

MOSFET

OptiMOS™ Power-MOSFET, 40 V

Features

- Optimized for synchronous rectification
- Very low on-state resistance $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Higher solder joint reliability due to enlarged source interconnection

TDSON-8 FL (enlarged source interconnection)

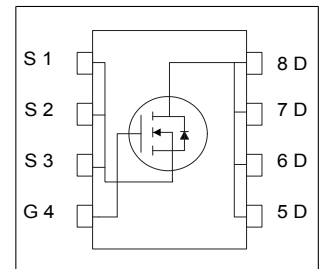
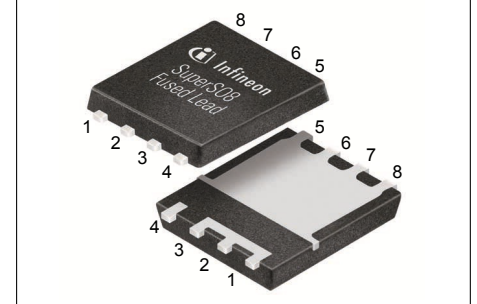


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	1.4	m Ω
I_D	100	A
Q_{oss}	54	nC
$Q_g(0V..10V)$	61	nC

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

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	-	-	100	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^1)$
		-	-	100		
		-	-	100		
		-	-	100		
		-	-	32		
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	400	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ³⁾	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	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	96	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^1)$
		-	-	2.5		
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, 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 ¹⁾	R_{thJA}	-	-	50	K/W	-

¹⁾ 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.

²⁾ See Diagram 3 for more detailed information

³⁾ See Diagram 13 for more detailed information

3 Electrical characteristics

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	$\text{m}\Omega$	$V_{GS}=4.5\text{ V}$, $I_D=50\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$
Gate resistance ¹⁾	R_G	0.45	0.9	1.8	Ω	-
Transconductance	g_{fs}	120	230	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=50\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance ¹⁾	C_{iss}	-	4300	6020	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Output capacitance ¹⁾	C_{oss}	-	1200	1680	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance ¹⁾	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	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics²⁾

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 ¹⁾	Q_{gd}	-	9.8	14	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
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 ¹⁾	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 ¹⁾	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 ¹⁾	Q_{oss}	-	54	76	nC	$V_{DD}=20\text{ V}$, $V_{GS}=0\text{ V}$

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 continuous forward current	I_S	-	-	96	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	400	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.82	1	V	$V_{GS}=0\text{ V}, I_F=50\text{ A}, T_j=25\text{ °C}$
Reverse recovery time ¹⁾	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	Q_{rr}	-	44	-	nC	$V_R=20\text{ V}, I_F=50\text{ A}, di_F/dt=400\text{ A}/\mu\text{s}$

¹⁾ Defined by design. Not subject to production test

4 Electrical characteristics diagrams

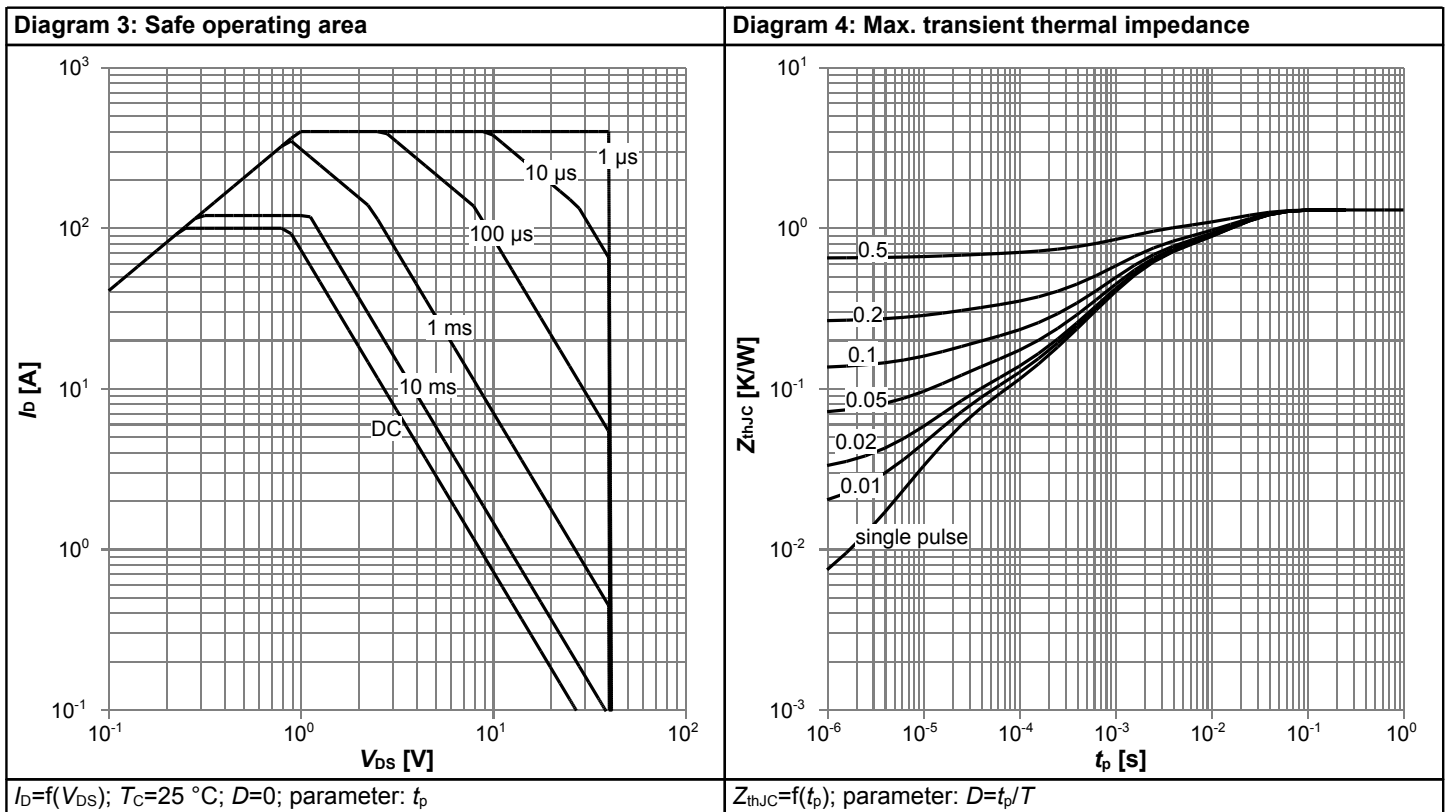
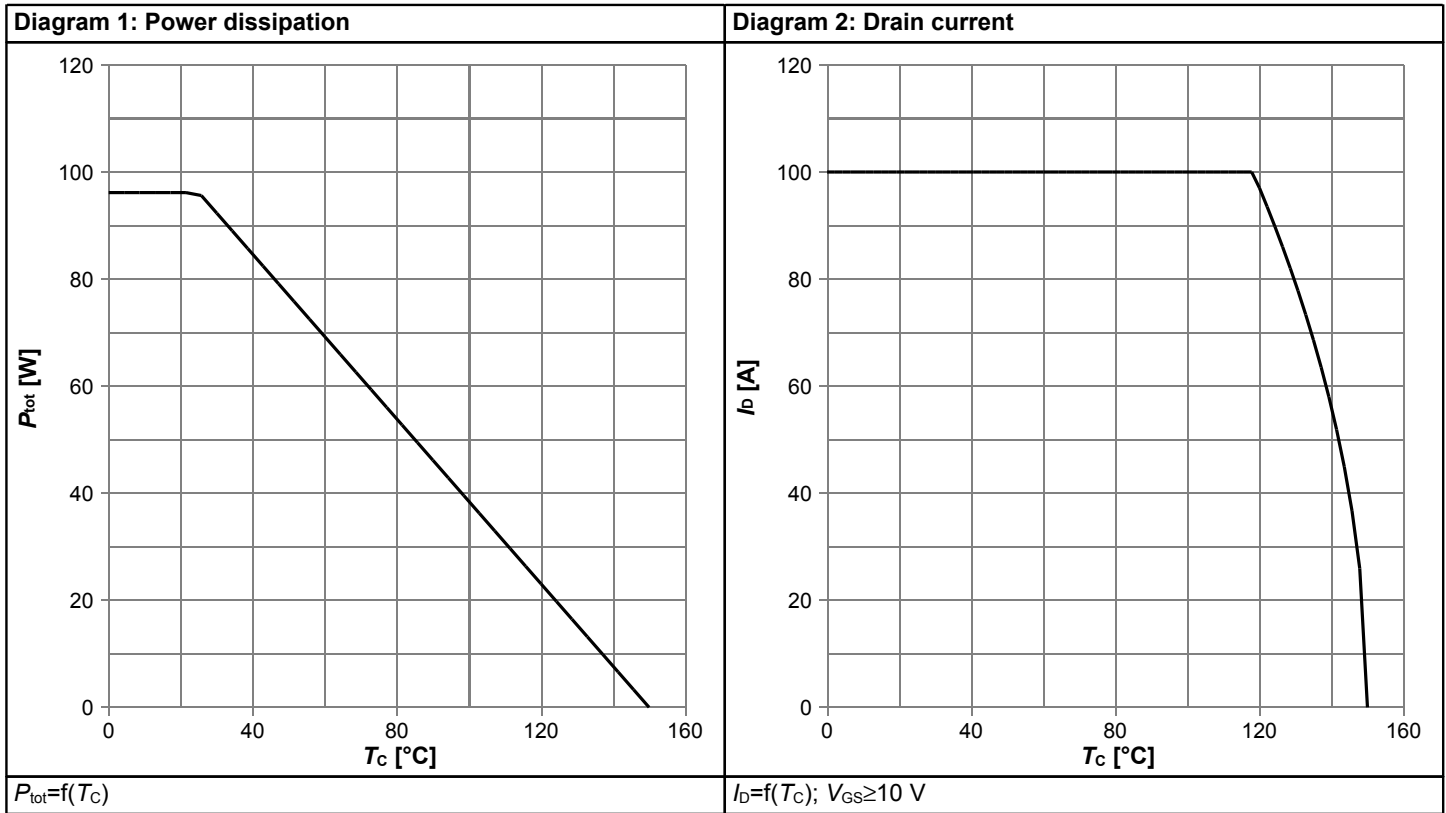
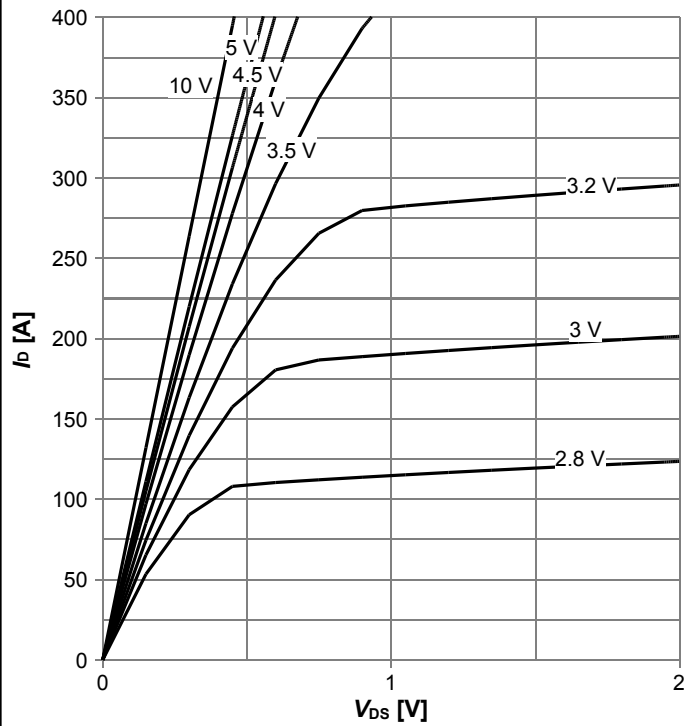
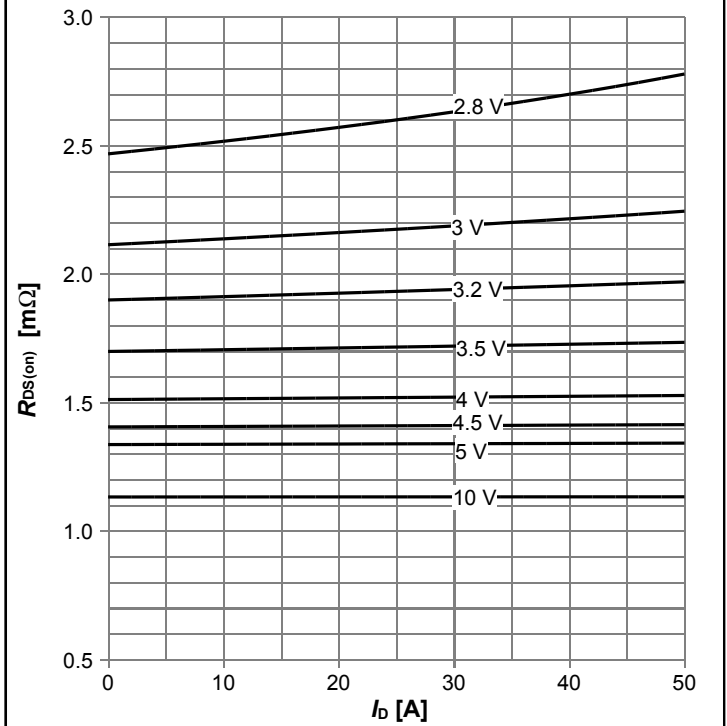


Diagram 5: Typ. output characteristics



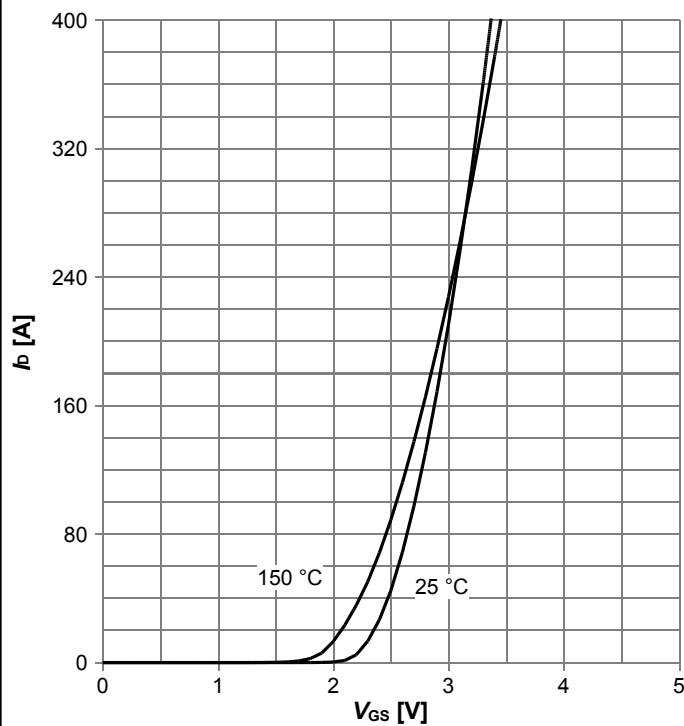
$I_D = f(V_{DS}); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



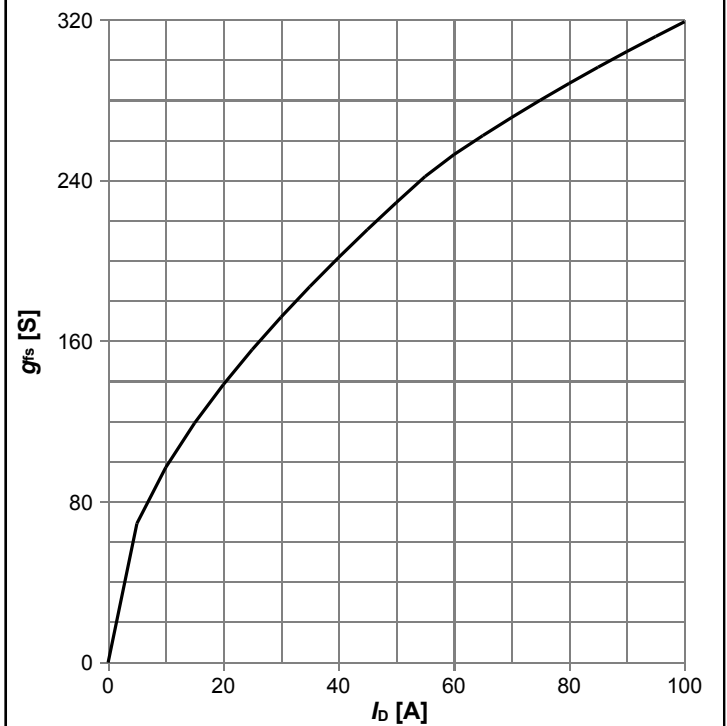
$R_{DS(on)} = f(I_D); T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



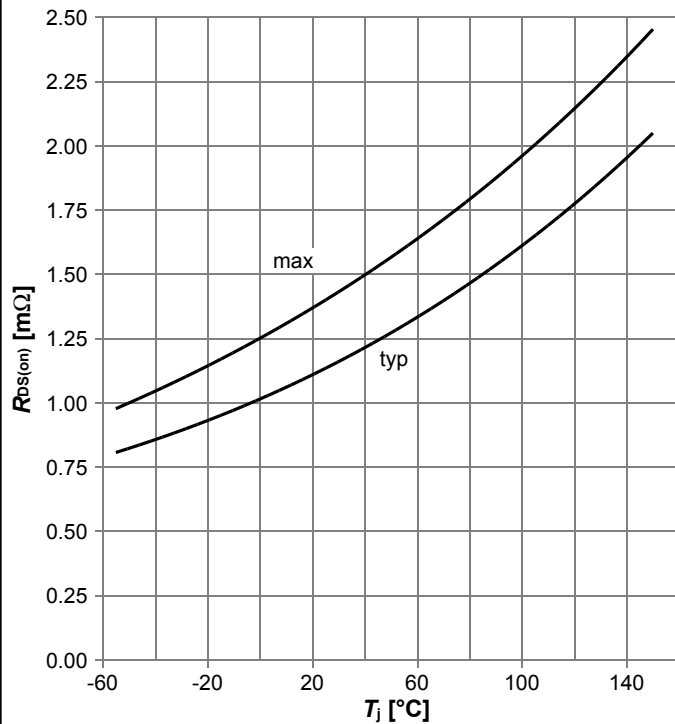
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. forward transconductance



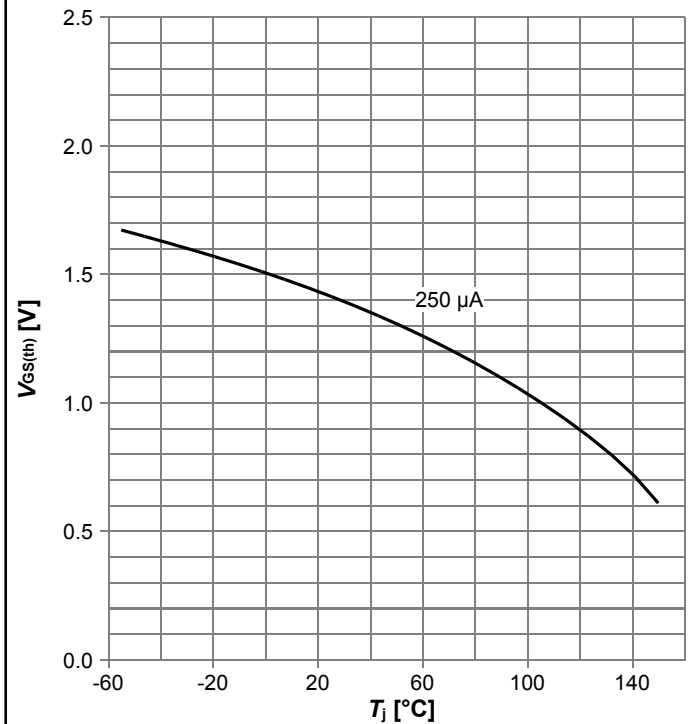
$g_{fs} = f(I_D); T_j = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



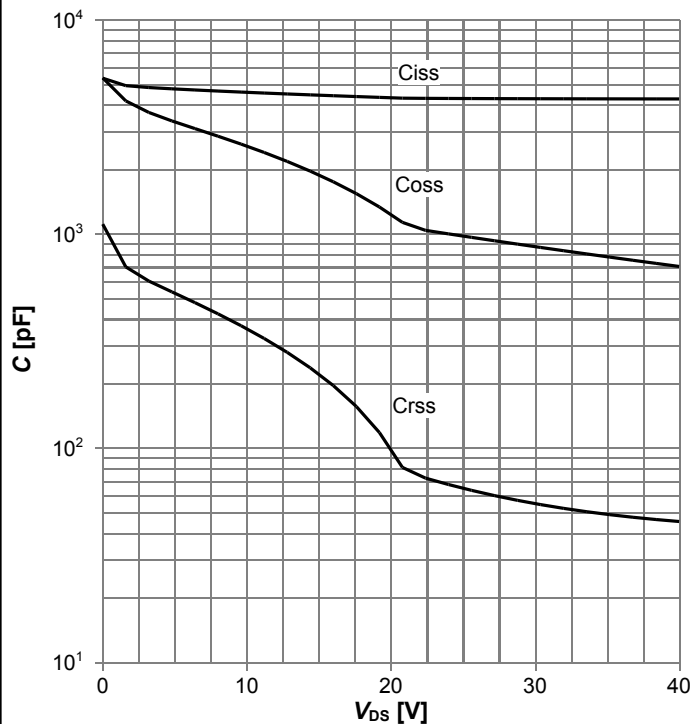
$R_{DS(on)}=f(T_j)$; $I_D=50\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



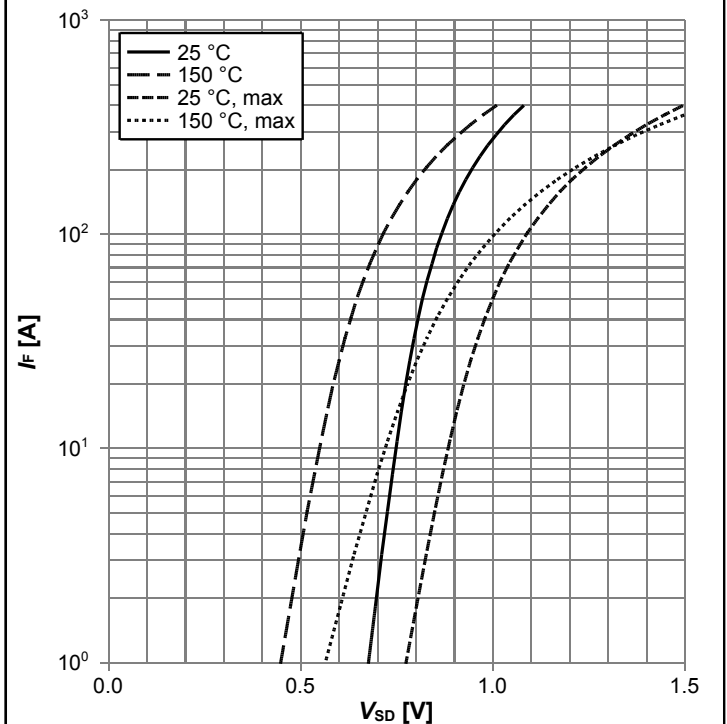
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=250\text{ μA}$

Diagram 11: Typ. capacitances



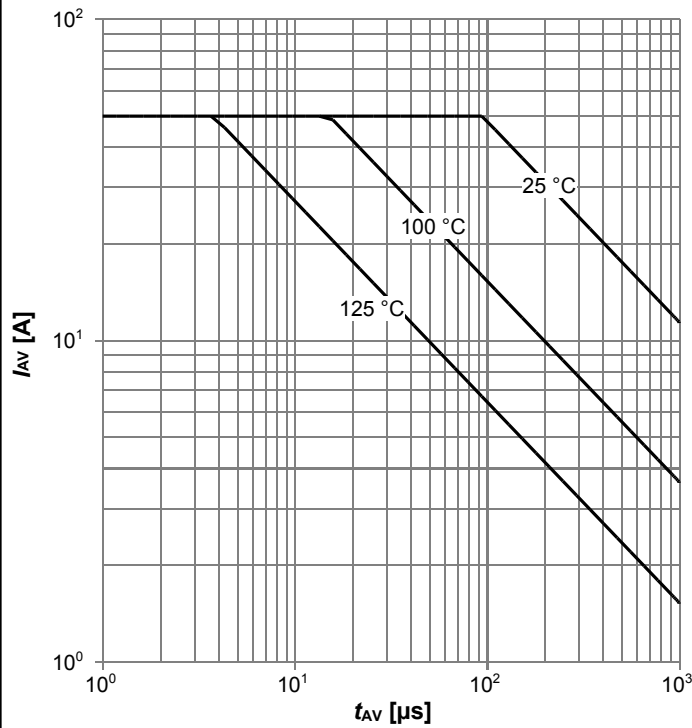
$C=f(V_{DS})$; $V_{GS}=0\text{ V}$; $f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



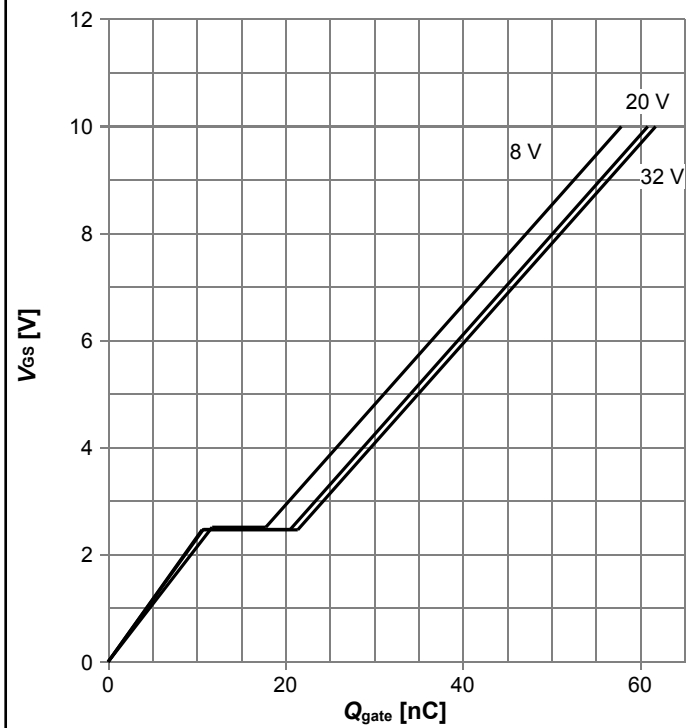
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



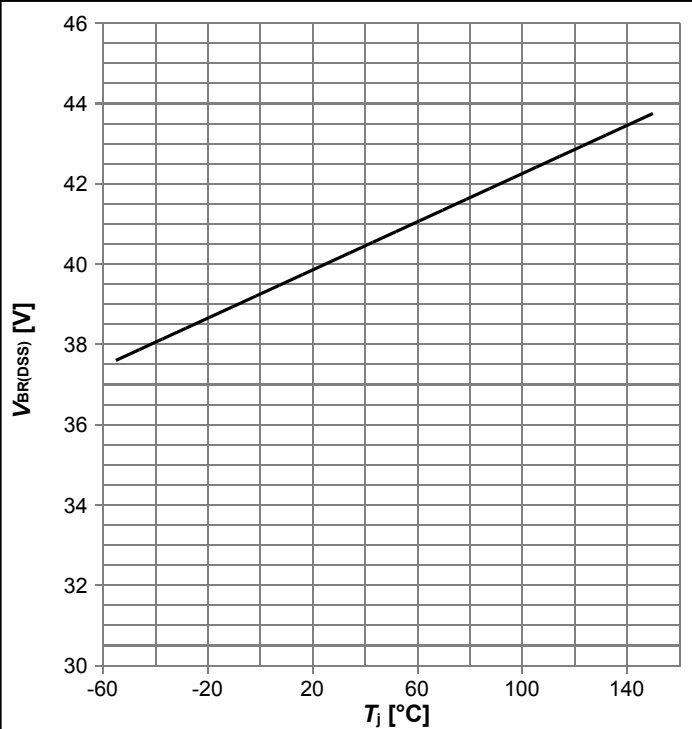
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



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

Diagram 15: Drain-source breakdown voltage

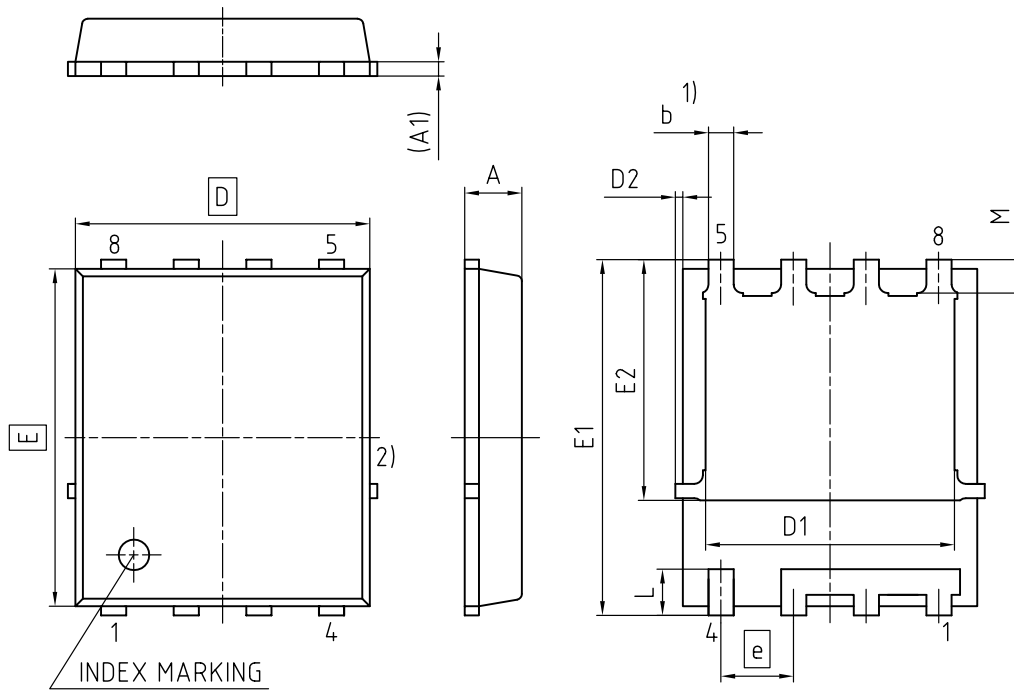


$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Diagram Gate charge waveforms



5 Package Outlines



1) EXCLUDING MOLD FLASH
 2) REMOVAL ON MOLD GATE
 INTRUSION 0.1 MM
 PROTRUSION 0.1 MM
 LEAD LENGTH UP TO ANTI FLASH LINE
 ALL METAL SURFACES ARE PLATED, EXCEPT AREA OF CUT

DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	0.90	1.20
A1	0.15	0.35
b	0.26	0.54
D	4.80	5.35
D1	3.70	4.40
D2	0.02	0.23
E	5.70	6.10
E1	5.90	6.42
E2	3.88	4.42
e	1.27	
L	0.69	0.90
M	0.45	0.69

DOCUMENT NO. Z8B000193699
REVISION 03
SCALE 10:1
EUROPEAN PROJECTION
ISSUE DATE 19.06.2019

Figure 1 Outline TDSON-8 FL, dimensions in mm

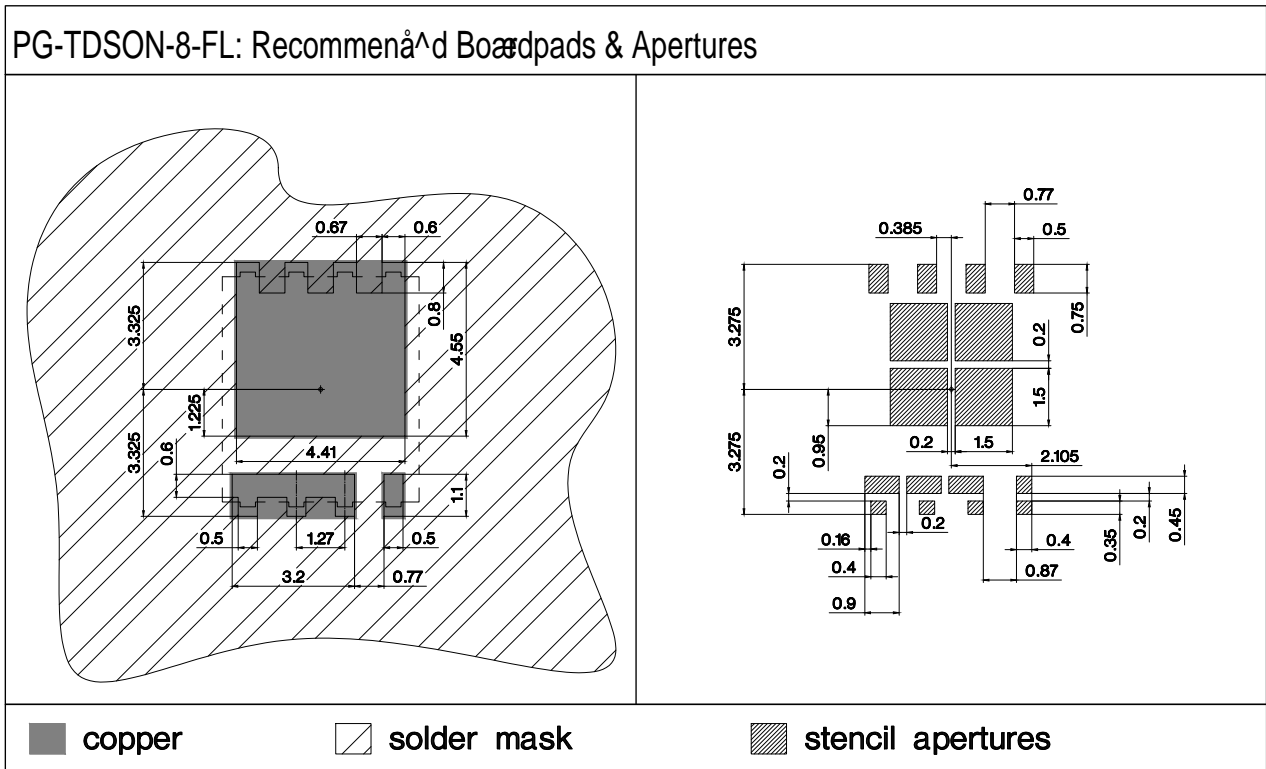


Figure 2 Outline Boardpads (TDSON-8 FL)

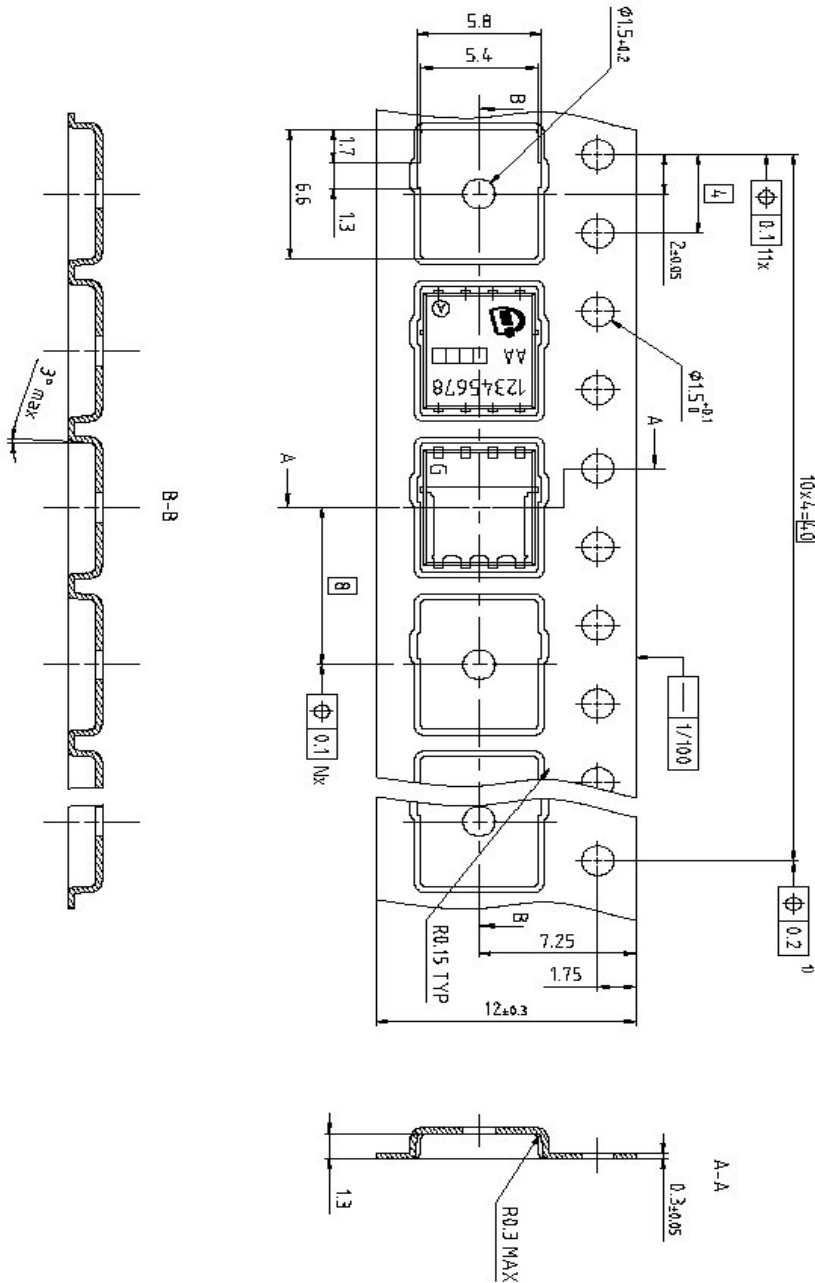


Figure 3 Outline Tape (TDSON-8 FL)

Revision History

BSC014N04LS

Revision: 2020-02-07, Rev. 2.6

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

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