

# MOSFET

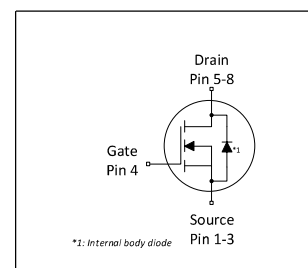
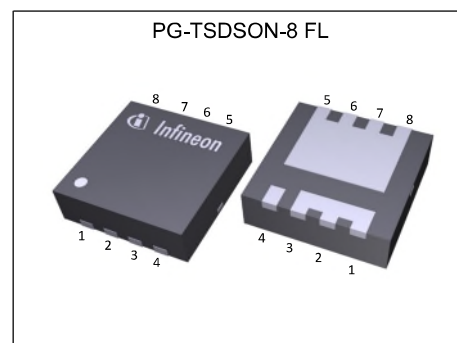
## OptiMOS™ Power-MOSFET, 30 V

### Features

- Optimized for high performance wireless charger
- Very low  $FOM_{Q_{oss}}$  for high frequency SMPS
- Low  $FOM_{Q_{sw}}$  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 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
$V_{DS}$	30	V
$R_{DS(on),max}$	7.0	m $\Omega$
$I_D$	47	A
$Q_{oss}$	6.9	nC
$Q_G(0V..4.5V)$	5.2	nC



RoHS

Type / Ordering Code	Package	Marking	Related Links
BSZ0994NS	PG-TSDSON-8 FL	0994NS	-

<sup>1)</sup> J-STD20 and JESD22

## Table of Contents

Description .....	1
Maximum ratings .....	3
Thermal characteristics .....	3
Electrical characteristics .....	4
Electrical characteristics diagrams .....	6
Package Outlines .....	10
Revision History .....	11
Trademarks .....	11
Disclaimer .....	11

## 1 Maximum ratings

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

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	47 30	A	$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_A=100\text{ °C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	188	A	$T_A=25\text{ °C}$
Avalanche current, single pulse <sup>3)</sup>	$I_{AS}$	-	-	20	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	16	mJ	$I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	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	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	$R_{thJC}$	-	-	4.9	K/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>4)</sup>	$R_{thJA}$	-	-	60	K/W	-

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

<sup>2)</sup> See Diagram 3 for more detailed information

<sup>3)</sup> See Diagram 13 for more detailed information

<sup>4)</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.

### 3 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	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
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	$\mu\text{A}$	$V_{DS}=30\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=30\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	7 5	9 7	m $\Omega$	$V_{GS}=4.5\text{ V}$ , $I_D=5\text{ A}$ $V_{GS}=10\text{ V}$ , $I_D=5\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	0.5	1.0	2.0	$\Omega$	-
Transconductance	$g_{fs}$	20	39	-	S	$ V_{DS} >2 I_D /R_{DS(on)max}$ , $I_D=9\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	670	890	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	270	360	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	40	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	2.4	-	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=5\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	3.4	-	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=5\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	12	-	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=5\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	2.4	-	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=5\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

**Table 6 Gate charge characteristics<sup>2)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	1.6	-	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	1.1	-	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	1.6	-	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	$Q_{sw}$	-	2.1	-	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	5.2	7	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.4	-	V	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	10	14	nC	$V_{DD}=15\text{ V}$ , $I_D=5\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	4.2	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge <sup>1)</sup>	$Q_{oss}$	-	6.9	9.2	nC	$V_{DD}=15\text{ V}$ , $V_{GS}=0\text{ V}$

<sup>1)</sup> Defined by design. Not subject to production test

<sup>2)</sup> 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	$I_S$	-	-	21	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	188	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.76	1.0	V	$V_{GS}=0\text{ V}, I_F=2\text{ A}, T_j=25\text{ °C}$
Reverse recovery charge	$Q_{rr}$	-	10	-	nC	$V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$

### 4 Electrical characteristics diagrams

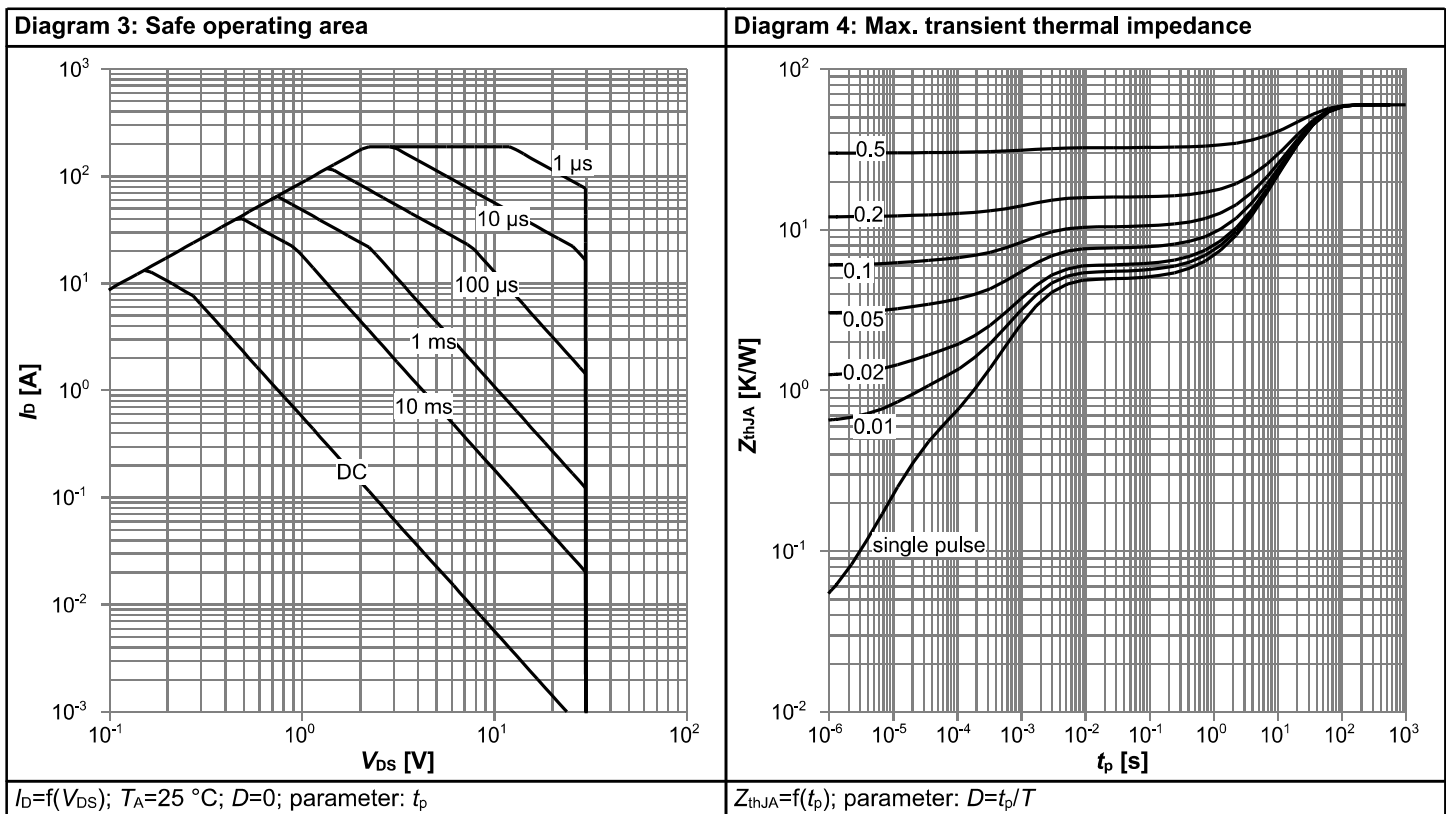
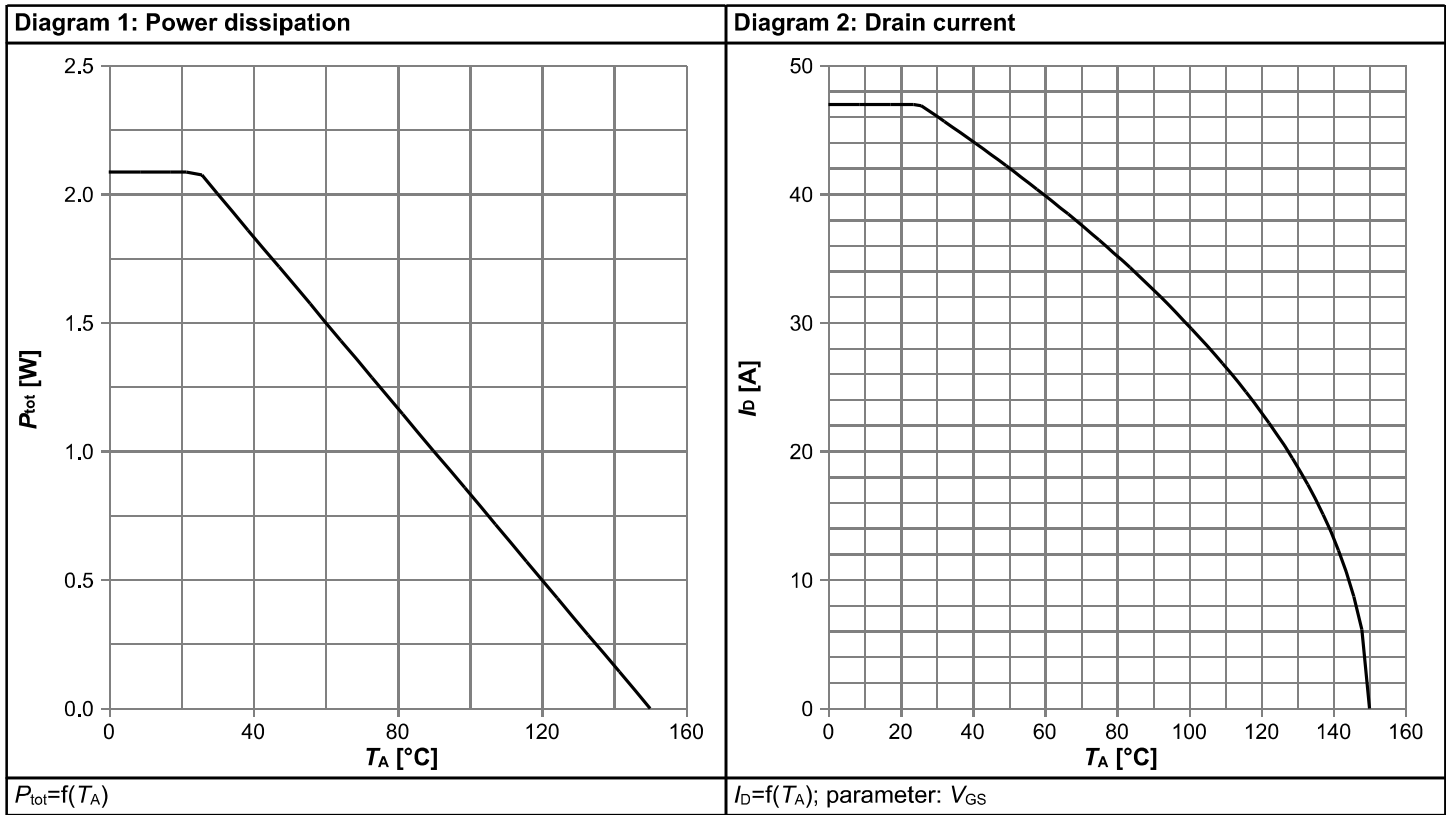
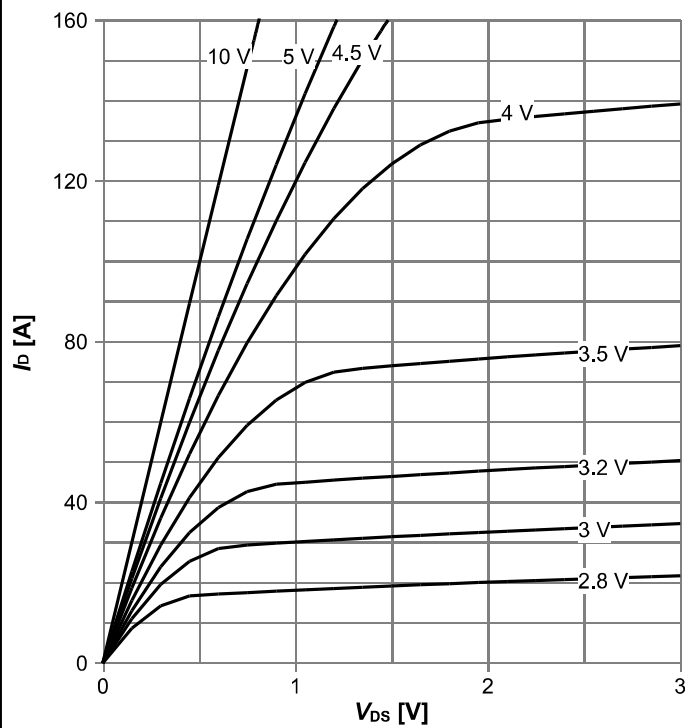
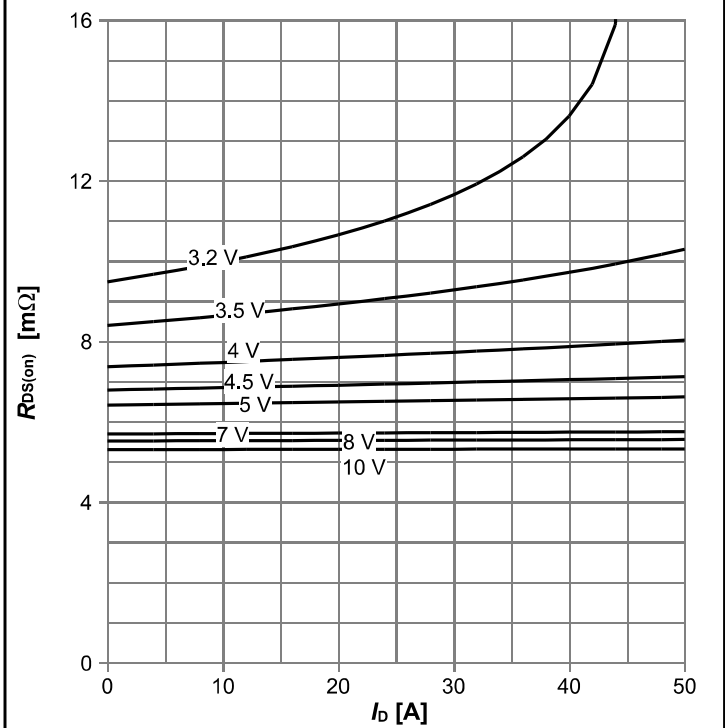


Diagram 5: Typ. output characteristics



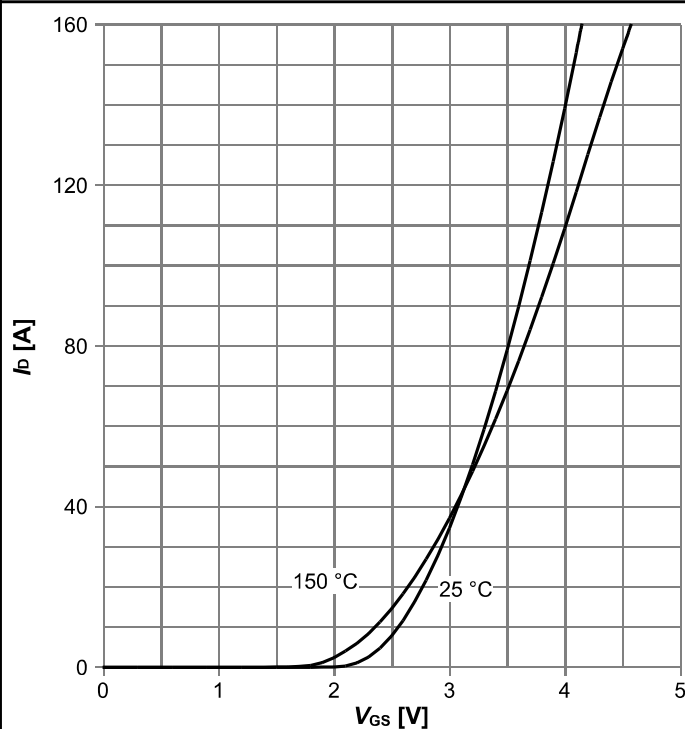
$I_D = f(V_{DS}); T_J = 25\text{ °C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



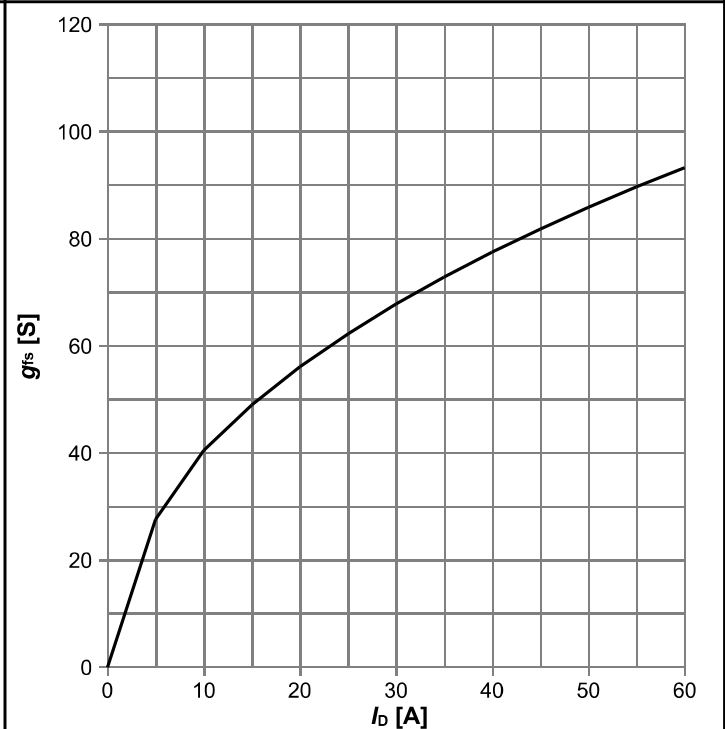
$R_{DS(on)} = f(I_D); T_J = 25\text{ °C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



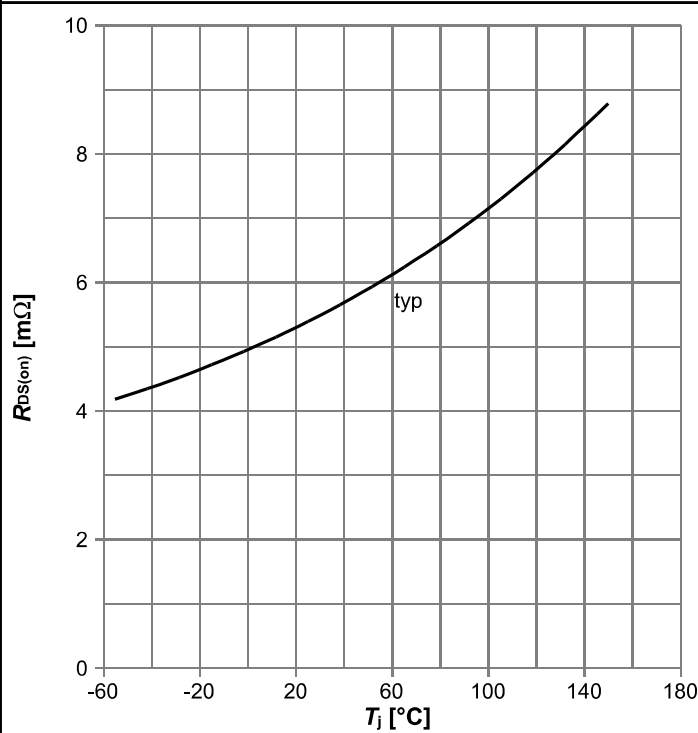
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max};$  parameter:  $T_J$

Diagram 8: Typ. forward transconductance



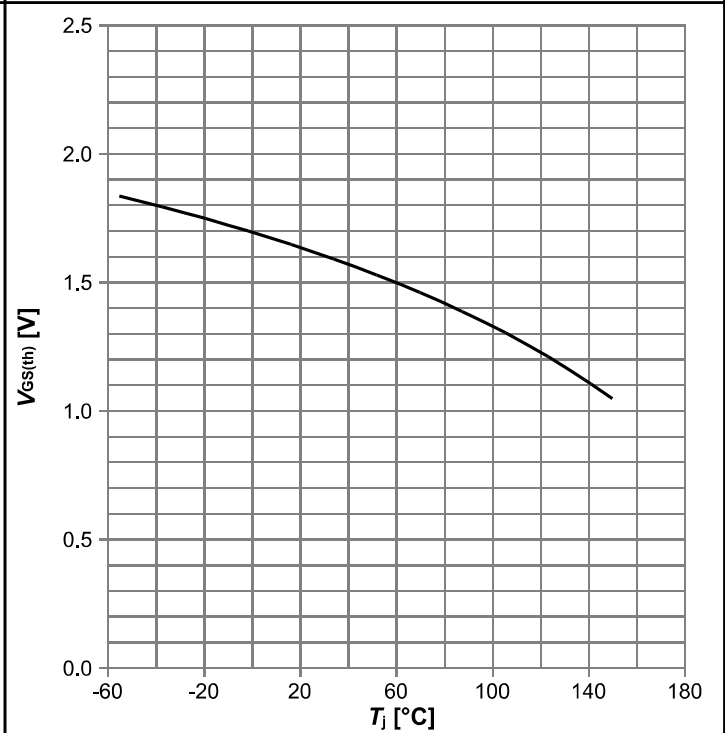
$g_{fs} = f(I_D); T_J = 25\text{ °C}$

Diagram 9: Drain-source on-state resistance



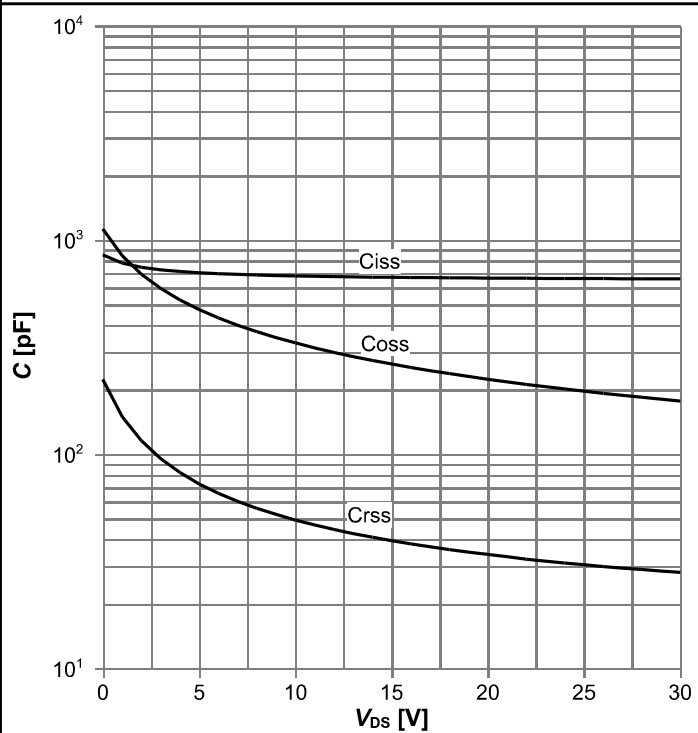
$R_{DS(on)}=f(T_j)$ ;  $I_D=5$  A;  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



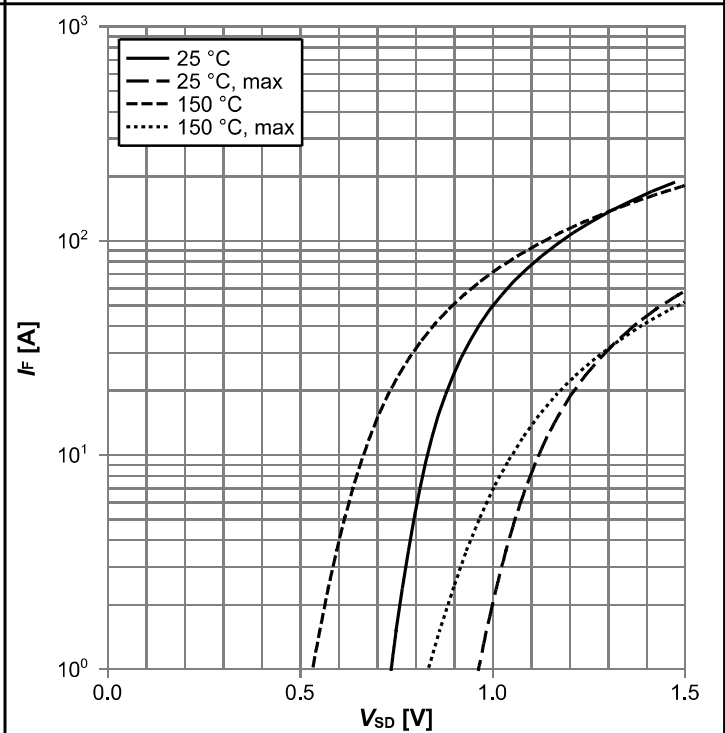
$V_{GS(th)}=f(T_j)$ ;  $V_{GS}=V_{DS}$ ;  $I_D=250$  μA

Diagram 11: Typ. capacitances



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

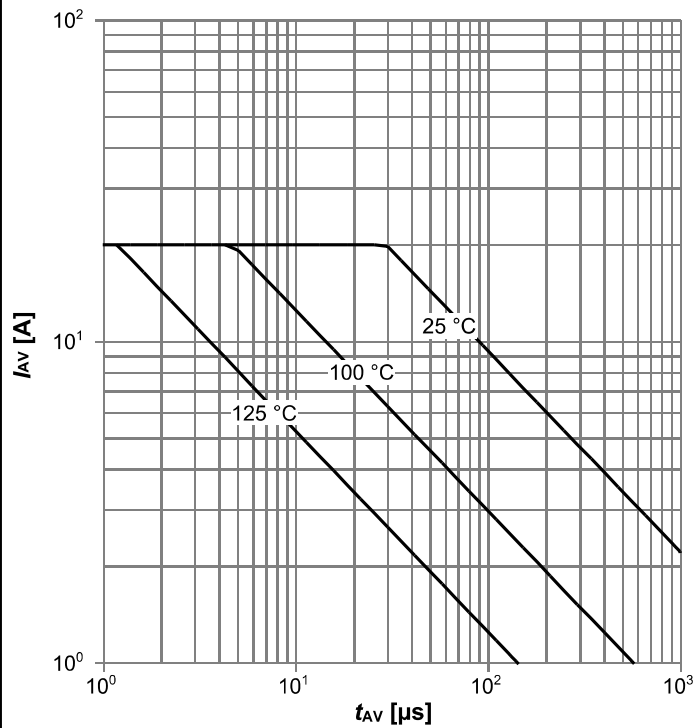
Diagram 12: Forward characteristics of reverse diode



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

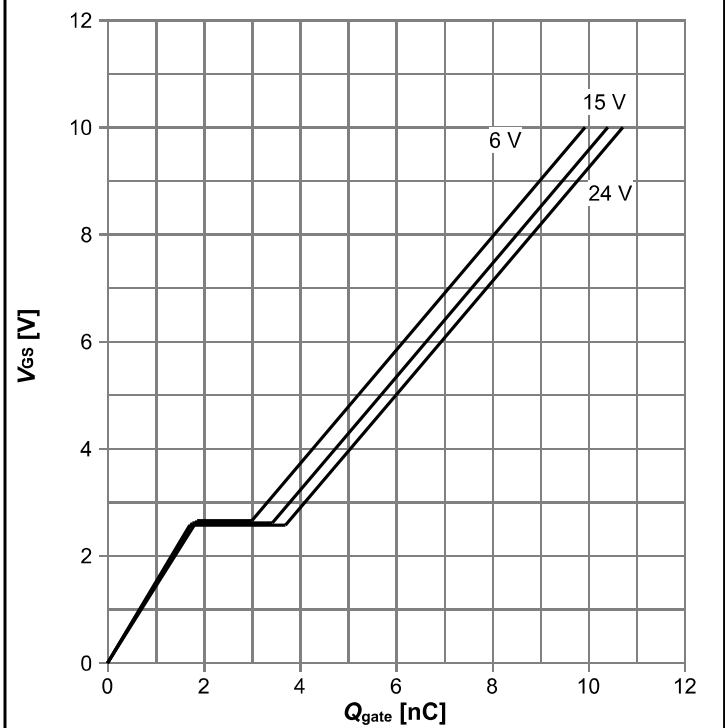


Diagram 13: Avalanche characteristics



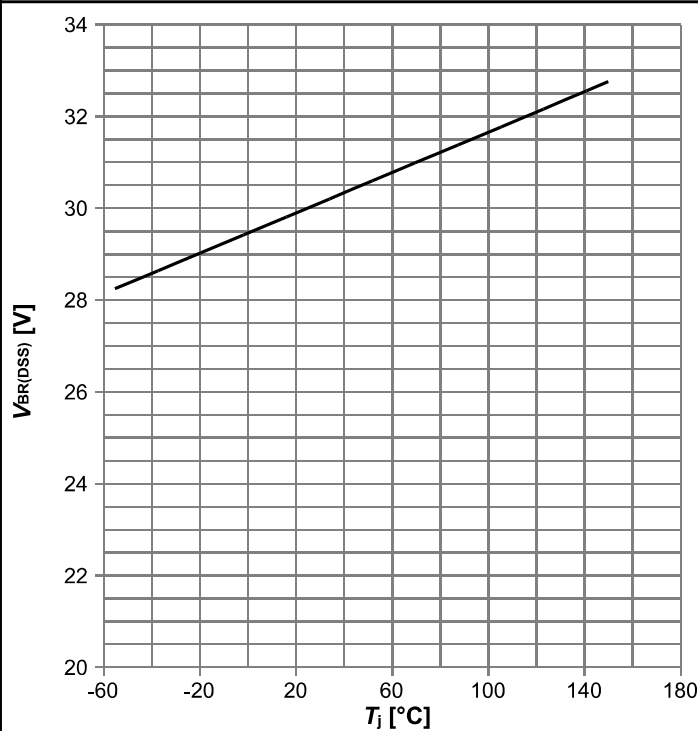
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate}); I_D=14$  A pulsed; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

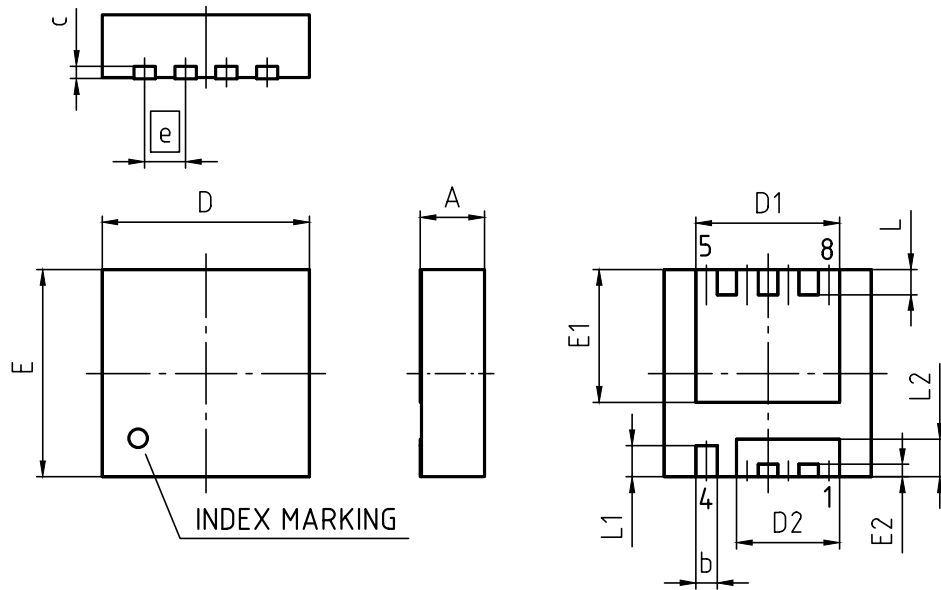


$V_{BR(DSS)}=f(T_j); I_D=1$  mA

Diagram Gate charge waveforms



## 5 Package Outlines



PACKAGE - GROUP NUMBER: <b>PG-TSDSON-8-U03</b>		
REVISION: 03	DATE: 20.10.2020	
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	0.90	1.10
b	0.24	0.44
c	(0.20)	
D	3.20	3.40
D1	2.19	2.39
D2	1.54	1.74
E	3.20	3.40
E1	2.01	2.21
E2	0.10	0.30
e	0.65	
L	0.30	0.50
L1	0.40	0.60
L2	0.50	0.70
aaa	0.06	

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

## Revision History

BSZ0994NS

**Revision: 2021-06-07, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2016-07-11	Release of final version
2.1	2021-06-07	Update current rating, POD, Vsd max, add max ratings Diagram 12 and fix typos

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