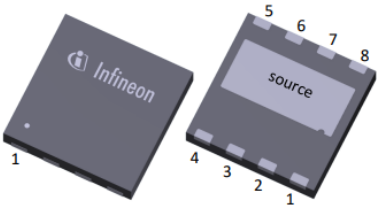
英飞凌 CoolGaN™ G5

PG-LSON-8

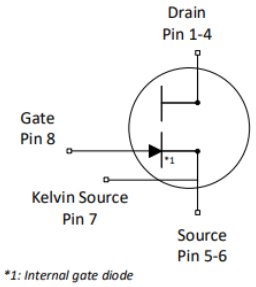


英飞凌 CoolGaN™晶体管 650 V G5

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。

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
$R_{DS(on),max}$	140	mΩ
$Q_{g,typ}$	2.4	nC
$I_{D,pulse}$	30	A
Q_{oss} @ 400 V	18	nC
Q_{rr}	0	nC

Type / Ordering code	Package	Marking	Related links
IGLD65R110D2	PG-LSON-8	65R110D2	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）。

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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	$I_{DS,trans}$	-	-	6.2	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	$V_{DS,pulsed}$	-	-	750 650	V	T_j = 25°C; V_{GS} ≤ 0 V; cumulated stress time ≤ 1 h T_j = 125°C; V_{GS} ≤ 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 $I_{D,pulse}$ =13 A; T_j = 105°C; f ≤ 100 kHz; t ≤100 s (10 million pulses)
Continuous current, drain source [1]	I_D	-	-	14	A	T_C=25°C; T_j = $T_{j,max}$
Pulsed current, drain source	$I_{D,pulse}$	-30 -18	-	30 18	A	T_j=25°C; I_G=13 mA; See Diagram 3, 5 T_j=125°C; I_G=13 mA; See Diagram 4, 6
Gate current, continuous [2]	$I_{G,avg}$	-	-	10	mA	T_j=-55°C to T_j=150°C; See Table 9
Gate current, pulsed [2]	$I_{G,pulsed}$	-1	-	1	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}	-	-	51	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 $T_{j,max}$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}	-	-	2.5	°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_{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	1.6 -	V	I_{DS}=1.3 mA; V_{DS}=10 V; T_j=25°C I_{DS}=1.3 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}	-	0.5 10	51 -	µA	V_{DS}=650 V; V_{GS}=0 V; T_j=25°C V_{DS}=650 V; V_{GS}=0 V; T_j=150°C
Drain-Source on-state resistance	$R_{DS(on)}$	-	0.110 0.240	0.140 -	Ω	I_G=13 mA; I_D=4.0 A; T_j=25°C I_G=13 mA; I_D=4.0 A; T_j=150°C
Gate resistance	$R_{G,int}$	-	0.96	-	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}	-	170	-	pF	V_{GS}=0 V; V_{DS}=400 V; f=1 MHz
Output capacitance	C_{oss}	-	29	-	pF	
Reverse transfer capacitance	C_{rss}	-	0.39	-	pF	
Effective output capacitance, time related [3)]	$C_{o(tr)}$	-	45	-	pF	V_{GS}=0 V; V_{DS}=0 to 400 V; I_D=const
Effective output capacitance, energy related [4)]	$C_{o(er)}$	-	33	-	pF	V_{DS}=0 to 400 V
Output charge	Q_{oss}	-	18	-	nC	
Coss stored energy	E_{oss}	-	2.6	.	µJ	
Turn-on delay time	$t_{d(on)}$	-	8	-	ns	I_D= 4 A; R_{ON}=10 Ohm; R_{OFF}=10 Ohm; R_{SS}=680 Ohm; C_C=1.5 nF; V_{DRV}=12 V; see Table 8
Turn-off delay time	$t_{d(off)}$	-	10	-	ns	
Rise time	t_r	-	7	-	ns	
Fall time	t_f	-	20	-	ns	

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	-	2.4	-	nC	V_{GS}=0 to 3 V; V_{DS}=400 V; I_D=4.0 A

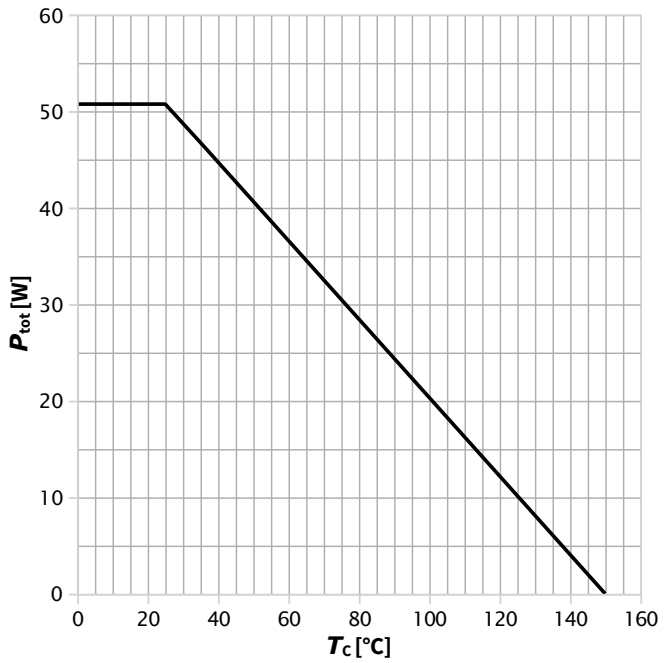
表7 反向传导特性

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}=4 A
Pulsed current, reverse	$I_{SD,pulse}$	-	-	30	A	I_G=13 mA
Reverse recovery charge [5)]	Q_{rr}	-	0	-	nC	I_{SD}=4 A; V_{DS}=400 V

5) 不包括 Qoss

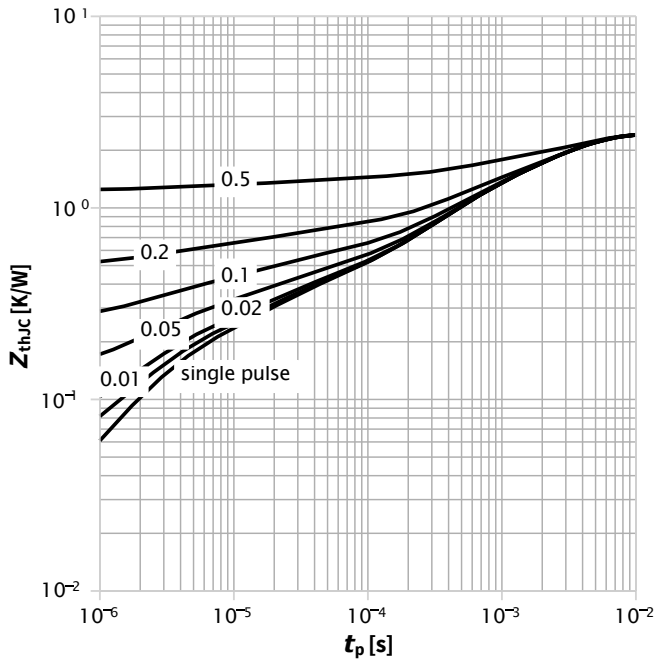
4 电气特性图

图 1：功率耗散



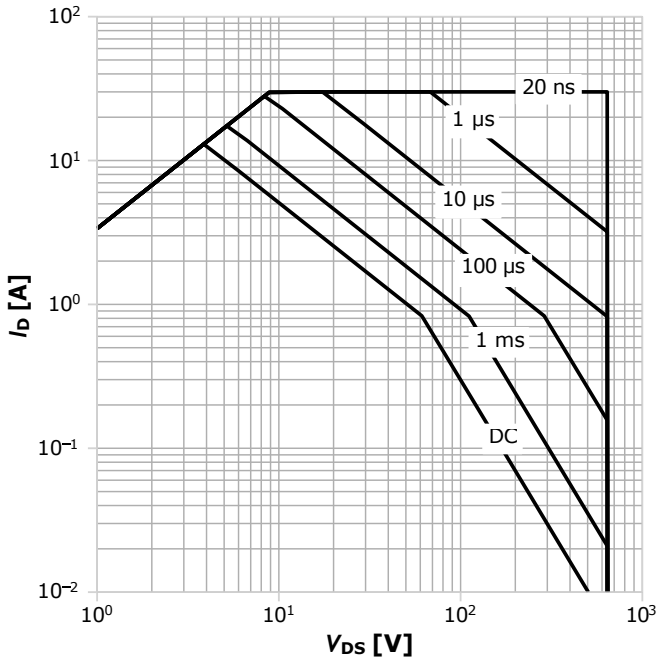
P_{tot}=f(T_C)

图 2：最大瞬态热阻抗



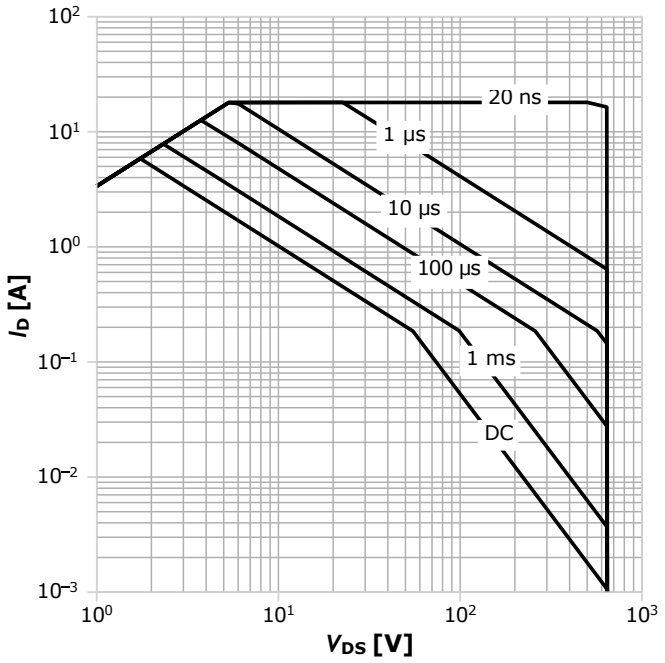
Z_{thJC}=f(t_P); parameter: D=t_p/T

图 3：安全操作区



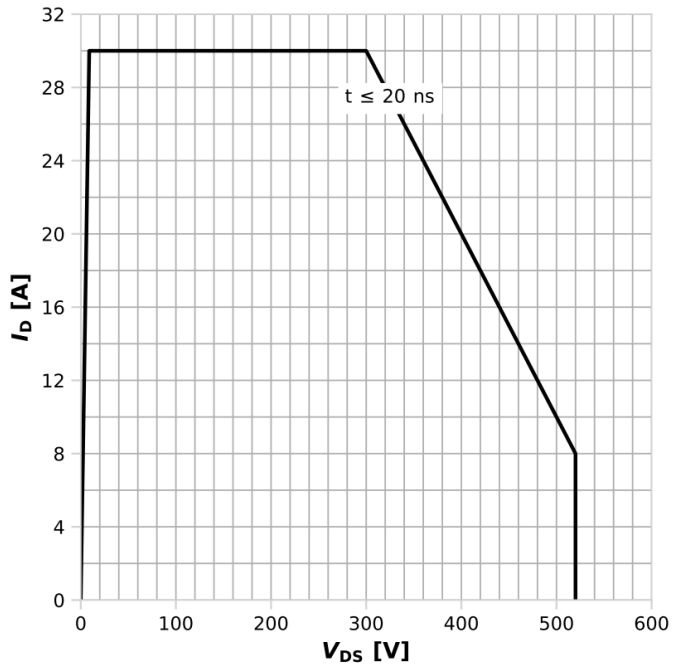
I_D=f(V_{DS}); T_C=25 °C; D=0; 参数：t_p

图 4：安全操作区



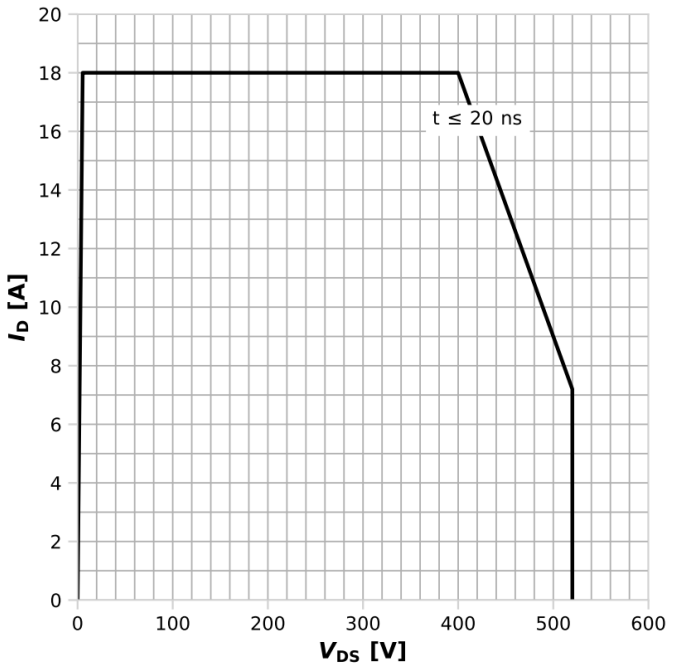
I_D=f(V_{DS}); T_C=125 °C; D=0; parameter: t_p

Diagram 5: Repetitive safe operating area



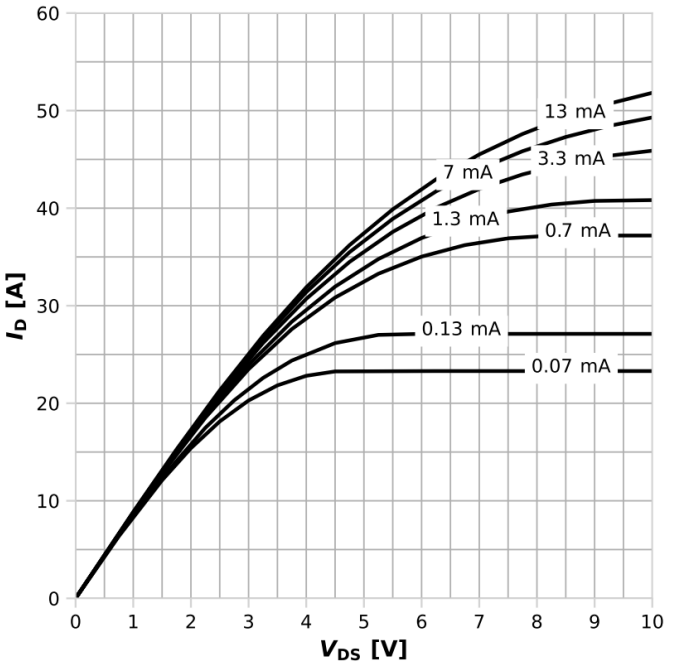
I_D=f(V_{DS}); T_C=25°C; T_j≤150°C; parameter: t_p

Diagram 6: Repetitive safe operating area



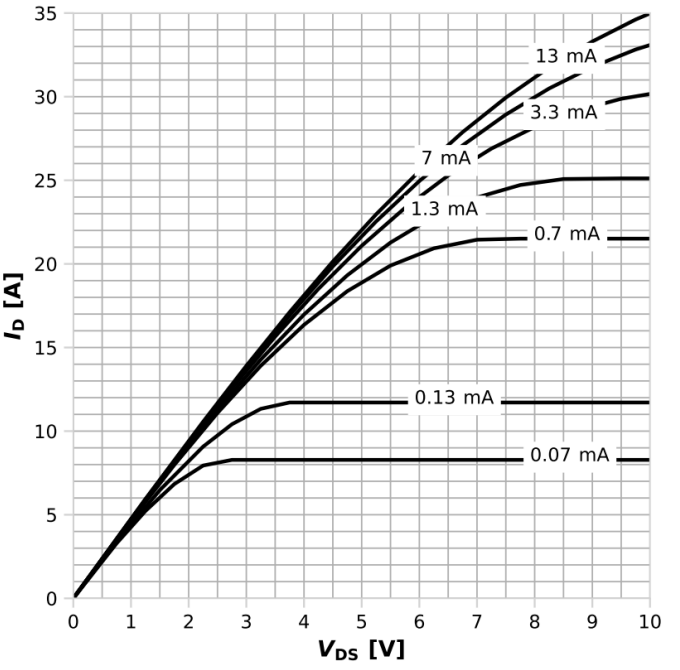
I_D=f(V_{DS}); T_C=125°C; T_j≤150°C; parameter: t_p

Diagram 7: Typ. output characteristics



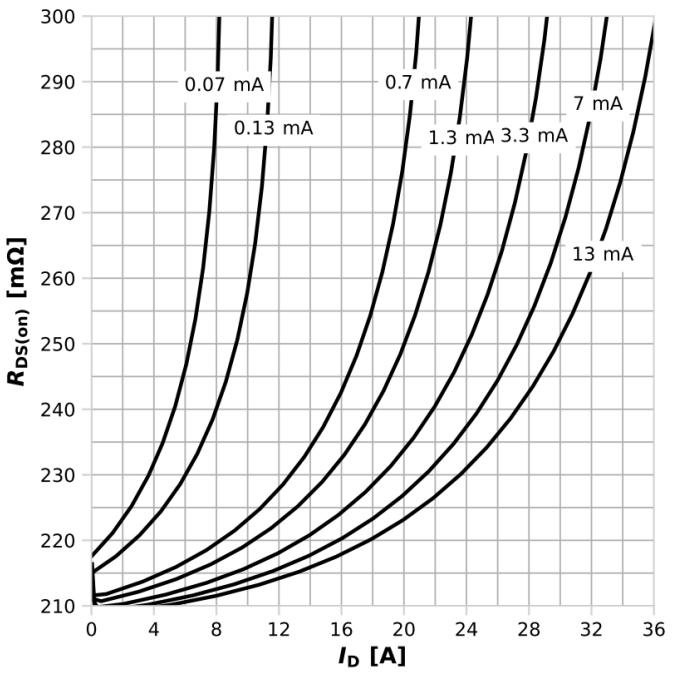
I_D=f(V_{DS}); T_j=25°C; parameter: I_{GS}

Diagram 8: Typ. output characteristics



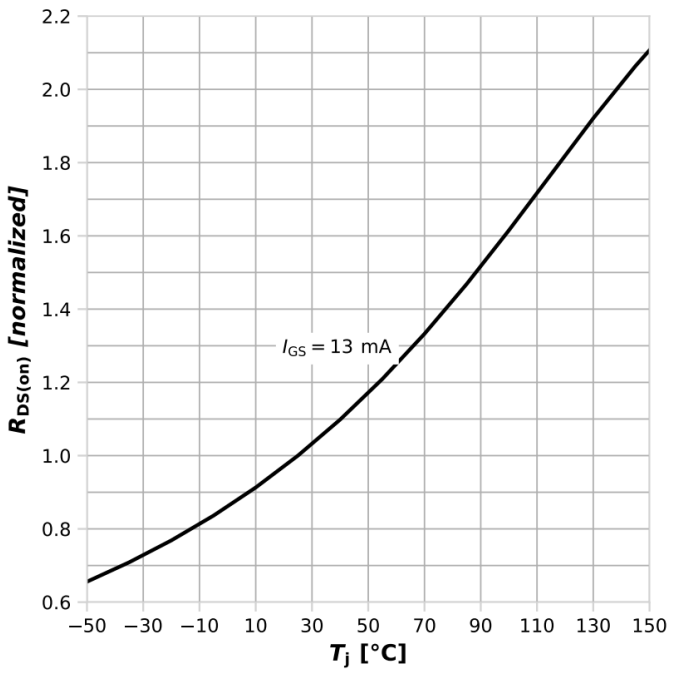
I_D=f(V_{DS}); T_j=125°C; parameter: I_{GS}

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



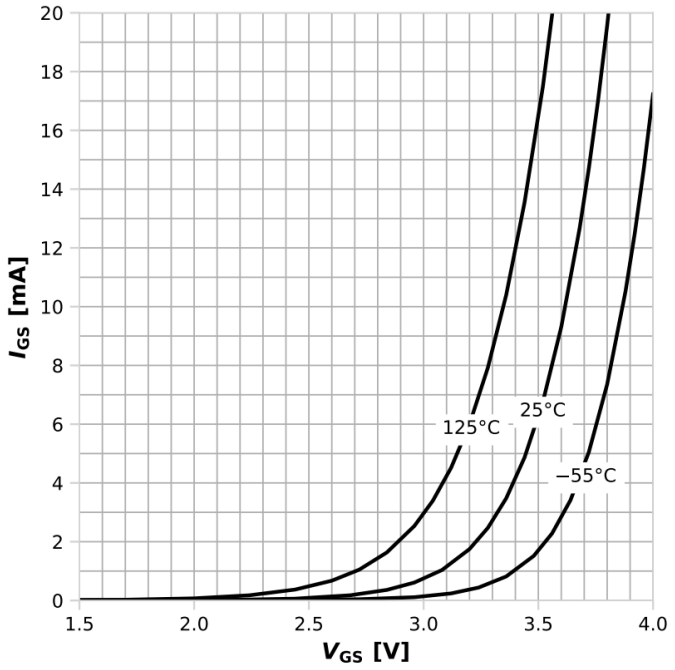
$R_{DS(on)}$=f(I_D); T_j=125°C; parameter: I_{GS}

Diagram 10: Drain-source on-state resistance



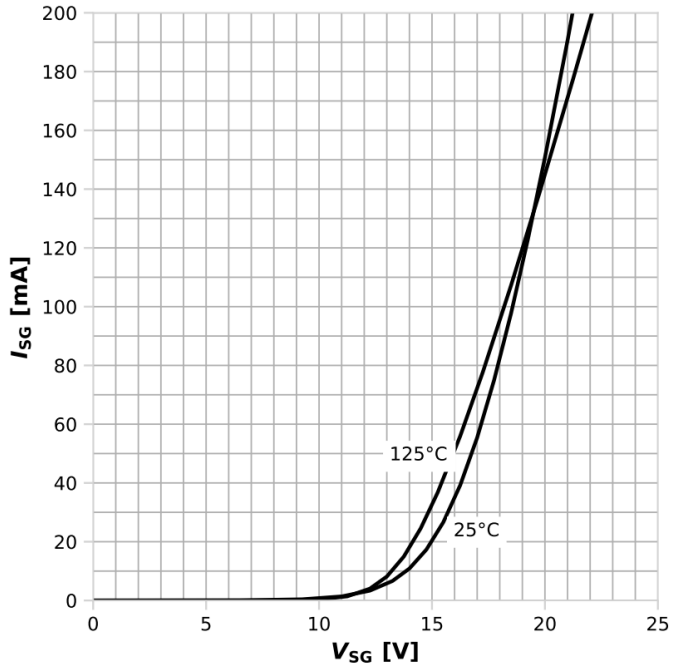
$R_{DS(on)}$=f(T_j); I_D=4.0 A

Diagram 11: Typ. gate characteristics forward



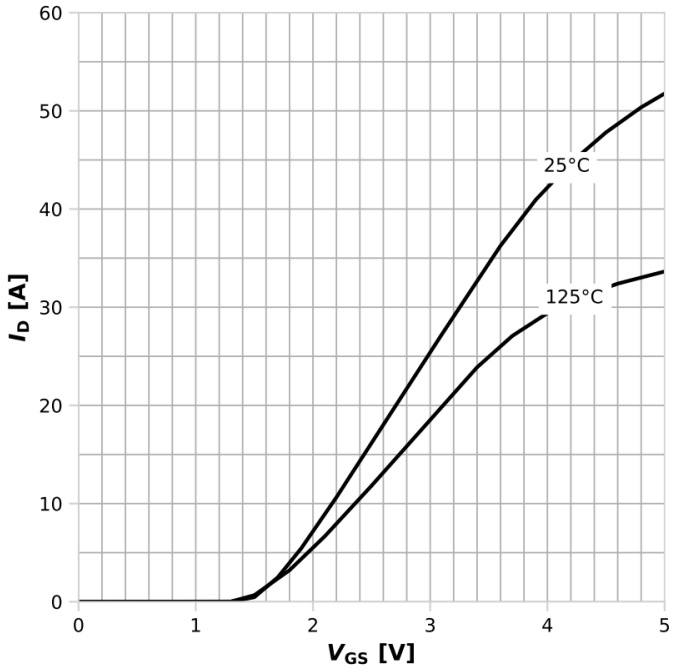
I_{GS}=f(V_{GS}); open drain; parameter: T_j

Diagram 12: Typ. gate characteristics reverse



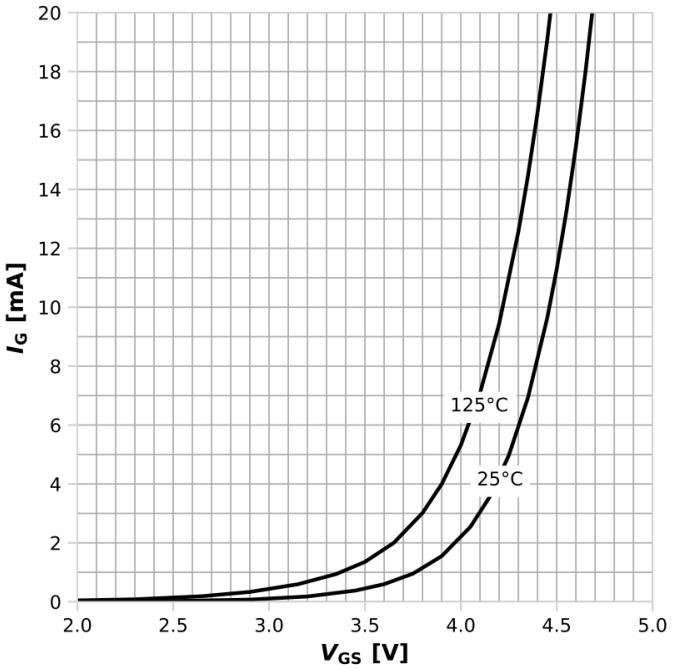
I_{SG}=f(V_{SG}); parameter: T_j

Diagram 13: Typ. transfer characteristics



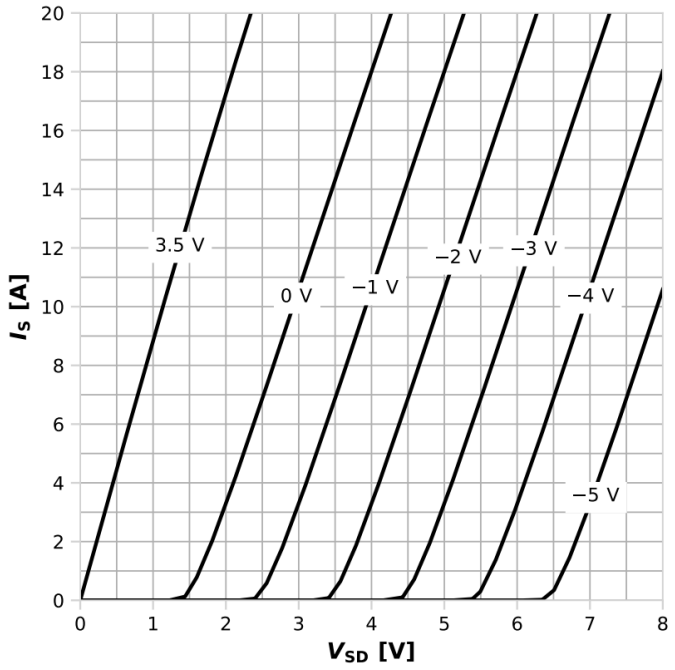
I_D=f(I_{GS}); V_{DS}=8V; parameter: T_j

Diagram 14: Typ. transfer gate current characteristic



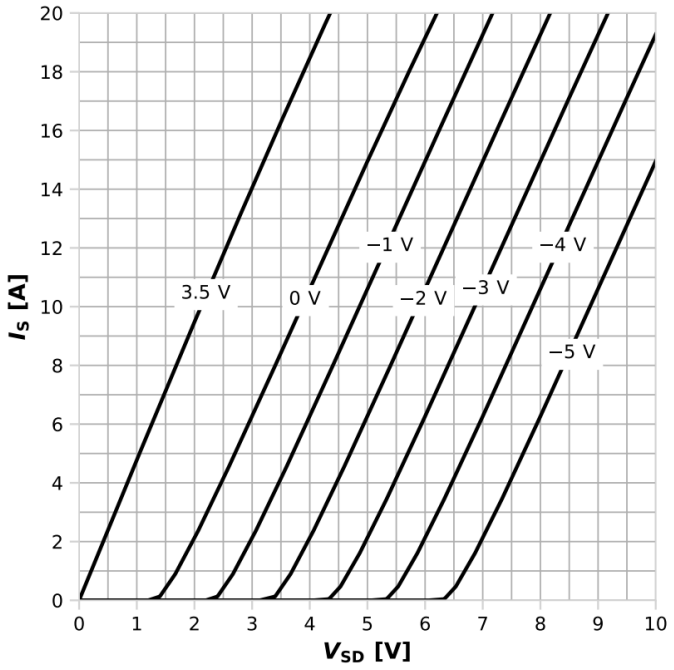
I_G=f(V_{GS}); V_{DS}=8V; parameter: T_j

Diagram 15: Typ. channel reverse characteristics



I_S=f(V_{SD}); T_j=25°C; parameter: V_{GS}

Diagram 16: Typ. channel reverse characteristics



I_S=f(V_{SD}); T_j=125°C; parameter: V_{GS}

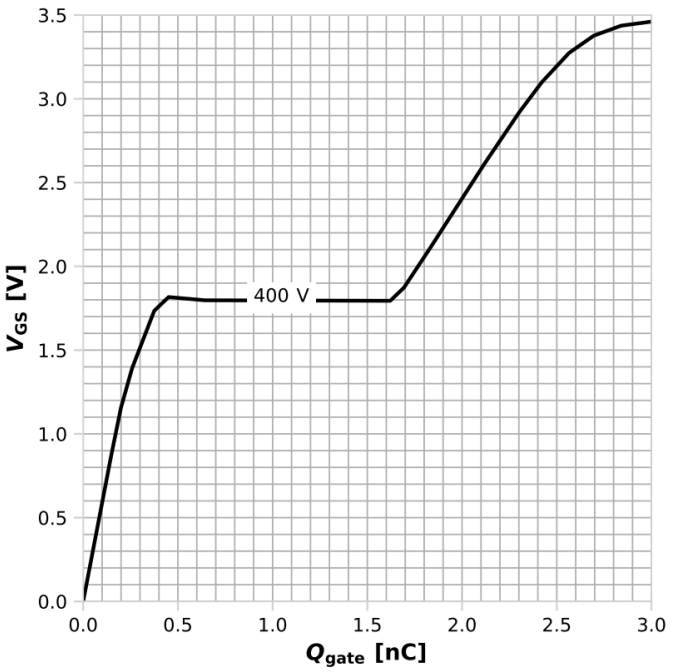
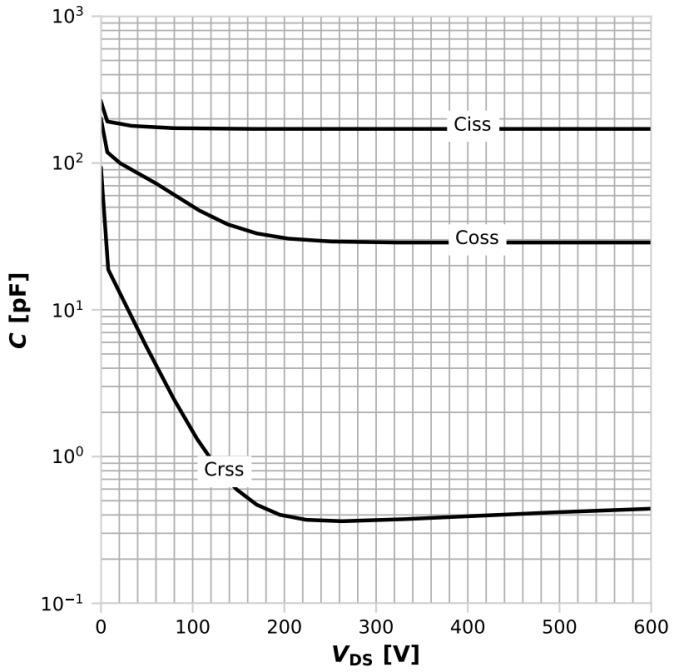
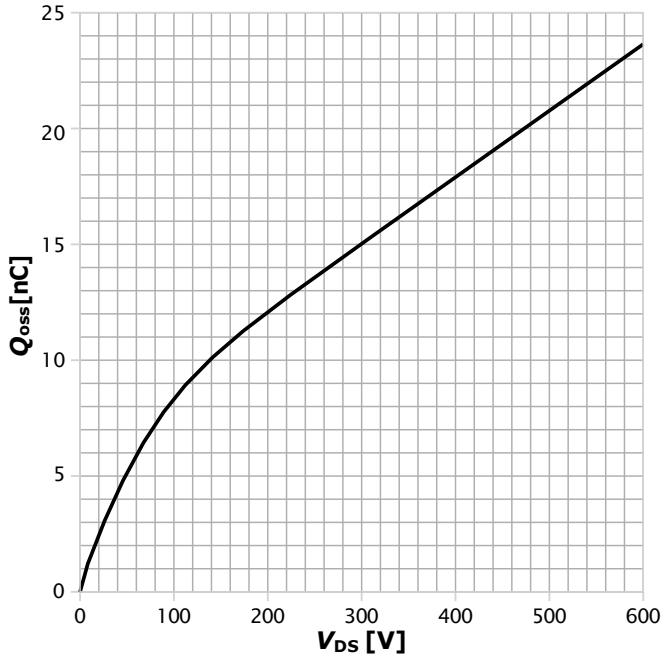
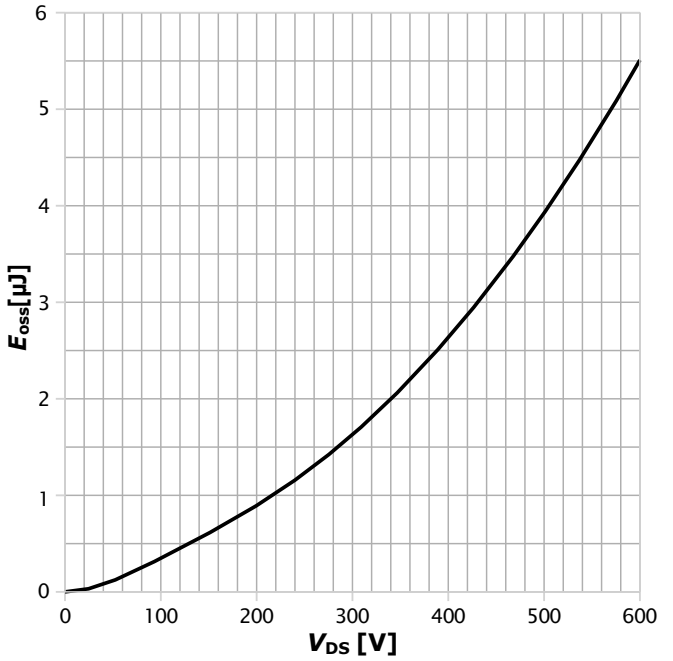
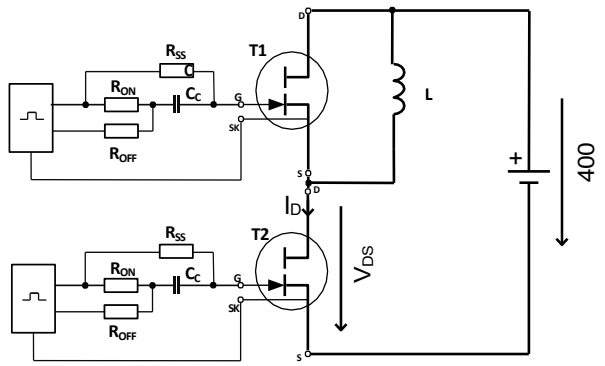
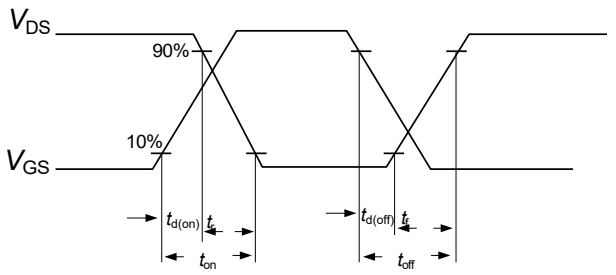
Diagram 17 Typ. gate charge	Diagram 18: Typ. capacitances
	
V_{GS}=f(Q_{gate}); I_D=4.0 A pulsed; I_G=4.5 mA; parameter: V_{DD}	C=f(V_{DS}); V_{GS}=0 V

图 19：典型输出电荷	Diagram 20: Typ. Coss stored energy
	
Q_{oss}=f(V_{DS})	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
	

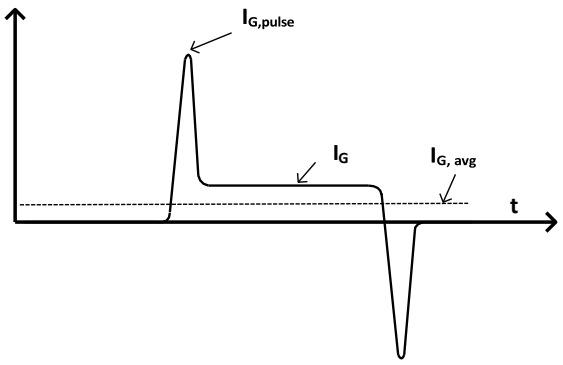
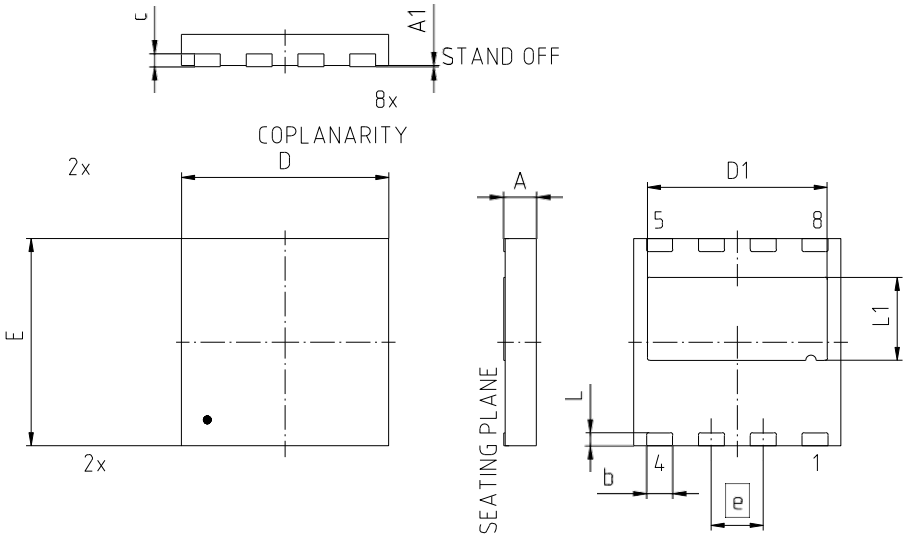
栅极电流开关波形


表9 栅极电流开关波形

6 封装外形



PACKAGE - GROUP NUMBER:	PG-LSON-8-U01	
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	-	1.35
A1	-	0.05
b	0.95	1.05
c	0.50	
D	7.90	8.10
D1	6.84	7.04
E	7.90	8.10
e	2.00	
L	0.45	0.55
L1	3.10	3.30

图 1 PG-HSOF-8 外形图，尺寸单位为毫米

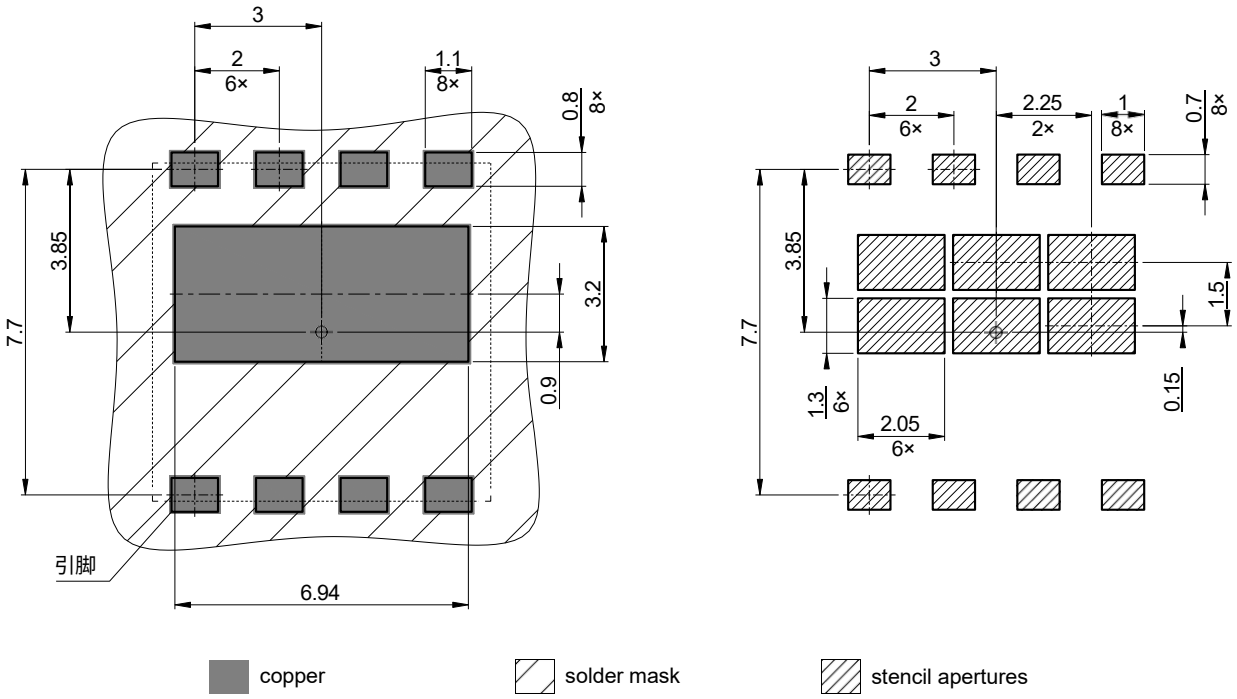


图 2 PG-LSON-8 封装图，尺寸单位为毫米

7 附录A

表 10 相关链接

- CoolGaN™ GaN 650 V 网页
- CoolGaN™ GaN 650 V 可靠性白皮书
- CoolGaN™ GaN 650 V 栅极驱动器应用笔记
- CoolGaN™ GaN 650 V 应用信息

修订记录

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历史修订版本

Revision	Date	Subjects (major changes since last revision)
1.0	2024-12-20	Release of final version

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