SIEMENS

SIPMOS Halbleiter
SIPMOS Semiconductors

Data Book

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SIEMENS

SIPMOS-Halbleiter
SIPMOS Semiconductors

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Balanstraße 73, D-8000 München 80.**

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Siemens AG is an approved CECC manufacturer.

Vorwort

Mit diesem neuen Datenbuch stellen wir Ihnen unser aktuelles SIPMOS®-Halbleiter-Produktspektrum vor. Das Buch beinhaltet alle derzeit bekannten Neuerungen und Verbesserungen bzw. Weiterentwicklungen auf diesem Gebiet.

Mit der Herausgabe dieses Datenbuches werden alle vorhergehenden Ausgaben ungültig.

Produktspektrum

- SIPMOS®-Leistungstransistoren
- SIRET
- IGBT
- Schnelle Dioden (FRED)
- SIPMOS®-Kleinsignaltransistoren
- SITAC®-AC-Schalter
- Smart SIPMOS (TEMPFET/PROFET/Dimmer)
- Leistungsmodule (SIMOPAC®/IGBT)
- Chip-Produkte

Bauelementeauswahl

Um die Bauelementeauswahl zu erleichtern, haben wir Typenübersichten mit den wichtigsten technischen Eckdaten eingearbeitet. Die Datenblätter sind alphanumerisch sortiert und erleichtern so das Auffinden des gesuchten Halbleiters. Ein Vorspann gibt Auskunft über die wichtigsten Parameter und enthält Angaben zur Qualität und zur Verarbeitung bzw. Verpackung.

Technik/Preise/Liefermöglichkeiten

Fragen zur Technik, zu den Preisen und zu den Liefermöglichkeiten richten Sie bitte an den Ihnen nächstgelegenen Siemens-Bauteile-Vertrieb in der Bundesrepublik Deutschland und Berlin (West) bzw. Ihre Landesgesellschaft im Ausland.

Kennzeichen in diesem Buch

®	Eingetragenes Warenzeichen
€	CECC-qualifizierte Halbleiter
F	FREDFET Leistungstransistor mit schneller Inversdiode
S	Schwerpunkttyp, kurzfristig ab Siemens Bauteilelager lieferbar
L	Logic Level
▼	In Vorbereitung
■	Nicht für Neuentwicklung

Preface

This new data book presents our actual product range of SIPMOS® semiconductors with respect to all innovations, improvements, and further developments.

All previous editions of this data book are no longer applicable.

Product range

- SIPMOS® power transistors
- SIRET
- IGBT
- Fast-recovery epitaxial diodes (FRED)
- SIPMOS® small-signal transistors
- SITAC® AC switches
- Smart SIPMOS (TEMPFET/PROFET/Dimmers)
- Power modules (SIMOPAC®/IGBT)
- Die products

Component selection

A selection guide comprising the different types of semiconductors and their most important parameters will help you to find your type of component. The individual data sheets are included in alphanumerical order and will further facilitate your type selection. An introduction provides you with information on the most important parameters, on quality, as well as packaging and mounting instructions.

Technology/prices/delivery

For questions on technology, prices, and delivery, please contact the Offices of Siemens Aktiengesellschaft in the Federal Republic of Germany and Berlin (West) or the Siemens Companies and Representatives worldwide.

Symbols

®	Registered trademark
€	CECC-approved semiconductors
F	FREDFET power transistor with fast-recovery reverse diode
S	Preferred type, available for prompt delivery via the Siemens Components Service
L	Logic Level
▼	In preparation
■	Not for new design

Inhaltsverzeichnis

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Problemlos bestellen mit der SDC Preis- und Lagerliste

Für Kunden in Deutschland.

Im Rahmen der hier vorliegenden Veröffentlichung möchten wir auch auf unseren jährlich neu erscheinenden Katalog „Semiconductor Distribution Center“ hinweisen. Er umfaßt die Schwerpunkttypen aus dem Siemens-Halbleiter-Gesamtprogramm mit den wichtigsten technischen Daten sowie den neuesten Preisen.

Soweit Schwerpunkttypen in der hier vorliegenden Druckschrift enthalten sind, tragen sie das Kennzeichen S und können über den Ihnen nächstgelegenen Siemens-Halbleiter-Vertrieb in Deutschland bestellt und sofort und problemlos geliefert werden.

Für Kunden im Ausland dient als Bezugsquelle der Vertrieb Halbleiter der jeweiligen Landesgesellschaften oder Vertretungen.

Die derzeit gültige SDC Preis- und Lagerliste erhalten Sie kostenlos bei

Siemens AG
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FAX (0911) 3001-271
Stichwort „SDC Preis- und Lagerliste“.

Straightforward ordering with the catalog “Semiconductor Distribution Center, Preferred Products”.

If you are not yet familiar with the SDC catalog on Preferred Products, this is the occasion to introduce our fast, reliable delivery service to you. Every year, a revised edition of the SDC catalog is published. It comprises all Preferred Products of the Siemens Semiconductor spectrum together with their most important technical specs.

If contained in the publication at hand, Preferred Products are marked with the symbol S, which means that these products are available for prompt delivery via the Siemens Semiconductor Service.

Please direct orders for Semiconductors as well as for the SDC catalog to your nearest Siemens Office, Semiconductor Group, or Distributor.

Typenübersicht
Bestellnummern
Symbole, Begriffe, Normen

Selection Guide
Ordering Codes
Symbols, Terms, Standards

Typenübersicht / Selection Guide

SIPMOS® Power MOS Transistors (Families of Types)

Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ A	P_{tot} W	Package	Page
N channel enhancement types						
≡ S BUZ 10	50	0.07	23	75	TO-220 AB	690
S L BUZ 10 L		0.07	23	75	TO-220 AB	700
≡ S BUZ 11		0.04	30	75	TO-220 AB	707
≡ S BUZ 11 A		0.055	26	75	TO-220 AB	707
L BUZ 11 AL		0.055	26	75	TO-220 AB	719
≡ S BUZ 12		0.028	42	125	TO-220 AB	726
≡ S BUZ 12 A		0.035	42	125	TO-220 AB	726
L BUZ 12 AL		0.035	42	125	TO-220 AB	734
≡ S BUZ 71		0.1	14	40	TO-220 AB	895
S BUZ 71 A		0.12	14	40	TO-220 AB	895
S L BUZ 71 L		0.1	14	40	TO-220 AB	906
L BUZ 71 AL		0.12	13	40	TO-220 AB	906
S BUZ 15		0.03	45	125	TO-204 AE	741
BUZ 347		0.03	45	125	TO-218 AA	741
BUZ 16		0.018	48	125	TO-204 AE	748
S BUZ 346		0.018	58	170	TO-218 AA	748
≡ BUZ 10 S2	60	0.07	24	75	TO-220 AB	690
≡ BUZ 11 S2		0.04	30	75	TO-220 AB	707
S BUZ 70		0.15	12	40	TO-220 AB	881
L BUZ 70 L		0.15	12	40	TO-220 AB	888
≡ BUZ 71 S2		0.1	14	40	TO-220 AB	895
▼ BUZ 346 S2		0.018	58	170	TO-218 AA	748
≡ S BUZ 20	100	0.2	13.5	75	TO-220 AB	759
S BUZ 21		0.085	21	75	TO-220 AB	766
L BUZ 21 L		0.085	21	75	TO-220 AB	773
≡ S BUZ 22		0.055	34	125	TO-220 AB	780
S BUZ 24		0.06	32	125	TO-204 AE	787
≡ S BUZ 72		0.2	10	40	TO-220 AB	914
≡ S BUZ 72 A		0.25	9	40	TO-220 AB	914
≡ L BUZ 72 AL		0.25	9	40	TO-220 AB	922
S L BUZ 72 L		0.2	10	40	TO-220 AB	922
S BUZ 345		0.045	41	150	TO-218 AA	1111
S BUZ 349		0.06	32	125	TO-218 AA	1118

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SIPMOS® Power MOS Transistors (Families of Types)

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ A	P_{tot} W	Package	Page
	N channel enhancement types						
S	BUZ 30 A	200	0.13	21	125	TO-220 AB	794
S	BUZ 31		0.2	13.5	75	TO-220 AB	801
S	BUZ 32		0.4	9.5	75	TO-220 AB	808
S	BUZ 36		0.12	22	125	TO-204 AE	815
S	BUZ 350		0.12	22	125	TO-218 AA	815
S	BUZ 73		0.4	7	40	TO-220 AB	930
S	BUZ 73 A		0.6	5.5	40	TO-220 AB	930
L	BUZ 73 AL		0.6	5.5	40	TO-220 AB	938
L	BUZ 73 L		0.4	7	40	TO-220 AB	938
	BUZ 341		0.07	33	170	TO-218 AA	1104
S	BUZ 60	400	1	5.5	75	TO-220 AB	867
S	BUZ 64		0.4	11.5	125	TO-204 AA	874
S	BUZ 76		1.8	3	40	TO-220 AB	954
S	BUZ 76 A		2.5	2.7	40	TO-220 AB	954
F	BUZ 205		1	6	75	TO-220 AB	1034
	BUZ 323		0.3	15	170	TO-218 AA	1063
S	BUZ 325		0.35	12.5	125	TO-218 AA	1070
S	BUZ 326		0.5	10.5	125	TO-218 AA	1070
F	BUZ 382		0.4	12.5	125	TO-218 AA	1132
S	BUZ 41 A	500	1.5	4.5	75	TO-220 AB	822
S	BUZ 42		2	4	75	TO-220 AB	829
S	BUZ 45		0.6	9.6	125	TO-204 AA	836
S	BUZ 45 A		0.8	8.3	125	TO-204 AA	836
S	BUZ 45 B		0.5	10	125	TO-204 AA	836
S	BUZ 74		3	2.4	40	TO-220 AB	946
S	BUZ 74 A		4	2.1	40	TO-220 AB	946
F	BUZ 210		0.6	10.5	125	TO-204 AA	1041
F	BUZ 211		0.8	9	125	TO-204 AA	1041
F	BUZ 384		0.6	10.5	125	TO-218 AA	1041
F	BUZ 385		0.8	9	125	TO-218 AA	1041
F	BUZ 215		1.5	5	75	TO-220 AB	1049
S	BUZ 330		0.6	9.5	125	TO-218 AA	1078
S	BUZ 331		0.8	8	125	TO-218 AA	1078

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SIPMOS® Power MOS Transistors (Families of Types)

N channel enhancement types

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ A	P_{tot} W	Package	Page
	BUZ 338	500	0.4	13.5	180	TO-218 AA	1093
	BUZ 339		0.5	11.5	170	TO-218 AA	1093
	BUZ 77 A	600	4	2.7	75	TO-220 AB	962
S	BUZ 77 B		3.5	2.9	75	TO-220 AB	962
S	BUZ 90		1.6	4.5	75	TO-220 AB	993
S	BUZ 90 A		2	4	75	TO-220 AB	993
S	BUZ 92		3	3.2	80	TO-220 AB	1002
S	BUZ 94		0.9	7.8	125	TO-204 AA	1009
S	BUZ 332 A		0.9	8	150	TO-218 AA	1086
S	BUZ 78	800	8	1.5	40	TO-220 AB	970
S	BUZ 80		4	2.6	75	TO-220 AB	977
S	BUZ 80 A		3	3	75	TO-220 AB	977
S	BUZ 307		3	3	75	TO-218 AA	977
S	BUZ 308		4	2.6	75	TO-218 AA	977
S	BUZ 84		2	5.3	125	TO-204 AA	985
S	BUZ 84 A		1.5	6	125	TO-204 AA	985
S	BUZ 355		1.5	6	125	TO-218 AA	985
S	BUZ 356		2	5	125	TO-218 AA	985
S	BUZ 50 A	1000	5	2.5	75	TO-220 AB	845
S	BUZ 50 B		8	2	75	TO-220 AB	845
S	BUZ 50 C		6	2.3	75	TO-220 AB	845
S	BUZ 310		5	2.5	75	TO-218 AA	845
S	BUZ 311		6	2.3	75	TO-218 AA	845
S	BUZ 54		2	5.1	125	TO-204 AA	857
S	BUZ 54 A		2.6	4.5	125	TO-204 AA	857
S	BUZ 357		2	5	125	TO-218 AA	857
S	BUZ 358		2.6	4.5	125	TO-218 AA	857
F	BUZ 230		2	5.5	125	TO-204 AA	1056
F	BUZ 380		2	5.5	125	TO-218 AA	1125

P channel enhancement types

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ A	P_{tot} W	Package	Page
S	BUZ 171	−50	0.3	−8	40	TO-220 AB	1016
S	BUZ 172	−100	0.6	−5.5	40	TO-220 AB	1022
S	BUZ 173	−200	1.5	−3.6	40	TO-220 AB	1028

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SIRET/IGBT (Families of Types)

Type	V_{CE} V	I_C A	Package	Page
SIRET				
BUP 101	1000	20	TO-218 AA	670
IGBT (Families of Types)				
BUP 200	1200	5	TO-220 AB	675
BUP 202	1000	12	TO-220 AB	678
BUP 203	1000	21	TO-220 AB	681
BUP 304	1000	35	TO-218 AA	684
BUP 307	1200	35	TO-218 AA	684

Fast-Recovery Epitaxial Diodes

Type	V_{RRM} V	I_{FRMS} A	$t_{rr(typ)}$ ns	Package	Page
BYP 101	1000	25	80	TO-218 AD*	1139
BYP 102	1000	50	130	TO-218 AD*	1142
BYP 103	1000	75	140	TO-218 AD*	1145

*) 2 pins

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SIPMOS® Small-Signal Transistors (Families of Types)

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ mA	$V_{GS(th)}$ V	Package	Page
	N channel enhancement types						
S	BSS 98	50	3.5	300	0.8...1.6	TO-92	446
S	BSS 138		3.5	220	0.8...1.6	SOT-23	446
S	BSP 295		0.3	1700	0.8...2.0	SOT-223	394
S	BSS 295		0.3	1400	0.8...2.0	TO-92	394
■	BSS 395		0.3	4400	0.8...2.0	TO-202	489
▼	BSP 17		0.1	2900	2.1...4.0	SOT-223	338
	BS 170	60	5	300	0.8...2.0	TO-92	121
	SN 7000		5	250	0.8...2.0	TO-92	121
	SN 7002		5	190	0.8...2.0	SOT-23	121
	BSS 145	65	3.5	220	1.4...2.3	SOT-23	486
S	BSS 100	100	6	220	0.8...2.0	TO-92	453
S	BSS 123		6	170	0.8...2.0	SOT-23	453
	BSS 119		6	170	1.6...2.6	SOT-23	467
S	BSP 296		0.8	1000	0.8...2.0	SOT-223	402
S	BSS 296		0.8	800	0.8...2.0	TO-92	402
	BS 107	200	26	130	0.8...2.0	TO-92	115
S	BSP 297		2	600	0.8...2.0	SOT-223	410
S	BSS 297		2	480	0.8...2.0	TO-92	410
■	BSS 97		2	1500	0.8...2.8	TO-202	440
S	BSP 88	240	8	290	0.6...1.2	SOT-223	341
S	BSS 88		8	250	0.6...1.2	TO-92	341
S	BSP 89		6	340	0.8...2.0	SOT-223	348
S	BSS 87		6	290	0.8...2.0	SOT-89	348
S	BSS 89		6	290	0.8...2.0	TO-92	348
■	BSS 91		6	350	0.8...2.0	TO-18	428
■	BSS 95		6	800	0.8...2.0	TO-202	434
S	BSS 101		16	130	0.8...2.0	TO-92	460
S	BSS 131		16	100	0.8...2.0	SOT-23	460
	BSS 124	400	28	120	1.5...2.5	TO-92	473
S	BSP 125	600	45	110	1.5...2.5	SOT-223	366
S	BSS 125		45	100	1.5...2.5	TO-92	366

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SIPMOS® Small-Signal Transistors (Families of Types)

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	$I_{D(max)}$ mA	$V_{GS(th)}$ V	Package	Page
	N channel depletion types						
S	BSP 149	200	3.5	440	-1.8...-0.7	SOT-223	387
	BSS 149		3.5	350	-1.8...-0.7	TO-92	387
	BSP 129	240	20	190	-1.8...-0.7	SOT-223	373
S	BSS 129		20	150	-1.8...-0.7	TO-92	373
S	BSS 139	250	100	40	-1.8...-0.7	SOT-23	479
S	BSS 229		100	70	-1.8...-0.7	TO-92	479
S	BSP 135	600	60	100	-1.8...-0.7	SOT-223	380
S	BSS 135		60	80	-1.8...-0.7	TO-92	380
	P channel enhancement types						
▼	BSP 315	-50	0.8	-1000	-0.8...-2.0	SOT-223	418
S	BSS 84		10	-130	-0.8...-2.0	SOT-23	421
S	BSS 110		10	-170	-0.8...-2.0	TO-92	421
	SP 0610L	-60	10	-180	-1.0...-2.0	TO-92	1148
	SP 0610T		10	-130	-1.0...-2.0	SOT-23	1148
▼	BSP 316	-100	2.2	-600	-0.8...-2.0	SOT-223	–
▼	BSP 317	-200	6	-340	-0.8...-2.0	SOT-223	–
S	BSP 92	-240	20	-180	-0.8...-2.0	SOT-223	357
S	BSS 92		20	-150	-0.8...-2.0	TO-92	357
S	BSS 192		20	-150	-0.8...-2.0	SOT-89	357

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SITAC® AC Switches

	Type	V_{DRM} V	I_{TRMS} mA	I_H mA	dv/dt V/µs	I_{FT} mA	Package	Page
S	BRT 11 H	400	300	0.5	10000	2	DIP-6	102
	BRT 11 M		300	0.5	10000	3	DIP-6	102
	BRT 21 H		300	0.5	10000	2	DIP-6	109
	BRT 21 M		300	0.5	10000	3	DIP-6	109
S	BRT 12 H	600	300	0.5	10000	2	DIP-6	102
	BRT 12 M		300	0.5	10000	3	DIP-6	102
	BRT 22 H		300	0.5	10000	2	DIP-6	109
	BRT 22 M		300	0.5	10000	3	DIP-6	109
▼	BRT 13 H	800	300	0.5	10000	2	DIP-6	102
▼	BRT 13 M		300	0.5	10000	3	DIP-6	102
▼	BRT 23 H		300	0.5	10000	2	DIP-6	109
▼	BRT 23 M		300	0.5	10000	3	DIP-6	109

Smart SIPMOS®

TEMPFET® N channel enhancement types

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ mΩ	$I_{D\text{-}ISO}$[1] A	$I_{D\text{-}MOS(max)}$[2] A	Package	Page
S	BTS 114	50	100	3.5	14	TO-220 AB	511
S L	BTS 115		125	3	12.5	TO-220 AB	519
	BTS 116		100	3.5	14	TO-220 E3045	527
S	BTS 130		50	7.5	27	TO-220 AB	559
S L	BTS 131		60	6.5	25	TO-220 AB	567
	BTS 136		50	7.5	27	TO-220 E3045	583
	BTS 140 A		28	13.5	42	TO-220 AB	591
	BTS 240 A		18	21	58	TO-218 AA	599
	BTS 129	60	50	7.5	27	TO-220 AB	551
S L	BTS 132		65	6	24	TO-220 AB	575
S	BTS 110	100	200	1.75	10	TO-220 AB	503
	BTS 120		100	3.5	19	TO-220 AB	535
L	BTS 121 A		100	3.5	22	TO-220 AB	543
F	BTS 950	500	800	–	9	TO-218/5	664

TEMPFET® P channel enhancement types

	Type	$V_{DS(max)}$ V	$R_{DS(on)max}$ mΩ	$I_{D\text{-}ISO}$[1] A	$I_{D\text{-}MOS(max)}$[2] A	Package	Page
S	BTS 100	– 50	300	– 1.5	– 8	TO-220 AB	495
	BTS 903	– 200	1500	–	– 3.6	TO-220/5	656

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[1] Proposed ISO standard: $T_C = 85$ °C and voltage drop ≤ 0.5 V

[2] MOS standard: $T_C = 25$ °C, $T_C = 150$ °C

Typenübersicht / Selection Guide

Smart SIPMOS®

Type	$V_{bb(BR)}$ V	$V_{bb(op)}$ V	$R_{on(max)}$ mΩ	$I_{L\text{-}ISO}$[1] A	$I_{L\text{-}MOS(max)}$[2] A	Package	Page
PROFET®							
S BTS 412 A	45	7...35	400	1	9.5	TO-220/5	615
S BTS 413 A		7...35	400	1	9.5	TO-220/5	631
BTS 410 D	56	4.9...42	220	1.6	13	TO-220/5	607
BTS 410 E		4.9...42	220	1.6	13	TO-220/5	607
BTS 410 F		4.9...42	220	1.6	(13)	TO-220/5	607
BTS 410 G		4.9...42	220	1.6	(13)	TO-220/5	607
S BTS 412 B		4.9...42	250	1.4	12	TO-220/5	625
BTS 432 D		4.9...42	40	9	20	TO-220/5	642
BTS 432 E		4.9...42	40	9	20	TO-220/5	642
BTS 432 F		4.9...42	40	(9)	(20)	TO-220/5	642
BTS 542 D		4.9...42	20	17	42	TO-218/5	649
BTS 542 E		4.9...42	20	17	42	TO-218/5	649
BTS 542 F		4.9...42	20	(17)	(42)	TO-218/5	649

Dimmers

Type	$V_{bb(BR)}$ V	$V_{bb(op)}$ V	$R_{on(max)}$ mΩ	$P_{A(typ)}$ W	–	Package	Page
▼ BTS 629	60	6...17	200	35	–	TO-220/7	–
▼ BTS 630		6...17	60	60	–	TO-220/7	–

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[1] Proposed ISO standard: $T_C = 85$ °C and voltage drop ≤ 0.5 V

[2] MOS standard: $T_C = 25$ °C, $T_C = 150$ °C

( ) Theoretical values only since I_{SC} is limited by the device BTS XXX customer-specific PROFETS on request.

Typenübersicht / Selection Guide

Power Modules

	Type	$V_{DS(max)}$ V	$I_{D(max)}$ A	$R_{th(JC)}$ K/W	$R_{DS(on)max}$ mΩ	Fig.	Configuration	Page
	SIMOPAC®							
S	BSM 111 AR (C)	100	200	0.18	8.5	1a	Single switch	171
S	BSM 214 A		2 x 125	0.31	13	2a	Half-bridge	247
S	BSM 121 AR (C)	200	130	0.18	20	1a	Single switch	178
S	BSM 224 A		2 x 81	0.31	30	2a	Half-bridge	254
S	BSM 141	400	60	0.2	75	1a	Single switch	185
: S	BSM 244 F		2 x 45	0.31	100	2a	Half-bridge	261
S	BSM 151 (C)	500	48	0.2	120	1a	Single switch	199
S	BSM 151 R		48	0.2	120	1a		199
: S	BSM 151 F (C)		56	0.18	110	1a	Single switch	205
:	BSM 151 FR		56	0.18	110	1a		205
: S	BSM 254 F		2 x 35	0.31	170	2a	Half-bridge	268
: S	BSM 651 F		6 x 9	1	700	3a	3-phase full-bridge	296
: S	BSM 652 F		6 x 17	0.55	350	3a	3-phase full-bridge	303
S	BSM 181 (C)	800	36	0.18	240	1a	Single switch	212
S	BSM 181 R		36	0.18	240	1a		212
: S	BSM 181 F (C)		34	0.18	320	1a	Single switch	219
:	BSM 181 FR		34	0.18	320	1a		219
: S	BSM 284 F		2 x 20	0.31	480	2a	Half-bridge	275
: S	BSM 681 F		6 x 5.3	1	1900	3a	3-phase full-bridge	310
: S	BSM 682 F		6 x 10	0.55	950	3a	3-phase full-bridge	317
S	BSM 191 (C)	1000	28	0.18	370	1a	Single switch	226
: S	BSM 191 F (C)		28	0.18	420	1a	Single switch	233
: S	BSM 294 F		2 x 18	0.31	630	2a	Half-bridge	282
: S	BSM 691 F		6 x 4.8	1	2500	3a	3-phase full-bridge	324
: S	BSM 692 F		6 x 9	0.55	1250	3a	3-phase full-bridge	331

(C) Modules with internal floating drive circuit on request.

Typenübersicht / Selection Guide

Power Modules

Type	V_{CE} V	$I_{C(max)}$ A	$R_{th(JC)}$ K/W	$V_{CE(sat)}$ V typ.	Fig.	Configuration	Page
IGBT							
BSM 15 GD 100 D	1000	6 x 15	0.8	3.0	3b	3-phase full-bridge	129
▼ BSM 25 GAL 100 D		25	0.4	3.0	2c	Chopper	–
S BSM 25 GB 100 D		2 x 25	0.4	3.0	2b	Half-bridge	136
BSM 25 GD 100 D		6 x 25	0.4	3.0	3b	3-phase full-bridge	143
▼ BSM 50 GAL 100 D		50	0.25	3.0	2c	Chopper	–
S BSM 50 GB 100 D		2 x 50	0.25	3.0	2b	Half-bridge	150
▼ BSM 75 GAL 100 D		75	0.2	3.0	2c	Chopper	–
BSM 75 GB 100 D		2 x 75	0.2	3.0	2b	Half-bridge	157
▼ BSM 100 GAL 100 D		100	0.13	3.0	5b	Chopper	–
BSM 100 GB 100 D		2 x 100	0.13	3.0	5a	Half-bridge	164
▼ BSM 150 GAL 100 D		150	0.1	3.0	5b	Chopper	–
BSM 150 GB 100 D		2 x 150	0.1	3.0	5a	Half-bridge	192
BSM 200 GA 100 D		200	0.07	3.0	4a	Single switch	240
BSM 300 GA 100 D		300	0.05	3.0	4a	Single switch	289

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BRT 11 H	C67079-A1000-A6	102
BRT 11 M	C67079-A1000-A10	102
BRT 12 H	C67079-A1001-A6	102
BRT 12 H (Option 1)	C67079-A1041-A005	102
BRT 12 H (Option 6)	C67079-A1041-A008	102
BRT 12 H (Option 7)	C67079-A1041-A011	102
BRT 12 H (Option 1+6)	C67079-A1041-A014	102
BRT 12 H (Option 1+7)	C67079-A1041-A017	102
BRT 12 M	C67079-A1001-A10	102
BRT 13 H	C67079-A1002-A6	102
BRT 13 M	C67079-A1002-A10	102
BRT 21 H	C67079-A1201-A1	109
BRT 21 M	C67079-A1200-A1	109
BRT 22 H	C67079-A1203-A1	109
BRT 22 H (Option 1)	C67079-A1051-A005	109
BRT 22 H (Option 6)	C67079-A1051-A008	109
BRT 22 H (Option 7)	C67079-A1051-A011	109
BRT 22 H (Option 1+6)	C67079-A1051-A014	109
BRT 22 H (Option 1+7)	C67079-A1051-A017	109
BRT 22 M	C67079-A1202-A1	109
BRT 23 H	C67079-A1022-A6	109
BRT 23 M	C67079-A1022-A10	109
BS 107	Q67000-S060 (bulk)	115
BS 107	Q67000-S078 (taped)	115
BS 170	Q67000-S061 (bulk)	121
BS 170	Q67000-S076 (taped)	121
BSM 15 GD 100 D	C67076-A2500-A2	129
BSM 25 GAL 100 D	on request	–
BSM 25 GB 100 D	C67076-A2101-A2	136
BSM 25 GD 100 D	C67076-A2501-A2	143
BSM 50 GAL 100 D	on request	–
BSM 50 GB 100 D	C67076-A2100-A2	150
BSM 75 GAL 100 D	on request	–
BSM 75 GB 100 D	C67076-A2104-A2	157
BSM 100 GAL 100 D	on request	–
BSM 100 GB 100 D	C67076-A2103-A2	164
BSM 111 AR (C)	C67076-S1013-A2	171
BSM 121 AR (C)	C67076-S1014-A2	178
BSM 141	C67076-A1010-A2	185
BSM 150 GAL 100 D	on request	–
BSM 150 GB 100 D	C67076-A2102-A2	192
BSM 151 (C)	C67076-A1004-A2	199
BSM 151 F (C)	C67076-A1050-A2	205
BSM 151 FR	C67076-A1056-A2	205
BSM 151 R	C67076-A1015-A2	199
BSM 181 (C)	C67076-A1001-A2	212
BSM 181 F (C)	C67076-A1052-A2	219
BSM 181 FR	C67076-A1057-A2	219
BSM 181 R	C67076-A1016-A2	212
BSM 191 (C)	C67076-A1009-A2	226
BSM 191 F (C)	C67076-A1053-A2	233
BSM 200 GA 100 D	C67076-A2001-A2	240
BSM 214 A	C67076-S1100-A2	247

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BSM 224 A	C67076-S1101-A2	254
BSM 244 F	C67076-A1155-A2	261
BSM 254 F	C67076-A1150-A2	268
BSM 284 F	C67076-A1152-A2	275
BSM 294 F	C67076-A1151-A2	282
BSM 300 GA 100 D	C67076-A2000-A2	289
BSM 651 F	C67076-A1500-A2	296
BSM 652 F	C67076-A1501-A2	303
BSM 681 F	C67076-A1504-A2	310
BSM 682 F	C67076-A1505-A2	317
BSM 691 F	C67076-A1502-A2	324
BSM 692 F	C67076-A1503-A2	331
BSP 17	Q67000-S025	338
BSP 88	Q67000-S101 (bulk)	341
BSP 88	Q67000-S070 (taped)	341
BSP 89	Q67000-S100 (bulk)	348
BSP 89	Q62702-S652 (taped)	348
BSP 92	Q67000-S059 (bulk)	357
BSP 92	Q62702-S653 (taped)	357
BSP 125	Q67000-S111 (bulk)	366
BSP 125	Q62702-S654 (taped)	366
BSP 129	Q67000-S030 (bulk)	373
BSP 129	Q67000-S073 (taped)	373
BSP 135	Q67000-S099 (bulk)	380
BSP 135	Q62702-S655 (taped)	380
BSP 149	Q67000-S098 (bulk)	387
BSP 149	Q67000-S071 (taped)	387
BSP 295	Q67000-S095 (bulk)	394
BSP 295	Q67000-S066 (taped)	394
BSP 296	Q67000-S096 (bulk)	402
BSP 296	Q67000-S067 (taped)	402
BSP 297	Q67000-S097 (bulk)	410
BSP 297	Q67000-S068 (taped)	410
BSP 315	Q62702-S075 (bulk)	418
BSP 315	Q67000-S075 (taped)	418
BSP 316	Q67000-S091 (bulk)	–
BSP 316	Q67000-S092 (taped)	–
BSP 317	Q67000-S093 (bulk)	–
BSP 317	Q67000-S094 (taped)	–
BSS 84	Q62702-S393 (bulk)	421
BSS 84	Q62702-S568 (taped)	421
BSS 87	Q62702-S453 (bulk)	348
BSS 87	Q62702-S506 (taped)	348
BSS 88	Q62702-S454 (bulk)	341
BSS 88 1)	Q62702-S303	341
BSS 89	Q62702-S455 (bulk)	348
BSS 89 2)	Q62702-S519	348
BSS 89 3)	Q62702-S385	348
BSS 91	Q62702-S457 (bulk)	428
BSS 92	Q62702-S458 (bulk)	357

1) E6296: on reel, 1500 pieces/reel. 2 reels/carton: (Gate first)
2) E6288: on reel, 1500 pieces/reel. 2 reels/carton: (Source first)
3) E6325: Ammopack, 2000 pieces/carton

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BSS 92 [2])	Q62702-S497	357
BSS 92 [3])	Q62702-S502	357
BSS 95	Q62702-S461 (bulk)	434
BSS 97	Q62702-S463 (bulk)	440
BSS 98	Q62702-S464 (bulk)	446
BSS 98 [1])	Q62702-S517 (taped)	446
BSS 100	Q62702-S483 (bulk)	453
BSS 100 [2])	Q62702-S499 (taped)	453
BSS 101	Q62702-S484 (bulk)	460
BSS 101 [2])	Q62702-S493 (taped)	460
BSS 110	Q62702-S489 (bulk)	421
BSS 110 [2])	Q62702-S500	421
BSS 119	Q62702-S624 (bulk)	467
BSS 119	Q62702-S631 (taped)	467
BSS 123	Q62702-S507 (bulk)	453
BSS 123	Q62702-S512 (taped)	453
BSS 124	Q62702-S614 (bulk)	473
BSS 125	Q62702-S505 (bulk)	366
BSS 129	Q62702-S510 (bulk)	373
BSS 129	Q62702-S510-P1 (bulk, grouped)	373
BSS 131	Q62702-S554 (bulk)	460
BSS 131	Q62702-S565 (taped)	460
BSS 135	Q62702-S601 (bulk)	380
BSS 138	Q62702-S558 (bulk)	446
BSS 138	Q62702-S566 (taped)	446
BSS 139	Q62702-S575 (bulk)	479
BSS 139	Q62702-S612 (taped)	479
BSS 145	Q67000-S102	486
BSS 149	Q62702-S623 (bulk)	387
BSS 192	Q62702-S602 (bulk)	357
BSS 229	Q62702-S567 (bulk)	479
BSS 229	Q62702-S567-P1 (bulk, grouped)	479
BSS 229[1])	Q62702-S600 (taped)	479
BSS 229[1])	Q62702-S600-P1 (taped, grouped)	479
BSS 295	Q62702-S603 (bulk)	394
BSS 296	Q62702-S615 (bulk)	402
BSS 297	Q62702-S616 (bulk)	410
BSS 395	Q62702-S604 (bulk)	489
BTS 100	C67078-A5007-A2	495
BTS 110	C67078-A5008-A2	503
BTS 114	C67078-A5000-A3	511
BTS 115	C67078-A5004-A4	519
BTS 116	C67078-A5005-A3	527
BTS 120	C67078-A5009-A2	535
BTS 121 A	C67078-S5010-A4	543
BTS 129	C67078-A5013-A2	551
BTS 130	C67078-A5001-A3	559
BTS 131	C67078-A5002-A4	567
BTS 132	C67078-A5003-A4	575
BTS 136	C67078-A5006-A3	583

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[1]) E6296: on reel, 1500 pieces/reel. 2 reels/carton: (Gate first)
[2]) E6288: on reel, 1500 pieces/reel. 2 reels/carton: (Source first)
[3]) E6325: Ammopack, 2000 pieces/carton

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BTS 140 A	C67078-S5011-A2	591
BTS 240 A	C67078-S5100-A3	599
BTS 410 D	C67078-S5305-A3	607
BTS 410 E	C67078-S5305-A4	607
BTS 410 F	C67078-S5305-A5	607
BTS 410 G	C67078-S5305-A6	607
BTS 412 A	C67078-A5300-A5	615
BTS 412 B	C67078-S5300-A9	625
BTS 413 A	C67078-A5307-A2	631
BTS 432 D	C67078-S5303-A3	642
BTS 432 E	C67078-S5303-A4	642
BTS 432 F	C67078-S5303-A5	642
BTS 542 D	C67078-S5400-A3	649
BTS 542 E	C67078-S5400-A4	649
BTS 542 F	C67078-S5400-A5	649
BTS 629	C67078-S5501-A2	–
BTS 630	C67078-S5500-A2	–
BTS 903	C67078-S5800-A2	656
BTS 950	C67078-A5850-A2	664
BUP 101	C67060-A1000-A2	670
BUP 200	C67078-A4400-A2	675
BUP 202	C67078-A4401-A2	678
BUP 203	C67078-A4402-A2	681
BUP 304	C67078-A4200-A2	684
BUP 307	C67078-A4201-A2	684
BUZ 10	C67078-S1300-A2	690
BUZ 10 L	C67078-S1329-A2	700
BUZ 10 S2	C67078-S1300-A7	690
BUZ 11	C67078-A1301-A2	707
BUZ 11 A	C67078-S1301-A3	707
BUZ 11 AL	C67078-S1330-A3	719
BUZ 11 S2	C67078-S1301-A5	707
BUZ 12	C67078-S1331-A2	726
BUZ 12 A	C67078-S1331-A3	726
BUZ 12 AL	C67078-S1332-A3	734
BUZ 15	C67078-A1001-A2	741
BUZ 16	C67078-A1020-A2	748
BUZ 20	C67078-S1302-A2	759
BUZ 21	C67078-S1308-A2	766
BUZ 21 L	C67078-S1338-A2	773
BUZ 22	C67078-S1333-A2	780
BUZ 24	C67078-A1003-A2	787
BUZ 30 A	C67078-S1303-A3	794
BUZ 31	C67078-S1304-A2	801
BUZ 32	C67078-S1310-A2	808
BUZ 36	C67078-A1018-A2	815
BUZ 41 A	C67078-A1306-A3	822
BUZ 42	C67078-A1311-A2	829
BUZ 45	C67078-A1008-A2	836
BUZ 45 A	C67078-A1008-A3	836
BUZ 45 B	C67078-A1008-A4	836
BUZ 50 A	C67078-A1307-A3	845
BUZ 50 B	C67078-A1307-A4	845

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BUZ 50 C	C67078-A1307-A5	845
BUZ 54	C67078-A1010-A2	857
BUZ 54 A	C67078-A1010-A3	857
BUZ 60	C67078-A1312-A2	867
BUZ 64	C67078-A1017-A2	874
BUZ 70	C67078-S1334-A2	881
BUZ 70 L	C67078-S1334-A3	888
BUZ 71	C67078-S1316-A2	895
BUZ 71 A	C67078-S1316-A3	895
BUZ 71 AL	C67078-S1326-A3	906
BUZ 71 L	C67078-S1326-A2	906
BUZ 71 S2	C67078-S1316-A9	895
BUZ 72	C67078-S1313-A2	914
BUZ 72 A	C67078-S1313-A3	914
BUZ 72 AL	C67078-S1327-A3	922
BUZ 72 L	C67078-S1327-A2	922
BUZ 73	C67078-S1317-A2	930
BUZ 73 A	C67078-S1317-A3	930
BUZ 73 AL	C67078-S1328-A3	938
BUZ 73 L	C67078-S1328-A2	938
BUZ 74	C67078-A1314-A2	946
BUZ 74 A	C67078-A1314-A3	946
BUZ 76	C67078-A1315-A2	954
BUZ 76 A	C67078-A1315-A3	954
BUZ 77 A	C67078-S1320-A3	962
BUZ 77 B	C67078-S1320-A5	962
BUZ 78	C67078-A1318-A2	970
BUZ 80	C67078-A1309-A2	977
BUZ 80 A	C67078-A1309-A3	977
BUZ 84	C67078-A1013-A2	985
BUZ 84 A	C67078-A1013-A3	985
BUZ 90	C67078-S1321-A2	993
BUZ 90 A	C67078-S1321-A3	993
BUZ 92	C67078-S1343-A2	1002
BUZ 94	C67078-A1019-A2	1009
BUZ 171	C67078-A1450-A2	1016
BUZ 172	C67078-A1451-A2	1022
BUZ 173	C67078-A1452-A2	1028
BUZ 205	C67078-A1401-A2	1034
BUZ 210	C67078-A1102-A2	1041
BUZ 211	C67078-A1100-A2	1041
BUZ 215	C67078-A1400-A2	1049
BUZ 230	C67078-A1105-A2	1056
BUZ 307	C67078-A3100-A2	977
BUZ 308	C67078-A3109-A2	977
BUZ 310	C67078-A3101-A2	845
BUZ 311	C67078-A3102-A2	845
BUZ 323	C67078-S3127-A2	1063
BUZ 325	C67078-A3118-A2	1070
BUZ 326	C67078-A3112-A2	1070
BUZ 330	C67078-A3105-A2	1078
BUZ 331	C67078-A3114-A2	1078
BUZ 332 A	C67078-S3123-A4	1086

Bestellnummern/Ordering Codes

Type	Ordering code	Page
BUZ 338	C67078-S3126-A2	1093
BUZ 339	C67078-S3133-A2	1093
BUZ 341	C67078-S3128-A2	1104
BUZ 345	C67078-S3121-A2	1111
BUZ 346	C67078-S3120-A2	748
BUZ 346 S2	C67078-S3131-A2	748
BUZ 347	C67078-S3115-A2	741
BUZ 349	C67078-S3113-A2	1118
BUZ 350	C67078-S3117-A2	815
BUZ 355	C67078-A3107-A2	985
BUZ 356	C67078-A3108-A2	985
BUZ 357	C67078-A3110-A2	857
BUZ 358	C67078-A3111-A2	857
BUZ 380	C67078-A3205-A2	1125
BUZ 382	C67078-A3207-A2	1132
BUZ 384	C67078-A3209-A2	1041
BUZ 385	C67078-A3210-A2	1041
BYP 101	C67047-A2072-A2	1139
BYP 102	C67047-A2071-A2	1142
BYP 103	C67047-A2066-A2	1145
SN 7000	Q67000-S062 (bulk)	121
SN 7002	Q67000-S063 (taped)	121
SP 0610 L	Q67000-S065 (bulk)	1148
SP 0610 T	Q67000-S088 (taped)	1148

Symbole, Begriffe, Normen

Symbole und Begriffe der wichtigsten Größen

Symbole	Begriffe
C	Kapazität
C_{IO}	Optokoppler-Kapazität (Eingang/Ausgang)
C_{iss}	Eingangskapazität
C_{oss}	Ausgangskapazität
C_{rss}	Rückwirkkapazität
C_{SS}	Kapazität (Sensor/Source)
D	Tastverhältnis/Tastgrad ($D = t_p/T$)
$\mathrm{d}i_F/\mathrm{d}t$	Dioden-Stromsteilheit
$\mathrm{d}i/\mathrm{d}t_{\mathrm{cr}}$	Kritische Stromsteilheit
$\mathrm{d}i/\mathrm{d}t_{\mathrm{crq}}$	Kritische Stromsteilheit bei Kommutierung
$\mathrm{d}v/\mathrm{d}t_{\mathrm{cr}}$	Kritische Spannungssteilheit
$\mathrm{d}v/\mathrm{d}t_{\mathrm{crq}}$	Kritische Spannungssteilheit bei Kommutierung
E_{AR}	Avalanche-Energie, periodisch
E_{AS}	Avalanche-Energie, Einzelpuls
E_{off}	Abschaltverlust-Energie
f	Frequenz
g_{fs}	Übertragungssteilheit
I_{AR}	Avalanche-Strom, periodisch
I_{C}	Kollektor-Gleichstrom
I_{CES}	Kollektor-Reststrom
I_{Cpuls}	Kollektor-Gleichstrom, gepulst
I_{D}	Drain-Gleichstrom/Thyristor Vorwärtssperrstrom
I_{Dpuls}	Drain-Gleichstrom, gepulst
I_{D}-ISO	Drain-Gleichstrom (ISO-Norm)
I_{D}-MOS	Drain-Gleichstrom (MOS-Norm)
I_{L}-ISO	Laststrom (ISO-Norm)
I_{L}-MOS	Laststrom (MOS-Norm)
I_{DSS}	Drain-Reststrom
I_{DR}, I_{S}	Inversdioden-Gleichstrom
I_{DINH}	Inhibitsperrstrom
I_{DRM}, I_{SM}	Inversdioden-Gleichstrom, gepulst
I_{F}	Dioden-Durchlaßstrom (allgemein)
I_{FT}	Thyristor/Triac-Zündstrom
I_{FAV}	Dioden-Durchlaßstrom (Mittelwert)
I_{FRMS}	Dioden-Durchlaßstrom (Effektivwert)
I_{FRM}	Periodischer Dioden-Spitzenstrom
I_{FSM}	Dioden-Stoßstromscheitelwert (50-Hz-Sinus-Halbwelle)
I_{FSM}	Dioden-Stoßdurchlaßstrom
I_{GES}	Gate-Emitter-Leckstrom
I_{GSS}	Gate-Source-Leckstrom
I_{H}	Haltestrom
I_{K}	Kurzschlußstrom
I_{Ktyp}	Typischer Kurzschlußstrom
I_{R}	Sperrstrom

Symbole und Begriffe der wichtigsten Größen

Symbole	Begriffe
I_T	Thyristor-Durchlaßstrom
I_{RRM}	Sperrverzögerungsrückstromspitze
I_{TRMS}	Thyristor-Durchlaßstrom (Effektivwert)
I_{TSM}	Thyristor-Stoßstromgrenzwert (50-Hz-Sinus-Vollwelle)
I_{TSS}	Sperrstrom
$I_{TS(on)}$	Durchlaßstrom
P_A	Anschlußleistung
P_F	Dioden-Verlustleistung
P_{Kmax}	Kurzschlußleistung
P_T	Thyristor-Verlustleistung
P_{tot}	Gesamtverlustleistung
Q_{Gate}	Gate-Ladung
Q_{rr}	Sperrverzögerungsladung
$R_{DS(on)}$	Drain-Source-Einschaltwiderstand
R_{is}	Isolationswiderstand
R_{GS}	Gate-Source-Widerstand
R_L	Lastwiderstand
R_{on}	Einschaltwiderstand
R_{thCH}	Wärmewiderstand (Gehäuse/Kühlkörper)
R_{thJA}	Wärmewiderstand (Chip/Umgebung)
R_{thJC}	Wärmewiderstand (Chip/Gehäuse)
R_{thJSR}	Wärmewiderstand (Chip/Substrat-Rückseite)
S	Softfaktor
T_A	Umgebungstemperatur
T_C	Gehäusetemperatur
$t_{d(off)}$	Ausschaltverzögerungszeit
$t_{d(on)}$	Einschaltverzögerungszeit
t_f	Fallzeit
t_{gd}	Zündverzugszeit
T_j	Chip-/Betriebstemperatur
t_{off}	Ausschaltzeit
t_{on}	Einschaltzeit
t_p	Pulszeit
t_r	Anstiegszeit
t_{rr}	Sperrverzögerungszeit
t_S	Spannungsnachlaufzeit
T_{stg}	Lagertemperatur
T_{sold}	Löttemperatur
$T_{TS(on)}$	Schalttemperatur
V_B, V_{bb}, $V_{bb\,(op)}$	Betriebsspannung
$V_{bb(BR)}$	Durchbruchspannung
$V_{bb(off)}$	Betriebsspannung-Aus
$V_{bb(on)}$	Betriebsspannung-Ein
$V_{(BR)CES}$	Kollektor-Emitter-Durchbruchspannung

Symbole, Begriffe, Normen

Symbole und Begriffe der wichtigsten Größen

Symbole	Begriffe
$V_{(BR)DSS}$	Drain-Source-Durchbruchspannung
V_{CC}	Versorgungsspannung
V_{CE}	Kollektor-Emitter-Spannung
$V_{CE(sat)}$	Kollektor-Emitter-Sättigungsspannung
V_{CGR}	Kollektor-Gate-Spannung
V_{DINH}	Inhibitspannung
V_{DGR}	Drain-Gate-Spannung
V_{DRM}	Periodische Vorwärtsspitzensperrspannung
V_{DS}	Drain-Source-Spannung
V_F	Dioden-Durchlaßspannung
V_{GE}	Gate-Emitter-Spannung
$V_{GE(th)}$	Gate-Schwellenspannung
V_{GS}	Gate-Source-Spannung
$V_{GS(th)}$	Gate-Schwellenspannung
V_{gs}	Gate-Source-Spitzenspannung
V_{in}, V_{IN}	Eingangs-/Ansteuerspannung
$V_{in(max)}$	Eingangs-/Ansteuerspannung
$V_{in(off)}$	Eingangsspannung-Aus
$V_{in(on)}$	Eingangsspannung-Ein
V_{is}	Isolationsprüfspannung
V_{Logik}	Interne Logikspannung
V_{OUT}	Ausgangsspannung
V_R	Dioden-Sperrspannung
V_{RRM}	Periodischer Rückwärts-Spitzensperrstrom
V_{RSM}	Rückwärts-Stoßspitzenspannung
V_{SCD}	Kurzschlußerkennungsspannung
V_{SD}	Inversdioden-Durchlaßspannung
V_{SS}	Isolationsspannung (Sensor/Source)
V_{ST}	Statusspannung
V_T	Thyristor-Durchlaßspannung
V_{TS}	Angelegte Spannung
V_{ZD}	Zenerdiodenspannung
Z_{thJC}	Transienter Wärmewiderstand (Chip/Gehäuse)

Normen

Spezielle Einzelheiten können auch folgenden Unterlagen entnommen werden:
IEC Publication 147-0C, Part 0, IEC Publication 147-1 Part 1 und Publication 147-2G, Part 2, DIN 41782, DIN 41791 Teil 9, DIN 41792, Teil 6, DIN 41858, Diode: DIN 41741.
DIN 41781, DIN/IEC 747, S N 73257 (EGB = Elektrostatisch gefährdetes Bauelement)

The Most Relevant Symbols And Terms

Symbols	Terms
C	Capacitance
C_{IO}	Optocoupler capacitance (input/output)
C_{iss}	Input capacitance
C_{oss}	Output capacitance
C_{rss}	Reverse transfer capacitance
C_{SS}	Capacitance (sensor/source)
D	Duty cycle ($D = t_p/T$)
di_F/dt	Diode rate of rise of on-state current
di/dt_{cr}	Critical rate of rise of on-state current
di/dt_{crq}	Critical rate of rise of on-state current at commutation
dv/dt_{cr}	Critical rate of rise of off-state voltage
dv/dt_{crq}	Critical rate of rise of off-state voltage at commutation
E_{AR}	Avalanche energy, periodic
E_{AS}	Avalanche energy, single pulse
E_{off}	Turn-off loss
f	Frequency
g_{fs}	Forward transconductance
I_{AR}	Repetitive avalanche current
I_C	Continuous collector current
I_{CES}	Zero gate voltage collector current
I_{Cpuls}	Pulsed collector current
I_D	Continuous drain current/Thyristor reverse current
I_{Dpuls}	Pulsed drain current
I_D-ISO	Continuous drain current (ISO standard)
I_D-MOS	Continuous drain current (MOS standard)
I_L-ISO	Load current (ISO standard)
I_L-MOS	Load current (MOS standard)
I_{DSS}	Zero gate voltage drain current
I_{DR}, I_S	Continuous reverse drain current
I_{DINH}	Off-state current in inhibit state
I_{DRM}, I_{SM}	Pulsed reverse drain current
I_F	Forward current (in general)
I_{FT}	Thyristor/Triac trigger current
I_{FAV}	Max. mean forward current
I_{FRM}	Repetitive peak forward current
I_{FRMS}	Max. RMS forward current
I_{FSM}	Max. surge forward current
I_{FSM}	Diode forward-on current (50-Hz sine halfwave)
I_{GES}	Gate-emitter leakage current
I_{GSS}	Gate-source leakage current
I_H	Holding current
I_{SC}	Short-circuit current
I_{SCtyp}	Typical short-circuit current
I_R	Reverse current

The Most Relevant Symbols And Terms (continued)

Symbols	Terms
I_{T}	Thyristor on-state current
I_{RRM}	Peak reverse recovery current
I_{TRMS}	Thyristor RMS on-state current
I_{TSM}	Thyristor single cycle surge current (50-Hz)
I_{TSS}	Reverse current
$I_{TS(on)}$	On-state current
P_{A}	Connected load
P_{F}	Forward power dissipation
P_{SCmax}	Max. short-circuit power
P_{T}	Thyristor power dissipation
P_{tot}	Max./Total power dissipation
Q_{Gate}	Gate charge
Q_{rr}	Reverse recovery charge
$R_{DS(on)}$	Drain-source on-resistance
R_{is}	Insulation resistance
R_{GS}	Gate-source resistance
R_{L}	Load resistance
R_{on}	On-state resistance
R_{thCH}	Thermal resistance (case/heat sink)
R_{thJA}	Thermal resistance (chip/ambient)
R_{thJC}	Thermal resistance (chip/case)
R_{thJSR}	Thermal resistance (chip/substrate-reverse side)
S	Soft factor
T_{A}	Ambient temperature
T_{C}	Case temperature
$t_{d(off)}$	Turn-off delay time
$t_{d(on)}$	Turn-on delay time
t_{f}	Fall time
t_{gd}	Trigger delay time
T_{j}	Chip/Operating temperature
t_{off}	Turn-off time
t_{on}	Turn-on time
t_{p}	Pulse time
t_{r}	Rise time
t_{rr}	Reverse recovery time
t_{S}	Storage time
T_{stg}	Storage temperature
T_{sold}	Soldering temperature
$T_{TS(on)}$	Switching temperature
V_{B}, V_{bb}, $V_{bb\,(op)}$	Operating voltage
$V_{bb(BR)}$	Breakdown voltage
$V_{bb(off)}$	Operating voltage-off
$V_{bb(on)}$	Operating voltage-on
$V_{(BR)CES}$	Collector-emitter breakdown voltage

The Most Relevant Symbols And Terms (continued)

Symbols	Terms
$V_{(BR)DSS}$	Drain-source breakdown voltage
V_{CC}	Supply voltage
V_{CE}	Collector-emitter voltage
$V_{CE(sat)}$	Collector-emitter saturation voltage
V_{CGR}	Collector-gate voltage
V_{DINH}	Inhibit voltage
V_{DGR}	Drain-gate voltage
V_{DRM}	Repetitive peak off-state voltage
V_{DS}	Drain-source voltage
V_F	Diode forward voltage
V_{GE}	Gate-emitter voltage
$V_{GE(th)}$	Gate threshold voltage
V_{GS}	Gate-source voltage
$V_{GS(th)}$	Gate threshold voltage
V_{gs}	Gate-source peak voltage
V_{in}, V_{IN}	Input/Control voltage
$V_{in(max)}$	Input/Control voltage
$V_{in(off)}$	Input voltage-off
$V_{in(on)}$	Input voltage-on
V_{is}	Insulation test voltage
V_{Logic}	Internal logic voltage
V_{OUT}	Output voltage
V_R	Reverse voltage
V_{RRM}	Repetitive peak reverse voltage
V_{RSM}	Surge peak reverse voltage
V_{SCD}	Short-circuit detection voltage
V_{SD}	Reverse diode forward on-voltage
V_{SS}	Insulation voltage (sensor/source)
V_{ST}	Status voltage
V_T	Thyristor on-state voltage
V_{TS}	Supply voltage
V_{ZD}	Zener diode voltage
Z_{thJC}	Transient thermal impedance (chip/case)

Standards

Special units may also be taken from the following documents:
IEC Publication 147-0C, Part 0, IEC Publication 147-1, Part 1 and Publication 147-2G, Part 2, DIN 41782, DIN 41791, Part 9, DIN 41792, Part 6, DIN 41858, Diode: DIN 41741.
DIN 41781, DIN/IEC 747, S N 73257 (ESD = Electrostatic discharge sensitive device).

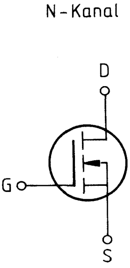
Technische Angaben Qualität und Zuverlässigkeit Erläuterungen der Datenblattwerte

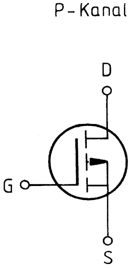
Technical Information Quality and Reliability Data Sheet Parameters

SIPMOS-Leistungstransistoren und Dioden

SIPMOS-Leistungstransistoren

Transistoren im Bereich 50 V ... 1000 V, 1,5 A ... 60 A und 18 mΩ ... 8 Ω.





Produktpalette

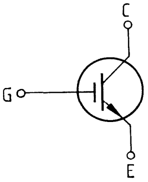
- N- und P-Kanal-Anreicherungstypen
- FREDFET
- Logic Level
- Bedrahtete und SMD-Bauformen
- Die-Produkte

SIRET

Schneller bipolarer Leistungstransistor im Bereich 1000 V und 20 A ohne „second breakdown".

IGBT

Hochsperrende spannungsgesteuerte Bipolartransistoren.

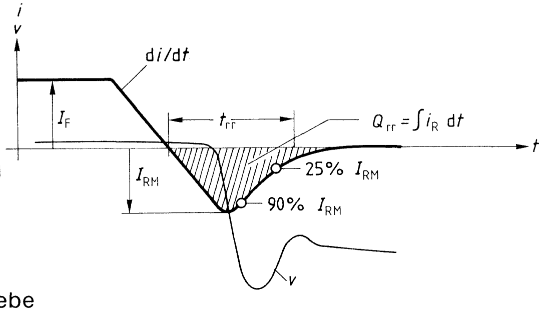


Schnelle Dioden (FRED)

Freilaufdiode für superschnelle Schalter mit „Soft"-Abschaltverhalten.

Einsatzgebiete (Auswahl)

- Schaltnetzteile
- Gleichspannungswandler
- Wechselrichter
- Motorsteuerungen
- Unterbrechungsfreie Stromversorgung
- Näherungsschalter
- Ultraschallgeneratoren
- Flimmerfreie Monitore
- NF-Verstärker
- Frequenzumrichter für Drehstromantriebe
- Getaktete Stromversorgungen für Schweißgeräte
- Kfz-Zündungen



Literaturhinweise

Leistungshalbleiter SIMPOS und IGBT
Bestell-Nr. B152-B6299-X-X-7400

Anwendungsbeispiele für SIPMOS-Transistoren
Bestell-Nr. B352-B6084

Durchbruchfestigkeit (Avalanchefestigkeit)

Ein Maß für die Robustheit von MOSFET ist die Überspannungsfestigkeit. Durch die unvermeidlichen parasitären Induktivitäten L_p, die sich in einem auch sehr sorgfältigen Schaltungsaufbau befinden, kommt es beim Abschalten von Transistoren zum Auftreten von Überspannung $L_p \times di/dt$.

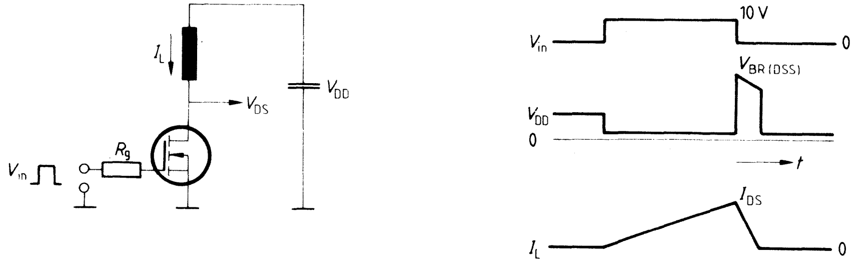
Bedingt durch die kurzen Schaltzeiten von MOSFET wird das beim Schalten hoher Ströme besonders kritisch, denn die beim Abschalten auftretenden Spannungspitzen können die Durchbruchspannung $V_{BR(DSS)}$ des Transistors überschreiten. Der Transistor geht dabei in den Durchbruch (Avalanche). Der Hersteller muß deshalb durch ein sorgfältiges Transistordesign verhindern, daß die parasitäre, bipolare Struktur zum Einschalten kommt und den Transistor zerstört.

Alle SIPMOS Transistoren werden einem 100 %-Durchbruchtest unterzogen. Das untenstehende Bild zeigt das Prinzipschaltbild der Testschaltung. Der Prüfling befindet sich in Serie mit einer ungeklemmten Induktivität und, nachdem er eingeschaltet wird, steigt der Strom linear an, bis er seinen spezifizierten Wert (in der Regel seinen Nennstrom) erreicht hat.

Wenn der Transistor abgeschaltet wird, bildet sich über dem Prüfling – abhängig von der Induktivität – eine Drain-Source-Spannung aus, die auf die Durchbruchspannung $V_{BR(DSS)}$ des Bauelements begrenzt wird. Dabei wird im Bauteil die Energie, die in der Spule gespeichert ist, und ein Anteil aus der Spannungsquelle umgesetzt.

$$W = 1/2\ L \times I^2 \times V_{BR(DSS)}/(V_{BR(DSS)} - V_{CC})$$

Schaltung zur Messung der Durchbruchfestigkeit am Beispiel des BUZ 338



Die Energie, die im Bauelement umgesetzt wird, ist durch die maximal zulässige Chiptemperatur T_j begrenzt. Das Diagramm zeigt die maximal zulässige Durchbruchenergie in Abhängigkeit von der Chiptemperatur.

In der Anwendung muß berücksichtigt werden, daß die im Durchbruch verursachten Verluste zusätzlich zu den Schaltverlusten und Durchlaßverlusten auftreten.

$$P_{tot} = P_S + P_F + P_{BR}$$

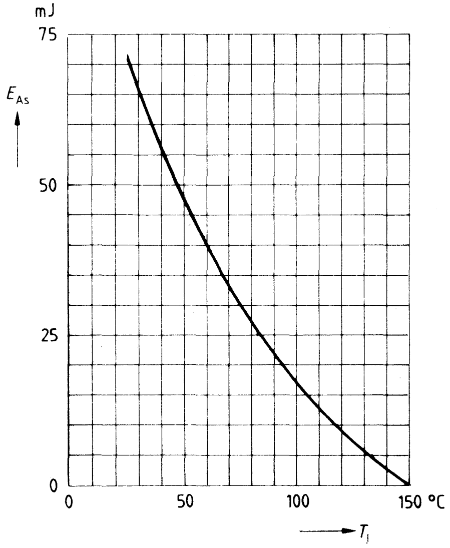
Deshalb muß das Ziel einer sorgfältigen Schaltungsauslegung immer in einer Minimierung der parasitären Induktivität liegen und damit in einer Reduzierung der dadurch entstehenden Durchbruchverluste.

Vorteile

- Keine Ausfälle durch transiente Überspannungen
- Externe überspannungsbegrenzende Bauelemente wie z.B. Z-Dioden, Supressordioden, Varistoren etc. sind überflüssig
- Eine spannungsmäßige Überdimensionierung der MOSFET ist nicht notwendig.

Max. Avalanche-Energie

Parameter: $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $L = 21{,}4\ \mu$H



Technische Angaben

SIPMOS-Kleinsignaltransistoren

Transistoren im Bereich 50 V ... 600 V und 40 mA ... 4400 mA

Produktpalette

- N- und P-Kanal-Transistoren
- Anreicherungstransistoren
- Verarmungstransistoren
- Logic Level Transistoren
- Hochsperrende Transistoren
- Bedrahtete- und SMD-Bauformen
- Die-Produkte

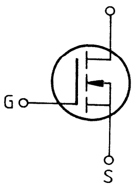
Einsatzgebiete (Auswahl)

- Universell einsetzbar in Nachrichtentechnik, Messen, Steuern, Regeln, Kfz
- Konstantstromquellen
- Strombegrenzer
- Hilfsstromversorgungen
- Konstantspannungsquellen
- Näherungsschalter

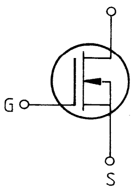
Literaturhinweise

SIPMOS Kleinsignaltransistoren
Bestell-Nr. B352-B6155-X-X-7400

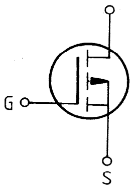
N-Kanal
Anreicherungstyp



N-Kanal
Verarmungstyp



P-Kanal
Anreicherungstyp



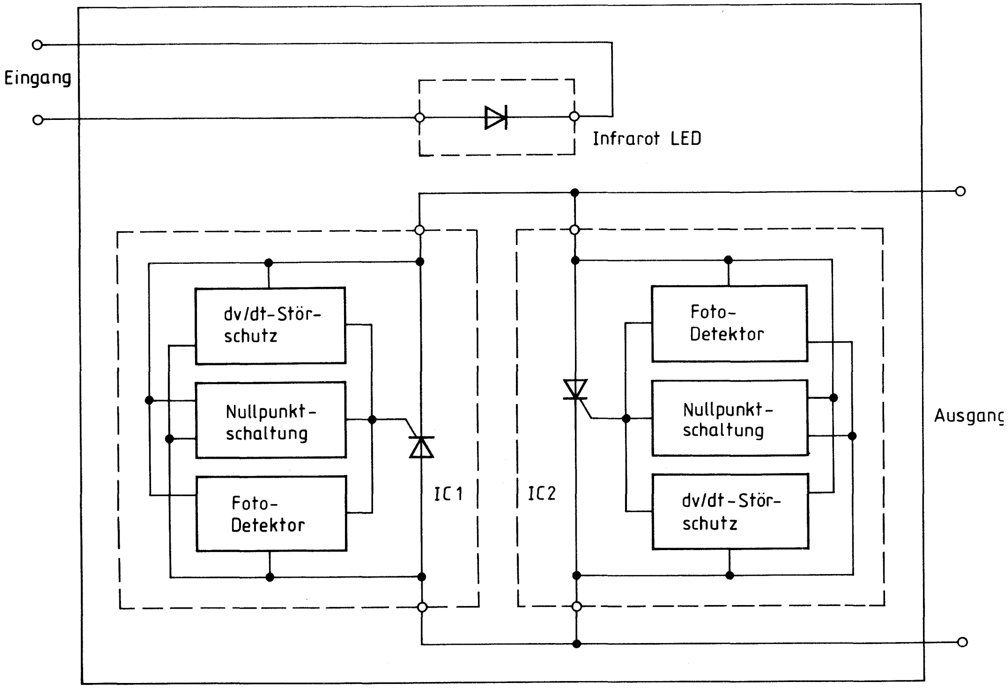
SITAC-AC-Schalter

(SITAC = **Si**emens **I**solierter **T**hyristor **AC** Schalter)

Der SITAC ist ein Wechselstromschalter, bei dem Steuer- und Lastkreis optisch gekoppelt sind. Damit läßt sich durch einen Steuerstrom (wenige mA) am 220-V-Netz eine Last von 65 W (300 mA) direkt schalten. Trotz dieser relativ hohen Ansteuerempfindlichkeit ist der Ausgang des SITAC unempfindlich gegenüber steilen Spannungsanstiegsflanken ($dv/dt_{cr} \geq 10.000$ V/µs), hohen Stromanstiegsgeschwindigkeiten ($di/dt_{cr} \geq 8$ A/µs) sowie gegenüber jeglicher Kommutierungsbeanspruchung.

Ein besonderer Vorteil des SITAC ist die Fähigkeit, induktive Lasten problemlos zu schalten. Die maximale Betriebsfrequenz beträgt 1,5 kHz. Standardmäßig werden die Anforderungen einer sicheren elektrischen Trennung für Isolationsgruppe C bei einer Bezugsspannung bis 250 V_{AC} nach DIN VDE 0804/1.83 erfüllt. SITAC für eine maximale Betriebsisolationsspannung von 630 V nach VDE 0884 sind als Option 1 lieferbar.

Aufbau



Kommutierungsverhalten

Bei Verwendung eines Triac am Ausgang ergeben sich wegen struktureller Verknüpfung der beiden integrierten Thyristorsysteme Schwierigkeiten bei der Kommutierung. Der Triac kann nach Abschalten des Steuerstroms durch Parasitärzündung weiter leitend bleiben. Durch die Ausstattung mit zwei separaten Thyristor-Chips mit hoher dv/dt-Festigkeit ist auch für den Kommutierungsfall keine RC-Beschaltung notwendig.

Ansteuerung und Einschaltverhalten

Der Zündstrom des SITAC besitzt einen positiven Temperaturgradienten. Vom Anlegen des Steuerstroms bis zum Einschalten des Laststroms vergeht die Zündverzugszeit (t_{gd}). Sie ist im wesentlichen eine Funktion der Übersteuerung, das ist das Verhältnis vom angebotenen Steuerstrom zum Zündstrom (I_F/I_{FT}). Entspricht der Steuerstrom gerade dem individuellen Zündstrom eines SITAC, dann ergeben sich Einschaltverzugszeiten in der Größenordnung von Millisekunden. Als kürzeste Zeiten sind 5...10 µs für eine Übersteuerung ≥ 10 erreichbar. Die Zündverzugszeit steigt mit höherer Temperatur an.

Für sehr kurze Steuerstromimpulse ($t_{pIF} < 500$ µs) muß ein entsprechend höherer Steuerstrom angeboten werden. Für diese Betriebsart eignet sich nur der SITAC ohne Nullpunktschalter.

Nullpunktschalter

Der SITAC mit Nullpunktschalter kann nur im Bereich des Nulldurchgangs der Sinus-Wechselspannung gezündet werden. Dies verhindert Stromspitzen z. B. beim Einschalten von kalten Lampen oder kapazitiven Lasten.

Anwendungen

Direkter Schalterbetrieb: Der SITAC eignet sich hier bevorzugt zum Steuern von Synchronmotoren, Ventilen, Relais und Hubmagneten in Grätz-Schaltungen. Wegen seines niedrigen Einraststroms (500 µA) lassen sich auch sehr kleine Lastströme problemlos schalten. Dies gilt besonders auch deshalb, weil der SITAC keine RC-Beschaltung am Ausgang benötigt.

Indirekter Schalterbetrieb: Der SITAC dient in diesem Fall als Treiber. In dieser Funktion ermöglicht er ein Ansteuern von Thyristoren und Triacs höherer Leistung durch Mikroprozessoren. Der Treiberstrompuls darf den maximal zulässigen Stoßstrom des SITAC nicht überschreiten. Für den SITAC ohne Nullpunktschalter ist deshalb in vielen Fällen eine Strombegrenzung durch einen Vorwiderstand notwendig.

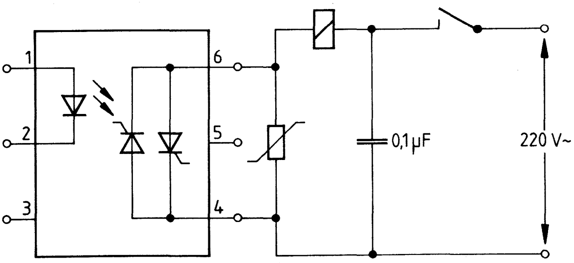
Auch in dieser Betriebsart ist der geringe Einraststrom vorteilhaft, weil sich daraus Wechselstromschalter ergeben, die Lastströme von wenigen Milliamper bis zu hohen Strömen störungsfrei schalten.

Anwendungshinweise:

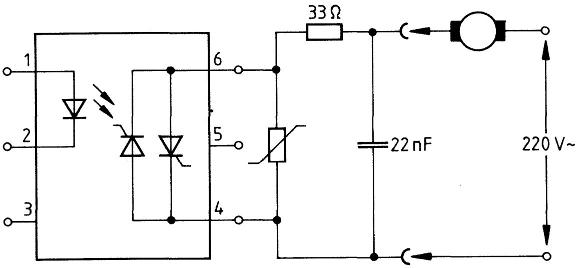
- **Schutz gegen Überspannungen:** Kann durch einen spannungsbegrenzenden Varistor erfolgen (z. B. SIO VS05K250), der unmittelbar an den SITAC-Ausgang angeschlossen wird.
- **Stromkommutierung:** Die Werte 100 A/ms mit nachfolgender Rückstromspitze > 80 mA dürfen nicht überschritten werden.

- **Vermeiden von hochfrequenten Abschalt-Stromoszillationen:** Dieser Effekt kann auftreten, wenn ein Stromkreis geschaltet wird. Stromoszillationen, die im wesentlichen bei induktiven Lasten mit größerer Wicklungskapazität entstehen, wirken sich als Stromkommutierung aus und können relativ hohe Rückstromspitzen erzeugen. Wir empfehlen für die Betriebsfälle folgende alternative Schutzmaßnahmen:

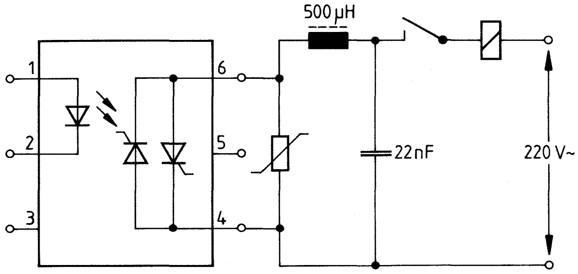
1. Abschluß der Anschlußleitungen zur Spannungsversorgung lastseitig mit einem Kondensator.



2. Vorschalten eines Widerstandes am SITAC-Ausgang und Überbrükken dieser Reihenschaltung mit einem Kondensator.



3. Vorschalten einer Drossel mit geringer Wicklungskapazität (z. B. Ringkerndrossel), bei höheren Lastströmen.



Die Maßnahmen nach 2 und 3 sind besonders dann erforderlich, wenn während des Betriebs die Last vom SITAC abgetrennt wird. Bei SITAC-Stromkreisen, die über Transformatoren mit dem Netz gekoppelt sind, und die intern keine mechanische Stromunterbrechung erfahren, treten die Effekte nicht auf. Die diesbezüglichen Schutzbeschaltungen können entfallen; dies gilt hier auch für Anwendungsfälle mit rein ohmscher Last.

Literaturhinweise

SIPMOS Kleinsignaltransistoren
Bestell-Nr. B352-B6155-X-X-7400

Option 1

SITAC für sichere elektrische Trennung nach VDE 0884

Dieses Bauelement ist für sichere elektrische Trennung **nur** innerhalb der Sicherheitsgrenzdaten geeignet. Die Einhaltung der Sicherheitsgrenzdaten muß durch Schutzschaltungen sichergestellt sein.

Die Teilentladungsmessung stellt sicher, daß während des Betriebs mit der maximal zulässigen Betriebsisolationsspannung (V_{IORM}) keine Teilentladung auftritt. Fortwährende Teilentladung schädigt die Isolationsmaterialien und kann zum Hochspannungsdurchschlag führen.

Von Prüfungen mit der Isolationsprüfspannung (V_{ISOL}) ist abzuraten. Dabei könnten Teilentladungen auftreten, die die Isolationseigenschaften so verschlechtern, daß dann auch bei Betrieb mit der maximal zulässigen Betriebsisolationsspannung Teilentladungen auftreten können. Die Isolationsprüfung nach VDE 0884 ist allen anderen Hochspannungsprüfungen nachgeschaltet.

Isoliereigenschaften

(Alle angegebenen Spannungen sind Scheitelwerte.)

Bezeichnung	**Symbol**	**Werte**	**Einheit**
Einsatzklasse (DIN VDE 0109, Dez. 83, Tab.[1]) für Nenn-Netzspannungen ≤ 300 V_{eff} für Nenn-Netzspannungen ≤ 600 V_{eff}		 I – IV I – III	–
Klimatische Prüfklasse (DIN IEC 68 Teil 1/09.80)		55/150/21	–
Verschmutzungsgrad (DIN VDE 0109 Dez. 83)		2	–
Max. Betriebsisolationsspannung	V_{IORM}	630	V
Prüfspannung Eingang/Ausgang, Verfahren b) [1]) $V_{Pr} = 1,6 \times V_{IORM}$, Stückprüfung mit $t_P = 1$ s TE < 5 pC	V_{Pr}	1000	
Prüfspannung Eingang/Ausgang, Verfahren a) [1]) $V_{Pr} = 1,2 \times V_{IORM}$, Typ- und Stichprobenprüfung mit $t_P = 60$ s, TE < 5 pC	V_{Pr}	720	
Höchste zulässige Überspannung [1]) (Transiente Überspannung, $t_{Tr} = 10$ s, Verfahren a)	V_{Tr}	6000	
Sicherheitsgrenzwerte (im Fehlerfall maximal zulässige Werte, siehe auch Diagramm)		DIP-6	
● Gehäusetemperatur	T_{si}	175	°C
● Strom (Eingangsstrom I_F, $P_{si} = 0$)	I_{si}	400	mA
● Leistung (Ausgangs- bzw. Gesamtverlustleistung)	P_{si}	2000	mW
Isolationswiderstand bei T_{si} $V_{I/O} = 500$ V	R_{ISOL}	$\geq 10^9$	Ω

---

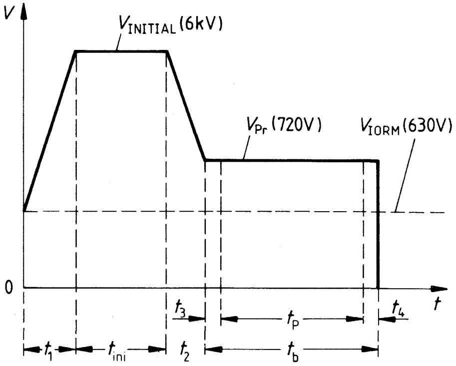
[1]) siehe Zeit-Prüfspannungsdiagramm.

Zeit-Prüfspannungs-Diagramm nach VDE 0884

Verfahren a)

(für Typ- und Stichprobenprüfung, zerstörende Prüfung)

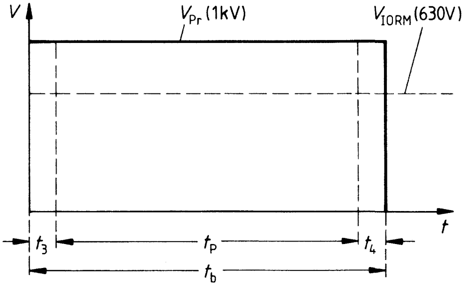
t_1, t_2 = 1 bis 10 s
t_3, t_4 = 1 s
t_p (Meßzeit für TE) = 60 s
t_b = 62 s
t_{ini} = 10 s



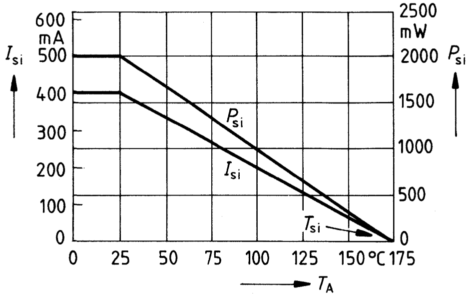
Verfahren b)

(für Stückprüfung, zerstörungsfreie Prüfung)

t_3, t_4 = 0,1 s
t_p (Meßzeit für TE) = 1 s
t_b = 1,2 s



Sicherheitsgrenzdaten nach VDE 0884
für SITAC BRT11 und BRT12



P_{si} = Sicherheitsgrenzleistung
I_{si} = Sicherheitsgrenzstrom
T_{si} = Sicherheitsgrenztemperatur

Option 6

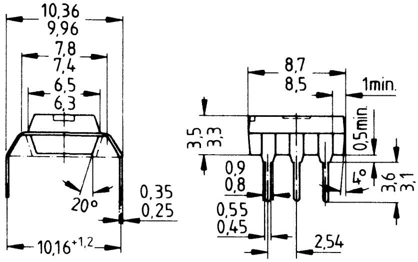
SITAC mit
Anschlüssen im 10,16-mm-Raster

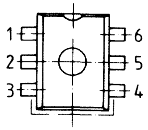
Die Anschlüsse sind aufgebogen auf 10,16-mm-Raster. Vom Standardtyp abweichende Abmessungen:

Rastermaß	10,16 mm
Kriechstrecke	$>$ 8,0 mm
Luftstrecke	$>$ 8,0 mm

Es werden zusätzlich folgende Normen erfüllt:

- DIN IEC 380/VDE 0806/8.81
  Verstärkte Isolierung bis zu einer Betriebsspannung von 250 $V_{\mathrm{AC\ eff}}$
- DIN IEC 435/VDE 0805 Entwurf Nov. 84.
  Verstärkte Isolierung bis zu einer Betriebsspannung von 250 $V_{\mathrm{AC\ eff}}$





Maße in mm
— — — Luft-Kriechstrecke 8,0 min.

Anschlußbelegung siehe Kapitel Package Outlines.

Option 7
SITAC mit Anschlüssen für SMD Montage

Diese Version ist für SMD Montage geeignet.

Vom Standardtyp abweichende Abmessungen:

Kriechstrecke	> 8,0 mm
Luftstrecke	> 8,0 mm

Es werden zusätzlich folgende Normen erfüllt:

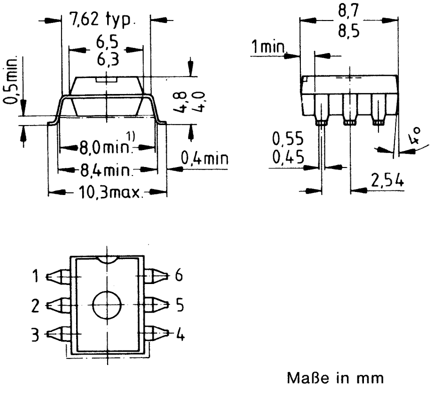
- DIN IEC 380/VDE 0806/8.81
  Verstärkte Isolierung bis zu einer Betriebsspannung von 250 $V_{\text{AC eff}}$
- DIN IEC 435/VDE 0805 Entwurf Nov. 84.
  Verstärkte Isolierung bis zu einer Betriebsspannung von 250 $V_{\text{AC eff}}$

Um die Isolationseigenschaften nicht zu beeinträchtigen, darf das Gehäuse während des Lötvorgangs nicht durch das Lötzinn benetzt werden.

Zulässig sind (außer Kolbenlötung) nur Reflowlötverfahren: (Vaporphase, Infrarot- und Heizgas-Lötung).

Zulässige Lötbedingungen:	260 °C	10 s
	:	:
	215 °C	30 s

Der Lötvorgang darf max. zweimal wiederholt werden. Dabei ist jedoch zu beachten, daß das Bauteil zwischen den Lötungen auf 25 °C abkühlt.



Maße in mm

[1]) Luft-Kriechstrecke ist beim Lötpaddesign zu beachten.
— — — Luft-Kriechstrecke 8,0 min.

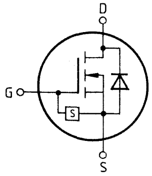
Anschlußbelegung siehe Kapitel Package Outlines.

Smart SIPMOS

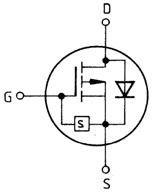
TEMPFET (Temperature Protected FET)

SIPMOS Leistungstransistor mit thermisch gekoppeltem Temperatursensor in „Chip-on-chip“-Technologie mit integrierten Schutzfunktionen gegen Übertemperatur, Überlast und Kurzschluß.

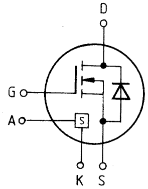
N-Kanal



P-Kanal

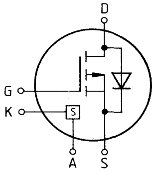


N-Kanal



Separater Sensor-Anschluß

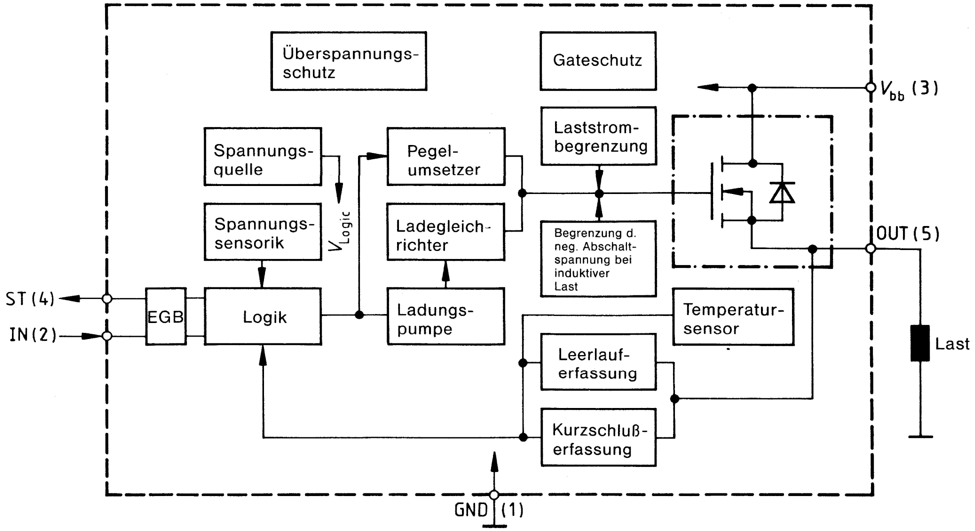
P-Kanal

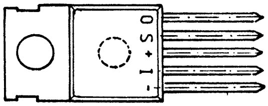


Separater Sensor-Anschluß

PROFET (Protected FET)

Intelligenter CMOS-kompatibler SIPMOS Leistungstransistor in Monolith- oder „Chip-on-chip“-Technologie, mit Statusrückmeldung und integrierten Schutzfunktionen gegen Kurzschluß, Übertemperatur, Überlast, Überspannung, ESD etc., zum Schalten masseseitiger Lasten.





O (OUT)	Ausgang (5)
S (ST)	Status (4)
+ (V_{bb})	Betriebsspannung (3)
I (IN)	Eingang (2)
– (GND)	Masse (1)

Produktpalette

- P- und N-Kanal-Anreicherungstypen
- Bedrahtete und SMD-Versionen
- Logic Level
- Schalter für masseseitige Lasten
- Schalter für batterieseitige Lasten
- Dimmer
- FREDFET
- Die-Produkte

Einsatzgebiete (Auswahl)

- Industrieelektronik
  Programmierbare Maschinensteuerungen
- Autoelektronik
  ABS
  Motormanagement
  Getriebesteuerungen
  Beleuchtung

Literaturhinweise

Smart SIPMOS, TEMPFET und PROFET
Bestell-Nr. B352-B6138

Technische Angaben

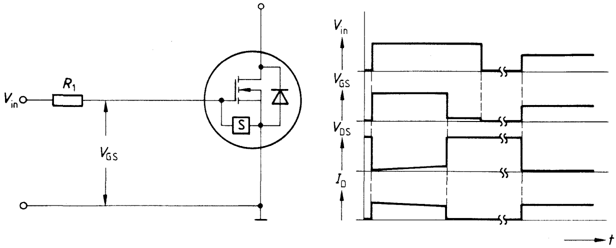
Funktionstabelle PROFET

Typ BTS ...	**412**	**412**	**413A**	**410** **432** **542**	**410** **432** **542**	**410** **432** **542**	**410**
Logik-Version	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Schalter für masseseitige Lasten	X	X	X	X	X	X	X
Eingangsschutz	X	X	X	X	X	X	X
Übertemperaturschutz							
($T_j > 150$ °C) Latch-Funktion	X	X	X	X		X	
($T_j > 150$ °C) mit Wiedereinschalten bei Unterschreitung der Temperaturschwelle					X		X
Kurzschlußschutz							
Durch Abschalten nach ca. 40 µs, wenn $V_{out} \leq 3$ V	X		X				
Durch Abschalten nach ca. 150 µs, wenn Spannungsabfall > 8 V über Leistungstransistor		X		X	X	X	
Durch Übertemperaturschutz.							X
Lastunterbrechungserkennung							
In ausgeschaltetem Zustand bei Prüfstrom von 30 µA.	X	X	X				
In eingeschaltetem Zustand bei 10 mV min. Spannungsabfall über dem Leistungstransistor				X	X	X	X
Statusrückmeldung bei Übertemperatur, Kurzschluß (wo zutreffend) und Lastunterbrechung	X	X	X	X	X	X	X
Begrenzung der negativen Abschaltspannungsspitze bei induktiver Last auf −10 V	X	X	X	X	X	X	X
Elektrostatischer Entladungsschutz (EGB-Schutz)	X	X	X	X	X	X	X
Status-Ausgang							
CMOS-kompatibel	X	X	X	X			
Offener Drain-Anschluß					X	X	X
Ausgangsstrombegrenzung							
(High) Lasten mit hohen Einschaltströmen	X	X	X	X	X		
(Low) besserer Schutz für induktive Lasten						X	X
$R_{DS(on)}$-unabhängig von der Speisespannung		X		X	X	X	X
Unterspannungsabschaltung							
bei $V_{bb} < 7$ V	X						
mit Wiedereinschalten und Hysterese (bei V_{bb} ca. 4 V, 0,5 V Hysterese).		X		X	X	X	X
Status-Rückmeldung bei Unterspannungsabschaltung	X	X		X			
Überspannungsabschaltung mit Wiedereinschalten (V_{bb} ca. 46 V, 0,5 V Hysterese).		X		X	X	X	X
Status-Rückmeldung bei Überspannungsabschaltung		X		X			
Verpolungsschutz BTS 410, 412, 413 mit 150 Ω in der Masse-Leitung	X	X	X	X	X	X	X
Load-dump geschützt bis 80 V (BTS 410 und BTS 412 B bei 150 Ω in der Masse-Leitung)		X		X	X	X	X

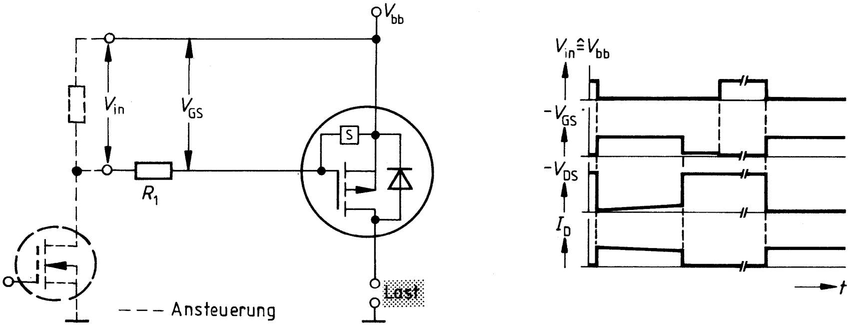
TEMPFET-Beschaltungsvorschriften

Bild 1 Übertemperaturschutz – schließt den Überlastschutz ein.
Schaltpunkt des Temperatursensors 155 °C $< T_{TS} <$ 170 °C

N-Kanal



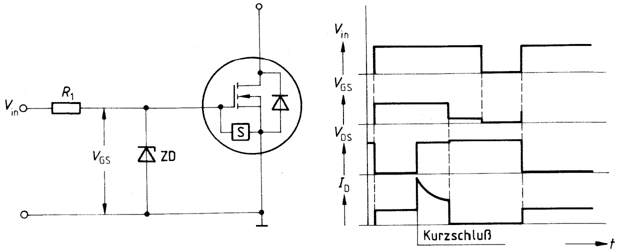
P-Kanal



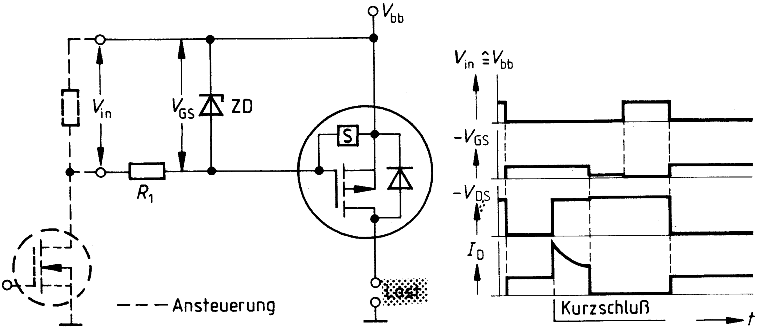
Achtung! Überspannungsschutz vorsehen – siehe Bilder 5 und 6
R_1: Bestimmen des Vorwiderstandes siehe Seite 51; S = Sensor

Bild 2 **Kurzschlußschutz** – schließt den Überlast- und Übertemperaturschutz ein.

N-Kanal



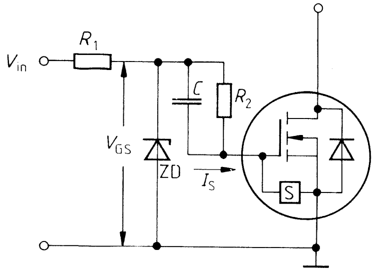
P-Kanal

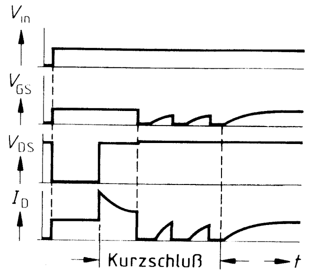


Achtung! Überspannungsschutz vorsehen – siehe Bilder 5 und 6
R_1: Bestimmen des Vorwiderstandes siehe Seite 51; S = Sensor

Bild 3 Kurzschlußschutz mit Wiedereinschalten – schließt den Überlast- und Übertemperaturschutz ein.

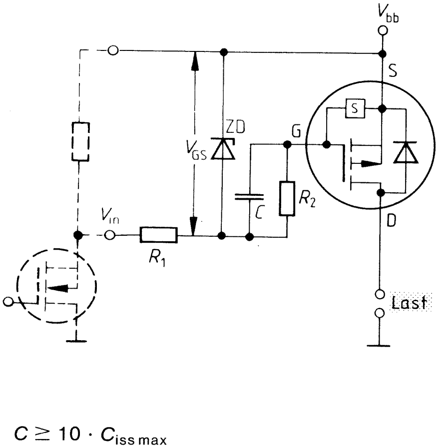
N-Kanal

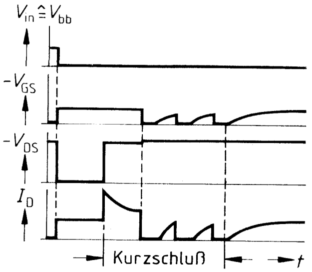




$C \geq 10 \cdot C_{iss\,max}$

P-Kanal





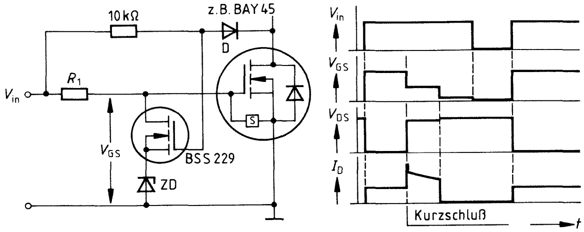
$C \geq 10 \cdot C_{iss\,max}$

Achtung! Überspannungsschutz vorsehen – siehe Bilder 5 und 6.
Kühlkörper notwendig.
R_1, R_2: Bestimmen des Vorwiderstandes siehe Seite 51; S = Sensor

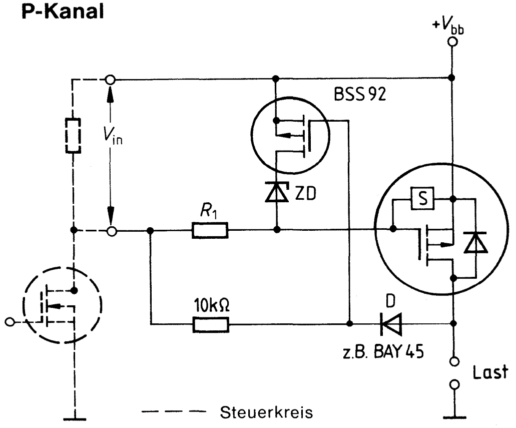
Bild 4 **Optimierter Kurzschlußschutz** – schließt den Überlast- und Übertemperaturschutz ein.

- Strombegrenzung für den Kurzschlußfall, variierbar durch ZD
- Niedriger $R_{DS(on)}$
- Standard-Typen $V_{in(max)} = 20$ V
- Logic-Level-Typen $V_{in(max)} = 10$ V

N-Kanal



P-Kanal



Bestimmen des Vorwiderstandes R_1

- Standard-Typen

$$\frac{V_{in} - 1{,}5\ \text{V}}{10\ \text{mA}} \leq R_1 \leq \frac{V_{in} - 1{,}5\ \text{V}}{0.5\ \text{mA}}$$

- Logic-Level-Typen

$$\frac{V_{in} - 1{,}4\ \text{V}}{5\ \text{mA}} \leq R_1 \leq \frac{V_{in} - 1{,}4\ \text{V}}{0{,}5\ \text{mA}}$$

Bestimmen des Vorwiderstandes R_2

$$1{,}1\,\frac{V_{in} - 1{,}4\ \text{V}}{0{,}05\ \text{mA}} \leq R_2 \leq 1{,}3\,\frac{V_{in} - 1{,}4\ \text{V}}{0{,}05\ \text{mA}}$$

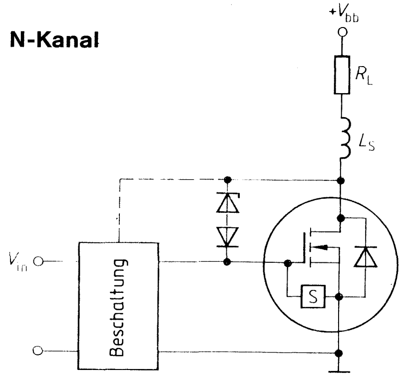
Gilt für alle Beschaltungsvorschriften.

Achtung! Überspannungsschutz vorsehen – siehe Bilder 5 und 6; S = Sensor

Bild 5 Überspannungsschutz für Leitungsinduktivitäten – Variante 1

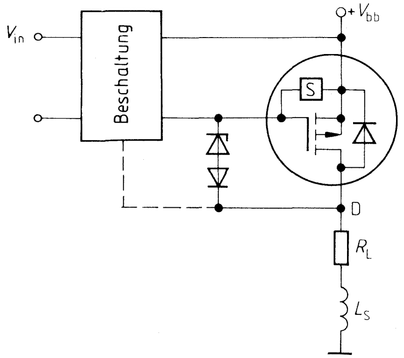
Der Schutz ist so auszulegen, daß die Durchbruchspannung $V_{(BR)DSS}$ nicht überschritten wird.

N-Kanal



$V_{bb} < V_{ZD} < V_{(BR)DSS}$ -10 V

P-Kanal



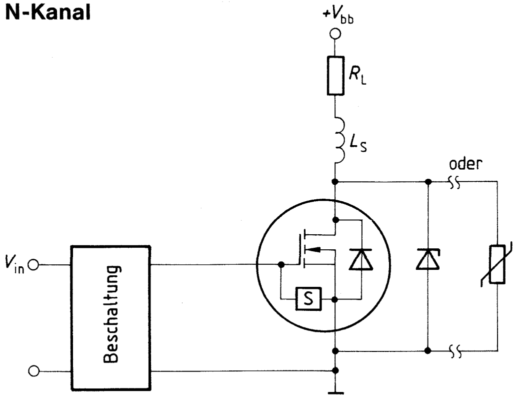
$V_{bb} < V_{ZD} < V_{(BR)DSS}$ -10 V

L_S = Leitungsinduktivität: R_L = Lastwiderstand; S = Sensor

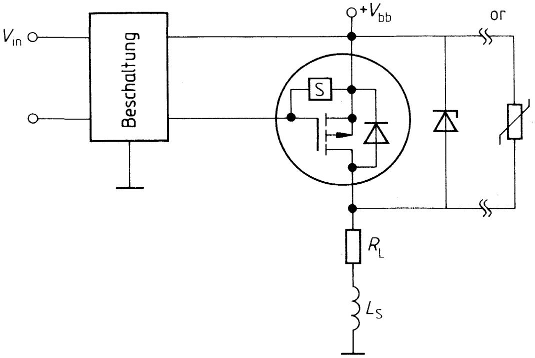
Bild 6 Überspannungsschutz für Leitungsinduktivitäten – Variante 2

Der Schutz ist so auszulegen, daß die Durchbruchspannung $V_{(BR)DSS}$ nicht überschritten wird.

N-Kanal



P-Kanal

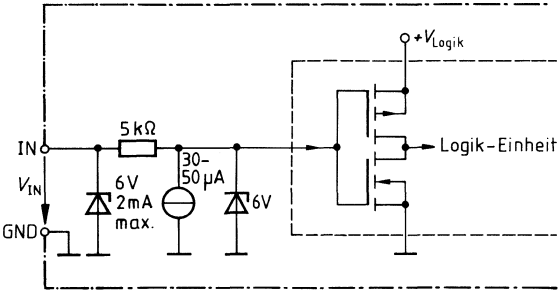


L_S = Leitungsinduktivität: R_L = Lastwiderstand; S = Sensor

PROFET-Beschaltungsvorschriften

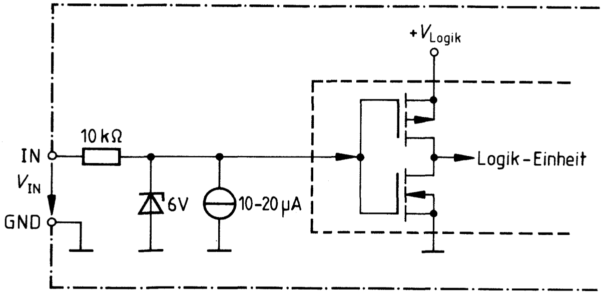
Bild 1 Eingang IN (2):

BTS 410, BTS 412 B, BTS 432, BTS 542



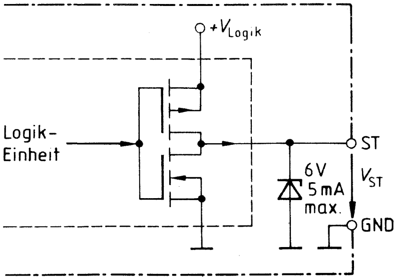
$V_{in(on)}$: 1,9 V typ. mit Hysterese von ca. 0,5 V.

BTS 412 A, BTS 413 A



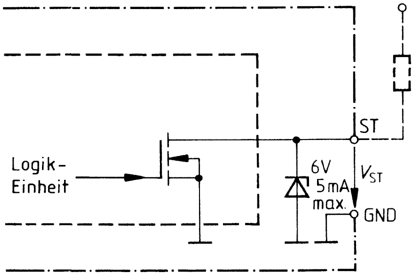
$V_{in(on)}$: 1,9 V typ. mit Hysterese von ca. 0,5 V.

Bild 2 Status-Ausgang ST (4):
CMOS-Ausgang: BTS 412 A, BTS 413 A, BTS 410 D, BTS 412 B, BTS 432 D, BTS 542 D



V_{st} high: 5,2 V typ.; low: 0,4 V (1,6 mA)

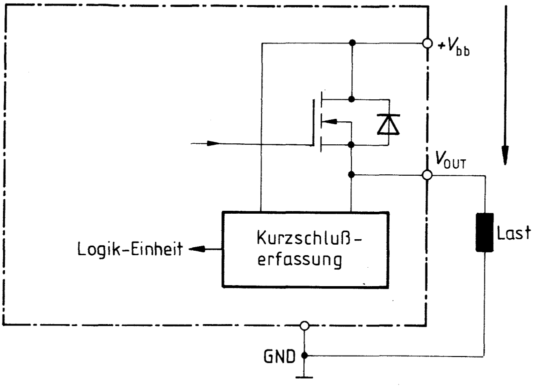
Open-Drain: BTS 410 E/F/G, BTS 432 E/F, BTS 542 E/F



V_{st} high: 6 V typ.; low: 0,4 V (1,6 mA)

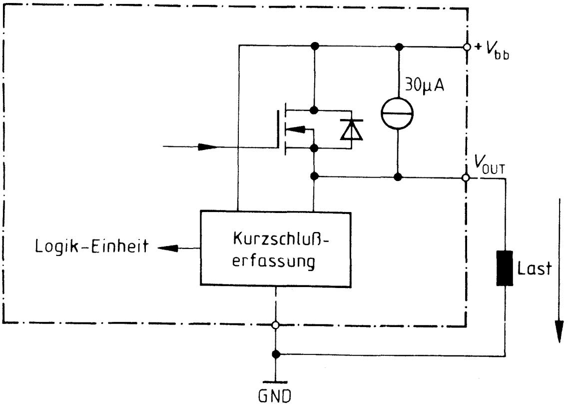
Bild 3 Kurzschlußerkennung

BTS 410, BTS 432, BTS 542, BTS 412 B



Messen des Spannungsabfalls *über dem Leistungstransistor.* Entsteht im *Ein-Zustand* ein Spannungsabfall > 8 V, wird sofort abgeschaltet. Liegt beim *Einschalten* ein Spannungsabfall > 8 V vor, so erfolgt das Abschalten nach 150 µs.

BTS 412 A, BTS 413 A

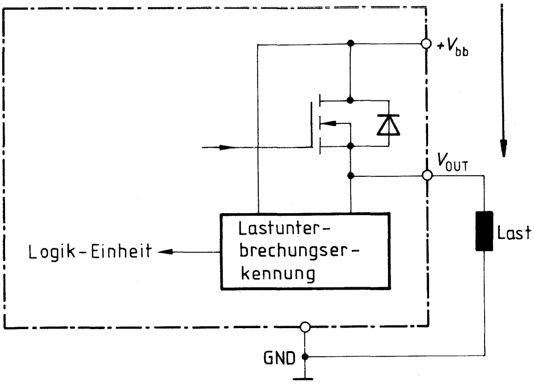


Messen des Spannungsabfalls *über der Last.* Entsteht *im Ein-Zustand* ein Spannungsabfall < 3 V, wird sofort abgeschaltet. Liegt beim *Einschalten* ein Spannungsabfall < 3 V vor, so wird nach 40 µs abgeschaltet.

Bild 4 Lastunterbrechungserkennung

Bedingungen: V_{bb}–$V_{OUT} < 10$ mV; IN: high

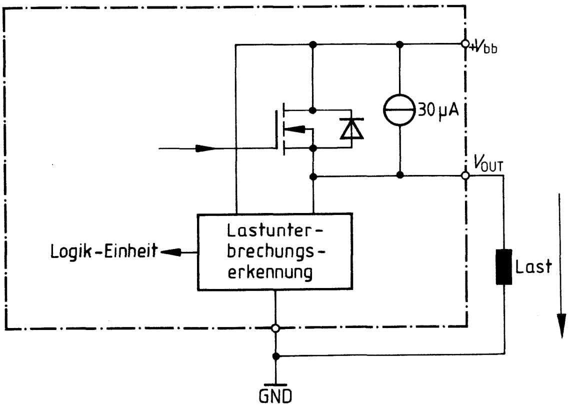
BTS 410, BTS 432, BTS 542



Überwachen des Spannungsabfalls *über dem Leistungstransistor im Ein-Zustand.*

Bedingungen: $V_{OUT} > 3$ V; IN: low

BTS 412 A, BTS 412 B, BTS 413 A



Überwachen der Spannung *zwischen Ausgang und Masse im Aus-Zustand* (Prüfstrom 30 µA).

Elektromagnetische Verträglichkeit (EMV) in Kraftfahrzeugen

Leitungsgeführte Störgrößen auf Versorgungsleitungen in 12-V-Bordnetzen.
(DIN 40 839, Teil 1, Anhang B; Auszug)

Störfestigkeitsgrade

B.1 Einleitung

Dieser Anhang soll Herstellern und Anwendern von elektronischen Systemen für Kraftfahrzeuge Kriterien aufzeigen, nach denen sie gemeinsam die Bedingungen für die Störfestigkeit festlegen können, die diese Geräte im Einzelfall zu erfüllen haben. Die Verträglichkeit eines Gerätes gegenüber leitungsgeführten Störgrößen ist gegeben durch den gewählten Funktionszustand des Gerätes bei Anwendung von Prüfimpulsen bestimmter Schärfegrade.

B.2 Funktionszustände

B.2.1 Funktionszustand A

Gerät arbeitet innerhalb der vorgegebenen Toleranzen.

B.2.2 Funktionszustand B

Gerät arbeitet, jedoch außerhalb der vorgegebenen Toleranzen, und kehrt nach Abklingen der Störung wieder in Funktionszustand A zurück.

B.3 Schärfegrade der Prüfimpulse

Die Prüfimpulse selbst sind in den Abschnitten 4.6.1 bis 4.6.5 (DIN 40 839) beschrieben.
Der Schärfegrad ist durch die aus Tabelle B.1 gewählte Höhe der Amplitude V_s bestimmt.

Tabelle B.1.

V_s / Prüfimpuls	Schärfegrad				Mindest-Prüfumfang
	I	II	III	IV	
1	-25 V	-50 V	- 75 V	-100 V	5000 Impulse
2	+25 V	+50 V	+ 75 V	+100 V	5000 Impulse
3 a	-40 V	-75 V	-110 V	-150 V	1 h
3 b	+25 V	+50 V	+ 75 V	+100 V	1 h
4	- 3 V	- 5 V	- 6 V	- 7 V	einmalig
5	+35 V	+50 V	+ 80 V	+120 V	einmalig

Aus technisch-wirtschaftlichen Gründen ist zu beachten, daß ein Gerät nur mit solchen Impulsen geprüft wird, denen es in der Praxis auch tatsächlich ausgesetzt ist.

SIMOPAC®-Leistungsmodule

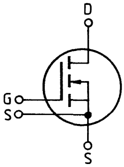
SIMOPAC-Module sind leistungsstarke SIPMOS-Schalter, die durch Parallelschalten mehrerer SIPMOS-Transistorchips hohe Ströme schalten können.

Die aus einem Halbleiterwafer/Charge entnommenen Chips sind auf einem rotationssymmetrischen vollisolierten Keramik-Substratträger (DCB = direct copper bonding) aufgebaut, der nach HF-technischen Gesichtspunkten entwickelt wurde. Bereits auf Chipebene wird eine Trennung von Steuer- und Lastkreis vorgenommen, um sourceseitig gegenkoppelnde Induktivitäten (Bondinduktivität) zu eliminieren. Speziell zum Schalten induktiver Lasten sowie für Brückenkonfigurationen wurden die SIMOPAC-FREDFET-Module (**F**ast **R**ecovery **E**ptaxial **D**iode-FET) entwickelt. Sie zeichnen sich durch sehr kleine Sperrverzögerungsladung und damit geringerer Sperrverzögerungszeit der im SIPMOS-Transistor vorhandenen parallelen Diode aus.

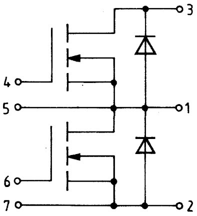
Produktpalette

● Einzelschalter	100 V ... 1000 V; 200 A ... 28 A
● Halbbrücken	100 V ... 1000 V; 2 x 125 A ... 2 x 18 A
● 3-Phasen-Vollbrücken	500 V ... 1000 V; 6 x 17 A ... 6 x 4,8 A

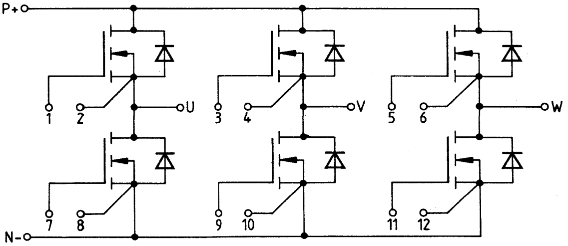
Einzelschalter



Halbbrücke



3-Phasen-Vollbrücke



Einsatzgebiete (Auswahl)

- Schweißgeräte
- USV-Anlagen
- Induktive Erwärmung
- Getaktete Hochstromversorgungen
- Antriebstechnik

Literaturhinweise

Leistungshalbleiter SIPMOS und IGBT
Bestell-Nr. B152-B6299-X-X-7400

IGBT-Leistungsmodule (**I**nsulated **G**ate **B**ipolar **T**ransistoren)

IGBT sind MOS-gesteuerte Hochstrom-Hochspannungsschalter für getaktete Anwendungen im Frequenzbereich 2 kHz ... > 20 kHz. Die erreichbare Schaltfrequenz wird im wesentlichen durch den beim Abschalten des IGBT exponentiell abklingenden Tailstrom bestimmt. Der Tailstrom ist temperaturunabhängig und beträgt 5 ... 10 % des Nennstromes I_C. Das gewählte Design des IGBT verhindert zuverlässig das beim Abschalten mögliche „Latchen" (einrasten) und weist für alle IGBT-Bauelemente ein rechteckförmiges RBSOA-Diagramm auf. Im Kurzschlußfall ist der Kollektorstrom bei gegebener Gatespannung über den gesamten Bereich nahezu unabhängig von der Kollektor-Emitter-Spannung; es tritt kein „thermisches Weglaufen" auf. Ein Abschalten des Kurzschlußstroms ist innerhalb von 10 µs problemlos möglich.

Produktpalette

Kollektorstrom I_C bei T_C = 80 °C	V_{CE} = 1000 V			V_{CE} = 1200 V		
	Einzelschalter	Halbbrücke Chopper	Vollbrücke	Einzelschalter	Halbbrücke Chopper	Vollbrücke
15 A	-	-	BSM 15 GD 100 D	-	-	BSM 15 GD 120 D
25 A	-	BSM 25 GB 100 D	BSM 25 GD 100 D	-	BSM 25 GB 120 D	BSM 25 GD 120 D
50 A	-	BSM 50 GB 100 D	-	-	BSM 50 GB 120 D	-
75 A	-	BSM 75 GB 100 D	-	-	BSM 75 GB 120 D	-
100 A	-	BSM 100 GB 100 D	-	-	BSM 100 GB 120 D	-
150 A	-	BSM 150 GB 100 D	-	-	BSM 150 GB 120 D	-
200 A	BSM 200 GA 100 D	-	-	BSM 200 GA 120 D	-	-
300 A	BSM 300 GA 100 D	-	-	BSM 300 GA 120 D	-	-

Einsatzgebiete (Auswahl)

- DC-/AC-Antriebstechnik
- USV-Anlagen
- Getaktete Hochstromversorgungen
- Schweißanlagen

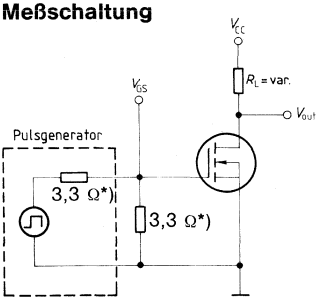
Literaturhinweise

Leistungshalbleiter SIPMOS und IGBT
Bestell-Nr. B152-B6299-X-X-7400

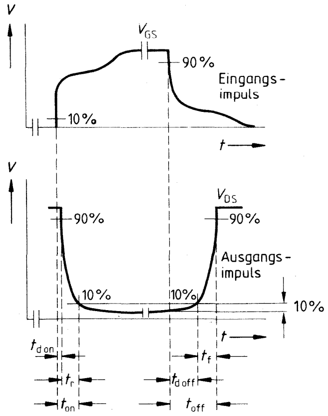
Schaltzeitmessung und Verlustleistung

Leistungstransistoren/Kleinsignaltransistoren/SIMOPAC®-Leistungsmodule

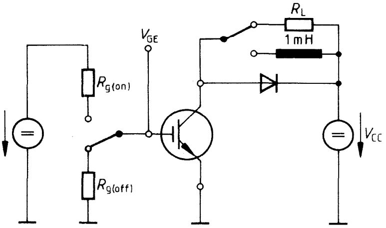
Meßschaltung



Definition



IGBT-Leistungsmodule Meßschaltung



Definition der Verlustleistungen

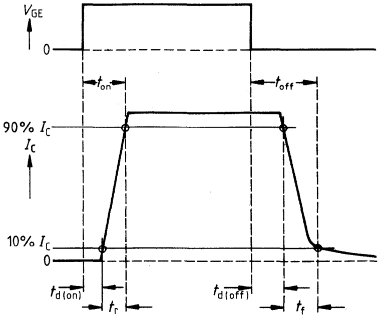
$$E_{off} = E_{off\,1} + E_{off\,2} \qquad \Delta\, V_{CE} \leq 0{,}2 \times V_{CE}$$

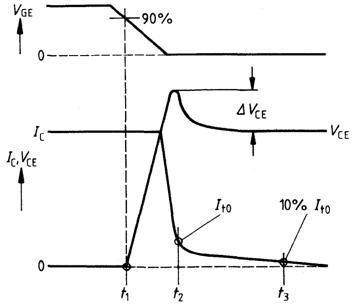
$$I_{t0} \approx 0{,}1 \times I_C$$

$$E_{off\,1} = \int_{t_1}^{t_2} v_{CE(t)} \times i_C \; dt$$

$$E_{off\,2} = \int_{t_2}^{t_3} v_{CE(t)} \times i_C \; dt$$

Definition der Schaltzeiten





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*) Bei Leistungs- und Kleinsignaltransistoren 50 Ω

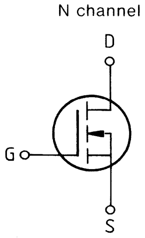
SIPMOS Power Transistors And Diodes

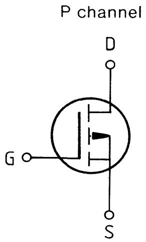
SIPMOS Power Transistors

Transistors in the range of 50 V … 1000 V, 1.5 A … 60 A and 18 mΩ … 8 Ω.

Product range

- N and P channel enhancement types
- FREDFET
- Logic level
- Leaded and SMD versions
- Die products



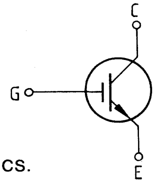


SIRET

Fast bipolar power transistor in the range of 1000 V and 20 A without second breakdown.

IGBT

High-blocking voltage-controlled bipolar transistors.

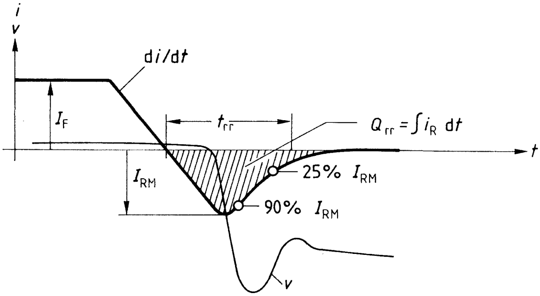


Fast-Recovery Epitaxial Diodes

Free-wheel diode for super-fast switches with soft-recovery characteristics.

Application (selection)

- Switched-mode power supplies
- DC converters
- Inverters
- Motor controllers
- Uninterruptible power systems (UPS)
- Proximity switches
- Ultrasonic generators
- Flicker-free monitors
- AF amplifiers
- Frequency converters for 3-phase motors
- Switched-mode power supplies for welding equipment
- Automotive ignitions



Literature

Power Semiconductors SIMPOS and IGBT
Ordering No. B152-B6299-X-X-7400

Application Notes for SIPMOS Transistors
Ordering No. B352-B6084-X-X-7600

Avalanche

A measure of the ruggedness of a MOSFET is its overvoltage strength. Due to the unavoidable parasitic inductances L_p in a circuit, no matter how carefully it is designed, overvoltage $L_p\, di/dt$ occurs when transistors are turned off.

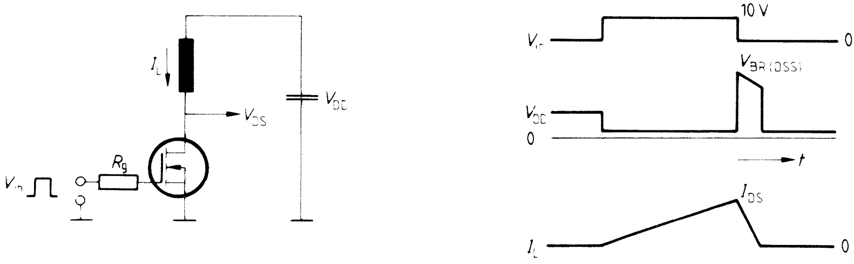
Owing to the short switching times of MOSFETs this can be especially critical when high currents are switched, since the voltage peaks that appear at turn-off can exceed the breakdown voltage $V_{BR(DSS)}$ of the transistor. The transistor goes into avalanche. So the manufacturer, through careful transistor design, has to reduce the possibility of the parasitic bipolar structure turning on and destroying the transistor.

All SIPMOS transistors are put through a 100 % breakdown test. The principle of the test circuit is shown in the figure below. The device under test is in series with an unclamped inductance and, after it is turned on, the current increases linearly until it has reached its specified value (usually the current rating).

When the transistor is turned off, a drain-source voltage – as a function of the inductance – is formed across the DUT that is limited to the breakdown voltage $V_{BR(DSS)}$ of the component. The energy that is stored in the coil and a portion from the voltage source is converted in the component.

$W = 1/2\ L \times I^2 \times V_{BR(DSS)} / (V_{BR(DSS)} - V_{CC})$

Avalanche test circuit e.g. BUZ 338



The energy converted in the component is limited by the maximum permissible chip temperature T. The figure below shows the maximum permissible breakdown energy as a function of the chip temperature.

In an application it is necessary to remember that the breakdown losses are added to the switching losses and forward losses.

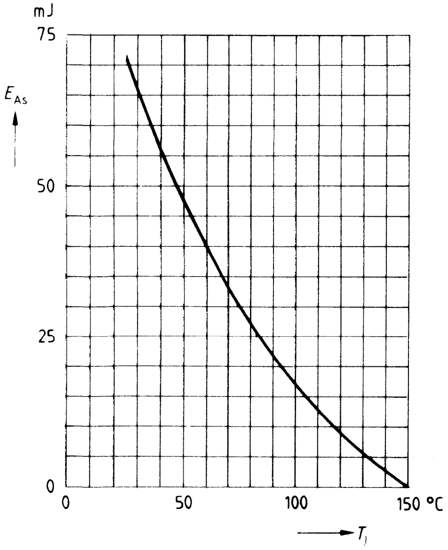
$$P_{tot} = P_s + P_F = P_{BR}$$

Consequently the aim of careful circuit design must always be to minimize the parasitic inductance and thus reduce the breakdown losses.

Advantages

- No failures through transient overvoltages
- There is no need for external components to limit overvoltage, e.g. Zener diodes, suppressor diodes, varistors, etc.
- No overscaling of the MOSFET in terms of voltage is called for.

Max. avalanche energy
parameter: $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $L = 21.4\ \mu$H



SIPMOS Small-Signal Transistors

Transistors in the range of 50 V ... 600 V and 40 mA ... 4400 mA.

Product range

- N and P channel transistors
- Enhancement transistors
- Depletion transistors
- Logic level transistors
- High-blocking transistors
- Leaded and SMD versions
- Die products

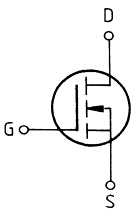
Application (selection)

- Suitable for all purposes in
  telecommunication
  measuring and control
  automobiles
- Constant-current sources (CCS)
- Current limiters
- Auxiliary current supplies
- Constant-voltage sources

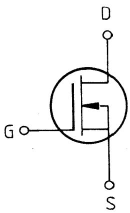
Literature

SIPMOS Small-Signal Transistors
Ordering No. B352-B6155-X-X-7400

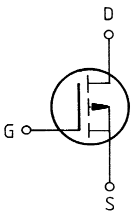
N channel
Enhancement mode



N channel
Depletion mode



P channel
Enhancement mode



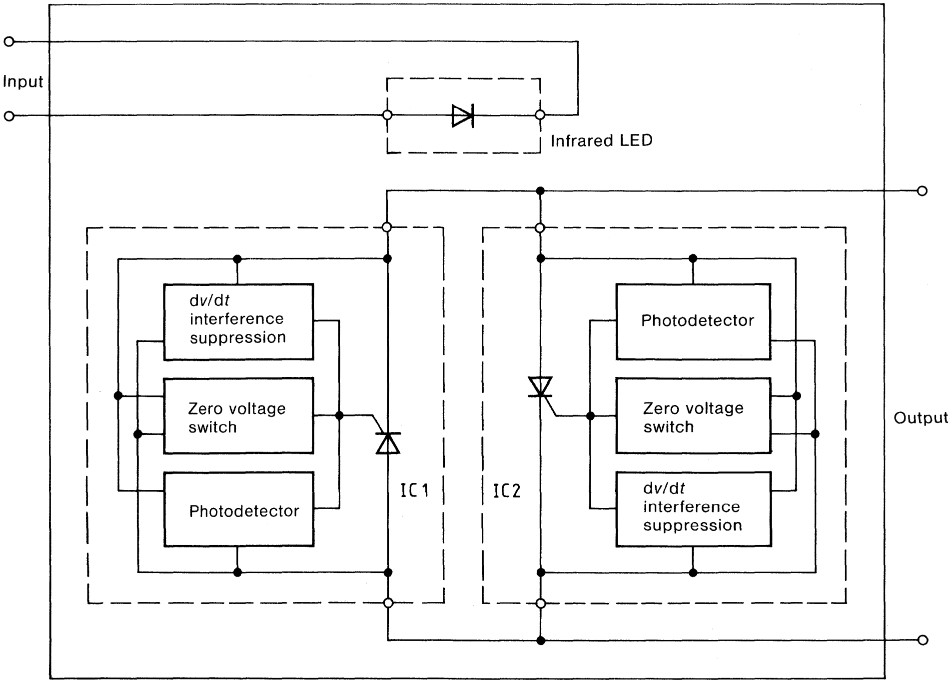
SITAC AC Switch

(SITAC = **S**iemens **I**nsulated **T**hyristor **AC** Switch)

The SITAC AC switch consists of optically coupled input and output circuits which can directly switch a load of 65 W (300 mA) on a 220 V-line using a control current of a few mA only. Despite this relatively high control sensitivity, the output of the switch is not sensitive to steep edges of voltage rise ($dv/dt_{cr} \geq 10000$ V/µs), high rates of current rise ($di/dt_{cr} \geq$ 8 A/µs) nor to any commutation stress.

A special feature of the SITAC is the switching of inductive loads without problems. The maximum operating frequency is 1.5 kHz. The switch complies with the standards of safe electrical separation for insulation group C at a reference voltage up to 250 V_{AC} according to DIN VDE 0804/1.83. SITAC switches for a maximum operating insulation voltage of 630 V in accordance with VDE 0884 are available as Option 1.

Circuit Design



Commutating Behavior

The use of a triac at the output creates difficulties in commutation due to both the built-in coupled thyristor systems. The triac can remain conducting by parasitic triggering after turning off the control current. However, if the SITAC is equipped with two separate thyristor chips featuring high dv/dt strength, no *RC* circuit is needed in case of commutation.

Control And Turn-On Behavior

The trigger current of the SITAC has a positive temperature gradient. The time which expires from applying the control current to the turn-on of the load current is defined as the trigger delay time (t_{gd}). On the whole this is a function of the overdrive meaning the ratio of the applied control current versus the trigger current (I_F/I_{FT}). If the value of the control current corresponds to that of the individual trigger current of a SITAC, turn-on delay times amount to a few milliseconds only. The shortest times of 5 to 10 µs can be achieved for an overdrive greater or equal than 10. The trigger delay time rises with an increase in temperature.

For very short control current pulses (t_{pIF} <500 µs) a correspondingly higher control current must be used. Only the SITAC without zero voltage switch is suitable for this operating mode.

Zero Voltage Switch

The SITAC with zero voltage switch can only be triggered during the zero crossing of the sine AC voltage. This prevents current spikes, e.g. when turning-on cold lamps or capacitive loads.

Applications

Direct switching operation: The SITAC switch is mainly suited to control synchronous motors, valves, relays and solenoids in Grätz circuits. Due to the low latching current (500 µA) and the lack of an *RC* circuit at the output, very low load currents can easily be switched.

Indirect switching operation: The SITAC switch acts here as a driver and thus enables the driving of thyristors and triacs of higher performance by microprocessors. The driving current pulse should not exceed the maximum permissible surge current of the SITAC. For this reason, the SITAC without zero voltage switch often requires current limiting by a series resistor.

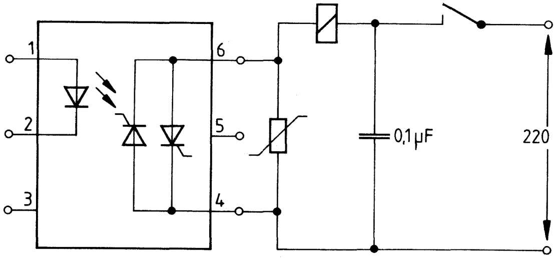
The favorably low latching current in this operating mode results in AC current switches which can handle load currents from some milliamperes up to high currents.

Application Notes

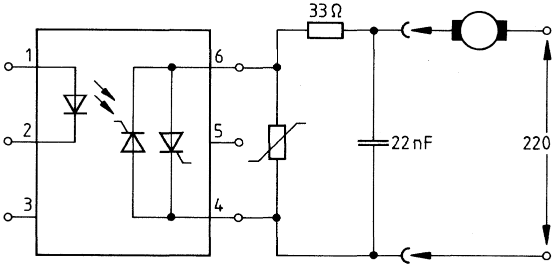
- **Overvoltage protection:** A voltage-limiting varistor (e.g. SIO VS05K250) which is directly connected to the SITAC output can protect the component against overvoltage.

- **Current commutation:** The values 100 A/ms with following peak reverse recovery current > 80 mA should not be exceeded.
- **Avoiding high-frequency turn-off current oscillations:**
  This effect can occur when switching a circuit. Current oscillations which appear essentially with inductive loads of a higher winding capacity result in current commutation and can generate a relatively high peak reverse recovery current. The following alternating protective measures are recommended for the individual operating states:

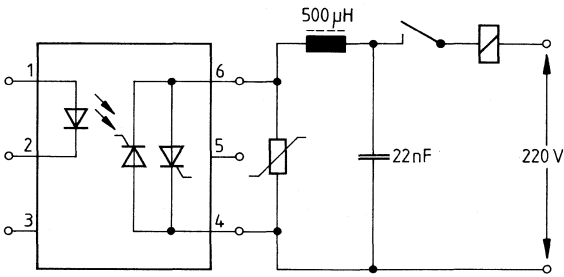
1. Apply a capacitor to the supply pins at the load-side.



2. Connect a series resistor to the SITAC output and bridge both by a capacitor.



3. Connect a choke of low winding capacity in series e. g. a ringcore choke, with higher load currents.



Measures 2 to 3 are especially required for the load separated from the SITAC during operation. The above-mentioned effects do not occur with SITAC circuits which are connected to the line by transformers and which are not mechanically interrupted. In such cases as well as in applications with a resistive load the corresponding protective circuits can be neglected.

Literature

SIPMOS Small-Signal Transistors
Ordering No. B352-B6155-X-X-7400

Option 1

SITAC For Safe Electrical Insulation In Acc. With VDE 0884

This component is suitable for safe electrical insulation **only** within the safety maximum ratings. The compliance with the safety maximum ratings must be ensured by protective circuits.

The partial discharge measurement ensures that no partial discharge occurs during operation at maximum permissible operating insulation voltage (V_{IORM}). Permanent partial discharge affects the insulating materials and can result in a high-voltage breakdown.

It is recommended that tests with the insulation test voltage (V_{ISOL}) should not be made. Otherwise, partial discharges may occur impairing the insulation characteristics. Thus, partial discharges may also occur at the maximum permissible operating insulation voltage. The insulation test in acc. with VDE 0884 is carried out after all the other high-voltage tests.

Insulation Characteristics

(All voltages referred to are peak values.)

Parameter	Symbol	Value	Unit
Installation category (DIN VDE 0109, Dec. 83, table[1]) for rated line voltages $\leq 300\ V_{rms}$ for rated line voltages $\leq 600\ V_{rms}$		 I – IV I – III	–
IEC climatic category (DIN IEC 68 part 1/09.80)		55/150/21	–
Pollution degree (DIN VDE 0109 Dec. 83)		2	–
Max. operating insulation voltage	V_{IORM}	630	V
Test voltage input/output, procedure b) [1]) $V_{Pr} = 1.6 \times V_{IORM}$, routine test with $t_P = 1$ s Partial discharge < 5 pC	V_{Pr}	1000	
Test voltage input/output, procedure a) [1]) $V_{Pr} = 1.2 \times V_{IORM}$, type and sampling test with $t_P = 60$ s, partial discharge < 5 pC	V_{Pr}	720	
Maximum permissible overvoltage [1]) (transient overvoltage, $t_{Tr} = 10$ s, procedure a)	V_{Tr}	6000	
Safety maximum ratings (max. permissible ratings in case of a fault, also refer to diagram) ● Package temperature ● Current (Input current I_F, $P_{si} = 0$) ● Power (Output or total power dissipation)	 T_{si} I_{si} P_{si}	DIP-6 175 400 2000	 °C mA mW
Insulation resistance at T_{si} $V_{I/O} = 500$ V	R_{IS}	$\geq 10^9$	Ω

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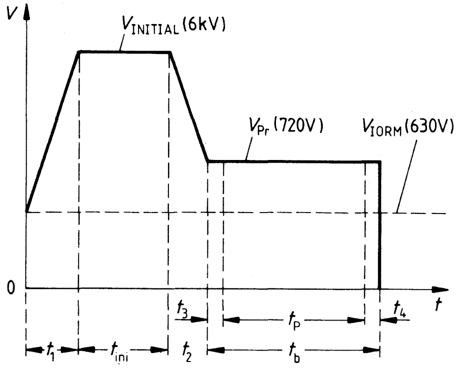
[1]) see time – test voltage diagram

Time-test voltage diagram in acc. with VDE 0884

Procedure a)

(for type and sampling tests, destructive tests)

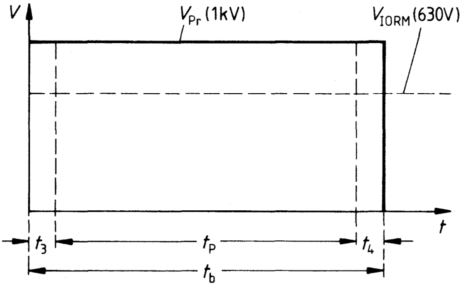
t_1, t_2 = 1 to 10 s
t_3, t_4 = 1 s
t_p (Measuring time for partial discharge = 60 s
t_b = 62 s
t_{ini} = 10 s



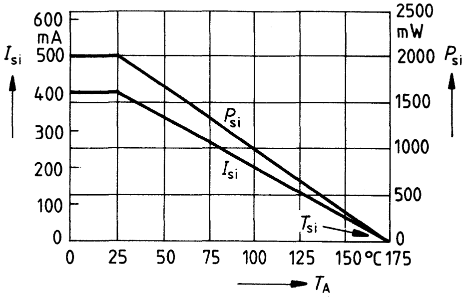
Procedure b)

(for sample test, non-destructive test)

t_3, t_4 = 0.1 s
t_p (Measuring time for partial discharge = 1 s
t_b = 1.2 s



Safety maximum ratings in acc. with VDE 0884 for SITAC BRT11 and BRT12



P_{Si} = Safety maximum power
I_{Si} = Safety maximum current
T_{Si} = Safety maximum temperature

Option 6

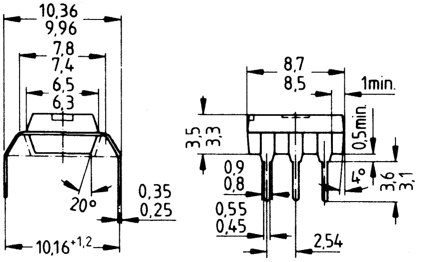
SITAC With Leads In 10.16 mm (0.4″) Spacing

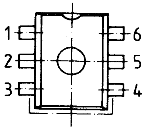
The leads are bent according to a 10.16 mm spacing. Dimensions deviating from the standard type:

Lead spacing	10.16 mm (0.4″)
Creepage distance	> 8.0 mm
Clearance	> 8.0 mm

This additionally complies with the following standards:

- DIN IEC 380/VDE 0806/8.81
  Reinforced insulation up to an operating voltage of 250 $V_{\mathrm{AC\ rms}}$
- DIN IEC 435/VDE 0805 draft Nov. 84.
  Reinforced insulation up to an operating voltage of 250 $V_{\mathrm{AC\ rms}}$





Dimensions in mm
— — — Clearance-creepage distance 8.0 min.

Pin configuration see chapter Package Outlines.

Option 7

SITAC With Lead Forming For Surface Mounting (SMD)

These versions are suitable for surface mounting.
Dimensions deviating from the standard type:

Creepage distance $>$ 8.0 mm
Clearance $>$ 8.0 mm

This additionally complies with the following standards:

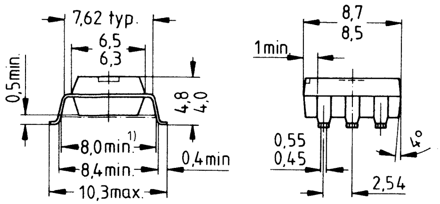
- DIN IEC 380/VDE 0806/8.81
  Reinforced insulation up to an operating voltage of 250 $V_{\text{AC rms}}$
- DIN IEC 435/VDE 0805 draft Nov. 84.
  Reinforced insulation up to an operating voltage of 250 $V_{\text{AC rms}}$

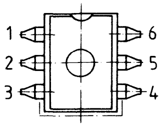
During the soldering process, the package should not be wetted with tin-lead solder in order to prevent the impairment of the insulation features.

Apart from iron soldering, only reflow soldering methods (vapor phase, infrared and hot gas) are permissible.

Permissible soldering conditions: 260 °C 10 s
⋮ ⋮
215 °C 30 s

The soldering process may be repeated two times at the most. However, attention must be paid to the cooling down of the device to 25 °C between the soldering processes.





Dimensions in mm

[1] Clearance and creepage distances must be taken into account for the solder pad design.
— — — Clearance-creepage distance 8.0 min.

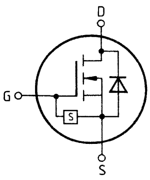
Pin configuration see chapter Package Outlines.

Smart SIPMOS

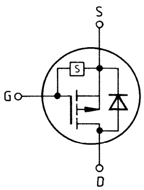
TEMPFET (**Tem**perature **P**rotected **FET**)

SIPMOS power transistor with thermally coupled temperature sensor in "chip-on-chip" technology with integrated protective functions against overtemperature, overload, and short-circuit.

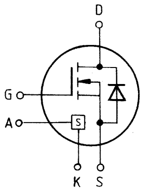
N channel



P channel

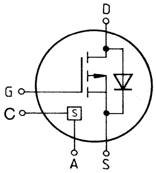


N channel



Separate sensor connection

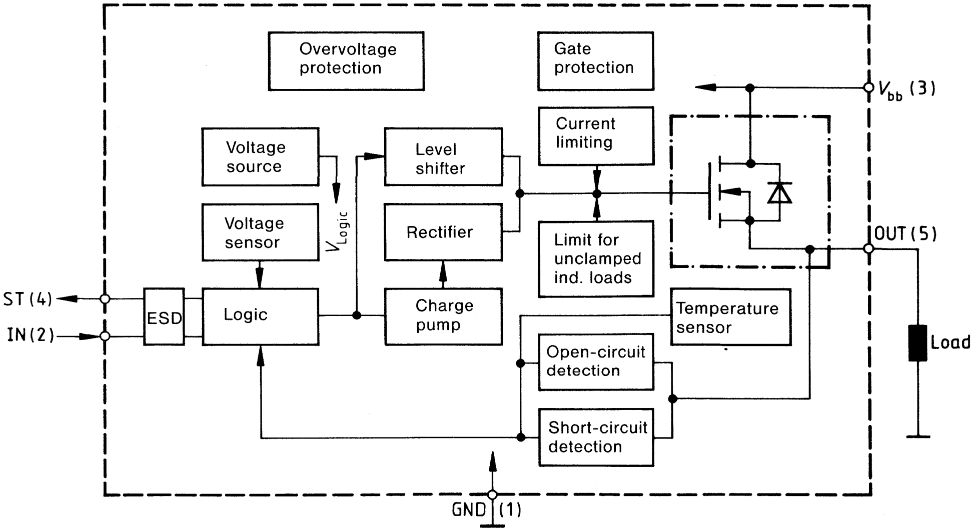
P channel

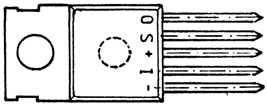


Separate sensor connection

PROFET (**Pro**tected **FET**)

An intelligent CMOS-compatible SIPMOS high-side switch in monolithic or "chip-on-chip" technology with status feed-back and integrated protective functions against short-circuit, overtemperature, overload, overvoltage, electrostatic discharge (ESD), etc.





O (OUT) Output (5)
S (ST) Status (4)
+ (V_{bb}) Operating voltage (3)
I (IN) Input (2)
– (GND) Ground (1)

Product range

- P and N channel enhancement types
- Leaded and SMD versions
- Logic level
- High-side switch
- Low-side switch
- Dimmers
- FREDFET
- Chips

Application (selection)

- Industrial electronics
  Programmable machine controls
- Automotive electronics
  Stop control system (SCS)
  Motor management
  Gear box control
  Lamp control

Literature

Smart SIPMOS, TEMPFET and PROFET
Ordering No. B352-B6278-X-X-7600

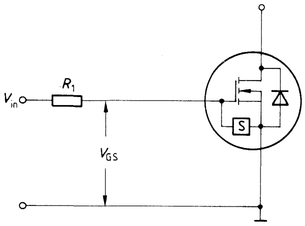
Function Table PROFET

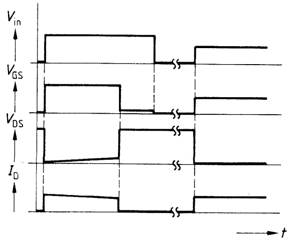
Type number BTS ...	412	412	413A	410 432 542	410 432 542	410 432 542	410
Logic version	A	B	C	D	E	F	G
High-side switch	X	X	X	X	X	X	X
Input protection	X	X	X	X	X	X	X
Overtemperature protected							
($T_j > 150$ °C) latch function	X	X	X	X		X	
($T_j > 150$ °C) with auto-restart on cooling					X		X
Short-circuit protected							
Switches off when $V_{out} \leq 3$ V. When first turned on switches off after approx. 40 µs.	X		X				
Switches off when power transistor voltage drop > 8 V. When first turned on switches off after approx. 150 µs.		X		X	X	X	
Achieved through overtemperature protection.							X
Open-load detection							
In ”off“ condition with test current 30 µA.	X	X	X				
In ”on“ condition with testing for min. 10 mV drop across power transistor.				X	X	X	X
Status feedback for overtemperature, short-circuit (where applicable) and open-load conditions	X	X	X	X	X	X	X
Negative inductive load switch-off voltage transient limited to −10 V	X	X	X	X	X	X	X
Electrostatic protection	X	X	X	X	X	X	X
Status output							
CMOS compatible	X	X	X	X			
Open drain					X	X	X
Output current limit							
(High level) can handle loads with high inrush currents.	X	X	X	X	X		
(Low level) better protection for inductive loads.						X	X
$R_{DS(on)}$ independent of supply voltage		X		X	X	X	X
Undervoltage shutdown							
when $V_{bb} < 7$ V	X						
with auto-restart and hysteresis (when V_{bb} approx. 4 V, 0.5 hysteresis).		X		X	X	X	X
Undervoltage shutdown status feedback	X	X		X			
Overvoltage shutdown with auto-restart (V_{bb} approx. 46 V, 0.5 hysteresis).		X		X	X	X	X
Overvoltage shutdown status feedback		X		X			
Reverse polarity protected BTS 410, 412, 413 with 150 Ω in ground connection	X	X	X	X	X	X	X
Load dump protected to 80 V (BTS 410 and BTS 412 B with 150 Ω in ground connection)		X		X	X	X	X

TEMPFET Circuit Design Hints

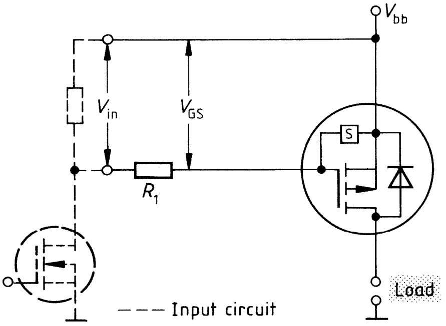
Figure 1 Overtemperature protection – including overload protection. Temperature sensor trip point 150 °C < T_{TS} < 170 °C

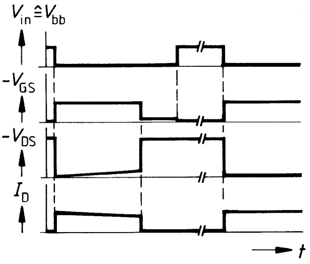
N channel





P channel

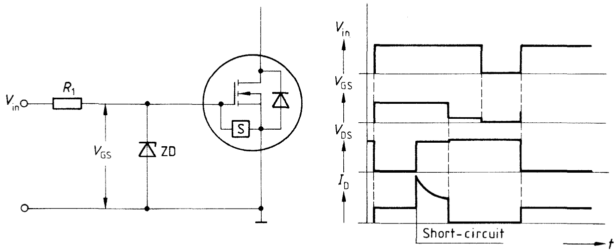




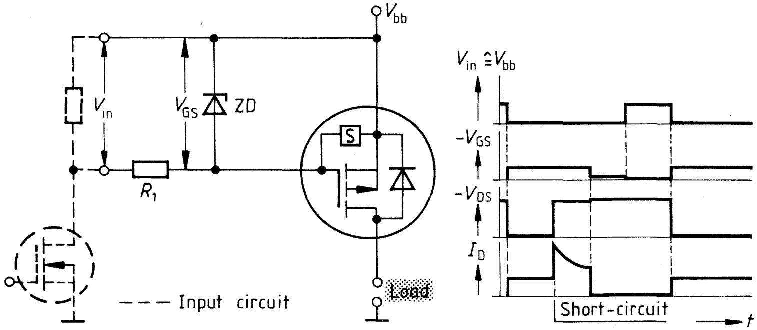
Note! Overvoltage protection necessary – see figures 5 and 6
R_1: For selection of the series resistance see page 79; S = sensor

Figure 2 Short-circuit protection – including overload and overtemperature protection.

N channel



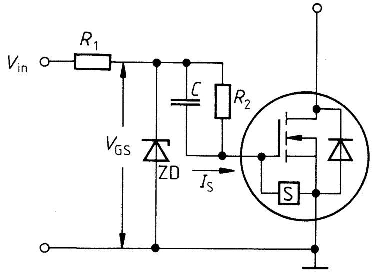
P channel

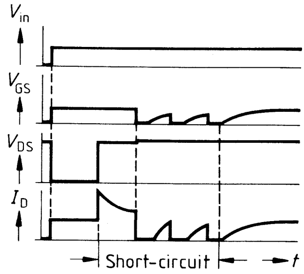


Note! Overvoltage protection necessary – see figures 5 and 6
R_1: For selection of the series resistance see page 79; S = sensor

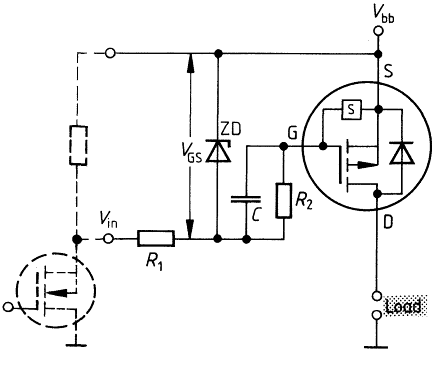
Figure 3 **Short-circuit protection with auto-restart** – including overload and over-temperature protection.

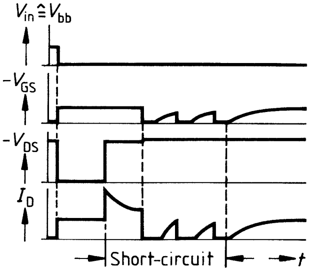
N channel





P channel



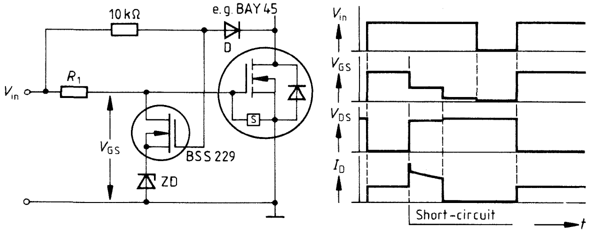


Note! Overvoltage protection necessary – see figures 5 and 6.
Heat sink necessary.
R_1, R_2: For selection of the series resistance see page 79; S = sensor

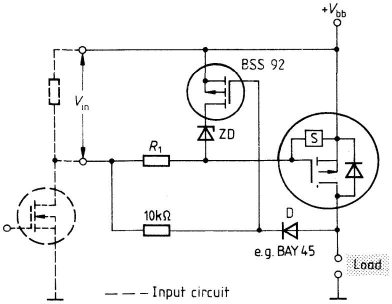
Figure 4 **Optimized short-circuit protection** – including overload and overtemperature protection.

- Short-circuit current limit controlled by Zener diode
- No on-state $R_{DS(on)}$ compromise
- Standard types $V_{in(max)} = 20$ V
- Logic level types $V_{in(max)} = 10$ V

N channel



P channel



Selection of series resistance R_1

- Standard types

$$\frac{V_{in} - 1.5\ \text{V}}{10\ \text{mA}} \leq R_1 \leq \frac{V_{in} - 1.5\ \text{V}}{0.5\ \text{mA}}$$

- Logic level types

$$\frac{V_{in} - 1.4\ \text{V}}{5\ \text{mA}} \leq R_1 \leq \frac{V_{in} - 1.4\ \text{V}}{0.5\ \text{mA}}$$

Selection of series resistance R_2

$$1.1\ \frac{V_{in} - 1.4\ \text{V}}{0.05\ \text{mA}} \leq R_2 \leq 1.3\ \frac{V_{in} - 1.4\ \text{V}}{0.05\ \text{mA}}$$

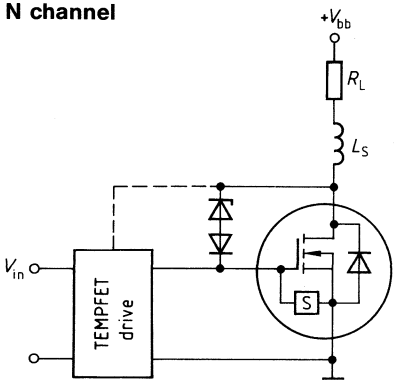
Applies to all circuit design hints.

Note! Overvoltage protection necessary – see figures 5 and 6; S = sensor

Figure 5 Overvoltage protection for line inductances – version 1

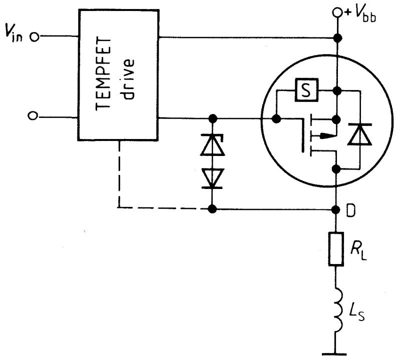
The protection is designed such that the breakdown voltage $V_{(BR)DSS}$ will not be exceeded.

N channel



$V_{bb} < V_{ZD} < V_{(BR)DSS} - 10$ V

P channel



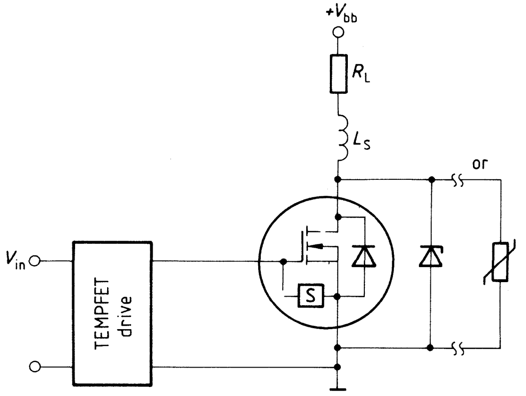
$V_{bb} < V_{ZD} < V_{(BR)DSS} - 10$ V

L_S = line inductance; R_L = load resistance; S = sensor

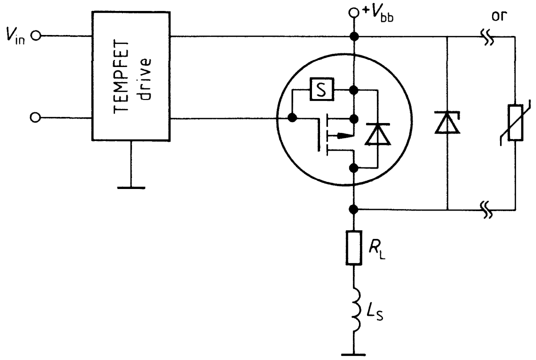
Figure 6 Overvoltage protection for line inductances - version 2

The protection is designed such that the breakdown voltage $V_{(BR)DSS}$ will not be exceeded.

N channel



P channel

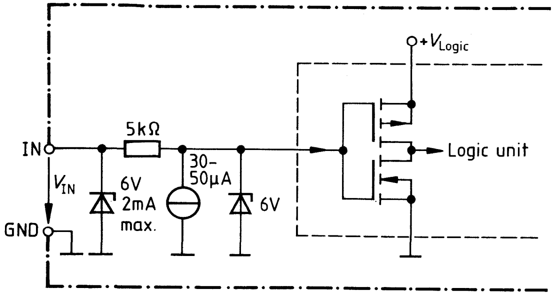


L_S = line inductance; R_L = load resistance; S = sensor

PROFET Circuit Design Hints

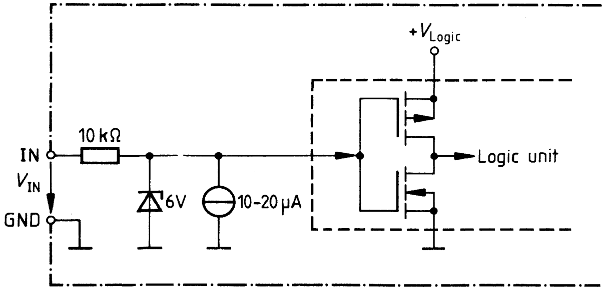
Figure 1 Input IN (2):

BTS 410, BTS 412 B, BTS 432, BTS 542



$V_{in(on)}$: 1.9 V typ. with hysteresis of approx. 0.5 V.

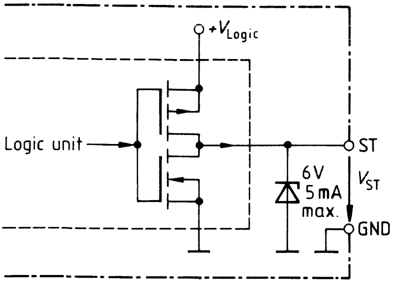
BTS 412 A, BTS 413 A



$V_{in(on)}$: 1.9 V typ. with hysteresis of approx. 0.5 V.

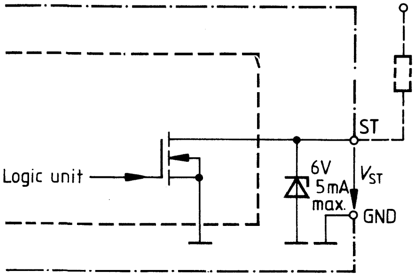
Figure 2 Status output ST (4):

CMOS output: BTS 412 A, BTS 413 A, BTS 410 D, BTS 412 B, BTS 432 D, BTS 542 D



V_{ST} high: 5.2 V typ.; low: 0.4 V (1.6 mA)

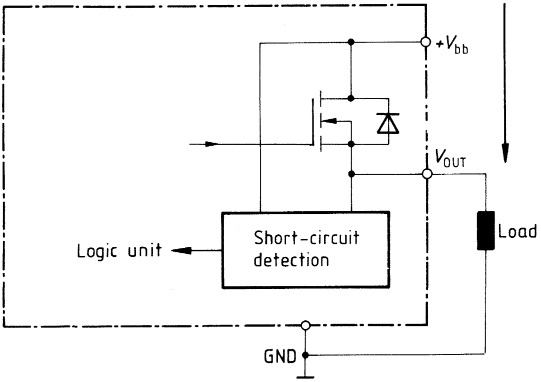
Open-Drain: BTS 410 E/F/G, BTS 432 E/F, BTS 542 E/F



V_{ST} high: 6 V typ.; low: 0.4 V (1.6 mA)

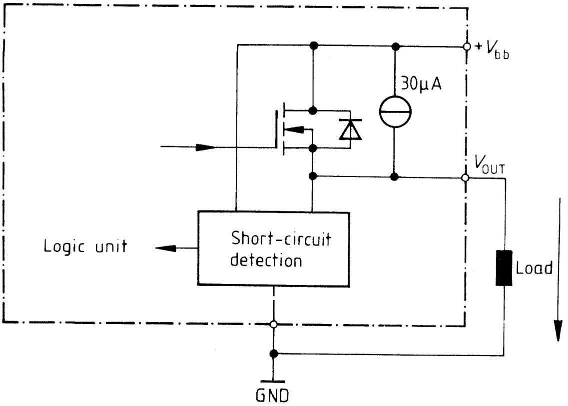
Figure 3 Short-circuit detection

BTS 410, BTS 432, BTS 542, BTS 412 B



The short-circuit detection unit monitors the voltage *across the power transistor.* In the case of a voltage drop of more than 8 V *in the on-state,* the unit immediately forces the device to turn off. If the device has *just turned on* with a voltage drop of more than 8 V, the turn-off is delayed by 150 µs.

BTS 412 A, BTS 413 A

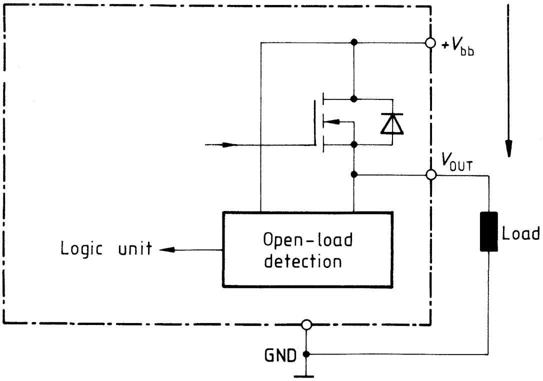


The short-circuit detection unit monitors the voltage *across the load.* In the case of a voltage drop of less than 3 V in the on-state, the unit immediately forces the device to turn off. If the device has *just turned on* with a voltage drop of less than 3 V, the turn-off is delayed by 40 µs.

Figure 4 Open-load detection

Conditions: V_{bb}–$V_{OUT} < 10$ mV; IN: high

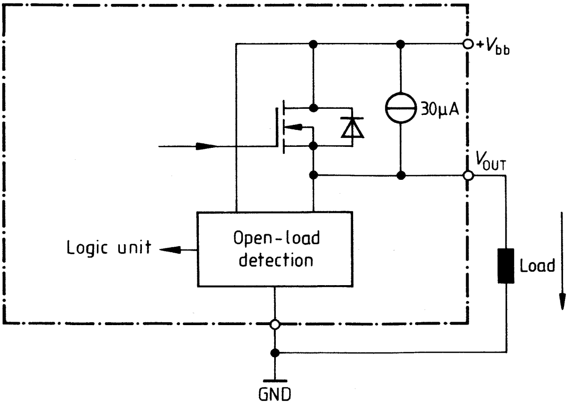
BTS 410, BTS 432, BTS 542



Monitoring of voltage drop *across the power transistor in the on-state.*

Conditions: $V_{OUT} > 3$ V; IN: low

BTS 412 A, BTS 412 B, BTS 413 A



Monitoring of voltage *between output and ground in the off-state* (test current 30 µA).

Electromagnetic Compatibility (EMC) in Motor Vehicles

Interferences conducted along supply lines in 12 V on-board systems.
(DIN 40 839-Standard, Part 1, Annex B, excerpt, correlation with ISO-Technical Report 7537/0 and 7637/1)

B.1 Introduction

The purpose of this annex is to provide a basis for mutual agreement between vehicle manufacturers and component suppliers on the interference immunity of their equipment.

The susceptibility of a device to conduction depends on the chosen operating state by applying test pulses of a certain severity.

B.2 Operating states

B.2.1 Operating state A

The device works within the given tolerances.

B.2.2 Operating state B

The device works, however out of the given tolerances, and returns to operating state A after decay of the interference.

B.3 Test pulse severity

The test pulses are specified in the paragraphs 4.6.1 to 4.6.5 of DIN 40 839. The severity is determined by the chosen amplitude V_S in table B.1.

Table B.1

V_S / Test pulse	Severity				Minimum test range
	I	II	III	IV	
1	-25 V	-50 V	- 75 V	-100 V	5000 pulses
2	+25 V	+50 V	+ 75 V	+100 V	5000 pulses
3 a	-40 V	-75 V	-110 V	-150 V	1 hour
3 b	+25 V	+50 V	+ 75 V	+100 V	1 hour
4	- 3 V	- 5 V	- 6 V	- 7 V	one time
5	+35 V	+50 V	+ 80 V	+120 V	one time

Note that a device should only be exposed to test pulses which are applicable to that device in practical operation.

SIMOPAC® Power Modules

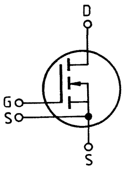
SIMOPAC modules are high-performance SIPMOS switches which can handle high currents if several SIPMOS transistor chips are paralleled.

The chips taken from one semiconductor wafer are mounted on a rotationally symmetric, electrically insulating ceramic substrate (DCB = **D**irect **C**opper **B**onding) designed on the basis of RF-engineering aspects. The separation of control and load circuits is made at chip level in order to eliminate the source-side negative feedback inductances (bond inductance). The SIMOPAC FREDFET-modules (**F**ast **R**ecovery **E**pitaxial **D**iode-FET) are particularly designed for switching inductive loads as well as bridge configurations. They feature a very low reverse recovery charge and thus a shorter reverse recovery time of the paralleled diode in the SIPMOS transistor.

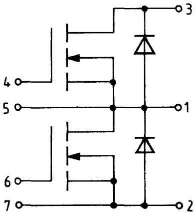
Product range

● Single switches	100 V ... 1000 V; 200 A ... 28 A
● Half-bridges	100 V ... 1000 V; 2 x 125 A ... 2 x 18 A
● 3-phase full-bridges	500 V ... 1000 V; 6 x 17 A ... 6 x 4.8 A

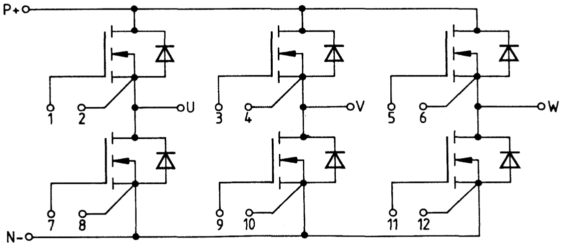
Single switch



Half-bridge



3-phase full-bridge



Application (selection)

- Welding equipment
- Uninterruptible power systems (UPS)
- Inductive heating
- Switched-mode high-power supplies
- Drive systems

Literature

Power Semiconductors SIPMOS and IGBT
Ordering No. B152-B6299-X-X-7400

IGBT Power Modules (Insulated Gate Bipolar Transistors)

IGBT are MOS-controlled high-current/high-voltage switches for switching applications in the frequency range of 2 kHz ... > 20 kHz. When the IGBT is turned off, the tail current decays exponentially which determines the attainable switching frequency essentially. The tail current is independent on temperature and ranges from 5 to 10 % of the rated I_C current. The selected design of the IGBT reliably prevents the possible latch-up effect at turn-off and shows a square-wave RBSOA diagram. In the case of a short-circuit, the collector current is, for a given gate voltage, almost independent of the collector-emitter voltage over the entire range. Therefore no "thermal surges" occur. The short-circuit current can be turned-off within 10 µs without any problems.

Product range

Collector current I_C at T_C = 80 °C	V_{CE} = 1000 V			V_{CE} = 1200 V		
	Single switch	Half-bridge chopper	Full-bridge	Single switch	Half-bridge chopper	Full-bridge
15 A	-	-	BSM 15 GD 100 D	-	-	BSM 15 GD 120 D
25 A	-	BSM 25 GB 100 D	BSM 25 GD 100 D	-	BSM 25 GB 120 D	BSM 25 GD 120 D
50 A	-	BSM 50 GB 100 D	-	-	BSM 50 GB 120 D	-
75 A	-	BSM 75 GB 100 D	-	-	BSM 75 GB 120 D	-
100 A	-	BSM 100 GB 100 D	-	-	BSM 100 GB 120 D	-
150 A	-	BSM 150 GB 100 D	-	-	BSM 150 GB 120 D	-
200 A	BSM 200 GA 100 D	-	-	BSM 200 GA 120 D	-	-
300 A	BSM 300 GA 100 D	-	-	BSM 300 GA 120 D	-	-

Application (selection)

- DC/AC drive systems
- Uninterruptible power systems (UPS)
- Switched-mode high-power supplies
- Welding equipment

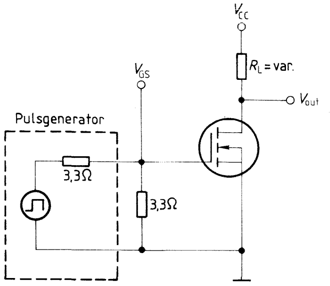
Literature

Power Semiconductors SIPMOS and IGBT
Ordering No. B152-B6299-X-X-7400

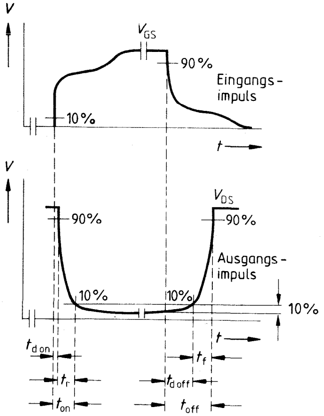
Measurement of Switching Times And Power Dissipation

Power Transistors/Small-Signal Transistors/SIMOPAC® Power Modules

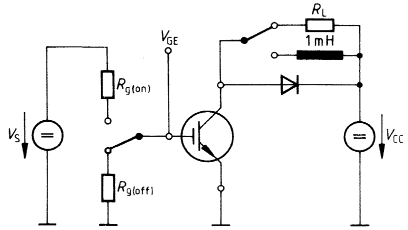
Test Circuit



Definition



IGBT Power Modules



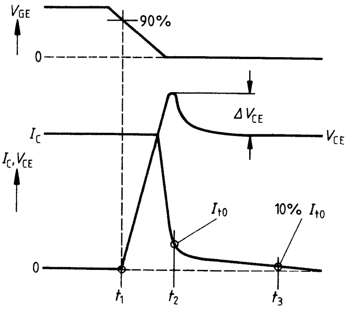
Definition of turn-off loss

$$E_{off} = E_{off\,1} + E_{off\,2} \qquad \Delta\, V_{CE} \leq 0.2 \times V_{CE}$$

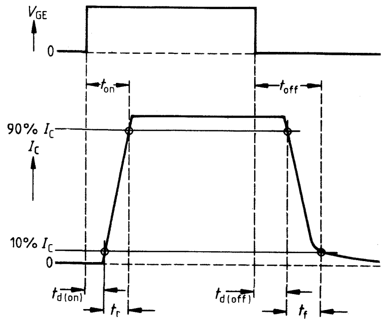
$$I_{t0} \approx 0.1 \times I_C$$

$$E_{off\,1} = \int_{t_1}^{t_2} v_{CE(t)} \times i_C \, dt$$

$$E_{off\,2} = \int_{t_2}^{t_3} v_{CE(t)} \times i_C \, dt$$



Definition of switching times



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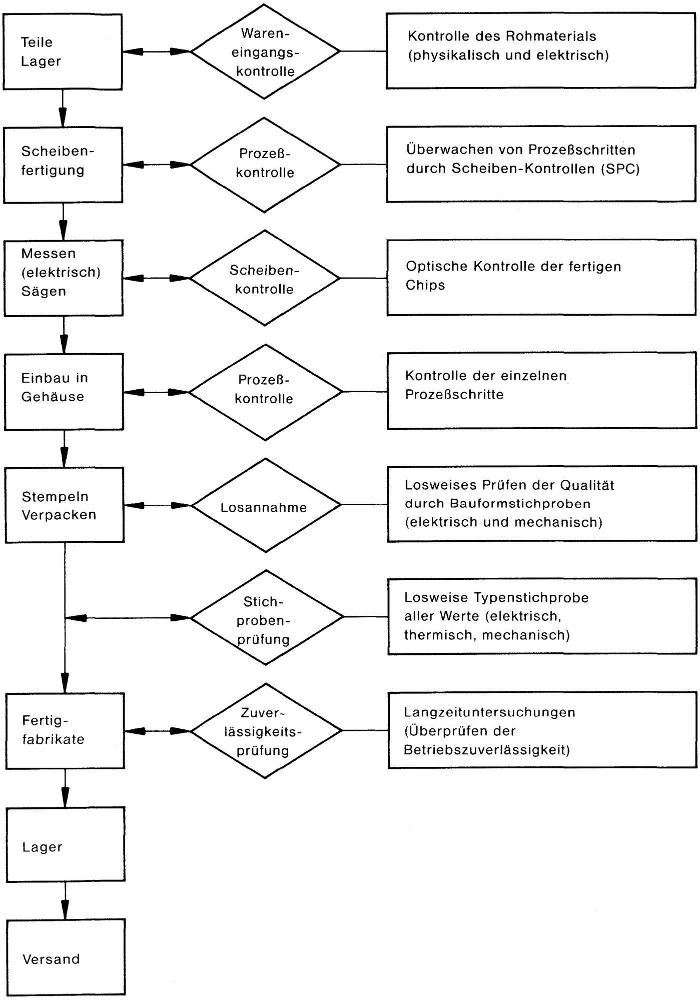
*) Power and small-signal transistors 50 Ω

1.1 Produkt-Ablaufdiagramm

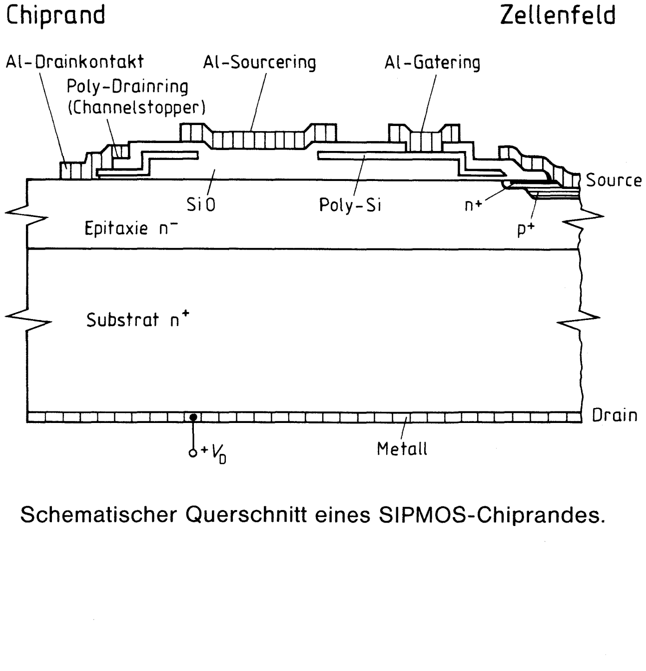


SPC ≙ Statistische Prozeßkontrolle

1.2 Chip-Technologie

Betrachtet man die Zuverlässigkeit von SIPMOS-Halbleitern, so sind die Bereiche mechanischer Aufbau, Montage und Chip-Technologie zu berücksichtigen. SIPMOS-Halbleiter werden auf den bei Bipolar-Transistoren millionenfach bewährten Fertigungslinien montiert. Die hier gesammelten Erfahrungen kommen den SIPMOS-Halbleitern voll zugute. Stabilität und damit die Zuverlässigkeit wurde bei der Chipentwicklung besonders berücksichtigt.

Der schematische Querschnitt eines SIPMOS-Chiprandes ist unten dargestellt. Die Oberfläche ist durch Feldplatten, bestehend aus Polysilizium bzw. Aluminium abgedeckt. Dies gilt nicht nur für die Randzone, sondern für die gesamte Oberfläche des aktiven Systems. Damit ist der SIPMOS gegen äußere Einflüsse, wie bewegliche Ionen, abgeschirmt. Der Channel-Stopper verhindert die Ausdehnung der Raumladungszone zum Rand. Durch den lückenlosen Schutz des SIPMOS gegen äußere Einflüsse wird eine hohe Stabilität und Zuverlässigkeit auch bei Feuchteeinwirkung erreicht.



Schematischer Querschnitt eines SIPMOS-Chiprandes.

1.3 100-%-Prüfung

Alle SIPMOS-Halbleiter werden bei folgenden Parametern einer 100-%-Prüfung unterzogen.

Parameter	
Drain-Source-Durchbruchspannung	$V_{(BR)DSS}$
Gate-Schwellenspannung	$V_{GS(th)}$
Drain-Reststrom	I_{DSS}
Gate-Source-Leckstrom	I_{GSS}
Drain-Source-Einschaltwiderstand	$R_{DS(on)}$
Übertragungssteilheit	g_{fs}
Inversdioden-Durchlaßspannung	V_{SD}

1.3.1 Stichprobenprüfung, AQL-Werte

Fehlerart	**AQL-Wert**
Totalfehler	0,1
Elektrische Fehler	0,4
Mechanische Fehler	0,4

Zusätzlich zur 100-%-Prüfung wird vor der Auslieferung eine losweise Stichprobenprüfung durchgeführt. Grundlage hierfür sind DIN 40 080 (IEC 410) bzw. MIL-STD-105 D. Die Stichprobenprüfung wird durch die von der Fertigung unabhängige Qualitätsabteilung vorgenommen.

1.3.2 Zuverlässigkeitsprüfungen

Prüfungen	**Norm**
Stabilität bei Hochtemperatur-Lagerung 1000 h bei +150 °C	IEC 68/2-2
Stabilität bei Tieftemperatur-Lagerung 168 h bei −55 °C	IEC 68/2-1
Temperaturwechsel-Beanspruchung 1000 Zyklen −55 °C ... +150 °C	IEC 68/2-14
Hochtemperatur-Sperrlagerung 1000 h bei +150 °C und V_{DSmax}	IEC 147-4/11.1
Hochtemperatur-Sperrlagerung 1000 h bei +150 °C und V_{GSmax}	CECC 50012
Wechsellast-Beanspruchung 10 000 Zyklen $\Delta T_j = 100$ K	IEC 147-4/11.1
Feuchtebeanspruchung 1000 h bei 85 °C/85 % rel. Feuchte	IEC 68/2-3
Feuchtesperrlagerung 1000 h bei 85 °C/85 % rel. Feuchte $V_{DSS} = 0{,}8 \times V_{DS(max)}$ (max. 80 V)	CECC 50012

1.3.3 **AOQL** (**A**verage **O**utgoing **Q**uality **L**evel)

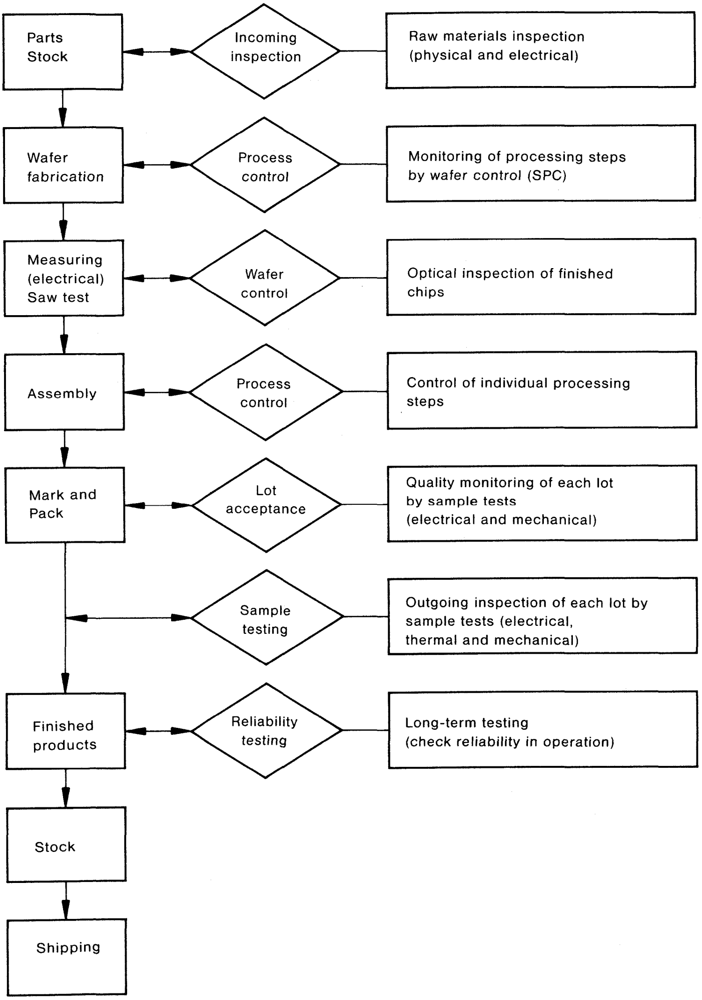
Die Bewertung des tatsächlichen Qualitätsstandes der ausgelieferten Ware erfolgt in dpm (defects per million).

Der derzeitige Stand ist < 50 dpm gemessen an den sogenannten Stichproben für nicht funktionsfähige Bauelemente (Totalfehler).

Dieser Qualitätsstand wird durch eine ständig überwachte und kontrollierte Fertigung (SPC ≙ Statistical processing control) sowohl in der Scheibenproduktion als auch in der Montage erreicht. Eine zweifach durchgeführte elektrische Prüfung verhindert außerdem, daß bedingt durch Automatenfehler, Verwurfteile in das Lieferlos gelangen.

AQL ≙ Annehmbare Qualitätsgrenzlage (**A**cceptable **Q**uality **L**evel)

1.1 Product Flow Chart

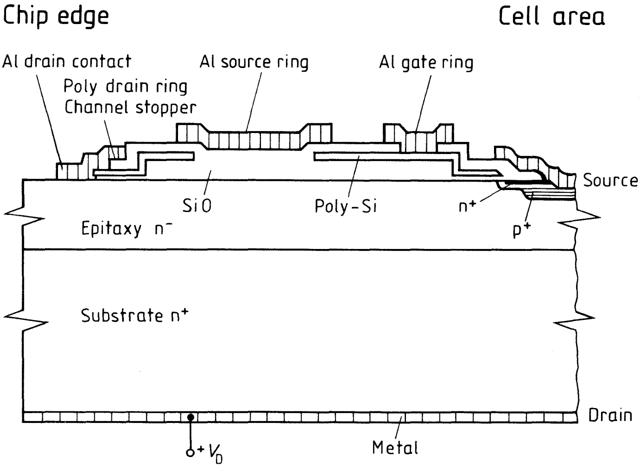


SPC ≙ Statistical processing control

1.2 Chip Technology

When it comes to the reliability of SIPMOS semiconductors, the focus is on mechanical design, mounting and chip technology. SIPMOS semiconductors are manufactured on the same lines that have already been used to produce millions of bipolar transistors. So this experience is fully utilized in the production of SIPMOS semiconductors. The stability and thus the reliability was particularly important during chip development.

The figure at the bottom shows a schematic cross-section through a SIPMOS chip edge. The surface is covered by field plates consisting of polysilicon and aluminum. This applies not only to the edge zone but also to the complete surface of the active system. In this way the SIPMOS is shielded against external influences, such as ion mobility. The channel stopper prevents the space-charge zone from expanding to the edge. The complete protection of the SIPMOS against exterior effects means that high stability and reliability is guaranteed in humid conditions.



Schematic cross-section of SIPMOS chip edge.

1.3 100 % Tests

All SIPMOS semiconductors are subject to 100 % testing of the following parameters:

Parameter	
Drain-source breakdown voltage	$V_{(BR)DSS}$
Gate threshold voltage	$V_{GS(th)}$
Zero gate voltage drain current	I_{DSS}
Gate-source leakage current	I_{GSS}
Drain-source on-resistance	$R_{DS(on)}$
Forward transconductance	g_{fs}
Reverse-diode forward on-voltage	V_{SD}

1.3.1 Sample Tests, AQL

Defect type	AQL
Total defects	0.1
Electrical defects	0.4
Mechanical defects	0.4

In addition to 100 % tests, lot by lot sampling is made before shipment. This is based on DIN 40 080 (IEC 410) and MIL-STD-105 D. Sample tests are performed by a QA department that is independent of the manufacturing process.

1.3.2 Reliability Tests

Test	Standard
Stability in high-temperature storage 1000 h at +150 °C	IEC 68/2-2
Stability in low-temperature storage 168 h at – 55 °C	IEC 68/2-1
Temperature cycling 1000 cycles – 55 °C to +150 °C	IEC 68/2-14
High-temperature biased storage 1000 h at +150 °C and V_{DSmax}	IEC 147-4/11.1
High-temperature biased storage 1000 h at +150 °C and V_{GSmax}	CECC 50012
Load cycling 10 000 cycles $\Delta T_j = 100$ K	IEC 147-4/11.1
Humidity stressing 1000 h at 85 °C/85 % RH	IEC 68/2-3
HTRB 1000 h at 85 °C/85 % RH at $V_{DSS} = 0.8 \times V_{DS(max)}$ (max. 80 V)	CECC 50012

1.3.3 AOQL (**A**verage **O**utgoing **Q**uality **L**evel)

AOQL is measured in dpm (defects per million).

The present AOQL level is $<$ 50 dpm based on sample inspections for total failures.

This quality level is achieved by continuous process monitoring (SPC ≙ "statistical process control") of wafer production as well as product assembly. In order to prevent that defective electrical test equipment allows delivery of non-conforming devices the final 100 % electrical test is done twice.

AQL ≙ **A**cceptable **Q**uality **L**evel

Erläuterungen der Datenblattwerte

Grenzwerte

Die angegebenen Grenzwerte sind eigenständige Absolutdaten der Belastbarkeit, bei deren Überschreiten eine Zerstörung des Bauelementes oder eine nachhaltige Beeinträchtigung seiner Daten bzw. Funktion zu erwarten ist. Bei Bauelementeprüfungen, etwa der Durchbruchspannungen, wie auch in der Anwendung, muß deswegen mit entsprechenden Sicherungen das Überschreiten der Grenzwerte zuverlässig verhindert werden.

Kennwerte

Typische Kennwerte charakterisieren den Bauelementetyp unter definierten Meßbedingungen in Zahlen und Diagrammen. Sie sind nicht als Daten jedes einzelnen Exemplars aufzufassen. Die aus wichtigen Qualitäts- oder Anwendungserfordernissen angegebenen Minimal- und Maximalwerte bezeichnen den tatsächlichen Streubereich der Kennwerte, in Diagrammen eingetragene Streukurven in der Regel den überwiegend zu erwartenden Streubereich. Die elektrischen Kennwerte sind fallweise nach Gleichstromwerte „statisch“ und Wechselstromwerte „dynamisch“ gruppiert. Als eng mit der Belastbarkeit gekoppelter Kennwert ist der Wärmewiderstand als oberer Streuwert unmittelbar nach den Grenzwerten angeordnet.

Wärmewiderstände

Die Wärmeableitung der Bauelemente resultiert aus Materialart und -dicke der Platine und der Leiterbahnen (Eigenerwärmung), sowie der Packungsdichte (Fremderwärmung). Eigen- und Fremderwärmung bestimmen also die Sperrschichttemperatur und damit die zulässige Belastbarkeit der Bauelemente.

Die Datenblattwerte der Wärmewiderstände R_{thJA} dienen somit nur zum groben Abschätzen der Sperrschichttemperatur T_j, da sie unter bestimmten Randbedingungen im Labor gemessen werden und der jeweilige Anwendungsfall nicht berücksichtigt ist.

Die Datenblattwerte der Wärmewiderstände R_{thJC} bei Leistungsbauelementen dienen zur Berechnung der Chiptemperatur T_j und zur Kontrolle der Bauelemente (Qualität des Chipbondings) im Prüffeld oder beim Kunden.

Data Sheet Parameters

Maximum Ratings

The maximum ratings specified are absolute ratings which, if exceeded, may result in the destruction or permanent functional impairment of the component. When testing the component, as for example in respect to breakdown voltages, or during application, protection is to be provided in order to reliably ensure that maximum ratings are not exceeded.

Characteristics

Typical characteristics describe the component behavior at defined operating conditions. The numerical values and diagrams pertain to the component type and shall not be considered as characteristics of an individual component. The minimum and maximum ratings stated for reasons of essential quality and application requirements describe the actual spread of the characteristics, whereas spread curves in diagrams usually specify the spread range which is to be expected. Electrical values are grouped into “static” DC values and “dynamic” AC values. The thermal resistance is closely related to the maximum ratings and, constituting the upper spread value, comes immediately after the maximum ratings.

Thermal Resistance

The heat dissipation of components depends on material and thickness of the PC board and of the conductor paths (inherent heating), as well as on the packing density (external heating). Hence, inherent and external heating determine the junction temperature, and thus the permissible thermal stress of the components.

The values for thermal resistance given in the data sheets should only be used for rough estimations of the junction temperature T_j, since they were measured under certain laboratory conditions, where no regard was paid to specific applications.

The data sheet parameters of thermal resistance R_{thJC} of power semiconductors are specified for calculation of the chip temperature T_j and control of the devices in the laboratories (quality of the chip bonding) or by the clients.

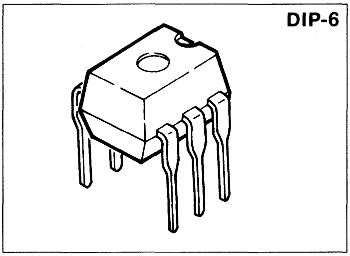
Datenblätter

Data Sheets

SITAC® AC Switches BRT 11 BRT 12 BRT 13

AC switch without zero-voltage detector consisting of two electrically insulated lateral power ICs which integrate a thyristor system, a photo detector and noise suppression at the output and an IR GaAs diode at the input.

V_{DRM} = **400...800 V**
I_{TRMS} = **300 mA**
$dv/dt_{cr} \geq$ **10 000 V/µs**



- Electrically insulated between input and output circuit
- Microcomputer-compatible by very low trigger current
- Trigger current grouping H (< 2 mA) and M (< 3 mA)
- VDE 0883 and VDE 0884-approved
- UL-tested (file no. E52744), code letter "J"
- Available with the following options:
  Option 1: VDE 0884-approved
  Option 6: Pins in 10.16 mm spacing
  Option 7: Pins for surface mounting
- Package: DIP-6 [1]

Type	Ordering code	Repetitive peak off-state voltage
BRT 11 H BRT 11 M	C67079-A1000-A6 C67079-A1000-A10	400 V
BRT 12 H BRT 12 M	C67079-A1001-A6 C67079-A1001-A10	600 V
BRT 13 H BRT 13 M	C67079-A1002-A6 C67079-A1002-A10	800 V

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[1] See chapter Package Outlines.

Maximum Ratings
at $T_j = 25$ °C, unless otherwise specified.

AC switch

Parameter	Symbol	Values	Unit
Max. power dissipation	P_{tot}	630	mW
Operating temperature range	T_j	–40 ... +100	°C
Storage temperature range	T_{stg}	–40 ... +150	
Creepage distance (input/output circuit)	–	$\geq$ 8.2	mm
Clearance (input/output circuit)	–	$\geq$ 7.2	
Insulation test voltage[1] between input/output circuit (climate in acc. with DIN 40 046, part 2, Nov. 74)	V_{is}	5300	V_{DC}
Reference voltage in acc. with VDE 0110 b (Insulation group C)	V_{ref}	500 600	V_{ACeff} V_{DC}
Creepage tracking resistance (in acc. with DIN IEC 112/VDE 0303, part 1)	*CTI*	175	(group IIIa acc. to DIN VDE 0109)
Insulation resistance, $V_{IO} = 500$ V $T_A = 25$ °C $T_A = 100$ °C	R_{is}	$\geq 10^{12}$ $\geq 10^{11}$	Ω
Humidity category (DIN 40 040)	–	F	–

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[1] Test dc voltage in acc. with DIN 57 883, June 1980.

Maximum Ratings (continued)
at $T_j = 25$ °C, unless otherwise specified.

Input circuit

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	6	V
Continuous forward current	I_F	20	mA
Surge forward current, $t \leq 10$ µs	$I_{FSM(I)}$	1.5	A
Max. power dissipation	P_{tot}	30	mW

Output circuit

Parameter	Symbol	BRT 11	BRT 12	BRT 13	Unit
Repetitive peak off-state voltage	V_{DRM}	400	600	800	V
RMS on-state current	$I_{TRMS(I)}$	300			mA
Single cycle surge current (50 Hz)	$I_{TSM(I)}$	3			A
Max. power dissipation	P_{tot}	600			mW

Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Input circuit

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage $I_F = 10$ mA	V_F	–	1.1	1.35	V
Reverse current $V_R = 6$ V	I_R	–	–	10	µA
Thermal resistance junction – ambient[1]	R_{thJA}	–	–	750	K/W

Output circuit

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Critical rate of rise of off-state voltage $V_D = 0.67\ V_{DRM}$	dv/dt_{cr}				V/µs
$T_j = 25$ °C		10000	–	–	
$T_j = 80$ °C		5000	–	–	
Critical rate of rise of voltage at current commutation $V_D = 0.67\ V_{DRM}$, $di/dt_{crq} \leq 15$ A/ms	dv/dt_{crq}				
$T_j = 25$ °C		10000	–	–	
$T_j = 80$ °C		5000	–	–	
Critical rate of rise of on-state current	di/dt_{cr}	–	–	8	A/µs
On-state voltage $I_T = 300$ mA	V_T	–	–	2.3	V
Off-state current $T_j = 100$ °C, V_{DRM}	I_D	–	0.5	100	µA
Holding current, $V_D = 10$ V	I_H	–	80	500	
Thermal resistance[1] junction – ambient	R_{thJA}	–	–	125	K/W

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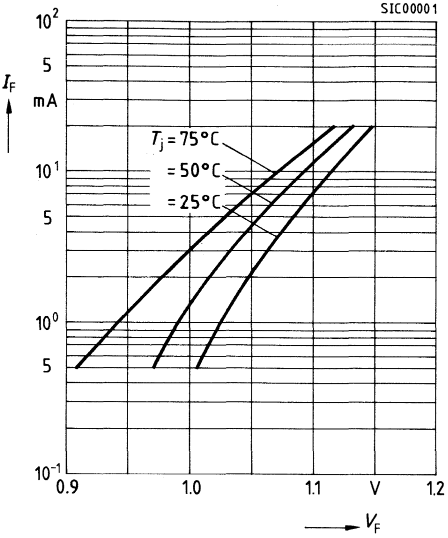
[1] Static air, SITAC soldered in pcb or base plate.

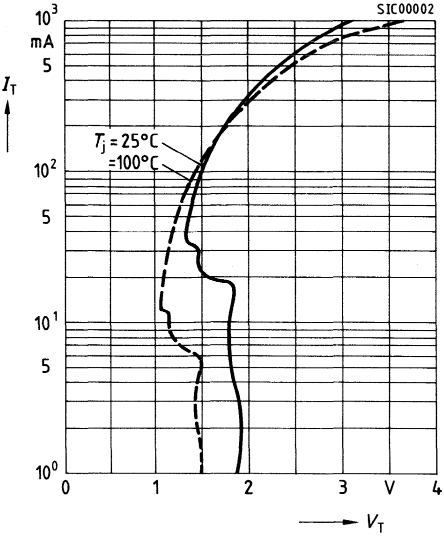
Response Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Trigger current $V_D = 10$ V type H type M	I_{FT}	 – –	 – –	 2.0 3.0	mA
Trigger current temperature gradient	$\Delta I_{FT}/\Delta T_j$	–	7	14	µA/K
Capacitance between input and output circuit $V_R = 0$, $f = 1$ kHz	C_{IO}	–	–	2	pF

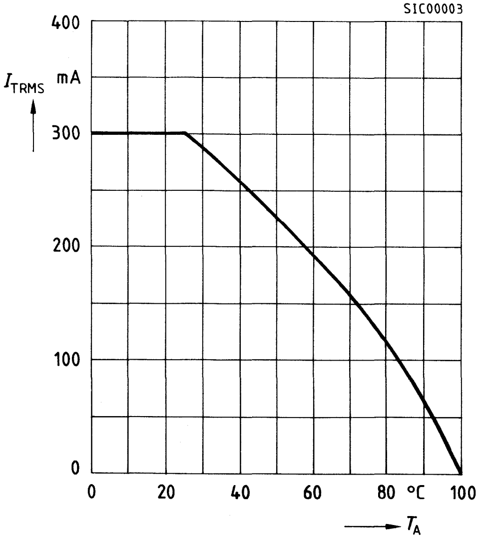
Typical input characteristics
$I_F = f(V_F)$
Parameter: T_j



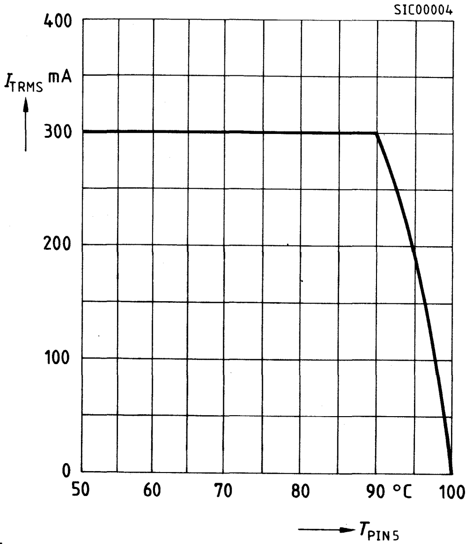
Typical output characteristics
$I_T = f(V_T)$
Parameter: T_j



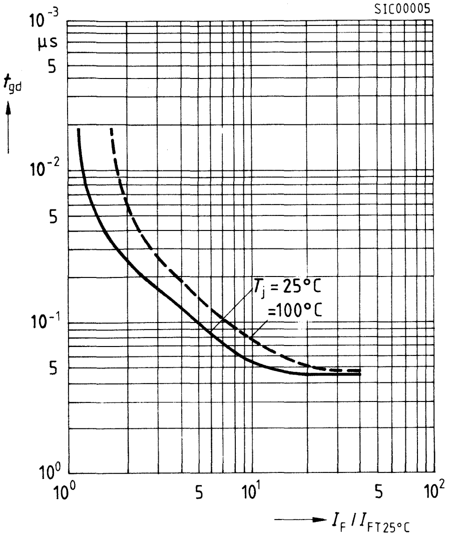
Current reduction $I_{TRMS} = f(T_A)$
R_{thJA} = 125 K/W
The SITAC switch is soldered in pcb or base plate



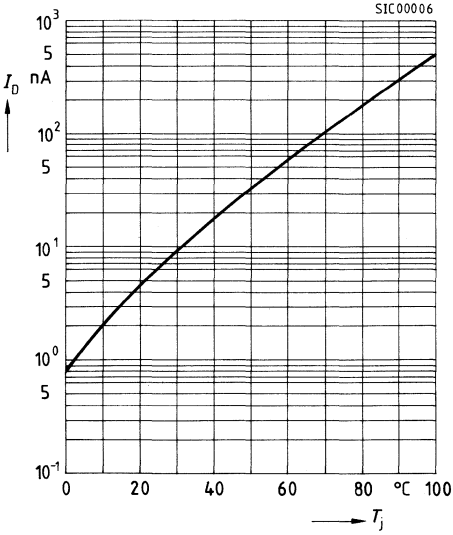
Current reduction $I_{TRMS} = f(T_{PIN5})$
$R_{thJ\text{-}PIN5}$ = 16.5 K/W
Thermocouple measurement has to be performed potentially separated to A1 and A2. The measuring junction should be as near as possible at the case



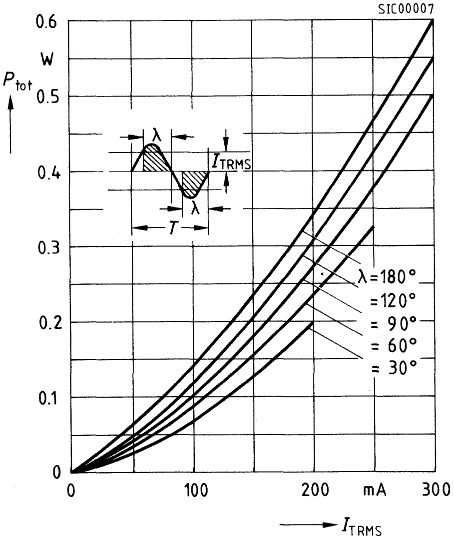
Typ. trigger delay time $t_{gd} = f\ (I_F/I_{FT25°C})$
$V_D = 200$ V
Parameter: T_j



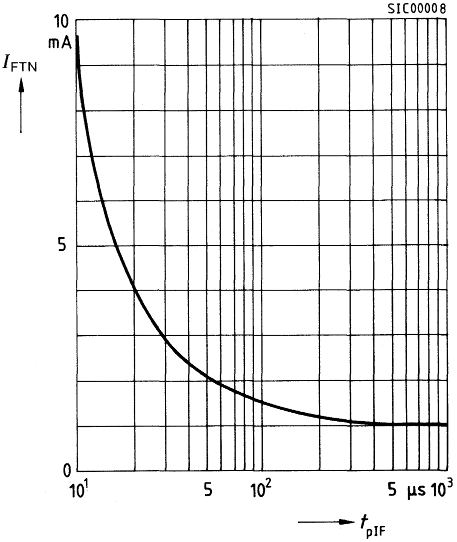
Typ. off-state current $I_D = f\ (T_j)$
$V_D = 800$ V
Parameter: T_j



Power dissipation for 40 ... 60 Hz line operation
$P_{tot} = f\ (I_{TRMS})$

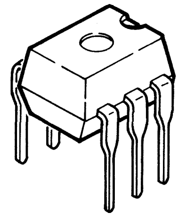


Pulse trigger current $I_{FTN} = f\ (t_{pIF})$
I_{FTN} normalized to I_{FT} referring to $t_{pIF} \geq 1$ ms
$V_{op} = 220$ V, $f = 40 \ldots 60$ Hz typ.



SITAC® AC Switches BRT 21 BRT 22 BRT 23

AC switch with zero-voltage detector consisting of two electrically insulated lateral power ICs. These power ICs integrate a thyristor system, a photo detector, noise suppression and a zero voltage switch at the output and an IR GaAs diode at the input. Turning on occurs at the zero crossing of the line voltage only.



DIP-6

V_{DRM} = **400...800 V**
I_{TRMS} = **300 mA**
$\mathrm{d}v/\mathrm{d}t_{\mathrm{cr}} \geq$ **10 000 V/µs**

- Electrically insulated between input and output circuit
- Microcomputer-compatible by very low trigger current
- Trigger current grouping H (< 2 mA) and M (< 3 mA)
- VDE 0883 and VDE 0884-approved
- UL-tested (file no. E52744), code letter "J"
- Available with the following options:
  Option 1: VDE 0884-approved
  Option 6: Pins in 10.16 mm spacing
  Option 7: Pins for surface mounting
- Package: DIP-6 [1]

Type	Ordering code	Repetitive peak off-state voltage
BRT 21 H	C67079-A1201-A1	400 V
BRT 21 M	C67079-A1200-A1	
BRT 22 H	C67079-A1203-A1	600 V
BRT 22 M	C67079-A1202-A1	
BRT 23 H	C67079-A1022-A6	800 V
BRT 23 M	C67079-A1022-A10	

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[1] See chapter Package Outlines.

Maximum Ratings

at $T_j = 25$ °C, unless otherwise specified.

AC switch

Parameter	Symbol	Values	Unit
Max. power dissipation	P_{tot}	630	mW
Operating temperature range	T_j	– 40 ... + 100	°C
Storage temperature range	T_{stg}	– 40 ... + 150	
Creepage distance (input/output circuit)	–	≥ 8.2	mm
Clearance (input/output circuit)	–	≥ 7.2	
Insulation test voltage[1] between input/output circuit (climate in acc. with DIN 40 046, part 2, Nov. 74)	V_{is}	5300	V_{DC}
Reference voltage in acc. with VDE 0110 b (Insulation group C)	V_{ref}	500 600	V_{ACeff} V_{DC}
Creepage tracking resistance (in acc. with DIN IEC 112/VDE 0303, part 1)	*CTI*	175	(group IIIa acc. to DIN VDE 0109)
Insulation resistance, $V_{IO} = 500$ V $T_A = 25$ °C $T_A = 100$ °C	R_{is}	$\geq 10^{12}$ $\geq 10^{11}$	Ω
Humidity category (DIN 40 040)	–	F	–

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[1] Test dc voltage in acc. with DIN 57 883, June 1980.

Maximum Ratings (continued)
at $T_j = 25$ °C, unless otherwise specified.

Input circuit

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	6	V
Continuous forward current	I_F	20	mA
Surge forward current, $t \leq 10$ µs	$I_{FSM(I)}$	1.5	A
Max. power dissipation	P_{tot}	30	mW

Output circuit

Parameter	Symbol	BRT 11	BRT 12	BRT 13	Unit
Repetitive peak off-state voltage	V_{DRM}	400	600	800	V
RMS on-state current	$I_{TRMS(I)}$	300			mA
Single cycle surge current (50 Hz)	$I_{TSM(I)}$	3			A
Max. power dissipation	P_{tot}	600			mW

Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Input circuit

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage $I_F = 10$ mA	V_F	–	1.1	1.35	V
Reverse current $V_R = 6$ V	I_R	–	–	10	µA
Thermal resistance junction – ambient[1])	R_{thJA}	–	–	750	K/W

Characteristics at T_j = 25 °C, unless otherwise specified.

Output circuit

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Critical rate of rise of off-state voltage	dv/dt_{cr}				V/µs
V_D = 0.67 V_{DRM} T_j = 25 °C		10000	–	–	
T_j = 80 °C		5000	–	–	
Critical rate of rise of voltage at current commutation V_D = 0.67 V_{DRM}, di/dt_{crq} $\leq$ 15 A/ms	dv/dt_{crq}				
T_j = 25 °C		10000	–	–	
T_j = 80 °C		5000	–	–	
Critical rate of rise of on-state current	di/dt_{cr}	–	–	8	A/µs
On-state voltage, I_T = 300 mA	V_T	–	–	2.3	V
Reverse current	I_D				µA
V_{DRM} T_j = 25 °C		–	7	30	
T_j = 100 °C		–	12	100	
Holding current, V_D = 10 V	I_H	–	80	500	
Thermal resistance[1]) junction – ambient	R_{thJA}	–	–	125	K/W

Response Characteristics at T_j = 25 °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Trigger current 1	I_{FT1}				mA
V_D = 6 V type H		–	–	2.0	
type M		–	–	3.0	
Trigger current 2	I_{FT2}				
V_{op} = 220 V, f = 50 Hz, T_j = 100 °C, type H		–	–	6.0	
$t_{pF} > 10$ ms type M		–	–	9.0	
Trigger current temperature gradient	$\Delta I_{FT1}/\Delta T_j$ $\Delta I_{FT2}/\Delta T_j$	–	7	14	µA/K
Inhibit voltage, $I_F = I_{FT1}$	V_{DINH}	–	8	12	V
Inhibit voltage temperature gradient	$\Delta V_{DINH}/\Delta T_j$	–	–20	–	mV/K
Off-state current in inhibit state $I_F = I_{FT1}$; V_{DRM}	I_{DINH}	–	50	200	µA
Capacitance between input and output circuit V_D = 0, f = 1 kHz	C_{IO}	–	–	2.0	pF

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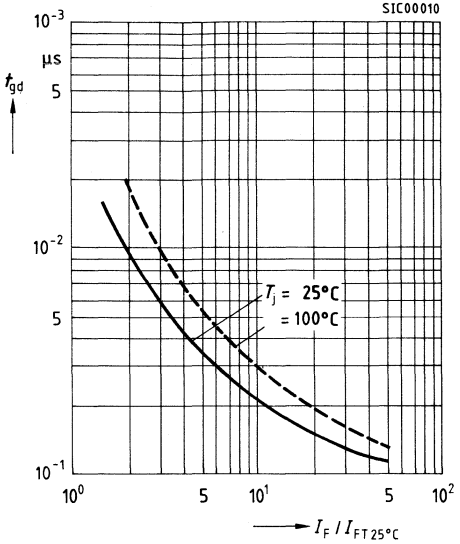
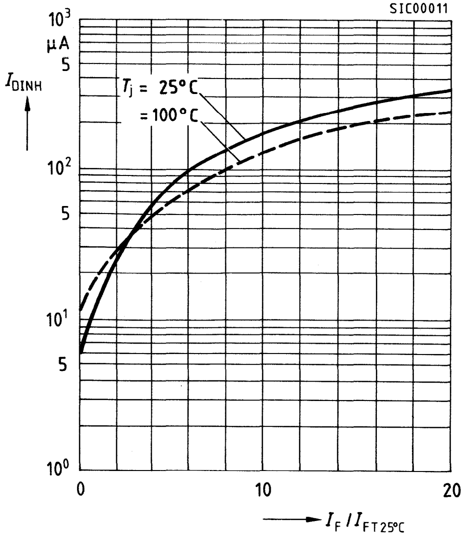
[1]) Static air, SITAC soldered in pcb or base plate.

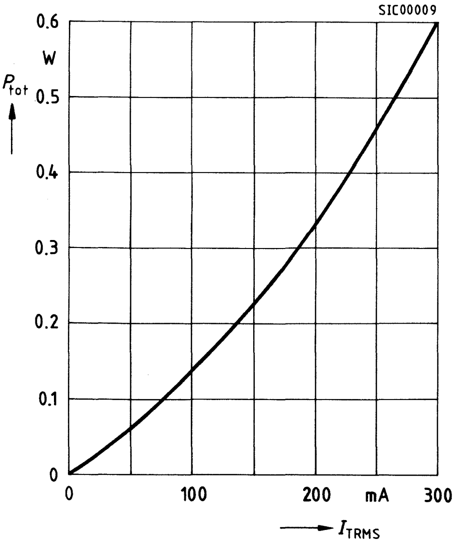
Typ. trigger delay time $t_{gd} = f\ (I_F/I_{FT25°C})$
$V_D = 200$ V, $f = 40 \ldots 60$ Hz
parameter: T_j



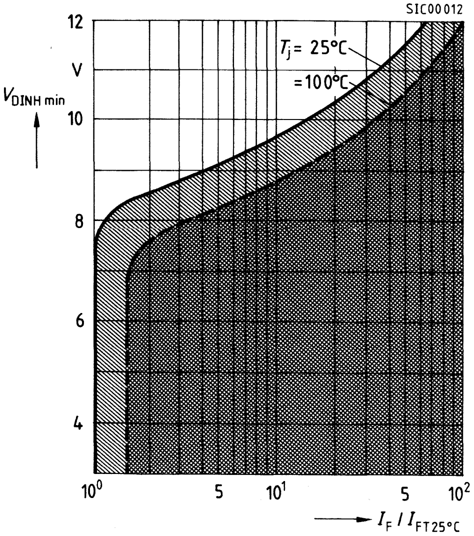
Typ. inhibit current $I_{DINH} = f\ (I_F/I_{FT25°C})$
$V_D = 800$ V
parameter: T_j



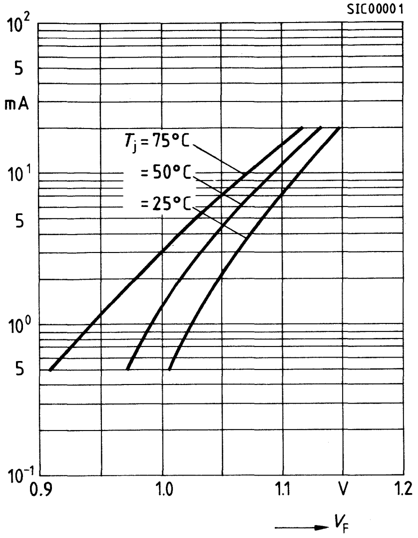
Power dissipation for 40 ... 60 Hz
line operation, $P_{tot} = f\ (I_{TRMS})$



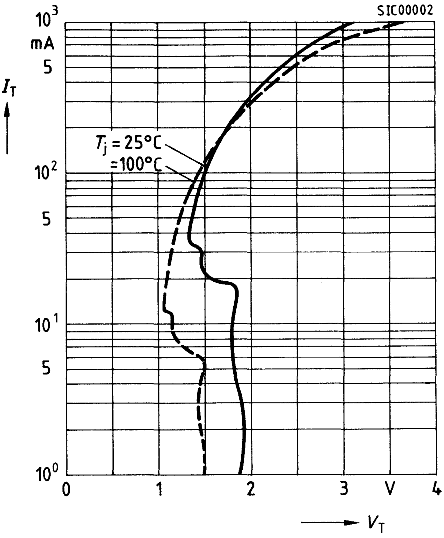
Typ. static inhibit voltage limit
$V_{DINHmin} = f\ (I_F/I_{FT25°C})$, parameter: T_j
The SITAC zero voltage switch can be triggered only in the hatched area below the T_j curves.



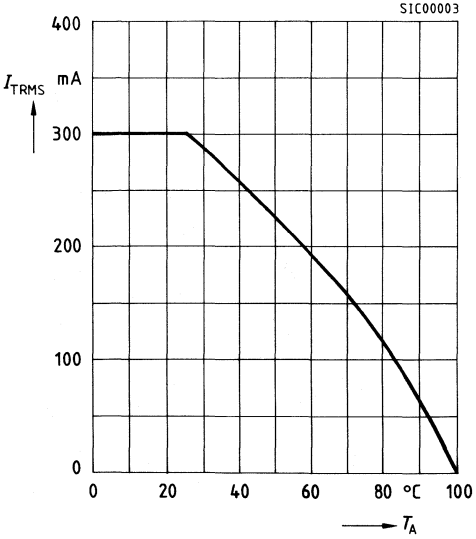
Typical input characteristics
$I_F = f\ (V_F)$
parameter: T_j



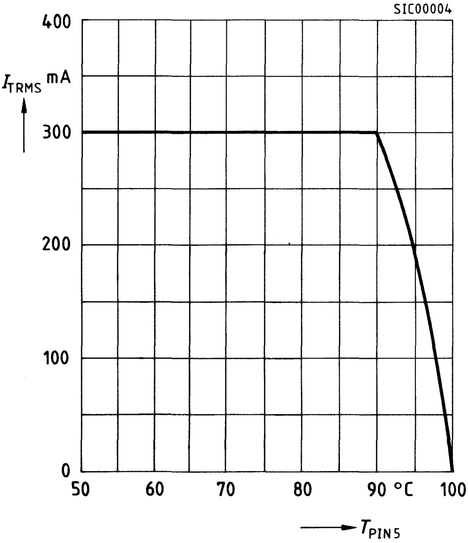
Typical output characteristics
$I_T = f\ (V_T)$
parameter: T_j



Current reduction $I_{TRMS} = f\ (T_A)$
$R_{thJA} = 125$ K/W
The SITAC switch is soldered in pcb or base plate.



Current reduction $I_{TRMS} = f\ (T_{PIN5})$
$R_{thJ\text{-}PIN5} = 16.5$ K/W
Thermocouple measurement has to be performed potentially separated to A1 and A2. The measuring junction should be as near as possible at the case.

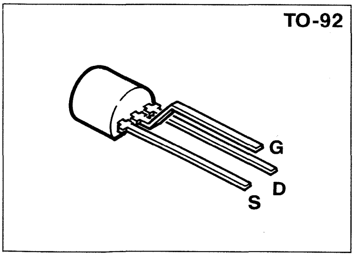


SIPMOS® Small-Signal Transistor

BS 107

V_{DS} = **200 V**
I_D = **0.13 A**
$R_{DS(on)}$ = **26 Ω**

- N channel
- Enhancement mode
- Package: TO-92 [1]



Type	Ordering code for version on tape	Ordering code for version in bulk
BS 107	Q67000-S078	Q67000-S060

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_A = 31 °C	I_D	0.13	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.52	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink)	R_{thJA}	≤ 125	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.0	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

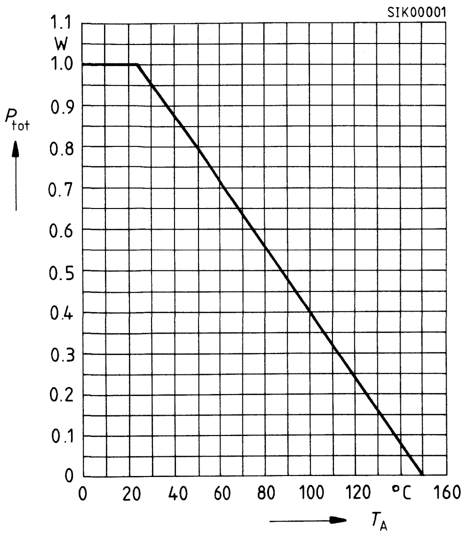
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	0.8	1.5	2.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1 2	15 60	µA
$V_{DS} = 130$ V, $V_{GS} = 0$ $T_j = 25$ °C		–	–	30	nA
$V_{DS} = 70$ V, $V_{GS} = 0.2$ V $T_j = 25$ °C		–	–	1	µA
Gate-source leakage current $V_{GS} = 25$ V, $V_{DS} = 0$	I_{GSS}	–	1	10	nA
Drain-source on-resistance $V_{GS} = 4.5$ V, $I_D = 0.12$ A $V_{GS} = 2.8$ V, $I_D = 0.02$ A	$R_{DS(on)}$	– –	14 14.5	26 28	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.12$ A	g_{fs}	0.06	0.16	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	60	90	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	8	12	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	2.5	5.0	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.24$ A	$t_{d(on)}$	–	5	8	ns
	t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.24$ A	$t_{d(off)}$	–	12	16	
	t_f	–	15	20	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

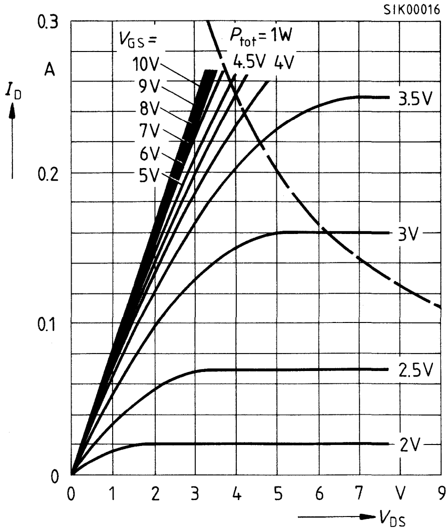
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	0.13	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	0.52	
Diode forward on-voltage $I_F = 0.5$ A, $V_{GS} = 0$	V_{SD}	–	0.9	1.2	V
Reverse recovery time $V_R = 100$ V, $I_F = 0.5$ A, $di_F/dt = 100$ A/µs	t_{rr}	–	115	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = 0.5$ A, $di_F/dt = 100$ A/µs	Q_{rr}	–	300	–	nC

Characteristics at T_j = 25 °C, unless otherwise specified.

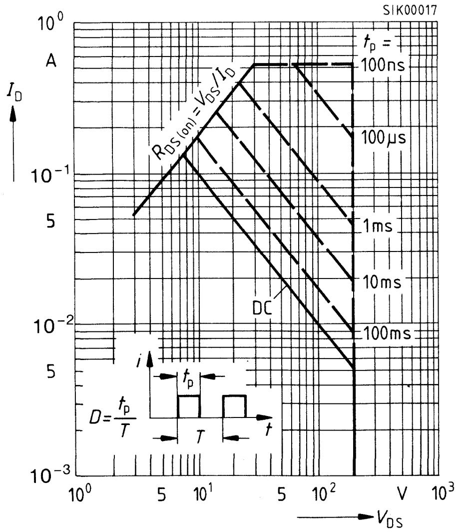
Total power dissipation $P_{tot} = f(T_A)$



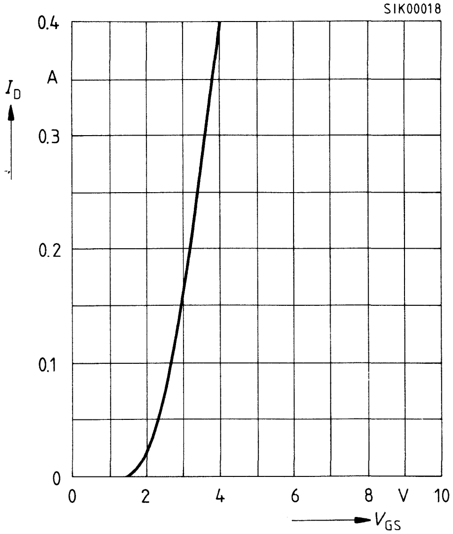
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



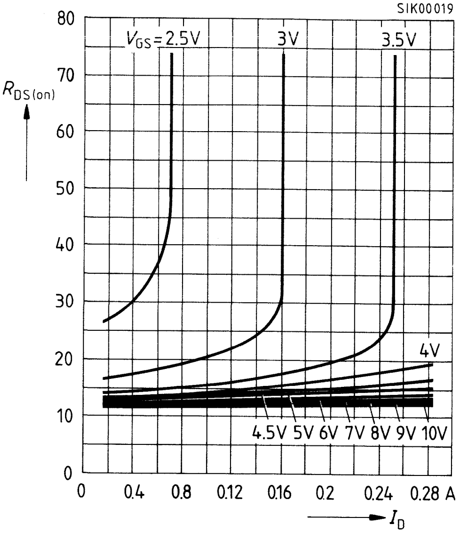
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



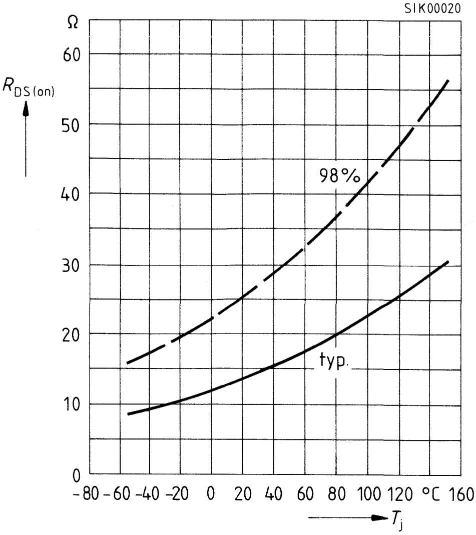
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



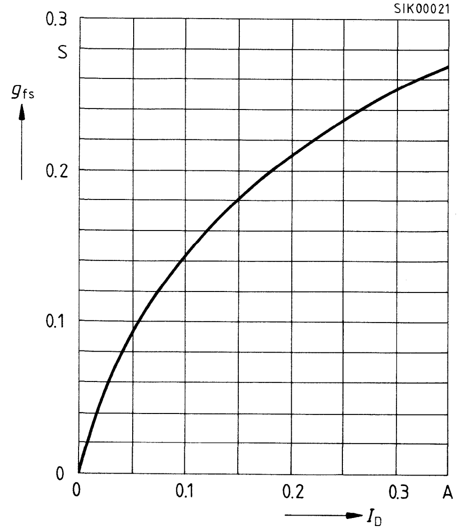
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



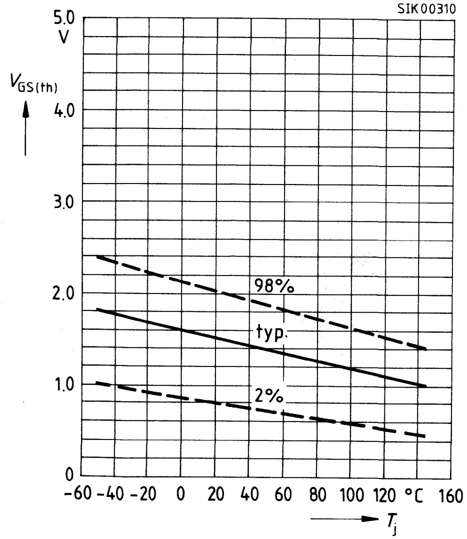
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.12$ A, $V_{GS} = 4.5$ V, (spread)



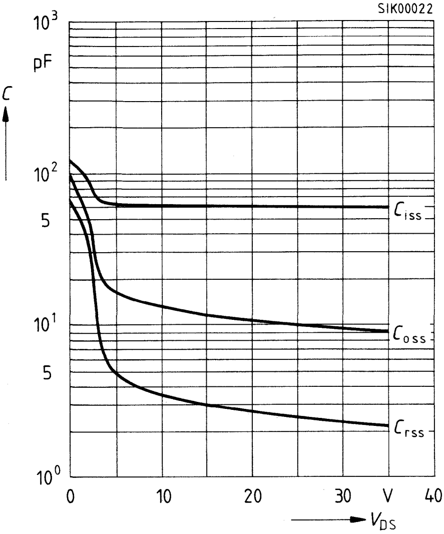
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



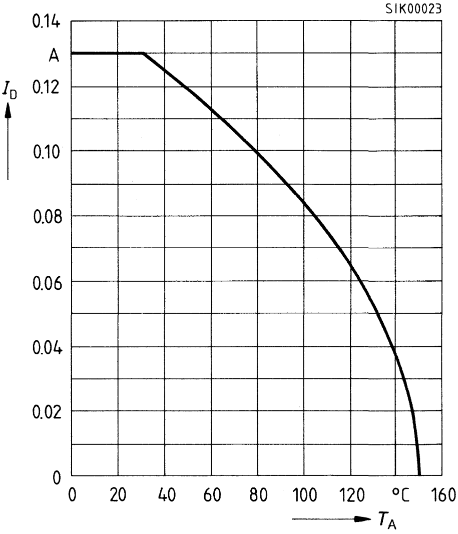
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



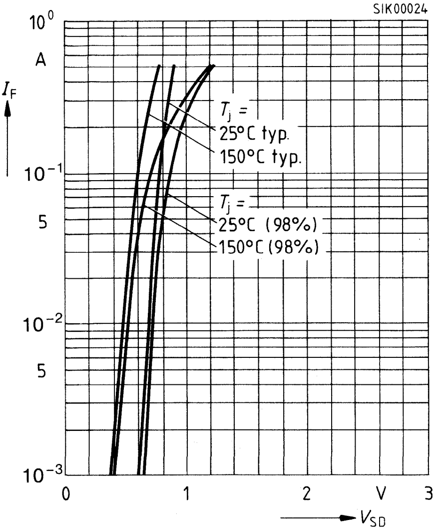
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

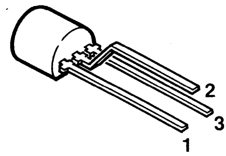


SIPMOS® Small-Signal Transistors SN 7000 SN 7002 BS 170

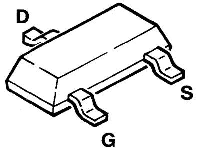
V_{DS} = 60 V
I_D = 0.19 ... 0.3 A
$R_{DS(on)}$ = 5.0 Ω

- N channel
- Enhancement mode
- Packages:
  TO-92, SOT-23 1)

TO-92
(SN 7000/BS 170)



SOT-23
(SN 7002)



Type	Marking	Ordering code for version in bulk	Ordering code for version on 8-mm tape	Ordering code for version on tape	Pins TO-92 1	2	3
SN 7000	–	C67000-S062	–	–	D	G	S
SN 7002	SSG	–	Q67000-S063	–	–	–	–
BS 170	–	C67000-S061	–	Q67000-S076	S	G	D

Maximum Ratings

Parameter	Symbol	SN 7000	SN 7002	BS 170	Unit
Drain-source voltage	V_{DS}	60			V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	60			
Gate-source voltage	V_{GS}	± 10			
Gate-source peak voltage, aperiodic	V_{gs}	± 20			
Continuous drain current, T_A = 25 °C	I_D	0.25	0.19	0.3	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	1.0	0.76	1.2	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side 2)	R_{thJA} R_{thJSR}	≤ 200	≤ 350 ≤ 285	≤ 200	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	0.36	0.63	W
DIN humidity category, DIN 40 040	–	E			–
IEC climatic category, DIN IEC 68-1	–	55/150/56			

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1) See chapter Package Outlines.
2) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage	$V_{(BR)DSS}$				V
$V_{GS} = 0$, $I_D = 0.25$ mA		60	–	–	
Gate threshold voltage	$V_{GS(th)}$				
$V_{GS} = V_{DS}$, $I_D = 1$ mA		0.8	1.4	2.0	
Zero gate voltage drain current	I_{DSS}				µA
$V_{GS} = 0$, $V_{DS} = 60$ V					
$T_j = 25$ °C SN 7000/7002		–	0.1	1.0	
$T_j = 125$ °C SN 7000		–	–	5	
$T_j = 25$ °C BS 170		–	0.05	0.5	
$V_{DS} = 50$ V $T_j = 125$ °C		–	–	5	
Gate-source leakage current	I_{GSS}				nA
$V_{GS} = 20$ V, $V_{DS} = 0$		–	1	10	
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.5$ A SN 7000/7002		–	2.0	5.0	
$I_D = 0.2$ A BS 170		–	2.5	5.0	
$V_{GS} = 4.5$ V, $I_D = 0.075$ A SN 7000		–	3.0	5.3	
$I_D = 0.050$ A SN 7002		–	3.0	7.5	

Dynamic characteristics

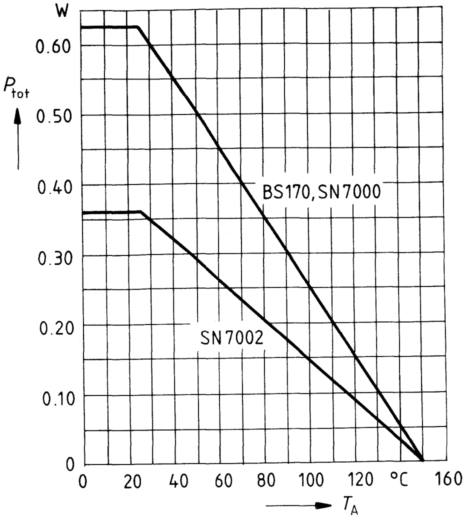
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.2$ A SN 7000/7002		0.1	0.18	–	
BS 170		0.12	0.18	–	
Input capacitance	C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	40	60	
Output capacitance	C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	15	25	
Reverse transfer capacitance	C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	5	10	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	–	5	8	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 0.29$ A	t_f	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	–	12	16	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 0.29$ A	t_f	–	17	22	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

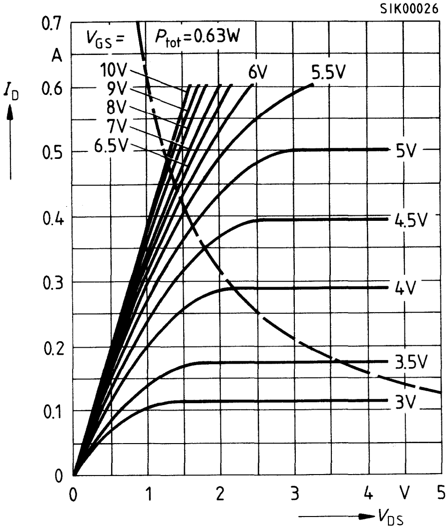
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	SN 7000		–	–	0.17	
	SN 7002		–	–	0.19	
	BS 170		–	–	0.3	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	SN 7000		–	–	0.68	
	SN 7002		–	–	0.76	
	BS 170		–	–	1.2	
Diode forward on-voltage		V_{SD}				V
$V_{GS} = 0$, $I_F = 0.34$ A	SN 7000		–	1.0	1.2	
$I_F = 0.28$ A	SN 7002		–	0.85	1.5	
$I_F = 0.50$ A	BS 170		–	0.9	1.2	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

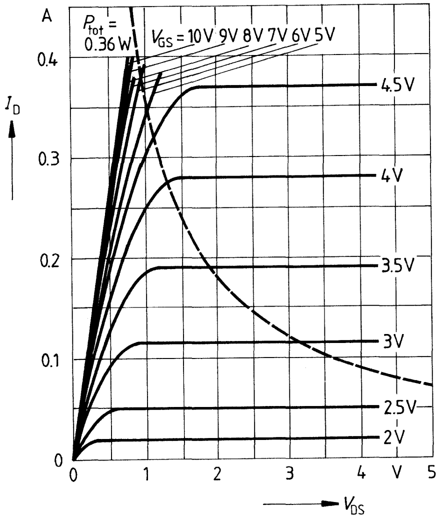
Total power dissipation $P_{tot} = f(T_C)$



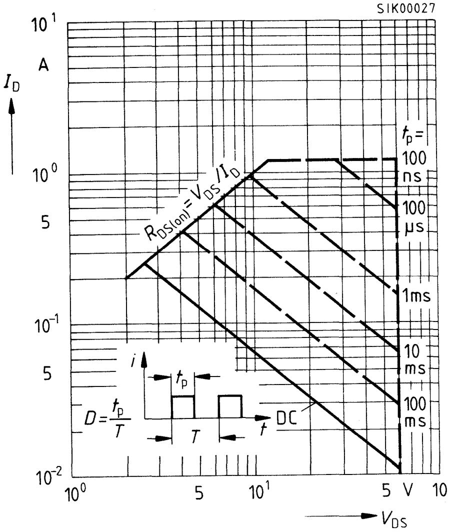
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
SN 7000/BS 170



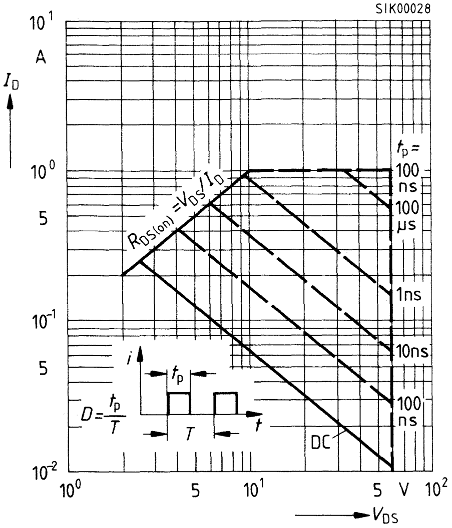
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
SN 7002



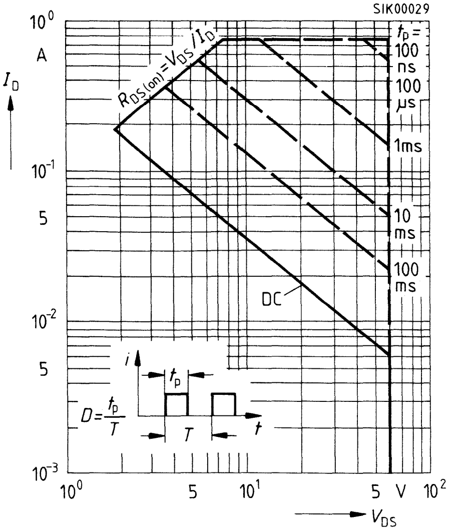
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BS 170



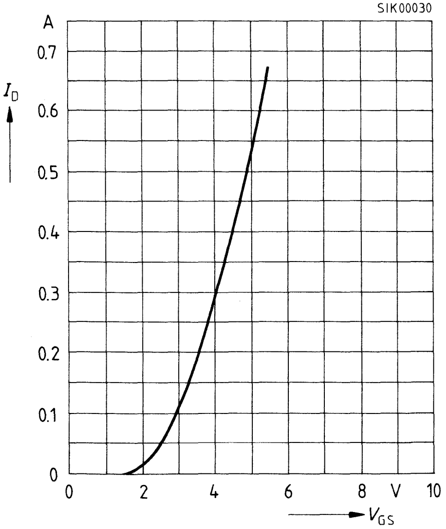
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
SN 7000



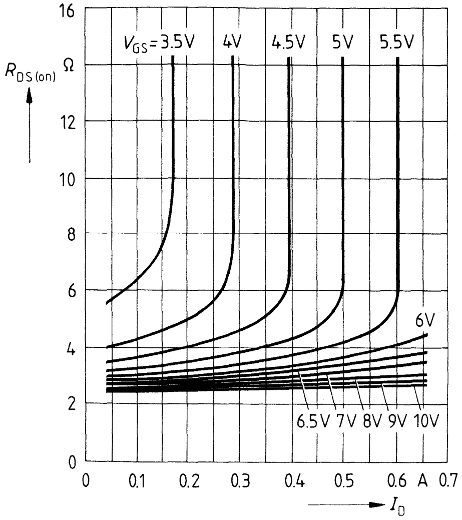
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
SN 7002



Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

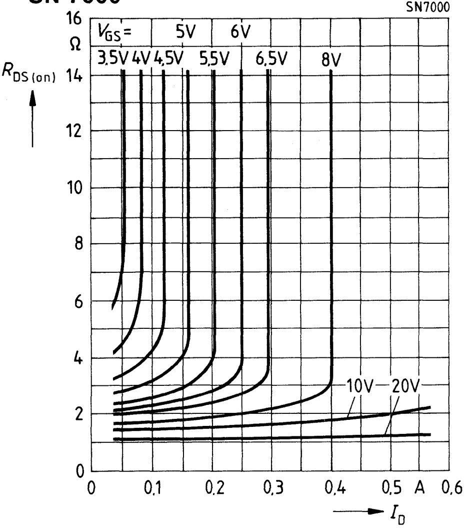


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BS 170



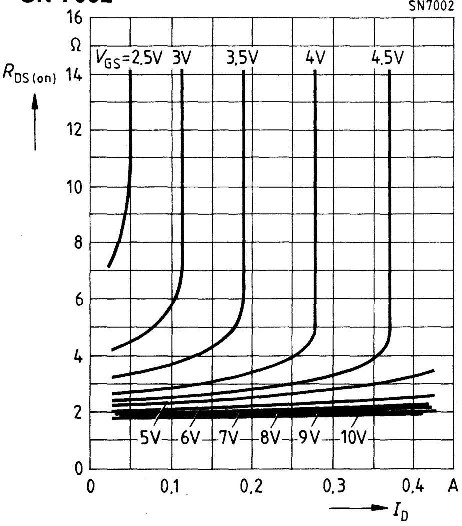
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

SN 7000



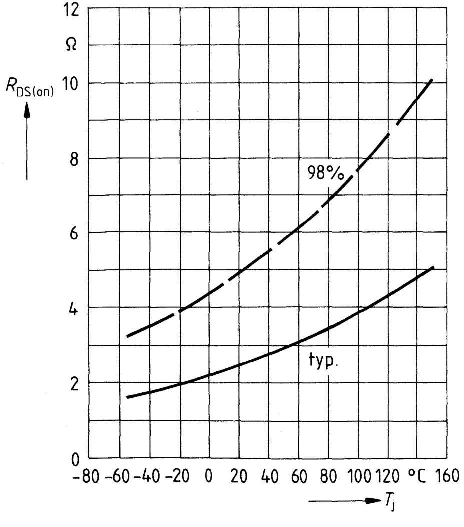
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

SN 7002



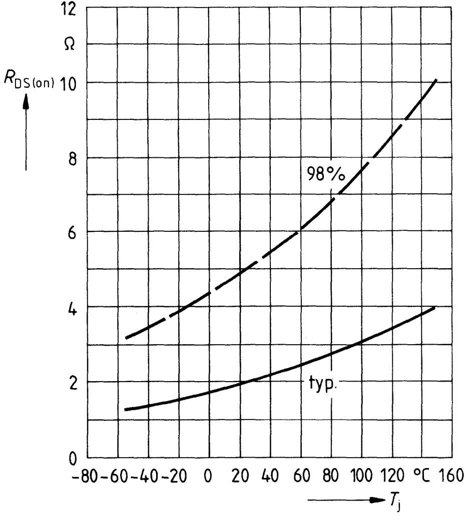
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.2$ A, $V_{GS} = 10$ V, (spread)

BS 170

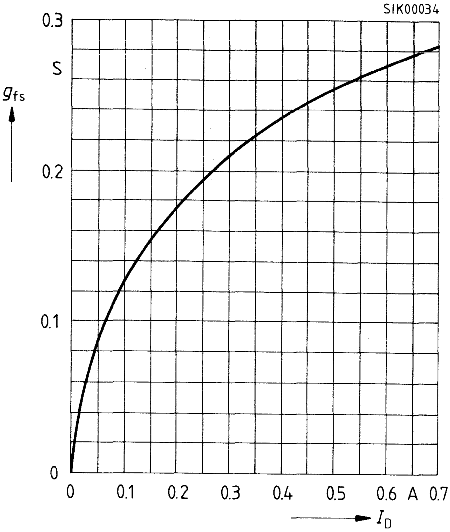


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.5$ A, $V_{GS} = 10$ V, (spread)

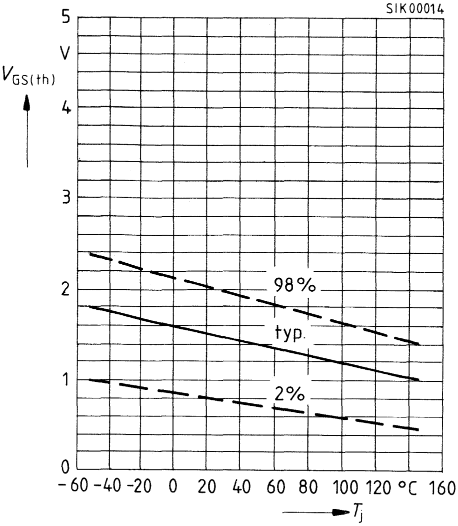
SN 7000/7002



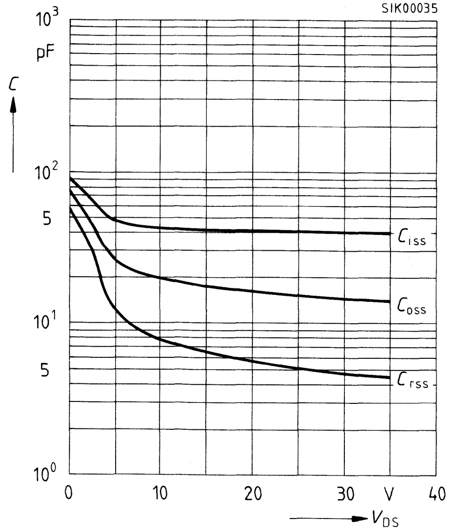
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



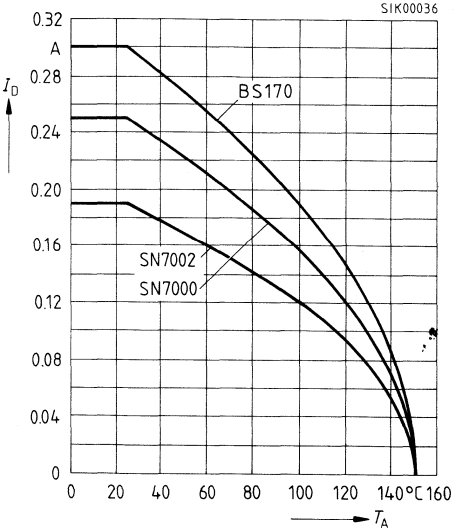
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

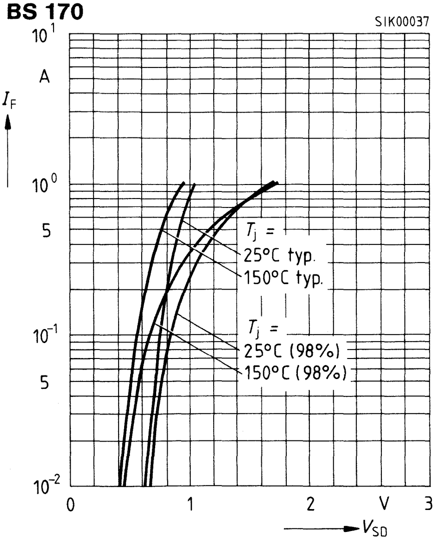


Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



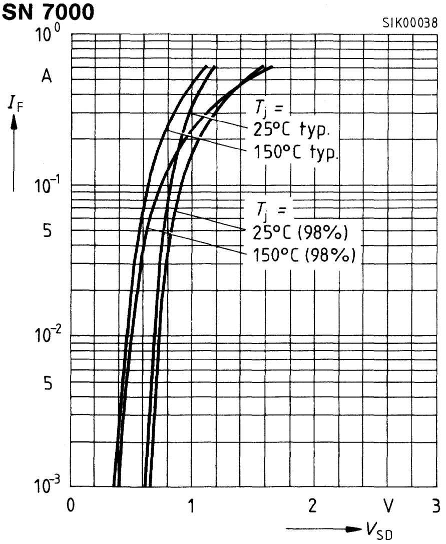
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

BS 170



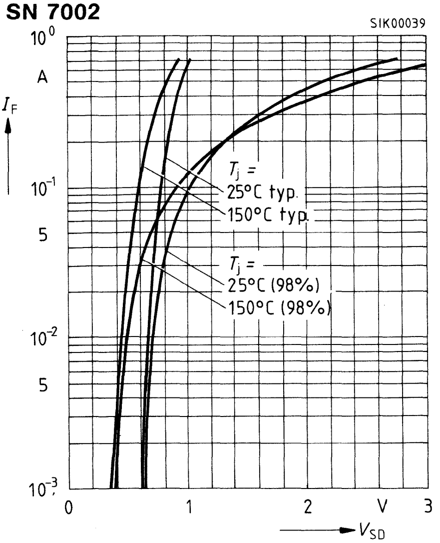
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

SN 7000



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

SN 7002

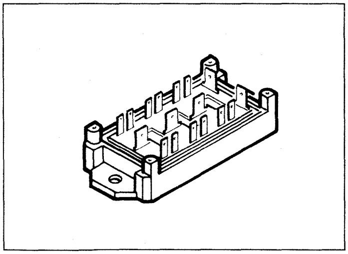


IGBT Module
Preliminary Data

BSM 15 GD 100 D

V_{CE} = 1000 V
I_C = 6 x 15 A

- Power module
- 3-phase full-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 b [1]



Type	Ordering code
BSM 15 GD 100 D	C67076-A2500-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20\ k\Omega$	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80\ °C$	I_C	15	A
Pulsed collector current, $T_C = 80\ °C$	$I_{C\ puls}$	30	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, $T_C = 25\ °C$	P_{tot}	150	W
Thermal resistance chip - case case - heat sink	R_{thJC} R_{thCH}	≤ 0.8 ≤ 0.05	K/W
Isolation test voltage [2], $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
Including fast free-wheel diodes	–	55 / 150 / 56	

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[1] See chapter Package Outlines.

[2] Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.5$ mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 1$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 15$ A $T_j = 25$ °C $T_j = 150$ °C	$V_{CE(sat)}$	– –	3.0 4.0	– 4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{CES}	– –	– –	500 2000	µA
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	–	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 15$ A	g_{fs}	5.5	8	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	2000	–	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	160	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	65	–	

Switching Characteristics

at $T_j = 125$ °C

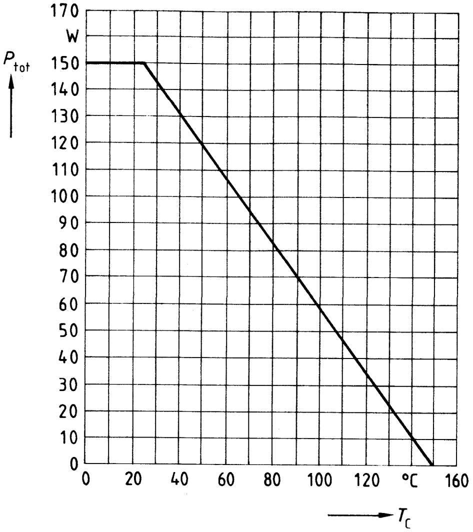
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	$t_{d(on)}$	–	50	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	t_r	–	200	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	$t_{d(off)}$	–	150	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	t_f	–	300	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	$t_{d(off)}$	–	150	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	t_f	–	150	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω, $T_j = 125$ °C	$E_{off\,1}$ $E_{off\,2}$	– –	0.7 0.8	– –	mWs

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

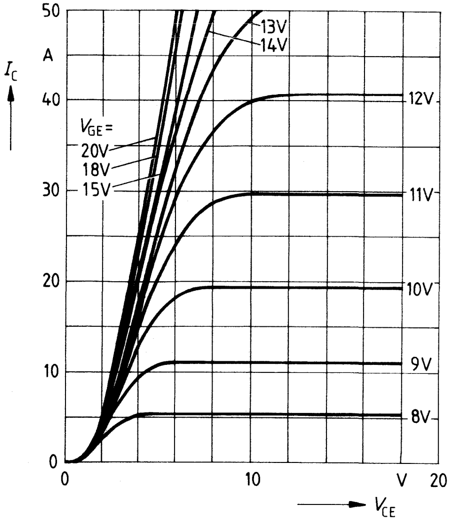
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 15$ A, $V_{GE} = 0$ $T_j = 25$ °C $T_j = 125$ °C	V_F	– –	1.9 1.7	– –	V
Reverse recovery time $I_F = 15$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.1	–	µs
Reverse recovery charge $I_F = 15$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 25$ °C $T_j = 125$ °C	Q_{rr}	– –	1 4	– –	µC
Soft factor $I_F = 15$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance chip - case	R_{thJC}	–	–	1.7	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

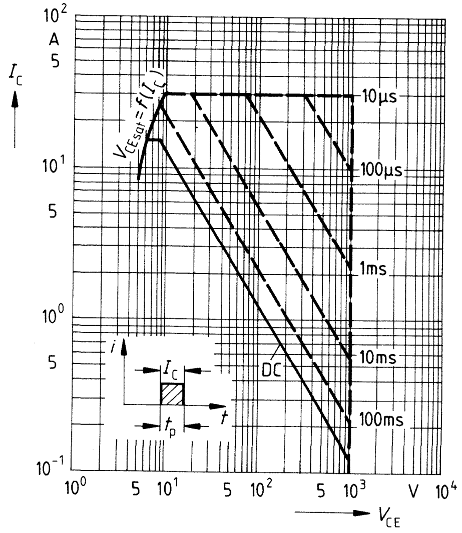
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



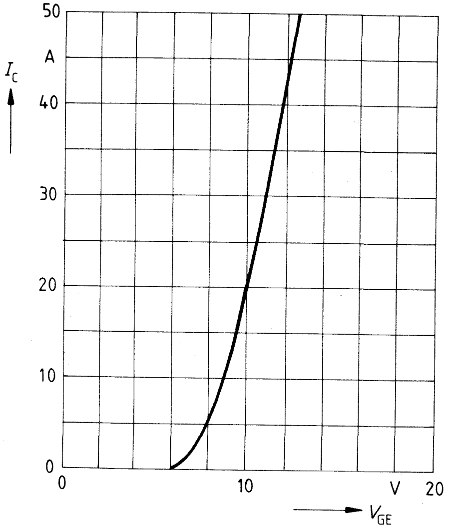
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



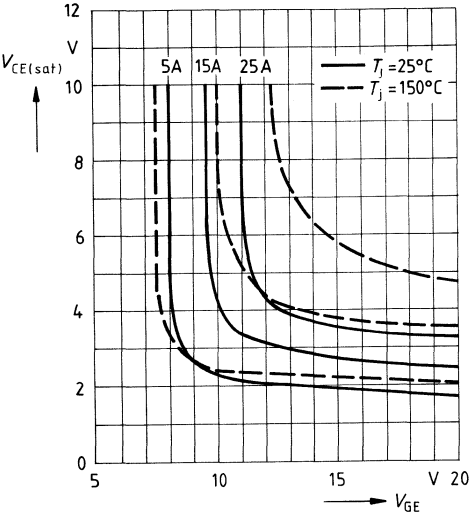
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



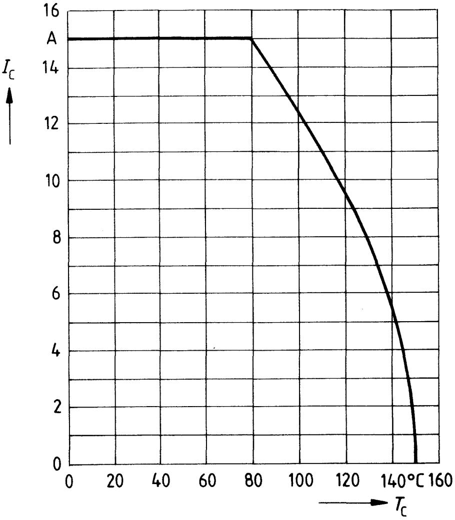
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



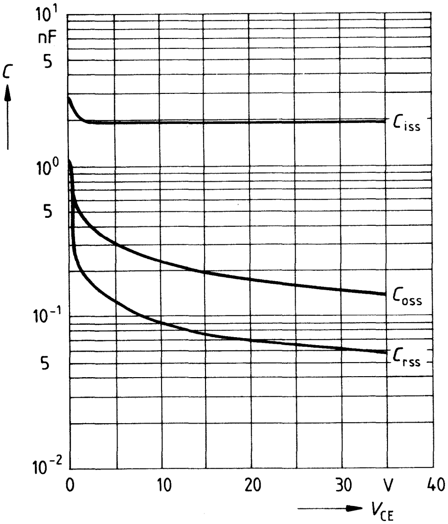
Typ. on-state characteristics
$V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



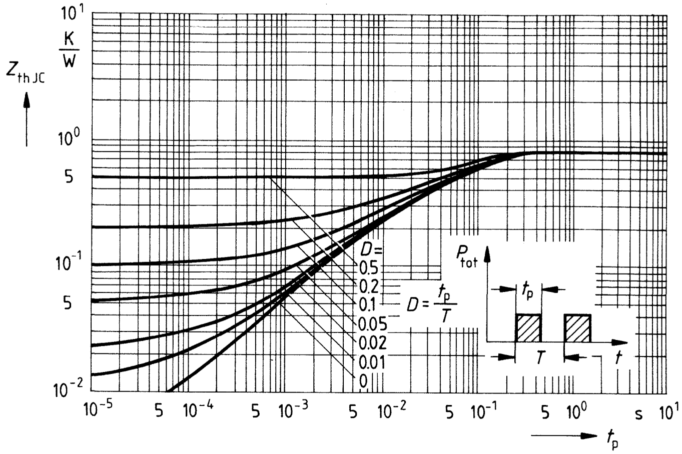
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



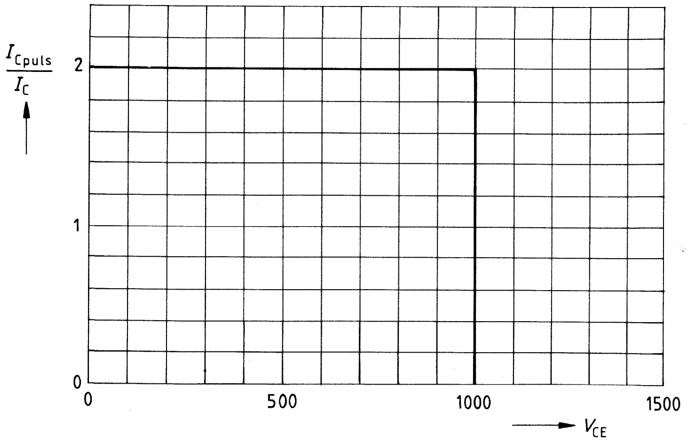
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\ puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 50 nH



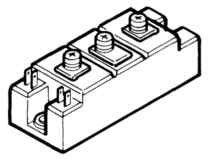
IGBT Module

Preliminary Data

BSM 25 GB 100 D

V_{CE} = 1000 V
I_C = 2 x 25 A

- Power module
- Half-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 b [1])



Type	Ordering code
BSM 25 GB 100 D	C67076-A2101-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20$ kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80$ °C	I_C	25	A
Pulsed collector current, $T_C = 80$ °C	$I_{C\ puls}$	50	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, $T_C = 25$ °C	P_{tot}	300	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 ≤ 0.4 ≤ 0.05	K/W
Isolation test voltage[2]), $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55 / 150 / 56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.75$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 2$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 25$ A $T_j = 25$ °C $T_j = 150$ °C	$V_{CE(sat)}$	- -	3.0 4.0	- 4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{CES}	- -	- -	750 3000	µA
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	-	100	nA

AC characteristics

Forward transconductance $V_{CE} = 20$ V, $I_C = 25$ A	g_{fs}	11	14	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	4000	-	pF
Output capacitance, $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	320	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	130	-	

Switching Characteristics
at T_j = 125 °C

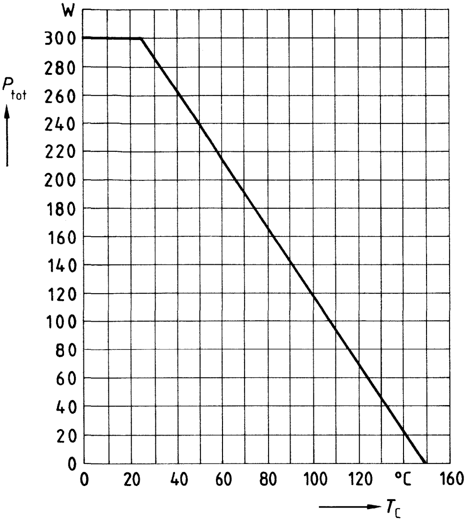
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(on)}$	–	60	–	ns
Rise time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_r	–	250	–	
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(off)}$	–	200	–	
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_f	–	300	–	
Inductive load					
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(off)}$	–	200	–	ns
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_f	–	150	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) V_{CC} = 600 V, V_{GE} = 15 V, I_C = 25 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$E_{off\,1}$ $E_{off\,2}$	– –	1.4 1.3	– –	mWs

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

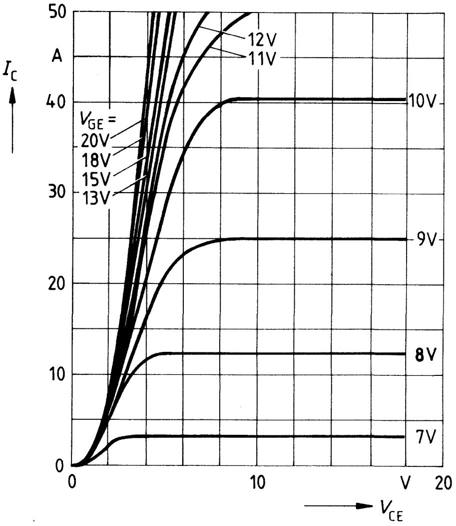
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage I_F = 25 A, V_{GE} = 0 T_j = 25 °C T_j = 125 °C	V_F	 – –	 1.9 1.7	 – –	V
Reverse recovery time I_F = 25 A, V_R = 600 V V_{GE} = 0, di_F/dt = –800 A/µs T_j = 125 °C	t_{rr}	–	0.13	–	µs
Reverse recovery charge I_F = 25 A, V_R = 600 V V_{GE} = 0, di_F/dt = –800 A/µs T_j = 25 °C T_j = 125 °C	Q_{rr}	 – –	 1.3 5	 – –	µC
Soft factor I_F = 25 A, V_R = 600 V V_{GE} = 0 V, di_F/dt = –800 A/µs T_j = 125 °C	S	–	1	–	–
Thermal resistance Chip - case	R_{thJC}	–	–	1.0	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

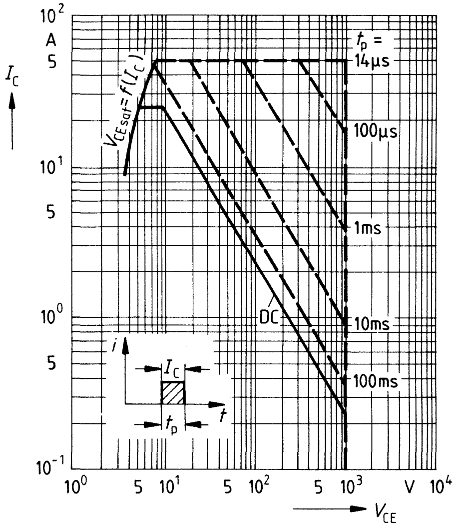
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



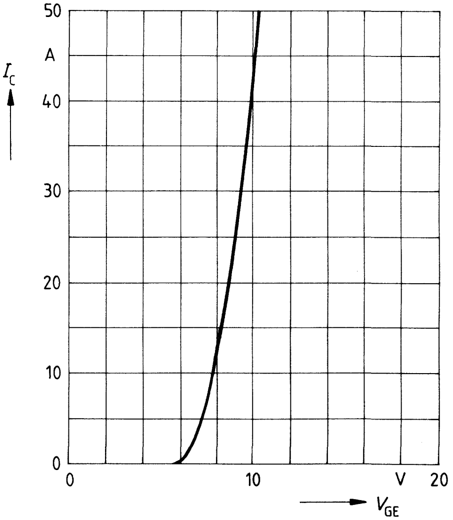
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



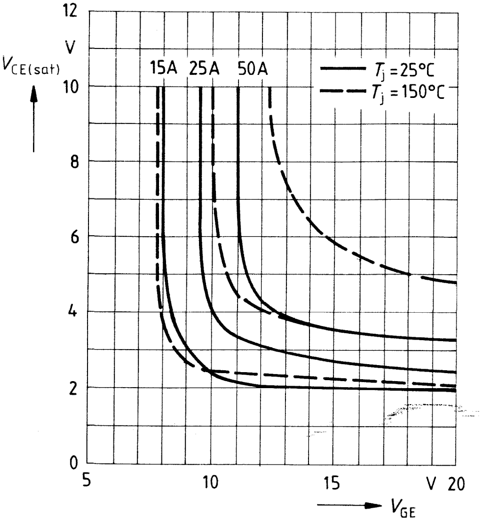
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



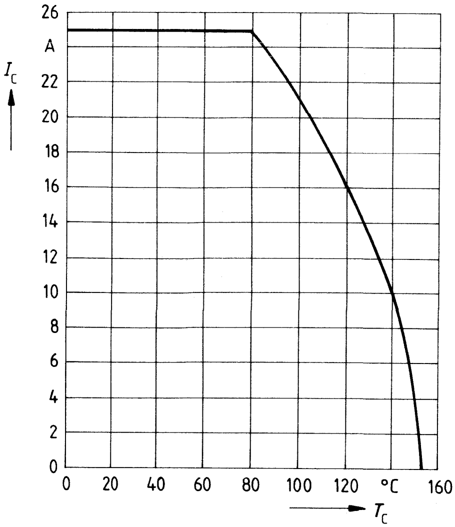
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



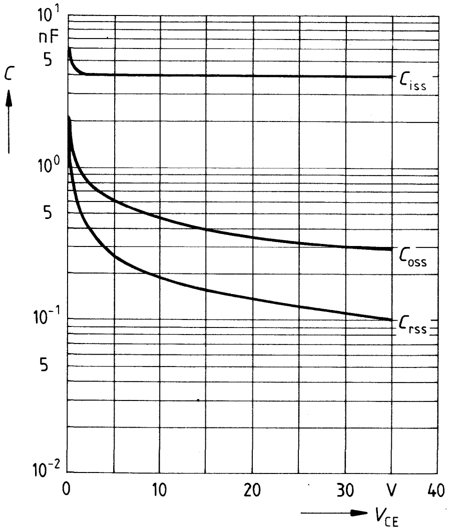
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



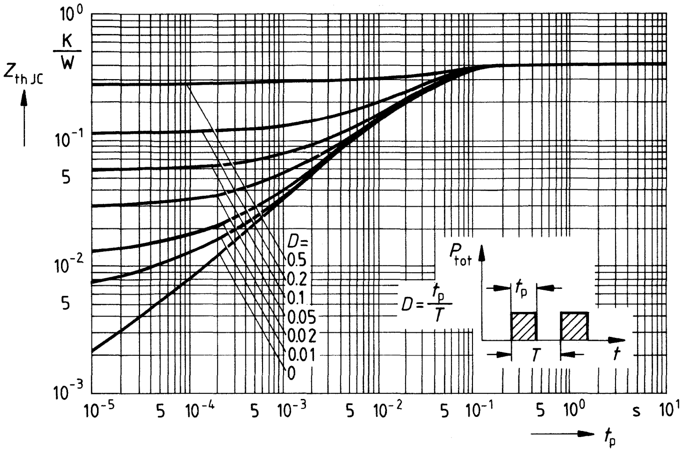
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



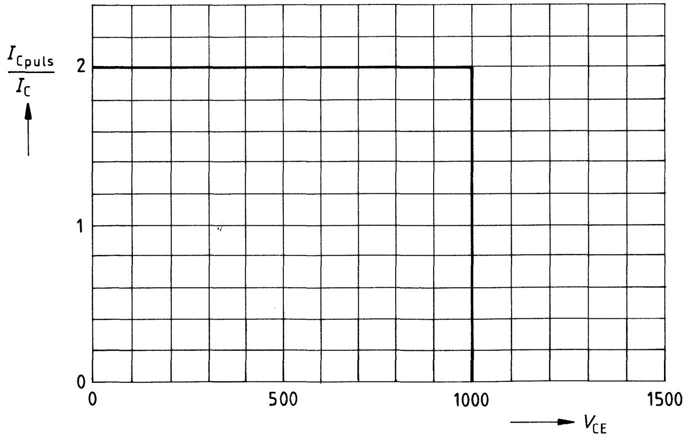
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_C = f(V_{CE})$
parameter: $T_j = 125\ °C$, $V_{GE} = 15\ V$, $R_{g(off)} = 5\ \Omega$,
L (parasitic inductance, module) $< 50\ nH$



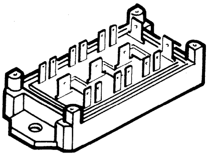
IGBT Module

BSM 25 GD 100 D

Preliminary Data

V_{CE} = 1000 V
I_C = 6 x 25 A

- Power module
- 3-phase full-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 b [1]



Type	Ordering code
BSM 25 GD 100 D	C67076-A2501-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20\ k\Omega$	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80\ °C$	I_C	25	A
Pulsed collector current, $T_C = 80\ °C$	$I_{C\ puls}$	50	
Operating and storage temperature range	T_j T_{stg}	 – 55 ... + 150	°C
Max. power dissipation, $T_C = 25\ °C$	P_{tot}	300	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 ≤ 0.4 ≤ 0.05	K/W
Isolation test voltage[2], $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines

[2] Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.75$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 2$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 25$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		-	3.0	-	
$T_j = 150$ °C		-	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		-	-	750	
$T_j = 125$ °C		-	-	3000	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	-	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 25$ A	g_{fs}	11	14	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	4000	-	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	320	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	130	-	

Switching Characteristics

at $T_j = 125\ °C$

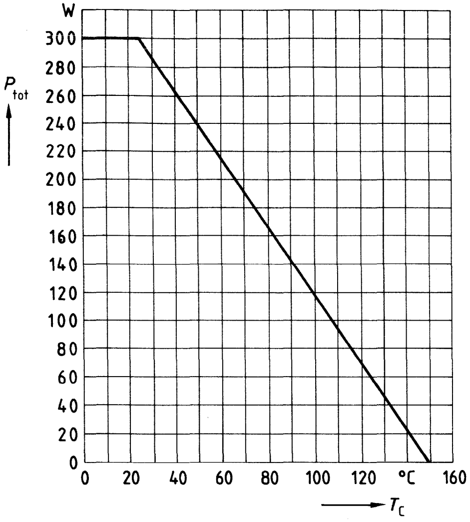
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(on)}$	–	60	–	ns
Rise time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_r	–	250	–	
Turn-off delay time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	200	–	
Fall time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	300	–	
Inductive load					
Turn-off delay time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	200	–	ns
Fall time $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	150	–	
Turn-off loss ($E_{off} = E_{off\ 1} + E_{off\ 2}$) $V_{CC} = 600\ V$, $V_{GE} = 15\ V$, $I_C = 25\ A$ $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$E_{off\ 1}$ $E_{off\ 2}$	– –	1.4 1.3	– –	mWs

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

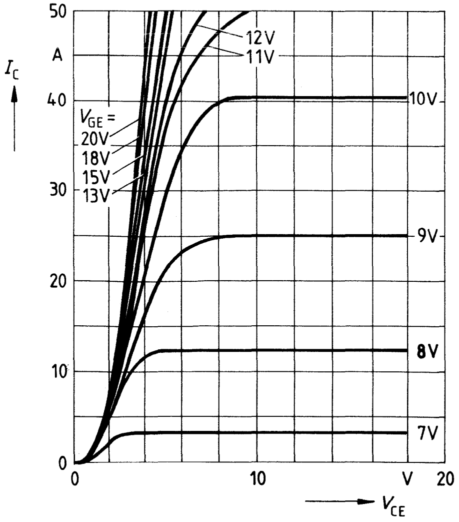
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 25$ A, $V_{GE} = 0$	V_F				V
$T_j = 25$ °C		–	1.9	–	
$T_j = 125$ °C		–	1.7	–	
Reverse recovery time $I_F = 25$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.13	–	µs
Reverse recovery charge $I_F = 25$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	Q_{rr}				µC
$T_j = 25$ °C		–	1.3	–	
$T_j = 125$ °C		–	5	–	
Soft factor $I_F = 25$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance chip – case	R_{thJC}	–	–	1.0	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

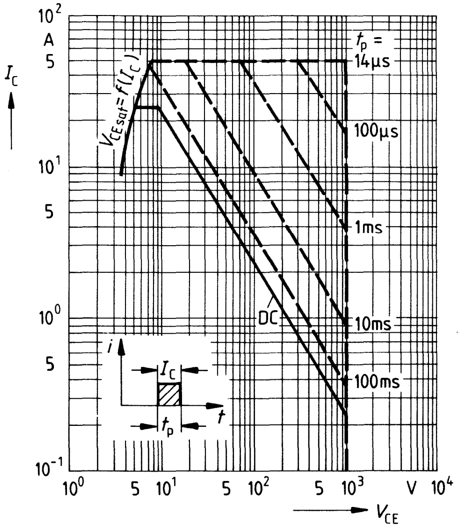
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



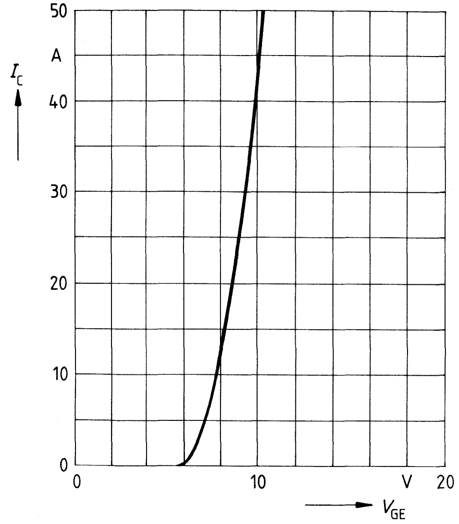
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



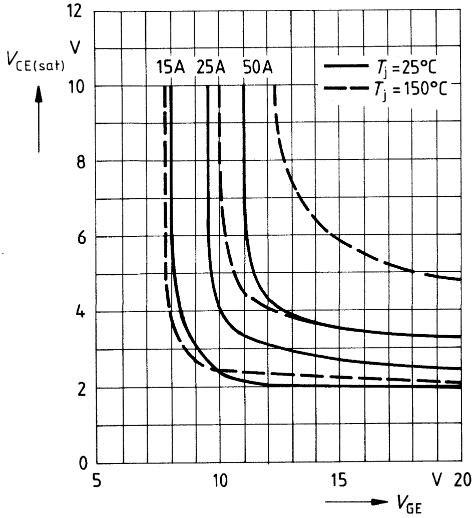
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



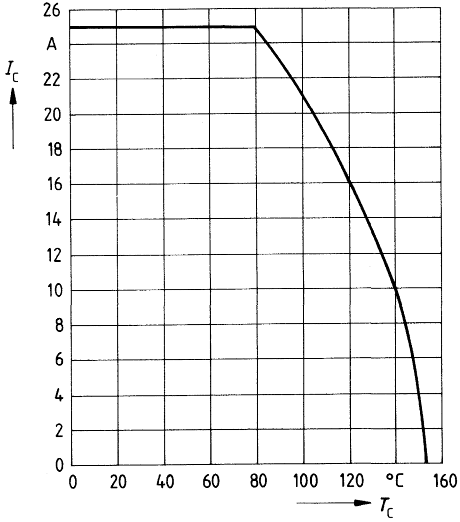
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



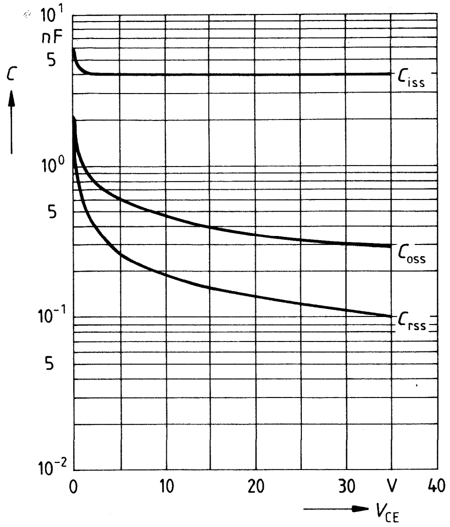
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



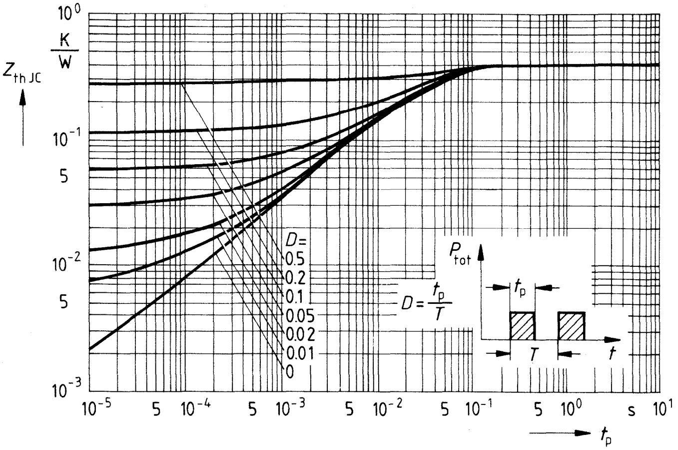
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



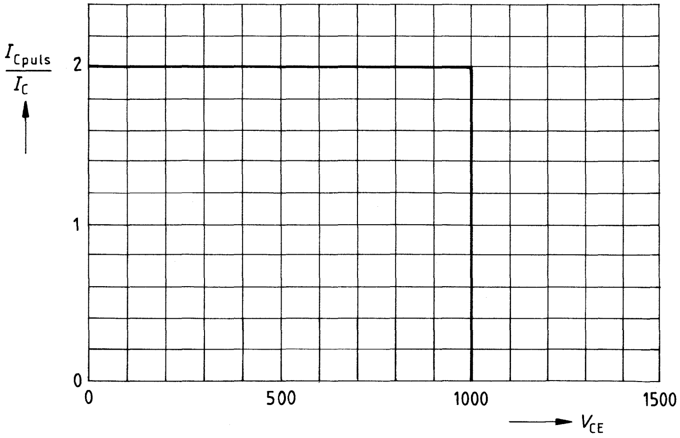
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\ puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 30 nH



SIEMENS

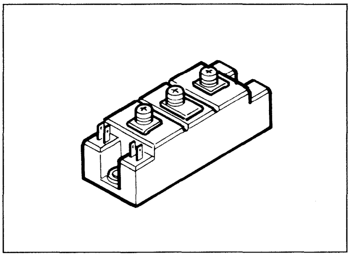
IGBT Module

Preliminary Data

BSM 50 GB 100 D

V_{CE} = 1000 V
I_C = 2 x 50 A

- Power module
- Half-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 b [1])



Type	Ordering code
BSM 50 GB 100 D	C67076-A2100-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20$ kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80$ °C	I_C	50	A
Pulsed collector current, $T_C = 80$ °C	$I_{C\ puls}$	100	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, $T_C = 25$ °C	P_{tot}	500	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 ≤ 0.25 ≤ 0.05	K/W
Isolation test voltage [2]), $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climate category, DIN IEC 68-1	–	55 / 150 / 56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 1$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 4$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 50$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		-	3.0	-	
$T_j = 150$ °C		-	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		-	-	1000	
$T_j = 125$ °C		-	-	4000	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	-	100	nA

AC characteristics

Forward transconductance $V_{CE} = 20$ V, $I_C = 50$ A	g_{fs}	22	28	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	8000	-	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	640	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	250	-	

Switching Characteristics
at $T_j = 125$ °C

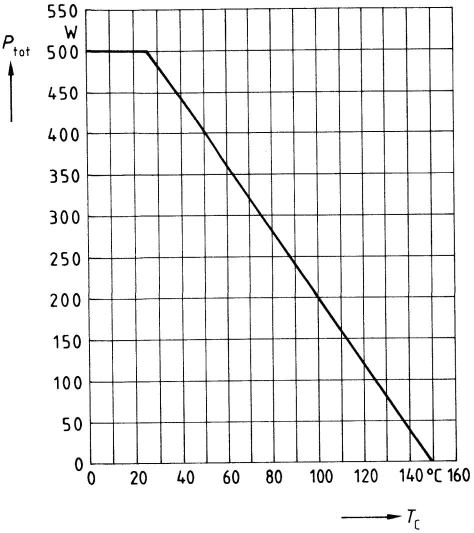
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(on)}$	–	100	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_r	–	300	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(off)}$	–	250	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_f	–	300	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(off)}$	–	250	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 50$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$E_{off\,1}$ $E_{off\,2}$	– –	2.0 2.0	– –	mWs

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

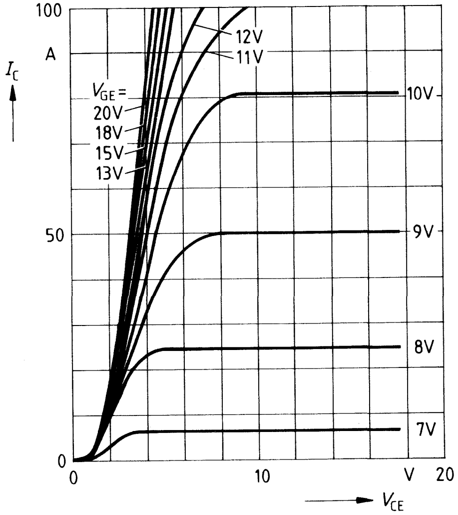
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 50$ A, $V_{GE} = 0$ $T_j = 25$ °C $T_j = 125$ °C	V_F	– –	1.8 1.6	– –	V
Reverse recovery time $I_F = 50$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.2	–	µs
Reverse recovery charge $I_F = 50$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 25$ °C $T_j = 125$ °C	Q_{rr}	– –	2 9	– –	µC
Soft factor $I_F = 50$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance chip - case	R_{thJC}	–	–	0.9	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

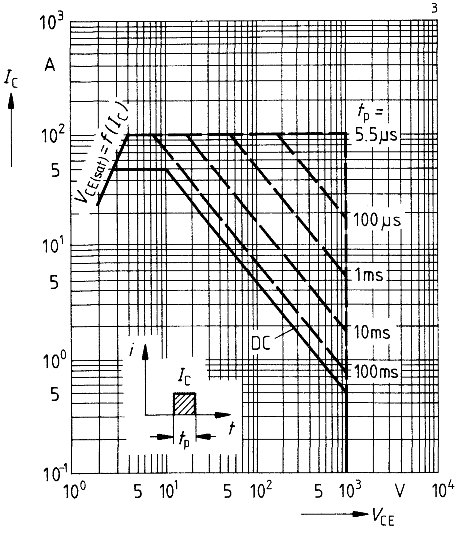
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



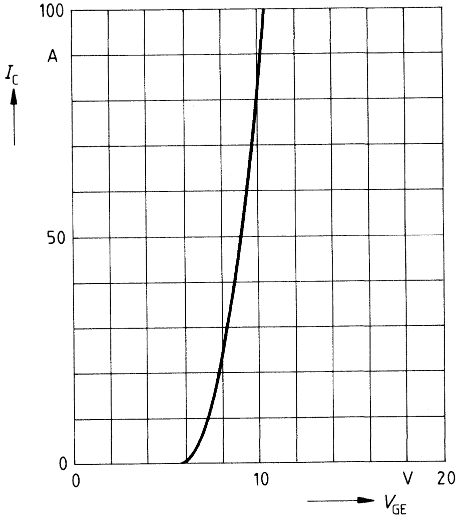
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



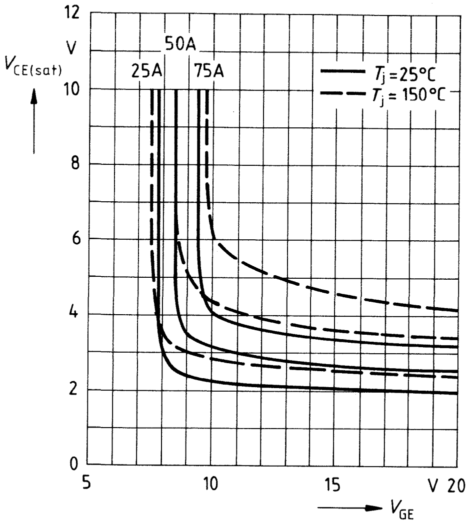
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



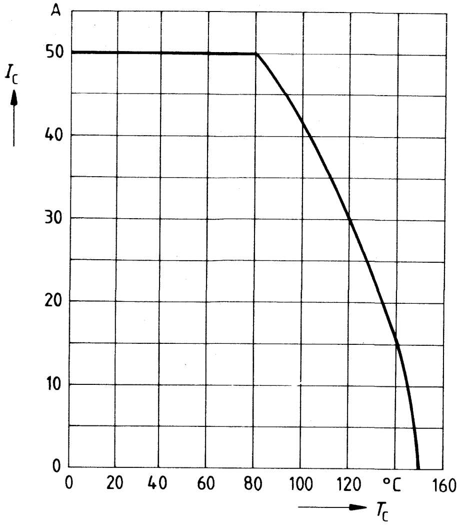
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



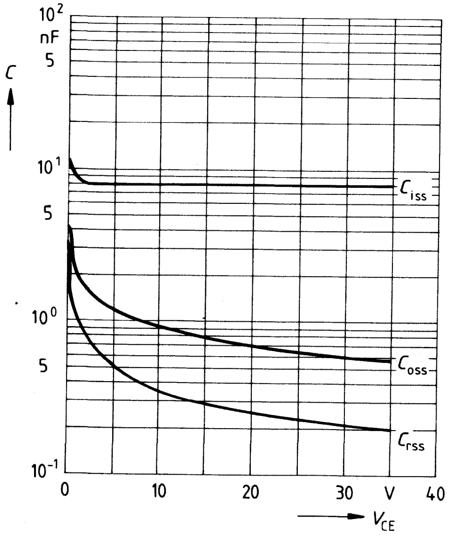
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



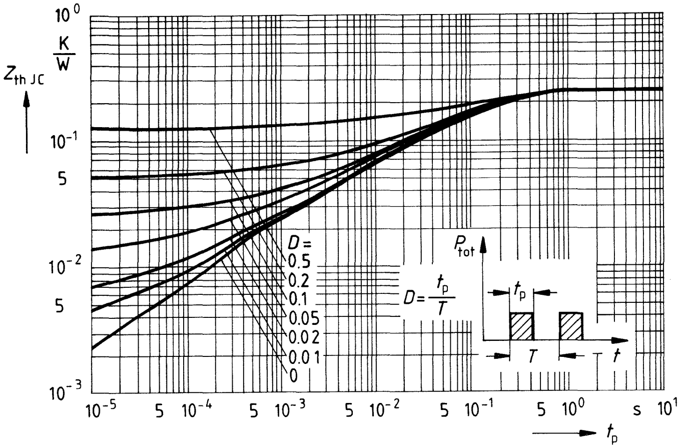
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



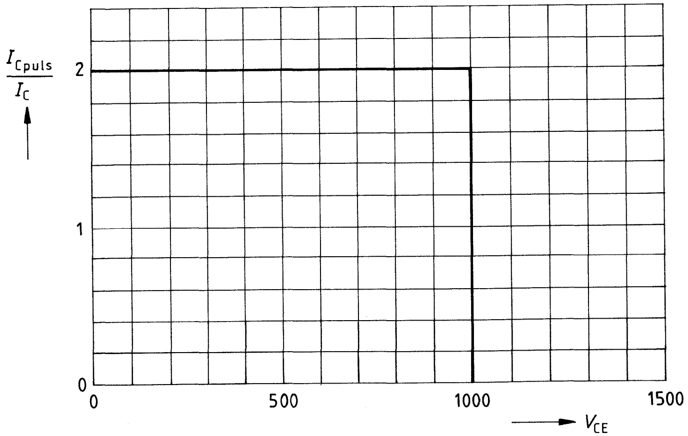
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\ puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 50 nH

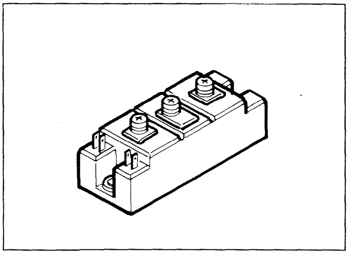


IGBT Module
Preliminary Data

BSM 75 GB 100 D

V_{CE} = 1000 V
I_C = 2 x 75 A

- Power module
- Half-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagramn: Fig. 2 b ¹)



Type	Ordering code
BSM 75 GB 100 D	C67076-A2104-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, R_{GE} = 20 kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, T_C = 80 °C	I_C	75	A
Pulsed collector current, T_C = 80 °C	$I_{C\ puls}$	150	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	625	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 $\leq$ 0.2 $\leq$ 0.038	K/W
Isolation test voltage²), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance	-	16	mm
Clearance	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1] See chapter Package Outlines.

[2] Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 1.4$ mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 5$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 75$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		–	3.0	–	
$T_j = 150$ °C		–	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		–	–	1400	
$T_j = 125$ °C		–	–	–	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	–	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 75$ A	g_{fs}	33	–	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	11000	–	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	850	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	350	–	

Switching Characteristics
at $T_j = 125$ °C

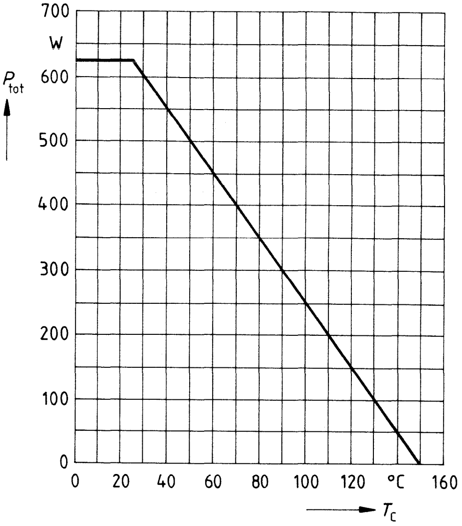
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(on)}$	–	130	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_r	–	400	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(off)}$	–	300	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_f	–	400	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$t_{d(off)}$	–	300	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 75$ A $R_{g(on)} = 3.3$ Ω, $R_{g(off)} = 3.3$ Ω	$E_{off\,1}$ $E_{off\,2}$	– –	4.5 3.5	– –	mWs

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

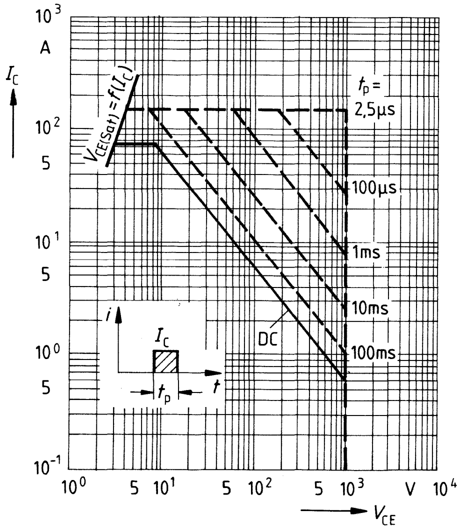
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 75$ A, $V_{GE} = 0$	V_F				V
$T_j = 25$ °C		–	1.8	–	
$T_j = 125$ °C		–	1.6	–	
Reverse recovery time $I_F = 75$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	t_{rr}				µs
$T_j = 125$ °C		–	0.25	–	
Reverse recovery charge $I_F = 75$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	Q_{rr}				µC
$T_j = 25$ °C		–	3	–	
$T_j = 125$ °C		–	13.5	–	
Soft factor $I_F = 75$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs	S				–
$T_j = 125$ °C		–	1	–	
Thermal resistance Chip-case	R_{thJC}	–	–	0.75	K/W

Characteristics at T_j = 25 °C, unless otherwise specified.

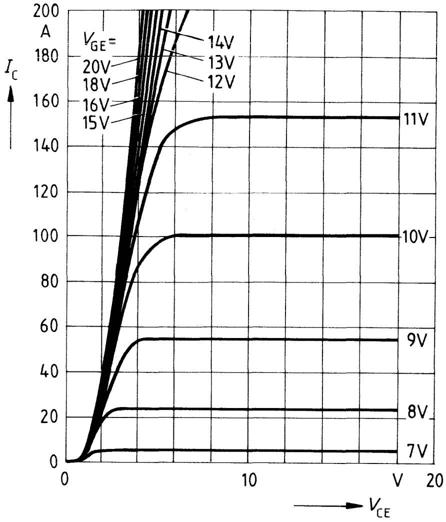
Total power dissipation $P_{tot} = f(T_C)$
parameter: T_j = 150 °C



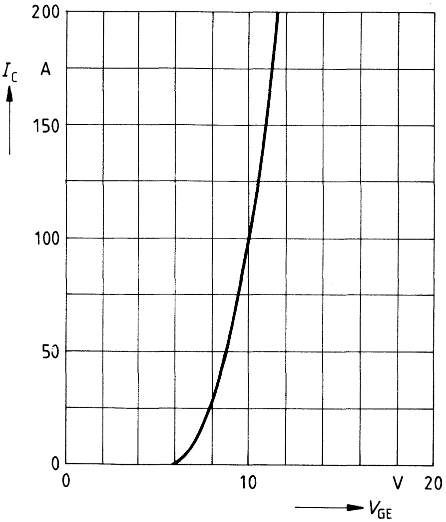
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, T_C = 25 °C,
T_j ≤ 150 °C



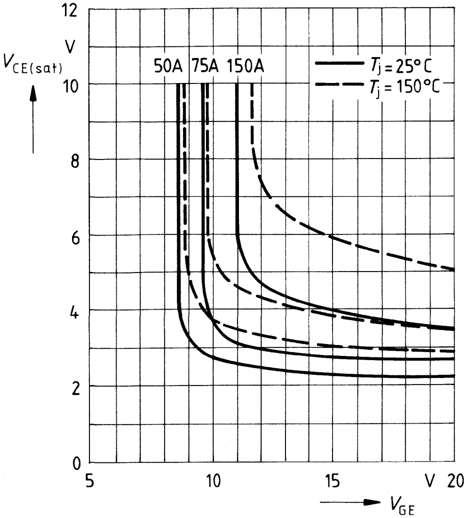
Typ. output characteristics $I_C = f(V_{CE})$
parameter: t_p = 80 µs



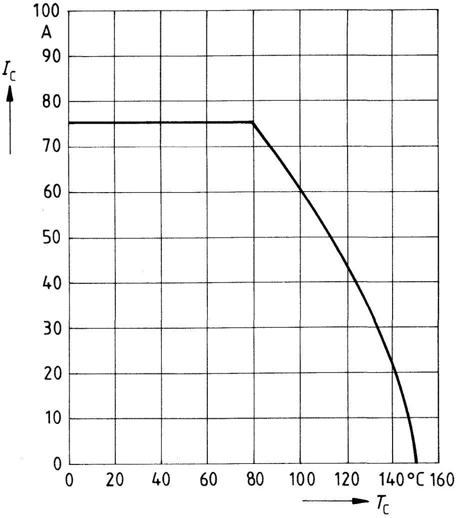
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: t_p = 80 µs, V_{CE} = 20 V



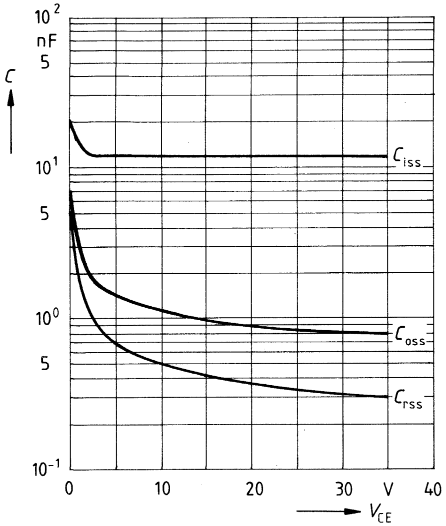
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



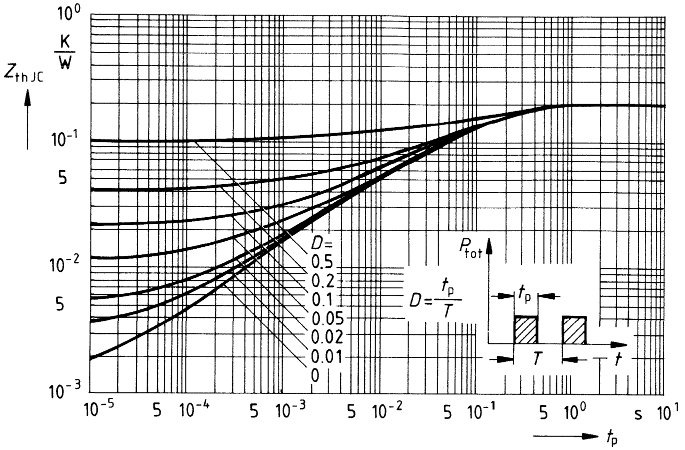
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



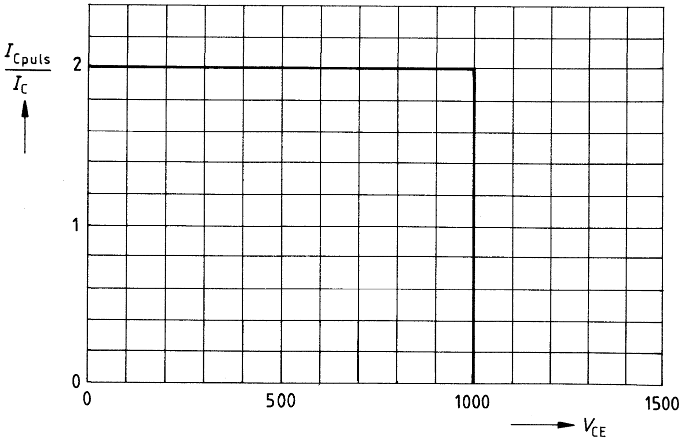
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\,puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g\,(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 50 nH

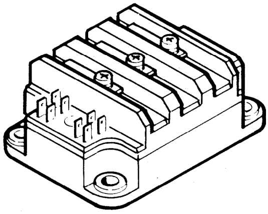


IGBT Module
Preliminary Data

BSM 100 GB 100 D

V_{CE} = 1000 V
I_C = 2 x 100 A

- Power Module
- Half-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 5 a [1])



Type	Ordering code
BSM 100 GB 100 D	C67076-A2103-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20$ kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80$ °C	I_C	100	A
Pulsed collector current, $T_C = 80$ °C	$I_{C\ puls}$	200	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	1000	W
Thermal resistance chip - case case - heat sink	R_{thJC} R_{thCH}	$\leq$ 0.13 $\leq$ 0.038	K/W
Isolation test voltage[2]), $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 2$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 8$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 100$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		-	3.0	-	
$T_j = 150$ °C		-	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		-	-	2000	
$T_j = 125$ °C		-	-	-	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	-	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 100$ A	g_{fs}	44	-	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	16000	-	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	1300	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	500	-	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage I_F = 100 A, V_{GE} = 0	V_F				V
T_j = 25 °C		–	1.8	–	
T_j = 125 °C		–	1.6	–	
Reverse recovery time I_F = 100 A, V_R = 600 V V_{GE} = 0, di_F/dt = -800 A/µs T_j = 125 °C	t_{rr}	–	0.3	–	µs
Reverse recovery charge I_F = 100 A, V_R = 600 V V_{GE} = 0, di_F/dt = -800 A/µs	Q_{rr}				µC
T_j = 25 °C		–	4	–	
T_j = 125 °C		–	18	–	
Soft factor I_F = 100 A, V_R = 600 V V_{GE} = 0 V, di_F/dt = -800 A/µs T_j = 125 °C	S	–	1	–	–
Thermal resistance Chip-case	R_{thJC}	–	–	0.5	K/W

Switching Characteristics

at $T_j = 125$ °C

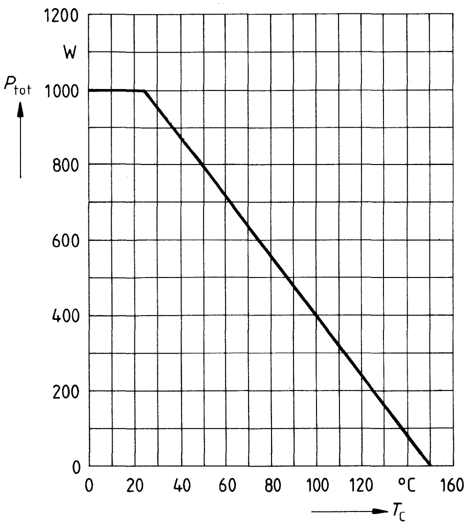
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(on)}$	–	180	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_r	–	450	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	350	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	450	–	

Inductive load

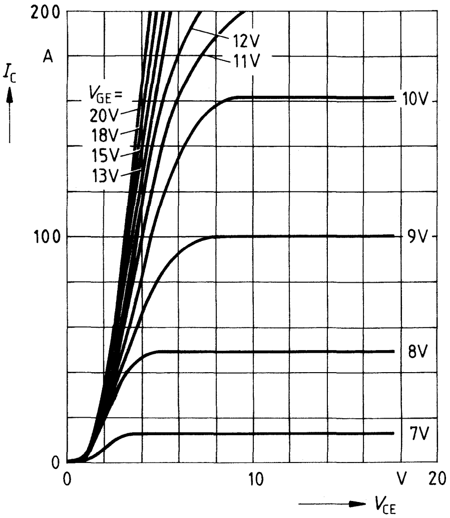
Parameter	Symbol	min.	typ.	max.	Unit
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	350	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\ 1} + E_{off\ 2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 100$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$E_{off\ 1}$ $E_{off\ 2}$	– –	6 5	– –	mWs

Characteristics at $T_j = 25$ °C, unless otherwise specified.

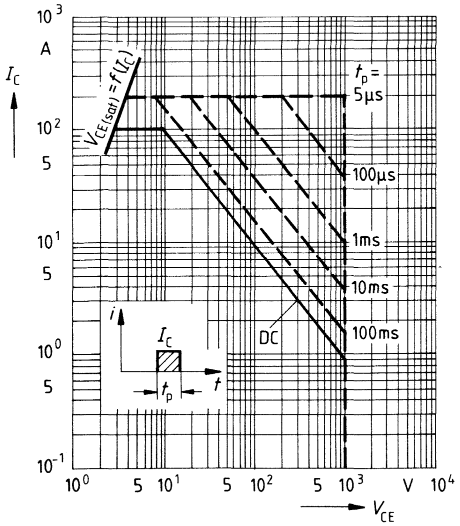
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



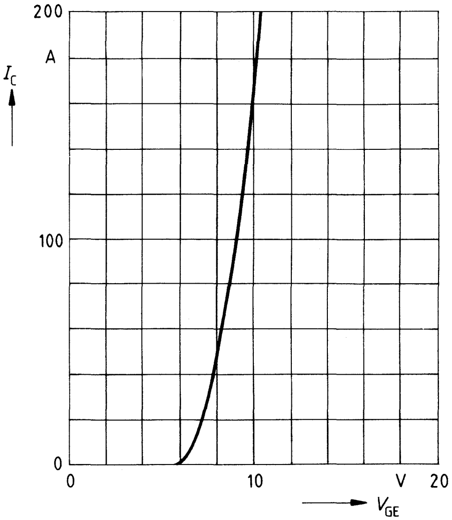
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



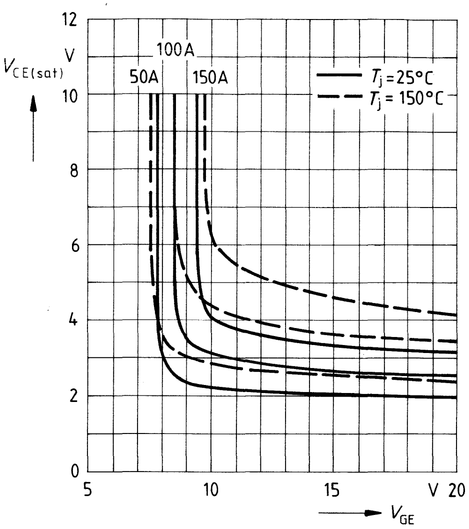
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



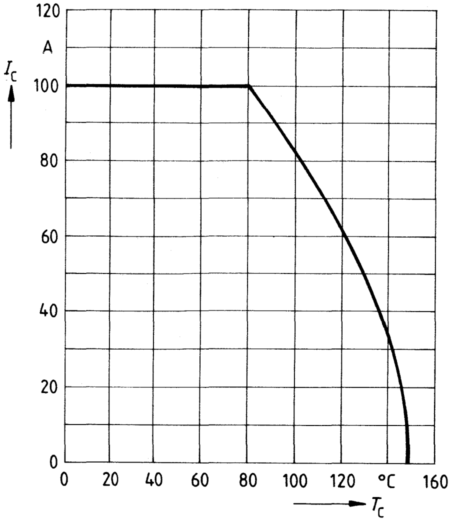
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



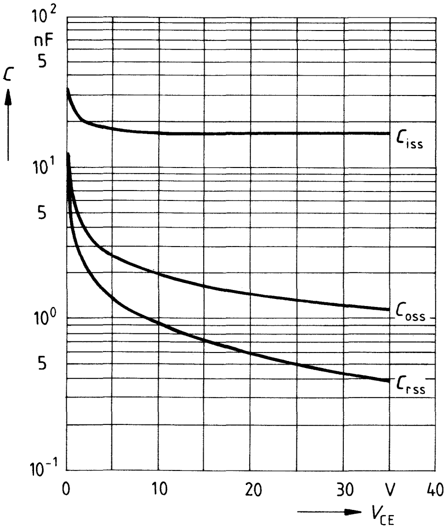
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



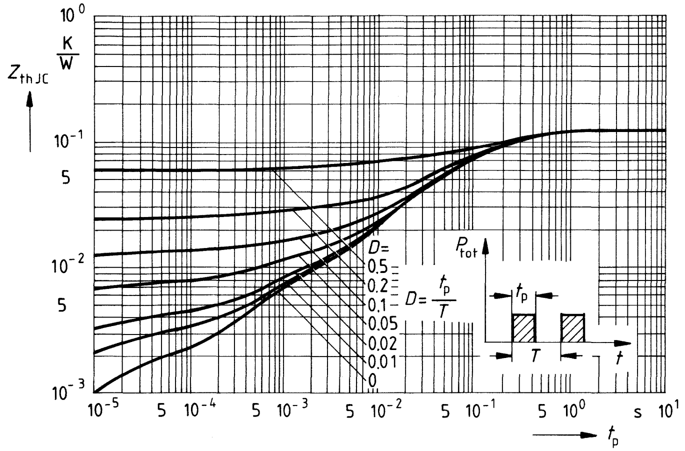
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



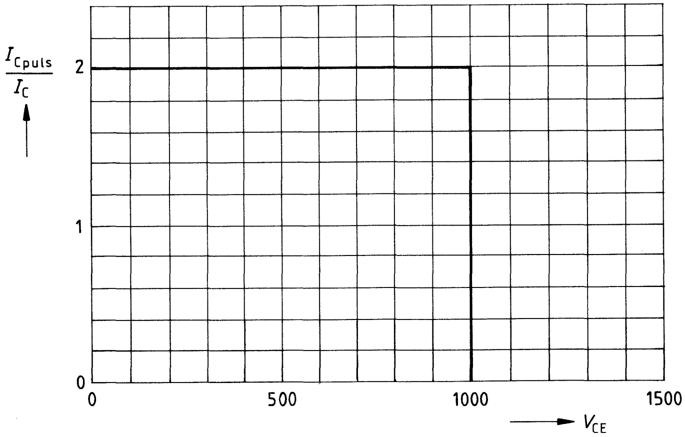
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\,puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g\,(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 80 nH



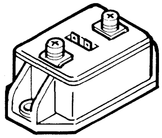
SIEMENS

SIMOPAC® MOSFET Module

BSM 111 AR (C)

V_{DS} = 100 V
I_D = 200 A
$R_{DS(on)}$ = 8.5 mΩ

- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1 a[1])



Type	**Ordering code**
BSM 111 AR (C)	C67076-S1013-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, $R_{GS} = 20$ kΩ	V_{DGR}	100	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	200	A
Pulsed drain current, $T_C = 25$ °C	I_{Dpuls}	600	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, $T_C = 25$ °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage[2]), $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040		F	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

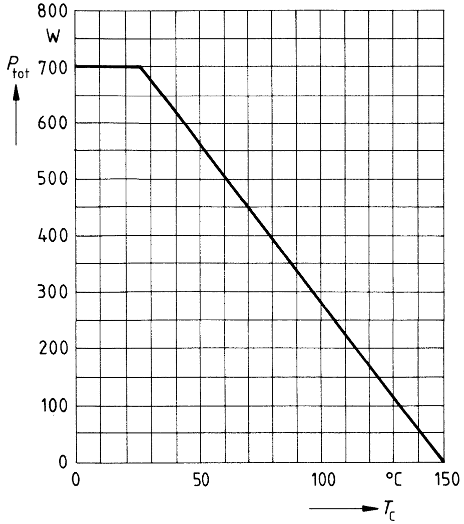
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	-	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	50 300	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 130$ A	$R_{DS(on)}$	-	7	8.5	mΩ
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 130$ A	g_{fs}	60	75	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	10	13	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	5	7.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	1.8	2.7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 50$ V, $V_{GS} = 10$ V, $I_D = 130$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	280	-	ns
	t_r	-	220	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 50$ V, $V_{GS} = 10$ V, $I_D = 130$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	220	-	
	t_f	-	60	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

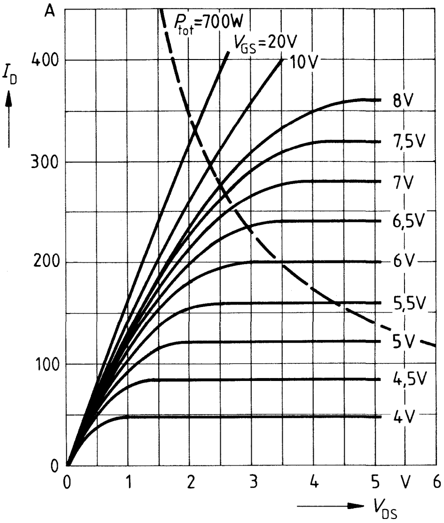
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	200	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	600	
Diode forward on-voltage $I_F = 400$ A, $V_{GS} = 0$	V_{SD}	–	1.25	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	400	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	3.5	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

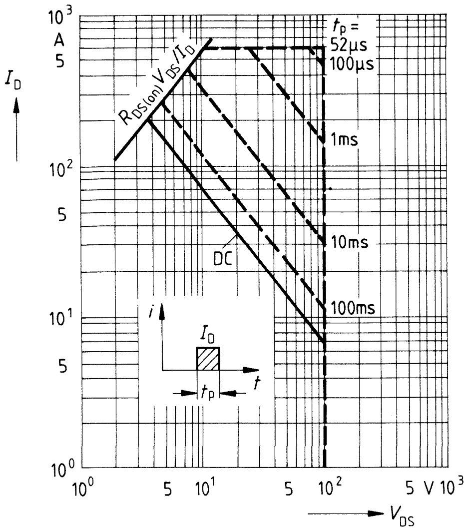
Power dissipation $P_{tot} = f\,(T_C)$
Parameter: $T_j = 150$ °C



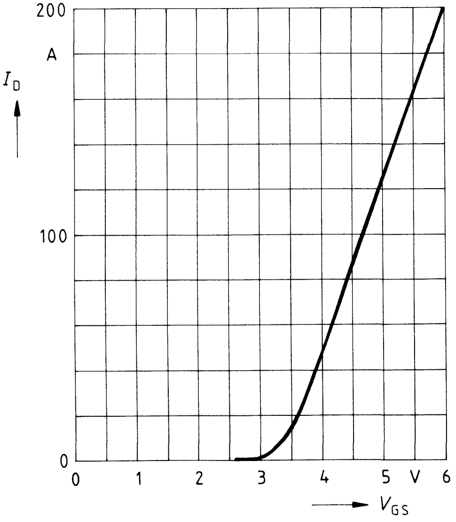
Typical output characteristics $I_D = f(V_{DS})$
parameter: 80 µs pulse test



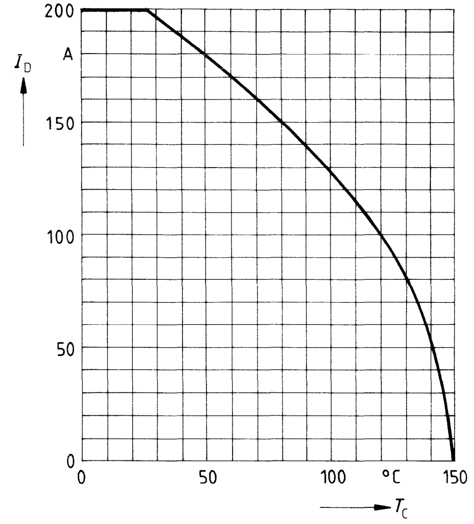
Safe operating area $I_D = f\,(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C



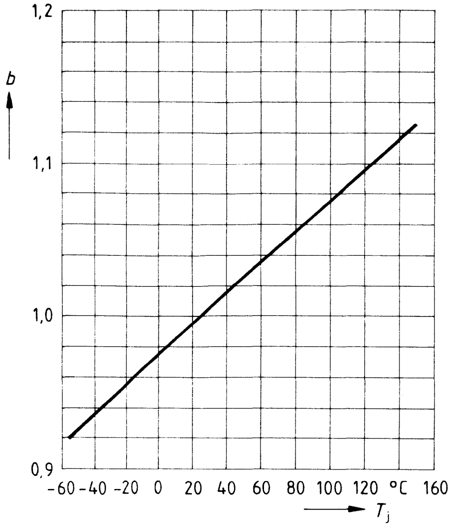
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: 80 µs pulse test, $V_{DS} = 25$ V



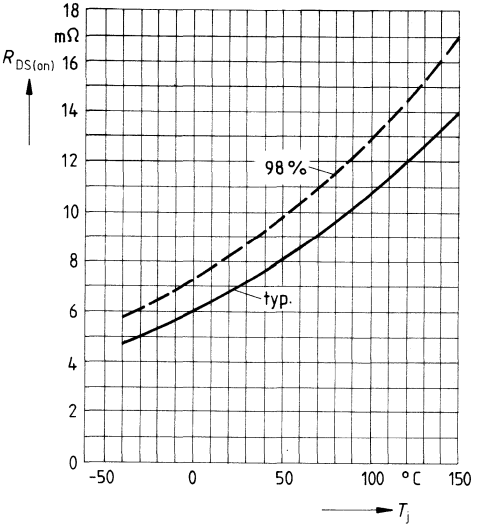
Continuous drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



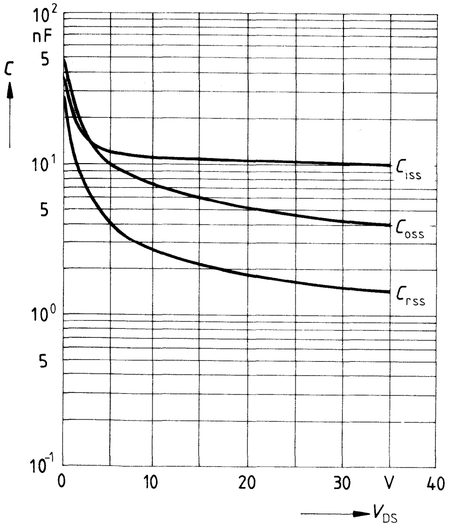
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}(25\ °C)$



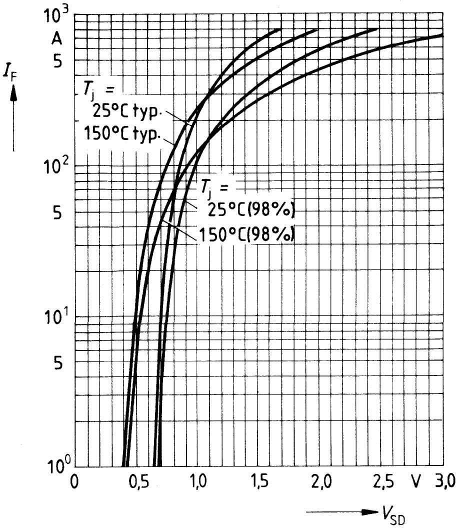
Drain source on-state resistance $R_{DS(on)} = f(T_j)$
parameter: $I_D = 130$ A; $V_{GS} = 10$ V
(spread)



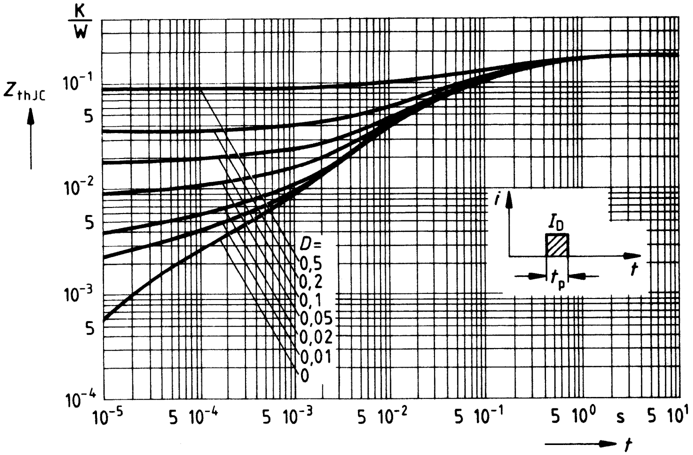
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



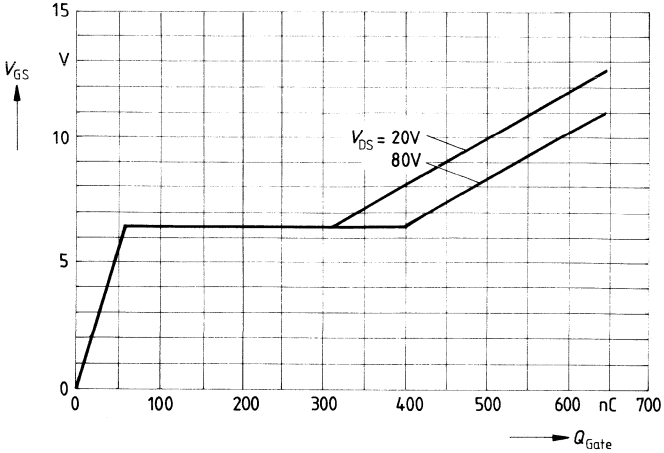
Forward characteristics of reverse diode $I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs
(spread)



Transient thermal resistance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$



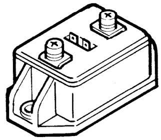
Typ. gate charge $V_{GS} = f(Q_{gate})$
parameter: $I_{Dpuls} = 300$ A



SIMOPAC® MOSFET Module BSM 121 AR (C)

V_{DS} = 200 V
I_D = 130 A
$R_{DS(on)}$ = 20 mΩ

- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1 a[1])



Type	Ordering code
BSM 121 AR (C)	C67076-S1014-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200	
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current, T_C = 25 °C	I_D	130	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	390	
Operating and storage temperature range	T_j T_{stg}	 – 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 50 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 80$ A	$R_{DS(on)}$	–	18	20	mΩ

Dynamic characteristics

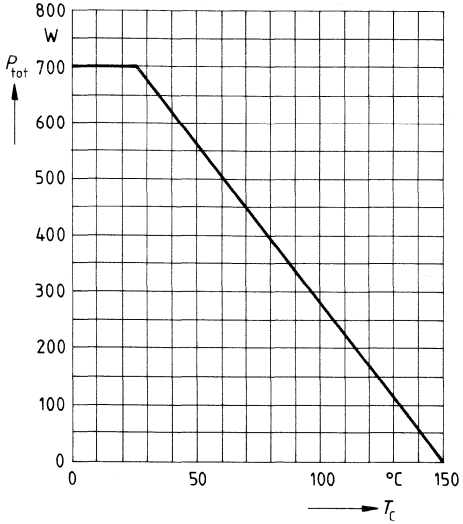
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 80$ A	g_{fs}	60	75	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	10	13	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	3	4.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.7	1.0	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 100$ V, $V_{GS} = 10$ V, $I_D = 80$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	120	–	ns
	t_r	–	60	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 100$ V, $V_{GS} = 10$ V, $I_D = 80$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	240	–	
	t_f	–	40	–	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

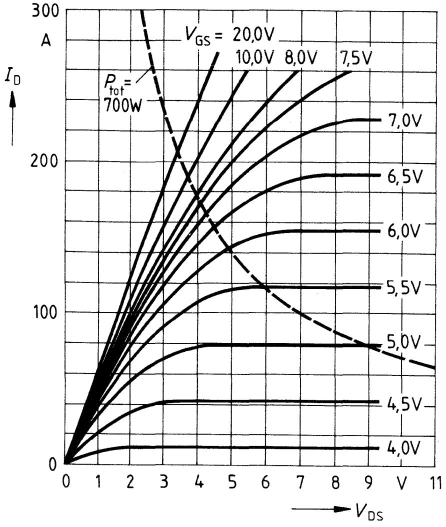
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	130	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	390	
Diode forward on-voltage $I_F = 260$ A, $V_{GS} = 0$	V_{SD}	–	1.05	1.4	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	400	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	4.3	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

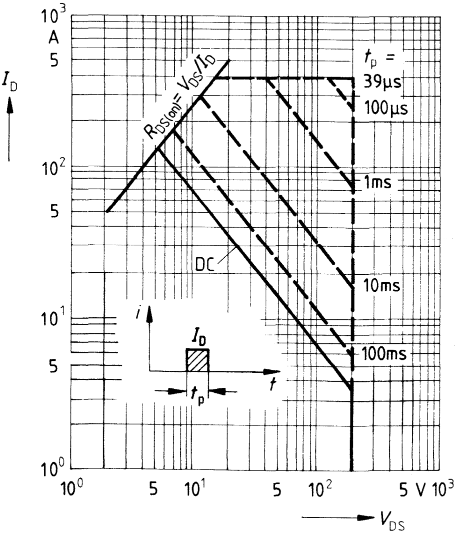
Power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



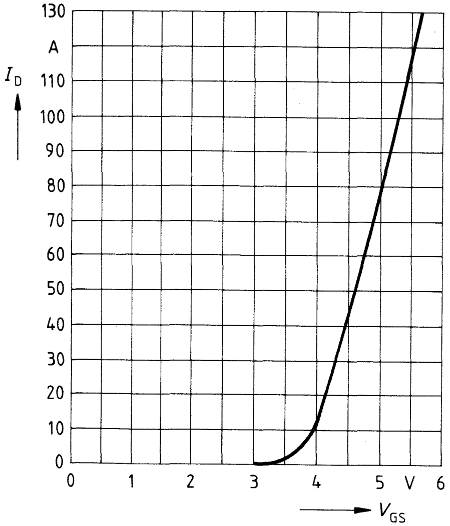
Typical output characteristics $I_D = f(V_{DS})$
parameter: 80 µs pulse test



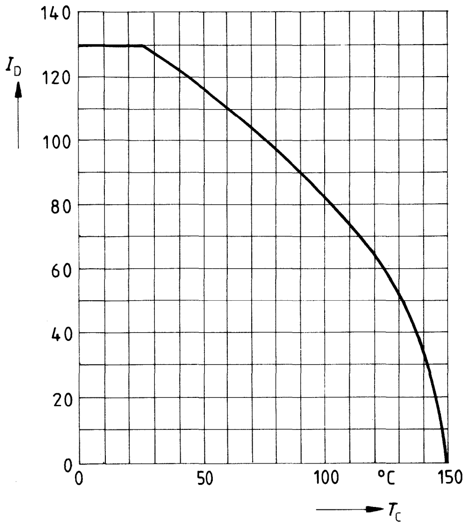
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C



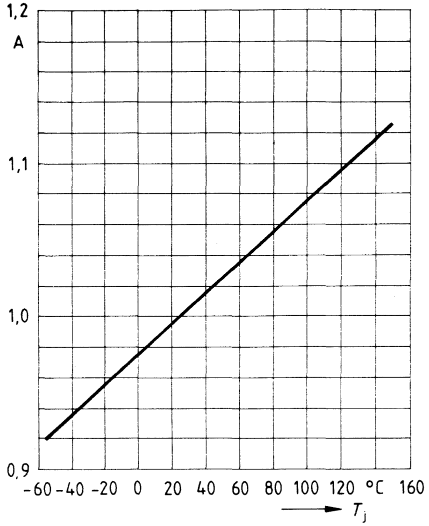
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: 80 µs pulse test, $V_{DS} = 25$ V



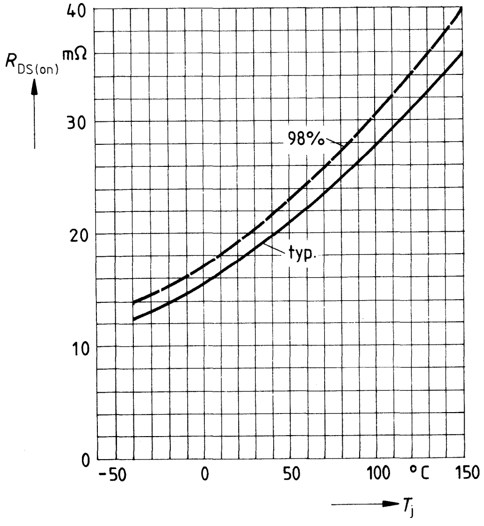
Continuous drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



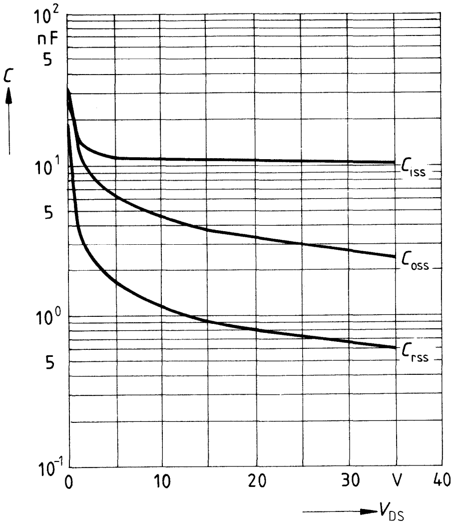
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ **(25 °C)**



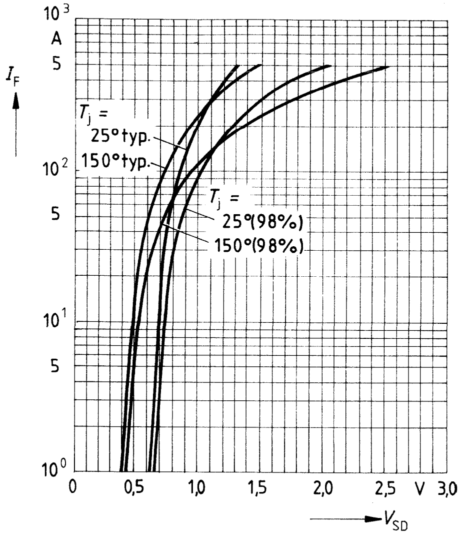
Drain source on-state resistance $R_{DS(on)} = f(T_j)$
parameter: $I_D = 80$ A; $V_{GS} = 10$ V
(spread)



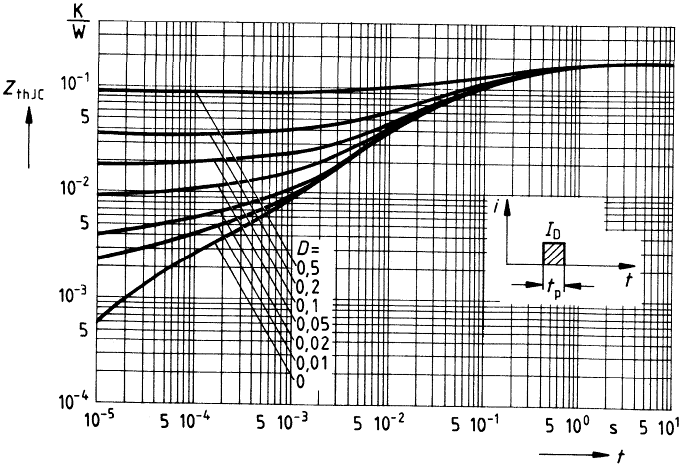
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



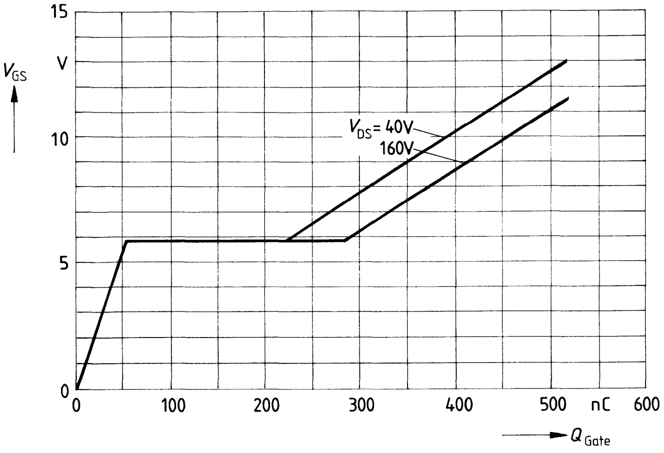
Forward characteristics of reverse diode $I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs
(spread)



Transient thermal resistance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$



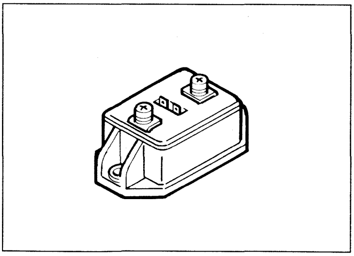
Typ. gate charge $V_{GS} = f(Q_{gate})$
parameter: I_{Dpuls} = 200 A



SIMOPAC® MOSFET Module **BSM 141**

V_{DS} = **400 V**
I_D = **60 A**
$R_{DS(on)}$ = **0.075 Ω**

- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1 a[1])



Type	Ordering code
BSM 141	C67076-A1010-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	400	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	60	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	240	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	625	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.2 ≤ 0.05	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50014, IEC 146, para 492.1.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	50 300	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 39$ A	$R_{DS(on)}$	–	0.06	0.075	Ω

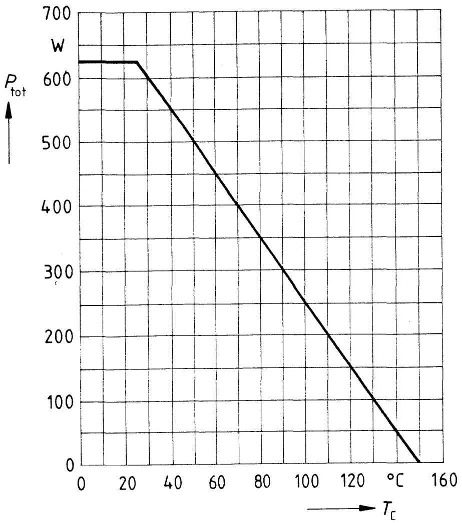
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 39$ A	g_{fs}	30	45	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	8	10.5	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1.5	2	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.6	0.7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 200$ V, $V_{GS} = 10$ V, $I_D = 40$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	36	-	ns
	t_r	-	25	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 200$ V, $V_{GS} = 10$ V, $I_D = 40$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	260	-	
	t_f	-	50	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

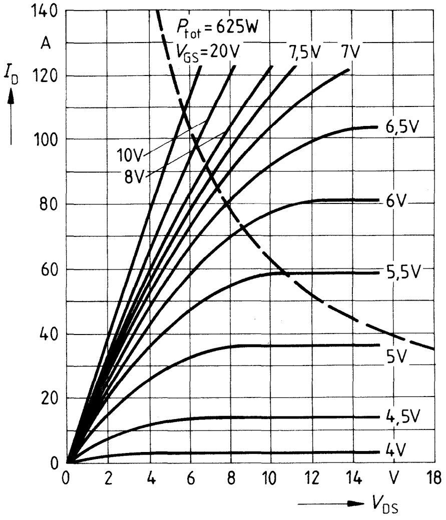
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	60	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	240	
Diode forward on-voltage $I_F = 120$ A, $V_{GS} = 0$	V_{SD}	–	1.1	1.4	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	–	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	–	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

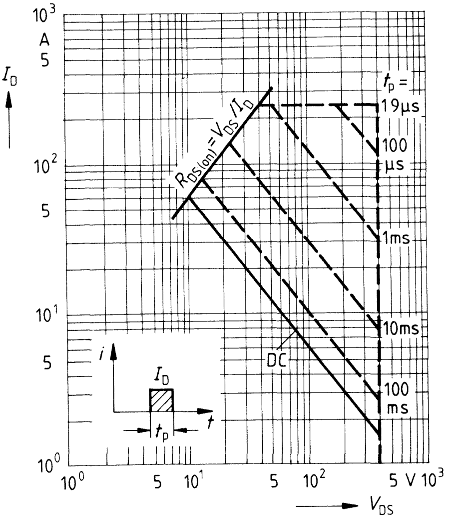
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



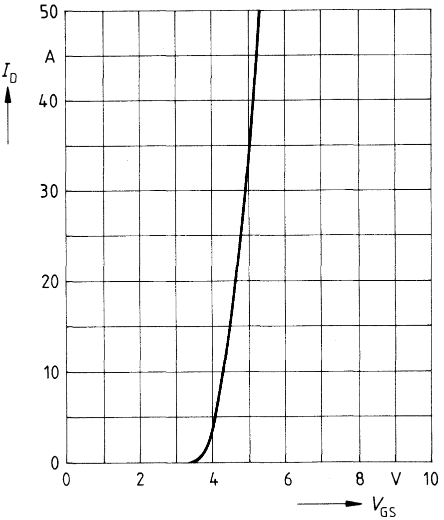
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



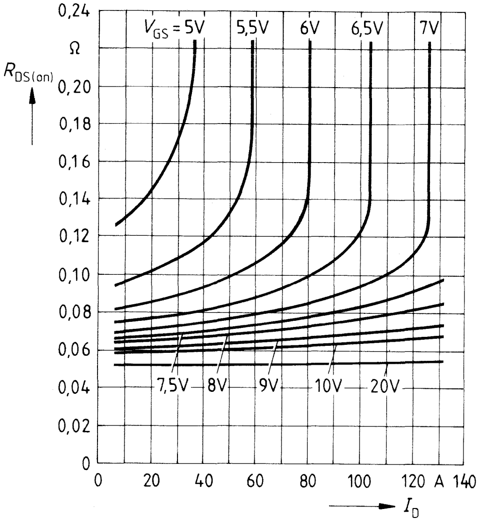
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



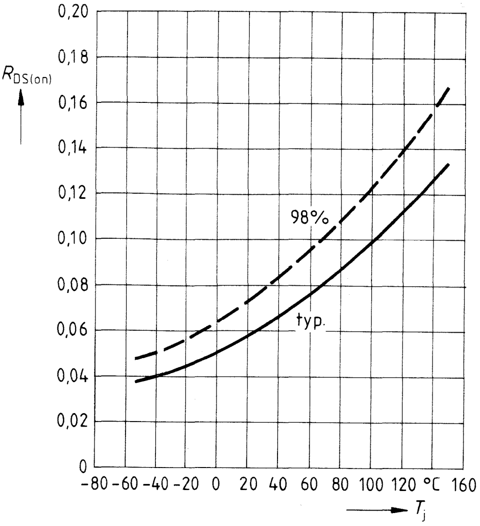
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



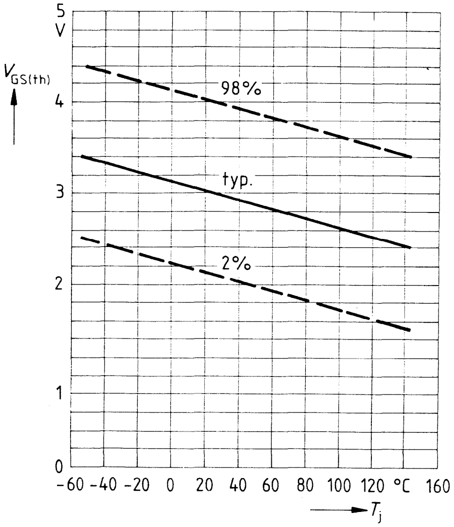
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



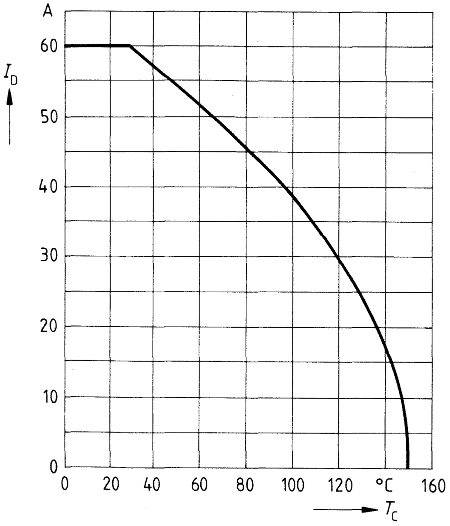
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 39$ A, $V_{GS} = 10$ V
(spread)



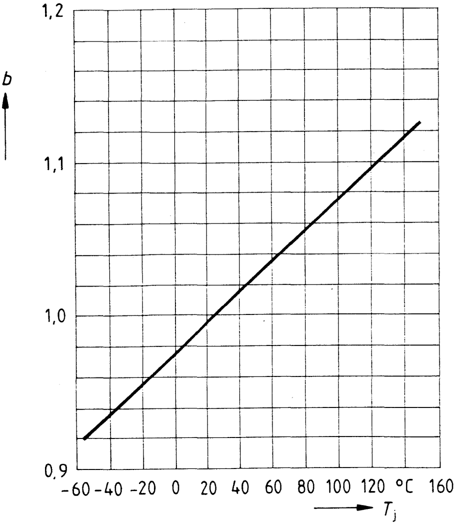
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



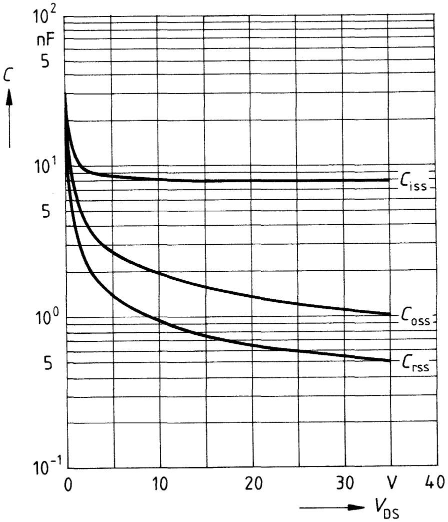
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



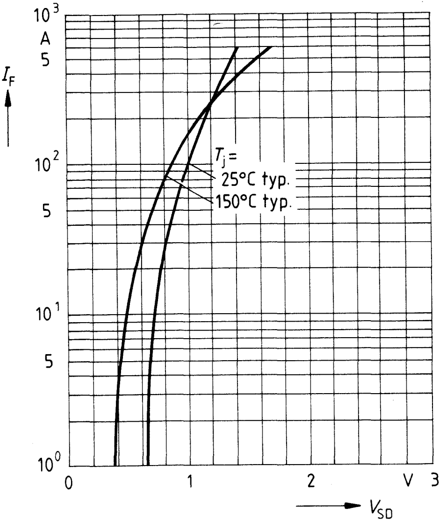
$V_{(BR)DSS}$ $(T_j) = b \times V_{(BR)DSS}$ (25 °C)



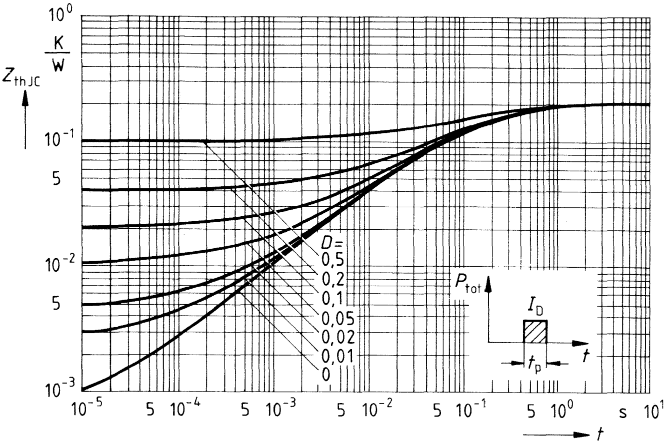
Typ. capacitances $C = f\ (V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



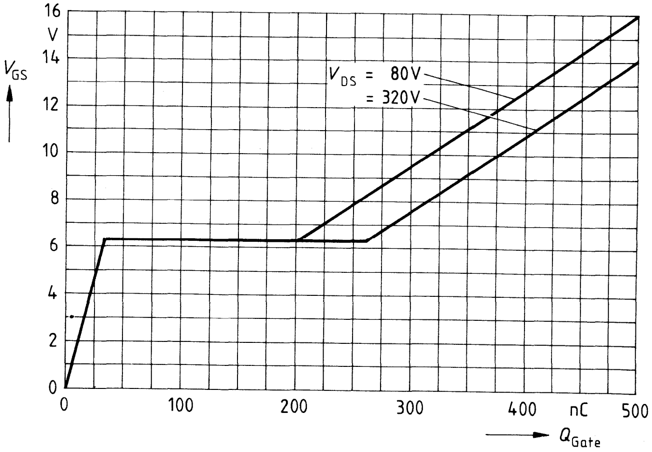
Forward characteristics of reverse diode
$I_F = f\ (V_{SD})$
Parameter: T_j, $t_p = 80$ µs
(spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 90$ A



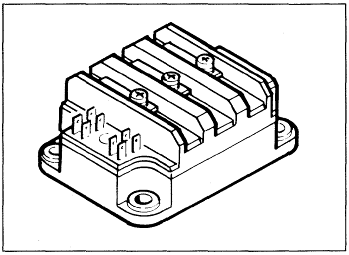
IGBT Module

Preliminary Data

BSM 150 GB 100 D

V_{CE} = **1000 V**
I_C = **2 x 150 A**

- Power module
- Half-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Cicruit diagram: Fig. 5 a[1])



Type	Ordering code
BSM 150 GB 100 D	C67076-A2102-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, R_{GE} = 20 kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, T_C = 80 °C	I_C	150	A
Pulsed collector current, T_C = 80 °C	$I_{C\ puls}$	300	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	1250	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 ≤ 0.1 ≤ 0.038	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines

[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 2.8$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 10$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 150$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		-	3.0	-	
$T_j = 150$ °C		-	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		-	-	2800	
$T_j = 125$ °C		-	-	-	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	-	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 150$ A	g_{fs}	66	-	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	22000	-	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	1700	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	700	-	

Switching Characteristics
at T_j = 125 °C

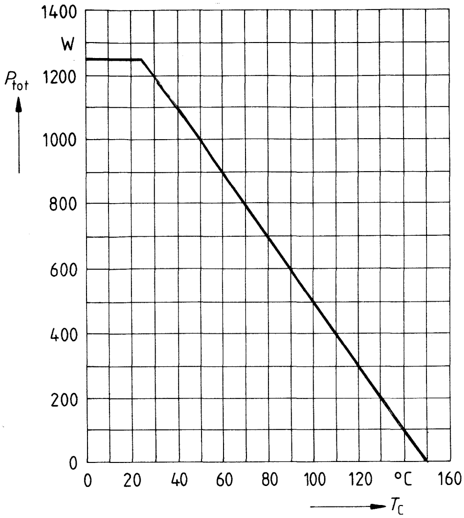
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Resistive load					
Turn-on delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(on)}$	–	250	–	ns
Rise time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_r	–	500	–	
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(off)}$	–	400	–	
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_f	–	500	–	
Inductive load					
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$t_{d(off)}$	–	400	–	ns
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) V_{CC} = 600 V, V_{GE} = 15 V, I_C = 150 A $R_{g(on)}$ = 3.3 Ω, $R_{g(off)}$ = 3.3 Ω	$E_{off\,1}$ $E_{off\,2}$	– –	9 7	– –	mWs

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

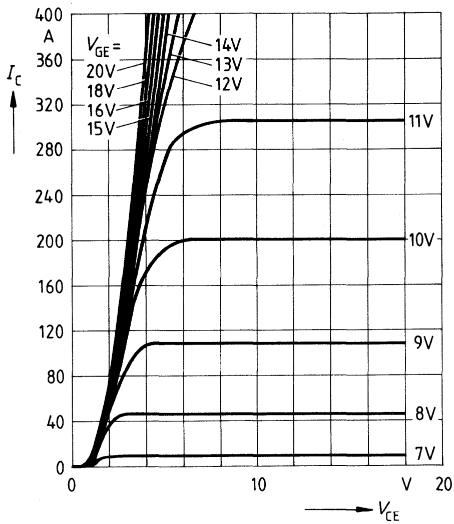
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 150$ A, $V_{GE} = 0$	V_F				V
$T_j = 25$ °C		–	1.8	–	
$T_j = 125$ °C		–	1.6	–	
Reverse recovery time $I_F = 150$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.35	–	µs
Reverse recovery charge $I_F = 150$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	Q_{rr}				µC
$T_j = 25$ °C		–	6	–	
$T_j = 125$ °C		–	27	–	
Soft factor $I_F = 150$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance Chip – case	R_{thJC}	–	–	0.38	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

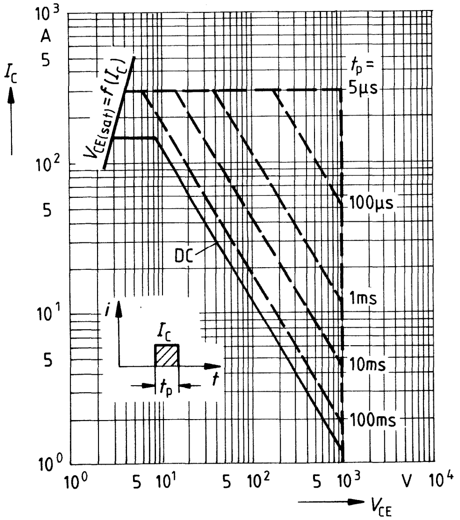
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



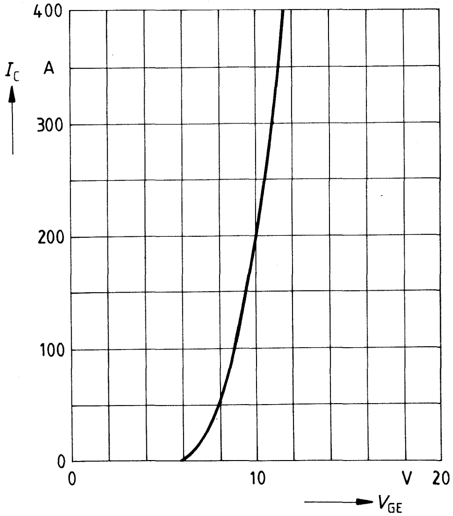
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



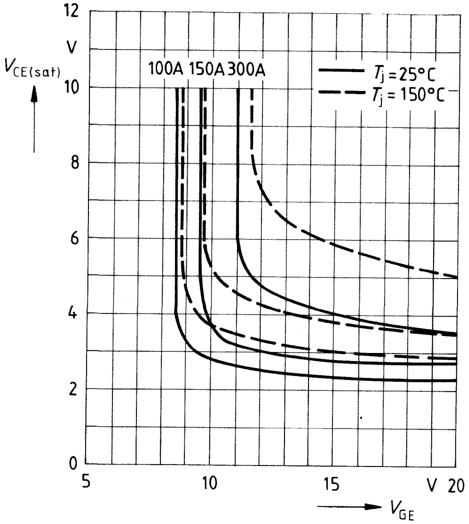
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



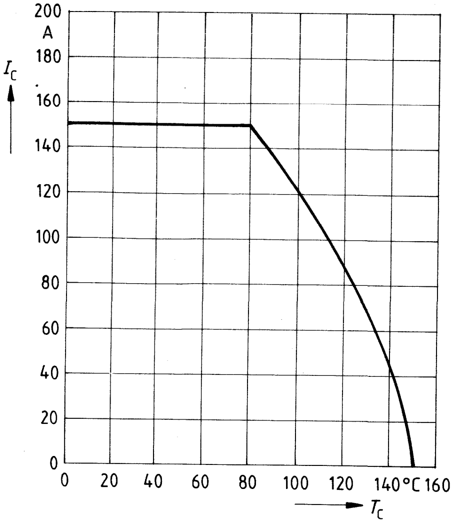
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



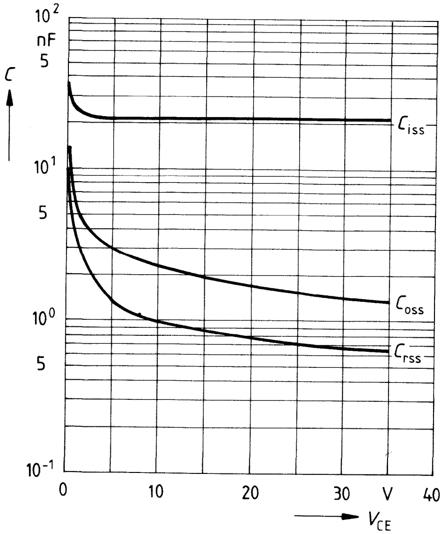
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



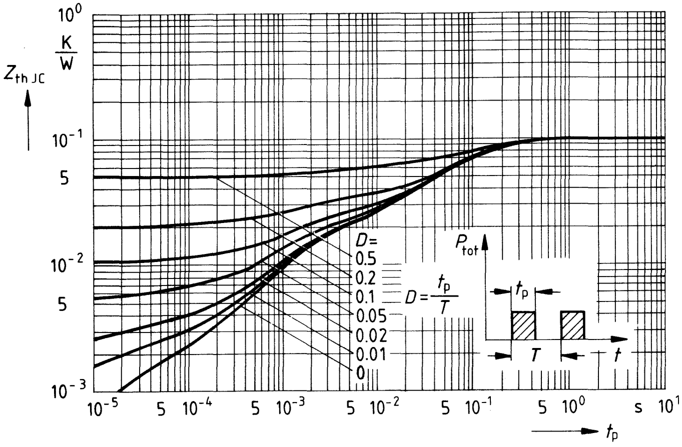
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



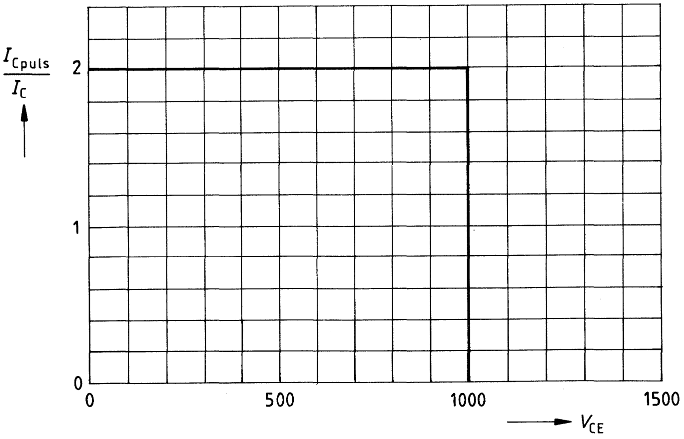
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



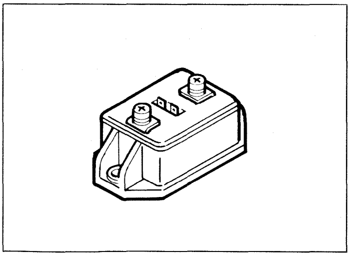
Reverse biased safe operating area $I_{C\,puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 80 nH



SIMOPAC® MOSFET Modules

BSM 151 (C)
BSM 151 R

V_{DS} = 500 V
I_D = 48 A
$R_{DS(on)}$ = 0.12 Ω



- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1a [1]

Type	Ordering code
BSM 151 (C)	C67076-A1004-A2
BSM 151 R	C67076-A1015-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	48	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	192	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	625	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.20 ≤ 0.05	K/W
Isolation test voltage[2], t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	-	16	mm
Clearance, drain-source	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1] See chapter Package Outlines.

[2] Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	50	250	
$T_j = 125$ °C		–	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 30$ A	$R_{DS(on)}$	–	0.1	0.12	Ω

Dynamic characteristics

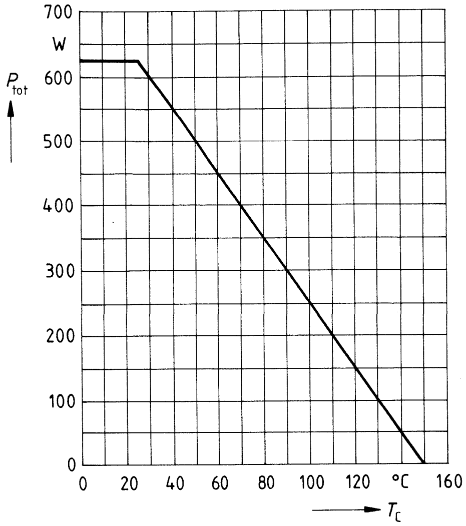
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 30$ A	g_{fs}	30	45	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1.1	1.6	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.1	1.6	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.5	0.7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 30$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	36	–	ns
	t_r	–	25	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 30$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	260	–	
	t_f	–	50	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

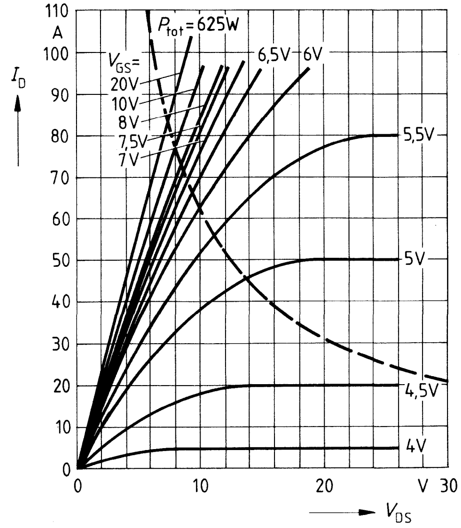
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	48	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	192	
Diode forward on-voltage $I_F = 96$ A, $V_{GS} = 0$	V_{SD}	–	1.1	1.4	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

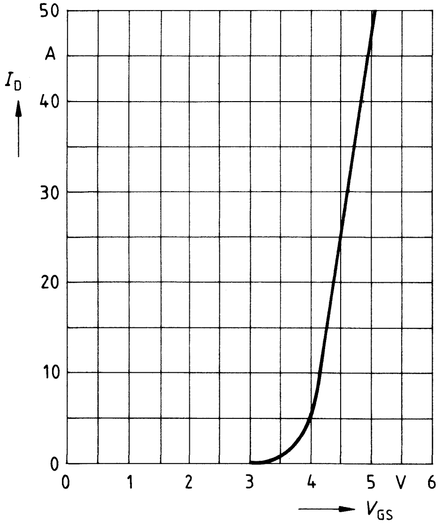
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



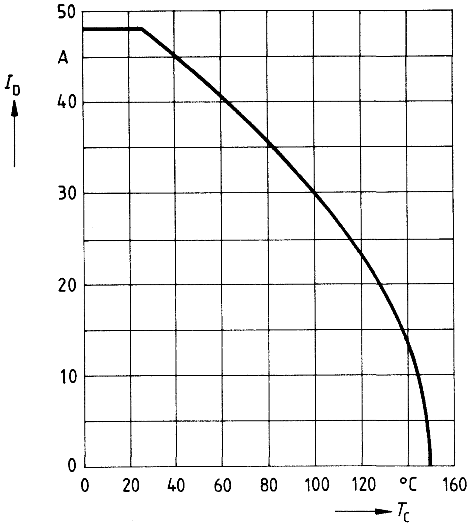
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



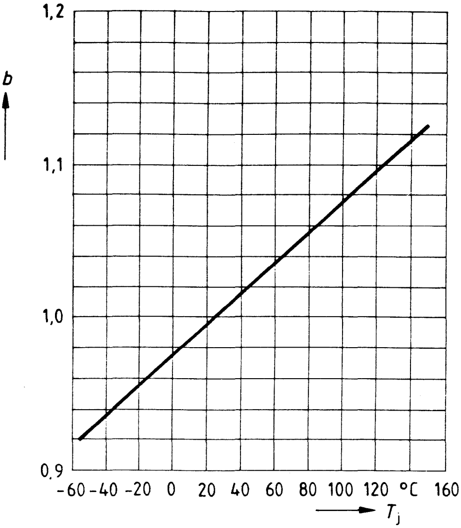
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



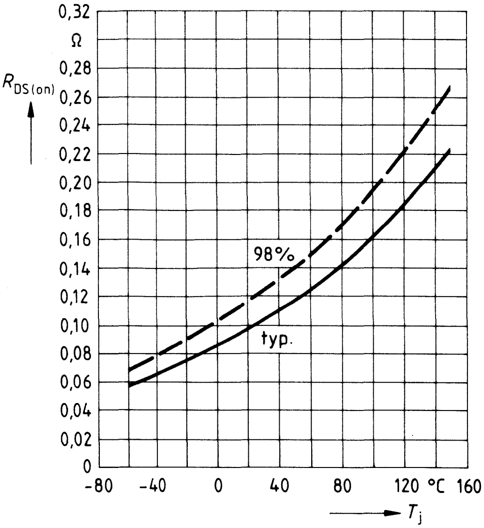
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



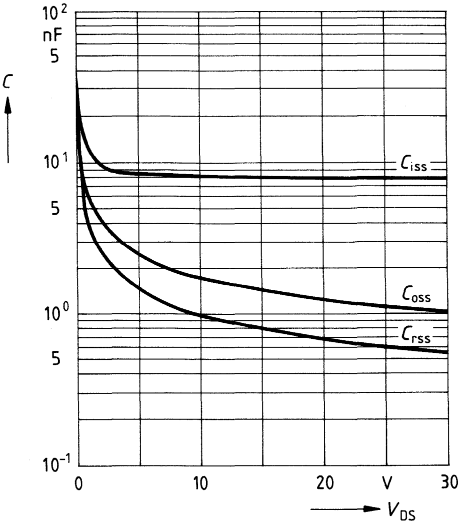
$V_{(BR)DSS}$ (T_j) = $b \times V_{(BR)DSS}$ (25 °C)



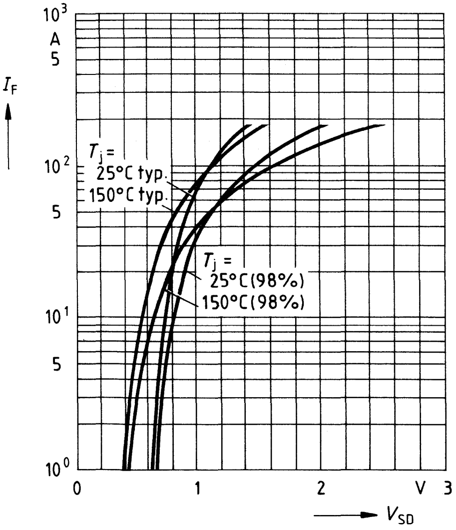
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 30 A, V_{GS} = 10 V, (spread)



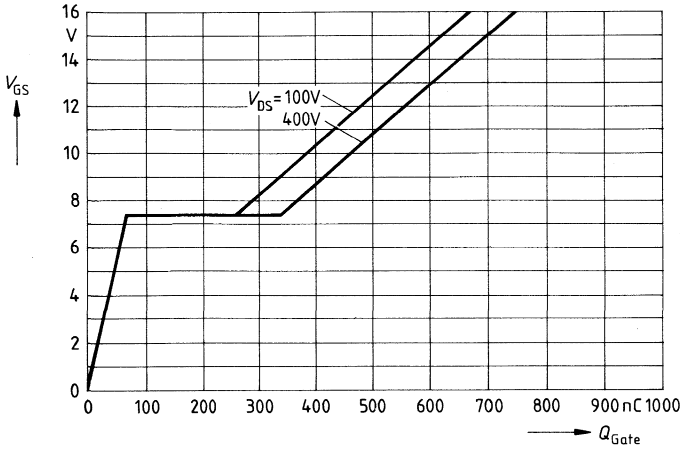
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



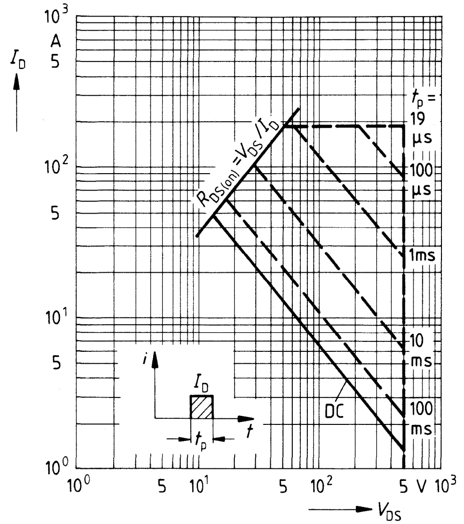
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{Dpuls} = 63$ A



Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C

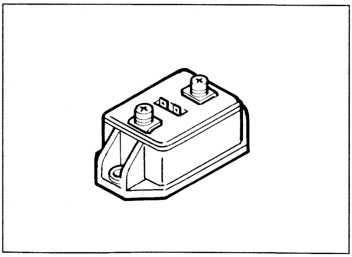


SIMOPAC® MOSFET Modules

BSM 151 F (C)
BSM 151 FR

V_{DS} = **500 V**
I_D = **56 A**
$R_{DS(on)}$ = **0.11 Ω**

- Power module
- Single switch
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1a [1])



Type	Ordering code
BSM 151 F (C)	C67076-A1050-A2
BSM 151 FR	C67076-A1056-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 32 °C	I_D	56	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	224	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 50 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 36$ A	$R_{DS(on)}$	–	0.09	0.11	Ω

Dynamic characteristics

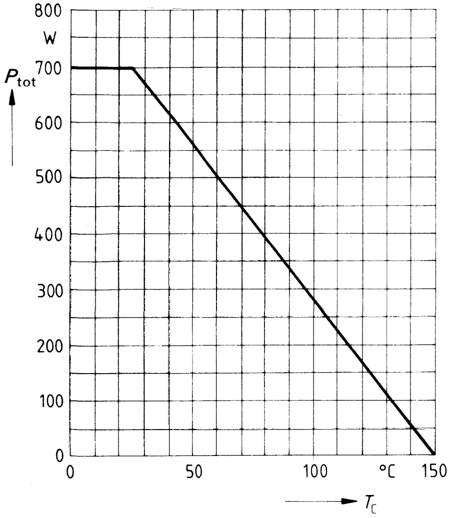
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 36$ A	g_{fs}	20	30	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	22	30	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.6	2.4	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.65	1.0	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 36$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	–	ns
	t_r	–	35	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 36$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	350	–	
	t_f	–	70	–	

Electrical Characteristics (continued)
at $T_j = 25\ °C$, unless otherwise specified.

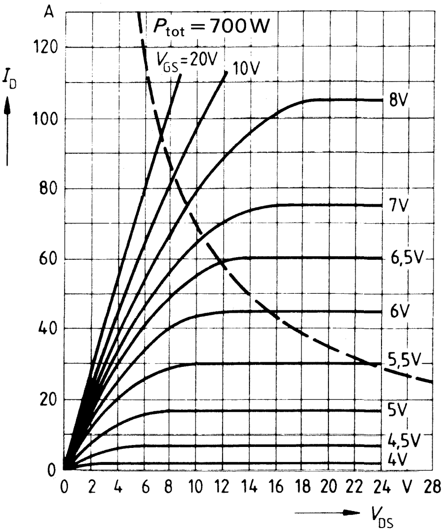
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25\ °C$	I_S	–	–	56	A
Pulsed reverse drain current $T_C = 25\ °C$	I_{SM}	–	–	224	
Diode forward on-voltage $I_F = 96\ A$, $V_{GS} = 0$	V_{SD}	–	1.3	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100\ A/\mu s$, $V_R = 100\ V$ $T_j = 25\ °C$ $T_j = 150\ °C$	t_{rr}	– –	200 350	280 500	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100\ A/\mu s$, $V_R = 100\ V$ $T_j = 25\ °C$ $T_j = 150\ °C$	Q_{rr}	– –	1.5 8.5	2.5 12	µC
Repetitive peak reverse current $I_F = I_S$, $di_F/dt = 100\ A/\mu s$, $V_R = 100\ V$ $T_j = 25\ °C$ $T_j = 150\ °C$	I_{RRM}	– –	12 28	– –	A

Characteristics at $T_j = 25$ °C, unless otherwise specified.

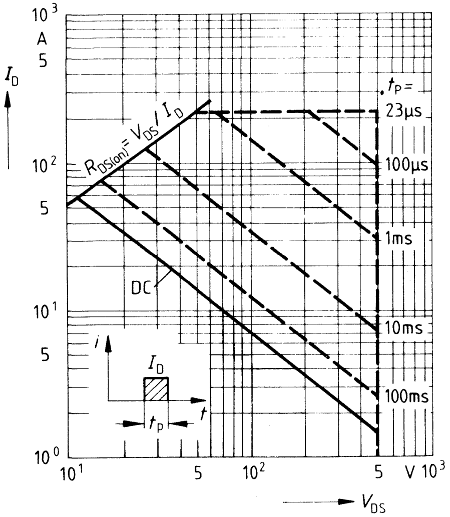
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



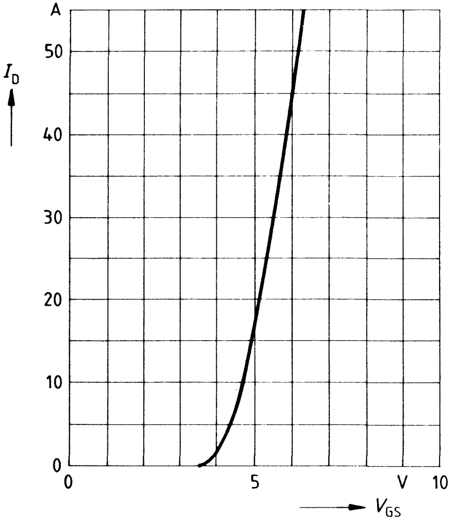
Typical output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs pulse test



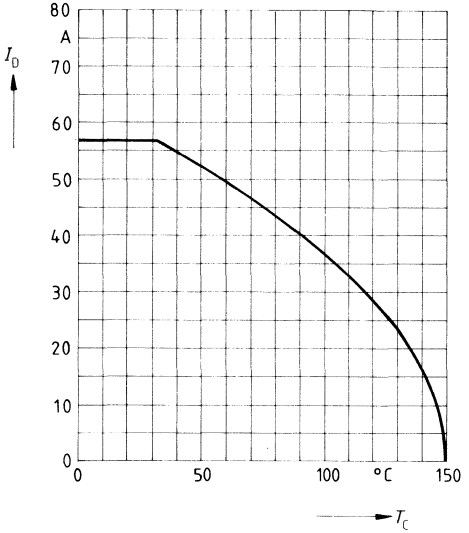
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C



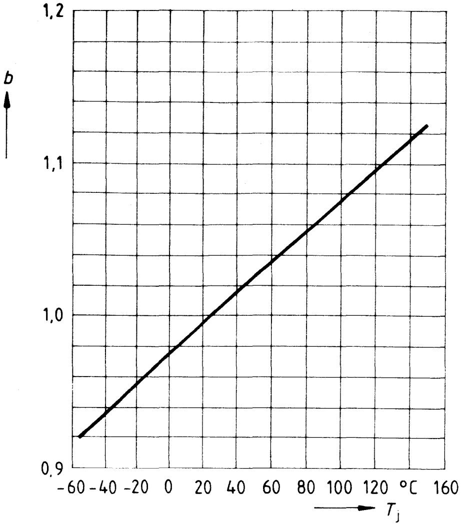
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



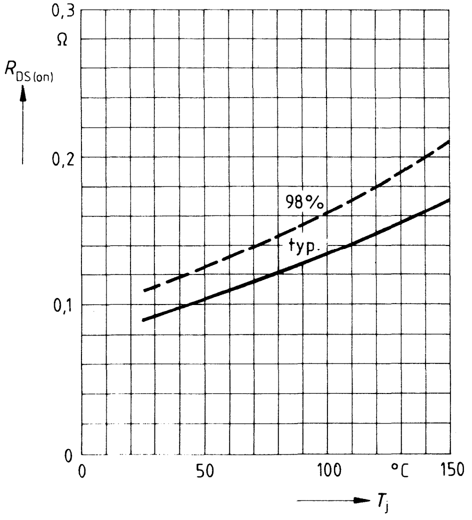
Continuous drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



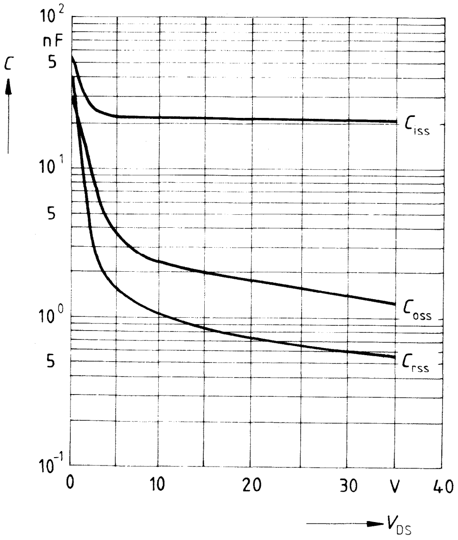
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



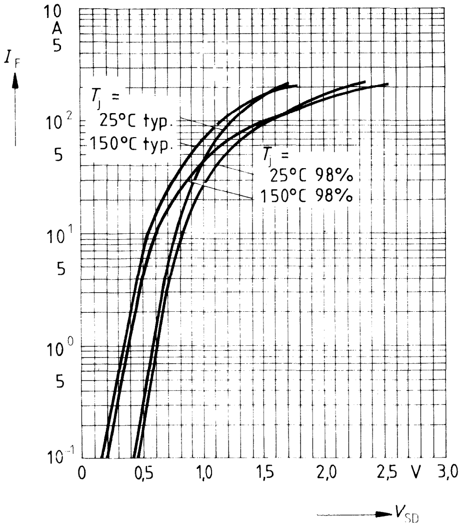
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 36$ A, $V_{GS} = 10$ V, (spread)



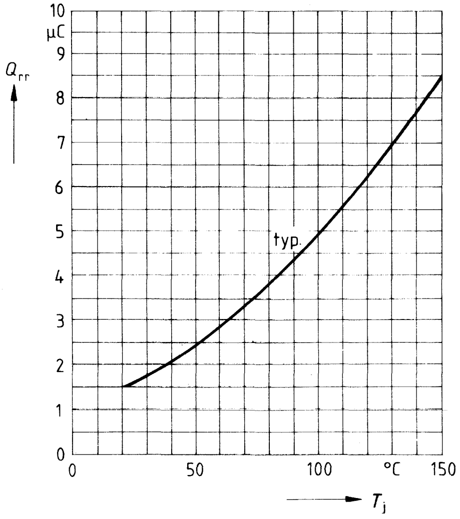
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



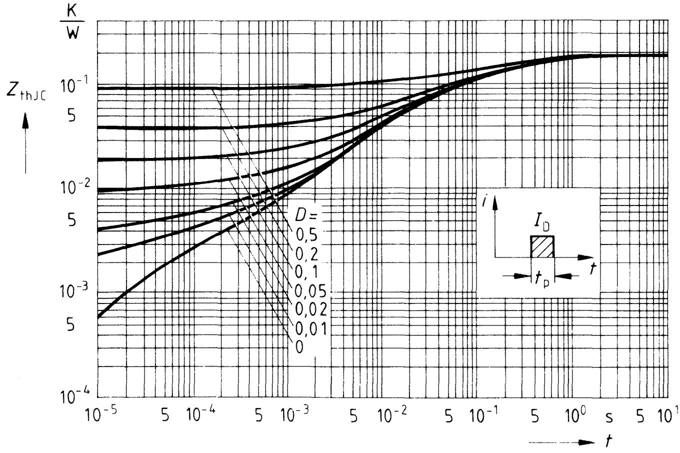
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



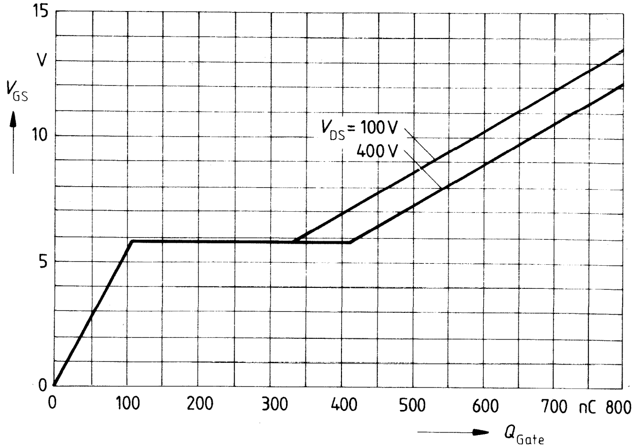
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
parameter: di/dt = 100 A/µs, $I_F = 56$ A
$V_R = 100$ V



Transient thermal resistance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{Dpuls} = 75$ A

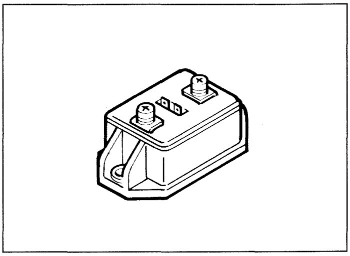


SIMOPAC® MOSFET Modules

BSM 181 (C)
BSM 181 R

V_{DS} = **800 V**
I_D = **36 A**
$R_{DS(on)}$ = **0.24 Ω**

- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1a [1]



Type	Ordering code
BSM 181 (C)	C67076-A1001-A2
BSM 181 R	C67076-A1016-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, $R_{GS} = 20$ kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	36	A
Pulsed drain current, $T_C = 25$ °C	I_{Dpuls}	144	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, $T_C = 25$ °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage [2], $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

[2] Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

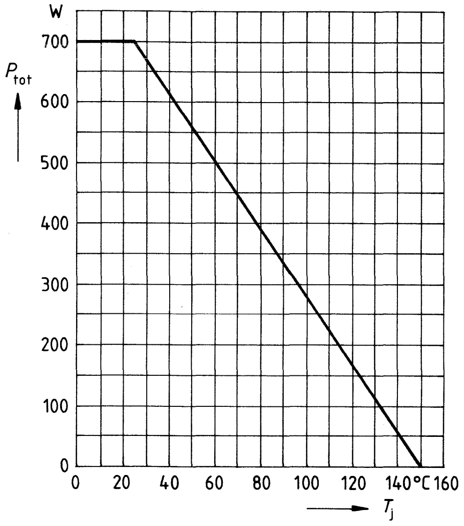
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	50	250	
$T_j = 125$ °C		–	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 23$ A	$R_{DS(on)}$	–	0.18	0.24	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 23$ A	g_{fs}	15	25	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	24	32	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.3	2.0	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.5	0.8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 23$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	–	ns
	t_r	–	30	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 23$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	370	–	
	t_f	–	70	–	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

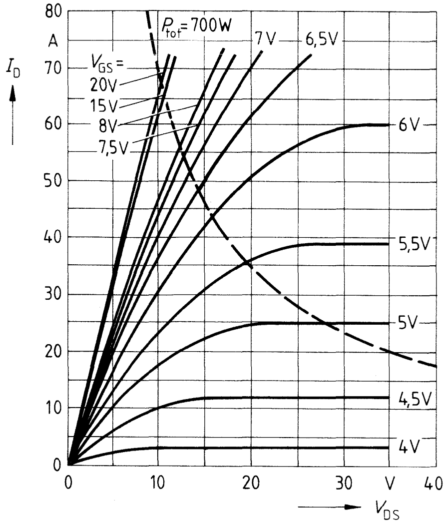
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	36	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	144	
Diode forward on-voltage $I_F = 72$ A, $V_{GS} = 0$	V_{SD}	–	1.1	1.4	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25$ °C $T_j = 125$ °C	t_{rr}	 – –	 1200 –	 – –	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25$ °C $T_j = 125$ °C	Q_{rr}	 – –	 42 50	 – –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

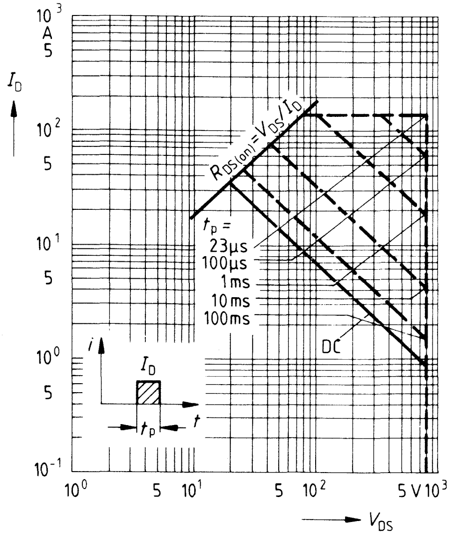
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



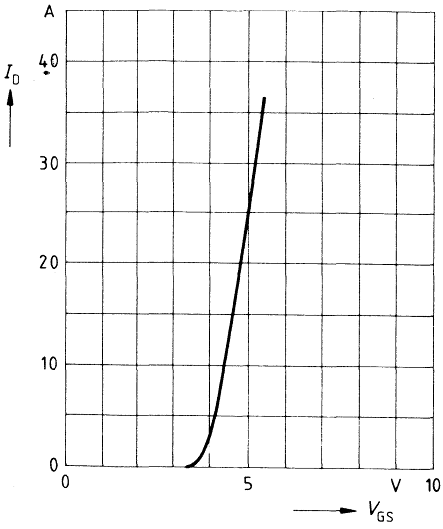
Typical output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs pulse test



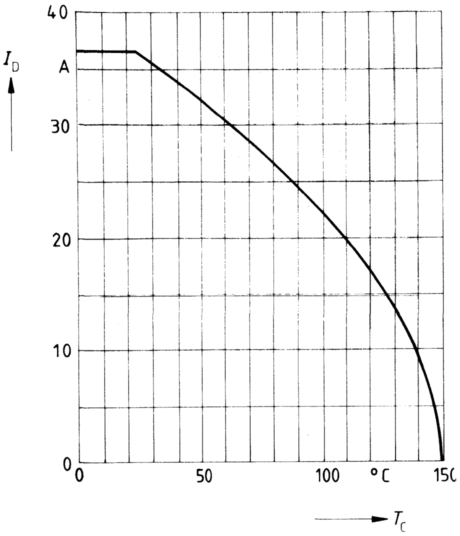
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C



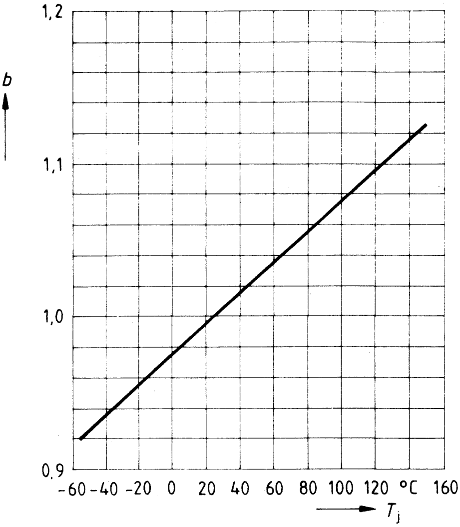
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



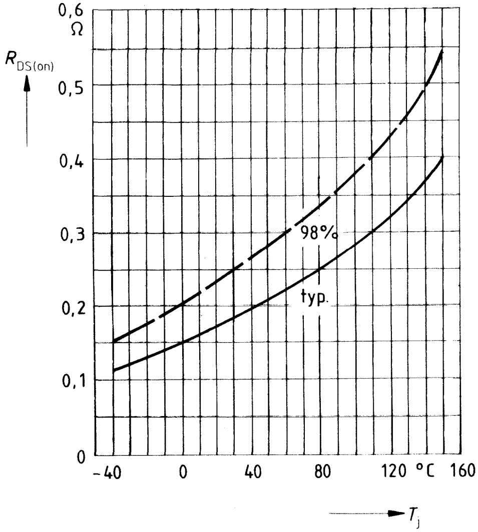
Continuous drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



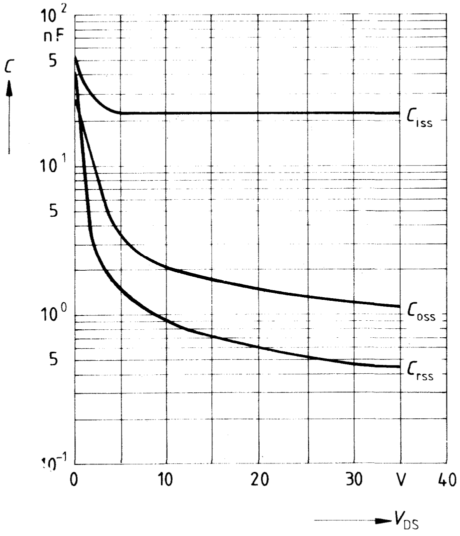
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



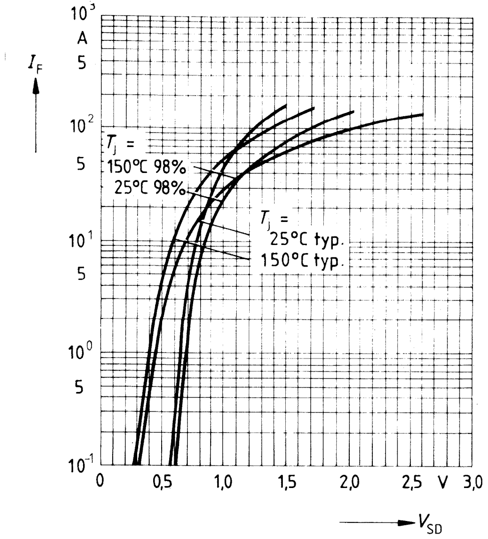
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 36$ A, $V_{GS} = 10$ V, (spread)



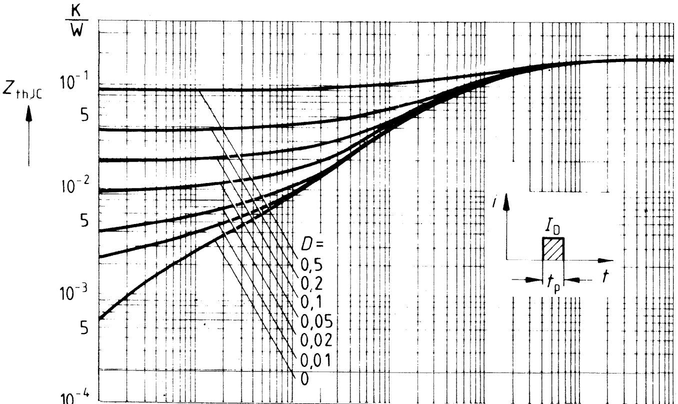
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



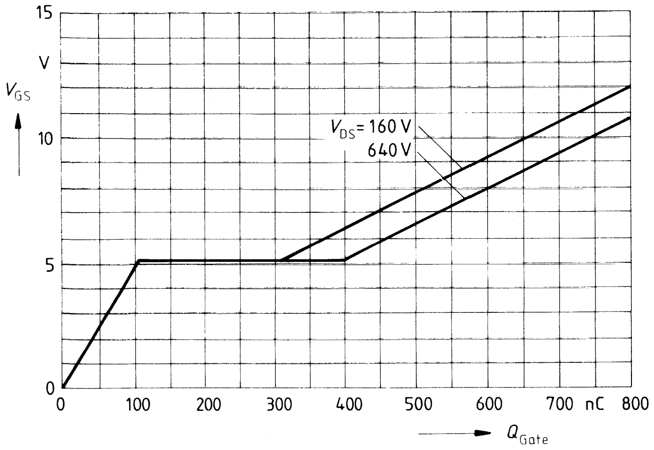
Forward characteristics of reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80\ \mu s$, (spread)



Transient thermal resistance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{Dpuls} = 52.5$ A



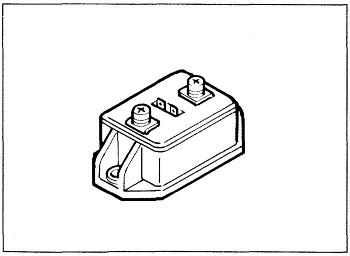
SIEMENS

SIMOPAC® MOSFET Modules

BSM 181 F (C)
BSM 181 FR

V_{DS} = **800 V**
I_D = **34 A**
$R_{DS(on)}$ = **0.32 Ω**

- Power module
- Single switch
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1a [1]



Type	Ordering code
BSM 181 F (C)	C67076-A1052-A2
BSM 181 FR	C67076-A1057-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	34	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	136	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\,JC}$ $R_{th\,CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage[2], t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.
[2] Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 20 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 21$ A	$R_{DS(on)}$	–	0.25	0.32	Ω

Dynamic characteristics

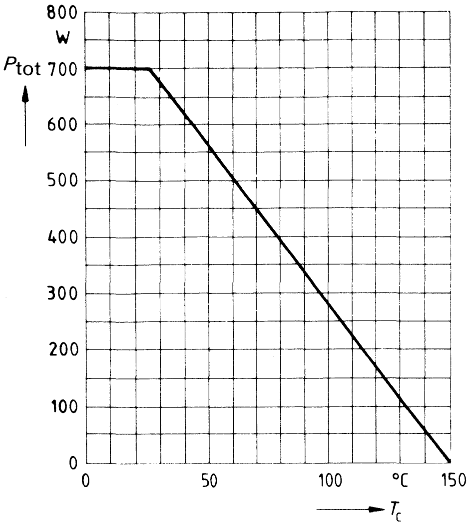
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 21$ A	g_{fs}	15	35	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	22	30	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1	1.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.48	0.8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 21$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	–	ns
	t_r	–	90	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 21$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	350	–	
	t_f	–	70	–	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

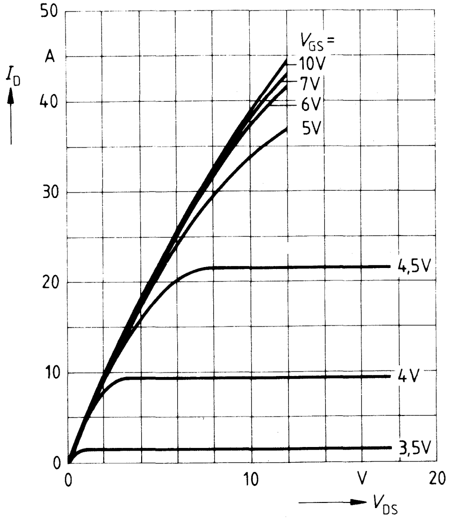
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	34	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	136	
Diode forward on-voltage I_F = 68 A, V_{GS} = 0	V_{SD}	–	1.6	2	V
Reverse recovery time $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V	t_{rr}	–	300	–	ns
Reverse recovery charge $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V T_j = 25 °C T_j = 125 °C	Q_{rr}	 – –	 – –	 2 16	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

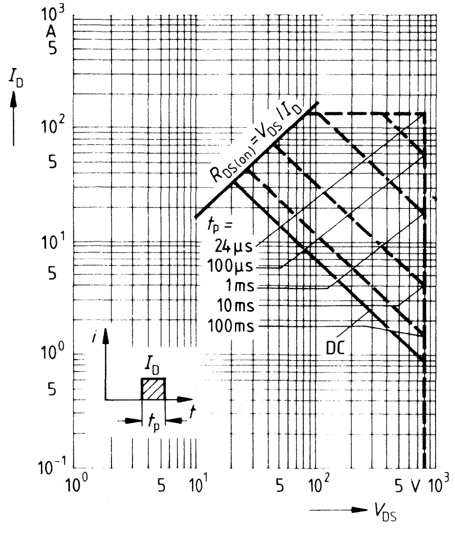
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



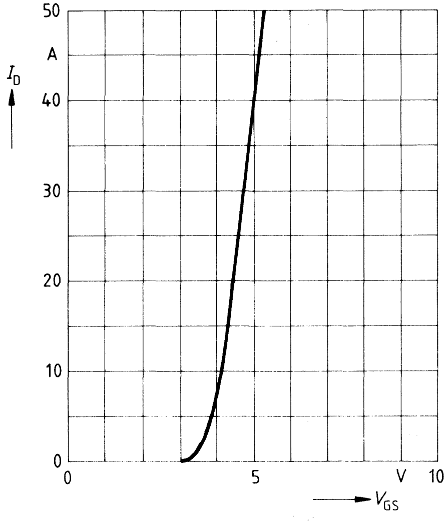
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



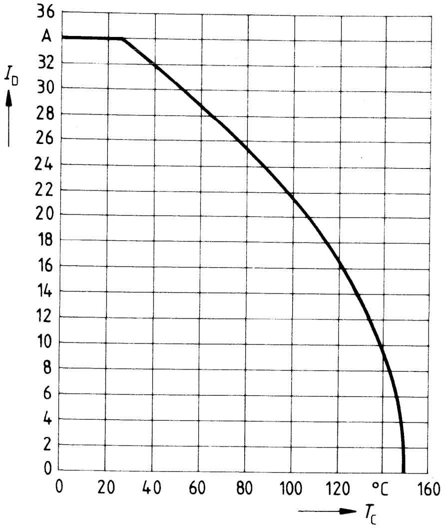
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, $T_C = 25$ °C, $T_j \leq 150$ °C



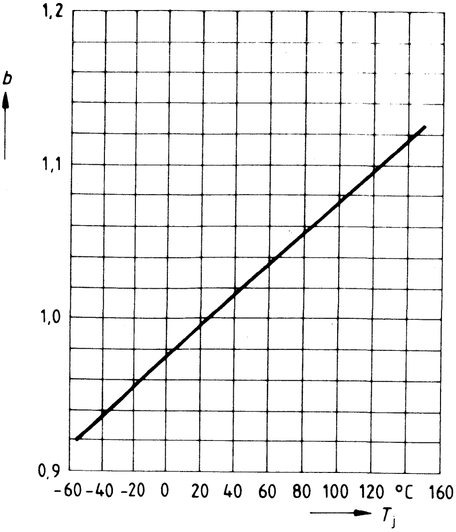
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



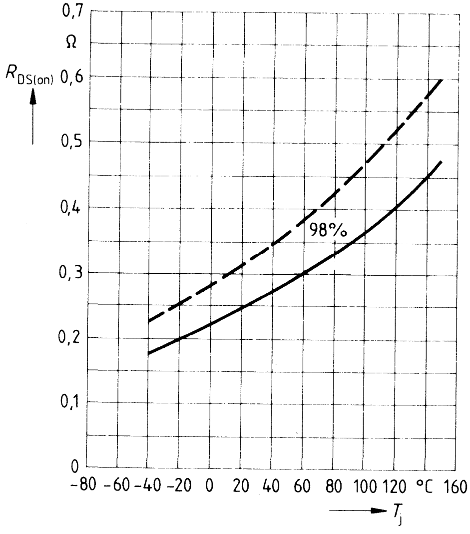
Continuous drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



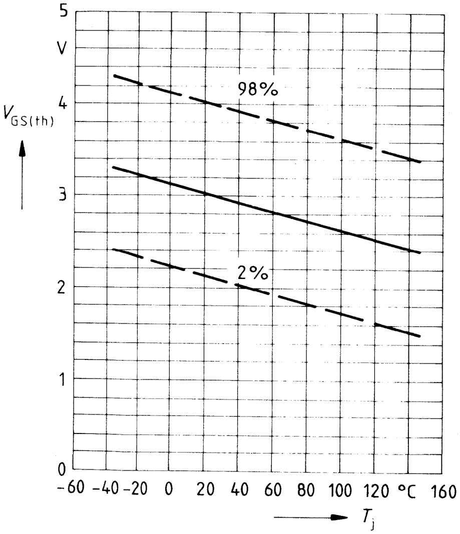
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



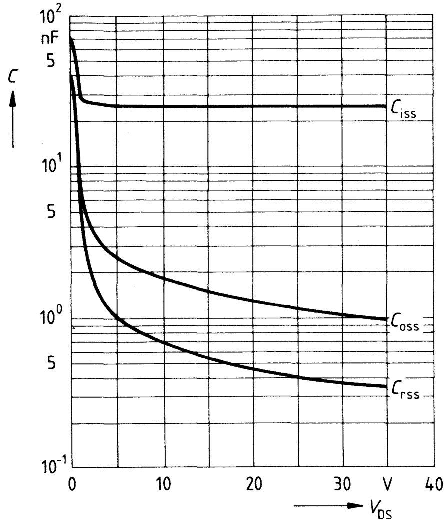
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 34$ A, $V_{GS} = 10$ V, (spread)



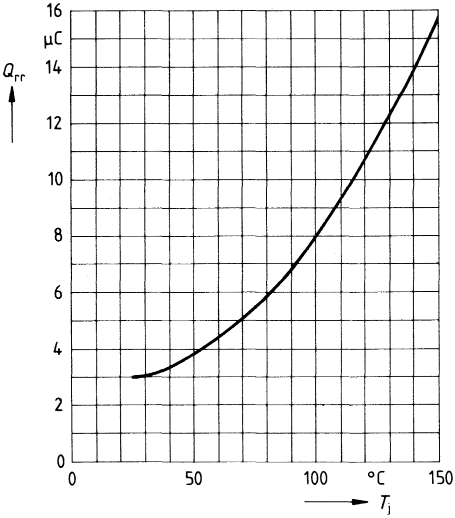
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA



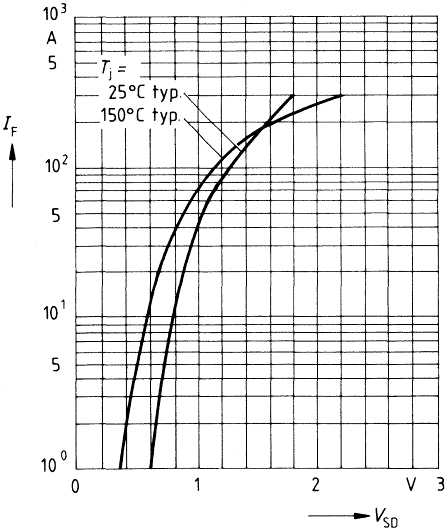
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



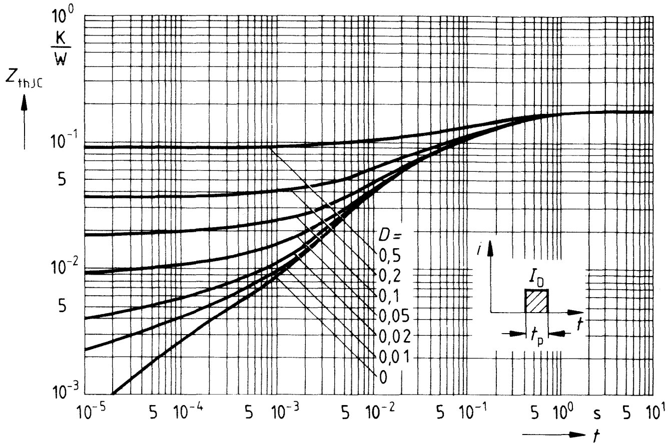
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
parameter: $di/dt = 100$ A/µs, $I_F = 34$ A
$V_R = 100$ V



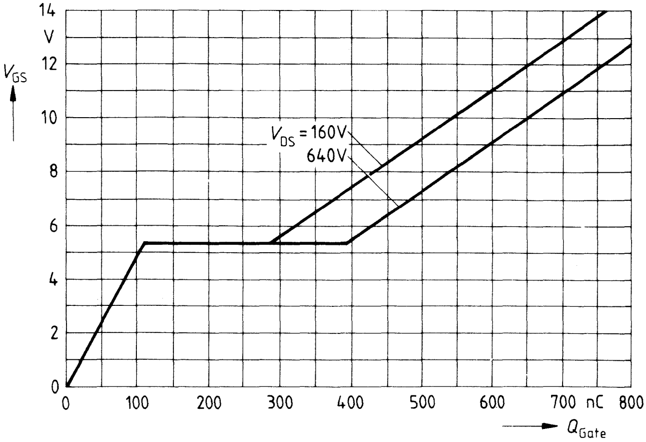
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$



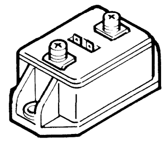
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: I_{Dpuls} = 51 A



SIMOPAC® MOSFET Module

BSM 191 (C)

V_{DS} = 1000 V
I_D = 28 A
$R_{DS(on)}$ = 0.37 Ω



- Power module
- Single switch
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1 a1)

Type	Ordering code
BSM 191 (C)	C67076-A1009-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	28	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	112	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	700	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.18 ≤ 0.05	K/W
Isolation test voltage2), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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1) See chapter Package Outlines.

2) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	50	250	
$T_j = 125$ °C		-	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 18$ A	$R_{DS(on)}$	-	0.33	0.37	Ω

Dynamic characteristics

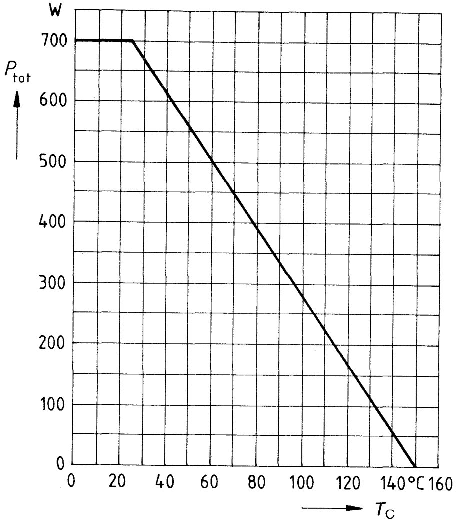
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 18$ A	g_{fs}	15	22	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	22	30	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	1	1.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.48	0.8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 18$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	60	-	ns
	t_r	-	30	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 18$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	350	-	
	t_f	-	60	-	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

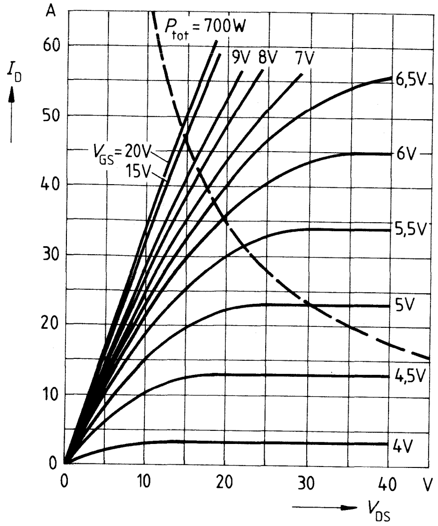
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	28	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	112	
Diode forward on-voltage I_F = 56 A, V_{GS} = 0	V_{SD}	–	1.15	1.4	V
Reverse recovery time $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V	t_{rr}	–	2	–	µs
Reverse recovery charge $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V	Q_{rr}	–	30	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

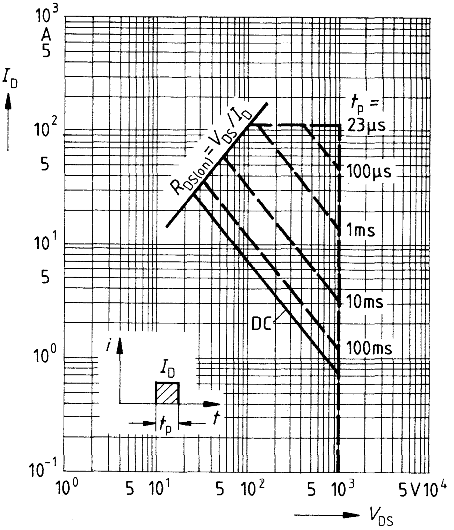
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



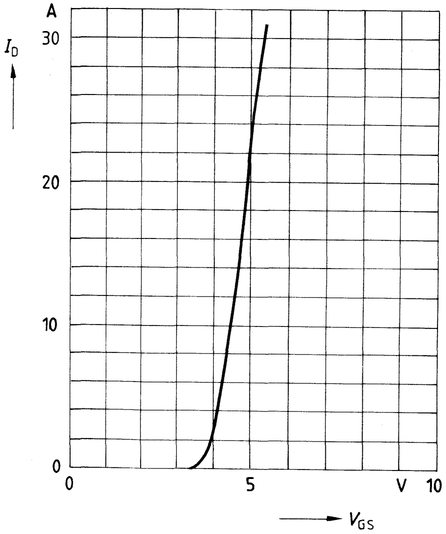
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



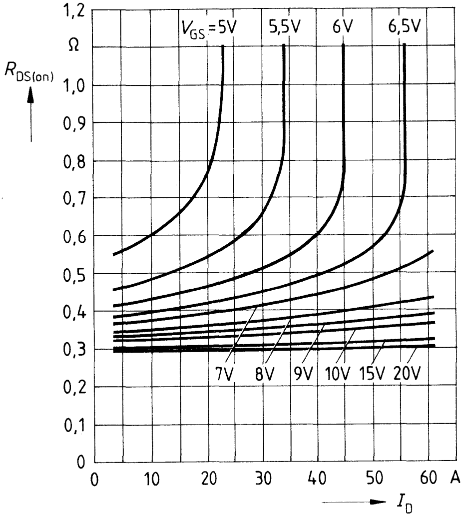
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



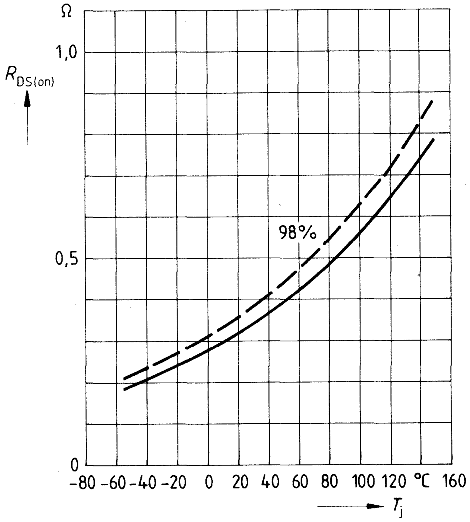
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



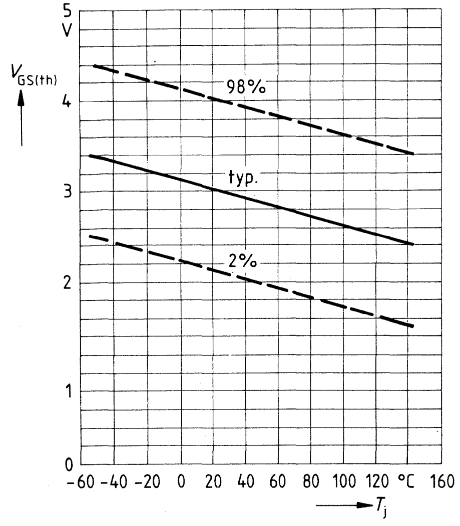
Typ. draine-source on-state resistance
$R_{DS(on)} = f\,(I_D)$
Parameter: V_{GS}



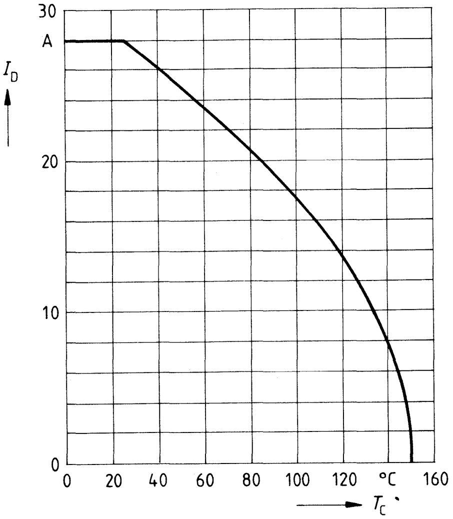
Drain-source on-state resistance
$R_{DS(on)} = f\,(T_j)$
Parameter: $I_D = 18$ A, $V_{GS} = 10$ V
(spread)



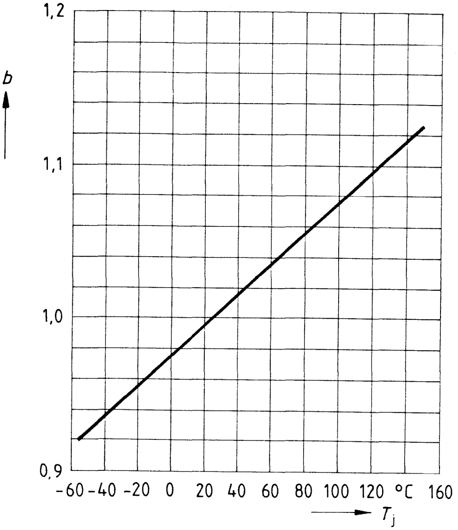
Gate threshold voltage $V_{GS(th)} = f\,(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA



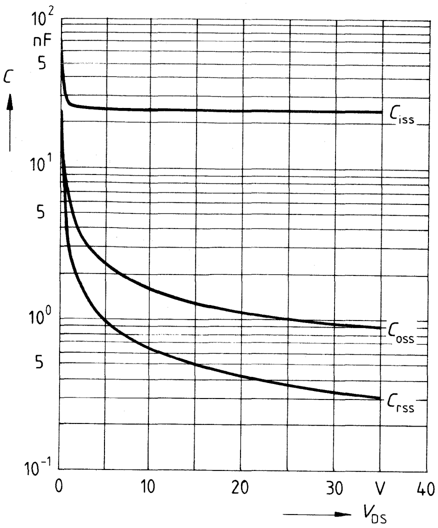
Drain current $I_D = f\,(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



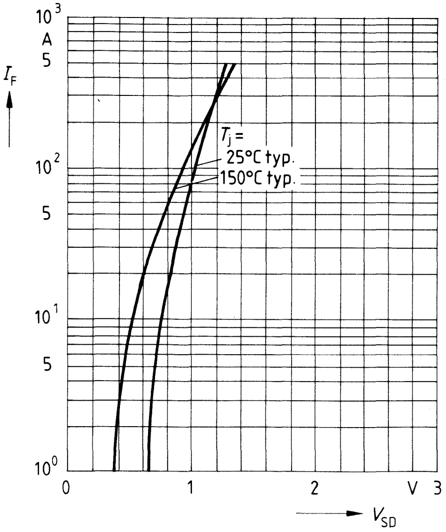
$V_{(BR)DSS}$ $(T_j) = b \times V_{(BR)DSS}$ (25 °C)



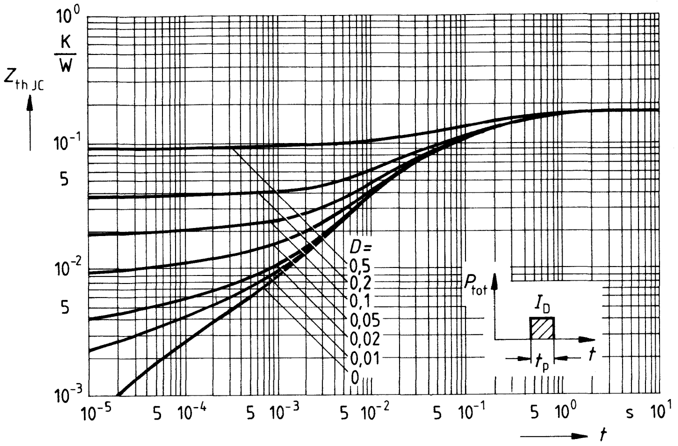
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



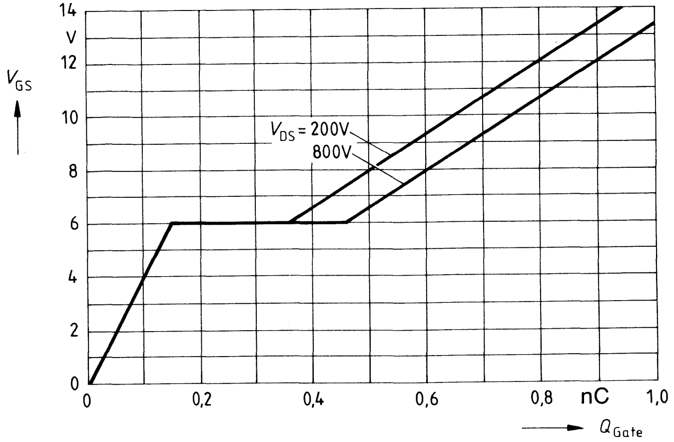
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs
(spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 42$ A

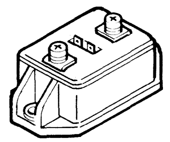


SIEMENS

SIMOPAC® MOSFET Module

BSM 191 F (C)

V_{DS} = **1000 V**
I_D = **28 A**
$R_{DS(on)}$ = **0.42 Ω**



- Power module
- Single switch
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 1 a[1])

Type	Ordering code
BSM 191 F (C)	C67076-A1053-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	28	A
Pulsed drain current, T_C = 25 °C	I_{Dpuls}	110	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	700	W
Thermal resistance			K/W
Chip - case	$R_{th\ JC}$	≤ 0.18	
Case - heat sink	$R_{th\ CH}$	≤ 0.05	
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	-	16	mm
Clearance, drain-source	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	1000	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current V_{DS} = 1000 V, V_{GS} = 0	I_{DSS}				µA
T_j = 25 °C		–	50	250	
T_j = 125 °C		–	300	1000	
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	10	100	nA
Drain-source on-state resistance V_{GS} = 10 V, I_D = 18 A	$R_{DS(on)}$	–	0.38	0.42	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, I_D = 18 A	g_{fs}	15	22	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	22	30	nF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	1.0	1.5	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	0.36	0.5	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 500 V, V_{GS} = 10 V, I_D = 18 A, R_{GS} = 3.3 Ω	$t_{d(on)}$	–	60	–	ns
	t_r	–	30	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 500 V, V_{GS} = 10 V, I_D = 18 A, R_{GS} = 3.3 Ω	$t_{d(off)}$	–	350	–	
	t_f	–	60	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	28	A
Pulsed reverse drain current $T_C = 25$ °C	I_{DS}	–	–	110	
Diode forward on-voltage[1] $I_F = 56$ A, $V_{GS} = 0$	V_{SD}	–	1.2	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	300	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	1.8	–	µC

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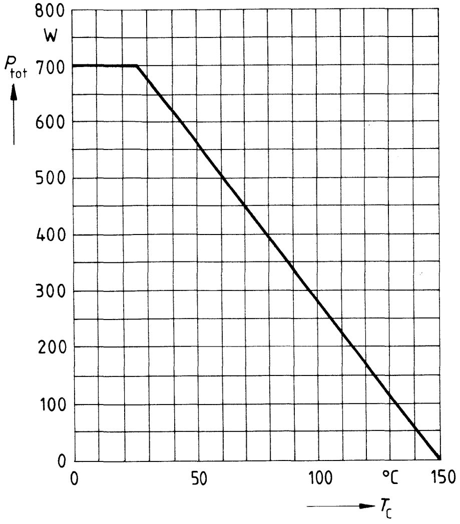
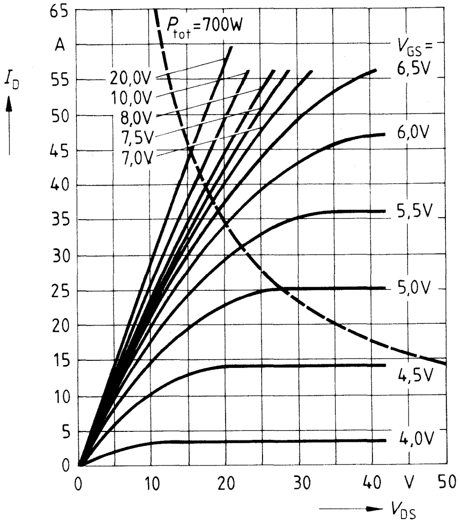
[1] upon request

Characteristics at $T_j = 25$ °C, unless otherwise specified

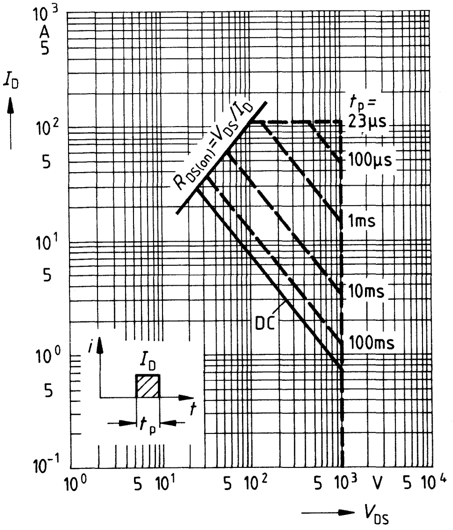
Power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



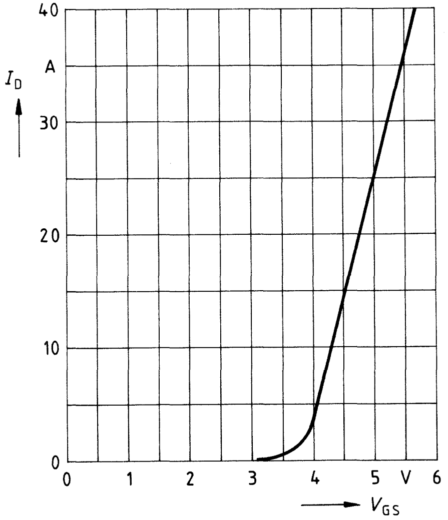
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



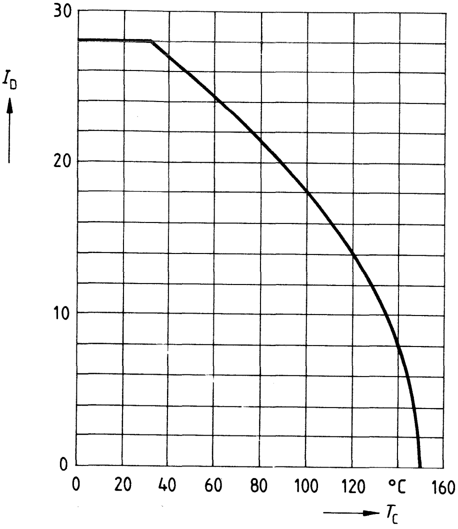
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



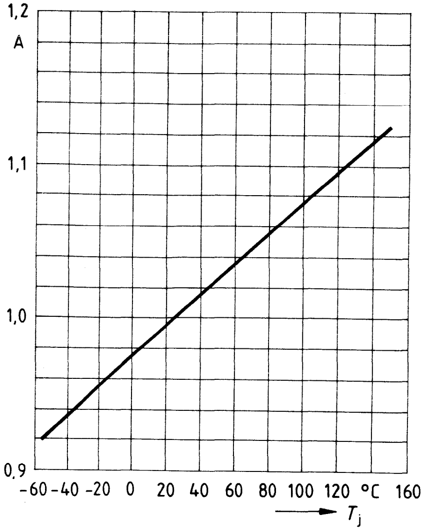
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



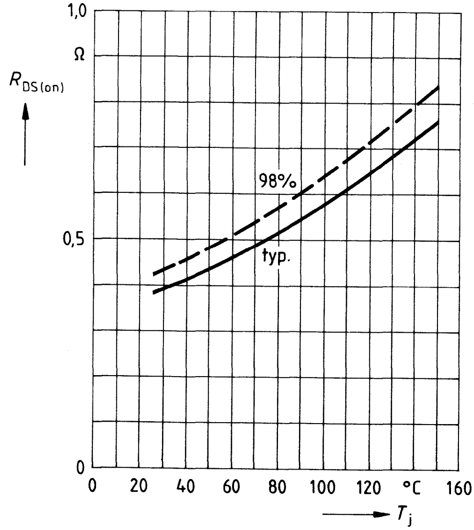
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



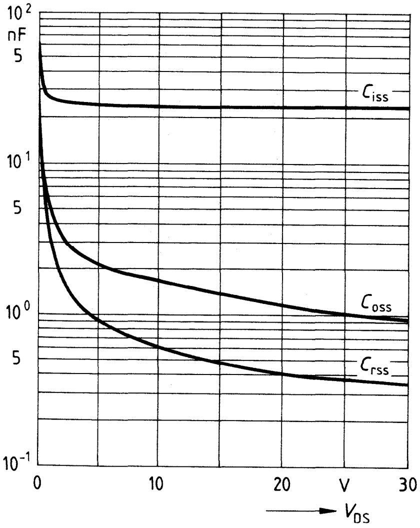
$V_{(BR)DSS}$ (T_j) = $b \times V_{(BR)DSS}$ (25 °C)



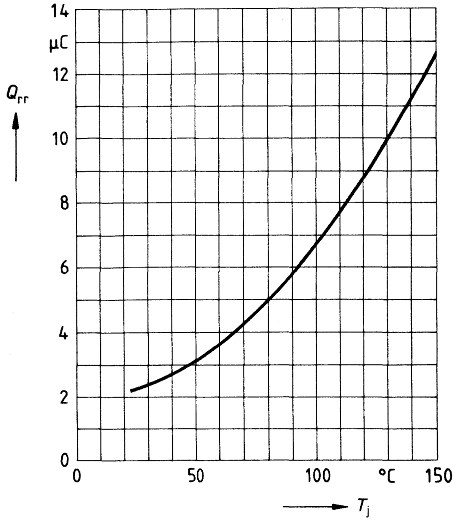
Drain-source on-state resistance
$R_{DS\,(on)} = f(T_j)$
Parameter: $I_D = 18$ A, $V_{GS} = 10$ V
(spread)



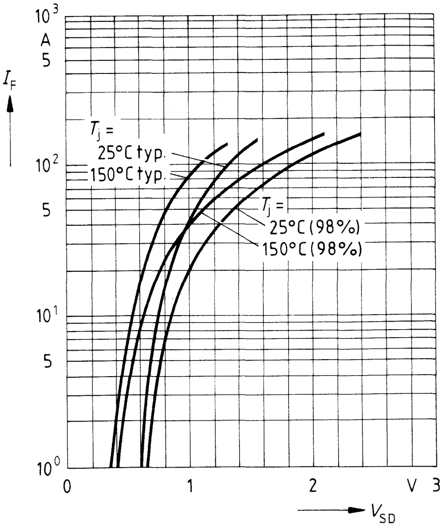
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



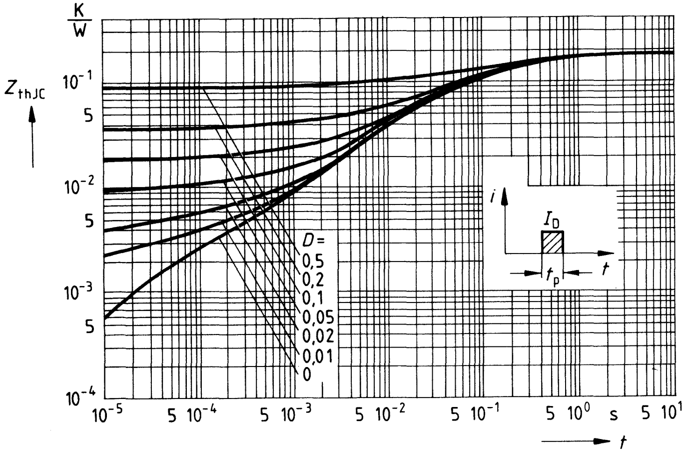
Typ. reverse recovery charge $Q_{rr} = f\,(T_j)$
Parameter: di_F/dt = 100 A/µs,
I_F = 28 A, V_R = 100 V



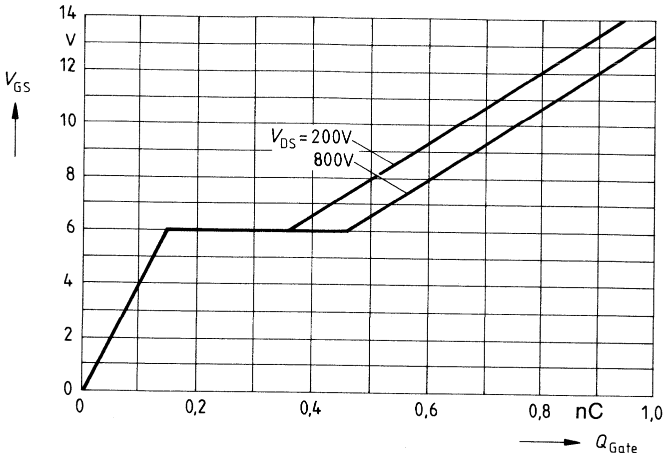
Forward characteristics of fast-recovery reverse diode $I_F = f\,(V_{SD})$
Parameter: T_j, t_p = 80 µs (spread)



Transient thermal impedance $Z_{thJC} = f\,(t)$
Parameter: $D = t_p/T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\,puls} = 42$ A

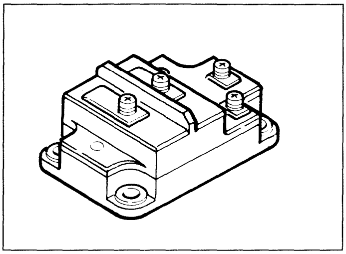


IGBT Module
Preliminary Data

BSM 200 GA 100 D

V_{CE} = 1000 V
I_C = 200 A

- Power module
- Single switch
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 4 a[1])



Type	Ordering code
BSM 200 GA 100 D	C67076-A2001-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, R_{GE} = 20 kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, T_C = 80 °C	I_C	200	A
Pulsed collector current, T_C = 80 °C	$I_{C\ puls}$	400	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	1750	W
Thermal resistance chip - case case - heat sink	 R_{thJC} R_{thCH}	 ≤ 0.07 ≤ 0.038	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 4$ mA	$V_{(BR)CES}$	1000	-	-	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 16$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 200$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		–	3.0	–	
$T_j = 150$ °C		–	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		–	–	4000	
$T_j = 125$ °C		–	–	–	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	–	100	nA
AC characteristics					
Forward transconductance $V_{CE} = 20$ V, $I_C = 200$ A	g_{fs}	88	–	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	32000	-	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	2600	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	1000	-	

Switching Characteristics

at $T_j = 125$ °C

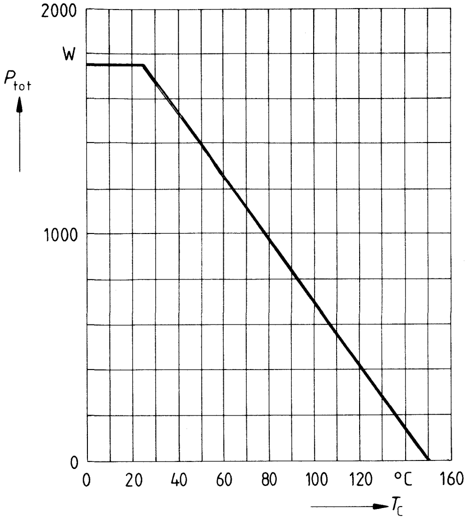
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(on)}$	-	360	-	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_r	-	600	-	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	-	500	-	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	-	600	-	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	-	500	-	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	-	200	-	
Turn-off loss ($E_{off} = E_{off\ 1} + E_{off\ 2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 200$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$E_{off\ 1}$ $E_{off\ 2}$	- -	15 10	- -	mWs

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

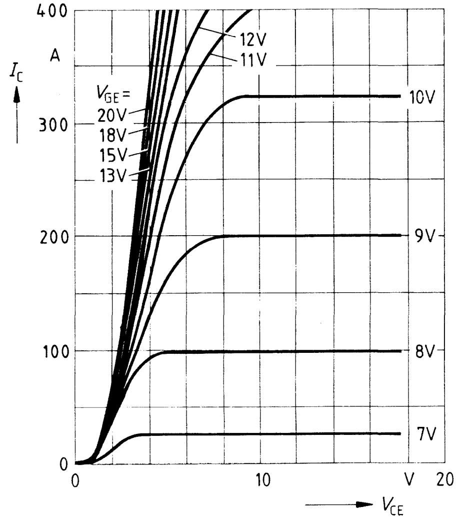
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 200$ A, $V_{GE} = 0$	V_F				V
$T_j = 25$ °C		–	1.8	–	
$T_j = 125$ °C		–	1.6	–	
Reverse recovery time $I_F = 200$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.4	–	µs
Reverse recovery charge $I_F = 200$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	Q_{rr}				µC
$T_j = 25$ °C		–	8	–	
$T_j = 125$ °C		–	36	–	
Soft factor $I_F = 200$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance Chip-case	R_{thJC}	–	–	0.25	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

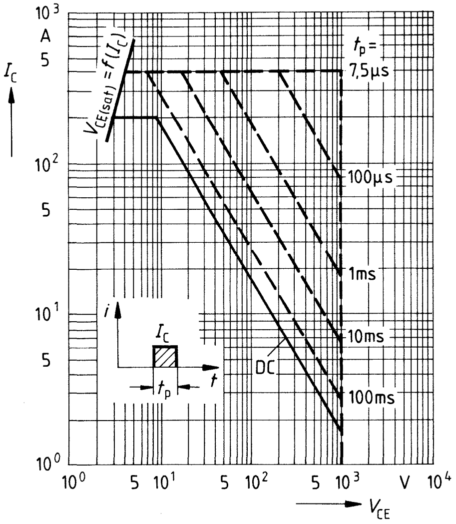
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



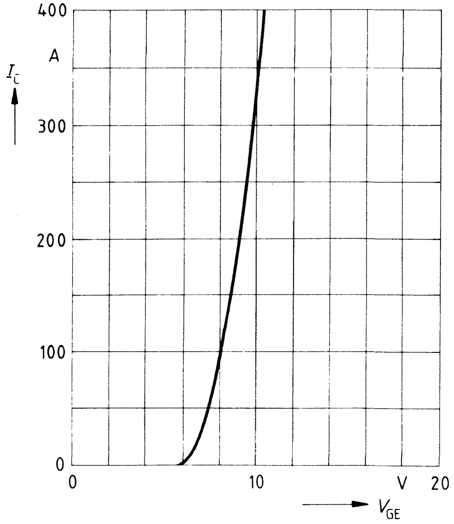
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



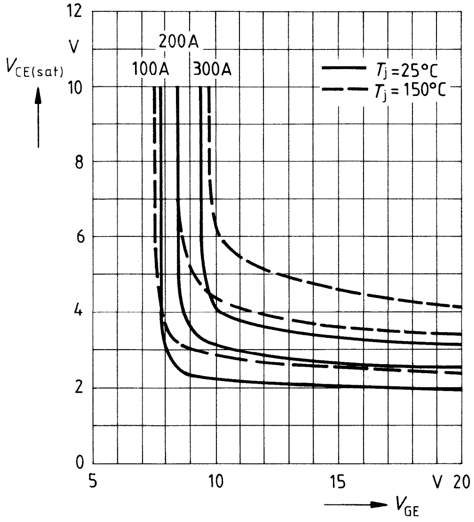
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



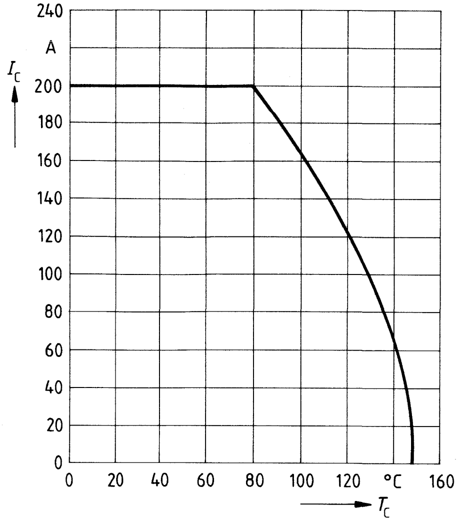
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



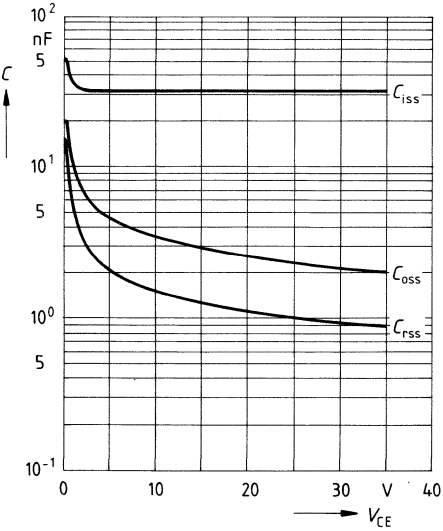
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



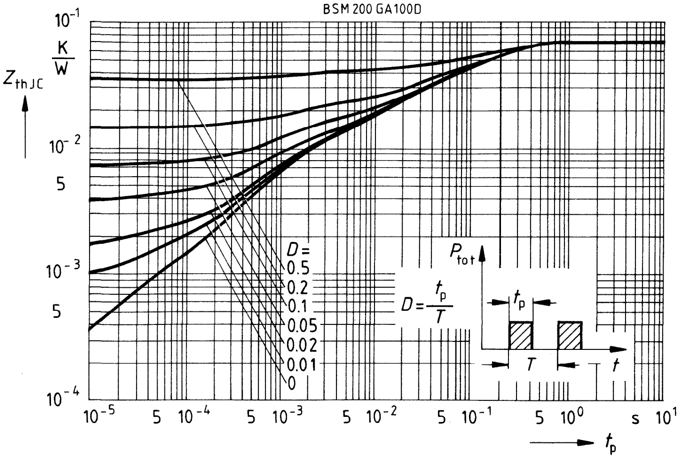
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



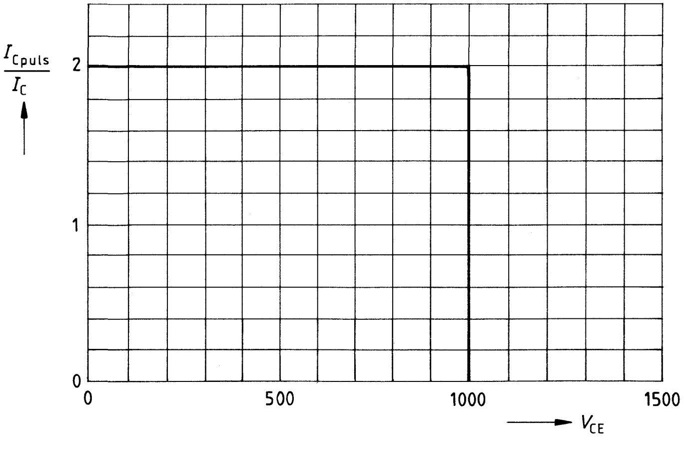
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{C\,puls} = f(V_{CE})$
parameter: $T_j = 125$ °C, $V_{GE} = 15$ V, $R_{g\,(off)} = 5\ \Omega$,
L (parasitic inductance, module) < 80 nH

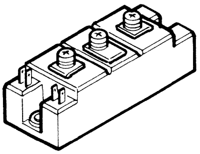


SIEMENS

SIMOPAC® MOSFET Module BSM 214 A

V_{DS} = 100 V
I_D = 2 x 125 A
$R_{DS(on)}$ = 0.013 Ω

- Power module
- Half-bridge
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2a[1])



Type	Ordering code
BSM 214 A	C67076-S1100-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	125	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	375	
Operating and storage temperature range	T_j T_{stg}	−55 ... +150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.31 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40040		F	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current V_{DS} = 100 V, V_{GS} = 0 T_j = 25 °C T_j = 125 °C	I_{DSS}	– –	50 300	250 1000	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	10	100	nA
Drain-source on-state resistance V_{GS} = 10 V, I_D = 38 A	$R_{DS(on)}$	–	0.01	0.013	Ω

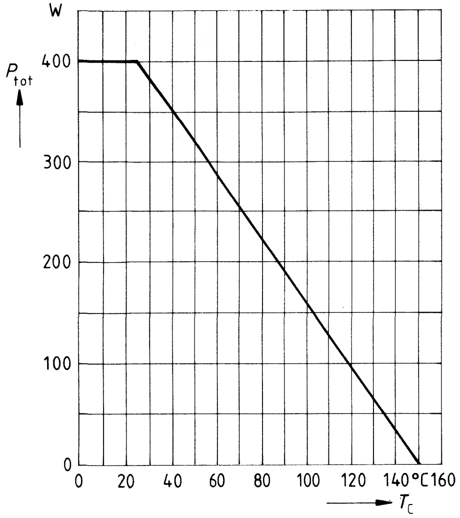
Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, I_D = 38 A	g_{fs}	40	60	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	9	12	nF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	4	6	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	1.6	2.4	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 50 V, V_{GS} = 10 V, I_D = 78 A, R_{GS} = 3.3 Ω	$t_{d(on)}$	–	50	–	ns
	t_r	–	190	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 50 V, V_{GS} = 10 V, I_D = 78 A, R_{GS} = 3.3 Ω	$t_{d(off)}$	–	190	–	
	t_f	–	50	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

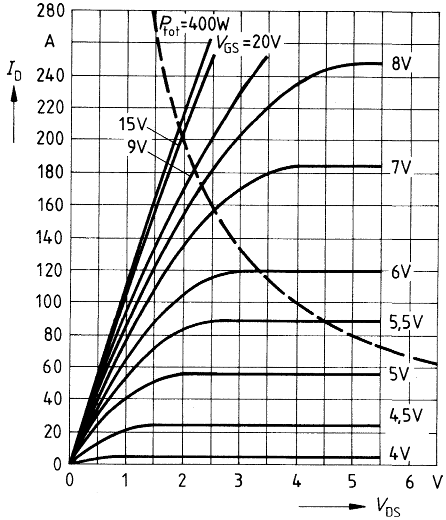
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	125	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	375	
Diode forward on-voltage $I_F = 250$ A, $V_{GS} = 0$	V_{SD}	–	1.25	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	320	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	3.6	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

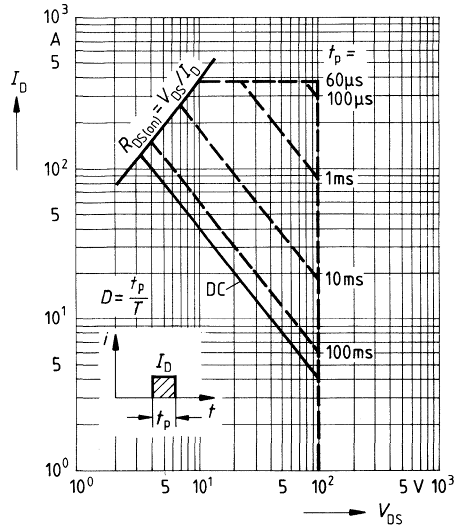
Power dissipation $P_{tot} = f\,(T_C)$
Parameter: $T_j = 150$ °C



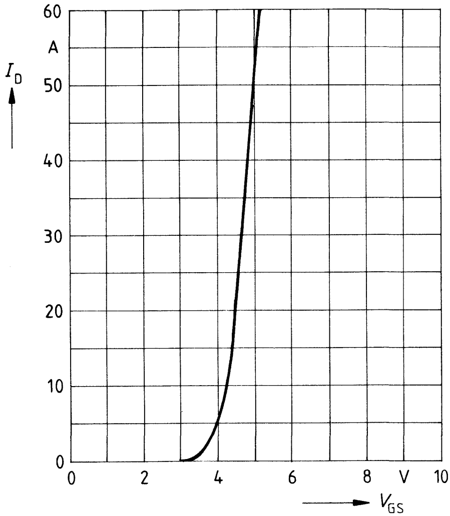
Typ. output characteristics $I_D = f\,(V_{DS})$
Parameter: $t_p = 80$ µs



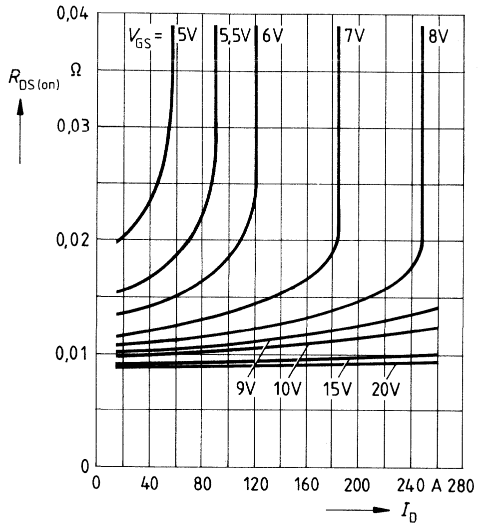
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



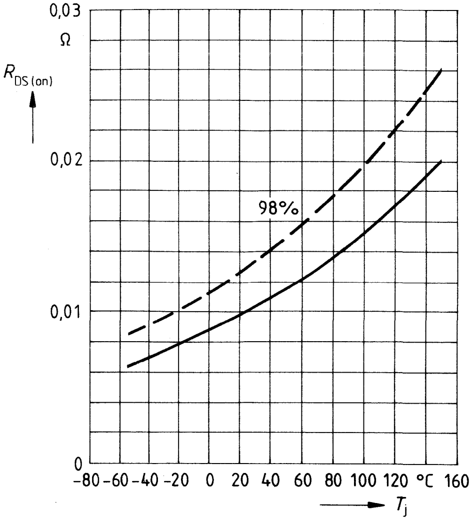
Typ. transfer characteristic
$I_D = f\,(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



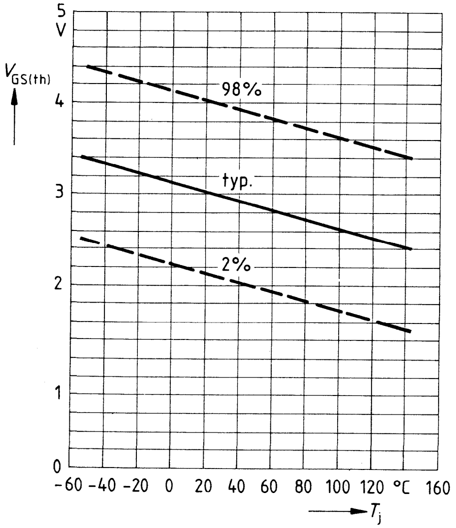
Typ. on-state resistance $R_{DS(on)} = f\ (I_D)$
Parameter: V_{GS}



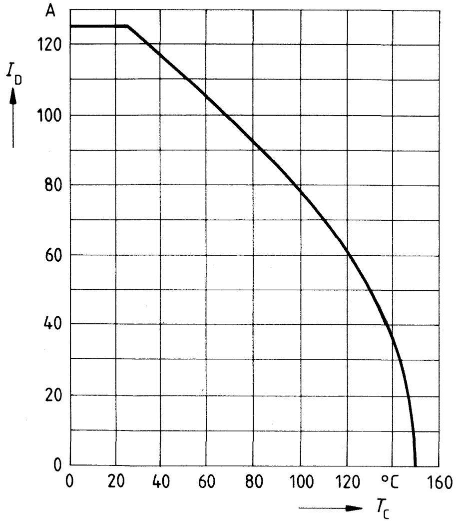
On-state resistance $R_{DS(on)} = f\ (T_j)$
Parameter: $I_D = 38$ A, $V_{GS} = 10$ V
(spread)



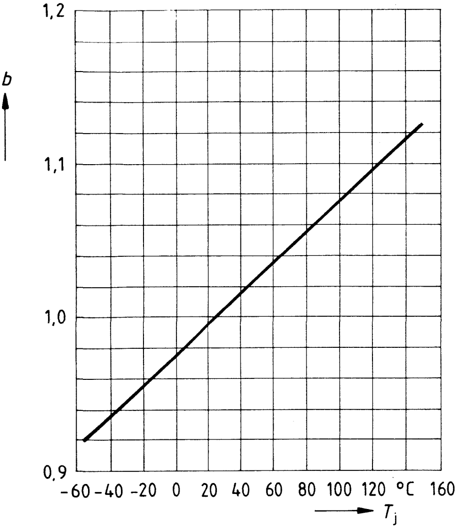
Gate threshold voltage $V_{GS(th)} = f\ (T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



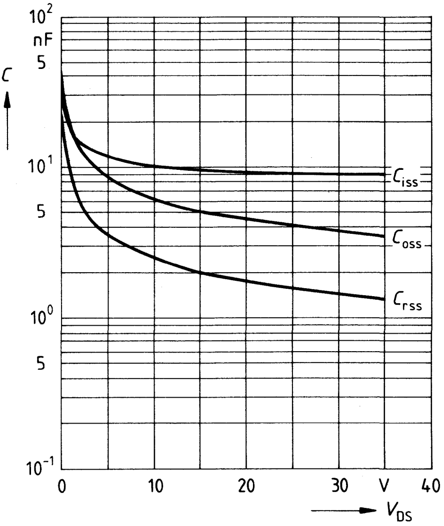
Drain current $I_D = f\ (T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



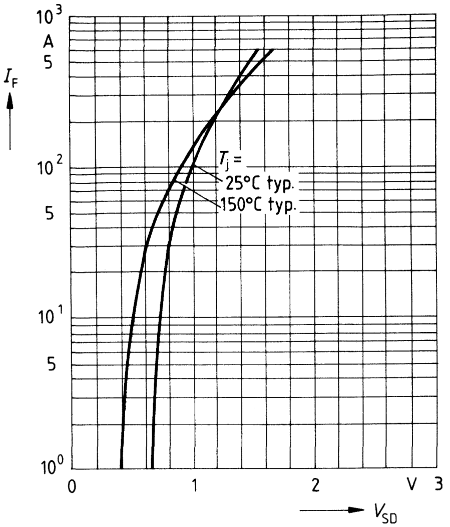
$V_{(BR)DSS}$ $(T_j) = b \times V_{(BR)DSS}$ (25 °C)



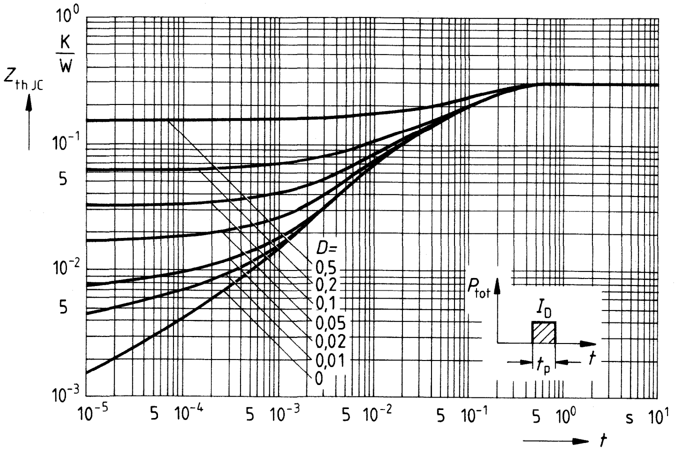
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



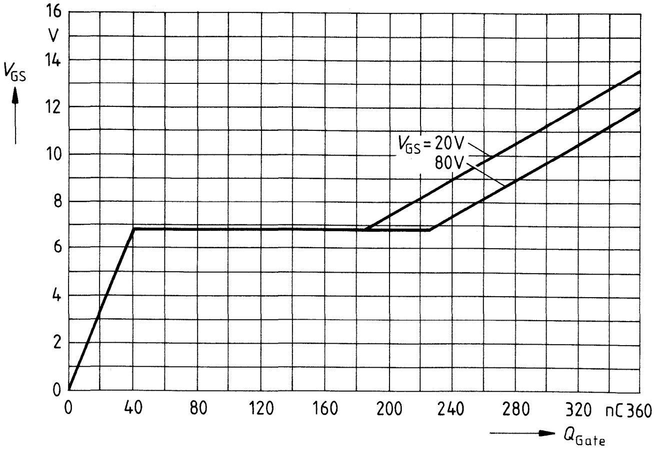
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs
(spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 185$ A

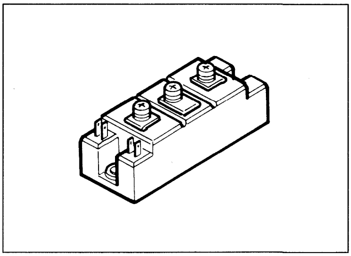


SIEMENS

SIMOPAC® MOSFET Module

BSM 224 A

V_{DS} = 200 V
I_D = 2 x 81 A
$R_{DS(on)}$ = 0.03 Ω



- Power module
- Half-bridge
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 a[1])

Type	Ordering code
BSM 224 A	C67076-S1101-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	81	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	250	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.31 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 50 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 50$ A	$R_{DS(on)}$	-	0.023	0.03	Ω

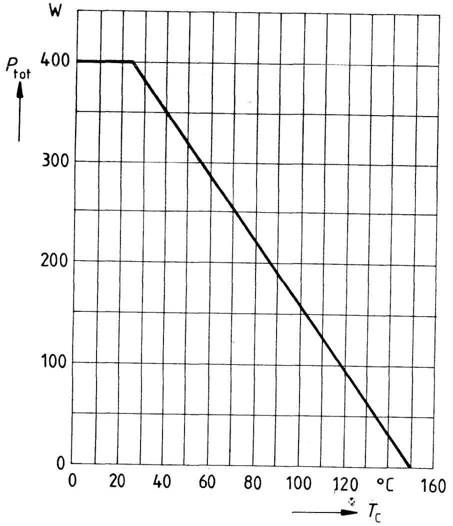
Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 50$ A	g_{fs}	40	58	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	7	9	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	2.5	4	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.8	1.5	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 100$ V, $V_{GS} = 10$ V, $I_D = 52$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	55	-	ns
	t_r	-	110	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 100$ V, $V_{GS} = 10$ V, $I_D = 52$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	220	-	
	t_f	-	35	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

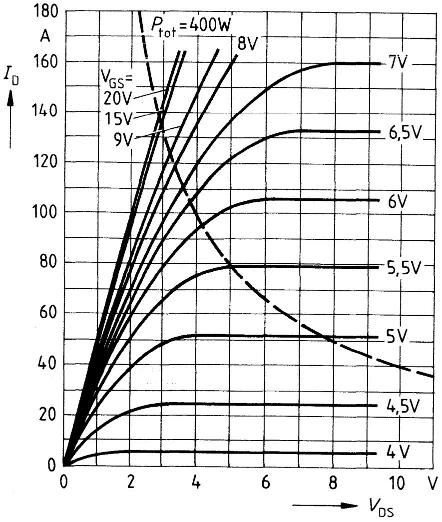
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	81	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	250	
Diode forward on-voltage $I_F = 162$ A, $V_{GS} = 0$	V_{SD}	–	1.25	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	320	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	4.3	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

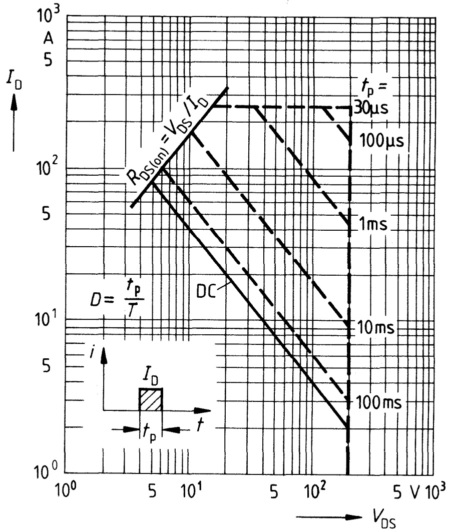
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



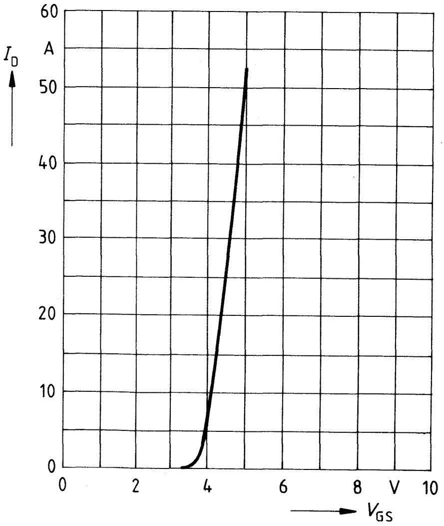
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



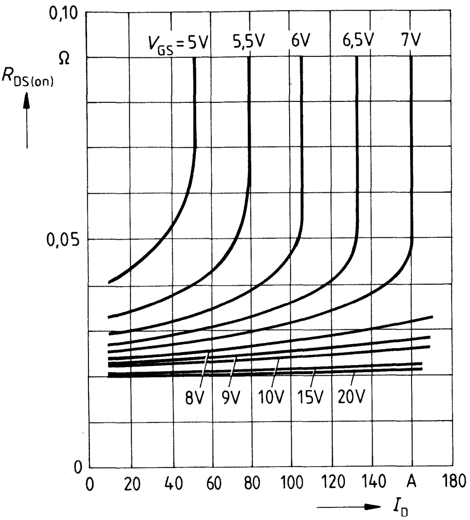
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



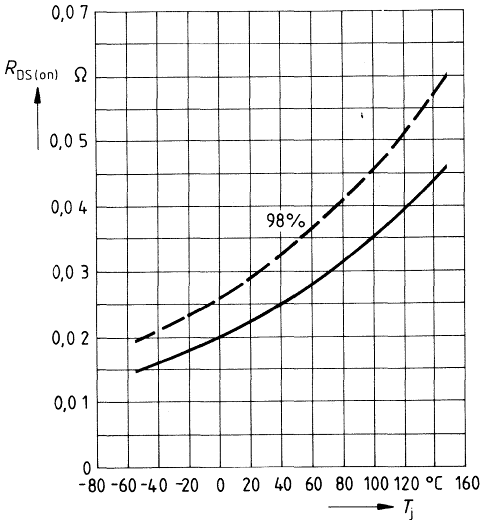
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



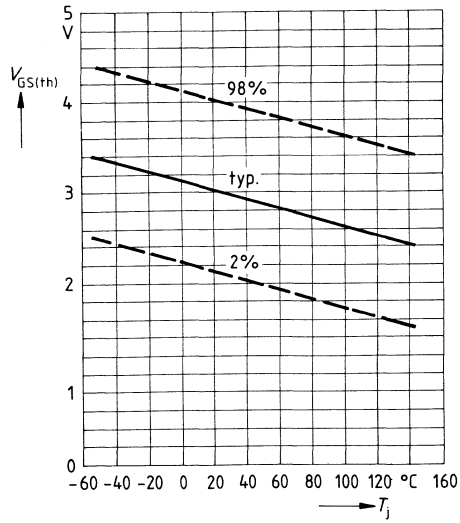
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



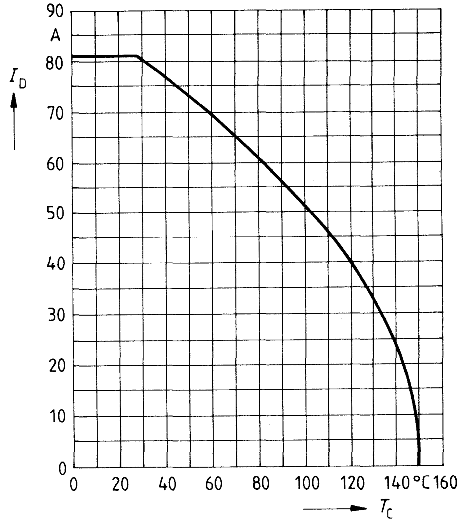
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 50$ A, $V_{GS} = 10$ V
(spread)



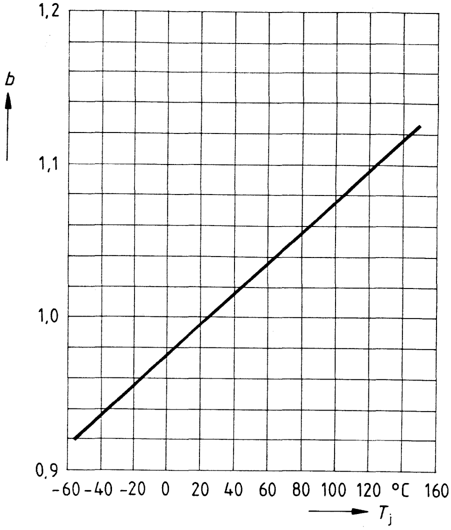
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



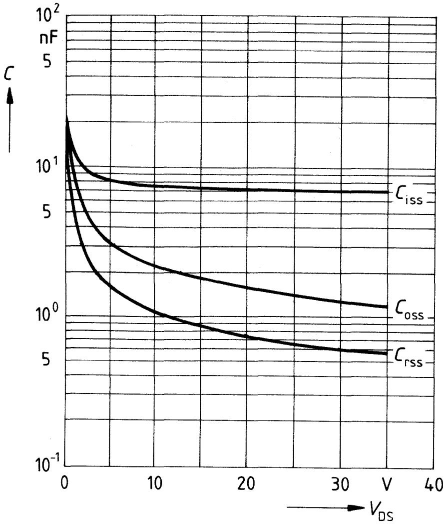
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



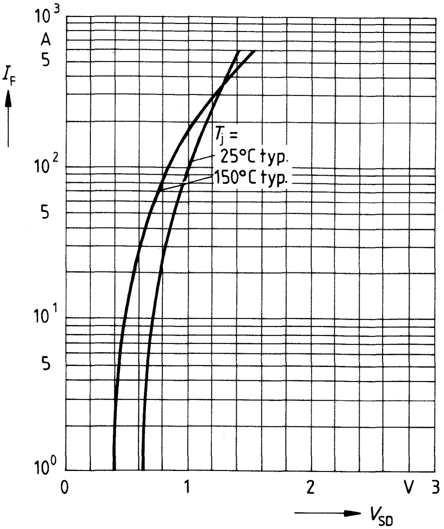
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



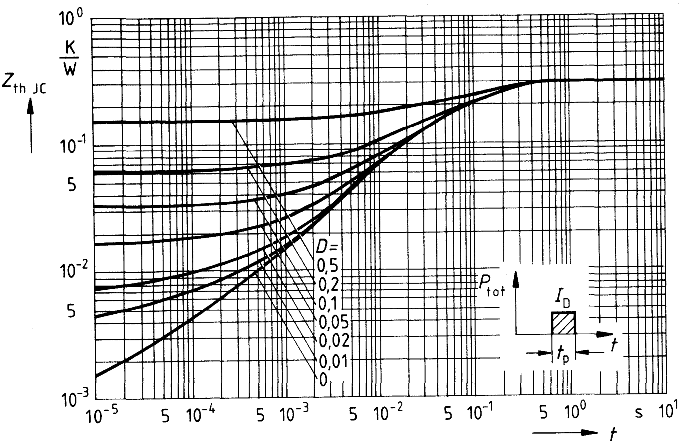
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



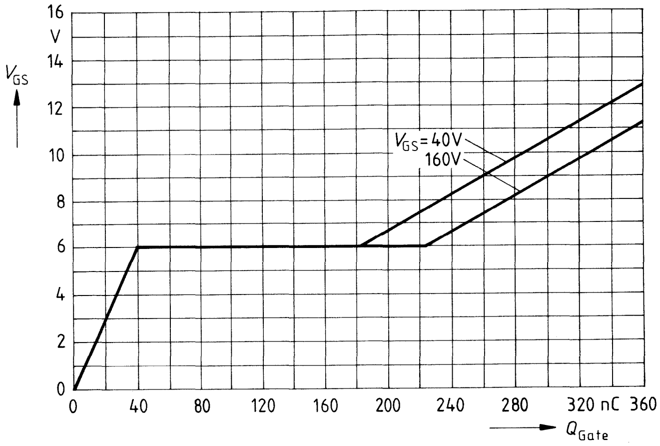
Forward characteristic of reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs
(spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 121$ A

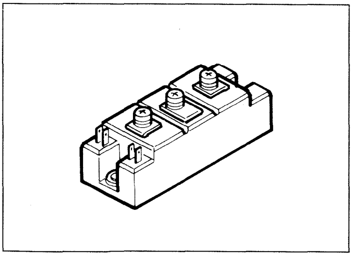


SIEMENS

SIMOPAC® MOSFET Module

BSM 244 F

V_{DS} = 400 V
I_D = 2 x 45 A
$R_{DS(on)}$ = 0.1 Ω



- Power module
- Half-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 a[1])

Type	**Ordering code**
BSM 244 F	C67076-A1155-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	400	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	400	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	45	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	180	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	$R_{th\ JC}$ $R_{th\ CH}$	≤ 0.31 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50014, IEC 146, para 492.1.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	50	250	
$T_j = 125$ °C		–	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 28$ A	$R_{DS(on)}$	–	0.09	0.1	Ω

Dynamic characteristics

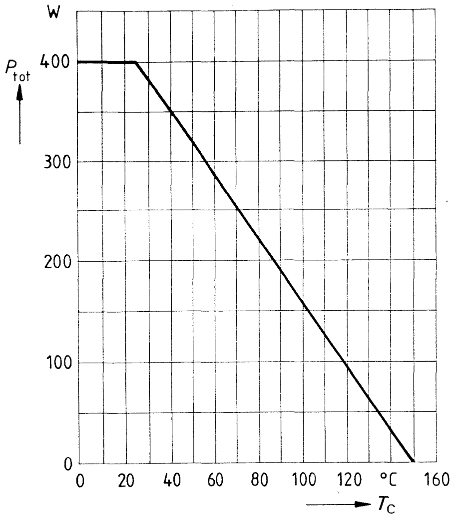
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 28$ A	g_{fs}	–	26	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	18	24	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.3	1.9	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.48	0.7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 200$ V, $V_{GS} = 10$ V, $I_D = 28$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	–	ns
	t_r	–	30	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 200$ V, $V_{GS} = 10$ V, $I_D = 28$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	130	–	
	t_f	–	40	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

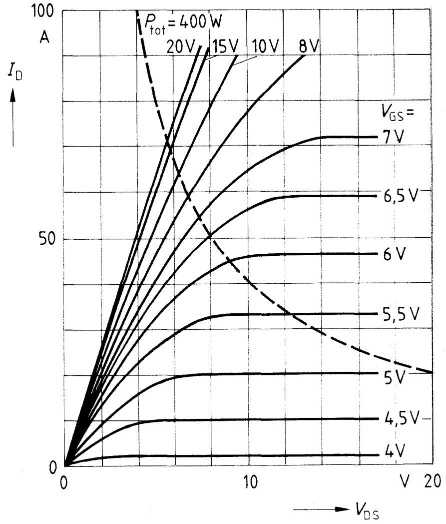
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	45	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	180	
Diode forward on-voltage $I_F = 90$ A, $V_{GS} = 0$	V_{SD}	–	1.2	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	200	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	1.5	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

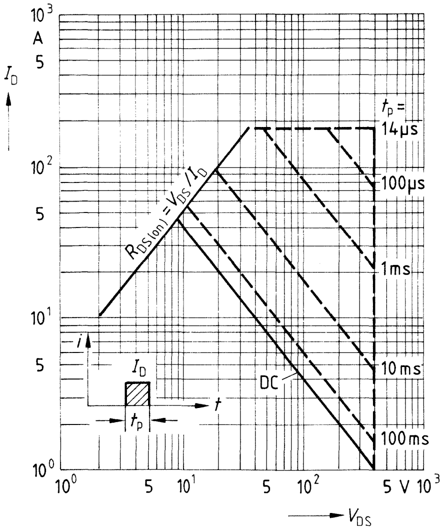
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



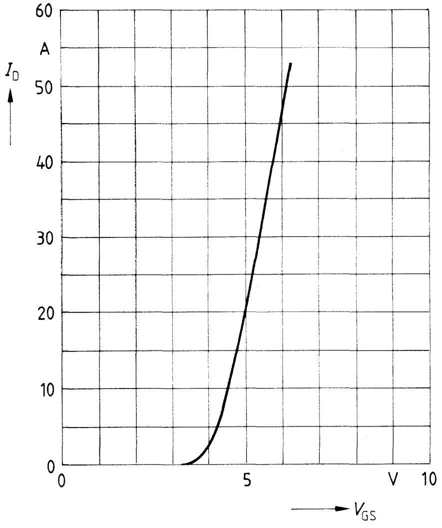
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



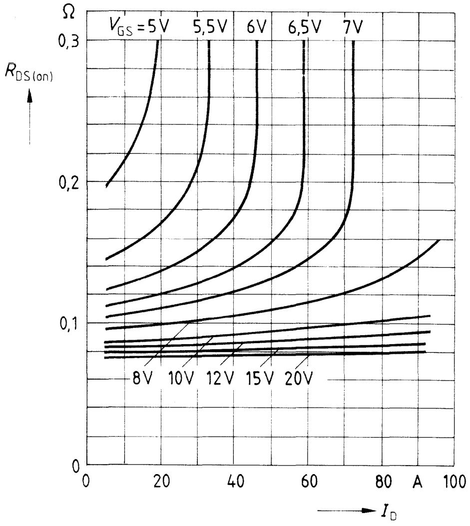
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



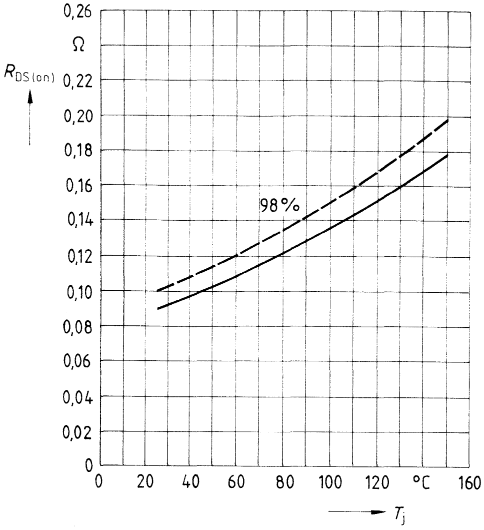
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



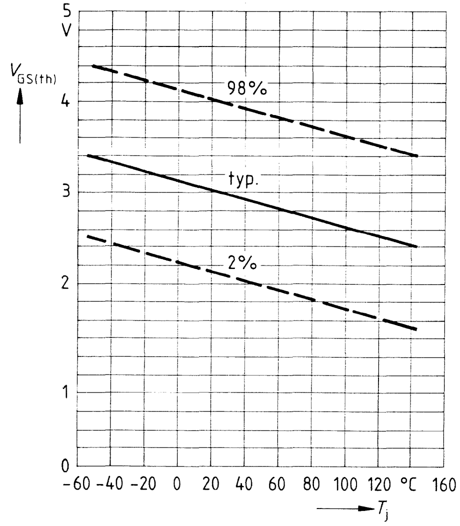
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



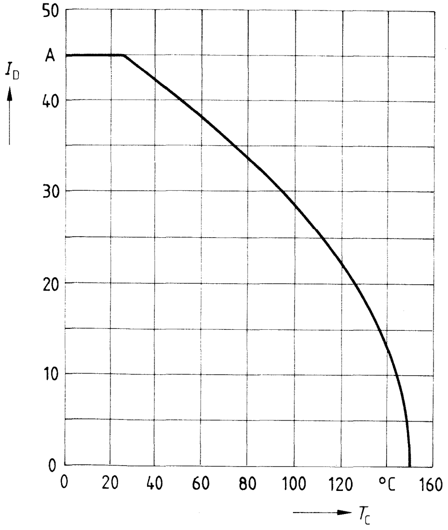
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 28$ A, $V_{GS} = 10$ V
(spread)



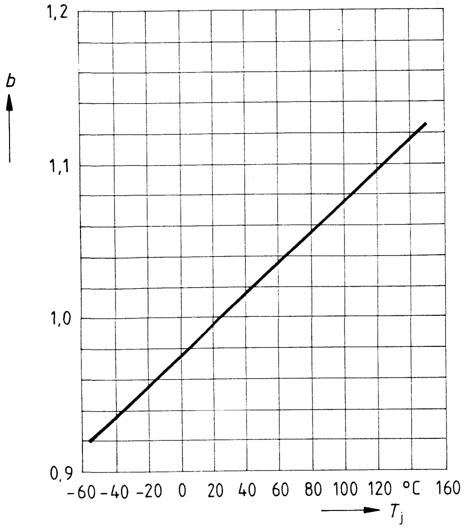
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



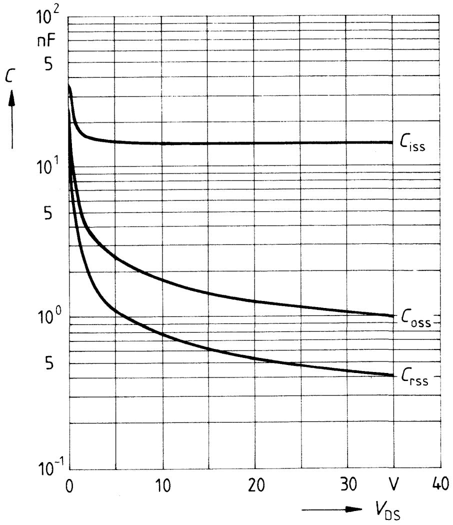
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



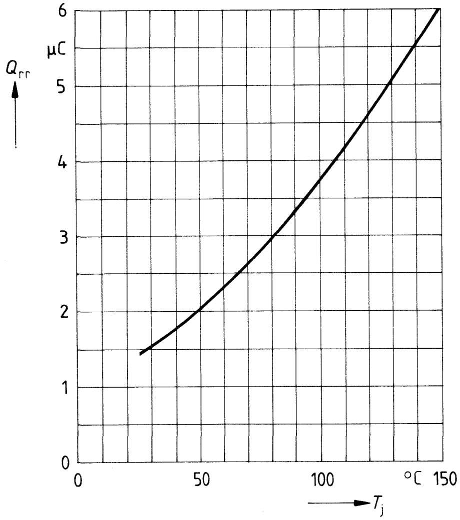
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



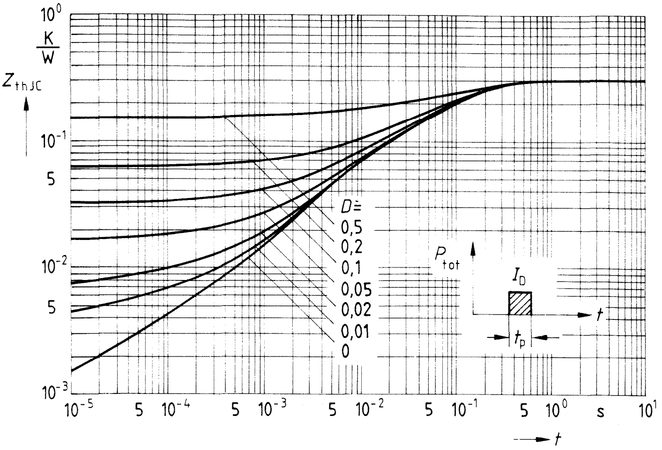
Typ. capacitances $C = f\,(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



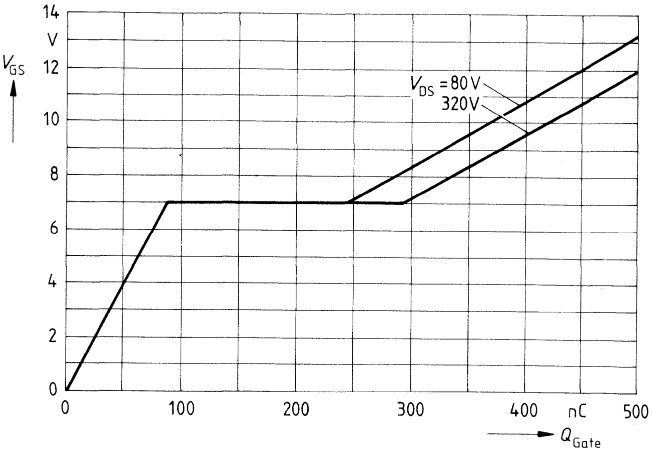
Typ. reverse recovery charge $Q_{rr} = f\,(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 45$ A
$V_R = 100$ V



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$

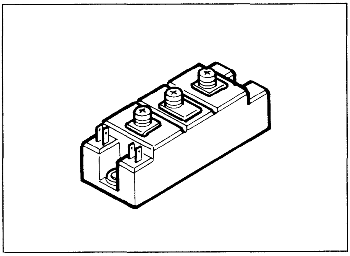


Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 67.5$ A



SIMOPAC® MOSFET Module BSM 254 F

V_{DS} = **500 V**
I_D = **2 x 35 A**
$R_{DS(on)}$ = **0.17 Ω**



- Power module
- Half-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2a 1)

Type	Ordering code
BSM 254 F	C67076-A1150-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	35	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	140	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.31 ≤ 0.07	K/W
Isolation test voltage2), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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1) See chapter Package Outlines.
2) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	50 300	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 22$ A	$R_{DS(on)}$	–	0.14	0.17	Ω

Dynamic characteristics

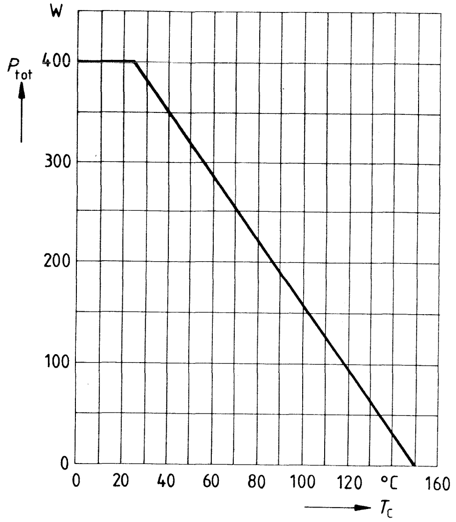
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 22$ A	g_{fs}	13	20	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	18	24	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.3	1.9	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.48	0.7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 22$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	40	–	ns
	t_r	–	30	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 22$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	70	–	
	t_f	–	55	–	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

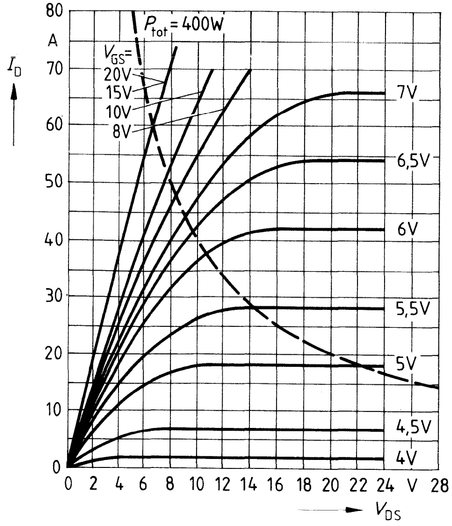
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	35	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	140	
Diode forward on-voltage I_F = 70 A, V_{GS} = 0	V_{SD}	–	1.2	1.6	V
Reverse recovery time $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V T_j = 25 °C T_j = 150 °C	t_{rr}	– –	200 350	280 500	ns
Reverse recovery charge $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V T_j = 25 °C T_j = 150 °C	Q_{rr}	– –	1.5 8.5	2.5 12	µC
Repetitive peak reverse current $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V T_j = 25 °C T_j = 150 °C	I_{RRM}	– –	12 28	– –	A

Characteristics at T_j = 25 °C, unless otherwise specified.

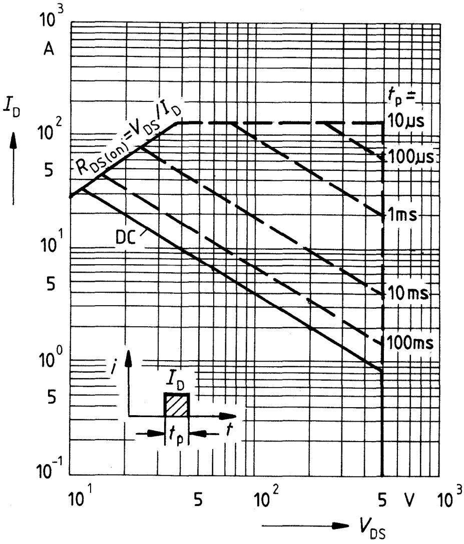
Total power dissipation $P_{tot} = f(T_C)$
parameter: T_j = 150 °C



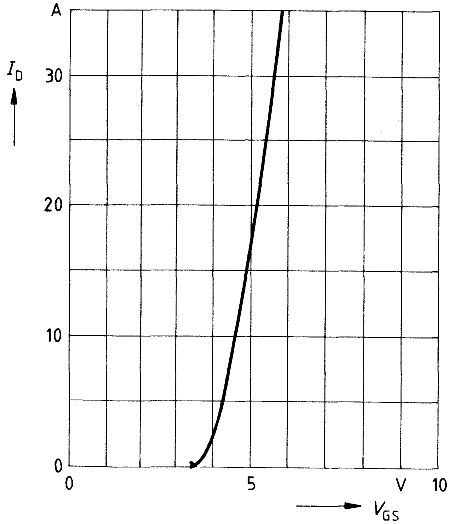
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



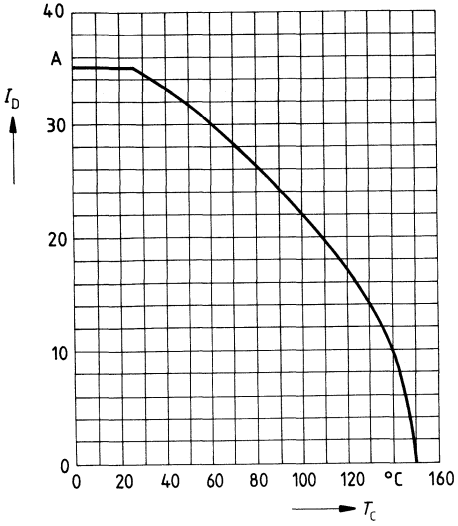
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse,
T_C = 25 °C, T_j ≤ 150 °C



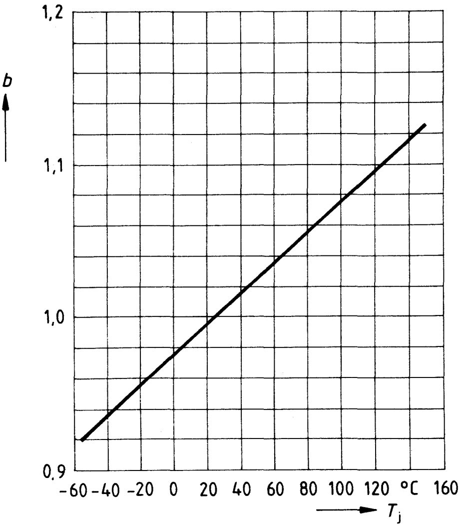
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



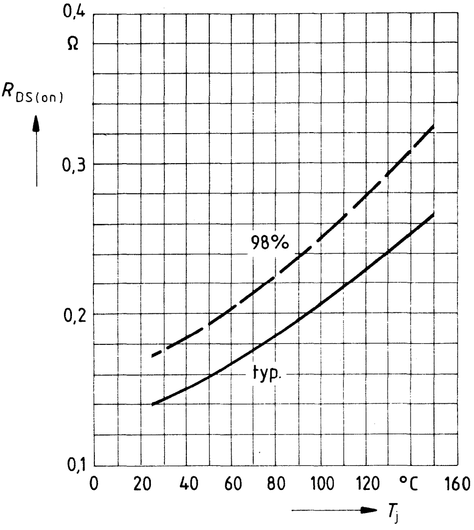
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



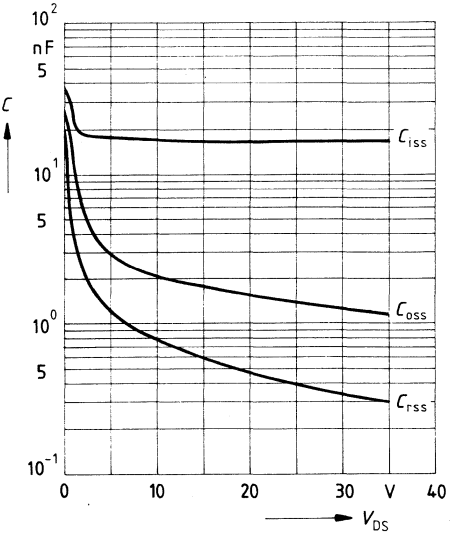
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



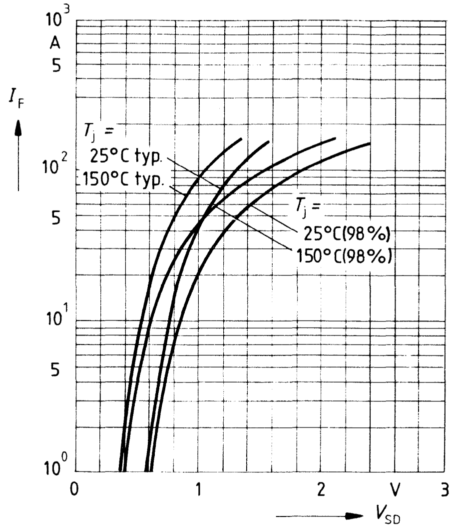
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 22$ A, $V_{GS} = 10$ V, (spread)



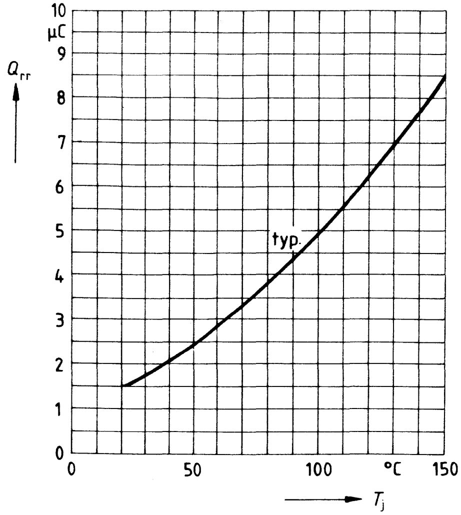
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz (spread)



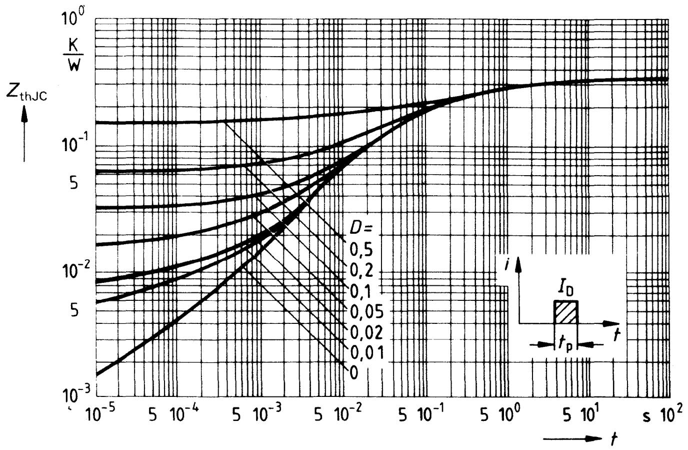
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)



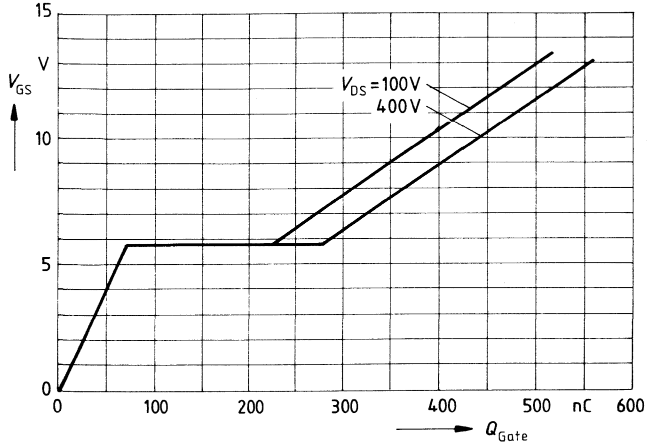
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
parameter: di/dt = 100 A/µs, I_F = 35 A
V_R = 100 V



Transient thermal impedance $Z_{thJC} = f(t)$
parameter: $D = t_p/T$

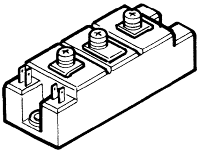


Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 52.5$ A



SIMOPAC® MOSFET Module **BSM 284 F**

V_{DS} = 800 V
I_D = 2 x 20 A
$R_{DS(on)}$ = 0.48 Ω



- Power module
- Half-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 a[1])

Type	Ordering code
BSM 284 F	C67076-A1152-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	20	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	80	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.31 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	-	16	mm
Clearance, drain-source	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	50	250	
$T_j = 125$ °C		-	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 13$ A	$R_{DS(on)}$	-	0.36	0.48	Ω

Dynamic characteristics

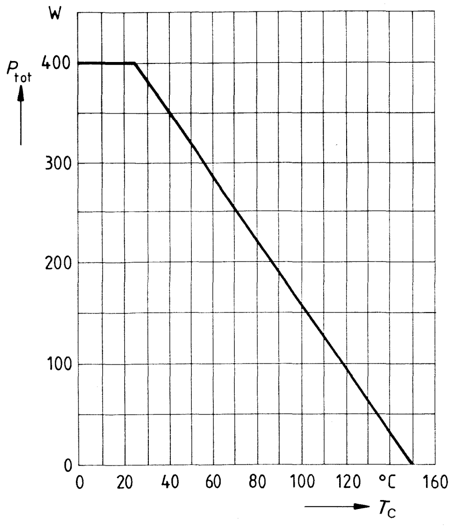
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 13$ A	g_{fs}	10	18	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	15	20	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	0.7	1.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.3	1	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 13$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	50	-	ns
	t_r	-	30	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 13$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	130	-	
	t_f	-	35	-	

Electrical Characteristics (continued)
at $T_j = 25\ °C$, unless otherwise specified.

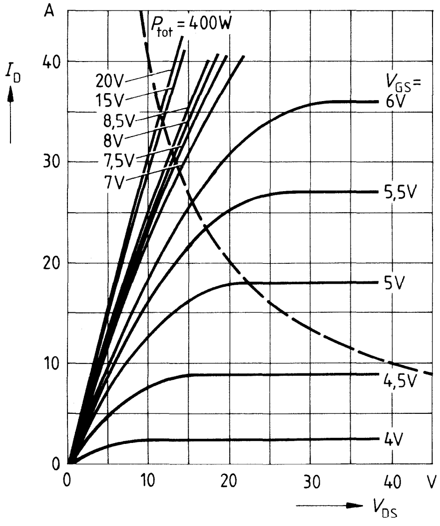
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Fast recovery reverse diode					
Continuous reverse drain current $T_C = 25\ °C$	I_S	–	–	20	A
Pulsed reverse drain current $T_C = 25\ °C$	I_{SM}	–	–	80	
Diode forward on-voltage $I_F = 40$ A, $V_{GS} = 0$	V_{SD}	–	1.2	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 150\ °C$	t_{rr}	–	300	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25\ °C$ $T_j = 150\ °C$	Q_{rr}	– –	2 6	– –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

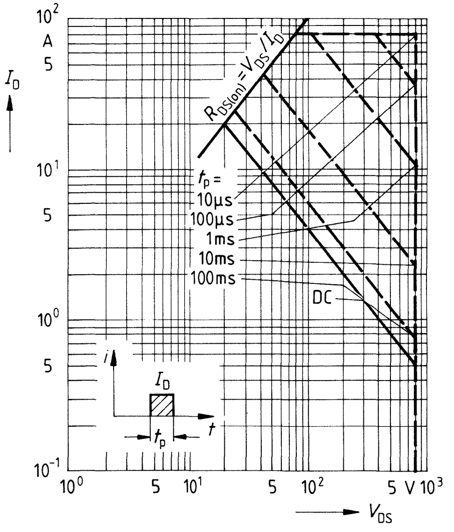
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



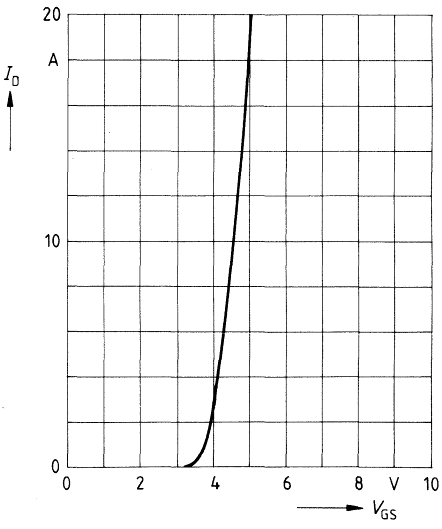
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



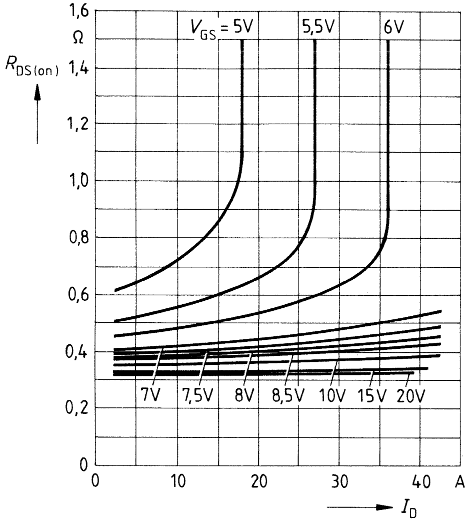
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



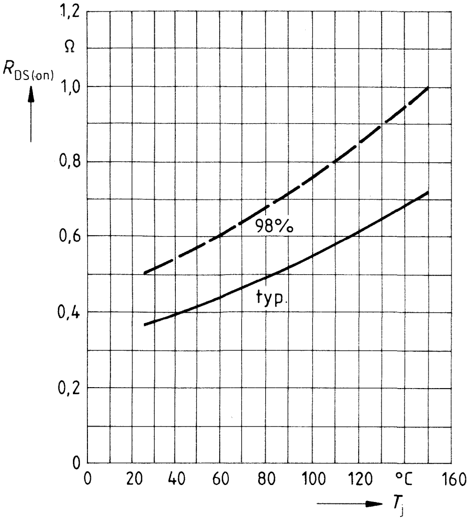
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



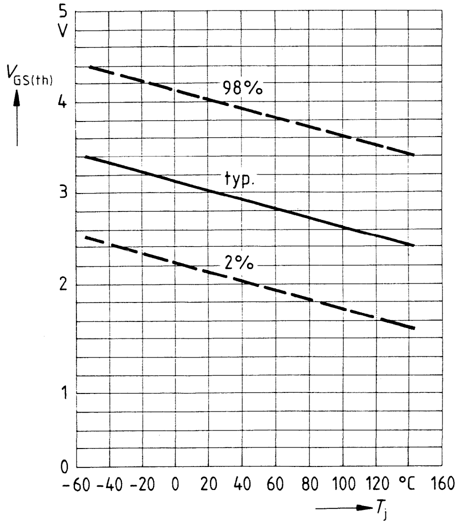
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



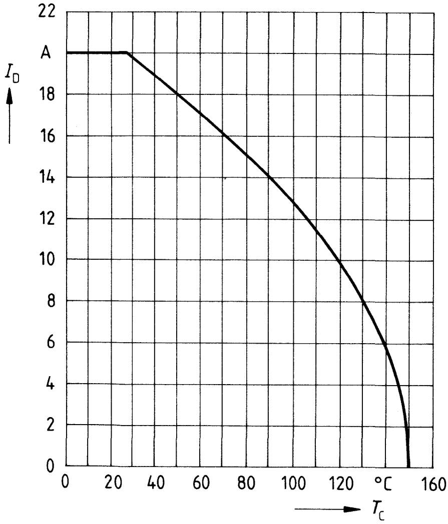
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 13$ A, $V_{GS} = 10$ V
(spread)



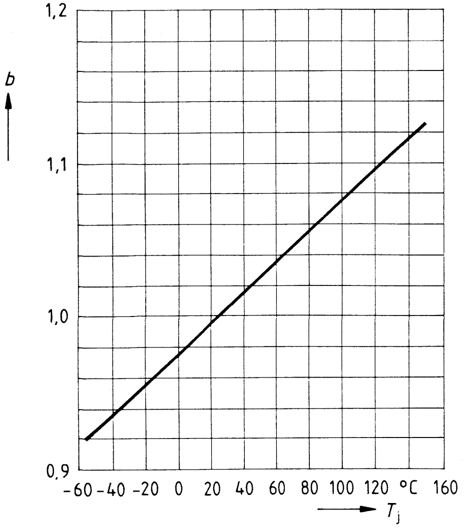
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



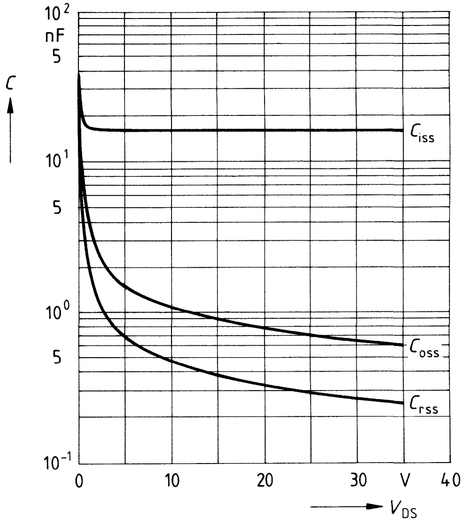
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



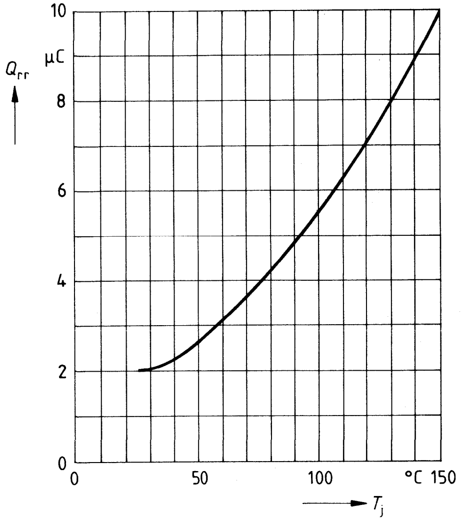
$V_{(BR)DSS}$ $(T_j) = b$ x $V_{(BR)DSS}$ (25 °C)



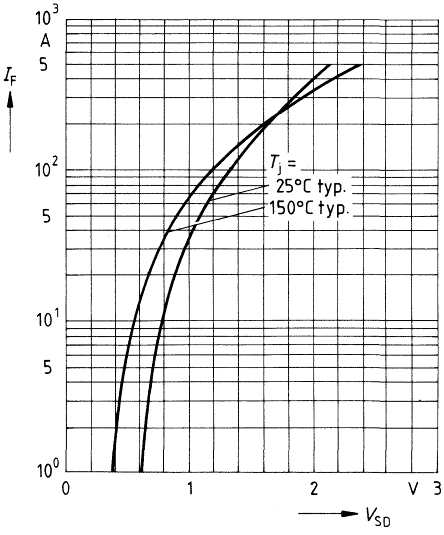
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



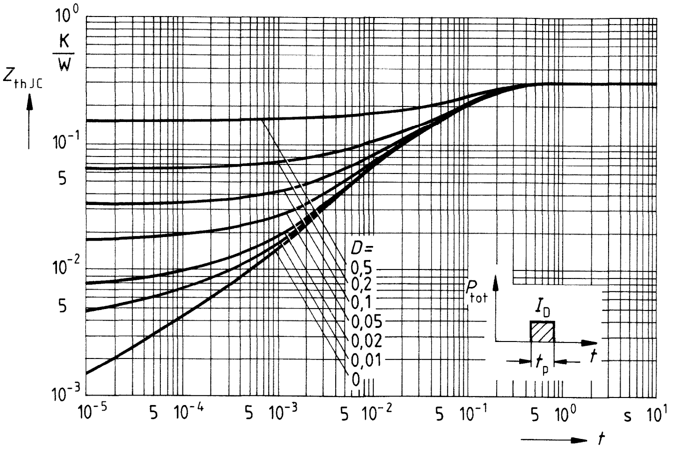
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 20$ A
$V_R = 100$ V



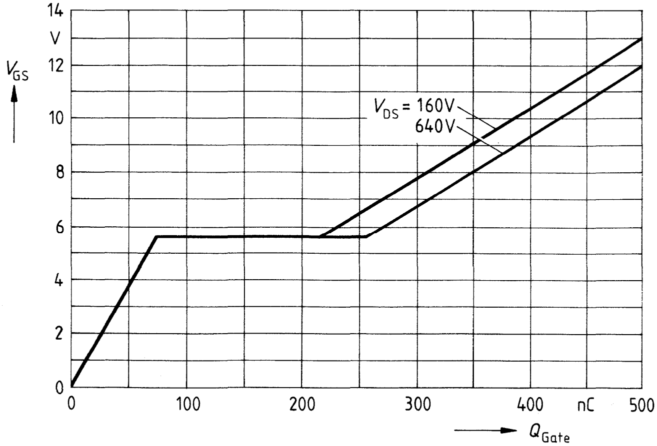
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal resistance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$

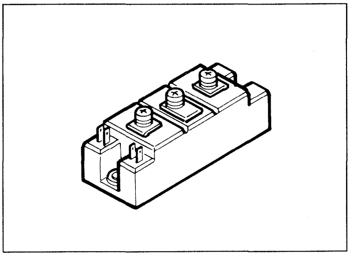


Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 30$ A



SIMOPAC® MOSFET Module **BSM 294 F**

V_{DS} = 1000 V
I_D = 2 x 18 A
$R_{DS(on)}$ = 0.63 Ω



- Power module
- Half-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 2 a[1])

Type	Ordering code
BSM 294 F	C67076-A1151-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	18	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	72	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	400	W
Thermal resistance Chip - case Case - heat sink	$R_{th\ JC}$ $R_{th\ CH}$	≤ 0.31 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

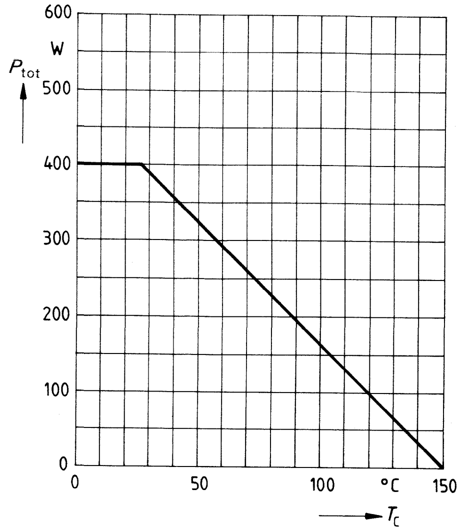
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	50	250	
$T_j = 125$ °C		-	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 11$ A	$R_{DS(on)}$	-	0.57	0.63	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 11$ A	g_{fs}	-	12	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	18	24	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	0.9	1.5	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.35	0.6	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 11$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	40	-	ns
	t_r	-	30	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 11$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	70	-	
	t_f	-	55	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

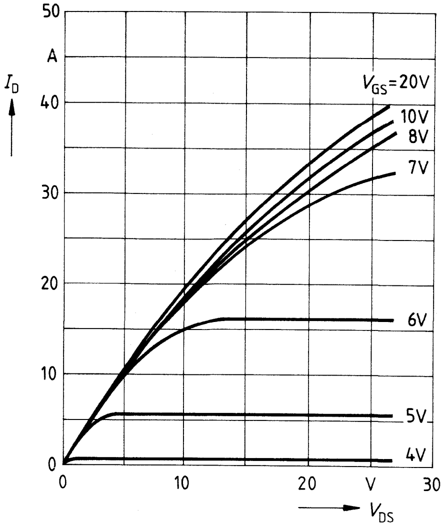
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	18	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	72	
Diode forward on-voltage $I_F = 36$ A, $V_{GS} = 0$	V_{SD}	–	1.2	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25$ °C $T_j = 150$	t_{rr}	– –	220 350	300 500	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25$ °C $T_j = 150$ °C	Q_{rr}	– –	1.5 8.5	2.5 13	µC
Repetitive peak reverse current $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V $T_j = 25$ °C $T_j = 150$ °C	I_{RRM}	– –	12 30	– –	A

Characteristics at T_j = 25 °C, unless otherwise specified

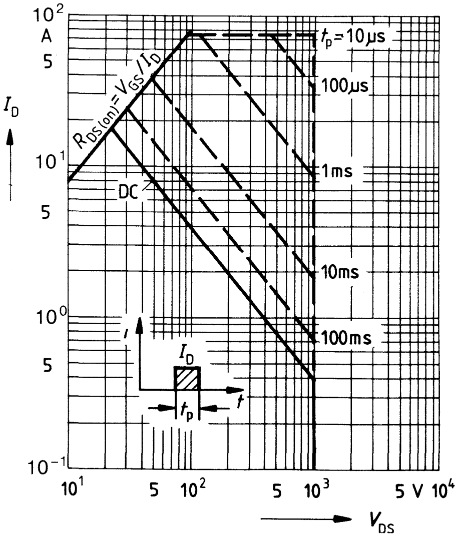
Power dissipation $P_{tot} = f(T_C)$
Parameter: T_j = 150 °C



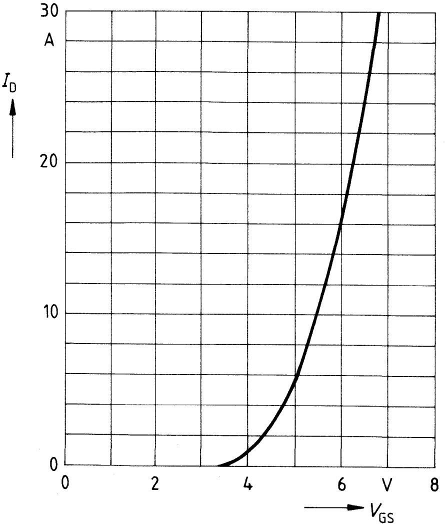
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: t_p = 80 µs



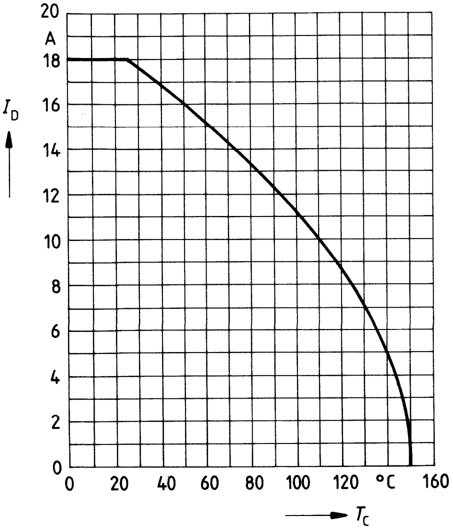
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse,
T_c = 25 °C, $T_j \leq$ 150 °C



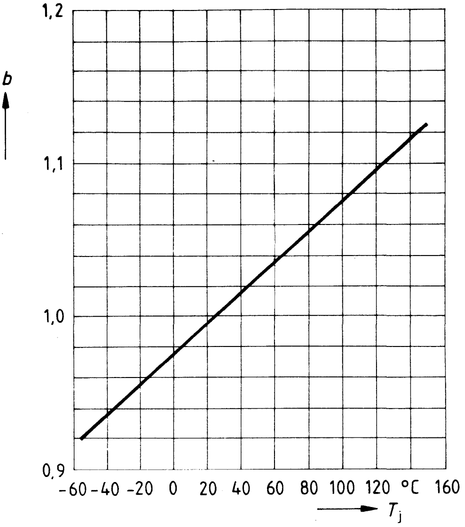
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: t_p = 80 µs, V_{DS} = 25 V



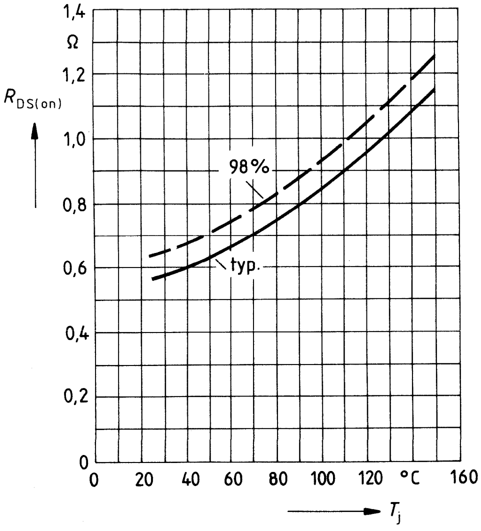
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



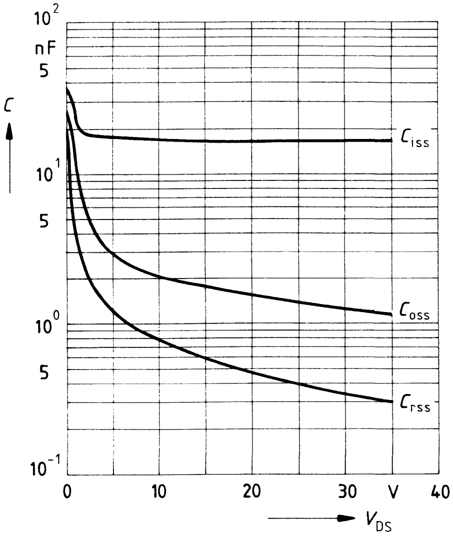
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}(25\ °C)$



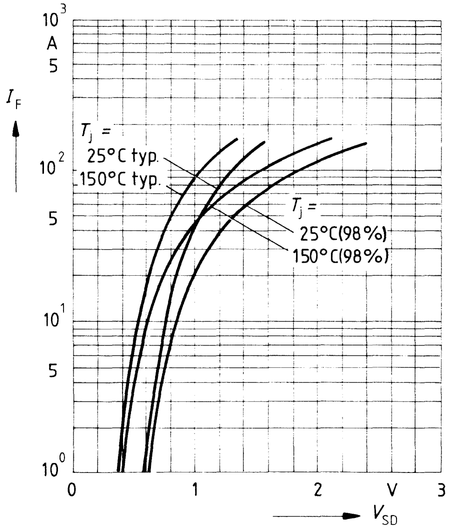
Drain-source on-state resistance
$R_{DS\,(on)} = f(T_j)$
Parameter: $I_D = 11$ A; $V_{GS} = 10$ V
(spread)



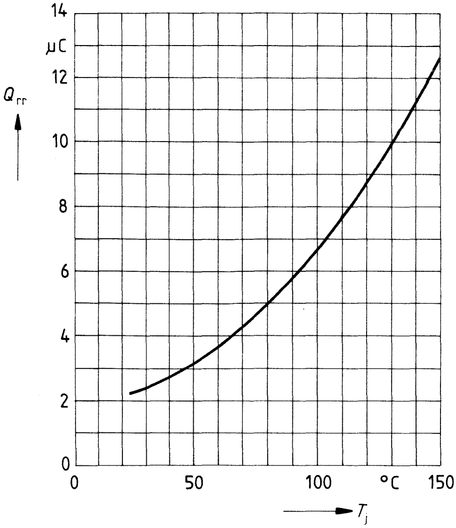
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



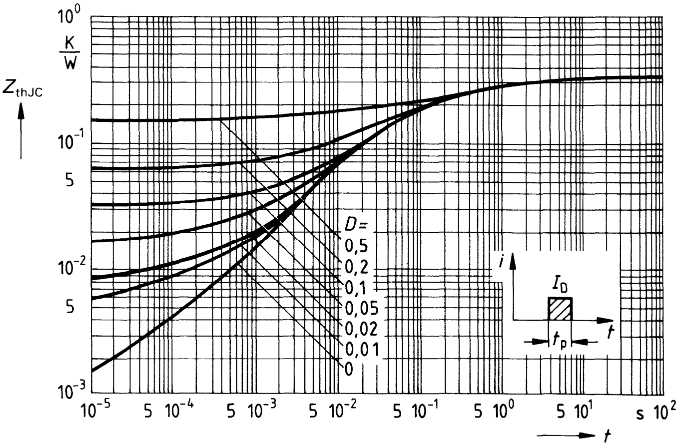
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, t_p = 80 µs (spread)



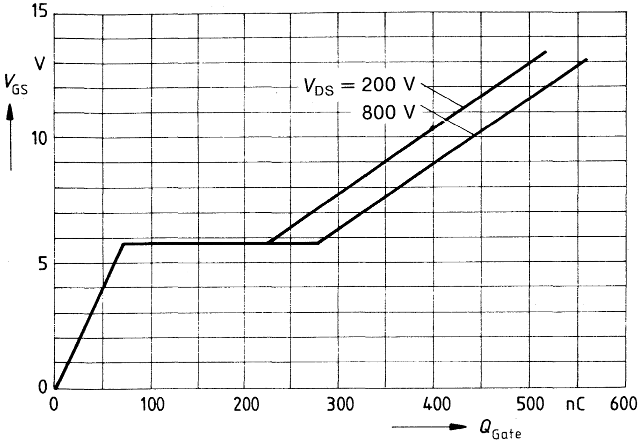
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: di_F/dt = 100 A/µs, I_F = 18 A, V_R = 100 V



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p/T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\,puls} = 30$ A

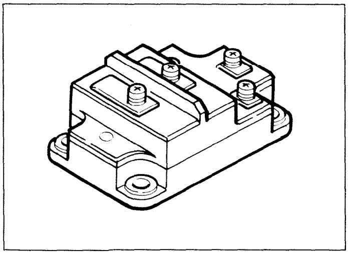


IGBT Module
Preliminary Data

BSM 300 GA 100 D

V_{CE} = 1000 V
I_C = 300 A

- Power module
- Single switch
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Circuit diagram: Fig. 4 a[1])



Type	Ordering code
BSM 300 GA 100 D	C67076-A2000-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, $R_{GE} = 20\ k\Omega$	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, $T_C = 80\ °C$	I_C	300	A
Pulsed collector current, $T_C = 80\ °C$	$I_{C\ puls}$	600	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25\ °C$	P_{tot}	2500	W
Thermal resistance			K/W
chip - case	R_{thJC}	≤ 0.05	
case - heat sink	R_{thCH}	≤ 0.038	
Isolation test voltage[2]), $t = 1$ min.	V_{is}	2500	V_{ac}
Creepage distance	–	16	mm
Clearance	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines

[2]) Isolation test voltage between collector and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 5.6$ mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 20$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 300$ A	$V_{CE(sat)}$				
$T_j = 25$ °C		–	3.0	–	
$T_j = 150$ °C		–	4.0	4.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		–	–	5500	
$T_j = 125$ °C		–	–	–	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	–	100	nA

AC characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 300$ A	g_{fs}	132	–	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	44000	–	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	3400	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	1400	–	

Switching Characteristics
at $T_j = 125$ °C

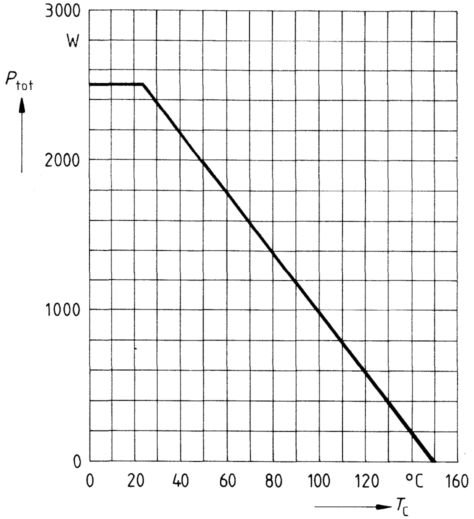
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(on)}$	–	500	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_r	–	700	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	550	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	700	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$t_{d(off)}$	–	550	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	t_f	–	250	–	
Turn-off loss ($E_{off} = E_{off\ 1} + E_{off\ 2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 300$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$	$E_{off\ 1}$ $E_{off\ 2}$	– –	24 14	– –	mWs

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

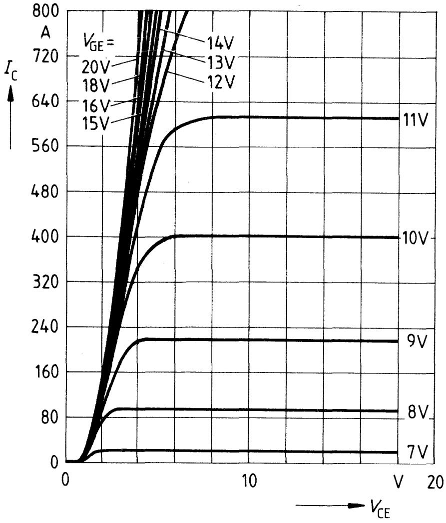
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-wheel diode					
Diode forward voltage $I_F = 300$ A, $V_{GE} = 0$	V_F				V
$T_j = 25$ °C		–	1.9	–	
$T_j = 125$ °C		–	1.7	–	
Reverse recovery time $I_F = 300$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs $T_j = 125$ °C	t_{rr}	–	0.5	–	µs
Reverse recovery charge $I_F = 300$ A, $V_R = 600$ V $V_{GE} = 0$, $di_F/dt = -800$ A/µs	Q_{rr}				µC
$T_j = 25$ °C		–	12	–	
$T_j = 125$ °C		–	54	–	
Soft factor $I_F = 300$ A, $V_R = 600$ V $V_{GE} = 0$ V, $di_F/dt = -800$ A/µs $T_j = 125$ °C	S	–	1	–	–
Thermal resistance Chip – case	R_{thJC}	–	–	0.18	K/W

Characteristics at $T_j = 25$ °C, unless otherwise specified.

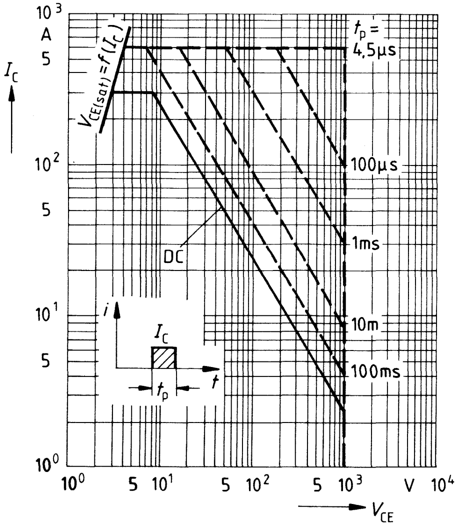
Total power dissipation $P_{tot} = f(T_C)$
parameter: $T_j = 150$ °C



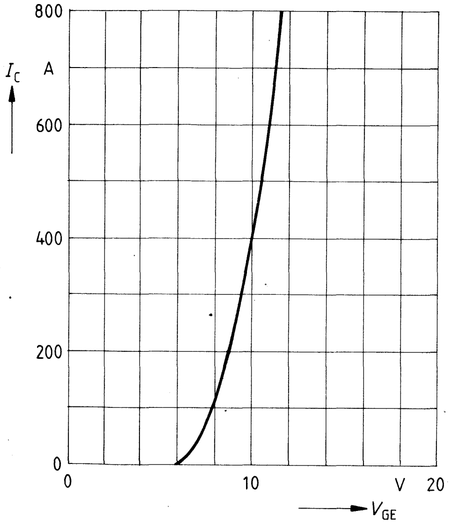
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



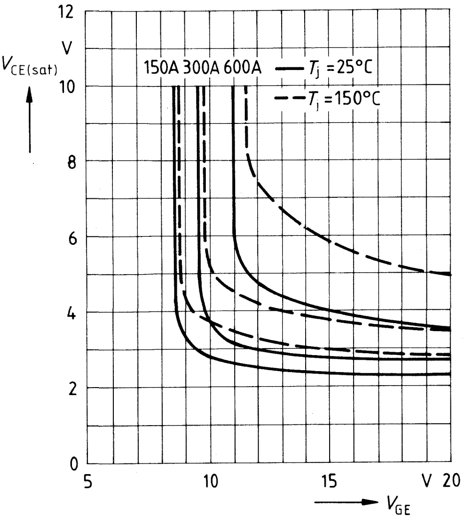
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



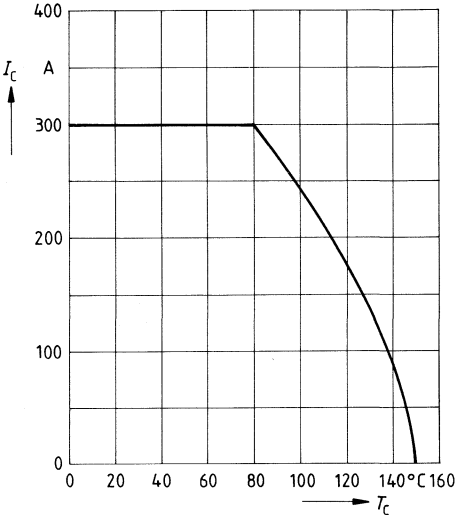
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



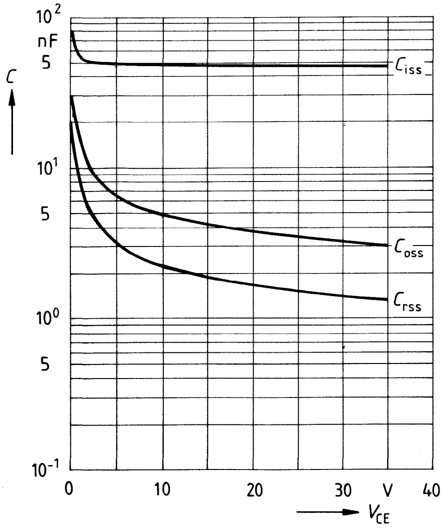
Typ. on-state characteristics $V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



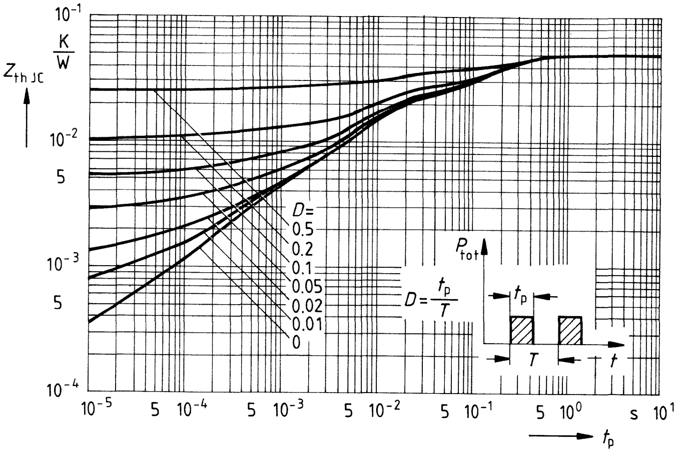
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



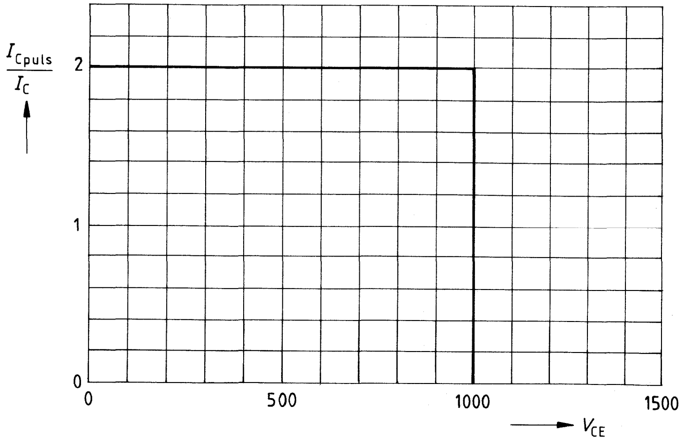
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Transient thermal impedance $Z_{\mathrm{thJC}} = f(t_p)$
parameter: $D = t_p / T$



Reverse biased safe operating area $I_{\mathrm{C\,puls}} = f(V_{\mathrm{CE}})$
parameter: $T_j = 125$ °C, $V_{\mathrm{GE}} = 15$ V, $R_{\mathrm{g(off)}} = 5\ \Omega$,
L (parasitic inductance, module) < 80 nH

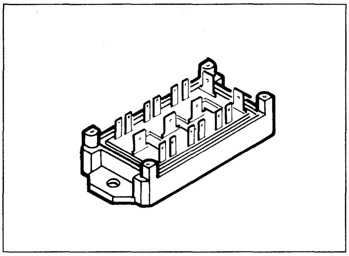


SIEMENS

SIMOPAC® MOSFET Module

BSM 651 F

V_{DS} = 500 V
I_D = 6 x 9 A
$R_{DS(on)}$ = 0.7 Ω



- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 651 F	C67076-A1500-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	9	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	36	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 1 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25\ °C$, unless otherwise specified.

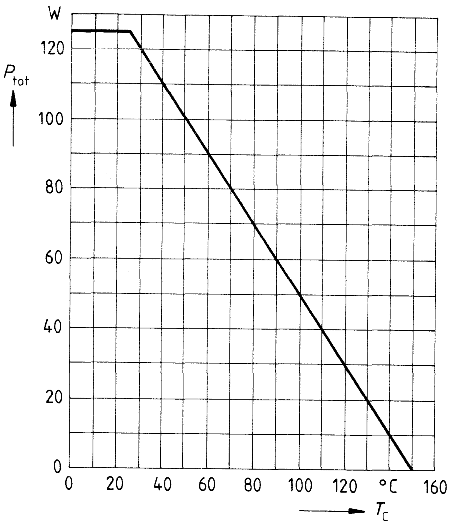
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25\ °C$		-	20	250	
$T_j = 125\ °C$		-	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 6.5$ A	$R_{DS(on)}$	-	0.6	0.7	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 6.5$ A	g_{fs}	2.7	6	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	3900	4900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	250	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	100	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 6.5$ A, $R_{GS} = 3.3\ \Omega$	$t_{d(on)}$	-	60	90	ns
	t_r	-	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 6.5$ A, $R_{GS} = 3.3\ \Omega$	$t_{d(off)}$	-	330	430	
	t_f	-	110	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

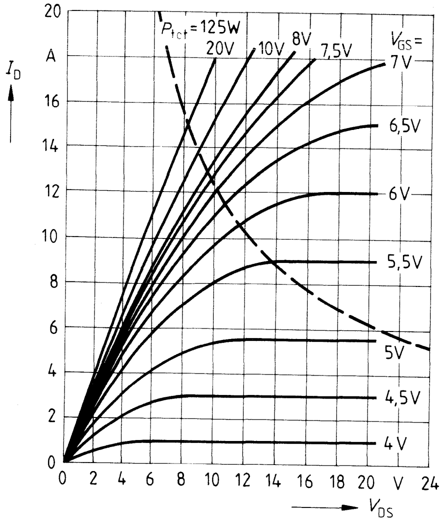
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	9	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	36	
Diode forward on-voltage $I_F = 18$ A, $V_{GS} = 0$	V_{SD}	–	1.5	1.9	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	1.2	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

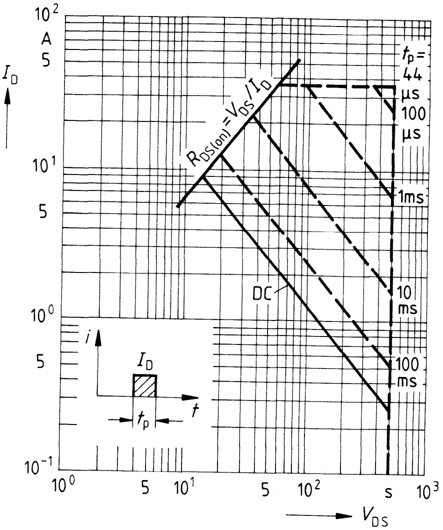
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



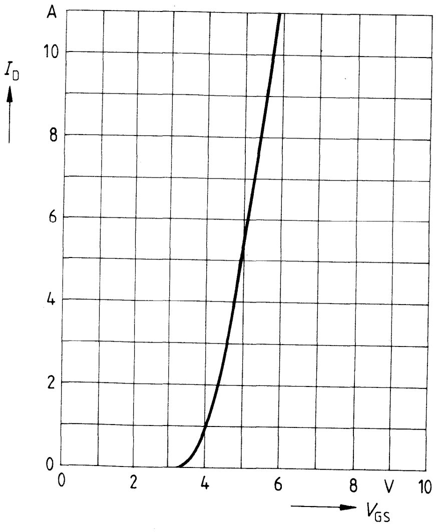
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



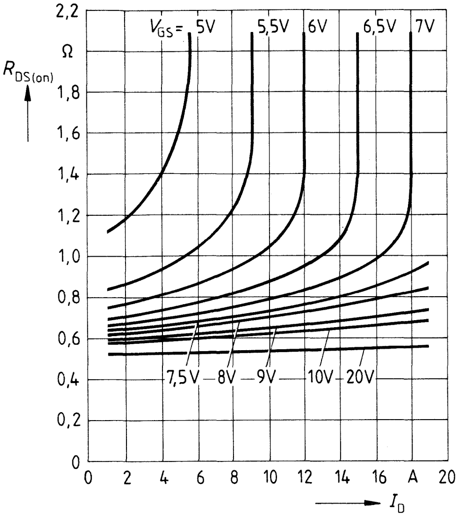
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



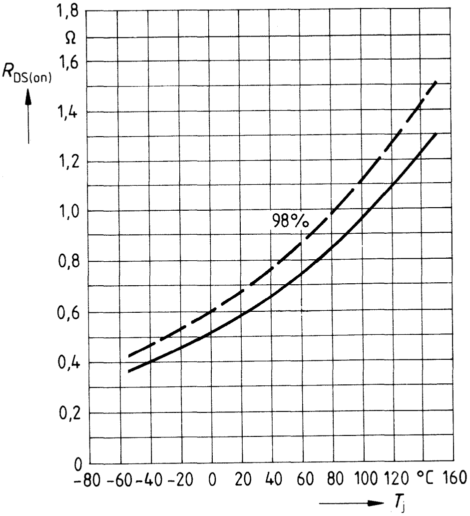
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



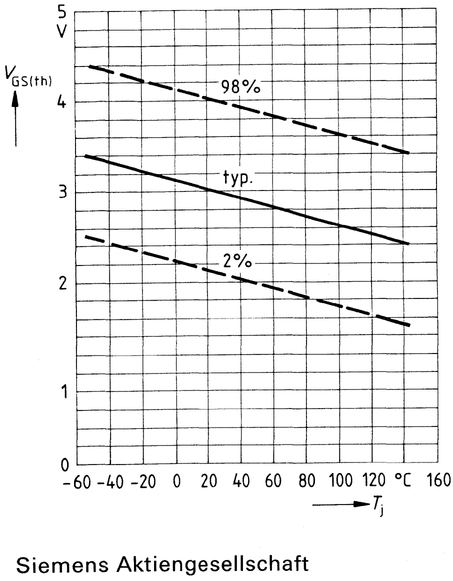
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



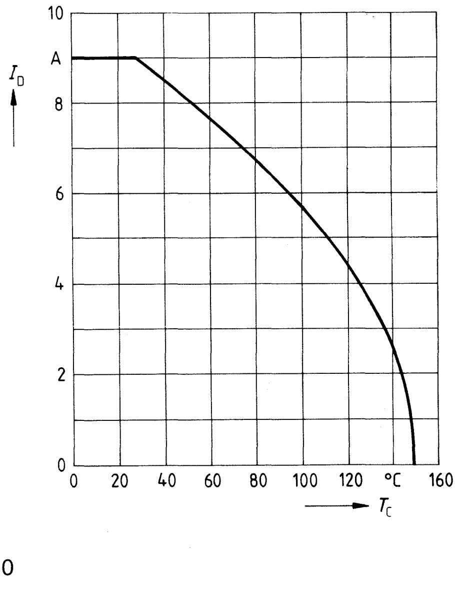
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 6.5$ A, $V_{GS} = 10$ V
(spread)



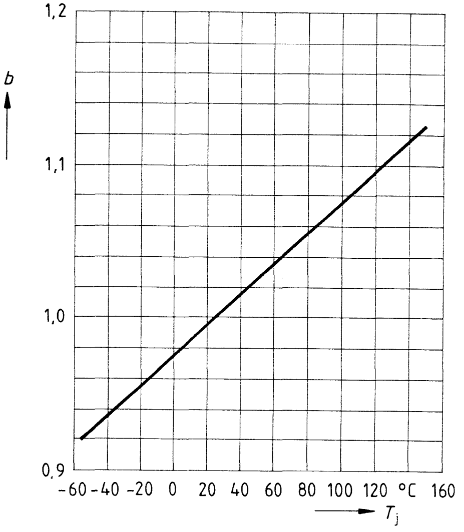
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



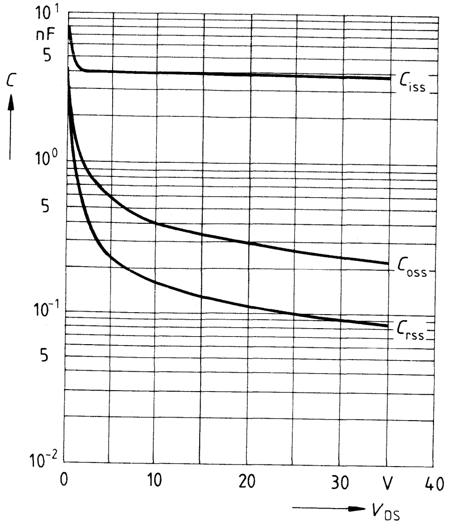
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



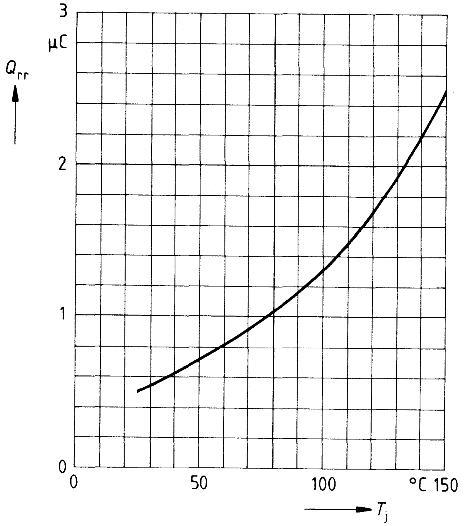
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



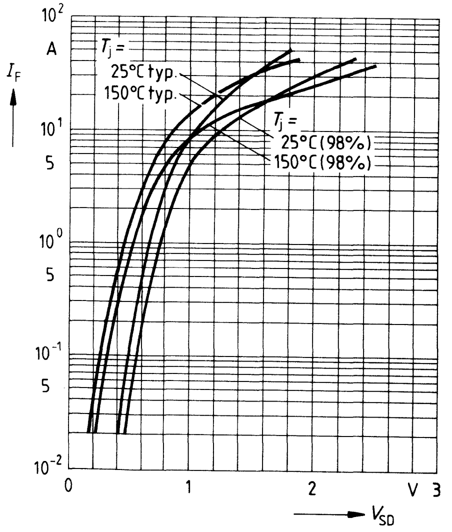
Typ. capacitances $C = f$ (V_{DS})
Parameter: V_{GS} = 0, f = 1 MHz
(spread)



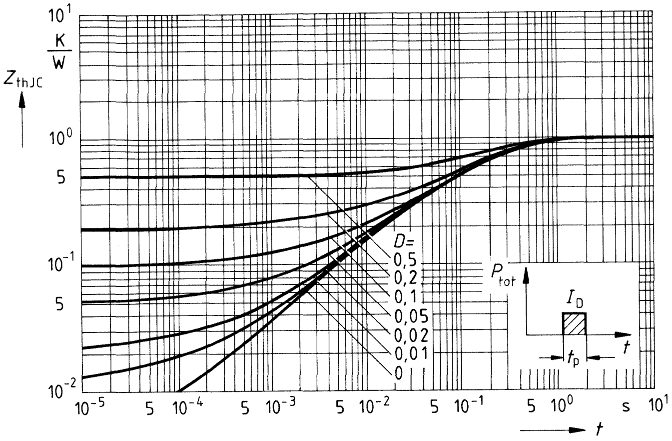
Typ. reverse recovery charge $Q_{rr} = f$ (T_j)
Parameter: di_F/dt = 100 A/µs, I_F = 9 A
V_R = 100 V



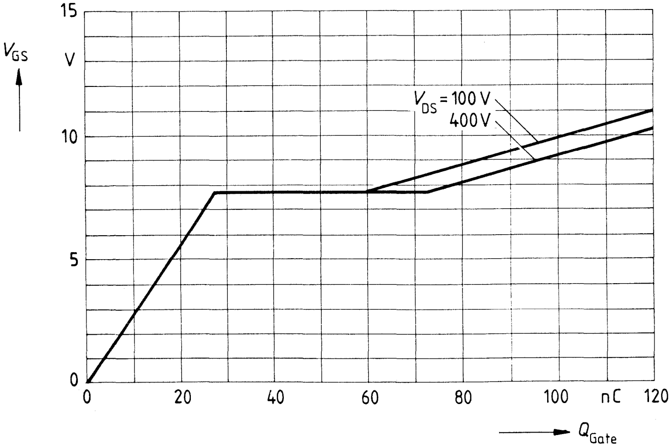
Forward characteristics of fast-recovery reverse diode $I_F = f$ (V_{SD})
Parameter: T_j, t_p = 80 µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 13.5$ A

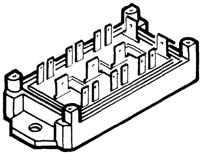


SIEMENS

SIMOPAC® MOSFET Module

BSM 652 F

V_{DS} = 500 V
I_D = 6 x 17 A
$R_{DS(on)}$ = 0.35 Ω



- Power module
- 3-phase pull-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 652 F	C67076-A1501-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	17	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	68	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	225	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.55 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	-	16	mm
Clearance, drain-source	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	50 300	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 10$ A	$R_{DS(on)}$	-	0.29	0.35	Ω

Dynamic characteristics

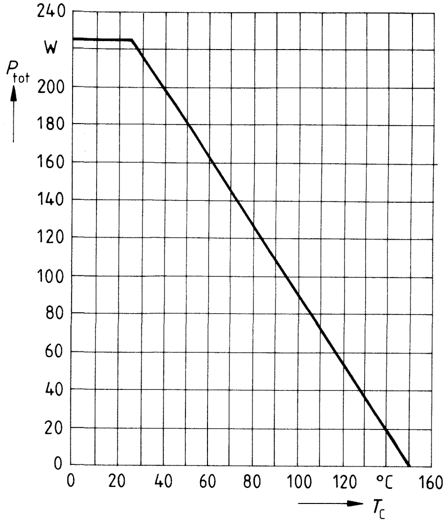
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 10$ A	g_{fs}	5	10	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	8	10	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	0.6	0.8	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.3	0.5	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 12$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	60	90	ns
	t_r	-	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 250$ V, $V_{GS} = 10$ V, $I_D = 12$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	350	430	
	t_f	-	70	110	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

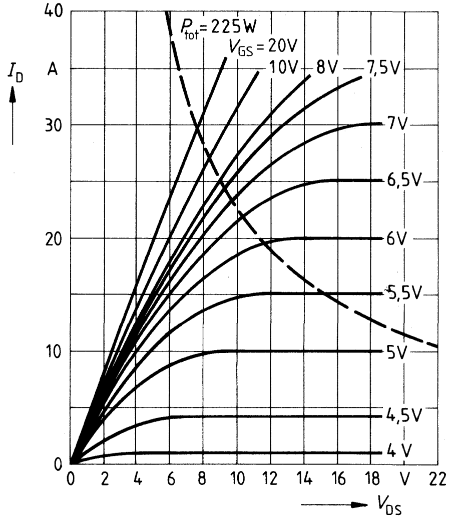
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	17	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	68	
Diode forward on-voltage $I_F = 34$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	300	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	2	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

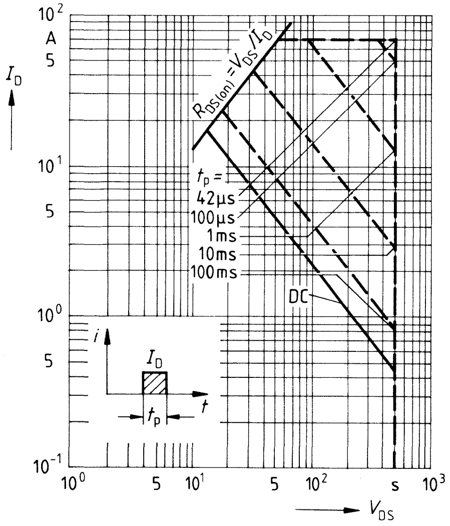
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



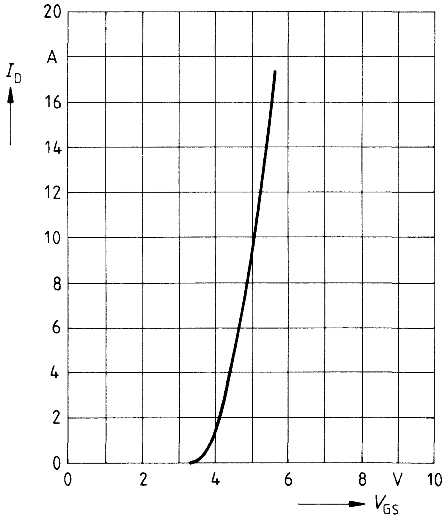
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



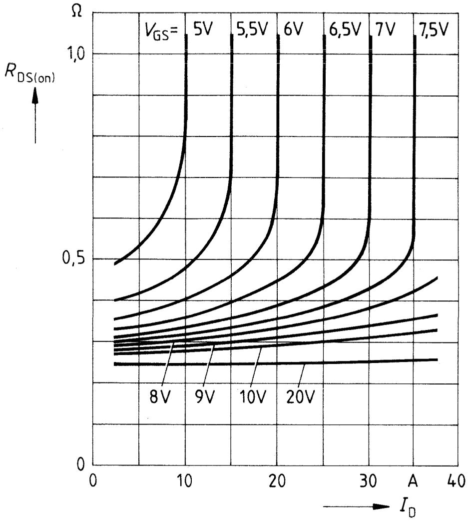
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



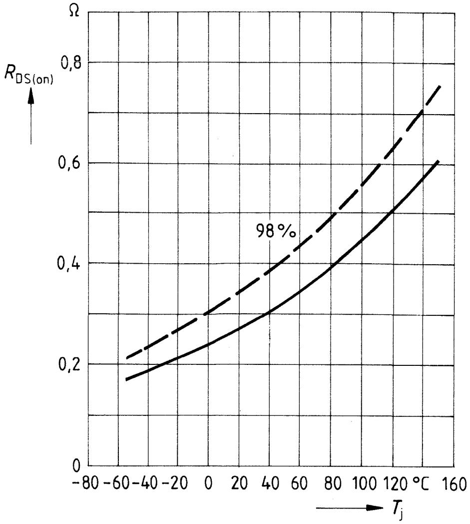
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



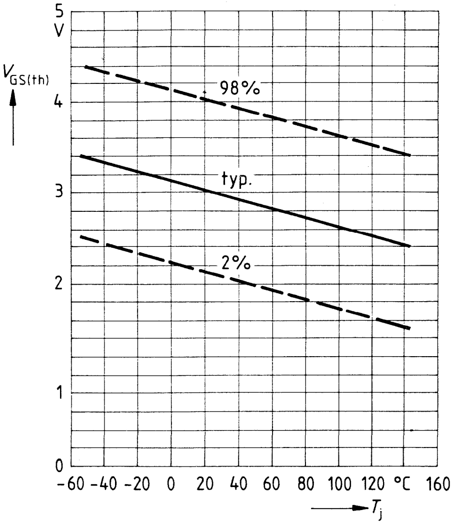
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



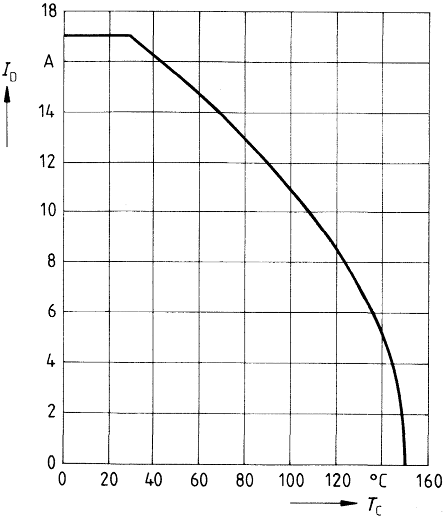
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 10$ A, $V_{GS} = 10$ V
(spread)



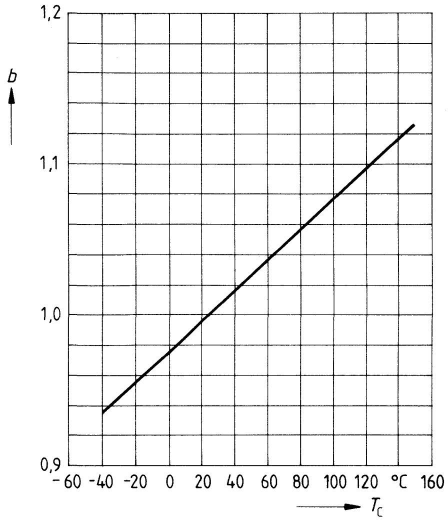
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



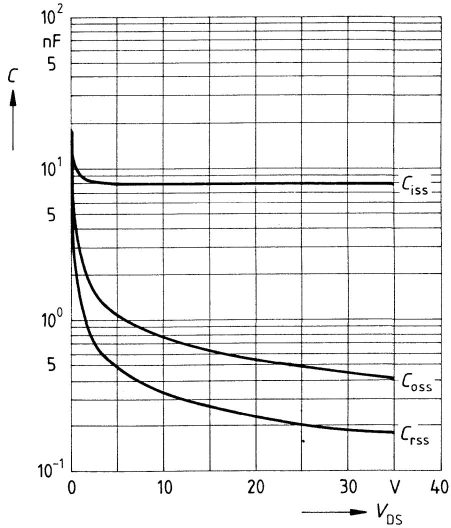
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



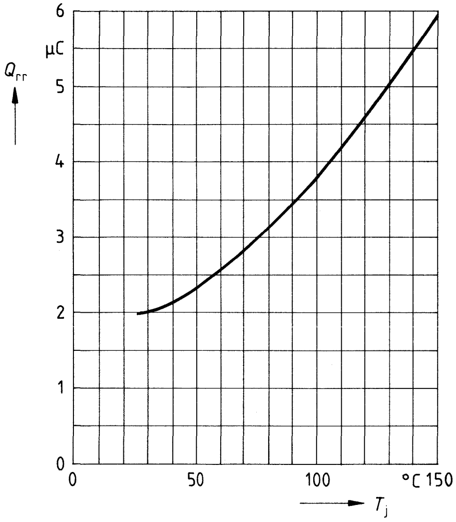
$V_{(BR)DSS}$ **(**T_j**) = b x** $V_{(BR)DSS}$ **(25 °C)**



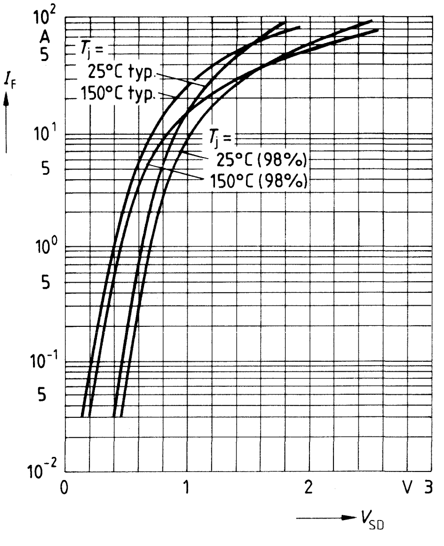
Typ. capacitances $C = f\,(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



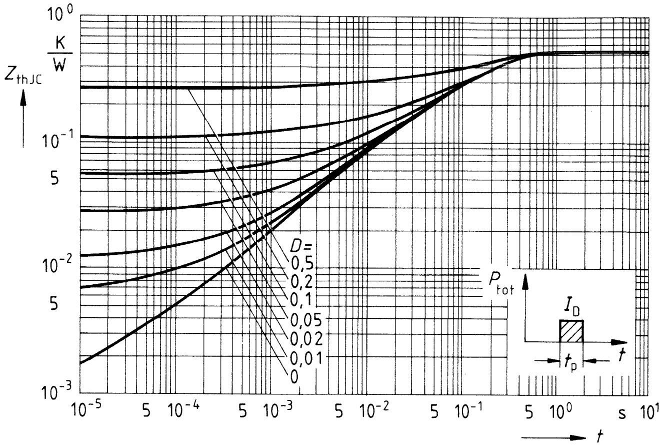
Typ. reverse recovery charge $Q_{rr} = f\,(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 17$ A
$V_R = 100$ V



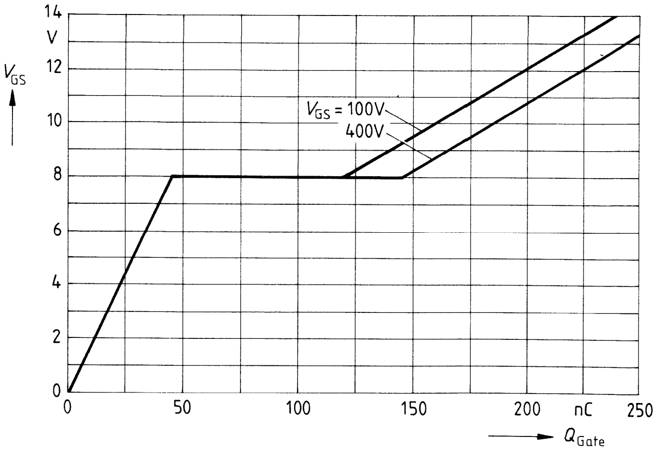
Forward characteristics of fast-recovery reverse diode $I_F = f\,(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$

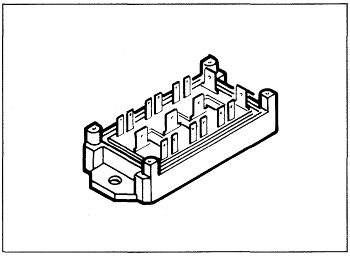


Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 25$ A



SIMOPAC® MOSFET Module **BSM 681 F**

V_{DS} = 800 V
I_D = 6 x 5.3 A
$R_{DS(on)}$ = 1.9 Ω



- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 681 F	C67076-A1504-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	5.3	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	21	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 1 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 20 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 3.5$ A	$R_{DS(on)}$	–	1.4	1.9	Ω

Dynamic characteristics

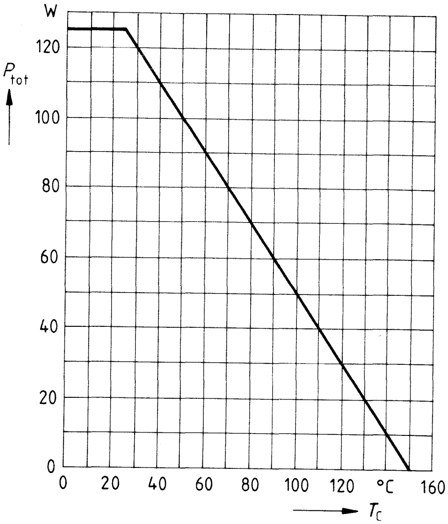
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 3.5$ A	g_{fs}	2	5	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	3900	5000	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	200	350	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	80	140	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 3.5$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	90	ns
	t_r	–	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 3.5$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	330	430	
	t_f	–	110	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

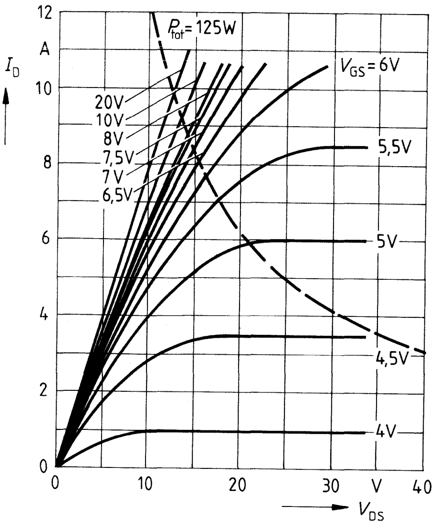
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	5.3	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	21	
Diode forward on-voltage $I_F = 11$ A, $V_{GS} = 0$	V_{SD}	–	1.1	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	2.5	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

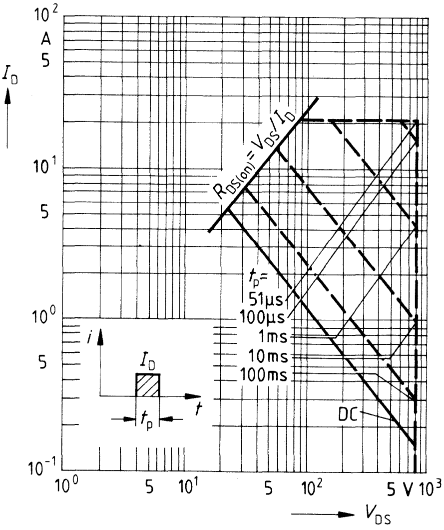
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



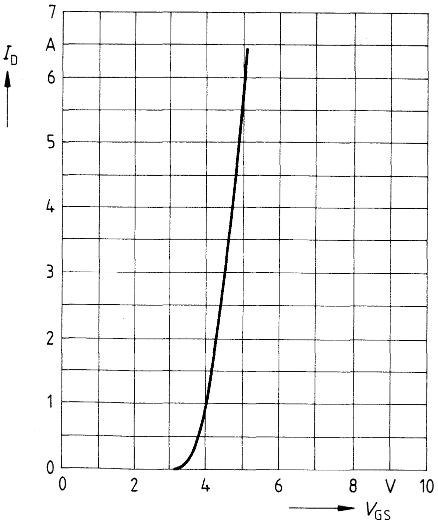
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



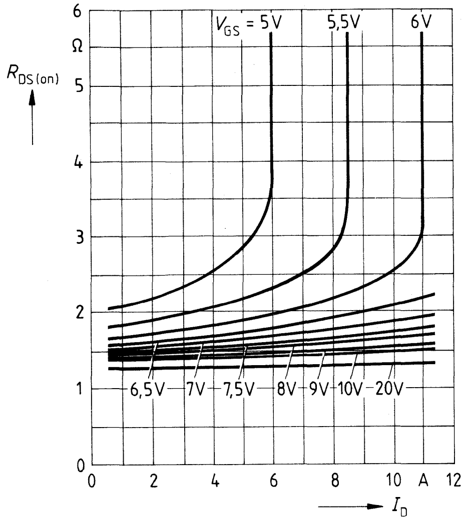
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



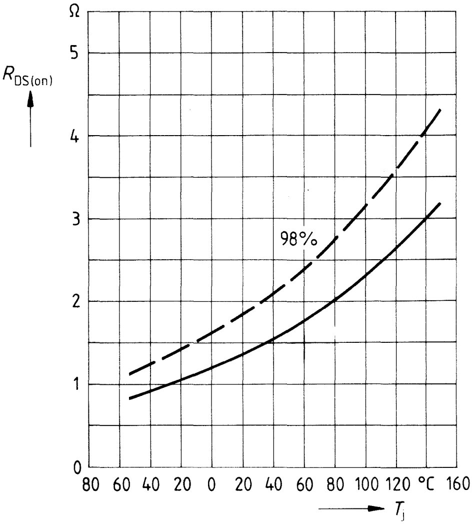
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



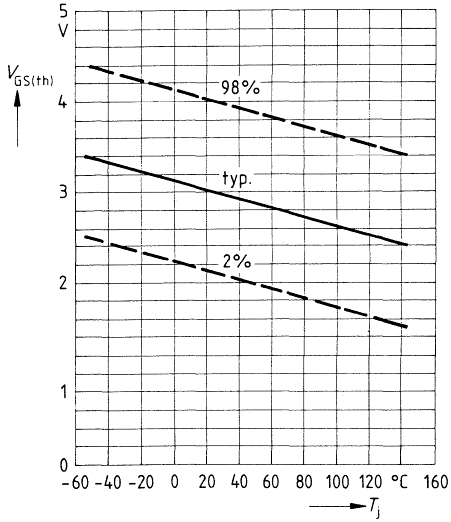
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



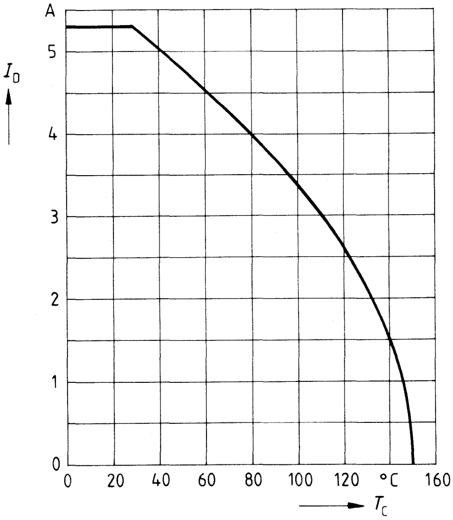
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 3.5$ A, $V_{GS} = 10$ V
(spread)



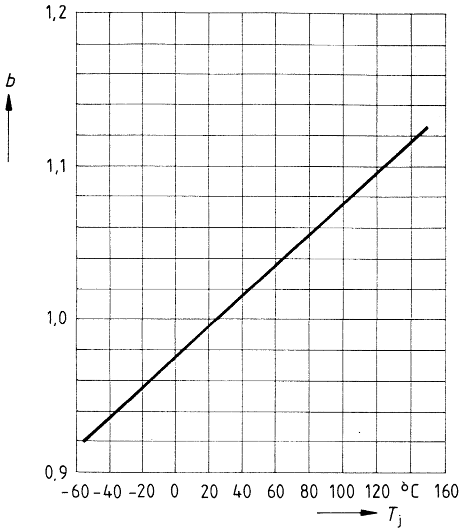
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



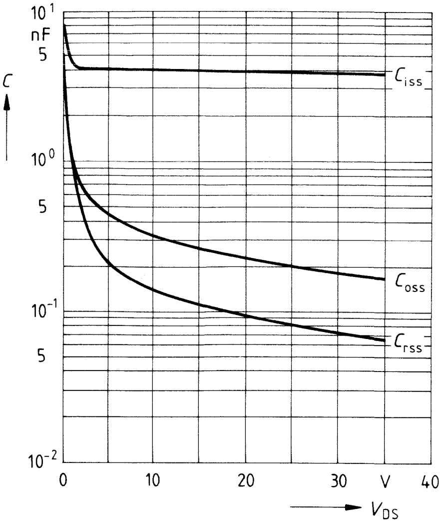
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



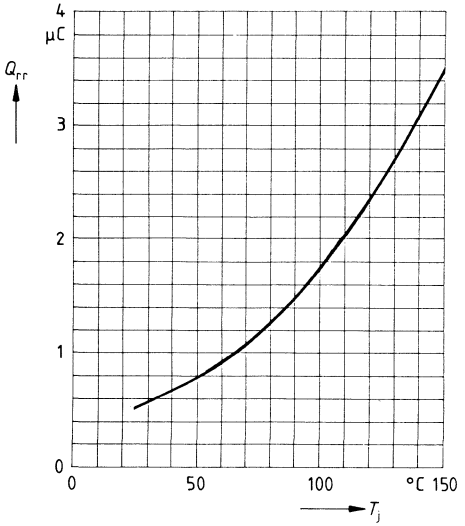
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



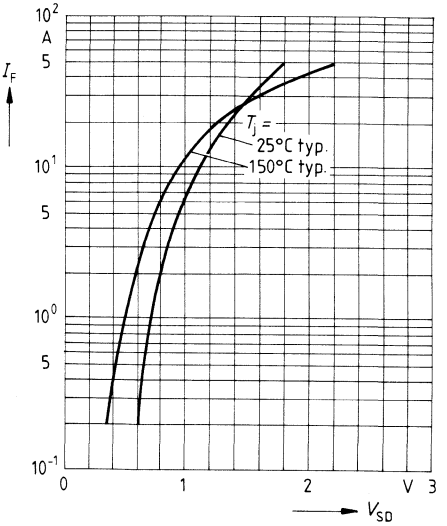
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



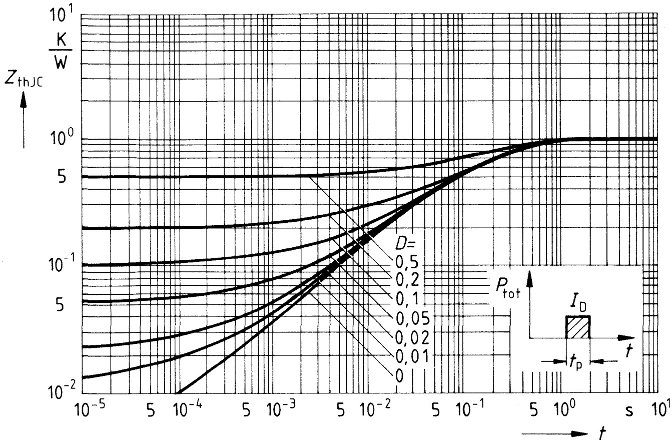
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 5.3$ A
$V_R = 100$ V



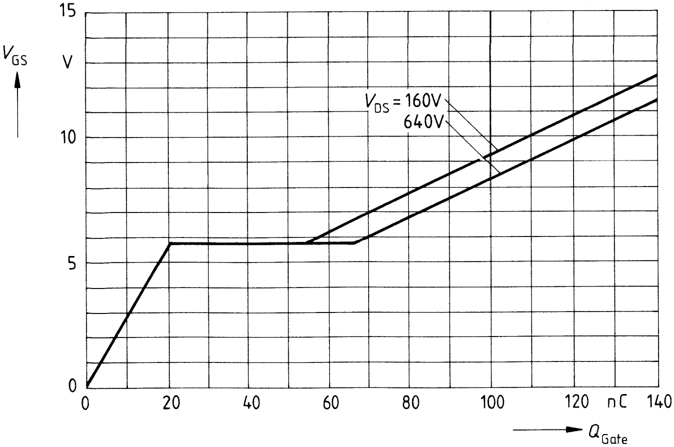
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$

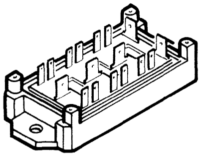


Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 9$ A



SIMOPAC® MOSFET Module **BSM 682 F**

V_{DS} = 800 V
I_D = 6 x 10 A
$R_{DS(on)}$ = 0.95 Ω



- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 682 F	C67076-A1505-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	10	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	225	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.55 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

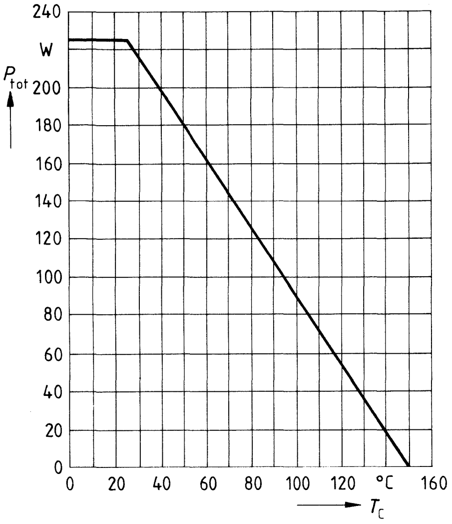
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	50	250	
$T_j = 125$ °C		–	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 6$ A	$R_{DS(on)}$	–	0.7	0.95	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 6$ A	g_{fs}	3.5	10	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	8	10	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	0.4	0.6	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.15	0.25	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 6$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	–	60	90	ns
	t_r	–	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 400$ V, $V_{GS} = 10$ V, $I_D = 6$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	–	330	430	
	t_f	–	110	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

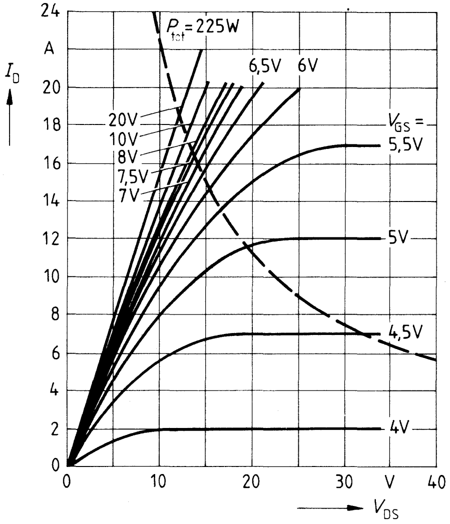
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	9	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	36	
Diode forward on-voltage $I_F = 18$ A, $V_{GS} = 0$	V_{SD}	–	1.35	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	2.5	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

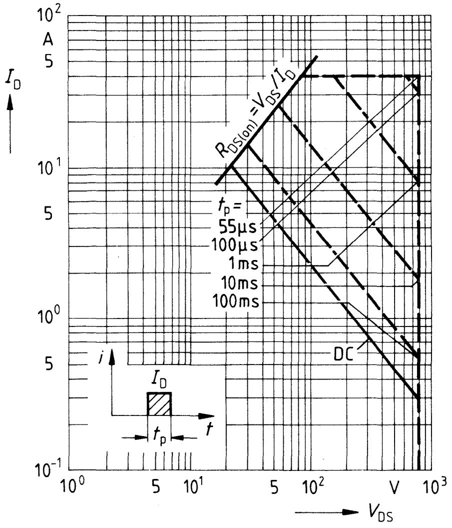
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



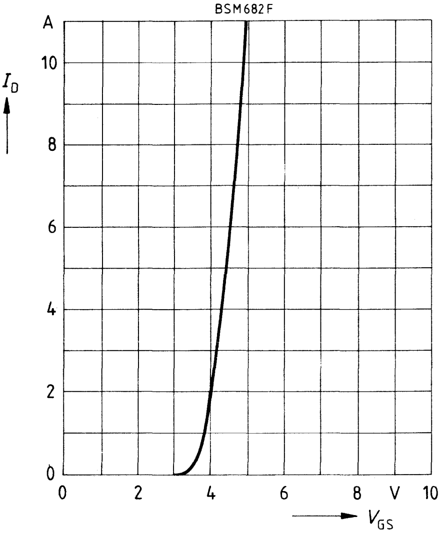
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



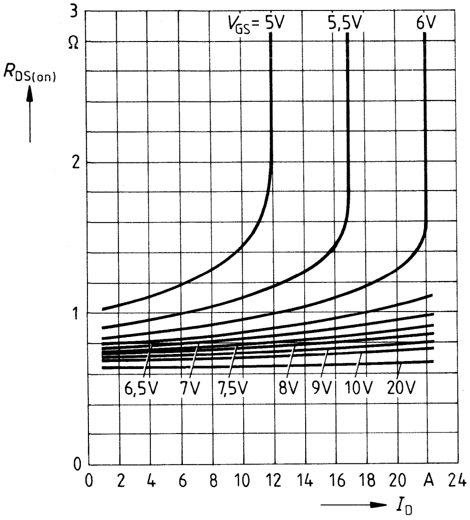
Permissible operating range $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leq 150$ °C



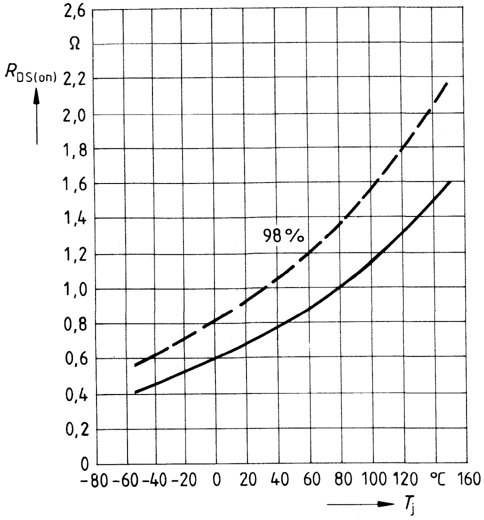
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



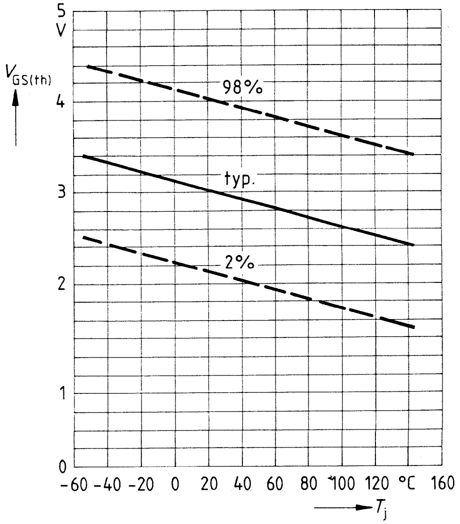
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



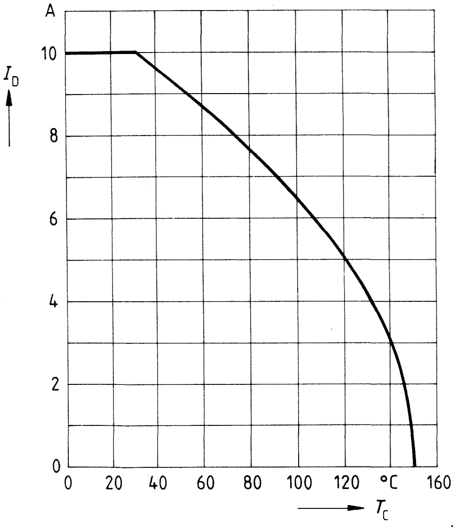
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 6$ A, $V_{GS} = 10$ V
(spread)



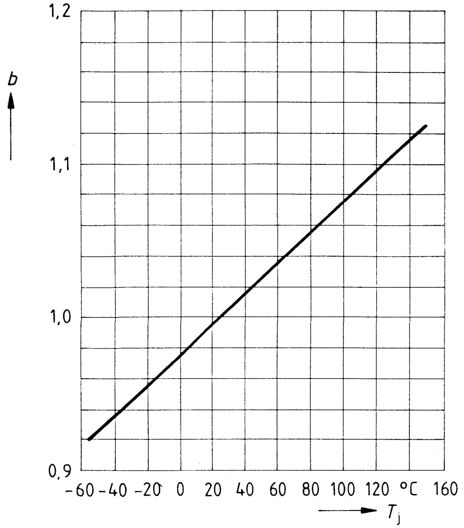
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



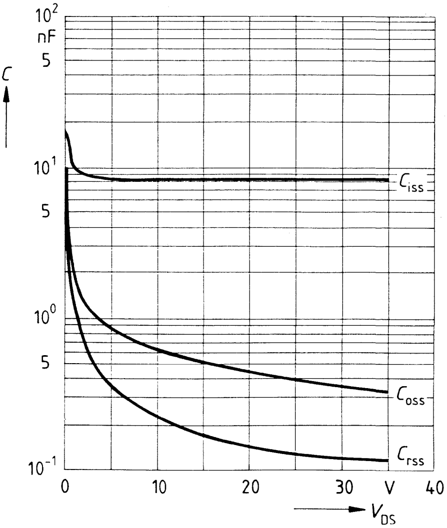
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



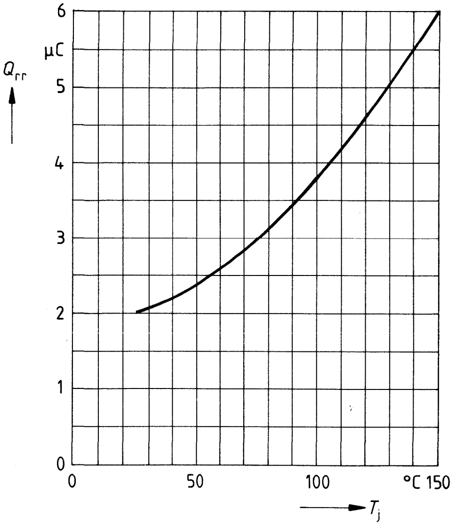
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



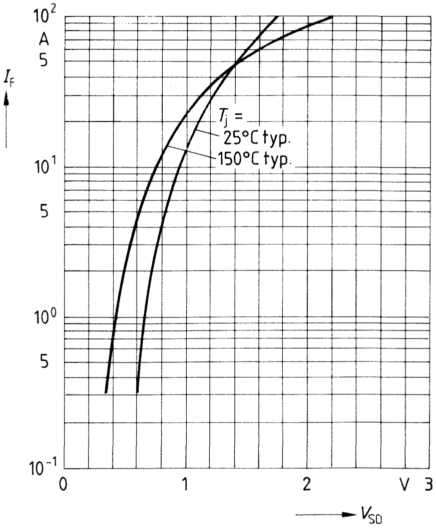
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



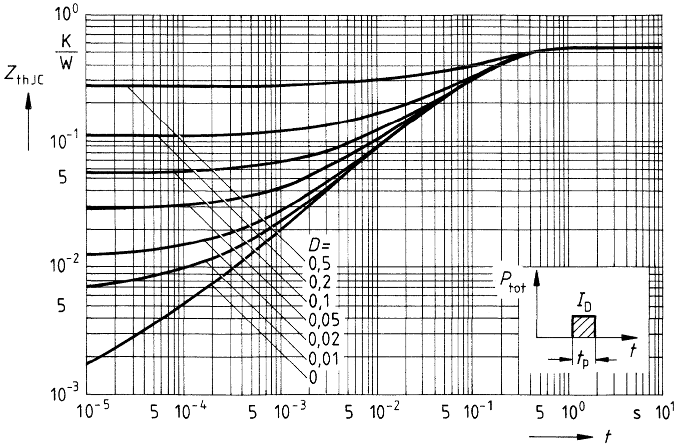
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 10$ A
$V_R = 100$ V



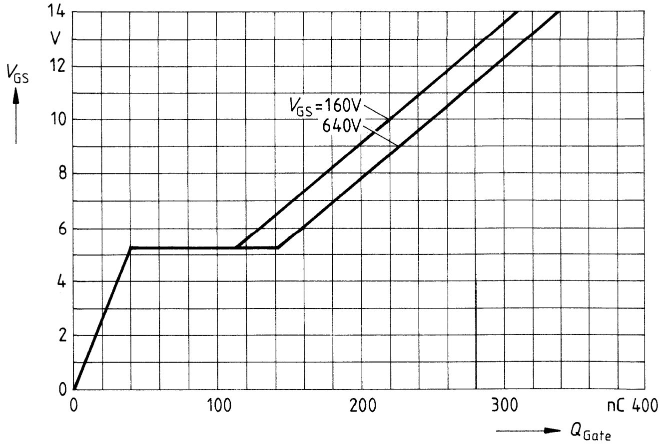
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 15$ A

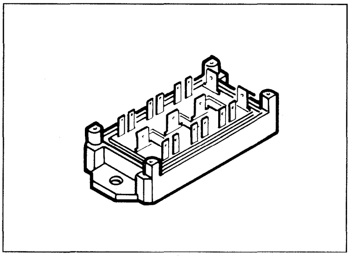


SIEMENS

SIMOPAC® MOSFET Module

BSM 691 F

V_{DS} = **1000 V**
I_D = **6 x 4.8 A**
$R_{DS(on)}$ = **2.5 Ω**



- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 691 F	C67076-A1502-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	4.8	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	19	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 1 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	–	16	mm
Clearance, drain-source	–	11	
DIN humidity category, DIN 40 040	–	F	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 20 300	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 3.5$ A	$R_{DS(on)}$	-	2.3	2.5	Ω

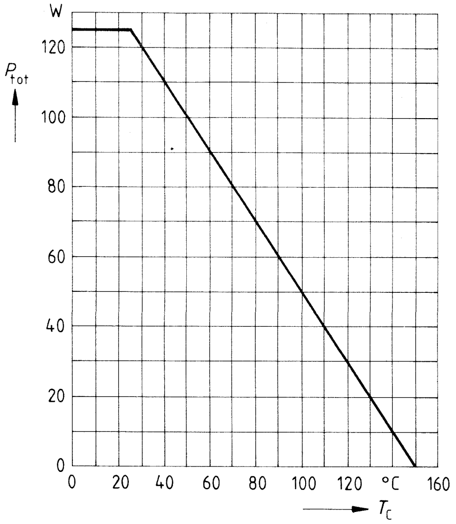
Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 3.5$ A	g_{fs}	1.4	4	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	3900	5000	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	180	300	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	70	120	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	60	90	ns
	t_r	-	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	330	430	
	t_f	-	110	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

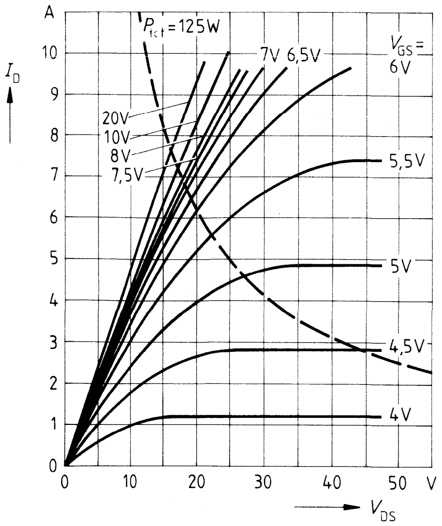
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	4.8	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	19	
Diode forward on-voltage $I_F = 9.6$ A, $V_{GS} = 0$	V_{SD}	–	1.35	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	1.2	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

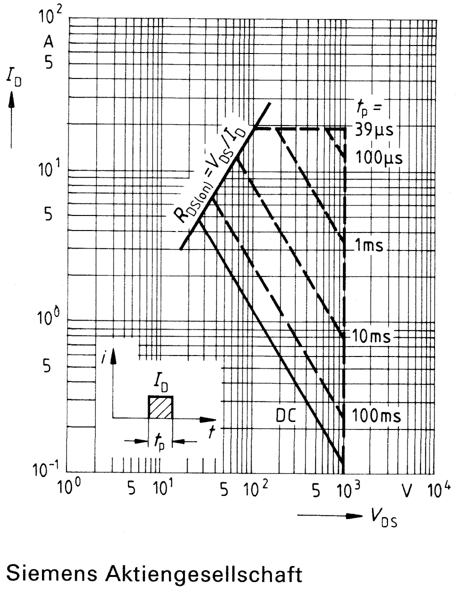
Power dissipation $P_{tot} = f\,(T_C)$
Parameter: $T_j = 150$ °C



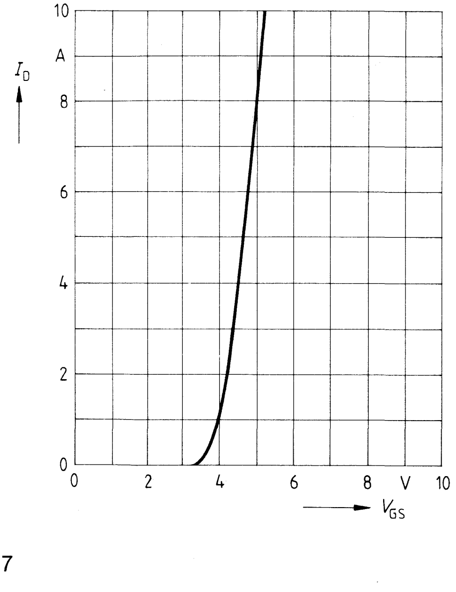
Typ. output characteristics $I_D = f\,(V_{DS})$
Parameter: $t_p = 80$ µs



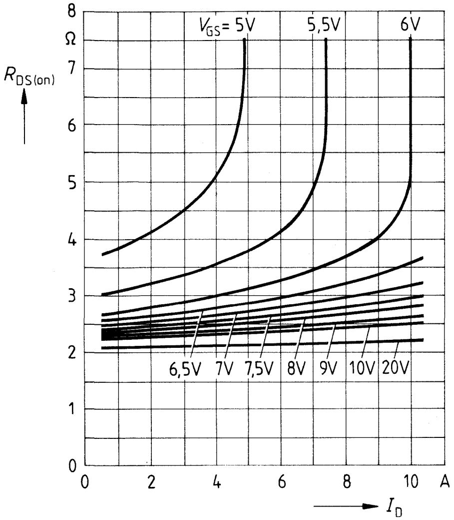
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



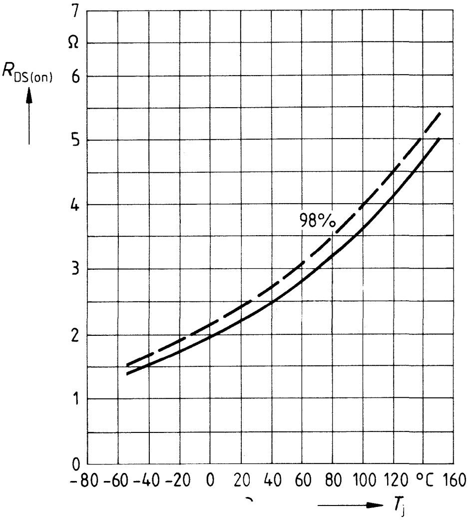
Typ. transfer characteristic
$I_D = f\,(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



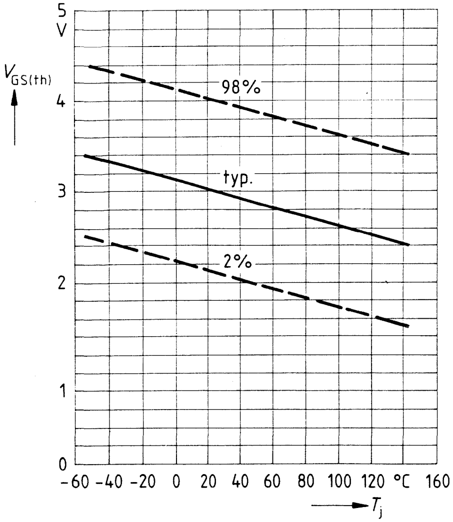
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



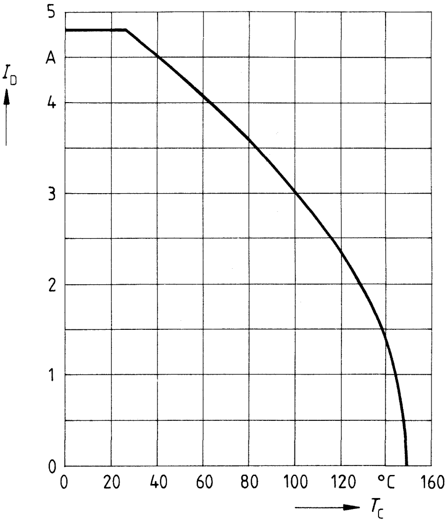
On-state resistance $R_{DS(on)} = f(T_j)$
Parameter: $I_D = 3.5$ A, $V_{GS} = 10$ V
(spread)



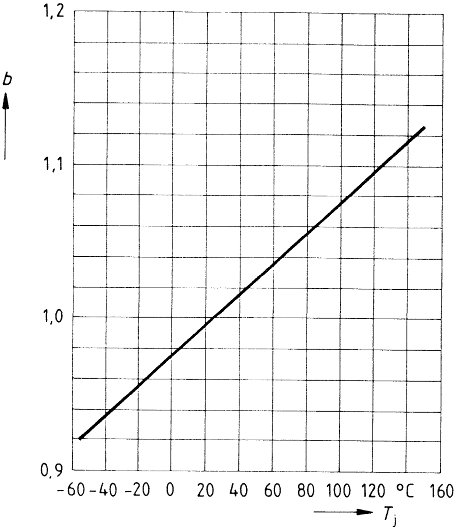
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



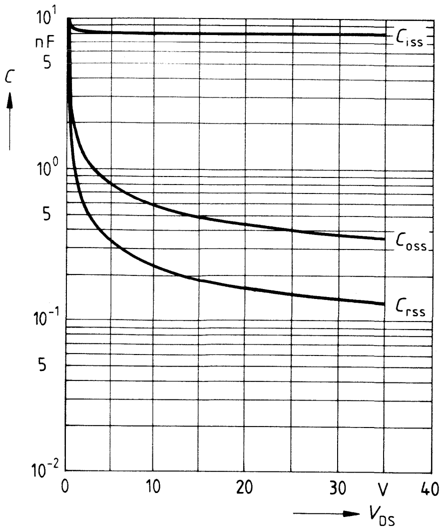
Drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



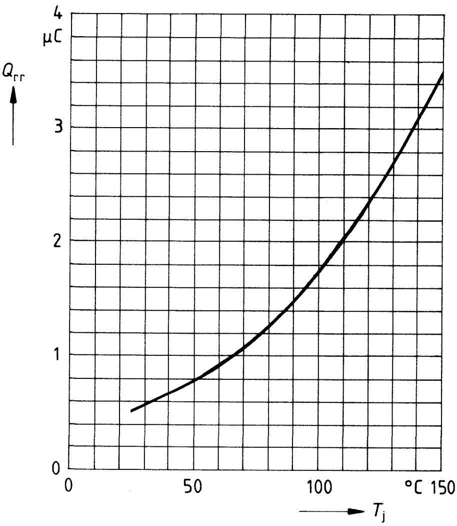
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



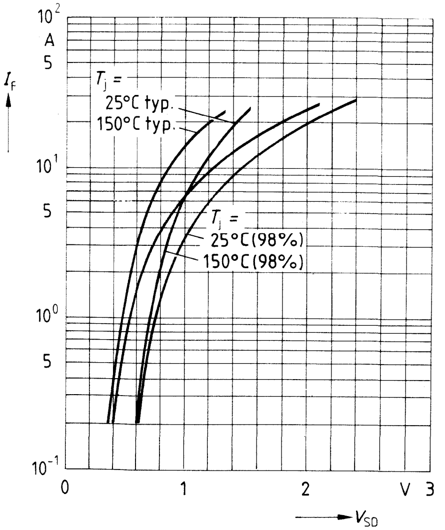
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



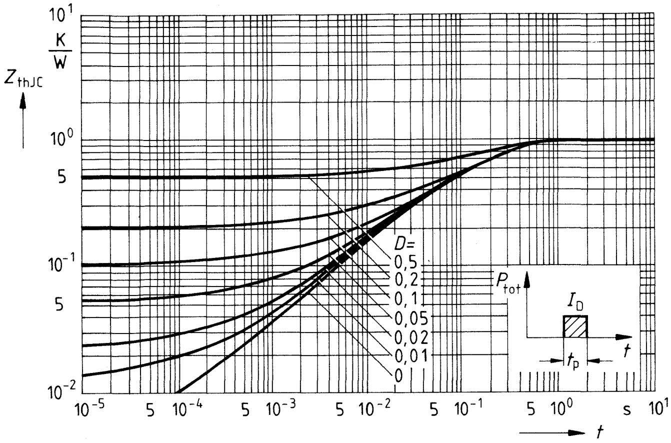
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 4.8$ A
$V_R = 100$ V



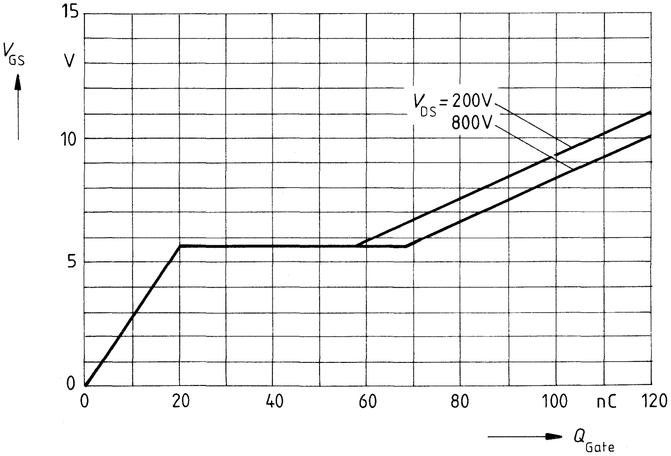
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 7.2$ A

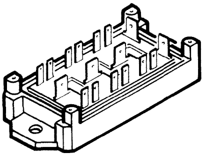


SIEMENS

SIMOPAC® MOSFET Module

BSM 692 F

V_{DS} = 1000 V
I_D = 6 x 9 A
$R_{DS(on)}$ = 1.25 Ω



- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Circuit diagram: Fig. 3 a[1])

Type	Ordering code
BSM 692 F	C67076-A1503-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	9	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	36	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Total power dissipation, T_C = 25 °C	P_{tot}	225	W
Thermal resistance Chip - case Case - heat sink	 $R_{th\ JC}$ $R_{th\ CH}$	 ≤ 0.55 ≤ 0.07	K/W
Isolation test voltage[2]), t = 1 min.	V_{is}	2500	V_{ac}
Creepage distance, drain-source	-	16	mm
Clearance, drain-source	-	11	
DIN humidity category, DIN 40 040	-	F	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	

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[1]) See chapter Package Outlines.

[2]) Isolation test voltage between drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para 492.1.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	50	250	
$T_j = 125$ °C		-	300	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 6$ A	$R_{DS(on)}$	-	1.13	1.25	Ω

Dynamic characteristics

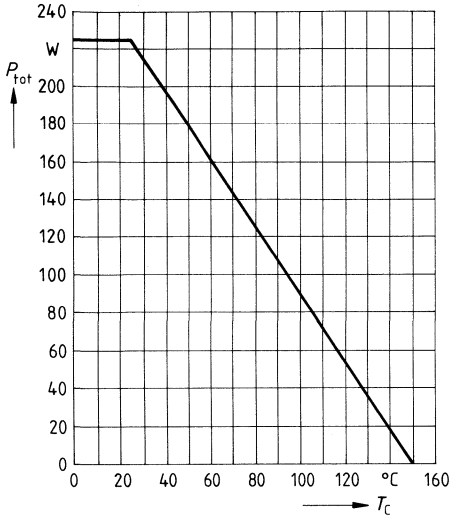
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $I_D = 6$ A	g_{fs}	6	7	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	8	10	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	0.4	0.6	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	0.15	0.25	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 6$ A, $R_{GS} = 3.3$ Ω	$t_{d(on)}$	-	60	90	ns
	t_r	-	90	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 500$ V, $V_{GS} = 10$ V, $I_D = 6$ A, $R_{GS} = 3.3$ Ω	$t_{d(off)}$	-	330	430	
	t_f	-	110	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

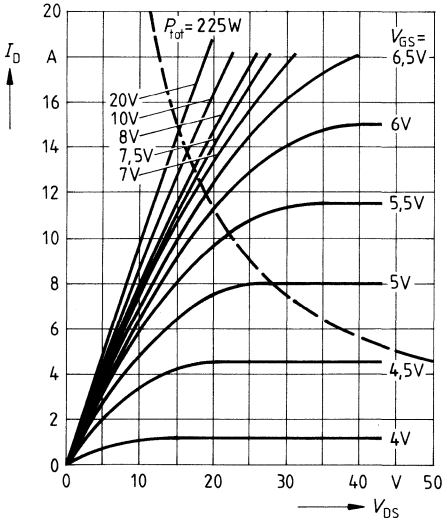
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	9	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	36	
Diode forward on-voltage $I_F = 18$ A, $V_{GS} = 0$	V_{SD}	–	1.35	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 100$ V	Q_{rr}	–	1.5	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified

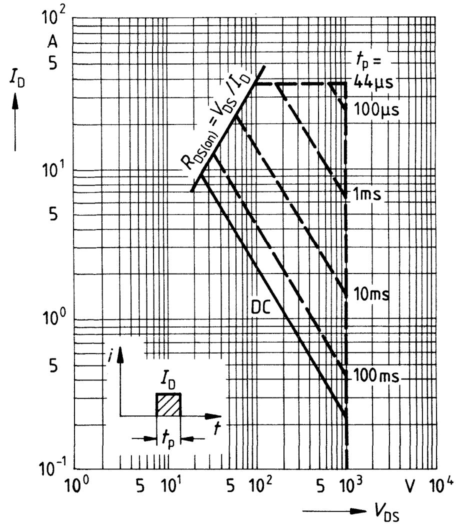
Power dissipation $P_{tot} = f(T_C)$
Parameter: $T_j = 150$ °C



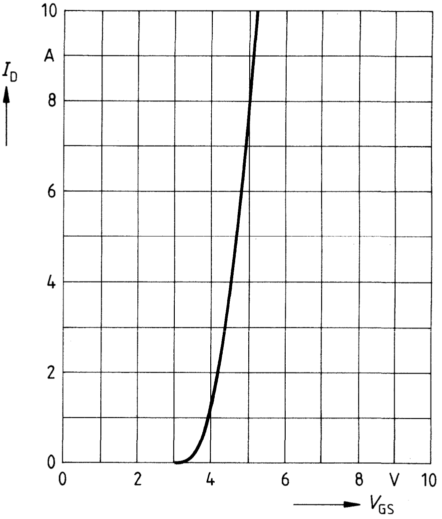
Typ. output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



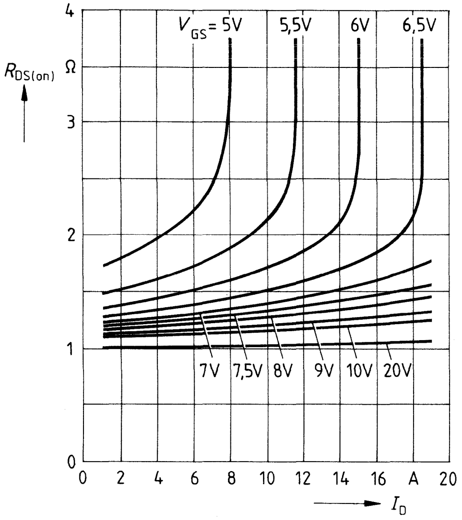
Safe operating area $I_D = f(V_{DS})$
Parameter: single pulse, $T_C = 25$ °C,
$T_j \leqq 150$ °C



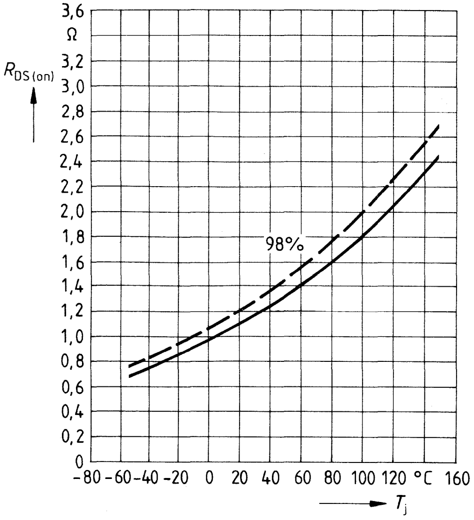
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



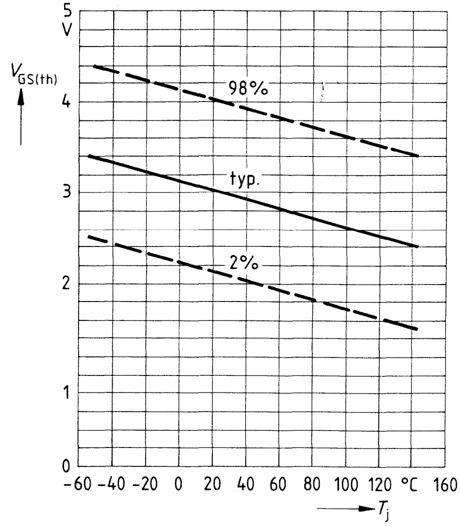
Typ. on-state resistance $R_{DS(on)} = f\,(I_D)$
Parameter: V_{GS}



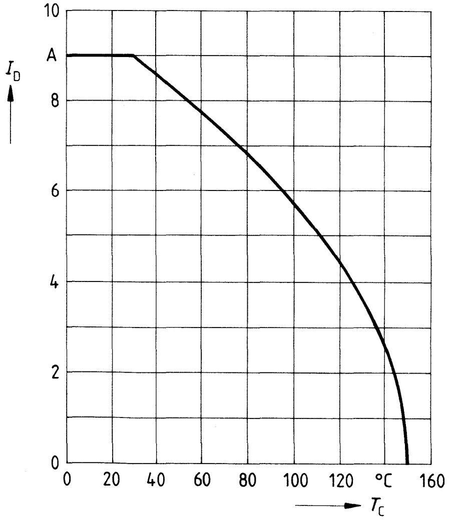
On-state resistance $R_{DS(on)} = f\,(T_j)$
Parameter: $I_D = 6$ A, $V_{GS} = 10$ V
(spread)



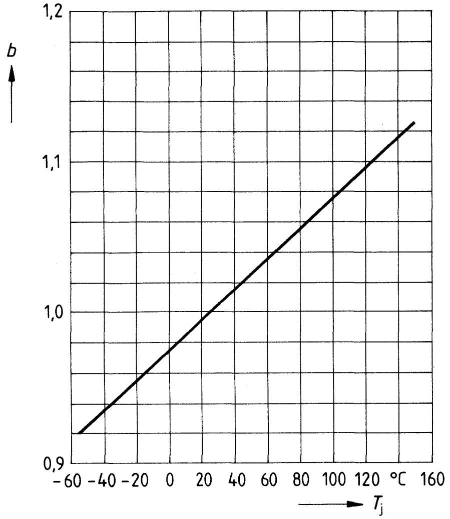
Gate threshold voltage $V_{GS(th)} = f\,(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



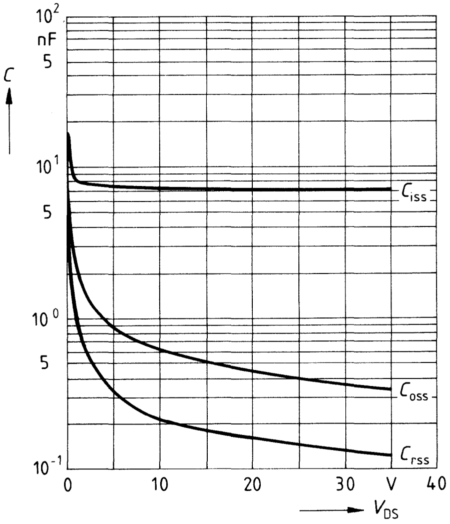
Drain current $I_D = f\,(T_C)$
Parameter: $V_{GS} \geq 10$ V, $T_j = 150$ °C



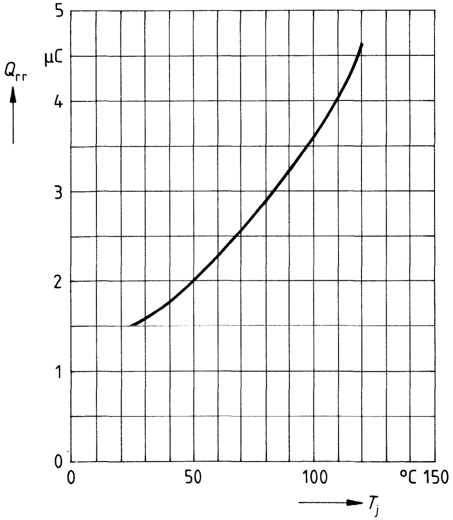
$V_{(BR)DSS}$ (T_j) = b x $V_{(BR)DSS}$ (25 °C)



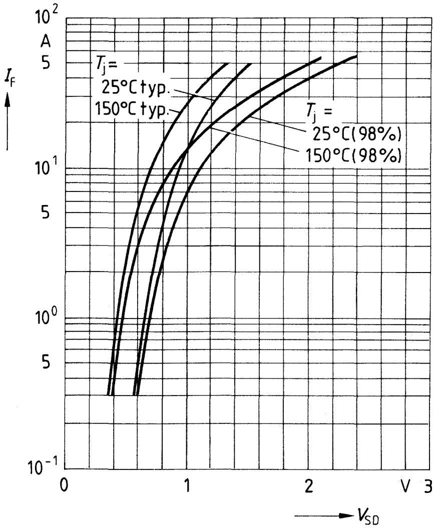
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



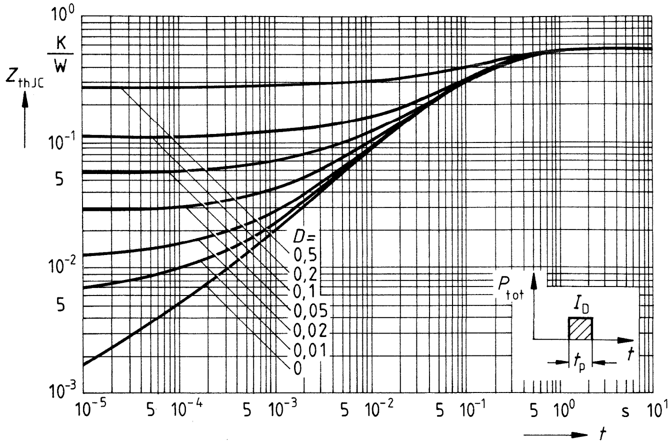
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
Parameter: $di_F/dt = 100$ A/µs, $I_F = 9$ A
$V_R = 100$ V



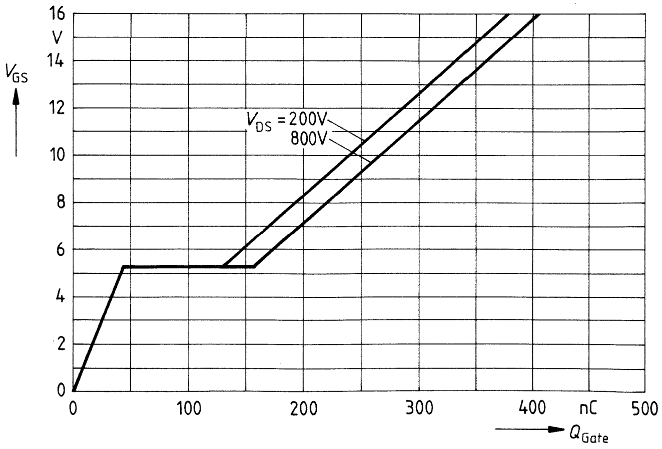
Forward characteristics of fast-recovery reverse diode $I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t)$
Parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
Parameter: $I_{D\ puls} = 13.5$ A

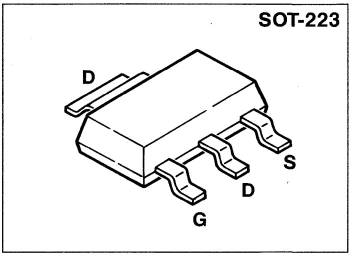


SIPMOS® Small-Signal Transistor BSP 17

Preliminary Data

V_{DS} = 50 V
I_D = 2.9 A
$R_{DS(on)}$ = 0.1 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: SOT-223 [1]



Type	Ordering code for version on 12-mm tape
BSP 17	Q67000-S025

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_A = 30$ °C	I_D	2.9	A
Pulsed drain current, $T_A = 25$ °C	$I_{D\ puls}$	11.6	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	2.9	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1	mJ
Avalanche energy, single pulse $I_D = 2.9$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 713$ µH, $T_j = 25$ °C	E_{AS}	6	
Operating and storage temperature range	T_j T_{stg}	− 55 ... + 150	°C
Max. power dissipation, $T_A = 25$ °C	P_{tot}	1.5	W
Thermal resistance chip - ambient [2]	R_{thJA}	≤ 83.3	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.
[2] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Static characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	0.1	1.0	
$T_j = 125$ °C		–	10	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 2.9$ A	$R_{DS(on)}$	–	0.09	0.1	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 2.9$ A	g_{fs}	2.5	5.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	450	600	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	220	350	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	85	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(on)}$	–	20	30	ns
	t_r	–	40	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(off)}$	–	55	70	
	t_f	–	40	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	2.9	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	11.6	
Diode forward on-voltage $I_F = 5.8$ A, $V_{GS} = 0$	V_{SD}	–	1.0	1.2	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	–	40	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	–	0.04	–	µC

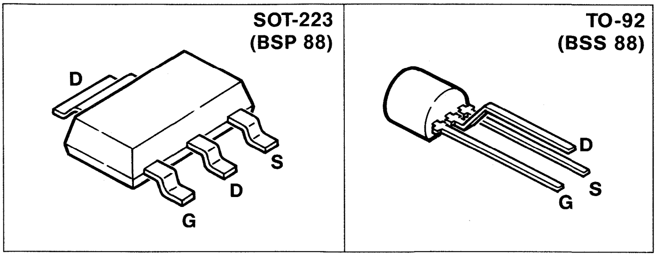
SIEMENS

SIPMOS® Small-Signal Transistors

BSP 88
BSS 88

V_{DS} = 240 V
I_D = 0.29 / 0.25 A
$R_{DS(on)}$ = 8 Ω

- N channel
- Enhancement mode
- Packages: SOT-223, TO-92 [1]



Type	Ordering code for version on tape [2]	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 88	–	Q67000-S101	Q67000-S070
BSS 88	Q62702-S303	Q62702-S454	–

Maximum Ratings

Parameter	Symbol	BSP 88	BSS 88	Unit
Drain-source voltage	V_{DS}	240		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	240		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 29 °C/25 °C	I_D	0.29	0.25	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	1.16	1.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance	R_{thJA}			K/W
chip - ambient (without heat sink)			≤ 125	
chip - ambient [3]		≤ 83.3		
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines
[2] E6296: on reel, 1500 pieces/reel, 2 reels/carton: (gate first)
[3] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Static characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$				V
$V_{GS} = 0$, $I_D = 0.25$ mA		240	–	–	
Gate threshold voltage	$V_{GS(th)}$				
$V_{GS} = V_{DS}$, $I_D = 1$ mA		0.6	0.8	1.2	
Zero gate voltage drain current	I_{DSS}				µA
$V_{DS} = 240$ V, $V_{GS} = 0$					
$T_j = 25$ °C		–	1	20	
$T_j = 125$ °C		–	10	200	
$V_{DS} = 100$ V, $V_{GS} = 0$					
$T_j = 25$ °C		–	–	100	nA
Gate-source leakage current	I_{GSS}				nA
$V_{GS} = 20$ V, $V_{DS} = 0$		–	10	100	
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 4.5$ V, $I_D = 0.29$ A BSP 88		–	6	8	
$I_D = 0.25$ A BSS 88		–	4.6	8	
$V_{GS} = 1.8$ V, $I_D = 14$ mA BSP 88		–	12	15	
BSS 88		–	6	15	

Dynamic characteristics

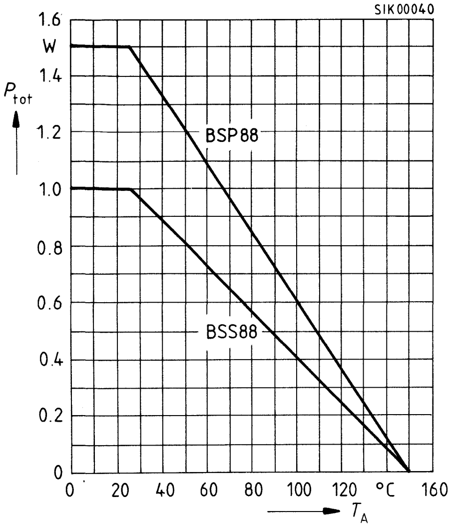
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.29$ A BSP 88		0.14	0.33	–	
$I_D = 0.25$ A BSS 88		0.14	0.32	–	
Input capacitance	C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	90	140	
Output capacitance	C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	20	30	
Reverse transfer capacitance	C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	6	9	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	–	5	8	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	t_r	–	10	15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	–	30	40	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	t_f	–	25	30	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

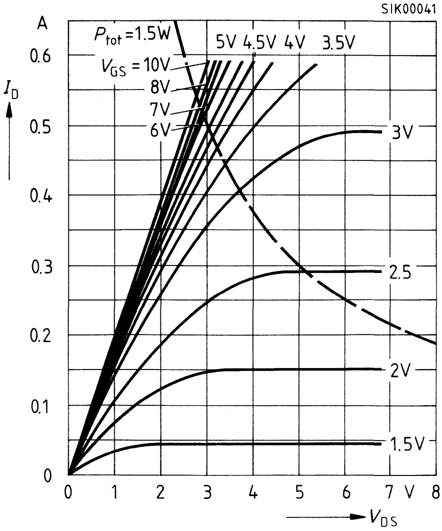
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSP 88		–	–	0.29	
	BSS 88		–	–	0.25	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSP 88		–	–	1.16	
	BSS 88		–	–	1.0	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.58$ A, $V_{GS} = 0$	BSP 88		–	1.0	1.3	
$I_F = 0.5$ A, $V_{GS} = 0$	BSS 88		–	0.85	1.3	

Characteristics at T_j = 25 °C, unless otherwise specified.

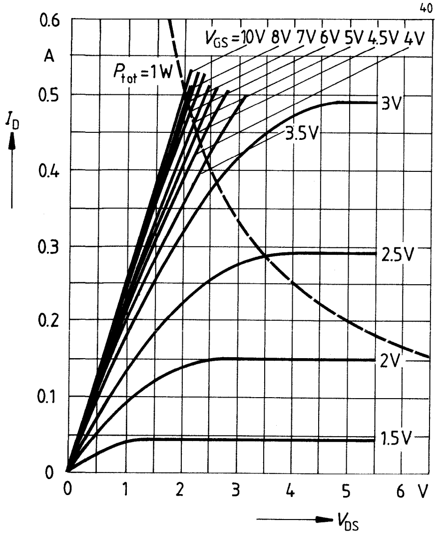
Total power dissipation $P_{tot} = f(T_A)$



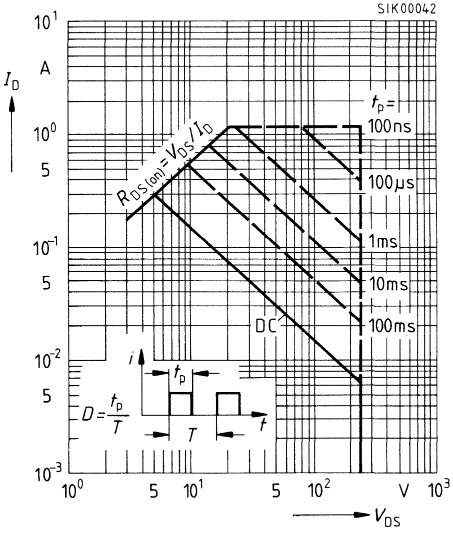
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 88



Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 88

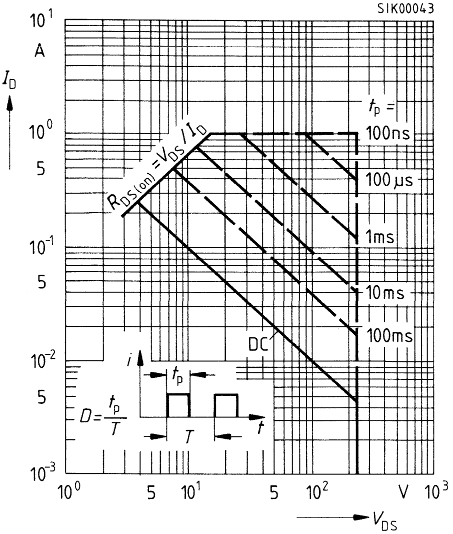


Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 88

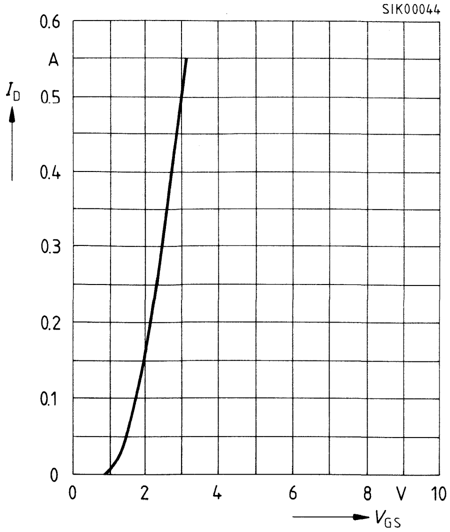


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$

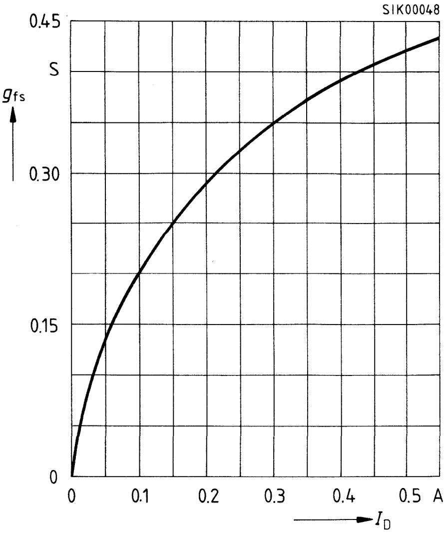
BSS 88



Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$

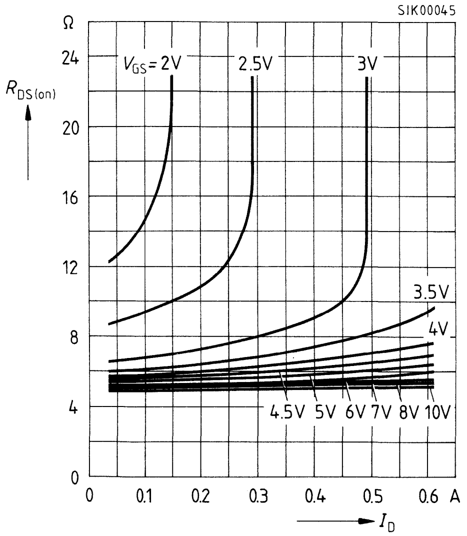


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



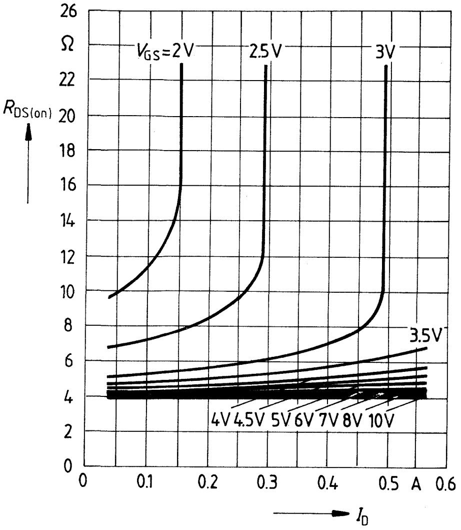
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BSP 88



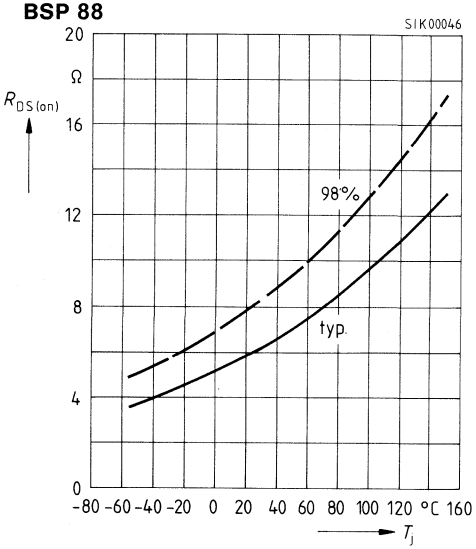
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BSS 88



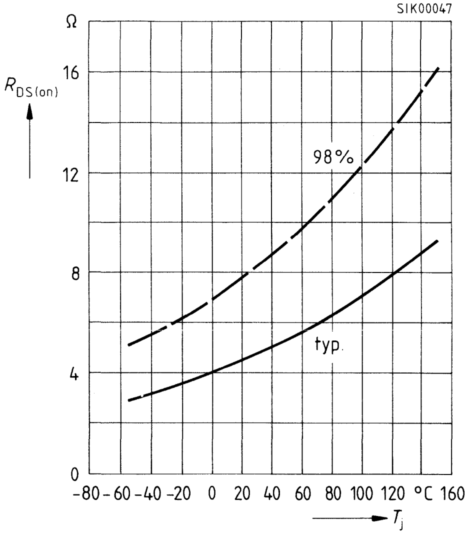
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.29 A, V_{GS} = 4.5 V, (spread)

BSP 88

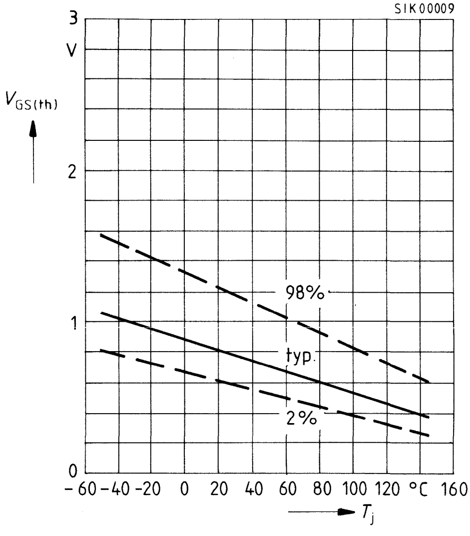


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.25 A, V_{GS} = 4.5 V, (spread)

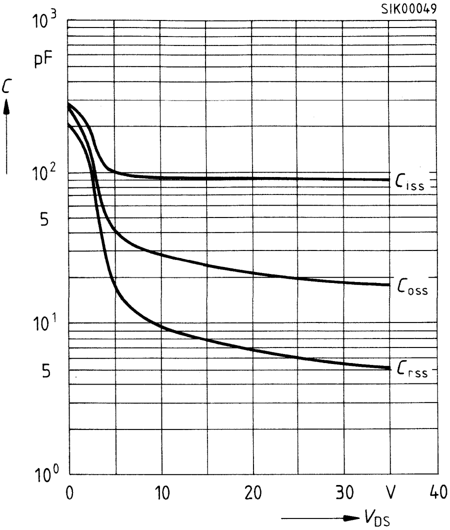
BSS 88



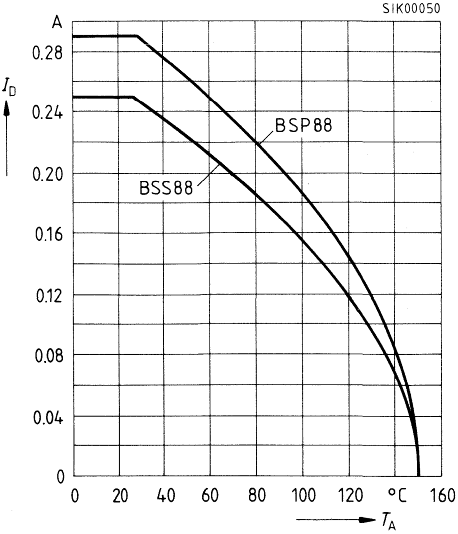
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



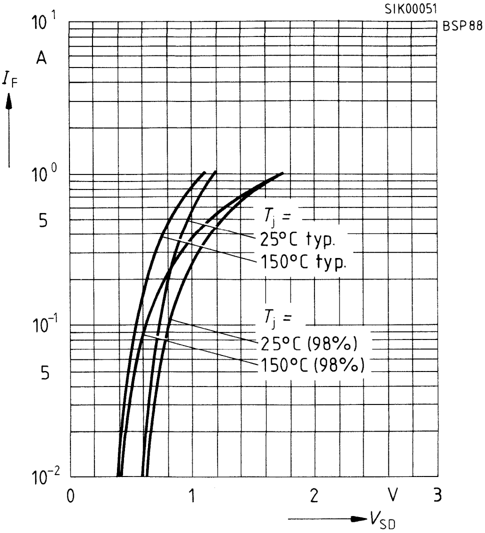
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



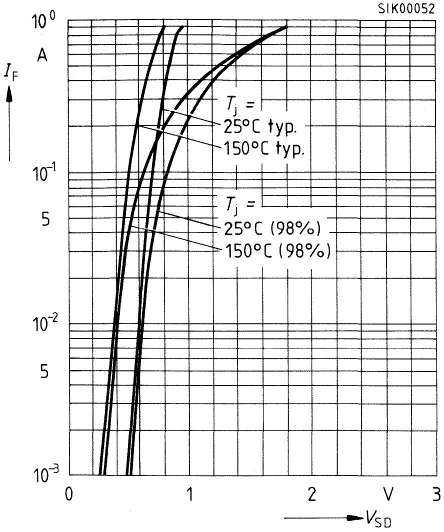
Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 88



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 88



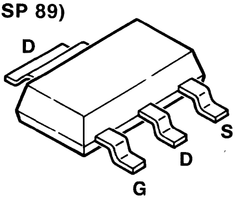
SIEMENS

SIPMOS® Small-Signal Transistors BSP 89 BSS 87 BSS 89

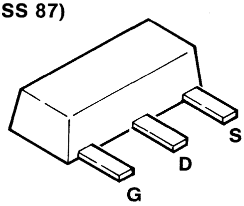
V_{DS} = 240 V
I_D = 0.29 ... 0.34 A
$R_{DS(on)}$ = 6.0 Ω

- N channel
- Enhancement mode
- Packages: SOT-223, SOT-89, TO-92 [1]

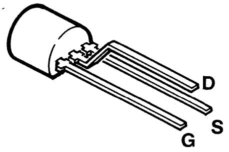
SOT-223 (BSP 89)



SOT-89 (BSS 87)



TO-92 (BSS 89)



Type	Marking	Ordering code for version in bulk	 for version on 12-mm-tape	 for version on tape[2]	 for version in Ammopack[3]
BSP 89	–	Q67000-S100	Q62702-S652	–	–
BSS 87	KA	Q62702-S453	Q62702-S506	–	–
BSS 89	–	Q62702-S455	–	Q62702-S519	Q62702-S385

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[1] See chapter Package Outlines.
[2] E6288: on reel, 1500 pieces / reel, 2 reels / carton. (Source first).
[3] E6325: Ammopack, 2000 pieces / carton.

Maximum Ratings

Parameter	Symbol	BSP 89	BSS 87	BSS 89	Unit
Drain-source voltage	V_{DS}	240			V
Drain-gate voltage, $R_{GS} = 20\ k\Omega$	V_{DGR}	240			
Gate-source voltage	V_{GS}	± 10			
Gate-source peak voltage, aperiodic	V_{gs}	± 20			
Continuous drain current, $T_A = 25/23/29$ °C	I_D	0.34	0.29		A
Pulsed drain current, $T_A = 25$ °C	$I_{D\ puls}$	1.36	1.16		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Thermal resistance	R_{thJA}				K/W
chip - ambient (without heat sink)		–	≤ 125		
chip - ambient [1]		≤ 83.3	–		
Max. power dissipation, $T_A = 25$ °C	P_{tot}	1.5	1		W
DIN humidity category, DIN 40 040	–	E			–
IEC climatic category, DIN IEC 68-1	–	55/150/56			

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[1] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm^2 copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	240	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA		$V_{GS(th)}$	0.8	1.5	2.0	
Zero gate voltage drain current		I_{DSS}				µA
$V_{DS} = 240$ V, $V_{GS} = 0$						
$T_j = 25$ °C			–	4	60	
$T_j = 125$ °C			–	8	200	
$V_{DS} = 60$ V, $V_{GS} = 0$						
$T_j = 25$ °C			–	–	0.2	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	10	100	nA
Drain-source on-resistance		$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.34$ A	BSP 89		–	5.5	6.0	
$I_D = 0.29$ A	BSS 87/89		–	4.0	6.0	
$V_{GS} = 4.5$ V, $I_D = 0.34$ A	BSP 89		–	9	10.0	
$I_D = 0.29$ A	BSS 87/89		–	5.7	10.0	

Dynamic characteristics

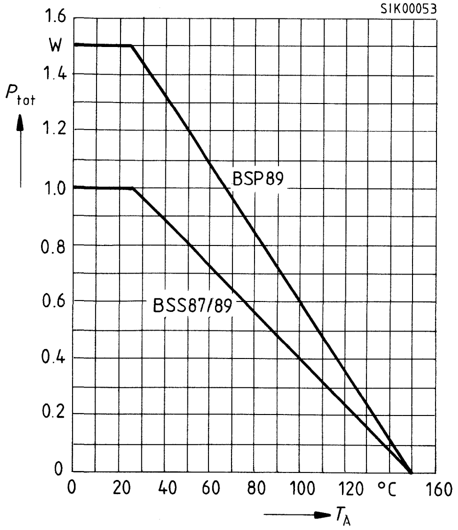
Parameter		Symbol	min.	typ.	max.	Unit
Forward transconductance		g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.34$ A	BSP 89		0.14	0.32	–	
$I_D = 0.29$ A	BSS 87/89		0.14	0.29	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	90	140	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	20	30	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	6	9	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 0.28$ A		$t_{d(on)}$	–	5	8	ns
		t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 0.28$ A		$t_{d(off)}$	–	25	30	
		t_f	–	22	28	

Electrical Characteristics (continued)
at $T_j = 25\ °C$, unless otherwise specified.

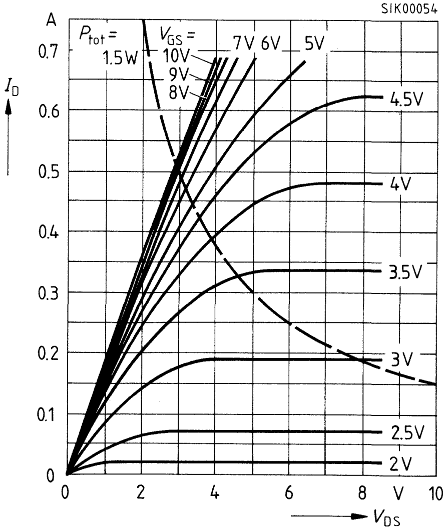
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25\ °C$	BSP 89		–	–	0.34	
	BSS 87/89		–	–	0.29	
Pulsed reverse drain current		I_{SM}				
$T_A = 25\ °C$	BSP 89		–	–	1.36	
	BSS 87/89		–	–	1.16	
Diode forward on-voltage		V_{SD}				V
$V_{GS} = 0$, $I_F = 0.68$ A	BSP 89		–	1.1	1.4	
$I_F = 0.58$ A	BSS 87/89		–	0.85	1.4	

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

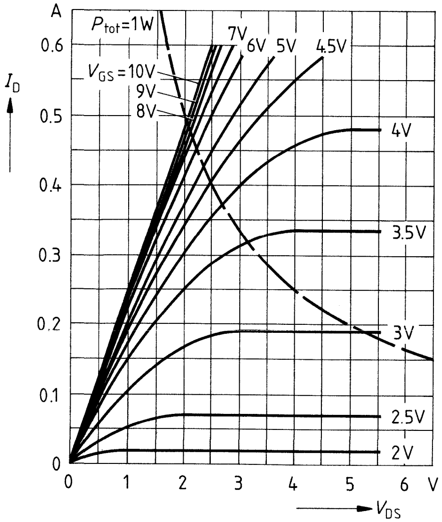
Total power dissipation $P_{tot} = f(T_C)$



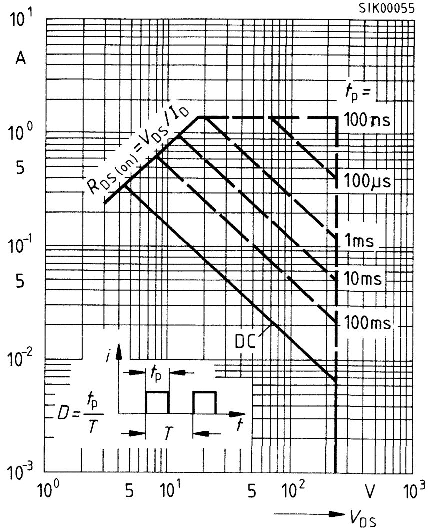
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSP 89



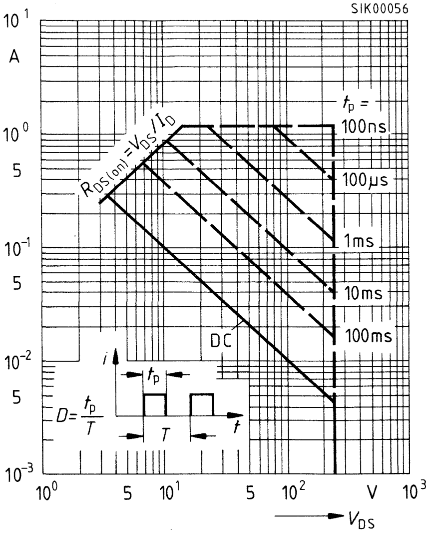
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSS 87/89



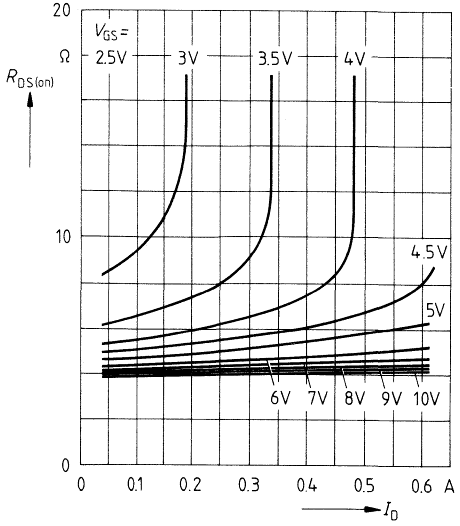
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BSP 89



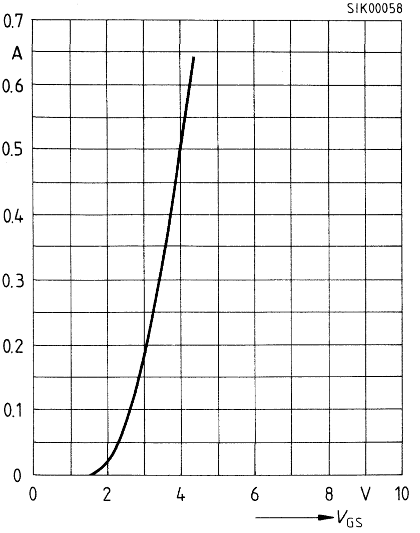
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 87/BSS 89



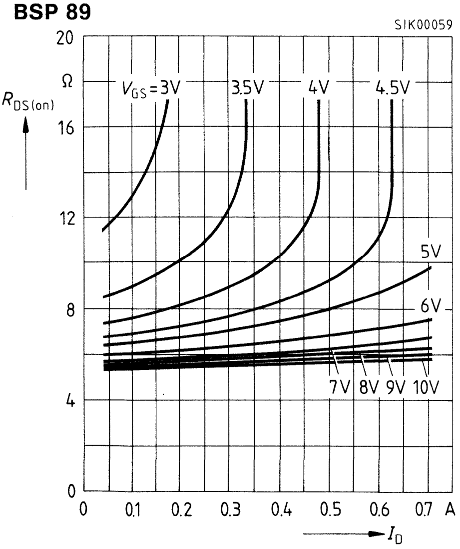
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 87/89



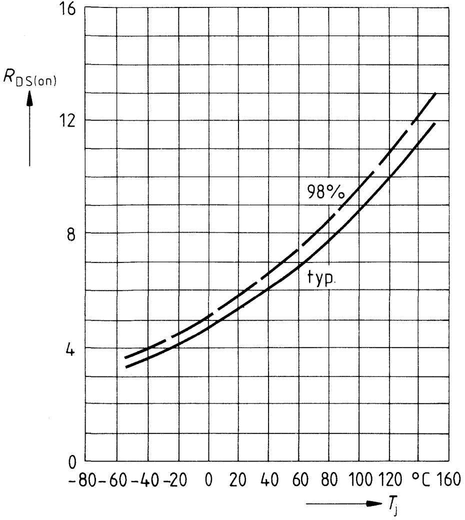
Typ. transfer characteristic, $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 2 \times I_D \times R_{DS(on)max}$



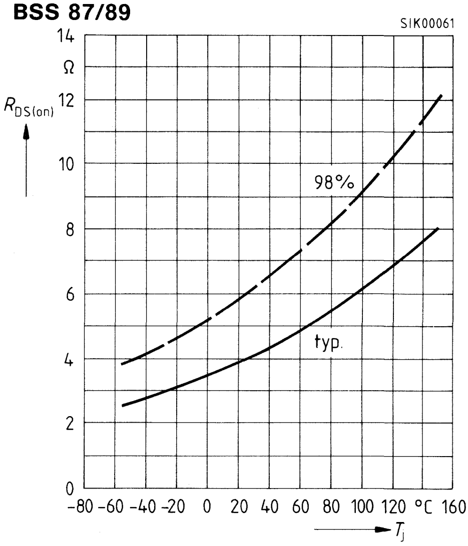
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSP 89



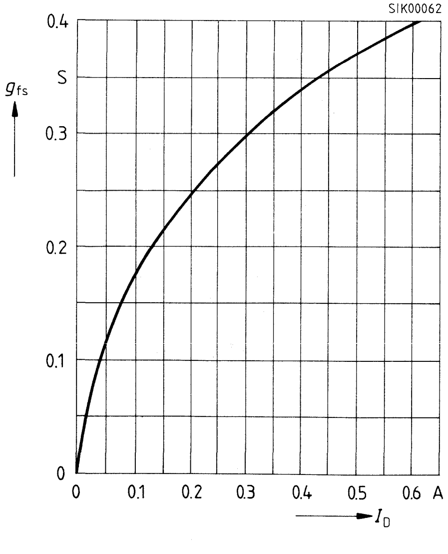
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.34$ A, $V_{GS} = 10$ V, (spread)
BSP 89



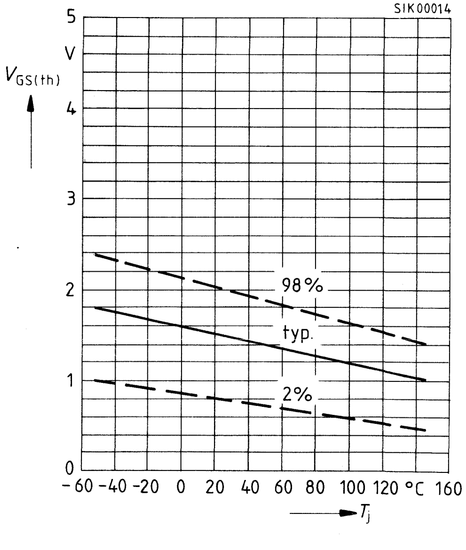
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.29$ A, $V_{GS} = 10$ V, (spread)
BSS 87/89



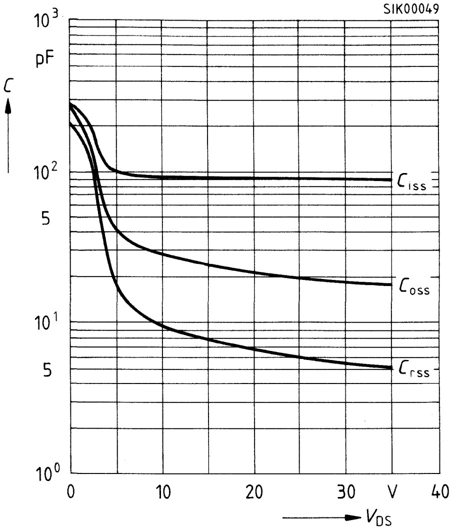
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



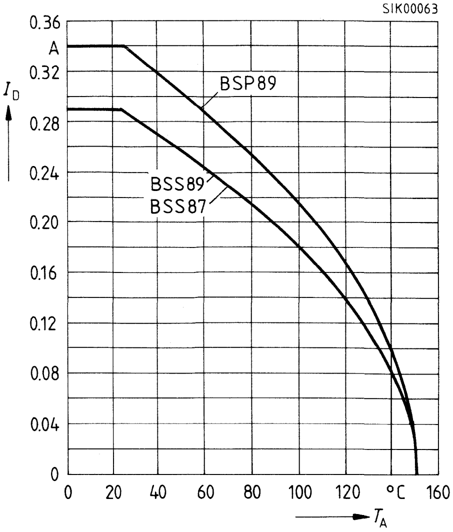
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



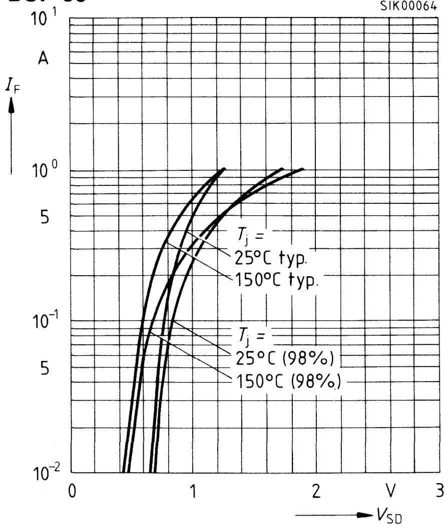
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



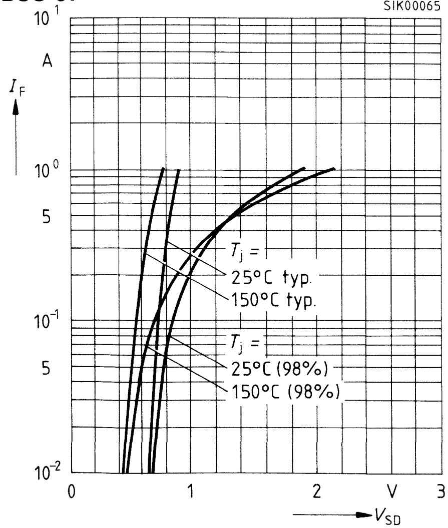
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 89

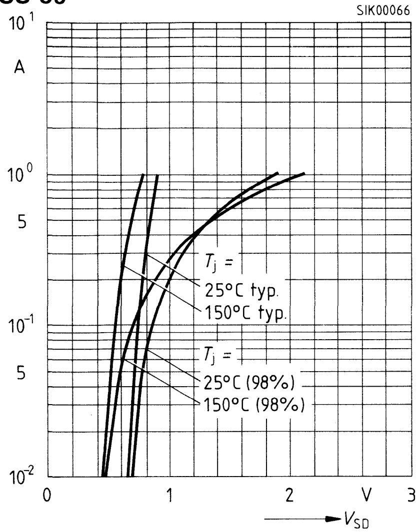


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 87



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

BSS 89

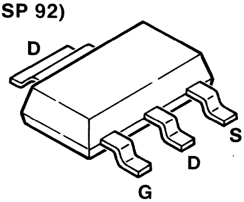


SIPMOS® Small-Signal Transistors BSP 92 BSS 92 BSS 192

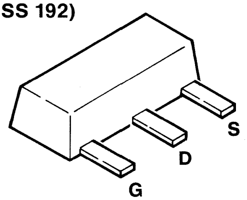
V_{DS} = – 240 V
I_D = – 0.15 ... – 0.18 A
$R_{DS(on)}$ = 20 Ω

- P channel
- Enhancement mode
- Packages: SOT-223, SOT-89, TO-92 [1]

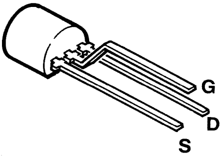
SOT-223
(BSP 92)



SOT-89
(BSS 192)



TO-92
(BSS 92)



Type	Marking	Ordering code for version in bulk	for version on 12-mm tape	for version on Ammopack [3]	for version on tape[2]
BSP 92	–	Q67000-S059	Q62702-S653	–	–
BSS 92	–	Q62702-S458	–	Q62702-S502	Q62702-S497
BSS 192	KB	Q62702-S602	–	–	–

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[1] See chapter Package Outlines.
[2] E6288: on reel, 1500 pieces / reel, 2 reels / carton: (Source first).
[3] E6325: Ammopack, 2000 pieces / carton.

Maximum Ratings

Parameter	Symbol	BSS 92	BSS 192	BSP 92	Unit
Drain-source voltage	V_{DS}	–240			V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	–240			
Gate-source voltage	V_{GS}	± 20			
Continuous drain current, T_A = 33/35/35 °C	I_D	–0.15		–0.18	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	–0.6		–0.72	
Operating and storage temperature range	T_j T_{stg}	–55 ... +150			°C
Thermal resistance chip-ambient (without heat sink) chip-ambient [1]	R_{thJA}	≤ 125 –		– ≤ 83.3	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1		1.5	W
DIN humidity category, DIN 40 040	–	E			–
IEC climatic category, DIN IEC 68-1	–	55/150/56			

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[1] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm^2 copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values min.	 typ.	 max.	Unit
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-240	-	-	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = -1$ mA	$V_{GS(th)}$	-0.8	-1.5	-2.0	
Zero gate voltage drain current $V_{DS} = -240$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	-4	-60	
$T_j = 125$ °C		-	-8	-200	
$V_{DS} = -60$ V, $V_{GS} = 0$ $T_j = 25$ °C		-	-	-0.2	
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-10	-100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = -10$ V, $I_D = -0.15$ A BSS 92/192		-	10	20	
$I_D = -0.18$ A BSP 92		-	12	20	

Dynamic characteristics

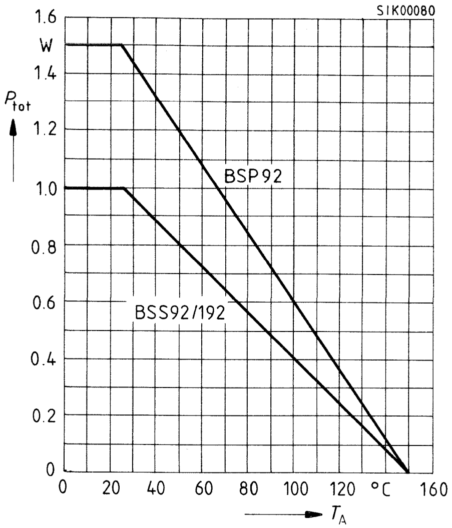
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -0.15$ A BSS 92/192		0.06	0.12	-	
$I_D = -0.18$ A BSP 92		0.06	0.13	-	
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	70	105	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	20	30	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	8	12	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	8	12	ns
$V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.25$ A	t_r	-	30	45	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	15	20	
$V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.25$ A	t_f	-	30	40	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

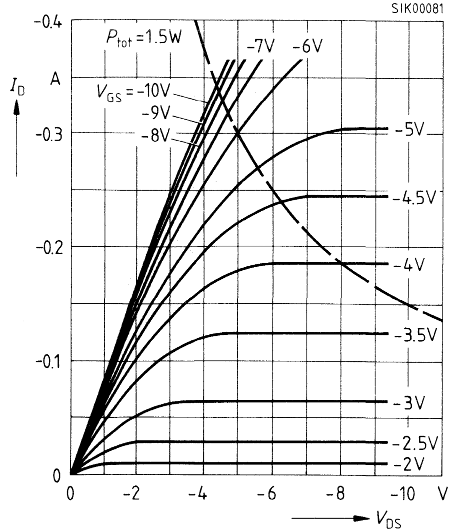
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
T_A = 25 °C	BSS 92/192		–	–	-0.15	
	BSP 92		–	–	-0.18	
Pulsed reverse drain current		I_{SM}				
T_A = 25 °C	BSS 92/192		–	–	-0.60	
	BSP 92		–	–	-0.72	
Diode forward on-voltage		V_{SD}				V
V_{GS} = 0, I_F = -0.3 A	BSS 92/192		–	-0.85	-1.2	
I_F = -0.36 A	BSP 92		–	-0.9	-1.2	

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

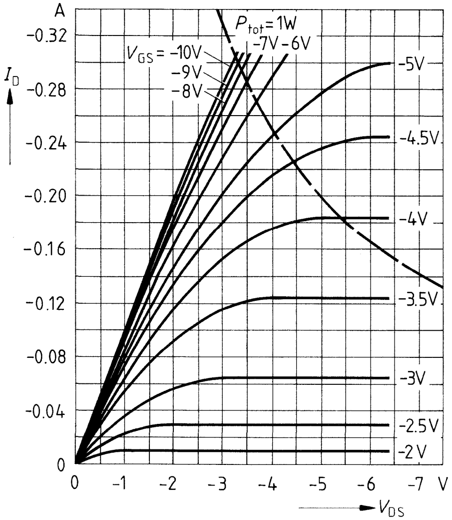
Total power dissipation $P_{tot} = f(T_C)$



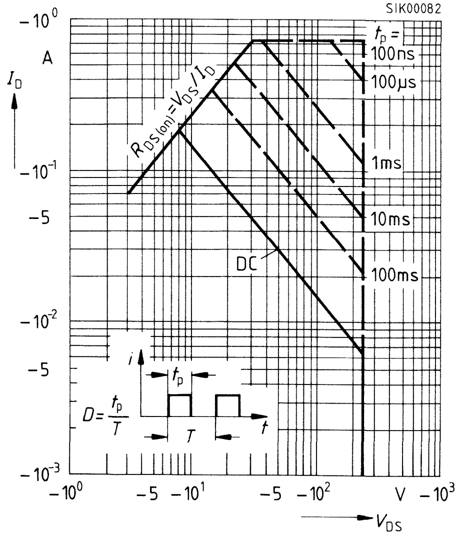
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSP 92



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSS 92/192

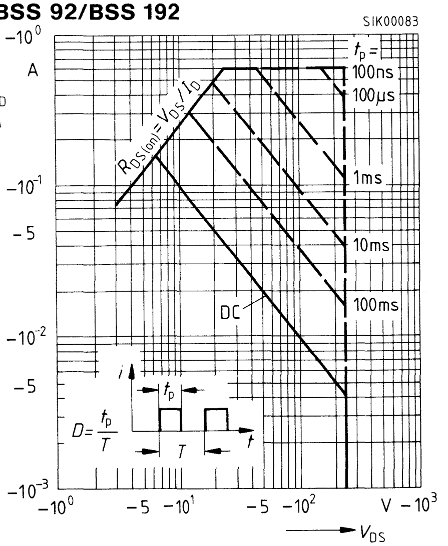


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BSP 92



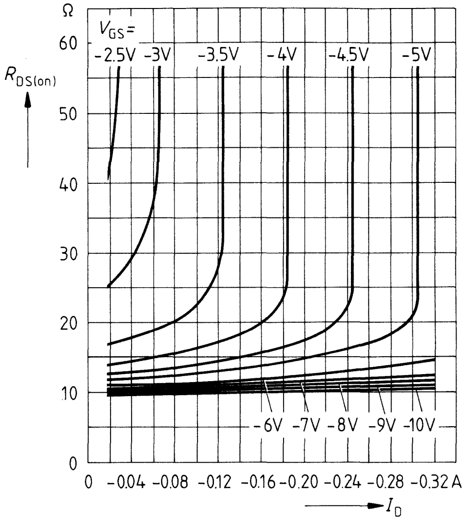
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$

BSS 92/BSS 192

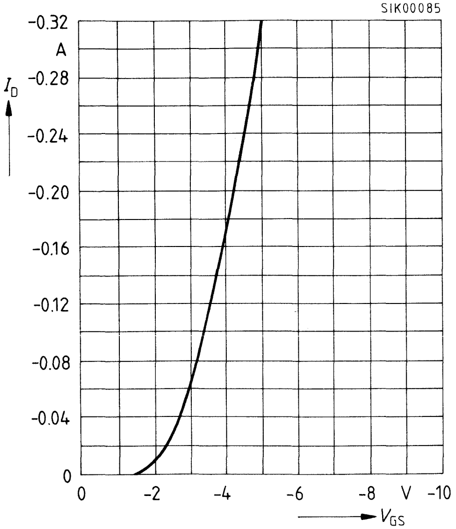


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BSS 92/BSS 192

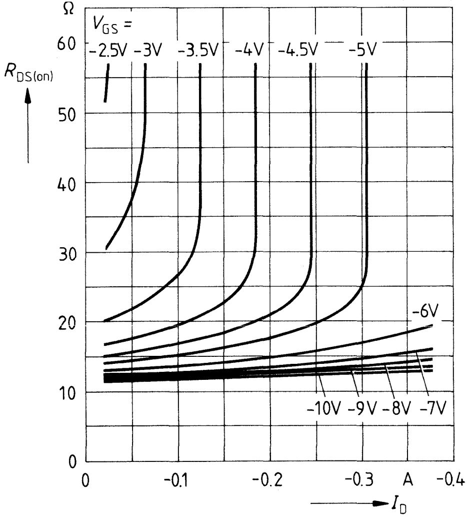


Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80\ µs$, $V_{DS} = 25\ V$

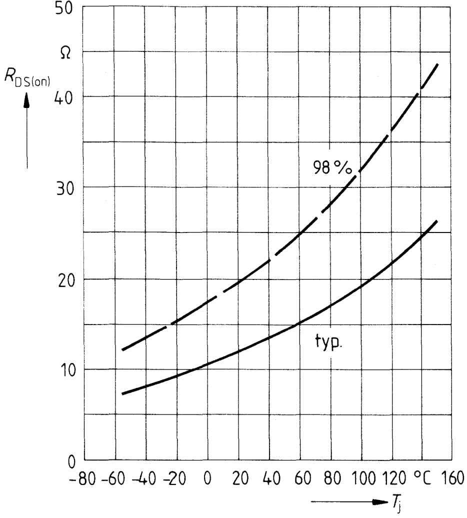


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

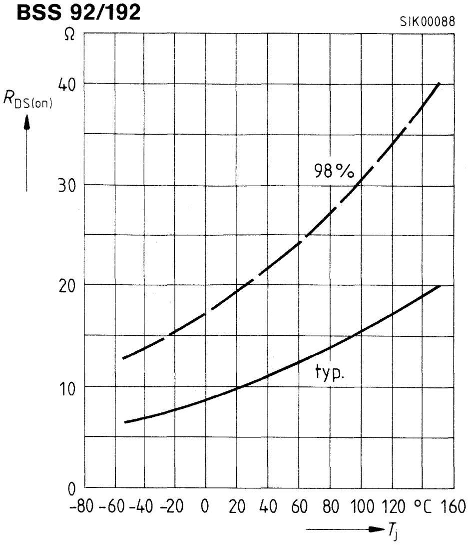
BSP 92



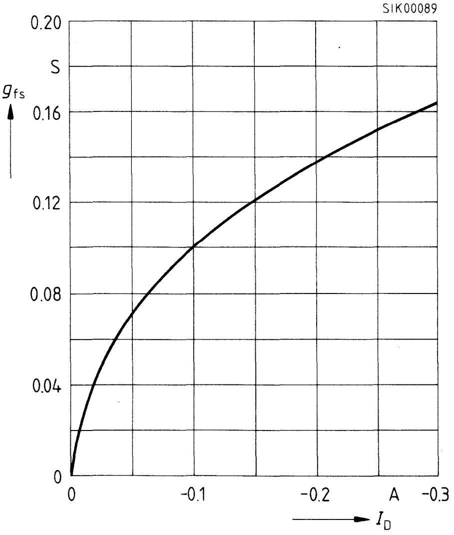
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -0.18$ A, $V_{GS} = 10$ V, (spread)
BSP 92



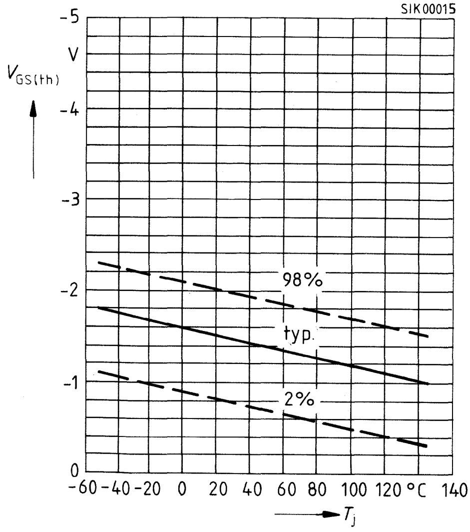
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -0.15$ A, $V_{GS} = 10$ V, (spread)
BSS 92/192



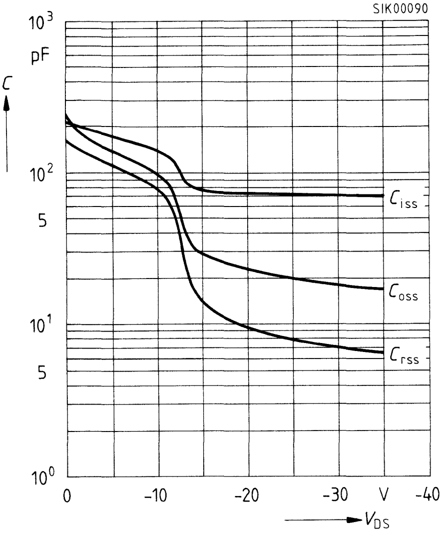
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



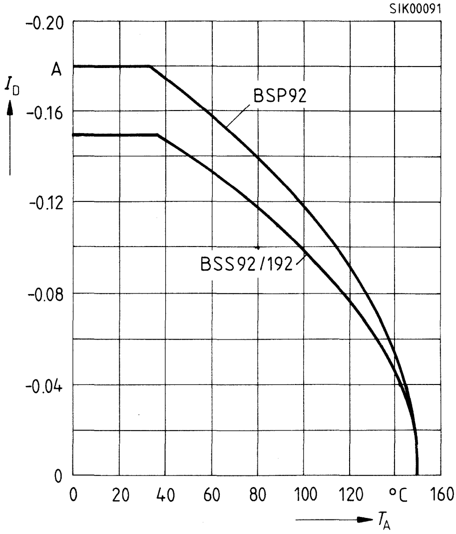
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

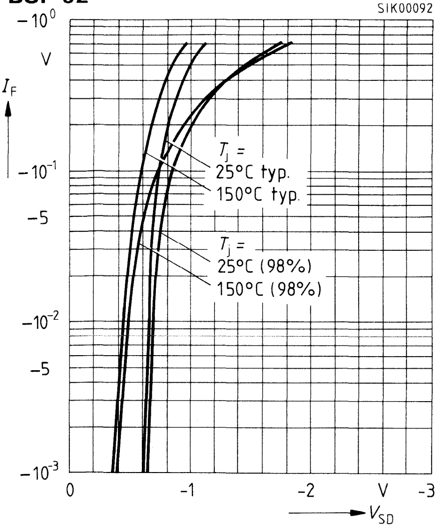


Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



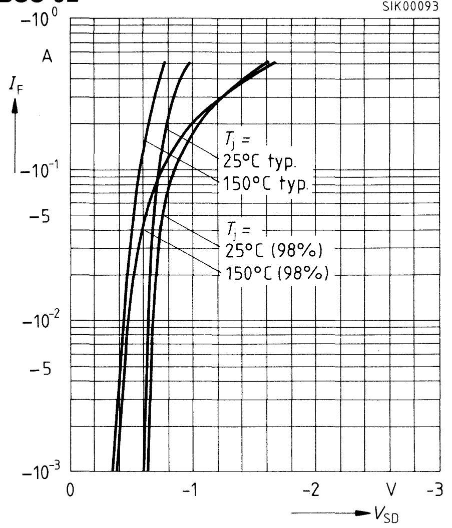
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

BSP 92

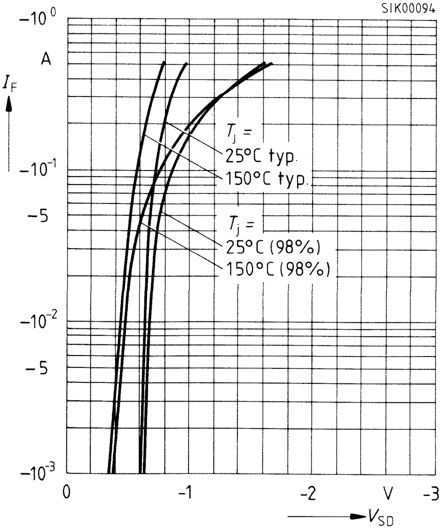


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

BSS 92



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80\ \mu s$, T_j, (spread)
BSS 192



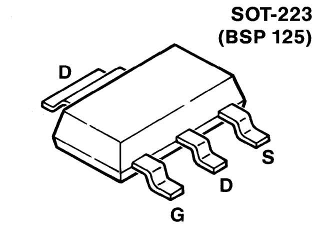
SIEMENS

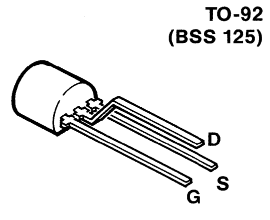
SIPMOS® Small-Signal Transistors

BSP 125
BSS 125

V_{DS} = 600 V
I_D = 0.110 / 0.100 A
$R_{DS(on)}$ = 45 Ω

- N channel
- Enhancement mode
- Packages: SOT-223, TO-92 ¹)





Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 125	Q67000-S111	Q62702-S654
BSS 125	Q62702-S505	–

Maximum Ratings

Parameter	Symbol	BSP 125	BSS 125	Unit
Drain-source voltage	V_{DS}	600		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	600		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 39 °C/35 °C	I_D	0.110	0.100	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.44	0.4	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - ambient ²)	R_{thJA}	 ≤ 83.3	 ≤ 125	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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¹) See chapter Package Outlines.
²) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	

Static characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	600	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 600$ V, $V_{GS} = 0$	I_{DSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 125$ °C		–	8	50	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.11$ A BSP 125		–	30	45	
$V_{GS} = 10$ V, $I_D = 0.1$ A BSS 125		–	30	45	

Dynamic characteristics

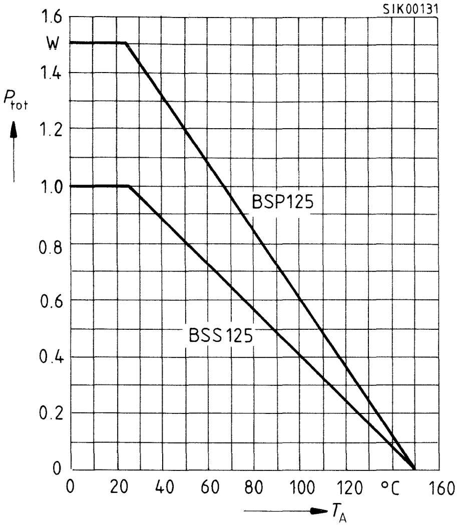
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.11$ A BSP 125		0.06	0.16	–	
$I_D = 0.1$ A BSS 125		0.06	0.15	–	
Input capacitance	C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz BSP 125		–	110	170	
BSS 125		–	110	150	
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	10	15	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	6	10	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.21$ A	$t_{d(on)}$	–	5	8	ns
	t_r	–	10	15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.21$ A	$t_{d(off)}$	–	18	25	
	t_f	–	20	25	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

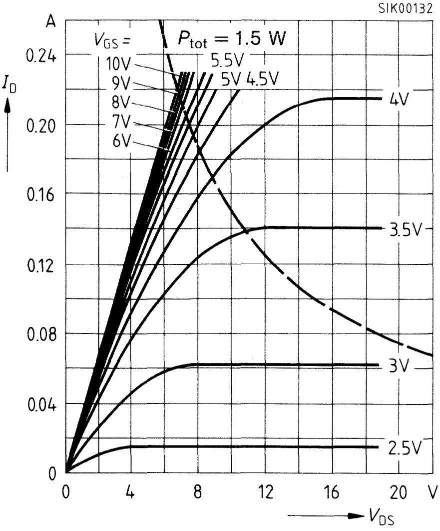
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
T_A = 25 °C	BSP 125		–	–	0.11	
	BSS 125		–	–	0.10	
Pulsed reverse drain current		I_{SM}				
T_A = 25 °C	BSP 125		–	–	0.44	
	BSS 125		–	–	0.40	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.22$ A, $V_{GS} = 0$	BSP 125		–	1.0	1.4	
$I_F = 0.20$ A, $V_{GS} = 0$	BSS 125		–	0.80	1.30	
Reverse recovery time $V_R = 100$ V, $I_F = 0.2$ A, $di_F/dt = 100$ A/µs		t_{rr}				ns
	BSP 125		–	–	–	
	BSS 125		–	300	–	
Reverse recovery charge $V_R = 100$ V, $I_F = 0.2$ A, $di_F/dt = 100$ A/µs		Q_{rr}				µC
	BSP 125		–	–	–	
	BSS 125		–	0.82	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

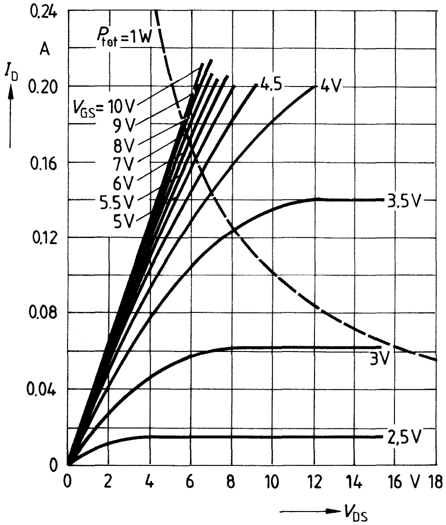
Total power dissipation $P_{tot} = f(T_A)$



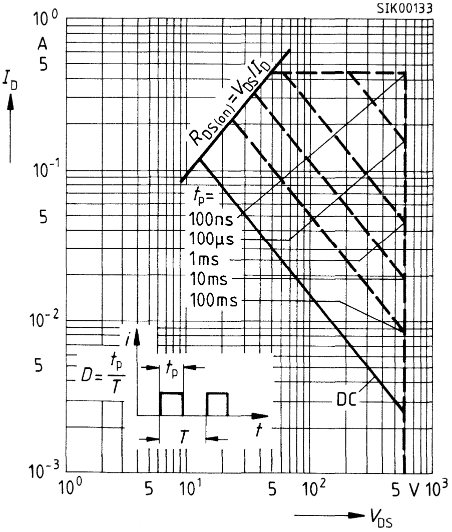
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSP 125



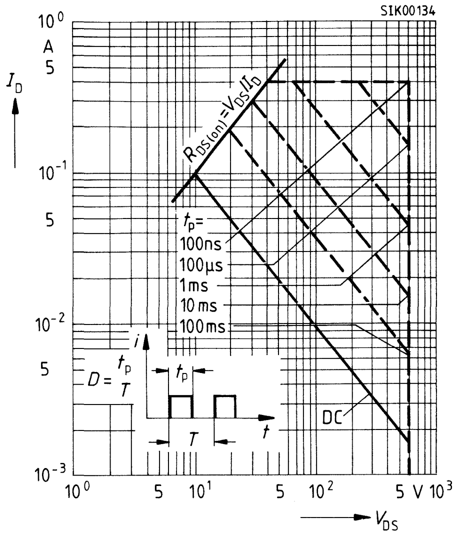
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSS 125



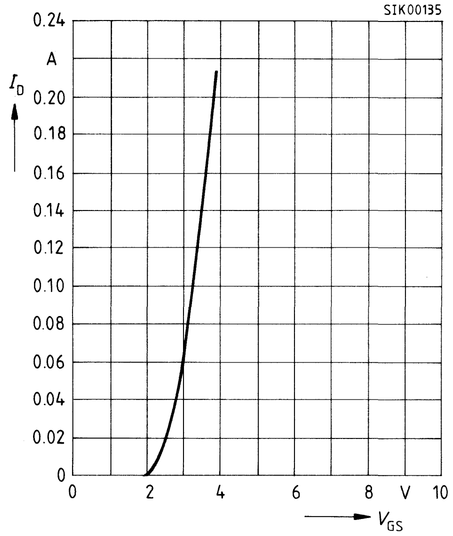
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSP 125



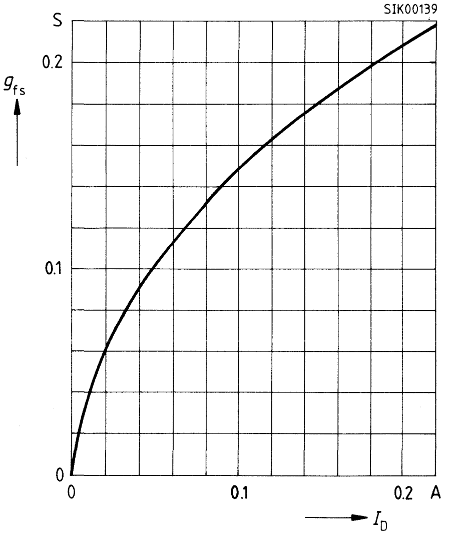
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 125



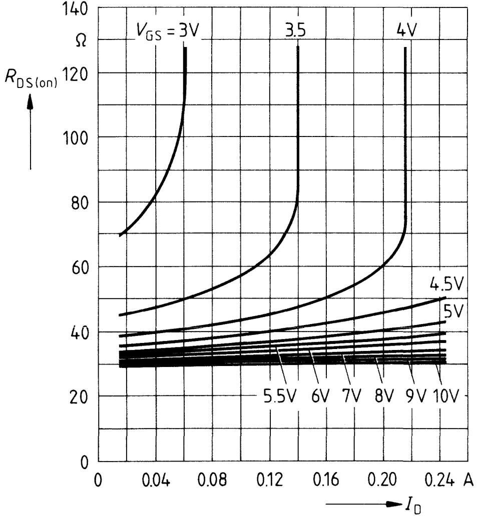
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

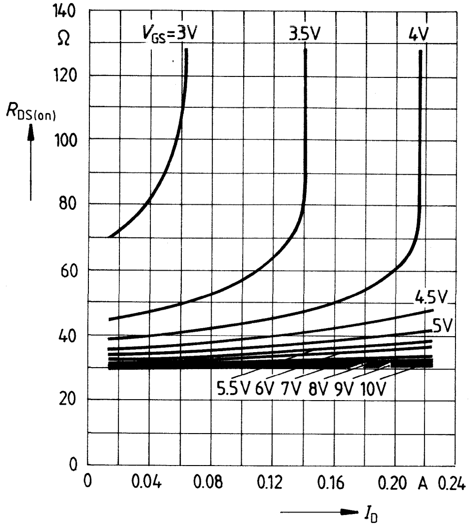


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSP 125



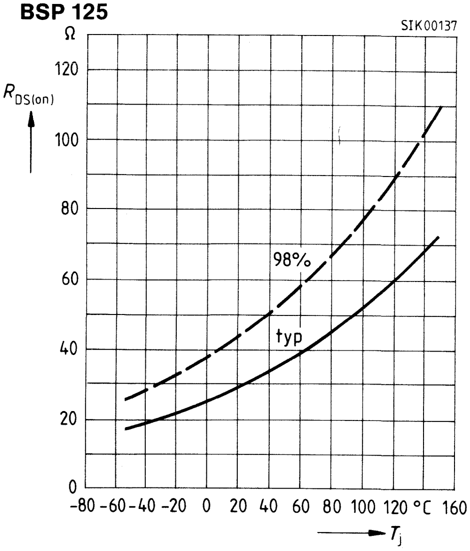
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BSS 125



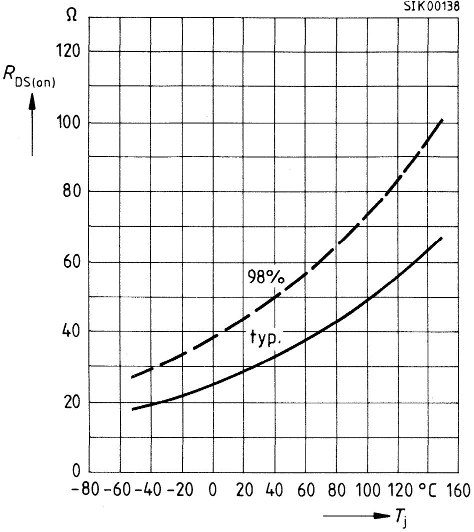
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.11 A, V_{GS} = 10 V, (spread)

BSP 125

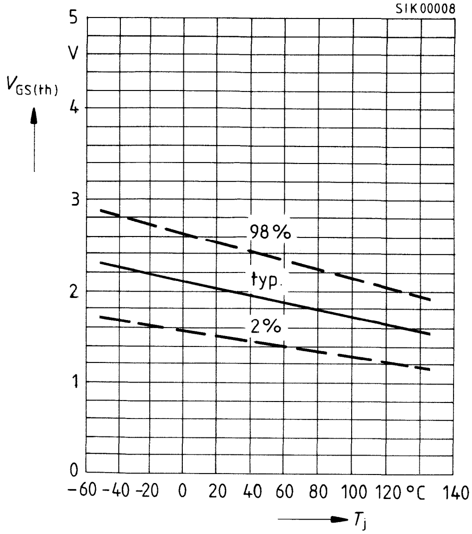


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.1 A, V_{GS} = 10 V, (spread)

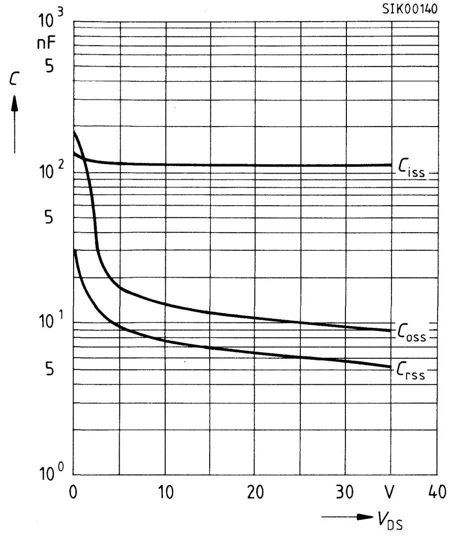
BSS 125



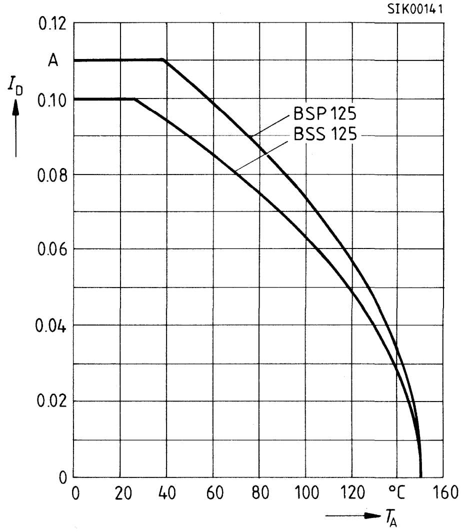
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



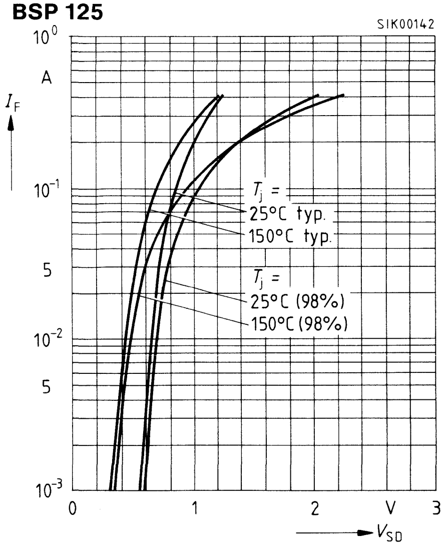
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



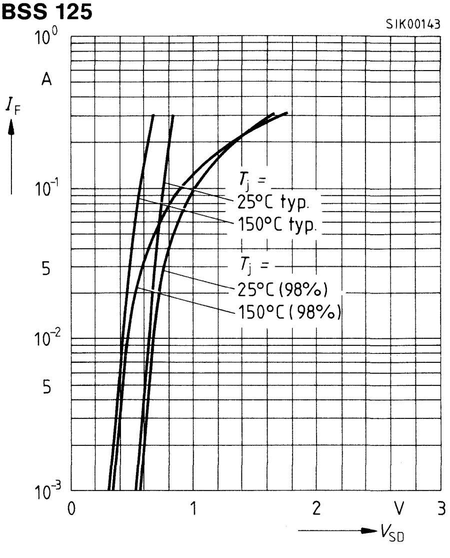
Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 125



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 125

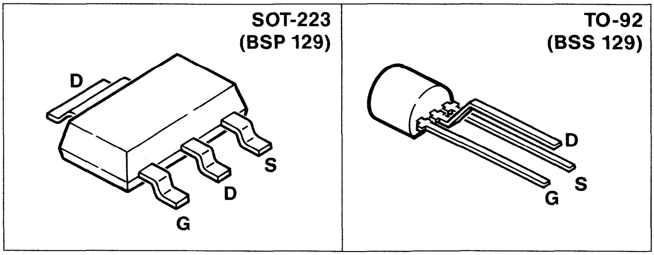


SIPMOS® Small-Signal Transistors

BSP 129
BSS 129

V_{DS} = 240 V
I_D = 0.19 / 0.15 A
$R_{DS(on)}$ = 20 Ω

- N channel
- Depletion mode
- Packages: SOT-223,
  TO-92 [1]



Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 129	Q67000-S030	Q67000-S073
BSS 129	Q62702-S510	–
BSS 129	Q62702-S510-P1 (grouped) [2]	–

Maximum Ratings

Parameter	Symbol	BSP 129	BSS 129	Unit
Drain-source voltage	V_{DS}	240		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	240		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 29 °C/37 °C	I_D	0.19	0.15	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.57	0.45	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - ambient [3]	R_{thJA}	≤ 83.3	≤ 125	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.
[2] Single groups are not available.
[3] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm^2 copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = -3$ V, $I_D = 0.25$ mA	$V_{(BR)DSV}$	240	–	–	V
Gate threshold voltage $V_{DS} = 3$ V, $I_D = 1$ mA	$V_{GS(th)}$	-1.8	-1.2	-0.7	
Drain-source cutoff current $V_{DS} = 240$ V, $V_{GS} = -3$ V	I_{DSV}				
$T_j = 25$ °C		–	–	100	nA
$T_j = 125$ °C		–	–	200	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 0$ V, $I_D = 0.014$ A	$R_{DS(on)}$	–	7.0	20	Ω

Dynamic characteristics

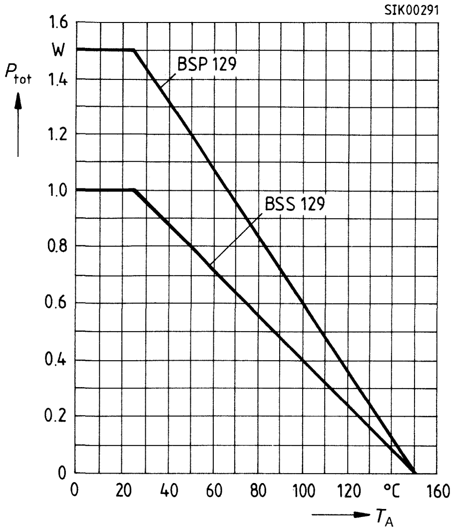
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.25$ A	g_{fs}	0.14	0.2	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	110	-	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	20	-	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	5	-	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.25$ A	$t_{d(on)}$	-	10	-	ns
	t_r	-	15	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.25$ A	$t_{d(off)}$	-	80	-	
	t_f	-	150	-	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

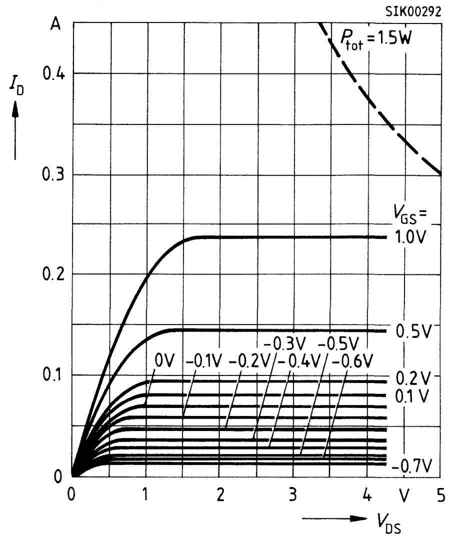
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_A = 25 °C	I_S	–	–	0.15	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	0.45	
Diode forward on-voltage I_F = 0.3 A, V_{GS} = 0	V_{SD}	–	0.7	1.4	V

Characteristics at T_j = 25 °C, unless otherwise specified.

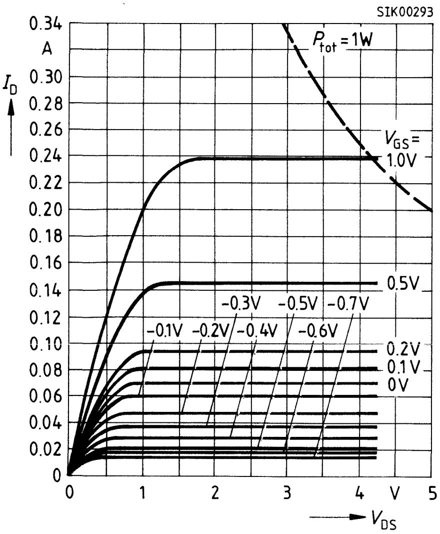
Total power dissipation $P_{tot} = f(T_A)$



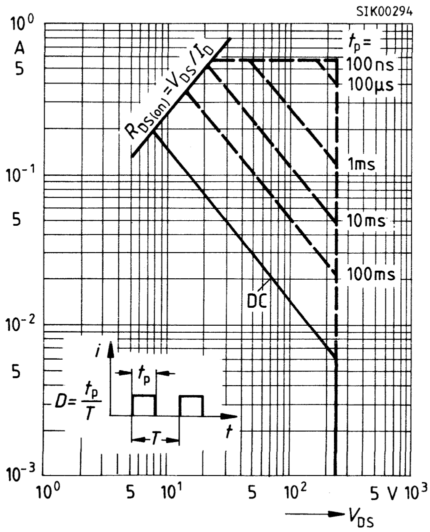
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 129



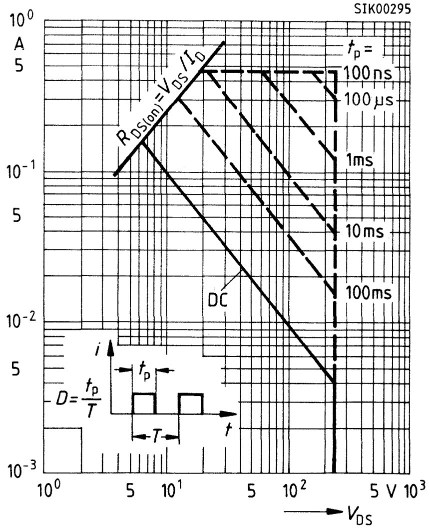
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 129



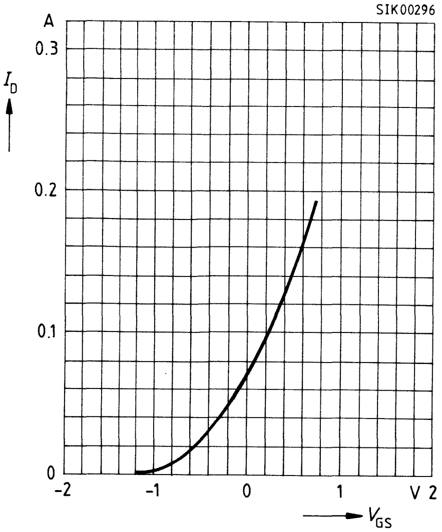
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 129



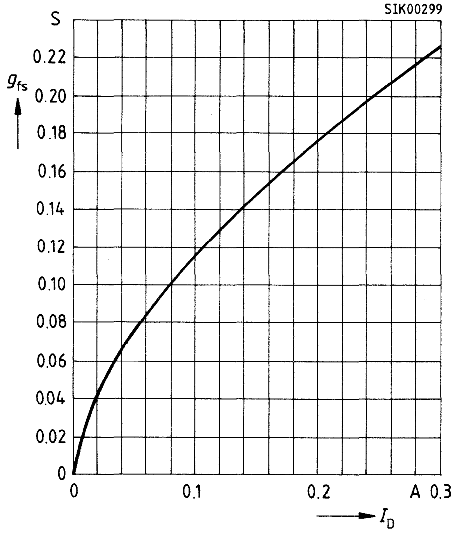
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 129



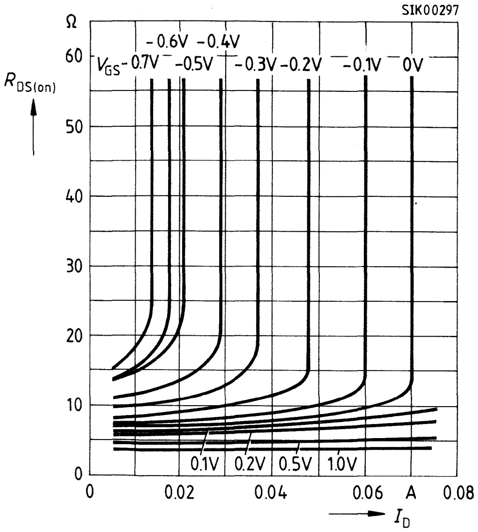
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



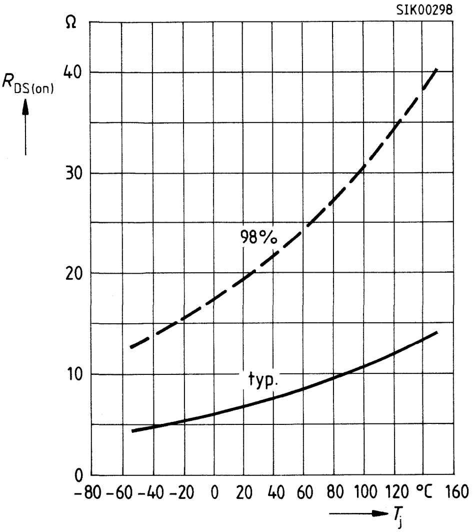
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



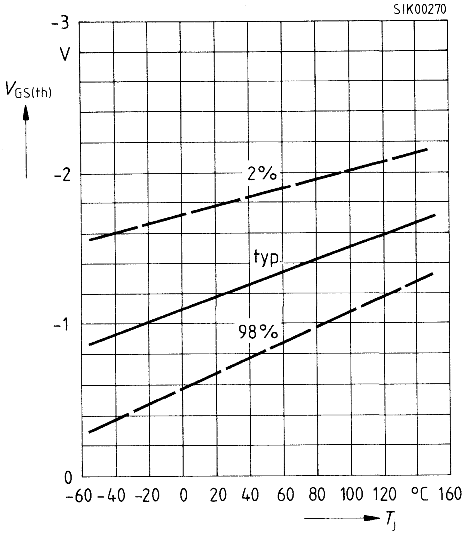
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



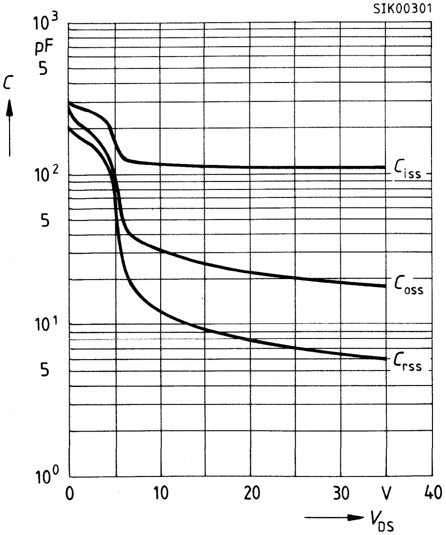
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.014$ A, $V_{GS} = 10$ V, (spread)



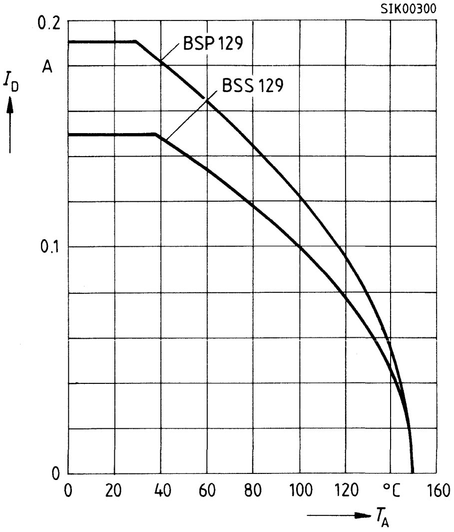
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



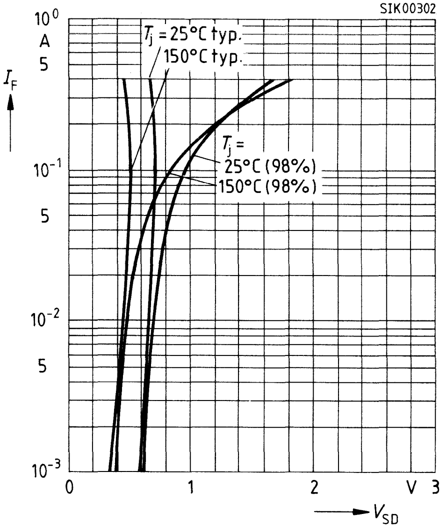
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80\ \mu s$, T_j, (spread)

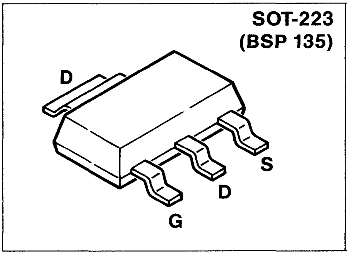


SIPMOS® Small-Signal Transistors

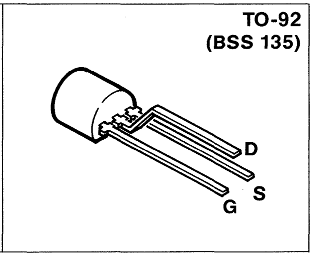
BSP 135
BSS 135

V_{DS} = **600 V**
I_D = **0.100 / 0.080 A**
$R_{DS(on)}$ = **60 Ω**

- N channel
- Depletion mode
- Packages: SOT-223, TO-92 1)



SOT-223
(BSP 135)



TO-92
(BSS 135)

Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 135	Q67000-S099	Q62702-S655
BSS 135	Q62702-S601	–

Maximum Ratings

Parameter	Symbol	BSP 135	BSS 135	Unit
Drain-source voltage	V_{DS}	600		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	600		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 27 °C/42 °C	I_D	0.100	0.080	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.30	0.24	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance	R_{thJA}			K/W
chip - ambient (without heat sink)			≤ 125	
chip - ambient 2)		≤ 83.3		
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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1) See chapter Package Outlines.
2) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = -3$ V, $I_D = 0.25$ mA	$V_{(BR)DSV}$	600	-	-	V
Gate threshold voltage $V_{DS} = 3$ V, $I_D = 1$ mA	$V_{GS(th)}$	-1.8	-1.5	-0.7	
Drain-source cutoff current $V_{DS} = 600$ V, $V_{GS} = -3$ V $T_j = 25$ °C $T_j = 125$ °C	I_{DSV}	 - -	 - -	 100 200	 nA µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-resistance $V_{GS} = 0$ V, $I_D = 0.01$ A	$R_{DS(on)}$	-	40	60	Ω

Dynamic characteristics

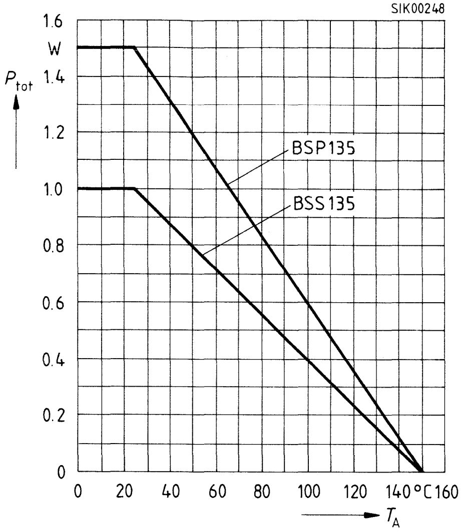
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.01$ A	g_{fs}	0.01	0.04	-	S
Input capacitance $V_{GS} = -3$ V, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	110	-	pF
Output capacitance $V_{GS} = -3$ V, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	20	-	
Reverse transfer capacitance $V_{GS} = -3$ V, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	5	-	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = -3$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.2$ A	$t_{d(on)}$	-	10	-	ns
	t_r	-	10	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = -3$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.2$ A	$t_{d(off)}$	-	15	-	
	t_f	-	25	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

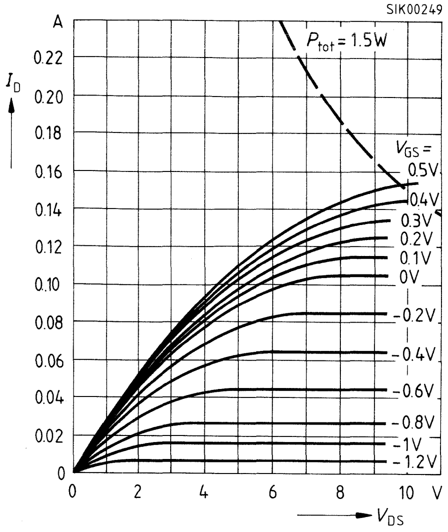
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSP 135		–	–	0.100	
	BSS 135		–	–	0.080	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSP 135		–	–	0.300	
	BSS 135		–	–	0.240	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.2$ A, $V_{GS} = 0$	BSP 135		–	0.90	1.30	
$I_F = 0.16$ A, $V_{GS} = 0$	BSS 135		–	0.80	1.30	

Characteristics at T_j = 25 °C, unless otherwise specified.

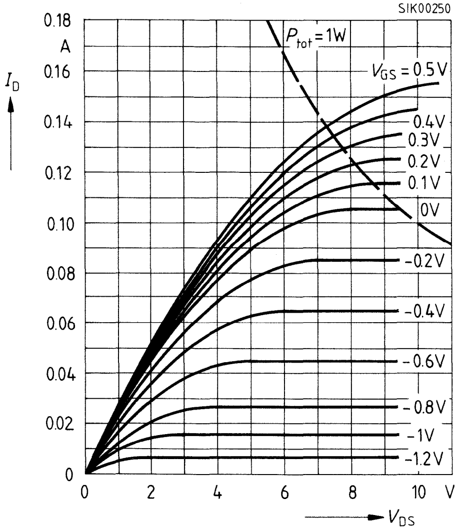
Total power dissipation $P_{tot} = f(T_A)$



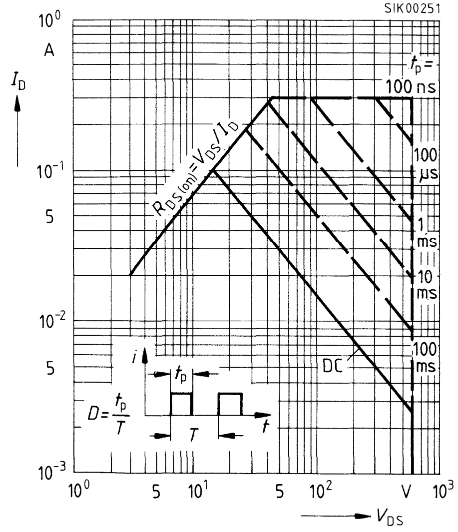
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 135



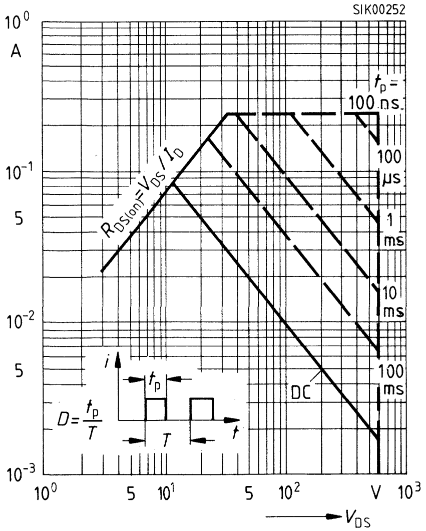
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 135



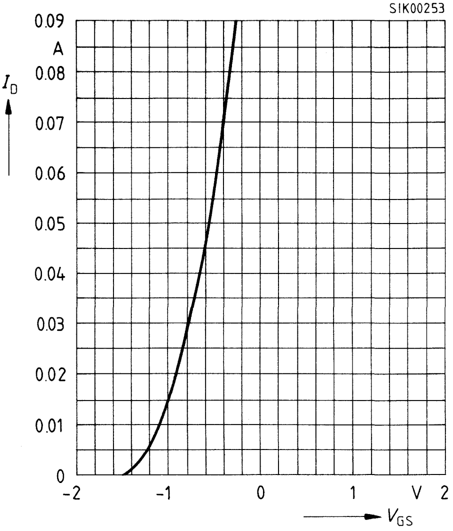
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 135



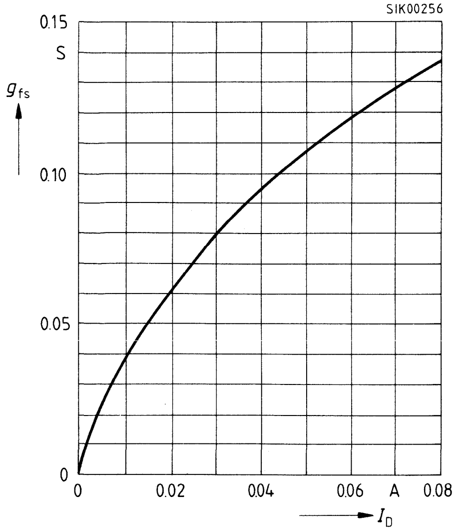
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BSS 135



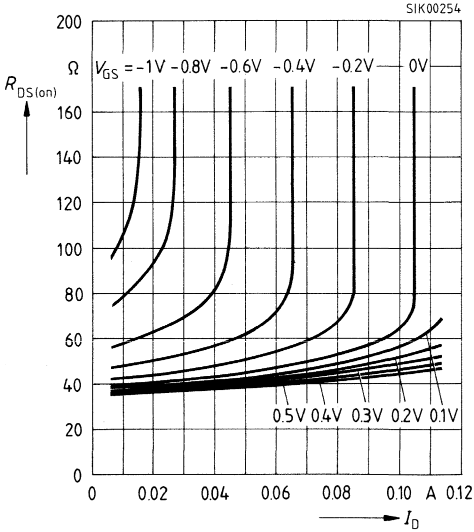
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$



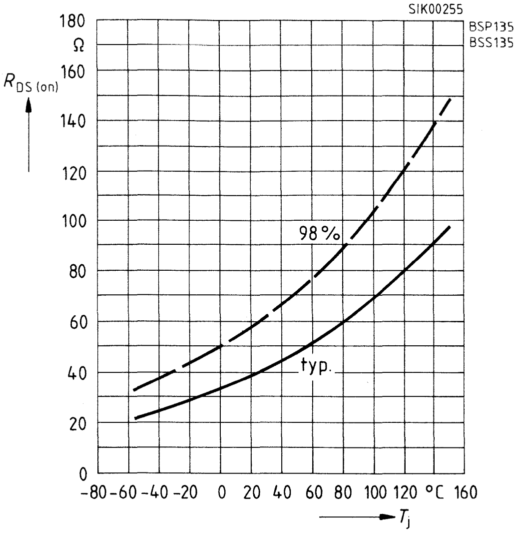
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



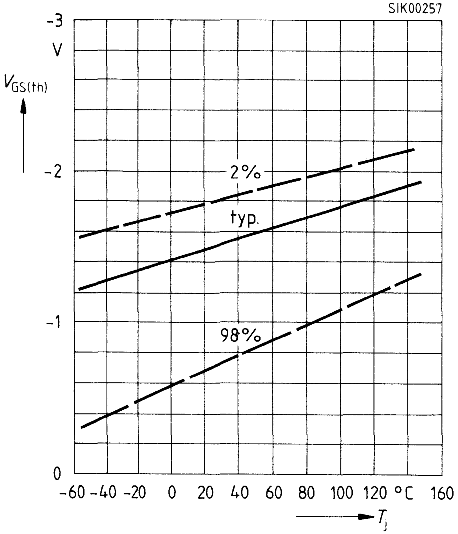
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



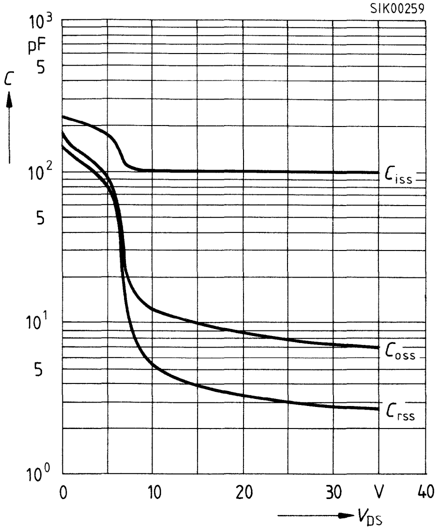
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.01$ A, $V_{GS} = 10$ V, (spread)



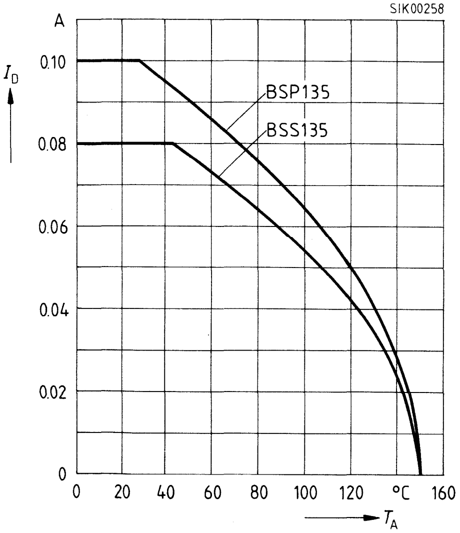
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

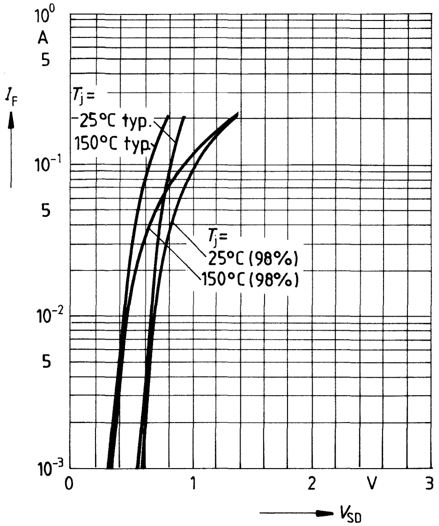


Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



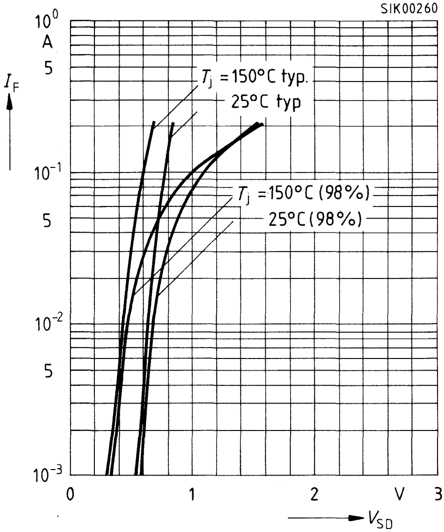
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

BSP 135



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

BSS 135



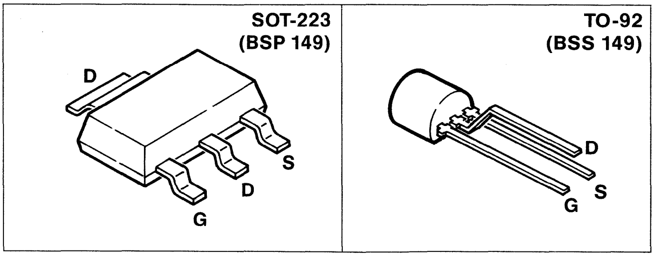
SIEMENS

SIPMOS® Small-Signal Transistors

BSP 149
BSS 149

V_{DS} = 200 V
I_D = 0.44 / 0.35 A
$R_{DS(on)}$ = 3.5 Ω

- N channel
- Depletion mode
- Packages: SOT-223, TO-92 1)



Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 149	Q67000-S098	Q67000-S071
BSS 149	Q62702-S623	–

Maximum Ratings

Parameter	Symbol	BSP 149	BSS 149	Unit
Drain-source voltage	V_{DS}	200		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 28 °C/34 °C	I_D	0.44	0.35	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	1.32	1.05	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance	R_{thJA}			K/W
chip - ambient (without heat sink)			≤ 125	
chip - ambient 2)		≤ 83.3		
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

1) See chapter Package Outlines.
2) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

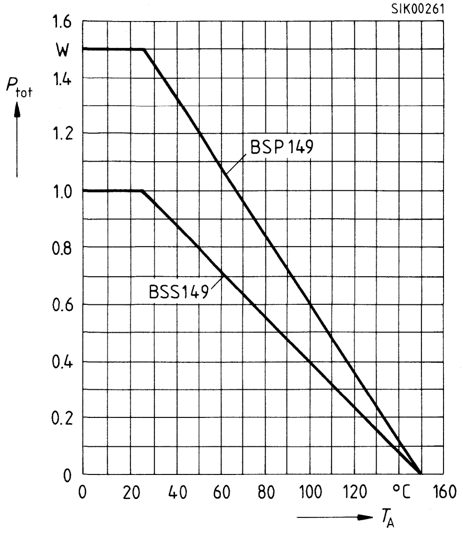
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = -3$ V, $I_D = 0.25$ mA	$V_{(BR)DSV}$	200	–	–	V
Gate threshold voltage $V_{DS} = 3$ V, $I_D = 1$ mA	$V_{GS(th)}$	-1.8	-1.2	-0.7	
Drain-source cutoff current $V_{DS} = 200$ V, $V_{GS} = -3$ V	I_{DSV}				µA
$T_j = 25$ °C		–	–	0.2	
$T_j = 125$ °C		–	–	200	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 0$ V, $I_D = 0.03$ A BSP 149		–	2.5	3.5	
$I_D = 0.05$ A BSS 149		–	2.5	3.5	
Dynamic characteristics					
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.44$ A BSP 149		0.4	0.7	–	
$I_D = 0.35$ A BSS 149		0.4	0.6	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	400	–	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	50	–	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	15	–	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	15	–	ns
$I_D = 0.29$ A	t_r	–	10	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	100	–	
$I_D = 0.29$ A	t_f	–	40	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

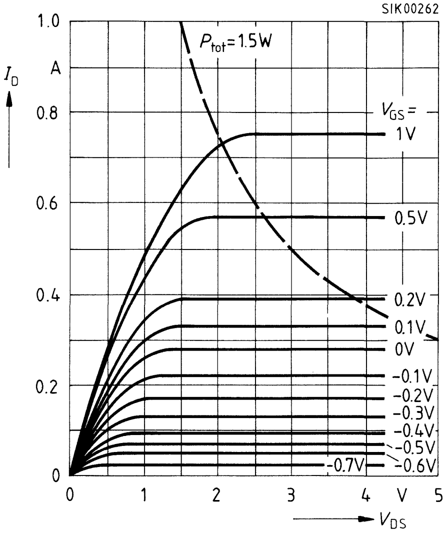
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSP 149		–	–	0.44	
	BSS 149		–	–	0.35	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSP 149		–	–	1.32	
	BSS 149		–	–	1.05	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.88$ A, $V_{GS} = 0$	BSP 149		–	0.9	1.2	
$I_F = 0.7$ A, $V_{GS} = 0$	BSS 149		–	0.8	1.2	

Characteristics at T_j = 25 °C, unless otherwise specified.

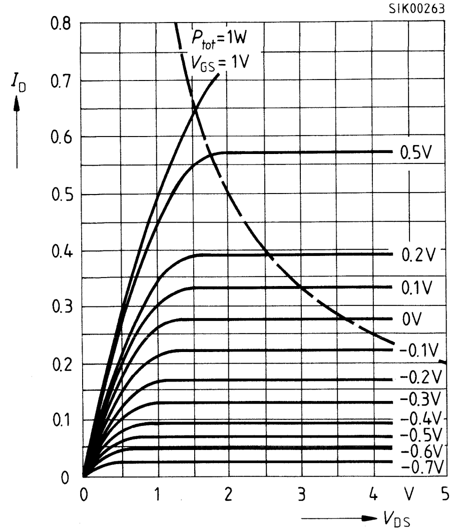
Total power dissipation $P_{tot} = f(T_A)$



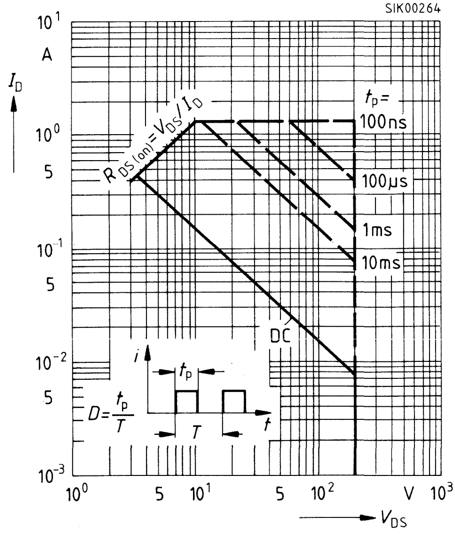
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 149



Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 149

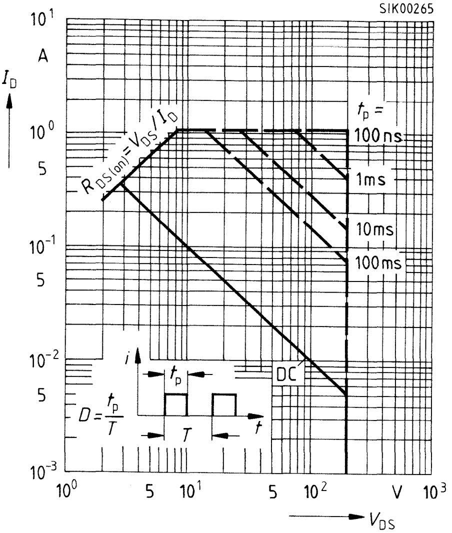


Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 149

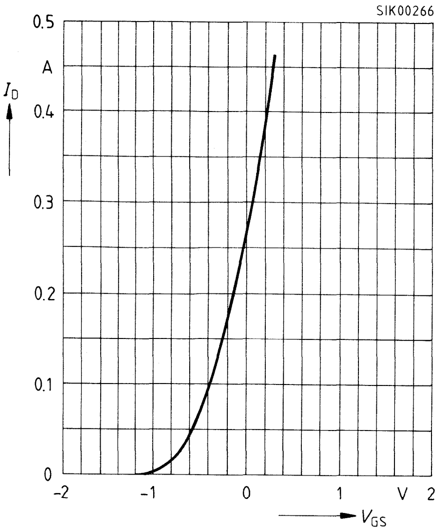


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

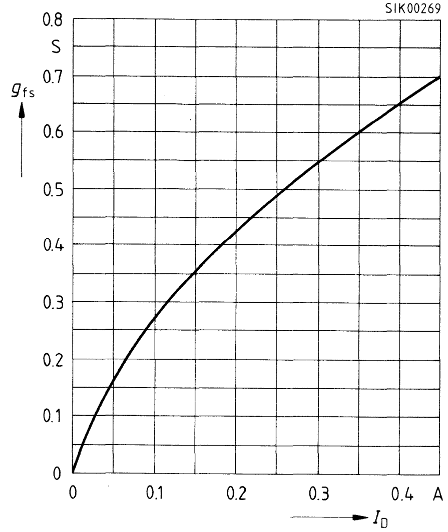
BSS 149



Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

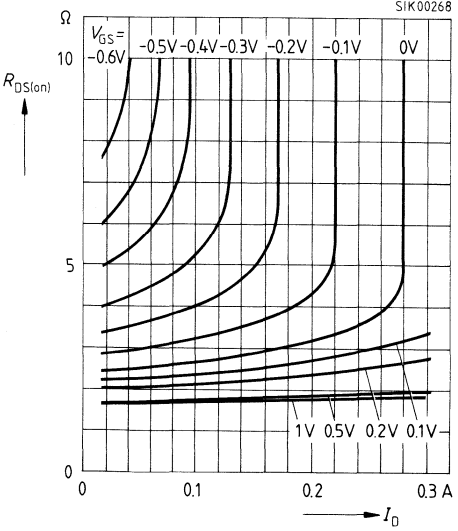


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



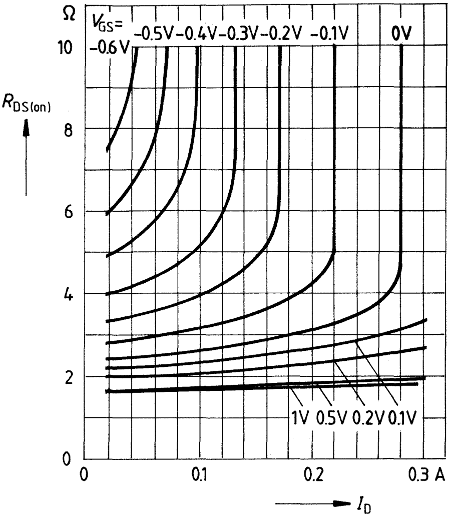
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BSP 149

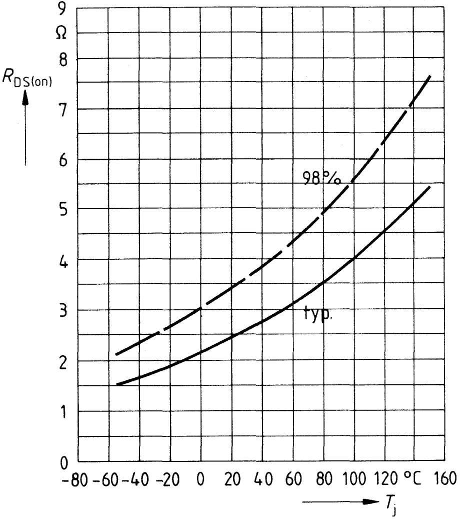


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

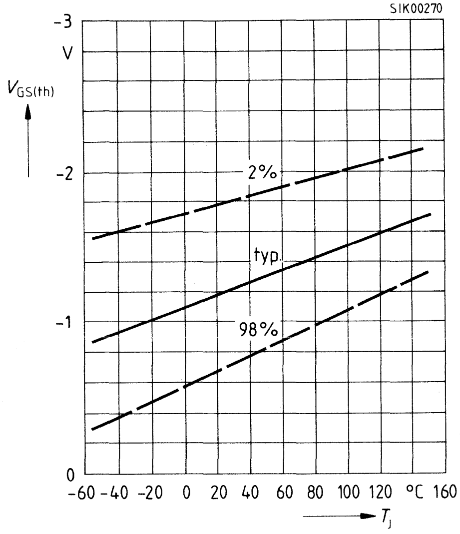
BSS 149



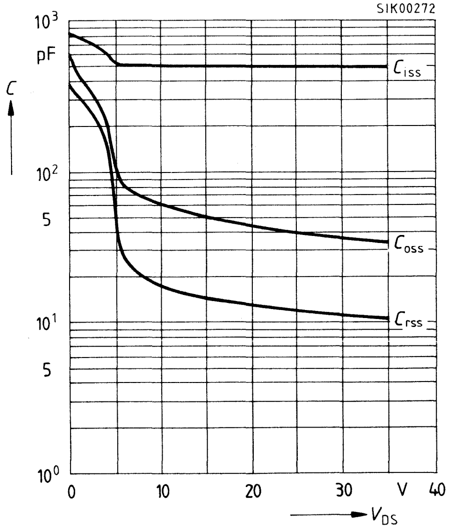
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.03 A/0.05 A, V_{GS} = 10 V,
(spread)



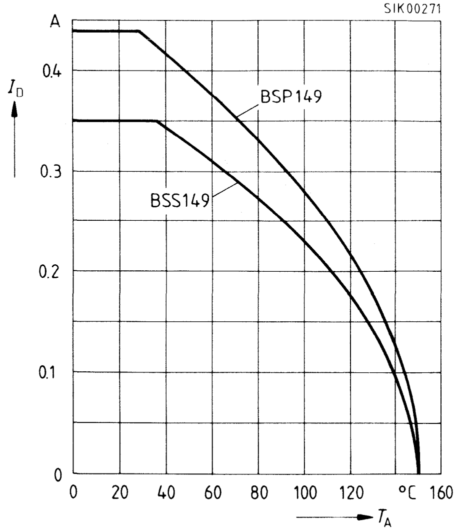
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



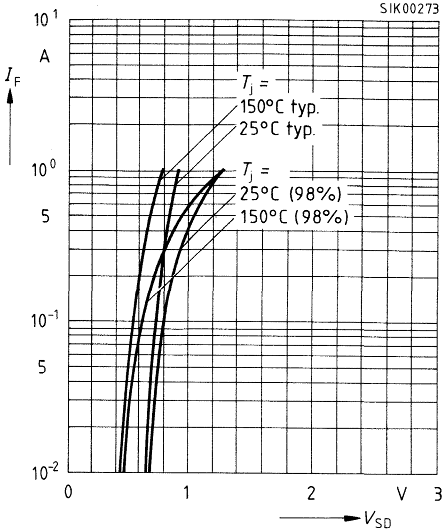
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



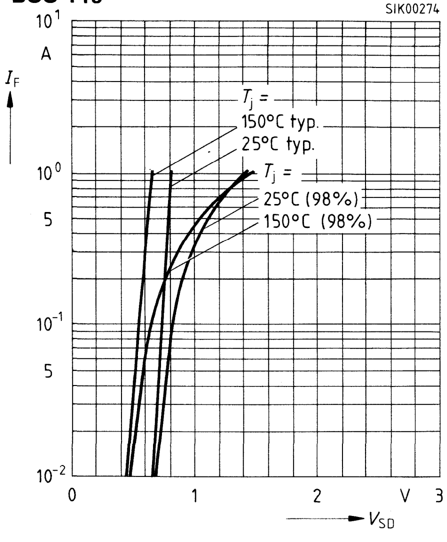
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 149



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 149



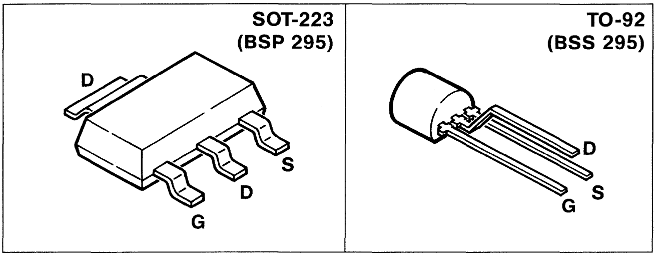
SIEMENS

SIPMOS® Small-Signal Transistors

BSP 295
BSS 295

V_{DS} = 50 V
I_D = 1.7 / 1.4 A
$R_{DS(on)}$ = 0.3 Ω

- N channel
- Enhancement mode
- Packages: SOT-223, TO-92 [1])



Type	Marking	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 295	–	Q67000-S095	Q67000-S066
BSS 295	–	Q62702-S603	

Maximum Ratings

Parameter	Symbol	BSP 295	BSS 295	Unit
Drain-source voltage	V_{DS}	50		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 27 °C/24 °C	I_D	1.7	1.4	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	6.8	5.6	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - ambient [2])	R_{thJA}	≤ 83.3	≤ 125	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.
[2]) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	BSP 295	$V_{GS(th)}$	0.8	1.2	2.0	
	BSS 295		0.8	1.4	2.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$		I_{DSS}				µA
$T_j = 25$ °C			–	0.1	1.0	
$T_j = 125$ °C			–	8.0	50	
$V_{DS} = 30$ V, $V_{GS} = 0$ $T_j = 25$ °C			–	–	100	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	10	100	nA
Drain-source on-resistance		$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 1.7$ A	BSP 295		–	0.2	0.3	
$I_D = 1.4$ A	BSS 295		–	0.25	0.3	
$V_{GS} = 4.5$ V, $I_D = 1.7$ A	BSP 295		–	0.4	0.50	
$I_D = 1.4$ A	BSS 295		–	0.45	0.50	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

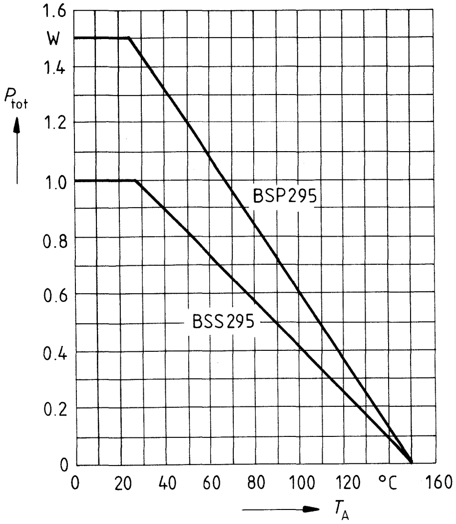
Parameter		Symbol	Values min.	Values typ.	Values max.	Unit
Dynamic characteristics						
Forward transconductance		g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.7$ A	BSP 295		0.5	1.4	–	
$I_D = 1.4$ A	BSS 295		0.5	1.3	–	
Input capacitance		C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 295		–	370	550	
	BSS 295		–	400	–	
Output capacitance		C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 295		–	110	170	
	BSS 295		–	50	–	
Reverse transfer capacitance		C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 295		–	40	60	
	BSS 295		–	15	–	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)		$t_{d(on)}$				ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω	BSP 295		–	8	12	
$I_D = 0.29$ A	BSS 295		–	15	20	
	BSP 295	t_r	–	15	25	
	BSS 295		–	10	15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)		$t_{d(off)}$				
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω	BSP 295		–	100	150	
$I_D = 0.29$ A	BSS 295		–	100	130	
	BSP 295	t_f	–	75	110	
	BSS 295		–	40	55	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

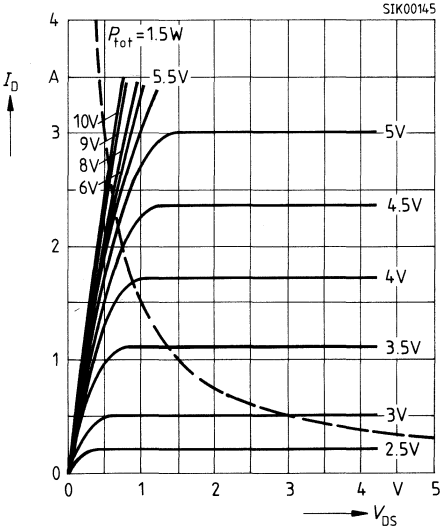
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current T_A = 25 °C	BSP 295	I_S	–	–	1.7	A
	BSS 295		–	–	1.4	
Pulsed reverse drain current T_A = 25 °C	BSP 295	I_{SM}	–	–	6.8	
	BSS 295		–	–	5.6	
Diode forward on-voltage I_F = 3.4 A, V_{GS} = 0	BSP 295	V_{SD}	–	1.0	1.5	V
I_F = 2.8 A, V_{GS} = 0	BSS 295		–	1.0	1.5	

Characteristics at T_j = 25 °C, unless otherwise specified.

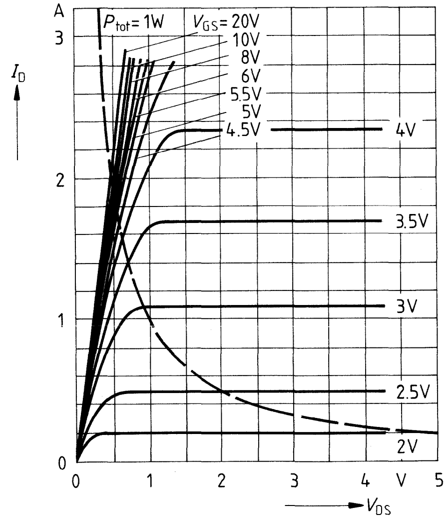
Total power dissipation $P_{tot} = f(T_A)$



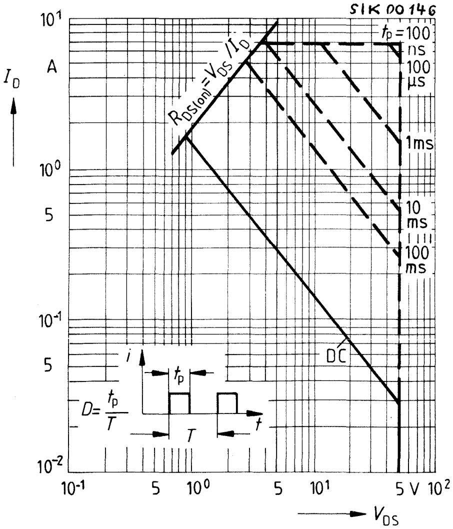
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 295



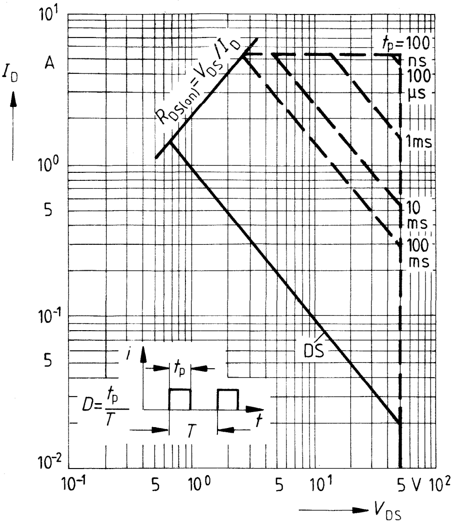
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 295



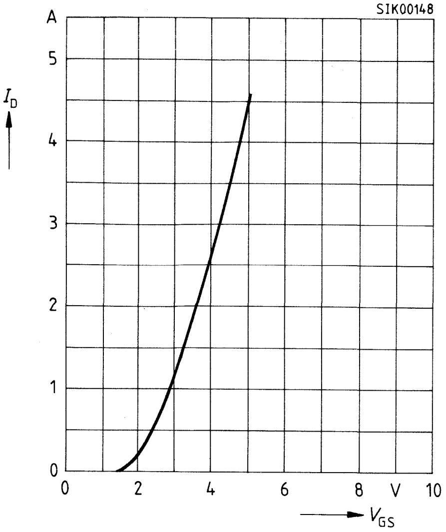
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 295



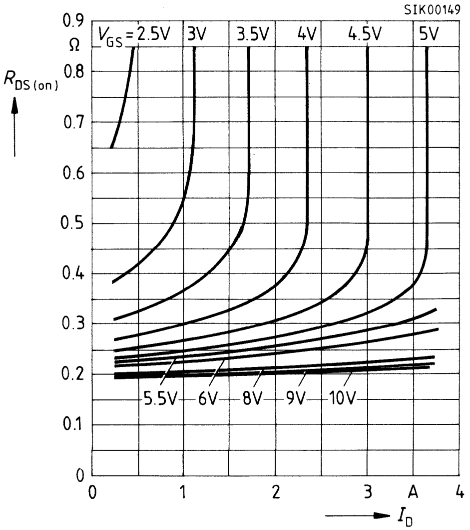
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 295



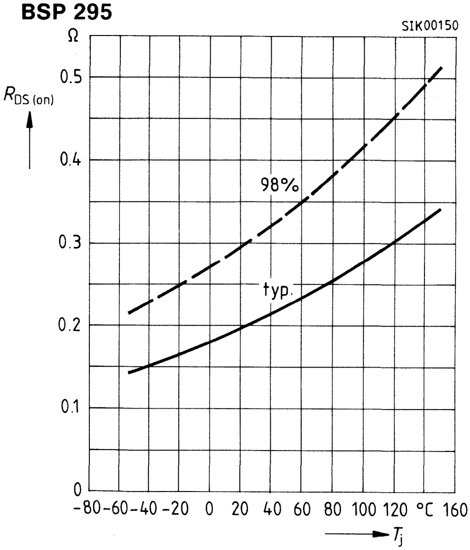
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



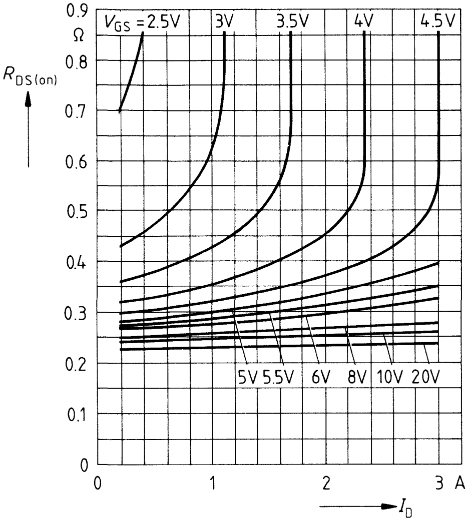
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



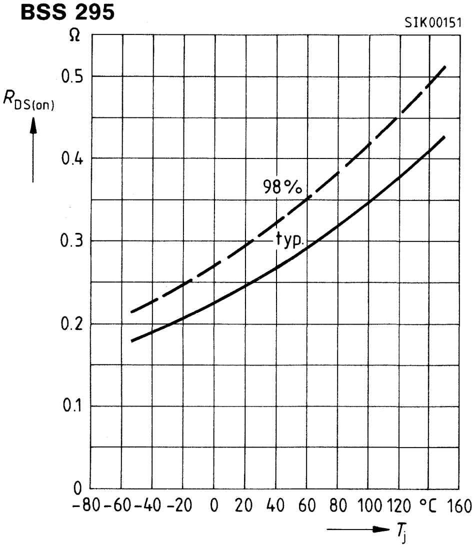
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.7$ A, $V_{GS} = 10$ V, (spread)
BSP 295



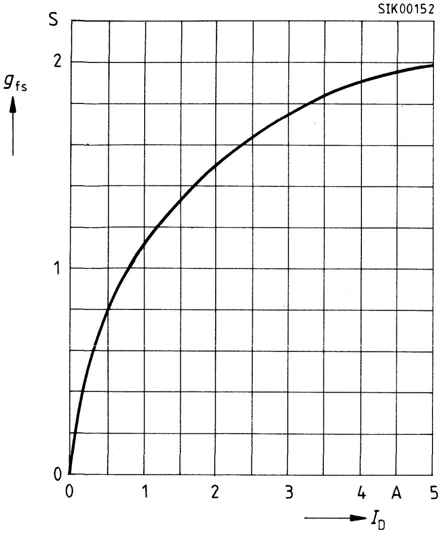
Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 295



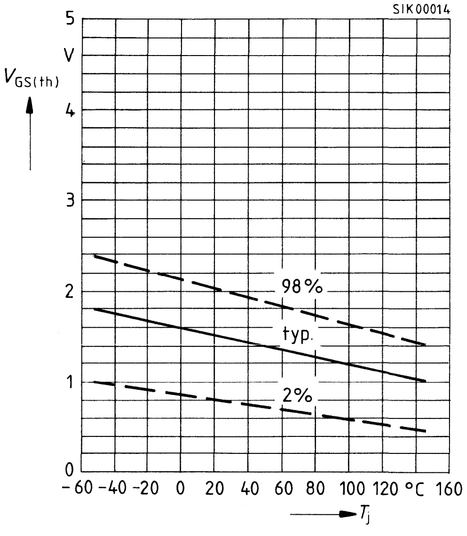
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.4$ A, $V_{GS} = 10$ V, (spread)
BSS 295



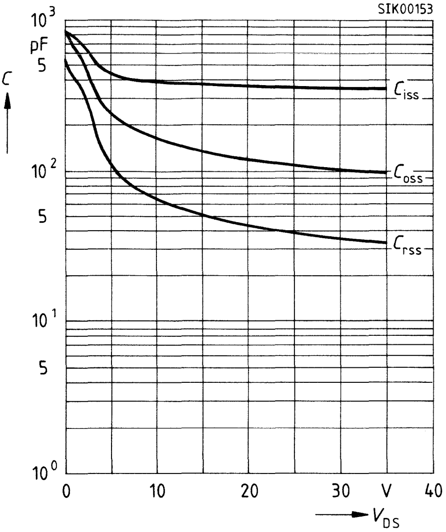
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



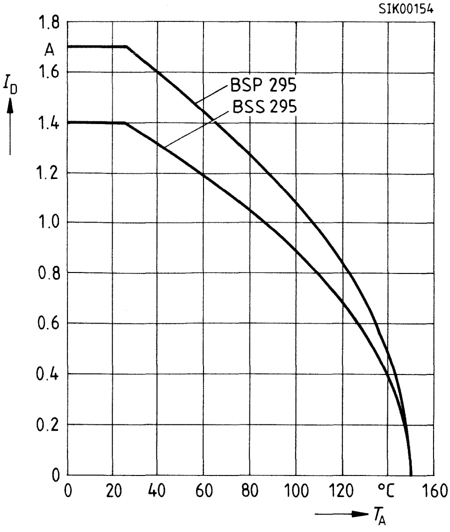
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



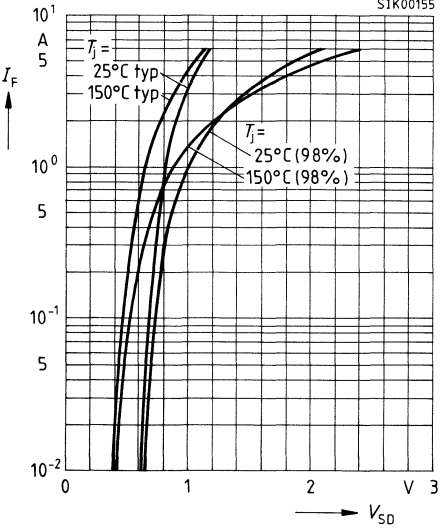
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



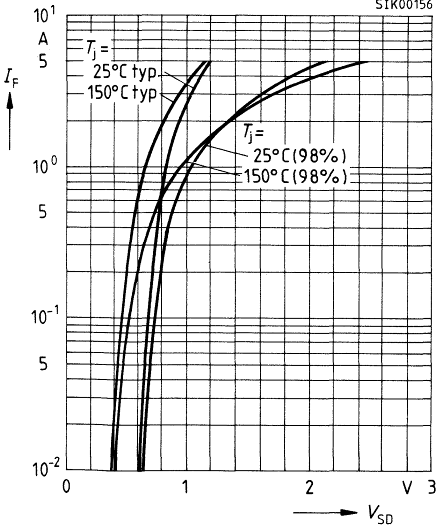
Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 295



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 295



SIEMENS

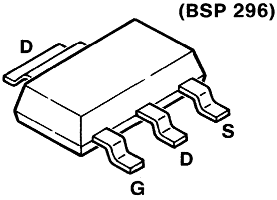
SIPMOS® Small-Signal Transistors

BSP 296
BSS 296

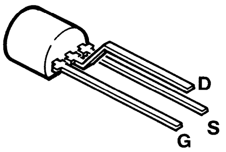
V_{DS} = **100 V**
I_D = **1 / 0.80 A**
$R_{DS(on)}$ = **0.8 Ω**

- N channel
- Enhancement mode
- Packages: SOT-223, TO-92 [1])

SOT-223
(BSP 296)



TO-92
(BSS 296)



Type	**Ordering code for version in bulk**	**Ordering code for version on 12-mm tape**
BSP 296	Q67000-S096	Q67000-S067
BSS 296	Q62702-S615	–

Maximum Ratings

Parameter	**Symbol**	**BSP 296**	**BSS 296**	**Unit**
Drain-source voltage	V_{DS}	100		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	$\hat{V}_{gs}$	± 20		
Continuous drain current, T_A = 21 °C/25 °C	I_D	1	0.80	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	4.0	3.2	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance	R_{thJA}			K/W
chip - ambient (without heat sink)			≤ 125	
chip - ambient[2])		≤ 83.3		
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.
[2]) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	BSP 296	$V_{GS(th)}$	0.8	1.2	2.0	
	BSS 296		0.8	1.4	2.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C		I_{DSS}	–	0.1	1.0	µA
$T_j = 125$ °C			–	8.0	50.0	
$V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C			–	–	100	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 1.0$ A	BSP 296	$R_{DS(on)}$	–	0.55	0.8	Ω
$I_D = 0.80$ A	BSS 296		–	–	0.8	
$V_{GS} = 4.5$ V, $I_D = 1.0$ A	BSP 296		–	0.95	1.4	
$I_D = 0.80$ A	BSS 296		–	–	1.00	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

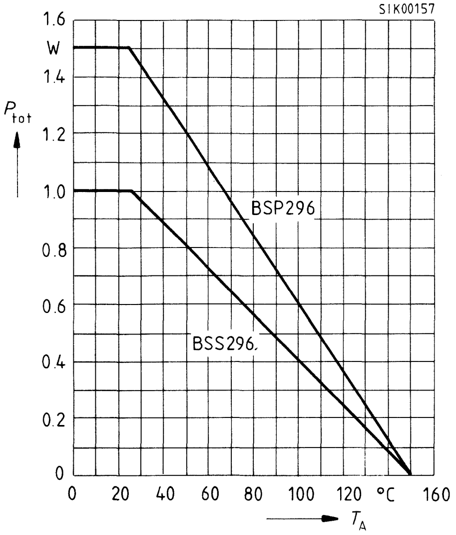
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Dynamic characteristics						
Forward transconductance		g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.0$ A	BSP 296		0.5	1.1	–	
$I_D = 0.80$ A	BSS 296		0.5	1.0	–	
Input capacitance		C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 296		–	400	600	
	BSS 296		–	400	–	
Output capacitance		C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 296		–	65	100	
	BSS 296		–	50	–	
Reverse transfer capacitance		C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 296		–	20	30	
	BSS 296		–	15	–	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)		$t_{d(on)}$				ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω	BSP 296		–	8	12	
$I_D = 0.29$ A	BSS 296		–	15	20	
	BSP 296	t_r	–	15	25	
	BSS 296		–	10	15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)		$t_{d(off)}$				
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω	BSP 296		–	100	150	
$I_D = 0.29$ A	BSS 296		–	100	130	
	BSP 296	t_f	–	75	110	
	BSS 296		–	40	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

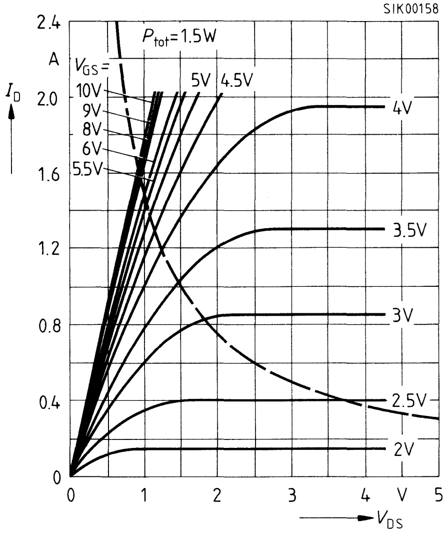
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSP 296		–	–	1.0	
	BSS 296		–	–	0.80	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSP 296		–	–	4.0	
	BSS 296		–	–	3.2	
Diode forward on-voltage		V_{SD}				V
$I_F = 2.0$ A, $V_{GS} = 0$	BSP 296		–	0.9	1.3	
$I_F = 1.6$ A, $V_{GS} = 0$	BSS 296		–	0.9	1.3	

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

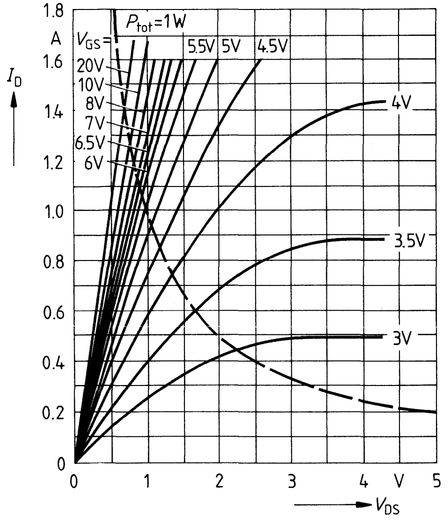
Total power dissipation $P_{tot} = f(T_A)$



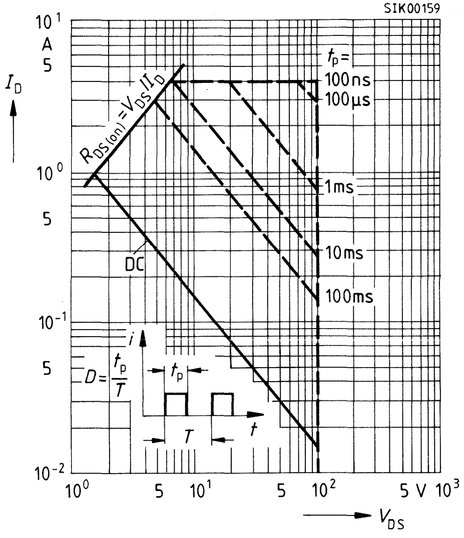
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSP 296



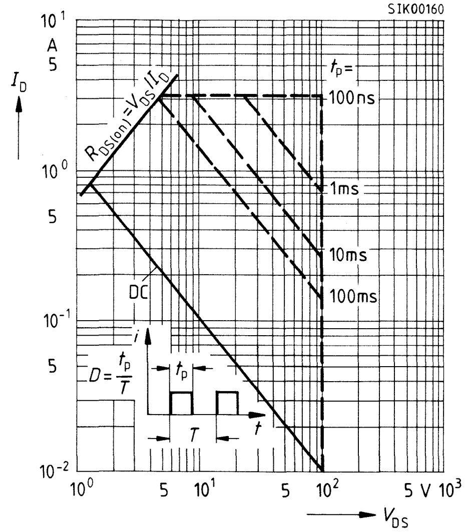
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BSS 296



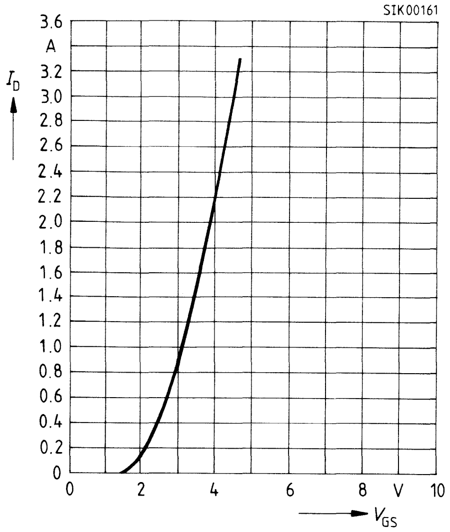
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BSP 296



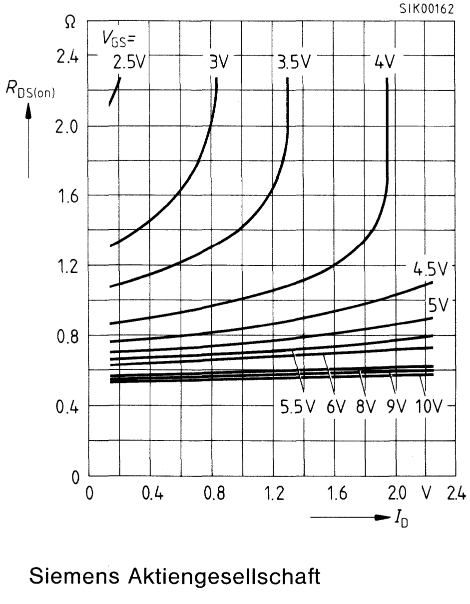
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 296



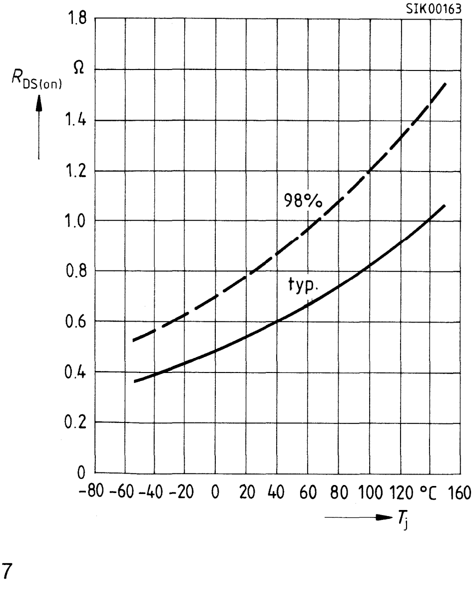
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



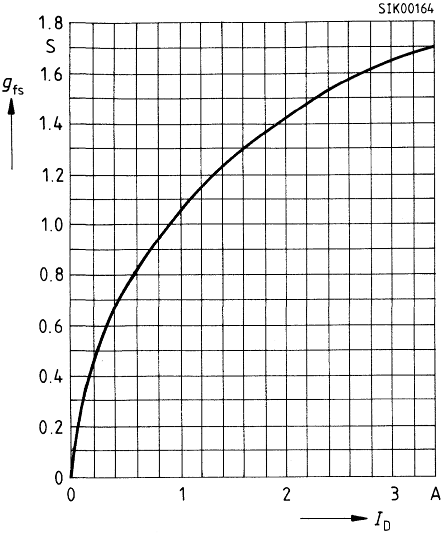
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



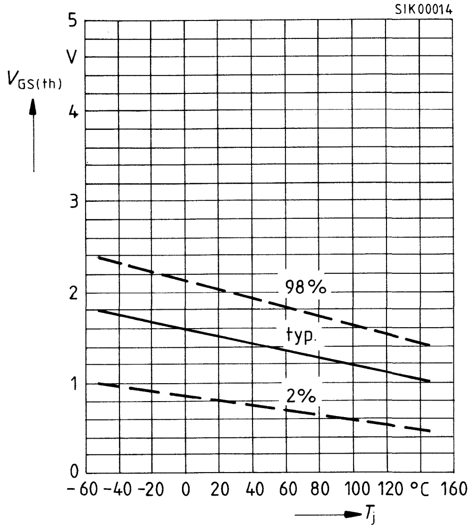
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.0$ A (BSP 296),
$I_D = 0.80$ A (BSS 296), $V_{GS} = 10$ V, (spread)



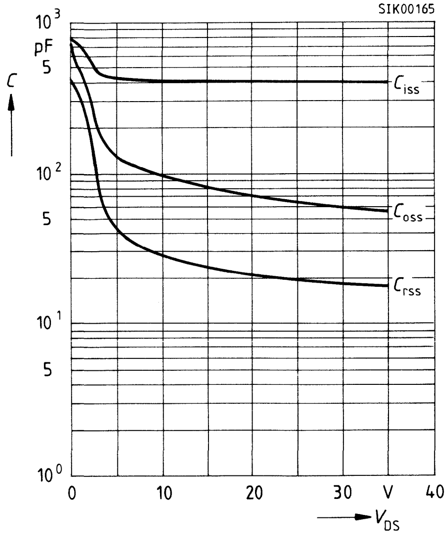
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



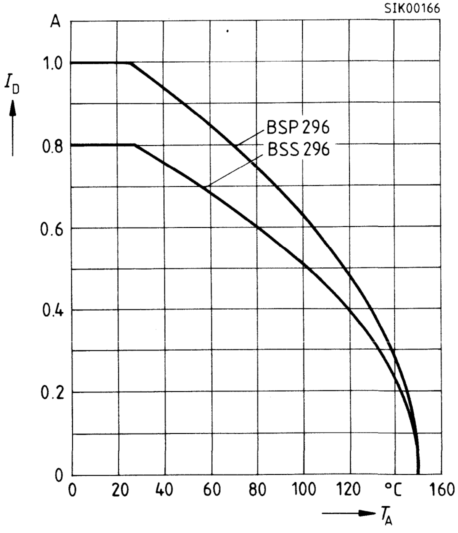
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

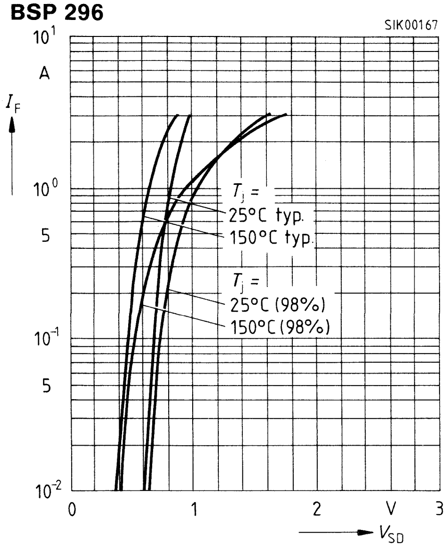


Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



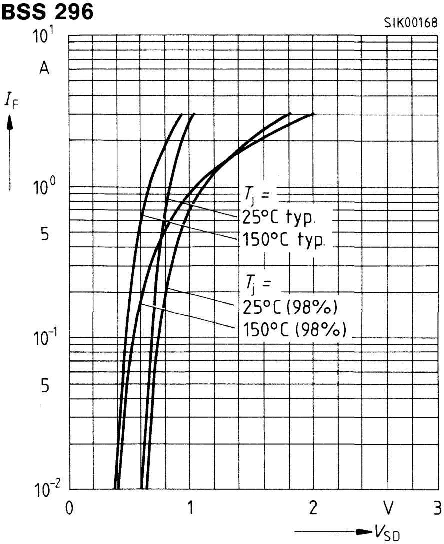
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

BSP 296



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)

BSS 296



SIEMENS

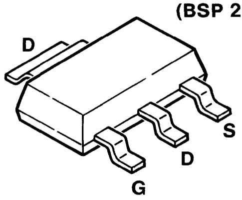
SIPMOS® Small-Signal Transistors

BSP 297
BSS 297

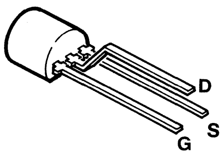
V_{DS} = 200 V
I_D = 0.6 / 0.48 A
$R_{DS(on)}$ = 2.0 Ω

- N channel
- Enhancement mode
- Packages: SOT-223, TO-92 [1])

SOT-223
(BSP 297)



TO-92
(BSS 297)



Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 297	Q67000-S097	Q67000-S068
BSS 297	Q62702-S616	–

Maximum Ratings

Parameter	Symbol	BSP 297	BSS 297	Unit
Drain-source voltage	V_{DS}	200		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 20 °C/25 °C	I_D	0.6	0.48	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	2.4	1.92	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance	R_{thJA}			K/W
chip - ambient (without heat sink)			≤ 125	
chip - ambient [2])		≤ 83.3		
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	1.0	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.

[2]) Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	200	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	BSP 297	$V_{GS(th)}$	0.8	1.2	2.0	
	BSS 297		0.8	1.4	2.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C		I_{DSS}	–	0.1	1.0	µA
$T_j = 125$ °C			–	8.0	50.0	
$V_{DS} = 130$ V, $V_{GS} = 0$ $T_j = 25$ °C			–	–	100	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 0.6$ A	BSP 297	$R_{DS(on)}$	–	1.6	2.0	Ω
$I_D = 0.45$ A	BSS 297		–	–	2.0	
$V_{GS} = 4.5$ V, $I_D = 0.6$ A	BSP 297		–	2.0	3.3	
$I_D = 0.45$ A	BSS 297		–	–	3.3	

Electrical Characteristics (continued)
at $T_j = 25\ °C$, unless otherwise specified.

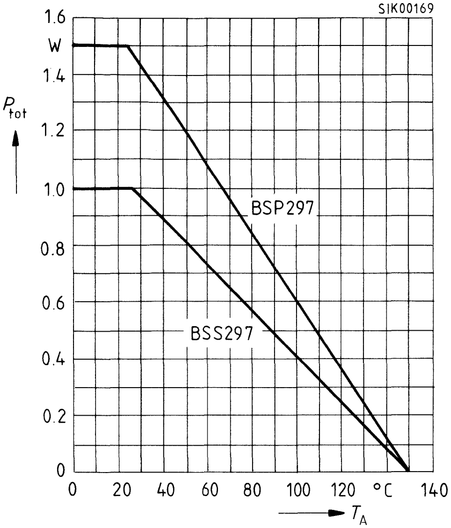
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.6$ A $I_D = 0.45$ A	BSP 297 BSS 297	g_{fs}	0.5 0.5	0.9 1.0	– –	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 297 BSS 297	C_{iss}	– –	420 400	630 –	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 297 BSS 297	C_{oss}	– –	40 50	60 –	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSP 297 BSS 297	C_{rss}	– –	10 15	15 –	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 0.29$ A	BSP 297 BSS 297	$t_{d(on)}$	– –	8 15	12 20	ns
	BSP 297 BSS 297	t_r	– –	15 10	25 15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 0.29$ A	BSP 297 BSS 297	$t_{d(off)}$	– –	100 100	150 130	
	BSP 297 BSS 297	t_f	– –	75 40	110 55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

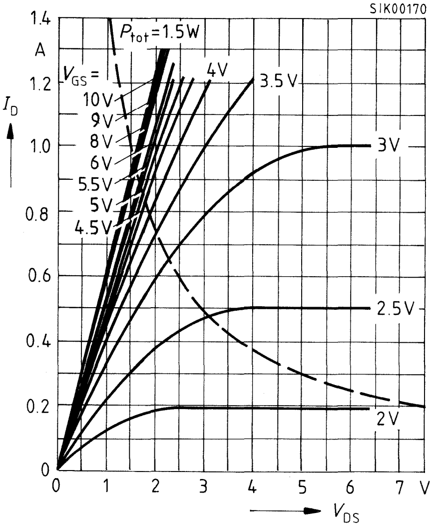
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSP 297		–	–	0.6	
	BSS 297		–	–	0.48	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSP 297		–	–	2.4	
	BSS 297		–	–	1.92	
Diode forward on-voltage		V_{SD}				V
$I_F = 1.2$ A, $V_{GS} = 0$	BSP 297		–	0.85	1.1	
$I_F = 0.96$ A, $V_{GS} = 0$	BSS 297		–	0.9	1.1	

Characteristics at T_j = 25 °C, unless otherwise specified.

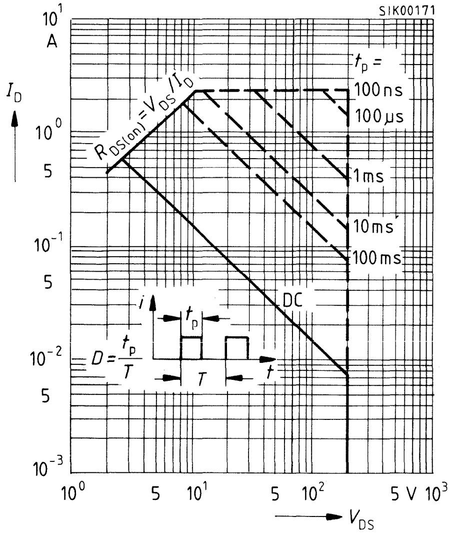
Total power dissipation $P_{tot} = f(T_A)$



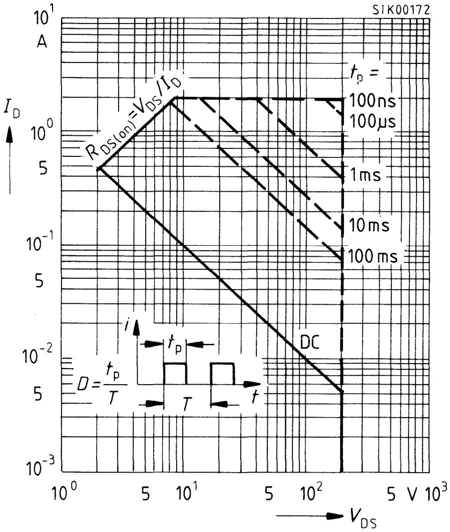
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSP 297



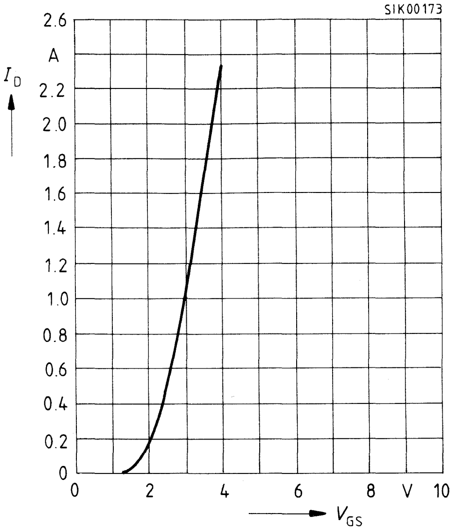
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSP 297



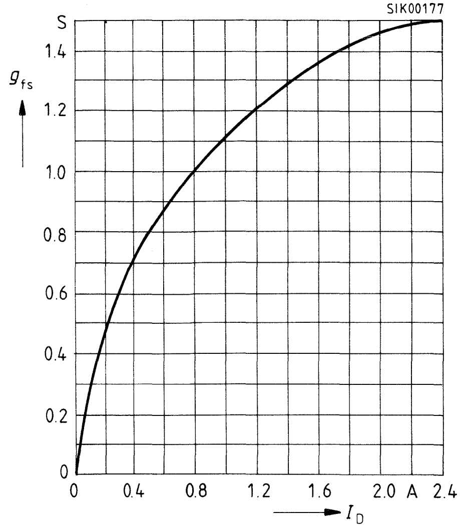
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSS 297



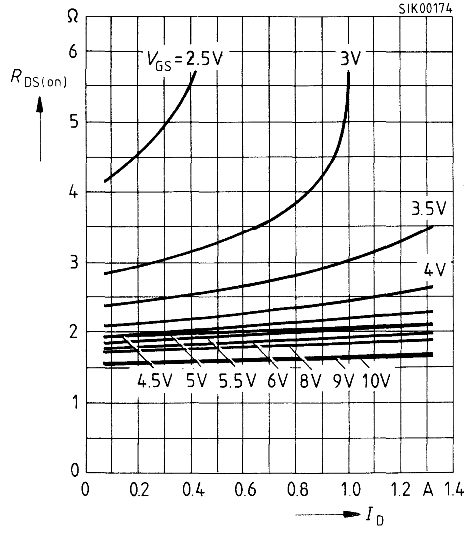
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



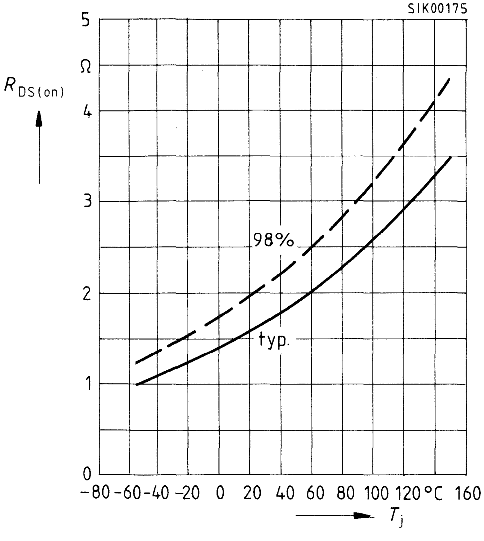
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



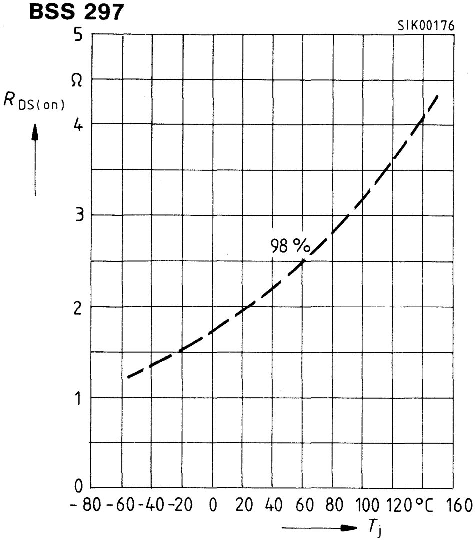
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSP 297



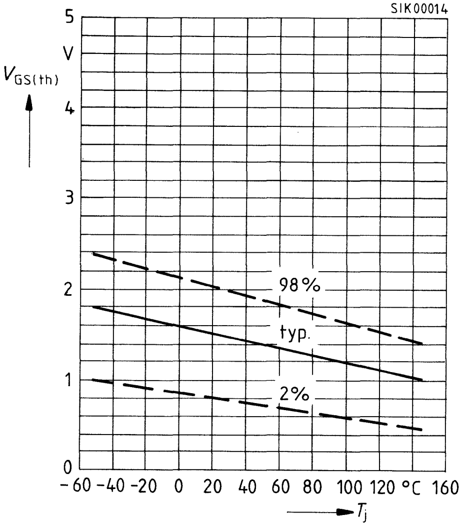
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.6$ A, $V_{GS} = 10$ V, (spread)
BSP 297



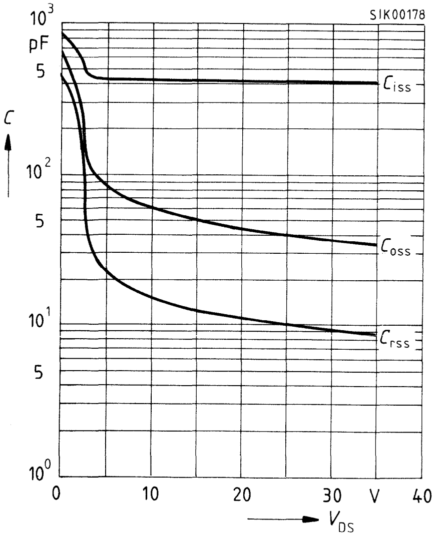
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.45$ A, $V_{GS} = 10$ V, (spread)
BSS 297



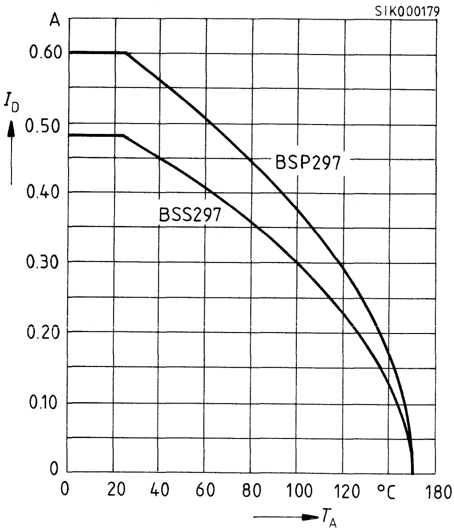
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



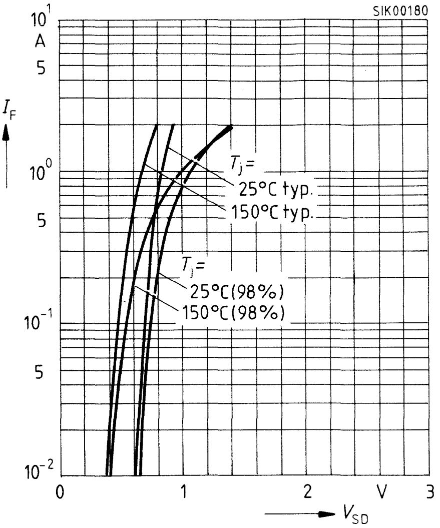
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



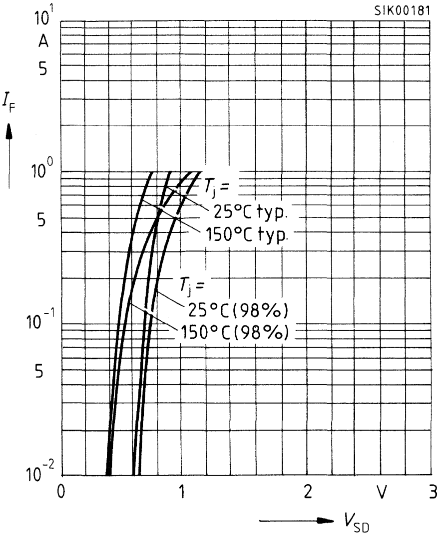
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSP 297



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 297

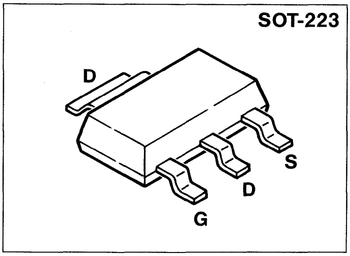


SIPMOS® Small-Signal Transistor BSP 315

Preliminary Data

V_{DS} = – 50 V
I_D = – 1.0 A
$R_{DS(on)}$ = 0.8 Ω

- P channel
- Enhancement mode
- Package: SOT-223 [1]



Type	Ordering code for version in bulk	Ordering code for version on 12-mm tape
BSP 315	Q62702-S075	Q67000-S075

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_A = 25 °C	I_D	– 1.0	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	– 4.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient [2]	R_{thJA}	≤ 83.3	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.
[2] Transistor on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for drain connection.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-50	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-0.8	-1.4	-2.0	
Zero gate voltage drain current $V_{GS} = 0$, $V_{DS} = -50$ V $V_{DS} = -30$ V	I_{DSS}	- -	-0.1 -	-1.0 -100	µA nA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-10	-100	nA
Drain-source on-resistance $I_D = -1.0$ A, $V_{GS} = -10$ V	$R_{DS(on)}$	-	-	-0.8	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -1.0$ A	g_{fs}	0.25	0.5	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	400	-	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	50	-	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	15		
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.29$ A	$t_{d(on)}$	-	15	20	ns
	t_r	-	10	15	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.29$ A	$t_{d(off)}$	-	100	130	
	t_f	-	40	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Reverse diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	– 1.0	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	– 4.0	
Diode forward on-voltage $I_F = -2.0$ A, $V_{GS} = 0$	V_{SD}	–	– 0.9	– 1.5	V

SIEMENS

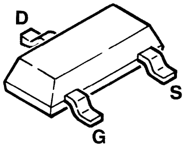
SIPMOS® Small-Signal Transistors

BSS 84
BSS 110

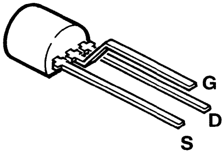
V_{DS} = –50 V
I_D = –0.13 / –0.17 A
$R_{DS(on)}$ = 10 Ω

- P channel
- Enhancement mode
- Packages: SOT-23, TO-92 [1])

SOT-23
(BSS 84)



TO-92
(BSS 110)



Type	Marking	Ordering code for version on bulk	Ordering code for version in tape [2])	Ordering code for version on 8-mm tape
BSS 84	SPs	Q62702-S393	–	Q62702-S568
BSS 110	–	Q62702-S489	Q62702-S500	–

Maximum Ratings

Parameter	Symbol	BSS 84	BSS 110	Unit
Drain-source voltage	V_{DS}	–50		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	–50		
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_A = 30/35 °C	I_D	–0.13	–0.17	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	–0.52	–0.68	
Operating and storage temperature range	T_j T_{stg}	–55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side [3])	 R_{thJA} R_{thJSR}	 ≤ 350 ≤ 285	 ≤ 200 –	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.36	0.63	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.
[2]) E6288: on reel, 1500 pieces/reel, 2 reels/carton: (source first)
[3]) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-50	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-0.8	-1.5	-2.0	
Zero gate voltage drain current	I_{DSS}				µA
$V_{DS} = -50$ V, $V_{GS} = 0$					
$T_j = 25$ °C		-	-1	-15	
$T_j = 125$ °C		-	-2	-60	
$V_{DS} = -25$ V, $V_{GS} = 0$					
$T_j = 25$ °C		-	-	-0.1	
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-1	-10	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = -10$ V, $I_D = -0.13$ A BSS 84		-	5.0	10	
$I_D = -0.17$ A BSS 110		-	5.3	10	

Dynamic characteristics

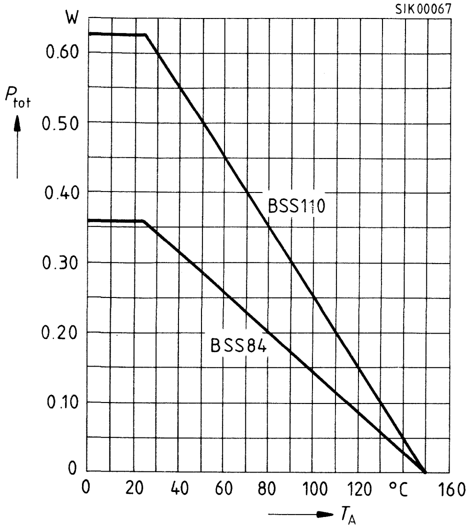
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -0.13$ A BSS 84		0.05	0.08	-	
$I_D = -0.17$ A BSS 110		0.05	0.085	-	
Input capacitance	C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz BSS 84		-	30	45	
BSS 110		-	30	40	
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	17	25	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	8	12	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.27$ A	$t_{d(on)}$	-	8	12	ns
	t_r	-	35	50	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.27$ A	$t_{d(off)}$	-	8	10	
	t_f	-	20	25	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

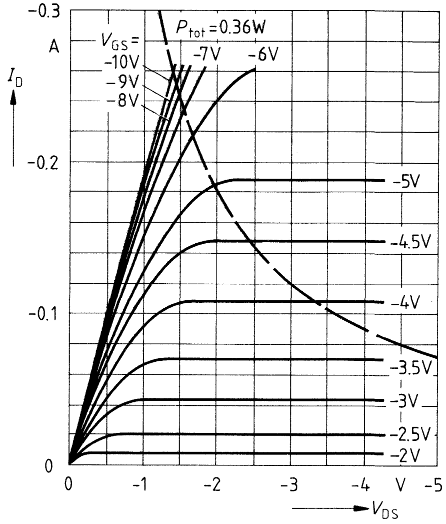
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current $T_A = 25$ °C	BSS 84	I_S	–	–	–0.13	A
	BSS 110		–	–	–0.17	
Pulsed reverse drain current $T_A = 25$ °C	BSS 84	I_{SM}	–	–	–0.52	
	BSS 110		–	–	–0.68	
Diode forward on-voltage $I_F = -0.26$ A, $V_{GS} = 0$	BSS 84	V_{SD}	–	–0.9	–1.2	V
$I_F = -0.34$ A, $V_{GS} = 0$	BSS 110		–	–0.95	–1.2	

Characteristics at T_j = 25 °C, unless otherwise specified.

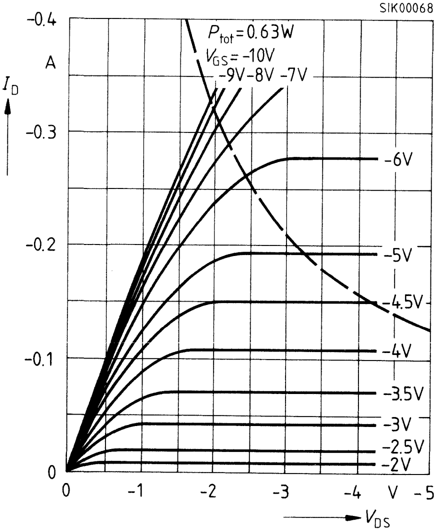
Total power dissipation $P_{tot} = f(T_A)$



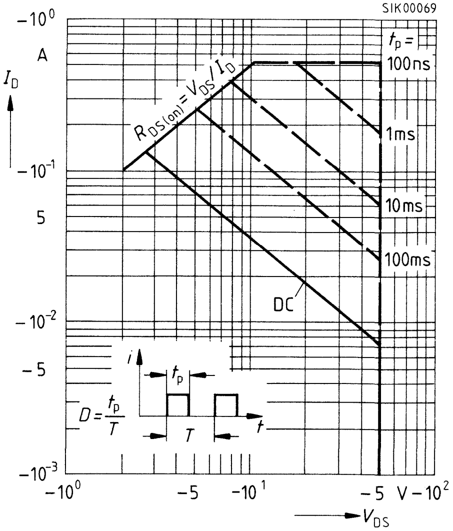
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 84



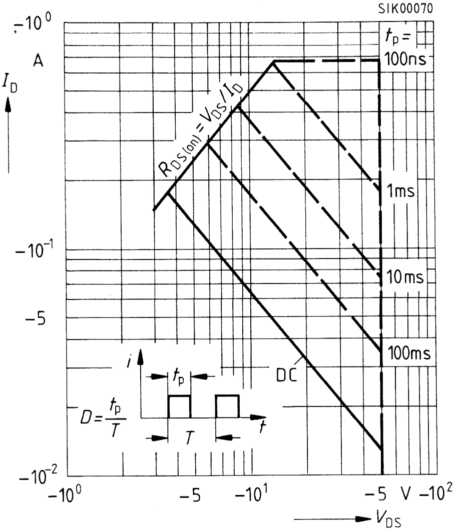
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 110



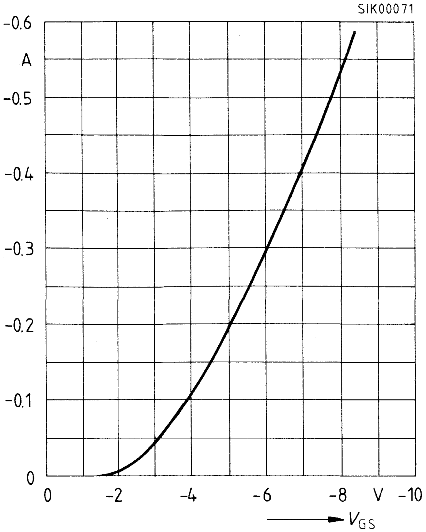
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSS 84



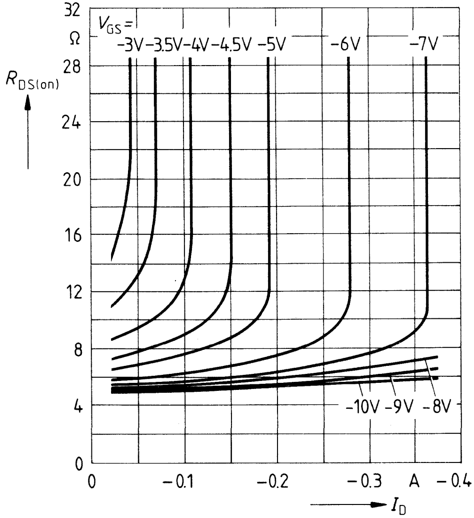
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 110



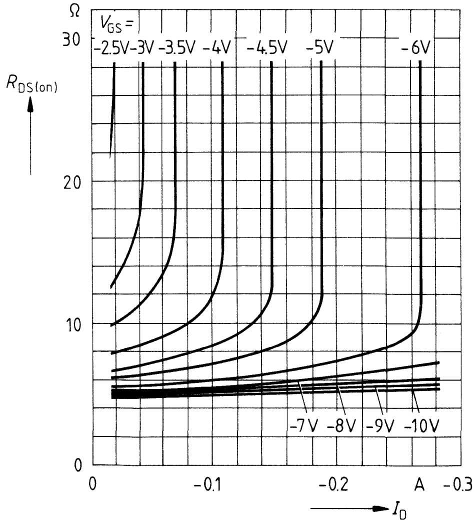
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



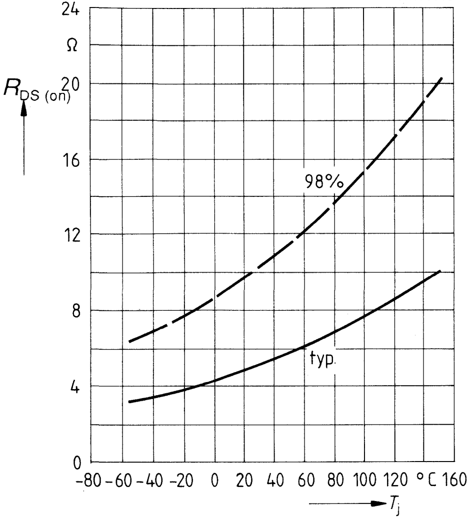
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 110



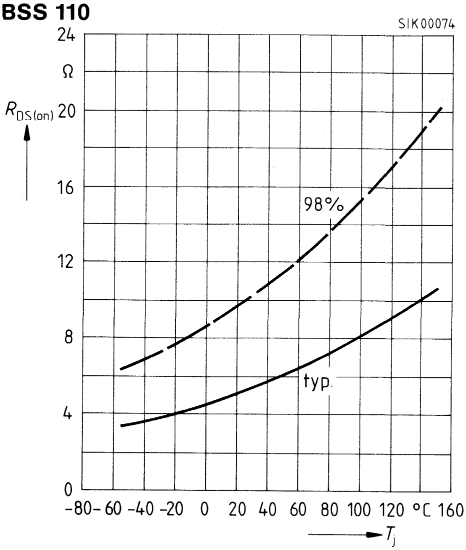
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 84



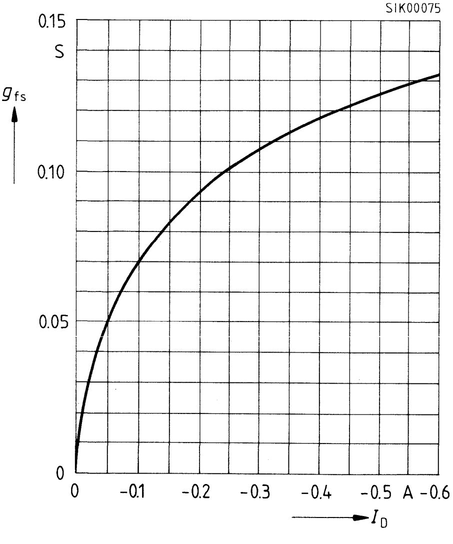
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -0.13$ A, $V_{GS} = -10$ V, (spread)
BSS 84



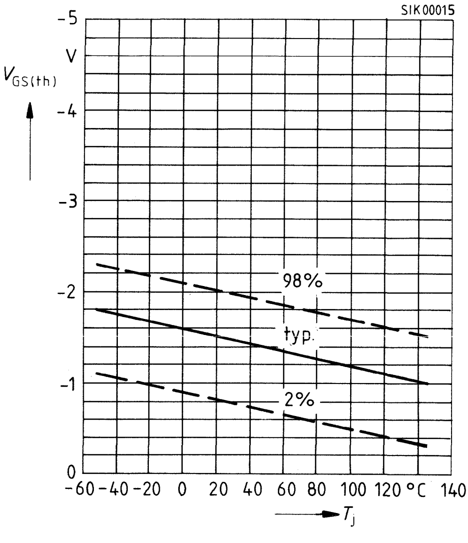
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -0.17$ A, $V_{GS} = -10$ V, (spread)
BSS 110



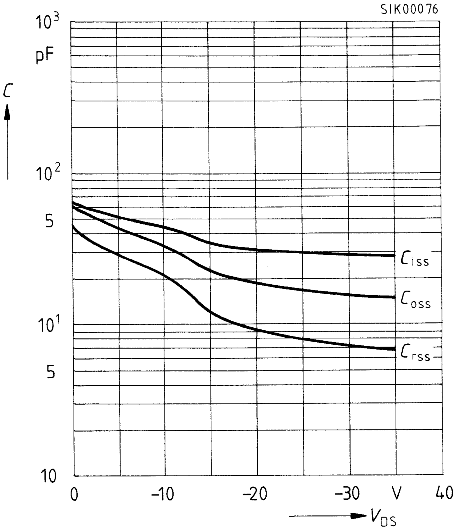
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



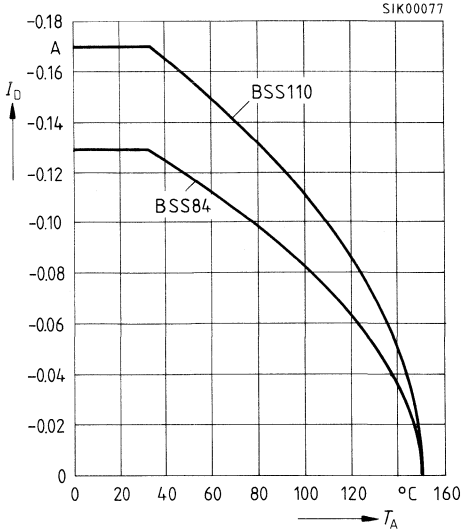
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = -1$ mA, (spread)



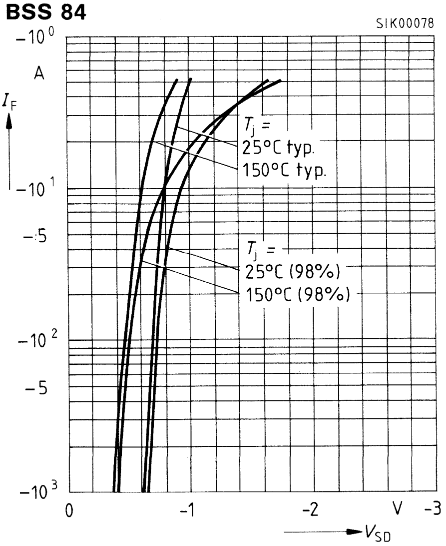
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



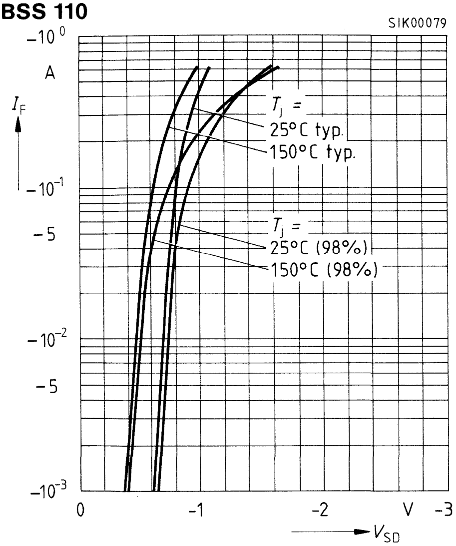
Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq -10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 84



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 110

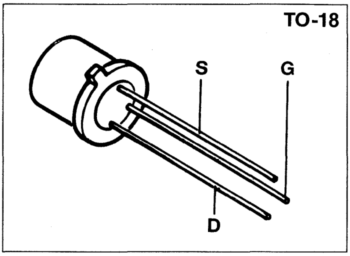


SIPMOS® Small-Signal Transistor

BSS 91

V_{DS} = 240 V
I_D = 0.35 A
$R_{DS(on)}$ = 6.0 Ω

- N channel
- Enhancement mode
- Package: TO-18 [1])



Type	Ordering code for version in bulk
BSS 91	Q62702-S457

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	240	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	240	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 25 °C	I_D	0.35	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	1.4	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - case	 R_{thJA} R_{thJC}	 ≤ 300 ≤ 83	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	1.5	W
DIN humidity category, DIN 40 040	–	C	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	240	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	0.8	1.5	2.0	
Zero gate voltage drain current $V_{DS} = 240$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	4	60	
$T_j = 125$ °C		-	8	200	
$V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C		-	-	200	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.35$ A		-	4.0	6.0	
$V_{GS} = 4.5$ V, $I_D = 0.35$ A		-	5.7	10.0	

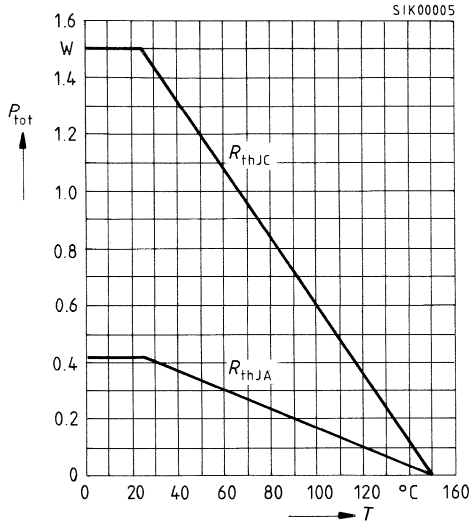
Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.35$ A	g_{fs}	0.14	0.32	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	90	140	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	20	30	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	6	9	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(on)}$	-	5	8	ns
	t_r	-	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(off)}$	-	25	30	
	t_f	-	22	28	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

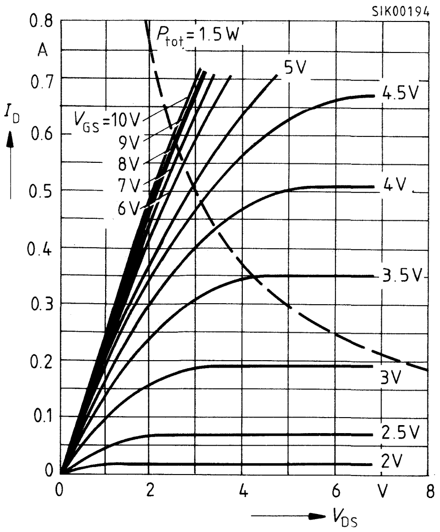
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_C = 25$ °C	I_S	–	–	0.35	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	–	1.4	
Diode forward on-voltage $I_F = 0.7$ A, $V_{GS} = 0$	V_{SD}	–	0.9	1.4	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

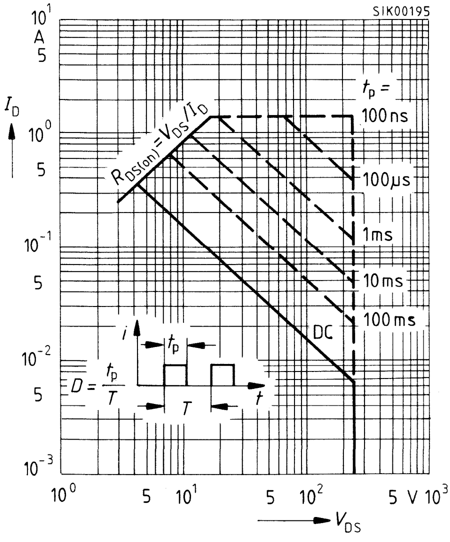
Total power dissipation $P_{tot} = f(T)$



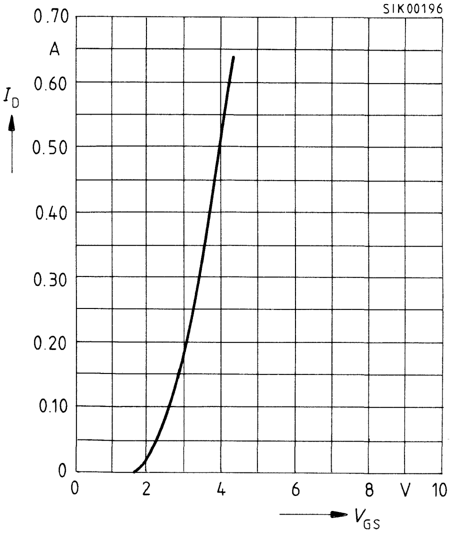
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



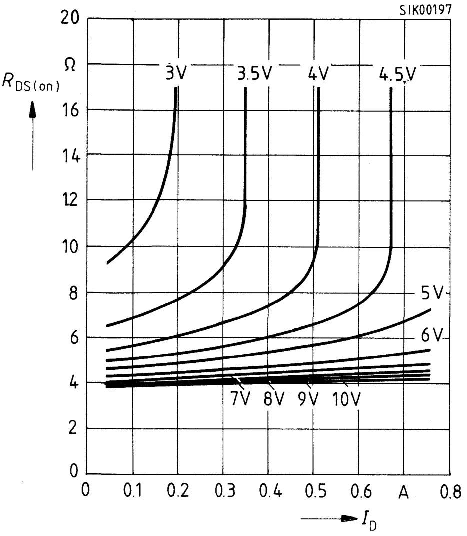
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



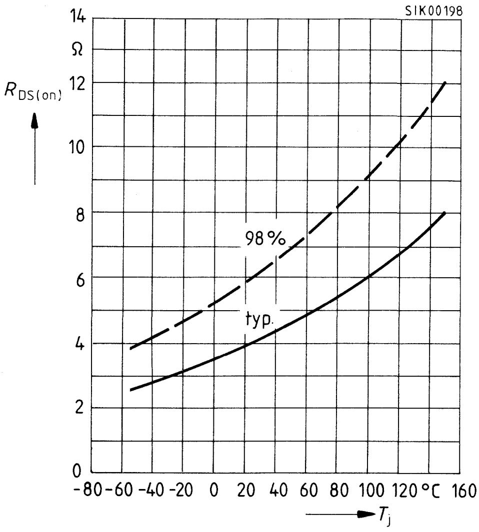
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



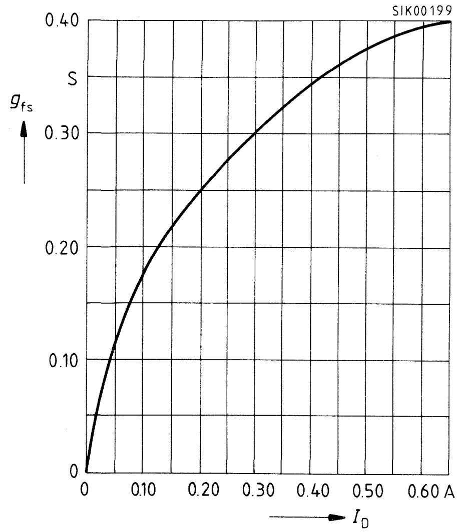
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



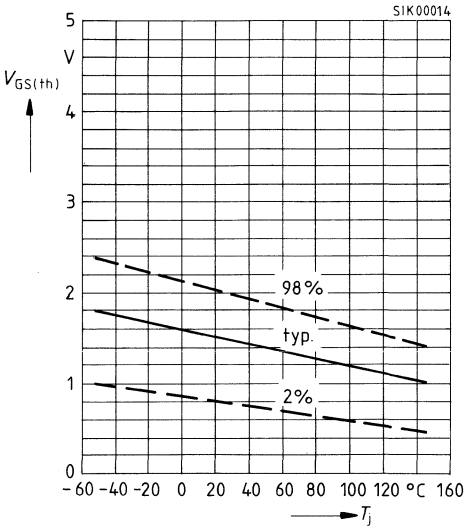
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.35$ A, $V_{GS} = 10$ V, (spread)



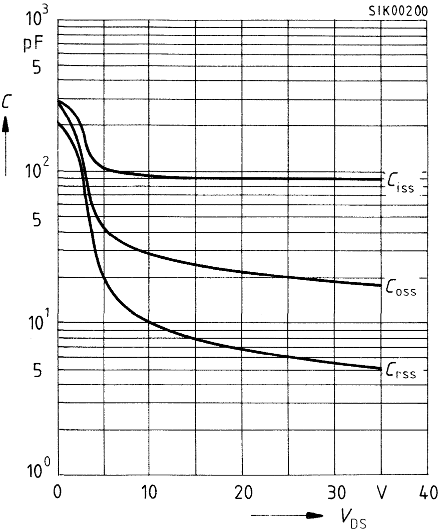
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



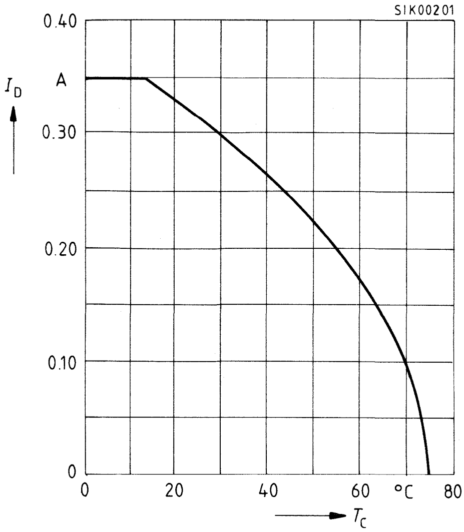
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



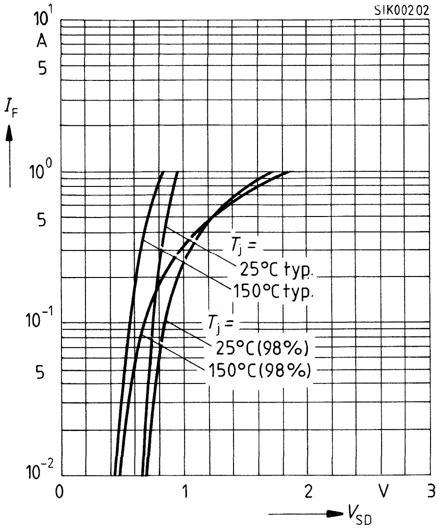
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



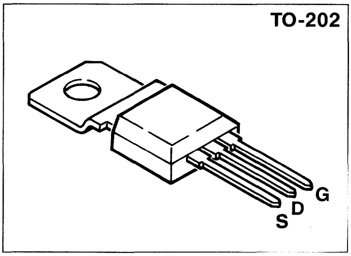
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)



SIPMOS® Small-Signal Transistor **BSS 95**

V_{DS} = 240 V
I_D = 0.8 A
$R_{DS(on)}$ = 6.0 Ω

- N channel
- Enhancement mode
- Package: TO-202 ¹)



Type	Ordering code for version in bulk
BSS 95	Q62702-S461

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	240	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	240	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 35 °C	I_D	0.8	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	3.2	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - case	 R_{thJA} R_{thJC}	 ≤ 65 ≤ 15	K/W
Max. power dissipation, T_C = 25 °C	P_{tot}	8.3	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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¹) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	240	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	0.8	1.5	2.0	
Zero gate voltage drain current $V_{DS} = 240$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	4	60	
$T_j = 125$ °C		-	8	200	
$V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C		-	-	200	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.5$ A		-	4.0	6.0	
$V_{GS} = 4.5$ V, $I_D = 0.5$ A		-	6.4	10.0	

Dynamic characteristics

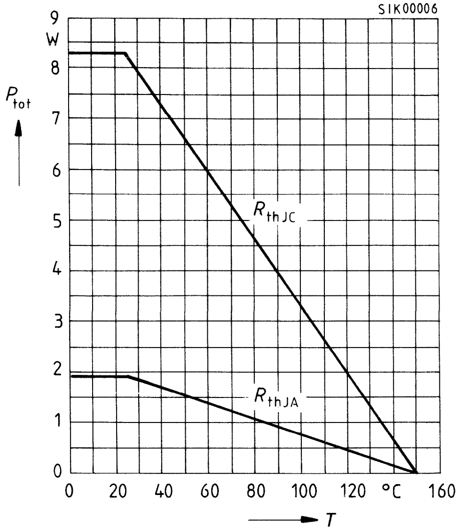
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.5$ A	g_{fs}	0.14	0.38	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	90	140	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	20	30	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	6	9	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(on)}$	-	5	8	ns
	t_r	-	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(off)}$	-	25	30	
	t_f	-	22	28	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

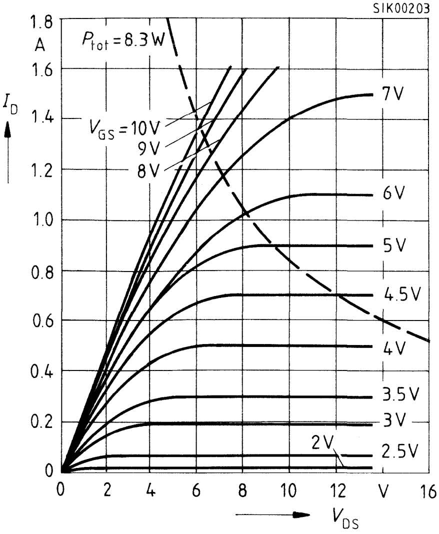
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	0.8	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	3.2	
Diode forward on-voltage I_F = 1.6 A, V_{GS} = 0	V_{SD}	–	1.05	1.4	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

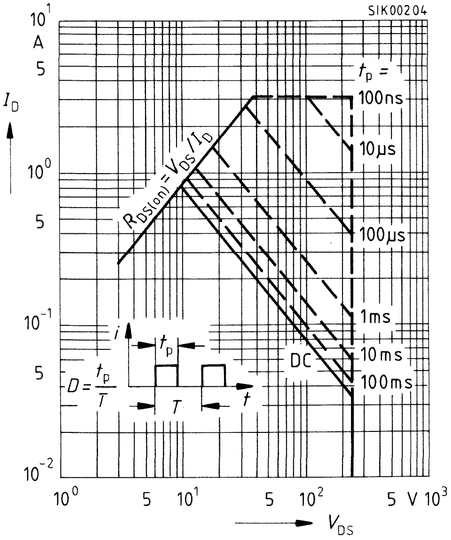
Total power dissipation $P_{tot} = f(T)$



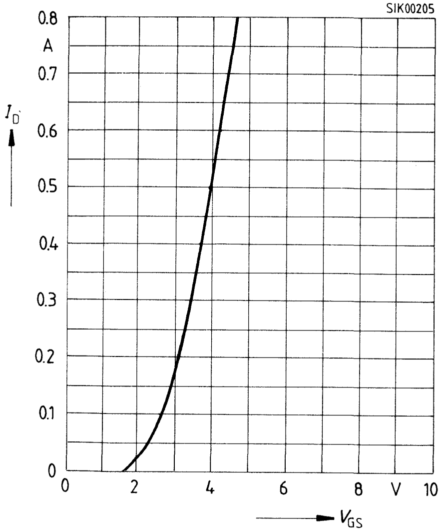
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



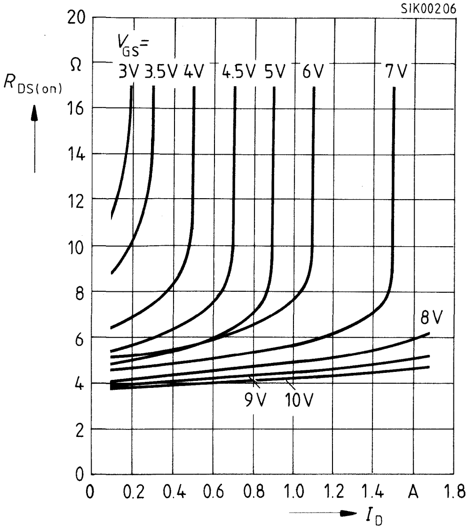
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



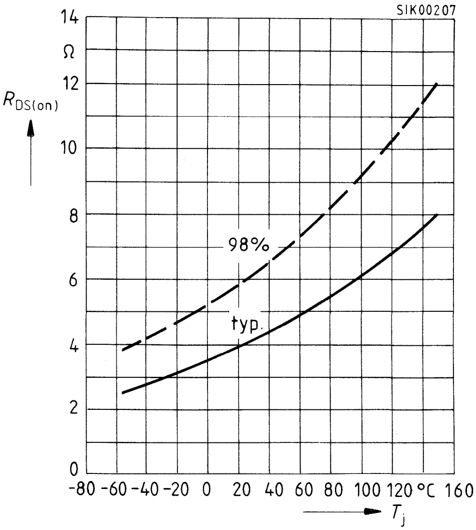
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



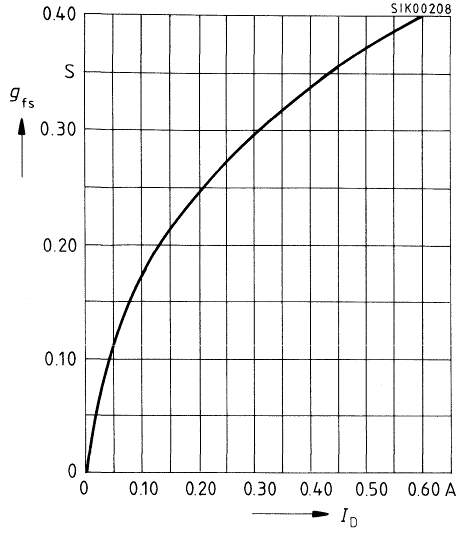
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



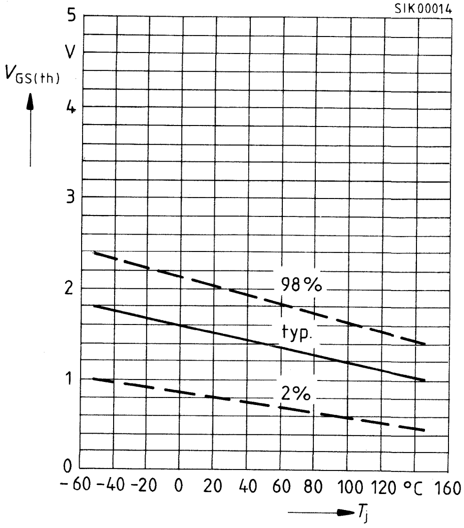
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.5 A, V_{GS} = 10 V, (spread)



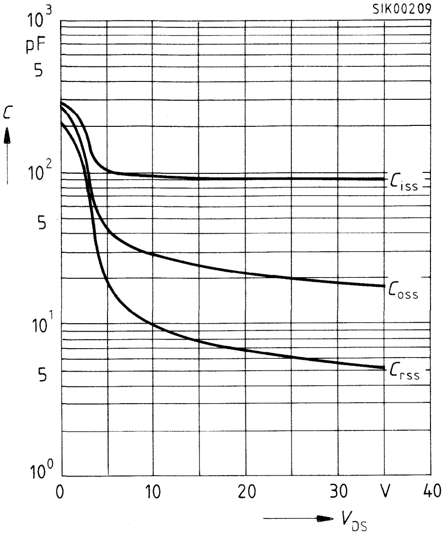
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



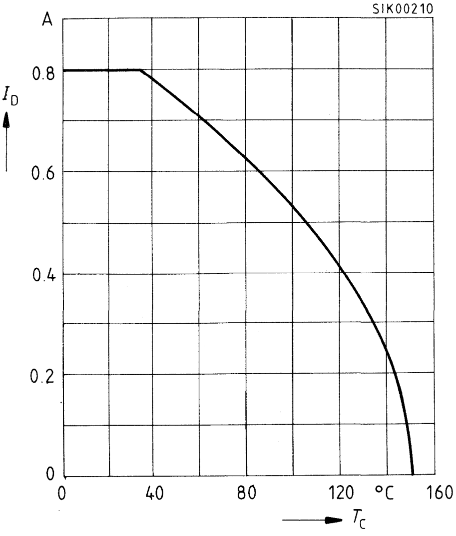
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



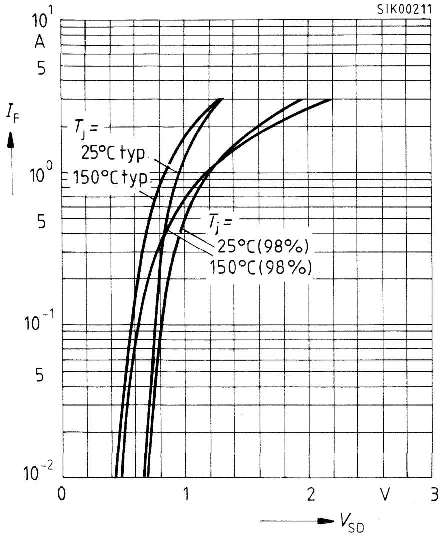
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f\ (T_C)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\ (V_{SD})$
parameter: $t_p = 80\ \mu s$, T_j, (spread)

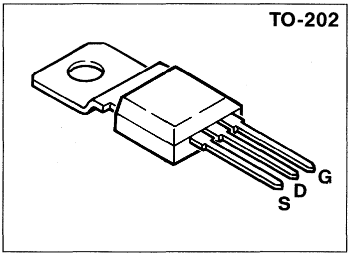


SIEMENS

SIPMOS® Small-Signal Transistor **BSS 97**

V_{DS} = 200 V
I_D = 1.5 A
$R_{DS(on)}$ = 2.0 Ω

- N channel
- Enhancement mode
- Package: TO-202 [1]



Type	Ordering code for version in bulk
BSS 97	Q62702-S463

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Gate-source voltage	V_{GS}	± 10	
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	200	
Gate-source peak voltage	V_{gs}	± 20	
Continuous drain current, T_A = 28 °C	I_D	1.5	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	6.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - case	 R_{thJA} R_{thJC}	 ≤ 65 ≤ 12.5	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	10	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	0.8	1.4	2.8	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		-	4	60	
$T_j = 125$ °C		-	8	200	
$V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C		-	-	200	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	10	100	
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 1.0$ A	$R_{DS(on)}$	-	1.5	2.0	Ω

Dynamic characteristics

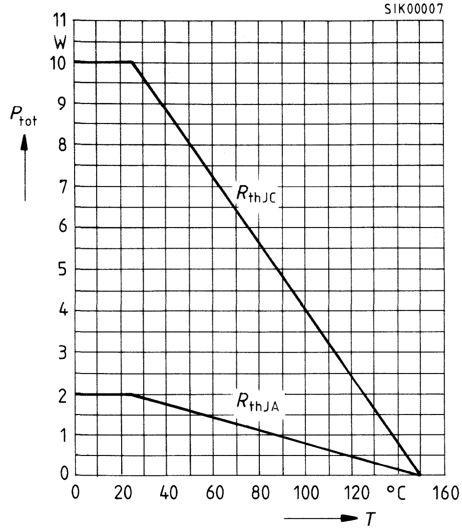
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.0$ A	g_{fs}	0.5	1.1	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	400	600	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	45	70	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	30	45	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.29$ A	$t_{d(on)}$	-	8	12	ns
	t_r	-	12	18	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.29$ A	$t_{d(off)}$	-	110	140	
	t_f	-	40	50	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

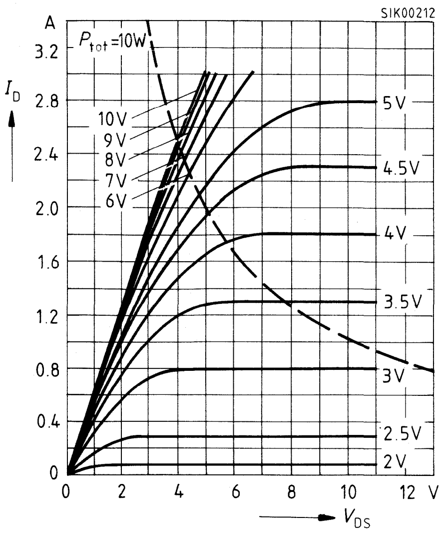
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	1.5	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	6.0	
Diode forward on-voltage $I_F = 3.0$ A, $V_{GS} = 0$	V_{SD}	–	1.05	1.8	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

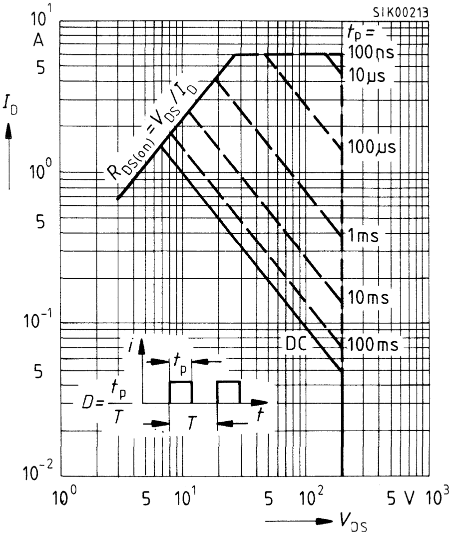
Total power dissipation $P_{tot} = f(T)$



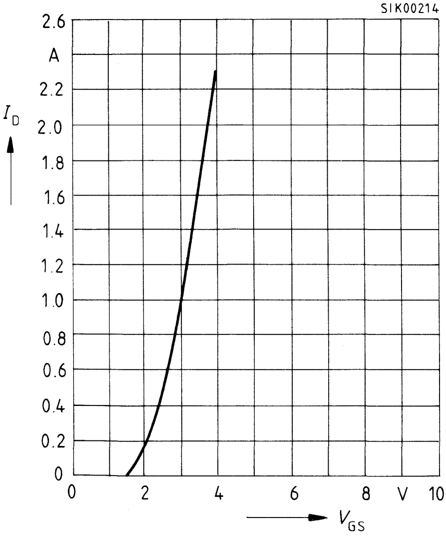
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



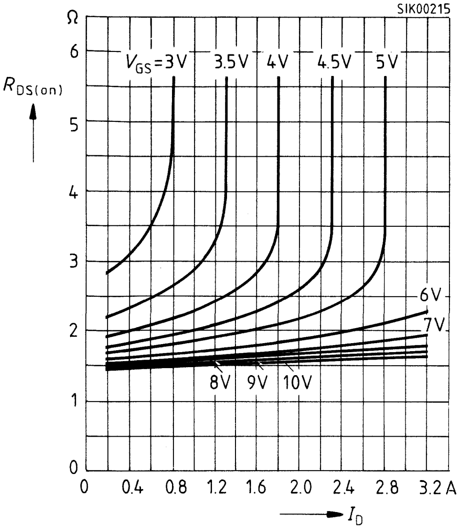
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



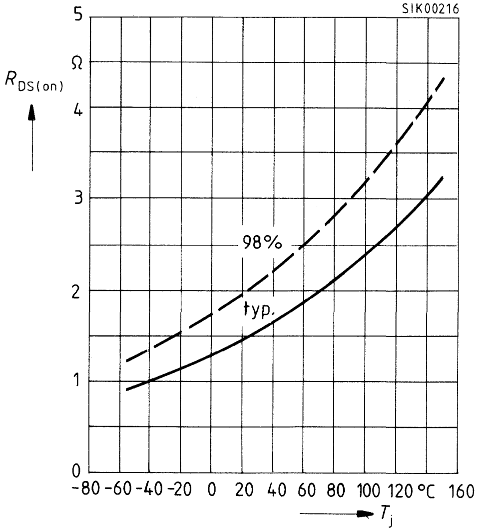
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



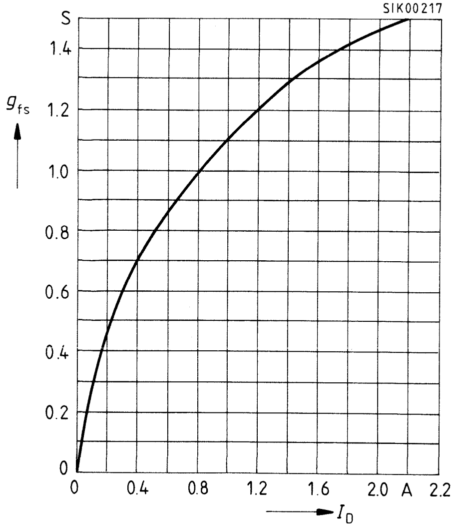
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



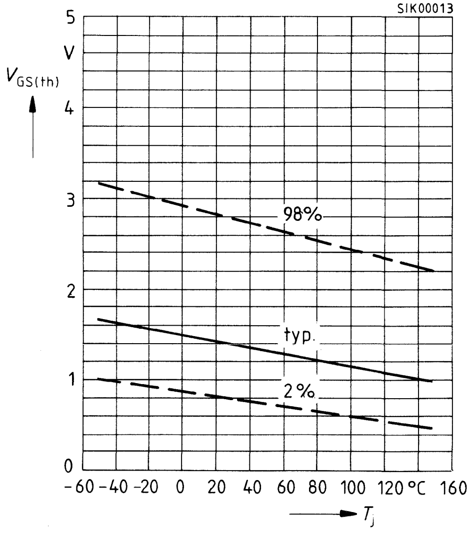
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 1.0 A, V_{GS} = 10 V, (spread)



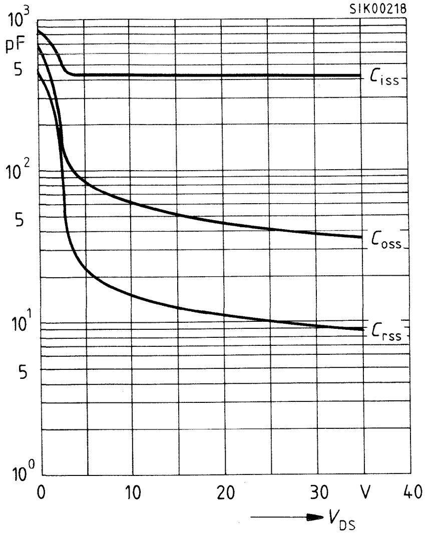
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



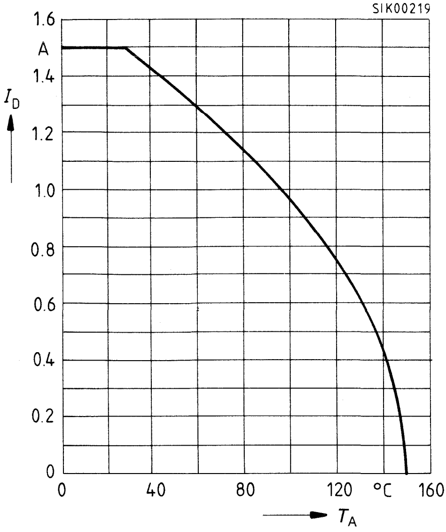
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



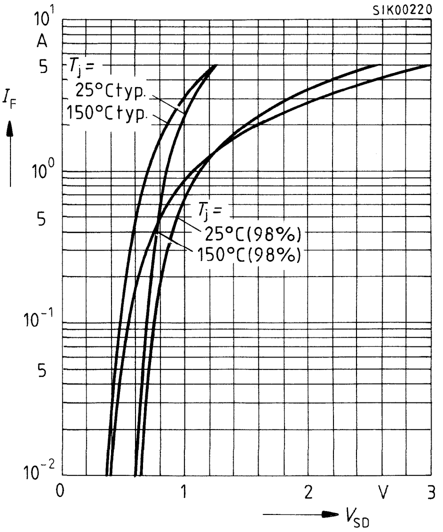
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)



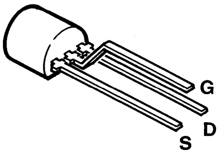
SIPMOS® Small-Signal Transistors

BSS 98
BSS 138

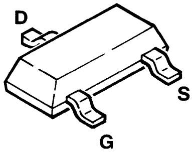
V_{DS} = 50 V
I_D = 0.3 / 0.22 A
$R_{DS(on)}$ = 3.5 Ω

- N channel
- Enhancement mode
- Packages: TO-92,
  SOT-23 [1]

TO-92
(BSS 98)



SOT-23
(BSS 138)



Type	Marking	Ordering code for version on bulk	Ordering code for version in tape [2]	Ordering code for version on 8-mm tape
BSS 98	–	Q62702-S464	Q62702-S517	–
BSS 138	SSs	Q62702-S558	–	Q62702-S566

Maximum Ratings

Parameter	Symbol	BSS 98	BSS 138	Unit
Drain-source voltage	V_{DS}	50		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 25/31 °C	I_D	0.3	0.22	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	1.2	0.88	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side [3]	R_{thJA} R_{thJSR}	≤ 200 –	≤ 350 ≤ 285	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	0.36	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.
[2] E6296: on reel, 1500 pieces/reel, 2 reels/carton: (gate first).
[3] For package mounted on alumina 25 mm x 25 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

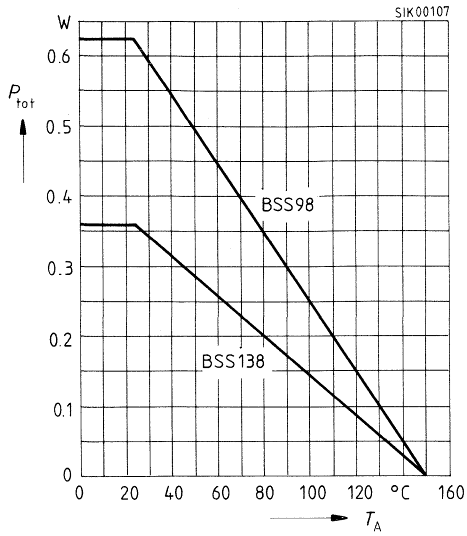
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage	$V_{(BR)DSS}$				V
$V_{GS} = 0$, $I_D = 0.25$ mA		50	-	-	
Gate threshold voltage	$V_{GS(th)}$				
$V_{GS} = V_{DS}$, $I_D = 1$ mA		0.8	1.2	1.6	
Zero gate voltage drain current	I_{DSS}				µA
$V_{DS} = 50$ V, $V_{GS} = 0$					
$T_j = 25$ °C BSS 98		-	0.05	0.5	
$T_j = 25$ °C BSS 138		-	-	0.5	
$T_j = 125$ °C		-	-	5	
$V_{DS} = 30$ V, $V_{GS} = 0$					
$T_j = 25$ °C		-	-	100	nA
Gate-source leakage current	I_{GSS}				nA
$V_{GS} = 20$ V, $V_{DS} = 0$		-	10	100	
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.3$ A BSS 98		-	1.8	3.5	
$I_D = 0.22$ A BSS 138		-	1.8	3.5	
$V_{GS} = 4.5$ V, $I_D = 0.3$ A BSS 98		-	2.8	6.0	
$I_D = 0.22$ A BSS 138		-	2.8	6.0	
Dynamic characteristics					
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.3$ A BSS 98		0.12	0.22	-	
$I_D = 0.22$ A BSS 138		0.12	0.20	-	
Input capacitance	C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		-	40	60	
Output capacitance	C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		-	15	25	
Reverse transfer capacitance	C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		-	5	10	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	5	8	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.29$ A	t_r	-	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	12	16	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.29$ A	t_f	-	17	22	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

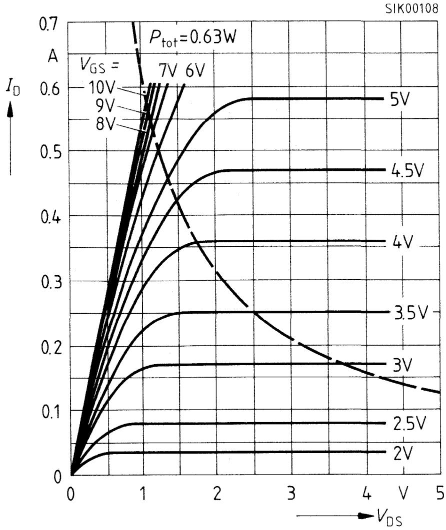
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
T_A = 25 °C	BSS 98		–	–	0.3	
	BSS 138		–	–	0.22	
Pulsed reverse drain current		I_{SM}				
T_A = 25 °C	BSS 98		–	–	1.2	
	BSS 138		–	–	0.88	
Diode forward on-voltage		V_{SD}				V
I_F = 0.6 A, V_{GS} = 0	BSS 98		–	1.0	1.4	
I_F = 0.44 A, V_{GS} = 0	BSS 138		–	0.9	1.4	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

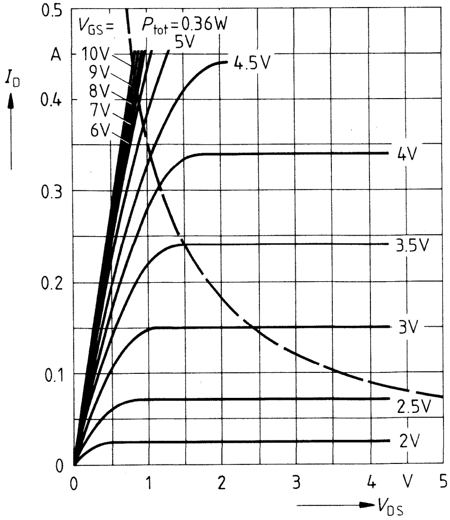
Total power dissipation $P_{tot} = f(T_A)$



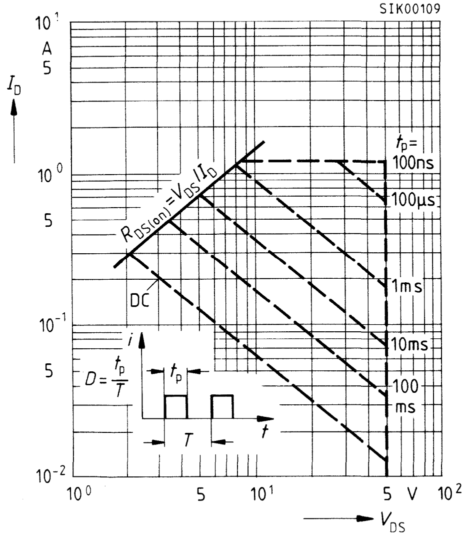
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSS 98



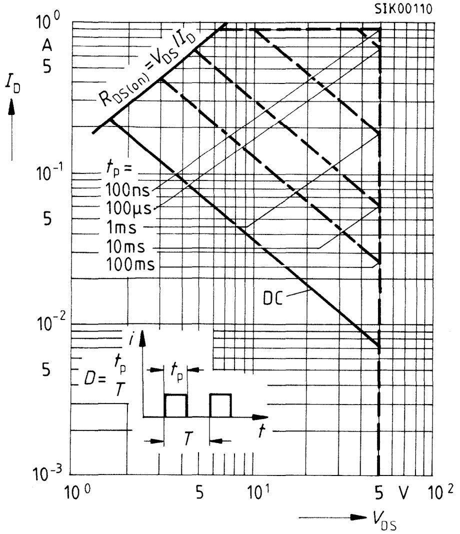
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSS 138



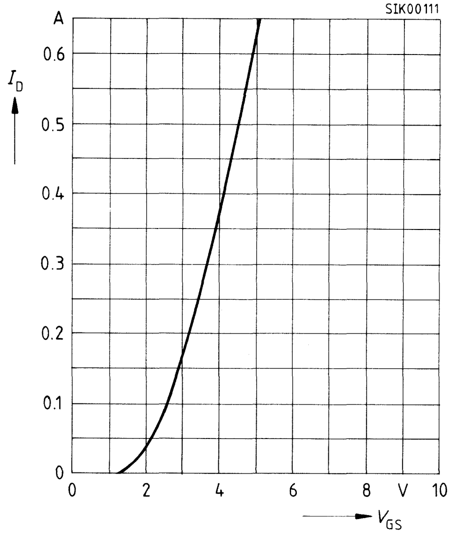
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 98



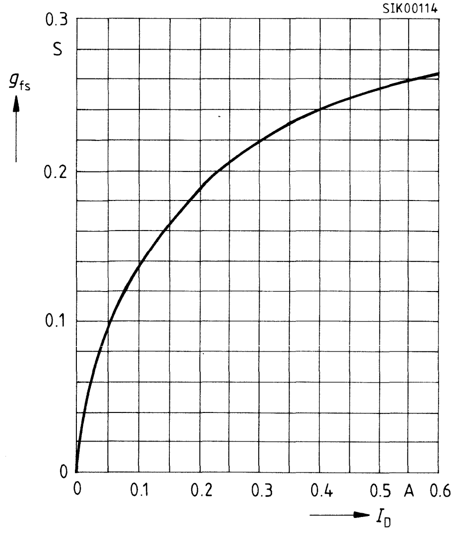
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BSS 138



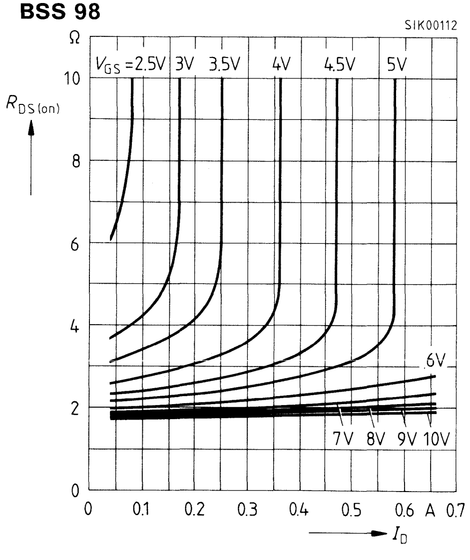
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80\ µs$, $V_{DS} = 25\ V$



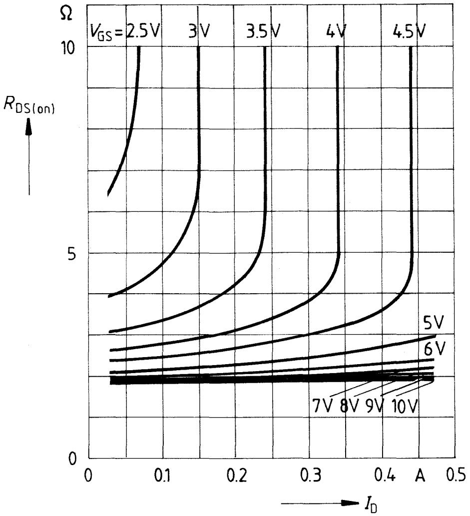
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ µs$



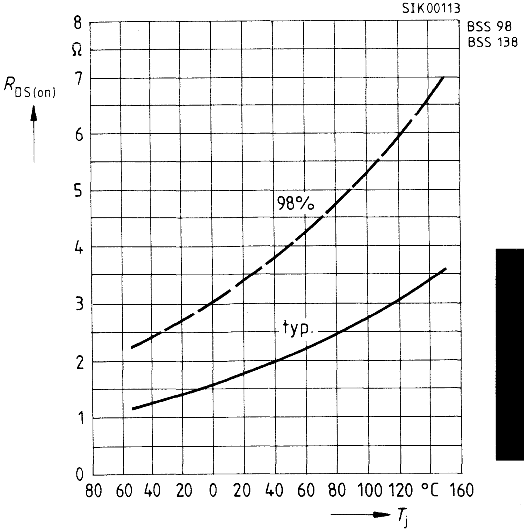
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 98



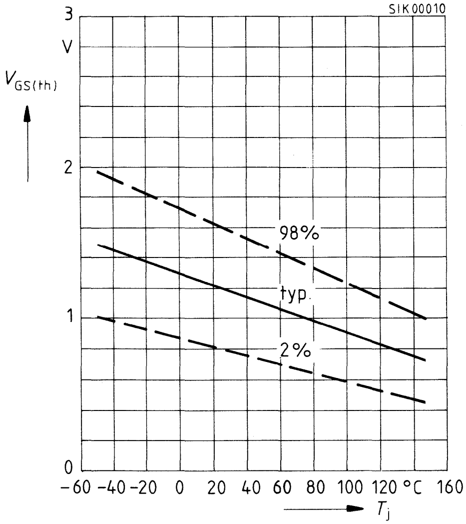
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 138



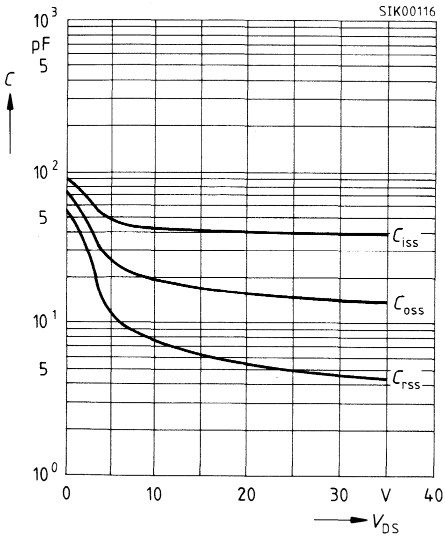
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.22 A, V_{GS} = 10 V, (spread)



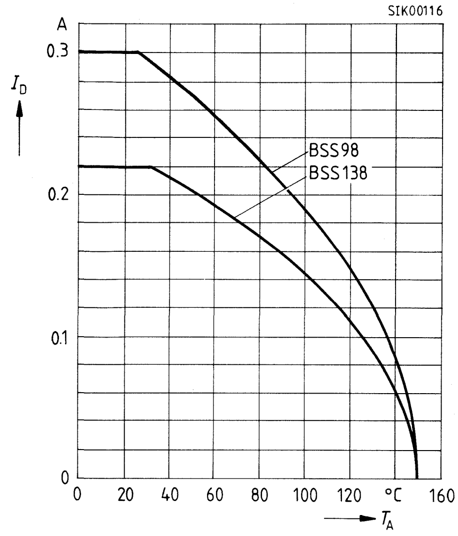
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



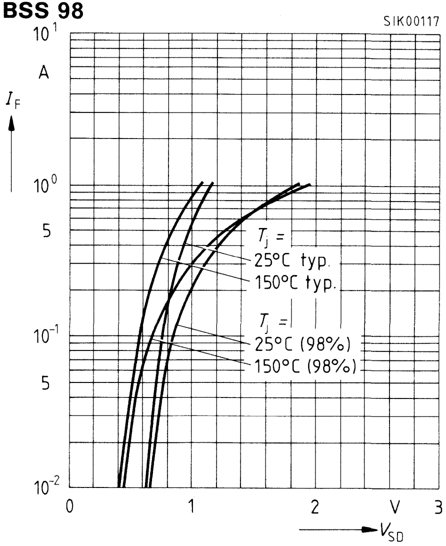
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



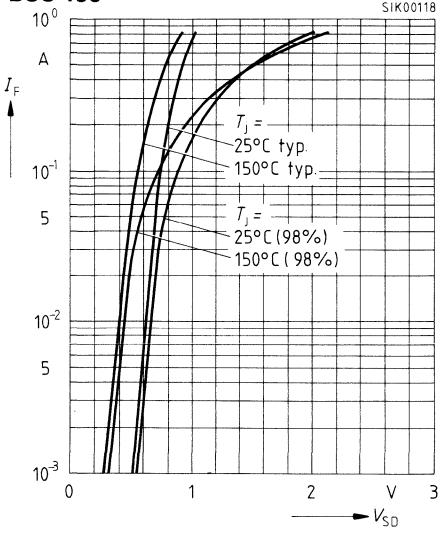
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 98



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 138



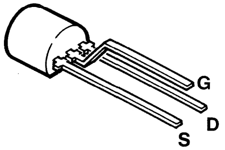
SIPMOS® Small-Signal Transistors

BSS 100
BSS 123

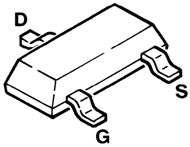
V_{DS} = 100 V
I_D = 0.22 / 0.17 A
$R_{DS(on)}$ = 6.0 Ω

- N channel
- Enhancement mode
- Packages: TO-92, SOT-23 [1]

TO-92
(BSS 100)



SOT-23
(BSS 123)



Type	Marking	Ordering code for version on tape [2]	Ordering code for version in bulk	Ordering code for version on 8-mm tape
BSS 100	–	Q62702-S499	Q62702-S483	–
BSS 123	SAs	–	Q62702-S507	Q62702-S512

Maximum Ratings

Parameter	Symbol	BSS 100	BSS 123	Unit
Drain-source voltage	V_{DS}	100		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 33/28 °C	I_D	0.22	0.17	A
Pulsed drain current, T_A = 25 °C	$I_{D\,puls}$	0.9	0.68	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side [3]	R_{thJA} R_{thJSR}	≤ 200 –	≤ 350 ≤ 285	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	0.36	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.
[2] E6288: on reel, 1500 pieces/reel, 2 reels/carton: (source first)
[3] For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

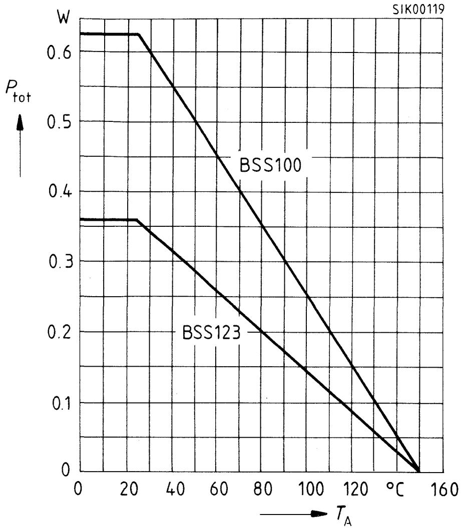
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage	$V_{(BR)DSS}$				V
V_{GS} = 0, I_D = 0.25 mA		100	–	–	
Gate threshold voltage	$V_{GS(th)}$				
V_{GS} = V_{DS}, I_D = 1 mA		0.8	1.5	2.0	
Zero gate voltage drain current	I_{DSS}				µA
V_{DS} = 100 V, V_{GS} = 0					
T_j = 25 °C BSS 100		–	1	15	
T_j = 25 °C BSS 123		–	0.1	1.0	
T_j = 125 °C		–	2	60	
V_{DS} = 60 V, V_{GS} = 0 BSS 100					
V_{DS} = 20 V, V_{GS} = 0 BSS 123					
T_j = 25 °C		–	–	10	nA
Gate-source leakage current	I_{GSS}				nA
V_{GS} = 20 V, V_{DS} = 0 BSS 100		–	1	10	
BSS 123		–	10	50	
Drain-source on-resistance	$R_{DS(on)}$				Ω
V_{GS} = 10 V, I_D = 0.22 A BSS 100		–	3.0	6.0	
I_D = 0.17 A BSS 123		–	3.0	6.0	
V_{GS} = 4.5 V, I_D = 0.22 A BSS 100		–	4.5	10.0	
I_D = 0.17 A BSS 123		–	4.1	10.0	
Dynamic characteristics					
Forward transconductance	g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 0.22 A BSS 100		0.08	0.19	–	
I_D = 0.17 A BSS 123		0.08	0.17	–	
Input capacitance	C_{iss}				pF
V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz		–	40	60	
Output capacitance	C_{oss}				
V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz		–	10	15	
Reverse transfer capacitance	C_{rss}				
V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz		–	4	6	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	–	5	8	ns
V_{CC} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.28 A	t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	–	12	16	
V_{CC} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.28 A	t_f	–	17	22	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

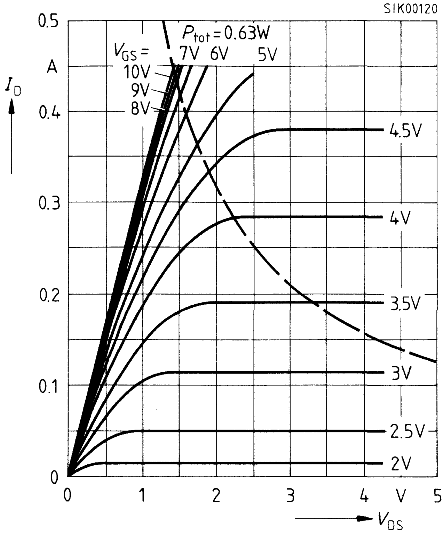
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSS 100		–	–	0.22	
	BSS 123		–	–	0.17	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSS 100		–	–	0.90	
	BSS 123		–	–	0.68	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.44$ A, $V_{GS} = 0$	BSS 100		–	0.9	1.3	
$I_F = 0.34$ A, $V_{GS} = 0$	BSS 123		–	0.85	1.3	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

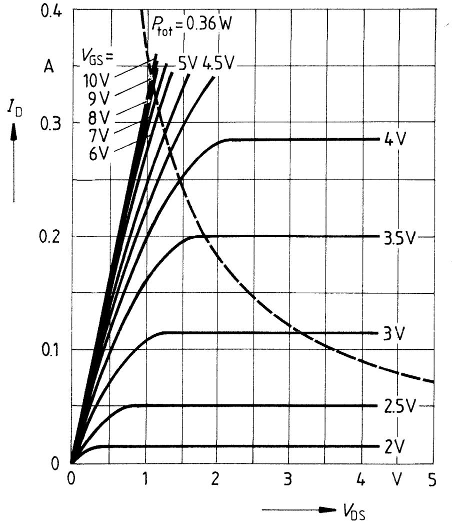
Total power dissipation $P_{tot} = f(T_A)$



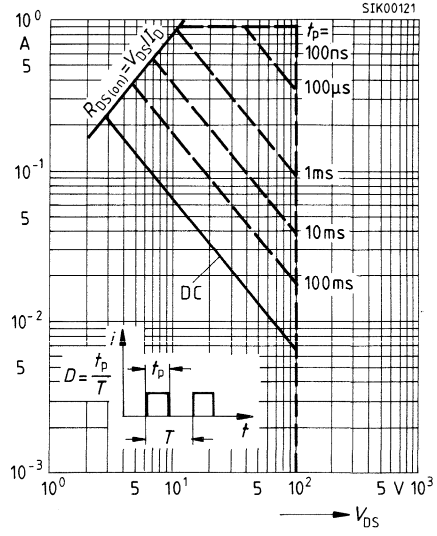
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSS 100



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BSS 123

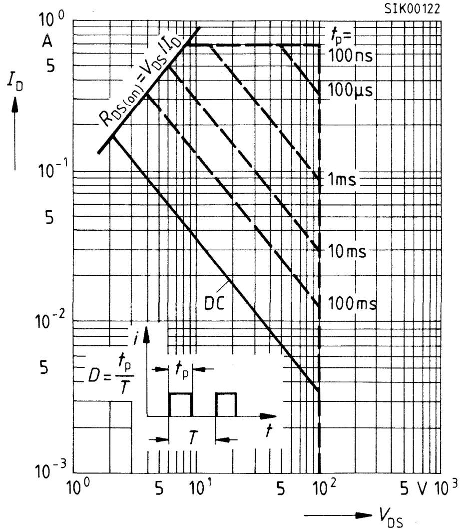


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 100

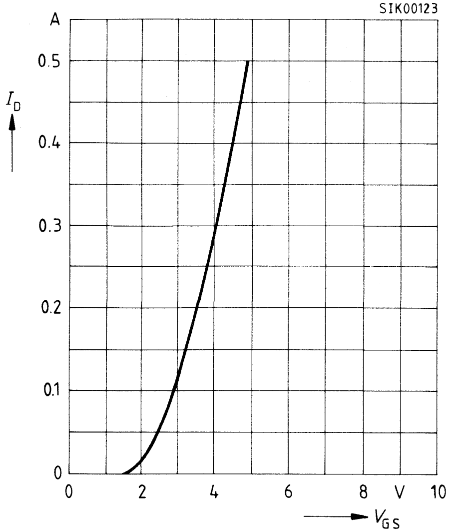


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

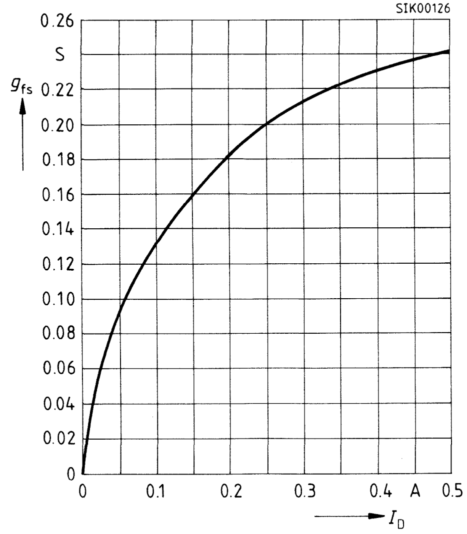
BSS 123



Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

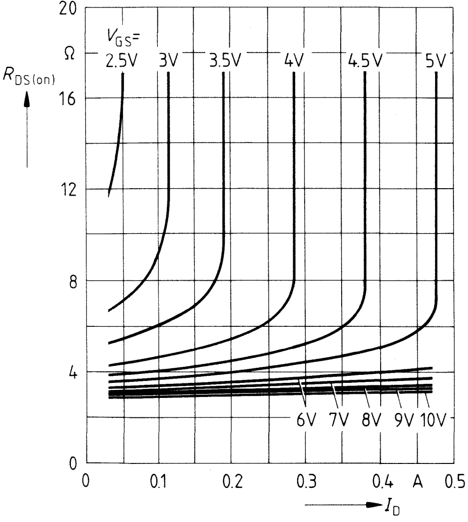


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

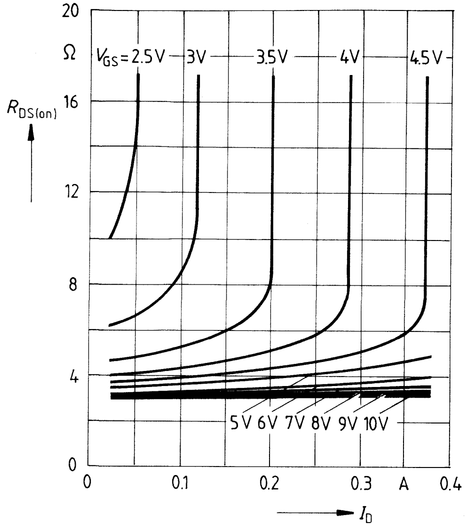


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

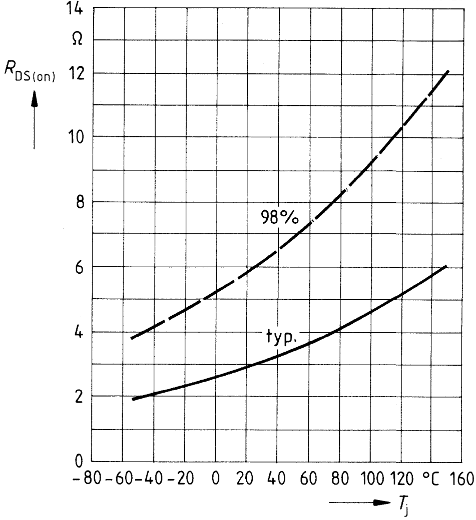
BSS 100



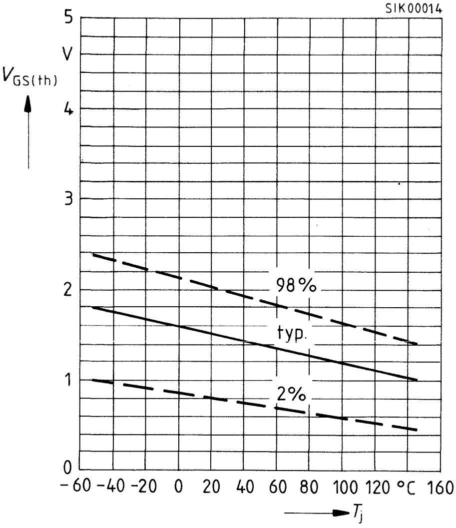
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 123



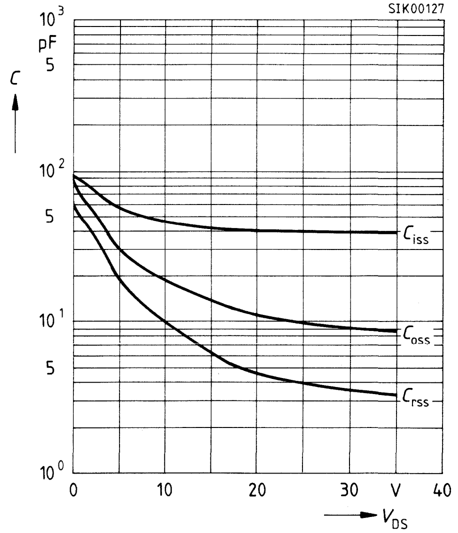
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.22 A/0.17 A, V_{GS} = 10 V,
(spread)



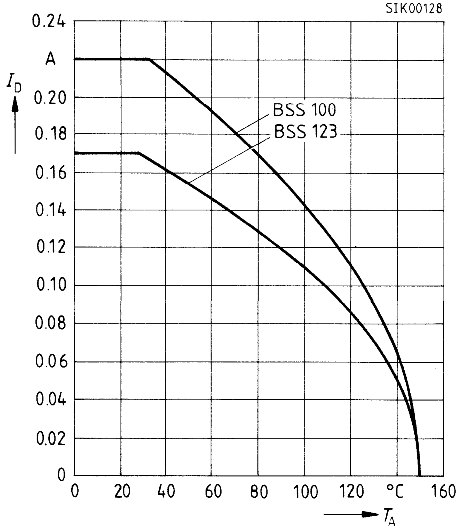
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



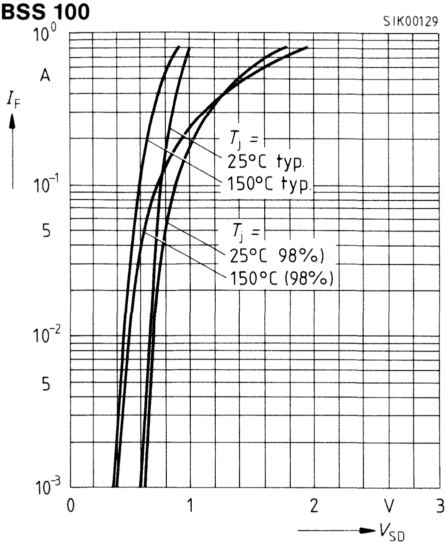
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



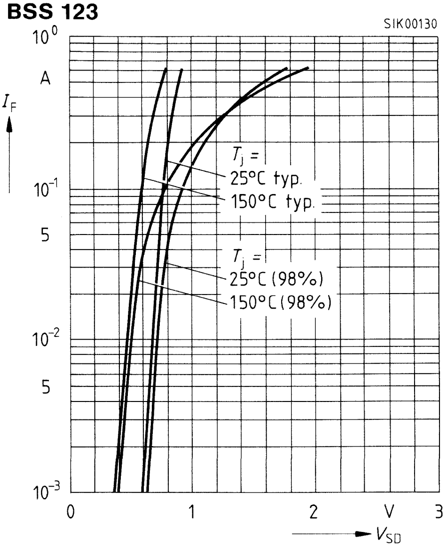
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 100



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 123



SIEMENS

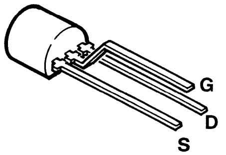
SIPMOS® Small-Signal Transistors

BSS 101
BSS 131

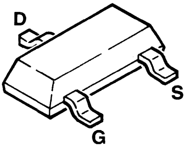
V_{DS} = 240 V
I_D = 0.13 / 0.10 A
$R_{DS(on)}$ = 16 Ω

- N channel
- Enhancement mode
- Packages: TO-92, SOT-23 [1])

TO-92
(BSS 101)



SOT-23
(BSS 131)



Type	Marking	Ordering code for version on bulk	Ordering code for version in tape [2])	Ordering code for version on 8-mm tape
BSS 101	–	Q62702-S484	Q62702-S493	–
BSS 131	SRs	Q62702-S554	–	Q62702-S565

Maximum Ratings

Parameter	Symbol	BSS		Unit
		101	131	
Drain-source voltage	V_{DS}	240		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	240		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 33 °C/26 °C	I_D	0.13	0.10	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.52	0.40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side [3])	R_{thJA} R_{thJSR}	≤ 200 –	≤ 350 ≤ 285	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	0.36	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.
[2]) E6288: on reel, 1500 pieces/reel, 2 reels/carton: (source first).
[3]) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Drain-source breakdown voltage		$V_{(BR)DSS}$				V
$V_{GS} = 0$, $I_D = 0.25$ mA			240	–	–	
Gate threshold voltage		$V_{GS(th)}$				
$V_{GS} = V_{DS}$, $I_D = 1$ mA			0.8	1.4	2.0	
Zero gate voltage drain current		I_{DSS}				µA
$V_{DS} = 240$ V, $V_{GS} = 0$						
$T_j = 25$ °C			–	1	15	
$T_j = 125$ °C			–	2	60	
$V_{DS} = 130$ V, $V_{GS} = 0$						
$T_j = 25$ °C			–	–	30	nA
Gate-source leakage current		I_{GSS}				nA
$V_{GS} = 20$ V, $V_{DS} = 0$			–	1	10	
Drain-source on-resistance		$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.13$ A	BSS 101		–	12	16	
$I_D = 0.1$ A	BSS 131					
$V_{GS} = 4.5$ V, $I_D = 0.13$ A	BSS 101		–	15	26	
$I_D = 0.1$ A	BSS 131					

Dynamic characteristics

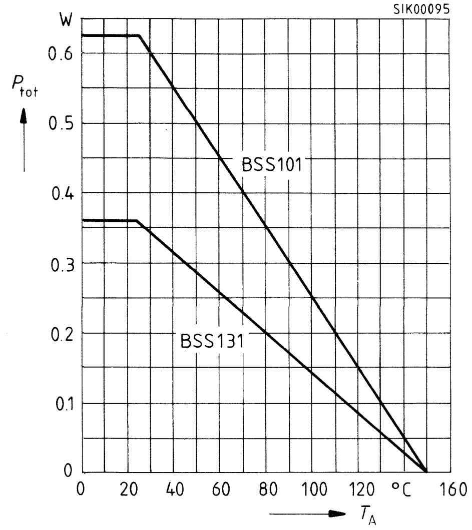
Parameter		Symbol	min.	typ.	max.	Unit
Forward transconductance		g_{fs}				S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.13$ A	BSS 101		0.06	0.16	–	
$I_D = 0.1$ A	BSS 131		0.06	0.14	–	
Input capacitance		C_{iss}				pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSS 101		–	60	80	
	BSS 131		–	60	90	
Output capacitance		C_{oss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz			–	8	12	
Reverse transfer capacitance		C_{rss}				
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BSS 101		–	2.5	4.0	
	BSS 131		–	2.5	5.0	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)		$t_{d(on)}$	–	5	8	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.26$ A		t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)		$t_{d(off)}$	–	12	16	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.26$ A		t_f	–	15	20	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

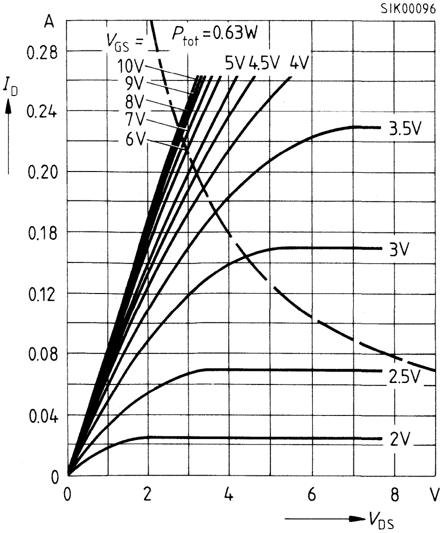
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
T_A = 25 °C	BSS 101		–	–	0.13	
	BSS 131		–	–	0.10	
Pulsed reverse drain current		I_{SM}				
T_A = 25 °C	BSS 101		–	–	0.52	
	BSS 131		–	–	0.40	
Diode forward on-voltage		V_{SD}				V
I_F = 0.26 A, V_{GS} = 0	BSS 101		–	0.85	1.2	
I_F = 0.2 A, V_{GS} = 0	BSS 131		–	0.8	1.2	

Characteristics at T_j = 25 °C, unless otherwise specified.

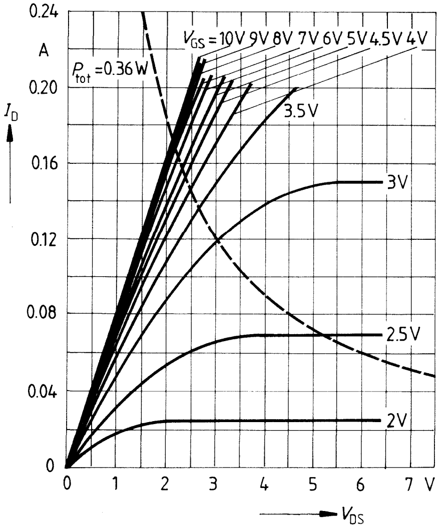
Total power dissipation $P_{tot} = f(T_A)$



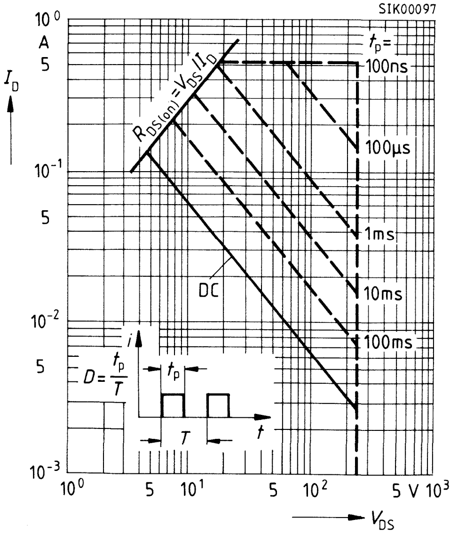
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 101



Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 131

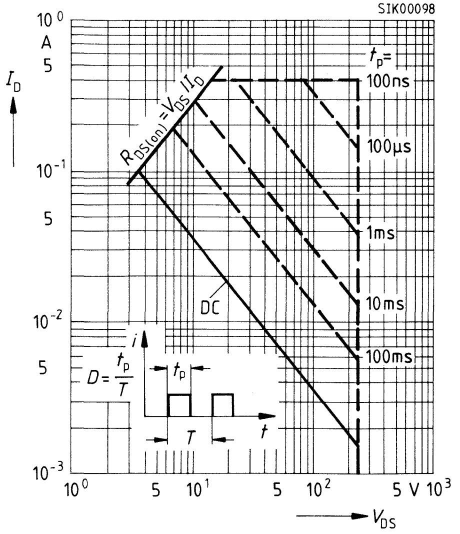


Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSS 101

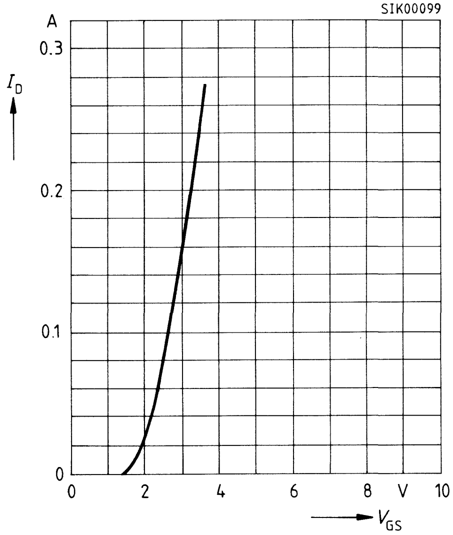


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

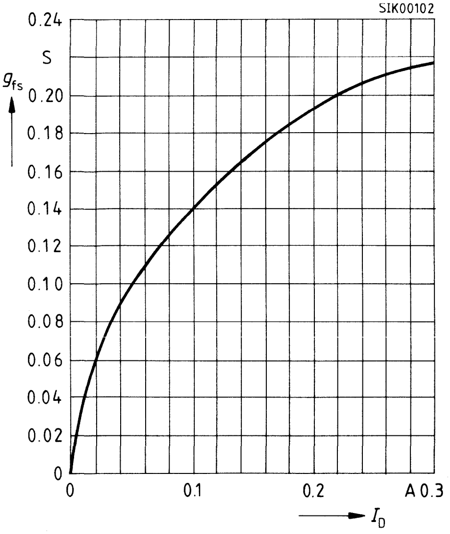
BSS 131



Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

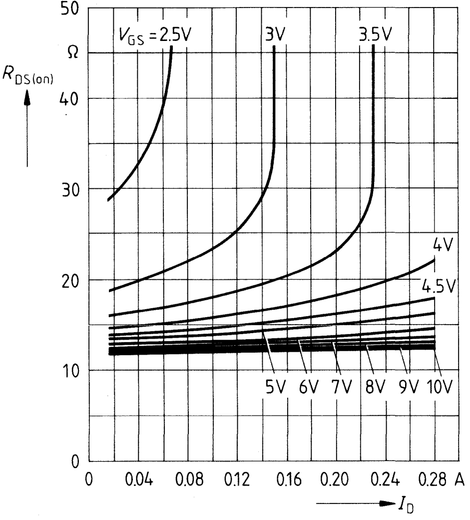


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

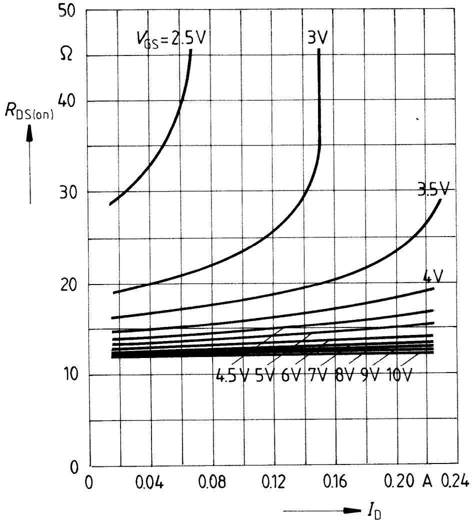


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

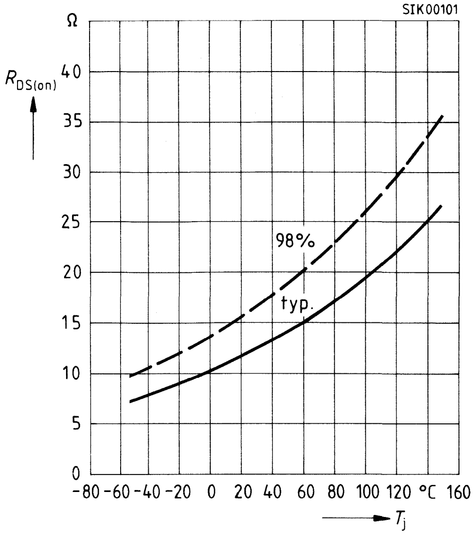
BSS 101



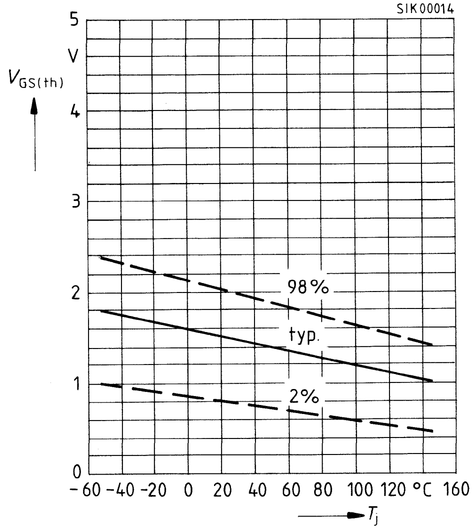
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 131



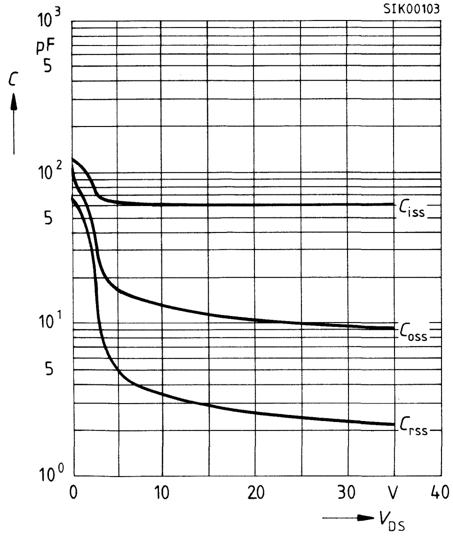
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.1 A, V_{GS} = 10 V, (spread)



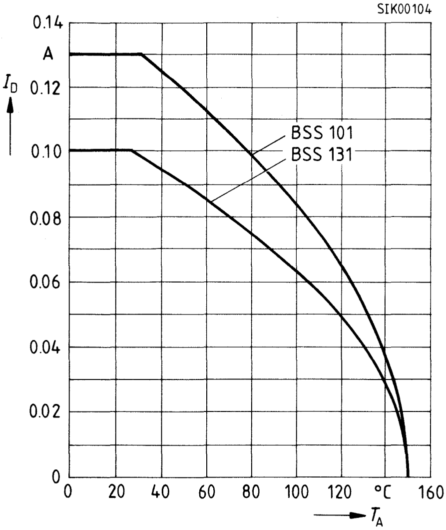
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



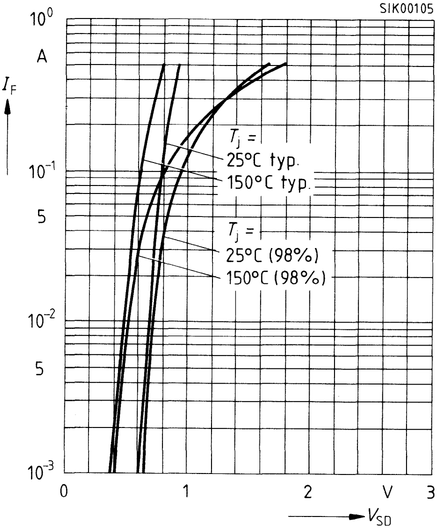
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, f = 1 MHz



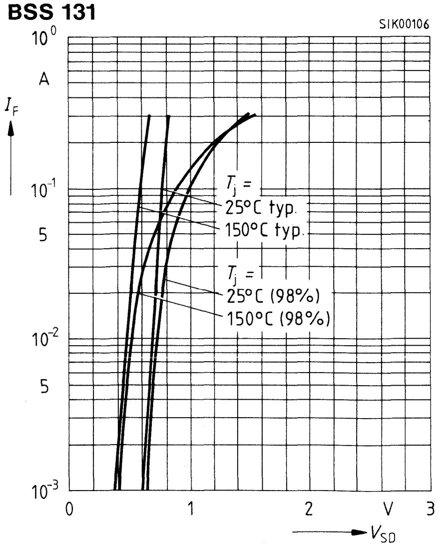
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 101



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 131



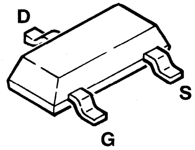
SIEMENS

SIPMOS® Small-Signal Transistor **BSS 119**

V_{DS} = **100 V**
I_D = **0.17 A**
$R_{DS(on)}$ = **6.0 Ω**

- N channel
- Enhancement mode
- Package: SOT-23 [1]

SOT-23



Type	Marking	Ordering code for version in bulk	Ordering code for version on 8-mm tape
BSS 119	sSH	Q62702-S624	Q62702-S631

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, $R_{GS} = 20$ kΩ	V_{DGR}	100	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, $T_A = 28$ °C	I_D	0.17	A
Pulsed drain current, $T_A = 25$ °C	$I_{D\ puls}$	0.68	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side[2]	 R_{thJA} R_{thJSR}	 ≤ 350 ≤ 285	K/W
Max. power dissipation, $T_A = 25$ °C	P_{tot}	0.36	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.
[2] For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

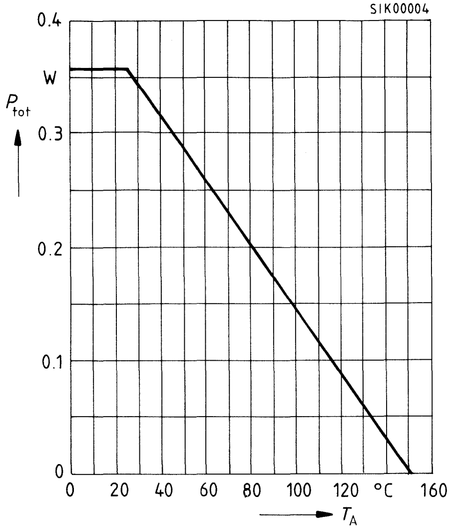
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.6	2.0	2.6	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	–	0.5	
$T_j = 125$ °C		–	–	5	
$V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C		–	–	100	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 0.17$ A		–	3.2	6.0	
$V_{GS} = 4.5$ V, $I_D = 0.17$ A		–	4.7	10.0	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.17$ A	g_{fs}	0.10	0.20	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	40	60	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	10	15	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	4	6	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(on)}$	–	5	8	ns
	t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.28$ A	$t_{d(off)}$	–	12	16	
	t_f	–	17	22	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

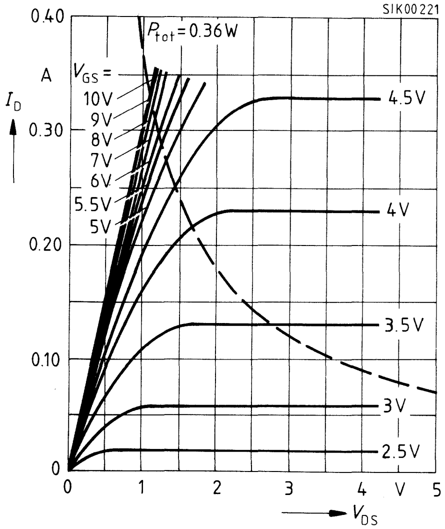
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	0.17	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	0.68	
Diode forward on-voltage $I_F = 0.34$ A, $V_{GS} = 0$	V_{SD}	–	0.85	1.4	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

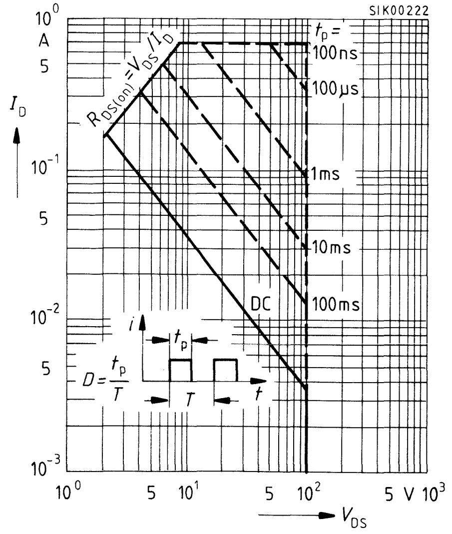
Total power dissipation $P_{tot} = f(T_A)$



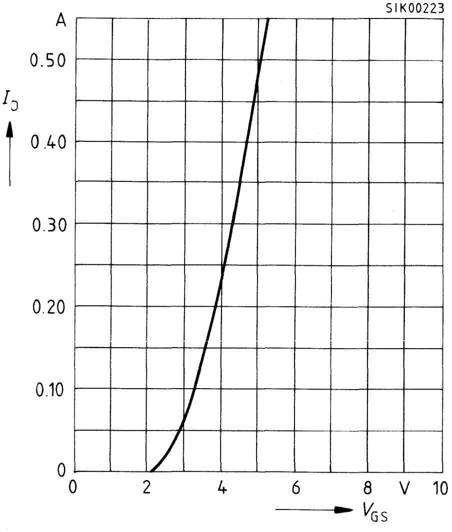
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



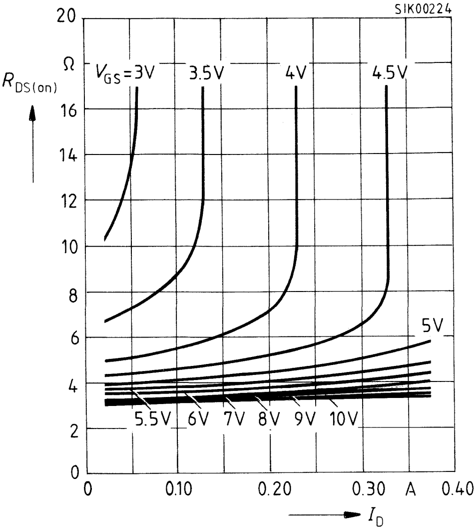
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



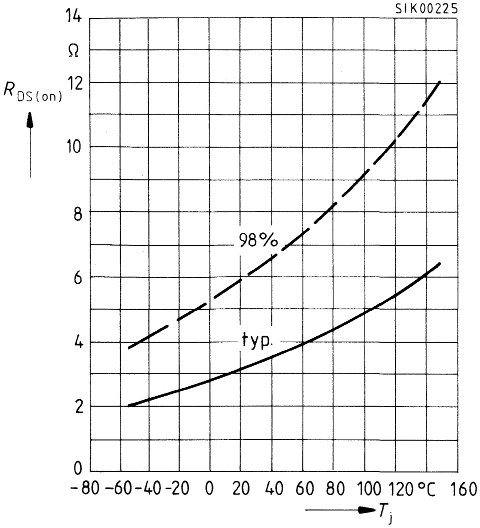
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



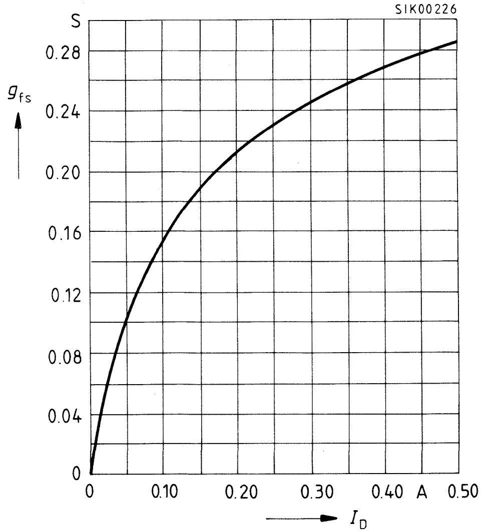
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



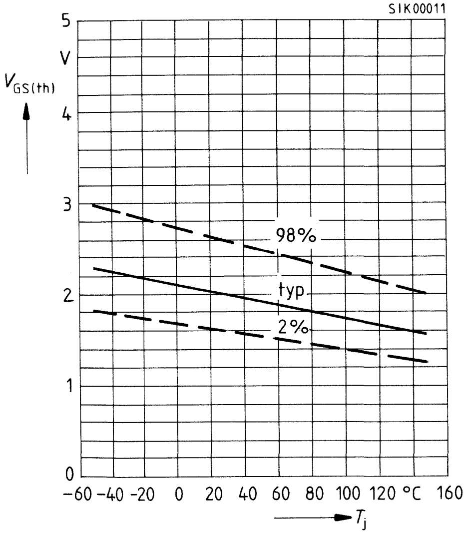
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.17$ A, $V_{GS} = 10$ V, (spread)



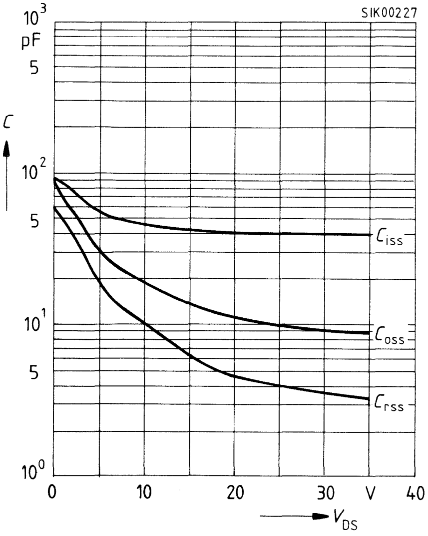
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



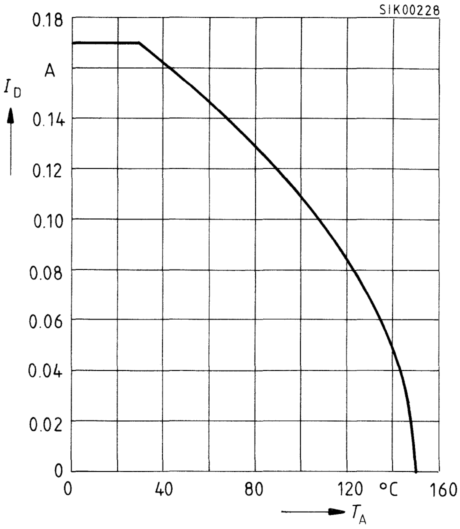
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



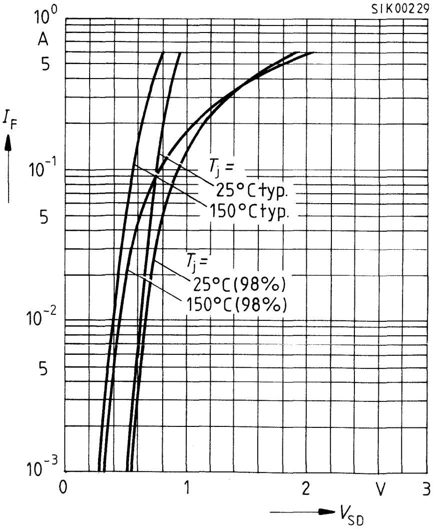
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



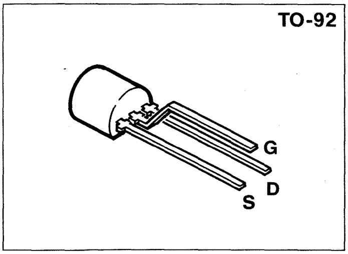
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)



SIPMOS® Small-Signal Transistor BSS 124

V_{DS} = 400 V
I_D = 0.12 A
$R_{DS(on)}$ = 28 Ω

- N channel
- Enhancement mode
- Package: TO-92 1)



Type	Ordering code for version in bulk
BSS 124	Q62702-S614

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Drain-gate voltage, $R_{GS} = 20$ kΩ	V_{DGR}	400	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, $T_A = 37$ °C	I_D	0.12	A
Pulsed drain current, $T_A = 25$ °C	$I_{D\ puls}$	0.48	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Thermal resistance chip-ambient (without heat sink)	R_{thJA}	≤ 125	K/W
Max. power dissipation, $T_A = 25$ °C	P_{tot}	1.0	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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1) See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 0.1 8	 1.0 50	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 0.12$ A	$R_{DS(on)}$	–	16	28	Ω

Dynamic characteristics

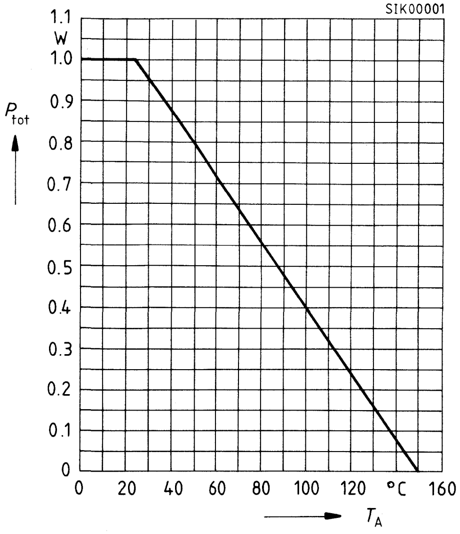
Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.12$ A	g_{fs}	0.10	0.20	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	100	135	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	10	15	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	7	11	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 210$ mA	$t_{d(on)}$	–	10	–	ns
	t_r	–	10	–	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 210$ mA	$t_{d(off)}$	–	15	–	
	t_f	–	25	–	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

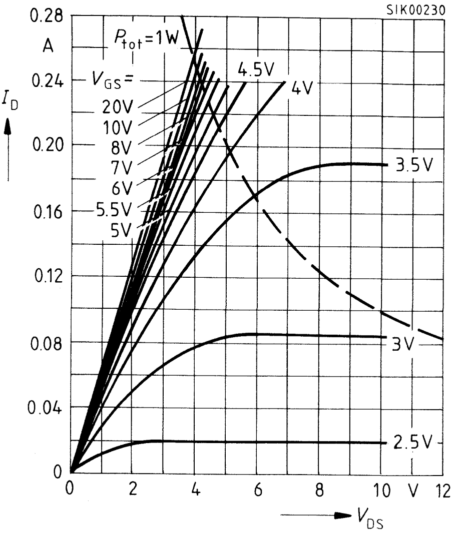
Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	0.12	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	0.48	
Diode forward on-voltage $I_F = 0.24$ A, $V_{GS} = 0$	V_{SD}	–	0.85	1.30	V
Reverse recovery time $V_R = 100$ V, $I_F = 0.2$ A, $di_F/dt = 100$ A/µs	t_{rr}	–	300	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = 0.2$ A, $di_F/dt = 100$ A/µs	Q_{rr}	–	0.82	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

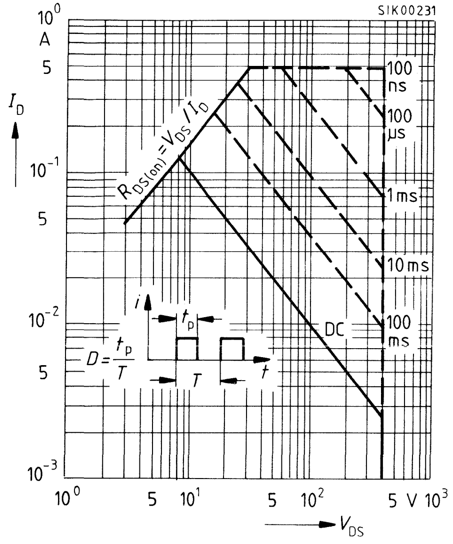
Total power dissipation $P_{tot} = f(T_A)$



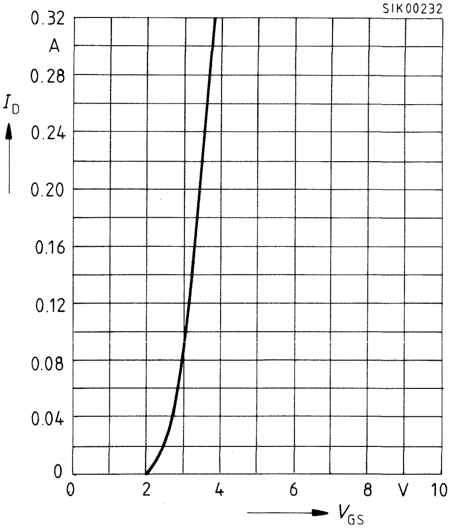
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



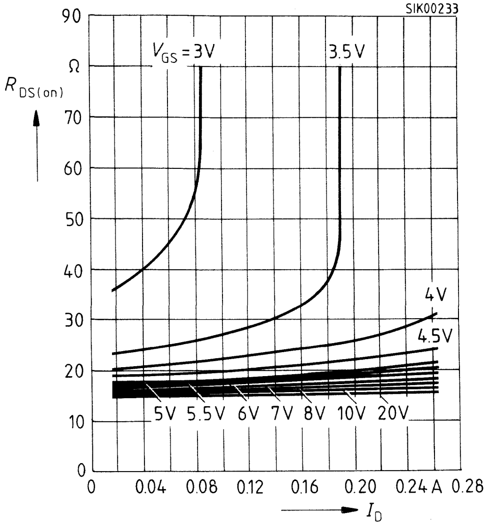
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



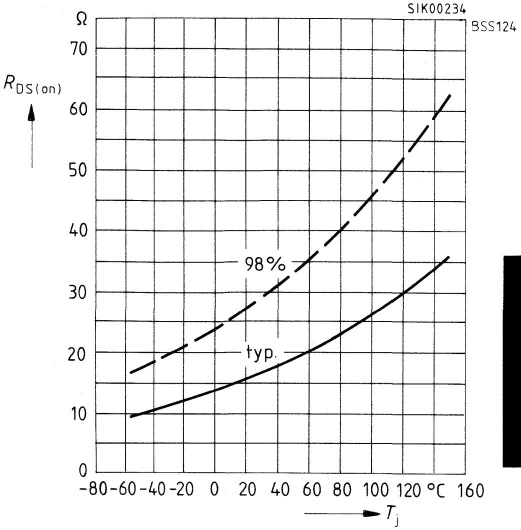
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



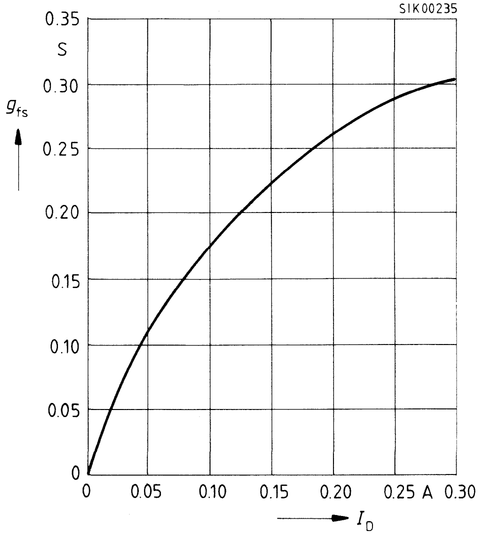
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



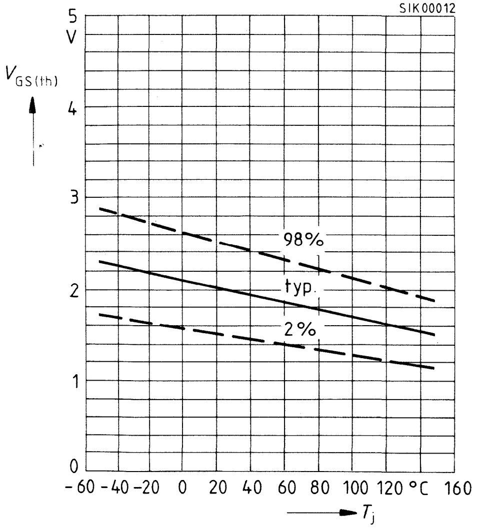
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.12 A, V_{GS} = 10 V, (spread)



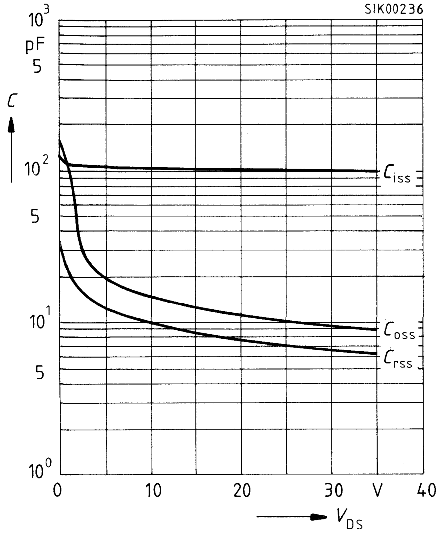
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



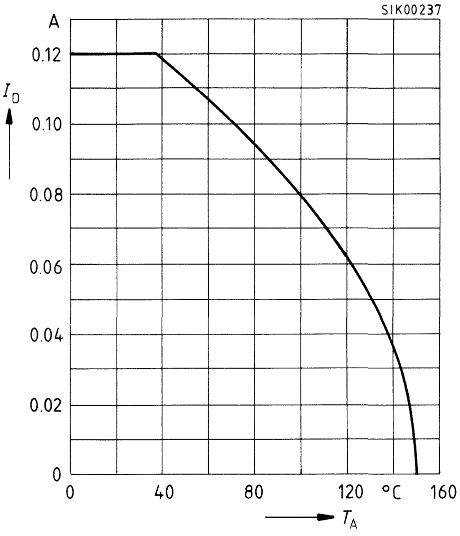
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



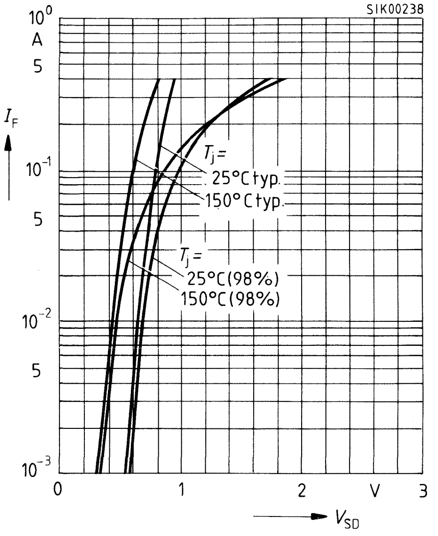
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

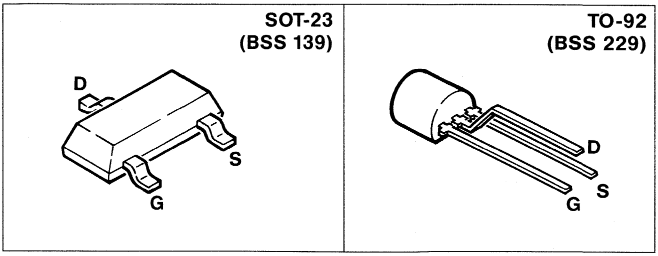


SIPMOS® Small-Signal Transistors

BSS 139
BSS 229

V_{DS} = 250 V
I_D = 0.04 / 0.07 A
$R_{DS(on)}$ = 100 Ω

- N channel
- Depletion mode
- Packages: SOT-23, TO-92 1)



Type	Marking	Ordering code for version in bulk	Ordering code for version on 8-mm tape	Ordering code for version on tape 2)
BSS 139	STs	Q62702-S575	Q62702-S612	-
BSS 229	-	Q62702-S567 Q62702-S567-P1 (grouped) 3)	-	Q62702-S600 Q62702-S600-P1 (grouped) 3)

Maximum Ratings

Parameter	Symbol	BSS 139	BSS 229	Unit
Drain-source voltage	V_{DS}	250		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	250		
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_A = 25 °C	I_D	0.04	0.07	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.12	0.21	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side 4)	 R_{thJA} R_{thJSR}	 ≤ 350 ≤ 285	 ≤ 200 –	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.36	0.63	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		–

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1) See chapter Package Outlines.
2) E6296: on reel, 1500 pieces/reel, 2 reels/carton: (gate first).
3) Single groups are not available.
4) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

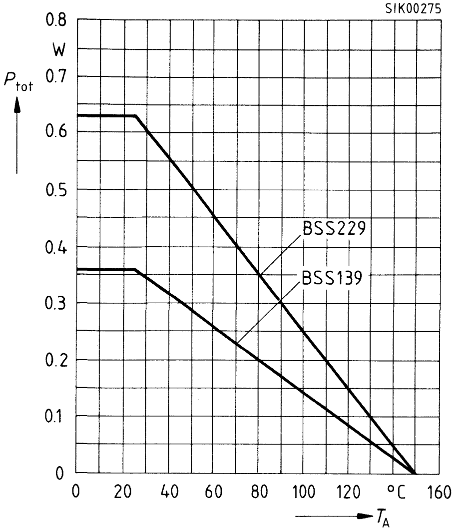
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = -3$ V, $I_D = 0.25$ mA	$V_{(BR)DSV}$	250	–	–	V
Gate threshold voltage $V_{DS} = 3$ V, $I_D = 1$ mA	$V_{GS(th)}$	-1.8	-1.4	-0.7	
Drain-source cutoff current $V_{DS} = 250$ V, $V_{GS} = -3$ V $T_j = 25$ °C $T_j = 125$ °C	I_{DSV}	– –	– –	100 200	nA µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 0$ V, $I_D = 0.014$ A	$R_{DS(on)}$	–	75	100	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.04$ A BSS 139 $I_D = 0.07$ A BSS 229	g_{fs}	0.05 0.05	0.07 0.10	- -	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	50	-	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	10	-	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	3	-	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.15$ A	$t_{d(on)}$	-	10	-	ns
	t_r	-	20	-	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = -2$ V...+5 V, $R_{GS} = 50$ Ω $I_D = 0.15$ A	$t_{d(off)}$	-	70	-	
	t_f	-	120	-	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

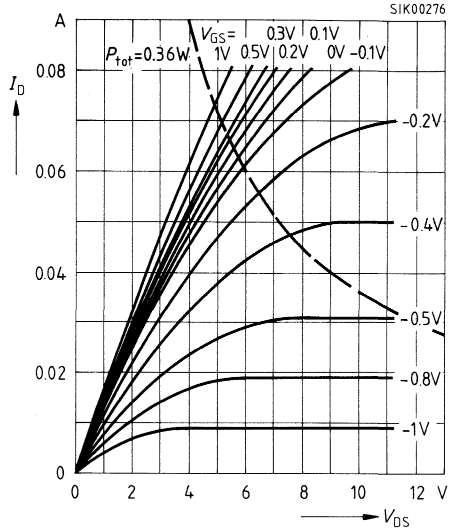
Parameter		**Symbol**	**Values**			**Unit**
			min.	typ.	max.	
Reverse Diode						
Continuous reverse drain current		I_S				A
$T_A = 25$ °C	BSS 139		–	–	0.04	
	BSS 229		–	–	0.07	
Pulsed reverse drain current		I_{SM}				
$T_A = 25$ °C	BSS 139		–	–	0.12	
	BSS 229		–	–	0.21	
Diode forward on-voltage		V_{SD}				V
$I_F = 0.08$ A, $V_{GS} = 0$	BSS 139		–	0.7	1.2	
$I_F = 0.14$ A, $V_{GS} = 0$	BSS 229		–	0.8	1.2	

Characteristics at T_j = 25 °C, unless otherwise specified.

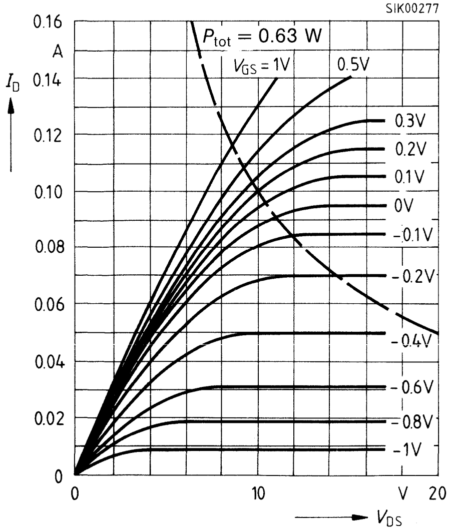
Total power dissipation $P_{tot} = f(T_A)$



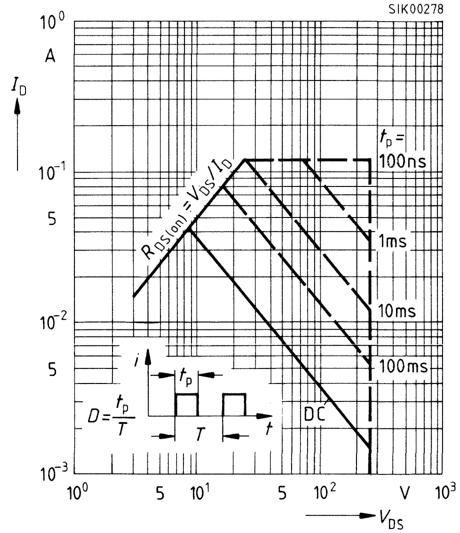
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 139



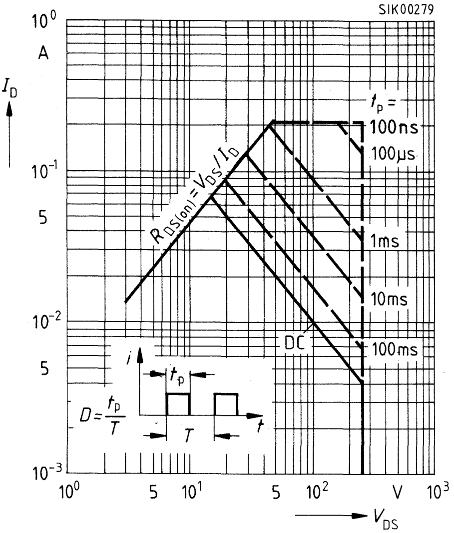
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BSS 229



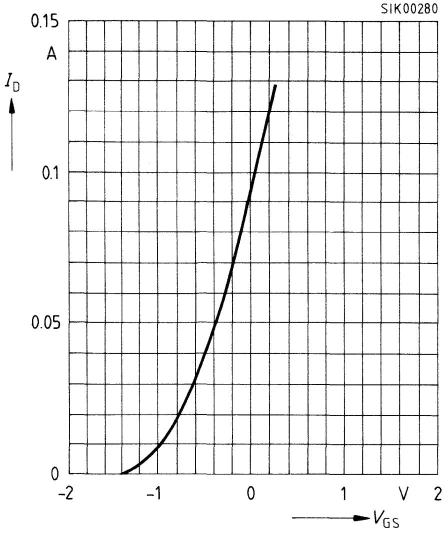
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C
BSS 139



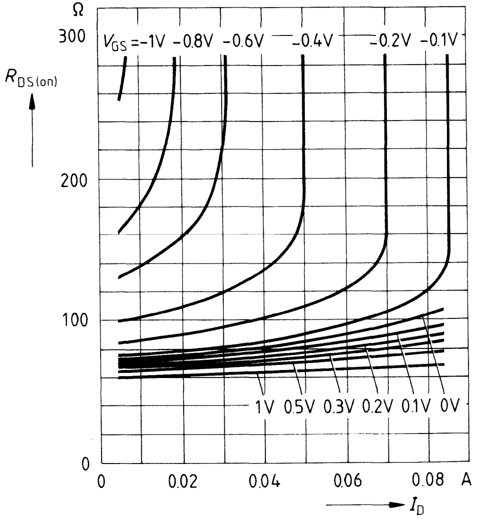
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BSS 229



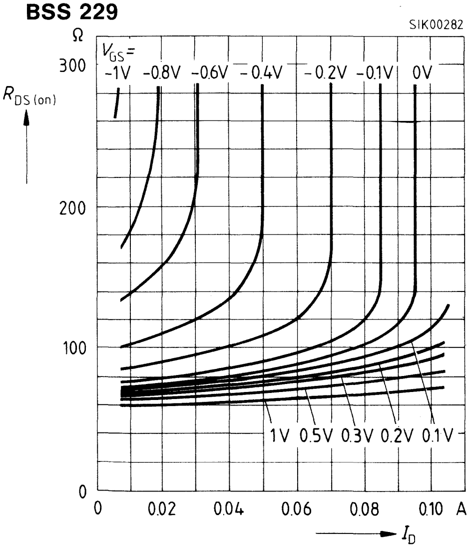
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



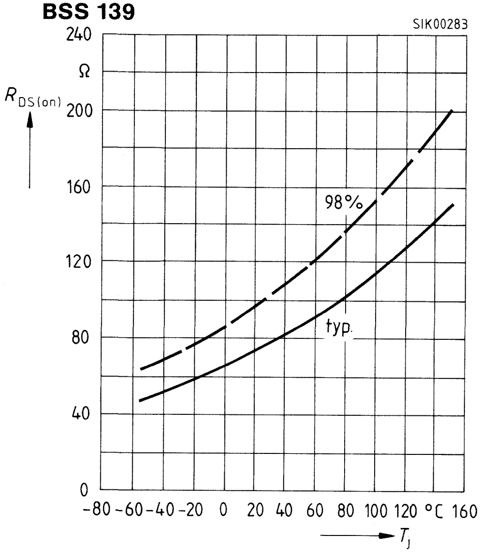
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 139



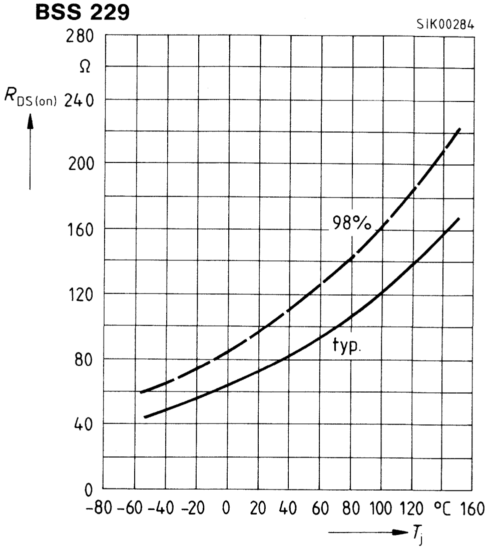
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BSS 229



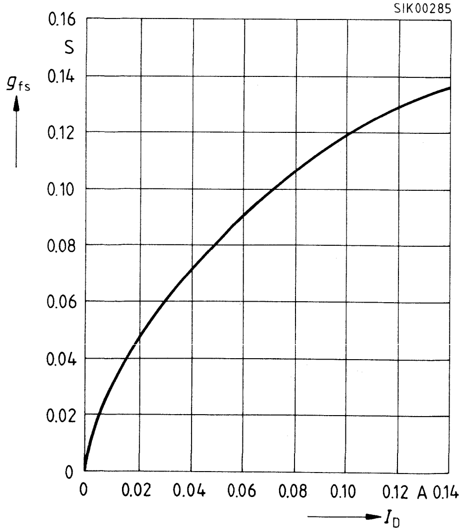
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.014$ A, $V_{GS} = 10$ V, (spread)
BSS 139



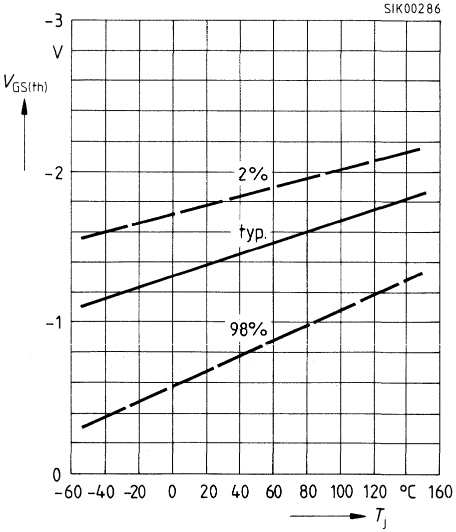
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.014$ A, $V_{GS} = 10$ V, (spread)
BSS 229



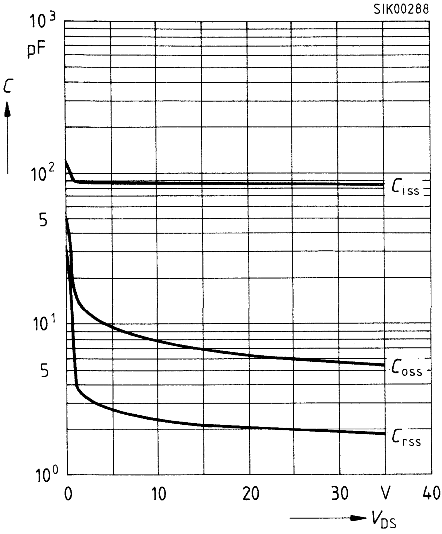
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



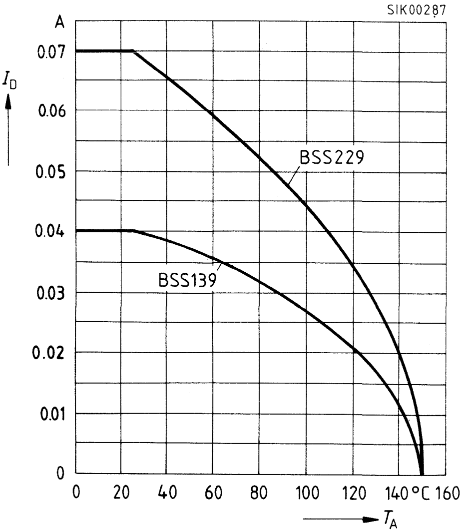
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



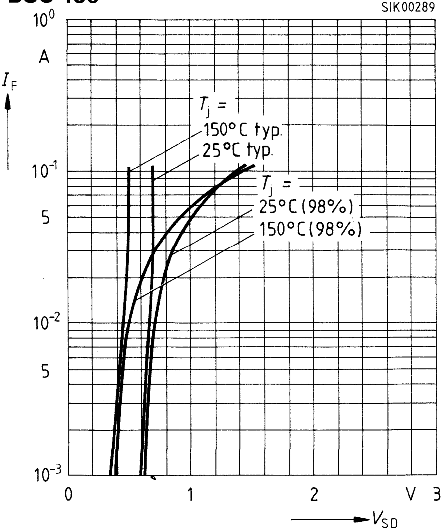
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



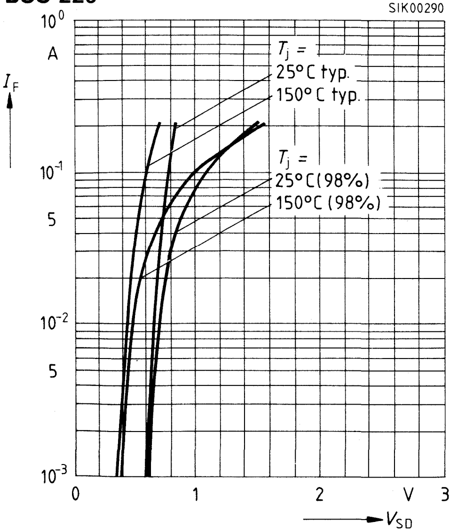
Drain current $I_D = f\,(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 139



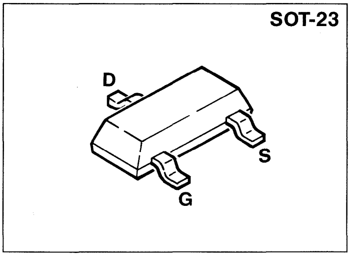
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)
BSS 229



SIPMOS® Small-Signal Transistor BSS 145
Preliminary Data

V_{DS} = 65 V
I_D = 0.22 A
$R_{DS(on)}$ = 3.5 Ω

- N channel
- Enhancement mode
- Package: SOT-23 [1]



Type	Marking	Ordering code for version in bulk	Ordering code for version on 8-mm tape
BSS 145	SD	–	Q67000-S102

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	65	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	65	
Gate-source voltage, aperiodic	V_{GS}	± 10	
Gate-source peak voltage	V_{gs}	± 20	
Continuous drain current, T_A = 31 °C	I_D	0.22	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	0.88	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side[2]	 R_{thJA} R_{thJSR}	 ≤ 350 ≤ 285	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.36	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.
[2]) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current $T_A = 25$ °C	I_S	–	–	0.22	A
Pulsed reverse drain current $T_A = 25$ °C	I_{SM}	–	–	0.88	
Diode forward on-voltage $I_F = 0.4$ A, $V_{GS} = 0$	V_{SD}	–	0.85	1.4	V

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.01$ mA	$V_{(BR)DSS}$	65	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 0.25$ mA	$V_{GS(th)}$	1.4	2.0	2.3	
Zero gate voltage drain current $V_{DS} = 65$ V, $V_{GS} = 0$ $T_j = 25$ °C	I_{DSS}	–	–	1.0	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 0.2$ A $V_{GS} = 3.5$ V, $I_D = 0.02$ A	$R_{DS(on)}$	– –	– –	3.5 6.5	Ω

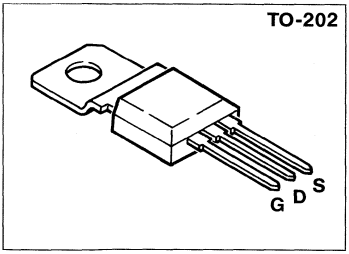
Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 0.2$ A	g_{fs}	0.12	0.20	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	40	60	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	10	25	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	4	7	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.2$ A	$t_{d(on)}$	–	5	8	ns
	t_r	–	8	12	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.2$ A	$t_{d(off)}$	–	12	16	
	t_f	–	17	22	

SIPMOS® Small-Signal Transistor **BSS 395**

V_{DS} = 50 V
I_D = 4.4 A
$R_{DS(on)}$ = 0.3 Ω

- N channel
- Enhancement mode
- Package: TO-202 [1])



Type	Ordering code for version in bulk
BSS 395	Q62702-S604

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 25 °C	I_D	4.4	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	17	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Thermal resistance chip - ambient (without heat sink) chip - case	 R_{thJA} R_{thJC}	 ≤ 65 ≤ 12.5	K/W
Max. power dissipation, T_C = 25 °C	P_{tot}	10	W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

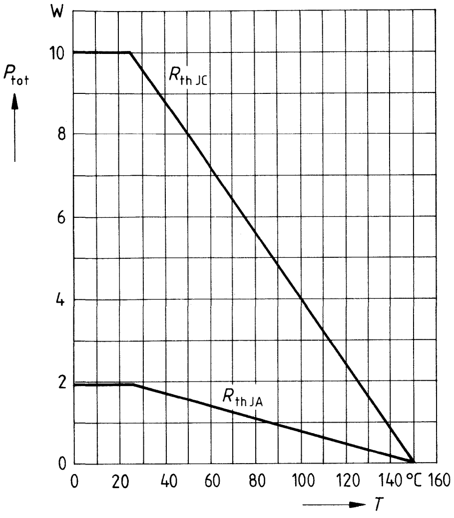
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 0.25$ mA	$V_{GS(th)}$	0.8	1.2	2.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	0.1	1.0	
$T_j = 125$ °C		–	8	50	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance	$R_{DS(on)}$				Ω
$V_{GS} = 10$ V, $I_D = 2.8$ A		–	0.25	0.3	
$V_{GS} = 4.5$ V, $I_D = 2.8$ A		–	0.48	0.60	
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 2.8$ A	g_{fs}	0.5	1.7	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	370	550	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	110	170	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	40	60	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.3$ A	$t_{d(on)}$	–	8	12	ns
	t_r	–	15	25	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 0.3$ A	$t_{d(off)}$	–	100	150	
	t_f	–	75	110	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

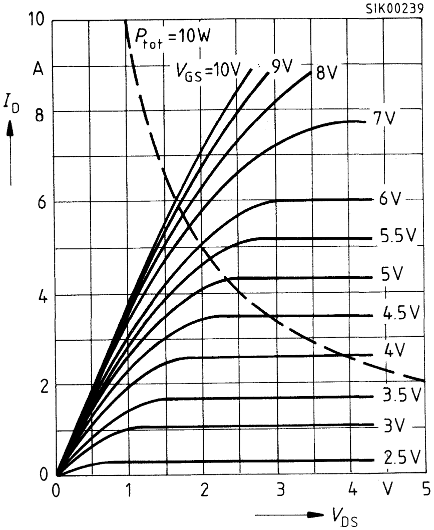
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	4.4	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	17	
Diode forward on-voltage I_F = 8.8 A, V_{GS} = 0	V_{SD}	–	1.7	2.0	V

Characteristics at $T_j = 25$ °C, unless otherwise specified.

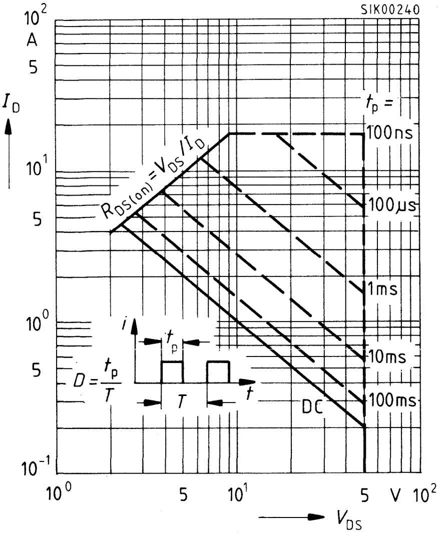
Total power dissipation $P_{tot} = f(T)$



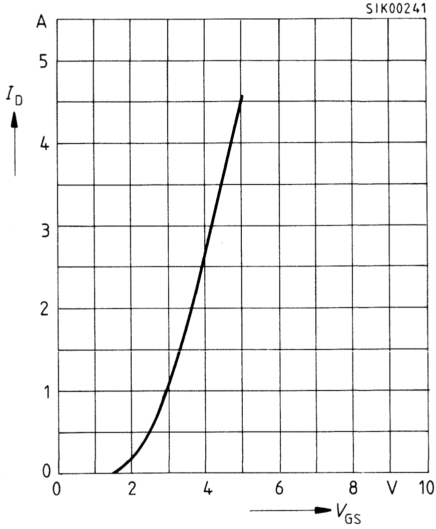
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



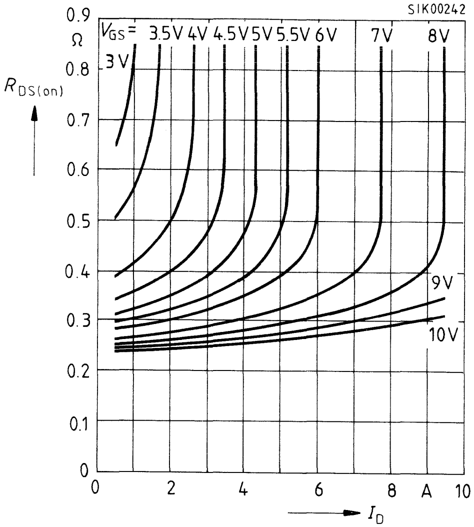
Safer operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



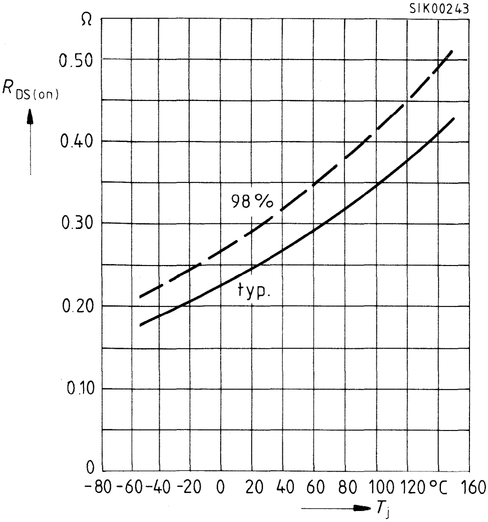
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



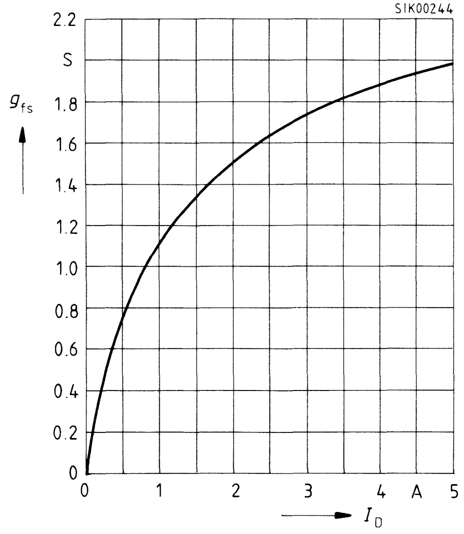
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



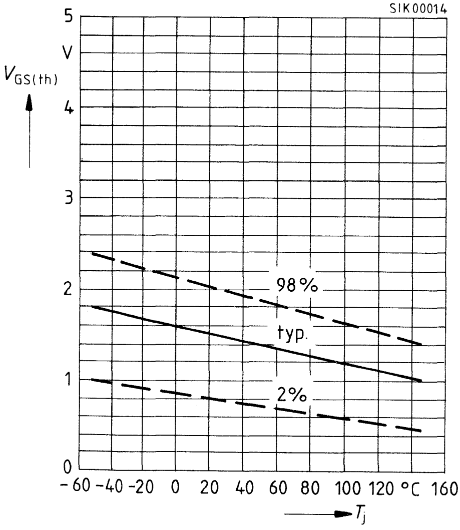
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 2.8 A, V_{GS} = 10 V, (spread)



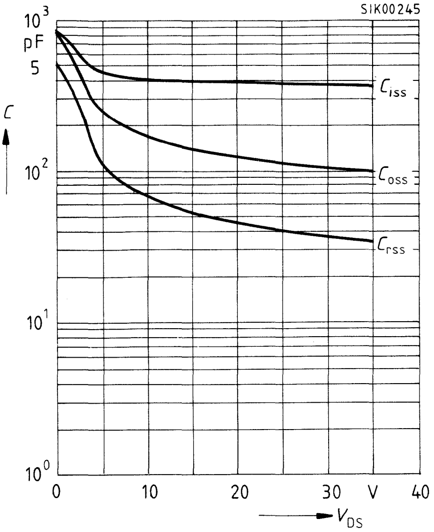
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



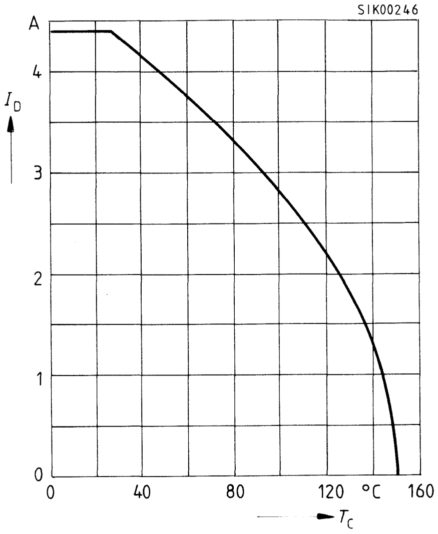
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



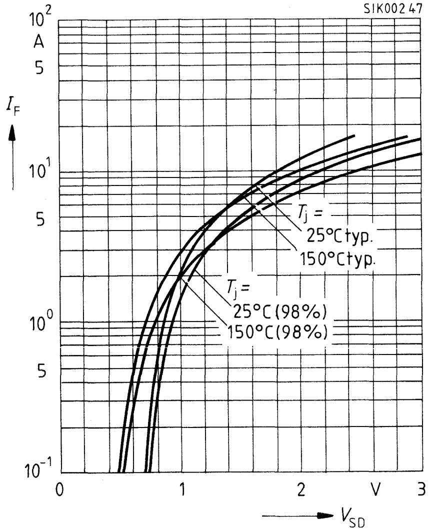
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



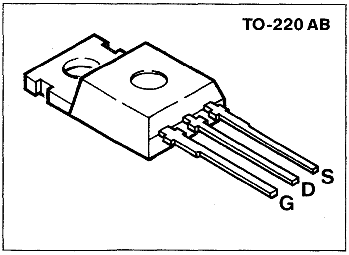
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)



TEMPFET

BTS 100

V_{DS} = – 50 V
I_D = – 8 A
$R_{DS(on)}$ = 0.3 Ω



- P channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1]

Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 100	C67078-A5007-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	– 8.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	– 32	
Short-circuit current T_j = – 55 ... +150 °C	I_{SC}	– 25	
Short-circuit dissipation T_j = – 55 ... +150 °C	P_{SCmax}	500	W
Max. power dissipation	P_{tot}	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 75	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-50	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-2.5	-3.0	-3.5	
Zero gate voltage drain current $V_{DS} = -50$ V, $V_{GS} = 0$ T_j = 25 °C T_j = 125 °C	I_{DSS}	- -	-1 -100	-10 -300	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$ T_j = 25 °C T_j = 150 °C	I_{GSS}	- -	-10 -2	-100 -4	nA µA
Drain-source on-state resistance $V_{GS} = -10$ V, $I_D = -5$ A	$R_{DS(on)}$	-	0.25	0.3	Ω

Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} = -25$ V, $I_D = -5$ A	g_{fs}	1.5	2.3	4.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	900	1200	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	350	550	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	130	230	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = -30 V, V_{GS} = -10 V, I_D = -2.9 A, R_{GS} = 50 Ω	$t_{d(on)}$	-	20	30	ns
	t_r	-	60	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = -30 V, V_{GS} = -10 V, I_D = -2.9 A, R_{GS} = 50 Ω	$t_{d(off)}$	-	70	90	
	t_f	-	55	75	

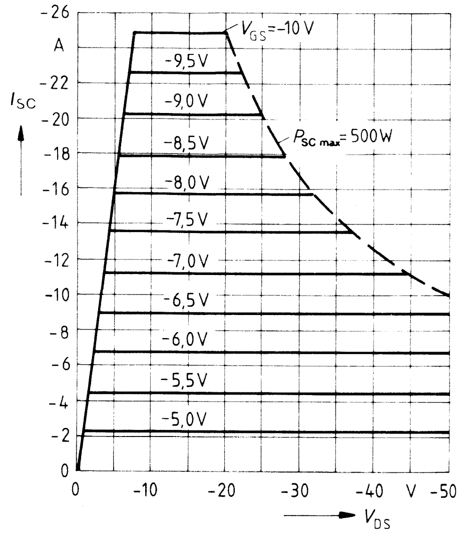
Electrical Characteristics
at T_j = 25 °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	– 8.0	A
Pulsed source current	I_{SM}	–	–	– 32	
Diode forward on-voltage	V_{SD}				V
I_F = – 16 A, V_{GS} = 0		–	– 1.0	– 1.7	
Reverse recovery time	t_{rr}				ns
$I_F = I_S$, di_F/dt = – 100 A/µs, V_R = – 30 V		–	90	–	
Reverse recovery charge	Q_{rr}				µC
$I_F = I_S$, di_F/dt = – 100 A/µs, V_R = – 30 V		–	0.23	–	
Temperature sensor					
Forward voltage	$V_{TS(on)}$				V
$I_{TS(on)}$ = –10 mA, T_j = – 55...+150 °C		– 0.7	– 1.4	– 1.5	
Sensor override, $t_p \leq$ 100 µs, $f \leq$ 1 kHz T_j = – 55...+160 °C		–	–	– 15	
Forward current	$I_{TS(on)}$				mA
T_j = – 55...+150 °C		–	–	– 10	
Sensor override, $t_p \leq$ 100 µs, $f \leq$ 1 kHz T_j = – 55...+160 °C		–	–	– 600	
Holding current	I_H				mA
$V_{TS(off)}$ = – 5 V, T_j = 25 °C		– 0.05	– 0.3	– 0.5	
T_j = 150 °C		– 0.05	– 0.2	– 0.3	
Switching temperature	$T_{TS(on)}$				°C
V_{TS} = – 5 V		150	–	–	
Turn-off time	t_{off}				µs
V_{TS} = – 5 V, $I_{TS(on)}$ = – 2 mA		1.0	2.5	5.0	

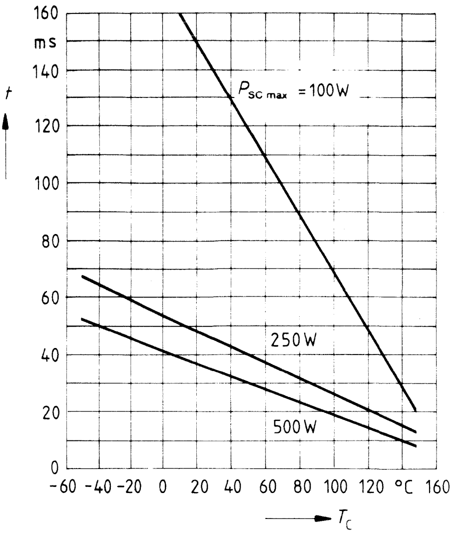
Examples for short-circuit protection
($T_j = -55 \ldots +150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	– 15	– 30	–	V
Gate-source voltage	V_{GS}	– 10	– 8.2	–	
Short-circuit current	I_{SC}	≤ – 25	≤ – 16	–	A
Short-circuit dissipation	P_{SC}	375	500	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	55	55	–	ms

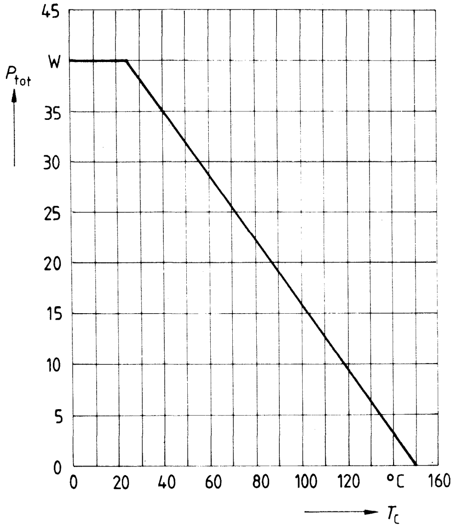
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \dots +150$ °C



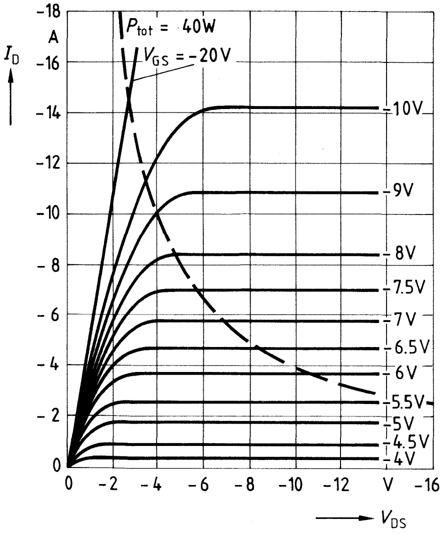
Turn-off time $t = f(T_C)$
Parameter: $P_{SC} = V_{DS} \times I_D$



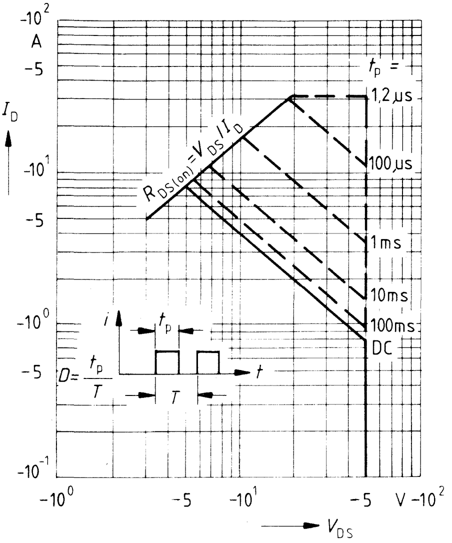
Max. power dissipation $P_{tot} = f(T_C)$



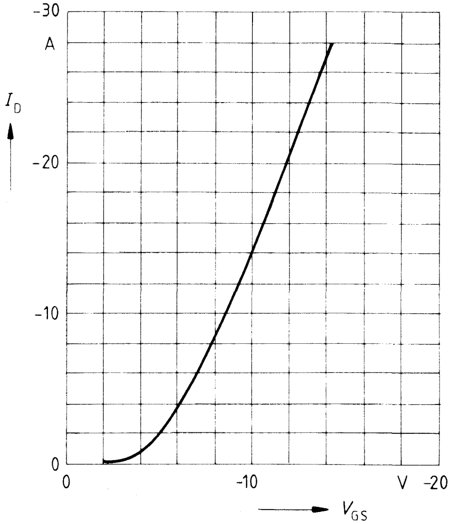
Typical output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



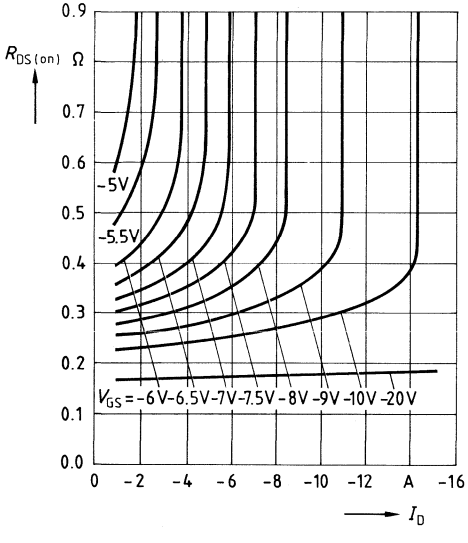
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



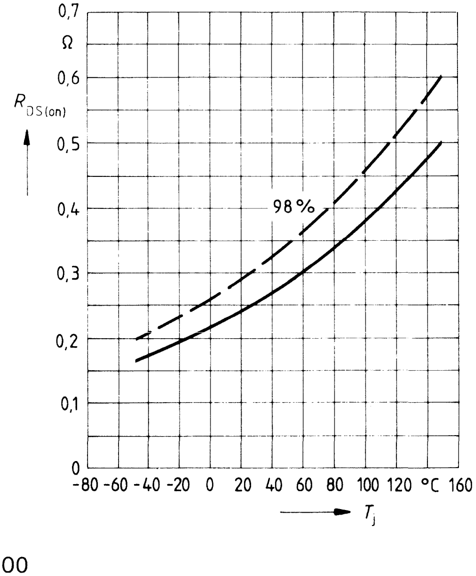
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



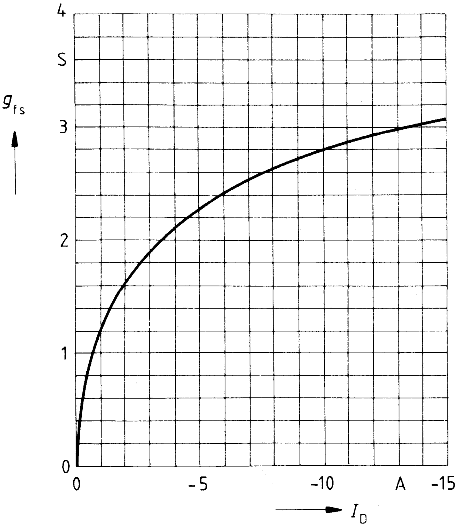
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



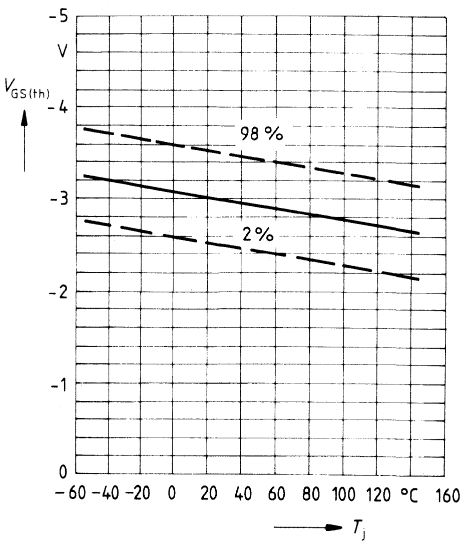
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = -5$ A, $V_{GS} = -10$ V
(spread)



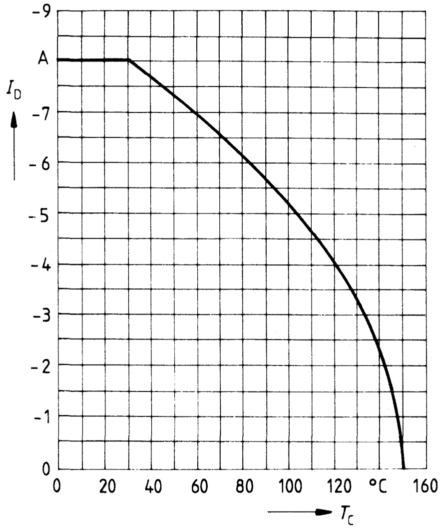
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80\ \mu s$, $V_{DS} = -25\ V$



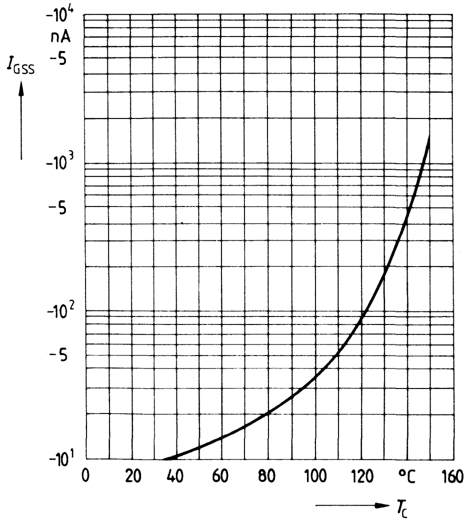
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = -1$ mA
(spread)



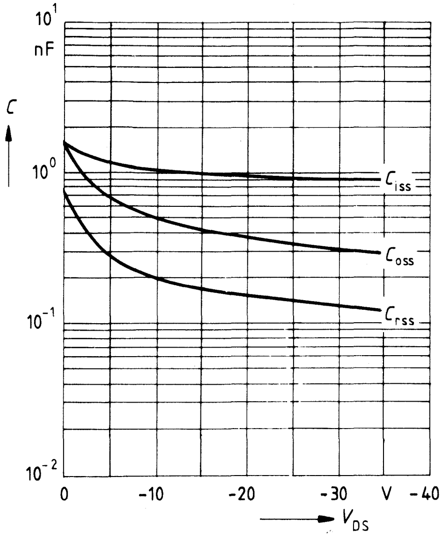
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq -10\ V$



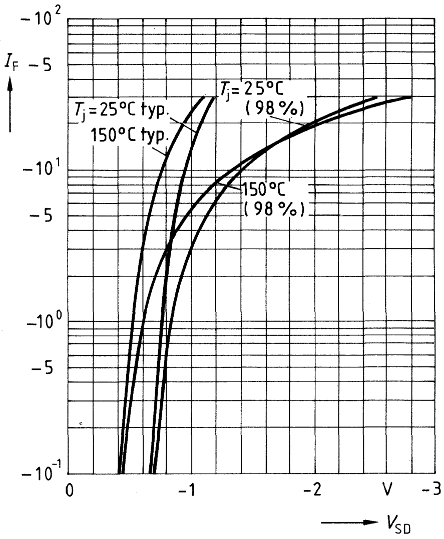
Typ. gate-source leakage current
$I_{GSS} = f(T_C)$
Parameter: $V_{GS} = -20\ V$, $V_{DS} = 0$



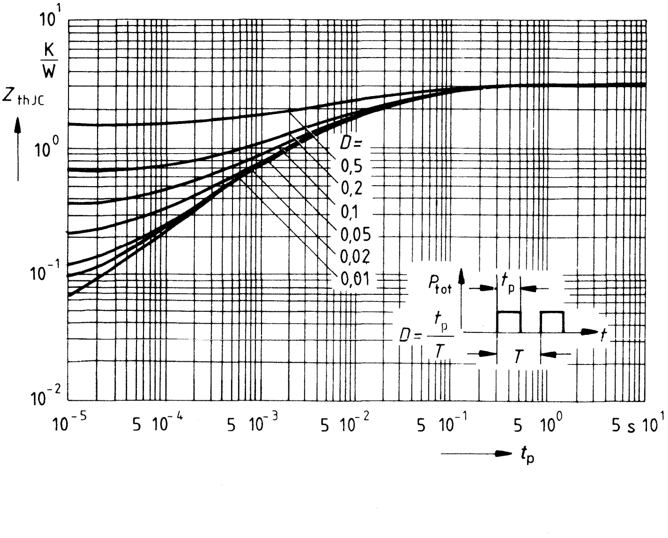
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs
(spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

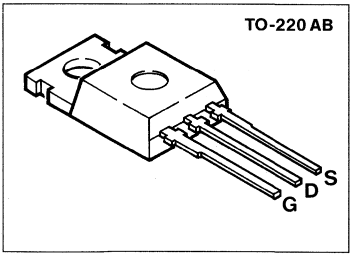


TEMPFET

BTS 110

V_{DS} = 100 V
I_D = 10 A
$R_{DS(on)}$ = 0.2 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 110	C67078-A5008-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	10	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	40	
Short-circuit current, $V_{DS} \leq 50$ V, T_j = – 55 ... +150 °C	I_{SC}	37	
Short-circuit dissipation, $V_{DS} \leq 50$ V, T_j = – 55 ... +150 °C	P_{SCmax}	500	W
Max. power dissipation	P_{tot}	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 75	K/W

[1]) See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 1$ mA	$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1 100	 10 300	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$ $T_j = 25$ °C $T_j = 150$ °C	I_{GSS}	 – –	 10 2.0	 100 4.0	 nA µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 5$ A	$R_{DS(on)}$	–	0.17	0.2	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 5$ A	g_{fs}	2.7	3.8	8.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	450	600	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	150	240	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	80	130	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	20	30	ns
	t_r	–	45	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	70	90	
	t_f	–	55	70	

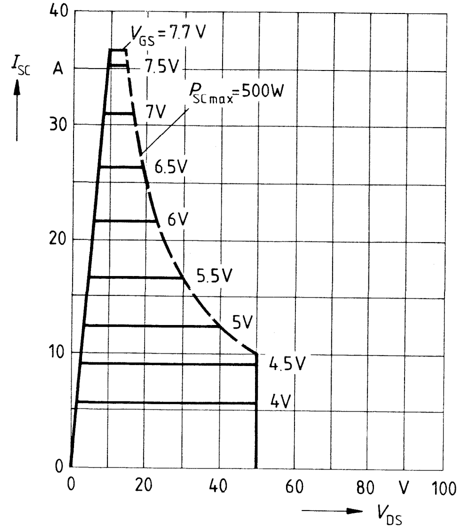
Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	10	A
Pulsed source current	I_{SM}	–	–	40	
Diode forward on-voltage $I_F = 20$ A, $V_{GS} = 0$	V_{SD}	–	1.3	1.6	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	170	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.30	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$V_{TS(on)}$	0.7 –	1.4 –	1.5 15	V
Forward current $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

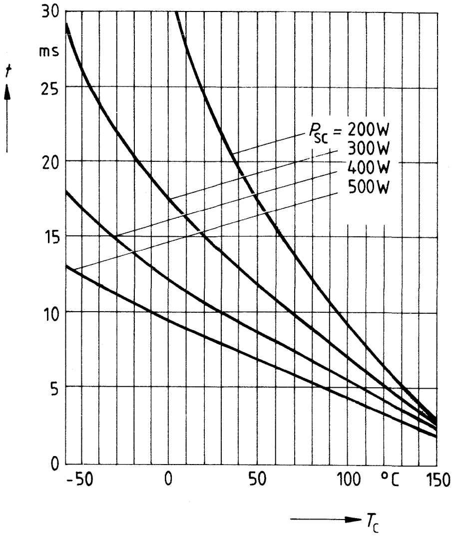
Examples for short-circuit protection
(T_j = – 55 . . . +150 °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	50	V
Gate-source voltage	V_{GS}	7.3	5.5	4.7	
Short-circuit current	I_{SC}	33.3	16.6	10	A
Short-circuit dissipation	P_{SC}	500	500	500	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	30	30	30	ms

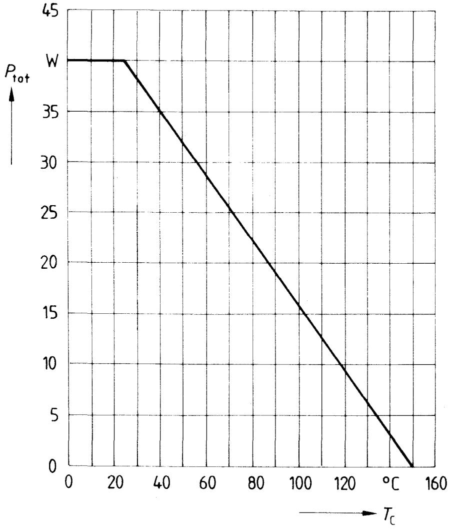
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \ldots +150$ °C



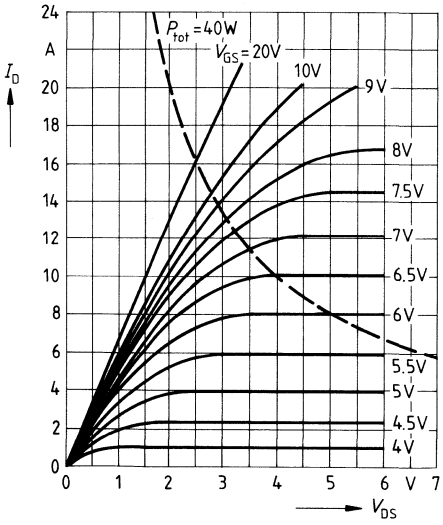
Turn-off time $t = f(T_C)$
Parameter: $P_{SC} = V_{DS} \times I_D$



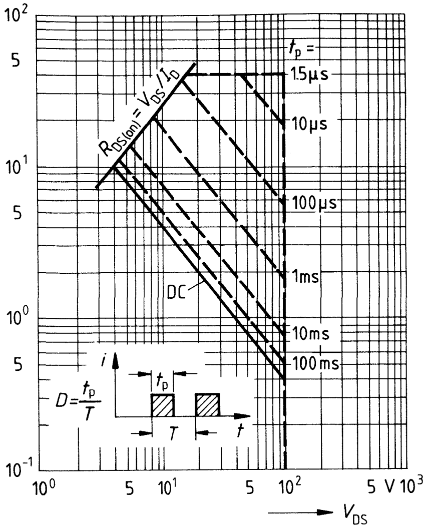
Max. power dissipation $P_{tot} = f(T_C)$



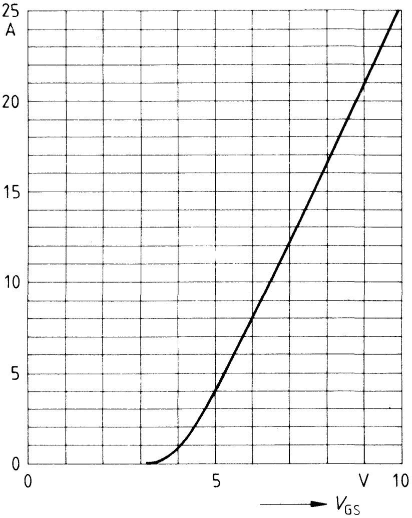
Typ. output characteristics $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



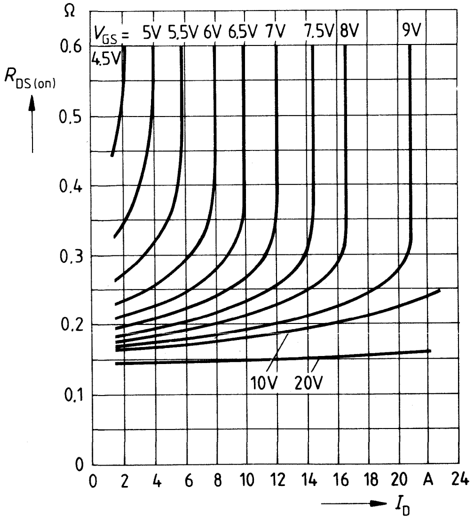
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



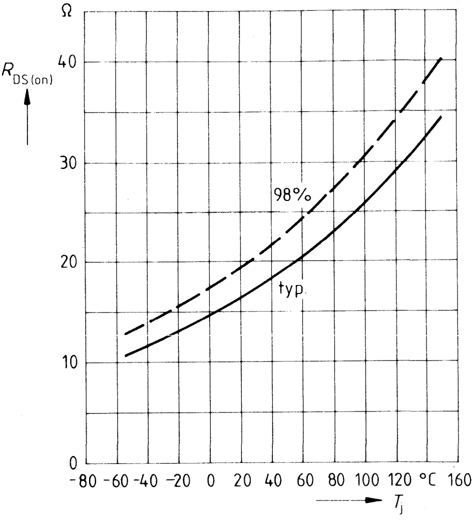
Typ. transfer characteristic
$I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



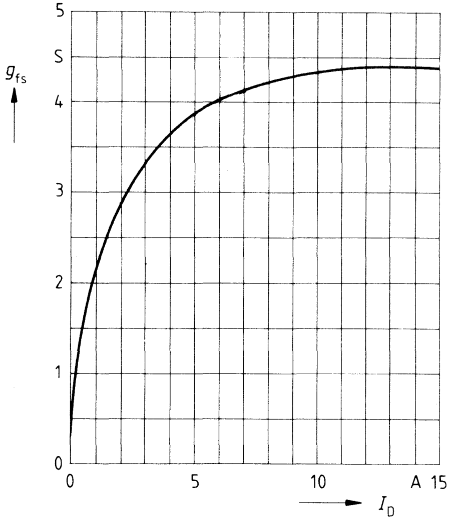
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



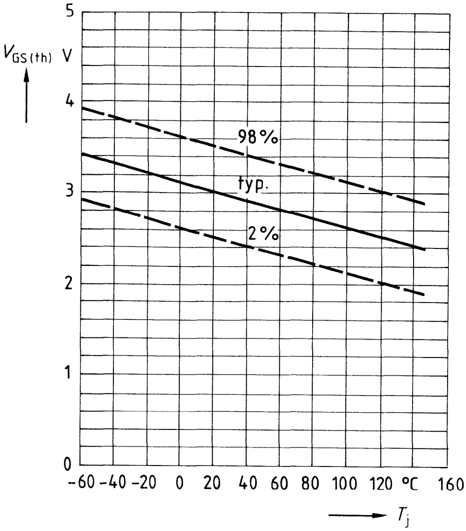
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 5$ A, $V_{GS} = 10$ V
(spread)



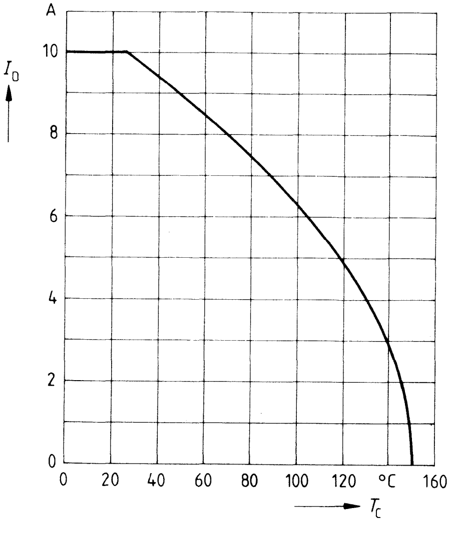
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80\ \mu s$, $V_{DS} = 25$ V



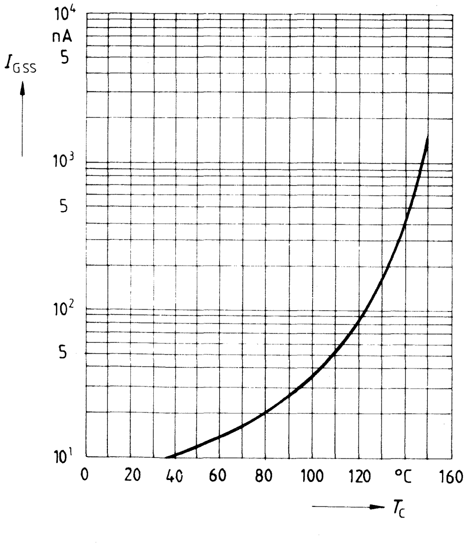
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



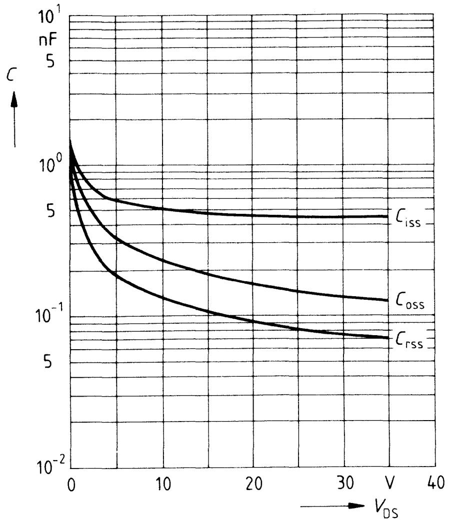
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V



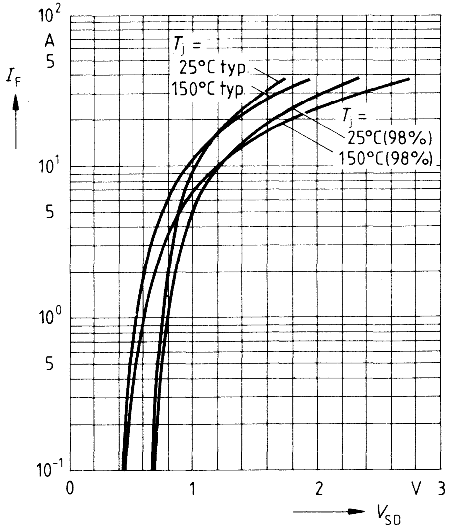
Typ. gate-source leakage current
$I_{GSS} = f(T_C)$
Parameter: $V_{GS} = 20$ V, $V_{DS} = 0$



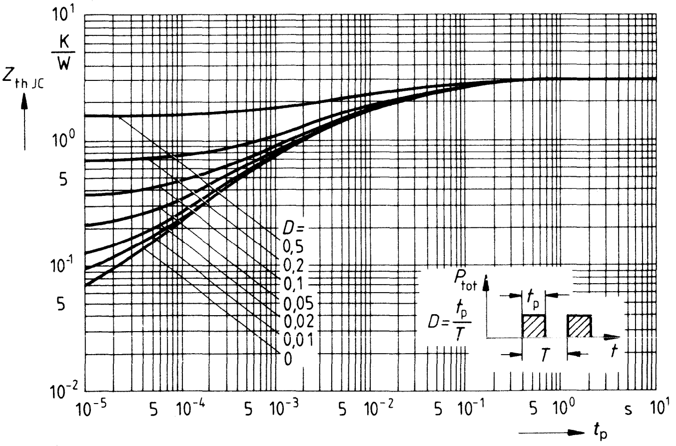
Typ. capacitances $C = f\,(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
Parameter: $D = t_p/T$

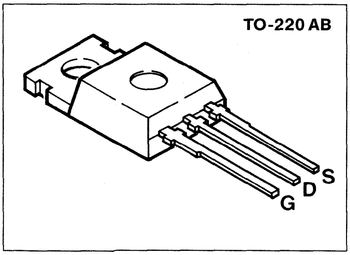


TEMPFET

BTS 114

V_{DS} = 50 V
I_D = 14 A
$R_{DS(on)}$ = 0.1 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 114	C67078-A5000-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	14	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	56	
Short-circuit current T_j = – 55 ... +150 °C	I_{SC}	40	
Short-circuit dissipation T_j = – 55 ... +150 °C	P_{SCmax}	600	W
Max. power dissipation	P_{tot}	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current V_{DS} = 50 V, V_{GS} = 0	I_{DSS}				µA
T_j = 25 °C		–	1	10	
T_j = 125 °C		–	100	300	
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}				
T_j = 25 °C		–	10	100	nA
T_j = 150 °C		–	2	4	µA
Drain-source on-state resistance V_{GS} = 10 V, I_D = 9 A	$R_{DS(on)}$	–	0.08	0.10	Ω

Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance V_{DS} = 25 V, I_D = 9 A	g_{fs}	3.0	5.2	12.0	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	360	480	650	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	280	450	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	160	280	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(on)}$	–	20	30	ns
	t_r	–	55	85	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(off)}$	–	70	90	
	t_f	–	80	110	

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	14	C
Pulsed source current	I_{SM}	–	–	56	
Diode forward on-voltage $I_F = 28$ A, $V_{GS} = 0$	V_{SD}	–	1.6	1.8	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	120	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.15	–	µC

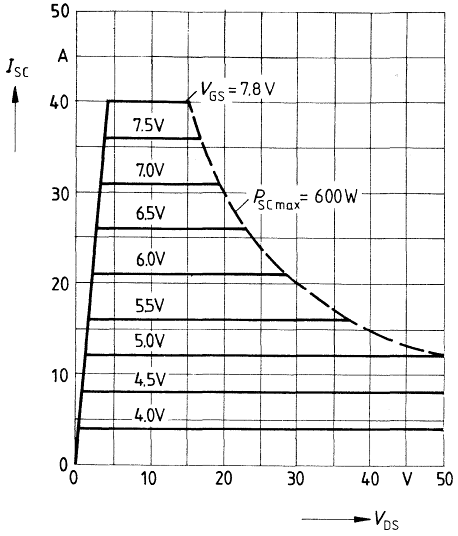
Temperature sensor

Parameter	Symbol	min.	typ.	max.	Unit
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55\ldots+150$ °C	$V_{TS(on)}$	0.7	1.4	1.5	V
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+160$ °C		–	–	15	
Forward current $T_j = -55\ldots+150$ °C	$I_{TS(on)}$	–	–	10	mA
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+160$ °C		–	–	600	
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C	I_H	0.05	0.3	0.5	mA
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

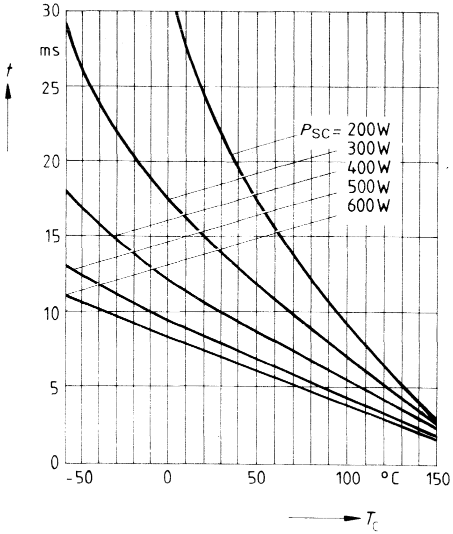
Examples for short-circuit protection
($T_j = -55...+150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	7.8	5.9	–	
Short-circuit current	I_{SC}	≤ 40	≤ 20	–	A
Short-circuit dissipation	P_{SC}	600	600	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

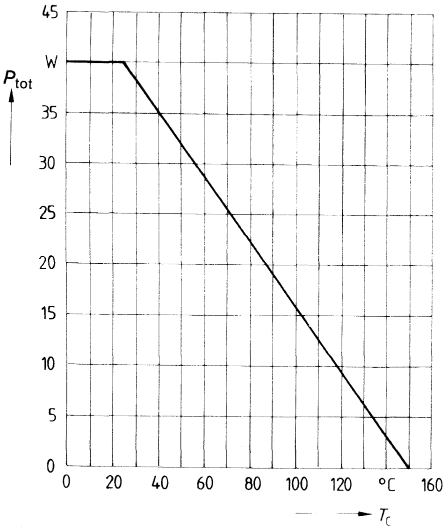
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \dots +150$ °C



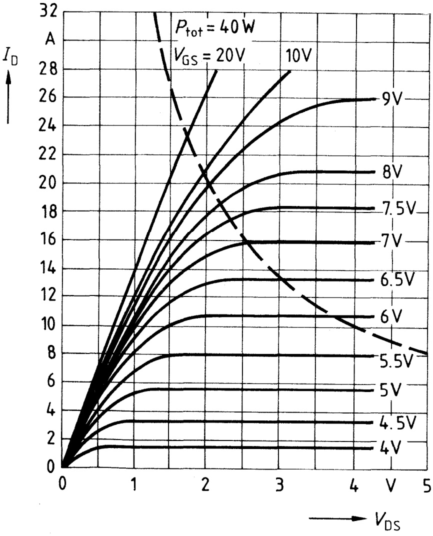
Turn-off time $t = f(T_C)$
Parameter: $P_{SC\,max} = V_{DS} \times I_D$



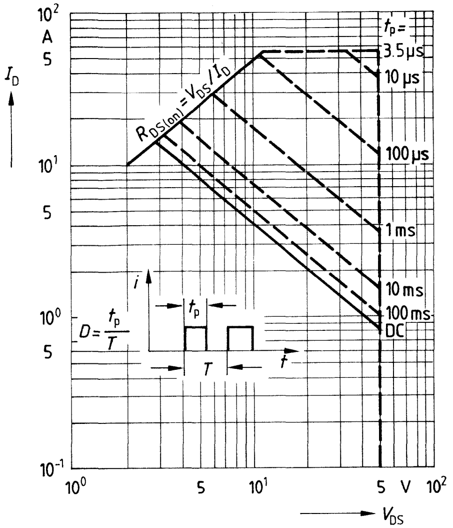
Power dissipation $P_{tot} = f(T_C)$



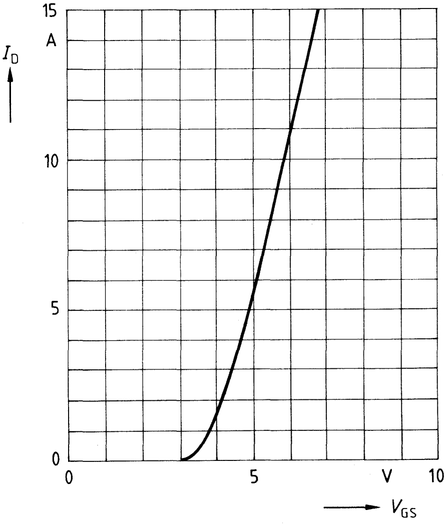
Typical output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



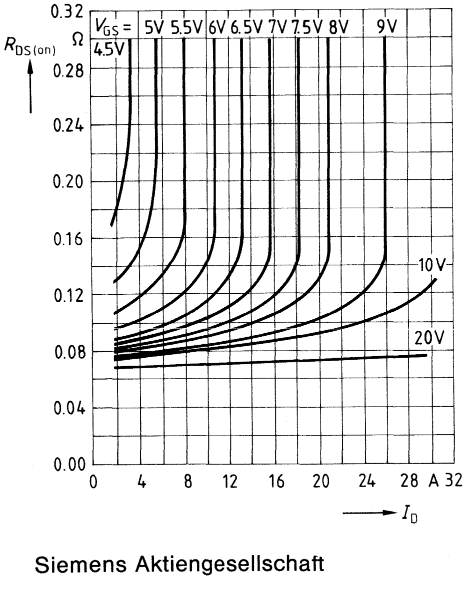
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



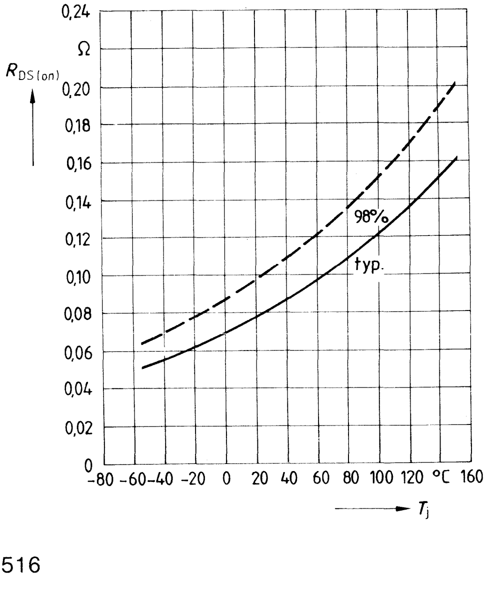
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



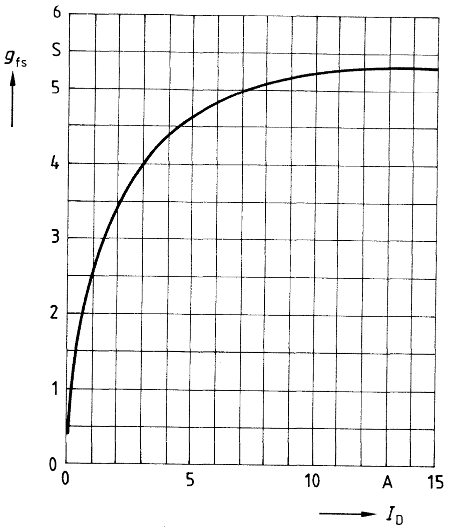
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



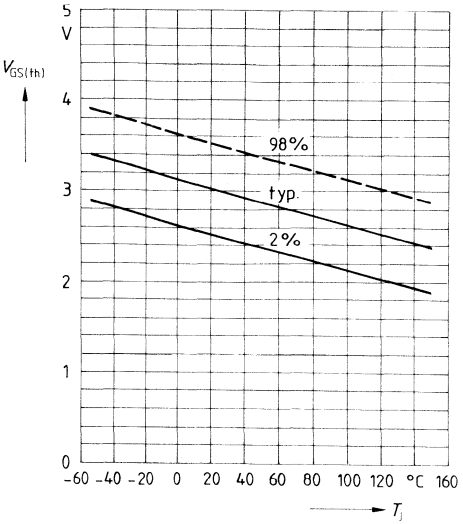
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 9$ A, $V_{GS} = 10$ V, (spread)



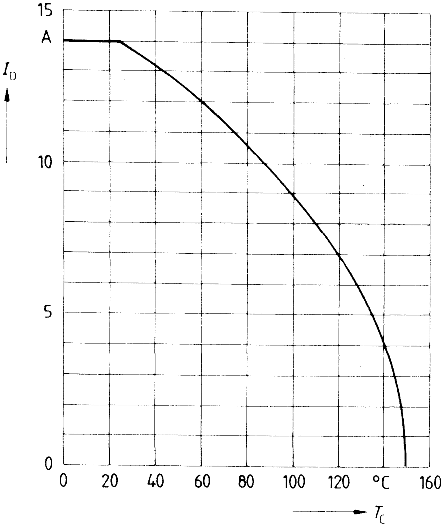
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$



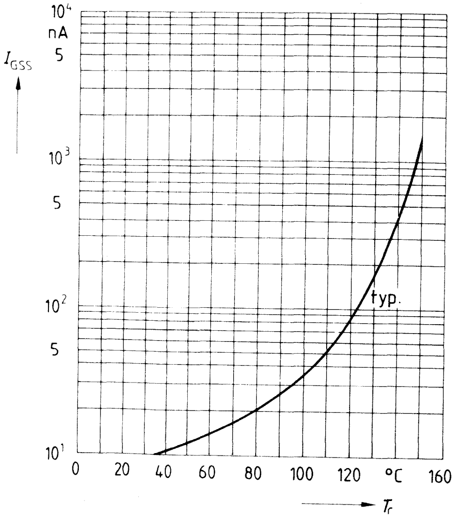
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1\ mA$
(spread)



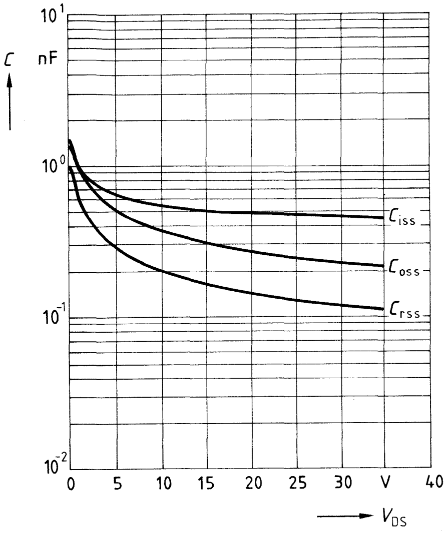
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10\ V$



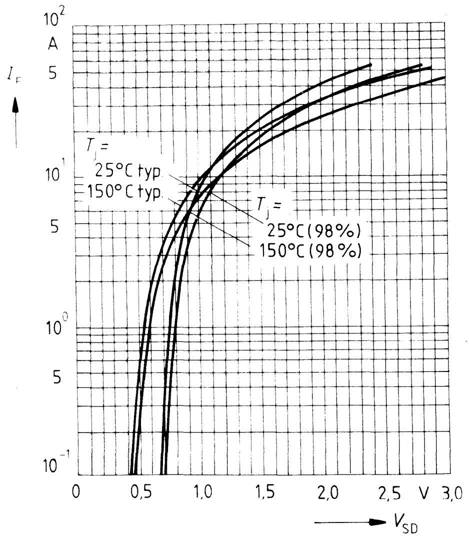
Gate-source leakage current $I_{GSS} = f(T_C)$
Parameter: $V_{GS} = 20\ V$, $V_{DS} = 0$



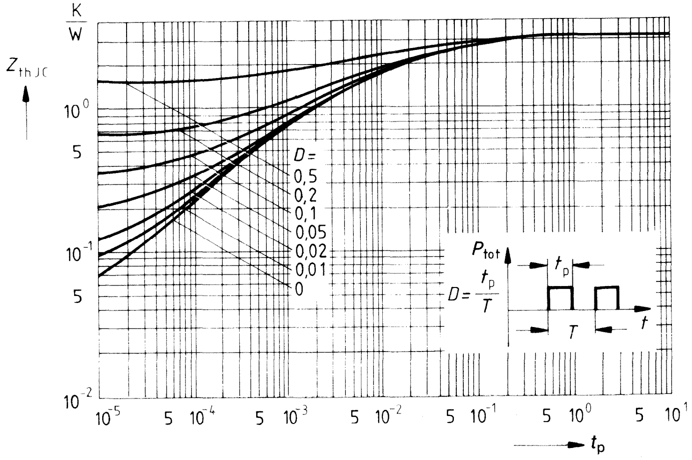
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

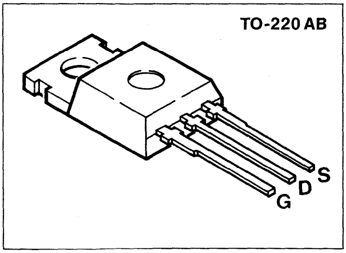


TEMPFET

BTS 115

V_{DS} = 50 V
I_D = 12.5 A
$R_{DS(on)}$ = 0.125 Ω

- N channel
- Enhancement mode
- Logic level
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1]



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 115	C67078-A5004-A4

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 10	
Continuous drain current, T_C = 28 °C	I_D	12.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	50	
Short-circuit current T_j = – 55 … + 150 °C	I_{SC}	40	
Short-circuit dissipation T_j = – 55 … + 150 °C	P_{SCmax}	600	W
Max. power dissipation	P_{tot}	40	
Operating and storage temperature range	T_j T_{stg}	– 55 … + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 75	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 4.5$ V, $I_D = 6$ A	$R_{DS(on)}$	–	0.09	0.125	Ω

Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 6.5$ A	g_{fs}	5.0	9.0	14.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	460	620	825	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	280	450	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	95	180	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	20	30	ns
	t_r	–	100	150	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	90	115	
	t_f	–	50	70	

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified (continued).

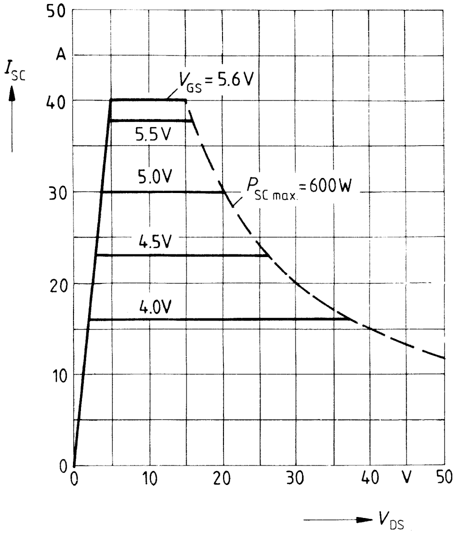
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	12.5	A
Pulsed source current	I_{SM}	–	–	50	
Diode forward on-voltage $I_F = 25$ A, $V_{GS} = 0$	V_{SD}	–	1.3	1.7	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	120	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.15	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 5$ mA, $T_j = -55...+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C	$V_{TS(on)}$	0.7 –	1.3 –	1.4 15	V
Forward current $T_j = -55...+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C	$I_{TS(on)}$	– –	– –	5 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

Examples for short-circuit protection

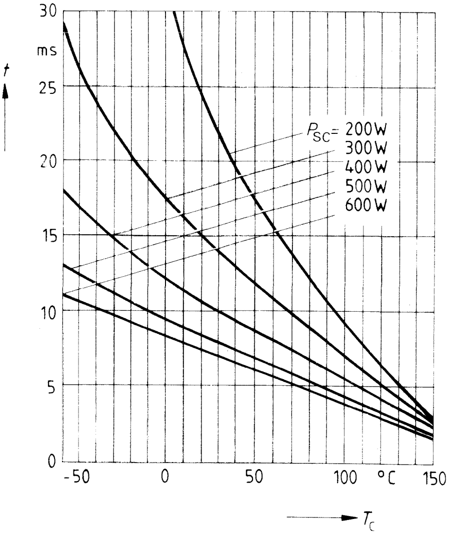
(T_j = – 55 . . . + 150 °C, unless otherwise specified)

Parameter	**Symbol**	**Values**			**Unit**
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	5.6	4.3	–	
Short-circuit current	I_{SC}	$\leq$ 40	$\leq$ 20	–	A
Short-circuit dissipation	P_{SC}	600	600	–	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

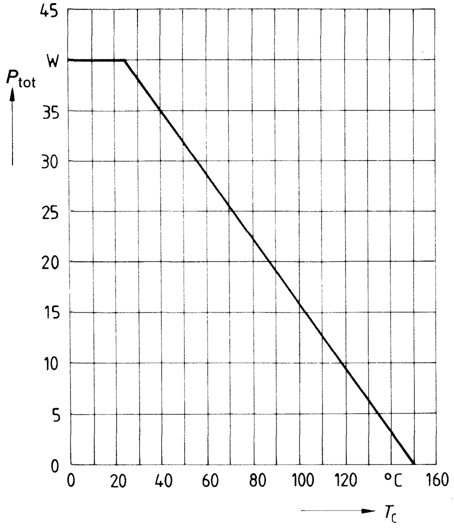
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 ... +150$ °C



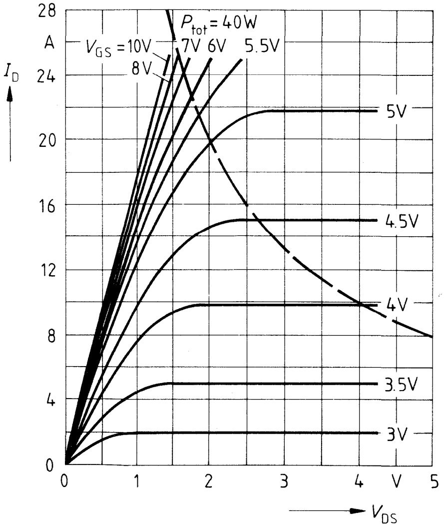
Turn-off time $t = f(T_C)$
Parameter: $P_{SC\,max} = V_{DS} \times I_D$



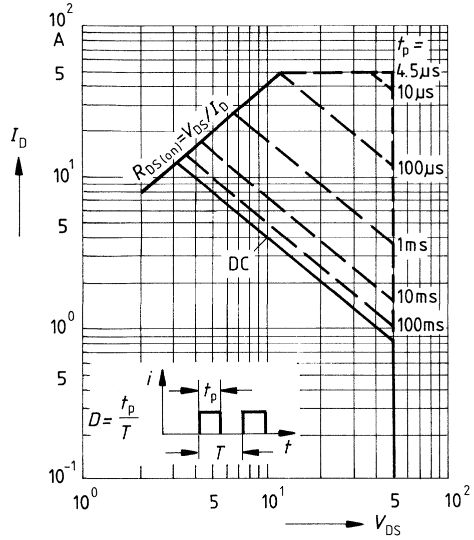
Power dissipation $P_{tot} = f(T_C)$



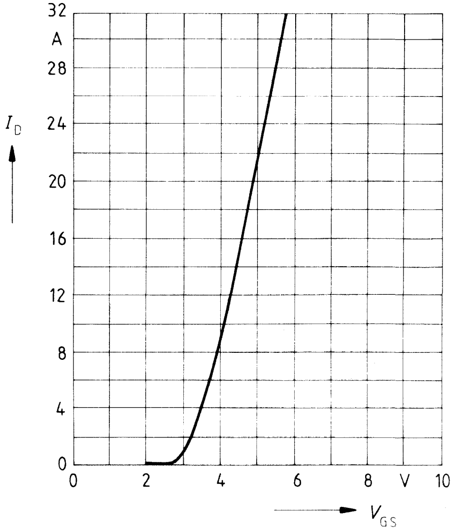
Typical output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



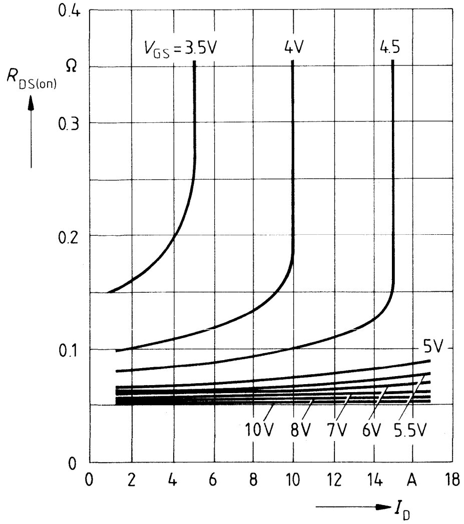
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



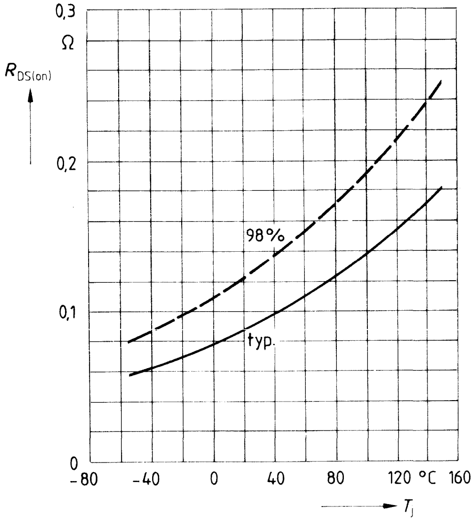
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



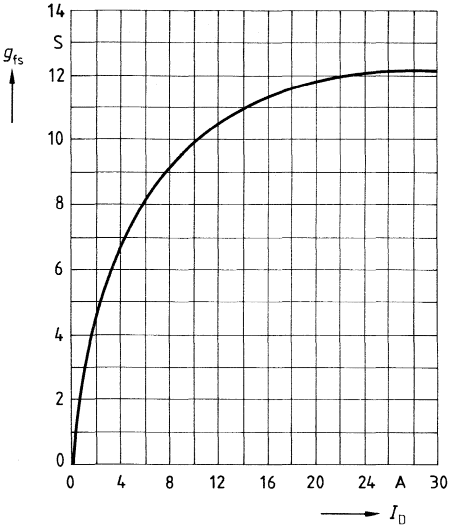
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



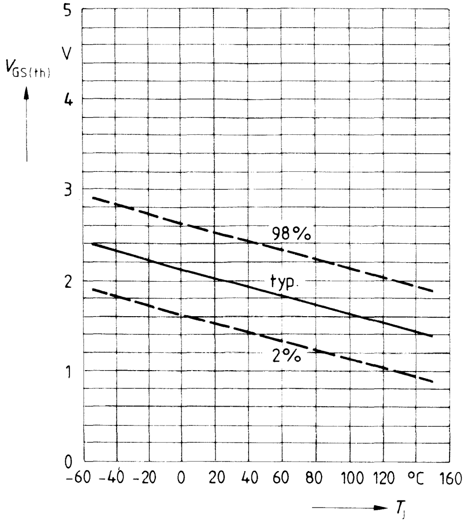
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 6$ A, $V_{GS} = 4.5$ V, (spread)



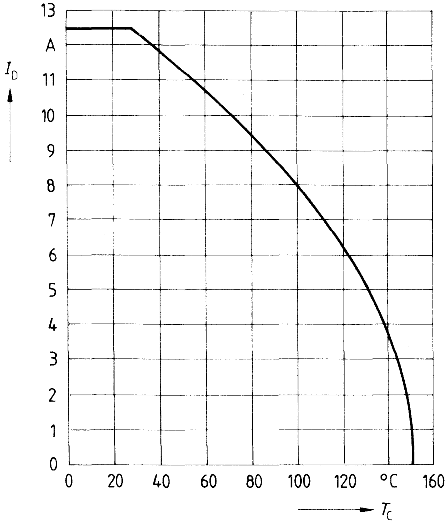
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: t_p = 80 µs, V_{DS} = 25 V



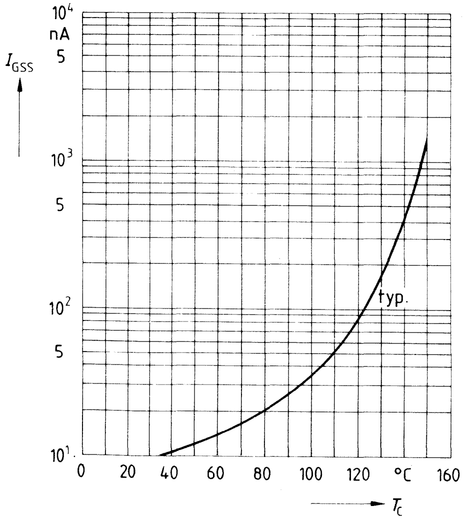
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, I_D = 1 mA
(spread)



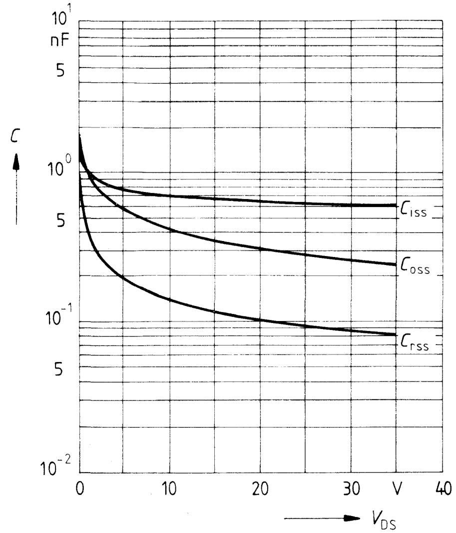
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq$ 10 V



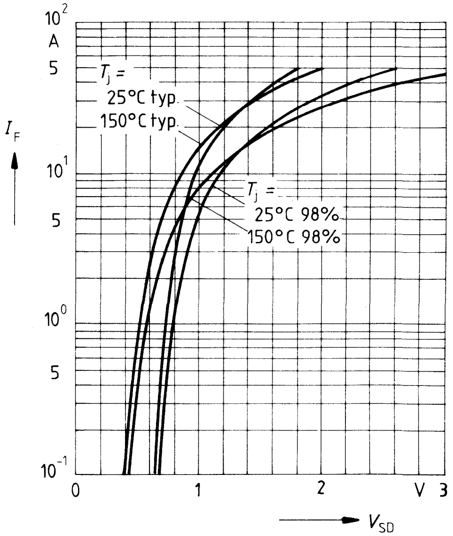
Gate-source leakage current $I_{GSS} = f(T_C)$
Parameter: V_{GS} = 20 V, V_{DS} = 0



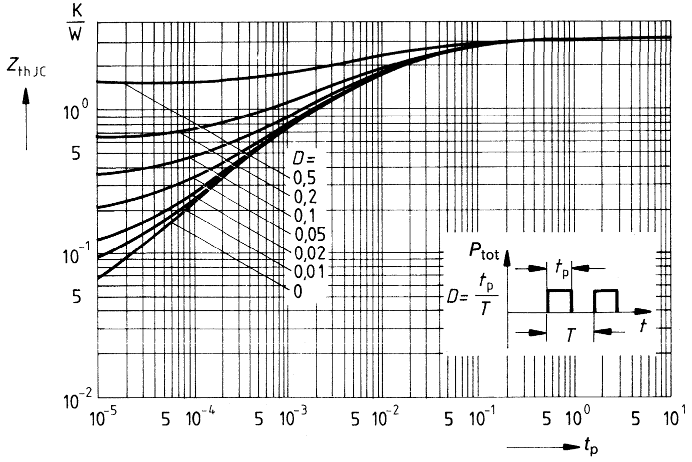
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristic of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



SIEMENS

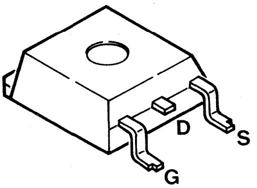
TEMPFET

BTS 116

V_{DS} = 50 V
I_D = 14 A
$R_{DS(on)}$ = 0.1 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 (E 3045) [1], SMD version

TO-220 (E 3045)



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 116	C67078-A5005-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	14	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	56	
Short-circuit current T_j = – 55 ... + 150 °C	I_{SC}	40	
Short-circuit dissipation T_j = – 55 ... + 150 °C	P_{SCmax}	600	W
Max. power dissipation	P_{tot}	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 95	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 9$ A	$R_{DS(on)}$	–	0.08	0.10	Ω

Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 9$ A	g_{fs}	3.0	5.2	12.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	360	480	650	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	280	450	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	160	280	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	20	30	ns
	t_r	–	55	85	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	70	90	
	t_f	–	80	110	

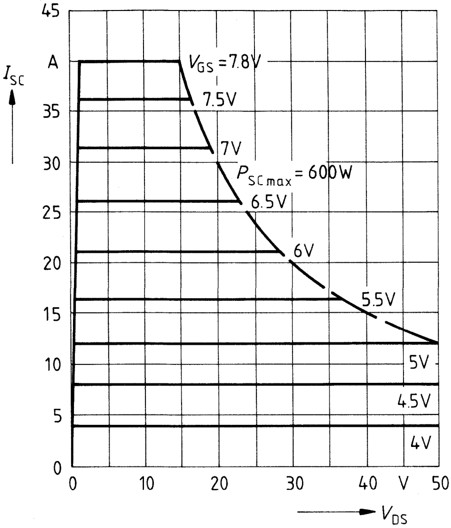
Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	14	A
Pulsed source current	I_{SM}	–	–	56	
Diode forward on-voltage $I_F = 28$ A, $V_{GS} = 0$	V_{SD}	–	1.6	1.8	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	120	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.15	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55 \ldots +150$ °C	$V_{TS(on)}$	0.7	1.4	1.5	V
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C		–	–	15	
Forward current $T_j = -55 \ldots +150$ °C	$I_{TS(on)}$	–	–	10	mA
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C		–	–	600	
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C	I_H	0.05	0.3	0.5	mA
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

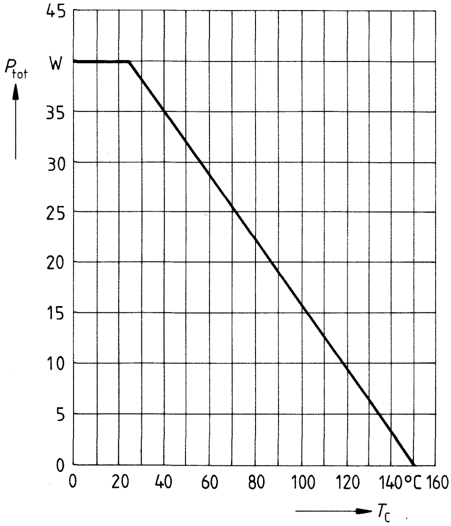
Examples for short-circuit protection
($T_j = -55...+150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	7.8	5.9	–	
Short-circuit current	I_{SC}	≤ 40	≤ 20	–	A
Short-circuit dissipation	P_{SC}	600	600	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

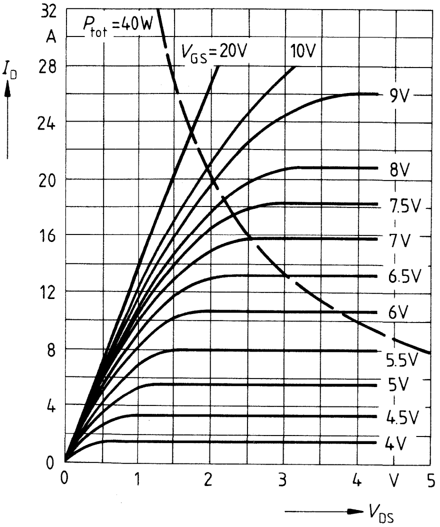
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



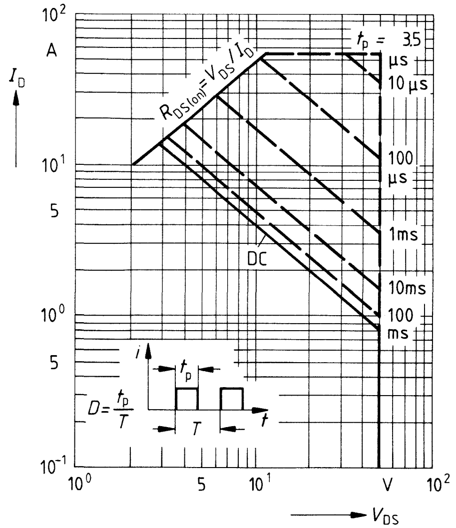
Permissible power dissipation $P_{tot} = f(T_C)$



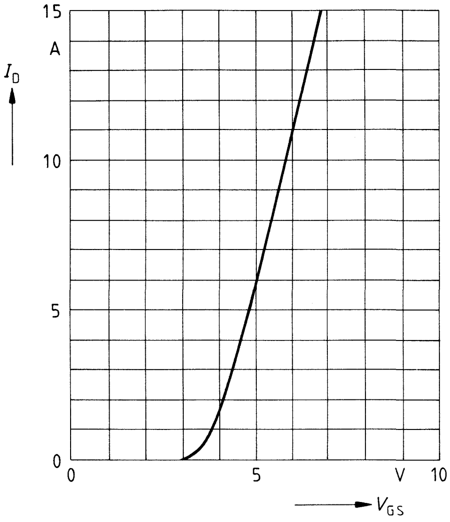
Typical output characteristics $I_D = f(V_{DS})$



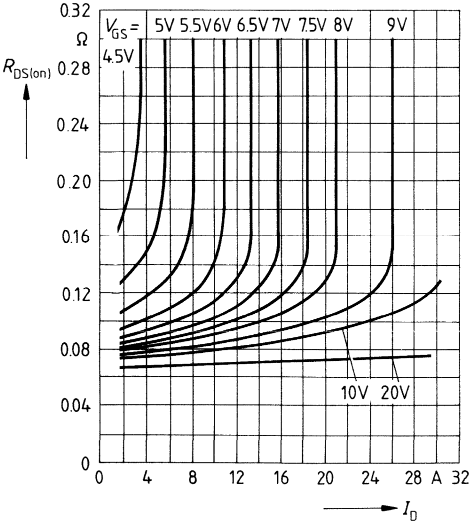
Permissible operating area $I_D = f(V_{DS})$



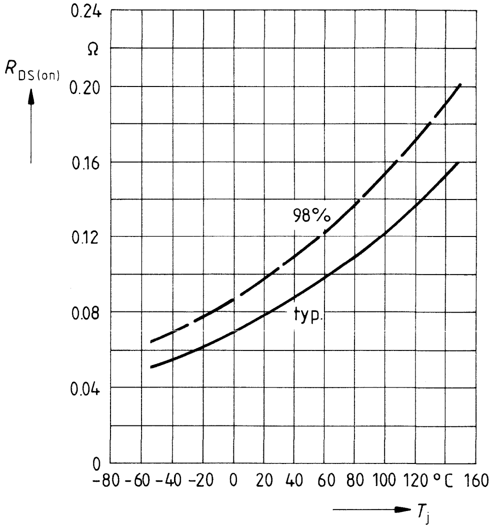
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



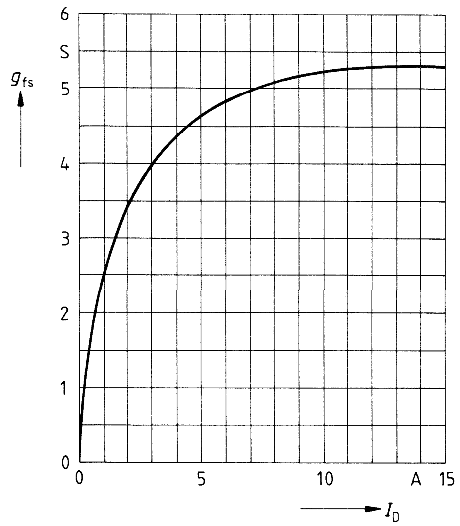
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, T_j = 25 °C



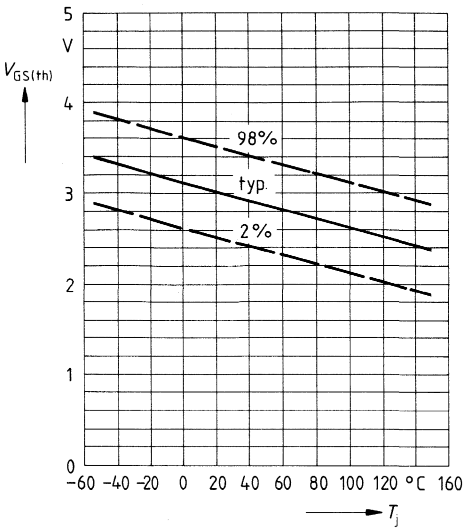
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: V_{GS} = 10 V, I_D = 9 A, (spread)



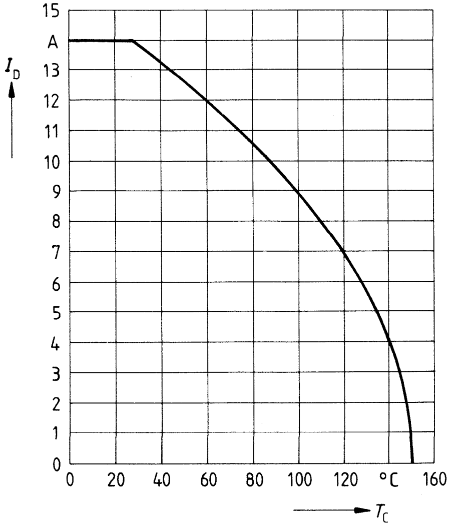
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



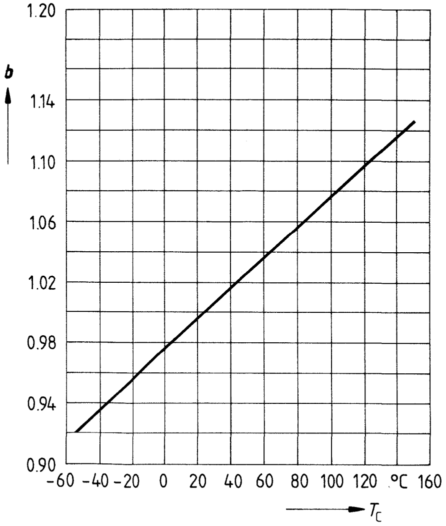
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



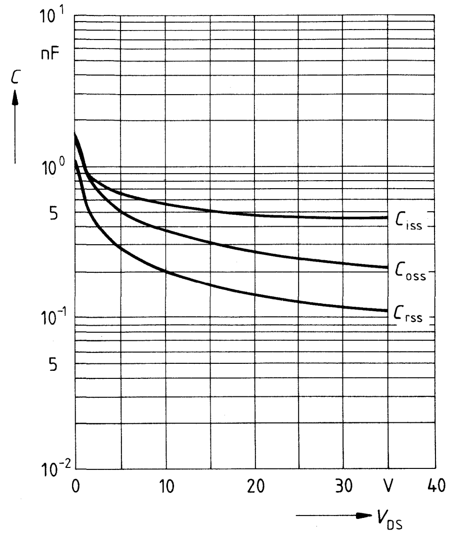
Continuous drain current $I_D = f(T_C)$



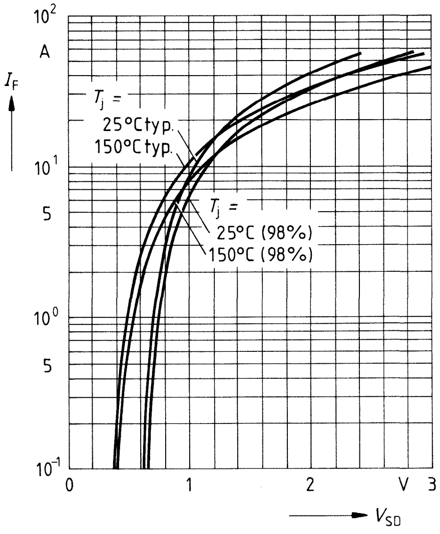
Drain-source breakdown voltage
$V_{(BR)\,DSS}\,(T_j) = b \times V_{(BR)DSS}$ (25 °C)



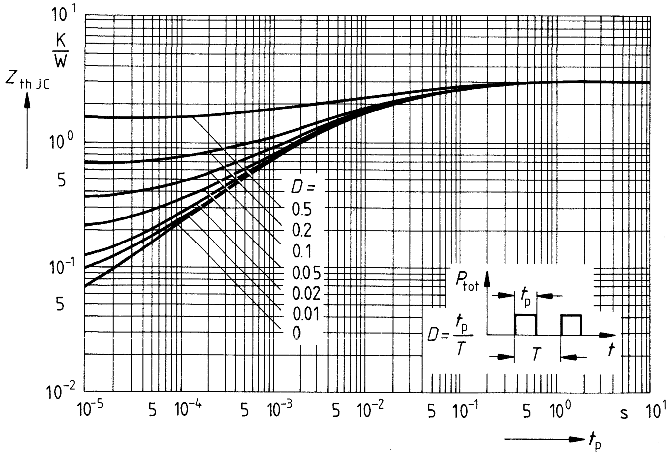
Typ. capacitances C = $f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: t_p = 80 µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

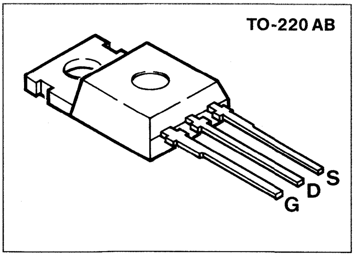


SIEMENS

TEMPFET

BTS 120

V_{DS} = **100 V**
I_D = **19 A**
$R_{DS(on)}$ = **0.1 Ω**



- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB[1]

Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 120	C67078-A5009-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	19	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	76	
Short-circuit current, $V_{DS} \leq 50$ V, $T_j = -55 \ldots +150$ °C	I_{SC}	55	
Short-circuit dissipation, $V_{DS} \leq 50$ V, $T_j = -55 \ldots +150$ °C	P_{SCmax}	800	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
DIN humidity category, DIN 40 040	-	E	-
IEC climatic category, DIN IEC 68-1	-	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1 100	10 300	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$ $T_j = 25$ °C $T_j = 150$ °C	I_{GSS}	– –	10 2	100 4	nA µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 9$ A	$R_{DS(on)}$	–	0.09	0.1	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 12$ A	g_{fs}	7	13	18	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1500	2000	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	450	700	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	150	240	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	30	45	ns
	t_r	–	50	75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	170	220	
	t_f	–	80	110	

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	19	A
Pulsed source current	I_{SM}	–	–	75	
Diode forward on-voltage $I_F = 38$ A, $V_{GS} = 0$	V_{SD}	–	1.4	1.7	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	200	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.25	–	µC

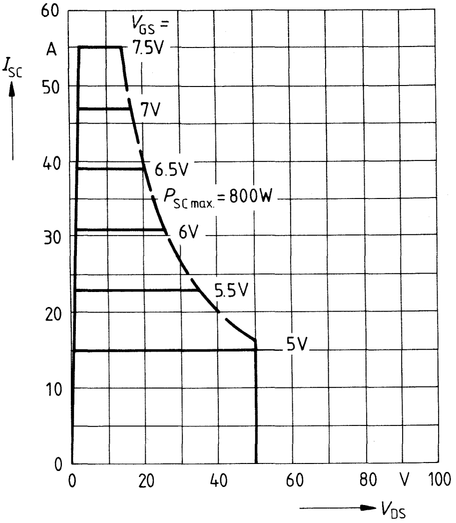
Temperature sensor

Parameter	Symbol	min.	typ.	max.	Unit
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$V_{TS(on)}$	0.7 – 	1.4 –	1.5 15	V
Forward current $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

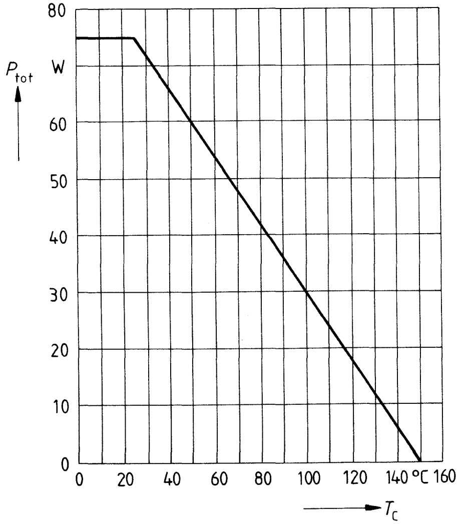
Examples for short-circuit protection
(T_j = – 55 … +150 °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	50	V
Gate-source voltage	V_{GS}	7.3	5.7	5.1	
Short-circuit current	I_{SC}	53.3	26.7	16.0	A
Short-circuit dissipation	P_{SC}	800	800	800	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	25	25	25	ms

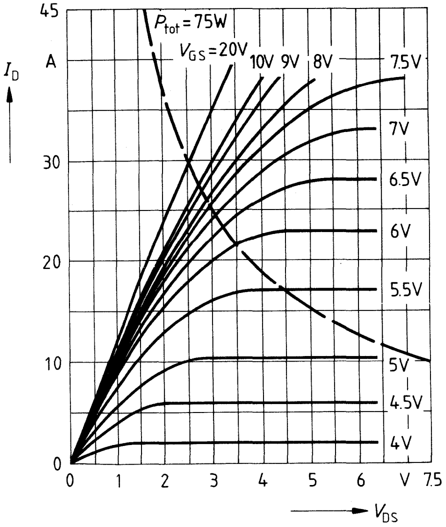
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



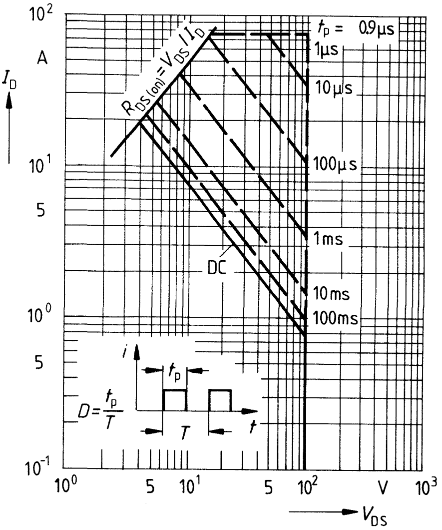
Permissible power dissipation $P_{tot} = f(T_C)$



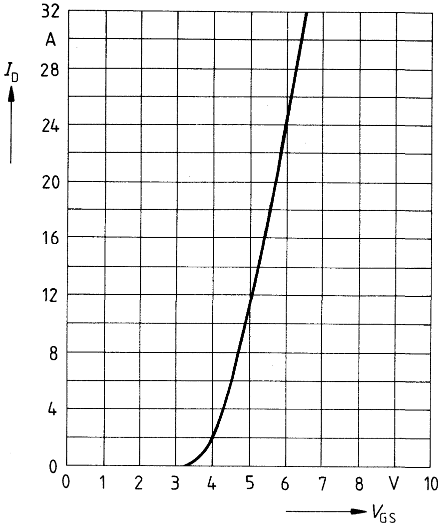
Typ. output characteristics $I_D = f(V_{DS})$



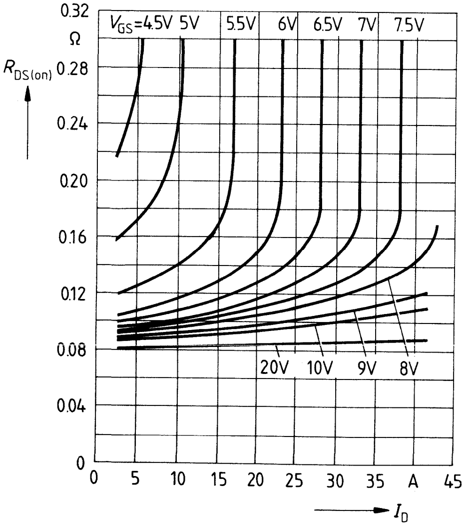
Permissible operating area $I_D = f(V_{DS})$



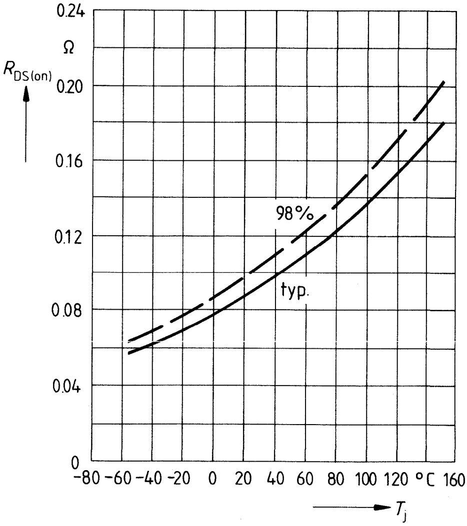
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



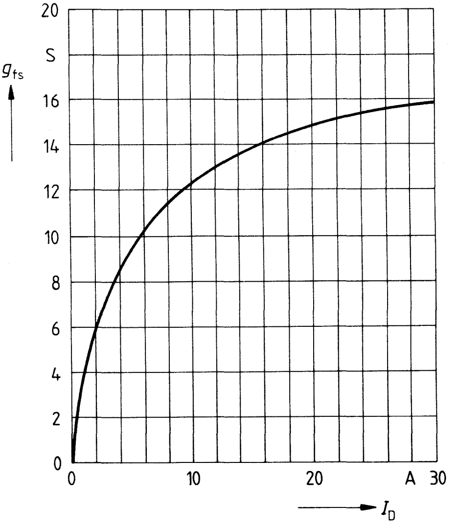
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, T_j = 25 °C



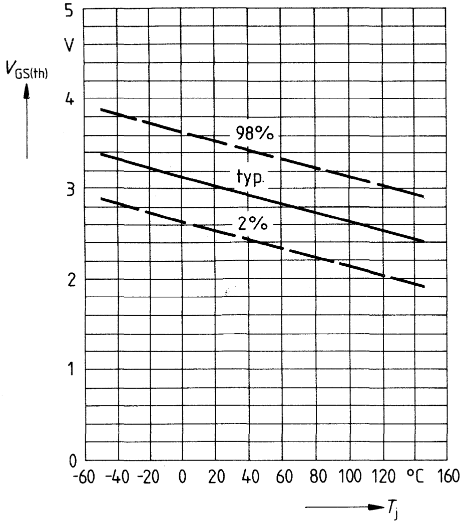
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: V_{GS} = 10 V, I_D = 9 A, (spread)



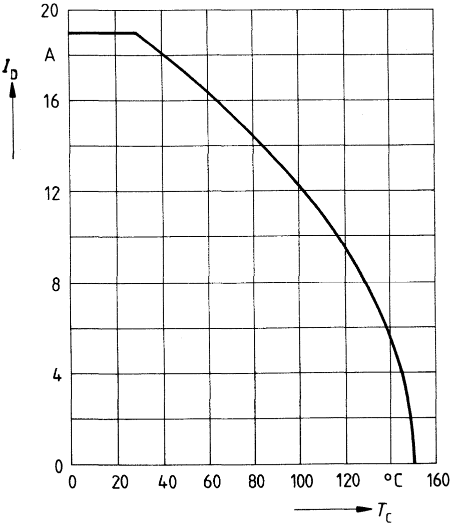
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



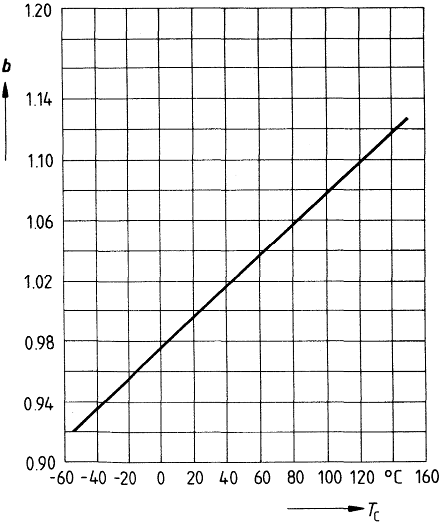
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, I_D = 1 mA
(spread)



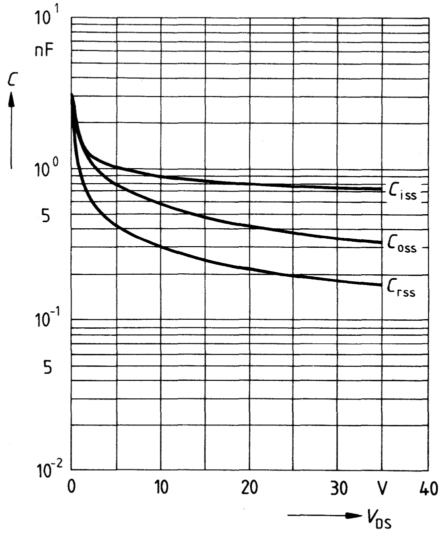
Continuous drain current $I_D = f(T_C)$



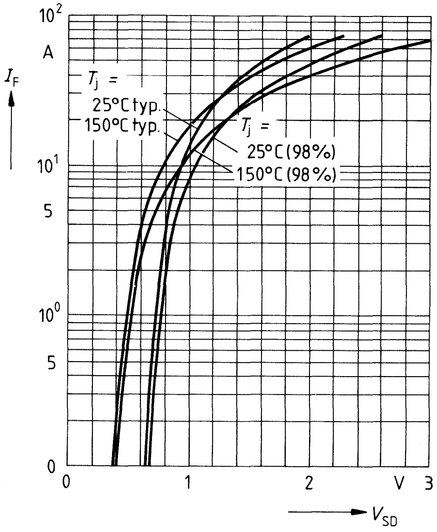
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



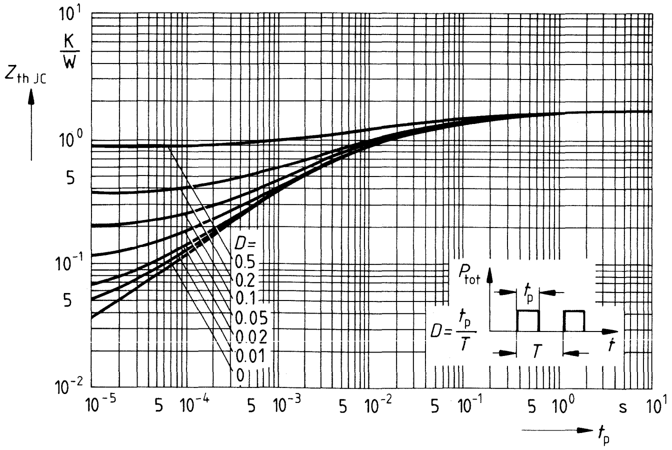
Typ. capacitances C = $f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



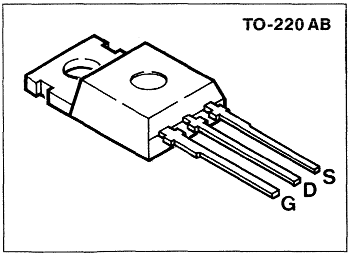
Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



SIEMENS

TEMPFET BTS 121 A

V_{DS} = 100 V
I_D = 22 A
$R_{DS(on)}$ = 0.1 Ω



- N channel
- Enhancement mode
- Logic level
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])

Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 121 A	C67078-S5010-A4

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	100	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Gate-source voltage	V_{GS}	± 10	
Continuous drain current, T_C = 25 °C	I_D	22	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	88	
Short-circuit current, T_j = – 55 ... + 150 °C	I_{SC}	68	
Short-circuit dissipation, T_j = – 55 ... + 150 °C $V_{DS} \leq 50$ V $V_{DS} \leq 15$ V	P_{SCmax}	 800 1000	W
Max. power dissipation	P_{tot}	95	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.32 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	0.1	1.0	
$T_j = 125$ °C		–	10	100	
Gate-source leakage current $V_{GS} = \pm 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 4.5$ V, $I_D = 9.5$ A	$R_{DS(on)}$	–	0.085	0.1	Ω

Parameter	Symbol	min.	typ.	max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 9.5$ A	g_{fs}	8	14	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1200	1500	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	320	580	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	160	260	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	40	ns
	t_r	–	110	170	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	210	270	
	t_f	–	100	130	

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	19	A
Pulsed source current	I_{SM}	–	–	76	
Diode forward on-voltage $I_F = 39$ A, $V_{GS} = 0$	V_{SD}	–	1.35	1.7	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.58	–	µC

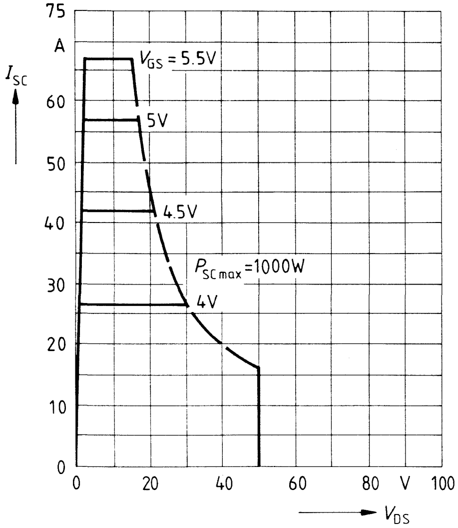
Temperature sensor

Parameter	Symbol	min.	typ.	max.	Unit
Forward voltage $I_{TS(on)} = 5$ mA, $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$V_{TS(on)}$	0.7 –	1.3 –	1.4 15	V
Forward current $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$I_{TS(on)}$	– –	– –	5.0 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

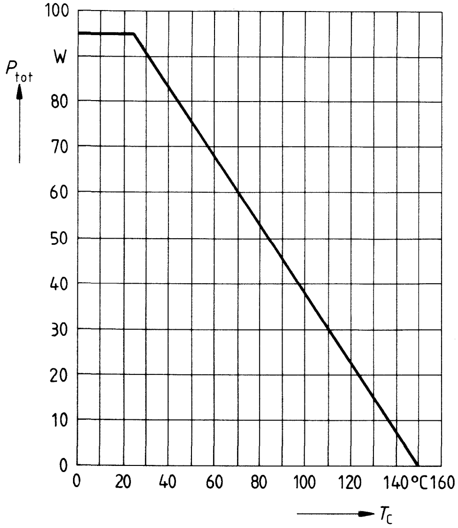
Examples for short-circuit protection
(T_j = −55...+150 °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	5.5	4.0	–	
Short-circuit current	I_{SC}	66.7	26.7	–	A
Short-circuit dissipation	P_{SC}	1000	800	–	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	$\leq$25	$\leq$25	–	ms

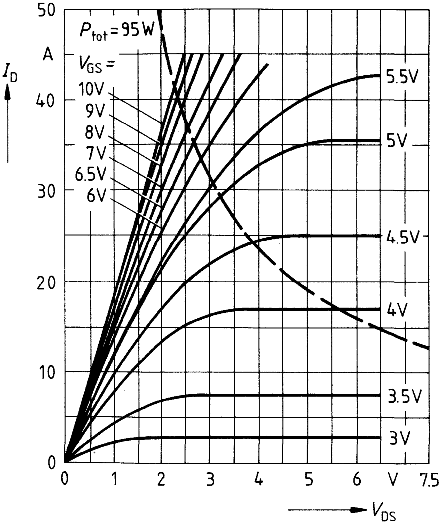
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



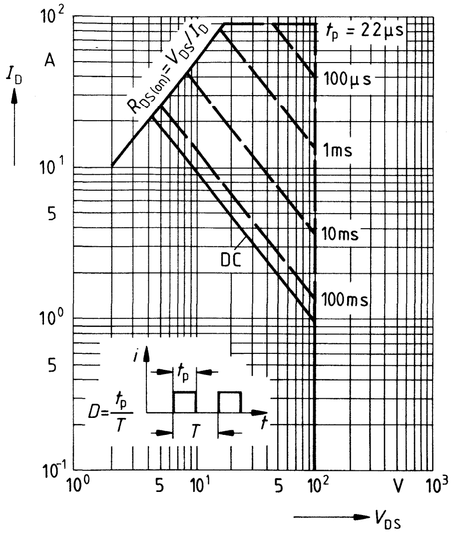
Permissible power dissipation $P_{tot} = f(T_C)$



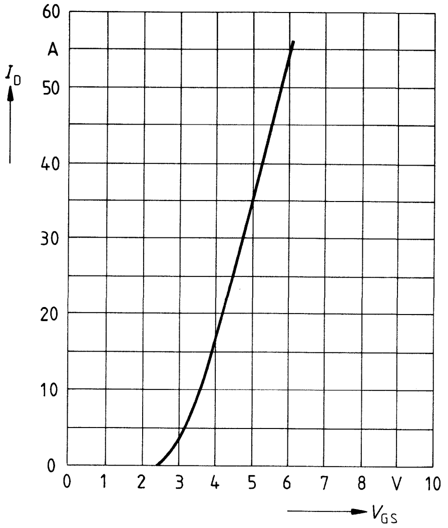
Typ. output characteristics $I_D = f(V_{DS})$



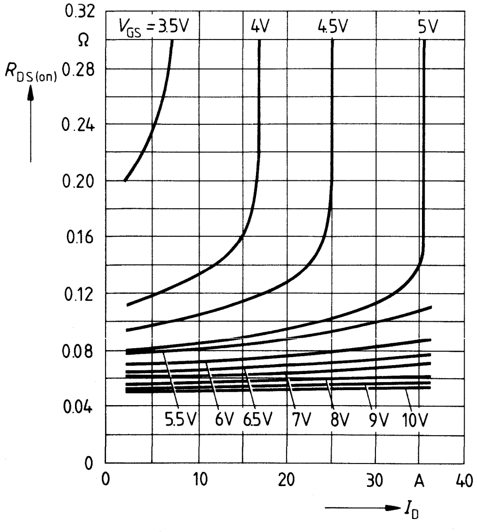
Permissible operating area $I_D = f(V_{DS})$



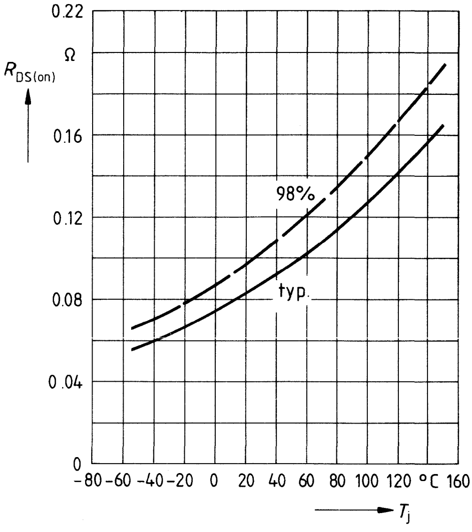
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



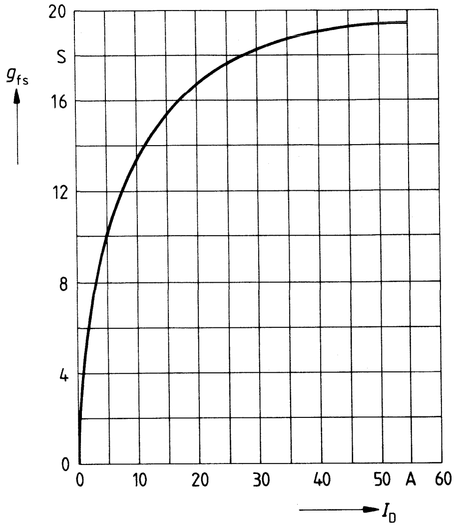
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, T_j = 25 °C



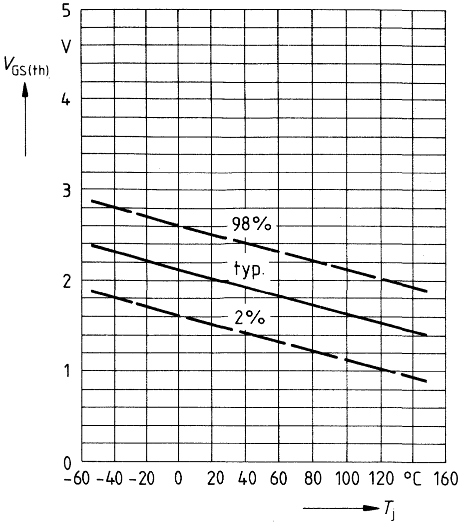
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: V_{GS} = 5 V, I_D = 11 A, (spread)



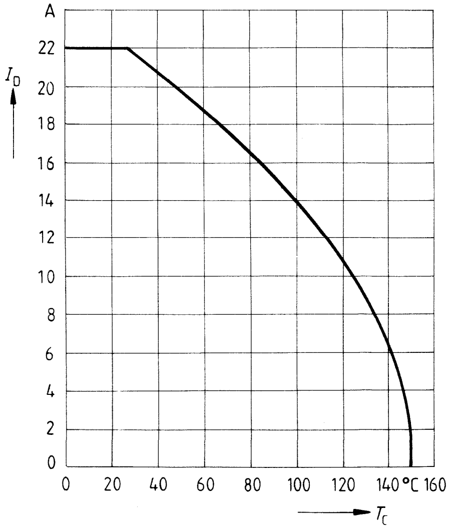
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



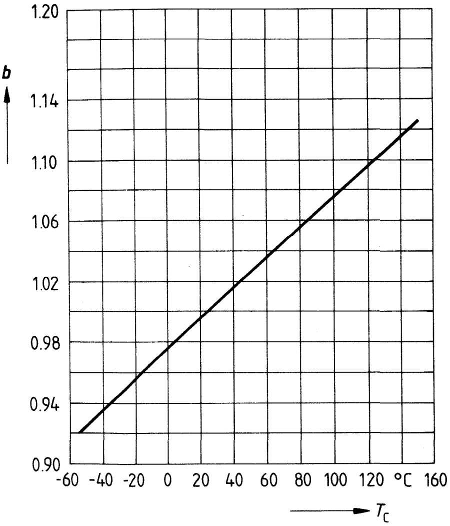
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



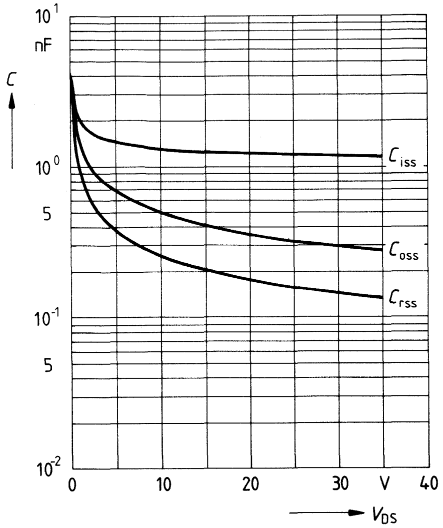
Continuous drain current $I_D = f(T_C)$



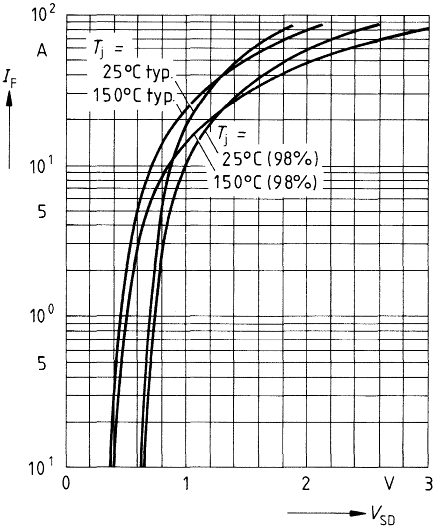
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



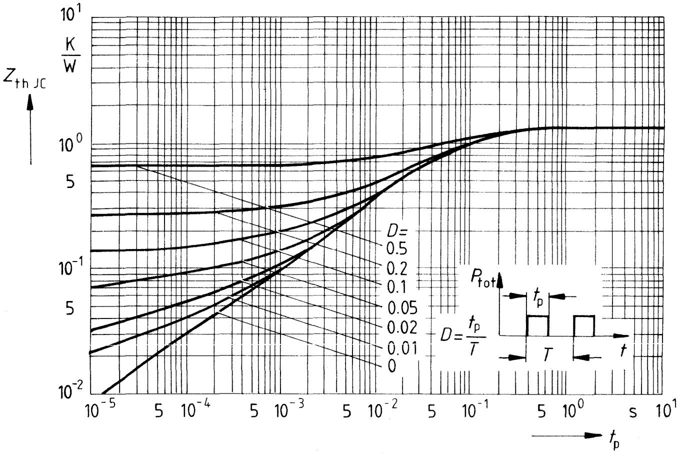
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

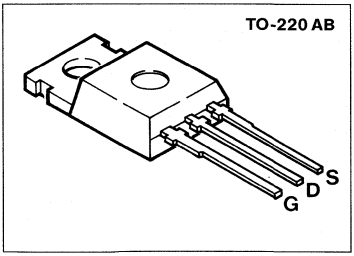


SIEMENS

TEMPFET

BTS 129

V_{DS} = 60 V
I_D = 27 A
$R_{DS(on)}$ = 0.05 Ω



- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])

Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 129	C67078-A5013-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	60	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 25 °C	I_D	27	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	108	
Short-circuit current T_j = – 55 ... + 150 °C	I_{SC}	80	
Short-circuit dissipation T_j = – 55 ... + 150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	60	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 60$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 17$ A	$R_{DS(on)}$	–	0.04	0.05	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} = 25$ V, $I_D = 17$ A	g_{fs}	8.0	13.0	18.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	700	940	1250	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	500	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	180	270	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	40	ns
	t_r	–	60	90	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	100	130	
	t_f	–	75	95	

Electrical Characteristics

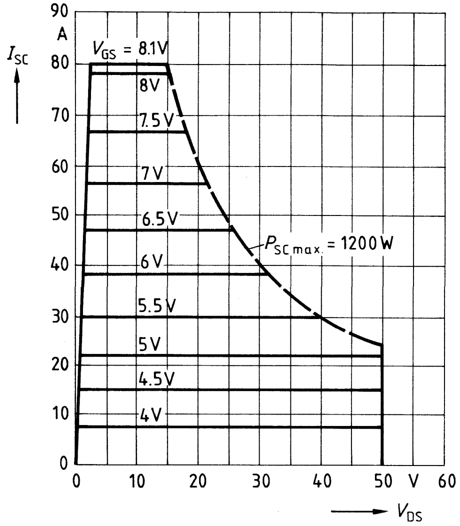
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	27	A
Pulsed source current	I_{SM}	–	–	108	
Diode forward on-voltage $I_F = 54$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	1.0	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55...+150$ °C	$V_{TS(on)}$	0.7	1.4	1.5	V
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C		–	–	15	
Forward current $T_j = -55...+150$ °C	$I_{TS(on)}$	–	–	10	mA
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C		–	–	600	
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C	I_H	0.05	0.3	0.5	mA
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

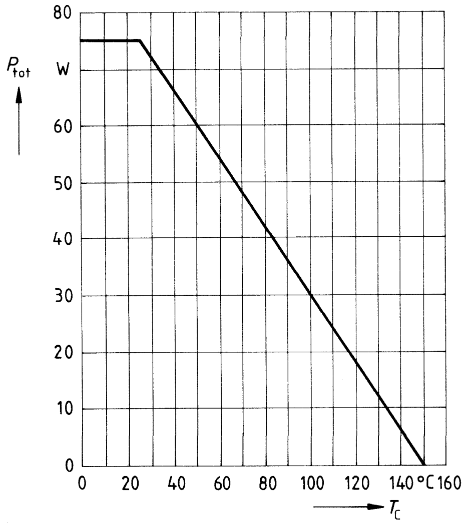
Examples for short-circuit protection
($T_j = -55 \ldots +150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	8.1	5.9	–	
Short-circuit current	I_{SC}	$\leq$80	$\leq$37	–	A
Short-circuit dissipation	P_{SC}	1200	1100	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

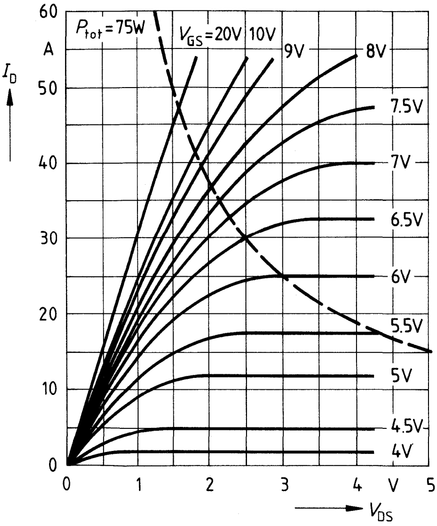
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



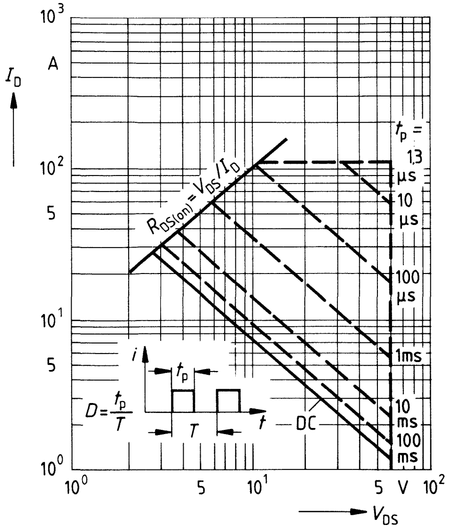
Permissible power dissipation $P_{tot} = f(T_C)$



Typ. output characteristics $I_D = f(V_{DS})$

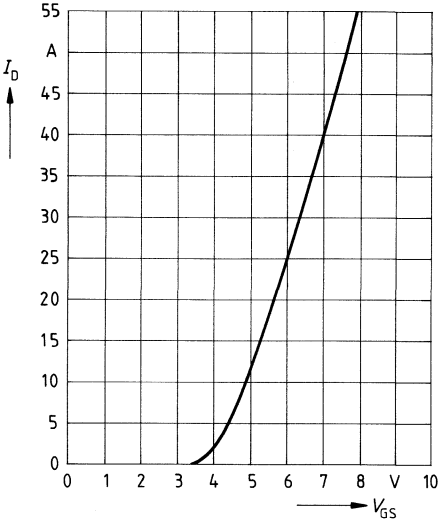


Permissible operating area $I_D = f(V_{DS})$



Typ. transfer characteristic $I_D = f(V_{GS})$

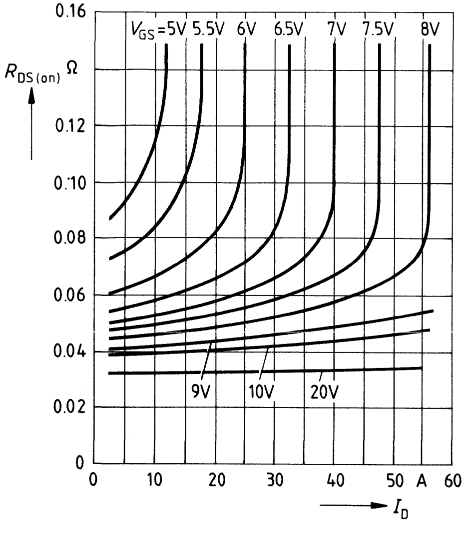
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



Typ. drain-source on-state resistance

$R_{DS(on)} = f(I_D)$

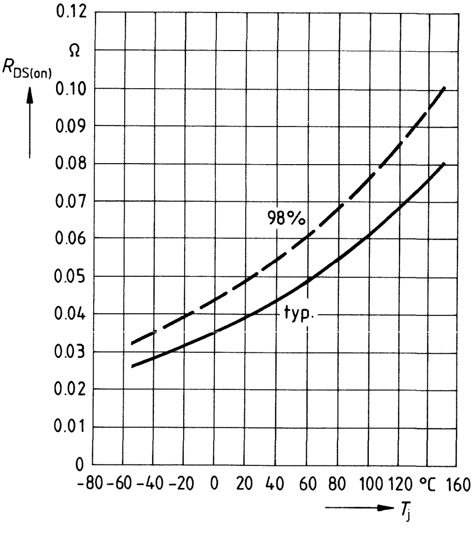
Parameter: V_{GS}, T_j = 25 °C



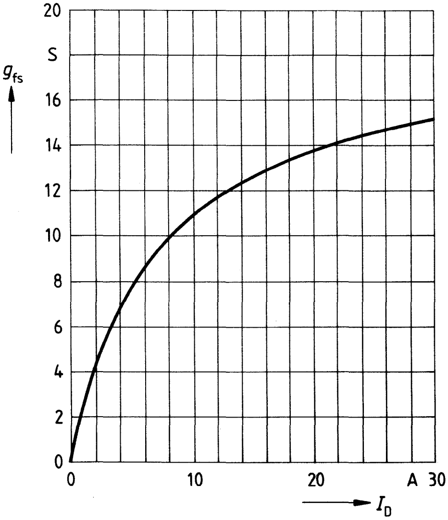
Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$

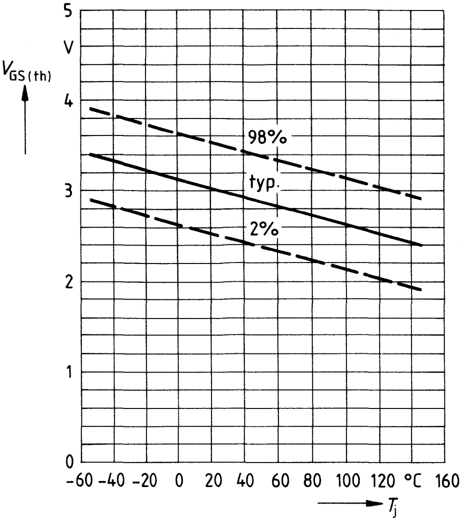
Parameter: V_{GS} = 10 V, I_D = 17 A, (spread)



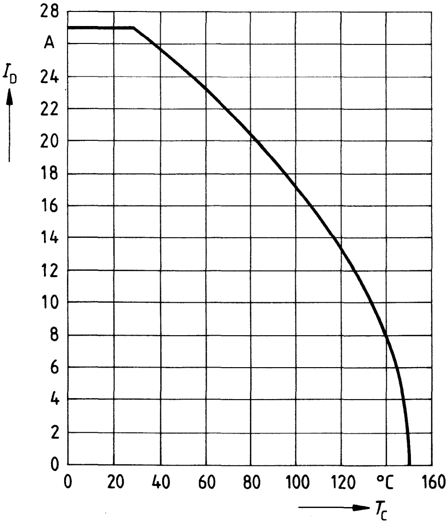
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



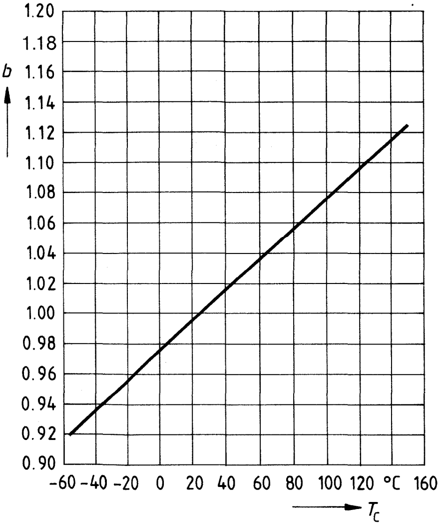
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



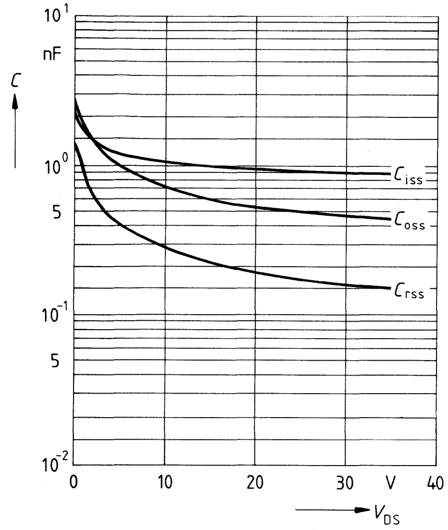
Continuous drain current $I_D = f(T_C)$



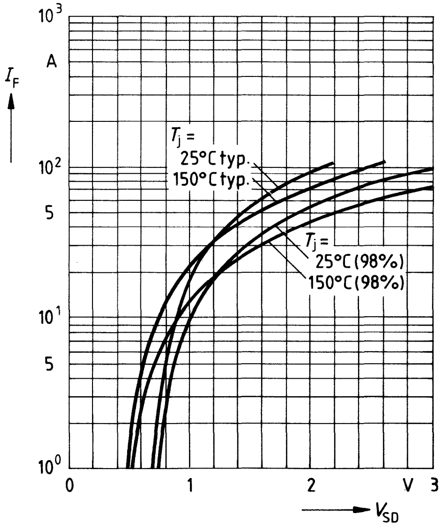
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}(25\ °C)$



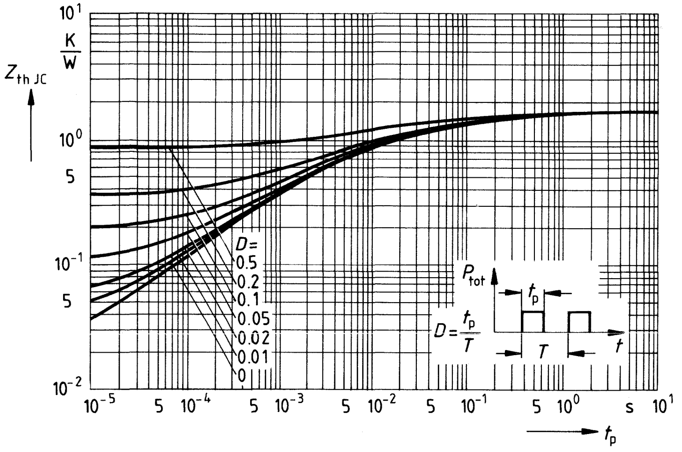
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

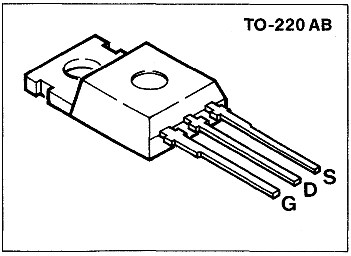


TEMPFET

BTS 130

V_{DS} = 50 V
I_D = 27 A
$R_{DS(on)}$ = 0.05 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 130	C67078-A5001-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 25 °C	I_D	27	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	108	
Short-circuit current T_j = – 55 ... +150 °C	I_{SC}	80	
Short-circuit dissipation T_j = – 55 ... +150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
T_j = 25 °C		–	1	10	
T_j = 125 °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
T_j = 25 °C		–	10	100	nA
T_j = 150 °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 17$ A	$R_{DS(on)}$	–	0.04	0.05	Ω

Dynamic characteristics

Forward transconductance $V_{DS} = 25$ V, $I_D = 17$ A	g_{fs}	8.0	13.0	18.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	700	940	1250	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	500	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	180	270	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	40	ns
	t_r	–	60	90	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	100	130	
	t_f	–	75	95	

Electrical Characteristics

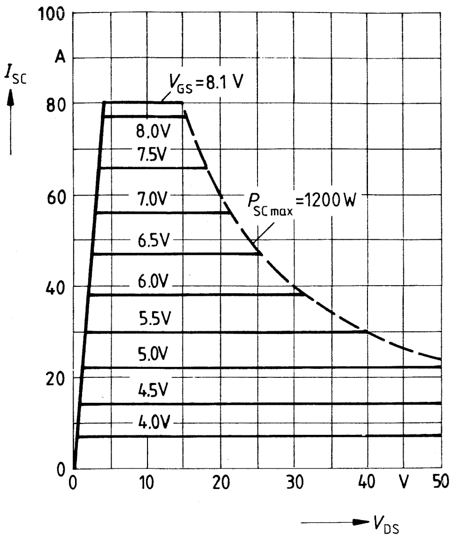
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	27	A
Pulsed source current	I_{SM}	–	–	108	
Diode forward on-voltage $I_F = 54$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	1.0	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$V_{TS(on)}$	0.7 –	1.4 –	1.5 15	V
Forward current $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

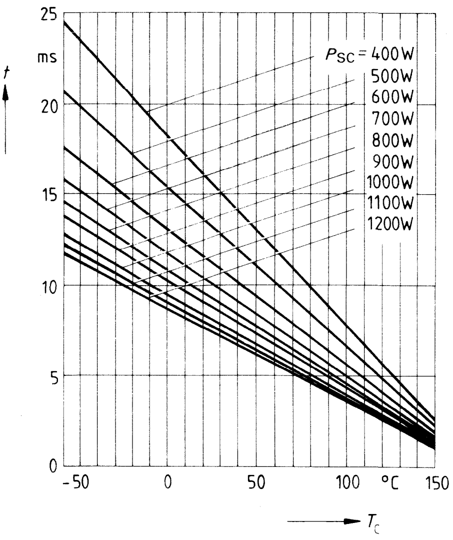
Examples for short-circuit protection
(T_j = – 55 . . . + 150 °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	8.1	5.9	–	
Short-circuit current	I_{SC}	$\leq$80	$\leq$37	–	A
Short-circuit dissipation	P_{SC}	1200	1100	–	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

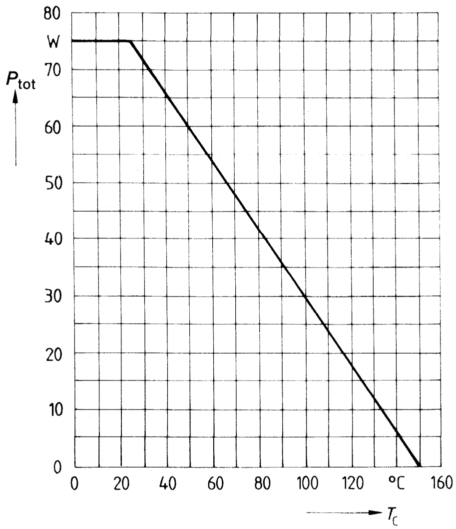
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \dots +150$ °C



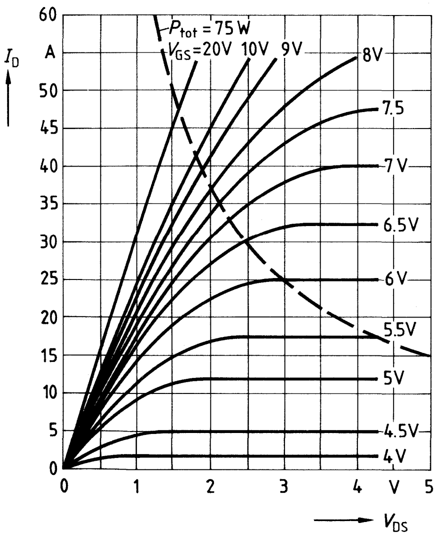
Turn-off time $t = f(T_C)$
Parameter: $P_{SC\,max} = V_{DS} \times I_D$



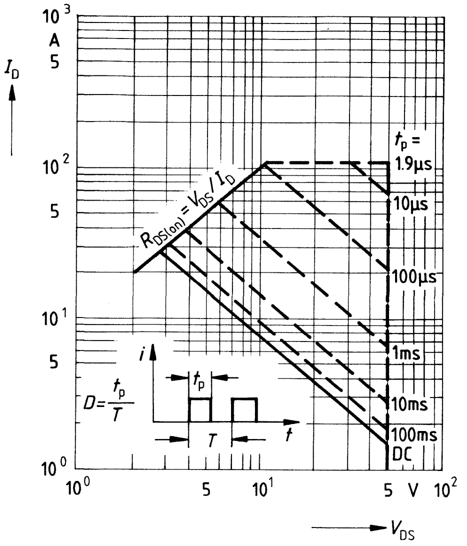
Power dissipation $P_{tot} = f(T_C)$



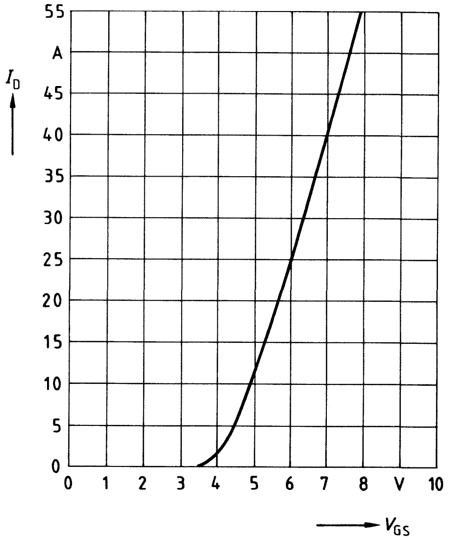
Typical output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



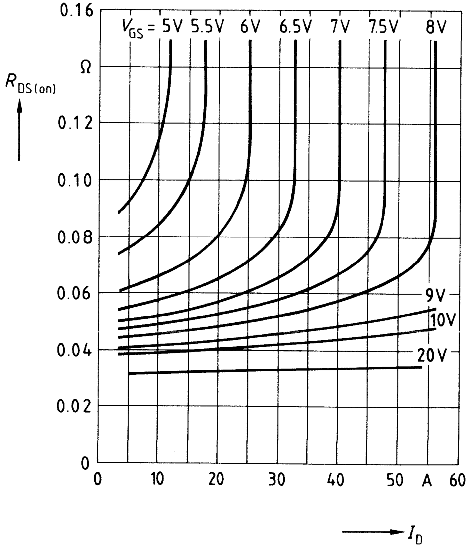
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



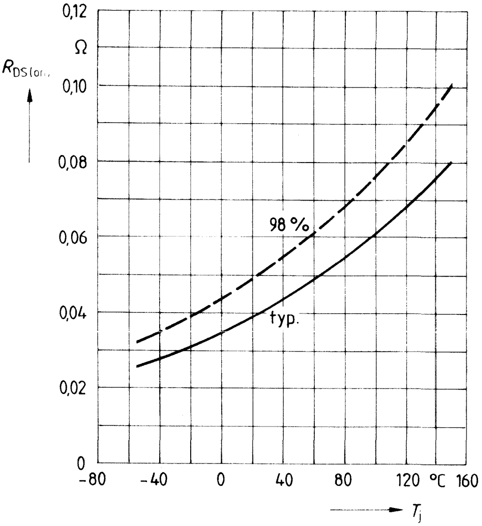
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



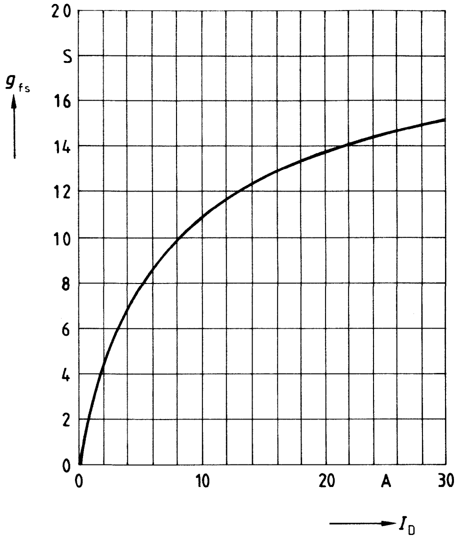
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



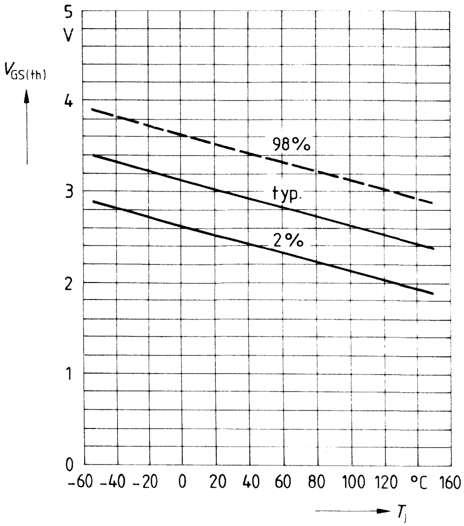
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 17$ A, $V_{GS} = 10$ V, (spread)



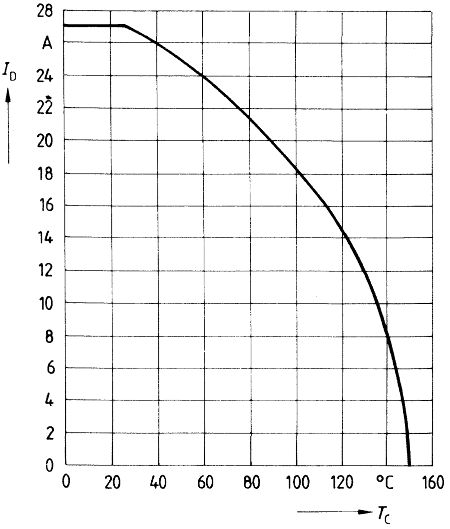
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



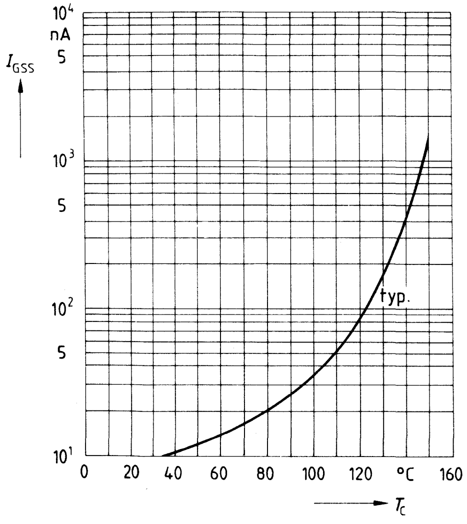
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



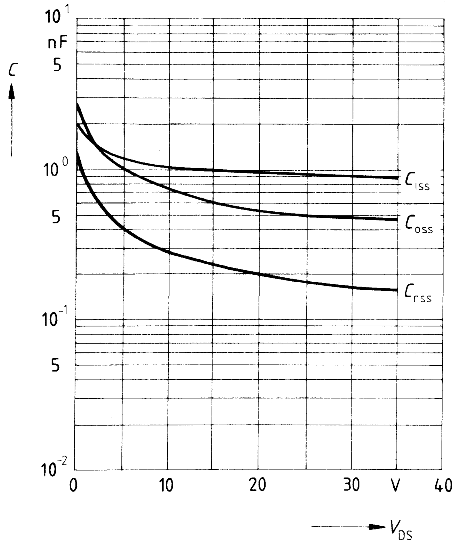
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V



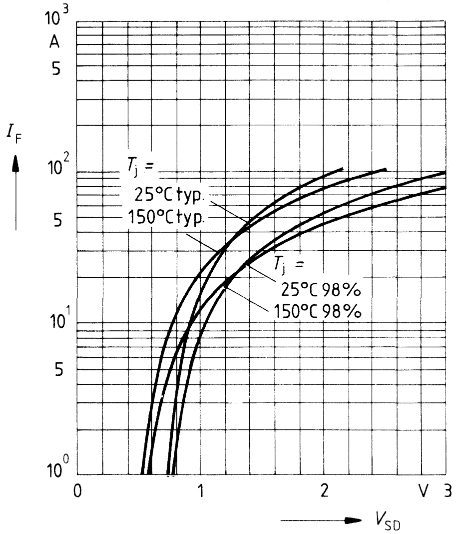
Gate-source leakage current $I_{GSS} = f(T_C)$
Parameter: $V_{GS} = 20$ V, $V_{DS} = 0$



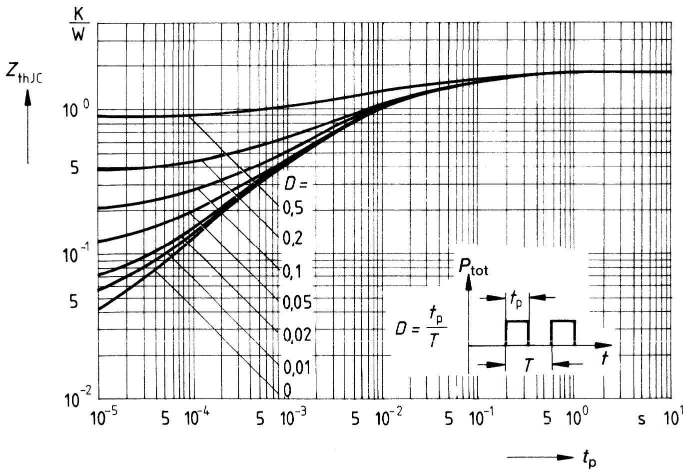
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristic of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

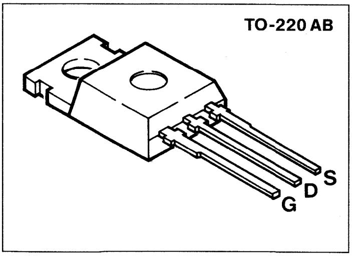


TEMPFET

BTS 131

V_{DS} = 50 V
I_D = 25 A
$R_{DS(on)}$ = 0.06 Ω

- N channel
- Enhancement mode
- Logic level
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 131	C67078-A5002-A4

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Gate-source voltage	V_{GS}	± 10	
Continuous drain current, T_C = 25 °C	I_D	25	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	100	
Short-circuit current T_j = – 55 ... + 150 °C	I_{SC}	80	
Short-circuit dissipation T_j = – 55 ... + 150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 4.5$ V, $I_D = 12$ A	$R_{DS(on)}$	–	0.05	0.06	Ω

Dynamic characteristics

Forward transconductance $V_{DS} = 25$ V, $I_D = 12$ A	g_{fs}	12	17	22	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	800	1050	1400	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	500	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	200	300	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	40	ns
	t_r	–	60	90	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	100	130	
	t_f	–	75	95	

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	25	A
Pulsed source current	I_{SM}	–	–	100	
Diode forward on-voltage $I_F = 50$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	1.0	–	µC

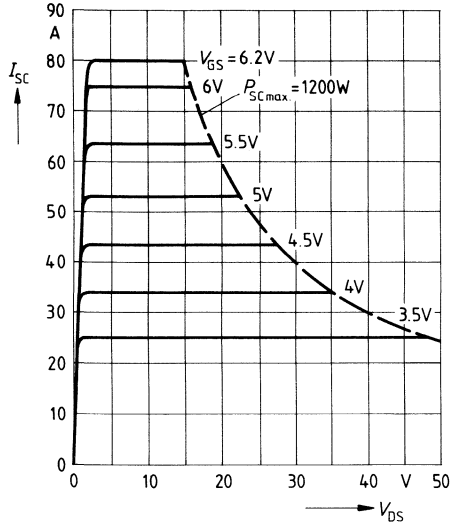
Temperature sensor

Parameter	Symbol	min.	typ.	max.	Unit
Forward voltage	$V_{TS(on)}$				V
$I_{TS(on)} = 5$ mA, $T_j = -55 \ldots +150$ °C		0.7	1.3	1.4	
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +150$ °C		–	–	15	
Forward current	$I_{TS(on)}$				mA
$T_j = -55 \ldots +150$ °C		–	–	5	
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +150$ °C		–	–	600	
Holding current	I_H				mA
$V_{TS} = 5$ V, $T_j = 25$ °C		0.05	0.3	0.5	
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

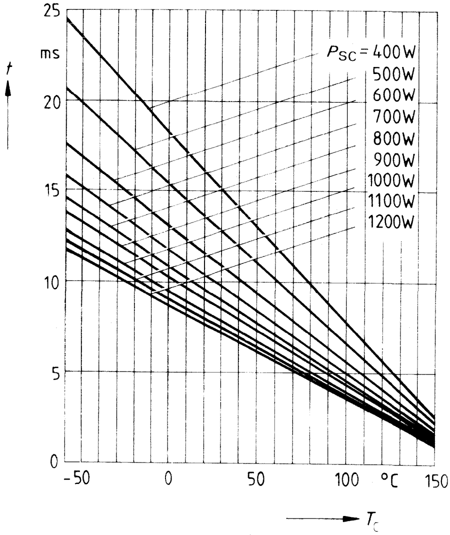
Examples for short-circuit protection
($T_j = -55 \ldots +150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	6.2	4.1	–	
Short-circuit current	I_{SC}	≤ 80	≤ 37	–	A
Short-circuit dissipation	P_{SC}	1200	1100	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

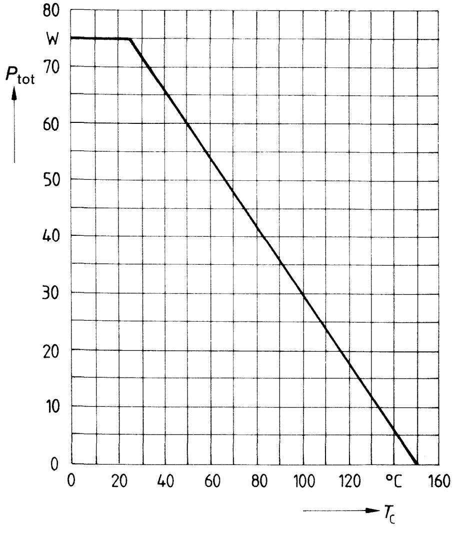
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \ldots +150$ °C



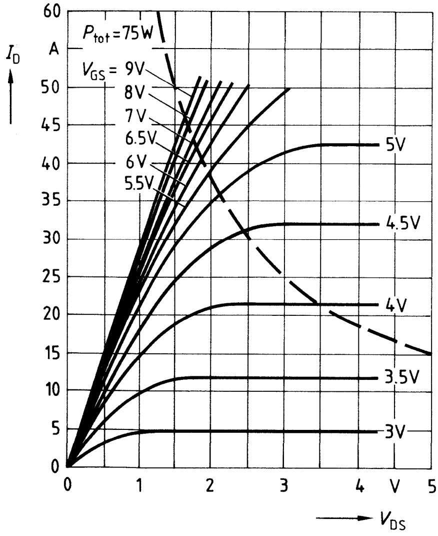
Turn-off time $t = f(T_C)$
Parameter: $P_{SC max} = V_{DS} \times I_D$



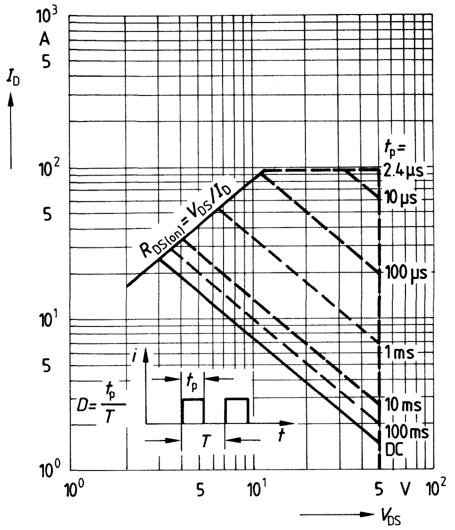
Power dissipation $P_{tot} = f(T_C)$



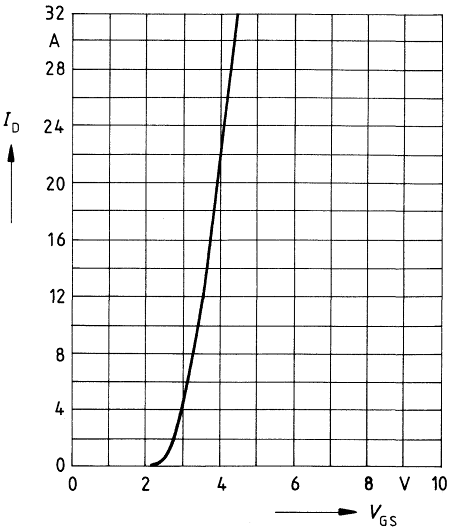
Typical output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



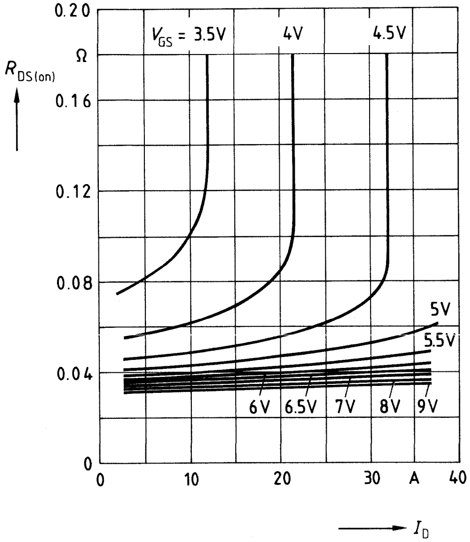
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



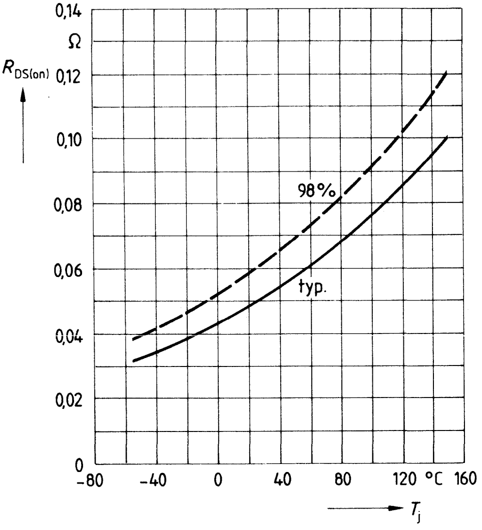
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



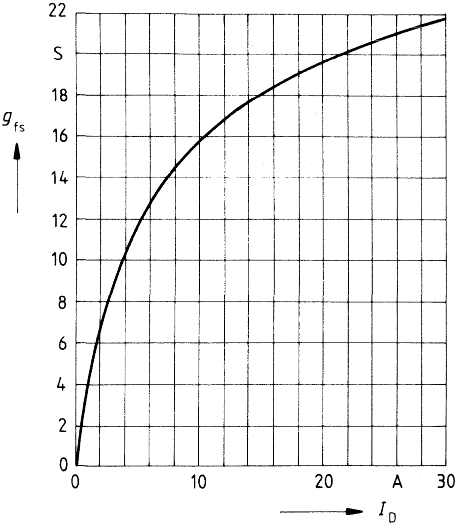
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



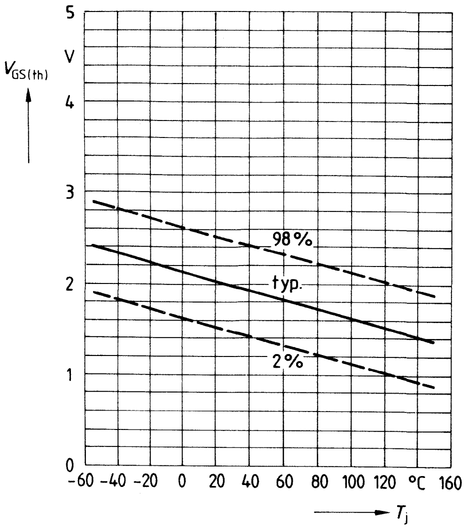
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 12$ A, $V_{GS} = 4.5$ V, (spread)



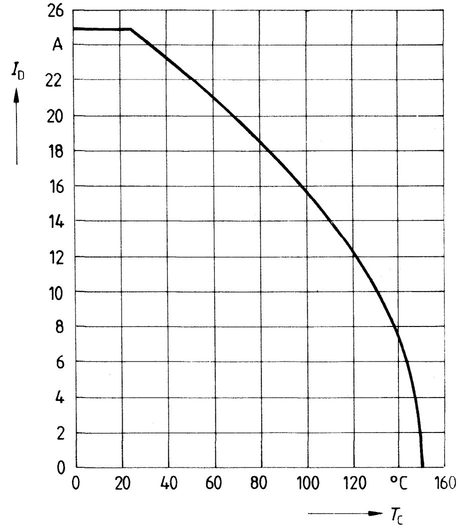
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$



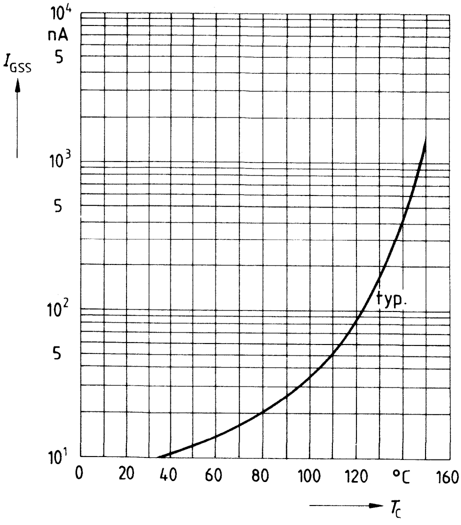
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



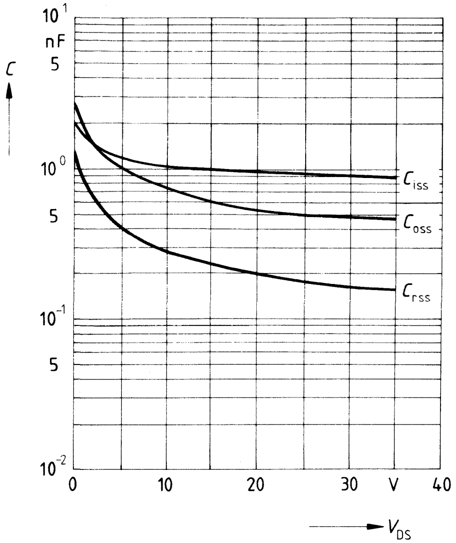
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10$ V



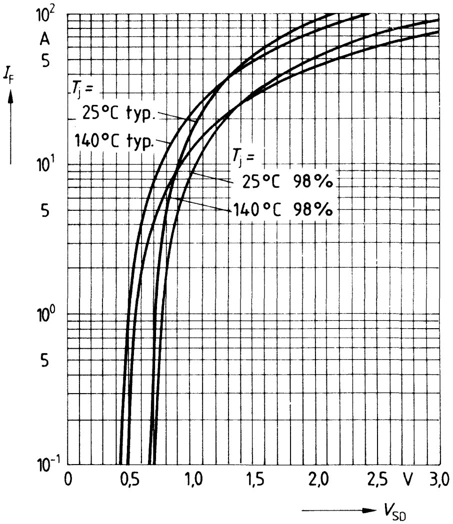
Gate-source leakage current $I_{GSS} = f(T_C)$
Parameter: $V_{GS} = 20$ V, $V_{DS} = 0$



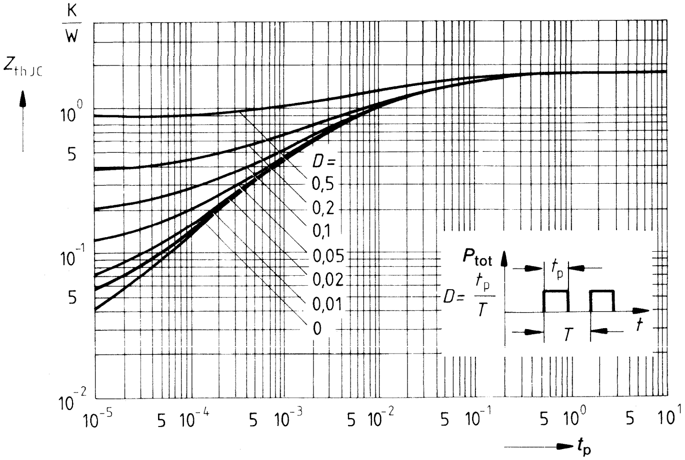
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristic of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



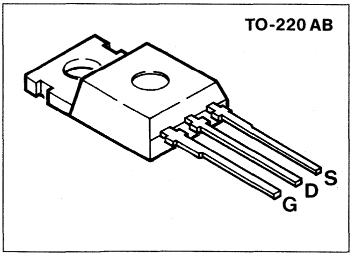
SIEMENS

TEMPFET

BTS 132

V_{DS} = 60 V
I_D = 24 A
$R_{DS(on)}$ = 0.065 Ω

- N channel
- Enhancement mode
- Logic level
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1])



Observe circuit design hints (see chapter Technical Information)!

Type	**Ordering code**
BTS 132	C67078-A5003-A4

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	60	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Gate-source voltage	V_{GS}	± 10	
Continuous drain current, T_C = 25 °C	I_D	24	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	96	
Short-circuit current T_j = – 55 ... + 150 °C	I_{SC}	80	
Short-circuit dissipation T_j = – 55 ... + 150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1]) See chapter Package Outlines

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	60	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.0	2.5	
Zero gate voltage drain current $V_{DS} = 60$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 4.5$ V, $I_D = 12$ A	$R_{DS(on)}$	–	0.055	0.065	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 12$ A	g_{fs}	12	17	22	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	800	1050	1400	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	500	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	200	300	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	40	ns
	t_r	–	150	200	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	180	250	
	t_f	–	125	160	

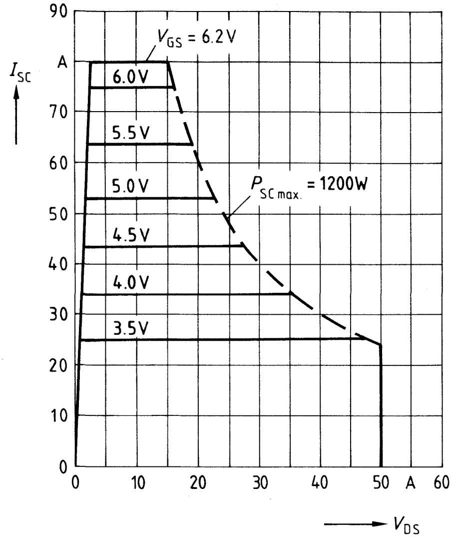
Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	24	A
Pulsed source current	I_{SM}	–	–	96	
Diode forward on-voltage $I_F = 50$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	1.0	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 5$ mA, $T_j = -55 \ldots +150$ °C	$V_{TS(on)}$	0.7	1.3	1.4	V
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C		–	–	15	
Forward current $T_j = -55 \ldots +150$ °C	$I_{TS(on)}$	–	–	5	mA
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +160$ °C		–	–	600	
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C	I_H	0.05	0.3	0.5	mA
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

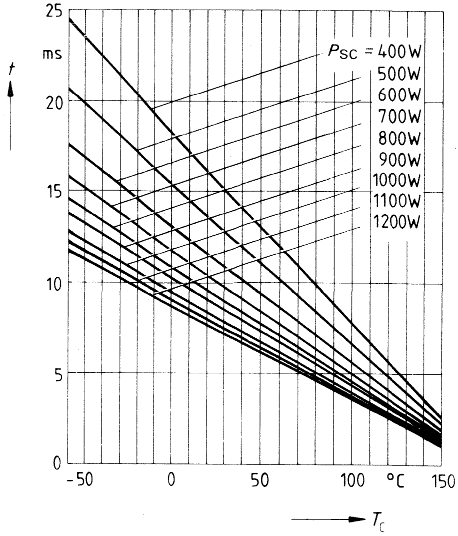
Examples for short-circuit protection
($T_j = -55 \ldots +150$ °C, unless otherwise specified)

Parameter	**Symbol**	**Values**			**Unit**
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	6.2	4.1	–	
Short-circuit current	I_{SC}	≤ 80	≤ 37	–	A
Short-circuit dissipation	P_{SC}	1200	1100	–	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

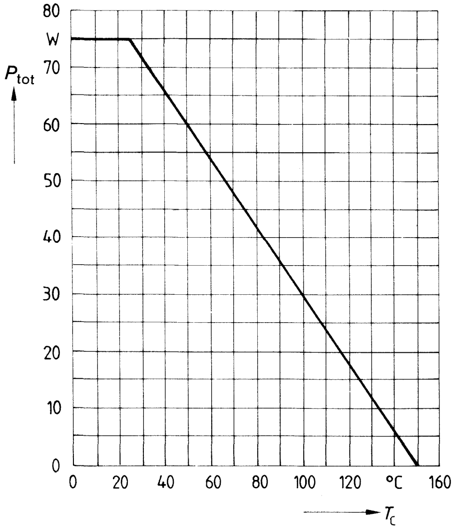
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}
Diagram to determine I_{SC}
for $T_j = -55 \ldots +150$ °C



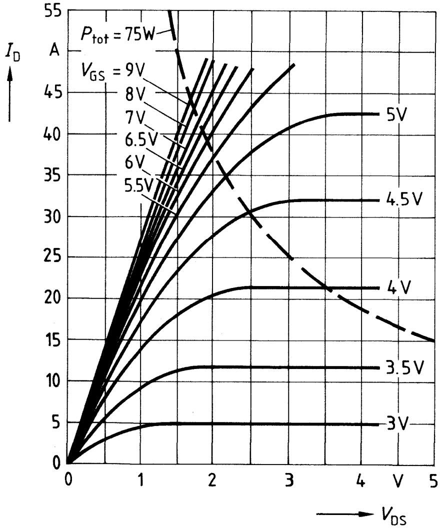
Turn-off time $t = f(T_C)$
Parameter: $P_{SC\,max} = V_{DS} \times I_D$



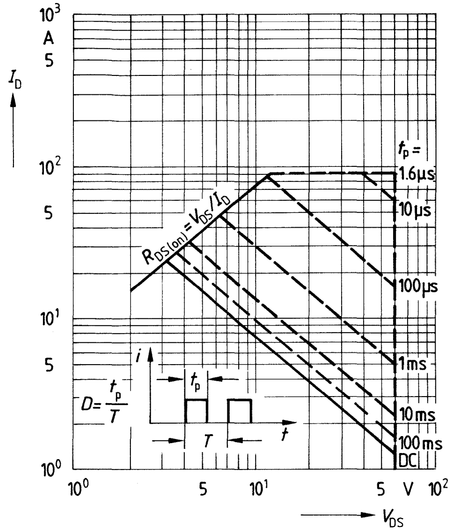
Power dissipation $P_{tot} = f(T_C)$



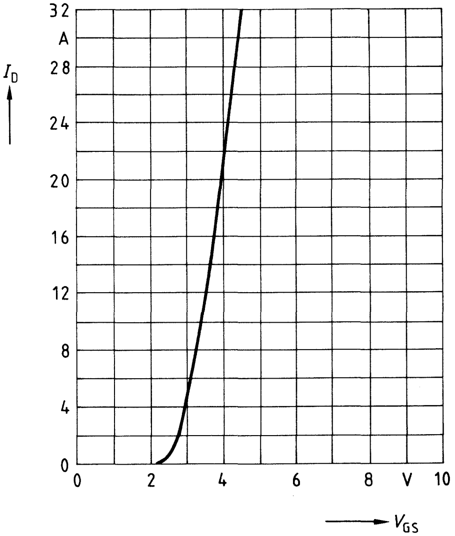
Typical output characteristic $I_D = f(V_{DS})$
Parameter: $t_p = 80$ µs



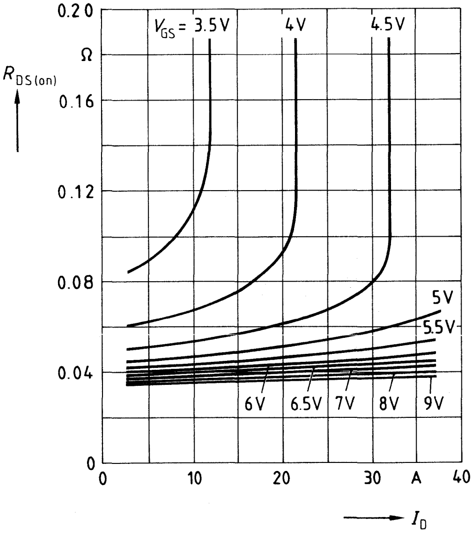
Safe operating area $I_D = f(V_{DS})$
Parameter: $D = 0.01$, $T_C = 25$ °C



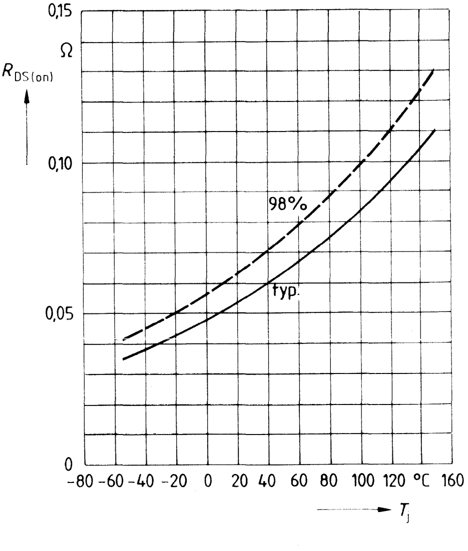
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



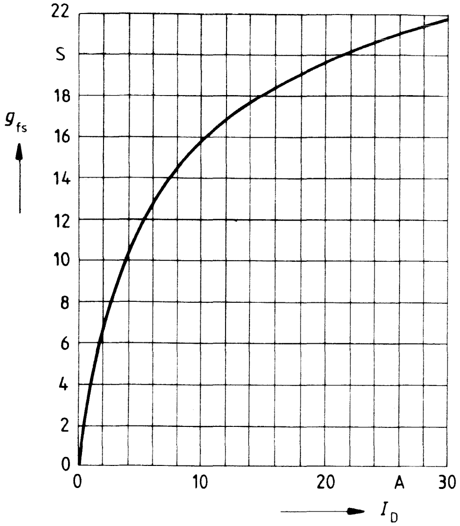
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}



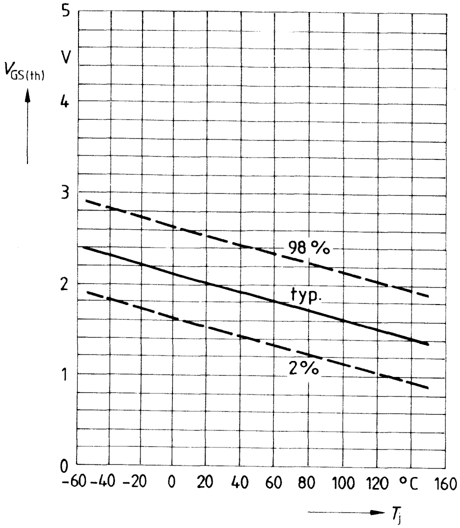
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $I_D = 12$ A, $V_{GS} = 4.5$ V, (spread)



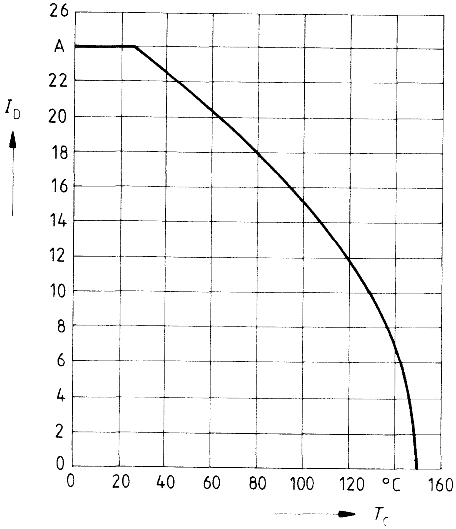
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$



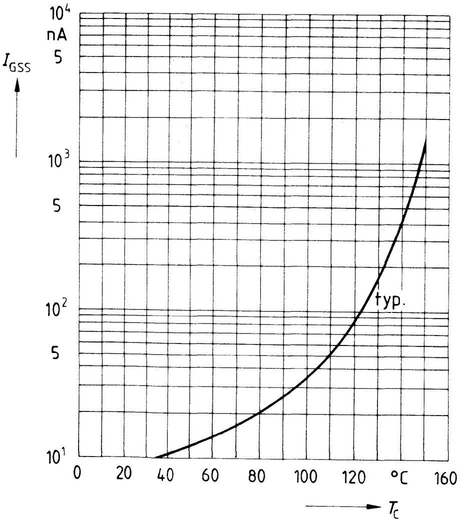
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA
(spread)



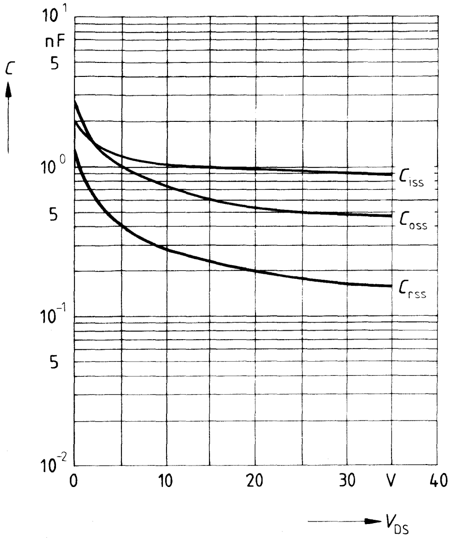
Continuous drain current $I_D = f(T_C)$
Parameter: $V_{GS} \geq 10\ V$



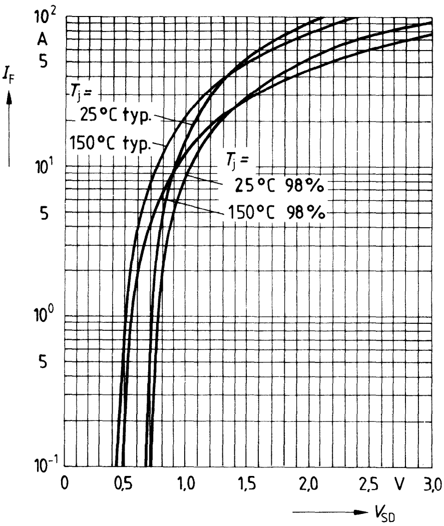
Gate-source leakage current $I_{GSS} = f(T_C)$
Parameter: $V_{GS} = 20\ V$, $V_{DS} = 0$



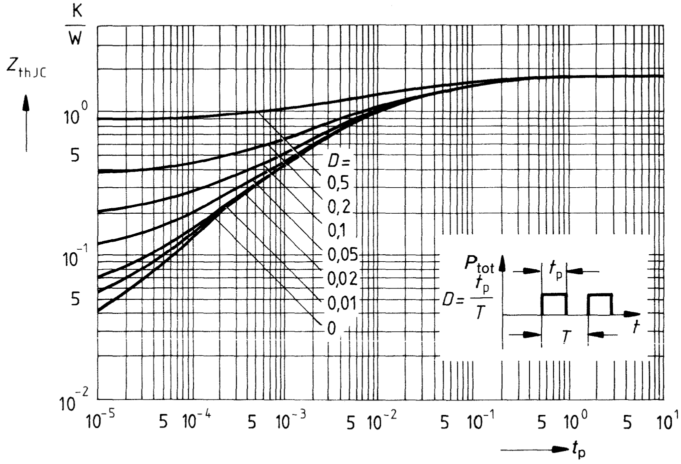
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristic of reverse diode
$I_F = f(V_{SD})$
Parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



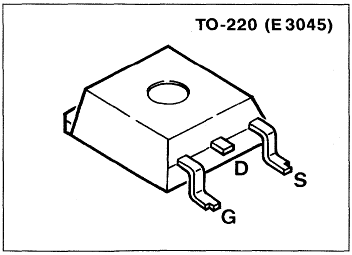
SIEMENS

TEMPFET

BTS 136

V_{DS} = 50 V
I_D = 27 A
$R_{DS(on)}$ = 0.05 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 (E 3045)[1], SMD version



Observe circuit design hints (see chapter Technical Information)!

Type	**Ordering code**
BTS 136	C67078-A5006-A3

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	27	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	108	
Short-circuit current T_j = – 55 ... + 150 °C	I_{SC}	80	
Short-circuit dissipation T_j = – 55 ... + 150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 95	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	1	10	
$T_j = 125$ °C		–	100	300	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2	4	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 17$ A	$R_{DS(on)}$	–	0.04	0.05	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 17$ A	g_{fs}	8.0	13.0	18.0	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	700	940	1250	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	500	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	180	270	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	25	40	ns
	t_r	-	60	90	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	100	130	
	t_f	-	75	95	

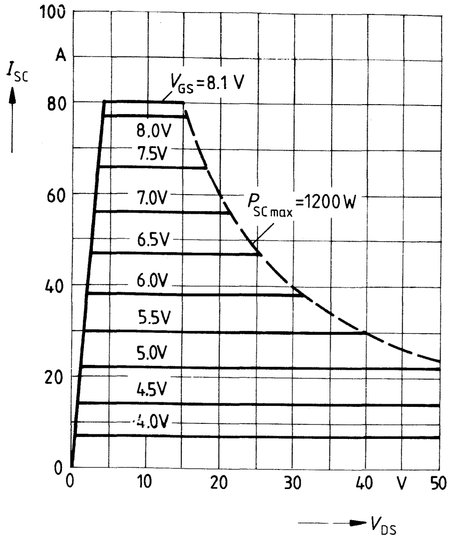
Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	27	A
Pulsed source current	I_{SM}	–	–	108	
Diode forward on-voltage $I_F = 54$ A, $V_{GS} = 0$	V_{SD}	–	1.5	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	150	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	1.0	–	µC
Temperature sensor					
Forward voltage	$V_{TS(on)}$				V
$I_{TS(on)} = 10$ mA, $T_j = -55...+150$ °C		0.7	1.4	1.5	
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C		–	–	15	
Forward current	$I_{TS(on)}$				mA
$T_j = -55...+150$ °C		–	–	10	
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+160$ °C		–	–	600	
Holding current	I_H				mA
$V_{TS} = 5$ V, $T_j = 25$ °C		0.05	0.3	0.5	
$T_j = 150$ °C		0.05	0.2	0.3	
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

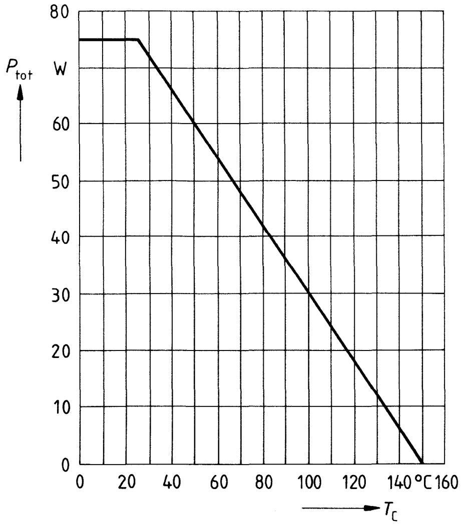
Examples for short-circuit protection
(T_j = – 55 ... +150 °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	8.1	5.9	–	
Short-circuit current	I_{SC}	≤ 80	≤ 37	–	A
Short-circuit dissipation	P_{SC}	1200	1100	–	W
Response time T_j = 25 °C, before short-circuit	$t_{SC(off)}$	25	25	–	ms

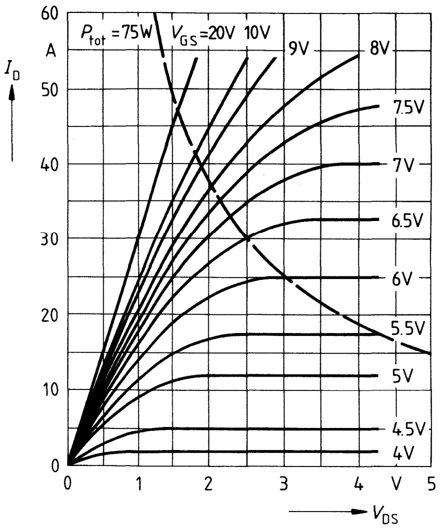
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



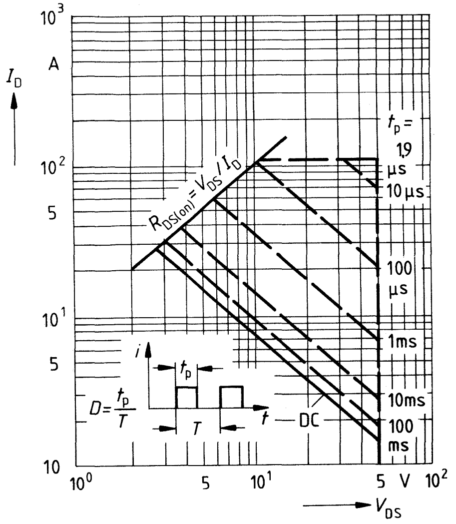
Permissible power dissipation $P_{tot} = f(T_C)$



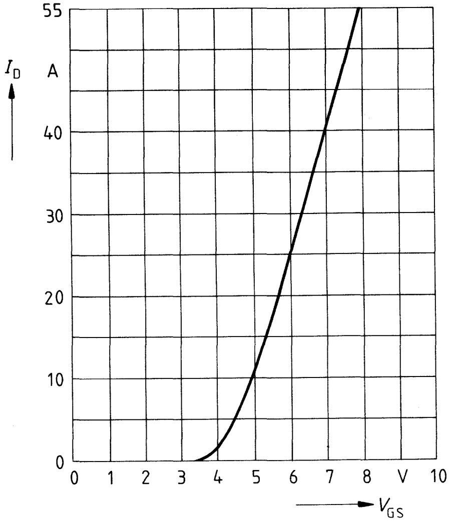
Typ. output characteristics $I_D = f(V_{DS})$



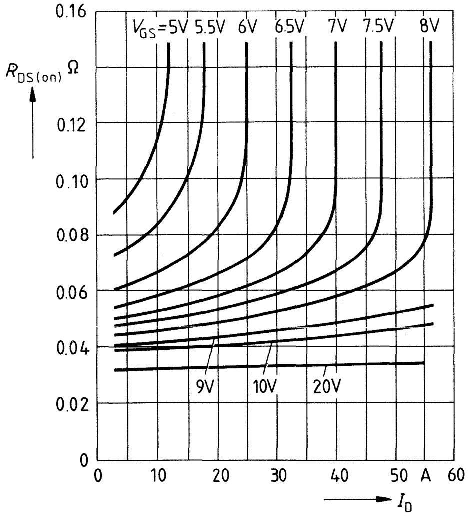
Permissible operating area $I_D = f(V_{DS})$



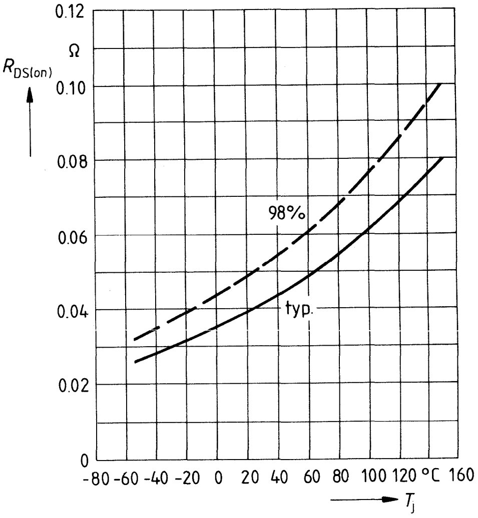
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



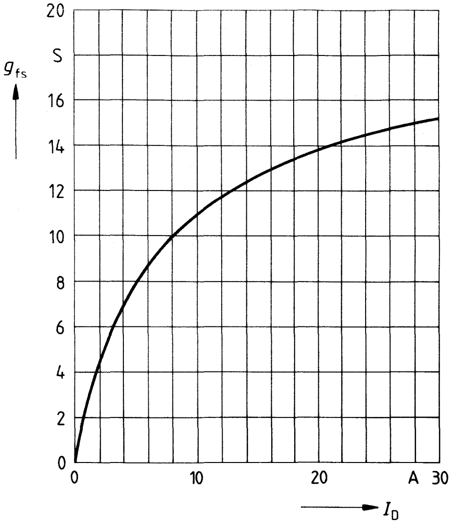
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, T_j = 25 °C



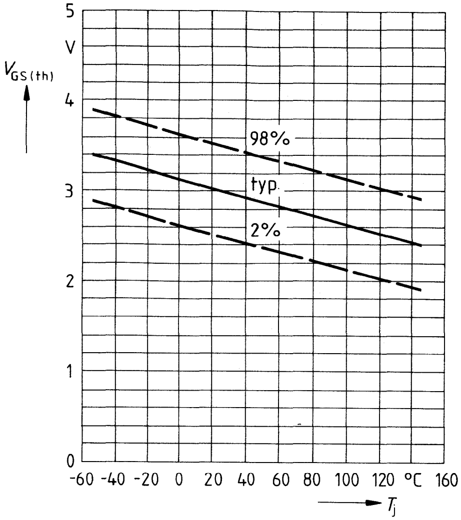
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: V_{GS} = 10 V, I_D = 17 A, (spread)



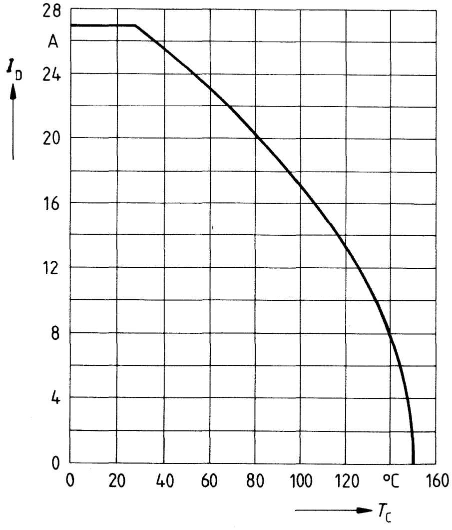
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



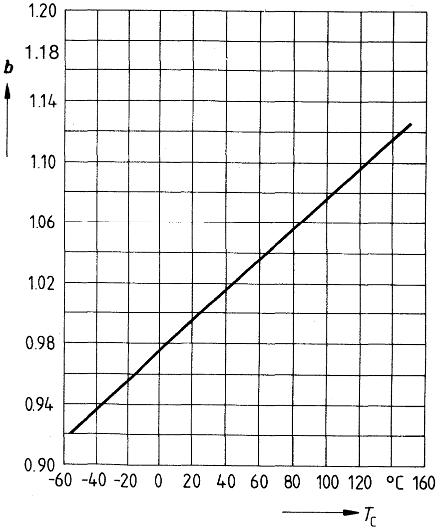
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



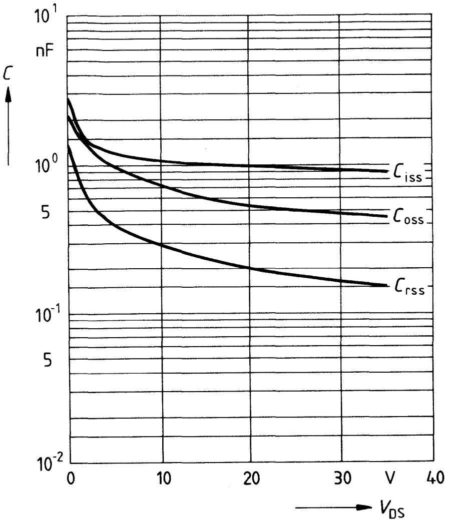
Continuous drain current $I_D = f(T_C)$



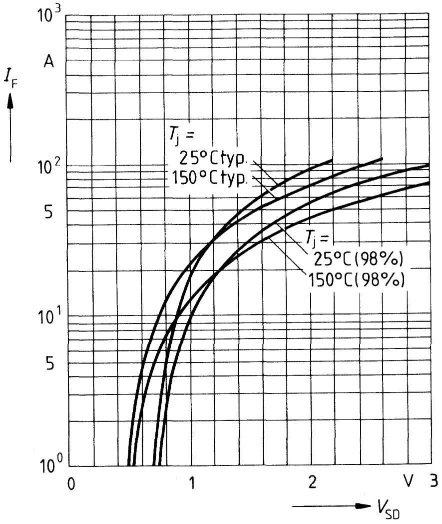
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}(25\text{ °C})$



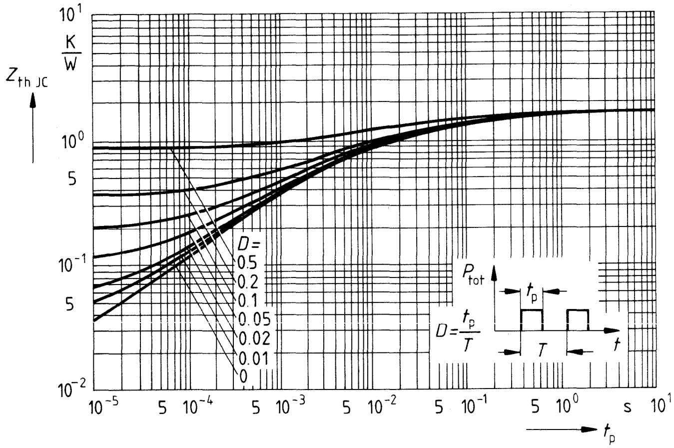
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



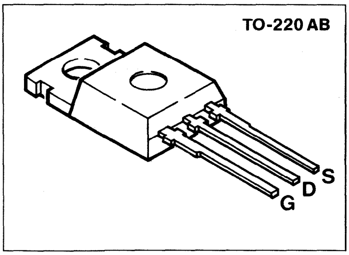
SIEMENS

TEMPFET

BTS 140 A

V_{DS} = 50 V
I_D = 39 A
$R_{DS(on)}$ = 0.028 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220 AB [1]



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 140 A	C67078-S5011-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	39	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	156	
Short-circuit current T_j = - 55 ... +150 °C	I_{SC}	80	
Short-circuit dissipation T_j = - 55 ... +150 °C	P_{SCmax}	1200	W
Max. power dissipation	P_{tot}	75	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 1.67 ≤ 75	K/W

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[1] See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
$T_j = 25$ °C		–	0.1	1.0	
$T_j = 125$ °C		–	10	100	
Gate-source leakage current $V_{GS} = \pm 20$ V, $V_{DS} = 0$	I_{GSS}				
$T_j = 25$ °C		–	10	100	nA
$T_j = 150$ °C		–	2.0	4.0	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 25$ A	$R_{DS(on)}$	–	0.024	0.028	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 25$ A	g_{fs}	12	23	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1800	2400	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	800	1200	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	280	450	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 25$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	35	50	ns
	t_r	–	85	130	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 25$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	220	280	
	t_f	–	140	180	

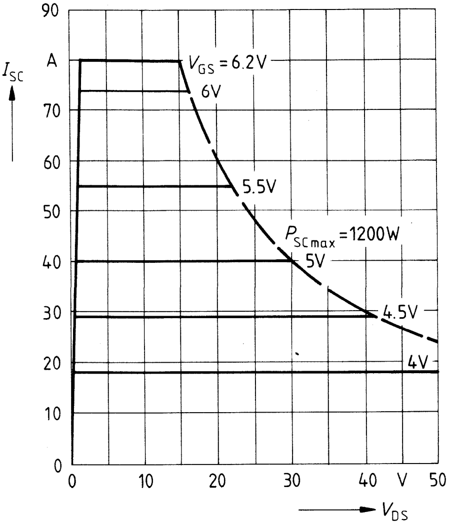
Electrical Characteristics
at T_j = 25 °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	39	A
Pulsed source current	I_{SM}	–	–	156	
Diode forward on-voltage $I_F = 78$ A, $V_{GS} = 0$	V_{SD}	–	1.8	2.2	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	80	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.14	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55\ldots+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+150$ °C	$V_{TS(on)}$	0.7 – –	1.4 – –	1.5 15	V
Forward current $T_j = -55\ldots+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+150$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1	2.5	5	µs

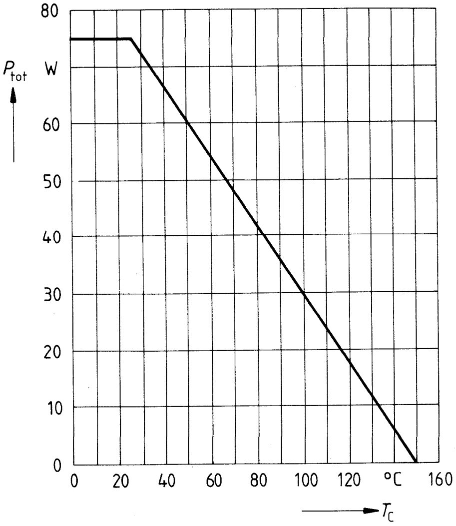
Examples for short-circuit protection
($T_j = -55\ldots+150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	6.2	5.0	–	
Short-circuit current	I_{SC}	≤ 80	≤ 40	–	A
Short-circuit dissipation	P_{SC}	≤ 1.2	≤ 1.2	–	kW
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	≤ 30	≤ 30	–	ms

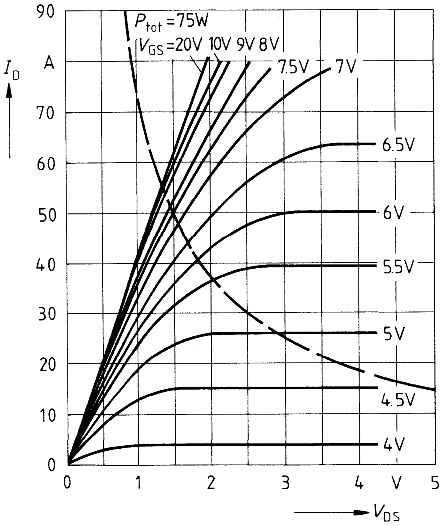
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



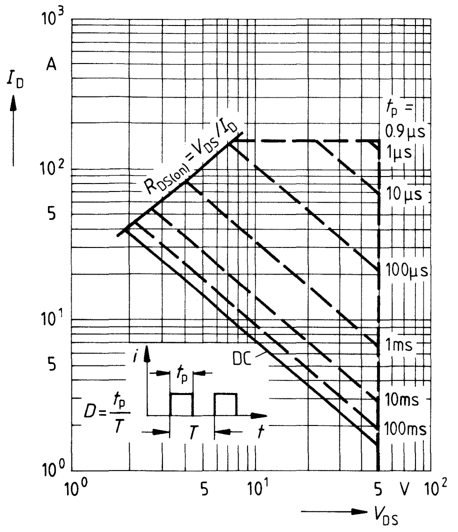
Permissible power dissipation $P_{tot} = f(T_C)$



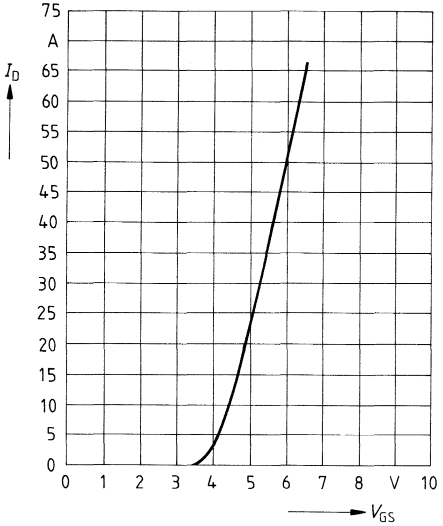
Typ. output characteristics $I_D = f(V_{DS})$



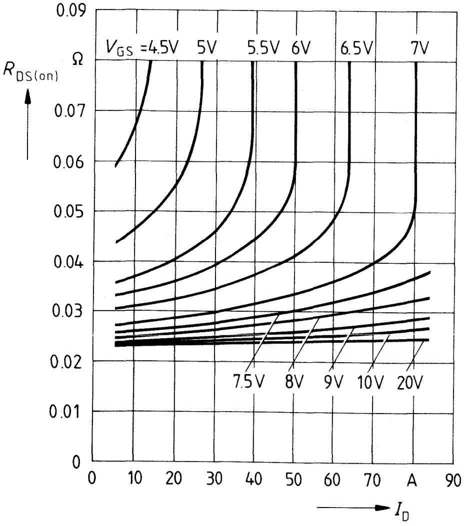
Permissible operating area $I_D = f(V_{DS})$



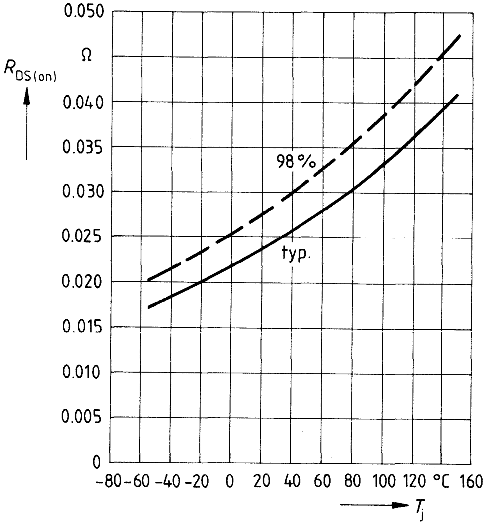
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



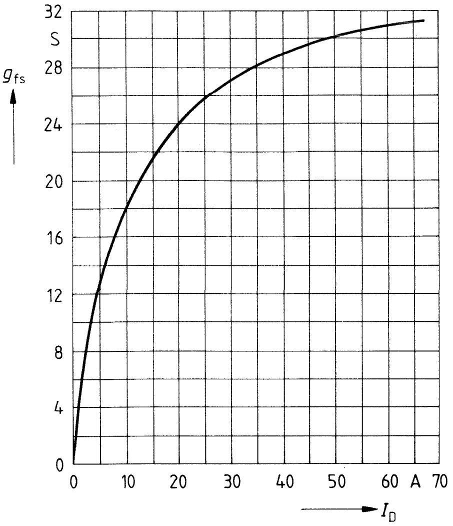
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, $T_j = 25$ °C



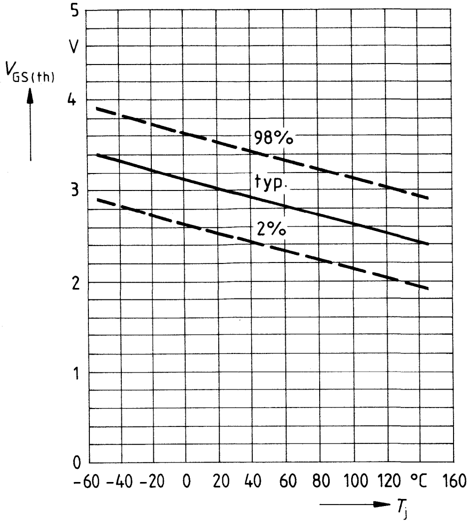
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $V_{GS} = 10$ V, $I_D = 32$ A, (spread)



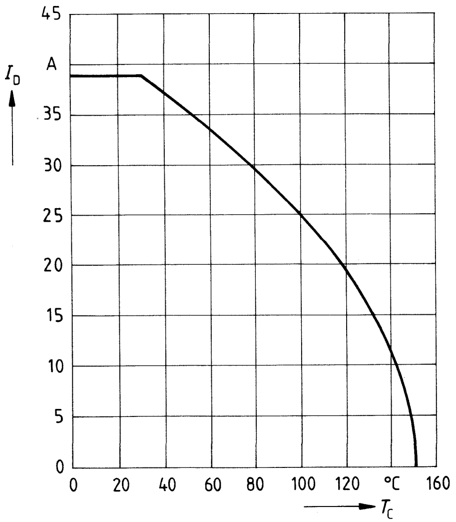
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



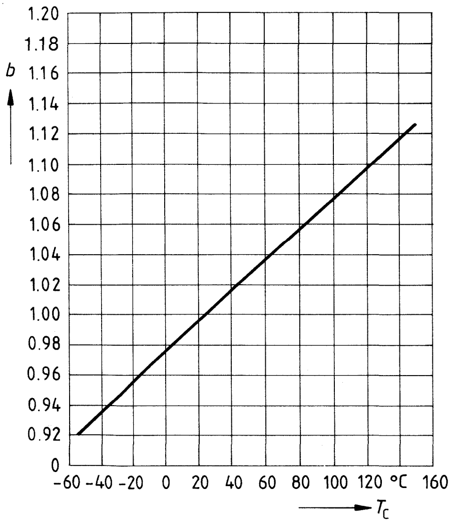
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



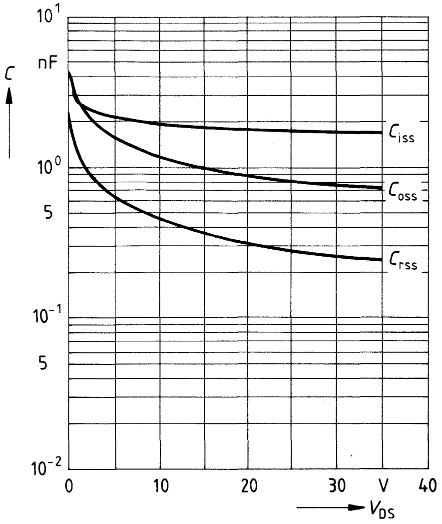
Continuous drain current $I_D = f(T_C)$



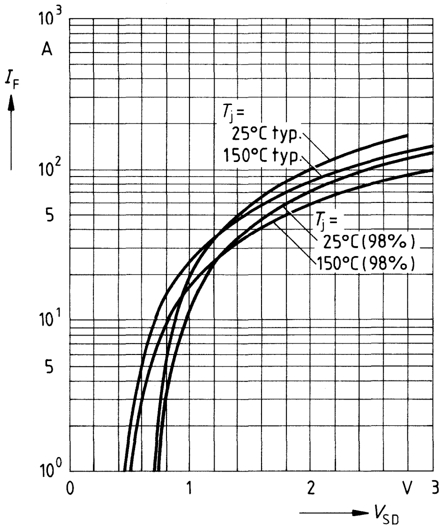
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



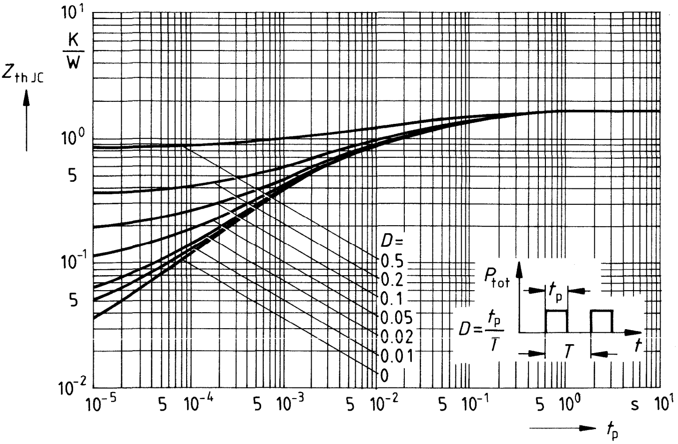
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



SIEMENS

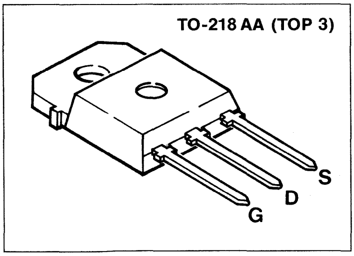
TEMPFET

Preliminary Data

BTS 240 A

V_{DS} = **50 V**
I_D = **58 A**
$R_{DS(on)}$ = **0.018 Ω**

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-218 AA 1)



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 240 A	C67078-S5100-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 73 °C	I_D	58	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	232	
Short-circuit current, $V_{DS} \leq 15$ V, T_j = – 55 ... + 150 °C	I_{SC}	147	
Short-circuit dissipation, $V_{DS} \leq 15$ V, T_j = – 55 ... + 150 °C	P_{SC}	2200	W
Max. power dissipation	P_{tot}	170	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 0.74 ≤ 45	K/W

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1) See chapter Package Outlines

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.5	3.0	3.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}				µA
T_j = 25 °C		–	0.1	10	
T_j = 125 °C		–	10	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}				
T_j = 25 °C		–	10	100	nA
T_j = 150 °C		–	2.0	4.0	µA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 47$ A	$R_{DS(on)}$	–	0.012	0.018	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 47$ A	g_{fs}	20.0	43.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	2.9	4.3	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	1.4	2.1	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	0.5	0.8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	50	75	ns
	t_r	–	150	230	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	350	560	
	t_f	–	250	330	

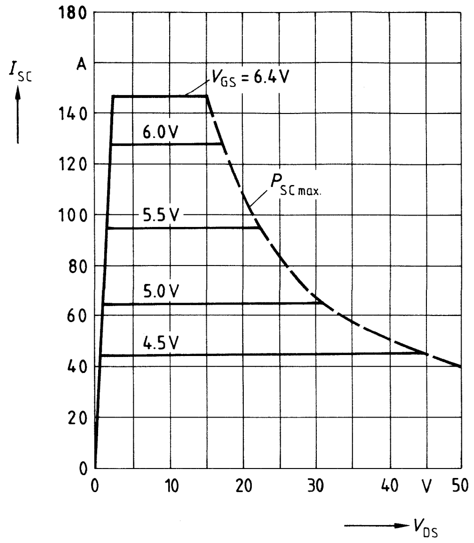
Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	58	A
Pulsed source current	I_{SM}	–	–	232	
Diode forward on-voltage $I_F = 116$ A, $V_{GS} = 0$	V_{SD}	–	1.6	2.0	V
Reverse recovery time $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	t_{rr}	–	100	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = 100$ A/µs, $V_R = 30$ V	Q_{rr}	–	0.3	–	µC
Temperature sensor					
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55\ldots+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+150$ °C	$V_{TS(on)}$	0.7 –	1.4 –	1.5 15	V
Forward current $T_j = -55\ldots+150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55\ldots+150$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS(off)} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	mA
Switching temperature $V_{TS(off)} = 5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS(off)} = 5$ V, $I_{TS(on)} = 2$ mA	t_{off}	1.0	2.5	5.0	µs

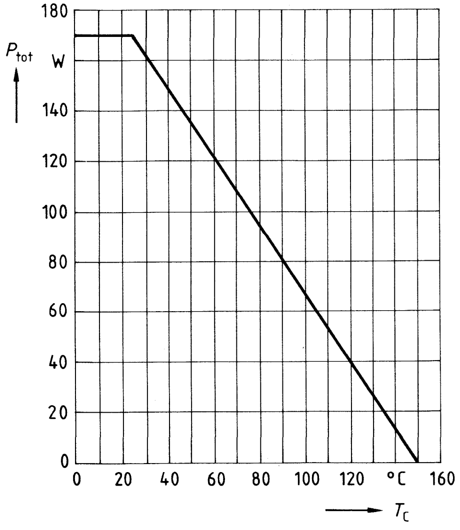
Examples for short-circuit protection
($T_j = -55 \ldots +150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	15	30	–	V
Gate-source voltage	V_{GS}	6.4	5.1	–	
Short-circuit current	I_{SC}	<147	<67	–	A
Short-circuit dissipation	P_{SC}	<2.2	<2.0	–	kW
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	<25	<25	–	ms

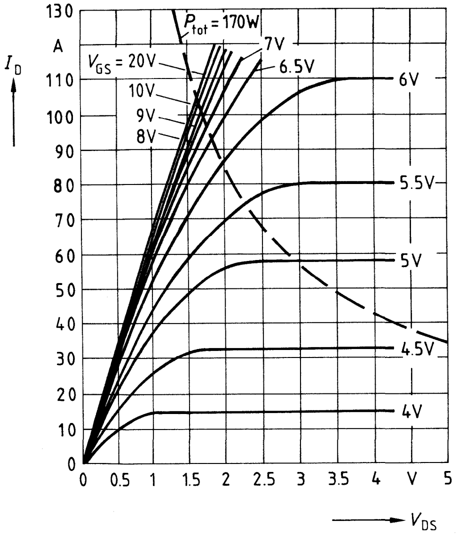
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



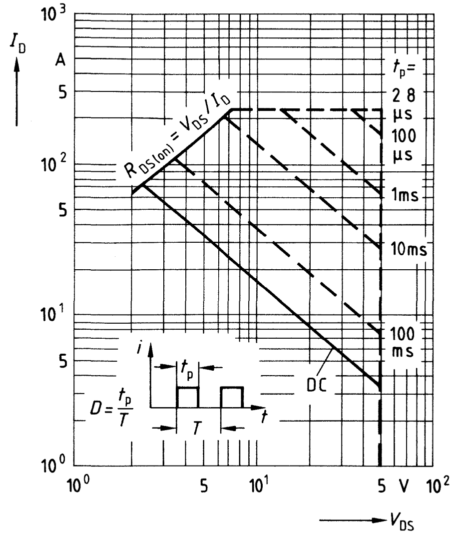
Permissible power dissipation $P_{tot} = f(T_C)$



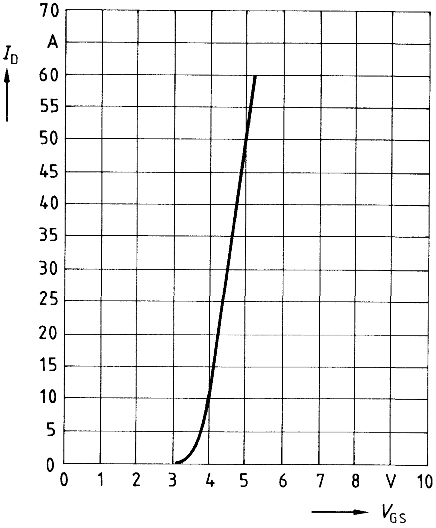
Typ. output characteristics $I_D = f(V_{DS})$



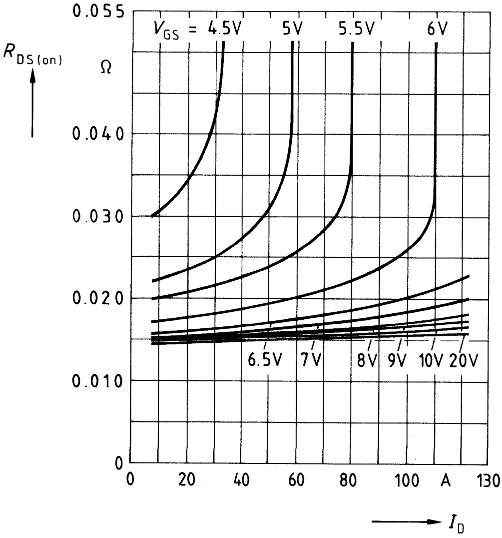
Permissible operating area $I_D = f(V_{DS})$



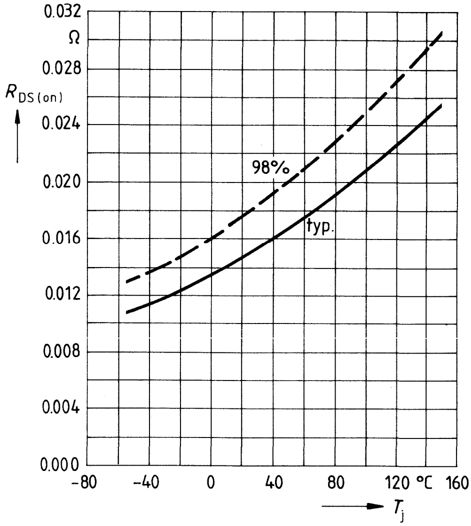
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: V_{DS} = 25 V, t_p = 80 µs, T_j = 25 °C



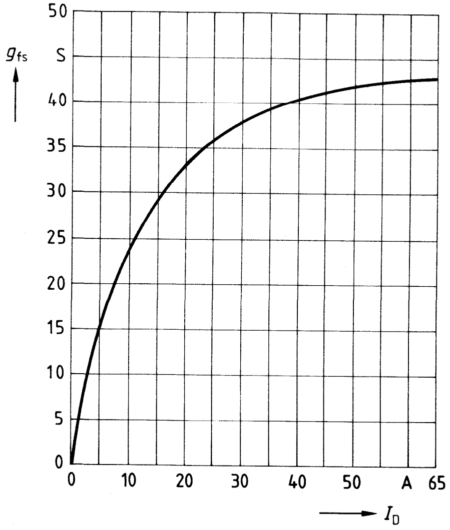
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, T_j = 25 °C



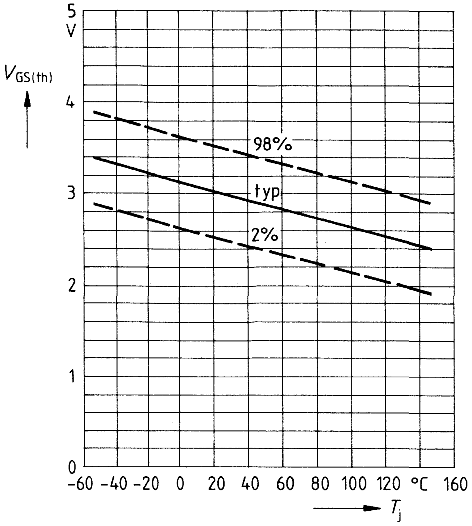
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: V_{GS} = 10 V, I_D = 47 A, (spread)



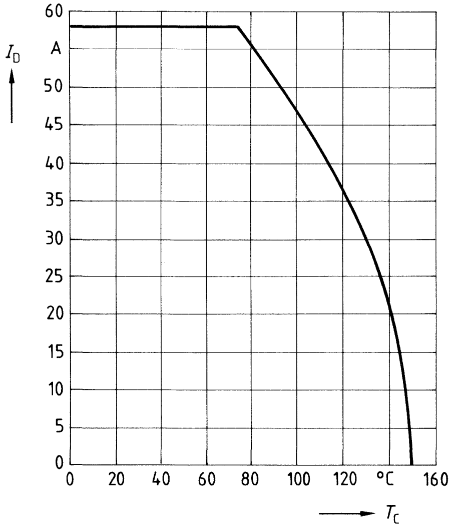
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



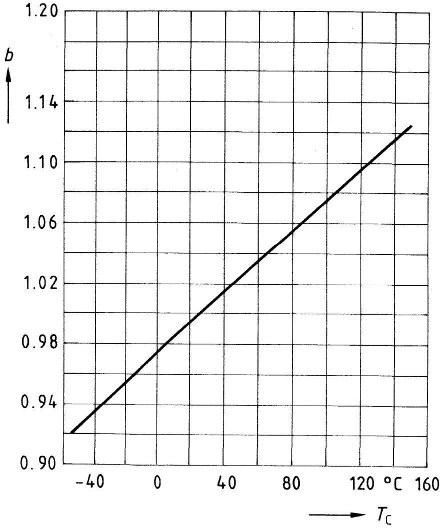
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



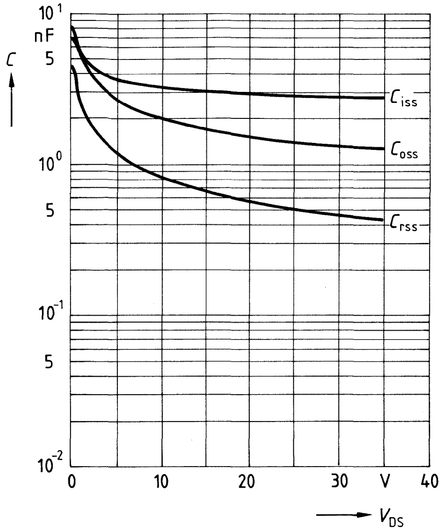
Continuous drain current $I_D = f(T_C)$



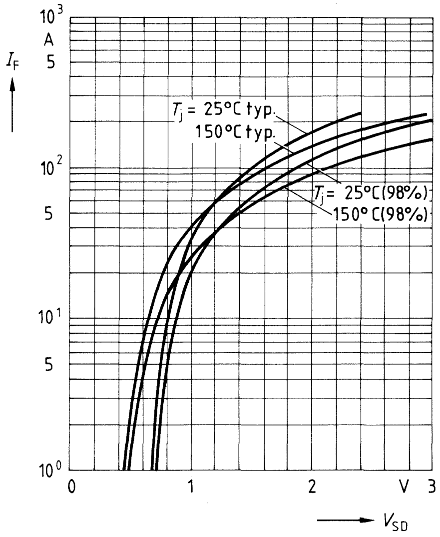
Drain-source breakdown voltage
$V_{(BR)\,DSS}\,(T_j) = b \times V_{(BR)DSS}$ (25 °C)



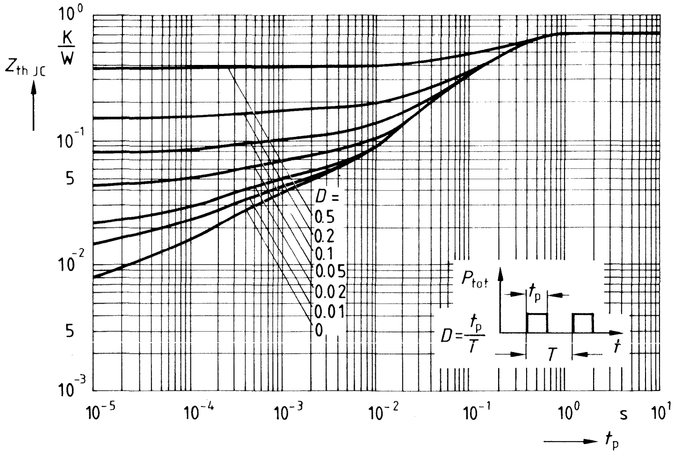
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



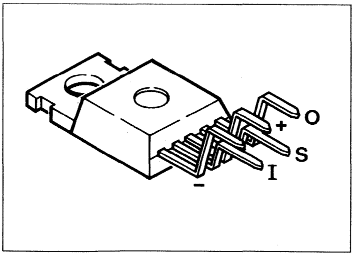
Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$



PROFET
Preliminary Data

BTS 410 D/E/F/G

- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Load dump protection up to 80 V[1])
- Undervoltage and overvoltage shutdown with auto-restart and hysteresis
- Reverse battery protection [1])
- Input protection
- Inductive load generated negative voltage transient limit to typ. −10 V
- Broken inductive load protection [2])
- Open-load detection in on-condition
- Max. current internally limited
- Status output
- R_{on} constant versus V_{bb}
- **E**lectro**s**tatic **d**ischarge (**ESD**) protection
- Version E, G: Overtemperature shutdown with auto-restart
- Version G: Short-circuit protection by overtemperature protection



Type	Ordering code
BTS 410D	C67078-S5305-A3
BTS 410E	C67078-S5305-A4
BTS 410F	C67078-S5305-A5
BTS 410G	C67078-S5305-A6

Maximum Ratings

Parameter	Symbol	Values	Unit
Active overvoltage protection	$V_{bb(AZ)}$	>50	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	75	W
Operating and storage temperature range	T_j T_{stg}	−55 ... +150	°C
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 1.67 75	K/W

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[1]) with 150 Ω resistor in GND connection

[2]) with 150 Ω resistor in GND connection or freewheel diode parallel to load.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) $V_{bb} = 12$ V, $I_L = 1$ A	R_{on}	–	190	220	mΩ
Operating voltage (pin 3 to 1) $T_j = -40 \ldots +150$ °C	V_{bb}	4.9	–	42	V
Nominal current, calculated value (pin 5 to 1) ISO-proposal: V_{bb}–$V_{out} \leq 0.5$ V, $T_C = 85$ °C	I_L-ISO	–	–	1.6	A
Load current, theoretical value (pin 5 to 1) MOS-standard: $T_C = 25$ °C, $T_j = 150$ °C	I_L-MOS	–	–	13	
Load current limit (pin 5 to 1) active regulation starts BTS 410 D, E when V_{bb}–$V_{out} > 1$ V BTS 410 F, G	I_{LLim}	– –	15 5	– –	
Standby current (pin 3 to 1), $V_{bb} = 12$ V	I_R	–	10	50	µA
Short-circuit detection voltage, $V_{SC} = V_{bb} - V_{out}$	V_{SC}	–	8	–	V
Open-load detection current	I_{OL}	–	20	150	mA
Input voltage, (pin 2 to 1) $V_{bb} = 12$ V	$V_{in(off)}$ $V_{in(on)}$	-0.5 2.4	– –	1.5 –	V
Max. input current at typ $V_{in(on)} = 6.0$ V	I_{in}	–	–	2	mA
Input current (pin 2 to 1) $V_{in(off)} = 0.4$ V $V_{in(on)} = 2.5$ V	$I_{in(off)}$ $I_{in(on)}$	1 10	– –	30 70	µA
Trip temperature automatic tripping when $T_j \geq 150$ °C	T_t	150	–	–	°C
Turn-on time Turn-off time $V_{bb} = 12$ V, 90% V_{out}, $I_L = 1$ A, 10% V_{out}	t_{on} t_{off}	15 5	– –	60 50	µs
Switching edge on Switching edge off $V_{bb} = 12$ V, 10...30% V_{out} $I_L = 1$ A, 70...40% V_{out}	dv/dt_{on} dv/dt_{off}	– –	– –	3 5	V/µs
Status (CMOS) BTS 410D, $I_{St} = 50$ µA to GND. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.4 –	– –	6.5 0.4	V
Max. status current BTS 410D, $I_{St} = 50$ µA to GND. Status valid > 300 µs after switching edge	I_{St}	–	–	5	mA

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Status (open drain) BTS 410 E/F/G, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	5.0 –	– –	6.6 0.4	V
Max. status current BTS 410 E/F/G, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	I_{St}	–	–	5	mA
Inductive load switch-off energy dissipation $T_j = 150$ °C	W_{ab}	–	–	0.4	J

Truth Table

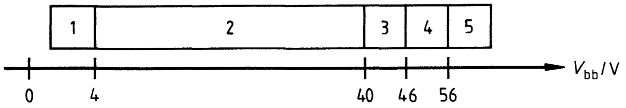
L = "Low" level H = "High" level	**Input voltage**	**Status version D**	**Status version E, F**	**Status version G**	**Output voltage**
Normal operation	L H	H H	H H	H H	L H
Open load	L H	H L	H L	H L	H[1] H
Short-circuit	L H	H L	H L	H H	L L
Overtemperature	L H	L L	L L	L L	L L
Undervoltage	L H	L L	H H	H H	L L
Overvoltage	L H	L L	H H	H H	L L

Options Overview

	Version D	**Version E**	**Version F**	**Version G**
Load current limit	High level	High level	Low level	Low level
Status	CMOS	Open drain	Open drain	Open drain
Short-circuit protection	Switch off	Switch off	Switch off	By temp. protection
Overtemperature shutdown	Latch function [2]	Restart on cooling	Latch function [2]	Restart on cooling
Under- and overvoltage status feedback	Yes	No	No	No

[1] Power transistor off
[2] For type D and F: $V_{bb} > 9$ V

Operating Range (typ.)



1 Undervoltage sensor causes the device to switch off
2 Normal operation
3 Reduction of load current limit to reduce the short-circuit power dissipation of the switch
4 Overvoltage sensor causes the device to switch off
5 Increase of current between pin 3 and 1 from Zener diode to protect the circuit against overvoltage spikes

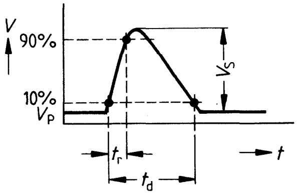
Interference Immunity[1]
in acc. with DIN 40839, part 1 (12 V supply voltage)

Test pulse	Interference levels				with 150 Ω in GND connection			
	I	II	III	IV	I	II	III	IV
1	A	A	A	A	A	A	A	A
2	A	A	B	B	A	A	A	A
3 a	A	A	A	A	A	A	A	A
3 b	A	A	A	A	A	A	A	A
4	A	A	A	A	A	A	A	A
5	A	A	B	B	A	A	A	B

Class A: All functions of the device are performed as designed after exposure to disturbance.

Class B: One or more functions of the device are not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

Test pulse 5: load dump



Parameters: $V_S = 50$ V (level 2)
$V_p = 13.5$ V
$R_i = 0.5 \dots 4\ \Omega$
$t_d = 40 \dots 400$ ms
$t_r = 0.1 \dots 10$ ms
I_{Load} (Pin 5 to 1) $= I_L$-ISO (see page 135)
with 150 Ω in GND connection:
$V_S = 80$ V (level 3)

Note:
The conditions are related to each other in that the high setting values of V_S, R_i and t_d belong together as do respectively the low values.

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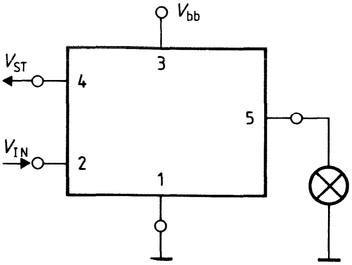
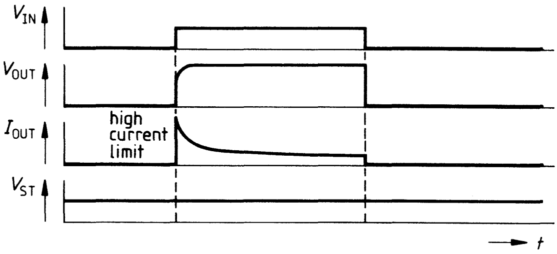
[1] For detailed information refer to chapter Technical Information (DIN 40839: Electromagnetic compatibility (EMC) in motor vehicles; correlation with ISO-Technical Report 7637/0 and 7637/1).

Applications

Figure 1: Switching a lamp



Version D/E



Version F/G

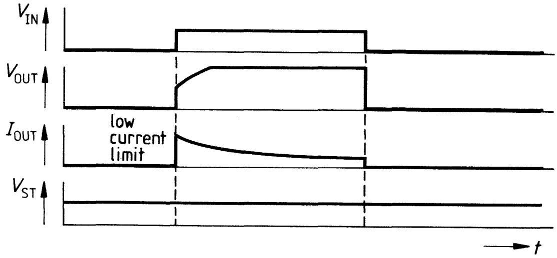


Figure 2: Switching a solenoid

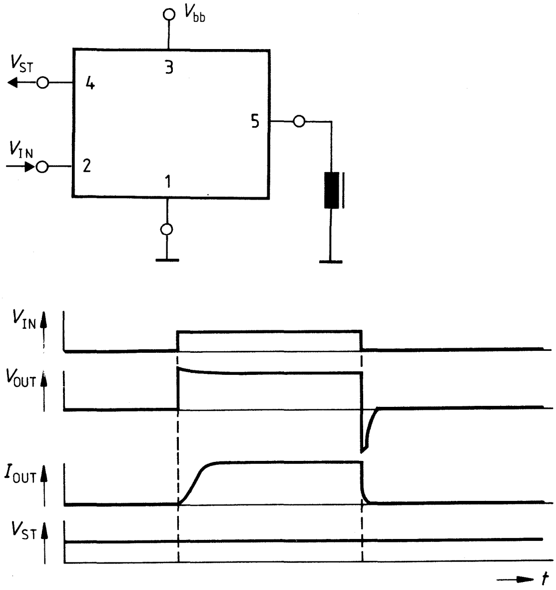


Figure 3: Operation with output short-circuited
Version D/E/F

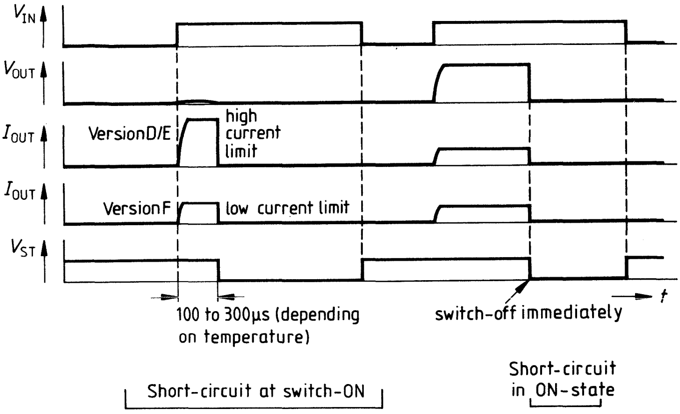


Figure 3: Operation with output short-circuited

Version G (short-circuit protection by overtemperature protection)

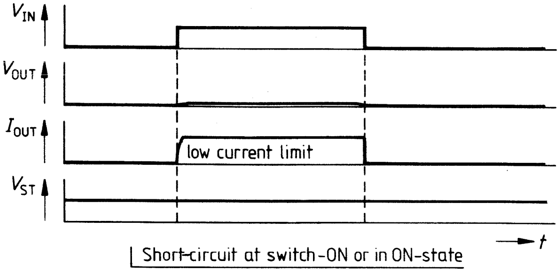


Figure 4: Operation with overload

Version D/F

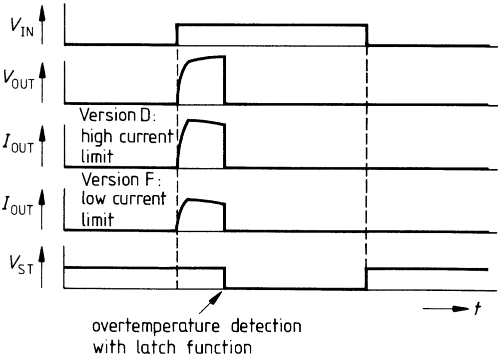


Figure 4: Operation with overload
Version E/G

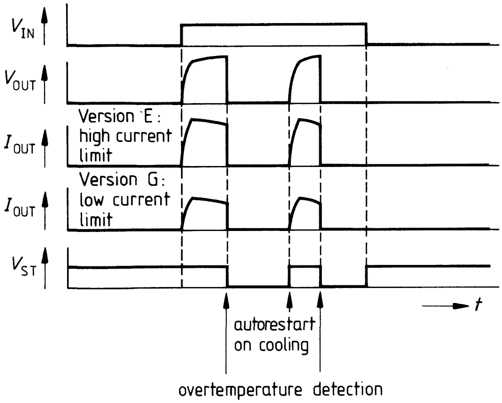
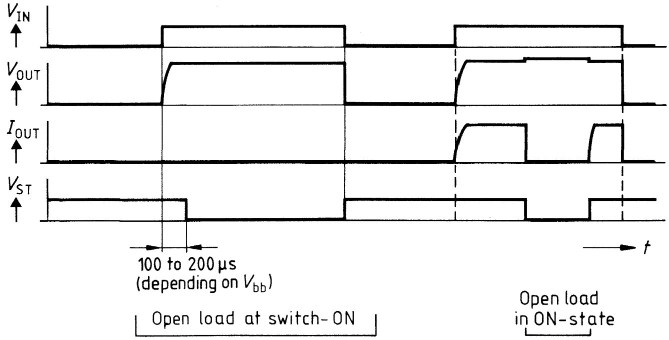


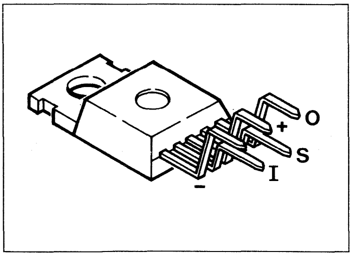
Figure 5: Operation with open load



SIEMENS

PROFET

BTS 412 A



- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Input protection
- Open-load detection in off-condition
- Undervoltage shutdown
- Negative transient voltage peak at inductive load limited to – 10 V
- In case of a fault, the outputs trips and remains open
- Status output
- In case of a fault, the status changes from "H" to "L" and remains on "L"
- Restart: $V_{\text{in (off)}}/V_{\text{in (on)}}$

Type	Ordering code
BTS 412 A	C67078-A5300-A5

Maximum Ratings

Parameter	Symbol	Values	Unit
Breakdown voltage	$V_{\text{bb(BR)}}$	45	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	75	W
Operating and storage temperature range	T_{j} T_{stg}	– 55 ... + 150	°C
Thermal resistance Chip - case Chip – ambient	 $R_{\text{th JC}}$ $R_{\text{th JA}}$	 1.67 50	K/W

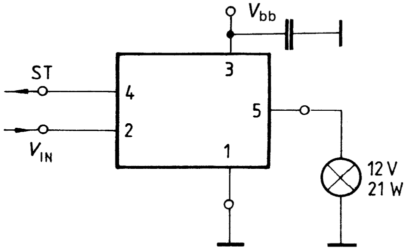
Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) $V_{bb} = 24$ V, $I_L = 2$ A $V_{bb} = 12$ V, $V_{in} = 3.5$ A	R_{on}	 – –	 0.25 0.35	 0.29 0.40	Ω
Operating voltage (pin 3 to 1)	V_{bb}	7	–	35	V
Load current, (pin 5 to 1) $T_C = 25$ °C, $V_{bb} = 24$ V	I_L	–	–	11	A
Short-circuit current $V_{bb} = 12$ V	I_{SC}	–	25	–	
Standby current (pin 3 to 1 and 5) (with and without load) $V_{bb} = 12$ V, $T_j = 25$ °C $T_j = 115$ °C	I_R	 – –	 – –	 20 0.25	mA
Input voltage (pin 2 to 1) $V_{bb} = 12$ V	$V_{in(off)}$ $V_{in(on)}$	– 0.5 3	– –	1.5 35	V
Input current (pin 2 to 1) $V_{in(off)} = 0.4$ V $V_{in(on)} = 3.5$ V	 $I_{in(off)}$ $I_{in(on)}$	 1 3	 – –	 20 50	µA
Input capacitance (pin 2 to 1), $V_{in} = 0$	C_{in}	–	2	–	pF
Trip temperature automatic tripping when $T_j \geq 150$ °C	T_t	150	–	–	°C
Turn-on time Turn-off time	t_{on} t_{off}	15 5	– –	60 30	µs
Switching edge $V_{bb} = 12$ V, $I_L = 2$ A	dv/dt	–	–	10	V/µs
Status $I_{St} = 50$ µA, $V_{bb} = 12$ V Status determination > 40 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.5 –	– –	6.5 0.4	V

Truth Table

L = "Low" level H = "High" level	**Input voltage**	**Status**	**Output voltage**
Normal operation	L H	H H	L H
Open load	L H	L H	H H
Short-circuit	L H	H L	L L
Overtemperature	L H	L L	L L
Undervoltage	L H	H L	L L

Figure 1: Switching a lamp



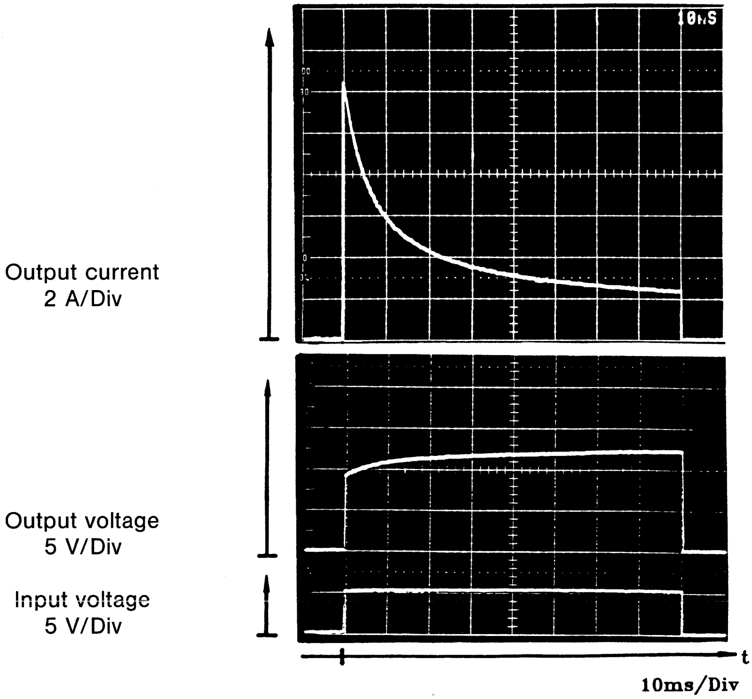


Figure 2: Switching a solenoid

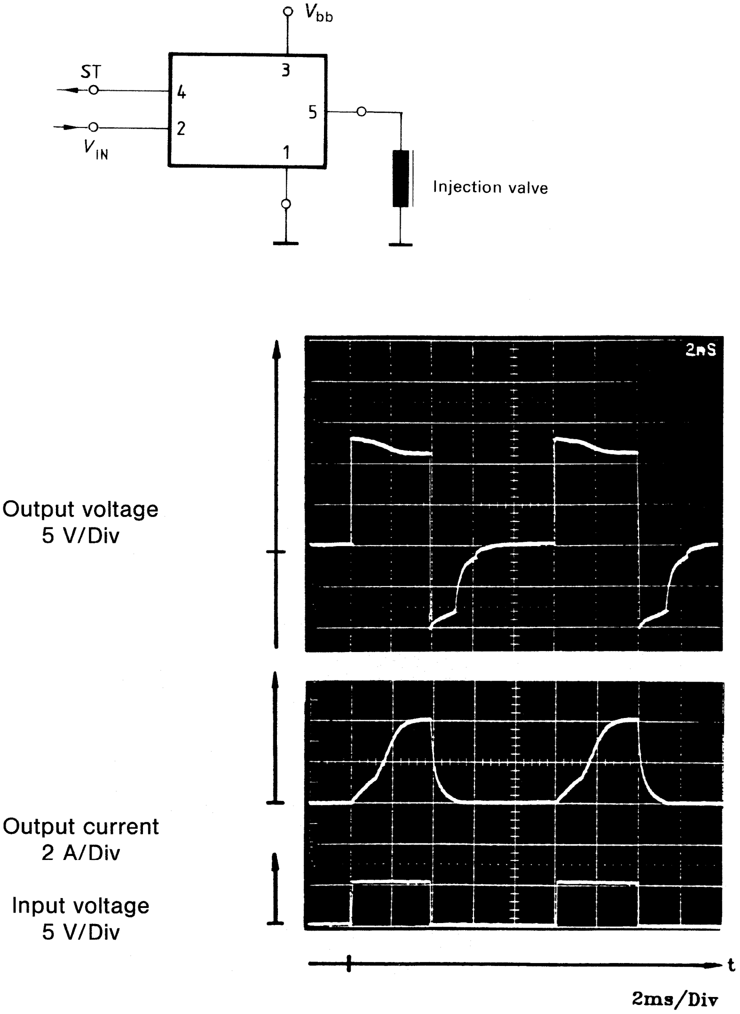
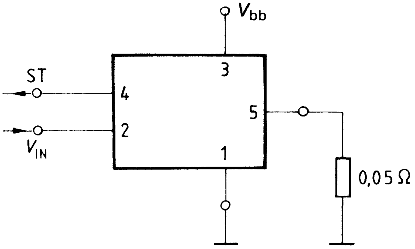
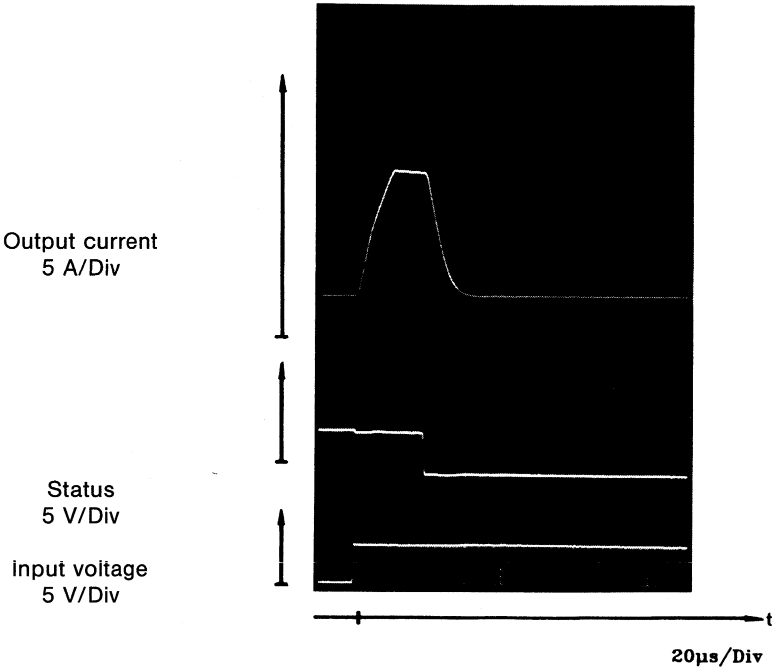
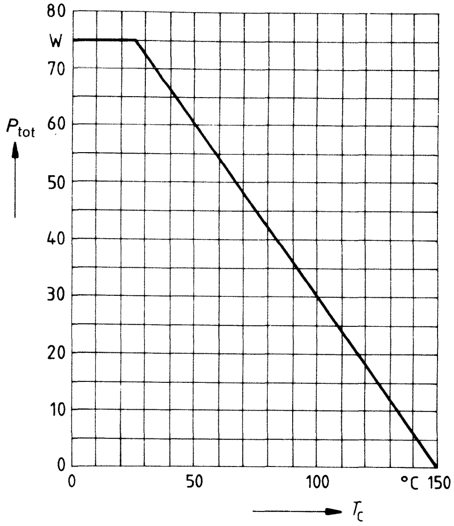


Figure 3: Switching with output short-circuited

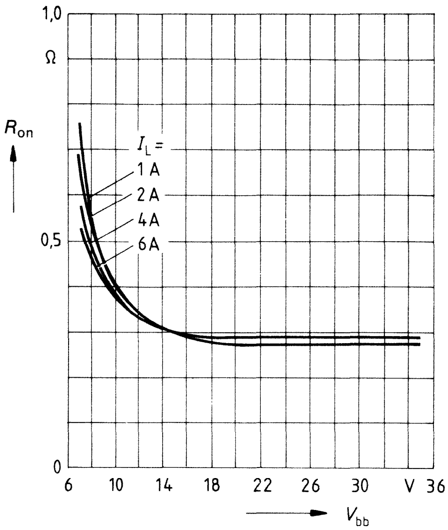




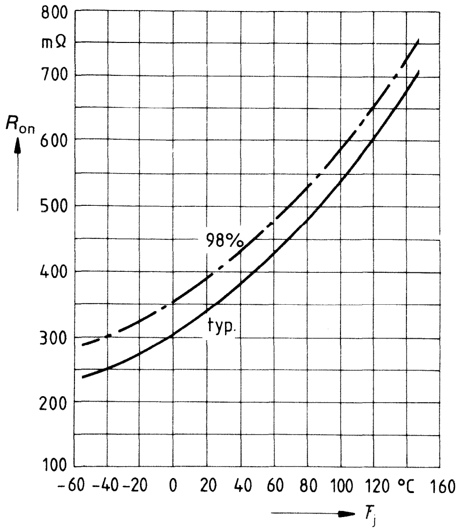
Power dissipation $P_{tot} = f(T_c)$



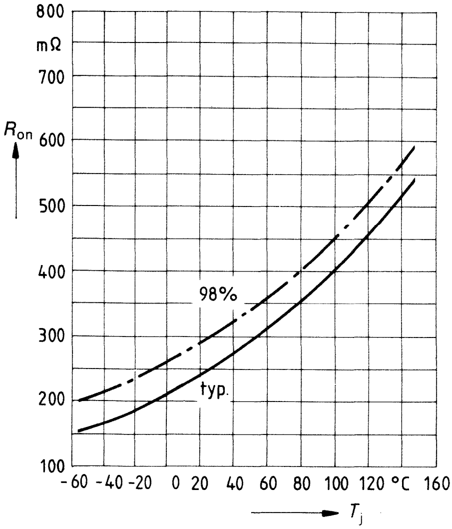
Typ. drain-source on-state resistance
$R_{on} = f(I_L \text{ and } V_{bb})$
Parameter: $V_{in} = 5$ V



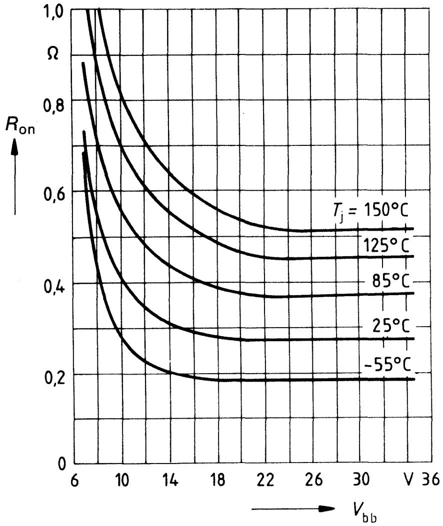
Drain-source on-state resistance
$R_{on} = f(T_j)$
Parameter: $V_{bb} = 12$ V; $I_L = 2$ A; $V_{in} = 5$ V



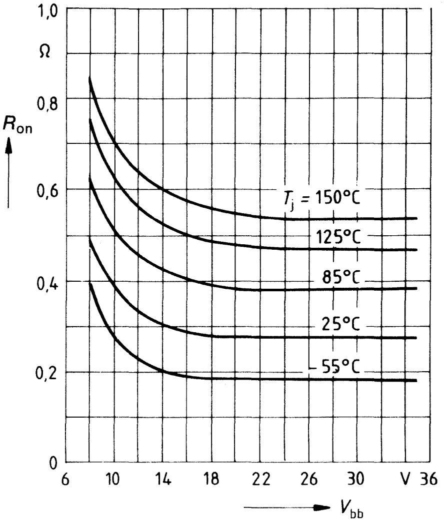
Drain-source on-state resistance
$R_{on} = f(T_j)$
Parameter: $V_{bb} = 24$ V, $I_L = 2$ A; $V_{in} = 5$ V



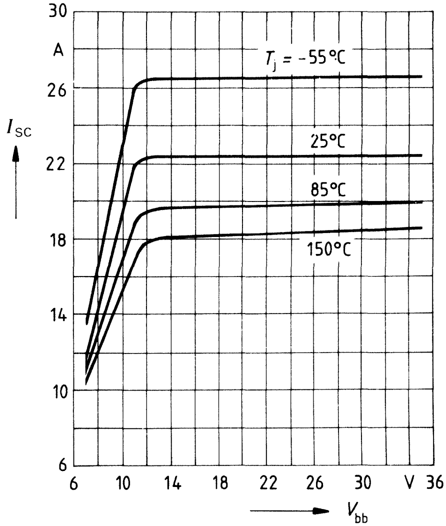
Typ. drain-source on-state resistance
$R_{on} = f(V_{bb})$
Parameter: $I_L = 1.25$ A



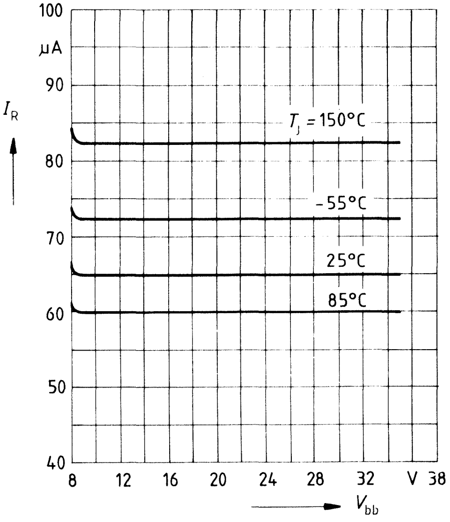
Typ. drain-source on-state resistance
$R_{on} = f(V_{bb})$
Parameter: $I_L = 4$ A



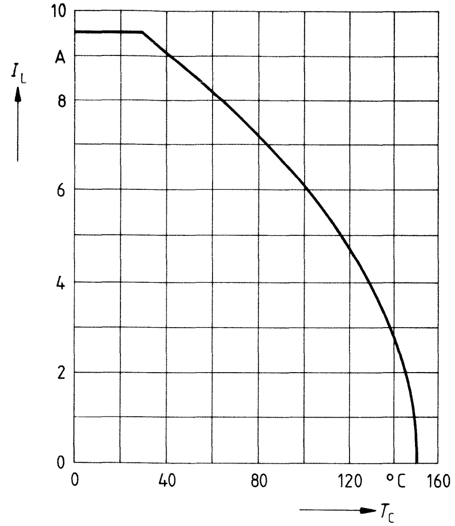
Typ. short-circuit current $I_{SC} = f(V_{bb}$ and $T_j)$
Parameter: $R_L = 0.05\ \Omega$; $V_{in} = 5$ V



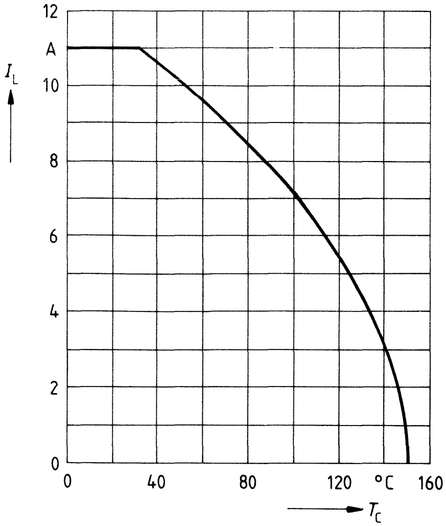
Typ. stand-by current $I_R = f(V_{bb})$



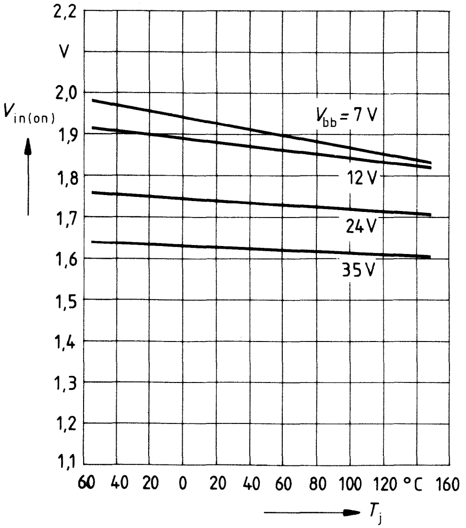
Load current $I_L = f(T_c)$
Parameter: $V_{bb} = 12$ V; $V_{in} = 5$ V



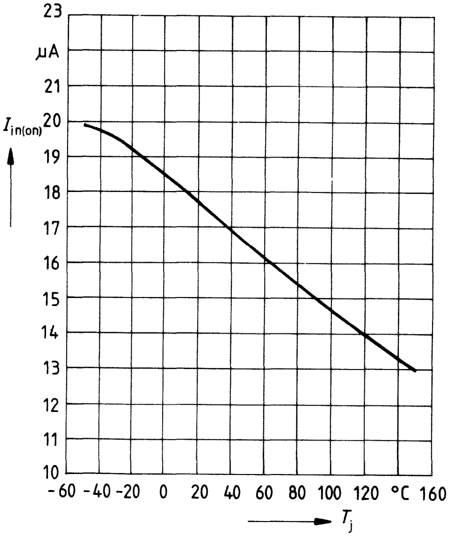
Load current $I_L = f(T_c)$
Parameter: $V_{bb} = 24$ V; $V_{in} = 5$ V



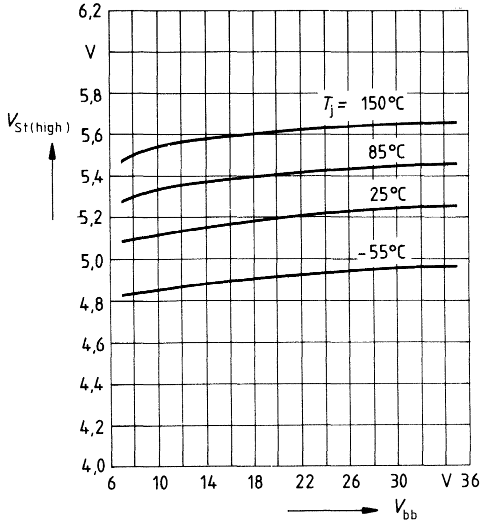
Typ. input voltage $V_{in(on)} = f(T_j)$
Parameter: $R_L = 100\ \Omega$



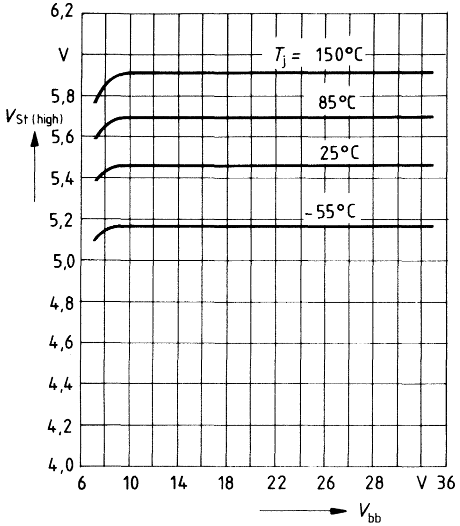
Typ. input current $I_{in(on)} = f(T_j)$
Parameter: $V_{bb} = 12$ V; $V_{in} = 5$ V; $R_L = 100\ \Omega$



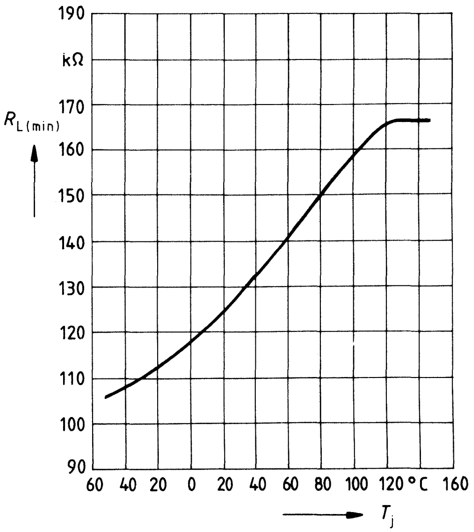
Typ. status voltage $V_{St(high)} = f(V_{bb})$
with load current
Parameter: $V_{in} = 3.5$ V; $I_{St} = 50$ µA;
$R_L = 100\ \Omega$



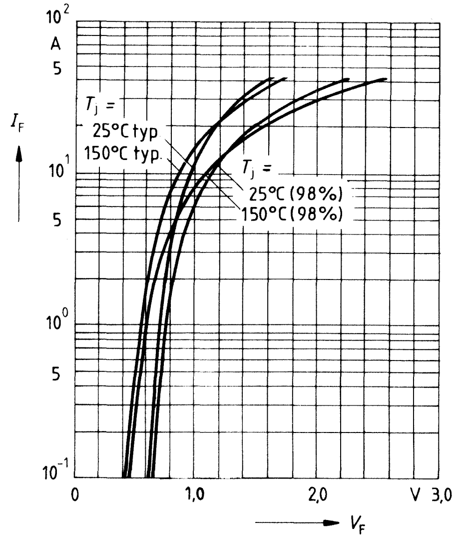
Typ. status voltage $R_{St(high)} = f(V_{bb})$
without load current
Parameter: $V_{in} = 0$; $R_L = 100\ \Omega$



Typ. open load detection $R_{L(min)} = f(T_j)$
Parameter: $V_{bb} = 12$ V

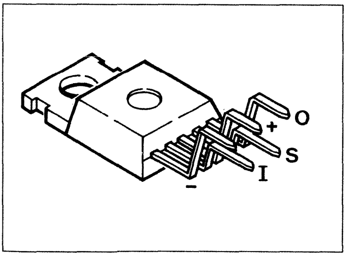


Forward characteristic of reverse diode
$I_F = f(V_F)$ (pin 5 to 3)
Parameter: T_j; $t_p = 80$ µA



PROFET
Preliminary Data

BTS 412 B



- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Load dump protection up to 80 V[1]
- Undervoltage and overvoltage shutdown with auto-restart and hysteresis
- Reverse battery protection[1]
- Input protection
- Inductive load generated negative voltage transient limit to – 10 V
- Broken inductive load protection[2]
- Open-load detection in on-condition
- Status output
- R_{on} constant versus V_{bb}
- **E**lectro**s**tatic **d**ischarge (**ESD**) protection

Type	Ordering code
BTS 412 B	C67078-S5300-A9

Maximum Ratings

Parameter	Symbol	Values	Unit
Active overvoltage protection	$V_{bb(AZ)}$	> 50	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	75	W
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 1.67 75	K/W

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[1] with 150 Ω resistor in GND connection
[2] with 150 Ω resistor in GND connection or freewheel diode parallel to load.

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) V_{bb} = 12 V, I_L = 1 A	R_{on}	–	190	250	mΩ
Operating voltage (pin 3 to 1) T_j = –40…+150 °C	V_{bb}	4.9	-	42	V
Nominal current, calculated value (pin 5 to 1) ISO-proposal: V_{bb}–V_{out} ≤ 0.5 V, T_C = 85 °C	I_L-ISO	–	–	1.4	A
Load current, theoretical value (pin 5 to 1) MOS-standard: T_C = 25 °C, T_j = 150 °C	I_L-MOS	–	–	12	
Short-circuit current, V_{bb} = 12 V	I_{SC}	-	25	-	
Standby current (pin 3 to 1) V_{bb} = 12 V	I_R	–	25	80	µA
Short-circuit detection voltage V_{SC} = V_{bb} – V_{out}	V_{SC}	–	8	–	V
Input voltage, (pin 2 to 1) V_{bb} = 12 V	$V_{in(off)}$ $V_{in(on)}$	–0.5 2.4	- -	1.5 –	
Max. input current at typ. $V_{in(on)}$ = 6.0 V	I_{in}	–	–	2	mA
Input current (pin 2 to 1) $V_{in(off)}$ = 0.4 V $V_{in(on)}$ = 2.5 V	$I_{in(off)}$ $I_{in(on)}$	1 10	- -	30 70	µA
Trip temperature automatic tripping when T_j ≥ 150 °C	T_t	150	-	-	°C
Turn-on time Turn-off time V_{bb} = 12 V, 90 % V_{out}, I_L = 1 A, 10 % V_{out}	t_{on} t_{off}	15 5	- -	60 50	µs
Switching edge on Switching edge off V_{bb} = 12 V 10…30% V_{out} I_L = 1 A 70…40% V_{out}	dv/dt_{on} dv/dt_{on}	– –	– –	4 5	V/µs
Status (CMOS) I_{St} = 50 µA to GND. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.4 –	- -	6.5 0.4	V
Max. status current I_{St} = 50 µA to GND. Status valid > 300 µs after switching edge	I_{St}	–	–	5	mA
Inductive load switch-off energy dissipation T_j = 150 °C	W_{ab}	-	-	0.4	J

Truth Table

L = "Low" level H = "High" level	**Input voltage**	**Status**	**Output voltage**
Normal operation	L H	H H	L H
Open load	L H	L H	H [1] H
Short-circuit	L H	H L	L L
Overtemperature	L H	L L	L L
Undervoltage	L H	L L	L L
Overvoltage	L H	L L	L L

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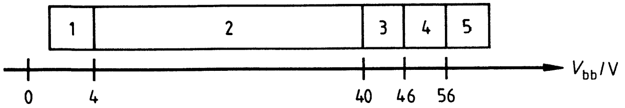
[1] Power transistor off

Operating Range (typ.)



1 Undervoltage sensor causes the device to switch off
2 Normal operation
3 Reduction of load current limit to reduce the short-circuit power dissipation of the switch
4 Overvoltage sensor causes the device to switch off
5 Increase of current between pin 3 and 1 from Zener diode to protect the circuit against overvoltage spikes

Interference Immunity[1]

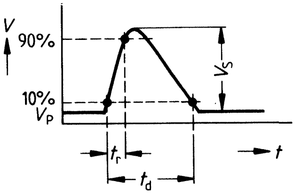
in acc. with DIN 40839, part 1 (12 V supply voltage)

Test pulse	Interference levels				with 150 Ω in GND connection			
	I	II	III	IV	I	II	III	IV
1	A	A	A	A	A	A	A	A
2	A	A	B	B	A	A	A	A
3 a	A	A	A	A	A	A	A	A
3 b	A	A	A	A	A	A	A	A
4	A	A	A	A	A	A	A	A
5	A	A	B	B	A	A	A	B

Class A: All functions of the device are performed as designed after exposure to disturbance.

Class B: One or more functions of the device are not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

Test pulse 5: load dump



Parameters: V_S = 50 V (level 2)
V_p = 13.5 V
R_i = 0.5 ... 4 Ω
t_d = 40 ... 400 ms
t_r = 0.1 ... 10 ms
I_{Load} (Pin 5 to 1) = I_L-ISO (see page 154)
with 150 Ω in GND connection:
V_S = 80 V (level 3)

Note:
The conditions are related to each other in that the high setting values of V_S, R_i and t_d belong together as do respectively the low values.

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[1] For detailed information refer to chapter Technical Information (DIN 40839: Electromagnetic compatibility (EMC) in motor vehicles; correlation with ISO-Technical Report 7637/0 and 7637/1).

Applications

Figure 1: Switching a lamp

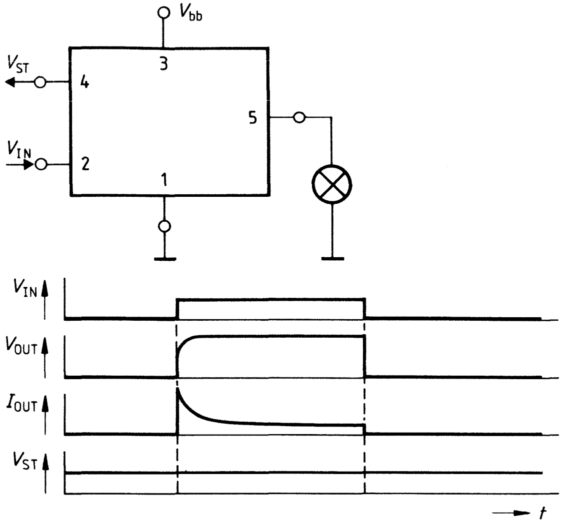


Figure 2: Switching a solenoid

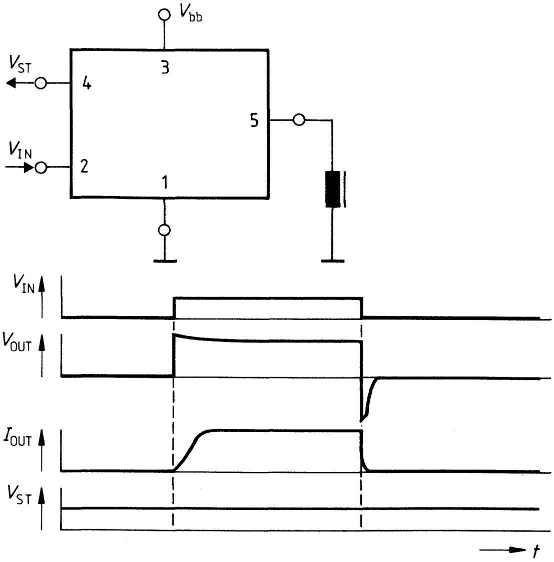


Figure 3: Operation with output short-circuited

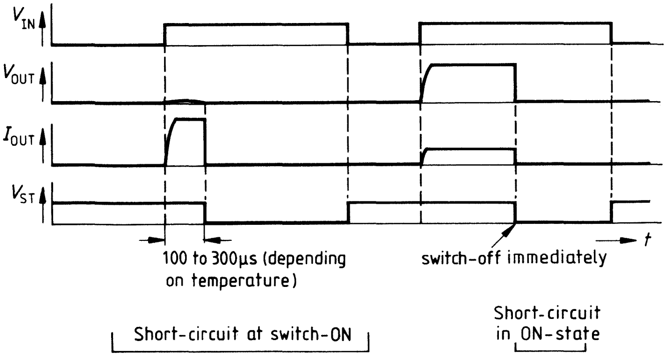


Figure 4: Operation with overload

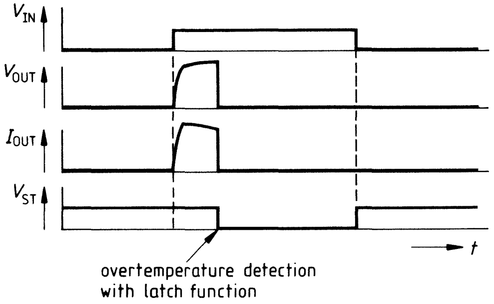
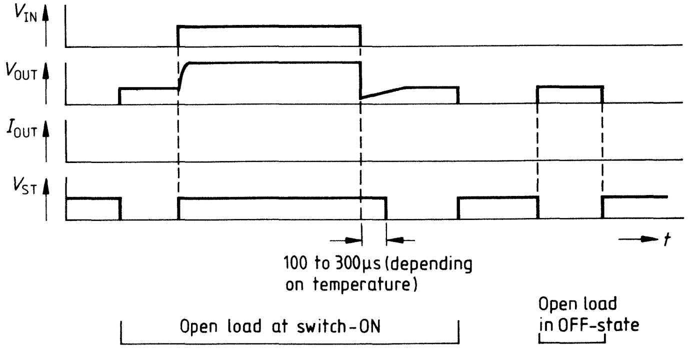


Figure 5: Operation with open load

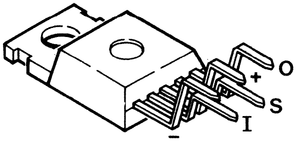


SIEMENS

PROFET

BTS 413 A

- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Input protection
- Open-load detection in off-condition
- Negative transient voltage peak at inductive load limited to – 10 V
- In case of a fault, the outputs trips and remains open
- Status output
- In case of a fault, the status changes from "H" to "L" and remains on "L"
- Restart: $V_{\mathrm{in\,(off)}}/V_{\mathrm{in\,(on)}}$



Type	Ordering code
BTS 413 A	C67078-A5307-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Breakdown voltage	$V_{\mathrm{bb(BR)}}$	45	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	75	W
Operating and storage temperature range	T_{j} T_{stg}	– 55 ... + 150	°C
Thermal resistance Chip - case Chip – ambient	 $R_{\mathrm{th\,JC}}$ $R_{\mathrm{th\,JA}}$	 1.67 50	K/W

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5)	R_{on}				Ω
$V_{bb} = 24$ V, $I_L = 2$ A		–	0.25	0.29	
$V_{bb} = 12$ V, $I_L = 3.5$ A		–	0.35	0.40	
Operating voltage (pin 3 to 1)	V_{bb}	*)	-	35	V
Load current (pin 5 to 1) $T_C = 25$ °C, $V_{bb} = 24$ V	I_L	–	–	11	A
Short-circuit current $V_{bb} = 12$ V	I_{SC}	–	25	-	
Standby current (pin 3 to 1 and 5) (with and without load)	I_R				mA
$V_{bb} = 12$ V, $T_j = 25$ °C		–	–	0.20	
$T_j = 115$ °C		–	–	0.25	
Input voltage (pin 2 to 1) $V_{bb} = 12$ V	$V_{in(off)}$ $V_{in(on)}$	–0.5 3	- -	1.5 35	V
Input current (pin 2 to 1) $V_{in(off)} = 0.4$ V, $V_{in(on)} = 3.5$ V	$I_{in(off)}$ $I_{in(on)}$	1 3	- -	20 50	µA
Input capacitance (pin 2 to 1) $V_{in} = 0$	C_{in}	–	2	–	pF
Trip temperature automatic tripping when $T_j \geq 150$ °C	T_t	150	-	–	°C
Turn-on time Turn-off time	t_{on} t_{off}	15 5	- -	60 30	µs
Switching edge $V_{bb} = 12$ V, $I_L = 2$ A	dv/dt	–	–	10	V/µs
Status $I_{St} = 50$ µA, $V_{bb} = 12$ V Status determination > 40 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.5 –	- -	6.5 0.4	V

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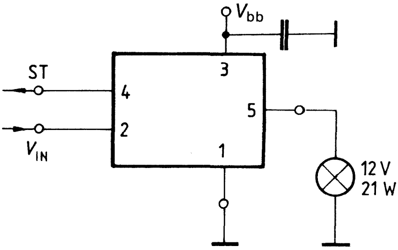
*) see diagram $I_{L(max)} = f(V_{bb})$ on page 639

Truth Table

L = "Low" level H = "High" level	**Input voltage**	**Status**	**Output voltage**
Normal operation	L H	H H	L H
Open load	L H	L H	H H
Short-circuit	L H	H L	L L
Overtemperature	L H	L L	L L

Figure 1: Switching a lamp



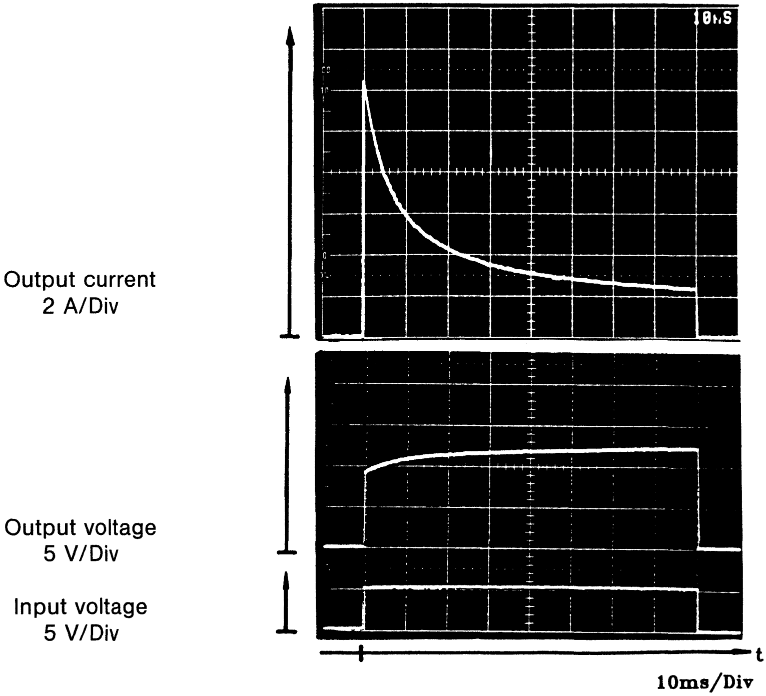


Figure 2: Switching a solenoid

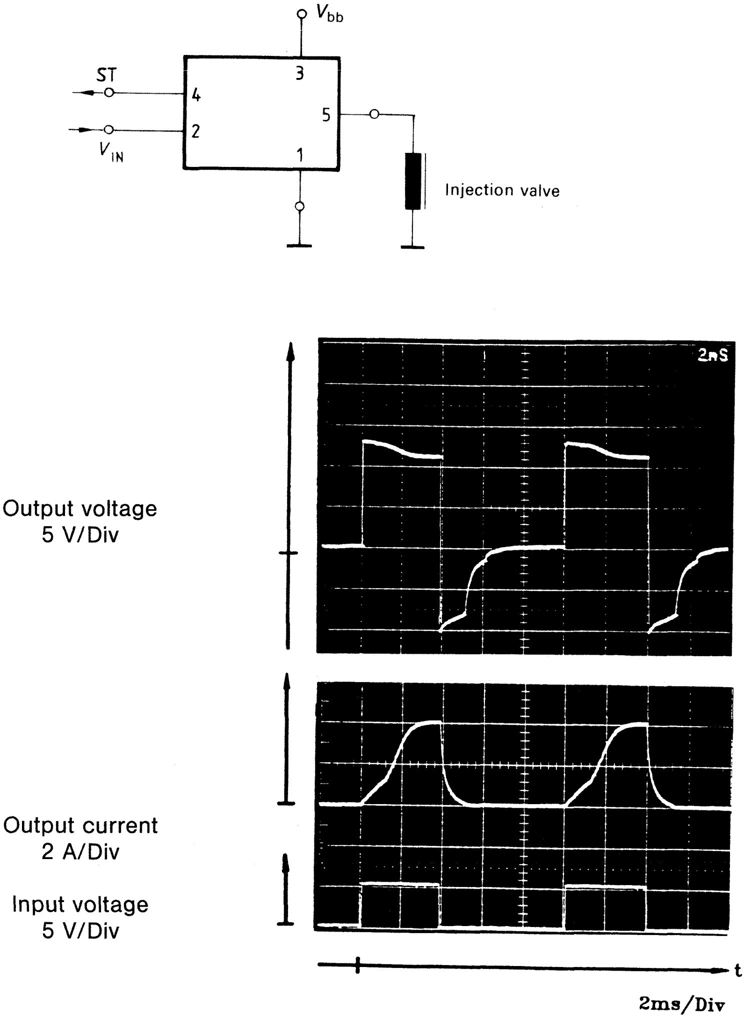
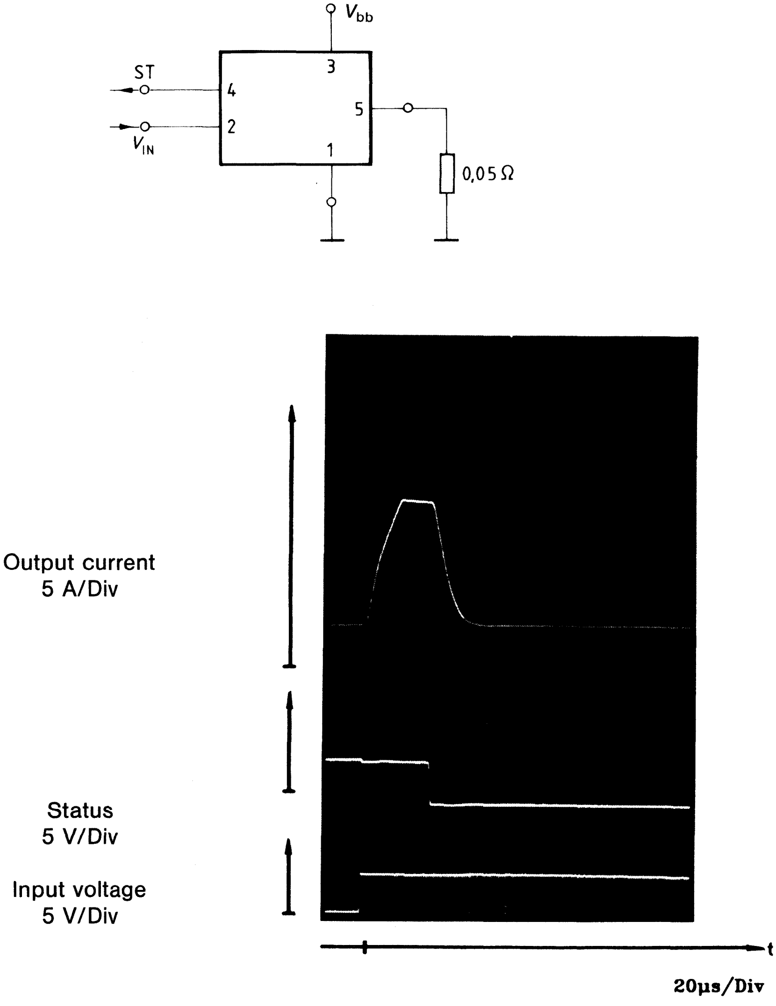
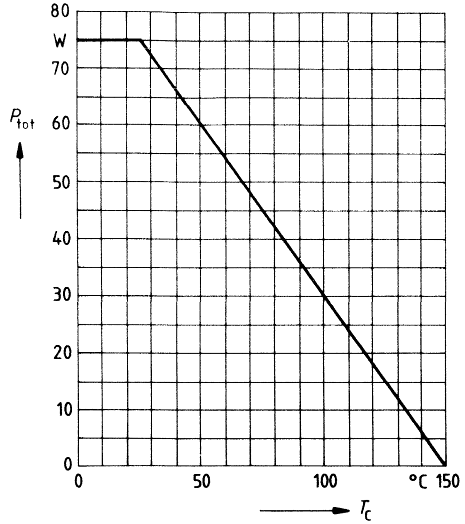


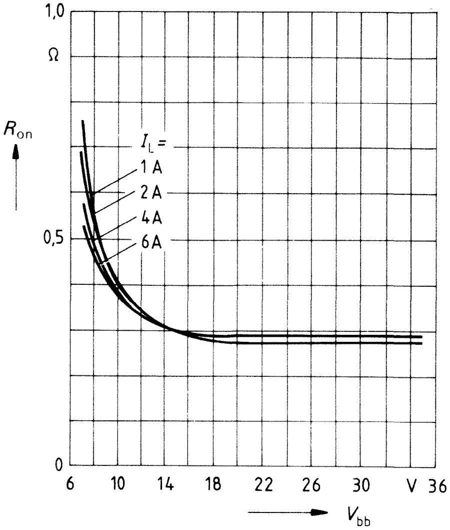
Figure 3: Switching with output short-circuited



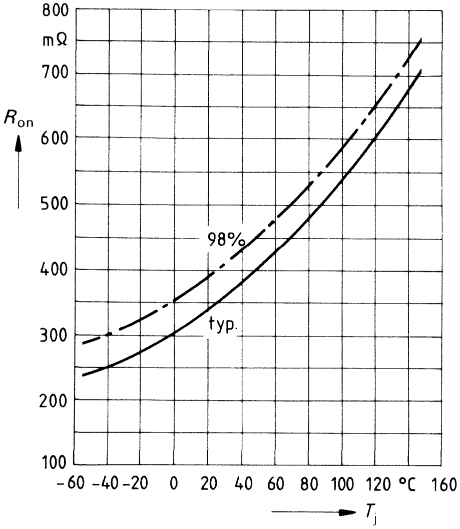
Power dissipation $P_{tot} = f(T_c)$



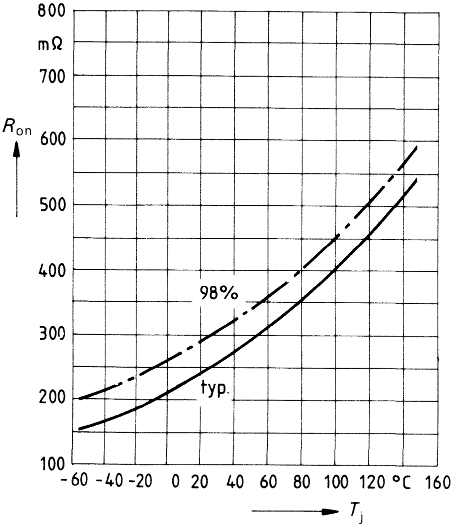
Typ. on-state resistance $R_{on} = f(V_{bb})$
Parameter: $V_{in} = 5$ V



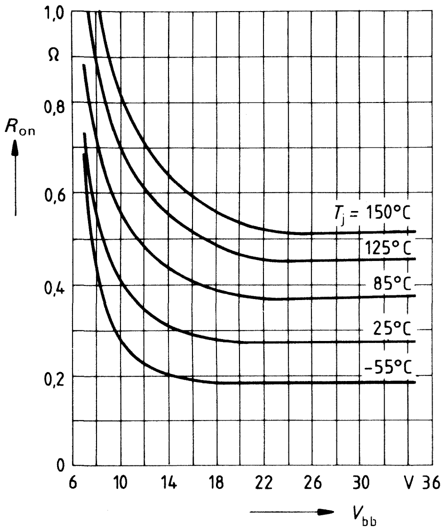
On-state resistance $R_{on} = f(T_j)$
Parameter: $V_{bb} = 12$ V; $I_L = 2$ A; $V_{in} = 5$ V



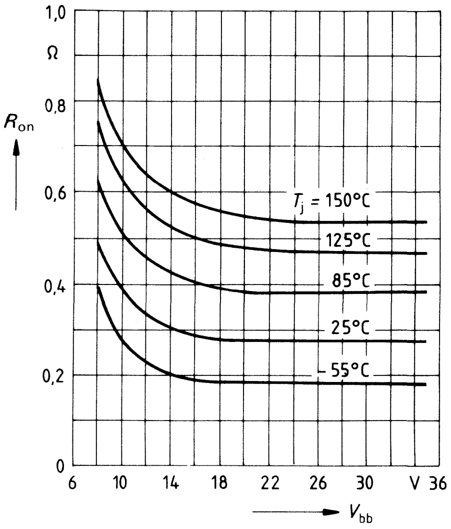
On-state resistance $R_{on} = f(T_j)$
Parameter: $V_{bb} = 24$ V, $I_L = 2$ A; $V_{in} = 5$ V



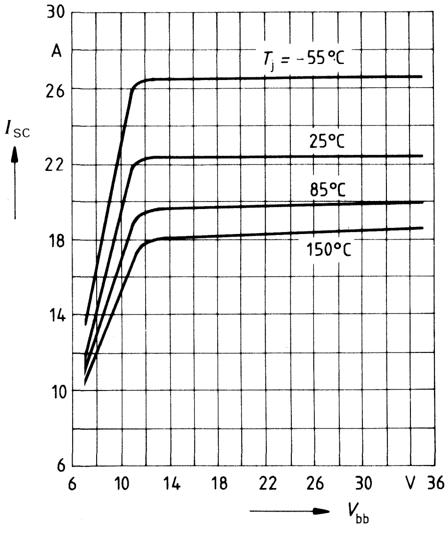
Typ. on-state resistance $R_{on} = f(V_{bb})$
Parameter: $I_L = 1.25$ A



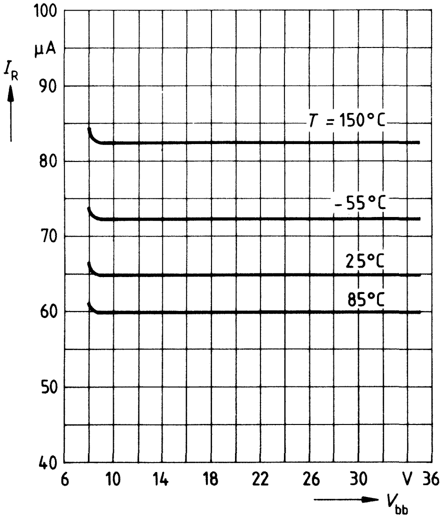
Typ. on-state resistance $R_{on} = f(V_{bb})$
Parameter: $I_L = 4$ A



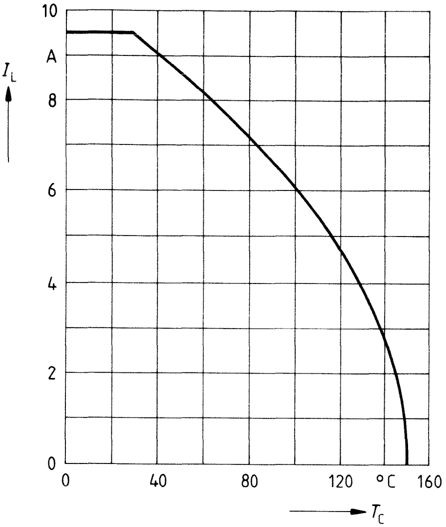
Typ. short-circuit current $I_{SC} = f(V_{bb})$
Parameter: $R_L = 0.05$ Ω; $V_{in} = 5$ V



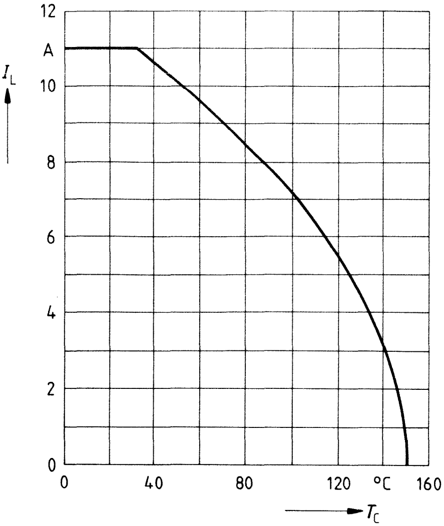
Typ. stand-by current $I_R = f(V_{bb})$



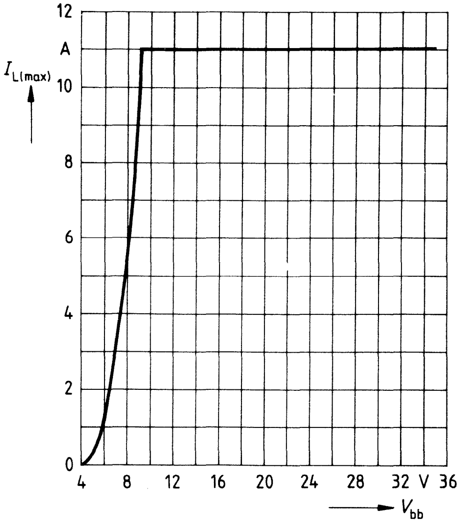
Load current $I_L = f(T_c)$
Parameter: $V_{bb} = 12$ V; $V_{in} = 5$ V



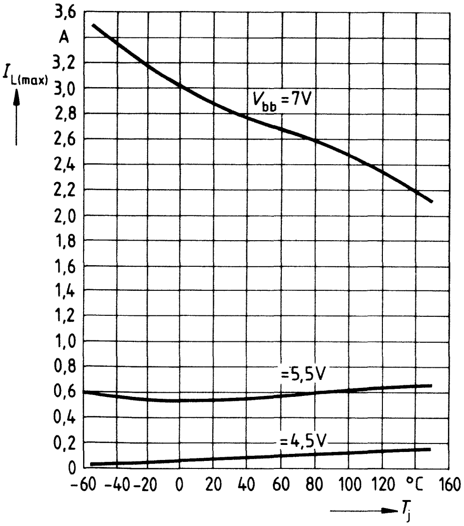
Load current $I_L = f(T_c)$
Parameter: $V_{bb} = 24$ V; $V_{in} = 5$ V



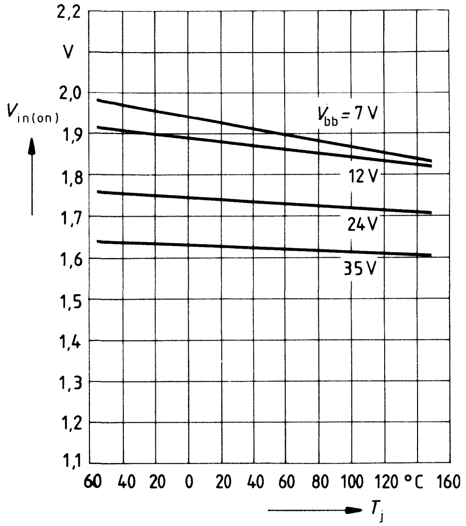
Typ. switchable load current $I_{L(max)} = f(V_{bb})$
Parameter: $V_{bb} = 12$ V; $V_{in} = 5$ V



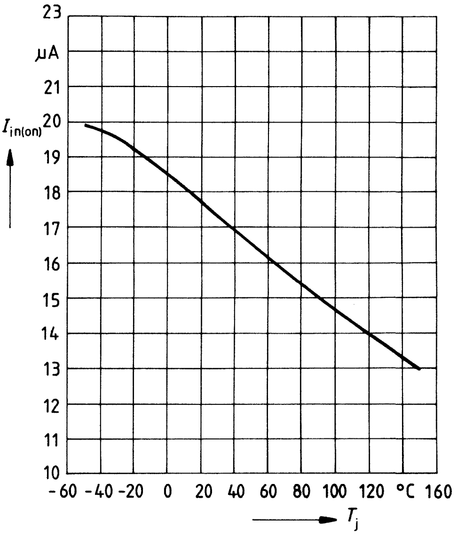
Typ. switchable load current $I_{L(max)} = f(T_j)$
Parameter: $V_{bb} = 24$ V; $V_{in} = 5$ V



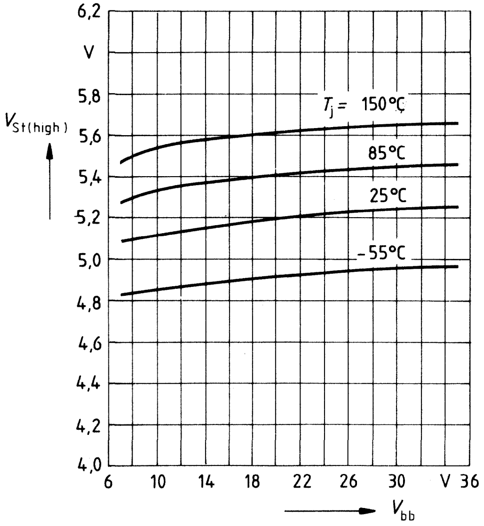
Typ. input voltage $V_{in(on)} = f(T_j)$
Parameter: $R_L = 100\ \Omega$



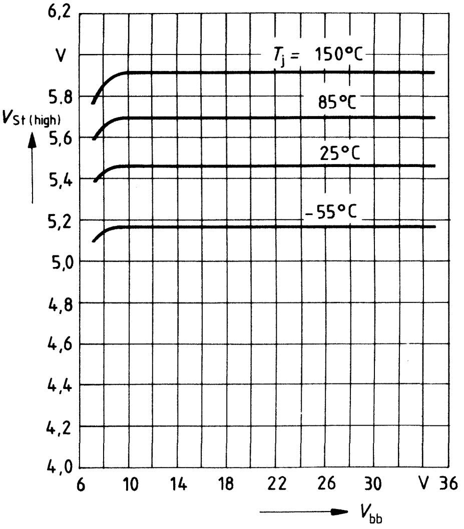
Typ. input current $I_{in(on)} = f(T_j)$
Parameter: $V_{bb} = 12$ V; $V_{in} = 5$ V; $R_L = 100\ \Omega$



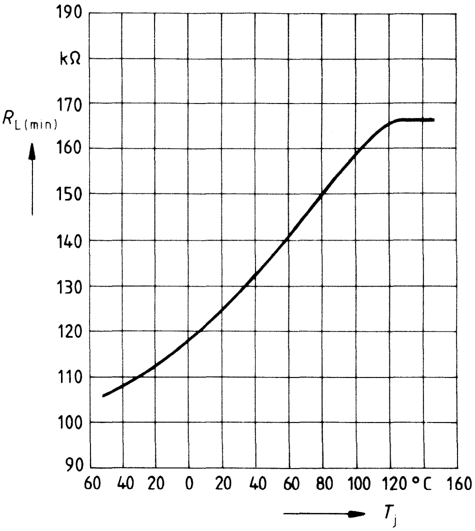
Typ. status voltage $V_{St(high)} = f(V_{bb})$
with load current
Parameter: $V_{in} = 3.5$ V; $I_{St} = 50$ µA;
$R_L = 100\ \Omega$



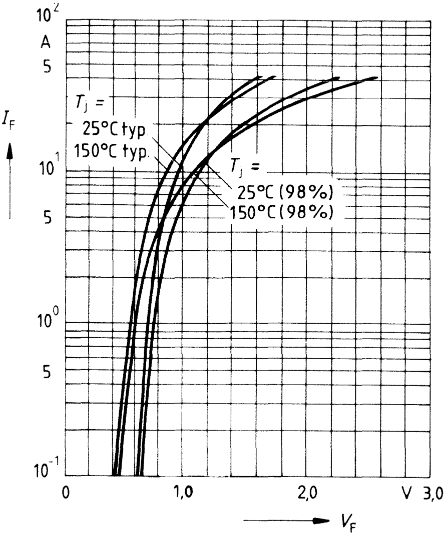
Typ. status voltage $R_{St(high)} = f(V_{bb})$
without load current
Parameter: $V_{in} = 0$; $R_L = 100\ \Omega$



Typ. open load detection $R_{L(min)} = f(T_j)$
Parameter: $V_{bb} = 12$ V



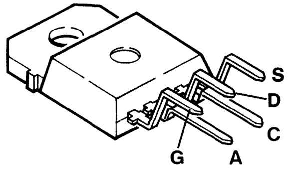
Forward characteristic of reverse diode
$I_F = f(V_F)$ (pin 5 to 3)
Parameter: T_j; $t_p = 80$ µs



SIEMENS

PROFET
Preliminary Data

BTS 432 D/E/F



- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Load dump protection up to 80 V
- Undervoltage and overvoltage shutdown with auto-restart and hysteresis
- Reverse battery protection
- Input protection
- Inductive load generated negative voltage transient limit to typ. -10 V
- Broken inductive load protection
- Open-load detection in on-condition
- Max. current internally limited
- Status output
- R_{on} constant versus V_{bb}
- **E**lectro**st**atic **d**ischarge (**ESD**) protection
- Version E: Overtemperature shutdown with auto-restart

Type	**Ordering code**
BTS 432 D	C67078-S5303-A3
BTS 432 E	C67078-S5303-A4
BTS 432 F	C67078-S5303-A5

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Active overvoltage protection	$V_{bb(AZ)}$	>50	V
Short-circuit current	I_{SC}	self-limited	
Max. power dissipation	P_{tot}	125	W
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Thermal resistance Chip - case Chip - ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 1.0 75	K/W

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) V_{bb} = 12 V, I_L = 2 A	R_{on}	–	35	38	mΩ
Operating voltage (pin 3 to 1) T_j = – 40 . . . + 150 °C	V_{bb}	4.9	–	42	V
Nominal current, calculated value (pin 5 to 1) ISO-proposal: V_{bb}–V_{out} $\leq$0.5 V, T_C = 85 °C	I_L-ISO	–	–	9	A
Load current, theoretical value (pin 5 to 1) MOS-standard: T_C = 25 °C, T_j = 150 °C	I_L-MOS	–	–	20	
Load current limit (pin 5 to 1) active regulation starts BTS 432 D/E when V_{bb}–V_{out} $>$ 1 V BTS 432 F	I_{LLim}	– –	40 7	– –	
Standby current (pin 3 to 1), V_{bb} = 12 V	I_R	–	10	50	µA
Short-circuit detection voltage, V_{SC} = V_{bb} – V_{out}	V_{SC}	–	8	–	V
Open-load detection current	I_{OL}	–	300	750	mA
Input voltage, (pin 2 to 1) V_{bb} = 12 V	$V_{in(off)}$ $V_{in(on)}$	– 0.5 2.4	– –	1.5 –	V
Max. input current at typ $V_{in(on)}$ = 6.0 V	I_{in}	–	–	2	mA
Input current (pin 2 to 1) $V_{in(off)}$ = 0.4 V $V_{in(on)}$ = 2.5 V	$I_{in(off)}$ $I_{in(on)}$	1 10	– –	30 70	µA
Trip temperature automatic tripping when $T_j \geq$ 150 °C	T_t	150	–	–	°C
Turn-on time Turn-off time V_{bb} = 12 V, 90 % V_{out}, I_L = 1 A, 10 % V_{out}	t_{on} t_{off}	50 10	– –	300 60	µs
Switching edge on Switching edge off V_{bb} = 12 V, 10 . . . 30 % V_{out} I_L = 1 A, 70 . . . 40 % V_{out}	dv/dt_{on} dv/dt_{off}	– –	– –	2 4	V/µs
Status (CMOS) BTS 432 D, I_{St} = 50 µA to GND. Status valid $>$ 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.4 –	– –	6.5 0.4	V
Max. status current BTS 432 D, I_{St} = 50 µA to GND. Status valid $>$ 300 µs after switching edge	I_{St}	–	–	5.0	mA

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Status (open drain) BTS 432 E/F, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	5.0 –	– –	6.6 0.4	V
Max. status current BTS 432 E/F, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	I_{St}	–	–	5.0	mA
Inductive load switch-off energy dissipation $T_j = 150$ °C	W_{ab}	–	–	0.8	J
Reverse battery	$-V_{bbmax}$	–	–	32	V

Truth Table

L = "Low" level H = "High" level	**Input voltage**	**Status version D**	**Status version E, F**	**Output voltage**
Normal operation	L H	H H	H H	L H
Open load	L H	H L	H L	H[1]) H
Short-circuit	L H	H L	H L	L L
Overtemperature	L H	L L	L L	L L
Undervoltage	L H	L L	H H	L L
Overvoltage	L H	L L	H H	L L

Options Overview

	Version D	**Version E**	**Version F**
Load current limit	High level	High level	Low level
Status	CMOS	Open drain	Open drain
Overtemperature shutdown	Latch function [2])	Restart on cooling	Latch function [2])
Under- and overvoltage status feedback	Yes	No	No

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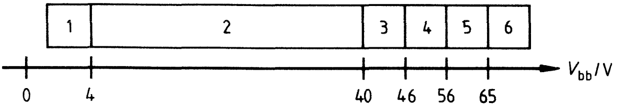
[1]) Power transistor off

[2]) For $V_{bb} > 9$ V

Operating Range (typ.)



1 Undervoltage sensor causes the device to switch off
2 Normal operation
3 Reduction of load current limit to reduce the short-circuit power dissipation of the switch
4 Overvoltage sensor causes the device to switch off
5 Increase of current between pin 3 and 1 from Zener diode to protect the circuit against overvoltage spikes
6 Power transistor begins to turn on to protect itself against overvoltage spikes

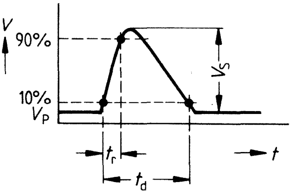
Interference Immunity[1]
in acc. with DIN 40839, part 1 (12 V supply voltage)

Test pulse	Interference levels			
	I	II	III	IV
1	A	A	A	A
2	A	A	A	A
3 a	A	A	A	A
3 b	A	A	A	A
4	A	A	A	A
5	A	A	A	B

Class A: All functions of the device are performed as designed after exposure to disturbance.

Class B: One or more functions of the device are not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

Test pulse 5: load dump



Parameters: $V_S = 80$ V (level 3)
$V_p = 13.5$ V
$R_i = 0.5 \dots 4\ \Omega$
$t_d = 40 \dots 400$ ms
$t_r = 0.1 \dots 10$ ms
I_{Load} (Pin 5 to 1) $= I_L$-ISO (see page 172)

Note:
The conditions are related to each other in that the high setting values of V_S, R_i and t_d belong together as do respectively the low values.

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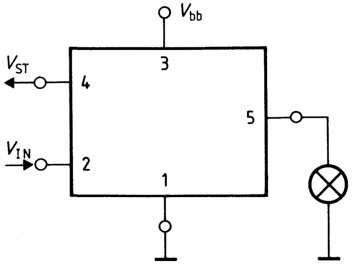
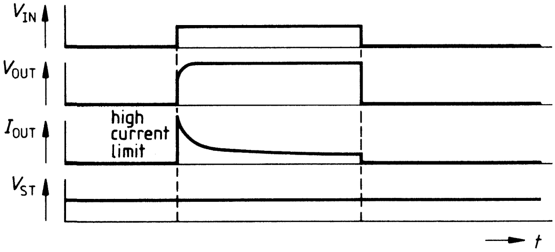
[1] For detailed information refer to chapter Technical Information (DIN 40839: Electromagnetic compatibility (EMC) in motor vehicles; correlation with ISO-Technical Report 7637/0 and 7637/1).

Applications

Figure 1: Switching a lamp



Version D/E



Version F

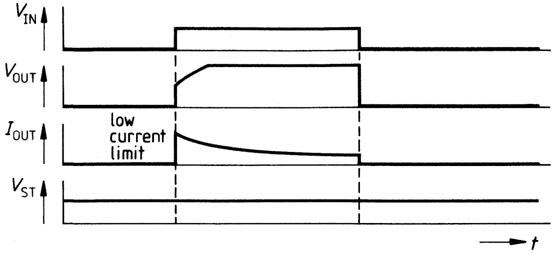


Figure 2: Switching a solenoid

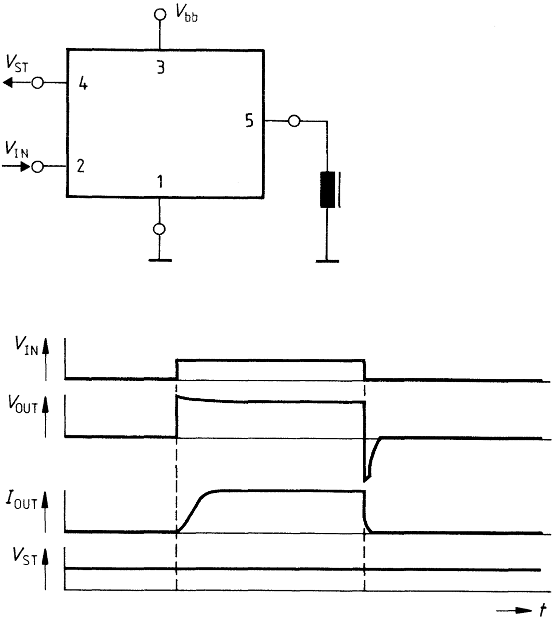


Figure 3: Operation with output short-circuited

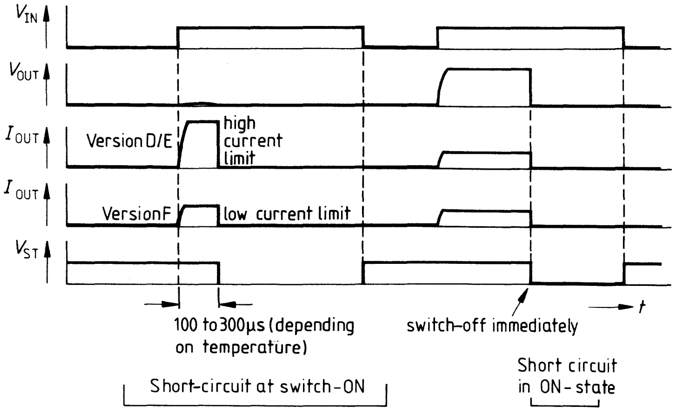
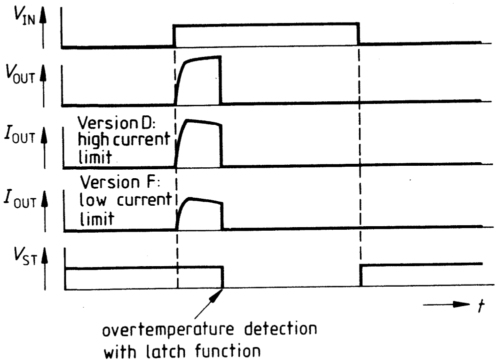


Figure 4: Operation with overload

Version D/F



Version E

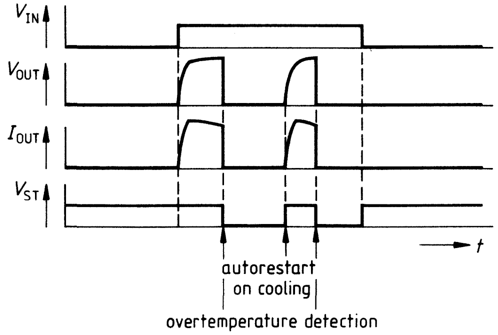
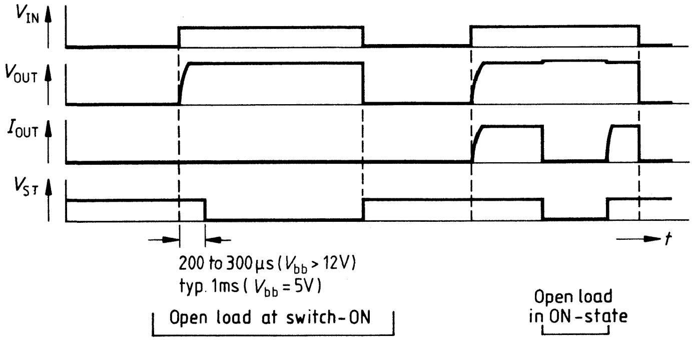


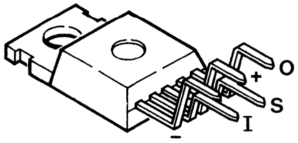
Figure 5: Operation with open load



PROFET
Preliminary Data

BTS 542 D/E/F

- High-side switch
- Short-circuit protection
- Overtemperature protection
- Overload protection
- Load dump protection up to 80 V
- Undervoltage and overvoltage shutdown with auto-restart and hysteresis
- Reverse battery protection
- Input protection
- Inductive load generated negative voltage transient limit to typ. –10 V
- Broken inductive load protection
- Open-load detection in on-condition
- Max. current internally limited
- Status output
- R_{on} constant versus V_{bb}
- **E**lectro**s**tatic **d**ischarge (**ESD**) protection
- Version E: Overtemperature shutdown with auto-restart



Type	**Ordering code**
BTS 542 D	C67078-S5400-A3
BTS 542 E	C67078-S5400-A4
BTS 542 F	C67078-S5400-A5

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Active overvoltage protection	$V_{bb(AZ)}$	>50	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	170	W
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 0.75 45	K/W

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) $V_{bb} = 12$ V, $I_L = 2$ A	R_{on}	–	17	20	mΩ
Operating voltage (pin 3 to 1) $T_j = -40 \ldots +150$ °C	V_{bb}	4.9	–	42	V
Nominal current, calculated value (pin 5 to 1) ISO-proposal: V_{bb}–$V_{out} \leq 0.5$ V, $T_C = 85$ °C	I_L-ISO	–	–	17	A
Load current, theoretical value (pin 5 to 1) MOS-standard: $T_C = 25$ °C, $T_j = 150$ °C	I_L-MOS	–	–	42	
Load current limit (pin 5 to 1) active regulation starts BTS 542 D/E when V_{bb}–$V_{out} > 1$ V BTS 542 F	I_{LLim}	– –	70 11	– –	
Standby current (pin 3 to 1), $V_{bb} = 12$ V	I_R	–	10	50	µA
Short-circuit detection voltage, $V_{SC} = V_{bb} - V_{out}$	V_{SC}	–	8	–	V
Open-load detection current	I_{OL}	–	0.5	1.5	A
Input voltage, (pin 2 to 1) $V_{bb} = 12$ V	$V_{in(off)}$ $V_{in(on)}$	-0.5 2.4	– –	1.5 –	V
Max. input current at typ $V_{in(on)} = 6.0$ V	I_{in}	–	–	2	mA
Input current (pin 2 to 1) $V_{in(off)} = 0.4$ V $V_{in(on)} = 2.5$ V	$I_{in(off)}$ $I_{in(on)}$	1 10	– –	30 70	µA
Trip temperature automatic tripping when $T_j \geq 150$ °C	T_t	150	–	–	°C
Turn-on time Turn-off time $V_{bb} = 12$ V, 90 % V_{out}, $I_L = 1$ A, 10 % V_{out}	t_{on} t_{off}	100 10	– –	350 80	µs
Switching edge on Switching edge off $V_{bb} = 12$ V, 10 ... 30 % V_{out} $I_L = 1$ A, 70 ... 40 % V_{out}	dv/dt_{on} dv/dt_{off}	– –	– –	2 4	V/µs
Status (CMOS) BTS 542 D, $I_{St} = 50$ µA to GND. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	4.4 –	– –	6.5 0.4	V
Max. status current BTS 542 D, $I_{St} = 50$ µA to GND. Status valid > 300 µs after switching edge	I_{St}	–	–	5.0	mA

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values min.	Values typ.	Values max.	Unit
Status (open drain) BTS 542 E/F, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	$V_{St\ (high)}$ $V_{St\ (low)}$	5.0 –	– –	6.6 0.4	V
Max. status current BTS 542 E/F, $I_{St} = 50$ µA to V_{bb}. Status valid > 300 µs after switching edge	I_{St}	–	–	5.0	mA
Inductive load switch-off energy dissipation $T_j = 150$ °C	W_{ab}	–	–	1.0	J
Reverse battery	$-V_{bbmax}$	–	–	32	V

Truth Table

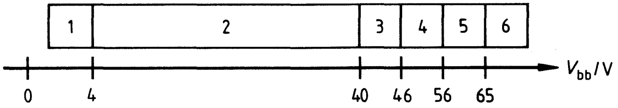
L = "Low" level H = "High" level	**Input voltage**	**Status version D**	**Status version E, F**	**Output voltage**
Normal operation	L H	H H	H H	L H
Open load	L H	H L	H L	H[1] H
Short-circuit	L H	H L	H L	L L
Overtemperature	L H	L L	L L	L L
Undervoltage	L H	L L	H H	L L
Overvoltage	L H	L L	H H	L L

Options Overview

	Version D	**Version E**	**Version F**
Load current limit	High level	High level	Low level
Status	CMOS	Open drain	Open drain
Overtemperature shutdown	Latch function[2]	Restart on cooling	Latch function[2]
Under- and overvoltage status feedback	Yes	No	No

[1] Power transistor off
[2] For $V_{bb} > 9$ V

Operating Range (typ.)



1 Undervoltage sensor causes the device to switch off
2 Normal operation
3 Reduction of load current limit to reduce the short-circuit power dissipation of the switch
4 Overvoltage sensor causes the device to switch off
5 Increase of current between pin 3 and 1 from Zener diode to protect the circuit against overvoltage spikes
6 Power transistor begins to turn on to protect itself against overvoltage spikes

Interference Immunity[1)]

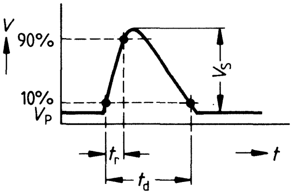
in acc. with DIN 40839, part 1 (12 V supply voltage)

Test pulse	Interference levels			
	I	II	III	IV
1	A	A	A	A
2	A	A	A	A
3 a	A	A	A	A
3 b	A	A	A	A
4	A	A	A	A
5	A	A	A	B

Class A: All functions of the device are performed as designed after exposure to disturbance.

Class B: One or more functions of the device are not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

Test pulse 5: load dump



Parameters: $V_S = 80$ V (level 3)
$V_p = 13.5$ V
$R_i = 0.5 \ldots 4\ \Omega$
$t_d = 40 \ldots 400$ ms
$t_r = 0.1 \ldots 10$ ms

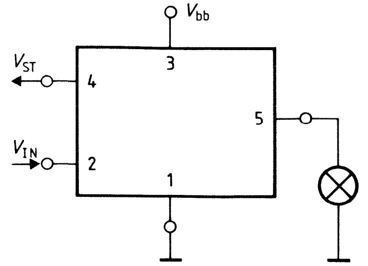
I_{Load} (Pin 5 to 1) $= I_L$-ISO (see page 180)

Note:
The conditions are related to each other in that the high setting values of V_S, R_i and t_d belong together as do respectively the low values.

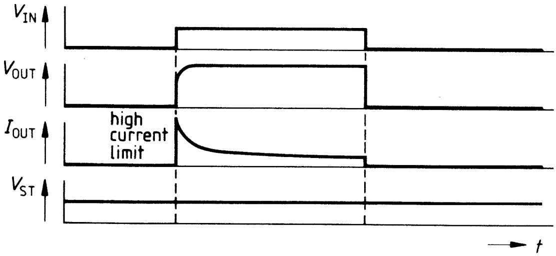
[1)] For detailed information refer to chapter Technical Information (DIN 40839: Electromagnetic compatibility (EMC) in motor vehicles; correlation with ISO-Technical Report 7637/0 and 7637/1).

Applications

Figure 1: Switching a lamp



Version D/E



Version F

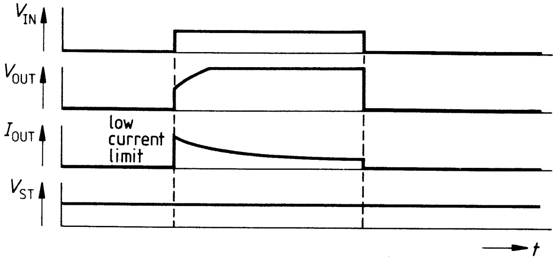


Figure 2: Switching a solenoid

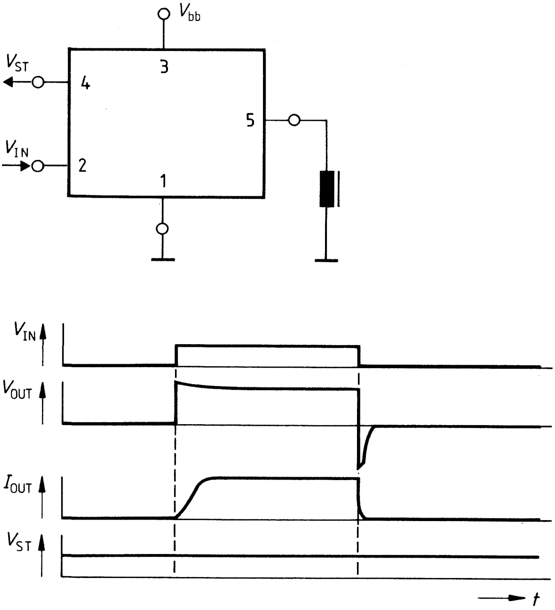


Figure 3: Operation with output short-circuited

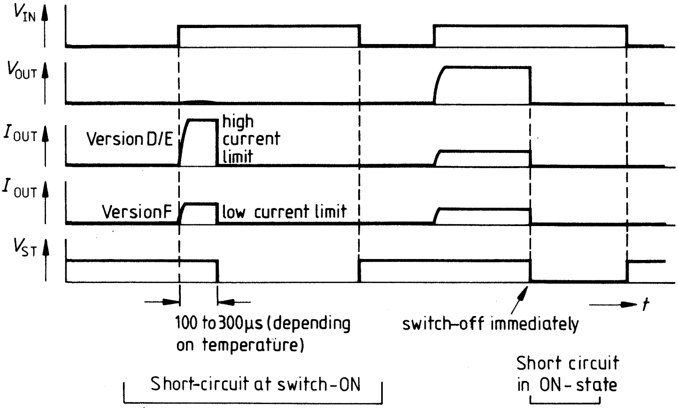
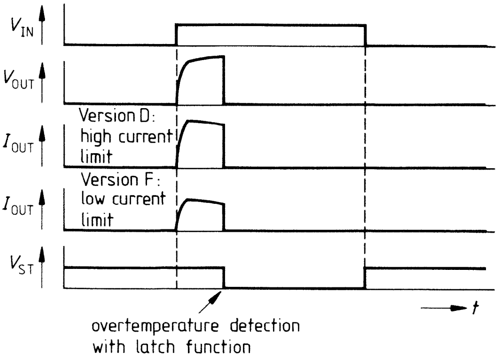


Figure 4: Operation with overload

Version D/F



Version E

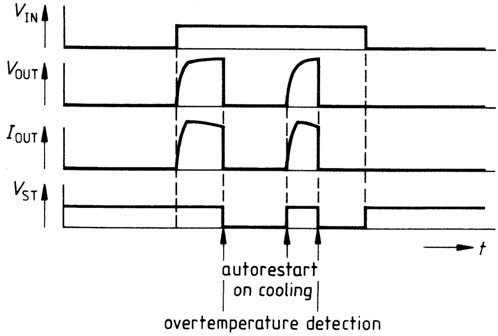
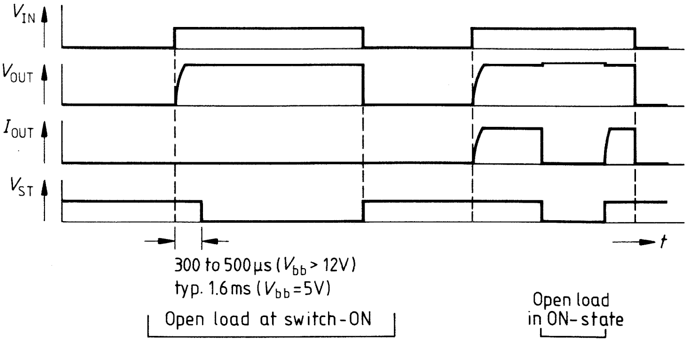


Figure 5: Operation with open load



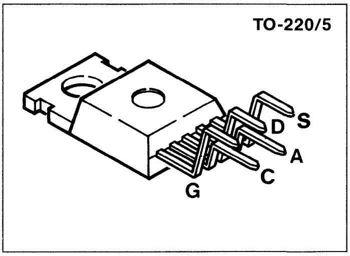
TEMPFET

BTS 903

Preliminary Data

V_{DS} = – 200 V
I_D = – 3.6 A
$R_{DS(on)}$ = 1.5 Ω

- P channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package TO-220/5 1)



Observe circuit design hints (see chapter Technical Information)!

Type	Ordering code
BTS 903	C67078-S5800-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 200	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 200	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	– 3.6	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	– 14	
Short-circuit current, – $V_{DS} \leq$ 50 V, T_j = – 55 ... + 150 °C	I_{SC}	– 10.6	
Short-circuit dissipation, – $V_{DS} \leq$ 50 V, T_j = – 55 ... + 150 °C, see diagram	P_{SC}	525	W
Max. power dissipation	P_{tot}	50	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance Chip - case Chip – ambient	 $R_{th\ JC}$ $R_{th\ JA}$	 ≤ 3.1 ≤ 75	K/W

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1) See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-200	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-2.5	-3.0	-3.5	
Zero gate voltage drain current $V_{DS} = -200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 -1 -100	 -10 -300	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	–	-10	-100	nA
Drain-source on-state resistance $V_{GS} = -10$ V, $I_D = -2.3$ A	$R_{DS(on)}$	–	1.2	1.5	Ω

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = -25$ V, $I_D = -2.3$ A	g_{fs}	1.5	2.5	3.5	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	–	900	1200	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	–	350	550	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	–	130	230	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.6$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	20	30	ns
	t_r	–	60	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.6$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	70	90	
	t_f	–	55	75	

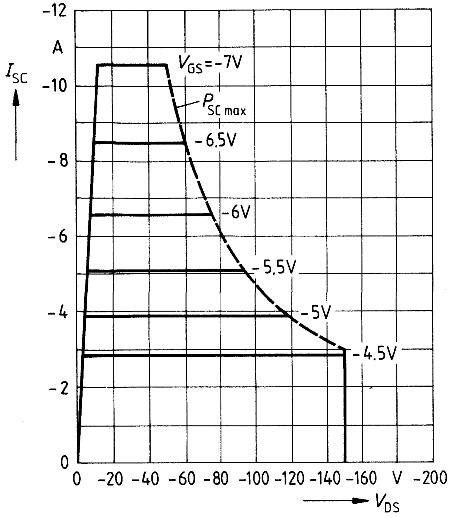
Electrical Characteristics
at T_j = 25 °C, unless otherwise specified (continued).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	-3.0	A
Pulsed source current	I_{SM}	–	–	-14.0	
Diode forward on-voltage $I_F = -7.2$ A, $V_{GS} = 0$	V_{SD}	–	-1.0	-1.3	V
Reverse recovery time $I_F = I_S$, $di_F/dt = -100$ A/µs, $V_R = -30$ V	t_{rr}	–	200	–	ns
Reverse recovery charge $I_F = I_S$, $di_F/dt = -100$ A/µs, $V_R = -30$ V	Q_{rr}	–	0.75	–	µC
Temperature sensor					
Reverse and blocking voltage $T_j = -55...+150$ °C	V_{TS}	±20	–	–	V
Reverse and blocking current $V_{TS} = \pm 20$ V, T_j = 25 °C	I_{sensor}	–	±10	±100	nA
T_j = 150 °C		–	±2.0	±4.0	µA
Forward voltage $I_{TS(on)} = -10$ mA, $T_j = -55...+150$ °C	$V_{TS(on)}$	- 0.7	- 1.4	- 1.5	V
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+150$ °C		–	–	- 15	
Forward current $T_j = -55...+150$ °C	$I_{TS(on)}$	–	–	- 10	mA
Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55...+150$ °C		–	–	- 600	
Holding current $V_{TS} = -5$ V, T_j = 25 °C	I_H	- 0.05	- 0.3	- 0.5	mA
T_j = 150 °C		- 0.05	- 0.2	- 0.3	
Switching temperature $V_{TS} = -5$ V	$T_{TS(on)}$	150	–	–	°C
Turn-off time $V_{TS} = -5$ V, $I_{TS(on)} = -2$ mA	t_{off}	1.0	2.5	5.0	µs
Sensor-source isolation voltage $T_j = -55...+150$ °C	V_{SS}	±20	–	–	V
Sensor-source capacitance	C_{SS}	–	300	–	pF

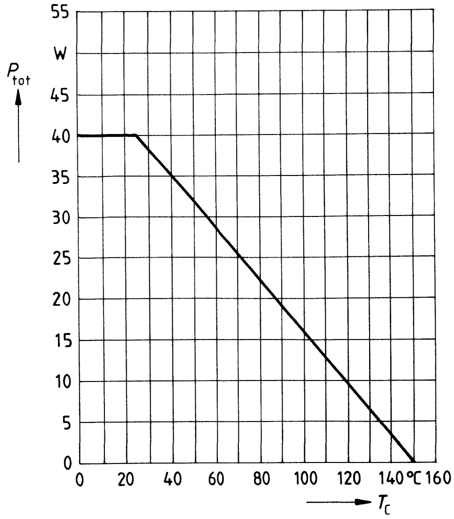
Examples for short-circuit protection
($T_j = -55\ldots+150$ °C, unless otherwise specified)

Parameter	Symbol	Values			Unit
		1	2	3	
Drain-source voltage	V_{DS}	-50	-100	-150	V
Gate-source voltage	V_{GS}	-7.0	-5.4	-4.6	
Short-circuit current	I_{SC}	-10.5	-4.7	-3.0	A
Short-circuit dissipation	P_{SC}	<525	<470	<450	W
Response time $T_j = 25$ °C, before short-circuit	$t_{SC(off)}$	<25	<25	<25	ms

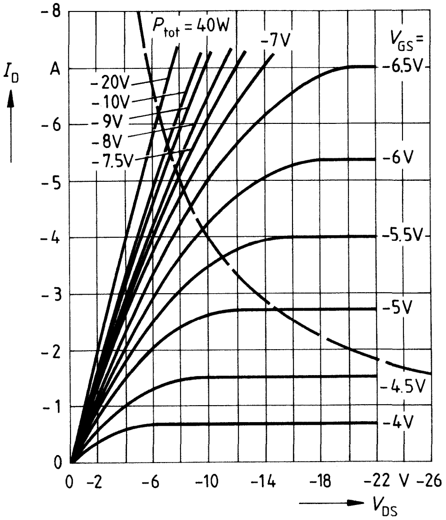
Short-circuit protection $I_{SC} = f(V_{DS})$
Parameter: V_{GS}, $T_j = -55 \ldots +150$ °C



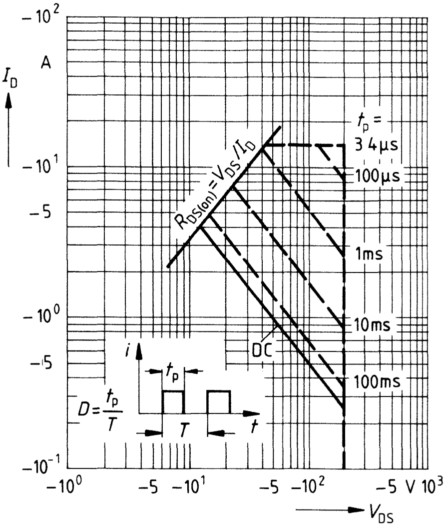
Permissible power dissipation $P_{tot} = f(T_C)$



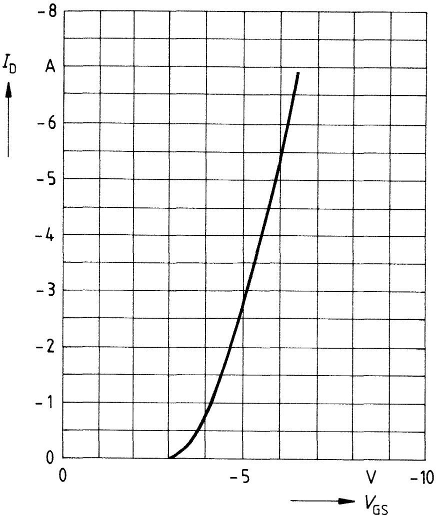
Typ. output characteristics $I_D = f(V_{DS})$



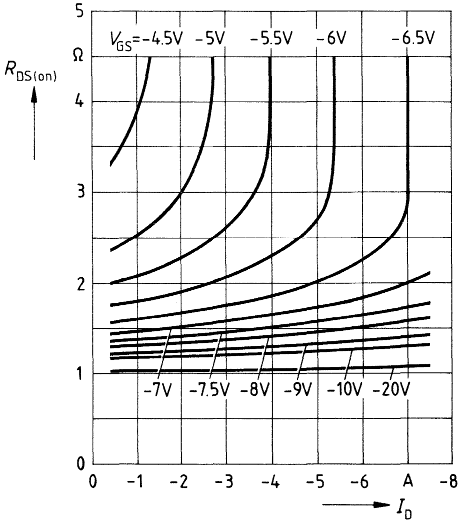
Permissible operating area $I_D = f(V_{DS})$



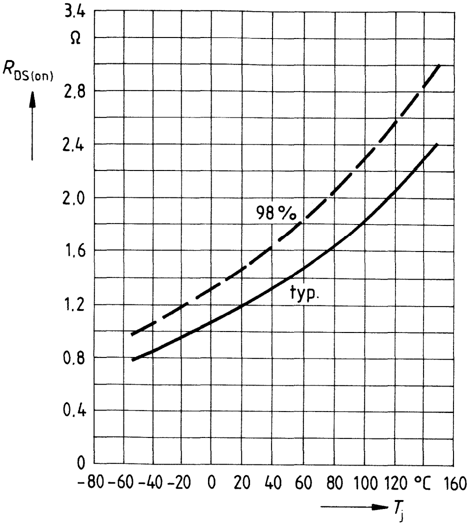
Typ. transfer characteristic $I_D = f(V_{GS})$
Parameter: $V_{DS} = -25$ V, $t_p = 80$ µs, $T_j = 25$ °C



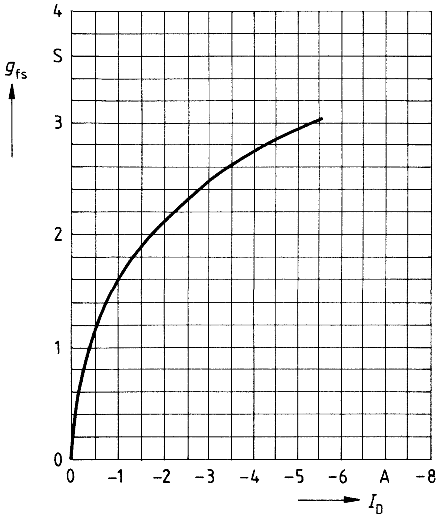
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
Parameter: V_{GS}, $T_j = 25$ °C



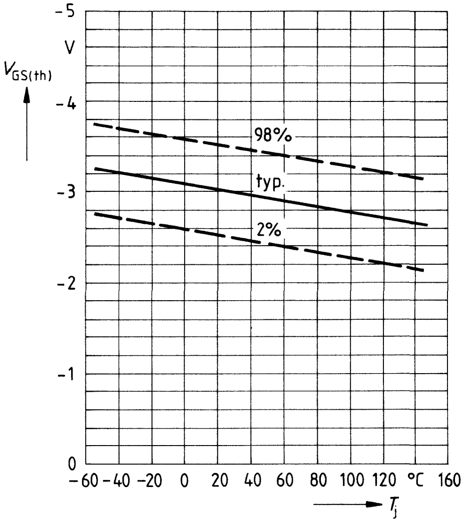
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
Parameter: $V_{GS} = -10$ V, $I_D = -2.3$ A, (spread)



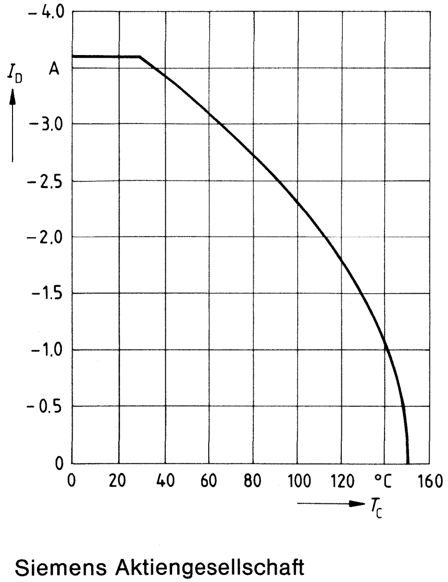
Typ. transconductance $g_{fs} = f(I_D)$
Parameter: $V_{DS} = -25$ V, $t_p = 80$ µs, $T_j = 25$ °C



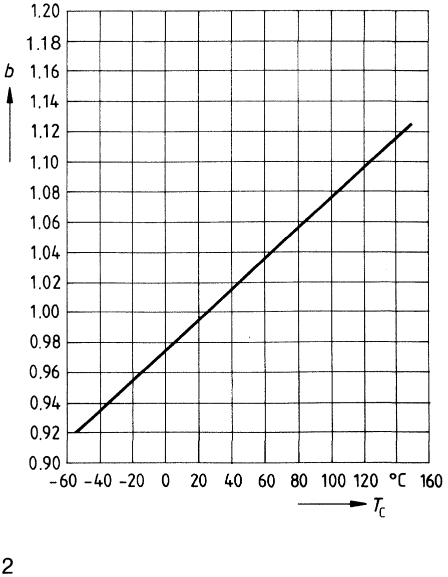
Gate threshold voltage $V_{GS(th)} = f(T_j)$
Parameter: $V_{GS} = V_{DS}$, $I_D = -1$ mA
(spread)



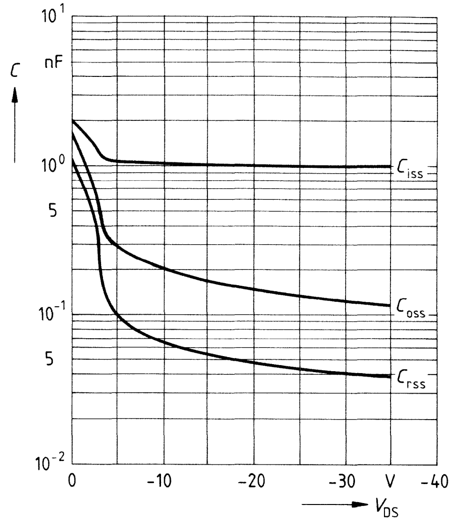
Continuous drain current $I_D = f(T_C)$



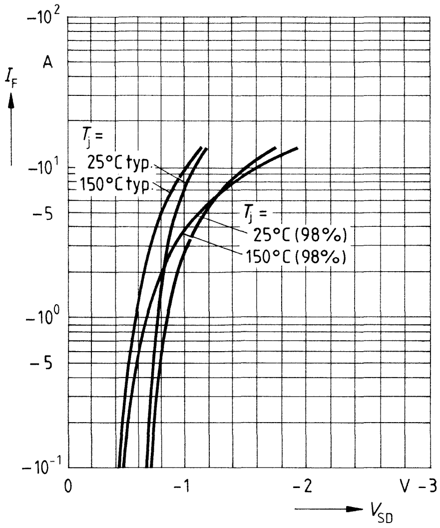
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



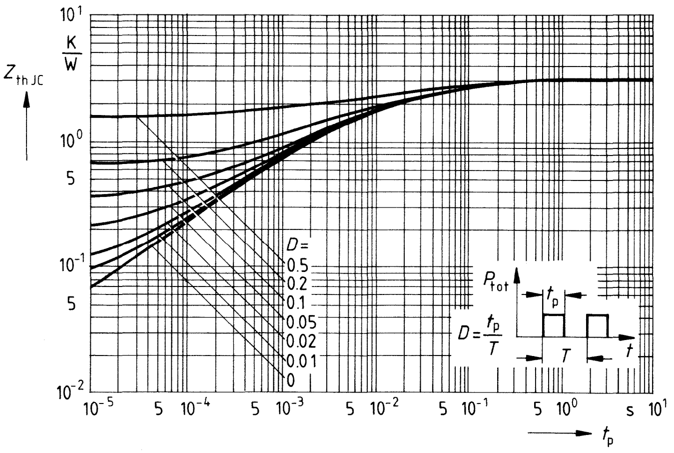
Typ. capacitances $C = f(V_{DS})$
Parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
Parameter: $t_p = 80$ µs, T_j, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
Parameter: $D = t_p/T$

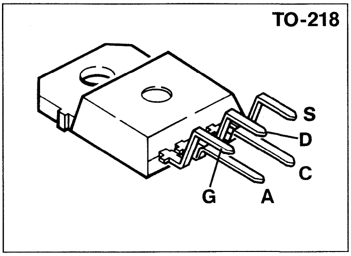


TEMPFET
Preliminary Data

BTS 950

V_{DS} = 500 V
I_D = 9.0 A
$R_{DS(on)}$ = 0.8 Ω

- N channel
- Enhancement mode
- Temperature sensor with thyristor characteristic
- Package: TO-218/5 [1]



Type	**Ordering code**
BTS 950	Q67078-A5850-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	9.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	36	
Max. power dissipation	P_{tot}	125	W
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	
Thermal resistance chip - case chip - ambient	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45	K/W

[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ T_j 25 °C T_j 125 °C	I_{DSS}	– –	20 100	250 1000	µA
Gate-source leakage current $V_{GS} = \pm 20$ V, $V_{DS} = 0$	I_{GSS}	–	10	100	nA
Drain-source on-resistance $I_D = 6.5$ A, $V_{GS} = 10$ V	$R_{DS(on)}$	–	0.7	0.8	Ω

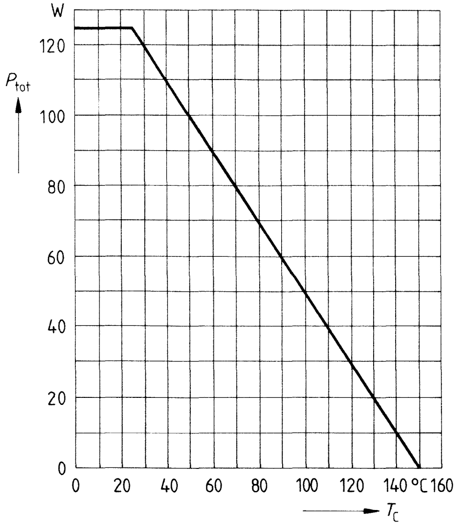
Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 6.5$ A	g_{fs}	2.7	6.6	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	3800	4900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	250	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	100	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 2.8$ A	$t_{d(on)}$	–	50	75	ns
	t_r	–	80	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 2.8$ A	$t_{d(off)}$	–	330	430	
	t_f	–	110	140	

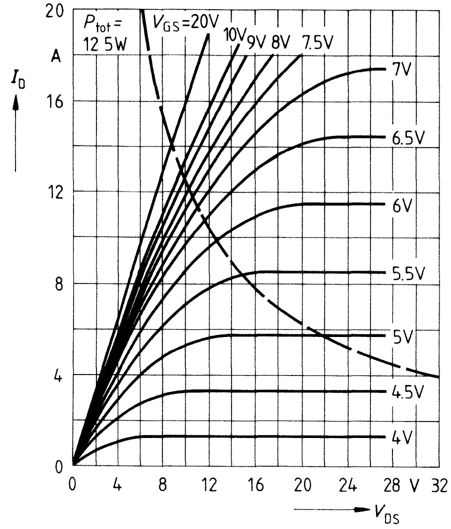
Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse diode					
Continuous source current	I_S	–	–	9.0	A
Pulsed source current	I_{SM}	–	–	36	
Diode forward on-voltage $I_F = 21$ A, $V_{GS} = 0$	V_{SD}	–	1.3	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	–	180	250	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	–	0.65	1.2	µC
Temperature sensor					
Reverse and blocking voltage $T_j = -55 \ldots +150$ °C	V_{TS}	±20	–	–	V
Reverse and blocking current $V_{TS} = \pm 20$ V $T_j = 150$ °C	I_{sensor}	– –	±10 ±2.0	±100 ±4.0	nA µA
Forward voltage $I_{TS(on)} = 10$ mA, $T_j = -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +150$ °C	$V_{TS(on)}$	0.7 –	1.4 –	1.5 15	V
Forward current $T_j -55 \ldots +150$ °C Sensor override, $t_p \leq 100$ µs, $f \leq 1$ kHz $T_j = -55 \ldots +150$ °C	$I_{TS(on)}$	– –	– –	10 600	mA
Holding current $V_{TS(off)} = 5$ V, $T_j = 25$ °C $T_j = 150$ °C	I_H	0.05 0.05	0.3 0.2	0.5 0.3	
Switching temperature $V_{TS(off)} = 5$ V	$T_{TS(off)}$	150	–	–	°C
Turn-off time $V_{TS(off)} = 5$ V, $I_{TS(off)} = 2$ mA	t_{off}	1.0	2.5	5	µs
Sensor-source insulation voltage $T_j = -55 \ldots +150$ °C	V_{SS}	±20	–	–	V
Sensor-source capacitance	C_{SS}	–	100	–	pF

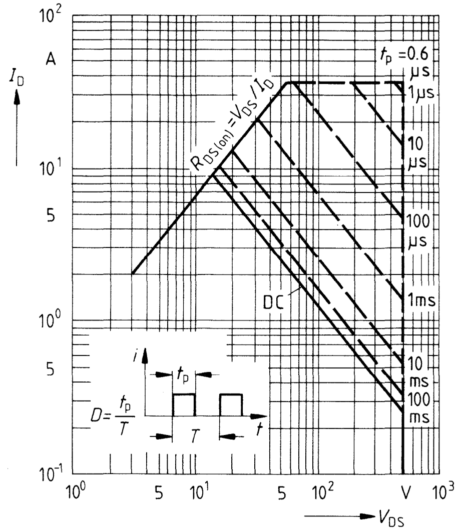
Permissible power dissipation $P_{tot} = f\ (T_C)$



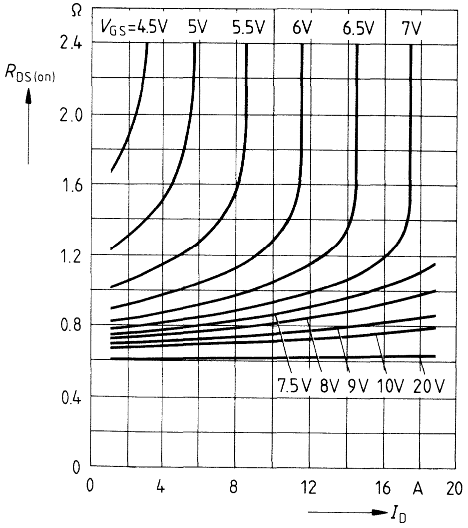
Typical output characteristics $I_D = f\ (V_{DS})$



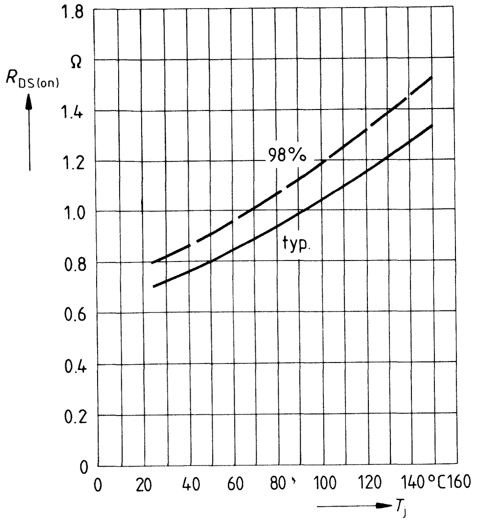
Safe operating area $I_D = f\ (V_{DS})$



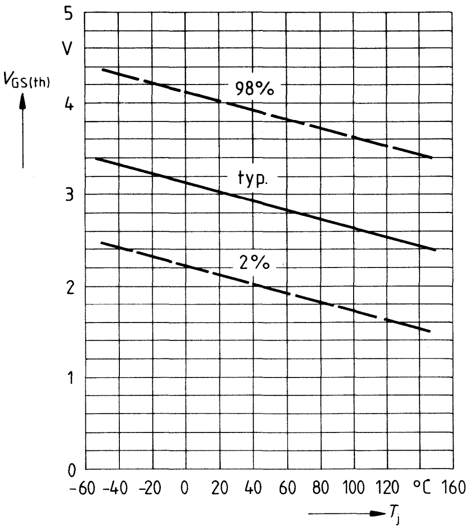
Typ. drain-source on-state resistance
$R_{DS(on)} = f\ (I_D)$
parameter: V_{GS}, T_j = 25 °C



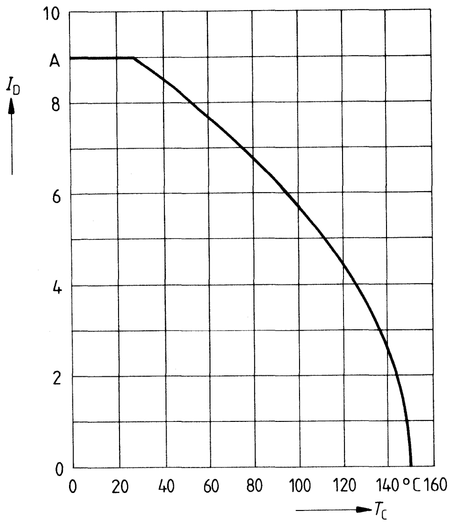
Drain-source on-state resistance
$R_{DS(on)} = f\,(T_j)$
parameter: V_{GS} = 10 V, I_D = 6.5 A (spread)



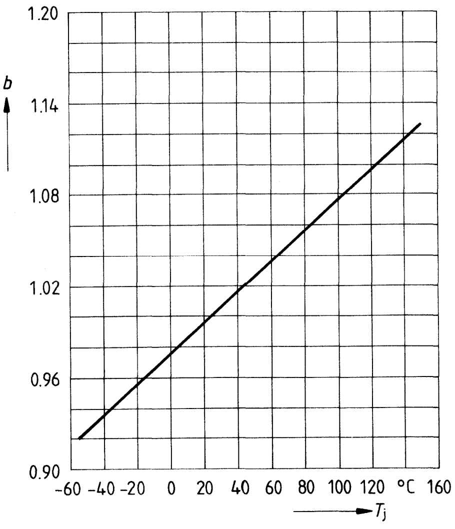
Gate threshold voltage $V_{GS(th)} = f\,(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA (spread)



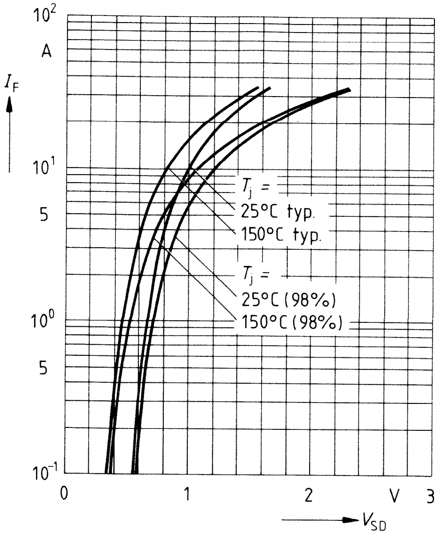
Continuous drain current $I_D = f\,(T_C)$



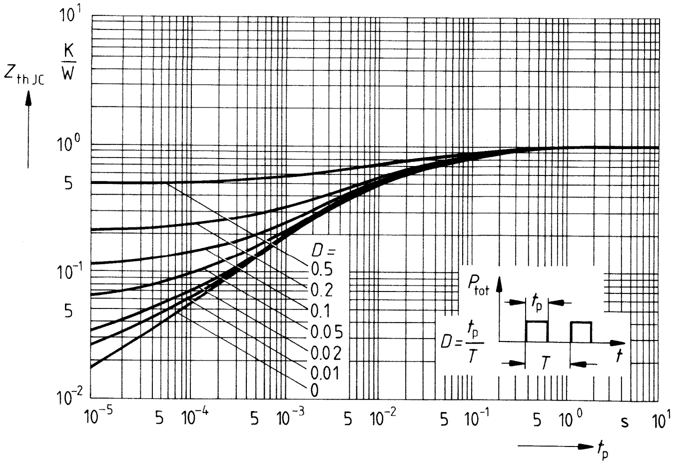
Drain-source breakdown voltage
$V_{(BR)DSS}\,(T_j) = b \times V_{(BR)DSS}\,(25\,°C)$



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p/T$

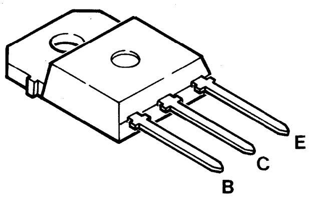


SIRET® Siemens Ring Emitter Transistor **BUP 101**

V_{CE} = 1000 V
I_C = 15 A

- N channel
- Breakdown-proof
- Package: TO-218 AA (TOP-3) [1]

TO-218 AA



Type	Ordering code
BUP 101	C67060-A1000-A2

Maximum Ratings
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values	Unit
Collector-base voltage	V_{VB0}	1000	V
Collector-emitter voltage [2] $V_{BE} = -2.5$ V	$V_{CEV(sus)}$	1000	
Emitter-base voltage	V_{EB0}	6	
Collector current	I_C	15	A
Max. collector current $t_p < 5$ µs	I_{CM}	25	
Max. collector current at turn-on $t_p \leq 0.5$ µs	I_{CSM}	50	
Base current	I_B	5	
Operating and storage temperature range	T_{op} T_{stg}	– 55 ... + 150	°C
Power dissipation $T_C = 60$ °C	P_{tot}	90	W
Thermal resistance junction-case	R_{thJC}	≤ 1	K/W

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[1] See chapter Package Outlines.
[2] The values are permissible with negative base voltage only.

Characteristics

at $T_j = 25$ °C, unless otherwise specified.

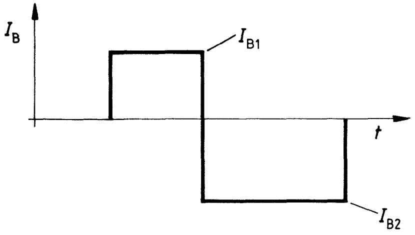
Parameter	Symbol	Values		Unit
		min.	typ.	
Static characteristics				
Collector-emitter current $T_j = 125$ °C, $V_{CE} = V_{CEV}$, $V_{BE} = -2.5$ V	I_{CEV}	–	< 0.1	mA
Collector-emitter voltage $V_{BE} = -2.5$ V	$V_{CEV(sus)}$	1000	–	V
Collector-emitter saturation voltage	V_{CEsat}			
$I_C = 10$ A, $I_{B1} = 2.5$ A		–	1	
$I_C = 15$ A, $I_{B1} = 4$ A		–	5	
Base-emitter saturation voltage $I_C = 10$ A, $I_{B1} = 2.5$ A	V_{BEsat}	–	1	
Emitter-base voltage $I_{B1} = 10$ µA	V_{EB}	6.5	8	

Dynamic characteristics

Switching times at turn-off (inductive load)

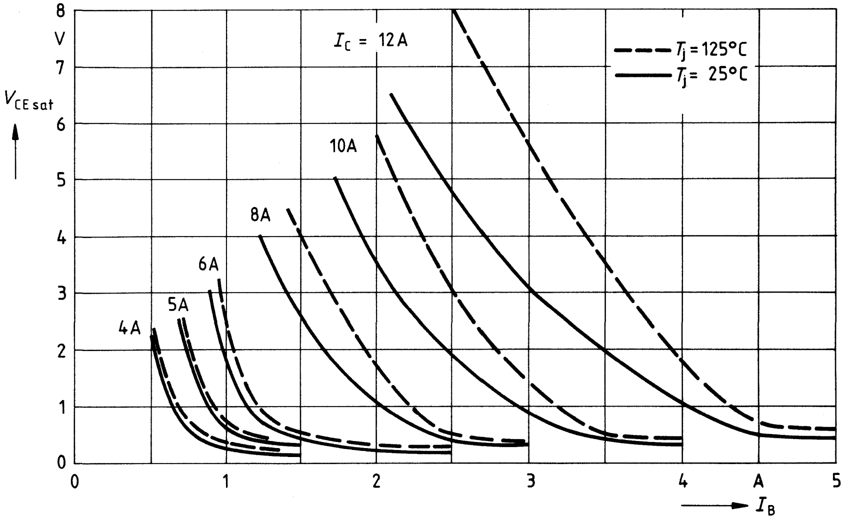
Parameter	Symbol	min.	typ.	Unit
Storage time $V_{CC} = 800$ V, $I_C = 10$ A, $I_{B1} = -I_{B2} = 2$ A	t_s			µs
$T_j = 25$ °C		–	1.5	
$T_j = 125$ °C		–	3	
Fall time $V_{CC} = 800$ V, $I_C = 10$ A, $I_{B1} = -I_{B2} = 2$ A	t_f			
$T_j = 25$ °C		–	0.05	
$T_j = 125$ °C		–	0.05	

Base current $I_B = f(t)$
(schematic diagram)

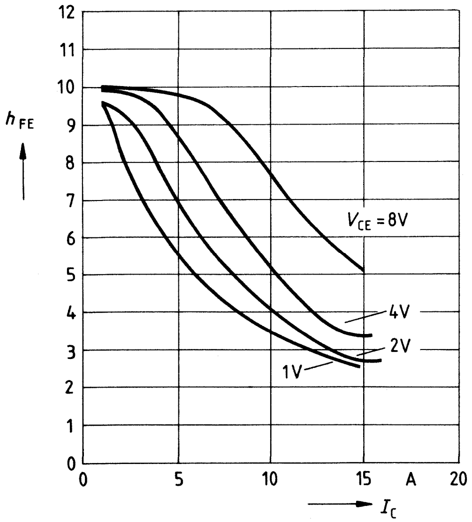


Characteristics at $T_j = 25$ °C, unless otherwise specified.

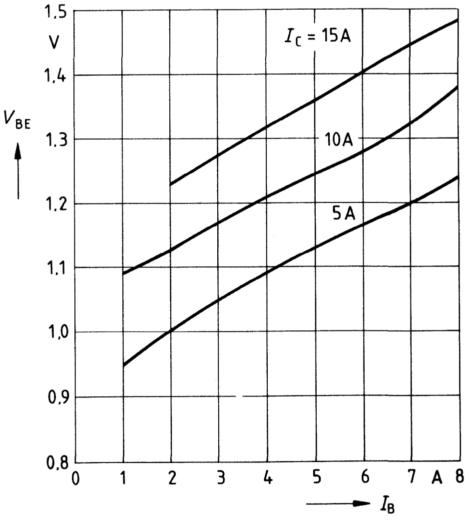
Saturation voltage $V_{CEsat} = f(I_B)$



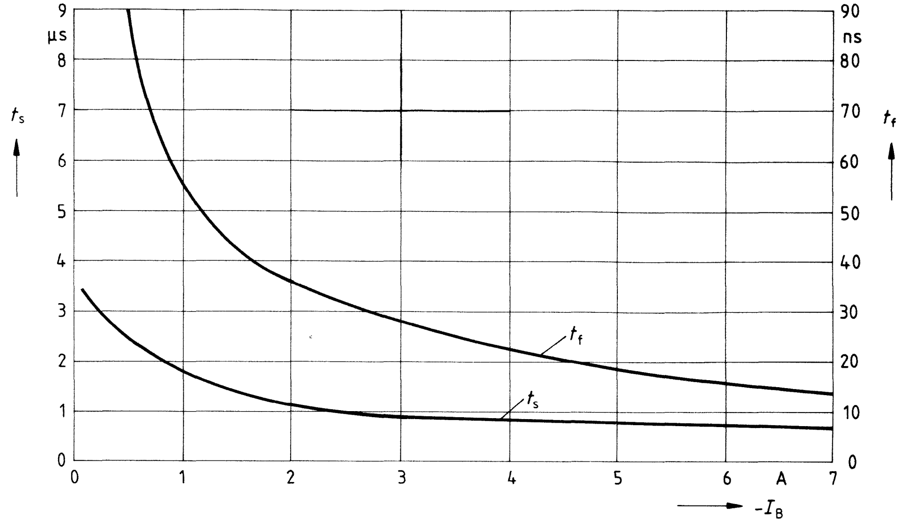
Current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V . . . 8 V



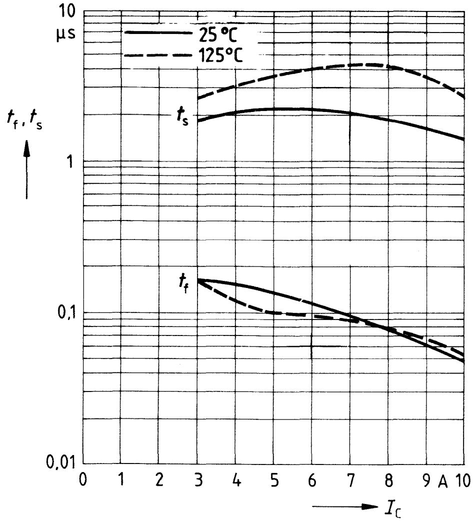
Base-emitter voltage $V_{BE} = f(I_B)$
$I_C = 5$ A . . . 15 A



Switching time t_s, $t_f = f\,(-I_B)$
$V_{CC} = 500$ V, $I_C = 8$ A

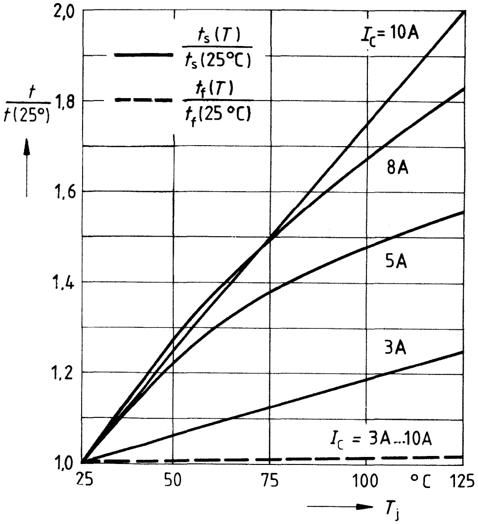


Storage time $t_s = f\,(I_C)$
Fall time $t_f = f\,(I_C)$
$V_{CC} = 800$ V, $I_C/I_B = 5$, $I_{B1} = -I_{B2}$

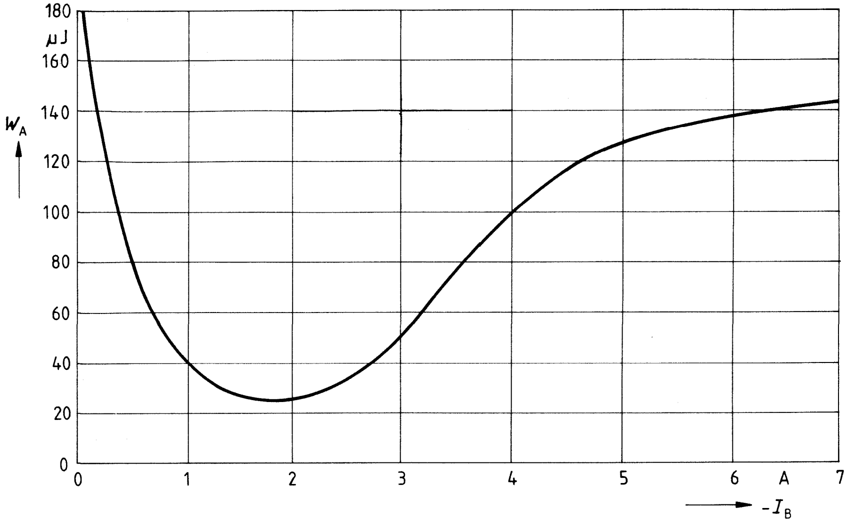


Temperature dependence of storage and fall time $\frac{t}{t\,(25\ °C)} = f\,(T_j)$

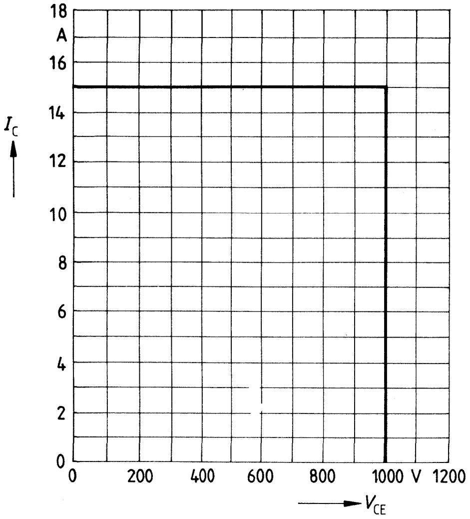
$I_C = 3 \ldots 10$ A, $V_{CC} = 800$ V, $I_C/I_B = 5$, $I_{B1} = -I_B$



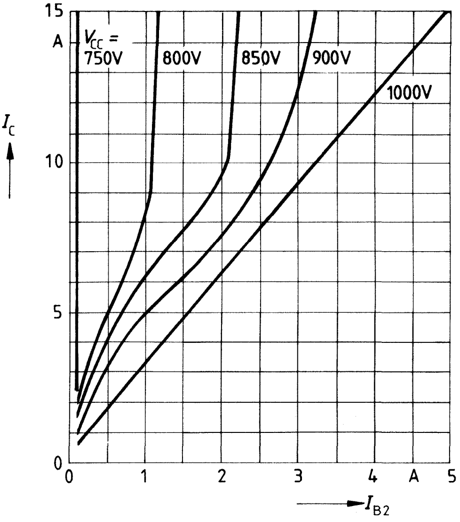
Heat loss at turn-off $W_A = f(-I_B)$
$V_{CC} = 500$ V, $I_C = 8$ A



Safe operating area at negative base supply (RBSOA)
Max. collector-emitter voltage V_{CE}
$T_j = 25$ °C ... 125 °C



Max. supply voltage V_{CC}

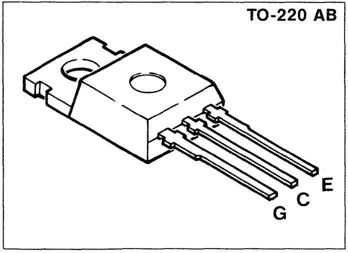


IGBT (High Power Switch) BUP 200

Preliminary Data

V_{CE} = 1200 V
I_C = 1.5 A

- N channel
- MOS input (voltage-controlled)
- Low forward voltage drop
- High switching speed
- Very low tail current
- Low temperature sensitivity
- Avalanche-proof
- Latch-up-free
- Package: TO-220 AB [1])



Type	Ordering code
BUP 200	C67078-A4400-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1200	V
Gate-emitter voltage	V_{GE}	±20	
Continuous collector current, $T_C = 25$ °C $T_C = 90$ °C	I_C	5 1.5	A
Pulsed collector current, $T_C = 90$ °C	$I_{C\ puls}$	3	
Repetitive avalanche current, $T_{jmax} = 150$ °C	I_{AR}	0.3	
Total power dissipation, $T_C = 25$ °C	P_{tot}	50	W
Avalanche energy, single pulse $I_C = 1.5$ A, $V_{CC} = 24$ V, $R_{GE} = 25\ \Omega$	E_{AS}	2	mJ
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	–
Thermal resistance Chip - case	$R_{th\ JC}$	≤ 2.5	K/W

IGBT = **I**nsulated **G**ate **B**ipolar **T**ransistor

[1]) See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.5$ mA	$V_{(BR)CES}$	1200	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 0.1$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		–	1	25	
$T_j = 125$ °C		–	–	100	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	0.1	100	nA
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 1.5$ A	$V_{CE(sat)}$				V
$T_j = 25$ °C		–	3.0	3.5	
$T_j = 150$ °C		–	4.0	4.5	

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 1.5$ A	g_{fs}	0.5	0.6	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	325	–	pF
Output capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	25	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	13	–	

Switching Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(on)}$	-	50	-	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_r	-	200	-	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	-	200	-	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	-	300	-	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	-	200	-	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	-	300	-	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 1.5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$E_{off\,1}$ $E_{off\,2}$	- -	0.09 0.1	-	mWs

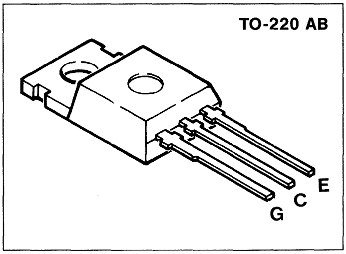
SIEMENS

IGBT (High Power Switch)

Preliminary Data

BUP 202

V_{CE} = 1000 V
I_C = 8 A



- N channel
- MOS input (voltage-controlled)
- Low forward voltage drop
- High switching speed
- Very low tail current
- Low temperature sensitivity
- Avalanche-proof
- Latch-up-free
- Package: TO-220 AB ¹)

Type	Ordering code
BUP 202	C67078-A4401-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1000	V
Gate-emitter voltage	V_{GE}	±20	
Continuous collector current, $T_C = 25$ °C $T_C = 90$ °C	I_C	12 8	A
Pulsed collector current, $T_C = 90$ °C	$I_{C\ puls}$	16	
Repetitive avalanche current, $T_{jmax} = 150$ °C	I_{AR}	1.6	
Total power dissipation, $T_C = 25$ °C	P_{tot}	100	W
Avalanche energy, single pulse $I_C = 5$ A, $V_{CC} = 24$ V, $R_{GE} = 25\ \Omega$	E_{AS}	10	mJ
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	–
Thermal resistance Chip - case	$R_{th\ JC}$	≤ 1.25	K/W

IGBT = **I**nsulated **G**ate **B**ipolar **T**ransistor

¹) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.1$ mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 0.3$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$	I_{CES}				µA
$T_j = 25$ °C		–	1	100	
$T_j = 125$ °C		–	–	300	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	0.1	100	nA
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 5$ A	$V_{CE(sat)}$				V
$T_j = 25$ °C		–	3.0	3.5	
$T_j = 150$ °C		–	4.0	4.5	

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 5$ A	g_{fs}	1.7	2.5	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	650	–	pF
Output capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	50	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	20	–	

Switching Characteristics

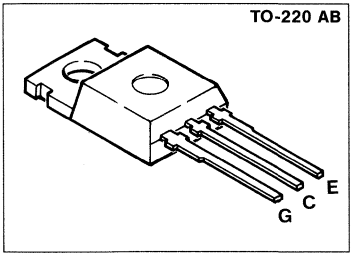
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(on)}$	–	50	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_r	–	200	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	300	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 5$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$E_{off\,1}$ $E_{off\,2}$	– –	0.25 0.35	–	mWs

IGBT (High Power Switch) **BUP 203**
Preliminary Data

V_{CE} = 1000 V
I_C = 15 A

- N channel
- MOS input (voltage-controlled)
- Low forward voltage drop
- High switching speed
- Very low tail current
- Low temperature sensitivity
- Avalanche-proof
- Latch-up-free
- Package: TO-220 AB [1])



Type	**Ordering code**
BUP 203	C67078-A4402-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Collector-emitter voltage	V_{CE}	1000	V
Gate-emitter voltage	V_{GE}	±20	
Continuous collector current, $T_C = 25$ °C $T_C = 90$ °C	I_C	21 15	A
Pulsed collector current, $T_C = 90$ °C	$I_{C\ puls}$	30	
Repetitive avalanche current, $T_{jmax} = 150$ °C	I_{AR}	3	
Total power dissipation, $T_C = 25$ °C	P_{tot}	165	W
Avalanche energy, single pulse $I_C = 10$ A, $V_{CC} = 24$ V, $R_{GE} = 25\ \Omega$	E_{AS}	20	mJ
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	–
Thermal resistance Chip - case	$R_{th\ JC}$	≤ 0.75	K/W

IGBT = **I**nsulated **G**ate **B**ipolar **T**ransistor
[1]) See chapter Package Outlines

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage $V_{GE} = 0$, $I_C = 0.15$ mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 0.7$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{CES}	 – –	 1 –	 150 700	µA
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	–	0.1	100	nA
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 10$ A $T_j = 25$ °C $T_j = 150$ °C	$V_{CE(sat)}$	 – –	 3.0 4.0	 3.5 4.5	V

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 10$ A	g_{fs}	3.5	5.5	–	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	–	1300	–	pF
Output capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	–	100	–	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	–	50	–	

Switching Characteristics
at $T_j = 25$ °C, unless otherwise specified.

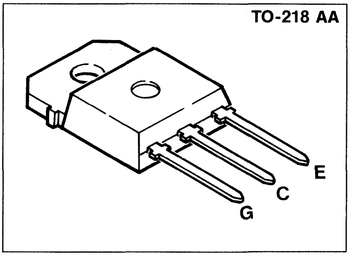
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(on)}$	–	50	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_r	–	200	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	300	–	
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 10$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$E_{off\,1}$ $E_{off\,2}$	– –	0.5 0.6	–	mWs

IGBT (High Power Switch)

BUP 304
BUP 307

V_{CE} **= 1000 V / 1200 V**
I_C **= 25 A**

- N channel
- MOS input (voltage-controlled)
- Low forward voltage drop
- High switching speed
- Very low tail current
- Low temperature sensitivity
- Avalanche-proof
- Latch-up-free
- Package: TO-218 AA



Type	Ordering code
BUP 304	C67078-A4200-A2
BUP 307	C67078-A4201-A2

Maximum Ratings

Parameter	Symbol	BUP 304	BUP 307	Unit
Collector-emitter voltage	V_{CE}	1000	1200	V
Gate-emitter voltage	V_{GE}	±20		
Continuous collector current $T_C = 25$ °C $T_C = 90$ °C	I_C	35 25		A
Pulsed collector current, $T_C = 90$ °C	$I_{C\ puls}$	50		
Repetitive avalanche current, $T_{jmax} = 150$ °C	I_{AR}	5		
Total power dissipation, $T_C = 25$ °C	P_{tot}	310		W
Avalanche energy, single pulse $I_C = 15$ A, $V_{CC} = 24$ V, $R_{GE} = 25\ \Omega$	E_{AS}	22.5		mJ
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		
Thermal resistance Chip - case	R_{thJC}	≤ 0.4		K/W

IGBT = **I**nsulated **G**ate **B**ipolar **T**ransistor

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Collector-emitter breakdown voltage	$V_{(BR)CES}$				V
$V_{GE} = 0$, $I_C = 0.25$ mA BUP 304		1000	-	-	
BUP 307		1200	-	-	
Gate threshold voltage $V_{GE} = V_{CE}$, $I_C = 1$ mA	$V_{GE(th)}$	4.5	5.5	6.5	
Zero gate voltage collector current $V_{CE} = 1000$ V, $V_{GE} = 0$ BUP 304 $V_{CE} = 1200$ V, $V_{GE} = 0$ BUP 307	I_{CES}				µA
$T_j = 25$ °C		-	1	250	
$T_j = 125$ °C		-	-	1000	
Gate-emitter leakage current $V_{GE} = 20$ V, $V_{CE} = 0$	I_{GES}	-	0.1	100	nA
Collector-emitter saturation voltage $V_{GE} = 15$ V, $I_C = 15$ A	$V_{CE(sat)}$				V
$T_j = 25$ °C		-	3	3.5	
$T_j = 150$ °C		-	4.0	4.5	

Dynamic characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance $V_{CE} = 20$ V, $I_C = 15$ A	g_{fs}	5.5	8	-	S
Input capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{iss}	-	2000	-	pF
Output capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{oss}	-	160	-	
Reverse transfer capacitance $V_{CE} = 25$ V, $V_{GE} = 0$, $f = 1$ MHz	C_{rss}	-	65	-	

Switching Characteristics

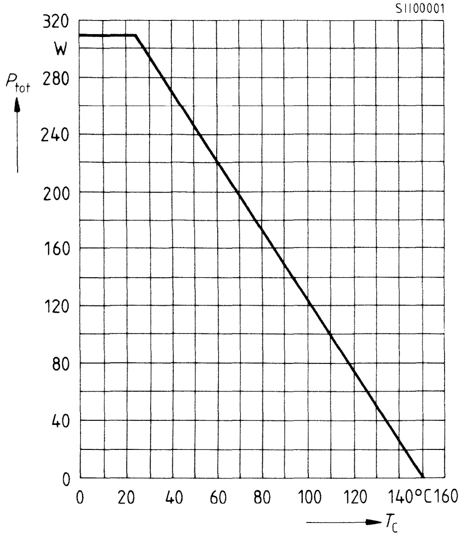
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive load					
Turn-on delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(on)}$	–	50	–	ns
Rise time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_r	–	200	–	
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	300	–	

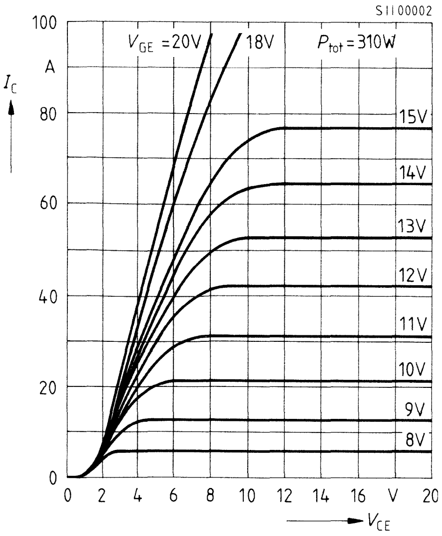
Parameter	Symbol	min.	typ.	max.	Unit
Inductive load					
Turn-off delay time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	$t_{d(off)}$	–	200	–	ns
Fall time $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	t_f	–	200	–	
Turn-off loss ($E_{off} = E_{off\ 1} + E_{off\ 2}$) $V_{CC} = 600$ V, $V_{GE} = 15$ V, $I_C = 15$ A $R_{g(on)} = 3.3\ \Omega$, $R_{g(off)} = 3.3\ \Omega$, $T_j = 125$ °C	 $E_{off\ 1}$ $E_{off\ 2}$	 – –	 0.7 0.8	 –	mWs

Characteristics at $T_j = 25$ °C, unless otherwise specified.

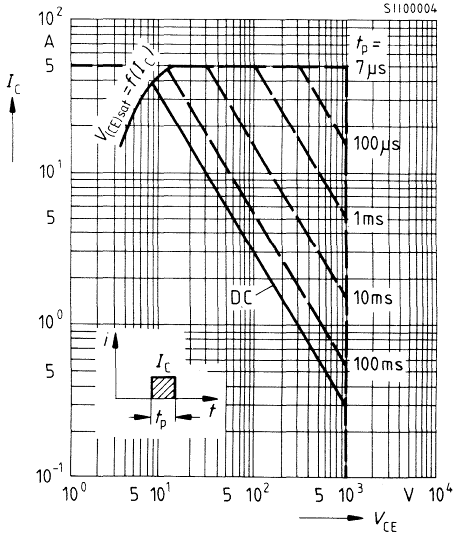
Total power dissipation $P_{tot} = f(T_C)$



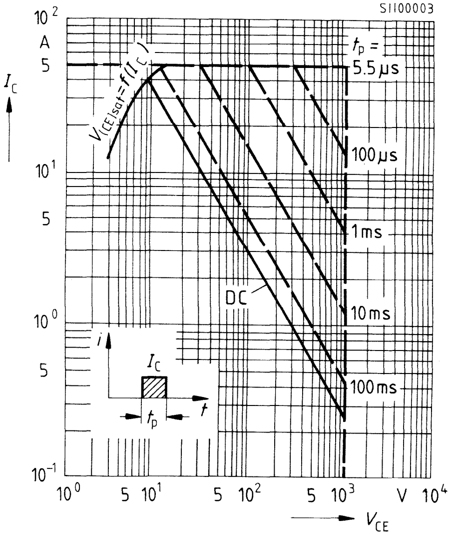
Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80$ µs



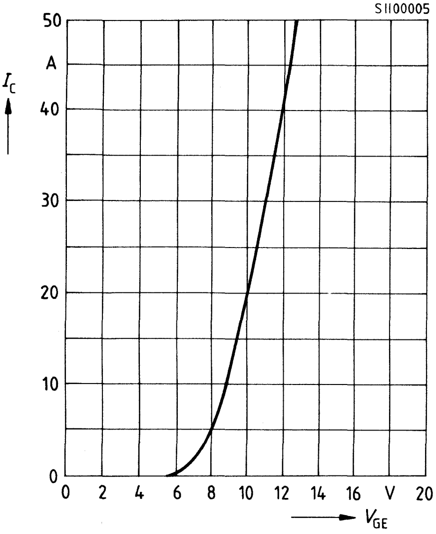
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse
BUP 304



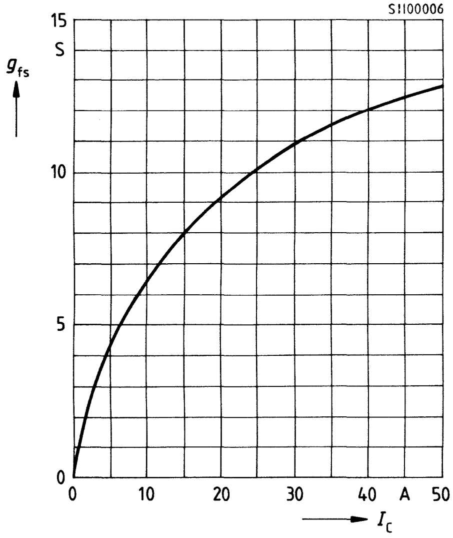
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse
BUP 307



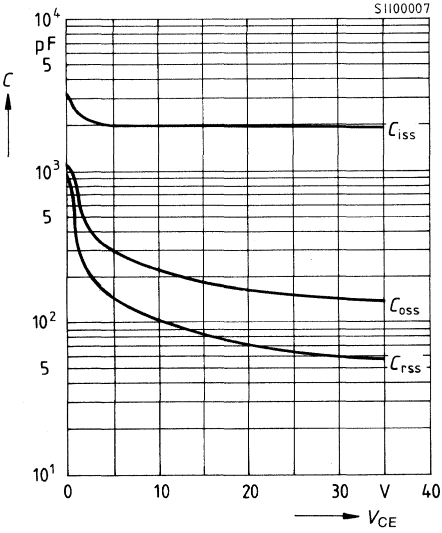
Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80\ \mu s$, $V_{CE} = 20$ V



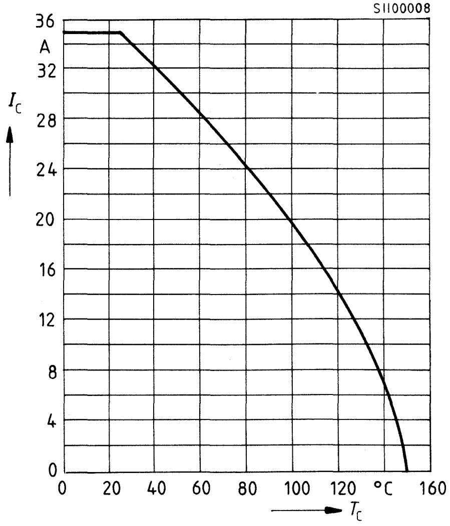
Typ. forward transconductance $g_{fs} = f(I_C)$
parameter: $t_p = 80\ \mu s$, $V_{CE} = 20$ V



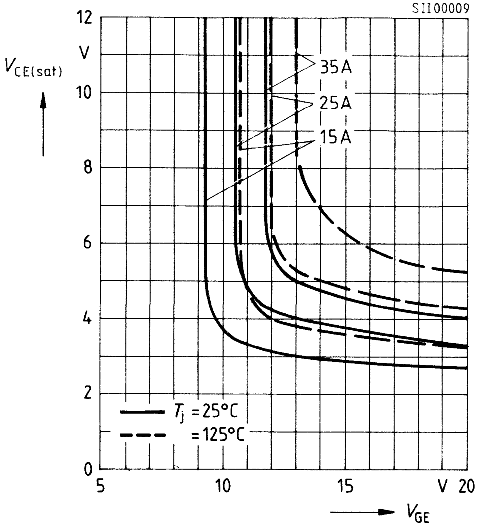
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



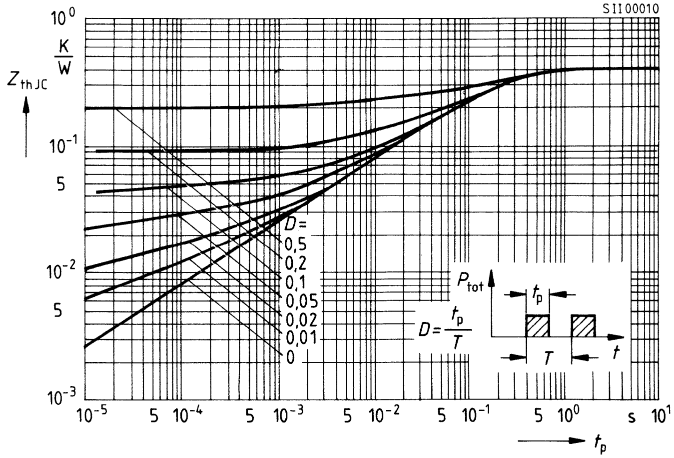
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V



Typ. saturation characteristics
$V_{CE(sat)} = f(V_{GE})$
parameter: I_C, T_j



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p/T$



SIEMENS

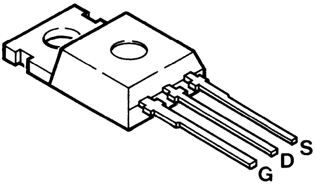
SIPMOS® Power MOS Transistors

BUZ 10
BUZ 10 S2

V_{DS} = **50 / 60 V**
I_D = **23 / 24 A**
$R_{DS(on)}$ = **0.07 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]

TO-220 AB



Type	Ordering code
BUZ 10	C67078-S1300-A2
BUZ 10 S 2	C67078-S1300-A7

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		10	10 S 2	
Drain-source voltage	V_{DS}	50	60	V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, $T_C = 26\ °C / 32\ °C$	I_D	23	24	A
Pulsed drain current, $T_C = 25\ °C$	$I_{D\ puls}$	92	96	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	23	24	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1.3		mJ
Avalanche energy, single pulse $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $T_j = 25\ °C$ $I_D = 23$ A, $L = 15.1\ \mu H$ BUZ 10 $I_D = 24$ A, $L = 22.3\ \mu H$ BUZ 10 S 2	E_{AS}	8	11	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, $T_C = 25\ °C$	P_{tot}	75		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75		K/W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	BUZ 10	$V_{(BR)DSS}$	50	–	V
	BUZ 10 S 2		60	–	
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	BUZ 10	I_{DSS}			µA
$V_{DS} = 60$ V, $V_{GS} = 0$	BUZ 10 S 2				
$T_j = 25$ °C			–	1.0	
$T_j = 125$ °C			–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 16$ A	BUZ 10	$R_{DS(on)}$	–	0.07	Ω
$I_D = 15$ A	BUZ 10 S 2		–	0.07	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

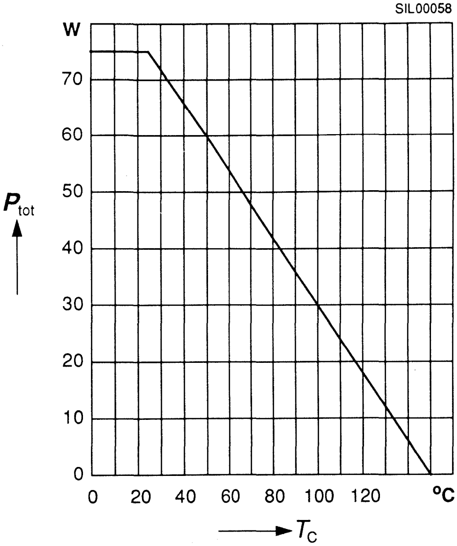
Parameter		Symbol	Values		Unit
			min.	max.	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 16$ A $I_D = 15$ A	 BUZ 10 BUZ 10 S 2	g_{fs}	 7 8.0	 – –	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	 BUZ 10 BUZ 10 S 2	C_{iss}	 – –	 820 960	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	 BUZ 10 BUZ 10 S 2	C_{oss}	 – –	 450 420	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	 BUZ 10 BUZ 10 S 2	C_{rss}	 – –	 170 135	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 3$ A	 BUZ 10 BUZ 10 S 2	$t_{d(on)}$	 – –	 35 30	ns
	BUZ 10 BUZ 10 S 2	t_r	– –	65 60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 3$ A	 BUZ 10 BUZ 10 S 2	$t_{d(off)}$	 – –	 110 100	
	BUZ 10 BUZ 10 S 2	t_f	– –	75 70	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

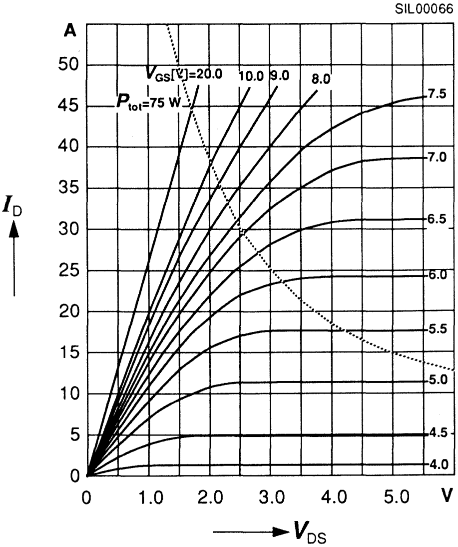
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 10		–	23	
	BUZ 10 S 2		–	24	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 10		–	92	
	BUZ 10 S 2		–	96	
Diode forward on-voltage		V_{SD}			V
$I_F = 46$ A, $V_{GS} = 0$	BUZ 10		–	1.9	
$I_F = 48$ A, $V_{GS} = 0$	BUZ 10 S 2		–	2.0	
Reverse recovery time		t_{rr}	typ.		ns
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	BUZ 10		60	–	
	BUZ 10 S 2		150	–	
Reverse recovery charge		Q_{rr}	typ.		µC
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	BUZ 10		0.1	–	
	BUZ 10 S 2		1.0	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

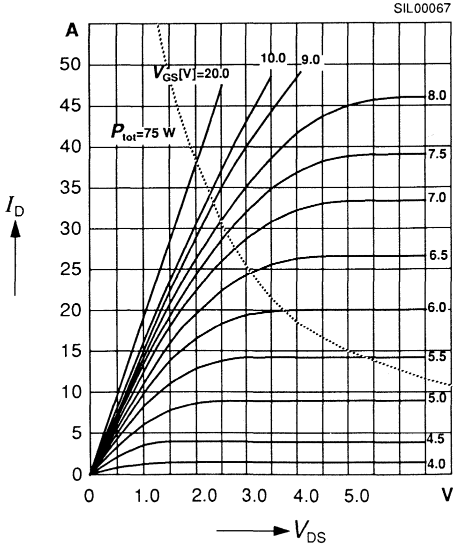
Total power dissipation $P_{tot} = f(T_C)$



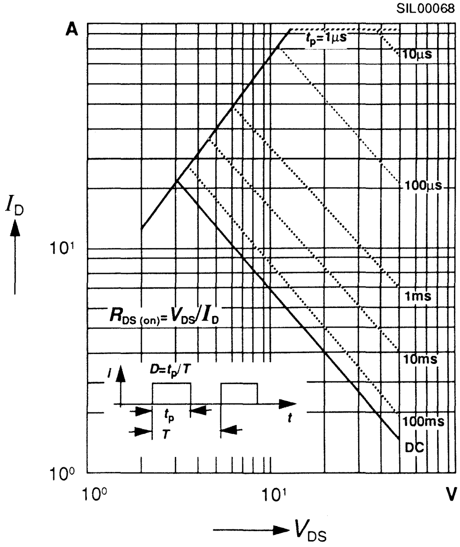
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 10



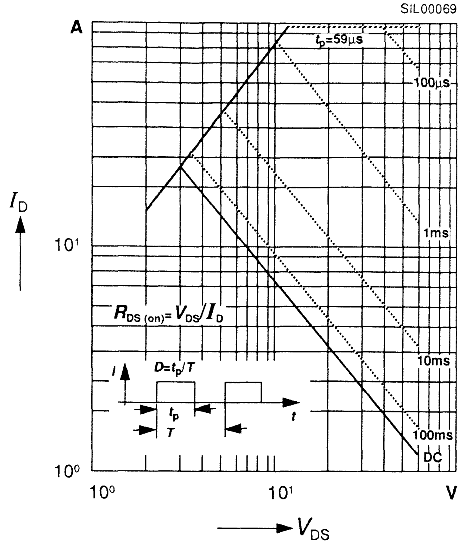
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 10 S2



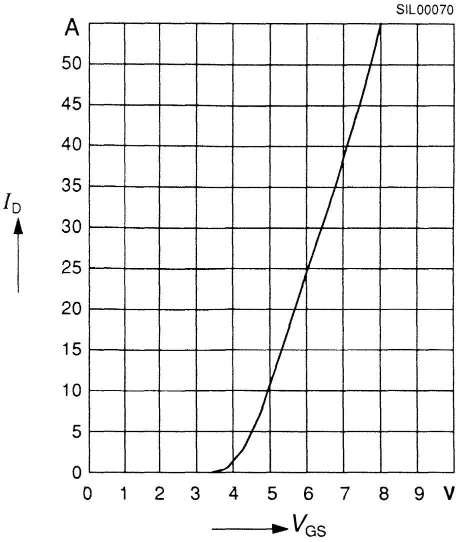
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 10



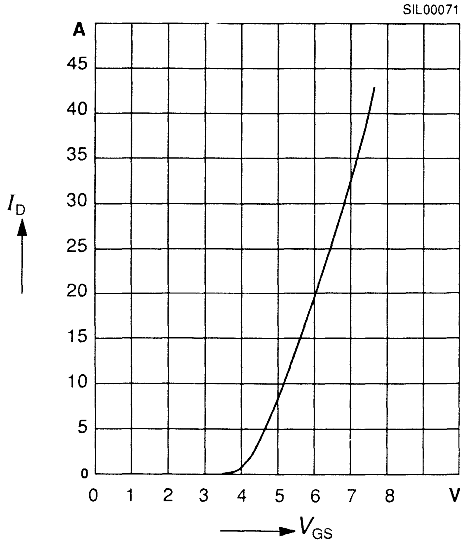
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 10 S2



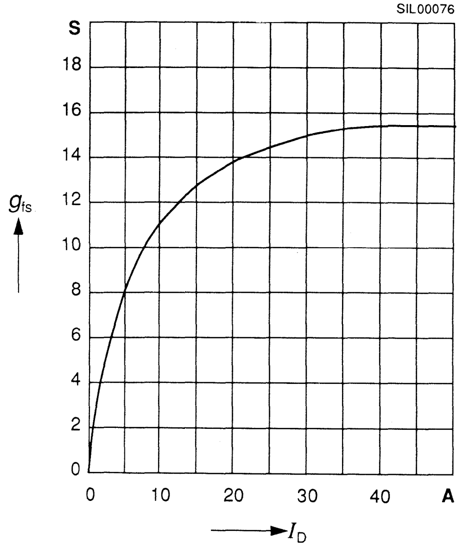
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 10



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 10 S2

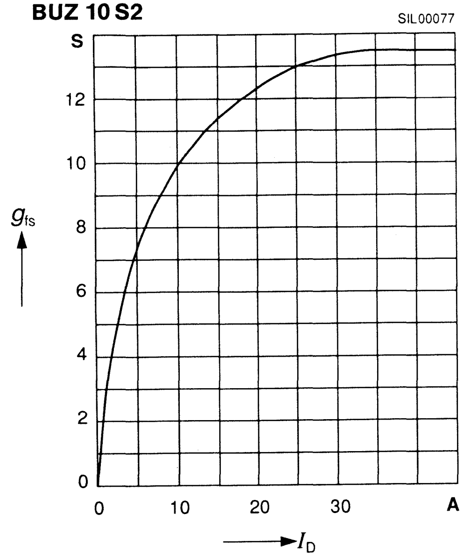


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs
BUZ 10



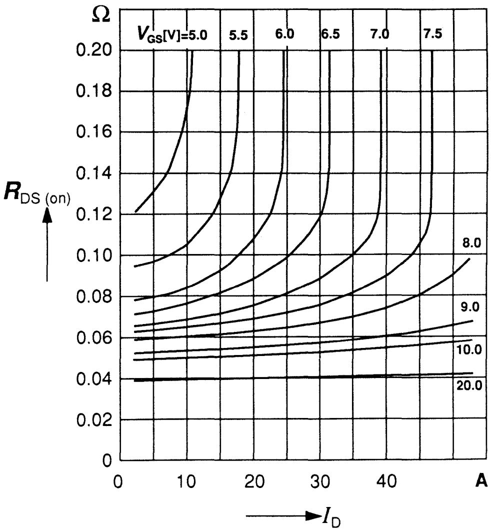
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$

BUZ 10 S2



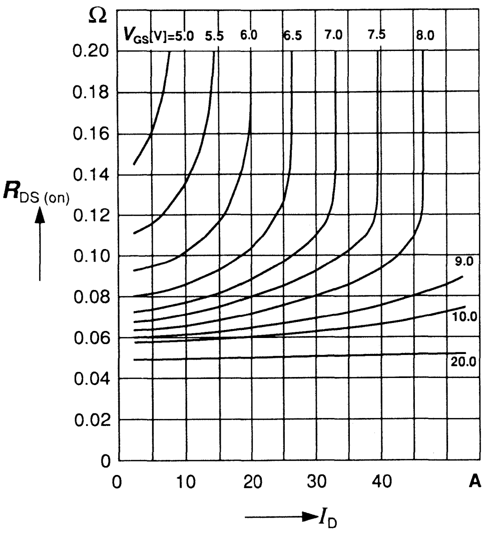
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 10



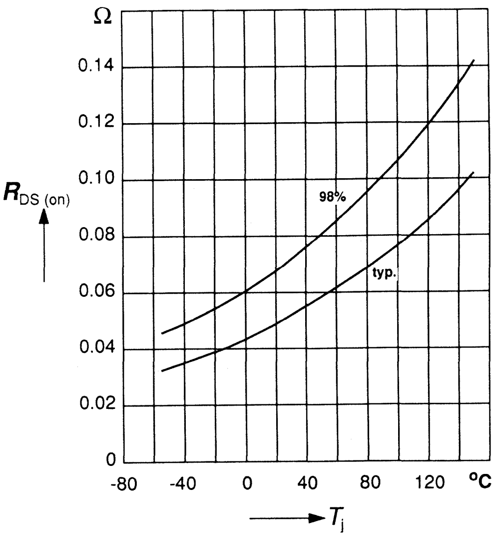
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 10 S2

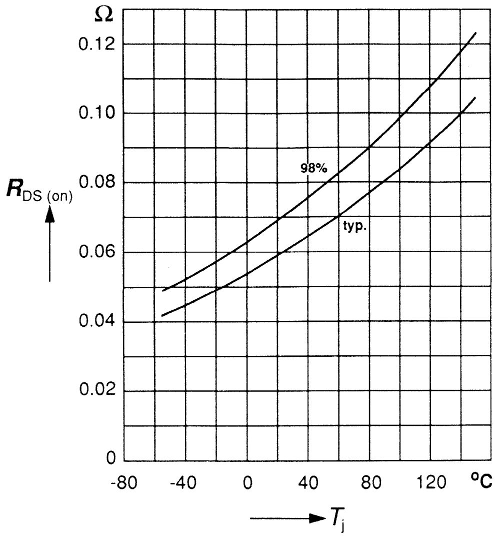


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 16$ A, $V_{GS} = 10$ V, (spread)

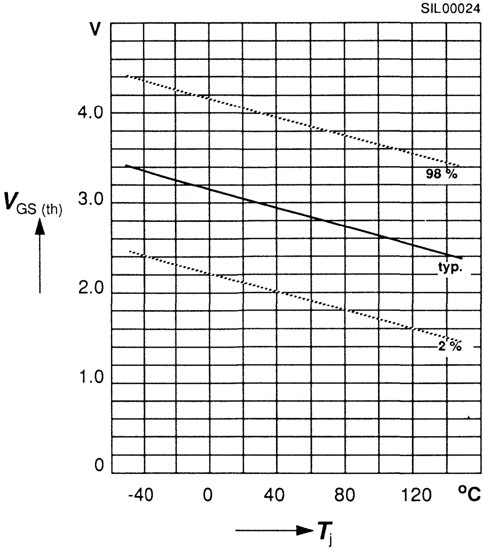
BUZ 10



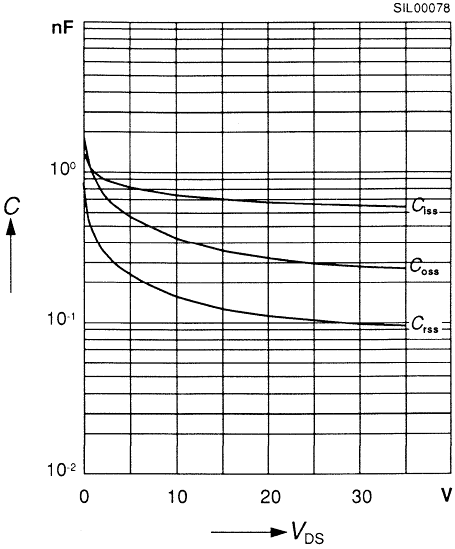
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 15$ A, $V_{GS} = 10$ V, (spread)
BUZ 10 S2



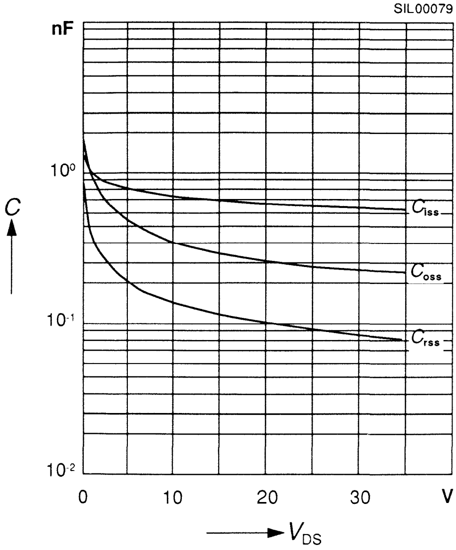
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



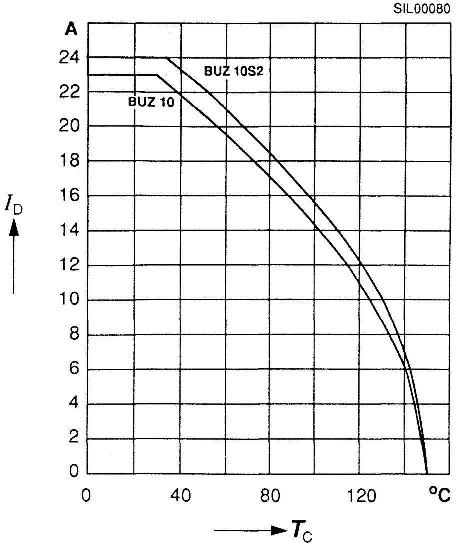
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
BUZ 10



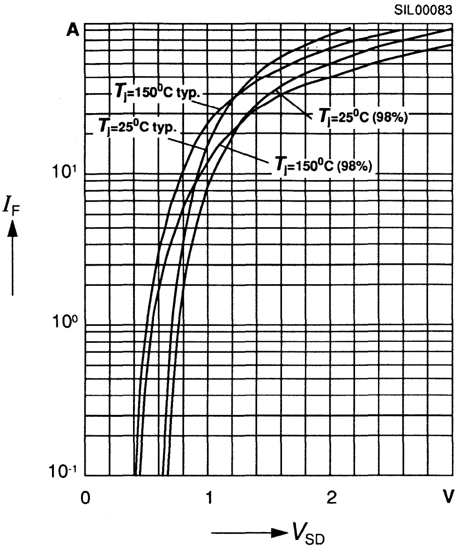
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
BUZ 10 S2



Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V

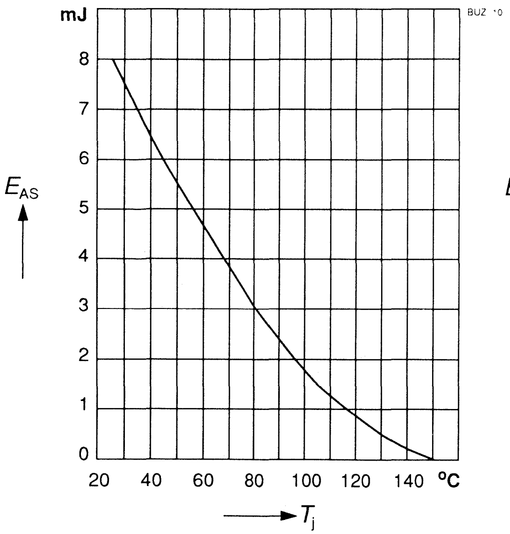


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



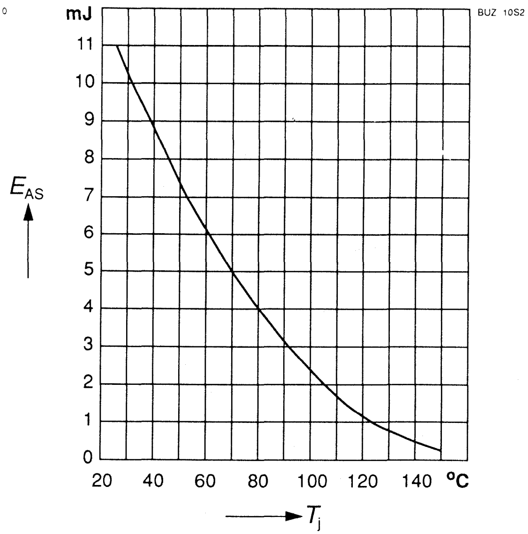
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 23$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 15.1$ µH

BUZ 10

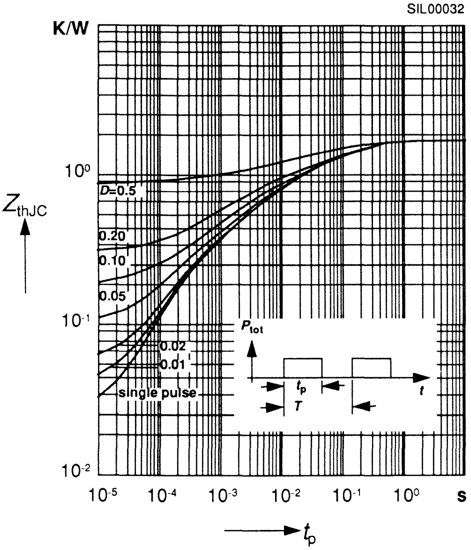


Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 24$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 22.3$ µH

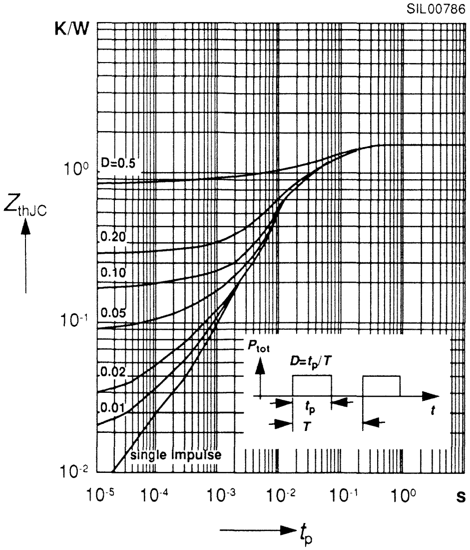
BUZ 10 S2



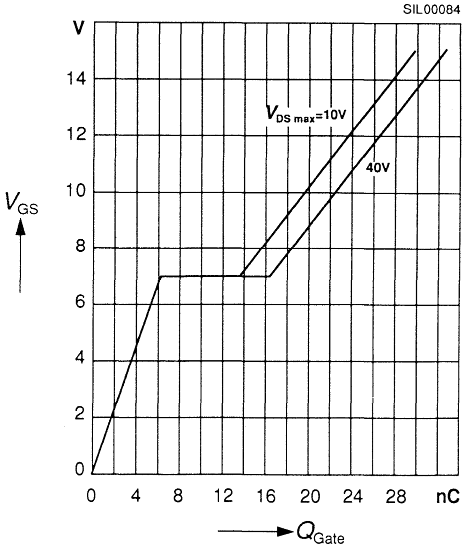
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$
BUZ 10



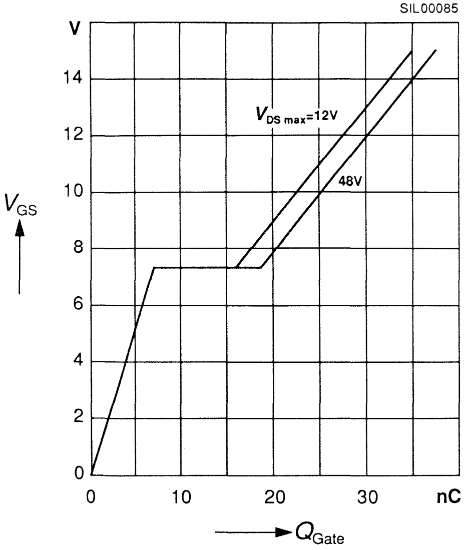
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$
BUZ 10 S2



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 37.5$ A
BUZ 10



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 36.0$ A
BUZ 10 S2

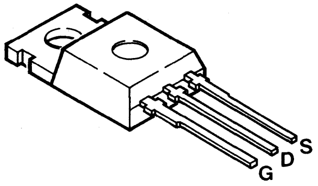


SIEMENS

SIPMOS® Power MOS Transistor BUZ 10 L

V_{DS} = 50 V
I_D = 23 A
$R_{DS(on)}$ = 0.07 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1])



TO-220 AB

Type	Ordering code
BUZ 10 L	C67078-S1329-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, $T_C = 26$ °C	I_D	23	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	92	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	23	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1.3	mJ
Avalanche energy, single pulse $I_D = 23$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 15.1$ µH, $T_j = 25$ °C	E_{AS}	8	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 11.5$ A	$R_{DS(on)}$	-	0.07	Ω

Dynamic characteristics

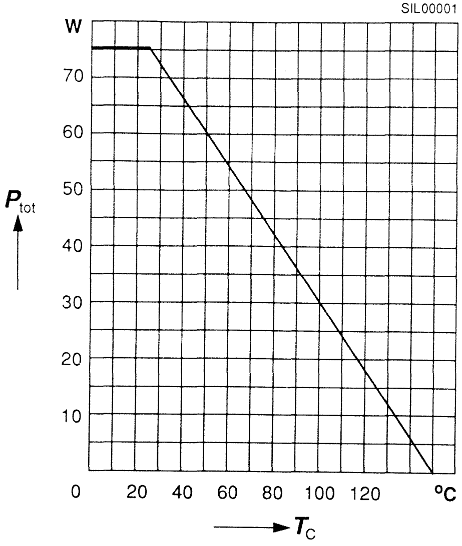
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 11.5$ A	g_{fs}	8	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1100	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	450	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	40	ns
	t_r	-	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	160	
	t_f	-	95	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

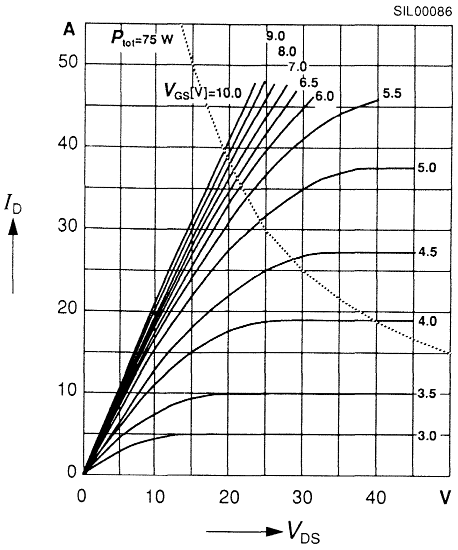
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	25	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	100	
Diode forward on-voltage $I_F = 50$ A, $V_{GS} = 0$	V_{SD}	–	2.0	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	60 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.1 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

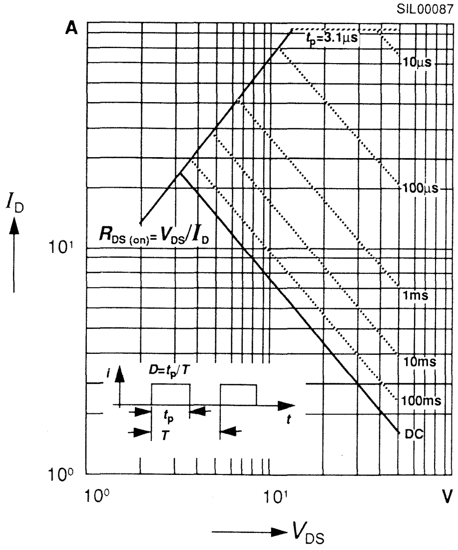
Total power dissipation $P_{tot} = f(T_C)$



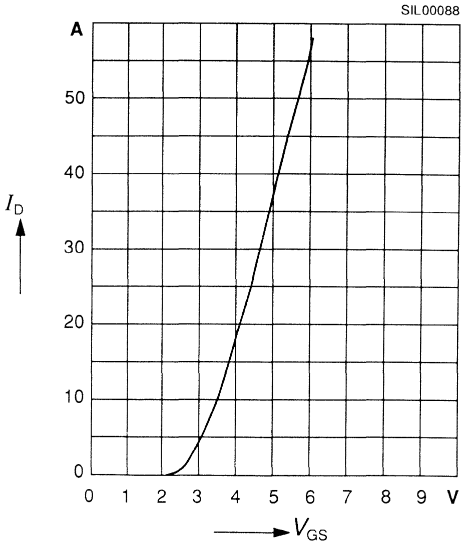
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



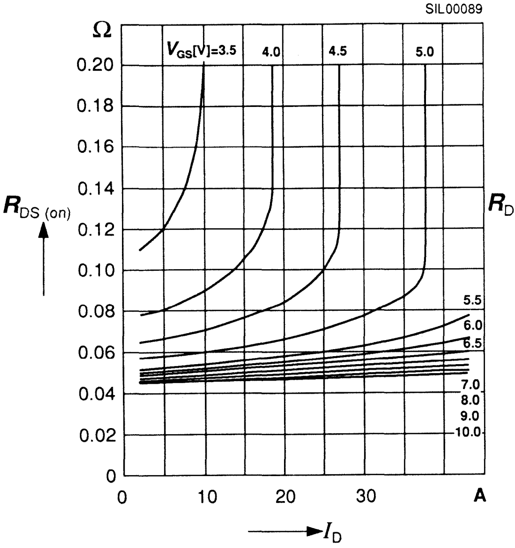
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



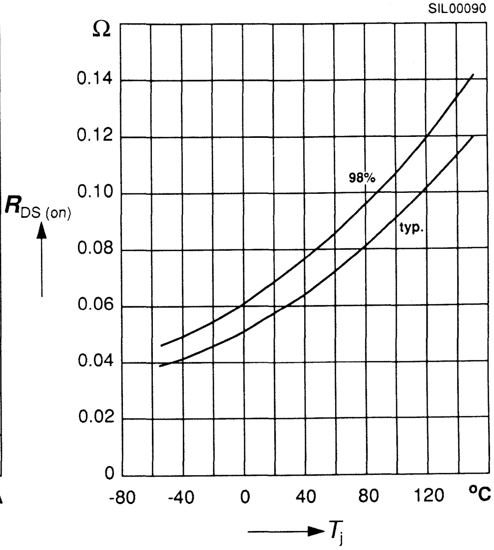
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



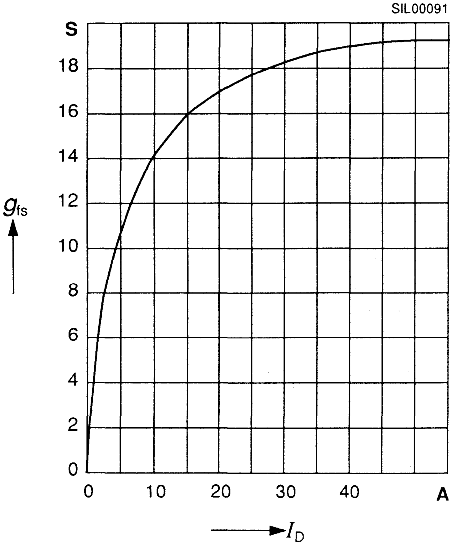
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



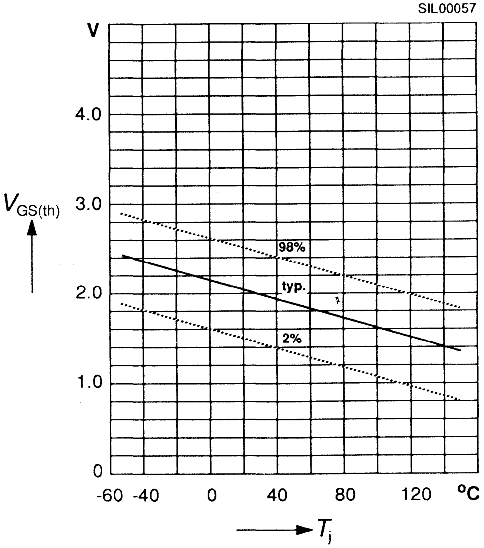
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 11.5 A, V_{GS} = 5 V, (spread)



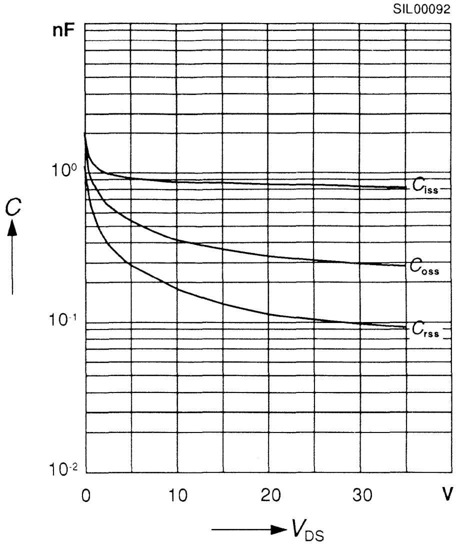
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



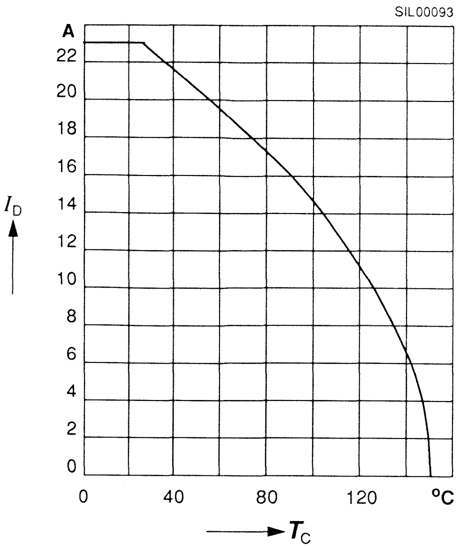
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



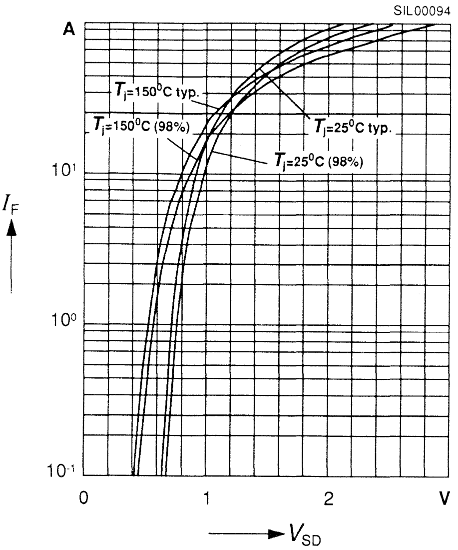
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



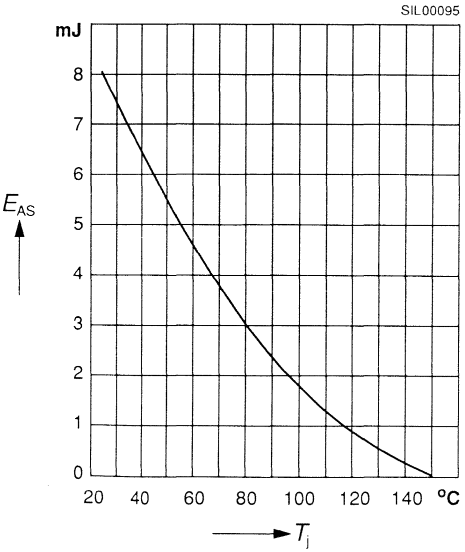
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



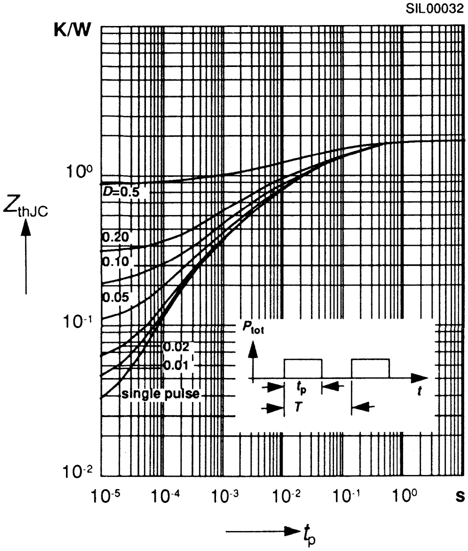
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



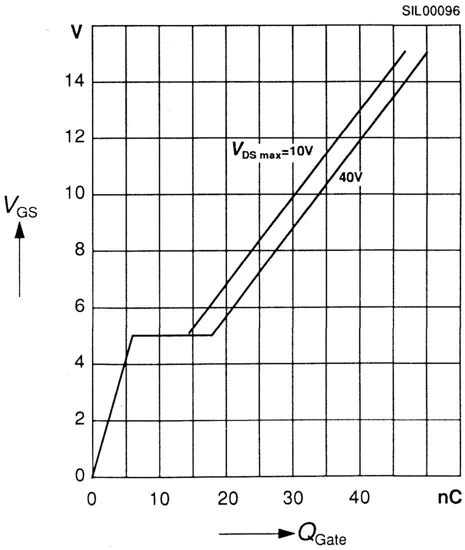
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 23$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 15.1$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 37.5$ A



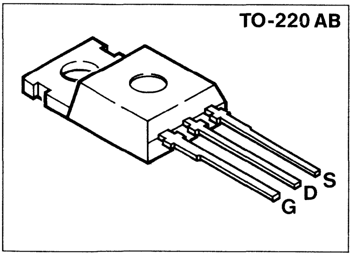
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 11
BUZ 11 A
BUZ 11 S2

V_{DS} = **50 ... 60 V**
I_D = **26 ... 30 A**
$R_{DS(on)}$ = **0.04 ... 0.055 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 11	C67078-A1301-A2
BUZ 11 A	C67078-S1301-A3
BUZ 11 S2	C67078-S1301-A5

Maximum Ratings

Parameter	Symbol	BUZ			Unit
		11	11 A	11 S2	
Drain-source voltage	V_{DS}	50	50	60	V
Gate-source voltage	V_{GS}	± 20			
Continuous drain current, T_C = 29/25/29 °C	I_D	30	26	30	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	120	104	120	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	30	26	30	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1.9	1.9	2.0	mJ
Avalanche energy, single pulse V_{DD} = 25 V, R_{GS} = 25 Ω, T_j = 25 °C	E_{AS}				
I_D = 30 A, L = 15.6 µH BUZ 11		14	–	–	
I_D = 26 A, L = 20.7 µH BUZ 11 A		–	14	–	
I_D = 30 A, L = 24.6 µH BUZ 11 S2		–	–	19	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75			W
Thermal resistance					K/W
chip - case	R_{thJC}	1.67			
chip - ambient, without heat sink	R_{thJA}	75			
DIN humidity category, DIN 40 040		E			–
IEC climatic category, DIN IEC 68-1		55/150/56			

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[1]) See chapter Package Outlines

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage		$V_{(BR)DSS}$			V
$V_{GS} = 0$, $I_D = 0.25$ mA	BUZ 11/11 A		50	–	
	BUZ 11 S2		60	–	
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 0.25$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current		I_{DSS}			µA
$V_{GS} = 0$ $V_{DS} = 50$ V	BUZ 11/11 A				
$V_{DS} = 60$ V	BUZ 11 S2				
$T_j = 25$ °C			–	0.1	
$T_j = 125$ °C			–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance		$R_{DS(on)}$			Ω
$V_{GS} = 10$ V, $I_D = 19$ A	BUZ 11/11 S2		–	0.04	
$I_D = 16$ A	BUZ 11 A		–	0.055	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

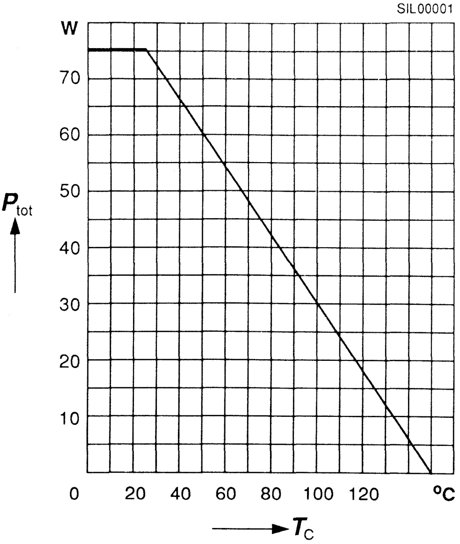
Parameter		**Symbol**	**Values**		**Unit**
			min.	max.	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 19$ A	BUZ 11/11 S2	g_{fs}	–	–	S
$I_D = 16$ A	BUZ 11 A		10	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	1600	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 11/11 A	C_{oss}	–	800	
	BUZ 11 S2		–	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 11/11 A	C_{rss}	–	240	
	BUZ 11 S2		–	270	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 3$ A		$t_{d(on)}$	–	40	ns
	BUZ 11/11 A	t_r	–	80	
	BUZ 11 S2		–	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 3$ A	BUZ 11/11 A	$t_{d(off)}$	–	180	
	BUZ 11 S2		–	200	
	BUZ 11/11 A	t_f	–	90	
	BUZ 11 S2		–	110	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

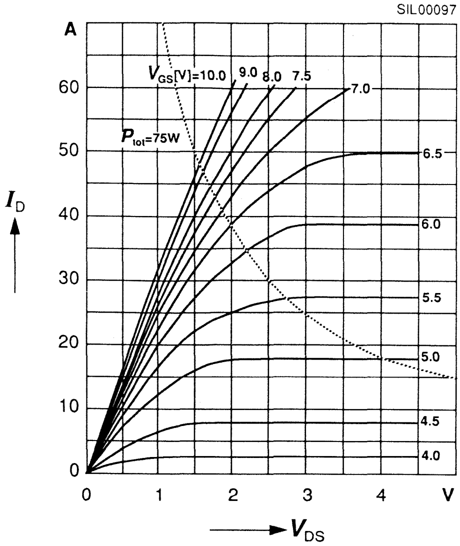
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 11/11 S2		–	30	
	BUZ 11 A		–	26	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 11/11 S2		–	120	
	BUZ 11 A		–	104	
Diode forward on-voltage		V_{SD}			V
$V_{GS} = 0$ $I_F = 60$ A	BUZ 11/11 S2		–	1.8	
$I_F = 52$ A	BUZ 11 A		–	1.8	
Reverse recovery time		t_{rr}			ns
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	BUZ 11/11 A		200 typ.	– –	
	BUZ 11 S2		80 typ.	– –	
Reverse recovery charge		Q_{rr}			µC
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	BUZ 11/11 A		0.25 typ.	– –	
	BUZ 11 S2		0.1 typ.	– –	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

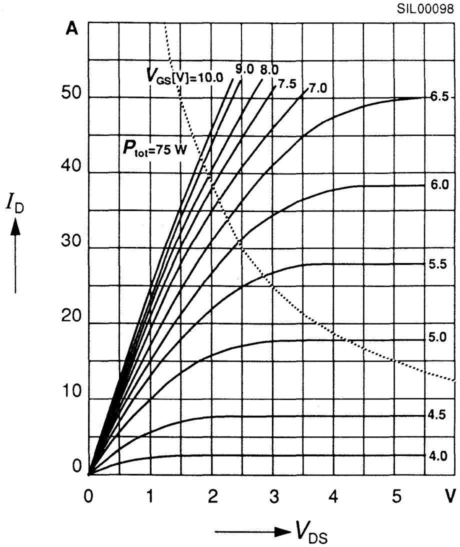
Total power dissipation $P_{tot} = f(T_C)$



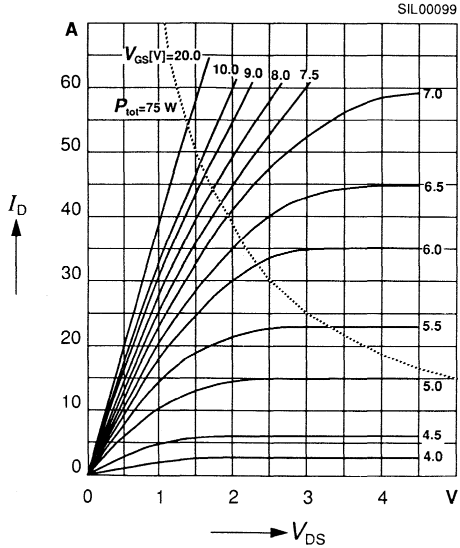
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 11



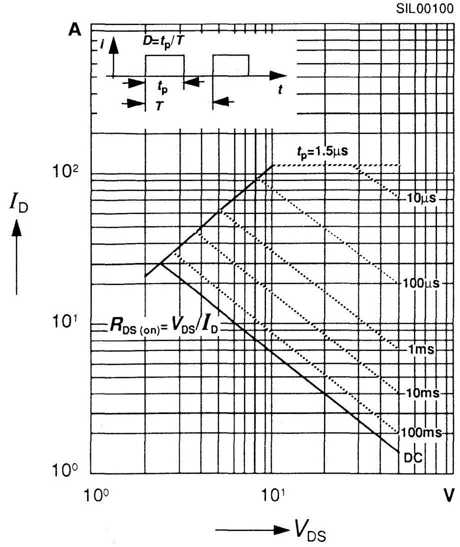
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 11 A



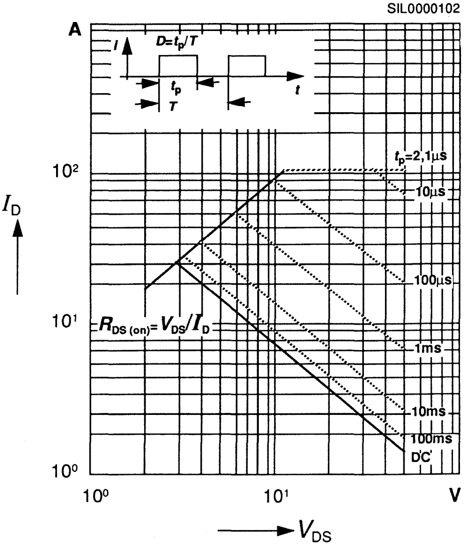
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 11 S2



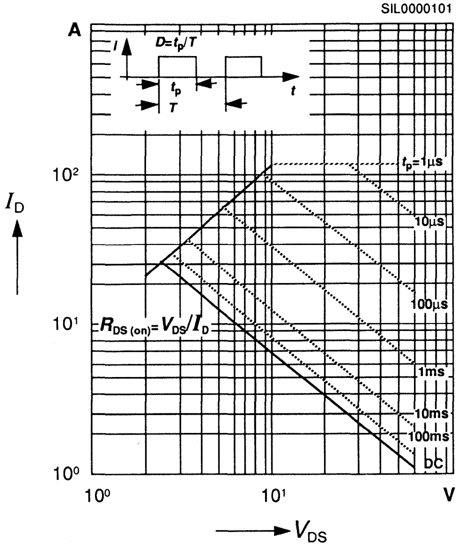
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 11



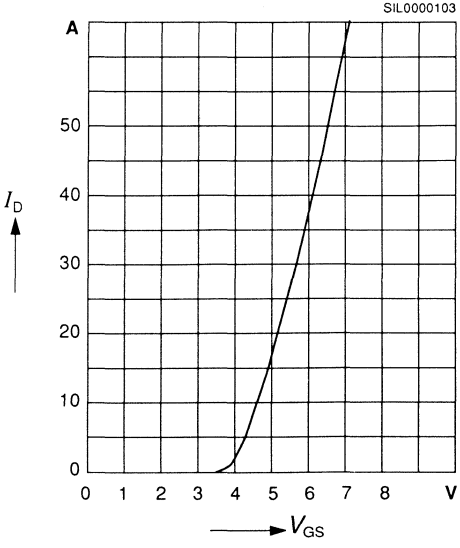
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 11 A



Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 11 S2

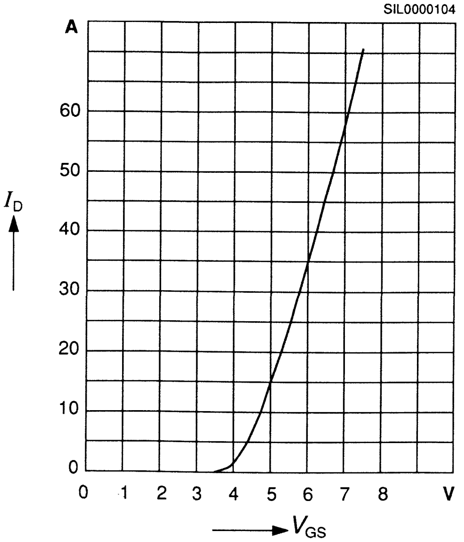


Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 11/11 A



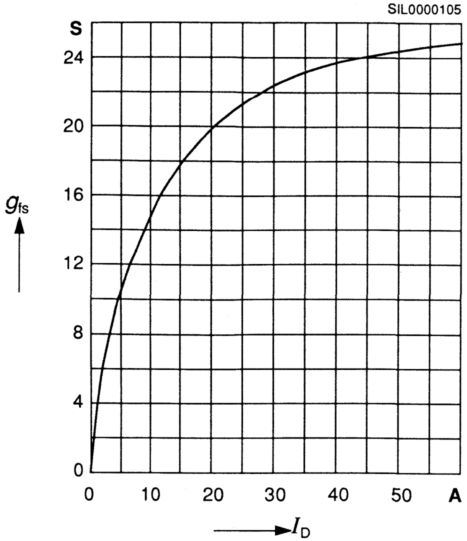
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$

BUZ 11 S2



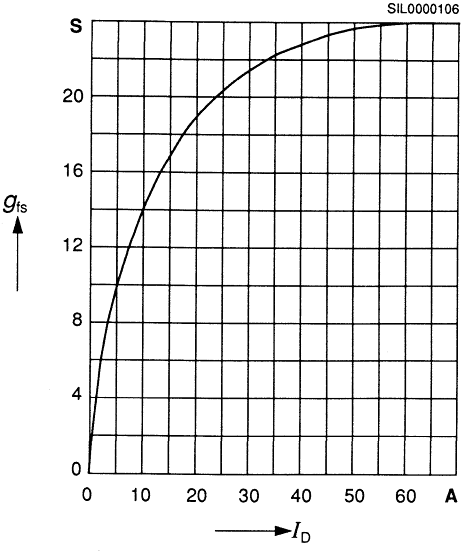
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$

BUZ 11/11 A



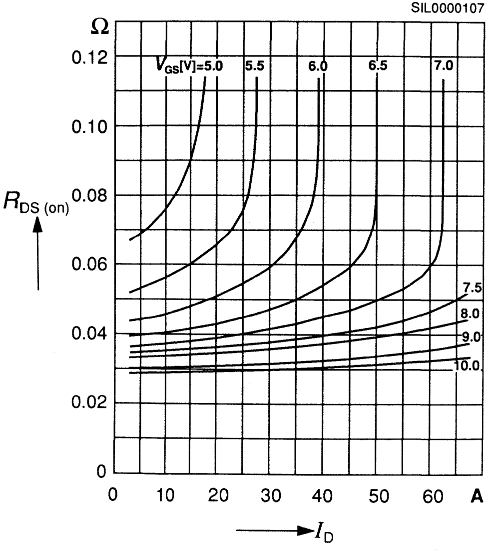
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$

BUZ 11 S2

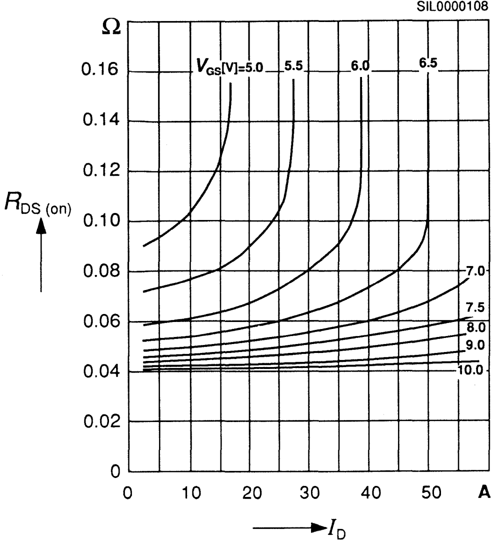


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

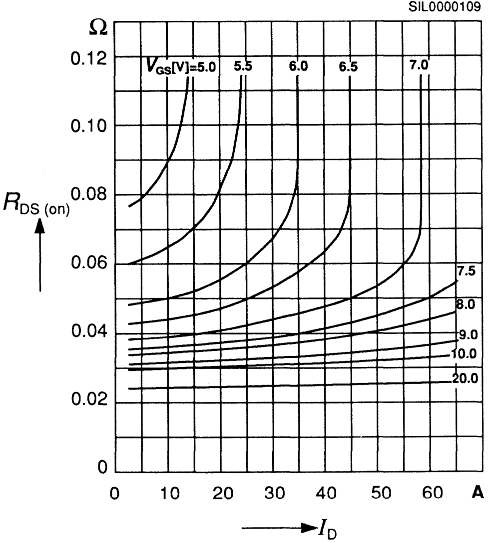
BUZ 11



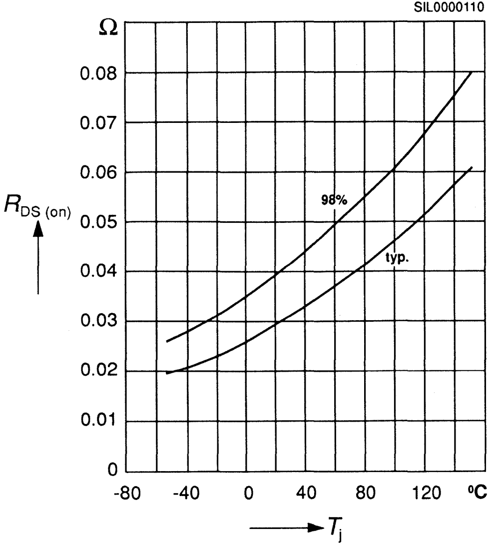
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 11 A



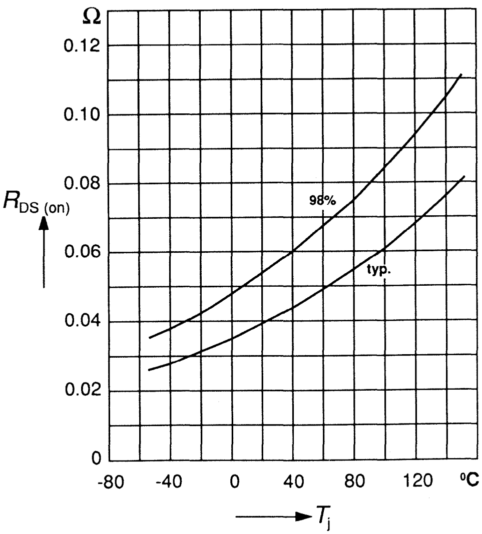
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 11 S2



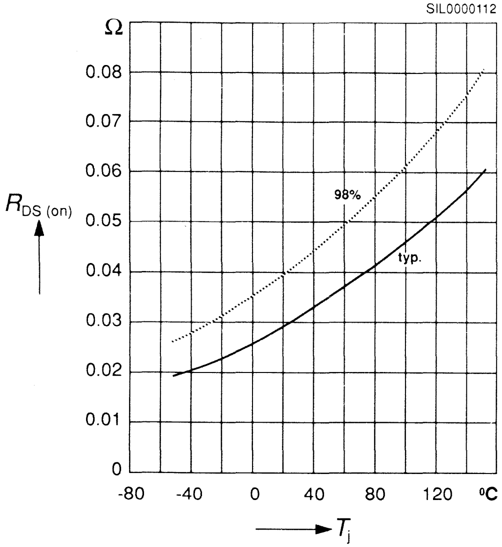
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 19$ A, $V_{GS} = 10$ V, (spread)
BUZ 11



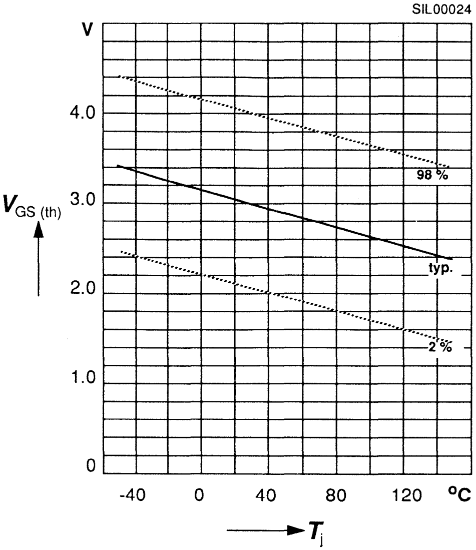
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 16$ A, $V_{GS} = 10$ V, (spread)
BUZ 11 A



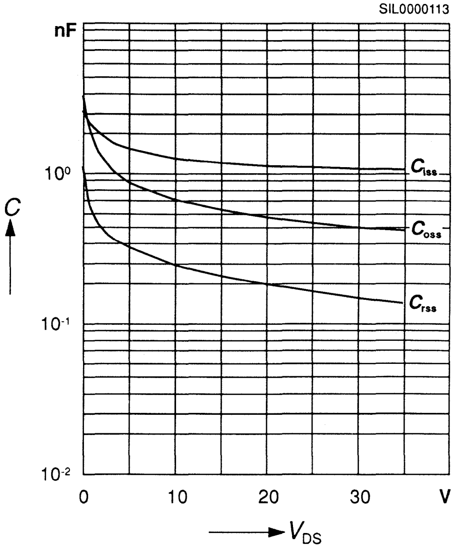
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 19$ A, $V_{GS} = 10$ V, (spread)
BUZ 11 S2



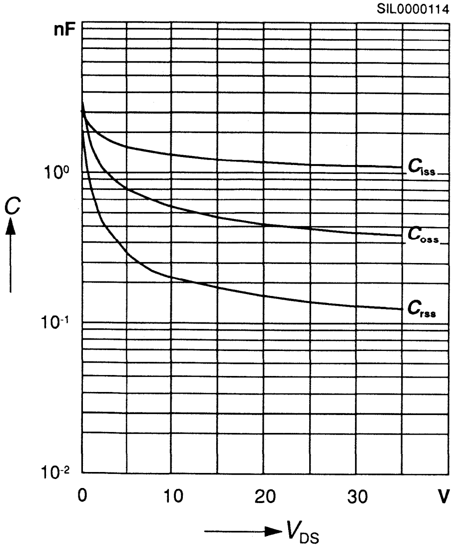
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



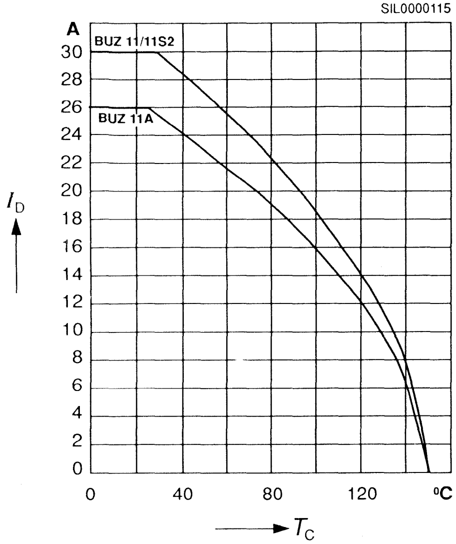
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
BUZ 11/11 A



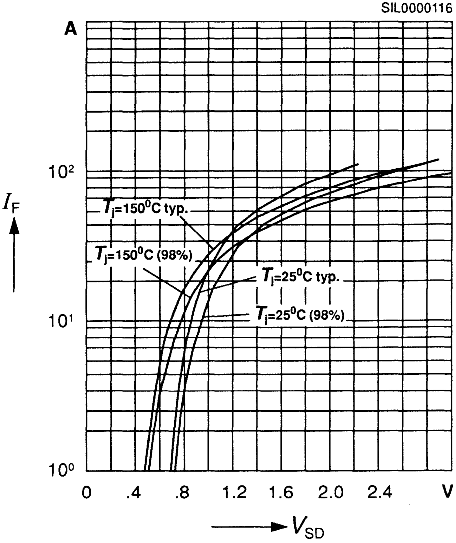
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
BUZ 11 S2



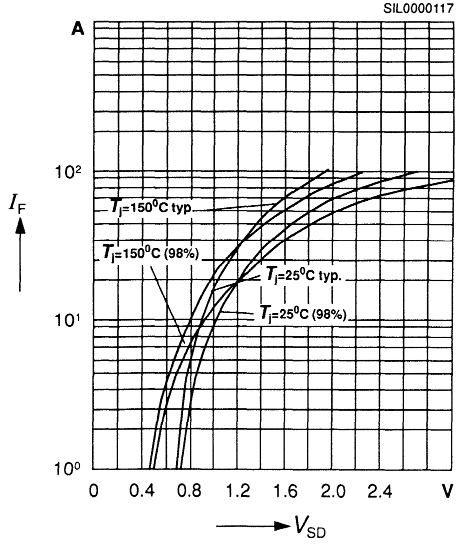
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



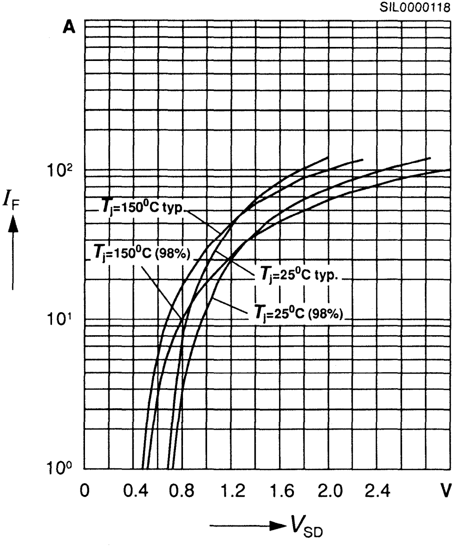
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 11



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 11 A

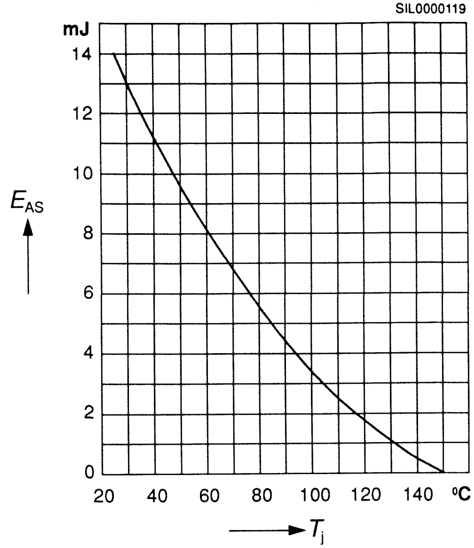


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 11 S2



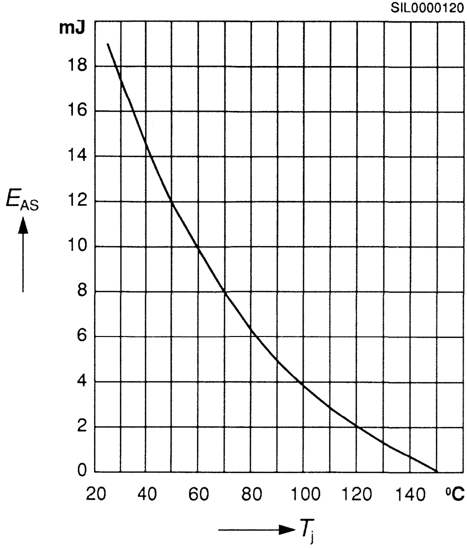
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 30$ A/26 A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 15.6\ \mu$H/20 μH

BUZ 11/11 A

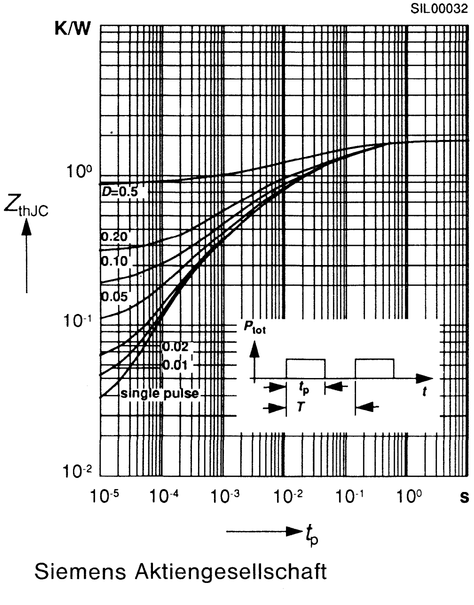


Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 30$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 24.6\ \mu$H

BUZ 11 S2

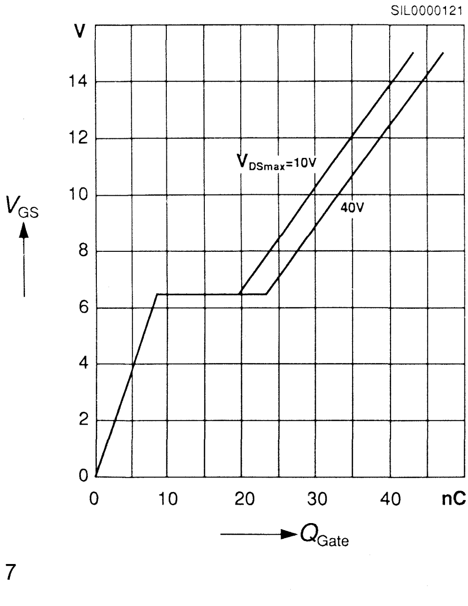


Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$

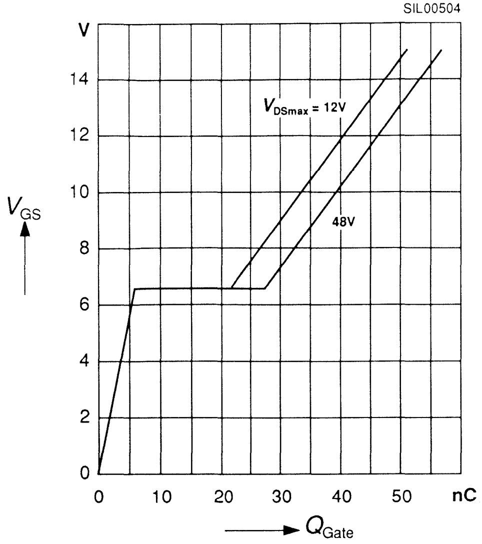


Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 55.5$ A

BUZ 11/11 A



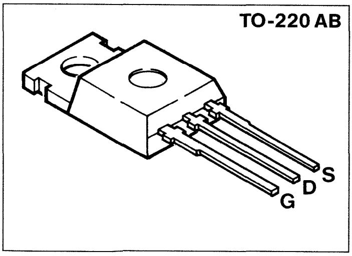
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 45.0$ A
BUZ 11 S2



SIPMOS® Power MOS Transistor **BUZ 11 AL**

V_{DS} = **50 V**
I_D = **26 A**
$R_{DS(on)}$ = **0.055 Ω**

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 11 AL	C67078-S1330-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	26	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	104	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	26	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1.9	mJ
Avalanche energy, single pulse $I_D = 26$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 20.7$ µH, $T_j = 25$ °C	E_{AS}	14	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 13$ A	$R_{DS(on)}$	-	0.055	Ω

Dynamic characteristics

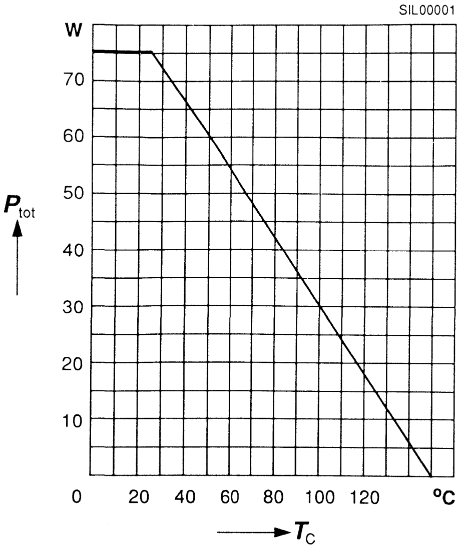
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 13$ A	g_{fs}	10	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	2000	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	840	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	300	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	40	ns
	t_r	-	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	160	
	t_f	-	110	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

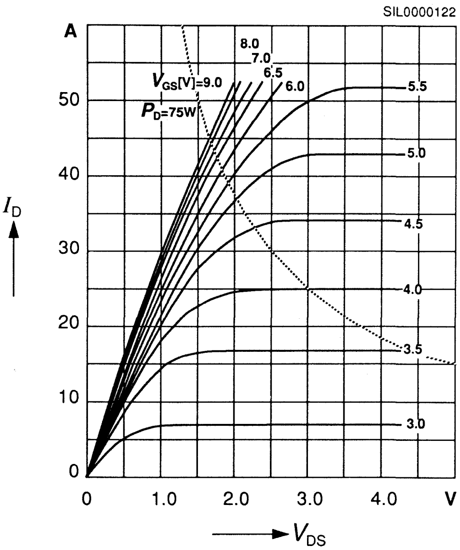
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	26	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	104	
Diode forward on-voltage I_F = 52 A, V_{GS} = 0	V_{SD}	–	1.8	V
Reverse recovery time V_R = 30 V, I_F = I_S, di_F/dt = 100 A/µs	t_{rr}	100 typ.	–	ns
Reverse recovery charge V_R = 30 V, I_F = I_S, di_F/dt = 100 A/µs	Q_{rr}	0.2 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

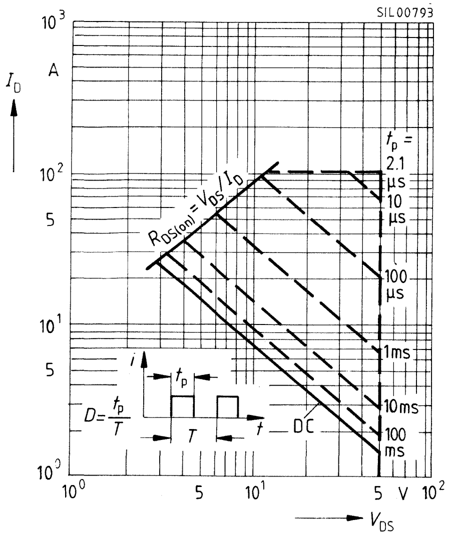
Total power dissipation $P_{tot} = f(T_C)$



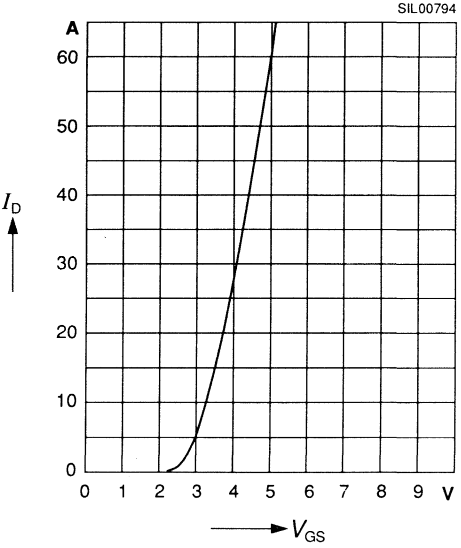
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



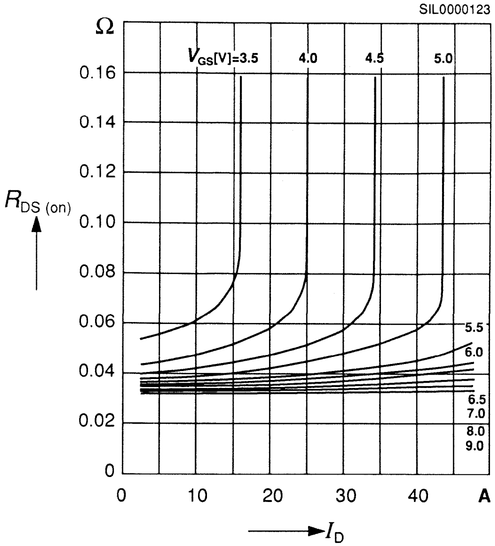
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



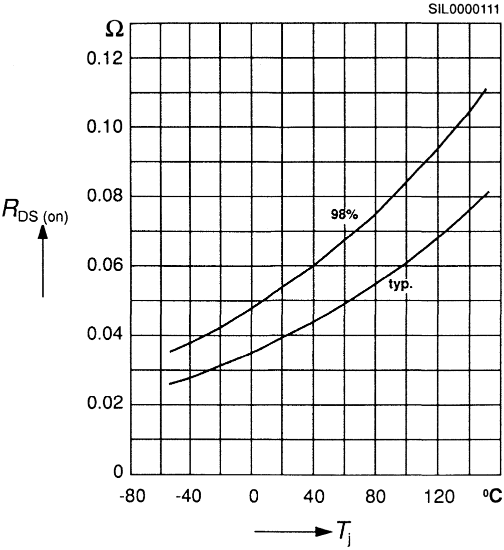
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



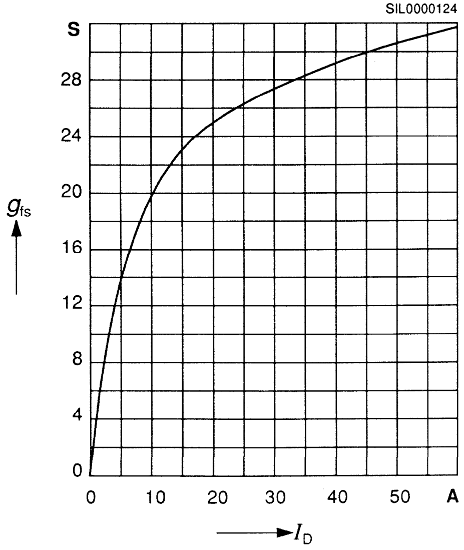
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



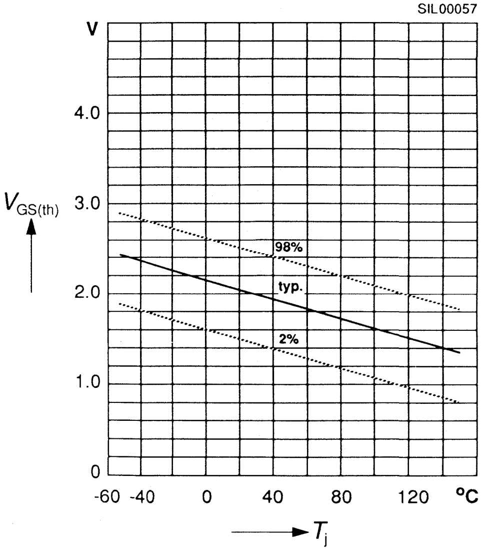
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 13$ A, $V_{GS} = 5$ V, (spread)



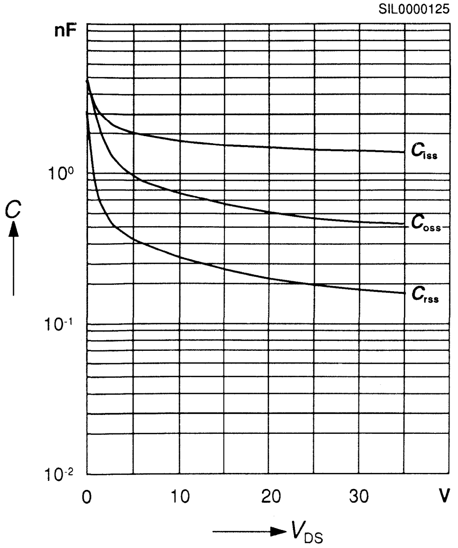
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



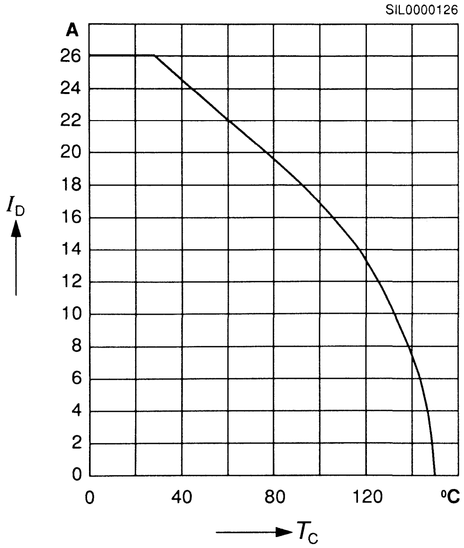
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



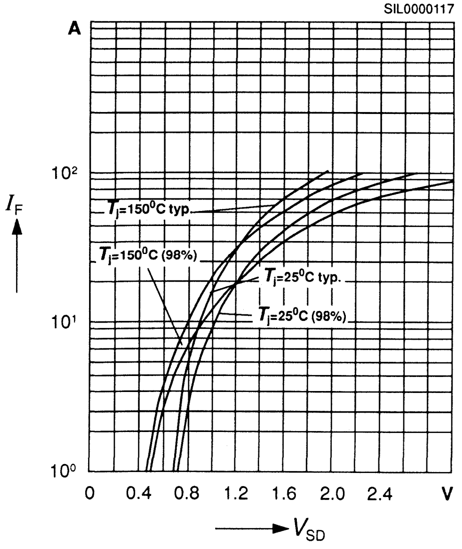
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



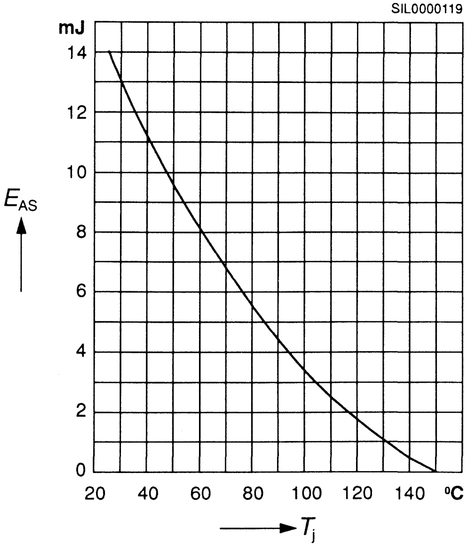
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



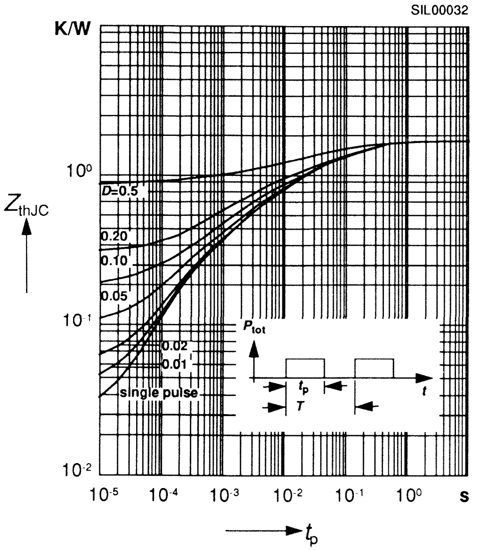
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



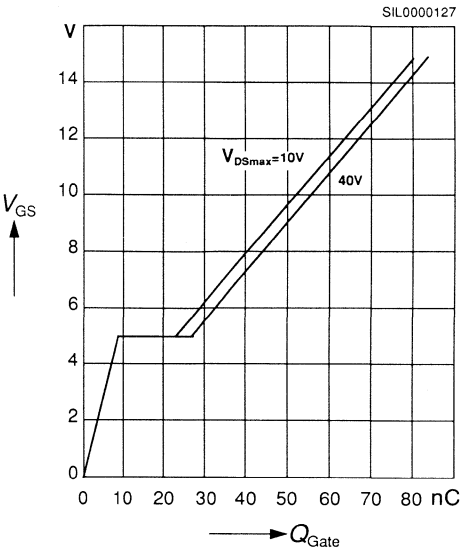
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 26$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 20.7$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 39$ A



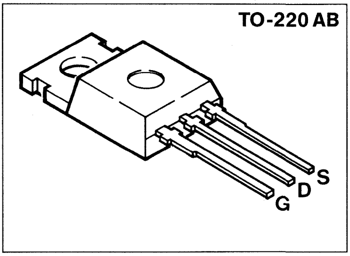
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 12
BUZ 12 A

V_{DS} = **50 V**
I_D = **42 A**
$R_{DS(on)}$ = **0.028 / 0.035 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 12	C67078-S1331-A2
BUZ 12 A	C67078-S1331-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		12	12 A	
Drain-source voltage	V_{DS}	50		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 65 °C / 44 °C	I_D	42		A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	168		
Avalanche current, limited by $T_{j\ max}$	I_{AR}	42		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	2.5		mJ
Avalanche energy, single pulse $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $T_j = 25$ °C $I_D = 42$ A, $L = 23.2\ \mu$H	E_{AS}	41		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

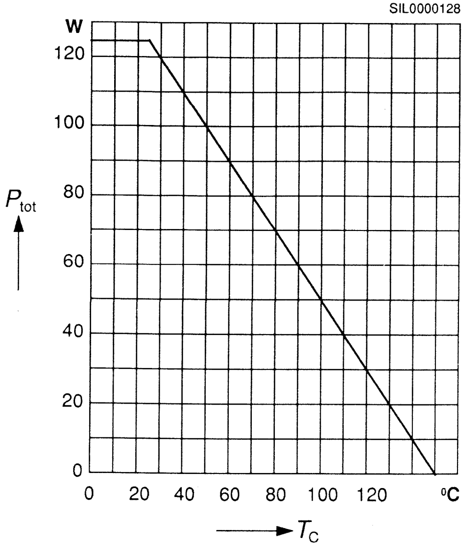
Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	50	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C		I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 32$ A	BUZ 12 BUZ 12 A	$R_{DS(on)}$	– –	0.028 0.035	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 32$ A		g_{fs}	12.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	2400	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	1200	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	450	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A		$t_{d(on)}$	–	50	ns
		t_r	–	130	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A		$t_{d(off)}$	–	280	
		t_f	–	180	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

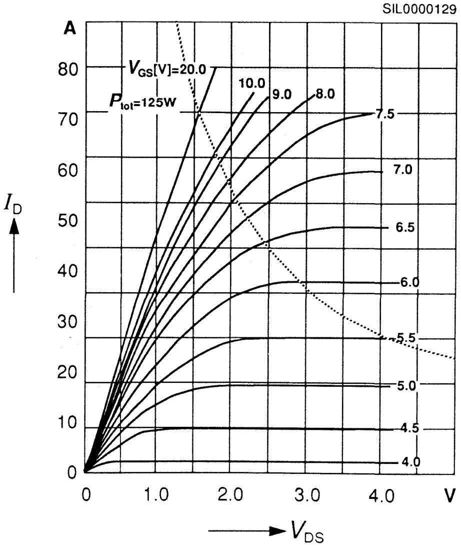
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	42	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	168	
Diode forward on-voltage $I_F = 84$ A, $V_{GS} = 0$	V_{SD}	–	2.2	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	80 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.14 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

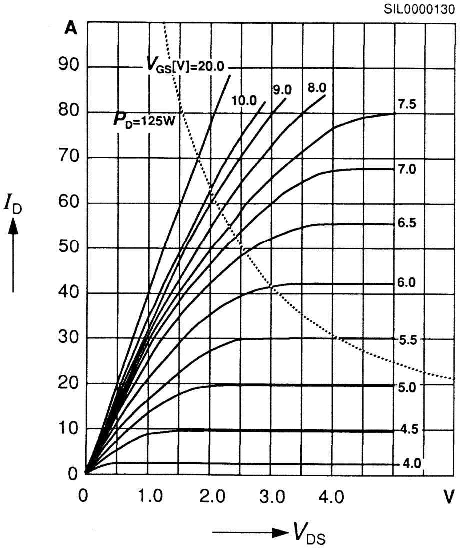
Total power dissipation $P_{tot} = f(T_C)$



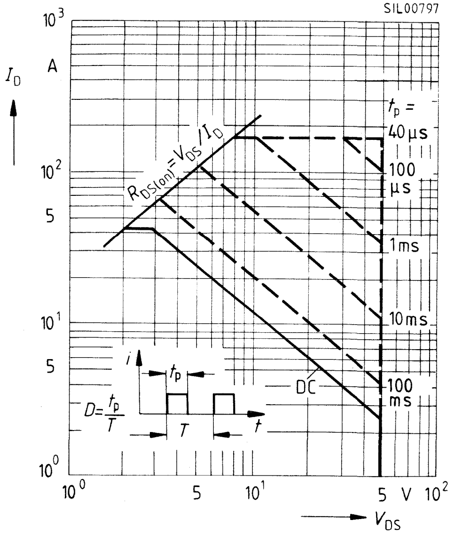
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 12



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 12 A

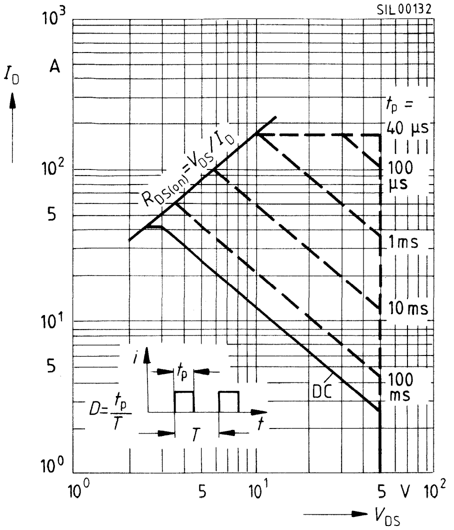


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 12

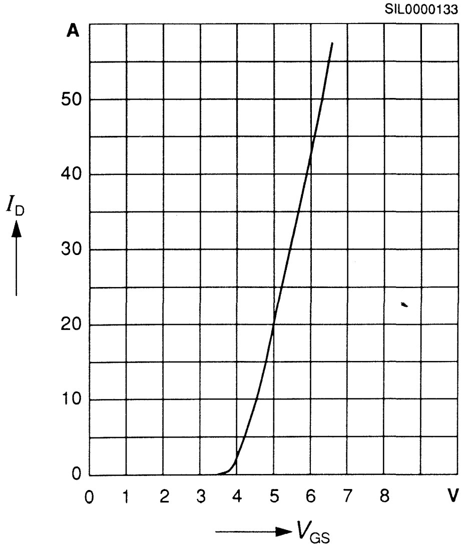


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

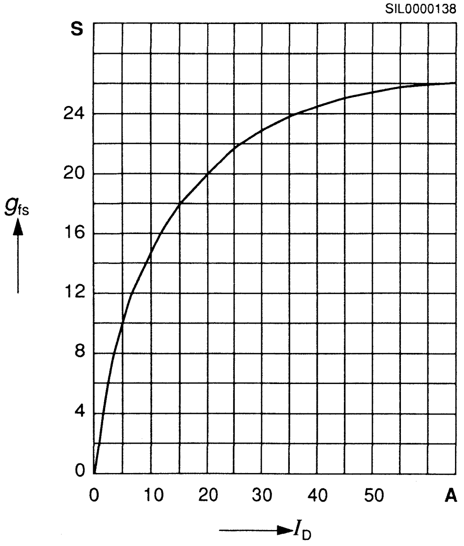
BUZ 12 A



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

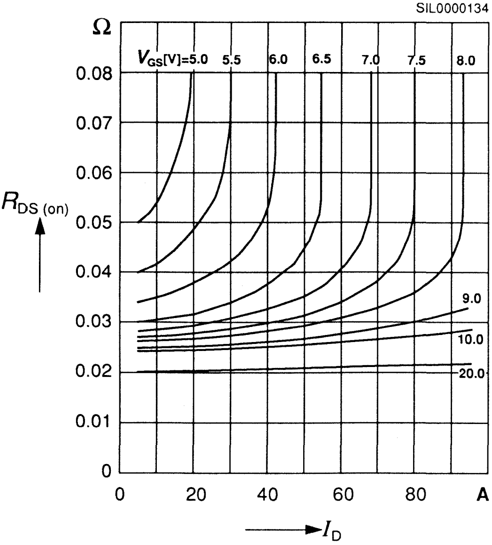


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



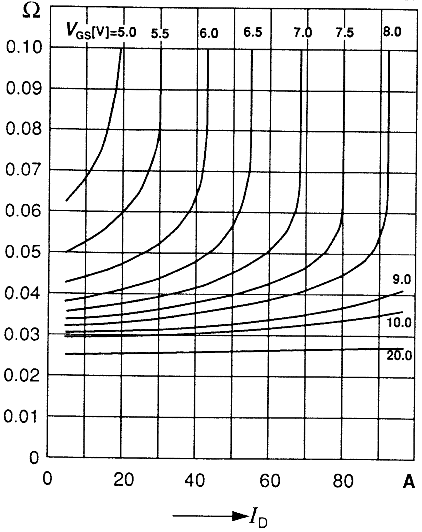
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 12



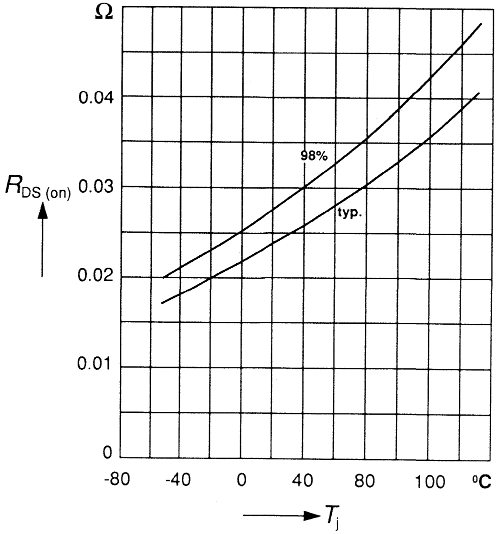
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 12 A



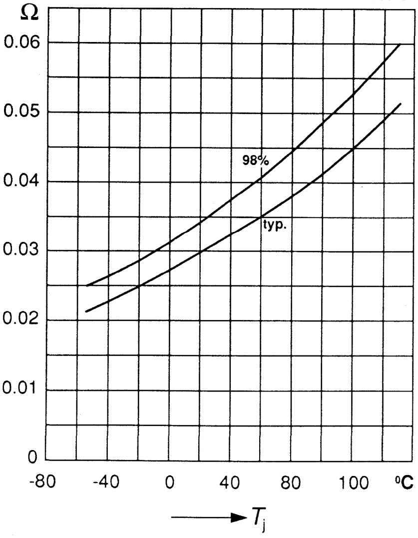
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 32$ A, $V_{GS} = 10$ V, (spread)

BUZ 12

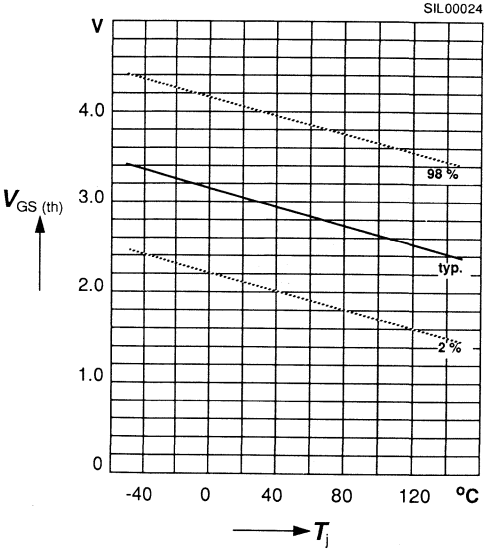


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 32$ A, $V_{GS} = 10$ V, (spread)

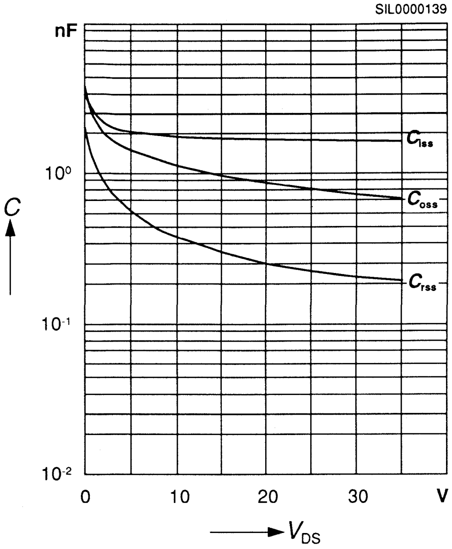
BUZ 12 A



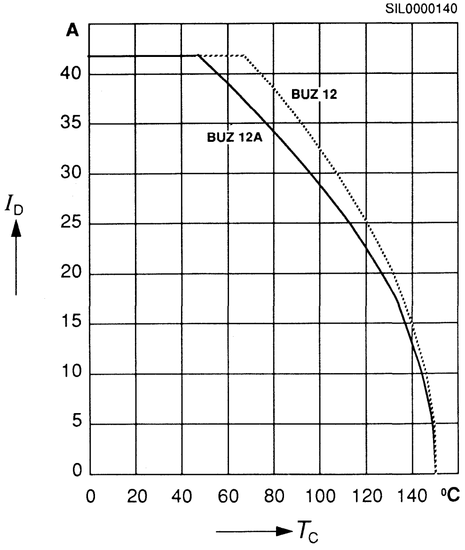
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



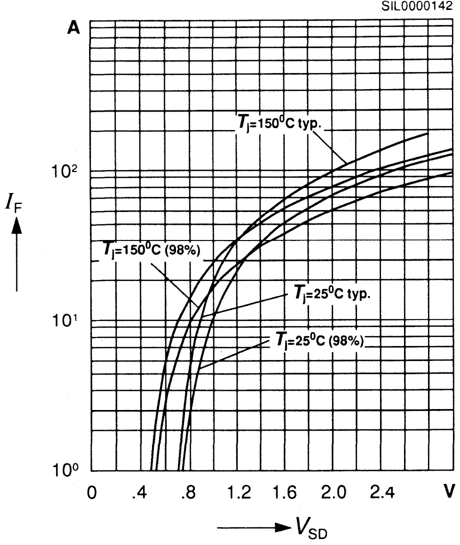
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



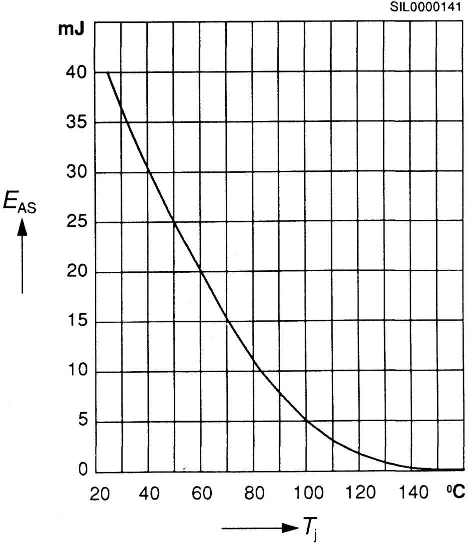
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



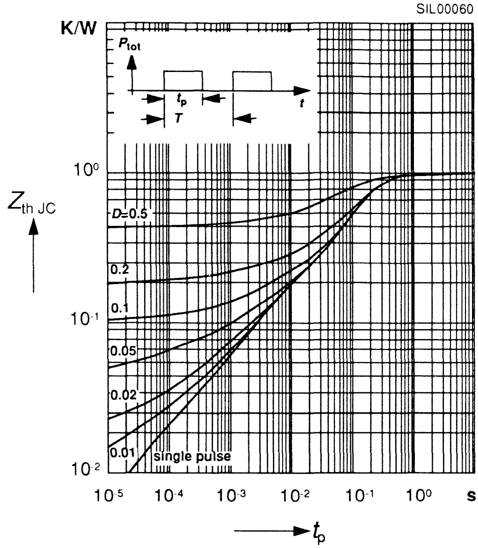
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



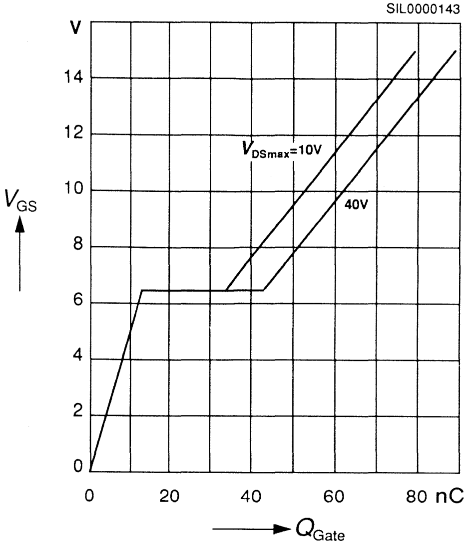
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 42$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 23.2$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



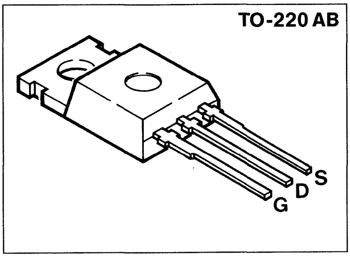
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls} = 63.0$ A



SIPMOS® Power MOS Transistor **BUZ 12 AL**

V_{DS} = 50 V
I_D = 42 A
$R_{DS(on)}$ = 0.035 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB[1]



Type	Ordering code
BUZ 12 AL	C67078-S1332-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	50	V
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage aperiodic	V_{gs}	± 20	
Continuous drain current, T_C = 44 °C	I_D	42	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	168	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	42	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	2.5	mJ
Avalanche energy, single pulse $I_D = 42$ A, $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$ $L = 23.2\ \mu$H, $T_j = 25$ °C	E_{AS}	41	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 21$ A	$R_{DS(on)}$	-	0.035	Ω

Dynamic characteristics

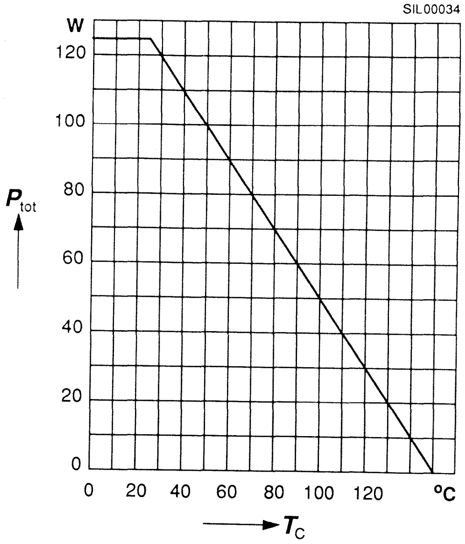
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 21$ A	g_{fs}	16.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	2800	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	1200	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	450	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	60	ns
	t_r	-	240	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	350	
	t_f	-	200	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

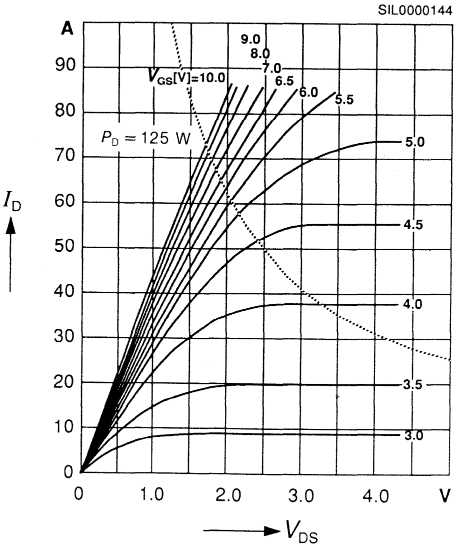
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	42	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	168	
Diode forward on-voltage $I_F = 84$ A, $V_{GS} = 0$	V_{SD}	–	2.2	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.25 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

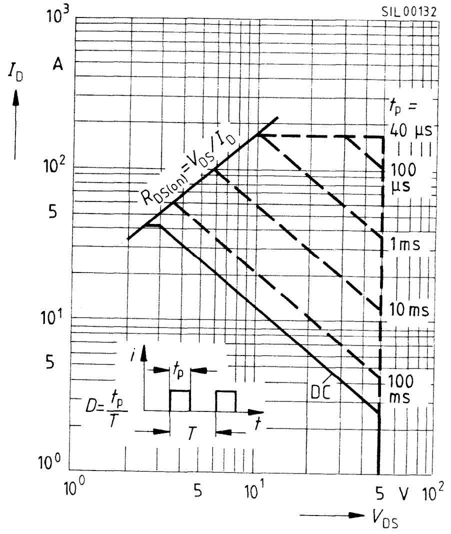
Total power dissipation $P_{tot} = f(T_C)$



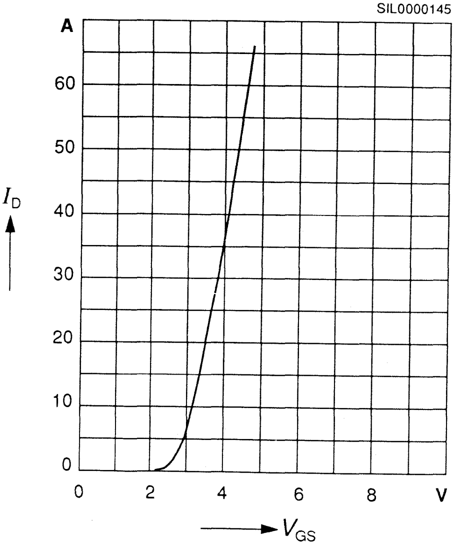
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



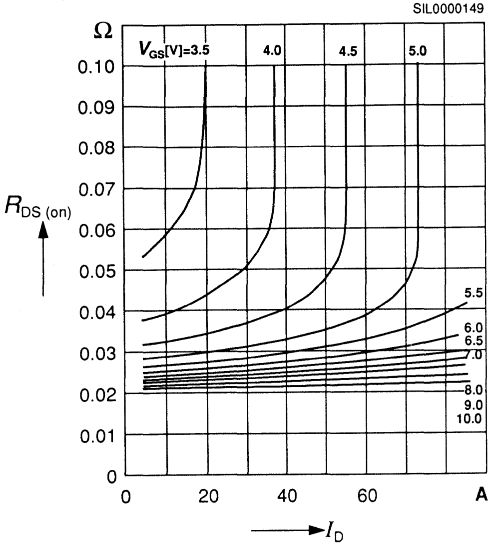
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



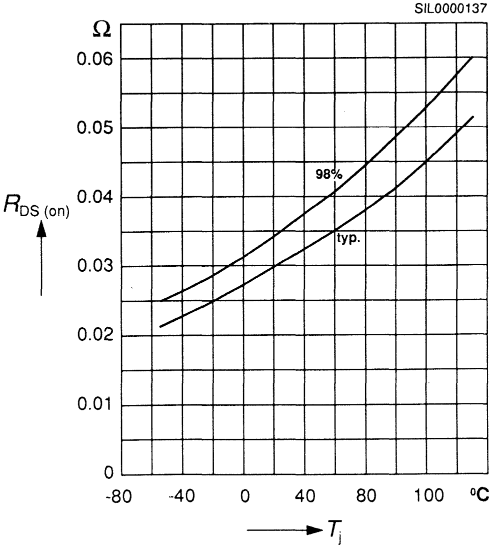
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



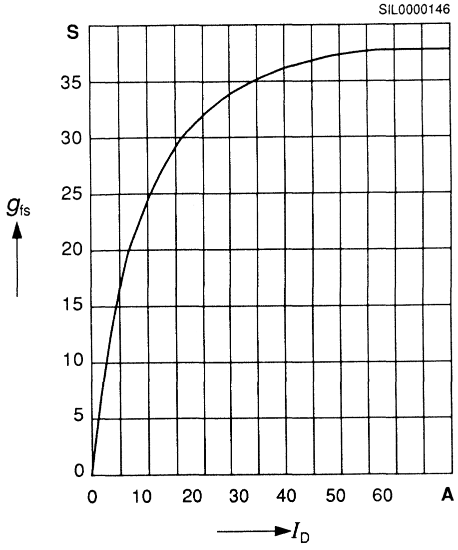
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



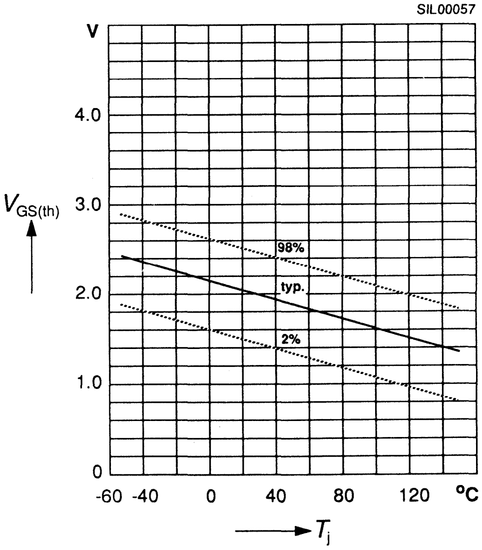
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 21$ A, $V_{GS} = 5$ V, (spread)



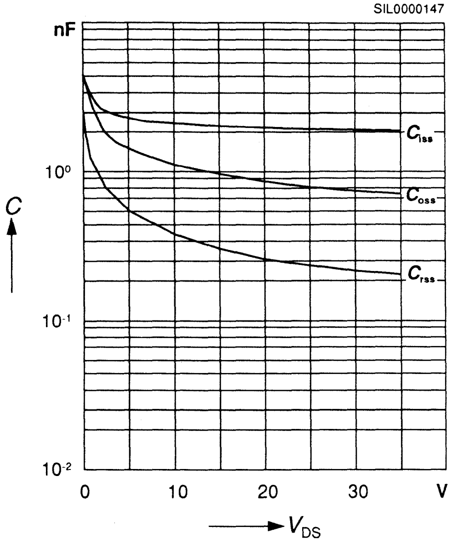
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



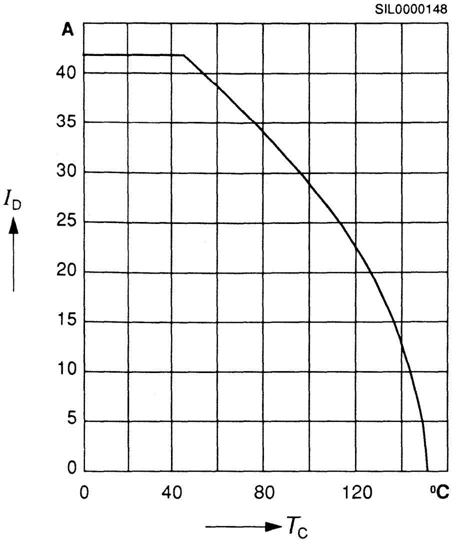
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



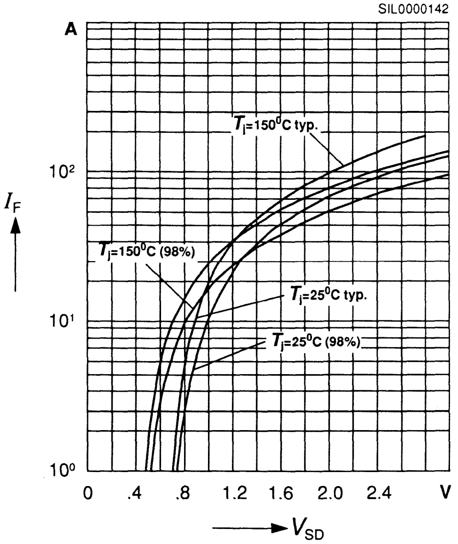
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



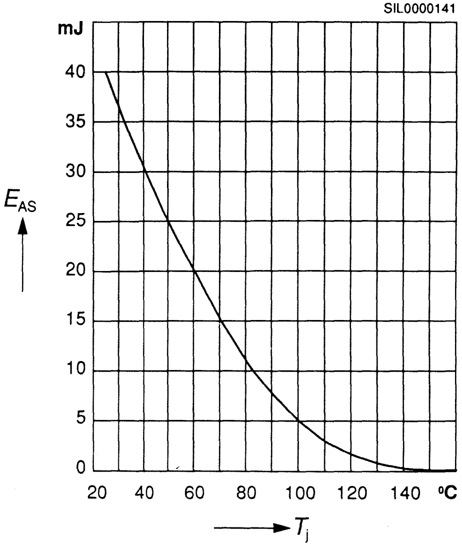
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



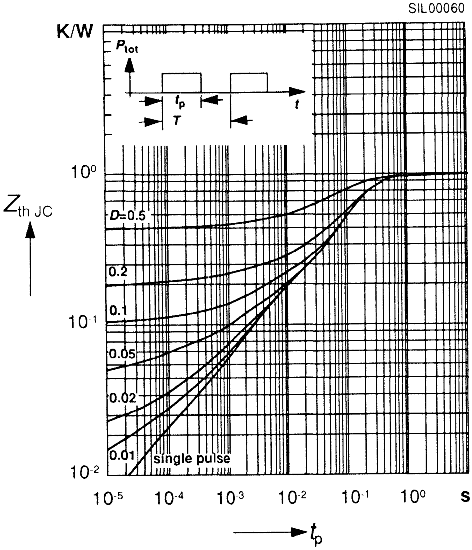
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



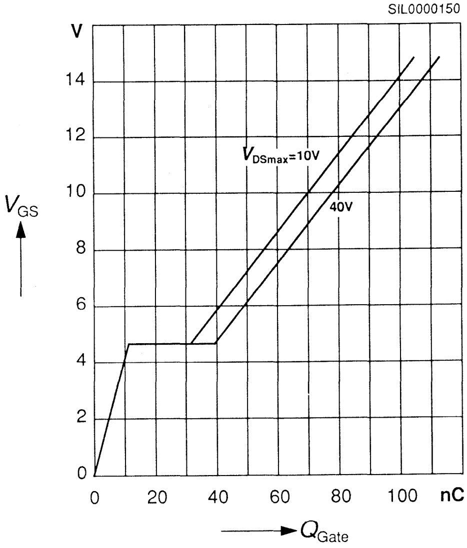
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 42$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 23.2$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 63$ A



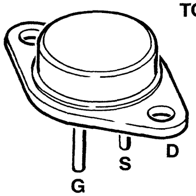
SIEMENS

SIPMOS® Power MOS Transistors

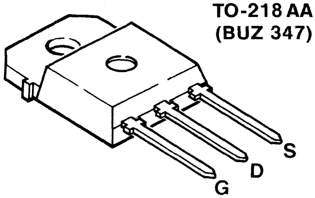
BUZ 15
BUZ 347

V_{DS} = 50 V
I_D = 45 A
$R_{DS(on)}$ = 0.03 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Packages: TO-204 AE (TO-3),
  TO-218 AA (TOP-3) [1]



TO-204 AE
(BUZ 15)



TO-218 AA
(BUZ 347)

Type	Ordering code
BUZ 15	C67078-A1001-A2
BUZ 347	C67078-S3115-A2

Maximum Ratings

Parameter	Symbol	BUZ 15	 347	Unit
Drain-source voltage	V_{DS}	50		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, $T_C = 28$ °C	I_D	45		A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	180		
Avalanche current, limited by $T_{j\ max}$	I_{AR}	45		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	2.5		mJ
Avalanche energy, single pulse $V_{DD} = 25$ V, $R_{GS} = 25$ Ω, $T_j = 25$ °C $I_D = 45$ A, $L = 20.2$ µH	E_{AS}	41		
Operating and storage temperature range	T_j T_{stg}	− 55 … + 150		°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125		W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 45		K/W
DIN humidity category, DIN 40 040		C	E	–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

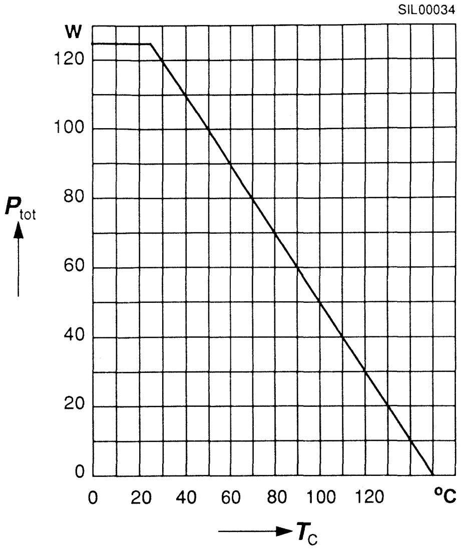
Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	50	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C		I_{DSS}	– –	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 29$ A $I_D = 28$ A	BUZ 15 BUZ 347	$R_{DS(on)}$	– –	0.030 0.030	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 29$ A $I_D = 28$ A	BUZ 15 BUZ 347	g_{fs}	7.0 12.0	– –	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	2400	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	1200	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	450	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A		$t_{d(on)}$	–	50	ns
		t_r	–	130	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A		$t_{d(off)}$	–	280	
		t_f	–	180	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

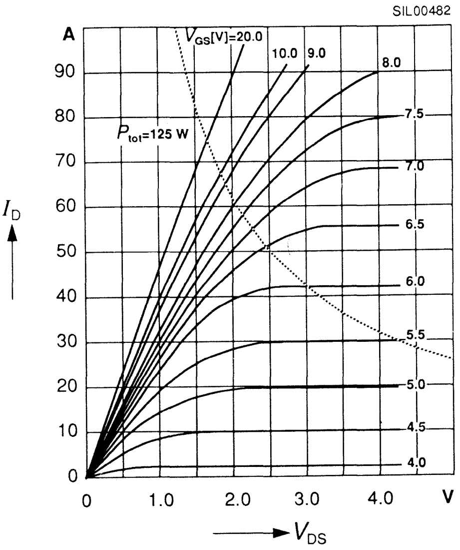
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C		I_S	–	45	A
Pulsed reverse drain current $T_C = 25$ °C		I_{SM}	–	180	
Diode forward on-voltage $I_F = 90$ A, $V_{GS} = 0$	BUZ 15	V_{SD}	–	2.2	V
	BUZ 347		–	1.9	
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	80 typ.	– –	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	0.14 typ.	– –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

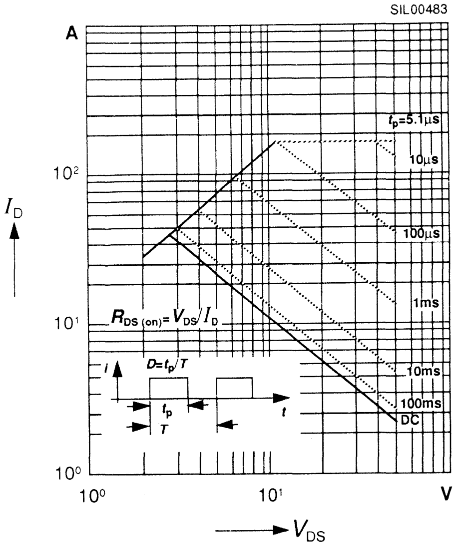
Total power dissipation $P_{tot} = f(T_C)$



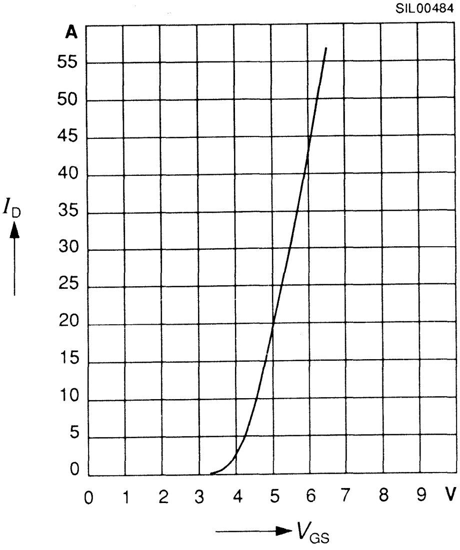
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



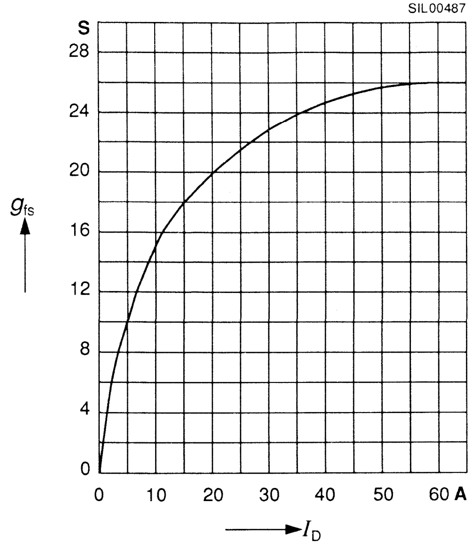
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



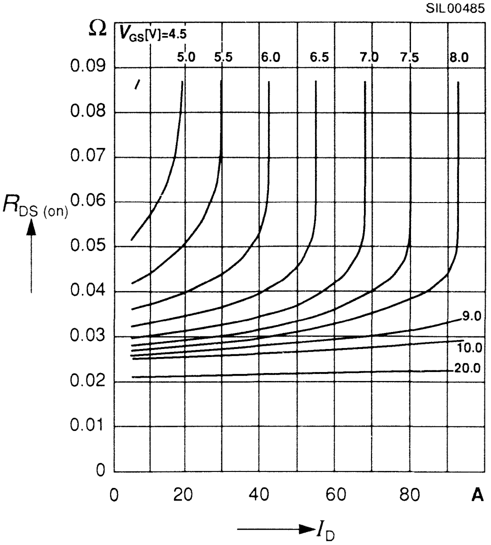
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



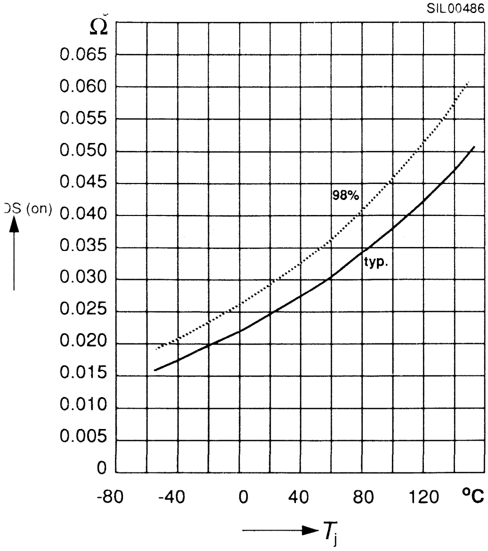
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



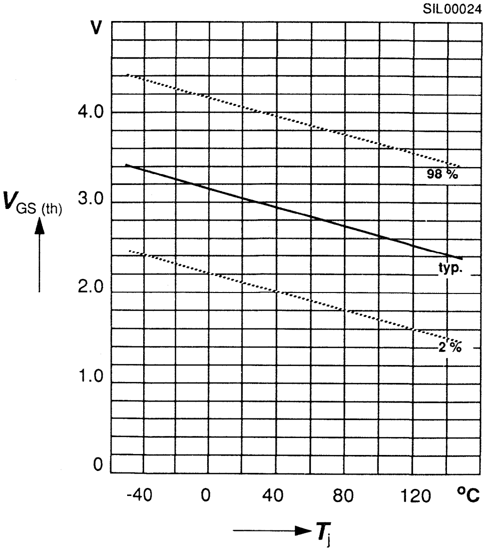
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



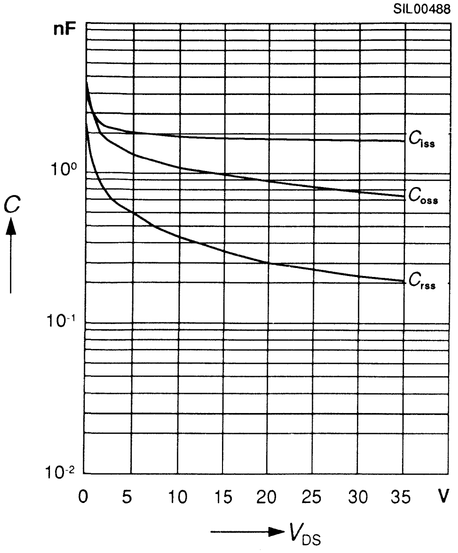
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 29$ A, $V_{GS} = 10$ V, (spread)



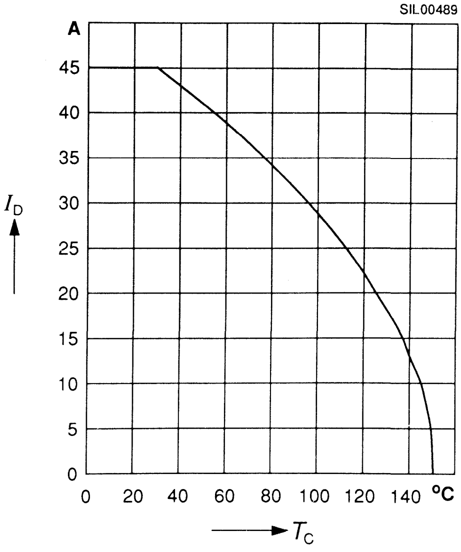
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



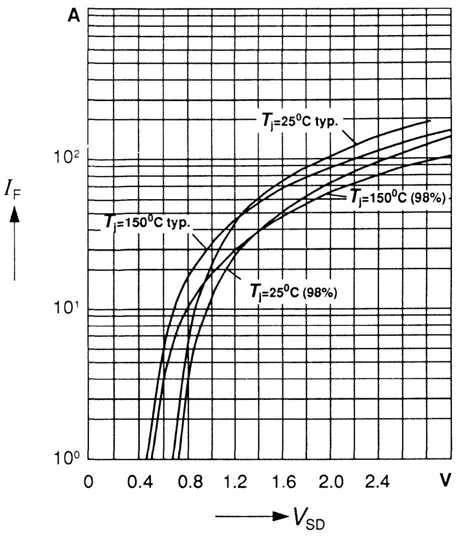
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



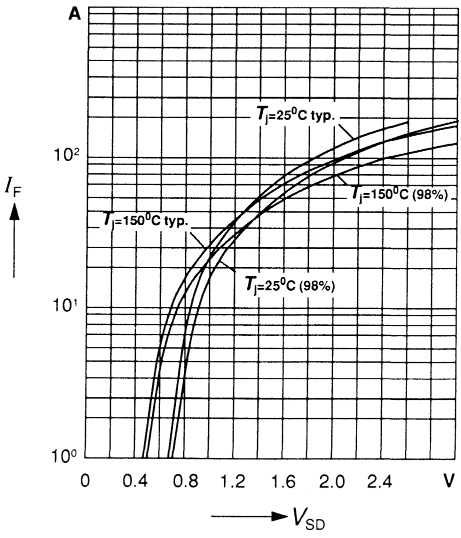
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



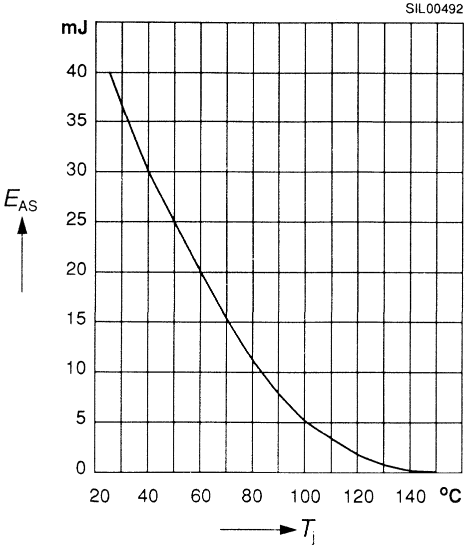
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 15



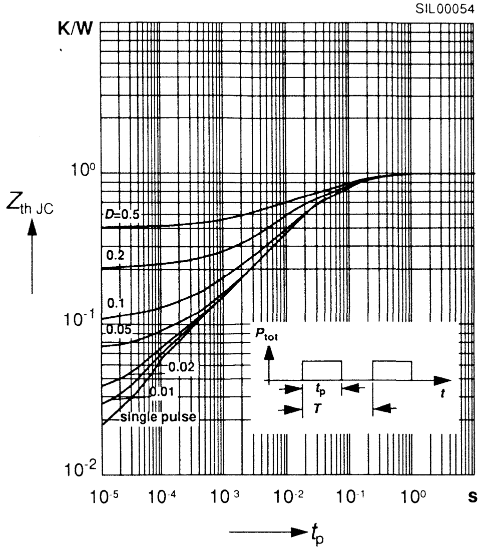
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 347



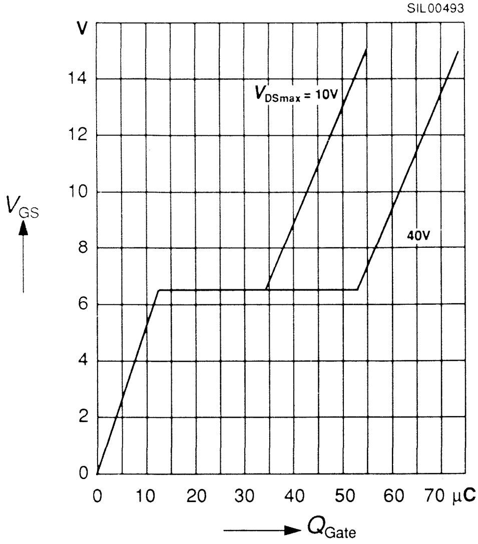
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 45$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 20.2\ \mu$H



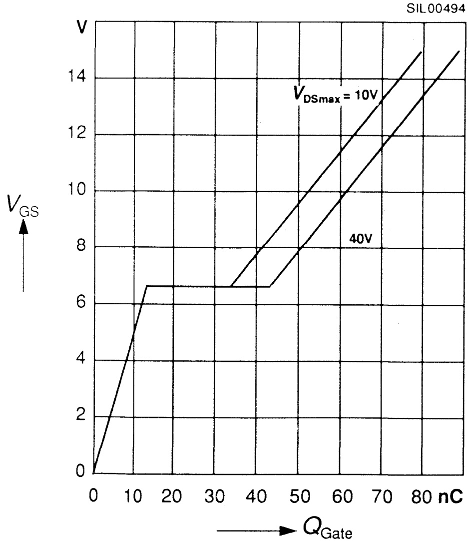
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 63.0$ A
BUZ 15



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 63.0$ A
BUZ 347



SIPMOS® Power MOS Transistors

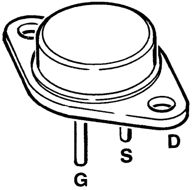
BUZ 16 BUZ 346 BUZ 346 S2

V_{DS} = 50 ... 60 V
I_D = 48 ... 58 A
$R_{DS(on)}$ = 0.018 Ω

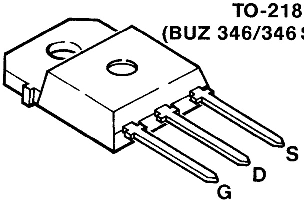
- N channel
- Enhancement mode
- Avalanche-proof
- Packages: TO-204 AE (TO-3)
  TO-218 AA (TOP-3) [1]

Type	Ordering code
BUZ 16	C67078-A1020-A2
BUZ 346	C67078-S3120-A2
BUZ 346 S2	C67078-S3131-A2

TO-204 AE (BUZ 16)



TO-218 AA (BUZ 346/346 S2)



Maximum Ratings

Parameter	Symbol	BUZ 16	BUZ 346	BUZ 346 S2	Unit
Drain-source voltage	V_{DS}	50		60	V
Gate-source voltage	V_{GS}	± 20			
Continuous drain current, T_C = 79/73/71 °C	I_D	48	58		A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	192	232		
Avalanche current, limited by $T_{j\ max}$	I_{AR}	48	58		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	4.5			mJ
Avalanche energy, single pulse V_{DD} = 25 V, R_{GS} = 25 Ω, T_j = 25 °C	E_{AS}				
I_D = 48 A, L = 31.3 µH BUZ 16		72	–	–	
I_D = 58 A, L = 21.4 µH BUZ 346		–	72	–	
I_D = 58 A, L = 31.2 µH BUZ 346 S2		–	–	90	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125	170		W
Thermal resistance					K/W
chip - case	R_{thJC}	≤ 1.0	≤ 0.74		
chip - ambient, without heat sink	R_{thJA}	≤ 45	≤ 0.45		
DIN humidity category, DIN 40 040		C	E		–
IEC climatic category, DIN IEC 68-1		55/150/56			

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25\ °C$, unless otherwise specified.

Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	BUZ 16/346 BUZ 346 S2	$V_{(BR)DSS}$	50 60	– –	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{GS} = 0$ $V_{DS} = 50$ V $V_{DS} = 60$ V	BUZ 16/346 BUZ 346 S2	I_{DSS}			µA
$T_j = 25\ °C$			–	0.1	
$T_j = 125\ °C$			–	100	
Gate-source leakage current $V_{GS} = 20$ V $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V $I_D = 40$ A	BUZ 16	$R_{DS(on)}$	–	0.018	Ω
$I_D = 47$ A	BUZ 346		–	0.018	
$I_D = 46$ A	BUZ 346 S2		–	0.018	

Dynamic characteristics

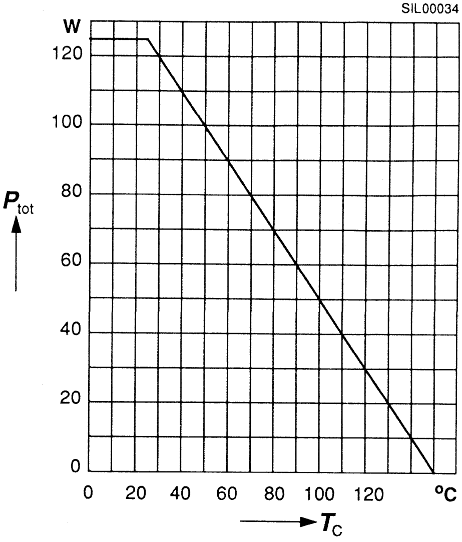
Parameter		Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 40$ A	BUZ 16	g_{fs}	30	–	S
$I_D = 47$ A	BUZ 346		30	–	
$I_D = 46$ A	BUZ 346 S2		20	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	4300	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	2100	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	750	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 3$ A		$t_{d(on)}$	–	80	ns
		t_r	–	210	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 3$ A		$t_{d(off)}$	–	560	
		t_f	–	330	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

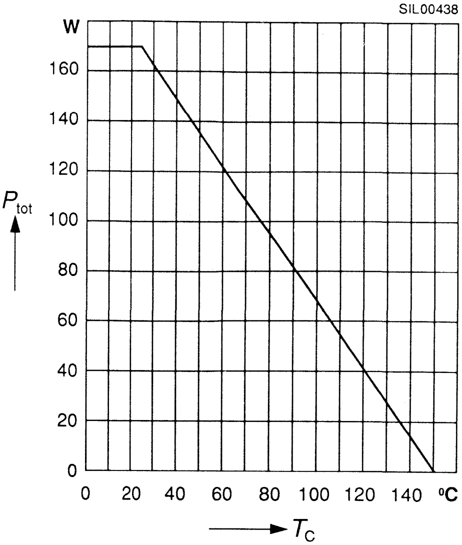
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	BUZ 16 BUZ 346 BUZ 346 S2	I_S	– – –	48 58 58	A
Pulsed reverse drain current $T_C = 25$ °C	BUZ 16 BUZ 346 BUZ 346 S2	I_{SM}	– – –	192 232 232	
Diode forward on-voltage $V_{GS} = 0$ $I_F = 96$ A $I_F = 116$ A $I_F = 116$ A	BUZ 16 BUZ 346 BUZ 346 S2	V_{SD}	– – –	2.0 2.0 1.9	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	100 typ.	– –	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	0.3 typ.	– –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

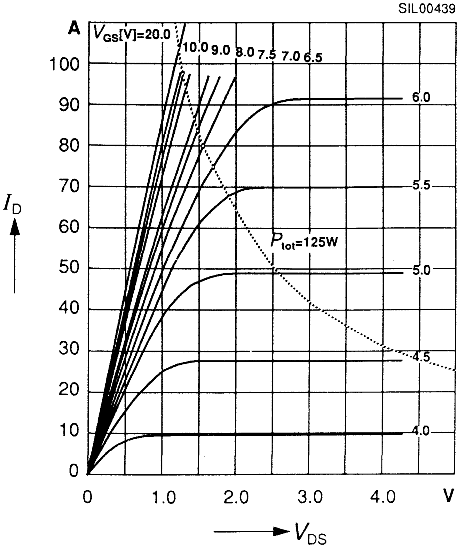
Total power dissipation $P_{tot} = f(T_C)$
BUZ 16



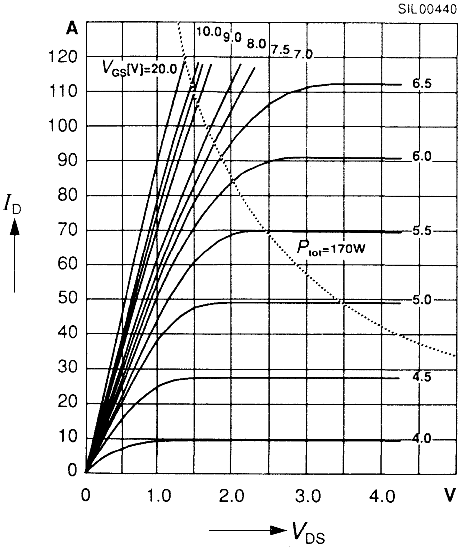
Total power dissipation $P_{tot} = f(T_C)$
BUZ 346 / 346 S2



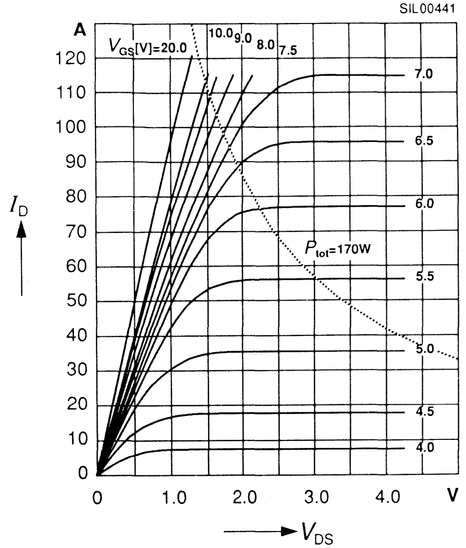
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 16



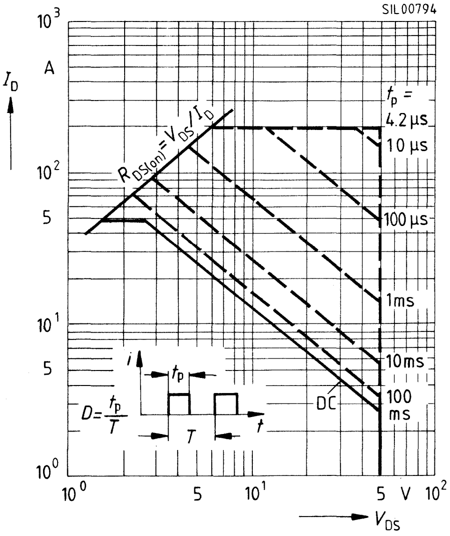
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 346



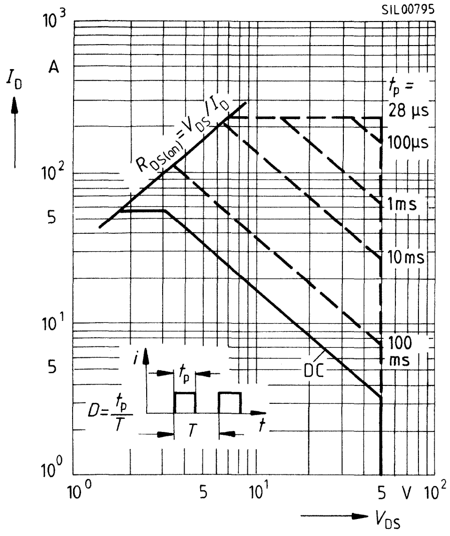
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BUZ 346 S2



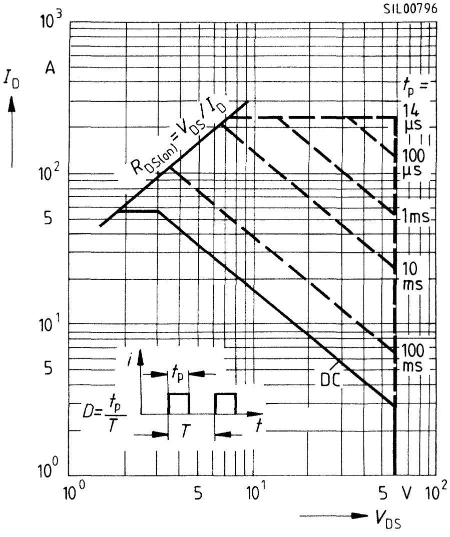
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 16



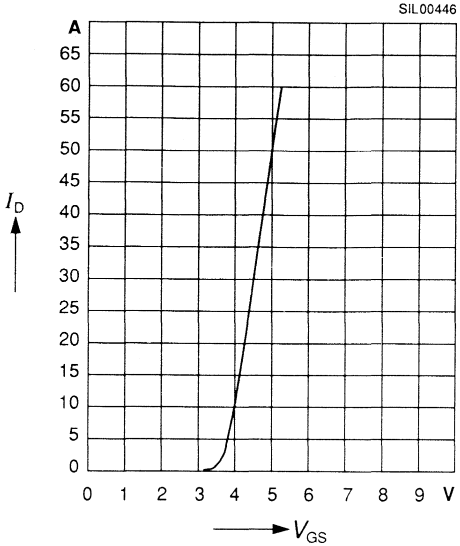
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 346



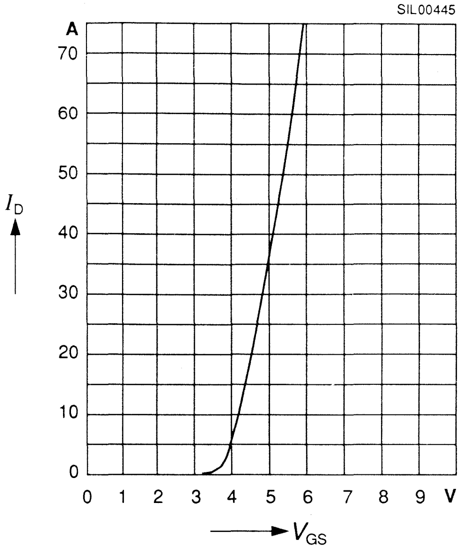
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 346 S2



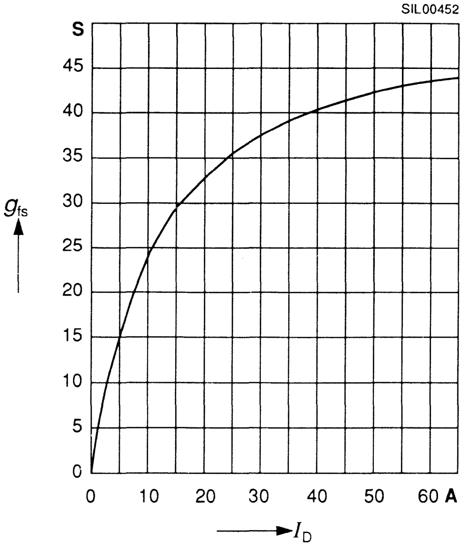
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25$ V
BUZ 16 / 346



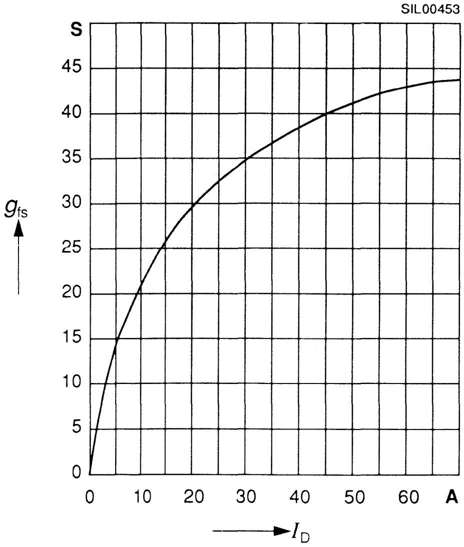
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25$ V
BUZ 346 S2



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$
BUZ 16 / 346

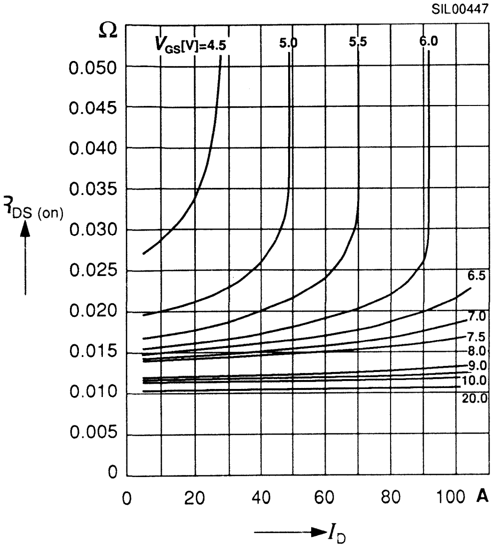


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$
BUZ 346 S2



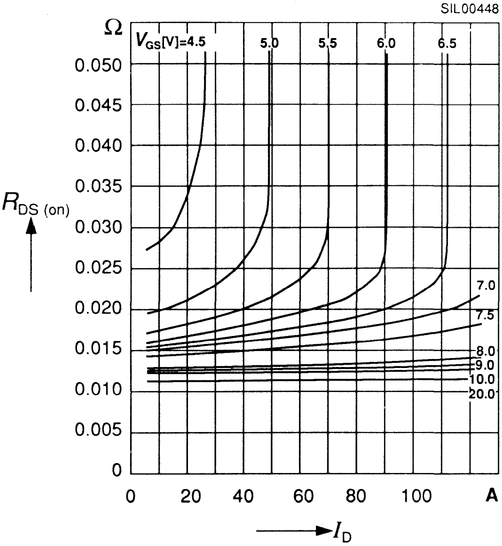
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 16



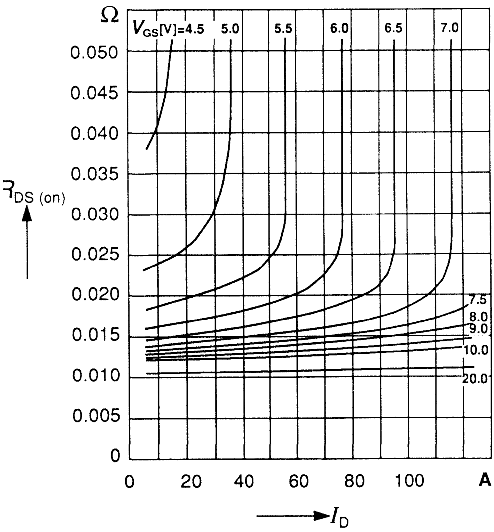
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 346



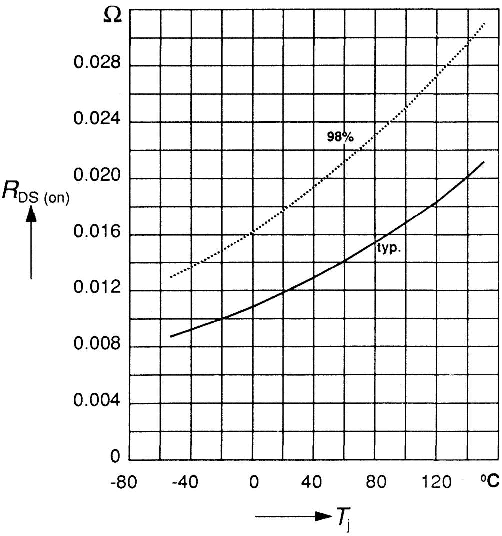
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 346 S2

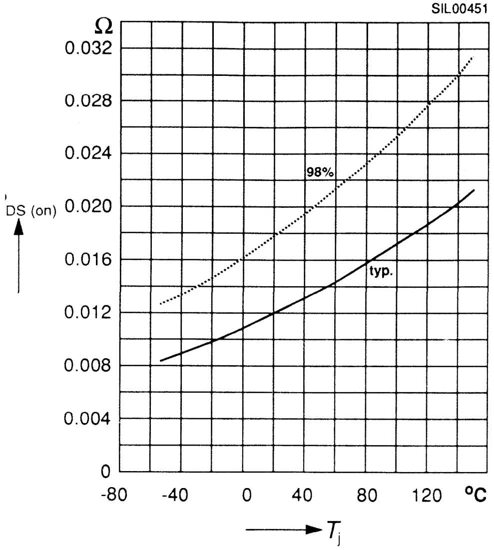


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 40$ A/47 A, $V_{GS} = 10$ V, (spread)

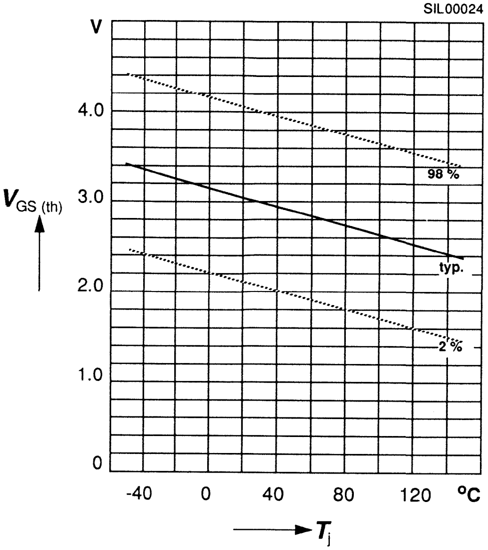
BUZ 16 / 346



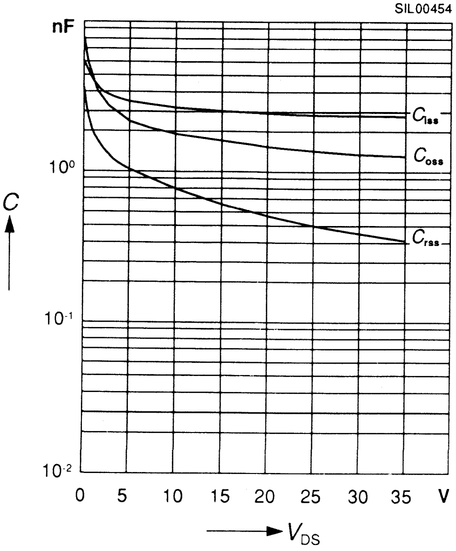
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 46$ A, $V_{GS} = 10$ V, (spread)
BUZ 346 S2



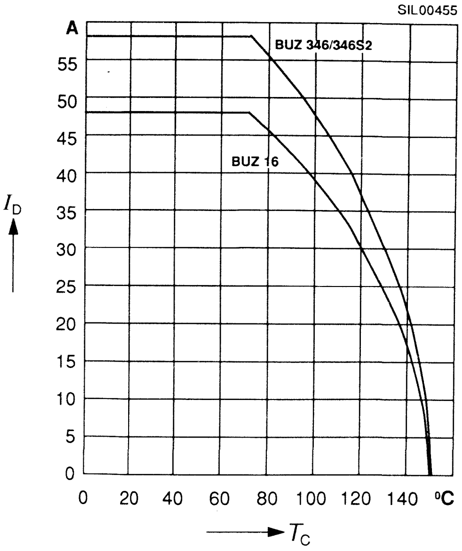
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



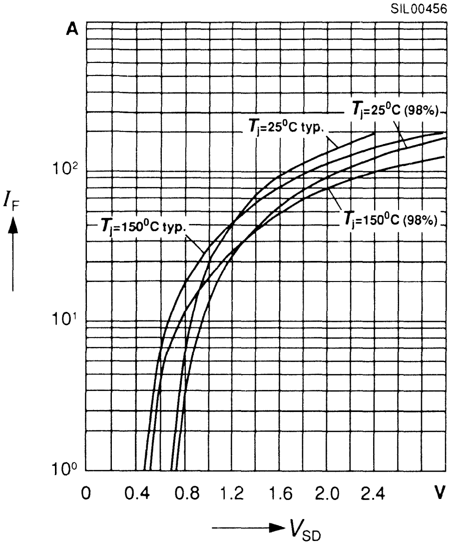
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



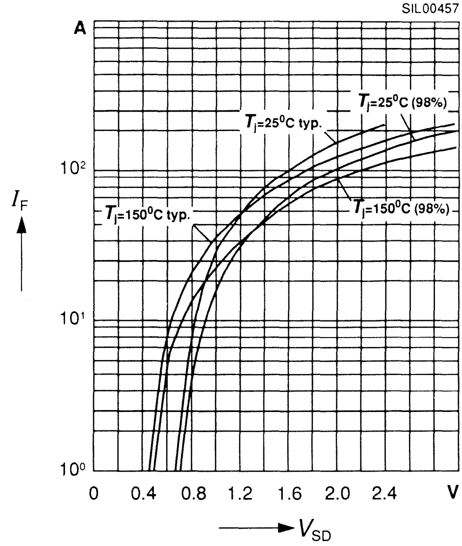
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



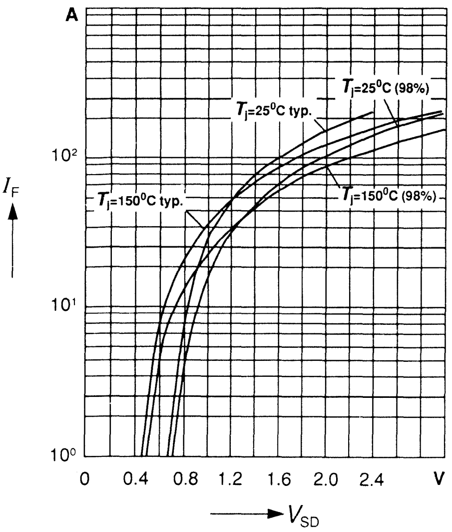
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80\ \mu s$, (spread)
BUZ 16



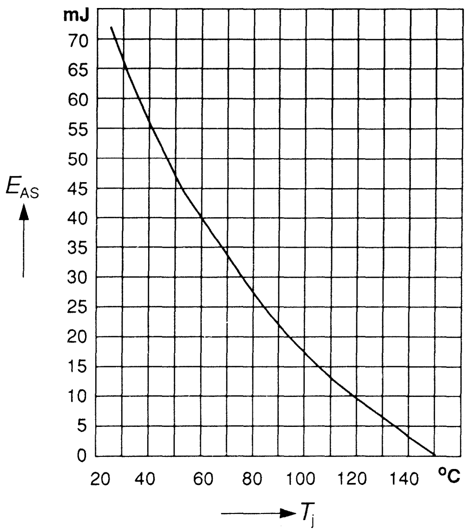
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80\ \mu s$, (spread)
BUZ 346



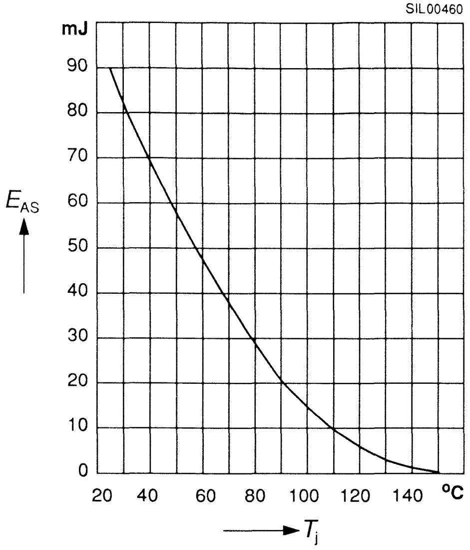
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80\ \mu s$, (spread)
BUZ 346 S2



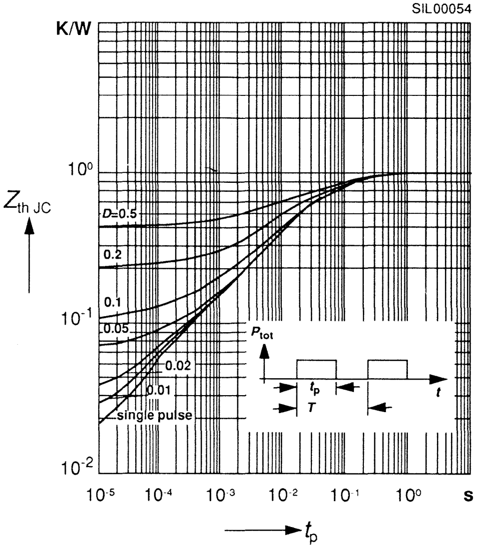
Avalanche energy $E_{AS} = f(T_j)$
parameter: $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$,
$I_D = 48$ A/58 A, $L = 31.3\ \mu H/21.4\ \mu H$
BUZ 16 / 346



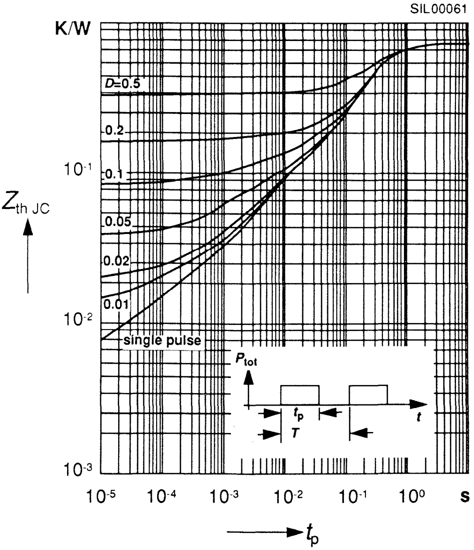
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 58$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 31.2\ \mu$H
BUZ 346 S2



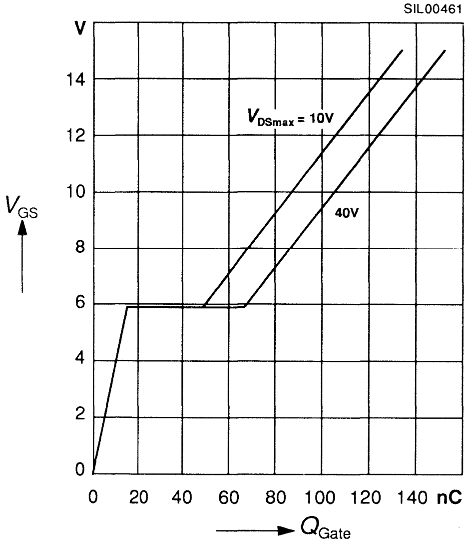
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$
BUZ 16



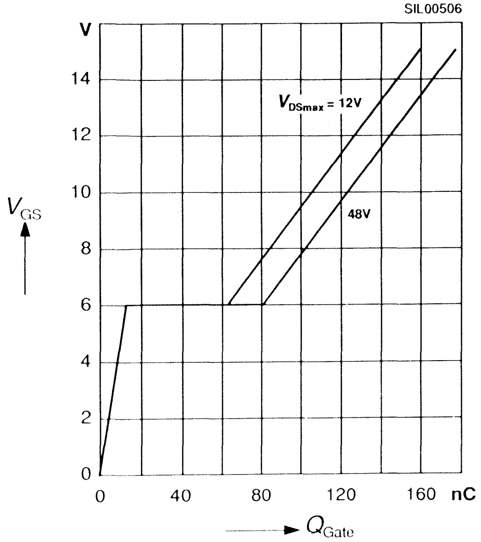
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$
BUZ 346 / 346 S2



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 87.0$ A
BUZ 16



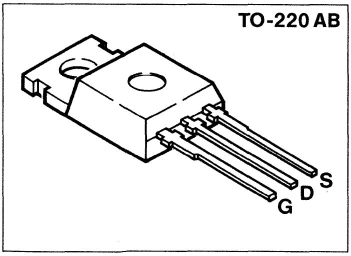
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 87.0$ A
BUZ 346 / 346 S2



SIPMOS® Power MOS Transistor BUZ 20

V_{DS} = 100 V
I_D = 13.5 A
$R_{DS(on)}$ = 0.2 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 20	C67078-S1302-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 28$ °C	I_D	13.5	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	54	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	13.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	7.9	mJ
Avalanche energy, single pulse $I_D = 13.5$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 486$ µH, $T_j = 25$ °C	E_{AS}	59	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	1.0	
$T_j = 125$ °C		-	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 8.5$ A	$R_{DS(on)}$	-	0.2	Ω

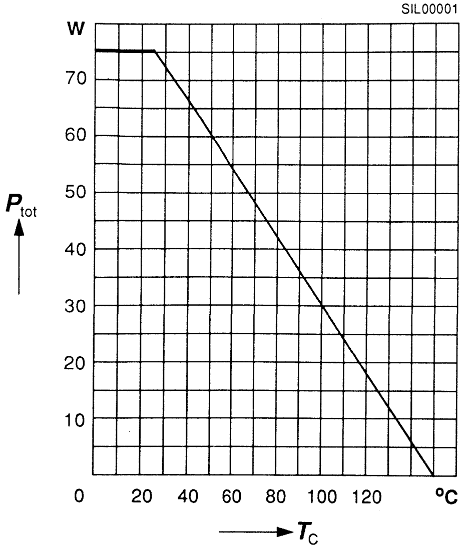
Parameter	Symbol	min.	max.	Unit
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 8.5$ A	g_{fs}	3.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	730	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	290	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	140	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	120	
	t_f	-	65	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

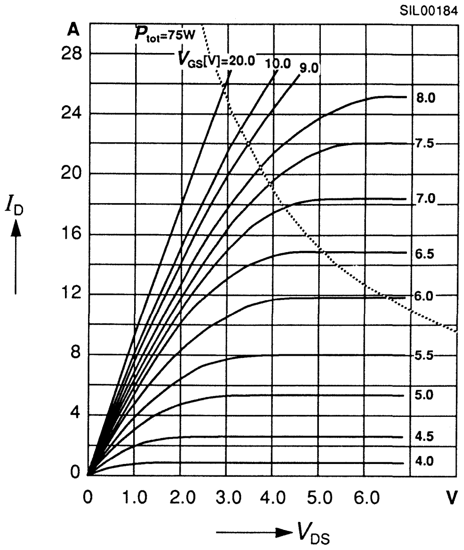
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	13.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	54	
Diode forward on-voltage $I_F = 27$ A, $V_{GS} = 0$	V_{SD}	–	1.6	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	170 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.30 typ.	–	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

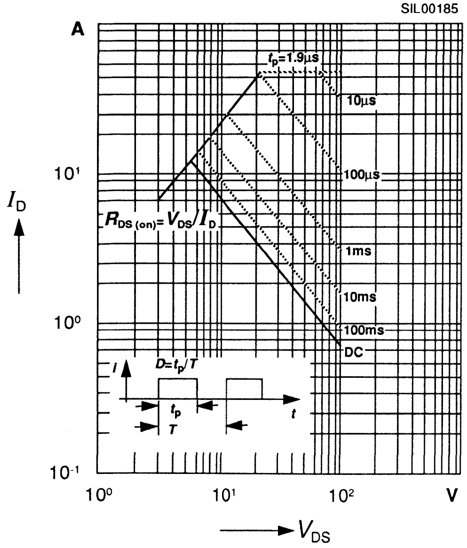
Total power dissipation $P_{tot} = f(T_C)$



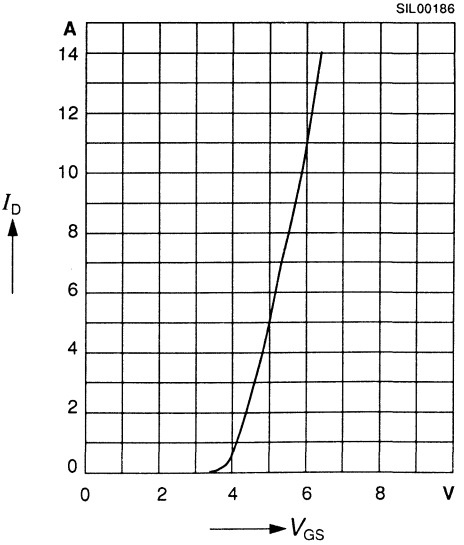
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



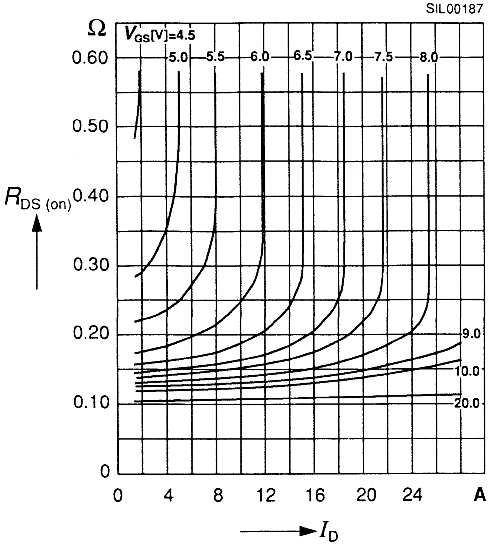
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



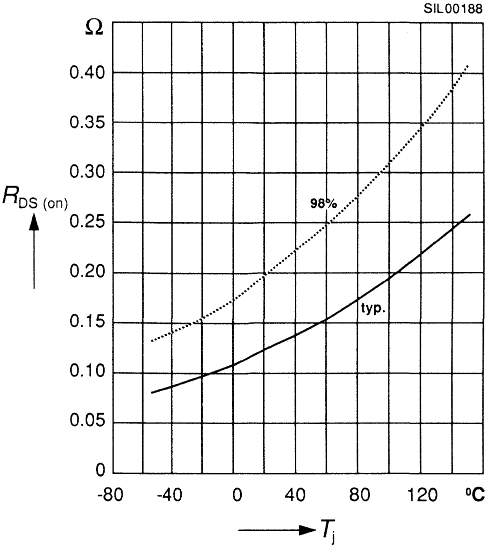
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



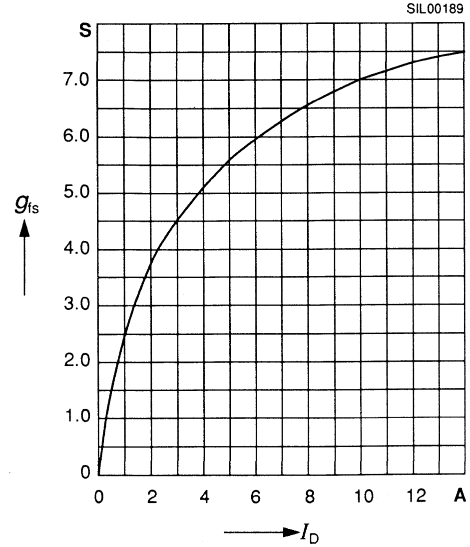
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



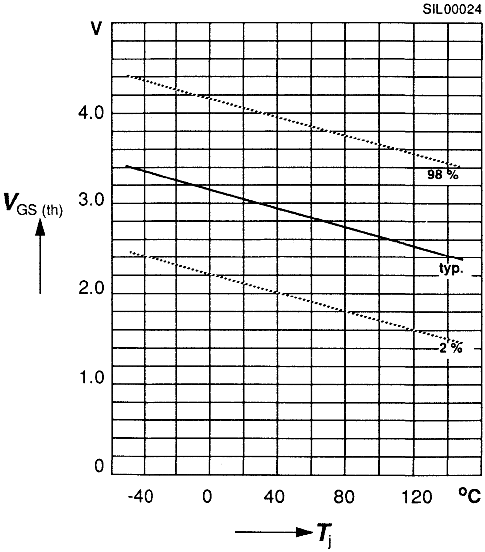
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 8.5 A, V_{GS} = 10 V, (spread)



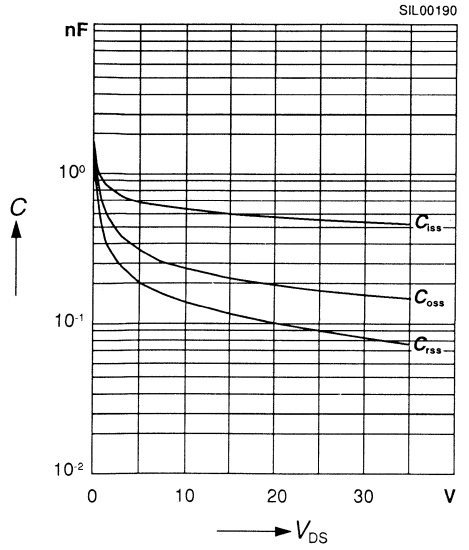
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



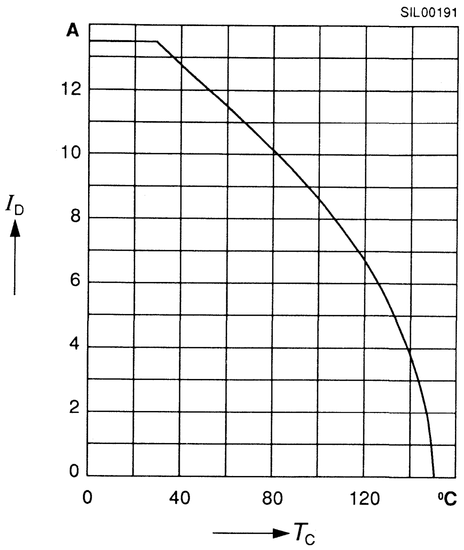
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



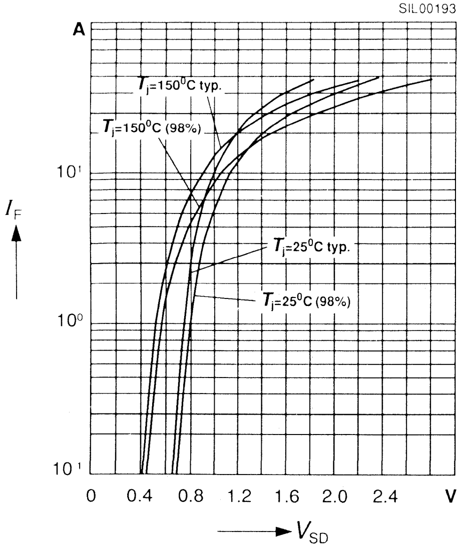
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



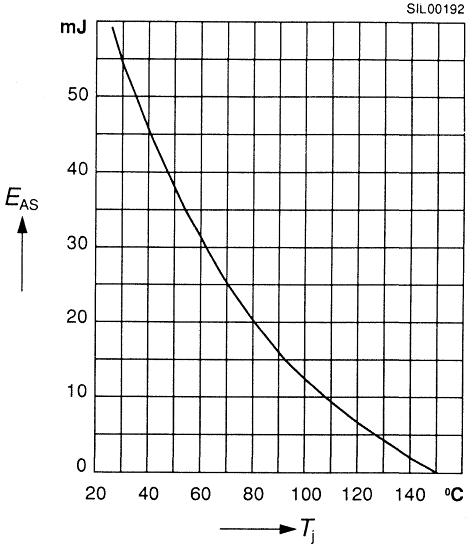
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



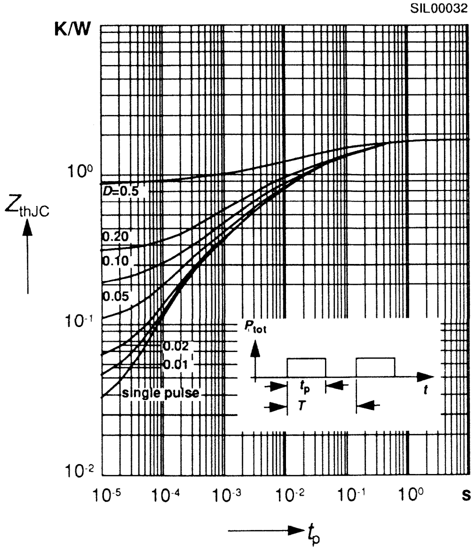
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



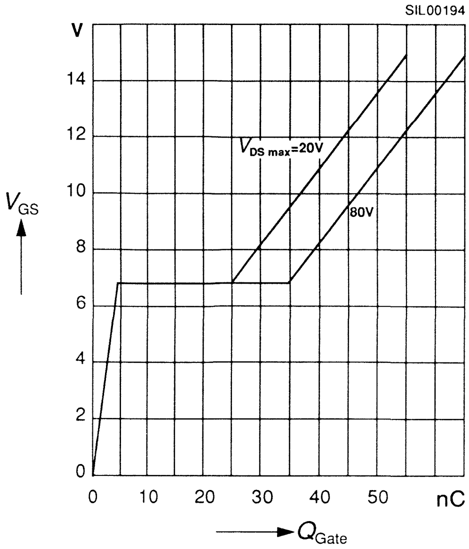
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 13.5$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 486$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 21.0$ A

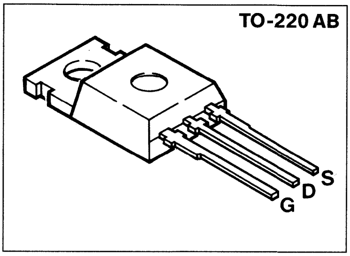


SIEMENS

SIPMOS® Power MOS Transistor BUZ 21

V_{DS} = 100 V
I_D = 21 A
$R_{DS(on)}$ = 0.085 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 21	C67078-S1308-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	21	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	84	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	21	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	11	mJ
Avalanche energy, single pulse $I_D = 21$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 340$ µH, $T_j = 25$ °C	E_{AS}	100	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	1.0	
$T_j = 125$ °C		-	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 13$ A	$R_{DS(on)}$	-	0.085	Ω

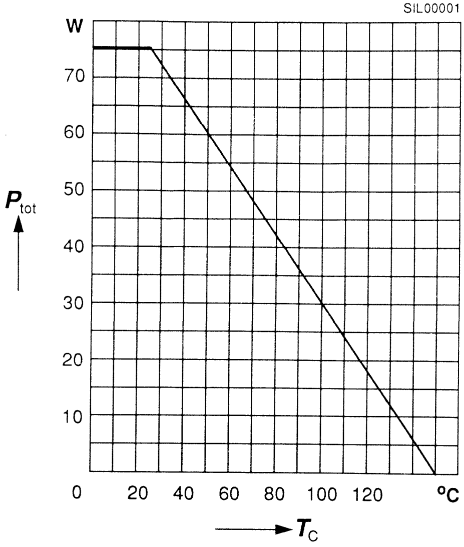
Parameter	Symbol	min.	max.	Unit
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 13$ A	g_{fs}	8	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1300	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	530	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	240	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	40	ns
	t_r	-	75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	210	
	t_f	-	110	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

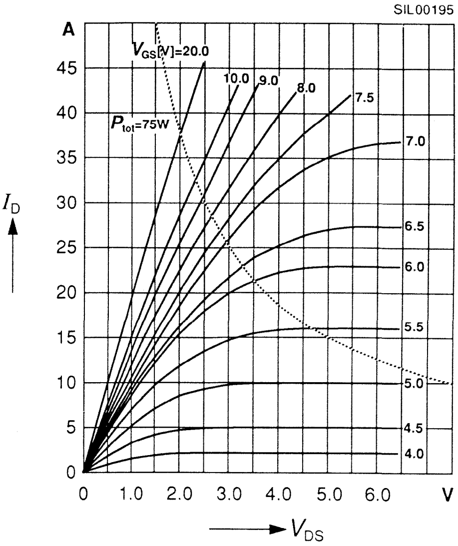
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	21	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	84	
Diode forward on-voltage $I_F = 42$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	150 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.48 typ.	–	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

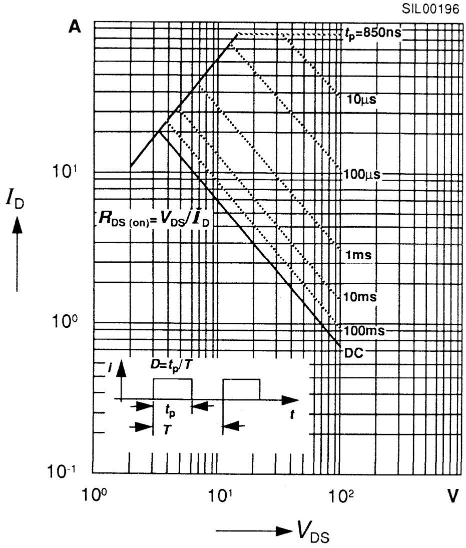
Total power dissipation $P_{tot} = f(T_C)$



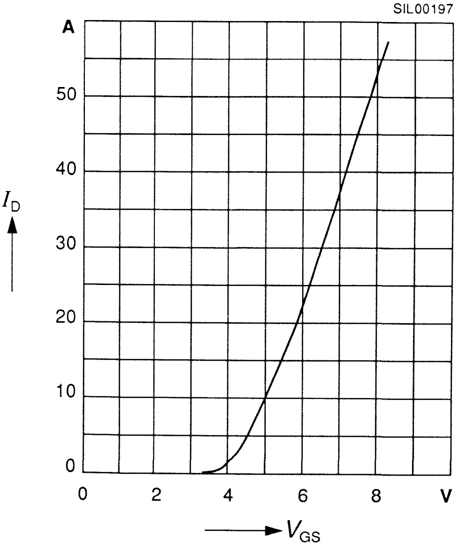
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



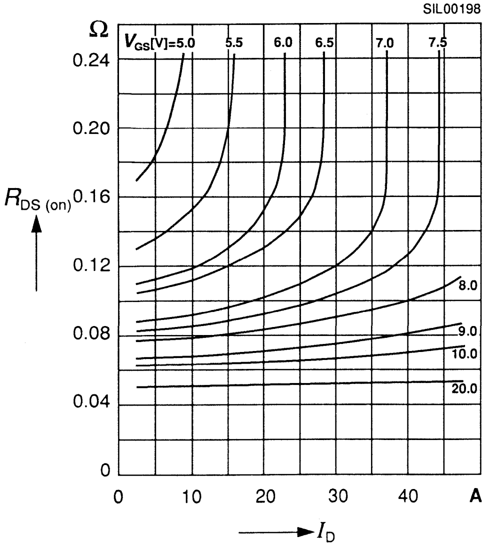
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



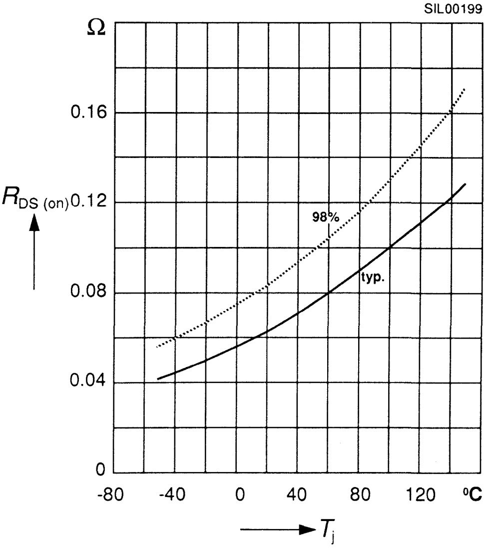
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



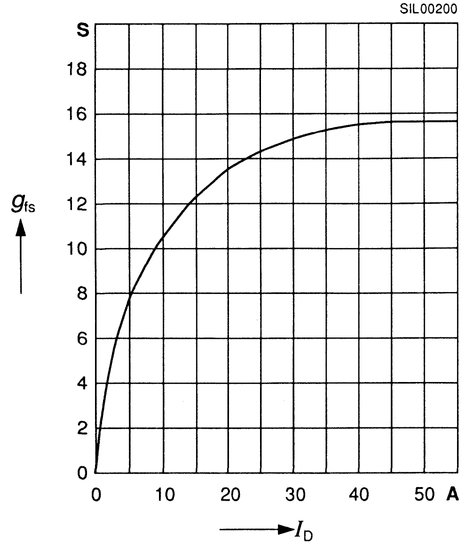
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



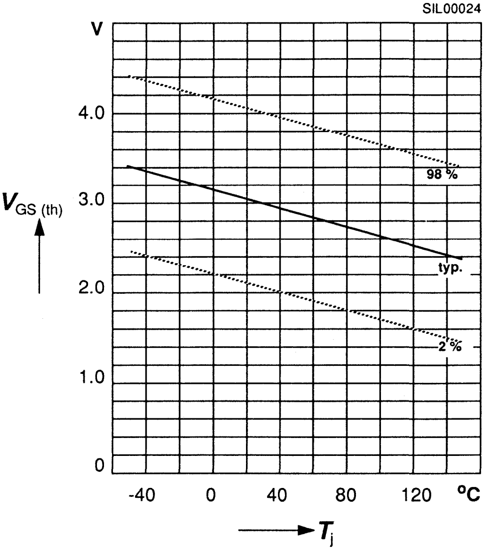
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 13 A, V_{GS} = 10 V, (spread)



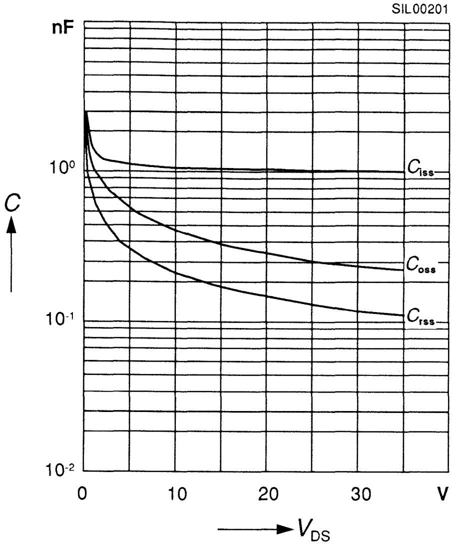
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



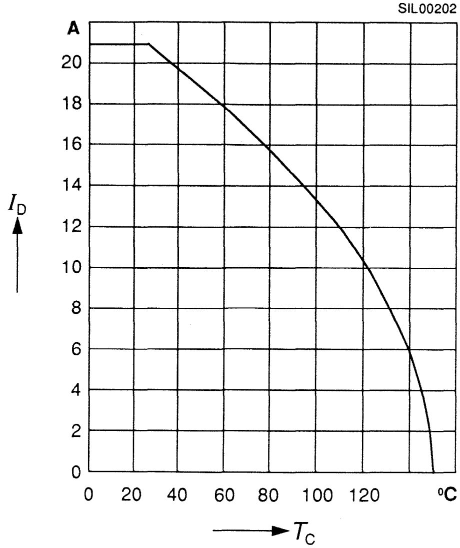
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



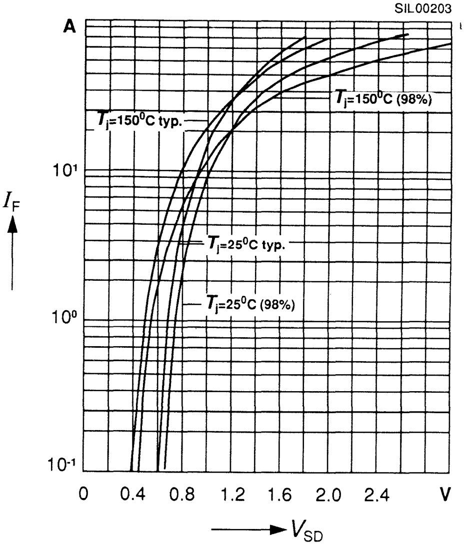
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



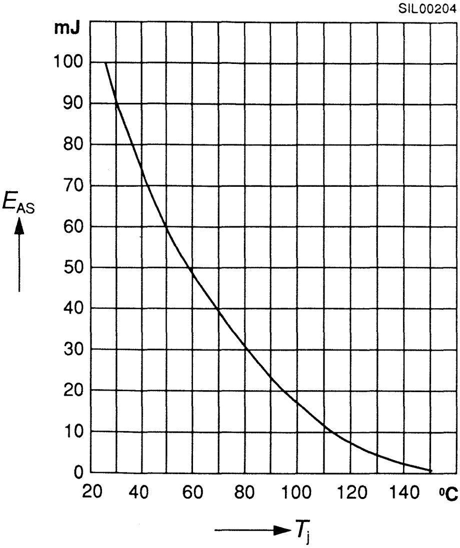
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



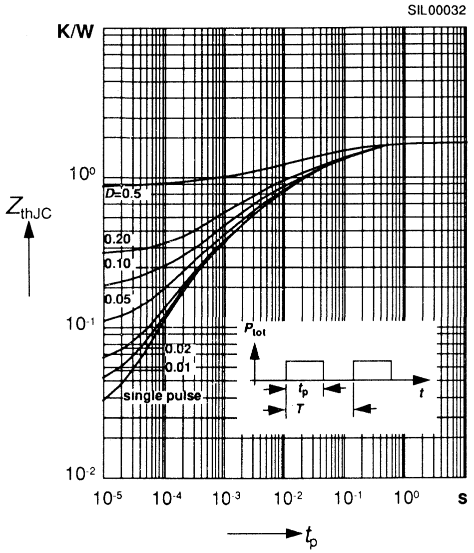
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



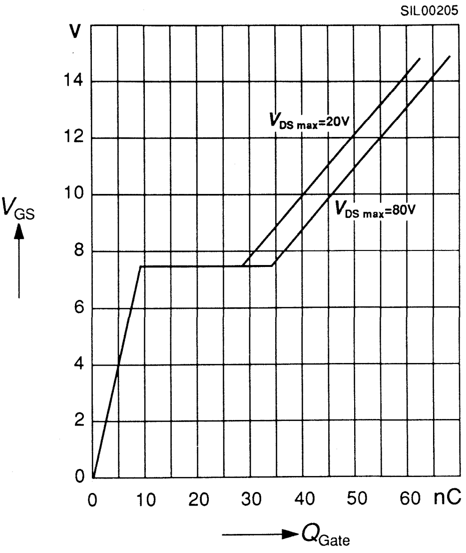
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 21$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 340$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 36.0$ A

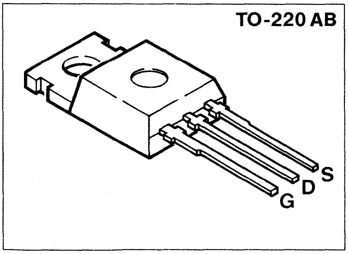


SIEMENS

SIPMOS® Power MOS Transistor BUZ 21 L

V_{DS} = 100 V
I_D = 21 A
$R_{DS(on)}$ = 0.085 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 21 L	C67078-S1338-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	21	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	84	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	21	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	11.5	mJ
Avalanche energy, single pulse $I_D = 21$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 340$ µH, $T_j = 25$ °C	E_{AS}	100	
Operating and storage temperature range	T_j T_{stg}	−55 ... +150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current V_{DS} = 100 V, V_{GS} = 0 T_j = 25 °C T_j = 125 °C	I_{DSS}	- -	1.0 100	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	-	100	nA
Drain-source on-resistance V_{GS} = 5 V, I_D = 10.5 A	$R_{DS(on)}$	-	0.085	Ω

Dynamic characteristics

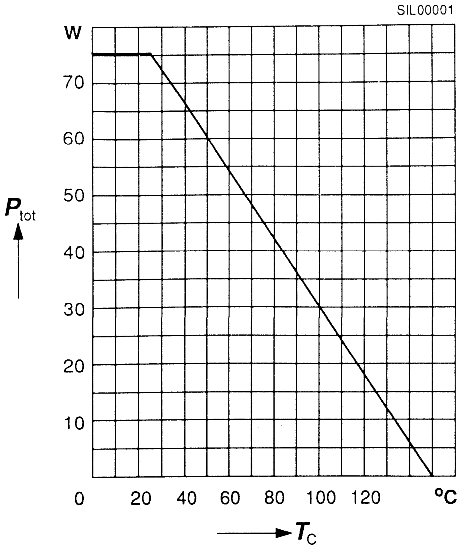
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 10.5 A	g_{fs}	8	-	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	-	1500	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	-	580	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	-	260	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 30 V, V_{GS} = 5 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(on)}$	-	40	ns
	t_r	-	170	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 30 V, V_{GS} = 5 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(off)}$	-	270	
	t_f	-	130	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

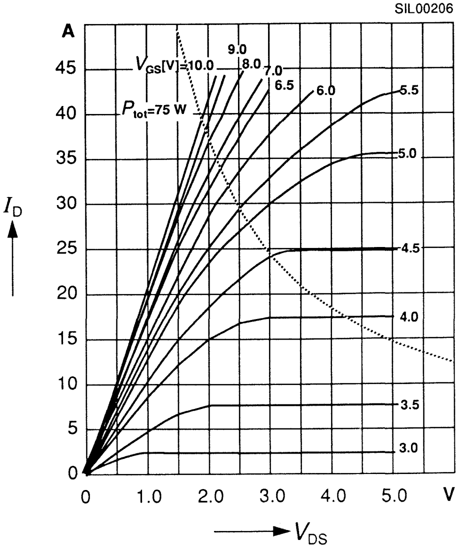
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	21	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	84	
Diode forward on-voltage $I_F = 42$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	150 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.58 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

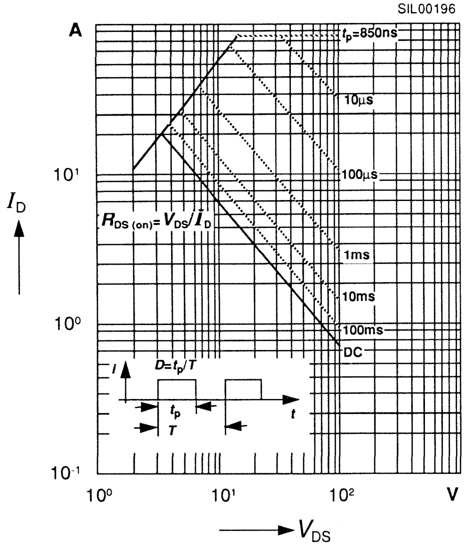
Total power dissipation $P_{tot} = f(T_C)$



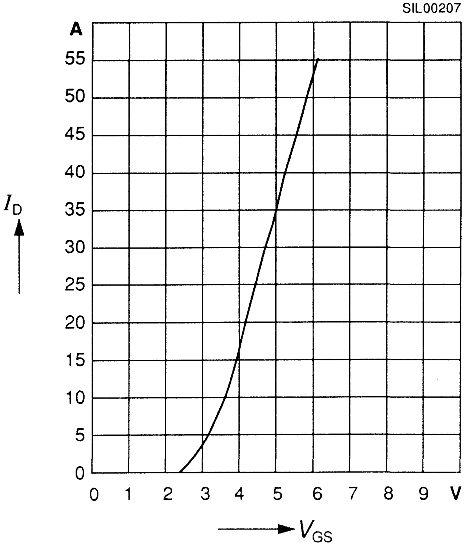
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



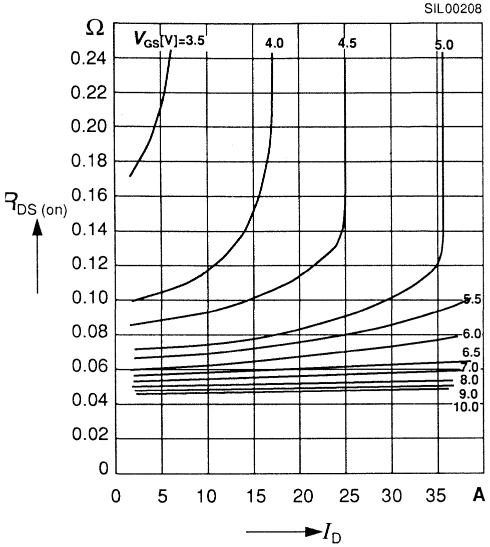
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



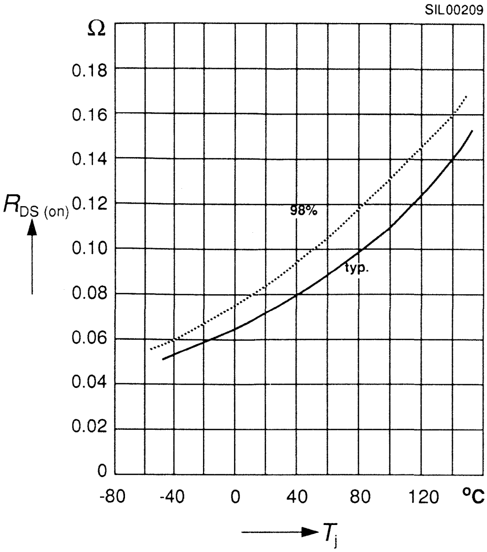
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



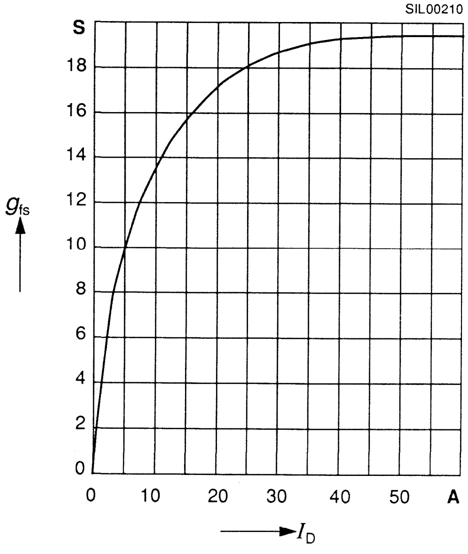
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



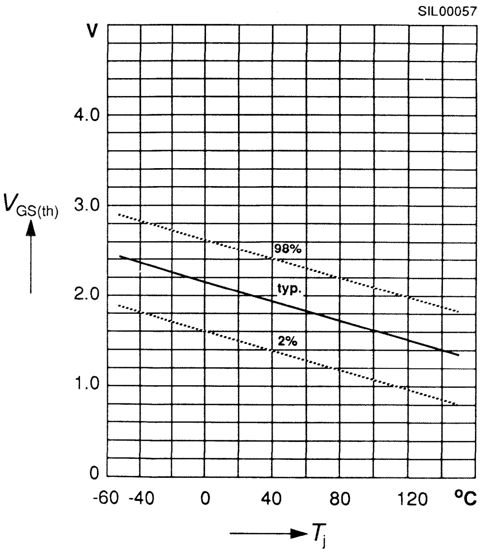
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 10.5$ A, $V_{GS} = 5$ V, (spread)



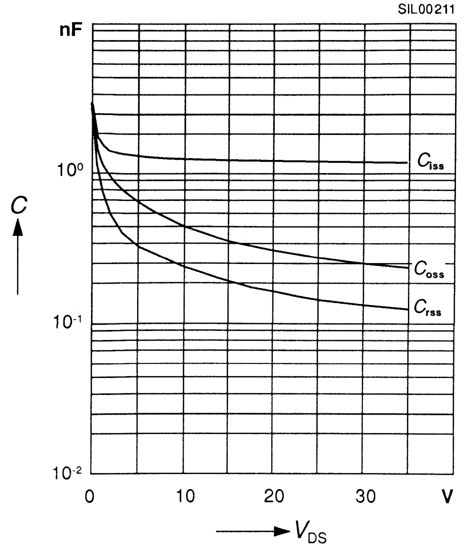
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



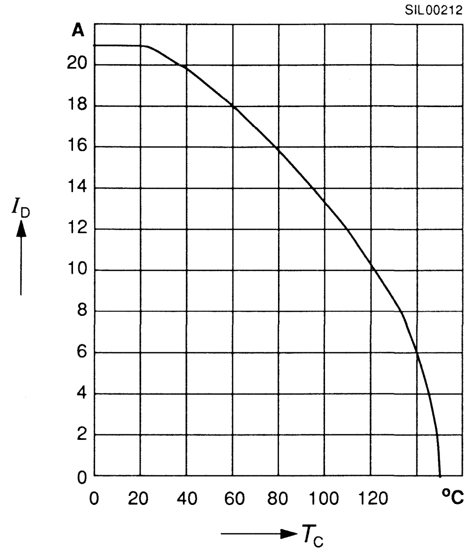
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



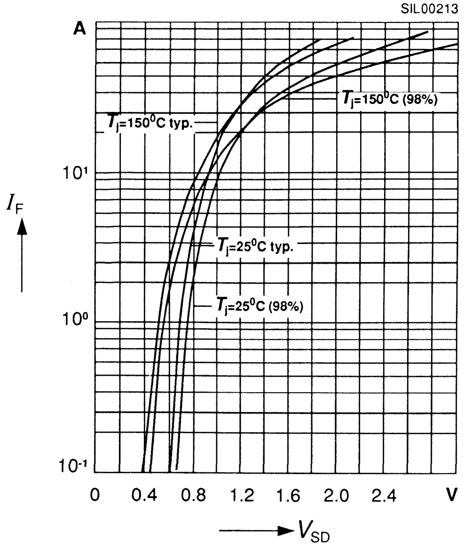
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



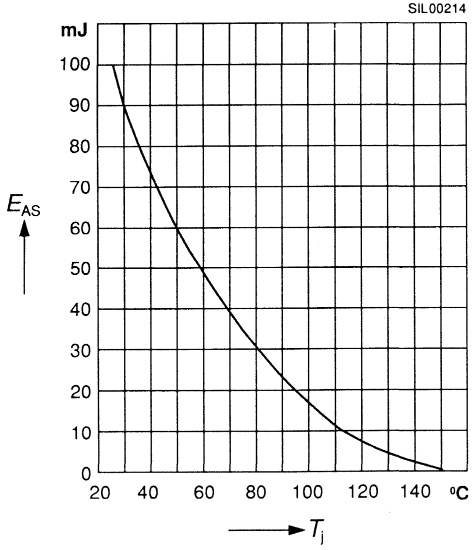
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



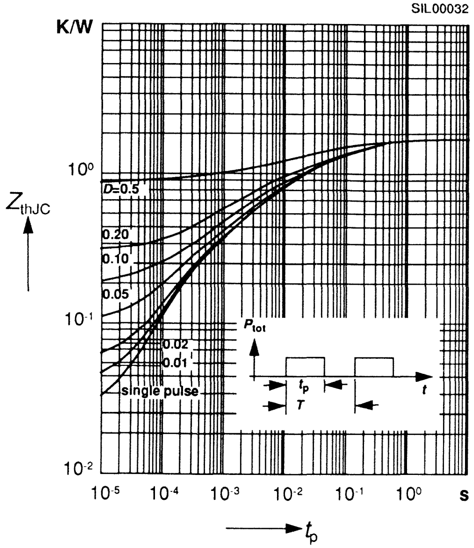
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



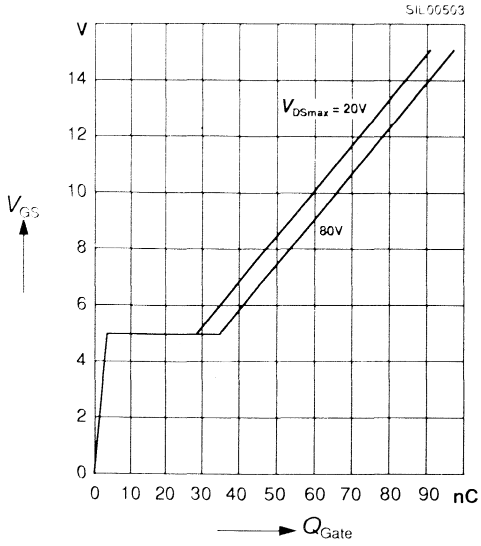
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 21$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 340$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



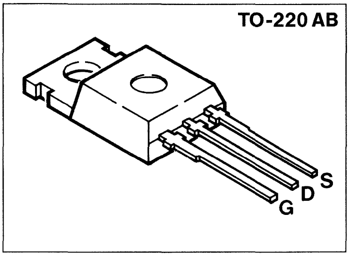
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 31.5$ A



SIPMOS® Power MOS Transistor **BUZ 22**

V_{DS} = **100 V**
I_D = **34 A**
$R_{DS(on)}$ = **0.055 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 22	C67078-S1333-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 27$ °C	I_D	34	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	136	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	34	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	15	mJ
Avalanche energy, single pulse $I_D = 34$ A, $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$ $L = 285.5\ \mu$H, $T_j = 25$ °C	E_{AS}	220	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

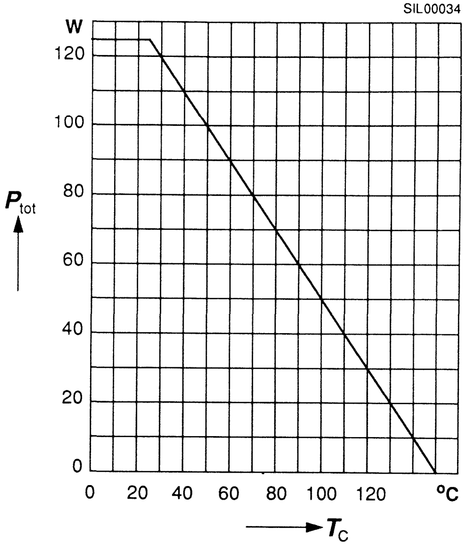
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Static characteristics				
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	100	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current V_{DS} = 100 V, V_{GS} = 0	I_{DSS}			µA
T_j = 25 °C		–	1.0	
T_j = 125 °C		–	100	
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	100	nA
Drain-source on-resistance V_{GS} = 10 V, I_D = 22 A	$R_{DS(on)}$	–	0.055	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 22 A	g_{fs}	10	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	1850	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	700	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	370	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(on)}$	–	30	ns
	t_r	–	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3 A, R_{GS} = 50 Ω	$t_{d(off)}$	–	300	
	t_f	–	160	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

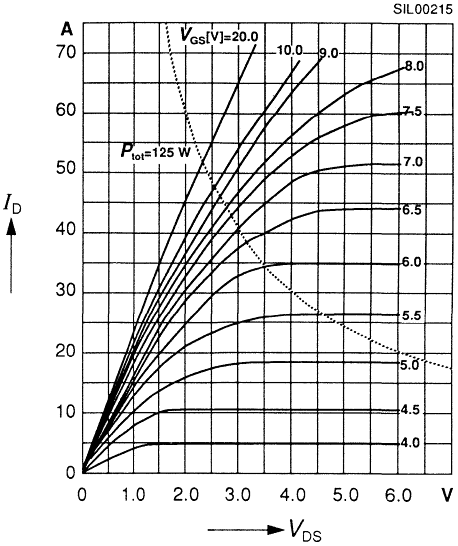
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	34	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	136	
Diode forward on-voltage $I_F = 68$ A, $V_{GS} = 0$	V_{SD}	–	1.8	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.25 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

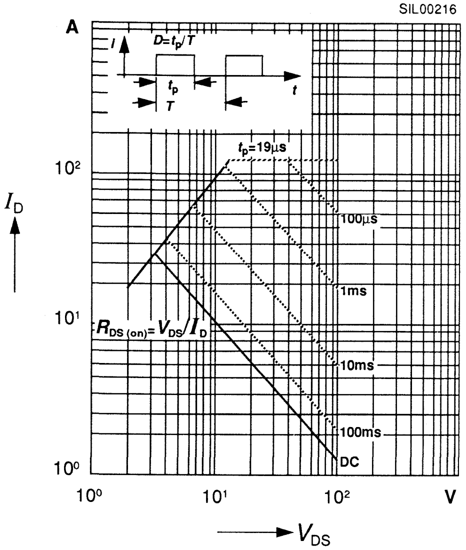
Total power dissipation $P_{tot} = f(T_C)$



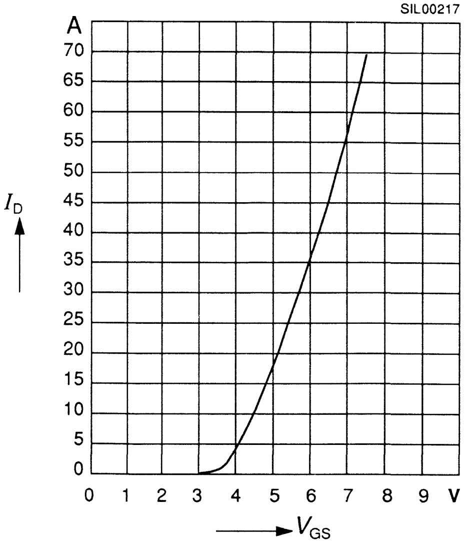
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



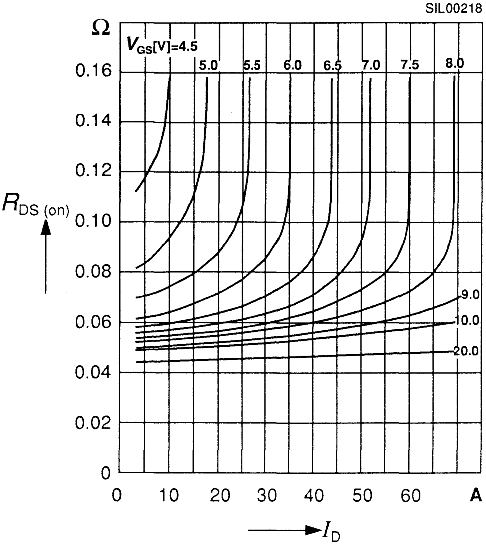
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



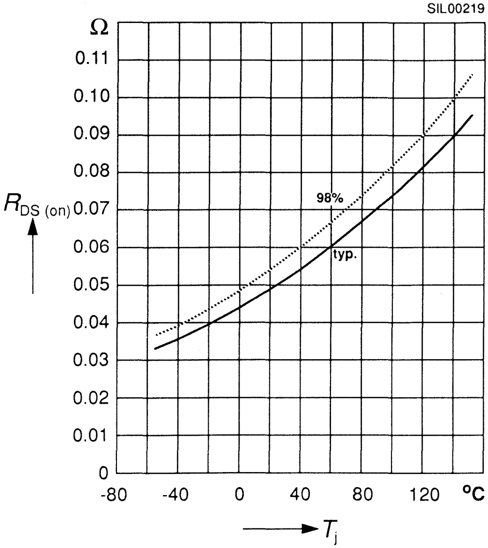
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



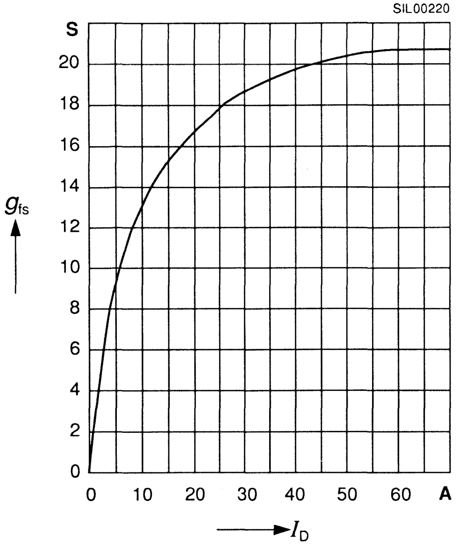
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



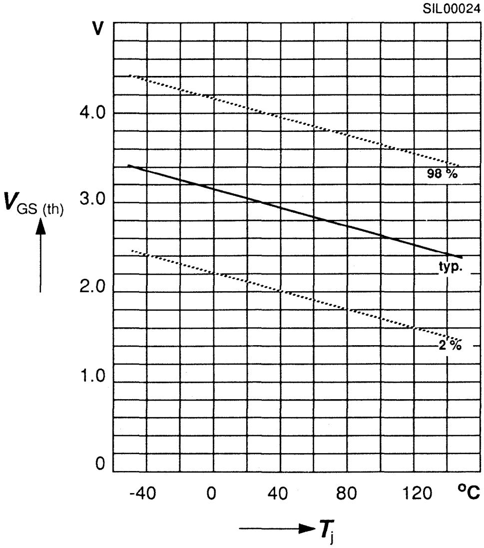
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 22$ A, $V_{GS} = 10$ V, (spread)



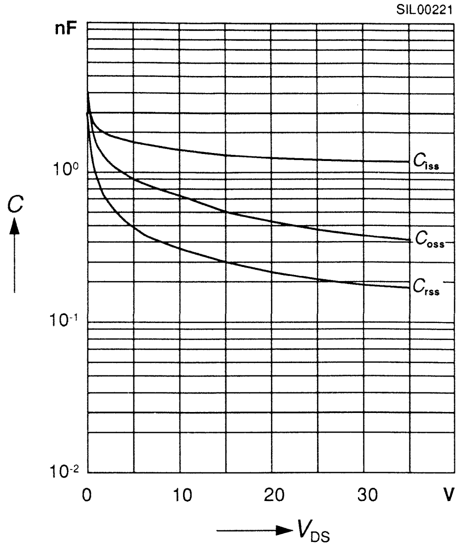
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



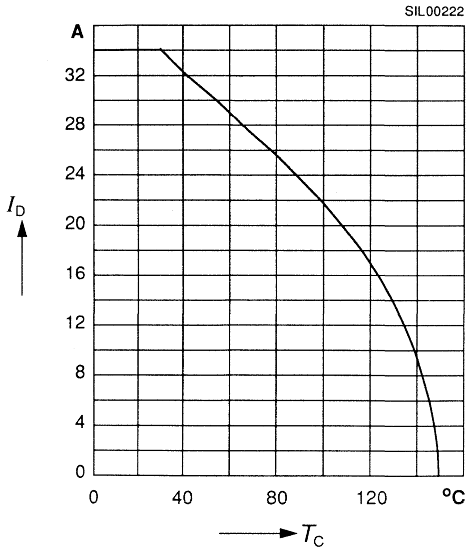
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



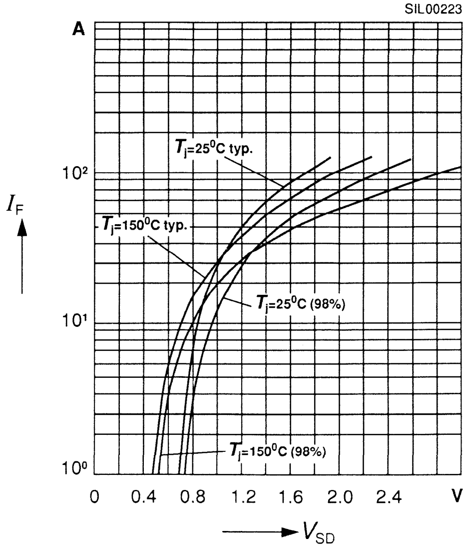
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



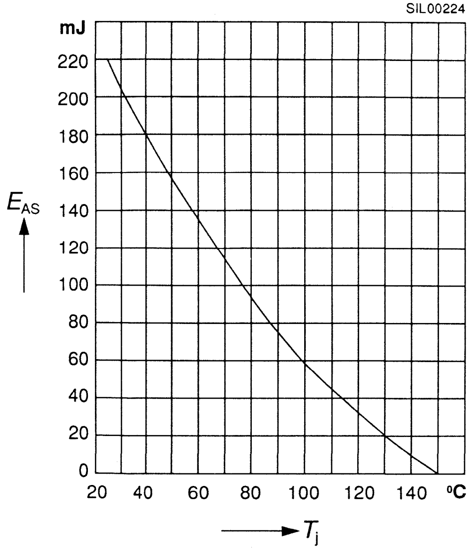
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



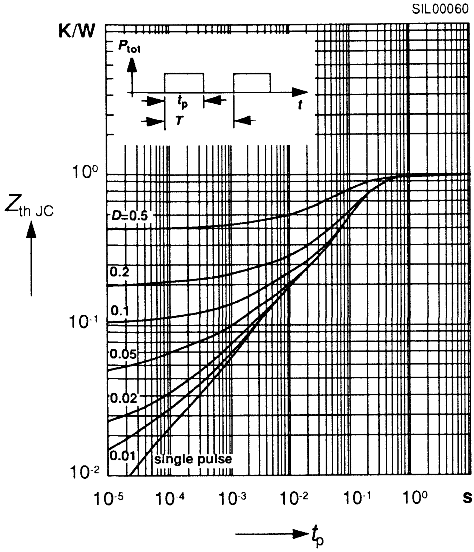
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



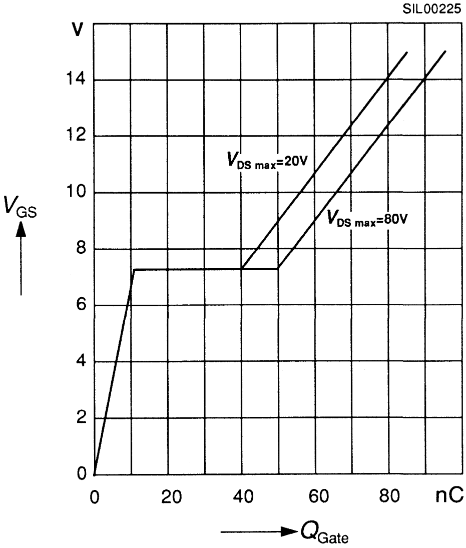
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 34$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 285.5$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



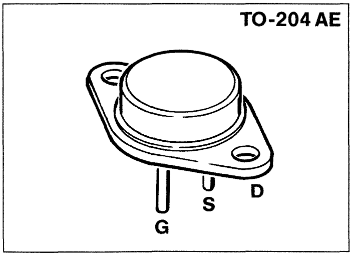
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 51.0$ A



SIPMOS® Power MOS Transistor **BUZ 24**

V_{DS} = 100 V
I_D = 32 A
$R_{DS(on)}$ = 0.06 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-204 AE (TO-3) [1]



Type	Ordering code
BUZ 24	C67078-A1003-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 27$ °C	I_D	32	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	128	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	32	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	15	mJ
Avalanche energy, single pulse $I_D = 32$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 322$ µH, $T_j = 25$ °C	E_{AS}	220	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 35	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 20$ A	$R_{DS(on)}$	–	0.06	Ω

Dynamic characteristics

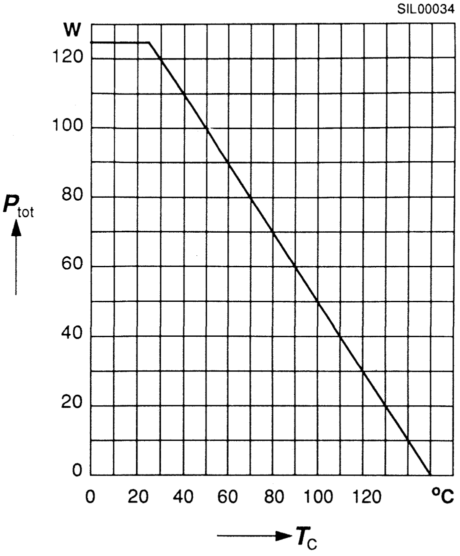
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 20$ A	g_{fs}	10	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1850	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	700	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	370	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	45	ns
	t_r	–	125	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	320	
	t_f	–	160	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

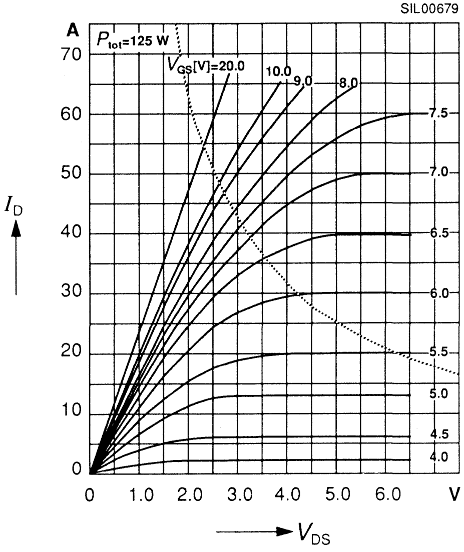
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	32	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	128	
Diode forward on-voltage $I_F = 64$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.25 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

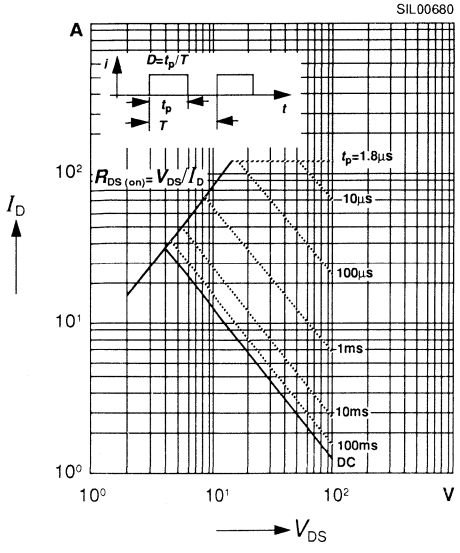
Total power dissipation $P_{tot} = f(T_C)$



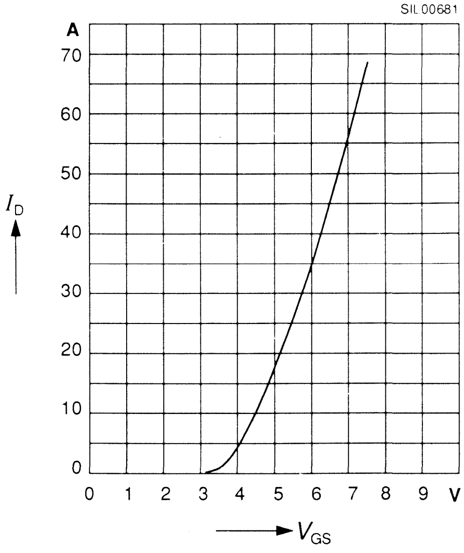
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



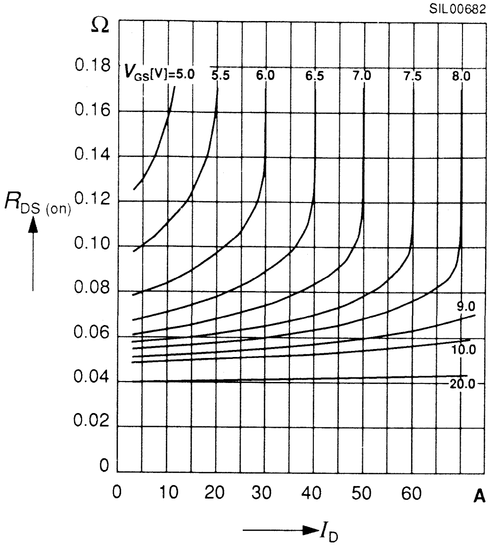
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



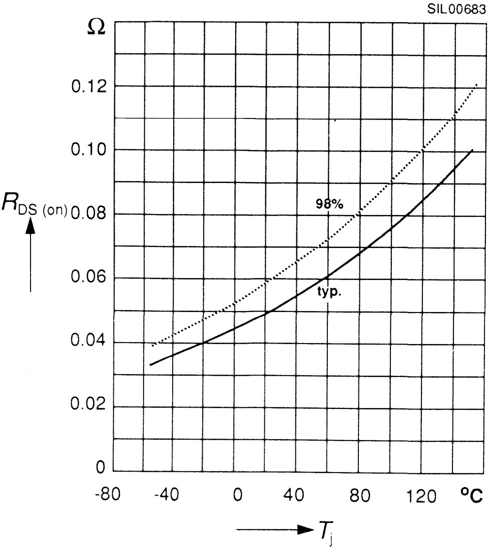
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



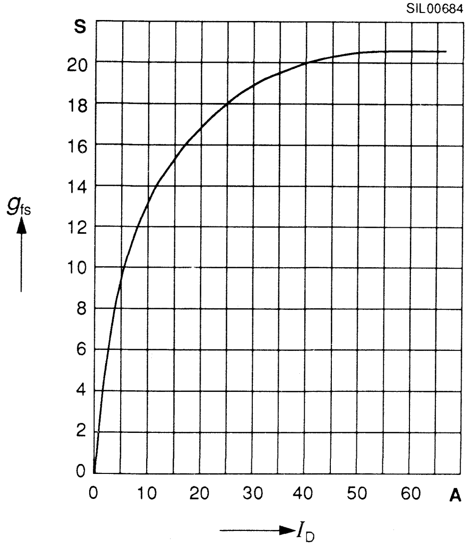
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



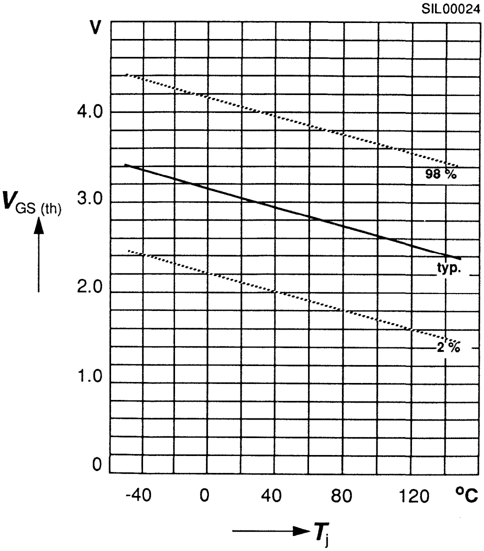
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 20$ A, $V_{GS} = 10$ V, (spread)



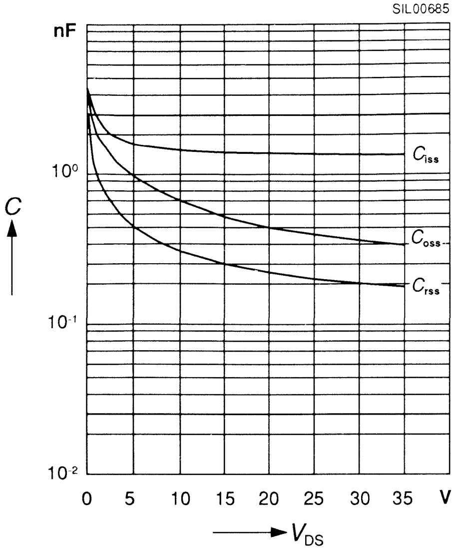
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



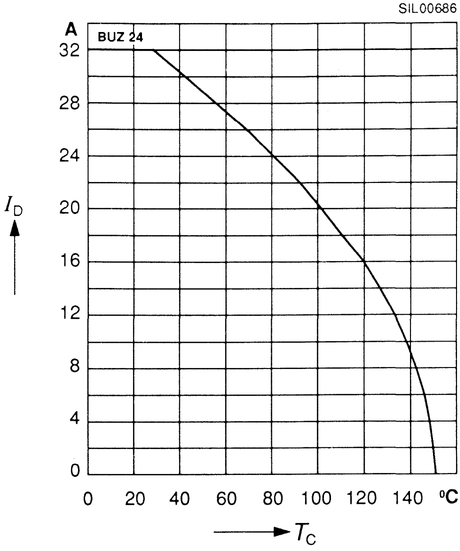
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



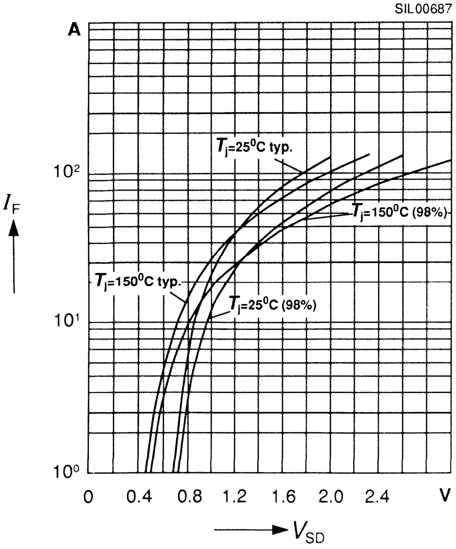
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



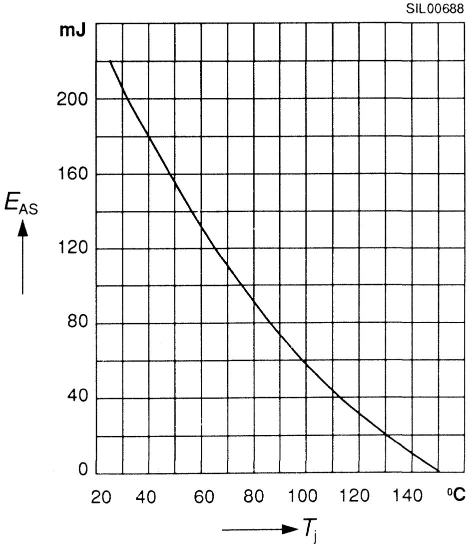
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



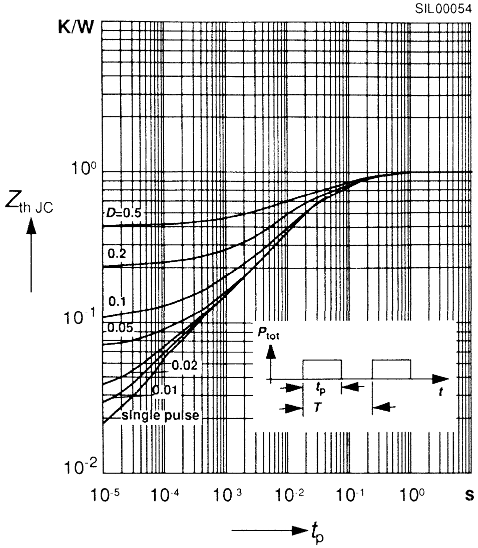
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



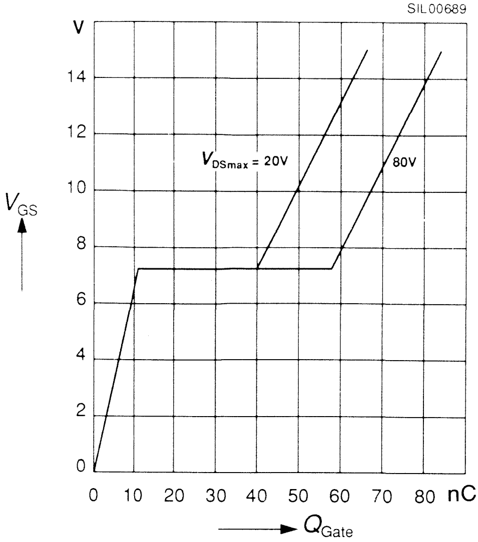
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 32$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 322$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 51.0$ A

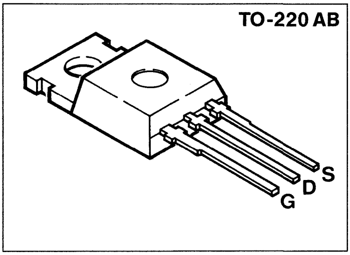


SIEMENS

SIPMOS® Power MOS Transistor BUZ 30 A

V_{DS} = **200 V**
I_D = **21 A**
$R_{DS(on)}$ = **0.13 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 30 A	C67078-S1303-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 26$ °C	I_D	21	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	84	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	21	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	12	mJ
Avalanche energy, single pulse $I_D = 21$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 1.53$ mH, $T_j = 25$ °C	E_{AS}	450	
Operating and storage temperature range	T_j T_{stg}	– 55 … + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1.0 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 13.5$ A	$R_{DS(on)}$	–	0.13	Ω

Dynamic characteristics

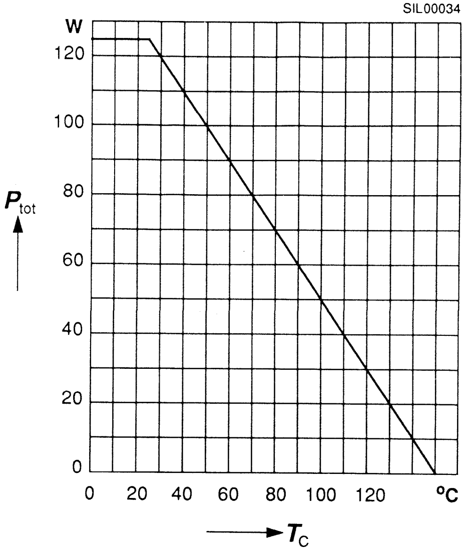
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 13.5$ A	g_{fs}	6	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	200	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	45	ns
	t_r	–	110	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	320	
	t_f	–	120	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

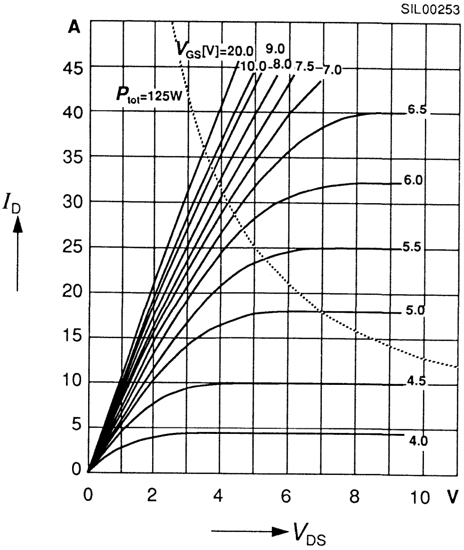
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	21	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	84	
Diode forward on-voltage $I_F = 42$ A, $V_{GS} = 0$	V_{SD}	–	1.6	V
Reverse recovery time $V_R = 10$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	180 typ.	–	ns
Reverse recovery charge $V_R = 10$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	1.2 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

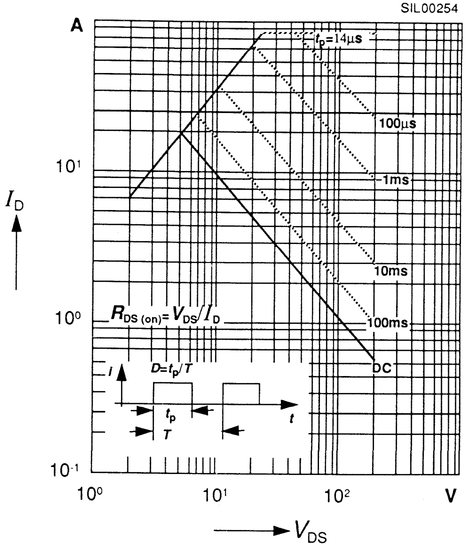
Total power dissipation $P_{tot} = f(T_C)$



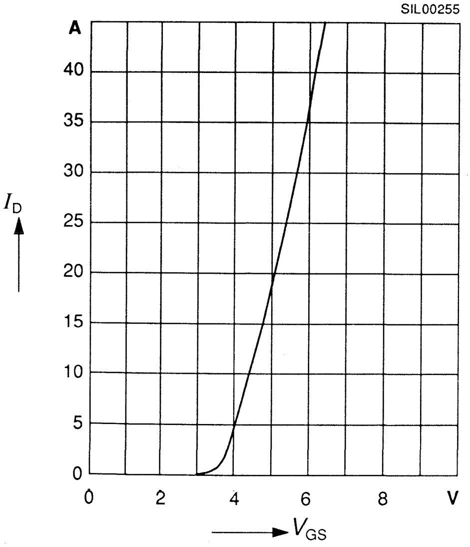
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



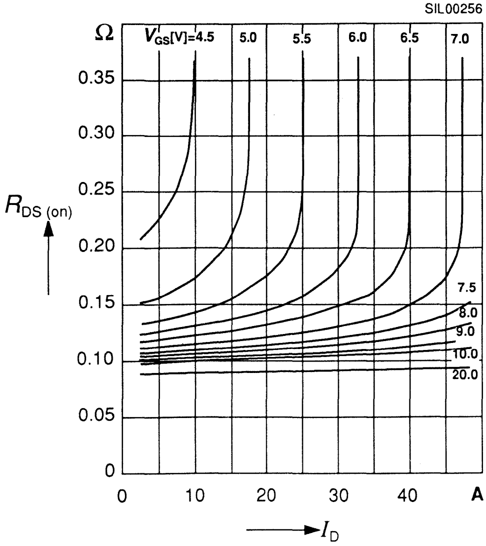
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



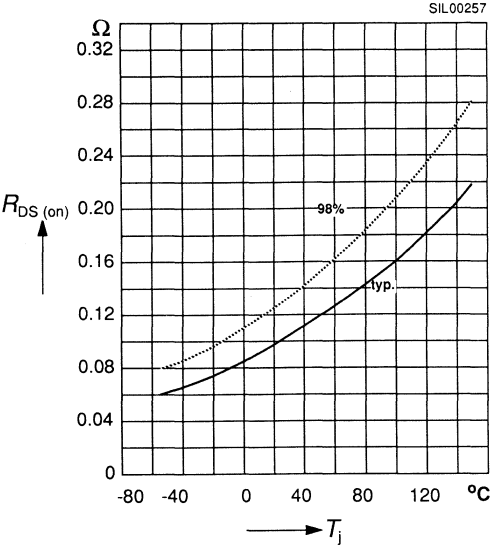
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



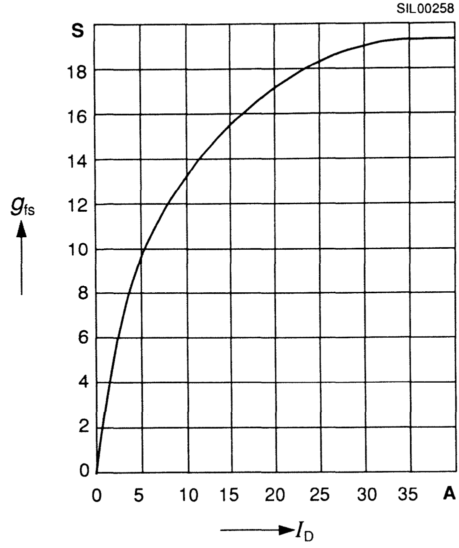
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



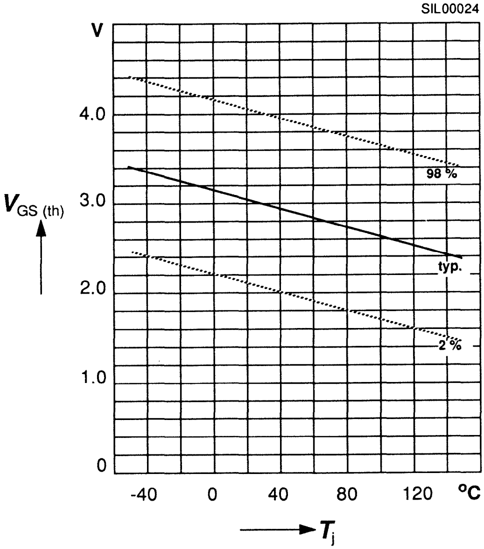
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 13.5 A, V_{GS} = 10 V, (spread)



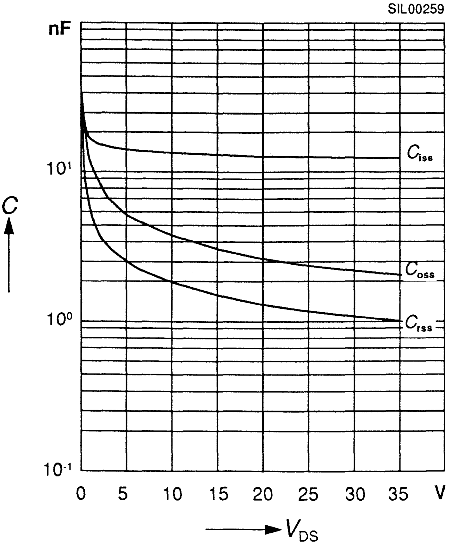
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



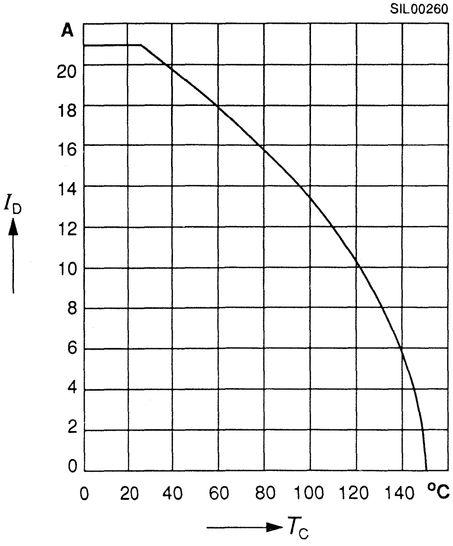
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



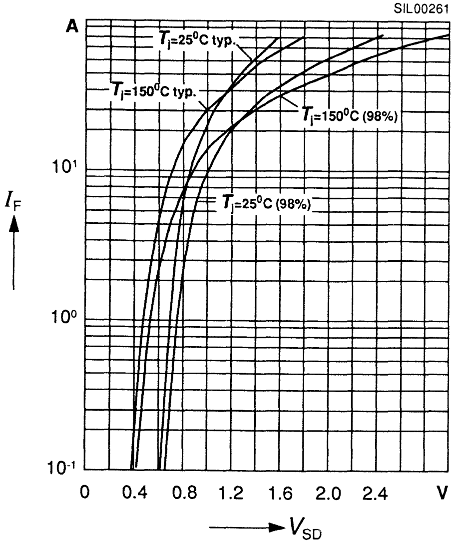
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



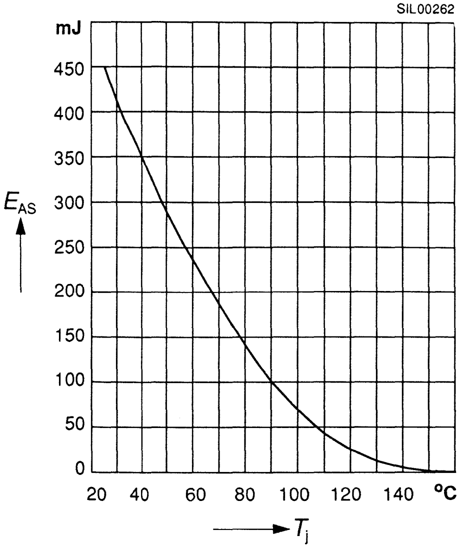
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



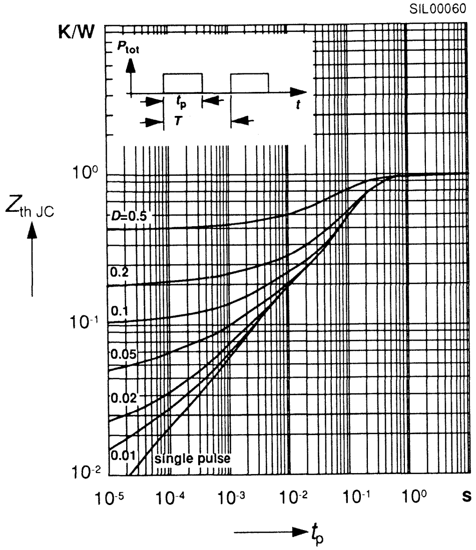
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



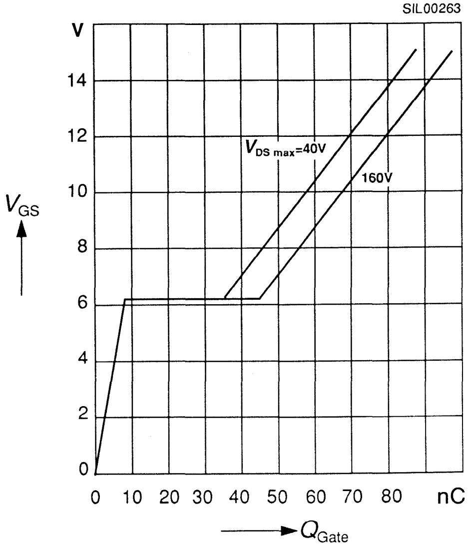
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 21$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 1.53$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 31.5$ A

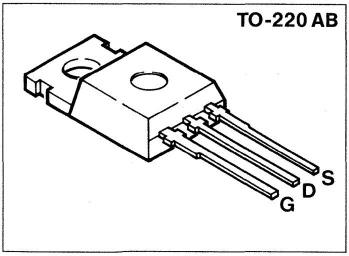


SIEMENS

SIPMOS® Power MOS Transistor **BUZ 31**

V_{DS} = 200 V
I_D = 13.5 A
$R_{DS(on)}$ = 0.2 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 31	C67078-S1304-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 28$ °C	I_D	13.5	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	54	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	13.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	9	mJ
Avalanche energy, single pulse $I_D = 13.5$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 1.65$ mH, $T_j = 25$ °C	E_{AS}	200	
Operating and storage temperature range	T_j T_{stg}	-55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	1.0	
$T_j = 125$ °C		-	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 8.5$ A	$R_{DS(on)}$	-	0.2	Ω

Dynamic characteristics

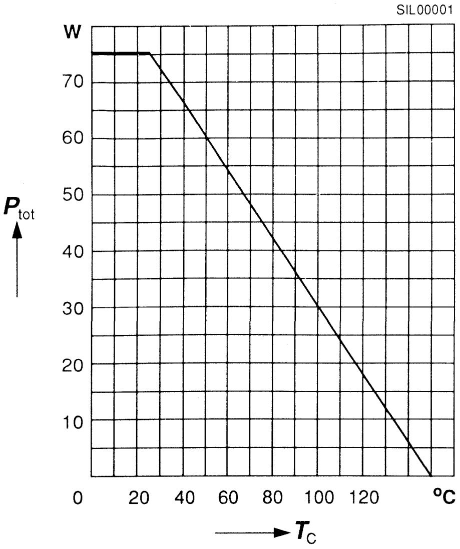
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 8.5$ A	g_{fs}	5.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1250	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	330	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	230	
	t_f	-	80	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

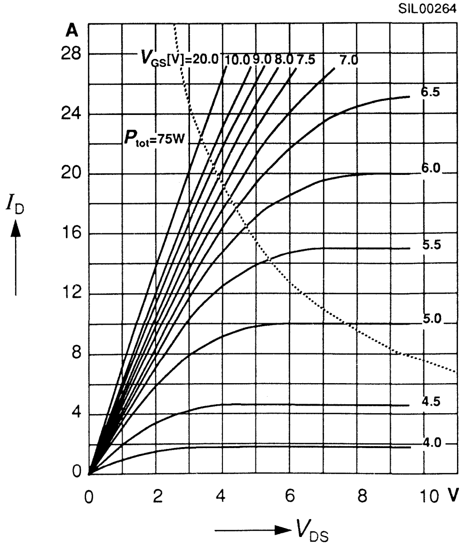
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	13.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	54	
Diode forward on-voltage $I_F = 27$ A, $V_{GS} = 0$	V_{SD}	–	1.6	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	180 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	1.2 typ.	–	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

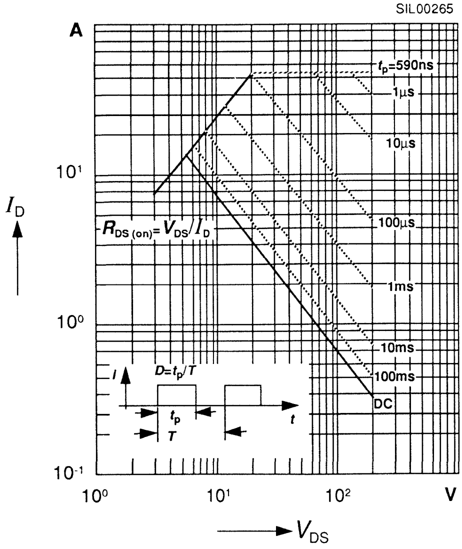
Total power dissipation $P_{tot} = f(T_C)$



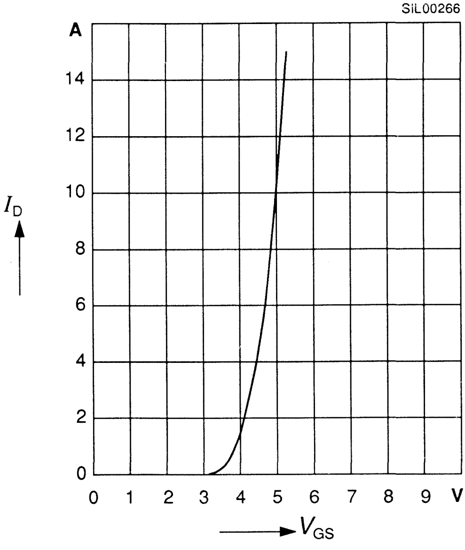
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



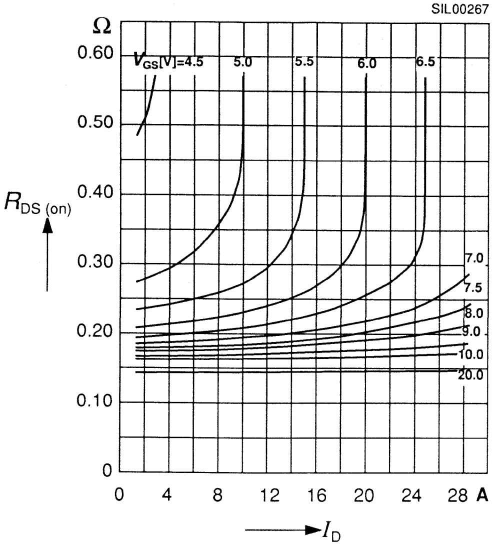
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



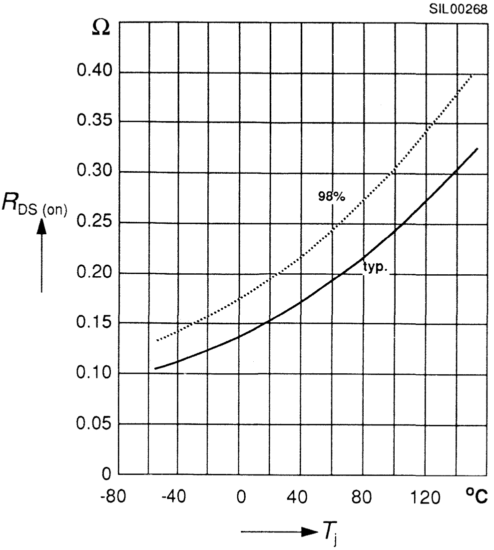
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



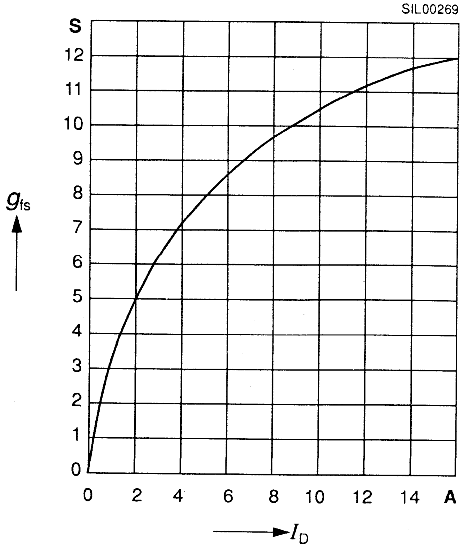
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



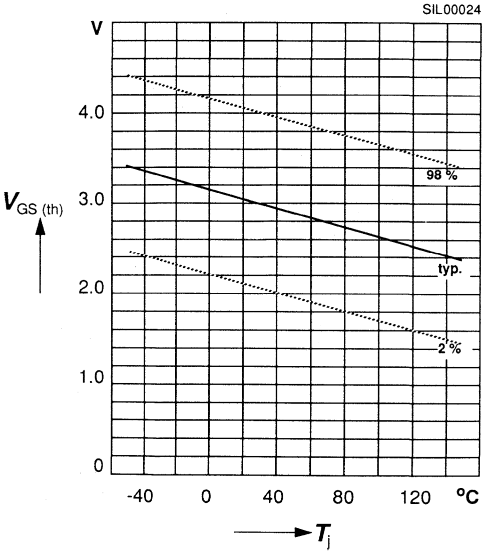
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 8.5 A, V_{GS} = 10 V, (spread)



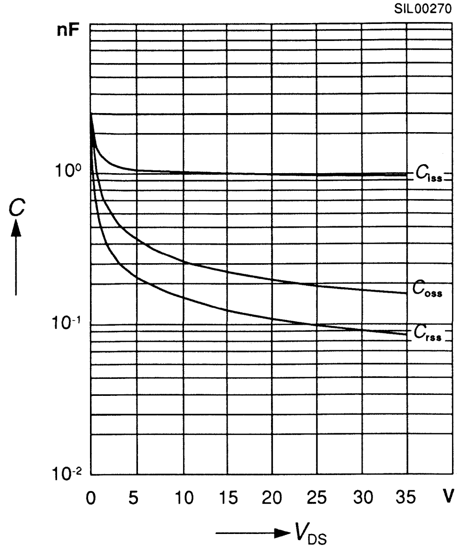
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



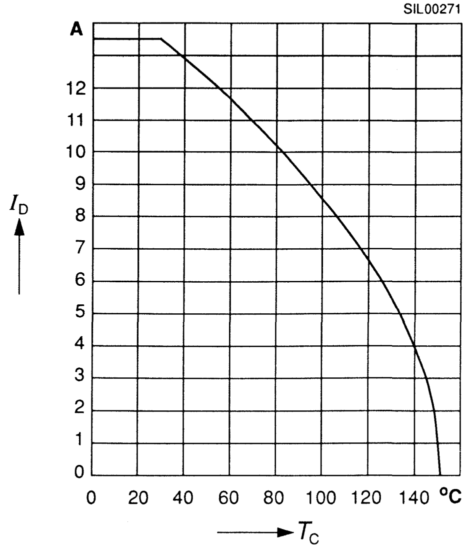
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



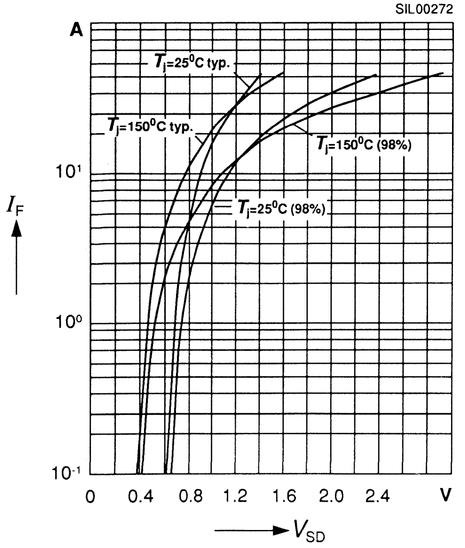
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



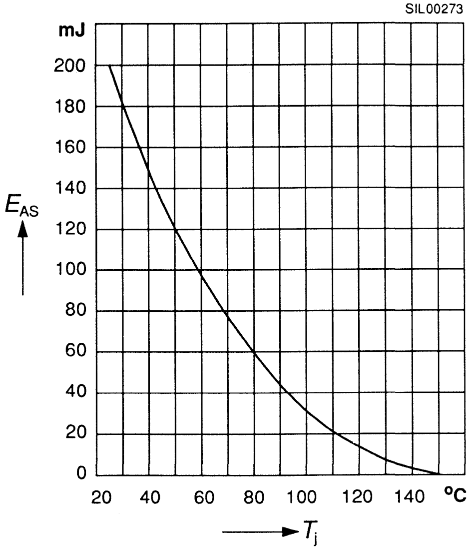
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



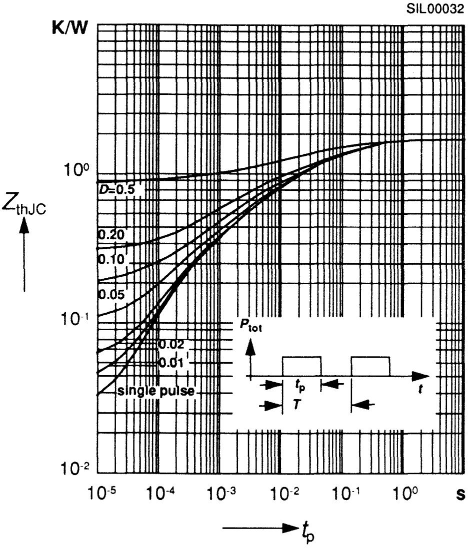
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



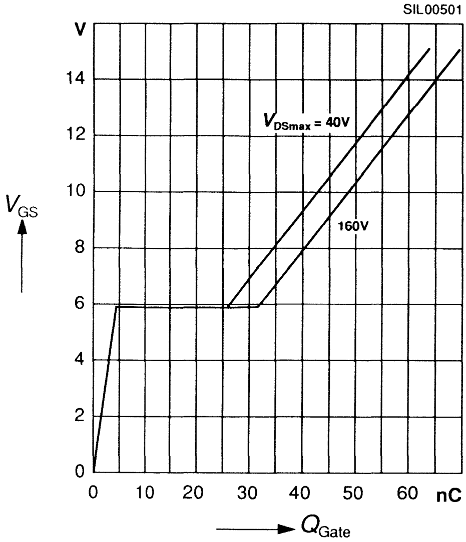
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 13.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 1.65$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



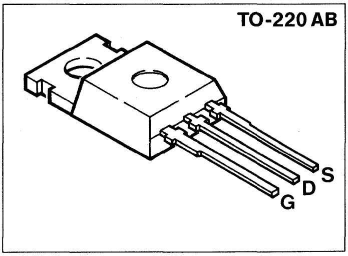
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 20.3$ A



SIPMOS® Power MOS Transistor **BUZ 32**

V_{DS} = **200 V**
I_D = **9.5 A**
$R_{DS(on)}$ = **0.4 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 32	C67078-S1310-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 29$ °C	I_D	9.5	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	38	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	9.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	6.5	mJ
Avalanche energy, single pulse $I_D = 9.5$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 2.0$ mH, $T_j = 25$ °C	E_{AS}	120	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 6.0$ A	$R_{DS(on)}$	–	0.4	Ω

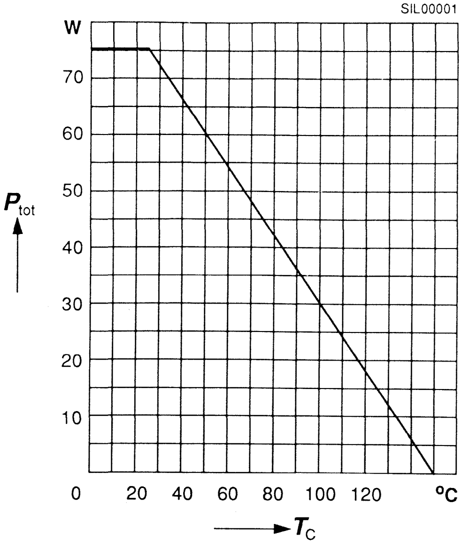
Parameter	Symbol	min.	max.	Unit
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 6.0$ A	g_{fs}	3.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	730	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	190	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	90	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	20	ns
	t_r	–	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	120	
	t_f	–	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

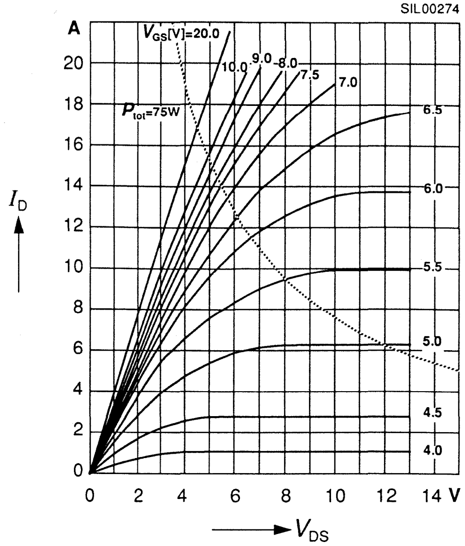
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	9.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	38	
Diode forward on-voltage $I_F = 19$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.60 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

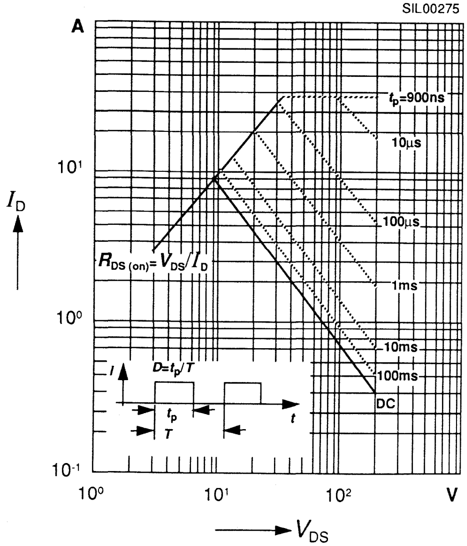
Total power dissipation $P_{tot} = f(T_C)$



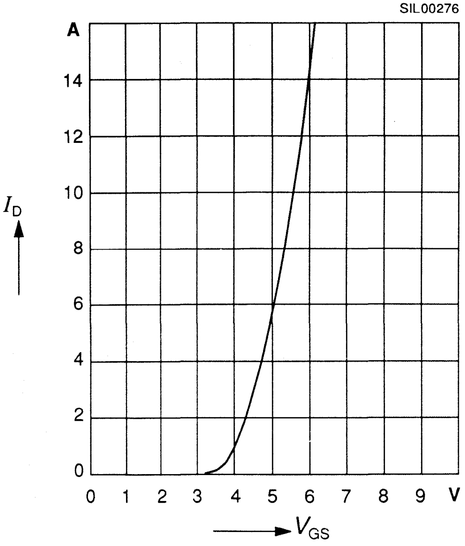
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



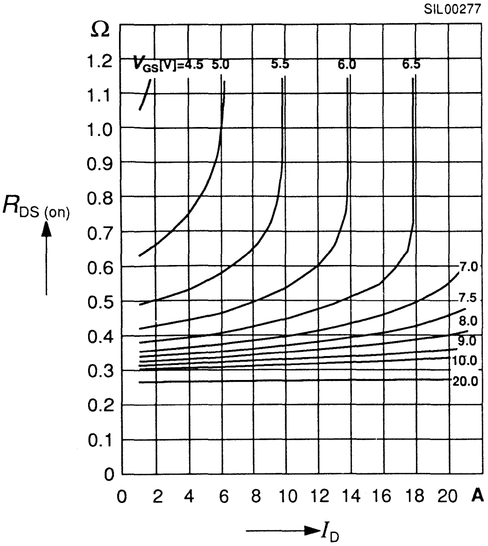
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



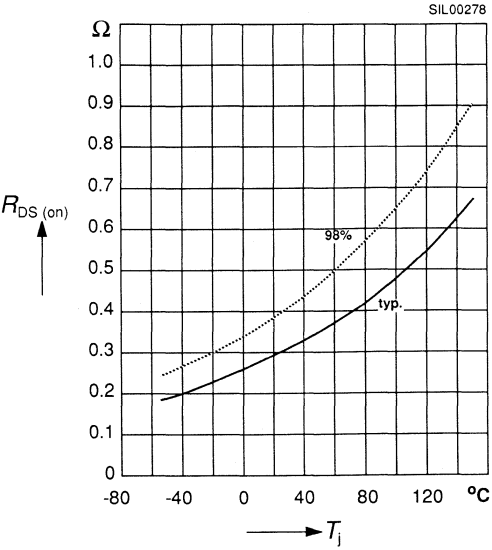
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



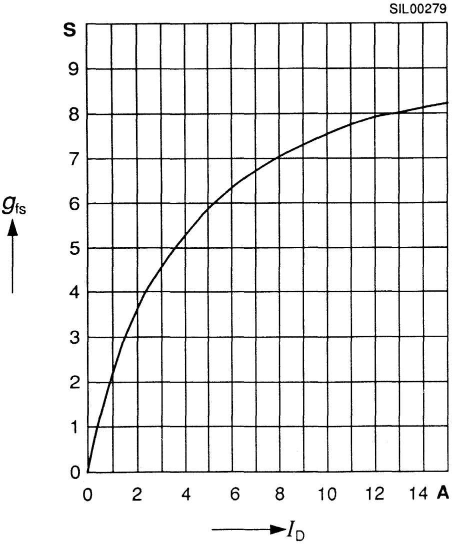
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



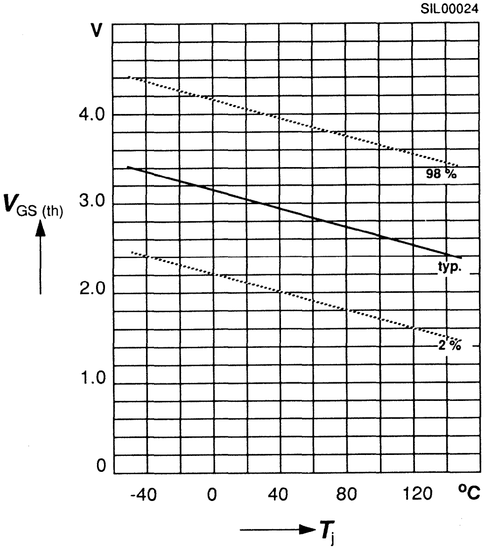
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 6.0 A, V_{GS} = 10 V, (spread)



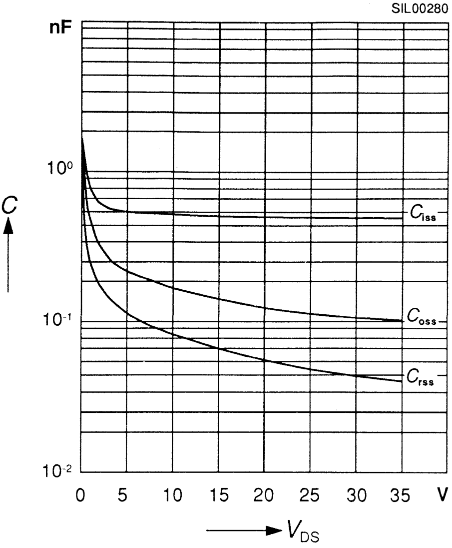
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



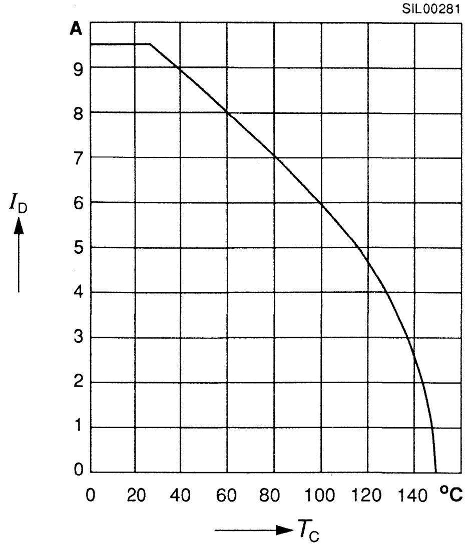
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



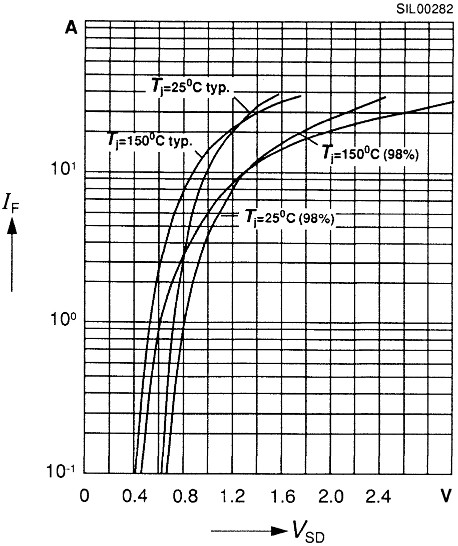
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



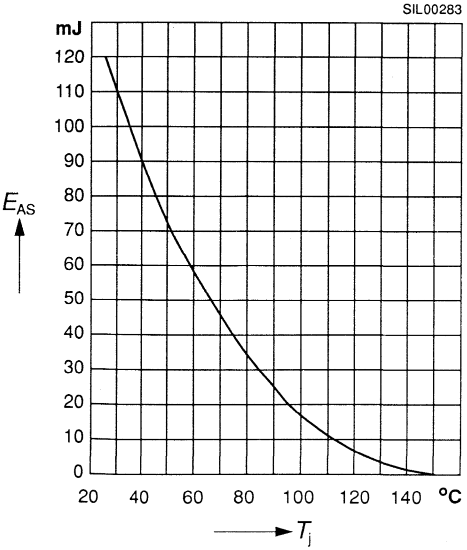
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



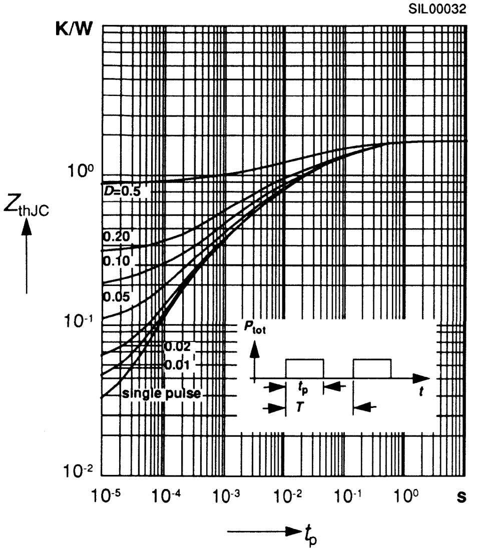
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



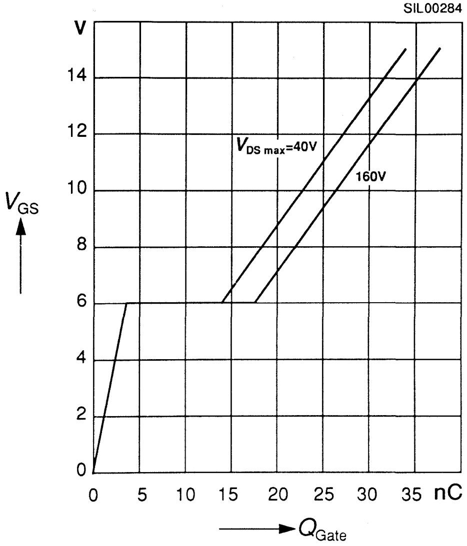
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 9.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 2.0$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 13.5$ A

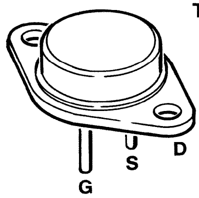


SIPMOS® Power MOS Transistors

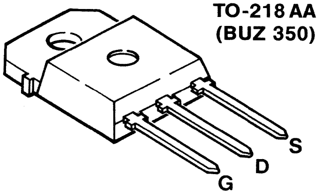
BUZ 36
BUZ 350

V_{DS} = 200 V
I_D = 22 A
$R_{DS(on)}$ = 0.12 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Packages: TO-204 AE (TO-3),
  TO-218 AA (TOP-3) [1]



TO-204 AE
(BUZ 36)



TO-218 AA
(BUZ 350)

Type	Ordering code
BUZ 36	C67078-A1018-A2
BUZ 350	C67078-S3117-A2

Maximum Ratings

Parameter	Symbol	BUZ 36	 350	Unit
Drain-source voltage	V_{DS}	200		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, $T_C = 33$ °C	I_D	22		A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	88		
Avalanche current, limited by $T_{j\ max}$	I_{AR}	22.0		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	13		mJ
Avalanche energy, single pulse $V_{DD} = 50$ V, $R_{GS} = 25$ Ω, $T_j = 25$ °C $I_D = 22$ A, $L = 1.77$ mH	E_{AS}	570		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 35	 ≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040		C	E	–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 14$ A	$R_{DS(on)}$	-	0.12	Ω

Dynamic characteristics

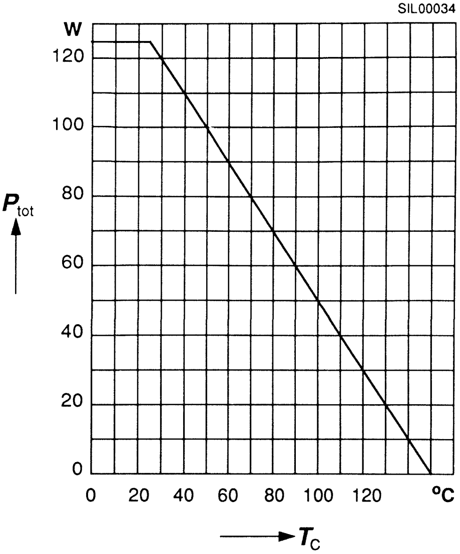
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 14$ A	g_{fs}	9.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	2700	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	540	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	240	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(on)}$	-	50	ns
	t_r	-	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(off)}$	-	420	
	t_f	-	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

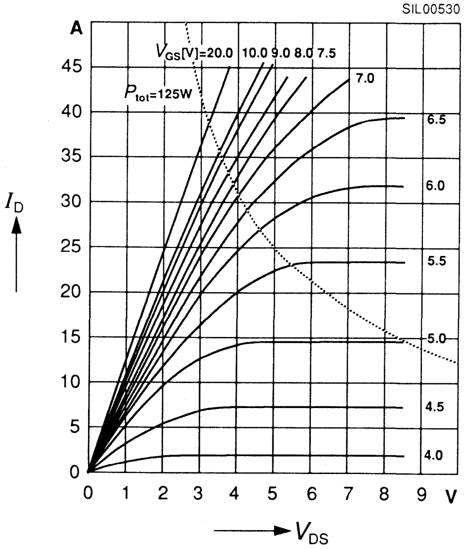
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	22	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	88	
Diode forward on-voltage $I_F = 44$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	400 typ.	– –	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	6 typ.	– –	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

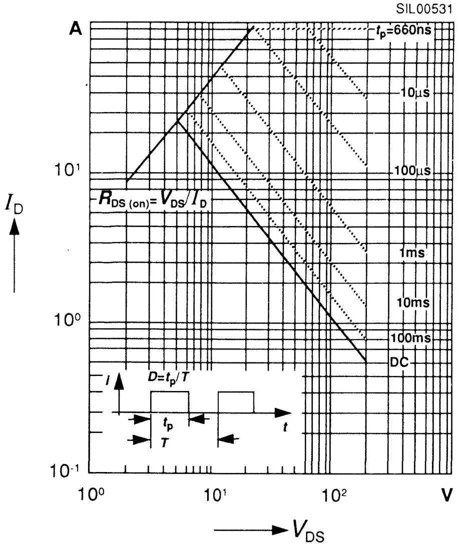
Total power dissipation $P_{tot} = f(T_C)$



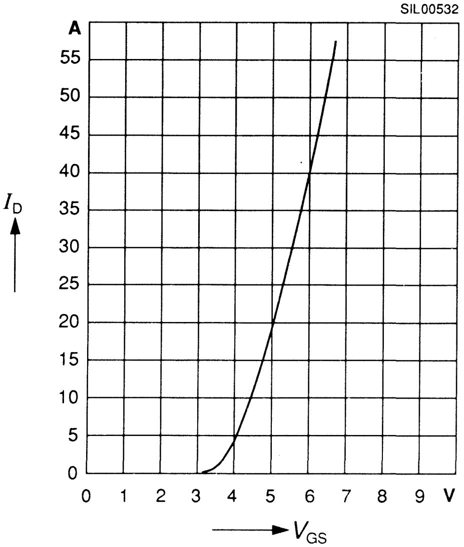
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



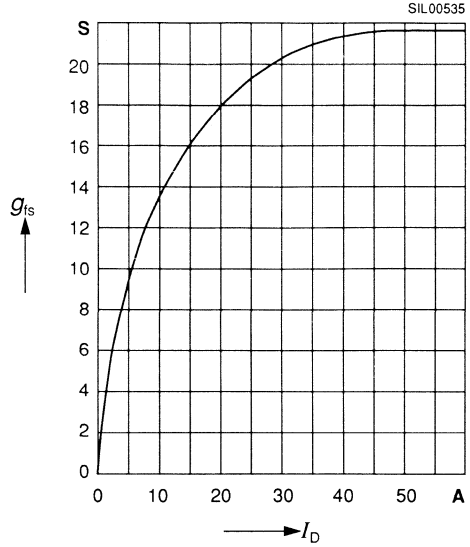
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



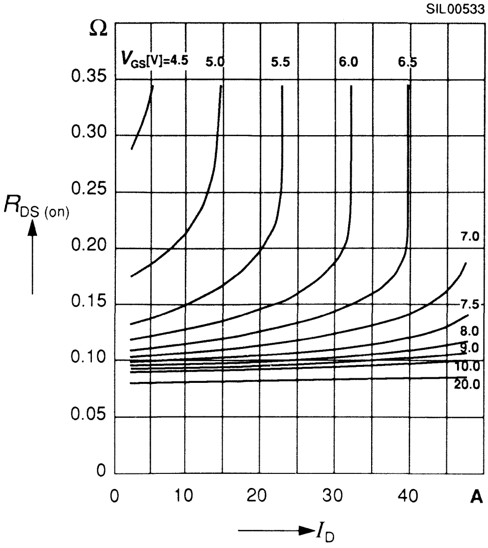
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



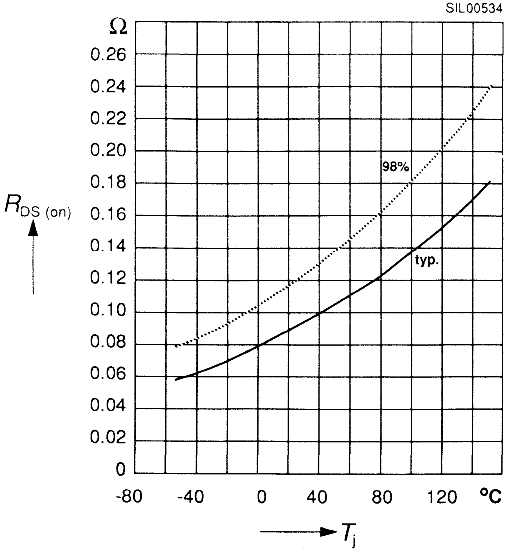
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



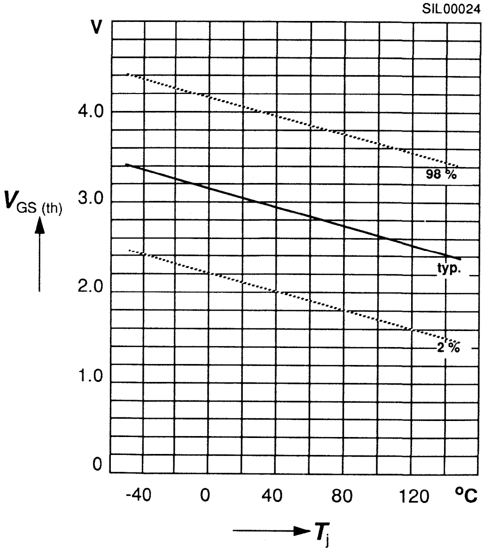
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



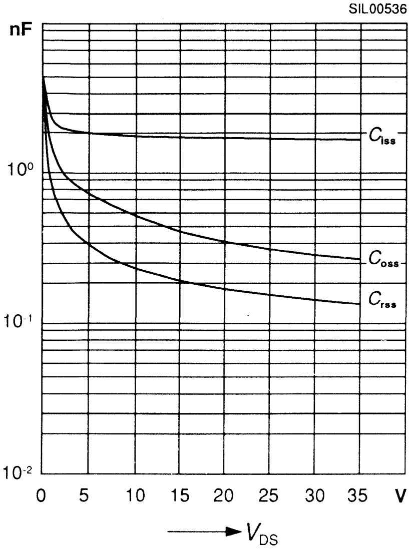
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 14$ A, $V_{GS} = 10$ V, (spread)



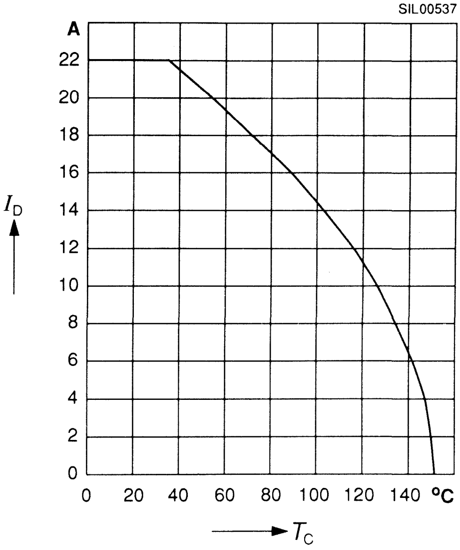
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



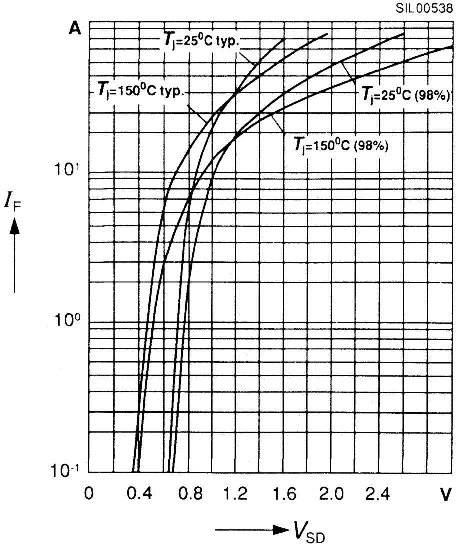
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



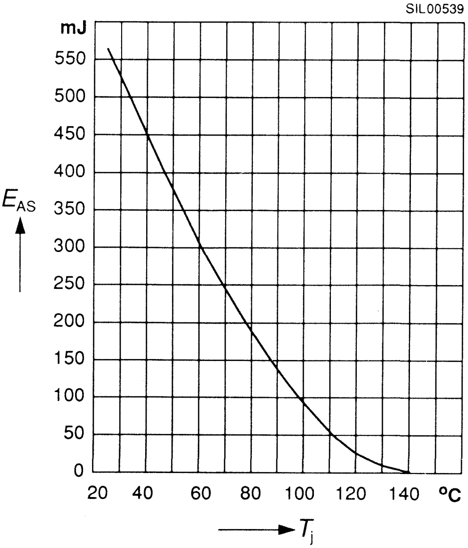
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



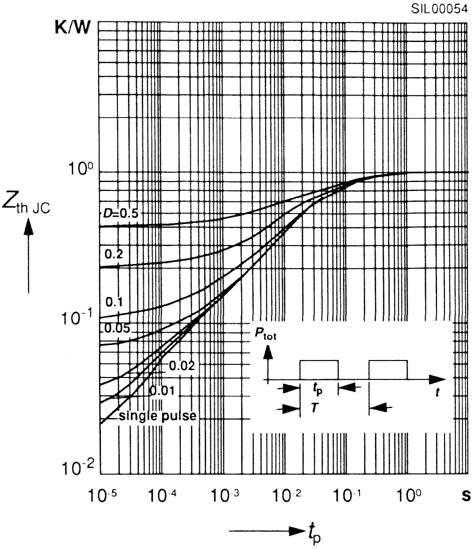
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



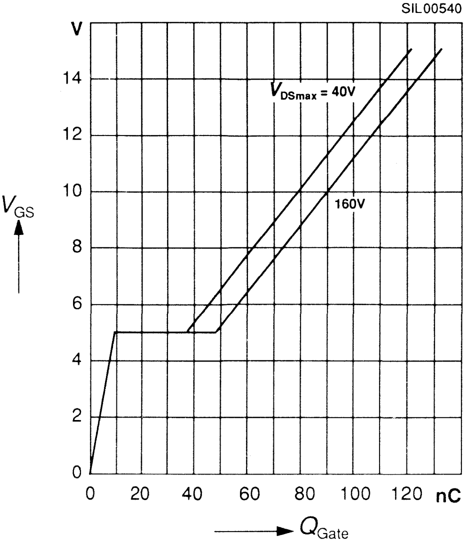
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 22$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 1.77$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls} = 33.0$ A

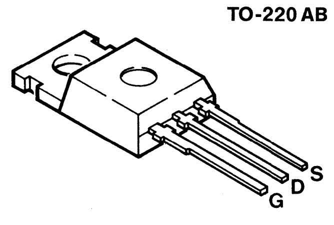


SIPMOS® Power MOS Transistor

BUZ 41 A

V_{DS} = **500 V**
I_D = **4.5 A**
$R_{DS(on)}$ = **1.5 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 41 A	C67078-A1306-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 36 °C	I_D	4.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	18	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	4.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	8	mJ
Avalanche energy, single pulse I_D = 4.5 A, V_{DD} = 50 V, R_{GS} = 25 Ω L = 28.4 mH, T_j = 25 °C	E_{AS}	320	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	1.0	
$T_j = 125$ °C		-	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.0$ A	$R_{DS(on)}$	-	1.5	Ω

Dynamic characteristics

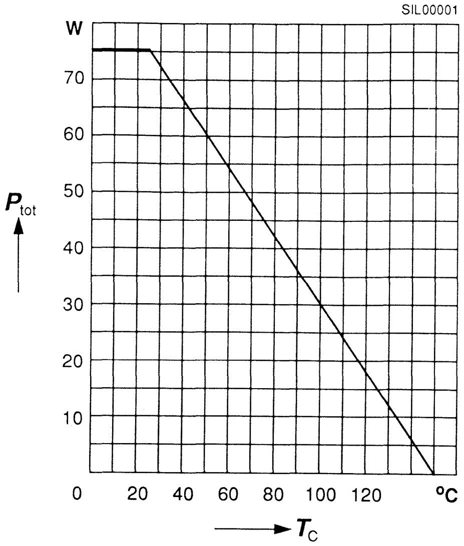
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.0$ A	g_{fs}	2.5	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1300	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	150	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	60	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.6$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	20	ns
	t_r	-	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.6$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	190	
	t_f	-	70	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

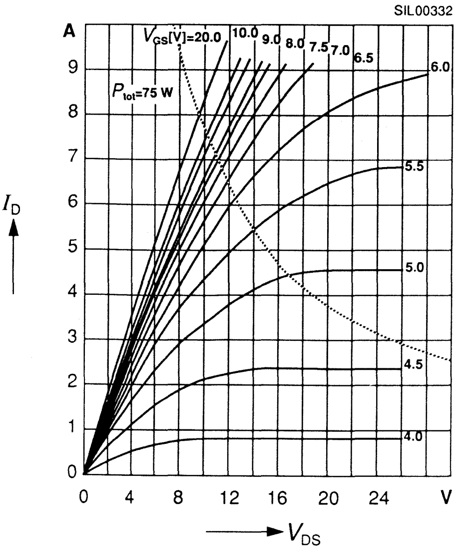
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	4.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	18	
Diode forward on-voltage $I_F = 9$ A, $V_{GS} = 0$	V_{SD}	–	1.2	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	1.2 typ.	–	µs
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	6 typ.	–	µC

Characteristics at $T_j = 25°C$, unless otherwise specified.

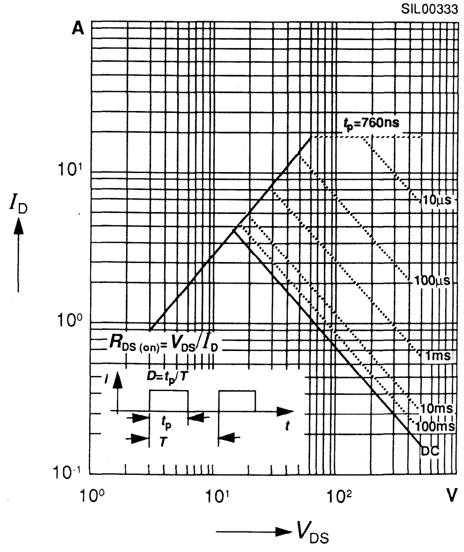
Total power dissipation $P_{tot} = f(T_C)$



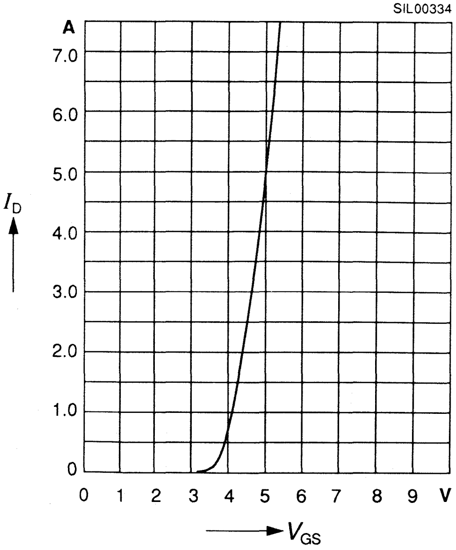
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



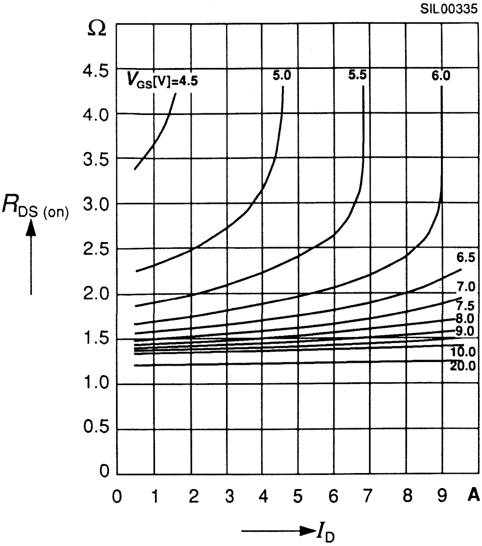
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



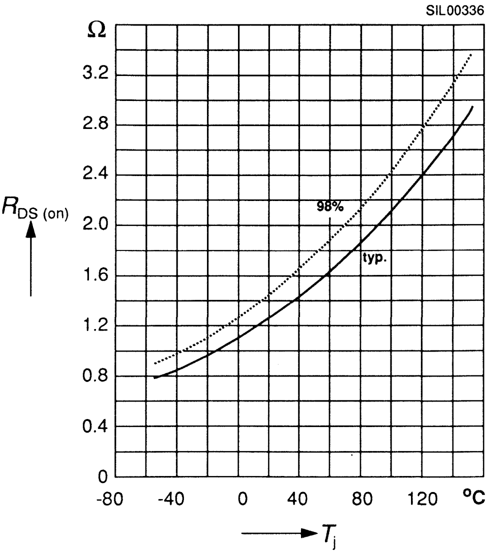
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



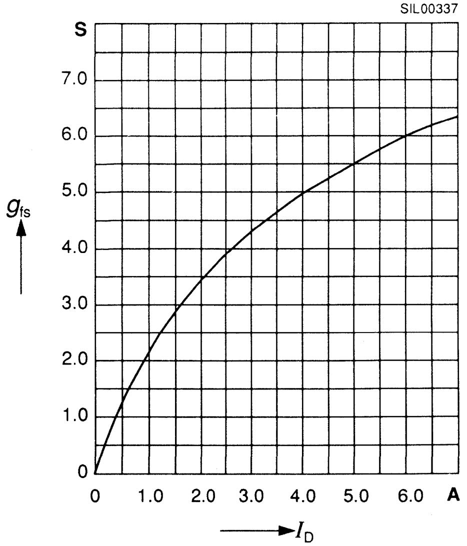
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



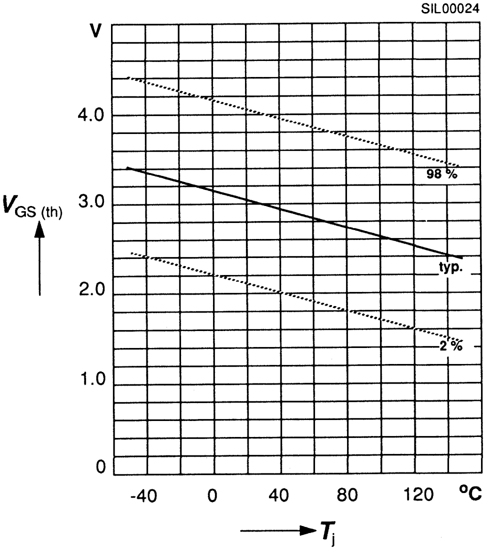
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.0$ A, $V_{GS} = 10$ V, (spread)



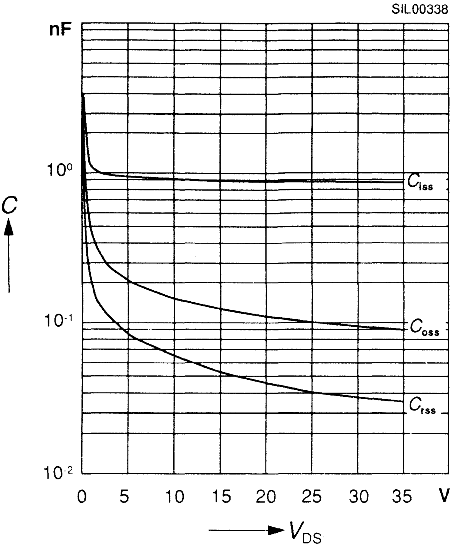
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



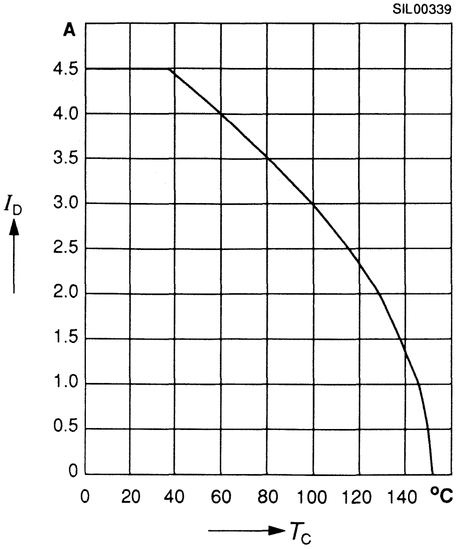
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



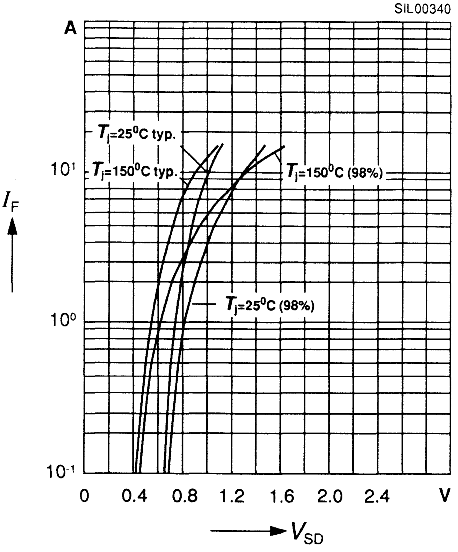
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



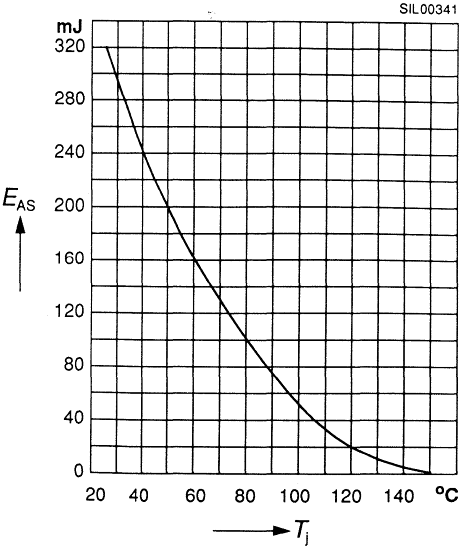
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



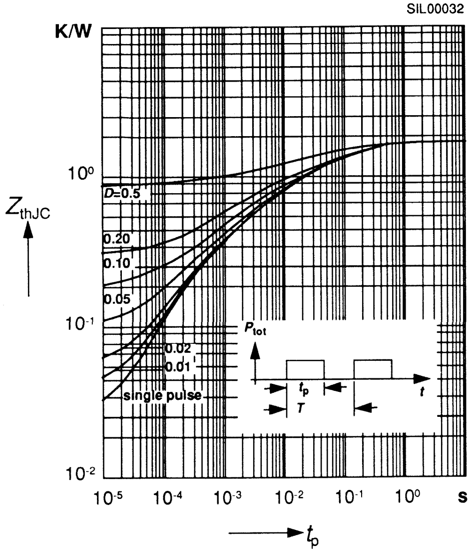
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



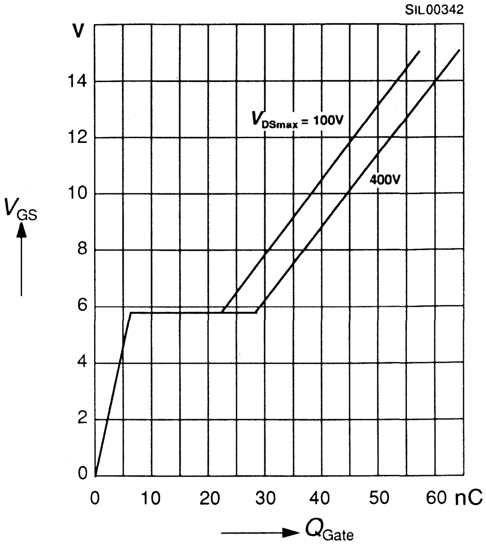
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 4.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 28.4$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



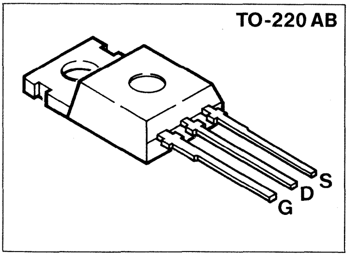
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 6.75$ A



SIPMOS® Power MOS Transistor BUZ 42

V_{DS} = 500 V
I_D = 4.0 A
$R_{DS(on)}$ = 2.0 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 42	C67078-A1311-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 30$ °C	I_D	4.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	16	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	4.0	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	6	mJ
Avalanche energy, single pulse $I_D = 4.0$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 24.8$ mH, $T_j = 25$ °C	E_{AS}	220	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25\ ^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	

Static characteristics

Parameter	Symbol	min.	max.	Unit
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25\ ^\circ\text{C}$ $T_j = 125\ ^\circ\text{C}$	I_{DSS}	– –	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 2.6$ A	$R_{DS(on)}$	–	2.0	Ω

Dynamic characteristics

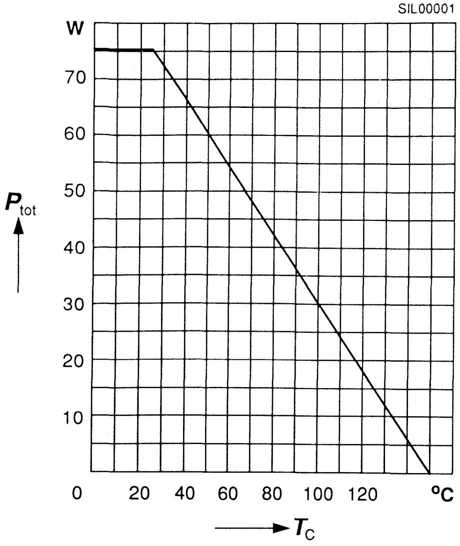
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 2.6$ A	g_{fs}	1.5	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	100	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	40	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50\ \Omega$	$t_{d(on)}$	–	15	ns
	t_r	–	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50\ \Omega$	$t_{d(off)}$	–	95	
	t_f	–	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

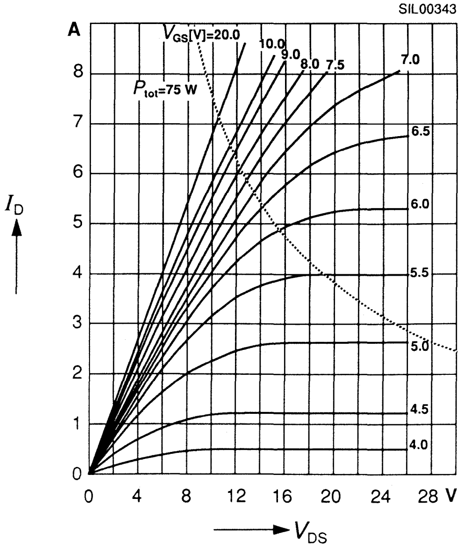
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	4.0	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	16	
Diode forward on-voltage $I_F = 8.0$ A, $V_{GS} = 0$	V_{SD}	–	1.4	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	300 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	2.5 typ.	–	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

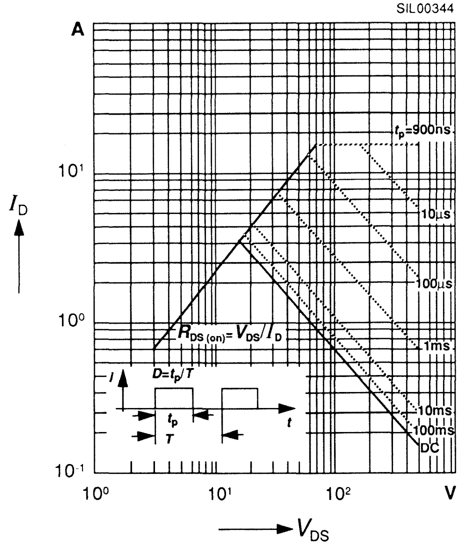
Total power dissipation $P_{tot} = f(T_C)$



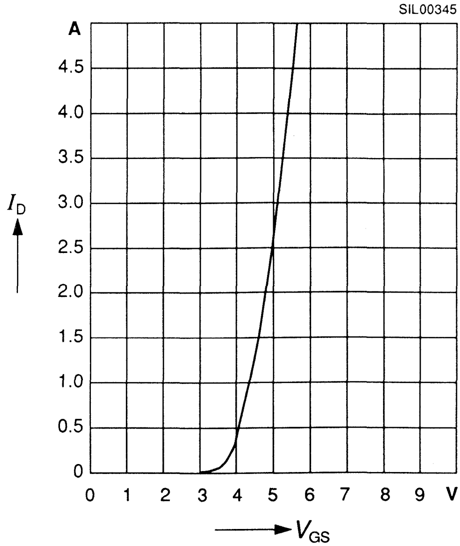
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



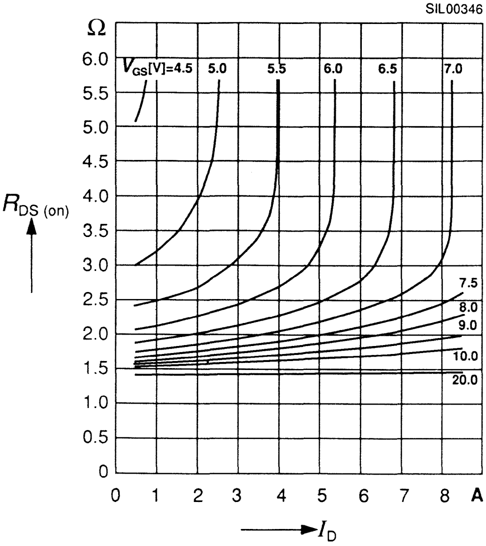
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



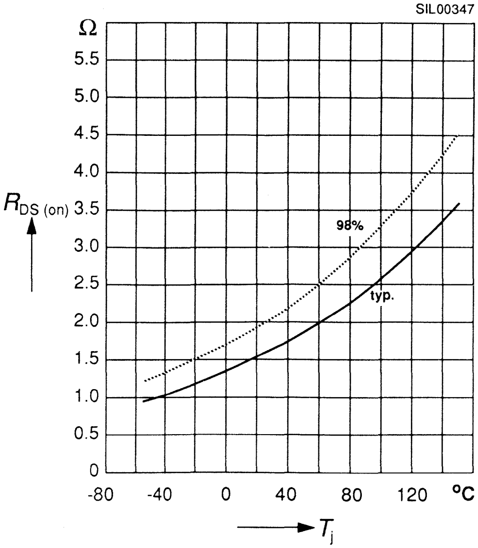
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



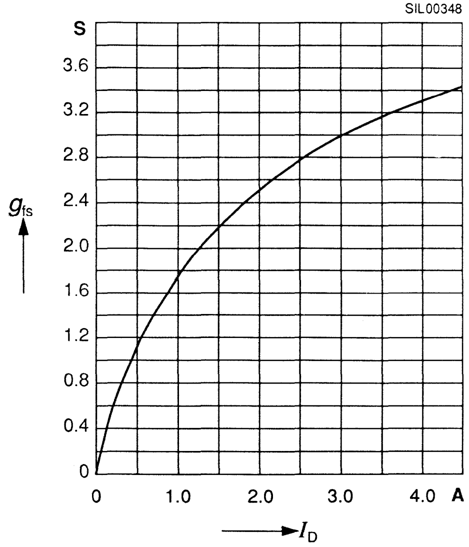
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



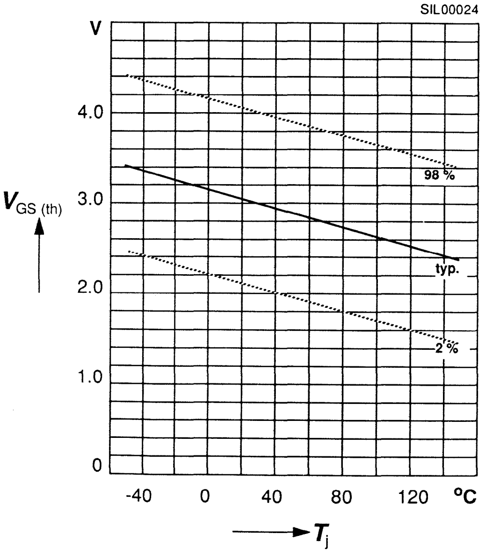
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 2.6 A, V_{GS} = 10 V, (spread)



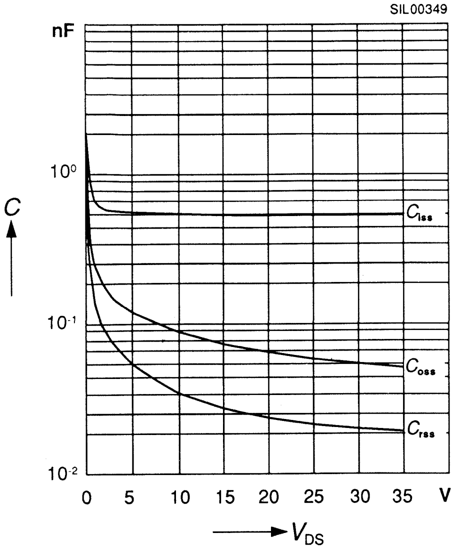
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



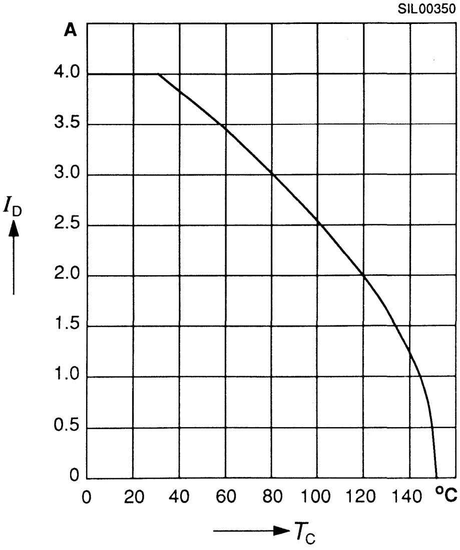
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



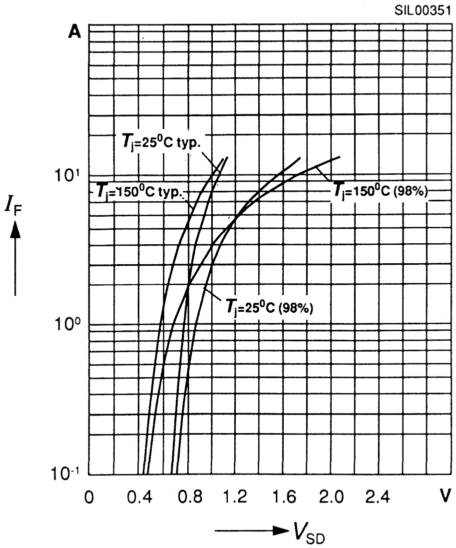
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



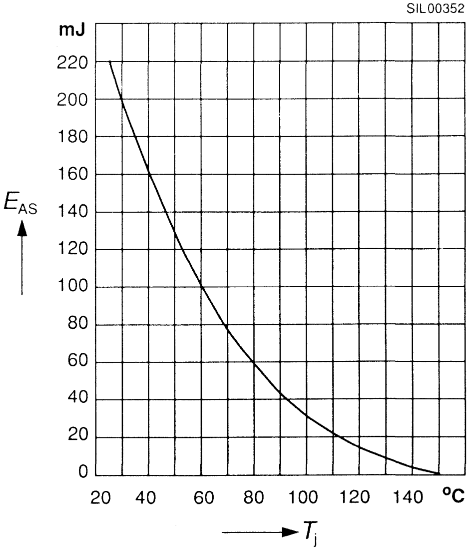
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



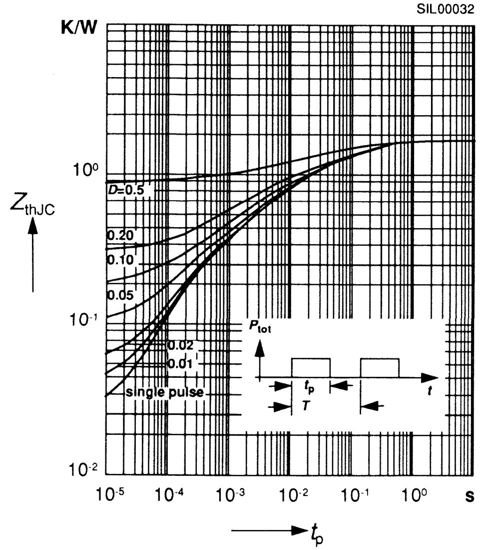
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



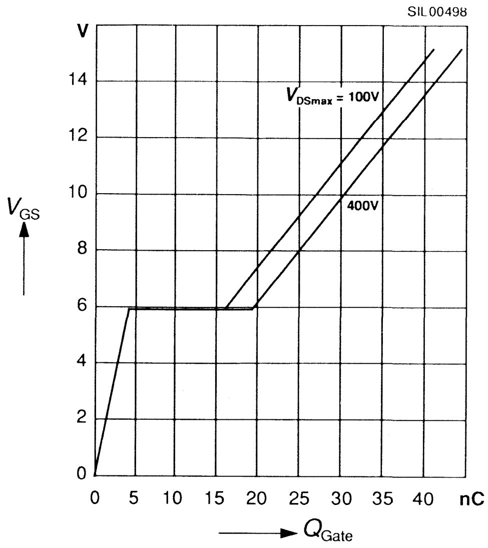
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 4.0$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 24.8$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 6.0$ A



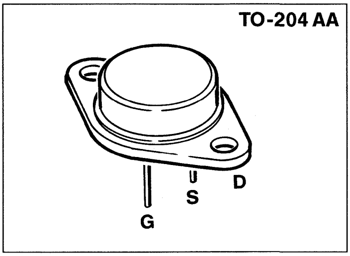
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 45
BUZ 45 A
BUZ 45 B

V_{DS} = 500 V
I_D = 8.3 ... 10 A
$R_{DS(on)}$ = 0.5 ... 0.8 Ω

- N channel
- Enhancement mode
- Package: TO-204 AA (TO-3) 1)



Type	Ordering code
BUZ 45	C67078-A1008-A2
BUZ 45 A	C67078-A1008-A3
BUZ 45 B	C67078-A1008-A4

Maximum Ratings

Parameter	Symbol	BUZ 45	45 A	45 B	Unit
Drain-source voltage	V_{DS}	500			V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500			
Gate-source voltage	V_{GS}	± 20			
Continuous drain current T_C = 25/25/40 °C	I_D	9.6	8.3	10	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	38	33	40	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125			W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 1.0 35			K/W
DIN humidity category, DIN 40 040	–	C			–
IEC climatic category, DIN IEC 68-1	–	55/150/56			

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1) See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

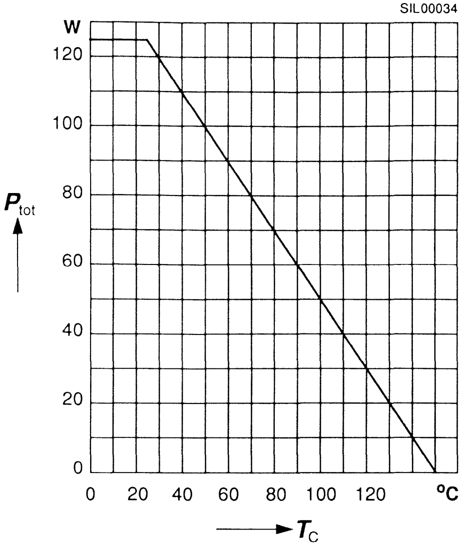
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C	I_{DSS}	–	250	µA
$T_j = 125$ °C		–	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 5$ A BUZ 45	$R_{DS(on)}$	–	0.6	Ω
BUZ 45 A		–	0.8	
BUZ 45 B		–	0.5	
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 5$ A	g_{fs}	2.7	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	4900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V $R_{GS} = 50$ Ω $I_D = 2.8$ A BUZ 45 $I_D = 2.8$ A BUZ 45 A $I_D = 2.9$ A BUZ 45 B	$t_{d(on)}$	–	75	ns
	t_r	–	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V $R_{GS} = 50$ Ω $I_D = 2.8$ A BUZ 45 $I_D = 2.8$ A BUZ 45 A $I_D = 2.9$ A BUZ 45 B	$t_{d(off)}$	–	430	
	t_f	–	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

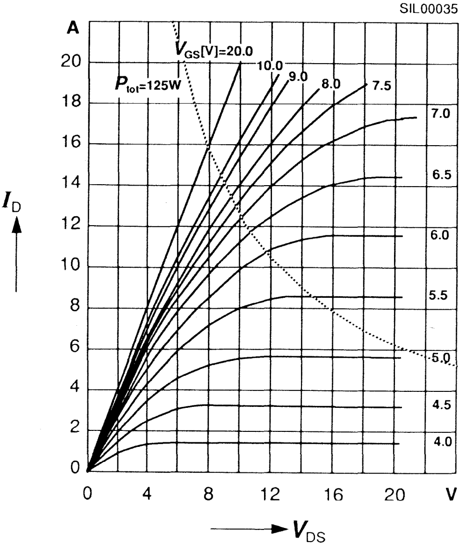
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
T_C = 25 °C	BUZ 45		–	9.6	
	BUZ 45 A		–	8.3	
	BUZ 45 B		–	10	
Pulsed reverse drain current		I_{SM}			
T_C = 25 °C	BUZ 45		–	38	
	BUZ 45 A		–	33	
	BUZ 45 B		–	40	
Diode forward on-voltage		V_{SD}			V
$V_{GS} = 0$ I_F = 21 A	BUZ 45		–	1.7	
I_F = 21 A	BUZ 45 A		–	1.6	
I_F = 23 A	BUZ 45 B		–	1.7	
Reverse recovery time		t_{rr}			µs
V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs			1.2	–	
			typ.	–	
Reverse recovery charge		Q_{rr}			µC
V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs			12	–	
			typ.	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

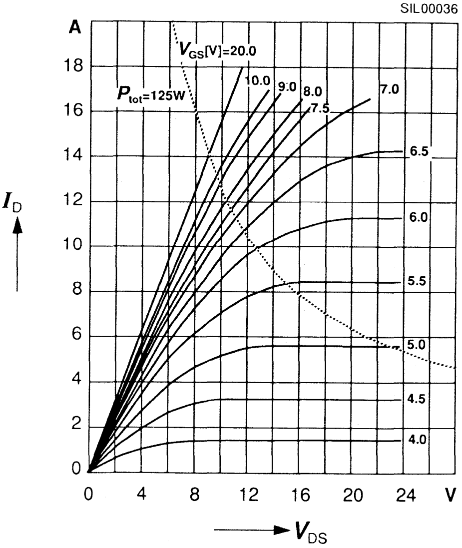
Total power dissipation $P_{tot} = f(T_C)$



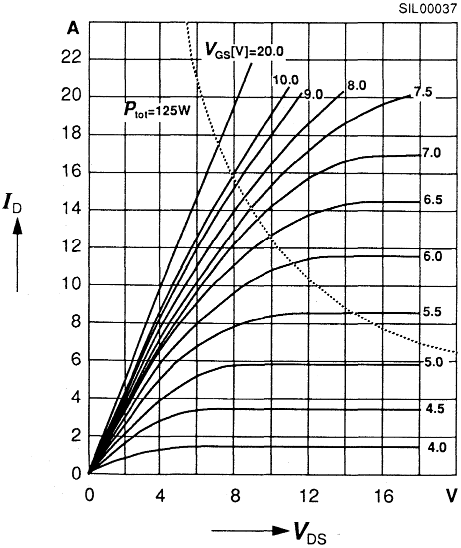
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 45



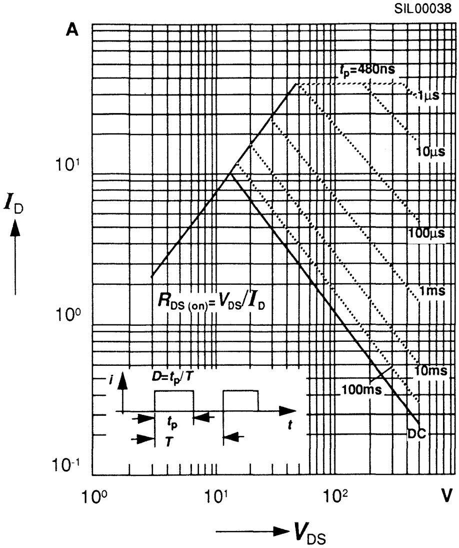
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 45 A



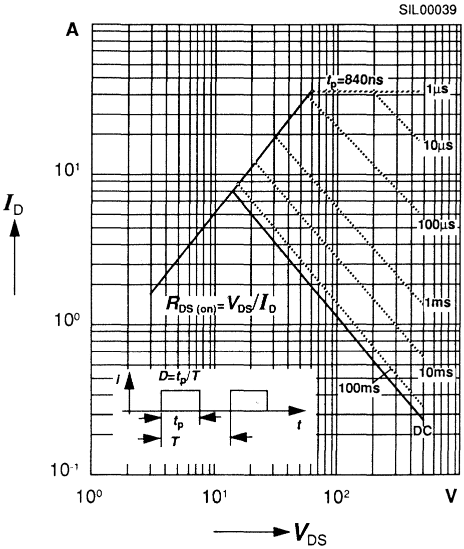
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 45 B



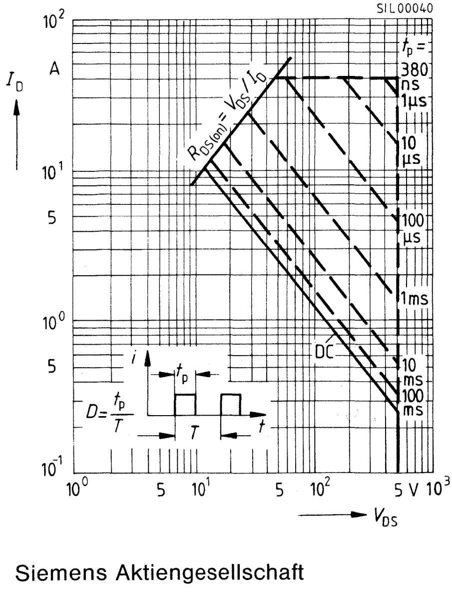
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 45



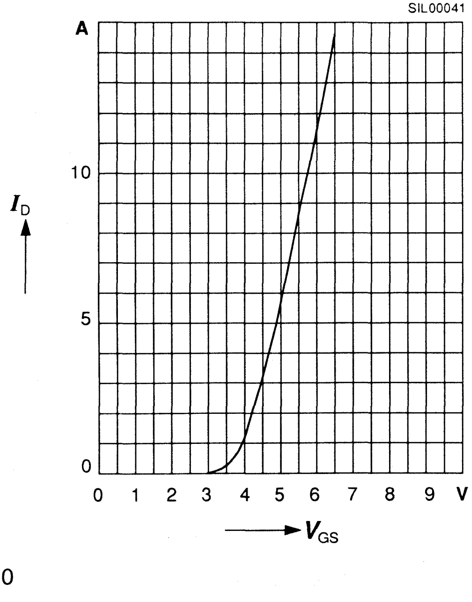
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 45 A



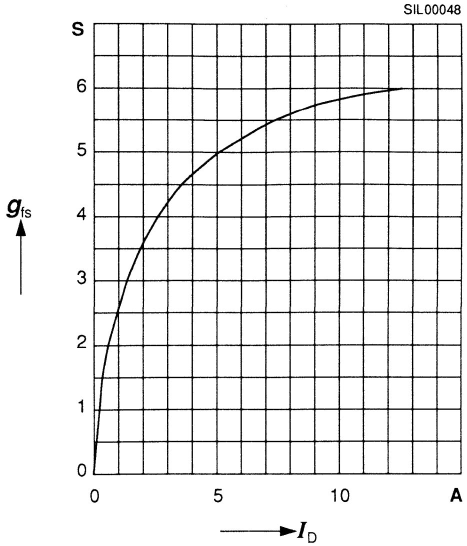
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 45 B



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

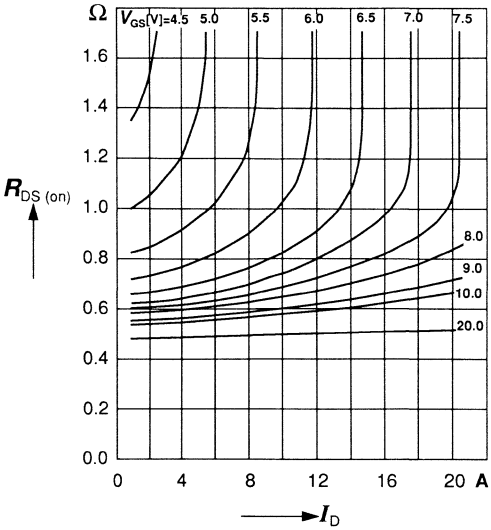


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



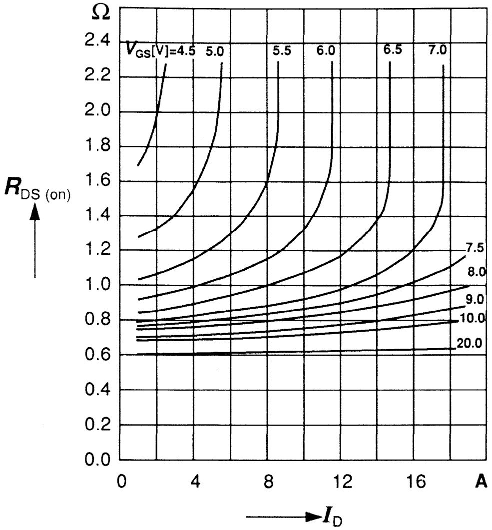
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 45



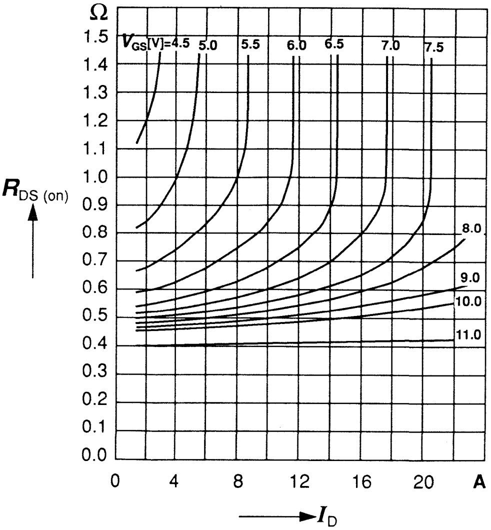
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 45 A



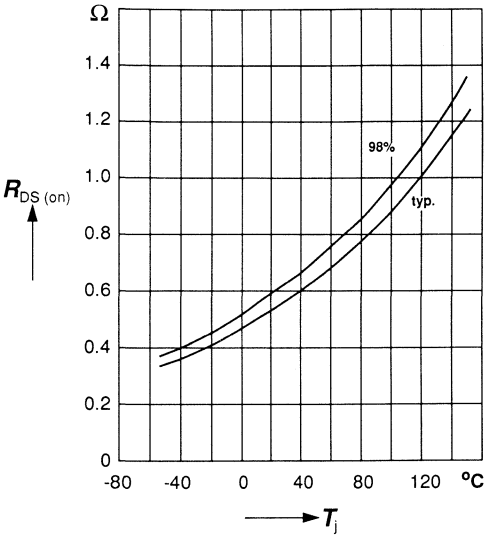
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 45 B



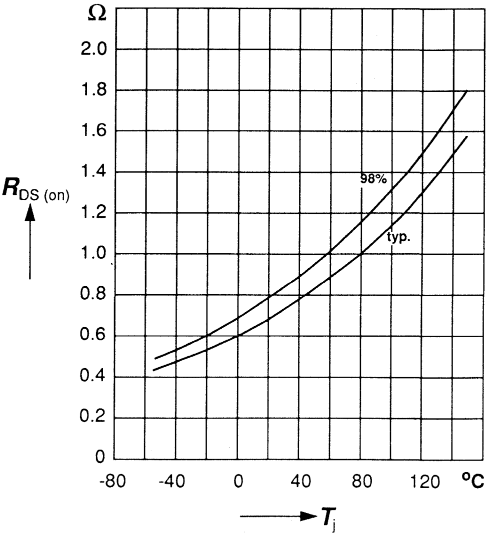
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5$ A, $V_{GS} = 10$ V, (spread)

BUZ 45



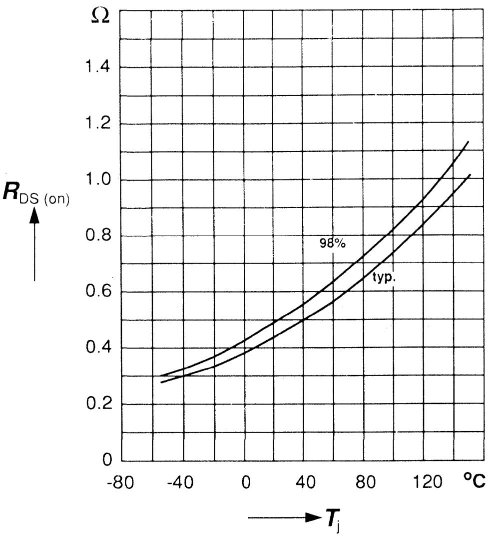
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5$ A, $V_{GS} = 10$ V, (spread)

BUZ 45 A

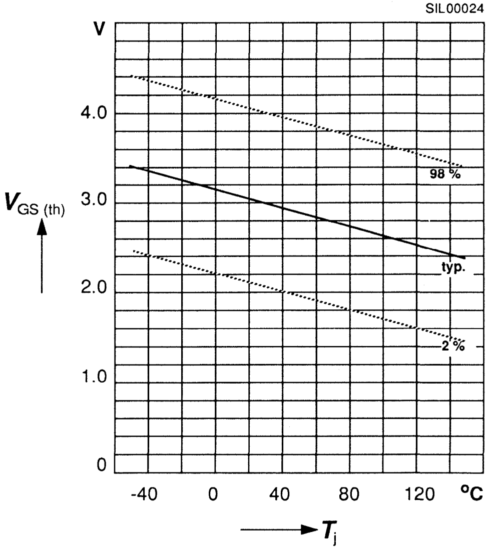


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5$ A, $V_{GS} = 10$ V, (spread)

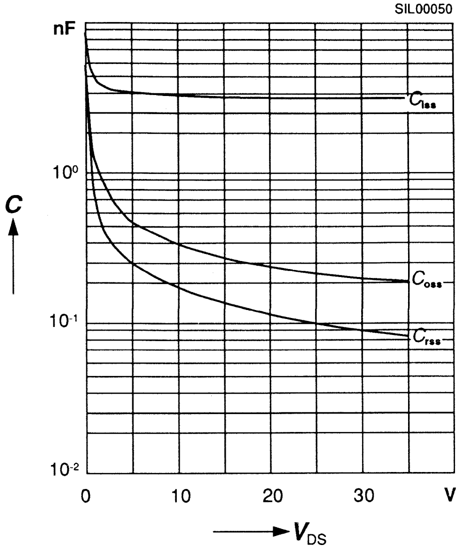
BUZ 45 B



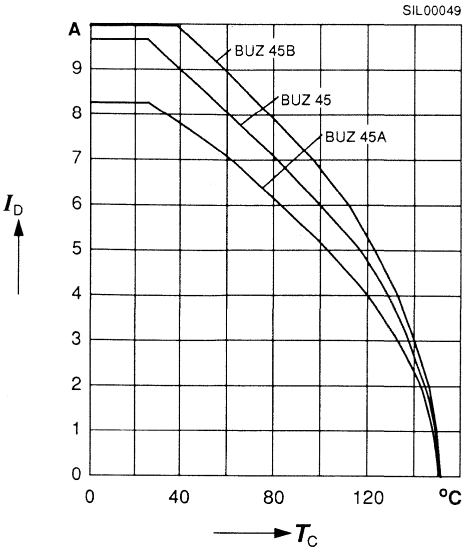
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



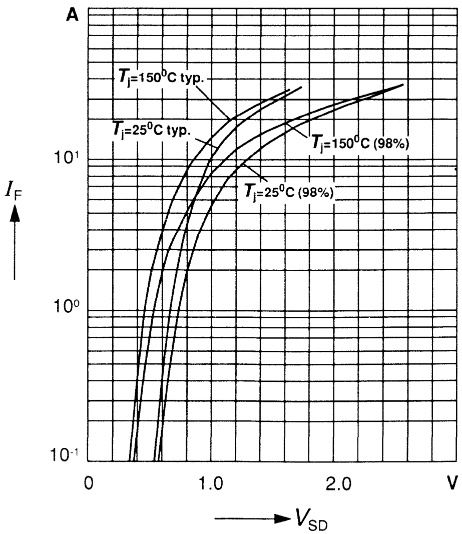
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



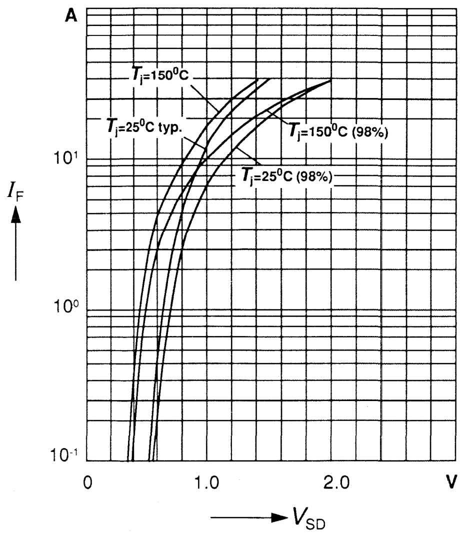
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



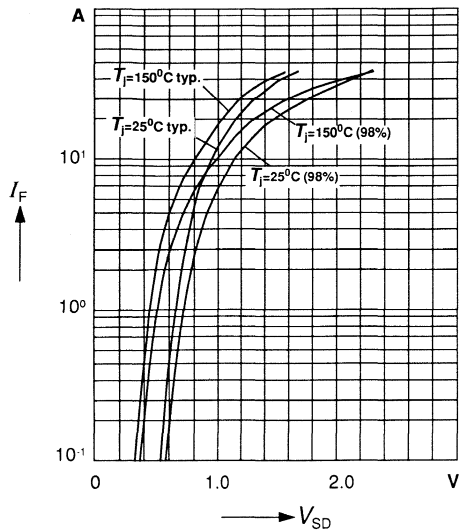
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 45



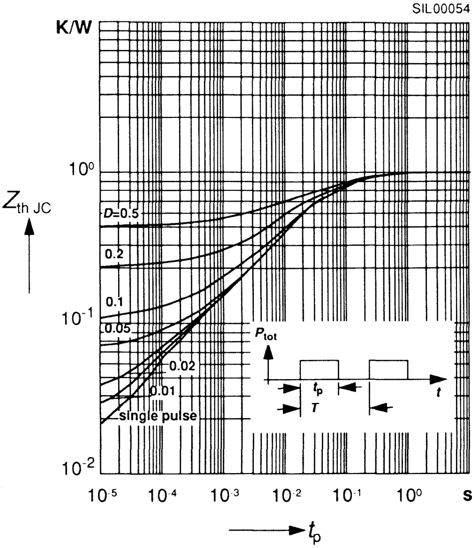
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 45 A



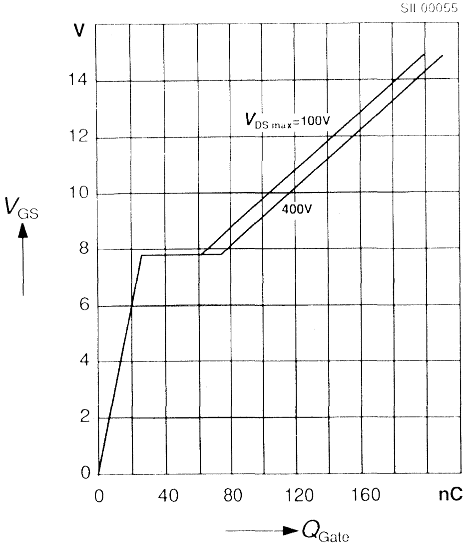
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)
BUZ 45 B



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls}$ = 14.4 A



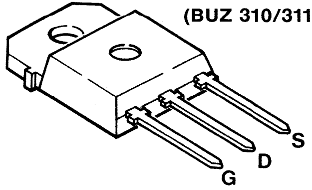
SIPMOS® Power MOS Transistors

BUZ 50 A BUZ 50 B BUZ 50 C BUZ 310 BUZ 311

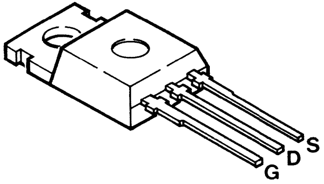
V_{DS} = 1000 V
I_D = 2.0...2.5 A
$R_{DS(on)}$ = 5.0...8.0 Ω

- N channel
- Enhancement mode
- Avalanche-proof
  (available as of Jan. '91)
- Packages: TO-218 AA, TO-220 AB [1])

TO-218 AA
(BUZ 310/311)



TO-220 AB
(BUZ 50 A/B/C)



Type	Ordering code
BUZ 50 A	C67078-A1307-A3
BUZ 50 B	C67078-A1307-A4
BUZ 50 C	C67078-A1307-A5
BUZ 310	C67078-A3101-A2
BUZ 311	C67078-A3102-A2

Maximum Ratings

Parameter	Symbol	BUZ					Unit
		50 A	50 B	50 C	310	311	
Drain-source voltage	V_{DS}	1000					V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000					
Gate-source voltage	V_{GS}	± 20					
Continuous drain current, T_C = 25 °C	I_D	2.5	2.0	2.3	2.5	2.3	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	10.0	8.0	9.0	10.0	9.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150					°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75					W
Thermal resistance							K/W
chip - case	R_{thJC}	≤ 1.67					
chip - ambient, without heat sink	R_{thJA}	≤ 75			≤ 45		
DIN humidity category, DIN 40 040	–	E					–
IEC climatic category, DIN IEC 68-1	–	55/150/56					

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[1]) See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

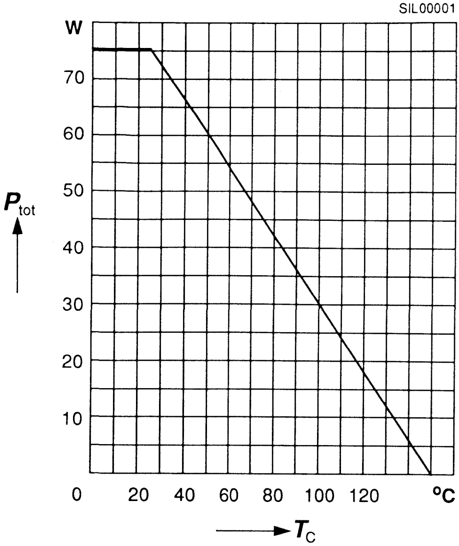
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage	$V_{(BR)DSS}$			V
$V_{GS} = 0$, $I_D = 0.25$ mA		1000	–	
Gate threshold voltage	$V_{GS(th)}$			
$V_{GS} = V_{DS}$, $I_D = 1$ mA		2.1	4.0	
Zero gate voltage drain current	I_{DSS}			µA
$V_{DS} = 1000$ V, $V_{GS} = 0$				
$T_j = 25$ °C		–	250	
$T_j = 125$ °C		–	1000	
Gate-source leakage current	I_{GSS}			nA
$V_{GS} = 20$ V, $V_{DS} = 0$		–	100	
Drain-source on-resistance	$R_{DS(on)}$			Ω
$V_{GS} = 10$ V, $I_D = 1.5$ A BUZ 50 A		–	5.0	
$I_D = 1.5$ A BUZ 50 B		–	8.0	
$I_D = 1.5$ A BUZ 50 C		–	6.0	
$I_D = 1.6$ A BUZ 310		–	5.0	
$I_D = 1.6$ A BUZ 311		–	6.0	
Dynamic characteristics				
Forward transconductance	g_{fs}			S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.5$ A BUZ 50 A/B/C $I_D = 1.6$ A BUZ 310/311		0.7	–	
Input capacitance	C_{iss}			pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	2100	
Output capacitance	C_{oss}			
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	120	
Reverse transfer capacitance	C_{rss}			
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		–	55	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	–	45	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2$ A BUZ 50 A / 310 $I_D = 1.7$ A BUZ 50 B $I_D = 1.9$ A BUZ 50 C / 311	t_r	–	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	–	140	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω $I_D = 2$ A BUZ 50 A / 310 $I_D = 1.7$ A BUZ 50 B $I_D = 1.9$ A BUZ 50 C / 311	t_f	–	80	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

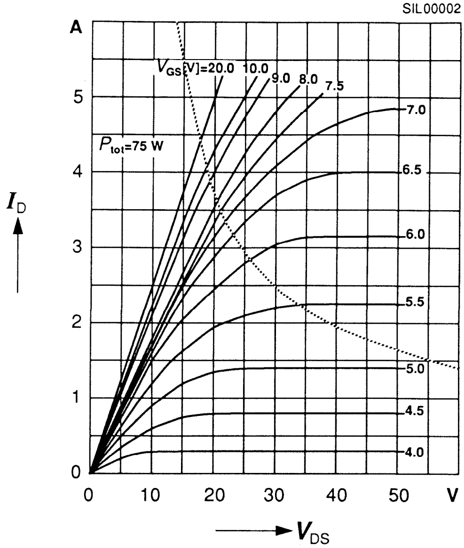
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 50 A		–	2.5	
	BUZ 50 B		–	2.0	
	BUZ 50 C		–	2.3	
	BUZ 310		–	2.5	
	BUZ 311		–	2.3	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 50 A		–	10.0	
	BUZ 50 B		–	8.0	
	BUZ 50 C		–	9.0	
	BUZ 310		–	10.0	
	BUZ 311		–	9.0	
Diode forward on-voltage $V_{GS} = 0$, $I_F = 6$ A BUZ 50 A/B/C $I_F = 5$ A BUZ 310/311		V_{SD}	–	1.3	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	typ. 2.0	–	µs
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	typ. 15	–	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

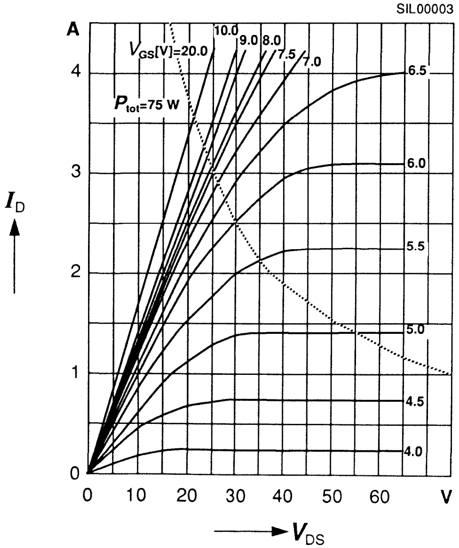
Total power dissipation $P_{tot} = f(T_C)$



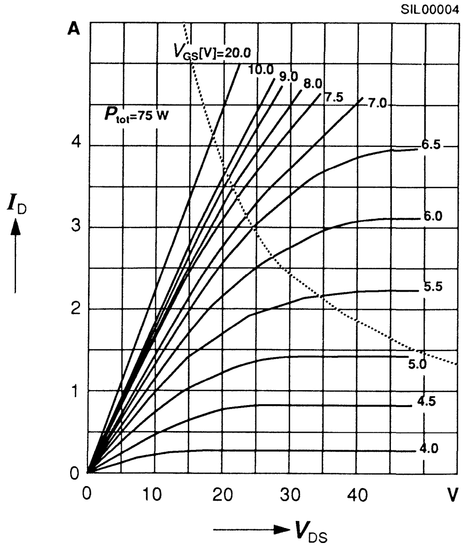
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BUZ 50 A



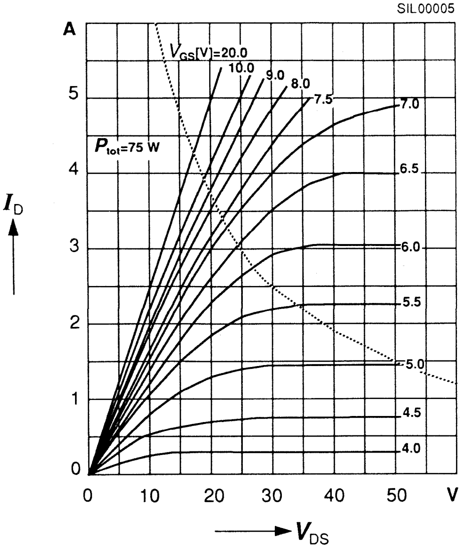
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BUZ 50 B



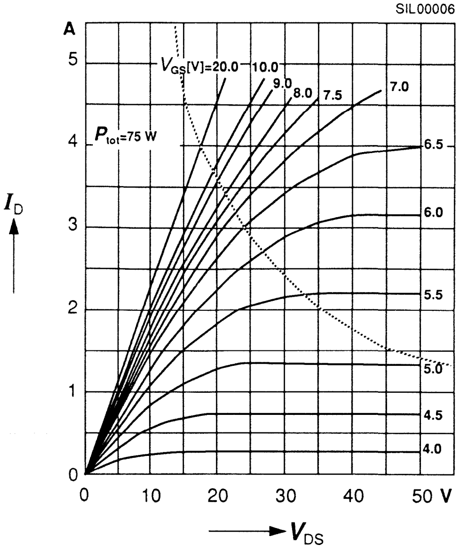
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs
BUZ 50 C



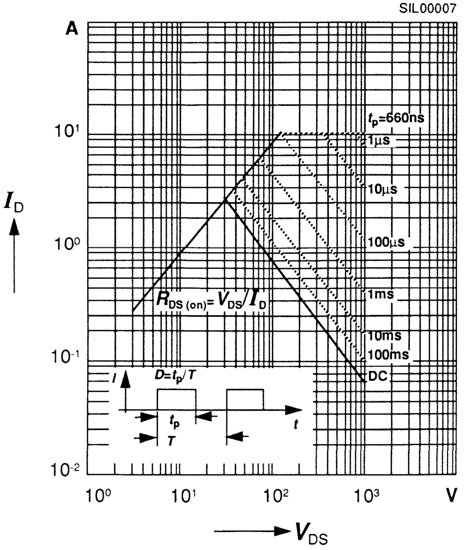
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 310



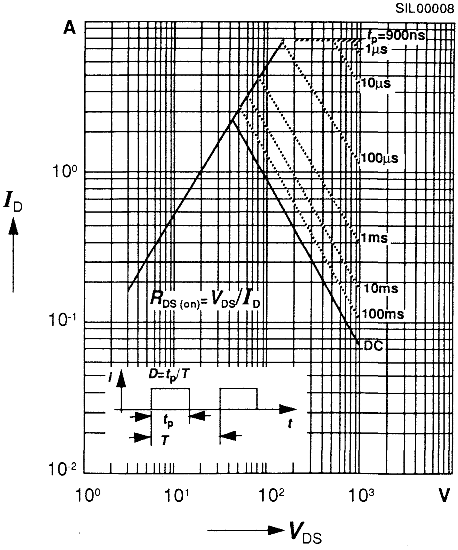
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 311



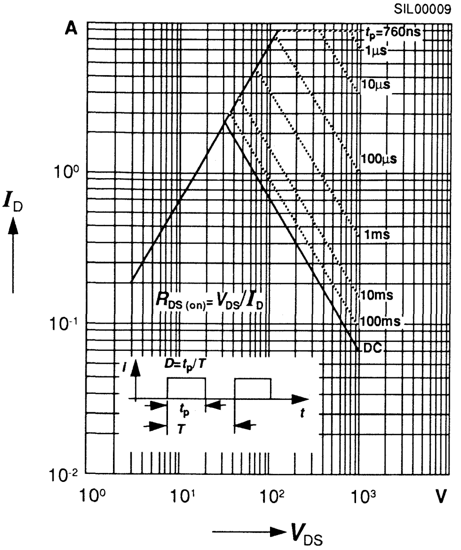
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 50 A



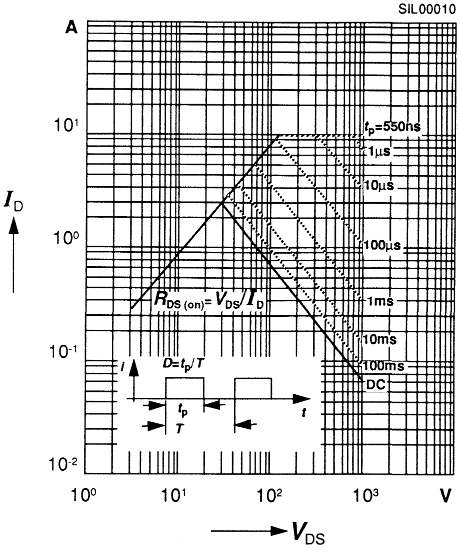
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 50 B



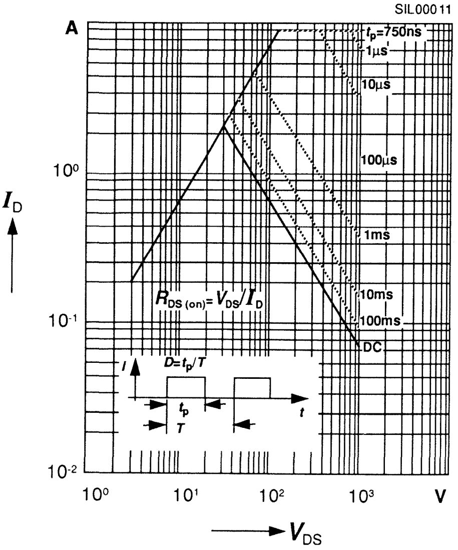
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 50 C



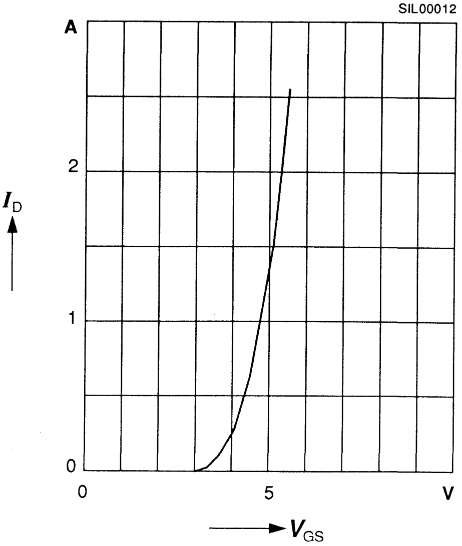
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 310



Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 311

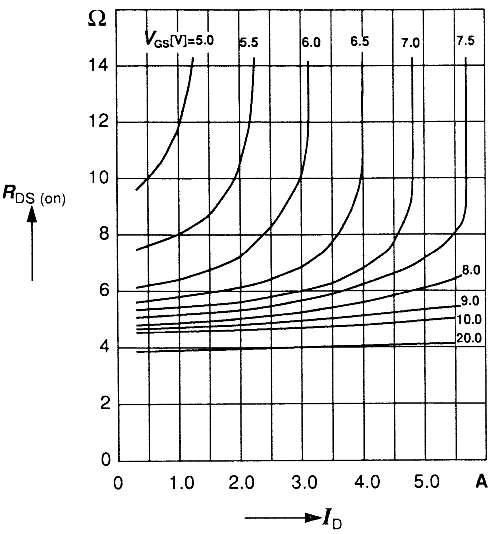


Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



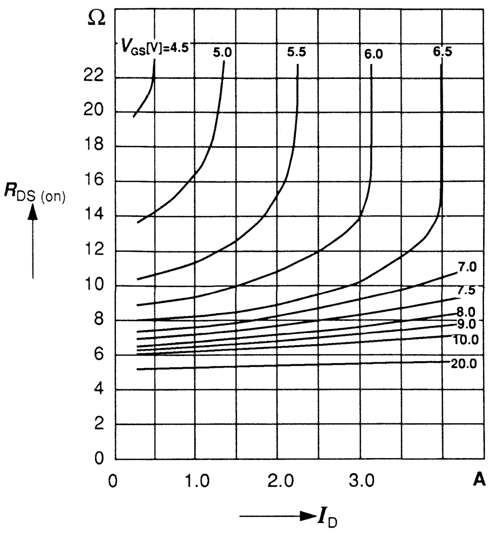
Typ. Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 50 A



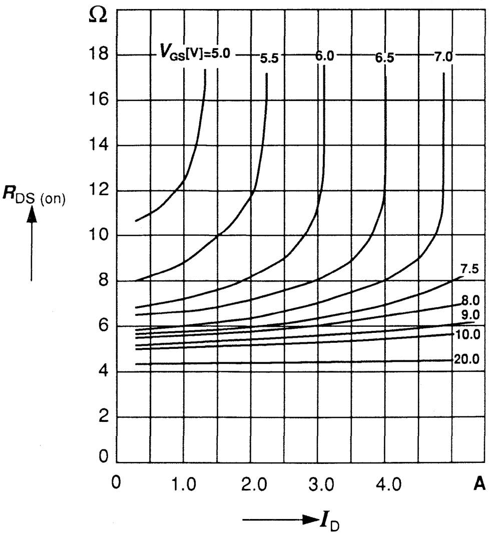
Typ. Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 50 B



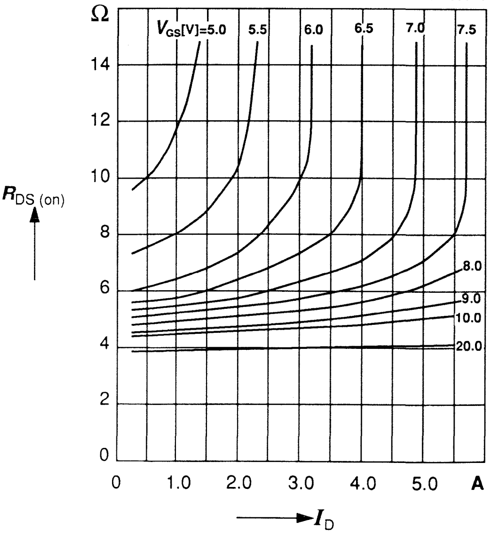
Typ. Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 50 C



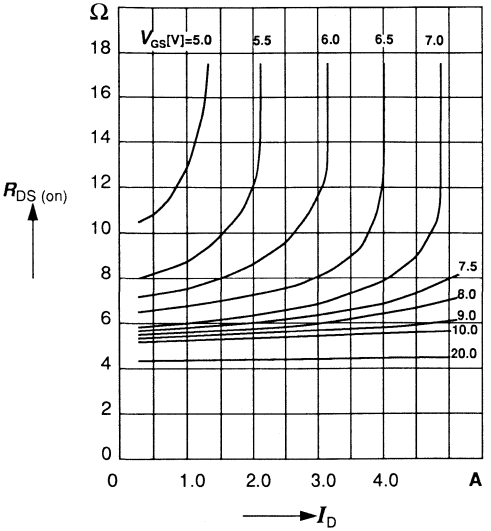
Typ. Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 310



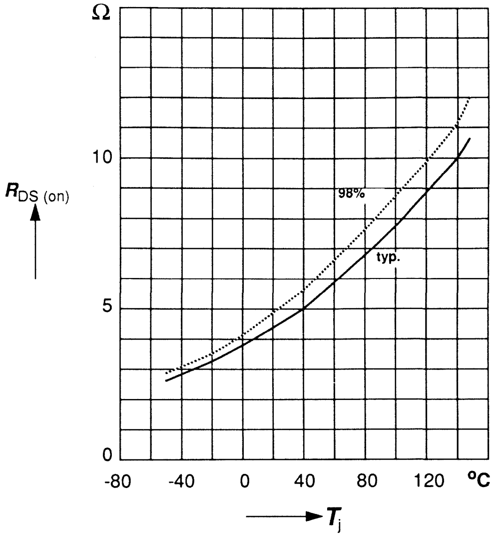
Typ. Drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 311

SIL00017



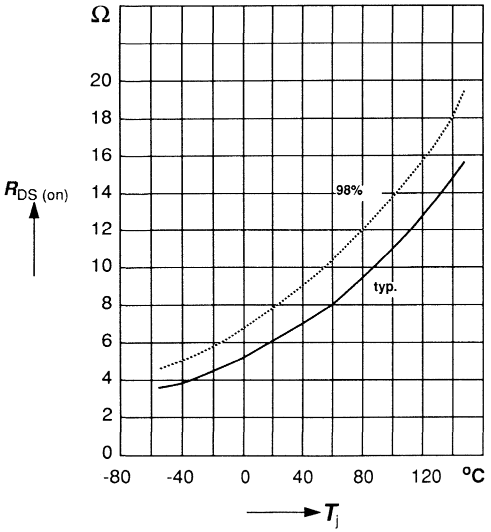
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 1.5 A, V_{GS} = 10 V, (spread)
BUZ 50 A

SIL00018



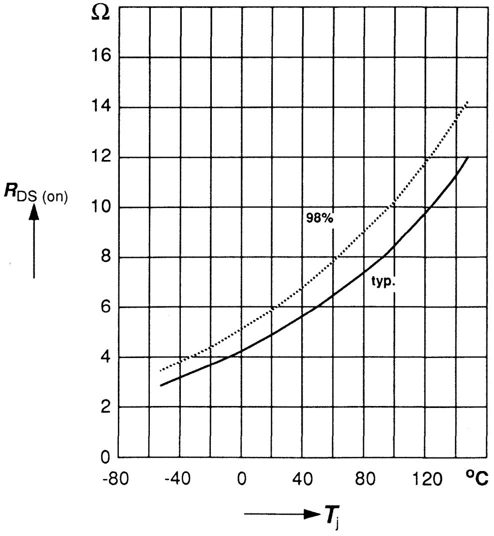
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 1.5 A, V_{GS} = 10 V, (spread)
BUZ 50 B

SIL00019

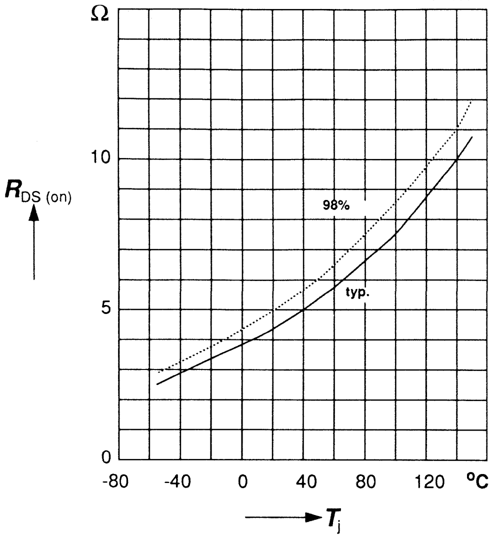


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 1.5 A, V_{GS} = 10 V, (spread)
BUZ 50 C

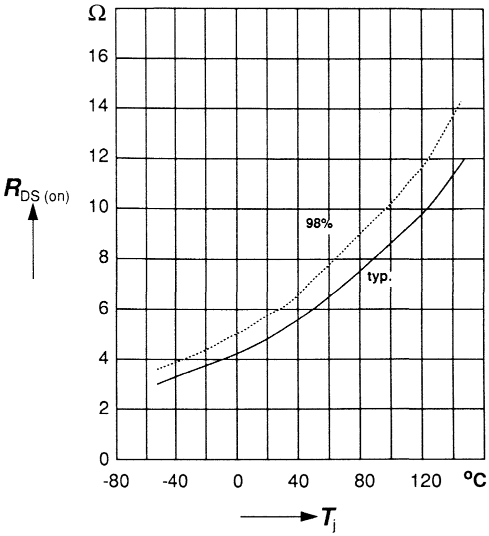
SIL00020



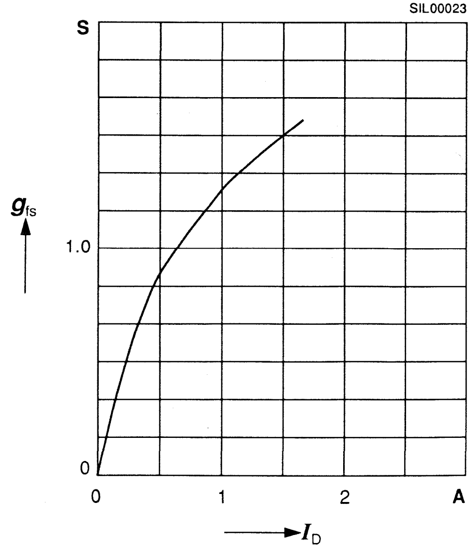
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.6$ A, $V_{GS} = 10$ V, (spread)
BUZ 310



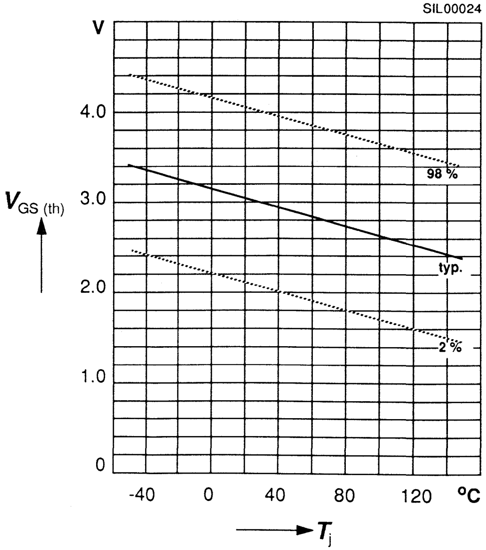
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.6$ A, $V_{GS} = 10$ V, (spread)
BUZ 311



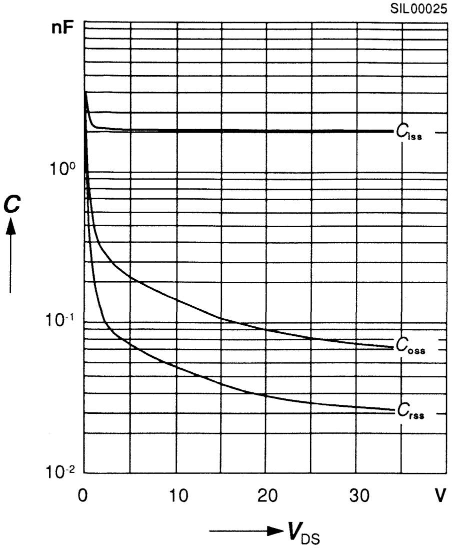
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geqq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



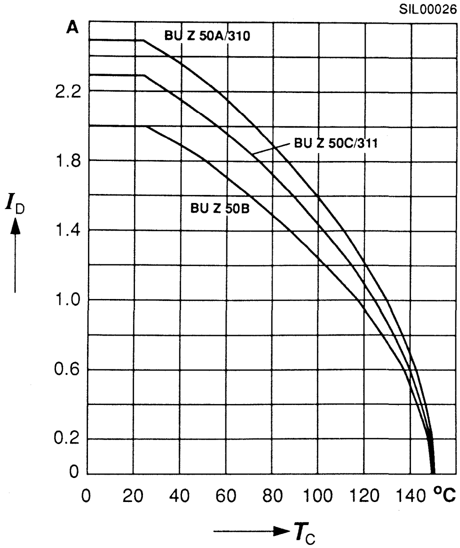
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



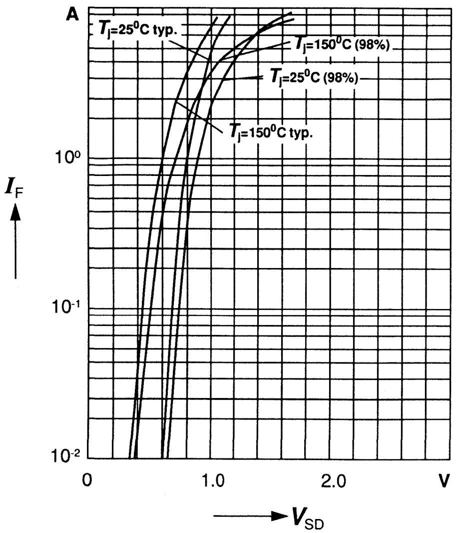
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



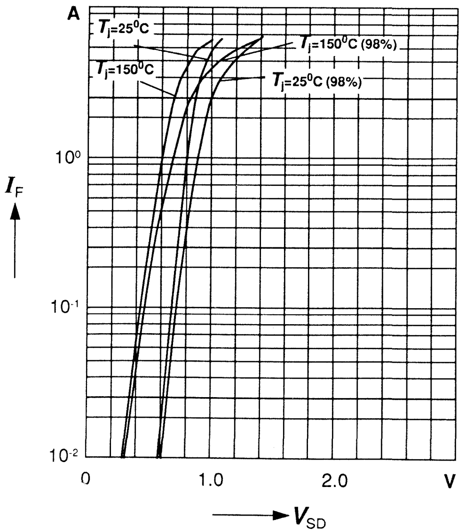
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs (spread)
BUZ 50 A



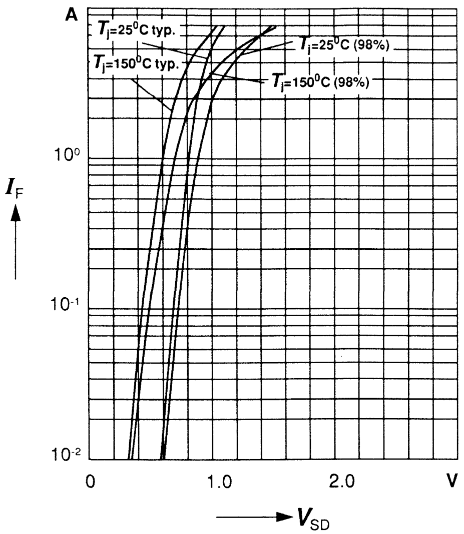
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs (spread)
BUZ 50 B



Forward characteristics of reverse diode

$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs (spread)

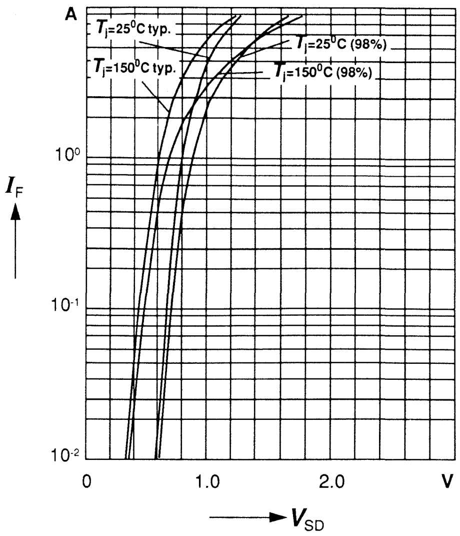
BUZ 50 C



Forward characteristics of reverse diode

$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs (spread)

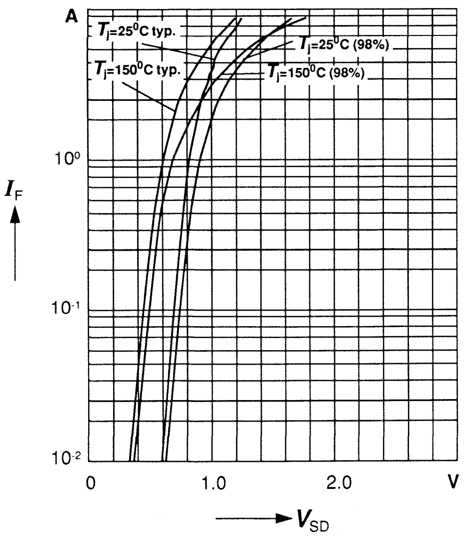
BUZ 310



Forward characteristics of reverse diode

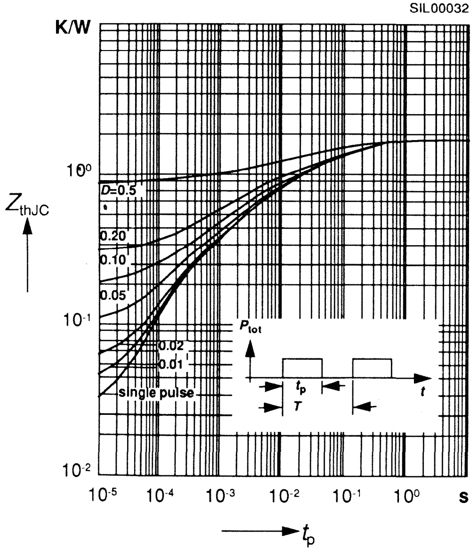
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs (spread)

BUZ 311

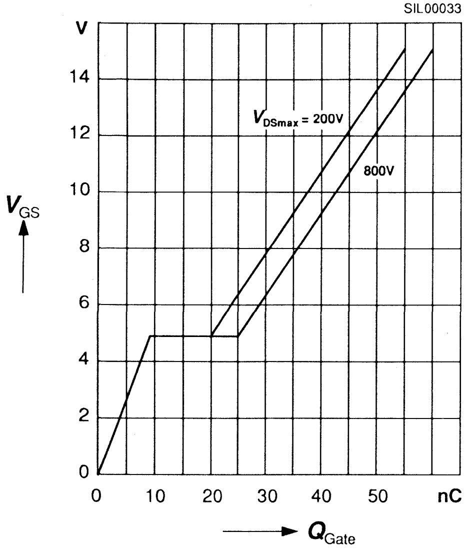


Transient thermal impedance $Z_{thJC} = f(t_p)$

parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 3.75$ A



SIEMENS

SIPMOS® Power MOS Transistors

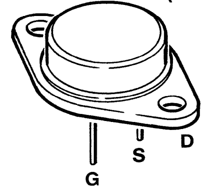
BUZ 54
BUZ 54 A
BUZ 357
BUZ 358

V_{DS} = 1000 V
I_D = 4.5 ... 5.1 A
$R_{DS(on)}$ = 2.0 ... 2.6 Ω

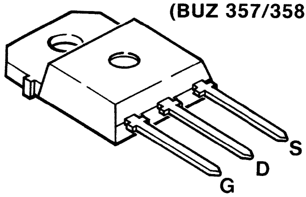
- N channel
- Enhancement mode
- Packages: TO-204 AA (TO-3)
  TO-218 AA (TOP-3) [1]

Type	Ordering code
BUZ 54	C67078-A1010-A2
BUZ 54 A	C67078-A1010-A3
BUZ 357	C67078-A3110-A2
BUZ 358	C67078-A3111-A2

TO-204 AA
(BUZ 54/54 A)



TO-218 AA
(BUZ 357/358)



Maximum Ratings

Parameter	Symbol	BUZ				Unit
		54	54 A	357	358	
Drain-source voltage	V_{DS}	1000				V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000				
Gate-source voltage	V_{GS}	± 20				
Continuous drain current T_C = 25/25/25/30 °C	I_D	5.1	4.5	5.0	4.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	20	18	20	18	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150				°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125				W
Thermal resistance						K/W
chip - case	R_{thJC}	≤ 1.0				
chip - ambient, without heat sink	R_{thJA}	≤ 35		≤ 45		
DIN humidity category, DIN 40 040	–	C		E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56				

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[1] See chapter Package Outlines.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}			µA
T_j = 25 °C		–	1.0	
T_j = 125 °C		–	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.2$ A	$R_{DS(on)}$			Ω
BUZ 54/357		–	2.0	
BUZ 54 A/358		–	2.6	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

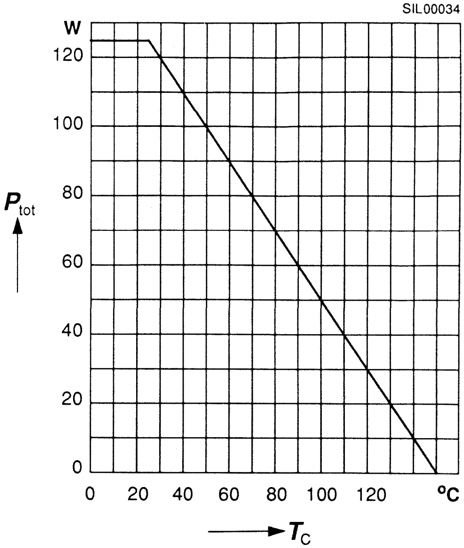
Parameter		**Symbol**	**Values**		**Unit**
			min.	max.	
Dynamic characteristics					
Forward transconductance		g_{fs}			S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.2$ A	BUZ 54/54 A		1.4	–	
	BUZ 357/358		2.5	–	
Input capacitance		C_{iss}			pF
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 54/54 A		–	2200	
	BUZ 357/358		–	2500	
Output capacitance		C_{oss}			
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 54/54 A		–	300	
	BUZ 357/358		–	240	
Reverse transfer capacitance		C_{rss}			
$V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz			–	140	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)		$t_{d(on)}$			ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 2.5$ A					
	BUZ 54/54 A		–	45	
	BUZ 357/358		–	35	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 2.5$ A		t_r			
	BUZ 54/54 A		–	160	
	BUZ 357/358		–	130	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)		$t_{d(off)}$			
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 2.5$ A					
	BUZ 54/54 A		–	520	
	BUZ 357/358		–	600	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$, $I_D = 2.5$ A		t_f			
	BUZ 54/54 A		–	170	
	BUZ 357/358		–	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

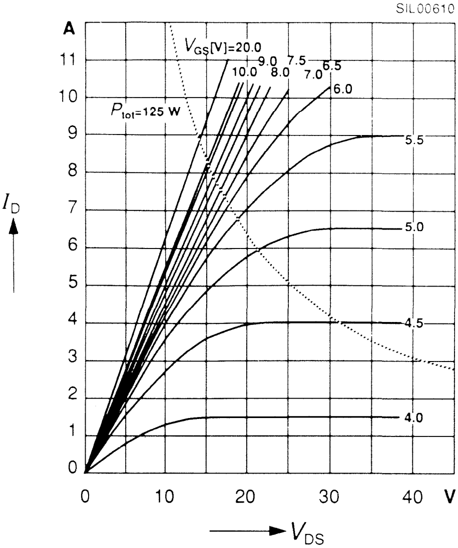
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 54		–	5.1	
	BUZ 54 A/358		–	4.5	
	BUZ 357		–	4.5	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 54/357		–	20	
	BUZ 54 A/358		–	18	
Diode forward on-voltage		V_{SD}			V
$I_F = 10$ A, $V_{GS} = 0$	BUZ 54/A/357		–	1.2	
$I_F = 9$ A, $V_{GS} = 0$	BUZ 358		–	1.2	
Reverse recovery time		t_{rr}			ns
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			1.5	–	
			typ.	–	
Reverse recovery charge		Q_{rr}			µC
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			6.5	–	
			typ.	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

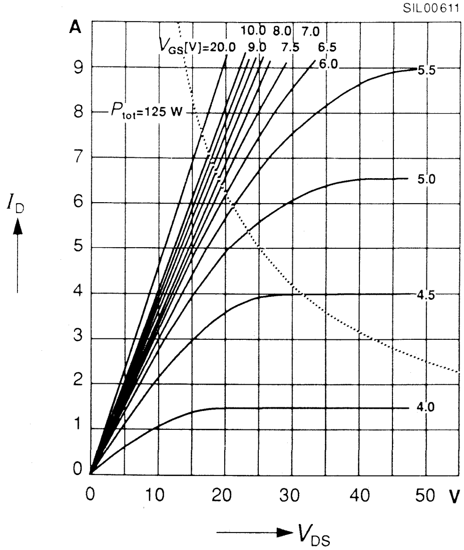
Total power dissipation $P_{tot} = f(T_C)$



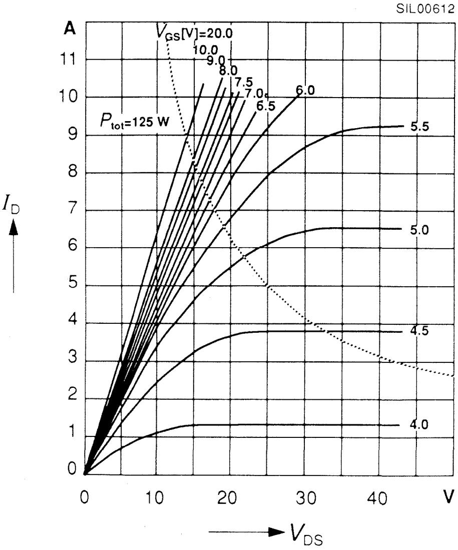
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 54



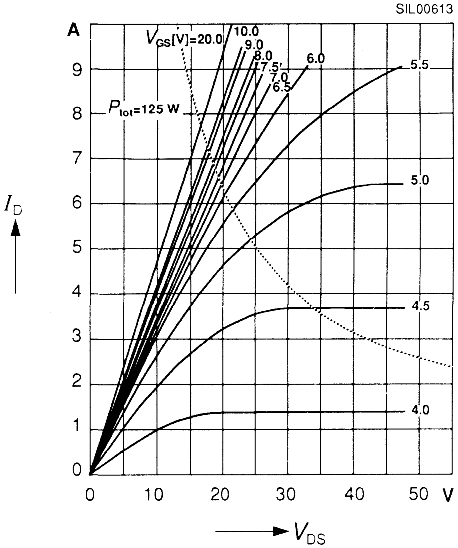
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 54 A



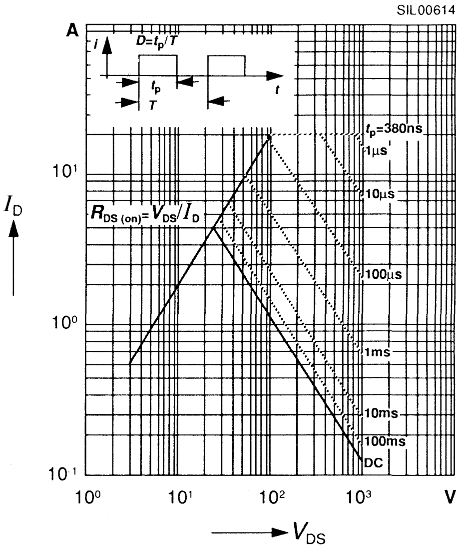
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 357



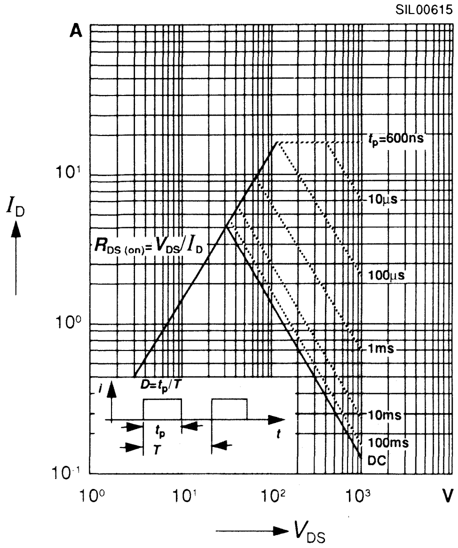
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BUZ 358



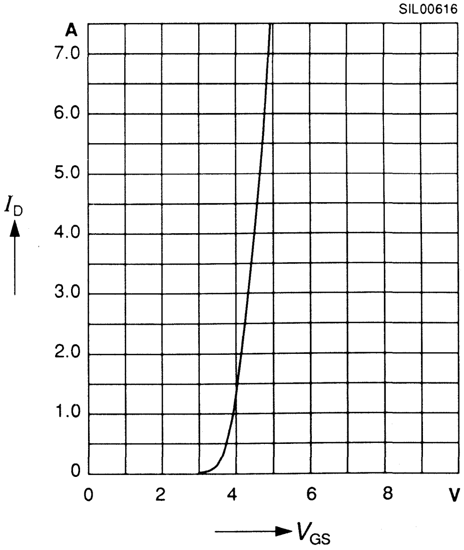
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 54/357



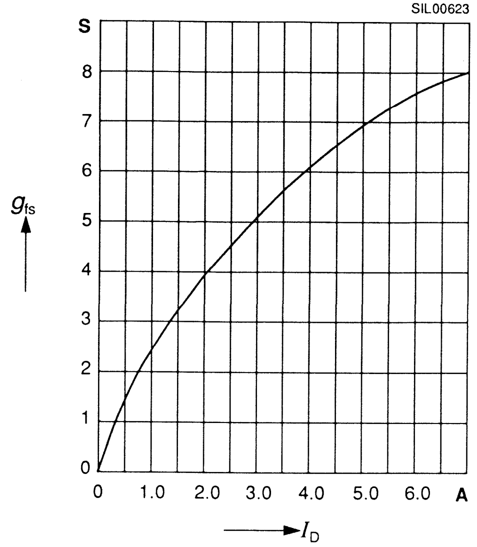
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 54 A/358



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25$ V

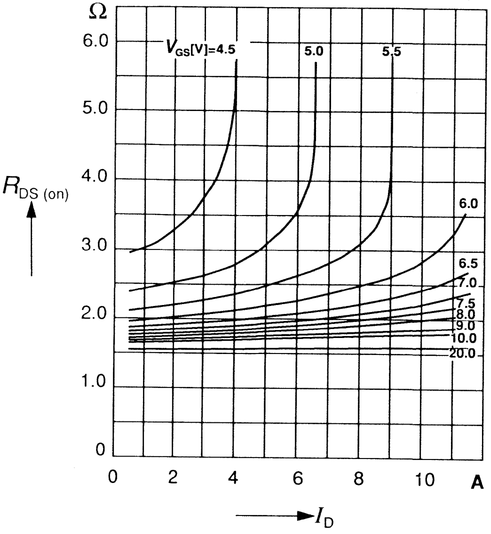


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



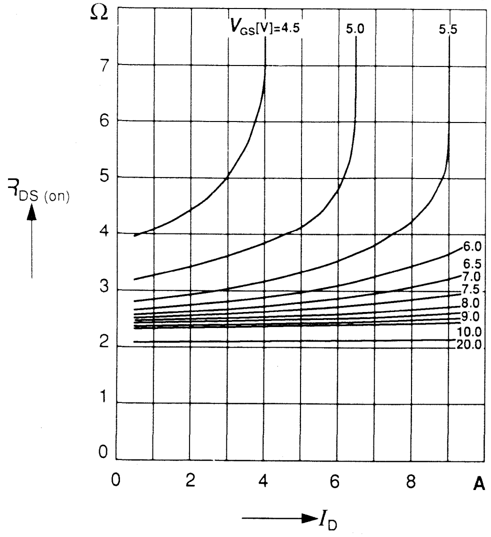
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 54



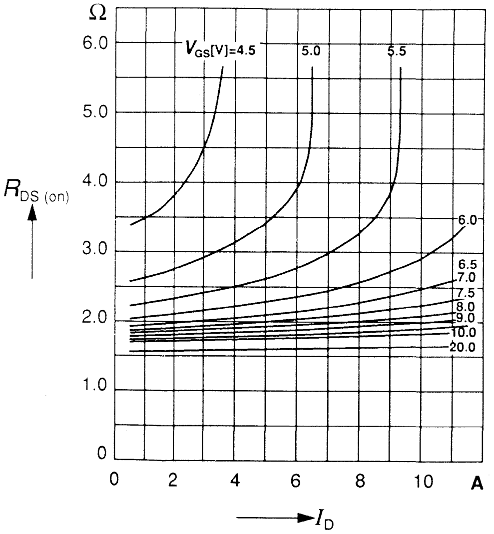
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 54 A



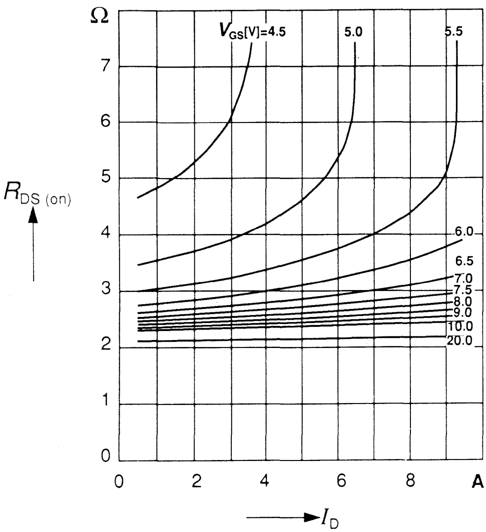
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 357



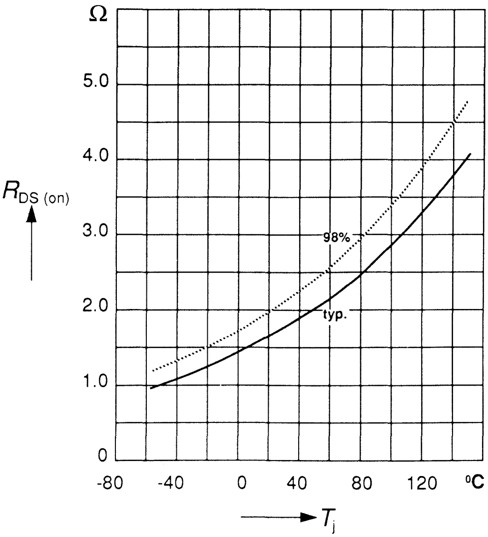
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 358



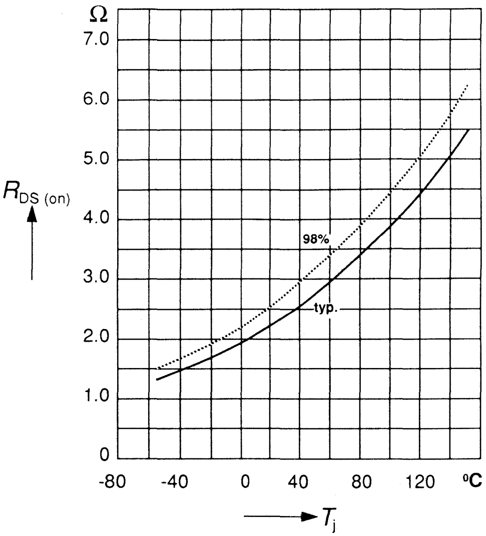
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.2$ A, $V_{GS} = 10$ V, (spread)

BUZ 54/357

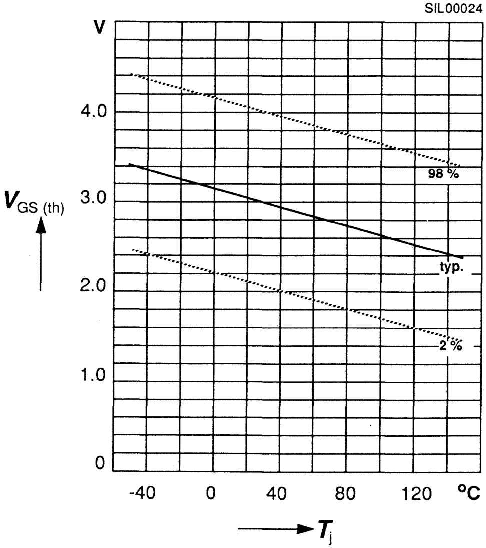


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.2$ A, $V_{GS} = 10$ V, (spread)

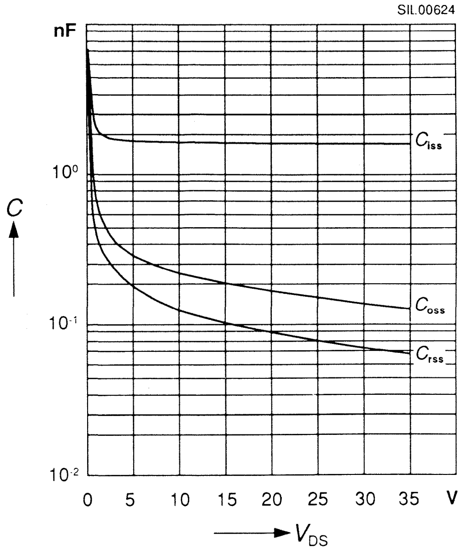
BUZ 54 A/358



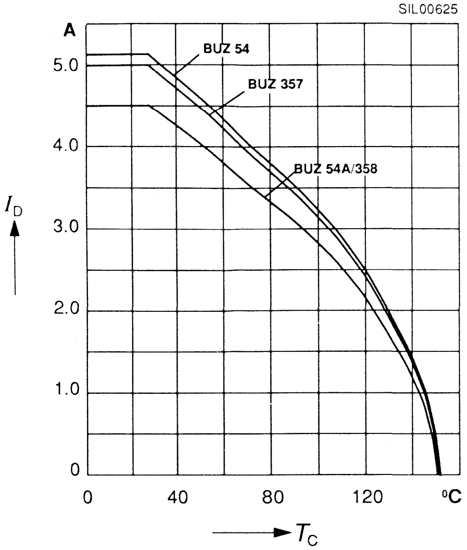
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

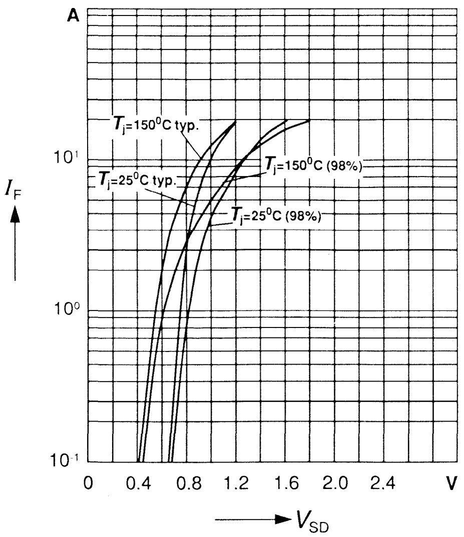


Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



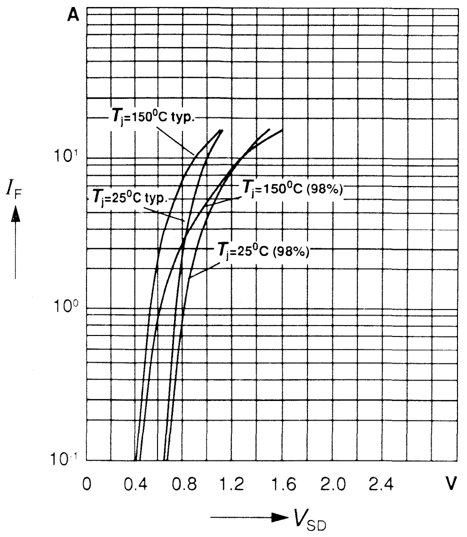
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 54/357

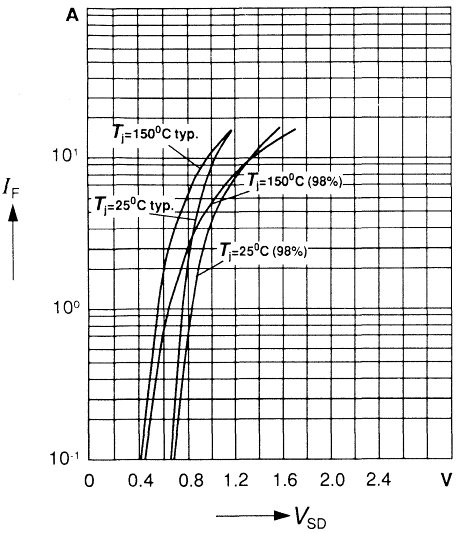


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

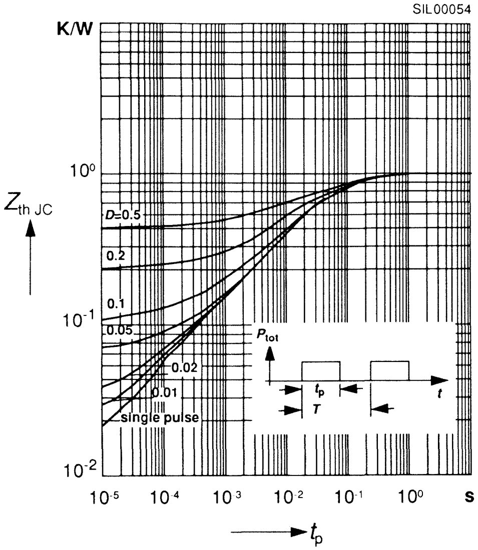
BUZ 54 A



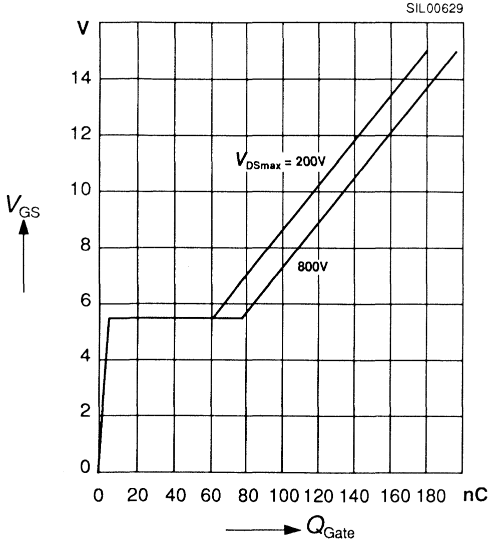
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)
BUZ 358



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls}$ = 7.5 A



SIEMENS

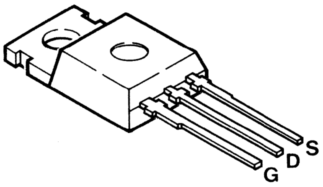
SIPMOS® Power MOS Transistor

BUZ 60

V_{DS} = 400 V
I_D = 5.5 A
$R_{DS(on)}$ = 1 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])

TO-220 AB



Type	**Ordering code**
BUZ 60	C67078-A1312-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 36$ °C	I_D	5.5	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	22	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	5.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	8	mJ
Avalanche energy, single pulse $I_D = 5.5$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 18.5$ mH, $T_j = 25$ °C	E_{AS}	320	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.5$ A	$R_{DS(on)}$	-	1.0	Ω

Dynamic characteristics

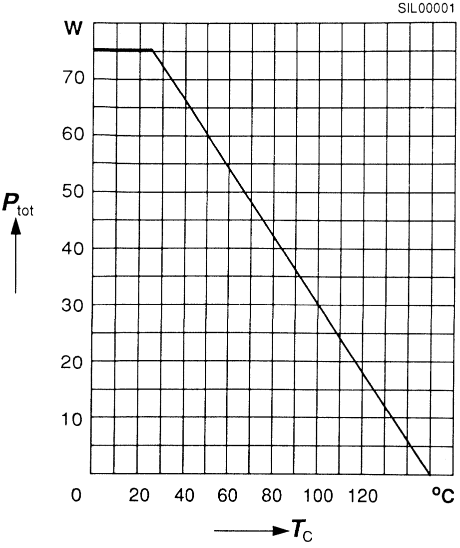
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.5$ A	g_{fs}	2.5	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1050	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	180	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	80	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.7$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.7$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	150	
	t_f	-	90	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

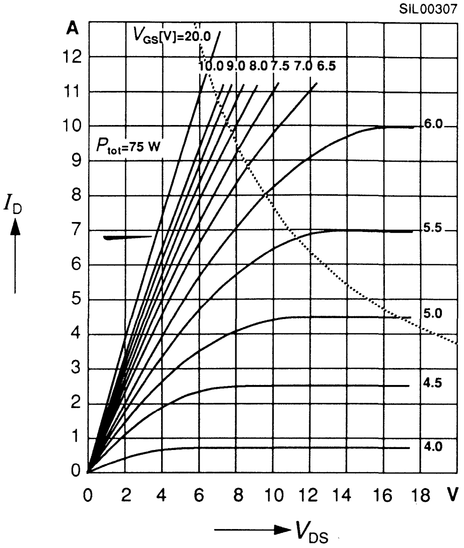
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	5.5	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	22	
Diode forward on-voltage I_F = 11 A, V_{GS} = 0	V_{SD}	–	1.2	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	t_{rr}	1.0 typ.	–	µs
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	Q_{rr}	5 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

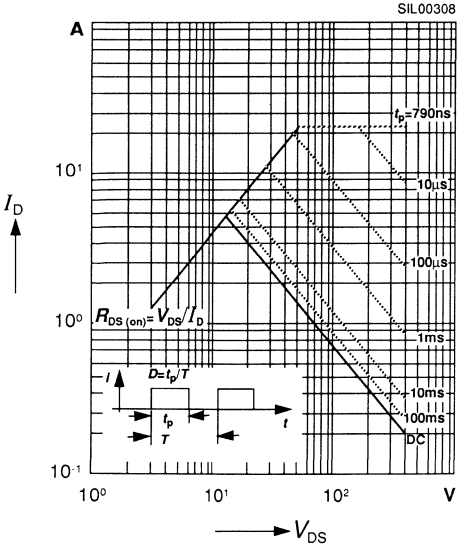
Total power dissipation $P_{tot} = f(T_C)$



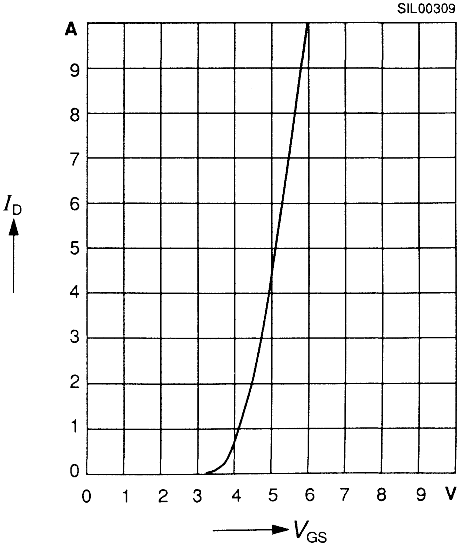
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



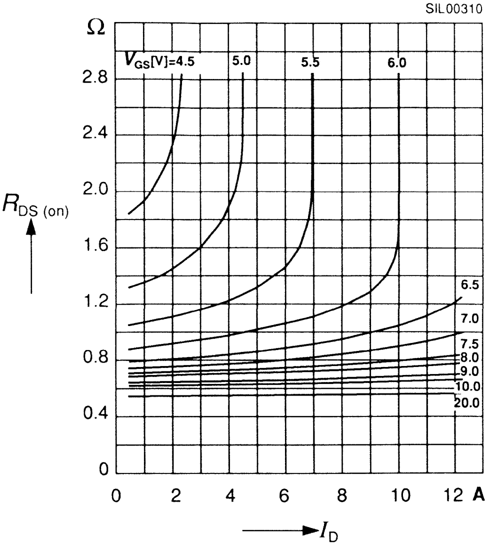
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



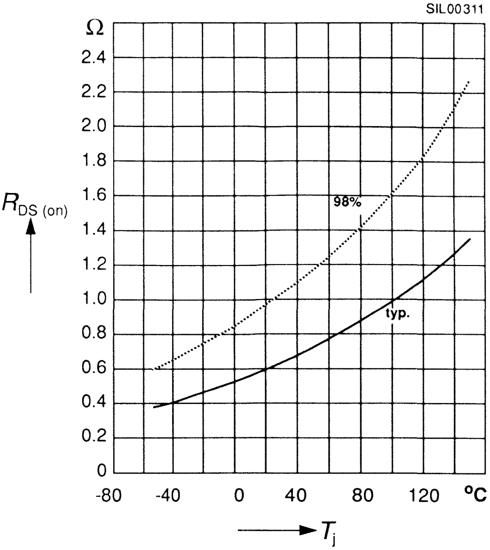
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



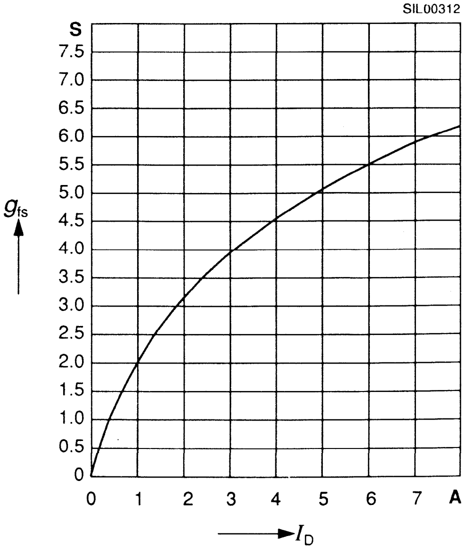
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



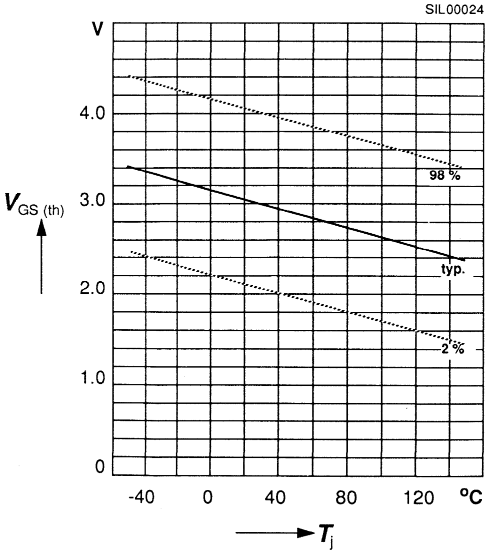
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.5$ A, $V_{GS} = 10$ V, (spread)



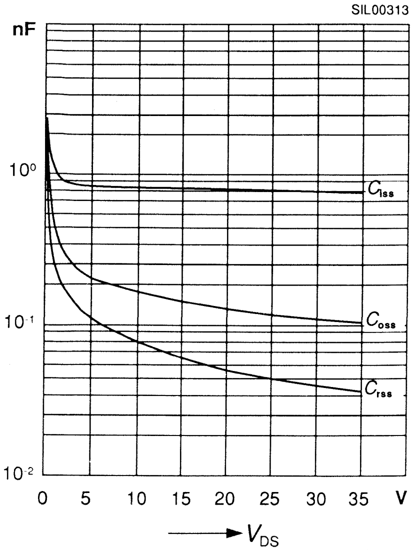
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



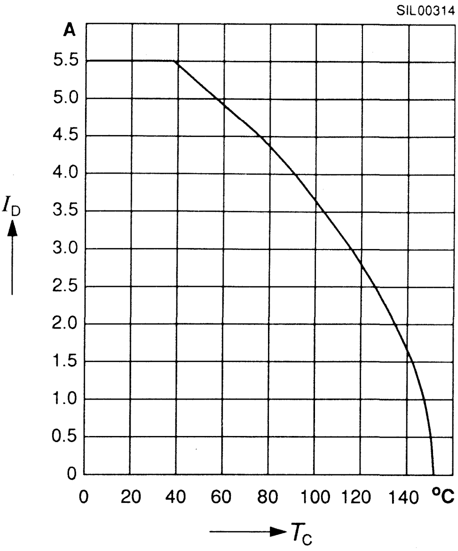
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



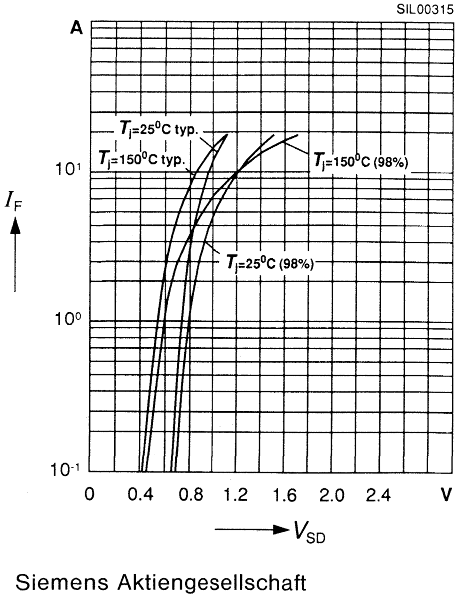
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



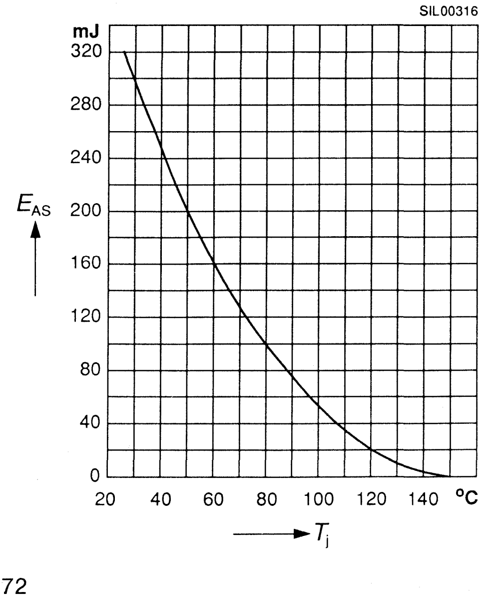
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



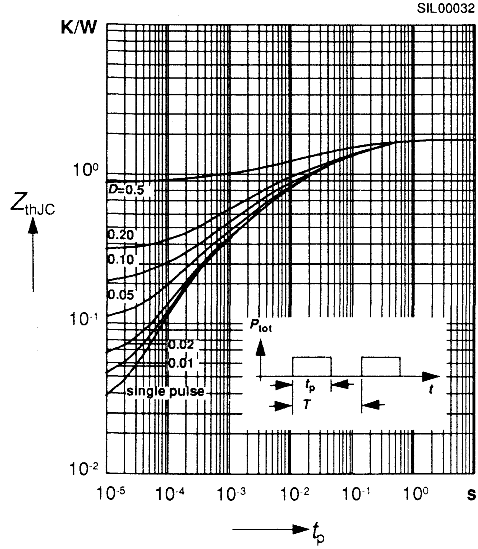
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



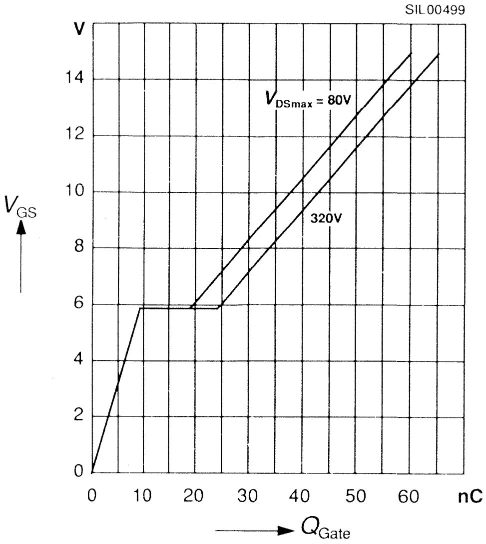
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 5.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 18.5$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



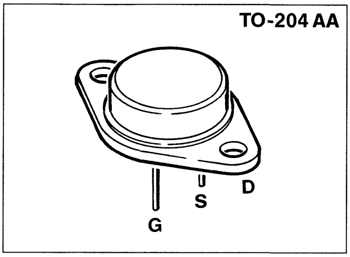
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 8.3$ A



SIPMOS® Power MOS Transistor BUZ 64

V_{DS} = 400 V
I_D = 11.5 A
$R_{DS(on)}$ = 0.40 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-204 AA (TO-3) [1]



Type	Ordering code
BUZ 64	C67078-A1017-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 31$ °C	I_D	11.5	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	46	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	11.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	13	mJ
Avalanche energy, single pulse $I_D = 11.5$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 7.54$ mH, $T_j = 25$ °C	E_{AS}	570	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 35	K/W
DIN humidity category, DIN 40 040	–	C	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 7.5$ A	$R_{DS(on)}$	–	0.40	Ω

Dynamic characteristics

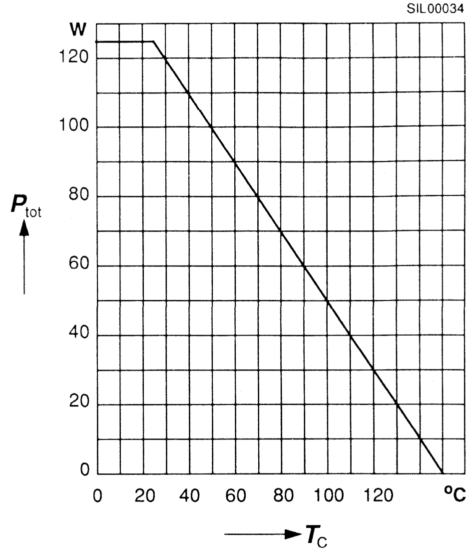
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 7.5$ A	g_{fs}	5.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	2250	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	315	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	110	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	30	ns
	t_r	–	100	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	340	
	t_f	–	100	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

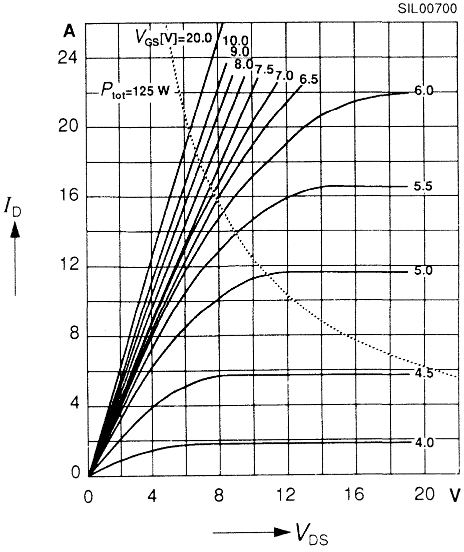
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	11.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	46	
Diode forward on-voltage $I_F = 23$ A, $V_{GS} = 0$	V_{SD}	–	1.2	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	1.2 typ.	–	µs
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	6 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

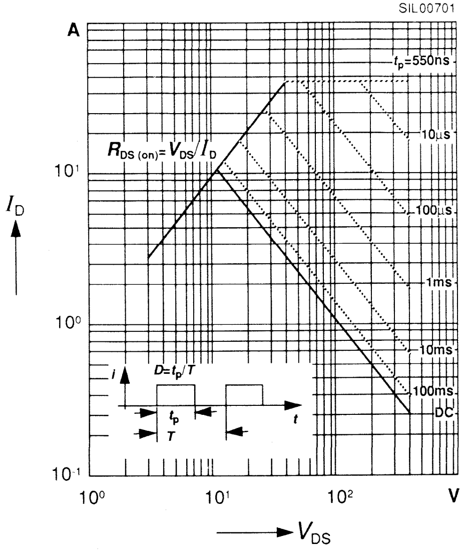
Total power dissipation $P_{tot} = f(T_C)$



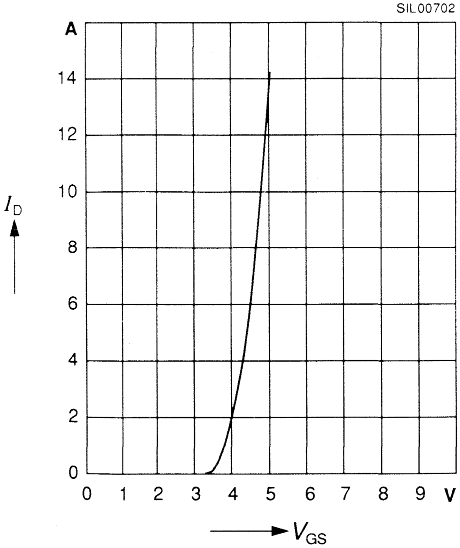
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



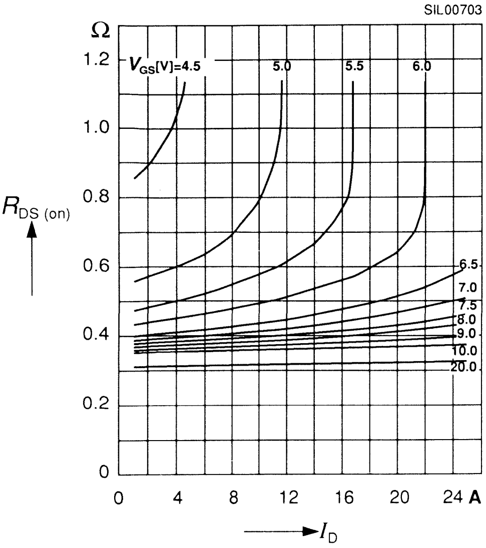
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



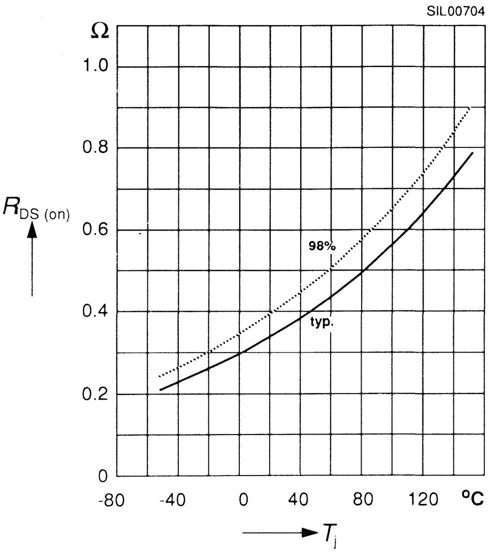
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



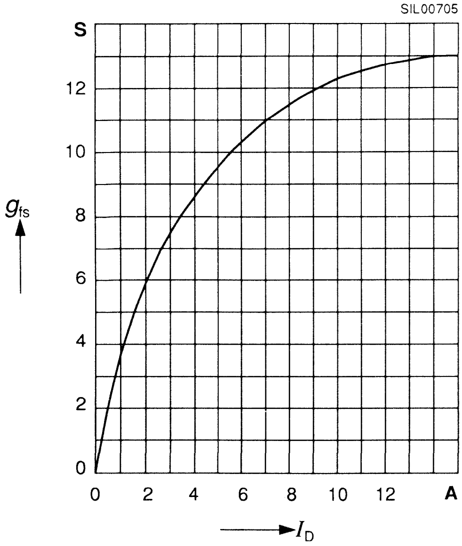
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



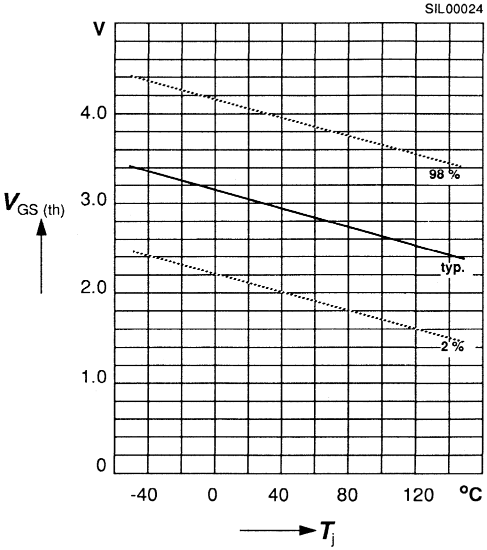
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 7.5$ A, $V_{GS} = 10$ V, (spread)



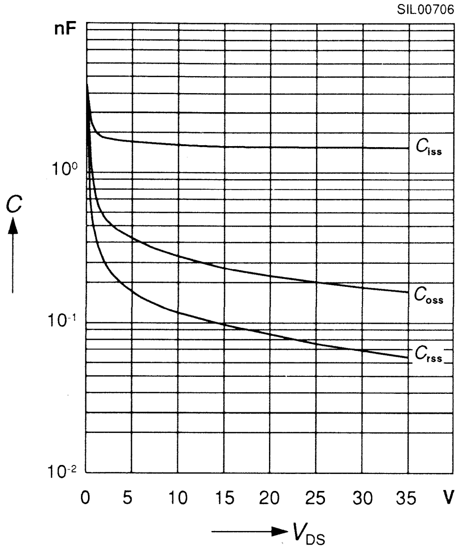
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



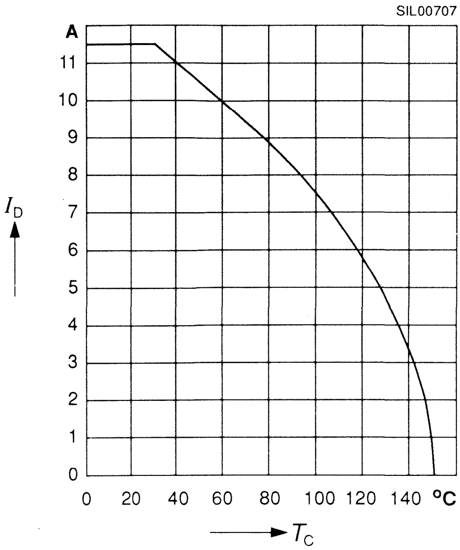
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



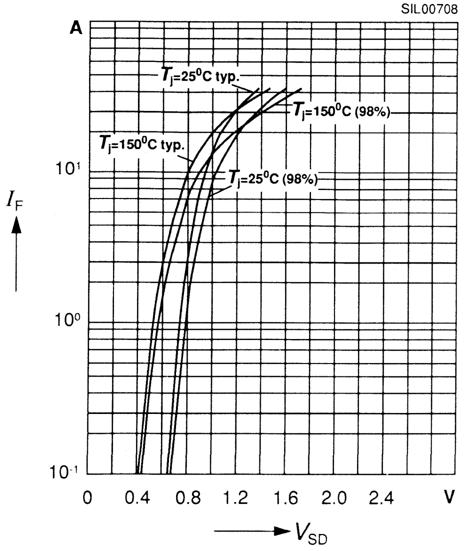
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



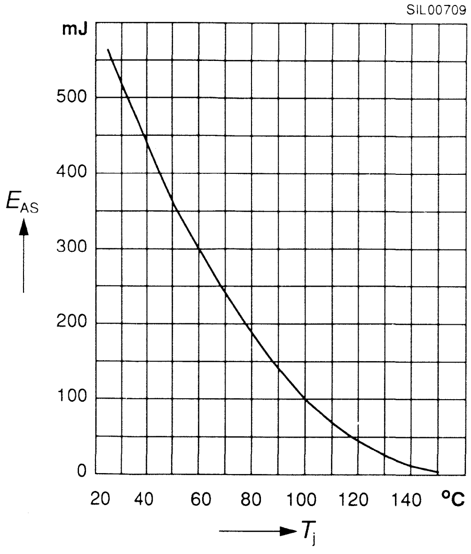
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



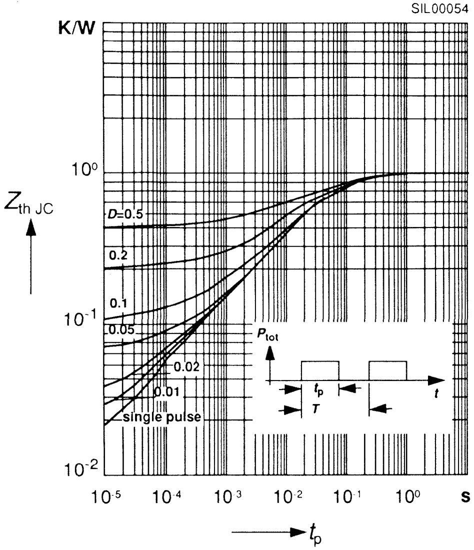
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



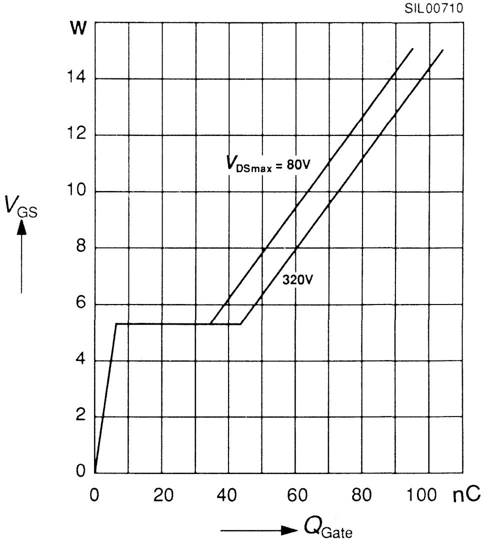
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 11.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 7.54$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



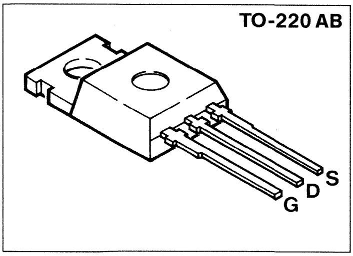
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 15.0$ A



SIPMOS® Power MOS Transistor BUZ 70

V_{DS} = 60 V
I_D = 12 A
$R_{DS(on)}$ = 0.15 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 70	C67078-S1334-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	60	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 33$ °C	I_D	12	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	48	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	12	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1	mJ
Avalanche energy, single pulse $I_D = 12$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 48.6$ µH, $T_j = 25$ °C	E_{AS}	6	
Operating and storage temperature range	T_j T_{stg}	-55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	60	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 7.5$ A	$R_{DS(on)}$	–	0.15	Ω

Dynamic characteristics

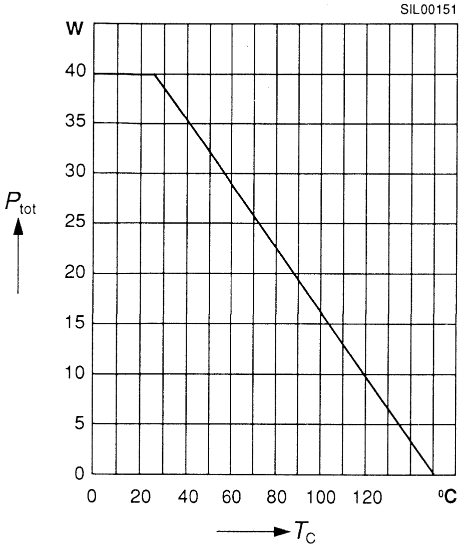
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 7.5$ A	g_{fs}	2.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	480	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	250	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	90	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	ns
	t_r	–	45	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	55	
	t_f	–	75	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

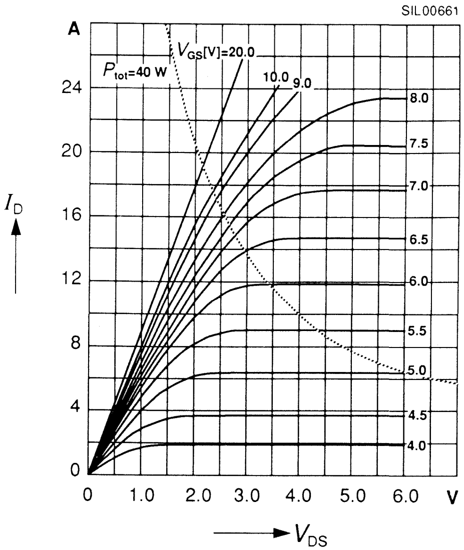
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	12	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	48	
Diode forward on-voltage $I_F = 25$ A, $V_{GS} = 0$	V_{SD}	–	1.8	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	60 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.10 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

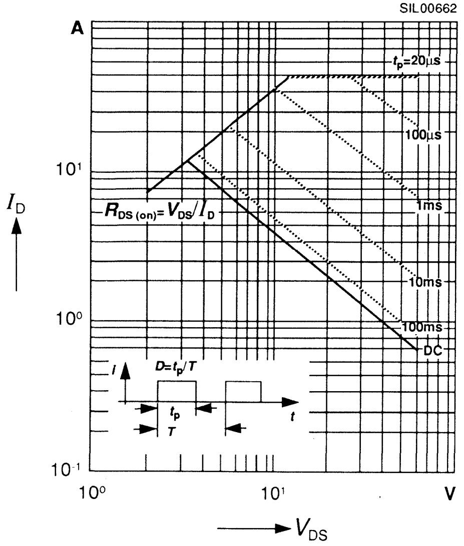
Total power dissipation $P_{tot} = f(T_C)$



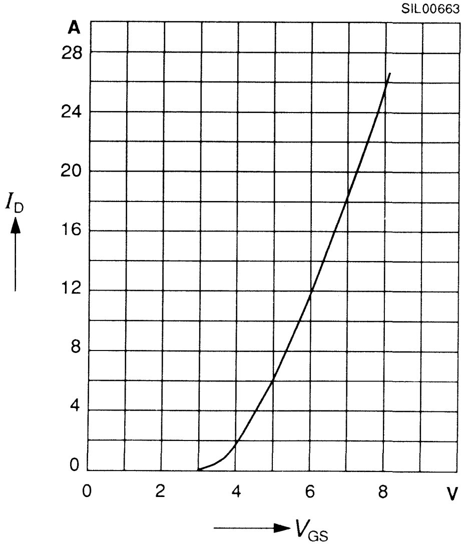
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



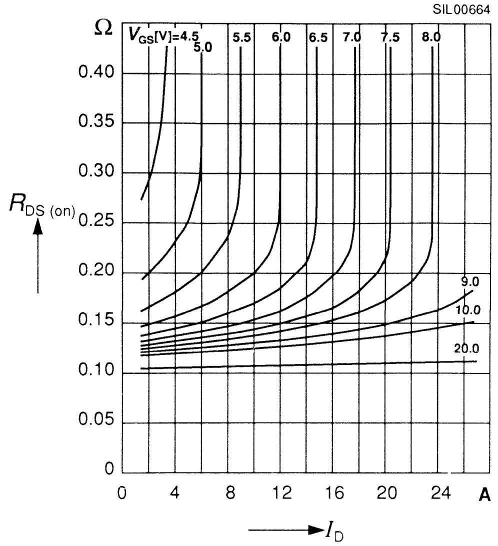
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



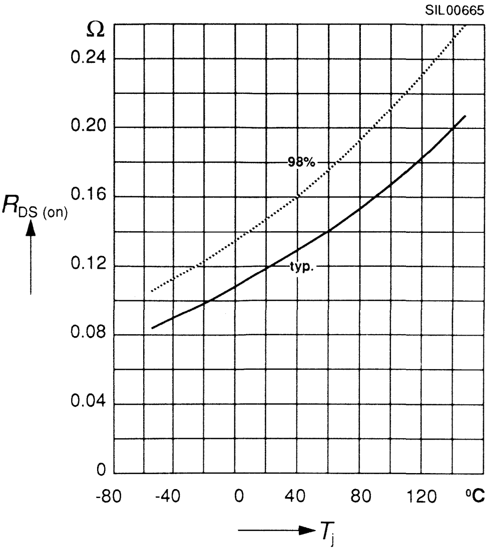
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



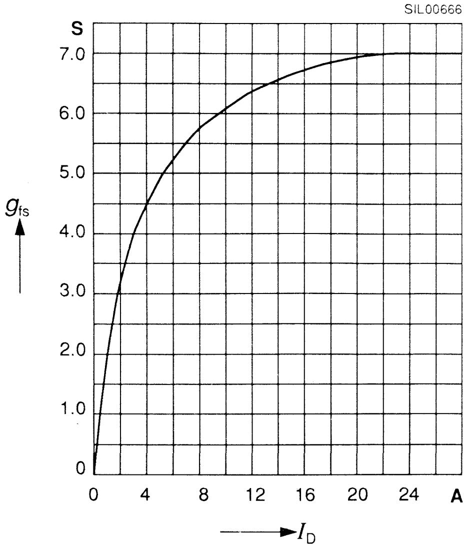
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



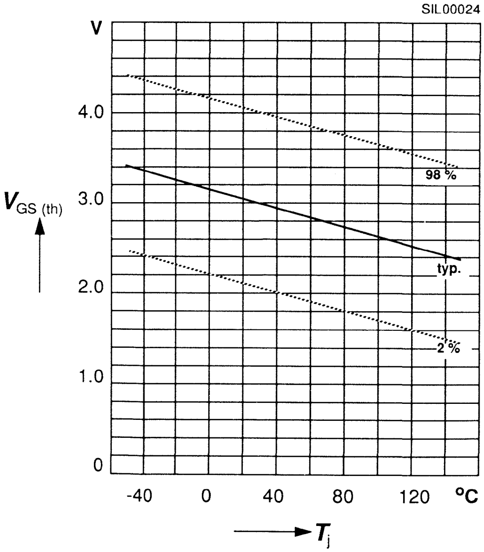
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 7.5$ A, $V_{GS} = 10$ V, (spread)



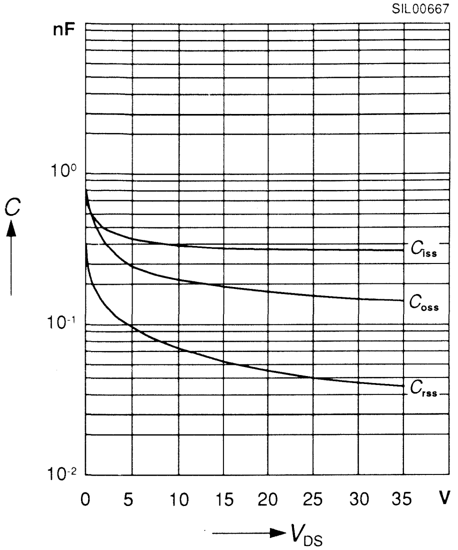
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



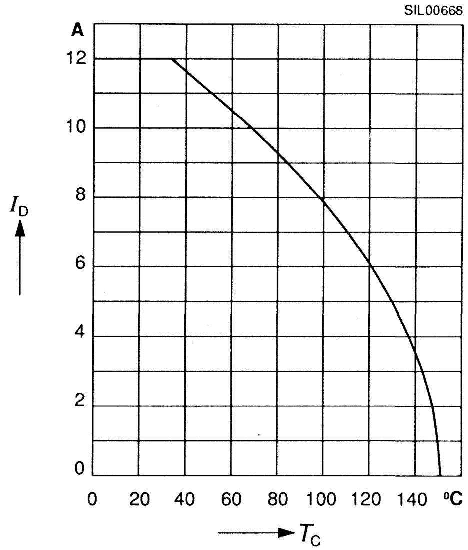
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



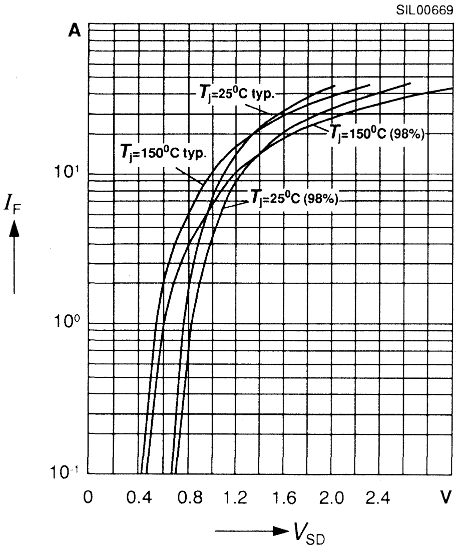
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



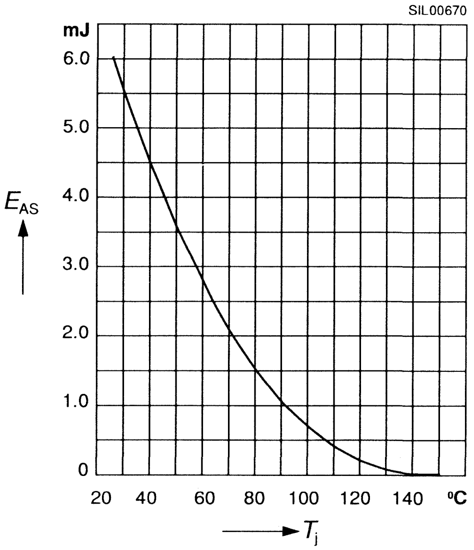
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



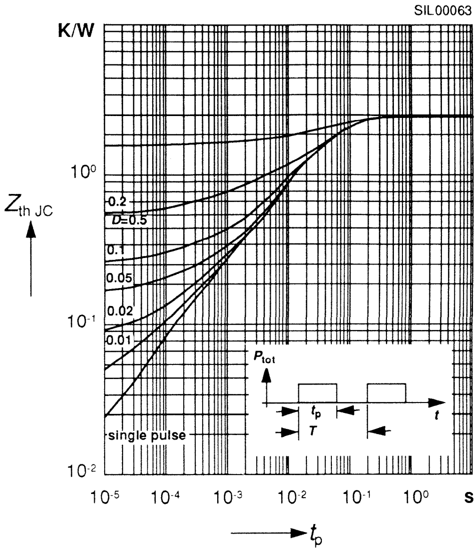
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



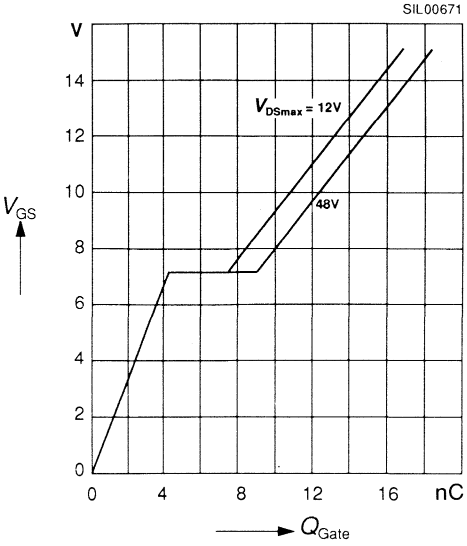
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 12$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 48.6$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 18.0$ A



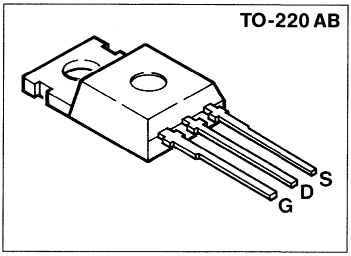
SIEMENS

SIPMOS® Power MOS Transistor

BUZ 70 L

V_{DS} = **60 V**
I_D = **12 A**
$R_{DS(on)}$ = **0.15 Ω**

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 70 L	C67078-S1334-A3

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	60	V
Gate-source voltage	V_{GS}	± 10	
Gate-source peak voltage aperiodic	V_{gs}	± 20	
Continuous drain current, $T_C = 33$ °C	I_D	12	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	48	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	12	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1	mJ
Avalanche energy, single pulse $I_D = 12$ A, $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$ $L = 48.6\ \mu$H, $T_j = 25$ °C	E_{AS}	6	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	

Static characteristics

Parameter	Symbol	min.	max.	Unit
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	60	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 60$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 6.0$ A	$R_{DS(on)}$	–	0.15	Ω

Dynamic characteristics

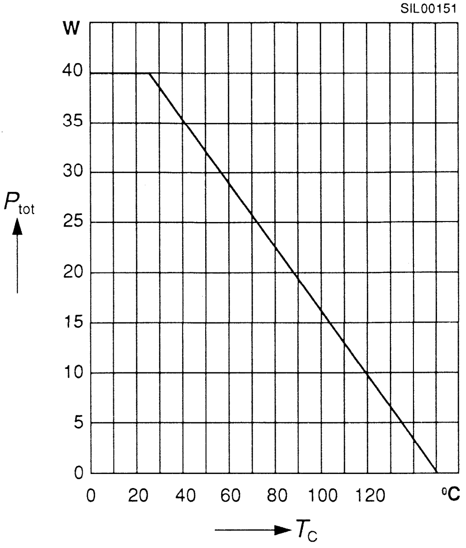
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 6.0$ A	g_{fs}	2.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	560	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	250	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	110	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	25	ns
	t_r	–	80	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	60	
	t_f	–	55	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

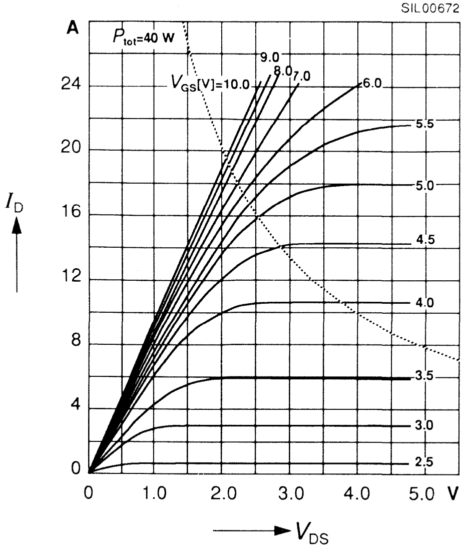
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	12	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	48	
Diode forward on-voltage $I_F = 24$ A, $V_{GS} = 0$	V_{SD}	–	1.8	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	60 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.10 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

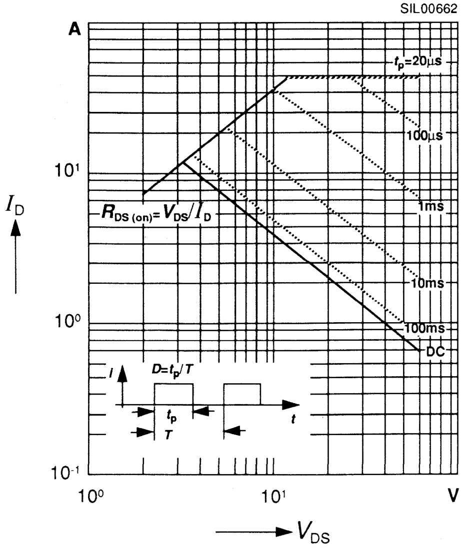
Total power dissipation $P_{tot} = f(T_C)$



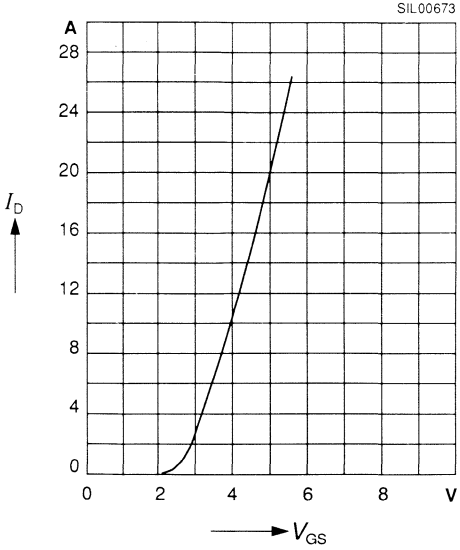
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



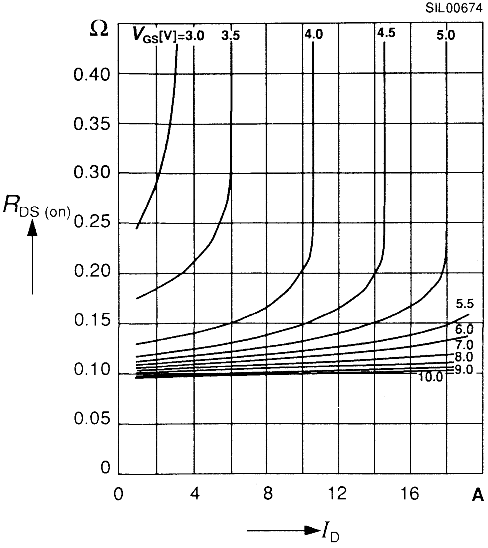
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



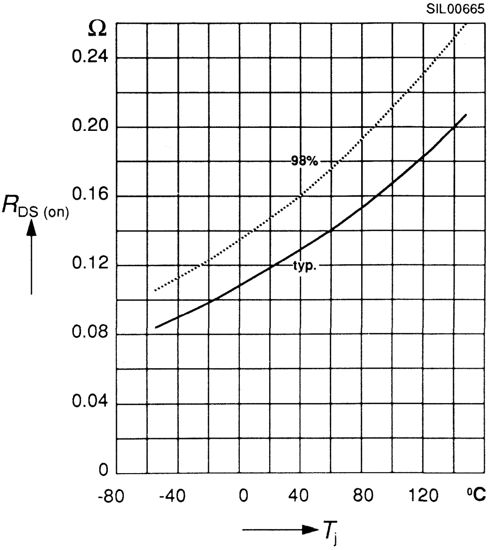
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



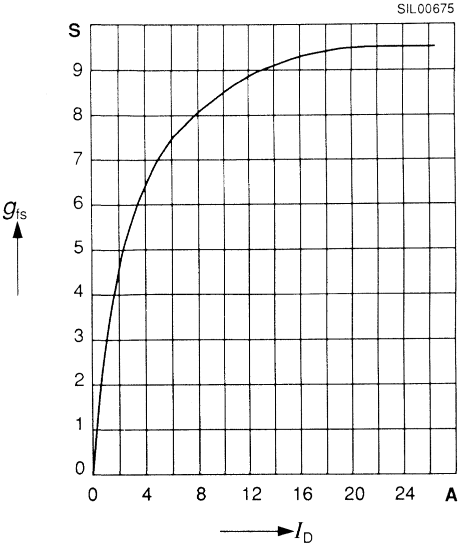
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



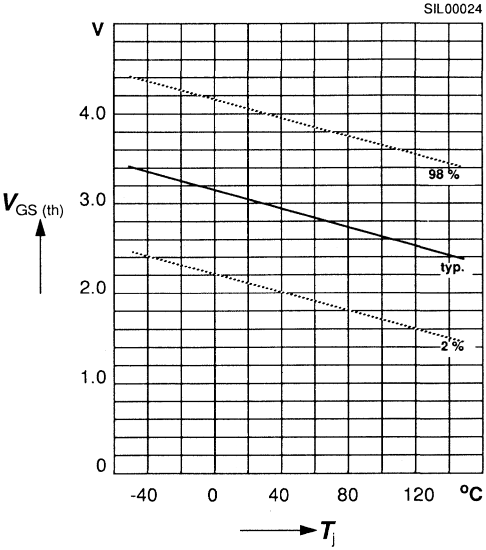
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 6.0$ A, $V_{GS} = 5$ V, (spread)



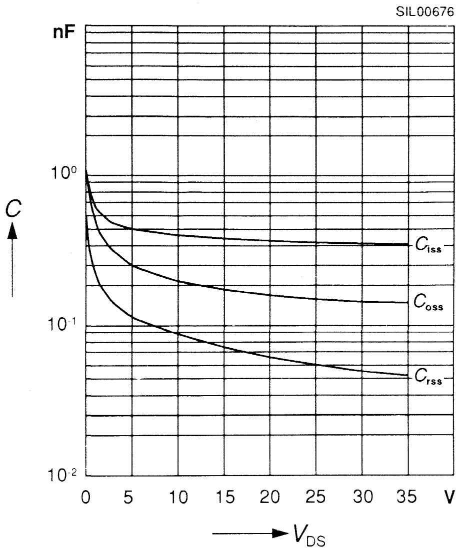
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



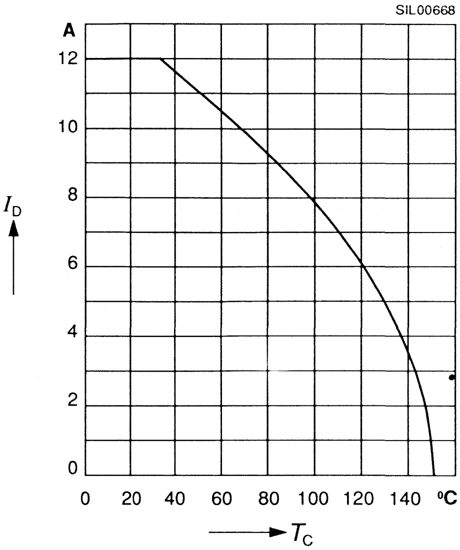
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



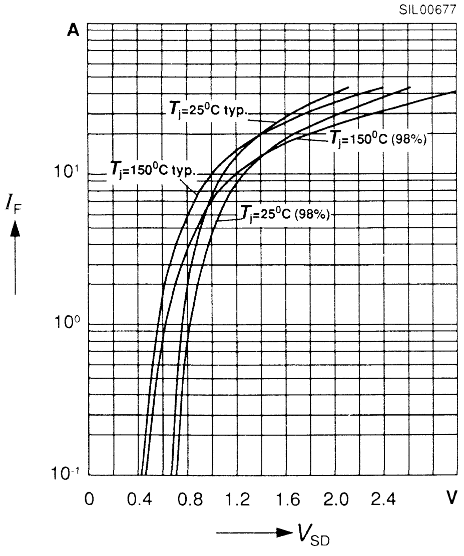
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



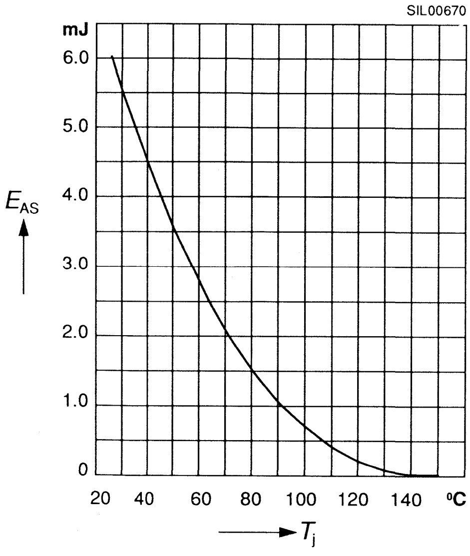
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 5$ V



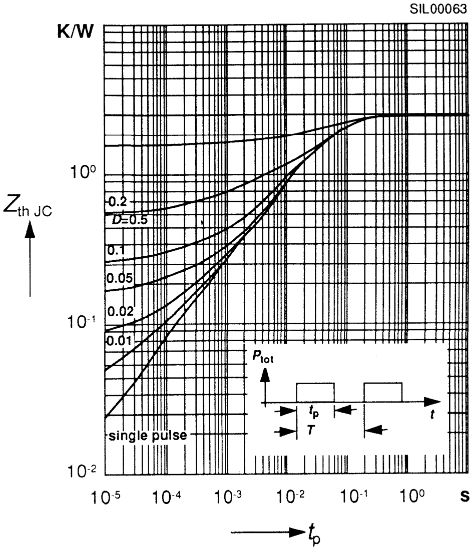
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



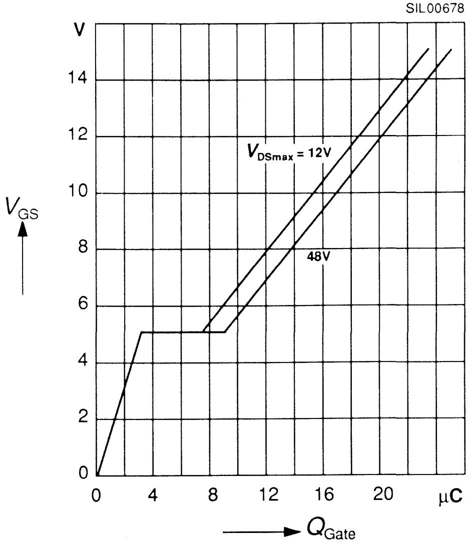
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 12$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 48.6$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 18$ A



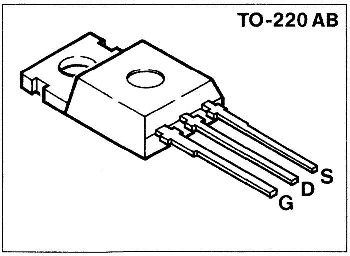
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 71 BUZ 71 S2 BUZ 71 A

V_{DS} = **50 ... 60 V**
I_D = **13 ... 14 A**
$R_{DS(on)}$ = **0.1 ... 0.12 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 71	C67078-S1316-A2
BUZ 71 A	C67078-S1316-A3
BUZ 71 S2	C67078-S1316-A9

Maximum Ratings

Parameter	Symbol	BUZ			Unit
		71	71 A	71 S2	
Drain-source voltage	V_{DS}	50	50	60	V
Gate-source voltage	V_{GS}	± 20			
Continuous drain current, T_C = 25/28/28 °C	I_D	14	13	14	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	56	52	56	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	14			
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1	1	1.3	mJ
Avalanche energy, single pulse V_{DD} = 25 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 14 A, L = 30.6 µH BUZ 71/71 A I_D = 14 A, L = 47.6 µH BUZ 71 S2	E_{AS}	6 8			
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150			°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40			W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75			K/W
DIN humidity category, DIN 40 040		E			–
IEC climatic category, DIN IEC 68-1		55/150/56			

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	Values max.	Unit
Static characteristics					
Drain-source breakdown voltage		$V_{(BR)DSS}$			V
$V_{GS} = 0$, $I_D = 1$ mA	BUZ 71/71 A		50	–	
	BUZ 71 S2		60	–	
Gate threshold voltage		$V_{GS(th)}$			
$V_{GS} = V_{DS}$, $I_D = 0.25$ mA			2.1	4.0	
Zero gate voltage drain current		I_{DSS}			µA
$V_{GS} = 0$ $V_{DS} = 50$ V	BUZ 71/71 A				
$V_{DS} = 60$ V	BUZ 71 S2				
$T_j = 25$ °C			–	1.0	
$T_j = 125$ °C			–	100	
Gate-source leakage current		I_{GSS}			nA
$V_{GS} = 20$ V, $V_{DS} = 0$			–	100	
Drain-source on-resistance		$R_{DS(on)}$			Ω
$V_{GS} = 10$ V, $I_D = 9$ A	BUZ 71/71 S2		–	0.1	
	BUZ 71 A		–	0.12	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

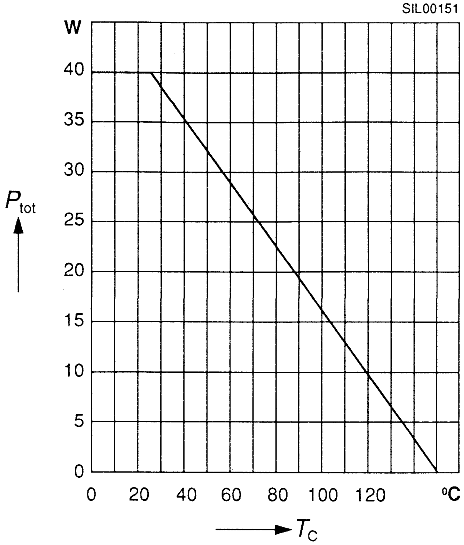
Parameter		Symbol	Values min.	Values max.	Unit
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 9$ A		g_{fs}	4.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 71/71 A	C_{iss}	–	600	pF
	BUZ 71 S2		–	675	
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 71/71 A	C_{oss}	–	350	
	BUZ 71 S2		–	300	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 71/71 A	C_{rss}	–	150	
	BUZ 71 S2		–	105	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 25$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	BUZ 71/71 A	$t_{d(on)}$	–	30	ns
	BUZ 71 S2		–	25	
	BUZ 71/71 A	t_r	–	60	
	BUZ 71 S2		–	55	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 25$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A		$t_{d(off)}$	–	70	
	BUZ 71/71 A	t_f	–	55	
	BUZ 71 S2		–	50	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

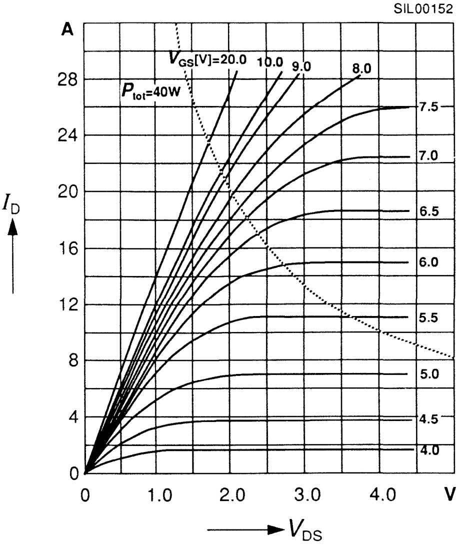
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 71/71 S2		–	14	
	BUZ 71 A		–	13	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 71/71 S2		–	56	
	BUZ 71 A		–	52	
Diode forward on-voltage		V_{SD}			V
$I_F = 28$ A, $V_{GS} = 0$			–	1.8	
Reverse recovery time		t_{rr}			ns
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			60	–	
			typ.	–	
Reverse recovery charge		Q_{rr}			µC
$V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			0.10	–	
			typ.	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

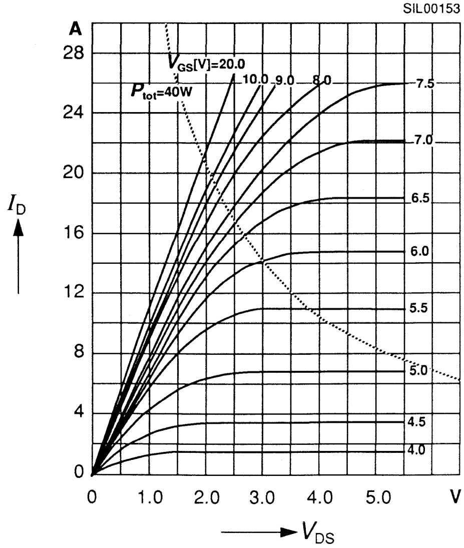
Total power dissipation $P_{tot} = f(T_C)$



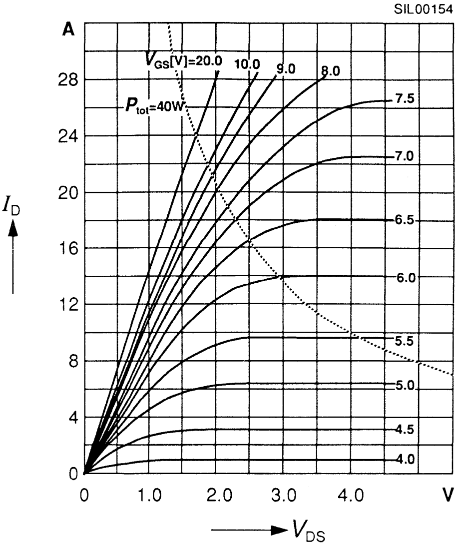
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 71



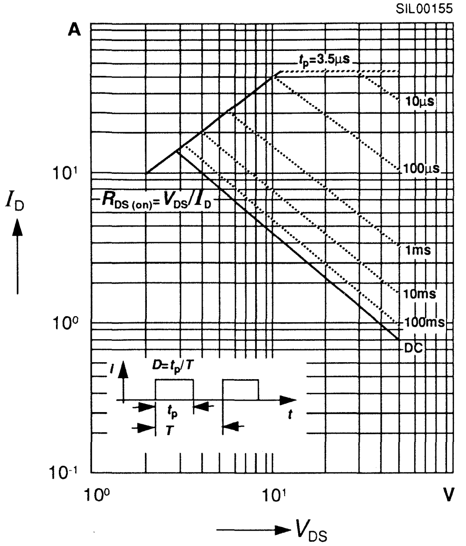
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 71 A



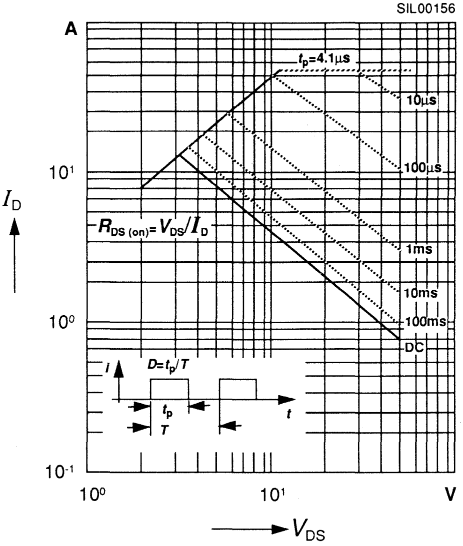
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 71 S2



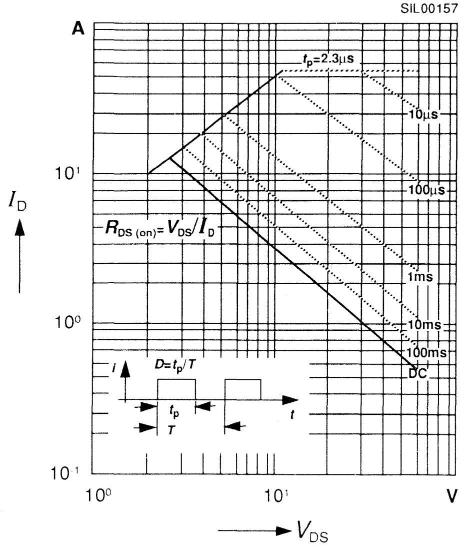
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 71



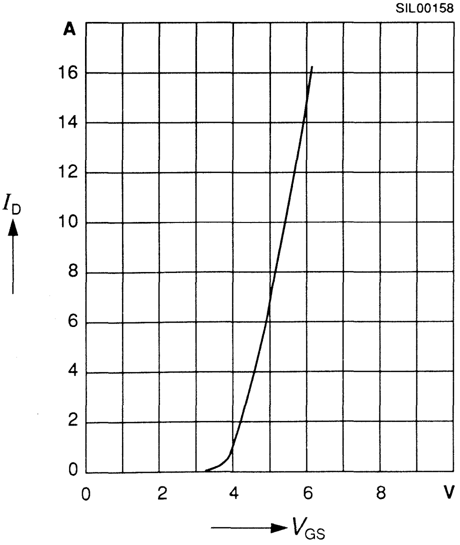
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 71 A



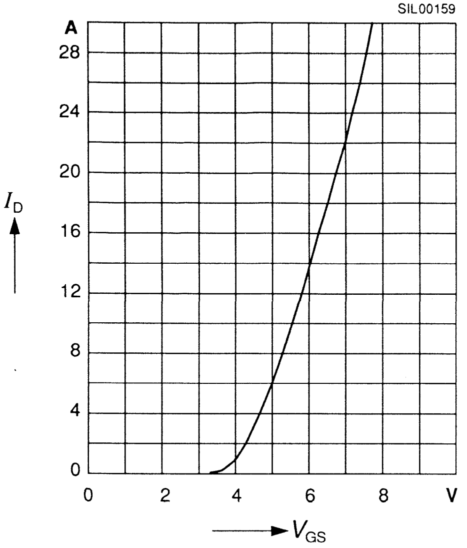
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 71 S2



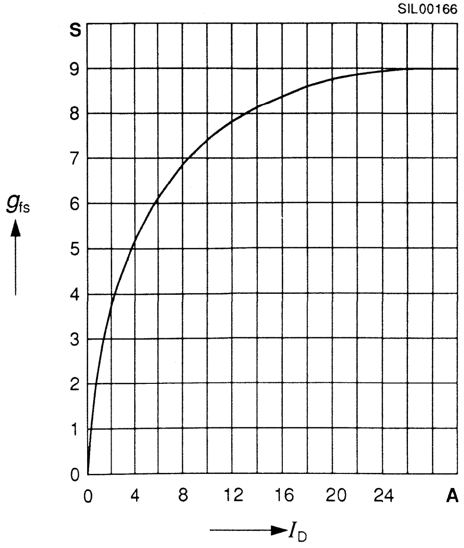
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 71/71 A



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25\ V$
BUZ 71 S2

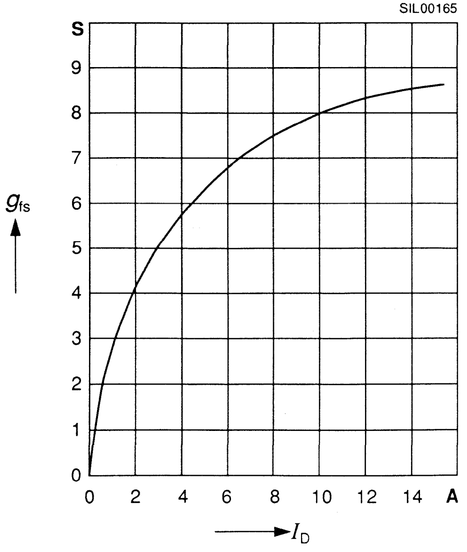


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$
BUZ 71/71 A

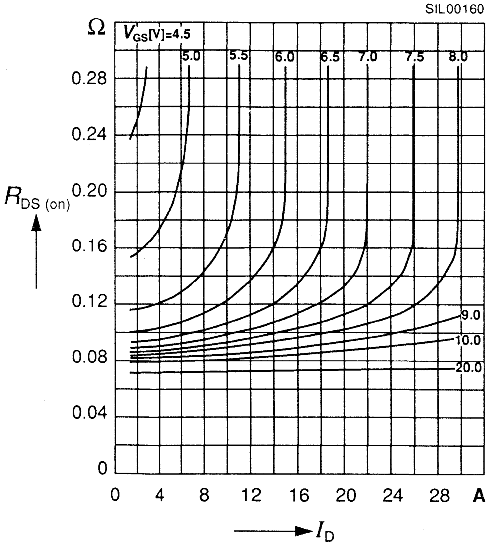


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$

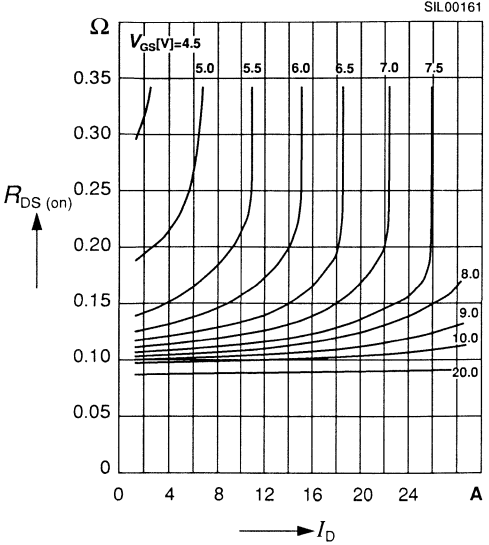
BUZ 71 S2



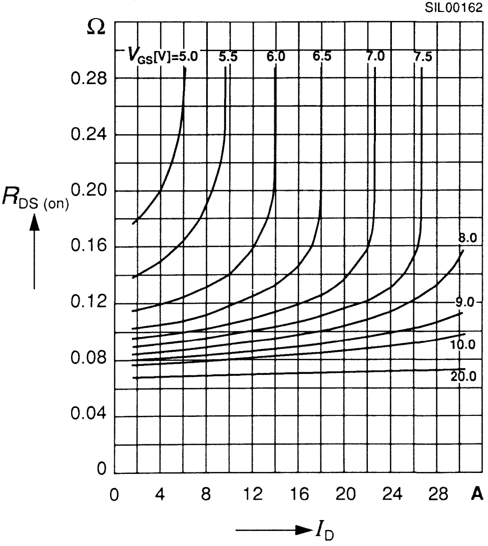
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 71



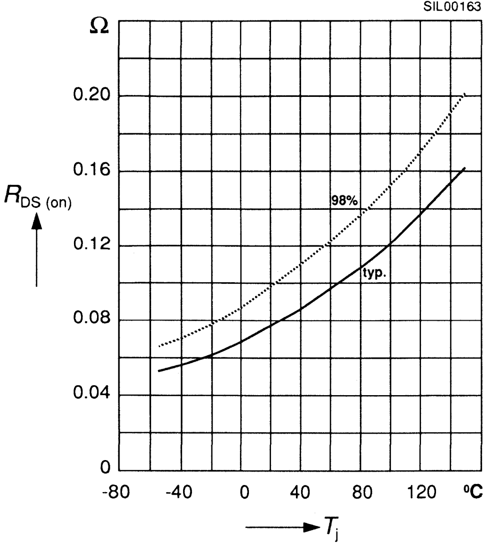
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 71 A



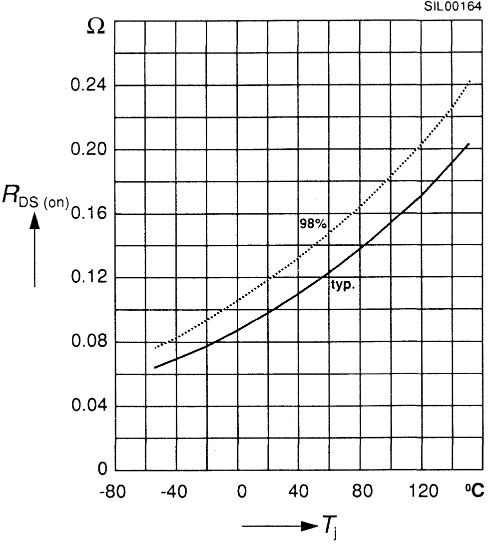
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 71 S2



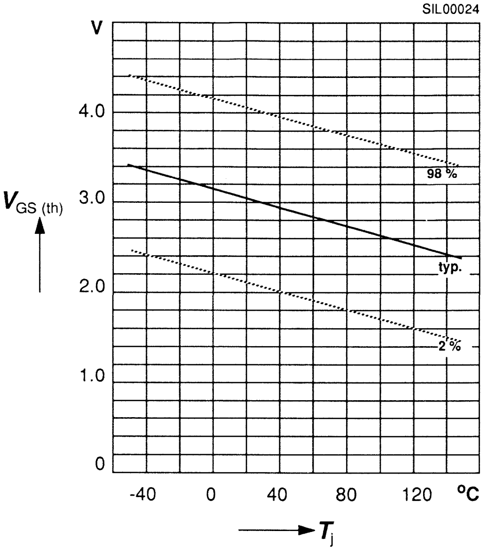
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 9 A, V_{GS} = 10 V, (spread)
BUZ 71 / 71 S2



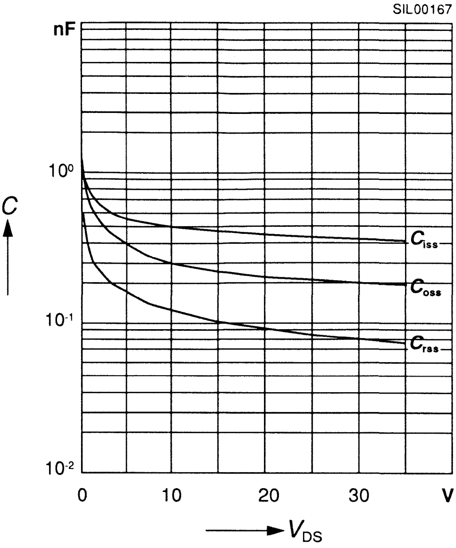
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 9 A, V_{GS} = 10 V, (spread)
BUZ 71 A



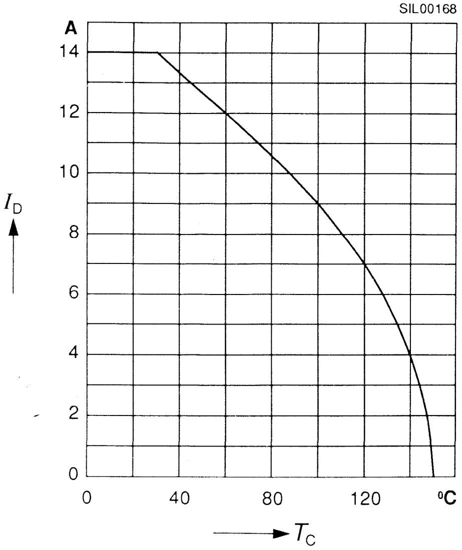
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



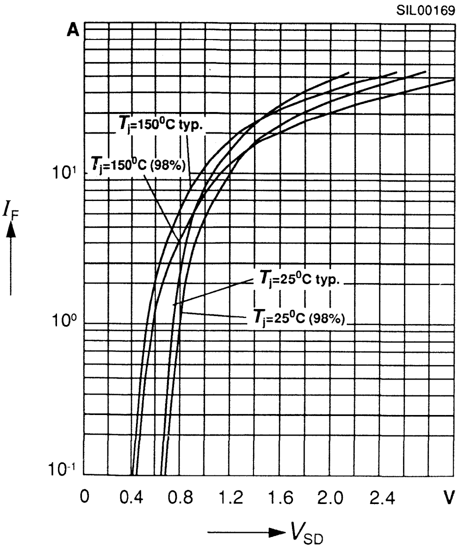
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



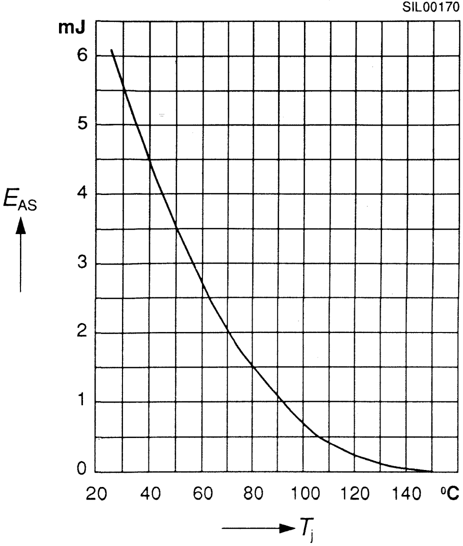
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



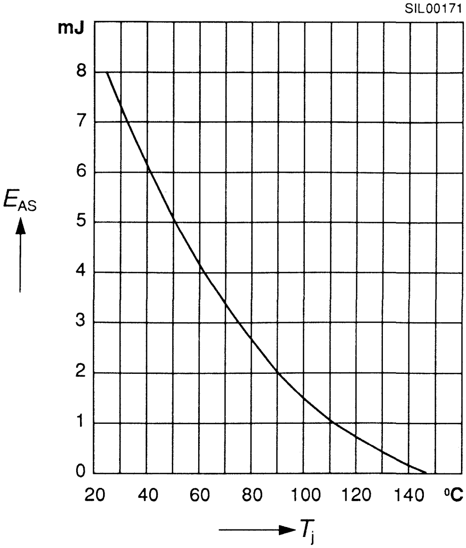
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



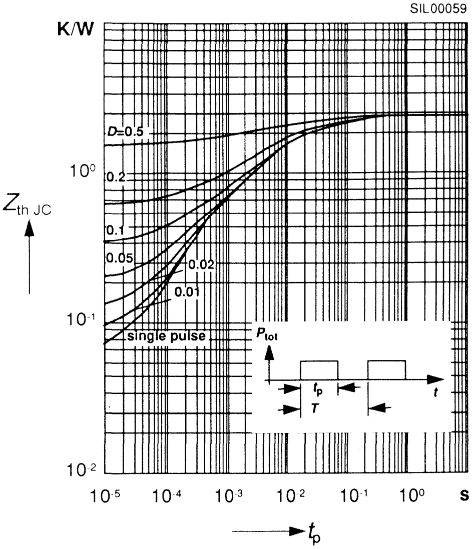
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 14$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 30.6\ \mu$H
BUZ 71 / 71 A



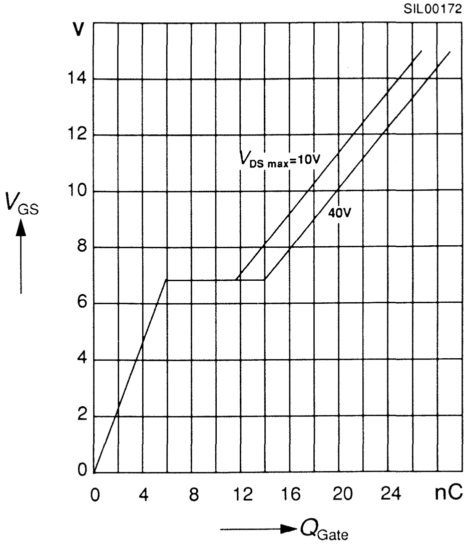
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 14$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 47.6\ \mu$H
BUZ 71 S2



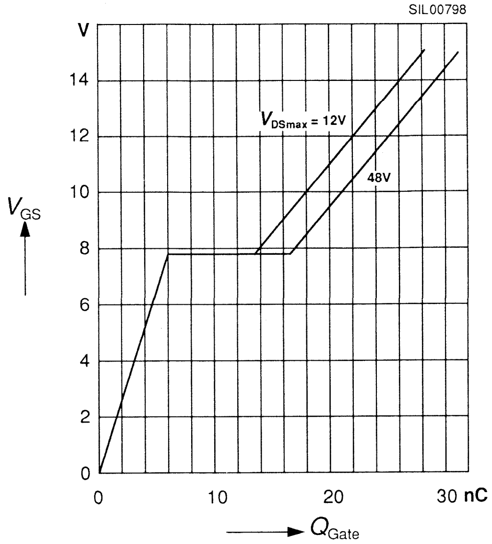
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 22.5$ A
BUZ 71/71 A



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 27.5$ A
BUZ 71 S2



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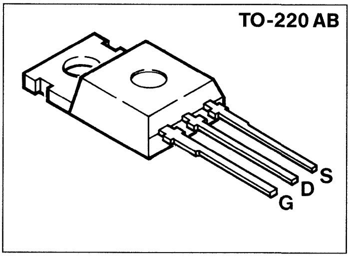
SIPMOS® Power MOS Transistors

BUZ 71 L
BUZ 71 AL

V_{DS} = 50 V
I_D = 14 / 13A
$R_{DS(on)}$ = 0.1 / 0.12 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 71 L	C67078-S1326-A2
BUZ 71 AL	C67078-S1326-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		71 L	71 AL	
Drain-source voltage	V_{DS}	50		V
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_C = 28 °C / 25 °C	I_D	14	13	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	56	52	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	14		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	1		mJ
Avalanche energy, single pulse I_D = 14 A, V_{DD} = 25 V, R_{GS} = 25 Ω L = 30.6 µH, T_j = 25 °C	E_{AS}	6		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	50	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 50$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance	$R_{DS(on)}$			Ω
$V_{GS} = 5$ V, $I_D = 7.0$ A BUZ 71 L		–	0.1	
BUZ 71 AL		–	0.12	

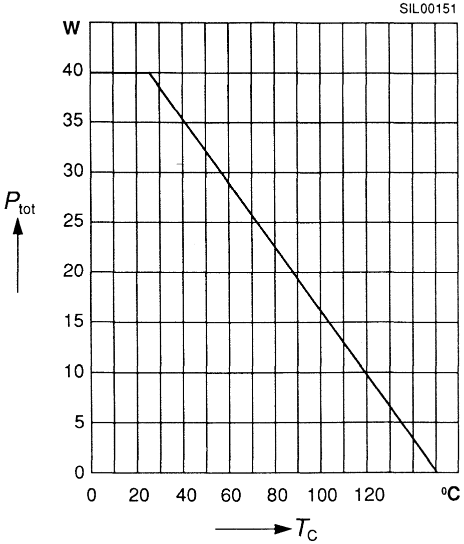
Parameter	Symbol	min.	max.	Unit
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 7.0$ A	g_{fs}	5.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	730	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	320	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(on)}$	–	25	ns
	t_r	–	100	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(off)}$	–	90	
	t_f	–	70	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

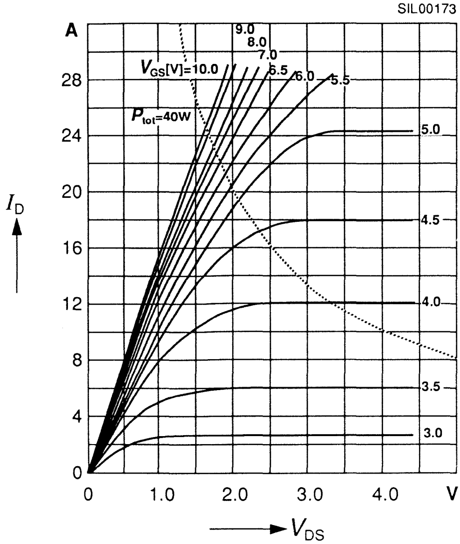
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current T_C = 25 °C	BUZ 71 L BUZ 71 AL	I_S	– –	14 13	A
Pulsed reverse drain current T_C = 25 °C	BUZ 71 L BUZ 71 AL	I_{SM}	– –	56 52	
Diode forward on-voltage I_F = 28 A, V_{GS} = 0		V_{SD}	–	1.8	V
Reverse recovery time V_R = 30 V, $I_F = I_S$, di_F/dt = 100 A/µs		t_{rr}	typ. 120	–	ns
Reverse recovery charge V_R = 30 V, $I_F = I_S$, di_F/dt = 100 A/µs		Q_{rr}	typ. 0.15	–	µC

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

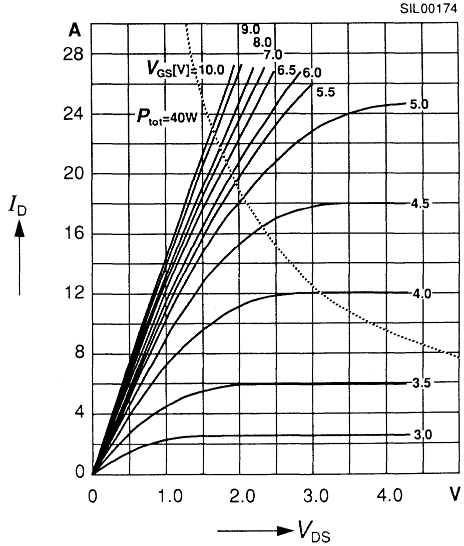
Total power dissipation $P_{tot} = f(T_C)$



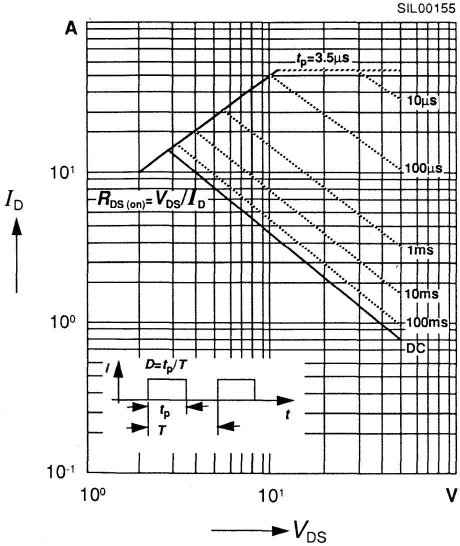
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BUZ 71 L



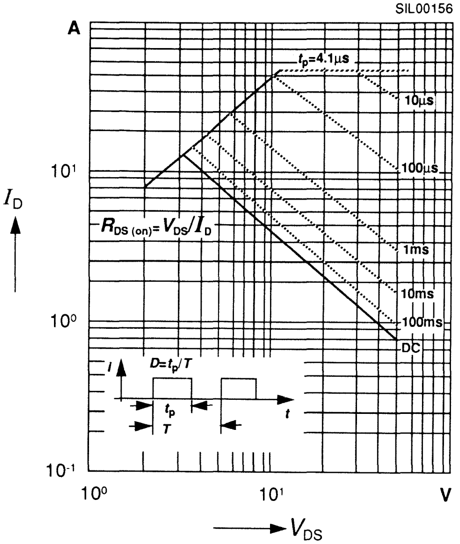
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
BUZ 71 AL



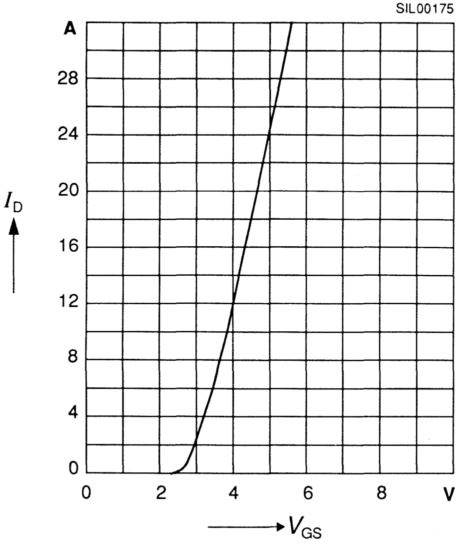
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 71 L



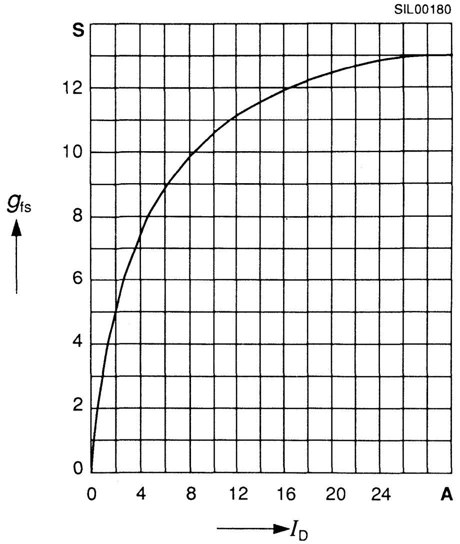
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 71 AL



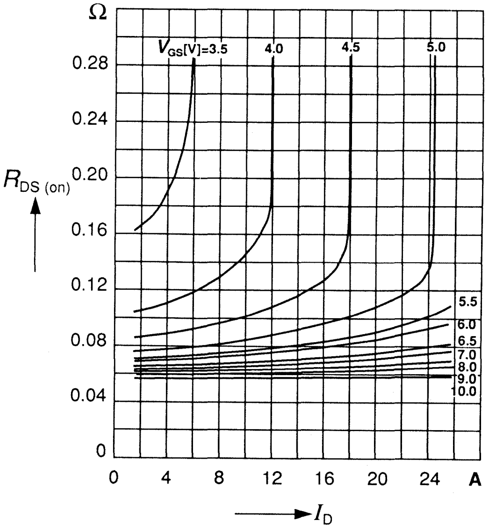
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



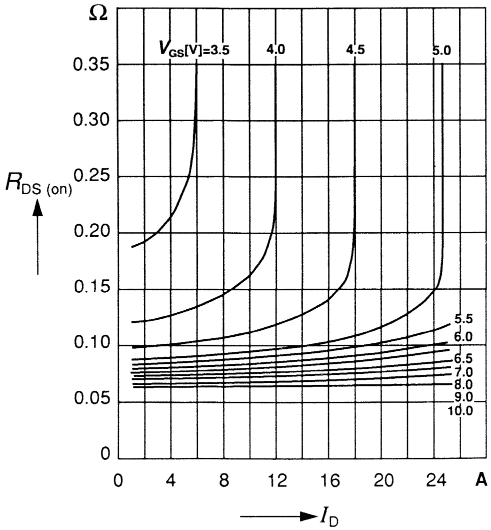
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



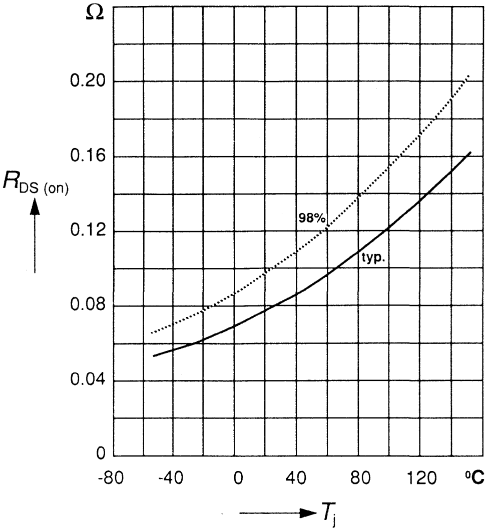
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 71 L



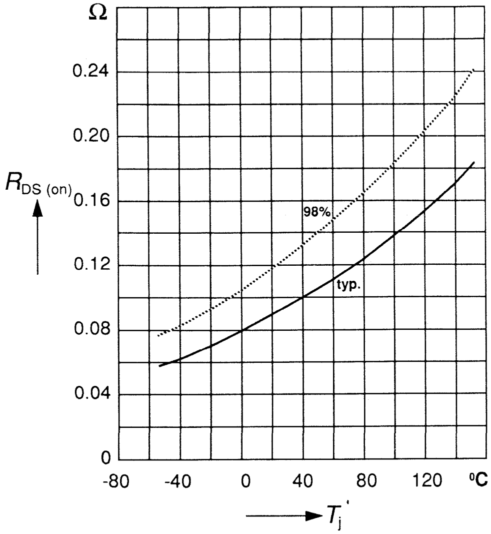
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 71 AL



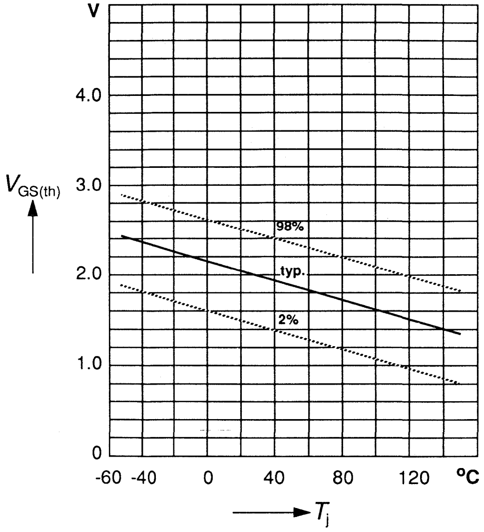
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 7$ A, $V_{GS} = 5$ V, (spread)
BUZ 71 L



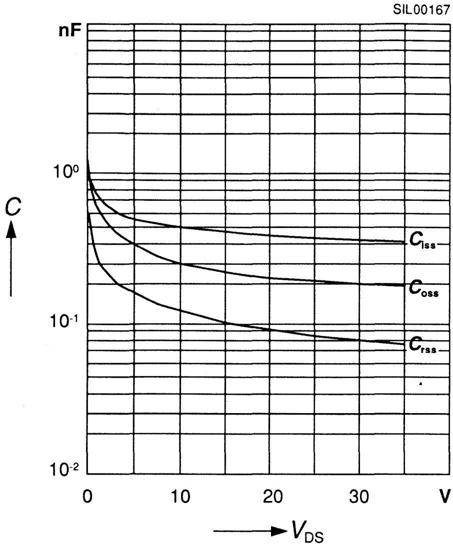
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 7$ A, $V_{GS} = 5$ V, (spread)
BUZ 71 AL



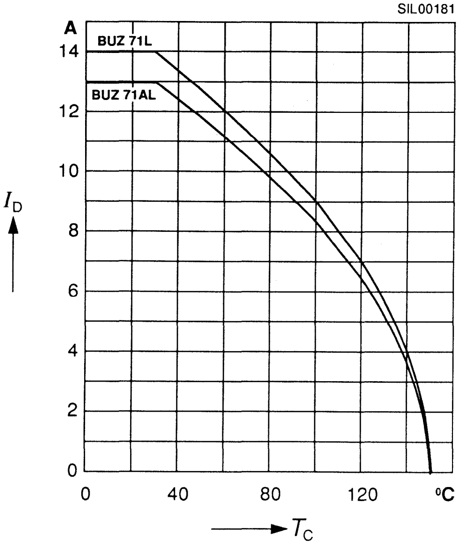
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



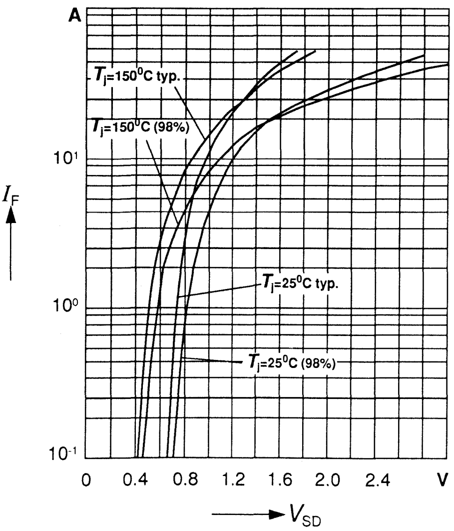
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



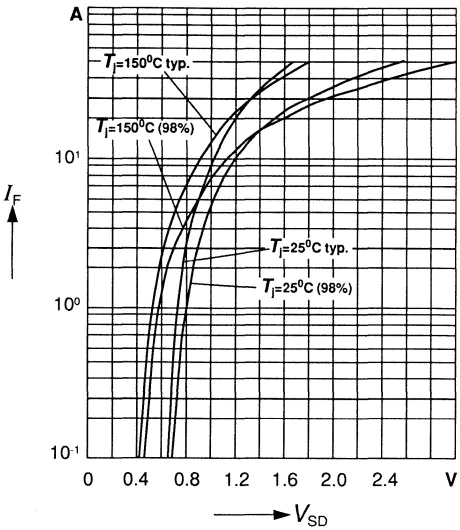
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 5$ V



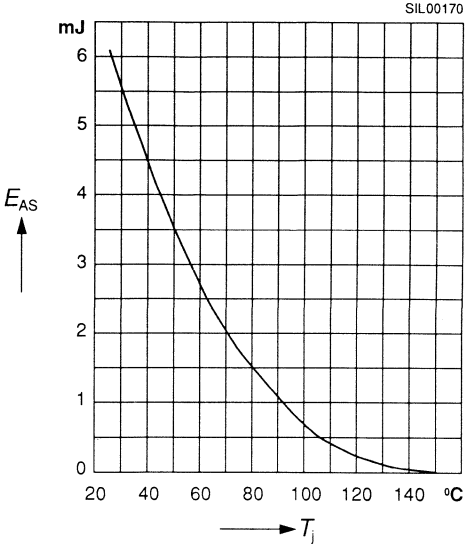
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 71 L



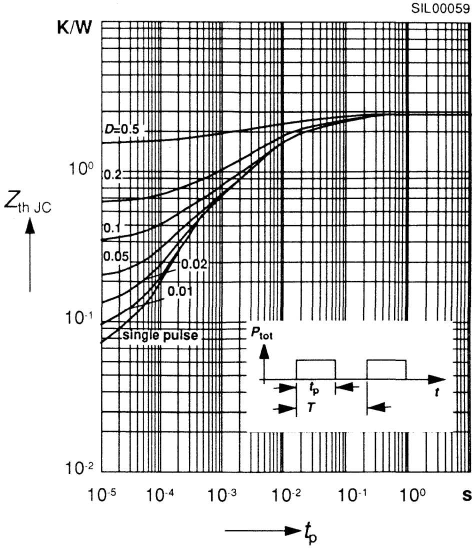
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 71 AL



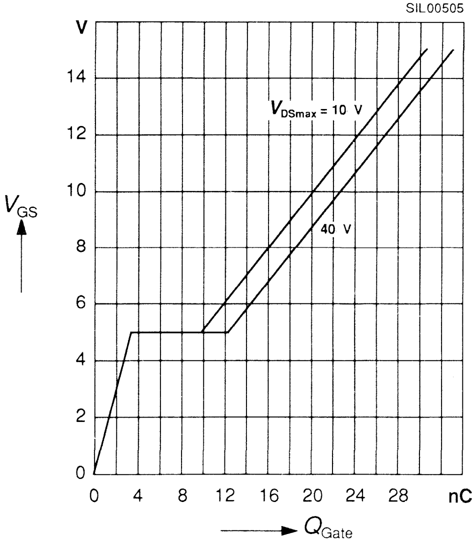
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 14$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 30.6\ \mu$H



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 21.0$ A



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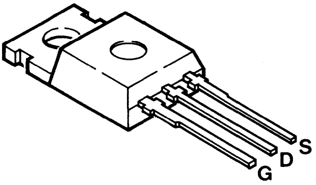
SIPMOS® Power MOS Transistors

BUZ 72
BUZ 72 A

V_{DS} = 100 V
I_D = 9.0 / 10 A
$R_{DS(on)}$ = 0.2 / 0.25 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 72	C67078-S1313-A2
BUZ 72 A	C67078-S1313-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		72	72 A	
Drain-source voltage	V_{DS}	100		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, $T_C = 25$ °C	I_D	10	9.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	40	36	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	10		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	7.9		mJ
Avalanche energy, single pulse $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $T_j = 25$ °C $I_D = 10$ A, $L = 885\ \mu$H	E_{AS}	59		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 6$ A BUZ 72 BUZ 72 A	$R_{DS(on)}$	 – –	 0.2 0.25	Ω

Dynamic characteristics

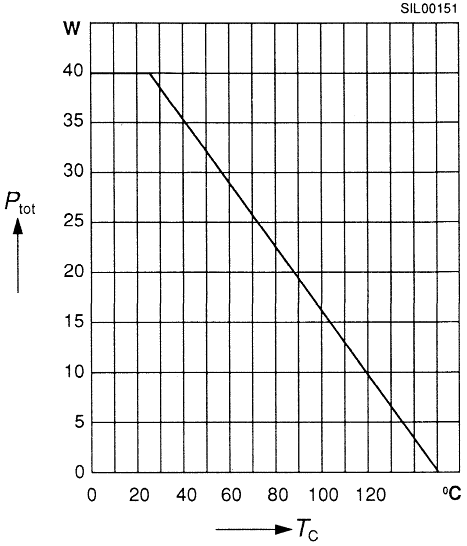
Parameter	**Symbol**	**min.**	**max.**	**Unit**
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 6$ A	g_{fs}	3.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	730	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	290	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	140	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3.0$ A	$t_{d(on)}$	–	30	ns
	t_r	–	75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3.0$ A	$t_{d(off)}$	–	120	
	t_f	–	65	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

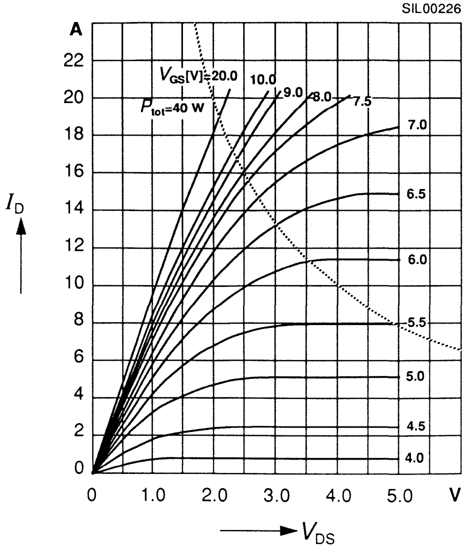
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	BUZ 72 BUZ 72 A	I_S	– –	10 9.0	A
Pulsed reverse drain current $T_C = 25$ °C	BUZ 72 BUZ 72 A	I_{SM}	– –	40 36	
Diode forward on-voltage $I_F = 20$ A, $V_{GS} = 0$		V_{SD}	–	1.6	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	170 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	0.30 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

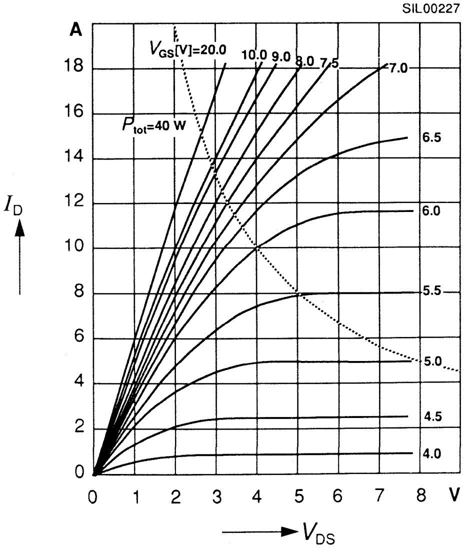
Total power dissipation $P_{tot} = f(T_C)$



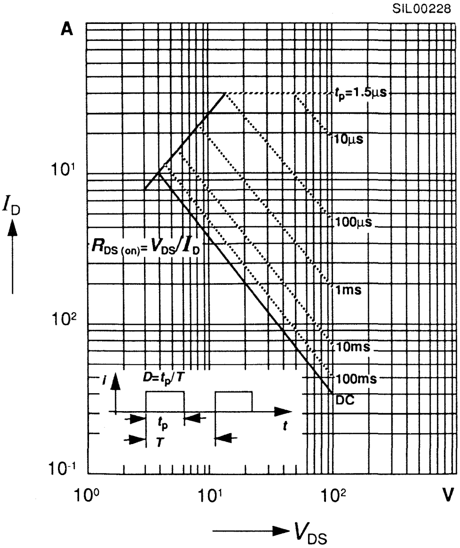
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 72



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 72 A

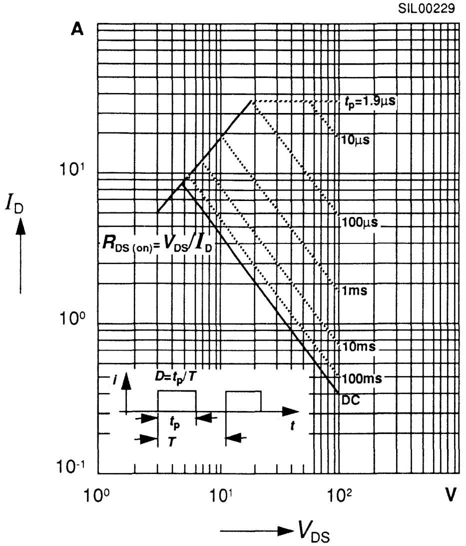


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 72

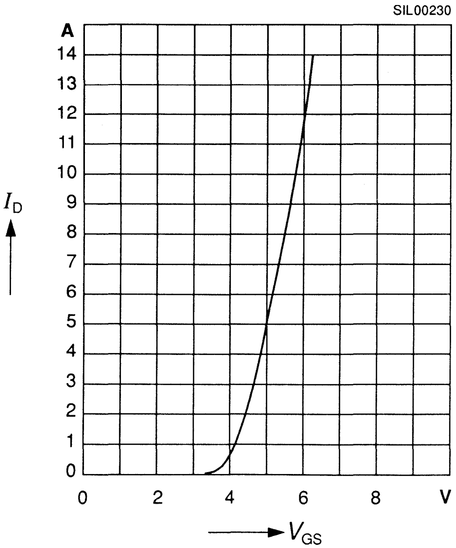


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

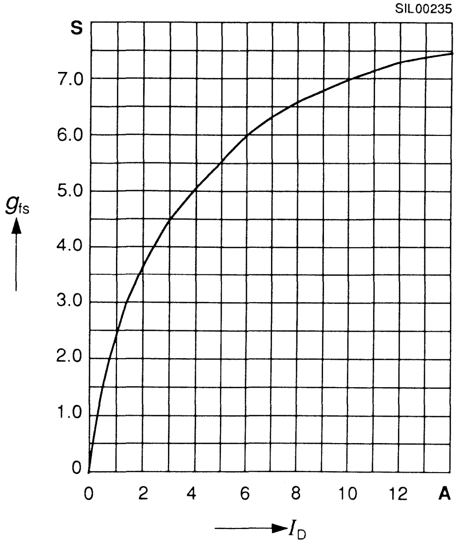
BUZ 72 A



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

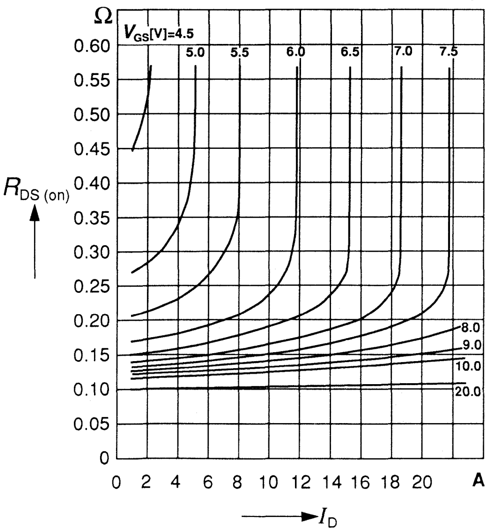


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

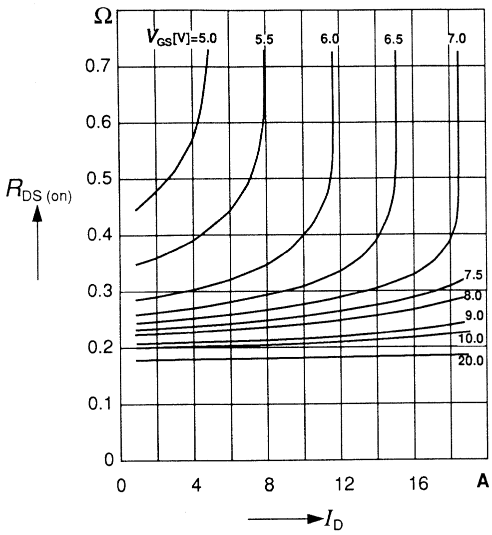
BUZ 72



Typ. drain-source on-resistance

$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

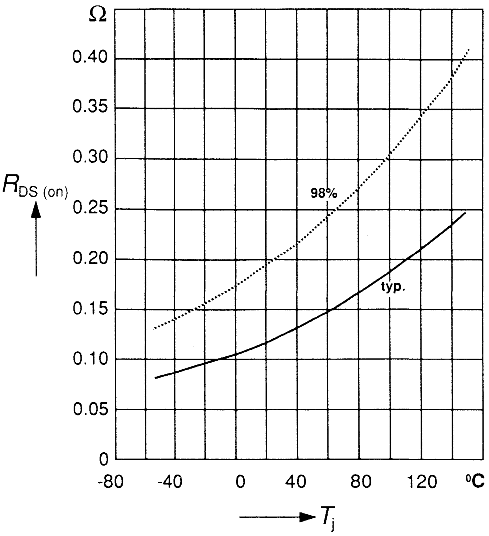
BUZ 72 A



Drain-source on-resistance

$R_{DS(on)} = f(T_j)$
parameter: $I_D = 6$ A, $V_{GS} = 10$ V, (spread)

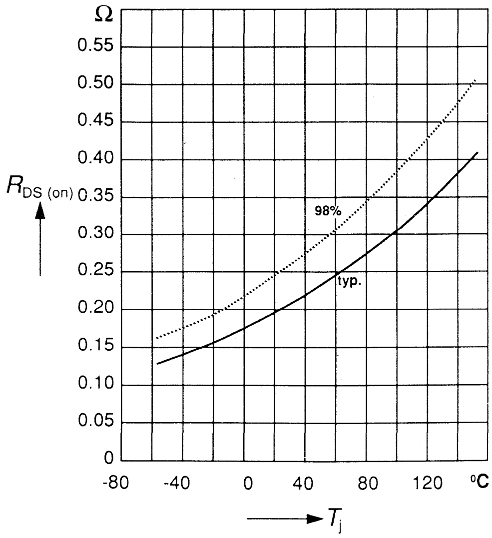
BUZ 72



Drain-source on-resistance

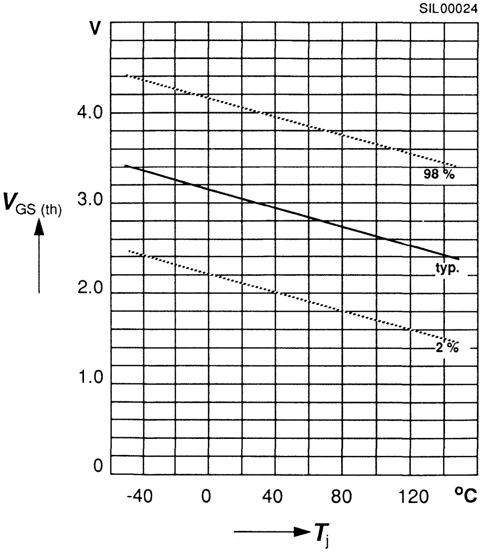
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 6$ A, $V_{GS} = 10$ V, (spread)

BUZ 72 A

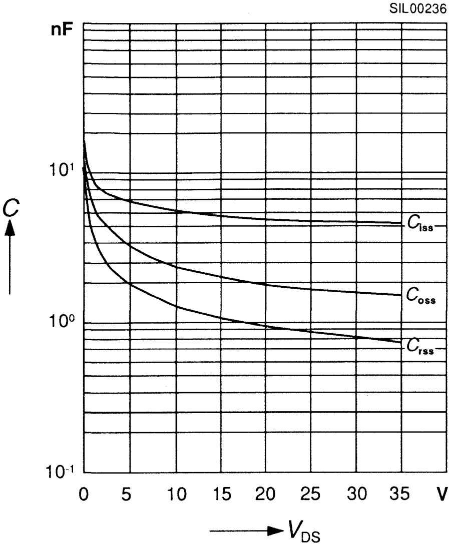


Gate threshold voltage $V_{GS(th)} = f(T_j)$

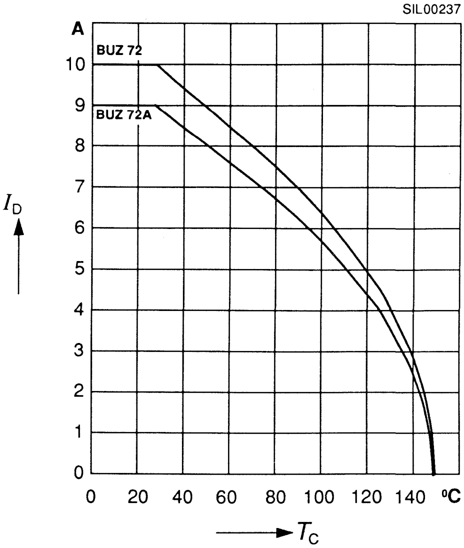
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



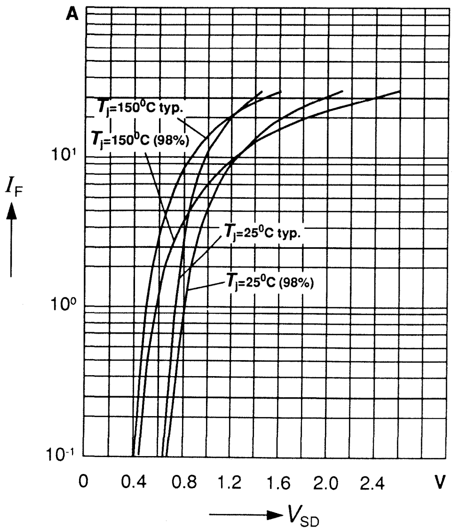
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



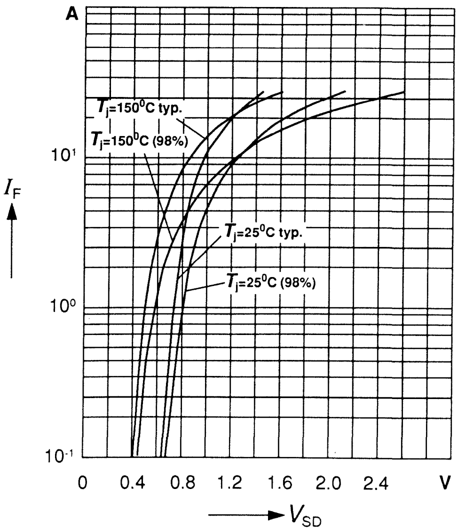
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



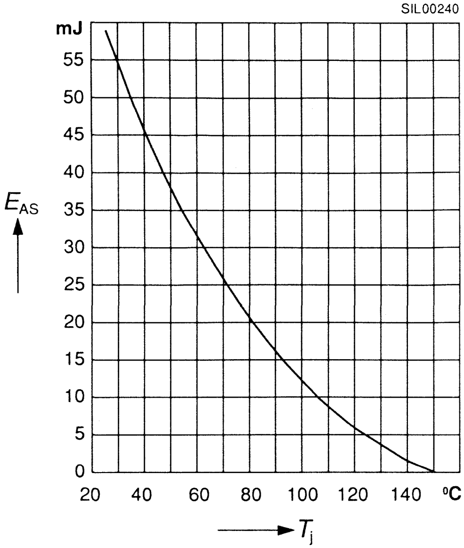
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 72



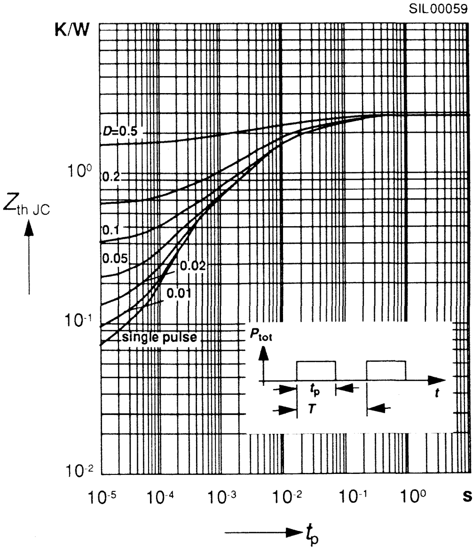
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 72A



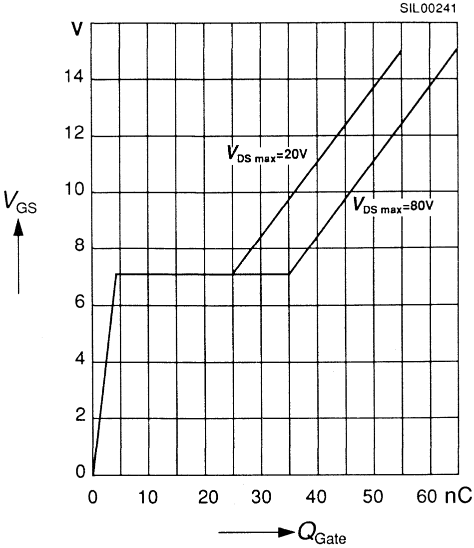
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 10$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 885\ \mu$H



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 21.0$ A



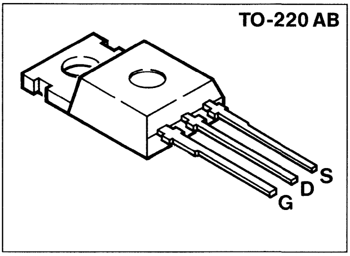
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 72 L
BUZ 72 AL

V_{DS} = 100 V
I_D = 10 / 9.0 A
$R_{DS(on)}$ = 0.2 / 0.25 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 72 L	C67078-S1327-A2
BUZ 72 AL	C67078-S1327-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		72 L	72 AL	
Drain-source voltage	V_{DS}	100		V
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage aperiodic	V_{gs}	± 20		
Continuous drain current, $T_C = 25$ °C	I_D	10	9.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	40	36	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	10		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	7.9		mJ
Avalanche energy, single pulse $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$, $T_j = 25$ °C $I_D = 10$ A, $L = 885\ \mu$H	E_{AS}	59		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	1.0	
$T_j = 125$ °C		-	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 5$ A BUZ 72 L	$R_{DS(on)}$	-	0.2	Ω
BUZ 72 AL		-	0.25	

Dynamic characteristics

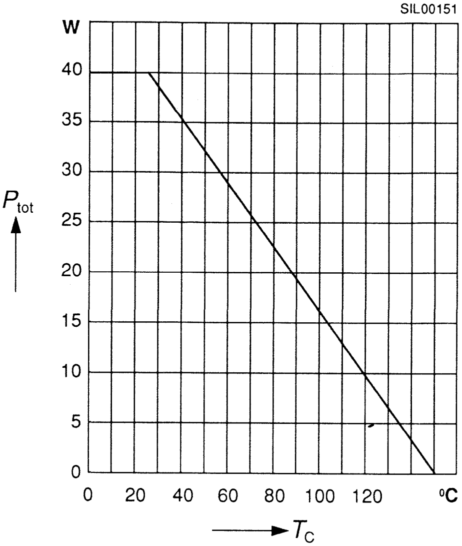
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 5$ A	g_{fs}	5.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	250	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(on)}$	-	30	ns
	t_r	-	130	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(off)}$	-	130	
	t_f	-	70	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

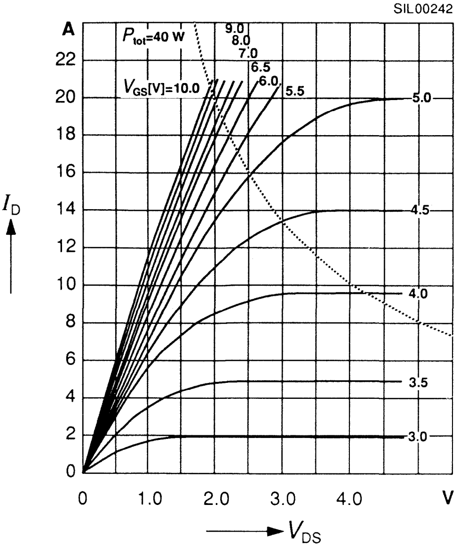
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	 BUZ 72 L BUZ 72 AL	I_S	 – –	 10 9.0	A
Pulsed reverse drain current $T_C = 25$ °C	 BUZ 72 L BUZ 72 AL	I_{SM}	 – –	 40 36	
Diode forward on-voltage $I_F = 20$ A, $V_{GS} = 0$		V_{SD}	 –	 1.5	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	180 typ.	 –	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	460 typ.	 –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

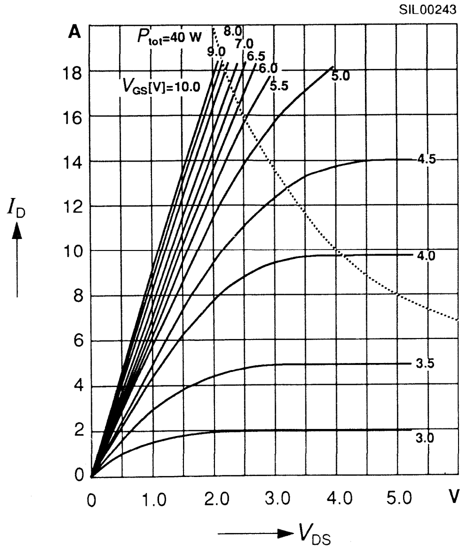
Total power dissipation $P_{tot} = f(T_C)$



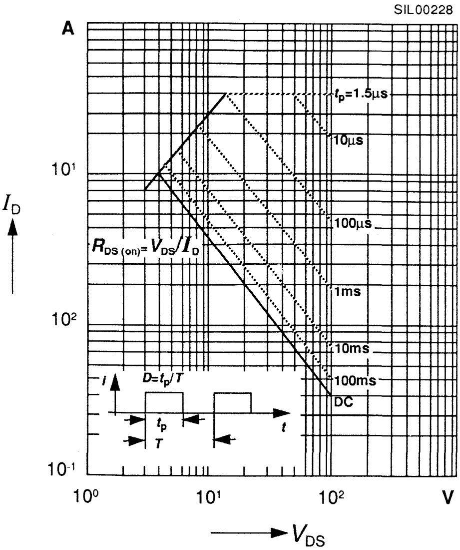
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 72 L



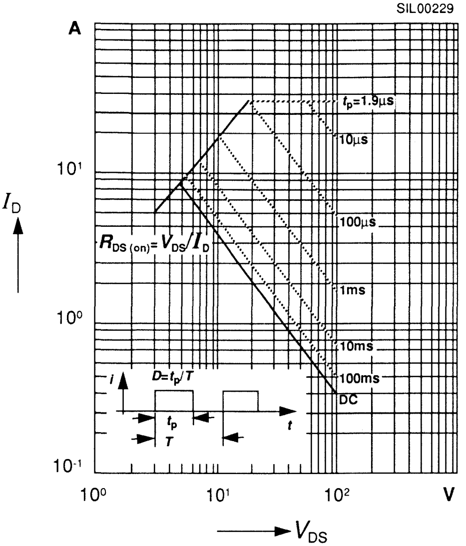
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 72 AL



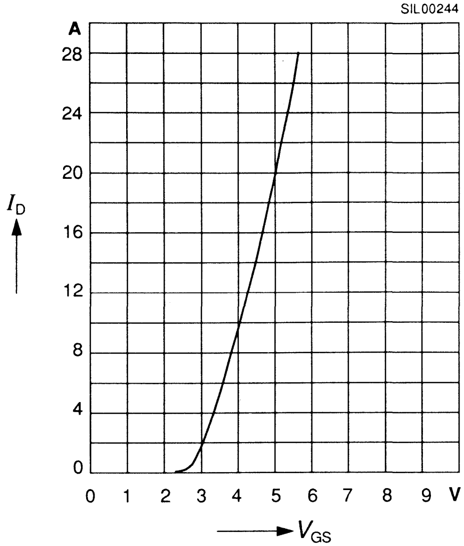
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 72 L



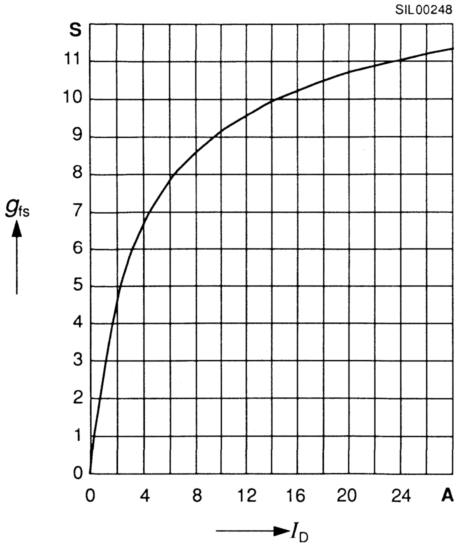
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 72 AL



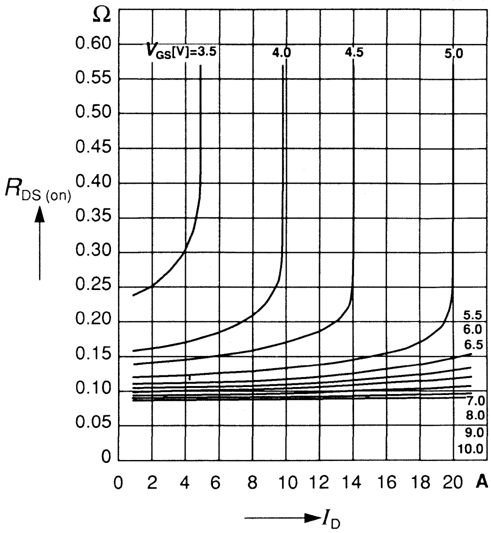
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

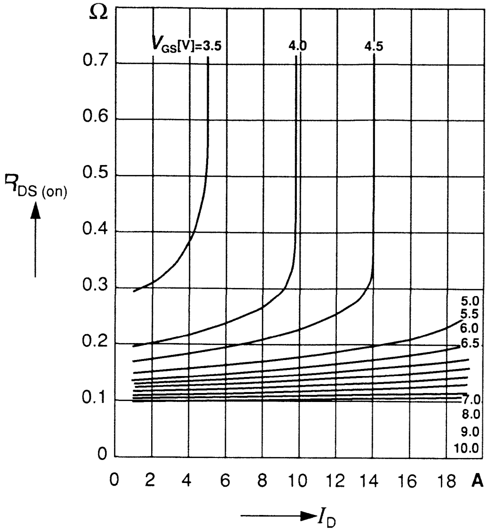


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 72 L



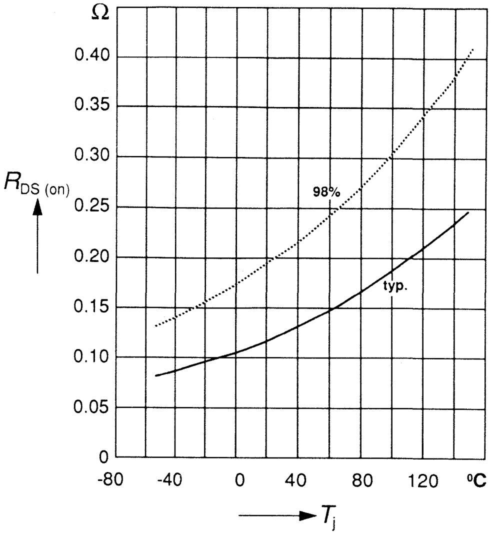
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 72 AL



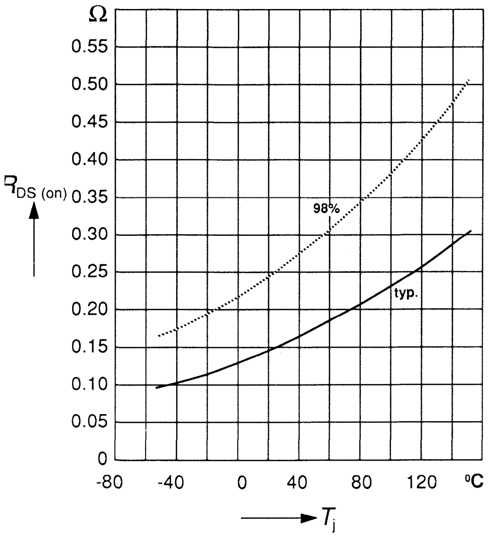
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 6$ A, $V_{GS} = 5$ V, (spread)

BUZ 72 L

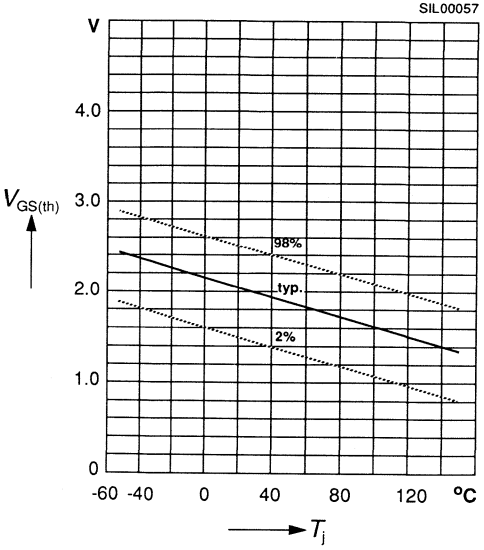


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5.0$ A, $V_{GS} = 5$ V, (spread)

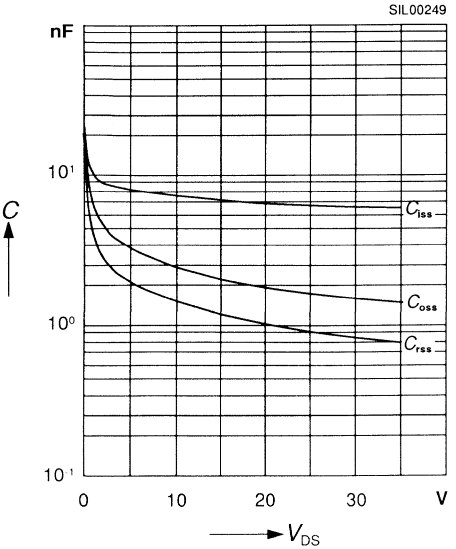
BUZ 72 AL



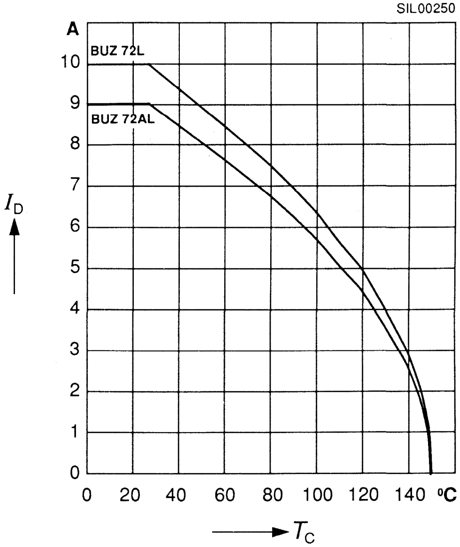
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

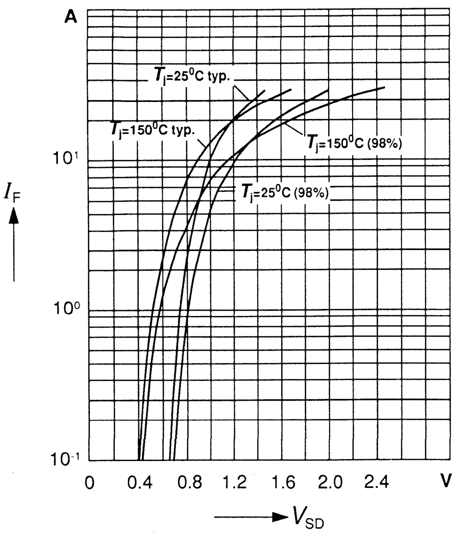


Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



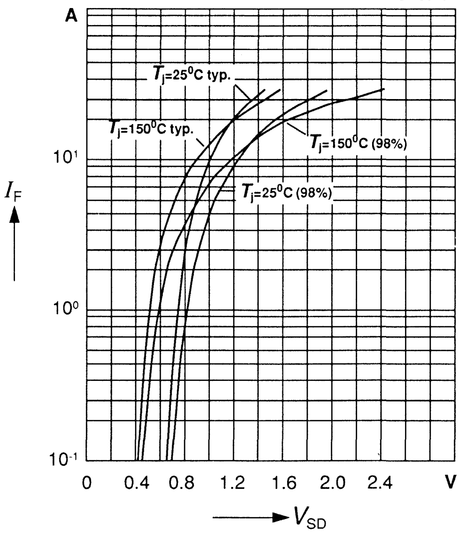
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 72 L

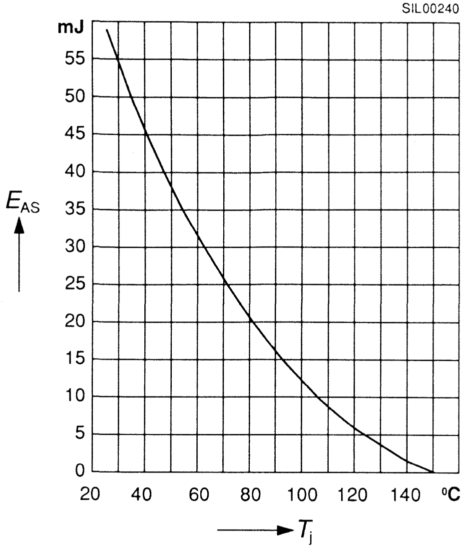


Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

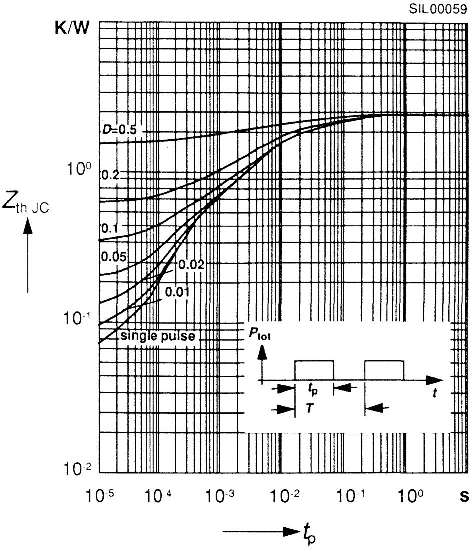
BUZ 72 AL



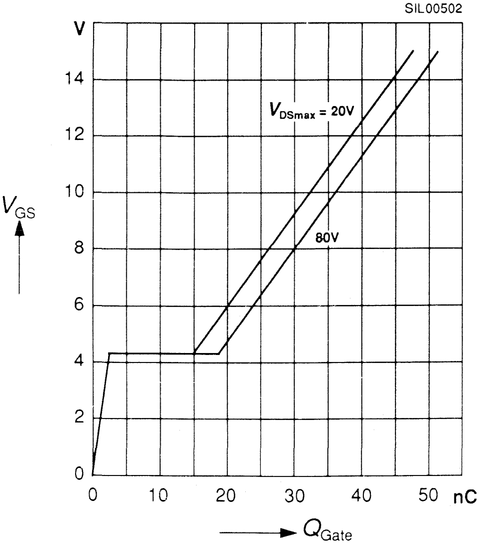
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 10$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 885\ \mu$H



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 15.0$ A

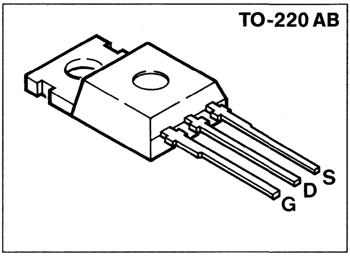


SIPMOS® Power MOS Transistors

BUZ 73
BUZ 73 A

V_{DS} = 200 V
I_D = 7.0 / 5.5 A
$R_{DS(on)}$ = 0.4 / 0.6 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 73	C67078-S1317-A2
BUZ 73 A	C67078-S1317-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		73	73 A	
Drain-source voltage	V_{DS}	200		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 28 °C / 37 °C	I_D	7.0	5.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	28	22	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	7.0		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	6.5		mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 7 A, L = 3.67 mH	E_{AS}	120		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

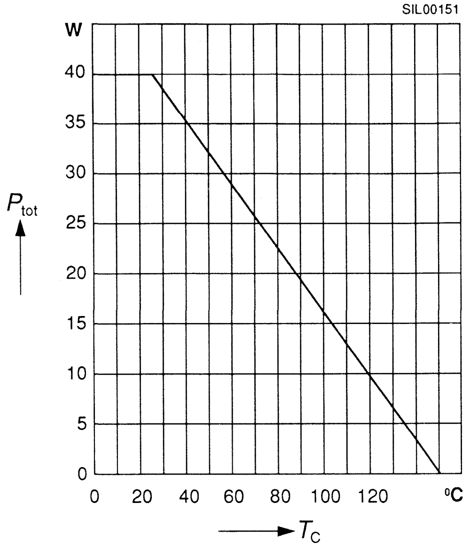
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 4.5$ A BUZ 73 BUZ 73 A	$R_{DS(on)}$	- -	0.4 0.6	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 4.5$ A	g_{fs}	3.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	730	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	190	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	90	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3.0$ A	$t_{d(on)}$	-	20	ns
	t_r	-	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 3.0$ A	$t_{d(off)}$	-	120	
	t_f	-	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

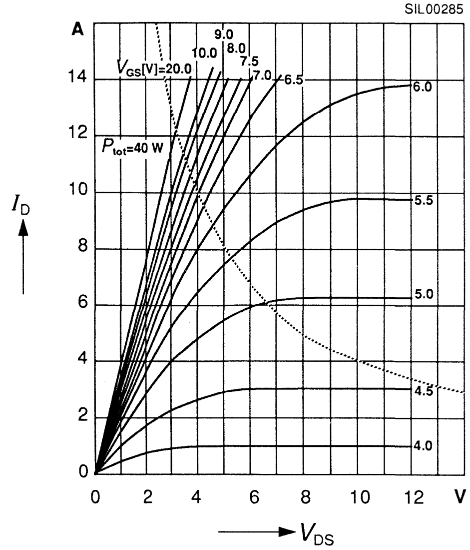
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	 BUZ 73 BUZ 73 A	I_S	 – –	 7.0 5.5	A
Pulsed reverse drain current $T_C = 25$ °C	 BUZ 73 BUZ 73 A	I_{SM}	 – –	 28 22	
Diode forward on-voltage $I_F = 14$ A, $V_{GS} = 0$		V_{SD}	 –	 1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	200 typ.	 –	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	0.60 typ.	 –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

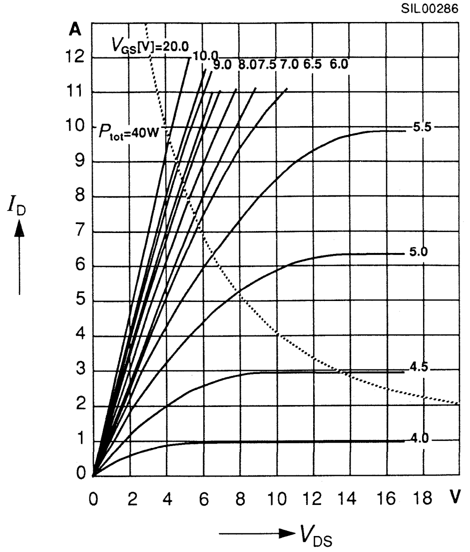
Total power dissipation $P_{tot} = f(T_C)$



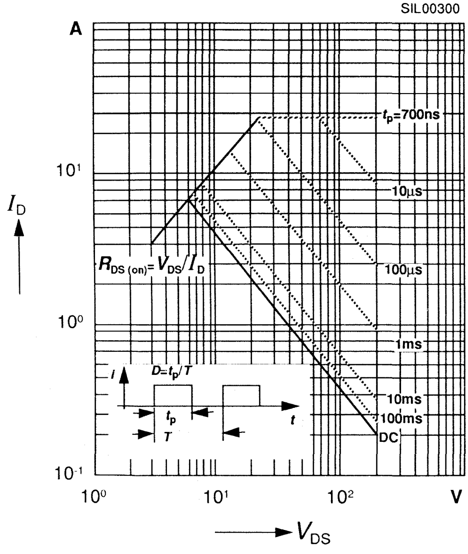
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 73



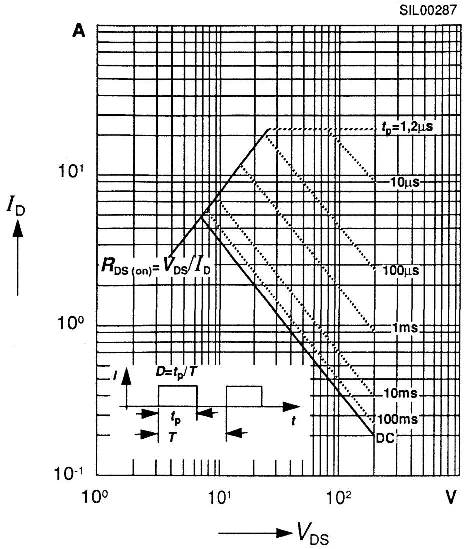
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 73 A



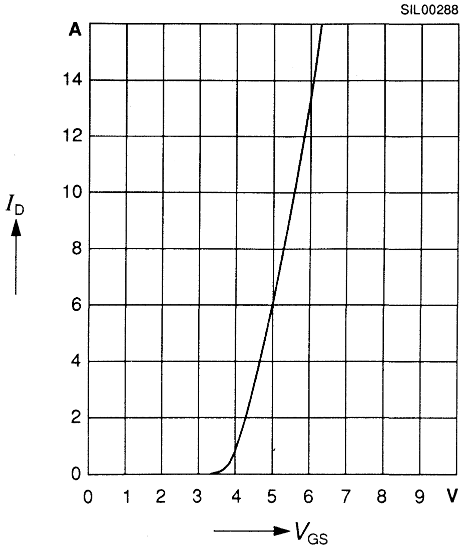
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 73



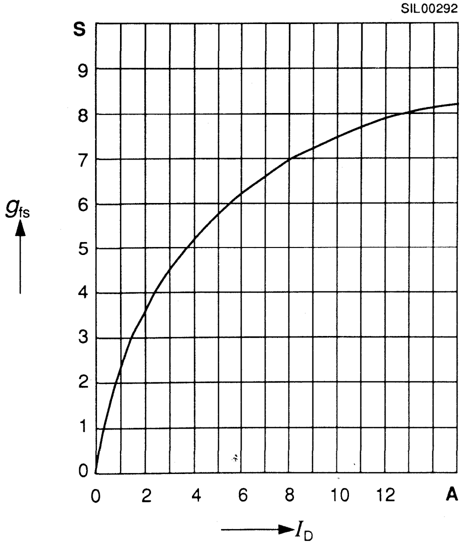
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 73 A



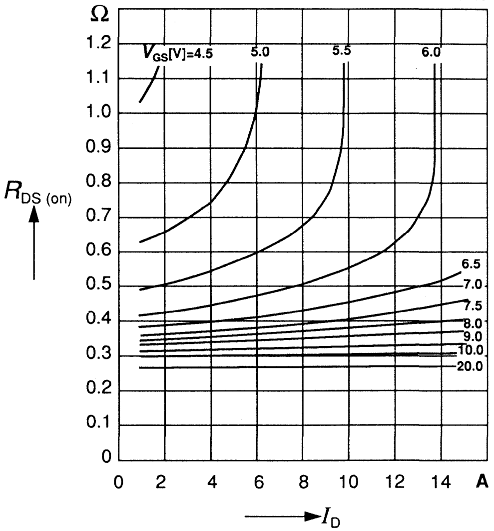
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



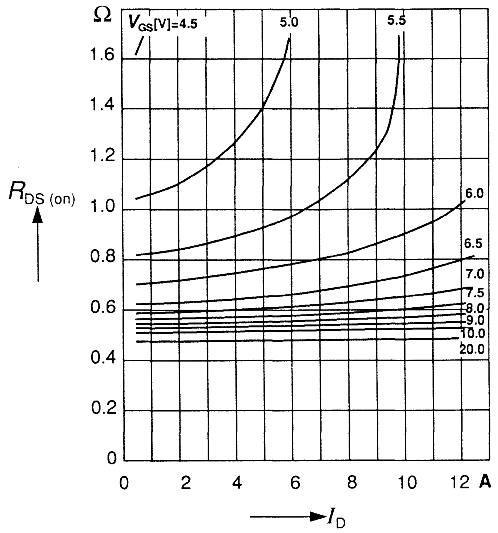
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



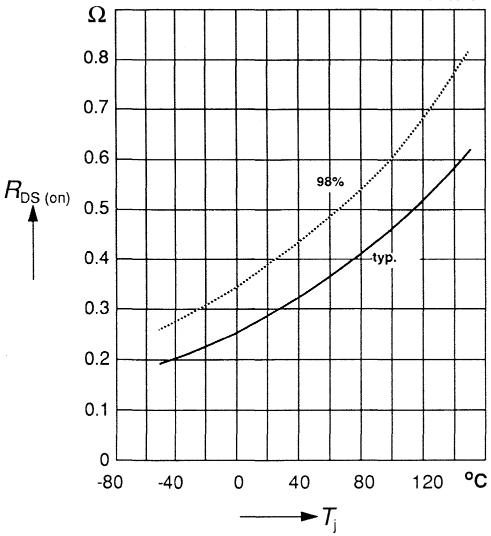
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 73



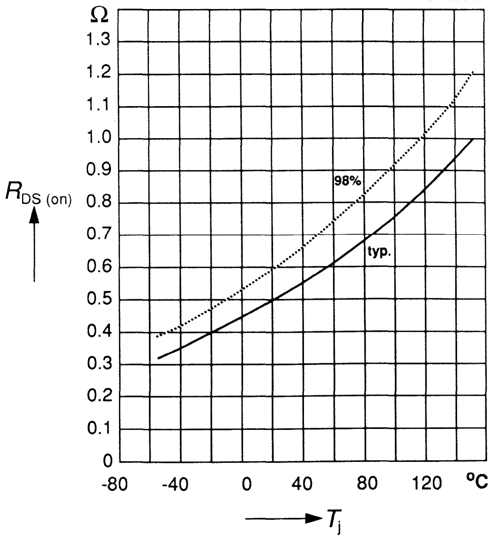
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 73A



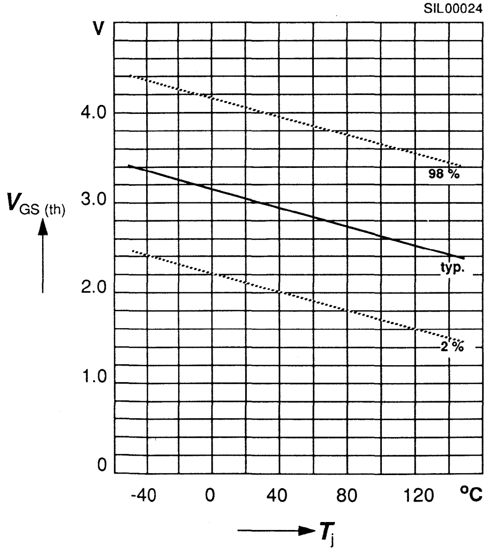
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 4.5 A, V_{GS} = 10 V, (spread)
BUZ 73



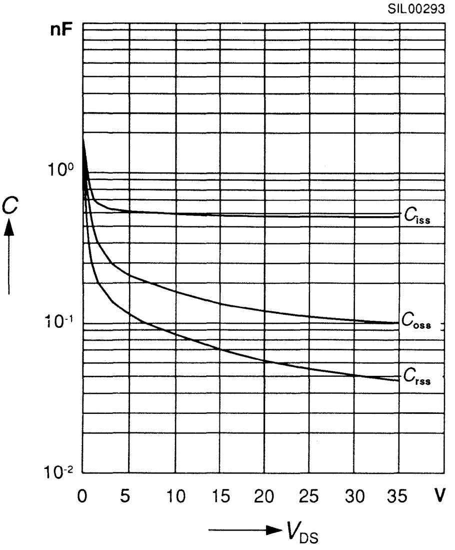
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 4.5 A, V_{GS} = 10 V, (spread)
BUZ 73A



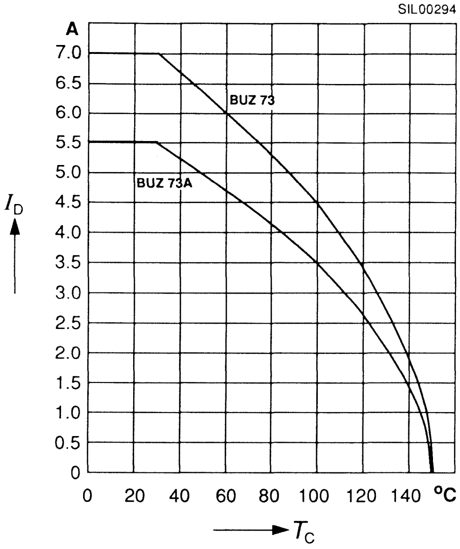
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

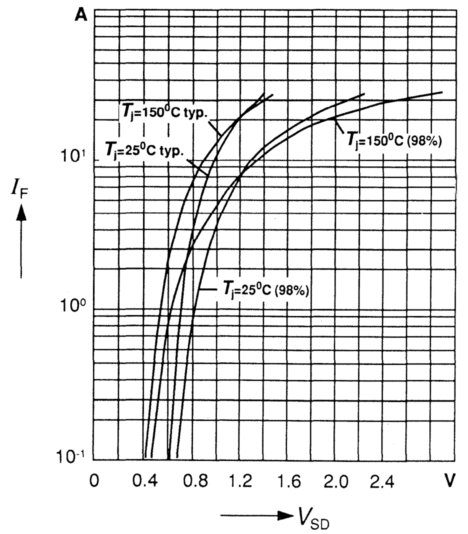


Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



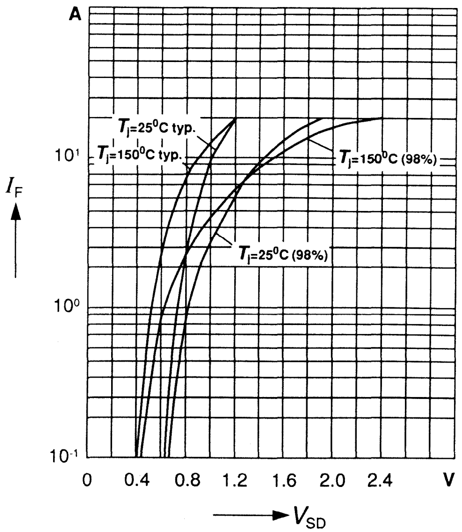
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 73

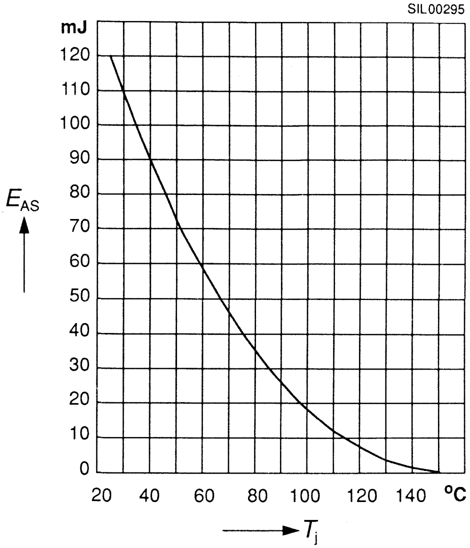


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

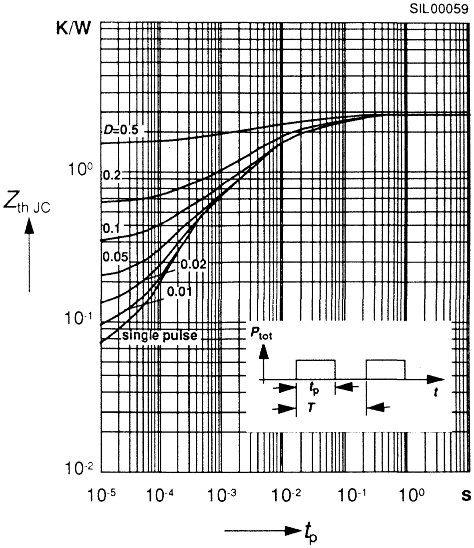
BUZ 73 A



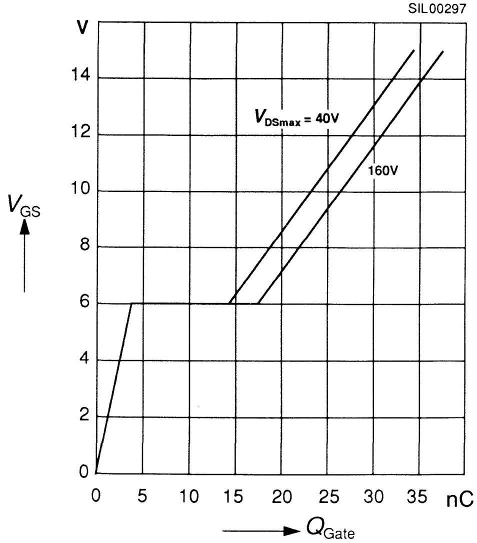
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 7$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 3.67$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 13.5$ A



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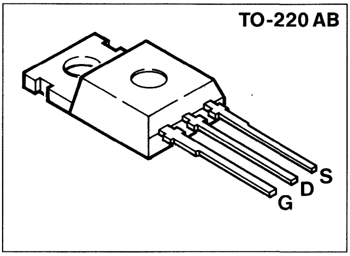
SIPMOS® Power MOS Transistors

BUZ 73 L
BUZ 73 AL

V_{DS} = 200 V
I_D = 7.0 / 5.5 A
$R_{DS(on)}$ = 0.4 / 0.6 Ω

- N channel
- Enhancement mode
- Logic level
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 73 L	C67078-S1328-A2
BUZ 73 AL	C67078-S1328-A3

Maximum Ratings

Parameter	Symbol	BUZ 73 L	 73 AL	Unit
Drain-source voltage	V_{DS}	200		V
Gate-source voltage	V_{GS}	± 10		
Gate-source peak voltage, aperiodic	V_{gs}	± 20		
Continuous drain current, T_C = 28 °C / 37 °C	I_D	7.0	5.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	28	22	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	7		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	6.5		mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 7 A, L = 3.67 mH	E_{AS}	120		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	1.5	2.5	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 5$ V, $I_D = 3.5$ A	$R_{DS(on)}$			Ω
BUZ 73 L		–	0.4	
BUZ 73 AL		–	0.6	

Dynamic characteristics

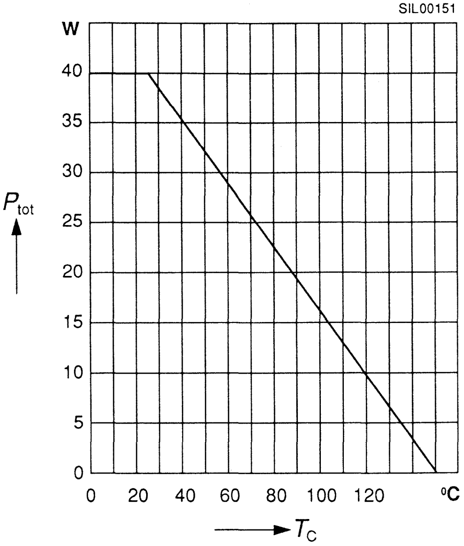
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.5$ A	g_{fs}	4	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	850	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	200	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}			
BUZ 73 L		–	95	
BUZ 73 AL		–	70	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(on)}$	–	20	ns
	t_r	–	90	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 5$ V, $R_{GS} = 50$ Ω, $I_D = 3$ A	$t_{d(off)}$	–	130	
	t_f	–	50	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

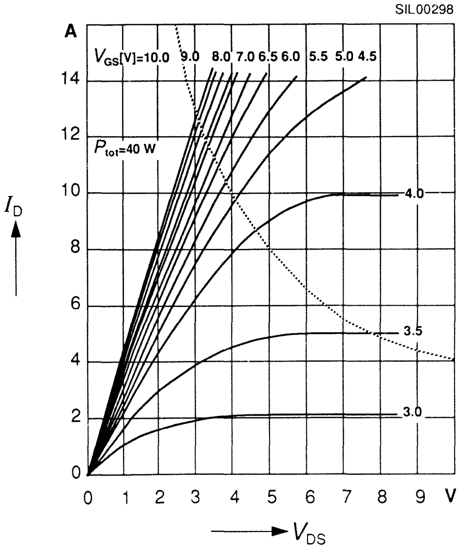
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	BUZ 73 L BUZ 73 AL	I_S	– –	7.0 5.5	A
Pulsed reverse drain current $T_C = 25$ °C	BUZ 73 L BUZ 73 AL	I_{SM}	– –	28 22	
Diode forward on-voltage $I_F = 14$ A, $V_{GS} = 0$		V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	140 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	0.7 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

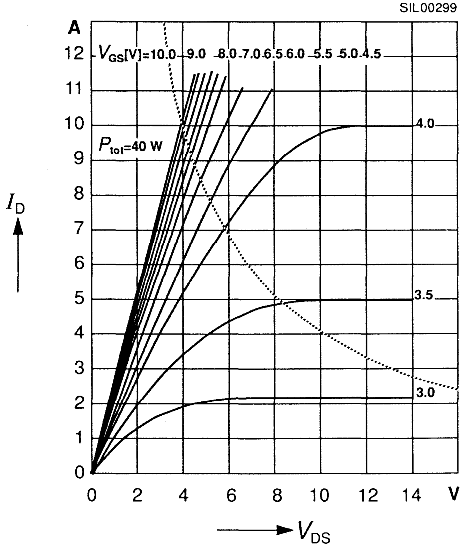
Total power dissipation $P_{tot} = f(T_C)$



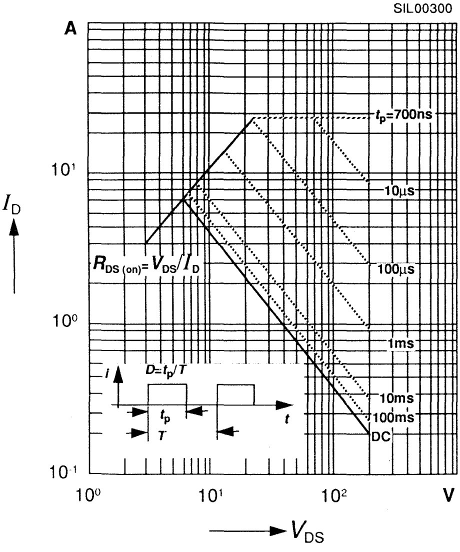
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 73 L



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 73 AL

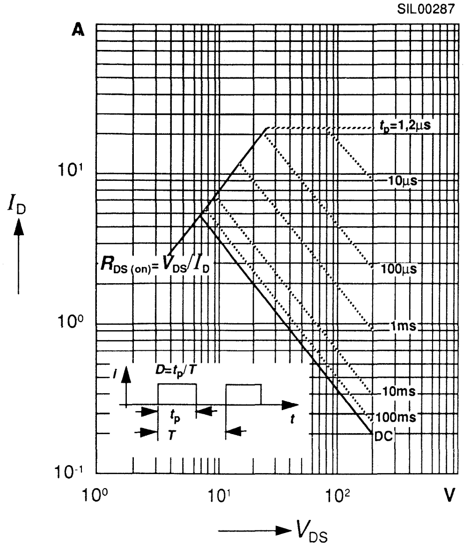


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 73 L

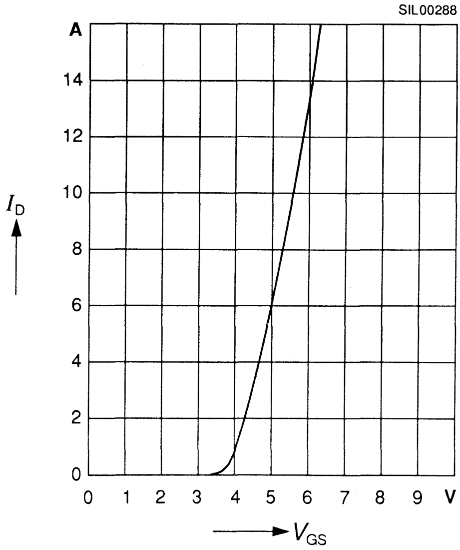


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

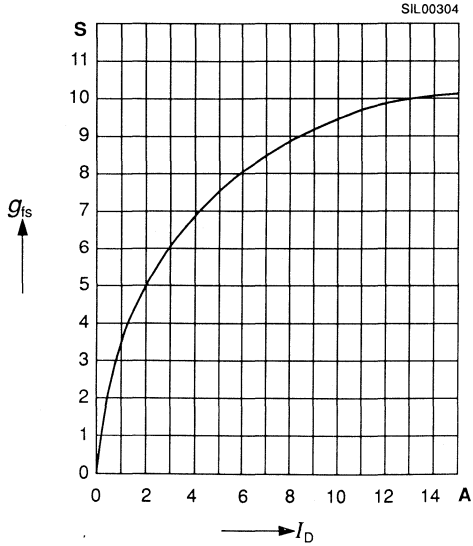
BUZ 73 AL



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

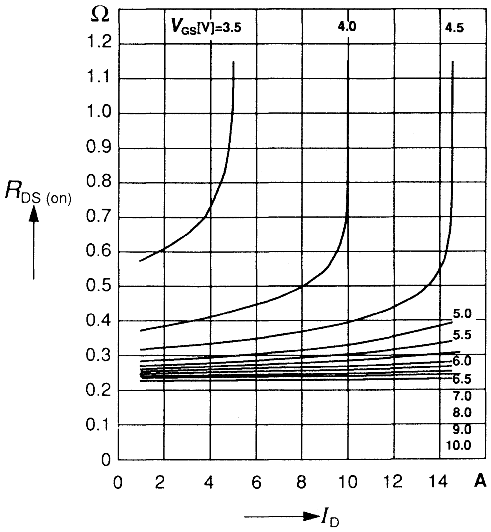


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



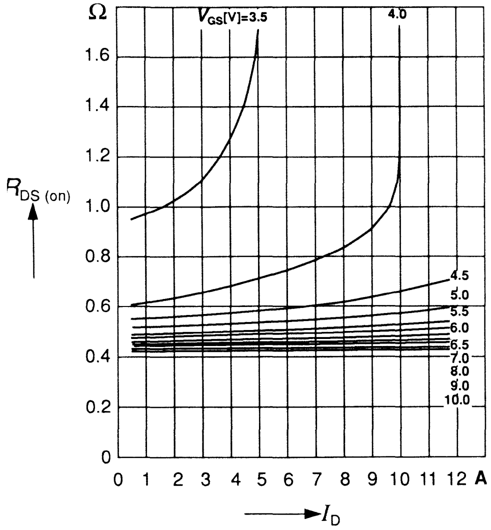
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 73 L



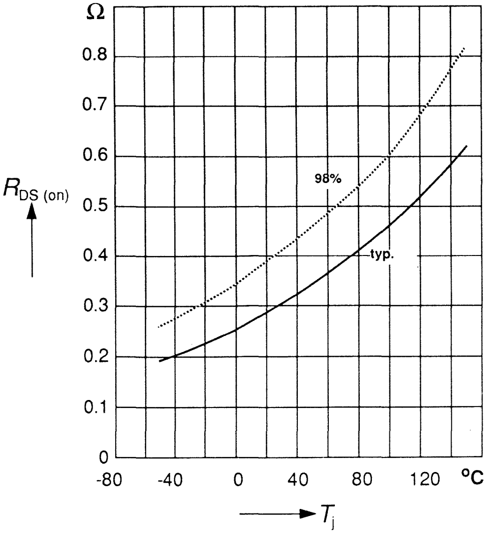
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 73 AL



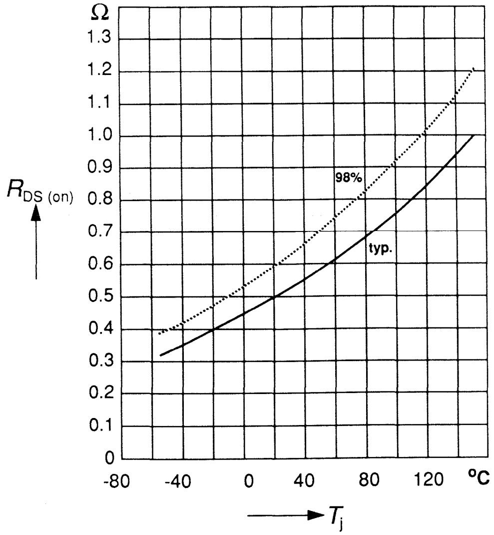
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 4.5 A, V_{GS} = 5 V, (spread)

BUZ 73 L

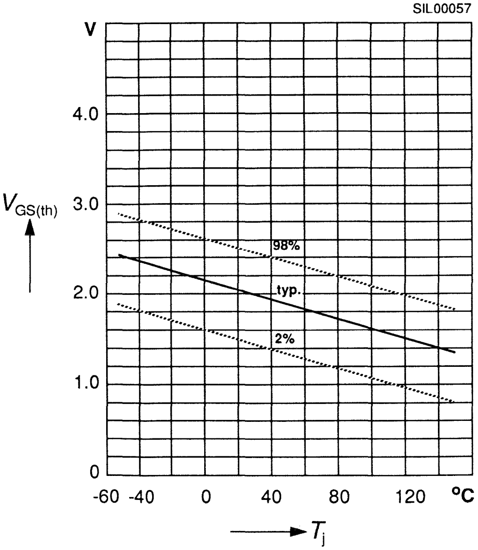


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 4.5 A, V_{GS} = 5 V, (spread)

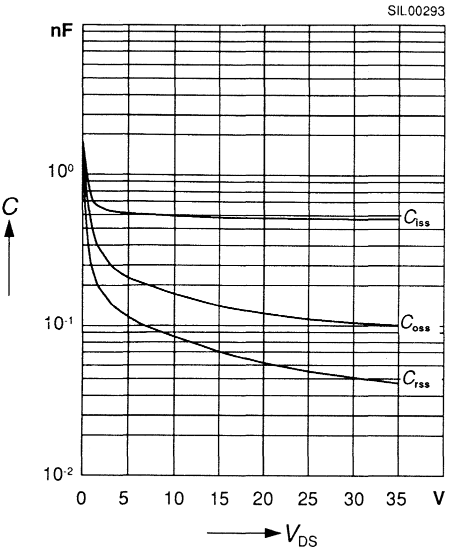
BUZ 73 AL



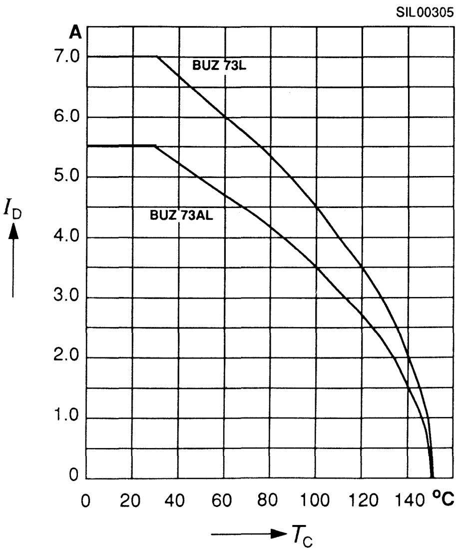
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

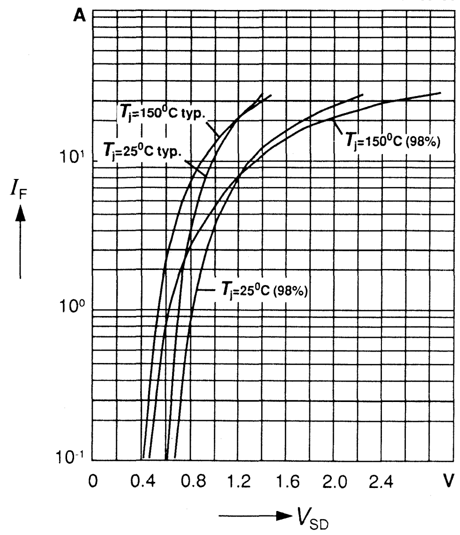


Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 5$ V



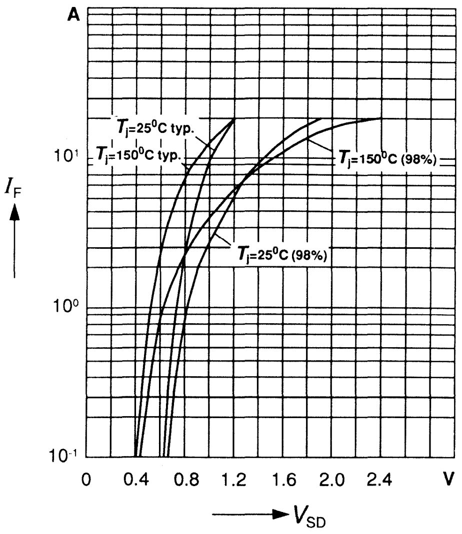
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 73 L

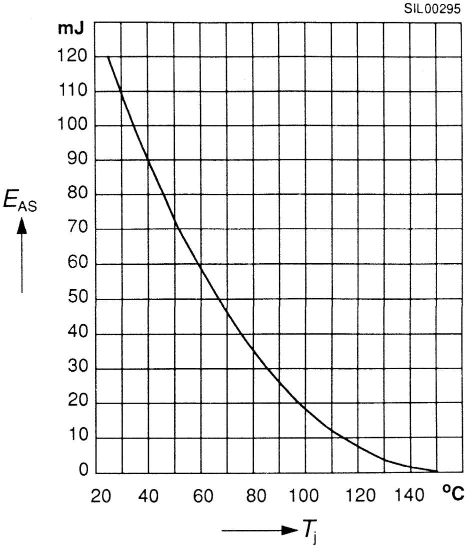


Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

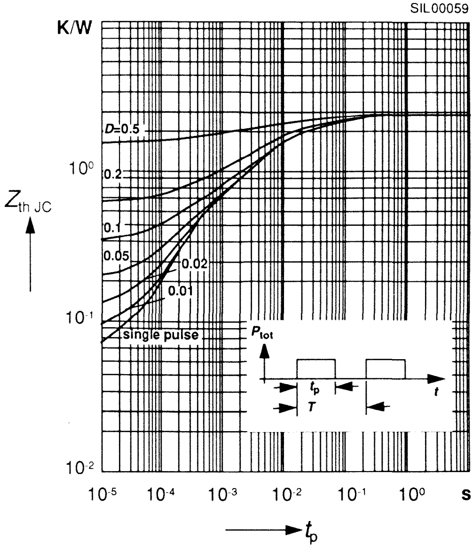
BUZ 73 AL



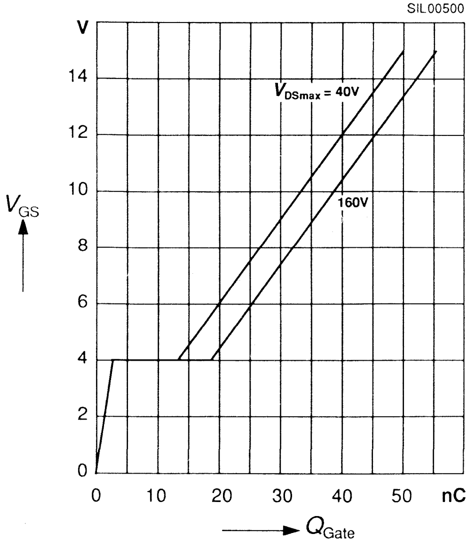
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 7$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 3.67$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 10.5$ A



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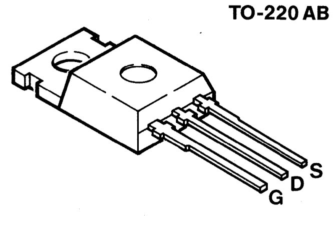
SIPMOS® Power MOS Transistors

BUZ 74
BUZ 74 A

V_{DS} = **500 V**
I_D = **2.4 / 2.1 A**
$R_{DS(on)}$ = **3.0 / 4.0 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 74	C67078-A1314-A2
BUZ 74 A	C67078-A1314-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		74	74 A	
Drain-source voltage	V_{DS}	500		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 30 °C / 27 °C	I_D	2.4	2.1	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	9.5	8.5	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	2.4		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	5		mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 2.4 A, L = 56.3 mH	E_{AS}	180		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 1.5$ A BUZ 74	$R_{DS(on)}$	–	3.0	Ω
BUZ 74 A		–	4.0	

Dynamic characteristics

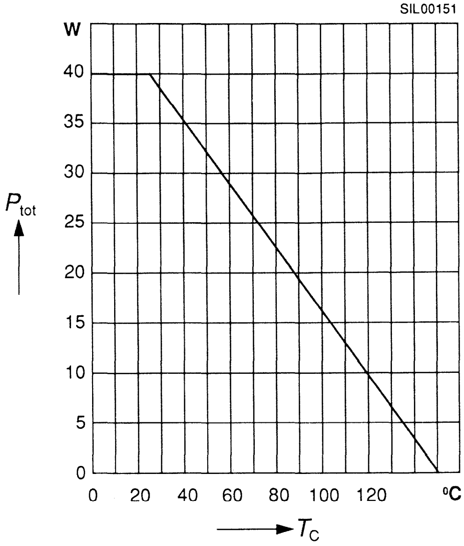
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.5$ A	g_{fs}	1.8	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	675	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	75	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	30	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.1$ A	$t_{d(on)}$	–	12	ns
	t_r	–	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.1$ A	$t_{d(off)}$	–	65	
	t_f	–	40	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

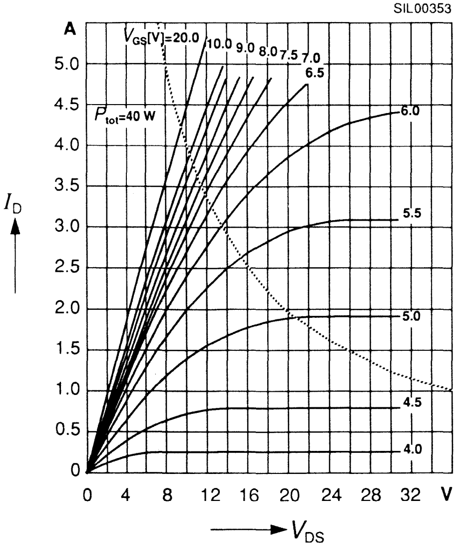
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current T_C = 25 °C	BUZ 74	I_S	–	2.4	A
	BUZ 74 A		–	2.1	
Pulsed reverse drain current T_C = 25 °C	BUZ 74	I_{SM}	–	9.5	
	BUZ 74 A		–	8.5	
Diode forward on-voltage I_F = 4.8 A, V_{GS} = 0		V_{SD}	–	1.3	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs		t_{rr}	300 typ.	–	ns
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs		Q_{rr}	2.5 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

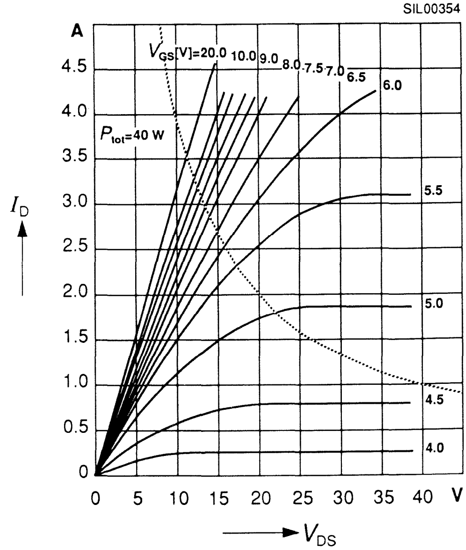
Total power dissipation $P_{tot} = f(T_C)$



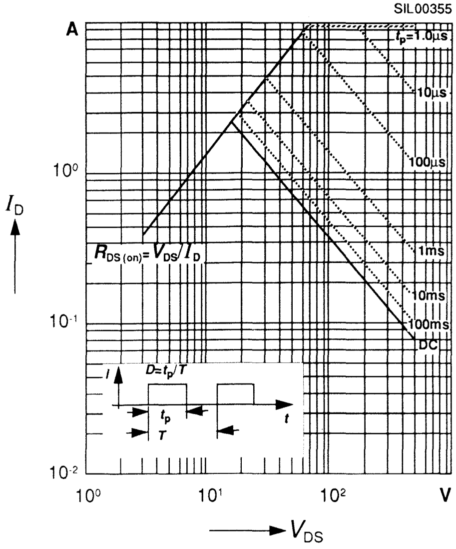
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 74



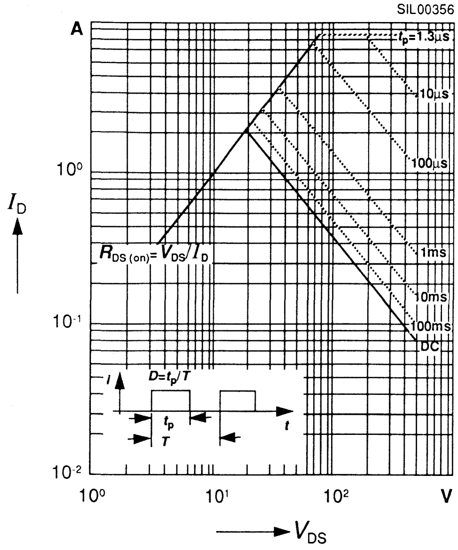
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 74 A



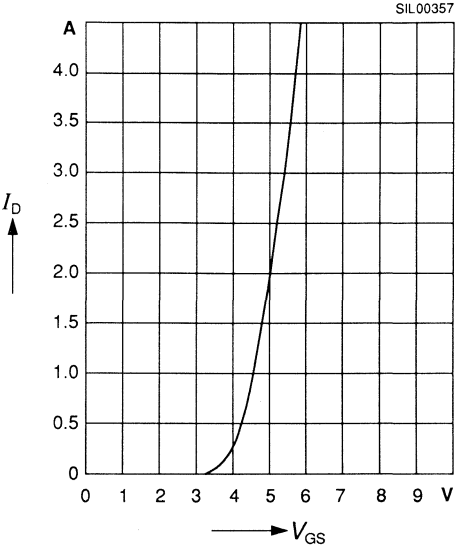
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 74



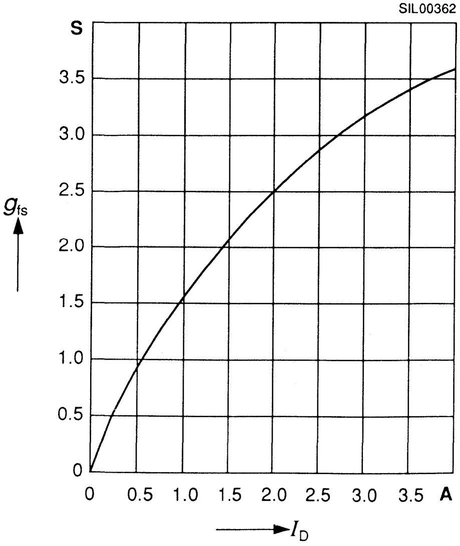
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 74 A



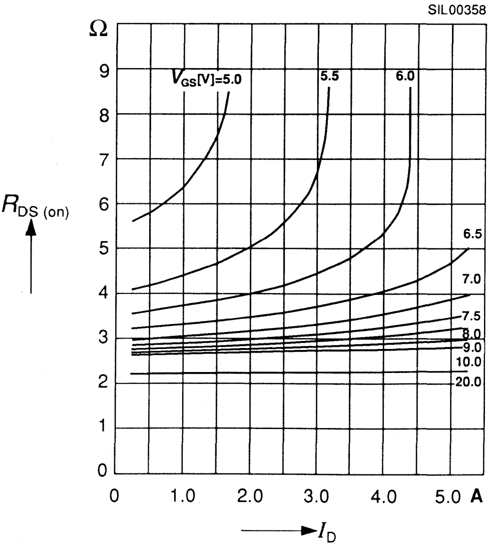
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



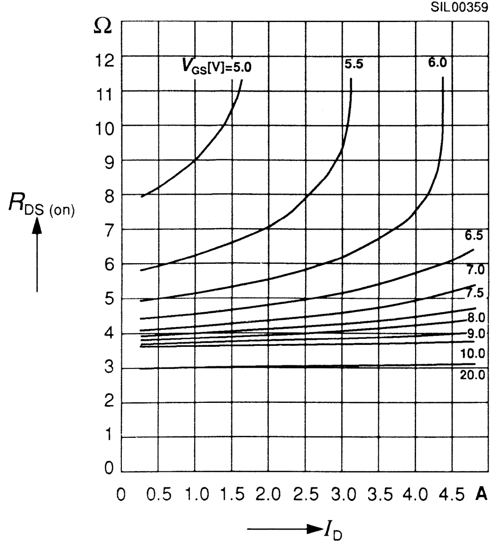
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 74



Typ. drain-source on-resistance

$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

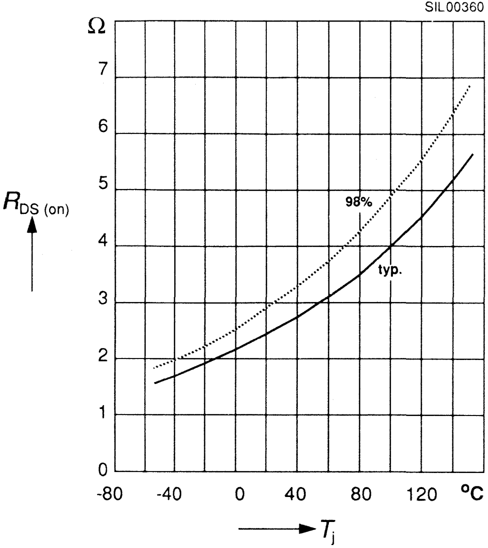
BUZ 74 A



Drain-source on-resistance

$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.5$ A, $V_{GS} = 10$ V, (spread)

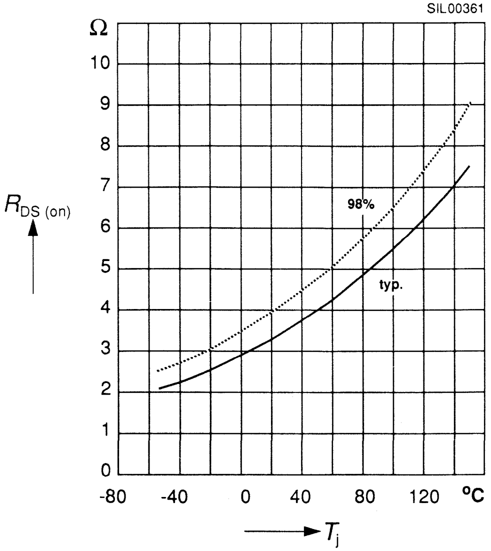
BUZ 74



Drain-source on-resistance

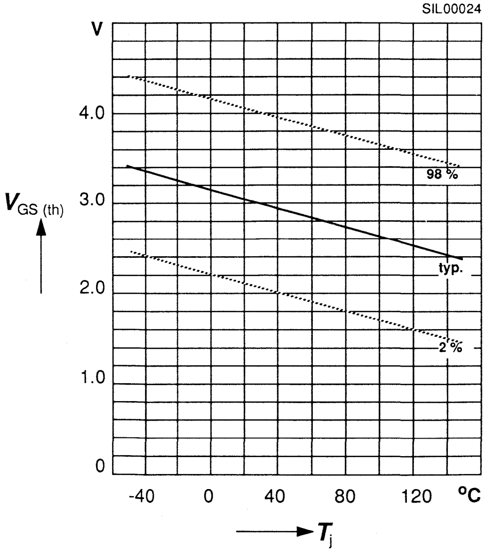
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.5$ A, $V_{GS} = 10$ V, (spread)

BUZ 74 A

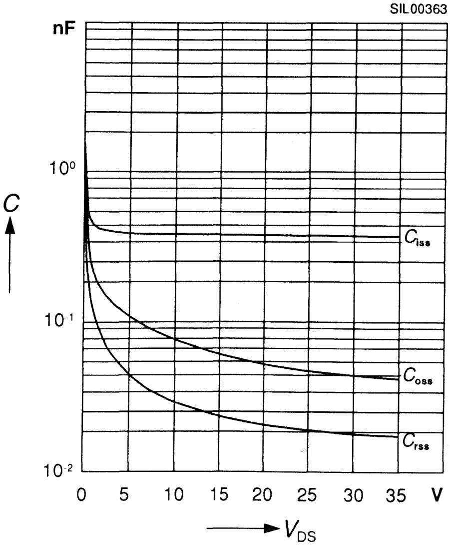


Gate threshold voltage $V_{GS(th)} = f(T_j)$

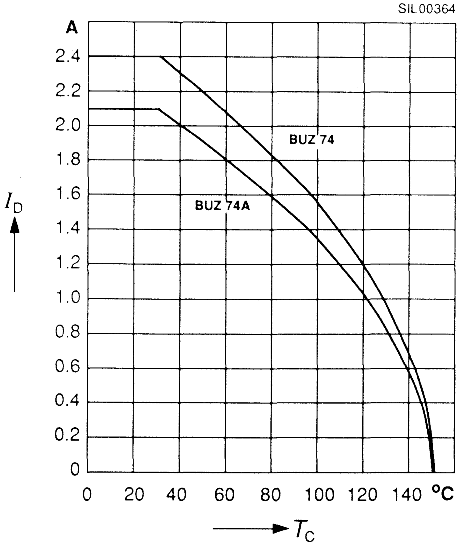
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



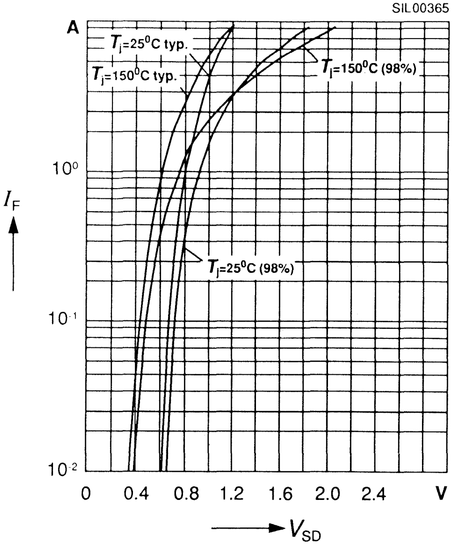
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



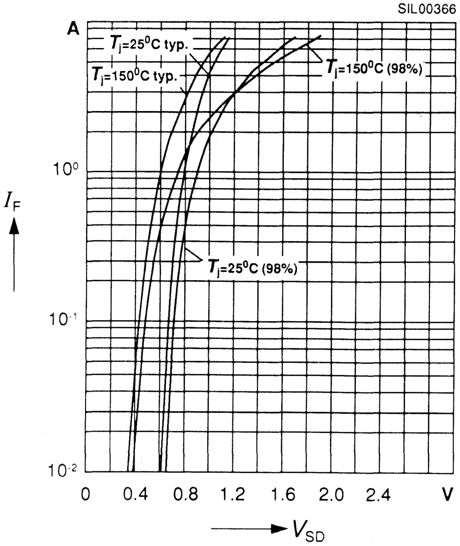
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



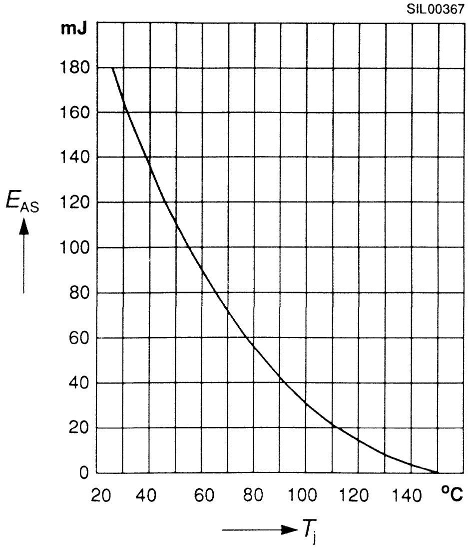
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 74



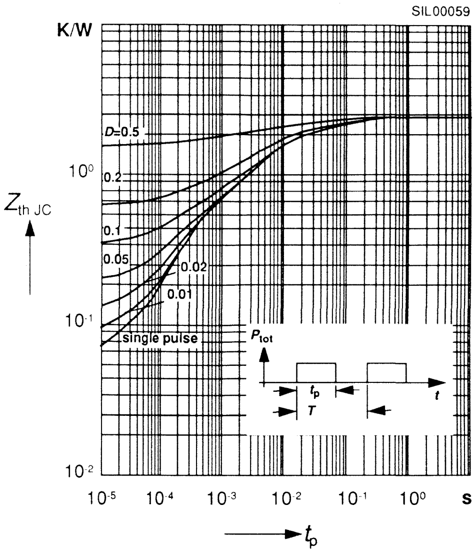
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 74 A



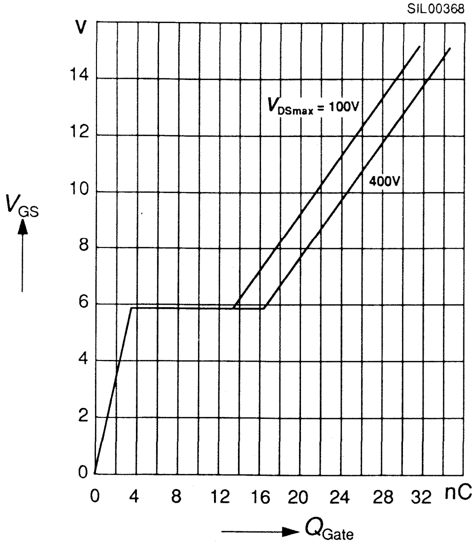
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 2.4$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 56.3$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 4.8$ A

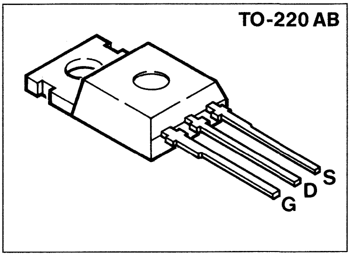


SIPMOS® Power MOS Transistors

BUZ 76
BUZ 76 A

V_{DS} = **400 V**
I_D = **3.0 / 2.7 A**
$R_{DS(on)}$ = **1.8 / 2.5 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 76	C67078-A1315-A2
BUZ 76 A	C67078-A1315-A3

Maximum Ratings

Parameter	Symbol	BUZ 76	BUZ 76 A	Unit
Drain-source voltage	V_{DS}	400		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, $T_C = 37\ °C / 23\ °C$	I_D	3.0	2.7	A
Pulsed drain current, $T_C = 25\ °C$	$I_{D\ puls}$	12	11	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	3		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	5		mJ
Avalanche energy, single pulse $V_{DD} = 50$ V, $R_{GS} = 25\ \Omega$, $T_j = 25\ °C$ $I_D = 3$ A, $L = 35$ mH	E_{AS}	180		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, $T_C = 25\ °C$	P_{tot}	40		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1]) See chapter Package Outlines

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 2.0$ A BUZ 76 BUZ 76 A	$R_{DS(on)}$	 – –	 1.8 2.5	Ω

Dynamic characteristics

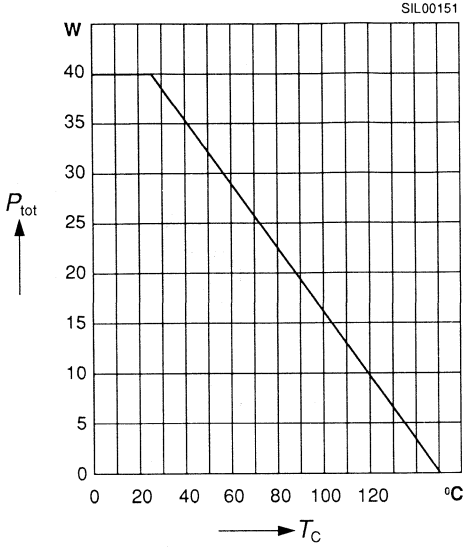
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 2.0$ A	g_{fs}	2.1	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	650	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	100	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	40	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.5$ A	$t_{d(on)}$	–	12	ns
	t_r	–	45	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.5$ A	$t_{d(off)}$	–	75	
	t_f	–	40	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

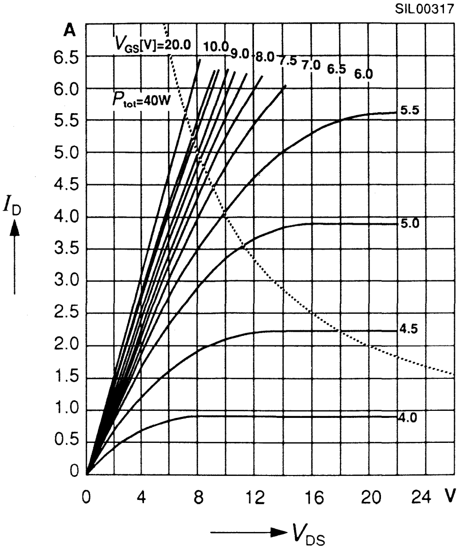
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current T_C = 25 °C	BUZ 76 BUZ 76 A	I_S	– –	3.0 2.7	A
Pulsed reverse drain current T_C = 25 °C	BUZ 76 BUZ 76 A	I_{SM}	– –	12 11	
Diode forward on-voltage I_F = 6.0 A, V_{GS} = 0		V_{SD}	–	1.4	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs		t_{rr}	300 typ.	–	ns
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs		Q_{rr}	2.5 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

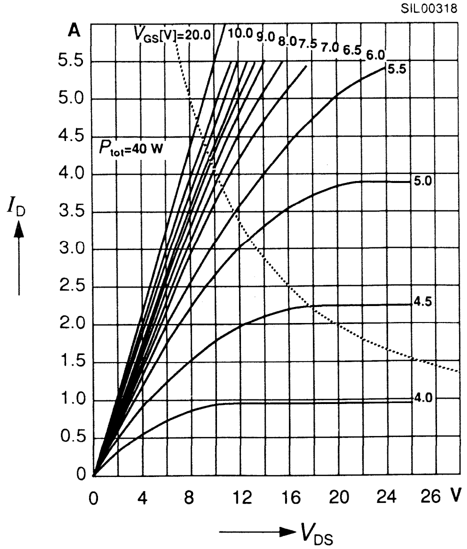
Total power dissipation $P_{tot} = f(T_C)$



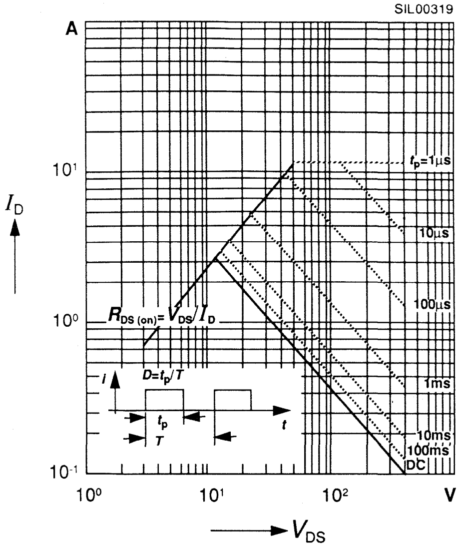
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 76



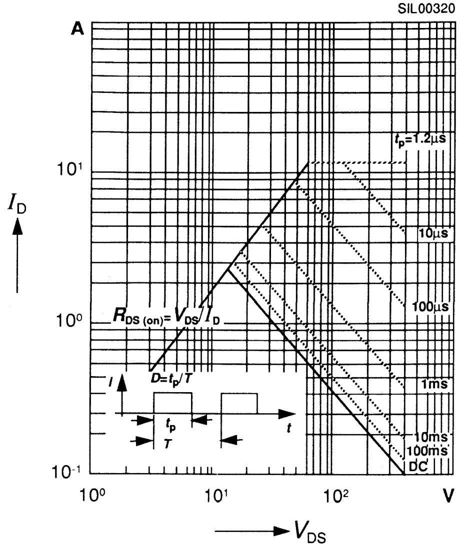
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 76 A



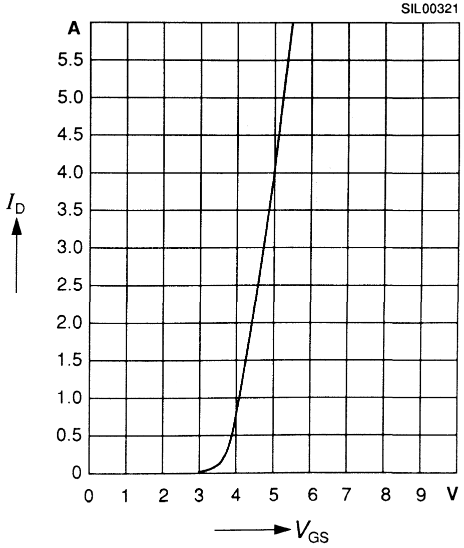
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 76



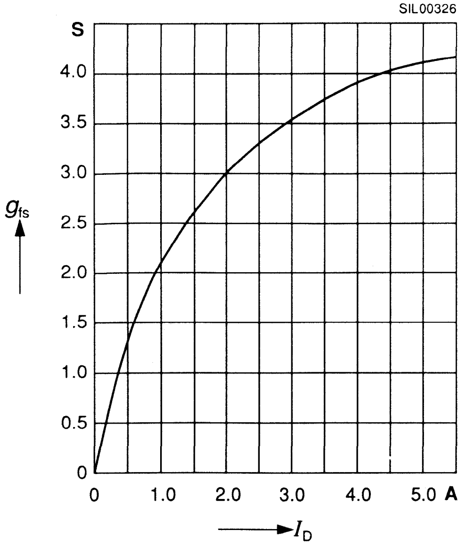
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
BUZ 76 A



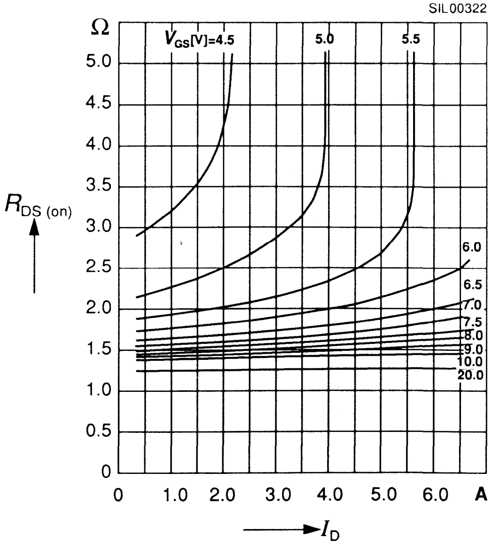
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ µs$, $V_{DS} = 25\ V$



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ µs$

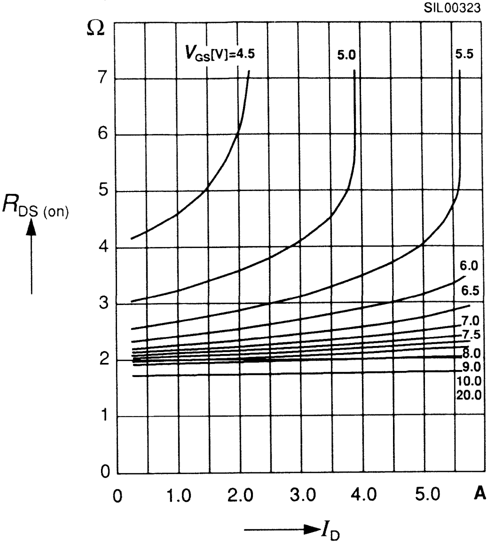


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 76



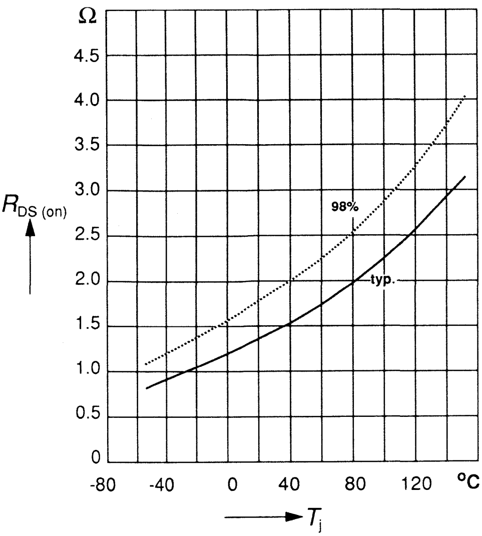
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 76 A



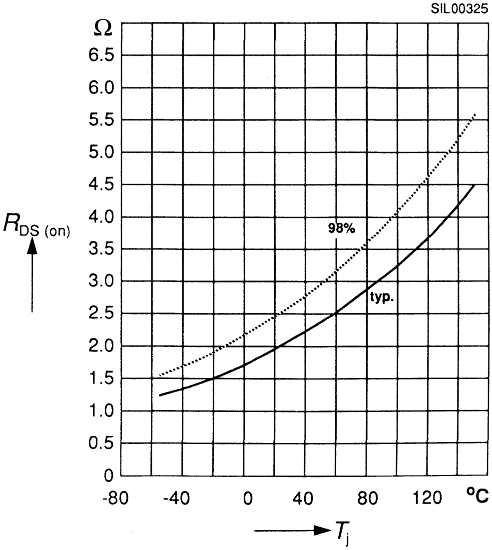
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 2.0$ A, $V_{GS} = 10$ V, (spread)

BUZ 76

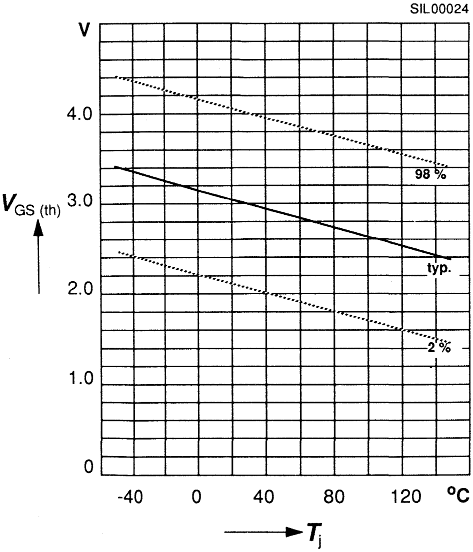


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 2.0$ A, $V_{GS} = 10$ V, (spread)

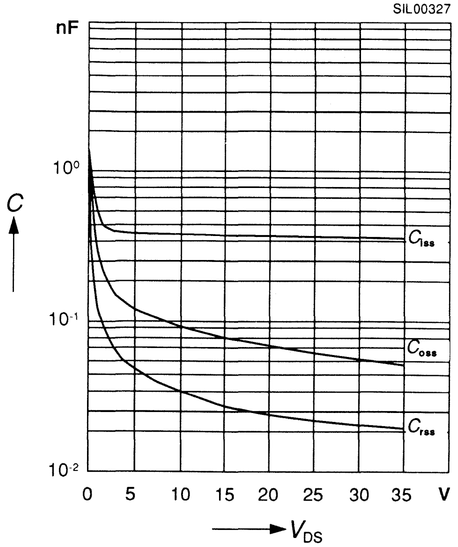
BUZ 76 A



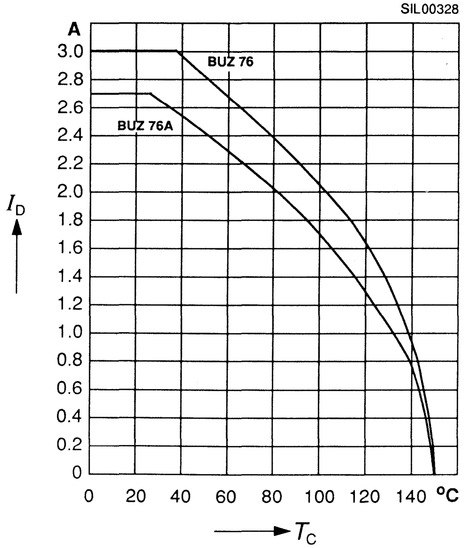
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



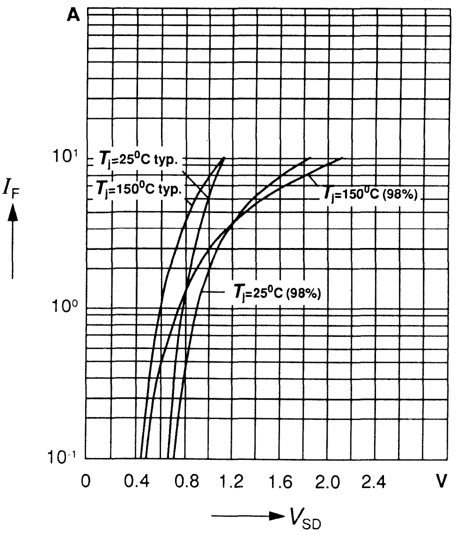
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



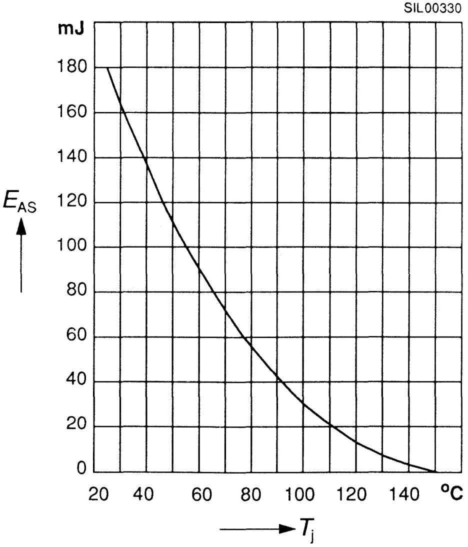
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



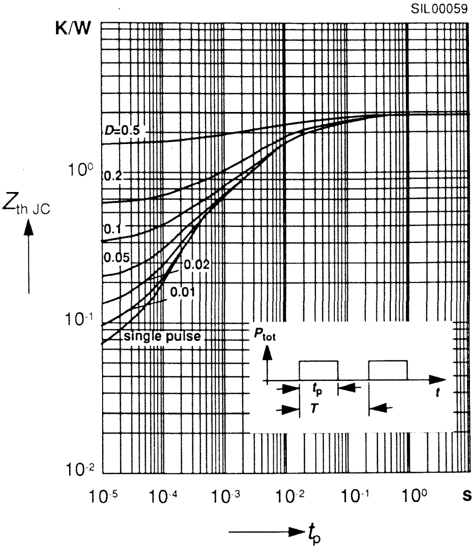
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



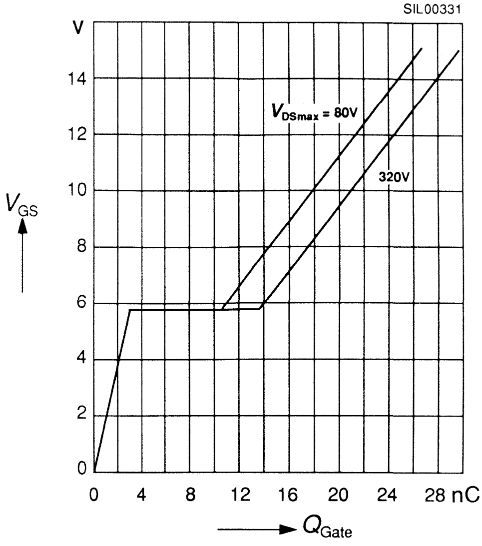
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 3$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 35$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 6.0\ A$



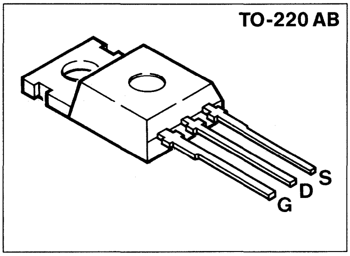
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 77 A
BUZ 77 B

V_{DS} = 600 V
I_D = 2.7 / 2.9 A
$R_{DS(on)}$ = 4.0 / 3.5 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 77 A	C67078-S1320-A3
BUZ 77 B	C67078-S1320-A5

Maximum Ratings

Parameter	Symbol	BUZ 77 A	 77 B	Unit
Drain-source voltage	V_{DS}	600		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 31 °C / 29 °C	I_D	2.7	2.9	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	11	11.5	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	2.7		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	5.0		mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 2.7 A, L = 45.3 mH	E_{AS}	180		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75		K/W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	600	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 600$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 1.7$ A BUZ 77A	$R_{DS(on)}$	–	4.0	Ω
BUZ 77B		–	3.5	

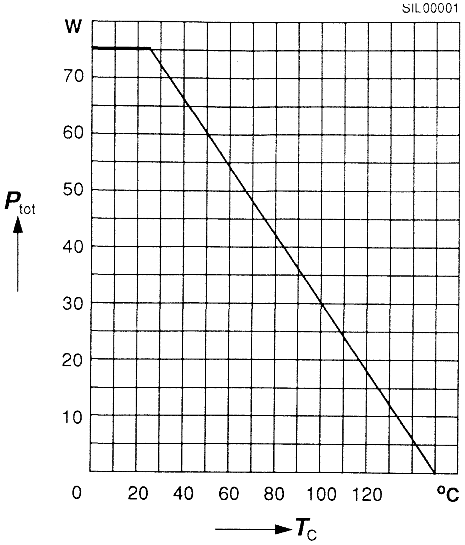
Parameter	Symbol	Values		Unit
		min.	max.	
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.7$ A	g_{fs}	1.5	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	690	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	85	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	30	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω $I_D = 2$ A BUZ 77A	$t_{d(on)}$	–	12	ns
BUZ 77B		–	10	
	t_r	–	40	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2$ A	$t_{d(off)}$	–	65	
	t_f	–	40	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

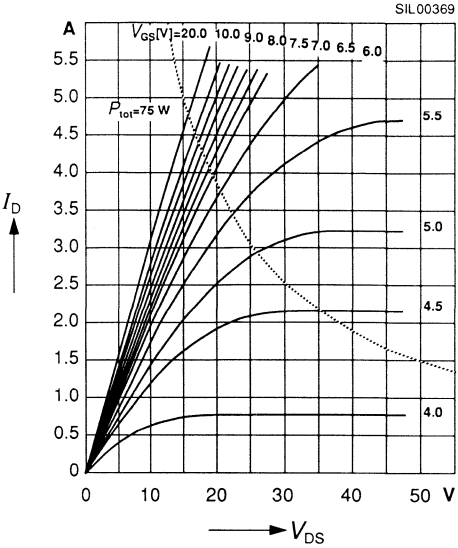
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	2.7	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	11.0	
Diode forward on-voltage $I_F = 5.4$ A, $V_{GS} = 0$	V_{SD}	–	1.3	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	350 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	3.50 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

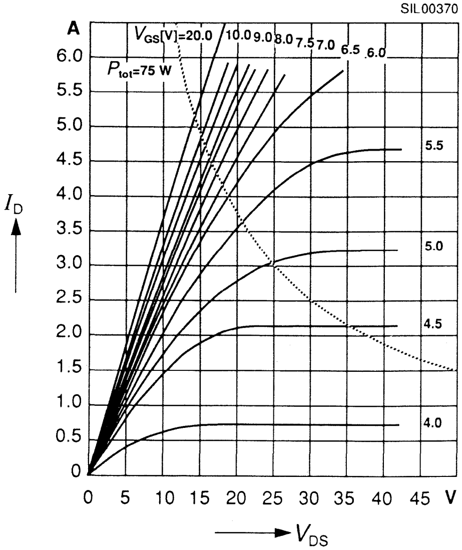
Total power dissipation $P_{tot} = f(T_C)$



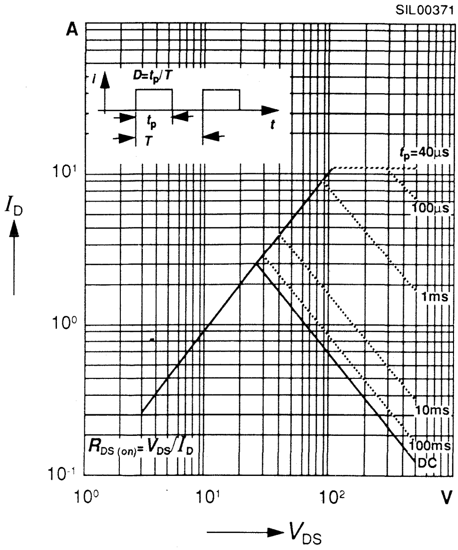
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 77 A



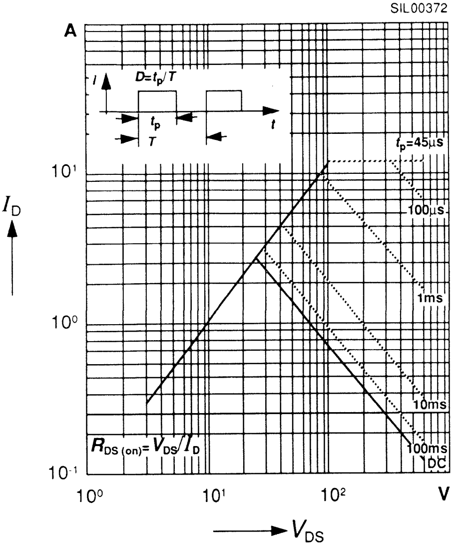
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 77 B



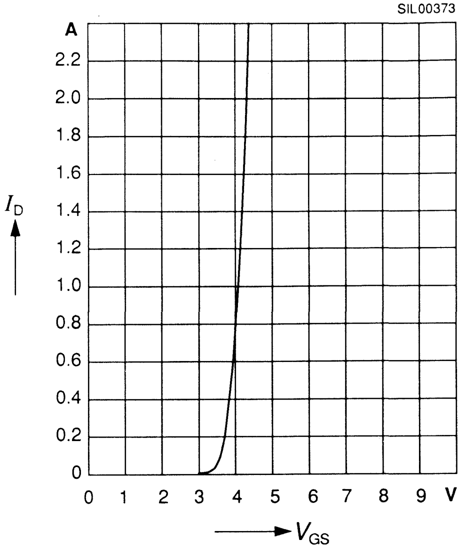
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 77 A



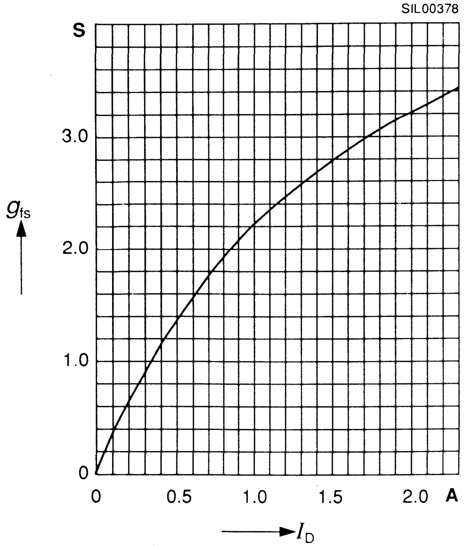
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 77 B



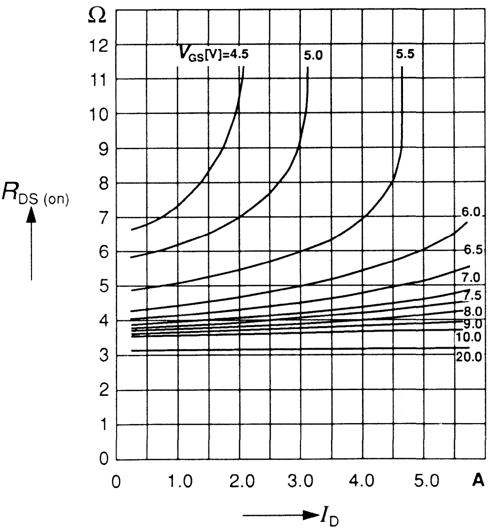
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

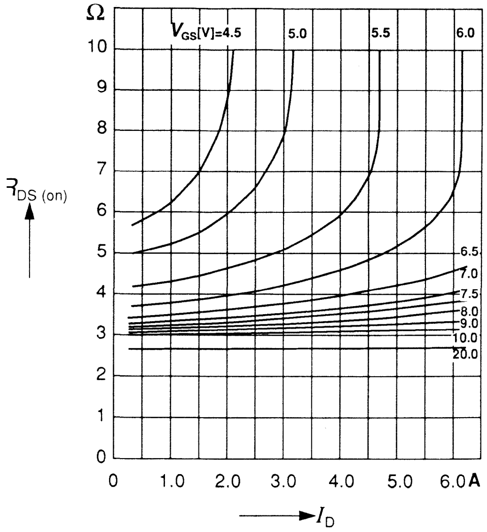


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 77 A



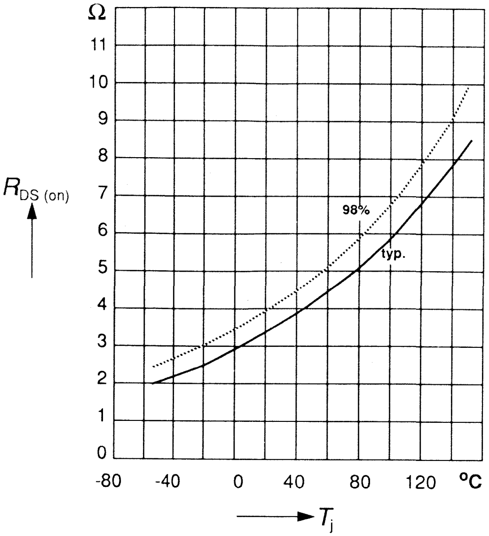
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 77 B



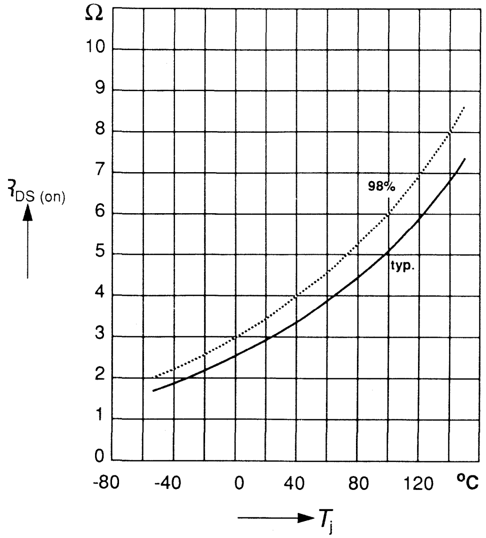
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.7$ A, $V_{GS} = 10$ V, (spread)

BUZ 77 A

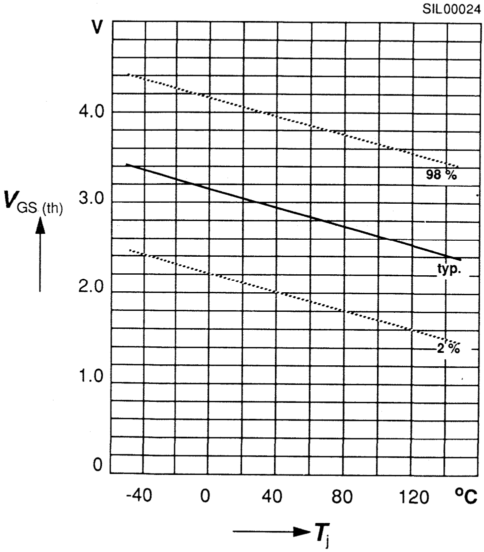


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.7$ A, $V_{GS} = 10$ V, (spread)

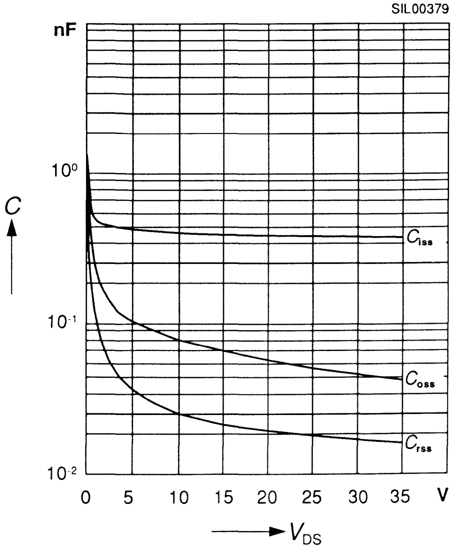
BUZ 77 B



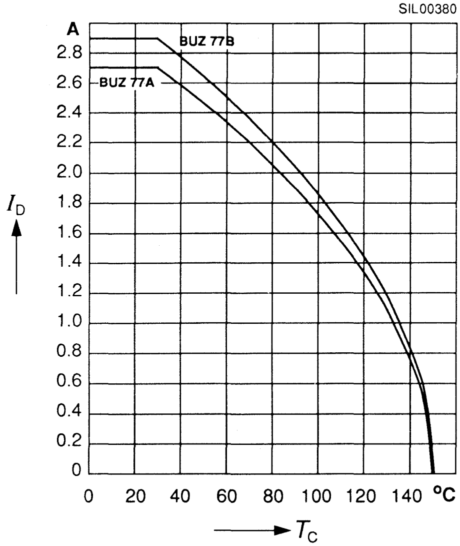
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



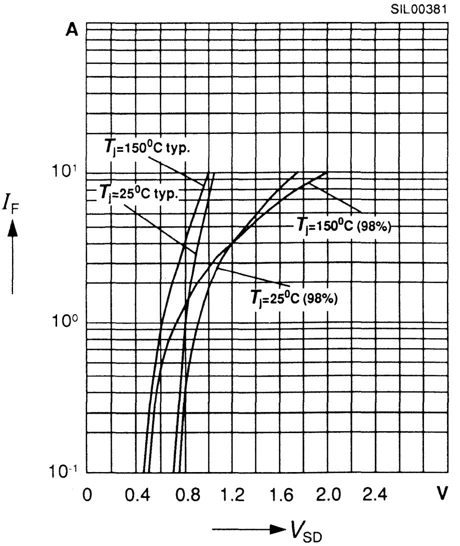
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



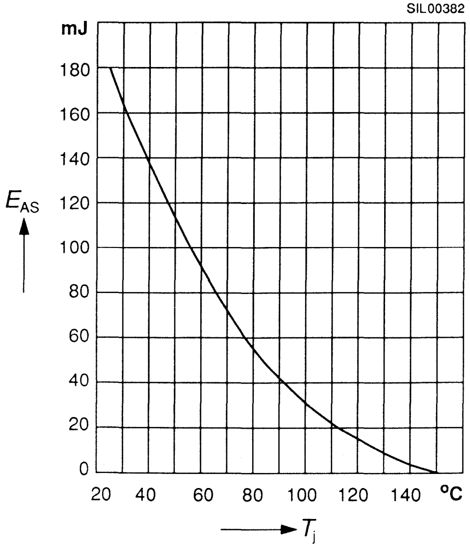
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



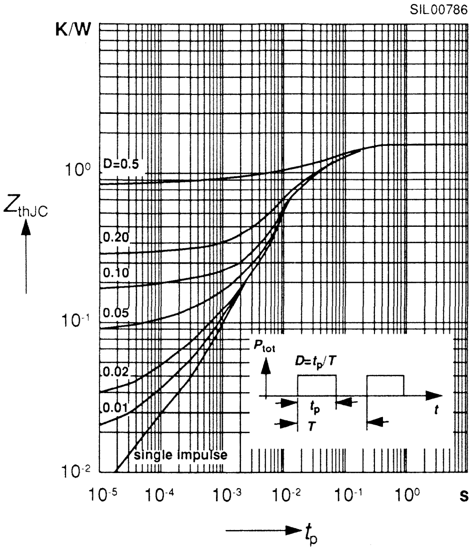
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



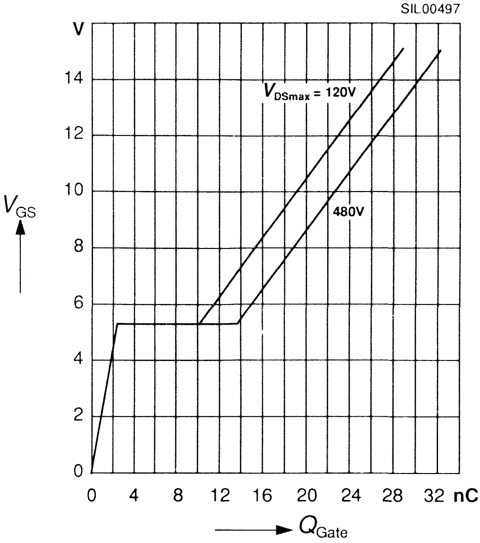
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 2.7$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 45.3$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 4.4$ A

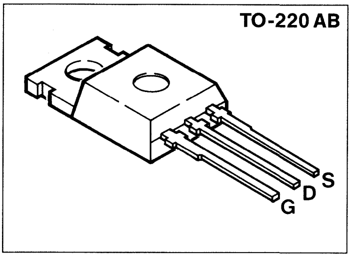


SIEMENS

SIPMOS® Power MOS Transistor BUZ 78

V_{DS} = 800 V
I_D = 1.5 A
$R_{DS(on)}$ = 8 Ω

- N channel
- Enhancement mode
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 78	C67078-A1318-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	800	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	1.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	6.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	250	
$T_j = 125$ °C		-	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 1.0$ A	$R_{DS(on)}$	-	8.0	Ω

Dynamic characteristics

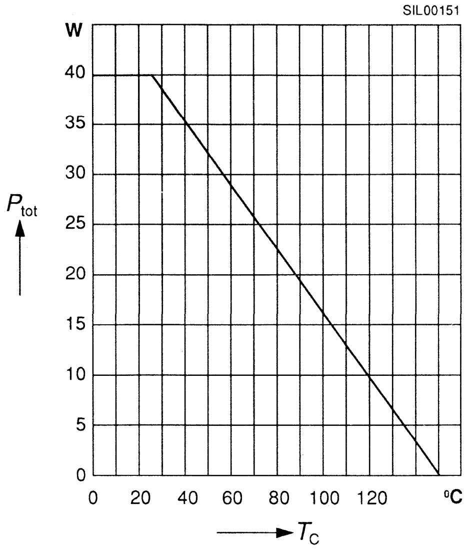
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.00$ A	g_{fs}	1.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	750	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	70	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	30	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 1.7$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	25	ns
	t_r	-	40	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 1.7$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	85	
	t_f	-	65	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

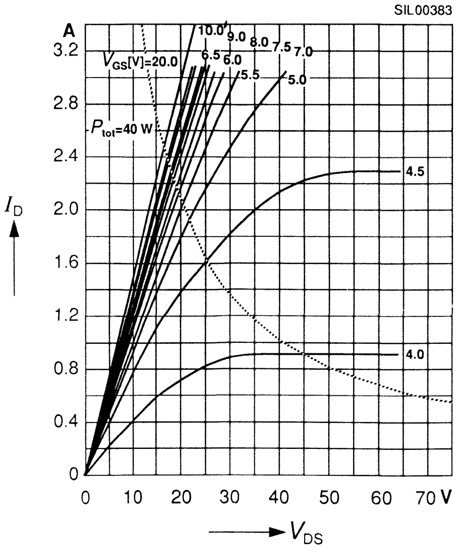
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	1.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	6.0	
Diode forward on-voltage $I_F = 3.0$ A, $V_{GS} = 0$	V_{SD}	–	1.4	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	1 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	12.0 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

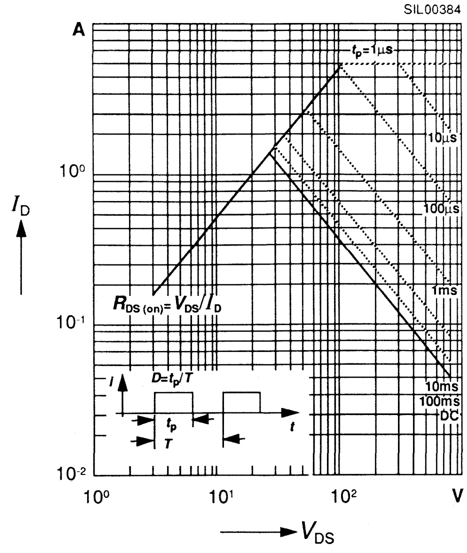
Total power dissipation $P_{tot} = f(T_C)$



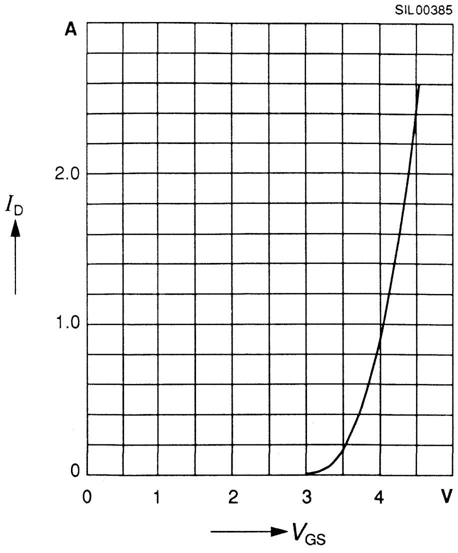
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



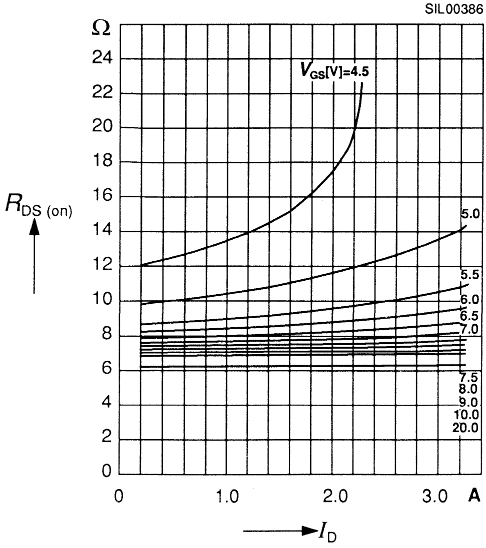
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



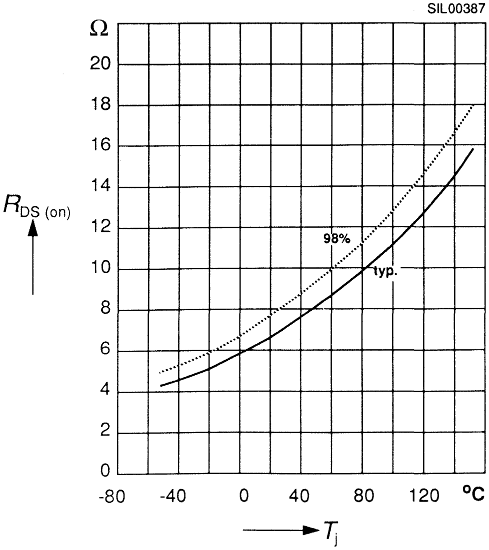
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



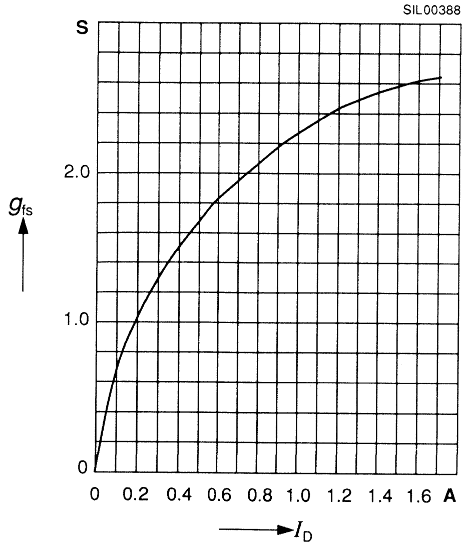
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



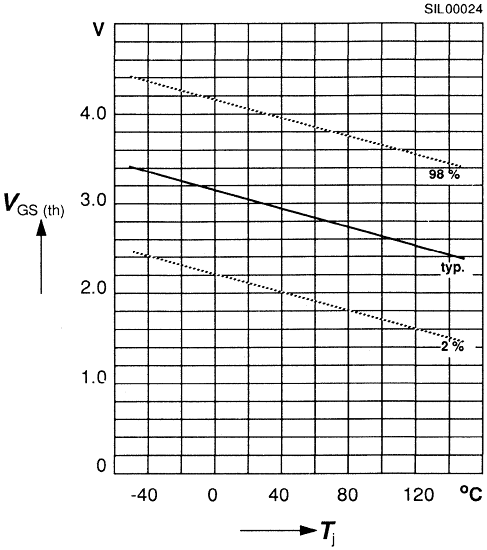
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 1.0 A, V_{GS} = 10 V, (spread)



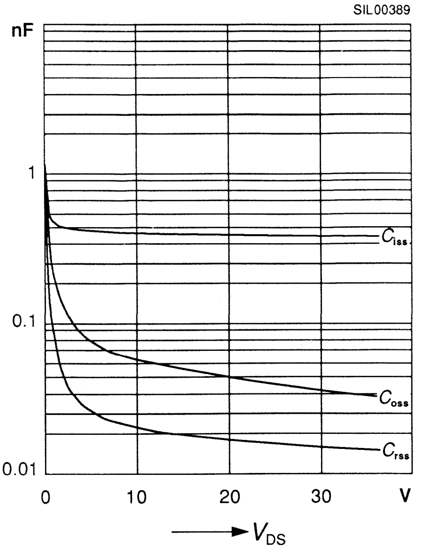
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



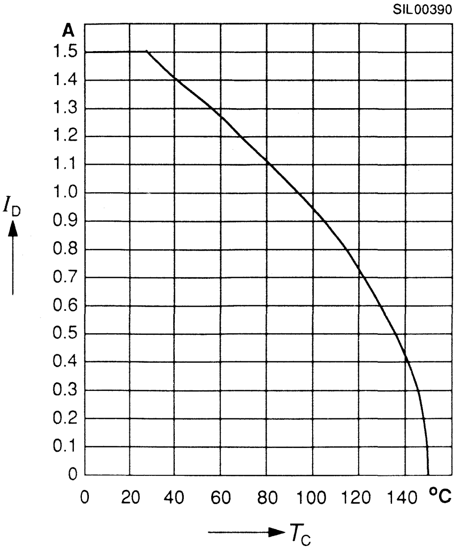
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



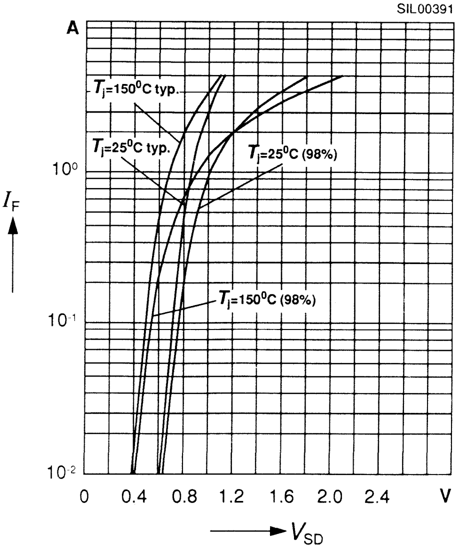
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



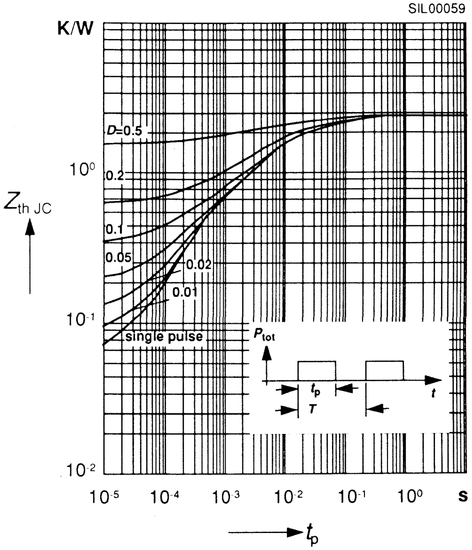
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



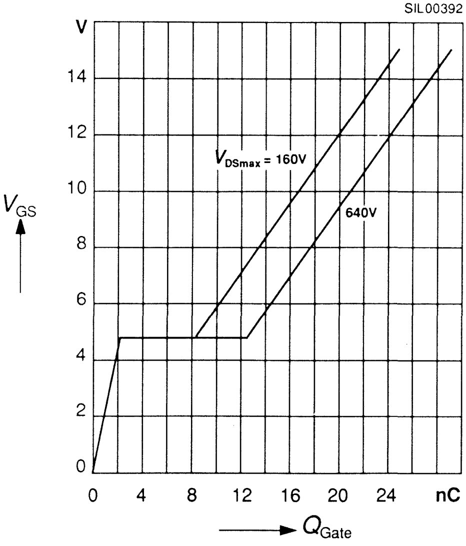
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 2.25$ A



SIEMENS

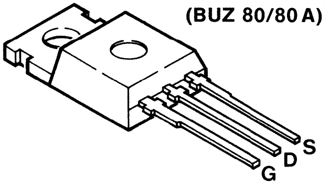
SIPMOS® Power MOS Transistors

BUZ 80
BUZ 80 A
BUZ 307
BUZ 308

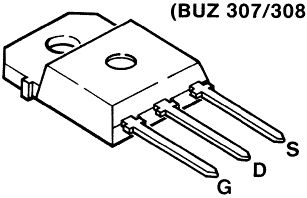
V_{DS} = **800 V**
I_D = **2.6 ... 3.0 A**
$R_{DS(on)}$ = **3.0 ... 4.0 Ω**

- N channel
- Enhancement mode
- Packages: TO-220 AB
  TO-218 AA (TOP-3) [1]

TO-220 AB
(BUZ 80/80 A)



TO-218 AA
(BUZ 307/308)



Type	Ordering code
BUZ 80	C67078-A1309-A2
BUZ 80 A	C67078-A1309-A3
BUZ 307	C67078-A3100-A2
BUZ 308	C67078-A3109-A2

Maximum Ratings

Parameter	Symbol	BUZ				Unit
		80	80 A	307	308	
Drain-source voltage	V_{DS}	800				V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800				
Gate-source voltage	V_{GS}	± 20				
Continuous drain current, T_C = 50 °C	I_D	2.6	3.0	3.0	2.6	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	10	12	12	10	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150				°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75				W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.67 ≤ 75				K/W
DIN humidity category, DIN 40 040		E				–
IEC climatic category, DIN IEC 68-1		55/150/56				

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[1] See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values		Unit
			min.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA		$V_{(BR)DSS}$	800	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA		$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$		I_{DSS}			µA
$T_j = 25$ °C			–	250	
$T_j = 125$ °C			–	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$		I_{GSS}	–	100	nA
Drain-source on-resistance		$R_{DS(on)}$			Ω
$V_{GS} = 10$ V, $I_D = 1.7$ A	BUZ 80		–	4.0	
	BUZ 80 A		–	3.0	
$V_{GS} = 10$ V, $I_D = 2.0$ A	BUZ 307		–	3.0	
	BUZ 308		–	4.0	

Dynamic characteristics

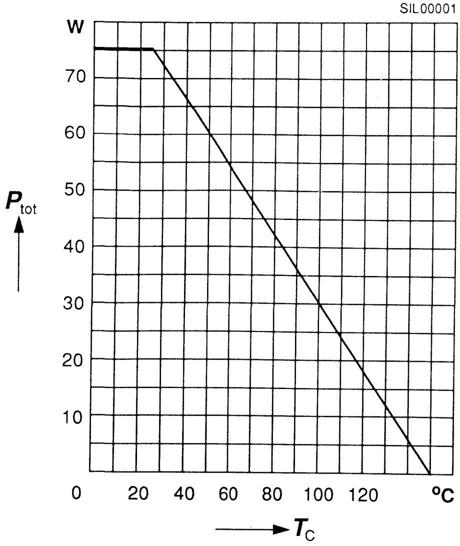
Parameter		Symbol	min.	max.	Unit
Forward transconductance		g_{fs}			S
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 1.7$ A	BUZ 80/80 A		1.0	–	
$I_D = 2.0$ A	BUZ 307/308		1.0	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	2100	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	150	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	55	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$)		$t_{d(on)}$	–	45	ns
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω		t_r	–	60	
$I_D = 2.1$ A	BUZ 80/308				
$I_D = 2.3$ A	BUZ 80 A/307				
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$)		$t_{d(off)}$	–	140	
$V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω		t_f	–	80	
$I_D = 2.1$ A	BUZ 80/308				
$I_D = 2.3$ A	BUZ 80 A/307				

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

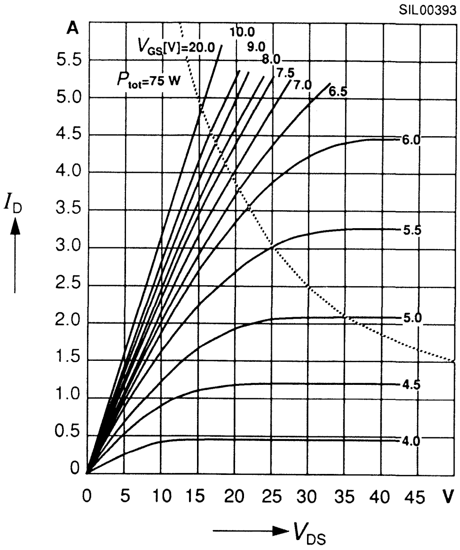
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 80		–	2.6	
	BUZ 80 A		–	3.0	
	BUZ 307		–	3.0	
	BUZ 308		–	2.6	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 80		–	10	
	BUZ 80 A		–	12	
	BUZ 307		–	12	
	BUZ 308		–	10	
Diode forward on-voltage		V_{SD}			V
$I_F = 6.8$ A, $V_{GS} = 0$	BUZ 80/80 A		–	1.3	
$I_F = 6.0$ A, $V_{GS} = 0$	BUZ 307/308		–	1.3	
Reverse recovery time		t_{rr}			µs
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			1.8	–	
			typ.	–	
Reverse recovery charge		Q_{rr}			µC
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			12	–	
			typ.	–	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

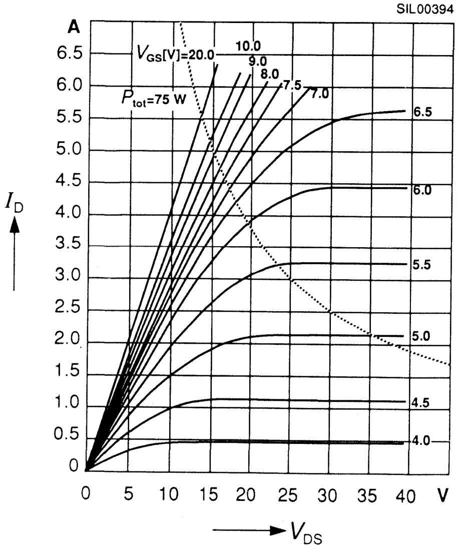
Total power dissipation $P_{tot} = f(T_C)$



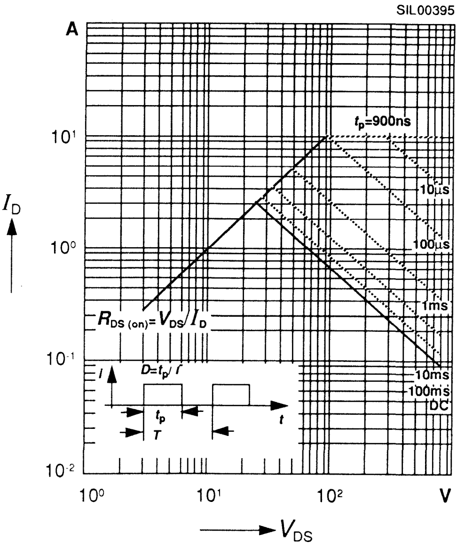
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 80/308



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 80 A/307

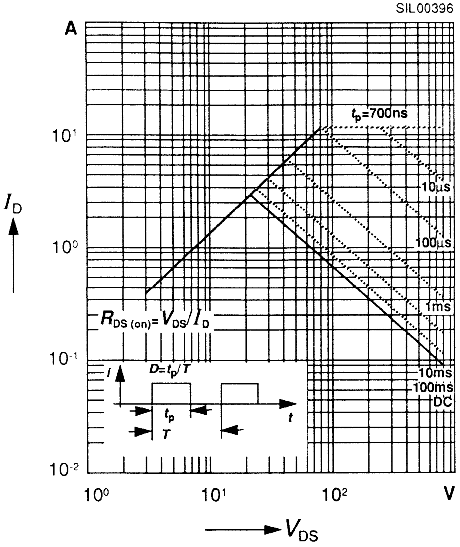


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 80/308

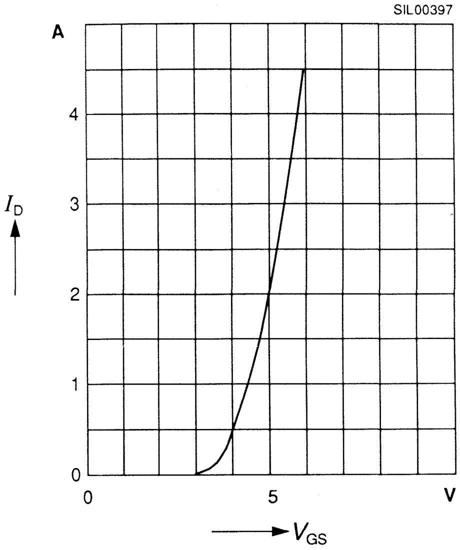


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

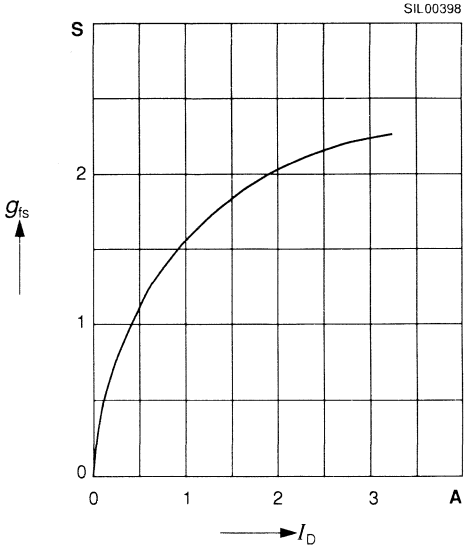
BUZ 80 A/307



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

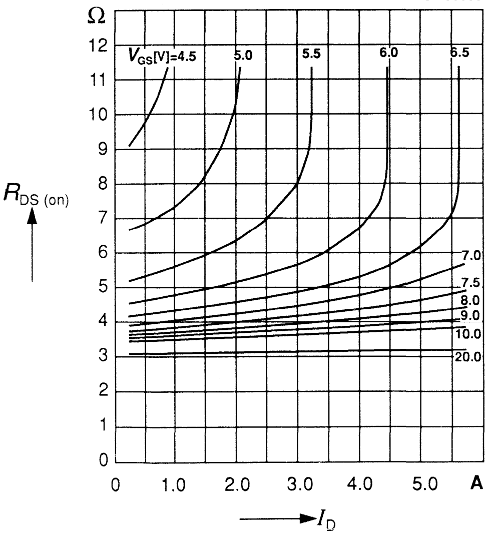


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

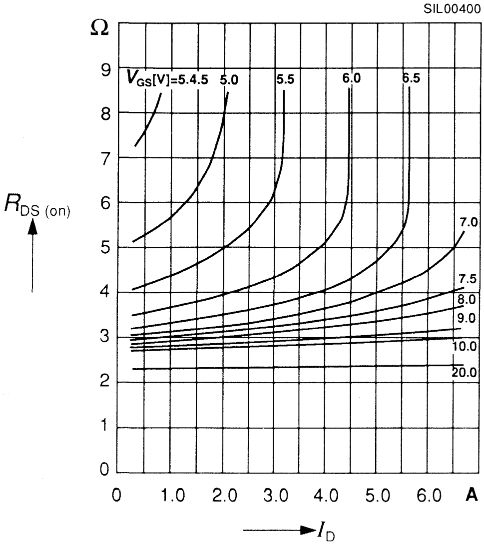


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

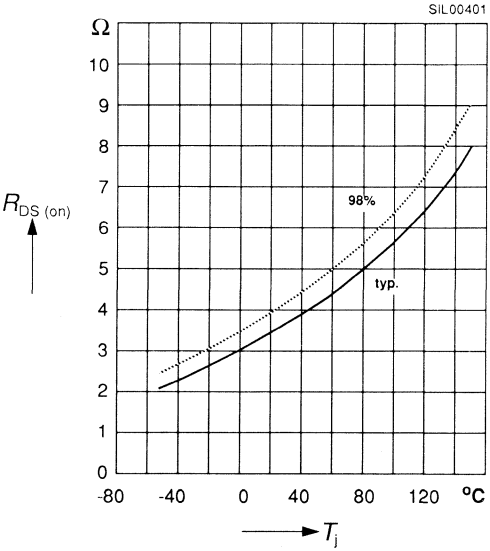
BUZ 80/308



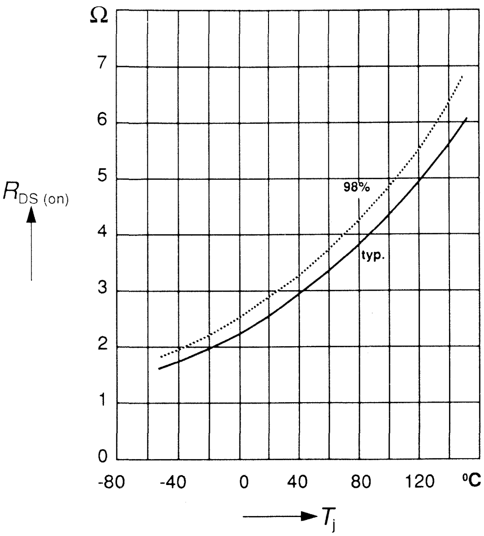
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 80 A/307



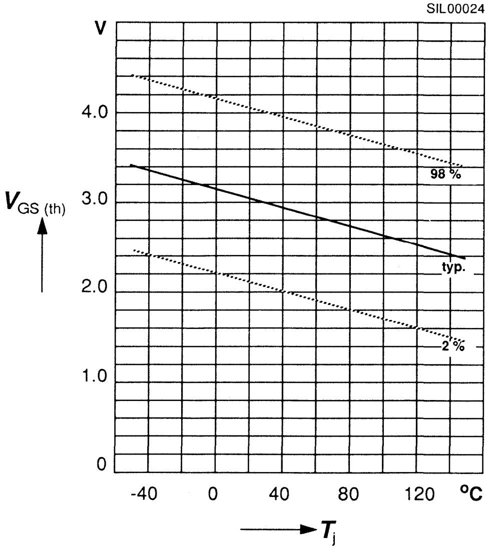
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.7/2.0$ A, $V_{GS} = 10$ V, (spread)
BUZ 80/308



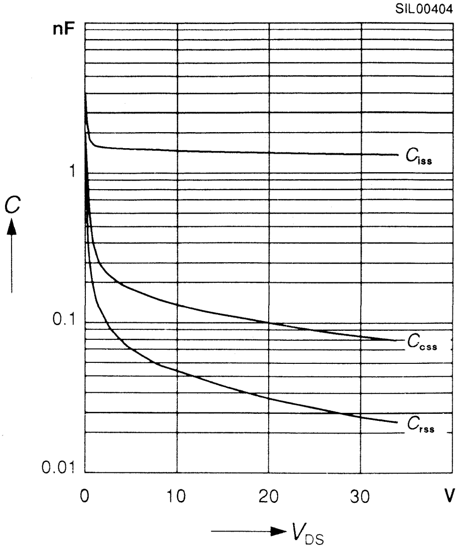
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 1.7$ A/2.0 A, $V_{GS} = 10$ V, (spread)
BUZ 80 A/307



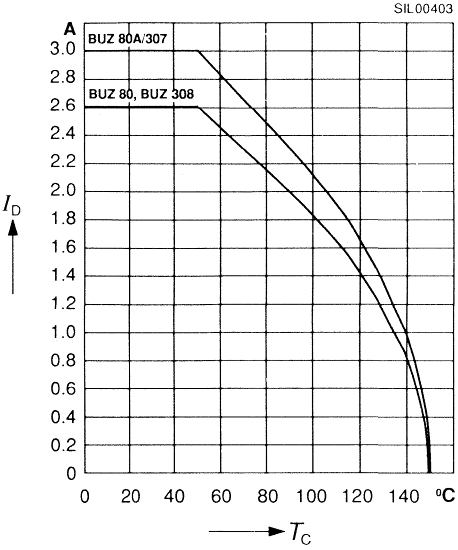
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

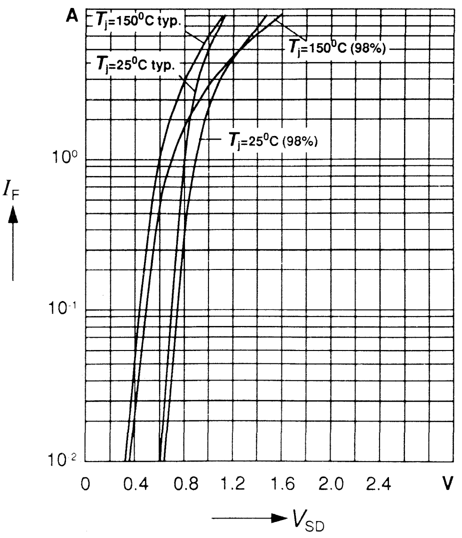


Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



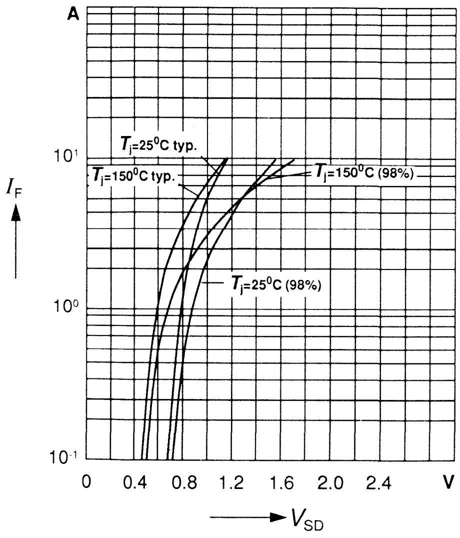
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 80

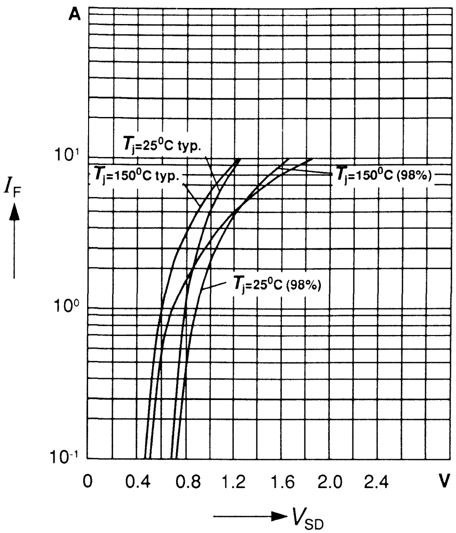


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

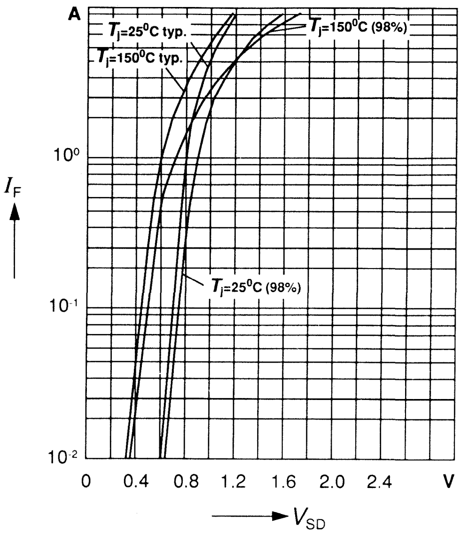
BUZ 80 A



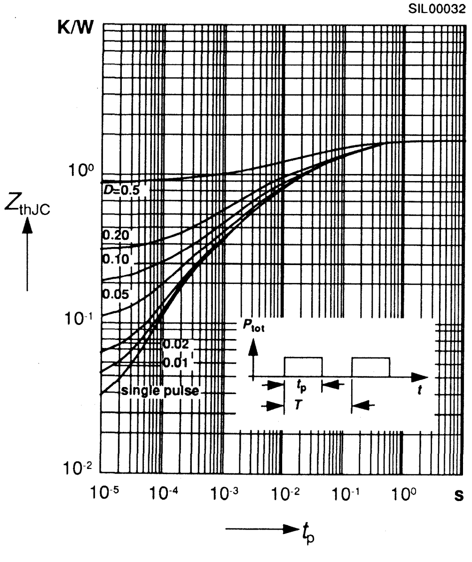
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 307



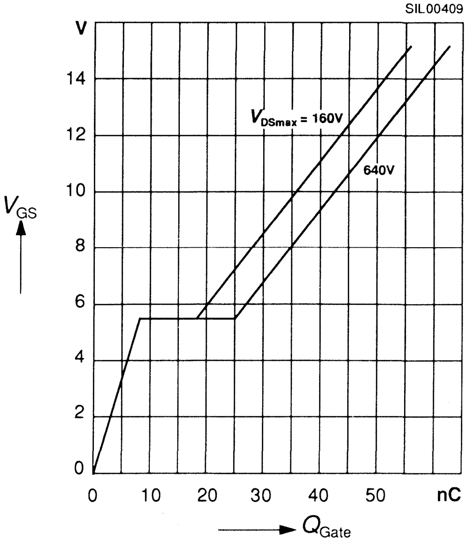
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 308



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 5.0$ A



SIEMENS

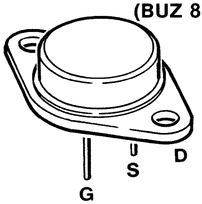
SIPMOS® Power MOS Transistors

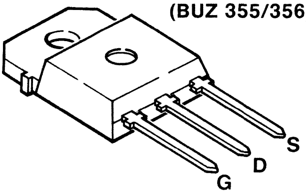
BUZ 84 BUZ 84 A BUZ 355 BUZ 356

V_{DS} = 800 V
I_D = 5.0 ... 6.0 A
$R_{DS(on)}$ = 1.5 ... 2.0 Ω

- N channel
- Enhancement mode
- Packages: TO-204 AA, (TO-3), TO-218 AA (TOP-3) ¹)

Type	Ordering code
BUZ 84	C67078-A1013-A2
BUZ 84 A	C67078-A1013-A3
BUZ 355	C67078-A3107-A2
BUZ 356	C67078-A3108-A2


TO-204 AA (BUZ 84/84 A)


TO-218 AA (BUZ 355/356)

Maximum Ratings

Parameter	Symbol	BUZ 84	84 A	355	356	Unit
Drain-source voltage	V_{DS}	800				V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	800				
Gate-source voltage	V_{GS}	± 20				
Continuous drain current T_C = 25/29/30/38 °C	I_D	5.3	6.0	6.0	5.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	21	24	24	20	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150				°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125				W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 1.0 35		 45		K/W
DIN humidity category, DIN 40 040	–	C		E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56				

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¹) See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	800	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 800$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.0$ A BUZ 84 $I_D = 3.0$ A BUZ 84 A $I_D = 3.8$ A BUZ 355 $I_D = 3.8$ A BUZ 356	$R_{DS(on)}$	 – – – –	 2.0 1,5 1.5 2.0	Ω

Dynamic characteristics

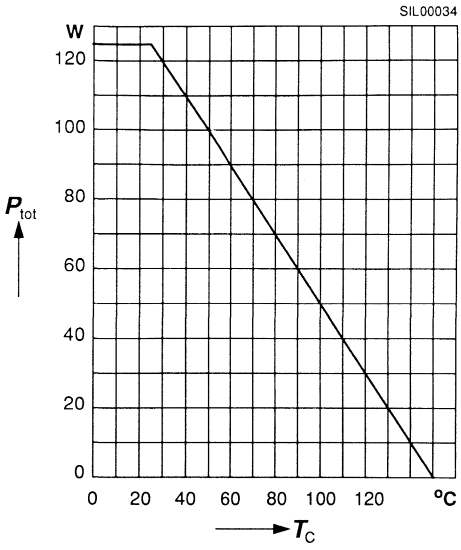
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.0$ A BUZ 84/84 A $I_D = 3.8$ A BUZ 355/356	g_{fs}	 1.8 2.5	 – –	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz BUZ 84/84 A BUZ 355/356	C_{iss}	 – –	 2500 2700	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	270	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.6$ A	$t_{d(on)}$	–	35	ns
	t_r	–	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.6$ A	$t_{d(off)}$	–	590	
	t_f	–	130	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

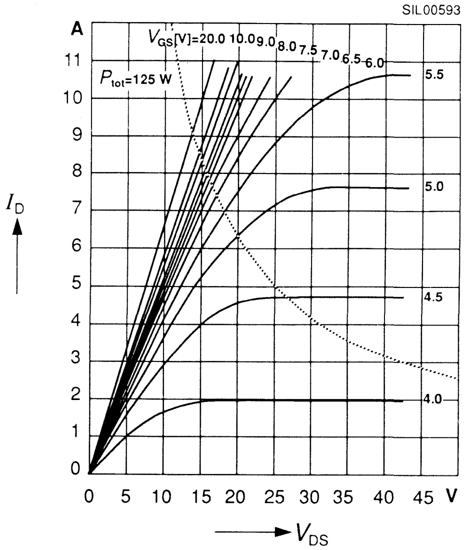
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 84		–	5.3	
	BUZ 84 A		–	6.0	
	BUZ 355		–	6.0	
	BUZ 356		–	5.0	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 84		–	21	
	BUZ 84 A		–	24	
	BUZ 355		–	24	
	BUZ 356		–	20	
Diode forward on-voltage		V_{SD}			V
$I_F = 12$ A, $V_{GS} = 0$			–	1.3	
Reverse recovery time		t_{rr}			µs
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			1.8 typ.	– –	
Reverse recovery charge		Q_{rr}			µC
$V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs			25 typ.	– –	

Characteristics at $T_j = 25$ °C, unless otherwise specified.

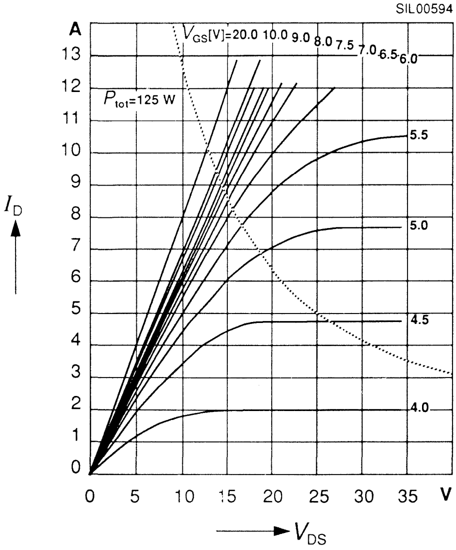
Total power dissipation $P_{tot} = f(T_C)$



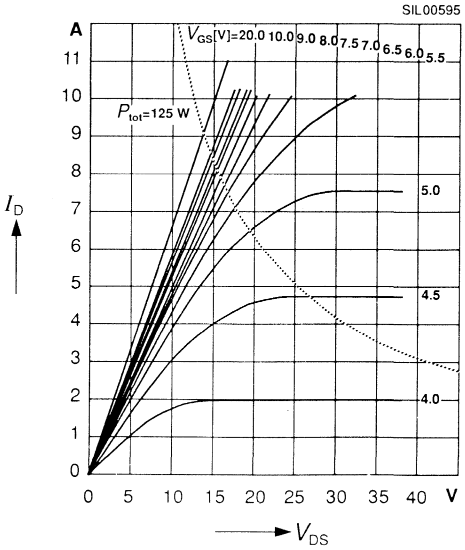
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 84



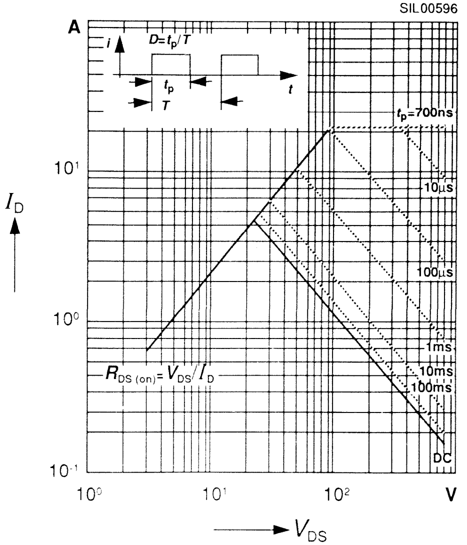
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 84 A/355



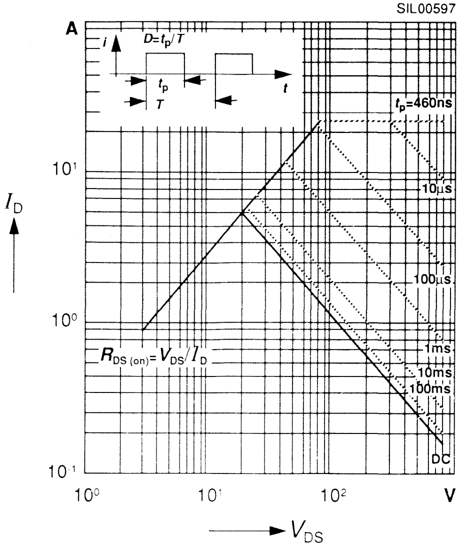
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 356



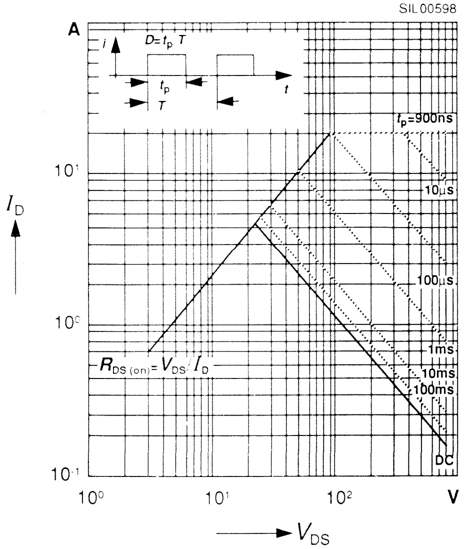
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 84



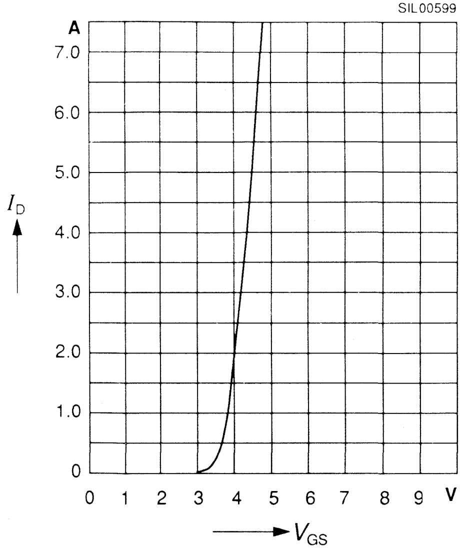
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 84 A/355



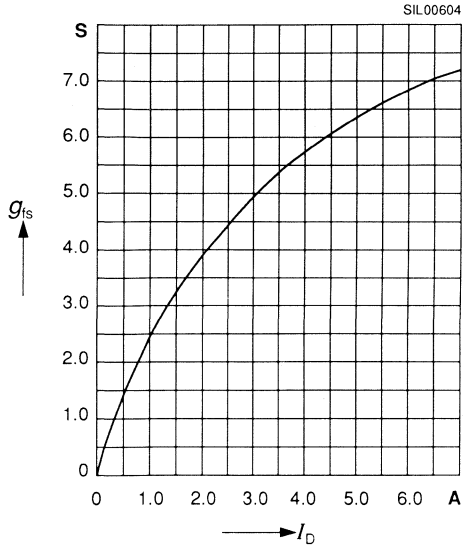
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 356



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

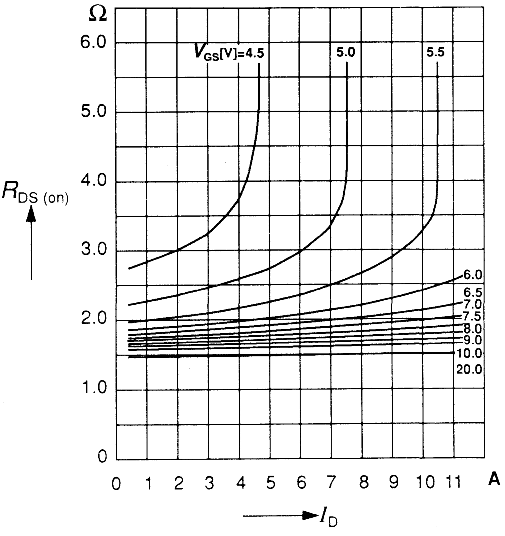


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



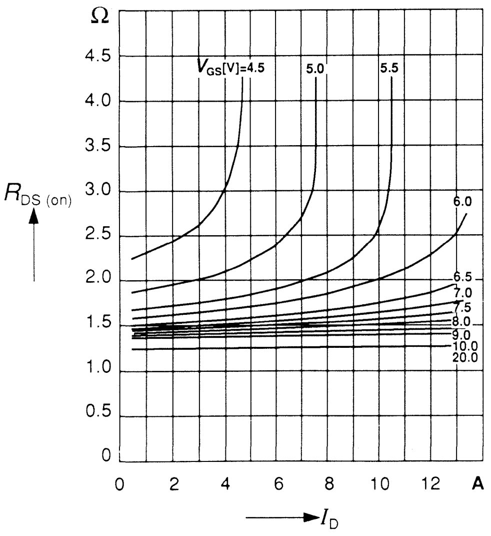
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 84/356



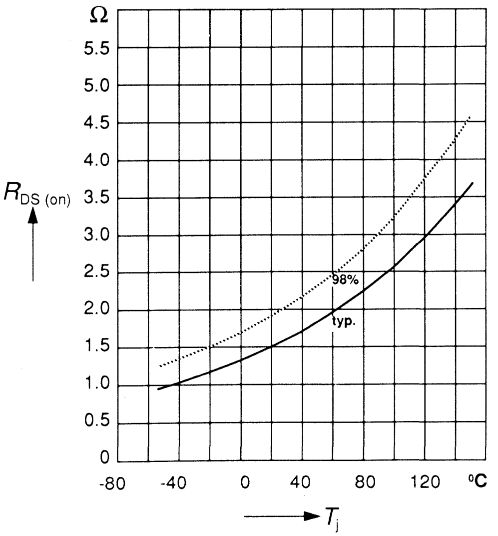
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 84 A/355



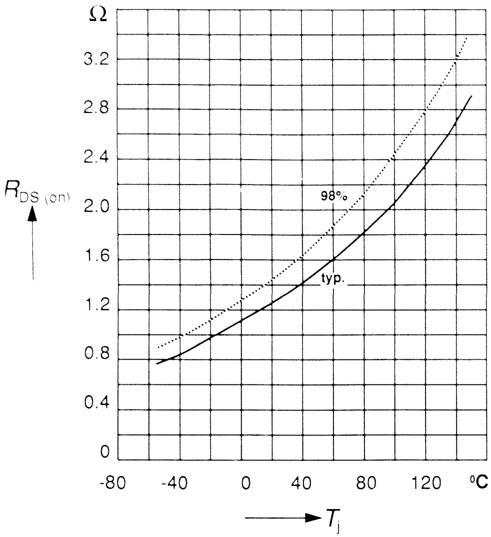
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 3.0/3.8 A, V_{GS} = 10 V, (spread)

BUZ 84/356

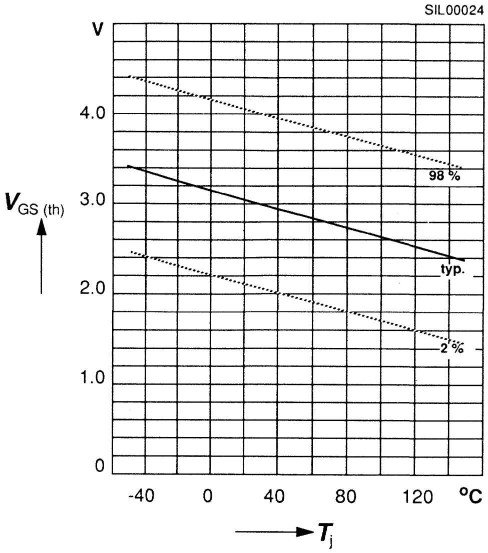


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.0$ A/3.8 A, $V_{GS} = 10$ V, (spread)

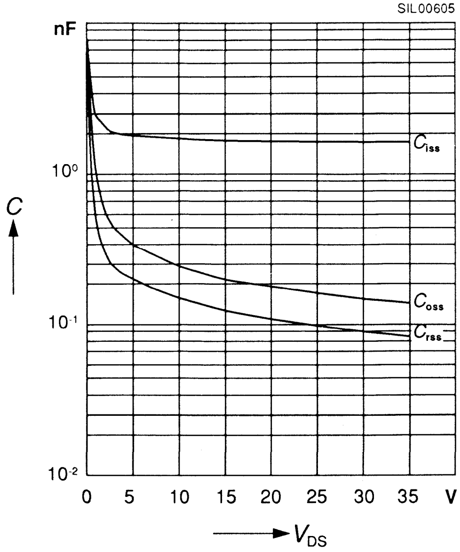
BUZ 84 A/355



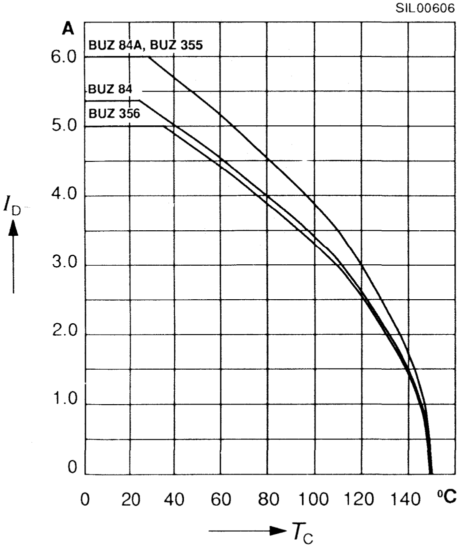
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



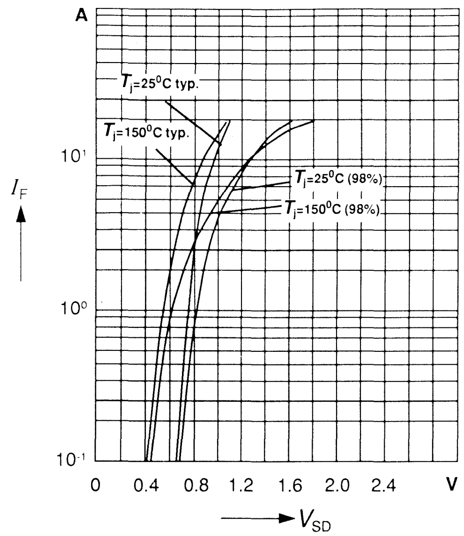
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



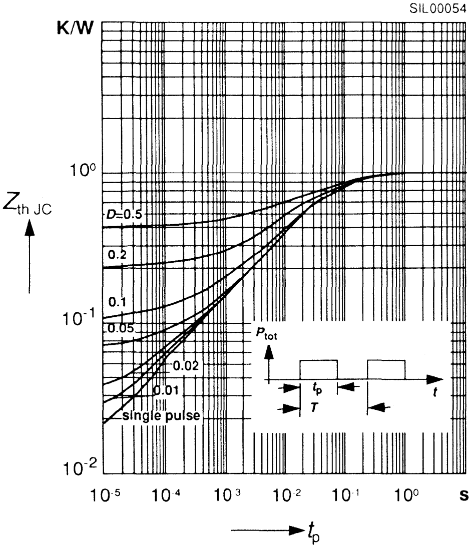
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



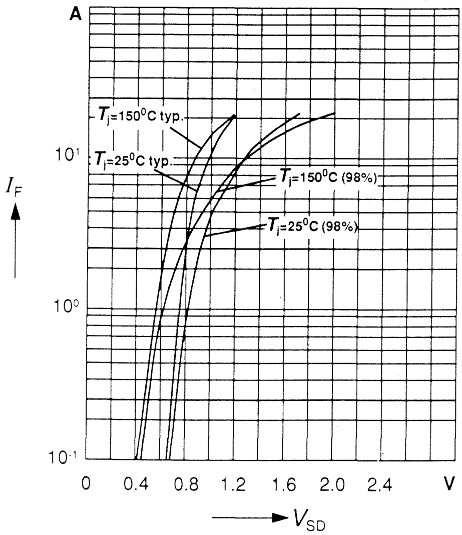
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)
BUZ 84/356



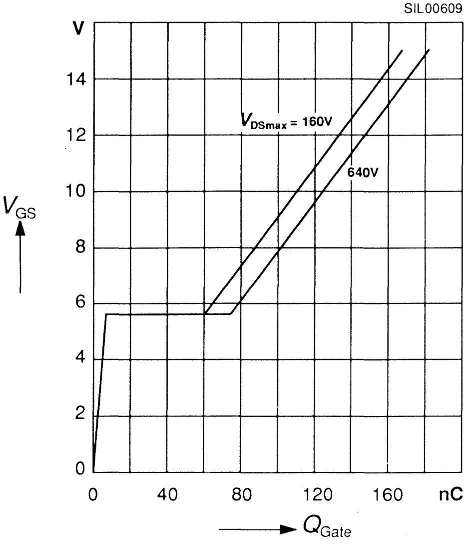
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs, (spread)
BUZ 84 A/355



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls}$ = 9.0 A



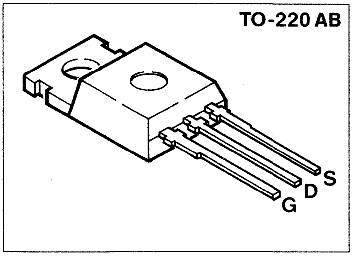
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 90
BUZ 90 A

V_{DS} = **600 V**
I_D = **4.5 / 4.0 A**
$R_{DS(on)}$ = **1.6 / 2.0 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])


TO-220 AB

Type	Ordering code
BUZ 90	C67078-S1321-A2
BUZ 90 A	C67078-S1321-A3

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		90	90 A	
Drain-source voltage	V_{DS}	600		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 28 °C / 30 °C	I_D	4.5	4.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	18	16	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	4.5		
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	8.0		mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 4.5 A, L = 29 mH	E_{AS}	320		
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	75		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75		K/W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1]) See chapter Package Outlines.

Electrical Characteristics
at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	600	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 600$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	1.0	
$T_j = 125$ °C		–	100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 2.8$ A BUZ 90	$R_{DS(on)}$	–	1.6	Ω
BUZ 90 A		–	2.0	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

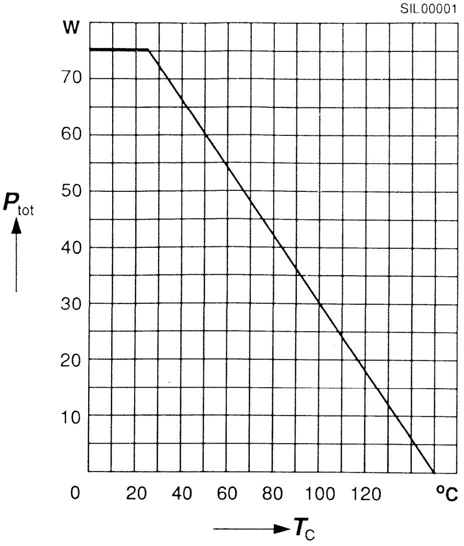
Parameter		**Symbol**	**Values**		**Unit**
			min.	max.	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 2.8$ A		g_{fs}	2.5	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{iss}	–	1050	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{oss}	–	170	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz		C_{rss}	–	70	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω		$t_{d(on)}$	–		ns
$I_D = 2.6$ A	BUZ 90			30	
$I_D = 2.5$ A	BUZ 90 A			30	
		t_r	–		
$I_D = 2.6$ A	BUZ 90			75	
$I_D = 2.5$ A	BUZ 90 A			75	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω		$t_{d(off)}$	–		
$I_D = 2.6$ A	BUZ 90			150	
$I_D = 2.5$ A	BUZ 90 A			150	
		t_f	–		
$I_D = 2.6$ A	BUZ 90			90	
$I_D = 2.5$ A	BUZ 90 A			90	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

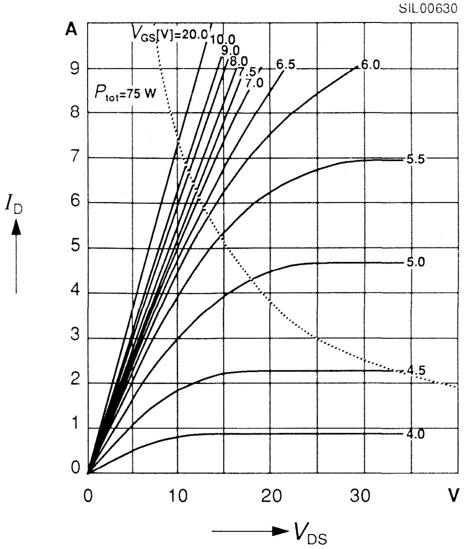
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	 BUZ 90 BUZ 90 A	I_S	 – –	 4.5 4.0	A
Pulsed reverse drain current $T_C = 25$ °C	 BUZ 90 BUZ 90 A	I_{SM}	 – –	 18 16	
Diode forward on-voltage $I_F = 8.0$ A, $V_{GS} = 0$		V_{SD}	 –	 1.2	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	350 typ.	 –	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	3.0 typ.	 –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

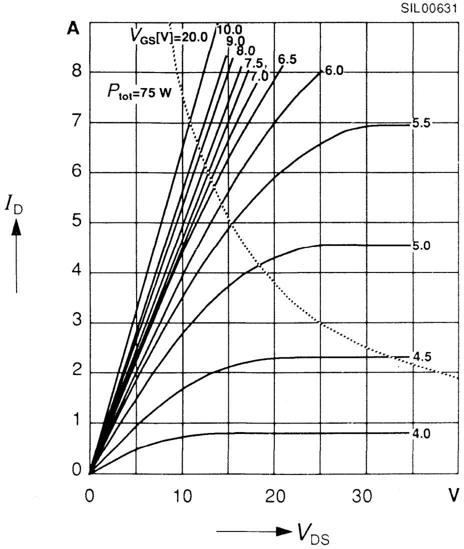
Total power dissipation $P_{tot} = f(T_C)$



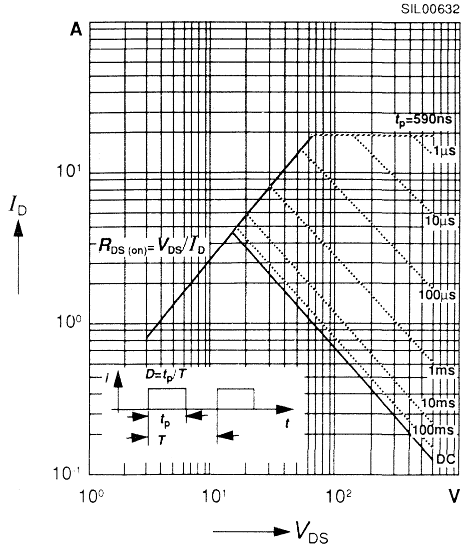
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 90



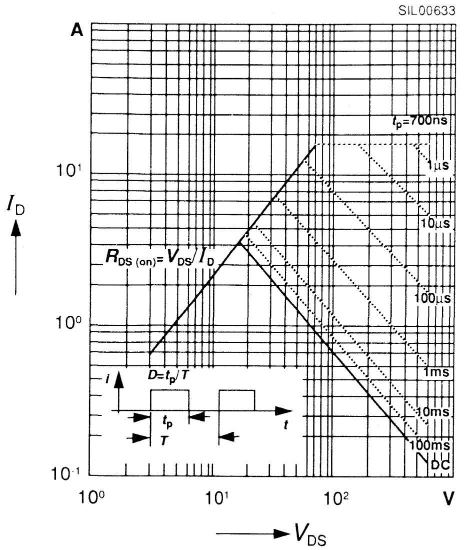
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 90 A



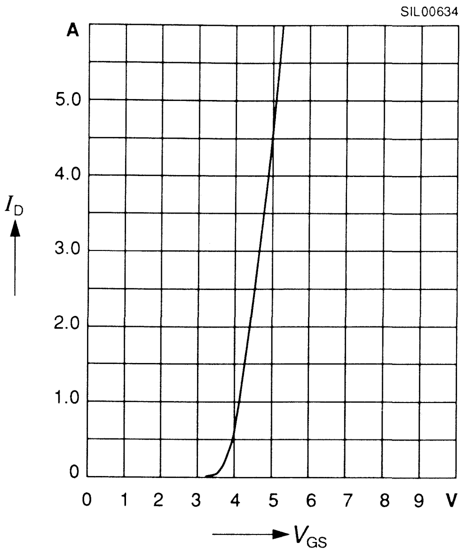
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 90



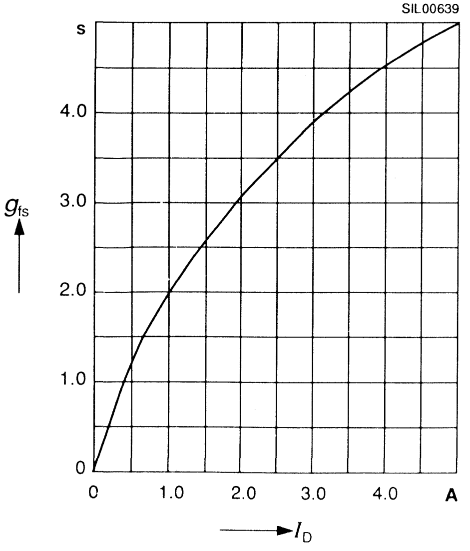
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 90 A



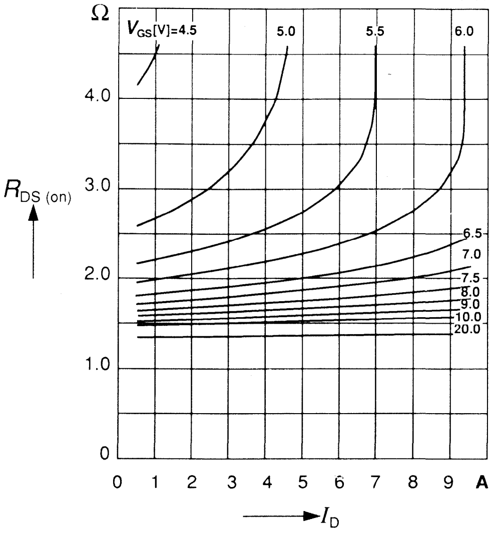
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

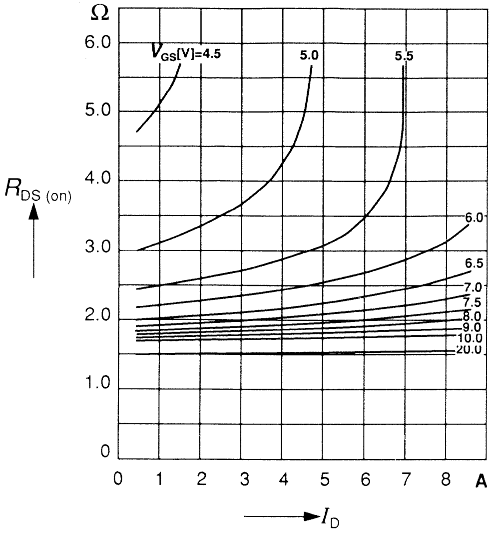


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 90

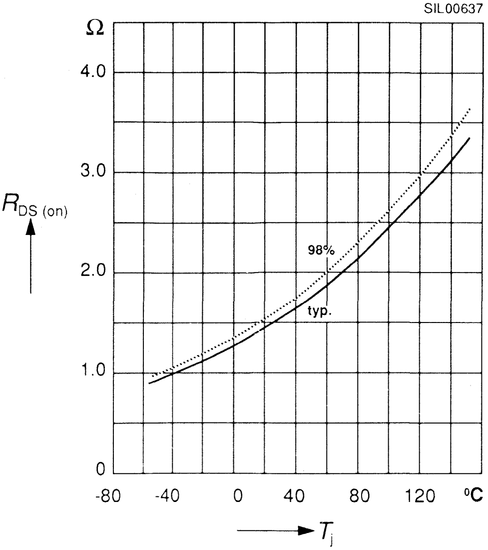


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

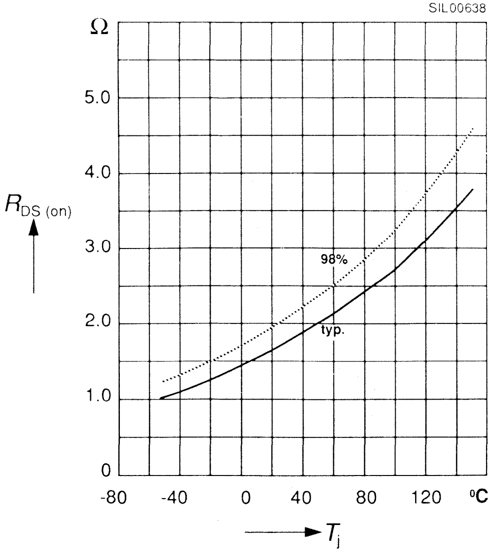
BUZ 90 A



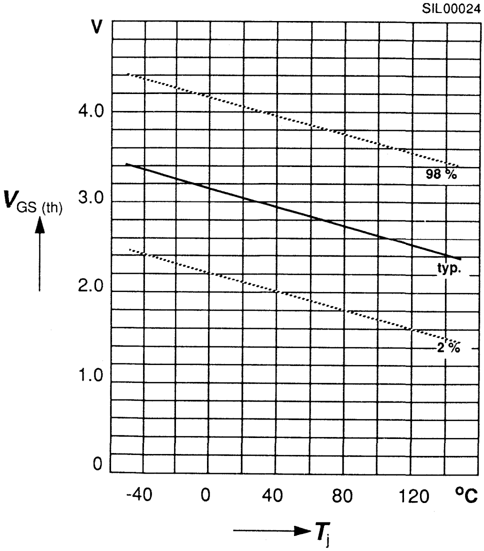
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 2.8$ A, $V_{GS} = 10$ V, (spread)



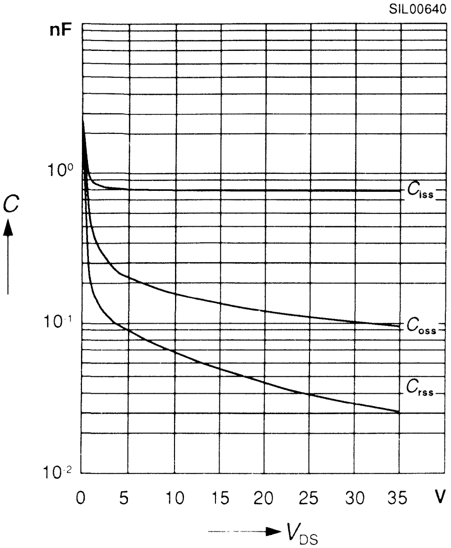
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 2.8$ A, $V_{GS} = 10$ V, (spread)



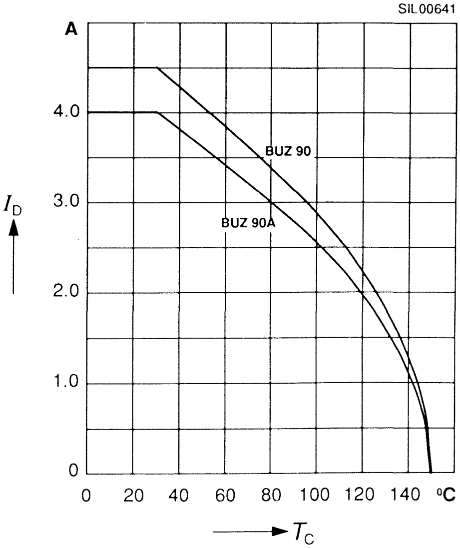
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



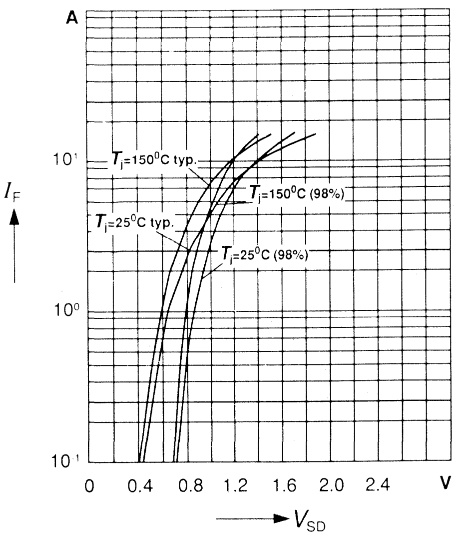
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



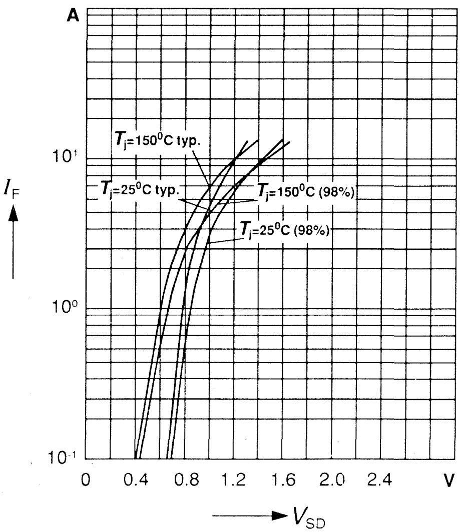
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



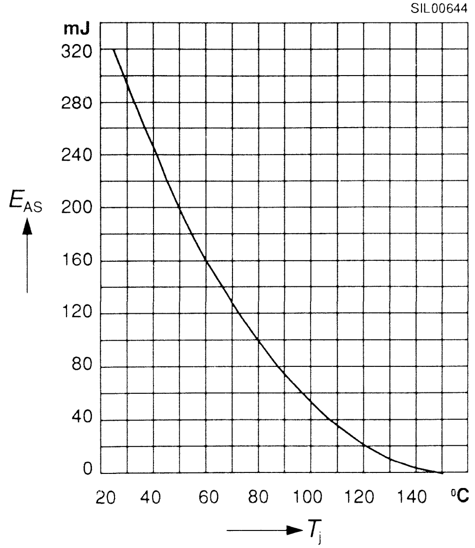
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 90



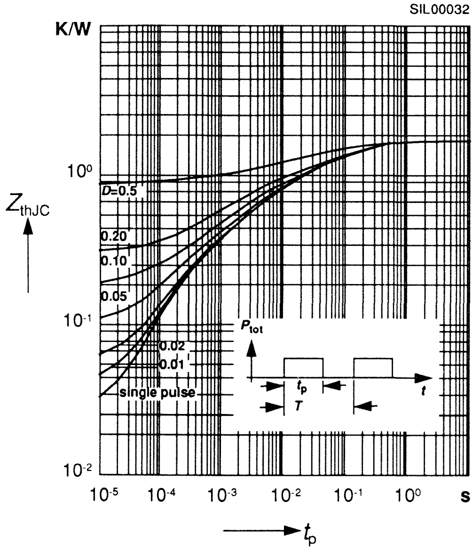
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 90 A



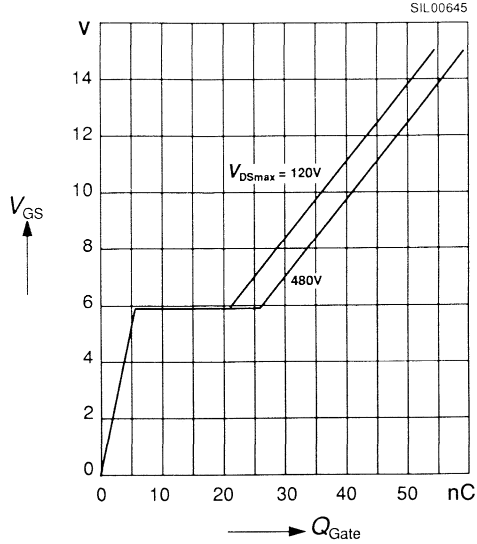
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 4.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 29$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 6.75$ A



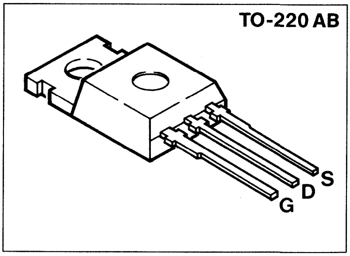
SIEMENS

SIPMOS® Power MOS Transistor

BUZ 92

V_{DS} = 600 V
I_D = 3.2 A
$R_{DS(on)}$ = 3.0 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 92	C67078-S1343-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	600	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 24$ °C	I_D	3.2	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	13	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	3.2	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	6	mJ
Avalanche energy, single pulse $I_D = 3.2$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 39.4$ mH, $T_j = 25$ °C	E_{AS}	220	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	80	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.56 ≤ 75	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

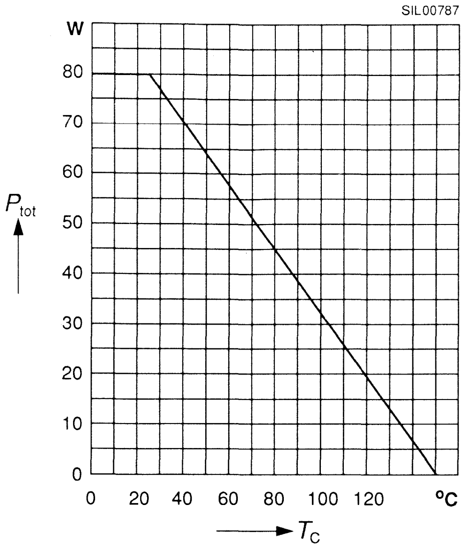
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	600	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 600$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 2.0$ A	$R_{DS(on)}$	–	3.0	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 2.0$ A	g_{fs}	2.1	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	100	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	40	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	15	ns
	t_r	–	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	95	
	t_f	–	55	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

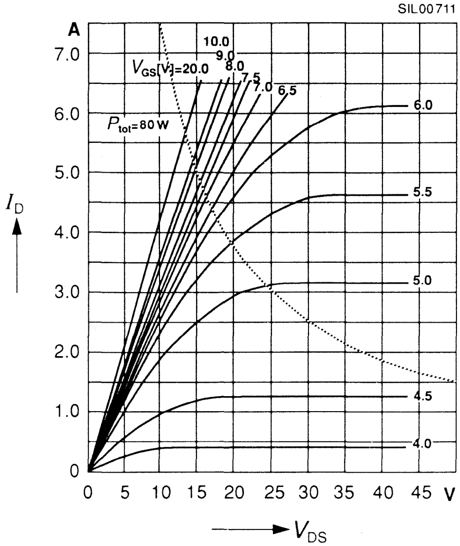
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	3.2	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	13	
Diode forward on-voltage $I_F = 6.4$ A, $V_{GS} = 0$	V_{SD}	–	1.4	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	300 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	2.5 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

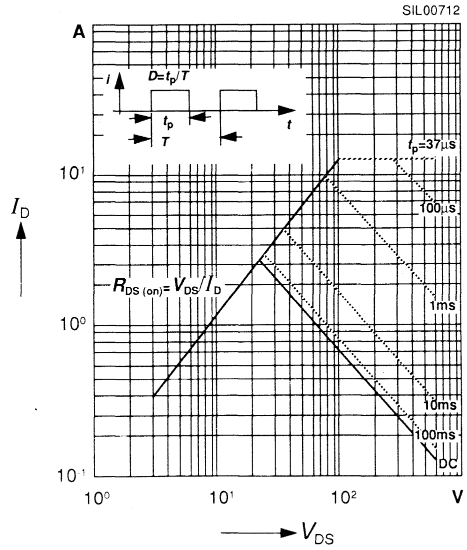
Total power dissipation $P_{tot} = f(T_C)$



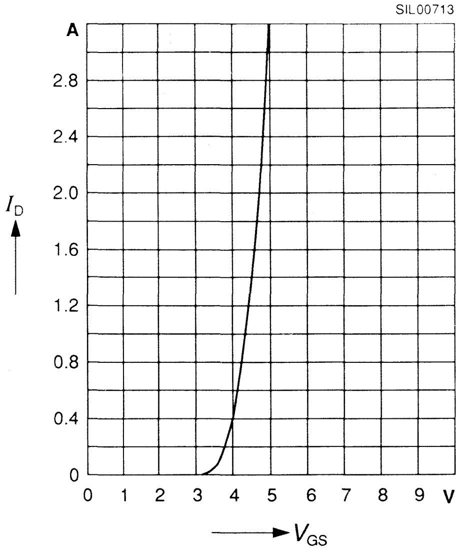
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



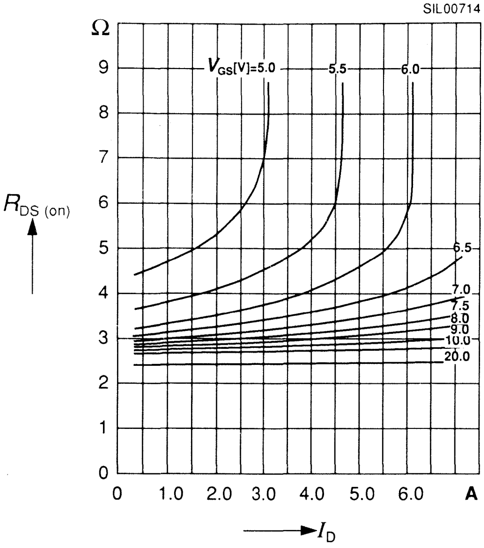
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



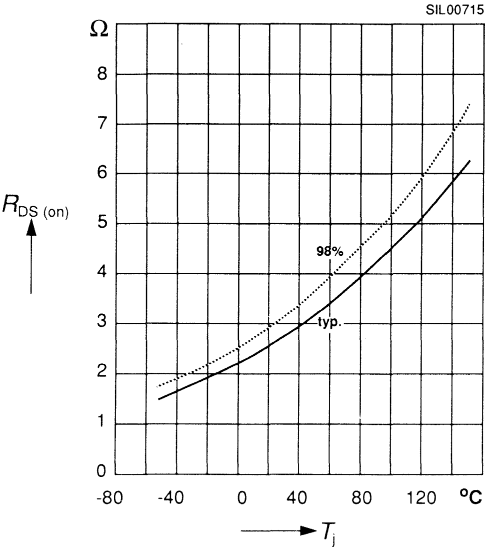
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



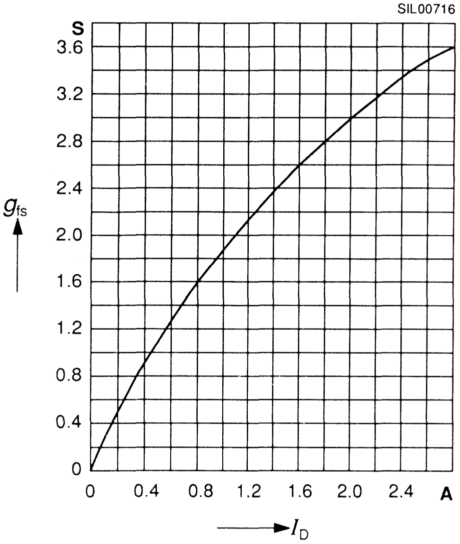
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



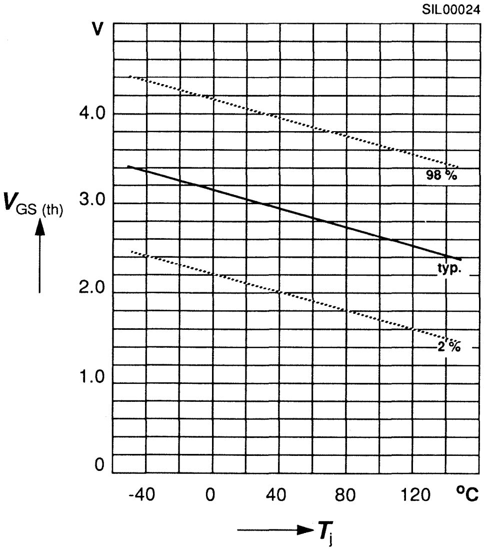
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 2.0$ A, $V_{GS} = 10$ V, (spread)



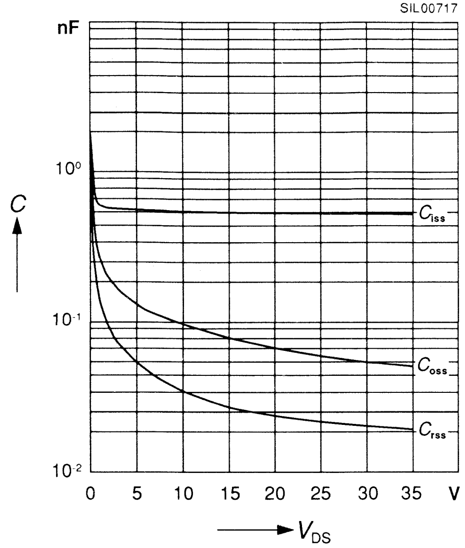
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



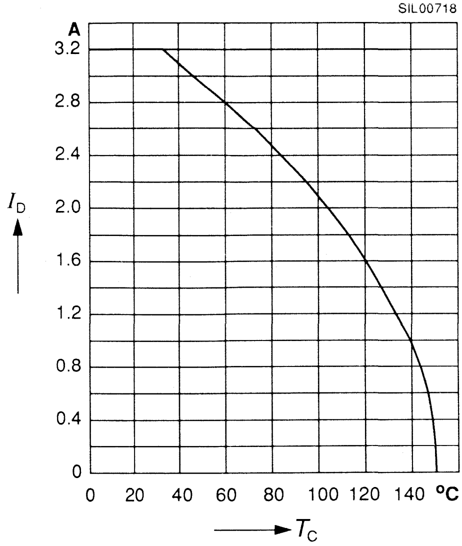
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



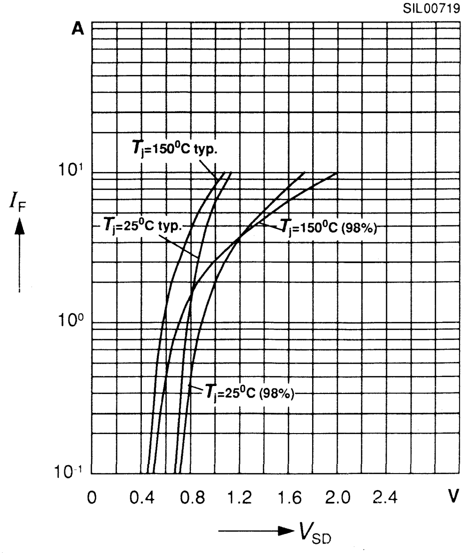
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



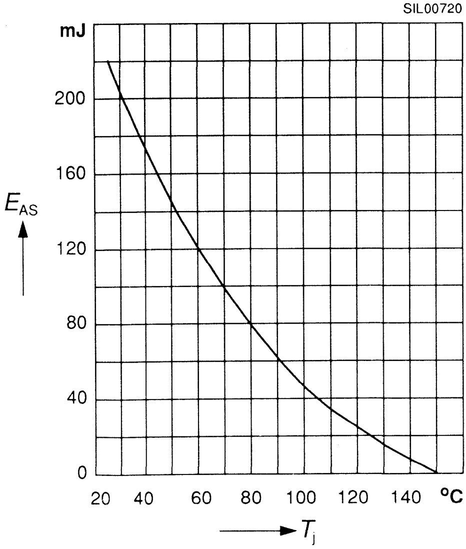
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



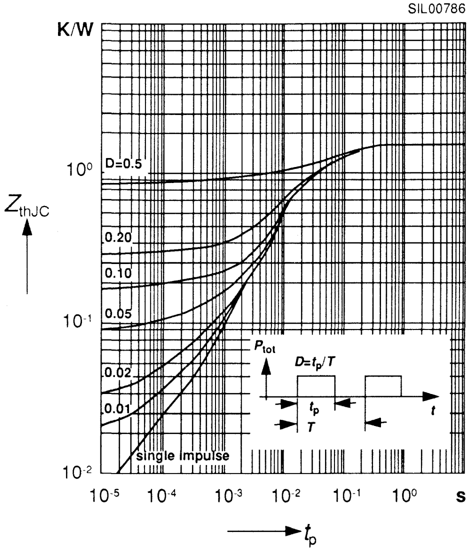
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



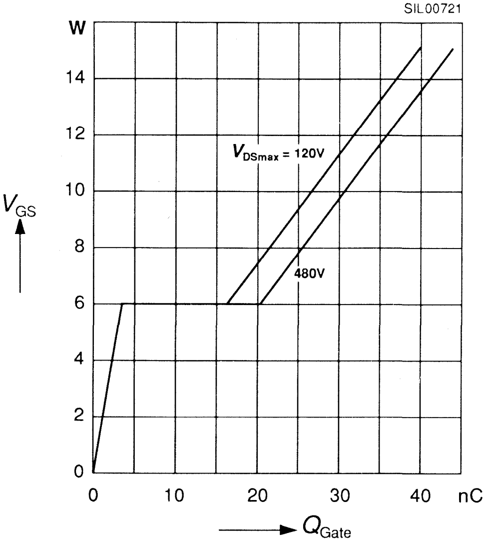
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 3.2$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 39.4$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 4.8$ A



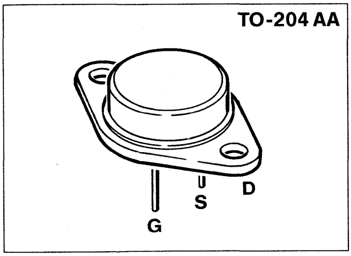
SIEMENS

SIPMOS® Power MOS Transistor

BUZ 94

V_{DS} = **600 V**
I_D = **7.8 A**
$R_{DS(on)}$ = **0.9 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-204 AA (TO-3) [1]



Type	Ordering code
BUZ 94	C67078-A1019-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	600	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 27$ °C	I_D	7.8	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	31	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	7.8	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	13	mJ
Avalanche energy, single pulse $I_D = 7.8$ A, $V_{DD} = 50$ V, $R_{GS} = 25\ \Omega$ $L = 17.2$ mH, $T_j = 25$ °C	E_{AS}	570	
Operating and storage temperature range	T_j T_{stg}	-55 ... +150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 35	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	600	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current V_{DS} = 600 V, V_{GS} = 0	I_{DSS}			µA
T_j = 25 °C		–	1.0	
T_j = 125 °C		–	100	
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	100	nA
Drain-source on-resistance V_{GS} = 10 V, I_D = 5.0 A	$R_{DS(on)}$	–	0.9	Ω

Dynamic characteristics

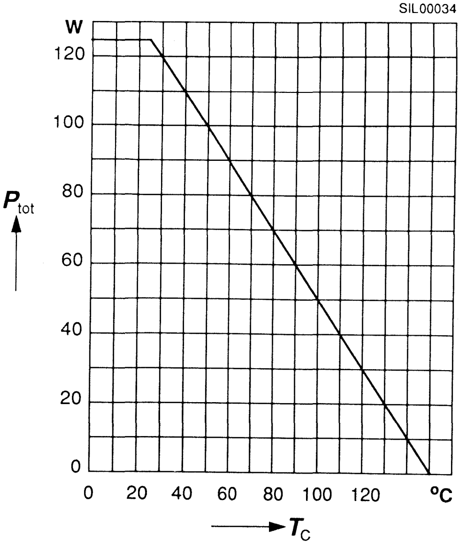
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 5.0 A	g_{fs}	2.7	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	2100	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	270	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	100	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3.0 A, R_{GS} = 50 Ω	$t_{d(on)}$	–	30	ns
	t_r	–	110	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 30 V, V_{GS} = 10 V, I_D = 3.0 A, R_{GS} = 50 Ω	$t_{d(off)}$	–	330	
	t_f	–	100	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

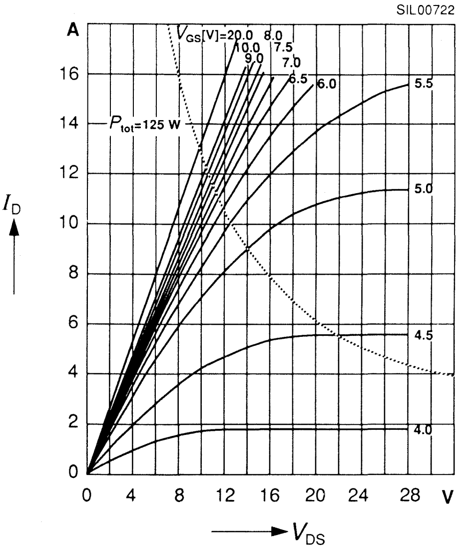
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	7.8	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	31	
Diode forward on-voltage $I_F = 15.5$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	1.2 typ.	–	µs
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	6 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

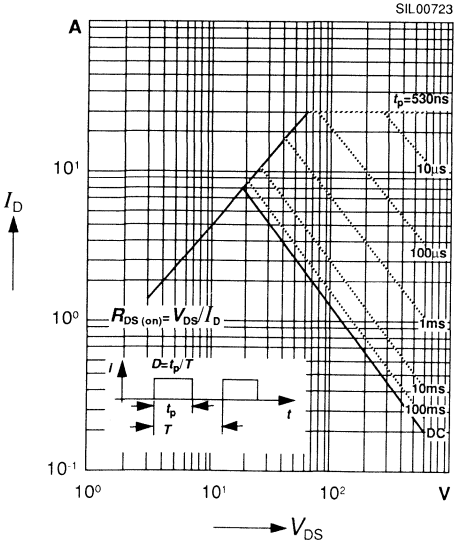
Total power dissipation $P_{tot} = f(T_C)$



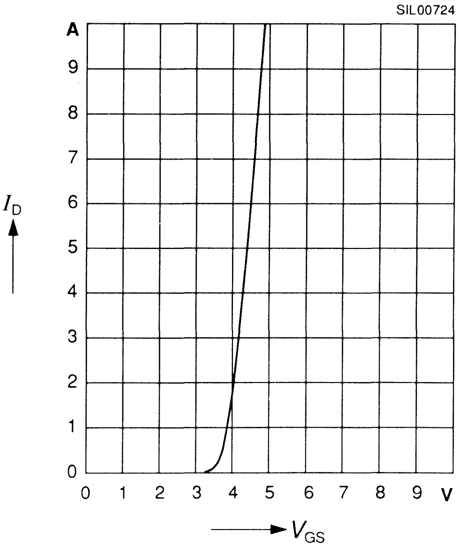
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



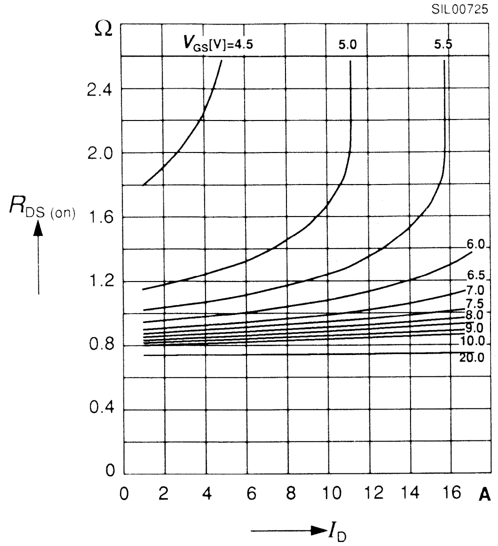
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



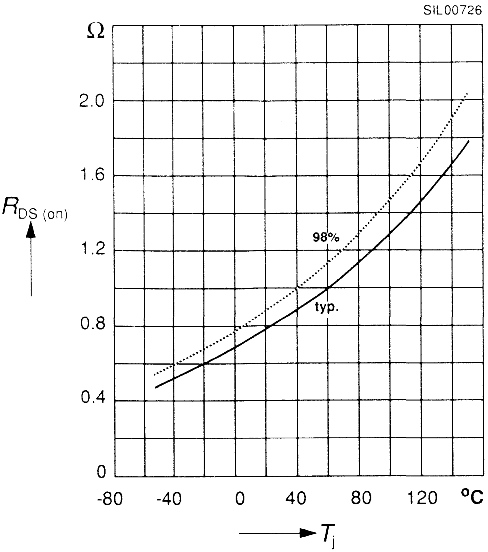
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



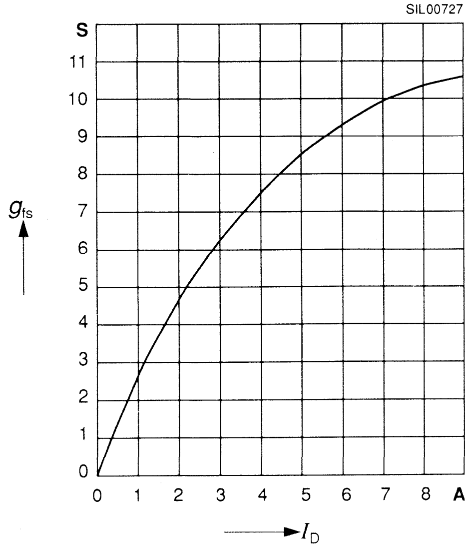
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



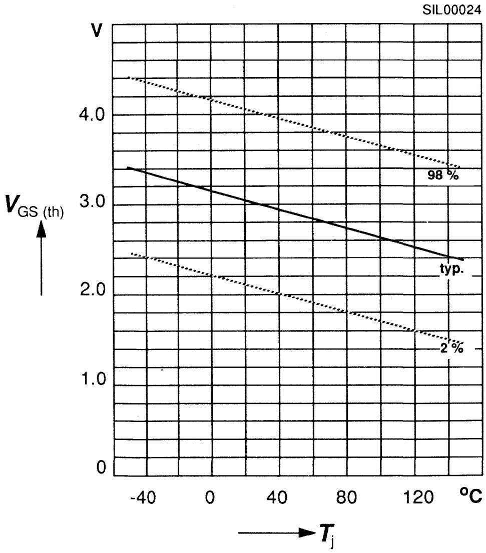
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5.0$ A, $V_{GS} = 10$ V, (spread)



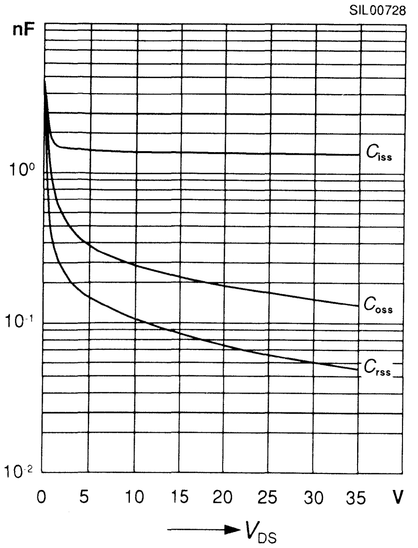
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



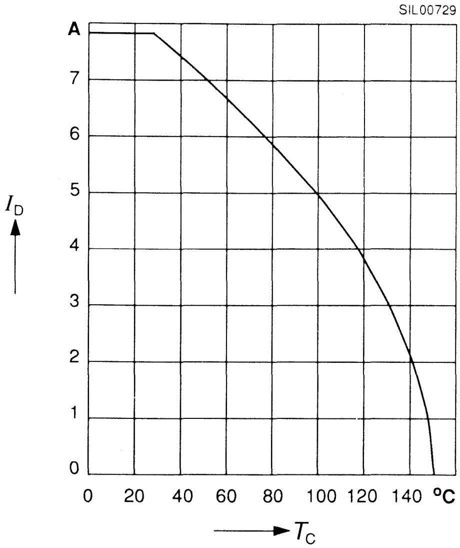
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



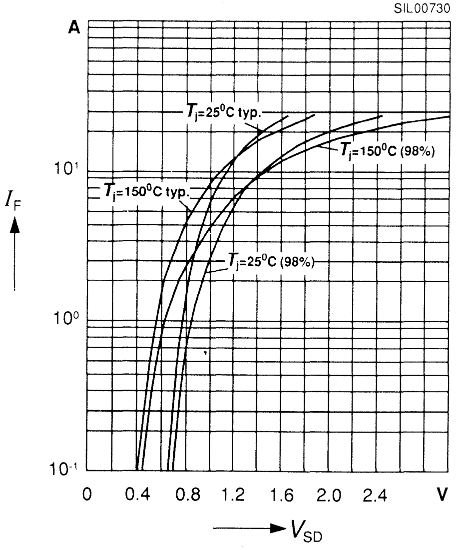
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



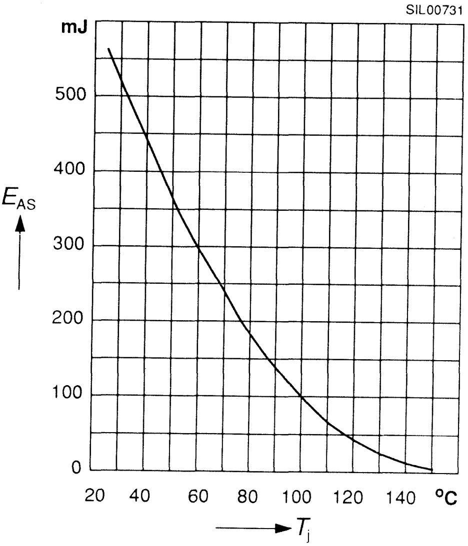
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



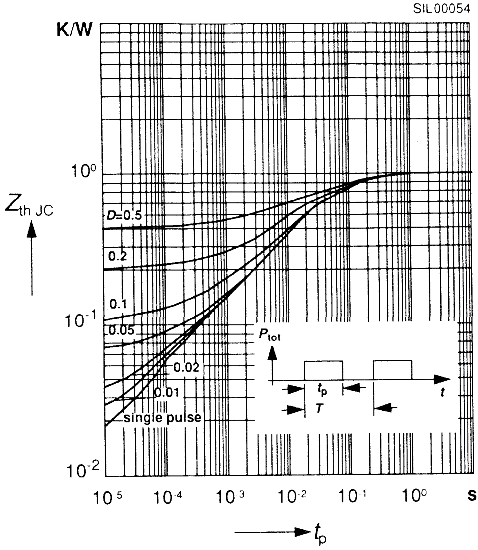
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



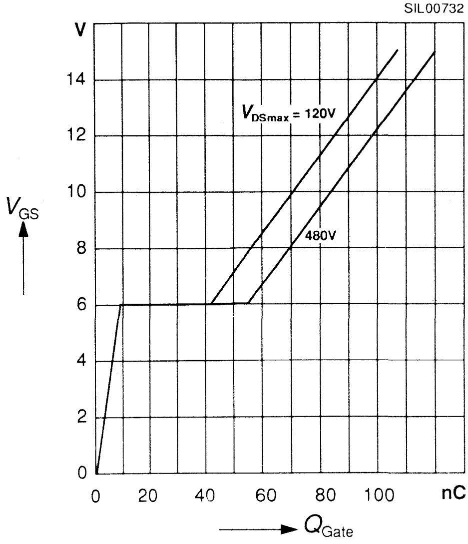
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 7.8$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 17.2$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 12.0$ A



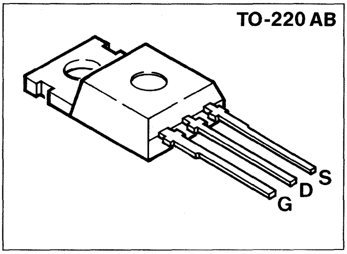
SIEMENS

SIPMOS® Power MOS Transistor

BUZ 171

V_{DS} = – 50 V
I_D = – 8.0 A
$R_{DS(on)}$ = 0.3 Ω

- P channel
- Enhancement mode
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 171	C67078-A1450-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 50	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 50	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	– 8.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	– 32	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

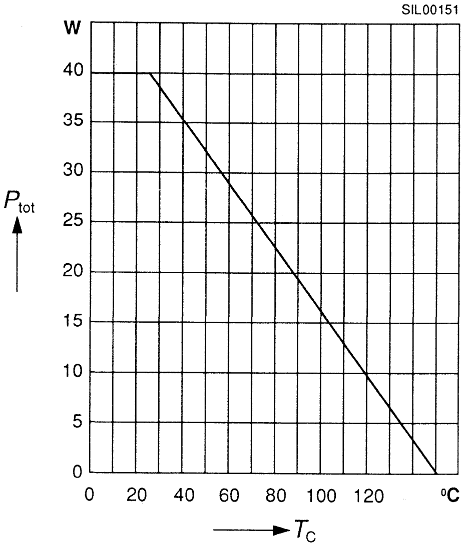
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-50	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-2.1	-4.0	
Zero gate voltage drain current $V_{DS} = -50$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	-250 -1000	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-100	nA
Drain-source on-resistance $V_{GS} = -10$ V, $I_D = -5.0$ A	$R_{DS(on)}$	-	0.3	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -5.0$ A	g_{fs}	1.5	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	1300	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	550	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	200	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.9$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.9$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	90	
	t_f	-	75	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

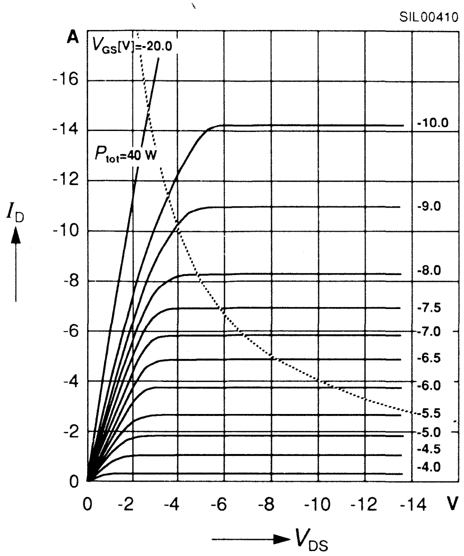
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	– 8.0	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	– 32	
Diode forward on-voltage I_F = – 16 A, V_{GS} = 0	V_{SD}	–	– 1.7	V
Reverse recovery time V_R = – 30 V, $I_F = I_S$, di_F/dt = – 100 A/µs	t_{rr}	90 typ.	–	ns
Reverse recovery charge V_R = – 30 V, $I_F = I_S$, di_F/dt = – 100 A/µs	Q_{rr}	0.23 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

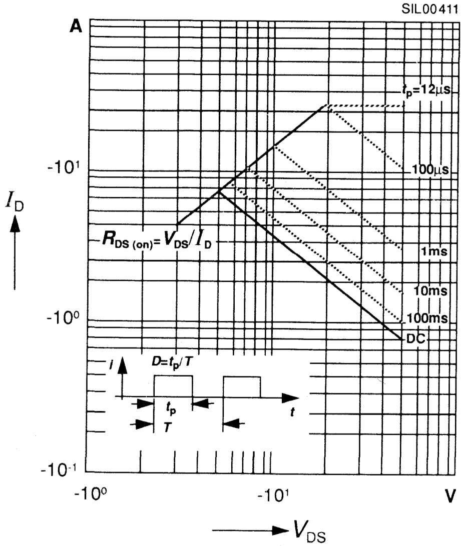
Total power dissipation $P_{tot} = f(T_C)$



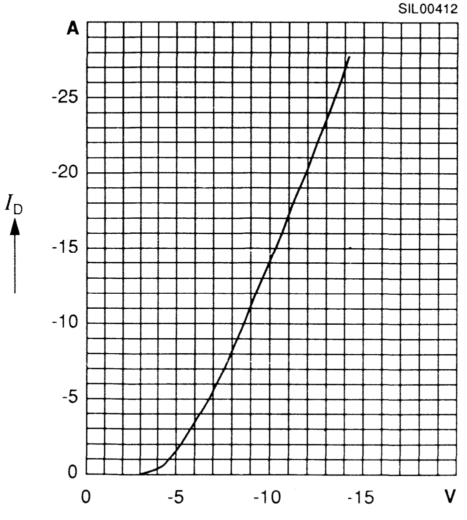
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



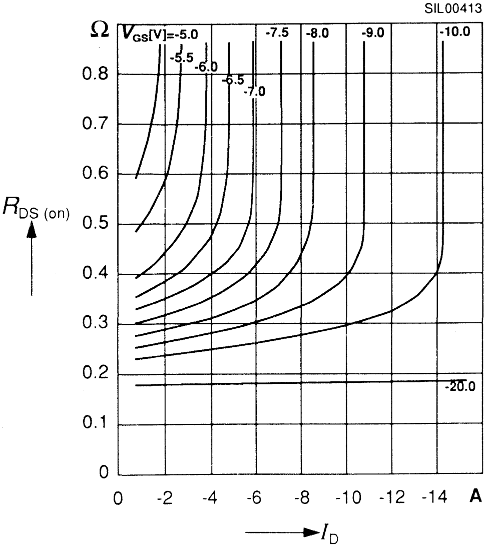
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



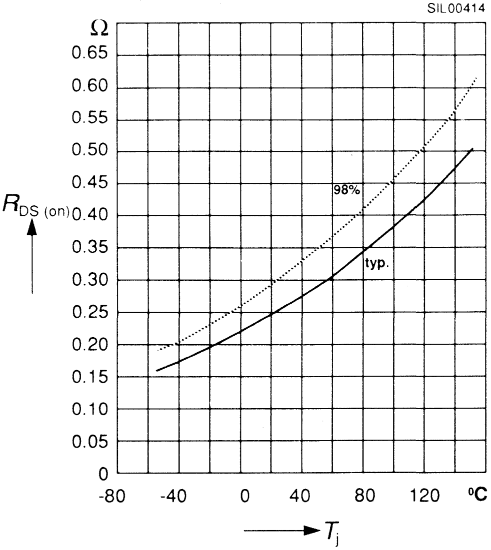
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



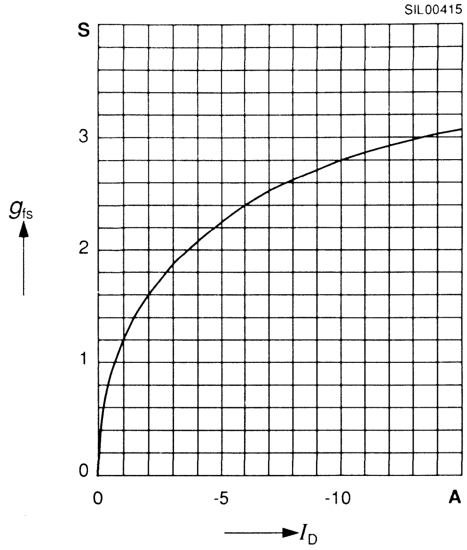
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



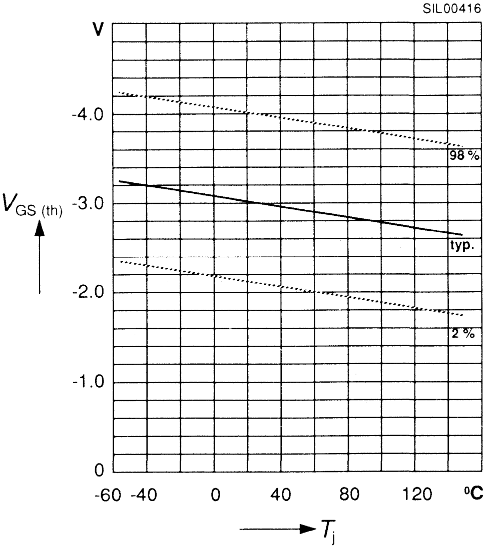
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -5.0$ A, $V_{GS} = -10$ V, (spread)



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

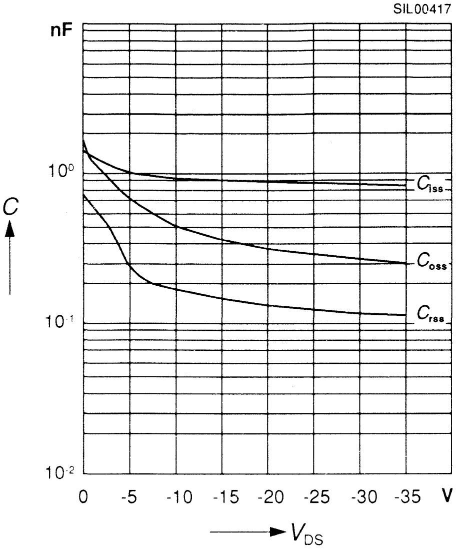


Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = -1$ mA, (spread)



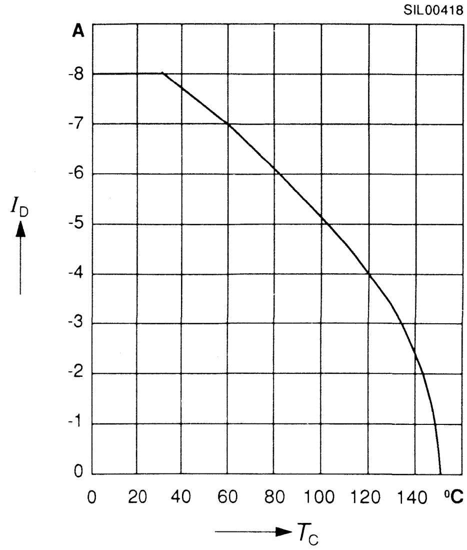
Typ. capacitances $C = f(V_{DS})$

parameter: $V_{GS} = 0$, $f = 1$ MHz



Drain current $I_D = f(T_C)$

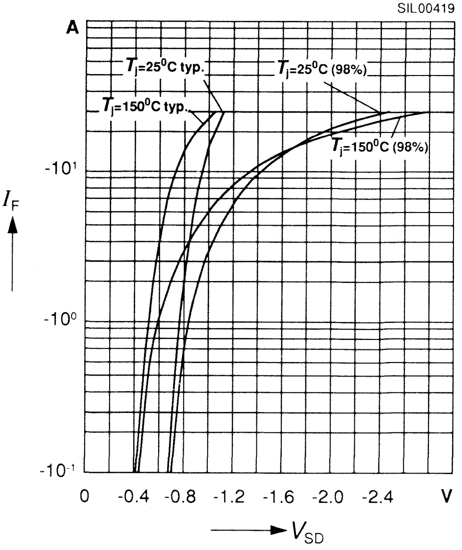
parameter: $V_{GS} \geq -10$ V



Forward characteristics of reverse diode

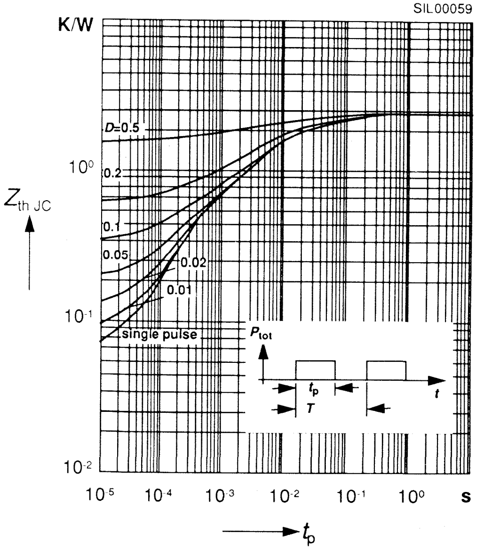
$I_F = f(V_{SD})$

parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$

parameter: $D = t_p / T$

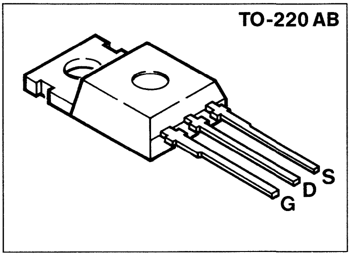


SIEMENS

SIPMOS® Power MOS Transistor BUZ 172

V_{DS} = – 100 V
I_D = – 5.5 A
$R_{DS(on)}$ = 0.6 Ω

- P channel
- Enhancement mode
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 172	C67078-A1451-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 100	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 100	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	– 5.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	– 22.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-2.1	-4.0	
Zero gate voltage drain current $V_{DS} = -100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 -250 -1000	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-100	nA
Drain-source on-resistance $V_{GS} = -10$ V, $I_D = -3.7$ A	$R_{DS(on)}$	-	0.6	Ω

Dynamic characteristics

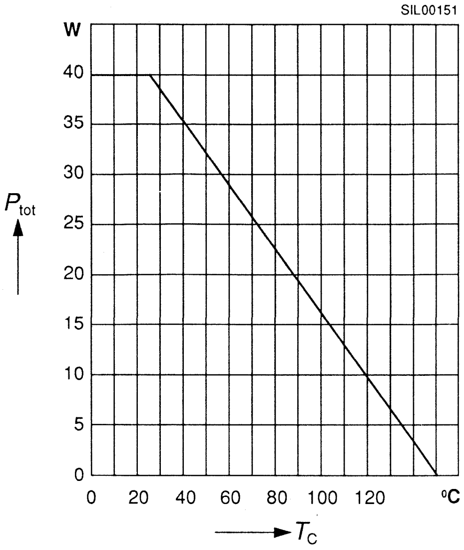
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -3.7$ A	g_{fs}	1.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	1200	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	330	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	140	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.8$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.8$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	90	
	t_f	-	75	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

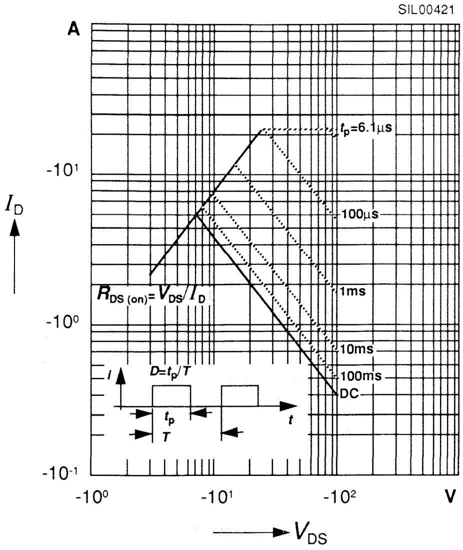
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	-5.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	-22.0	
Diode forward on-voltage $I_F = -11$ A, $V_{GS} = 0$	V_{SD}	–	-1.3	V
Reverse recovery time $V_R = -30$ V, $I_F = I_S$, $di_F/dt = -100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = -30$ V, $I_F = I_S$, $di_F/dt = -100$ A/µs	Q_{rr}	0.75 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

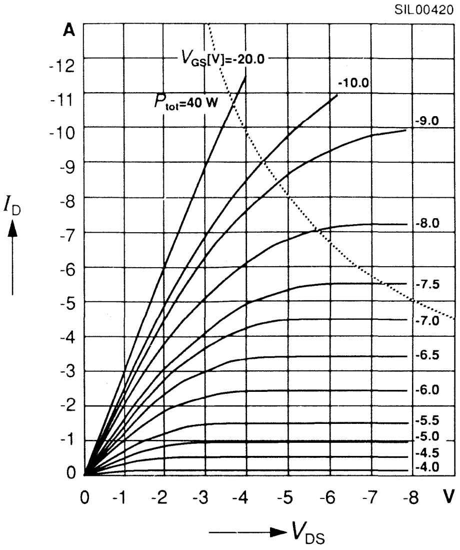
Total power dissipation $P_{tot} = f(T_C)$



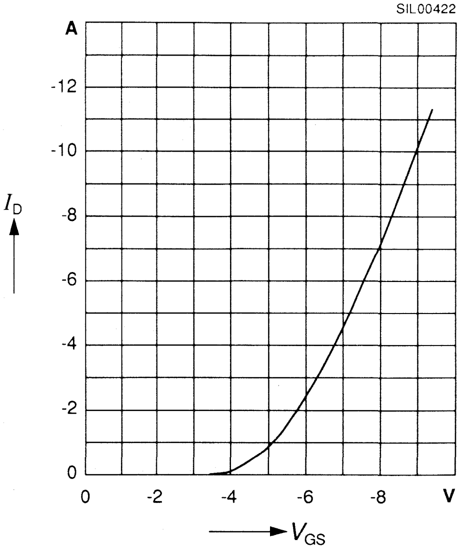
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



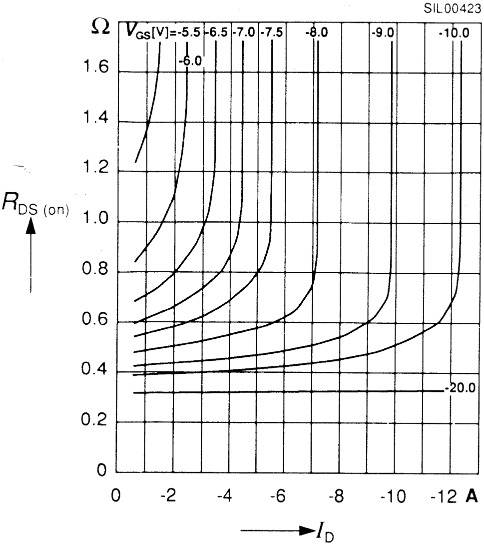
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



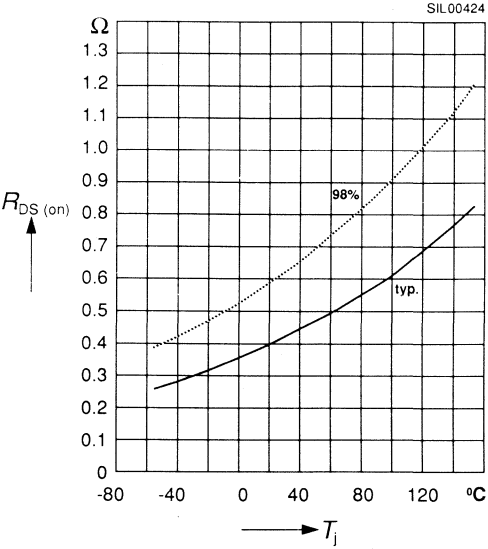
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



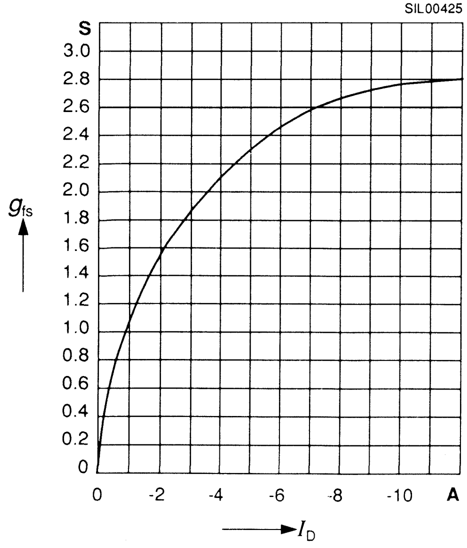
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



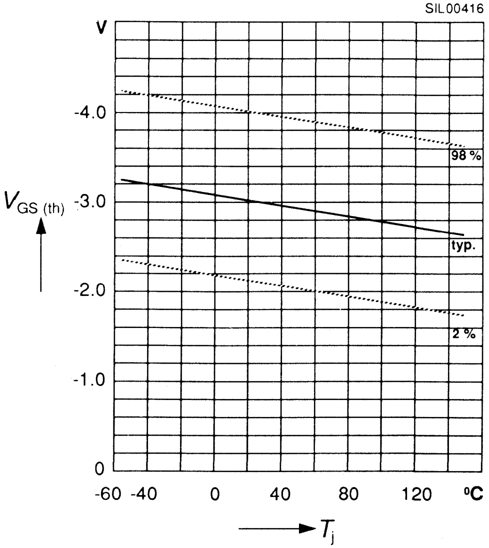
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -3.7$ A, $V_{GS} = -10$ V, (spread)



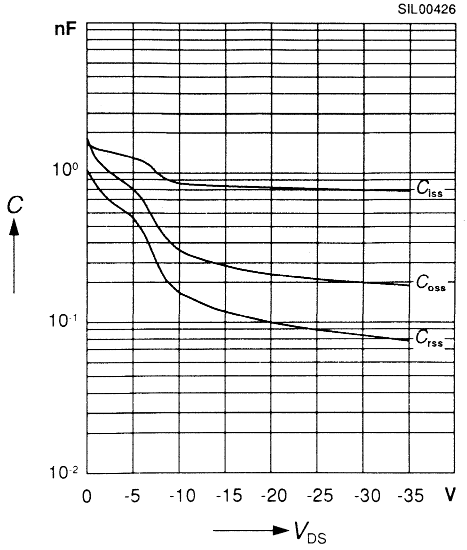
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



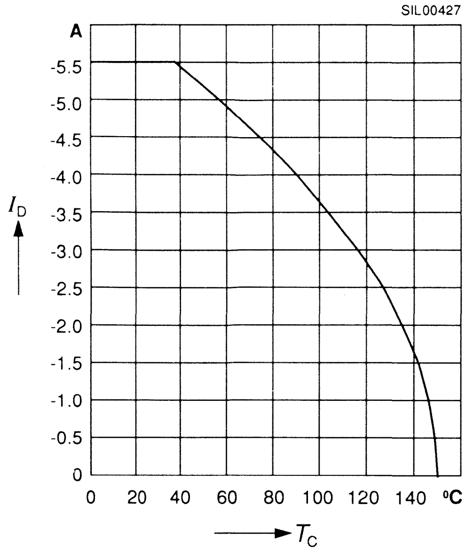
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = -1$ mA, (spread)



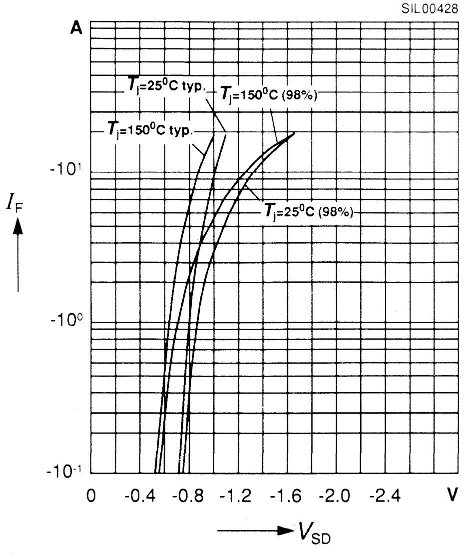
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



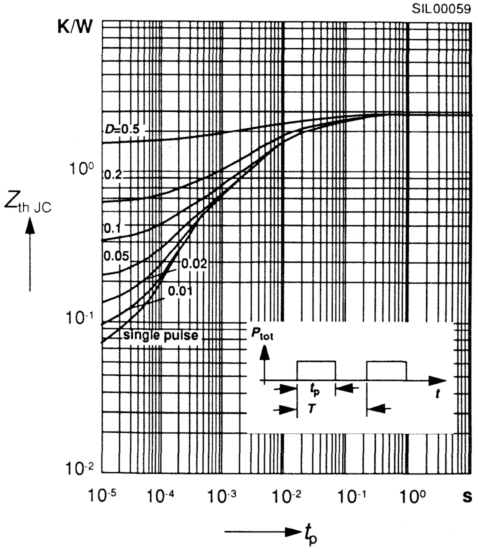
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq -10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
parameter: $D = t_p\,/\,T$



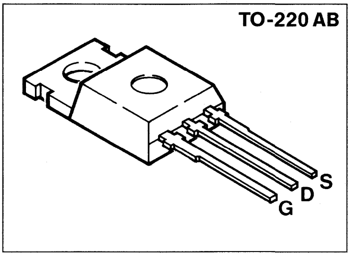
SIEMENS

SIPMOS® Power MOS Transistor

BUZ 173

V_{DS} = – 200 V
I_D = – 3.6 A
$R_{DS(on)}$ = 1.5 Ω

- P channel
- Enhancement mode
- Package: TO-220 AB [1]



Type	Ordering code
BUZ 173	C67078-A1452-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 200	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 200	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	– 3.6	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	– 14.0	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	40	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 3.1 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

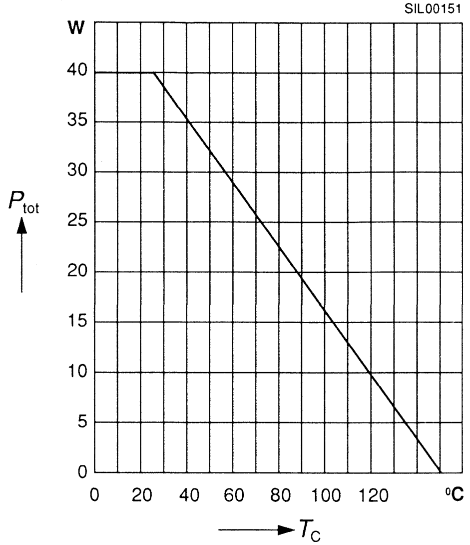
Parameter	Symbol	Values min.	Values max.	Unit
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-200	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-2.1	-4.0	
Zero gate voltage drain current $V_{DS} = -200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 -250 -1000	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-100	nA
Drain-source on-resistance $V_{GS} = -10$ V, $I_D = -2.3$ A	$R_{DS(on)}$	-	1.5	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -2.3$ A	g_{fs}	1.1	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	1150	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	190	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	60	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.6$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	95	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $I_D = -2.6$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	90	
	t_f	-	75	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

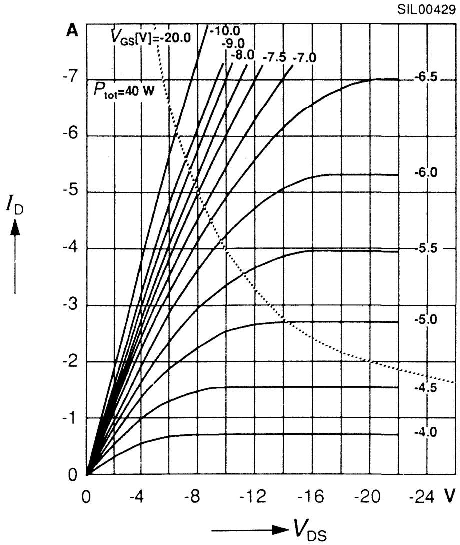
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	-3.6	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	-14.0	
Diode forward on-voltage $I_F = -7.0$ A, $V_{GS} = 0$	V_{SD}	–	-1.3	V
Reverse recovery time $V_R = -100$ V, $I_F = I_S$, $di_F/dt = -100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = -100$ V, $I_F = I_S$, $di_F/dt = -100$ A/µs	Q_{rr}	0.75 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

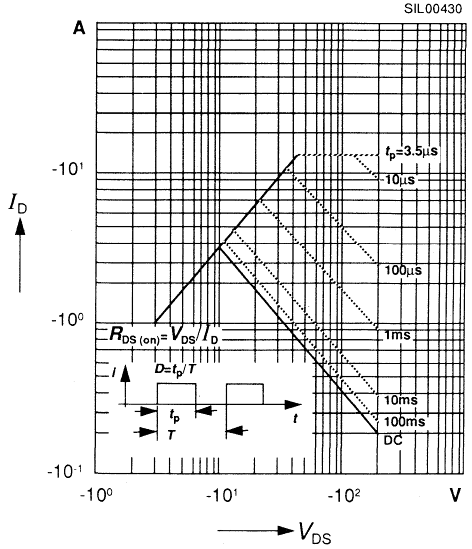
Total power dissipation $P_{tot} = f(T_C)$



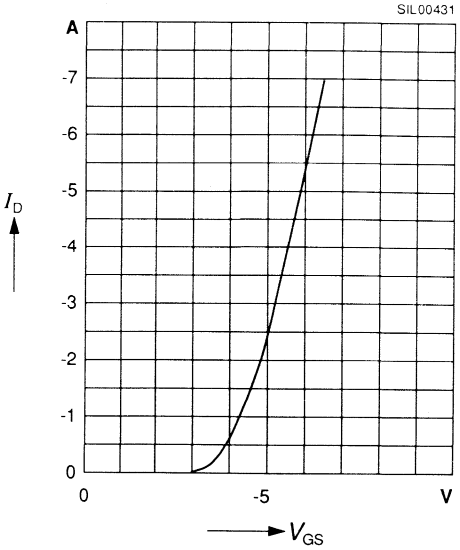
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



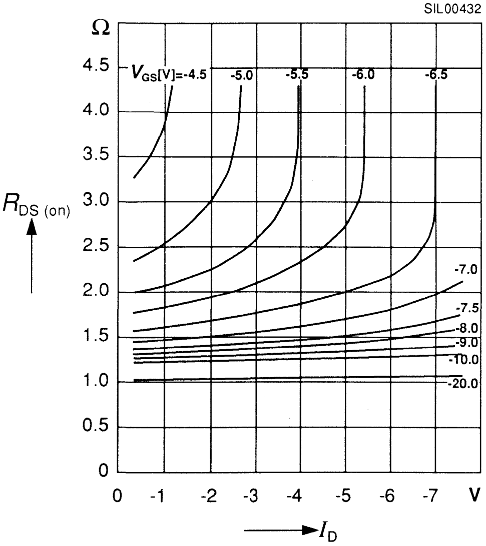
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



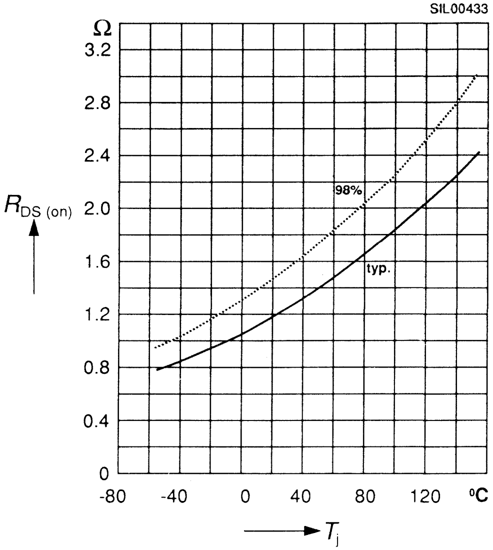
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



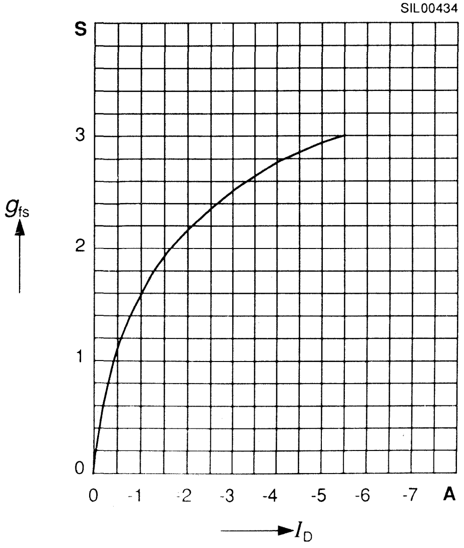
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



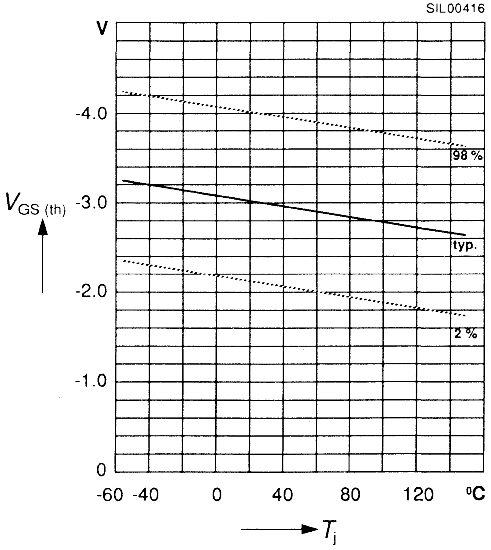
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -2.3$ A, $V_{GS} = -10$ V, (spread)



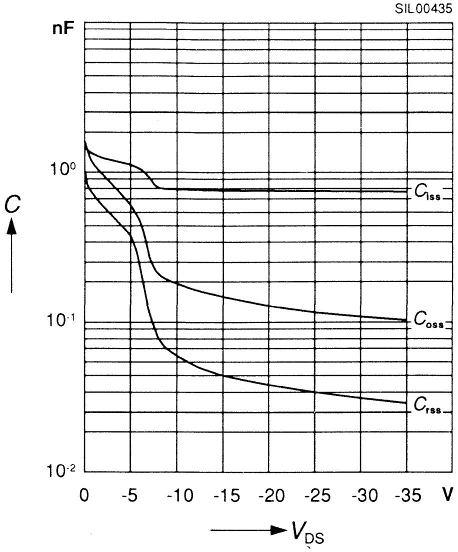
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



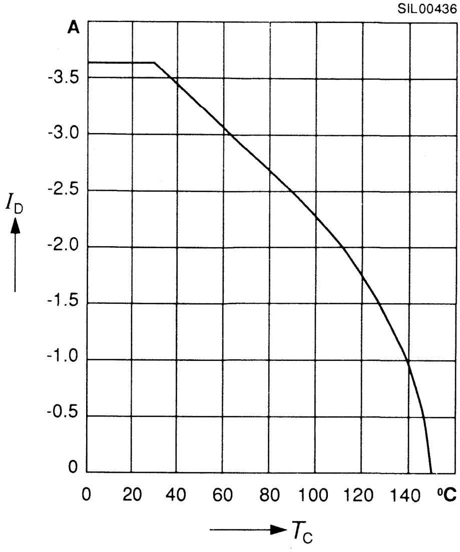
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = -1$ mA, (spread)



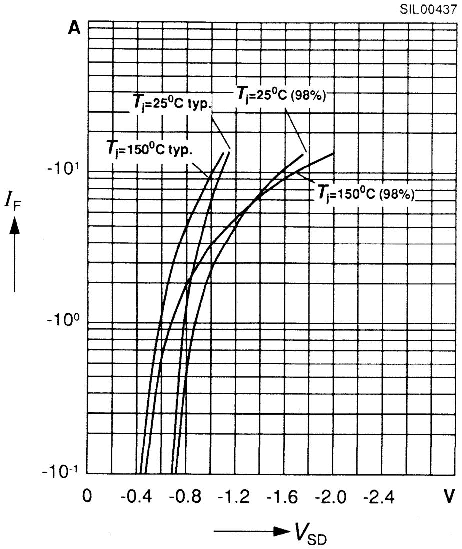
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



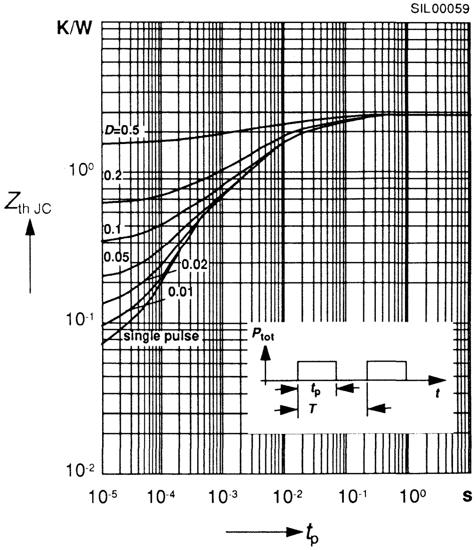
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq -10$ V



Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
parameter: $D = t_p\,/\,T$

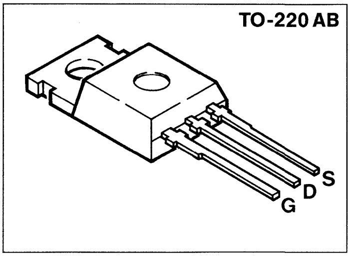


SIEMENS

SIPMOS® Power MOS Transistor BUZ 205

V_{DS} = 400 V
I_D = 6.0 A
$R_{DS(on)}$ = 1.0 Ω

- N channel
- FREDFET
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 205	C67078-A1401-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 36$ °C	I_D	6.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	24	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	6.0	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	8	mJ
Avalanche energy, single pulse $I_D = 6.0$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 15.6$ mH, $T_j = 25$ °C	E_{AS}	320	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	100 400	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 4.0$ A	$R_{DS(on)}$	–	1.0	Ω

Dynamic characteristics

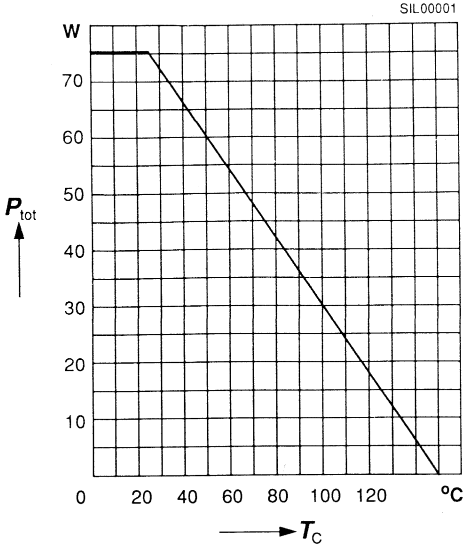
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 4.0$ A	g_{fs}	1.7	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1200	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	180	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	75	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	40	ns
	t_r	–	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	200	
	t_f	–	90	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

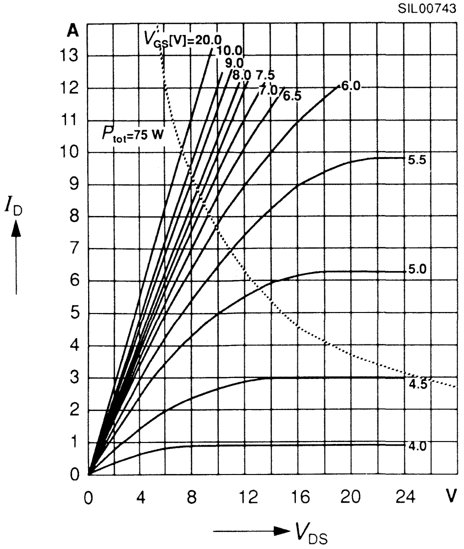
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	6.0	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	24	
Diode forward on-voltage I_F = 12 A, V_{GS} = 0	V_{SD}	–	1.6	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	t_{rr}	–	200	ns
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	Q_{rr}	–	0.8	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

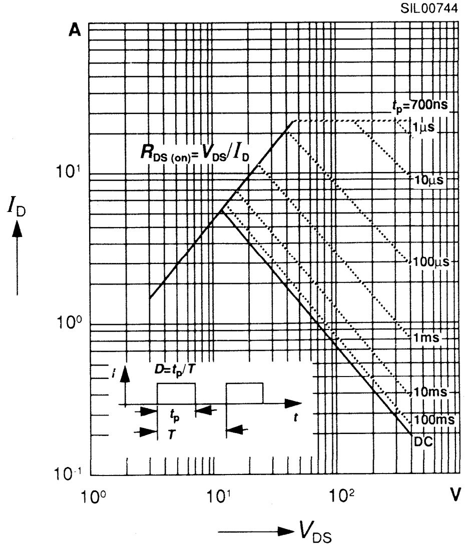
Total power dissipation $P_{tot} = f(T_C)$



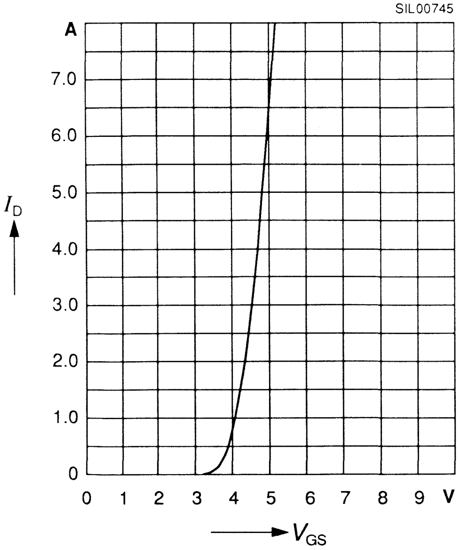
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



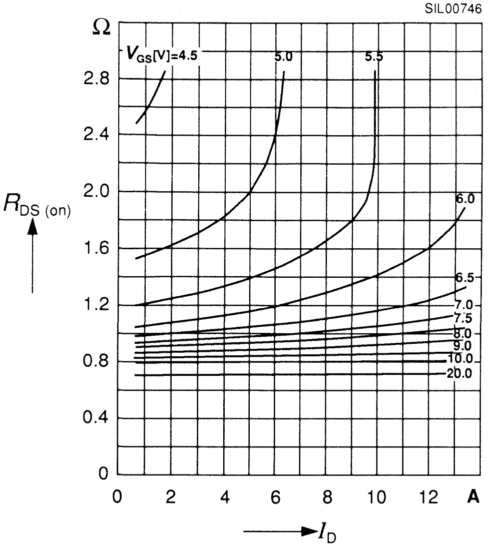
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



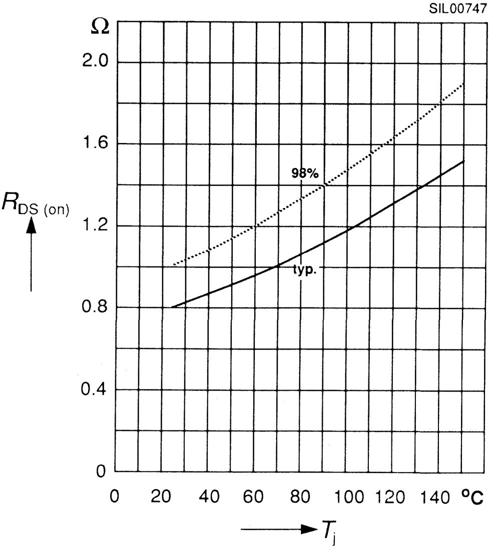
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



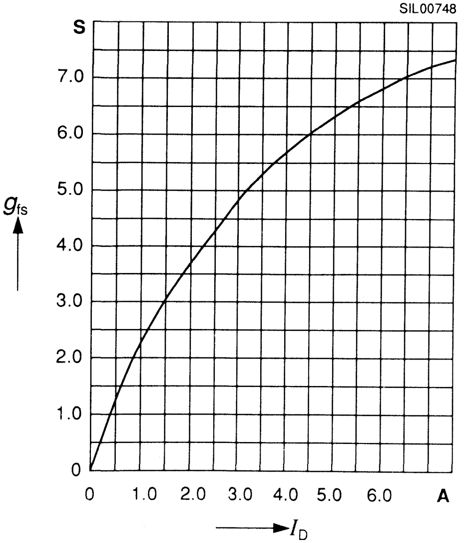
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



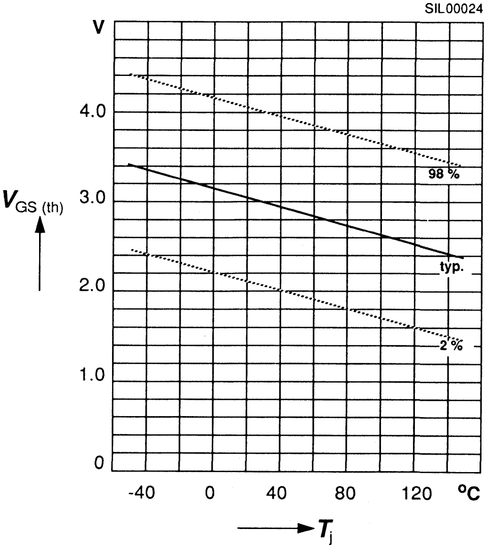
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 4.0 A, V_{GS} = 10 V, (spread)



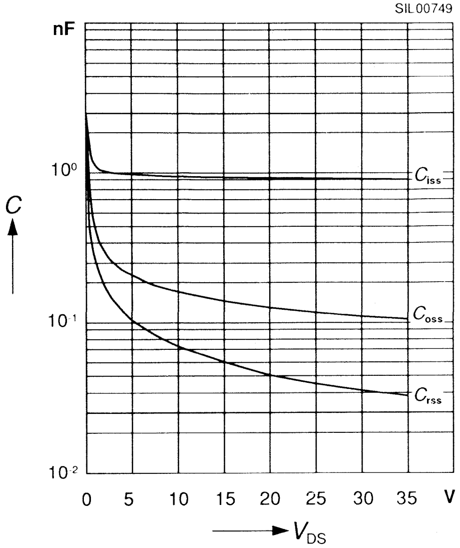
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



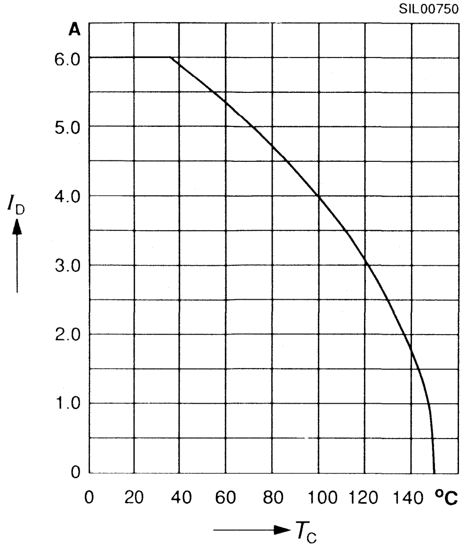
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



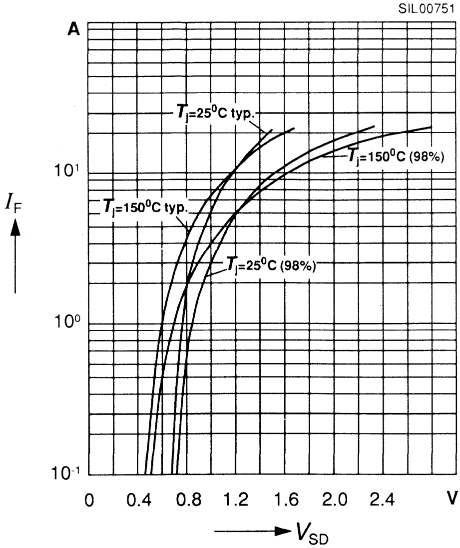
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



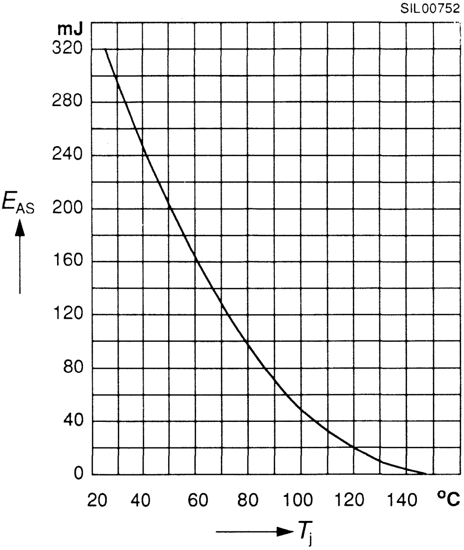
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



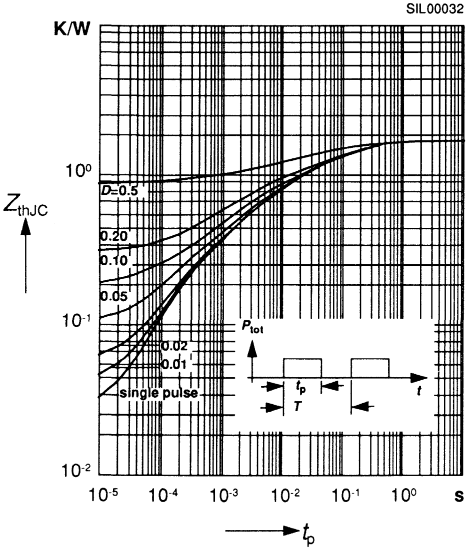
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



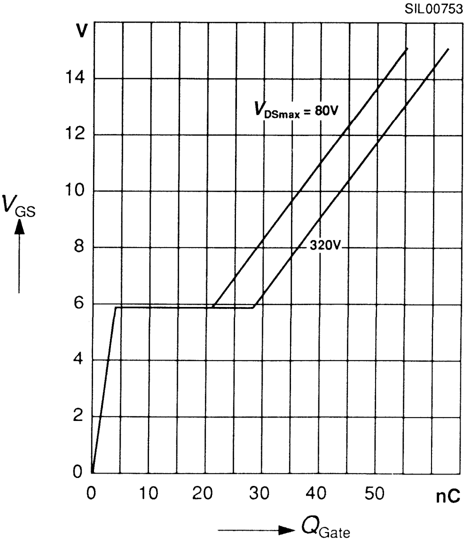
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 6.0$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 15.6$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 9.8$ A



SIEMENS

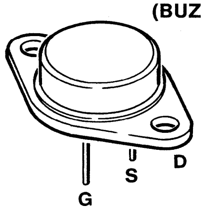
SIPMOS® Power MOS Transistors

BUZ 210
BUZ 211
BUZ 384
BUZ 385

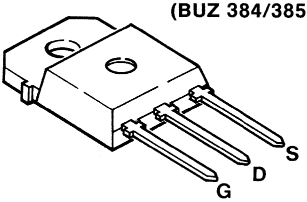
V_{DS} = 500 V
I_D = 9.0 ... 10.5 A
$R_{DS(on)}$ = 0.6 ... 0.8 Ω

- N channel
- FREDFET
- Enhancement mode
- Packages: TO-204 AA (TO-3),
  TO-218 AA (TOP-3) [1]

TO-204 AA
(BUZ 210/211)



TO-218 AA
(BUZ 384/385)



Type	**Ordering code**
BUZ 210	C67078-A1102-A2
BUZ 211	C67078-A1100-A2
BUZ 384	C67078-A3209-A2
BUZ 385	C67078-A3210-A2

Maximum Ratings

Parameter	**Symbol**	**BUZ** **210**	**211**	**384**	**385**	**Unit**
Drain-source voltage	V_{DS}	500				V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500				
Gate-source voltage	V_{GS}	± 20				
Continuous drain current, T_C = 25 °C	I_D	10.5	9.0	10.5	9.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	42	36	42	36	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150				°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125				W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	1.0 35		45		K/W
DIN humidity category, DIN 40 040		C		E		–
IEC climatic category, DIN IEC 68-1		55/150/56				

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

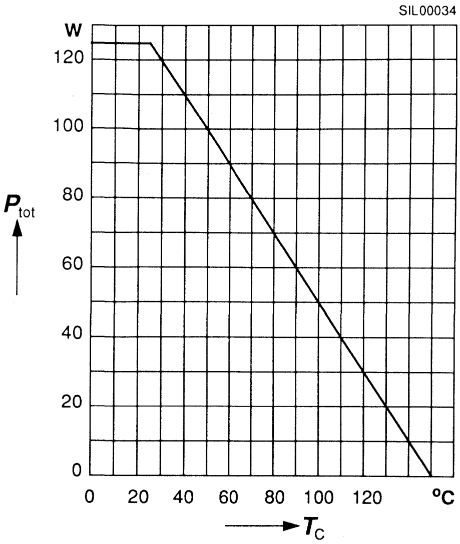
Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 6.5$ A BUZ 210/384 BUZ 211/385	$R_{DS(on)}$	– –	0.6 0.8	Ω
Dynamic characteristics				
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 6.5$ A	g_{fs}	2.7	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	4900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	170	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.8$ A	$t_{d(on)}$	–	75	ns
	t_r	–	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.8$ A	$t_{d(off)}$	–	430	
	t_f	–	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

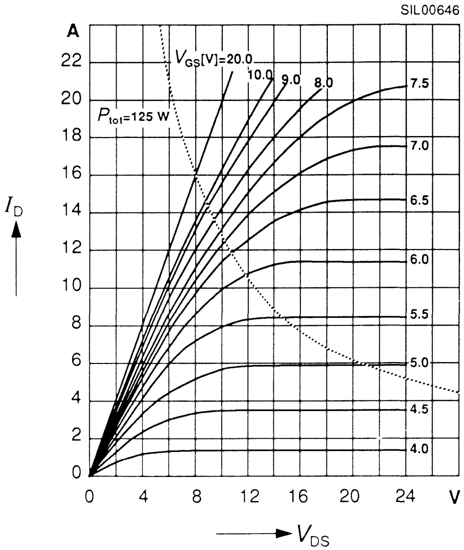
Parameter		Symbol	Values		Unit
			min.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current		I_S			A
$T_C = 25$ °C	BUZ 210/384		–	10.5	
	BUZ 211/385		–	9.0	
Pulsed reverse drain current		I_{SM}			
$T_C = 25$ °C	BUZ 210/384		–	42	
	BUZ 211/385		–	36	
Diode forward on-voltage $I_F = 21$ A, $V_{GS} = 0$		V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	–	250	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	–	1.2	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

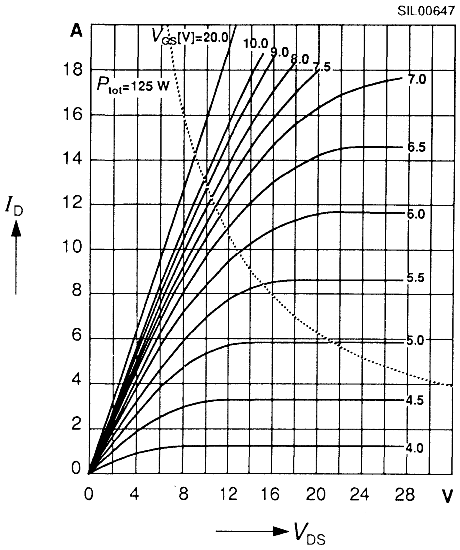
Total power dissipation $P_{tot} = f(T_C)$



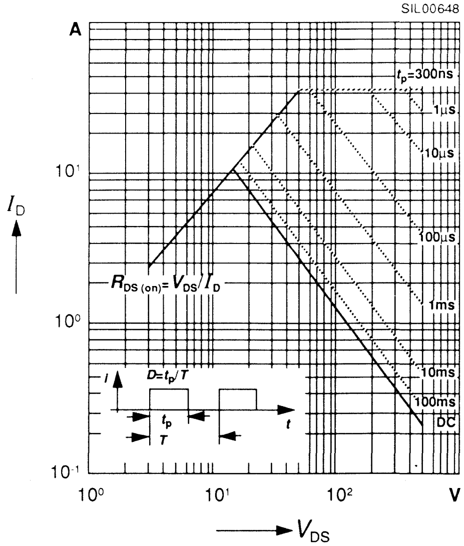
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 210/384



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 211/385

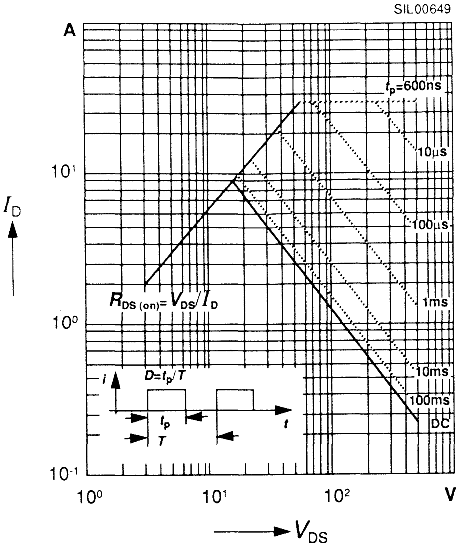


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 210/384

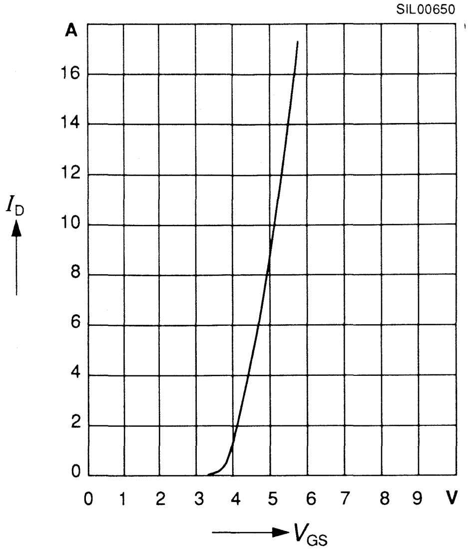


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

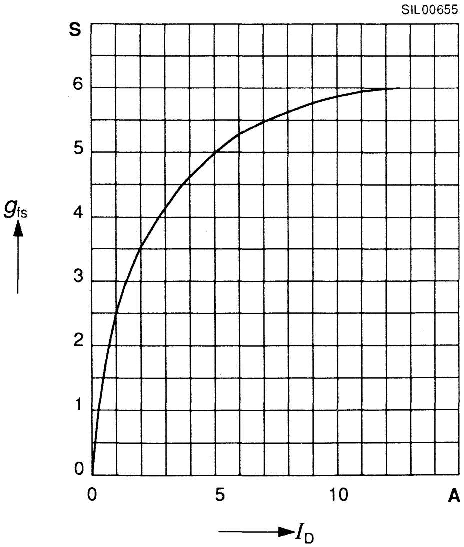
BUZ 211/385



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

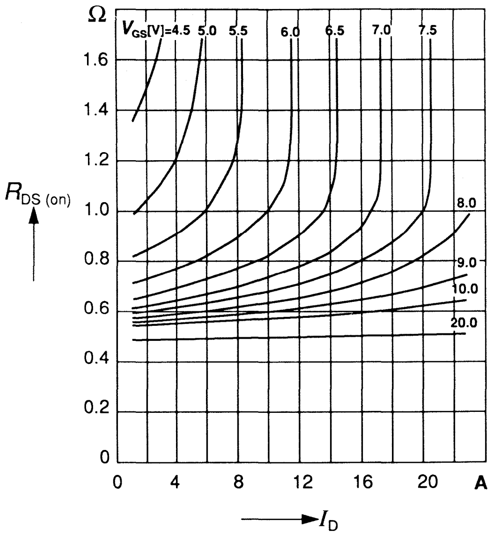


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



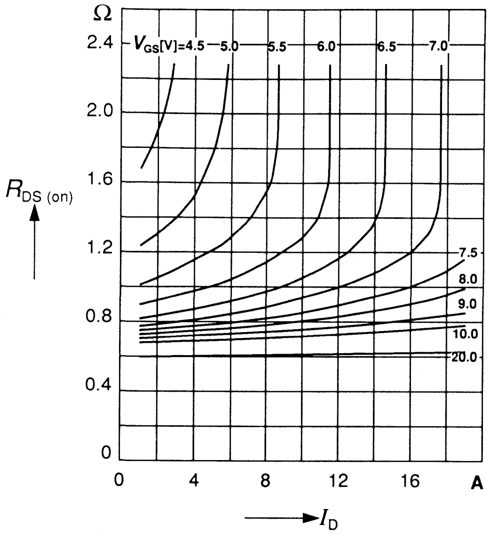
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 210/384



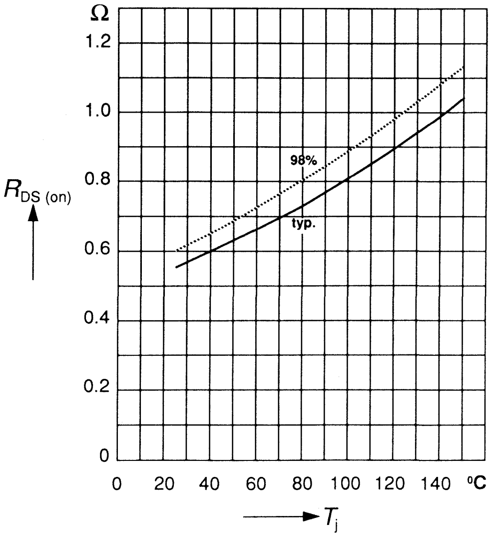
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 211/385



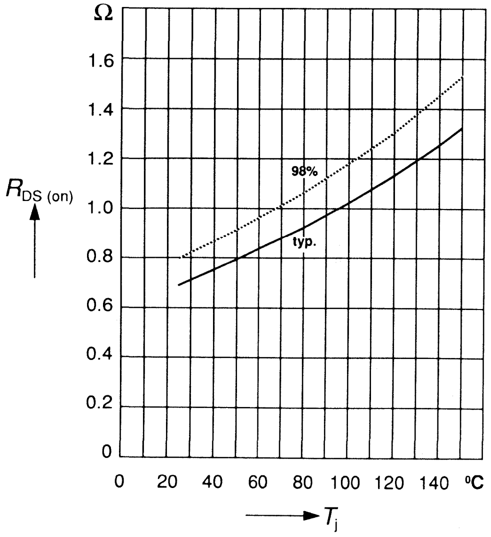
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 6.5 A, V_{GS} = 10 V, (spread)

BUZ 210/384

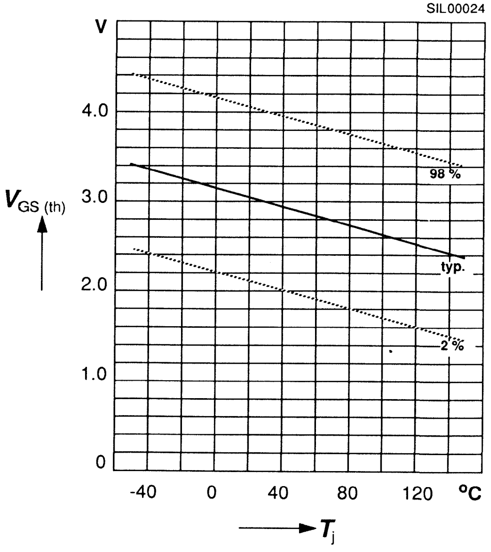


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 6.5 A, V_{GS} = 10 V, (spread)

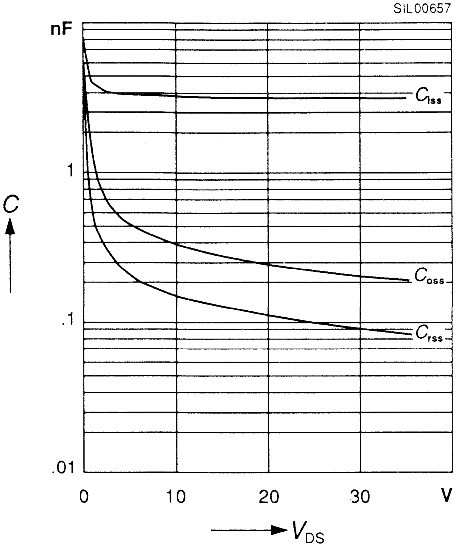
BUZ 211/385



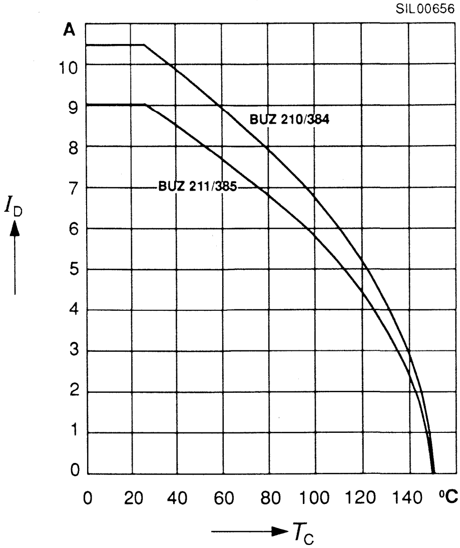
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



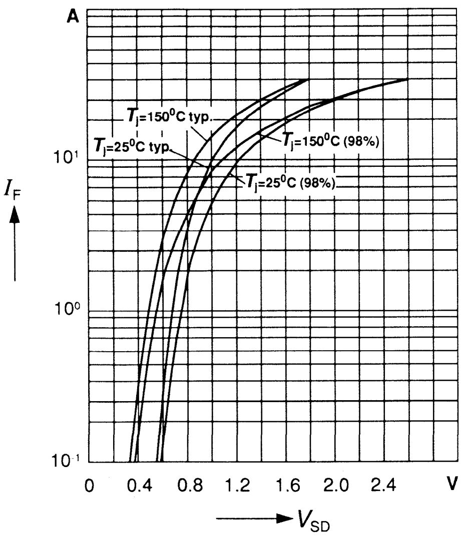
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



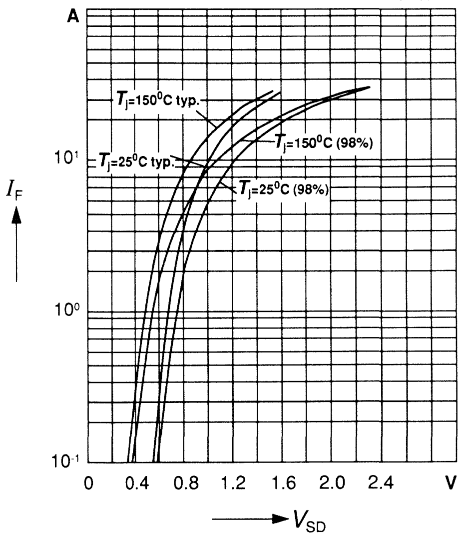
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



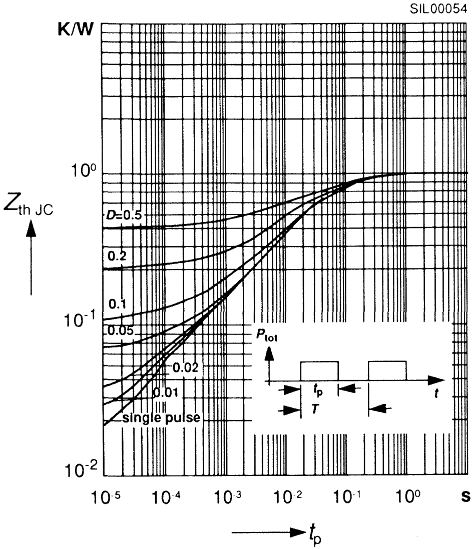
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 210/384



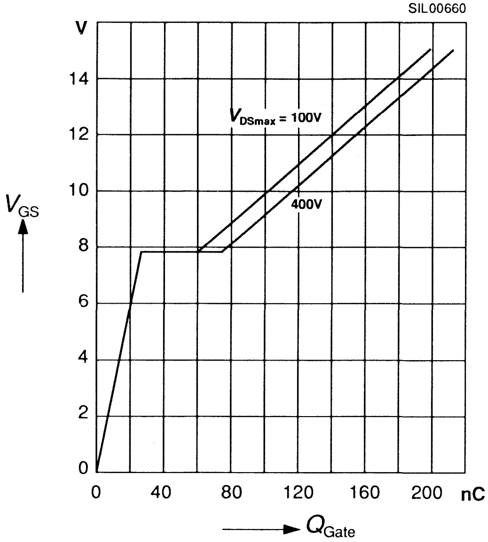
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 211/385



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



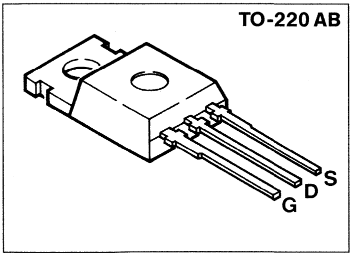
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls} = 14.4$ A



SIPMOS® Power MOS Transistor **BUZ 215**

V_{DS} = 500 V
I_D = 5.0 A
$R_{DS(on)}$ = 1.5 Ω

- N channel
- FREDFET
- Enhancement mode
- Avalanche-proof
- Package: TO-220 AB [1])



Type	Ordering code
BUZ 215	C67078-A1400-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 31$ °C	I_D	5.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	20	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	8.0	mJ
Avalanche energy, single pulse $I_D = 5$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 23.0$ mH, $T_j = 25$ °C	E_{AS}	320	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	75	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	100 400	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.2$ A	$R_{DS(on)}$	-	1.5	Ω

Dynamic characteristics

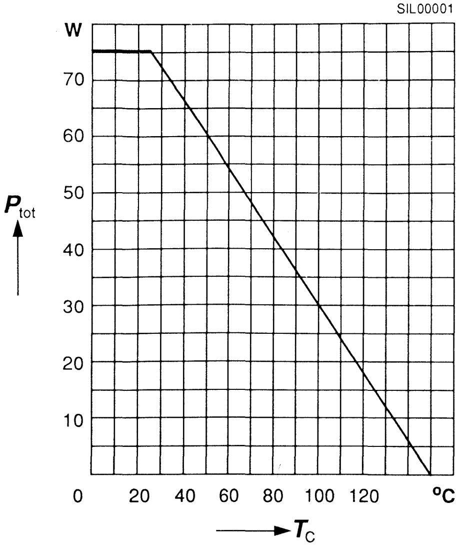
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.2$ A	g_{fs}	1.5	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1200	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	170	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	70	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	40	ns
	t_r	-	60	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	175	
	t_f	-	90	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

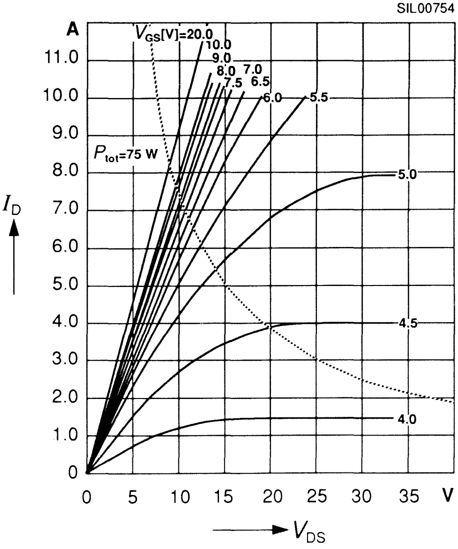
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	5.0	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	20	
Diode forward on-voltage $I_F = 10$ A, $V_{GS} = 0$	V_{SD}	–	1.6	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	–	200	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	–	0.85	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

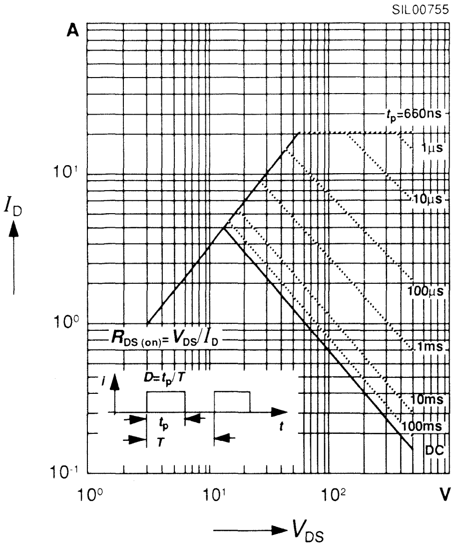
Total power dissipation $P_{tot} = f(T_C)$



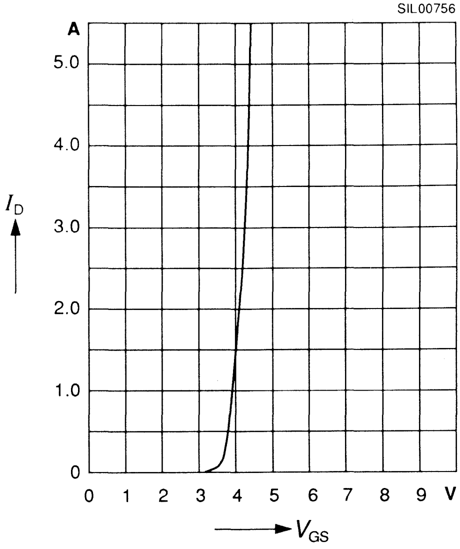
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



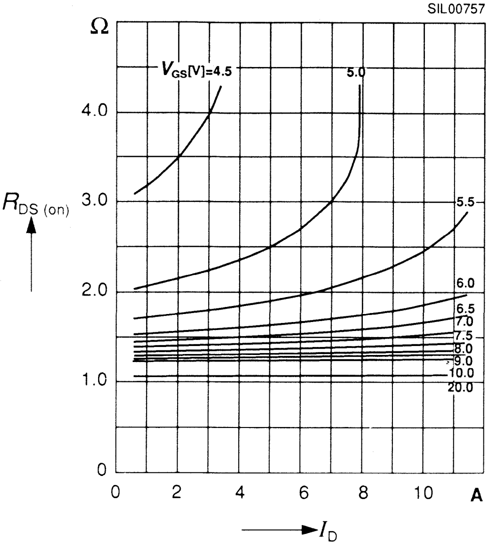
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



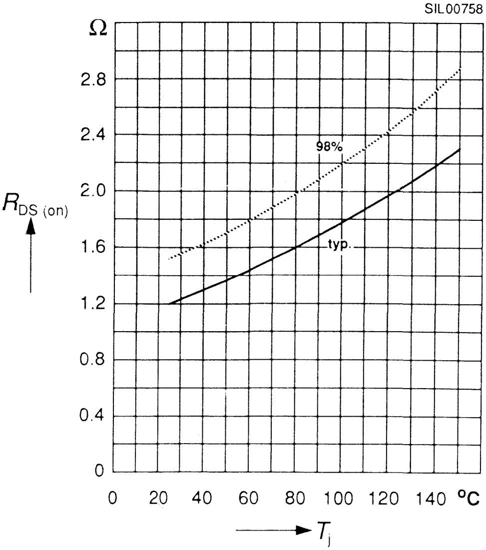
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



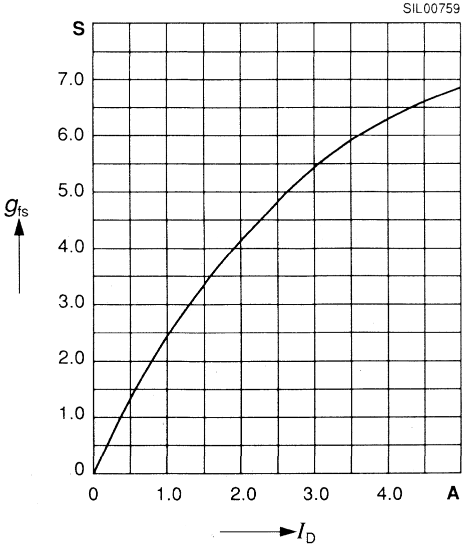
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



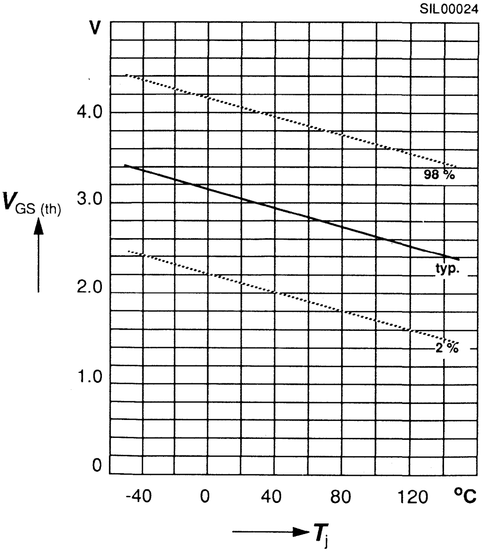
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.2$ A, $V_{GS} = 10$ V, (spread)



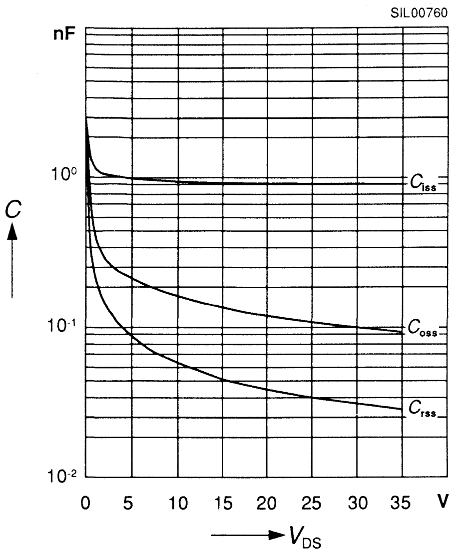
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



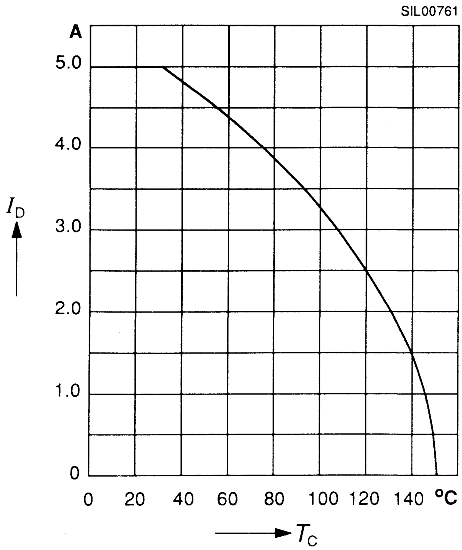
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



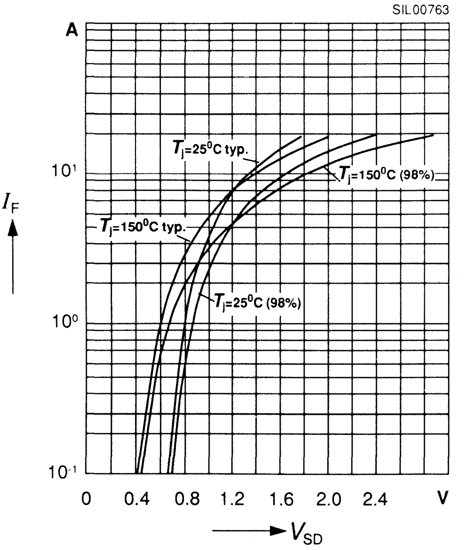
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



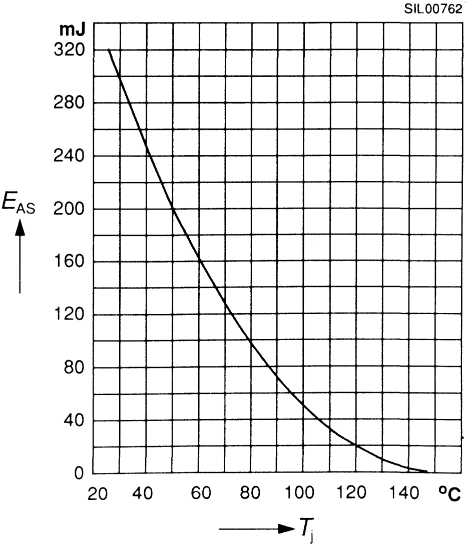
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



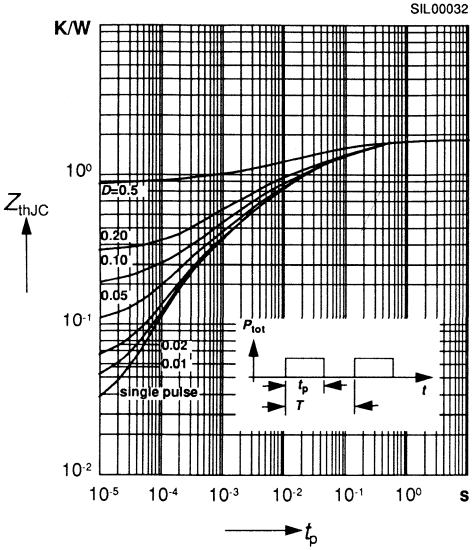
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



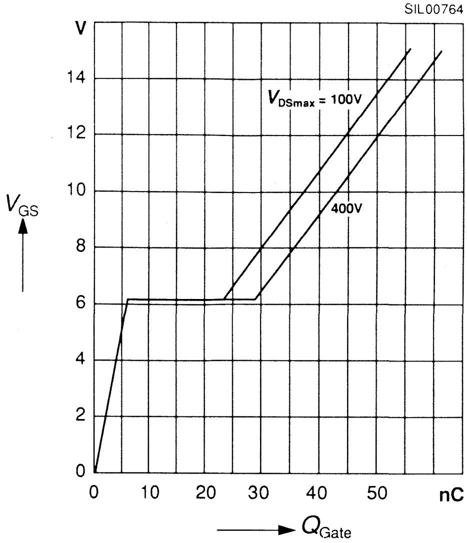
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 23.0$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 7.5$ A

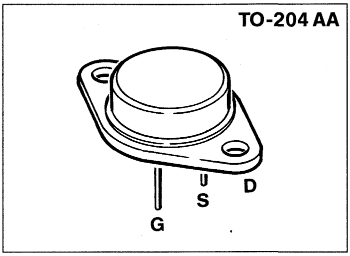


SIEMENS

SIPMOS® Power MOS Transistor **BUZ 230**

V_{DS} = 1000 V
I_D = 5.5 A
$R_{DS(on)}$ = 2.0 Ω

- N channel
- FREDFET
- Enhancement mode
- Package: TO-204 AA (TO-3) [1]



Type	Ordering code
BUZ 230	C67078-A1105-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	5.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	22	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 35	K/W
DIN humidity category, DIN 40 040	–	C	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	250	
$T_j = 125$ °C		-	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.5$ A	$R_{DS(on)}$	-	2.0	Ω

Dynamic characteristics

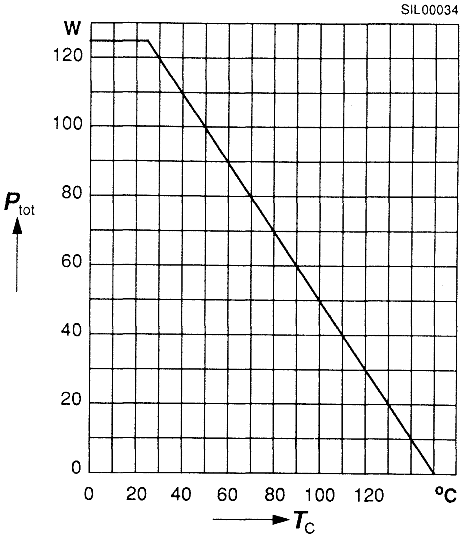
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.5$ A	g_{fs}	1.4	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	5.0	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	300	pF
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	120	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	90	ns
	t_r	-	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	430	
	t_f	-	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

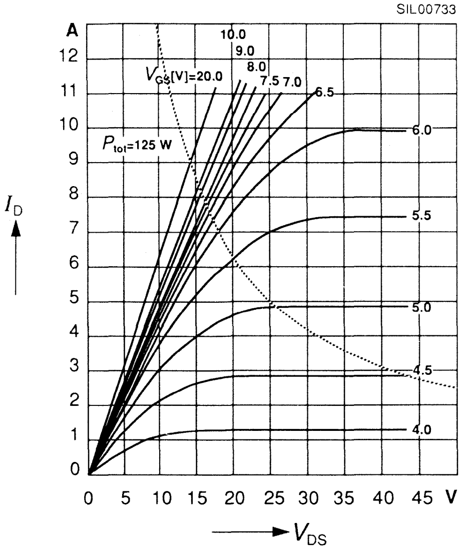
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	5.5	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	22	
Diode forward on-voltage I_F = 11 A, V_{GS} = 0	V_{SD}	–	1.6	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	t_{rr}	–	220	ns
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	Q_{rr}	–	0.9	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

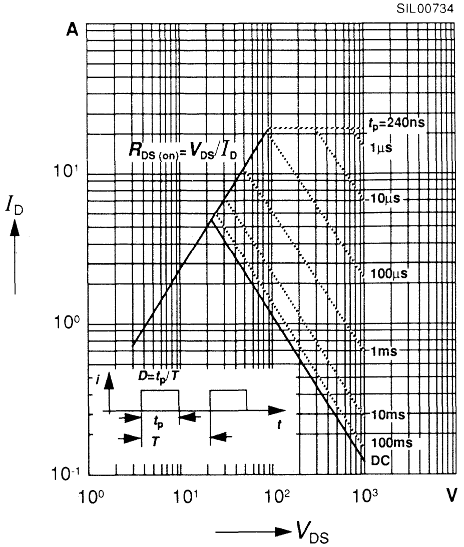
Total power dissipation $P_{tot} = f(T_C)$



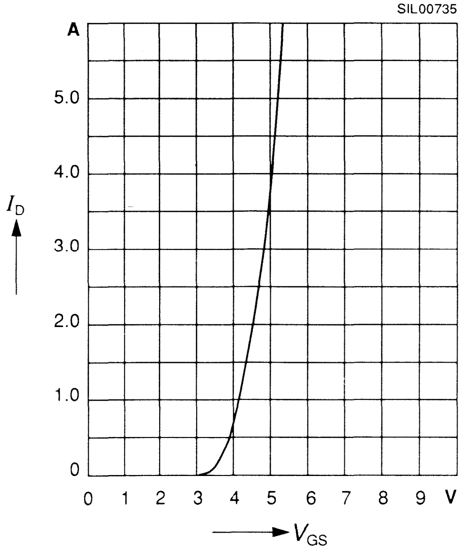
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



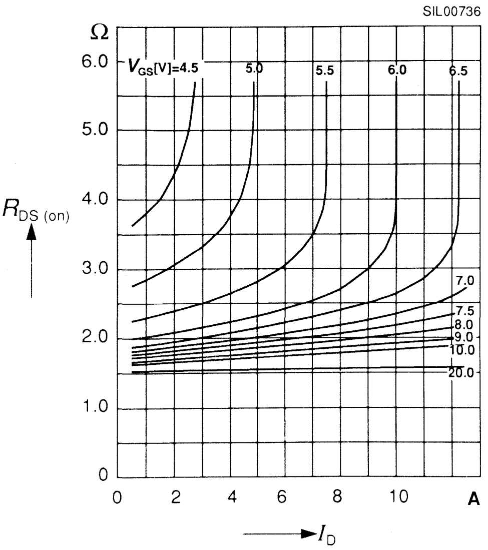
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



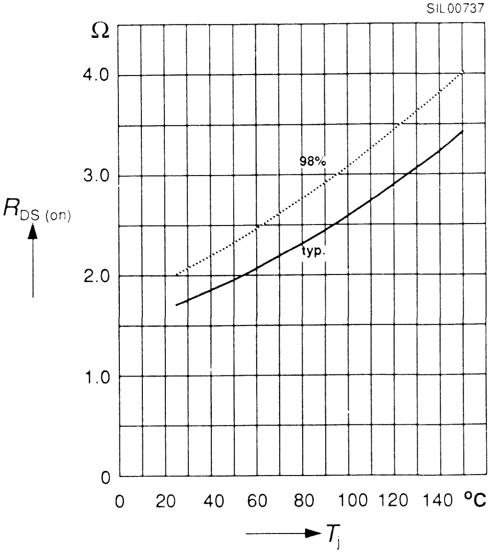
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



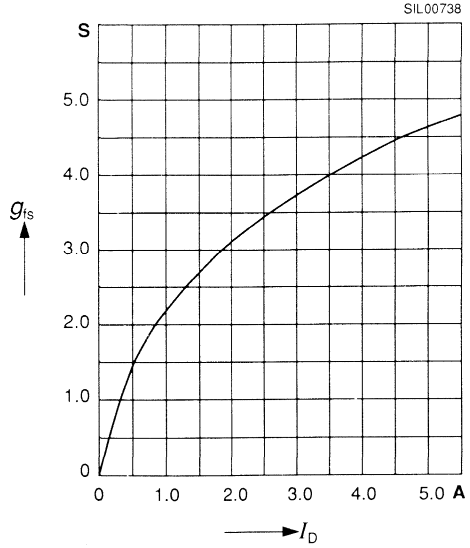
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



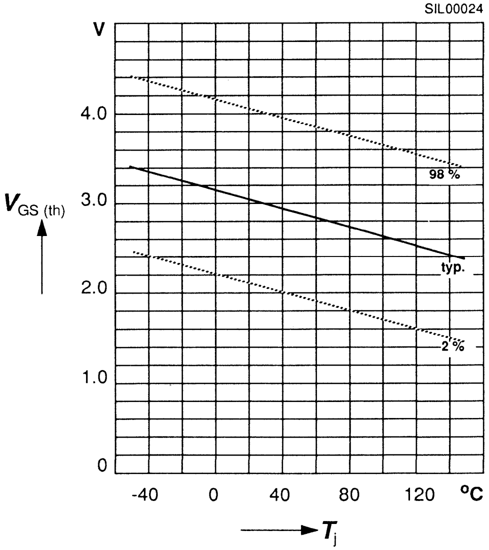
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.5$ A, $V_{GS} = 10$ V, (spread)



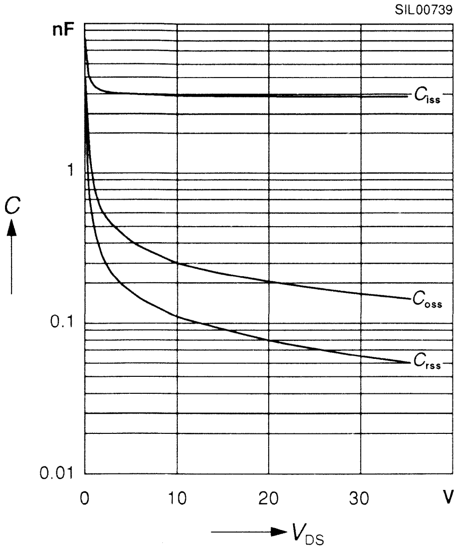
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



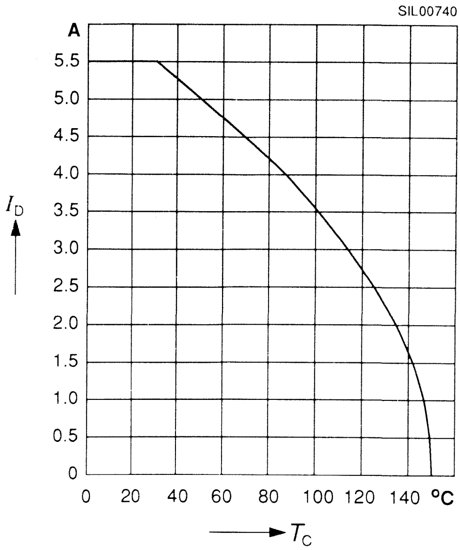
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



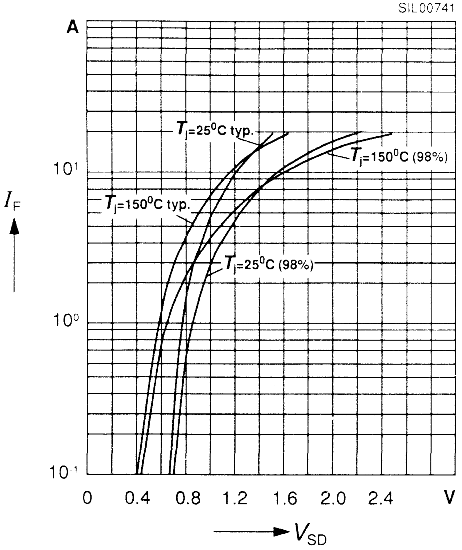
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



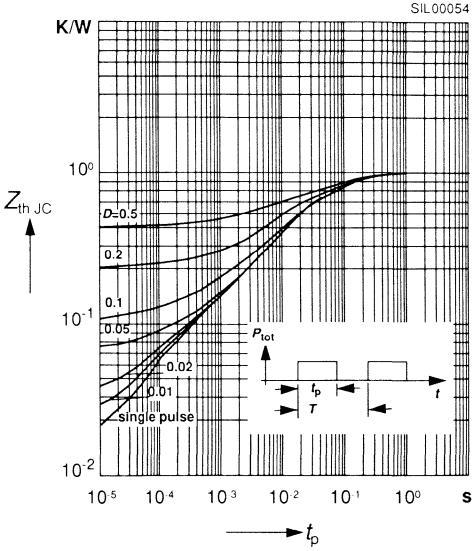
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



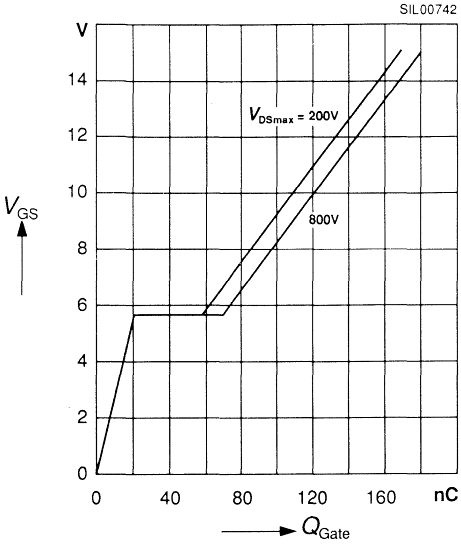
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
parameter: $D = t_p\,/\,T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 8.0$ A

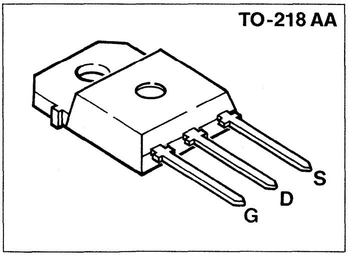


SIEMENS

SIPMOS® Power MOS Transistor BUZ 323

V_{DS} = 400 V
I_D = 15 A
$R_{DS(on)}$ = 0.30 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA [1])



Type	Ordering code
BUZ 323	C67078-S3127-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 25$ °C	I_D	15	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	60	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	15	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	18	mJ
Avalanche energy, single pulse $I_D = 15$ A, $V_{DD} = 50$ V, $R_{GS} = 25\ \Omega$ $L = 6.14$ mH, $T_j = 25$ °C	E_{AS}	790	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	170	W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 0.74 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	- -	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 9.5$ A	$R_{DS(on)}$	-	0.30	Ω

Dynamic characteristics

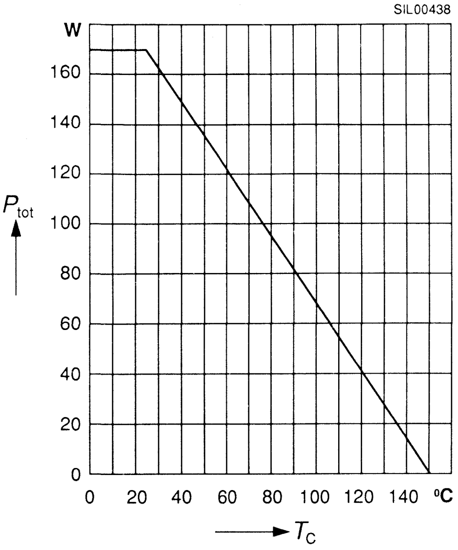
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 9.5$ A	g_{fs}	8	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	3000	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	480	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	180	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	65	ns
	t_r	-	115	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	350	
	t_f	-	170	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

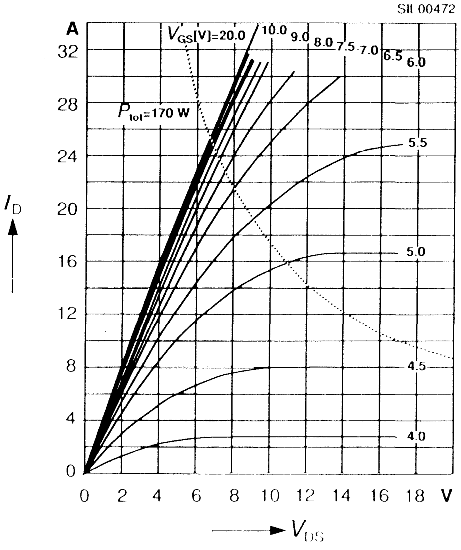
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	15	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	60	
Diode forward on-voltage $I_F = 30$ A, $V_{GS} = 0$	V_{SD}	–	1.5	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs $T_j = 25$ °C $T_j = 150$ °C	t_{rr}	 – –	 180 220	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs $T_j = 25$ °C $T_j = 150$ °C	Q_{rr}	 – –	 0.5 2.0	µC
Peak reverse recovery current $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs $T_j = 150$ °C	I_{RRM}	10 typ.	–	A

Characteristics at T_j = 25 °C, unless otherwise specified.

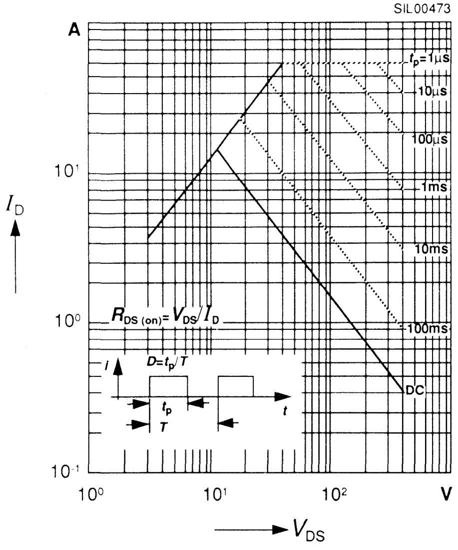
Total power dissipation $P_{tot} = f(T_C)$



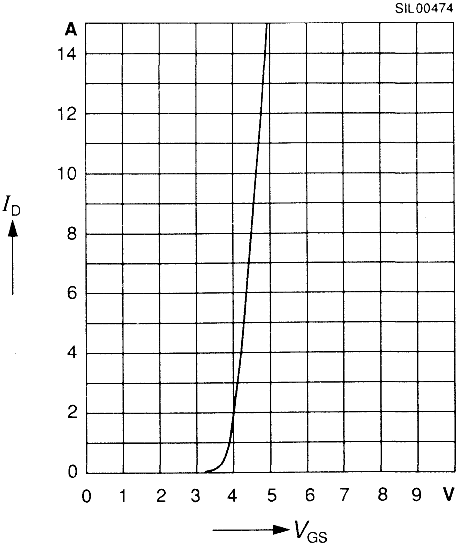
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



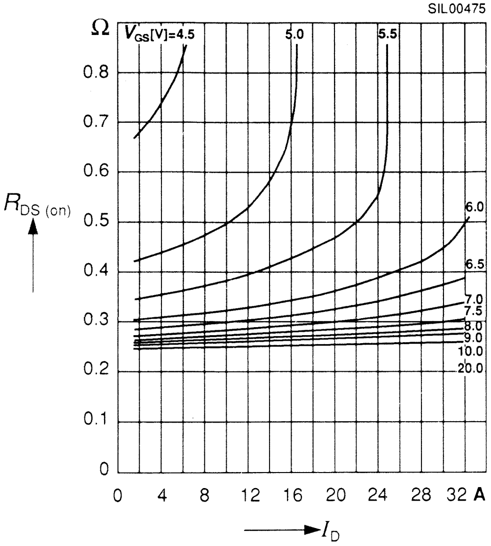
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



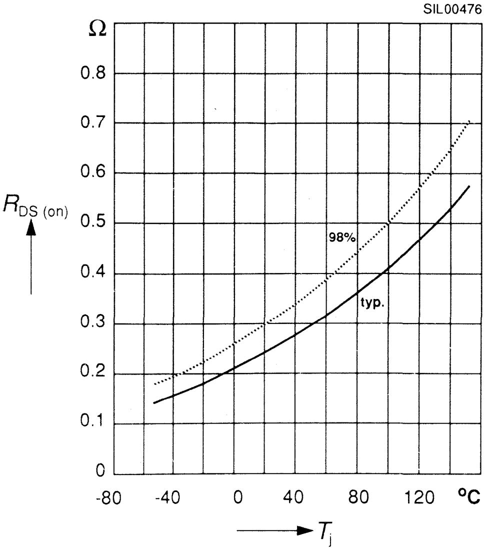
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



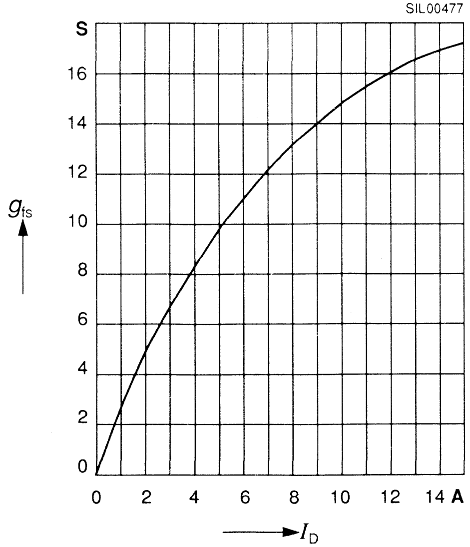
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



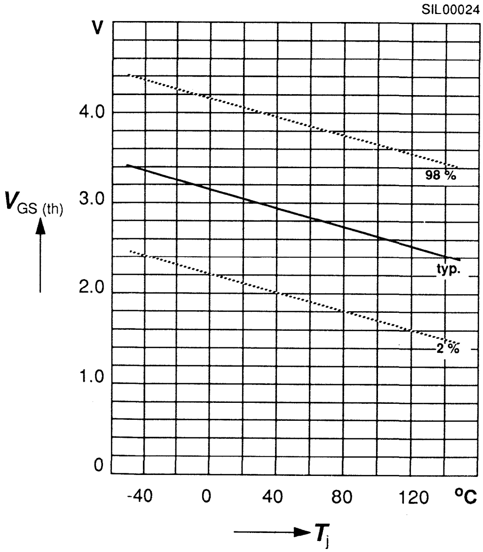
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 9.5$ A, $V_{GS} = 10$ V, (spread)



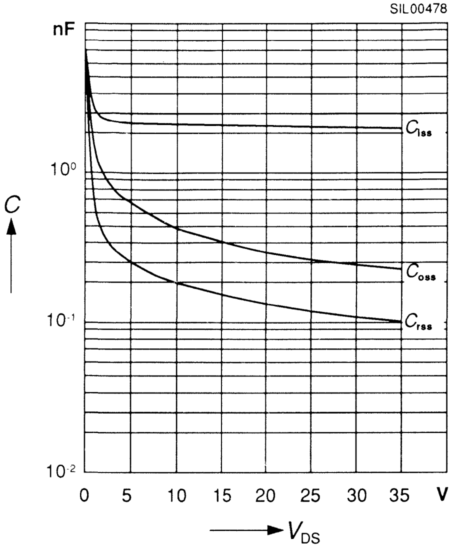
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



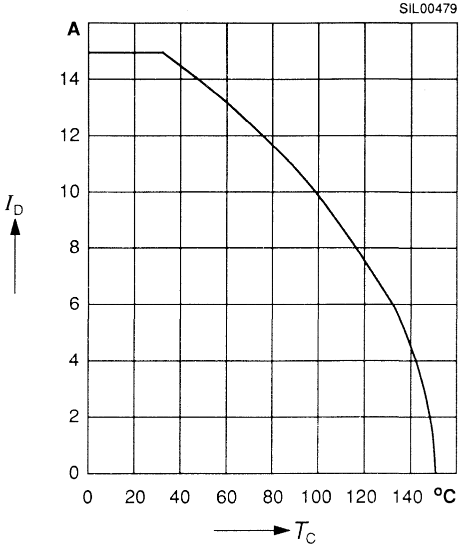
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



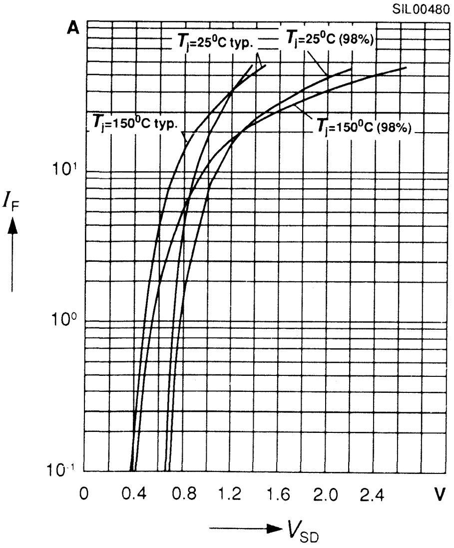
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



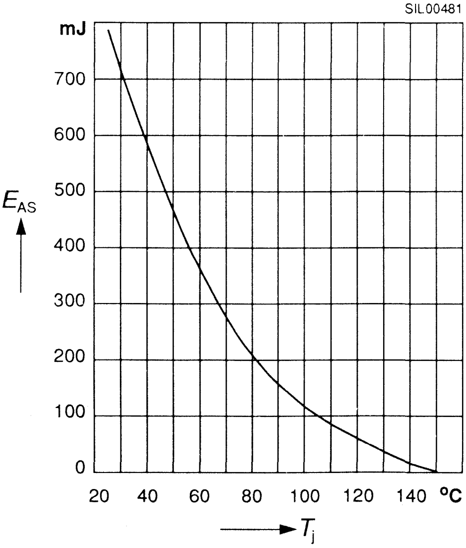
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



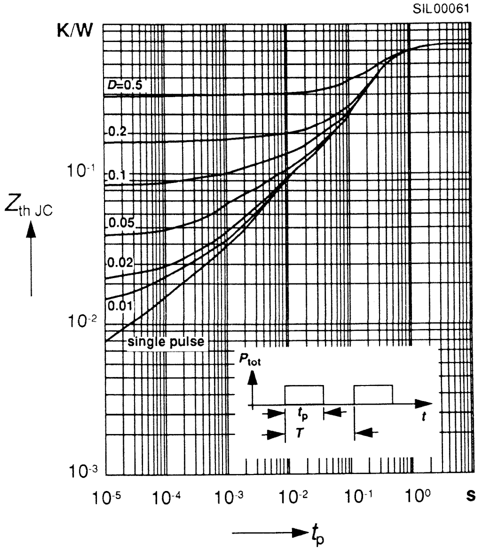
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



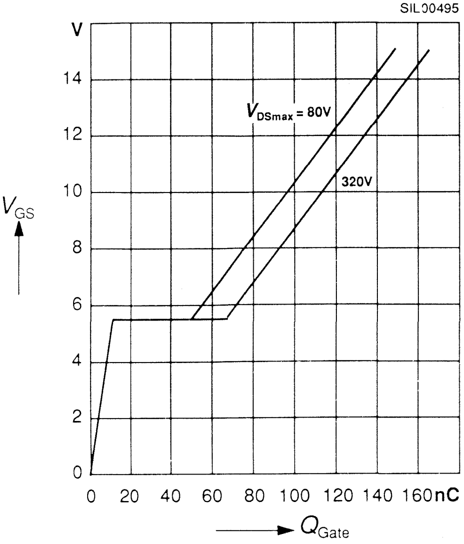
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 15$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 6.14$ mH



Transient thermal impedance $Z_{\text{thJC}} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{\text{Gate}})$
parameter: $I_{\text{D puls}} = 22.5$ A



SIEMENS

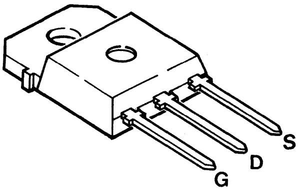
SIPMOS® Power MOS Transistors

BUZ 325
BUZ 326

V_{DS} = 400 V
I_D = 12.5 / 10.5 A
$R_{DS(on)}$ = 0.35 / 0.5 Ω

- N channel
- Enhancement mode
- Package: TO-218 AA (TOP-3) [1]

TO-218 AA



Type	Ordering code
BUZ 325	C67078-A3118-A2
BUZ 326	C67078-A3112-A2

Maximum Ratings

Parameter	Symbol	BUZ 325	 326	Unit
Drain-source voltage	V_{DS}	400		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	400		
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 25 °C	I_D	12.5	10.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	50	42	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125		W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 – –	 250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 8.0$ A BUZ 325 BUZ 326	$R_{DS(on)}$	 – –	 0.35 0.5	Ω

Dynamic characteristics

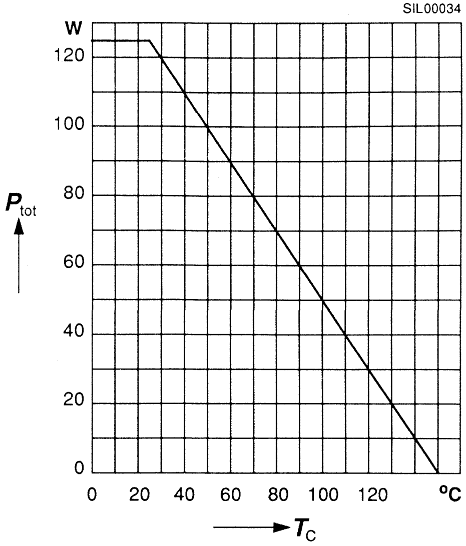
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 8.0$ A	g_{fs}	5.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1750	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	320	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.9$ A	$t_{d(on)}$	–	40	ns
	t_r	–	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.9$ A	$t_{d(off)}$	–	310	
	t_f	–	90	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

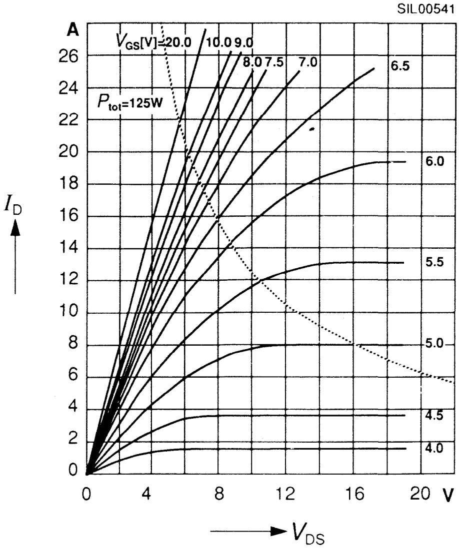
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C		I_S			A
	BUZ 325		–	12.5	
	BUZ 326		–	10.5	
Pulsed reverse drain current $T_C = 25$ °C		I_{SM}			
	BUZ 325		–	50	
	BUZ 326		–	42	
Diode forward on-voltage $I_F = 25$ A, $V_{GS} = 0$		V_{SD}	–	1.5	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	400 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	5.0 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

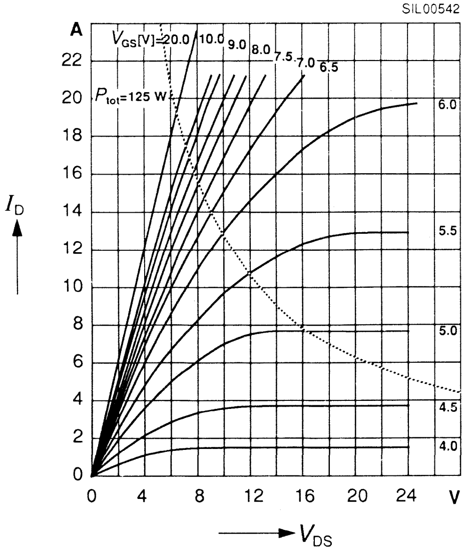
Total power dissipation $P_{tot} = f(T_C)$



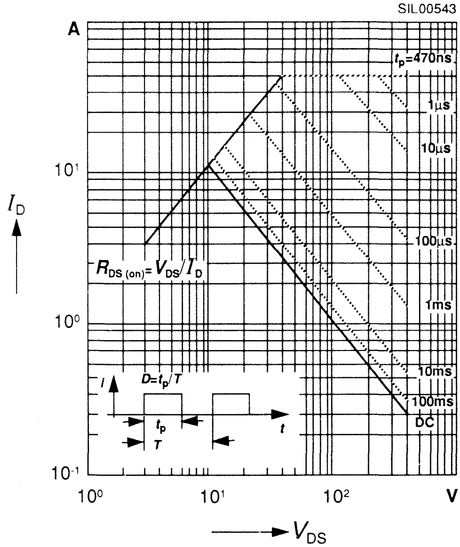
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 325



Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 326

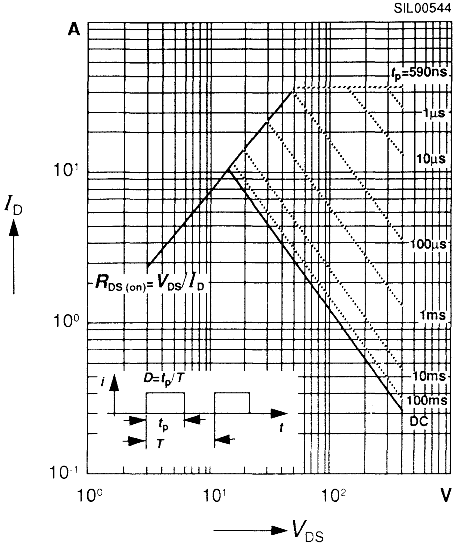


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 325

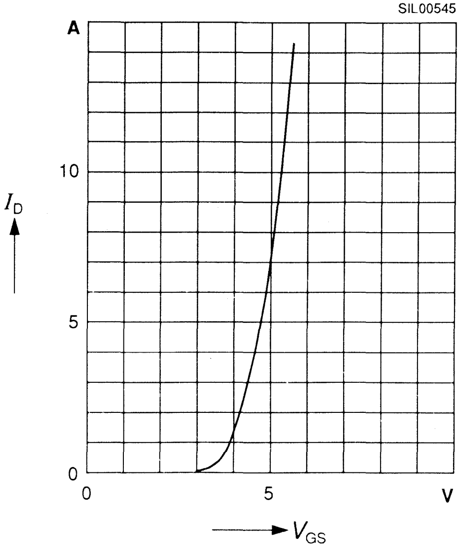


Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C

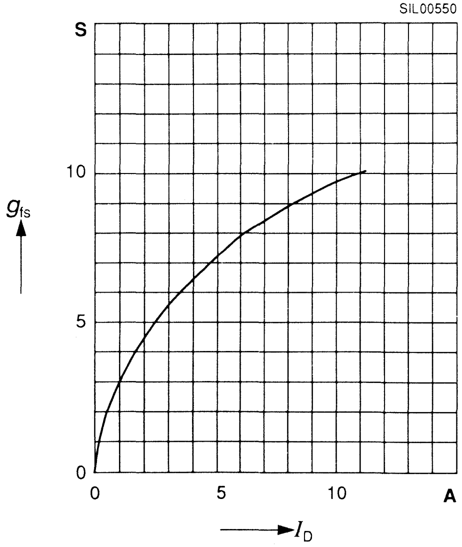
BUZ 326



Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V

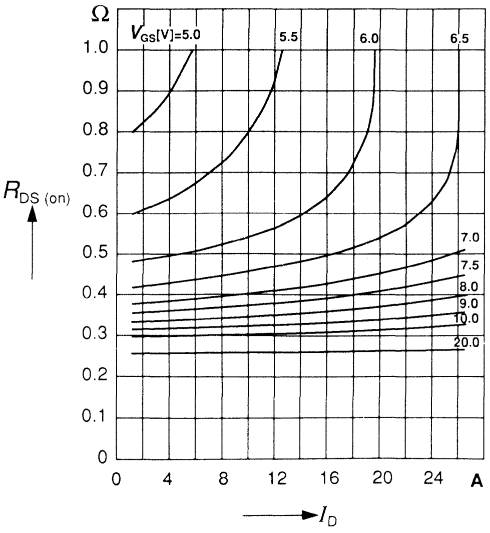


Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



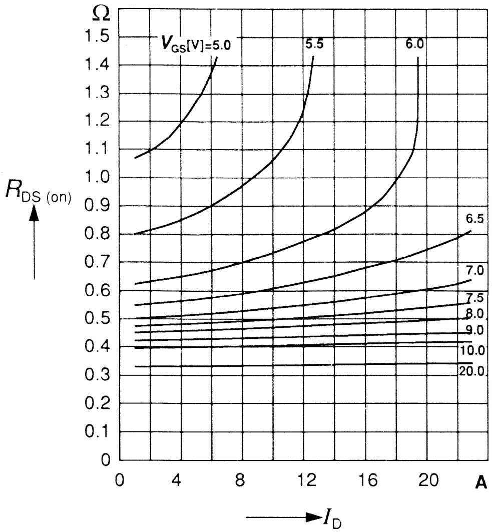
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 325



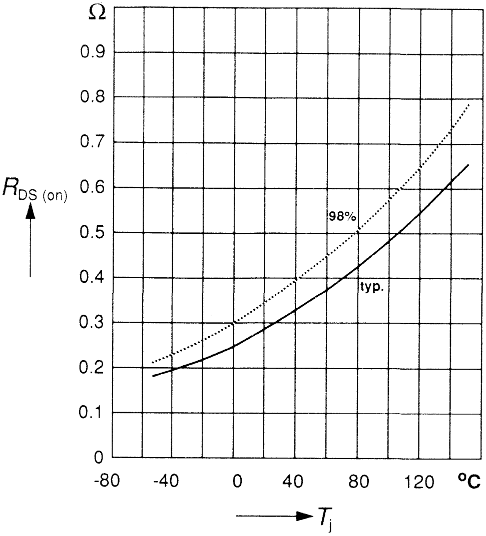
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}

BUZ 326



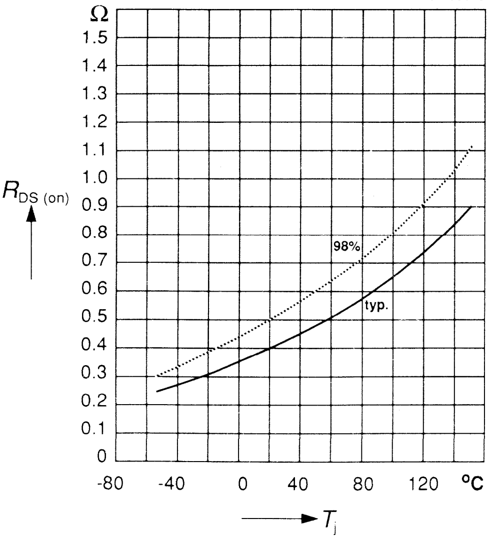
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 8.0 A, V_{GS} = 10 V, (spread)

BUZ 325

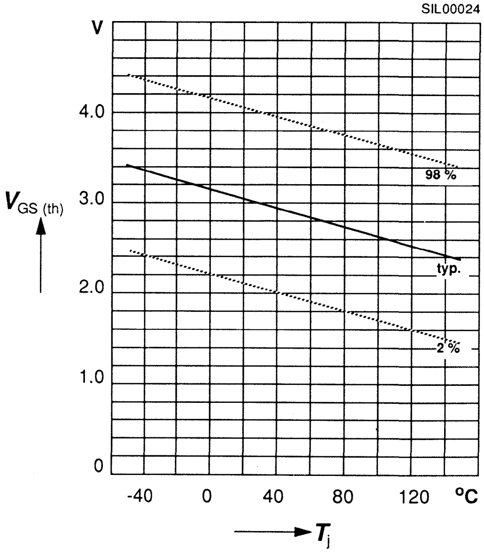


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 8.0 A, V_{GS} = 10 V, (spread)

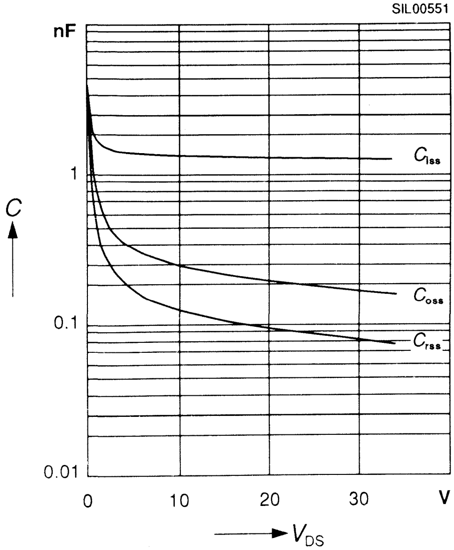
BUZ 326



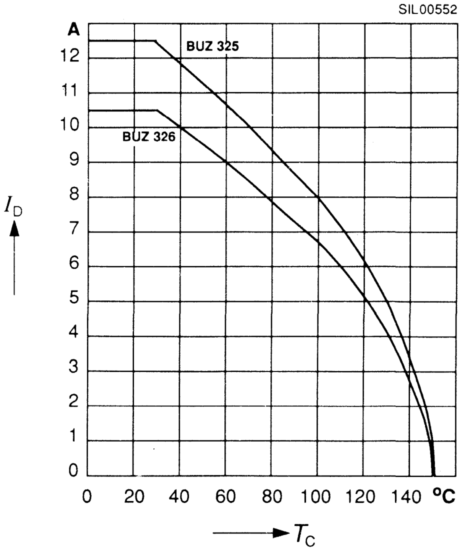
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



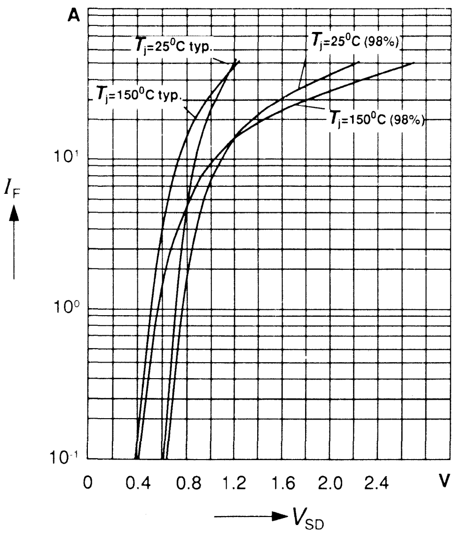
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



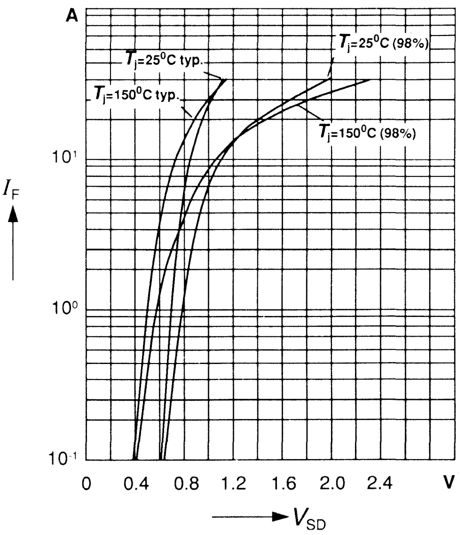
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



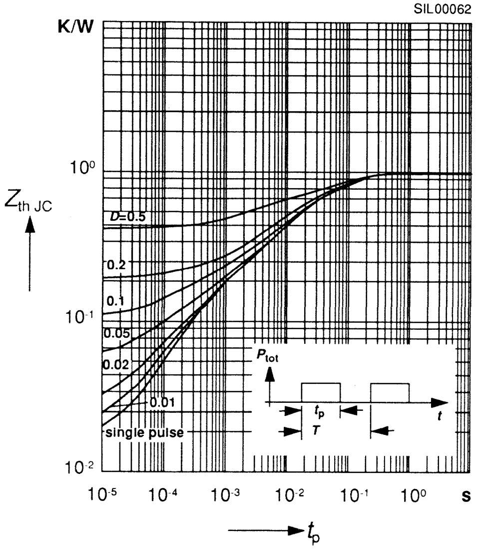
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 325



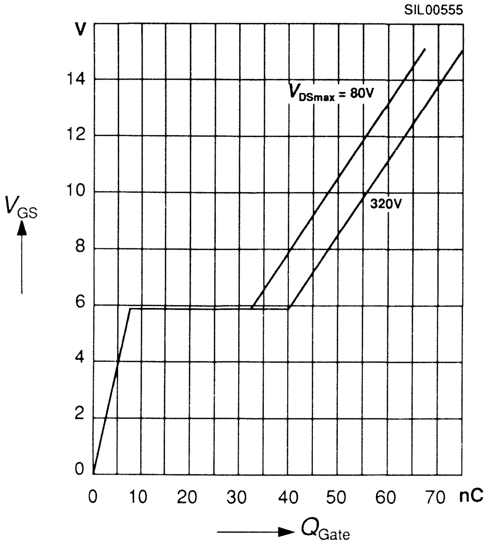
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)
BUZ 326



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 18.75$ A

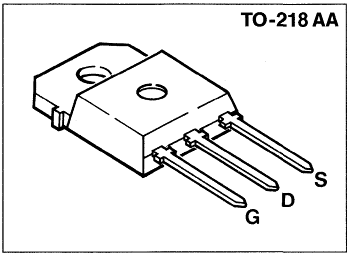


SIPMOS® Power MOS Transistors

BUZ 330
BUZ 331

V_{DS} = 500 V
I_D = 9.5 / 8.0 A
$R_{DS(on)}$ = 0.6 / 0.8 Ω

- N channel
- Enhancement mode
- Package: TO-218 AA (TOP-3) [1]



Type	Ordering code
BUZ 330	C67078-A3105-A2
BUZ 331	C67078-A3114-A2

Maximum Ratings

Parameter	Symbol	BUZ 330	BUZ 331	Unit
Drain-source voltage	V_{DS}	500		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500		
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 30 °C / 35 °C	I_D	9.5	8.0	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	38	32	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125		W
Thermal resistance chip - case chip - ambient, without heat sink	R_{thJC} R_{thJA}	≤ 1.0 ≤ 45		K/W
DIN humidity category, DIN 40 040		E		–
IEC climatic category, DIN IEC 68-1		55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		–	250	
$T_j = 125$ °C		–	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance	$R_{DS(on)}$			Ω
$V_{GS} = 10$ V, $I_D = 6.0$ A BUZ 330		–	0.6	
BUZ 331		–	0.8	

Dynamic characteristics

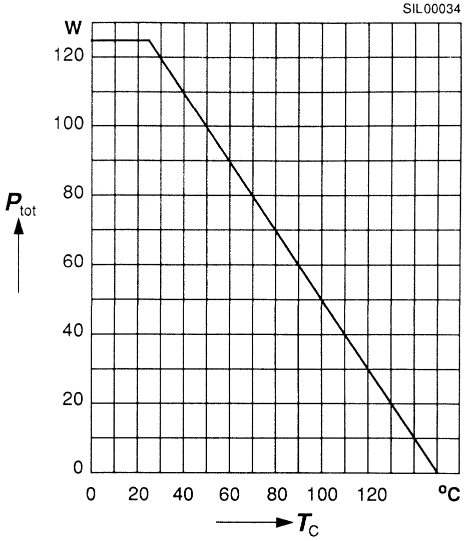
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 6.0$ A	g_{fs}	5.0	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	1800	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	270	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	120	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.8$ A	$t_{d(on)}$	–	40	ns
	t_r	–	70	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50$ Ω, $I_D = 2.8$ A	$t_{d(off)}$	–	310	
	t_f	–	90	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

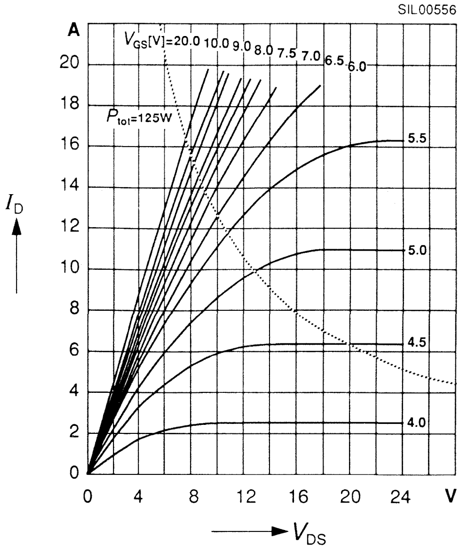
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current $T_C = 25$ °C	 BUZ 330 BUZ 331	I_S	 – –	 9.5 8.0	A
Pulsed reverse drain current $T_C = 25$ °C	 BUZ 330 BUZ 331	I_{SM}	 – –	 38 32	
Diode forward on-voltage $I_F = 19$ A, $V_{GS} = 0$		V_{SD}	 –	 1.4	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		t_{rr}	400 typ.	 –	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs		Q_{rr}	5.0 typ.	 –	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

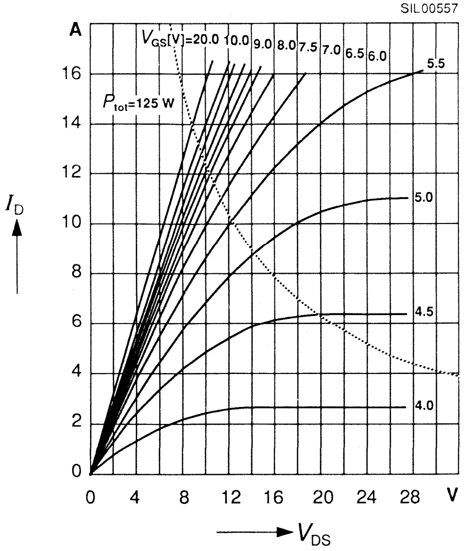
Total power dissipation $P_{tot} = f(T_C)$



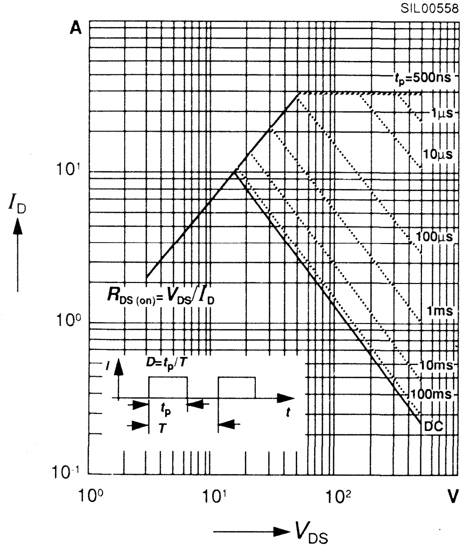
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 330



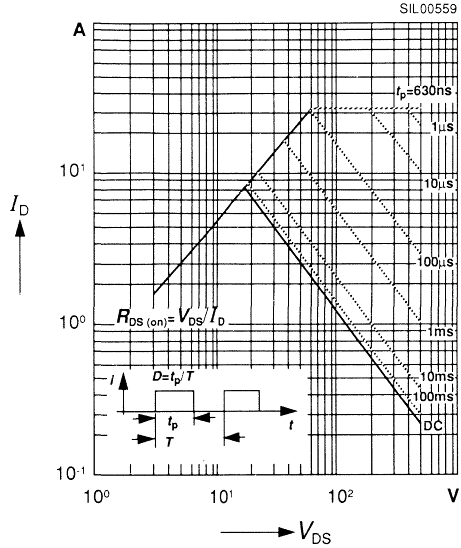
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 331



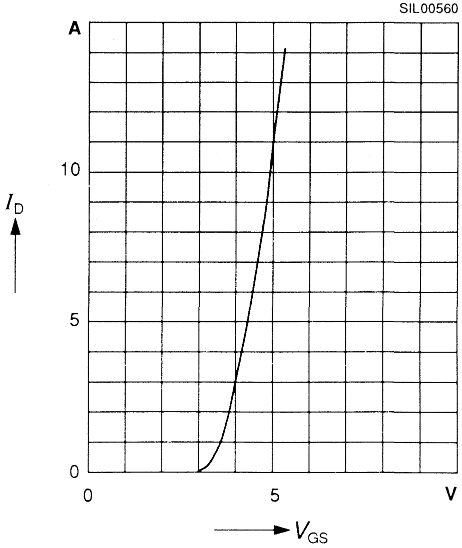
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 330



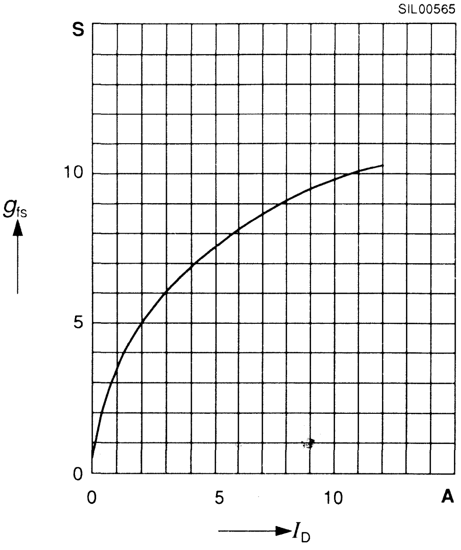
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 331



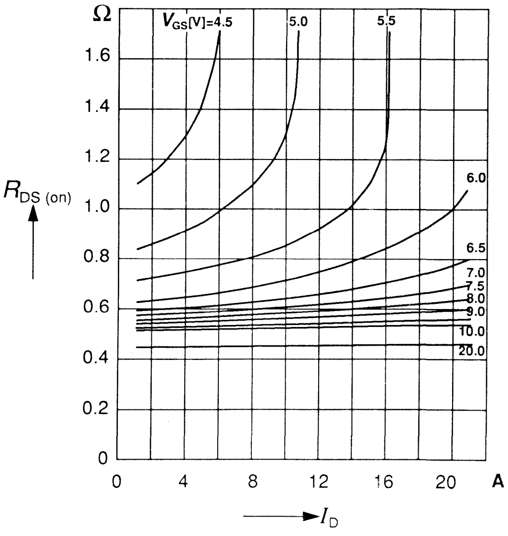
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



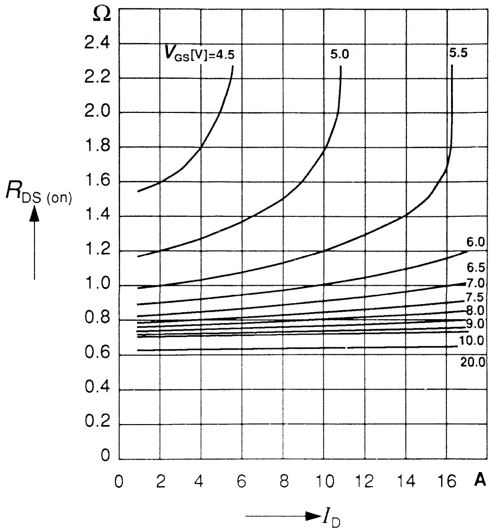
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



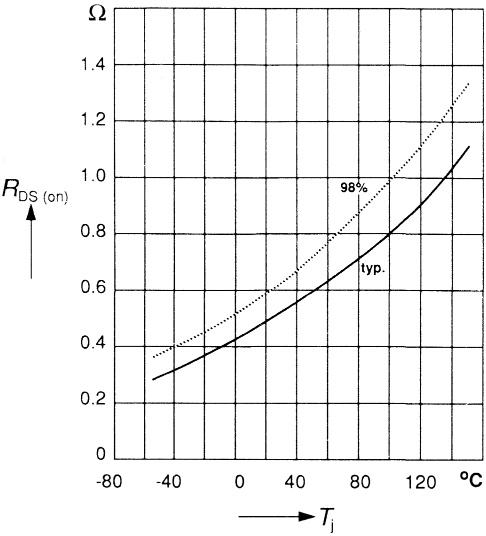
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 330



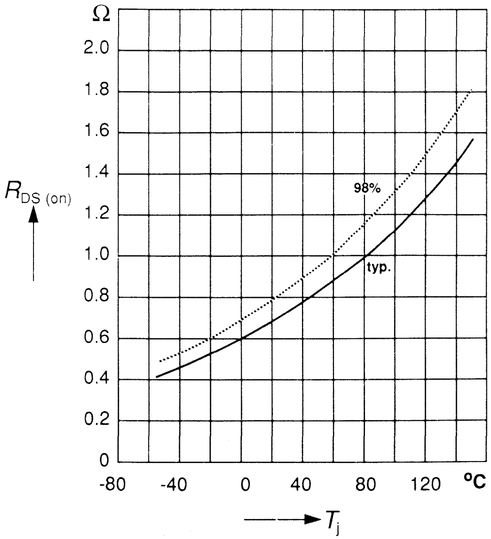
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 331



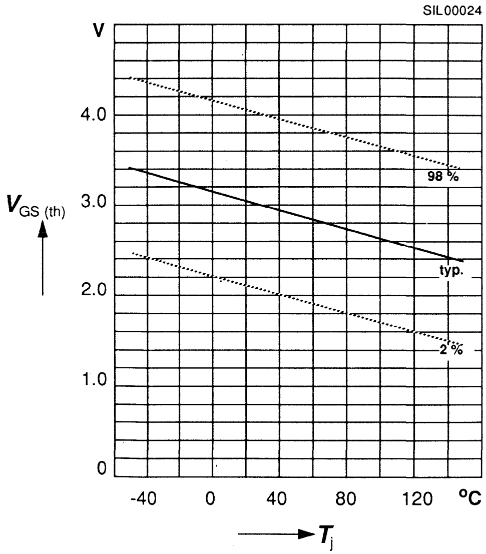
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.6$ A, $V_{GS} = 10$ V, (spread)
BUZ 330



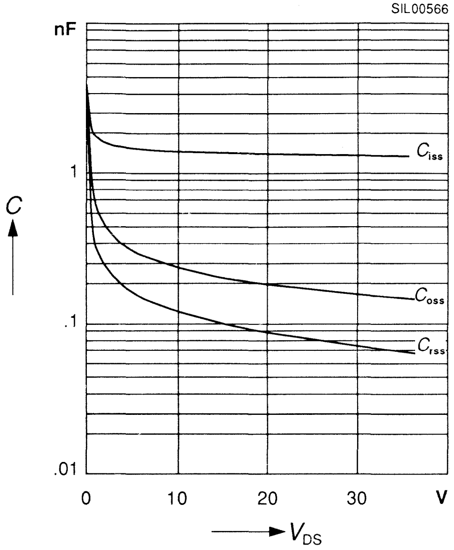
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.6$ A, $V_{GS} = 10$ V, (spread)
BUZ 331



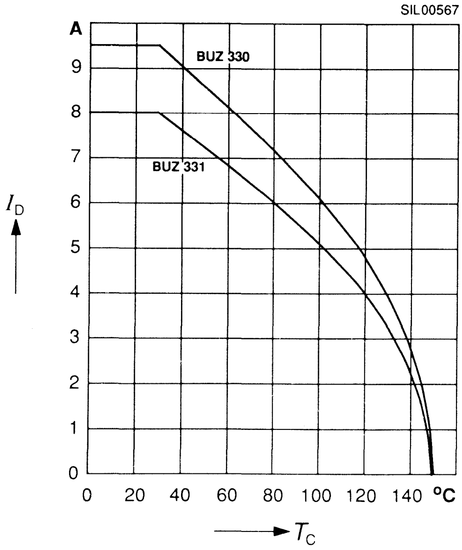
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

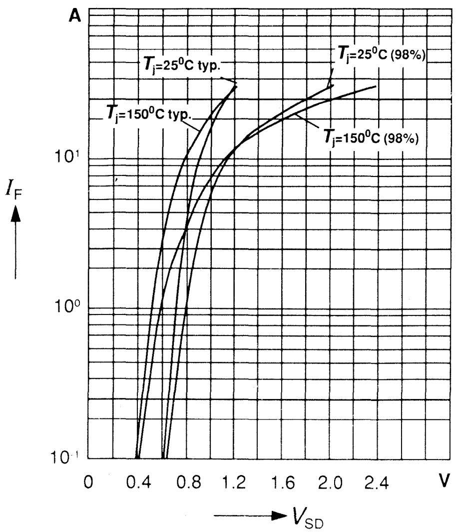


Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



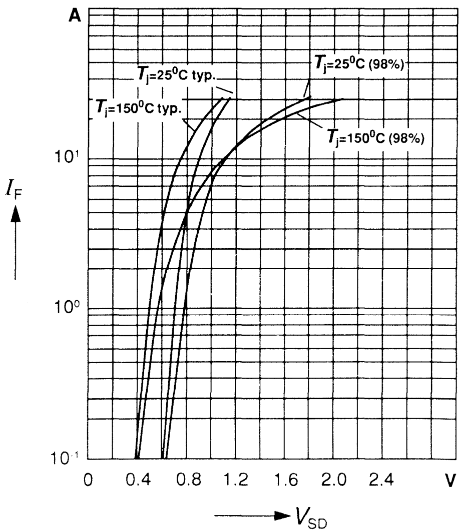
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 330

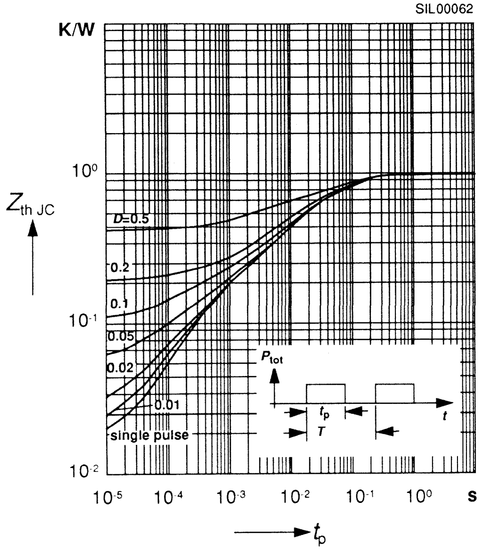


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

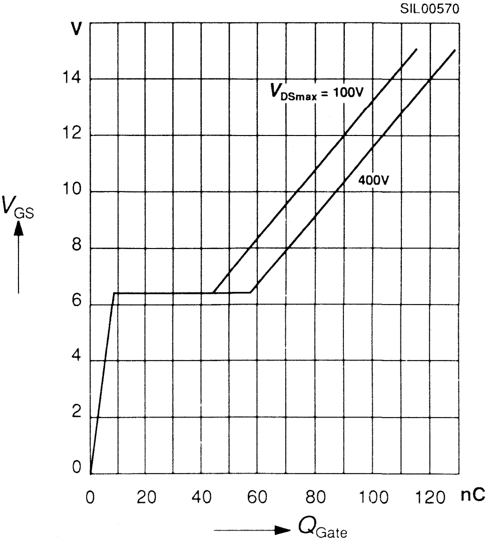
BUZ 331



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 12.8$ A

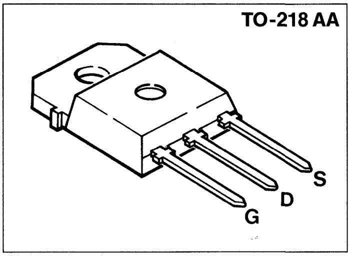


SIPMOS® Power MOS Transistor

BUZ 332 A

V_{DS} = 600 V
I_D = 8.0 A
$R_{DS(on)}$ = 0.9 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA (TOP-3) [1]



Type	Ordering code
BUZ 332 A	C67078-S3123-A4

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	600	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 33$ °C	I_D	8.0	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	32	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	8.0	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	13	mJ
Avalanche energy, single pulse $I_D = 8$ A, $V_{DD} = 50$ V, $R_{GS} = 25$ Ω $L = 16.3$ mH, $T_j = 25$ °C	E_{AS}	570	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	150	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 0.83 ≤ 75	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	600	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 600$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 5.0$ A	$R_{DS(on)}$	-	0.9	Ω

Dynamic characteristics

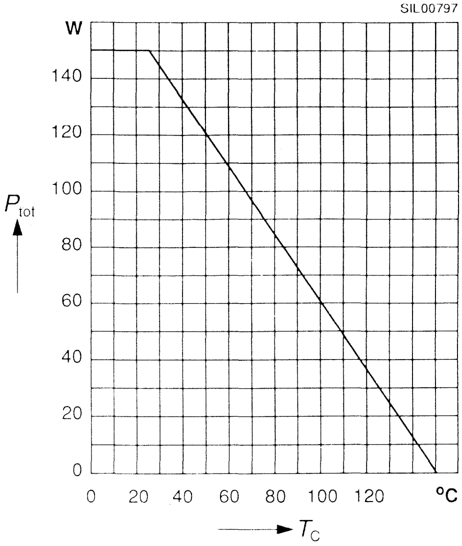
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 5.0$ A	g_{fs}	5.0	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	2100	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	270	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	100	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	30	ns
	t_r	-	110	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.0$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	330	
	t_f	-	100	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

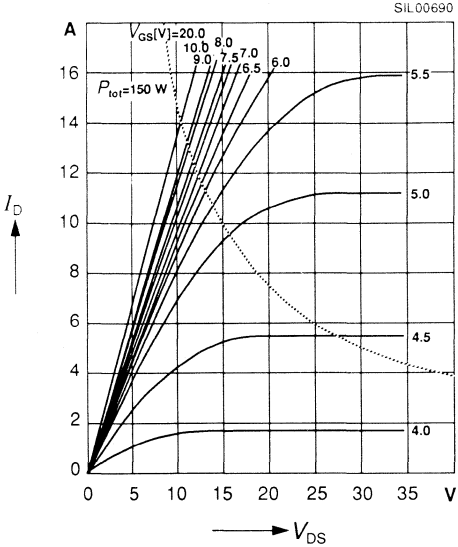
Parameter	**Symbol**	**Values**		**Unit**
		min.	max.	
Reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	8.0	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	32	
Diode forward on-voltage $I_F = 16$ A, $V_{GS} = 0$	V_{SD}	–	1.2	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	1.2 typ.	–	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	6 typ.	–	µC

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

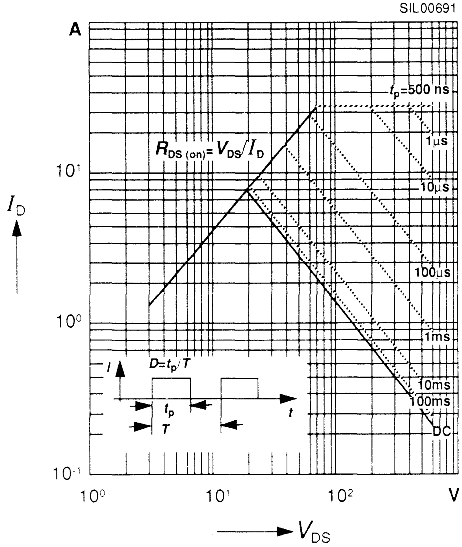
Total power dissipation $P_{tot} = f(T_C)$



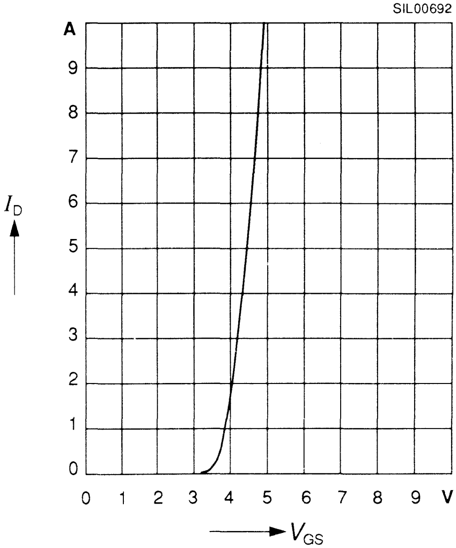
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$



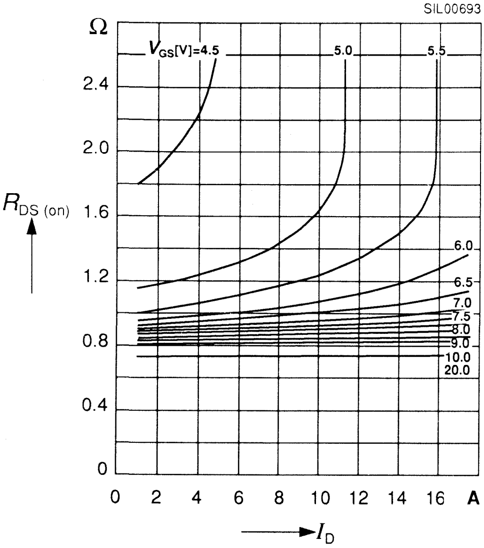
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$



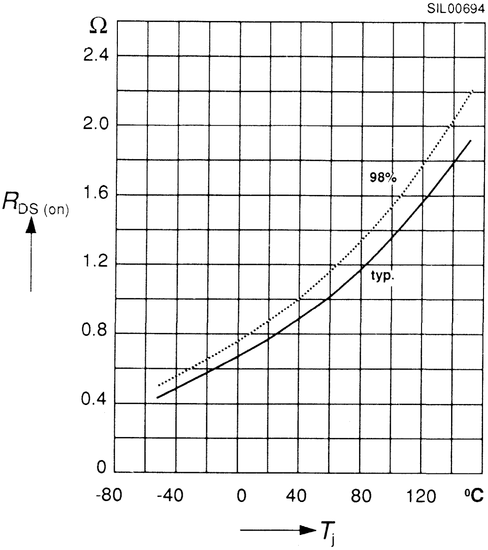
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80\ \mu s$, $V_{DS} = 25$ V



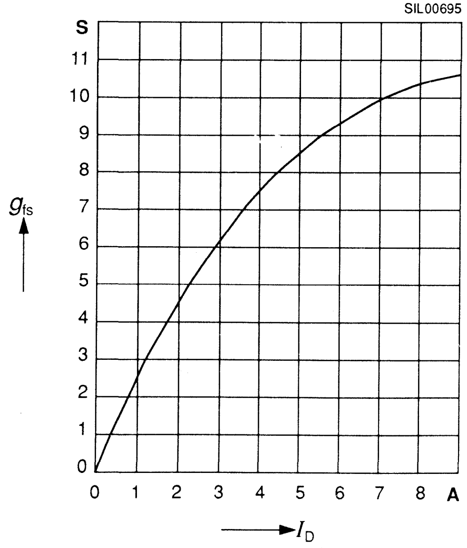
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



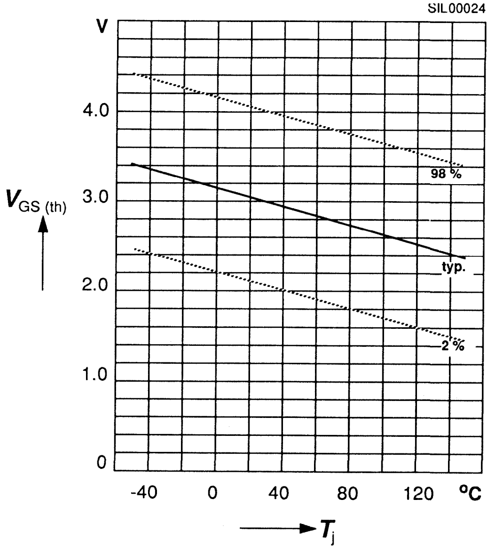
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 5.0$ A, $V_{GS} = 10$ V, (spread)



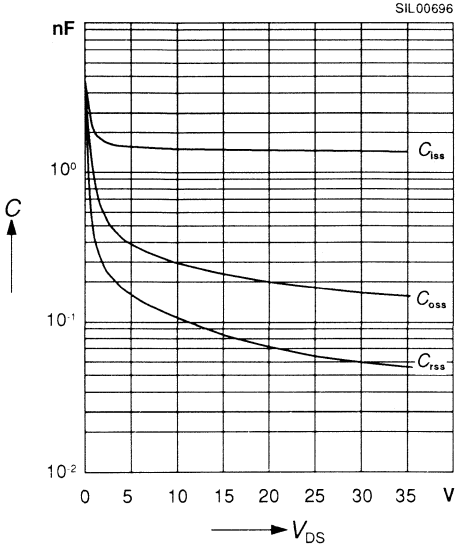
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



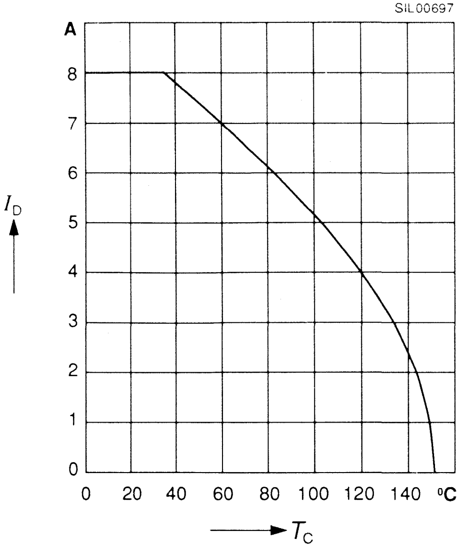
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



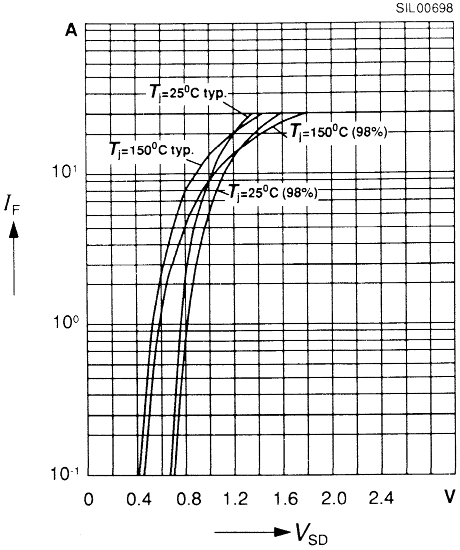
Typ. capacitances $C = f\ (V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



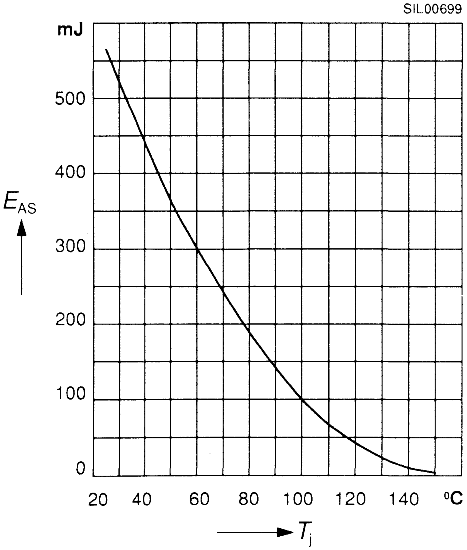
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



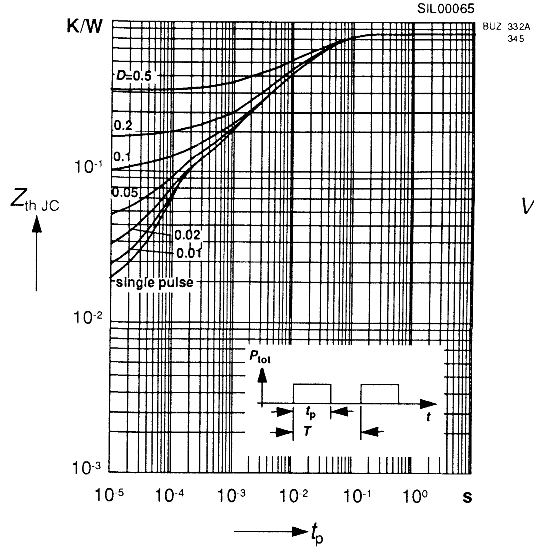
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



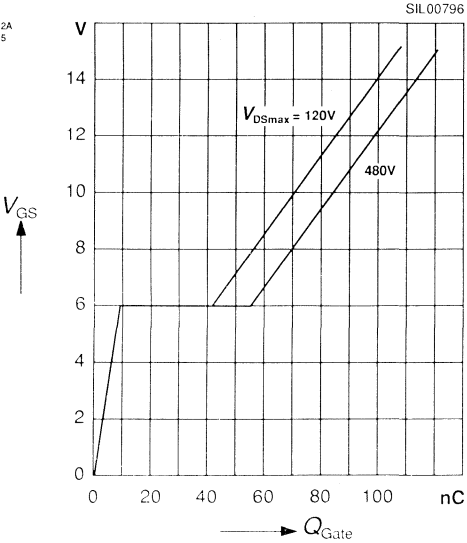
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 8$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 16.3$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 12.0$ A



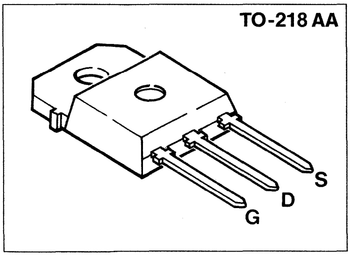
SIEMENS

SIPMOS® Power MOS Transistors

BUZ 338
BUZ 339

V_{DS} = 500 V
I_D = 13.5 / 11.5 A
$R_{DS(on)}$ = 0.4 / 0.5 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA (TOP-3) [1]



Type	Ordering code
BUZ 338	C67078-S3126-A2
BUZ 339	C67078-S3133-A2

Maximum Ratings

Parameter	Symbol	BUZ		Unit
		338	339	
Drain-source voltage	V_{DS}	500		V
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_C = 28 °C / 33 °C	I_D	13.5	11.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	54	46	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	13.5	11.5	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	18	16	mJ
Avalanche energy, single pulse V_{DD} = 50 V, R_{GS} = 25 Ω, T_j = 25 °C I_D = 13.5 A, L = 9.09 mH BUZ 338 I_D = 11.5 A, L = 10.8 mH BUZ 339	E_{AS}	920	790	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Max. power dissipation, T_C = 25 °C	P_{tot}	180	170	W
Thermal resistance				K/W
chip - case	R_{thJC}	≤ 0.7	≤ 0.74	
chip - ambient, without heat sink	R_{thJA}	≤ 45	≤ 75	
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25\ °C$, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	500	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 500$ V, $V_{GS} = 0$ $T_j = 25\ °C$ $T_j = 125\ °C$	I_{DSS}	 – –	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 8.5$ A BUZ 338 $I_D = 7.5$ A BUZ 339	$R_{DS(on)}$	 – –	 0.4 0.5	Ω

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

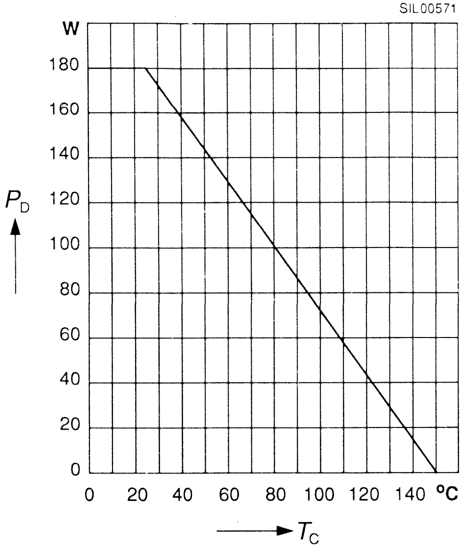
Parameter		Symbol	Values		Unit
			min.	max.	
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 8.5$ A	BUZ 338	g_{fs}	8	–	S
$I_D = 7.5$ A	BUZ 339		8	–	
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 338	C_{iss}	–	3325	pF
	BUZ 339		–	3000	
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 338	C_{oss}	–	480	
	BUZ 339		–	400	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	BUZ 338	C_{rss}	–	180	
	BUZ 339		–	150	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 2.9$ A	BUZ 338	$t_{d(on)}$	–	60	ns
	BUZ 339		–	50	
	BUZ 338	t_r	–	150	
	BUZ 339		–	100	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $R_{GS} = 50\ \Omega$ $I_D = 2.9$ A	BUZ 338	$t_{d(off)}$	–	600	
	BUZ 339		–	680	
		t_f	–	160	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

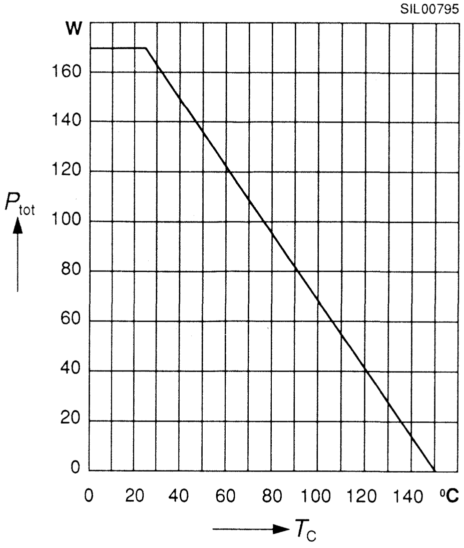
Parameter		Symbol	Values		Unit
			min.	max.	
Reverse diode					
Continuous reverse drain current		I_S			A
T_C = 25 °C	BUZ 338		–	13.5	
	BUZ 339		–	11.5	
Pulsed reverse drain current		I_{SM}			
T_C = 25 °C	BUZ 338		–	54	
	BUZ 339		–	46	
Diode forward on-voltage		V_{SD}			V
I_F = 27 A, V_{GS} = 0	BUZ 338		–	1.5	
I_F = 23 A, V_{GS} = 0	BUZ 339		–	1.5	
Reverse recovery time		t_{rr}			ns
V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	BUZ 338		–	200	
	BUZ 339		–	530	
Reverse recovery charge		Q_{rr}			µC
V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs					
T_j = 25 °C	BUZ 338		–	0.9	
	BUZ 339		–	9.0	
T_j = 150 °C	BUZ 339		–	2.0	
Peak reverse current	BUZ 339	I_{RRM}			A
V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs			10		
T_j = 150 °C			typ.		

Characteristics at $T_j = 25$ °C, unless otherwise specified.

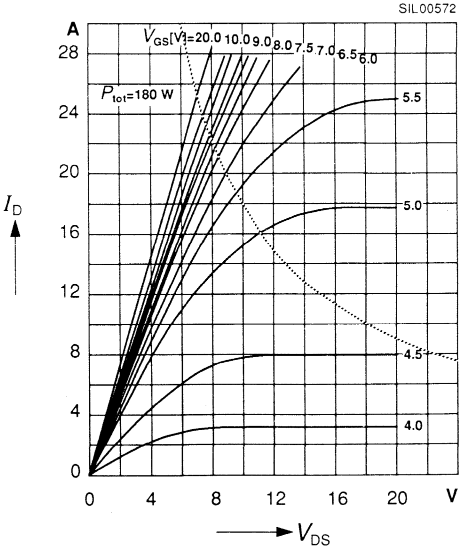
Total power dissipation $P_{tot} = f(T_C)$
BUZ 338



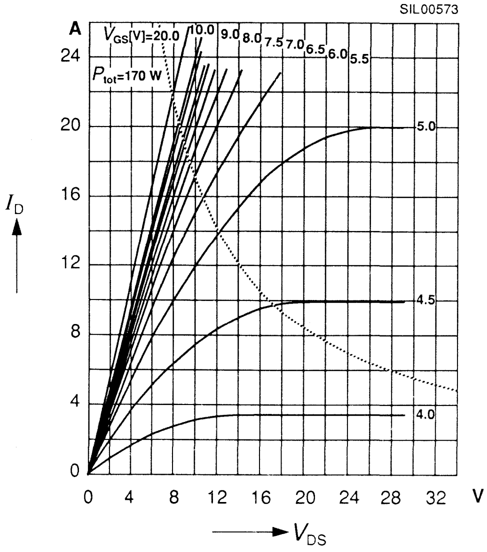
Total power dissipation $P_{tot} = f(T_C)$
BUZ 339



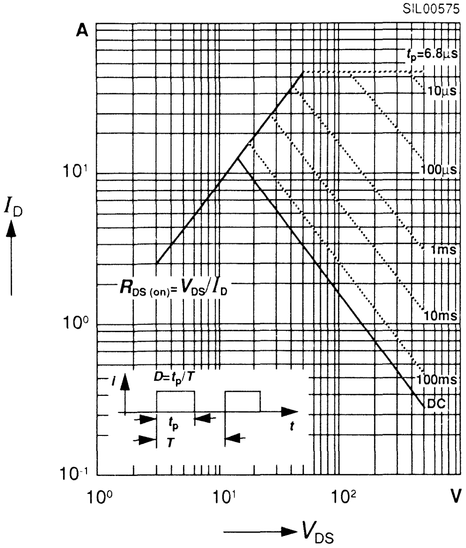
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 338



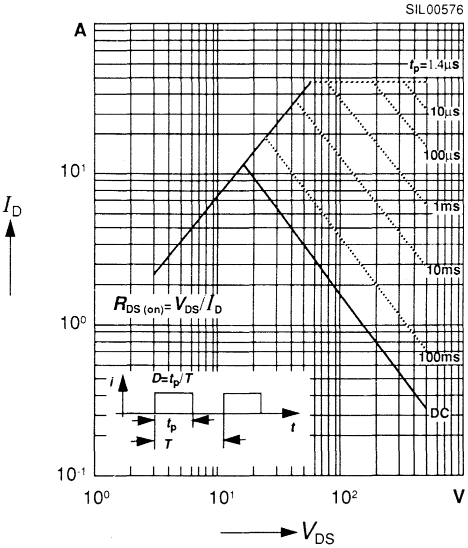
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs
BUZ 339



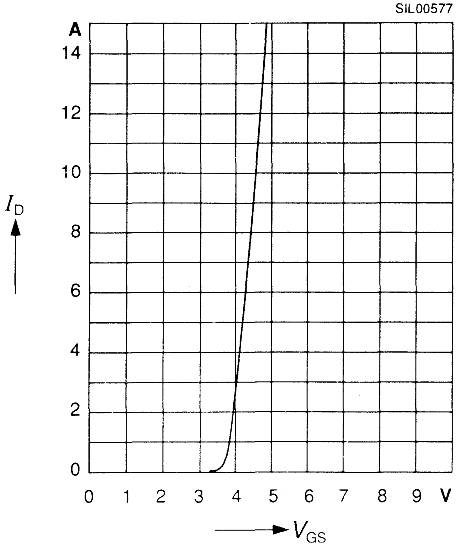
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 338



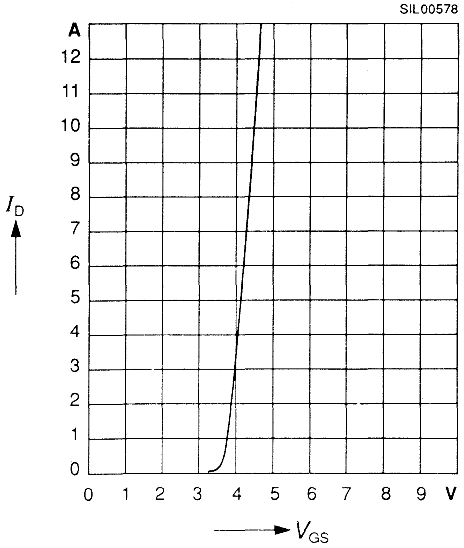
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
BUZ 339



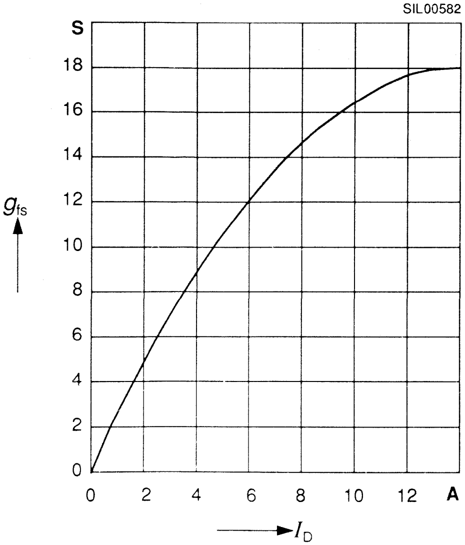
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 338



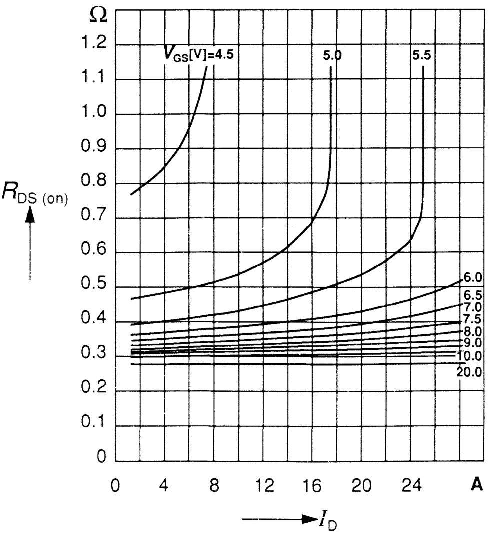
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V
BUZ 339



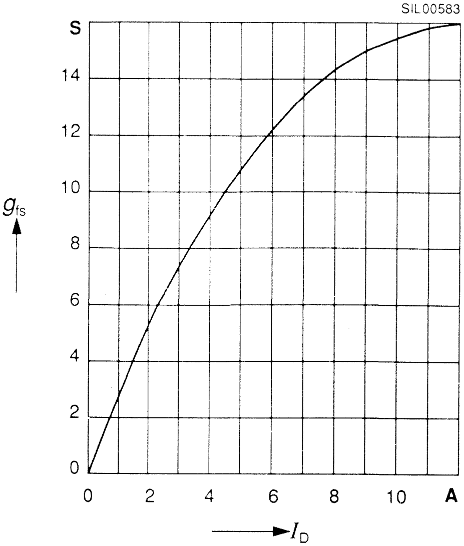
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs
BUZ 338



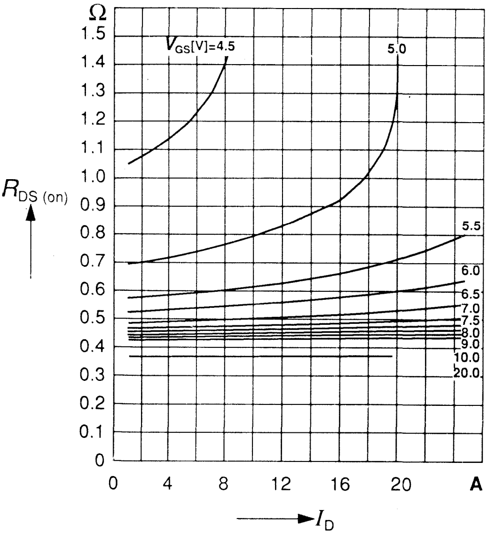
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 338



Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs
BUZ 339

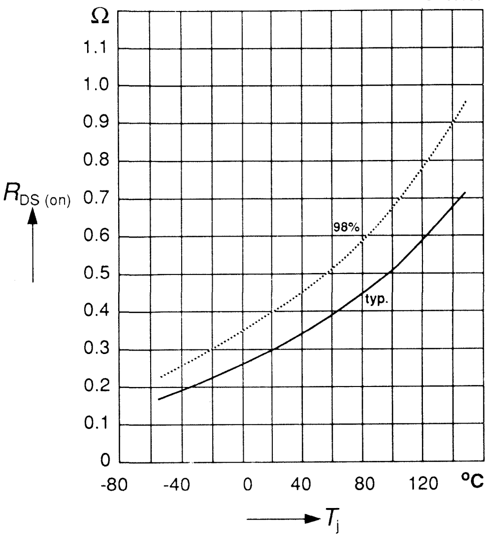


Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
BUZ 339



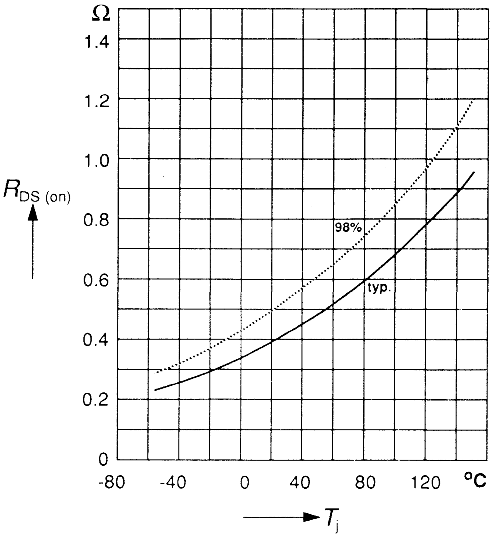
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 8.5$ A, $V_{GS} = 10$ V, (spread)

BUZ 338

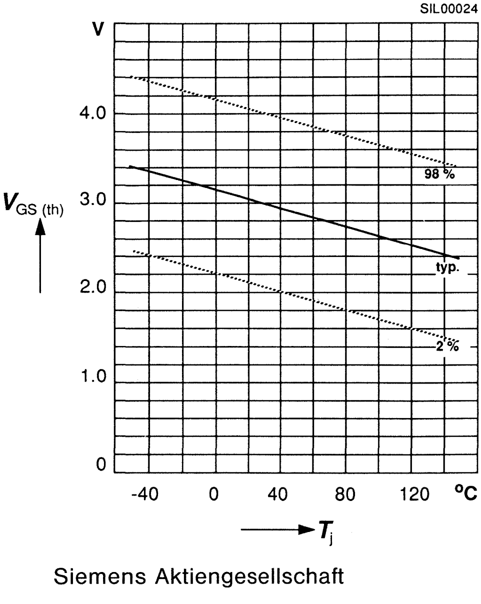


Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 7.5$ A, $V_{GS} = 10$ V, (spread)

BUZ 339

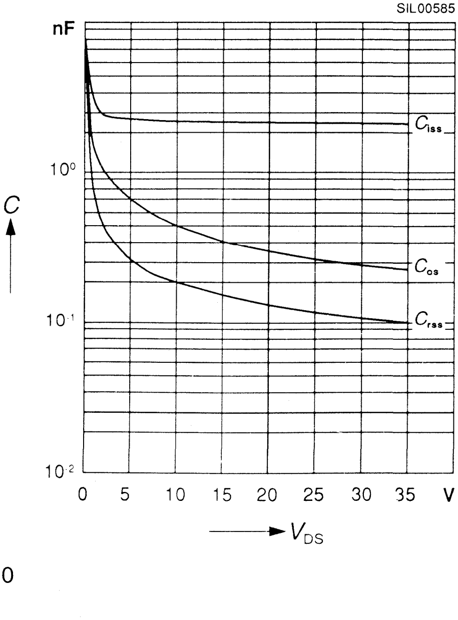


Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA, (spread)



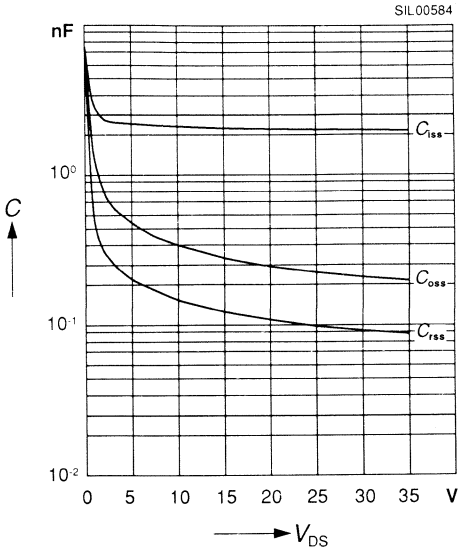
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

BUZ 338



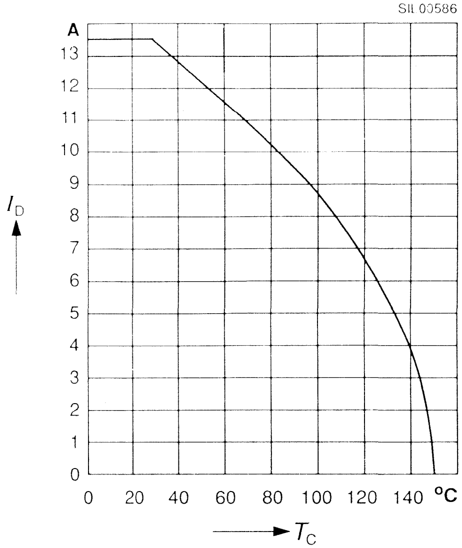
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

BUZ 339



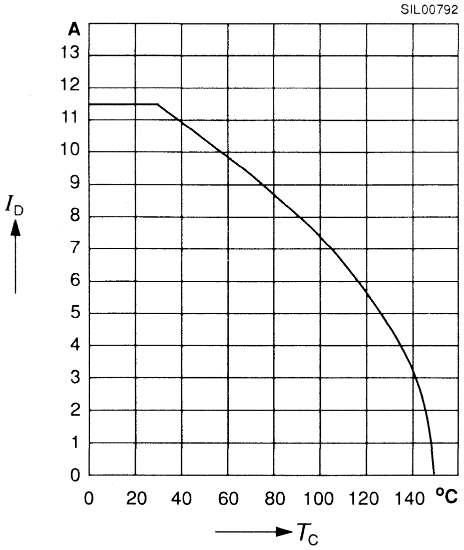
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V

BUZ 338



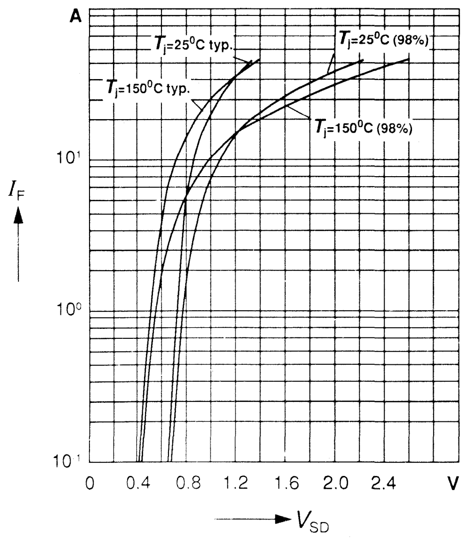
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V

BUZ 339



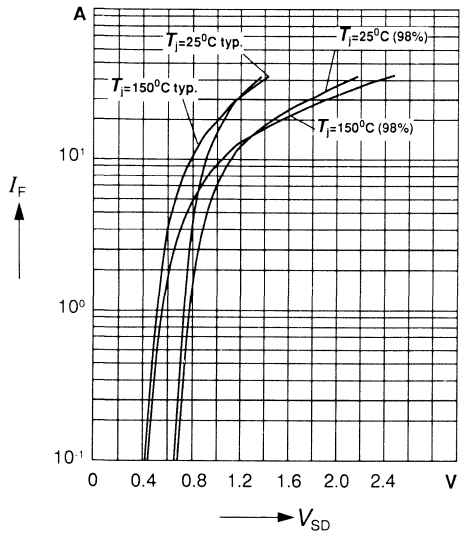
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)

BUZ 338



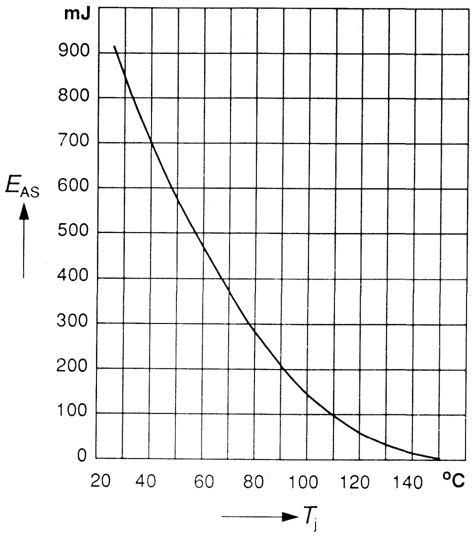
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80\ \mu s$, (spread)

BUZ 339



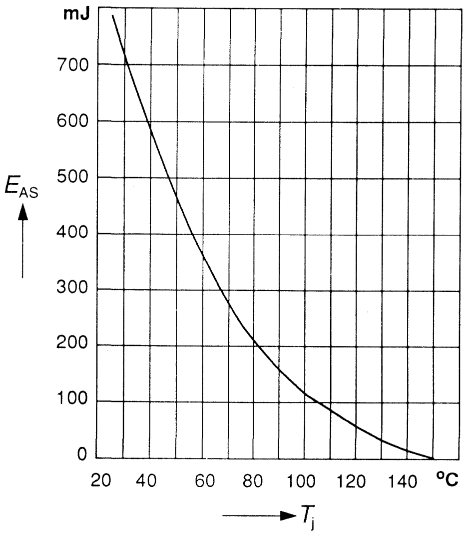
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 13.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 9.09$ mH

BUZ 338

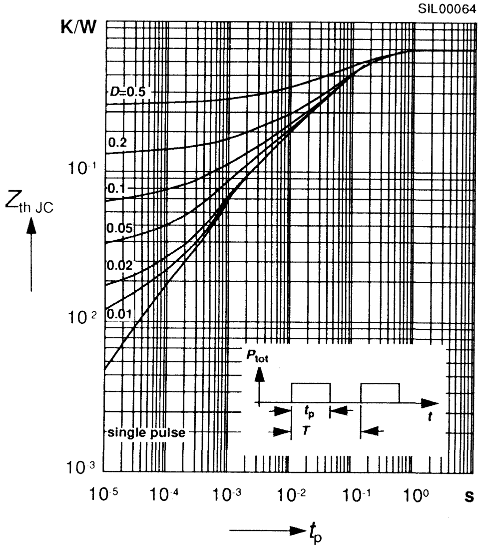


Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 11.5$ A, $V_{DD} = 50$ V,
$R_{GS} = 25\ \Omega$, $L = 10.8$ mH

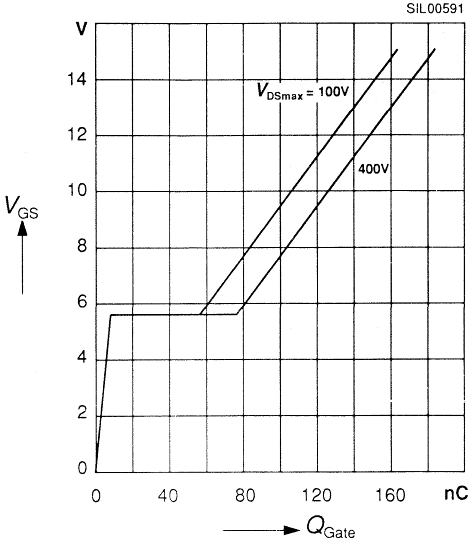
BUZ 339



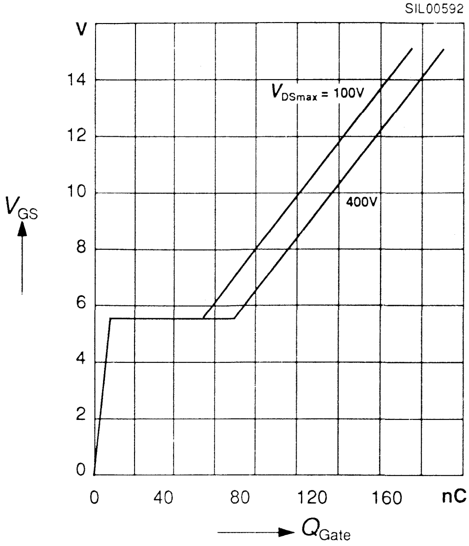
Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 17.3$ A
BUZ 338



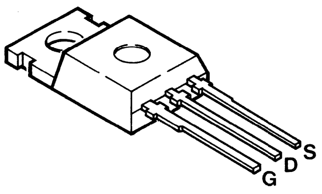
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 17.3$ A
BUZ 339



SIPMOS® Power MOS Transistor **BUZ 341**

V_{DS} = 200 V
I_D = 33 A
$R_{DS(on)}$ = 0.07 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA (TOP-3) [1]



TO-218 AA

Type	Ordering code
BUZ 341	C67078-S3128-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	200	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 28 °C	I_D	33	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	132	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	33	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	16	mJ
Avalanche energy, single pulse I_D = 33 A, V_{DD} = 50 V, R_{GS} = 25 Ω L = 1.09 mH, T_j = 25 °C	E_{AS}	790	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	170	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 0.74 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	200	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 200$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 21$ A	$R_{DS(on)}$	–	0.07	Ω

Dynamic characteristics

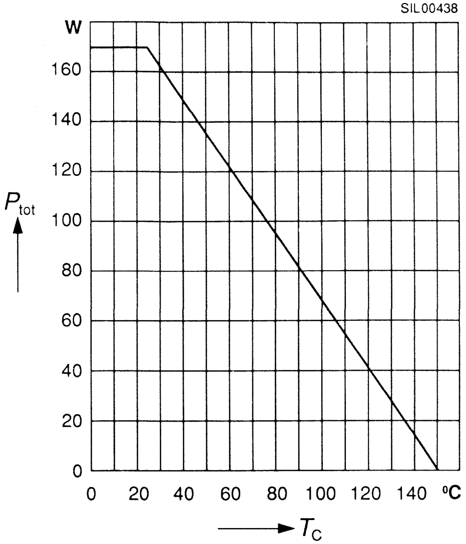
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 21$ A	g_{fs}	15	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	3900	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	750	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	350	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	60	ns
	t_r	–	170	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	680	
	t_f	–	240	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

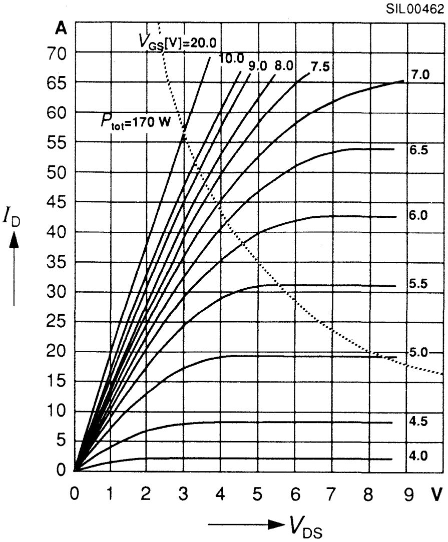
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	33	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	132	
Diode forward on-voltage $I_F = 66$ A, $V_{GS} = 0$	V_{SD}	–	1.6	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	100 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.3 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

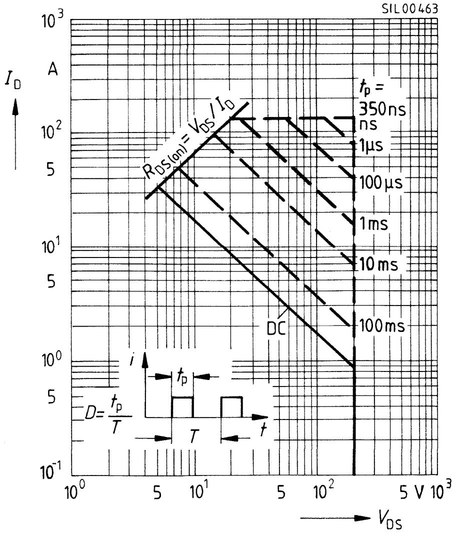
Total power dissipation $P_{tot} = f(T_C)$



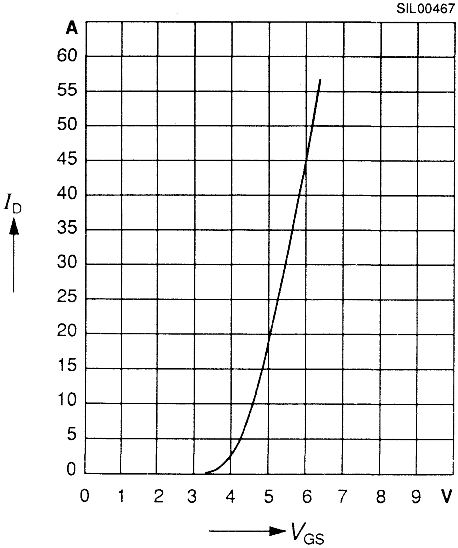
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



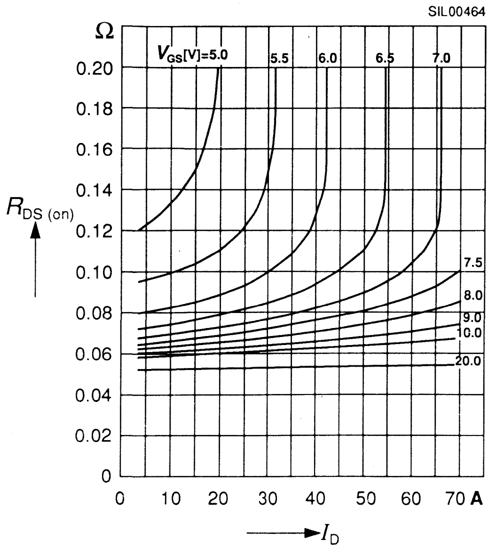
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



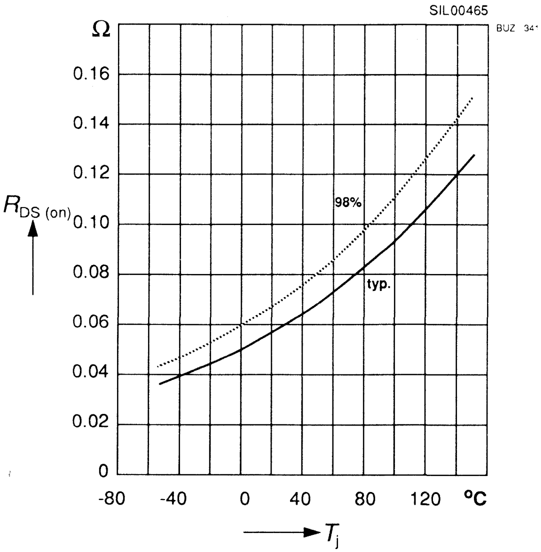
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



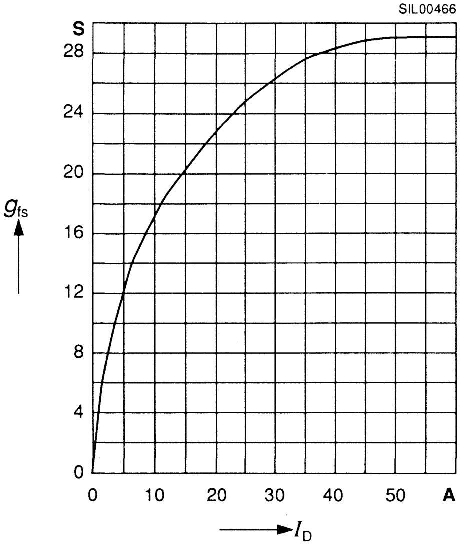
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



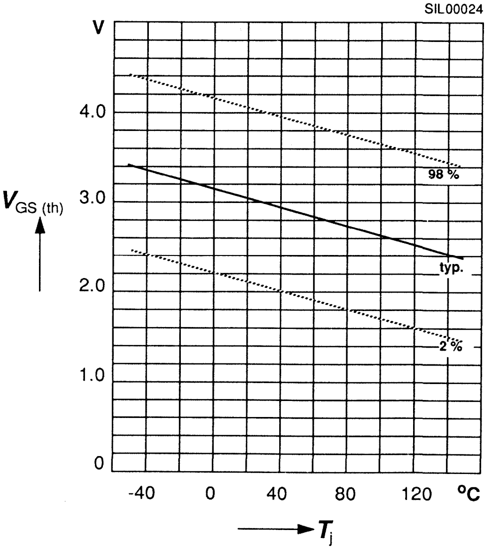
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 21 A, V_{GS} = 10 V, (spread)



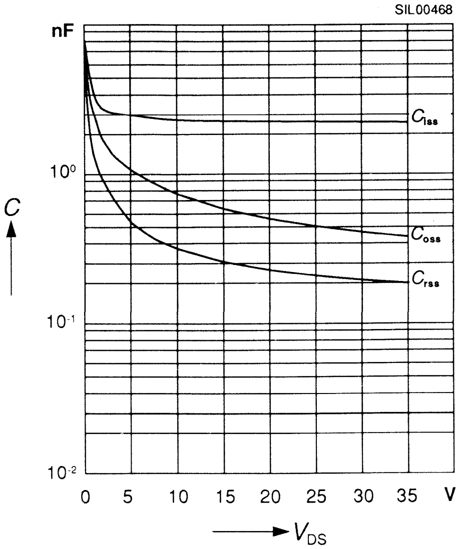
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



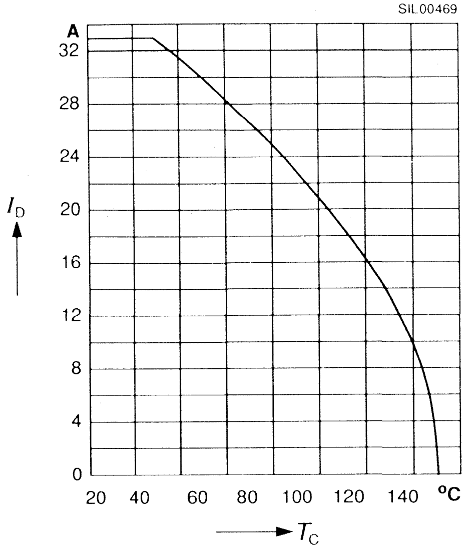
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



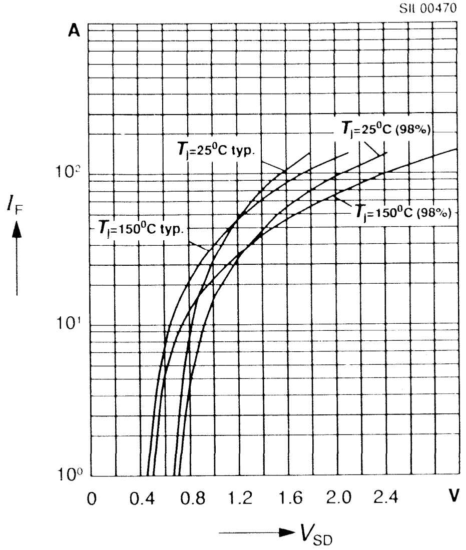
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



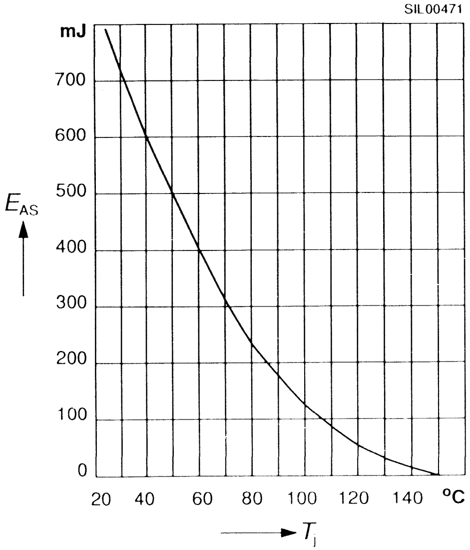
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



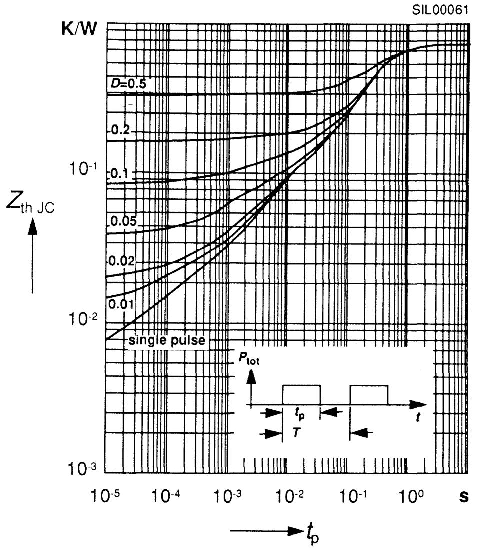
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



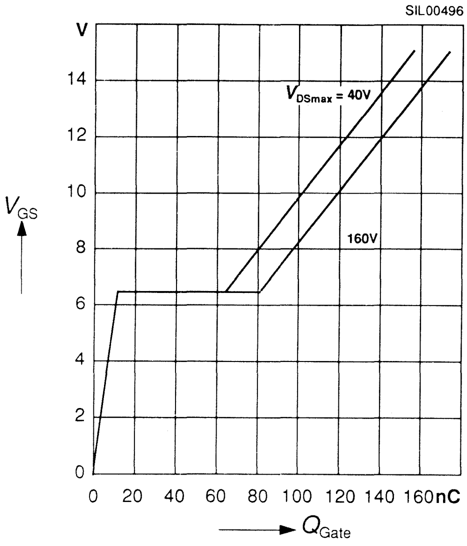
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 33$ A, $V_{DD} = 50$ V,
$R_{GS} = 25$ Ω, $L = 1.09$ mH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 49.5$ A



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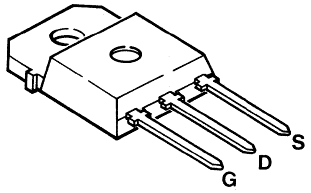
SIPMOS® Power MOS Transistor

BUZ 345

V_{DS} = 100 V
I_D = 41 A
$R_{DS(on)}$ = 0.045 Ω

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA (TOP-3) [1]

TO-218 AA



Type	Ordering code
BUZ 345	C67078-S3121-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 28$ °C	I_D	41	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	164	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	41	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	18	mJ
Avalanche energy, single pulse $I_D = 41$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 249.9$ µH, $T_j = 25$ °C	E_{AS}	280	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	150	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 0.83 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 100	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 26$ A	$R_{DS(on)}$	-	0.045	Ω

Dynamic characteristics

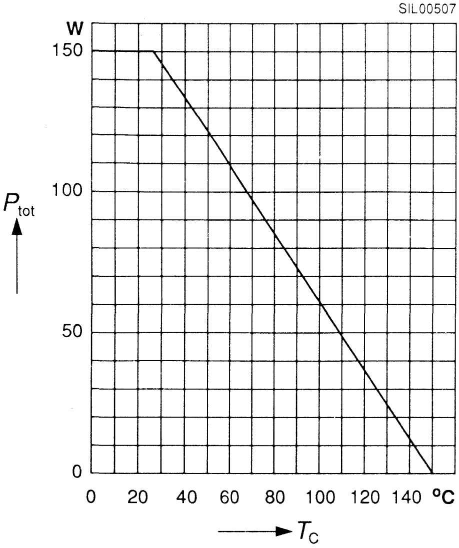
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 26$ A	g_{fs}	10	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	2700	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	840	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	400	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	45	ns
	t_r	-	165	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	390	
	t_f	-	195	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

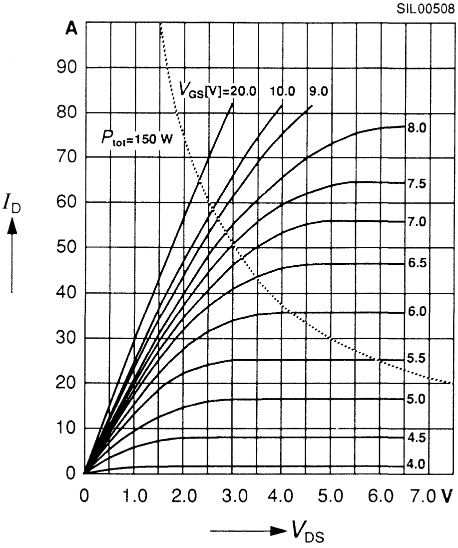
Parameter	Symbol	Values		Unit
		min.	max.	
Reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	41	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	164	
Diode forward on-voltage $I_F = 82$ A, $V_{GS} = 0$	V_{SD}	–	1.8	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	80 typ.	-	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.1 typ.	-	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

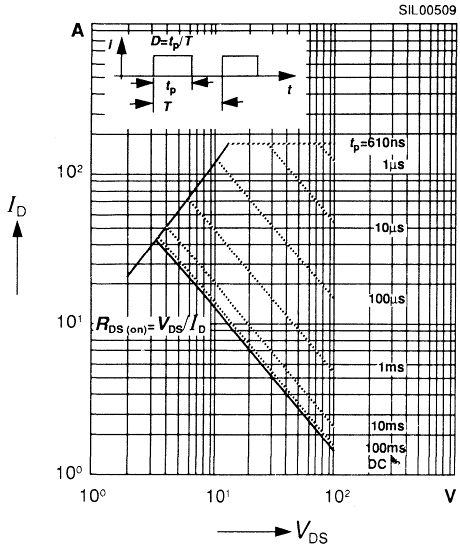
Total power dissipation $P_{tot} = f(T_C)$



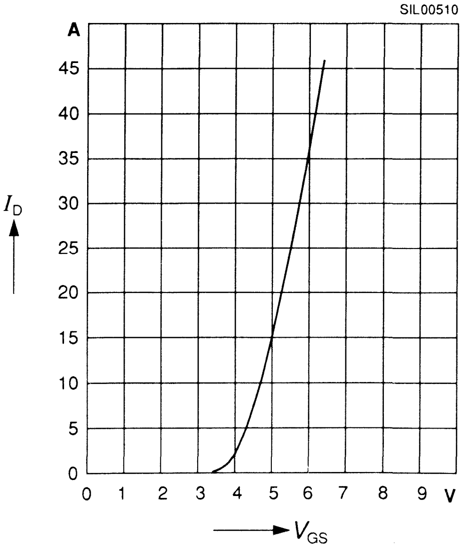
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



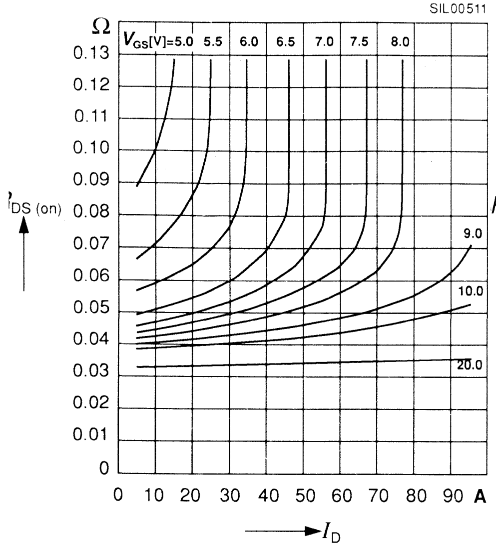
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



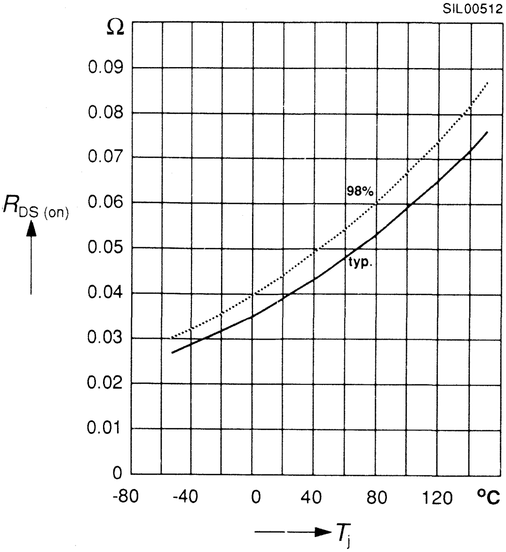
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



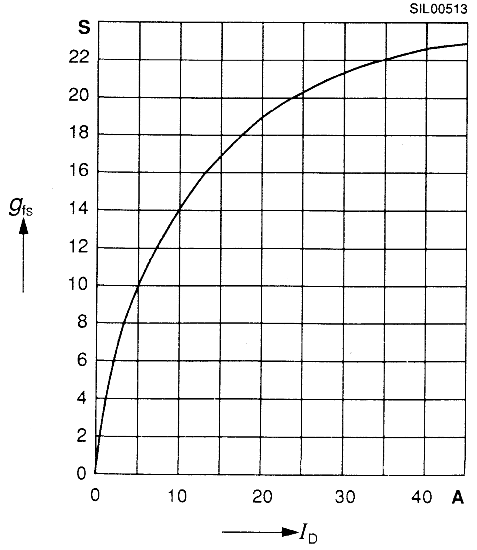
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



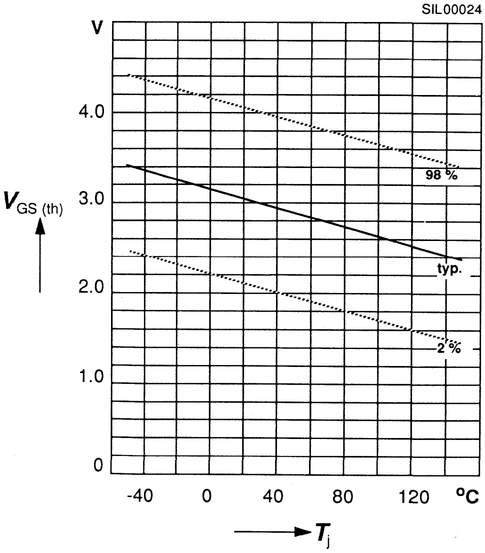
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 26 A, V_{GS} = 10 V, (spread)



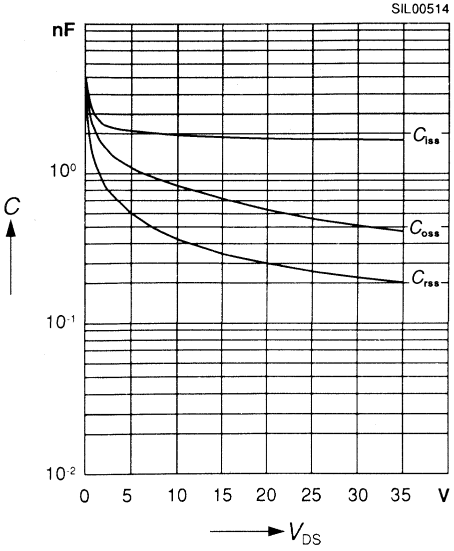
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



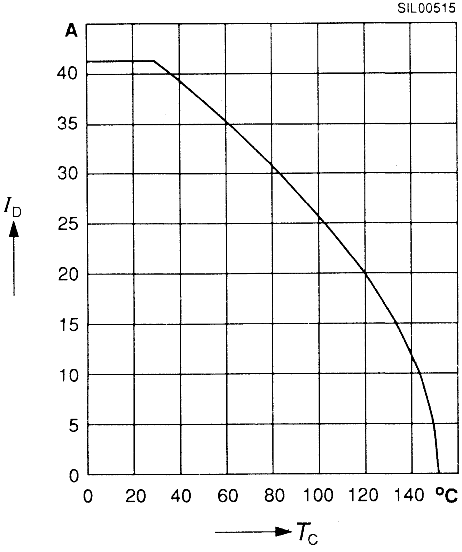
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



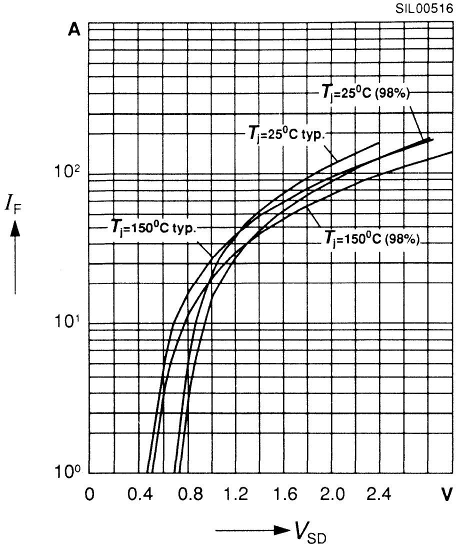
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



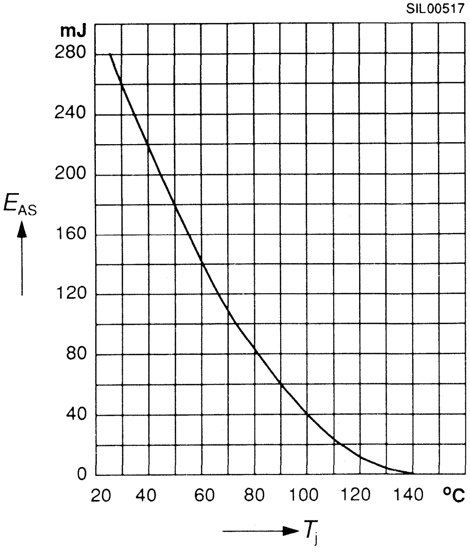
Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V



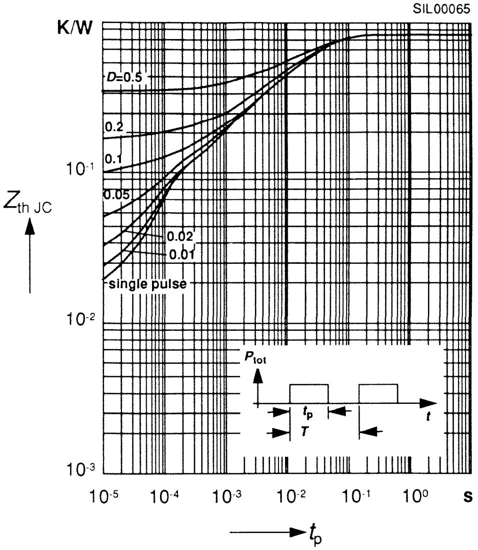
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



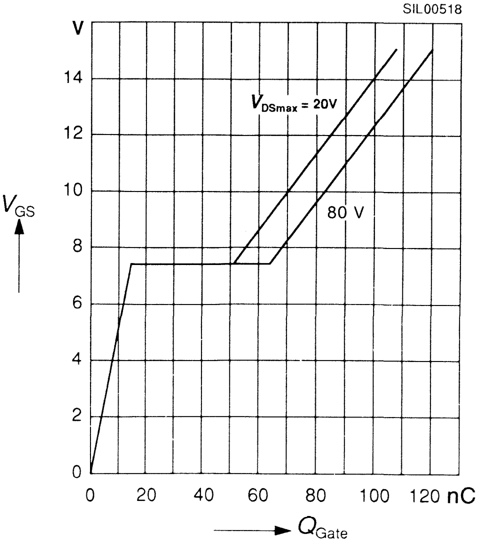
Avalanche energy $E_{AS} = f(T_j)$
parameter: $I_D = 41$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 249.9$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls} = 61.5$ A



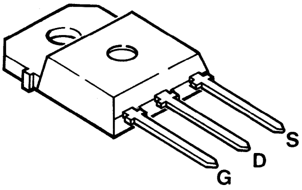
SIEMENS

SIPMOS® Power MOS Transistor BUZ 349

V_{DS} = **100 V**
I_D = **32 A**
$R_{DS(on)}$ = **0.06 Ω**

- N channel
- Enhancement mode
- Avalanche-proof
- Package: TO-218 AA (TOP-3) [1])

TO-218 AA



Type	Ordering code
BUZ 349	C67078-S3113-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	100	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, $T_C = 27$ °C	I_D	32	A
Pulsed drain current, $T_C = 25$ °C	$I_{D\ puls}$	128	
Avalanche current, limited by $T_{j\ max}$	I_{AR}	32	
Avalanche energy, periodic limited by $T_{j\ (max)}$	E_{AR}	15	mJ
Avalanche energy, single pulse $I_D = 32$ A, $V_{DD} = 25$ V, $R_{GS} = 25$ Ω $L = 322$ µH, $T_j = 25$ °C	E_{AS}	220	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, $T_C = 25$ °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1]) See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	100	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 100$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	 - -	 1.0 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 21$ A	$R_{DS(on)}$	-	0.06	Ω

Dynamic characteristics

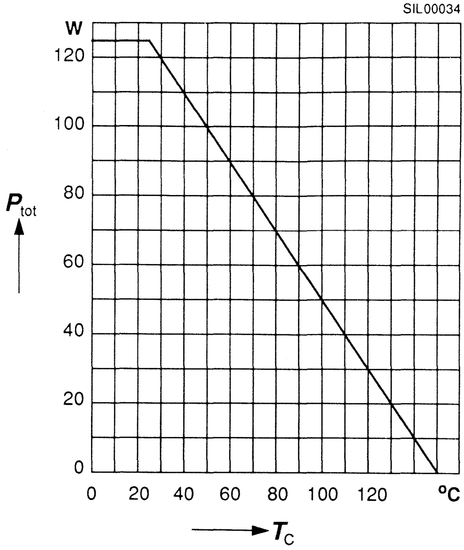
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 21$ A	g_{fs}	10	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	1850	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	700	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	370	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	45	ns
	t_r	-	125	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 3$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	320	
	t_f	-	160	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

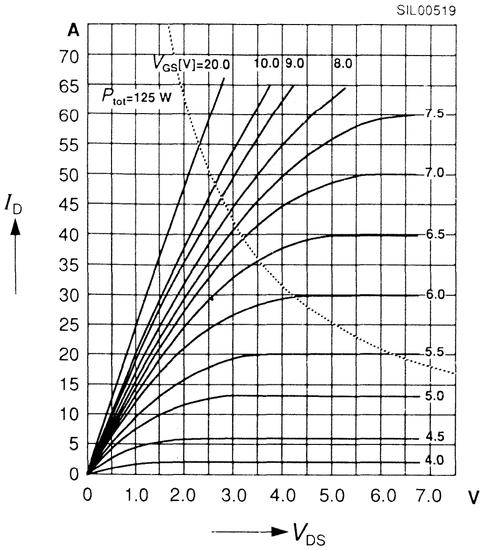
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	32	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	128	
Diode forward on-voltage $I_F = 64$ A, $V_{GS} = 0$	V_{SD}	–	1.8	V
Reverse recovery time $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	200 typ.	–	ns
Reverse recovery charge $V_R = 30$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	0.25 typ.	–	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

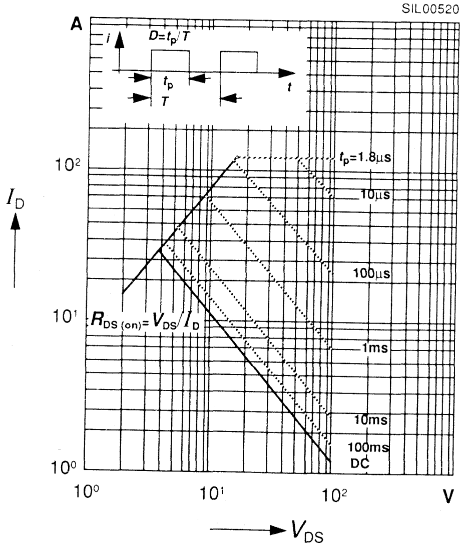
Total power dissipation $P_{tot} = f(T_C)$



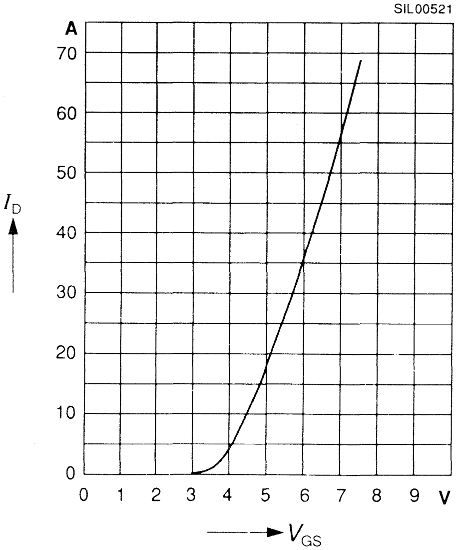
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



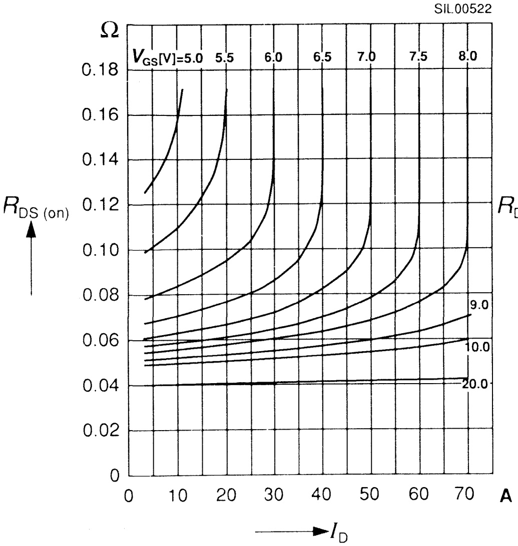
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



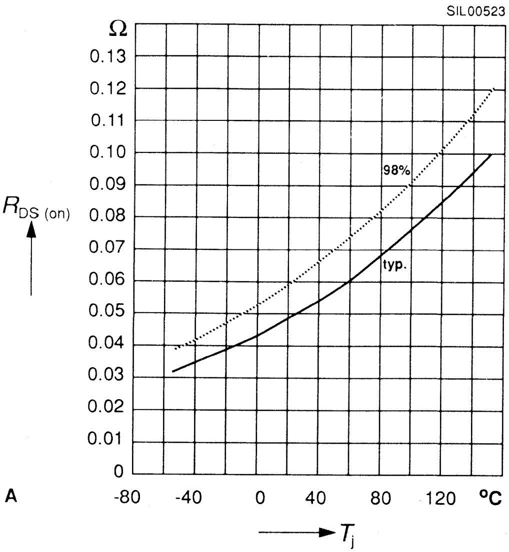
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



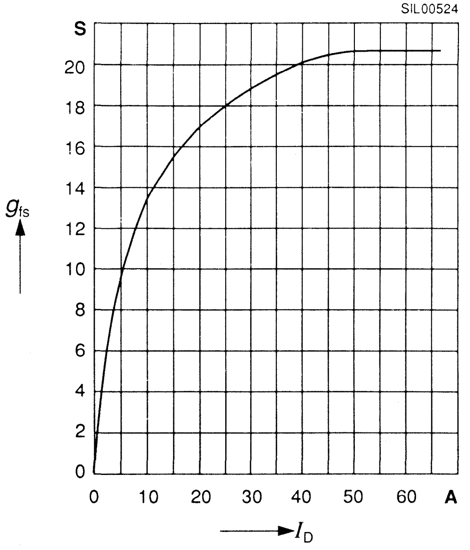
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



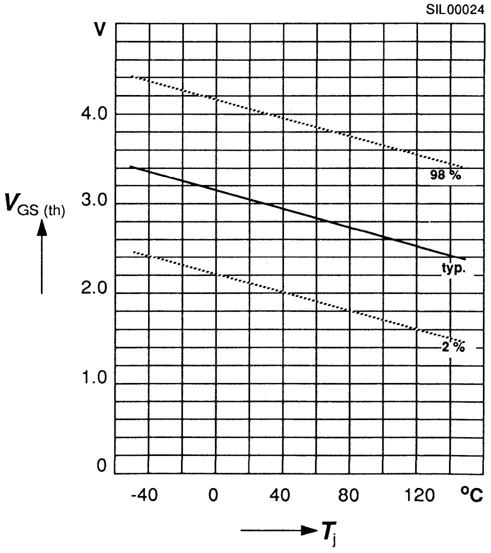
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 21 A, V_{GS} = 10 V, (spread)



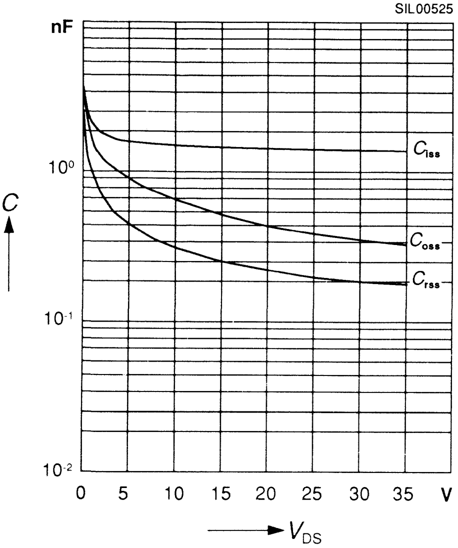
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



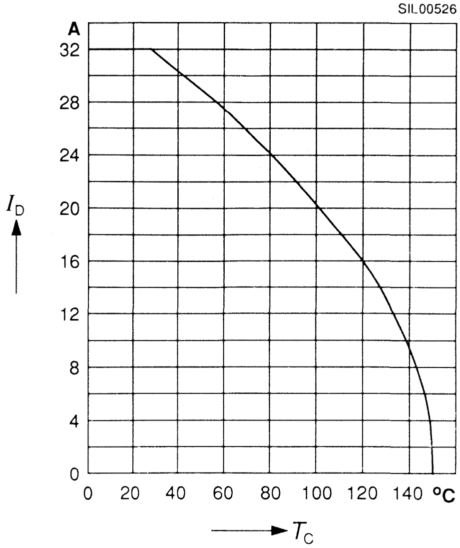
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



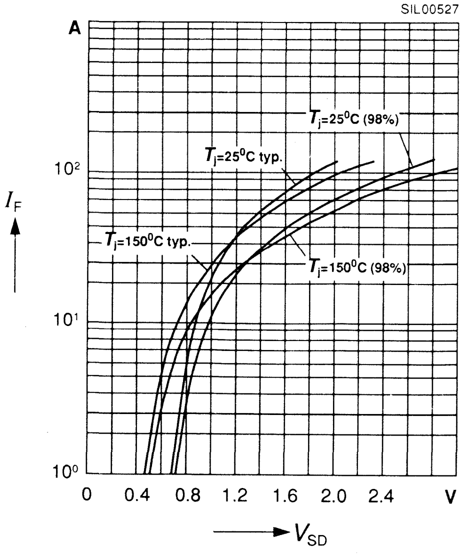
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



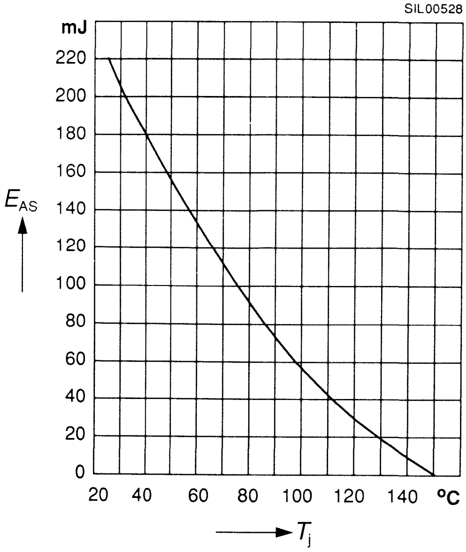
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



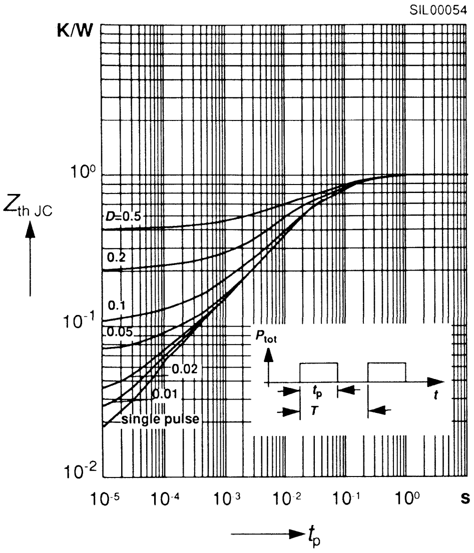
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



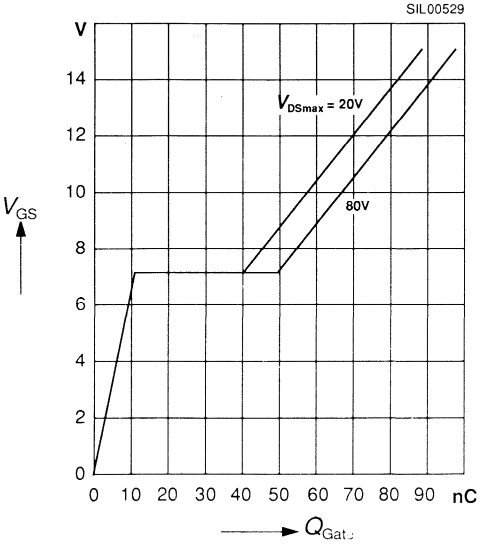
Avalanche energy $E_{AS} = f\,(T_j)$
parameter: $I_D = 32$ A, $V_{DD} = 25$ V,
$R_{GS} = 25\ \Omega$, $L = 322$ µH



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



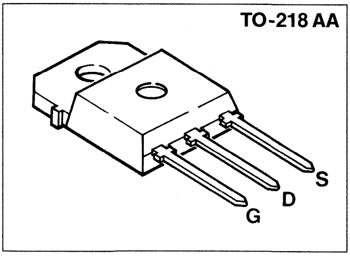
Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 51.0$ A



SIPMOS® Power MOS Transistor BUZ 380

V_{DS} = 1000 V
I_D = 5.5 A
$R_{DS(on)}$ = 2.0 Ω

- N channel
- FREDFET
- Enhancement mode
- Package: TO-218 AA (TOP-3) [1]



Type	Ordering code
BUZ 380	C67078-A3205-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	1000	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	1000	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	5.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	22	
Operating and storage temperature range	T_j T_{stg}	- 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	1000	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 1000$ V, $V_{GS} = 0$	I_{DSS}			µA
$T_j = 25$ °C		-	250	
$T_j = 125$ °C		-	1000	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	-	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 3.5$ A	$R_{DS(on)}$	-	2.0	Ω

Dynamic characteristics

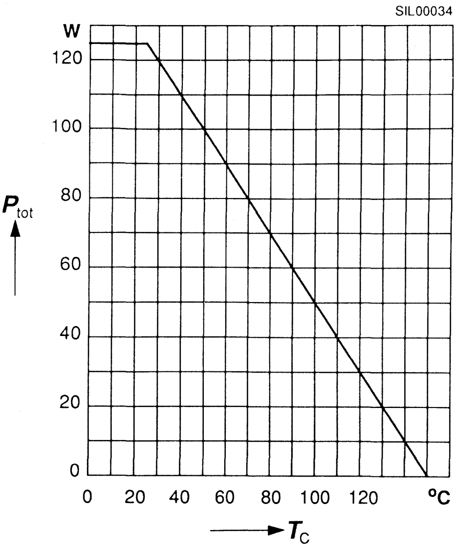
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 3.5$ A	g_{fs}	1.4	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	-	5.0	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	-	300	pF
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	-	120	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	-	90	ns
	t_r	-	140	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.5$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	-	430	
	t_f	-	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

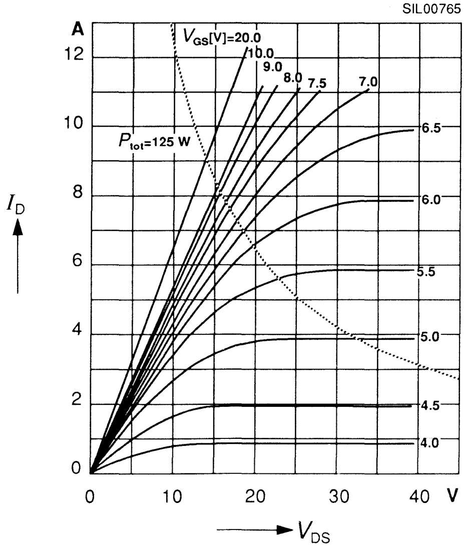
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current T_C = 25 °C	I_S	–	5.5	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	22	
Diode forward on-voltage I_F = 11 A, V_{GS} = 0	V_{SD}	–	1.6	V
Reverse recovery time V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	t_{rr}	–	220	ns
Reverse recovery charge V_R = 100 V, $I_F = I_S$, di_F/dt = 100 A/µs	Q_{rr}	–	0.9	µC

Characteristics at T_j = 25 °C, unless otherwise specified.

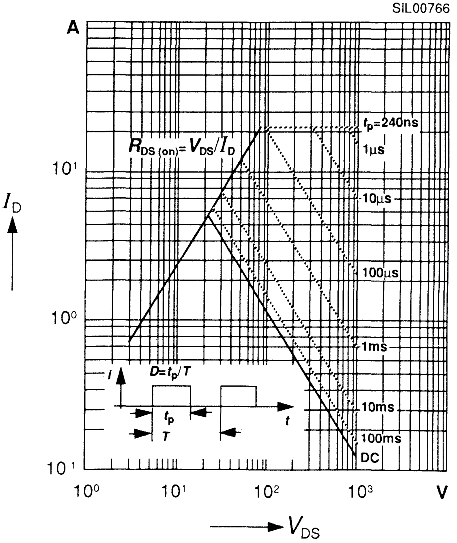
Total power dissipation $P_{tot} = f(T_C)$



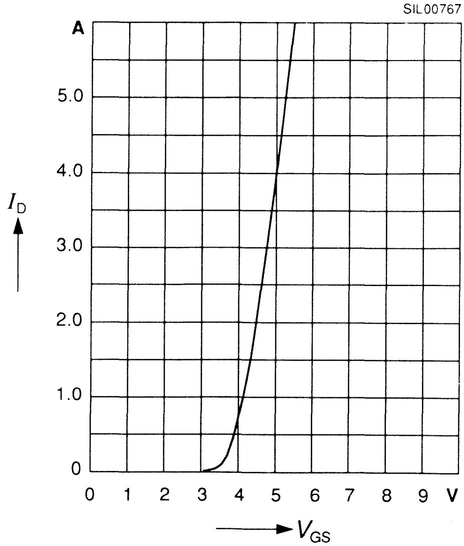
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



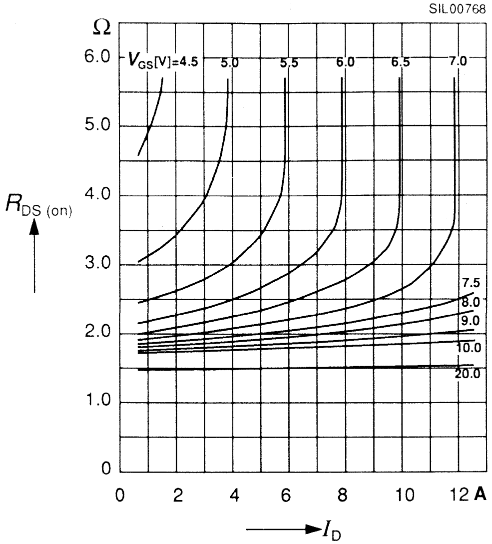
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



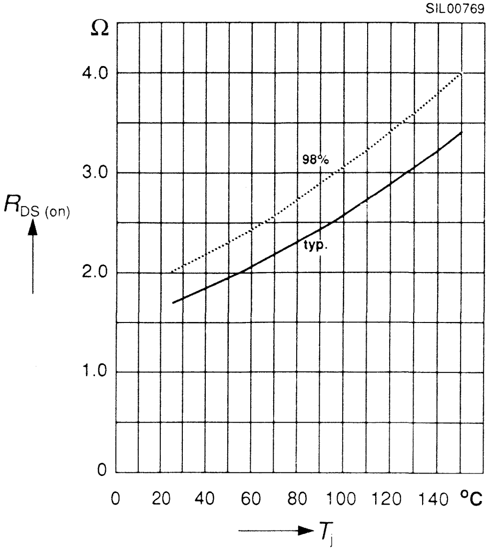
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



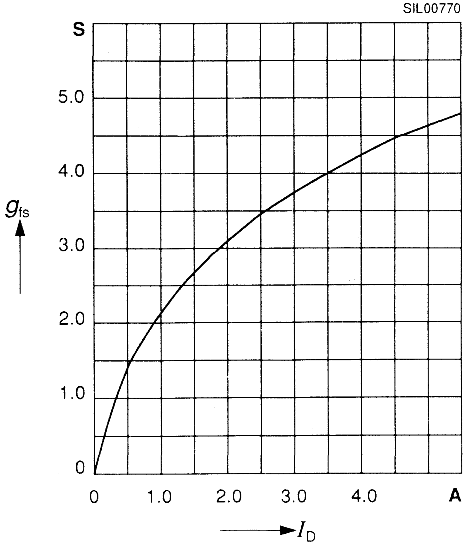
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



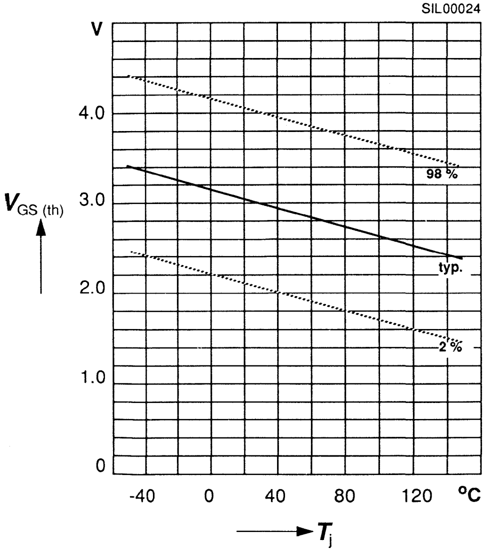
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 3.5$ A, $V_{GS} = 10$ V, (spread)



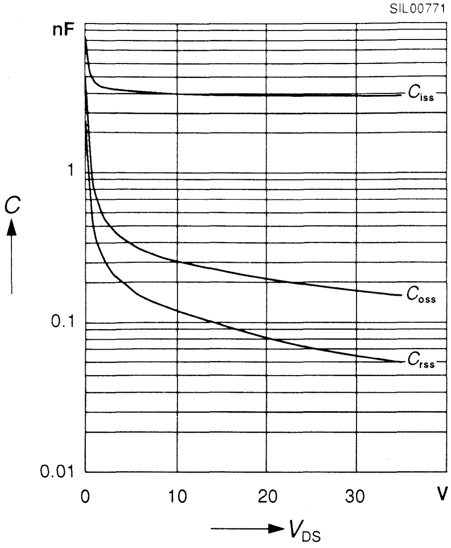
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



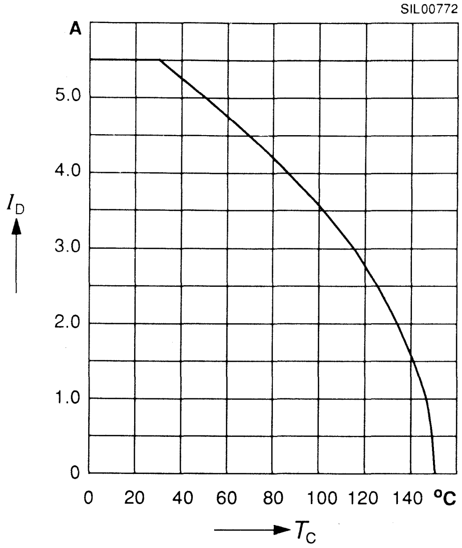
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA, (spread)



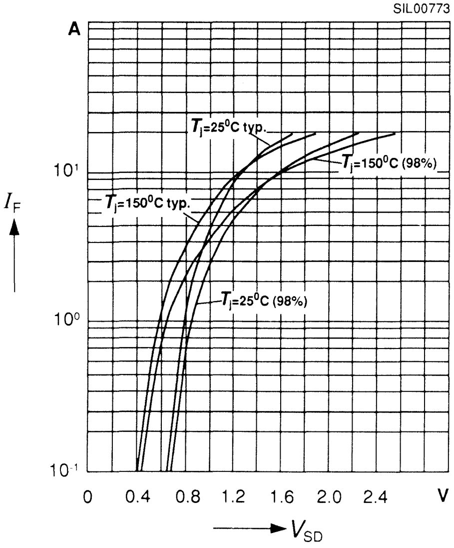
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



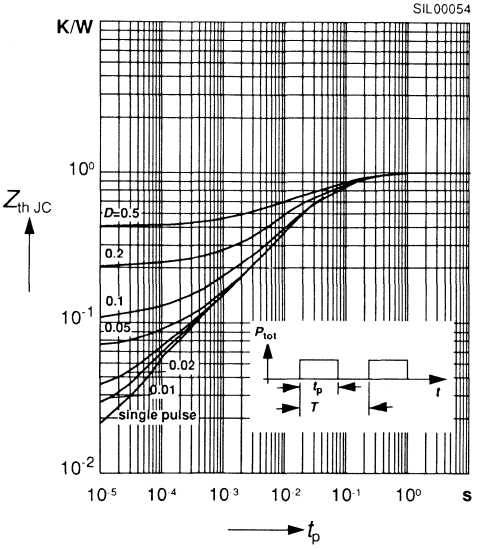
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



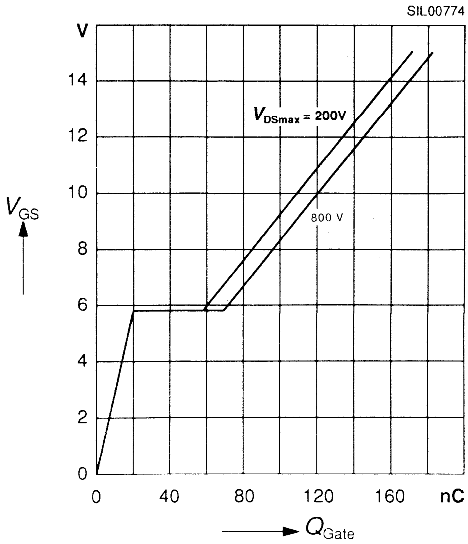
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
parameter: $D = t_p\,/\,T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 8.0$ A

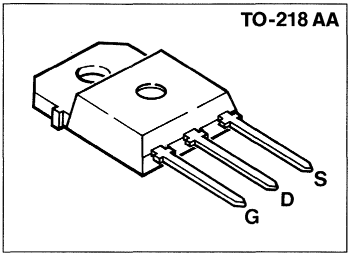


SIEMENS

SIPMOS® Power MOS Transistor **BUZ 382**

V_{DS} = 400 V
I_D = 12.5 A
$R_{DS(on)}$ = 0.4 Ω

- N channel
- FREDFET
- Enhancement mode
- Package: TO-218 AA (TOP-3) [1]



Type	Ordering code
BUZ 382	C67078-A3207-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	400	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	400	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 30 °C	I_D	12.5	A
Pulsed drain current, T_C = 25 °C	$I_{D\ puls}$	50	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Max. power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance chip - case chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.0 ≤ 45	K/W
DIN humidity category, DIN 40 040		E	–
IEC climatic category, DIN IEC 68-1		55/150/56	

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[1] See chapter Package Outlines.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values		Unit
		min.	max.	
Static characteristics				
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = 0.25$ mA	$V_{(BR)DSS}$	400	–	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = 1$ mA	$V_{GS(th)}$	2.1	4.0	
Zero gate voltage drain current $V_{DS} = 400$ V, $V_{GS} = 0$ $T_j = 25$ °C $T_j = 125$ °C	I_{DSS}	– –	250 1000	µA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$	I_{GSS}	–	100	nA
Drain-source on-resistance $V_{GS} = 10$ V, $I_D = 8.0$ A	$R_{DS(on)}$	–	0.4	Ω

Dynamic characteristics

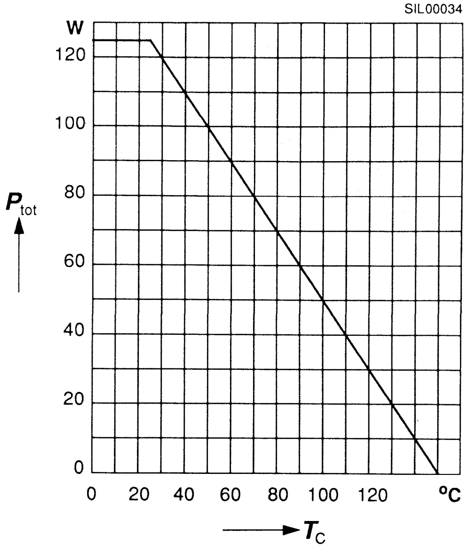
Parameter	Symbol	min.	max.	Unit
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = 8.0$ A	g_{fs}	3.3	–	S
Input capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{iss}	–	4.9	nF
Output capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{oss}	–	500	pF
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	200	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(on)}$	–	75	ns
	t_r	–	120	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = 30$ V, $V_{GS} = 10$ V, $I_D = 2.9$ A, $R_{GS} = 50$ Ω	$t_{d(off)}$	–	430	
	t_f	–	140	

Electrical Characteristics (continued)
at $T_j = 25$ °C, unless otherwise specified.

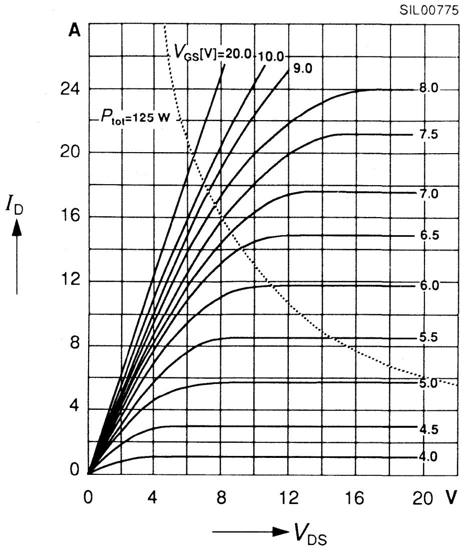
Parameter	Symbol	Values		Unit
		min.	max.	
Fast-recovery reverse diode				
Continuous reverse drain current $T_C = 25$ °C	I_S	–	12.5	A
Pulsed reverse drain current $T_C = 25$ °C	I_{SM}	–	50	
Diode forward on-voltage $I_F = 25$ A, $V_{GS} = 0$	V_{SD}	–	1.7	V
Reverse recovery time $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	t_{rr}	–	250	ns
Reverse recovery charge $V_R = 100$ V, $I_F = I_S$, $di_F/dt = 100$ A/µs	Q_{rr}	–	1.2	µC

Characteristics at $T_j = 25$ °C, unless otherwise specified.

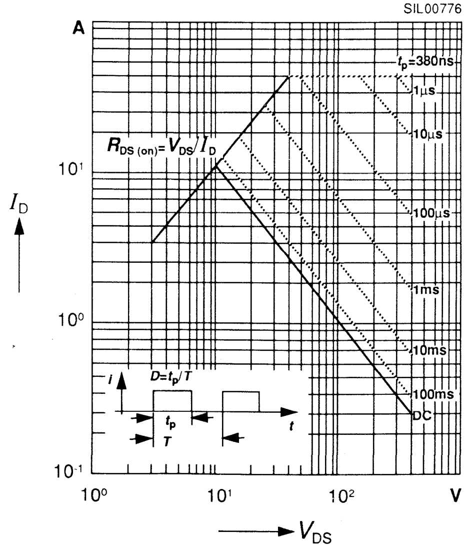
Total power dissipation $P_{tot} = f(T_C)$



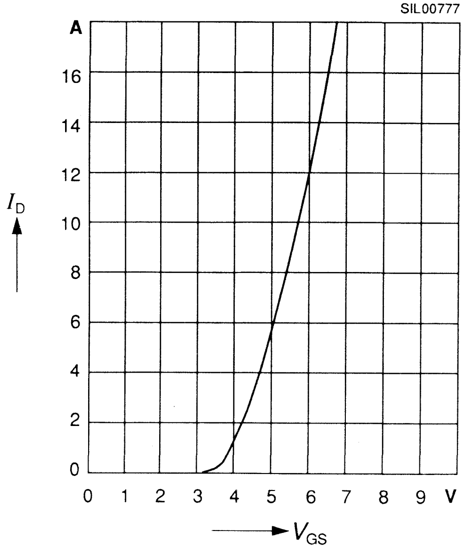
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80$ µs



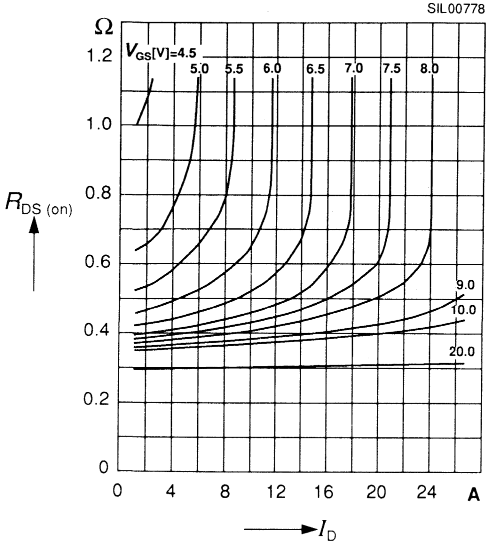
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



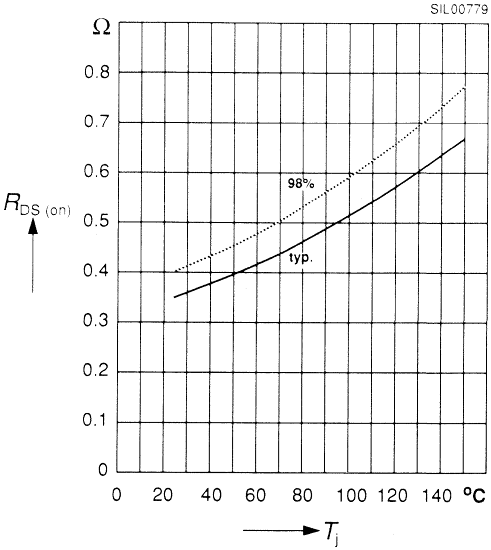
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



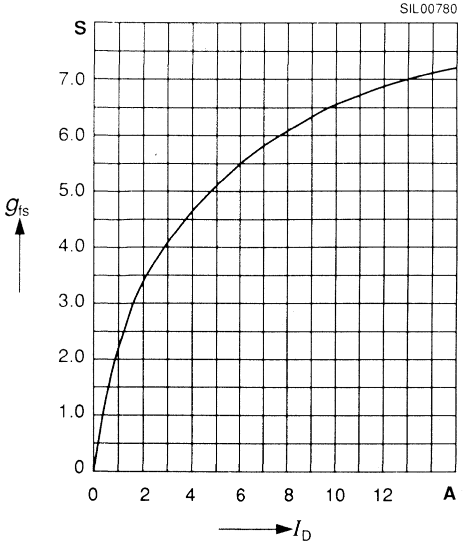
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



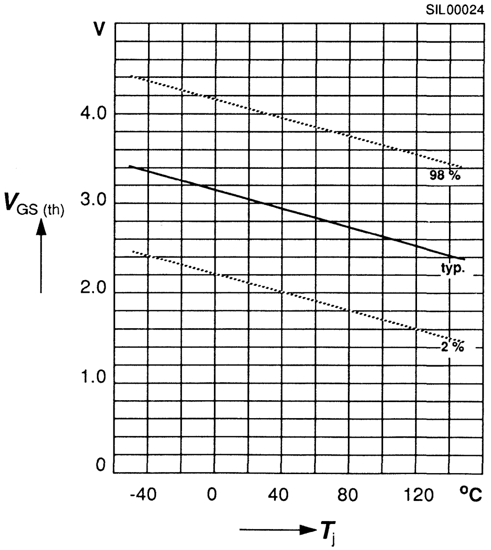
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 8.0 A, V_{GS} = 10 V, (spread)



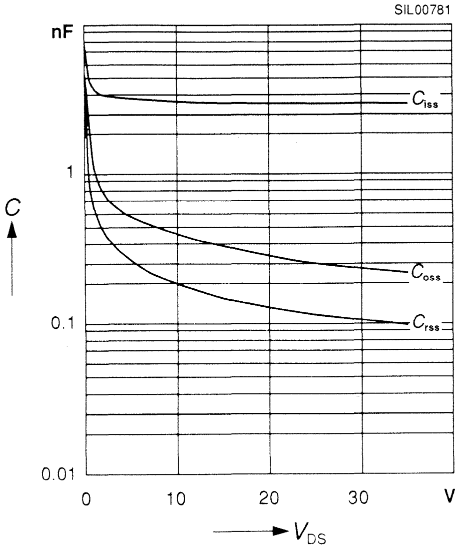
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



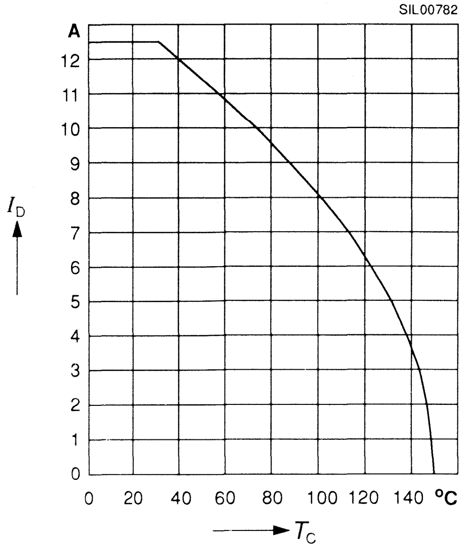
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA, (spread)



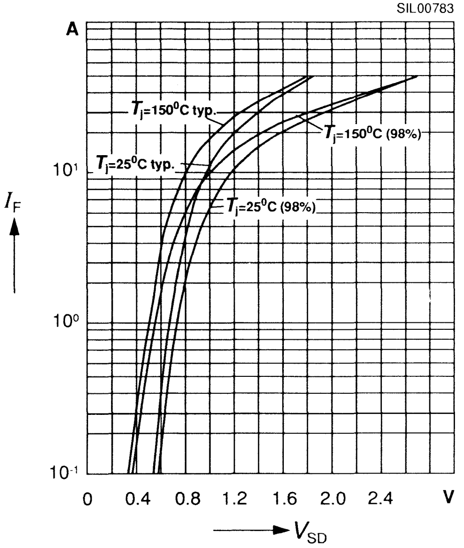
Typ. capacitances $C = f\,(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



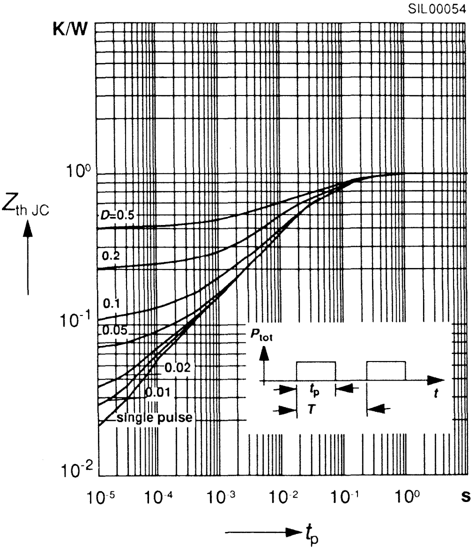
Drain current $I_D = f\,(T_C)$
parameter: $V_{GS} \geq 10$ V



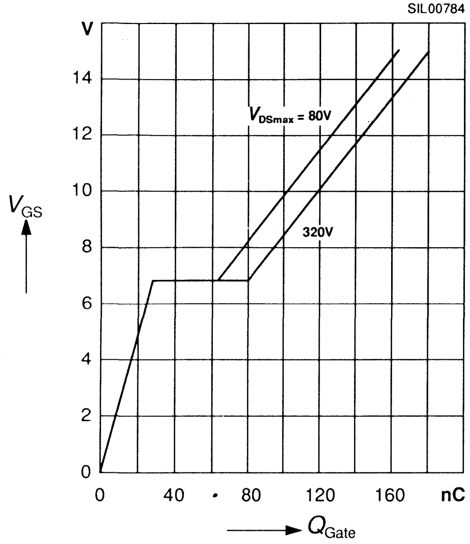
Forward characteristics of reverse diode
$I_F = f\,(V_{SD})$
parameter: T_j, $t_p = 80$ µs, (spread)



Transient thermal impedance $Z_{thJC} = f\,(t_p)$
parameter: $D = t_p\,/\,T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls} = 17.3$ A



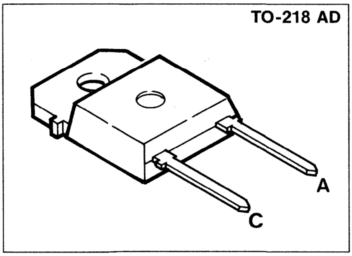
SIEMENS

Fast-Recovery Epitaxial Diode **BYP 101**

Preliminary Data

V_{RRM} = 1000 V
I_{FRMS} = 25 A
t_{rr} = 80 ns

- Soft recovery characteristics
- Package: TO-218 AD (TOP-3)



Type	Ordering code
BYP 101	C67047-A2072-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	1000	V
Surge peak reverse voltage	V_{RSM}	1000	
Max. mean forward current $T_C = 90$ °C, $D = 0.5$	I_{FAV}	15	A
Max. rms forward current	I_{FRMS}	25	
Max. surge forward current $T_j = 100$ °C, 50-Hz sine halfwave, aperiodic	I_{FSM}	70	
Repetitive peak forward current $T_j = 100$ °C, $t_p \leq 10$ µs	I_{FRM}	150	
i^2t value $T_j = 100$ °C, $t_p = 10$ ms	$\int i^2 dt$	25	A^2S
Max. power dissipation $T_C = 90$ °C	P_{tot}	40	W
Operating and storage temperature range	T_j T_{stg}	– 40 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	40/150/56	
Thermal resistance Chip - case Chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 1.5 ≤ 46	K/W

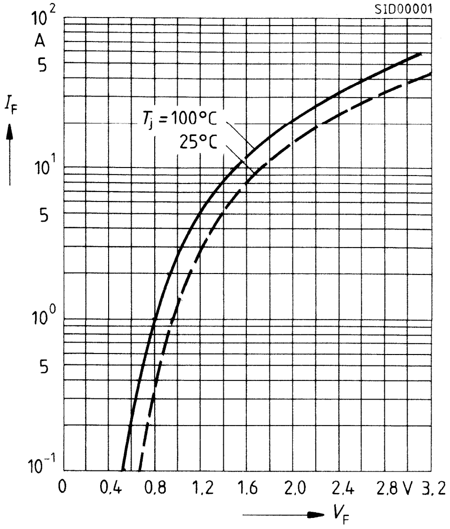
Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

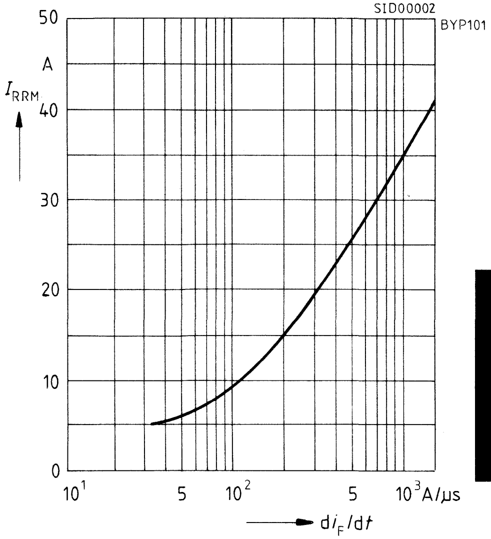
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Forward voltage drop I_F = 15 A T_j = 25 °C T_j = 100 °C	V_F	 – –	 2.0 1.7	 2.4 –	V
Reverse current V_R = 1000 V T_j = 25 °C T_j = 100 °C T_j = 150 °C	I_R	 – – –	 0.01 0.05 0.15	 – – –	mA
Max. forward characteristic T_j = 100 °C	V_F	$1.35 + 0.035 \times I_F$			V
Forward power dissipation T_j = 100 °C	P_F	$1.35 \times I_{FAV} +$ $0.035 \times (I_{FRMS})^2$			W
Dynamic characteristics					
Reverse recovery charge I_F = 15 A, V_{CC} = 300 V di_F/dt = – 1000 A/µs, T_j = 100 °C	Q_{rr}	–	2.2	–	µC
Peak reverse recovery current I_F = 15 A, V_{CC} = 300 V di_F/dt = – 1000 A/µs, T_j = 100 °C	I_{RRM}	–	35	–	A
Reverse recovery time I_F = 15 A, V_{CC} = 300 V di_F/dt = – 1000 A/µs, T_j = 100 °C	t_{rr}	–	80	–	ns
Storage time I_F = 15 A, V_{CC} = 300 V di_F/dt = – 1000 A/µs, T_j = 100 °C	t_s	–	45	–	
Soft factor I_F = 15 A, V_{CC} = 300 V di_F/dt = – 1000 A/µs, T_j = 100 °C	S	–	0.8	–	–

Characteristics

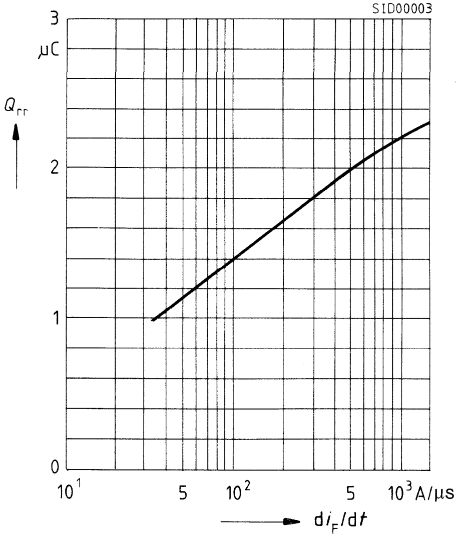
Typ. forward characteristic $I_F = f(V_F)$
parameter: T_j



Typ. reverse current $I_{RRM} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 15 A, T_j = 100 °C



Typ. reverse recovery charge $Q_{rr} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 15 A, T_j = 100 °C



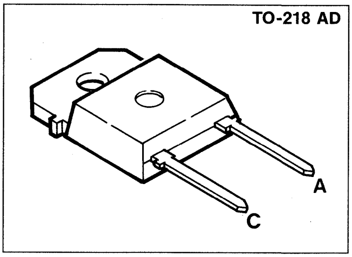
SIEMENS

Fast-Recovery Epitaxial Diode
Preliminary Data

BYP 102

V_{RRM} = 1000 V
I_{FRMS} = 50 A
t_{rr} = 130 ns

- Soft recovery characteristics
- Package: TO-218 AD (TOP-3)



Type	Ordering code
BYP 102	C67047-A2071-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	1000	V
Surge peak reverse voltage	V_{RSM}	1000	
Max. mean forward current T_C = 90 °C, D = 0.5	I_{FAV}	28	A
Max. rms forward current	I_{FRMS}	50	
Max. surge forward current T_j = 100 °C, 50-Hz sine halfwave, aperiodic	I_{FSM}	125	
Repetitive peak forward current T_j = 100 °C, $t_p \leq$ 10 µs	I_{FRM}	280	
i^2t value T_j = 100 °C, t_p = 10 ms	$\int i^2 dt$	78	A^2S
Max. power dissipation T_C = 90 °C	P_{tot}	75	W
Operating and storage temperature range	T_j T_{stg}	– 40 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	40/150/56	
Thermal resistance Chip - case Chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 0.8 ≤ 46	K/W

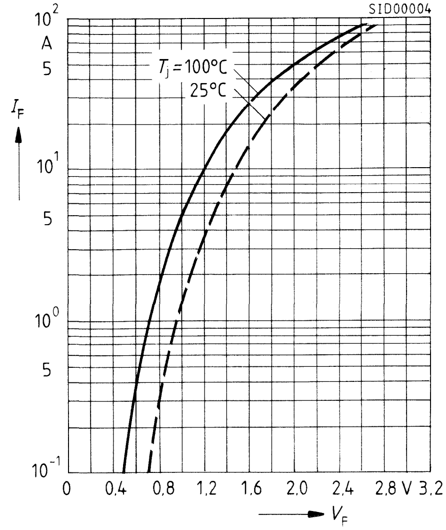
Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

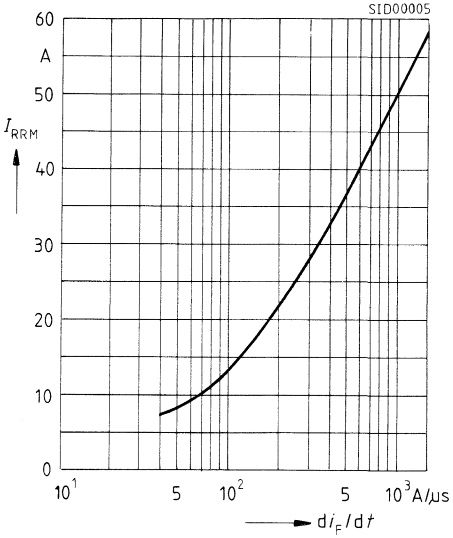
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Forward voltage drop	V_F				V
$T_j = 25$ °C, $I_F = 20$ A		-	1.65	-	
$I_F = 30$ A		-	1.9	2.35	
$T_j = 100$ °C, $I_F = 20$ A		-	1.5	-	
$I_F = 30$ A		-	1.7	-	
Reverse current $V_R = 1000$ V	I_R				mA
$T_j = 25$ °C		-	0.01	-	
$T_j = 100$ °C		-	0.05	-	
$T_j = 150$ °C		-	0.15	-	
Max. forward characteristic $T_j = 100$ °C	V_F	$1.2 + 0.021\ I_F$			V
Forward power dissipation $T_j = 100$ °C	P_F	$1.2 \times I_{FAV} + 0.021 \times (I_{FRMS})^2$			W
Dynamic characteristics					
Reverse recovery charge $I_F = 28$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C	Q_{rr}	-	4.5	-	µC
Peak reverse recovery current $I_F = 28$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C	I_{RRM}	-	50	-	A
Reverse recovery time $I_F = 28$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C	t_{rr}	-	130	-	ns
Storage time $I_F = 28$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C	t_s	-	65	-	
Soft factor $I_F = 28$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C	S	-	1	-	-

Characteristics

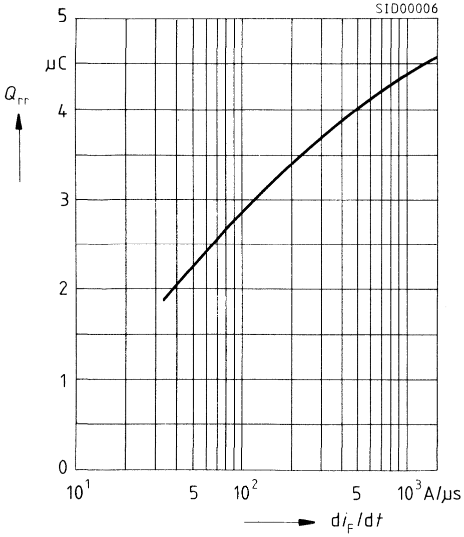
Typ. forward characteristics $I_F = f(V_F)$



Typ. reverse current $I_{RRM} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 30 A, T_j = 100 °C



Typ. reverse recovery charge $Q_{rr} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 30 A, T_j = 100 °C



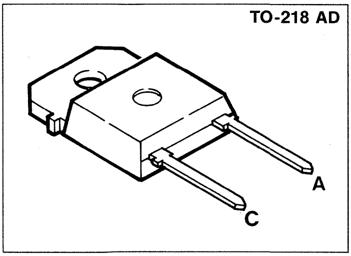
SIEMENS

Fast-Recovery Epitaxial Diode **BYP 103**

Preliminary Data

V_{RRM} = 1000 V
I_{FRMS} = 75 A
t_{rr} = 140 ns

- Soft recovery characteristics
- Package: TO-218 AD (TOP-3)



Type	**Ordering code**
BYP 103	C67047-A2066-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Repetitive peak reverse voltage	V_{RRM}	1000	V
Surge peak reverse voltage	V_{RSM}	1000	
Max. mean forward current $T_C = 90$ °C, $D = 0.5$	I_{FAV}	45	A
Max. rms forward current	I_{FRMS}	75	
Max. surge forward current $T_j = 100$ °C, 50-Hz sine halfwave, aperiodic	I_{FSM}	180	
Repetitive peak forward current $T_j = 100$ °C, $t_p \leq 10$ µs	I_{FRM}	400	
i^2t value $T_j = 100$ °C, $t_p = 10$ ms	$\int i^2 dt$	162	A^2S
Max. power dissipation $T_C = 90$ °C	P_{tot}	115	W
Operating and storage temperature range	T_j T_{stg}	– 40 ... + 150	°C
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	40/150/56	
Thermal resistance Chip - case Chip - ambient, without heat sink	 R_{thJC} R_{thJA}	 ≤ 0.5 ≤ 45	K/W

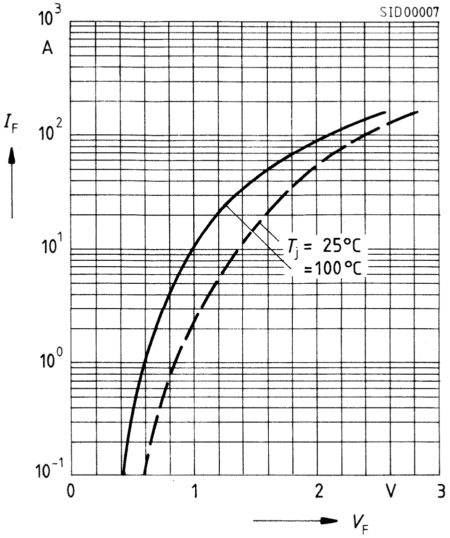
Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

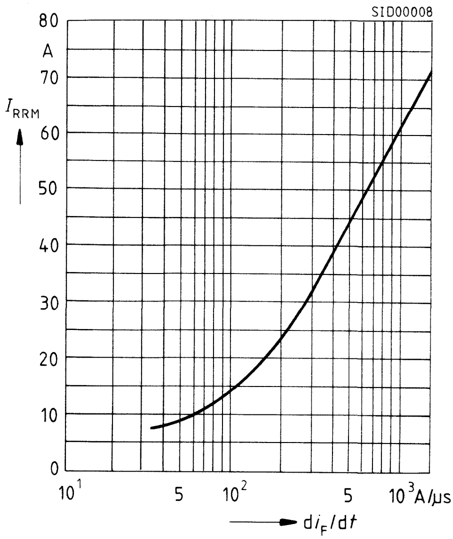
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Static characteristics						
Forward voltage drop		V_F				V
$T_j = 25$ °C	$I_F = 30$ A		–	1.7	–	
	$I_F = 45$ A		–	1.9	2.35	
$T_j = 100$ °C	$I_F = 30$ A		–	1.3	–	
	$I_F = 45$ A		–	1.5	–	
Reverse current $V_R = 1000$ V		I_R				mA
$T_j = 25$ °C			–	0.01	–	
$T_j = 100$ °C			–	0.05	–	
$T_j = 150$ °C			–	0.15	–	
Max. forward characteristic $T_j = 100$ °C		V_F	$V_F = 1.34 +$ $0.011 \times I_F$			V
Forward power dissipation $T_j = 100$ °C		P_F	$P_F = 1.34 \times I_{FAV} +$ $0.011 \times (I_{FRMS})^2$			W
Dynamic characteristics						
Reverse recovery charge $I_F = 45$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C		Q_{rr}	–	6.0	–	µC
Peak reverse recovery current $I_F = 45$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C		I_{RRM}	–	60	–	A
Reverse recovery time $I_F = 45$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C		t_{rr}	–	140	–	ns
Storage time $I_F = 45$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C		t_s	–	70	–	
Soft factor $I_F = 45$ A, $V_{CC} = 300$ V $di_F/dt = -1000$ A/µs, $T_j = 100$ °C		S	–	1	–	–

Characteristics

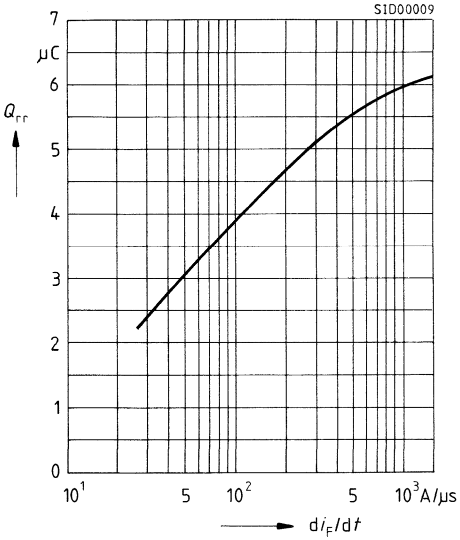
Typ. forward characteristic $I_F = f(V_F)$
parameter: T_j



Typ. reverse current $I_{RRM} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 45 A, T_j = 100 °C



Typ. reverse recovery charge $Q_{rr} = f(di_F/dt)$
parameter: V_{CC} = 300 V, I_F = 45 A, T_j = 100 °C



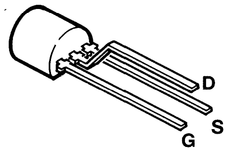
SIPMOS® Small-Signal Transistors

SP 0610 L
SP 0610 T

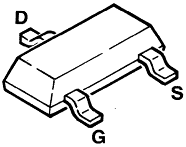
V_{DS} = –60 V
I_D = –0.13 / –0.18 A
$R_{DS(on)}$ = 10 Ω

- P channel
- Enhancement mode
- Packages: TO-92, SOT-23 1)

TO-92
(SP 0610 L)



SOT-23
(SP 0610 T)



Type	Marking	Ordering code for version in bulk	Ordering code for version on 8-mm tape
SP 0610 L	–	Q67000-S065	–
SP 0610 T	sSF	–	Q67000-S088

Maximum Ratings

Parameter	Symbol	SP 0610 L	SP 0610 T	Unit
Drain-source voltage	V_{DS}	– 60		V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 60		
Gate-source voltage	V_{GS}	± 20		
Continuous drain current, T_A = 25 °C/36 °C	I_D	– 0.18	– 0.13	A
Pulsed drain current, T_A = 25 °C	$I_{D\ puls}$	– 0.72	– 0.52	
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150		°C
Thermal resistance chip - ambient (without heat sink) chip - substrate – reverse side 2)	 R_{thJA} R_{thJSR}	 ≤ 200 –	 – ≤ 285	K/W
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	0.36	W
DIN humidity category, DIN 40 040	–	E		–
IEC climatic category, DIN IEC 68-1	–	55/150/56		

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1) See chapter Package Outlines.
2) For package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics

at $T_j = 25$ °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage $V_{GS} = 0$, $I_D = -0.25$ mA	$V_{(BR)DSS}$	-60	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$, $I_D = -1$ mA	$V_{GS(th)}$	-1.0	-1.5	-2.0	
Zero gate voltage drain current $V_{DS} = -60$ V, $V_{GS} = 0$ $T_j = 25$ °C	I_{DSS}	-	-0.1	-1	µA
Gate-source leakage current $V_{GS} = -20$ V, $V_{DS} = 0$	I_{GSS}	-	-1	-10	nA
Drain-source on-resistance $V_{GS} = -10$ V, $I_D = -0.5$ A	$R_{DS(on)}$	-	7	10	Ω
$V_{GS} = -4.5$ V, $I_D = -0.025$ A		-	9	25	

Dynamic characteristics

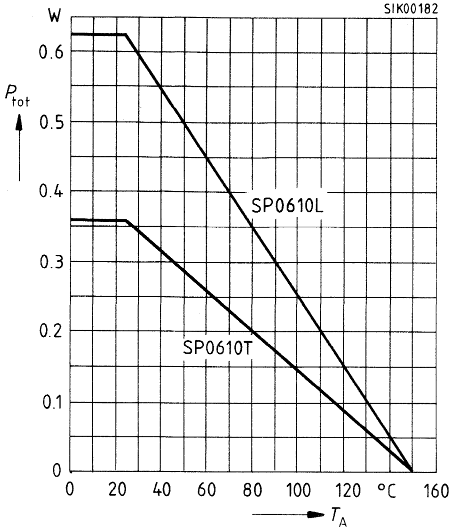
Parameter	**Symbol**	**min.**	**typ.**	**max.**	**Unit**
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, $I_D = -0.5$ A	g_{fs}	0.08	0.13	-	S
Input capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{iss}	-	30	45	pF
Output capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{oss}	-	17	25	
Reverse transfer capacitance $V_{GS} = 0$, $V_{DS} = -25$ V, $f = 1$ MHz	C_{rss}	-	8	12	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.27$ A	$t_{d(on)}$	-	8	12	ns
	t_r	-	35	50	
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) $V_{CC} = -30$ V, $V_{GS} = -10$ V, $R_{GS} = 50$ Ω $I_D = -0.27$ A	$t_{d(off)}$	-	8	10	
	t_f	-	20	25	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

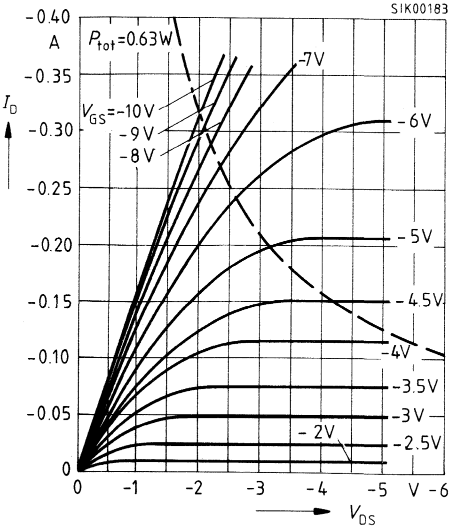
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse diode						
Continuous reverse drain current		I_S				A
T_A = 25 °C	SP 0610L		–	–	-0.18	
	SP 0610T		–	–	-0.12	
Pulsed reverse drain current		I_{SM}				
T_A = 25 °C	SP 0610L		–	–	-0.72	
	SP 0610T		–	–	-0.48	
Diode forward on-voltage		V_{SD}				V
I_F = – 0.18 A, V_{GS} = 0			–	-0.85	-1.2	

Characteristics at $T_j = 25\ °C$, unless otherwise specified.

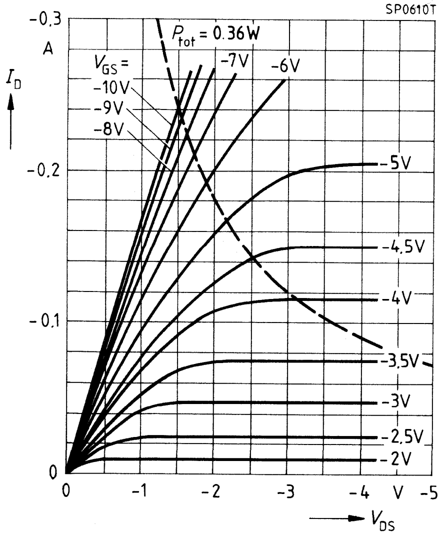
Total power dissipation $P_{tot} = f(T_A)$



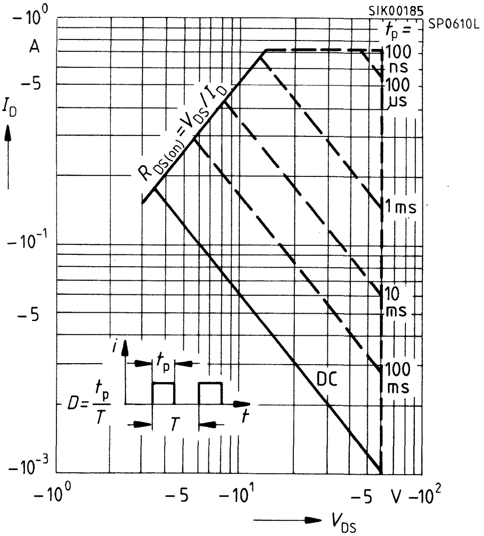
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
SP 0610 L



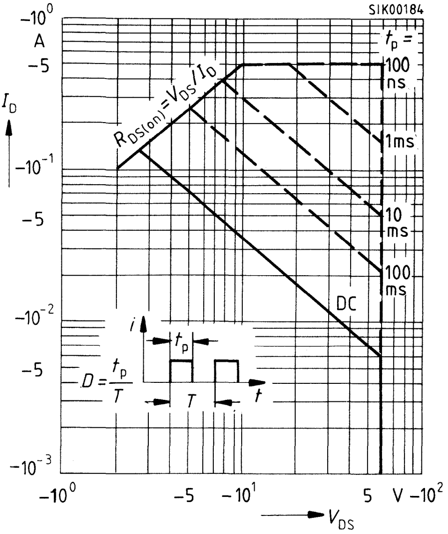
Typ. output characteristics $I_D = f(V_{DS})$
parameter: $t_p = 80\ \mu s$
SP 0610 T



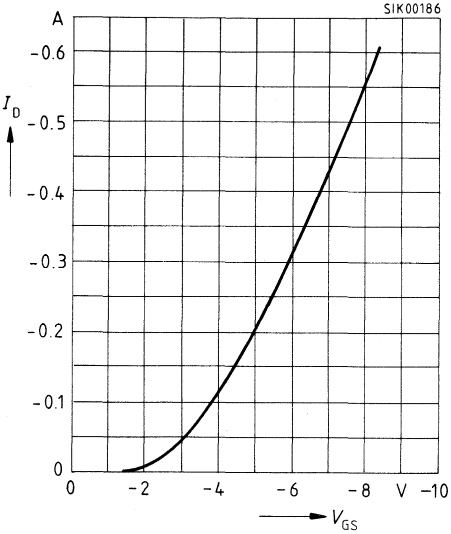
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25\ °C$
SP 0610 L



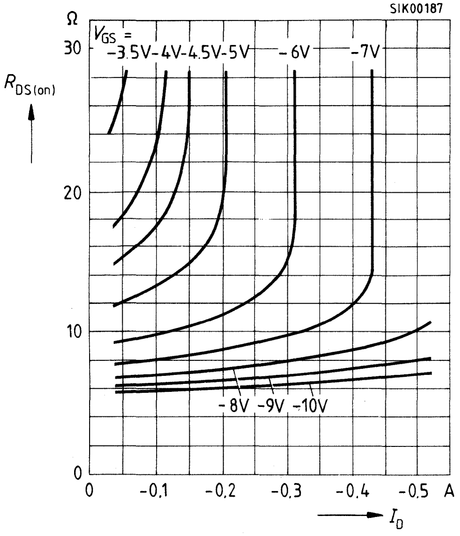
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C
SP 0610 T



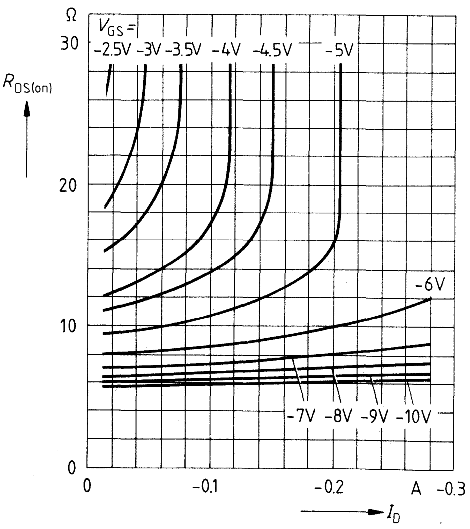
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = -25$ V



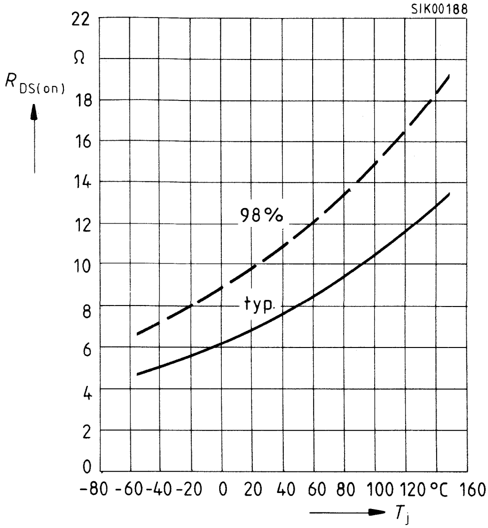
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
SP 0610 L



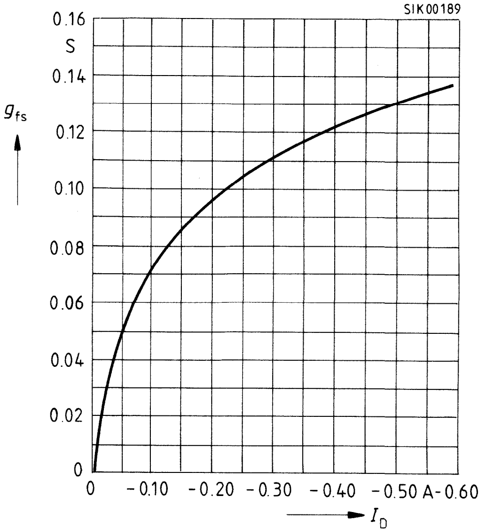
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
SP 0610 T



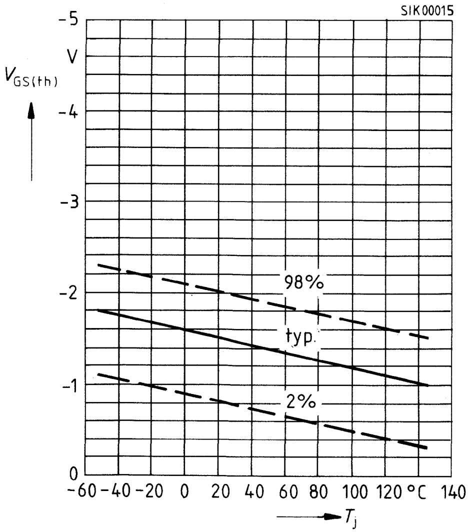
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = -0.5$ A, $V_{GS} = -10$ V, (spread)



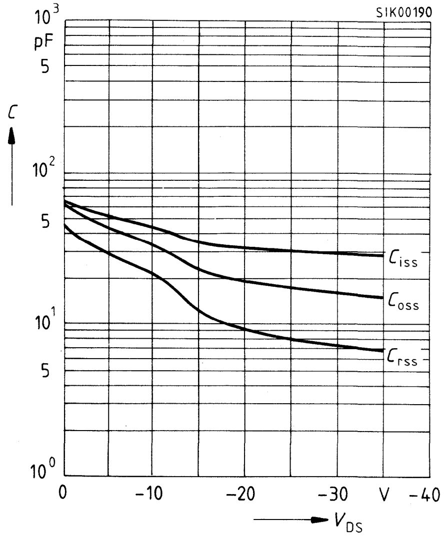
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs



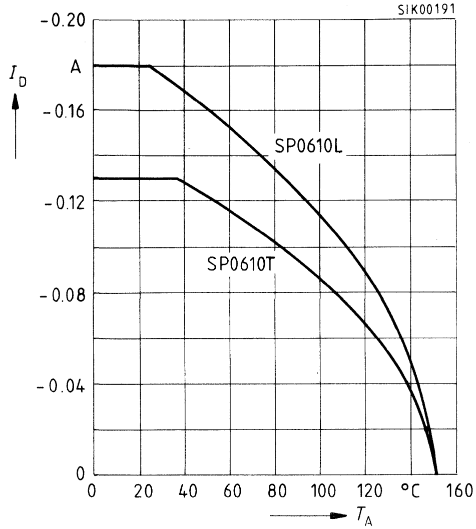
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = -1$ mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

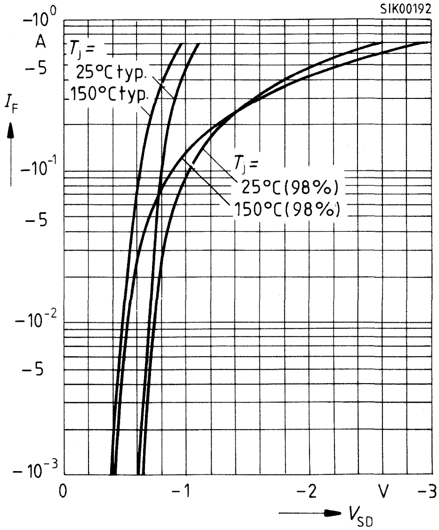


Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq -10$ V



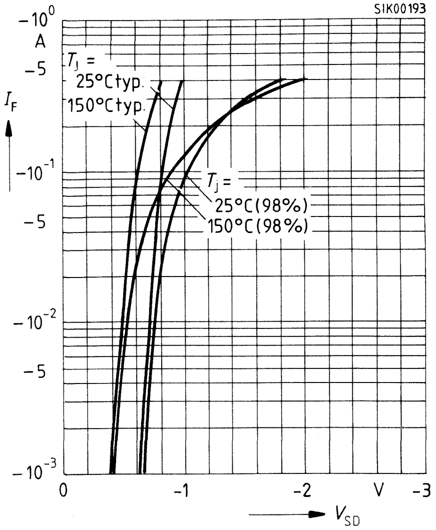
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

AP 0610 L



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j, (spread)

SP 0610 T

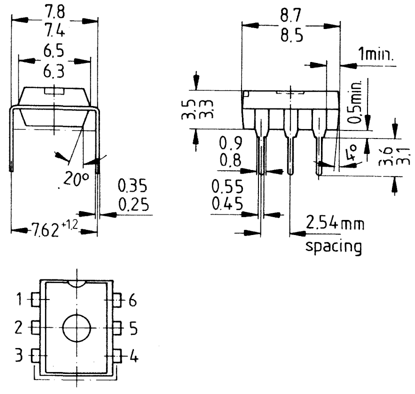


Gehäusemaßbilder
Verpackungshinweise
Verarbeitungsrichtlinien

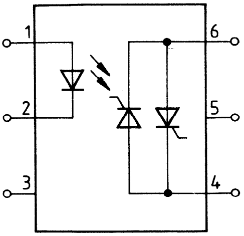
Package Outlines
Packaging Instructions
Handling Guidelines

DIP-6

Weight: 0.6 g
Dimensions in mm



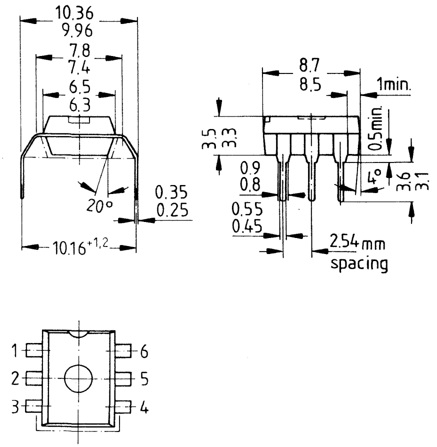
—·—·— Clearance-creepage distance 7.2 min.



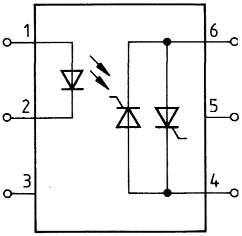
Pin	
1	A
2	C
3	–
4	A1
5	–
6	A2

DIP-6

Option 6: Pins in 10.16 mm spacing
Weight: 0.6 g
Dimensions in mm



—·—·— Clearance-creepage distance 8.0 min.

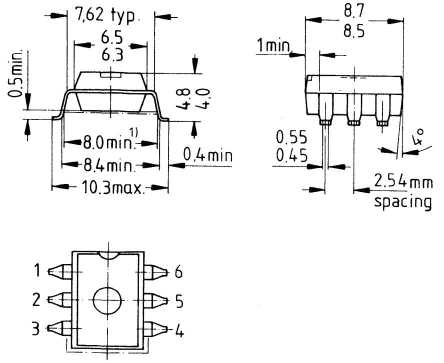


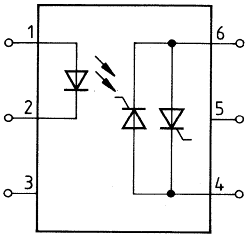
Pin	
1	A
2	C
3	–
4	A1
5	–
6	A2

Gehäusemaßbilder/Package Outlines

DIP-6

Option 7: Pins for surface mounting
Weight: 0.6 g
Dimensions in mm



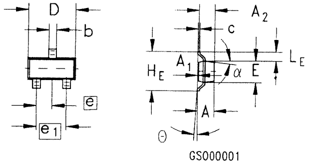


Pin	
1	A
2	C
3	–
4	A1
5	–
6	A2

1)Clearance and creepage distances must be taken into account for the solder pad design.
—·—·— Clearance-creepage distance 8.0 min.

SOT-23

Weight: 0.02 g
Dimensions in mm

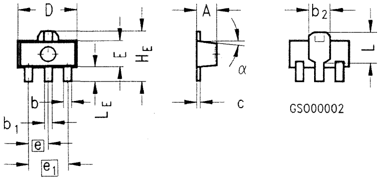


Dim.	min.	typ.	max.	Gradient
A			1.1	
A_1			0.1	
A_2			1.0	
b	0.35		0.50	
c	0.08		0.15	
D	2.8		3.0	
E	1.2		1.4	
$\lvert e \rvert$		1.95		
$\lvert e_1 \rvert$		1.7		
H_E			2.6	
L_E	0.6			
α*				max. 10°
Θ				2° ... 30°

* Note: Applicable to all sides

SOT-89

Weight: 0.1 g
Dimensions in mm

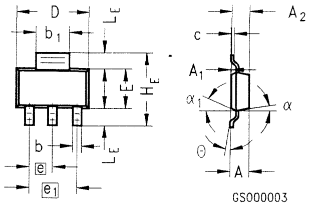


Dim.	min.	typ.	max.	Gradient
A		1.5		
b			0.65	
b_1			0.65	
b_2		1.6		
c	0.25			
D		4.5		
E			2.6	
$\lvert e \rvert$		1.5		
$\lvert e_1 \rvert$		3		
H_E			4.25	
L	2.6		2.85	
L_E	0.8		1.2	
α*				max. 10°

* Note: Applicable to all sides

SOT-223

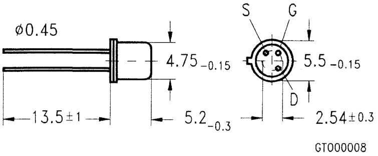
Weight: 0.1 g
Dimensions in mm



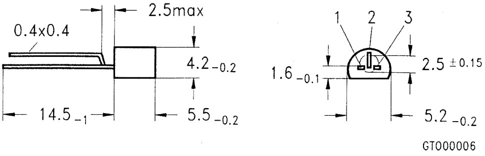
Dim.	min.	typ.	max.	Gradient
A			1.7	
A_1	0.02		0.1	
A_2			1.6	
b	0.60		0.80	
b_1	2.9		3.1	
c	0.24		0.32	
D	6.3		6.7	
E	3.3		3.7	
$\lvert e \rvert$		2.3		
$\lvert e_1 \rvert$		4.6		
H_E	6.7		7.3	
L_E		1.7		
α*				max. 16°
α_1**				13°
Θ				10°

* Applicable to case top
** Applicable to case bottom

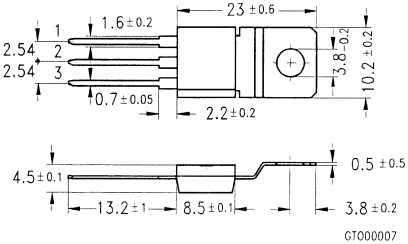
TO-18
Weight: 0.3 g
Dimensions in mm



TO-92
Weight: 2 g
Dimensions in mm



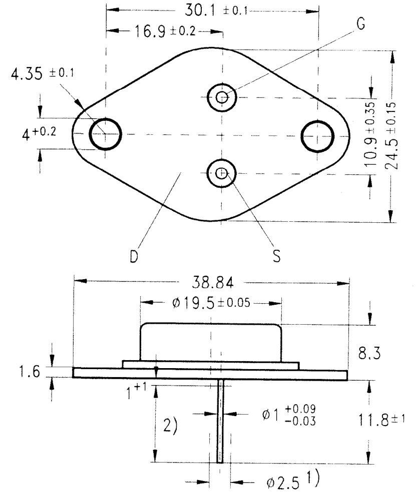
TO-202
Weight: 1.8 g
Dimensions in mm



Gehäusemaßbilder/Package Outlines

TO-204 AA (TO-3)

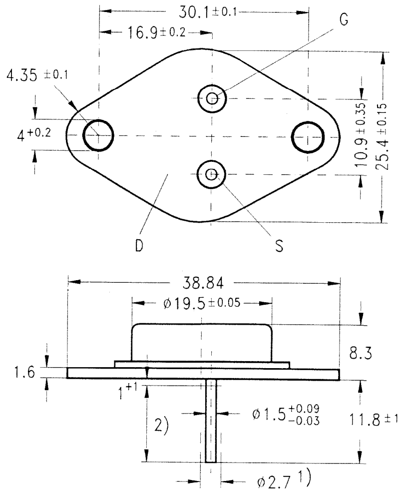
Weight: 12 g
Dimensions in mm



1) max. bending area 2) solderable

TO-204 AE (TO-3)

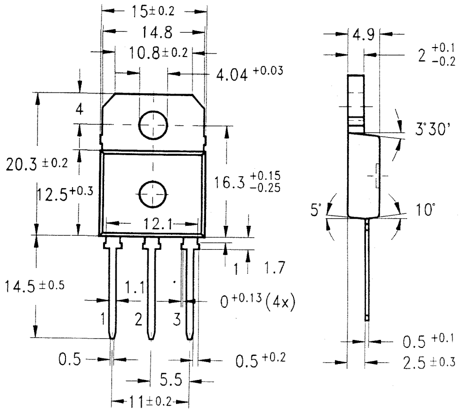
Weight: 12 g
Dimensions in mm



1) max. bending area 2) solderable

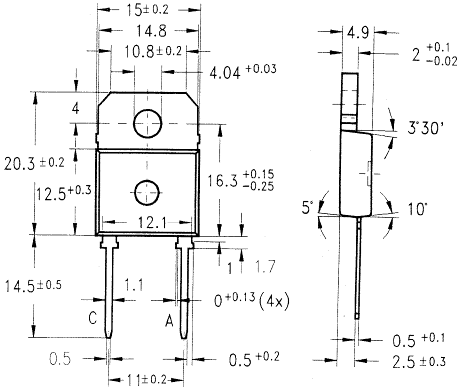
TO-218 AA (TOP 3)

Weight: 4.5 g
Dimensions in mm



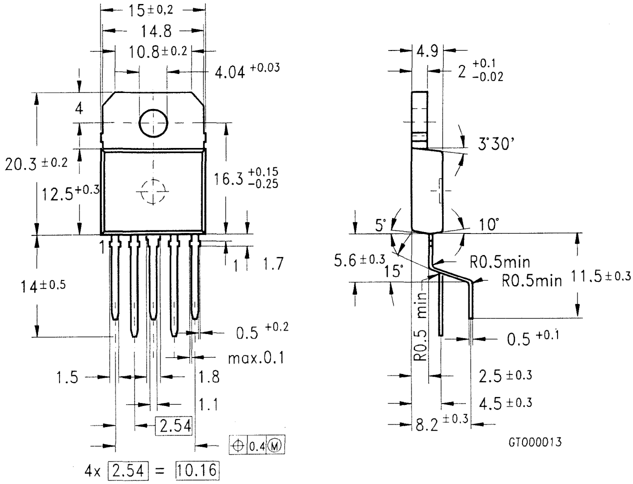
TO-218 AD

Weight: 4.5 g
Dimensions in mm



TO-218/5

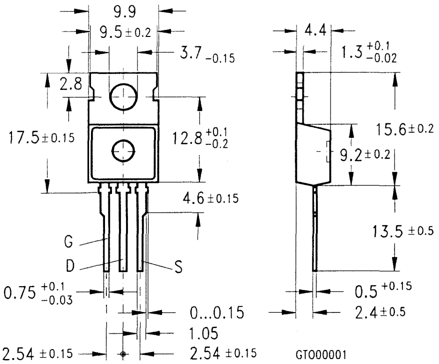
Weight: 4.5 g
Dimensions in mm



Pin	a	b
1	G	GND
2	A	IN
3	D	V_{bb}
4	C	St
5	S	Out

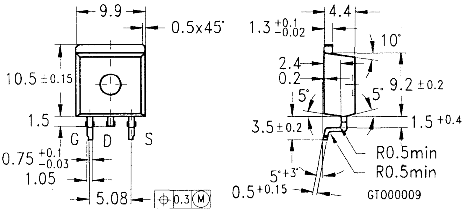
TO-220 AB

Weight: 2 g
Dimensions in mm



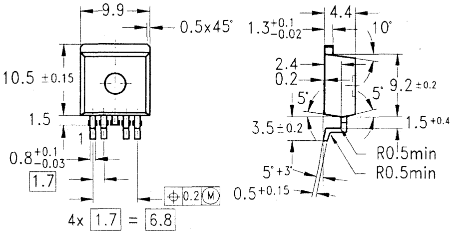
TO-220 (SMD)

TEMPFET option E 3045
Weight: 2.0 g
Dimensions in mm



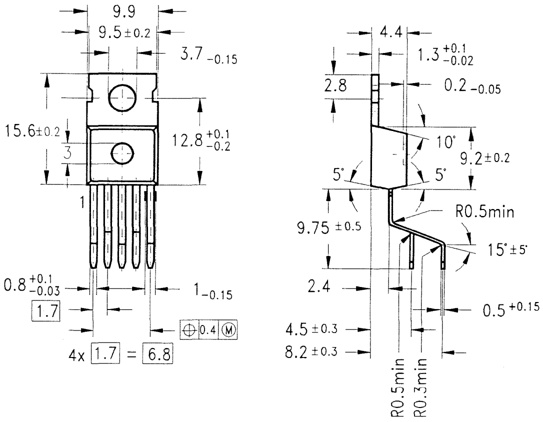
Gehäusemaßbilder/Package Outlines

TO-220/5 (SMD)
PROFET option E 3062
Weight: 2.0 g
Dimensions in mm



Pin	a
1	GND
2	IN
3	V_{bb}
4	St
5	OUT

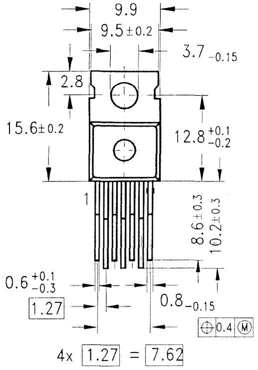
TO-220/5
Weight: 0.5 g
Dimensions in mm

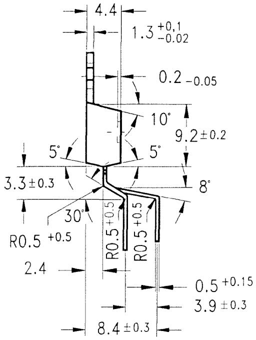


Pin	a
1	GND
2	IN
3	V_{bb}
4	St
5	OUT

Gehäusemaßbilder/Package Outlines

TO-220/7
Weight: 0.5 g
Dimensions in mm

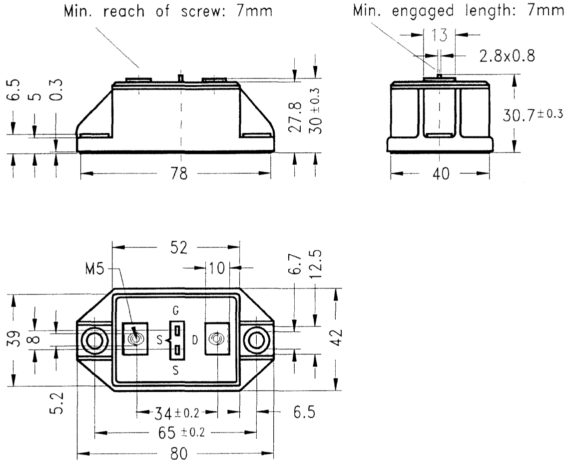




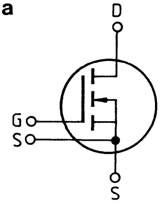
Pin	
1	GND
2	V_C
3	V_{REF}
4	V_{bb}
5	C_G
6	C_B
7	OUT

Modules

Fig. 1
Weight: 150 g
Dimensions in mm

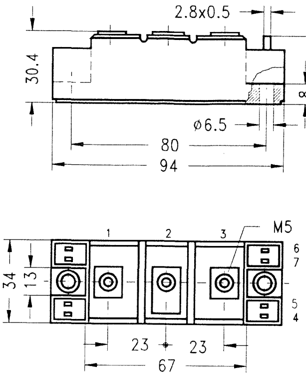


a

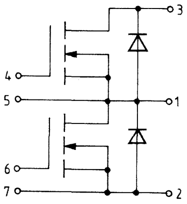


Gehäusemaßbilder/Package Outlines

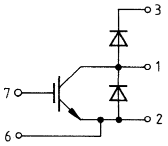
Fig. 2
Weight: 250 g
Dimensions in mm



a



b



c

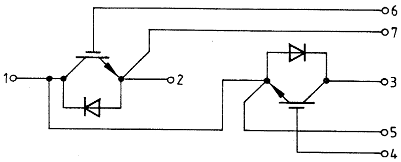
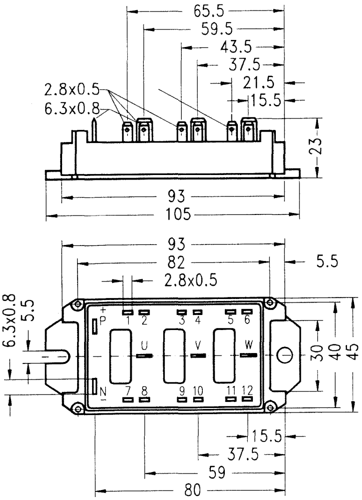
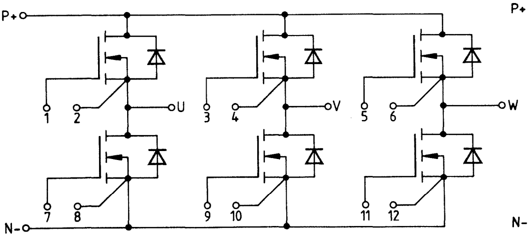


Fig. 3
Weight: 190 g
Dimensions in mm



a



b

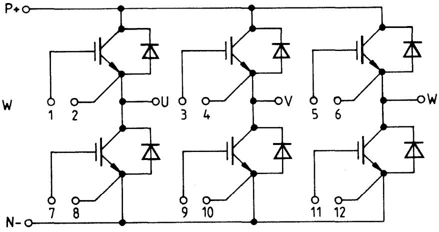
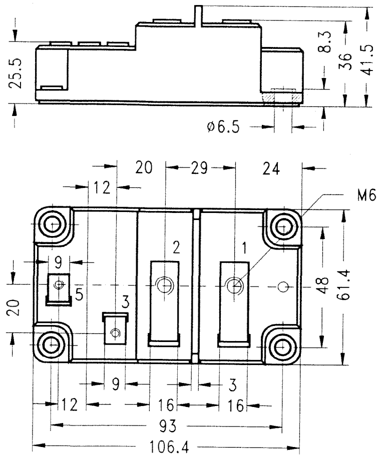


Fig. 4
Weight: 420 g
Dimensions in mm



a

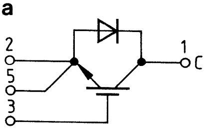
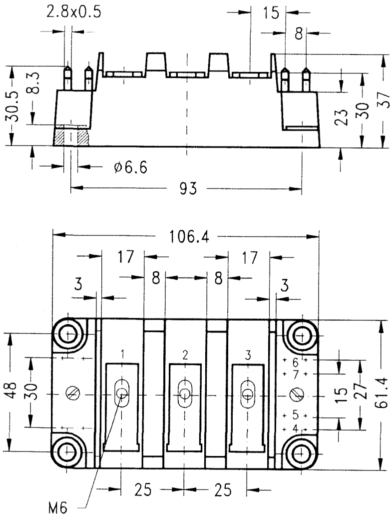
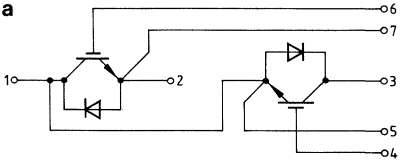
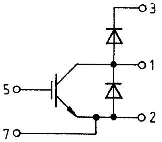


Fig. 5
Weight: 420 g
Dimensions in mm



a





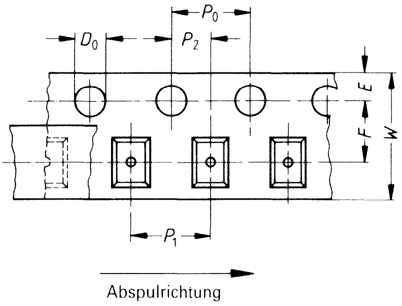
Verpackungshinweise

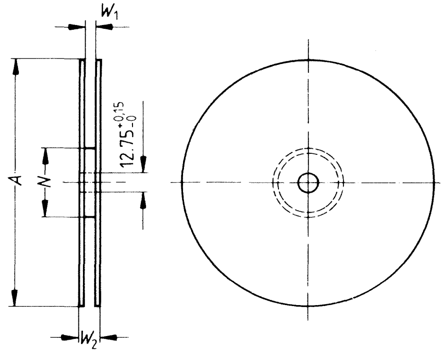
Jede Verpackungseinheit regulärer Lieferungen trägt Aufdrucke mit Informationen über Hersteller, Typ, Anzahl, Herstelldatum und -ort, Loszugehörigkeit, EGB-Empfindlichkeit usw. Diese für den Inhalt verbindlichen Angaben kennzeichnen im Klartext insbesondere Typen, deren Bauformen keine ausführliche Bestempelung zulassen und sind zur Rückmeldung wichtig, sollten einmal Reklamationen nötig sein.

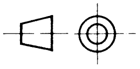
Schüttgut ist die allgemeine ungerichtete Verpackungsform („bulk packaging"), die eine ungehinderte Einzelentnahme ermöglicht, bei automatischer Gerätebestückung aber richtungsorientierende Zufuhrstationen erfordert. Unsere Leistungstransistoren, SITAC- und Smart-Bauelemente werden in Schienen verpackt ausgeliefert.

Die folgende Zusammenstellung gibt einen Überblick über die derzeitigen Gurtformen. Zu Einzelheiten über Maßtoleranzen oder Variationen der Orientierung erbitten wir Ihre Anfrage.

Blistergurt und Gurtrollenmaße nach IEC 286-3







Gurtmaße (mm)

W	P_0	P_1	P_2	D_0	E	F
8 ± 0,3	4 ± 0,1	4 ± 0,1	2 ± 0,05	$1{,}5\ ^{+0{,}1}_{-0}$	1,75 ± 0,1	3,5 ± 0,05
12 ± 0,3	4 ± 0,1	8 ± 0,1	2 ± 0,05	$1{,}5 \pm ^{0{,}1}_{0}$	1,75 ± 0,1	5,5 ± 0,05

Gurtrollenmaße (mm)

A	N	W_1	$W_{2\ \mathrm{max}}$
180/330	62 ± 1,5	$8{,}4\ ^{+1{,}5}_{-0}$	14,4
180/330	62 ± 1,5	$12{,}4\ ^{+2}_{-0}$	18,4

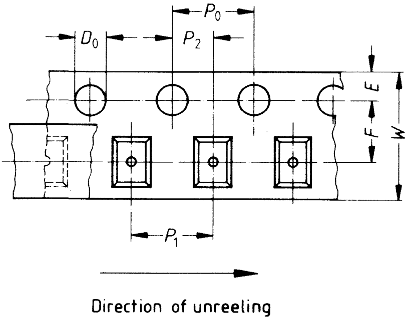
Packaging Instructions

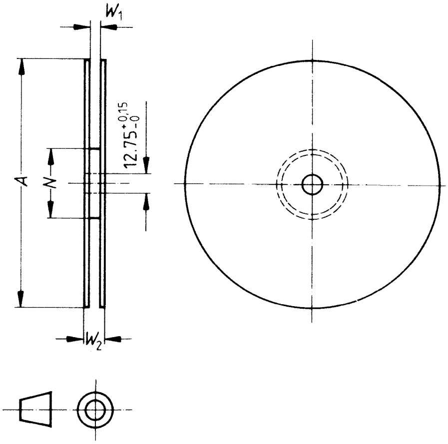
Each packaging unit of regular deliveries is marked with information about the manufacturer, type, quantity, date and place of manufacture, lot, ESD sensitivity, etc. These details on the content are mandatory and characterize in uncoded form particularly those types whose size does not permit the full marking. In addition, it is important for possible claims.

Bulk is the general loose form of packaging that enables components to be removed singly, but appropriate stations are needed to direct their supply for automatic placement. Our power transistors, SITAC and smart components are supplied in tubes.

Below, the current forms of taping are summarized. Please inquire for details of dimensional tolerances or variations in how the components are oriented.

Blister Tape And Reel Dimensions As Per IEC 286-3





Tape dimensions (mm)

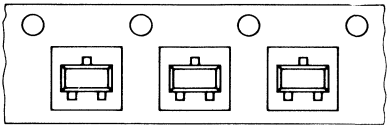
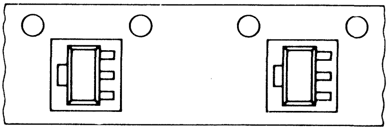
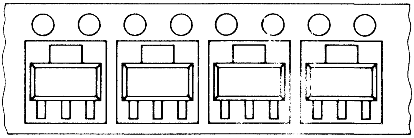
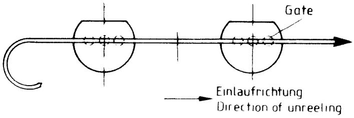
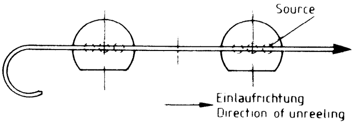
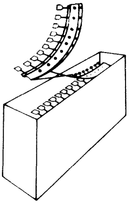
W	P_0	P_1	P_2	D_0	E	F
8 ± 0.3	4 ± 0.1	4 ± 0.1	2 ± 0.05	$1.5\ ^{+0.1}_{-0}$	1.75 ± 0.1	3.5 ± 0.05
12 ± 0.3	4 ± 0.1	8 ± 0.1	2 ± 0.05	$1.5 \pm ^{0.1}_{0}$	1.75 ± 0.1	5.5 ± 0.05

Reel dimensions (mm)

A	N	W_1	$W_{2\ \mathrm{max}}$
180/330	62 ± 1.5	$8.4\ ^{+1.5}_{-0}$	14.4
180/330	62 ± 1.5	$12.4\ ^{+2}_{-0}$	18.4

Verpackungshinweise/Packaging Instructions

Gurtausführung / Polarität und Lage etc.
Method of Taping / Polarity and Orientation etc.

Gehäuse **Package**	**Bestell-Nr.** **Ordering code**	**Verpackungs-einheit** **Packing unit**	**Gurtausführung** **Method of taping**
SOT-23 8-mm-Gurt 8-mm tape	E 6327 E 6433	3000/Rolle reel 10000/Rolle reel	
SOT-89 12-mm-Gurt 12-mm tape	E 6327 E 6433	1000/Rolle reel 2500/Rolle reel	
SOT-223 12-mm-Gurt 12-mm tape	E 6327 E 6433	1000/Rolle reel 2500/Rolle reel	
TO-92 auf Rolle on reel	E 6288	1500/Rolle 2 Rollen pro Karton 1500/reel 2 reels per carton	 Source: BSS 98, BSS 100, BSS 101, BSS 110
TO-92 auf Rolle on reel	E 6296	1500/Rolle 2 Rollen pro Karton 1500/reel 2 reels per carton	 Drain: BSS 98, BSS 100, BSS 101, BSS 110
TO-92 Ammopack (Zick-Zack-Lagen) Ammopack (Zig-zag layers)	E 6325	2000/Karton carton	

1. EGB (Elektrostatisch gefährdetes Bauelement)

SIPMOS-Halbleiter sind elektrostatisch gefährdete Bauelemente, bei deren Handhabung besondere Maßnahmen zu erfüllen sind: Unkontrollierte Ladungen, Spannungen von nicht geerdeten Geräten oder Personen, Funkentladungen oder ähnliche Einflüsse können das Bauelement zerstören. Ein Maß für die Empfindlichkeit der Bauelemente ist die Gate-Source-Kapazität C_{GS}. Bauelemente mit größerer Gate-Source-Kapazität sind unempfindlicher. Das bedeutet, daß großflächige Halbleiter im Sinne der IEC-Norm bereits als unempfindlich gegen elektrostatische Aufladungen gelten.

SIPMOS-Halbleiter haben im Vergleich zu HF-MOSFET relativ große Eingangskapazitäten und sind damit wesentlich unempfindlicher, trotzdem sind sie entsprechend den Richtlinien für elektrostatisch gefährdete Bauelemente zu behandeln.

Die notwendigen Schutzmaßnahmen sind in der IEC-Norm 47 701 zusammengefaßt.

Wichtige Punkte:

- Bis zur Verarbeitung müssen die Bauelemente in einer MOS-gerechten Verpackung bleiben.
- Die Handhabung darf nur an speziell eingerichteten Arbeitsplätzen mit hochohmig (ca. 10^6 Ω) mit Masse verbundenen leitenden Belägen erfolgen.
- Das Handgelenkband muß fest an der Haut anliegen und über einen Ableitwiderstand von 50 kΩ ... 1 MΩ geerdet sein.
- Alle Transporteinheiten und bestückte Leiterplatten müssen zuerst auf das gleiche Potential gebracht werden (durch Abstellen auf dem Arbeitsplatz bzw. Anfassen etc.).

2. Mechanische Beanspruchung

Bei Zurichtung und Einbau ist auf Freiheit der Teile von mechanischen Spannungen zu achten; gefährdet ist vor allem die Verankerung der Anschlüsse im Gehäuse, deren Lockerung Bauelementeausfall erwarten läßt.

- Abbiegen der Anschlüsse erfordert mechanische Entlastung zwischen Biegestelle und Gehäuse.
- Wiederholtes Biegen ist unzulässig.

3. Thermische Beanspruchung

Jedes Halbleiter-Bauelement ist äußerst empfindlich gegen Überschreitung der höchstzulässigen Sperrschichttemperatur. Man soll bei der Konstruktion der Geräte beachten, daß der Abstand zwischen Wärmeerzeugern und Halbleiter-Bauelementen ausreichend groß ist. Bei Vorwärmung auf 75 °C müssen die Lötzeiten um 30 % vermindert werden.

4. Lötmontage

4.1 Bedrahtete Bauelemente

- Lötbarkeit mit Voralterung 3 nach DIN IEC 68, Teil 2–20, Test Ta (235 °C, ±5 K, 5 sec)
- Lötwärmebeständigkeit nach DIN IEC 68, Teil 2–20, Test Tb (260 °C, ±5 K, 10 sec)

Alle bedrahteten Bauelemente sind nach obiger Spezifikation geprüft und qualifiziert.

4.2 SMD-Bauelemente

- Lötbarkeit mit Voralterung nach DIN IEC 68, Teil 2–20, Test Ta (215 °C, ±3 K, 4 sec)
- Lötwärmebeständigkeit nach SN 53063
  Doppelschwallöten (260 °C, ±5 K, 10 sec)
  Reflowlötverfahren (215 °C, ± 3 K, 2 x 40 sec)

Alle SMD-Bauelemente, außer SOT-89, sind nach obiger Spezifikation geprüft und qualifiziert.

Sonderbedingungen für SOT-89 (235 °C, ± 3 K, 1 sec)

5. Montagehinweise für Module

Um einen guten thermischen Kontakt zu gewährleisten, sollte folgendes beachtet werden:

- Die Kontaktflächen des Kühlkörpers müssen eben und frei von Fremdkörpern sowie von Staub sein.
- Rauhtiefe und Abweichungen von der Planheit sollten 10 μm nicht überschreiten.
- Die Kontaktflächen müssen mit einem geeigneten Kontaktmittel behandelt werden.
- Anzugsdrehmomente der Kontaktschrauben:
  M 5 = 4 ... 6 Nm
  M 6 = 3 ... 6 Nm

1. ESD (Electrostatic Discharge Sensitive Device)

SIPMOS semiconductors are electrostatic discharge (ESD) sensitive, meaning that they require special handling. Uncontrolled charges, voltages from items of equipment or persons that are not grounded, sparking and the like can damage these components. The gate-source capacitance C_{GS} is a measure of the sensitivity of the components. Devices with a higher gate-source capacitance are less sensitive. This means that large semiconductors rank as insensitive to eletrostatic discharge according to the IEC standard.

SIPMOS semiconductors have relatively large input capacitances compared to RF MOSFET and are thus considerably less sensitive, but they should nevertheless be handled according to the guidelines for ESD components.

The necessary protective measures are contained in IEC standard 47 701.

Important points:

- The components must be left in proper MOS packaging until they are processed.
- They should only be handled on specially equipped workstations of a conductive fabric that is connected to ground across a high resistance (approx. 10^6 Ω).
- The wrist strap must be very close to the skin and be grounded across a discharge resistance of 50 kΩ to 1 MΩ.
- All transport units and assembled circuit boards must first be brought to the same potential (by placing them on the workstation, touching them, etc.).

2. Mechanical Stress

When preparing and mounting the components, take care that the parts are free from mechanical tensions; especially endangered is the fixing of the pins in the package, the loosening of which may lead to a failure of the components.

- For the bending process, the pins should be relieved between bending point and package in order to avoid mechanical stress between package and connecting point.
- Avoid repeated bendings at the same point.

3. Thermal Stress

Each semiconductor component is extraordinarily sensitive to an exceeding of the maximum permissible junction temperature. When designing the devices, care must be taken that the distance between heat generators and semiconductors is large enough. If a preheating up to 75 °C is applied, the soldering times have to be shortened by 30 %.

4. Solder Mounting

4.1 Leaded components

- Solderability with preageing 3 according to DIN IEC 68, part 2–20, Test Ta (235 °C, ±5 K, 5 sec)
- Solder temperature profile according to DIN IEC 68, part 2–20, Test Tb (260 °C, ±5 K, 10 sec)

All leaded components are tested and qualified to the above standards.

4.2 SMD components

- Solderability with preageing according to DIN IEC 68, part 2–20, Test Ta (215 °C, ±3 K, 4 sec)
- Solder temperature profile according to SN 53063
  Double wave soldering (260 °C, ±5 K, 10 sec)
  Reflow soldering (215 °C, ± 3 K, 2 x 40 sec)

All SMD components with the exception of SOT-89 parts are tested and qualified to the above standards.

Special conditions for SOT-89 (235 °C, ± 3 K, 1 sec)

5. Assembly Instructions For Modules

In order the ensure good thermal contact the following instructions should be considered:

- The contact area of the heat sink must be even and clean.
- Unevenness and roughness should not be greater than 10 µm.
- The contact areas should be treated with the proper thermal compound.
- Mounting torques of the terminal screws:

  M 5 = 4 ... 6 Nm
  M 6 = 3 ... 6 Nm

SIPMOS Chip-Produkte SIPMOS Die Products

SIPMOS Chip-Produkte

Siemens fertigt SIPMOS-Halbleiter auch als Chip-Version. Diese SIPMOS-Chips bieten eine ebenso hohe und zuverlässige Leistung wie die entsprechenden Fertigprodukte.

Nähere Informationen erhalten Sie bei den Ihnen nächstgelegenen Siemens-Bauteilevertrieben in der BRD oder bei unseren Landesgesellschaften im Ausland.

Chip-Bezeichnung

Beispiel:

SI PC 42 A N 100 F

SI = SIEMENS-Chip
ST = SIEMENS Temperatur-Sensor Chip

DC = Dioden-Chip
GC = IGBT-Chip
LC = Logik-Chip
PC = Leistungs-Chip
RC = SIRET-Chip
SC = Kleinsignal-Chip
TC = SITAC-Chip

Chipfläche (mm^2)

A = Avalanche-fest
T = IGBT
B = Bipolar (SIRET)
D = Diode

N = N-Kanal
P = P-Kanal
C = CMOS

Drain-Source-Spannung $V_{DS(max)}$
100 = 1000 V

F = FREDFET
L = Logic level
D = Verarmungstyp (nur Kleinsignal)
E = Anreicherungstyp (nur Kleinsignal)
D, E, F, G = Logik-Version (nur Smart SIPMOS)
Y = PROFET
Z = TEMPFET

SIPMOS Die Products

Siemens offers SIPMOS semiconductors also as die version (die/dice ≙ chip/chips). These SIPMOS dice feature the same high and reliable performance as the respective finished products.

For further information please contact the Offices of Siemens Aktiengesellschaft in the Federal Republic of Germany or the Siemens Companies and Representatives worldwide.

Die Designation

Example:

SI PC 42 A N 100 F

SI = SIEMENS die
ST = SIEMENS temperature sensor die

DC = Diode die
GC = IGBT die
LC = Logic die
PC = Power die
RC = SIRET die
SC = Small-signal die
TC = SITAC die

Die size (mm^2)

A = Avalanche-proof
T = IGBT
B = Bipolar (SIRET)
D = Diode

N = N channel
P = P channel
C = CMOS

Drain-source voltage
$V_{DS(max)}$
100 = 1000 V

F = FREDFET
L = Logic level
D = Depletion type (small-signal only)
E = Enhancement type (small-signal only)
D, E, F, G = Logic version (Smart SIPMOS only)
Y = PROFET
Z = TEMPFET

SIPMOS Small-Signal Transistor Dice

$V_{\mathrm{DS(max)}}$ V	$R_{\mathrm{DS(on)max}}$ Ω	$V_{\mathrm{GS(th)}}$ V	Die type	Recommended bond wire diameter 1) µm	Die topology	Page
-50	10	-0.8...-2.0	SIS C 0.5P05E	22	LA	1183
	1	-0.8...-2.0	SIS C 3.2P05E	22	LC	1183
-60	10	-1.0...-2.0	SIS C 0.5P06E	22	LA	1183
-100	2.2	-0.8...-2.0	SIS C 3.2P10E	22	LC	1183
-200	6	-0.8...-2.0	SIS C 3.2P20E	22	LC	1183
-240	20	-0.8...-2.0	SIS C 1.4P24E	22	LB	1183
50	0.3	0.8...2.0	SIS C 3.2N05E	50	LC	1183
	3.5	0.8...1.6	SIS C 0.5N05E	22	LA	1183
60	5	0.8...2.0	SIS C 0.5N06E	22	LA	1183
65	3.5	1.4...2.3	SIS C 0.5N65E	22	LA	1183
100	6	1.6...2.6	SIS C 0.5N10E	22	LA	1183
	6	0.8...2.0	SIS C 0.5N10E	22	LA	1183
	0.8	0.8...2.0	SIS C 3.2N10E	50	LC	1183
200	3.5	-1.8...-0.7	SIS C 3.2N20D	22	LC	1183
	28	0.8...2.0	SIS C 0.6N24E	22	LD	1183
	2	0.8...2.0	SIS C 3.2N20E	25	LC	1183
240	8	0.6...1.2	SIS C 1.4N24E	25	LB	1183
	6	0.8...2.0	SIS C 1.4N24E	25	LB	1183
	16	0.8...2.0	SIS C 0.6N24E	22	LD	1183
	20	-1.8...-0.7	SIS C 1.4N24D	25	LB	1183
250	100	-1.8...-0.7	SIS C 0.6N25D	22	LD	1183
400	28	1.5...2.5	SIS C 1.4N40E	25	LE	1183
600	60	-1.8...-0.7	SIS C 1.4N60D	25	LE	1183
	45	1.5...2.5	SIS C 1.4N60E	25	LE	1183

L ≙ Low

1) Note: The recommended bond wire diameter is the same for gate and source.

SIPMOS Power Transistor Dice

$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	Die type	Recommended source bond wire diameter 1) µm	Die topology	Page
-200	1.500	SIPC08P20	250	2)	–
-100	0.600	SIPC08P10	250	2)	–
50	0.030	SIPC20AN05	500	PF	1184
	0.035	SIPC20AN05L	500	PF	1184
	0.055	SIPC14AN05	500	PD	1184
	0.055	SIPC14AN05L	500	PD	1184
	0.070	SIPC08AN05	500	PB	1184
	0.070	SIPC08AN05L	500	PB	1184
	0.100	SIPC06AN05	350	PA	1184
	0.100	SIPC06AN05L	350	PA	1184
60	0.055	SIPC14AN06	500	PD	1184
	0.070	SIPC08AN06	500	PB	1184
	0.120	SIPC06AN06	350	PA	1184
	0.150	SIPC05AN06L	250	2)	–
	0.150	SIPC05AN06	250	2)	–
100	0.055	SIPC20AN10	500	PF	1184
	0.085	SIPC14AN10	350	PD	1184
	0.100	SIPC14AN10L	350	PD	1184
	0.250	SIPC08AN10	250	PB	1184
	0.250	SIPC08AN10L	250	PB	1184
200	0.130	SIPC20AN20	500	PF	1184
	0.200	SIPC14AN20	350	PD	1184
	0.600	SIPC08AN20	250	PB	1184
	0.600	SIPC08AN20L	250	PB	1184
400	1.000	SIPC14AN40	250	PD	1184
	1.000	SIPC14AN40F	250	PE	1184
	2.500	SIPC08AN40	250	PB	1184
500	1.500	SIPC14AN50	250	PD	1184
	2.000	SIPC14AN50F	250	PE	1184
	2.000	SIPC10AN50	250	PC	1184
	4.000	SIPC08AN50	250	PB	1184
600	2.000	SIPC14AN60	250	PD	1184
	3.000	SIPC10AN60	250	PC	1184
	4.000	SIPC08AN60	250	PB	1184
800	4.000	SIPC16AN80	250	2)	–
	8.000	SIPC08AN80	250	PB	1184
1000	8.000	SIPC14AN100	250	PD	1184

P ≙ Power

1) The recommended gate bond wire diameter is 125 µm.

2) On request.

SIPMOS Power Transistor Dice

$V_{DS(max)}$ V	$R_{DS(on)max}$ Ω	Die type	Recommended source bond wire diameter[1]) µm	Die topology	Page
50	0.018	SIPC36AN05	500 x 2	PH	1185
100	0.045	SIPC36AN10	500	PH	1185
200	0.120	SIPC25AN20	350	PG	1185
	0.070	SIPC36AN20	500	PH	1185
400	0.500	SIPC25AN40	350	PG	1185
	0.300	SIPC36AN40	350	PH	1185
	0.400	SIPC36AN40F	350	2)	–
500	0.800	SIPC36N50F	250	2)	–
	0.400	SIPC42AN50	350	PI	1185
	0.800	SIPC25AN50	250	PG	1185
600	0.900	SIPC25AN60	250	PG	1185
800	2.000	SIPC42AN80	250	PI	1185
1000	2.600	SIPC42AN100	250	PI	1185
	2.600	SIPC42N100F	250	PK	1185

Smart SIPMOS Dice

TEMPFET Power Dice

$V_{DS(max)}$ V	$R_{DS(on)}$ Ω	Die type	Recommended source bond wire diameter[1]) µm	Die topology	Page
-50	0.3	SIPC08P05Z	350	2)	–
50	0.028	SIPC20AN05Z	500	PF	1184
	0.018	SIPC36AN05Z	500 x 2	PH	1185
	0.1	SIPC06AN05Z	350	PA	1184
	0.125	SIPC06AN05LZ	350	PA	1184
100	0.100	SIPC14AN10Z	500	PD	1184
	0.100	SIPC14AN10LZ	500	PD	1184
	0.100	SIPC08AN10Z	350	PB	1184

TEMPFET Sensor Dice[3])

Die type	Recommended bond wire diameter µm	Die topology	Page
STSC 0.6**	75 x 2	SA	1186

P ≙ Power

[1]) The recommended gate bond wire diameter is 125 µm.

[2]) On request.

[3]) Note: TEMPFET sensor dice can only be supplied together with TEMPFET power dice in the same quantities.

Smart SIPMOS Dice

PROFET Monolithic Dice

$V_{DS(max)}$ V	$R_{DS(on)}$ Ω	Die type	Recommended bond wire diameter µm Source	Logic	Die topology	Page
45	0.400	SIPC21A05	250 x 2	75 x 3	SE	1186
	0.400	SIPC21C05	250 x 2	75 x 3	SE	1186
60	0.250	SIPCXXB06	350	75 x 3	SE	1186
	0.220	SIPC14D06	350	75 x 3	SD	1186
	0.220	SIPC14E06	350	75 x 3	SD	1186
	0.220	SIPC14F06	350	75 x 3	SD	1186
	0.220	SIPC14G06	350	75 x 3	SD	1186

PROFET Power Dice

$V_{DS(max)}$ V	$R_{DS(on)}$ Ω	Die type	Recommended bond wire diameter µm Source	Logic	Die topology	Page
60	0.018	SIPC36AN06LY	500	75	PH	1185
	0.028	SIPC20AN06LY	350	75	SB	1186

PROFET Logic Dice¹)

Die type	Recommended bond wire diameter µm	Die topology	Page
SILC08C10D	75 x 6	SC	1186
SILC08C10E	75 x 6	SC	1186
SILC08C10F	75 x 6	SC	1186

S ≙ Smart

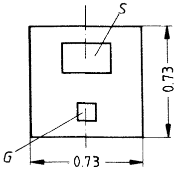
¹) Note: PROFET logic dice can only be supplied together with PROFET power dice in the same quantities.

SIPMOS Die Topologies

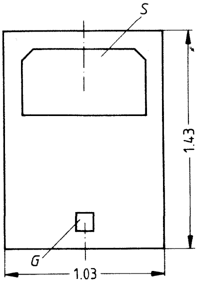
SIPMOS Small-Signal Transistor Dice

(Dimensions in mm)

LA



LB



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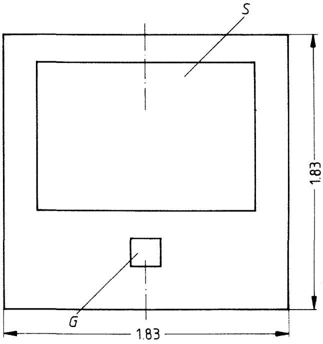
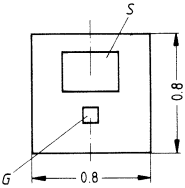
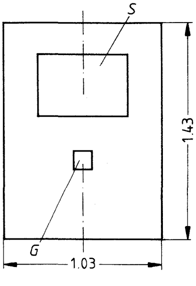


LD



LE

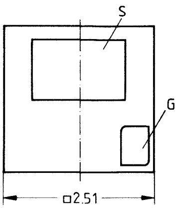


SIPMOS Die Topologies

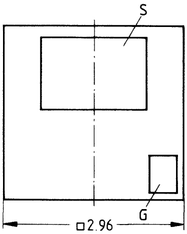
SIPMOS Power Transistor Dice

(Dimensions in mm)

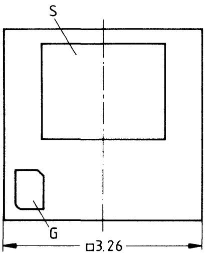
PA



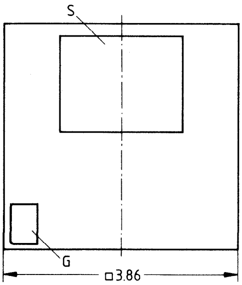
PB



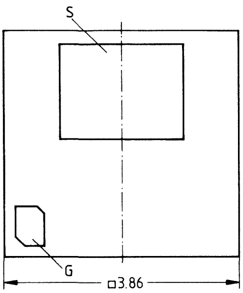
PC



PD



PE



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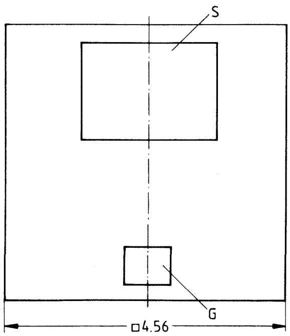

SIPMOS Die Topologies

SIPMOS Power Transistor Dice

(Dimensions in mm)

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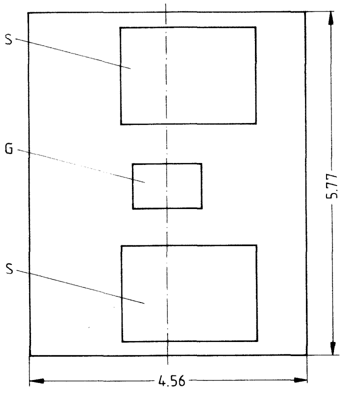

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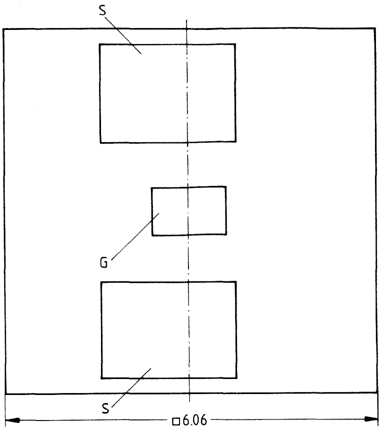

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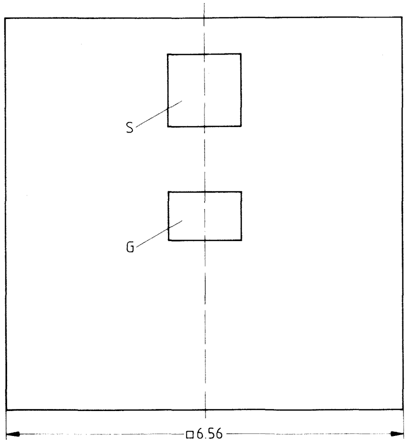

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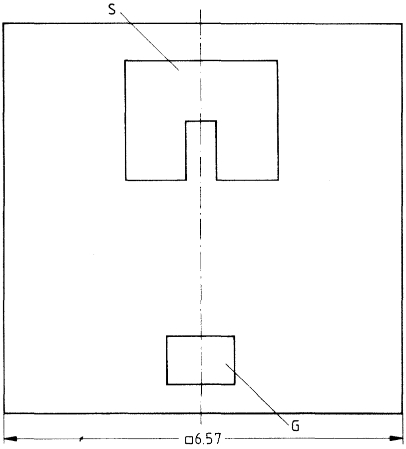
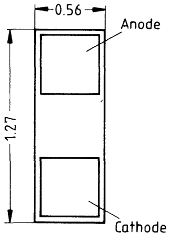


SIPMOS Die Topologies

Smart SIPMOS Dice

(Dimensions in mm)

SA



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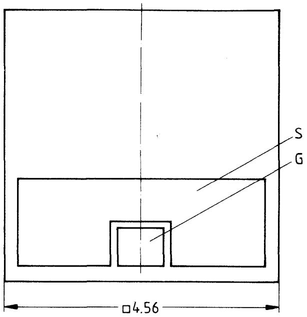

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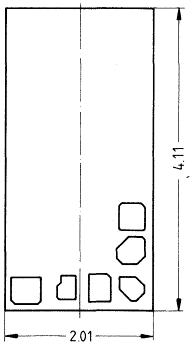

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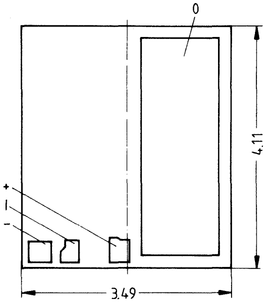

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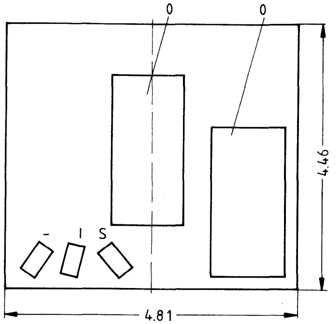

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