

英飞凌MOSFET功率晶体管

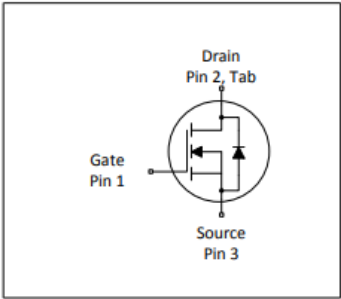
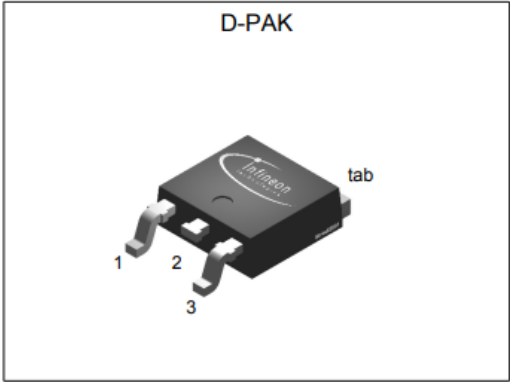
英飞凌IPD050N10N5OptiMOS™5 100 V 功率晶体管

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}	100	V
$R_{DS(on),max}$	5.0	mΩ
I_D	80	A
Q_{oss}	67	nC
$Q_g(0V..10V)$	51	nC



Type / Ordering Code	Package	Marking	Related Links
IPD050N10N5	P-T0252-3	050N10N5	-

¹⁾ J-STD20 和 JESD22

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目录

描述1

最大额定值3

热特性3

电气特性4

电气特性图6

封装外形10

修订记录11

商标11

免责声明11

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	-	-	80 80	A	$T_C = 25\text{ °C}^{1)}$ $T_C = 100\text{ °C}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	320	A	$T_C = 25\text{ °C}$
Avalanche energy, single pulse ²⁾	E_{AS}	-	-	110	mJ	$I_D = 80\text{ A}$, $R_{GS} = 25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	150	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}	-	0.6	1	K/W	-
Thermal resistance, junction - ambient, minimal footprint	R_{thJA}	-	-	75	K/W	-
Thermal resistance, junction - ambient, 6 cm ² cooling area ³⁾	R_{thJA}	-	-	50	K/W	-
Soldering temperature, wave and reflow soldering are allowed	T_{sold}	-	-	260	°C	reflow MSL1

¹⁾ 详细信息请参见图 3

²⁾ 详细信息请参见图 13

³⁾ 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) 铜面积用于漏极连接。印刷电路板在静止空气中垂直放置。

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	$V_{(BR)DSS}$	100	-	-	V	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.2	3.0	3.8	V	$V_{DS}=V_{GS}$, $I_D=84\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=100\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	1	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	4.3 5.1	5 6.7	$\text{m}\Omega$	$V_{GS}=10\text{ V}$, $I_D=40\text{ A}$ $V_{GS}=6\text{ V}$, $I_D=20\text{ A}$
Gate resistance ¹⁾	R_G	-	1.2	1.8	Ω	-
Transconductance	g_{fs}	48	95	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=40\text{ A}$

表 5 动态特性¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	3600	4700	pF	$V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	560	730	pF	$V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	25	44	pF	$V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=40\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	7	-	ns	$V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=40\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	27	-	ns	$V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=40\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	7	-	ns	$V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=40\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

表 6 栅极电荷特性²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	16	-	nC	$V_{DD}=50\text{ V}$, $I_D=40\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge ¹⁾	Q_{gd}	-	10	16	nC	$V_{DD}=50\text{ V}$, $I_D=40\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	16	-	nC	$V_{DD}=50\text{ V}$, $I_D=40\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total ¹⁾	Q_g	-	51	64	nC	$V_{DD}=50\text{ V}$, $I_D=40\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	$V_{DD}=50\text{ V}$, $I_D=40\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ¹⁾	Q_{oss}	-	67	89	nC	$V_{DD}=50\text{ V}$, $V_{GS}=0\text{ V}$

¹⁾ 由设计标定, 不受限于生产测试。

²⁾ 参数定义 请参见“栅极充电波形”

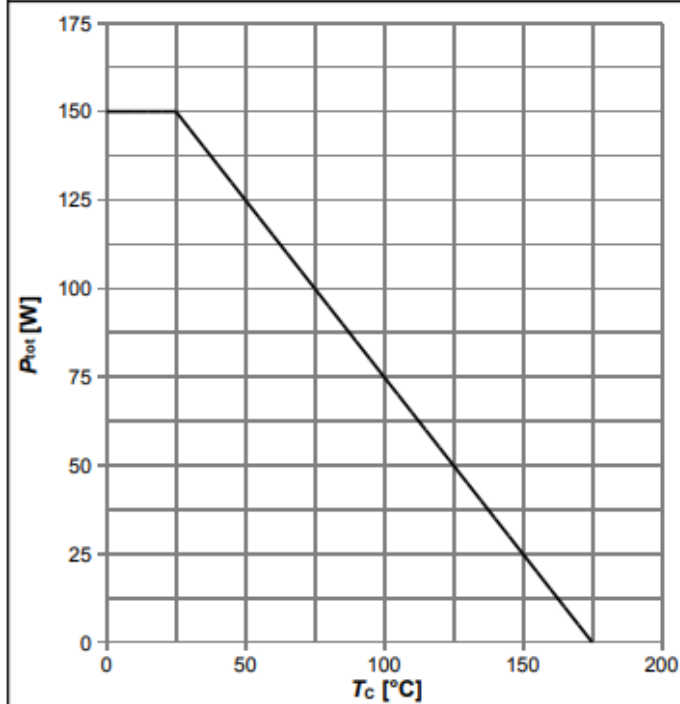
表 7 反向二极管

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	80	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	320	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.9	1.2	V	$V_{GS}=0\text{ V}$, $I_F=40\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ¹⁾	t_{rr}	-	48	96	ns	$V_R=50\text{ V}$, $I_F=40\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ¹⁾	Q_{rr}	-	62	124	nC	$V_R=50\text{ V}$, $I_F=40\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$

¹⁾由设计标定，不受制于生产测试。

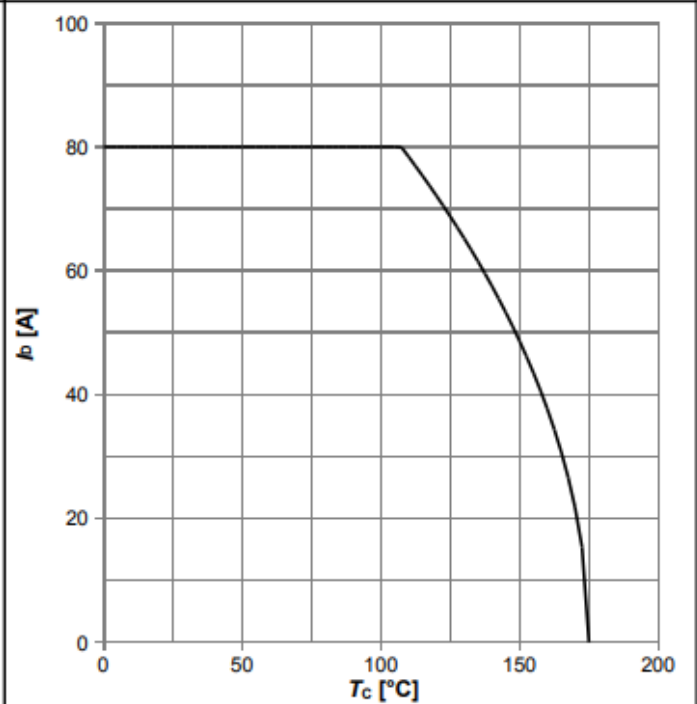
4 电气特性图

Diagram 1: Power dissipation



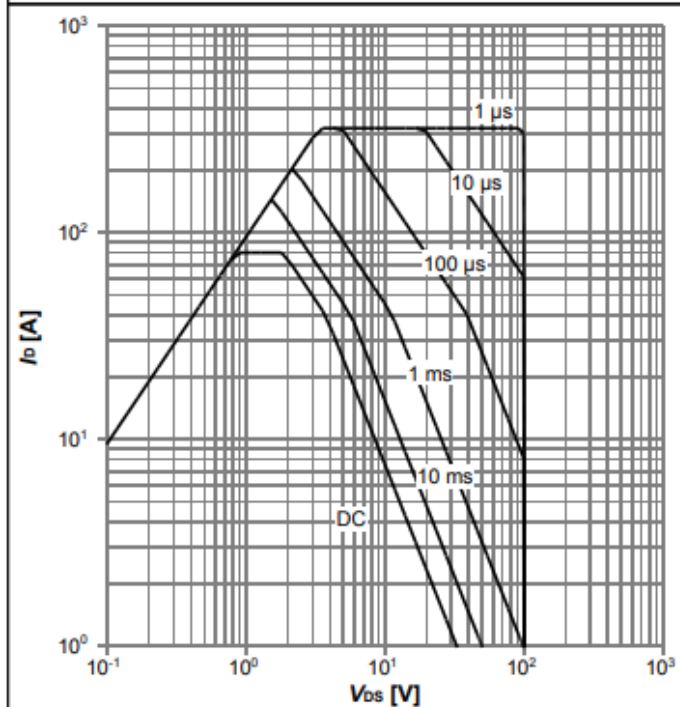
$$P_{tot}=f(T_c)$$

Diagram 2: Drain current



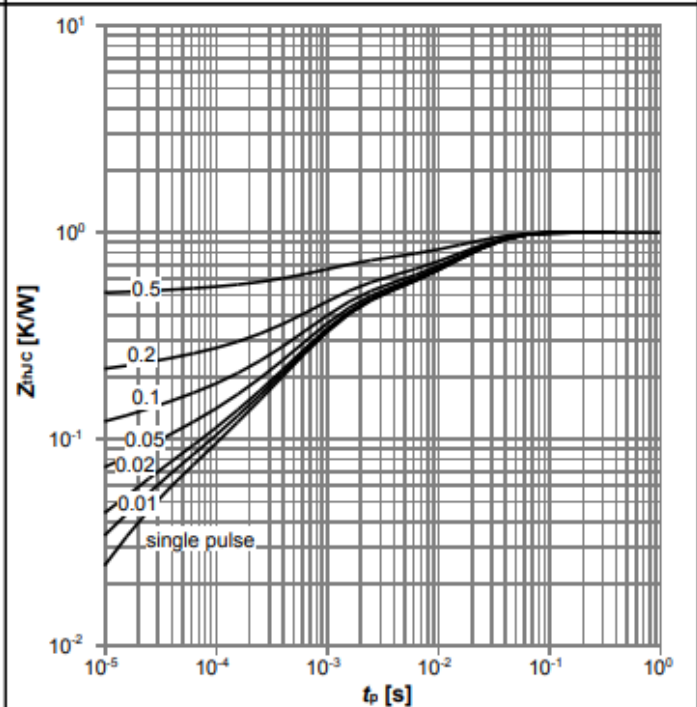
$$I_D=f(T_c); V_{GS} \geq 10 \text{ V}$$

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



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

Diagram 5: Typ. output characteristics

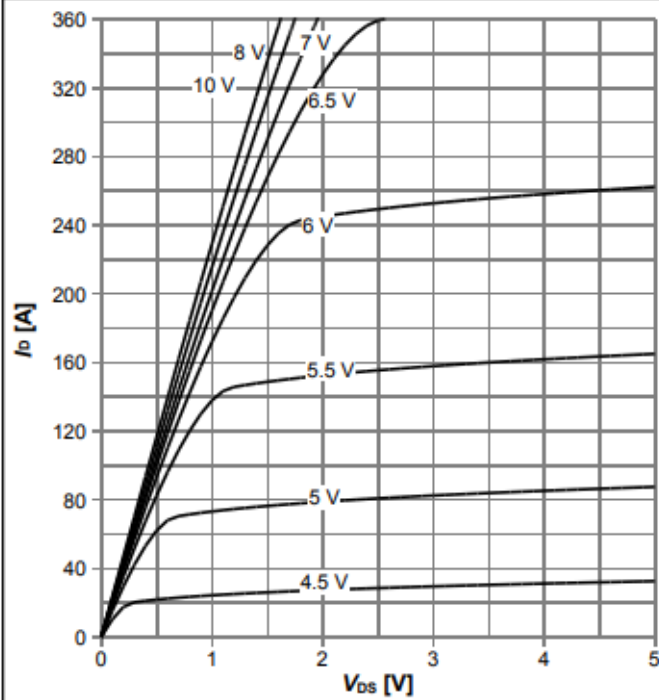


Diagram 6: Typ. drain-source on resistance

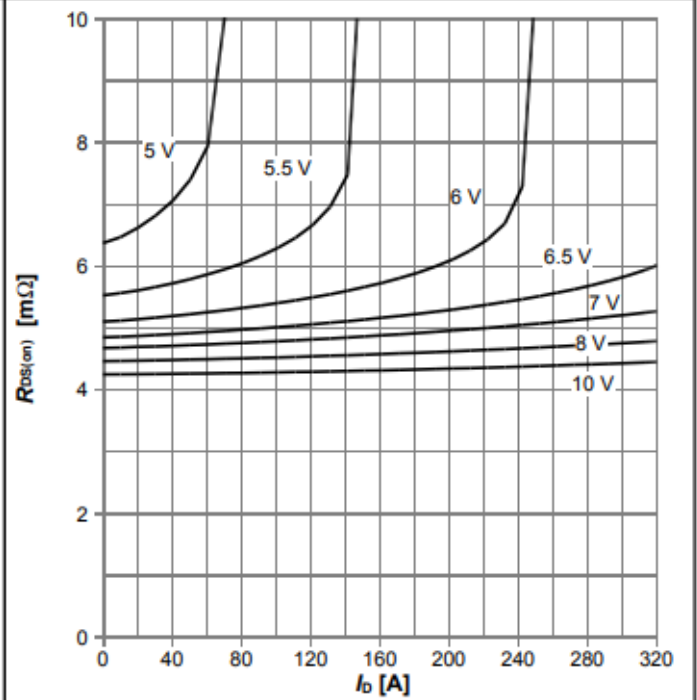


Diagram 7: Typ. transfer characteristics

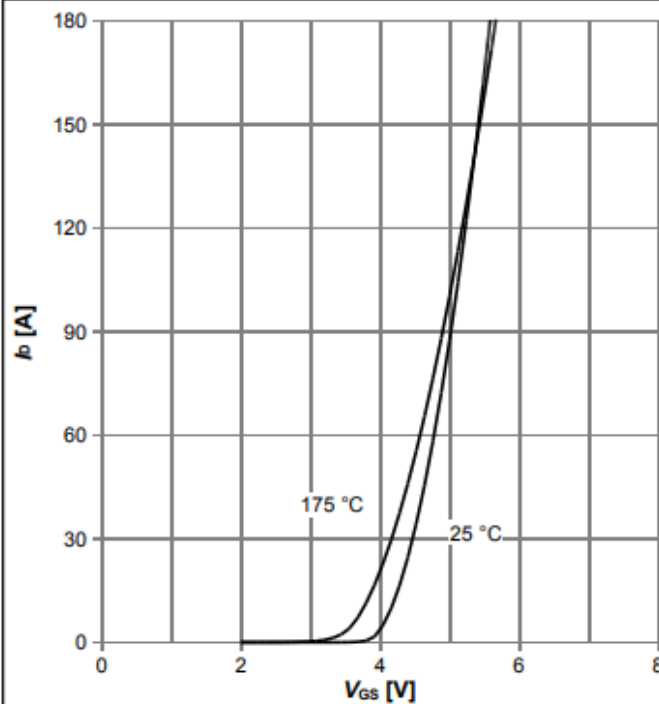


Diagram 8: Typ. forward transconductance

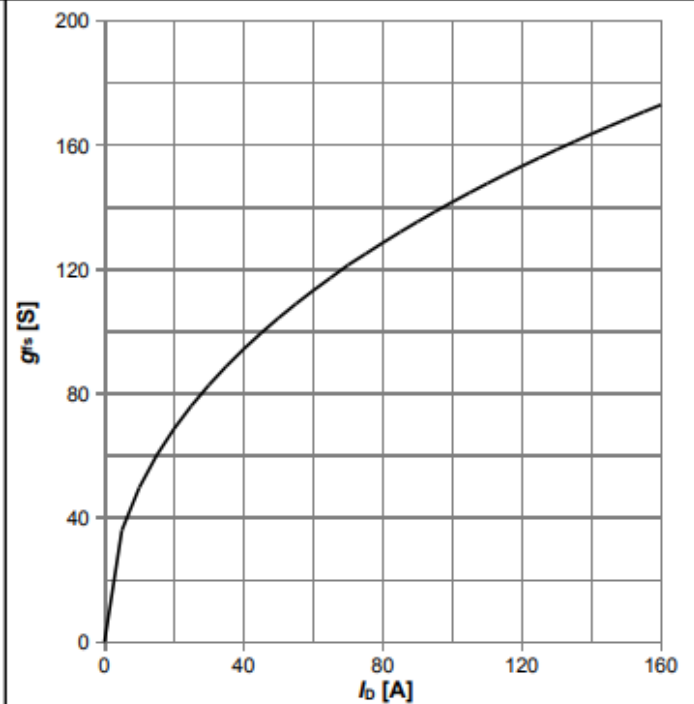
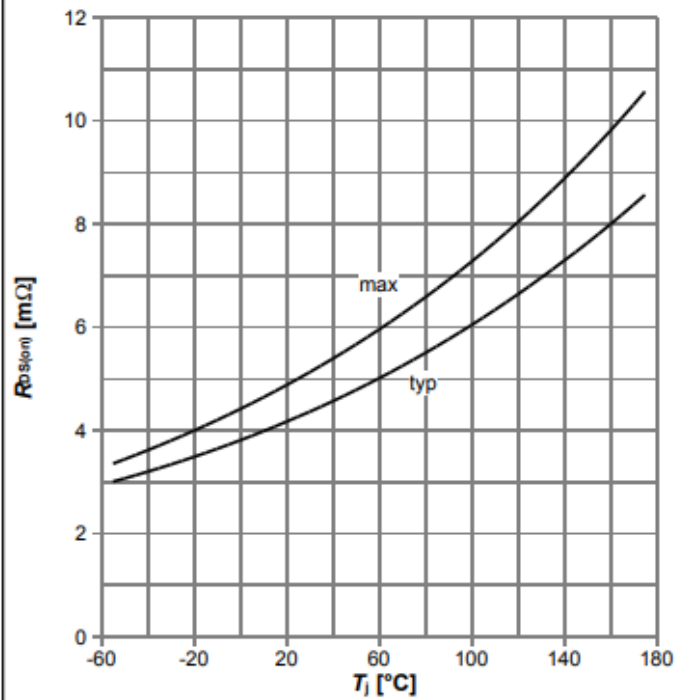
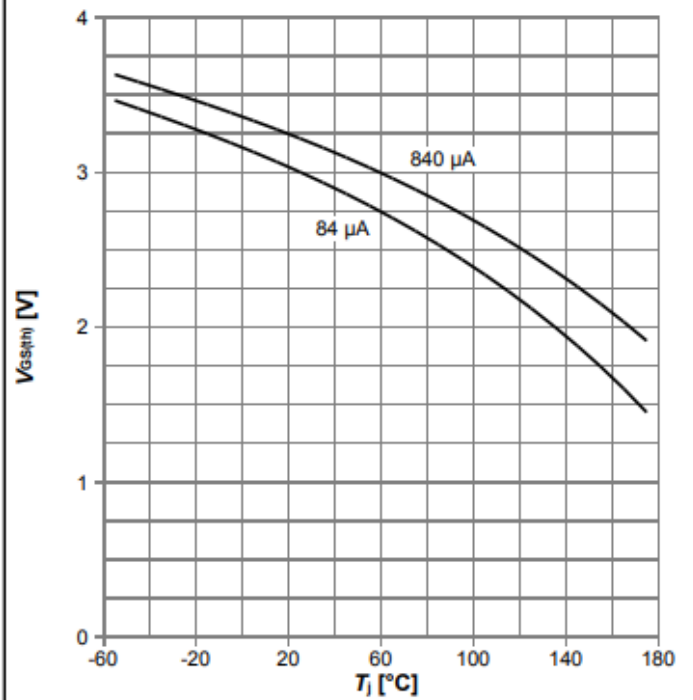


Diagram 9: Drain-source on-state resistance



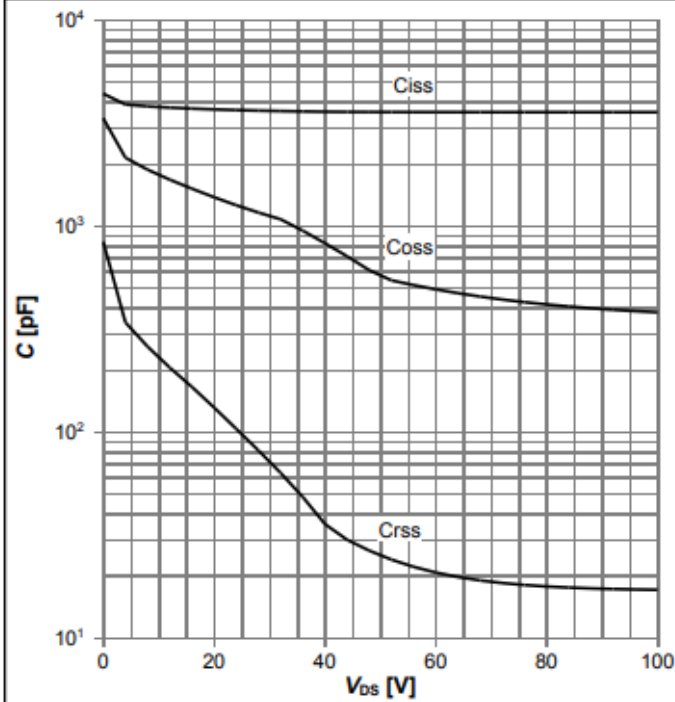
$R_{DS(on)} = f(T_J)$; $I_D = 40$ A; $V_{GS} = 10$ V

Diagram 10: Typ. gate threshold voltage



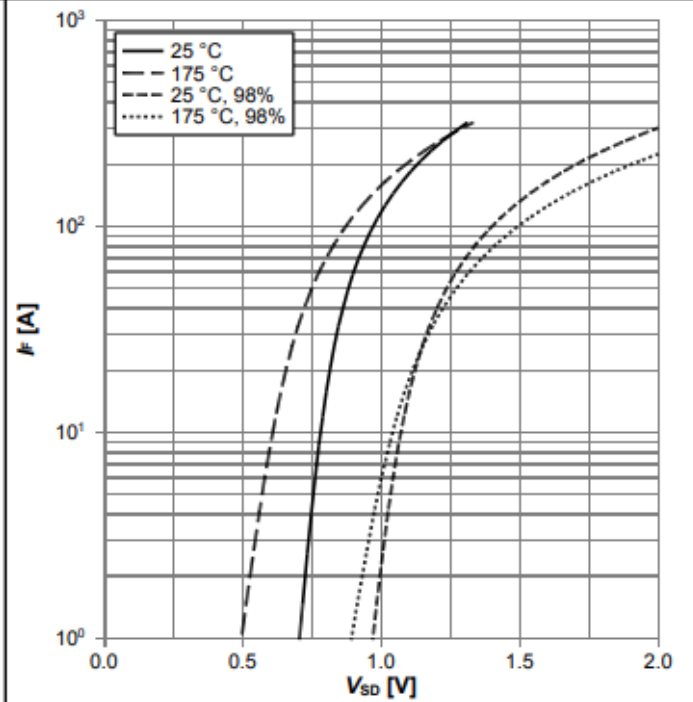
$V_{GS(th)} = f(T_J)$; $V_{GS} = V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



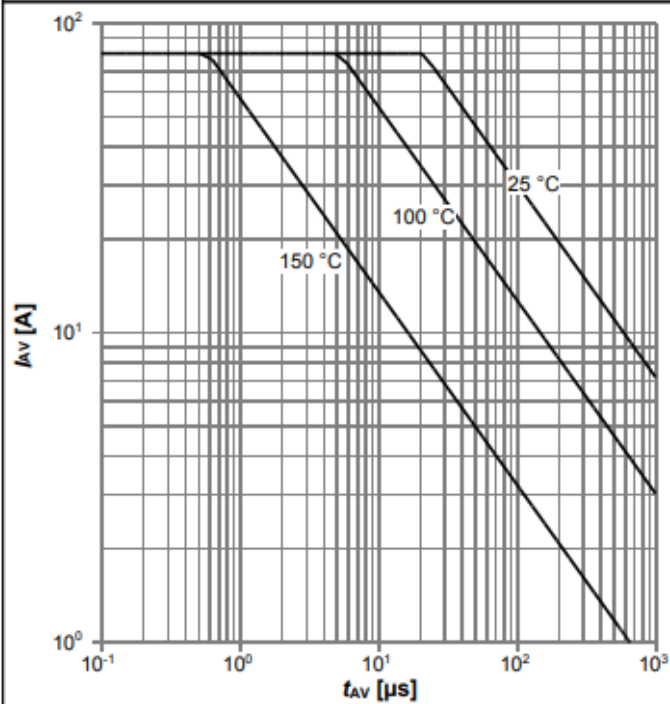
$C = f(V_{DS})$; $V_{GS} = 0$ V; $f = 1$ MHz

Diagram 12: Forward characteristics of reverse diode



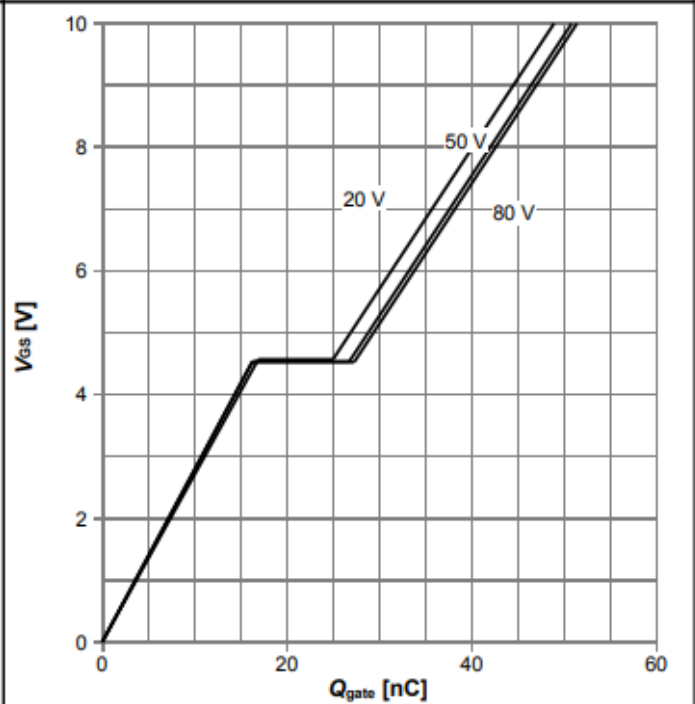
$I_F = f(V_{SD})$; parameter: T_J

Diagram 13: Avalanche characteristics



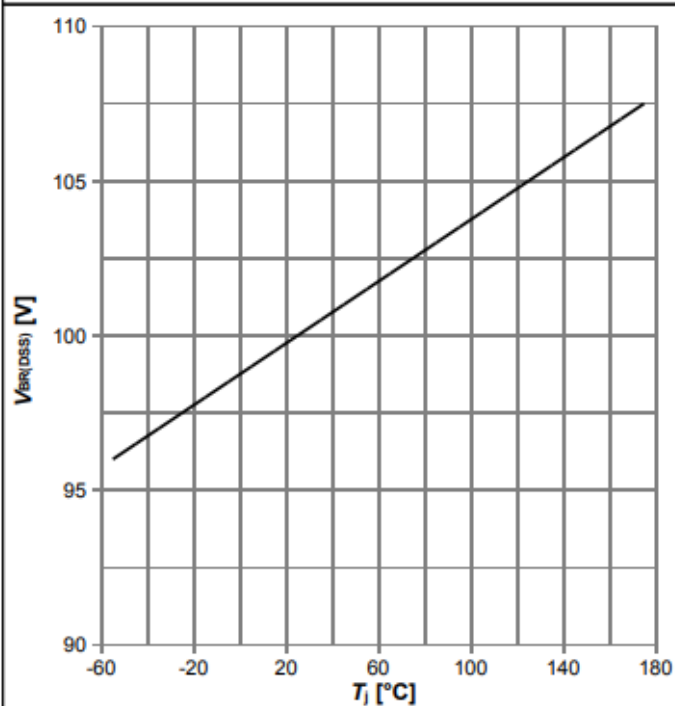
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{J(start)}$

Diagram 14: Typ. gate charge



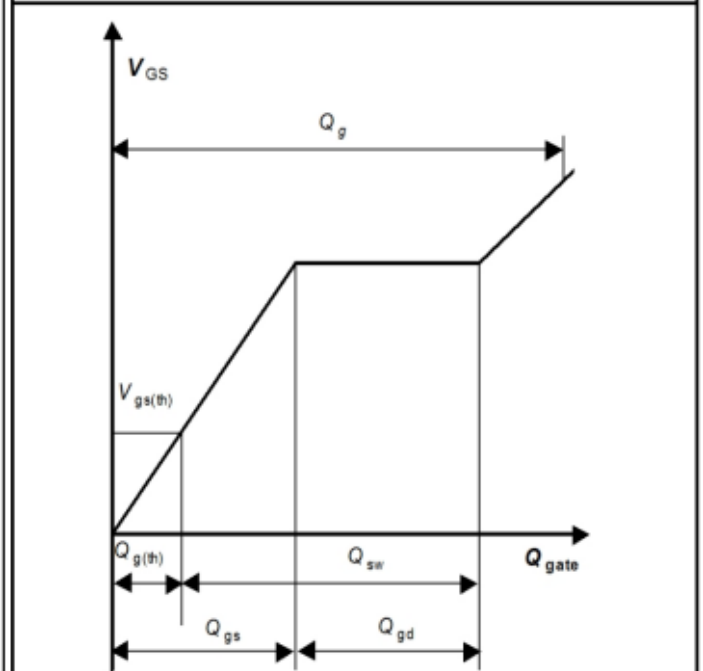
$V_{GS}=f(Q_{gate})$; $I_D=40\text{ A}$ pulsed; parameter: V_{DD}

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

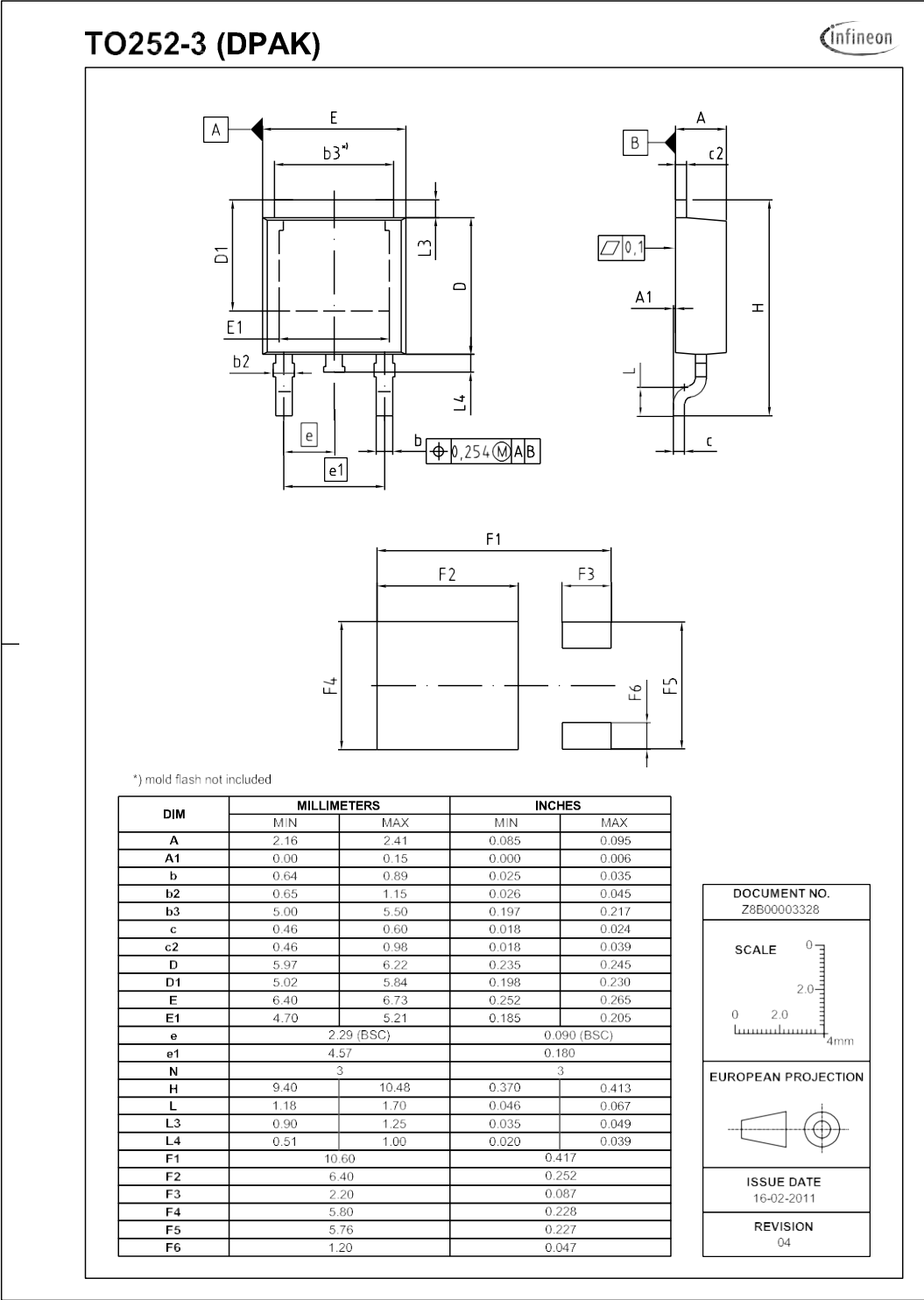


图 1 PG-TO252-3 外形图，尺寸单位为毫米/英寸

修订记录

IPD050N10N5

Revision: 2017-01-17, Rev. 2.1

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.0	2016-11-22	Release of final version
2.1	2017-01-17	Update Idss max at Tj=25°C

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