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1 Maximum ratings

at T_A=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- -	- -	52 41	A	T_C=25 °C T_C=100 °C
Pulsed drain current[1]	$I_{D,pulse}$	-	-	208	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	214	mJ	I_D=38 A, R_{GS}=25 Ω
Reverse diode peak dv/dt	dv/dt	-	-	60	kV/µs	I_D=52 A, V_{DS}=100 V, di/dt=1500 A/µs, $T_{j,max}$=175 °C
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	214	W	T_C=25 °C
Operating and storage temperature	T_j, T_{stg}	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

2 Thermal characteristics

T_j=25 °C, unless otherwise specified

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	0.4	0.7	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	75	K/W	-
Thermal resistance, junction - ambient, 6 cm^2 cooling area[2]	R_{thJA}	-	-	50	K/W	-

[1] See Diagram 3
[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

3 Electrical characteristics

at T_j=25 °C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	200	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	V_{DS}=V_{GS}, I_D=137 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=160 V, V_{GS}=0 V, T_j=25 °C V_{DS}=160 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	1	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	17.7	22	mΩ	V_{GS}=10 V, I_D=52 A
Gate resistance[1)]	R_G	-	3.7	5.5	Ω	-
Transconductance	g_{fs}	44	88	-	S	|V_{DS}|>2|I_D|$R_{DS(on)max}$, I_D=52 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	2770	3680	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	210	279	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	5.7	10	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	V_{DD}=100 V, V_{GS}=10 V, I_D=17 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	7	-	ns	V_{DD}=100 V, V_{GS}=10 V, I_D=17 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	28	-	ns	V_{DD}=100 V, V_{GS}=10 V, I_D=17 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	10	-	ns	V_{DD}=100 V, V_{GS}=10 V, I_D=17 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics[2)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	13.1	-	nC	V_{DD}=100 V, I_D=52 A, V_{GS}=0 to 10 V
Gate to drain charge[1)]	Q_{gd}	-	4.4	7	nC	V_{DD}=100 V, I_D=52 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	9.2	-	nC	V_{DD}=100 V, I_D=52 A, V_{GS}=0 to 10 V
Gate charge total[1)]	Q_g	-	34	43	nC	V_{DD}=100 V, I_D=52 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.7	-	V	V_{DD}=100 V, I_D=52 A, V_{GS}=0 to 10 V
Output charge[1)]	Q_{oss}	-	84	111	nC	V_{DD}=100 V, V_{GS}=0 V

[1)] Defined by design. Not subject to production test.
[2)] See ″Gate charge waveforms″ for parameter definition

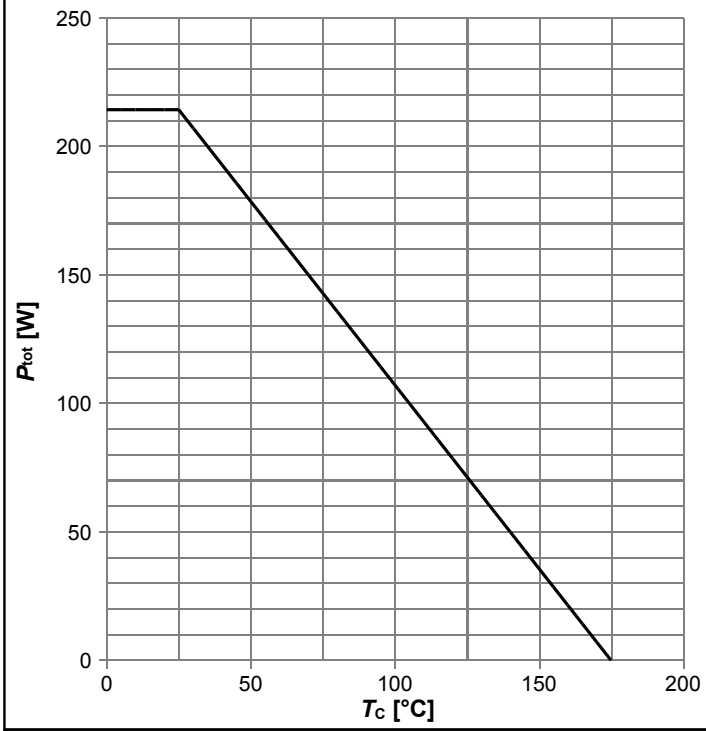
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	52	A	T_C=25 °C
Diode pulse current[1]	$I_{S,pulse}$	-	-	208	A	T_C=25 °C
Diode hard commutation current[2]	$I_{S,hard}$	-	-	52	A	T_C=25 °C, di_F/dt=1500 A/µs
Diode forward voltage	V_{SD}	-	1.0	1.2	V	V_{GS}=0 V, I_F=52 A, T_j=25 °C
Reverse recovery time[3]	t_{rr}	-	89	-	ns	V_R=100 V, I_F=12.5 A, di_F/dt=100 A/µs
Reverse recovery charge[3]	Q_{rr}	-	195	-	nC	V_R=100 V, I_F=12.5 A, di_F/dt=100 A/µs

[1] Diode pulse current is defined by thermal and/or package limits
[2] Maximum allowed hard-commutated current through diode at di/dt=1500 A/µs
[3] Defined by design. Not subject to production test.

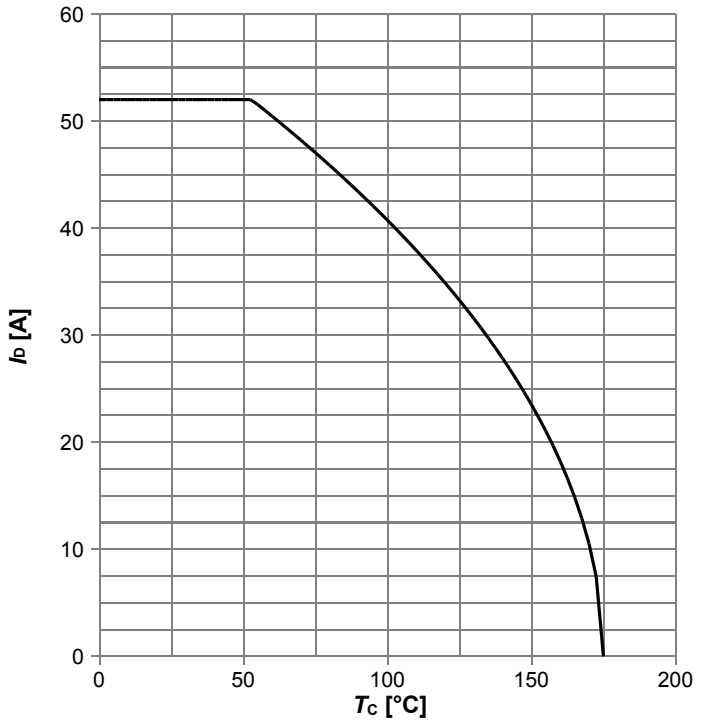
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



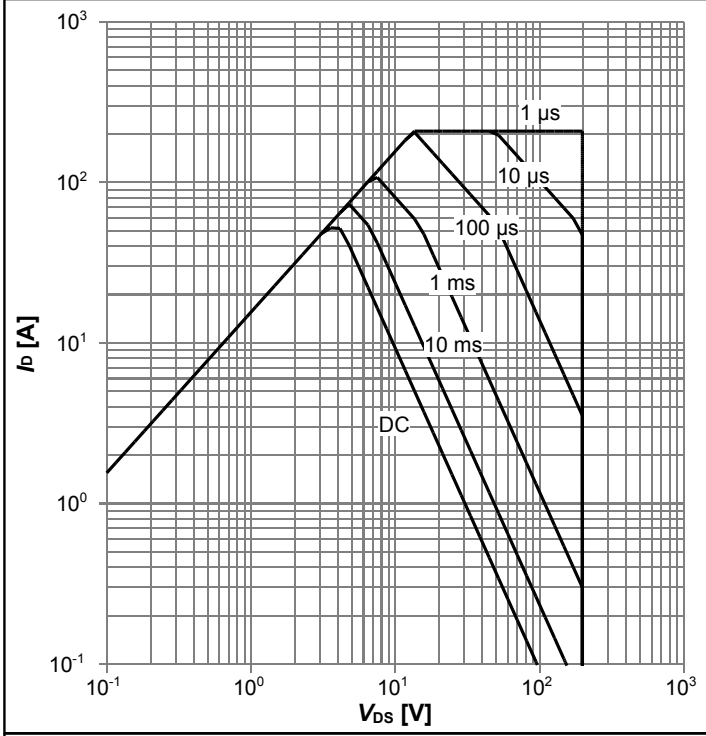
$P_{tot}=f(T_C)$

Diagram 2: Drain current



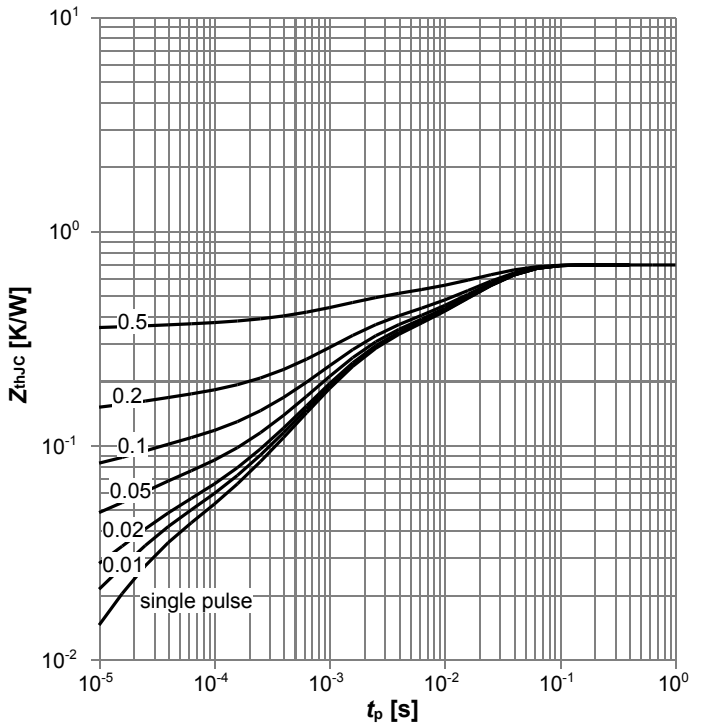
$I_D=f(T_C)$; V_{GS}>=10 V

Diagram 3: Safe operating area



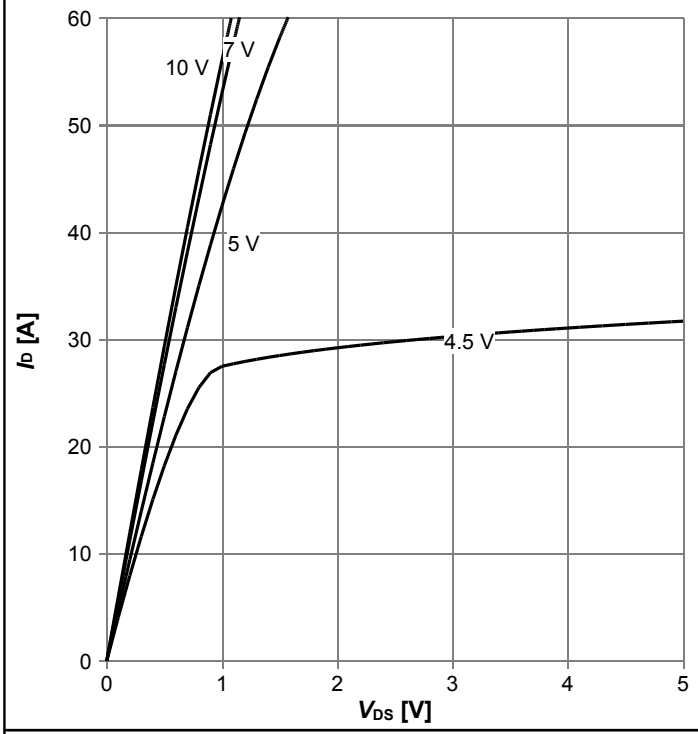
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



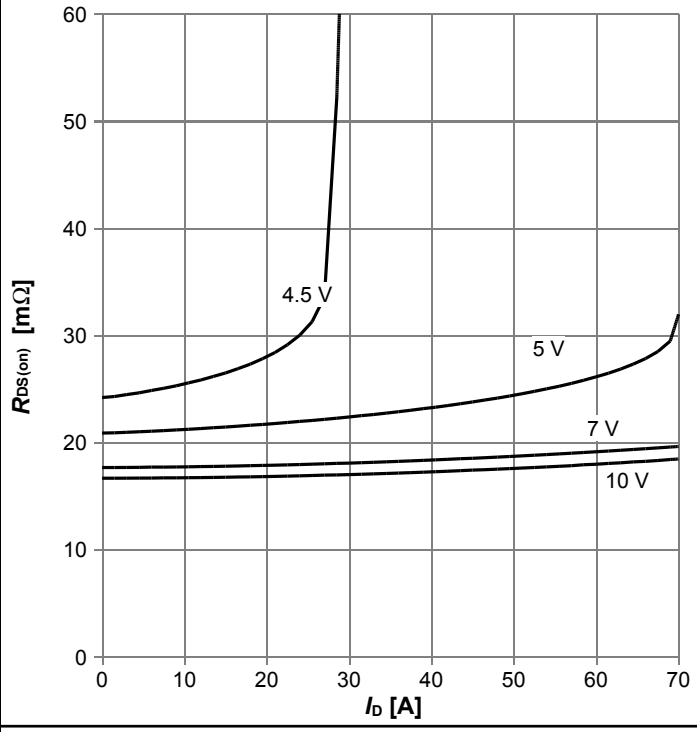
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



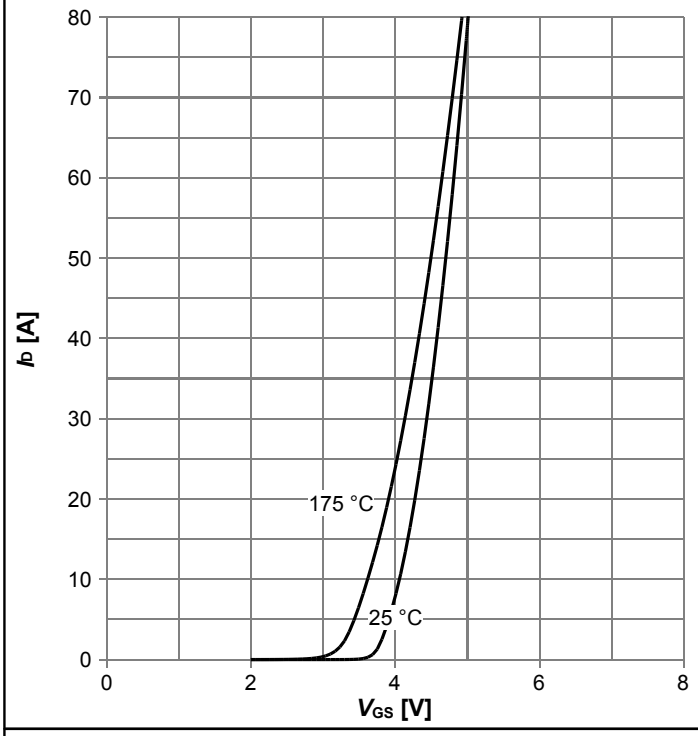
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



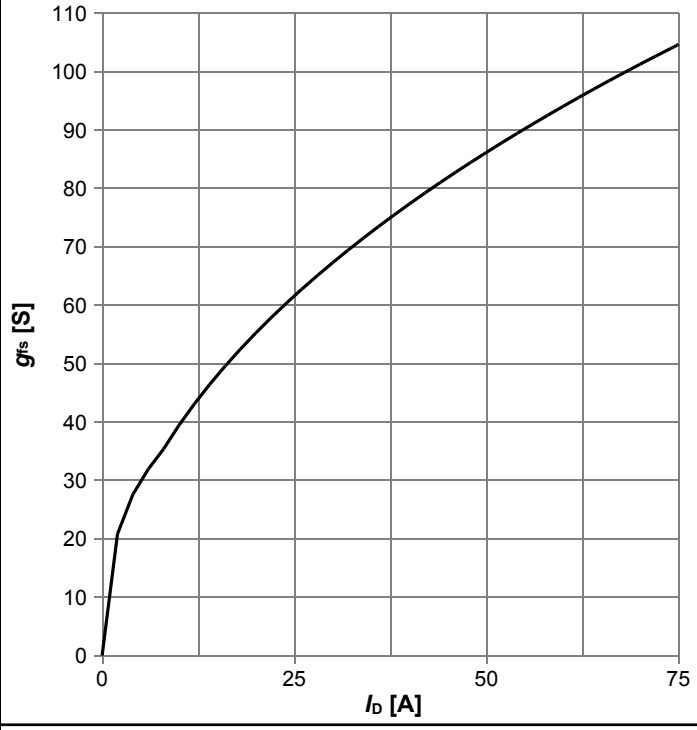
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



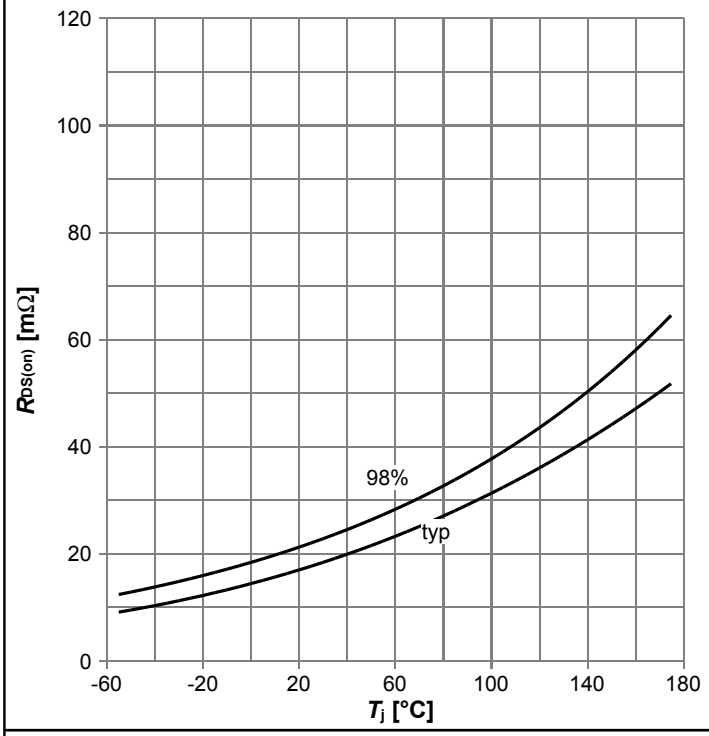
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



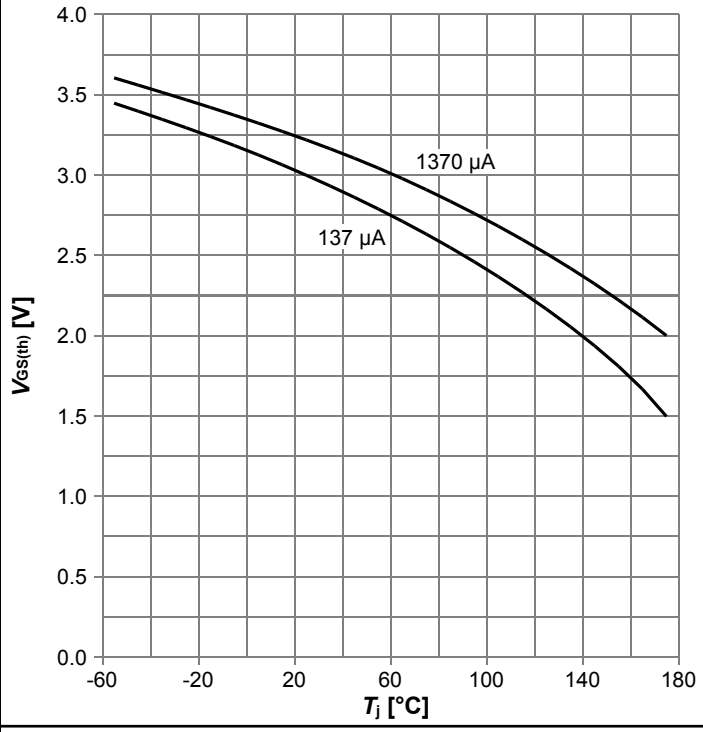
$g_{fs}=f(I_D)$; $T_j=25$ °C

Diagram 9: Drain-source on-state resistance



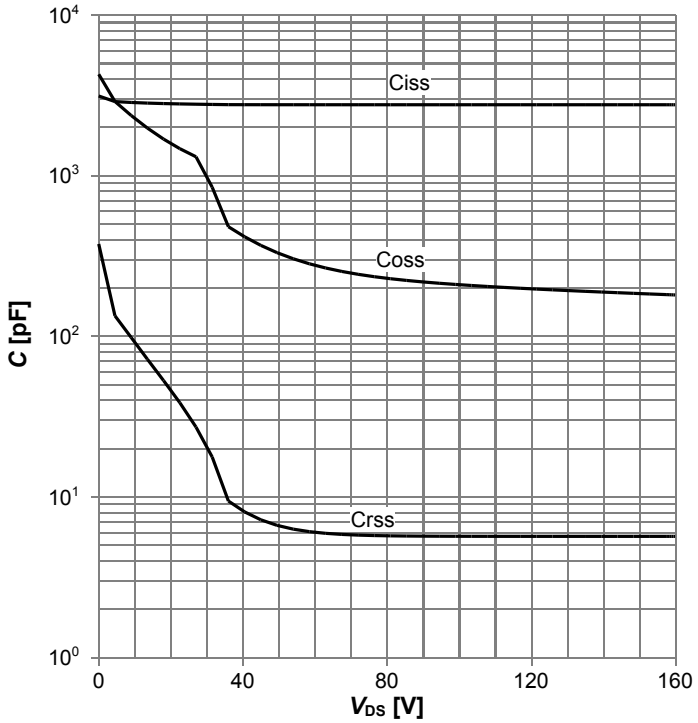
$R_{DS(on)}=f(T_j)$; I_D=55 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



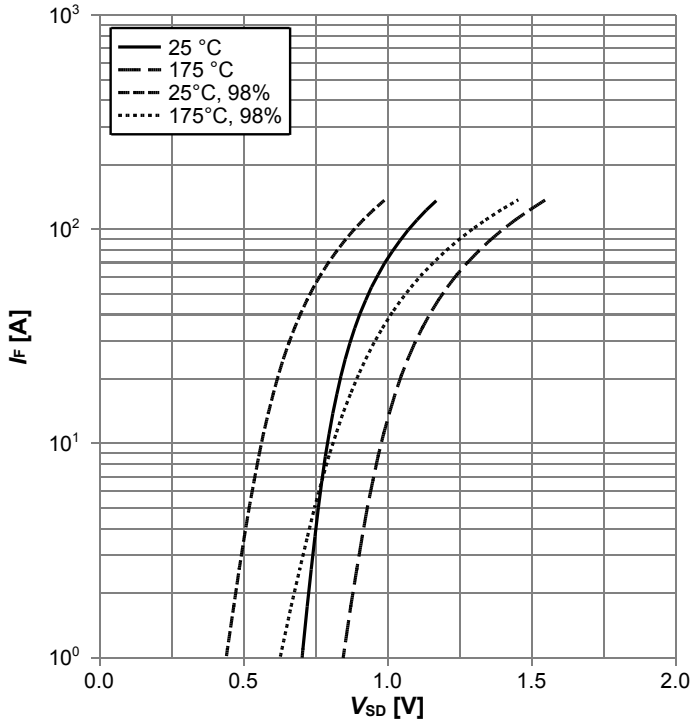
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



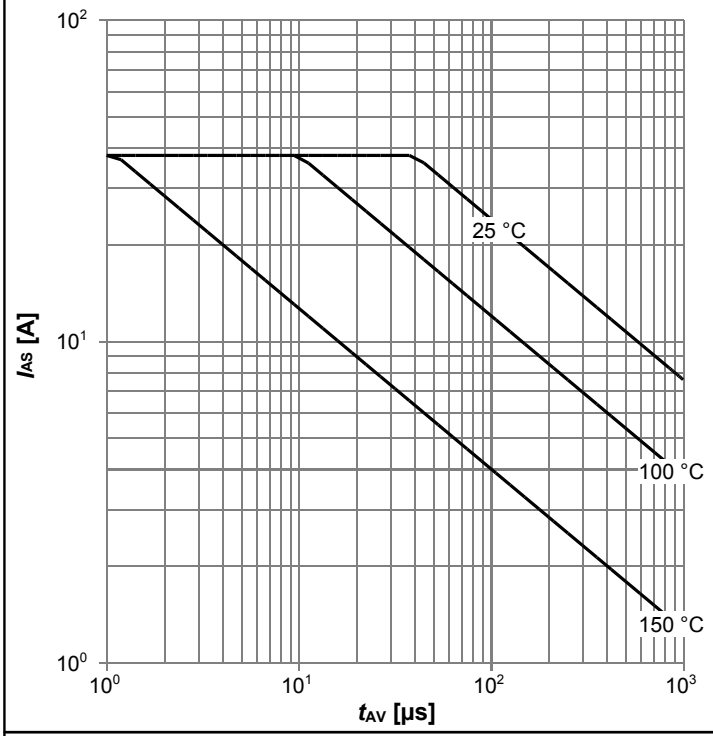
$C=f(V_{DS})$; V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



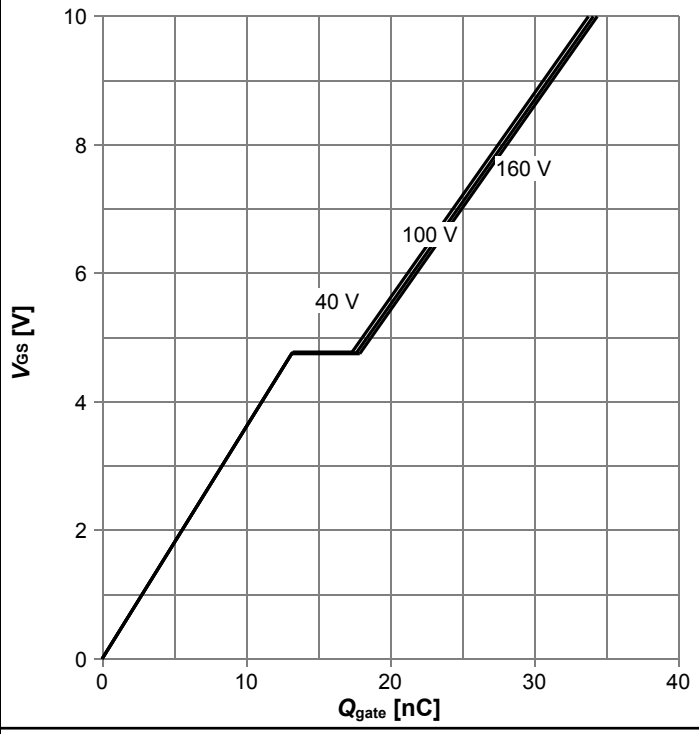
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



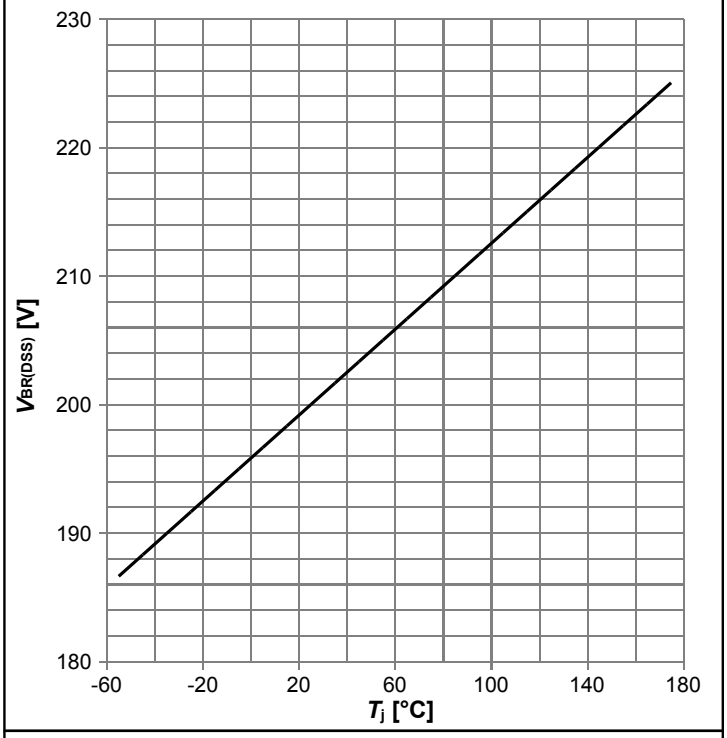
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



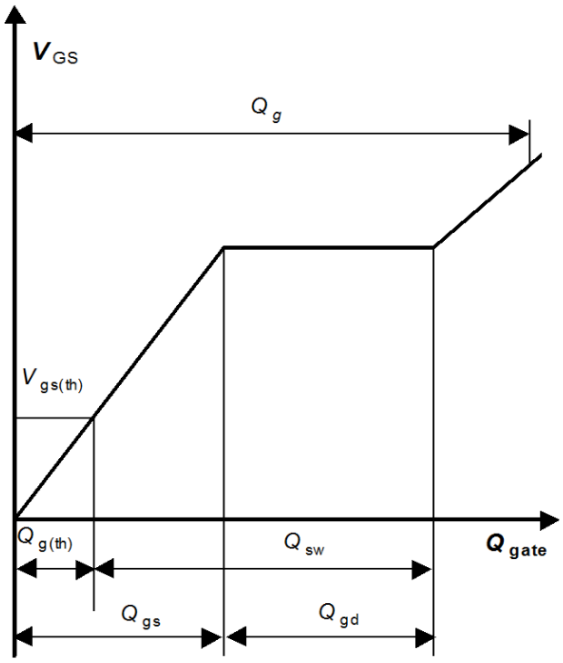
$V_{GS}=f(Q_{gate})$; $I_D=55$ A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

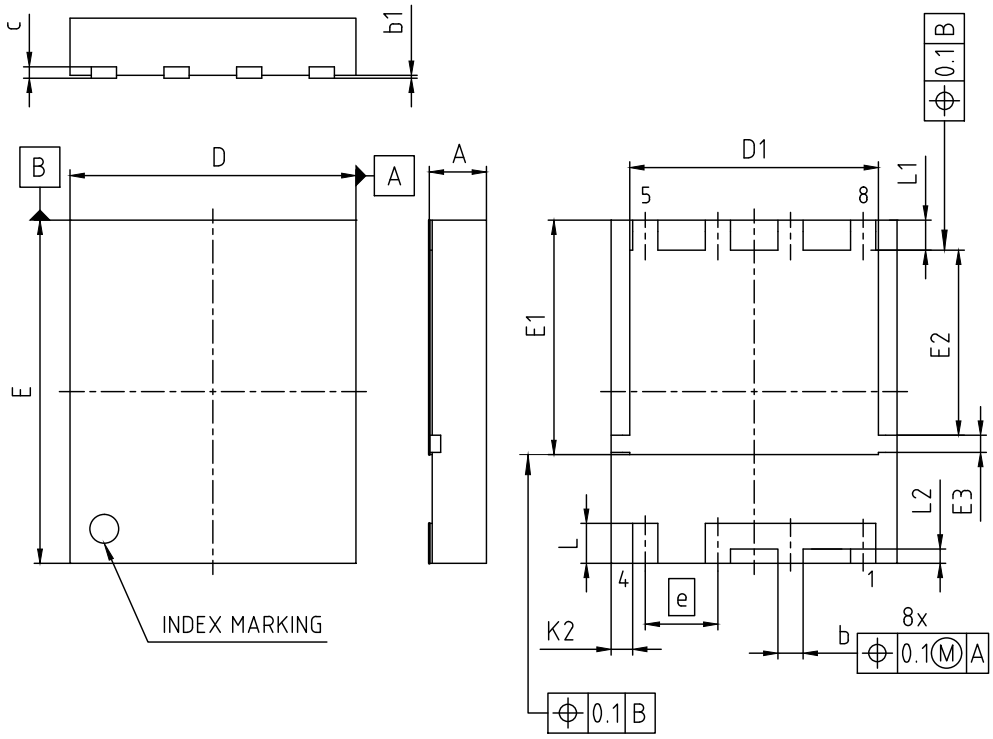


$V_{BR(DSS)}=f(T_j)$; $I_D=1$ mA

Diagram Gate charge waveforms



5 Package Outlines



DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	-	1.10
b	0.34	0.54
b1	-	0.05
c	0.20	
D	4.90	5.10
D1	4.25	4.45
E	5.90	6.10
E1	4.00	4.20
E2	3.14	3.34
E3	0.20	0.40
e	1.27	
K2	(0.37)	
L	0.60	0.80
L1	0.43	0.63
L2	(0.25)	

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Figure 1 Outline TSON-8-3, dimensions in mm/inches

Revision History

BSC220N20NSFD

Revision: 2018-03-14, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2018-03-14	Release of final version

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