

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-MOSFET, 40V
BSZ023N04LS

Data Sheet

Rev. 2.0
Final

1 Description

This N-channel MOSFET is optimized for low on-state resistance, gate charge and reverse recovery charge which make it a perfect choice for synchronous rectification in switch mode power supplies such as in servers.

Features

- Optimized for synchronous rectification
- Very low on-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
- Qualified according to JEDEC for target applications
- Higher solder joint reliability due to enlarged source interconnection

Applications

- Synchronous rectification
- Isolated DC/DC converters
- Motor control for 12-24V systems
- Or-ing switches

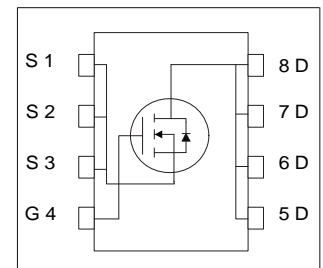
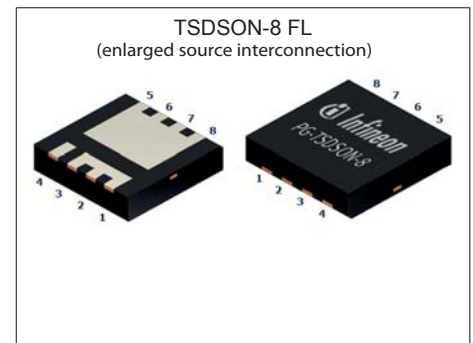


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40.0	V
$R_{DS(on),max}$	2.35	mΩ
I_D	40.0	A
Q_{OSS}	33.0	nC
$Q_G(0V..10V)$	37.0	nC

Type / Ordering Code	Package	Marking	Related Links
BSZ023N04LS	PG-TSDSON-8 FL	023N04L	-

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2 Maximum ratings

at $T_j = 25\text{ °C}$, unless otherwise specified

Table 2 Maximum ratings
at 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	40	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=60\text{ K/W}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	160	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ²⁾	I_{AS}	-	-	20	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	130	mJ	$I_D=20\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	69	W	$T_C=25\text{ °C}$
Power dissipation (for PCB version) ³⁾	P_{tot}	-	-	2.1	W	$T_A=25\text{ °C}$, $R_{thJA}=60\text{ K/W}$
Operating and storage temperature	T_j , T_{stg}	-55	-	150	°C	-

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 ⁴⁾	R_{thJA}	-	-	60	K/W	6 cm ² cooling area

¹⁾ See diagram 3 for more detailed information

²⁾ See diagram 13 for more detailed information

³⁾ See diagram 3 for more detailed information

⁴⁾ Referred to condition: 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.

4 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	-	2.0	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1.0 100	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	$R_{DS(on)}$	-	2.4 2.0	3.2 2.35	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	-	Ω	-
Transconductance	g_{fs}	55	110	-	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	C_{iss}	-	2630	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	750	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{riss}	-	60	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	38	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	42	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	8.0	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics

see table 16 for more details

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	6.3	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	4.2	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	Q_{gd}	-	6.0	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	8.1	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	Q_g	-	37	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.4	-	V	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	Q_g	-	19	-	nC	$V_{DD}=20\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	32	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge	Q_{oss}	-	33	-	nC	$V_{DD}=20\text{ V}$, $V_{GS}=0\text{ V}$

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}	-	0.8	1.0	V	$V_{GS}=0\text{ V}, I_F=20\text{ A}, T_J=25\text{ °C}$
Reverse recovery time	t_{rr}	-	24	-	ns	$V_R=20\text{ V}, I_F=20\text{ A}, di_F/dt=400\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}	-	20	-	nC	$V_R=20\text{ V}, I_F=20\text{ A}, di_F/dt=400\text{ A}/\mu\text{s}$

5 Electrical characteristics diagrams

Table 8

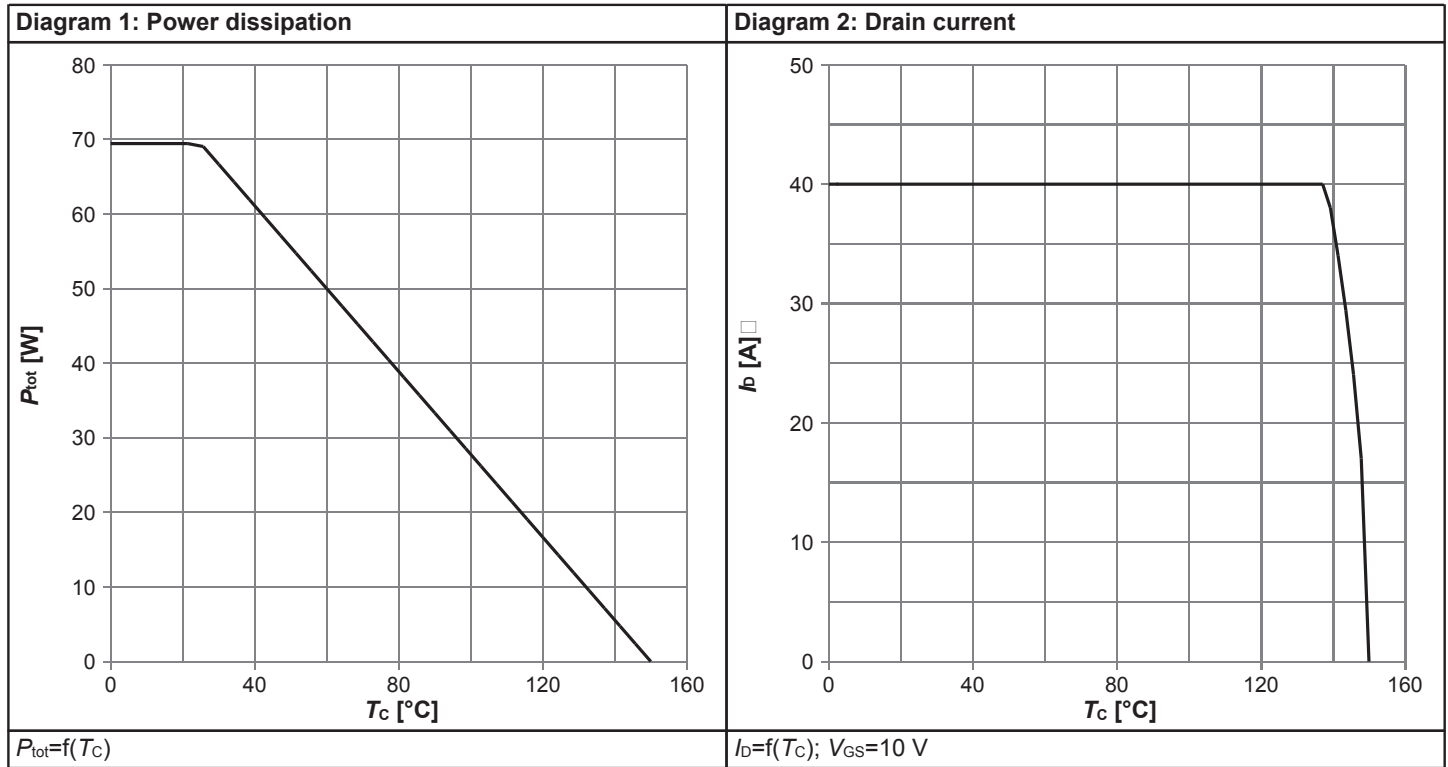


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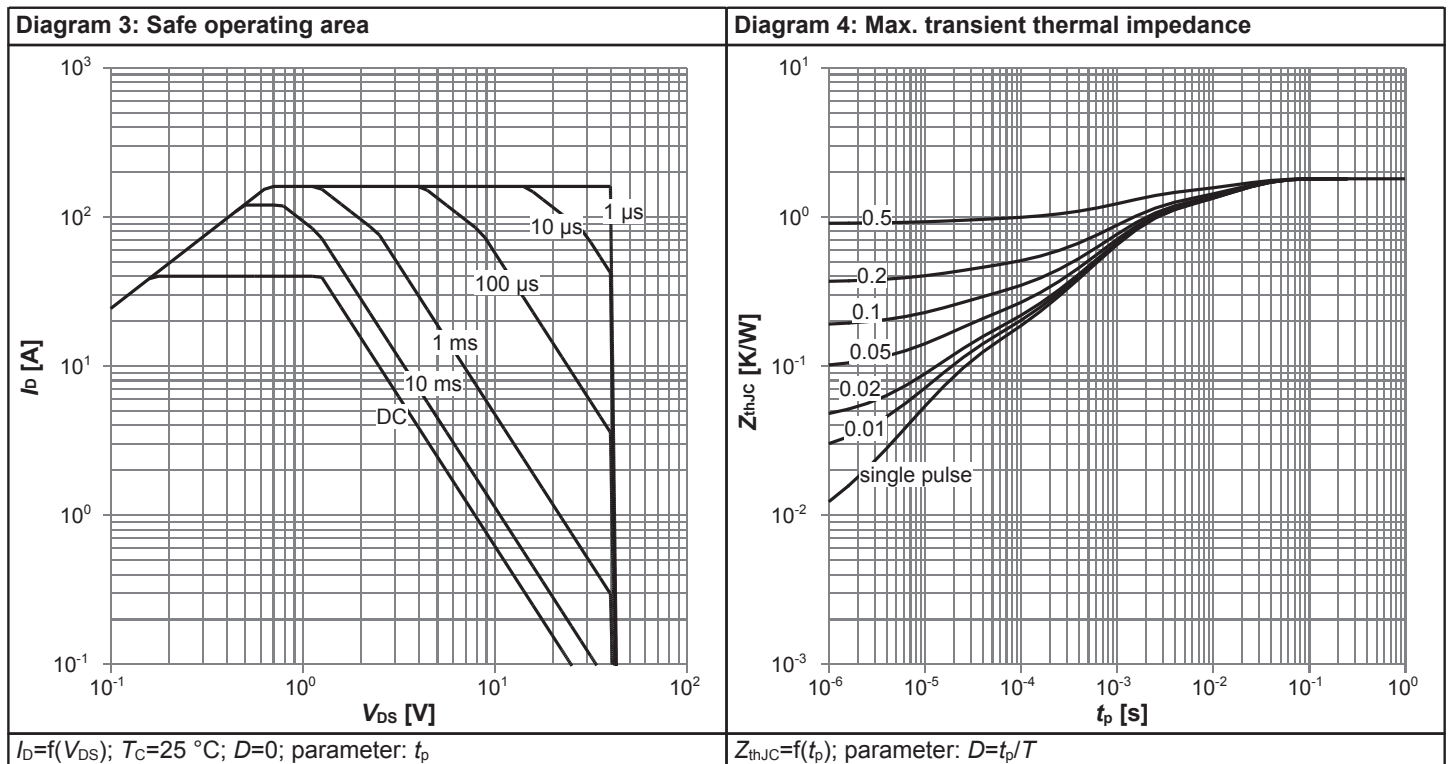


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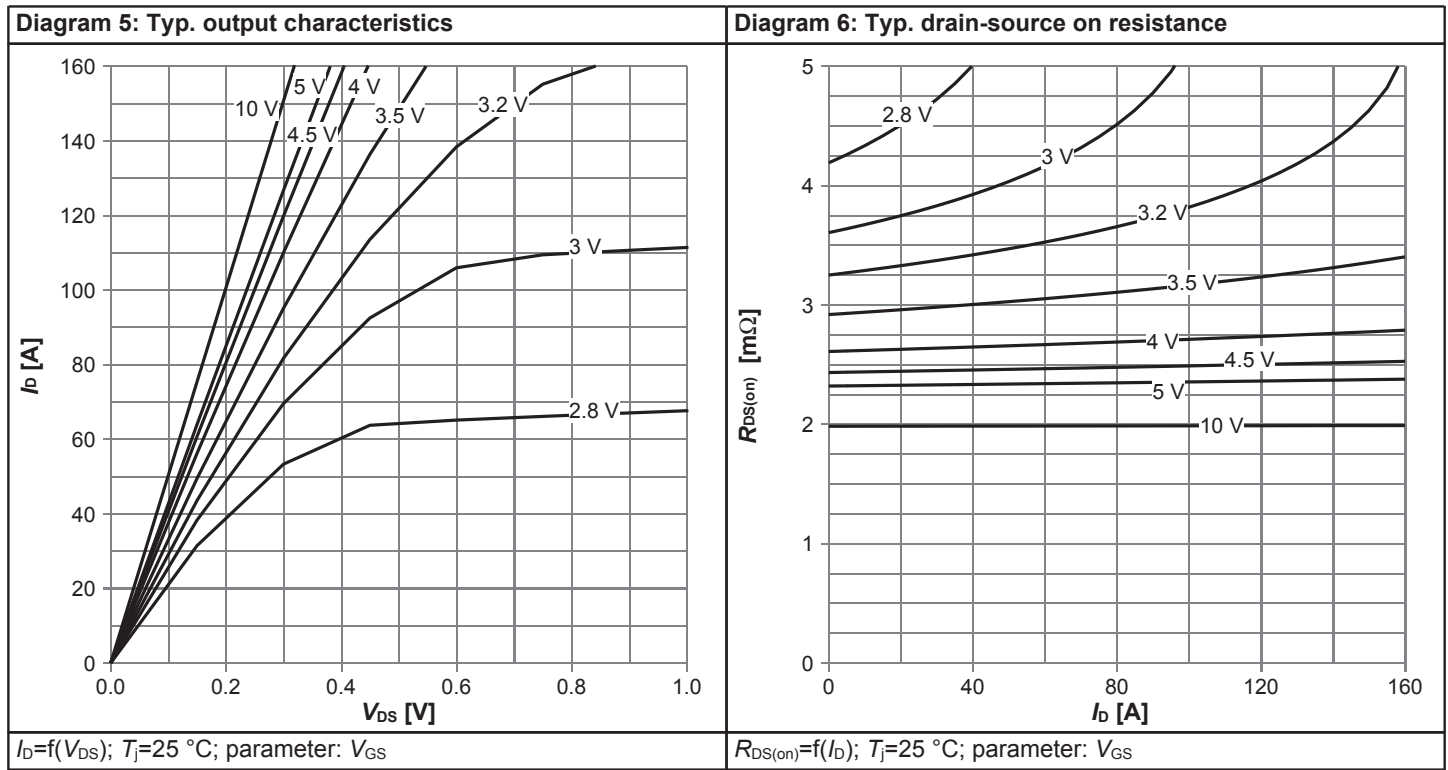


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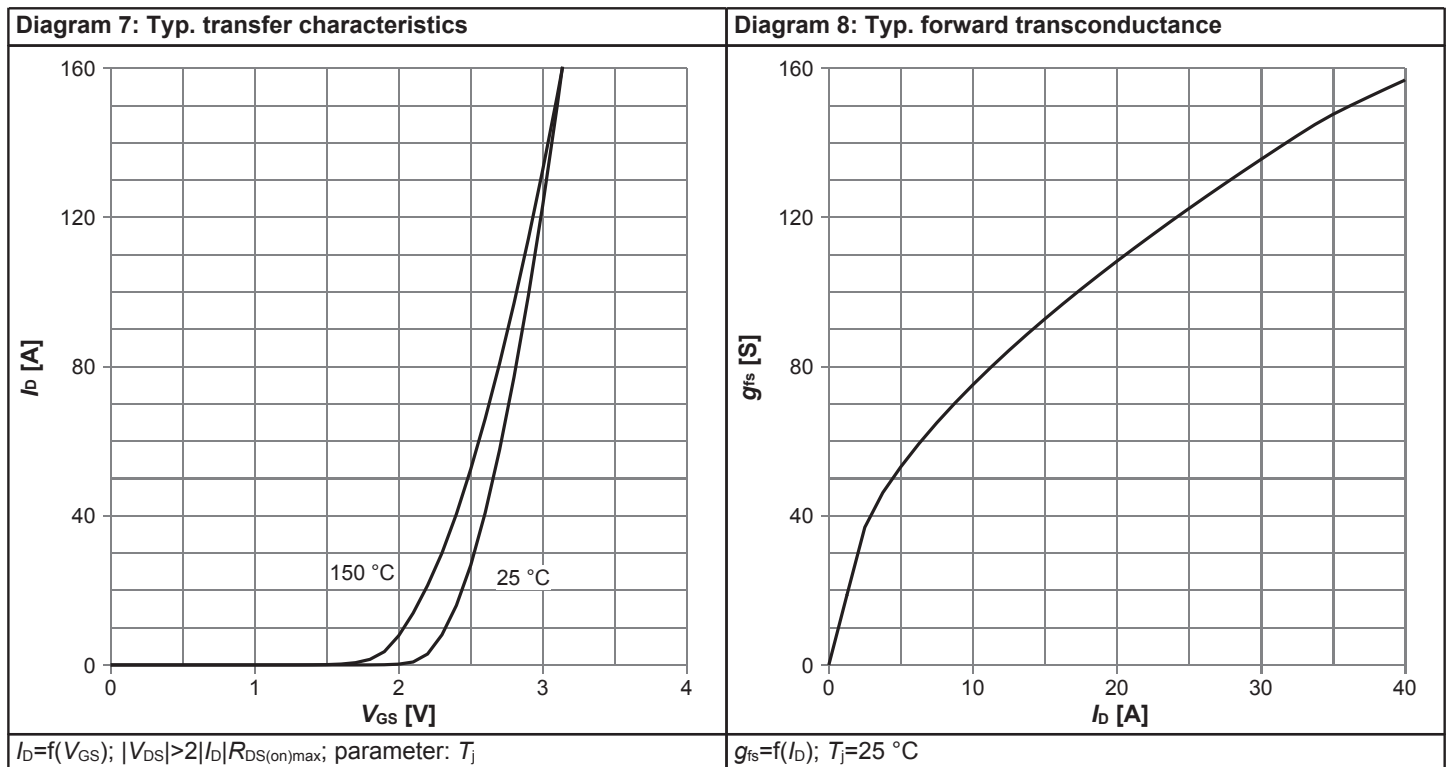


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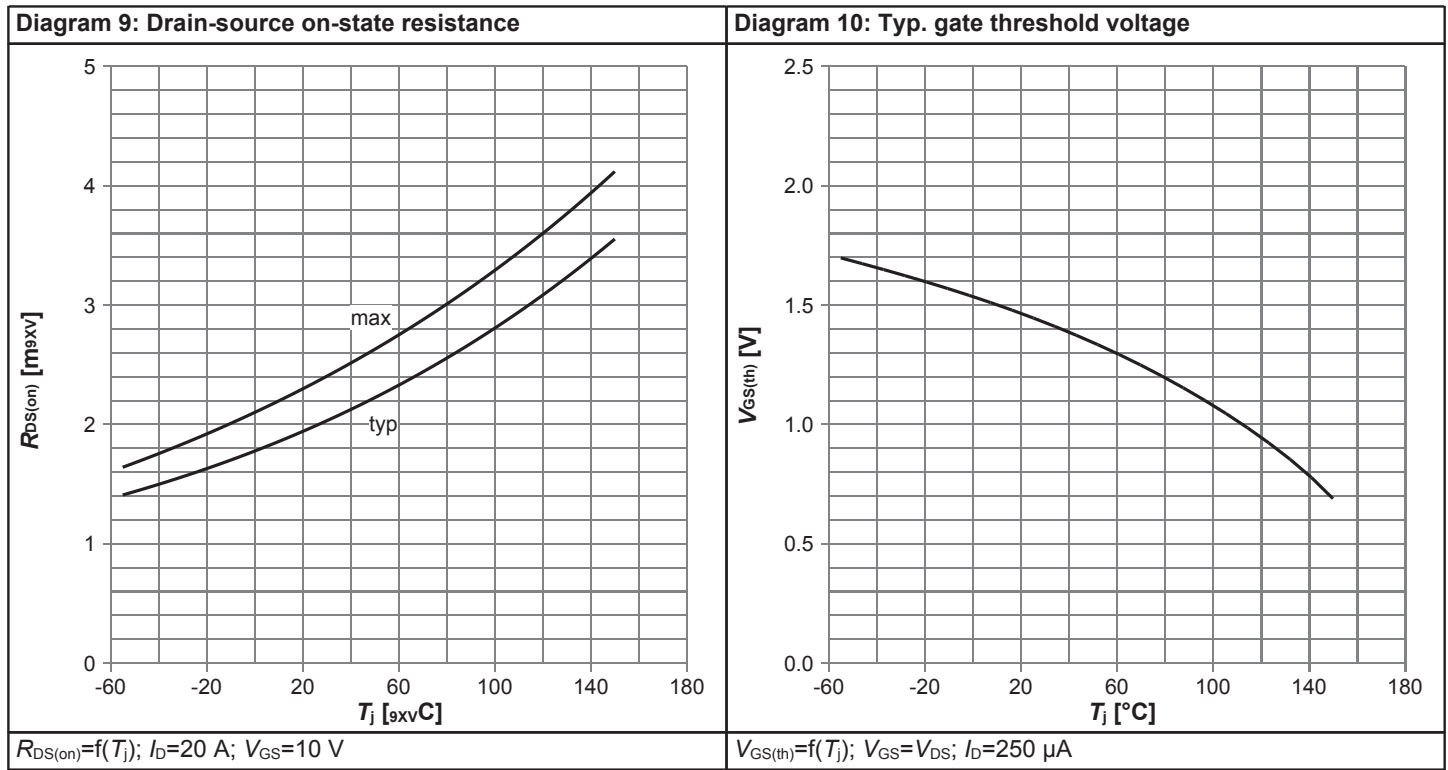


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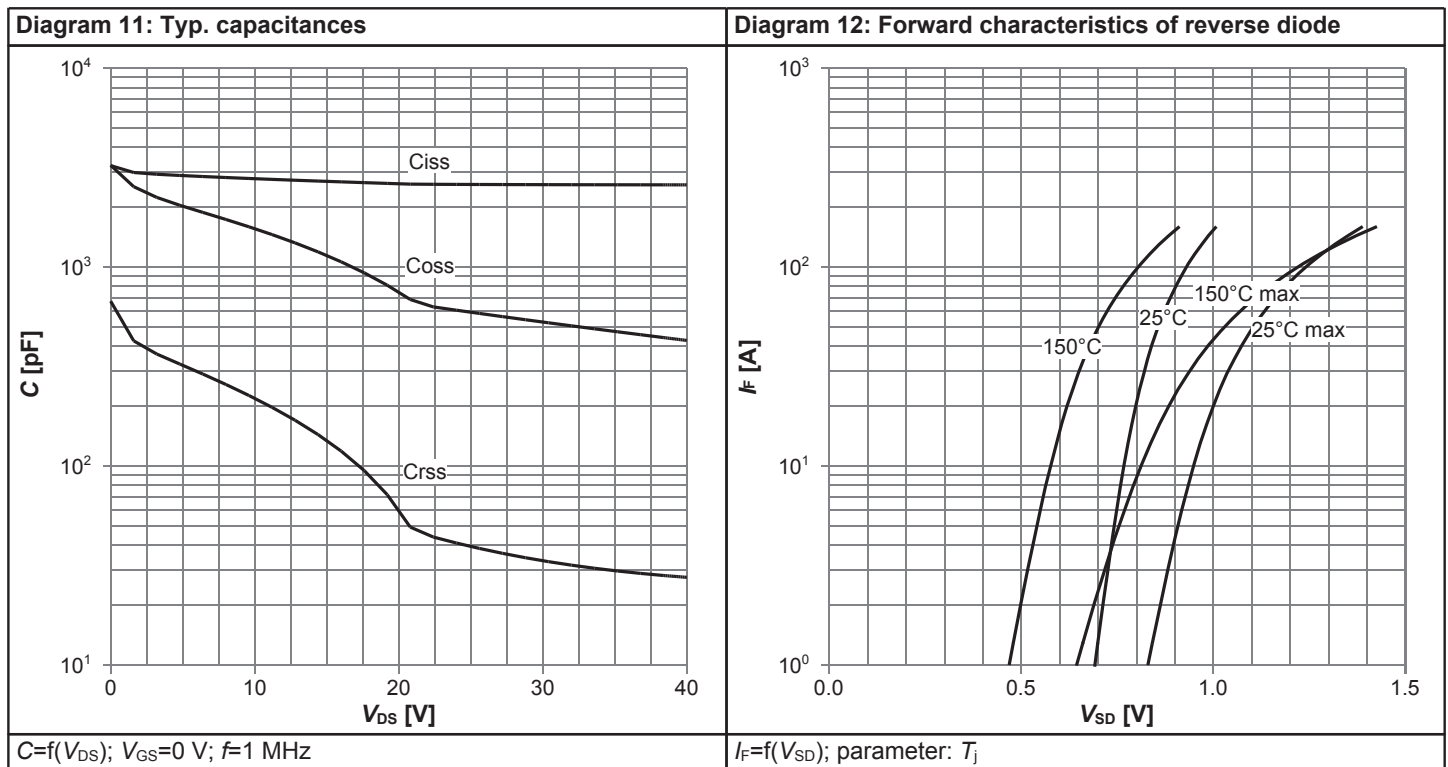


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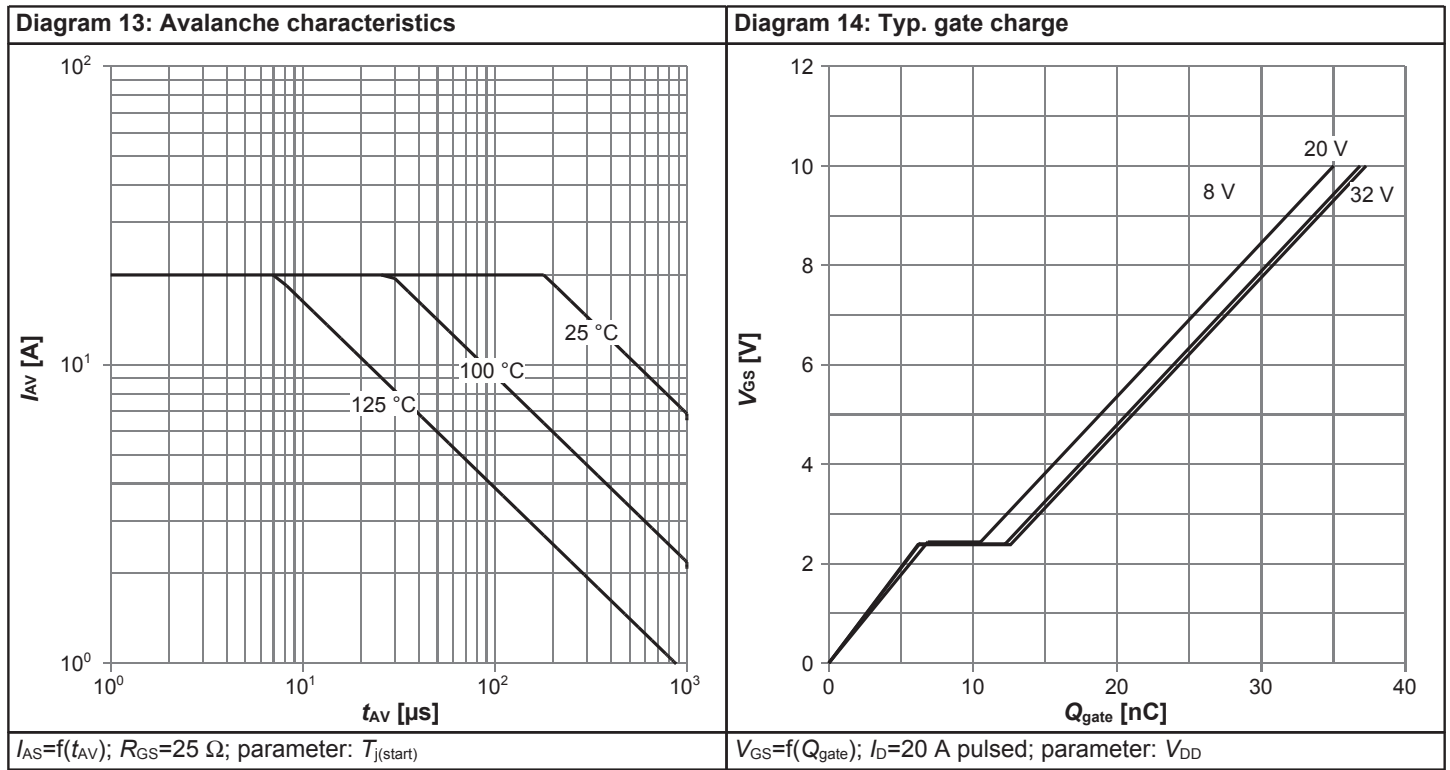
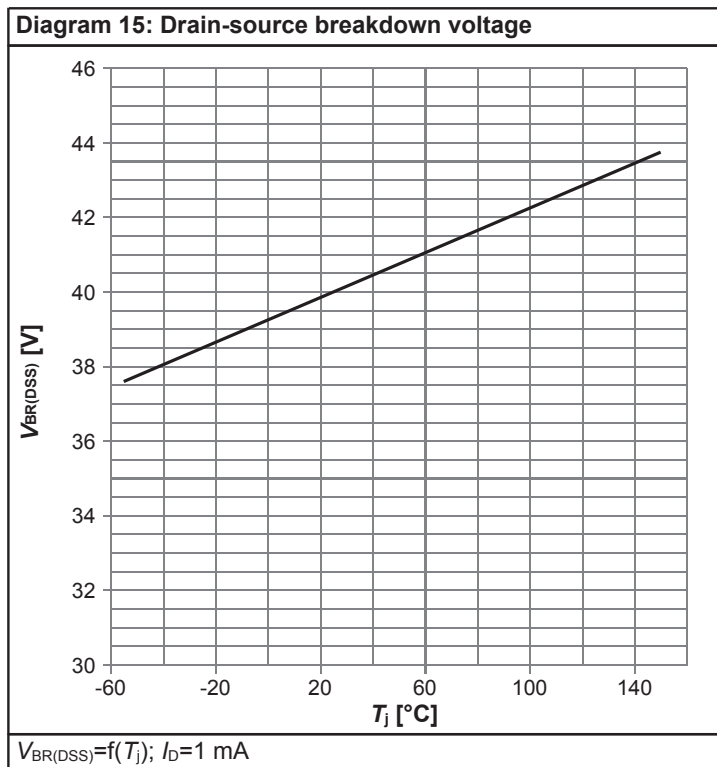
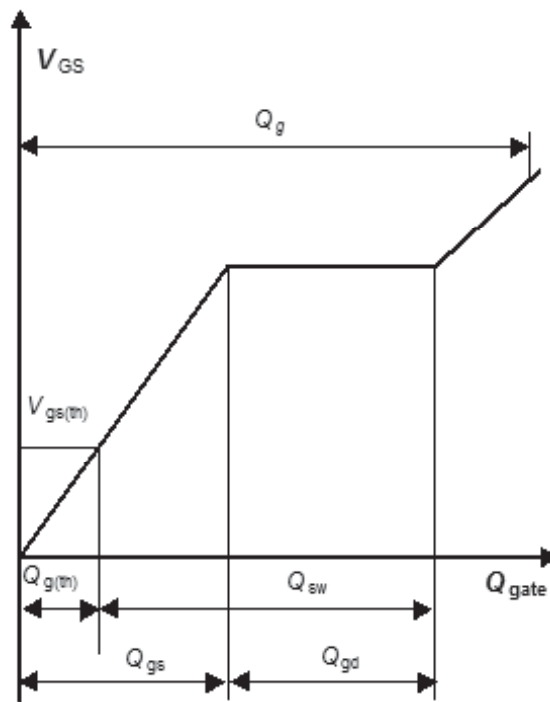


Table 15



6 Test Circuits

Table 16 Gate Charge Waveform



7 Package Outlines

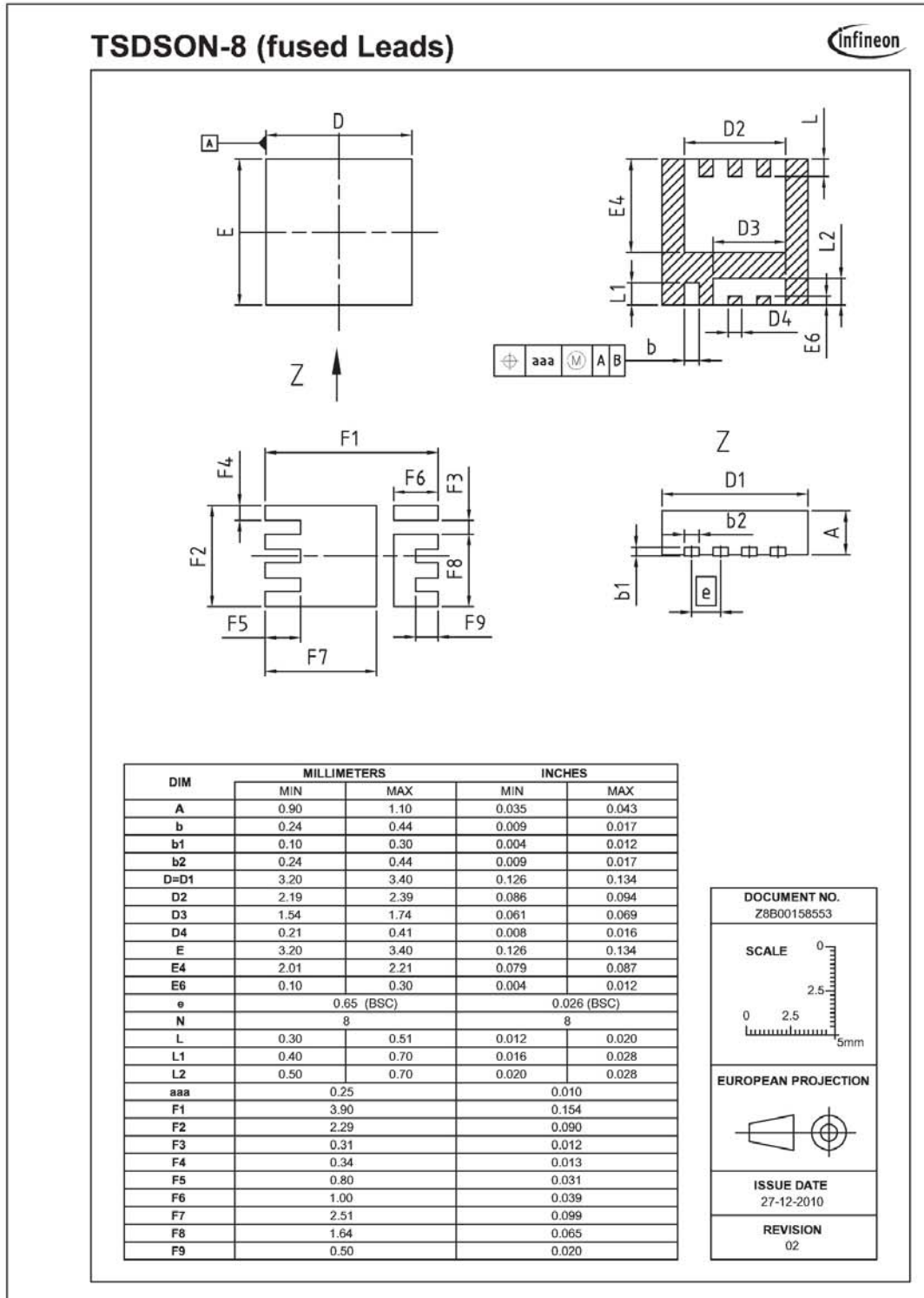


Figure 1 Outline PG-TSDSON-8 FL, dimensions in mm/inches

Revision History

BSZ023N04LS

Revision: 2012-11-22, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-11-22	Release of final version

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