

## MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

OptiMOS™ Power-Transistor, 300 V  
IPP410N30N

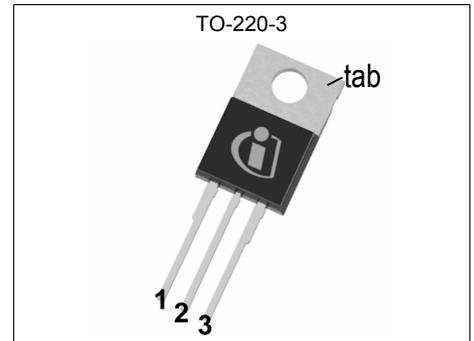
## Data Sheet

Rev. 2.0  
Final

## 1 Description

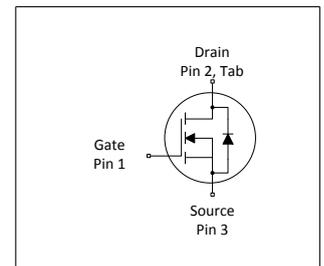
### Features

- N-channel, normal level
- Fast Diode 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<sup>1)</sup> for target application
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	300	V
$R_{DS(on),max}$	41	mΩ
$I_D$	44	A



Type / Ordering Code	Package	Marking	Related Links
IPP410N30N	PG-TO220-3	410N30N	-

<sup>1)</sup> 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	$I_D$	-	-	44 34	A	$T_C=25\text{ °C}$ $T_C=100\text{ °C}$
Pulsed drain current <sup>1)</sup>	$I_{D,pulse}$	-	-	176	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	240	mJ	$I_D=22\text{ A}$ , $R_{GS}=50\ \Omega$
Reverse diode peak $dv/dt$	$dv/dt$	-	-	60	kV/ $\mu$ s	$I_D=44\text{ A}$ , $V_{DS}=150\text{ V}$ , $di/dt=1000\text{ A}/\mu\text{s}$ , $T_{j,max}=175\text{ °C}$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Diode hard commutation breakdown current <sup>2)</sup>	$P_{tot}$	-	-	300	W	$T_C=25\text{ °C}$
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 <sup>3)</sup>	$R_{thJC}$	-	0.3	0.5	K/W	-
Thermal resistance, junction - ambient, minimal footprint	$R_{thJA}$	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>4)</sup>	$R_{thJA}$	-	-	40	K/W	-

<sup>1)</sup> See figure 3

<sup>2)</sup> Diode pulse current is defined by thermal and/or package limits

<sup>3)</sup> Defined by design. Not subject to production test.

<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  $\mu$ m 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	$V_{(BR)DSS}$	300	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2	3	4	V	$V_{DS}=V_{GS}$ , $I_D=270\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	1 10	10 300	$\mu\text{A}$	$V_{DS}=240\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=240\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	1	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	36	41	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=44\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	2.4	3.6	$\Omega$	-
Transconductance	$g_{fs}$	52	103	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=44\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	5400	7180	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=100\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	281	374	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=100\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	6	13	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=100\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	16	-	ns	$V_{DD}=100\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=22\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	9	-	ns	$V_{DD}=100\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=22\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	43	-	ns	$V_{DD}=100\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=22\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	9	-	ns	$V_{DD}=100\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=22\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	24	-	nC	$V_{DD}=100\text{ V}$ , $I_D=44\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	-	7	-	nC	$V_{DD}=100\text{ V}$ , $I_D=44\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	15	-	nC	$V_{DD}=100\text{ V}$ , $I_D=44\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	65	87	nC	$V_{DD}=100\text{ V}$ , $I_D=44\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.4	-	V	$V_{DD}=100\text{ V}$ , $I_D=44\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge	$Q_{oss}$	-	131	-	nC	$V_{DD}=100\text{ V}$ , $V_{GS}=0\text{ V}$

<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	$I_S$	-	-	44	A	$T_C=25\text{ °C}$
Diode pulse current <sup>1)</sup>	$I_{S,pulse}$	-	-	176	A	$T_C=25\text{ °C}$
Diode hard commutation current <sup>2)</sup>	$I_{S,hard}$	-	-	44	A	$T_C=25\text{ °C}$ , $di_F/dt=1000\text{ A}/\mu\text{s}$
Diode forward voltage	$V_{SD}$	-	0.9	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=44\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>3)</sup>	$t_{rr}$	-	152	304	ns	$V_R=100\text{ V}$ , $I_F=32.2\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>3)</sup>	$Q_{rr}$	-	844	1689	nC	$V_R=100\text{ V}$ , $I_F=32.2\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

<sup>1)</sup> Diode pulse current is defined by thermal and/or package limits

<sup>2)</sup> Maximum allowed hard-commutated current through diode at  $di/dt=1000\text{ A}/\mu\text{s}$

<sup>3)</sup> Defined by design. Not subject to production test.

## 5 Electrical characteristics diagrams

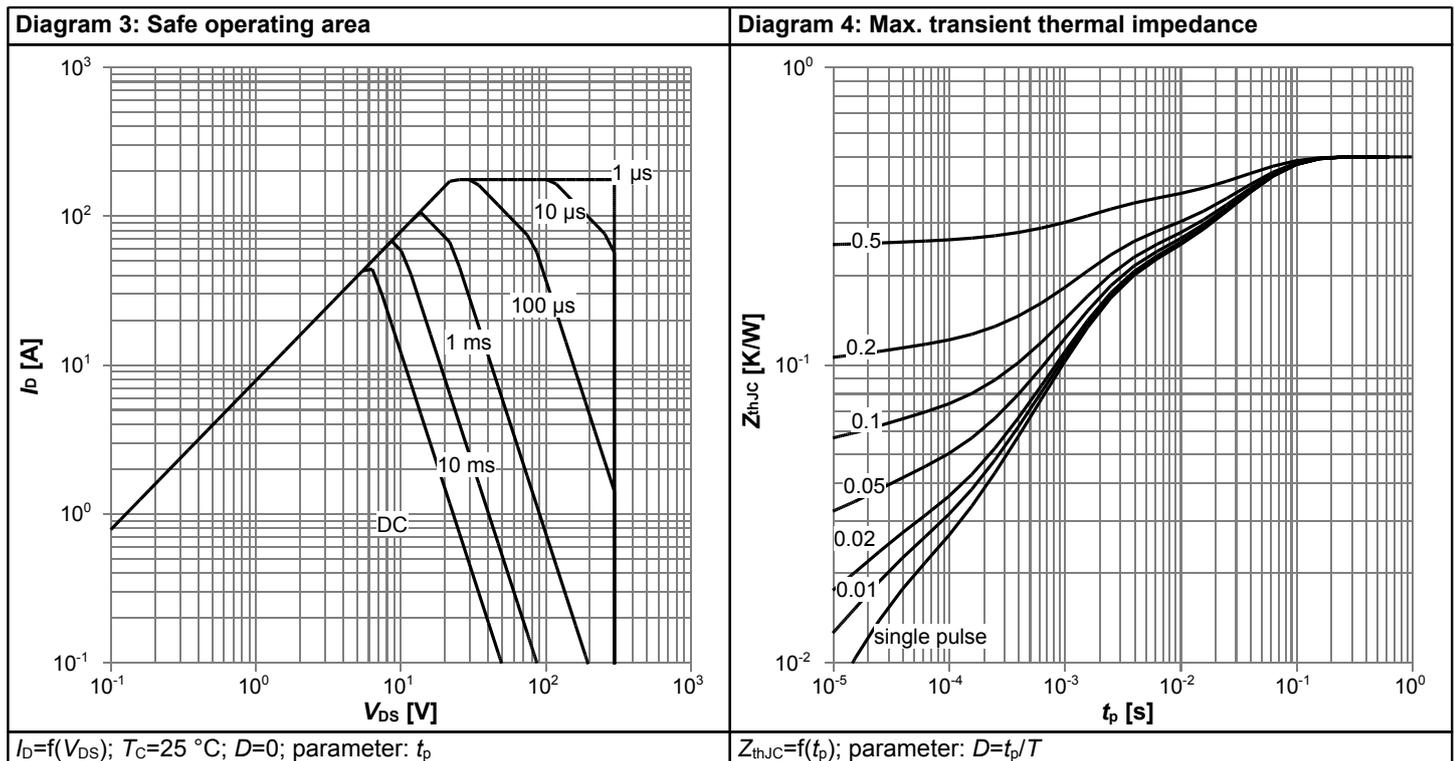
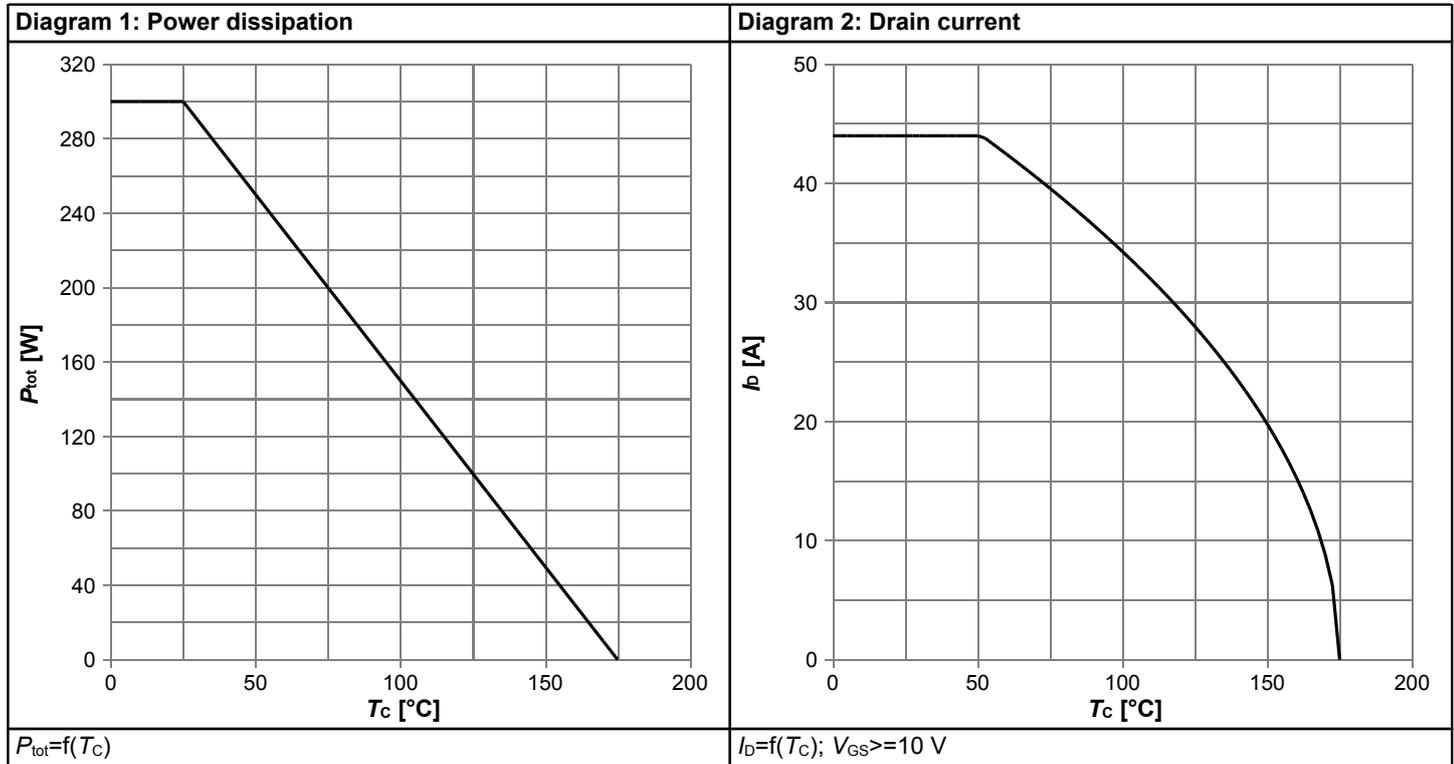
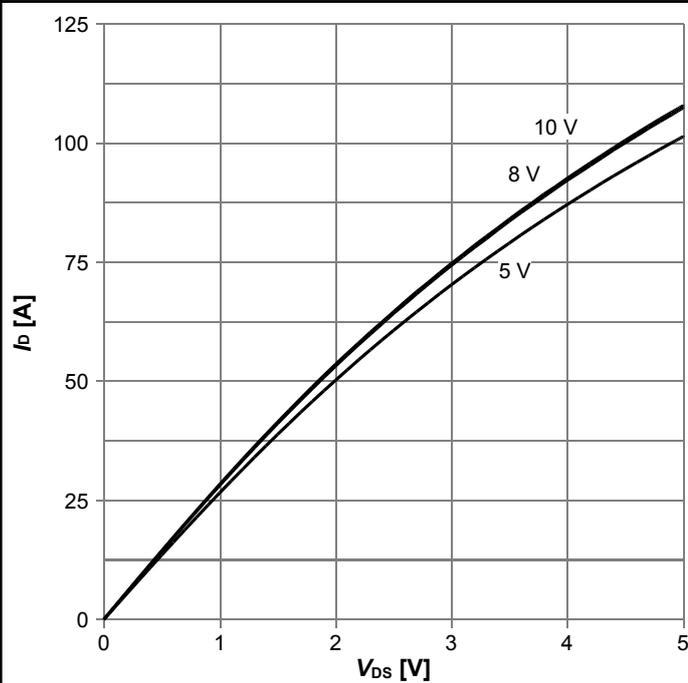
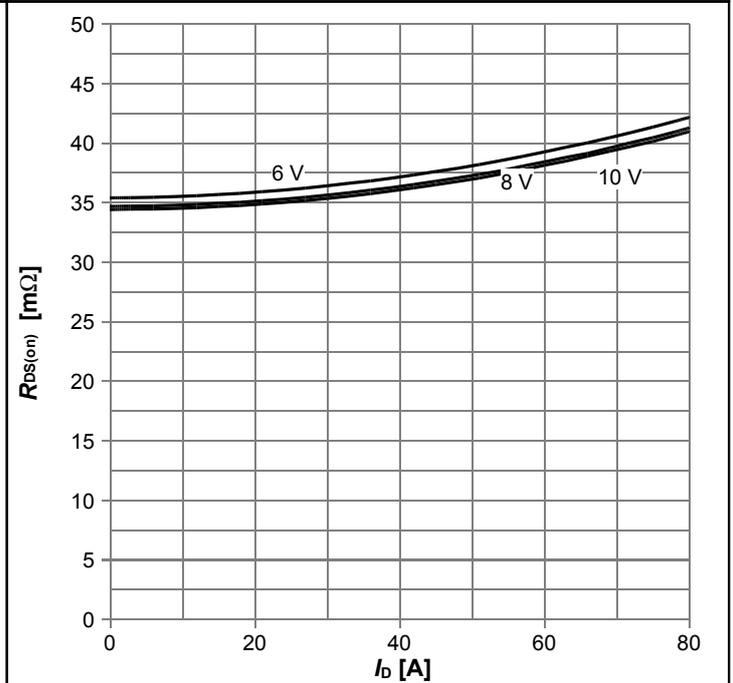


Diagram 5: Typ. output characteristics



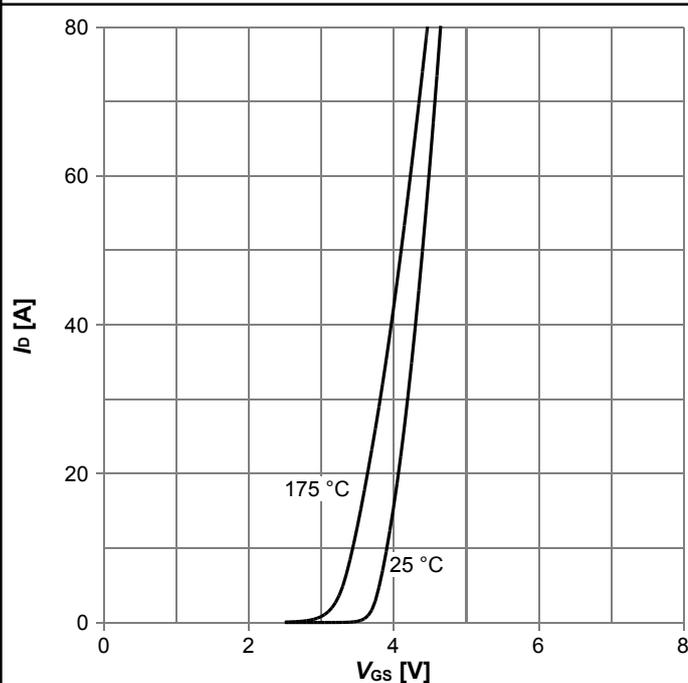
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



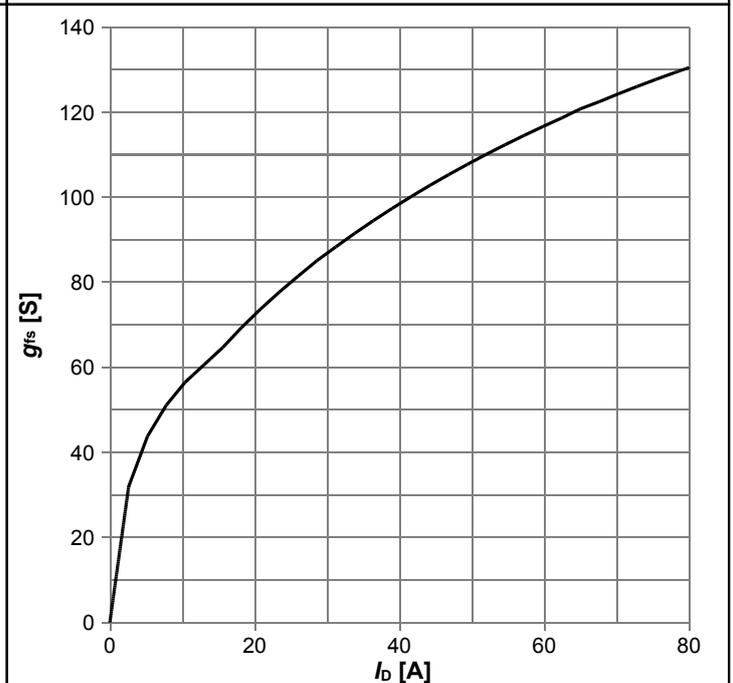
$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



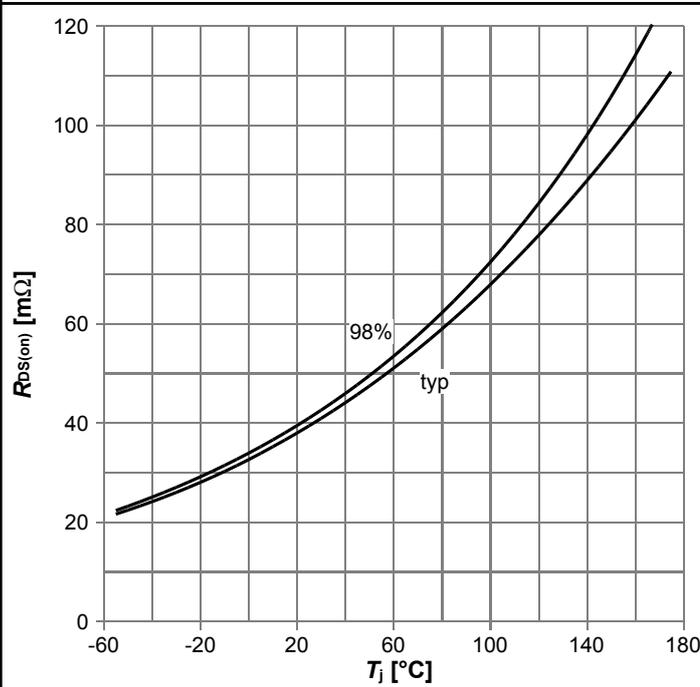
$I_D=f(V_{GS}); |V_{DS}|>2I_D R_{DS(on)max};$  parameter:  $T_j$

Diagram 8: Typ. forward transconductance



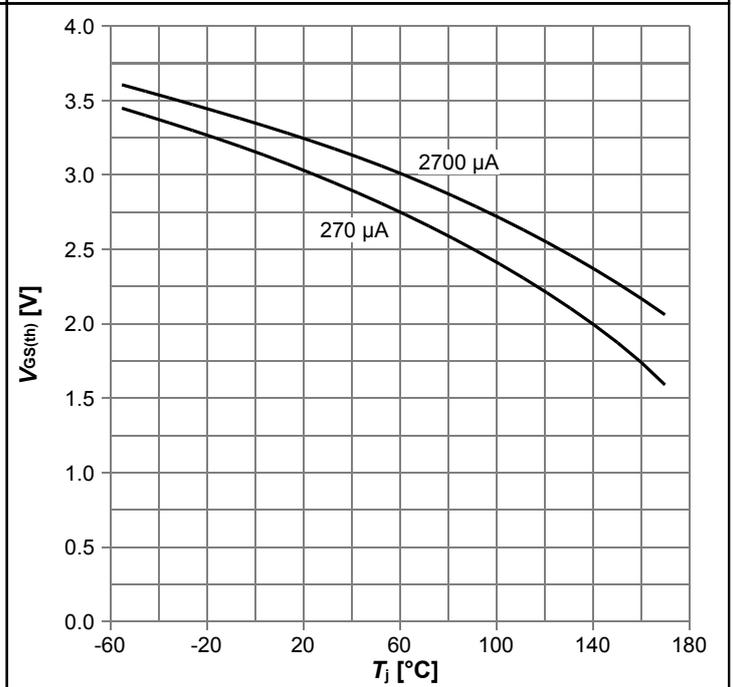
$g_{fs}=f(I_D); T_j=25\text{ }^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



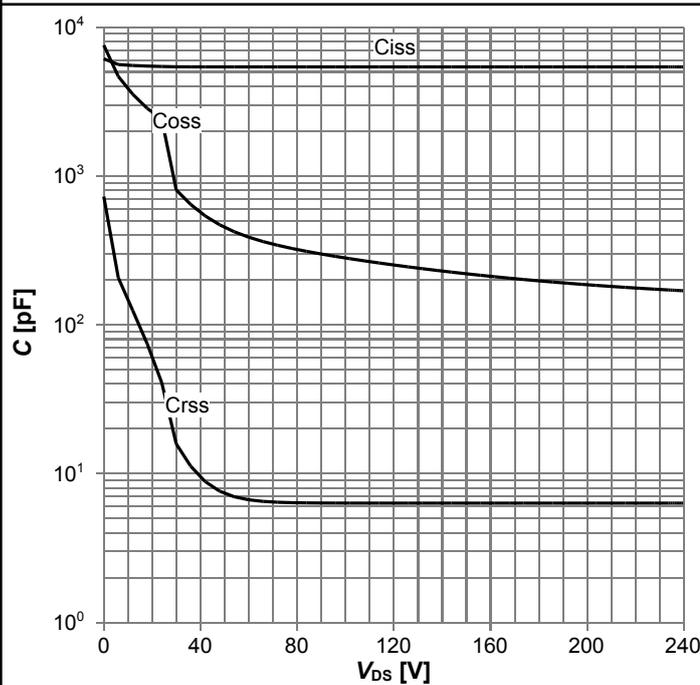
$R_{DS(on)}=f(T_j); I_D=44 \text{ A}; V_{GS}=10 \text{ V}$

Diagram 10: Typ. gate threshold voltage



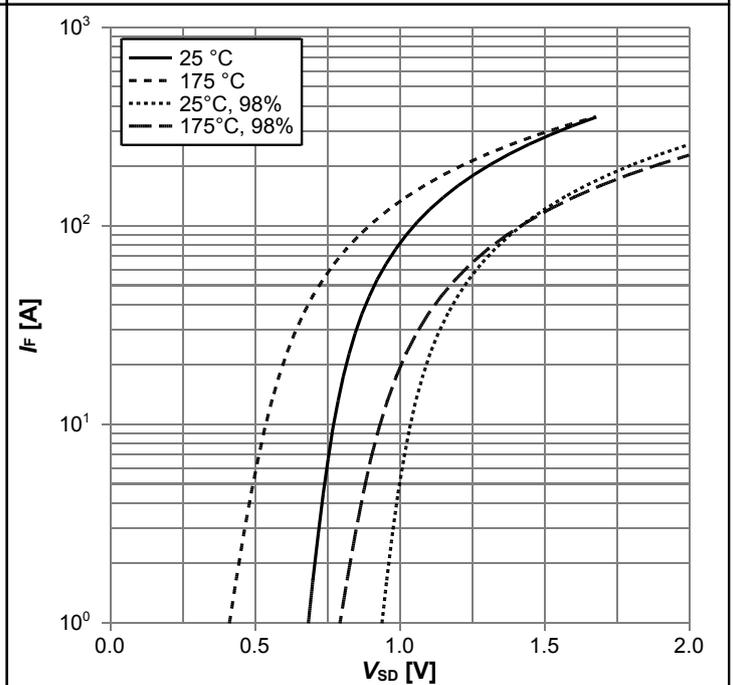
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}; \text{parameter: } I_D$

Diagram 11: Typ. capacitances



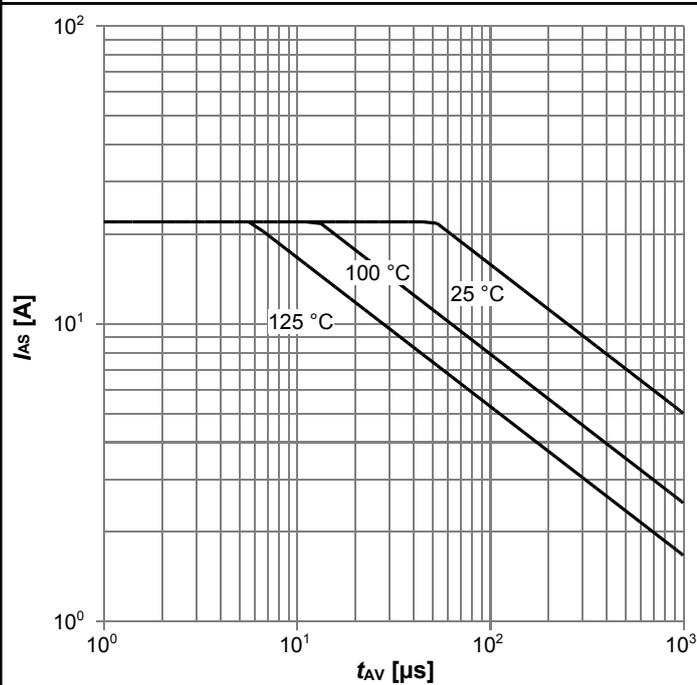
$C=f(V_{DS}); V_{GS}=0 \text{ V}; f=1 \text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



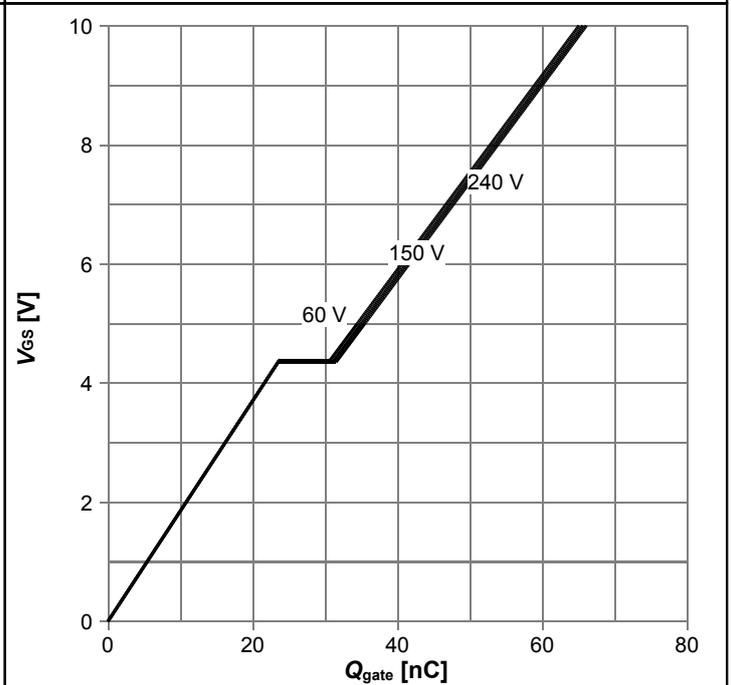
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



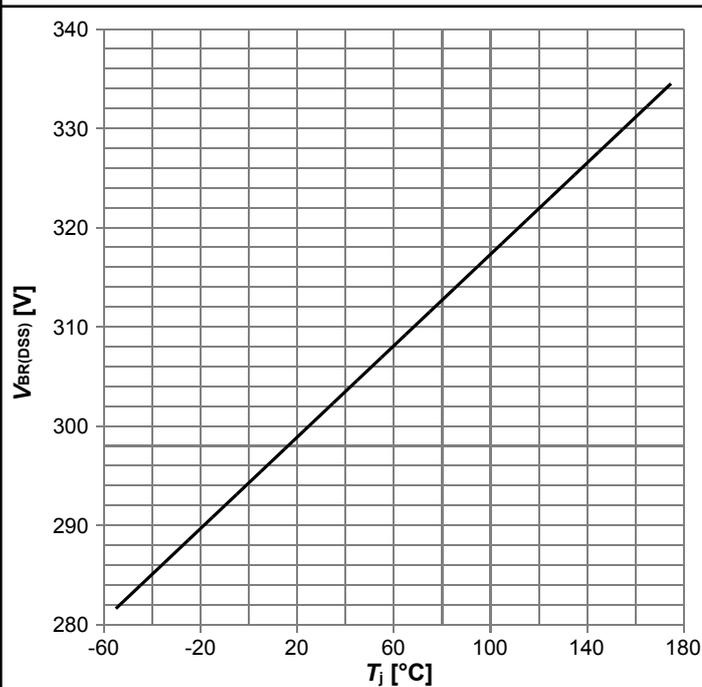
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j(start)}$

Diagram 14: Typ. gate charge



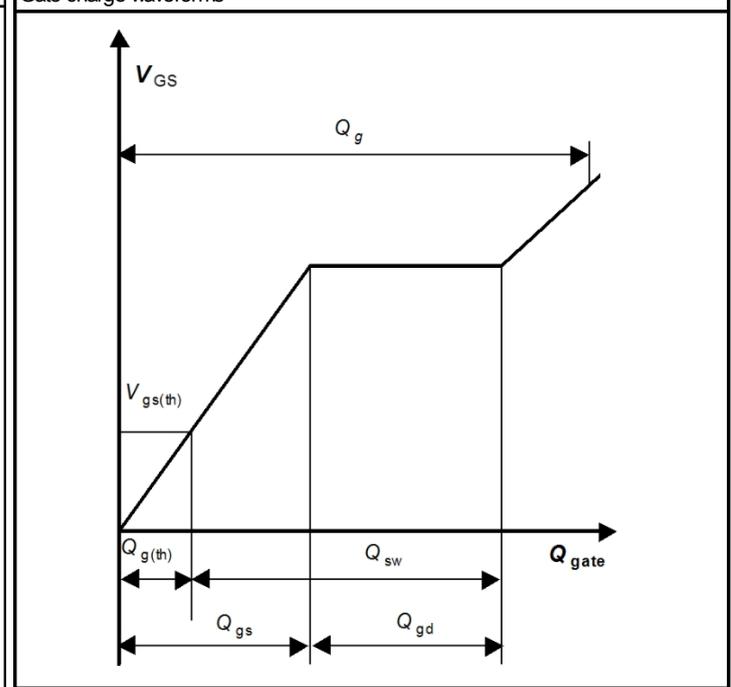
$V_{GS}=f(Q_{gate}); I_D=44$  A pulsed; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

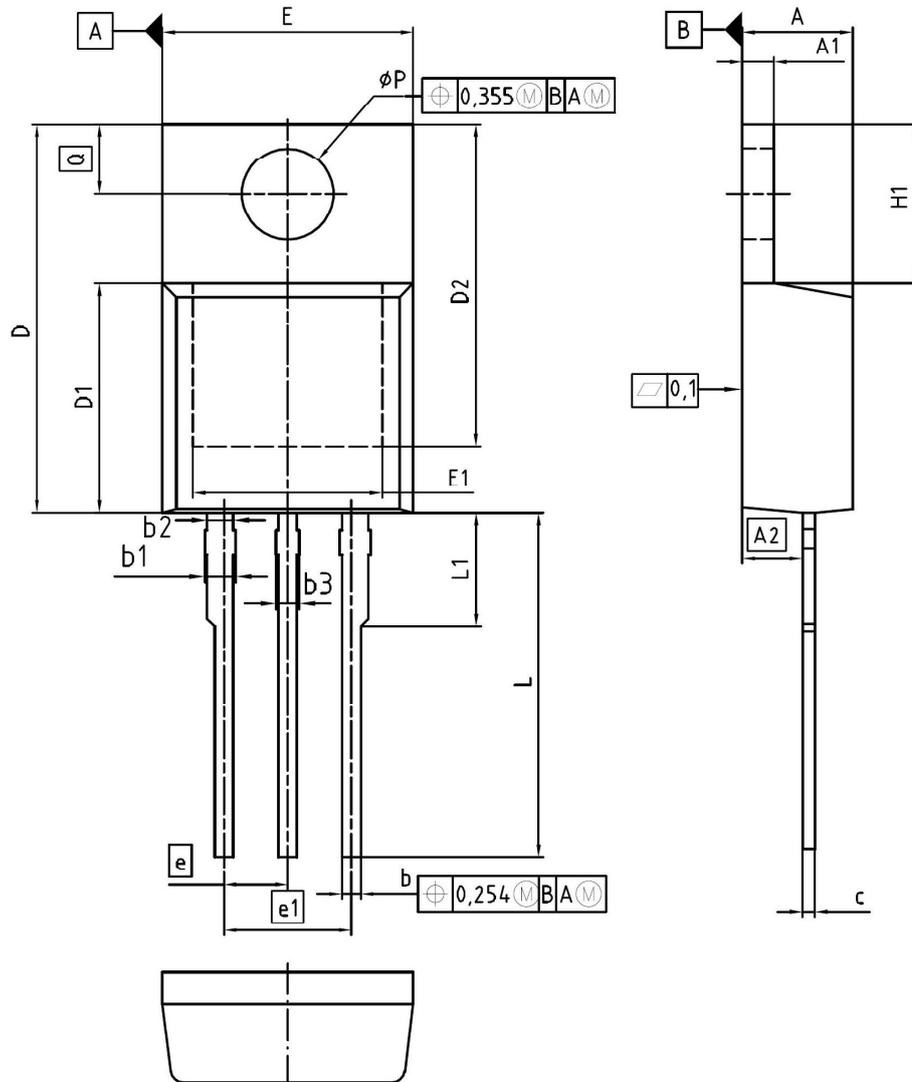


$V_{BR(DSS)}=f(T_j); I_D=1$  mA

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
φP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.  
Z8B00003318

SCALE

EUROPEAN PROJECTION

ISSUE DATE  
30-07-2009

REVISION  
06

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

## Revision History

IPP410N30N

**Revision: 2014-12-27, Rev. 2.0**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2014-12-27	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](mailto: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](http://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.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.