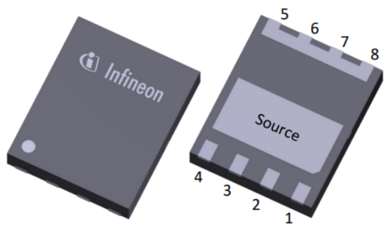
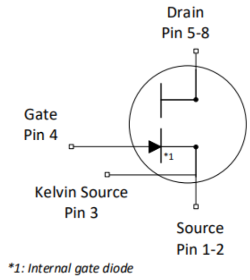
英飞凌 CoolGaN™ G5

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）晶圆技术生产，并完全自动化生产线，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。

PG-TSON-8





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
- 2kV HBM ESD 标准

优点

- 常闭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

这些共性使 CoolGaN™成为电源转换领域的游戏规则颠覆者，提供了一个令人叹服的高效、紧凑和可靠的完美组合。

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

完全符合 JEDEC 工业应用标准

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} @ 400 V	14	nC
Q_{rr}	0	nC

Part number	Package	Marking	Related links
IGLR65R140D2	PG-TSON-8	65R140D	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 参考最新的英文版本（控制文档）。

目录

1 最大额定值

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

1) 受 T 限制。最大占空比 D = 0.75

2) 我们建议使用先进的驱动技术来优化器件性能。请参阅栅极驱动器应用说明了解更多详细内容。

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}	-	-	163	°C/W	Device on PCB, minimum footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	74	°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_{sold}	-	-	260	°C	MSL3, wave & reflow soldering allowed

3 电气特性

除非另有规定， $T_j = 25°C$

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 mA; V_{DS}=10 V; T_j=25°C
		-	1	-		I_{DS}=1 mA; V_{DS}=10 V; T_j=150°C
Gate-Source reverse clamping voltage	$V_{GS, clamp}$	-	-	-8	V	I_{GS}=-1 mA
Drain-Source leakage current	I_{DSS}	-	0.39	39	µA	V_{DS}=650 V; V_{GS}=0 V; T_j=25°C
			7.8	-		V_{DS}=650 V; V_{GS}=0 V; T_j=150°C
Drain-Source on-state resistance	$R_{DS(on)}$	-	0.140	0.170	Ω	I_G=10 mA; I_D=3.1 A; T_j=25°C
			0.300	-		I_G=10 mA; I_D=3.1 A; T_j=150°C
Gate resistance	$R_{G,int}$	-	0.92	-	Ω	LCR impedance measurement; f=f_{res}, open drain;

表 5 动态特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	155	-	pF	V_{GS}=0 V; V_{DS}=400 V; f=1 MHz
Output capacitance	C_{oss}		22			
Reverse transfer capacitance	C_{rss}		0.31			
Effective output capacitance, time related [3]	$C_{o(tr)}$	-	35	-	pF	V_{GS}=0 V; V_{DS}=0 to 400 V; I_D=const
Effective output capacitance, energy related [4]	$C_{o(er)}$	-	26	-	pF	V_{DS}=0 to 400 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 A; R_{ON}=12 Ohm; R_{OFF}=12 Ohm; R_{SS}=820 Ohm; C_C=1.2 nF; V_{DRV}=12 V; see Table 8
Turn-off delay time	$t_{d(off)}$		10			
Rise time	t_r		7			
Fall time	t_f		23			

[3] Co(tr) 是一个固定电容， 当V DS从 0 升至 400 V 时，其充电时间与Coss 相同

[4] Co(er)是固定电容，当VDS从 0 升至 400 V 时，其存储能量与Coss 相同

表6 栅极电荷特性

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

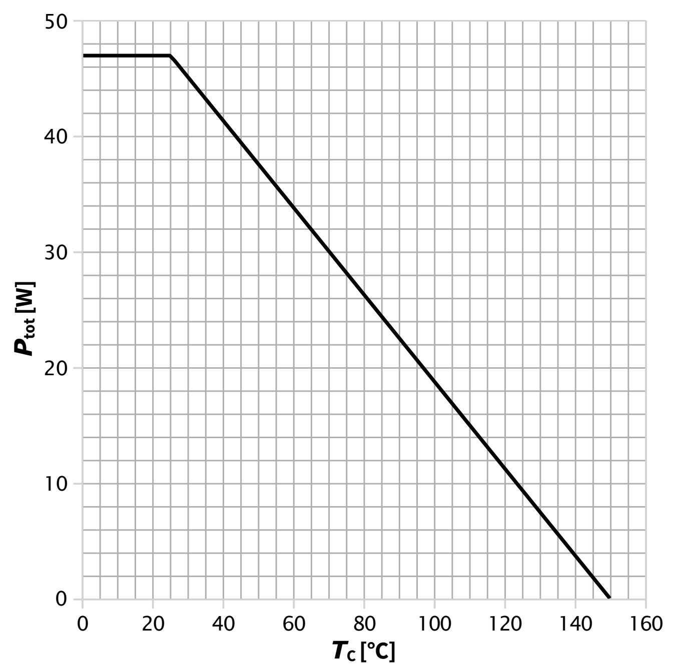
表7 反向传导特性

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 [5)]	Q_{rr}	-	0	-	nC	I_{SD}=3.1 A; V_{DS}=400 V

5) 不包括 Qoss

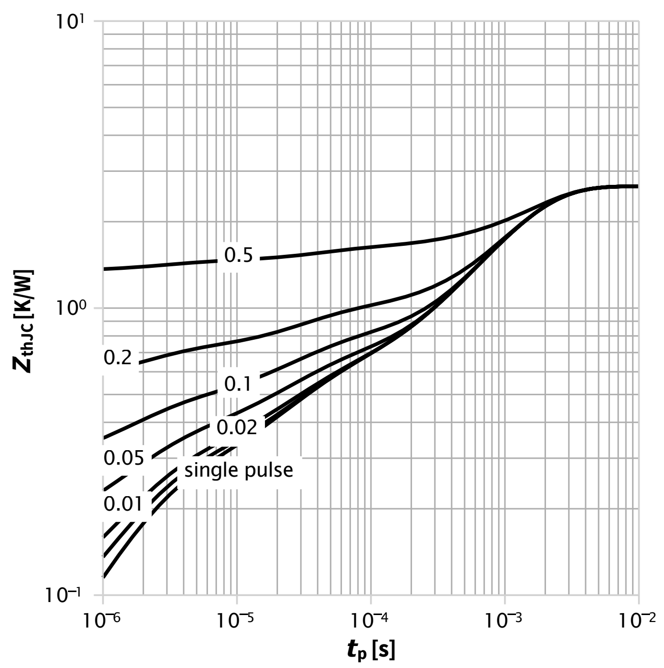
4 电气特性图

图 1：功率耗散



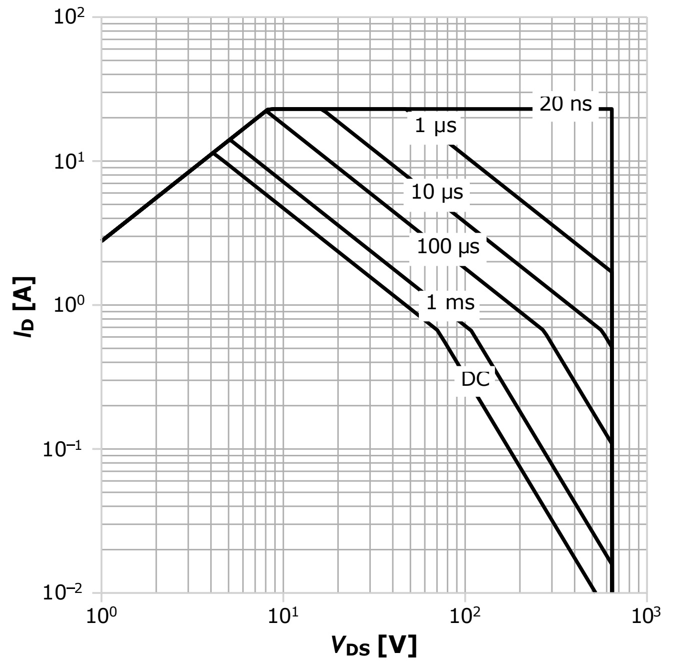
P_{tot}=f(T_C)

图 2：最大瞬态热阻抗



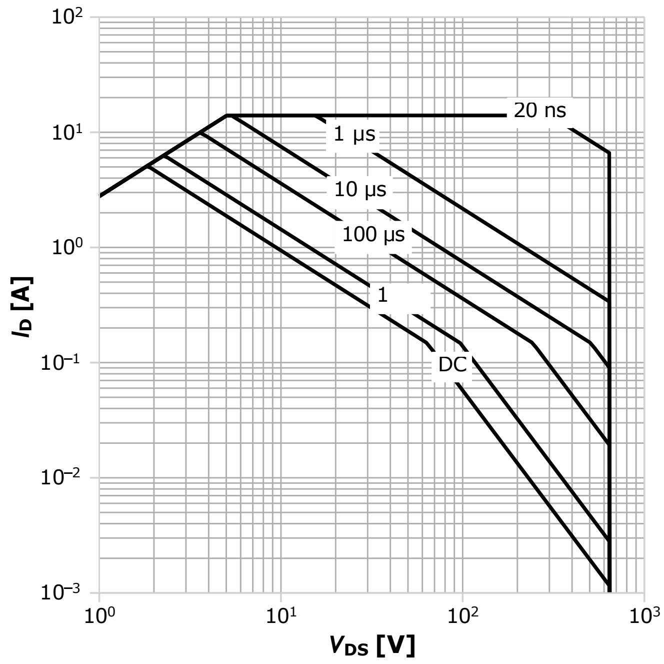
Z_{thJC}=f(t_P); parameter: D=t_p/T

图 3：安全操作区



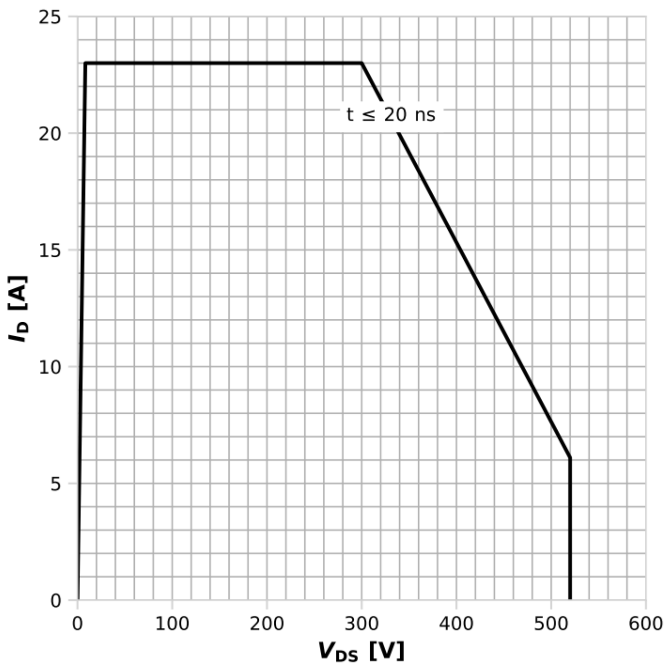
I_D=f(V_{DS}); T_C=25 °C; D=0; 参数：t_p

图 4：安全操作区



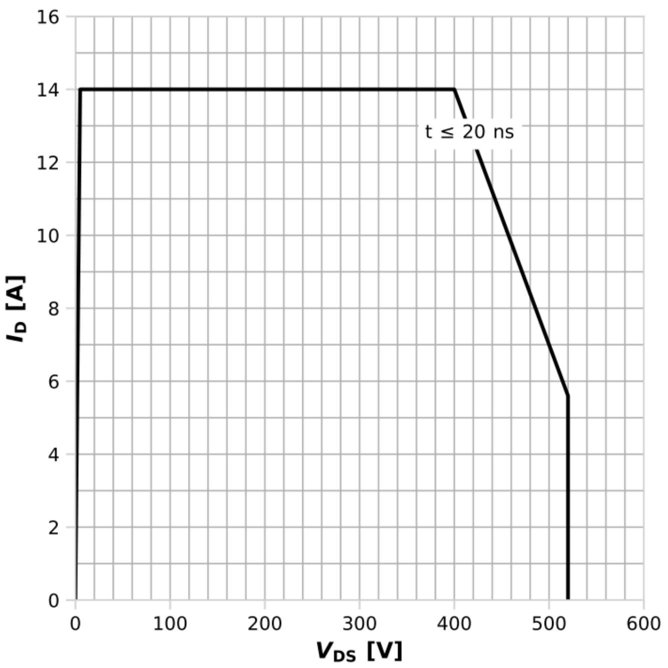
I_D=f(V_{DS}); T_C=125 °C; D=0; parameter: t_p

Diagram 5: Repetitive safe operating area



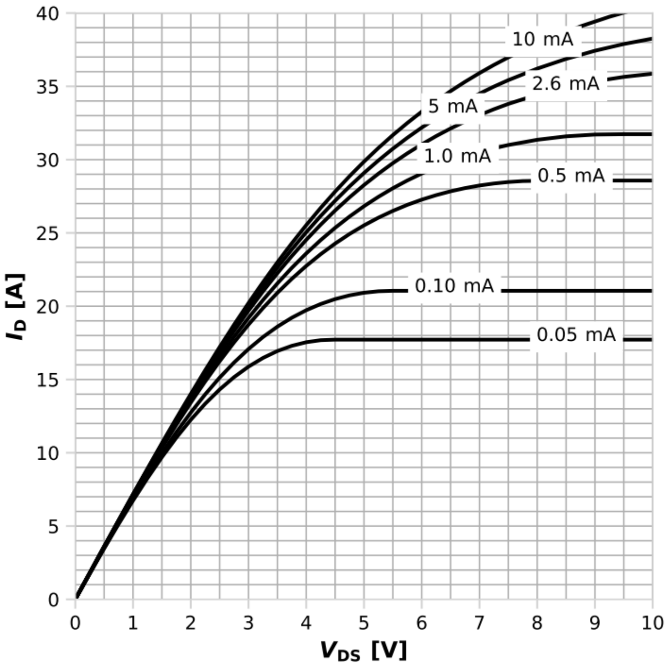
I_D=f(V_{DS}); T_C=25°C; T_j≤150°C; parameter: t_p

Diagram 6: Repetitive safe operating area



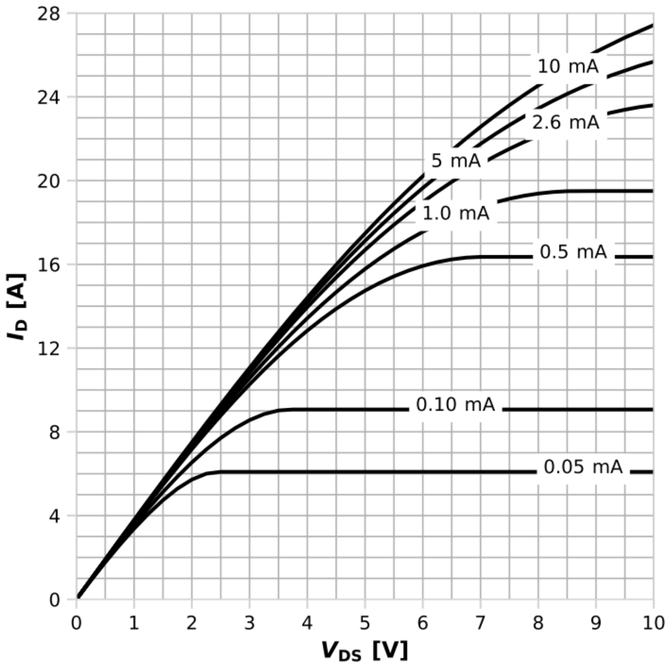
I_D=f(V_{DS}); T_C=125°C; T_j≤150°C; parameter: t_p

Diagram 7: Typ. output characteristics



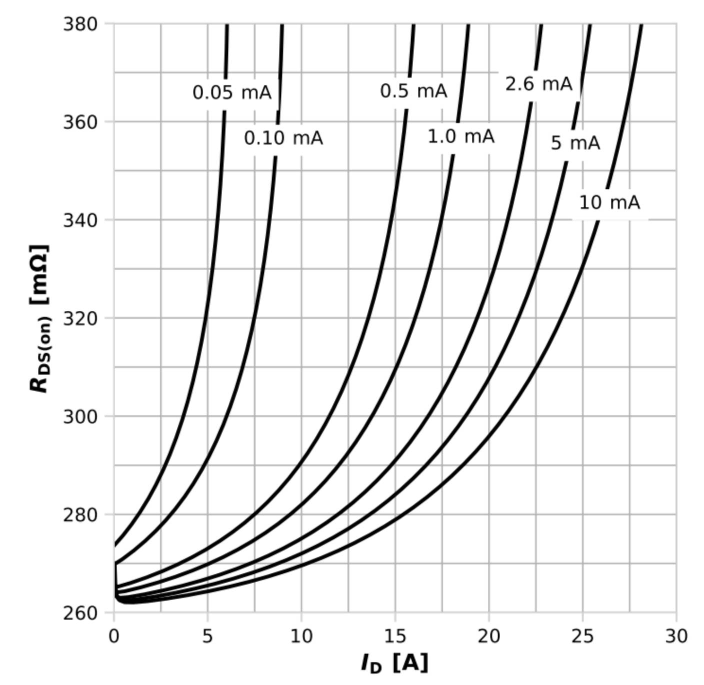
I_D=f(V_{DS}); T_j=25°C; parameter: I_{GS}

Diagram 8: Typ. output characteristics



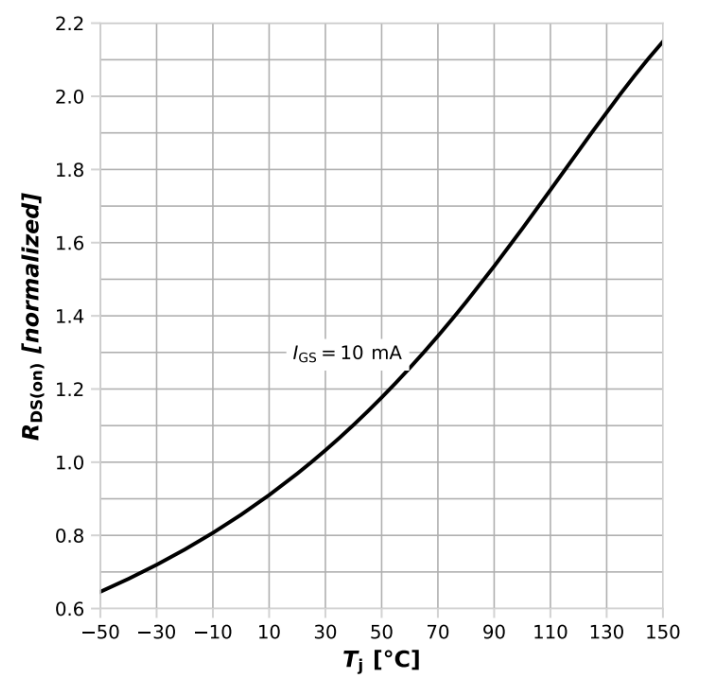
I_D=f(V_{DS}); T_j=125°C; parameter: I_{GS}

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



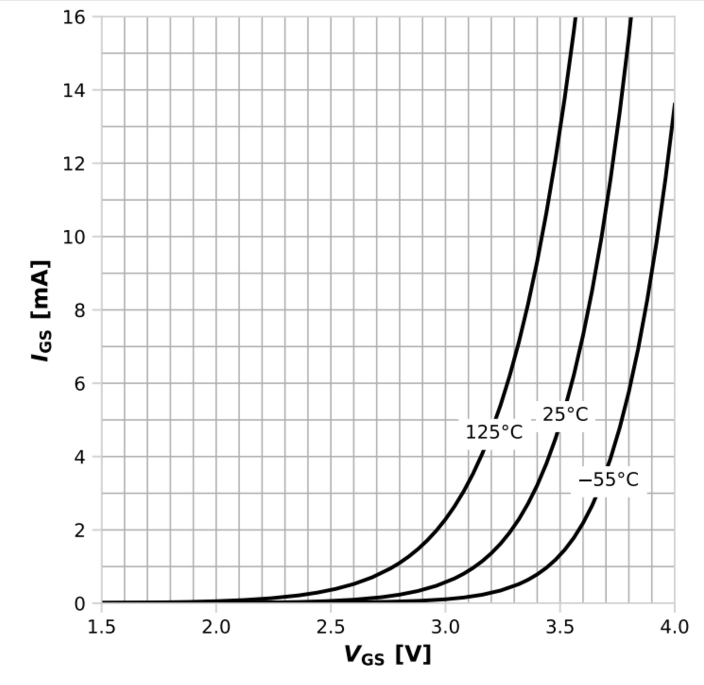
$R_{DS(on)}$=f(I_D); T_j=125°C; parameter: I_{GS}

Diagram 10: Drain-source on-state resistance



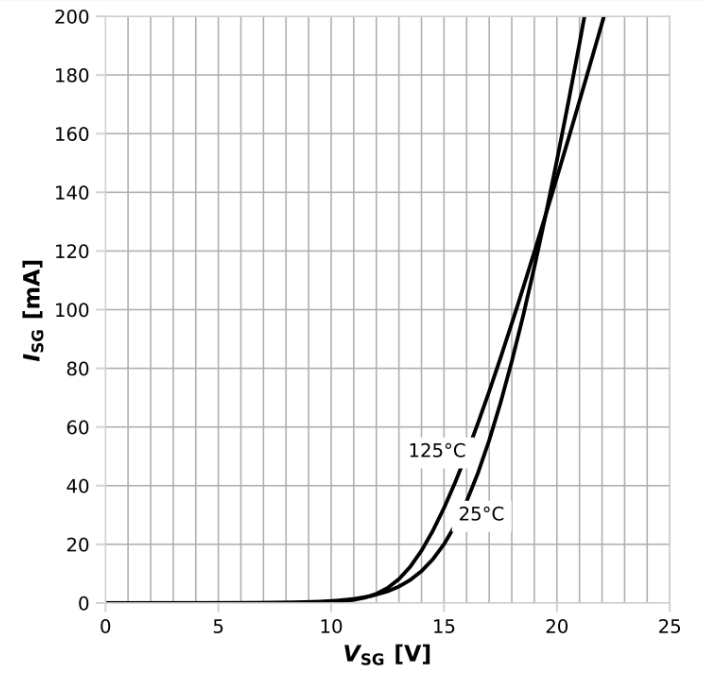
$R_{DS(on)}$=f(T_j); I_D=3.1 A

Diagram 11: Typ. gate characteristics forward



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

Diagram 12: Typ. gate characteristics reverse



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

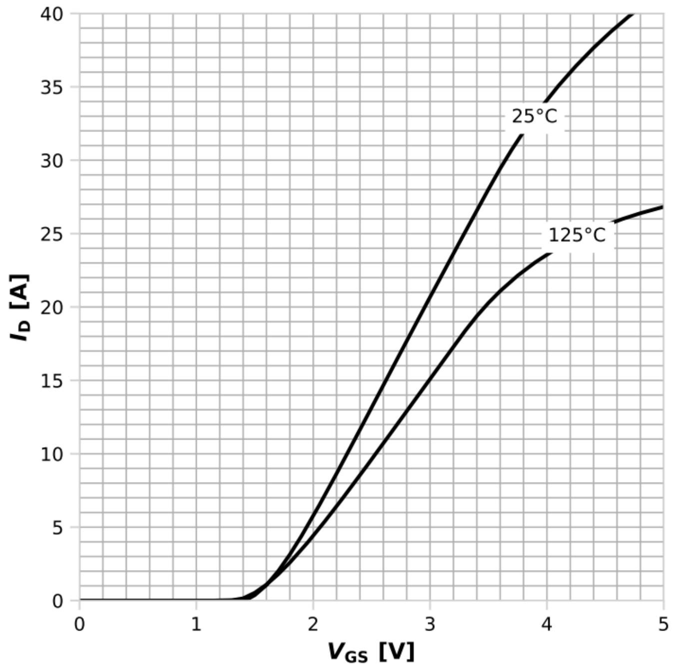
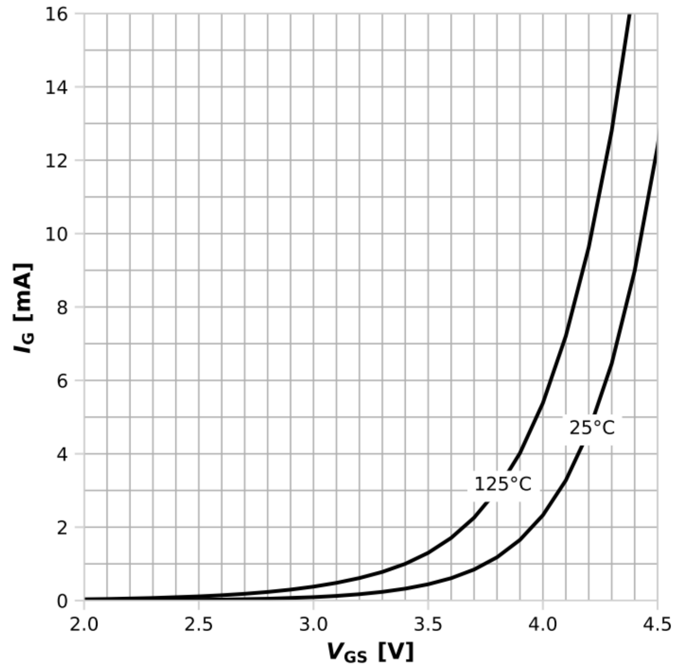
Diagram 13: Typ. transfer characteristics	Diagram 14: Typ. transfer gate current characteristic
	
I_D=f(I_{GS}); V_{DS}=8V; parameter: T_j	I_G=f(V_{GS}); V_{DS}=8V; parameter: T_j

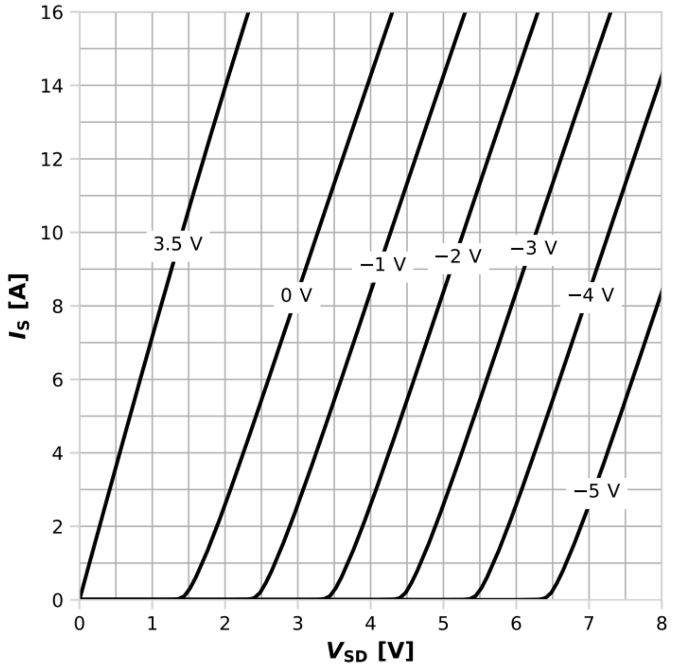
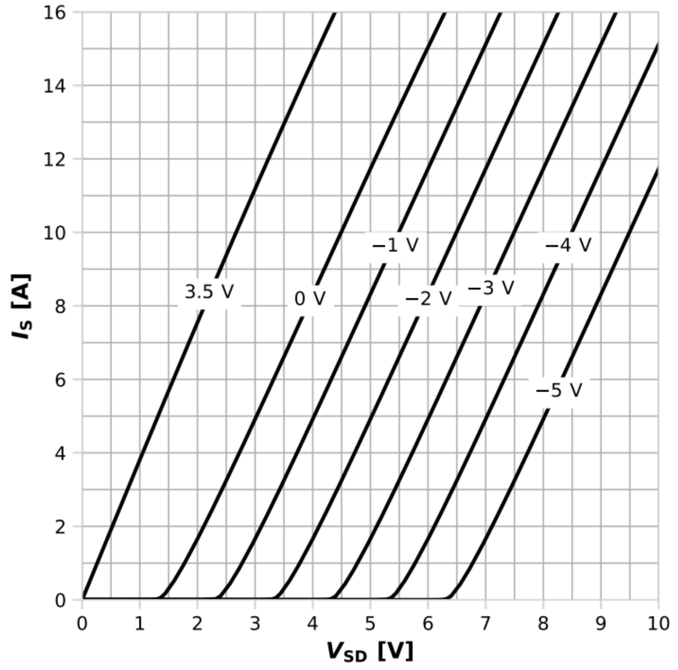
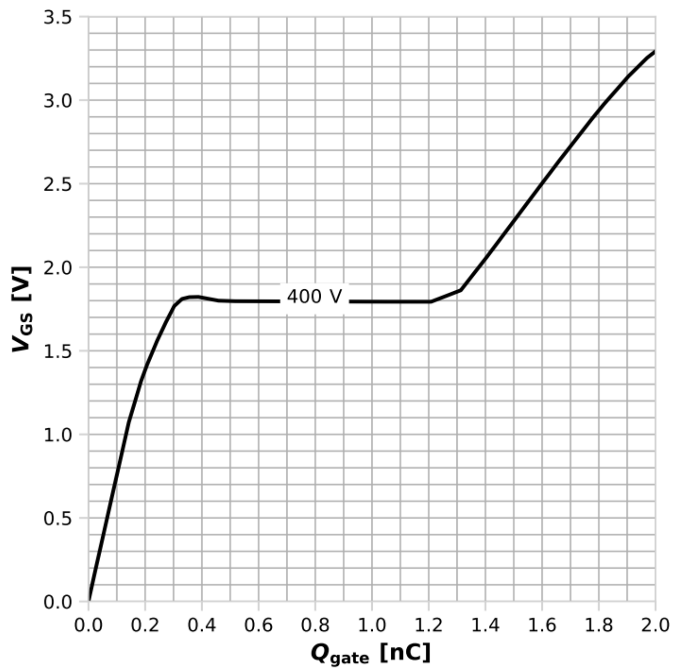
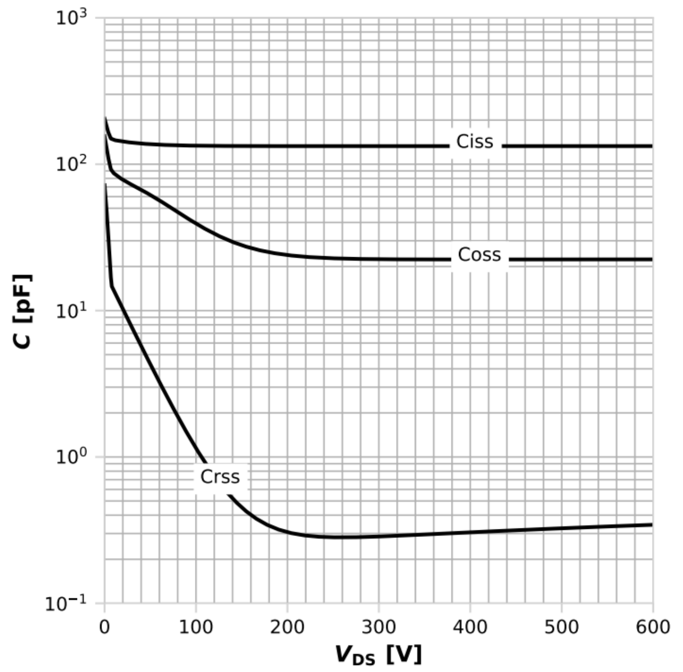
Diagram 15: Typ. channel reverse characteristics	Diagram 16: Typ. channel reverse characteristics
	
I_S=f(V_{SD}); T_j=25°C; parameter: V_{GS}	I_S=f(V_{SD}); T_j=125°C; parameter: V_{GS}

Diagram 17 Typ. gate charge



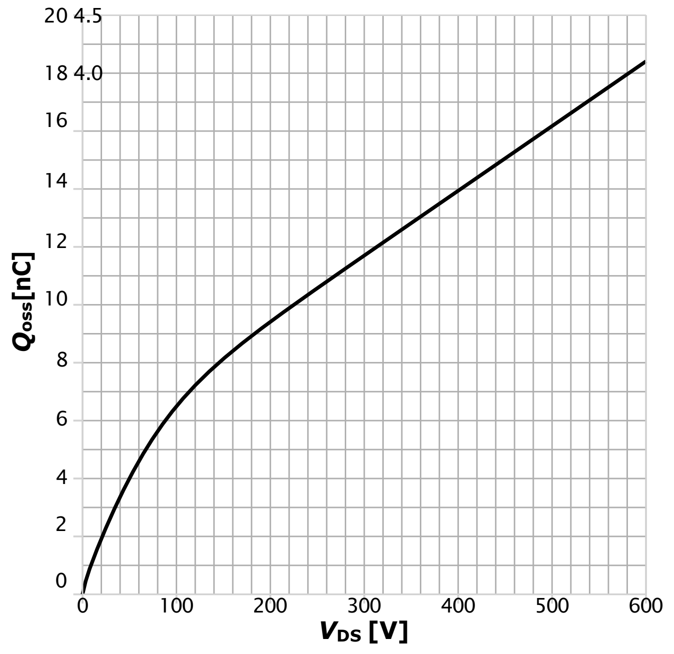
V_{GS}=f(Q_{gate}); I_D=3.1 A pulsed; I_G=4.5 mA; parameter: V_{DD}

Diagram 18: Typ. capacitances



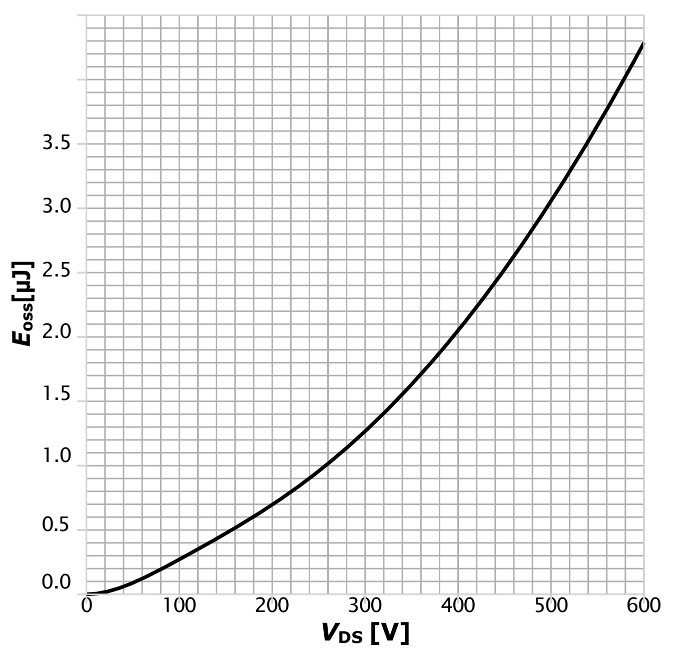
C=f(V_{DS}); V_{GS}=0 V

图 19：典型输出电荷



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

图 20：典型Coss 储存能量



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

5 测试电路

表8 反向通道特性测试

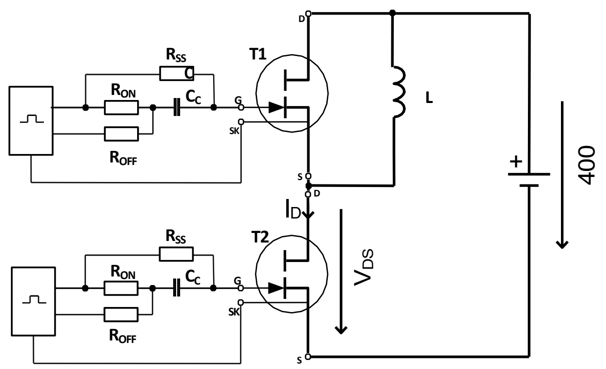
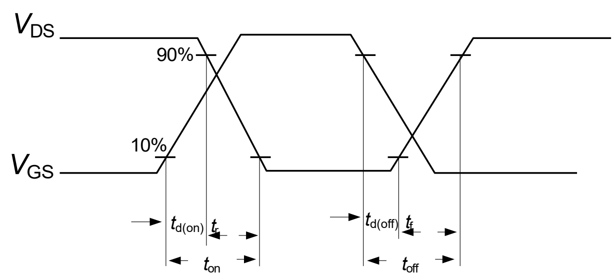
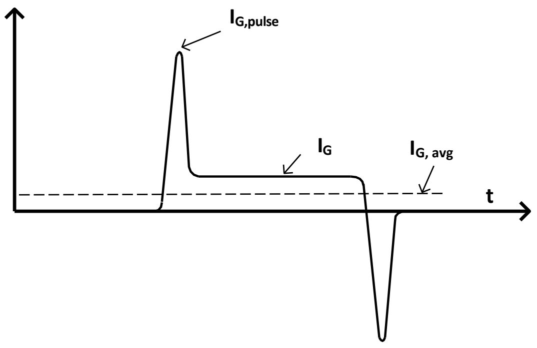
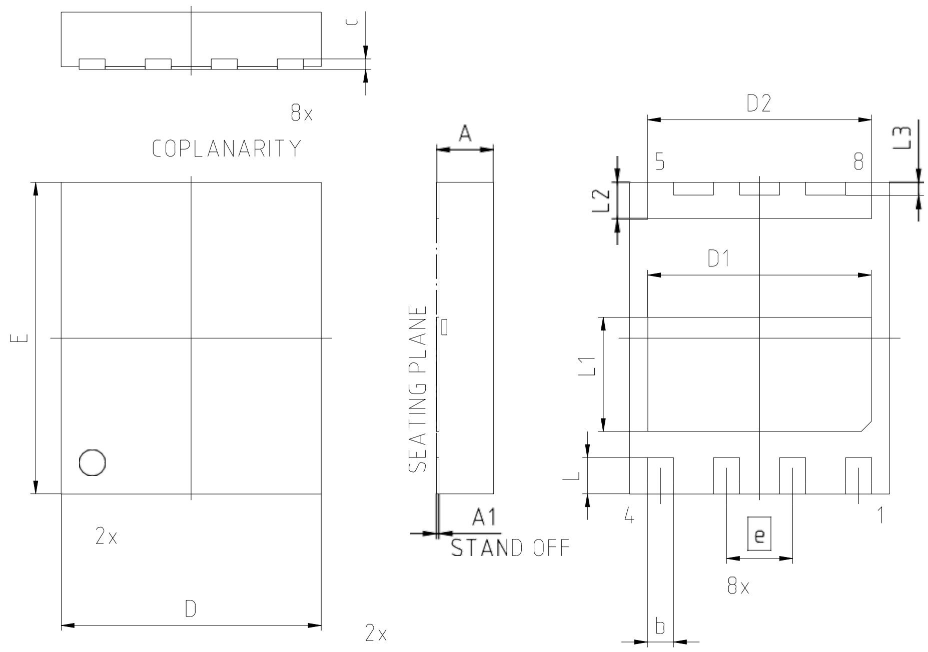
Switching times with inductive load	Switching times waveform
	

表9 栅极电流开关波形

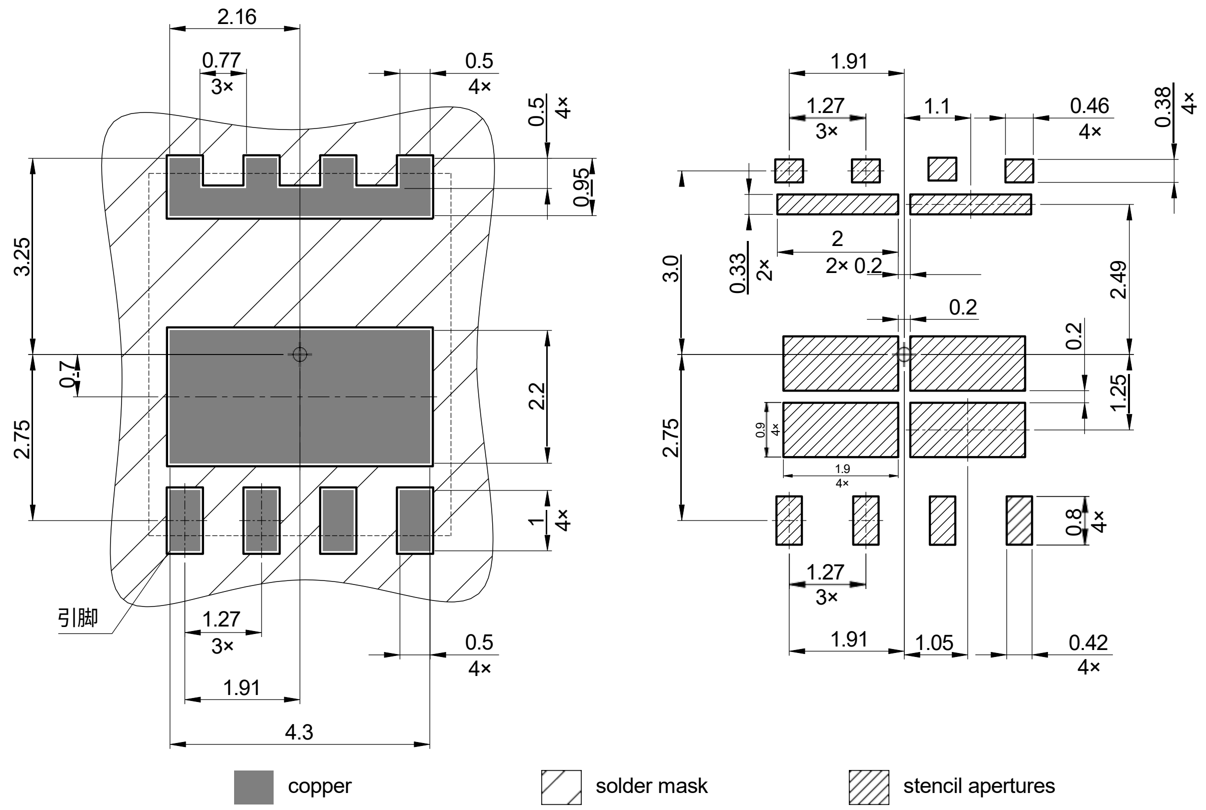
栅极电流开关波形


6 封装外形



PACKAGE - GROUP NUMBER:	PG-TSON-8-U03	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	-	1.10
A1	-	0.05
b	0.45	0.55
c	**0.20**	
D	**5.00**	
D1	4.20	4.40
D2	4.21	4.41
E	**6.00**	
e	**1.27**	
L	0.60	0.80
L1	2.10	2.30
L2	0.60	0.80
L3	0.15	0.35

图 1 PG-HSOF-8 外形图，尺寸单位为毫米



所有焊盘均非阻焊定义所有尺寸单位均为毫米

图 2 PG-HSOF-8 封装图，尺寸单位为毫米

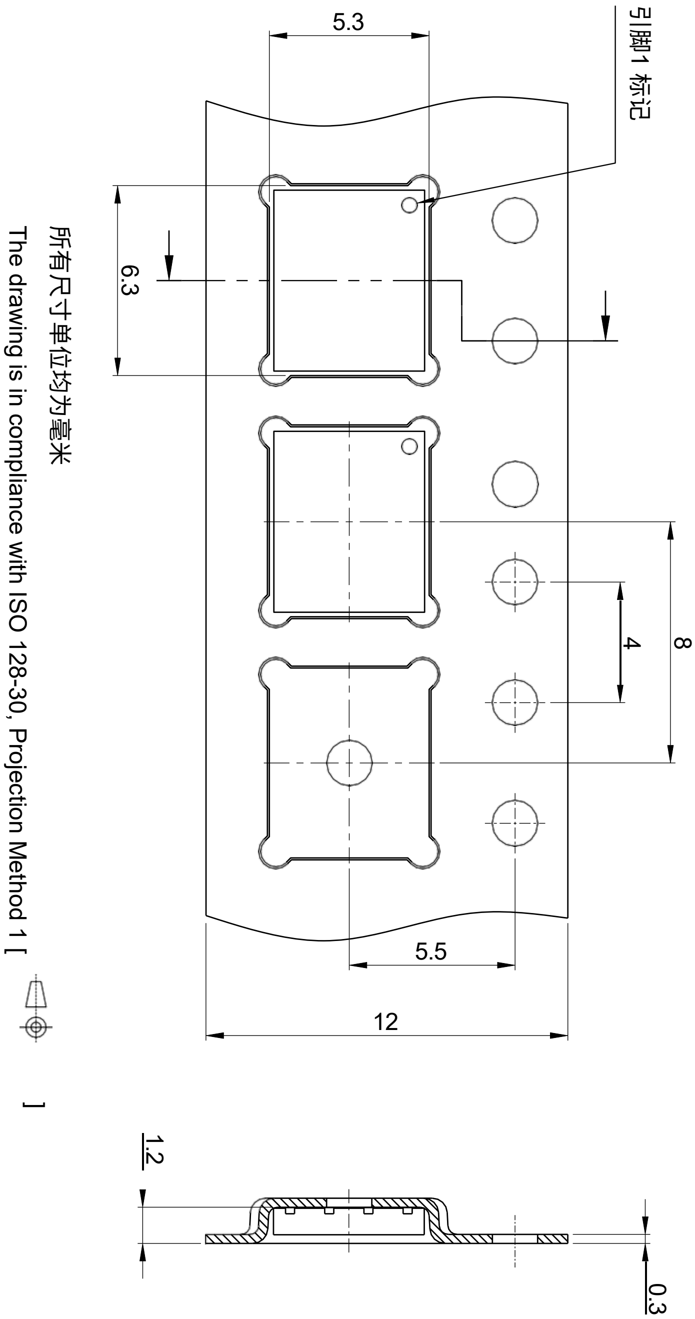


图 3　　PG-HSOF-8 包装型号，尺寸单位为毫米

7 附录 A

表 10 相关链接

- CoolGaN^{TM} webpage
- CoolGaN^{TM} reliability white paper
- CoolGaN^{TM} gate driver application note
- CoolGaN^{TM} applications information

修订记录

IGLR65R140D2

Revision 2025 - 02 - 25 , Rev. 1 . 1

历史修订版本

Revision	Date	Subjects (major changes since last revision)
1.0	2024-10-25	Release of final
1.1	2025-02-25	Package picture and symbol updated on page 1

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