

MOSFET

OptiMOS™3 Power-Transistor, 250 V

Features

- N-channel, normal level
- 175 °C rated
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target application
- Halogen-free according to IEC61249-2-21
- Ideal for high-frequency switching and synchronous rectification



Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	250	V
$R_{DS(on),max}$	67	mΩ
I_D	24	A



Type / Ordering Code	Package	Marking	Related Links
BSC670N25NSFD	PG-TDSON-8	670N25NF	-

¹⁾ J-STD20 and JESD22

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1 Maximum ratings

at $T_A=25\text{ °C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	24 19	A	$T_C=25\text{ °C}$ $T_C=100\text{ °C}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	96	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	69	mJ	$I_D=16\text{ A}$, $R_{GS}=25\text{ }\Omega$
Reverse diode dv/dt	dv/dt	-	-	60	kV/ μ s	$I_D=46\text{ A}$, $V_{DS}=125\text{ V}$, $di/dt=1500\text{ A}/\mu\text{s}$, $T_{j,max}=175\text{ °C}$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	150	W	$T_C=25\text{ °C}$
Operating and storage temperature	T_j , T_{stg}	-55	-	175	°C	-

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	0.6	1	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	-

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	250	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	$V_{DS}=V_{GS}$, $I_D=90\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=200\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=200\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	1	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	59	67	m Ω	$V_{GS}=10\text{ V}$, $I_D=24\text{ A}$
Gate resistance	R_G	-	3.3	5	Ω	-
Transconductance	g_{fs}	24	47	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=24\text{ A}$

¹⁾ See Diagram 3

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μ m thick) copper area for drain connection. PCB is vertical in still air.

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	1810	2410	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Output capacitance ¹⁾	C_{oss}	-	103	137	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance ¹⁾	C_{rss}	-	5.4	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=125\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	8.0	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=12\text{ A}$, $R_{G,ext}=1.6\ \Omega$
Rise time	t_r	-	3.6	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=12\text{ A}$, $R_{G,ext}=1.6\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	19	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=12\text{ A}$, $R_{G,ext}=1.6\ \Omega$
Fall time	t_f	-	4.0	-	ns	$V_{DD}=125\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=12\text{ A}$, $R_{G,ext}=1.6\ \Omega$

Table 6 Gate charge characteristics²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	8.2	-	nC	$V_{DD}=125\text{ V}$, $I_D=24\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	Q_{gd}	-	2.9	-	nC	$V_{DD}=125\text{ V}$, $I_D=24\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	5.6	-	nC	$V_{DD}=125\text{ V}$, $I_D=24\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total ¹⁾	Q_g	-	22	30	nC	$V_{DD}=125\text{ V}$, $I_D=24\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	$V_{DD}=125\text{ V}$, $I_D=24\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge	Q_{oss}	-	48	-	nC	$V_{DD}=125\text{ V}$, $V_{GS}=0\text{ V}$

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	24	A	$T_C=25\text{ °C}$
Diode pulse current ³⁾	$I_{S,pulse}$	-	-	96	A	$T_C=25\text{ °C}$
Diode hard commutation current ⁴⁾	$I_{S,hard}$	-	-	46	A	$T_C=25\text{ °C}$, $di_F/dt=1500\text{ A}/\mu\text{s}$
Diode forward voltage	V_{SD}	-	0.9	1.2	V	$V_{GS}=0\text{ V}$, $I_F=24\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ¹⁾	t_{rr}	-	69	138	ns	$V_R=125\text{ V}$, $I_F=16.1\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ¹⁾	Q_{rr}	-	153	306	nC	$V_R=125\text{ V}$, $I_F=16.1\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$

¹⁾ Defined by design. Not subject to production test.

²⁾ See "Gate charge waveforms" for parameter definition

³⁾ Diode pulse current is defined by thermal and/or package limits

⁴⁾ Maximum allowed hard-commutated current through diode at $di/dt=1500\text{ A}/\mu\text{s}$

4 Electrical characteristics diagrams

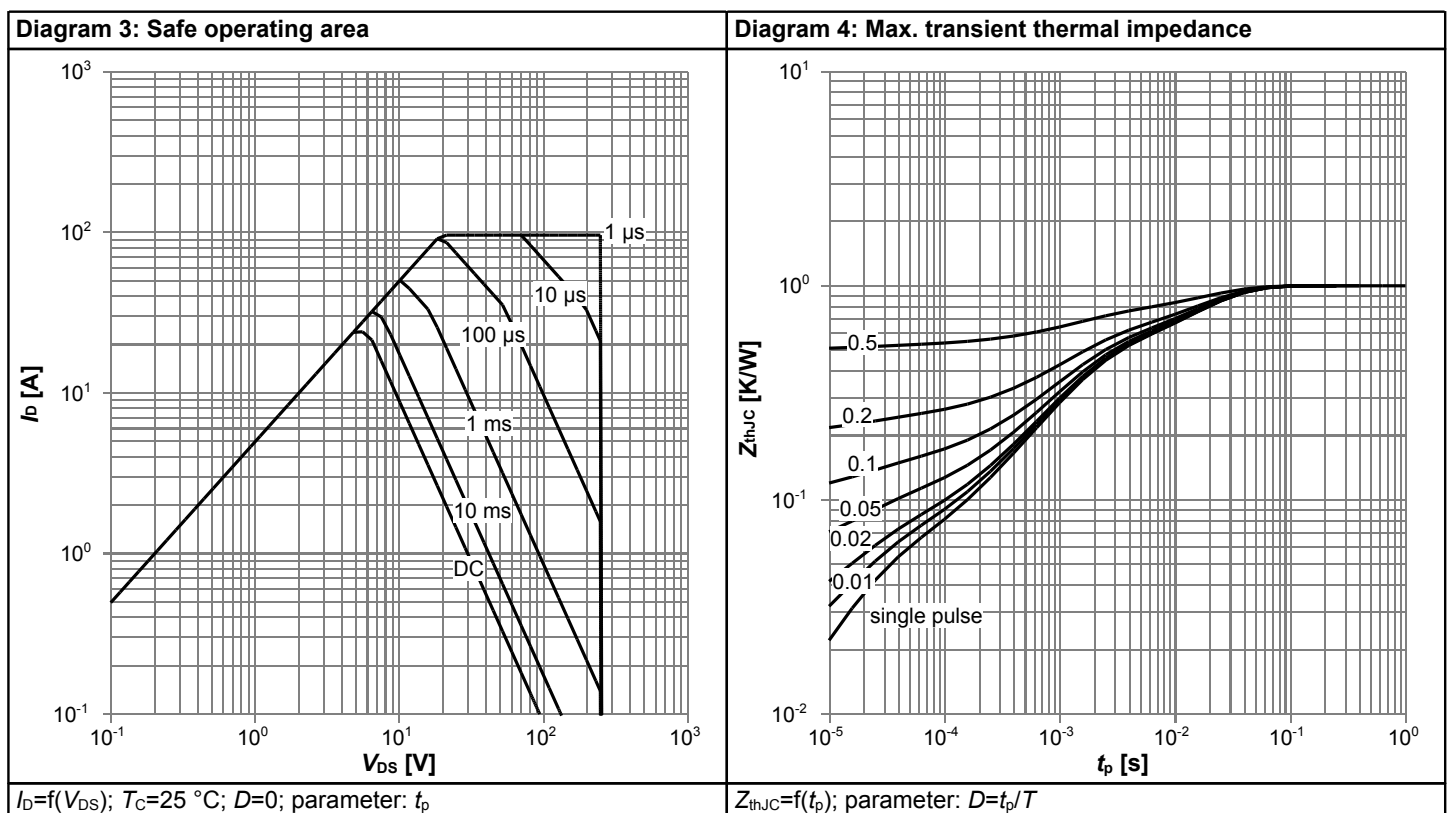
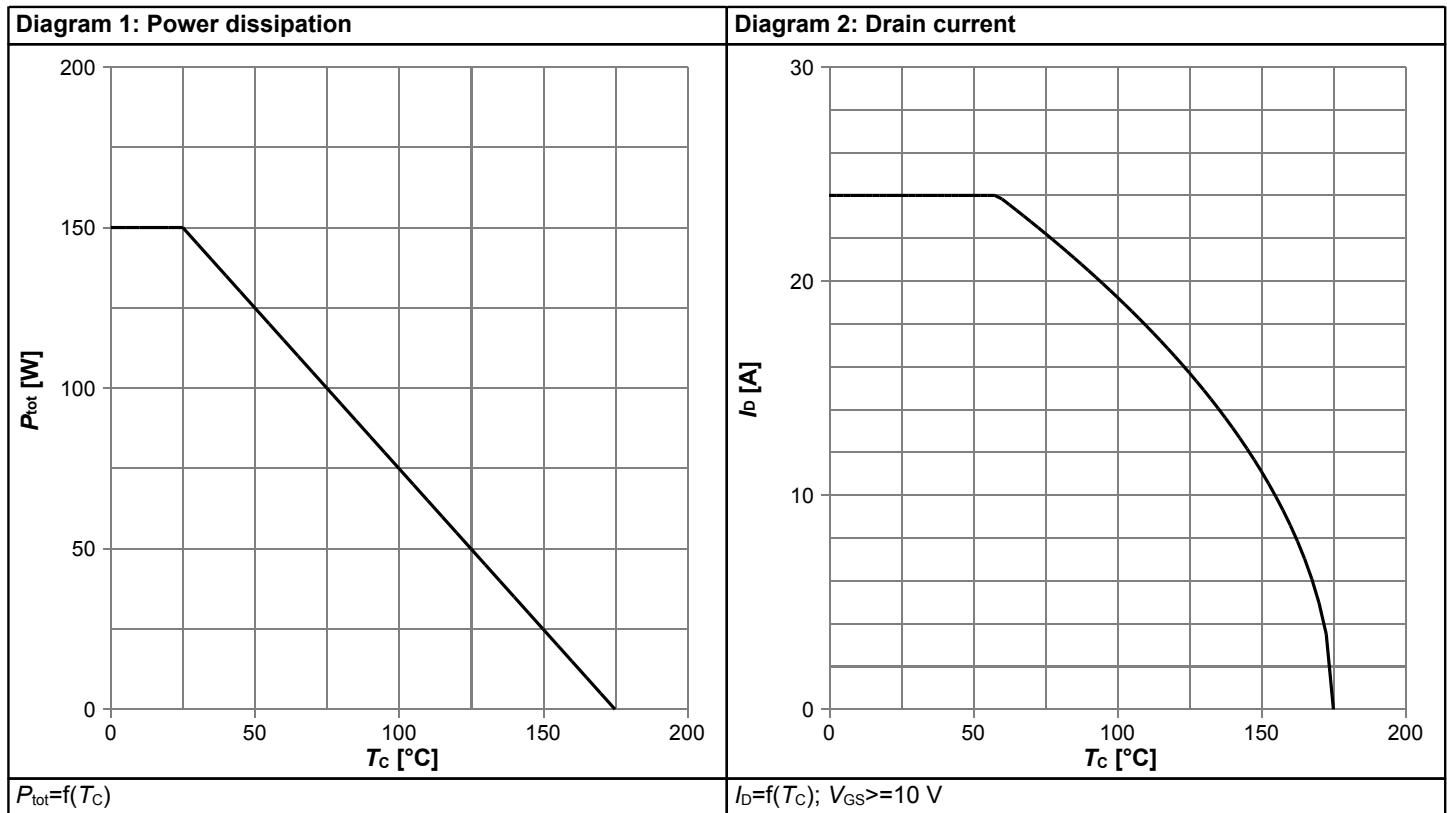
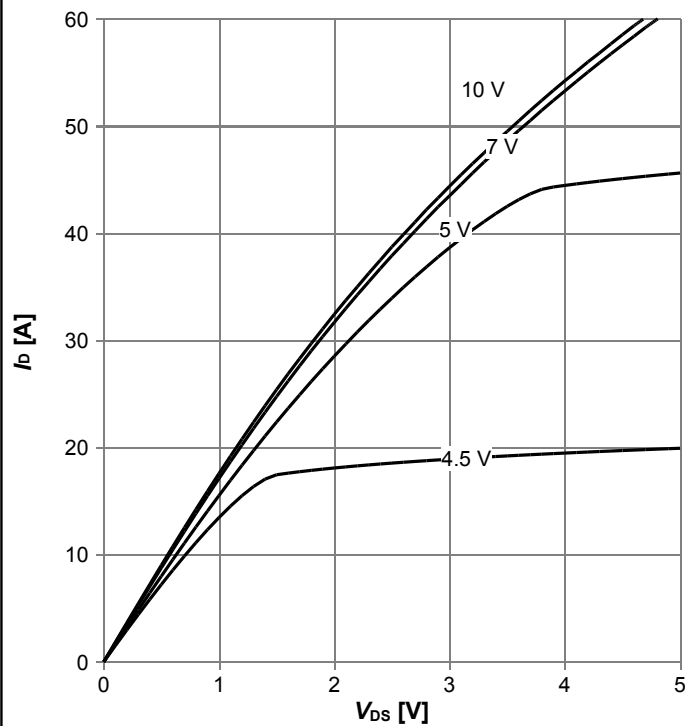
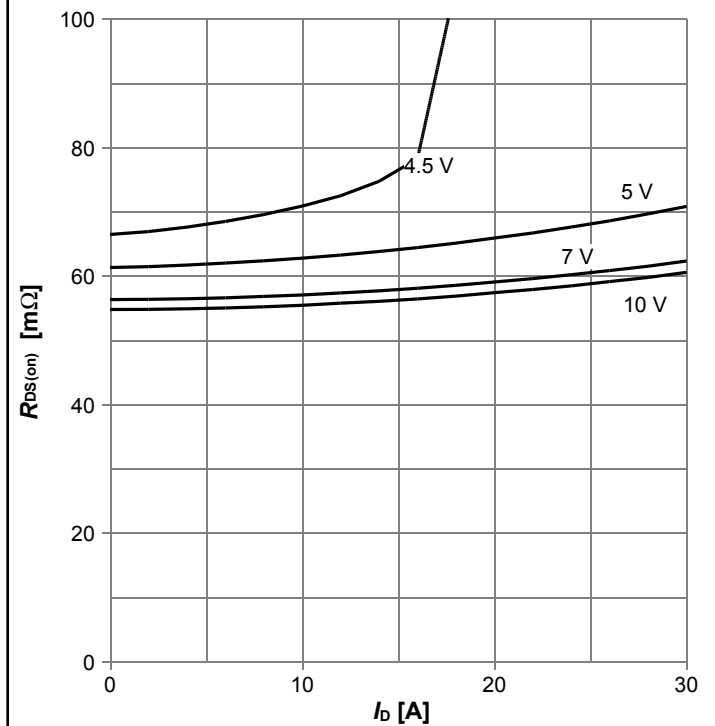


Diagram 5: Typ. output characteristics



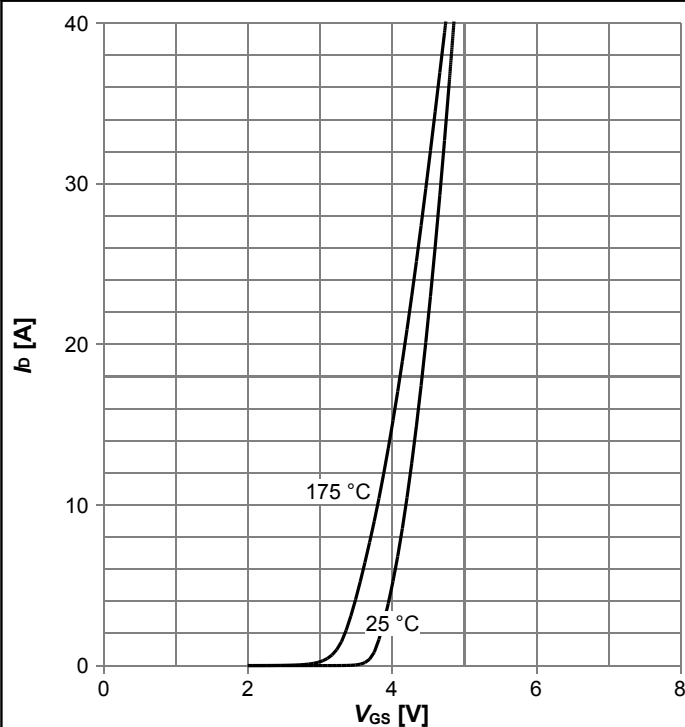
$I_D = f(V_{DS})$; $T_J = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



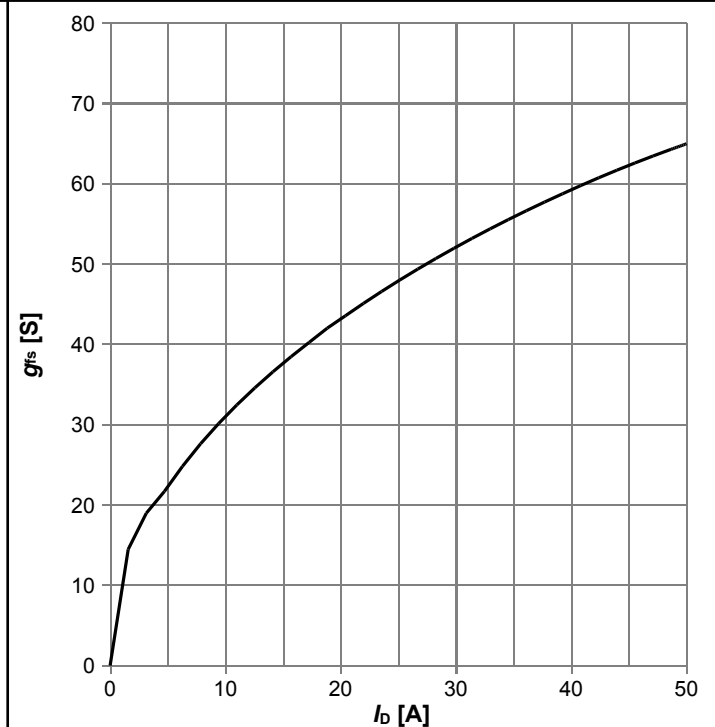
$R_{DS(on)} = f(I_D)$; $T_J = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



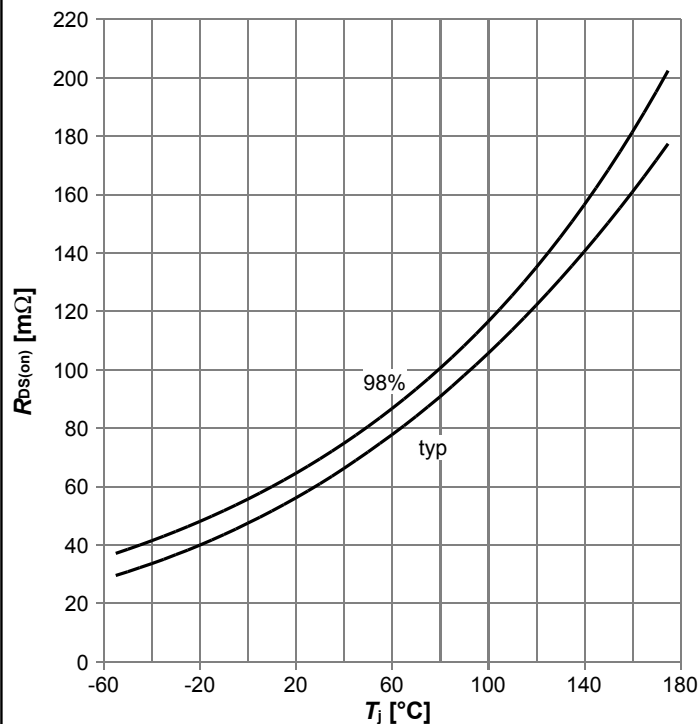
$I_D = f(V_{GS})$; $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_J

Diagram 8: Typ. forward transconductance



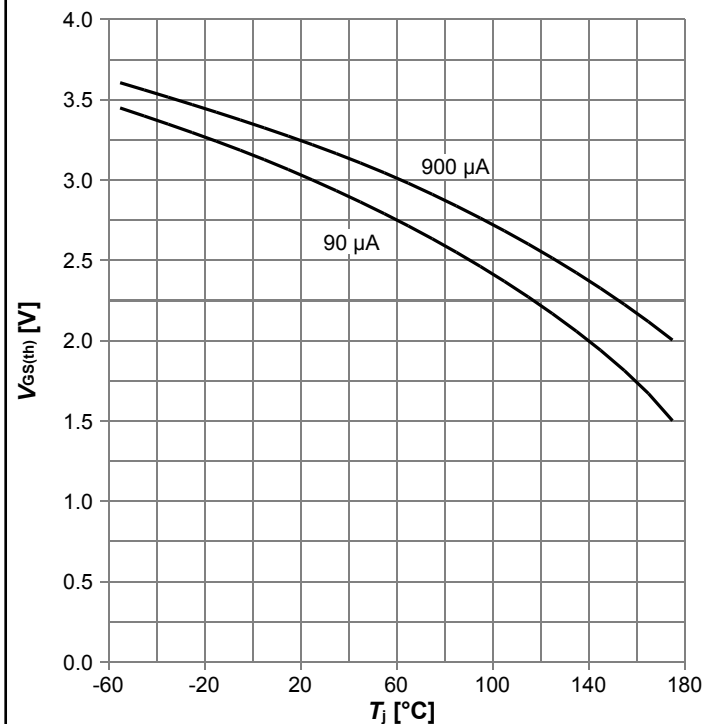
$g_{fs} = f(I_D)$; $T_J = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



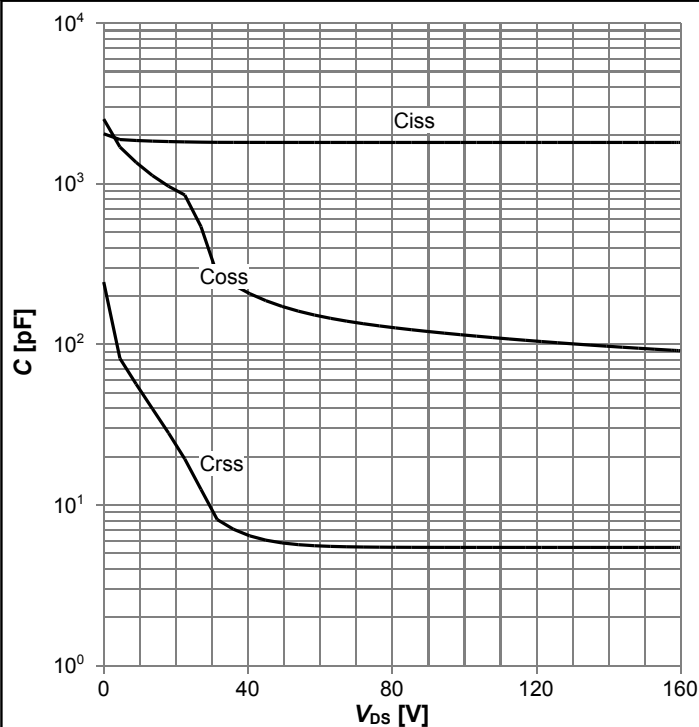
$R_{DS(on)} = f(T_j)$; $I_D = 24$ A; $V_{GS} = 10$ V

Diagram 10: Typ. gate threshold voltage



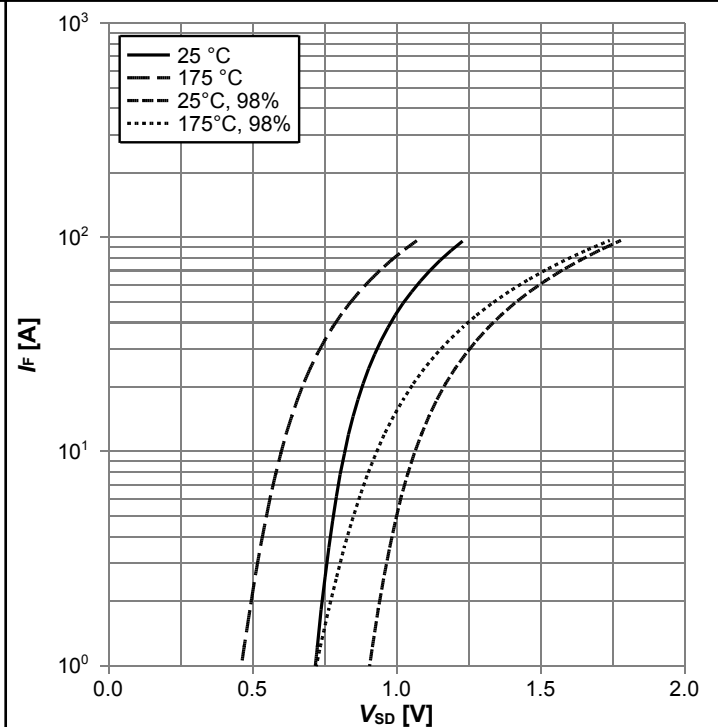
$V_{GS(th)} = f(T_j)$; $V_{GS} = V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



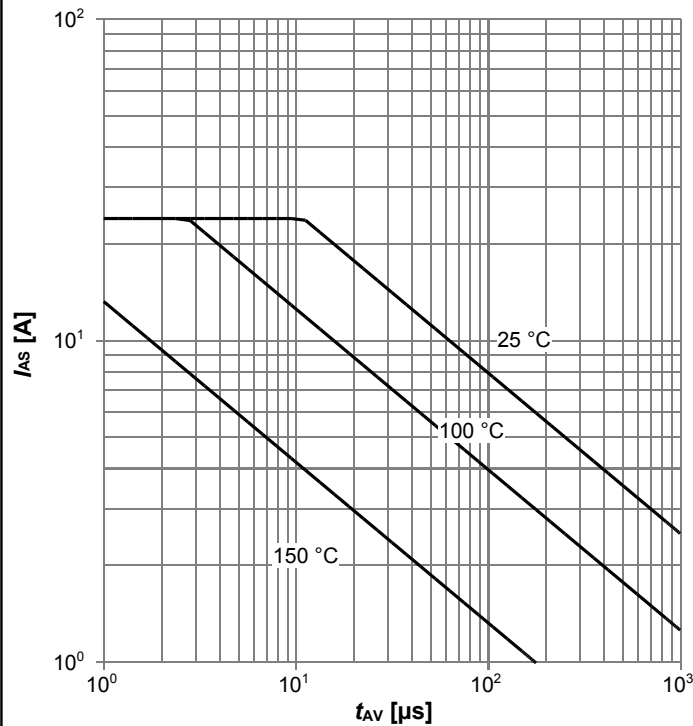
$C = f(V_{DS})$; $V_{GS} = 0$ V; $f = 1$ MHz

Diagram 12: Forward characteristics of reverse diode



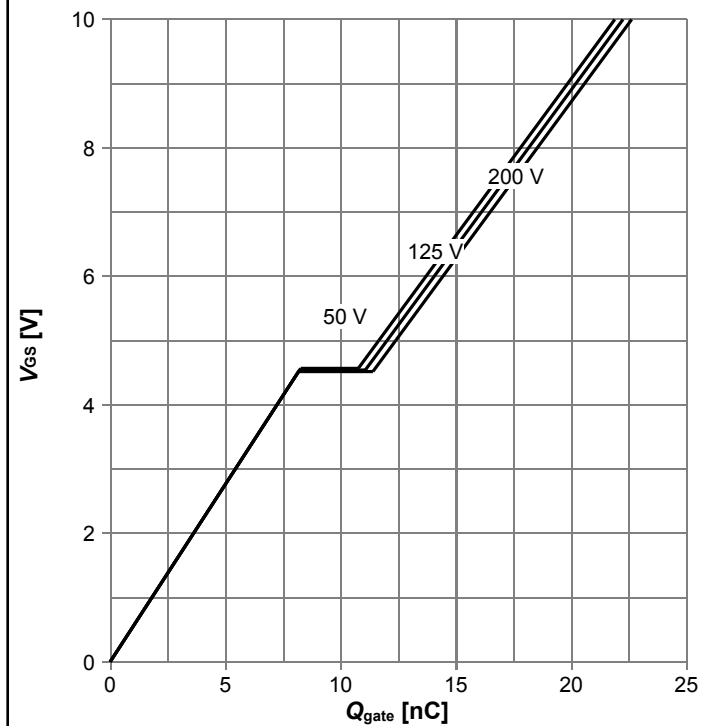
$I_F = f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



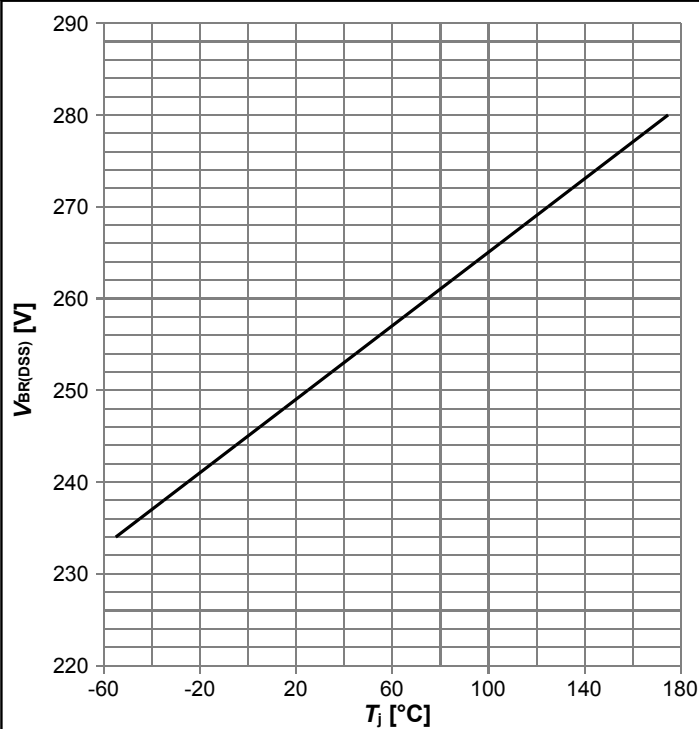
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



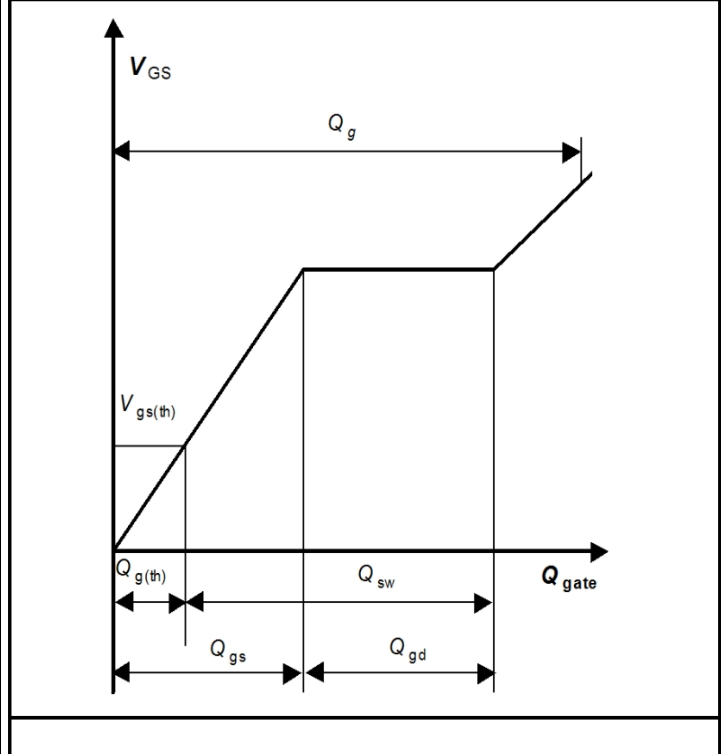
$V_{GS}=f(Q_{gate})$; $I_D=24\text{ A}$ pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

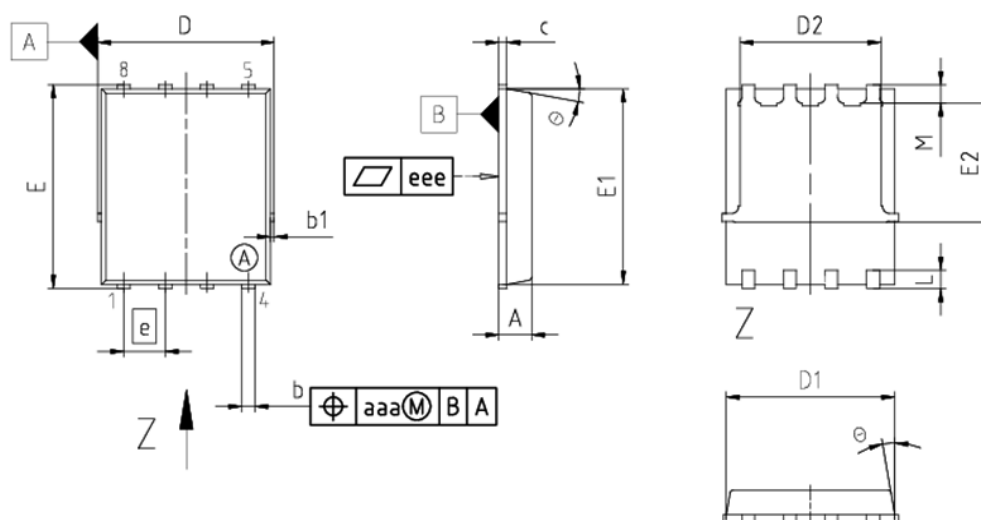


$V_{BR(DSS)}=f(T_j)$; $I_D=1\text{ mA}$

Gate charge waveforms



5 Package Outlines



DIM	MILLIMETERS	
	MIN	MAX
A	0.90	1.10
b	0.31	0.54
b1	0.02	0.22
c	0.15	0.35
D	5.15	5.49
D1	4.95	5.35
D2	3.70	4.40
E	5.95	6.35
E1	5.70	6.10
E2	3.40	3.80
e	1.27	
N	8	
L	0.45	0.71
M	0.45	0.75
ø	8.5°	12°
aaa	0.25	
eee	0.08	

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Figure 1 Outline PG-TDSON-8, dimensions in mm

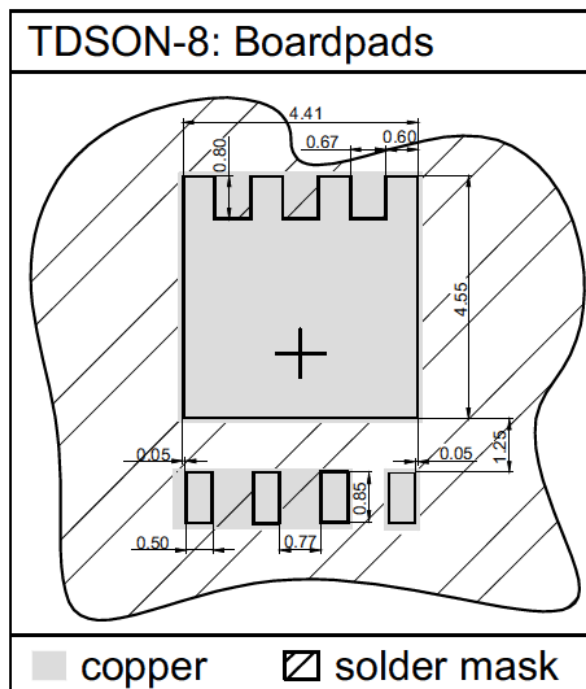


Figure 2 Outline Footprint (TDSON-8)

Revision History

BSC670N25NSFD

Revision: 2016-12-05, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.2	2016-05-13	Rev. 1.2 (preliminary datasheet)
2.0	2016-10-25	Release of final version
2.1	2016-12-05	Update Eas

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