

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-Transistor, 60 V
IPD025N06N

Data Sheet

Rev. 2.5
Final

1 Description

Features

- Optimized for synchronous rectification
- 100% avalanche tested
- Superior thermal resistance
- N-channel, normal level
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

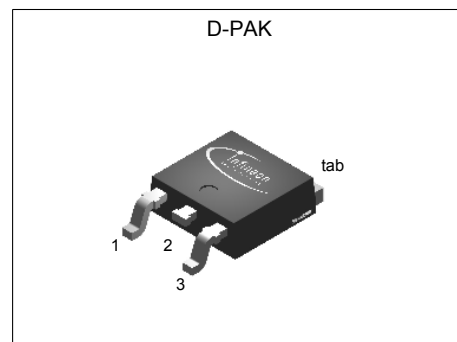
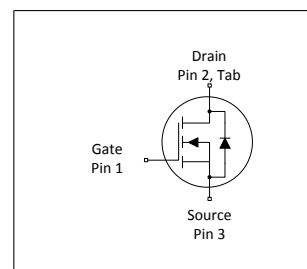


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(on),max}$	2.5	mΩ
I_D	90	A
Q_{OSS}	81	nC
$Q_G(0V..10V)$	71	nC



Type / Ordering Code	Package	Marking	Related Links
IPD025N06N	PG-TO252-3	025N06N	-

¹⁾ J-STD20 and JESD22

Table of Contents

Description	2
Maximum ratings	4
Thermal characteristics	4
Electrical characteristics	5
Electrical characteristics diagrams	7
Package Outlines	11
Revision History	12
Disclaimer	12

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	-	-	90 90 26	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$, $R_{thJA}=50\text{K/W}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	360	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse ²⁾	E_{AS}	-	-	210	mJ	$I_D=90\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	167 3.0	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}$
Operating and storage temperature	T_j, T_{stg}	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	0.5	0.9	K/W	-
Device on PCB, minimal footprint	R_{thJA}	-	-	62	K/W	-
Device on PCB, 6 cm ² cooling area ³⁾	R_{thJA}	-	-	40	K/W	-
Soldering temperature, wave and reflow soldering are allowed	T_{sold}	-	-	260	°C	Reflow MSL1

¹⁾ See figure 3 for more detailed information

²⁾ See figure 13 for more detailed information

³⁾ 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	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.1	2.8	3.3	V	$V_{DS}=V_{GS}$, $I_D=95\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.5 10	1 100	μA	$V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_J=25\text{ }^\circ\text{C}$ $V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_J=125\text{ }^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	2.1 2.7	2.5 3.8	$\text{m}\Omega$	$V_{GS}=10\text{ V}$, $I_D=90\text{ A}$ $V_{GS}=6\text{ V}$, $I_D=22.5\text{ A}$
Gate resistance ¹⁾	R_G	-	1.7	2.6	Ω	-
Transconductance	g_{fs}	80	160	-	S	$ V_{DS} >2 I_D /R_{DS(on)max}$, $I_D=90\text{ A}$

Table 5 Dynamic characteristics¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5200	6500	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	1200	1500	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	48	96	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	16	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	20	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	34	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	12	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=90\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$

¹⁾ Defined by design. Not subject to production test

Table 6 Gate charge characteristics¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	24	-	nC	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	14	-	nC	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge ²⁾	Q_{gd}	-	13	17	nC	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	23	-	nC	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	Q_g	-	71	83	nC	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.7	-	V	$V_{DD}=30\text{ V}$, $I_D=90\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	62	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ²⁾	Q_{oss}	-	81	102	nC	$V_{DD}=30\text{ V}$, $V_{GS}=0\text{ V}$

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	90	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	360	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	1.0	1.2	V	$V_{GS}=0\text{ V}$, $I_F=90\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ²⁾	t_{rr}	-	83	133	ns	$V_R=30\text{ V}$, $I_F=I_S$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}	-	105	-	nC	$V_R=30\text{ V}$, $I_F=I_S$, $di_F/dt=100\text{ A}/\mu\text{s}$

¹⁾ See "Gate charge waveforms" for parameter definition

²⁾ Defined by design. Not subject to production test

5 Electrical characteristics diagrams

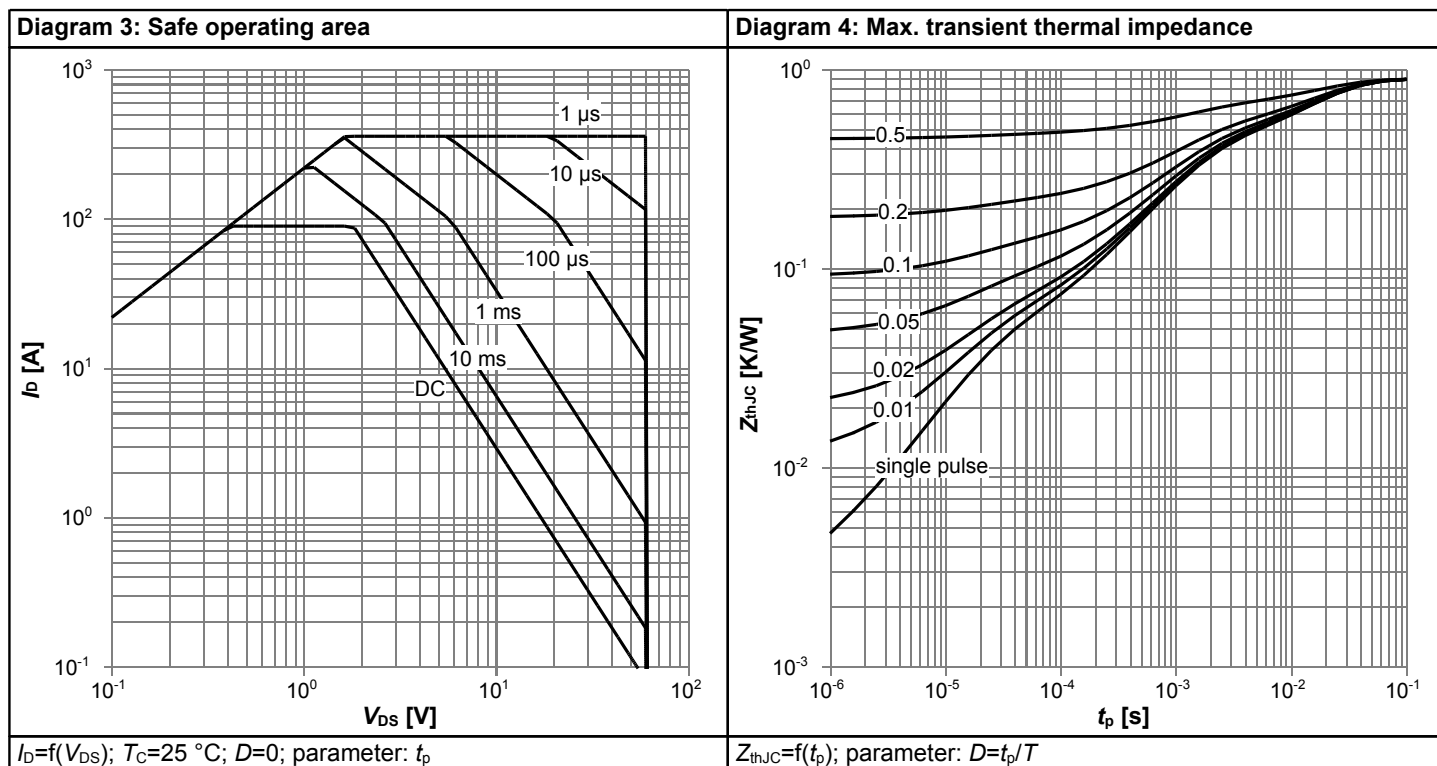
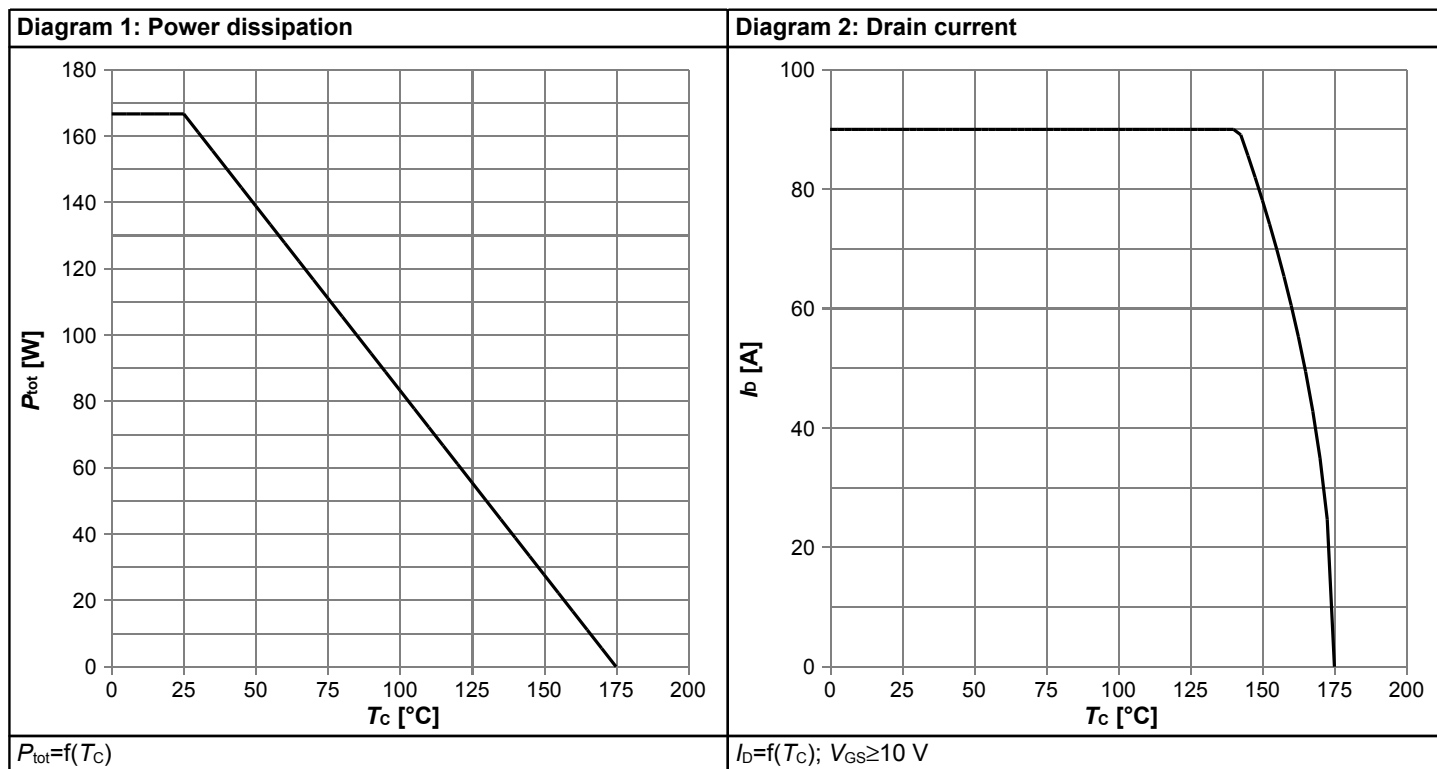


Diagram 5: Typ. output characteristics

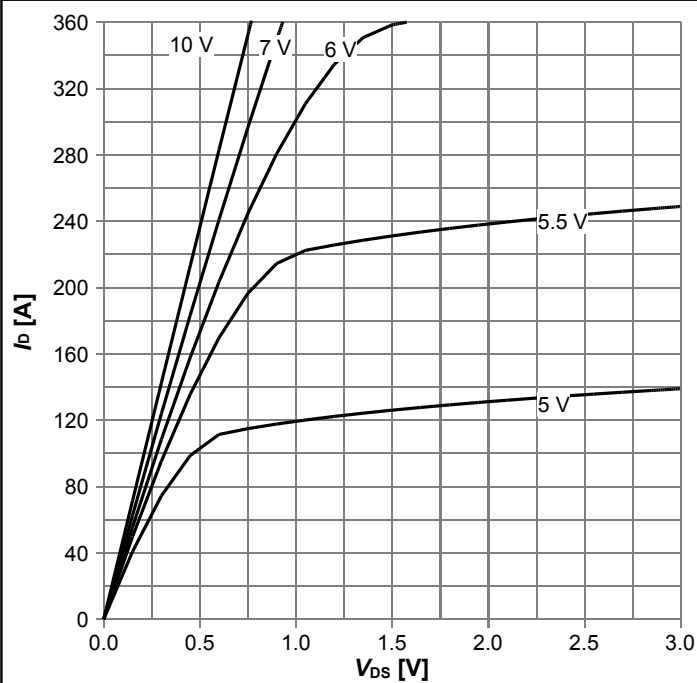

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance

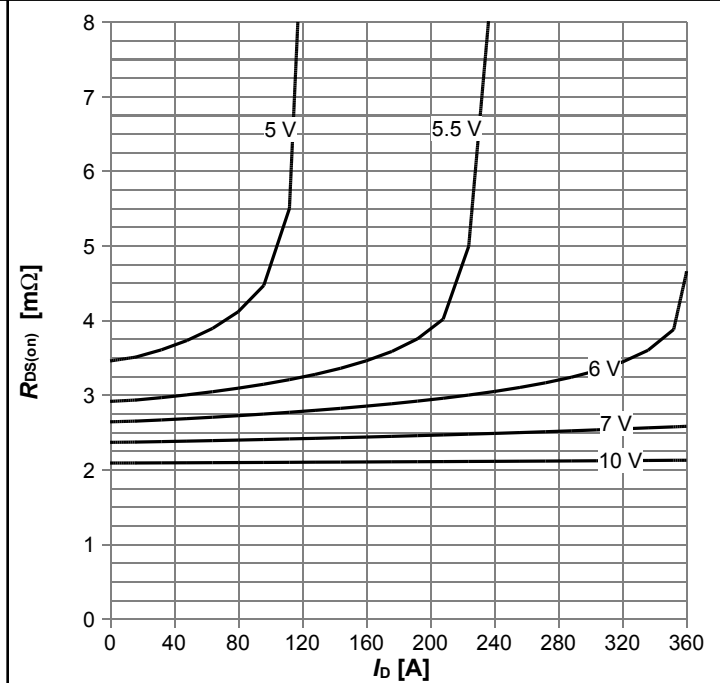

 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics

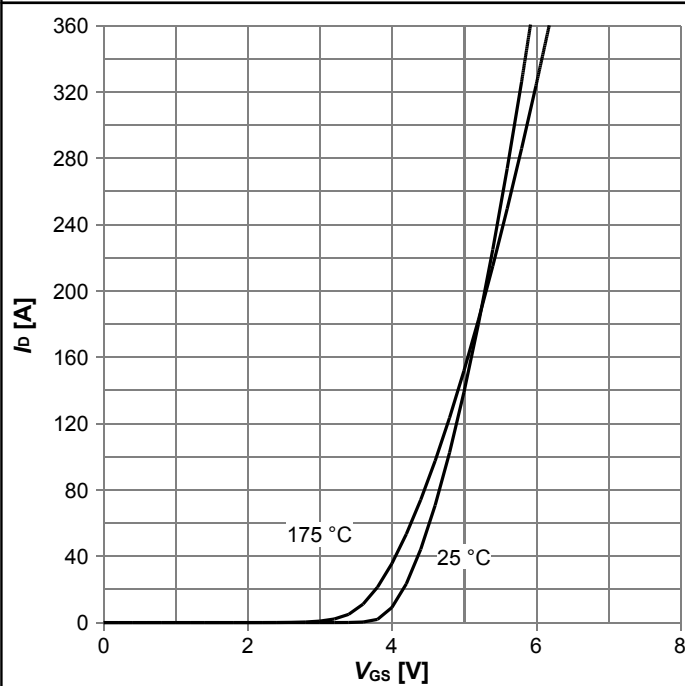

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)\text{max}}; \text{parameter: } T_j$

Diagram 8: Typ. forward transconductance

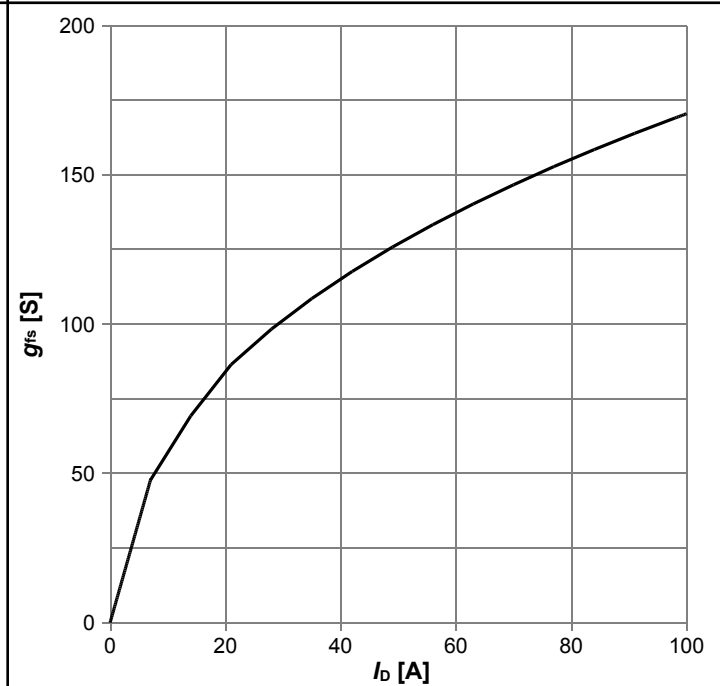
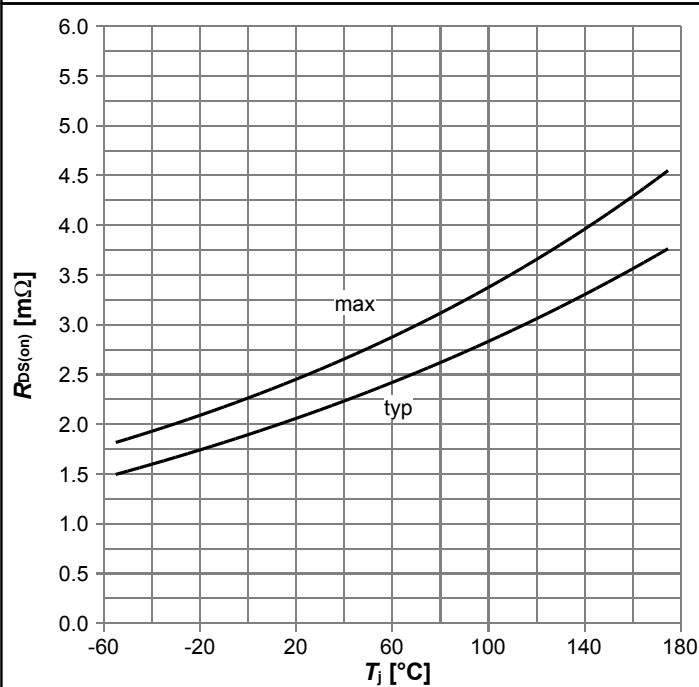
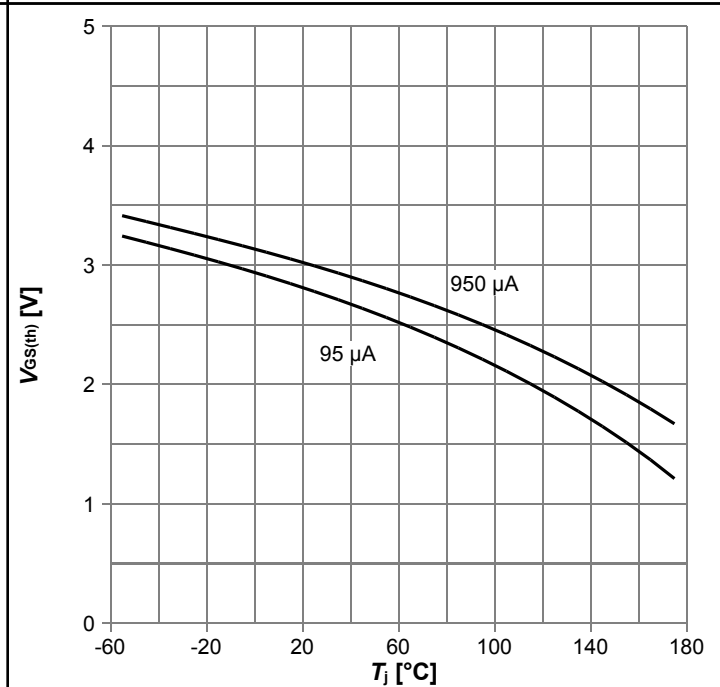

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



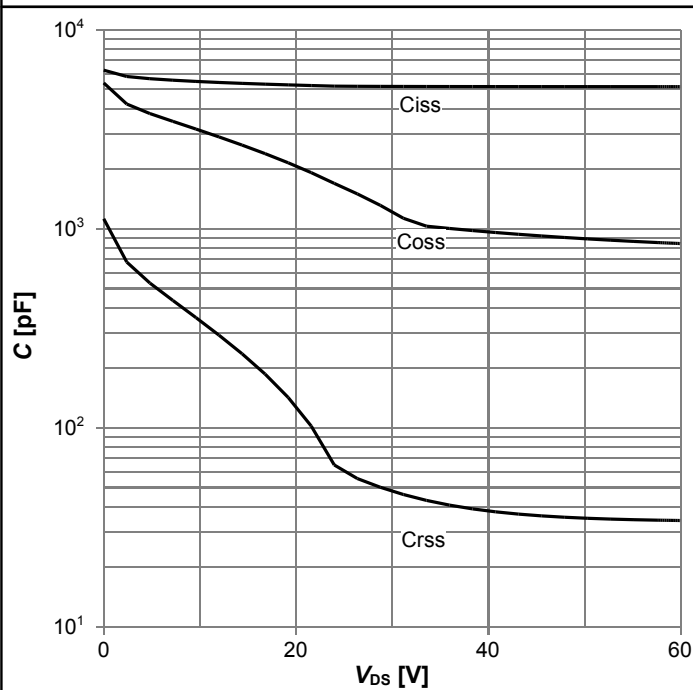
$R_{DS(on)} = f(T_j); I_D = 90 \text{ A}; V_{GS} = 10 \text{ V}$

Diagram 10: Typ. gate threshold voltage



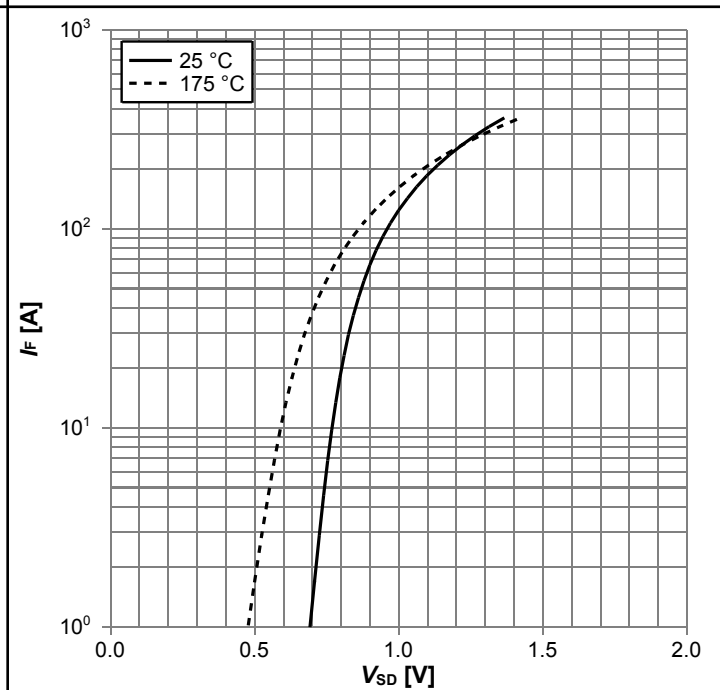
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

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

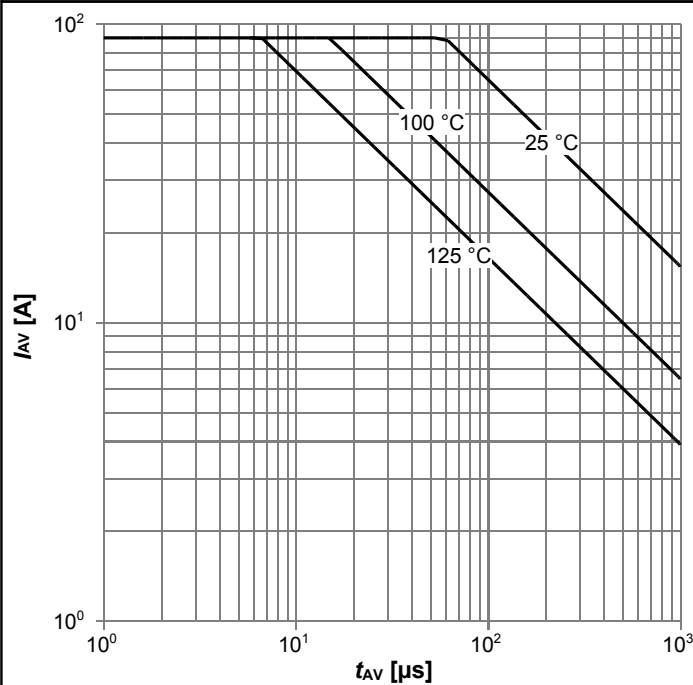

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j(\text{start})}$

Diagram 14: Typ. gate charge

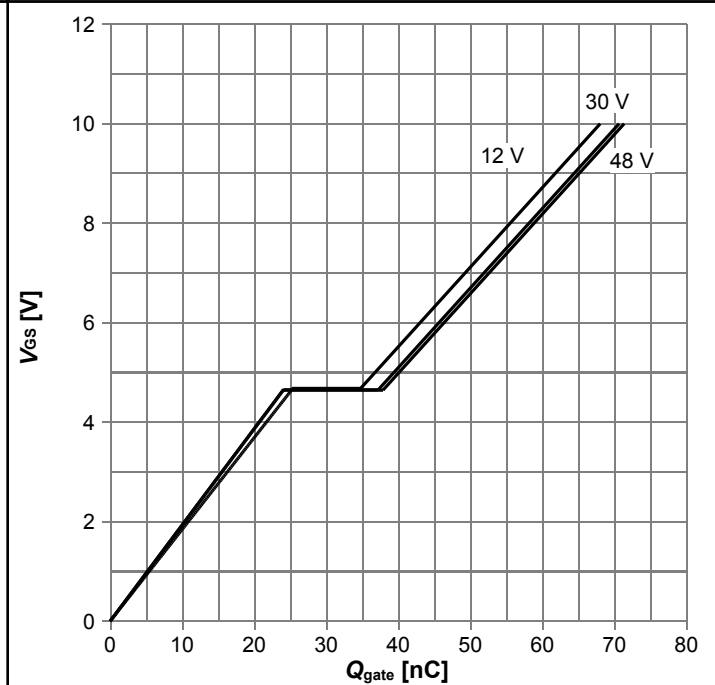
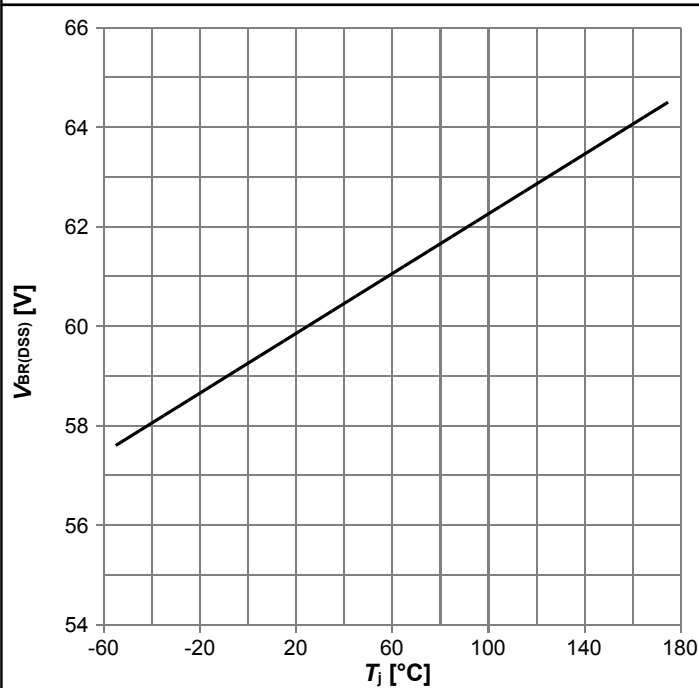
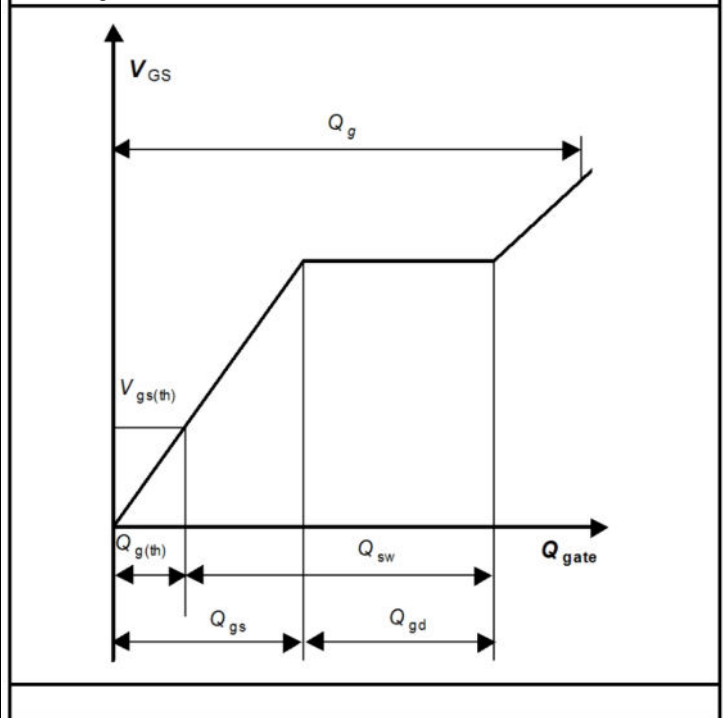

 $V_{GS}=f(Q_{\text{gate}}); I_D=90\text{A pulsed}; \text{parameter: } V_{DD}$

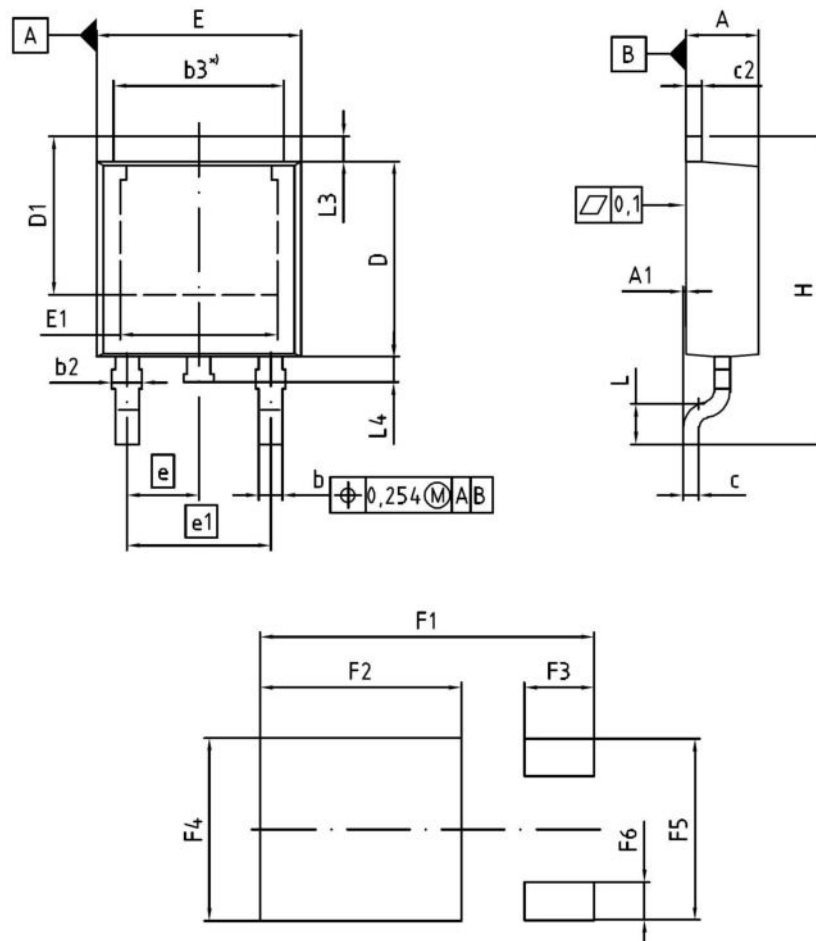
Diagram 15: Drain-source breakdown voltage


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

Gate charge waveforms



6 Package Outlines



*) mold flash not included

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29 (BSC)		0.090 (BSC)	
e1	4.57		0.180	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.60		0.417	
F2	6.40		0.252	
F3	2.20		0.087	
F4	5.80		0.228	
F5	5.76		0.227	
F6	1.20		0.047	

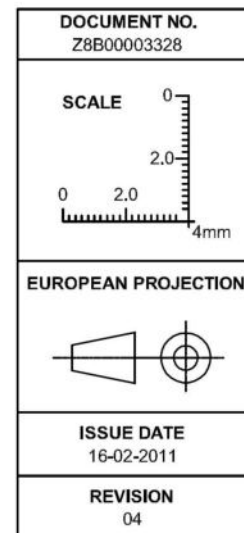


Figure 1 Outline PG-TO252-3, dimensions in mm/inches

Revision History

IPD025N06N

Revision: 2014-07-23, Rev. 2.5

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.5	2014-07-23	Rev.2.5

We Listen to Your Comments

Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:

erratum@infineon.com

Published by

Infineon Technologies AG

81726 München, Germany

© 2014 Infineon Technologies AG

All Rights Reserved.

Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**).

Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

The Infineon Technologies component described in this Data Sheet may be used in life-support devices or systems and/or automotive, aviation and aerospace applications or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support, automotive, aviation and aerospace device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.