

# n-Channel Power MOSFET

OptiMOS™  
BSZ0904NSI

## Data Sheet

2.0, 2011-03-29  
Final

Industrial & Multimarket

## 1 Description

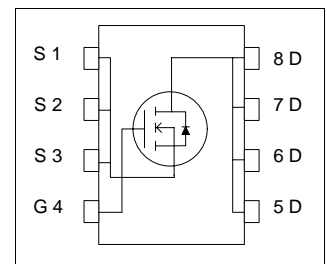
OptiMOS™30V products are class leading power MOSFETs for highest power density and energy efficient solutions. Ultra low gate and output charges together with lowest on state resistance in small footprint packages make OptiMOS™ 30V the best choice for the demanding requirements of voltage regulator solutions in Servers, Datacom and Telecom applications. Super fast switching Control FETs together with low EMI Sync FETs provide solutions that are easy to design in. OptiMOS™ products are available in high performance packages to tackle your most challenging applications giving full flexibility in optimizing space, efficiency and cost. OptiMOS™ products are designed to meet and exceed the energy efficiency and power density requirements of the sharpened next generation voltage regulation standards in computing applications.

### Features

- Optimized SyncFET for high performance buck converters
- 100% avalanche tested
- N-channel
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5\text{ V}$
- Ultra low gate ( $Q_g$ ) and output charge ( $Q_{oss}$ ) for given  $R_{DS(on)}$
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Superior thermal resistance
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Integrated monolithic Schottky-like diode

### Applications

- On board power for server
- Power management for high performance computing
- Synchronous rectification
- High power density point of load converters



**Table 1 Key Performance Parameters**

Parameter	Value	Unit	Related Links
$V_{DS}$	30	V	<a href="#">IFX OptiMOS webpage</a> <a href="#">IFX OptiMOS product brief</a> <a href="#">IFX OptiMOS spice models</a> <a href="#">IFX Design tools</a>
$R_{DS(on),max}$	4	mΩ	
$I_D$	40	A	
$Q_{OSS}$	12	nC	
$Q_{g,typ}$	17		

Type	Package	Marking
BSZ0904NSI	PG-TSDSON-8 (fused leads)	0904NSI

1) J-STD20 and JESD22

## 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	$V_{GS}=10\text{ V}, T_C=25\text{ °C}$
		-	-	40		$V_{GS}=10\text{ V}, T_C=100\text{ °C}$
		-	-	40		$V_{GS}=4.5\text{ V}, T_C=25\text{ °C}$
		-	-	40		$V_{GS}=4.5\text{ V}, T_C=100\text{ °C}$
		-	-	18		$V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=60\text{ K/W}^{(1)}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	160		$T_C=25\text{ °C}$
Avalanche current, single pulse <sup>3)</sup>	$I_{AS}$	-	-	20		
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	$P_{tot}$	-	-	37	W	$T_C=25\text{ °C}$
		-	-	2.1		$T_A=25\text{ °C}, R_{thJA}=60\text{ K/W}^{(1)}$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	150	°C	
IEC climatic category; DIN IEC 68-1		55/150/56				

1) 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.

2) See figure 3 for more detailed information

3) See figure 13 for more detailed information

## 3 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	3.4	K/W	
		-	-	20		top
Device on PCB	$R_{thJA}$	-	-	60		6 cm <sup>2</sup> cooling area <sup>1)</sup>

1) 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

## 4 Electrical characteristics

Electrical characteristics, at  $T_J=25\text{ °C}$ , unless otherwise specified.

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	30	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=10\text{ mA}$
Breakdown voltage temperature coefficient	$\frac{dV_{(BR)DSS}}{dT_j}$	-	15	-	mV/k	$I_D=10\text{ mA}$ , reference to $25\text{ °C}$
Gate threshold voltage	$V_{GS(th)}$	1	-	2.2		$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-	0.5	$\mu\text{A}$	$V_{DS}=24\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$
		-	1	-		$V_{DS}=24\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	4.6	5.7	m $\Omega$	$V_{GS}=4.5\text{ V}$ , $I_D=30\text{ A}$
		-	3.3	4		$V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$
Gate resistance	$R_G$	-	0.9	-	$\Omega$	
Transconductance	$g_{fs}$	41	82	-	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	$C_{iss}$	-	1100	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	460	-		
Reverse transfer capacitance	$C_{rss}$	-	64	-		
Turn-on delay time	$t_{d(on)}$	-	3.3	-	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_G=1.6\text{ }\Omega$
Rise time	$t_r$	-	4.4	-		
Turn-off delay time	$t_{d(off)}$	-	16	-		
Fall time	$t_f$	-	3	-		

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition	
		Min.	Typ.	Max.			
Gate to source charge	$Q_{gs}$	-	2.9	-	nC	$V_{DD}=15\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$	
Gate charge at threshold	$Q_{g(th)}$	-	1.7	-			
Gate to drain charge	$Q_{gd}$	-	2.9	-			
Switching charge	$Q_{sw}$	-	4.1	-			
Gate charge total	$Q_g$	-	8.5	8.1			
Gate plateau voltage	$V_{plateau}$	-	2.7	-	V		
Gate charge total	$Q_g$	-	17	-	nC	$V_{DD}=15\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$	
Gate charge total, sync. FET	$Q_{g(sync)}$	-	6.8	-			$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	$Q_{oss}$	-	12	-			$V_{DD}=15\text{ V}$ , $V_{GS}=0\text{ V}$

1) See figure 16 for gate charge parameter definition

**Table 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_s$	-	-	37	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{s,pulse}$	-	-	160		
Diode forward voltage	$V_{SD}$	-	0.56	0.7	V	$V_{GS}=0\text{ V}$ , $I_F=3\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery charge	$Q_{rr}$	-	2	-	nC	$V_R=15\text{ V}$ , $I_F=I_s$ , $di_F/dt=400\text{ A}/\mu\text{s}$

## 5 Electrical characteristics diagrams

Table 8

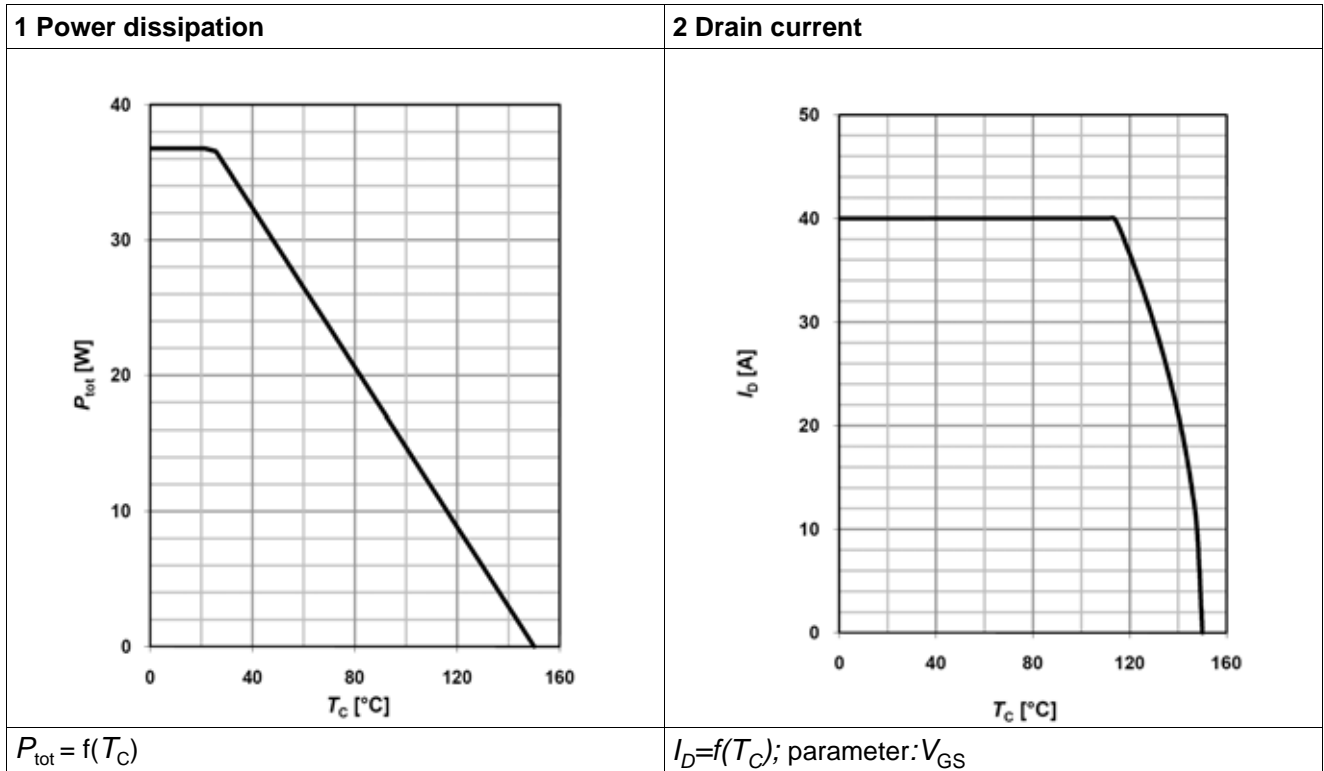


Table 9

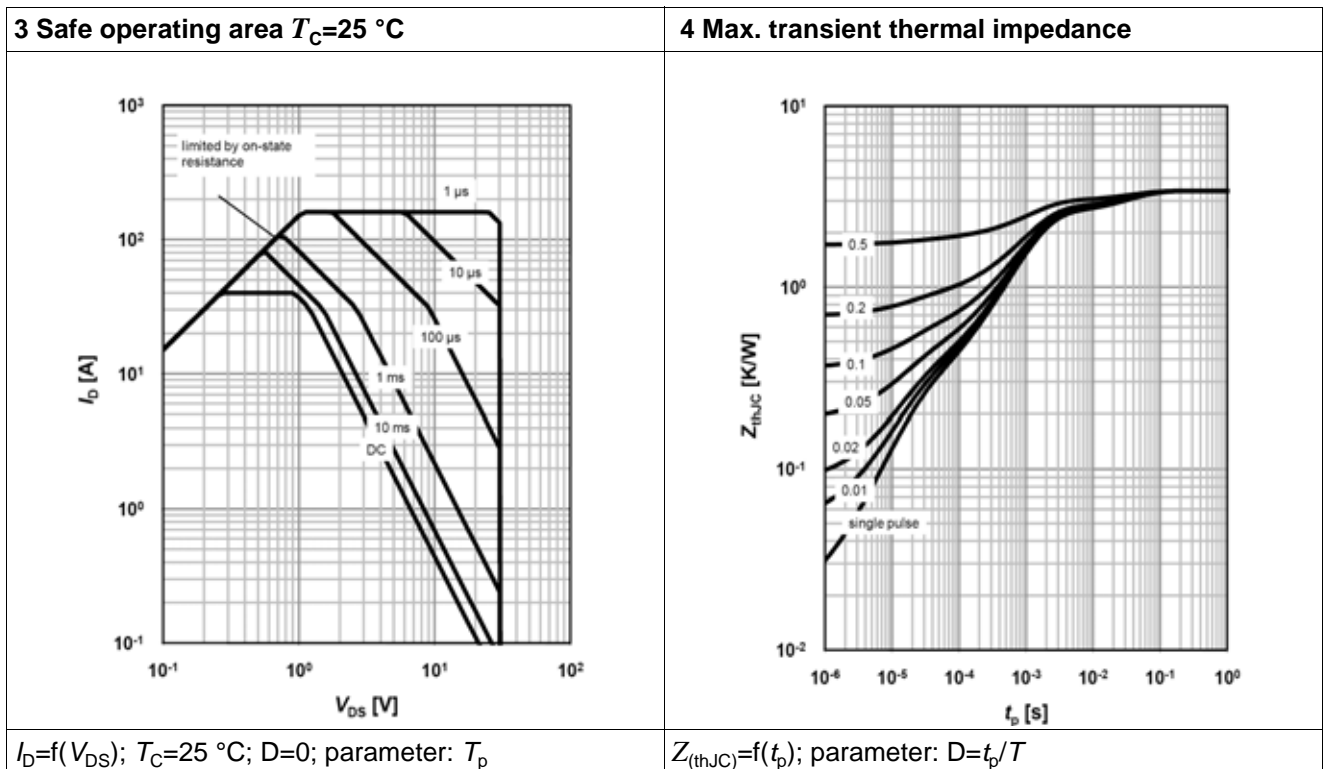


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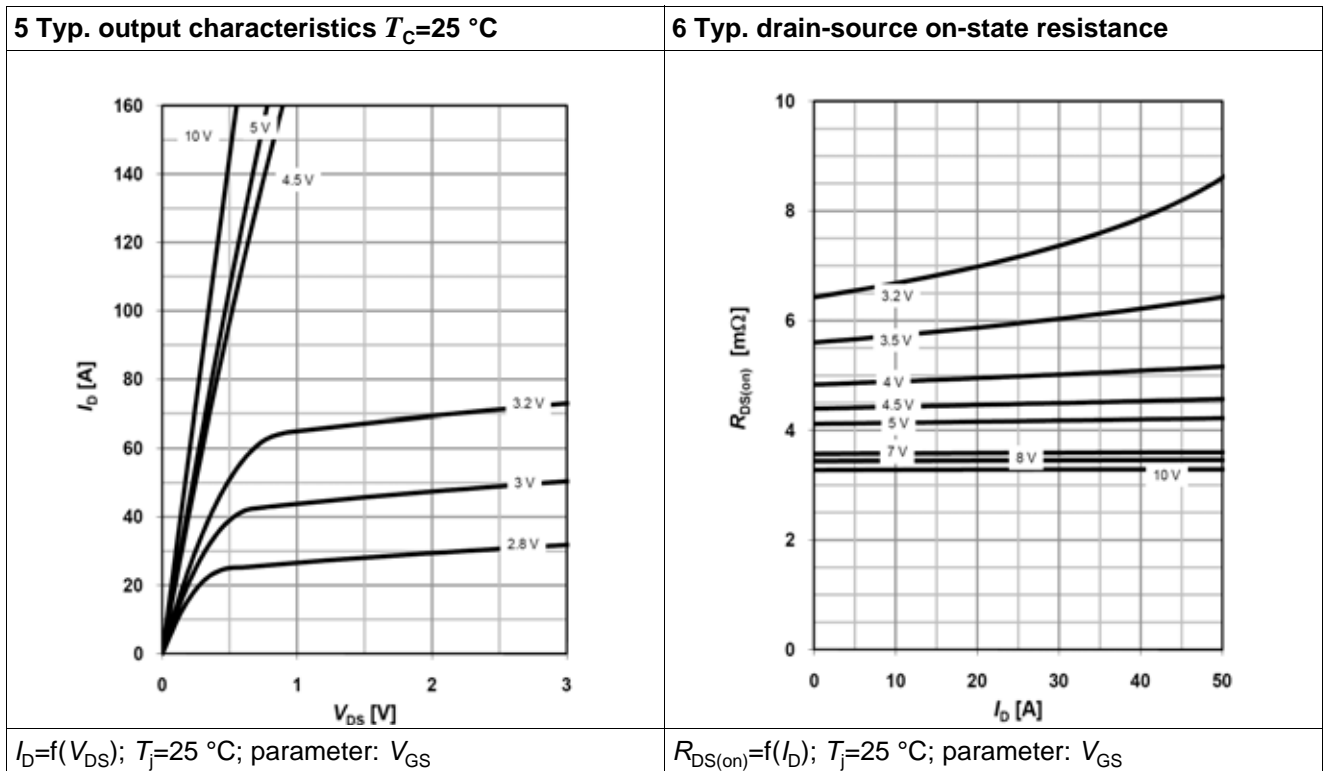


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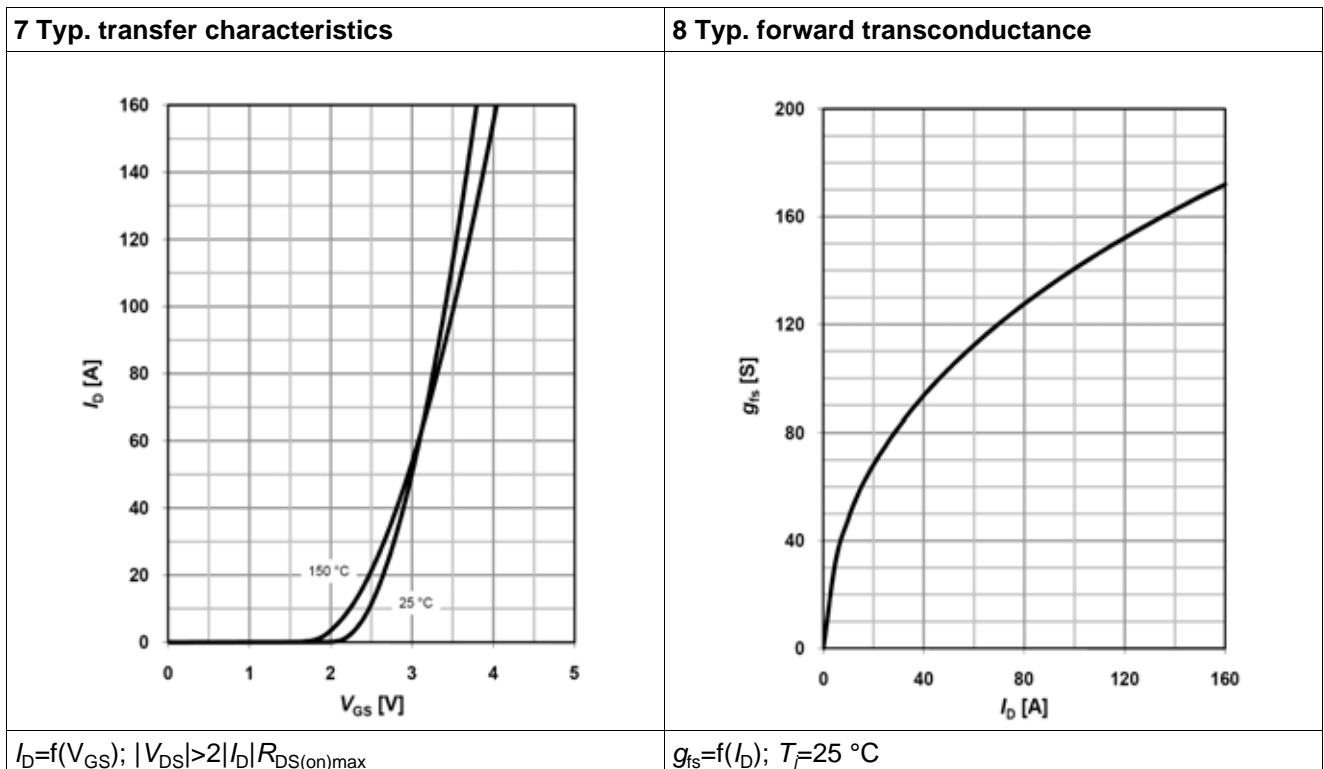


Table 12

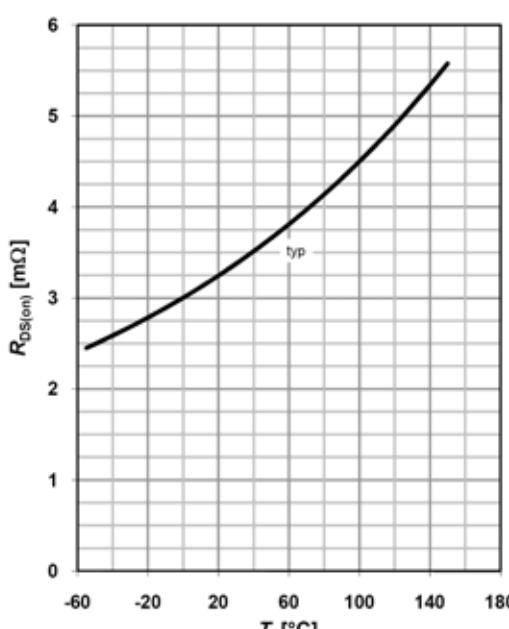
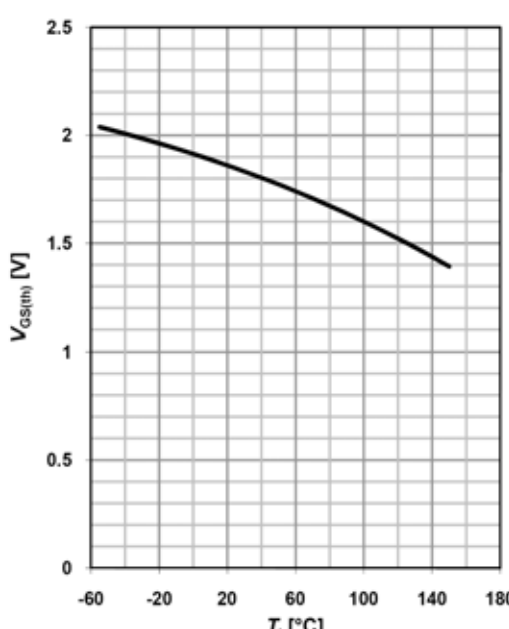
<p><b>9 Drain-source on-state resistance</b></p>  <p><math>R_{DS(on)} = f(T_j)</math>; <math>I_D = 30\text{ A}</math>; <math>V_{GS} = 10\text{ V}</math></p>	<p><b>10 Typ. gate threshold voltage</b></p>  <p><math>V_{GS(th)} = f(T_j)</math>; <math>V_{GS} = V_{DS}</math>; <math>I_D = 10\text{ mA}</math></p>
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Table 13

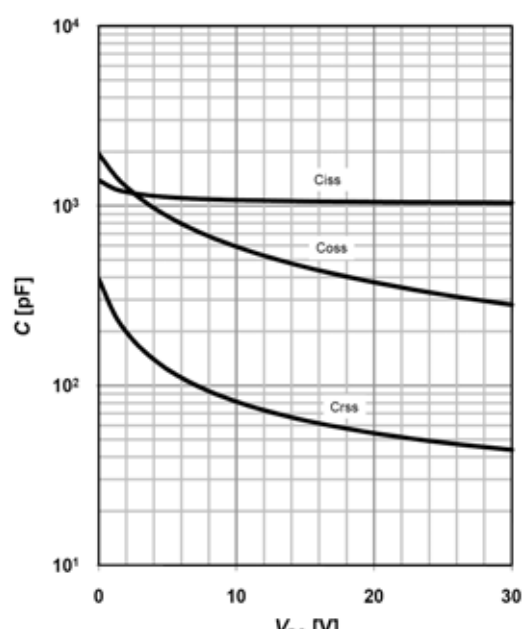
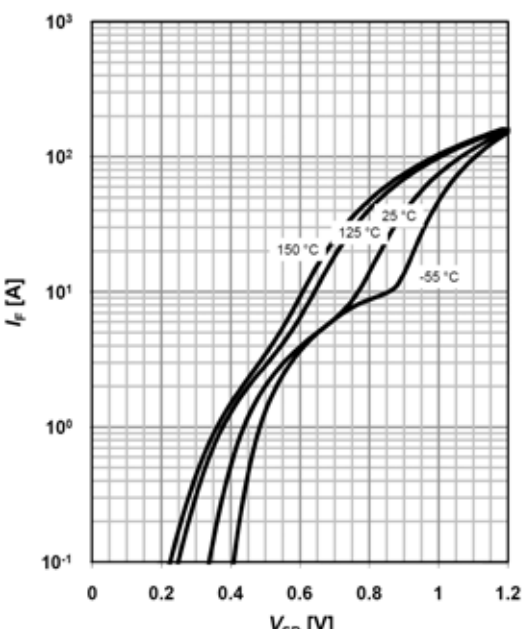
<p><b>11 Typ. capacitances</b></p>  <p><math>C = f(V_{DS})</math>; <math>V_{GS} = 0\text{ V}</math>; <math>f = 1\text{ MHz}</math></p>	<p><b>12 Forward characteristics of reverse diode</b></p>  <p><math>I_F = f(V_{SD})</math>; parameter: <math>T_j</math></p>
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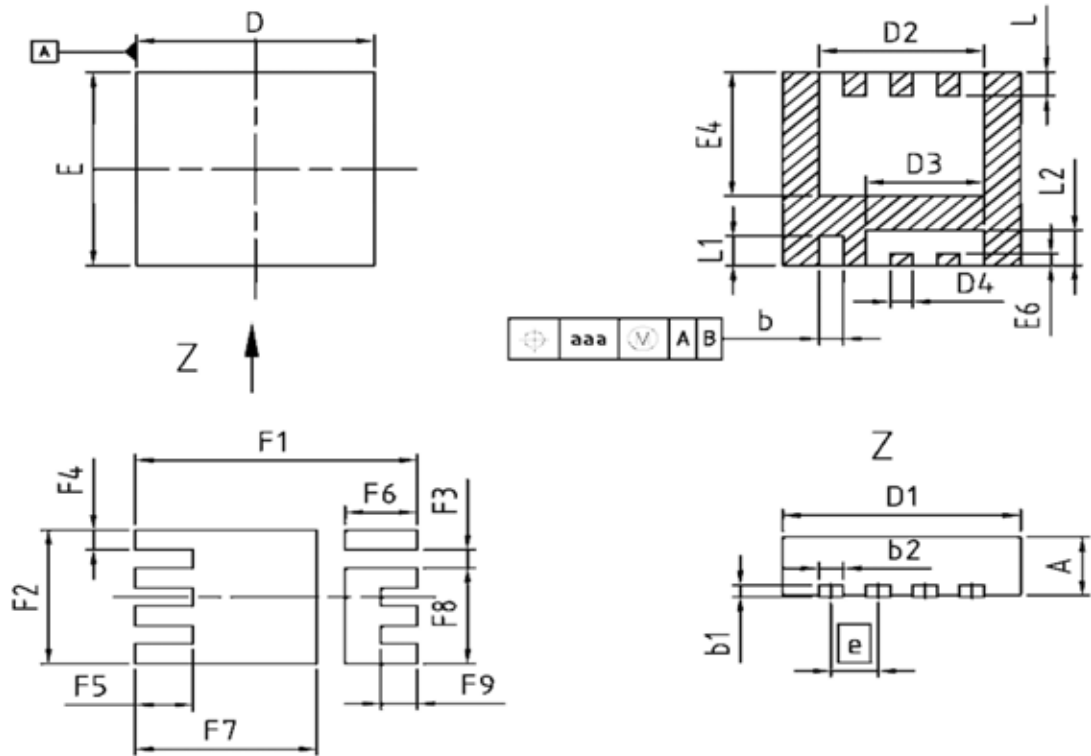
Table 14

13 Avalanche characteristics	14 Typ. gate charge
$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j(\text{start})}$	$V_{GS}=f(Q_{\text{gate}}); I_D=30\ \text{A pulsed}; \text{parameter: } V_{DD}$

Table 15

15 Drain-source leakage current	16 Gate charge waveforms
$I_{DSS}=f(V_{DS}); V_{GS}=0\ \text{V}$	

## 6 Package outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.24	0.44	0.009	0.017
b1	0.10	0.30	0.004	0.012
b2	0.24	0.44	0.009	0.017
D=D1	3.20	3.40	0.126	0.134
D2	2.19	2.39	0.086	0.094
D3	1.54	1.74	0.061	0.069
D4	0.21	0.41	0.008	0.016
E	3.20	3.40	0.126	0.134
E4	2.01	2.21	0.079	0.087
E6	0.10	0.30	0.004	0.012
e	0.65 (BSC)		0.026 (BSC)	
N	8		8	
L	0.30	0.51	0.012	0.020
L1	0.40	0.70	0.016	0.028
L2	0.50	0.70	0.020	0.028
aaa	0.25		0.010	
F1	3.90		0.154	
F2	2.29		0.090	
F3	0.31		0.012	
F4	0.34		0.013	
F5	0.80		0.031	
F6	1.00		0.039	
F7	2.51		0.099	
F8	1.64		0.065	
F9	0.50		0.020	

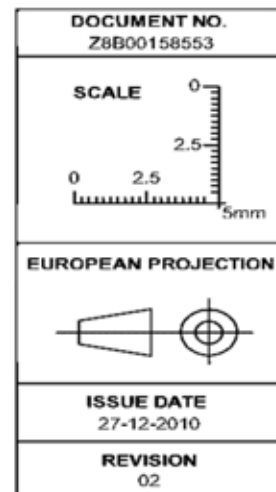


Figure 1 Outlines PG-TSDSON-8 (fused leads), dimensions in mm/inches

## 7 Revision History

Revision History: 2011-03-29, 2.0

Previous Revision:

Revision	Subjects (major changes since last revision)
0.1	Release of target data sheet
2.0	Release Final version

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