

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™5 Power-MOSFET, 30 V
BSZ0506NS

Data Sheet

Rev. 2.0
Final

1 Description

Features

- Optimized for high performance buck converters (Server,VGA)
- Very low FOM_{QOSS} for high frequency SMPS
- Low FOM_{SW} for high frequency SMPS
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$ @ $V_{GS}=4.5$ V
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

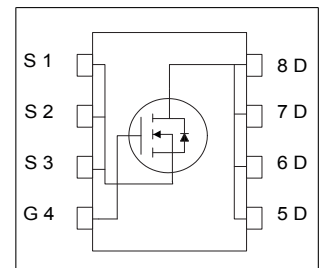
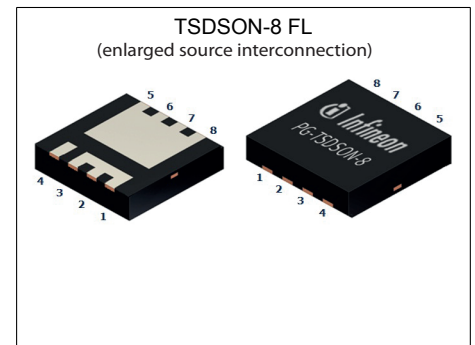


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	30	V
$R_{DS(on),max}$	4.4	mΩ
I_D	40	A
Q_{OSS}	7.2	nC
$Q_G(0V..4.5V)$	5.2	nC

Type / Ordering Code	Package	Marking	Related Links
BSZ0506NS	PG-TSDSON-8 FL	0506NS	-

¹⁾ 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	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=60\text{ K/W}^{1)}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	160	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ³⁾	I_{AS}	-	-	20	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	20	mJ	$I_D=20\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	27 2.1	-	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=60\text{ K/W}$
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}	-	-	4.6	K/W	-
Device on PCB, 6 cm ² cooling area ³⁾	R_{thJA}	-	-	60	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 figure 3 for more detailed information

³⁾ 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	$V_{(BR)DSS}$	30	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.2	1.6	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	$V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_J=25\text{ }^\circ\text{C}$ $V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_J=125\text{ }^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	4.4 3.5	5.3 4.4	m Ω	$V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$
Gate resistance	R_G	-	1	1.7	Ω	-
Transconductance	g_{fs}	49	98	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=30\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance ¹⁾	C_{iss}	-	700	950	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Output capacitance ¹⁾	C_{oss}	-	220	300	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	16	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	2.3	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	2.4	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	13	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	2.0	-	ns	$V_{DD}=15\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	1.9	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	1.1	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	Q_{gd}	-	1.4	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	Q_{sw}	-	2.2	-	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	Q_g	-	5.2	7.2	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.7	-	V	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	Q_g	-	11	15	nC	$V_{DD}=15\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	4.8	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	Q_{oss}	-	7.2	-	nC	$V_{DD}=15\text{ V}$, $V_{GS}=0\text{ V}$

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

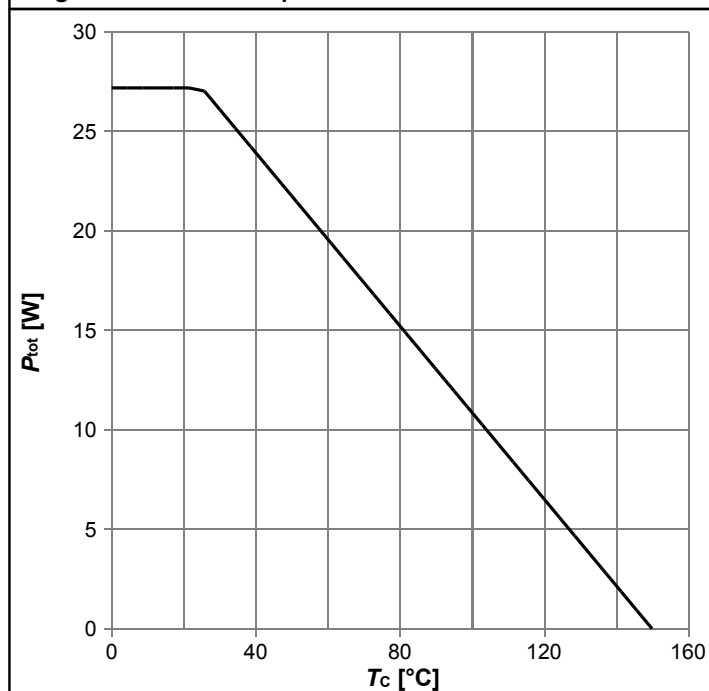
²⁾ See "Gate charge waveforms" for parameter definition

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	27	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	160	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.81	1.1	V	$V_{GS}=0\text{ V}$, $I_F=20\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery charge	Q_{rr}	-	10	-	nC	$V_R=15\text{ V}$, $I_F=30\text{ A}$, $di_F/dt=400\text{ A}/\mu\text{s}$

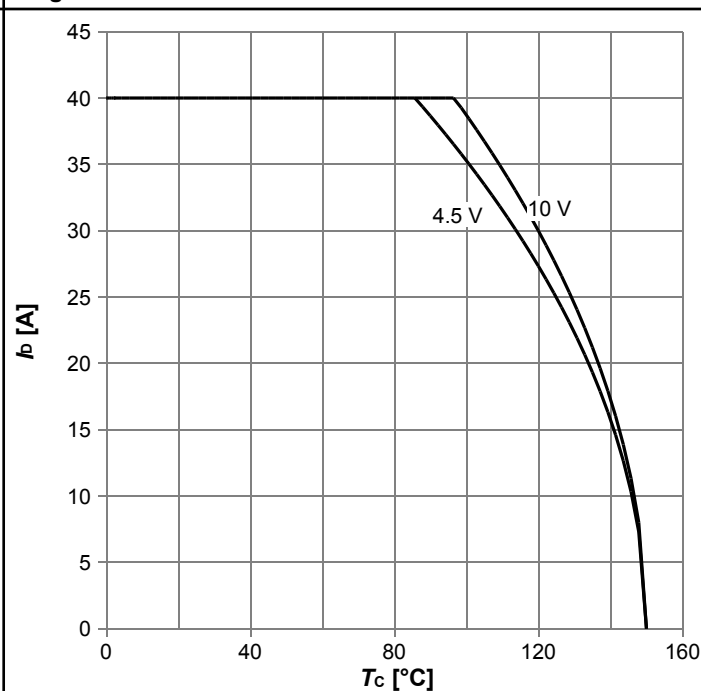
5 Electrical characteristics diagrams

Diagram 1: Power dissipation



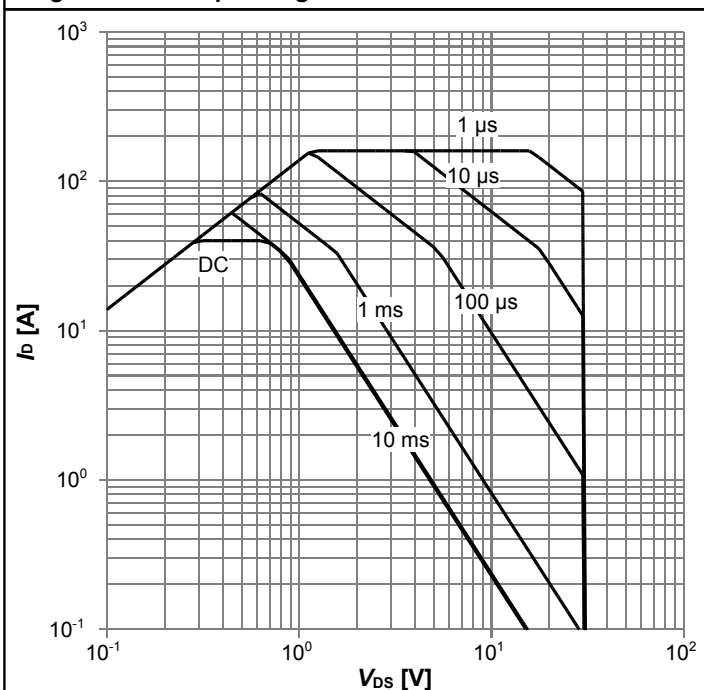
$$P_{\text{tot}} = f(T_c)$$

Diagram 2: Drain current



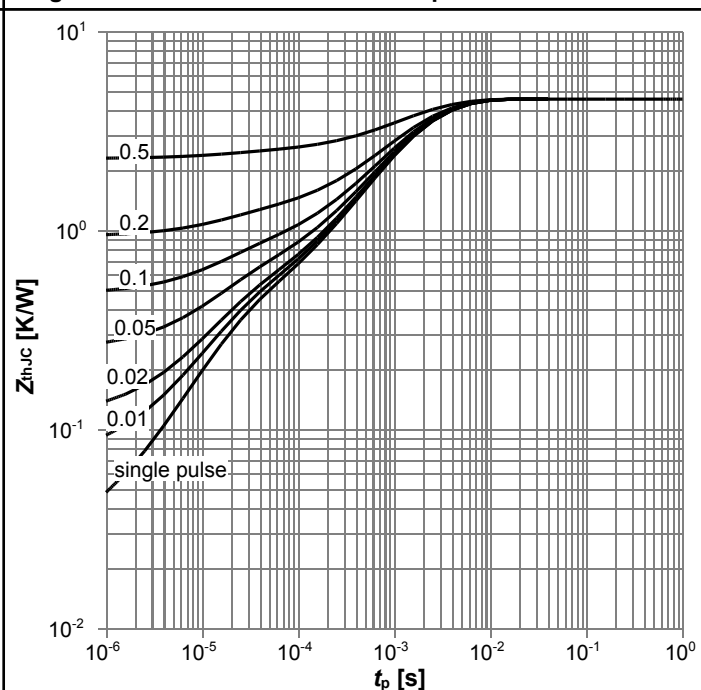
$$I_D = f(T_c); \text{ parameter: } V_{\text{GS}}$$

Diagram 3: Safe operating area



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

Diagram 4: Max. transient thermal impedance



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

Diagram 5: Typ. output characteristics

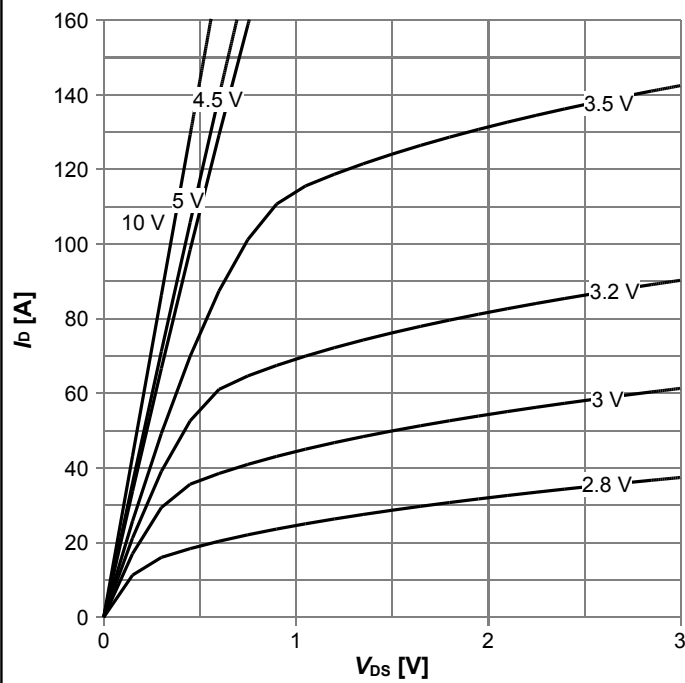

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance

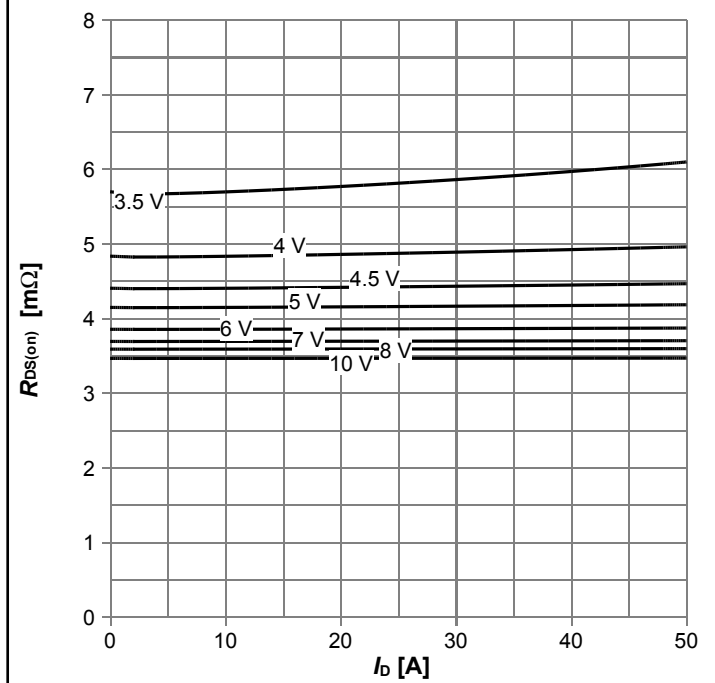

 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics

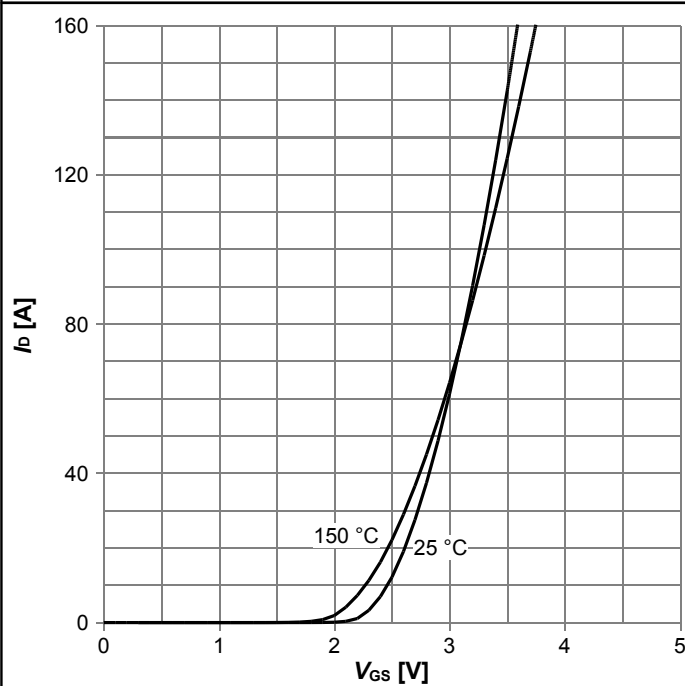

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$

Diagram 8: Typ. forward transconductance

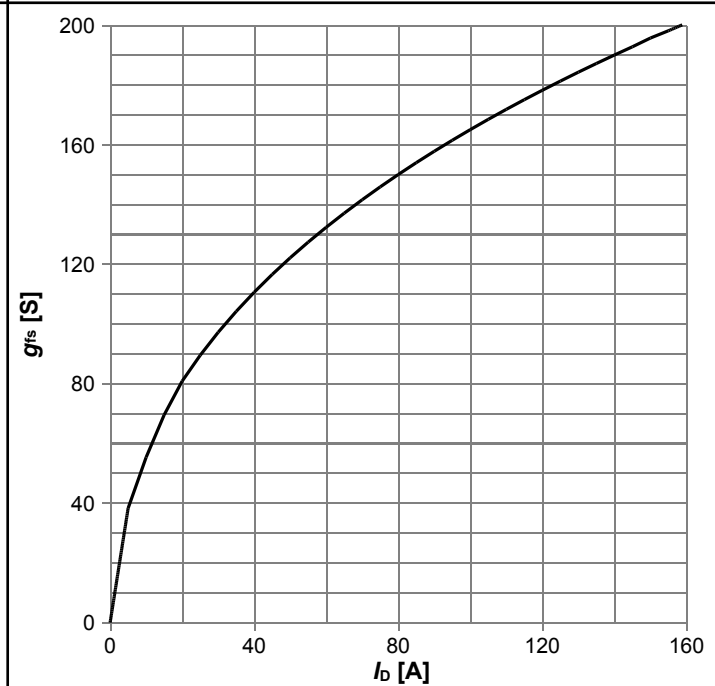
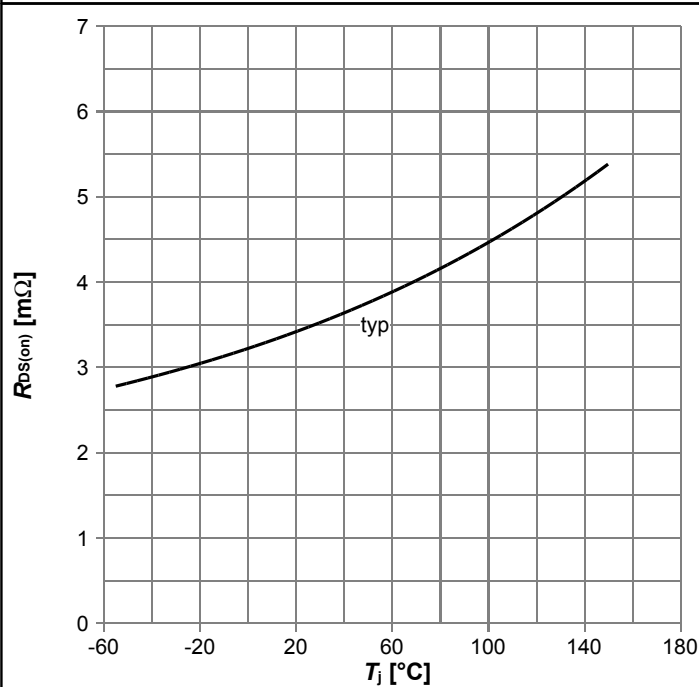
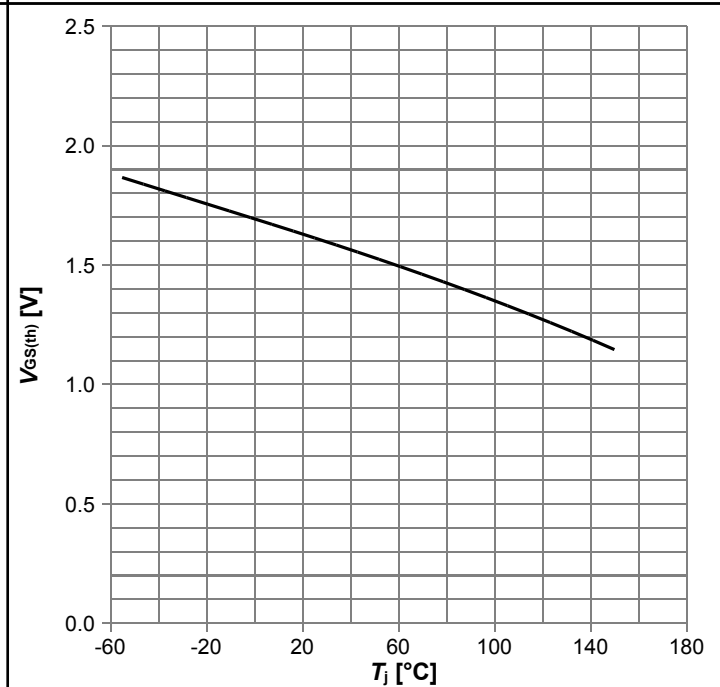

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



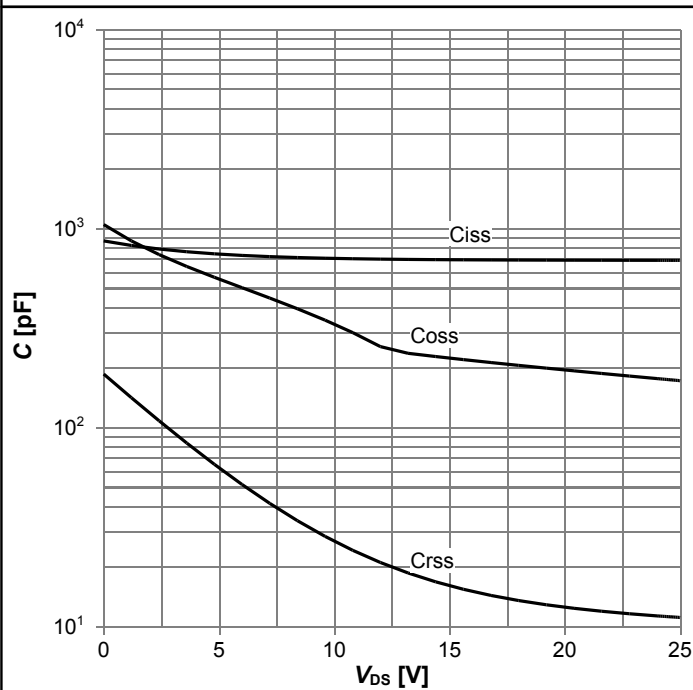
$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



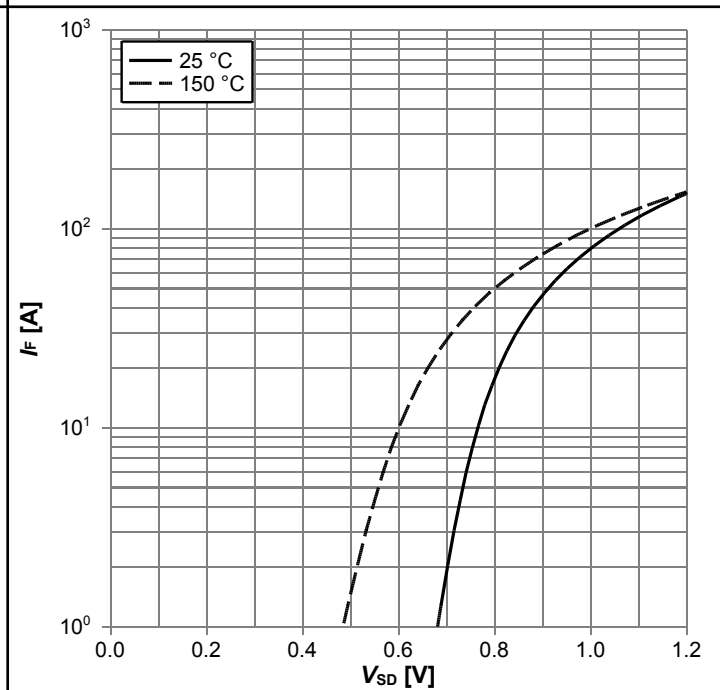
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 250 \text{ } \mu\text{A}$$

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

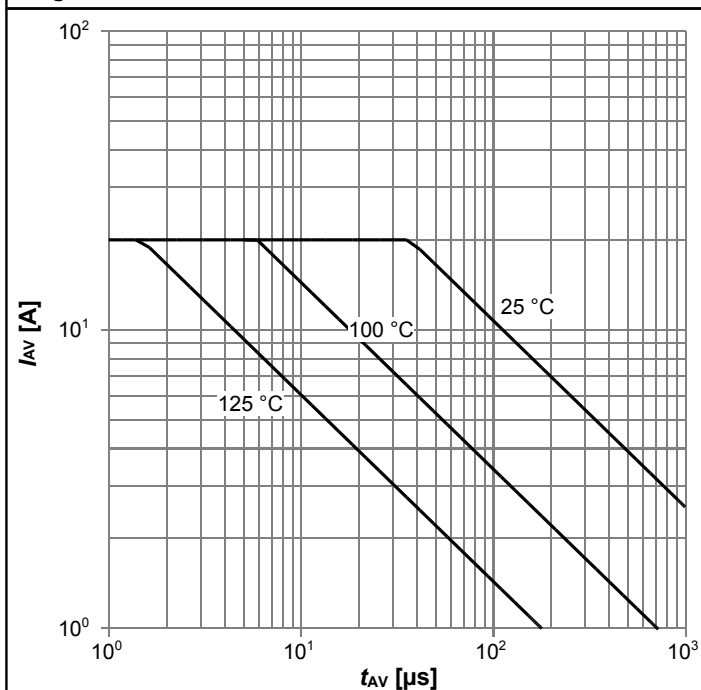

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j(\text{start})}$

Diagram 14: Typ. gate charge

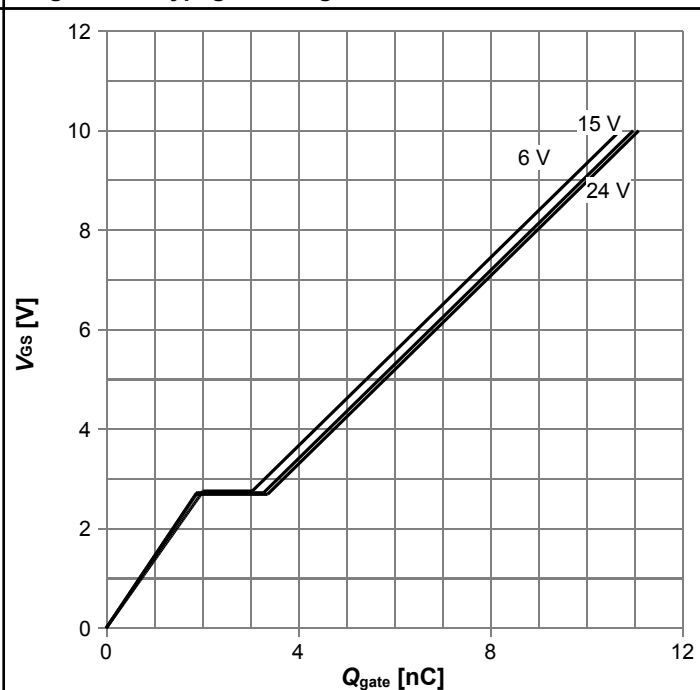
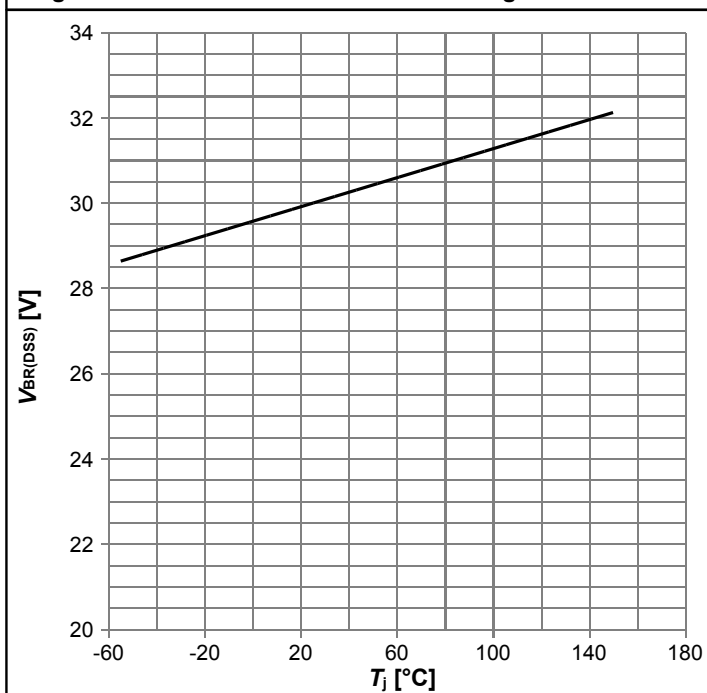
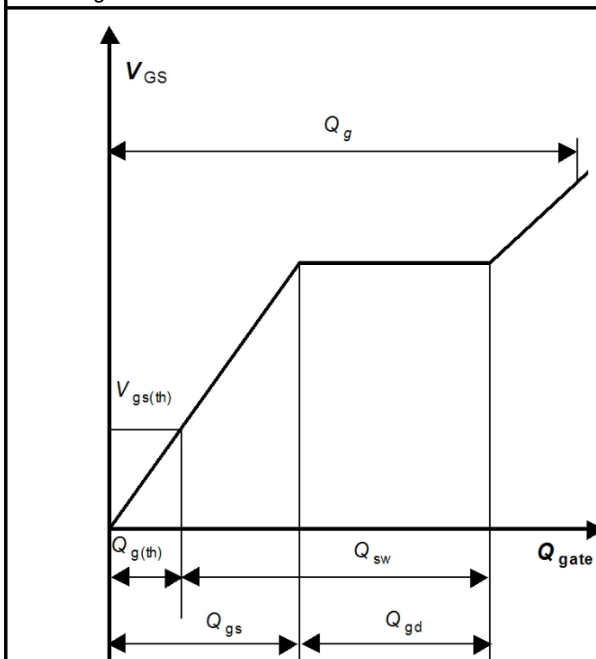

 $V_{GS}=f(Q_{\text{gate}}); I_D=30\ \text{A pulsed}; \text{parameter: } V_{DD}$

Diagram 15: Drain-source breakdown voltage


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

Gate charge waveforms



6 Package Outlines

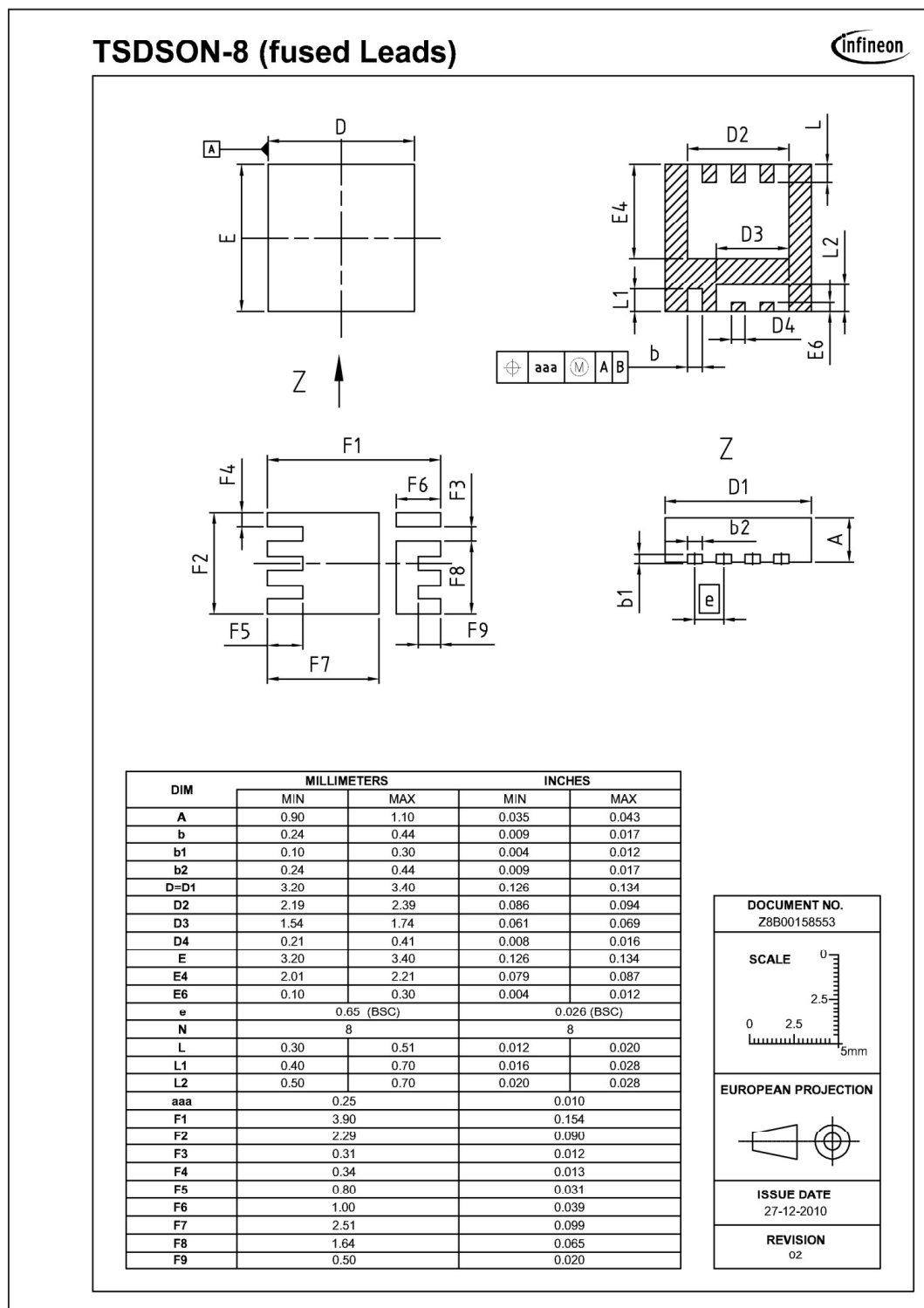


Figure 1 Outline PG-TSDSON-8 FL, dimensions in mm/inches

Revision History

BSZ0506NS

Revision: 2015-04-27, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2015-04-27	Release of final version

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