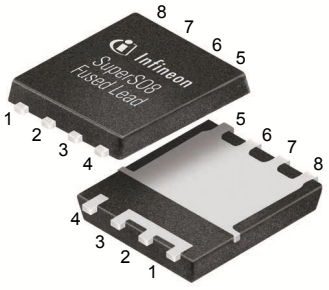
MOSFET

OptiMOS™ Power-MOSFET, 40 V

TDSON-8 FL (enlarged source interconnection)



Features

- Optimized for synchronous rectification
- Integrated monolithic Schottky-like diode
- Very low on-resistance $R_{DS(on)}$
- 100% avalanche tested
- N-channel, logic level
- Qualified according to JEDEC[1] 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

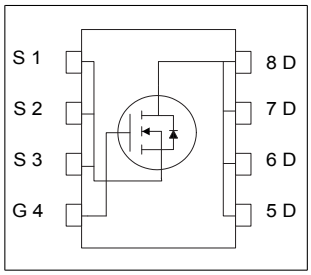


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	1.45	mΩ
I_D	195	A
Q_{OSS}	53	nC
Q_G(0V..10V)	55	nC

Type / Ordering Code	Package	Marking	Related Links
BSC014N04LSI	TDSON-8 FL	014N04LI	-

[1] J-STD20 and JESD22

Table of Contents

1 Maximum ratings

at T_A=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D	- - - - -	- - - - -	195 123 166 105 31	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=100 °C V_{GS}=4.5 V, T_C=25 °C V_{GS}=4.5 V, T_C=100 °C V_{GS}=10 V, T_A=25 °C, R_{thJA}=50 K/W[2]
Pulsed drain current[3]	$I_{D,pulse}$	-	-	780	A	T_C=25 °C
Avalanche current, single pulse[4]	I_{AS}	-	-	50	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	90	mJ	I_D=50 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	- -	- -	96 2.5	W	T_C=25 °C T_A=25 °C, R_{thJA}=50 K/W[2]
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 cm² cooling area[2]	R_{thJA}	-	-	50	K/W	-

[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

3 Electrical characteristics

at T_j=25 °C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	V_{GS}=0 V, I_D=10 mA
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	30	-	mV/K	I_D=10 mA, referenced to 25 °C
Gate threshold voltage	$V_{GS(th)}$	1.2	-	2	V	V_{DS}=V_{GS}, I_D=250 µA
Zero gate voltage drain current	I_{DSS}	- -	- 2	0.5 -	mA	V_{DS}=32 V, V_{GS}=0 V, T_j=25 °C V_{DS}=32 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	10	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	1.5 1.2	2 1.45	mΩ	V_{GS}=4.5 V, I_D=50 A V_{GS}=10 V, I_D=50 A
Gate resistance[1)]	R_G	0.45	0.9	1.8	Ω	-
Transconductance	g_{fs}	110	220	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=50 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	4000	5600	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	1200	1680	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	90	180	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	16	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Rise time	t_r	-	50	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	55	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Fall time	t_f	-	11	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω

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

Table 6 Gate charge characteristics[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	9.9	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	6.3	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate to drain charge[2)]	Q_{gd}	-	8.9	12.5	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	12	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total[2)]	Q_g	-	55	77	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	2.5	-	V	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total[2)]	Q_g	-	29	41	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 4.5 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	49	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 10 V
Output charge[2)]	Q_{oss}	-	53	74	nC	V_{DD}=20 V, V_{GS}=0 V

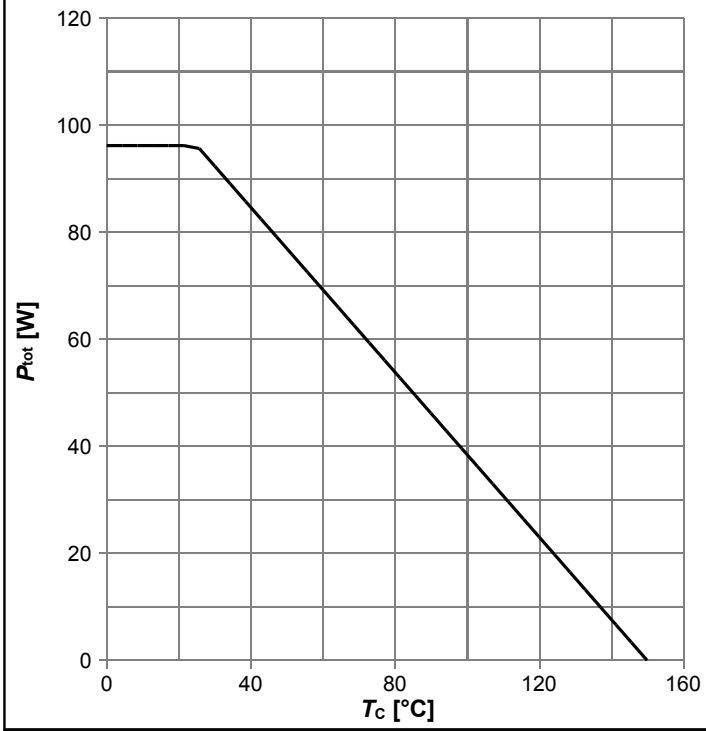
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	96	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	780	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.56	0.7	V	V_{GS}=0 V, I_F=12 A, T_j=25 °C
Reverse recovery charge	Q_{rr}	-	20	-	nC	V_R=20 V, I_F=12 A, di_F/dt=400 A/µs

[1)] See ″Gate charge waveforms″ for parameter definition
[2)] Defined by design. Not subject to production test

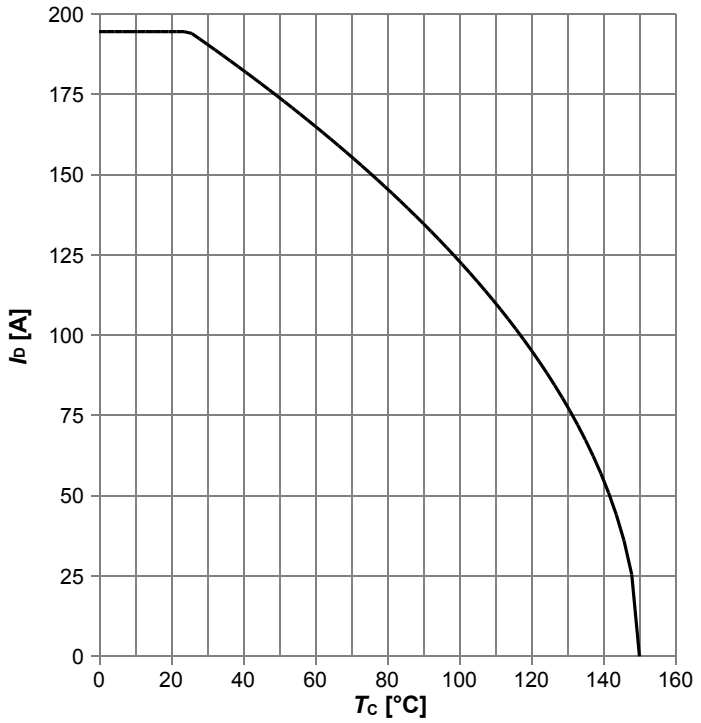
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



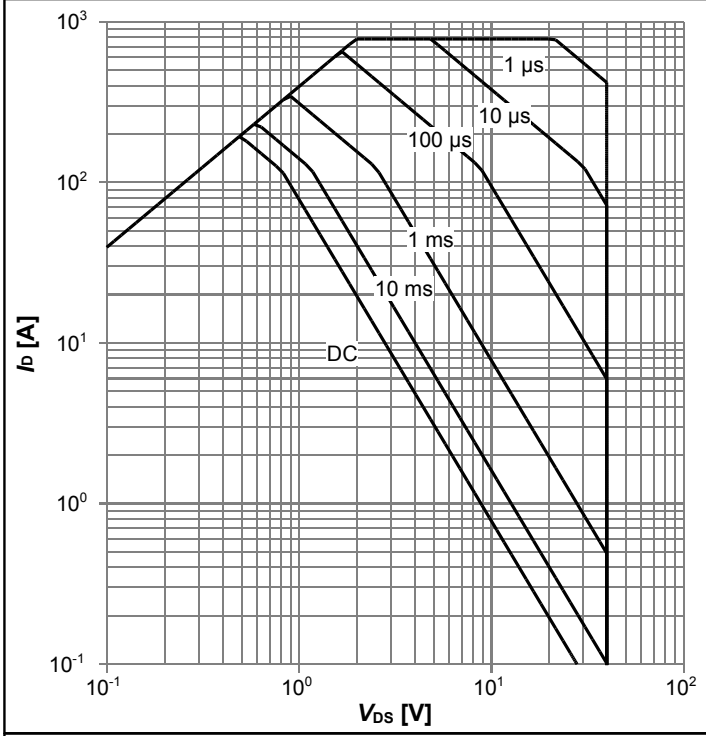
$P_{tot}=f(T_C)$

Diagram 2: Drain current



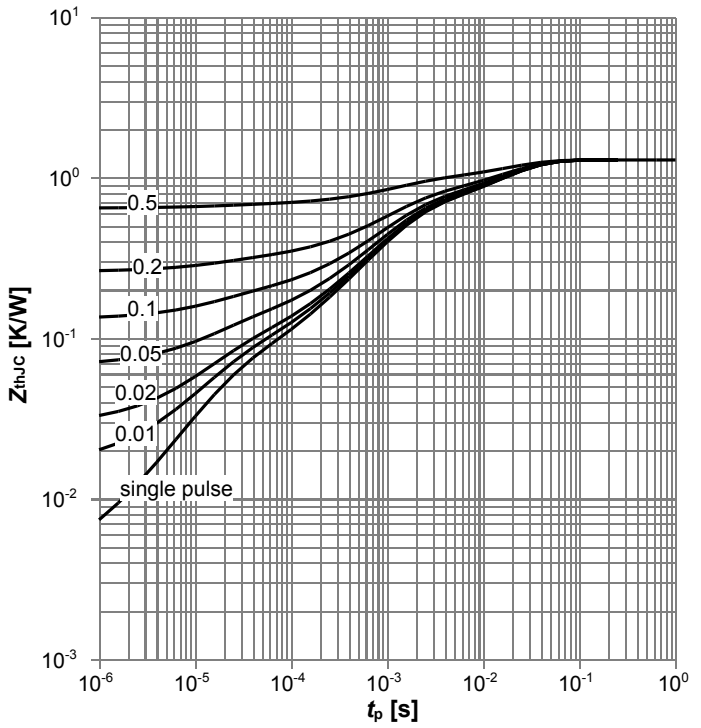
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



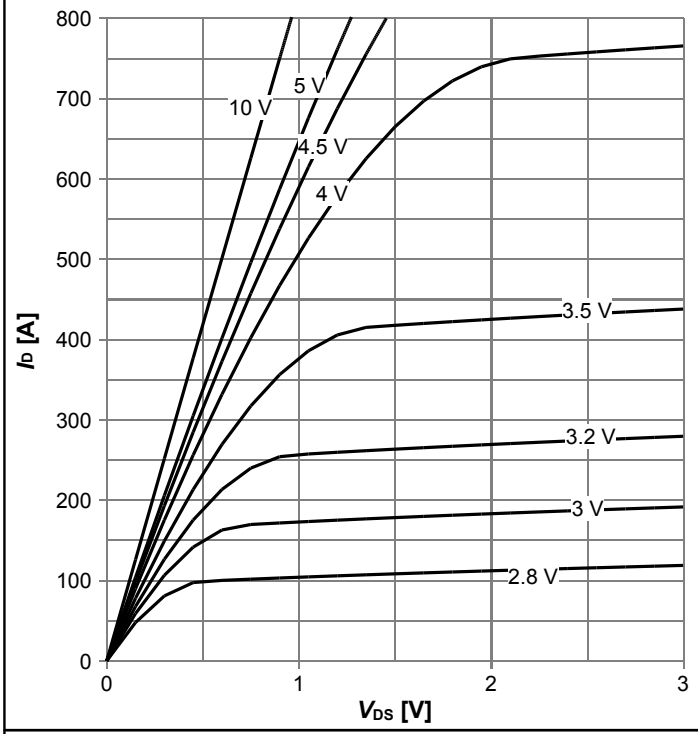
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



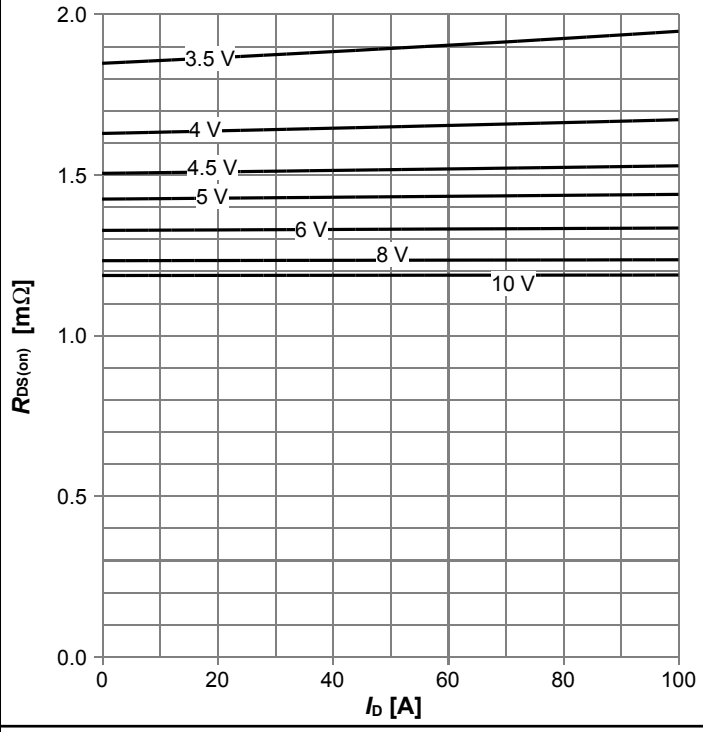
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



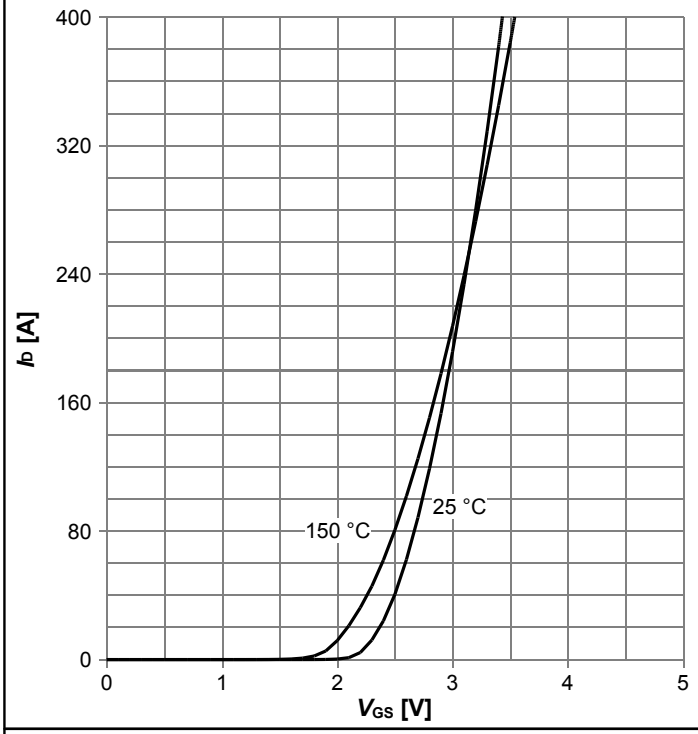
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



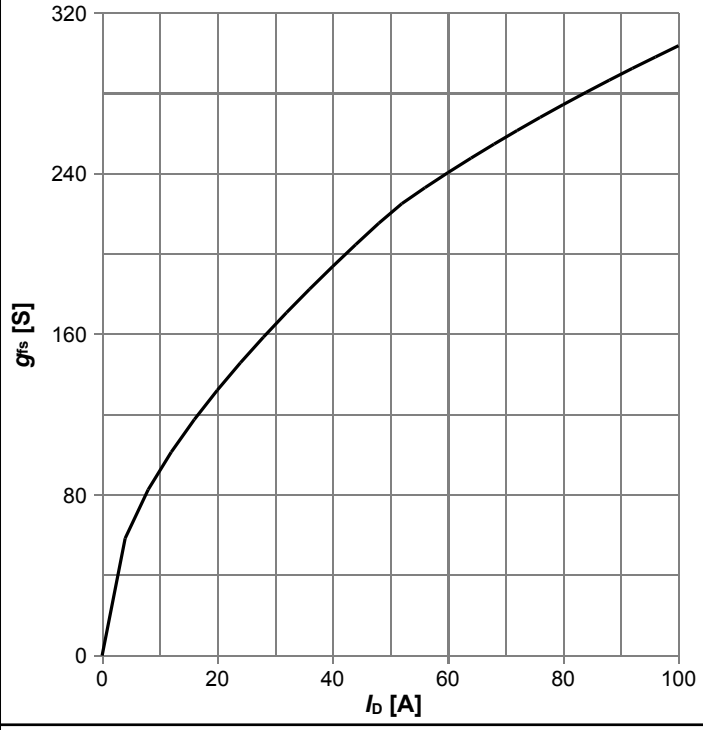
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



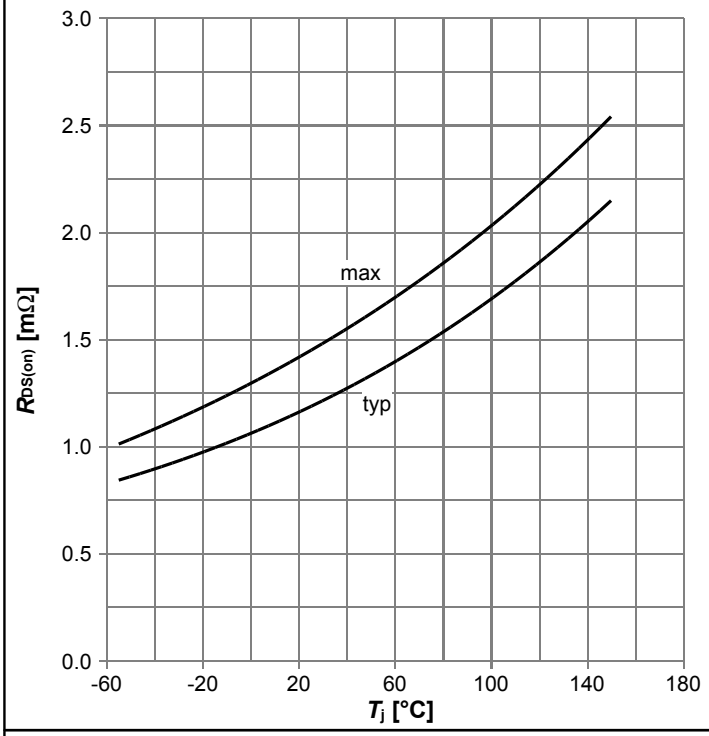
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



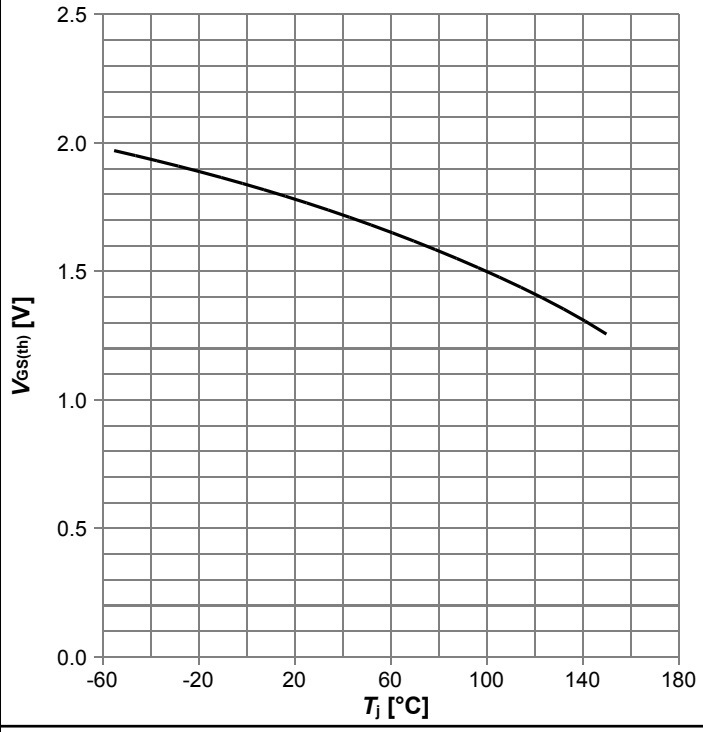
$g_{fs}=f(I_D)$; $T_j=25$ °C

Diagram 9: Drain-source on-state resistance



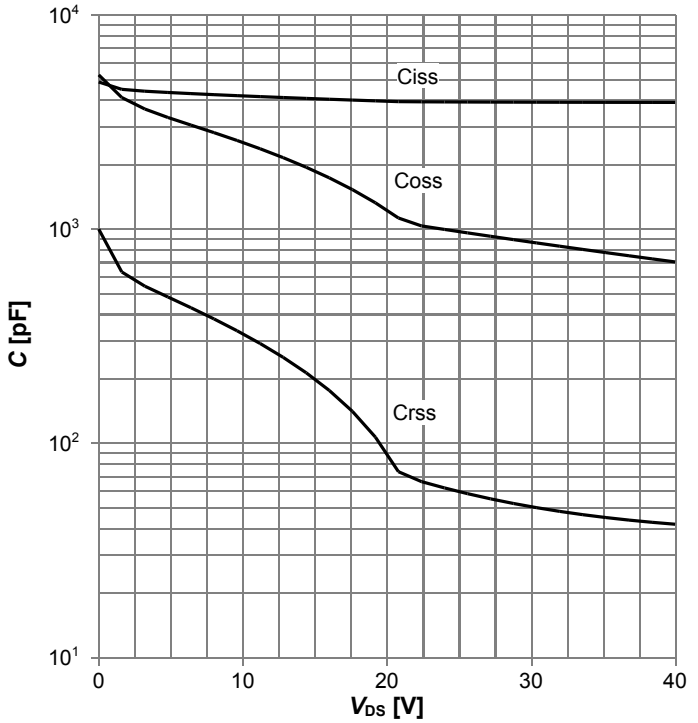
$R_{DS(on)}$=f(T_j); I_D=50 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



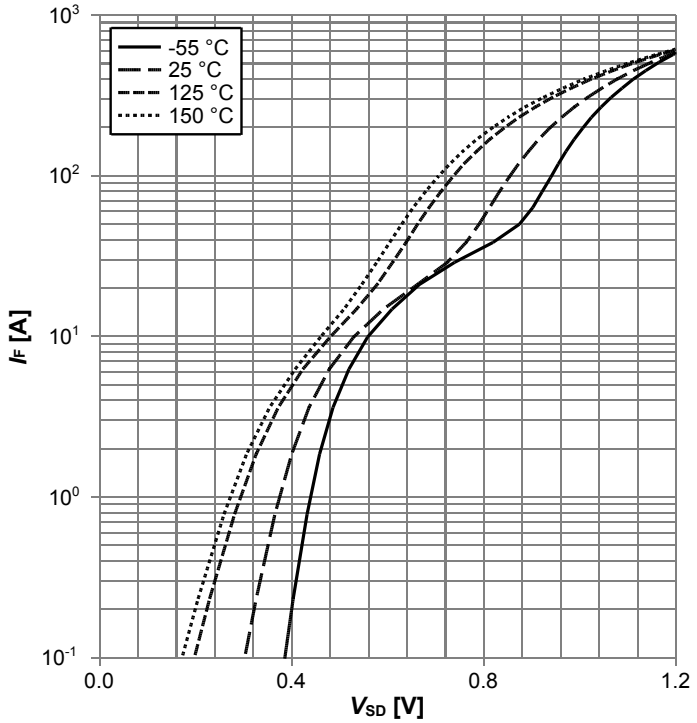
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_{DS}=10mA

Diagram 11: Typ. capacitances



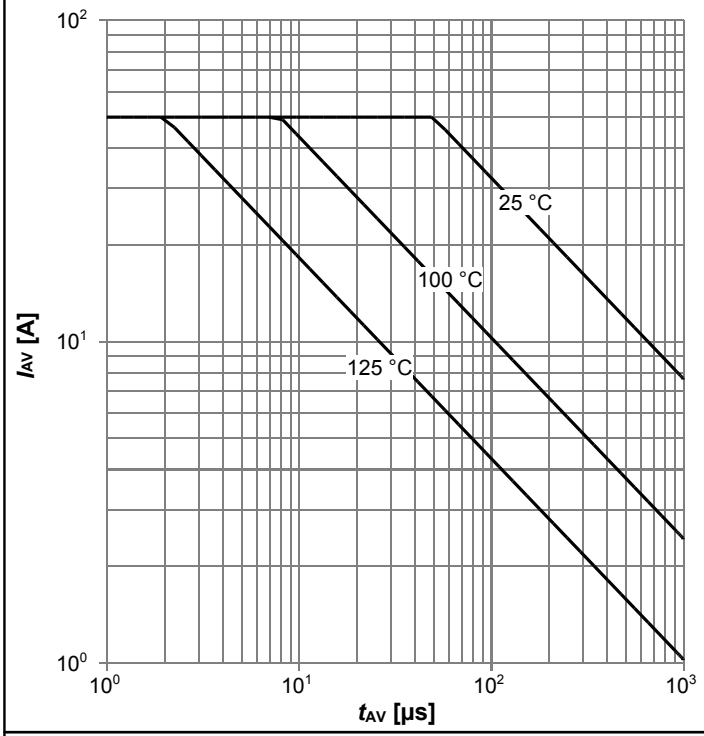
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



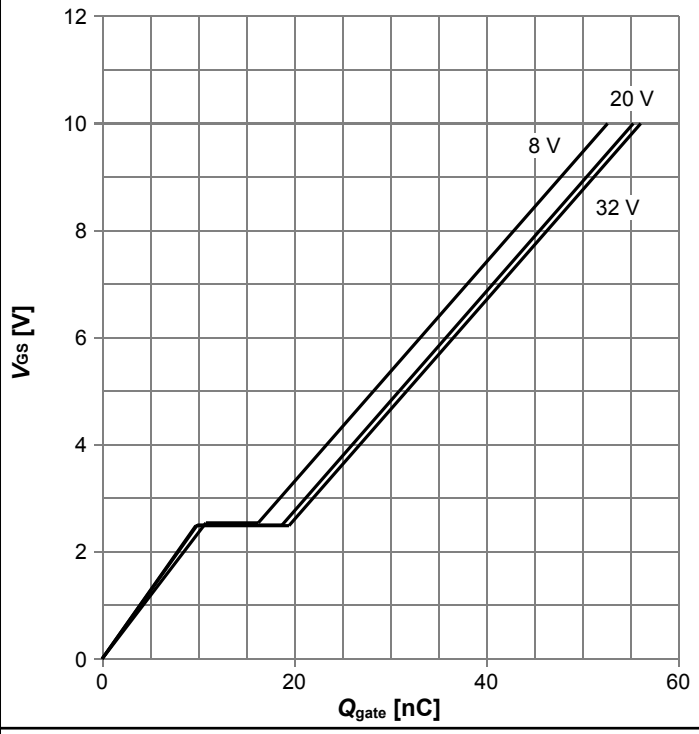
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



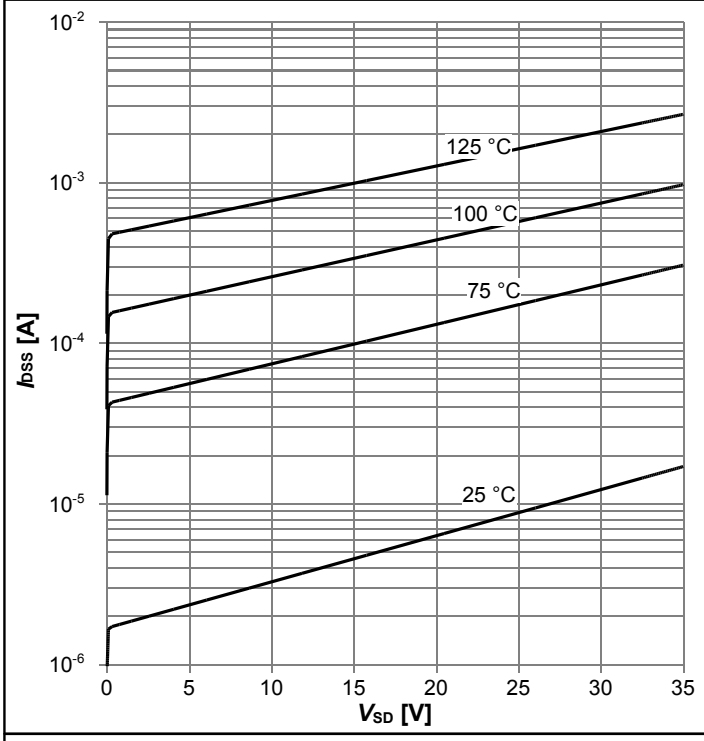
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



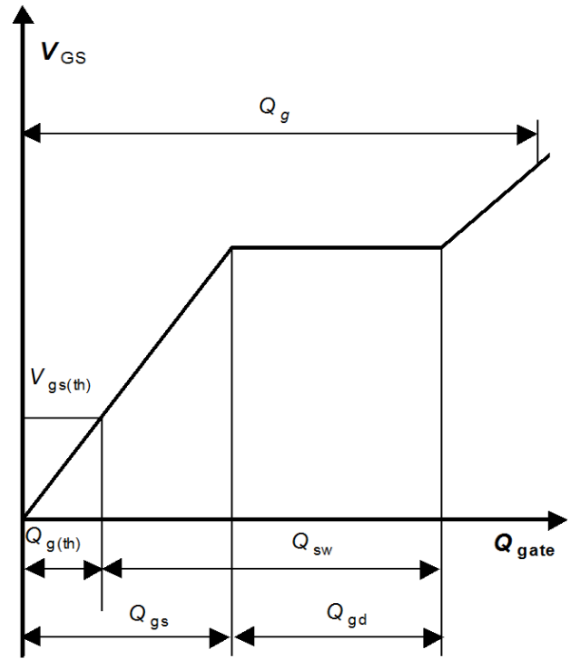
V_{GS}=f(Q_{gate}); I_D=50 A pulsed; parameter: V_{DD}

Diagram 15: Typ. drain-source leakage current

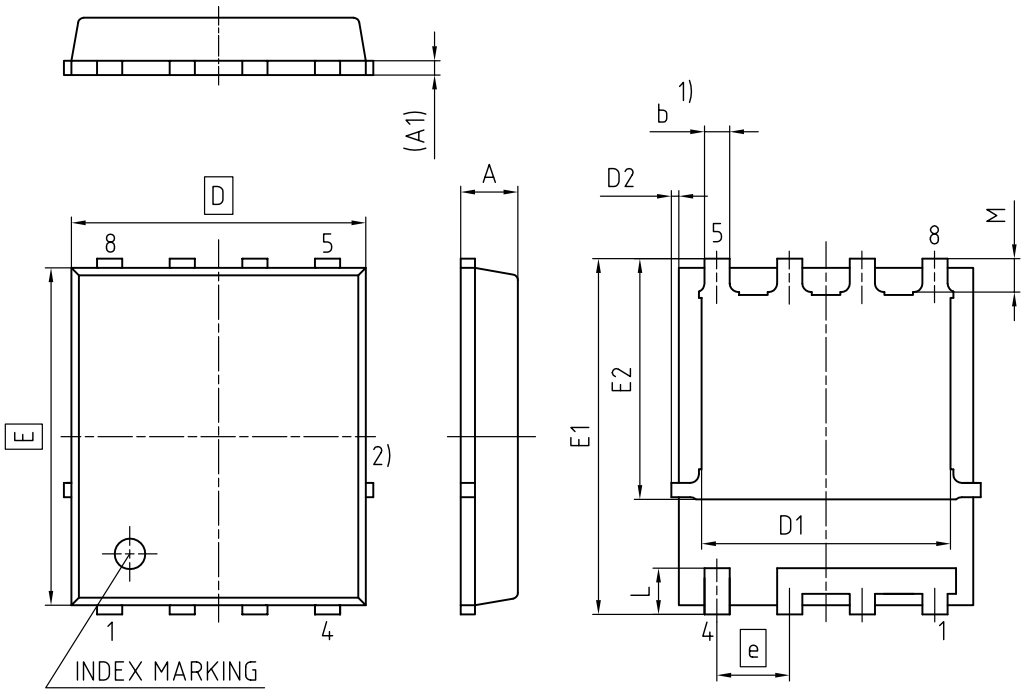


I_{DSS}=f(V_{DS}); V_{GS}=0 V; parameter: T_j

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	0 1 2 3mm
EUROPEAN PROJECTION	
ISSUE DATE	19.06.2019

Figure 1 Outline TDSON-8 FL, dimensions in mm

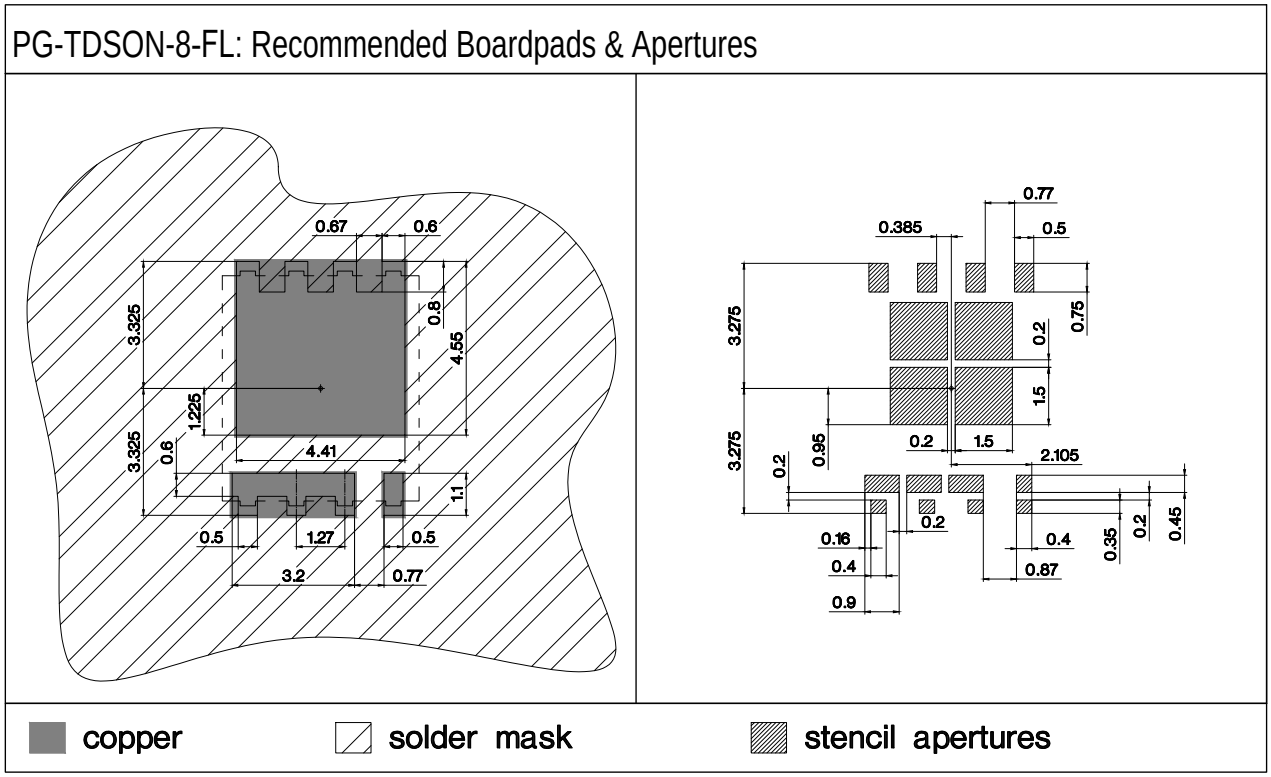


Figure 2 Outline Boardpads (TDSON-8 FL)

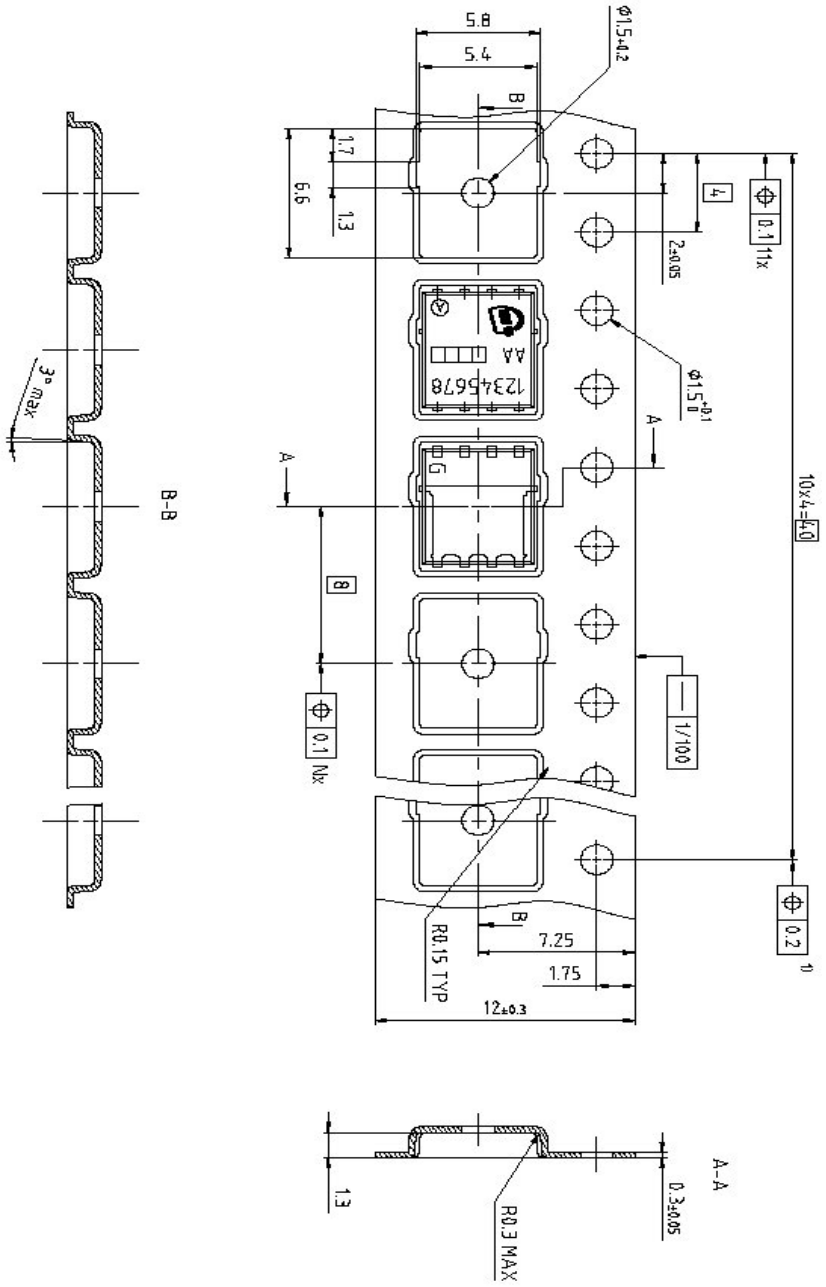


Figure 3 Outline Tape (TDSON-8 FL)

Revision History

BSC014N04LSI

Revision: 2020-05-15, Rev. 2.4

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.2	2016-05-04	Update footnotes and insert max values
2.3	2019-10-01	Update package drawings
2.4	2020-05-15	Update current rating