

MOSFET

OptiMOS™ Power-MOSFET, 40 V

Features

- Optimized for synchronous rectification
- 175°C rated
- Very low on-state resistance $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Higher solder joint reliability due to enlarged source interconnection

Product validation

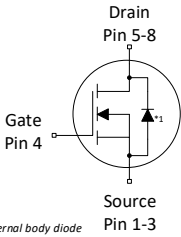
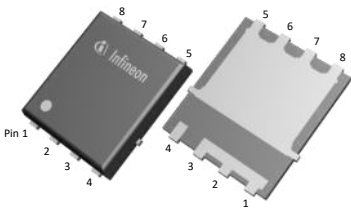
Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	1.4	mΩ
I_D	205	A
Q_{oss}	54	nC
$Q_g(0V..10V)$	61	nC

Type/Ordering Code	Package	Marking	Related Links
BSC014N04LS	PG-TDSON-8	014N04LS	-

PG-TDSON-8



*1: Internal body diode

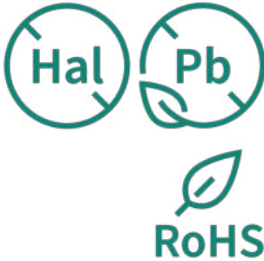




Table of Contents

Description 1

Maximum ratings 3

Thermal characteristics 4

Electrical characteristics 5

Electrical characteristics diagrams 7

Package Outlines 11

Revision History 14

Trademarks 14

Disclaimer 14

1 Maximum ratings

unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	205 145 176 124 33	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}$ ²⁾
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	820	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ⁴⁾	I_{AS}	-	-	50	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	170	mJ	$I_D=50\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage ⁵⁾	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	115 3.0	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	-	175	°C	-

¹⁾ Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

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

³⁾ See Diagram 3 for more detailed information

⁴⁾ See Diagram 13 for more detailed information

⁵⁾ The negative rating is for low duty cycle pulse occurrence. No continuous rating is implied

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	R_{thJC}	-	0.8	1.3	K/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	-	20	K/W	-
Device on PCB, 6 cm ² cooling area ⁶⁾	R_{thJA}	-	-	50	K/W	-

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

3 Electrical characteristics

unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.2	-	2	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.5 1.1	1.9 1.4	m Ω	$V_{GS}=4.5\text{ V}$, $I_D=50\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$
Gate resistance ⁷⁾	R_G	0.45	0.9	1.8	Ω	-
Transconductance	g_{fs}	120	230	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=50\text{ A}$

⁷⁾ Defined by design. Not subject to production test

Table 5 Dynamic characteristics ⁸⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	4300	6020	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	1200	1680	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	100	200	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	8	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}, ext=1.6\text{ }\Omega$
Rise time	t_r	-	9	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}, ext=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	35	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}, ext=1.6\text{ }\Omega$
Fall time	t_f	-	7	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}, ext=1.6\text{ }\Omega$

⁸⁾ Defined by design. Not subject to production test

Table 6 Gate charge characteristics ⁹⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	11	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	6.9	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	Q_{gd}	-	9.8	14	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$

Table 6 Gate charge characteristics ⁹⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Switching charge	Q_{sw}	-	14	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	Q_g	-	61	85	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.5	-	V	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	Q_g	-	31	44	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	24	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	Q_{oss}	-	54	76	nC	$V_{DD}=20\text{ V}$, $V_{GS}=0\text{ V}$

⁹⁾ See "Gate charge waveforms" for parameter definition. Defined by design. Not subject to production test

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	115	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	820	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.82	1	V	$V_{GS}=0\text{ V}$, $I_F=50\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ¹⁰⁾	t_{rr}	-	32	64	ns	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=400\text{ A}/\mu\text{s}$
Reverse recovery charge ¹⁰⁾	Q_{rr}	-	44	-	nC	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=400\text{ A}/\mu\text{s}$

¹⁰⁾ Defined by design. Not subject to production test

4 Electrical characteristics diagrams

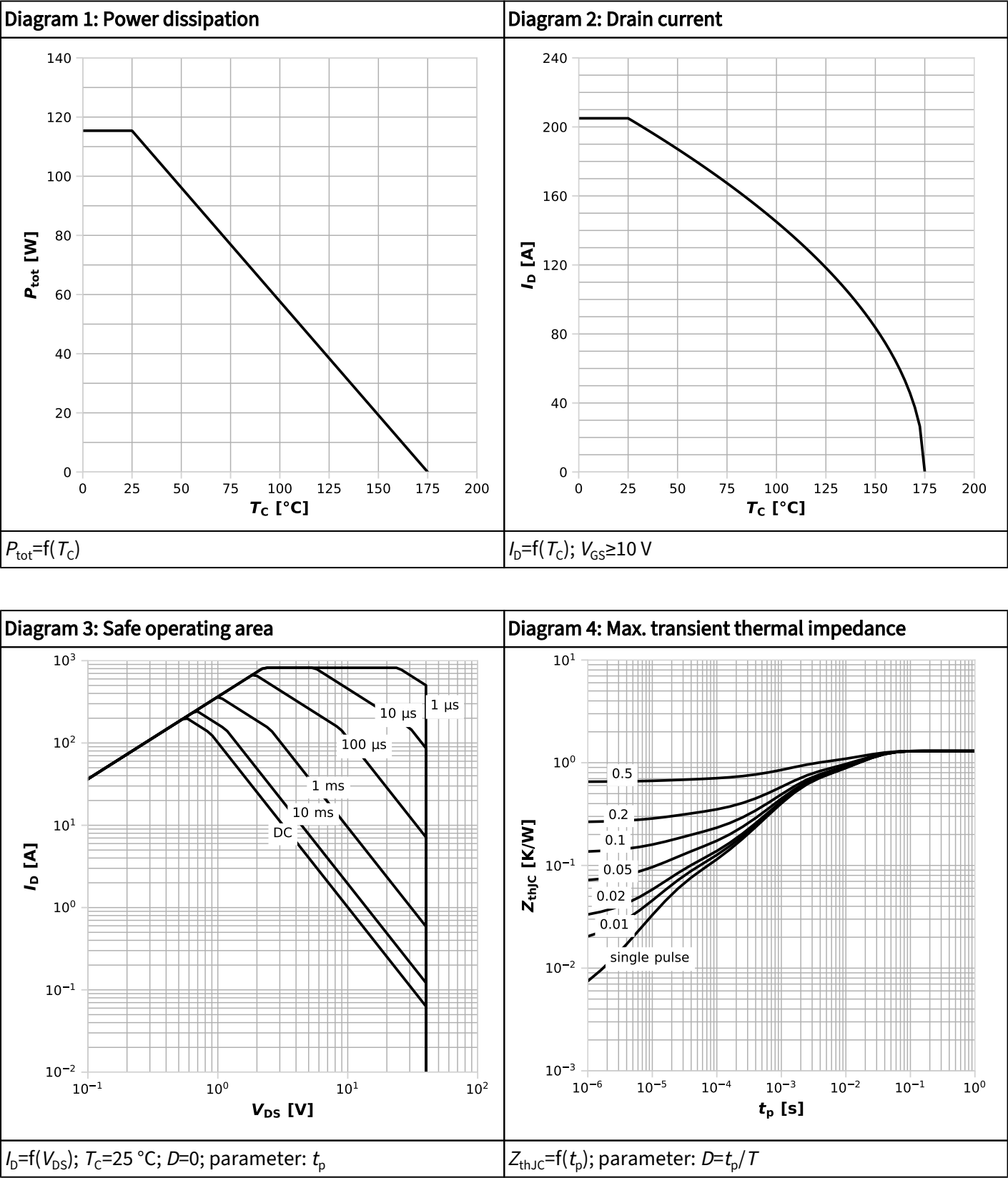
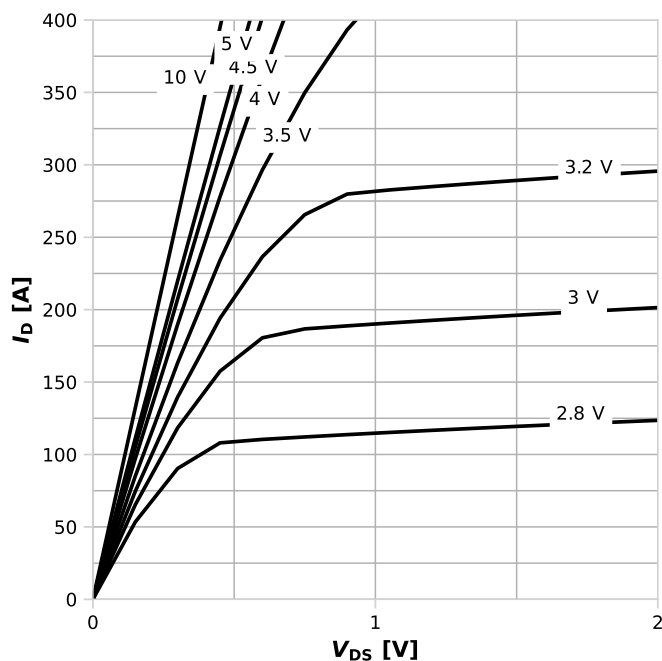
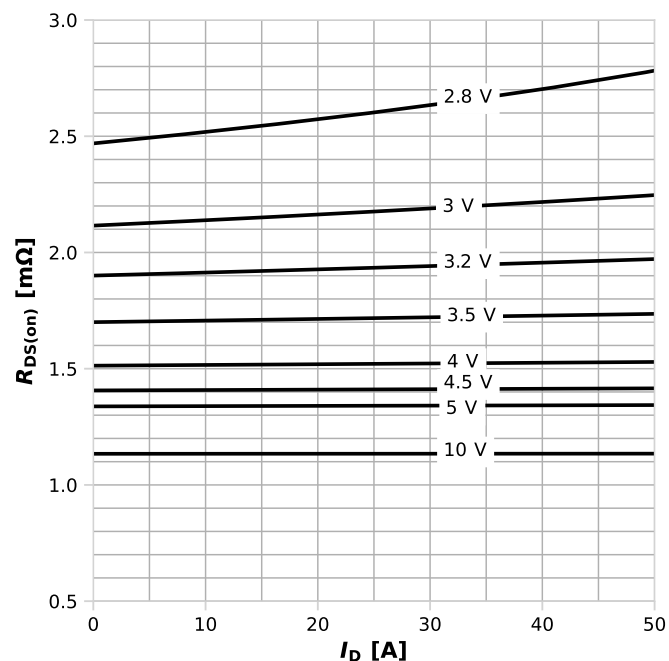


Diagram 5: Typ. output characteristics



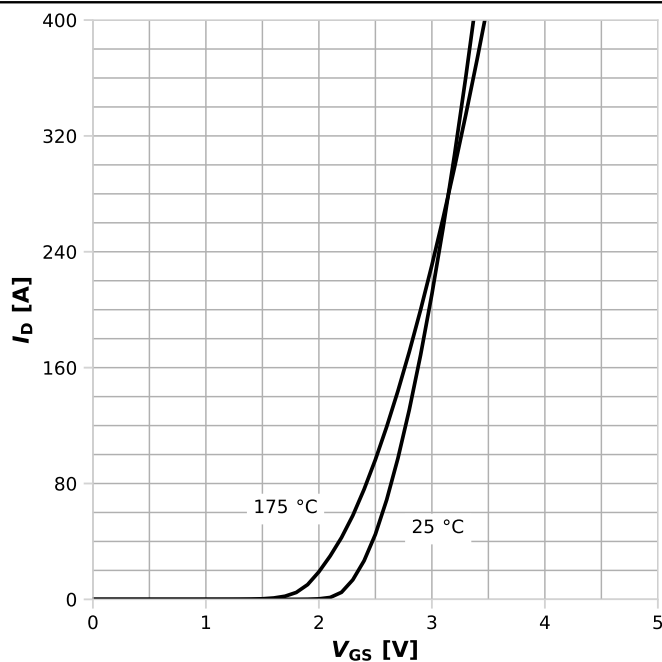
$I_D = f(V_{DS})$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



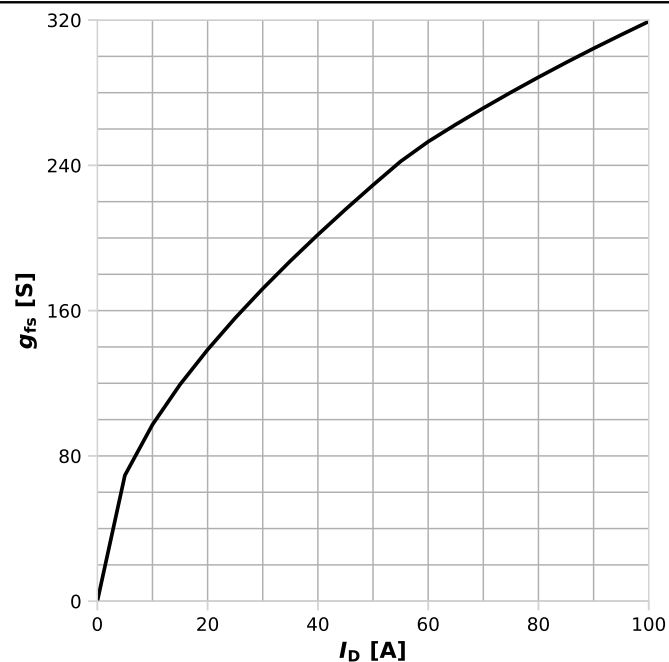
$R_{DS(on)} = f(I_D)$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



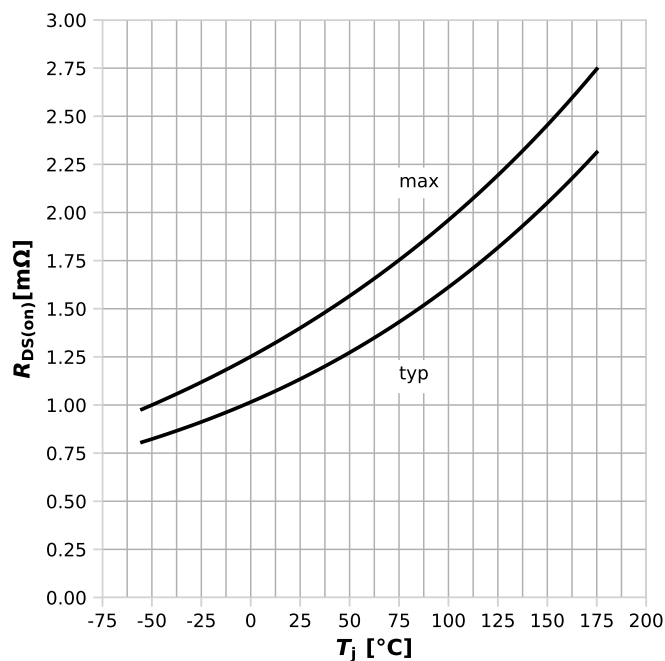
$I_D = f(V_{GS})$; $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



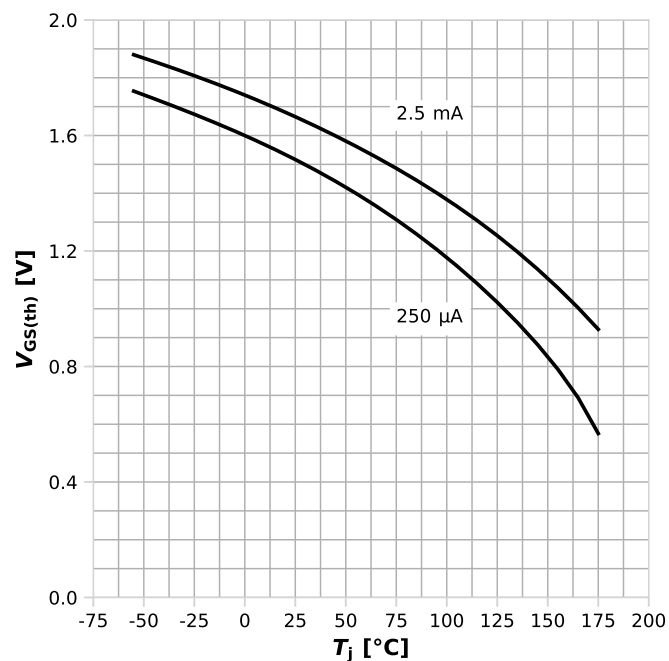
$g_{fs} = f(I_D)$; $T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



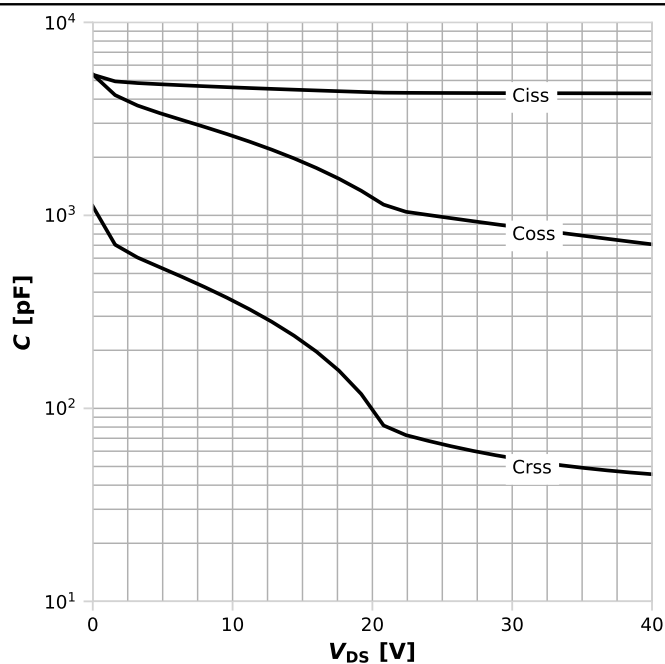
$$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



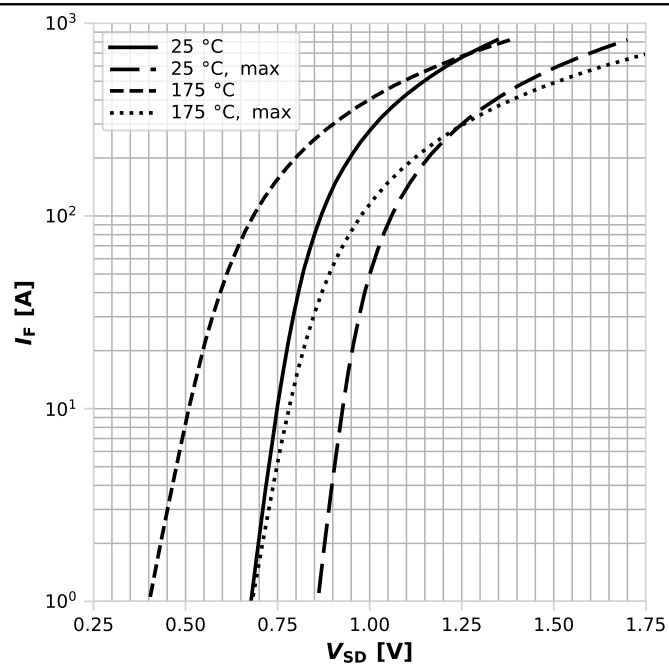
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 250 \text{ μA}$$

Diagram 11: Typ. capacitances

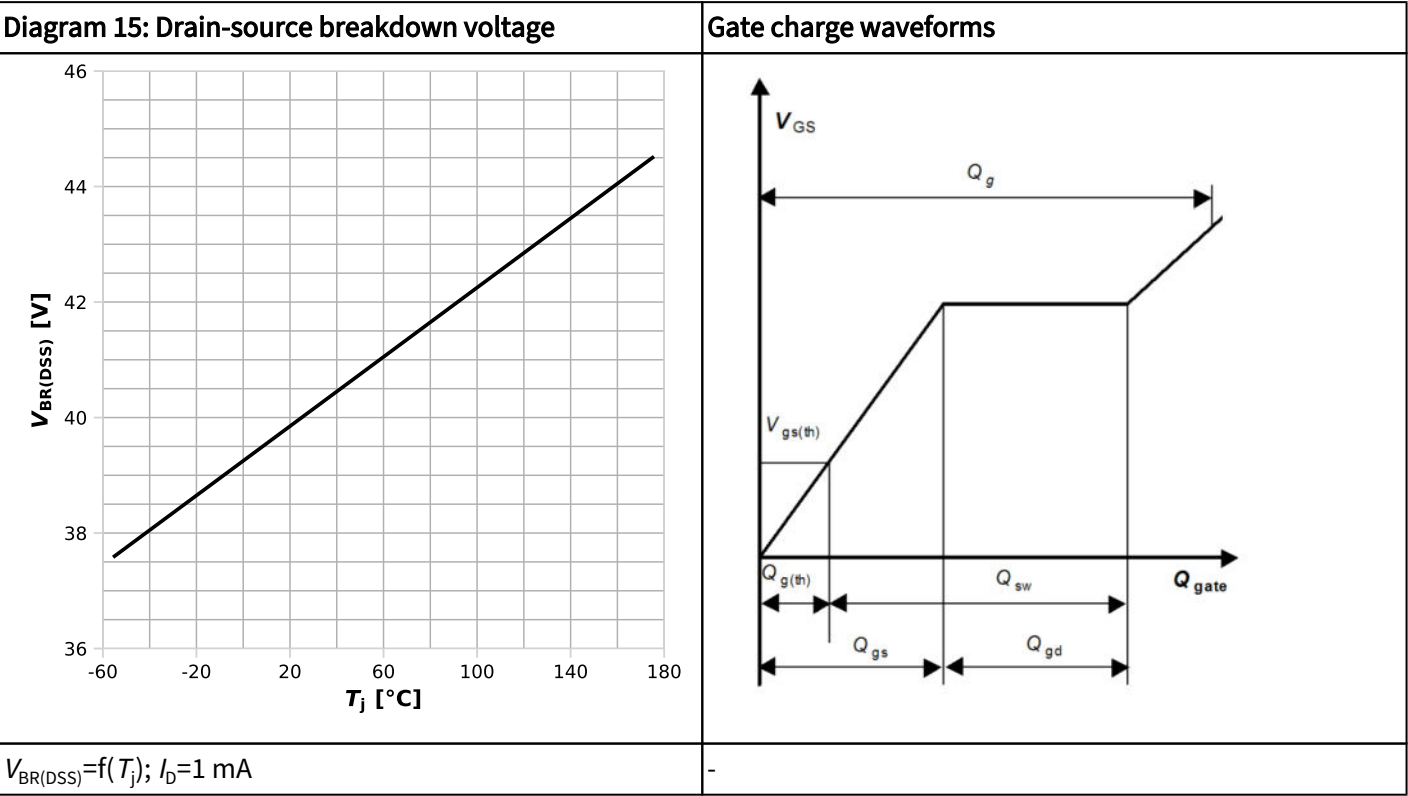
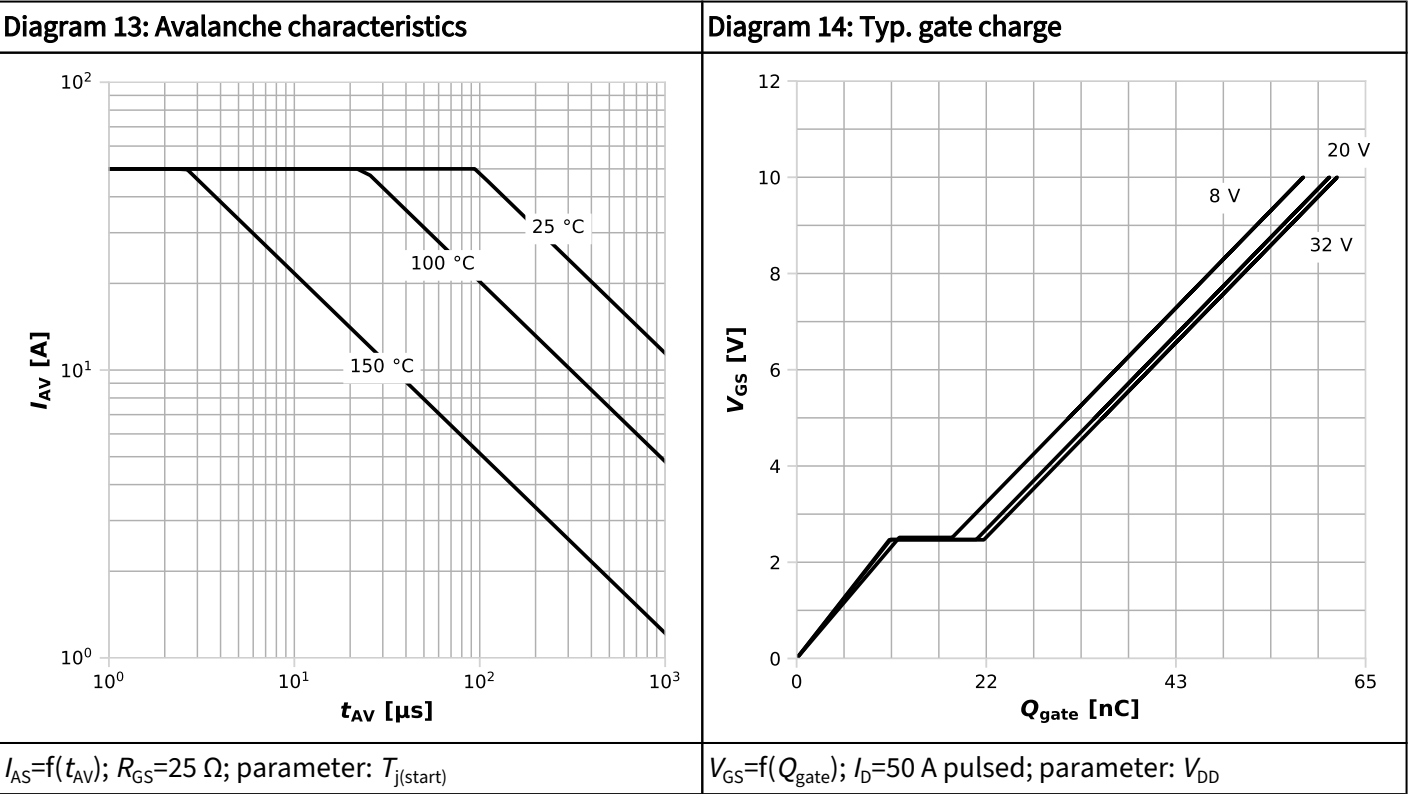


$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



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



5 Package Outlines

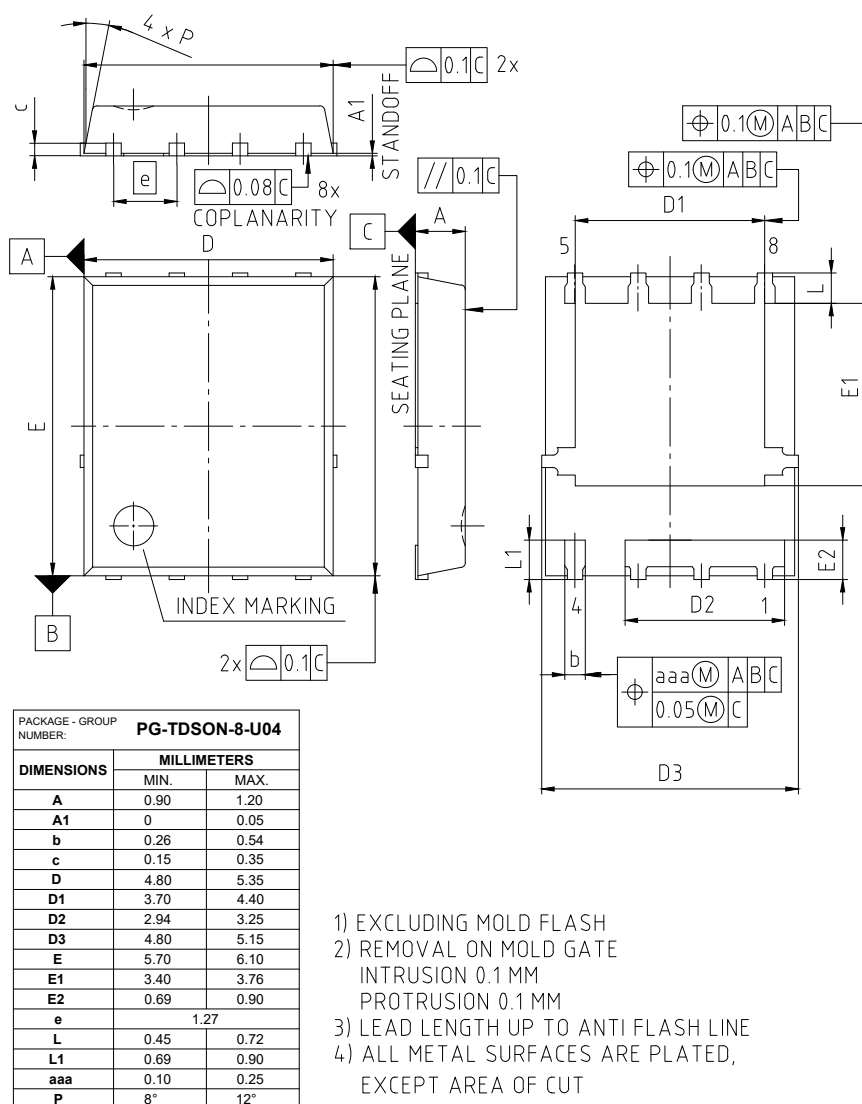


Figure 1 Outline PG-TDSON-8, dimensions in mm

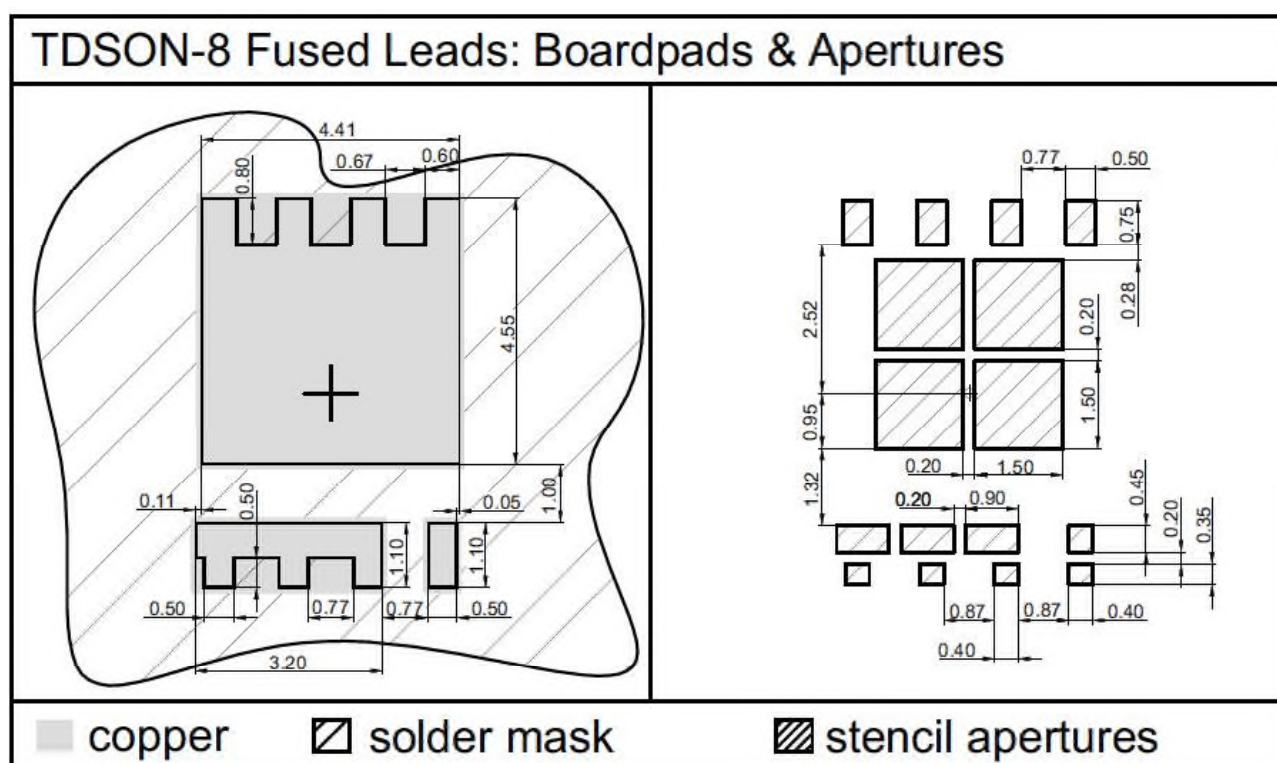


Figure 2 Outline PG-TDSON-8, dimensions in mm

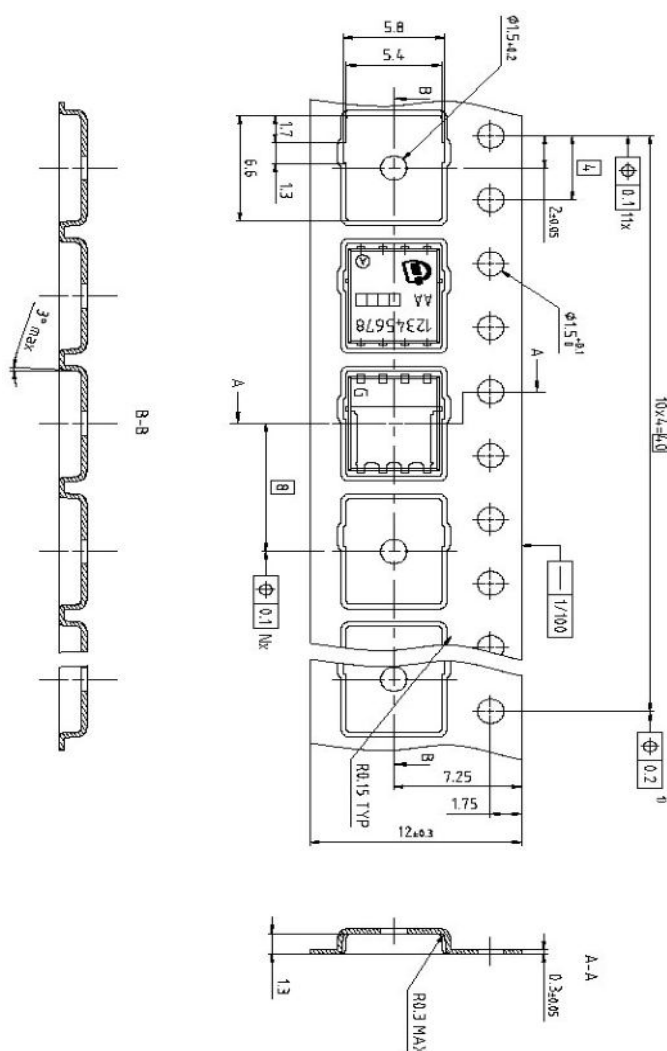


Figure 3 Outline PG-TDSON-8, dimensions in mm

Revision History

BSC014N04LS

Revision 2024-06-11, Rev. 2.9

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-10-11	Release of final version
2.1	2012-10-12	New diagram titles.
2.2	2013-02-27	Rev. 2.1
2.4	2016-05-04	Update footnotes and insert max values
2.5	2017-03-27	Update Qrr
2.6	2020-02-07	Update package drawings
2.7	2020-05-15	Update current rating
2.8	2023-04-20	Update package outline drawings
2.9	2024-06-11	Upgrade Operating and storage temperature max to 175°C. Update drawings in section 5 Package Outlines. Production validation added on page1.Updated foot notes.

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