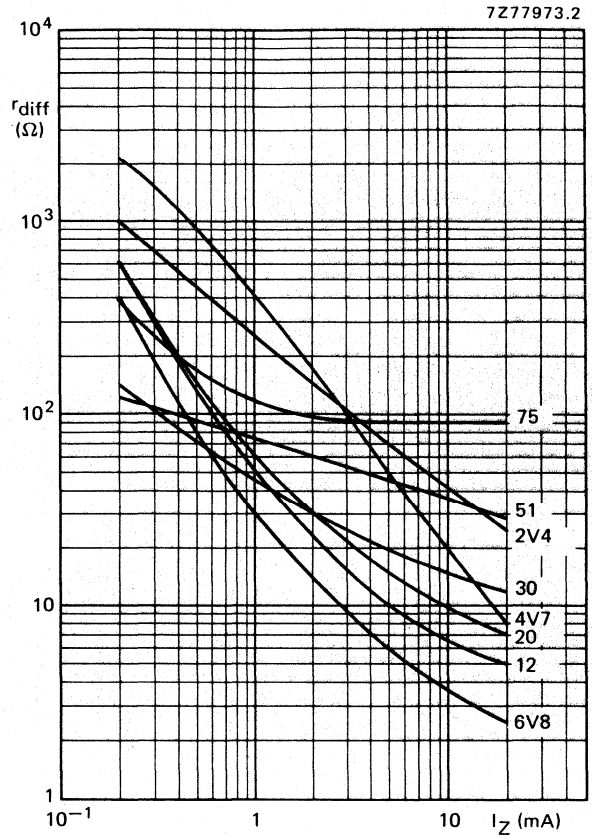


Fig. 15 Typical values; T_j = 25 °C; f = 1 kHz.

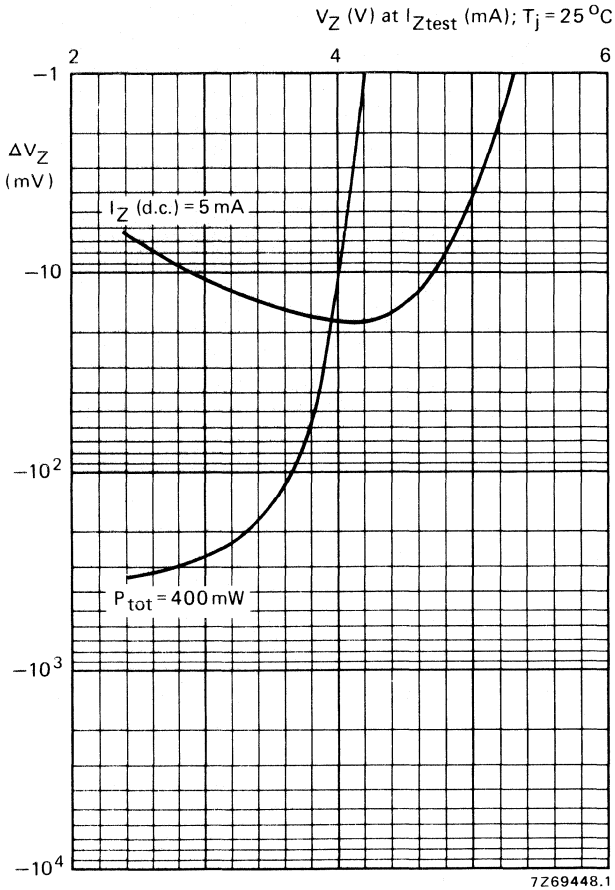


Fig. 16 Typical change of working voltage under operating conditions at T_{amb} = 25 °C.

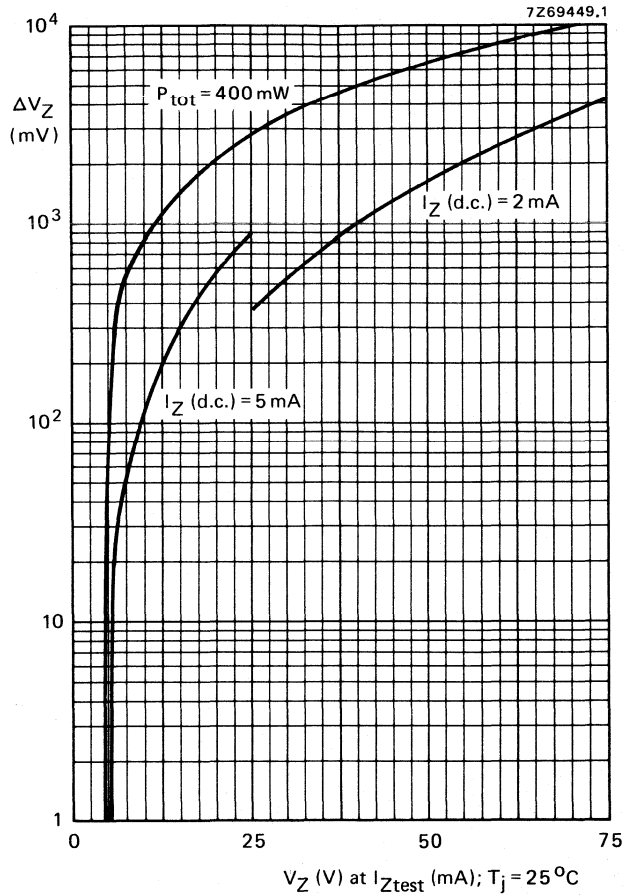


Fig. 17 Typical change of working voltage under operating conditions at T_{amb} = 25 °C.

VOLTAGE REFERENCE DIODES FOR SURFACE MOUNTING

Voltage reference diodes in a SOD-80 envelope. They have a low temperature coefficient and are primarily intended for use as voltage reference sources.

The SM diode is a leadless diode in a hermetically sealed glass SOD-80 envelope with tinplated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in bulk or in "super 8" tape.

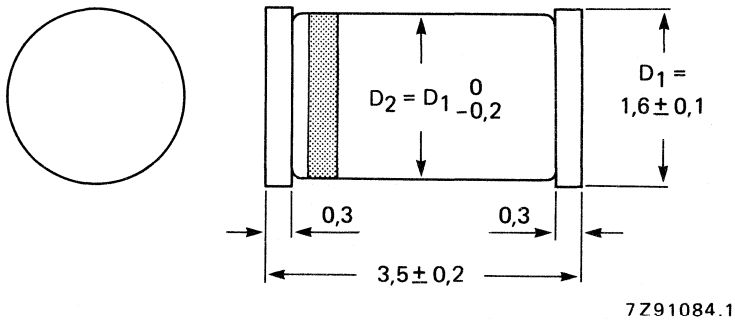
QUICK REFERENCE DATA

Reference voltage at I_Z = 7,5 mA		V_{ref}	>	5,89 V
			typ.	6,20 V
			<	6,51 V
Temperature coefficient at I_Z = 7,5 mA	BZV80	$\lvert S_Z \rvert$	<	0,01 %/K
	BZV81	$\lvert S_Z \rvert$	<	0,005 %/K
Operating temperature		T_{amb}		−20 to + 80 °C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80



Cathode indicated by yellow band

BZV80 second band: black

BZV81 second band: brown

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Working current (d.c.)	I_Z	max.	50	mA
Working current (peak value)	I_{ZM}	max.	50	mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	400	mW
Storage temperature	T_{stg}	−65 to + 200		°C
Operating ambient temperature	T_{amb}	−20 to + 80		°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 10 x 10 x 0,6 mm	$R_{th\ j\text{-}a}$	=	380	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reference voltage at I_Z = 7,5 mA		V_{ref}	>	5,89	V
			typ.	6,20	V
			<	6,51	V
Reference voltage excursion at I_Z = 7,5 mA					
ambient temperature test points	BZV80	$\lvert\Delta V_{ref}\rvert$	<	62	mV
−20; + 25; + 55; + 80 °C	BZV81	$\lvert\Delta V_{ref}\rvert$	<	31	mV
Effective temperature coefficient at I_Z = 7,5 mA					
	BZV80	$\lvert S_Z\rvert$	<	0,01	%/K
	BZV81	$\lvert S_Z\rvert$	<	0,005	%/K
Differential resistance at I_Z = 7,5 mA		r_{diff}	<	15	Ω

Notes

1. Tolerance and stability of I_Z.
   The quoted values of ΔV_{ref} are based on a constant current I_Z. Two factors can cause V_{ref} to change with I_Z, namely the differential resistance r_{diff} and the temperature coefficient S_Z.
   a. Each change of I_Z can result in a maximum change of V_{ref} as follows:

      $$\Delta V_{ref}\ (mV) = \Delta I_Z\ (mA) \times 15\ \Omega$$

      taking into account r_{diff} is max. 15 Ω.
   b. The temperature coefficient of the reference voltage is also a function of I_Z. However, for these reference diodes S_Z varies max. ± 0,05 mV/K or ± 0,001 %/K when I_Z is between 6 and 10 mA, so this effect can be neglected in practice for these types.

2. The temperature coefficient of the reference voltage is obtained from the following equation.

$$S_Z = \frac{(V_{ref\,1} - V_{ref\,2})}{(T_{amb\,2} - T_{mab\,1})} \times \frac{100}{V_{ref\,nom}}\ \%/K$$

SILICON PLANAR VOLTAGE REGULATOR DIODES

Low power general purpose voltage regulator diodes in a micro miniature plastic envelope. They are available in three series; one to the international standardized E24 (± 5%) range, one in a tolerance of ± 2% and the other in a tolerance of ± 1%.
Each series consists of 37 types with nominal working voltages from 2.4 V to 75 V.

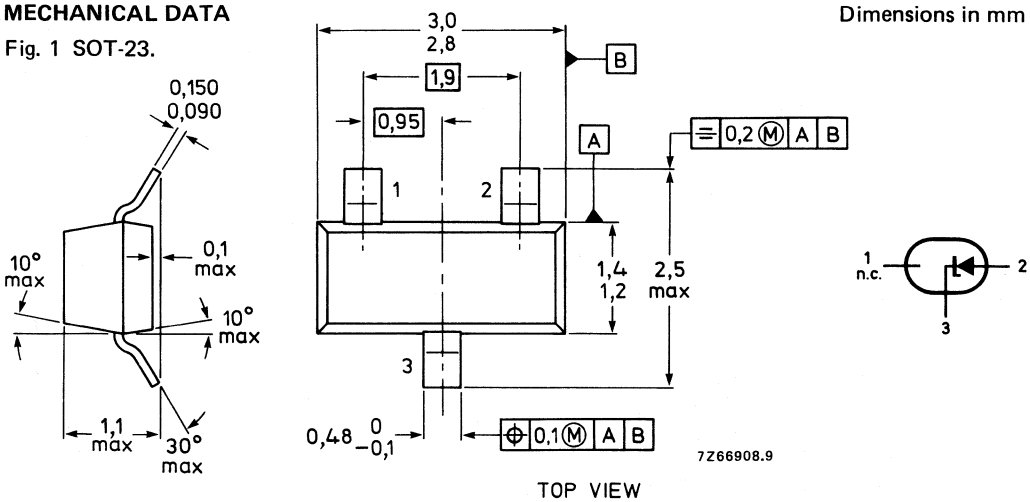
QUICK REFERENCE DATA

Working voltage range	V_Z	nom.	2.4 to 75 V
Working voltage tolerance			± 5 %
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	175 °C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

See also *Soldering recommendations.*

Marking code

BZX84-C2V4 = Z11	BZX84-C5V6 = Z3	BZX84-C13 = Y3	BZX84-C33 = Y12
C2V7 = Z12	C6V2 = Z4	C15 = Y4	C36 = Y13
C3V0 = Z13	C6V8 = Z5	C16 = Y5	C39 = Y14
C3V3 = Z14	C7V5 = Z6	C18 = Y6	C43 = Y15
C3V6 = Z15	C8V2 = Z7	C20 = Y7	C47 = Y16
C3V9 = Z16	C9V1 = Z8	C22 = Y8	C51 = Y17
C4V3 = Z17	C10 = Z9	C24 = Y9	C56 = Y18
C4V7 = Z1	C11 = Y1	C27 = Y10	C62 = Y19
C5V1 = Z2	C12 = Y2	C30 = Y11	C68 = Y20
			C75 = Y21

Marking for B and A types available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak forward current	I_{FRM}	max.	250	mA
Repetitive peak working current	I_{ZRM}	max.	250	mA
Total power dissipation up to T_{amb} = 25 °C**	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}	−65 to +	150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL CHARACTERISTICS*

Thermal resistance**

→ From junction to ambient	$R_{th\ j\text{-}t}$	=	420	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage					
I_F = 10 mA		V_F	<	0.9	V
Reverse current					
BZX84—.2V4	V_R = 1 V	I_R	<	50	μA
2V7	V_R = 1 V	I_R	<	20	μA
3V0	V_R = 1 V	I_R	<	10	μA
3V3	V_R = 1 V	I_R	<	5	μA
3V6	V_R = 1 V	I_R	<	5	μA
3V9	V_R = 1 V	I_R	<	3	μA
4V3	V_R = 1 V	I_R	<	3	μA
4V7	V_R = 2 V	I_R	<	3	μA
5V1	V_R = 2 V	I_R	<	2	μA
5V6	V_R = 2 V	I_R	<	1	μA
6V2	V_R = 4 V	I_R	<	3	μA
6V8	V_R = 4 V	I_R	<	2	μA
7V5	V_R = 5 V	I_R	<	1	μA
8V2	V_R = 5 V	I_R	<	700	nA
9V1	V_R = 6 V	I_R	<	500	nA
10	V_R = 7 V	I_R	<	200	nA
11	V_R = 8 V	I_R	<	100	nA
12	V_R = 8 V	I_R	<	100	nA
13	V_R = 8 V	I_R	<	100	nA
15 to 75	V_R = 0.7 V_{Znom}	I_R	<	50	nA

. = A for 1%
. = B for 2%
.. = C for (E24), 5%

* See *Thermal characteristics* in chapter GENERAL.
** Device mounted on a ceramic substrate of 7 mm x 5 mm x 0.6 mm.

T_j = 25 °C
± 5% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
C2V4	2.20	2.60	70	100	−3.5	−1.6	0	275	600
C2V7	2.50	2.90	75	100	−3.5	−2.0	0	300	600
C3V0	2.80	3.20	80	95	−3.5	−2.1	0	325	600
C3V3	3.10	3.50	85	95	−3.5	−2.4	0	350	600
C3V6	3.40	3.80	85	90	−3.5	−2.4	0	375	600
C3V9	3.70	4.10	85	90	−3.5	−2.5	0	400	600
C4V3	4.00	4.60	80	90	−3.5	−2.5	0	410	600
C4V7	4.40	5.00	50	80	−3.5	−1.4	0.2	425	500
C5V1	4.80	5.40	40	60	−2.7	−0.8	1.2	400	480
C5V6	5.20	6.00	15	40	−2.0	1.2	2.5	80	400
C6V2	5.80	6.60	6	10	0.4	2.3	3.7	40	150
C6V8	6.40	7.20	6	15	1.2	3.0	4.5	30	80
C7V5	7.00	7.90	6	15	2.5	4.0	5.3	30	80
C8V2	7.70	8.90	6	15	3.2	4.6	6.2	40	80
C9V1	9.50	9.60	6	15	3.8	5.5	7.0	40	100
C10	9.40	10.60	8	20	4.5	6.4	8.0	50	150
C11	10.40	11.60	10	20	5.4	7.4	9.0	50	150
C12	11.40	12.70	10	25	6.0	8.4	10.0	50	150
C13	12.40	14.10	10	30	7.0	9.4	11.0	50	170
C15	13.80	15.60	10	30	9.2	11.4	13.0	50	200
C16	15.30	17.10	10	40	10.4	12.4	14.0	50	200
C18	16.80	19.10	10	45	12.4	14.4	16.0	50	225
C20	18.80	21.20	15	55	14.4	16.4	18.0	60	225
C22	20.80	23.30	20	55	16.4	18.4	20.0	60	250
C24	22.80	25.60	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0.5 mA	
C27	25.10	28.90	25	80	21.4	23.4	25.3	65	300
C30	28.00	32.00	30	80	24.4	26.6	29.4	70	300
C33	31.00	35.00	35	80	27.4	29.7	33.4	75	325
C36	34.00	38.00	35	90	30.4	33.0	37.4	80	350
C39	37.00	41.00	40	130	33.4	36.4	41.2	80	350
C43	40.00	46.00	45	150	37.6	41.2	46.6	85	375
C47	44.00	50.00	50	170	42.0	46.1	51.8	85	375
C51	48.00	54.00	60	180	46.6	51.0	57.2	90	400
C56	52.00	60.00	70	200	52.2	57.0	63.8	100	425
C62	58.00	66.00	80	215	58.8	64.4	71.6	120	450
C68	64.00	72.00	90	240	65.6	71.7	79.8	150	475
C75	70.00	79.00	95	255	73.4	80.02	88.6	170	500

± 2% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
B2V4	2.35	2.45	70	100	−3.5	−1.6	0	275	600
B2V7	2.65	2.75	75	100	−3.5	−2.0	0	300	600
B3V0	2.94	3.06	80	95	−3.5	−2.1	0	325	600
B3V3	3.23	3.37	85	95	−3.5	−2.4	0	350	600
B3V6	3.53	3.67	85	90	−3.5	−2.4	0	375	600
B3V9	3.82	3.98	85	90	−3.5	−2.5	0	400	600
B4V3	4.21	4.39	80	90	−3.5	−2.5	0	410	600
B4V7	4.61	4.79	50	80	−3.5	−1.4	0.2	425	500
B5V1	5.00	5.20	40	60	−2.7	−0.8	1.2	400	480
B5V6	5.49	5.71	15	40	−2.0	1.2	2.5	80	400
B6V2	6.08	6.32	6	10	0.4	2.3	3.7	40	150
B6V8	6.66	6.94	6	15	1.2	3.0	4.5	30	80
B7V5	7.35	7.65	6	15	2.5	4.0	5.3	30	80
B8V2	8.04	8.36	6	15	3.2	4.6	6.2	40	80
B9V1	8.92	9.28	6	15	3.8	5.5	7.0	40	100
B10	9.80	10.20	8	20	4.5	6.4	8.0	50	150
B11	10.80	11.20	10	20	5.4	7.4	9.0	50	150
B12	11.80	12.20	10	25	6.0	8.4	10.0	50	150
B13	12.70	13.30	10	30	7.0	9.4	11.0	50	170
B15	14.70	15.30	10	30	9.2	11.4	13.0	50	200
B16	15.70	16.30	10	40	10.4	12.4	14.0	50	200
B18	17.60	18.40	10	45	12.4	14.4	16.0	50	225
B20	19.60	20.40	15	55	14.4	16.4	18.0	60	225
B22	21.60	22.40	20	55	16.4	18.4	20.0	60	250
B24	23.50	24.50	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_Z = 0.5 mA	
B27	26.50	27.50	25	80	21.4	23.4	25.3	65	300
B30	29.40	30.60	30	80	24.4	26.6	29.4	70	300
B33	32.30	33.70	35	80	27.4	29.7	33.4	75	325
B36	35.30	36.70	35	90	30.4	33.0	37.4	80	350
B39	38.20	39.80	40	130	33.4	36.4	41.2	80	350
B43	42.10	43.90	45	150	37.6	41.2	46.6	85	375
B47	46.10	47.90	50	170	42.0	46.1	51.8	85	375
B51	50.00	51.00	60	180	46.6	51.0	57.2	90	400
B56	54.90	57.10	70	200	52.2	57.0	63.8	100	425
B62	60.80	63.20	80	215	58.8	64.4	71.6	120	450
B68	66.60	69.40	90	240	65.6	71.7	79.8	150	475
B75	73.50	76.50	95	255	73.4	80.02	88.6	170	500

T_j = 25 °C
± 1% tolerance range

BZX84	working voltage V_Z (V) at I_{Ztest} = 5 mA		differential resistance r_{diff} (Ω) at I_{Ztest} = 5 mA		temperature coefficient S_Z (mV/K) at I_{Ztest} = 5 mA			differential resistance r_{diff} (Ω) at I_Z = 1 mA	
	min.	max.	typ.	max.	min.	typ.	max.	typ.	max.
A2V4	2.37	2.43	70	100	−3.5	−1.6	0	275	600
A2V7	2.67	2.73	75	100	−3.5	−2.0	0	300	600
A3V0	2.97	3.03	80	95	−3.5	−2.1	0	325	600
A3V3	3.26	3.34	85	95	−3.5	−2.4	0	350	600
A3V6	3.56	3.64	85	90	−3.5	−2.4	0	375	600
A3V9	3.86	3.94	85	90	−3.5	−2.5	0	400	600
A4V3	4.25	4.35	80	90	−3.5	−2.5	0	410	600
A4V7	4.65	4.75	50	80	−3.5	−1.4	0.2	425	500
A5V1	5.04	5.16	40	60	−2.7	−0.8	1.2	400	480
A5V6	5.54	5.66	15	40	−2.0	1.2	2.5	80	400
A6V2	6.13	6.27	6	10	0.4	2.3	3.7	40	150
A6V8	6.73	6.87	6	15	1.2	3.0	4.5	30	80
A7V5	7.42	7.58	6	15	2.5	4.0	5.3	30	80
A8V2	8.11	8.29	6	15	3.2	4.6	6.2	40	80
A9V1	9.0	9.2	6	15	3.8	5.5	7.0	40	100
A10	9.9	10.10	8	20	4.5	6.4	8.0	50	150
A11	10.8	11.11	10	20	5.4	7.4	9.0	50	150
A12	11.88	12.12	10	25	6.0	8.4	10.0	50	150
A13	12.87	13.13	10	30	7.0	9.4	11.0	50	170
A15	14.85	15.15	10	30	9.2	11.4	13.0	50	200
A16	15.84	16.16	10	40	10.4	12.4	14.0	50	200
A18	17.82	18.18	10	45	12.4	14.4	16.0	50	225
A20	19.80	20.20	15	55	14.4	16.4	18.0	60	225
A22	21.78	22.22	20	55	16.4	18.4	20.0	60	250
A24	23.76	24.24	25	70	18.4	20.4	22.0	60	250
	at I_{Ztest} = 2 mA		at I_{Ztest} = 2 mA		at I_{Ztest} = .2 mA			at I_Z = 0.5 mA	
A27	26.73	27.27	25	80	21.4	23.4	25.3	65	300
A30	29.70	30.30	30	80	24.4	26.6	29.4	70	300
A33	32.67	33.33	35	80	27.4	29.7	33.4	75	325
A36	35.64	36.36	35	90	30.4	33.0	37.4	80	350
A39	38.61	39.39	40	130	33.4	36.4	41.2	80	350
A43	42.57	43.43	45	150	37.6	41.2	46.6	85	375
A47	46.53	47.47	50	170	42.0	46.1	51.8	85	375
A51	50.49	51.51	60	180	46.6	51.0	57.2	90	400
A56	55.44	56.56	70	200	52.2	57.0	63.8	100	425
A62	61.38	62.62	80	215	58.8	64.4	71.6	120	450
A68	74.25	75.75	90	240	65.6	71.7	79.8	150	475
A75	90.09	91.91	95	255	73.4	80.02	88.6	170	500

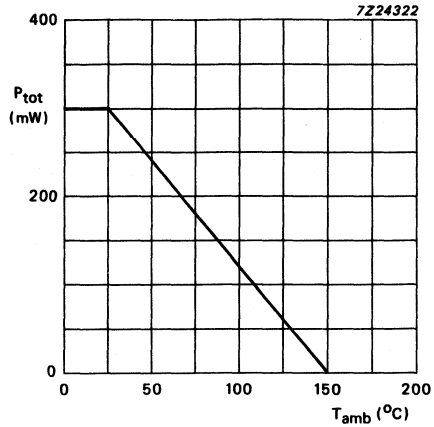


Fig. 2 Power derating curve.

Model for calculating the static working voltage ($V_{Z\ stat}$).

This model can be derived from $V_{Z\ stat} = V_{Z\ dyn} + \Delta V_Z$ of which $V_{Z\ dyn}$ is given in the preceding tables and can be derived from the typical dynamic characteristic curves in Figs 3 to 6.
$\Delta V_Z = \Delta T \times S_Z$. For S_Z see tables and graphs S_Z versus T_j.
$\Delta T = P_{tot} \times R_{th\ j\text{-}a} = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a}$.
Following $\Delta V_Z = I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$ and the model will be:

$$V_{Z\ stat} = V_{Z\ dyn} + I_Z \times V_{Z\ dyn} \times R_{th\ j\text{-}a} \times S_Z$$

Calculating example

BZX84-C24 mounted on a ceramic substrate of 7 x 5 x 0.6 mm; at I_Z = 7 mA.

$$V_{Z\ stat} = 24 + \left(\frac{7}{1000} \times 24 \times \frac{430}{1000} \times 20.3\right)$$

$$= 24 + 1.47 = 25.47\ V.$$

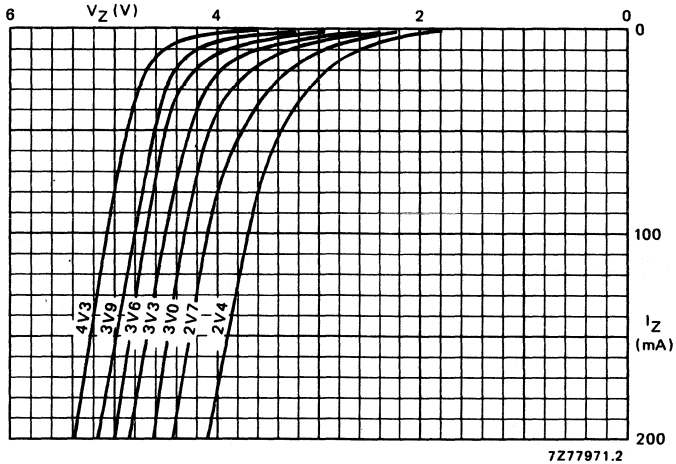


Fig. 3 Dynamic characteristics; typical values; T_j = 25 °C.

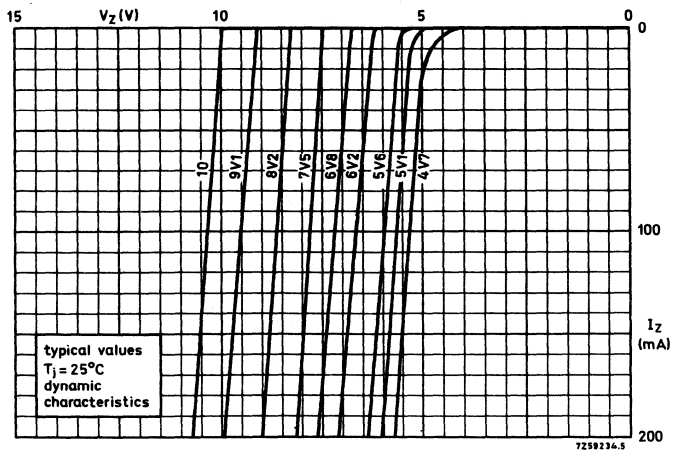


Fig. 4 Dynamic characteristics; typical values; T_j = 25 °C.

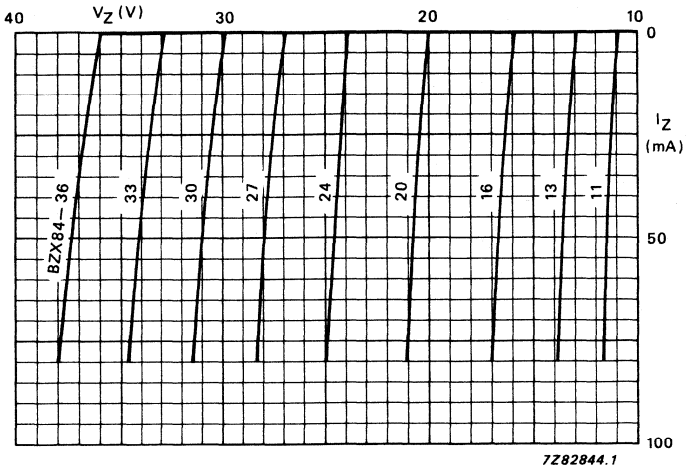


Fig. 5 Dynamic characteristics; typical values; T_j = 25 °C.

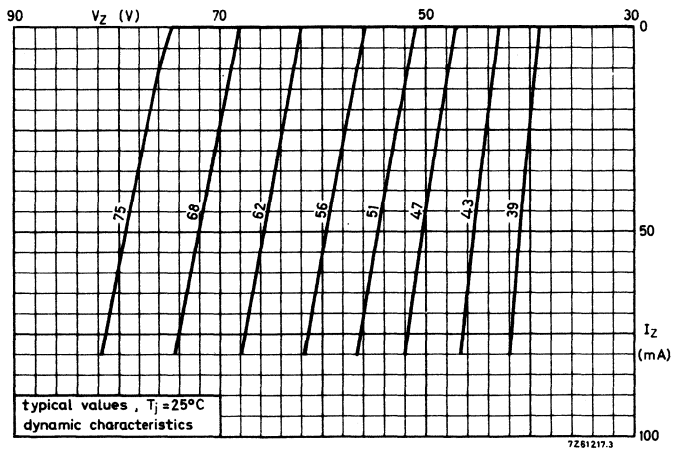


Fig. 6 Dynamic characteristics; typical values; T_j = 25 °C.

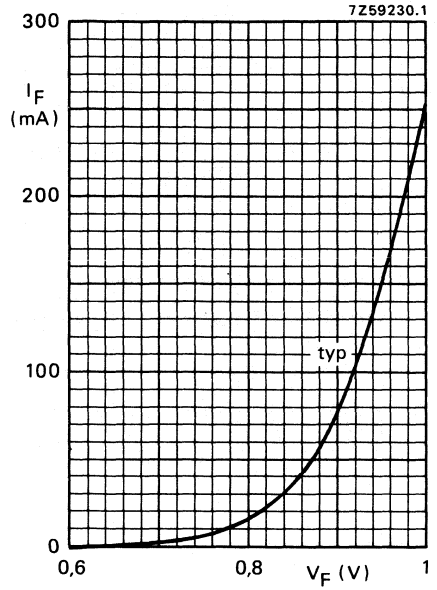


Fig. 7 Typical values at T_j = 25 °C.

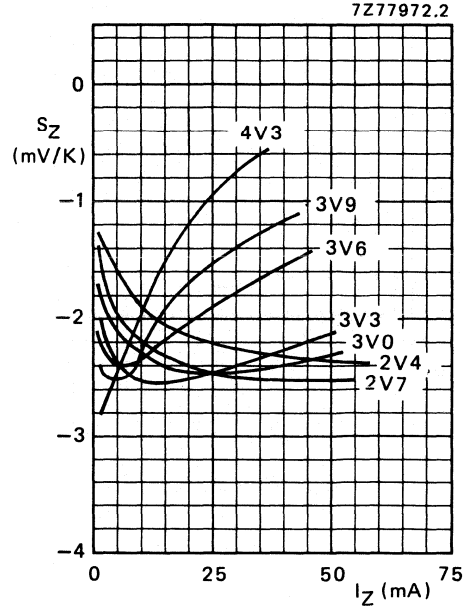


Fig. 8 Typical values; T_j = 25 to 175 °C.

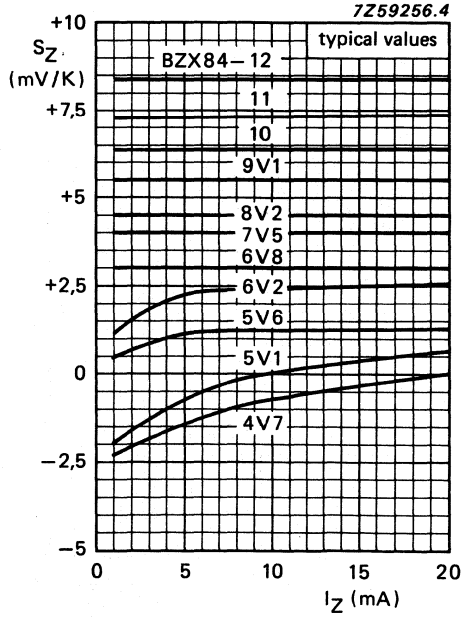


Fig. 9 Typical values; T_j = 25 to 175 °C.

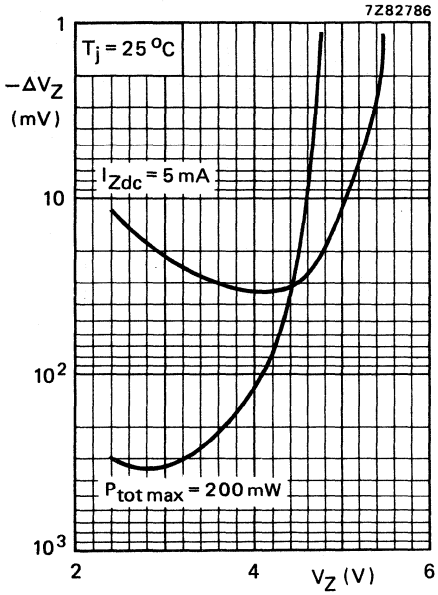


Fig. 10 Typical values; $T_j = 25\ ^oC$.

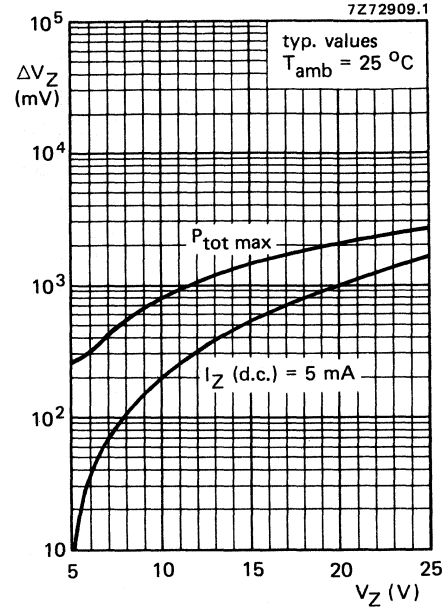


Fig. 11 Typical values; $T_{amb} = 25\ ^oC$.

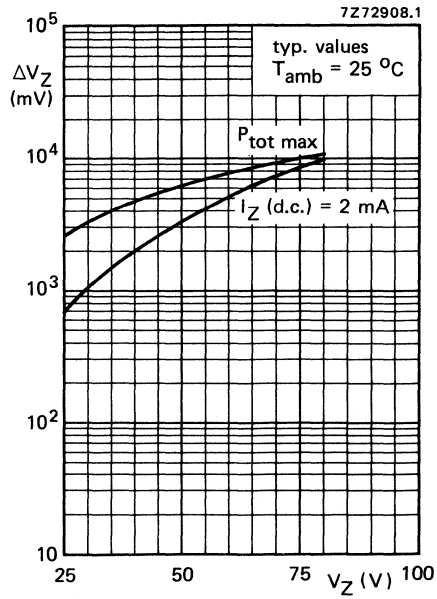


Fig. 12 Typical values; $T_{amb} = 25\ ^oC$.

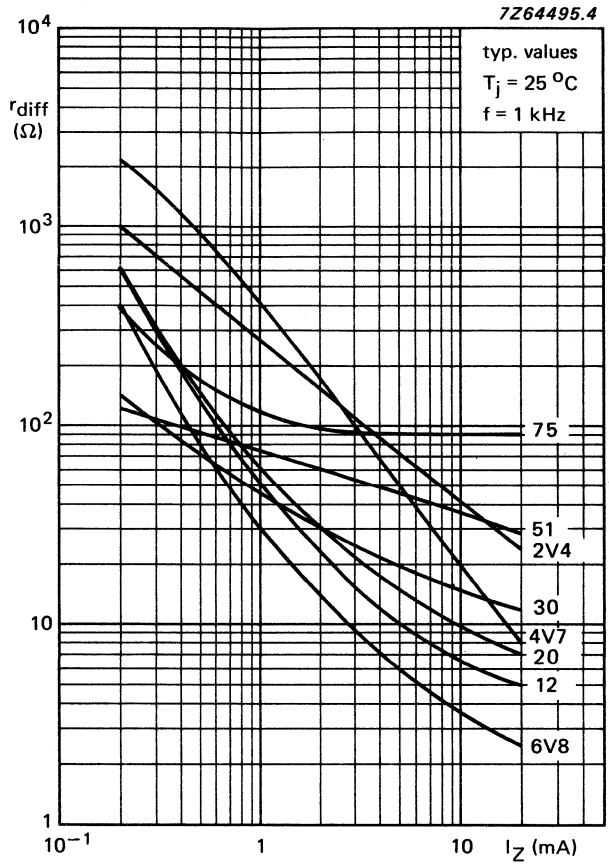

7Z64495.4
typ. values
T_j = 25 °C
f = 1 kHz
r_{diff} (Ω)
10^4
10^3
10^2
10
1
10^{-1}
1
10
I_Z (mA)
75
51
2V4
30
4V7
20
12
6V8

Fig. 13.

SILICON TEMPERATURE SENSORS

These sensors have a positive temperature coefficient of resistance and are for use in measurement and control.

QUICK REFERENCE DATA

Resistance at T_{amb} = 25 °C		Type tape (identification colour)
I_C = 1 mA		
	KTY85-110	R_{25} = 990 - 1010 Ω; yellow
	KTY85-120	R_{25} = 980 - 1020 Ω; white or green
	KTY85-121	R_{25} = 980 - 1000 Ω; white
	KTY85-122	R_{25} = 1000 - 1020 Ω; green
	KTY85-150	R_{25} = 950 - 1050 Ω; black or blue
	KTY85-151	R_{25} = 950 - 1000 Ω; black
	KTY85-152	R_{25} = 1000 - 1050 Ω; blue
	KTY85-120	is composed of groups −121 and −122, and is correspondingly designated.
	KTY85-150	is composed of groups −151 and −152, and is correspondingly designated.
Operating ambient temperature range T_{amb}		−40 to +125 °C

MECHANICAL DATA

Dimensions in mm

Indication of polarity and type tape

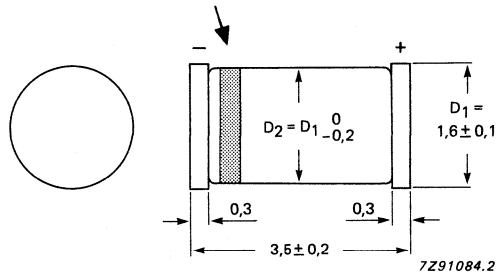


Fig. 1 SOD-80.

Note

The sensor has to be operated with the lower potential at the marked connection.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous sensor current in free air

T_{amb} = 25 °C	I_C max.	10	mA
T_{amb} = 125 °C	I_C max.	2.0	mA

CHARACTERISTICS

(Based on the measurements in liquid at T_{amb} = 25 °C unless otherwise specified)

Resistance

I_C = 1 mA	KTY85-110	R_{25} = 990 - 1010 Ω		
	KTY85-120	R_{25} = 980 - 1020 Ω		
	KTY85-121	R_{25} = 980 - 1000 Ω		
	KTY85-122	R_{25} = 1000 - 1020 Ω		
	KTY85-150	R_{25} = 950 - 1050 Ω		
	KTY85-151	R_{25} = 950 - 1000 Ω		
	KTY85-152	R_{25} = 1000 - 1050 Ω		
Temperature coefficient		typ.	0.76	%/K
Resistance ratio		R100/R25	1.670 ± 0.020	
		R-40/R25	0.577 ± 0.008	
Thermal time constant*				
in still air		typ.	20	s
in still liquid**		typ.	1.0	s
in flowing liquid**		typ.	0.5	s
Measuring temperature range			−40 to +125	°C

* The thermal time constant is the time the sensor needs to reach 63.2% of the total temperature difference. For instance, the time needed to reach a temperature of 72.4 °C, when a sensor with an initial temperature of 25 °C is put into an ambient with a temperature of 100 °C.

** Inert liquid FC43 of 3M company.

T_{amb} °C	Resistance Ω
−40	577
−30	632
−20	691
−10	754
0	820
10	889
20	962
25	1000
30	1039
40	1118
50	1202
60	1288
70	1379
80	1472
90	1569
100	1670
110	1774
120	1882
125	1937

Ambient temperatures and corresponding resistance values of sensor (I_C = 1mA).

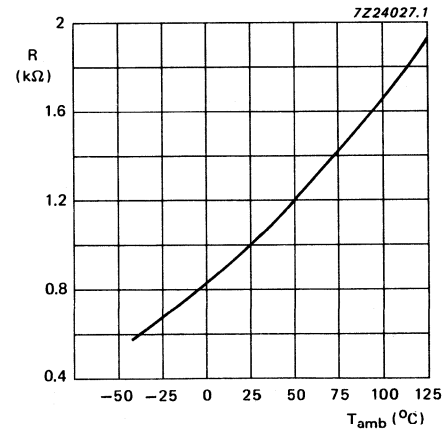


Fig. 2 Average resistance value of sensor at I_C = 1 mA as a function of ambient temperature.

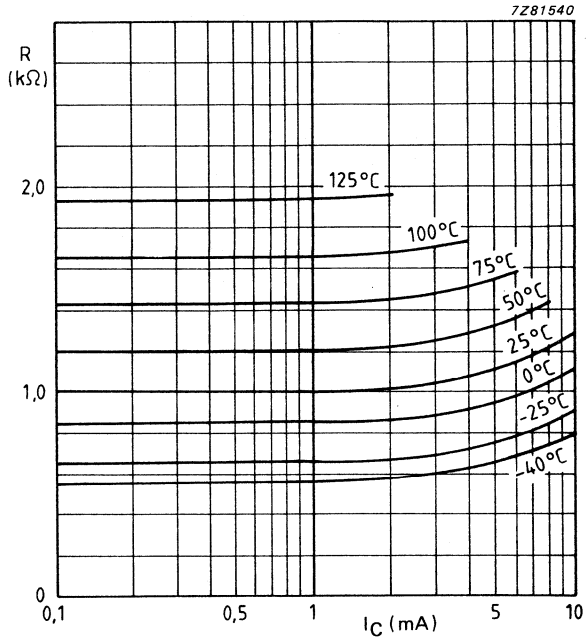


Fig. 3 Sensor resistance as a function of operating current.

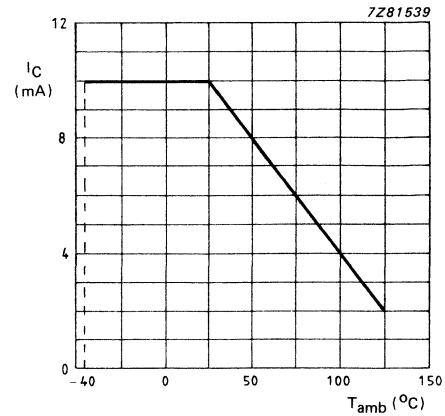


Fig. 4 Maximum operating current for safe operation.

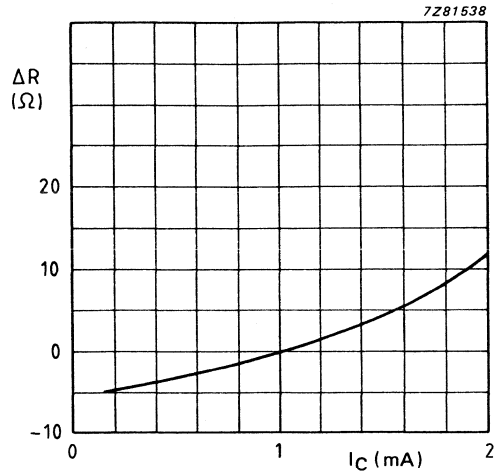


Fig. 5 Deviation of sensor resistance R as a function of operating current I_C in still liquid; T_{amb} = 25 °C.

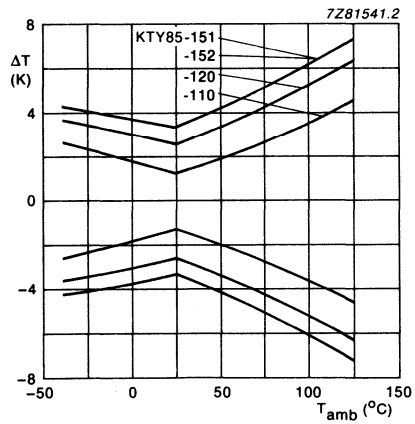


Fig. 6 Maximum expected temperature error ΔT.

N-CHANNEL FETS

Symmetrical silicon n-channel depletion type junction field-effect transistors on a plastic microminiature envelope intended for application in thick and thin-film circuits. The transistors are intended for low-power chopper or switching applications in industry.

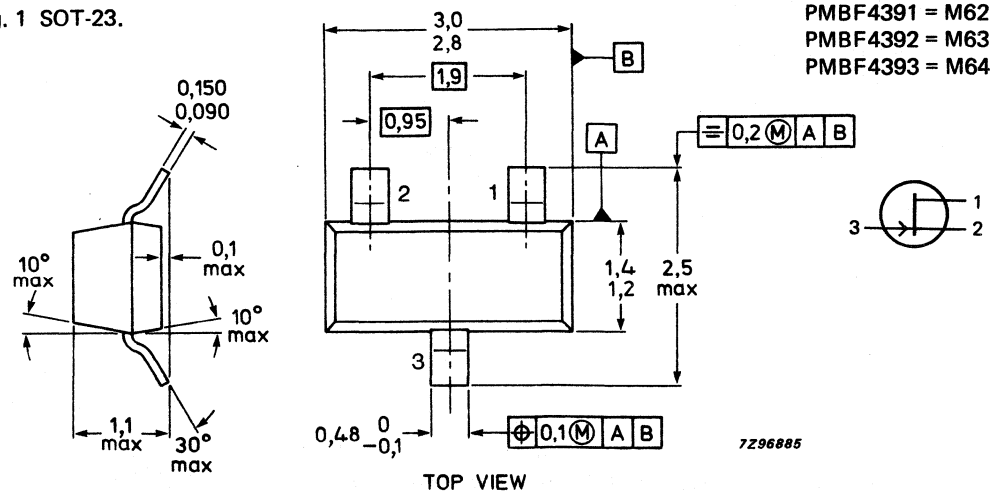
QUICK REFERENCE DATA

			PMBF4391	PMBF4392	PMBF4393	
Drain-source voltage	$\pm V_{DS}$	max.	40	40	40	V
Drain current						
V_{DS} = 20 V; V_{GS} = 0	I_{DSS}	>	50	25	5	mA
Gate-source cut-off voltage		>	4	2	0,5	V
V_{DS} = 20 V; I_D = 1 nA	$-V_{(P)GS}$	<	10	5	3	V
Drain-source resistance (on) at f = 1 kHz						
I_D = 1 mA; V_{GS} = 0	R_{DSon}	<	30	60	100	Ω
Feedback capacitance at f = 1 MHz						
$-V_{GS}$ = 12 V; V_{DS} = 0	C_{rs}	<	3,5	3,5	3,5	pF
Turn-off time						
V_{DD} = 10 V; V_{GS} = 0						
I_D = 12 mA; $-V_{GSM}$ = 12 V	t_{off}	<	20	–	–	ns
I_D = 6 mA; $-V_{GSM}$ = 7 V	t_{off}	<	–	35	–	ns
I_D = 3 mA; $-V_{GSM}$ = 5 V	t_{off}	<	–	–	50	ns

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm



Marking code

PMBF4391 = M62
PMBF4392 = M63
PMBF4393 = M64

Note: Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	40	V
Drain-gate voltage	V_{DGO}	max.	40	V
Gate-source voltage	$-V_{GSO}$	max.	40	V
Gate current (d.c.)	I_G	max.	50	mA
→ Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature range	T_{stg}		−65 to + 150	°C
→ Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

→ From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBF4391	PMBF4392	PMBF4393	
Gate-source voltage						
I_G = 1 mA; V_{DS} = 0	V_{GSon}	<	1	1	1	V
Gate-source cut-off current						
V_{DS} = 0 V; $-V_{GS}$ = 20 V	$-I_{GSS}$	<	1	1	1	nA
V_{DS} = 0 V; $-V_{GS}$ = 20 V; T_{amb} = 150 °C	$-I_{GSS}$	<	0,2	0,2	0,2	μA
Drain current**						
V_{DS} = 20 V; V_{GS} = 0	I_{DSS}	>	50	25	5	mA
		<	150	75	30	mA
Gate-source breakdown voltage						
$-I_G$ = 1 μA; V_{DS} = 0	$-V_{(BR)GSS}$	>	40	40	40	V
Gate-source cut-off voltage						
I_D = 1 nA; V_{DS} = 20 V	$-V_{(P)GS}$	>	4	2	0,5	V
		<	10	5	3	V
Drain-source voltage (on)						
I_D = 12 mA; V_{GS} = 0	V_{DSon}	<	0,4	–	–	V
I_D = 6 mA; V_{GS} = 0	V_{DSon}	<		0,4	–	V
I_D = 3 mA; V_{GS} = 0	V_{DSon}	<	–	–	0,4	V
Drain-source resistance (on)						
I_D = 0; V_{GS} = 0; f = 1 kHz	R_{DSon}	<	30	60	100	Ω

→ * Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** Measured under pulsed conditions; t_p = 100 μs; δ = 0,01.

			PMBF4391	PMBF4392	PMBF4393
Drain cut-off current					
$-V_{GS}$ = 12 V; V_{DS} = 20 V	I_{DSX}	<	1	–	– nA
$-V_{GS}$ = 7 V; V_{DS} = 20 V	I_{DSX}	<	–	1	– nA
$-V_{GS}$ = 5 V; V_{DS} = 20 V	I_{DSX}	<	–	–	1 nA
$-V_{GS}$ = 12 V; V_{DS} = 20 V; T_{amb} = 150 °C	I_{DSX}	<	0,2	–	– μA
$-V_{GS}$ = 7 V; V_{DS} = 20 V; T_{amb} = 150 °C	I_{DSX}	<	–	0,2	– μA
$-V_{GS}$ = 5 V; V_{DS} = 20 V; T_{amb} = 150 °C	I_{DSX}	<	–	–	0,2 μA
y-parameters (common source)					
V_{DS} = 20 V; V_{GS} = 0; f = 1 MHz					
Input capacitance	C_{is}	<	14	14	14 pF
Feedback capacitance	C_{rs}	<	3,5	3,5	3,5 pF
Switching times					
V_{DD} = 10 V; V_{GS} = 0					
Conditions I_D and $-V_{GSM}$	I_D	=	12	6	3 mA
	$-V_{GSM}$	=	12	7	5 V
Rise time	t_r	<	5	5	5 ns
Turn on time	t_{on}	<	15	15	15 ns
Fall time	t_f	<	15	20	30 ns
Turn off time	t_{off}	<	20	35	50 ns

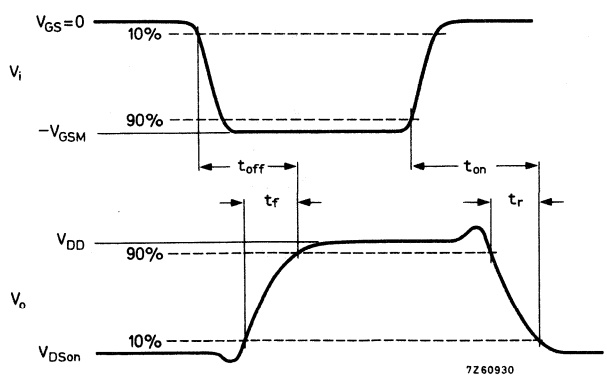


Fig. 2 Switching times waveforms.

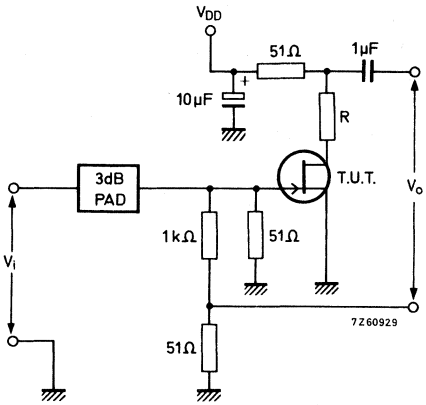


Fig. 3 Test circuit.

$$R = \frac{9,6}{I_D} - 51\ \Omega$$

Pulse generator:

t_r	<	0,5 ns
t_f	<	0,5 ns
t_p	=	100 μs
δ	=	0,01

Oscilloscope:

R_i	=	50 Ω

P-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Silicon symmetrical p-channel junction FETs in plastic microminiature SOT-23 envelopes.

They are intended for application with analogue switches, choppers, commutators etc. using SMD technology.

A special feature is the interchangeability of the drain and source connections.

QUICK REFERENCE DATA

Drain-source voltage	$\pm V_{DS}$	max.		30			V
Gate-source voltage	V_{GSO}	max.		30			V
Gate current	$-I_G$	max.		50			mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		300			mW
			PMBFJ174	**175**	**176**	**177**	
Drain current $-V_{DS}$ = 15 V; V_{GS} = 0	$-I_{DSS}$	>	20	7	2	1,5	mA
		<	135	70	35	20	mA
Drain-source ON-resistance $-V_{DS}$ = 0,1 V; V_{GS} = 0	$R_{DS\,on}$	<	85	125	250	300	Ω

MECHANICAL DATA

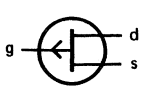
Dimensions in mm

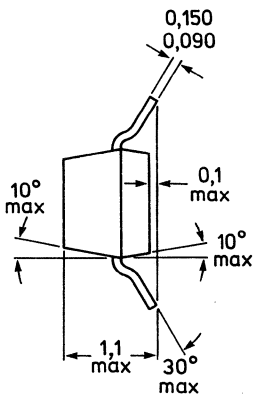
Fig. 1 SOT-23.

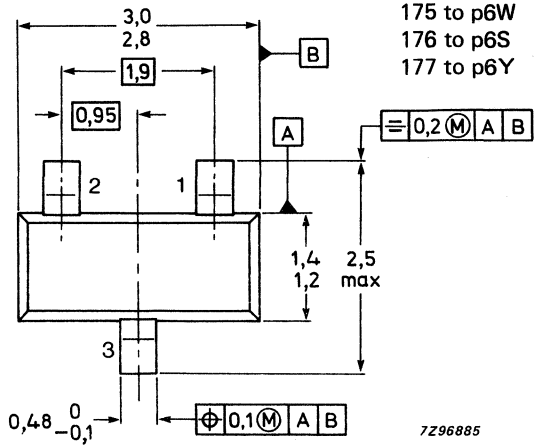
Matching codes:

174 to p6
175 to p6W
176 to p6S
177 to p6Y

Pinning:
1 = Drain
2 = Source
3 = Gate







TOP VIEW

Note: Drain and source are interchangeable.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	30	V
Gate-source voltage	V_{GSO}	max.	30	V
Gate-drain voltage	V_{GDO}	max.	30	V
Gate current (d.c.)	$-I_G$	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	430	K/W

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			PMBFJ174	175	176	177	
Gate cut-off current $-V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	<	1	1	1	1	nA
Drain cut-off current $-V_{DS}$ = 15 V; $-V_{GS}$ = 10 V	$-I_{DSX}$	<	1	1	1	1	nA
Drain current $-V_{DS}$ = 15 V; V_{GS} = 0	$-I_{DSS}$	>	20	7	2	1,5	mA
		<	135	70	35	20	mA
Gate-source breakdown voltage I_G = 1 μA; V_{DS} = 0	$V_{(BR)GSS}$	>	30	30	30	30	V
Gate-source cut-off voltage $-I_D$ = 10 nA; V_{DS} = 0	$V_{GS\,off}$	>	5	3	1	0,8	V
		<	10	6	4	2,25	V
Drain-source ON-resistance $-V_{DS}$ = 0,1 V; V_{GS} = 0	$R_{DS\,on}$	<	85	125	250	300	Ω

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

DYNAMIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Input capacitance, f = 1 MHz						
$-V_{GS}$ = 10 V; V_{DS} = 0 V	C_{is}	typ.		8		pF
$-V_{GS}$ = V_{DS} = 0	C_{is}	typ.		30		pF
Feedback capacitance, f = 1 MHz						
$-V_{GS}$ = 10 V; V_{DS} = 0 V	C_{rs}	typ.		4		pF

Switching times (see Fig. 2 + 3)		PMBFJ174		175	176	177	
Delay time	t_d	typ.	2	5	15	20	ns
Rise time	t_r	typ.	5	10	20	25	ns
Turn-on time	t_{on}	typ.	7	15	35	45	ns
Storage temperature	t_s	typ.	5	10	15	20	ns
Fall time	t_f	typ.	10	20	20	25	ns
Turn-off time	t_{off}	typ.	15	30	35	45	ns
Test conditions:	$-V_{DD}$		10	6	6	6	V
	$V_{GS\,off}$		12	8	6	3	V
	R_L		560	1200	2000	2900	Ω
	$V_{GS\,on}$		0	0	0	0	V

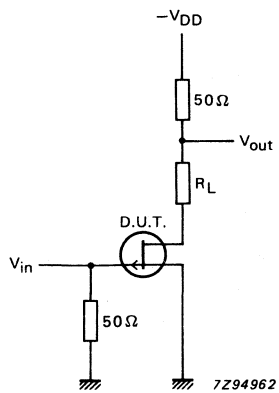


Fig. 2 Switching times test circuit

Rise time input voltage < 1 ns

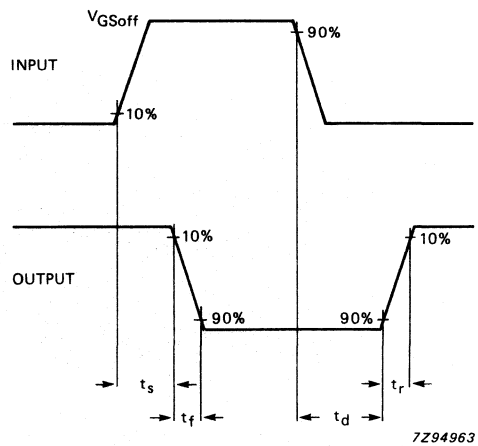


Fig. 3 Input and output waveforms

$t_d + t_r = t_{on}$

$t_s + t_f = t_{off}$

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope intended for switching and linear applications in thick and thin-film circuits.

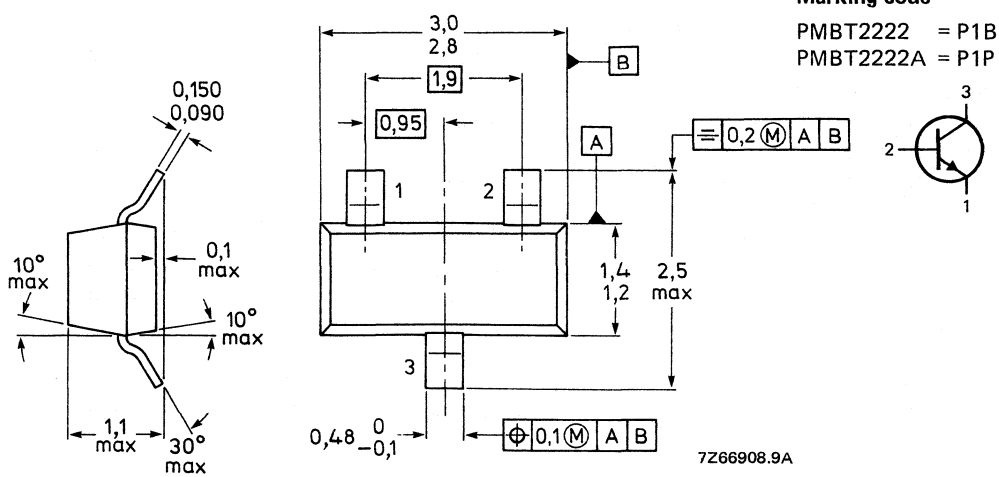
QUICK REFERENCE DATA

			PMBT2222	PMBT2222A	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5,0	6,0	V
Collector current (d.c.)	I_C	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
D.C. current gain					
I_C = 150 mA; V_{CE} = 10 V	h_{FE}		100 to 300		
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	30	40	
Transition frequency at f = 100 MHz					
I_C = 20 mA; V_{CE} = 20 V	f_T	>	250	300	MHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

Marking code

PMBT2222 = P1B
PMBT2222A = P1P

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBT2222	PMBT2222A	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5,0	6,0	V
Collector current (d.c.)	I_C	max.	600		mA
Total power dissipation*					
→ up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature range	T_{stg}		−55 to 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE *

→ From junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

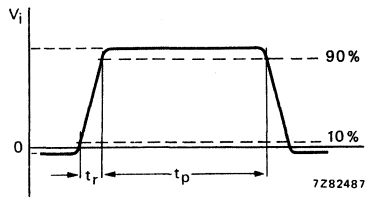
			PMBT2222	PMBT2222A	
Collector cut-off current					
I_E = 0; V_{CB} = 50 V	I_{CBO}	<	0,01	–	μA
I_E = 0; V_{CB} = 60 V	I_{CBO}	<	–	0,01	μA
I_E = 0; V_{CB} = 50 V; T_j = 125 °C	I_{CBO}	<	10	–	μA
I_E = 0; V_{CB} = 60 V; T_j = 125 °C	I_{CBO}	<	–	10	μA
V_{EB} = 3 V; V_{CE} = 60 V	I_{CEX}	<	–	10	nA
Base current					
with reverse biased emitter junction					
V_{EB} = 3 V; V_{CE} = 60 V	I_{BEX}	<	–	20	nA
Emitter cut-off current					
I_C = 0; V_{EB} = 3 V	I_{EBO}	<		10	nA
Saturation voltages**					
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	<	400	300	mV
	V_{BEsat}	<	1300	–	mV
	V_{BEsat}		–	0,6 to 1,2	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	1600	1000	mV
	V_{BEsat}	<	2600	2000	mV
Breakdown voltages					
I_C = 1,0 mA; I_B = 0	$V_{(BR)CEO}$	>	30	40	V
I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	>	60	75	V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	>	5,0	6,0	V

→ * Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

** Measured under pulsed conditions to avoid excessive dissipation; $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

			PMBT2222	PMBT2222A	
D.C. current gain					
I_C = 0,1 mA; V_{CE} = 10 V	h_{FE}	>	35		
I_C = 1 mA; V_{CE} = 10 V	h_{FE}	>	50		
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	>	75		
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	h_{FE}	>	35		
I_C = 150 mA; V_{CE} = 10 V	h_{FE}		100 to 300		
I_C = 150 mA; V_{CE} = 1 V	h_{FE}	>	50		
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	>	30	40	
Transition frequency at f = 100 MHz*					
I_C = 20 mA; V_{CE} = 20 V	f_T	>	250	300	MHz
Output capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 10 V	C_o	<	8,0		pF
Input capacitance at f = 1 MHz					
I_C = 0; V_{EB} = 0,5 V	C_i	<	30	25	
h-parameters (common emitter) at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V					
input impedance	h_{ie}		2,0 to 8,0		kΩ
reverse voltage transfer ratio	h_{re}		$< 8,0 \times 10^{-4}$		
small signal current gain	h_{fe}		50 to 300		
output admittance	h_{oe}		5,0 to 35		μS
I_C = 10 mA; V_{CE} = 10 V					
input impedance	h_{ie}		0,25 to 1,25		kΩ
reverse voltage transfer ratio	h_{re}		$< 4,0 \times 10^{-4}$		
small signal current gain	h_{fe}		75 to 375		
output admittance	h_{oe}		25 to 200		μS
Noise figure at R_S = 1 kΩ					
I_C = 100 μA; V_{CE} = 10 V; f = 1 kHz	F	<	4,0		dB
Switching times (between 10% and 90% levels)					
Turn-on time switched to I_C = 150 mA					
delay time	t_d	<	10		ns
rise time	t_r	<	25		ns
Turn-off time switched from I_C = 150 mA					
storage time	t_s	<	225		ns
fall time	t_f	<	60		ns

* f_T is defined as the frequency at which h_{fe} extrapolates to unity.



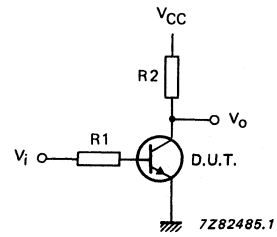
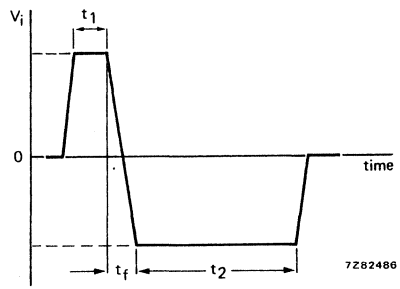


Fig. 2 Waveform and test circuit delay and rise time.

V_i = −0,5 to + 9,9 V; V_{CC} = 30 V; R1 = 619 Ω; R2 = 200 Ω.

Pulse generator:				Oscilloscope:			
pulse duration	t_p	⩽	200 ns	input impedance	Z_i	>	100 kΩ
rise time	t_r	⩽	2 ns	input capacitance	C_i	<	12 pF
duty factor	δ	=	2 %	rise time	t_r	<	5 ns



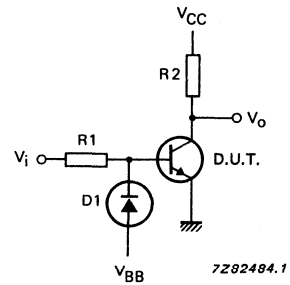


Fig. 3 Waveform and test circuit storage and fall time.

V_i = −13,8 to + 16,2 V; V_{CC} = 30 V; $-V_{BB}$ = 3 V; R1 = 1 kΩ; R2 = 200 Ω.

Pulse generator:				Oscilloscope:			
fall time	t_f	<	5 ns	input impedance	Z_i	>	100 kΩ
pulse time	t_1	=	100 μs	input capacitance	C_i	<	12 pF
	t_2	=	500 μs	rise time	t_r	<	5 ns

SILICON PLANAR EPITAXIAL SWITCHING TRANSISTOR

N-P-N transistor in a plastic SOT-23 envelope intended for high-speed switching applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	40 V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Collector current (d.c. value)	I_C	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
D.C. current gain			
I_C = 10 mA; V_{CE} = 1 V	h_{FE}		40 to 120
I_C = 100 mA; V_{CE} = 2 V	h_{FE}	>	20
Storage time			
$I_{Con} = I_{Bon} = I_{Boff}$ = 10 mA	t_s	<	13 ns

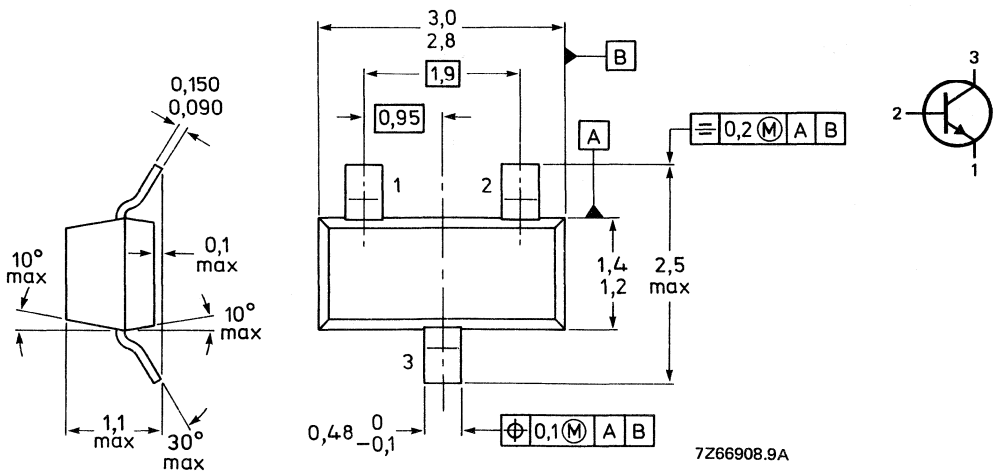
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

PMBT2369 = P1J



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,5	V
Collector current (d.c. value)	I_C	max.	500	mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−55 to 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	400	nA
I_E = 0; V_{CB} = 20 V; T_j = 125 °C	I_{CBO}	<	30	μA
Saturation voltages				
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	0,25	V
	V_{BEsat}		0,70 to 0,85	V
D.C. current gain				
I_C = 10 mA; V_{CE} = 1 V	h_{FE}		40 to 120	
I_C = 10 mA; V_{CE} = 1 V; T_{amb} = −55 °C	h_{FE}	>	20	
I_C = 100 mA; V_{CE} = 2 V	h_{FE}	>	20	
Output capacitance at f = 1 MHz				
I_E = 0; V_{CB} = 5 V	C_o	<	4,0	pF
Small-signal current gain				
I_C = 1,0 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C	h_{fe}	>	5,0	pF
Breakdown voltages				
I_C = 10 mA; I_B = 0	$V_{(BR)CEO}$	min.	15	V
I_C = 10 μA; I_E = 0	$V_{(BR)CBO}$	min.	40	V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	min.	4,5	V
I_C = 10 μA; V_{BE} = 0	$V_{(BR)CES}$	min.	40	V

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm .

Switching times at T_{amb} = 25 °C

Storage time (see Fig. 2)			
$I_{Con} = I_{Bon} = -I_{Boff}$ = 10 mA	t_s	typ.	5,0 ns
		<	13 ns
Turn-on time (see Fig. 3)			
I_C = 10 mA; I_{Bon} = 3 mA; V_{CC} = 3 V	t_{on}	typ.	8,0 ns
	t_{on}	<	12 ns
Turn-off time (see Fig. 3)			
I_C = 10 mA; I_{Bon} = 3 mA; I_{Boff} = 1,5 mA; V_{CC} = 3 V	t_{off}	typ.	10 ns
	t_{off}	<	18 ns

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for medium power switching and general purpose amplifier applications in thick and thin-film circuits.

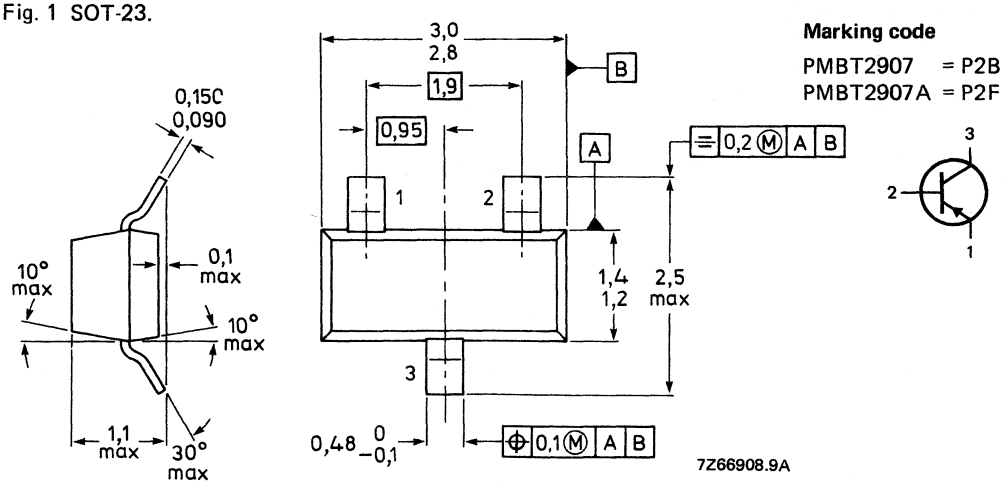
QUICK REFERENCE DATA

			PMBT2907	PMBT2907A	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	60	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5,0		V
Collector current (d.c.)	$-I_C$	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	30	50	
Turn-off switching time $-I_{Con}$ = 150 mA; $-I_{Bon} = I_{Boff}$ = 15 mA	t_{off}	<	100		ns
Transition frequency at f = 100 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 20 V	f_T	>	200		MHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

Marking code

PMBT2907 = P2B
PMBT2907A = P2F

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBT2907	PMBT2907A	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	60	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5,0		V
Collector current (d.c.)	$-I_C$	max.	600		mA
→ Power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE *

→ From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			PMBT2907	PMBT2907A	
Collector cut-off current					
I_E = 0; $-V_{CB}$ = 50 V	$-I_{CBO}$	<	20	10	nA
I_E = 0; $-V_{CB}$ = 50 V; T_j = 125 °C	$-I_{CBO}$	<	20	10	μA
$-V_{EB}$ = 0,5 V; $-V_{CE}$ = 30 V	$-I_{CEX}$	<	50		nA
Base current with reverse biased emitter junction					
$-V_{EB}$ = 3 V; $-V_{CE}$ = 30 V	$-I_{BEX}$	<	50		nA
Saturation voltages**					
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CEsat}$	<	0,4		V
	$-V_{BEsat}$	<	1,3		V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	1,6		V
	$-V_{BEsat}$	<	2,6		V
Collector-base breakdown voltage open emitter; $-I_C$ = 10 μA; I_E = 0	$-V_{(BR)CBO}$		60		V
Collector-emitter breakdown voltage open base; $-I_C$ = 10 mA; I_B = 0	$-V_{(BR)CEO}$	>	40	60	V
Emitter-base breakdown voltage open collector; $-I_E$ = 10 μA; I_C = 0	$-V_{(BR)EBO}$		5,0		V

→ * Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

			PMBT2907	PMBT2907A	
D.C. current gain					
$-I_C$ = 0,1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	35	75	
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	100	
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	>	75	100	
$-I_C$ = 150 mA; $-V_{CE}$ = 10 V	h_{FE}		100 to 300		
$-I_C$ = 500 mA; $-V_{CE}$ = 10 V	h_{FE}	>	30	50	
Transition frequency at f = 100 MHz					
$-I_C$ = 50 mA; $-V_{CE}$ = 20 V; T_{amb} = 25 °C	f_T	>	200		MHz
Output capacitance at f = 1 MHz					
$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_o	<	8,0		pF
Input capacitance at f = 1 MHz					
$I_C = I_c = 0$; $-V_{EB}$ = 2 V	C_i	<	30		pF
Switching times (between 10% and 90% levels)					
Turn-on time when switched to					
$-I_C$ = 150 mA; $-I_B$ = 15 mA; V_{CC} = 30 V					
delay time	t_d	<	10		ns
rise time	t_r	<	40		ns
turn-on time ($t_d + t_r$)	t_{on}	<	45		ns
Turn-off time when switched from					
$-I_C$ = 150 mA; $-I_B$ = 15 mA; V_{CC} = 6 V					
to cut-off with + I_{BM} = 15 mA (see Fig. 3)					
storage time	t_s	<	80		ns
fall time	t_f	<	30		ns
turn-off time ($t_s + t_f$)	t_{off}	<	100		ns

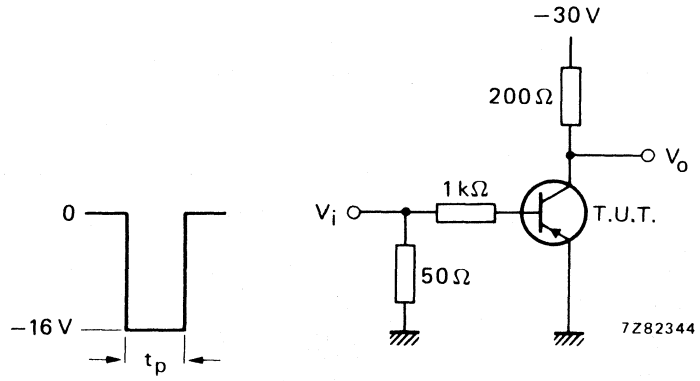


Fig. 2 Turn-on switching time test circuit.

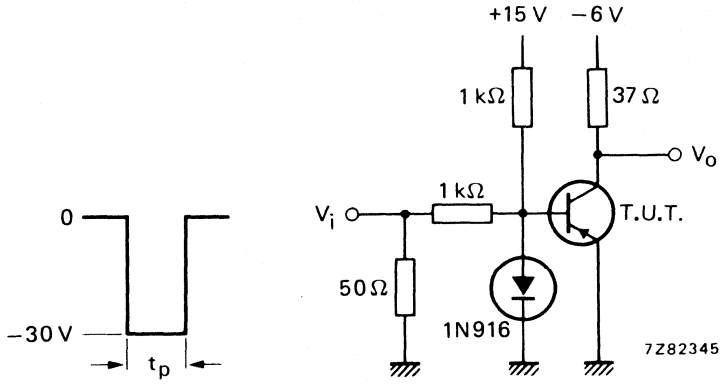


Fig. 3 Turn-off switching time test circuit.

Input pulse generator:	frequency	f	=	150	Hz
Fig. 2 and Fig. 3	pulse duration	t_p	=	200	ns
	rise time	t_r	⩽	2	ns
	output impedance	Z_o	=	50	Ω
Output oscilloscope:	rise time	t_r	⩽	5	ns
Fig. 2 and Fig. 3	input impedance	Z_i	=	10	MΩ

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature (SMD) plastic envelope intended for surface mounted applications. They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PMBT3903	PMBT3904	
Collector-base voltage (open emitter)	V_{CBO}	max.		60	V
Collector-emitter voltage (open base)	V_{CEO}	max.		40	V
Emitter-base voltage (open collector)	V_{EBO}	max.		6	V
Collector current (d.c.)	I_C	max.		200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		300	mW
D.C. current gain					
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	50	100	
		<	150	300	
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 20 V	f_T	>	250	300	MHz

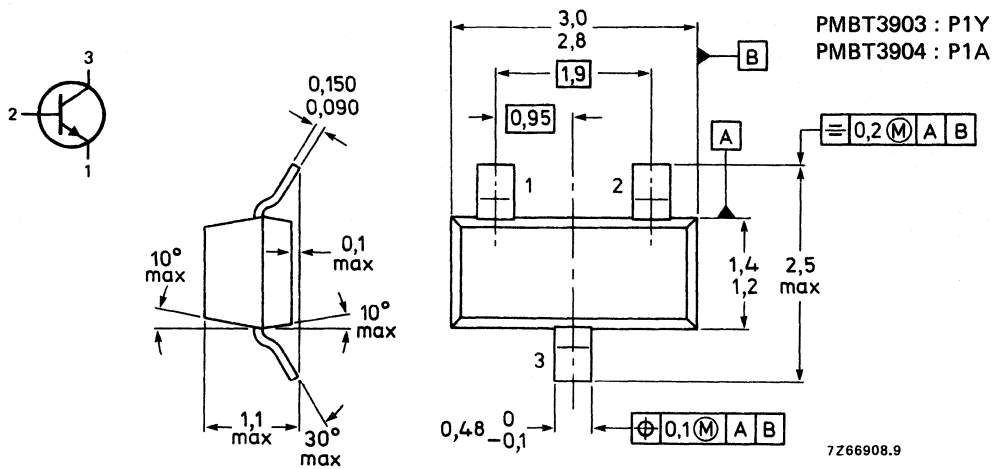
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

PMBT3903 : P1Y
PMBT3904 : P1A



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

$T_j = P\,(R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance from junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage▲ I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	min.	40	V
Collector-base breakdown voltage I_C = 10 μA; I_E = 0	$V_{(BR)CBO}$	min.	60	V
Emitter-base breakdown voltage I_E = 10 μA; I_C = 0	$V_{(BR)EBO}$	min.	6	V
Collector cut-off current V_{CE} = 30 V; V_{EB} = 3 V	I_{CEX}	max.	50	nA
Output capacitance at f = 1 MHz I_E = 0; V_{CB} = 5 V	C_c	max.	4	pF
Input capacitance at f = 1 MHz I_C = 0; V_{BE} = 0,5 V	C_e	max.	8	pF
Base current with reverse biased emitter junction V_{EB} = 3 V; V_{CE} = 30 V	I_{BEX}	max.	50	nA

* Mounted on a ceramic substrate: area = 10 x 8 mm²; thickness = 0,7 mm.

▲ Pulse test conditions: t_p = 300 μs; duty cycle ≤ 2%.

			PMBT3903	PMBT3904	
Saturation voltages					
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	max.	0,2		V
I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0,3		V
I_C = 10 mA; I_B = 1 mA	V_{BEsat}	min.	0,65		V
	V_{BEsat}	max.	0,85		V
I_C = 50 mA; I_B = 5 mA	V_{BEsat}	max.	0,95		V
D.C. current gain *					
I_C = 0,1 mA; V_{CE} = 1 V	h_{FE}	>	20	40	
I_C = 1 mA; V_{CE} = 1 V	h_{FE}	>	35	70	
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	50	100	
	h_{FE}	<	150	300	
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	>	30	60	
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	>	15	30	
Transition frequency at f = 100 MHz					
I_C = 10 mA; V_{CE} = 20 V	f_T	min.	250	300	MHz
Noise figure at R_S = 1 kΩ					
I_C = 100 μA; V_{CE} = 5 V					
f = 10 Hz to 15,7 kHz	F	max.	6	5	dB
h-parameters (common emitter)					
I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz					
Input impedance	h_{ie}		1 to 8	1 to 10	kΩ
Reverse voltage transfer ratio	h_{re}		0,1 to 5	0,5 to 8	10^{-4}
Small-signal current gain	h_{fe}		50 to 200	100 to 400	
Output admittance	h_{oe}		1 to 40	1 to 40	μS
Switching times					
Turn-on time when V_{CC} = 3 V; V_{BE} = 0,5 V					
I_C = 10 mA; I_{Bon} = 1 mA					
Delay time	t_d	<	35	35	ns
Rise time	t_r	<	35	35	ns
Turn-off time when V_{CC} = 3 V; I_C = 10 mA					
I_{Bon} = I_{Boff} = 1 mA					
Storage time	t_s	<	175	200	ns
Fall time	t_f	<	50	50	ns

* Pulse test conditions: t_p = 300 μs; duty cycle ⩽ 2%.

SILICON EPITAXIAL TRANSISTOR

P-N-P transistor in a microminiature (SMD) plastic envelope intended for surface mounted applications.
The PMBT3906 is primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

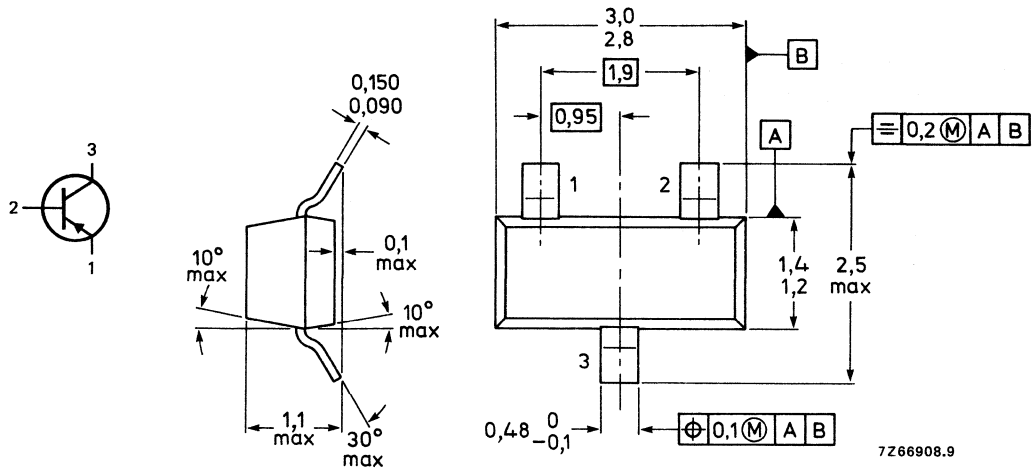
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
D.C. current gain $-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	100 to 300	
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	min.	250 MHz

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code
PMBT3906 : P2A



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
→ Storage temperature	T_{stg}		−65 to +150	°C

THERMAL CHARACTERISTICS**

$T_j = P(R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance → from junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage▲ $-I_C$ = 1 mA; I_B = 0	$-V_{(BR)CEO}$	min.	40	V
Collector-base breakdown voltage $-I_C$ = 10 μA; I_E = 0	$-V_{(BR)CBO}$	min.	40	V
Emitter-base breakdown voltage $-I_E$ = 10 μA; I_C = 0	$-V_{(BR)EBO}$	min.	5	V
Collector cut-off current $-V_{CE}$ = 30 V; $-V_{EB}$ = 3 V	$-I_{CE}$	max.	50	nA
Base current with reverse biased emitter junction	$-I_{BEX}$	max.	50	nA
Output capacitance at f = 100 kHz I_E = 0; $-V_{CB}$ = 5 V	C_c	max.	4,5	pF
Input capacitance at f = 100 kHz I_C = 0; $-V_{BE}$ = 0,5 V	C_e	max.	10	pF

* Mounted on a ceramic substrate: area = 10 x 8 mm; thickness = 0,7 mm.

** See Thermal characteristics.

▲ Pulse test conditions: t_p = 300 μs; duty cycle ⩽ 2%.

Saturation voltages				
$-I_C = 10$ mA; $-I_B = 1$ mA	$-V_{CEsat}$	max.	0,25	V
$-I_C = 50$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	max.	0,4	V
		min.	0,65	V
$-I_C = 10$ mA; $-I_B = 1$ mA	$-V_{BEsat}$	max.	0,85	V
$-I_C = 50$ mA; $-I_B = 5$ mA	$-V_{BBsat}$	max.	0,95	V
D.C. current gain				
$-I_C = 0{,}1$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	60	
$-I_C = 1$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	80	
$-I_C = 10$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	100	
		max.	300	
$-I_C = 50$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	60	
$-I_C = 100$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	30	
Transition frequency at f = 100 MHz				
$-I_C = 10$ mA; $-V_{CE} = 20$ V	f_T	min.	250	MHz
Noise figure at $R_S = 1$ kΩ				
$-I_C = 100$ μA; $-V_{CE} = 5$ V				
f = 10 Hz to 15,7 kHz	F	max.	4	dB
h-parameters (common emitter)				
$-I_C = 1$ mA; $-V_{CE} = 10$ V; f = 1 kHz				
Input impedance	h_{ie}	min.	2,0	kΩ
		max.	12	kΩ
Reverse voltage transfer ratio	h_{re}	min.	1,0	10^{-4}
		max.	10	10^{-4}
Small signal current gain	h_{fe}	min.	100	
		max.	400	
Output admittance	h_{oe}	min.	30	μS
		max.	60	μS
Switching times				
Turn-on time when $-V_{CC} = 3$ V; $-V_{BE} = 0{,}5$ V				
$-I_C = 10$ mA; $-I_{Bon} = 1$ mA				
Delay time	t_d	max.	35	ns
Rise time	t_r	max.	35	ns
Turn-off time when $-V_{CC} = 3$ V; $-I_C = 10$ mA				
$-I_{Bon} = -I_{Boff} = 1$ mA				
Storage time	t_s	max.	225	ns
Fall time	t_f	max.	75	ns

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN silicon planar epitaxial transistor, housed in a SOT-23 envelope.

It is intended for use in linear, switching, and general purpose applications.

The complementary type is the PMBT4403.

QUICK REFERENCE DATA

Collector-emitter voltage	V_{CEO}	max.	40 V
Collector current (DC)	I_C	max.	600 mA
DC current gain I_C = 150 mA; V_{CE} = 1 V	h_{FE}	min. max.	100 300
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW

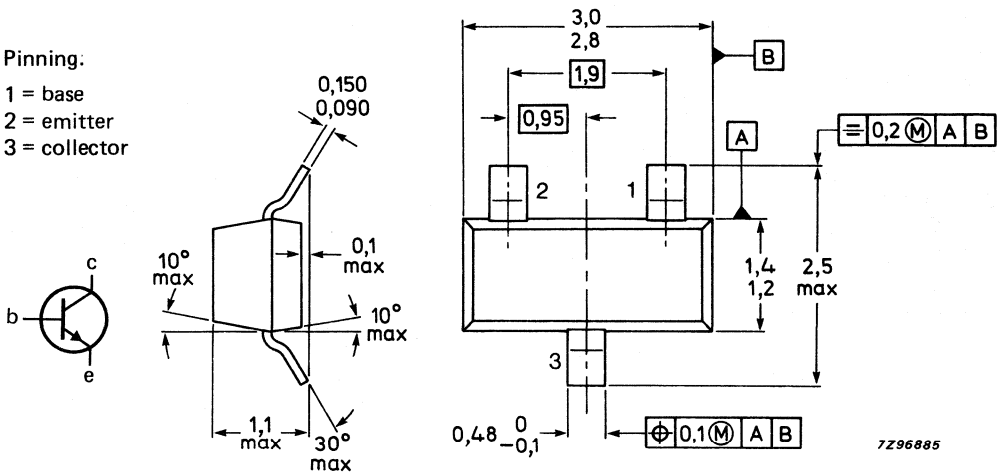
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23

Marking code
P2X

Pinning:
1 = base
2 = emitter
3 = collector



TOP VIEW

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	40 V
Collector-base voltage	V_{CBO}	max.	60 V
Emitter-base voltage	V_{EBO}	max.	6.0 V
Collector current (DC)	I_C	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW
Storage temperature range	T_{stg}		−55 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
I_C = 1.0 mA; I_B = 0	$V_{(BR)CEO}$	>	40 V
Collector-base breakdown voltage			
I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	>	60 V
Emitter-base breakdown voltage			
I_E = 100 μA; I_C = 0	$V_{(BR)EBO}$	>	6.0 V
Base cut-off current			
V_{CE} = 35 V; V_{EB} = 0.4 V	I_{BEX}	<	0.1 μA
Collector cut-off current			
V_{CE} = 35 V; V_{EB} = 0.4 V	I_{CEX}	<	0.1 μA
DC current gain			
I_C = 0.1 mA; V_{CE} = 1 V	h_{FE}	>	20
I_C = 1.0 mA; V_{CE} = 1 V	h_{FE}	>	40
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	80
I_C = 150 mA; V_{CE} = 1 V	h_{FE}		100 to 300
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	40
Saturation voltage			
I_C = 150 mA; I_B = 15 mA	$V_{CE\ sat}$	>	0.4 V
	$V_{BE\ sat}$		0.75 to 0.95 V
I_C = 500 mA; I_B = 50 mA	$V_{CE\ sat}$	<	0.75 V
	$V_{BE\ sat}$	<	1.2 V

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

Transition frequency; f = 100 MHz; I_C = 20 mA; V_{CE} = 10 V	f_T	>	250 MHz
Collector-base capacitance I_E = 0; V_{CB} = 5 V; f = 100 kHz	C_{cb}	<	8.0 pF
Emitter-base capacitance I_C = 0; V_{BE} = 0.5 V; f = 100 kHz	C_{eb}	<	30 pF
Input impedance; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{ie}	min. max.	1.0 kΩ 8.0 kΩ
Voltage feed-back ratio I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz	h_{re}	min. max.	0.1×10^{-4} 30×10^{-4}
Small-signal current gain; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{fe}	min. max.	40 500
Output admittance; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{oe}	min. max.	1.0 μS 30 μS
Switching times (resistive load)			
Turn-on time I_C = 150 mA; I_{B1} = 15 mA; V_{CC} = 30 V; V_{EB} = 2 V			
delay time	t_d	max.	15 ns
rise time	t_r	max.	20 ns
Turn-off time I_C = 150 mA; V_{CC} = 30 V; I_{B1} = I_{B2} = 15 mA			
storage time	t_s	max.	225 ns
fall time	t_f	max.	30 ns

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP silicon planar epitaxial transistor, housed in a SOT-23 envelope.

It is intended for use in linear, switching and general purpose applications.

The complementary type is the PMBT4401.

QUICK REFERENCE DATA

Collector-emitter voltage	$-V_{CEO}$	max.	40 V
Collector current (DC)	$-I_C$	max.	600 mA
DC current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}	min. max.	100 300
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW

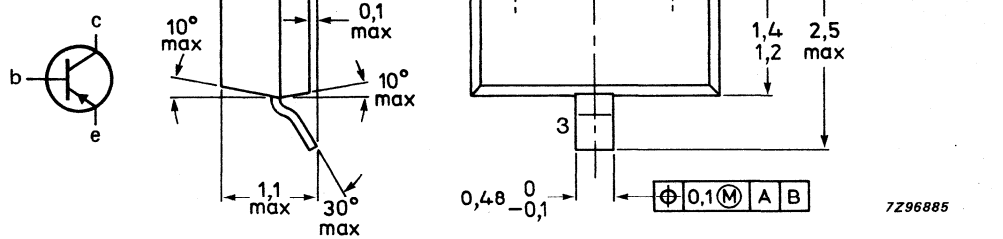
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23

Marking code
P2T

Pinning:
1 = base
2 = emitter
3 = collector



TOP VIEW

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	$-V_{CEO}$	max.	40	V
Collector-base voltage	$-V_{CBO}$	max.	40	V
Emitter-base voltage	$-V_{EBO}$	max.	5.0	V
Collector current (DC)	$-I_C$	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
$-I_C$ = 1.0 mA; I_B = 0	$-V_{(BR)CEO}$	>	40	V
Collector-base breakdown voltage				
$-I_C$ = 100 μA; I_E = 0	$-V_{(BR)CBO}$	>	40	V
Emitter-base breakdown voltage				
$-I_E$ = 100 μA; I_C = 0	$-V_{(BR)EBO}$	>	5.0	V
Base cut-off current				
$-V_{CE}$ = 35 V; $-V_{EB}$ = 0.4 V	$-I_{BEX}$	<	0.1	μA
Collector cut-off current				
$-V_{CE}$ = 35 V; $-V_{EB}$ = 0.4 V	$-I_{CEX}$	<	0.1	μA
DC current gain				
$-I_C$ = 0.1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
$-I_C$ = 1.0 mA; $-V_{CE}$ = 1 V	h_{FE}	>	60	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	>	100	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		100 to 300	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	>	20	
Saturation voltage				
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CE\ sat}$	<	0.4	V
	$-V_{BE\ sat}$		0.75 to 0.95	V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CE\ sat}$	<	0.75	V
	$-V_{BE\ sat}$	<	1.3	V

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

Transition frequency at f = 100 MHz; $-I_C$ = 20 mA; $-V_{CE}$ = 10 V	f_T	>	200 MHz
Collector-base capacitance I_E = 0; $-V_{CB}$ = 10 V; f = 100 kHz	C_{cb}	<	8.5 pF
Emitter-base capacitance at f = 100 kHz; I_C = 0; $-V_{BE}$ = 0.5 V	C_{eb}	<	35 pF
Input impedance at f = 1 kHz; $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{ie}	min. max.	1.5 kΩ 15 kΩ
Voltage feed-back ratio at f = 1 kHz; $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{re}	min. max.	0.1×10^{-4} 8.0×10^{-4}
Small-signal current gain at f = 1 kHz; $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{fe}	min. max.	60 500
Output admittance at f = 1 kHz; $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{oe}	min. max.	1.0 μS 100 μS
Switching times (resistive load)			
Turn-on time $-I_C$ = 150 mA; $-I_{B1}$ = 15 mA; $-V_{CC}$ = 30 V; $-V_{EB}$ = 2 V			
delay time	t_d	max.	15 ns
rise time	t_r	max.	20 ns
Turn-off time $-I_C$ = 150 mA; $-V_{CC}$ = 30 V; $-I_{B1} = +I_{B2}$ = 15 mA			
storage time	t_s	max.	225 ns
fall time	t_f	max.	30 ns

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N small-signal transistor in plastic SOT-23 envelope intended for low-noise input stages in audio equipment, when using SMD technology.

QUICK REFERENCE DATA

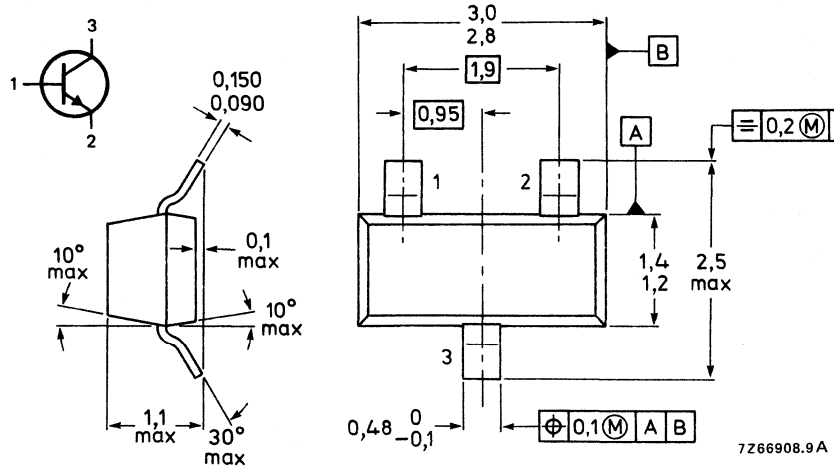
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	35 V
Collector current (d.c.)	I_C	max.	50 mA
Total device dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Collector-emitter saturation voltage I_C = 10 mA; I_B = 1 mA	V_{CEsat}	max.	0,5 V
D.C. current gain I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	350

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code: P1Q



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,5 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage I_B = 0; I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_E = 0; I_C = 100 μA	$V_{(BR)CBO}$	min.	35 V
Collector cut-off current V_{CB} = 20 V; I_E = 0	I_{CBO}	max.	50 nA
Emitter cut-off current V_{EBoff} = 3 V; I_C = 0	I_{EBO}	max.	50 nA
Saturation voltages I_C = 10 mA; I_B = 1 mA	V_{CEsat} V_{BEsat}	max. max.	0,5 V 0,8 V
D.C. current gain I_C = 100 μA; V_{CE} = 5 V	h_{FE}	min. max.	300 900
I_C = 1 mA; V_{CE} = 5 V I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min. min.	350 300
Small-signal current gain I_C = 1 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	min. max.	350 1400
Noise figure at R_S = 10 kΩ; T_{amb} = 25 °C I_C = 100 μA; V_{CE} = 5 V; f = 10 Hz to 15,7 kHz	F	max.	3,0 dB
Collector capacitance at f = 100 kHz V_{CB} = 5 V; I_E = 0	C_c	max.	4,0 pF
Emitter capacitance at f = 100 kHz V_{BE} = 0,5 V; I_C = 0	C_e	max.	10 pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON P-N-P HIGH-VOLTAGE TRANSISTOR

P-N-P high-voltage small-signal transistor for general purposes and especially in telephony applications and encapsulated in a SOT-23 envelope.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	160 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	150 V
Collector current	$-I_C$	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Collector-emitter saturation voltage I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0,5 V
D.C. current gain I_C = 10 mA; V_{CE} = −5 V	h_{FE}		60 to 240

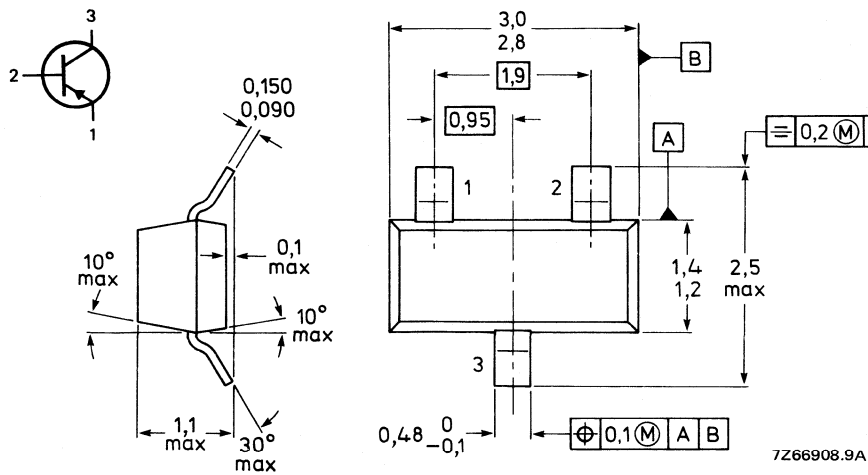
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

P2L



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	160 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	150 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5,0 V
Collector current	$-I_C$	max.	500 mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Storage temperature	T_{stg}		−65 to +150 °C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$		430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 120 V	$-I_{CBO}$	max.	50 nA
I_E = 0; $-V_{CB}$ = 120 V; T_{amb} = 150 °C	$-I_{CBO}$	max.	50 μA
Breakdown voltages			
I_C = 1,0 mA; I_B = 0	$-V_{(BR)CEO}$	min.	150 V
I_C = 100 μA; I_E = 0	$-V_{(BR)CBO}$	min.	160 V
I_C = 0; I_E = 10 μA	$-V_{(BR)EBO}$	min.	5,0 V
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 1,0 mA	$-V_{CEsat}$	max.	0,2 V
	$-V_{BEsat}$	max.	1,0 V
$-I_C$ = 50 mA; $-I_B$ = 5,0 mA	$-V_{CEsat}$	max.	0,5 V
	$-V_{BEsat}$	max.	1,0 V
D.C. current gain			
I_C = 1,0 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	50
I_C = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	60
		max.	240
I_C = 50 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	50
Small-signal current gain			
I_C = 1,0 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{fe}	min.	40
		max.	200
Output capacitance at f = 1 MHz			
I_E = 0; $-V_{CB}$ = 10 V	C_o	max.	6,0 pF
Transition frequency at f = 100 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	f_T	min.	100 MHz
		max.	300 MHz
Noise figure at R_S = 10 Ω			
I_C = 200 μA; $-V_{CE}$ = 5 V; f = 10 Hz to 15,7 kHz; T_{amb} = 25 °C	F	max.	8,0 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON N-P-N HIGH-VOLTAGE TRANSISTOR

N-P-N high-voltage small-signal transistor for general purposes and especially telephony applications and encapsulated in a SOT-23 envelope.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	160 V
Collector-emitter voltage (open base)	V_{CEO}	max.	140 V
Collector current	I_C	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Collector-emitter saturation voltage I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0,25 V
D.C. current gain I_C = 10 mA; V_{CE} = 5 V	h_{FE}		60 to 250

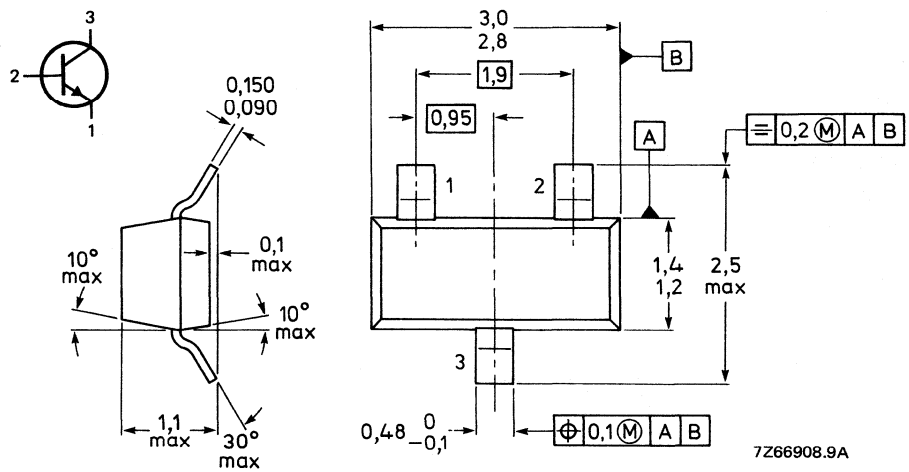
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

P1F



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	160	
Collector-emitter voltage (open base)	V_{CEO}	max.	140	
Emitter-base voltage (open collector)	V_{EBO}	max.	6	V
Collector current	I_C	max.	600	mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE *

From junction to ambient	$R_{th\ t\text{-}a}$		430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 100 V	I_{CBO}	max.	100	nA
I_E = 0; V_{CB} = 100 V; T_{amb} = 100 °C	I_{CBO}	max.	100	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 4,0 V	I_{EBO}	max.	50	nA
Breakdown voltages				
I_C = 1,0 mA; I_B = 0	$V_{(BR)CEO}$	min.	140	V
I_C = 10 μA; I_E = 0	$V_{(BR)CBO}$	min.	160	V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	min.	6	V
Saturation voltages				
I_C = 10 mA; I_B = 1,0 mA	V_{CEsat}	max.	0,15	V
	V_{BEsat}	max.	1,0	V
I_C = 50 mA; I_B = 5,0 mA	V_{CEsat}	max.	0,25	V
	V_{BEsat}	max.	1,2	V
D.C. current gain				
I_C = 1,0 mA; V_{CE} = 5 V	h_{FE}	min.	60	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	60	
		max.	250	
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min.	20	
Output capacitance at f = 1 MHz				
I_E = 0; V_{CB} = 10 V	C_o	max.	6	pF
Input capacitance at f = 1 MHz				
I_C = 0; V_{EB} = 0,5 V	C_i	max.	30	pF
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	f_T	min.	100	MHz
		max.	300	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON NPN HIGH-VOLTAGE TRANSISTOR

NPN high-voltage small-signal transistor for general purposes and especially telephony applications and encapsulated in a SOT23 envelope.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	180 V
Collector-emitter voltage (open base)	V_{CEO}	max.	160 V
Collector current	I_C	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Collector-emitter saturation voltage I_C = 50 mA; I_B = 5 mA	V_{CEsat}	max.	0.20 V
DC current gain I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	80

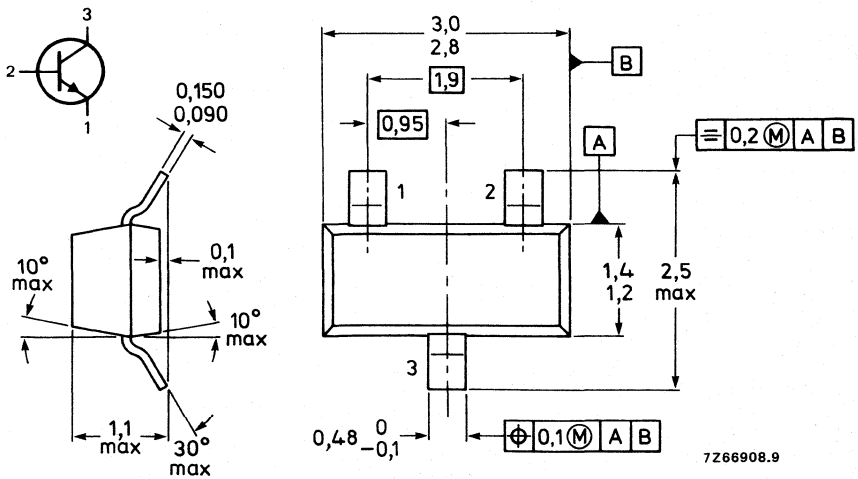
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT23.

Marking code

PMBT5551 = pGI



TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	180 V
Collector-emitter voltage (open base)	V_{CEO}	max.	160 V
Emitter-base voltage (open collector)	V_{EBO}	max.	6 V
Collector current	I_C	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Storage temperature range	T_{stg}		−65 to + 150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 120 V	I_{CBO}	max.	50 nA
I_E = 0; V_{CB} = 120 V; T_{amb} = 100 °C	I_{CBO}	max.	50 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 4.0 V	I_{EBO}	max.	50 nA
Breakdown voltages			
I_C = 1.0 mA; I_B = 0	$V_{(BR)CEO}$	min.	160 V
I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	min.	180 V
I_C = 0; I_E = 10 μA	$V_{(BR)EBO}$	min.	6.0 V
Saturation voltages			
I_C = 10 mA; I_B = 1.0 mA	V_{CEsat}	max.	0.15 V
	V_{BEsat}	max.	1.0 V
I_C = 50 mA; I_B = 5.0 mA	V_{CEsat}	max.	0.20 V
	V_{BEsat}	max.	1.0 V
DC current gain			
I_C = 1.0 mA; V_{CE} = 5 V	h_{FE}	min.	80
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	80
		max.	250
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	min.	30
Small-signal current gain			
I_C = 1.0 mA; V_{CE} = 10 V; f = 1 kHz	h_{fe}	min.	50
		max.	200
Output capacitance at f = 1 MHz			
I_E = 0; V_{CB} = 10 V	C_o	max.	6 pF
Input capacitance at f = 1 MHz			
I_C = 0; V_{EB} = 0.5 V	C_i	max.	30 pF
Transition frequency at f = 100 MHz			
I_C = 10 mA; V_{CE} = 10 V	f_T	min.	100 MHz
		max.	300 MHz
Noise figure at R_S = 1 kΩ			
I_C = 250 μA; V_{CE} = 5 V; f = 10 Hz to 15.7 kHz	F	max.	8 dB

* Substrate size 8 mm x 10 mm x 0.7 mm.

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature (SMD) plastic envelope intended for application in thick and thin-film circuits (Surface Mounted Device).

They are primarily intended for use in telephony and professional communication equipment.

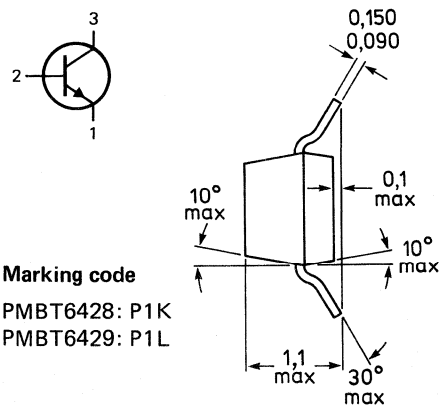
QUICK REFERENCE DATA

			PMBT6428	PMBT6429	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	55	V
Collector-emitter voltage (open base)	V_{CEO}	max.	50	45	V
Collector current (d.c.)	I_C	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
D.C. current gain					
I_C = 0,1 mA; V_{CE} = 5 V	h_{FE}	min.	250	500	
		max.	650	1250	
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	250	500	
Transition frequency at f = 100 MHz					
I_C = 1 mA; V_{CE} = 5 V	f_T	min.	100		MHz
		max.	700		MHz
Input capacitance at f = 1 MHz					
I_C = 0; V_{EB} = 0,5 V	C_e	max.	8,0		pF

MECHANICAL DATA

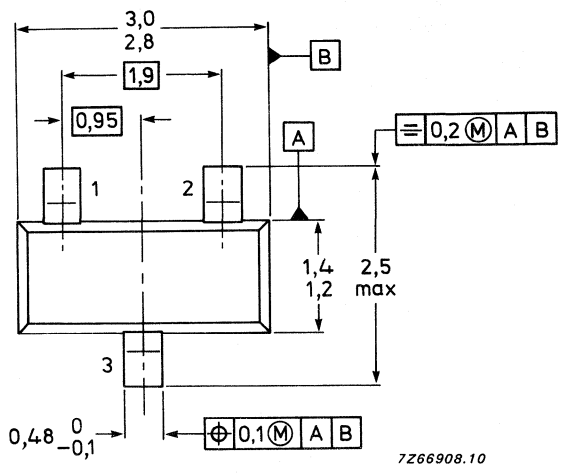
Dimensions in mm

Fig. 1 SOT-23.



Marking code

PMBT6428: P1K
PMBT6429: P1L



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBT6428	PMBT6429	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	55	V
Collector-emitter voltage (open base)	V_{CEO}	max.	50	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6,0		V
Collector current (d.c.)	I_C	max.	200		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}		300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS

Thermal resistance from junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBT6428	PMBT6429	
Collector-emitter breakdown voltage I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	min.	50	45	V
Collector-base breakdown voltage I_C = 0,1 mA; I_E = 0	$V_{(BR)CBO}$	min.	60	55	V
Collector cut-off current					
V_{CE} = 30 V	I_{CEO}	max.	100		nA
I_E = 0; V_{CB} = 30 V	I_{CBO}	max.	10		nA
Emitter cut-off current I_C = 0; V_{EB} = 5 V	I_{EBO}	max.	10		nA
Base-emitter On-voltage					
I_C = 1 mA; V_{CE} = 5 V	$V_{BE(on)}$	min.	560		mV
		max.	660		mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

			PMBT6428	PMBT6429	
Collector-emitter saturation voltage					
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	max.	0,2		V
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	max.	0,6		V
D.C. current gain					
I_C = 0,1 mA; V_{CE} = 5 V	h_{FE}	min.	250	500	
I_C = 0,1 mA; V_{CE} = 5 V	h_{FE}	min. max.	250 650	500 1250	
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	250	500	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	250	500	
Transition frequency at f = 100 MHz					
I_C = 1 mA; V_{CE} = 5 V	f_T	min. max.	100 700		MHz MHz
Output capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 10 V	C_c	max.	3,0		pF
Input capacitance at f = 1 MHz					
I_C = 0; V_{EB} = 0,5 V	C_e	max.	8,0		pF

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature (SMD) plastic envelope intended for surface mounted applications. They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PMBTA05	PMBTA06	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4		V
Collector current (d.c.)	I_C	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
D.C. current gain I_C = 100 mA; V_{CE} = 1 V	h_{FE}	min.	50		
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 2 V	f_T	min.	100		MHz
Collector-emitter saturation voltage I_C = 100 mA; I_B = 10 mA	V_{CEsat}	max.	0,25		V

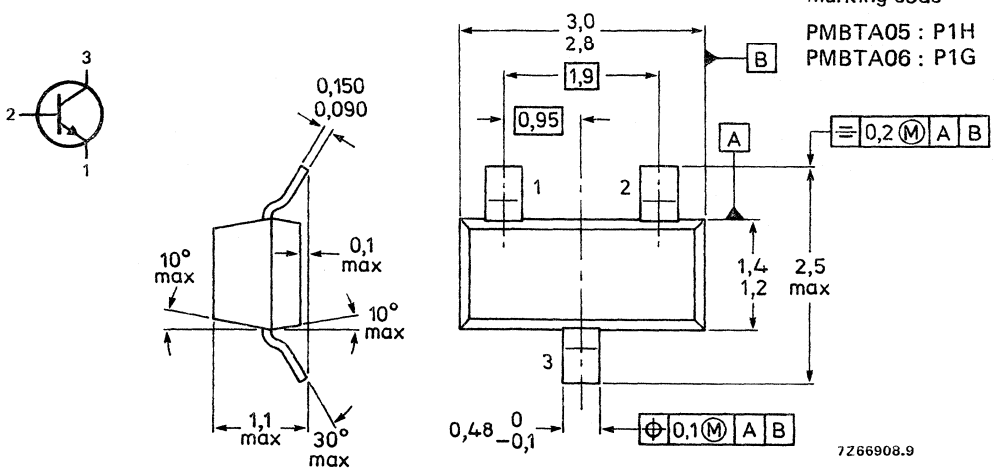
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

PMBTA05 : P1H
PMBTA06 : P1G



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBTA05	PMBTA06	
Collector-base voltage	V_{CBO}	max.	60	80	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4		V
Collector current (d.c.)	I_C	max.	500		mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS **

$T_j = P\ (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance from junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBTA05	PMBTA06	
Collector-emitter breakdown voltage ▲ I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	min.	60	80	V
Emitter-base breakdown voltage I_C = 0; I_E = 100 μA	$V_{(BR)EBO}$	min.	4		V
Collector cut-off current V_{CE} = 60 V; I_B = 0	I_{CEO}	max.	0,1		μA
Collector cut-off current					
V_{CB} = 60 V; I_E = 0	I_{CBO}	max.	0,1		μA
V_{CB} = 80 V; I_E = 0		max.	0,1		μA
Saturation voltages I_C = 100 mA; I_B = 10 mA	V_{CEsat}	max.	0,25		V
Base-emitter on voltage I_C = 100 mA; V_{CE} = 1 V	$V_{BE(on)}$	max.	1,2		V
D.C. current gain					
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	min.	50		
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	min.	50		
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 2 V	f_T	min.	100		MHz

* Mounted on a ceramic substrate: area = 10 x 8 mm; thickness = 0,7 mm.

** See Thermal characteristics.

▲ Pulse test conditions: t_p = 300 μs; duty cycle ⩽ 2%.

N-P-N SMALL-SIGNAL DARLINGTON TRANSISTORS

N-P-N small-signal darlington transistors in a microminiature SMD envelope (SOT-23).

Designed primarily for preamplifier input applications requiring high input impedance.

P-N-P complement is the PMBTA63/64.

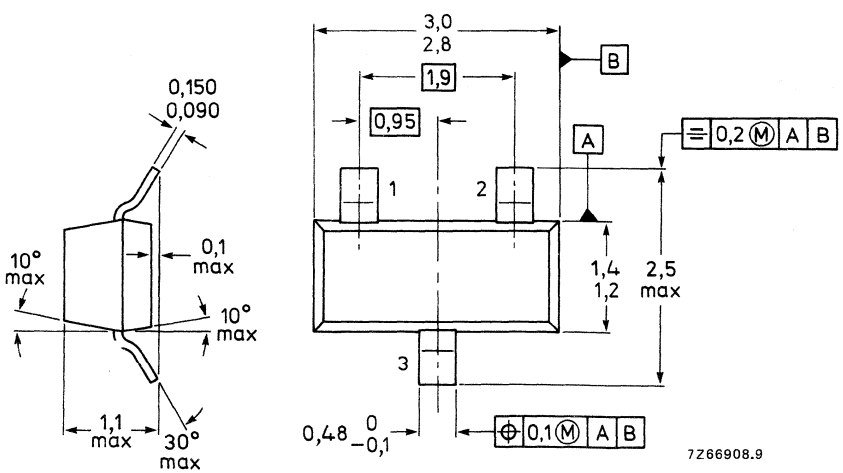
QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$		V_{CES}	max.	30 V
Collector current (d.c.)		I_C	max.	300 mA
Total power dissipation up to $T_{amb} = 25$ °C		P_{tot}	max.	300 mW
Junction temperature		T_j	max.	150 °C
D.C. current gain $I_C = 10$ mA; $V_{CE} = 5$ V	PMBTA13	h_{FE}	min.	5000
	PMBTA14	h_{FE}	min.	10 000
Transition frequency at f = 100 MHz $I_C = 10$ mA; $V_{CE} = 5$ V		f_T	min.	125 MHz

MECHANICAL DATA

Dimensions in mm

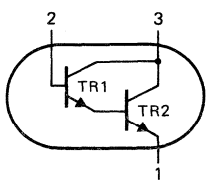
Fig. 1 SOT-23.



TOP VIEW

Marking code

PMBTA13: P1M
PMBTA14: P1N



See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)		V_{CBO}	max.	30 V
Collector-emitter voltage $V_{BE} = 0$		V_{CES}	max.	30 V
Emitter-base voltage (open collector)		V_{EBO}	max.	10 V
Collector current (d.c.)		I_C	max.	300 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*		P_{tot}	max.	300 mW
Storage temperature		T_{stg}		−65 to +150 °C
Junction temperature		T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*		$R_{th\ j\text{-}a}$		430 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)CES}$	min.	30 V
Emitter-base cut-off current $V_{BE} = 10$ V		I_{EBO}	max.	0,1 μA
Collector-base cut-off current $V_{CB} = 30$ V		I_{CBO}	max.	0,1 μA
D.C. current gain				
$I_C = 10$ mA; $V_{CE} = 5$ V	PMBTA13	h_{FE}	min.	5000
	PMBTA14	h_{FE}	min.	10 000
$I_C = 100$ mA; $V_{CE} = 5$ V	PMBTA13	h_{FE}	min.	10 000
	PMBTA14	h_{FE}	min.	20 000
Collector-emitter saturation voltage $I_C = 100$ mA; $I_B = 0{,}1$ mA		V_{CEsat}	max.	1,5 V
Base-emitter ON-voltage $I_C = 100$ mA; $V_{CE} = 5$ V		$V_{BE(on)}$	max.	2,0 V
Transition frequency at f = 100 MHz $I_C = 10$ mA; $V_{CE} = 5$ V		f_T	min.	125 MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature (SMD) plastic envelope intended for surface mounted applications. They are primarily intended for use in telephony and professional communication equipment.

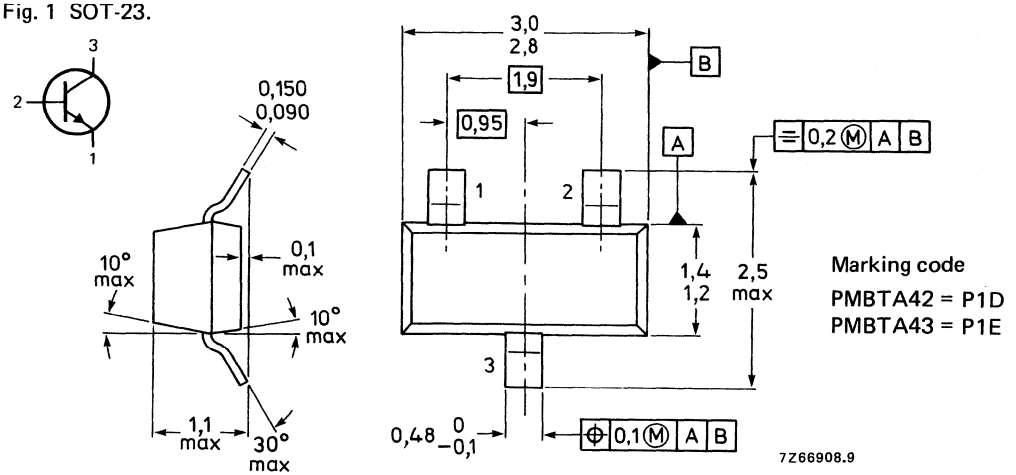
QUICK REFERENCE DATA

			PMBTA42	PMBTA43	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	200	V
Collector-emitter voltage (open base)	V_{CEO}	max.	300	200	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (DC)	I_C	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 10 mA; V_{CE} = 10 V	h_{FE}	min.	40		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 20 V	f_T	min.	50		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 20 V	C_{re}	max.	3	4	pF

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



TOP VIEW

Marking code
PMBTA42 = P1D
PMBTA43 = P1E

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBTA42	PMBTA43	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	200	V
Collector-emitter voltage (open base)	V_{CEO}	max.	300	200	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (DC)	I_C	max.	500		mA
Total power dissipation (note 1)					
→ up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS

$T_j = P\ (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance from junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBTA42	PMBTA43	
Collector-emitter breakdown voltage (note 2)					
I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	min.	300	200	V
Collector-base breakdown voltage					
I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	min.	300	200	V
Emitter-base breakdown voltage					
I_E = 100 μA; I_C = 0	$V_{(BR)EBO}$	min.	6	6	V
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	max.	0,1	–	μA
I_E = 0; V_{CB} = 160 V		max.	–	0,1	μA
Emitter cut-off current					
I_C = 0; V_{BE} = 6 V	I_{EBO}	max.	0,1	–	μA
I_C = 0; V_{BE} = 4 V		max.	–	0,1	μA
Feedback capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 20 V	C_{re}	max.	3	4	pF

Notes

1. Mounted on a ceramic substrate: area = 2,5 cm^2; thickness 0,7 mm.
2. Pulse test conditions: t_p = 300 μs; δ = 0,02.

Saturation voltages				
I_C = 20 mA; I_B = 2 mA	V_{CEsat}	max.	0,5	V
	V_{BEsat}	max.	0,9	V
D.C. current gain				
I_C = 1 mA; V_{CE} = 10 V		min.	25	
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	min.	40	
I_C = 30 mA; V_{CE} = 10 V		min.	40	
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 20 V	f_T	min.	50	MHz

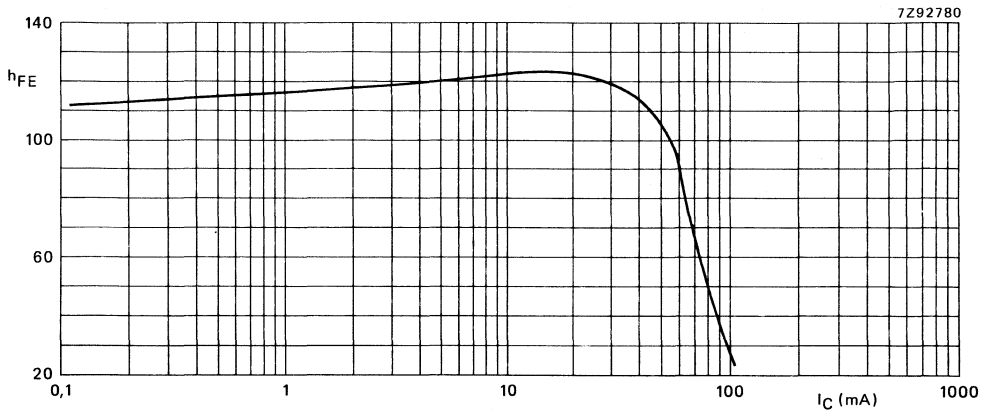


Fig. 2 T_j = 25 °C; V_{CE} = 20 V; typical values.

SILICON EPITAXIAL TRANSISTORS

P-N-P transistors in a microminiature (SMD) plastic envelope intended for surface mounted applications. They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PMBTA55	PMBTA56	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4		V
Collector current (d.c.)	$-I_C$	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
D.C. current gain $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	50		
Transition frequency at f = 100 MHz $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	f_T	min.	50		MHz
Collector-emitter saturation voltage $-I_C$ = 100 mA; I_B = 10 mA	V_{CEsat}	max.	0,25		V

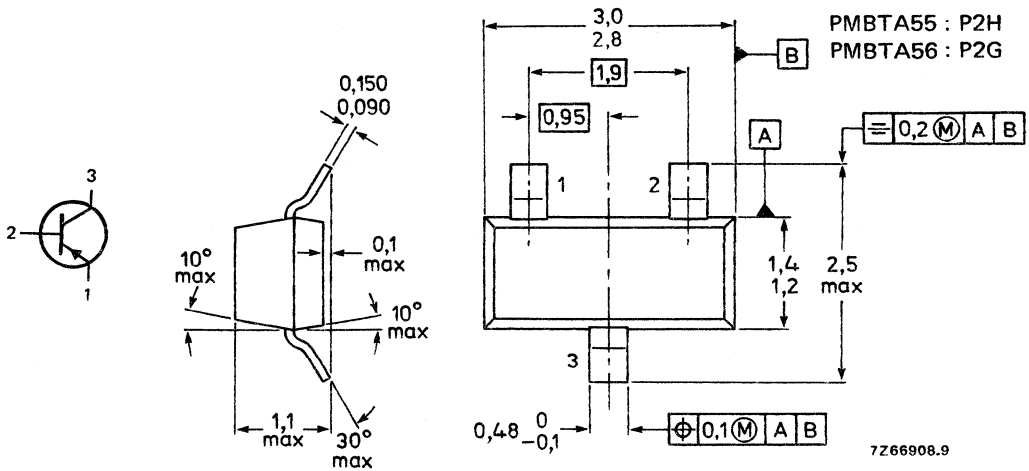
MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm

Marking code

PMBTA55 : P2H
PMBTA56 : P2G



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBTA55	PMBTA56	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4		V
Collector current (d.c.)	$-I_C$	max.	500		mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS**

$T_j = P\ (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance from junction to ambient	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBTA55	PMBTA56	
Collector-emitter breakdown voltage▲ $-I_C$ = 1 mA; I_B = 0	$-V_{(BR)CEO}$	min.	60	80	V
Emitter-base breakdown voltage $-I_C$ = 0; I_E = 100 μA	$-V_{(BR)EBO}$	min.	4		V
Collector cut-off current $-V_{CE}$ = 60 V; I_B = 0	$-I_{CEO}$	max.	0,1		μA
Collector cut-off current $-V_{CB}$ = 60 V; I_E = 0	$-I_{CBO}$	max.	0,1		μA
$-V_{CB}$ = 80 V; I_E = 0		max.	0,1		μA
Saturation voltages $-I_C$ = 100 mA; $-I_B$ = 10 mA	$-V_{CEsat}$	max.	0,25		V
Base-emitter on voltage $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	$-V_{BE(on)}$	max.	1,2		V
D.C. current gain $-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	50		
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	50		
Transition frequency at f = 100 MHz $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	f_T	min.	50		MHz

* Mounted on a ceramic substrate: area = 10 x 8 mm; thickness = 0,7 mm.

** See Thermal characteristics.

▲ Pulse test conditions: t_p = 300 μs; duty cycle ≤ 2%.

P-N-P SMALL-SIGNAL DARLINGTON TRANSISTORS

P-N-P small-signal darlington transistors in a microminiature SMD envelope (SOT-23).

Designed primarily for preamplifier input applications requiring high input impedance.

N-P-N complement is the PMBTA13/14.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$		$-V_{CES}$	max.	30	V
Collector current (d.c.)		$-I_C$	max.	500	mA
Total power dissipation up to $T_{amb} = 25$ °C		P_{tot}	max.	300	mW
Junction temperature		T_j	max.	150	°C
D.C. current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V	PMBTA63	h_{FE}	min.	5000	
	PMBTA64	h_{FE}	min.	10 000	
Transition frequency at f = 100 MHz $-I_C = 10$ mA; $-V_{CE} = 50$ V		f_T	min.	125	MHz

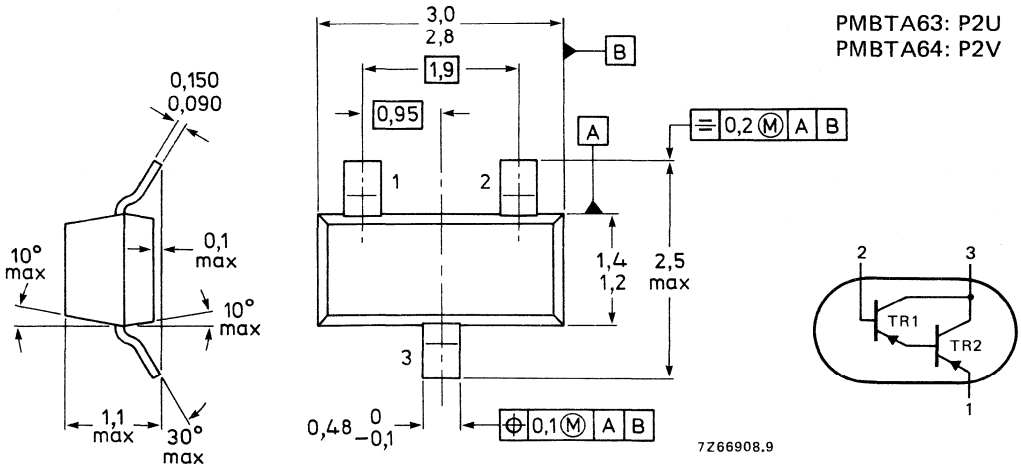
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

PMBTA63: P2U
PMBTA64: P2V



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)		$-V_{CBO}$	max.	30 V
Collector-emitter voltage $V_{BE} = 0$		$-V_{CES}$	max.	30 V
Emitter-base voltage (open collector)		$-V_{EBO}$	max.	10 V
Collector current (d.c.)		$-I_C$	max.	500 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*		P_{tot}	max.	500 mW
Storage temperature		T_{stg}		−65 to +150 °C
Junction temperature		T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*		$R_{th\ j\text{-}a}$		430 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $-I_C = 100\ \mu A$		$-V_{(BR)CES}$	min.	30 V
Emitter-base cut-off current $-V_{BE} = 10$ V		$-I_{EBO}$	max.	0,1 μA
Collector-base cut-off current $-V_{CB} = 30$ V		$-I_{CBO}$	max.	0,1 μA
D.C. current gain				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	PMBTA63	h_{FE}	min.	5000
	PMBTA64	h_{FE}	min.	10 000
$-I_C = 100$ mA; $-V_{CE} = 5$ V	PMBTA63	h_{FE}	min.	10 000
	PMBTA64	h_{FE}	min.	20 000
Collector-emitter saturation voltage $-I_C = 100$ mA; $-I_B = 0,1$ mA		$-V_{CEsat}$	max.	1,5 V
Base-emitter ON-voltage $-I_C = 100$ mA; $-V_{CE} = 5$ V		$-V_{BE(on)}$	max.	2,0 V
Transition frequency at f = 100 MHz $-I_C = 10$ mA; $-V_{CE} = 50$ V; $T_{amb} = 25\ ^oC$		f_T	min.	125 MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON EPITAXIAL TRANSISTORS

P-N-P transistors in a microminiature (SMD) plastic envelope intended for surface mounted applications. They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PMBTA92	PMBTA93	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	200	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	300	200	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
D.C. current gain $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	40		
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	min.	50		MHz
Collector-base capacitance at f = 1 MHz I_E = 0; $-V_{CB}$ = 20 V	C_{cb}	max.	6	8	pF

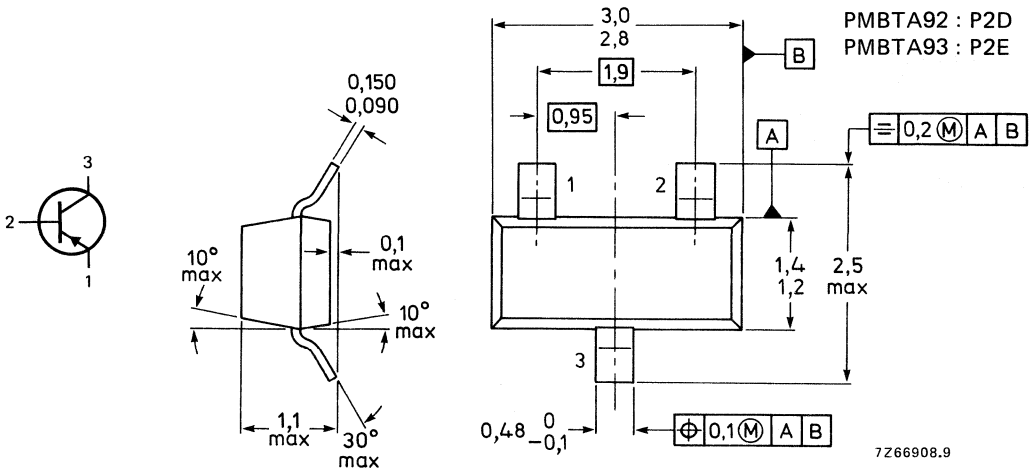
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code

PMBTA92 : P2D
PMBTA93 : P2E



TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PMBTA92	PMBTA93	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	200	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	300	200	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	500		mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS **

$T_j = P\ (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance from junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PMBTA92	PMBTA93	
Collector-emitter breakdown voltage $-I_C$ = 1 mA; I_B = 0	$-V_{(BR)CEO}$	min.	300	200	V
Collector-base breakdown voltage $-I_C$ = 100 μA; I_E = 0	$-V_{(BR)CBO}$	min.	300	200	V
Collector cut-off current					
$-V_{CB}$ = 200 V; I_E = 0	$-I_{CBO}$	max.	0,25	–	μA
$-V_{CB}$ = 160 V; I_E = 0		max.	–	0,25	μA
Emitter-base breakdown voltage $-I_E$ = 100 μA; I_C = 0	$-V_{(BR)EBO}$	min.	5		V
Emitter cut-off current I_C = 0; $-V_{BE}$ = 3 V	$-I_{EBO}$	max.	0,1		μA
Collector-base capacitance at f = 1 MHz; I_E = 0; $-V_{CB}$ = 20 V	C_{cb}	max.	6	8	pF
Saturation voltages					
$-I_C$ = 20 mA; $-I_B$ = 2 mA	$-V_{CEsat}$	max.	0,5		V
$-I_C$ = 20 mA; $-I_B$ = 2 mA	$-V_{BEsat}$	max.	0,9		V
D.C. current gain ▲					
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	25		
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	40		
$-I_C$ = 30 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	25		

* Mounted on a ceramic substrate: area = 10 x 8 mm; thickness = 0,7 mm.

** See Thermal characteristics.

▲ Pulse test conditions: t_p = 300 μs; duty cycle ⩽ 2%.

HIGH-SPEED SILICON DIODES FOR SURFACE MOUNTING

These diodes are primarily designed for fast logic applications.

These SM diodes are leadless diodes in a hermetically sealed SOD-80 envelope with tin-plated metal discs at each end. They are suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes can be delivered in "super 8" tape.

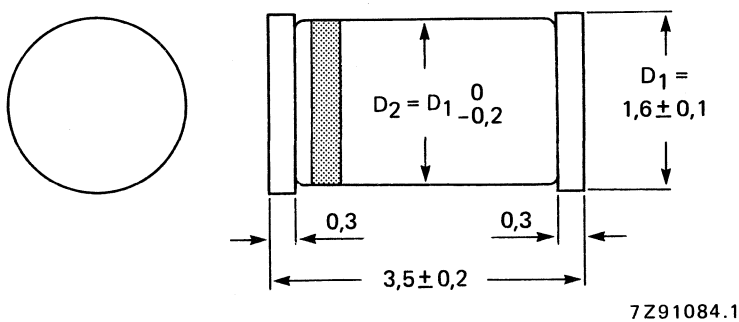
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	75 V
Repetitive peak forward current	I_{FRM}	max.	450 mA
Forward voltage PMLL4148: I_F = 10 mA PMLL4446: I_F = 20 mA PMLL4448: I_F = 100 mA	V_F	<	1 V
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	t_{rr}	<	4 ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



Cathode indicated by black band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Average rectified forward current	$I_{F(AV)}$	max.	150	mA
Forward current (d.c.)	I_F	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current				
$t = 1\ \mu s$	I_{FSM}	max.	2000	mA
$t = 1$ s	I_{FSM}	max.	500	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	500	mW
Derating factor			2,85	mW/K
Storage temperature	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltages					
PMLL4148: I_F = 10 mA PMLL4446: I_F = 20 mA PMLL4448: I_F = 100 mA		V_F	<	1	V
PMLL4448: I_F = 5 mA		V_F		0,62 to 0,72	V
Reverse avalanche breakdown voltage					
$I_R = 100\ \mu A$		$V_{(BR)R}$	>	100	V
$I_R = 5\ \mu A$		$V_{(BR)R}$	>	75	V
Reverse currents					
$V_R = 20$ V		I_R	<	25	nA
$V_R = 20$ V; $T_j = 100\ ^oC$	PMLL4448	I_R	<	3	μA
$V_R = 20$ V; $T_j = 150\ ^oC$		I_R	<	50	μA
Diode capacitance					
$V_R = 0$; $f = 1$ MHz		C_d	<	4	pF
Forward recovery voltage when switched to $I_F = 50$ mA; $t_r = 20$ ns		V_{fr}	<	2,5	V

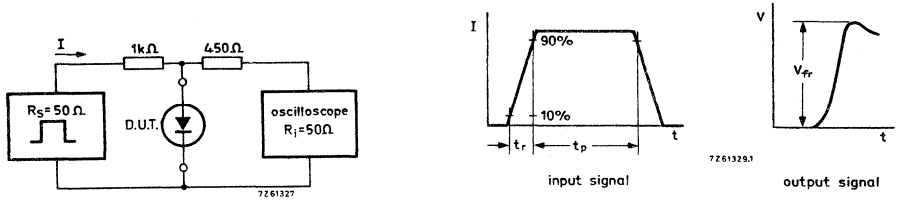


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal: Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns
Duty factor δ = 0,01

Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

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 t_{rr} < 4 ns

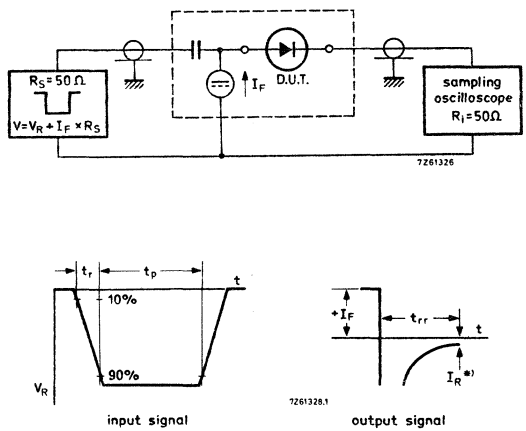


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal: Rise time of the reverse pulse t_r = 0,6 ns
Reverse pulse duration t_p = 100 ns
Duty factor δ = 0,05

* I_R = 1 mA

Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

ULTRA-HIGH-SPEED SILICON DIODES FOR SURFACE MOUNTING

Whiskerless diodes in SOD-80 envelopes.
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.

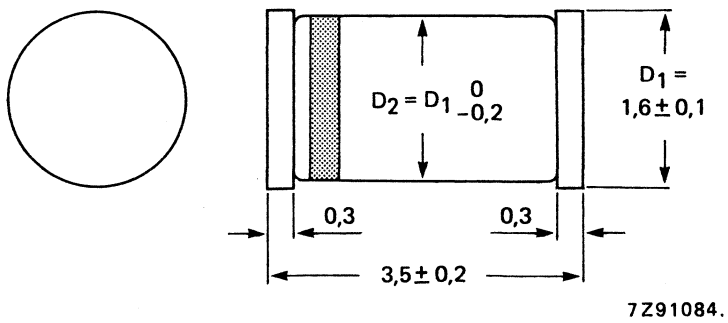
QUICK REFERENCE DATA

			PMLL4150	4151	4153	
Continuous reverse voltage	V_R	max.	50	50	50	V
Repetitive peak reverse voltage	V_{RRM}	max.	–	75	75	V
Repetitive peak forward current	I_{FRM}	max.	0,60	0,45	0,45	A
Non-repetitive peak forward current						
$t = 1\ \mu s$	I_{FSM}	max.	4,0	–	–	A
$t = 1\ s$	I_{FSM}	max.	0,5	–	–	A
Forward voltage						
$I_F = 20$ mA	V_F	<	–	–	0,88	V
$I_F = 50$ mA	V_F	<	–	1	–	V
$I_F = 200$ mA	V_F	<	1	–	–	V
Reverse recovery time when switched from $I_F = 400$ mA to $I_R = 400$ mA; $R_L = 100\ \Omega$; measured at $I_R = 40$ mA	t_{rr}	<	6	–	–	ns
$I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	<	–	4	4	ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



Cathode indicated by black band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

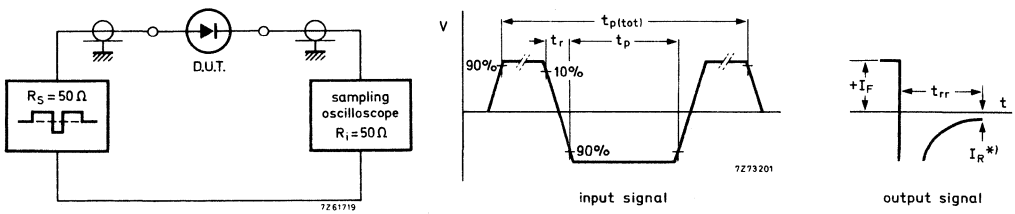
			PMLL4150	4151	4153	
Continuous reverse voltage	V_R	max.	50	50	50	V
Repetitive peak reverse voltage	V_{RRM}	max.	–	75	75	V
Forward current (d.c.)	I_F	max.	0,30	0,20	0,20	A
Repetitive peak forward current	I_{FRM}	max.	0,60	0,45	0,45	A
Non-repetitive peak forward current						
$t = 1\ \mu s$	I_{FSM}	max.	4,0	–	–	A
$t = 1\ s$	I_{FSM}	max.	0,5	–	–	A
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.		500		mW
Derating factor				2,85		mW/K
Storage temperature	T_{stg}			–65 to + 200		^oC
Junction temperature	T_j	max.		200		^oC

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

			PMLL4150	4151	4153	
Forward voltage						
$I_F = 0,1$ mA	V_F	>	–	–	0,49	V
		<	–	–	0,55	V
$I_F = 0,25$ mA	V_F	>	–	–	0,53	V
		<	–	–	0,59	V
$I_F = 1$ mA	V_F	>	0,54	–	0,59	V
		<	0,62	–	0,67	V
$I_F = 2$ mA	V_F	>	–	–	0,62	V
		<	–	–	0,70	V
$I_F = 10$ mA	V_F	>	0,66	–	0,70	V
		<	0,74	–	0,81	V
$I_F = 20$ mA	V_F	>	–	–	0,74	V
		<	–	–	0,88	V
$I_F = 50$ mA	V_F	>	0,76	–	–	V
		<	0,86	1	–	V
$I_F = 100$ mA	V_F	>	0,82	–	–	V
		<	0,92	–	–	V
$I_F = 200$ mA	V_F	>	0,87	–	–	V
		<	1,00	–	–	V
Reverse avalanche breakdown voltage						
$I_R = 5\ \mu A$	$V_{(BR)R}$	>	–	75	75	V
Reverse current						
$V_R = 50$ V	I_R	<	0,1	0,05	0,05	μA
$V_R = 50$ V; $T_{amb} = 150\ ^oC$	I_R	<	100	50	50	μA

			PMLL4150	4151	4153
Diode capacitance $V_R = 0$; $f = 1$ MHz	C_d	<	2,5	2	2 pF
Reverse recovery time when switched from $I_F = 10$ to 200 mA to $I_R = 10$ to 200 mA; $R_L = 100\ \Omega$; measured at $I_R = 0{,}1 \times I_F$	t_{rr}	<	4	–	– ns
$I_F = 200$ to 400 mA to $I_R = 200$ to 400 mA; $R_L = 100\ \Omega$; measured at $I_R = 0{,}1 \times I_F$	t_{rr}	<	6	–	– ns
$I_F = 10$ mA to $I_R = 1$ mA; $R_L = 100\ \Omega$; measured at $I_R = 0{,}1$ mA	t_{rr}	<	6	–	– ns
$I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	<	–	4	4 ns
$I_F = 10$ mA to $I_R = 60$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	<	–	2	2 ns



*) value at which t_{rr} is measured

Fig. 2 Test circuit and waveforms.

Input signal:	Total pulse duration	$t_{p(tot)}$	=	0,2 μs
	Duty factor	δ	=	0,0025
	Rise time of the reverse pulse	t_r	=	0,6 ns
	Reverse pulse duration	t_p	=	30 ns
Oscilloscope:	Rise time	t_r	=	0,35 ns

Circuit capacitance $C \leqslant 1$ pF (C = oscilloscope input capacitance + parasitic capacitance)

Forward recovery time when switched from
$I = 0$ to $I_F = 200$ mA; $t_r = 0{,}4$ ns; $t_p = 100$ ns; $\delta < 0{,}01$;
measured at $V_f = 1$ V $\quad t_{fr} < 10$ ns

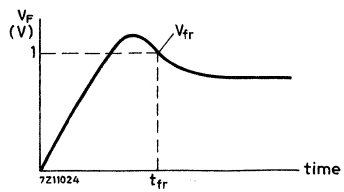


Fig. 3 PMLL4150.

VOLTAGE REGULATOR DIODES FOR SURFACE MOUNTING

Silicon planar diodes in a SOD-80 envelope intended for use as low-power voltage stabilizers or voltage references.
The series consists of 43 types with nominal working voltages in the range 3,0 V to 75 V with a tolerance of ± 5%. The SM diode is a leadless diode in a hermetically sealed glass SOD-80 envelope with tin plated metal discs at each end. It is suitable for "automatic placement" and as such can withstand immersion soldering.

The diodes are delivered on "super 8" tape.

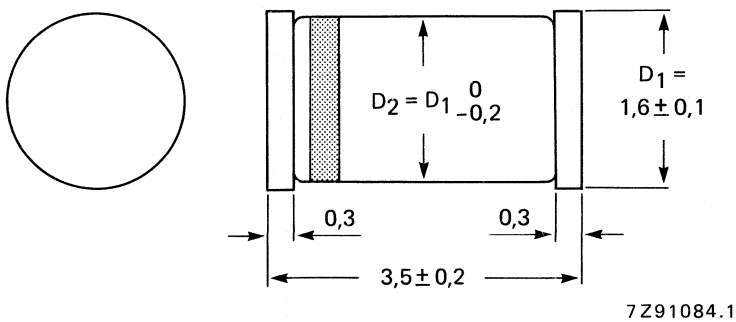
QUICK REFERENCE DATA

Working voltage range	V_Z	nom.	3,0 to 75 V
Working voltage tolerance			± 5 %
Total power dissipation	P_{tot}	max.	500 mW
Non-repetitive peak reverse power dissipation T_j = 55 °C; t_p = 8,3 ms, square wave	P_{ZSM}	max.	10 W
Junction temperature	T_j		−65 to + 200 °C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



Cathode indicated by yellow band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	250 mA
Repetitive peak forward current	I_{FRM}	max.	250 mA
Total power dissipation if flanges are kept at T_{flange} = 75 °C	P_{tot}	max.	500 mW
Derating factor			4 mW/K
Non-repetitive peak reverse power dissipation T_j = 55 °C; t_p = 8,3 ms, square wave	P_{ZSM}	max.	10 W
Storage temperature	T_{stg}		−65 to + 200 °C
Junction temperature	T_j		−65 to + 200 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

Forward voltage
I_F = 200 mA V_F max. 1,1 V

type number	working voltage V_Z (V) at I_{ztest} (note 1) nom.	test current I_{Ztest} (mA)	max. Zener impedance Z_{ZT} (Ω) at I_{Ztest} (note 2)	differential resistance r_{diff} (Ω) at I_{ZK} = 0,25 mA (note 2) max.	reverse current I_R (μA) at V_R max.	test voltage V_R (V)	temp. coeff. S_Z (%/K) (note 3) max.
PMLL5225B	3,0	20	29	1600	50	1,0	−0,075
PMLL5226B	3,3	20	28	1600	25	1,0	−0,070
PMLL5227B	3,6	20	24	1700	15	1,0	−0,065
PMLL5228B	3,9	20	23	1900	10	1,0	−0,060
PMLL5229B	4,3	20	22	2000	5	1,0	± 0,055
PMLL5230B	4,7	20	19	1900	5	2,0	± 0,030
PMLL5231B	5,1	20	17	1600	5	2,0	± 0,030
PMLL5232B	5,6	20	11	1600	5	3,0	+ 0,038
PMLL5233B	6,0	20	7	1600	5	3,5	+ 0,038
PMLL5234B	6,2	20	7	1000	5	4,0	+ 0,045
PMLL5235B	6,8	20	5	750	3	5,0	+ 0,050
PMLL5236B	7,5	20	6	500	3	6,0	+ 0,058
PMLL5237B	8,2	20	8	500	3	6,5	+ 0,062
PMLL5238B	8,7	20	8	600	3	6,5	+ 0,065
PMLL5239B	9,1	20	10	600	3	7,0	+ 0,068

type number	working voltage V_Z (V) at I_{Ztest} (note 1) nom.	test current I_{Ztest} (mA)	max. Zener impedance Z_{ZT} (Ω) at I_{Ztest} (note 2)	differential resistance r_{diff} (Ω) at I_{ZK} = 0,25 mA (note 2) max.	reverse current I_R (μA) at V_R max.	test voltage V_R (V)	temp. coeff. S_Z (%/K) (note 3) max.
PMLL5240B	10	20	17	600	3	8,0	+ 0,075
PMLL5241B	11	20	22	600	2	8,4	+ 0,076
PMLL5242B	12	20	30	600	1	9,1	+ 0,077
PMLL5243B	13	9,5	13	600	0,5	9,9	+ 0,079
PMLL5244B	14	9,0	15	600	0,1	10	+ 0,082
PMLL5245B	15	8,5	16	600	0,1	11	+ 0,082
PMLL5246B	16	7,8	17	600	0,1	12	+ 0,083
PMLL5247B	17	7,4	19	600	0,1	13	+ 0,084
PMLL5248B	18	7,0	21	600	0,1	14	+ 0,085
PMLL5249B	19	6,6	23	600	0,1	14	+ 0,086
PMLL5250B	20	6,2	25	600	0,1	15	+ 0,086
PMLL5251B	22	5,6	29	600	0,1	17	+ 0,087
PMLL5252B	24	5,2	33	600	0,1	18	+ 0,088
PMLL5253B	25	5,0	35	600	0,1	19	+ 0,089
PMLL5254B	27	4,6	41	600	0,1	21	+ 0,090
PMLL5255B	28	4,5	44	600	0,1	21	+ 0,091
PMLL5256B	30	4,2	49	600	0,1	23	+ 0,091
PMLL5257B	33	3,8	58	700	0,1	25	+ 0,092
PMLL5258B	36	3,4	70	700	0,1	27	+ 0,093
PMLL5259B	39	3,2	80	800	0,1	30	+ 0,094
PMLL5260B	43	3,0	93	900	0,1	33	+ 0,095
PMLL5261B	47	2,7	105	1000	0,1	36	+ 0,095
PMLL5262B	51	2,5	125	1100	0,1	39	+ 0,096
PMLL5263B	56	2,2	150	1300	0,1	43	+ 0,096
PMLL5264B	60	2,1	170	1400	0,1	46	+ 0,097
PMLL5265B	62	2,0	185	1400	0,1	47	+ 0,097
PMLL5266B	68	1,8	230	1600	0,1	52	+ 0,097
PMLL5267B	75	1,7	270	1700	0,1	56	+ 0,098

Notes to the characteristics

1. V_Z is measured with device at thermal equilibrium while held in clips in still air at 25 °C.
2. $I_{(ac\ rms)}$ = 10% of I_{Ztest} resp. I_{ZK}, 60 Hz superimposed.
3. For types PMLL5225B to PMLL5242B the current I_Z = 7,5 mA; for PMLL5243B and higher $I_Z = I_{Ztest}$. Testpoints at T_1 = 25 °C, T_2 = 125 °C.

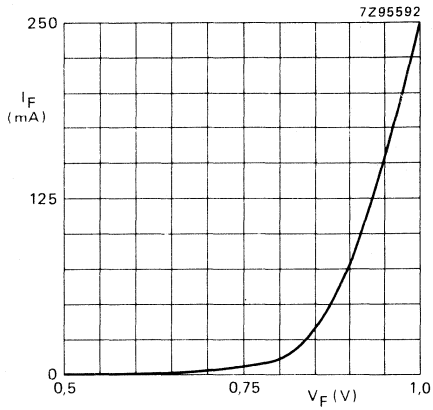


Fig. 2 T_{amb} = 25 °C; typical values.

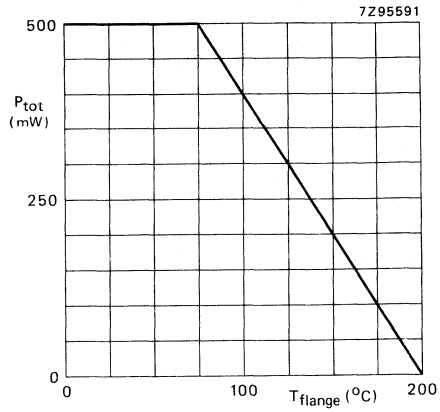


Fig. 3 Total power dissipation versus flange temperature.

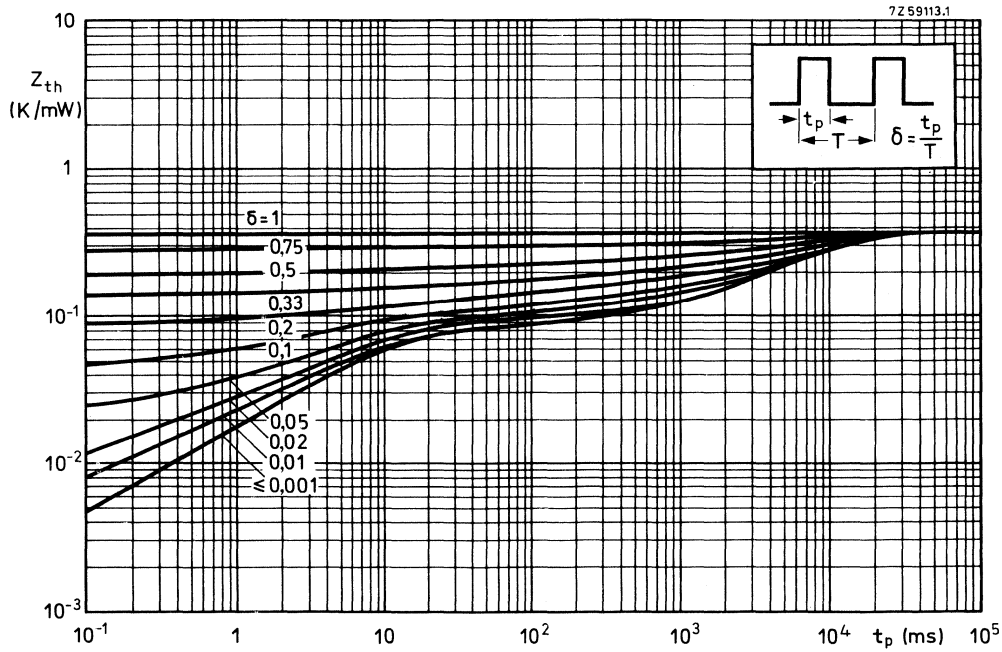


Fig. 4 Thermal impedance versus pulse duration.

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN silicon planar epitaxial transistor, housed in a SOT89 envelope.

It is intended for switching and linear applications.

The complementary type is PXT2907/A.

QUICK REFERENCE DATA

			PXT2222	PXT2222A	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5.0	6.0	V
Collector current (DC)	I_C	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
DC current gain I_C = 150 mA; V_{CE} = 10 V	h_{FE}		100 to 300	100 to 300	
Transition frequency at f = 100 MHz I_C = 20 mA; V_{CE} = 20 V	f_T	min.	250	300	MHz
Saturation voltage I_C = 150 mA; I_B = 15 mA	$V_{CE\,sat}$	max.	400	300	mV

MECHANICAL DATA

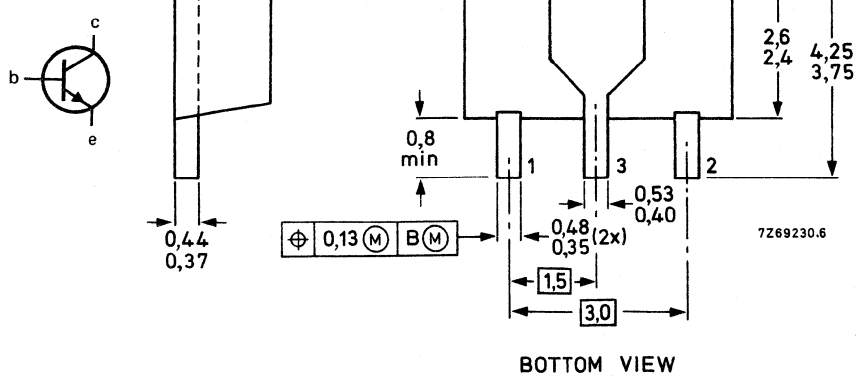
Fig.1 SOT89.

Dimensions in mm

PXT2222 : P1B
PXT2222A: P1P

Pinning

1 = emitter
2 = base
3 = collector



BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PXT2222	PXT2222A	
Collector-emitter voltage	V_{CEO}	max.	30	40	V
Collector-base voltage	V_{CBO}	max.	60	75	V
Emitter-base voltage	V_{EBO}	max.	5.0	6.0	V
Collector current (DC)	I_C	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			PXT2222	PXT2222A	
Collector cut-off current					
V_{CB} = 50 V; I_E = 0	I_{CBO}	max.	10	–	nA
V_{CB} = 50 V; I_E = 0; T_{amb} = 125 °C	I_{CBO}	max.	10	–	μA
V_{CB} = 60 V; I_E = 0	I_{CBO}	max.	–	10	nA
V_{CB} = 60 V; I_E = 0; T_{amb} = 125 °C	I_{CBO}	max.	–	10	μA
V_{CE} = 60 V; V_{EB} = 3 V	I_{CEX}	min.	–	10	nA
Base current with reverse biased emitter junction					
V_{CE} = 60 V; V_{BE} = 3 V	I_{BEX}	max.	–	20	nA
Emitter cut-off current					
V_{BE} = 3 V; I_C = 0	I_{EBO}	max.	–	10	nA
Saturation voltage					
I_C = 150 mA; I_B = 15 mA	$V_{CE\,sat}$	max.	0.4	0.3	V
	$V_{BE\,sat}$	max.	1.3	0.6 to 1.2	V
I_C = 500 mA; I_B = 50 mA	$V_{CE\,sat}$	max.	1.6	1.0	V
	$V_{BE\,sat}$	max.	2.6	2.0	V
Breakdown voltages					
I_C = 10 mA; I_B = 0	$V_{(BR)CEO}$	min.	30	40	V
I_C = 10 μA; I_E = 0	$V_{(BR)CBO}$	min.	60	75	V
I_E = 10 μA; I_C = 0	$V_{(BR)EBO}$	min.	5.0	6.0	V

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

			PXT2222	PXT2222A	
DC current gain					
I_C = 0.1 mA; V_{CE} = 10 V	h_{FE}	min.	35	35	
I_C = 1.0 mA; V_{CE} = 10 V	h_{FE}	min.	50	50	
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	min.	75	75	
I_C = 10 mA; V_C = 10 V; T_{amb} = −55 °C	h_{FE}	min.	–	35	
I_C = 150 mA; V_{CE} = 10 V	h_{FE}	min.	100	100	
		max.	300	300	
I_C = 150 mA; V_{CE} = 1 V	h_{FE}	min.	50	50	
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	min.	30	40	
Transition frequency at f = 100 MHz					
I_C = 20 mA; V_{CE} = 10 V	f_T	min.	250	300	MHz
Output capacitance at f = 1 MHz					
V_{CB} = 10 V; I_E = 0	C_o	max.	8.0	8.0	pF
Input capacitance at f = 1 MHz					
V_{EB} = 0.5 V; I_C = 0	C_i	max.	30	25	pF
Collector-base time constant					
I_E = 20 mA; V_{CB} = 20 V	$rb'C_c$	max.	–	150	ps
Noise figure at R_s = 1 KΩ					
I_C = 100 μA; V_{CE} = 10 V; f = 1 kHz	F	max.	–	4.0	dB
h-parameters (common emitter) at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V					
input impedance	h_{ie}		–	4.0 to 8.0	kΩ
voltage feedback ratio	h_{re}		–	8.0×10^{-4}	
small-signal current gain	h_{fe}		–	50 to 300	
output admittance	h_{oe}		–	5.0 to 35	μS
I_C = 10 mA; V_{CE} = 10 V					
input impedance	h_{ie}		–	0.25 to 1.25	kΩ
voltage feedback ratio	h_{re}		–	4.0×10^{-4}	
small-signal current gain	h_{fe}		–	75 to 375	
output admittance	h_{oe}		–	25 to 200	μS
Switching times					
Turn-on time (V_{cc} = 30 V; $V_{EB\,off}$ = 0.5 V; I_C = 150 mA; I_{B1} = 15 mA)					
Delay time	t_d	max.	10		ns
Rise time	t_r	max.	25		ns
Turn-off time (V_{cc} = 30 V; I_C = 150 mA; I_{B1} = I_{B2} = 15 mA)					
Storage time	t_s	max.	225		ns
Fall time	t_f	max.	60		ns

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP silicon planar epitaxial transistor, housed in a SOT89 envelope.

It is intended for switching and linear applications.

The complementary type is PXT2222/A.

QUICK REFERENCE DATA

			PXT2907	PXT2907A	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60		V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5.0		V
Collector current (DC)	$-I_C$	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
DC current gain $-I_C$ = 150 mA; $-V_{CE}$ = 10 V	h_{FE}		100 to 300	100 to 300	
Transition frequency at f = 100 MHz $-I_C$ = 20 mA; $-V_{CE}$ = 20 V	f_T	min.	200		MHz
Saturation voltage $-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CE\,sat}$	max.	0.4		V

MECHANICAL DATA

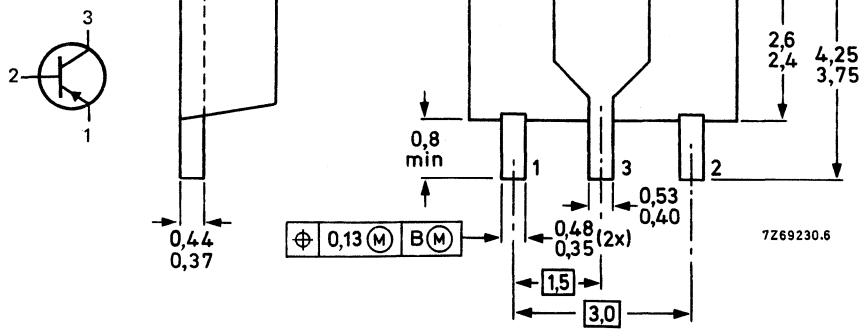
Fig.1 SOT89.

Dimensions in mm

Marking code:
PXT2907 : P2B
PXT2907A: P2F

Pinning

1 = emitter
2 = base
3 = collector



BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PXT2907	PXT2907A	
Collector-emitter voltage	$-V_{CEO}$	max.	40	60	V
Collector-base voltage	$-V_{CBO}$	max.	60		V
Emitter-base voltage	$-V_{EBO}$	max.	5.0		V
Collector current (DC)	$-I_C$	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
→ Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			PXT2907	PXT2907A	
Collector-cut-off current					
$-V_{CB}$ = 50 V; I_E = 0	$-I_{CBO}$	max.	20	10	nA
$-V_{CB}$ = 50 V; I_E = 0; T_{amb} = 125 °C	$-I_{CBO}$	max.	20	10	μA
$-V_{CE}$ = 30 V; $-V_{EB}$ = 0.5 V	$-I_{CEX}$	max.	50		nA
Base current with reverse biased emitter junction					
$-V_{CE}$ = 60 V; $-V_{BE}$ = 0.5 V	$-I_{BEX}$	max.	50		nA
Saturation voltage					
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CE\,sat}$	max.	0.4		V
	$-V_{BE\,sat}$	max.	1.3		V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CE\,sat}$	max.	1.6		V
	$-V_{BE\,sat}$	max.	2.6		V
Breakdown voltages					
$-I_C$ = 10 mA; I_B = 0	$-V_{(BR)CEO}$	min.	40	60	V
$-I_C$ = 10 μA; I_E = 0	$-V_{(BR)CBO}$	min.	60		V
$-I_E$ = 10 μA; I_C = 0	$-V_{(BR)EBO}$	min.	5.0		V

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

			PXT2907	PXT2907A	
DC current gain					
$-I_C$ = 0.1 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	35	75	
$-I_C$ = 1.0 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	50	100	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	75	100	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		100 to 300	100 to 300	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	min.	30	50	
Transition frequency at f = 100 MHz					
$-I_C$ = 20 mA; $-V_{CE}$ = 10 V	f_T	min.	200		MHz
Output capacitance at f = 1 MHz					
$-V_{CB}$ = 10 V; I_E = 0	C_o	max.	8.0		pF
Input capacitance at f = 1 MHz					
$-V_{EB}$ = 0.5 V; I_C = 0	C_i	max.	35		pF
h-parameters (common emitter) at f = 1 kHz					
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V					
input impedance	h_{ie}		1.5 to	15	kΩ
voltage feedback ratio	h_{re}		0.1 to	8.0×10^{-4}	
small-signal current gain	h_{fe}		60 to	500	
output admittance	h_{oe}		1.0 to	100	μmhos
Switching times					
Turn-on time ($-V_{cc}$ = 30 V; $-I_C$ = 150 mA $-I_{B1}$ = 15 mA)	t_{on}	max.	45		ns
Delay time	t_d	max.	10		ns
Rise time	t_r	max.	40		ns
Turn-off time ($-V_{cc}$ = 6.0 V; $-I_C$ = 150 mA; $-I_{B1} = I_{B2}$ = 15 mA)	t_{off}	max.	100		ns
Storage time	t_s	max.	80		ns
Fall time	t_f	max.	30		ns

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a SOT-89 envelope primarily intended for high-speed, saturated switching applications for industrial service.

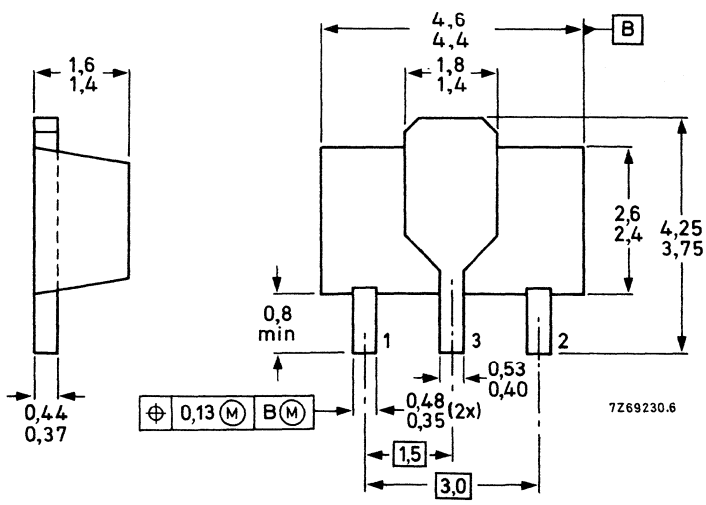
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	60 V
Collector-emitter voltage (open base)	V_{CEO}	max.	40 V
Collector current (d.c.)	I_C	max.	200 mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	1,0 W
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 10 mA; V_{CE} = 1 V	h_{FE}	> <	100 300
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 20 V	f_T	>	300 MHz
Storage time I_{Con} = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA	t_s	<	200 ns

MECHANICAL DATA

Dimensions in mm

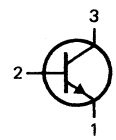
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

P1A



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation at T_{amb} = 25 °C*	P_{tot}	max.	1,0	W
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Currents at reverse biased emitter junction				
V_{CE} = 30 V; $-V_{BE}$ = 3 V	I_{CEX}	<	50	nA
	$-I_{BEX}$	<	50	nA
Saturation voltages				
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	200	mV
	V_{BEsat}		650 to 850	mV
I_C = 50 mA; I_B = 5 mA	V_{CEsat}	<	300	mV
	V_{BEsat}	<	950	mV
D.C. current gain				
I_C = 0,1 mA; V_{CE} = 1 V	h_{FE}	>	40	
I_C = 1 mA; V_{CE} = 1 V	h_{FE}	>	70	
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	100	
		<	300	
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	>	60	
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	>	30	
Collector capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	<	4,0	pF
Emitter capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	<	8,0	pF
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 20 V; T_{amb} = 25 °C	f_T	>	300	MHz
Noise figure at R_S = 1 kΩ				
I_C = 100 μA; V_{CE} = 5 V				
f = 10 Hz to 15,7 kHz; T_{amb} = 25 °C	F	<	5,0	dB

* Mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm.

h-parameters (common emitter)

I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz; T_{amb} = 25 °C

Input impedance	h_{ie}	1 to 10 kΩ
Reverse voltage transfer ratio	h_{re}	0,5 to 8x10^{-4}
Small-signal current gain	h_{fe}	100 to 400
Output admittance	h_{oe}	1 to 40 μS

Switching times

Turn-on time (see Figs 2 and 3) when switched from $-V_{BEoff}$ = 0,5 V to I_{Con} = 10 mA; I_{Bon} = 1 mA

Delay time	t_d	<	35 ns
Rise time	t_r	<	35 ns

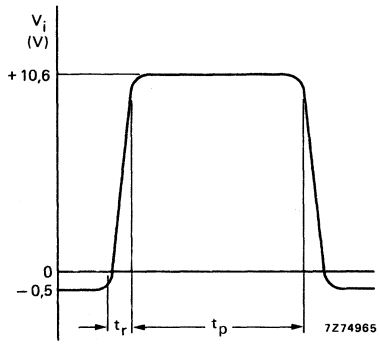


Fig. 2 Input waveform; $t_r < 1$ ns; t_p = 300 ns; δ = 0,02.

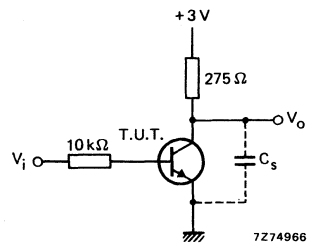


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

Turn-off time (see Figs 4 and 5)

I_{Con} = 10 mA; $I_{Bon} = -I_{Boff}$ = 1 mA

Storage time	t_s	<	200 ns
Fall time	t_f	<	50 ns

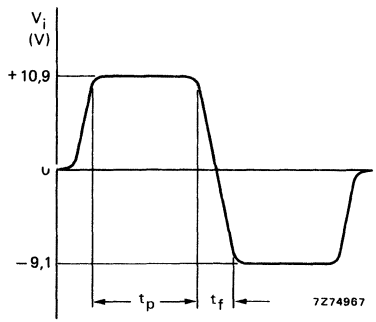


Fig. 4 Input waveform; $t_f < 1$ ns; 10 μs < t_p < 500 μs; δ = 0,02.

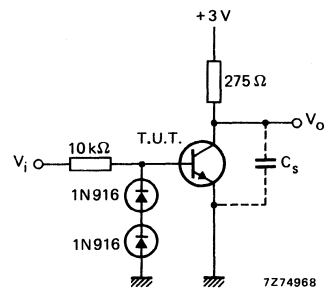


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a SOT-89 envelope primarily intended for high-speed, saturated switching applications for industrial service.

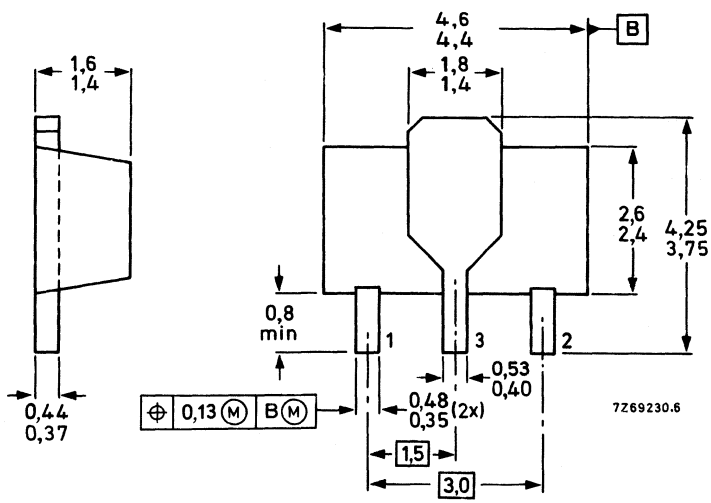
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	1,0 W
Junction temperature	T_j	max.	150 °C
D.C. current gain $-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	> <	100 300
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	>	250 MHz
Storage time $-I_{Con}$ = 10 mA; $-I_{Bon} = I_{Boff}$ = 1 mA	t_s	<	225 ns

MECHANICAL DATA

Dimensions in mm

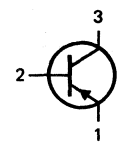
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

P2A



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation at T_{amb} = 25 °C*	P_{tot}	max.	1,0	W
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Currents at reverse biased emitter junction				
$-V_{CE}$ = 30 V; + V_{BE} = 3 V	$-I_{CEX}$	<	50	nA
	$+I_{BEX}$	<	50	nA
Saturation voltages				
$-I_C$ = 10 mA; $-I_B$ = 1 mA	$-V_{CEsat}$	<	250	mV
	$-V_{BEsat}$		650 to 850	mV
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	400	mV
	$-V_{BEsat}$	<	950	mV
D.C. current gain				
$-I_C$ = 0,1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	60	
$-I_C$ = 1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	80	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	>	100	
		<	300	
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	h_{FE}	>	60	
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
Collector capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V	C_c	<	4,5	pF
Emitter capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_C = I_c$ = 0; $-V_{EB}$ = 0,5 V	C_e	<	10	pF
Transition frequency at f = 100 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 20 V; T_{amb} = 25 °C	f_T	>	250	MHz
Noise figure at R_S = 1 kΩ				
$-I_C$ = 100 μA; $-V_{CE}$ = 5 V				
f = 10 Hz to 15,7 kHz; T_{amb} = 25 °C	F	<	4,0	dB

* Mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm.

h-parameters (common emitter)

$-I_C = 1$ mA; $-V_{CE} = 10$ V; $f = 1$ kHz; $T_{amb} = 25$ °C

Input impedance	h_{ie}	2 to 12 kΩ
Reverse voltage transfer ratio	h_{re}	0,1 to 10×10^{-4}
Small-signal current gain	h_{fe}	100 to 400
Output admittance	h_{oe}	3 to 60 μS

Switching times

Turn-on time (see Figs 2 and 3) when switched from
$+V_{BEoff} = 0{,}5$ V to $-I_{Con} = 10$ mA; $-I_{Bon} = 1$ mA

Delay time	t_d	<	35 ns
Rise time	t_r	<	35 ns

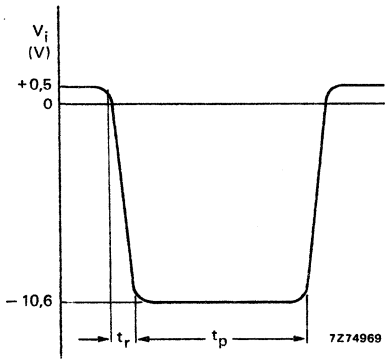


Fig. 2 Input waveform; $t_r < 1$ ns; $t_p = 300$ ns; $\delta = 0{,}02$.

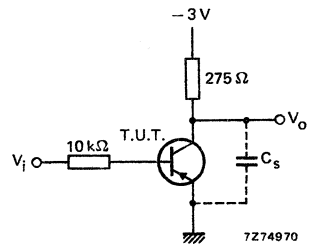


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

Turn-off time (see Figs 4 and 5)

$-I_{Con} = 10$ mA; $-I_{Bon} = I_{Boff} = 1$ mA

Storage time	t_s	<	225 ns
Fall time	t_f	<	75 ns

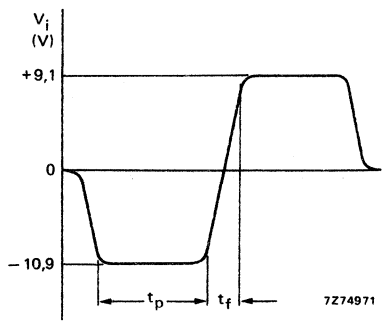


Fig. 4 Input waveform; $t_f < 1$ ns; $10\ \mu s < t_p < 500\ \mu s$; $\delta = 0{,}02$.

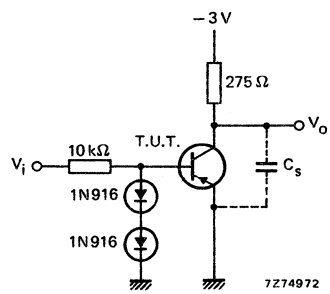


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN silicon planar epitaxial transistor, housed in a SOT-89 envelope.

It is intended for use in linear, switching, and general purpose applications.

QUICK REFERENCE DATA

Collector-emitter voltage	V_{CEO}	max.	40 V
Collector current (DC)	I_C	max.	600 mA
DC current gain I_C = 150 mA; V_{CE} = 1 V	h_{FE}	min. max.	100 300
Collector-emitter saturation voltage I_C = 500 mA; I_B = 50 mA	$V_{CE\ sat}$	max.	0.75 V
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1000 mW

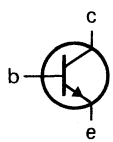
MECHANICAL DATA

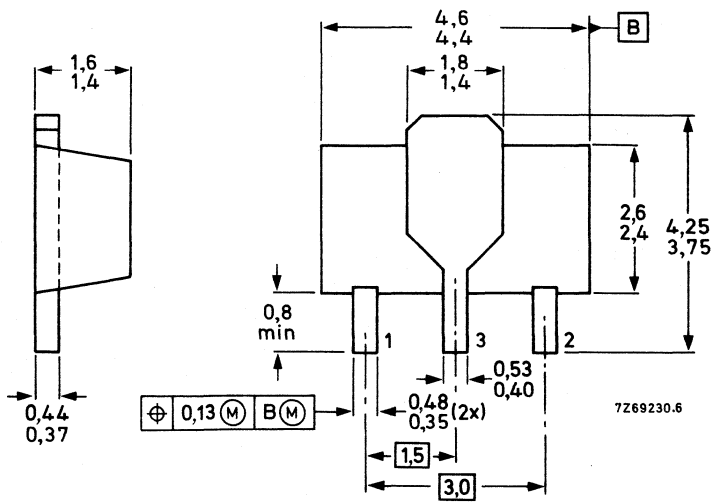
Dimensions in mm

Fig. 1 SOT-89

Marking code
P2X

Pinning:
1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	40	V
Collector-base voltage	V_{CBO}	max.	60	V
Emitter-base voltage	V_{EBO}	max.	6.0	V
Collector current (DC)	I_C	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1000	mW
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
I_C = 1.0 mA; I_B = 0	$V_{(BR)CEO}$	min.	40	V
Collector-base breakdown voltage				
I_C = 0.1 mA; I_E = 0	$V_{(BR)CBO}$	min.	60	V
Emitter-base breakdown voltage				
I_E = 0.1 mA; I_C = 0	$V_{(BR)EBO}$	min.	6.0	V
Base cut-off current				
V_{CE} = 35 V; $-V_{EB}$ = 0.4 V	I_{BEX}	max.	0.1	μA
Collector cut-off current				
V_{CE} = 35 V; $-V_{EB}$ = 0.4 V	I_{CEX}	max.	0.1	μA
DC current gain				
I_C = 0.1 mA; V_{CE} = 1 V	h_{FE}	min.	20	
I_C = 1.0 mA; V_{CE} = 1 V	h_{FE}	min.	40	
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	min.	80	
I_C = 150 mA; V_{CE} = 1 V	h_{FE}		100 to 300	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	min.	40	
Saturation voltage				
I_C = 150 mA; I_B = 15 mA	$V_{CE\ sat}$	max.	0.4	V
	$V_{BE\ sat}$		0.75 to 0.95	V
I_C = 500 mA; I_B = 50 mA	$V_{CE\ sat}$	max.	0.75	V
	$V_{BE\ sat}$	max.	1.2	V

* Mounted on a ceramic substrate; area = 2.5 cm^2 ; thickness = 0.7 mm.

Transition frequency; f = 100 MHz; I_C = 20 mA; V_{CE} = 10 V	f_T	min.	250 MHz
Collector-base capacitance I_E = 0; V_{CB} = 5 V; f = 100 kHz	C_{cb}	max.	8.0 pF
Emitter-base capacitance I_C = 0; V_{BE} = 0.5 V; f = 100 kHz	C_{eb}	max.	30 pF
Input impedance; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{ie}	min. max.	1.0 kΩ 15 kΩ
Voltage feed-back ratio; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{re}	min. max.	0.1×10^{-4} 8.0×10^{-4}
Small-signal current gain; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{fe}	min. max.	40 500
Output admittance; f = 1 kHz; I_C = 1 mA; V_{CE} = 10 V	h_{oe}	min. max.	1.0 μS 30 μS
Switching times (resistive load)			
Turn-on time I_C = 150 mA; I_{B1} = 15 mA; V_{CC} = 30 V; V_{EB} = 2 V			
delay time	t_d	max.	15 ns
rise time	t_r	max.	20 ns
Turn-off time I_C = 150 mA; V_{CC} = 30 V; I_{B1} = I_{B2} = 15 mA			
storage time	t_s	max.	225 ns
fall time	t_f	max.	30 ns

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP silicon planar epitaxial transistor, housed in a SOT89 envelope.

It is intended for linear switching applications.

The complementary type is PXT4401.

QUICK REFERENCE DATA

Collector-emitter voltage	$-V_{CEO}$	max.	40 V
Collector current (DC)	$-I_C$	max.	600 mA
DC current gain			
$-I_C$ = 0.1 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	30
$-I_C$ = 1.0 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	60
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	100
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	min.	100 to 300
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	min.	20
Total power dissipation			
up to T_{amb} = 25 °C*	P_{tot}	max.	1.0 W
Transition frequency at f = 100 MHz			
$-I_C$ = 20 mA; $-V_{CE}$ = 10 V	f_T	min.	200 MHz

MECHANICAL DATA

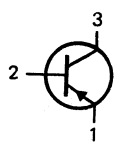
Dimensions in mm

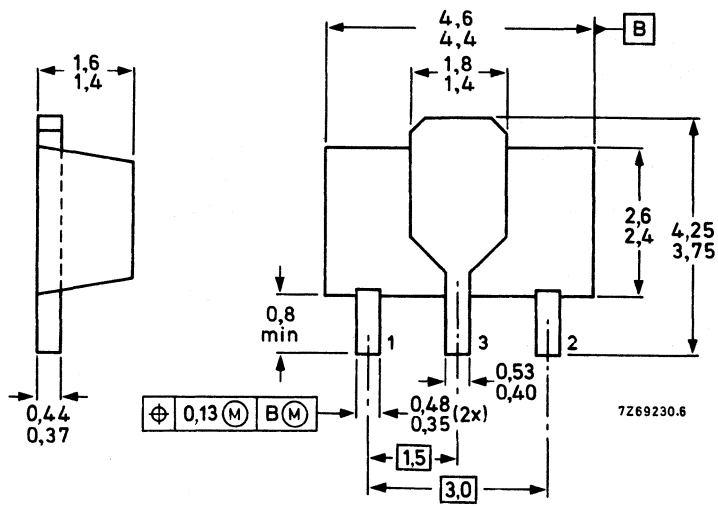
Fig.1 SOT89.

Marking code P2T

Pinning

1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	$-V_{CEO}$	max.	40	V
Emitter-base voltage	$-V_{EBO}$	max.	5.0	V
Collector-base voltage	$-V_{CBO}$	max.	40	V
Collector current (DC)	$-I_C$	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0	W
Storage temperature range	T_{stg}		−55 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
$-I_C$ = 1.0 mA; I_B = 0	$-V_{(BR)CEO}$	min.	40	V
Collector-base breakdown voltage				
$-I_C$ = 100 μA; I_E = 0	$-V_{(BR)CBO}$	min.	40	V
Emitter-base breakdown voltage				
$-I_E$ = 100 μA; I_C = 0	$-V_{(BR)EBO}$	min.	5.0	V
Base cut-off current				
$-V_{CE}$ = 35 V; $-V_{BE}$ = 0.4 V	$-I_{BEV}$	max.	0.1	μA
Collector cut-off current				
$-V_{CE}$ = 35 V; V_{BE} = 0.4 V	$-I_{CEX}$	max.	0.1	μA
DC current gain				
$-I_C$ = 0.1 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	30	
$-I_C$ = 1.0 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	60	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	min.	100	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	min.	100 to 300	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	min.	20	
Saturation voltage				
$-I_C$ = 150 mA; $-I_B$ = 15 mA	$-V_{CE\ sat}$	max.	0.4	V
	$-V_{BE\ sat}$		0.70 to 0.95	V
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CE\ sat}$	max.	0.75	V
	$-V_{BE\ sat}$	max.	1.3	V
Transition frequency at f = 100 MHz				
$-I_C$ = 20 mA; $-V_{CE}$ = 10 V	f_T	min.	200	MHz

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

Collector-base capacitance $-V_{CB}$ = 10 V; I_E = 0; f = 0.14 MHz	C_{cb}	max.	8.5 pF
Emitter-base capacitance $-V_{EB}$ = 0.5 V; I_C = 0; f = 0.14 MHz	C_{eb}	max.	35 pF
Input impedance $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{ie}		1.5 to 15 kΩ
Voltage feedback ratio $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{re}		0.1 to 8.0 x 10^{-4}
Small-signal current gain $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{fe}		60 to 500
Output admittance $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 1 kHz	h_{oe}		1.0 to 100 μS

SWITCHING CHARACTERISTICS

Turn-on time $-I_C$ = 150 mA; $-I_{B1}$ = 15 mA $-V_{CC}$ = 30 V; $-V_{BE}$ = 2 V			
Delay time	t_d	max.	15 ns
Rise time	t_r	max.	20 ns
Turn-off time $-I_C$ = 150 mA; $-I_{B1}$ = I_{B2} = 15 mA $-V_{CC}$ = 30 V			
Storage time	t_s	max.	225 ns
Fall time	t_f	max.	30 ns

NPN SMALL-SIGNAL DARLINGTON TRANSISTOR

NPN small-signal darlington transistor, housed in a microminiature envelope (SOT-89).

It is intended primarily for use in preamplifier input applications requiring a high input impedance.

The complementary type is the PXTA64.

QUICK REFERENCE DATA

Collector-emitter voltage V_{BE} = 0	V_{CES}	max.	30 V
Collector current (DC)	I_C	max.	300 mA
DC current gain I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20 000
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0 W
Transition frequency at f = 100 MHz; I_C = 30 mA; V_{CE} = 5 V	f_T	min.	125 MHz

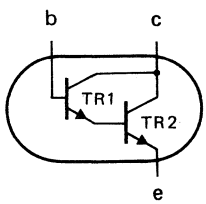
MECHANICAL DATA

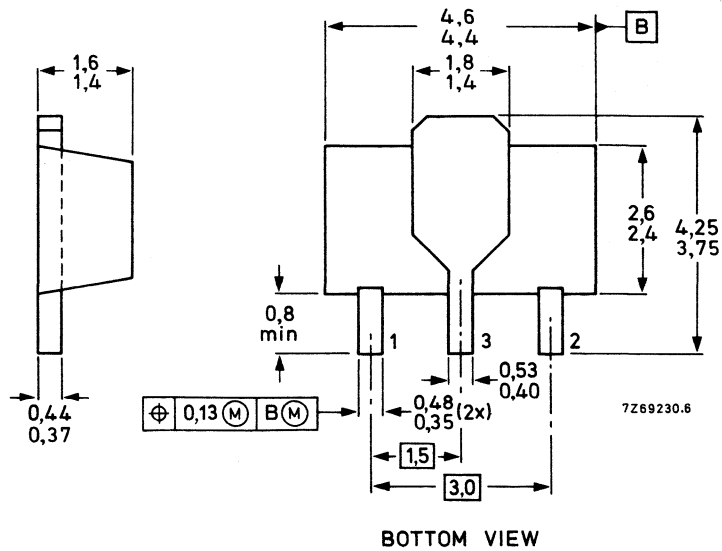
Dimensions in mm

Fig. 1 SOT-89.

Marking code P1N

Pinning:
1 = emitter
2 = collector
3 = base





BOTTOM VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage $V_{BE} = 0$	V_{CES}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	10 V
Collector current (DC)	I_C	max.	300 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*	P_{tot}	max.	1.0 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125 K/W

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $I_C = 100\ \mu A$	$V_{(BR)CES}$	min.	30 V
Emitter-base cut-off current $V_{BE} = 10$ V	I_{EBO}	max.	0.1 μA
Collector-base cut-off current $V_{CB} = 30$ V	I_{CBO}	max.	0.1 μA
DC current gain $I_C = 10$ mA; $V_{CE} = 5$ V $I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE} h_{FE}	min. 10 000 min. 20 000	
Collector-emitter saturation voltage $I_C = 100$ mA; $I_B = 0.1$ mA	$V_{CE\ sat}$	max.	1.5 V
Base-emitter on-state voltage $I_C = 100$ mA; $V_{CE} = 5$ V	$V_{BE(on)}$	max.	2.0 V
Transition frequency at f = 100 MHz; $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	min.	125 MHz

* Mounted on a ceramic substrate; area = 2.5 cm^2 ; thickness = 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

NPN small-signal darlington transistors, housed in a microminiature envelope (SOT89).

The complementary type is the PXTA77.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$	V_{CES}	max.	60 V
Collector current (DC)	I_C	max.	500 mA
DC current gain $I_C = 10$ mA; $V_{CE} = 5$ V $I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE} h_{FE}	min. 10000 min. 10000	
Total power dissipation up to $T_{amb} = 25$ °C*	P_{tot}	max.	1.0 W
Transition frequency at f = 100 MHz $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	min.	125 MHz

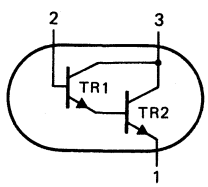
MECHANICAL DATA

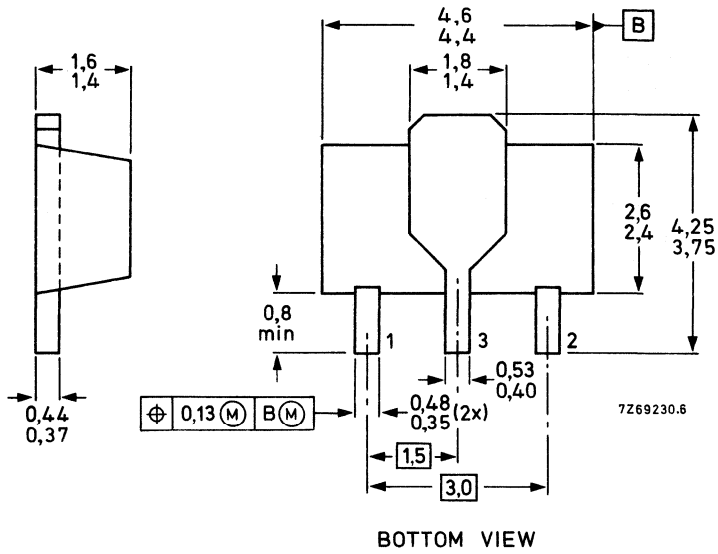
Dimensions in mm

Fig.1 SOT89.

Pinning

1 = emitter
2 = collector
3 = base





* Mounted on a ceramic substrate; area = 2.5 cm^2 ; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage $V_{BE} = 0$	V_{CES}	max.	60	V
Emitter-base voltage (open collector)	V_{EBO}	max.	10	V
Collector current (DC)	I_C	max.	500	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*	P_{tot}	max.	1.0	W
Storage temperature range	T_{stg}	−55 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $I_C = 100\ \mu A; -V_{BE} = 0$	$V_{(BR)CES}$	min.	60	V
Collector-base breakdown voltage $I_C = 100\ \mu A; I_E = 0$	$V_{(BR)CBO}$	min.	60	V
Emitter-base cut-off current $V_{BE} = 10\ V; I_C = 0$	I_{EBO}	max.	0.1	μA
Collector-base cut-off current $V_{CB} = 50\ V; I_E = 0$	I_{CBO}	max.	0.1	μA
Collector-emitter cut-off current $V_{CB} = 50\ V; V_{BE} = 0$	I_{CES}	max.	0.5	μA
DC current gain $I_C = 10\ mA; V_{CE} = 5\ V$ $I_C = 100\ mA; V_{CE} = 5\ V$	h_{FE} h_{FE}	min. min.	10000 10000	
Collector-emitter saturation voltage $I_C = 100\ mA; I_B = 0.1\ mA$	$V_{CE\ sat}$	max.	1.5	V
Base-emitter on-state voltage $I_C = 100\ mA; V_{CE} = 5\ V$	$V_{BE(on)}$	max.	2.0	V
Transition frequency at f = 100 MHz $I_C = 30\ mA; V_{CE} = 5\ V$ /	f_T	min.	125	MHz

* Mounted on a ceramic substrate; area = 2.5 cm^2 ; thickness = 0.7 mm.

PNP SMALL-SIGNAL DARLINGTON TRANSISTOR

PNP small-signal darlington transistor, housed in a microminiature envelope (SOT-89).

It is intended primarily for use in preamplifier input applications requiring high input impedance.

The complementary type is the PXTA14.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$	$-V_{CES}$	max.	30	V
Collector current (DC)	$-I_C$	max.	300	mA
DC current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V	h_{FE}	min.	10.000	
Total power dissipation up to $T_{amb} = 25$ °C*	P_{tot}	max.	1.0	W
Transition frequency at f = 100 MHz; $-I_C = 100$ mA; $-V_{CE} = 5$ V	f_T	min.	125	MHz

MECHANICAL DATA

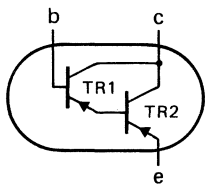
Dimensions in mm

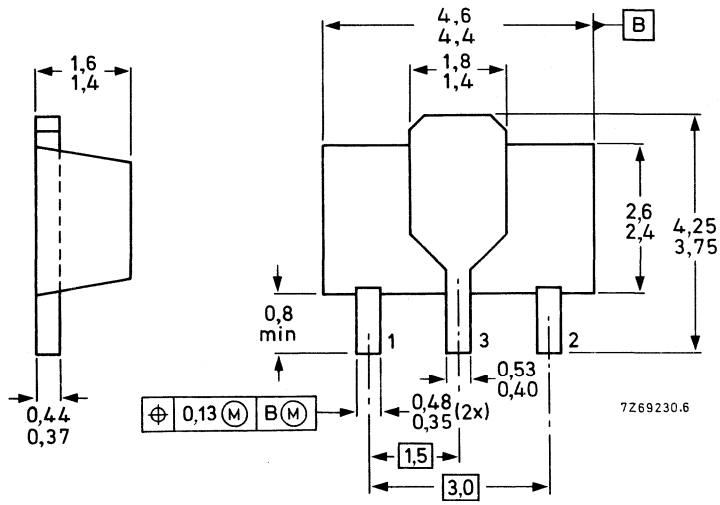
Fig. 1 SOT-89

Marking code:
P2V

Pinning:

1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage $V_{BE} = 0$	$-V_{CES}$	max.	30	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10	V
Collector current (DC)	$-I_C$	max.	300	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	1.0	W
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

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

Collector-emitter breakdown voltage $-I_C = 100\ \mu A$	$-V_{(BR)CES}$	min.	30	V
Emitter-base cut-off current $-V_{BE} = 10$ V	$-I_{EBO}$	max.	0.1	μA
Collector-base cut-off current $-V_{CB} = 30$ V	$-I_{CBO}$	max.	0.1	μA
DC current gain				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	h_{FE}	min.	10.000	
$-I_C = 100$ mA; $-V_{CE} = 5$ V	h_{FE}	min.	20.000	
Collector-emitter saturation voltage $-I_C = 100$ mA; $-I_B = 0.1$ mA	$-V_{CEsat}$	max.	1.5	V
Base-emitter on-state voltage $-I_C = 100$ mA; $-V_{CE} = 5$ V	$-V_{BE(on)}$	max.	2.0	V
Transition frequency at f = 100 MHz; $-I_C = 100$ mA; $-V_{CE} = 5$ V	f_T	min.	125	MHz

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

PNP small-signal darlington transistors, housed in a microminiature envelope (SOT89).

The complementary type is the PXTA27.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$	$-V_{CES}$	max.	60 V
Collector current (DC)	$-I_C$	max.	500 mA
DC current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V $-I_C = 100$ mA; $-V_{CE} = 5$ V	h_{FE} h_{FE}	min. 10 000 min. 10 000	
Total power dissipation up to $T_{amb} = 25$ °C*	P_{tot}	max.	1.0 W
Transition frequency at f = 100 MHz $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	min.	125 MHz

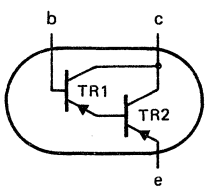
MECHANICAL DATA

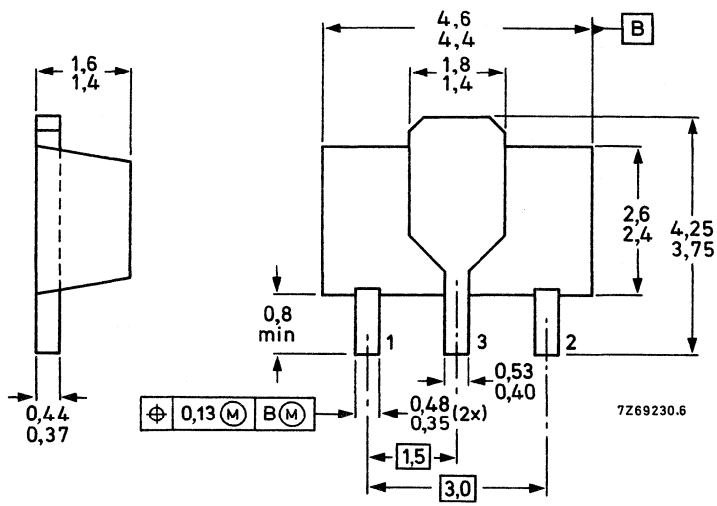
Dimensions in mm

Fig.1 SOT89.

Pinning

1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage $V_{BE} = 0$	$-V_{CES}$	max.	60 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10 V
Collector current (DC)	$-I_C$	max.	500 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*	P_{tot}	max.	1.0 W
Storage temperature range	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125 K/W

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $-I_C = 100\ \mu A$; $V_{BE} = 0$	$-V_{(BR)CES}$	min.	60 V
Collector-base breakdown voltage $-I_C = 100\ \mu A$; $I_E = 0$	$-V_{(BR)CBO}$	min.	60 V
Emitter-base cut-off current $-V_{BE} = 10$ V; $I_C = 0$	$-I_{EBO}$	max.	0.1 μA
Collector-base cut-off current $-V_{CB} = 50$ V; $I_E = 0$	$-I_{CBO}$	max.	0.1 μA
Collector-emitter cut-off current $-V_{CB} = 50$ V; $V_{BE} = 0$	$-I_{CES}$	max.	0.5 μA
DC current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V $-I_C = 100$ mA; $-V_{CE} = 5$ V	h_{FE} h_{FE}	min. 10 000 min. 10 000	
Collector-emitter saturation voltage $-I_C = 100$ mA; $-I_B = 0.1$ mA	$-V_{CE\ sat}$	max.	1.5 V
Base-emitter on-state voltage $-I_C = 100$ mA; $-V_{CE} = 5$ V	$-V_{BE\ (on)}$	max.	2.0 V
Transition frequency at f = 100 MHz $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	min.	125 MHz

* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

SILICON PLANAR EPITAXIAL TRANSISTORS

NPN silicon planar epitaxial transistors in a miniature SMD envelope (SOT-223), primarily intended for linear and switching applications.

PNP complements are PZT2907/2907A.

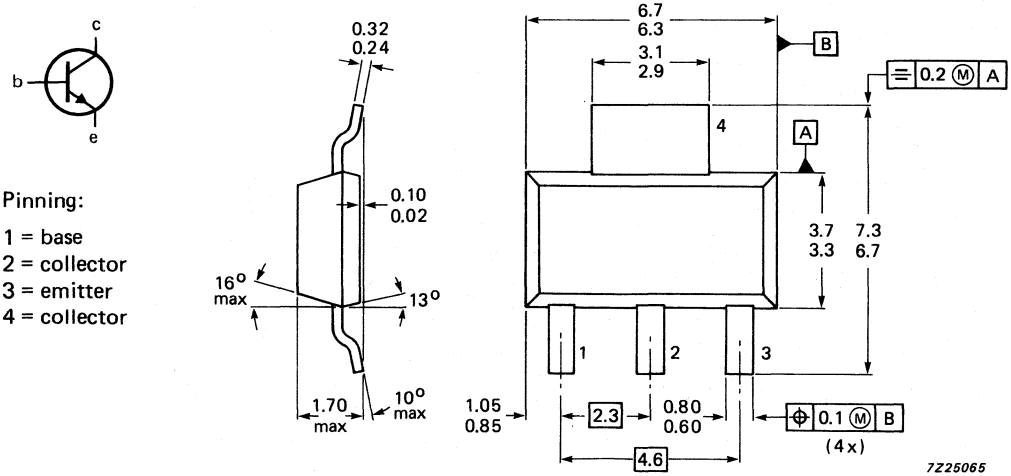
QUICK REFERENCE DATA

			PZT2222	PZT2222A
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40 V
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75 V
Collector current (DC)	I_C	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	1,5	W
Collector-emitter saturation voltage I_C = 150 mA; I_B = 15 mA	V_{CEsat}	max.	0,4	0,3 V
DC current gain I_C = 150 mA; V_{CE} = 10 V	h_{FE}	min. max.	100 300	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223



Pinning:

1 = base
2 = collector
3 = emitter
4 = collector

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PZT2222	PZT2222A	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	40	V
Collector-base voltage (open emitter)	V_{CBO}	max.	60	75	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5,0	6,0	V
Collector current (DC)	I_C	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−55 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient in free air *	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified			PZT2222	PZT2222A	
Collector-emitter breakdown voltage I_B = 0; I_C = 10 mA	$V_{(BR)CEO}$	min.	30	40	V
Collector-base breakdown voltage I_E = 0; I_C = 10 μA	$V_{(BR)CBO}$	min.	60	75	V
Emitter-base breakdown voltage I_E = 10 μA; I_C = 0	$V_{(BR)EBO}$	min.	5,0	6,0	V
Base cut-off current V_{CE} = 60 V; $-V_{BE}$ = 3 V	I_{BEX}	max.	–	20	nA
Collector cut-off current V_{CE} = 60 V; $-V_{BE}$ = 3 V	I_{CEX}	r ax.	–	10	nA
Emitter cut-off current I_C = 0; V_{EB} = 3 V	I_{EBO}	max.	–	10	nA
Collector cut-off current I_E = 0; V_{CB} = 50 V	I_{CBO}	max.	10	–	nA
I_E = 0; V_{CB} = 60 V	I_{CBO}	max.	–	10	nA
I_E = 0; V_{CB} = 50 V; T_{amb} = 125 °C	I_{CBO}	max.	10	–	μA
I_E = 0; V_{CB} = 60 V; T_{amb} = 125 °C	I_{CBO}	max.	–	10	μA

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

			PZT2222	PZT2222A	
DC current gain					
I_C = 0,1 mA; V_{CE} = 10 V	h_{FE}	min.		35	
I_C = 1 mA; V_{CE} = 10 V	h_{FE}	min.		50	
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	min.		75	
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C	h_{FE}	min.	–	35	
I_C = 150 mA; V_{CE} = 10 V	h_{FE}	min.		100	
		max.		300	
I_C = 150 mA; V_{CE} = 1 V	h_{FE}	min.		50	
I_C = 500 mA; V_{CE} = 10 V	h_{FE}	min.	30	40	
Saturation voltages					
I_C = 150 mA; I_B = 15 mA	V_{CEsat}	max.	0,4	0,3	V
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	min.	1,6	1,0	V
I_C = 150 mA; I_B = 15 mA	V_{BEsat}	max.	1,3	–	V
I_C = 150 mA; I_B = 15 mA	V_{BEsat}	min.		0,6	V
		max.		1,2	V
I_C = 500 mA; I_B = 50 mA	V_{BEsat}	max.	2,6	2,0	V
Transition frequency at f = 100 MHz					
I_C = 20 mA; V_{CE} = 20 V; T_{amb} = 25 °C	f_T	min.	250	300	MHz
Output capacitance at f = 1 MHz					
I_E = 0; V_{CB} = 10 V	C_c	max.		8,0	pF
Input capacitance at f = 1 MHz					
I_C = 0; V_{EB} = 0,5 V	C_e	max.	30	25	pF
Input impedance at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{ie}	min.	–	2,0	kΩ
		max.	–	8,0	kΩ
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{ie}	min.	–	0,25	kΩ
		max.	–	1,25	kΩ
Voltage feedback ratio at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{re}	max.	–	$8,0 \times 10^{-4}$	
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{re}	max.	–	$4,0 \times 10^{-4}$	
Small-signal current gain at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{fe}	min.	–	50	
		max.	–	300	
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{fe}	min.	–	75	
		max.	–	375	
Output admittance at f = 1 kHz					
I_C = 1 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{oe}	min.	–	5,0	μmhos
		max.	–	35	μmhos
I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	h_{oe}	min.	–	25	μmhos
		max.	–	200	μmhos

			PZT2222A
Noise figure at R_S = 1 kΩ I_C = 100 μA; V_{CE} = 10 V; f = 1 kHz; T_{amb} = 25 °C	F	max.	4,0 dB

Switching times at T_{amb} = 25 °C

Turn-on time (see Fig. 2) I_C = 150 mA; I_{Bon} = 15 mA V_{CC} = 30 V; $V_{EB(off)}$ = 0,5 V			
delay time	t_d	max.	10 ns
rise time	t_r	max.	25 ns
Turn-off time (see Fig. 3) I_C = 150 mA; I_{Bon} = I_{Boff} = 15 mA V_{CC} = 30 V			
storage time	t_s	max.	225 ns
fall time	t_f	max.	60 ns

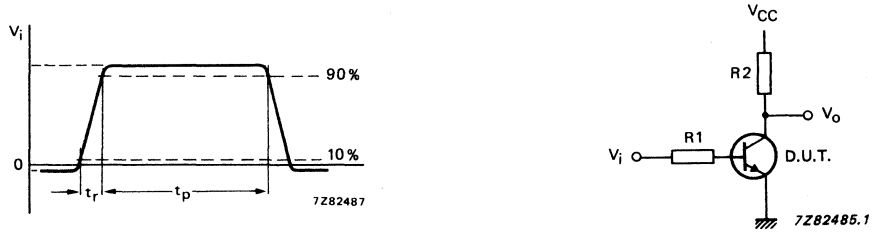


Fig. 2 Input waveform and test circuit for determining delay time and rise time.

V_i = −0,5 V to + 9,9 V; V_{CC} = + 30 V; R1 = 619 Ω; R2 = 200 Ω.

Pulse generator:				Oscilloscope:			
pulse duration	t_p	⩽	200 ns	input impedance	Z_i	>	100 kΩ
rise time	t_r	⩽	2 ns	input capacitance	C_i	<	12 pF
duty factor	δ	=	0,02	rise time	t_r	<	5 ns

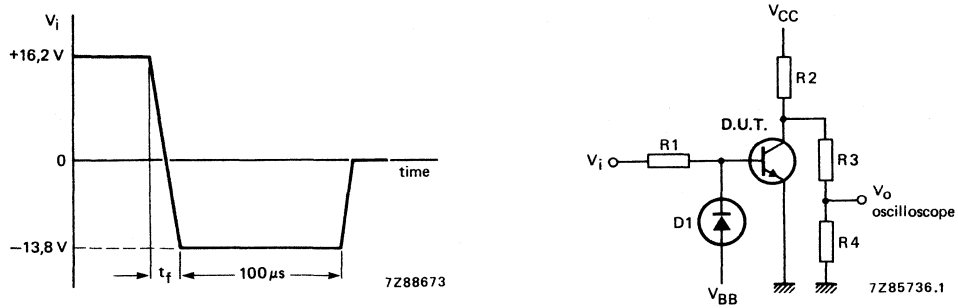


Fig. 3 Input waveform and test circuit for determining storage time and fall time.

SILICON PLANAR EPITAXIAL TRANSISTORS

PNP medium power transistors in a microminiature SMD envelope (SOT-223). Designed primarily for high-speed switching and driver applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)		$-V_{CBO}$	max.	60 V
Collector-emitter voltage (open base)	PZT2907	$-V_{CEO}$	max.	40 V
	PZT2907A	$-V_{CEO}$	max.	60 V
Collector current (DC)		$-I_C$	max.	600 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	1,5 W
Junction temperature		T_j	max.	150 °C
DC current gain at T_j = 25 °C $-I_C$ = 150 mA; $-V_{CE}$ = 10 V		h_{FE}	100 to 300	
Transition frequency at f = 100 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 20 V; T_j = 25 °C		f_T	>	200 MHz
Storage time $-I_{Con}$ = 150 mA; $-I_{Bon} = I_{Boff}$ = 15 mA		t_s	<	80 ns

MECHANICAL DATA

Dimensions in mm

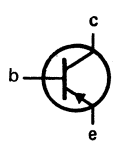
Fig. 1 SOT-223

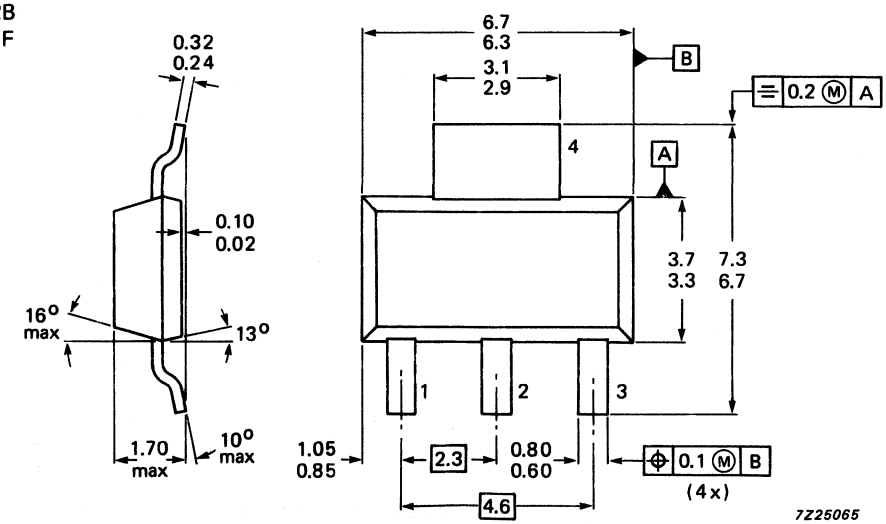
Marking code

PZT2907: P2B
PZT2907A: P2F

Pinning

1 = Base
2 = Emitter
3 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)		$-V_{CBO}$	max.	60	V
Collector-emitter voltage (open base)	**PZT2907**	$-V_{CEO}$	max.	40	V
	PZT2907A	$-V_{CEO}$	max.	60	V
Emitter-base voltage (open collector)		$-V_{EBO}$	max.	5	V
Collector current (DC)		$-I_C$	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	1,5	W
Storage temperature range		T_{stg}	−55 to	+150	°C
Junction temperature		T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PZT2907	PZT2907A	
Collector cut-off current					
$I_E = 0$; $-V_{CB} = 50$ V	$-I_{CBO}$	<	20	10	nA
$I_E = 0$; $-V_{CB} = 50$ V; $T_{amb} = 150$ °C	$-I_{CBO}$	<	20	10	μA
$+V_{BE} = 0{,}5$ V; $-V_{CE} = 30$ V	$-I_{CEX}$	<	50	50	nA
Base current					
$+V_{BE} = 0{,}5$ V; $-V_{CE} = 30$ V	I_{BEX}	<	50	50	nA
Collector-base breakdown voltage					
open emitter; $-I_C = 10$ μA	$-V_{(BR)CBO}$	>	60	60	V
Collector-emitter breakdown voltage*					
open base; $-I_C = 10$ mA	$-V_{(BR)CEO}$	>	40	60	V
Emitter-base breakdown voltage					
open collector; $-I_E = 10$ μA	$-V_{(BR)EBO}$	>	5	5	V
Saturation voltages*					
$-I_C = 150$ mA; $-I_B = 15$ mA	$-V_{CEsat}$	<	0,4	0,4	V
	$-V_{BEsat}$	<	1,3	1,3	V
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	<	1,6	1,6	V
	$-V_{BEsat}$	<	2,6	2,6	V
DC current gain					
$-I_C = 0{,}1$ mA; $-V_{CE} = 10$ V	h_{FE}	>	35	75	
$-I_C = 1$ mA; $-V_{CE} = 10$ V	h_{FE}	>	50	100	
$-I_C = 10$ mA; $-V_{CE} = 10$ V	h_{FE}	>	75	100	
$-I_C = 150$ mA; $-V_{CE} = 10$ V*	h_{FE}	>	100	100	
		<	300	300	
$-I_C = 500$ mA; $-V_{CE} = 10$ V*	h_{FE}	>	30	50	
Collector capacitance at f = 100 kHz					
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	<	8		pF
Emitter capacitance at f = 100 kHz					
$I_C = I_c = 0$; $-V_{EB} = 2$ V	C_e	<	30		pF
Transition frequency at f = 100 MHz					
$-I_C = 50$ mA; $-V_{CE} = 20$ V*	f_T	>	200		MHz

* Measured under pulse conditions to avoid excessive dissipation: $t_p \leqslant 300$ μs; $\delta \leqslant 0{,}02$.

Turn-on time (see Fig. 2)
when switched to $-I_{Con}$ = 150 mA; $-I_{Bon}$ = 15 mA

delay time	t_d	<	10 ns
rise time	t_r	<	40 ns
turn-on time	t_{on}	<	45 ns

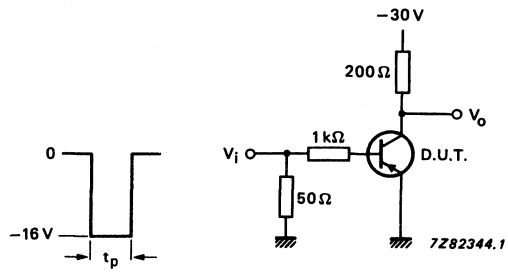


Fig. 2 Input waveform and test circuit for determining delay, rise and turn-on time.

Turn-off time (see Fig. 3)
when switched from $-I_{Con}$ = 150 mA; $-I_{Bon}$ = 15 mA
to cut-off with + I_{Boff} = 15 mA

storage time	t_s	<	80 ns
fall time	t_f	<	30 ns
turn-off time	t_{off}	<	100 ns

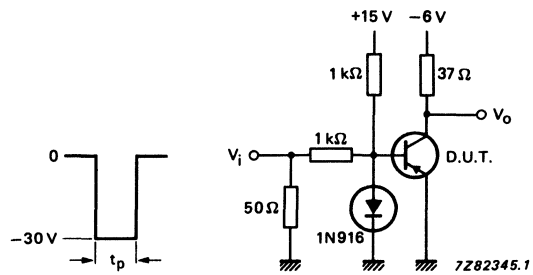


Fig. 3 Input waveform and test circuit for determining storage, fall and turn-off time.

Pulse generator (see Figs 2 and 3)

frequency	f	=	150 Hz
pulse duration	t_p	=	200 ns
rise time	t_r	⩽	2 ns
output impedance	Z_o	=	50 Ω

Oscilloscope (see Figs 2 and 3)

rise time	t_r	⩽	5 ns
input impedance	Z_i	⩽	10 MΩ

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN transistor in a microminiature SMD envelope (SOT-223). Designed primarily for high-speed, saturated switching applications in industrial service.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	60 V
Collector-emitter voltage (open base)	V_{CEO}	max.	40 V
Collector current (DC)	I_C	max.	200 mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	1,5 W
Junction temperature	T_j	max.	150 °C
DC current gain I_C = 10 mA; V_{CE} = 1 V	h_{FE}	> <	100 300
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 20 V	f_T	>	300 MHz
Storage time I_{Con} = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA	t_s	<	200 ns

MECHANICAL DATA

Dimensions in mm

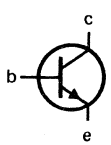
Fig. 1 SOT-223

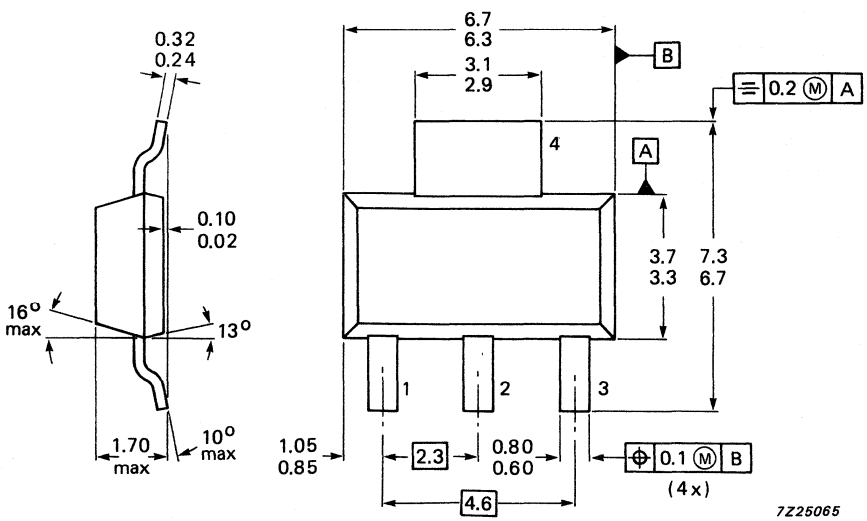
Marking code

P1A

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	V
Collector current (DC)	I_C	max.	200	mA
Total power dissipation at T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}	−55 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Currents at reverse biased emitter junction				
V_{CE} = 30 V; $-V_{BE}$ = 3 V	I_{CEX}	<	50	nA
	$-I_{BEX}$	<	50	nA
Saturation voltages				
I_C = 10 mA; I_B = 1 mA	V_{CEsat}	<	200	mV
	V_{BEsat}		650 to 850	mV
I_C = 50 mA; I_B = 5 mA	V_{CEsat}	<	300	mV
	V_{BEsat}	<	950	mV
DC current gain				
I_C = 0,1 mA; V_{CE} = 1 V	h_{FE}	>	40	
I_C = 1 mA; V_{CE} = 1 V	h_{FE}	>	70	
I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	100	
		<	300	
I_C = 50 mA; V_{CE} = 1 V	h_{FE}	>	60	
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	>	30	
Collector capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 5 V	C_c	<	4,0	pF
Emitter capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0,5 V	C_e	<	8,0	pF
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 20 V; T_{amb} = 25 °C	f_T	>	300	MHz
Noise figure at R_S = 1 kΩ				
I_C = 100 μA; V_{CE} = 5 V				
f = 10 Hz to 15,7 kHz; T_{amb} = 25 °C	F	<	5,0	dB

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

h-parameters (common emitter)

I_C = 1 mA; V_{CE} = 10 V; f = 1 kHz; T_{amb} = 25 °C

Input impedance	h_{ie}	1 to 10 kΩ
Reverse voltage transfer ratio	h_{re}	0,5 to 8×10^{-4}
Small-signal current gain	h_{fe}	100 to 400
Output admittance	h_{oe}	1 to 40 μS

Switching times

Turn-on time (see Figs 2 and 3) when switched from $-V_{BEoff}$ = 0,5 V to I_{Con} = 10 mA; I_{Bon} = 1 mA

Delay time	t_d	<	35 ns
Rise time	t_r	<	35 ns

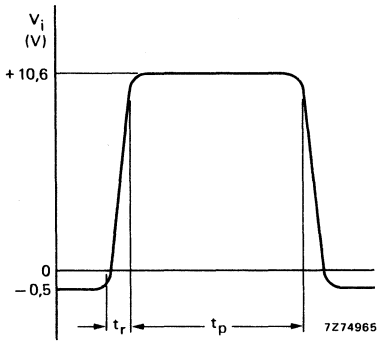


Fig. 2 Input waveform; $t_r < 1$ ns; t_p = 300 ns; δ = 0,02.

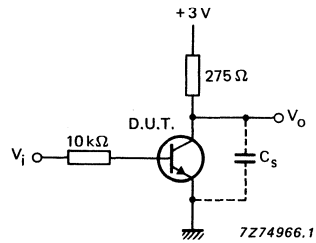


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

Turn-off time (see Figs 4 and 5)

I_{Con} = 10 mA; $I_{Bon} = -I_{Boff}$ = 1 mA

Storage time	t_s	<	200 ns
Fall time	t_f	<	50 ns

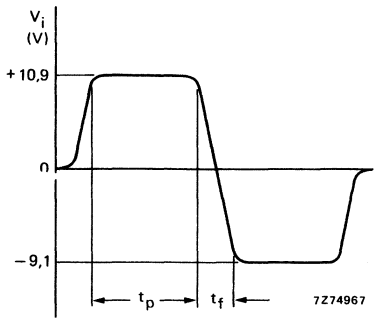


Fig. 4 Input waveform; $t_f < 1$ ns; 10 μs < t_p < 500 μs; δ = 0,02.

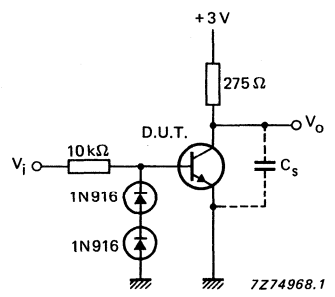


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP transistor in a microminiature SMD envelope (SOT-223). Designed primarily for high-speed, saturated switching applications in industrial service.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Collector current (DC)	$-I_C$	max.	200	mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	150	°C
DC current gain $-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	> <	100 300	
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	>	250	MHz
Storage time $-I_{Con}$ = 10 mA; $-I_{Bon} = I_{Boff}$ = 1 mA	t_s	<	225	ns

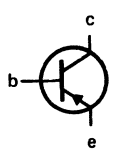
MECHANICAL DATA

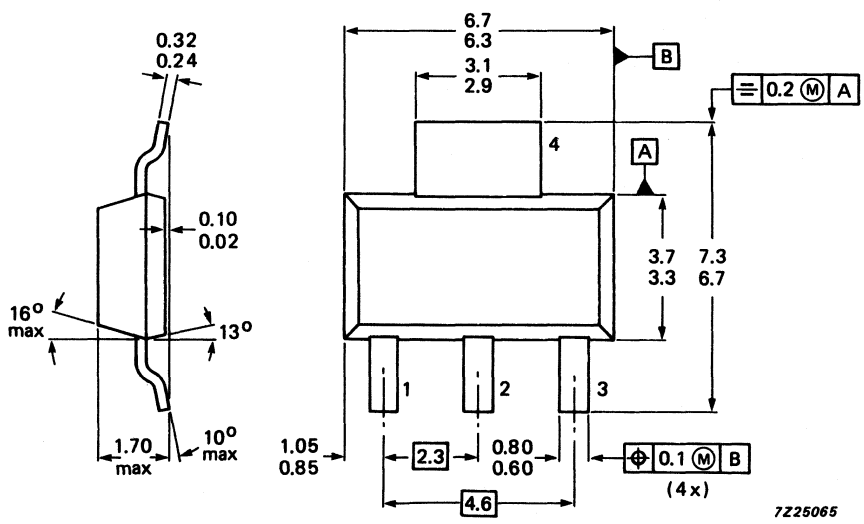
Dimensions in mm

Fig. 1 SOT-223

Marking code
P2A

Pinning
1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (DC)	$-I_C$	max.	200	mA
Total power dissipation at T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Currents at reverse biased emitter junction				
$-V_{CE}$ = 30 V; + V_{BE} = 3 V	$-I_{CEX}$	<	50	nA
	$+I_{BEX}$	<	50	nA
Saturation voltages				
$-I_C$ = 10 mA; $-I_B$ = 1 mA	$-V_{CEsat}$	<	250	mV
	$-V_{BEsat}$		650 to 850	mV
$-I_C$ = 50 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	400	mV
	$-V_{BEsat}$	<	950	mV
DC current gain				
$-I_C$ = 0,1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	60	
$-I_C$ = 1 mA; $-V_{CE}$ = 1 V	h_{FE}	>	80	
$-I_C$ = 10 mA; $-V_{CE}$ = 1 V	h_{FE}	>	100	
		<	300	
$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	h_{FE}	>	60	
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}	>	30	
Collector capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V	C_c	<	4,5	pF
Emitter capacitance at 100 kHz ≤ f ≤ 1 MHz				
$I_C = I_c$ = 0; $-V_{EB}$ = 0,5 V	C_e	<	10	pF
Transition frequency at f = 100 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 20 V; T_{amb} = 25 °C	f_T	>	250	MHz
Noise figure at R_S = 1 kΩ				
$-I_C$ = 100 μA; $-V_{CE}$ = 5 V				
f = 10 Hz to 15,7 kHz; T_{amb} = 25 °C	F	<	4,0	dB

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

h-parameters (common emitter)

$-I_C = 1$ mA; $-V_{CE} = 10$ V; f = 1 kHz; $T_{amb} = 25$ °C

Input impedance	h_{ie}	2 to 12 kΩ
Reverse voltage transfer ratio	h_{re}	0,1 to 10×10^{-4}
Small-signal current gain	h_{fe}	100 to 400
Output admittance	h_{oe}	3 to 60 μS

Switching times

Turn-on time (see Figs 2 and 3) when switched from $+V_{BEoff} = 0{,}5$ V to $-I_{Con} = 10$ mA; $-I_{Bon} = 1$ mA

Delay time	t_d	<	35 ns
Rise time	t_r	<	35 ns

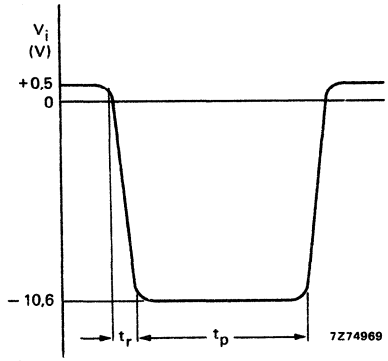


Fig. 2 Input waveform; $t_r < 1$ ns; $t_p = 300$ ns; $\delta = 0{,}02$.

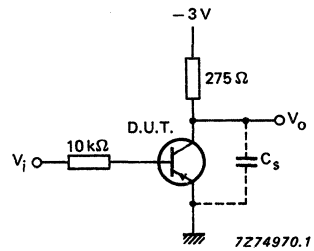


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

Turn-off time (see Figs 4 and 5)

$-I_{Con} = 10$ mA; $-I_{Bon} = I_{Boff} = 1$ mA

Storage time	t_s	<	225 ns
Fall time	t_f	<	75 ns

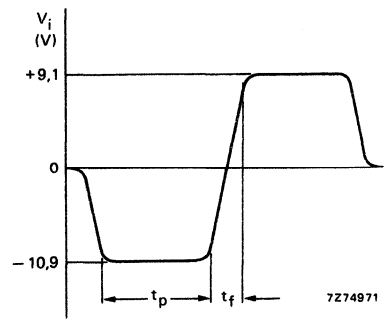


Fig. 4 Input waveform; $t_f < 1$ ns; $10\ \mu s < t_p < 500\ \mu s$; $\delta = 0{,}02$.

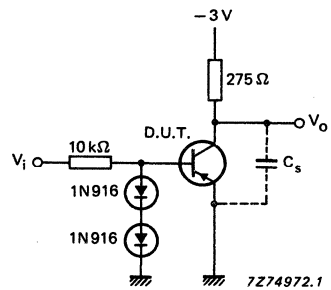


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4$ pF; scope impedance = 10 MΩ.

SMALL-SIGNAL DARLINGTON TRANSISTORS

NPN small-signal Darlington transistors in a microminiature SMD envelope (SOT-223).

Designed primarily for preamplifier input applications requiring high input impedance.

PNP complement is the PZTA63/64.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$		V_{CES}	max.	30	V
Collector current (DC)		I_C	max.	300	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$		P_{tot}	max.	1,5	W
Junction temperature		T_j	max.	150	^oC
DC current gain $I_C = 10$ mA; $V_{CE} = 5$ V	**PZTA13**	h_{FE}	min.	5000	
	PZTA14	h_{FE}	min.	10 000	
Transition frequency at f = 100 MHz $I_C = 10$ mA; $V_{CE} = 5$ V		f_T	min.	125	MHz

MECHANICAL DATA

Dimensions in mm

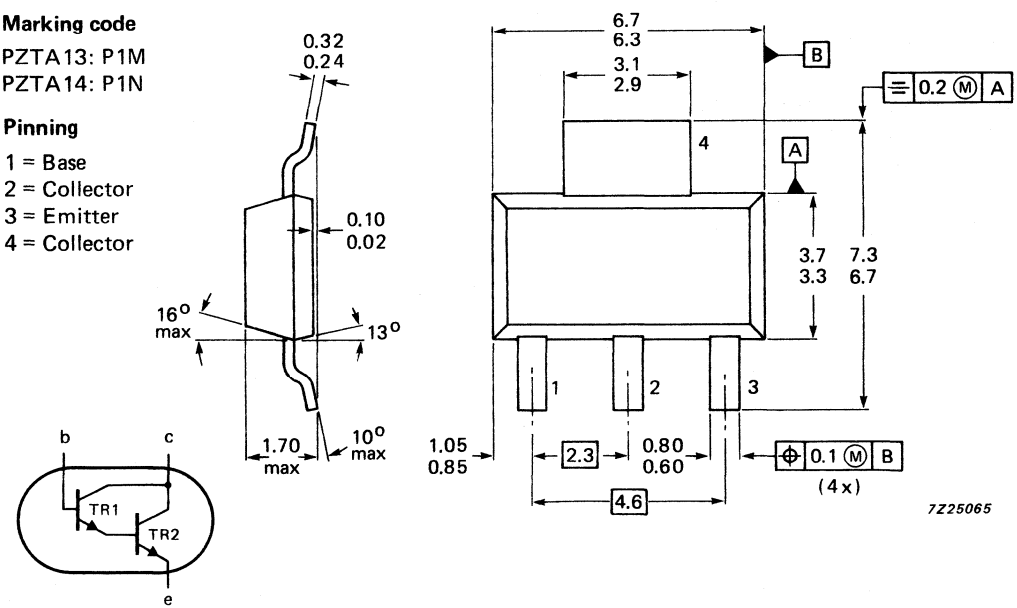
Fig. 1 SOT-223

Marking code

PZTA13: P1M
PZTA14: P1N

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)		V_{CBO}	max.	30 V
Collector-emitter voltage $V_{BE} = 0$		V_{CES}	max.	30 V
Emitter-base voltage (open collector)		V_{EBO}	max.	10 V
Collector current (DC)		I_C	max.	300 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*		P_{tot}	max.	1,5 W
Storage temperature range		T_{stg}		−65 to +150 °C
Junction temperature		T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*		$R_{th\ j\text{-}a}$		83,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)CES}$	min.	30 V
Emitter-base cut-off current $V_{BE} = 10$ V		I_{EBO}	max.	0,1 μA
Collector-base cut-off current $V_{CB} = 30$ V		I_{CBO}	max.	0,1 μA
DC current gain				
$I_C = 10$ mA; $V_{CE} = 5$ V	**PZTA13**	h_{FE}	min.	5000
	PZTA14	h_{FE}	min.	10 000
$I_C = 100$ mA; $V_{CE} = 5$ V	**PZTA13**	h_{FE}	min.	10 000
	PZTA14	h_{FE}	min.	20 000
Collector-emitter saturation voltage $I_C = 100$ mA; $I_B = 0{,}1$ mA		V_{CEsat}	max.	1,5 V
Base-emitter ON-voltage $I_C = 100$ mA; $V_{CE} = 5$ V		$V_{BE(on)}$	max.	2,0 V
Transition frequency at f = 100 MHz $I_C = 10$ mA; $V_{CE} = 5$ V		f_T	min.	125 MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

SILICON EPITAXIAL TRANSISTORS

NPN transistors in a microminiature SMD envelope (SOT-223).
They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PZTA42	PZTA43	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	200	V
Collector-emitter voltage (open base)	V_{CEO}	max.	300	200	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (DC)	I_C	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain I_C = 10 mA; V_{CE} = 10 V	h_{FE}	>	40		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 20 V	f_T	>	50		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 20 V	C_{re}	<	3	4	pF

MECHANICAL DATA

Dimensions in mm

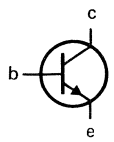
Fig. 1 SOT-223

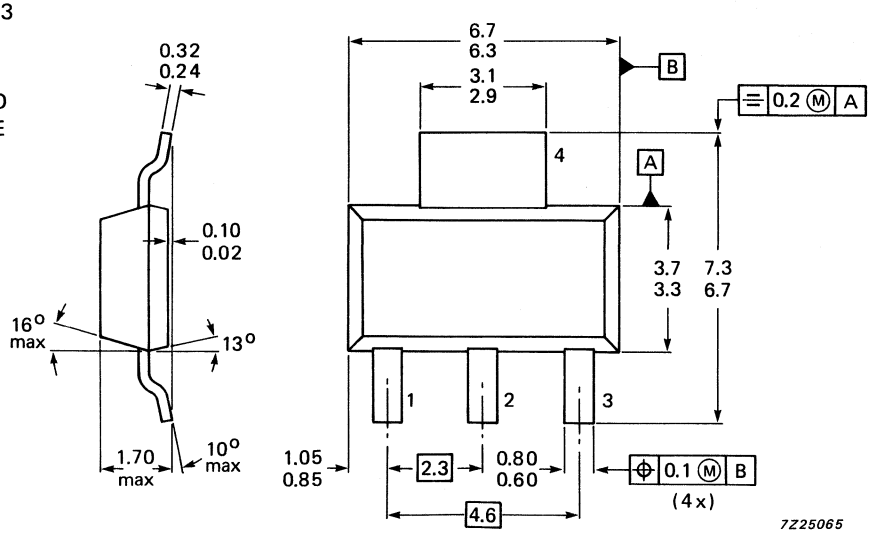
Marking code

PZTA42 = P1D
PZTA43 = P1E

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PZTA42	PZTA43	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	200	V
Collector-emitter voltage (open base)	V_{CEO}	max.	300	200	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (DC)	I_C	max.	500		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS

Thermal resistance from junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PZTA42	PZTA43	
Collector-emitter breakdown voltage** I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	>	300	200	V
Collector-base breakdown voltage I_C = 100 μA; I_E = 0	$V_{(BR)CBO}$	>	300	200	V
Emitter-base breakdown voltage I_E = 100 μA; I_C = 0	$V_{(BR)EBO}$	>	6	6	V
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	<	0,1	–	μA
I_E = 0; V_{CB} = 160 V		<	–	0,1	μA
Emitter cut-off current					
I_C = 0; V_{BE} = 6 V	I_{EBO}	<	0,1	–	μA
I_C = 0; V_{BE} = 4 V		<	–	0,1	μA
Feedback capacitance at f = 1 MHz I_E = 0; V_{CB} = 20 V	C_{re}	<	3	4	pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

** Pluse test conditions t_p = 300 μs; δ = 0,02.

Saturation voltages				
I_C = 20 mA; I_B = 2 mA	V_{CEsat}	<	0,5	V
	V_{BEsat}	<	0,9	V
DC current gain				
I_C = 1 mA; V_{CE} = 10 V		>	25	
I_C = 10 mA; V_{CE} = 10 V	h_{FE}	>	40	
I_C = 30 mA; V_{CE} = 10 V		>	40	
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 20 V	f_T	>	50	MHz

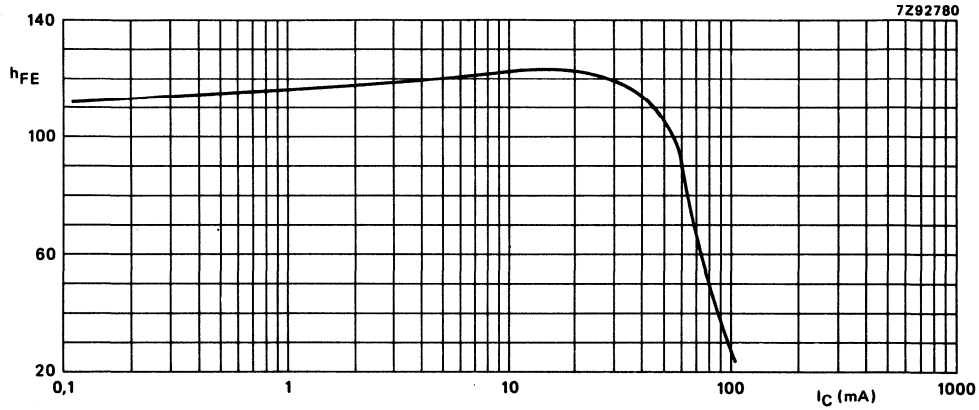


Fig. 2 T_j = 25 °C; V_{CE} = 20 V; typical values.

SMALL-SIGNAL DARLINGTON TRANSISTORS

PNP small-signal Darlington transistors in a microminiature SMD envelope (SOT-223).

Designed primarily for preamplifier input applications requiring high input impedance.

NPN complement is the PZTA13/14.

QUICK REFERENCE DATA

Collector-emitter voltage $V_{BE} = 0$		$-V_{CES}$	max.	30 V
Collector current (DC)		$-I_C$	max.	500 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$		P_{tot}	max.	1,5 W
Junction temperature		T_j	max.	150 °C
DC current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V	**PZTA63**	h_{FE}	min.	5000
	PZTA64	h_{FE}	min.	10 000
Transition frequency at f = 100 MHz $-I_C = 10$ mA; $-V_{CE} = 50$ V		f_T	min.	125 MHz

MECHANICAL DATA

Dimensions in mm

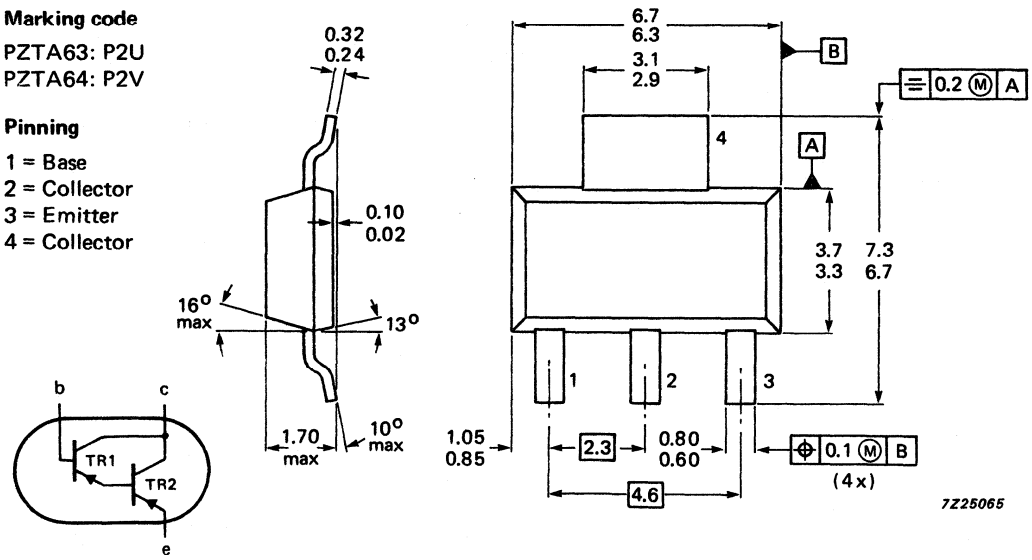
Fig. 1 SOT-223

Marking code

PZTA63: P2U
PZTA64: P2V

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)		$-V_{CBO}$	max.	30 V
Collector-emitter voltage $V_{BE} = 0$		$-V_{CES}$	max.	30 V
Emitter-base voltage (open collector)		$-V_{EBO}$	max.	10 V
Collector current (DC)		$-I_C$	max.	500 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*		P_{tot}	max.	1,5 W
Storage temperature range		T_{stg}		−65 to +150 °C
Junction temperature		T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*		$R_{th\ j\text{-}a}$	=	83,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $-I_C = 100\ \mu A$		$-V_{(BR)CES}$	min.	30 V
Emitter-base cut-off current $-V_{BE} = 10$ V		$-I_{EBO}$	max.	0,1 μA
Collector-base cut-off current $-V_{CB} = 30$ V		$-I_{CBO}$	max.	0,1 μA
DC current gain $-I_C = 10$ mA; $-V_{CE} = 5$ V	**PZTA63**	h_{FE}	min.	5000
	PZTA64	h_{FE}	min.	10 000
$-I_C = 100$ mA; $-V_{CE} = 5$ V	**PZTA63**	h_{FE}	min.	10 000
	PZTA64	h_{FE}	min.	20 000
Collector-emitter saturation voltage $-I_C = 100$ mA; $-I_B = 0,1$ mA		$-V_{CEsat}$	max.	1,5 V
Base-emitter ON-voltage $-I_C = 100$ mA; $-V_{CE} = 5$ V		$-V_{BE(on)}$	max.	2,0 V
Transition frequency at f = 100 MHz $-I_C = 10$ mA; $-V_{CE} = 50$ V; $T_{amb} = 25\ ^oC$		f_T	min.	125 MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

SILICON EPITAXIAL TRANSISTORS

PNP transistors in a microminiature SMD envelope (SOT-223).
They are primarily intended for use in telephony and professional communication equipment.

QUICK REFERENCE DATA

			PZTA92	PZTA93	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	200	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	300	200	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (DC)	$-I_C$	max.	500		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
DC current gain $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	40		
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 20 V	f_T	min.	50		MHz
Collector-base capacitance at f = 1 MHz I_E = 0; $-V_{CB}$ = 20 V	C_{cb}	max.	6	8	pF

MECHANICAL DATA

Dimensions in mm

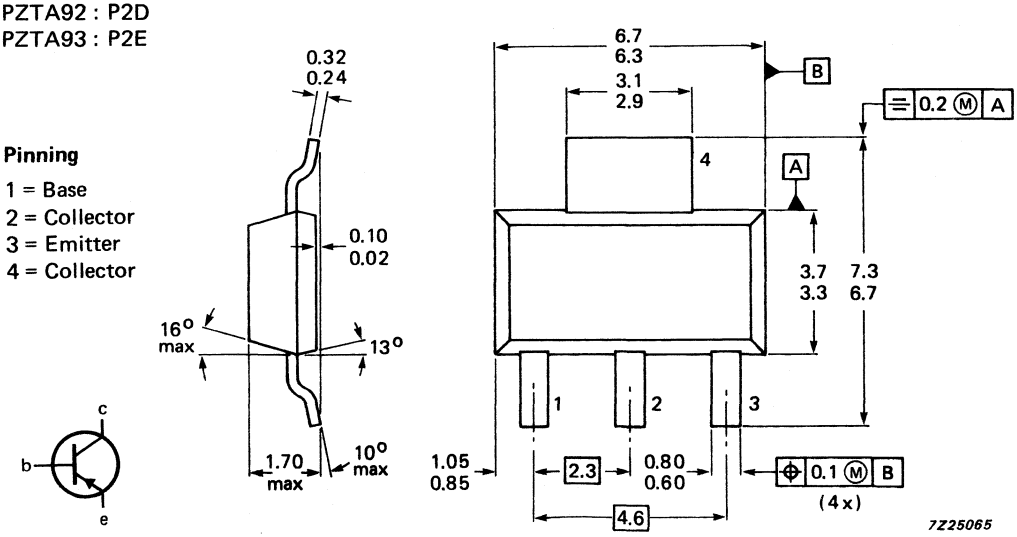
Fig. 1 SOT-223

Marking code

PZTA92 : P2D
PZTA93 : P2E

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			PZTA92	PZTA93	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	200	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	300	200	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (DC)	$-I_C$	max.	500		mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS

Thermal resistance from junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			PZTA92	PZTA93	
Collector-emitter breakdown voltage $-I_C$ = 1 mA; I_B = 0	$-V_{(BR)CEO}$	min.	300	200	V
Collector-base breakdown voltage $-I_C$ = 100 μA; I_E = 0	$-V_{(BR)CBO}$	min.	300	200	V
Collector cut-off current					
$-V_{CB}$ = 200 V; I_E = 0	$-I_{CBO}$	max.	0,25	—	μA
$-V_{CB}$ = 160 V; I_E = 0		max.	—	0,25	μA
Emitter-base breakdown voltage $-I_E$ = 100 μA; I_C = 0	$-V_{(BR)EBO}$	min.	5		V
Emitter cut-off current I_C = 0; $-V_{BE}$ = 3 V	$-I_{EBO}$	max.	0,1		μA
Collector-base capacitance at f = 1 MHz; I_E = 0; $-V_{CB}$ = 20 V	C_{cb}	max.	6	8	pF
Saturation voltages					
$-I_C$ = 20 mA; $-I_B$ = 2 mA	$-V_{CEsat}$	max.	0,5		V
$-I_C$ = 20 mA; $-I_B$ = 2 mA	$-V_{BEsat}$	max.	0,9		V
DC current gain**					
$-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	25		
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	40		
$-I_C$ = 30 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	25		

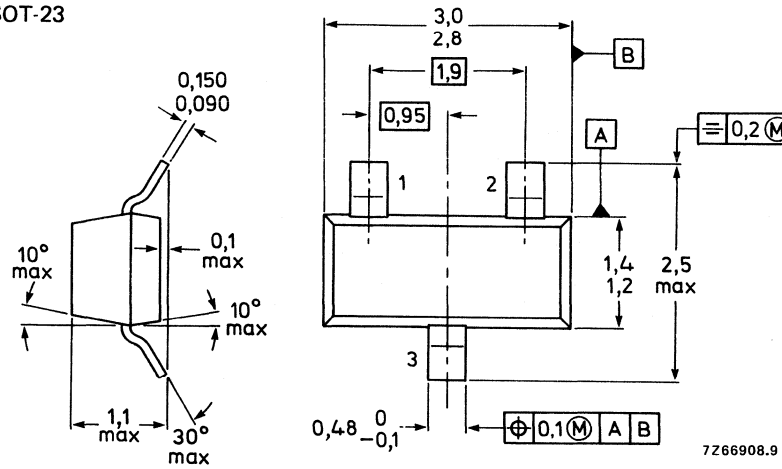
* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 mm^2.

** Pulse test conditions: t_p = 300 μs; duty cycle ≤ 2%.

MECHANICAL DATA
(European projection)

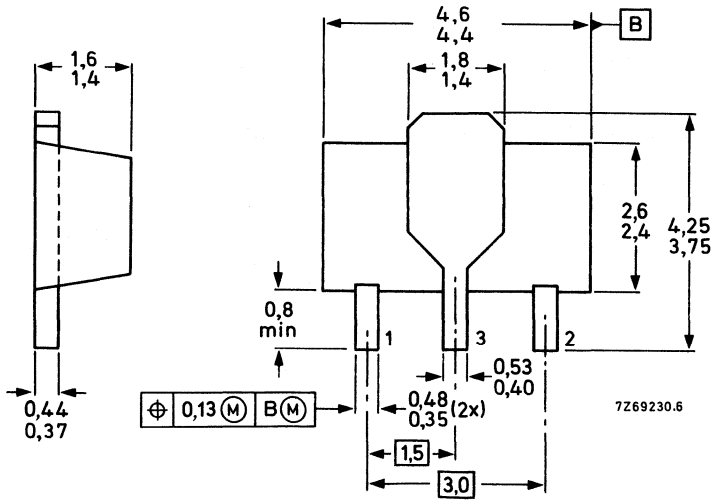
Dimensions in mm

SOT-23



TOP VIEW

SOT-89



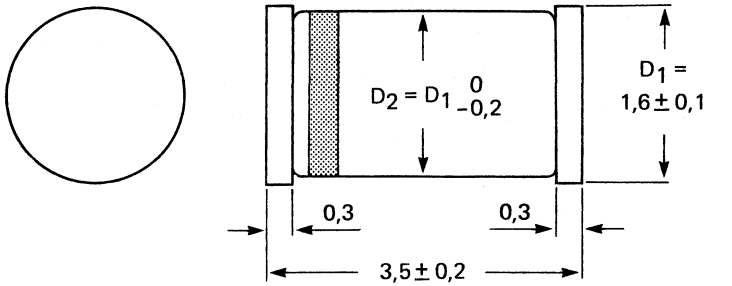
BOTTOM VIEW

MECHANICAL DATA

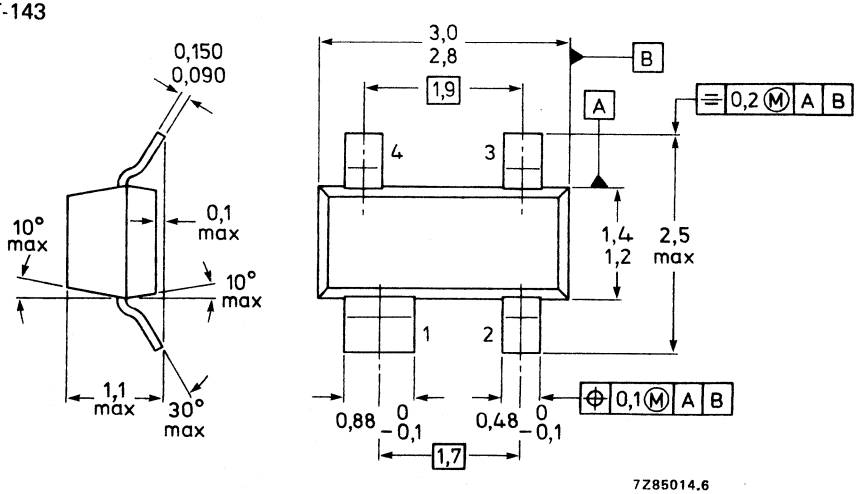
Dimensions in mm

(European projection)

SOD-80



SOT-143

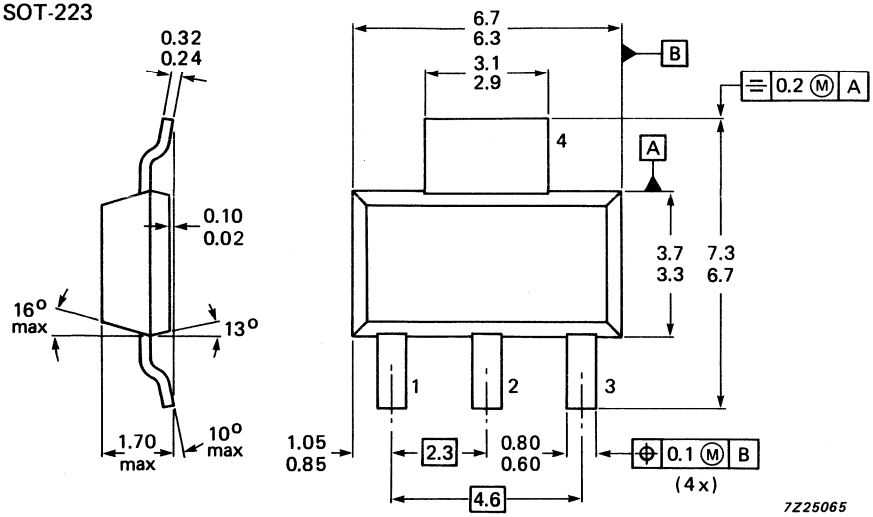


TOP VIEW

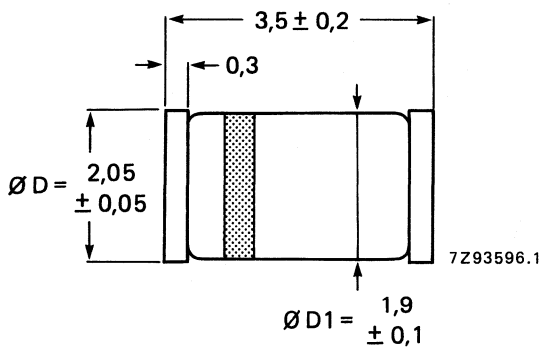
MECHANICAL DATA
(European projection)

Dimensions in mm

SOT-223



SOD-87



NOTES

INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
BA220	S1	SD	BAS28	S1/S7	SD/Mm	BAV45	S1	Sp
BA221	S1	SD	BAS29	S1/S7	SD/Mm	BAV70	S7/S1	Mm/SD
BA223	S1	T	BAS31	S1/S7	SD/Mm	BAV74	S1	SD
BA281	S1	SD	BAS32	S1/S7	SD/Mm	BAV99	S1/S7	SD/Mm
BA314	S1	Vrg	BAS32L	S1/S7	SD/Mm	BAV100	S1/S7	SD/Mm
BA315	S1	Vrg	BAS35	S1/S7	SD/Mm	BAV101	S1/S7	SD/Mm
BA316	S1	SD	BAS45	S1	SD	BAV102	S1/S7	SD/Mm
BA317	S1	SD	BAS45L	S1/S7	SD	BAV103	S1/S7	SD/Mm
BA318	S1	SD	BAS56	S1/S7	SD/Mm	BAV105	S1/S7	SD
BA423	S1	T	BAS85	S1	SD	BAW56	S1/S7	SD/Mm
BA423L	S1	T	BAT17	S1/S7	T/Mm	BAW62	S1	SD
BA480	S1	T	BAT18	S7/S1	T/Mm	BAX12	S1	SD
BA481	S1	T	BAT54	S1/S7	SD/Mm	BAX14	S1	SD
BA482	S1	T	BAT74	S1/S7	SD/Mm	BAX18	S1	SD
BA483	S1	T	BAT81	S1	T	BAY80	S1	SD
BA484	S1	T	BAT82	S1	T	BB112	S1	T
BA682	S1/S7	T/Mm	BAT83	S1	T	BB119	S1	T
BA683	S1/S7	T/Mm	BAT85	S1	T	BB130	S1	T
BAS11	S1	SD	BAT86	S1	T	BB204B	S1	T
BAS15	S1	SD	BAV10	S1	SD	BB204G	S1	T
BAS16	S1/S7	SD/Mm	BAV18	S1	SD	BB212	S1	T
BAS17	S1/S7	Vrg/Mm	BAV19	S1	SD	BB215	S1/S7	SD/Mm
BAS19	S1/S7	SD/Mm	BAV20	S1	SD	BB219	S1/S7	SD/Mm
BAS20	S1/S7	SD/Mm	BAV21	S1	SD	BB240	S1/S7	T
BAS21	S1/S7	SD/Mm	BAV23	S1/S7	SD/Mm	BB241	S1/S7	T

Key to handbook sections

A = Accessories
FET = Field-effect transistors
I = Infrared devices
LED = Light-emitting diodes
LCD = Liquid crystal displays
Mm = Surface-mounted devices
M = Microwave transistors
P = Low-frequency power transistors and modules
PDT = Photodiodes or transistors
Ph = Photoconductive devices
PhC = Photocouplers
PM = PowerMOS transistors
R = Rectifier diodes
RFP = RF power transistors and modules
RT = Triplers
SEN = Semiconductor sensors
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
SP = Low-frequency switching power diodes
St = Rectifier stacks
T = Tuner diodes
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

* series.

type no.	book	section
BB405B	S1	T
BB417	S1	T
BB804	S1/S7	T
BB809	S1	T
BB909A	S1	T
BB909B	S1	T
BB910	S1	T
BB911	S1	T
BBY31	S1/S7	T/Mm
BBY39	S1	T
BBY40	S1/S7	T/Mm
BBY42	S1	T
BBY62	S1	T
BC107	S3	Sm
BC108	S3	Sm
BC109	S3	Sm
BC140	S3	Sm
BC141	S3	Sm
BC160	S3	Sm
BC161	S3	Sm
BC177	S3	Sm
BC178	S3	Sm
BC179	S3	Sm
BC264A	S5	FET
BC264B	S5	FET
BC264C	S5	FET
BC264D	S5	FET
BC327;A	S3	Sm
BC328	S3	Sm
BC337;A	S3	Sm
BC338	S3	Sm
BC368	S3	Sm
BC369	S3	Sm
BC375	S3	Sm
BC376	S3	Sm
BC516	S3	Sm
BC517	S3	Sm
BC546	S3	Sm
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BC548	S3	Sm
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BC637	S3	Sm
BC638	S3	Sm
BC639	S3	Sm
BC640	S3	Sm
BC807	S7	Mm
BC808	S7	Mm
BC817	S7	Mm
BC818	S7	Mm
BC846	S7	Mm
BC847	S7	Mm
BC848	S7	Mm
BC849	S7	Mm
BC850	S7	Mm
BC856	S7	Mm
BC857	S7	Mm
BC858	S7	Mm
BC859	S7	Mm
BC860	S7	Mm
BC868	S7	Mm
BC869	S7	Mm
BCF29;R	S7	Mm
BCF30;R	S7	Mm
BCF32;R	S7	Mm
BCF33;R	S7	Mm
BCF70;R	S7	Mm
BCF81;R	S7	Mm
BCP51	S7	Mm
BCP52	S7	Mm
BCP53	S7	Mm
BCP54	S7	Mm
BCP55	S7	Mm
BCP56	S7	Mm
BCP68	S7	Mm
BCP69	S7	Mm
BCV26	S7	Mm
BCV27	S7	Mm
BCV28	S7	Mm
BCV29	S7	Mm
BCV46	S7	Mm
BCV47	S7	Mm
BCV48	S7	Mm
BCV49	S7	Mm
BCV61	S7	Mm
BCV62	S7	Mm
BCV63	S7	Mm
BCV64	S7	Mm
BCV65	S7	Mm
BCV71;R	S7	Mm
BCV72;R	S7	Mm
BCW29;R	S7	Mm
BCW30;R	S7	Mm
BCW31;R	S7	Mm
BCW32;R	S7	Mm
BCW33;R	S7	Mm
BCW60*	S7	Mm
BCW61*	S7	Mm
BCW69;R	S7	Mm
BCW70;R	S7	Mm
BCW71;R	S7	Mm
BCW72;R	S7	Mm
BCW81;R	S7	Mm
BCW89;R	S7	Mm
BCX17;R	S7	Mm
BCX18;R	S7	Mm
BCX19;R	S7	Mm
BCX20;R	S7	Mm
BCX51	S7	Mm
BCX52	S7	Mm
BCX53	S7	Mm
BCX54	S7	Mm
BCX55	S7	Mm

type no.	book	section
BCX56	S7	Mm
BCX58	S3	Sm
BCX59	S3	Sm
BCX70*	S7	Mm
BCX71*	S7	Mm
BCX78	S3	Sm
BCX79	S3	Sm
BCY56	S3	Sm
BCY57	S3	Sm
BCY58	S3	Sm
BCY59	S3	Sm
BCY65	S3	Sm
BCY70	S3	Sm
BCY71	S3	Sm
BCY72	S3	Sm
BCY78	S3	Sm
BCY79	S3	Sm
BCY87	S3	Sm
BCY88	S3	Sm
BCY89	S3	Sm
BD131	S4a	P
BD132	S4a	P
BD135	S4a	P
BD136	S4a	P
BD137	S4a	P
BD138	S4a	P
BD139	S4a	P
BD140	S4a	P
BD201	S4a	P
BD202	S4a	P
BD203	S4a	P
BD204	S4a	P
BD226	S4a	P
BD227	S4a	P
BD228	S4a	P
BD229	S4a	P
BD230	S4a	P
BD231	S4a	P
BD233	S4a	P
BD234	S4a	P
BD235	S4a	P
BD236	S4a	P
BD237	S4a	P
BD238	S4a	P
BD239	S4a	P
BD239A	S4a	P
BD239B	S4a	P
BD239C	S4a	P
BD240	S4a	P
BD240A	S4a	P
BD240B	S4a	P
BD240C	S4a	P
BD241	S4a	P
BD241A	S4a	P
BD241B	S4a	P
BD241C	S4a	P
BD242	S4a	P
BD242A	S4a	P
BD242B	S4a	P
BD242C	S4a	P
BD243	S4a	P
BD243A	S4a	P
BD243B	S4a	P
BD243C	S4a	P
BD244	S4a	P
BD244A	S4a	P
BD244B	S4a	P
BD244C	S4a	P
BD329	S4a	P
BD330	S4a	P
BD331	S4a	P
BD332	S4a	P
BD333	S4a	P
BD334	S4a	P
BD335	S4a	P
BD336	S4a	P
BD337	S4a	P
BD338	S4a	P
BD433	S4a	P
BD434	S4a	P
BD435	S4a	P
BD436	S4a	P
BD437	S4a	P
BD438	S4a	P
BD645	S4a	P
BD646	S4a	P
BD647	S4a	P
BD648	S4a	P
BD649	S4a	P
BD650	S4a	P
BD651	S4a	P
BD652	S4a	P
BD675	S4a	P
BD676	S4a	P
BD677	S4a	P
BD678	S4a	P
BD679	S4a	P
BD680	S4a	P
BD681	S4a	P
BD682	S4a	P
BD683	S4a	P
BD684	S4a	P
BD813	S4a	P
BD814	S4a	P
BD815	S4a	P
BD816	S4a	P
BD817	S4a	P
BD818	S4a	P
BD825	S4a	P
BD826	S4a	P
BD827	S4a	P
BD828	S4a	P
BD829	S4a	P
BD830	S4a	P
BD839	S4a	P
BD840	S4a	P
BD841	S4a	P
BD842	S4a	P
BD843	S4a	P
BD844	S4a	P

type no.	book	section
BD845	S4a	P
BD846	S4a	P
BD847	S4a	P
BD848	S4a	P
BD849	S4a	P
BD850	S4a	P
BD933	S4a	P
BD934	S4a	P
BD935	S4a	P
BD936	S4a	P
BD937	S4a	P
BD938	S4a	P
BD939	S4a	P
BD940	S4a	P
BD941	S4a	P
BD942	S4a	P
BD943	S4a	P
BD944	S4a	P
BD945	S4a	P
BD946	S4a	P
BD947	S4a	P
BD948	S4a	P
BD949	S4a	P
BD950	S4a	P
BD951	S4a	P
BD952	S4a	P
BD953	S4a	P
BD954	S4a	P
BD955	S4a	P
BD956	S4a	P
BDT20	S4a	P
BDT21	S4a	P
BDT29	S4a	P
BDT29A	S4a	P
BDT29B	S4a	P
BDT29C	S4a	P
BDT30	S4a	P
BDT30A	S4a	P
BDT30B	S4a	P
BDT30C	S4a	P
BDT31	S4a	P
BDT31A	S4a	P
BDT31B	S4a	P
BDT31C	S4a	P
BDT32	S4a	P
BDT32A	S4a	P
BDT32B	S4a	P
BDT32C	S4a	P
BDT41	S4a	P
BDT41A	S4a	P
BDT41B	S4a	P
BDT41C	S4a	P
BDT42	S4a	P
BDT42A	S4a	P
BDT42B	S4a	P
BDT42C	S4a	P
BDT51	S4a	P
BDT52	S4a	P
BDT53	S4a	P
BDT54	S4a	P
BDT55	S4a	P
BDT56	S4a	P
BDT57	S4a	P
BDT58	S4a	P
BDT60	S4a	P
BDT60A	S4a	P
BDT60B	S4a	P
BDT60C	S4a	P
BDT61	S4a	P
BDT61A	S4a	P
BDT61B	S4a	P
BDT61C	S4a	P
BDT62	S4a	P
BDT62A	S4a	P
BDT62B	S4a	P
BDT62C	S4a	P
BDT63	S4a	P
BDT63A	S4a	P
BDT63B	S4a	P
BDT63C	S4a	P
BDT64	S4a	P
BDT64A	S4a	P
BDT64B	S4a	P
BDT64C	S4a	P
BDT65	S4a	P
BDT65A	S4a	P
BDT65B	S4a	P
BDT65C	S4a	P
BDT81	S4a	P
BDT82	S4a	P
BDT83	S4a	P
BDT84	S4a	P
BDT85	S4a	P
BDT86	S4a	P
BDT87	S4a	P
BDT88	S4a	P
BDT91	S4a	P
BDT92	S4a	P
BDT93	S4a	P
BDT94	S4a	P
BDT95	S4a	P
BDT96	S4a	P
BDV64	S4a	P
BDV64A	S4a	P
BDV64B	S4a	P
BDV64C	S4a	P
BDV65	S4a	P
BDV65A	S4a	P
BDV65B	S4a	P
BDV65C	S4a	P
BDV66A	S4a	P
BDV66B	S4a	P
BDV66C	S4a	P
BDV66D	S4a	P
BDV67A	S4a	P
BDV67B	S4a	P
BDV67C	S4a	P
BDV67D	S4a	P
BDV91	S4a	P
BDV92	S4a	P

type no.	book	section	type no.	book	section	type no.	book	section
BDV93	S4a	P	BDX67A	S4a	P	BF410C	S5	FET
BDV94	S4a	P	BDX67B	S4a	P	BF410D	S5	FET
BDV95	S4a	P	BDX67C	S4a	P	BF420	S3	Sm
BDV96	S4a	P	BDX68	S4a	P	BF421	S3	Sm
BDW55	S4a	P	BDX68A	S4a	P	BF422	S3	Sm
BDW56	S4a	P	BDX68B	S4a	P	BF423	S3	Sm
BDW57	S4a	P	BDX68C	S4a	P	BF450	S3	Sm
BDW58	S4a	P	BDX69	S4a	P	BF451	S3	Sm
BDW59	S4a	P	BDX69A	S4a	P	BF483	S3	Sm
BDW60	S4a	P	BDX69B	S4a	P	BF485	S3	Sm
BDX35	S4a	P	BDX69C	S4a	P	BF487	S3	Sm
BDX36	S4a	P	BDX77	S4a	P	BF494	S3	Sm
BDX37	S4a	P	BDX78	S4a	P	BF495	S3	Sm
BDX42	S4a	P	BDX91	S4a	P	BF496	S3	Sm
BDX43	S4a	P	BDX92	S4a	P	BF510	S5/S7	FET/Mm
BDX44	S4a	P	BDX93	S4a	P	BF511	S5/S7	FET/Mm
BDX45	S4a	P	BDX94	S4a	P	BF512	S5/S7	FET/Mm
BDX46	S4a	P	BDX95	S4a	P	BF513	S5/S7	FET/Mm
BDX47	S4a	P	BDX96	S4a	P	BF550;R	S7	Mm
BDX62	S4a	P	BDY90	S4a	P	BF569	S7	Mm
BDX62A	S4a	P	BDY90A	S4a	P	BF570	S7	Mm
BDX62B	S4a	P	BDY91	S4a	P	BF579	S7	Mm
BDX62C	S4a	P	BDY92	S4a	P	BF620	S7	Mm
BDX63	S4a	P	BF198	S3	Sm	BF621	S7	Mm
BDX63A	S4a	P	BF199	S3	Sm	BF622	S7	Mm
BDX63B	S4a	P	BF240	S3	Sm	BF623	S7	Mm
BDX63C	S4a	P	BF241	S3	Sm	BF660;R	S7	Mm
BDX64	S4a	P	BF245A	S5	FET	BF689K	S10	WBT
BDX64A	S4a	P	BF245B	S5	FET	BF720	S7	Mm
BDX64B	S4a	P	BF245C	S5	FET	BF721	S7	Mm
BDX64C	S4a	P	BF247A	S5	FET	BF722	S7	Mm
BDX65	S4a	P	BF247B	S5	FET	BF723	S7	Mm
BDX65A	S4a	P	BF247C	S5	FET	BF763	S10	WBT
BDX65B	S4a	P	BF256A	S5	FET	BF820	S7	Mm
BDX65C	S4a	P	BF256B	S5	FET	BF821	S7	Mm
BDX66	S4a	P	BF256C	S5	FET	BF822	S7	Mm
BDX66A	S4a	P	BF324	S3	Sm	BF823	S7	Mm
BDX66B	S4a	P	BF370	S3	Sm	BF824	S7	Mm
BDX66C	S4a	P	BF410A	S5	FET	BF840	S7	Mm
BDX67	S4a	P	BF410B	S5	FET	BF841	S7	Mm

type no.	book	section
BF926	S3	Sm
BF936	S3	Sm
BF939	S3	Sm
BF960	S5	FET
BF964	S5	FET
BF964S	S5	FET
BF965	S5	FET
BF966	S5	FET
BF966S	S5	FET
BF967	S3	Sm
BF970	S3	Sm
BF970A	S3	Sm
BF979	S3	Sm
BF980	S5	FET
BF981	S5	FET
BF982	S5	FET
BF989	S5/S7	FET/Mm
BF990A	S5/S7	FET/Mm
BF991	S5/S7	FET/Mm
BF992	S5/S7	FET/Mm
BF994S	S5/S7	FET/Mm
BF996S	S5/S7	FET/Mm
BF997	S5/S7	FET/Mm
BFG23	S10	WBT
BFG32	S10	WBT
BFG34	S10	WBT
BFG35	S7	WBT/Mm
BFG51	S10	WBT
BFG65	S10	WBT
BFG67	S10/S7	WBT/Mm
BFG90A	S10	WBT
BFG91A	S10	WBT
BFG92A	S10	WBT
BFG93A	S10	WBT
BFG96	S10	WBT
BFG97	S7	WBT/Mm
BFG135	S7	WBT/Mm
BFG195	S10	WBT
BFG198	S7	WBT/Mm
BFP90A	S10	WBT
BFP91A	S10	WBT
BFP96	S10	WBT
BFQ10	S5	FET
BFQ11	S5	FET
BFQ12	S5	FET
BFQ13	S5	FET
BFQ14	S5	FET
BFQ15	S5	FET
BFQ16	S5	FET
BFQ17	S10/S7	WBT/Mm
BFQ18A	S10/S7	WBT/Mm
BFQ19	S10/S7	WBT/Mm
BFQ22S	S10	WBT
BFQ23	S10	WBT
BFQ23C	S10	WBT
BFQ24	S10	WBT
BFQ32	S10	WBT
BFQ32C	S10	WBT
BFQ32M	S10	WBT
BFQ32S	S10	WBT
BFQ33	S10	WBT
BFQ33C	S10	WBT
BFQ34	S10	WBT
BFQ34T	S10	WBT
BFQ42	S6	RFP
BFQ43	S6	RFP
BFQ43S	S6	RFP
BFQ51	S10	WBT
BFQ51C	S10	WBT
BFQ52	S10	WBT
BFQ53	S10	WBT
BFQ63	S10	WBT
BFQ65	S10	WBT
BFQ66	S10	WBT
BFQ67	S10/S7	WBT/Mm
BFQ68	S10	WBT
BFQ136	S10	WBT
BFR29	S5	FET
BFR30	S5/S7	FET/Mm
BFR31	S5/S7	FET/Mm
BFR49	S10	WBT
BFR53	S10/S7	WBT/Mm
BFR54	S3	Sm
BFR64	S10	WBT
BFR65	S10	WBT
BFR84	S5	FET
BFR90	S10	WBT
BFR90A	S10	WBT
BFR91	S10	WBT
BFR91A	S10	WBT
BFR92	S10/S7	WBT/Mm
BFR92A	S10/S7	WBT/Mm
BFR93	S10/S7	WBT/Mm
BFR93A	S10/S7	WBT/Mm
BFR94	S10	WBT
BFR95	S10	WBT
BFR96	S10	WBT
BFR96S	S10	WBT
BFR101A;B	S5/S7	FET/Mm
BFS17	S10/S7	WBT/Mm
BFS17A	S10	WBT
BFS18;R	S7	Mm
BFS19;R	S7	Mm
BFS20;R	S7	Mm
BFS21	S5	FET
BFS21A	S5	FET
BFS22A	S6	RFP
BFS23A	S6	RFP
BFT24	S10	WBT
BFT25	S10/S7	WBT/Mm
BFT44	S3	Sm
BFT45	S3	Sm
BFT46	S5/S7	FET/Mm
BFT92	S10/S7	WBT/Mm
BFT93	S10/S7	WBT/Mm
BFW10	S5	FET
BFW11	S5	FET
BFW12	S5	FET
BFW13	S5	FET
BFW16A	S10	WBT

type no.	book	section
BFW17A	S10	WBT
BFW30	S10	WBT
BFW61	S5	FET
BFW92	S10	WBT
BFW92A	S10	WBT
BFW93	S10	WBT
BFX34	S3	Sm
BFX89	S10	WBT
BFY50	S3	Sm
BFY51	S3	Sm
BFY52	S3	Sm
BFY55	S3	Sm
BFY90	S10	WBT
BG2000	S1	RT
BG2097	S1	RT
BGD102	S10	WBM
BGD102E	S10	WBM
BGD104	S10	WBM
BGD104E	S10	WBM
BGD502	S10	WBM
BGD504	S10	WBM
BGX885	S10	WBM
BGY22	S6	RFP
BGY22A	S6	RFP
BGY23	S6	RFP
BGY23A	S6	RFP
BGY32	S6	RFP
BGY33	S6	RFP
BGY35	S6	RFP
BGY36	S6	RFP
BGY40A	S6	RFP
BGY40B	S6	RFP
BGY41A	S6	RFP
BGY41B	S6	RFP
BGY43	S6	RFP
BGY45A	S6	RFP
BGY45B	S6	RFP
BGY46A	S6	RFP
BGY46B	S6	RFP
BGY47 *	S6	RFP
BGY48 *	S6	RFP
BGY50	S10	WBM
BGY51	S10	WBM
BGY52	S10	WBM
BGY53	S10	WBM
BGY54	S10	WBM
BGY55	S10	WBM
BGY56	S10	WBM
BGY57	S10	WBM
BGY58	S10	WBM
BGY58A	S10	WBM
BGY59	S10	WBM
BGY60	S10	WBM
BGY61	S10	WBM
BGY65	S10	WBM
BGY67	S10	WBM
BGY67A	S10	WBM
BGY70	S10	WBM
BGY71	S10	WBM
BGY74	S10	WBM
BGY75	S10	WBM
BGY78	S10	WBM
BGY84	S10	WBM
BGY84A	S10	WBM
BGY85	S10	WBM
BGY85A	S10	WBM
BGY86	S10	WBM
BGY87	S10	WBM
BGY88	S10	WBM
BGY90A	S6	RFP
BGY90B	S6	RFP
BGY93 *	S6	RFP
BGY94 *	S6	RFP
BGY95A	S6	RFP
BGY95B	S6	RFP
BGY96A	S6	RFP
BGY96B	S6	RFP
BGY584A	S10	WBM
BGY585A	S10	WBM
BGY586	S10	WBM
BGY587	S10	WBM
BLF146	S6	RFP/FET
BLF242	S6	RFP/FET
BLF244	S6	RFP/FET
BLF245	S6	RFP/FET
BLT90/SL	S6	RFP
BLT91/SL	S6	RFP
BLT92/SL	S6	RFP
BLU20/12	S6	RFP
BLU30/12	S6	RFP
BLU45/12	S6	RFP
BLU50	S6	RFP
BLU51	S6	RFP
BLU52	S6	RFP
BLU53	S6	RFP
BLU60/12	S6	RFP
BLU97	S6	RFP
BLU98	S6	RFP
BLU99	S6	RFP
BLV10	S6	RFP
BLV11	S6	RFP
BLV20	S6	RFP
BLV21	S6	RFP
BLV25	S6	RFP
BLV30	S6	RFP
BLV30/12	S6	RFP
BLV31	S6	RFP
BLV32F	S6	RFP
BLV33	S6	RFP
BLV33F	S6	RFP
BLV36	S6	RFP
BLV45/12	S6	RFP
BLV57	S6	RFP
BLV59	S6	RFP
BLV75/12	S6	RFP
BLV80/28	S6	RFP
BLV90	S6	RFP
BLV90/SL	S6	RFP
BLV91	S6	RFP
BLV91/SL	S6	RFP

type no.	book	section
BLV92	S6	RFP
BLV93	S6	RFP
BLV94	S6	RFP
BLV95	S6	RFP
BLV97	S6	RFP
BLV98	S6	RFP
BLV99	S6	RFP
BLW29	S6	RFP
BLW31	S6	RFP
BLW32	S6	RFP
BLW33	S6	RFP
BLW34	S6	RFP
BLW50F	S6	RFP
BLW60	S6	RFP
BLW60C	S6	RFP
BLW76	S6	RFP
BLW77	S6	RFP
BLW78	S6	RFP
BLW79	S6	RFP
BLW80	S6	RFP
BLW81	S6	RFP
BLW83	S6	RFP
BLW84	S6	RFP
BLW85	S6	RFP
BLW86	S6	RFP
BLW87	S6	RFP
BLW89	S6	RFP
BLW90	S6	RFP
BLW91	S6	RFP
BLW95	S6	RFP
BLW96	S6	RFP
BLW97	S6	RFP
BLW98	S6	RFP
BLW99	S6	RFP
BLX13	S6	RFP
BLX13C	S6	RFP
BLX14	S6	RFP
BLX15	S6	RFP
BLX39	S6	RFP
BLX65	S6	RFP
BLX65E	S6	RFP
BLX65ES	S6	RFP
BLX67	S6	RFP
BLX68	S6	RFP
BLX69A	S6	RFP
BLX91A	S6	RFP
BLX91CB	S6	RFP
BLX92A	S6	RFP
BLX93A	S6	RFP
BLX94A	S6	RFP
BLX94C	S6	RFP
BLX95	S6	RFP
BLX96	S6	RFP
BLX97	S6	RFP
BLX98	S6	RFP
BLY87A	S6	RFP
BLY87C	S6	RFP
BLY88A	S6	RFP
BLY88C	S6	RFP
BLY89A	S6	RFP
BLY89C	S6	RFP
BLY90	S6	RFP
BLY91A	S6	RFP
BLY91C	S6	RFP
BLY92A	S6	RFP
BLY92C	S6	RFP
BLY93A	S6	RFP
BLY93C	S6	RFP
BLY94	S6	RFP
BPF24	S8b	PDT
BPW22A	S8a/b	PDT
BPW50	S8a/b	PDT
BPW71	S8b	PDT
BPX25	S8b	PDT
BPX29	S8b	PDT
BPX40	S8b	PDT
BPX41	S8b	PDT
BPX42	S8b	PDT
BPX61	S8b	PDT
BPX61P	S8b	PDT
BPX71	S8b	PDT
BPX72	S8b	PDT
BR100/03	S2b	Th
BR101	S3	Sm
BR210*	S2a	Th
BR216*	S2a	Th
BR220*	S2a	Th
BRY39	S3	Sm
BRY56	S3	Sm
BRY61	S7	Mm
BRY62	S7	Mm
BS107	S5	FET
BS170	S5	FET
BS250	S5	FET
BSD10	S5	FET
BSD12	S5	FET
BSD20	S5/S7	FET/Mm
BSD22	S5/S7	FET/Mm
BSD212	S5	FET
BSD213	S5	FET
BSD214	S5	FET
BSD215	S5	FET
BSJ174	S5	FET
BSJ175	S5	FET
BSJ176	S5	FET
BSJ177	S5	FET
BSP15	S7	Mm
BSP16	S7	Mm
BSP19	S7	Mm
BSP20	S7	Mm
BSP30	S7	Mm
BSP31	S7	Mm
BSP32	S7	Mm
BSP33	S7	Mm
BSP40	S7	Mm
BSP41	S7	Mm
BSP42	S7	Mm
BSP43	S7	Mm
BSP50	S7	Mm
BSP51	S7	Mm

type no.	book	section
BSP52	S7	Mm
BSP60	S7	Mm
BSP61	S7	Mm
BSP62	S7	Mm
BSR12;R	S7	Mm
BSR13;R	S7	Mm
BSR14;R	S7	Mm
BSR15;R	S7	Mm
BSR16;R	S7	Mm
BSR17;R	S7	Mm
BSR17A;R	S7	Mm
BSR18;R	S7	Mm
BSR18A;R	S7	Mm
BSR19	S7	Mm
BSR19A	S7	Mm
BSR20	S7	Mm
BSR20A	S7	Mm
BSR30	S7	Mm
BSR31	S7	Mm
BSR32	S7	Mm
BSR33	S7	Mm
BSR40	S7	Mm
BSR41	S7	Mm
BSR42	S7	Mm
BSR43	S7	Mm
BSR50	S3	Sm
BSR51	S3	Sm
BSR52	S3	Sm
BSR56	S5/S7	FET/Mm
BSR57	S5/S7	FET/Mm
BSR58	S5/S7	FET/Mm
BSR60	S3	Sm
BSR61	S3	Sm
BSR62	S3	Sm
BSR174	S5/S7	FET
BSR175	S5/S7	FET
BSR176	S5/S7	FET
BSR177	S5/S7	FET
BSS38	S3	Sm
BSS50	S3	Sm
BSS51	S3	Sm
BSS52	S3	Sm
BSS60	S3	Sm
BSS61	S3	Sm
BSS62	S3	Sm
BSS63;R	S7	Mm
BSS64;R	S7	Mm
BSS68	S3	Sm
BSS83	S5/S7	FET/Mm
BST15	S7	Mm
BST16	S7	Mm
BST39	S7	Mm
BST40	S7	Mm
BST50	S7	Mm
BST51	S7	Mm
BST52	S7	Mm
BST60	S7	Mm
BST61	S7	Mm
BST62	S7	Mm
BST70A	S5	FET
BST72A	S5	FET
BST74A	S5	FET
BST76A	S5	FET
BST78	S5	FET
BST80	S5/S7	FET/Mm
BST82	S5/S7	FET/Mm
BST84	S5/S7	FET/Mm
BST86	S5/S7	FET/Mm
BST95	S5	FET
BST97	S5	FET
BST100	S5	FET
BST110	S5	FET
BST120	S5/S7	FET/Mm
BST122	S5/S7	FET/Mm
BSV15	S3	Sm
BSV16	S3	Sm
BSV17	S3	Sm
BSV52;R	S7	Mm
BSV64	S3	Sm
BSV78	S5	FET
BSV79	S5	FET
BSV80	S5	FET
BSV81	S5	FET
BSW66A	S3	Sm
BSW67A	S3	Sm
BSW68A	S3	Sm
BSX19	S3	Sm
BSX20	S3	Sm
BSX32	S3	Sm
BSX45	S3	Sm
BSX46	S3	Sm
BSX47	S3	Sm
BSX59	S3	Sm
BSX60	S3	Sm
BSX61	S3	Sm
BT136*	S2b	Tri
BT136F*	S2b	Tri
BT137*	S2b	Tri
BT137F*	S2b	Tri
BT138*	S2b	Tri
BT138F*	S2b	Tri
BT139*	S2b	Tri
BT139F*	S2b	Tri
BT145*	S2b	Tri
BT149*	S2b	Th
BT150	S2b	Th
BT151*	S2b	Th
BT151F*	S2b	Th
BT152*	S2b	Th
BT153	S2b	Th
BT157*	S2b	Th
BT169*	S2b	Th
BTA140*	S2b	Tri
BTR59*	S2b	Tri
BTS59*	S2b	Tri
BTV58*	S2b	Th
BTV59*	S2b	Th
BTV59D*	S2b	Th
BTV60*	S2b	Th
BTV60D*	S2b	Th

type no.	book	section	type no.	book	section	type no.	book	section
BTV70*	S2b	Th	BUS132*	S4b	SP	BUX46;A	S4b	SP
BTV70D*	S2b	Th	BUS133*	S4b	SP	BUX47;A	S4b	SP
BTW23*	S2b	Th	BUT11;A	S4b	SP	BUX48;A	S4b	SP
BTW38*	S2b	Th	BUT11F;AF	S4b	SP	BUX84	S4b	SP
BTW40*	S2b	Th	BUT12;A	S4b	SP	BUX84F	S4b	SP
BTW42*	S2b	Th	BUT12F;AF	S4b	SP	BUX85	S4b	SP
BTW43*	S2b	Tri	BUT18;A	S4b	SP	BUX85F	S4b	SP
BTW45*	S2b	Th	BUT18F;AF	S4b	SP	BUX86	S4b	SP
BTW58*	S2b	Th	BUT21B;C	S4b	SP	BUX87	S4b	SP
BTW62*	S2b	Th	BUT21BF;CF	S4b	SP	BUX88	S4b	SP
BTW62D*	S2b	Th	BUT22B;C	S4b	SP	BUX98;A	S4b	SP
BTW63*	S2b	Th	BUT22BF;CF	S4b	SP	BUX99	S4b	SP
BTY79*	S2b	Th	BUT131	S4b	SP	BUY89	S4b	SP
BTY91*	S2b	Th	BUV26;A	S4b	SP	BUZ10	S9	PM
BU306	S4b	SP	BUV26F;AF	S4b	SP	BUZ11	S9	PM
BU306F	S4b	SP	BUV27;A	S4b	SP	BUZ11A	S9	PM
BU505	S4b	SP	BUV27F;AF	S4b	SP	BUZ14	S9	PM
BU506	S4b	SP	BUV28;A	S4b	SP	BUZ15	S9	PM
BU506D	S4b	SP	BUV28F;AF	S4b	SP	BUZ20	S9	PM
BU508A	S4b	SP	BUV47;A	S4b	SP	BUZ21	S9	PM
BU508D	S4b	SP	BUV48;A	S4b	SP	BUZ23	S9	PM
BU705	S4b	SP	BUV82	S4b	SP	BUZ24	S9	PM
BU706	S4b	SP	BUV83	S4b	SP	BUZ25	S9	PM
BU706D	S4b	SP	BUV89	S4b	SP	BUZ31	S9	PM
BU806	S4b	SP	BUV90	S4b	SP	BUZ32	S9	PM
BU807	S4b	SP	BUV90F	S4b	SP	BUZ34	S9	PM
BU808	S4b	SP	BUV98(V);A	S4b	SP	BUZ35	S9	PM
BU824	S4b	SP	BUV298(V);A	S4b	SP	BUZ36	S9	PM
BU826	S4b	SP	BUW11;A	S4b	SP	BUZ41A	S9	PM
BUP22*	S4b	SP	BUW12;A	S4b	SP	BUZ42	S9	PM
BUP23*	S4b	SP	BUW12F;AF	S4b	SP	BUZ45	S9	PM
BUS11;A	S4b	SP	BUW13;A	S4b	SP	BUZ45A	S9	PM
BUS12;A	S4b	SP	BUW13F;AF	S4b	SP	BUZ45B	S9	PM
BUS13;A	S4b	SP	BUW84	S4b	SP	BUZ50A	S9	PM
BUS14;A	S4b	SP	BUW85	S4b	SP	BUZ50B	S9	PM
BUS21*	S4b	SP	BUW86	S4b	SP	BUZ50C	S9	PM
BUS22*	S4b	SP	BUW87;A	S4b	SP	BUZ53A	S9	PM
BUS23*	S4b	SP	BUW131*	S4b	SP	BUZ54	S9	PM
BUS24*	S4b	SP	BUW132*	S4b	SP	BUZ54A	S9	PM
BUS131*	S4b	SP	BUW133*	S4b	SP	BUZ60	S9	PM

type no.	book	section
BUZ63	S9	PM
BUZ64	S9	PM
BUZ71	S9	PM
BUZ71A	S9	PM
BUZ72	S9	PM
BUZ72A	S9	PM
BUZ73	S9	PM
BUZ73A	S9	PM
BUZ74	S9	PM
BUZ74A	S9	PM
BUZ76	S9	PM
BUZ76A	S9	PM
BUZ78	S9	PM
BUZ80	S9	PM
BUZ80A	S9	PM
BUZ83	S9	PM
BUZ83A	S9	PM
BUZ84	S9	PM
BUZ84A	S9	PM
BUZ90	S9	PM
BUZ90A	S9	PM
BUZ94	S9	PM
BUZ211	S9	PM
BUZ307	S9	PM
BUZ308	S9	PM
BUZ310	S9	PM
BUZ311	S9	PM
BUZ326	S9	PM
BUZ330	S9	PM
BUZ331	S9	PM
BUZ347	S9	PM
BUZ348	S9	PM
BUZ349	S9	PM
BUZ350	S9	PM
BUZ351	S9	PM
BUZ355	S9	PM
BUZ356	S9	PM
BUZ357	S9	PM
BUZ358	S9	PM
BUZ384	S9	PM
BUZ385	S9	PM
BY224*	S2a	R
BY225*	S2a	R
BY228	S1	R
BY229*	S2a	R
BY229F*	S2a	R
BY249*	S2a	R
BY260*	S2a	R
BY261*	S2a	R
BY328	S1	SD
BY329*	S2a	R
BY359*	S2a	R
BY438	S1	R
BY448	S1	R
BY458	S1	R
BY505	S1	R
BY509	S1	R
BY527	S1	R
BY584	S1	R
BY588	S1	R
BY609	S1	R
BY610	S1	R
BY614	S1	R
BY619	S1	R
BY620	S1	R
BY627	S1	R
BY705	S1	R
BY706	S1	R
BY707	S1	R
BY708	S1	R
BY709	S1	R
BY710	S1	R
BY711	S1	R
BY712	S1	R
BY713	S1	R
BY714	S1	R
BY715	S1	R
BY716	S1	R
BY717	S1	R
BY718	S1	R
BY719	S1	R
BY720	S1	R
BY721	S1	R
BY722	S1	R
BY723	S1	R
BY724	S1	R
BYD11 *	S1	R
BYD13 *	S1	R
BYD14 *	S1	R
BYD17 *	S1/S7	R/Mm
BYD31 *	S1	R
BYD33 *	S1	R
BYD34 *	S1	R
BYD37 *	S1/S7	R/Mm
BYD73 *	S1	R
BYD74 *	S1	R
BYD77 *	S1	R
BYM26 *	S1	R
BYM36 *	S1	R
BYM56 *	S1	R
BYP21*	S2a	R
BYP22*	S2a	R
BYP59*	S2a	R
BYQ27*	S1	R
BYQ28*	S2a	R
BYR29*	S2a	R
BYR29F*	S2a	R
BYR30*	S1	R
BYR79*	S1	R
BYT28*	S2a	R
BYT79*	S2a	R
BYT230PIV	S1	R
BYV10*	S1	R
BYV18*	S2a	R
BYV19*	S2a	R
BYV20*	S2a	R
BYV21*	S2a	R
BYV22*	S2a	R
BYV23*	S2a	R
BYV24*	S2a	R

type no.	book	section
BYV26 *	S1/S2a	R
BYV27*	S1/S2a	R
BYV28*	S1/S2a	R
BYV29*	S2a	R
BYV29F*	S2a	R
BYV30*	S2a	R
BYV31*	S2a	R
BYV32*	S2a	R
BYV32F*	S2a	R
BYV33*	S2a	R
BYV33F*	S2a	R
BYV34*	S2a	R
BYV36 *	S1	R
BYV39*	S2a	R
BYV42*	S2a	R
BYV43*	S2a	R
BYV43F*	S2a	R
BYV44*	S2a	R
BYV54V	S1	R
BYV60*	S2a	R
BYV72*	S2a	R
BYV73*	S2a	R
BYV74*	S2a	R
BYV79*	S2a	R
BYV92*	S2a	R
BYV95A	S1	R
BYV95B	S1	R
BYV95C	S1	R
BYV96D	S1	R
BYV96E	S1	R
BYW25*	S2a	R
BYW29*	S2a	R
BYW29F*	S2a	R
BYW30*	S2a	R
BYW31*	S2a	R
BYW54	S1	R
BYW55	S1	R
BYW56	S1	R
BYW92*	S2a	R
BYW93*	S2a	R
BYW95A	S1	R
BYW95B	S1	R
BYW95C	S1	R
BYW96D	S1	R
BYW96E	S1	R
BYX10G	S1	R
BYX25*	S2a	R
BYX30*	S2a	R
BYX32*	S2a	R
BYX38*	S2a	R
BYX39*	S2a	R
BYX42*	S2a	R
BYX46*	S2a	R
BYX50*	S2a	R
BYX52*	S2a	R
BYX56*	S2a	R
BYX90G	S1	R
BYX96*	S2a	R
BYX97*	S2a	R
BYX98*	S2a	R
BYX99*	S2a	R
BZD23	S1	Vrg
BZD27	S1/S7	Vrg/Mm
BZT03	S1	Vrg
BZV10	S1	Vrf
BZV11	S1	Vrf
BZV12	S1	Vrf
BZV13	S1	Vrf
BZV14	S1	Vrf
BZV37	S1	Vrf
BZV49*	S1/S7	Vrg/Mm
BZV55*	S7	Mm
BZV60	S1	Vrg
BZV80	S1	Vrf
BZV81	S1	Vrf
BZV85*	S1	Vrg
BZV86	S1	SD
BZW03*	S1	Vrg
BZW14	S1	Vrg
BZW86*	S2a	TS
BZX55*	S1	Vrg
BZX70*	S2a	Vrg
BZX75*	S1	Vrg
BZX79*	S1	Vrg
BZX84*	S1/S7	Vrg/Mm
BZY91*	S2a	Vrg
BZY93*	S2a	Vrg
CNG35	SC12	PhC
CNG36	SC12	PhC
CNG40	SC12	PhC
CNG82	SC12	PhC
CNG83	SC12	PhC
CNR36	SC12	PhC
CNS35	SC12	PhC
CNW82	SC12	PhC
CNW83	SC12	PhC
CNX21	SC12	PhC
CNX35	SC12	PhC
CNX35U	SC12	PhC
CNX36	SC12	PhC
CNX36U	SC12	PhC
CNX38	SC12	PhC
CNX38U	SC12	PhC
CNX39	SC12	PhC
CNX39U	SC12	PhC
CNX48	SC12	PhC
CNX48U	SC12	PhC
CNX62	SC12	PhC
CNX62A	SC12	PhC
CNX71	SC12	PhC
CNX72A	SC12	PhC
CNX82A	SC12	PhC
CNX83A	SC12	PhC
CNY17-1	SC12	PhC
CNY17-2	SC12	PhC
CNY17-3	SC12	PhC
CNY17-4	SC12	PhC
CQW58A	S8a	I
CQW89A	S8a	I
CQW89B	S8a	I

type no.	book	section
CQY58A	S8a	I
CQY89A	S8a	I
CQY89F	S8a	I
ESM3045A(V)	S4b	SP
ESM3045D(V)	S4b	SP
ESM4045A(V)	S4b	SP
ESM4045D(V)	S4b	SP
ESM5045D(V)	S4b	SP
ESM6045A(V)	S4b	SP
ESM6045D(V)	S4b	SP
Fresnel-lens	S8b	A
H11A1	SC12	PhC
H11A2	SC12	PhC
H11A3	SC12	PhC
H11A4	SC12	PhC
H11A5	SC12	PhC
H11B1	SC12	PhC
H11B2	SC12	PhC
H11B3	SC12	PhC
H11B255	SC12	PhC
KMZ10A	S13	SEN
KMZ10B	S13	SEN
KMZ10C	S13	SEN
KP100A	S13	SEN
KP101A	S13	SEN
KPZ20G	S13	SEN
KPZ21G	S13	SEN
KTY81-100*	S13	SEN
KTY81-200*	S13	SEN
KTY83-100*	S13	SEN
KTY84-100*	S13	SEN
KTY85-100*	S7	SEN
LAE2001R	S11	M
LAE4000Q	S11	M
LAE4001R	S11	M
LAE4002S	S11	M
LAE6000Q	S11	M
LBE1004R	S11	M
LBE1010R	S11	M
LBE2003S	S11	M
LBE2005Q	S11	M
LBE2008T	S11	M
LBE2009S	S11	M
LCE1004R	S11	M
LCE1010R	S11	M
LCE2003S	S11	M
LCE2005Q	S11	M
LCE2008T	S11	M
LCE2009S	S11	M
LJE42002T	S11	M
LKE1004R	S11	M
LKE2002T	S11	M
LKE2004T	S11	M
LKE2015T	S11	M
LKE21004R	S11	M
LKE21015T	S11	M
LKE21050T	S11	M
LKE27010R	S11	M
LKE27025R	S11	M
LKE32002T	S11	M
LKE32004T	S11	M
LTE21009R	S11	M
LTE21015R	S11	M
LTE21025R	S11	M
LTE4002S	S11	M
LTE42005S	S11	M
LTE42008R	S11	M
LTE42012R	S11	M
LUE2003S	S11	M
LUE2009S	S11	M
LV1721E50R	S11	M
LV2024E45R	S11	M
LV2327E40R	S11	M
LV2931E50S	S11	M
LV3742E16R	S11	M
LV3742E24R	S11	M
LVE21050R	S11	M
LWE2015R	S11	M
LWE2025R	S11	M
LZ1418E100R	S11	M
MCA230	SC12	PhC
MCA231	SC12	PhC
MCA255	SC12	PhC
MCT2	SC12	PhC
MCT26	SC12	PhC
MJE13004	S4b	SP
MJE13005	S4b	SP
MJE13006	S4b	SP
MJE13007	S4b	SP
MJE13008	S4b	SP
MJE13009	S4b	SP
MKB12040WS	S11	M
MKB12100WS	S11	M
MKB12140W	S11	M
MO6075B200Z	S11	M
MO6075B400Z	S11	M
MPS6513	S3	Sm
MPS6514	S3	Sm
MPS6515	S3	Sm
MPS6517	S3	Sm
MPS6518	S3	Sm
MPS6519	S3	Sm
MPS6520	S3	Sm
MPS6521	S3	Sm
MPS6522	S3	Sm
MPS6523	S3	Sm
MPSA05	S3	Sm
MPSA06	S3	Sm
MPSA13	S3	Sm
MPSA14	S3	Sm
MPSA42	S3	Sm
MPSA43	S3	Sm
MPSA55	S3	Sm
MPSA56	S3	Sm
MPSA63	S3	Sm
MPSA64	S3	Sm
MPSA92	S3	Sm
MPSA93	S3	Sm
MRB11080Y	S11	M

type no.	book	section
MRB11175Y	S11	M
MRB11350Y	S11	M
MRB12175YR	S11	M
MRB12350YR	S11	M
MS1011B700Y	S11	M
MS6075B800Z	S11	M
MSB11900Y	S11	M
MSB12900Y	S11	M
MZ0912B75Y	S11	M
MZ0912B150Y	S11	M
OM286; M	S13	SEN
OM287; M	S13	SEN
OM320	S10	WBM
OM321	S10	WBM
OM322	S10	WBM
OM323	S10	WBM
OM323A	S10	WBM
OM335	S10	WBM
OM336	S10	WBM
OM337	S10	WBM
OM337A	S10	WBM
OM339	S10	WBM
OM345	S10	WBM
OM350	S10	WBM
OM360	S10	WBM
OM361	S10	WBM
OM370	S10	WBM
OM386B	S13	SEN
OM386M	S13	SEN
OM387B	S13	SEN
OM387M	S13	SEN
OM388B	S13	SEN
OM389B	S13	SEN
OM931	S4a	P
OM961	S4a	P
OSB9115	S2a	St
OSB9215	S2a	St
OSB9415	S2a	St
OSM9115	S2a	St
OSM9215	S2a	St
OSM9415	S2a	St
OSM9510	S2a	St
OSM9511	S2a	St
OSM9512	S2a	St
OSS9115	S2a	St
OSS9215	S2a	St
OSS9415	S2a	St
P2105	S8b	I
PBMF4391	S5	FET
PBMF4392	S5	FET
PBMF4393	S5	FET
PDE1001U	S11	M
PDE1003U	S11	M
PDE1005U	S11	M
PDE1010U	S11	M
PEE1001U	S11	M
PEE1003U	S11	M
PEE1005U	S11	M
PEE1010U	S11	M
PH2222/A	S3	Sm
PH2369	S3	Sm
PH2907	S3	Sm
PH2907A	S3	Sm
PH2955T	S4a	P
PH3055T	S4a	P
PH5415	S3	Sm
PH5416	S3	Sm
PH6659	S5	FET
PH6660	S5	FET
PH6661	S5	FET
PH13002	S4b	SP
PH13003	S4b	SP
PHSD51	S2a	R
PKB3001U	S11	M
PKB3003U	S11	M
PKB3005U	S11	M
PKB12005U	S11	M
PKB20010U	S11	M
PKB23001U	S11	M
PKB23003U	S11	M
PKB23005U	S11	M
PKB25006T	S11	M
PKB32001U	S11	M
PKB32003U	S11	M
PKB32005U	S11	M
PLED-G313A	S8a	LED
PLED-G313N	S8a	LED
PLED-G314A	S8a	LED
PLED-G314N	S8a	LED
PLED-G511C	S8a	LED
PLED-G513C	S8a	LED
PLED-G513M	S8a	LED
PLED-G514B	S8a	LED
PLED-G514M	S8a	LED
PLED-G544KL	S8a	LED
PLED-G544LL	S8a	LED
PLED-GR14E	S8a	LED
PLED-GR14F	S8a	LED
PLED-GR14G	S8a	LED
PLED-GR44DL	S8a	LED
PLED-H313A	S8a	LED
PLED-H314A	S8a	LED
PLED-H511C	S8a	LED
PLED-H514B	S8a	LED
PLED-H544KL	S8a	LED
PLED-H544LL	S8a	LED
PLED-HR14E	S8a	LED
PLED-HR14F	S8a	LED
PLED-HR14G	S8a	LED
PLED-HR44DL	S8a	LED
PLED-O313N	S8a	LED
PLED-O314N	S8a	LED
PLED-O513M	S8a	LED
PLED-O514M	S8a	LED
PLED-P313N	S8a	LED
PLED-P314N	S8a	LED
PLED-P513M	S8a	LED
PLED-P514M	S8a	LED
PLED-T512B	S8a	LED
PLED-TR12E	S8a	LED

type no.	book	section
CQY58A	S8a	I
CQY89A	S8a	I
CQY89F	S8a	I
ESM3045A(V)	S4b	SP
ESM3045D(V)	S4b	SP
ESM4045A(V)	S4b	SP
ESM4045D(V)	S4b	SP
ESM5045D(V)	S4b	SP
ESM6045A(V)	S4b	SP
ESM6045D(V)	S4b	SP
Fresnel-lens	S8b	A
H11A1	SC12	PhC
H11A2	SC12	PhC
H11A3	SC12	PhC
H11A4	SC12	PhC
H11A5	SC12	PhC
H11B1	SC12	PhC
H11B2	SC12	PhC
H11B3	SC12	PhC
H11B255	SC12	PhC
KMZ10A	S13	SEN
KMZ10B	S13	SEN
KMZ10C	S13	SEN
KP100A	S13	SEN
KP101A	S13	SEN
KPZ20G	S13	SEN
KPZ21G	S13	SEN
KTY81-100*	S13	SEN
KTY81-200*	S13	SEN
KTY83-100*	S13	SEN
KTY84-100*	S13	SEN
KTY85-100*	S7	SEN
LAE2001R	S11	M
LAE4000Q	S11	M
LAE4001R	S11	M
LAE4002S	S11	M
LAE6000Q	S11	M
LBE1004R	S11	M
LBE1010R	S11	M
LBE2003S	S11	M
LBE2005Q	S11	M
LBE2008T	S11	M
LBE2009S	S11	M
LCE1004R	S11	M
LCE1010R	S11	M
LCE2003S	S11	M
LCE2005Q	S11	M
LCE2008T	S11	M
LCE2009S	S11	M
LJE42002T	S11	M
LKE1004R	S11	M
LKE2002T	S11	M
LKE2004T	S11	M
LKE2015T	S11	M
LKE21004R	S11	M
LKE21015T	S11	M
LKE21050T	S11	M
LKE27010R	S11	M
LKE27025R	S11	M
LKE32002T	S11	M
LKE32004T	S11	M
LTE21009R	S11	M
LTE21015R	S11	M
LTE21025R	S11	M
LTE4002S	S11	M
LTE42005S	S11	M
LTE42008R	S11	M
LTE42012R	S11	M
LUE2003S	S11	M
LUE2009S	S11	M
LV1721E50R	S11	M
LV2024E45R	S11	M
LV2327E40R	S11	M
LV2931E50S	S11	M
LV3742E16R	S11	M
LV3742E24R	S11	M
LVE21050R	S11	M
LWE2015R	S11	M
LWE2025R	S11	M
LZ1418E100R	S11	M
MCA230	SC12	PhC
MCA231	SC12	PhC
MCA255	SC12	PhC
MCT2	SC12	PhC
MCT26	SC12	PhC
MJE13004	S4b	SP
MJE13005	S4b	SP
MJE13006	S4b	SP
MJE13007	S4b	SP
MJE13008	S4b	SP
MJE13009	S4b	SP
MKB1204OWS	S11	M
MKB1210OWS	S11	M
MKB1214OW	S11	M
MO6075B200Z	S11	M
MO6075B400Z	S11	M
MPS6513	S3	Sm
MPS6514	S3	Sm
MPS6515	S3	Sm
MPS6517	S3	Sm
MPS6518	S3	Sm
MPS6519	S3	Sm
MPS6520	S3	Sm
MPS6521	S3	Sm
MPS6522	S3	Sm
MPS6523	S3	Sm
MPSA05	S3	Sm
MPSA06	S3	Sm
MPSA13	S3	Sm
MPSA14	S3	Sm
MPSA42	S3	Sm
MPSA43	S3	Sm
MPSA55	S3	Sm
MPSA56	S3	Sm
MPSA63	S3	Sm
MPSA64	S3	Sm
MPSA92	S3	Sm
MPSA93	S3	Sm
MRB11080Y	S11	M

type no.	book	section
MRB11175Y	S11	M
MRB11350Y	S11	M
MRB12175YR	S11	M
MRB12350YR	S11	M
MS1011B700Y	S11	M
MS6075B800Z	S11	M
MSB11900Y	S11	M
MSB12900Y	S11	M
MZ0912B75Y	S11	M
MZ0912B150Y	S11	M
OM286; M	S13	SEN
OM287; M	S13	SEN
OM320	S10	WBM
OM321	S10	WBM
OM322	S10	WBM
OM323	S10	WBM
OM323A	S10	WBM
OM335	S10	WBM
OM336	S10	WBM
OM337	S10	WBM
OM337A	S10	WBM
OM339	S10	WBM
OM345	S10	WBM
OM350	S10	WBM
OM360	S10	WBM
OM361	S10	WBM
OM370	S10	WBM
OM386B	S13	SEN
OM386M	S13	SEN
OM387B	S13	SEN
OM387M	S13	SEN
OM388B	S13	SEN
OM389B	S13	SEN
OM931	S4a	P
OM961	S4a	P
OSB9115	S2a	St
OSB9215	S2a	St
OSB9415	S2a	St
OSM9115	S2a	St
OSM9215	S2a	St
OSM9415	S2a	St
OSM9510	S2a	St
OSM9511	S2a	St
OSM9512	S2a	St
OSS9115	S2a	St
OSS9215	S2a	St
OSS9415	S2a	St
P2105	S8b	I
PBMF4391	S5	FET
PBMF4392	S5	FET
PBMF4393	S5	FET
PDE1001U	S11	M
PDE1003U	S11	M
PDE1005U	S11	M
PDE1010U	S11	M
PEE1001U	S11	M
PEE1003U	S11	M
PEE1005U	S11	M
PEE1010U	S11	M
PH2222/A	S3	Sm
PH2369	S3	Sm
PH2907	S3	Sm
PH2907A	S3	Sm
PH2955T	S4a	P
PH3055T	S4a	P
PH5415	S3	Sm
PH5416	S3	Sm
PH6659	S5	FET
PH6660	S5	FET
PH6661	S5	FET
PH13002	S4b	SP
PH13003	S4b	SP
PHSD51	S2a	R
PKB3001U	S11	M
PKB3003U	S11	M
PKB3005U	S11	M
PKB12005U	S11	M
PKB20010U	S11	M
PKB23001U	S11	M
PKB23003U	S11	M
PKB23005U	S11	M
PKB25006T	S11	M
PKB32001U	S11	M
PKB32003U	S11	M
PKB32005U	S11	M
PLED-G313A	S8a	LED
PLED-G313N	S8a	LED
PLED-G314A	S8a	LED
PLED-G314N	S8a	LED
PLED-G511C	S8a	LED
PLED-G513C	S8a	LED
PLED-G513M	S8a	LED
PLED-G514B	S8a	LED
PLED-G514M	S8a	LED
PLED-G544KL	S8a	LED
PLED-G544LL	S8a	LED
PLED-GR14E	S8a	LED
PLED-GR14F	S8a	LED
PLED-GR14G	S8a	LED
PLED-GR44DL	S8a	LED
PLED-H313A	S8a	LED
PLED-H314A	S8a	LED
PLED-H511C	S8a	LED
PLED-H514B	S8a	LED
PLED-H544KL	S8a	LED
PLED-H544LL	S8a	LED
PLED-HR14E	S8a	LED
PLED-HR14F	S8a	LED
PLED-HR14G	S8a	LED
PLED-HR44DL	S8a	LED
PLED-O313N	S8a	LED
PLED-O314N	S8a	LED
PLED-O513M	S8a	LED
PLED-O514M	S8a	LED
PLED-P313N	S8a	LED
PLED-P314N	S8a	LED
PLED-P513M	S8a	LED
PLED-P514M	S8a	LED
PLED-T512B	S8a	LED
PLED-TR12E	S8a	LED

type no.	book	section
PLED-TR12F	S8a	LED
PLED-TR12G	S8a	LED
PLED-TR42DL	S8a	LED
PLED-Y313A	S8a	LED
PLED-Y313N	S8a	LED
PLED-Y314A	S8a	LED
PLED-Y314N	S8a	LED
PLED-Y511C	S8a	LED
PLED-Y513C	S8a	LED
PLED-Y513M	S8a	LED
PLED-Y514B	S8a	LED
PLED-Y514M	S8a	LED
PLED-Y544KL	S8a	LED
PLED-Y544LL	S8a	LED
PLED-YR14E	S8a	LED
PLED-YR14F	S8a	LED
PLED-YR14G	S8a	LED
PLED-YR44DL	S8a	LED
PMBD914	S1	SD
PMBD2835	S1	SD
PMBD2836	S1	SD
PMBD2837	S1	SD
PMBD2838	S1	SD
PMBD6050	S1	SD
PMBD6100	S1	SD
PMBD7000	S1	SD
PMBF4391	S5/S7	FET/Mm
PMBF4392	S5/S7	FET/Mm
PMBF4393	S5/S7	FET/Mm
PMBFJ174	S7	FET/Mm
PMBFJ175	S7	FET/Mm
PMBFJ176	S7	FET/Mm
PMBFJ177	S7	FET/Mm
PMBT2222	S7	Mm
PMBT2222A	S7	Mm
PMBT2369	S7	Mm
PMBT2907	S7	Mm
PMBT2907A	S7	Mm
PMBT3903	S7	Mm
PMBT3904	S7	Mm
PMBT3906	S7	Mm
PMBT4401	S7	Mm
PMBT4403	S7	Mm
PMBT5088	S7	Mm
PMBT5401	S7	Mm
PMBT5550	S7	Mm
PMBT5551	S7	Mm
PMBT6428	S7	Mm
PMBT6429	S7	Mm
PMBTA05	S7	Mm
PMBTA06	S7	Mm
PMBTA13	S7	Mm
PMBTA14	S7	Mm
PMBTA42	S7	Mm
PMBTA43	S7	Mm
PMBTA55	S7	Mm
PMBTA56	S7	Mm
PMBTA63	S7	Mm
PMBTA64	S7	Mm
PMBTA92	S7	Mm
PMBTA93	S7	Mm
PMBZ5226	S1	SD
PMLL4148	S1/S7	SD
PMLL4150	S1/S7	SD
PMLL4151	S1/S7	SD
PMLL4153	S1/S7	SD
PMLL4446	S1/S7	SD
PMLL4448	S1/S7	SD
PMLL5225B to PMLL5267B	S1/S7	SD
PN2222	S3	Sm
PN2222A	S3	Sm
PN2369	S3	Sm
PN2369A	S3	Sm
PN2907	S3	Sm
PN2907A	S3	Sm
PN3439	S3	Sm
PN3440	S3	Sm
PN5415	S3	Sm
PN5416	S3	Sm
PO44	SC12	PhC
PO44A	SC12	PhC
PPC5001T	S11	M
PQC5001T	S11	M
PTB23001X	S11	M
PTB23003X	S11	M
PTB23005X	S11	M
PTB32001X	S11	M
PTB32003X	S11	M
PTB32005X	S11	M
PTB42001X	S11	M
PTB42002X	S11	M
PTB42003X	S11	M
PV3742B4X	S11	M
PVB42004X	S11	M
PXT2222	S7	Mm
PXT2222A	S7	Mm
PXT2907	S7	Mm
PXT2907A	S7	Mm
PXT3904	S7	Mm
PXT3906	S7	Mm
PXT4401	S7	Mm
PXT4403	S7	Mm
PXTA14	S7	Mm
PXTA27	S7	Mm
PXTA64	S7	Mm
PXTA77	S7	Mm
PZ1418B15U	S11	M
PZ1418B30U	S11	M
PZ1721B12U	S11	M
PZ1721B25U	S11	M
PZ2024B10U	S11	M
PZ2024B20U	S11	M
PZ2327B15U	S11	M
PZB16035U	S11	M
PZB16040U	S11	M
PZB27020U	S11	M
PZT2222	S7	Mm
PZT2222A	S7	Mm

type no.	book	section
PZT2907	S7	Mm
PZT2907A	S7	Mm
PZT3904	S7	Mm
PZT3906	S7	Mm
PZTA13	S7	Mm
PZTA14	S7	Mm
PZTA42	S7	Mm
PZTA43	S7	Mm
PZTA63	S7	Mm
PZTA64	S7	Mm
PZTA92	S7	Mm
PZTA93	S7	Mm
RPY97	S8b	I
RPY100	S8b	I
RPY101	S8b	I
RPY102	S8b	I
RPY103	S8b	I
RPY107	S8b	I
RPY109	S8b	I
RV2833B5X	S11	M
RV3135B5X	S11	M
RX1011B250Y	S11	M
RX1011B350Y	S11	M
RX1214B150Y	S11	M
RX1214B300Y	S11	M
RX2731B90W	S11	M
RX3034B70W	S11	M
RXB12350Y	S11	M
RZ1214B35Y	S11	M
RZ1214B65Y	S11	M
RZ1214B125Y	S11	M
RZ1214B150Y	S11	M
RZ2731B45W	S11	M
RZ2731B60W	S11	M
RZ2833B15W	S11	M
RZ2833B30W	S11	M
RZ2833B45W	S11	M
RZ2833B60W	S11	M
RZ3135B15W	S11	M
RZ3135B30W	S11	M
RZ3135B40W	S11	M
RZ3135B50W	S11	M
RZB12050Y	S11	M
RZB12100Y	S11	M
RZB12250Y	S11	M
SL5500	SC12	PhC
SL5501	SC12	PhC
SL5504	SC12	PhC
SL5511	SC12	PhC
SL5505S	SC12	PhC
TIP29*	S4a	P
TIP30*	S4a	P
TIP31*	S4a	P
TIP32*	S4a	P
TIP33*	S4a	P
TIP34*	S4a	P
TIP41*	S4a	P
TIP42*	S4a	P
TIP47	S4b	P
TIP48	S4b	P
TIP49	S4b	P
TIP50	S4b	P
TIP110	S4a	P
TIP111	S4a	P
TIP112	S4a	P
TIP115	S4a	P
TIP116	S4a	P
TIP117	S4a	P
TIP120	S4a	P
TIP121	S4a	P
TIP122	S4a	P
TIP125	S4a	P
TIP126	S4a	P
TIP127	S4a	P
TIP130	S4a	P
TIP131	S4a	P
TIP132	S4a	P
TIP135	S4a	P
TIP136	S4a	P
TIP137	S4a	P
TIP140	S4a	P
TIP141	S4a	P
TIP145	S4a	P
TIP146	S4a	P
TIP147	S4a	P
TIP2955	S4a	P
TIP3055	S4a	P
1N821;A	S1	Vrf
1N823;A	S1	Vrf
1N825;A	S1	Vrf
1N827;A	S1	Vrf
1N829;A	S1	Vrf
1N914	S1	SD
1N916	S1	SD
1N3879	S2a	R
1N3880	S2a	R
1N3881	S2a	R
1N3882	S2a	R
1N3883	S2a	R
1N3889	S2a	R
1N3890	S2a	R
1N3891	S2a	R
1N3892	S2a	R
1N3893	S2a	R
1N3909	S2a	R
1N3910	S2a	R
1N3911	S2a	R
1N3912	S2a	R
1N3913	S2a	R
1N4001D	S1	R
1N4002D	S1	R
1N4003D	S1	R
1N4004D	S1	R
1N4005D	S1	R
1N4006D	S1	R
1N4007D	S1	R
1N4001G	S1	R
1N4002G	S1	R
1N4003G	S1	R
1N4004G	S1	R

type no.	book	section	type no.	book	section	type no.	book	section
1N4005G	S1	R	2N2907A	S3	Sm	2N4859	S5	FET
1N4006G	S1	R	2N3019	S3	Sm	2N4860	S5	FET
1N4007G	S1	R	2N3020	S3	Sm	2N4861	S5	FET
1N4148	S1	SD	2N3053	S3	Sm	2N5086	S3	Sm
1N4150	S1	SD	2N3375	S6	RFP	2N5087	S3	Sm
1N4151	S1	SD	2N3553	S6	RFP	2N5088	S3	Sm
1N4153	S1	SD	2N3632	S6	RFP	2N5089	S3	Sm
1N4446	S1	SD	2N3822	S5	FET	2N5400	S3	Sm
1N4448	S1	SD	2N3823	S5	FET	2N5401	S3	Sm
1N4531	S1	SD	2N3866	S6	RFP	2N5415	S3	Sm
1N4532	S1	SD	2N3903	S3	Sm	2N5416	S3	Sm
1N4933	S1	R	2N3904	S3	Sm	2N5550	S3	Sm
1N5059	S1	R	2N3905	S3	Sm	2N5551	S3	Sm
1N5060	S1	R	2N3906	S3	Sm	2N6659	S5	FET
1N5061	S1	R	2N3924	S6	RFP	2N6660	S5	FET
1N5062	S1	R	2N3926	S6	RFP	2N6661	S5	FET
1N5225B			2N3927	S6	RFP	4N25	SC12	PhC
to	S1	R	2N3966	S5	FET	4N25A	SC12	PhC
1N5267B			2N4030	S3	Sm	4N26	SC12	PhC
2N918	S10	WBT	2N4031	S3	Sm	4N27	SC12	PhC
2N930	S3	Sm	2N4032	S3	Sm	4N28	SC12	PhC
2N1613	S3	Sm	2N4033	S3	Sm	4N29	SC12	PhC
2N1711	S3	Sm	2N4091	S5	FET	4N30	SC12	PhC
2N1893	S3	Sm	2N4092	S5	FET	4N31	SC12	PhC
2N2219	S3	Sm	2N4093	S5	FET	4N32	SC12	PhC
2N2219A	S3	Sm	2N4123	S3	Sm	4N33	SC12	PhC
2N2222	S3	Sm	2N4124	S3	Sm	4N35	SC12	PhC
2N2222A	S3	Sm	2N4125	S3	Sm	4N36	SC12	PhC
2N2297	S3	Sm	2N4126	S3	Sm	4N37	SC12	PhC
2N2369	S3	Sm	2N4391	S5	FET	4N38	SC12	PhC
2N2369A	S3	Sm	2N4392	S5	FET	4N38A	SC12	PhC
2N2483	S3	Sm	2N4393	S5	FET	4N46	SC12	PhC
2N2484	S3	Sm	2N4400	S3	Sm	56201d	S4b	A
2N2904	S3	Sm	2N4401	S3	Sm	56201j	S4b	A
2N2904A	S3	Sm	2N4402	S3	Sm	56245	S3,10	A
2N2905	S3	Sm	2N4403	S3	Sm	56246	S3,10	A
2N2905A	S3	Sm	2N4427	S6	RFP	56261a	S4b	A
2N2906	S3	Sm	2N4856	S5	FET	56264	S2a/b	A
2N2906A	S3	Sm	2N4857	S5	FET	56295	S2a/b	A
2N2907	S3	Sm	2N4858	S5	FET	56326	S4b	A

type no.	book	section
56339	S4b	A
56352	S4b	A
56353	S4b	A
56354	S4b	A
56359b	S2/4	A
56359c	S2/4	A
56359d	S2/4	A
56360a	S2/4	A
56363	S2/4	A
56364	S2/4	A
56367	S2/4	A
56368b	S2/4	A
56368c	S2/4	A
56369	S2/4	A
56378	S2/4	A
56379	S2/4	A
56387a,b	S4b	A
56397	S1	A
6N135	SC12	PhC
6N136	SC12	PhC

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of six series of handbooks:

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MATERIALS*

The contents of each series are listed on pages iii to viii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Components is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

INTEGRATED CIRCUITS

This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
IC03	**ICs for Telecom** Bipolar, MOS Subscriber sets, Cordless Telephones
IC04	**HE4000B logic family** CMOS
IC05	**not yet issued**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**not yet issued**
IC08	**ECL 10K and 100K logic families**
IC09N	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
Supplement to IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** Bipolar, MOS
IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**

DISCRETE SEMICONDUCTORS

This series of data handbooks comprises:

current code	new code	handbook title
S1	**SC01***	**Diodes** High-voltage tripler units
S2a	**SC02***	**Power diodes**
S2b	**SC03***	**Thyristors and triacs**
S3	**SC04***	**Small-signal transistors**
S4a	**SC05***	**Low-frequency power transistors and hybrid IC power modules**
S4b	**SC06**	**High-voltage and switching power transistors**
S5	**SC07***	**Small-signal field-effect transistors**
S6	**SC08***	**RF power transistors**
	SC09*	**RF power modules**
S7	**SC10***	**Surface mounted semiconductors**
S8a	**SC11***	**Light emitting diodes**
S8b	**SC12***	**Optocouplers**
S9	**SC13***	**PowerMOS transistors**
S10	**SC14***	**Wideband transistors and wideband hybrid IC modules**
S11	**SC15**	**Microwave transistors**
S15**	**SC16**	**Laser diodes**
S13	**SC17**	**Semiconductor sensors**
S14	**SC18***	**Liquid crystal displays and driver ICs for LCDs**

* Not yet issued with the new code in this series of handbooks.
** New handbook in this series; will be issued shortly.

DISPLAY COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T8	**DC01**	**Colour display systems**
T16	**DC02***	**Monochrome tubes and deflection units**
C2	**DC03***	**Television tuners, coaxial aerial input assemblies**
C3	**DC04***	**Loudspeakers**
C20	**DC05***	**Wire-wound components for TVs and monitors**

* These handbooks are currently issued in another series; they are not yet issued in the Display Components series of handbooks.

PASSIVE COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
C14	**PA01**	**Electrolytic capacitors; solid and non-solid**
C11	**PA02***	**Varistors, thermistors and sensors**
C12	**PA03***	**Potentiometers, encoders and switches**
C7	**PA04***	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08***	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

PROFESSIONAL COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T1	*	**Power tubes for RF heating and communications**
T2a	*	**Transmitting tubes for communications, glass types**
T2b	*	**Transmitting tubes for communications, ceramic types**
T3	**PC01****	**High-power klystrons**
T4	*	**Magnetrons for microwave heating**
T5	**PC02****	**Cathode-ray tubes**
T6	**PC03****	**Geiger-Müller tubes**
T9	**PC04****	**Photo and electron multipliers**
T10	**PC05****	**Plumbicon camera tubes and accessories**
T11	**PC06****	**Microwave diodes and sub-assemblies**
T12	**PC07****	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08****	**Image intensifiers and infrared detectors**
T15	**PC09****	**Dry reed switches**
C8	**PC10**	**Variable mains transformers; annular fixed transformers**

* These handbooks will not be reissued.

** Not yet issued with the new code in this series of handbooks.

MATERIALS

This series of data handbooks comprises:

current code	new code	handbook title
C4 C5	MA01*	**Soft Ferrites**
C16	MA02**	**Permanent magnet materials**
C19	MA03**	**Piezoelectric ceramics**

* Handbooks C4 and C5 will be reissued as one handbook having the new code MA01.

** Not yet issued with the new code in this series of handbooks.

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Argentina: PHILIPS ARGENTINA S.A., Div. Components, Vedia 3892, 1430 BUENOS AIRES, Tel. (01) 541 - 7141 to 7747.
Australia: PHILIPS COMPONENTS PTY Ltd, 11 Waltham Street, ARTARMON, N.S.W. 2064, Tel. (02) 439 3322.
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Brazil: CONSTANTA-IBRAPE; (Active Devices): Av. Brigadeiro Faria Lima, 1735-SAO PAULO-SP, Tel. (011) 211-2600. CONSTANTA-IBRAPE; (Passive Devices & Materials): Av. Francisco Monteiro, 702 – RIBEIRAO PIRES-SP, Tel. (011) 459-8211.
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Sweden: PHILIPS Components, A.B., Tegeluddsvägen 1, S-11584 STOCKHOLM, Tel. (0)8-782 1000.
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For all other countries apply to: Philips Components Division, International Business Relations, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Telex 35000 phtcnl

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