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MOSFET

OptiMOS™3 Power-Transistor, 150 V

HSOF



Features

- N-channel, normal level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 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

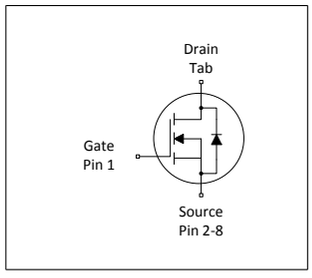

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	150	V
$R_{DS(on),max}$	5.9	mΩ
I_D	155	A

Type / Ordering Code	Package	Marking	Related Links
IPT059N15N3	PG-HSOF-8	059N15N3	-

[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	- -	- -	155 110	A	T_C=25 °C T_C=100 °C
Pulsed drain current[1]	$I_{D,pulse}$	-	-	620	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	520	mJ	I_D=150 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	375	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}	-	0.2	0.4	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	62	K/W	-
Thermal resistance, junction - ambient, 6 cm2 cooling area[2]	R_{thJA}	-	-	40	K/W	-

3 Electrical characteristics

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	$V_{GS(th)}$	2	3	4	V	V_{DS}=V_{GS}, I_D=270 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	$R_{DS(on)}$	- -	5 5.2	5.9 6.2	mΩ	V_{GS}=10 V, I_D=150 A V_{GS}=8 V, I_D=75 A
Gate resistance	R_G	-	2.1	3.2	Ω	-
Transconductance	g_{fs}	86	172	-	S	|V_{DS}|>2|I_D|$R_{DS(on)max}$, I_D=150 A

[1] See figure 3
[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

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Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5400	7182	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Output capacitance	C_{oss}	-	630	838	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	10	19	pF	V_{GS}=0 V, V_{DS}=75 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	25	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	35	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	46	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	14	-	ns	V_{DD}=75 V, V_{GS}=10 V, I_D=100 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	29	-	nC	V_{DD}=75 V, I_D=100 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	11	-	nC	V_{DD}=75 V, I_D=100 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	24	-	nC	V_{DD}=75 V, I_D=100 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	69	92	nC	V_{DD}=75 V, I_D=100 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	V_{DD}=75 V, I_D=100 A, V_{GS}=0 to 10 V
Output charge	Q_{oss}	-	178	-	nC	V_{DD}=75 V, V_{GS}=0 V

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continous forward current	I_S	-	-	155	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	620	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.94	1.2	V	V_{GS}=0 V, I_F=150 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	146	292	ns	V_R=75 V, I_F=I_S, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	478	-	nC	V_R=75 V, I_F=I_S, di_F/dt=100 A/µs

[1)] See ″Gate charge waveforms″ for parameter definition

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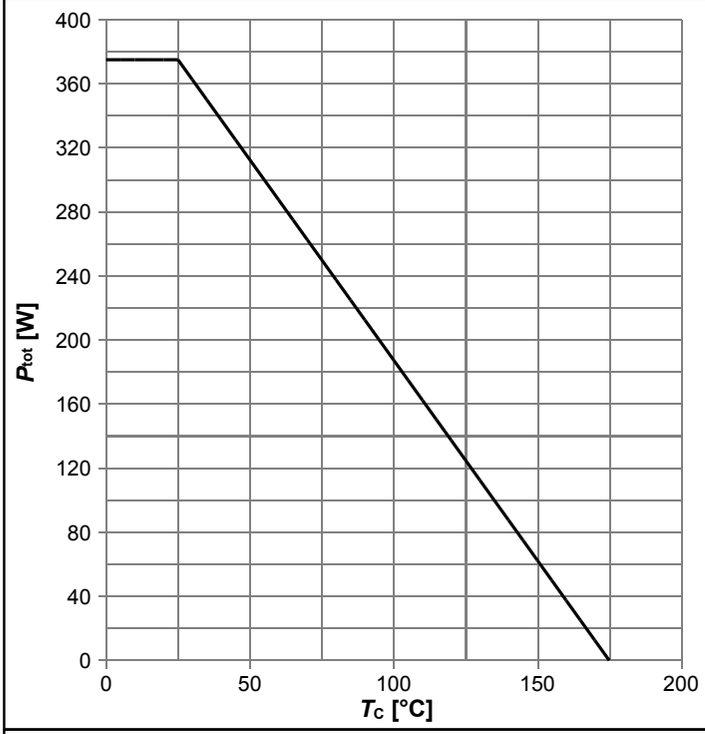
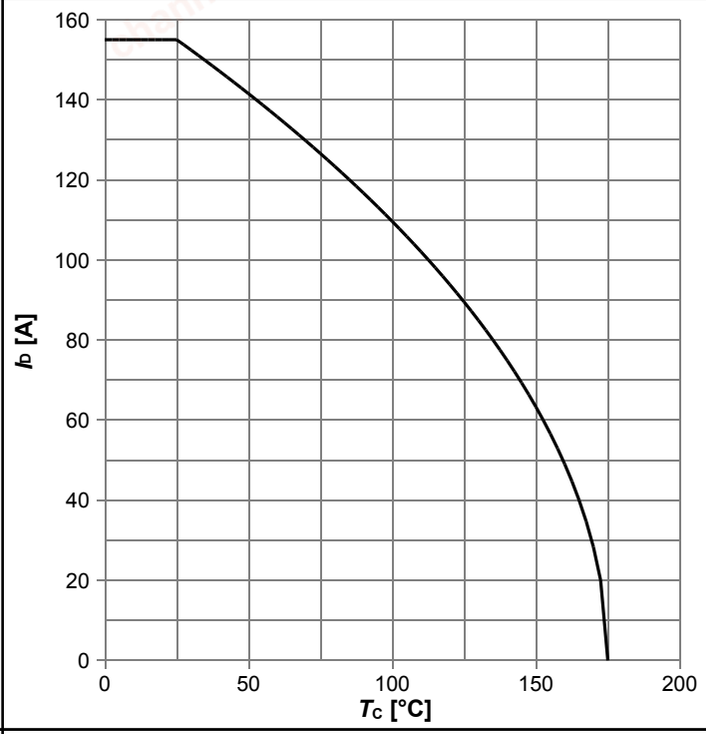
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



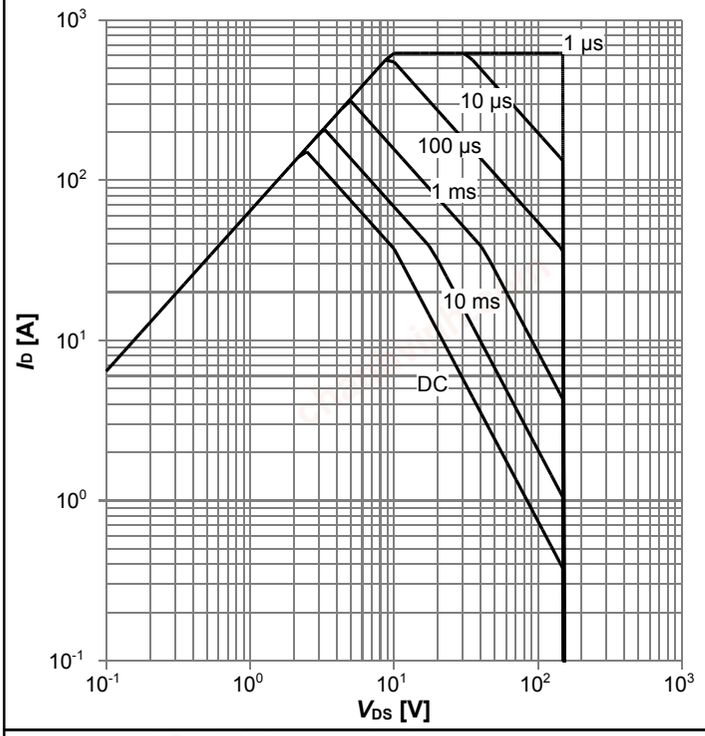
$P_{tot}=f(T_C)$

Diagram 2: Drain current



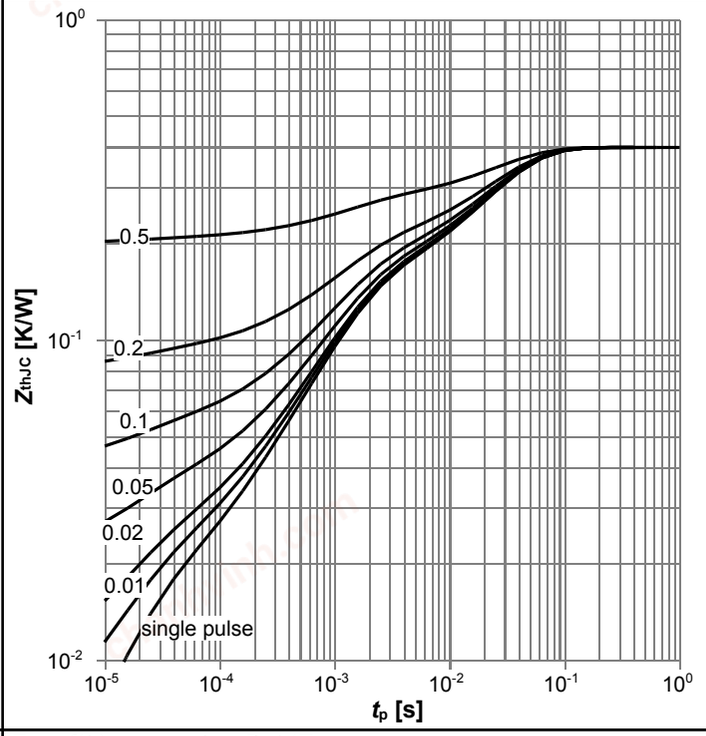
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

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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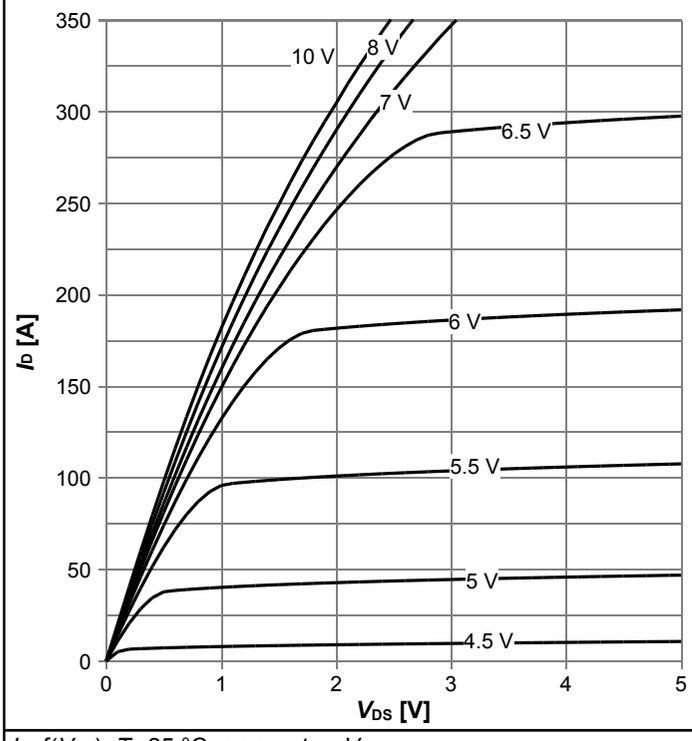
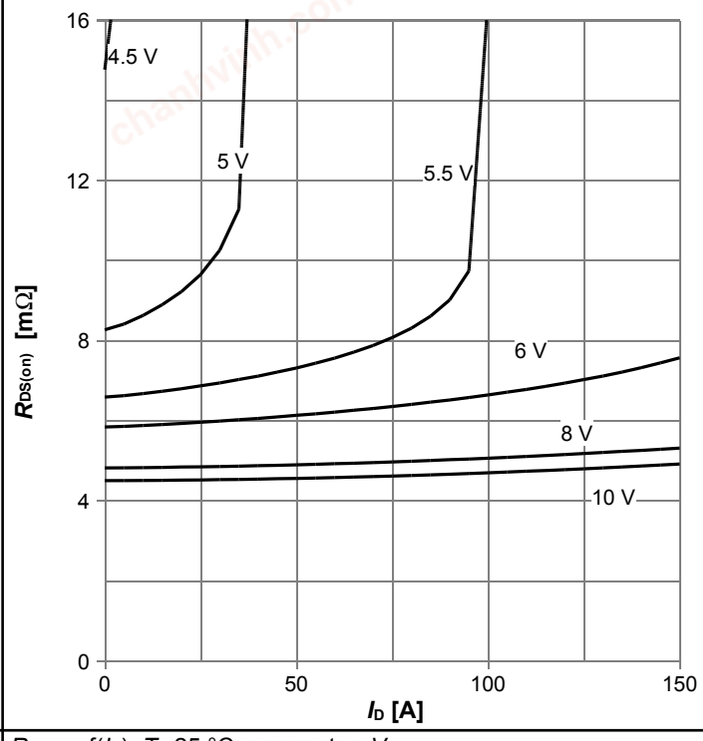
Diagram 5: Typ. output characteristics



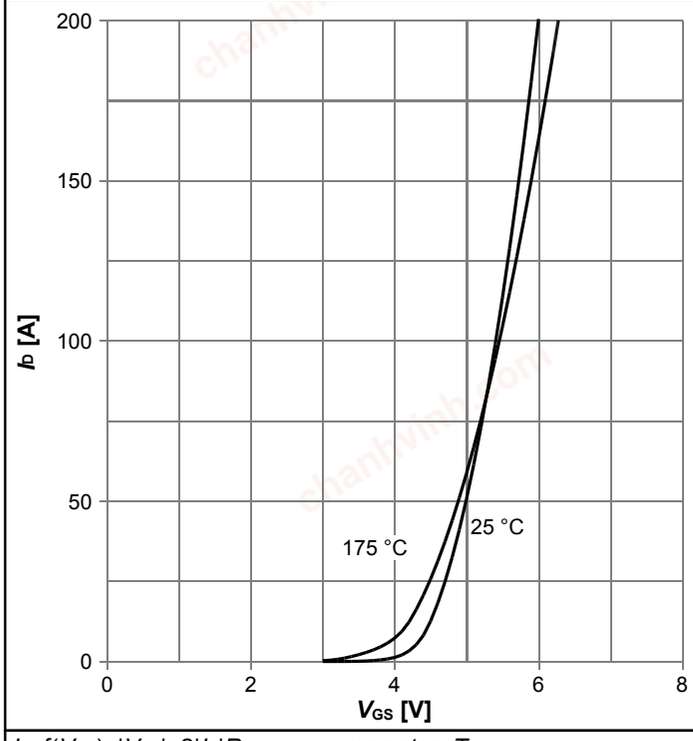
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



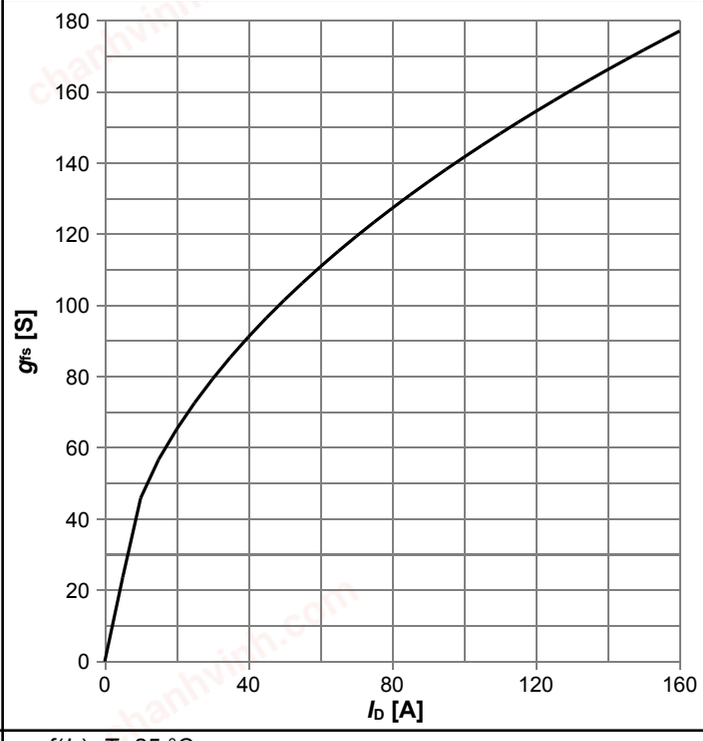
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C; parameter: V_{GS}

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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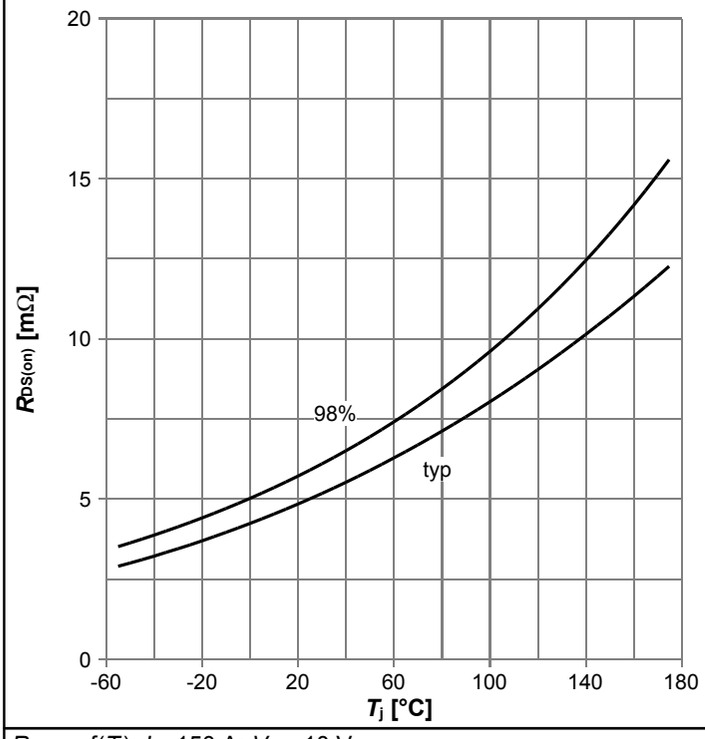
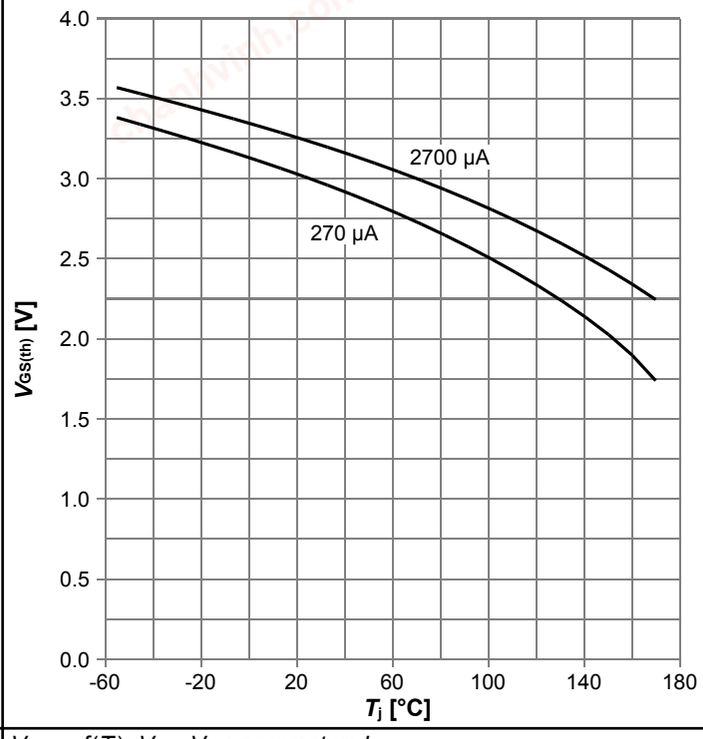
Diagram 9: Drain-source on-state resistance



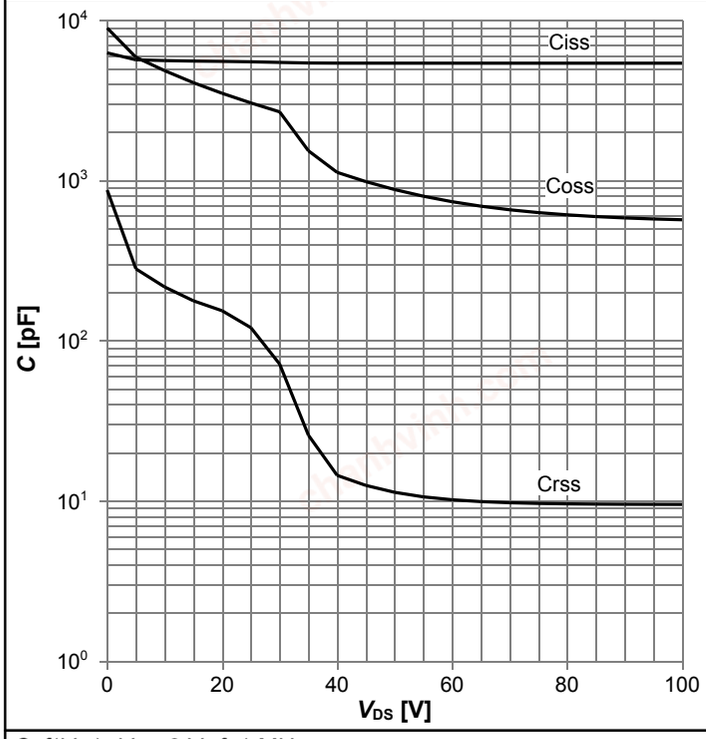
$R_{DS(on)}=f(T_j)$; I_D=150 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



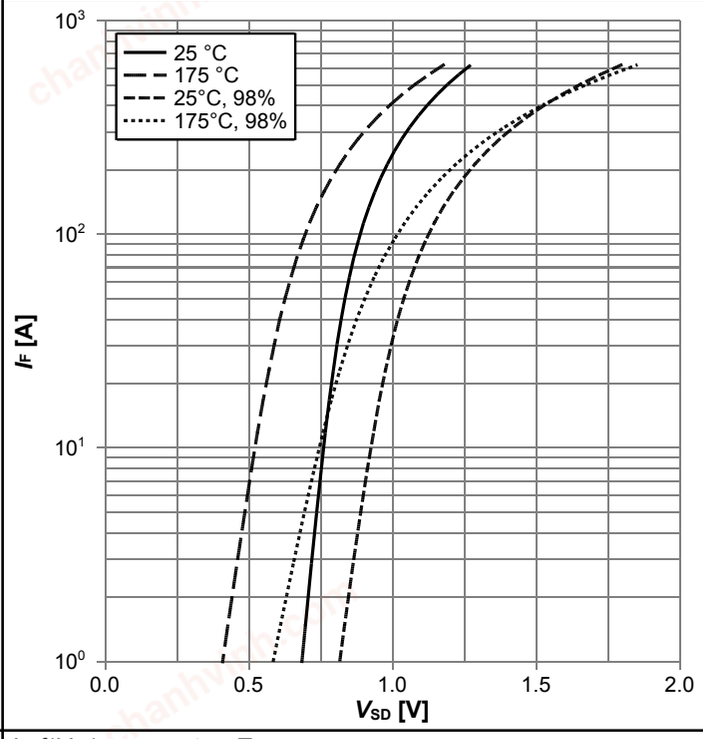
$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; parameter: I_D

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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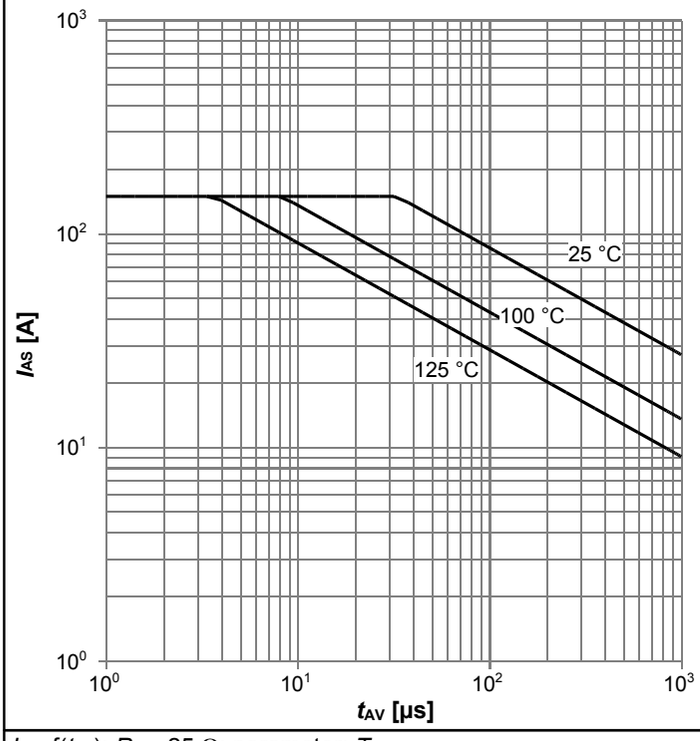
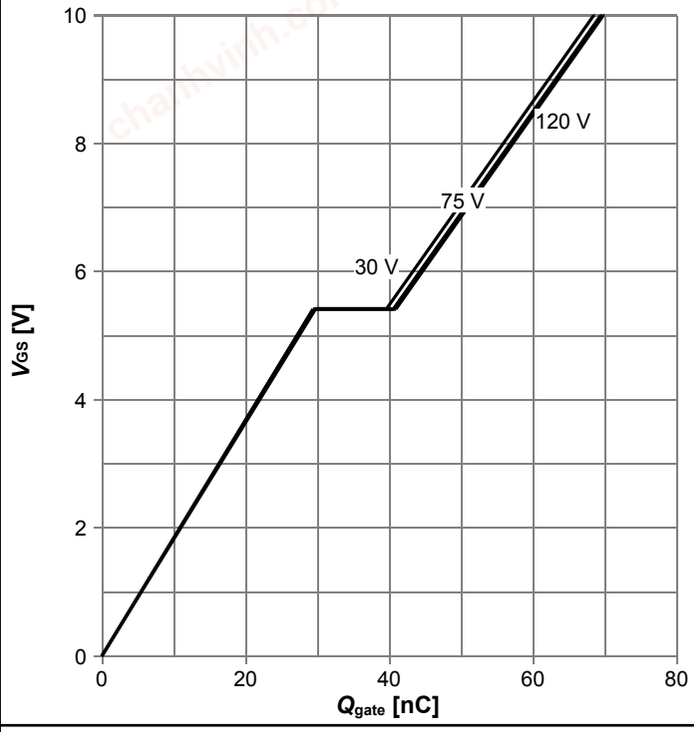
Diagram 13: Avalanche characteristics



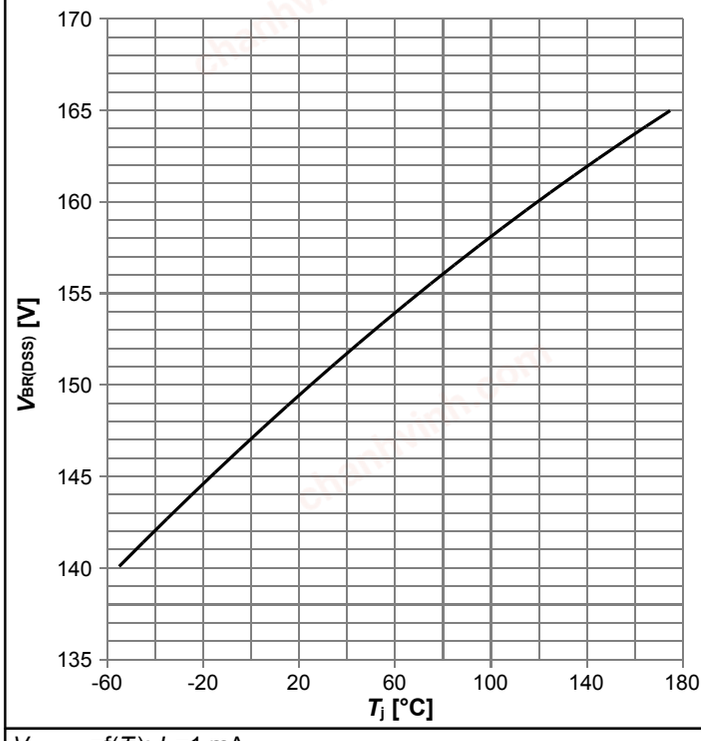
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



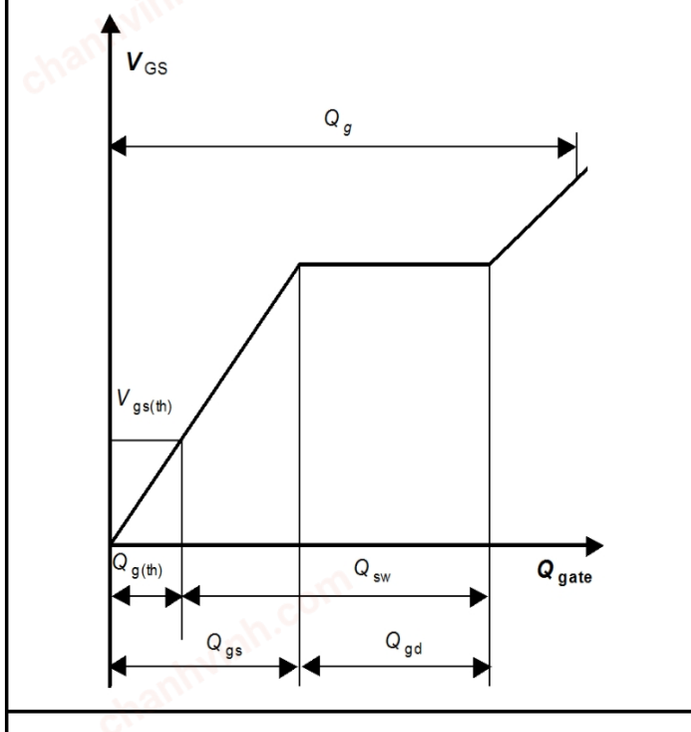
V_{GS}=f(Q_{gate}); I_D=100 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage



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

Gate charge waveforms



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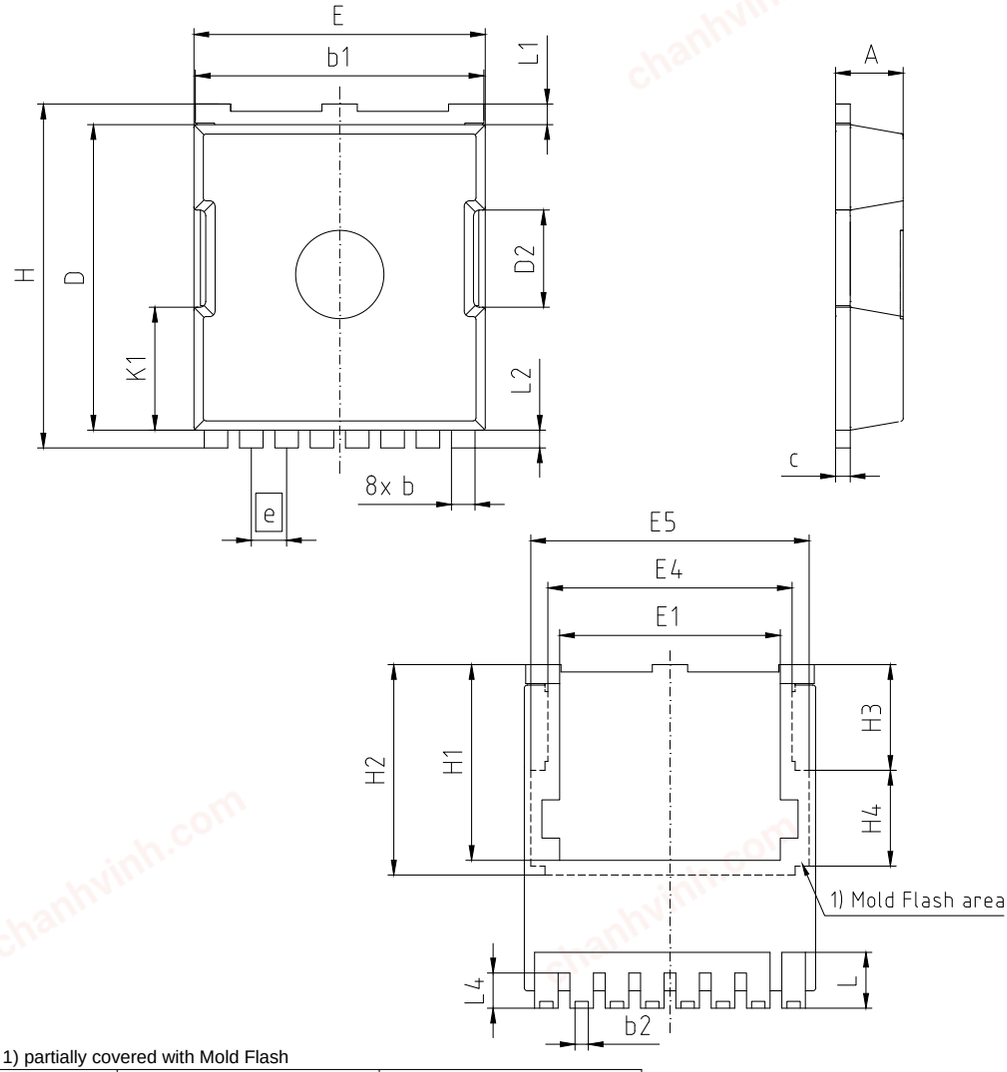
5 Package Outlines



1) partially covered with Mold Flash

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.094
b	0.70	0.90	0.028	0.035
b1	9.70	9.90	0.382	0.390
b2	0.42	0.50	0.017	0.020
c	0.40	0.60	0.016	0.024
D	10.28	10.58	0.405	0.416
D2	3.30		0.130	
E	9.70	10.10	0.382	0.398
E1	7.50		0.295	
E4	8.50		0.335	
E5	9.46		0.372	
e	1.20 (BSC)		0.047 (BSC)	
H	11.48	11.88	0.452	0.468
H1	6.55	6.75	0.258	0.266
H2	7.15		0.281	
H3	3.59		0.141	
H4	3.26		0.128	
N	8		8	
K1	4.18		0.165	
L	1.60	2.10	0.063	0.083
L1	0.70		0.028	
L2	0.60		0.024	
L4	1.00	1.30	0.039	0.051

DOCUMENT NO.
Z8B00169619

SCALE
0 2 0 2 4mm

EUROPEAN PROJECTION

ISSUE DATE
20-02-2014

REVISION
02

Figure 1 Outline PG-HSOF-8

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Revision History

IPT059N15N3

Revision: 2017-05-16, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2014-01-27	Release of final version
2.1	2014-02-07	Insert aditional typ value (Rthjc) and max values (Crss,trr, Rg,Qg, Coss, Ciss)
2.2	2017-05-16	Update Zth Diagram and "T" condition in "Maximum ratings"

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