

## MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

OptiMOS™5 Power-MOSFET, 25 V  
BSZ013NE2LS5I

## Data Sheet

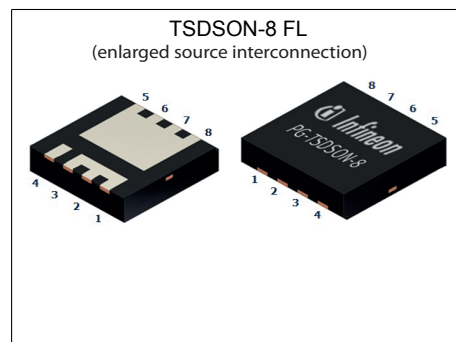
Rev. 2.0  
Final

Power Management & Multimarket

## 1 Description

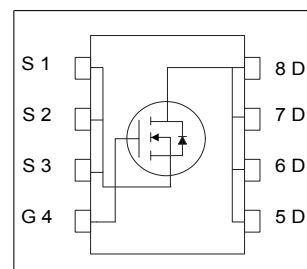
### Features

- Optimized for high performance buck converters
- Monolithic integrated Schottky-like diode
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5\text{ V}$
- 100% avalanche tested
- 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
$V_{DS}$	25	V
$R_{DS(on),max}$	1.3	$m\Omega$
$I_D$	40	A
$Q_{OSS}$	29	nC
$Q_G(0V..4.5V)$	17	nC



Type / Ordering Code	Package	Marking	Related Links
BSZ013NE2LS5I	PG-TSDSON-8 FL	13NE25I	-

<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	$I_D$	-	-	40	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=60\text{ K/W}^1)$
		-	-	40		
		-	-	40		
		-	-	40		
		-	-	32		
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	160	A	$T_C=25\text{ °C}$
Avalanche current, single pulse <sup>3)</sup>	$I_{AS}$	-	-	20	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	90	mJ	$I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-16	-	16	V	-
Power dissipation	$P_{tot}$	-	-	69	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=60\text{ K/W}^1)$
		-	-	2.1		
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	$R_{thJC}$	-	-	1.8	K/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	60	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 Diagram 3 for more detailed information

<sup>3)</sup> See Diagram 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	$V_{(BR)DSS}$	25	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=10\text{ mA}$
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	15	-	mV/K	$I_D=10\text{ mA}$ , referenced to 25 °C
Gate threshold voltage	$V_{GS(th)}$	1.2	-	2.0	V	$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-	0.5	mA	$V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=20\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.3	1.7	m $\Omega$	$V_{GS}=4.5\text{ V}$ , $I_D=20\text{ A}$ $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$
Gate resistance	$R_G$	-	0.7	1.2	$\Omega$	-
Transconductance	$g_{fs}$	75	150	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=20\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	2500	3400	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	1200	1600	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	92	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=12\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	5	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	4	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	26	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	3	-	ns	$V_{DD}=12\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

<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	$Q_{gs}$	-	5.8	-	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	4.0	-	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	3.6	-	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	$Q_{sw}$	-	5.5	-	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	$Q_g$	-	17	23	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.3	-	V	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>2)</sup>	$Q_g$	-	37	50	nC	$V_{DD}=12\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	16	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge <sup>2)</sup>	$Q_{oss}$	-	29	39	nC	$V_{DD}=12\text{ V}$ , $V_{GS}=0\text{ V}$

**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	40	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	160	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.5	0.65	V	$V_{GS}=0\text{ V}$ , $I_F=11\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery charge	$Q_{rr}$	-	20	-	nC	$V_R=15\text{ V}$ , $I_F=11\text{ A}$ , $di_F/dt=400\text{ A}/\mu\text{s}$

<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

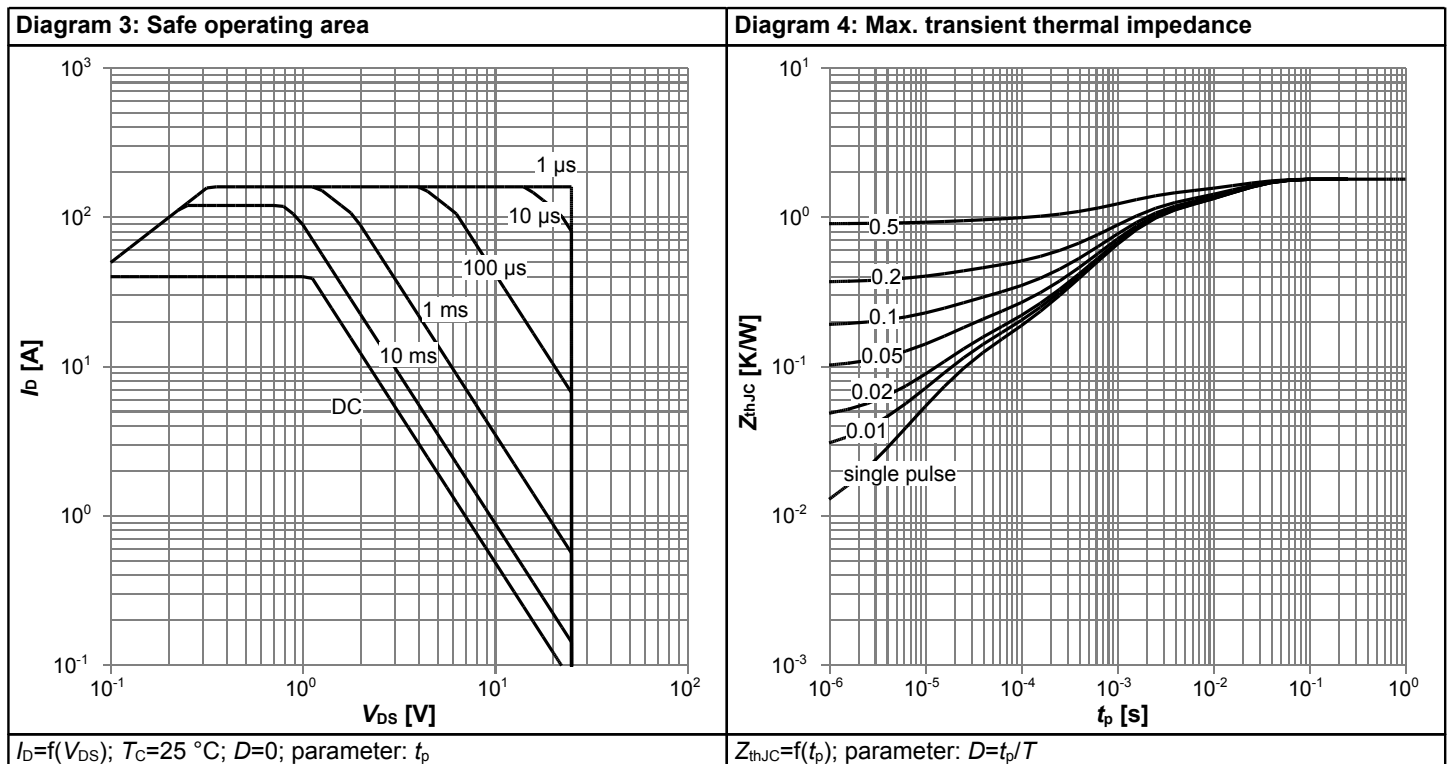
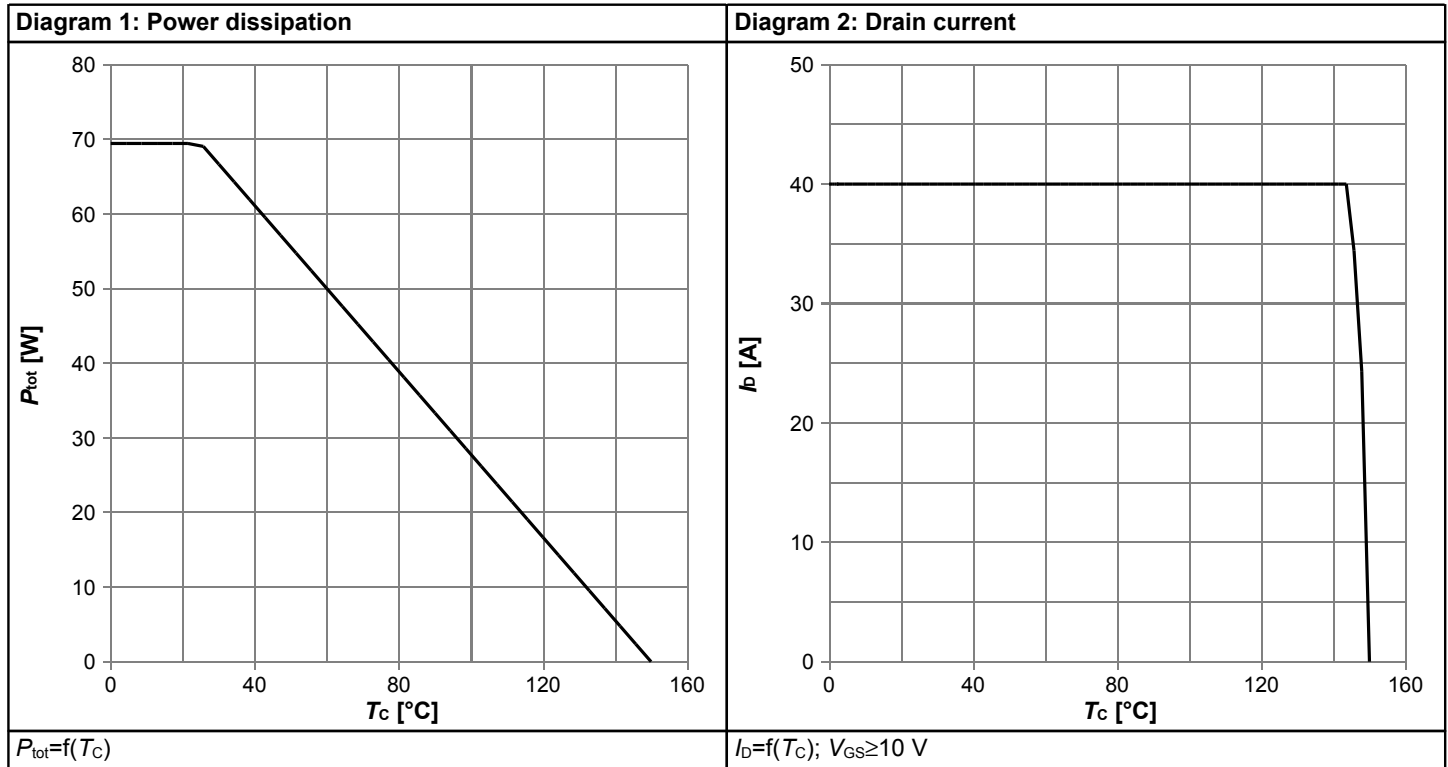
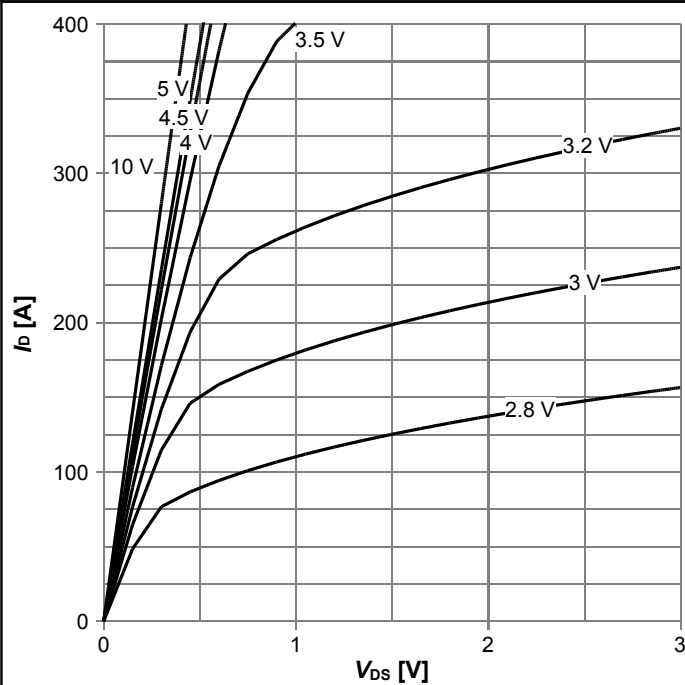
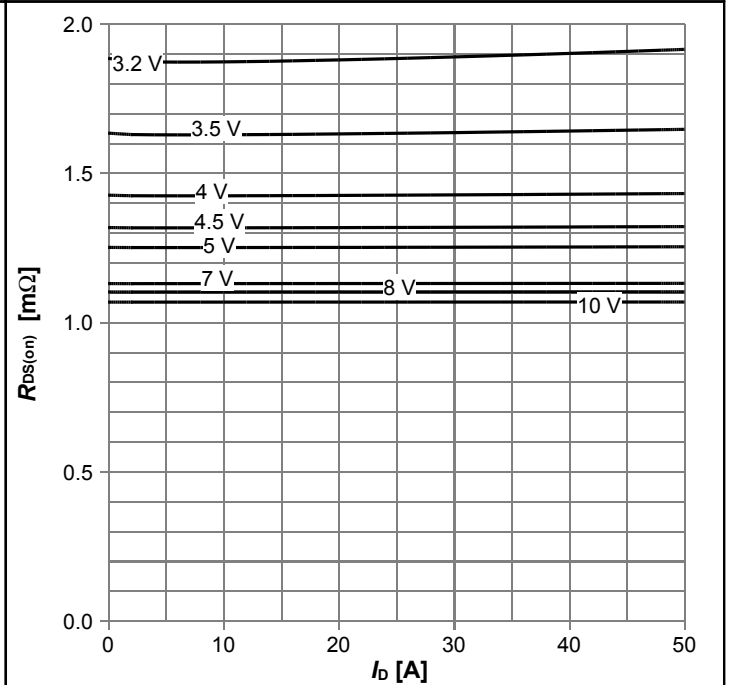


Diagram 5: Typ. output characteristics



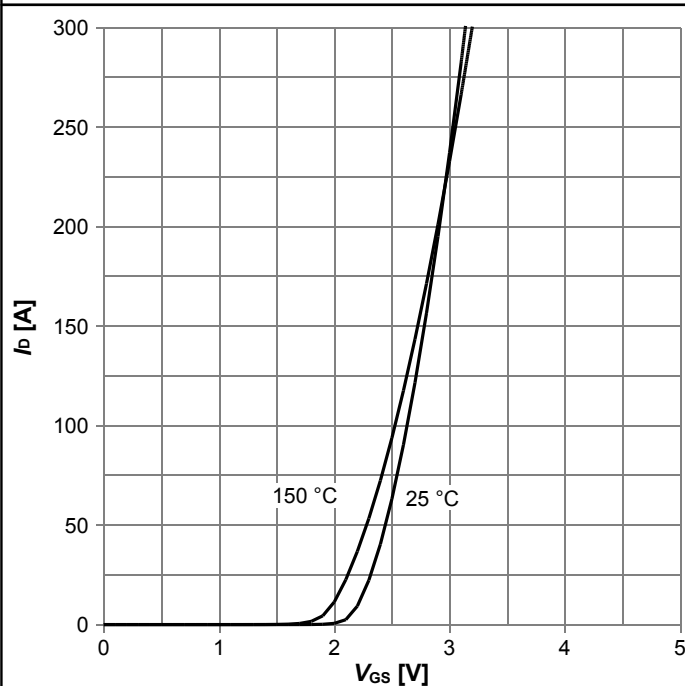
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



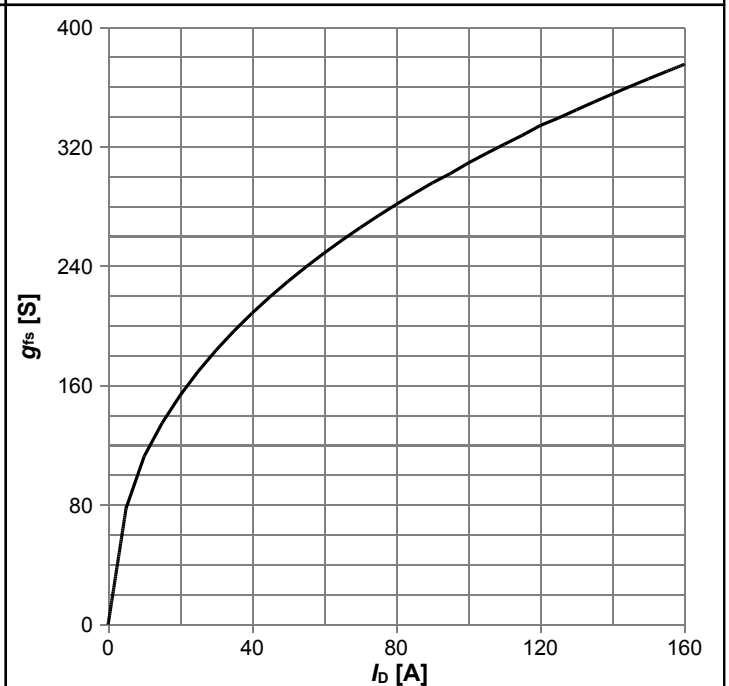
$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



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

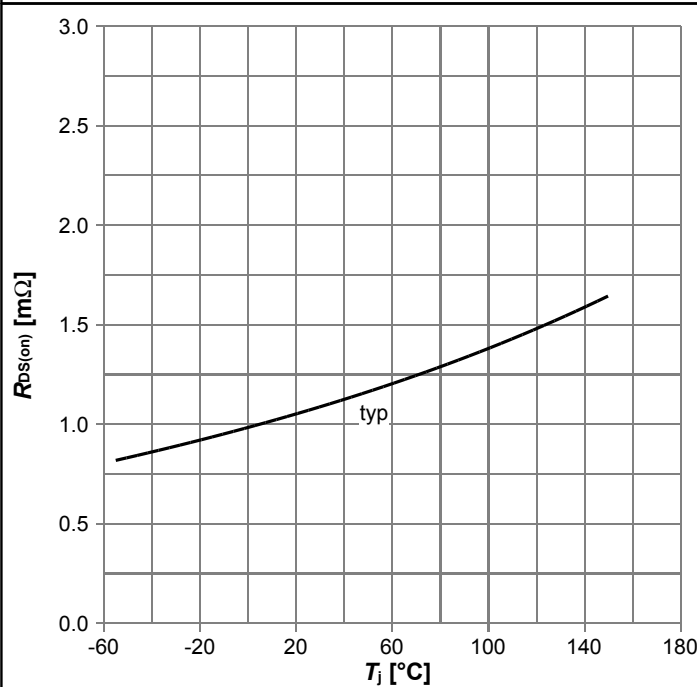
Diagram 8: Typ. forward transconductance



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

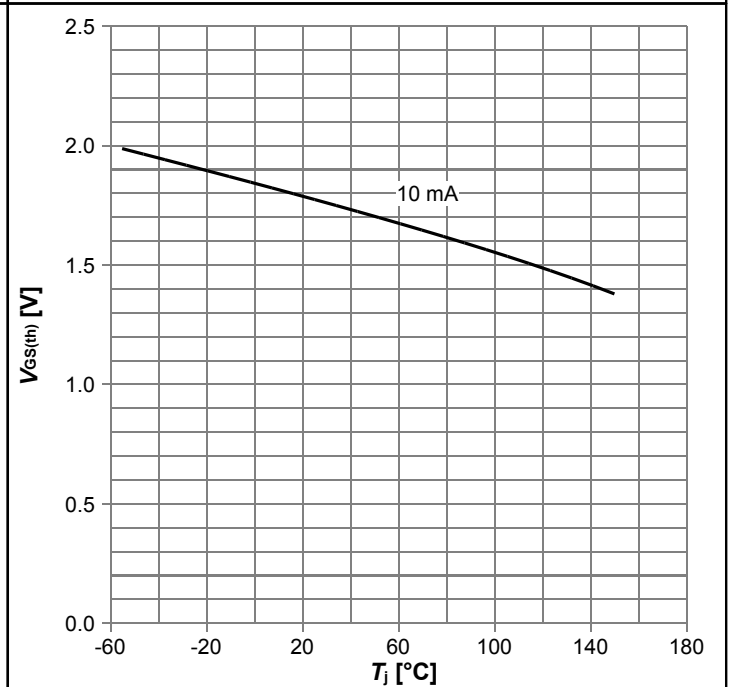


Diagram 9: Drain-source on-state resistance



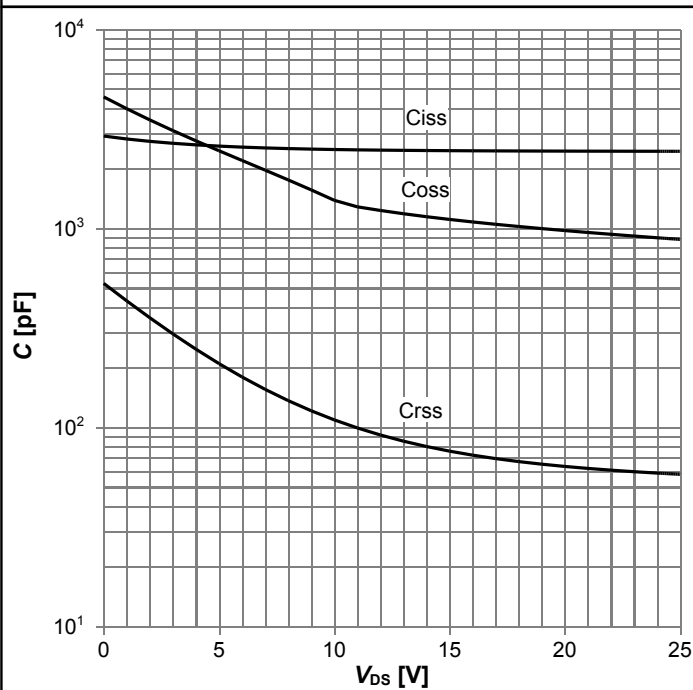
$R_{DS(on)}=f(T_j); I_D=20\text{ A}; V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



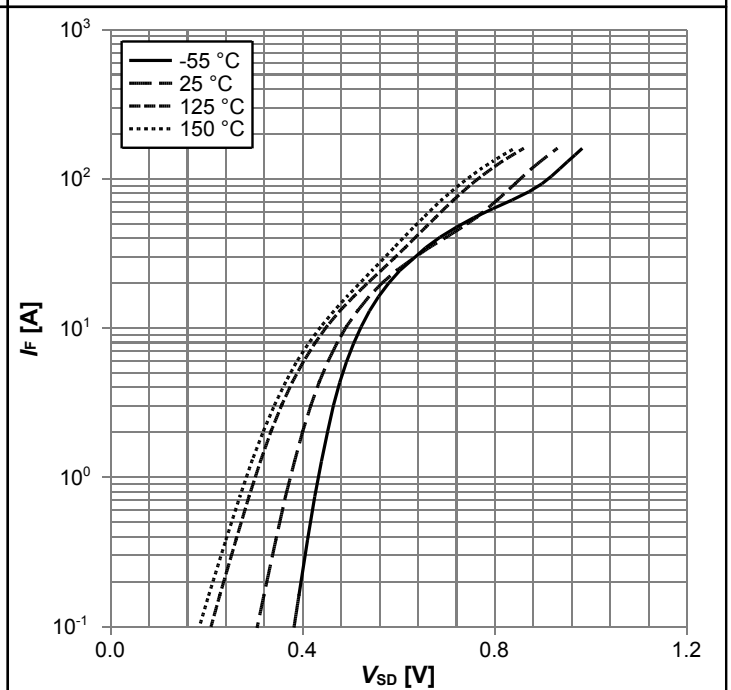
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}; I_D=10\text{ mA}$

Diagram 11: Typ. capacitances



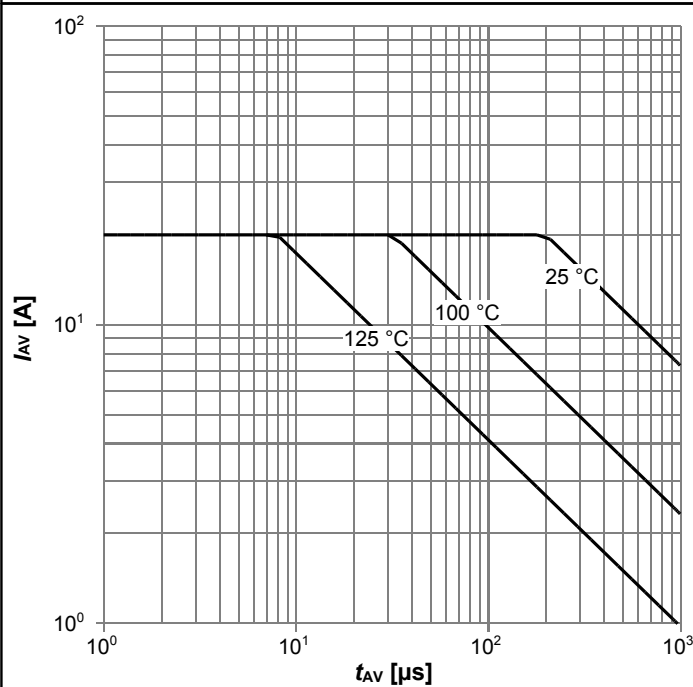
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



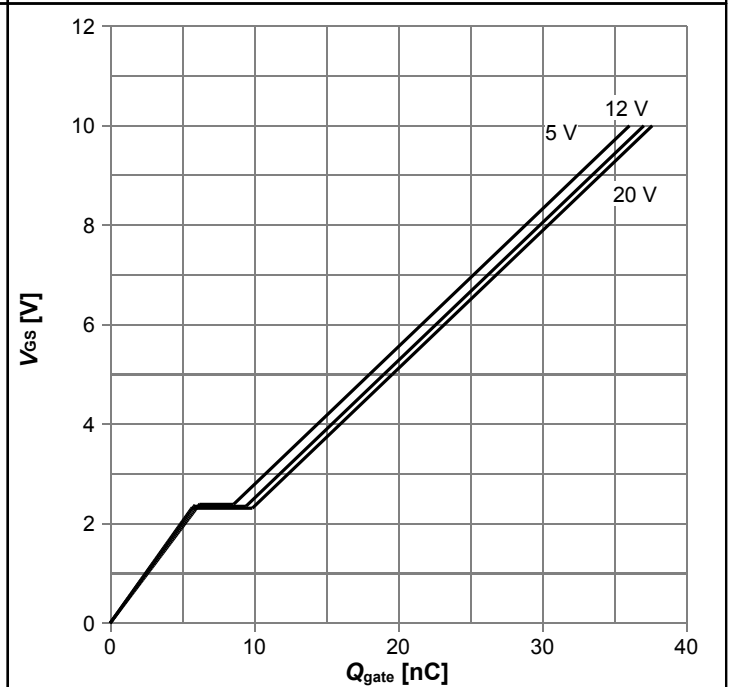
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



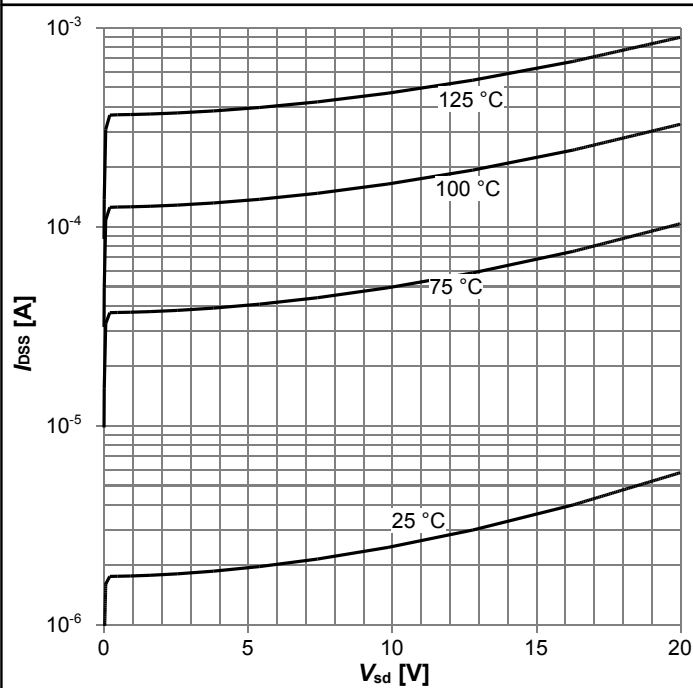
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



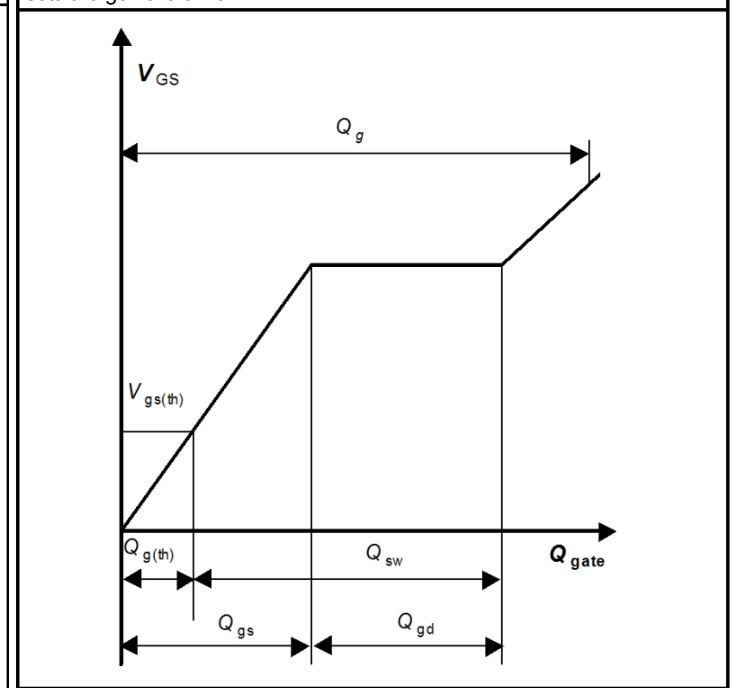
$V_{GS}=f(Q_{gate}); I_D=30 \text{ A pulsed}$ ; parameter:  $V_{DD}$

Diagram 15: Typ. drain-source leakage current



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

Gate charge waveforms



6 Package Outlines

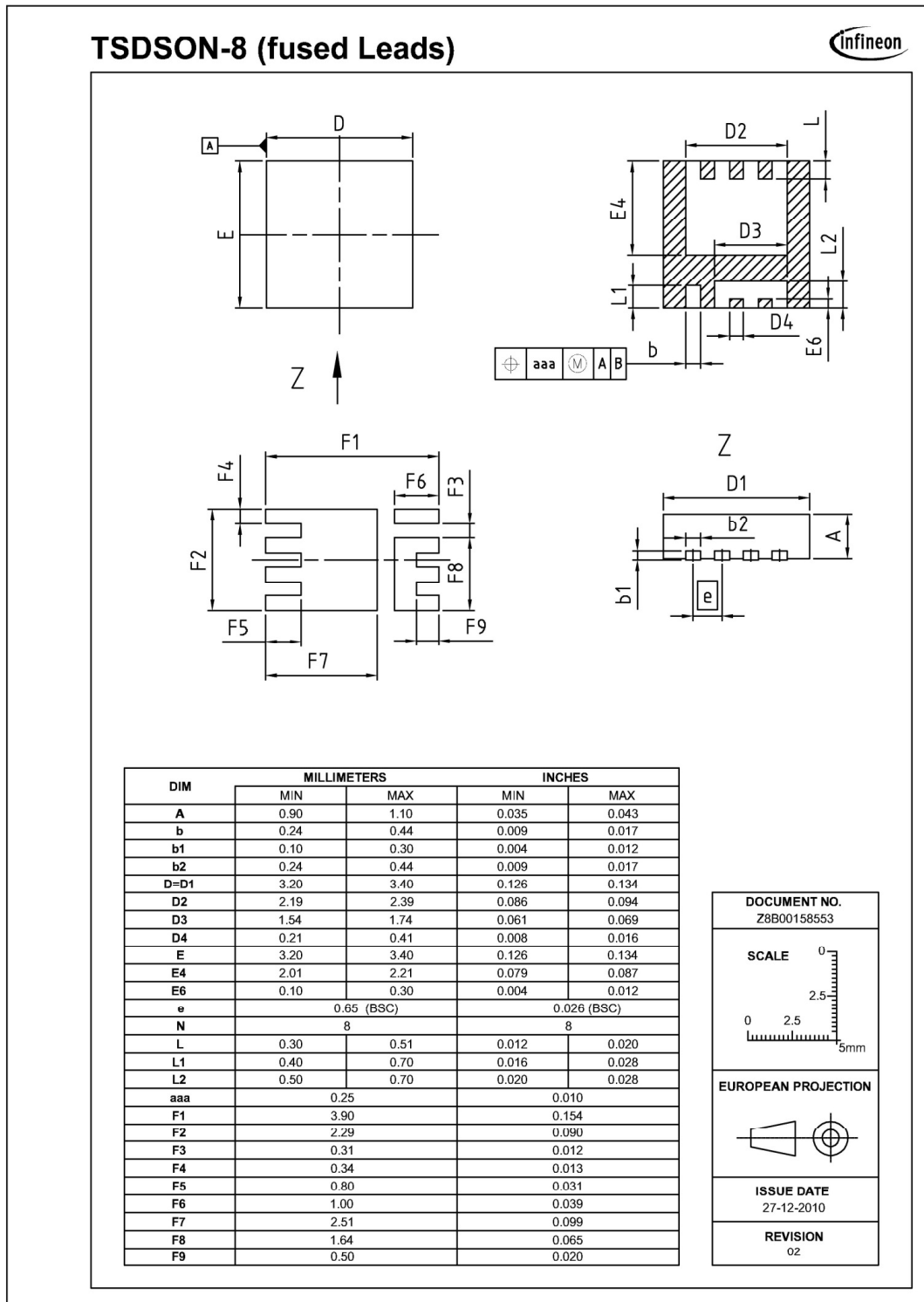


Figure 1 Outline PG-TSDSON-8 FL, dimensions in mm/inches

## Revision History

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BSZ013NE2LS5I

**Revision: 2015-08-17, Rev. 2.0**

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Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2015-08-17	Release of final version

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