MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™FD Power-Transistor, 250 V

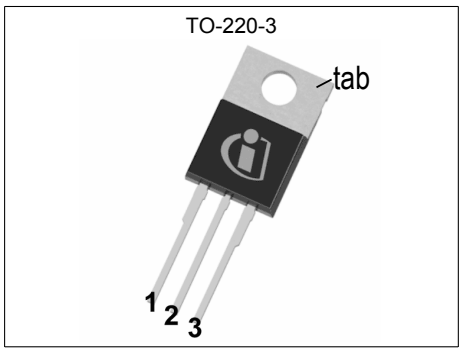
IPP220N25NFD

Data Sheet

Rev. 2.0
Final

Power Management & Multimarket

1 Description



Features

- N-channel, normal level
- Fast Diode (FD) with reduced Q_{rr}
- Optimized for hard commutation ruggedness
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC [1] for target application
- Halogen-free according to IEC61249-2-21

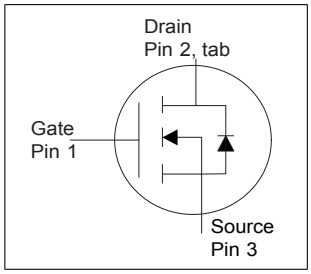


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	250	V
$R_{DS(on),max}$	22	mΩ
I_D	61	A

Type / Ordering Code	Package	Marking	Related Links
IPP220N25NFD	PG-TO220-3	220N25NF	-

[1] J-STD20 and JESD22

Table of Contents

2 Maximum ratings

at T_j = 25 °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	- -	- -	61 44	A	T_C=25 °C T_C=100 °C
Pulsed drain current [1]	$I_{D,pulse}$	-	-	244	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	610	mJ	I_D=37 A, R_{GS}=25 Ω
Reverse diode peak dv/dt	dv/dt	-	-	60	kV/µs	I_D=122 A, V_{DS}=125 V, di/dt=1500 A/µs, $T_{j,max}$=175 °C
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	300	W	T_C=25 °C
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}	-	0.3	0.5	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm2 cooling area [2]	R_{thJA}	-	-	40	K/W	-

[1] See figure 3

[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (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	$V_{(BR)DSS}$	250	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	V_{DS}=V_{GS}, I_D=270 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=200 V, V_{GS}=0 V, T_j=25 °C V_{DS}=200 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	1	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	19	22	mΩ	V_{GS}=10 V, I_D=61 A
Gate resistance	R_G	-	2.5	3.8	Ω	-
Transconductance	g_{fs}	60	120	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=61 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5320	7076	pF	V_{GS}=0 V, V_{DS}=125 V, f=1 MHz
Output capacitance	C_{oss}	-	299	398	pF	V_{GS}=0 V, V_{DS}=125 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	6	13	pF	V_{GS}=0 V, V_{DS}=125 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	14	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=30.5 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	10	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=30.5 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	26	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=30.5 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	8	-	ns	V_{DD}=125 V, V_{GS}=10 V, I_D=30.5 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics [1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	24	-	nC	V_{DD}=125 V, I_D=61 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	7	-	nC	V_{DD}=125 V, I_D=61 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	16	-	nC	V_{DD}=125 V, I_D=61 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	65	86	nC	V_{DD}=125 V, I_D=61 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	V_{DD}=125 V, I_D=61 A, V_{GS}=0 to 10 V
Output charge	Q_{oss}	-	144	-	nC	V_{DD}=125 V, V_{GS}=0 V

[1)] See ″Gate charge waveforms″ for parameter definition

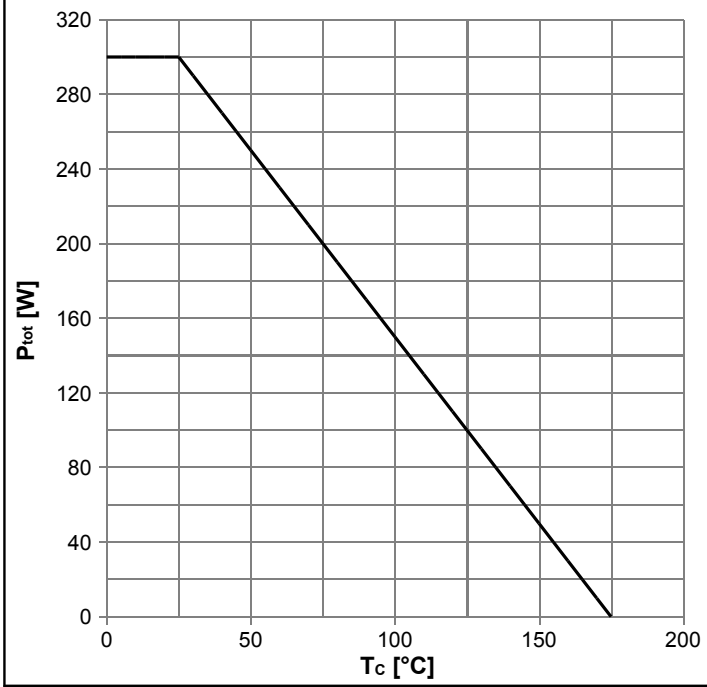
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	61	A	T_C=25 °C
Diode pulse current [1]	$I_{S,pulse}$	-	-	244	A	T_C=25 °C
Diode hard commutation current [2]	$I_{S,hard}$	-	-	122	A	-
Diode forward voltage	V_{SD}	-	1	1.2	V	V_{GS}=0 V, I_F=61 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	128	257	ns	V_R=100 V, I_F=42.7A, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	623	-	nC	V_R=100 V, I_F=42.7A, di_F/dt=100 A/µs

[1] Diode pulse current is defined by thermal and/or package limits
[2] Maximum allowed hard-commutated current through diode at di/dt=1500 A/µs

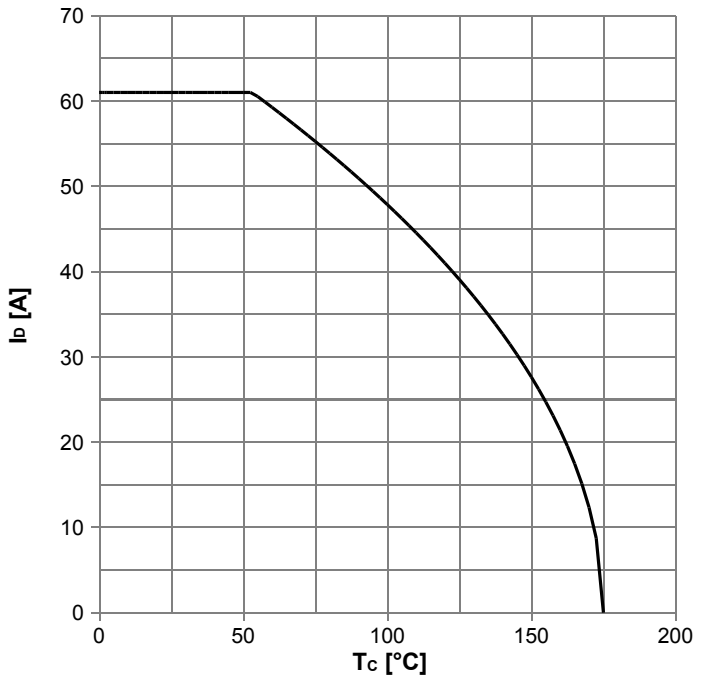
5 Electrical characteristics diagrams

Diagram 1: Power dissipation



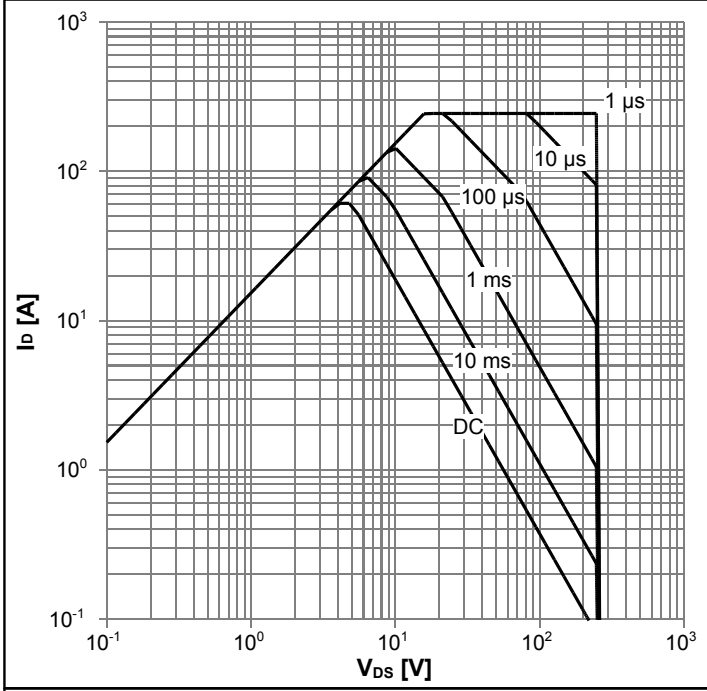
$P_{tot}=f(T_C)$

Diagram 2: Drain current



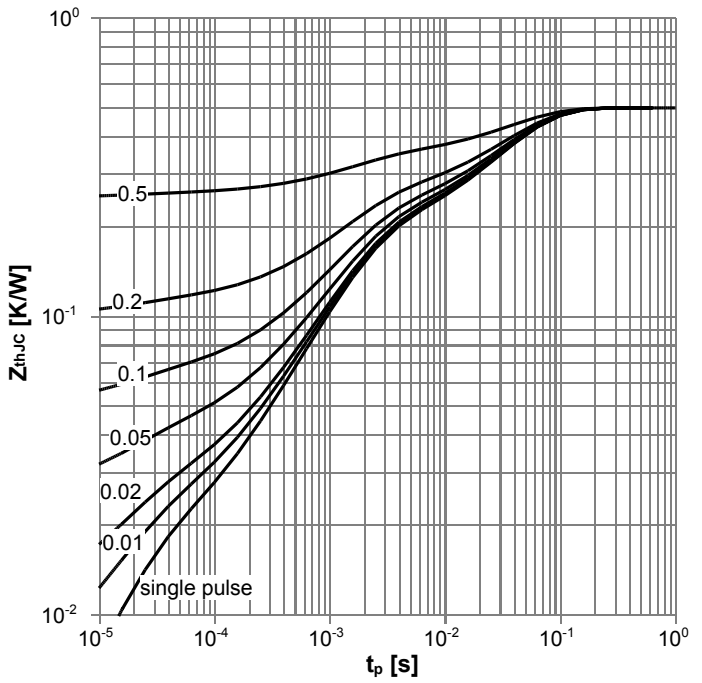
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



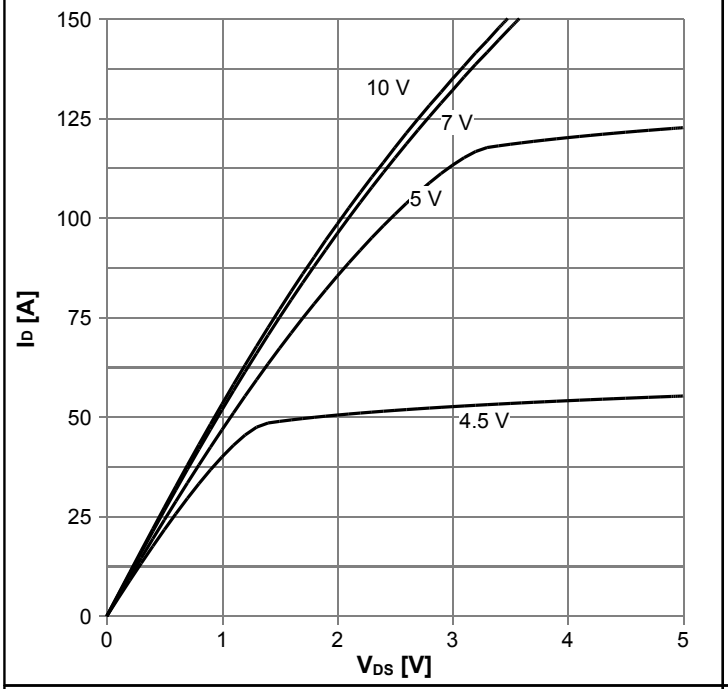
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



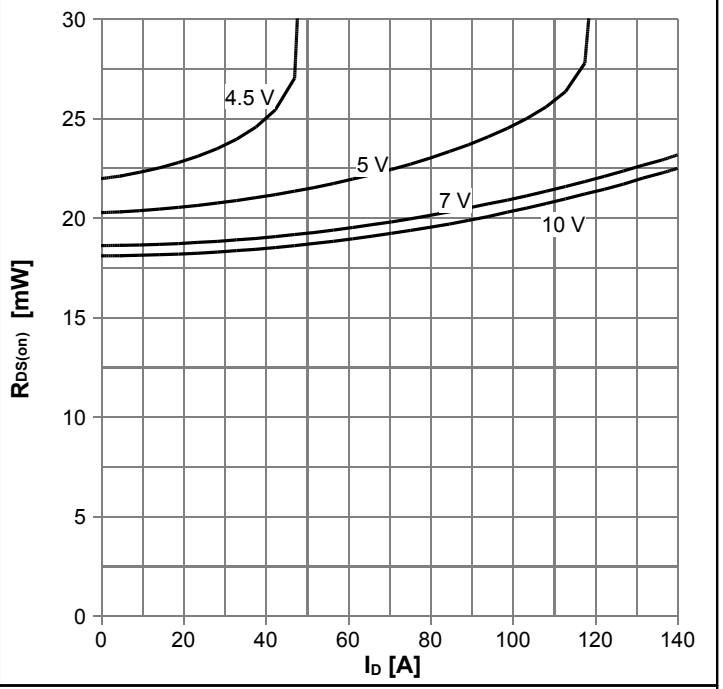
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



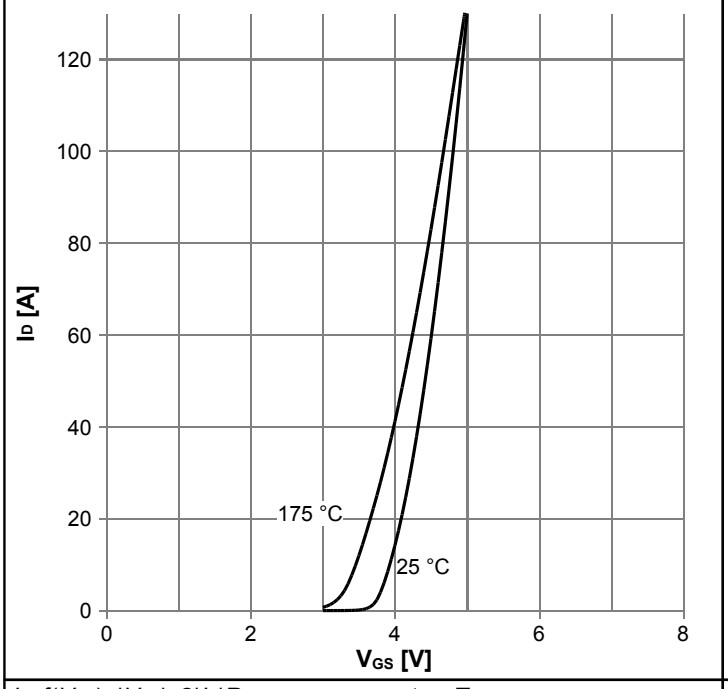
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



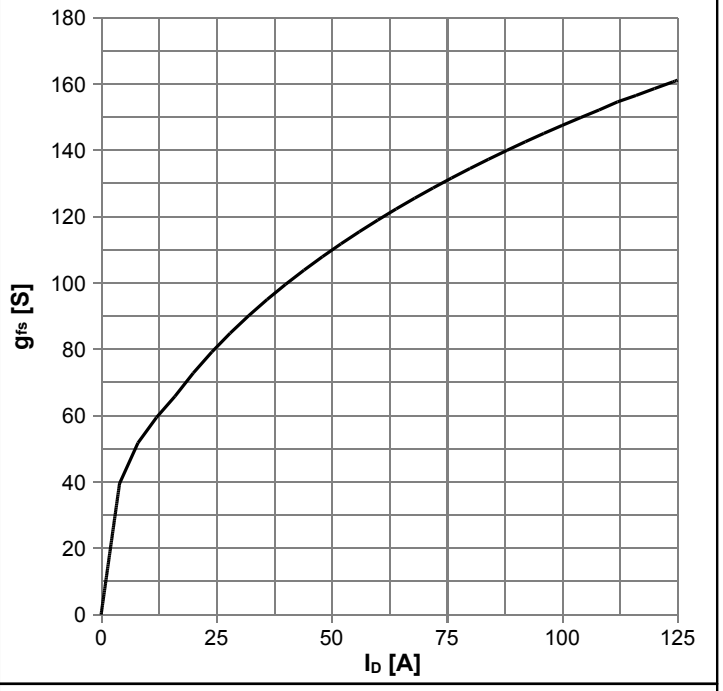
$R_{DS(on)}$=f(I_D); T_j=25 °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



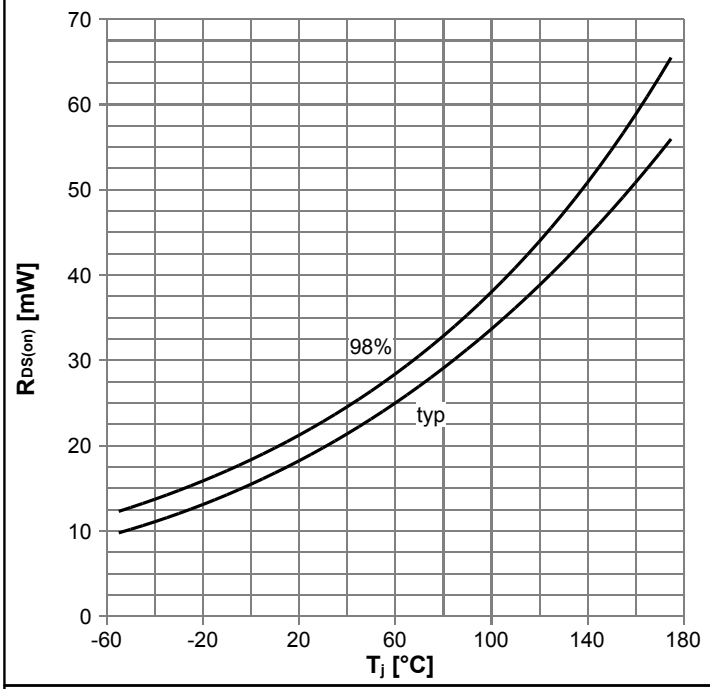
I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



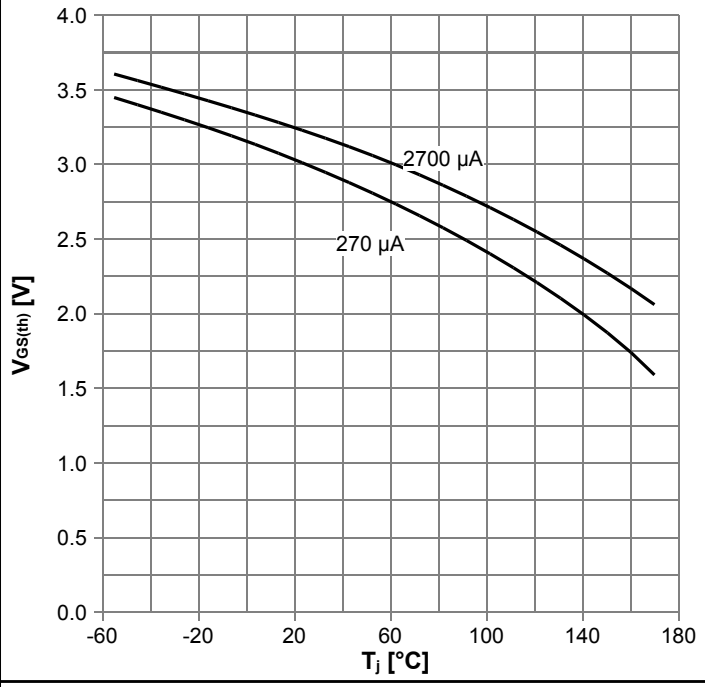
g_{fs}=f(I_D); T_j=25 °C

Diagram 9: Drain-source on-state resistance



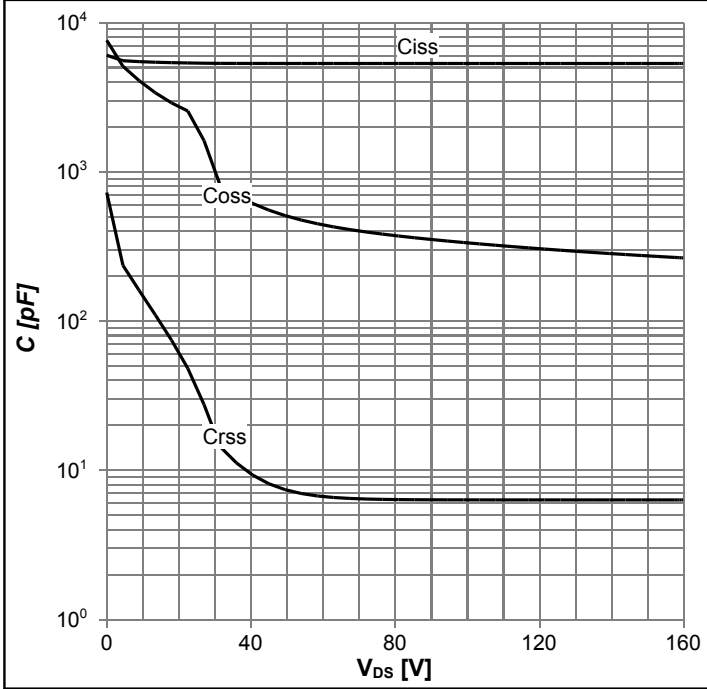
$R_{DS(on)}$=f(T_j); I_D=61 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



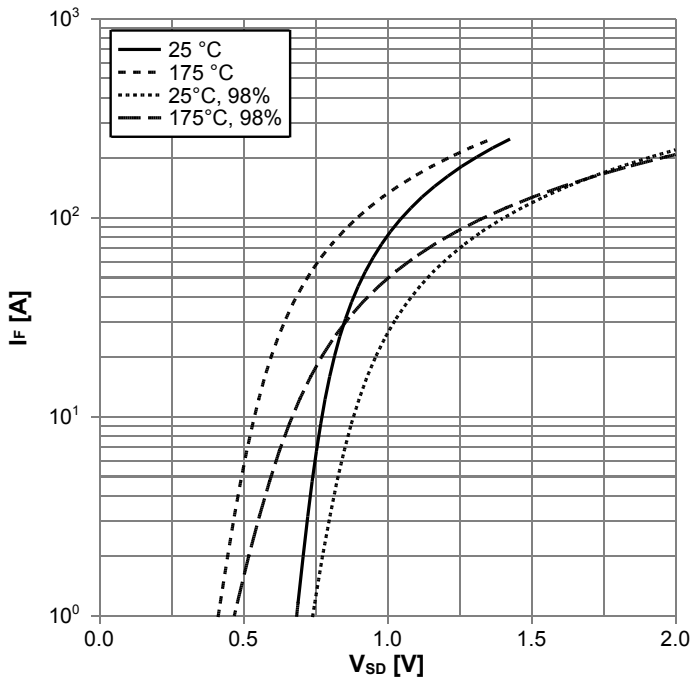
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



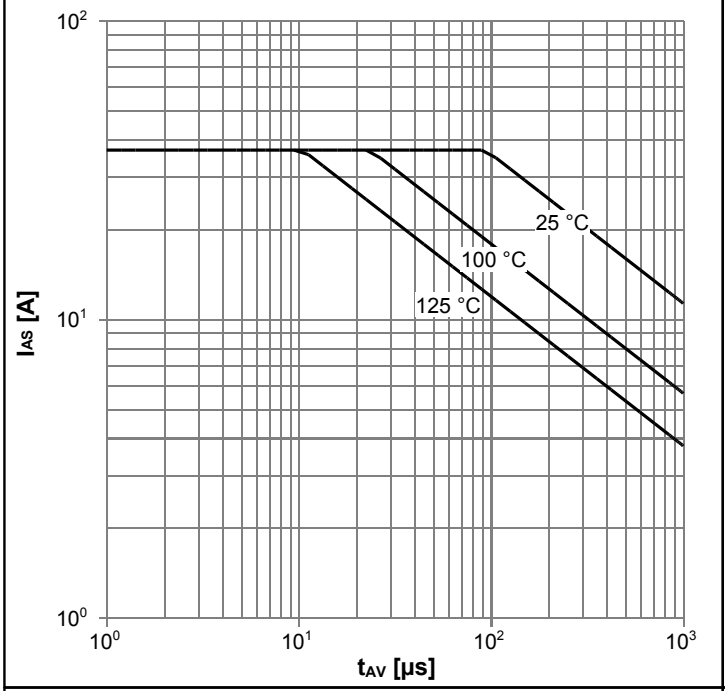
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



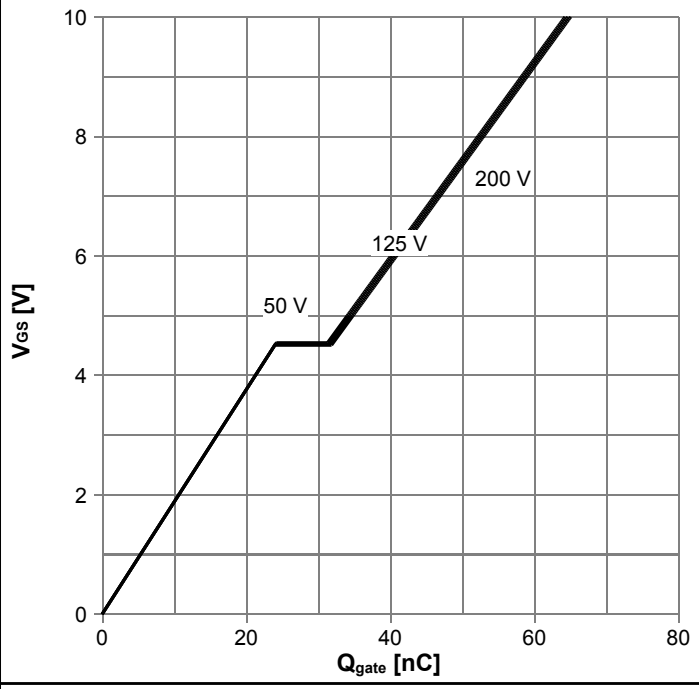
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



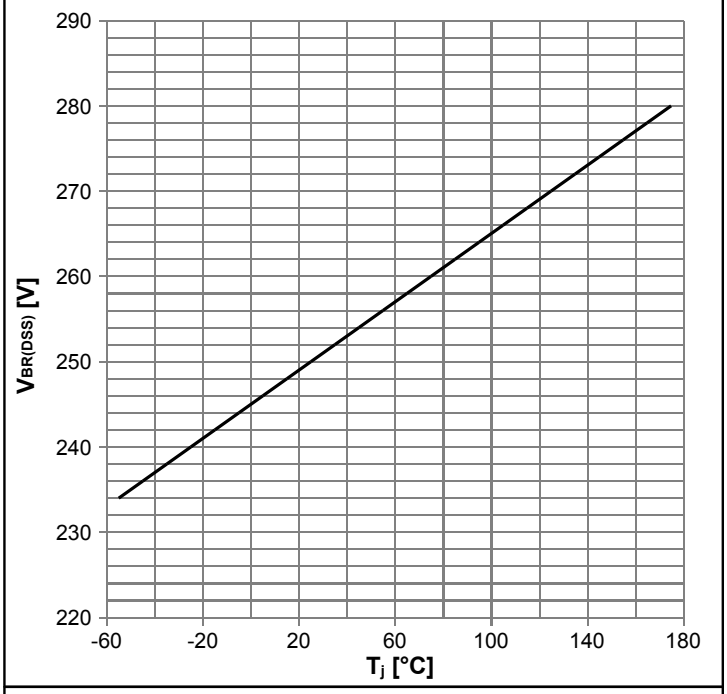
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



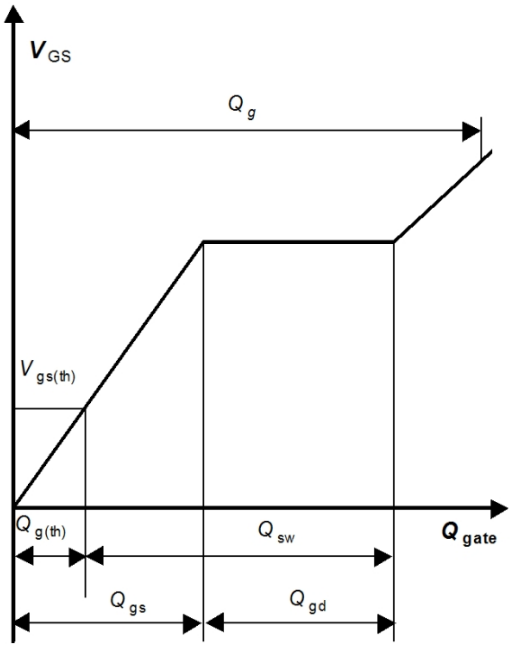
V_{GS}=f(Q_{gate}); I_D=61 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

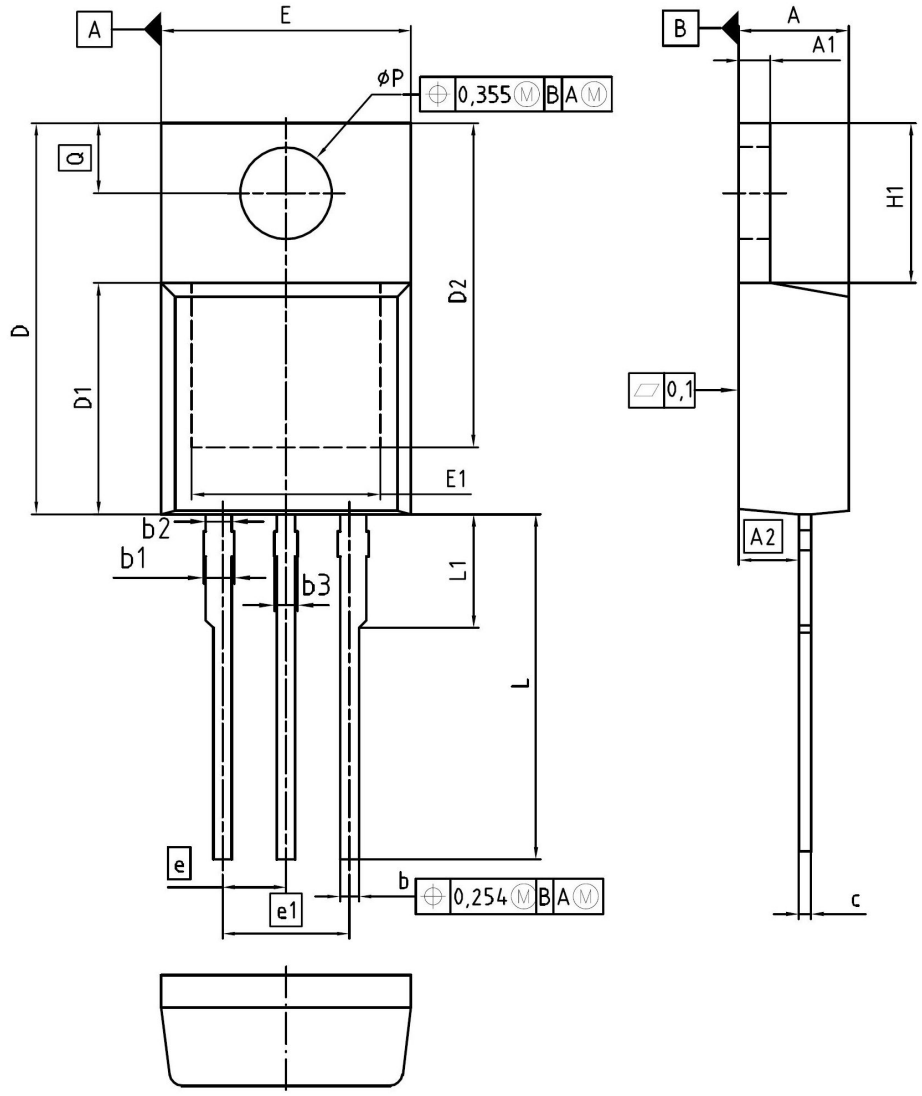


$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Gate charge waveforms



6 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.
Z8B00003318

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
30-07-2009

REVISION
06

Figure 1 Outline PG-TO220-3, dimensions in mm/inches

Revision History

IPP220N25NFD

Revision: 2014-02-06, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2014-02-06	Release of final version

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

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.