

英飞凌MOSFET功率晶体管

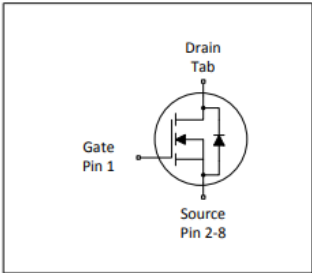
英飞凌IPT059N15N3 OptiMOS™3 150 V 功率晶体管

特性

- N沟道，标准电平
- 出色的栅极电荷 $\times R_{DS(on)}$ 乘积 (FOM)
- 极低的导通电阻 $R_{DS(on)}$
- 工作温度 175°C
- 无铅镀层；符合RoHS标准
- 符合 JEDEC ¹⁾ 的目标应用要求
- 非常适合高频开关和同步整流
- 符合 IEC61249-2-21 标准的无卤素

表 1 主要性能参数

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 和 JESD22

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1 最大额定值

除非另有规定, $T_A = 25\text{ °C}$

表 2 最大额定值

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	155 110	A	$T_C = 25\text{ °C}$ $T_C = 100\text{ °C}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	620	A	$T_C = 25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	520	mJ	$I_D = 150\text{ A}$, $R_{GS} = 25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	375	W	$T_C = 25\text{ °C}$
Operating and storage temperature	T_j, T_{stg}	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

2 热特性

表 3 热特性

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 cm ² cooling area ²⁾	R_{thJA}	-	-	40	K/W	-

3 电气特性

表 4 静态特性

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	$V_{GS(th)}$	2	3	4	V	$V_{DS} = V_{GS}$, $I_D = 270\text{ }\mu\text{A}$
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}	-	1	100	nA	$V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	5 5.2	5.9 6.2	m Ω	$V_{GS} = 10\text{ V}$, $I_D = 150\text{ A}$ $V_{GS} = 8\text{ V}$, $I_D = 75\text{ A}$
Gate resistance	R_G	-	2.1	3.2	Ω	-
Transconductance	g_{fs}	86	172	-	S	$ V_{DS} > 2 I_D R_{DS(on)max}$, $I_D = 150\text{ A}$

¹⁾ 请参见图 3

²⁾ 器件置于 40 mm x 40 mm x 1.5 mm 环氧树脂印刷电路板 FR4 上, 配有 6 cm² (一层, 70 μm 厚) 铜层面积用于漏极连接。印刷电路板在静止空气中垂直放置。

表 5 动态特性

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

表 6 栅极电荷特性¹⁾

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

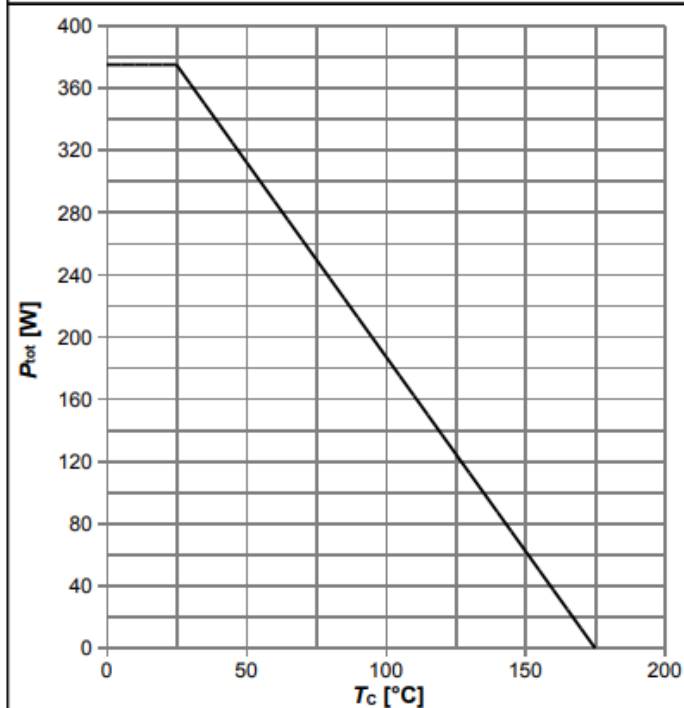
表 7 反向二极管

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

¹⁾参数定义请参见“栅极充电波形”

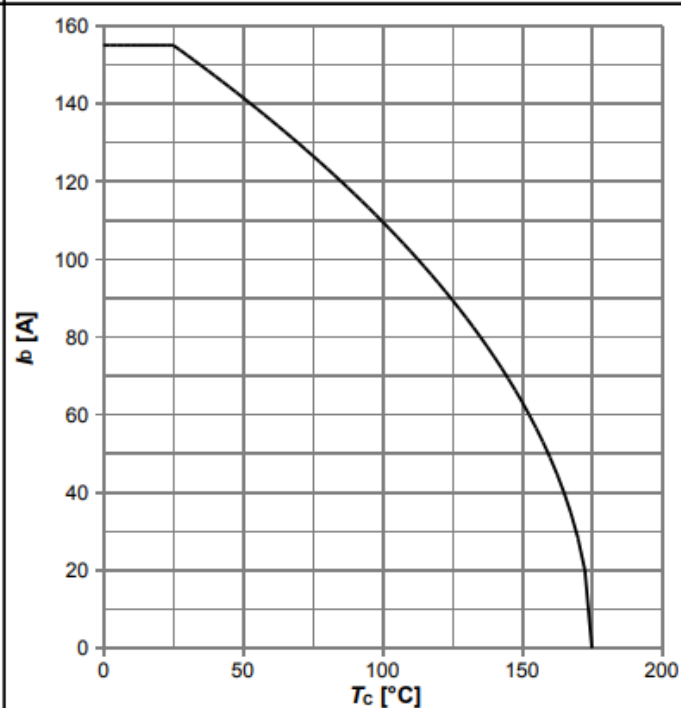
4 电气特性图

Diagram 1: Power dissipation



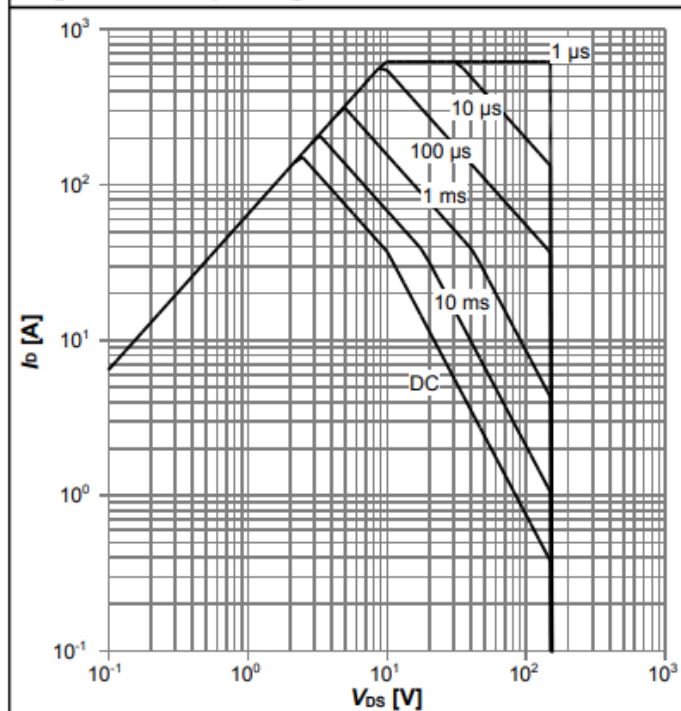
$$P_{tot}=f(T_c)$$

Diagram 2: Drain current



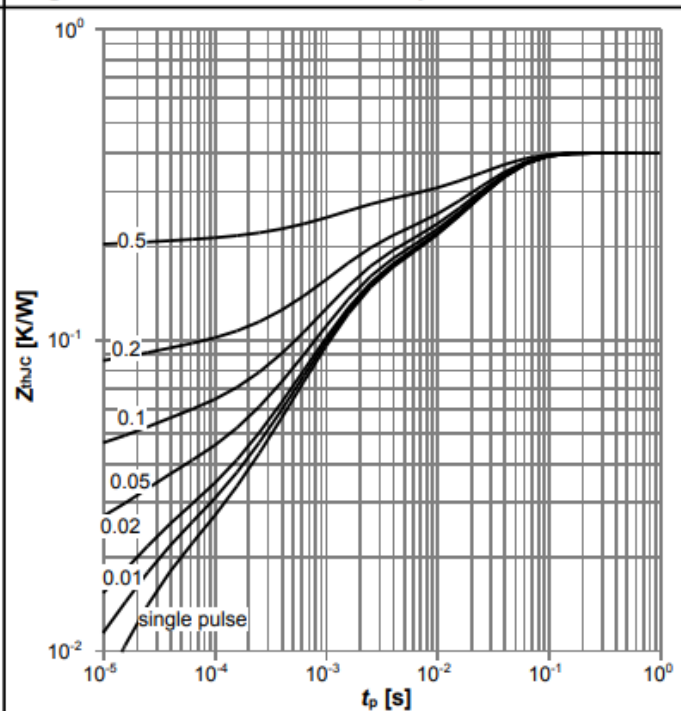
$$I_D=f(T_c); V_{GS}\geq 10\text{ V}$$

Diagram 3: Safe operating area



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

Diagram 4: Max. transient thermal impedance



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

Diagram 5: Typ. output characteristics

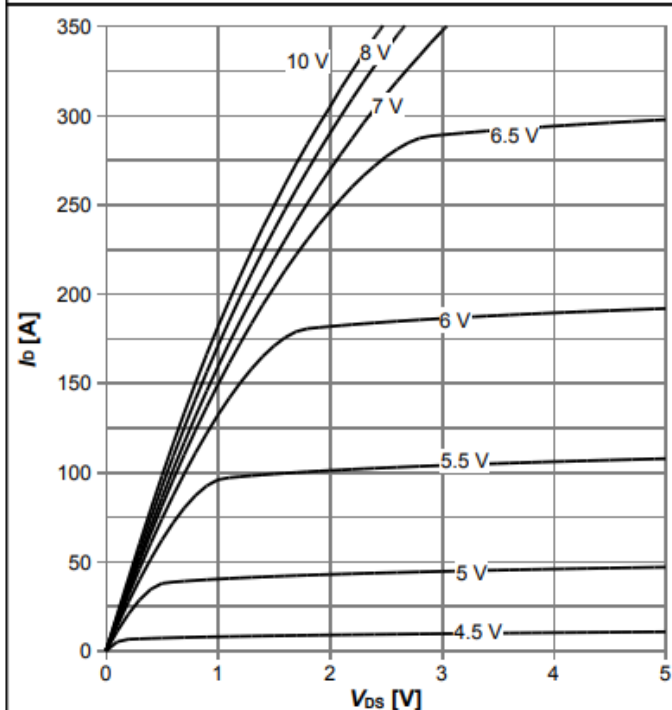

 $I_D = f(V_{DS}); T_J = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance

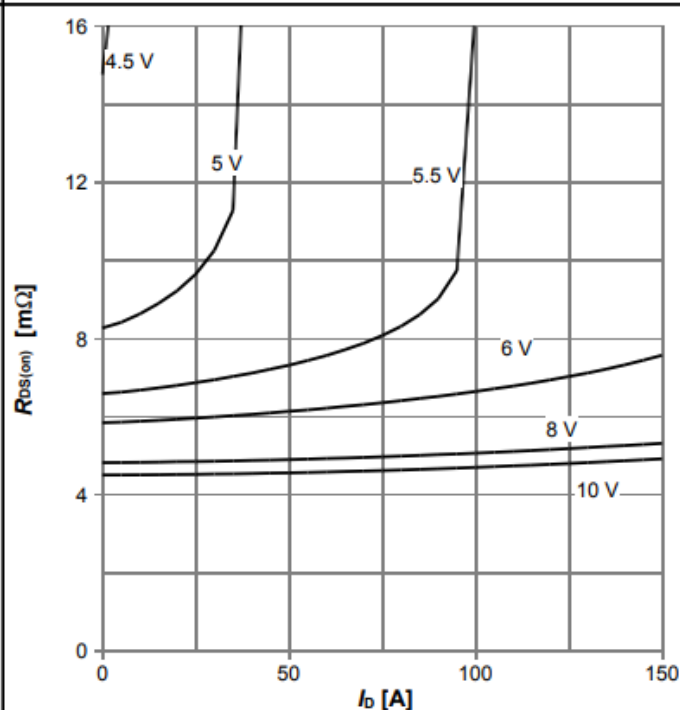

 $R_{DS(on)} = f(I_D); T_J = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics

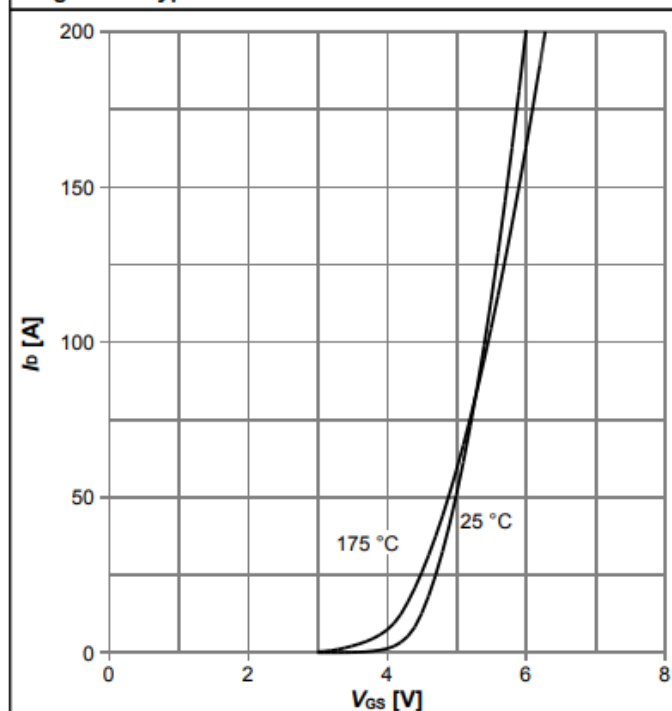

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_J$

Diagram 8: Typ. forward transconductance

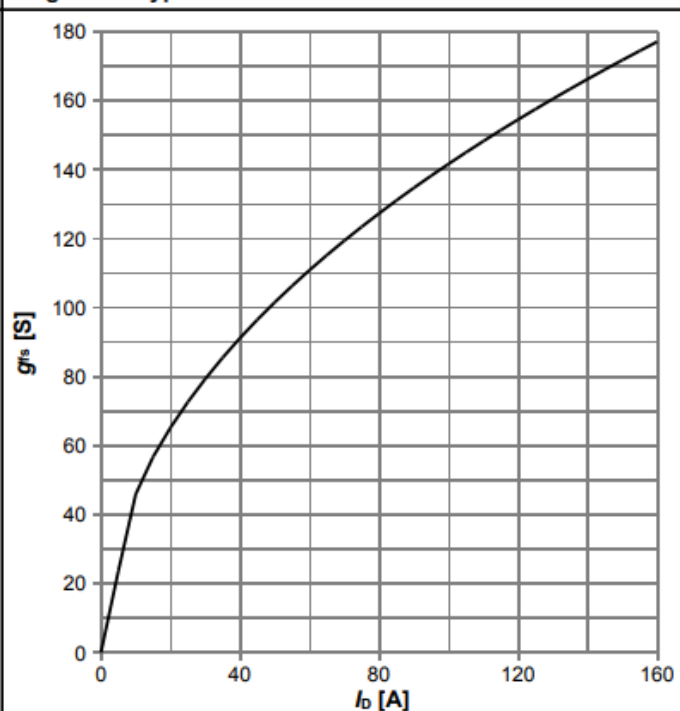
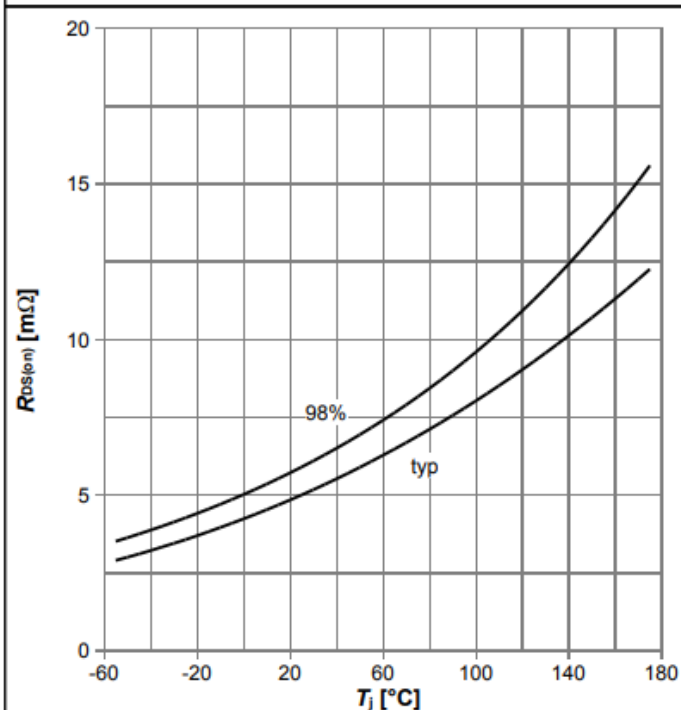
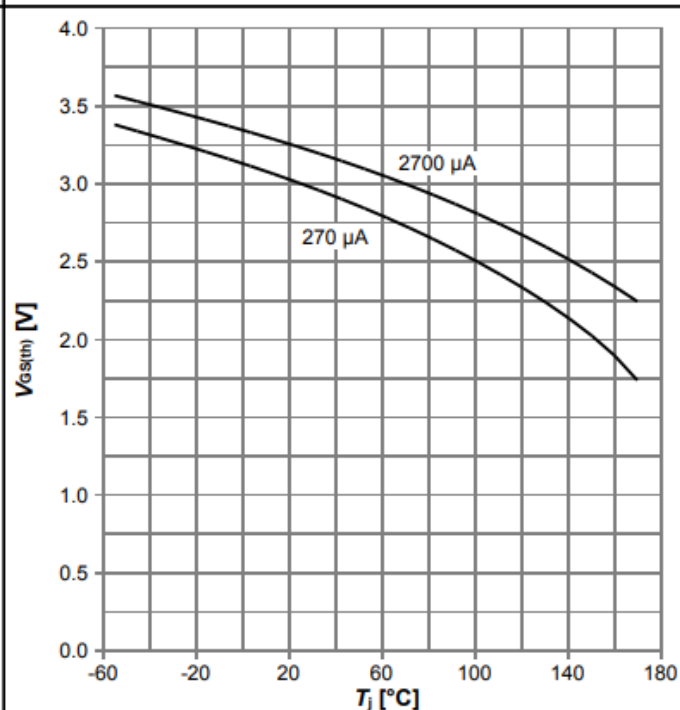

 $g_{fs} = f(I_D); T_J = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



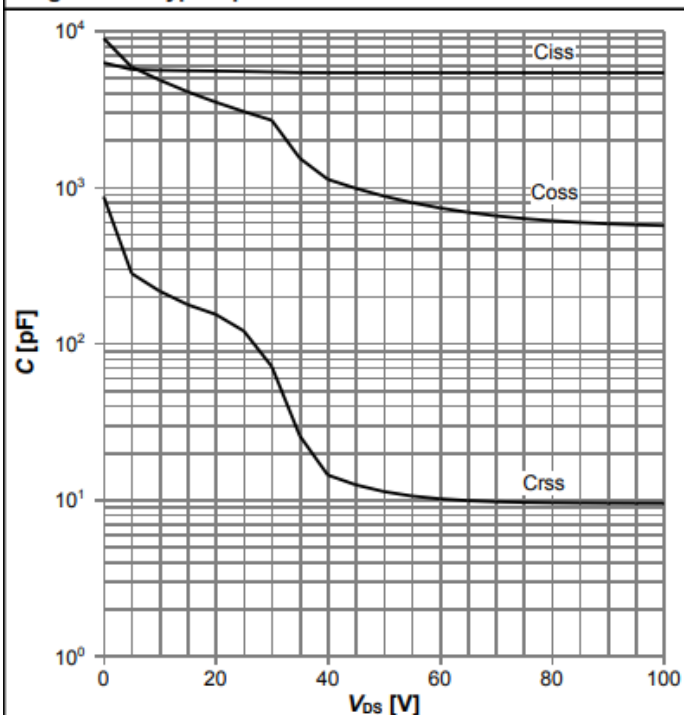
$R_{DS(on)} = f(T_J)$; $I_D = 150$ A; $V_{GS} = 10$ V

Diagram 10: Typ. gate threshold voltage



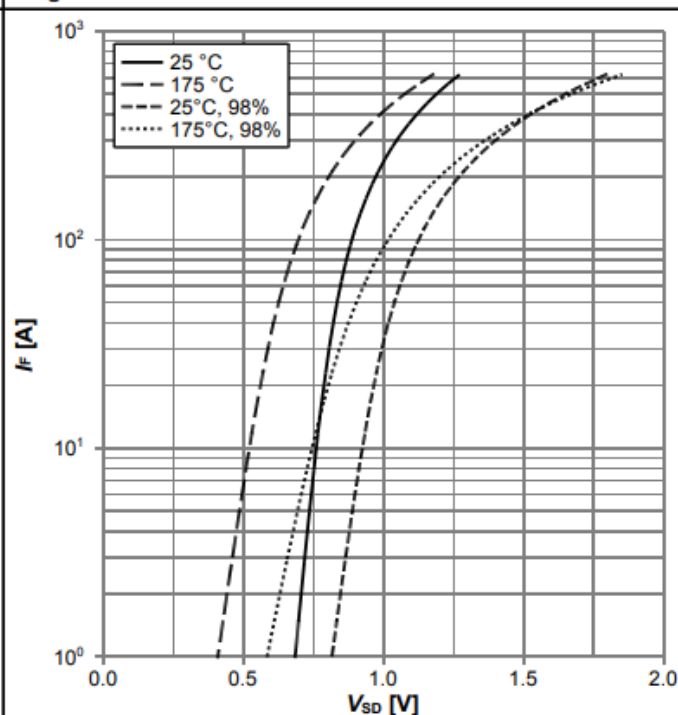
$V_{GS(th)} = f(T_J)$; $V_{GS} = V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



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

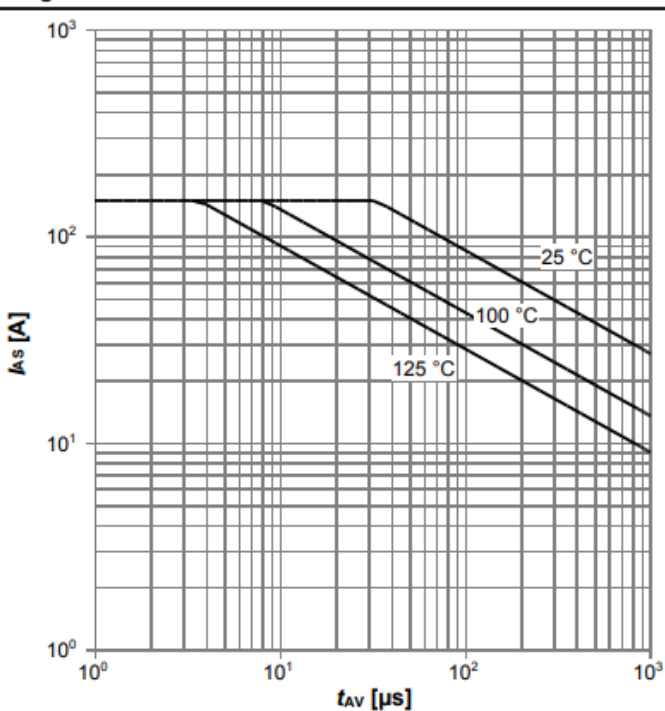
Diagram 12: Forward characteristics of reverse diode



$I_F = f(V_{SD})$; parameter: T_J

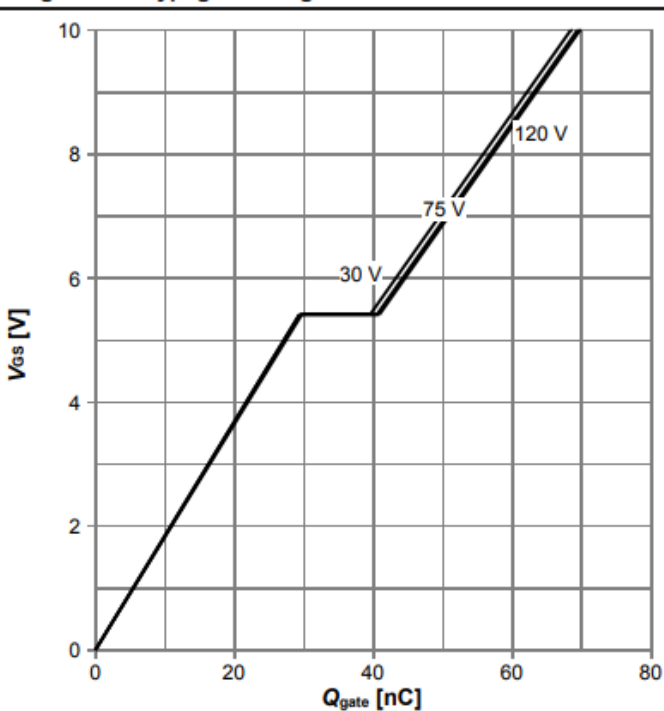


Diagram 13: Avalanche characteristics



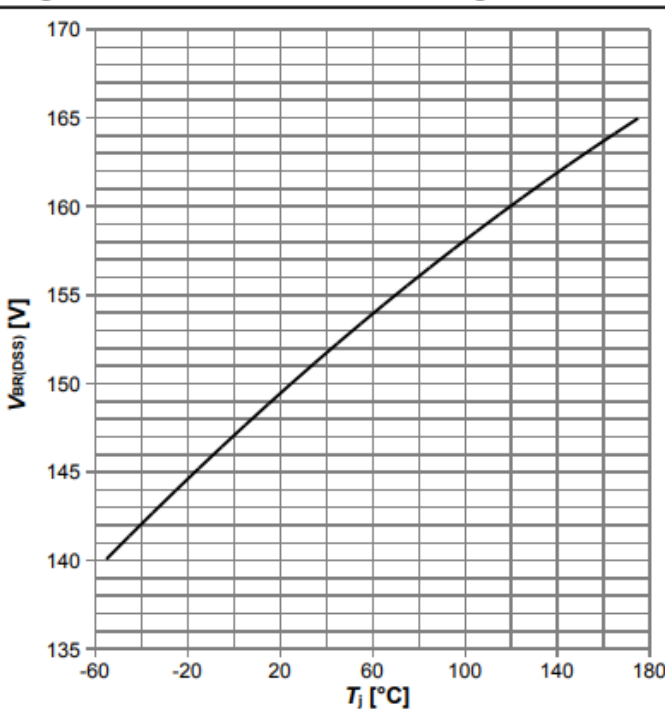
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



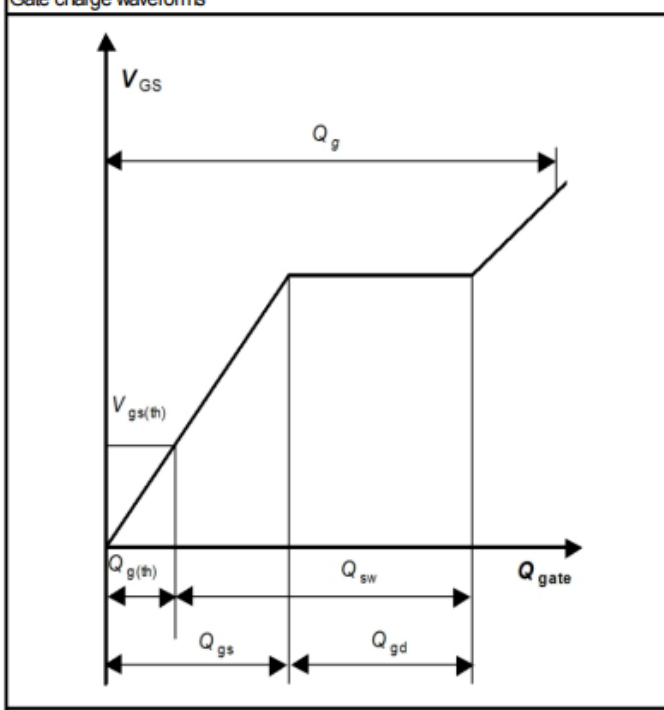
$V_{GS}=f(Q_{gate})$; $I_D=100\text{ A}$ pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

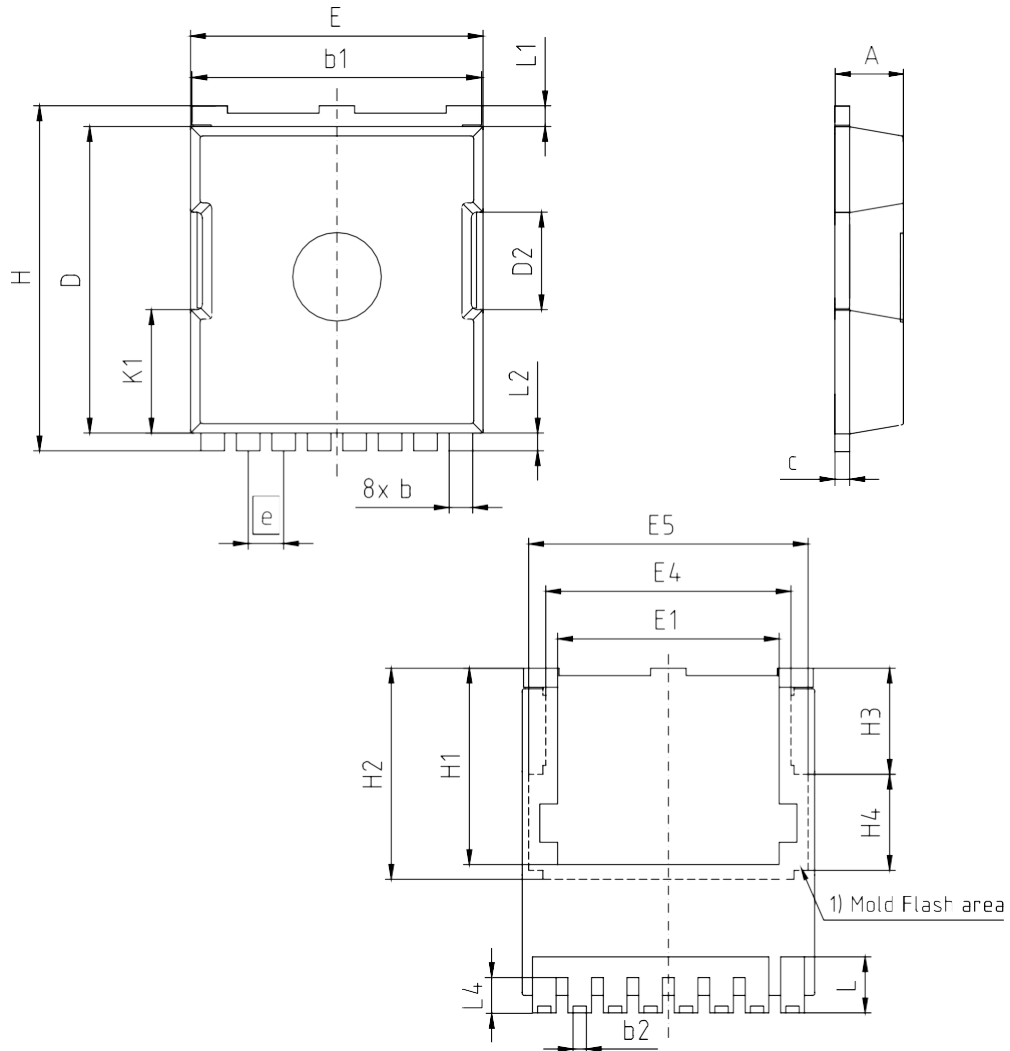


$V_{BR(DSS)}=f(T_j)$; $I_D=1\text{ mA}$

Gate charge waveforms



5 封装外形

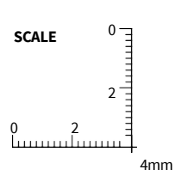


1) partially covered with Mold Flash

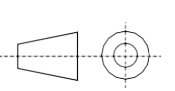
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.094
b	0.70	0.90	0.028	0.035
b1	9.70	9.90	0.382	0.390
b2	0.42	0.50	0.017	0.020
c	0.40	0.60	0.016	0.024
D	10.28	10.58	0.405	0.416
D2	3.30		0.130	
E	9.70	10.10	0.382	0.398
E1	7.50		0.295	
E4	8.50		0.335	
E5	9.46		0.372	
e	1.20 (BSC)		0.047 (BSC)	
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

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SCALE



EUROPEAN PROJECTION



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REVISION
02

图1 PG-HSOF-8 外形图

OptiMOS™3 功率晶体管, 150 V

IPT059N15N3



修订记录

IPT059N15N3

Revision: 2017-05-16, Rev. 2.2

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.0	2014-01-27	Release of final version
2.1	2014-02-07	Insert additional 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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