

## MOSFET

Metal Oxide Semiconductor Field Effect Transistor

### OptiMOS™

OptiMOS™ 5 Power-Transistor, 100 V  
BSC040N10NS5

## Data Sheet

Rev. 2.1  
Final

## 1 Description

### Features

- Optimized for high performance SMPS, e.g. sync. rec.
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	100	V
$R_{DS(on),max}$	4.0	mΩ
$I_D$	100	A
$Q_{oss}$	75	nC
$Q_G(0V..10V)$	58	nC



Type / Ordering Code	Package	Marking	Related Links
BSC040N10NS5	PG-TDSON-8	040N10NS	-

<sup>1)</sup> J-STD20 and JESD22

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## 2 Maximum ratings

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

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	$I_D$	-	-	100 86 18	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ , $R_{thJA}=50\text{K/W}^1)$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	400	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	-	-	200	mJ	$I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	139 2.5	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}^2)$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	150	°C	IEC climatic category; DIN IEC 68-1: 55/150/56

## 3 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	$R_{thJC}$	-	0.5	0.9	K/W	-
Thermal resistance, junction - case, top	$R_{thJC}$	-	-	20	K/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	50	K/W	-

<sup>1)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

<sup>2)</sup> See figure 3 for more detailed information

<sup>3)</sup> See figure 13 for more detailed information

## 4 Electrical characteristics

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.2	3.0	3.8	V	$V_{DS}=V_{GS}$ , $I_D=95\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1 10	1 100	$\mu\text{A}$	$V_{DS}=100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	3.4 4.0	4.0 5.6	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ $V_{GS}=6\text{ V}$ , $I_D=25\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	1.3	2.0	$\Omega$	-
Transconductance	$g_{fs}$	60	120	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=50\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	4100	5300	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	630	820	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	28	49	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3.0\text{ }\Omega$
Rise time	$t_r$	-	9	-	ns	$V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3.0\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	32	-	ns	$V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3.0\text{ }\Omega$
Fall time	$t_f$	-	10	-	ns	$V_{DD}=50\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3.0\text{ }\Omega$

<sup>1)</sup> Defined by design. Not subject to production test.

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	19	-	nC	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	11	-	nC	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge <sup>2)</sup>	$Q_{gd}$	-	12	18	nC	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	19	-	nC	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total <sup>2)</sup>	$Q_g$	-	58	72	nC	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.6	-	V	$V_{DD}=50\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	50	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge <sup>2)</sup>	$Q_{oss}$	-	75	100	nC	$V_{DD}=50\text{ V}$ , $V_{GS}=0\text{ V}$

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	100	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	400	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.9	1.1	V	$V_{GS}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>2)</sup>	$t_{rr}$	-	54	108	ns	$V_R=50\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$	-	90	180	nC	$V_R=50\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

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

<sup>2)</sup> Defined by design. Not subject to production test.

## 5 Electrical characteristics diagrams

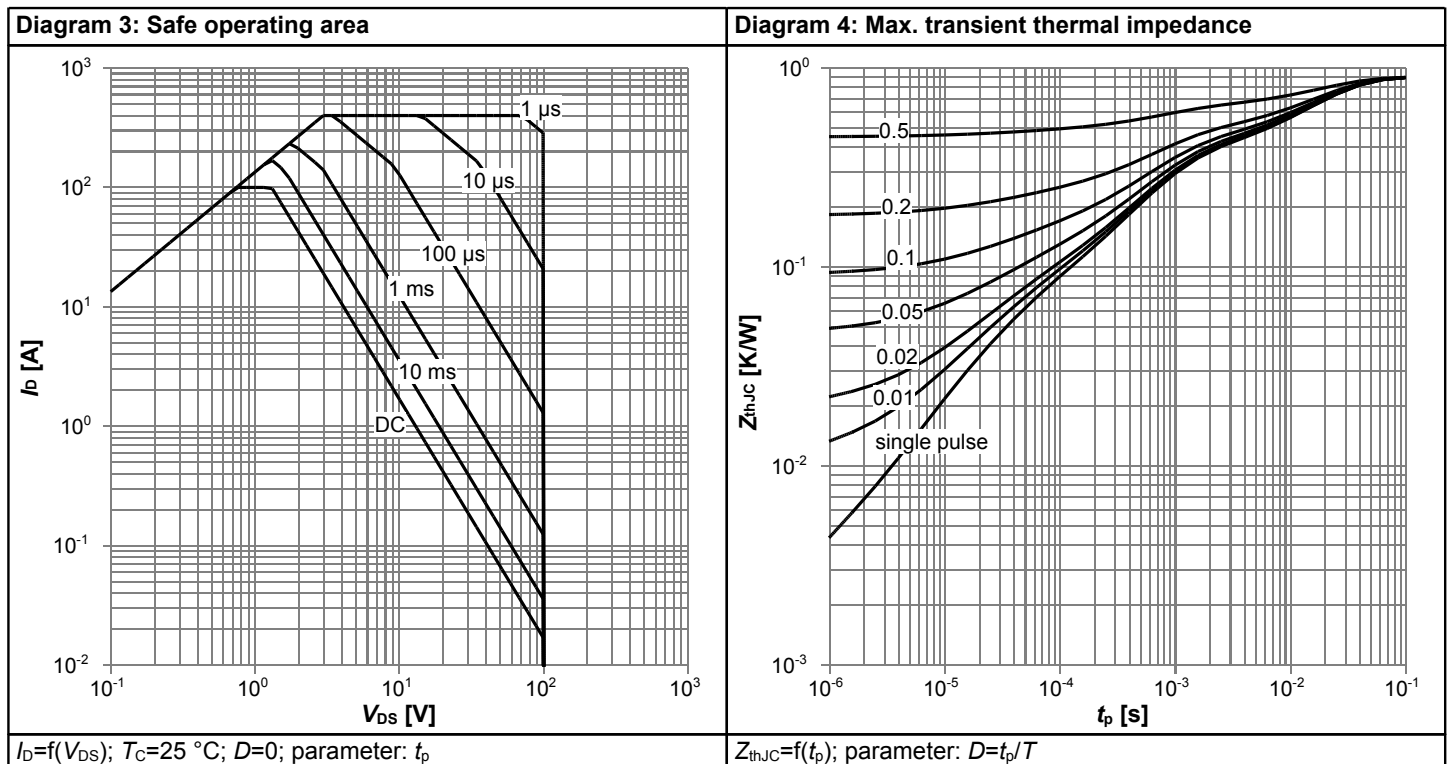
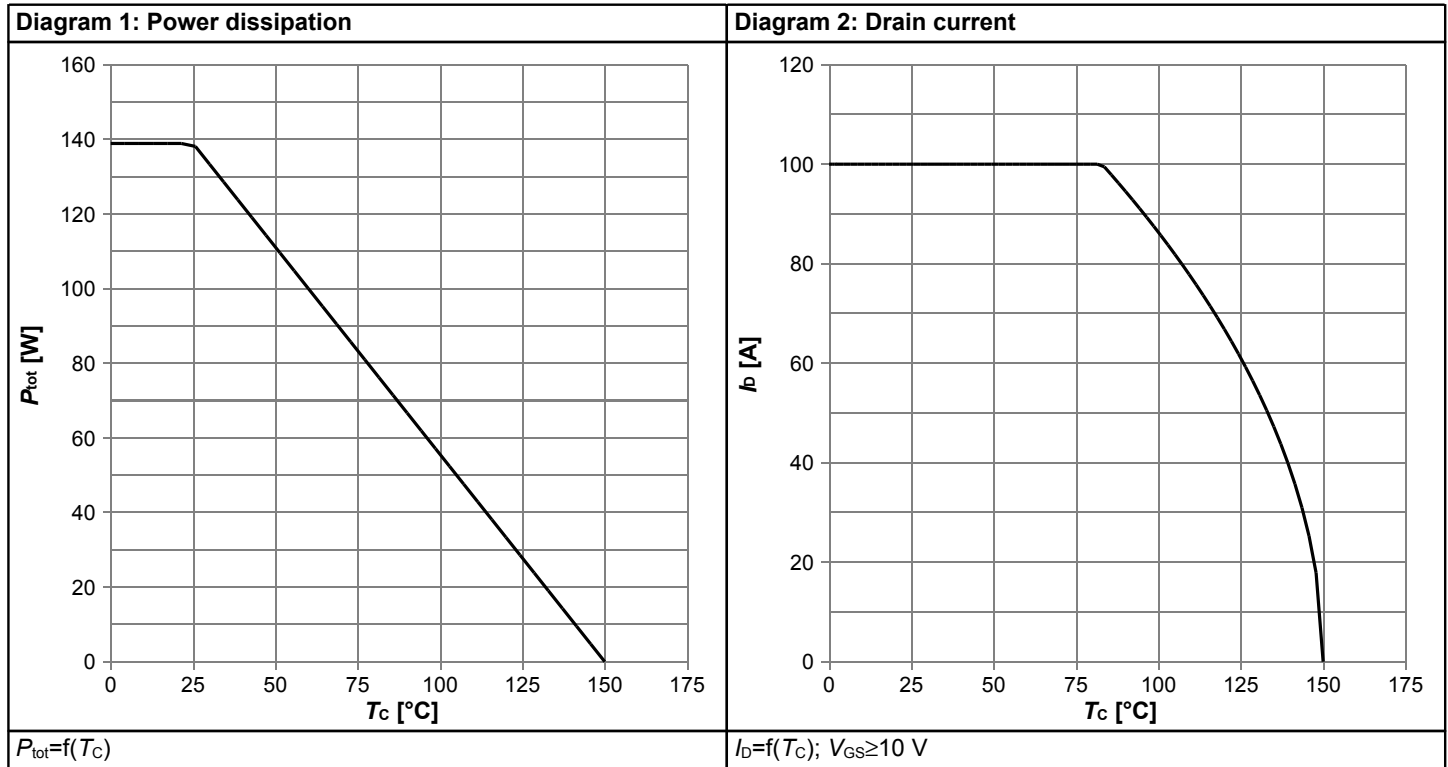
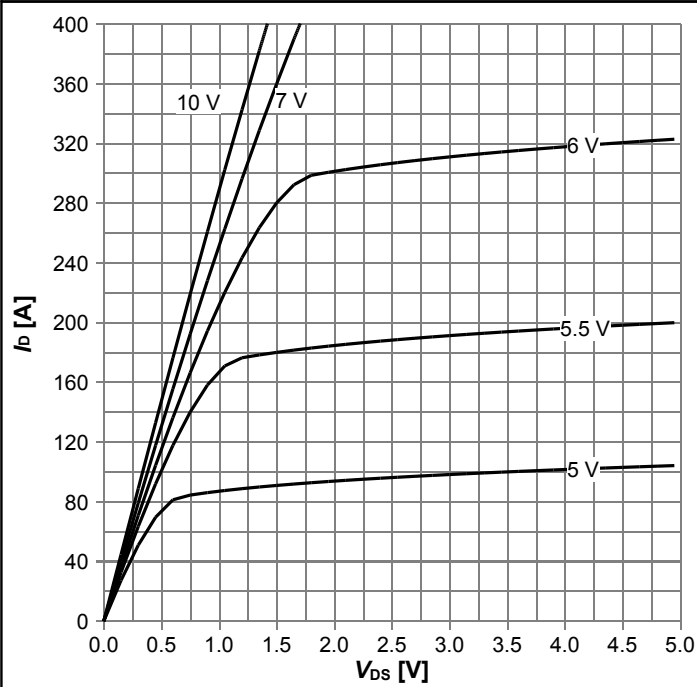
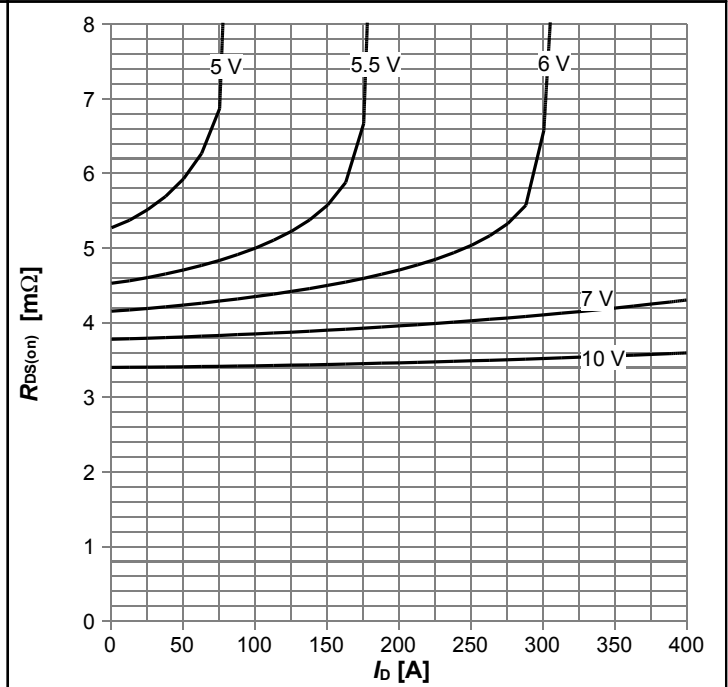


Diagram 5: Typ. output characteristics



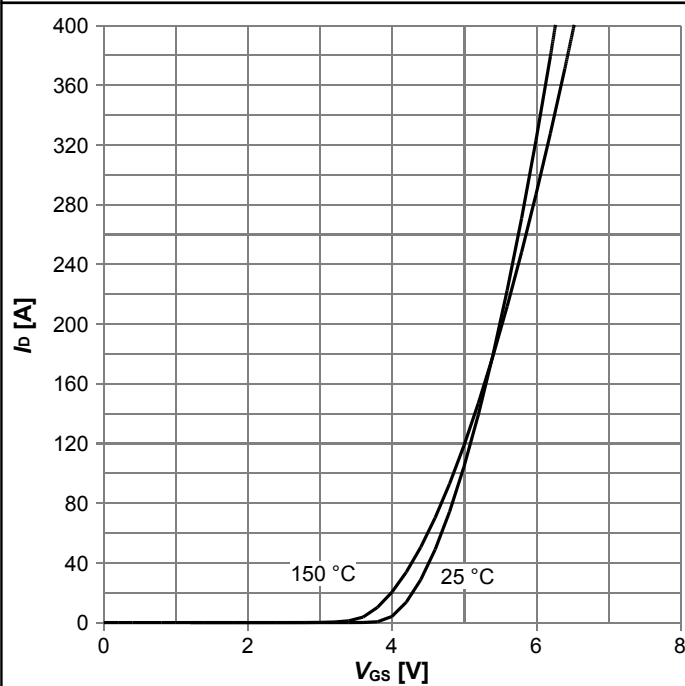
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



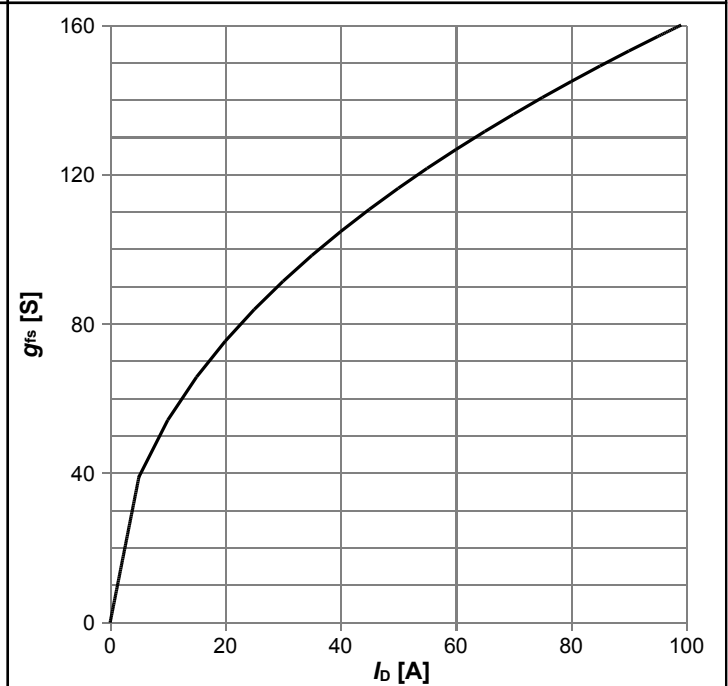
$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



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

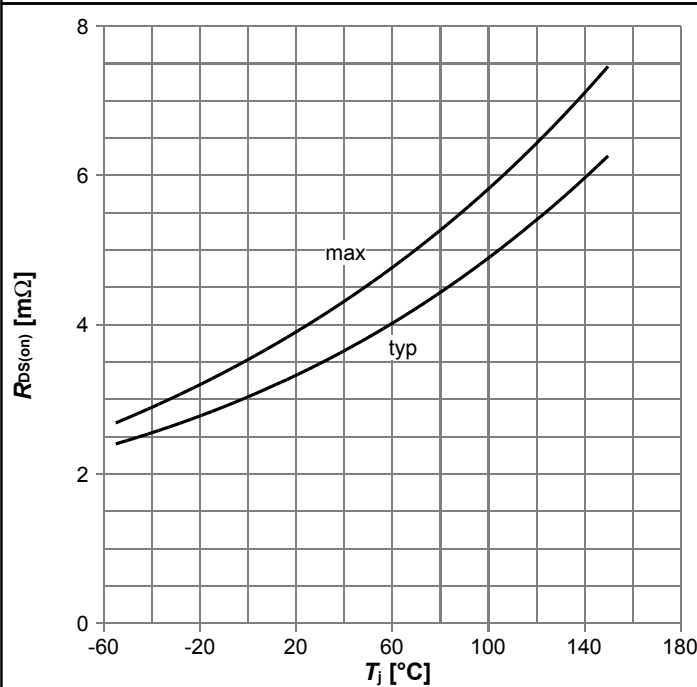
Diagram 8: Typ. forward transconductance



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

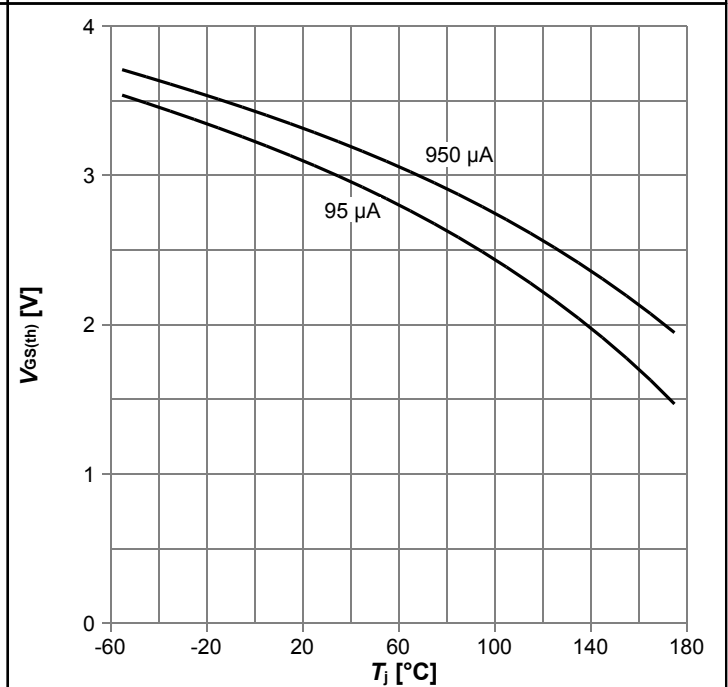


Diagram 9: Drain-source on-state resistance



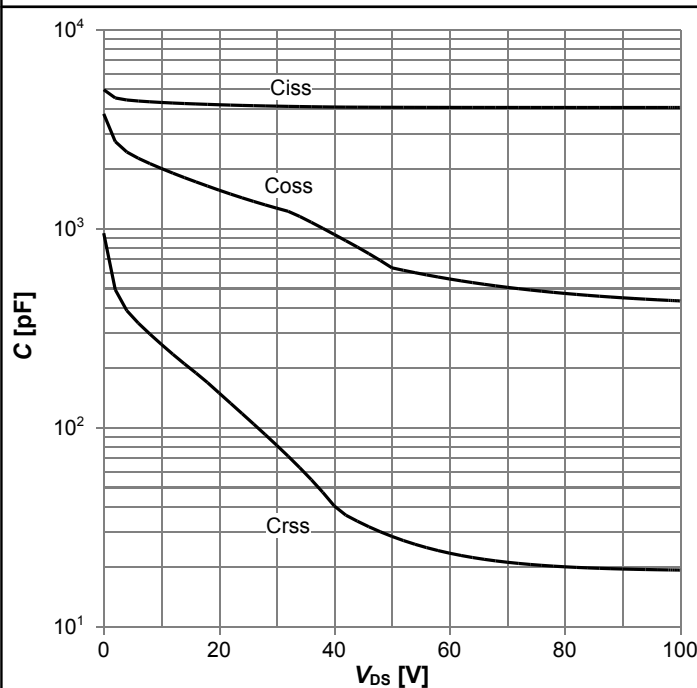
$R_{DS(on)}=f(T_j); I_D=50 \text{ A}; V_{GS}=10 \text{ V}$

Diagram 10: Typ. gate threshold voltage



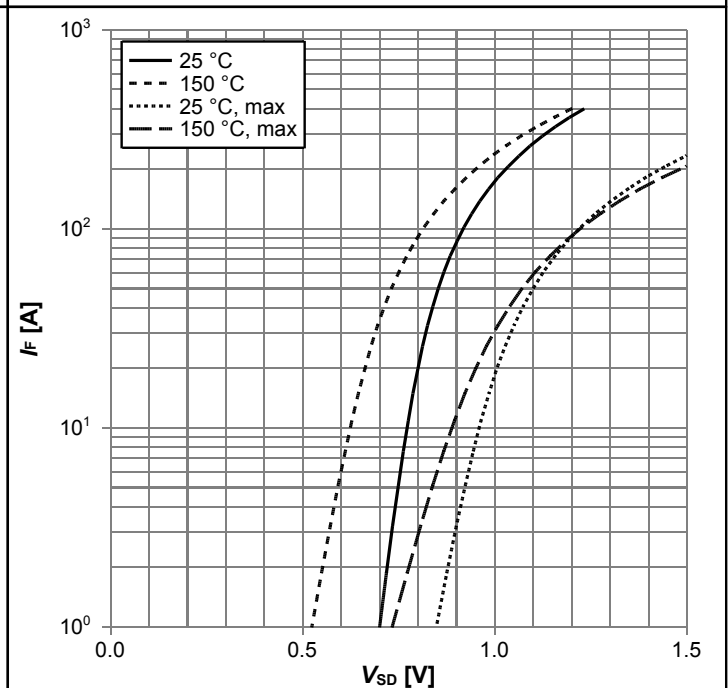
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}$

Diagram 11: Typ. capacitances



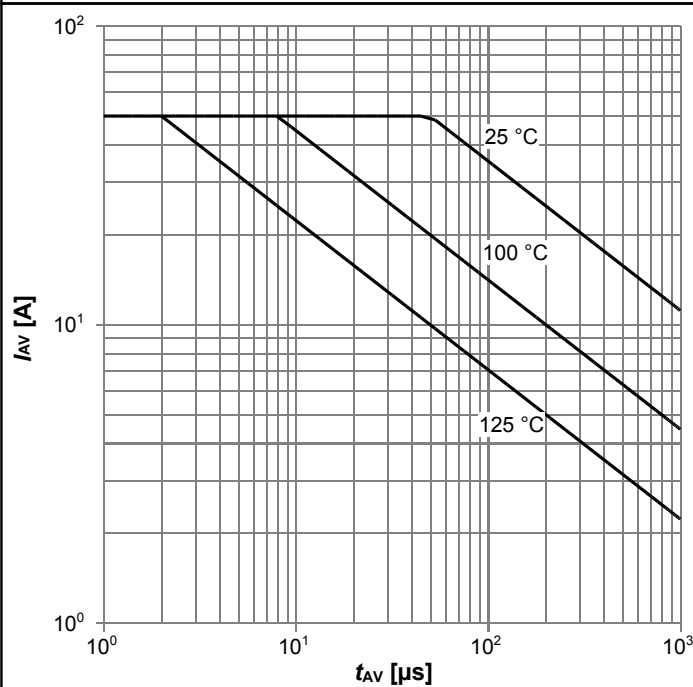
$C=f(V_{DS}); V_{GS}=0 \text{ V}; f=1 \text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



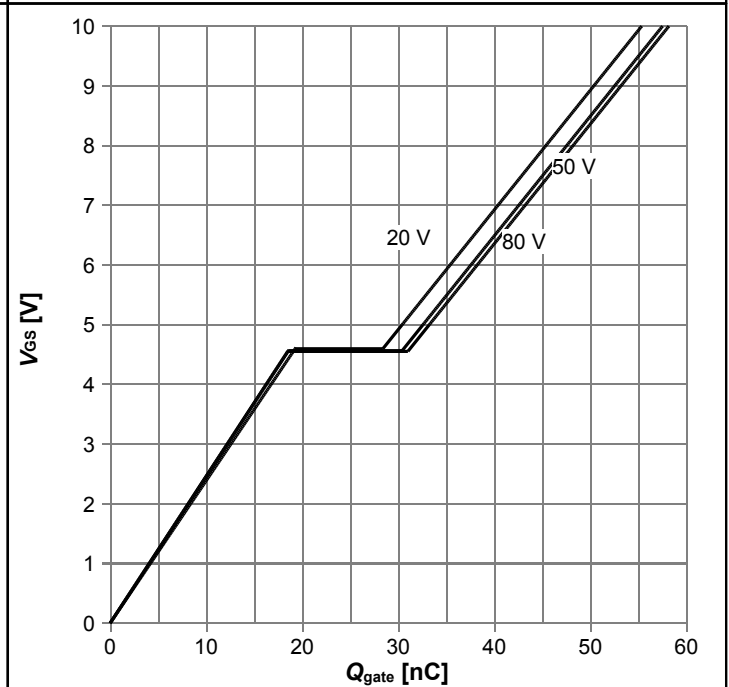
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



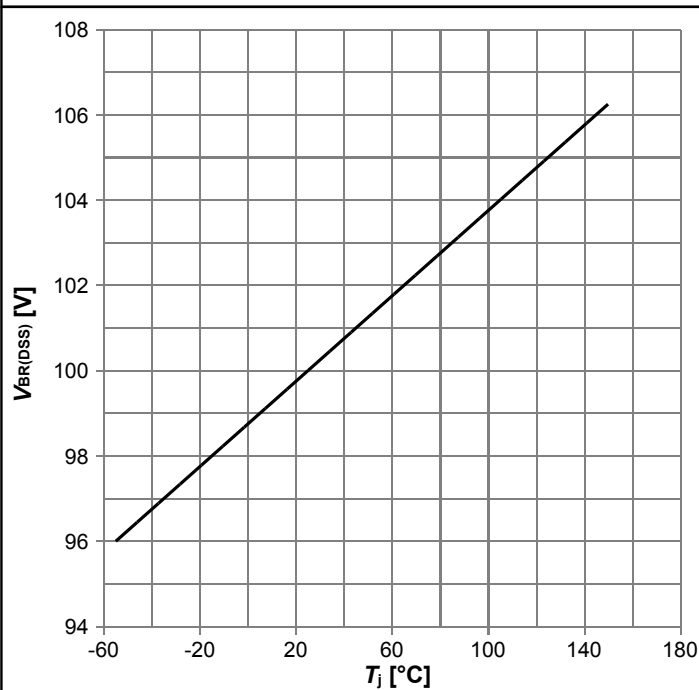
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



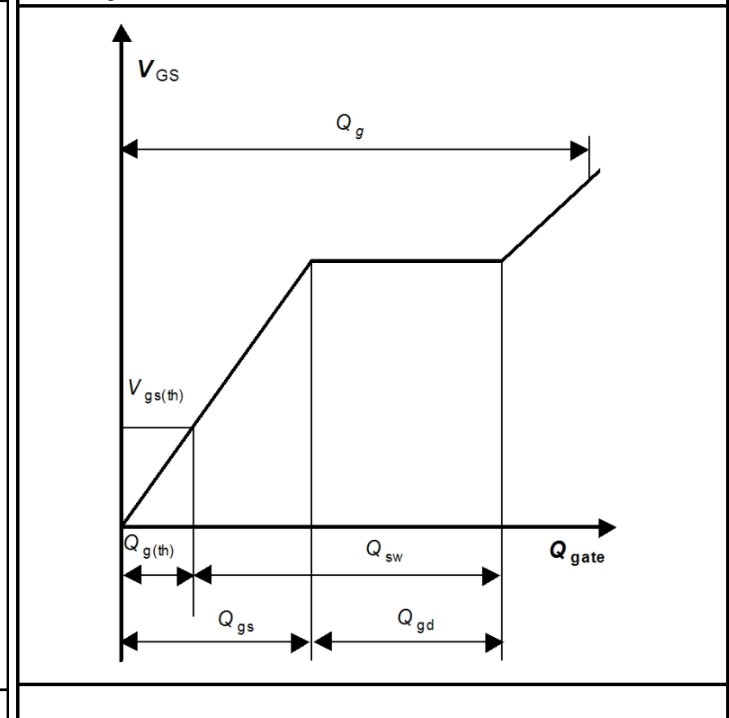
$V_{GS}=f(Q_{gate}); I_D=50$  A pulsed; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage



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

Gate charge waveforms



## 6 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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**EUROPEAN PROJECTION**



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

## Revision History

BSC040N10NS5

**Revision: 2015-01-07, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2014-11-26	Release of final version
2.1	2015-01-07	Update measurement condition for IDSS

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