

## MOSFET

### StrongIRFET™ 2 Power-Transistor, 30 V

#### Features

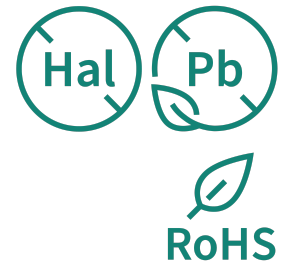
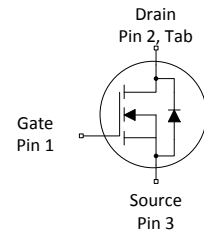
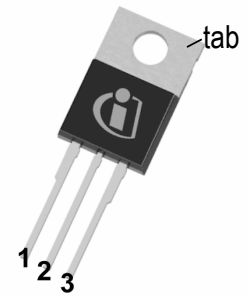
- Optimized for a wide range of applications
- N-channel, logic level
- 100% avalanche tested
- 175°C rated
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

#### Product validation

Qualified according to JEDEC Standard

**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	30	V
$R_{DS(on),max}$	2.35	mΩ
$I_D$	121	A
$Q_{oss}$	39	nC
$Q_g (0V..4.5V)$	24	nC



Type/Ordering Code	Package	Marking	Related Links
IPP023N03LF2S	PG-TO220-3	023N03F2	-



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## 1 Maximum ratings

unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	121 93 30	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>	$I_{D,pulse}$	-	-	484	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	176 352	mJ	$I_D=70\text{ A}, R_{GS}=25\text{ }\Omega$ $I_D=35\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	107 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	-

<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

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.4	°C/W	-
Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>5)</sup>	$R_{thJA}$	-	-	40	°C/W	-
Thermal resistance, junction - ambient, minimal footprint	$R_{thJA}$	-	-	62	°C/W	-

<sup>5)</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

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	$V_{GS}=0\text{ V}, I_D=2\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.35	1.85	2.35	V	$V_{DS}=V_{GS}, I_D=60\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1 10	1 100	$\mu\text{A}$	$V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ $V_{DS}=30\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$
Drain-source on-state resistance <sup>6)</sup>	$R_{DS(on)}$	-	2.0 2.4	2.35 3.5	m $\Omega$	$V_{GS}=10\text{ V}, I_D=70\text{ A}$ $V_{GS}=4.5\text{ V}, I_D=35\text{ A}$
Gate resistance	$R_G$	-	1.8	-	$\Omega$	-
Transconductance <sup>7)</sup>	$g_{fs}$	90	-	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}, I_D=70\text{ A}$

<sup>6)</sup>  $R_{DS(on)}$  is specified at a distance of 1.8 mm distance to the package body; mounting at a larger distance increases the overall package resistance of approximately 0.04 mOhm/mm per leg.

<sup>7)</sup> Defined by design. Not subject to production test.

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	3400	-	pF	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	660	-	pF	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	175	-	pF	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	21	-	ns	$V_{DD}=15\text{ V}, V_{GS}=4.5\text{ V}, I_D=70\text{ A},$ $R_{G,ext}=1.6\text{ }\Omega$
Rise time	$t_r$	-	57	-	ns	$V_{DD}=15\text{ V}, V_{GS}=4.5\text{ V}, I_D=70\text{ A},$ $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	16	-	ns	$V_{DD}=15\text{ V}, V_{GS}=4.5\text{ V}, I_D=70\text{ A},$ $R_{G,ext}=1.6\text{ }\Omega$
Fall time	$t_f$	-	9.3	-	ns	$V_{DD}=15\text{ V}, V_{GS}=4.5\text{ V}, I_D=70\text{ A},$ $R_{G,ext}=1.6\text{ }\Omega$

**Table 6 Gate charge characteristics <sup>8)</sup>**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	11	-	nC	$V_{DD}=15\text{ V}, I_D=70\text{ A}, V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	6.1	-	nC	$V_{DD}=15\text{ V}, I_D=70\text{ A}, V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	$Q_{gd}$	-	7.4	-	nC	$V_{DD}=15\text{ V}, I_D=70\text{ A}, V_{GS}=0\text{ to }4.5\text{ V}$

**Table 6 Gate charge characteristics** <sup>8)</sup>

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Switching charge	$Q_{sw}$	-	13	-	nC	$V_{DD}=15\text{ V}$ , $I_D=70\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>9)</sup>	$Q_g$	-	24	36	nC	$V_{DD}=15\text{ V}$ , $I_D=70\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	3.4	-	V	$V_{DD}=15\text{ V}$ , $I_D=70\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total <sup>9)</sup>	$Q_g$	-	50	75	nC	$V_{DD}=15\text{ V}$ , $I_D=70\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET <sup>9)</sup>	$Q_{g(sync)}$	-	21	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge <sup>9)</sup>	$Q_{oss}$	-	39	-	nC	$V_{DS}=15\text{ V}$ , $V_{GS}=0\text{ V}$

<sup>8)</sup> See "Gate charge waveforms" for parameter definition

<sup>9)</sup> Defined by design. Not subject to production test.

**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	$I_{S,pulse}$	-	-	484	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.86	1.0	V	$V_{GS}=0\text{ V}$ , $I_F=70\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time	$t_{rr}$	-	18	-	ns	$V_R=15\text{ V}$ , $I_F=70\text{ A}$ , $di_F/dt=500\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	51	-	nC	$V_R=15\text{ V}$ , $I_F=70\text{ A}$ , $di_F/dt=500\text{ A}/\mu\text{s}$

## 4 Electrical characteristics diagrams

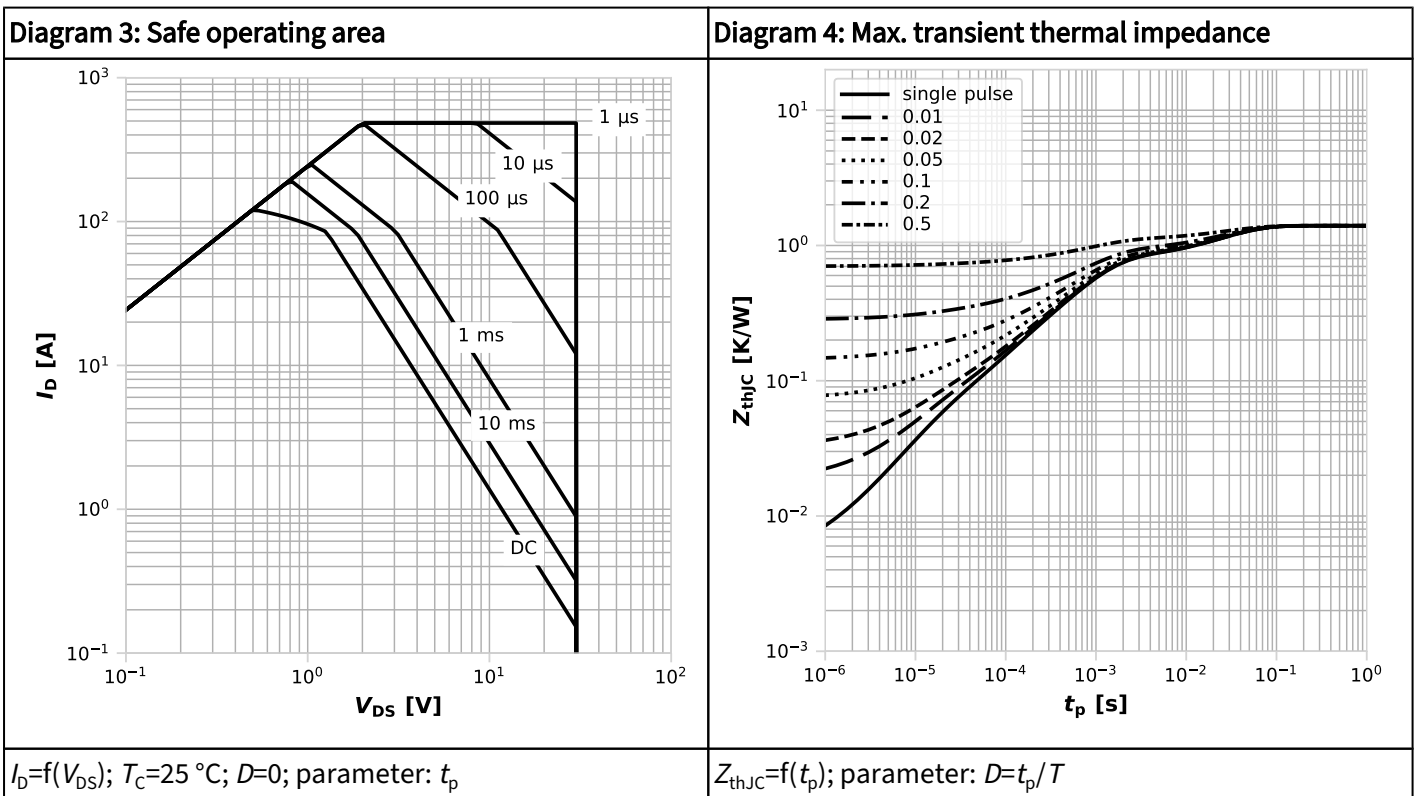
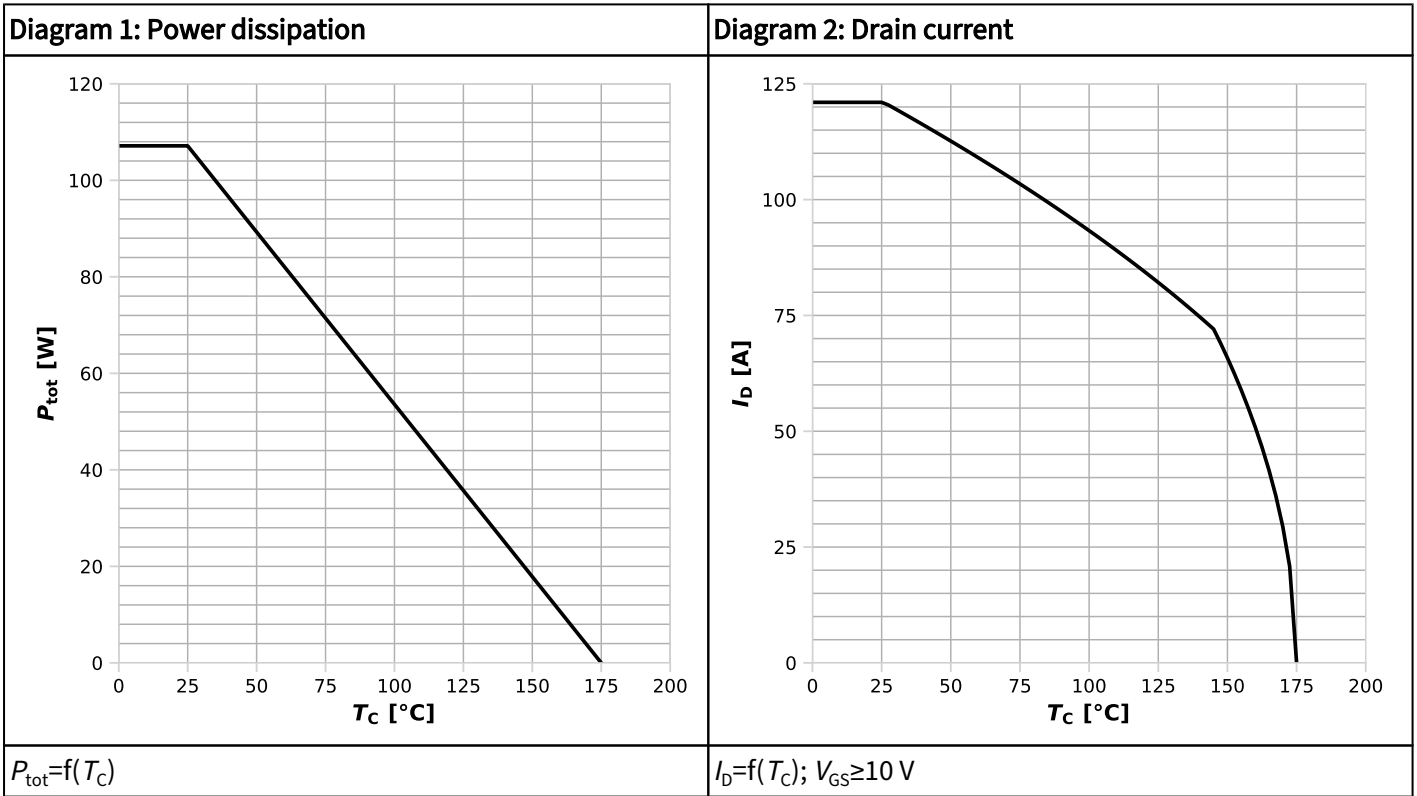
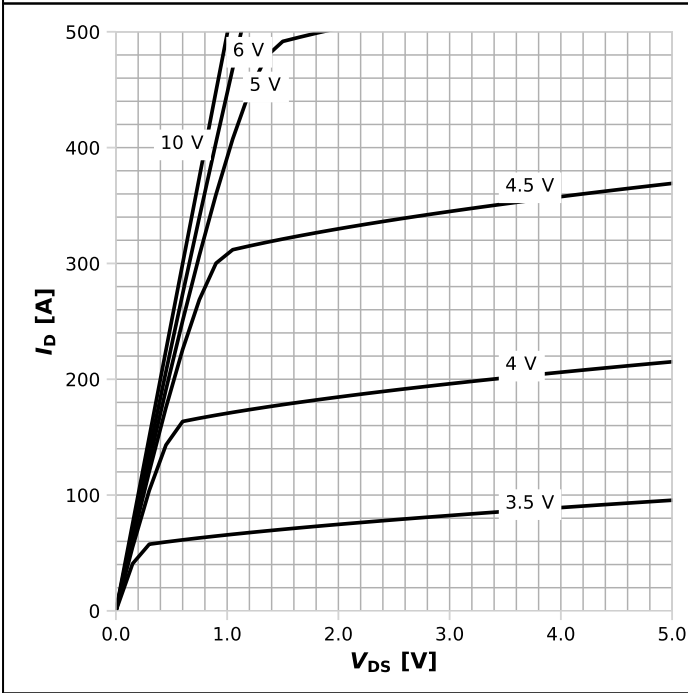
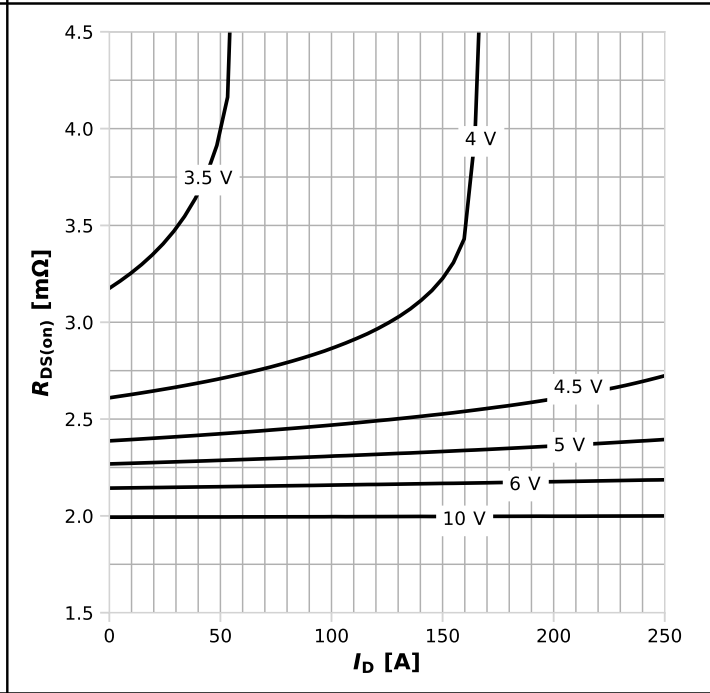


Diagram 5: Typ. output characteristics



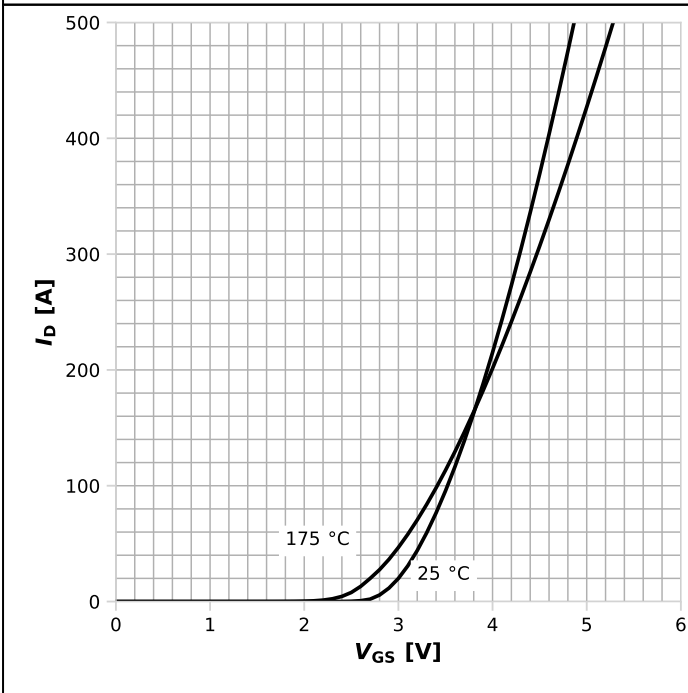
$I_D = f(V_{DS}), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



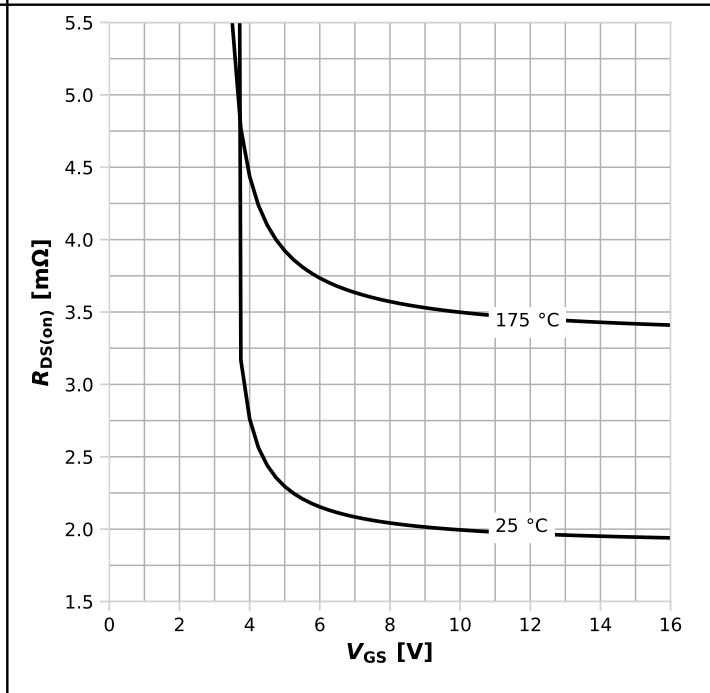
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



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

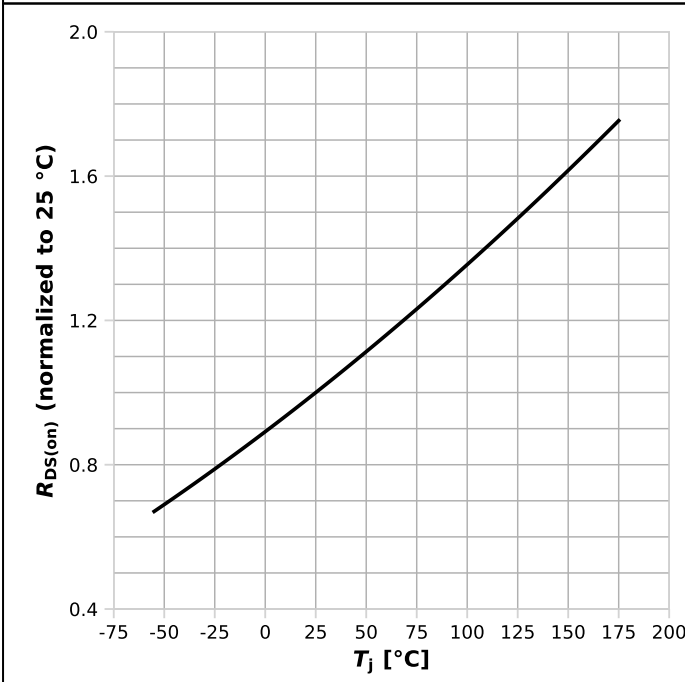
Diagram 8: Typ. drain-source on resistance



$R_{DS(on)} = f(V_{GS}), I_D = 70\text{ A};$  parameter:  $T_j$

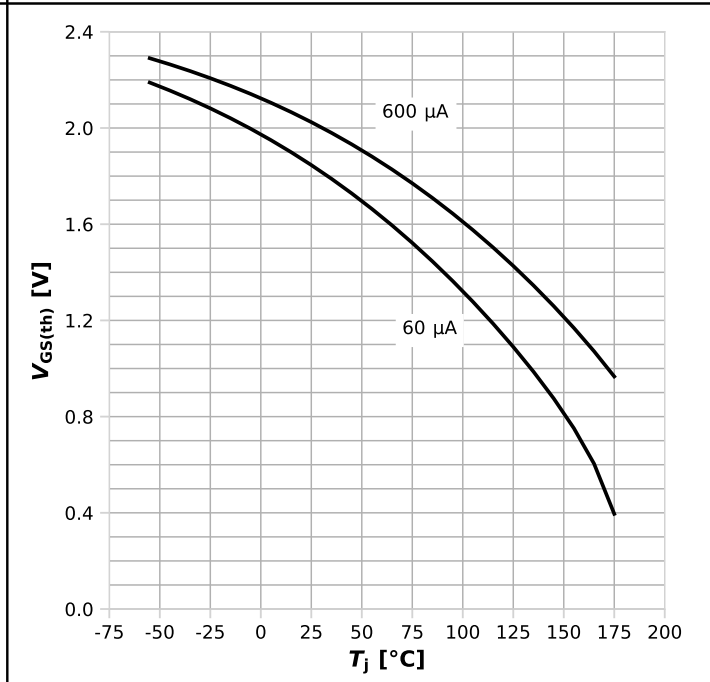


Diagram 9: Normalized drain-source on resistance



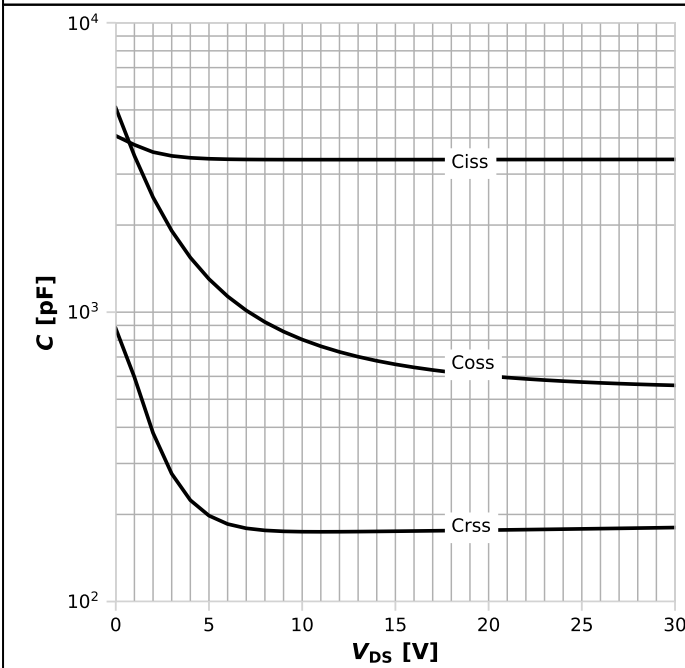
$R_{DS(on)}=f(T_j), I_D=70\text{ A}, V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



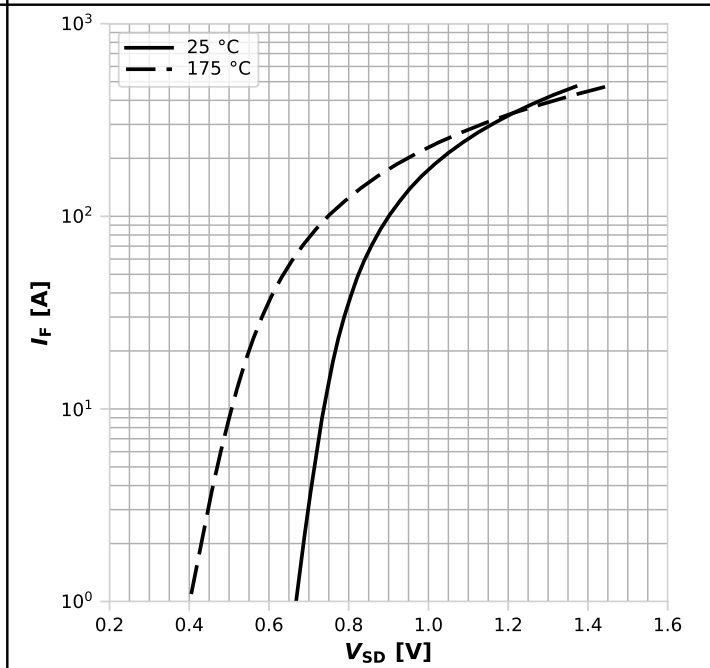
$V_{GS(th)}=f(T_j), V_{GS}=V_{DS}; \text{parameter: } I_D$

Diagram 11: Typ. capacitances



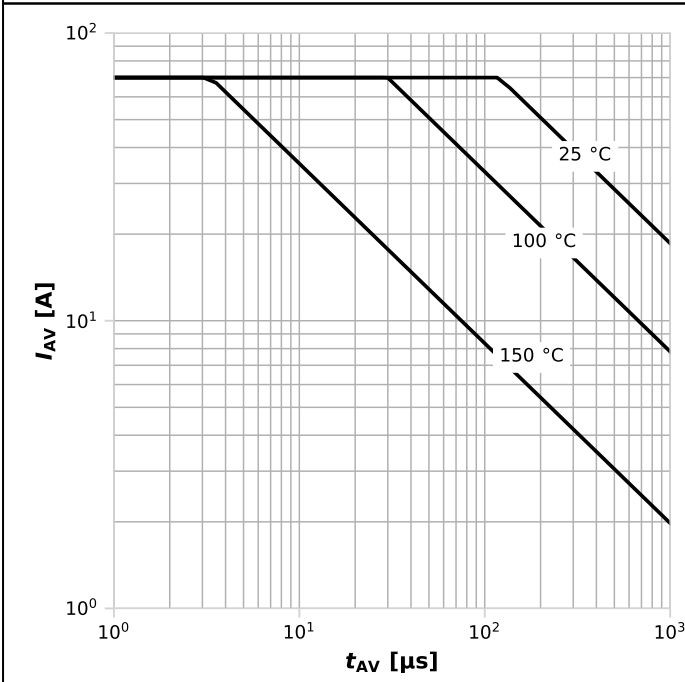
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



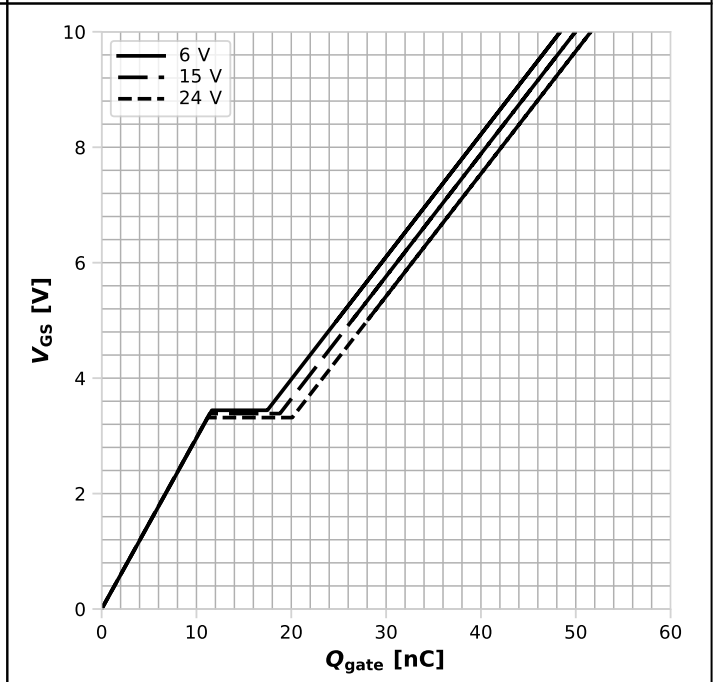
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



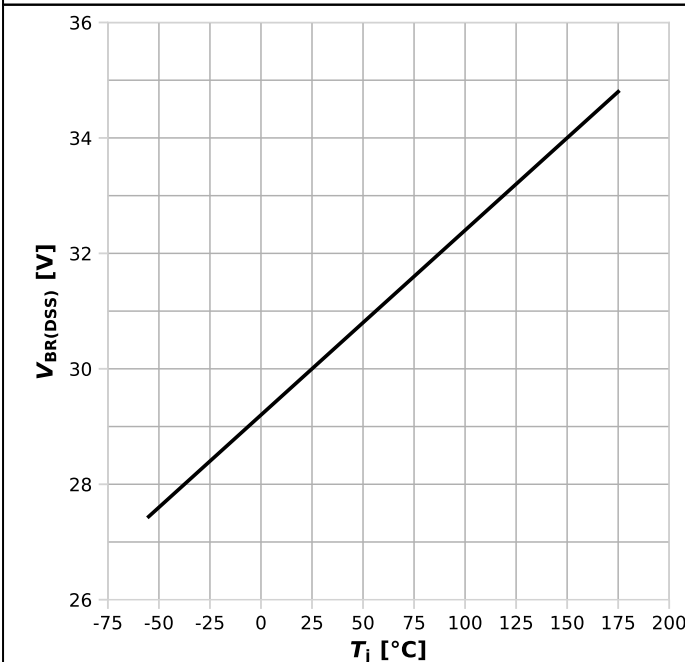
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$ ; parameter:  $T_{j,start}$

Diagram 14: Typ. gate charge



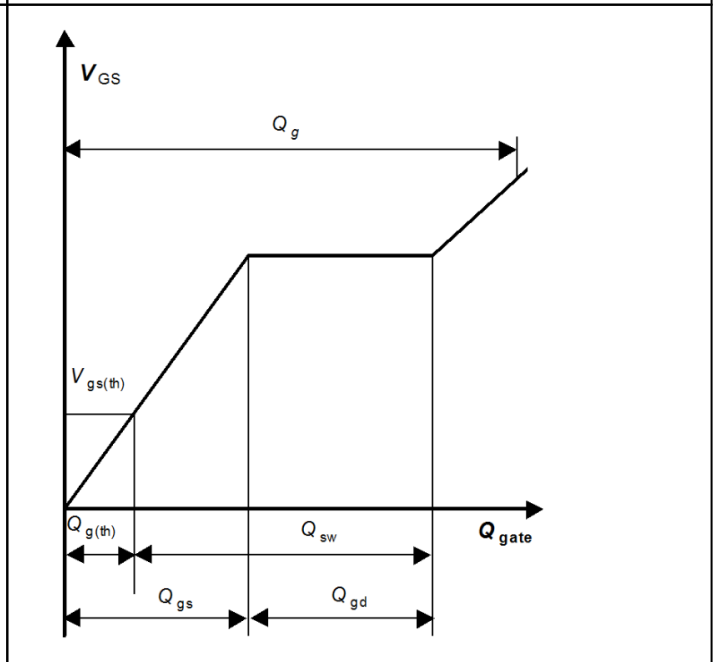
$V_{GS}=f(Q_{gate}), I_D=70$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

Diagram 15: Drain-source breakdown voltage



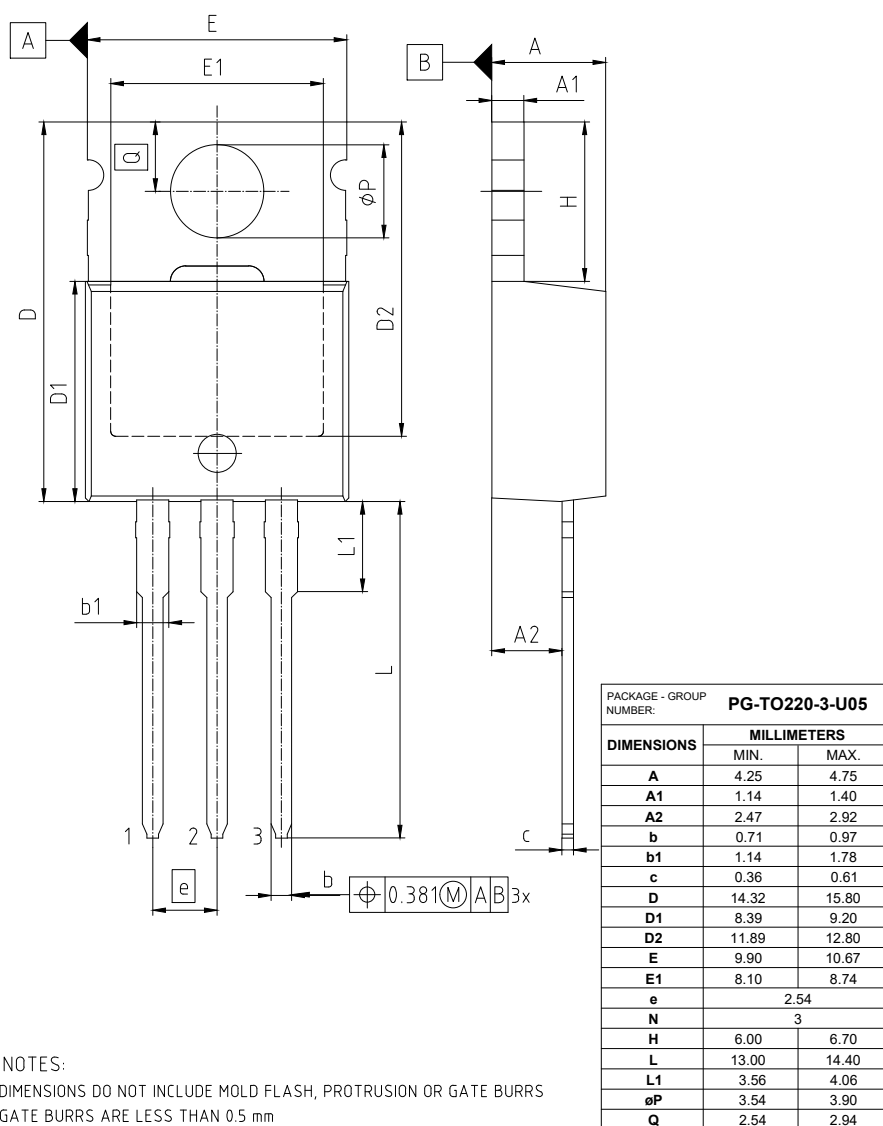
$V_{BR(DSS)}=f(T_j); I_D=2$  mA

Gate charge waveforms



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## 5 Package Outlines



**Figure 1 Outline PG-TO220-3, dimensions in mm**

## Revision History

IPP023N03LF2S

### Revision 2024-05-24, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2024-05-24	Release of final

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Published by Infineon Technologies AG

81726 München, Germany

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