

MOSFET

StrongIRFET™2 Power-Transistor, 30 V

Features

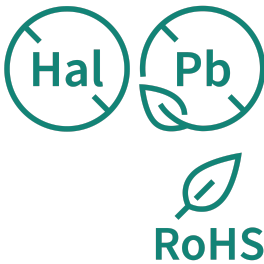
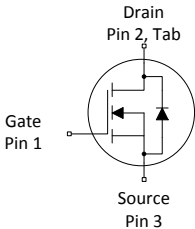
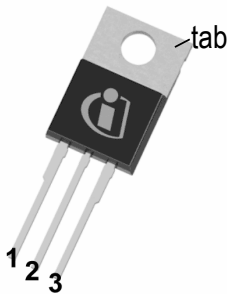
- Optimized for a wide range of applications
- N-channel, logic level
- 100% avalanche tested
- 175°C rated
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Qualified according to JEDEC Standard

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	30	V
$R_{DS(on),max}$	2.05	mΩ
I_D	125	A
Q_{oss}	54	nC
$Q_G(0V..4.5V)$	33	nC



Type/Ordering Code	Package	Marking	Related Links
IPP020N03LF2S	PG-TO220-3	020N03F2	-



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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 ¹⁾	I_D	-	-	125 97 33	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 ³⁾	$I_{D,pulse}$	-	-	500	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse ⁴⁾	E_{AS}	-	-	338 676	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}	-	-	136 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	-

¹⁾ 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.

²⁾ 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.

³⁾ See Diagram 3 for more detailed information

⁴⁾ 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}	-	-	1.1	°C/W	-
Thermal resistance, junction - ambient, 6 cm ² cooling area ⁵⁾	R_{thJA}	-	-	40	°C/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	°C/W	-

⁵⁾ 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.

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	$V_{(BR)DSS}$	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	$V_{DS}=V_{GS}$, $I_D=80\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=30\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=30\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance ⁶⁾	$R_{DS(on)}$	-	1.76 2.1	2.05 3.0	m Ω	$V_{GS}=10\text{ V}$, $I_D=70\text{ A}$ $V_{GS}=4.5\text{ V}$, $I_D=35\text{ A}$
Gate resistance	R_G	-	2.3	-	Ω	-
Transconductance ⁷⁾	g_{fs}	100	-	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}$, $I_D=70\text{ A}$

⁶⁾ $R_{DS(on)}$ 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.

⁷⁾ 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}	-	4700	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	910	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	235	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	22	-	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	-	70	-	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	$t_{d(off)}$	-	28	-	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	-	13	-	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 ⁸⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	15	-	nC	$V_{DD}=15\text{ V}$, $I_D=70\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	8.6	-	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}	-	10	-	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 ⁸⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Switching charge	Q_{sw}	-	17	-	nC	$V_{DD}=15\text{ V}$, $I_D=70\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ⁹⁾	Q_g	-	33	50	nC	$V_{DD}=15\text{ V}$, $I_D=70\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	3.3	-	V	$V_{DD}=15\text{ V}$, $I_D=70\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ⁹⁾	Q_g	-	69	104	nC	$V_{DD}=15\text{ V}$, $I_D=70\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET ⁹⁾	$Q_{g(sync)}$	-	29	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge ⁹⁾	Q_{oss}	-	54	-	nC	$V_{DS}=15\text{ V}$, $V_{GS}=0\text{ V}$

⁸⁾ See "Gate charge waveforms" for parameter definition

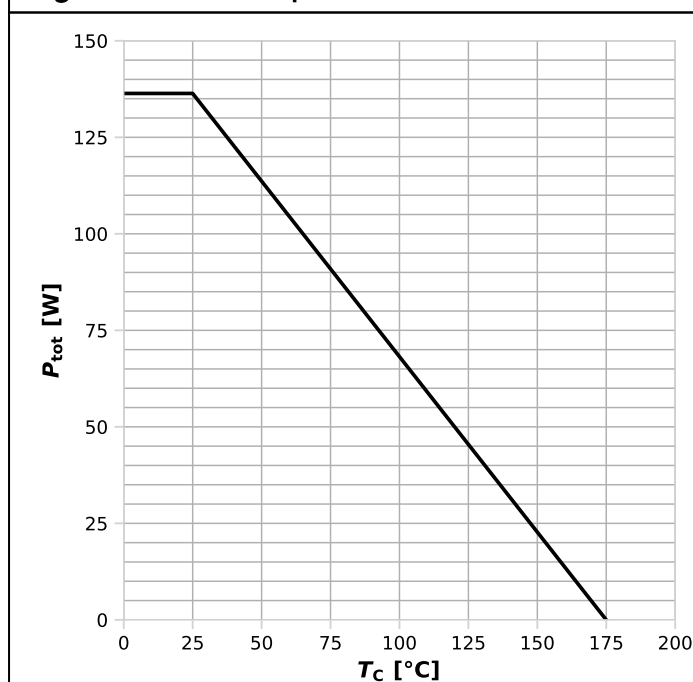
⁹⁾ Defined by design. Not subject to production test.

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	96	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	500	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.85	1.0	V	$V_{GS}=0\text{ V}$, $I_F=70\text{ A}$, $T_j=25\text{ °C}$
Reverse recovery time	t_{rr}	-	20	-	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}	-	63	-	nC	$V_R=15\text{ V}$, $I_F=70\text{ A}$, $di_F/dt=500\text{ A}/\mu\text{s}$

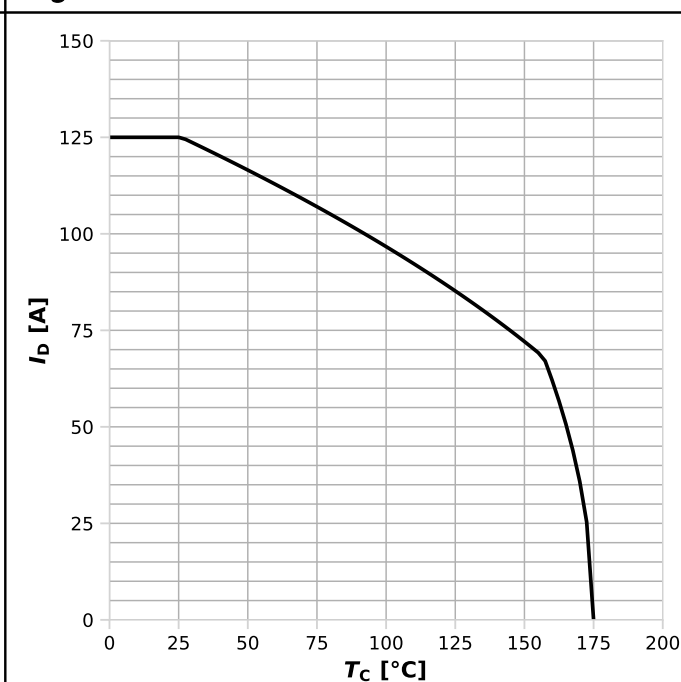
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



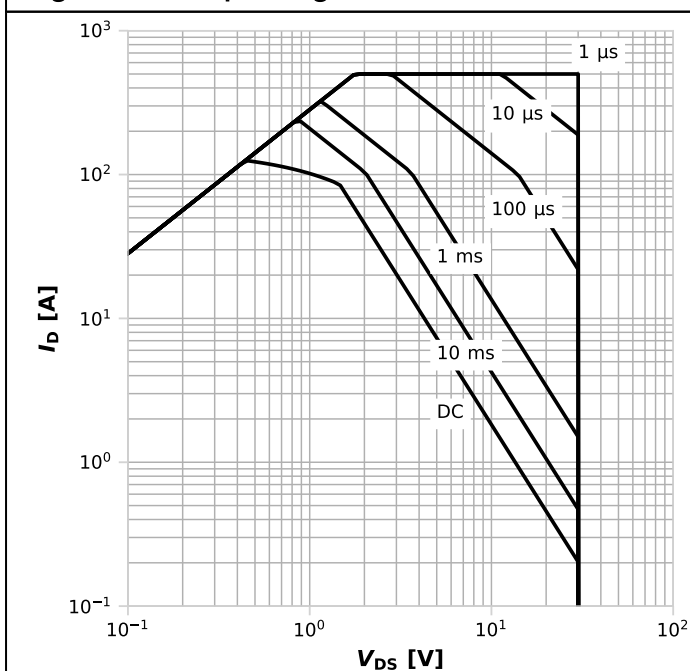
$$P_{tot}=f(T_c)$$

Diagram 2: Drain current



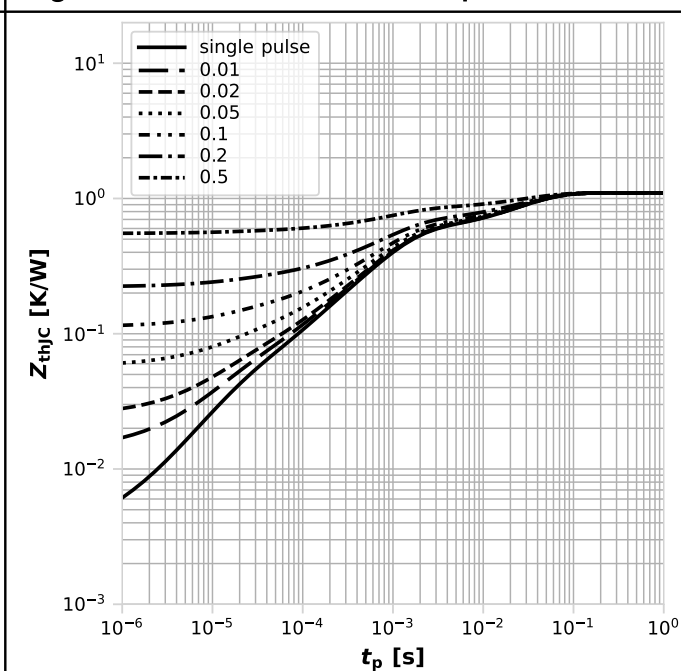
$$I_D=f(T_c); V_{GS} \geq 10 \text{ V}$$

Diagram 3: Safe operating area



$$I_D=f(V_{DS}); T_c=25^\circ\text{C}; D=0; \text{parameter: } t_p$$

Diagram 4: Max. transient thermal impedance



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

Diagram 5: Typ. output characteristics

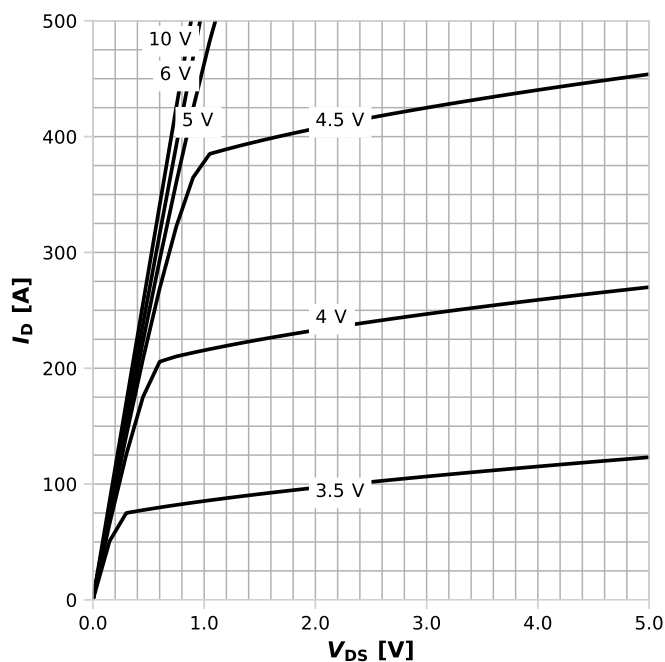

 $I_D = f(V_{DS}), T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance

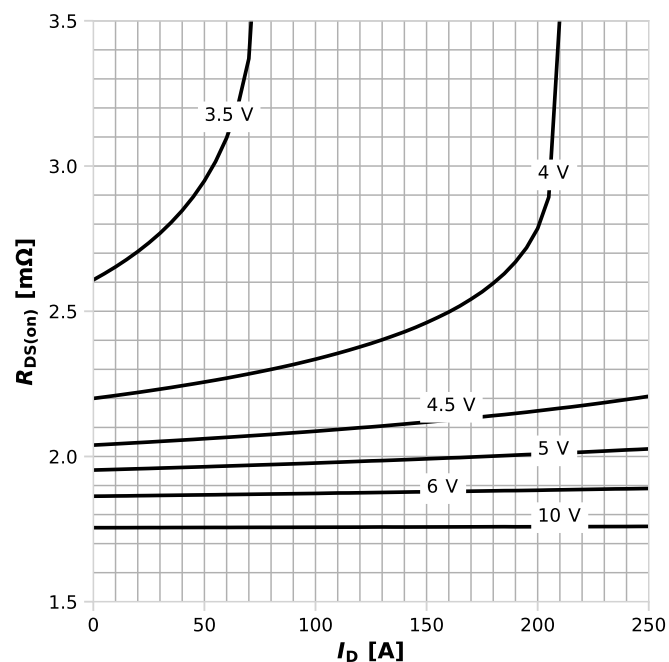

 $R_{DS(on)} = f(I_D), T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics

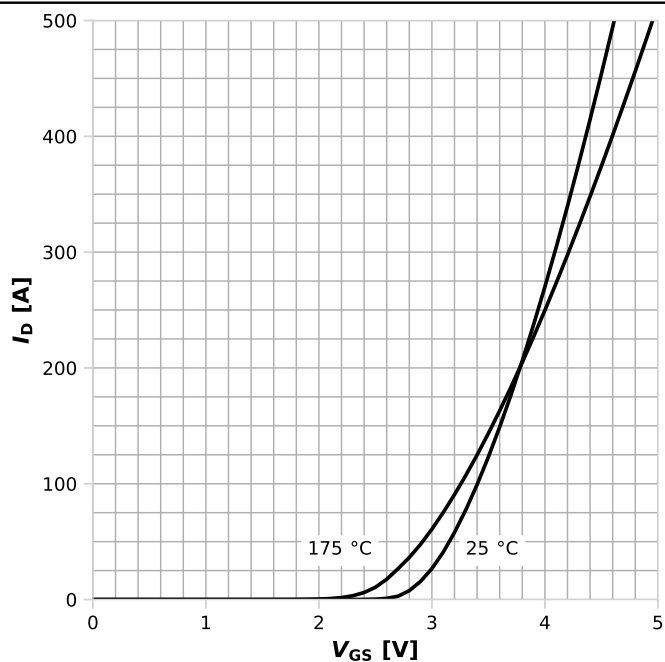

 $I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)\max}; \text{parameter: } T_j$

Diagram 8: Typ. drain-source on resistance

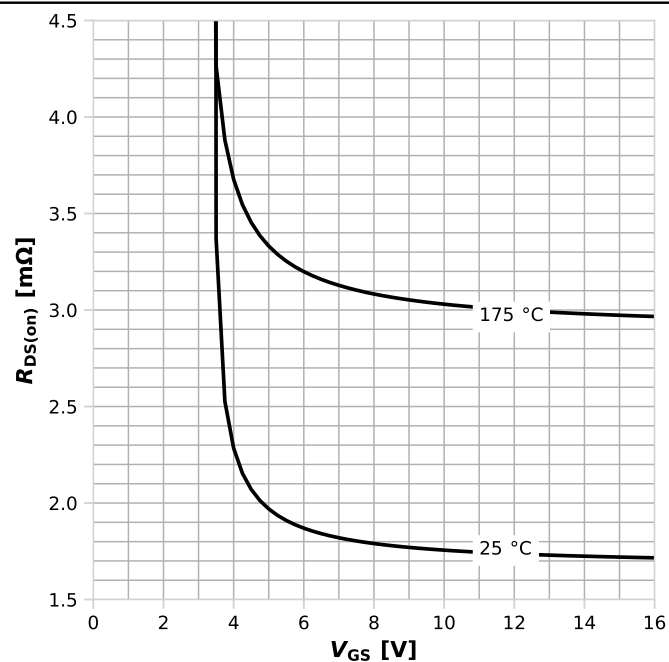
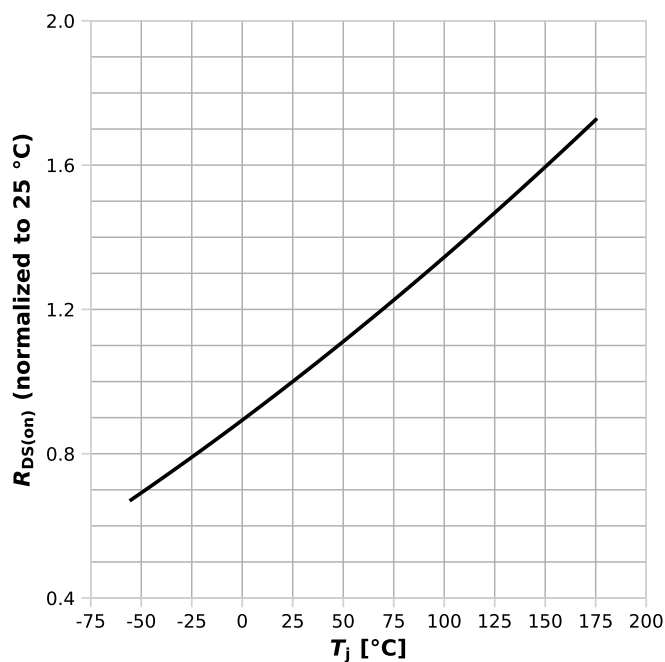
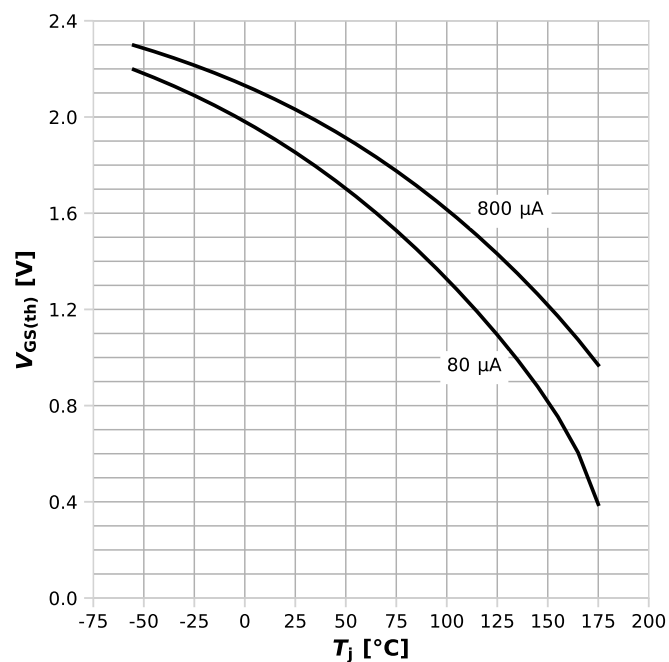

 $R_{DS(on)} = f(V_{GS}), I_D = 70 \text{ A}; \text{parameter: } T_j$

Diagram 9: Normalized drain-source on resistance



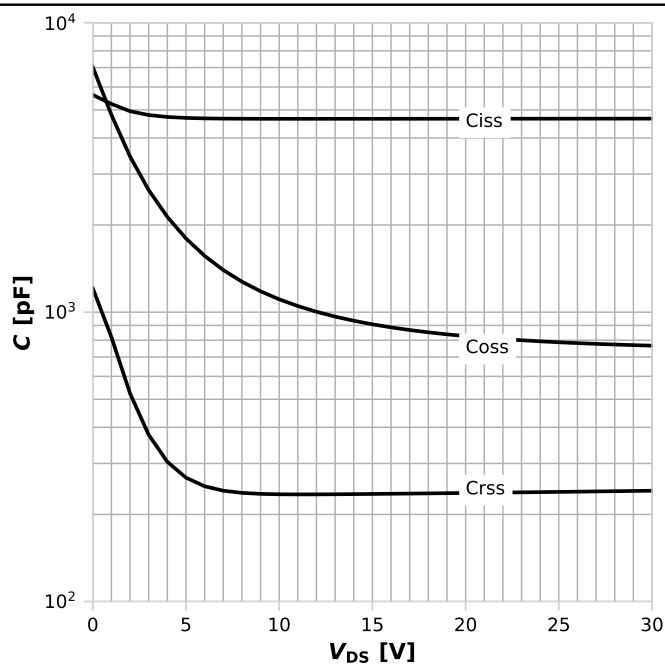
$$R_{DS(on)} = f(T_j), I_D = 70 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



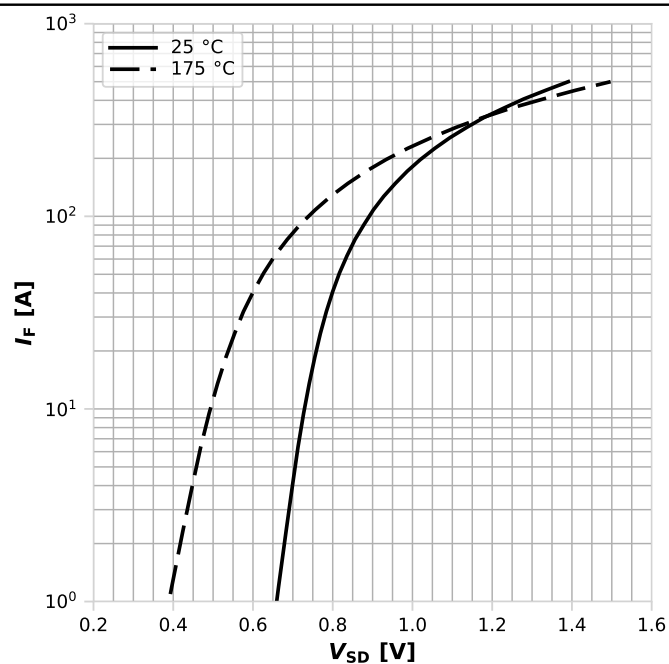
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances

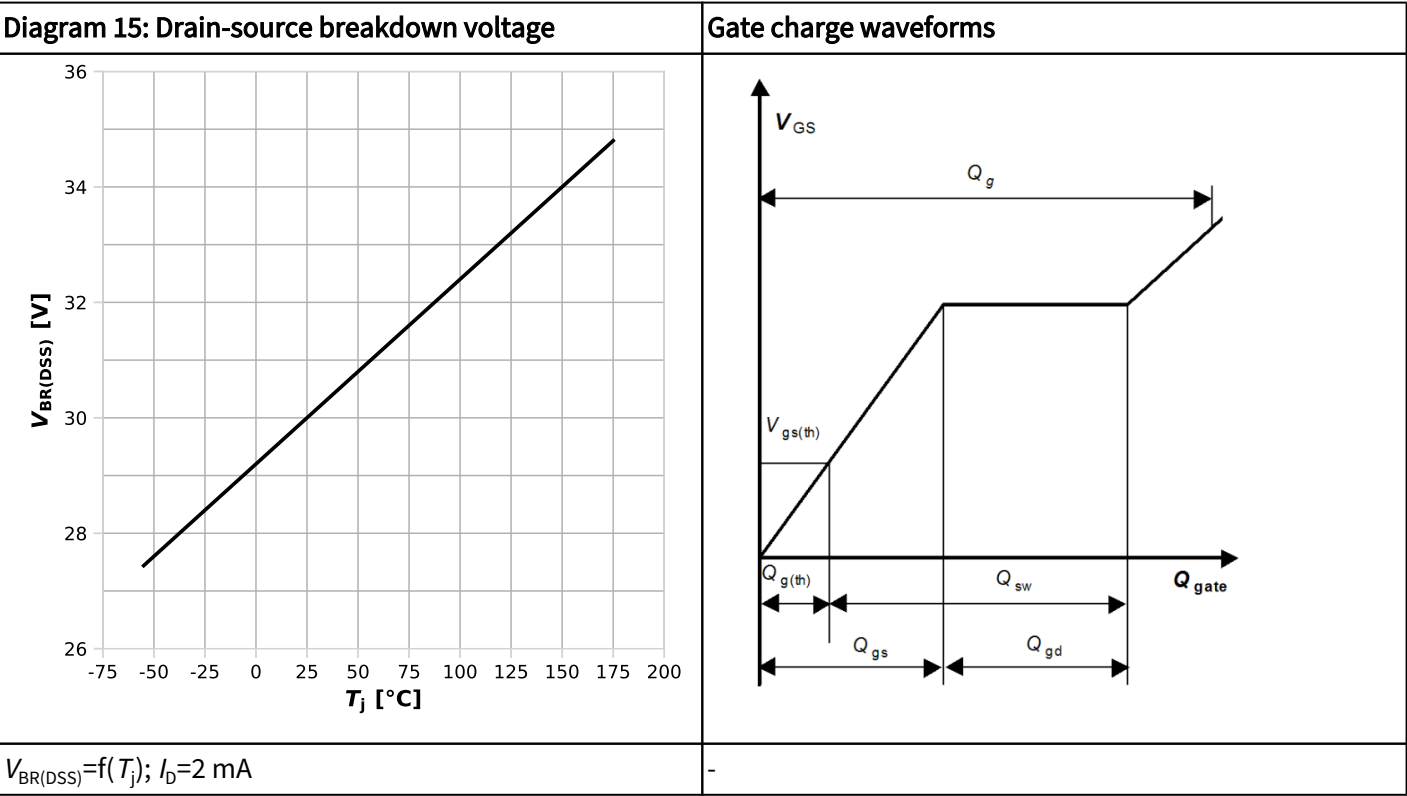
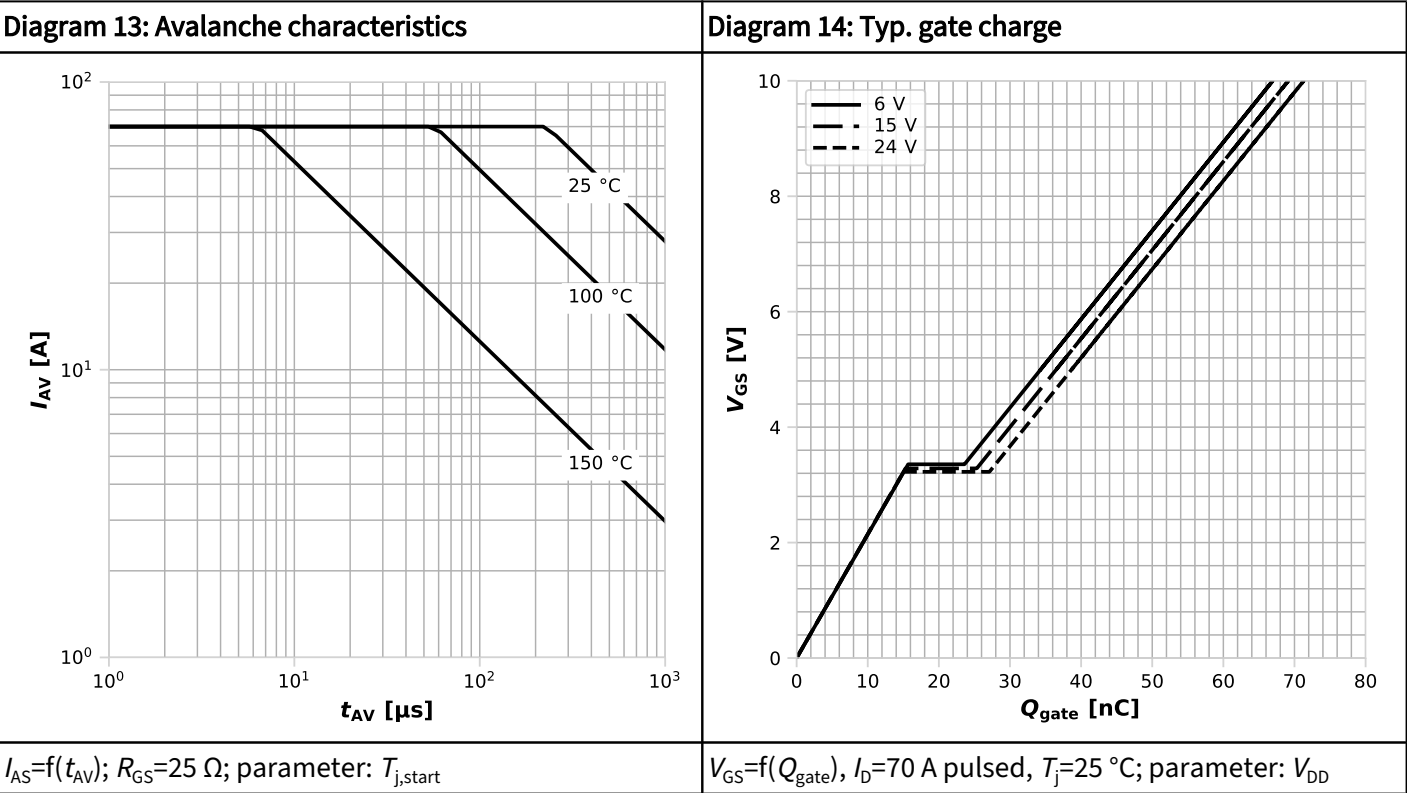


$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



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



5 Package Outlines

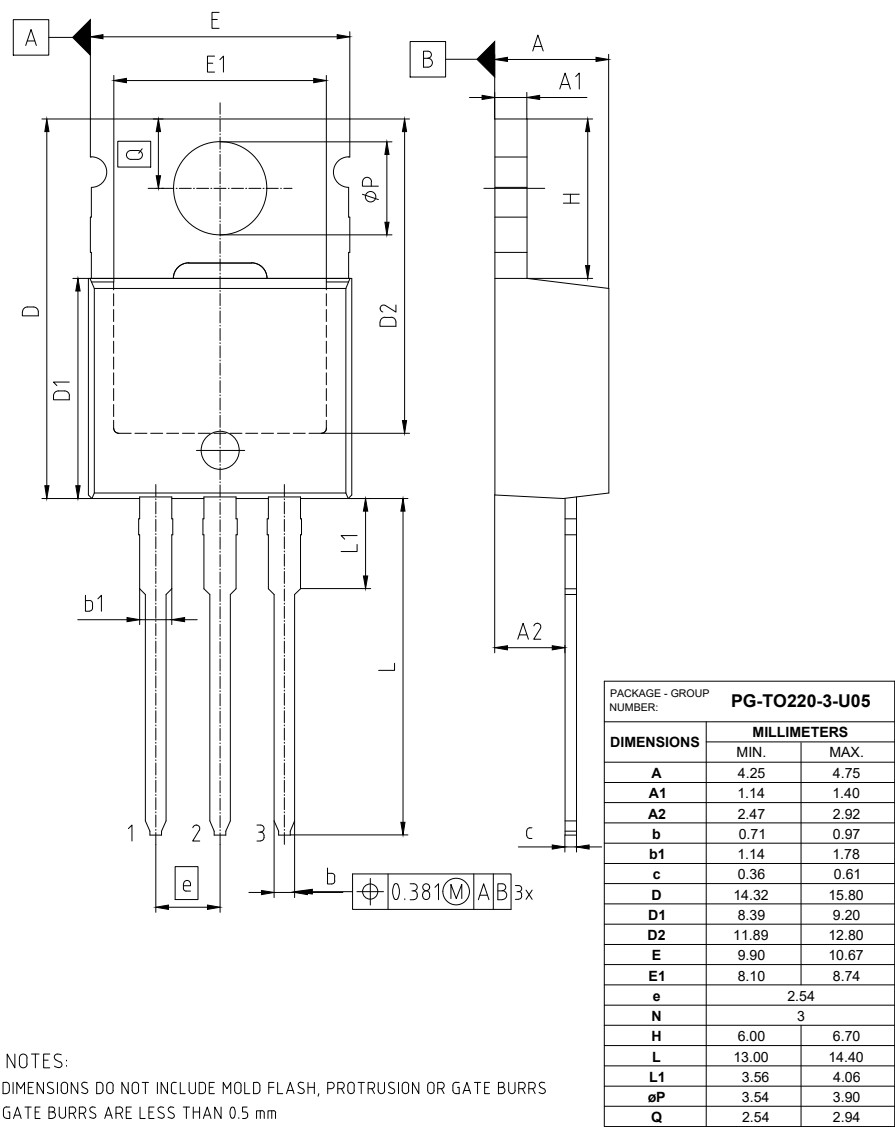


Figure 1 Outline PG-TO220-3, dimensions in mm

Revision History

IPP020N03LF2S

Revision 2024-05-29, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2024-05-24	Release of final
2.1	2024-05-29	Updated typo in Product Validation

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