

英飞凌CoolGaN™ G5

英飞凌CoolGaN™ 晶体管 650 V G5

英飞凌的 CoolGaN™ 是一款高效氮化镓 (GaN) 晶体管，专为 650 V 的功率转换而设计。它可实现更高的功率密度，降低系统 BOM 成本，并有助于实现小型化外形尺寸。采用 200 毫米（8 英寸）晶圆技术和全自动化生产线生产，生产公差小，产品质量行业领先。这使其适用于从消费电子到工业的广泛应用。

特性

- 增强型晶体管
- 超快速开关
- 无反向恢复电荷
- 能够反向传导
- 低栅极和输出电荷
- 出色的换向耐用性
- 2 kV HBM ESD（静电防护）标准

优点

- 常关断晶体管技术确保安全运行
- 实现快速、精确的电力输送控制
- 提高系统效率和可靠性
- 确保在严苛条件下的稳健表现

这些特性共同使 CoolGaN™ 成为电源转换领域的变革者，兼具高效率、紧凑性和可靠性。

潜在应用

基于半桥硬开关和软开关拓扑（例如图腾柱 PFC 和高频 LLC）的工业、通信、数据中心 SMPS，以及充电器和适配器。

产品验证

已通过 JEDEC 相关测试。

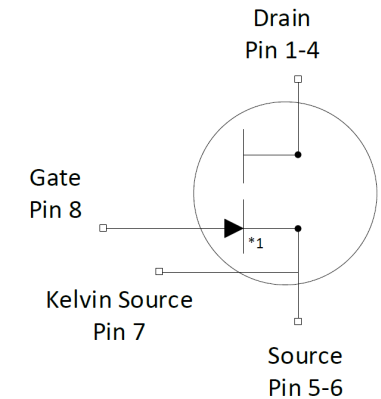
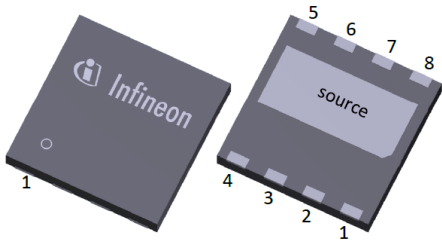
表 1 主要性能参数

Parameter	Value	Unit
$V_{DS,max}$	650	V
$V_{DS,trans-max}$	900	V
$R_{DS(on),max}$	170	mΩ
$Q_{g,typ}$	1.8	nC
$I_{D,pulse}$	23	A
$Q_{oss@400V}$	14	nC
Q_{rr}	0	nC

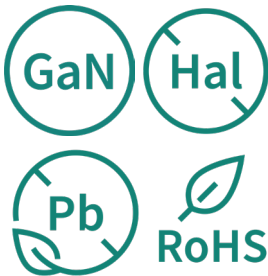
Part number	Package	Marking	Related links
IGL65R140D2	PG-TSON-8	65R140D2	see Appendix A

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 [infineon.com](https://www.infineon.com) 参考最新的英文版本（控制文档）。

PG-TSON-8



*1: Internal gate diode



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1 最大额定值

除非另有说明，否则 $T_j = 25^\circ\text{C}$ 。超过最大额定值的应力可能会对器件造成永久性损坏。为获得最佳使用寿命和可靠性，英飞凌建议运行条件不要持续超过所述最大额定值的 80%（除非另有明确说明）。如需更多信息，请联系您当地的英飞凌销售办事处。

表 2 最大额定值

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain source voltage, continuous	$V_{DS,max}$	-	-	650	V	$V_{GS} = 0\text{ V}$; derating recommendation according JEDEC JEP198
Leakage current at drain source transient voltage	$I_{DS,trans}$	-	-	4.8	mA	$V_{GS} = 0\text{ V}$; $V_{DS,trans} = 900\text{ V}$
Drain source voltage transient	$V_{DS,trans}$	-	-	900	V	<1% duty cycle; <1 μs ; 1 million pulses
Drain source voltage, pulsed	$V_{DS,pulsed}$	-	-	750	V	$T_j = 25^\circ\text{C}$; $V_{GS} \leq 0\text{ V}$; cumulated stress time $\leq 10\text{ h}$
						$T_j = 125^\circ\text{C}$; $V_{GS} \leq 0\text{ V}$; cumulated stress time $\leq 1\text{ h}$
Switching surge voltage, pulsed	$V_{DS,surge}$	-	-	750	V	DC bus voltage = 700 V; turn off $V_{DS,pulse} = 750\text{ V}$; turn on $I_{D,pulse} = 10\text{ A}$; $f \leq 100\text{ kHz}$; $T_j = 105^\circ\text{C}$; $t \leq 100\text{ s}$ (10 million pulses)
Continuous current, drain source ¹⁾	I_D	-	-	13	A	$T_C = 25^\circ\text{C}$; $T_j = T_{j,max}$
Pulsed current, drain source ²⁾	$I_{D,pulse}$	-23	-	23	A	$T_j = 25^\circ\text{C}$; $I_G = 10\text{ mA}$; See Diagram 3, 5
		-14		14		$T_j = 125^\circ\text{C}$; $I_G = 10\text{ mA}$; See Diagram 4, 6
Gate current, continuous ³⁾	$I_{G,avg}$	-	4.6	7.7	mA	$T_j = -55^\circ\text{C}$ to $T_j = 150^\circ\text{C}$; See Table 9
Gate current, pulsed ³⁾	$I_{G,pulsed}$	-0.77	-	0.77	A	$T_j = -55^\circ\text{C}$ to $T_j = 150^\circ\text{C}$; $t_{pulse} = 50\text{ ns}$; $f = 100\text{ kHz}$; See Table 9
Gate source voltage, continuous ³⁾	V_{GS}	-10	-	-	V	$T_j = -55^\circ\text{C}$ to $T_j = 150^\circ\text{C}$; See Diagram 12
Gate source voltage, pulsed ³⁾	$V_{GS,pulse}$	-25	-	-	V	$T_j = -55^\circ\text{C}$ to $T_j = 150^\circ\text{C}$; $t_{pulse} = 50\text{ ns}$; $f = 100\text{ kHz}$; open drain
Power dissipation	P_{tot}	-	-	47	W	$T_C = 25^\circ\text{C}$
Operating junction temperature	T_j	-55	-	150	$^\circ\text{C}$	-
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	Max shelf life depends on storage conditions
Drain-source voltage slew-rate	dv/dt	-	-	200	V/ns	-

- 1) 受 $T_{j,max}$ 限制。最大占空比 $D = 0.75$
- 2) 由设计指定，未经过生产测试。
- 3) 考虑栅极电流 (I_G) 对漏极电流 (I_D) 的影响。更多详情，请参见表 10（相关链接）并参考栅极驱动应用笔记和可靠性白皮书，或联系当地英飞凌销售办事处。

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}	-	-	2.7	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	130	°C/W	Device on PCB, minimum footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	67	°C/W	Device on 40 mm*40 mm*1.5 mm epoxy PCB FR4 with 6 cm ² (one layer, 70 µm thickness) copper area for tab (source) connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature	T_{solder}	-	-	260	°C	MSL3, wave & reflow soldering allowed

3 电气特性

除非另有规定, $T_j = 25^\circ\text{C}$

表 4 静态特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate threshold voltage	$V_{GS(th)}$	0.9	1.2	1.6	V	$I_{DS}=1\text{ mA}; V_{DS}=10\text{ V}; T_j=25^\circ\text{C}$
		-	1	-		$I_{DS}=1\text{ mA}; V_{DS}=10\text{ V}; T_j=150^\circ\text{C}$
Gate-Source reverse clamping voltage	$V_{GS, clamp}$	-	-	-8	V	$I_{GS}=-1\text{ mA}$
Drain-Source leakage current	I_{DSS}	-	0.39	39	μA	$V_{DS}=650\text{ V}; V_{GS}=0\text{ V}; T_j=25^\circ\text{C}$
			7.8	-		$V_{DS}=650\text{ V}; V_{GS}=0\text{ V}; T_j=150^\circ\text{C}$
Drain-Source on-state resistance	$R_{DS(on)}$	-	0.140	0.170	Ω	$I_G=10\text{ mA}; I_D=3.1\text{ A}; T_j=25^\circ\text{C}$
			0.300	-		$I_G=10\text{ mA}; I_D=3.1\text{ A}; T_j=150^\circ\text{C}$
Gate resistance ⁴⁾	$R_{G,int}$	-	0.92	-	Ω	LCR impedance measurement; $f=f_{res}$, open drain

⁴⁾ 由设计指定, 未经过生产测试。

表 5 动态特性

由设计指定, 未经过生产测试。

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	130	-	pF	$V_{GS}=0\text{ V}; V_{DS}=400\text{ V}; f=1\text{ MHz}$
Output capacitance	C_{oss}		22			
Reverse transfer capacitance	C_{rss}		0.31			
Effective output capacitance, time related ⁵⁾	$C_{o(tr)}$	-	35	-	pF	$V_{GS}=0\text{ V}; V_{DS}=0\text{ to }400\text{ V}; I_D=\text{const}$
Effective output capacitance, energy related ⁶⁾	$C_{o(er)}$	-	26	-	pF	$V_{DS}=0\text{ to }400\text{ V}$
Output charge	Q_{oss}		14	-	nC	
Coss stored energy	E_{oss}		2.1	-	μJ	
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	$I_D=3.1\text{ A}; R_{ON}=12\text{ }\Omega; R_{OFF}=12\text{ }\Omega;$ $R_{SS}=820\text{ }\Omega; C_C=1.2\text{ nF};$ $V_{DRV}=12\text{ V}; \text{ see Table 8}$
Turn-off delay time	$t_{d(off)}$		10			
Rise time	t_r		7			
Fall time	t_f		23			

⁵⁾ $C_{o(tr)}$ 是一个固定电容, 当 V_{DS} 从 0 升至 400 V 时, 其充电时间与 C_{oss} 相同

⁶⁾ $C_{o(er)}$ 是一个固定电容, 当 V_{DS} 从 0 升至 400 V 时, 其存储能量与 C_{oss} 相同

表 6 栅极电荷特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate charge ⁷⁾	Q_G	-	1.8	-	nC	$V_{GS}=0$ to 3 V; $V_{DS}=400$ V; $I_D=3.1$ A

⁷⁾ 由设计指定, 未经过生产测试。

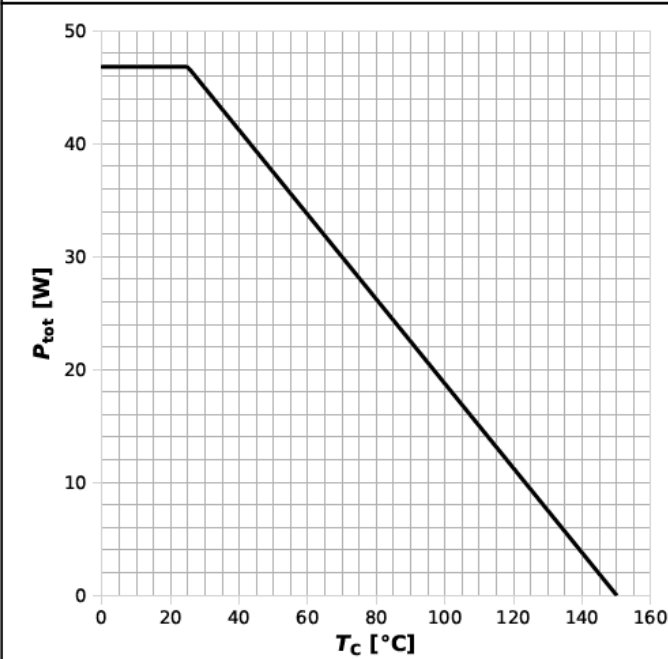
表 7 反向传导特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Source-Drain reverse voltage	V_{SD}	-	2.0	2.4	V	$V_{GS}=0$ V; $I_{SD}=3.1$ A
Pulsed current, reverse	$I_{SD,pulse}$	-	-	23	A	$I_G=10$ mA
Reverse recovery charge ⁸⁾	Q_{rr}	-	0	-	nC	$I_{SD}=3.1$ A; $V_{DS}=400$ V

⁸⁾ 由设计指定, 未经过生产测试。不包括 Q_{OSSO}

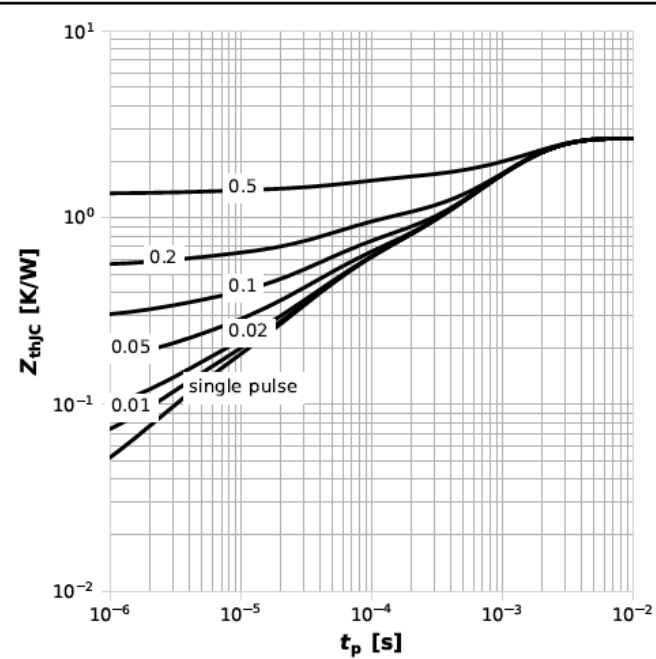
4 电气特性图

Diagram 1: Power dissipation



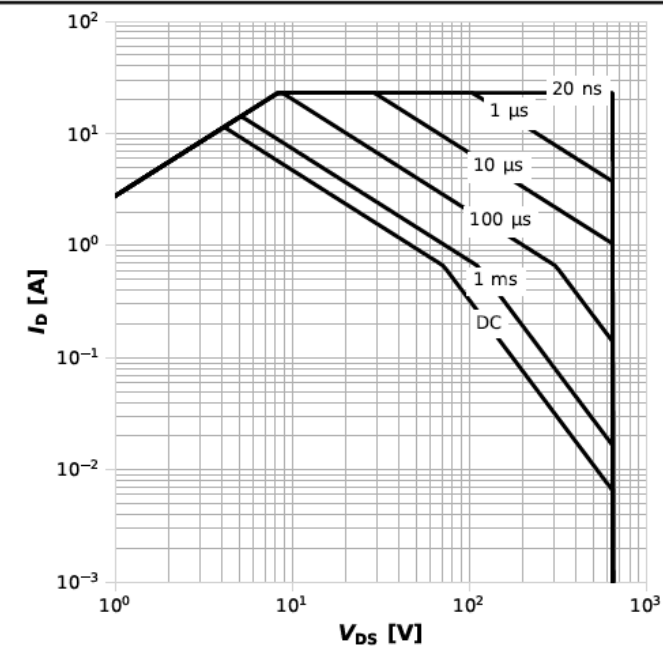
$P_{tot}=f(T_c)$

Diagram 2: Max. transient thermal impedance



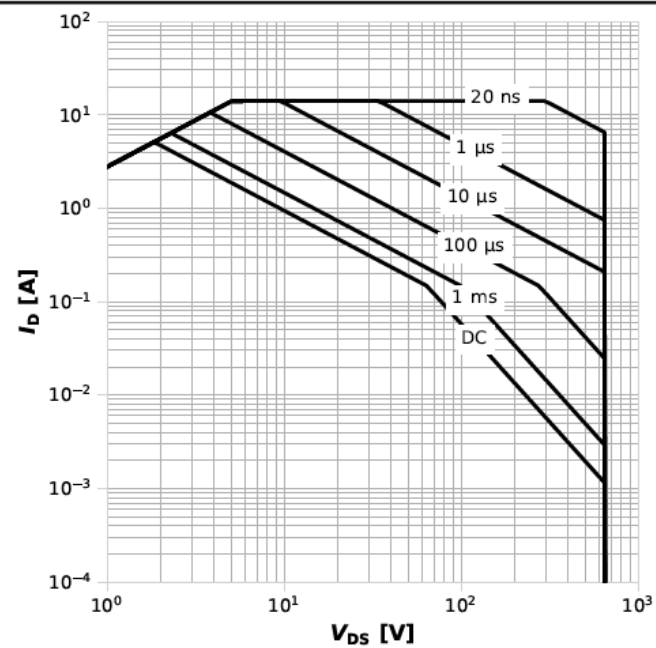
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 3: Safe operating area



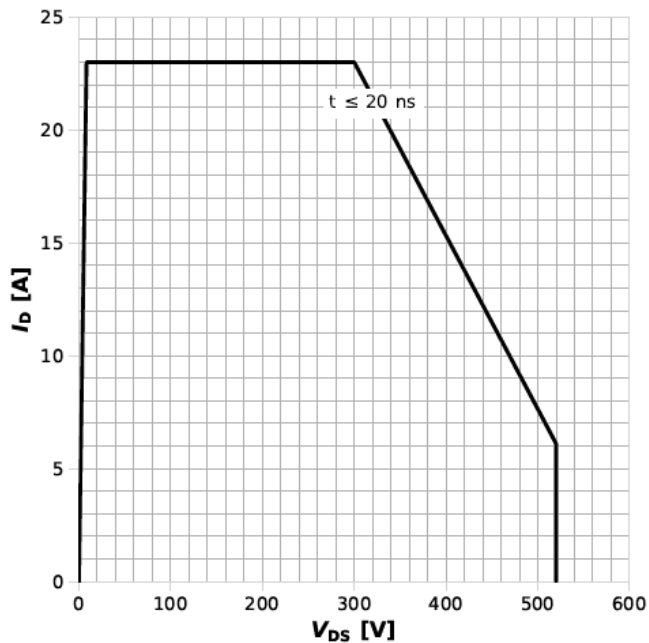
$I_D=f(V_{DS})$; $T_c=25^\circ\text{C}$; $D=0$; parameter: t_p

Diagram 4: Safe operating area



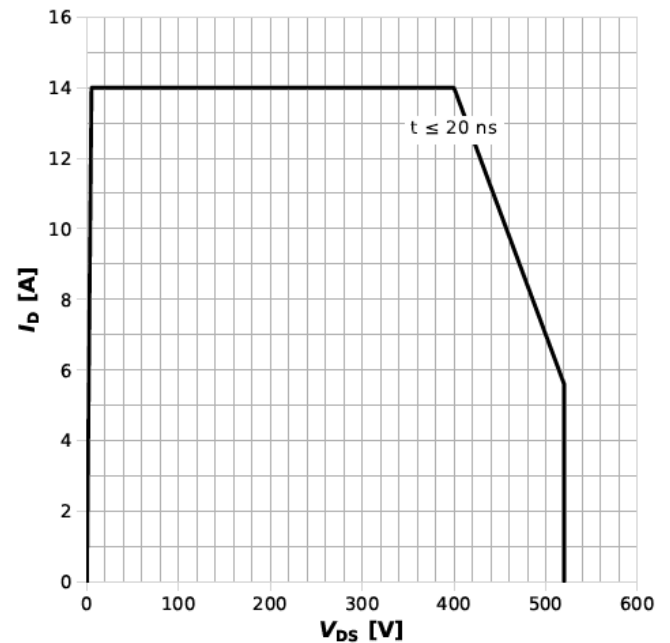
$I_D=f(V_{DS})$; $T_c=125^\circ\text{C}$; $D=0$; parameter: t_p

Diagram 5: Repetitive safe operating area



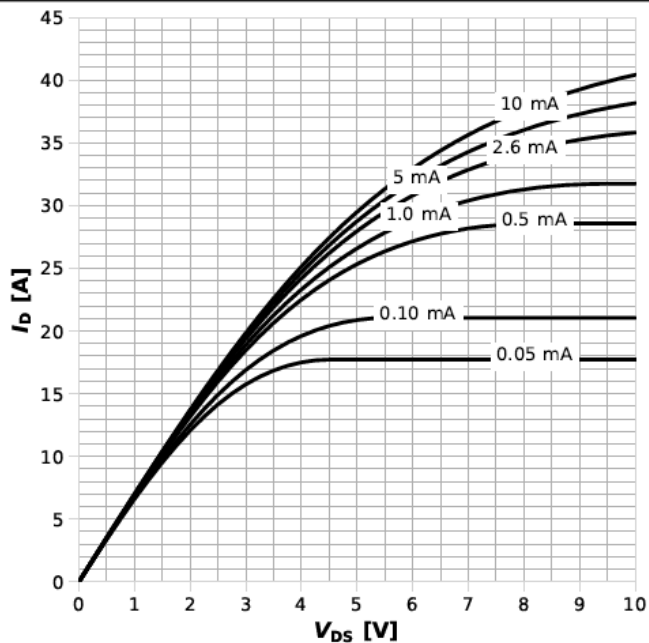
$I_D = f(V_{DS})$; $T_C = 25^\circ\text{C}$; $T_j \leq 150^\circ\text{C}$; parameter: t_p

Diagram 6: Repetitive safe operating area



$I_D = f(V_{DS})$; $T_C = 125^\circ\text{C}$; $T_j \leq 150^\circ\text{C}$; parameter: t_p

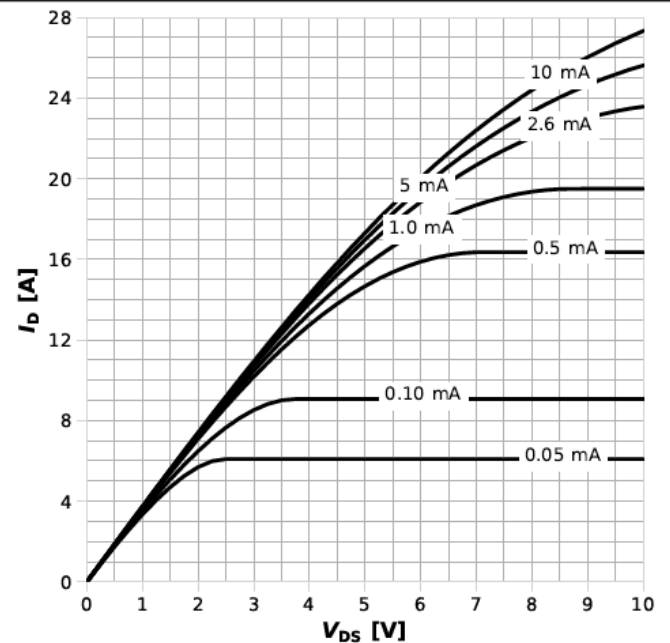
Diagram 7: Typ. static* output characteristics



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

* Refer to gate drive application note (see table 10)

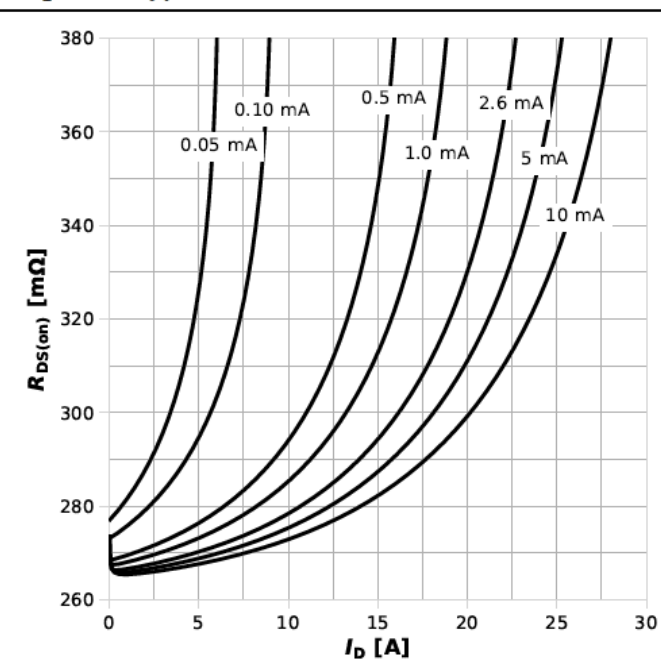
Diagram 8: Typ. static* output characteristics



$I_D = f(V_{DS})$; $T_j = 125^\circ\text{C}$; parameter: I_{GS}

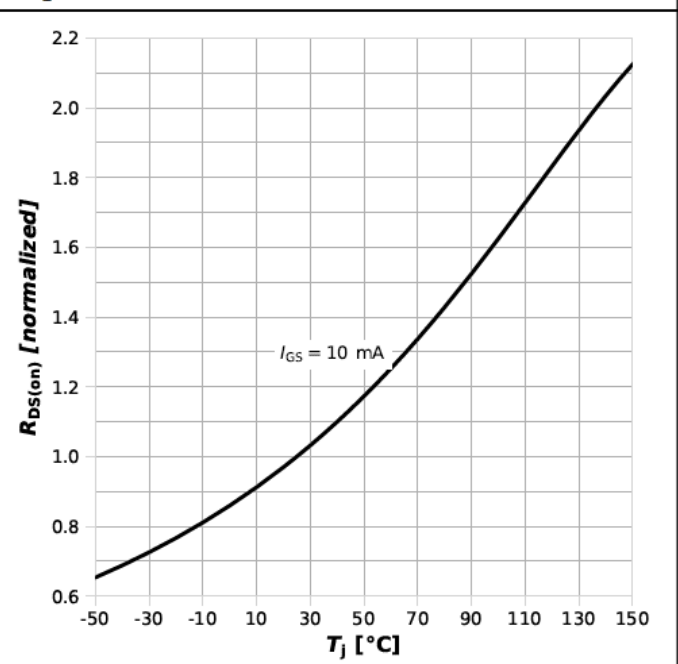
* Refer to gate drive application note (see table 10)

Diagram 9: Typ. Drain-source on-state resistance



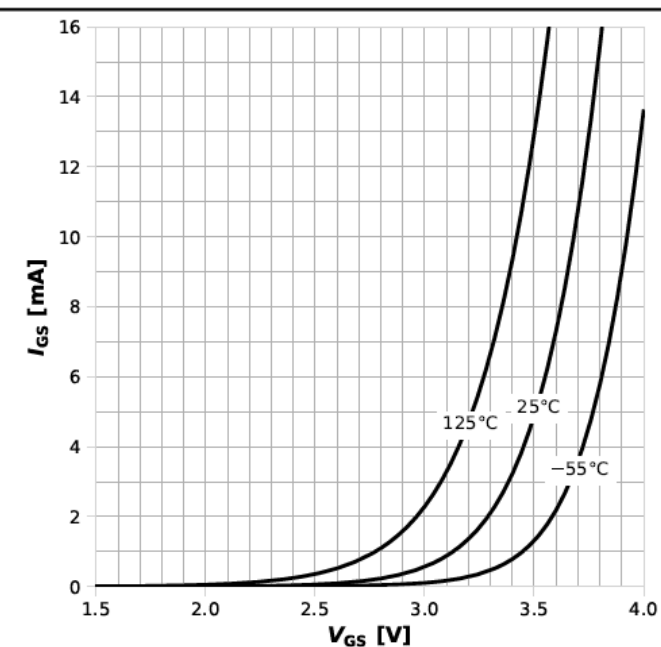
$R_{DS(on)} = f(I_D); T_j = 125^\circ\text{C}; \text{parameter: } I_{GS}$

Diagram 10: Drain-source on-state resistance



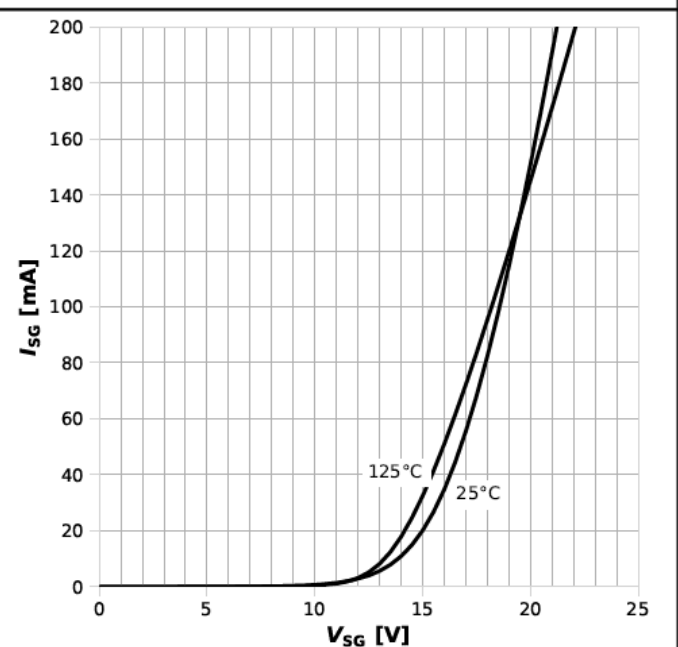
$R_{DS(on)} = f(T_j); I_D = 3.1 \text{ A}$

Diagram 11: Typ. gate characteristics forward



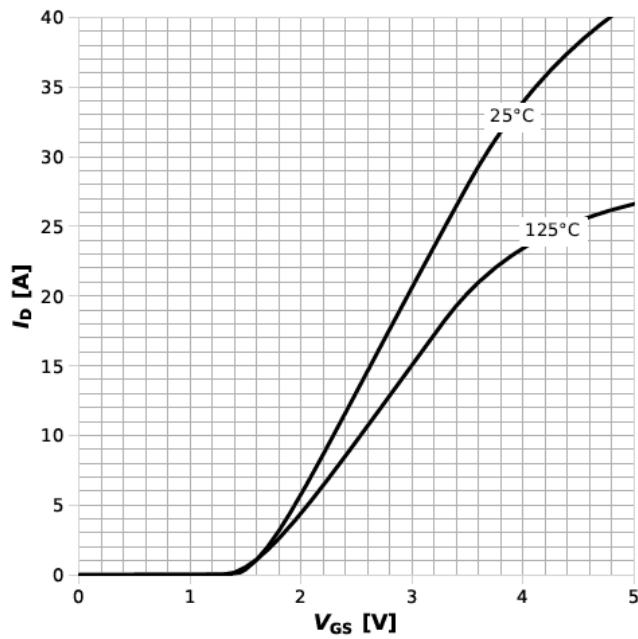
$I_{GS} = f(V_{GS}); \text{open drain}; \text{parameter: } T_j$

Diagram 12: Typ. gate characteristics reverse



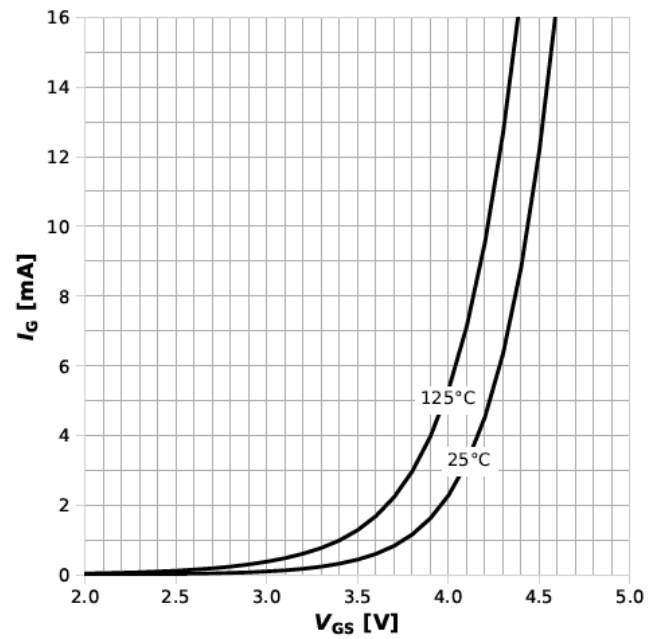
$I_{SG} = f(V_{SG}); \text{parameter: } T_j$

Diagram 13: Typ. transfer characteristics



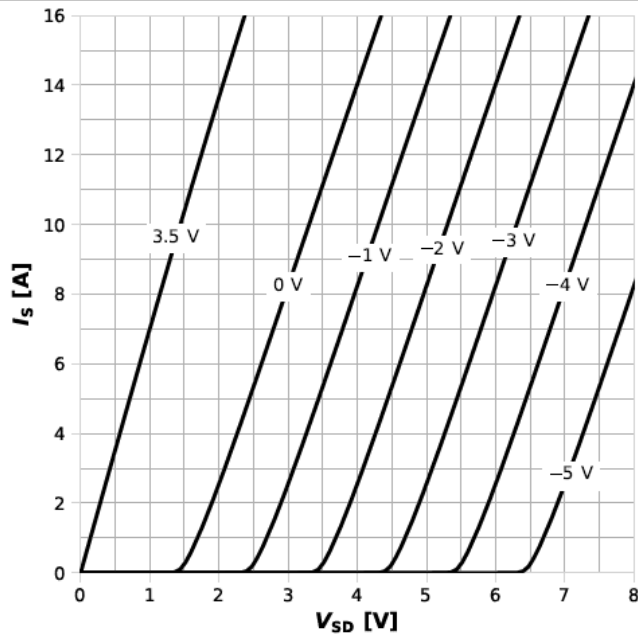
$I_D = f(V_{GS}); V_{DS} = 8V; \text{parameter: } T_j$

Diagram 14: Typ. transfer gate current characteristic



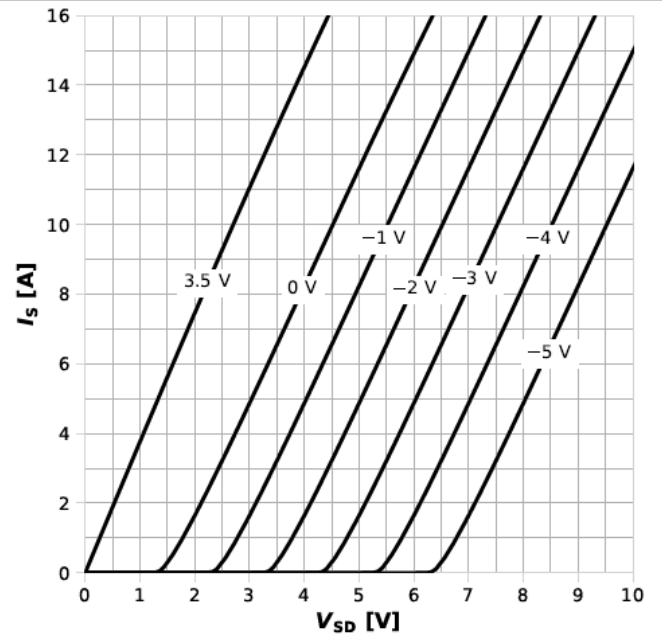
$I_G = f(V_{GS}); V_{DS} = 8V; \text{parameter: } T_j$

Diagram 15: Typ. channel reverse characteristics



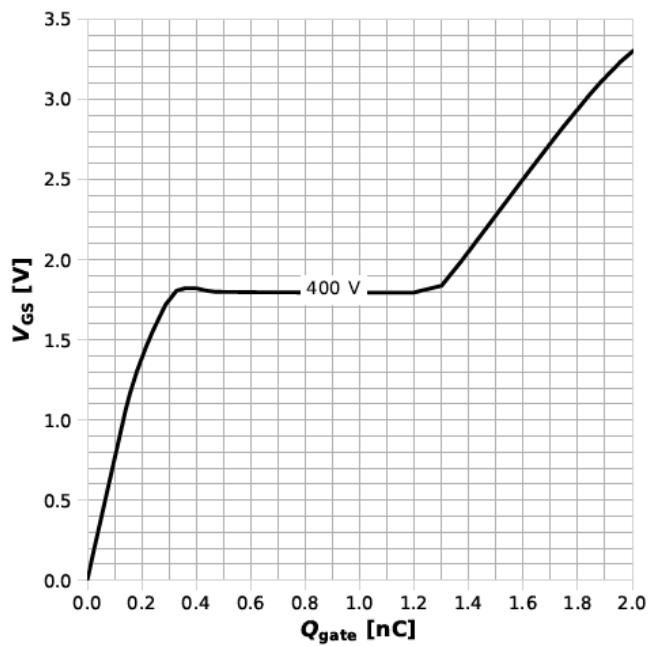
$I_S = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 16: Typ. channel reverse characteristics



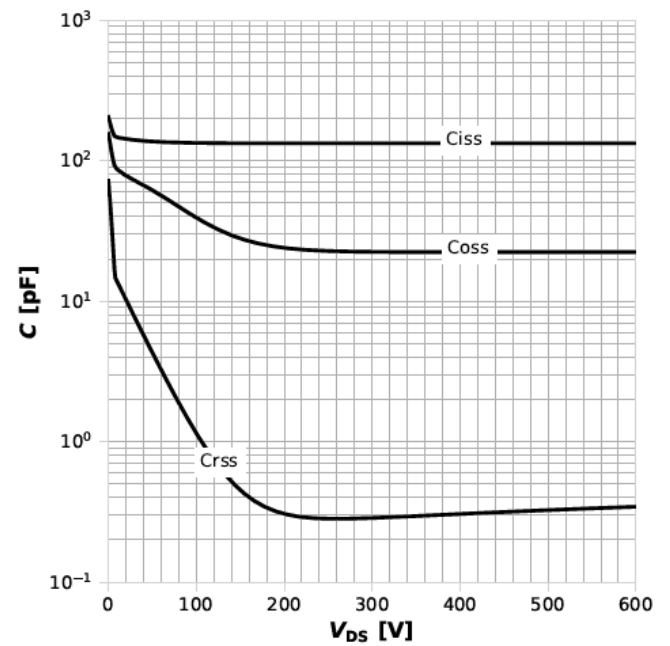
$I_S = f(V_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 17 Typ. gate charge



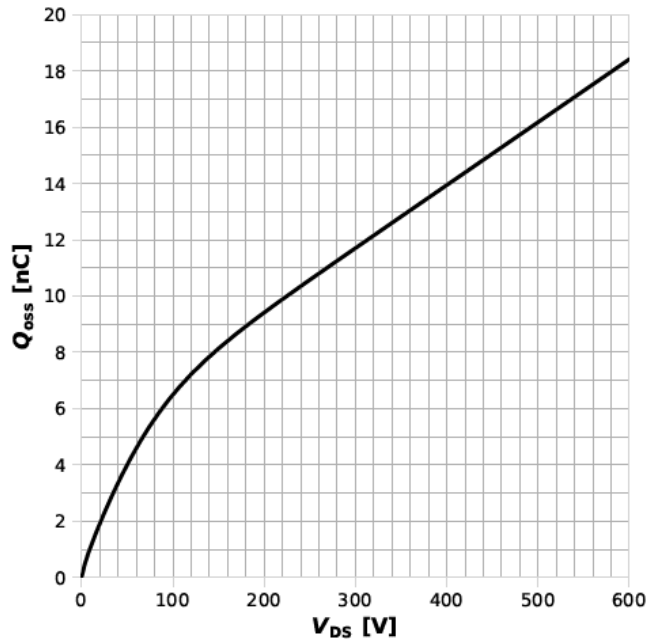
$V_{GS}=f(Q_{gate})$; $I_D=3.1$ A pulsed; $I_G=4.5$ mA; parameter: V_{DD}

Diagram 18: Typ. capacitances



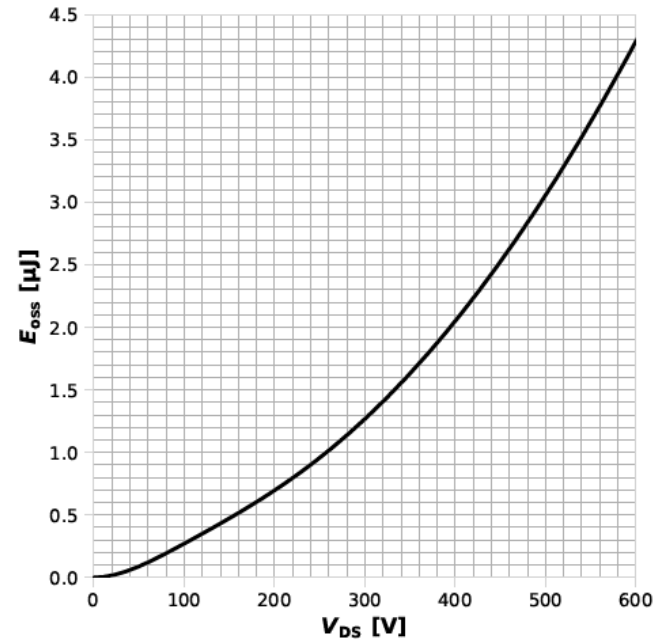
$C=f(V_{DS})$; $V_{GS}=0$ V

Diagram 19: Typ. output charge



$Q_{oss}=f(V_{DS})$

Diagram 20: Typ. Coss stored energy



$E_{oss}=f(V_{DS})$

5 测试电路

表 8 反向通道特性测试

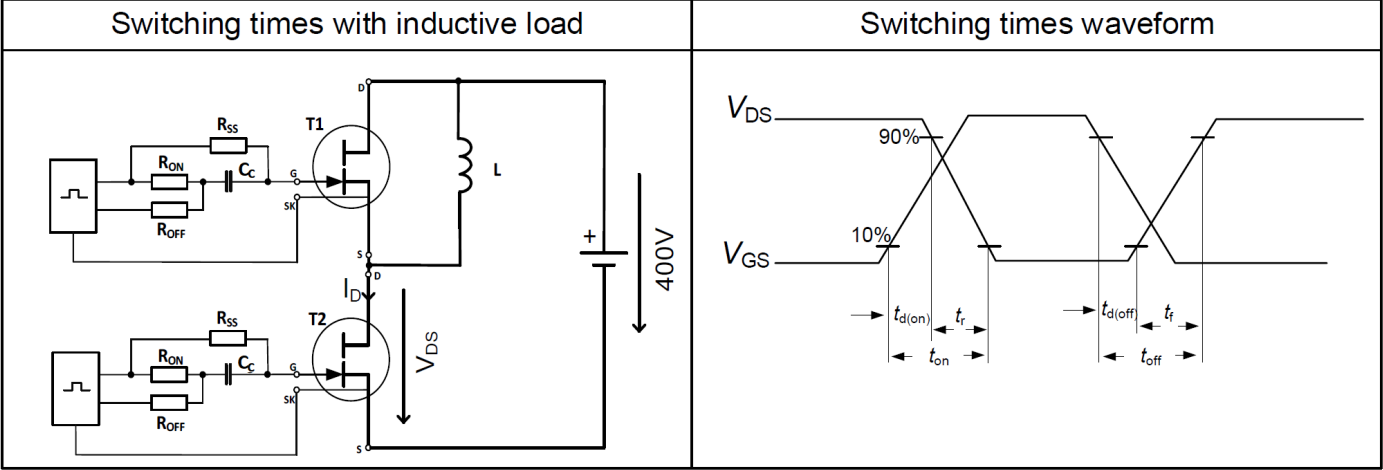
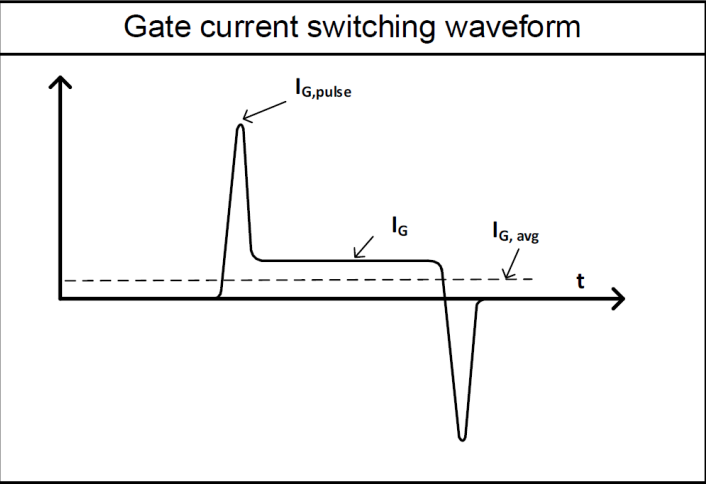
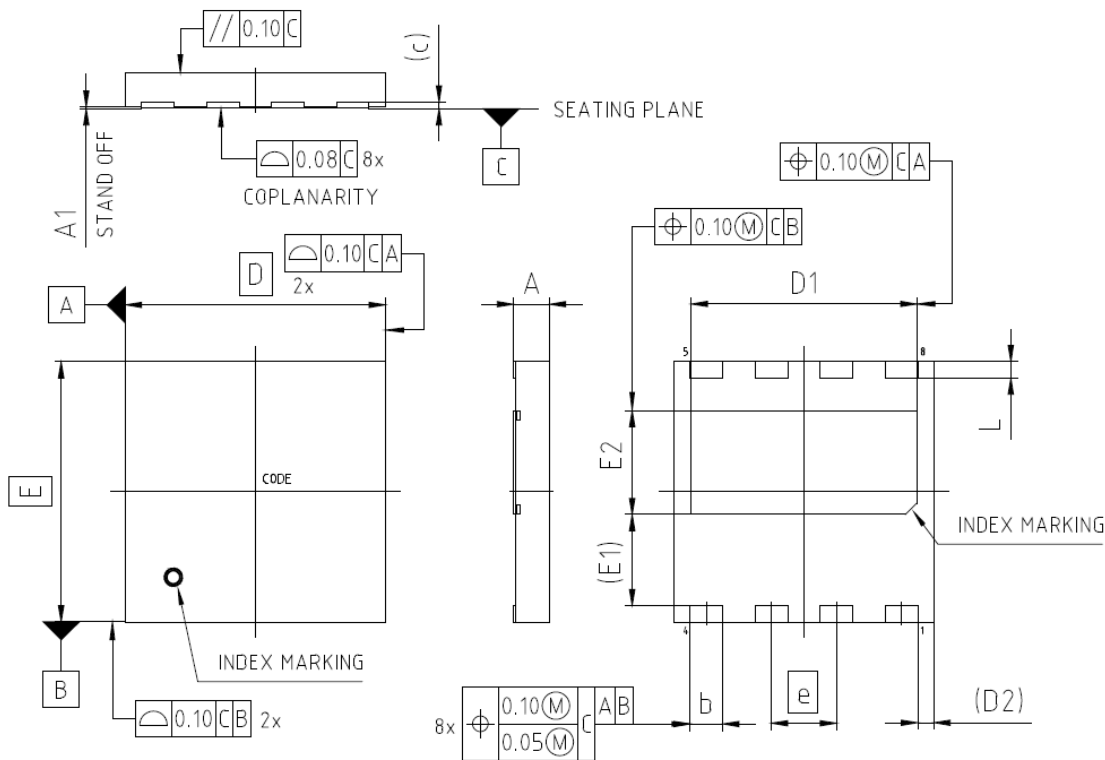


表 9 栅极电流开关波形



6 封装外形



PACKAGE - GROUP NUMBER: PG-TSON-8-U06		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	---	1.10
A1	---	0.05
b	0.90	1.10
c	0.20	
D	8.00	
D1	6.84	7.04
D2	0.50	
E	8.00	
E1	2.80	
E2	3.10	3.30
e	2.00	
L	0.40	0.60

NOTE: DIMENSIONS DO NOT INCLUDE MOLD FLASH; PROTRUSION OR GATE BURRS

图 1 PG-TSON-8 外形图，尺寸单位为毫米



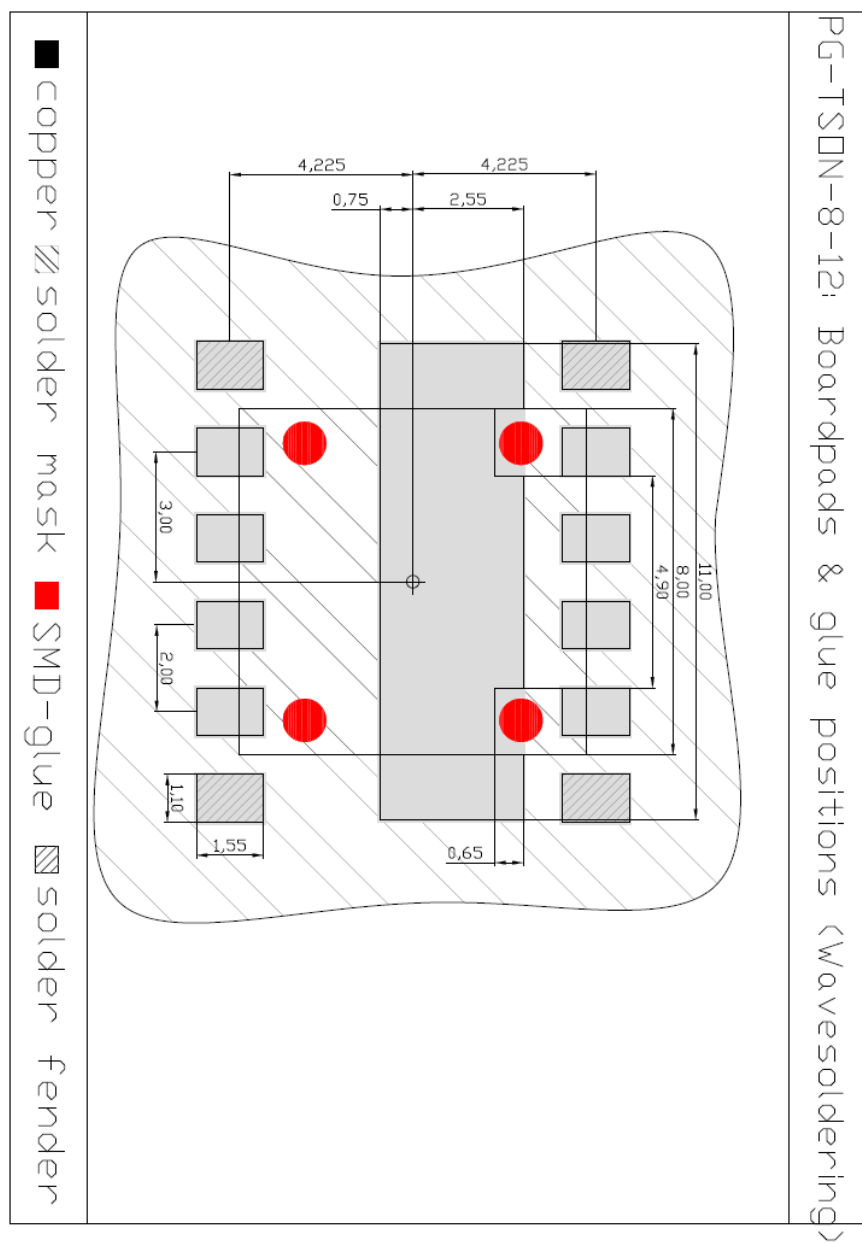
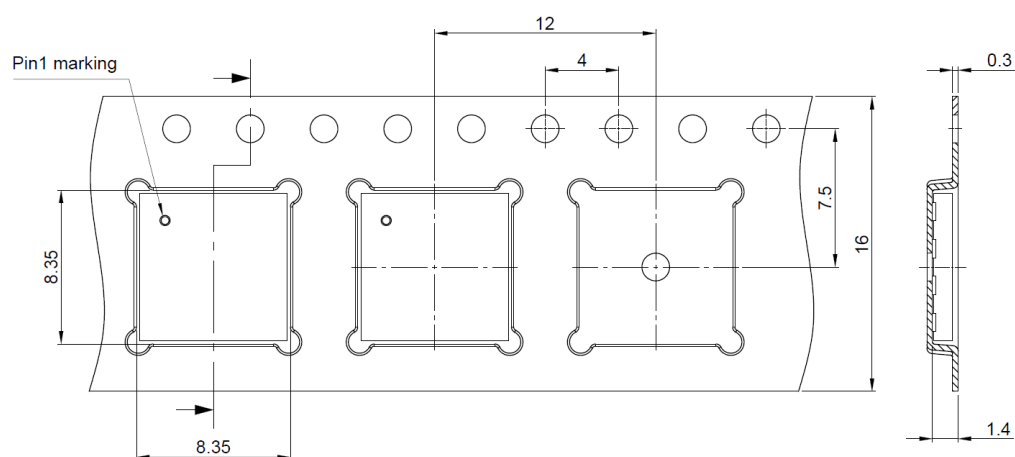


图 3 PG-TSON-8 板焊盘图，尺寸单位为毫米



All dimensions are in units mm
The drawing is in compliance with ISO 128-30, Projection Method 1 []

图 4 PG-TSON-8 封装变体，尺寸单位为毫米

7 附录 A

表 10 相关链接

- CoolGaN™ 网页
- CoolGaN™ 可靠性白皮书
- CoolGaN™ 栅极驱动应用笔记
- CoolGaN™ 应用信息
- 封装信息

修订记录

IGL65R140D2

Revision 2026-03-05, Rev. 1. 1

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-05-19	Final
1.1	2026-03-05	Update of format and footnotes. Typical gate current added.

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