

# MOSFET

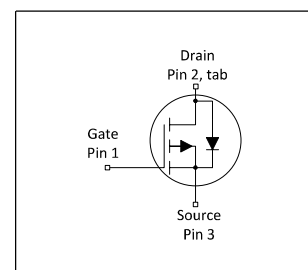
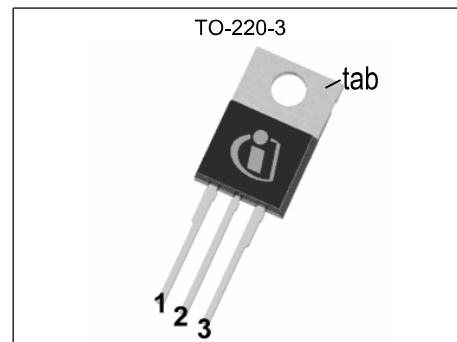
## OptiMOS™ Power-Transistor, -100 V

### Features

- P-channel
- 100% avalanche tested
- Normal level
- Enhancement mode
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

### Product validation

Fully qualified according to JEDEC for Industrial Applications



RoHS

**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	-100	V
$R_{DS(on),max}$	33	mΩ
$I_D$	-62	A
$Q_{oss}$	-66	nC
$Q_G$	-189	nC

Type / Ordering Code	Package	Marking	Related Links
IPP330P10NM	PG-TO220-3	330P10NM	-

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## 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>	$I_D$	-	-	-62 -44 -6.9	A	$V_{GS}=-10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=-10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=-10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=40\text{ °C/W}^{2)}$
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	-248	A	$T_A=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	1960	mJ	$I_D=-53\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	300 3.8	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=40\text{ °C/W}^{2)}$
Operating and storage temperature	$T_j$ , $T_{stg}$	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	0.5	°C/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area	$R_{thJA}$	-	-	40	°C/W	-
Thermal resistance, junction - ambient, minimal footprint <sup>2)</sup>	$R_{thJA}$	-	-	62	°C/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> 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.

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

<sup>4)</sup> See Diagram 13 for more detailed information

### 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	$V_{(BR)DSS}$	-100	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=-1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	-2.1	-3.0	-4.0	V	$V_{DS}=V_{GS}$ , $I_D=-5550\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-0.1 -10	-1.0 -100	$\mu\text{A}$	$V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	-10	-100	nA	$V_{GS}=-20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	27.1	33	m $\Omega$	$V_{GS}=-10\text{ V}$ , $I_D=-53\text{ A}$
Gate resistance	$R_G$	-	5.4	-	$\Omega$	-
Transconductance	$g_{fs}$	-	75	-	S	$ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=-53\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	8200	11000	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	580	750	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	110	190	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=-50\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-53\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	45.35	-	ns	$V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-53\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	155.05	-	ns	$V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-53\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	84.05	-	ns	$V_{DD}=-50\text{ V}$ , $V_{GS}=-10\text{ V}$ , $I_D=-53\text{ A}$ , $R_{G,ext}=1.6\text{ }\Omega$

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	-39	-	nC	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	-25	-	nC	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Gate to drain charge <sup>1)</sup>	$Q_{gd}$	-	-59	-89	nC	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Switching charge	$Q_{sw}$	-	-74	-	nC	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Gate charge total <sup>1)</sup>	$Q_g$	-	-189	-236	nC	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	-4.8	-	V	$V_{DD}=-50\text{ V}$ , $I_D=-53\text{ A}$ , $V_{GS}=0\text{ to }-10\text{ V}$
Output charge <sup>1)</sup>	$Q_{oss}$	-	-66	-88	nC	$V_{DS}=-50\text{ V}$ , $V_{GS}=0\text{ V}$

<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	$I_S$	-	-	-62	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	-248	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	-0.88	-1.2	V	$V_{GS}=0\text{ V}$ , $I_F=-53\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time <sup>1)</sup>	$t_{rr}$	-	110	220	ns	$V_R=-50\text{ V}$ , $I_F=-53\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>1)</sup>	$Q_{rr}$	-	557.58	1115.1	nC	$V_R=-50\text{ V}$ , $I_F=-53\text{ A}$ , $di_F/dt=-100\text{ A}/\mu\text{s}$

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

## 4 Electrical characteristics diagrams

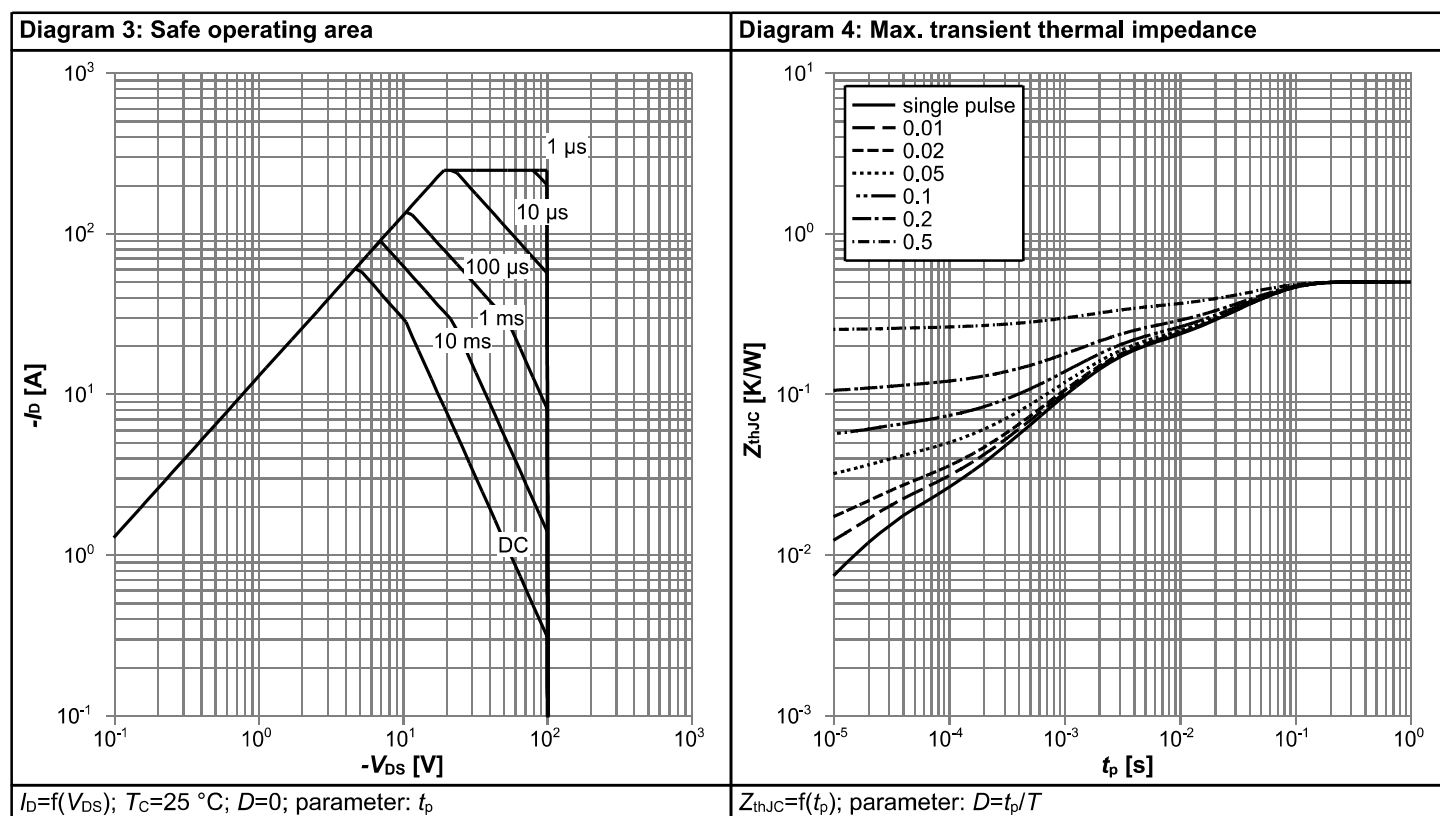
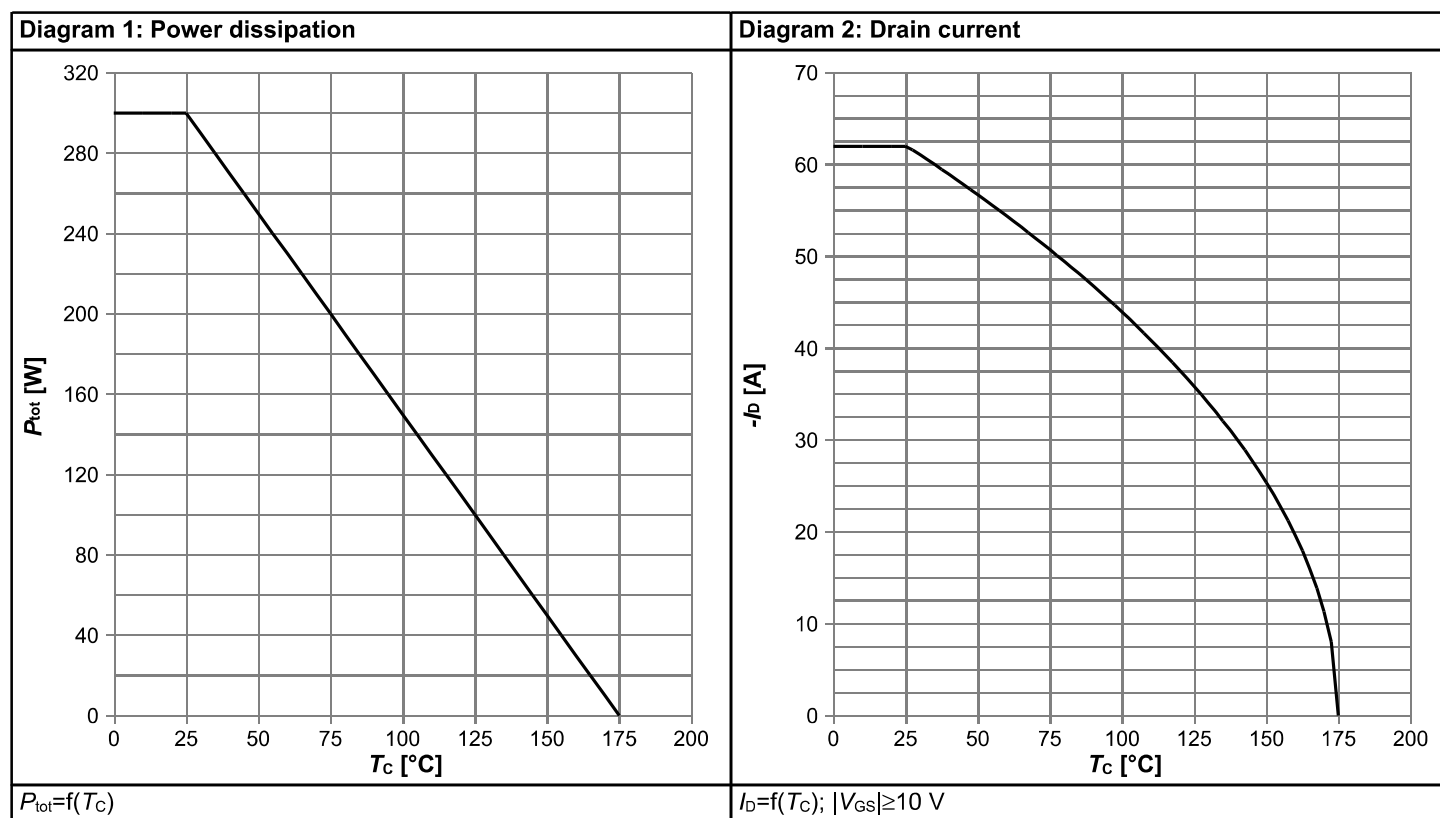
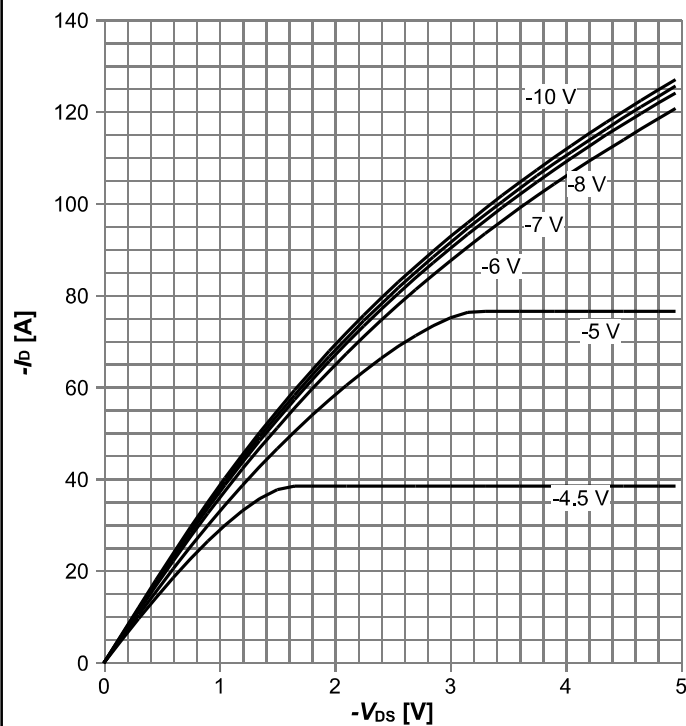
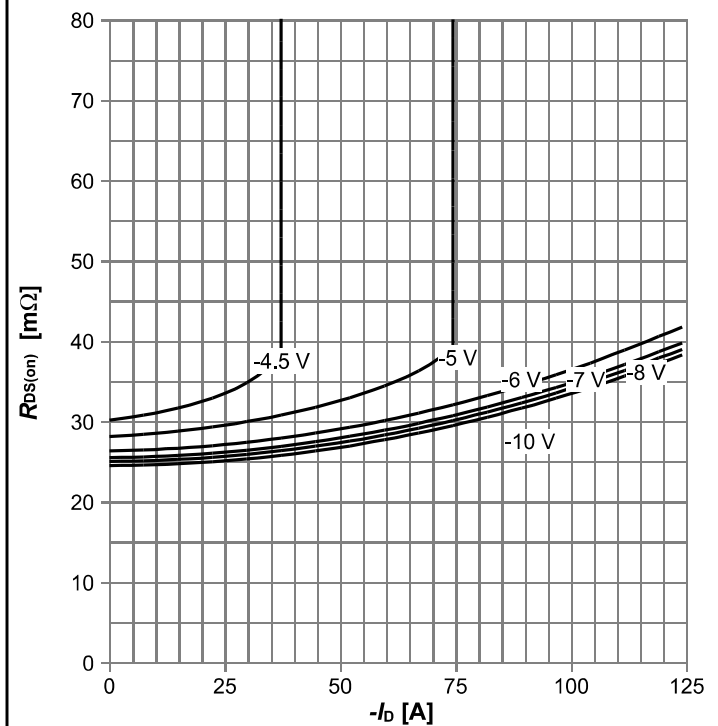


Diagram 5: Typ. output characteristics



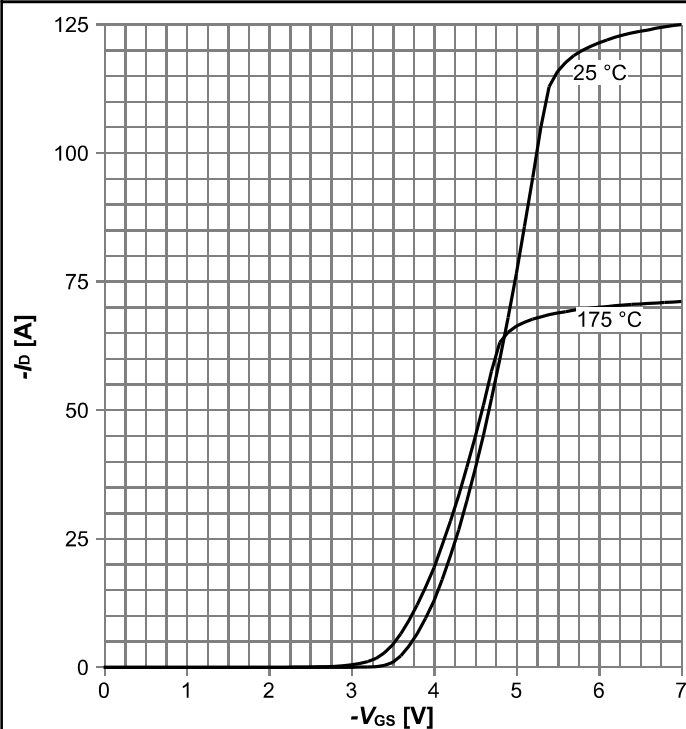
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



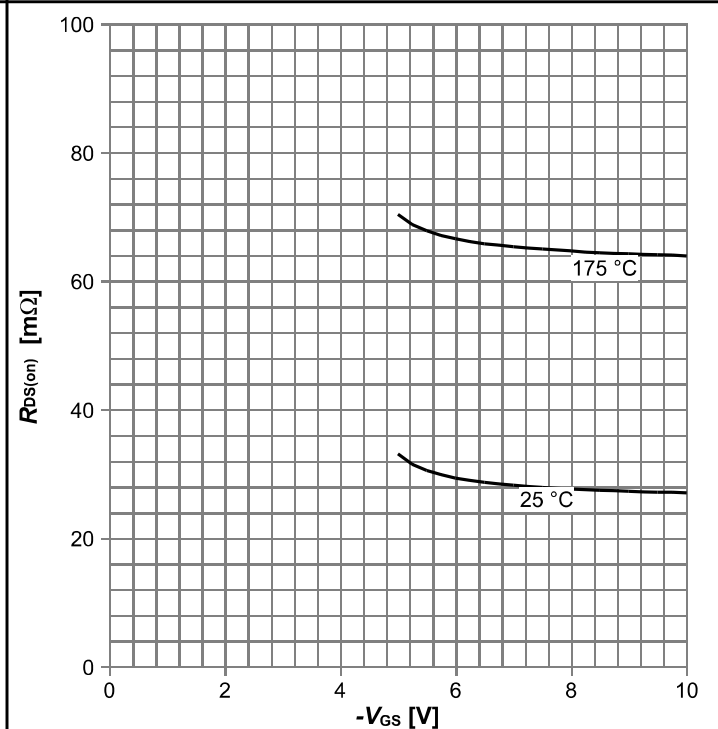
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



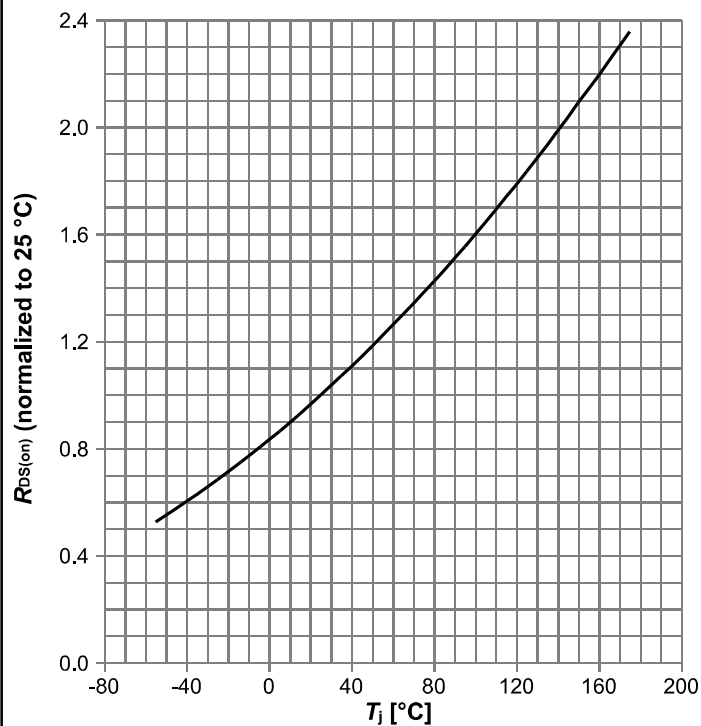
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



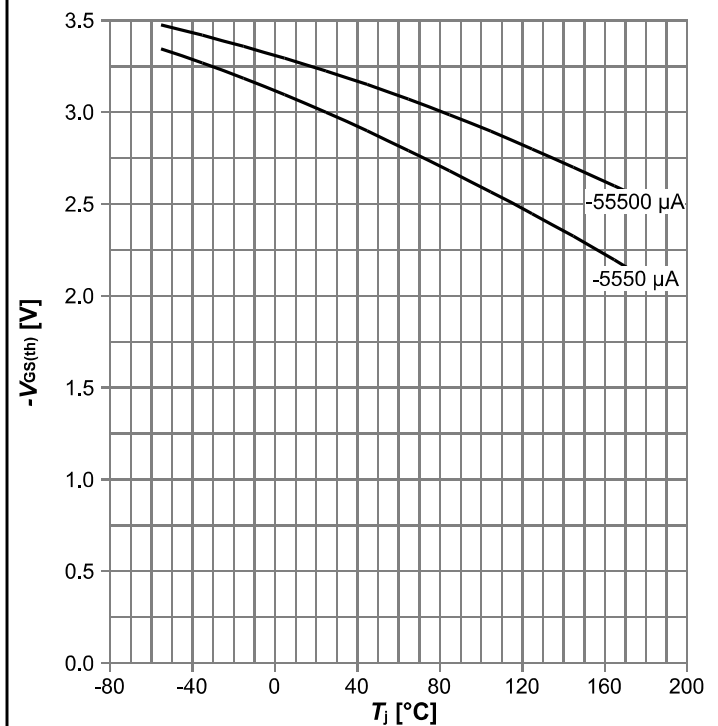
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = -53\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



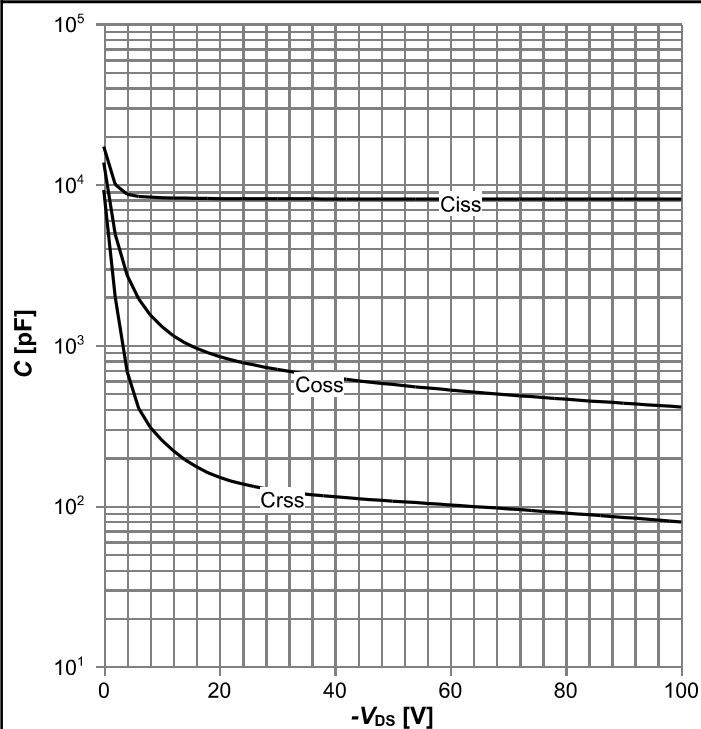
$R_{DS(on)} = f(T_j)$ ,  $I_D = -53$  A,  $V_{GS} = -10$  V

Diagram 10: Typ. gate threshold voltage



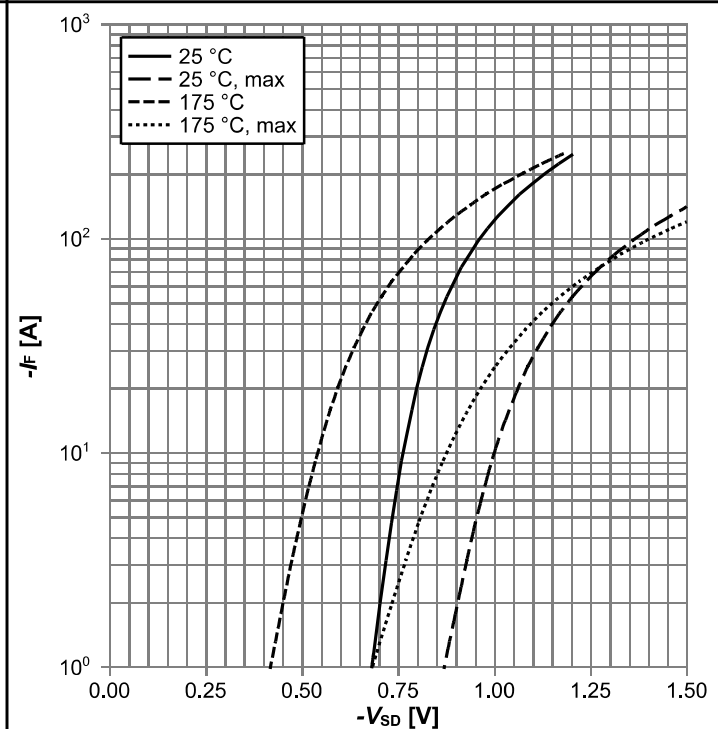
$V_{GS(th)} = f(T_j)$ ,  $V_{GS} = V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

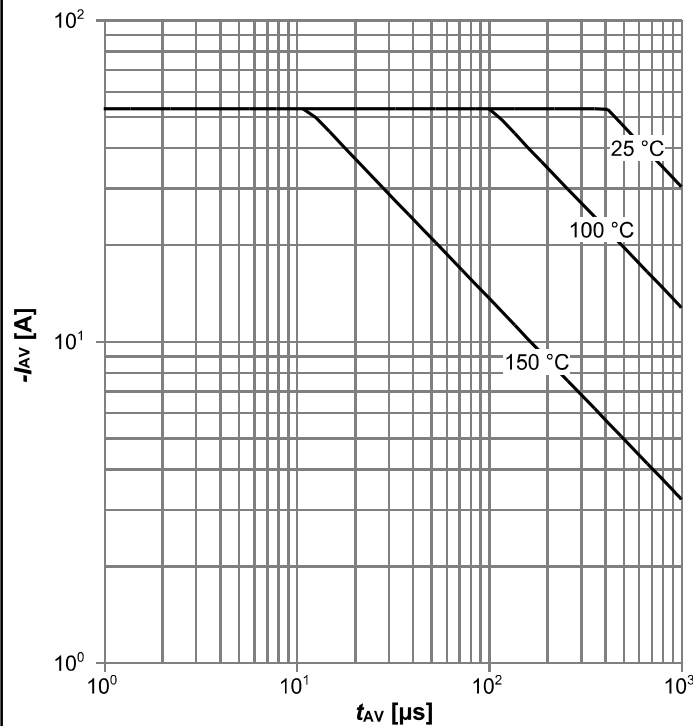
Diagram 12: Forward characteristics of reverse diode



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

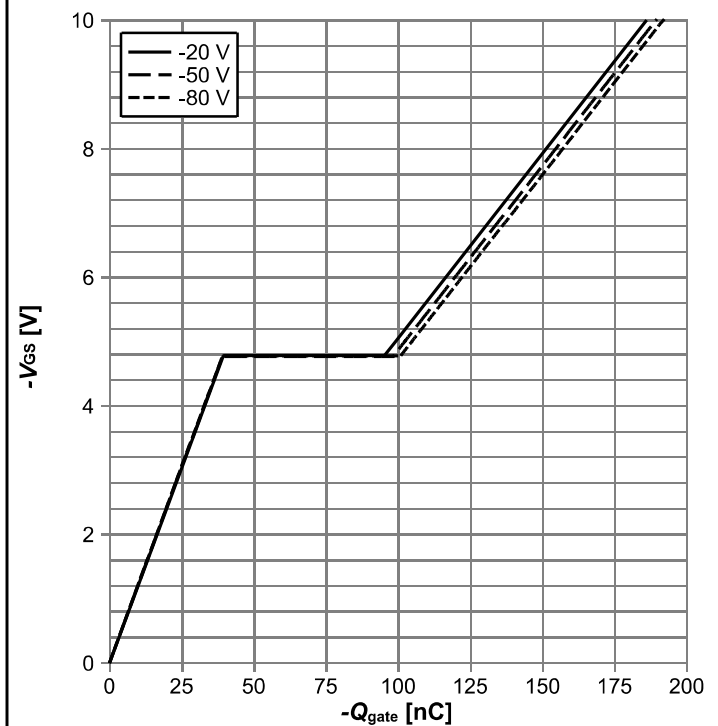


Diagram 13: Avalanche characteristics



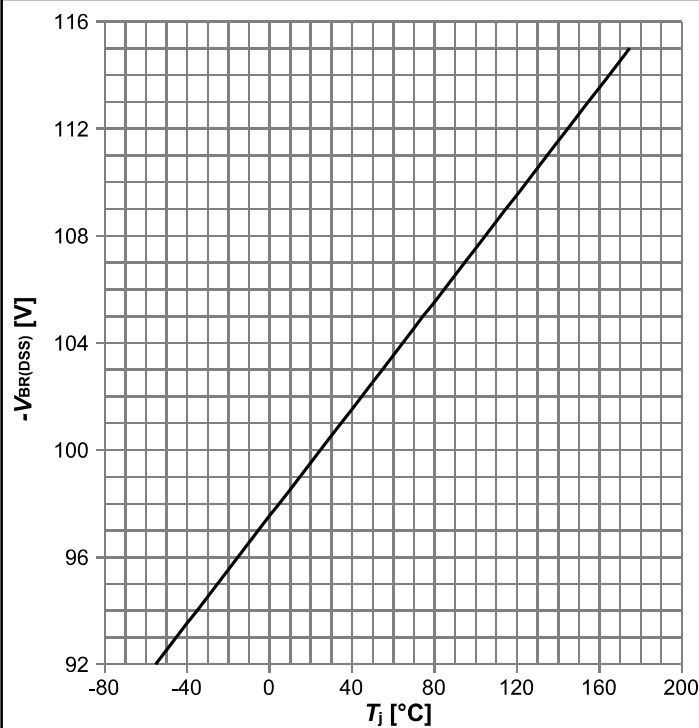
$I_{AS}=f(t_{AV})$ ;  $R_{GS}=25\ \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



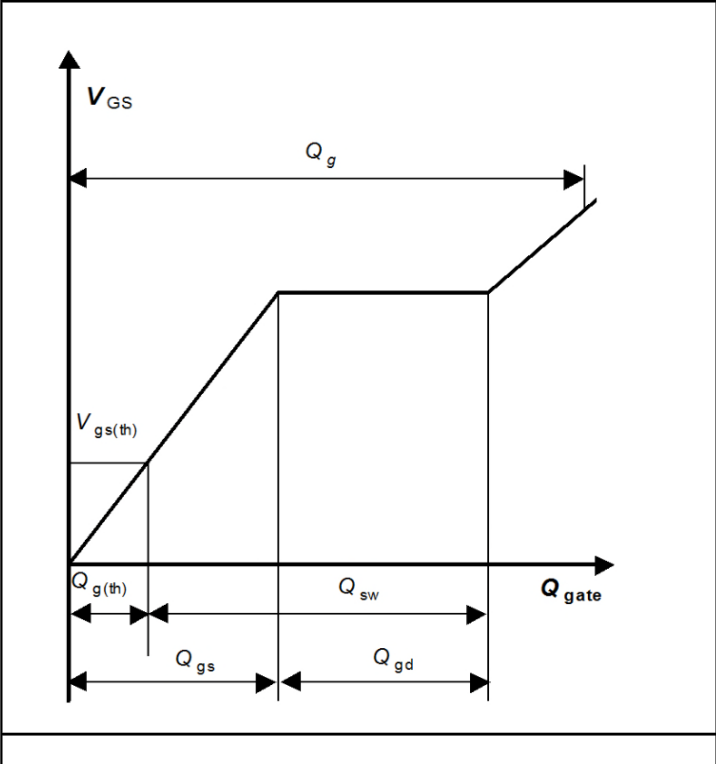
$V_{GS}=f(Q_{gate})$ ,  $I_D=-53\text{ A}$  pulsed,  $T_j=25\text{ °C}$ ; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage

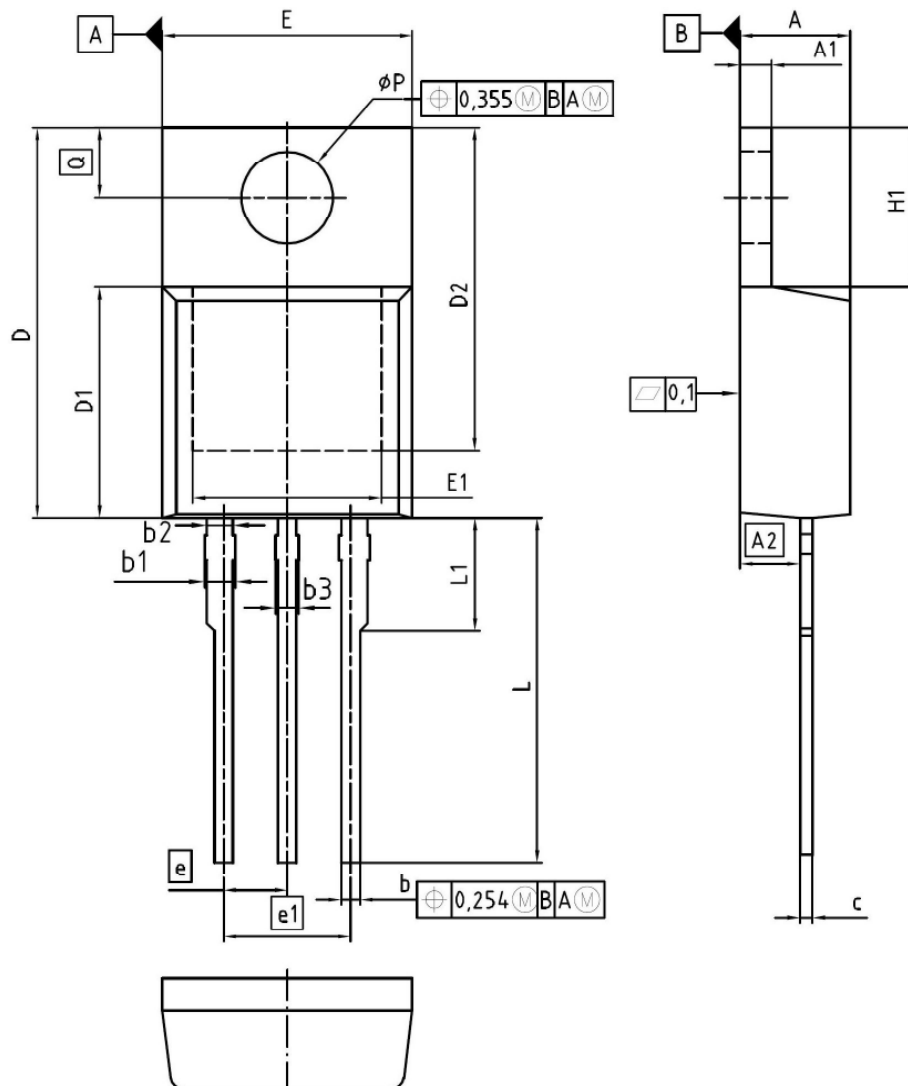


$V_{BR(DSS)}=f(T_j)$ ;  $I_D=-1\text{ mA}$

Diagram Gate charge waveforms



## 5 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

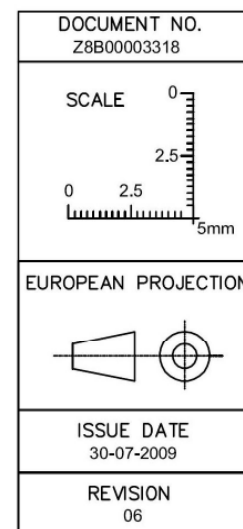


Figure 1 Outline PG-TO220-3, dimensions in mm/inches

## Revision History

IPP330P10NM

**Revision: 2021-05-10, Rev. 2.0**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-05-10	Release of final version

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