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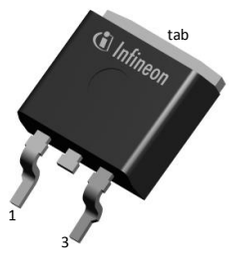
MOSFET

OptiMOS™5 Power-Transistor, 150 V

D²PAK



Features

- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Very low reverse recovery charge (Qrr)
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[1] for target application
- Ideal for high-frequency switching and synchronous rectification
- Halogen-free according to IEC61249-2-21

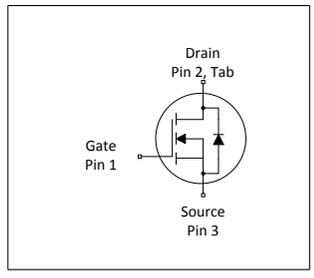


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	150	V
$R_{DS(on),max\ (TO263)}$	4.8	mΩ
I_D	120	A
Q_{rr}	83	nC

Type / Ordering Code	Package	Marking	Related Links
IPB048N15N5	PG-TO 263-3	048N15N5	-

[1] J-STD20 and JESD22

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1 Maximum ratings

at T_A=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- -	- -	120 118	A	T_C=25 °C T_C=100 °C
Pulsed drain current[1]	$I_{D,pulse}$	-	-	480	A	T_C=25 °C
Avalanche energy, single pulse[2]	E_{AS}	-	-	230	mJ	I_D=100 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	300	W	T_C=25 °C
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}	-	0.3	0.5	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm² cooling area[3]	R_{thJA}	-	-	40	K/W	-

[1] See Diagram 3
[2] See Diagram 13
[3] 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.

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3 Electrical characteristics

at T_j=25 °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 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	3.0	3.8	4.6	V	V_{DS}=V_{GS}, I_D=264 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=120 V, V_{GS}=0 V, T_j=25 °C V_{DS}=120 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	1	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	3.7 4.0	4.8 5.2	mΩ	V_{GS}=10 V, I_D=60 A V_{GS}=8 V, I_D=30 A
Gate resistance[1)]	R_G	-	1.1	1.6	Ω	-
Transconductance	g_{fs}	59	117	-	S	|V_{DS}|>2|I_D|$R_{DS(on)max}$, I_D=60 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	6000	7800	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	1500	1950	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	34	60	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	19.6	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=60 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	5.3	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=60 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	25.5	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=60 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	4.5	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=60 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics[2)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	33	-	nC	V_{DD}=75 V, I_D=60 A, V_{GS}=0 to 10 V
Gate to drain charge[1)]	Q_{gd}	-	16	24	nC	V_{DD}=75 V, I_D=60 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	26	-	nC	V_{DD}=75 V, I_D=60 A, V_{GS}=0 to 10 V
Gate charge total[1)]	Q_g	-	80	100	nC	V_{DD}=75 V, I_D=60 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	V_{DD}=75 V, I_D=60 A, V_{GS}=0 to 10 V
Output charge[1)]	Q_{oss}	-	225	299	nC	V_{DD}=75 V, V_{GS}=0 V

[1)] Defined by design. Not subject to production test
[2)] See ″Gate charge waveforms″ for parameter definition

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Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	120	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	480	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.85	1.1	V	V_{GS}=0 V, I_F=60 A, T_j=25 °C
Reverse recovery time[1)]	t_{rr}	-	60	120	ns	V_R=75 V, I_F=*60*, di_F/dt=100 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	83	166	nC	V_R=75 V, I_F=*60*, di_F/dt=100 A/µs

[1)] Defined by design. Not subject to production test

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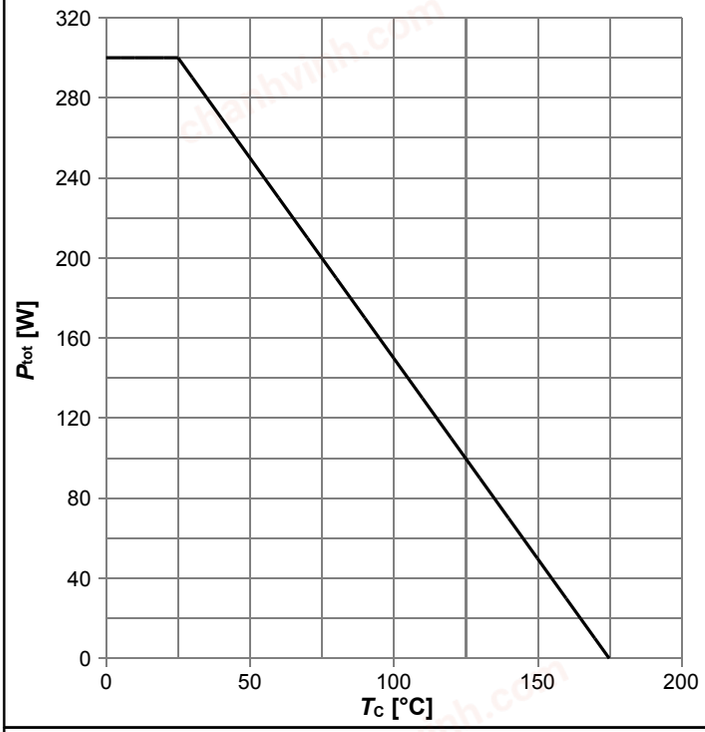
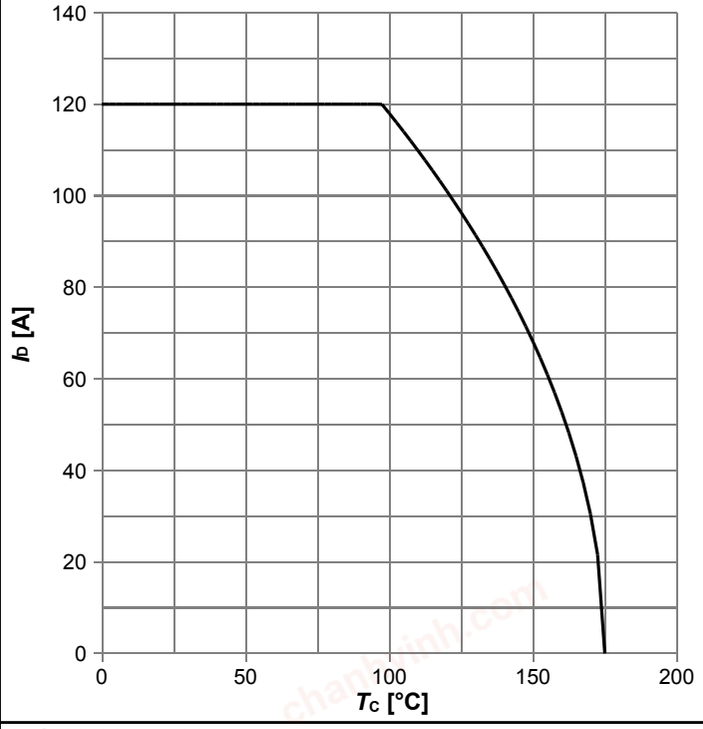
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



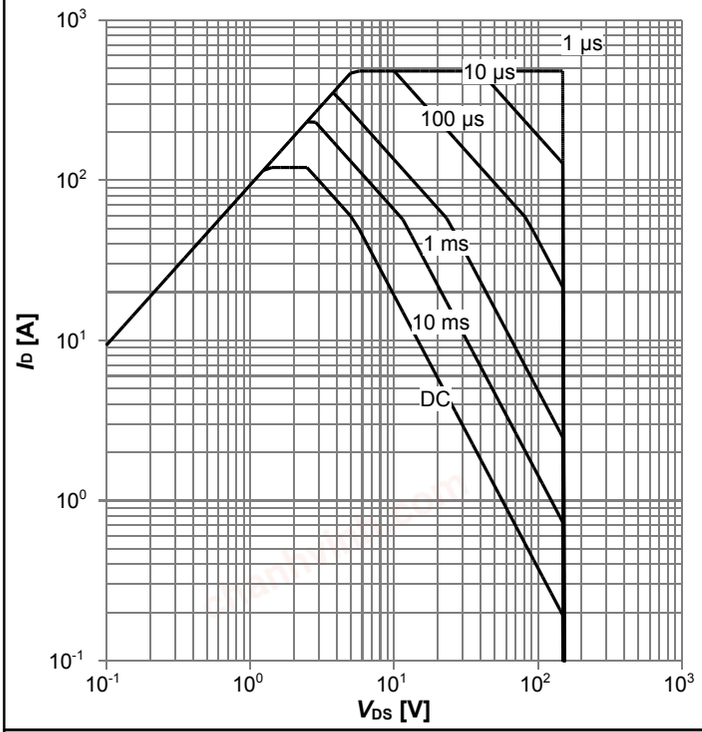
$P_{tot}=f(T_C)$

Diagram 2: Drain current



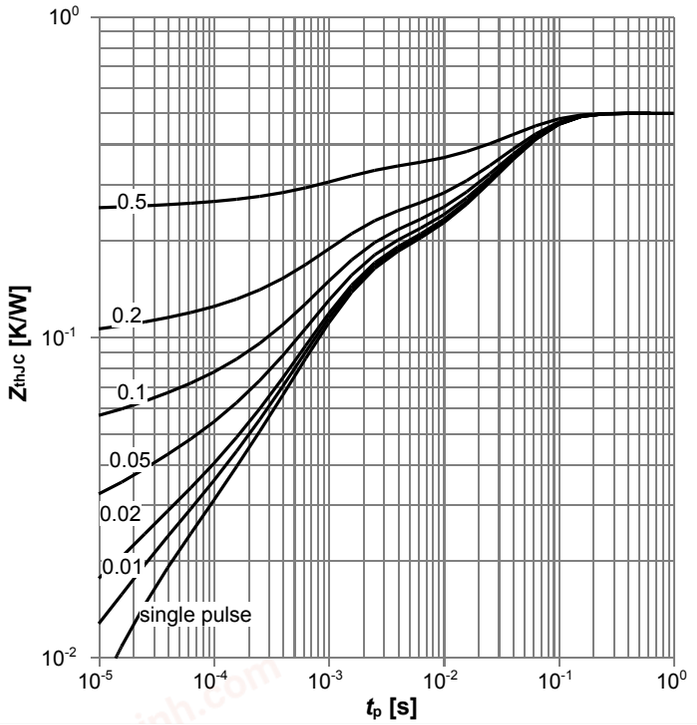
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



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

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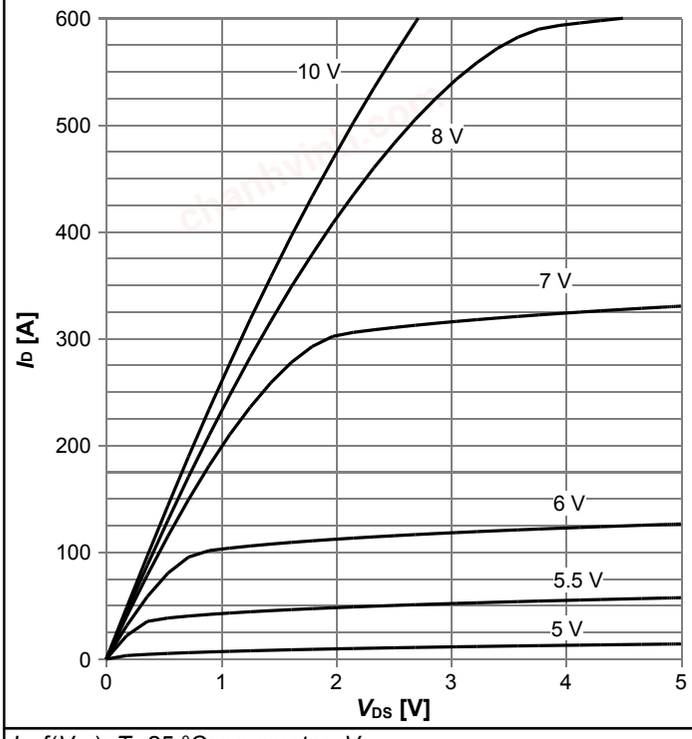
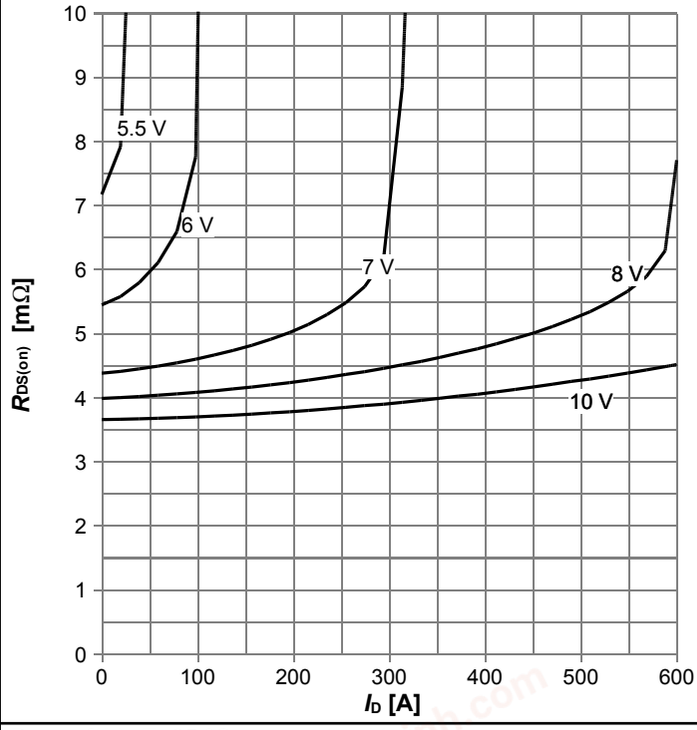
Diagram 5: Typ. output characteristics



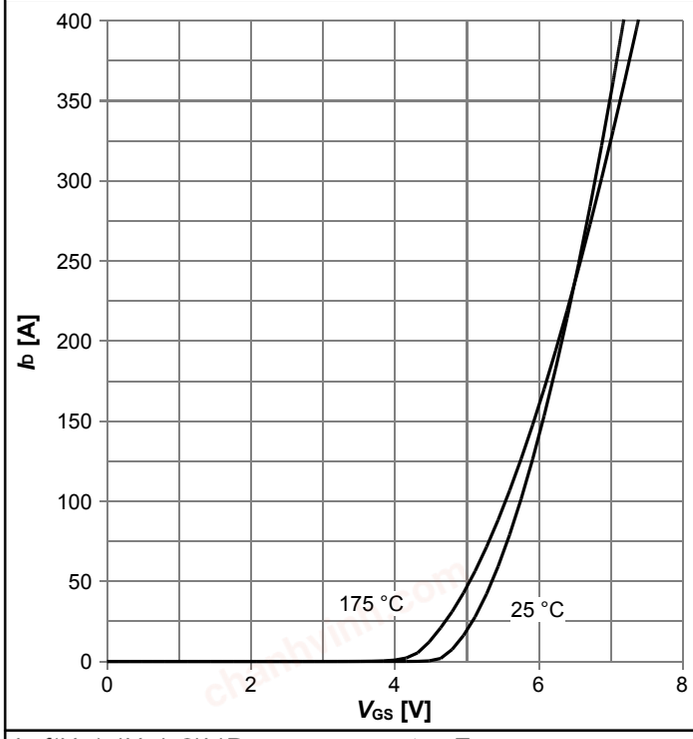
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



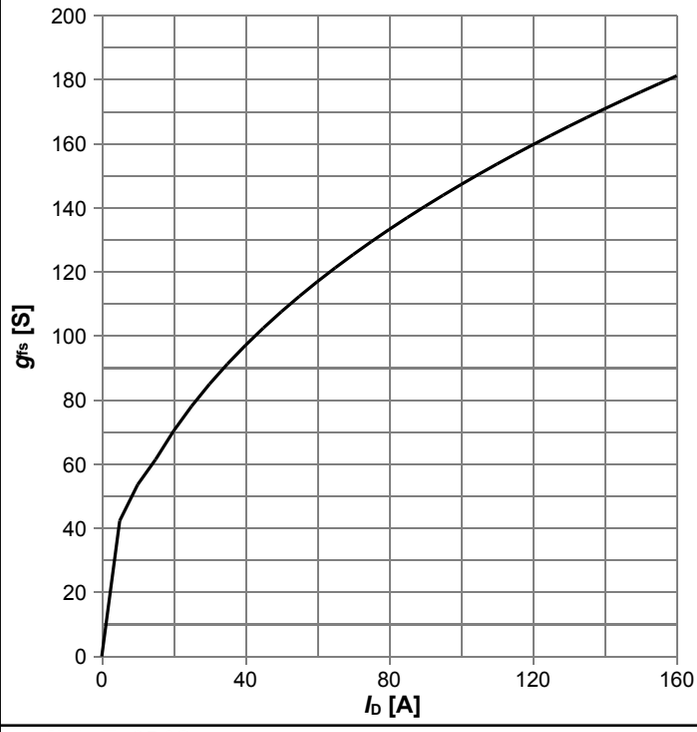
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

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. forward transconductance



$g_{fs}=f(I_D)$; $T_j=25$ °C

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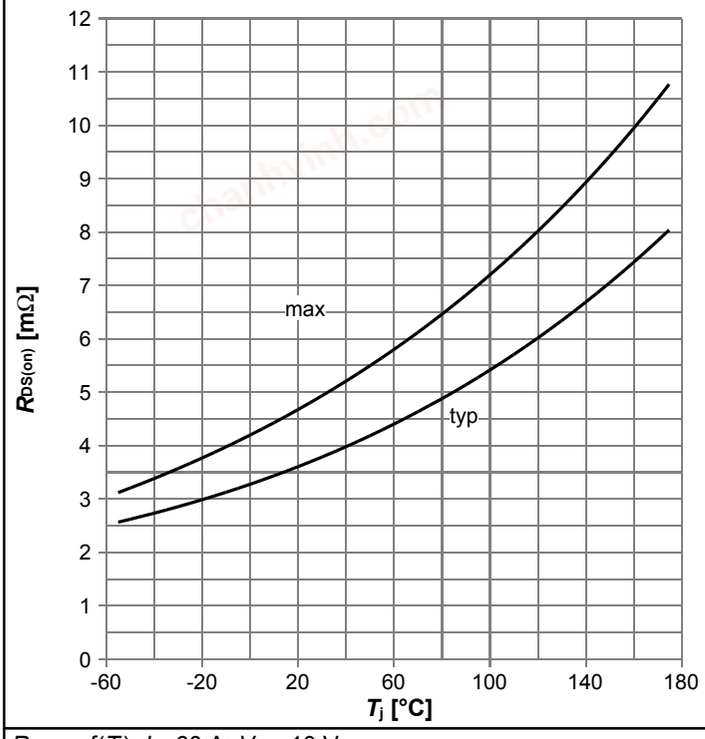
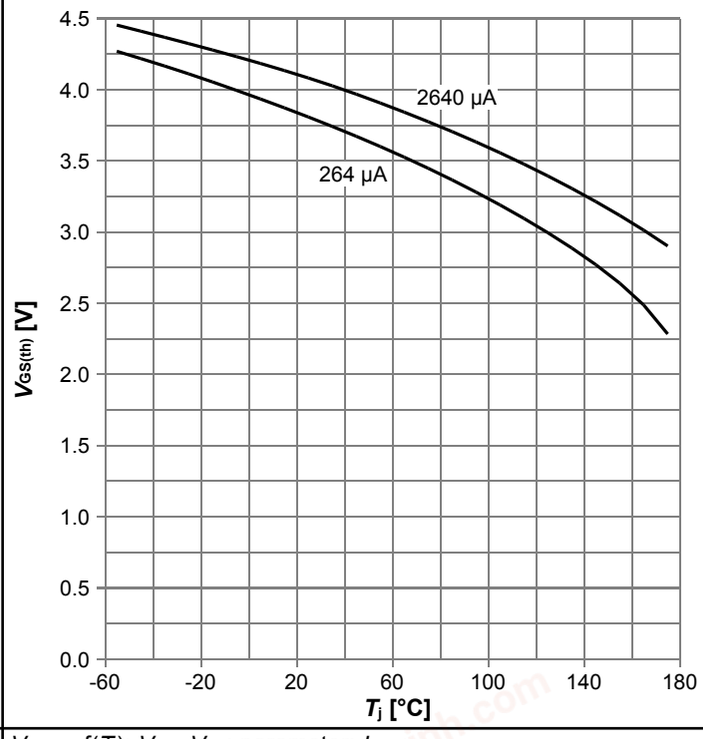
Diagram 9: Drain-source on-state resistance



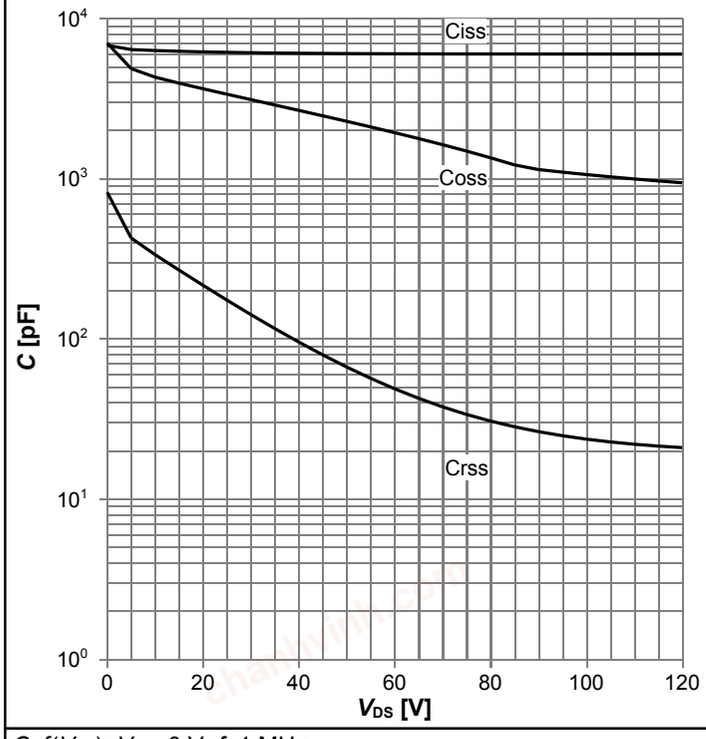
$R_{DS(on)}$=f(T_j); I_D=60 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



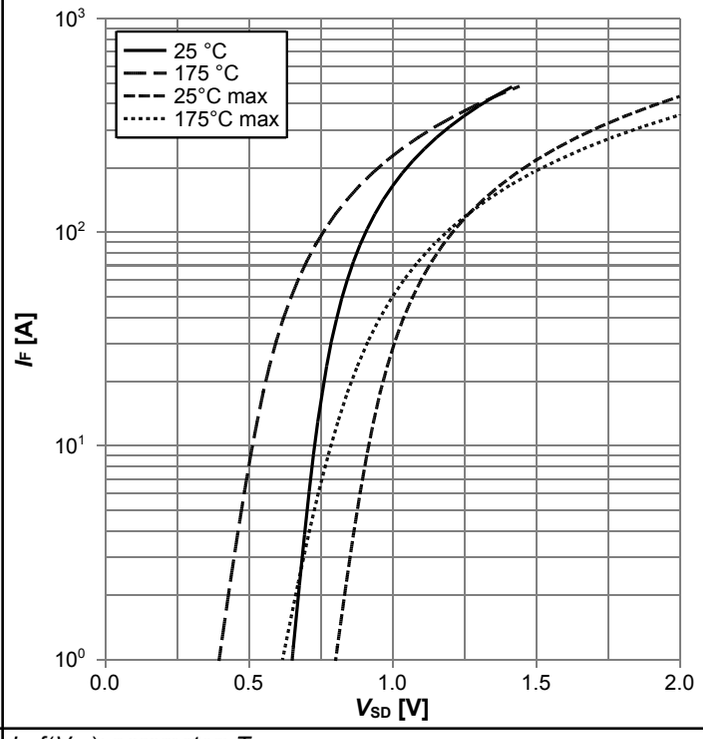
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; parameter: I_D

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

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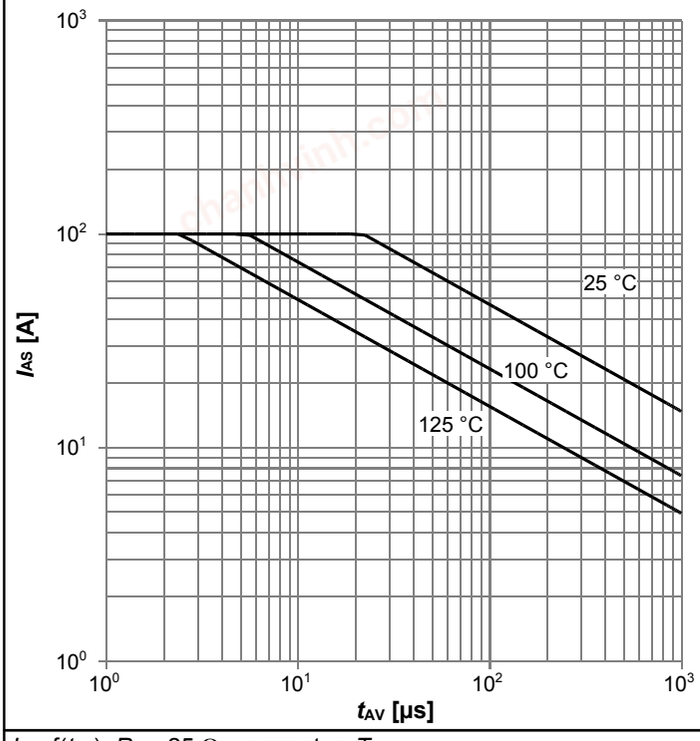
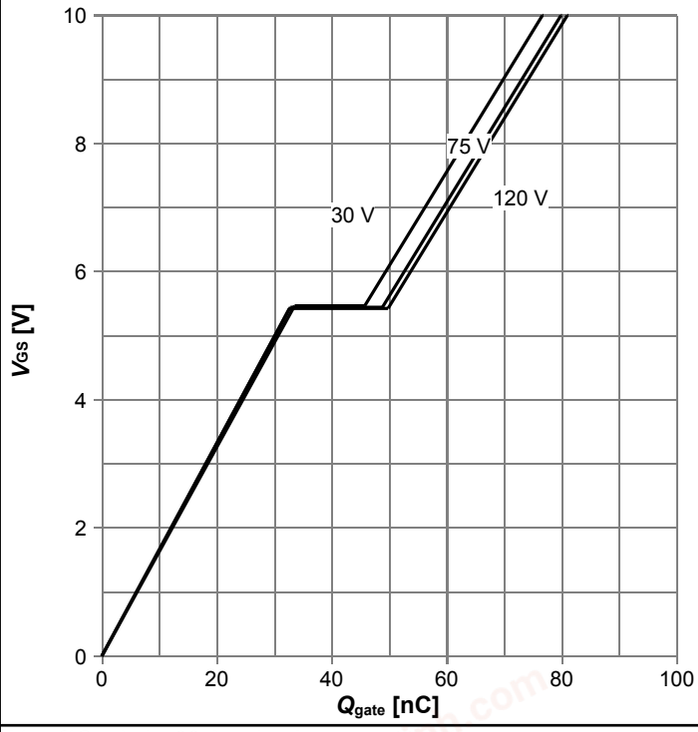
Diagram 13: Avalanche characteristics



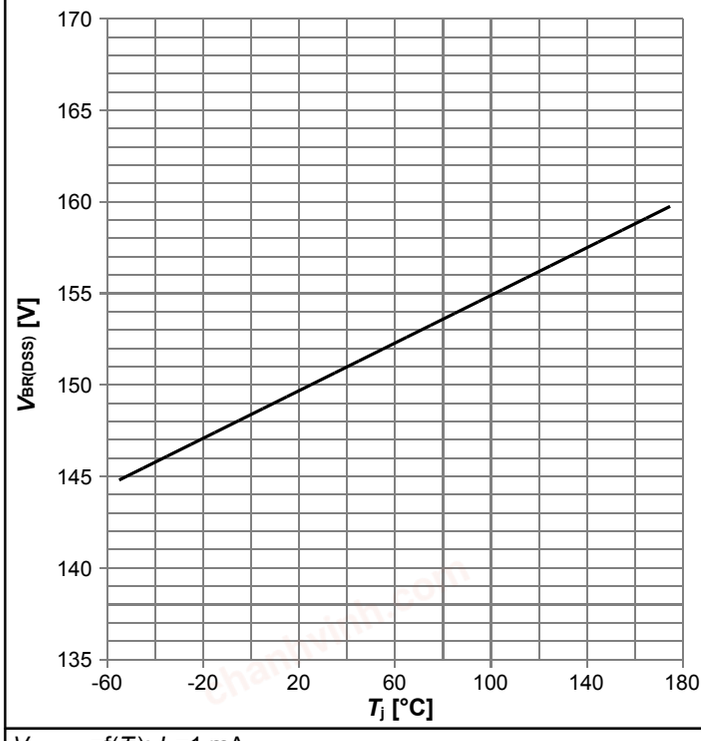
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



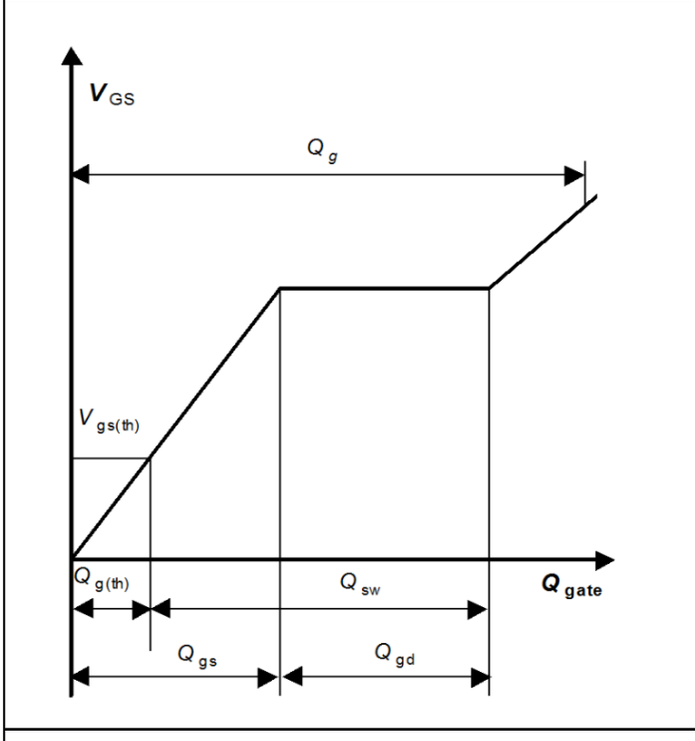
V_{GS}=f(Q_{gate}); I_D=60 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage



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

Diagram Gate charge waveforms



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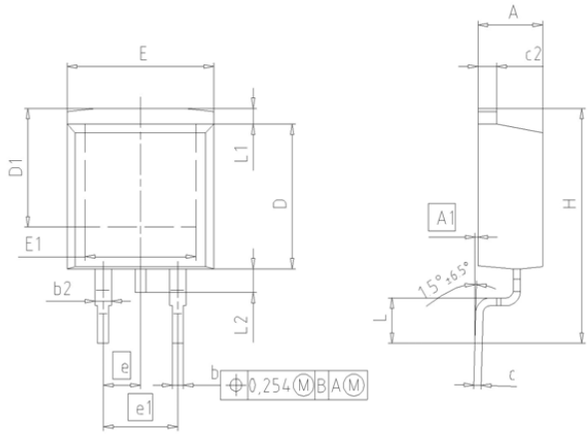
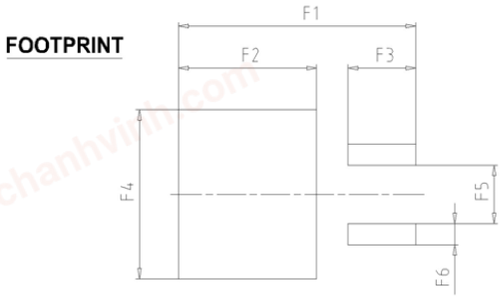
5 Package Outlines



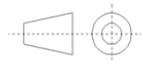


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

DOCUMENT NO.
Z8B00003324

SCALE 0 5 0 5 7.5mm

EUROPEAN PROJECTION



ISSUE DATE
30-08-2007

REVISION
01

Figure 1 Outline PG-TO 263-3, dimensions in mm/inches

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Revision History

IPB048N15N5

Revision: 2018-04-20, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2016-02-05	Release of final version
2.1	2018-04-20	Update trr, Qrr, tf and td(off)

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