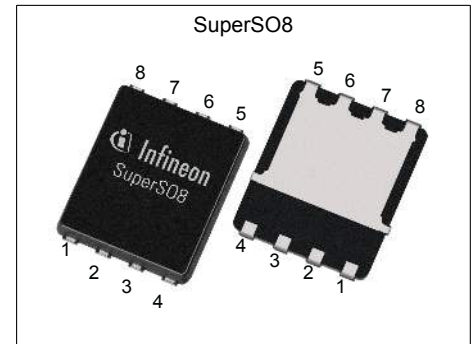


# MOSFET

## OptiMOS™ 3 Power-Transistor, 150 V

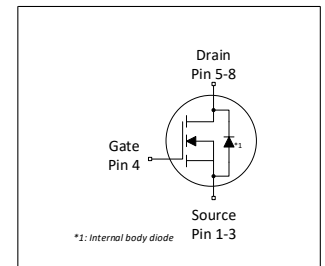
### Features

- Optimized for dc-dc conversion
- N-channel, normal level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating; RoHS compliant;
- Qualified according to JEDEC<sup>1)</sup> for target application
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	150	V
$R_{DS(on),max}$	52	m $\Omega$
$I_D$	21	A



RoHS

Type / Ordering Code	Package	Marking	Related Links
BSC520N15NS3 G	PG-TDSON-8	520N15NS	-

<sup>1)</sup> 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	$I_D$	-	-	21 14	A	$T_C=25\text{ °C}$ $T_C=100\text{ °C}$
Pulsed drain current <sup>1)</sup>	$I_{D,pulse}$	-	-	84	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	60	mJ	$I_D=18\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	57	W	$T_C=25\text{ °C}$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	150	°C	IEC climatic category; DIN IEC 68-1: 55/150/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	2.2	K/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>2)</sup>	$R_{thJA}$	-	-	50	K/W	-

## 3 Electrical characteristics

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

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	150	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	$V_{DS}=V_{GS}$ , $I_D=35\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.01 10	1 100	$\mu\text{A}$	$V_{DS}=120\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=120\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	1	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	42 42	52 52	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=18\text{ A}$ $V_{GS}=8\text{ V}$ , $I_D=9\text{ A}$
Gate resistance	$R_G$	-	2.1	-	$\Omega$	-
Transconductance	$g_{fs}$	11	21	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=18\text{ A}$

<sup>1)</sup> see Diagram 3

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  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	$C_{iss}$	-	670	890	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=75\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	80	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=75\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	3.4	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=75\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	$V_{DD}=75\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$ , $R_G=1.6\ \Omega$
Rise time	$t_r$	-	4	-	ns	$V_{DD}=75\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$ , $R_G=1.6\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	10	-	ns	$V_{DD}=75\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$ , $R_G=1.6\ \Omega$
Fall time	$t_f$	-	3	-	ns	$V_{DD}=75\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$ , $R_G=1.6\ \Omega$

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	3.5	4.6	nC	$V_{DD}=75\text{ V}$ , $I_D=9\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	-	1.5	-	nC	$V_{DD}=75\text{ V}$ , $I_D=9\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	3	-	nC	$V_{DD}=75\text{ V}$ , $I_D=9\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	$Q_g$	-	8.7	12	nC	$V_{DD}=75\text{ V}$ , $I_D=9\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	5.2	-	V	$V_{DD}=75\text{ V}$ , $I_D=9\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge	$Q_{oss}$	-	22	29	nC	$V_{DD}=75\text{ V}$ , $V_{GS}=0\text{ V}$

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	21	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	84	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.9	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=21\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time	$t_{rr}$	-	66	-	ns	$V_R=50\text{ V}$ , $I_F=9\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	226	-	nC	$V_R=50\text{ V}$ , $I_F=9\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

<sup>1)</sup> See "Gate charge waveforms" for parameter definition

## 4 Electrical characteristics diagrams

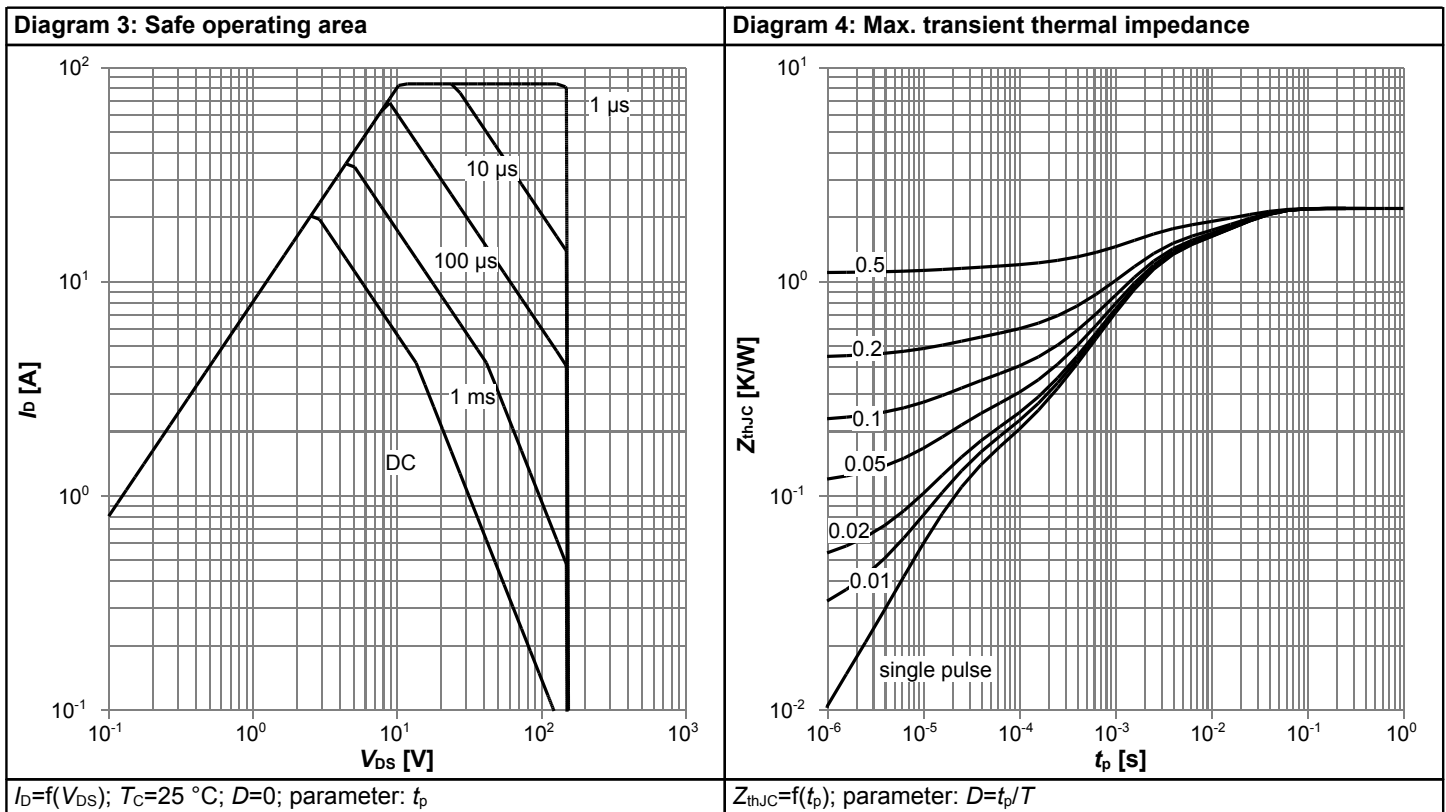
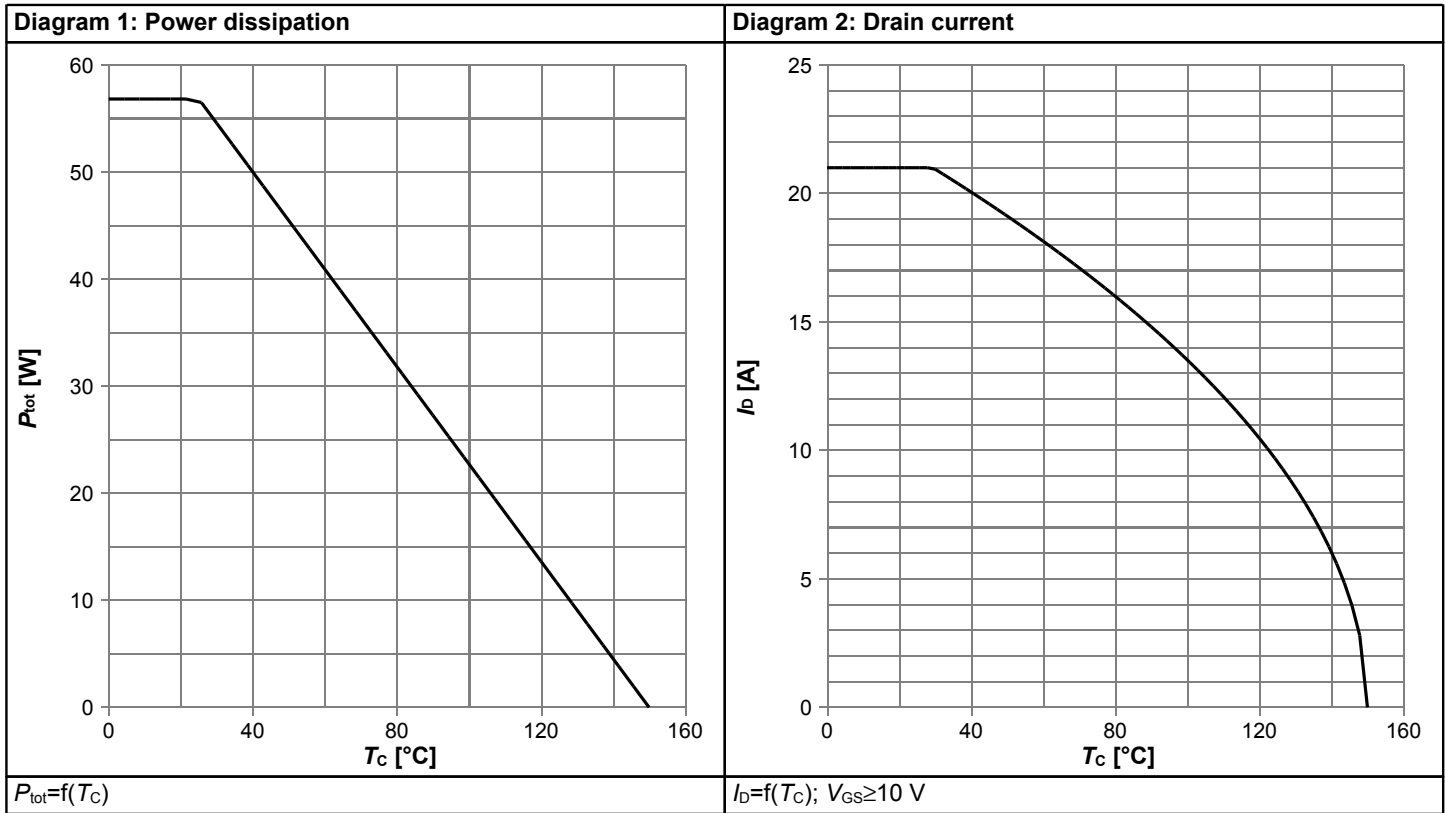
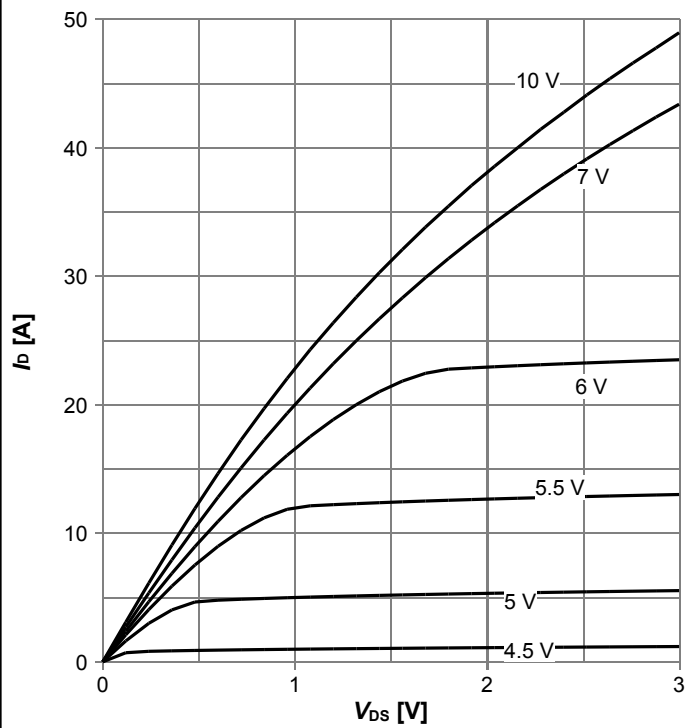
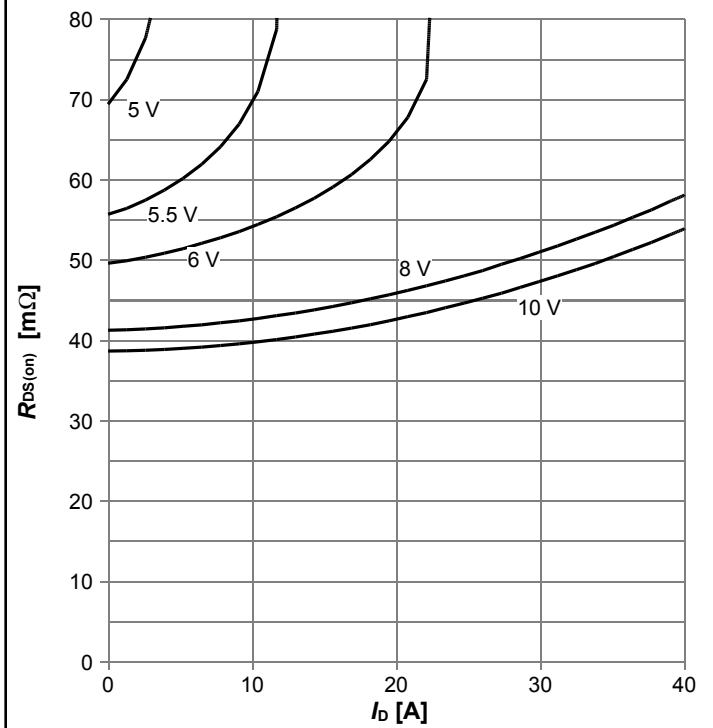


Diagram 5: Typ. output characteristics



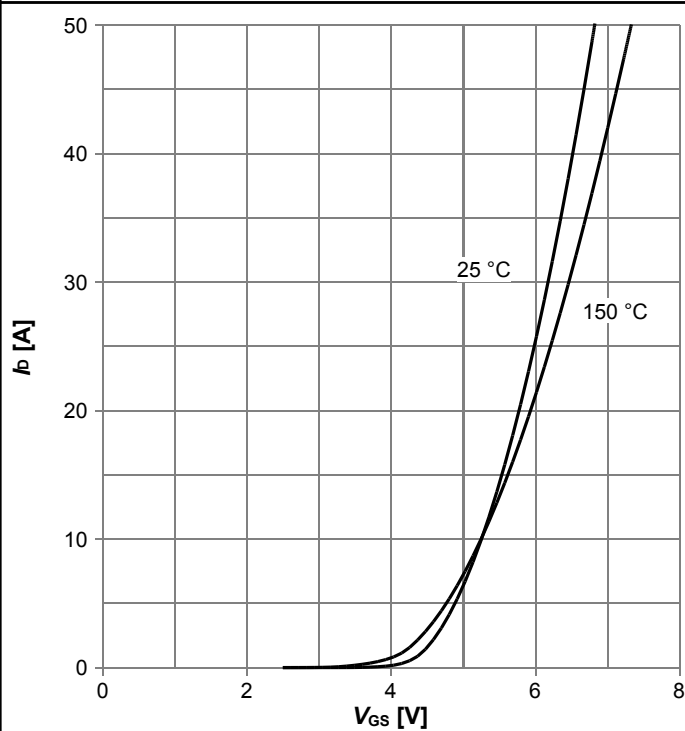
$I_D = f(V_{DS})$ ;  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



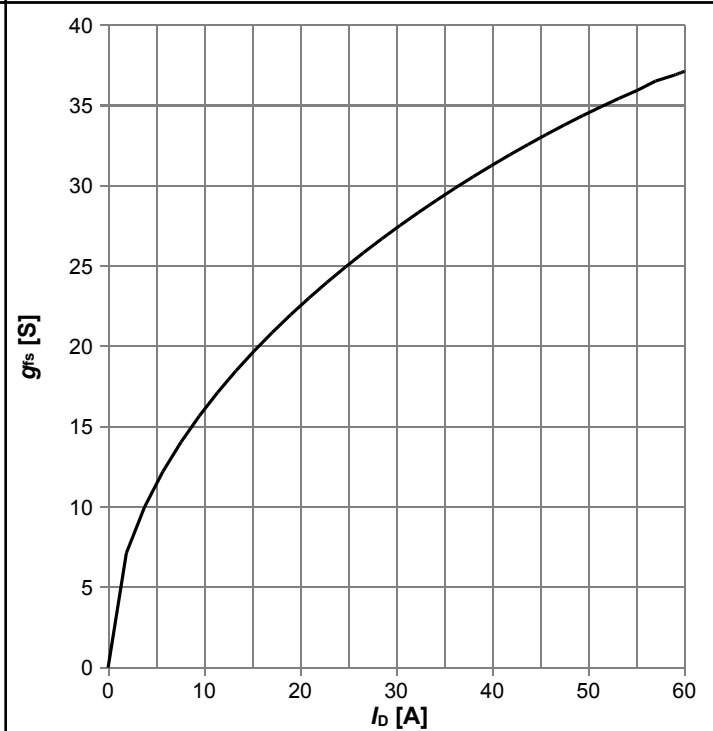
$R_{DS(on)} = f(I_D)$ ;  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



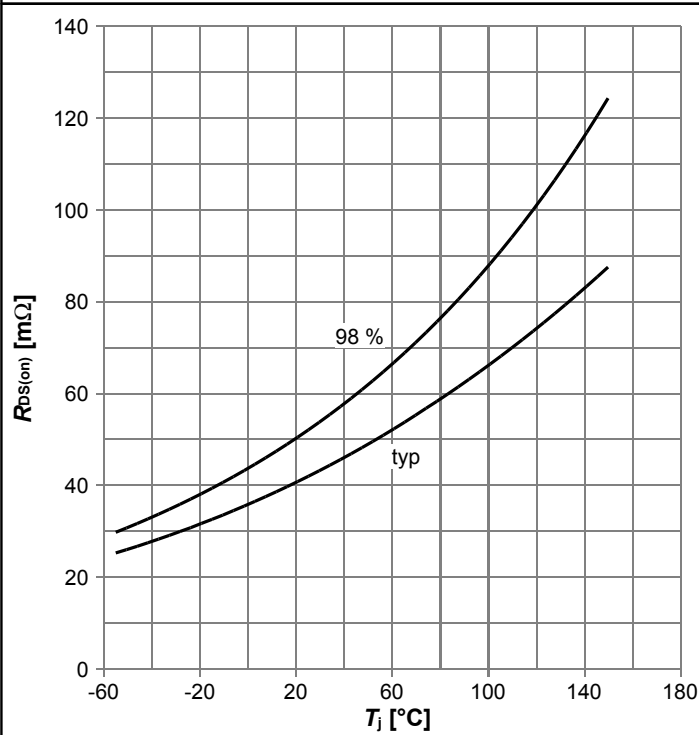
$I_D = f(V_{GS})$ ;  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. forward transconductance



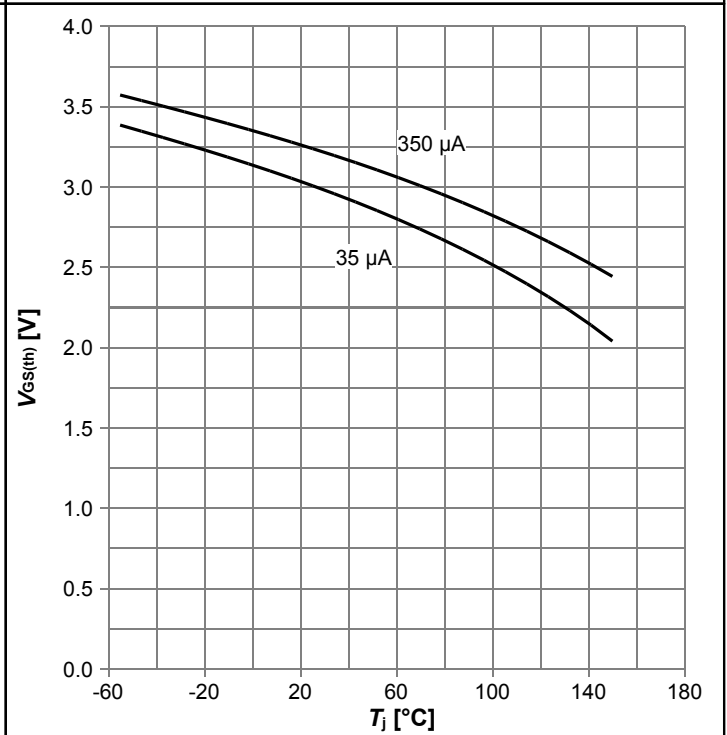
$g_{fs} = f(I_D)$ ;  $T_j = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



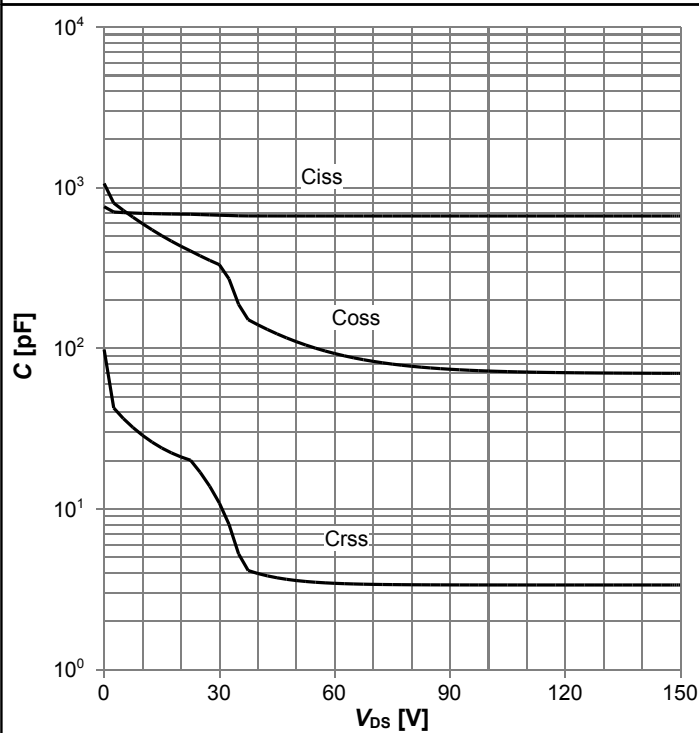
$R_{DS(on)}=f(T_j)$ ;  $I_D=18\text{ A}$ ;  $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



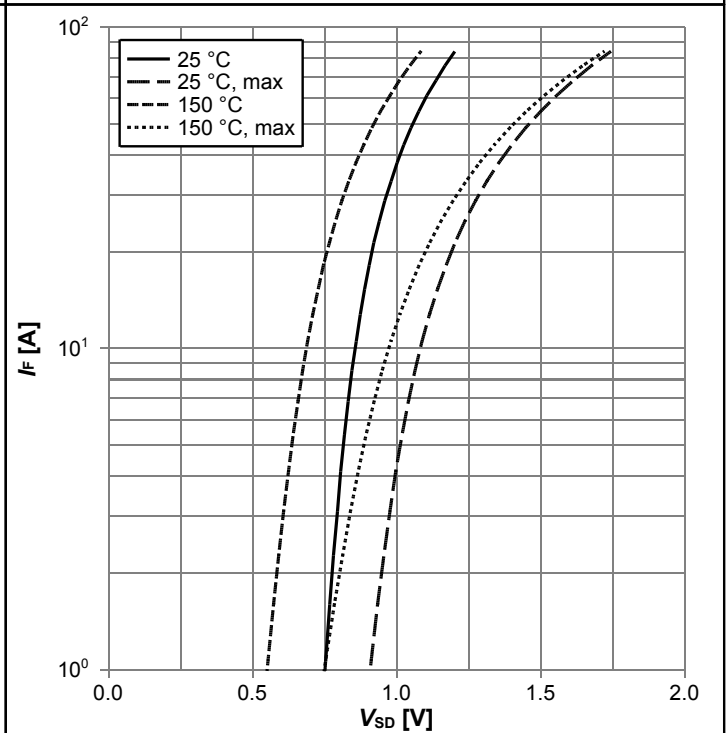
$V_{GS(th)}=f(T_j)$ ;  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



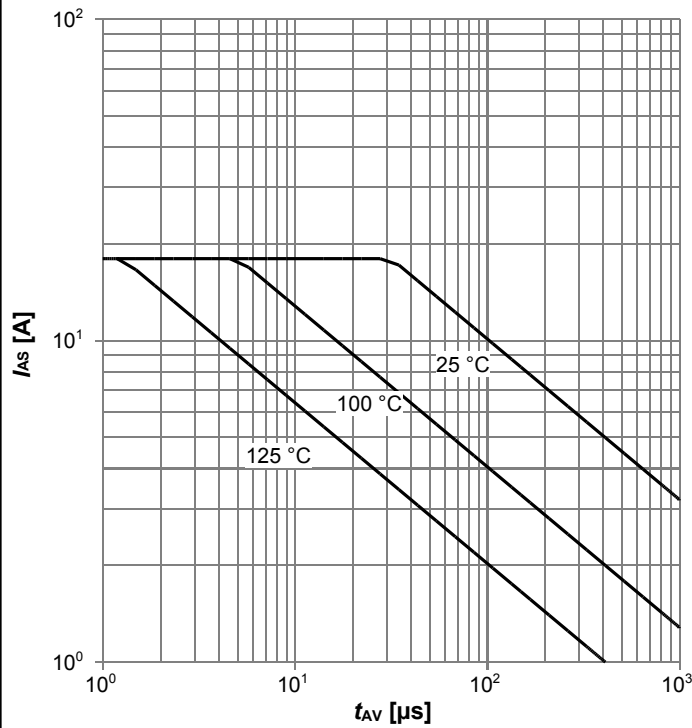
$C=f(V_{DS})$ ;  $V_{GS}=0\text{ V}$ ;  $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



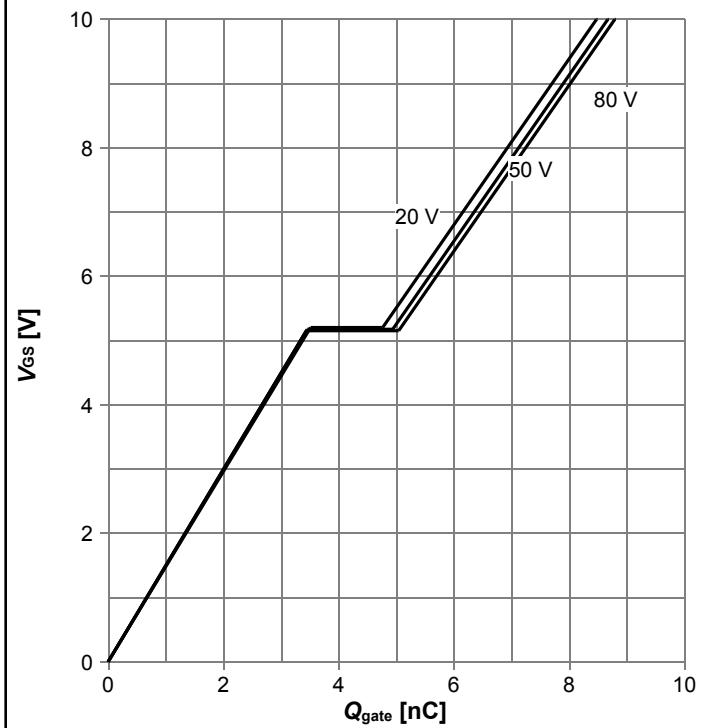
$I_F=f(V_{SD})$ ; parameter:  $T_j$

**Diagram 13: Avalanche characteristics**



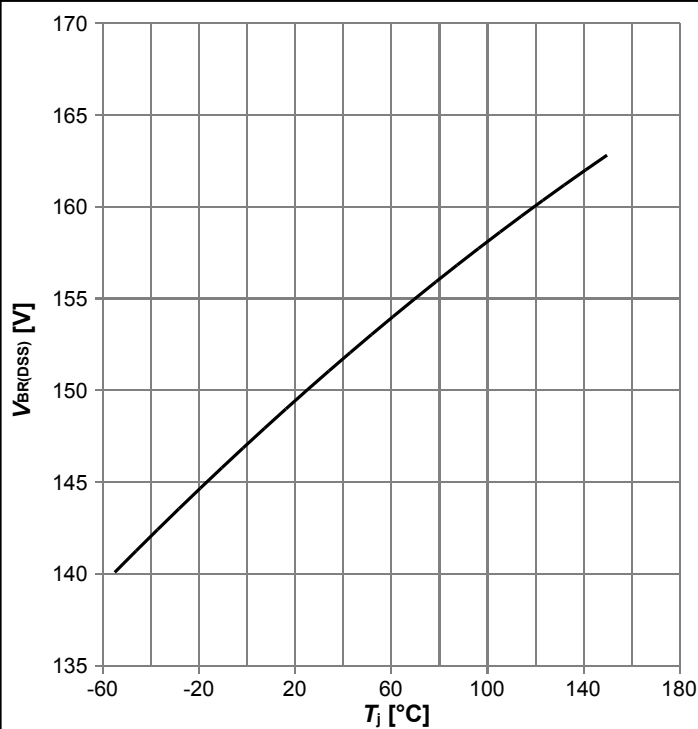
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

**Diagram 14: Typ. gate charge**



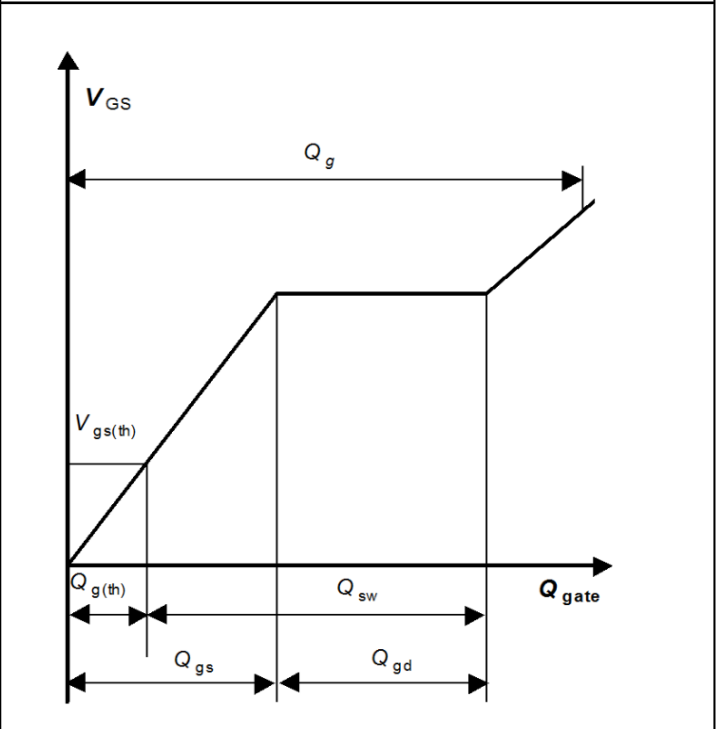
$V_{GS}=f(Q_{gate}); I_D=9$  A pulsed; parameter:  $V_{DD}$

**Diagram 15: Drain-source breakdown voltage**



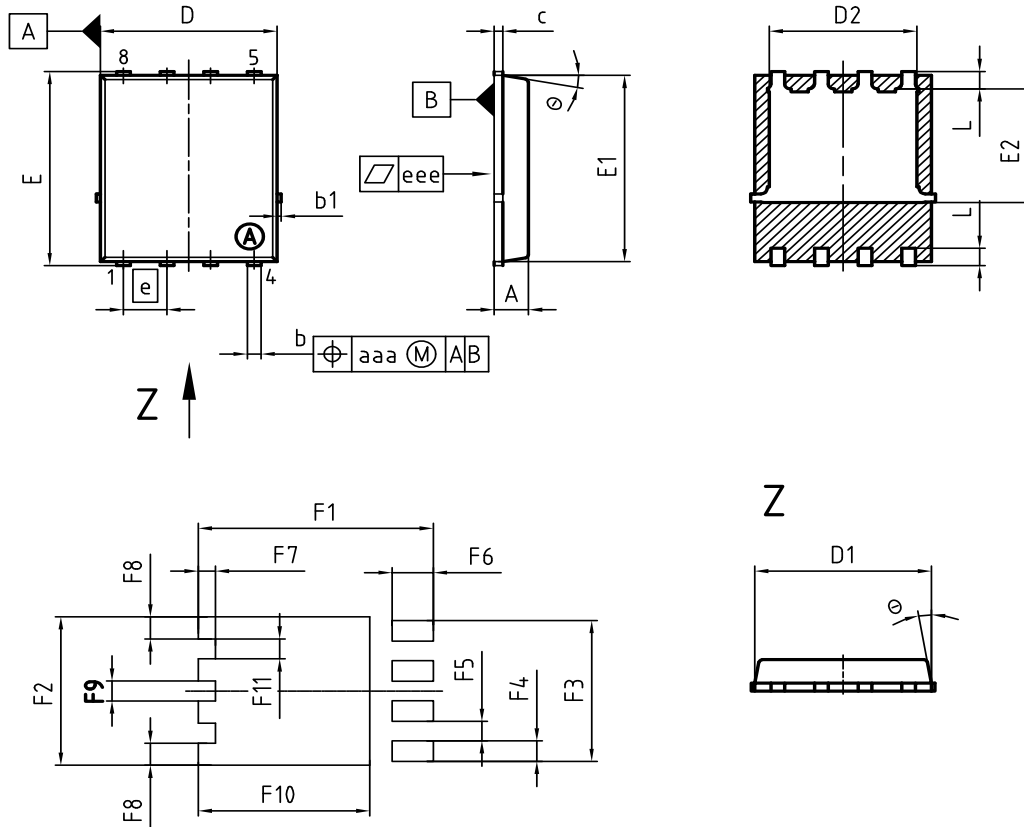
$V_{BR(DSS)}=f(T_j); I_D=1$  mA

**Diagram Gate charge waveforms**





## 5 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.34	0.54	0.013	0.021
b1	0.02	0.22	0.001	0.008
c	0.15	0.35	0.006	0.014
D=D1	4.95	5.35	0.195	0.211
D2	4.20	4.40	0.165	0.173
E	5.95	6.35	0.234	0.250
E1	5.70	6.10	0.224	0.240
E2	3.40	3.80	0.134	0.150
e	1.27		0.050	
N	8		8	
L	0.45	0.65	0.018	0.026
ϑ	8.5°	11.5°	8.5°	11.5°
aaa	0.25		0.010	
eee	0.05		0.002	
F1	6.75	6.95	0.266	0.274
F2	4.60	4.80	0.181	0.189
F3	4.36	4.56	0.172	0.180
F4	0.55	0.75	0.022	0.030
F5	0.52	0.72	0.020	0.028
F6	1.10	1.30	0.043	0.051
F7	0.40	0.60	0.016	0.024
F8	0.60	0.80	0.024	0.031
F9	0.53	0.73	0.021	0.029
F10	4.90	5.10	0.193	0.201
F11	0.53	0.73	0.021	0.029

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REVISION 03

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

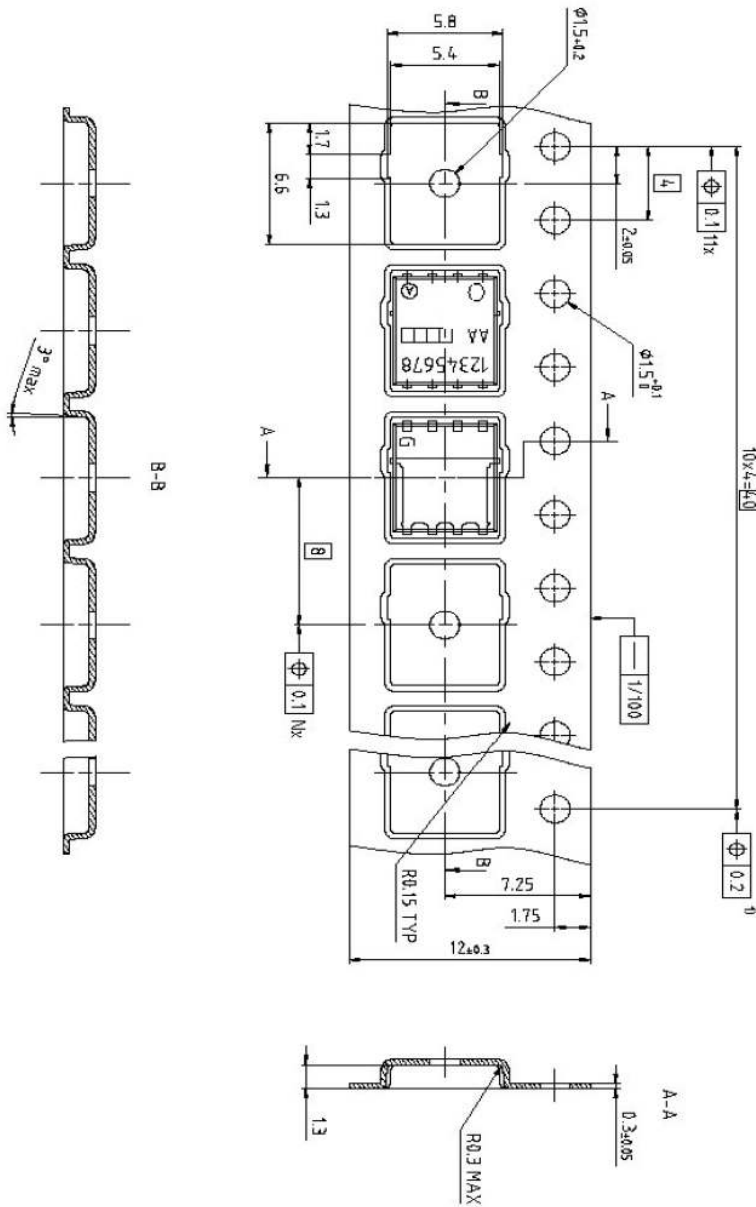


Figure 2 Outline Tape (PG-TDSON-8), dimensions in mm

## Revision History

BSC520N15NS3 G

**Revision: 2023-03-24, Rev. 2.3**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.3	2023-03-24	Fix bug Diagram 4

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