

MOSFET

OptiMOS™ 6 Power-Transistor, 150 V

Features

- N-channel, normal level
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 100% avalanche tested
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- MSL 1 classified according to J-STD-020

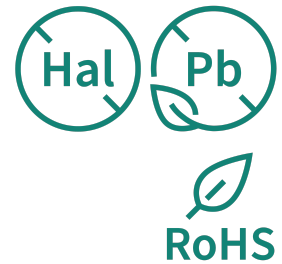
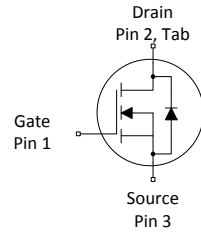
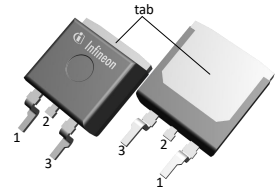
Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key performance parameters

Parameter	Value	Unit
V_{DS}	150	V
$R_{DS(on),max}$	5.1	m Ω
I_D	139	A
Q_{oss}	153	nC
Q_G	51	nC
Q_{rr} (500A/ μ s)	145	nC

D²PAK



Type / Ordering code	Package	Marking	Related links
IPB051N15NM6	PG-TO263-3	051N15N6	-



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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	-	-	139	A	$V_{GS}=10\text{ V}, T_C=25\text{ °C}$ $V_{GS}=10\text{ V}, T_C=100\text{ °C}$ $V_{GS}=8\text{ V}, T_C=100\text{ °C}$ $V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=40\text{ °C/W}$ ²⁾
				101		
				93		
				18		
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	556	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ⁴⁾	I_{AS}	-	-	58	A	
Avalanche energy, single pulse	E_{AS}	-	-	312	mJ	$I_D=44\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	234	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}, R_{thJA}=40\text{ °C/W}$ ²⁾
				3.8		
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}	-	-	0.64	°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	$V_{(BR)DSS}$	150	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	3.0	3.5	4.0	V	$V_{DS}=V_{GS}$, $I_D=131\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=120\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=120\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	4.1 4.5 5.1	4.8 5.1 6.0	m Ω	$V_{GS}=15\text{ V}$, $I_D=58\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=58\text{ A}$ $V_{GS}=8\text{ V}$, $I_D=29\text{ A}$
Gate resistance	R_G	-	0.93	1.4	Ω	-
Transconductance	g_{fs}	49	97	-	S	$ V_{DS} \geq 2 I_D $, $R_{DS(on)max}$, $I_D=58\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance ⁶⁾	C_{iss}	-	3600	4700	pF	$V_{GS}=0\text{ V}$, $V_{DS}=75\text{ V}$, $f=1\text{ MHz}$
Output capacitance ⁶⁾	C_{oss}	-	1100	1400	pF	
Reverse transfer capacitance ⁶⁾	C_{rss}	-	16	28	pF	
Turn-on delay time	$t_{d(on)}$	-	15	-	ns	$V_{DD}=75\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=29\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	10	-	ns	
Turn-off delay time	$t_{d(off)}$	-	23	-	ns	
Fall time	t_f	-	11	-	ns	

⁶⁾ Defined by design. Not subject to production test.

Table 6 Gate charge characteristics ⁷⁾

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge ⁸⁾	Q_{gs}	-	19.7	26	nC	$V_{DD}=75\text{ V}$, $I_D=29\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	12.8	-	nC	
Gate to drain charge ⁸⁾	Q_{gd}	-	11.8	17.7	nC	
Switching charge	Q_{sw}	-	18.7	-	nC	
Gate charge total ⁸⁾	Q_g	-	51	64	nC	
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	
Gate charge total, sync. FET	$Q_{g(sync)}$	-	43	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ⁸⁾	Q_{oss}	-	153	203	nC	$V_{DS}=75\text{ V}$, $V_{GS}=0\text{ V}$

⁷⁾ See "Gate charge waveforms" for parameter definition

⁸⁾ 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	-	-	139	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	556	A	
Diode forward voltage	V_{SD}	-	0.87	1.0	V	$V_{GS}=0\text{ V}$, $I_F=58\text{ A}$, $T_j=25\text{ °C}$
Reverse recovery time ⁹⁾	t_{rr}	-	35	70	ns	$V_R=75\text{ V}$, $I_F=29\text{ A}$, $di_F/dt=500\text{ A}/\mu\text{s}$
Reverse recovery charge ⁹⁾	Q_{rr}	-	145	290	nC	
Reverse recovery time ⁹⁾	t_{rr}	-	30	60	ns	$V_R=75\text{ V}$, $I_F=29\text{ A}$, $di_F/dt=1000\text{ A}/\mu\text{s}$
Reverse recovery charge ⁹⁾	Q_{rr}	-	242	484	nC	

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

4 Electrical characteristics diagrams

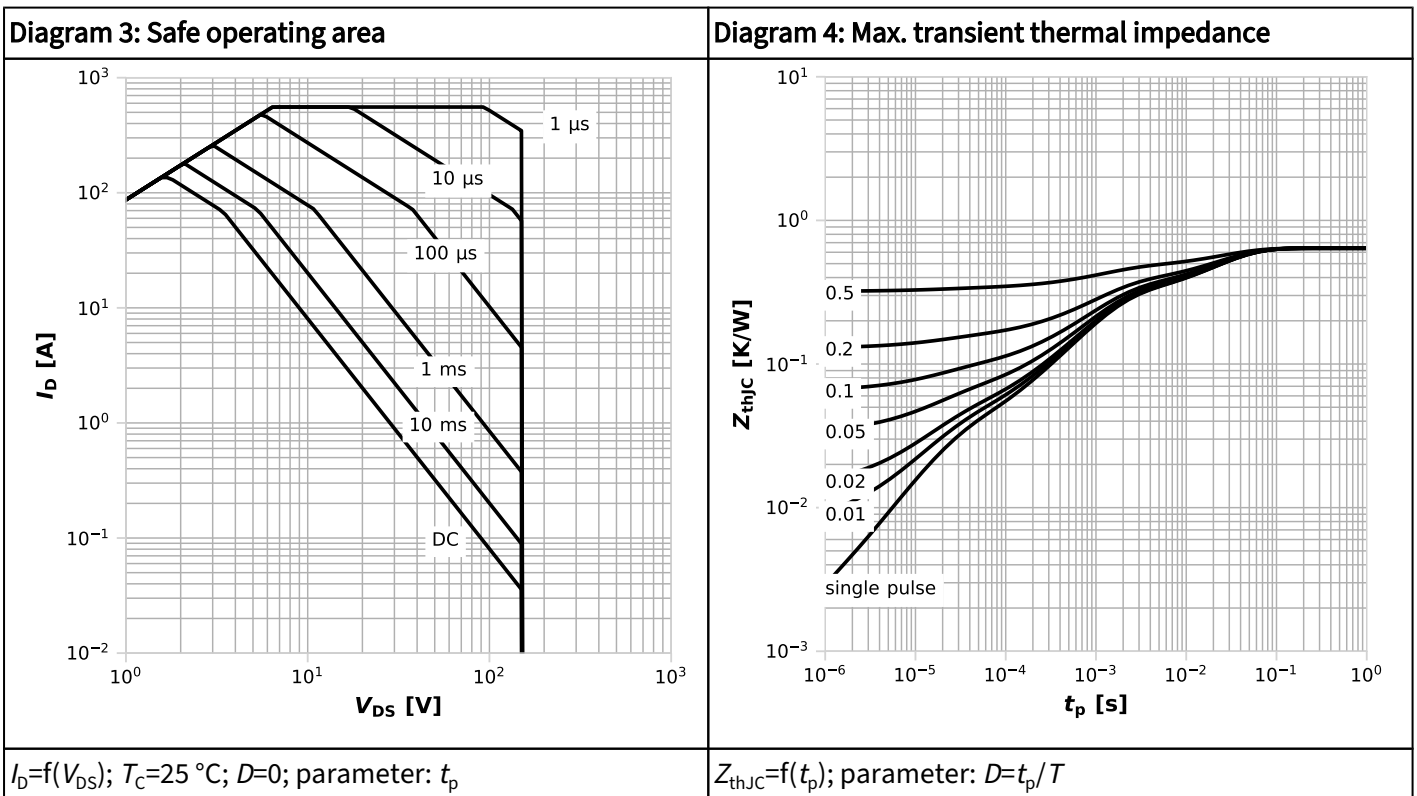
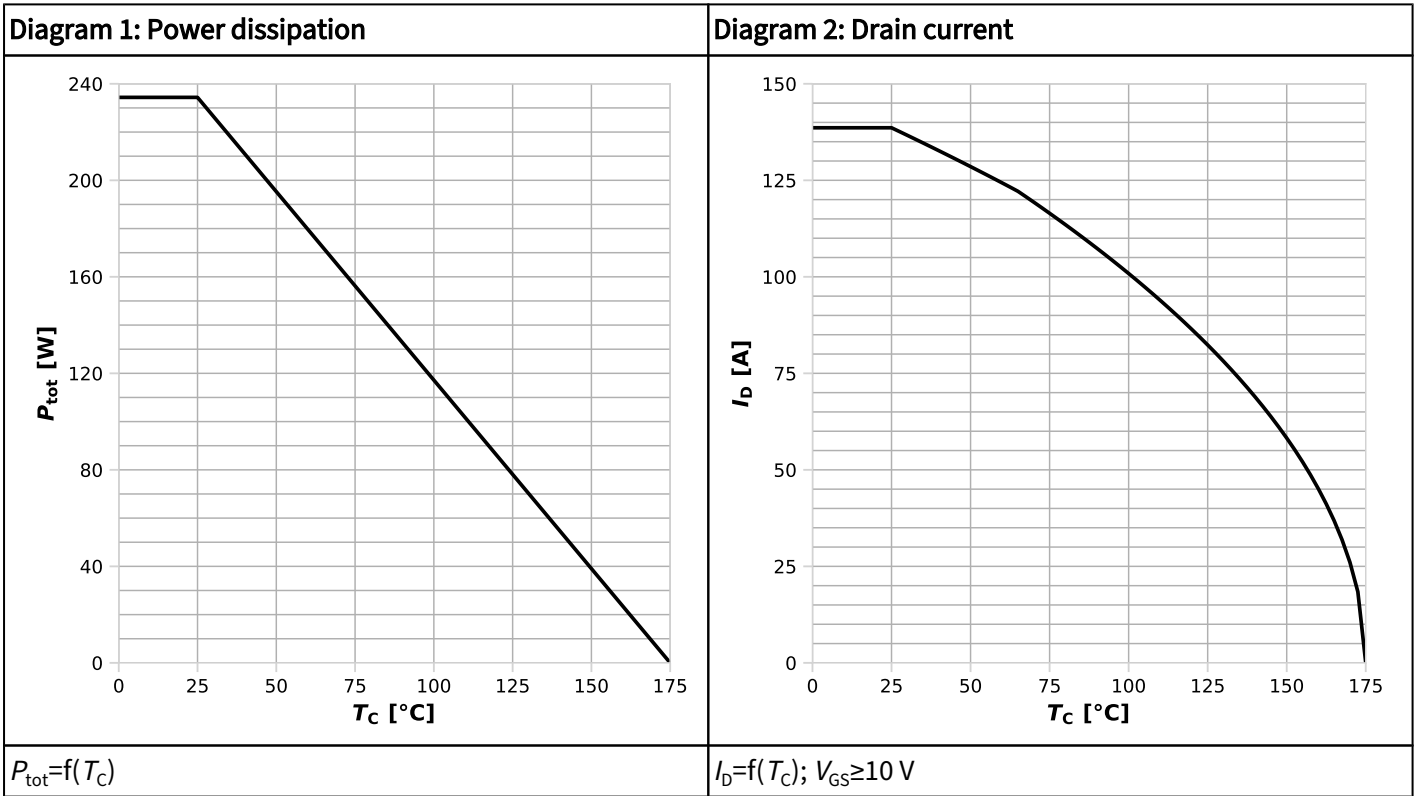
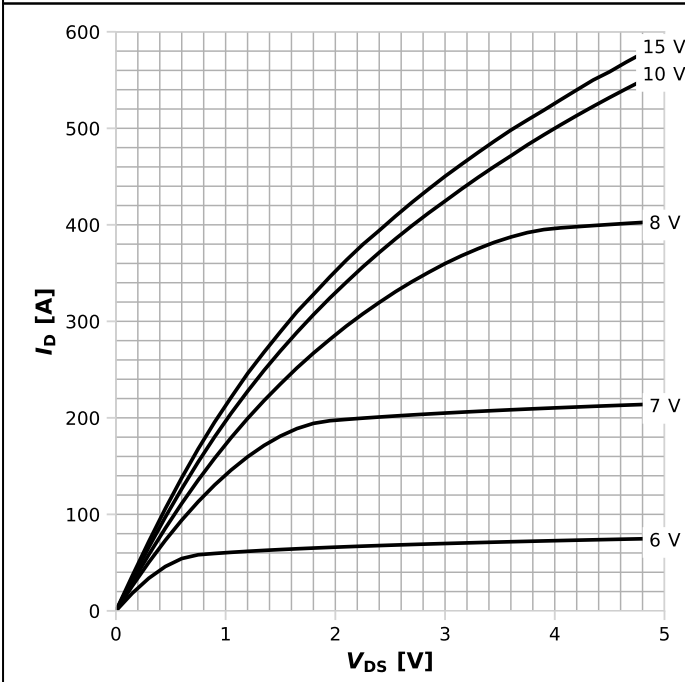
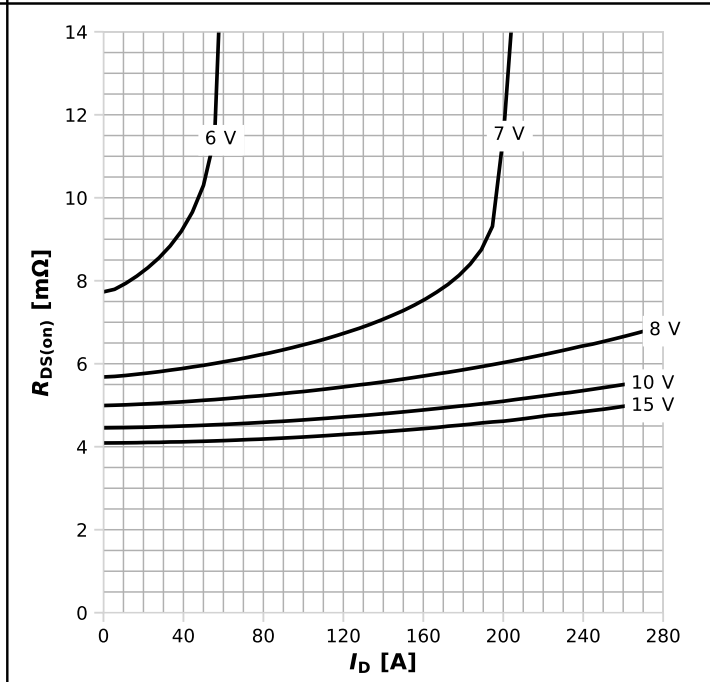


Diagram 5: Typ. output characteristics



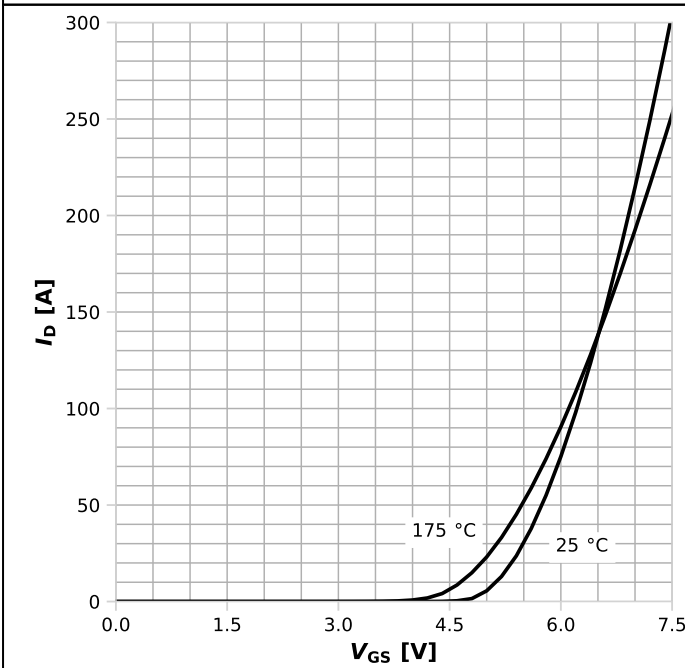
$I_D = f(V_{DS}), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



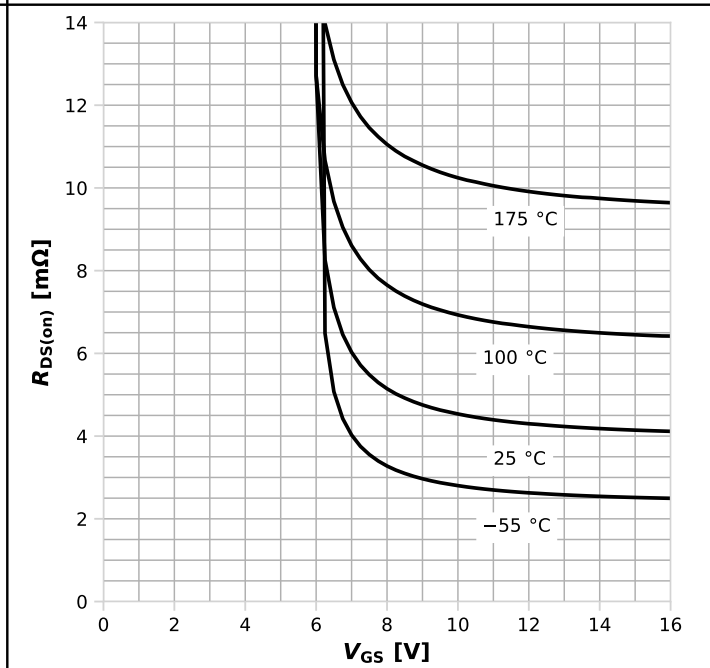
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



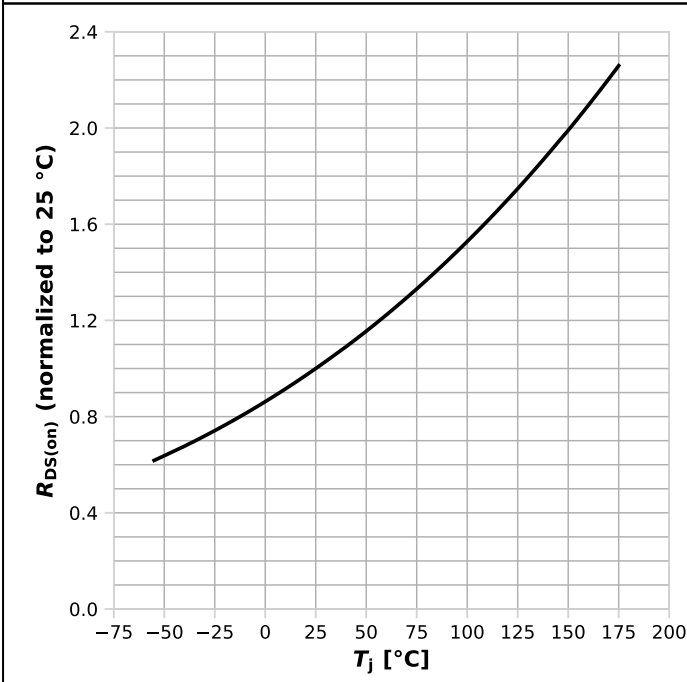
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. drain-source on resistance



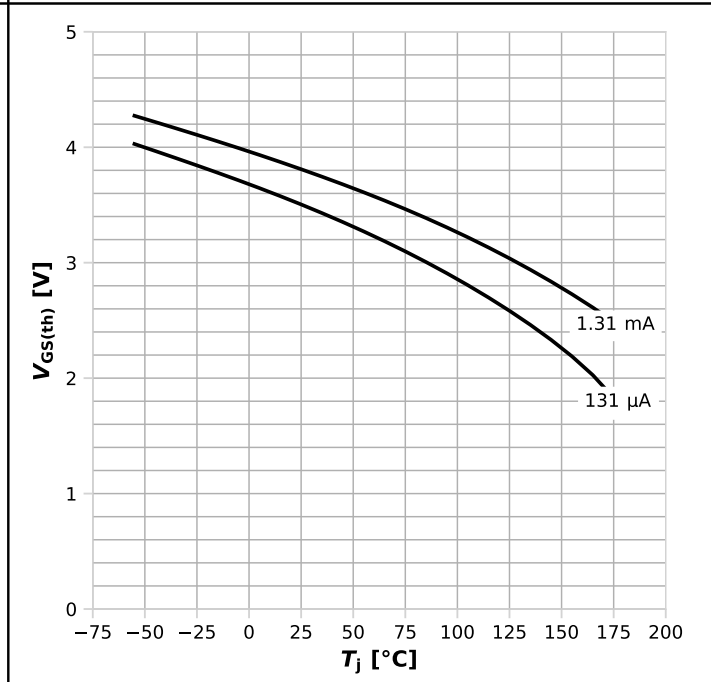
$R_{DS(on)} = f(V_{GS}), I_D = 58\text{ A};$ parameter: T_j

Diagram 9: Normalized drain-source on resistance



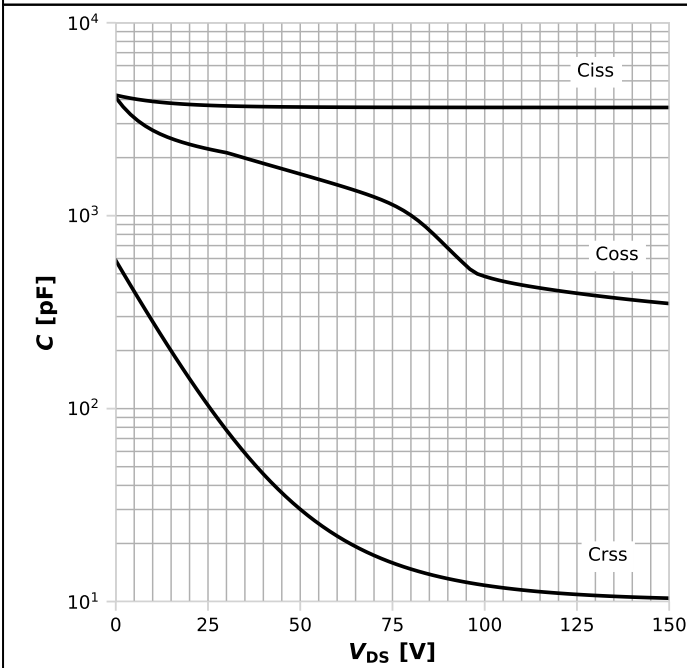
$R_{DS(on)}=f(T_j), I_D=58\text{ A}, V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



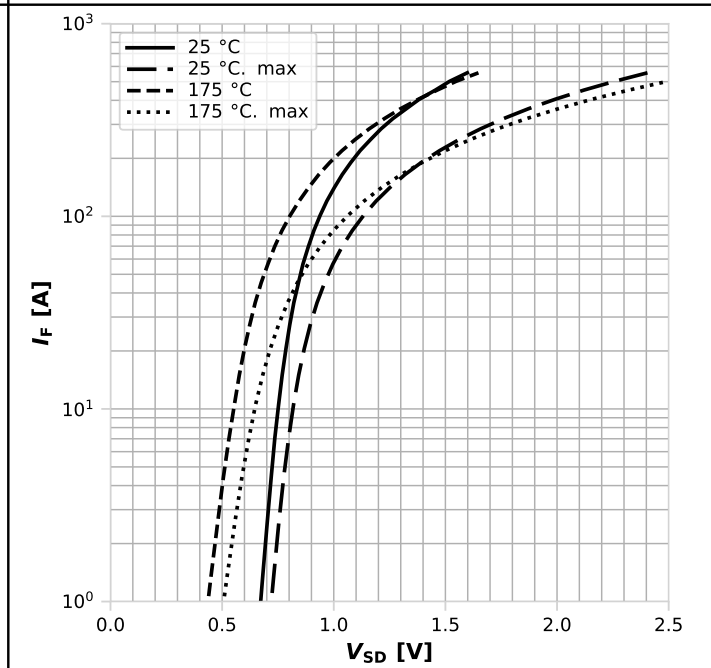
$V_{GS(th)}=f(T_j), V_{GS}=V_{DS}; \text{parameter: } I_D$

Diagram 11: Typ. capacitances



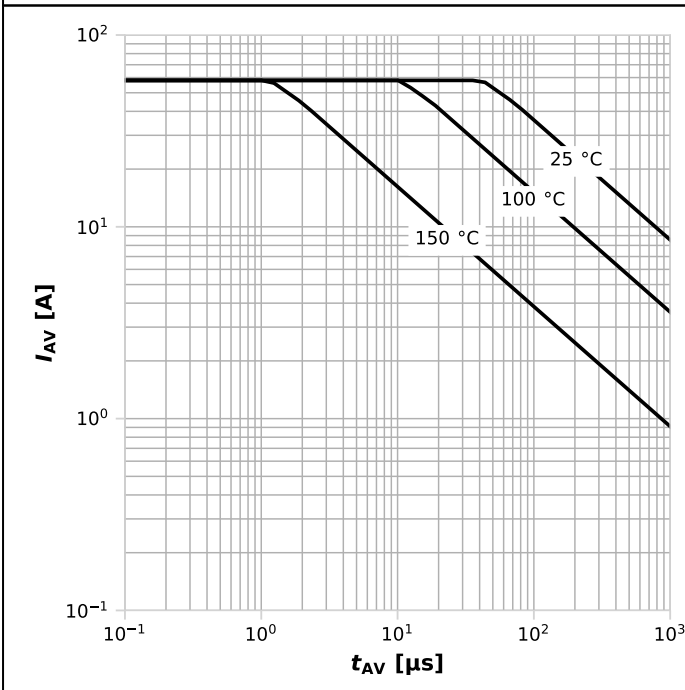
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



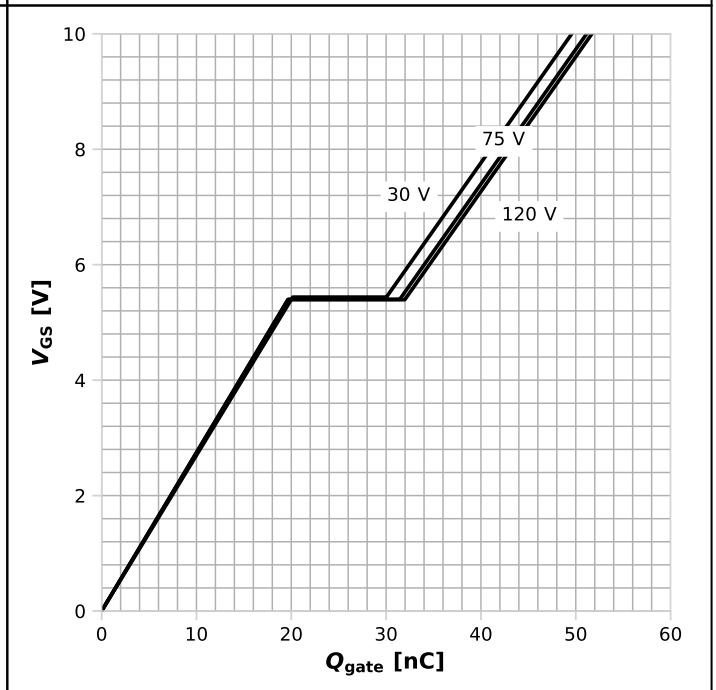
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



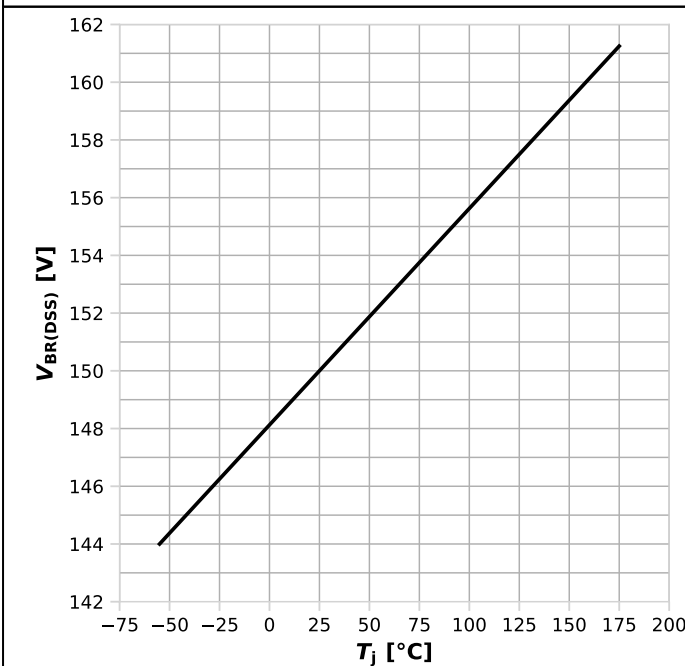
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



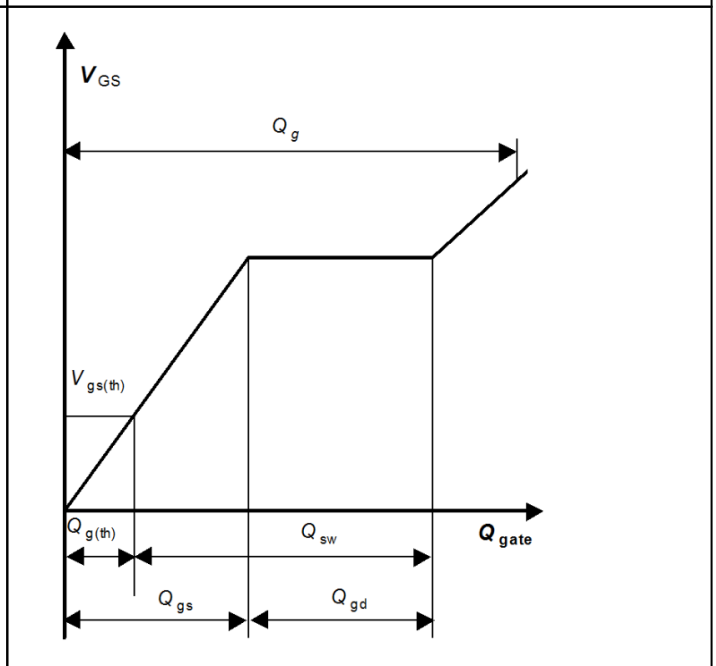
$V_{GS}=f(Q_{gate}), I_D=29 \text{ A pulsed}, T_j=25 \text{ °C}$; parameter: V_{DD}

Diagram 15: Min. drain-source breakdown voltage



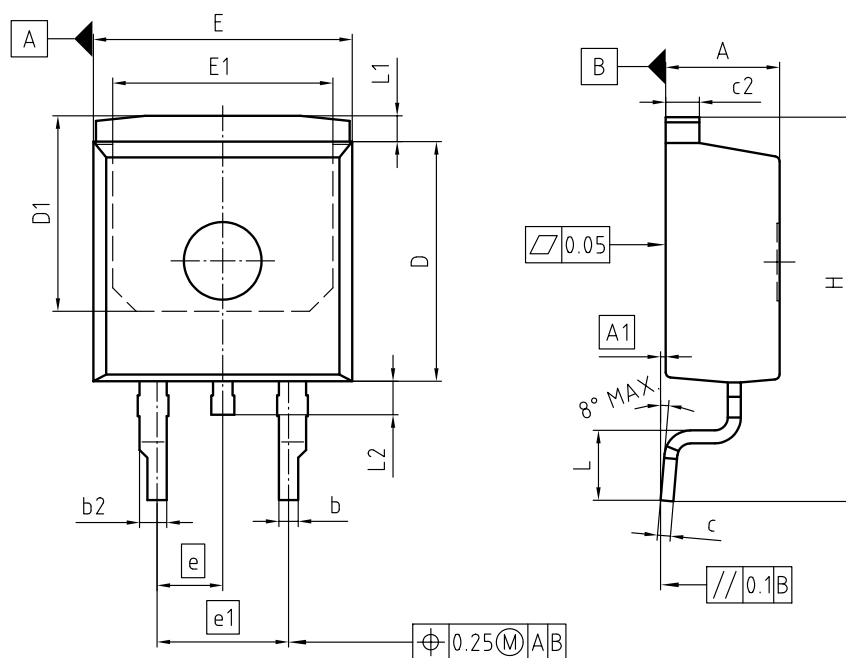
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Gate charge waveforms



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5 Package outlines



PACKAGE - GROUP NUMBER: PG-TO263-3-U01		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.30	4.50
A1	0.00	0.10
b	0.65	0.85
b2	0.95	1.15
c	0.40	0.60
c2	1.17	1.37
D	9.05	9.45
D1	7.45	7.65
E	9.80	10.20
E1	8.40	8.60
e	2.54	
e1	5.08	
N	2	
H	14.60	15.90
L	2.40	3.00
L1	0.70	1.30
L2	1.00	1.60

Figure 1 Outline PG-TO263-3, dimensions in mm

Revision history

IPB051N15NM6

Revision 2024-11-22, Rev. 1.0

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2024-11-22	Release of final datasheet

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