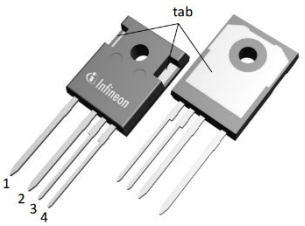
英飞凌碳化硅 MOSFET

英飞凌CoolSiC™ 汽车功率器件 750 V G2

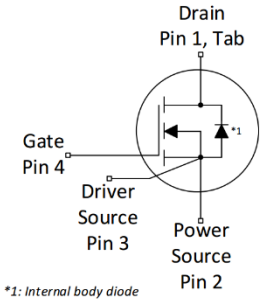
PG-TO247-4



750 V CoolSiC™ MOSFET 采用英飞凌强大的第 2 代碳化硅沟槽技术，提供无与伦比的性能、卓越的可靠性和极佳的易用性。它能够实现经济高效且简化的设计，满足不断增长的系统和市场需求。

特性

- 高度稳健的 750 V 技术，100% 经过雪崩测试
- 同类最佳的 $R_{DS(on)}$ x Q_{fr}
- 出色的 $R_{DS(on)}$ x Q_{oss} 和 $R_{DS(on)}$ x Q_G
- 低 C_{rss}/C_{iss} 和高 $V_{GS(th)}$ 的独特组合
- 英飞凌专有芯片贴装技术
- 驱动器源引脚可用



优点

- 增强了 500 V 以上总线电压的稳健性和可靠性
- 硬开关效率卓越
- 软开关拓扑中的开关频率更高
- 单极栅极驱动的抗寄生导通稳健性
- 一流的散热性能
- 通过改进栅极控制减少开关损耗

潜在应用

- 单向和双向车载充电器和 HV-LV DCDC 转换器（硬开关半桥和软开关拓扑）
- 断路器（高压电池隔离开关、直流和交流低频开关、高压电子熔断器）
- 辅助驱动

产品验证

符合汽车应用标准。
根据 AEC-Q101 进行产品验证。

请注意：源引脚和驱动器源引脚不可互换。交换可能会导致故障。对于并联 MOSFET 器件，通常建议将栅极电阻串联在驱动源引脚侧，而非栅极侧。

表 1　　主要性能参数

Parameter	Value	Unit
V_{DSS} over full $T_{j,range}$	750	V
$R_{DS(on),typ}$	25	mΩ
$R_{DS(on),max}$	31	mΩ
$Q_{G,typ}$	49	nC
$I_{D,pulse}$	242	A
$Q_{oss,typ}$ @ 500 V	106	nC
$E_{oss,typ}$ @ 500 V	18.5	µJ

Part number	Package	Marking	Related links
AIMZA75R025M2H	PG-TO247-4	75A025M2	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

除非另有规定，T_j = 25 °C。

注：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的80%。
对于施加阻断电压 > 525 V 的应用，要求客户在早期设计阶段评估宇宙辐射效应的影响，并联系英飞凌销售办事处获取必要的技术支持。
不建议采用“线性模式”运行。如需评估潜在的“线性模式”运行，请联系英飞凌销售办事处。

表 2 最大额定值

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source voltage	V_{DSS}	-	-	750	V	static, T_j = -55°C to 175°C
Continuous DC drain current [1]	I_{DDC}	-	-	60	A	T_c = 25°C
				42		T_c = 100°C
Peak drain current [2]	I_{DM}	-	-	242	A	T_c = 25°C, V_{GS} = 18 V
Avalanche energy, single pulse	E_{AS}	-	-	230	mJ	I_D = 8.6 A, V_{DD} = 50 V; see table 11
Avalanche current, single pulse	I_{AS}	-	-	8.6	A	-
MOSFET *dv/dt* ruggedness	*dv/dt*	-	-	200	V/ns	V_{DS}= 0…500 V
Gate source voltage (static) [3]	V_{GS}	-7	-	23	V	-
Gate source voltage (transient)	V_{GS}	-11	-	25	V	t_p ≤ 500 ns, duty cycle ≤ 1%
Power dissipation	P_{tot}	-	-	202	W	T_c = 25°C
Storage temperature	T_{stg}	-55	-	150	°C	-
Operating junction temperature	T_j			175		
Extended operating junction temperature [4]	T_j	-	-	200	°C	≤ 100 h in the application lifetime
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous reverse drain current [1]	I_{SDC}	-	-	60	A	V_{GS} = 18 V, T_c = 25°C
				48		V_{GS} = 0 V, T_c = 25°C
Peak reverse drain current [2]	I_{SM}	-	-	242	A	T_c = 25°C, t_p ≤ 250 ns
				69		T_c = 25°C
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms}, T_c = 25°C, t = 1 min

1) 受 $T_{j,max}$ 限制。
2) 脉冲宽度 t_{pulse} 受 $T_{j,max}$ 限制。
3) 应用设计中的最大栅极源电压应符合 IPC-9592B 的规定。
4) 温度循环次数高达 7500 次，其中最大 delta*T* 限制为 100K。

2 热特性

表 3 热特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{th(j-c)}$	-	0.53	0.74	°C/W	Not subject to production test. Parameter verified by design/characterization according to JESD51-14.
Soldering temperature, wave soldering only allowed at leads	T_{sold}	-	-	260	°C	1.6mm (0.063in.) from case for 10s

3 工作范围

表 4 工作范围

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Recommended turn-on voltage	$V_{GS(on)}$	-	18	-	V	-
Recommended turn-off voltage	$V_{GS(off)}$		0			

4 电气特性

除非另有规定， T_j = 25 °C

表 5 静态特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage [5]	$V_{(BR)DSS}$	840	-	-	V	V_{GS} = 0 V, I_D = 0.81 mA
Gate threshold voltage [6]	$V_{GS(th)}$	3.5	4.5	5.6	V	V_{DS} = V_{GS}, I_D = 8.1 mA, T_j = 25°C
		-	3.3	-		V_{DS} = V_{GS}, I_D = 8.1 mA, T_j = 175°C
Zero gate voltage drain current	I_{DSS}	-	1	75	µA	V_{DS} = 750 V, V_{GS} = 0 V, T_j = 25°C
			10	-		V_{DS} = 750 V, V_{GS} = 0 V, T_j = 175°C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS} = 23V, V_{DS} = 0 V, T_j = 25°C
				-100		V_{GS} = -7V, V_{DS} = 0 V, T_j = 25°C
Forward transconductance	g_{fs}	-	21.7	-	S	I_D = 36.7 A, V_{DS} = 20 V
Drain-source on-state resistance	$R_{DS(on)}$	-	32.0	-	mΩ	V_{GS} = 15 V, I_D = 36.7 A, T_j = 25°C
			25.0	31.0		V_{GS} = 18 V, I_D = 36.7 A, T_j = 25°C
			22.0	-		V_{GS} = 20 V, I_D = 36.7 A, T_j = 25°C
Drain-source on-state resistance [7]	$R_{DS(on)}$	-	39.0	49.0	mΩ	V_{GS} = 18 V, I_D = 36.7 A, T_j = 150°C
Drain-source on-state resistance	$R_{DS(on)}$	-	45.0	-	mΩ	V_{GS} = 18 V, I_D = 36.7 A, T_j =175°C
Short-circuit withstand time [7]	t_{SC}	-	2.0	-	µs	V_{DD} = 500 V, V_{GS} = 18 V, $V_{DS(peak)}$ < 750 V, $R_{G,ext}$ = 2.3 Ω
Internal gate resistance	$R_{G,int}$	-	2.7	-	Ω	f = 1 MHz

5) 作为异常工作条件下的稳健性测量，不建议用于正常工作。

6) 在 V_{GS} = +20 V条件下，经过预处理脉冲后测试。不建议采用“线性模式”运行。如需评估潜在的“线性模式”运行，请联系英飞凌销售办事处。

7) 由设计规定，不进行生产测试。

表 6 动态特性

外部寄生元件（PCB 布局）对开关行为有显著影响。
必须尽量减少杂散电感和耦合电容。
如需布局建议，请使用提供的应用笔记或联系英飞凌销售办事处。

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	1729	-	pF	V_{GS} = 0 V, V_{DS} = 500 V, f = 250 kHz
Reverse transfer capacitance	C_{rss}		9.0	-		
Output capacitance [8]	C_{oss}		117	153		
Output charge [8]	Q_{oss}	-	106	138	nC	calculation based on C_{oss}
Effective output capacitance, energy related [9]	$C_{o(er)}$	-	148	-	pF	V_{GS} = 0 V, V_{DS} = 0…500 V

表 6　　动态特性

外部寄生元件（PCB 布局）对开关行为有显著影响。
必须尽量减少杂散电感和耦合电容。
如需布局建议，请使用提供的应用笔记或联系英飞凌销售办事处。

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Effective output capacitance, time related [10]	$C_{o(tr)}$	-	212	-	pF	I_D = constant, V_{GS} = 0 V, V_{DS} = 0…500 V
Turn-on delay time	$t_{d(on)}$	-	10	-	ns	V_{DD} = 500 V, V_{GS} = 0/18 V, I_D = 36.7 A, $R_{G,ext}$ = 1.8 Ω, L_{stray} = 15 nH; see table 10
Rise time	t_r		9		ns	
Turn-off delay time	$t_{d(off)}$		19		ns	
Fall time	t_f		7		ns	
Turn-ON switching losses [11]	E_{on}		67		µJ	
Turn-OFF switching losses [11]	E_{off}		37		µJ	
Total switching losses [11]	E_{tot}		104		µJ	

[8] 最大规格由计算出的六西格玛置信上限定义。

[9] $C_{o(er)}$ 是一个固定电容，当 V_{DS} 从 0 上升至 500 V 时，其存储能量与 C_{oss} 相同

[10] $C_{o(tr)}$ 是一个固定电容，当 V_{DS} 从 0 上升至 500 V 时，其充电时间与 C_{oss} 相同

[11] MOSFET 采用半桥配置，无外部二极管。参数通过特性描述验证，符合 IEC 60747 8 标准。

表 7　　栅极电荷特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Plateau gate to source charge	$Q_{GS(pl)}$	-	12.5	-	nC	V_{DD} = 500 V, I_D = 36.7 A, V_{GS} = 0 to 18 V
Gate to drain charge	Q_{GD}		10.7			
Total gate charge	Q_G		49			

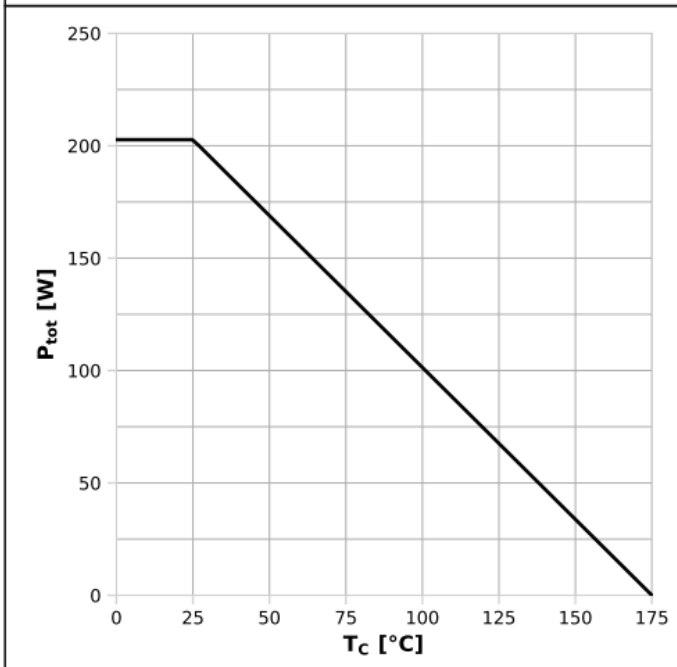
表 8　　反向二极管特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source reverse voltage	V_{SD}	-	4.1	5.0	V	V_{GS} = 0 V, I_S = 36.7 A, T_j = 25°C
			3.8	-		V_{GS} = 0 V, I_S = 36.7 A, T_j = 175°C
MOSFET forward recovery time	t_{fr}	-	10.1	-	ns	V_{DD} = 500 V, I_S = 36.7 A, di_S/dt = 4000 A/µs; see table 9
MOSFET forward recovery charge [12]	Q_{fr}		134		nC	
MOSFET peak forward recovery current	I_{frm}		27		A	

[12] Q_{fr} 包括 Q_{oss}

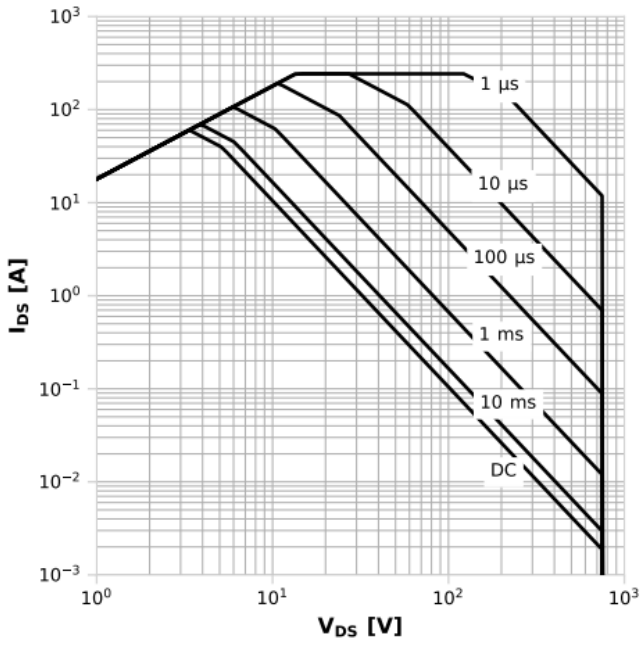
5 电气特性图

Diagram 1: Power dissipation



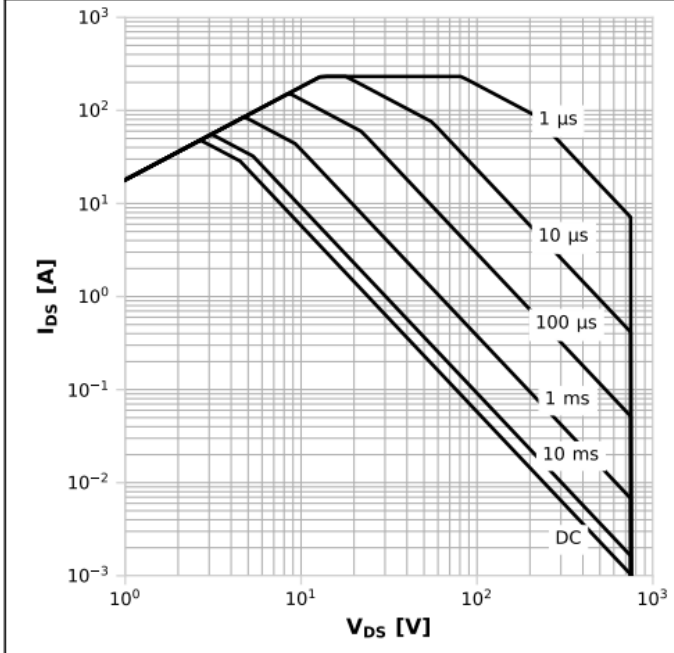
$P_{tot}=f(T_C)$

Diagram 2: Safe operating area



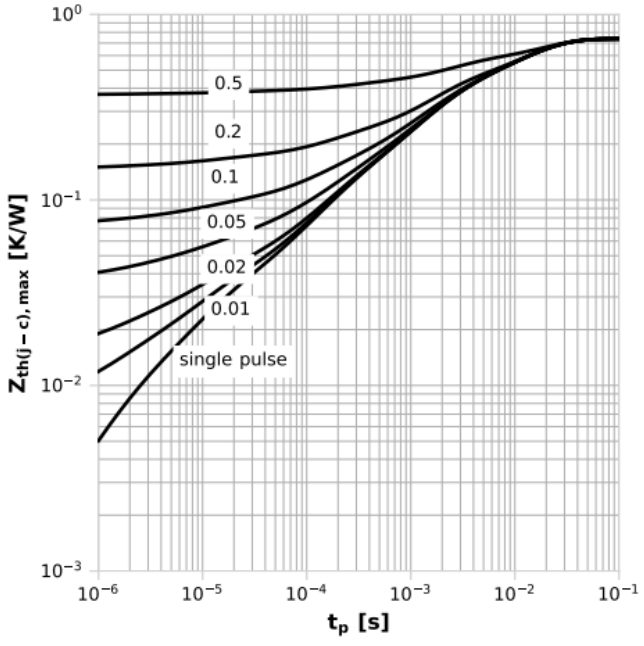
$I_{DS}=f(V_{DS})$; T_C=25°C; D=0; parameter: t_p

Diagram 3: Safe operating area



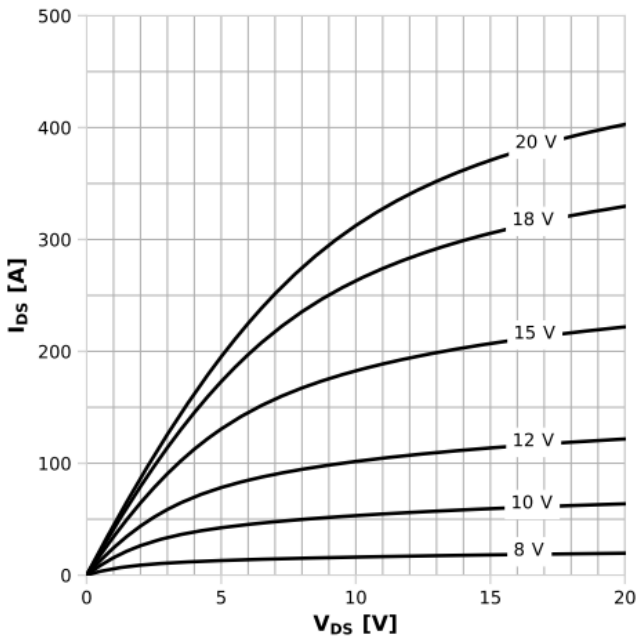
$I_{DS}=f(V_{DS})$; T_C=80°C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



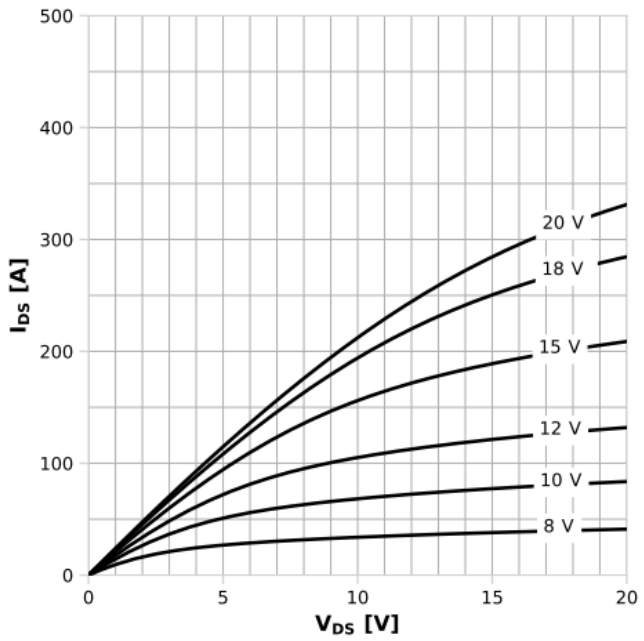
$Z_{th(j-c),max}=f(t_P)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



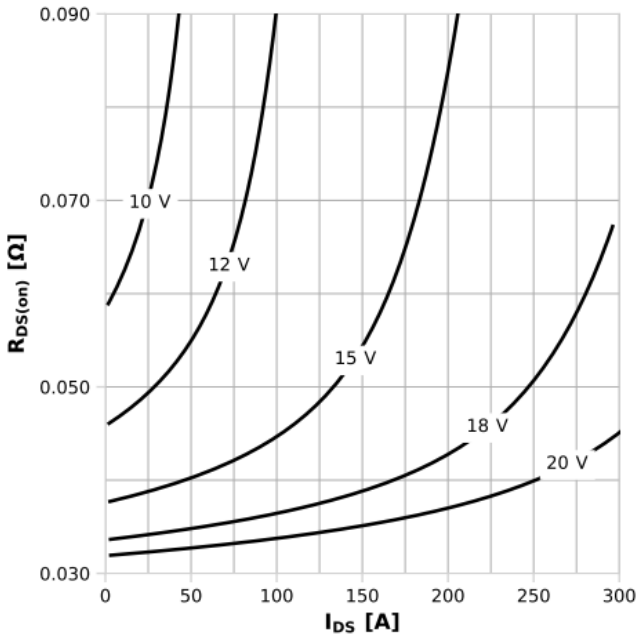
$I_{DS}=f(V_{DS})$; $T_j=25°C$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



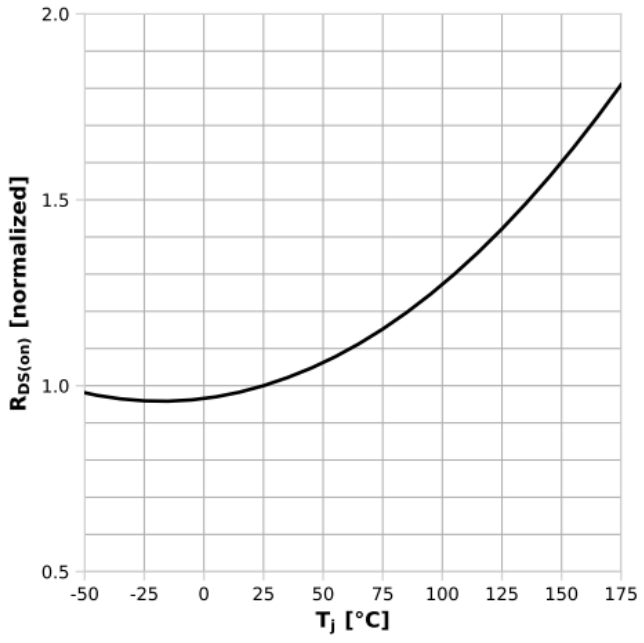
$I_{DS}=f(V_{DS})$; $T_j=175°C$; parameter: V_{GS}

Diagram 7: Typ. drain-source on-state resistance



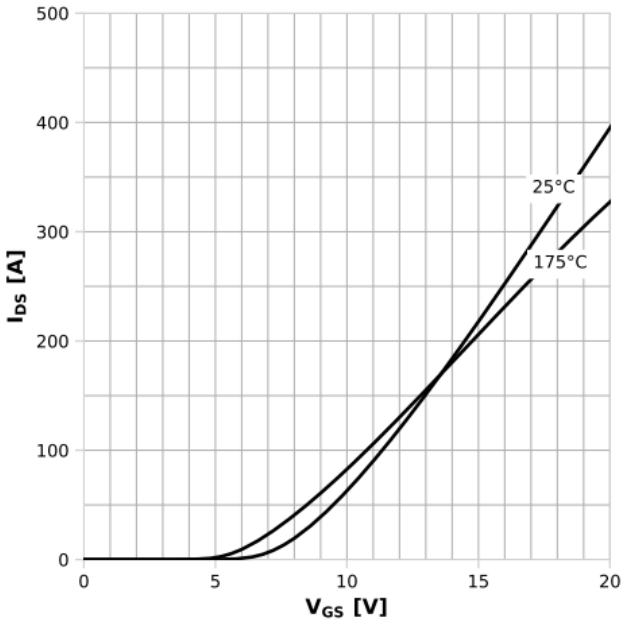
$R_{DS(on)}=f(I_{DS})$; $T_j=125°C$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



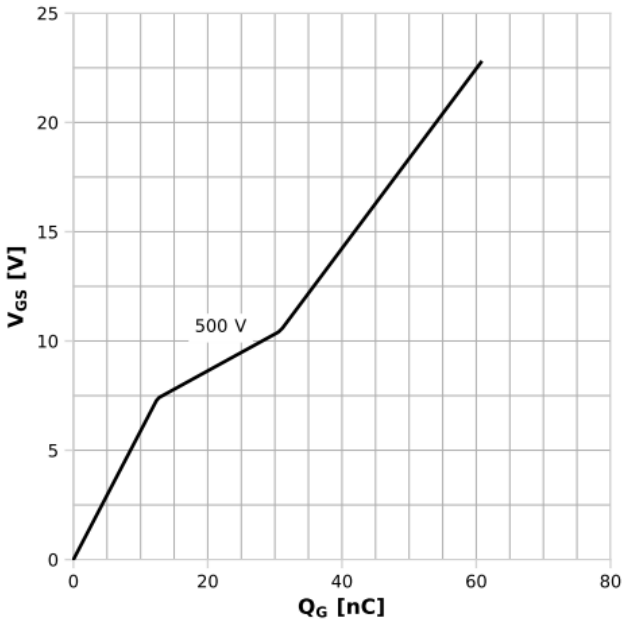
$R_{DS(on)}=f(T_j)$; $I_D=36.7$ A; $V_{GS}=18$ V

Diagram 9: Typ. transfer characteristics



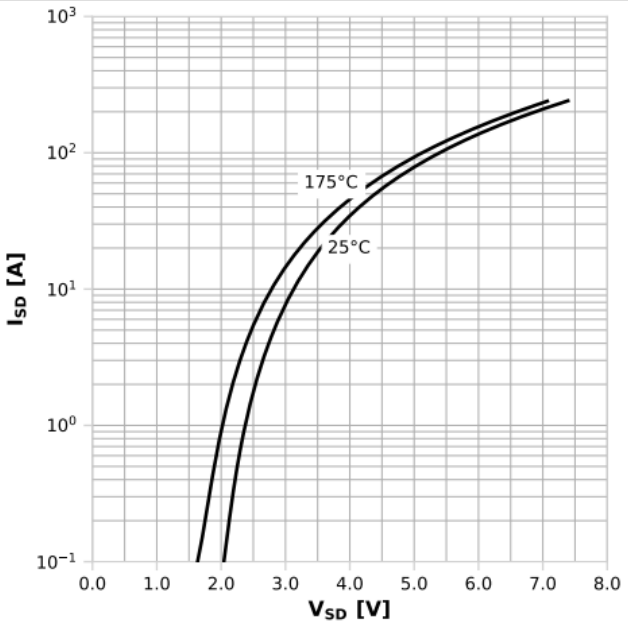
$I_{DS}=f(V_{GS})$; $V_{DS}=20$ V; parameter: T_j

Diagram 10: Typ. gate charge



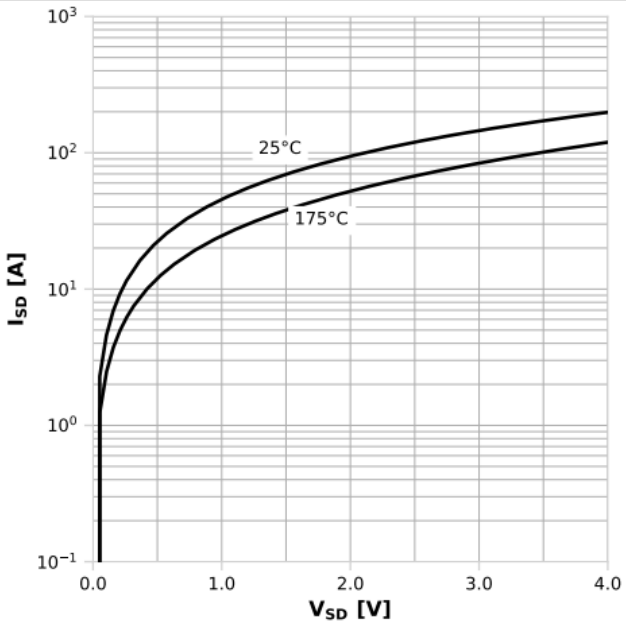
$V_{GS}=f(Q_G)$; $I_D=36.7$ A pulsed; parameter: V_{DD}

Diagram 11: Typ. reverse drain current characteristics



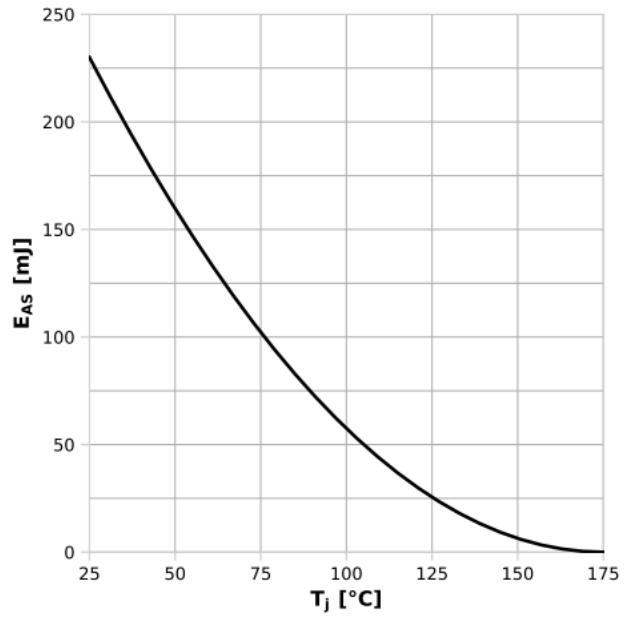
$I_{SD}=f(V_{SD})$; $V_{GS}=0$ V; parameter: T_j

Diagram 12: Typ. reverse drain current characteristics



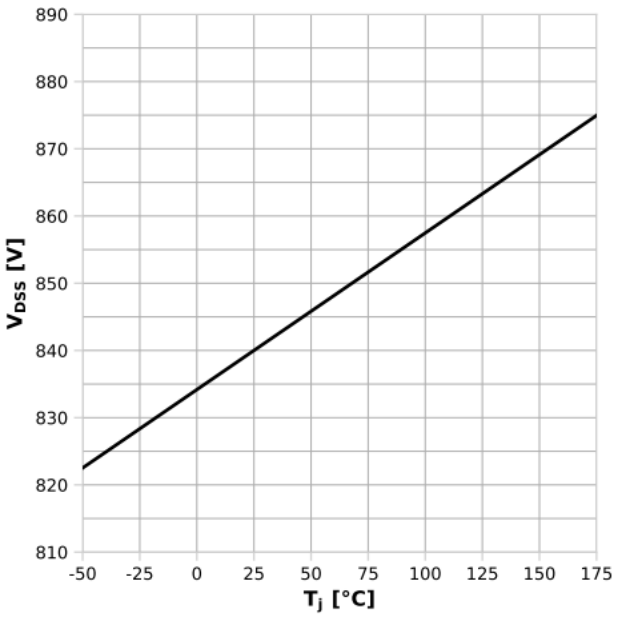
$I_{SD}=f(V_{SD})$; $V_{GS}=18$ V; parameter: T_j

Diagram 13: Avalanche energy



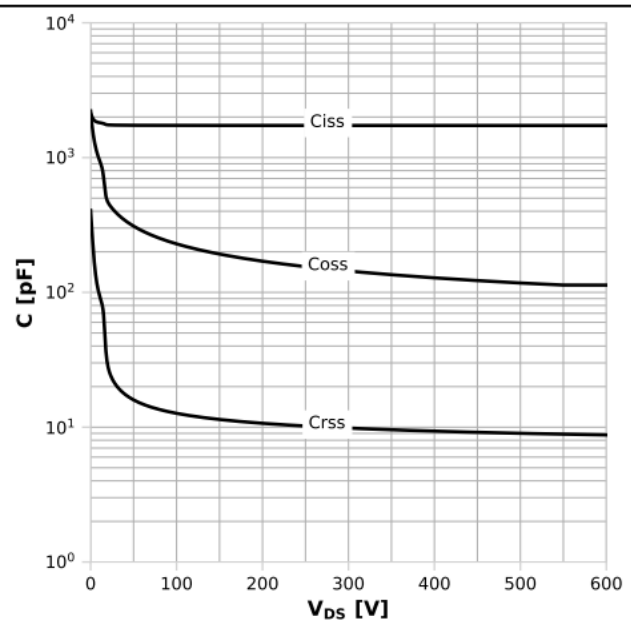
$E_{AS}=f(T_j)$; I_D=8.6 A; V_{DD}=50 V

Diagram 14: Drain-source breakdown voltage



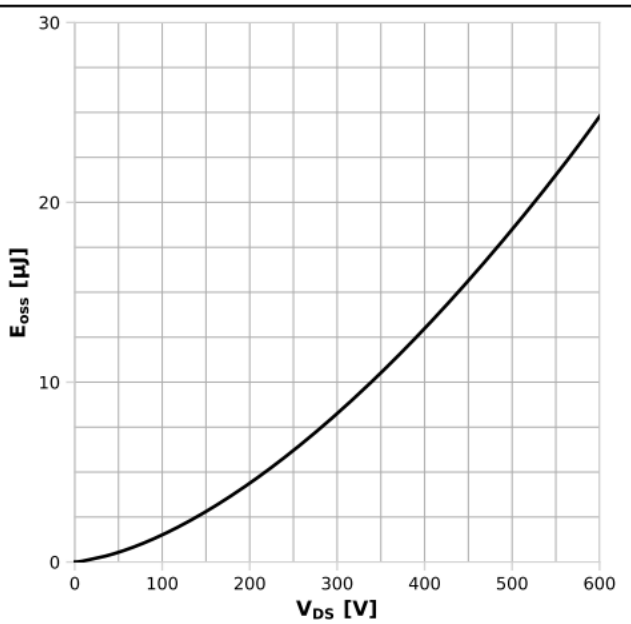
$V_{DSS}=f(T_j)$; I_D=0.81 mA

Diagram 15: Typ. capacitances



$C=f(V_{DS})$; V_{GS}=0 V; f=250 kHz

Diagram 16: Typ. Coss stored energy



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

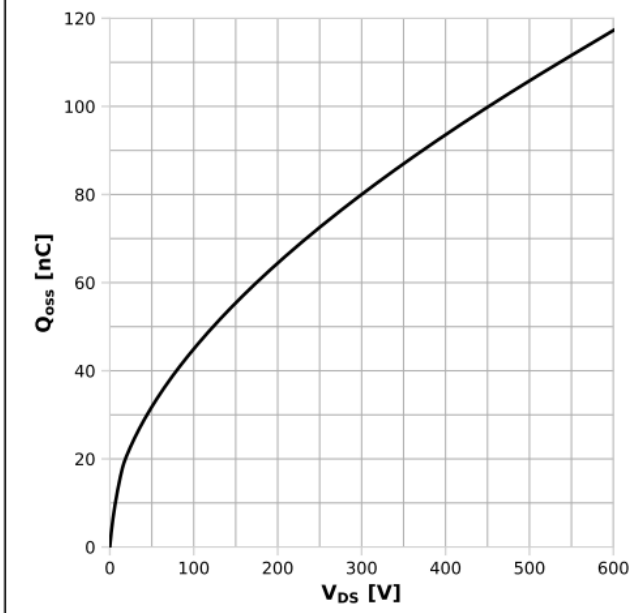
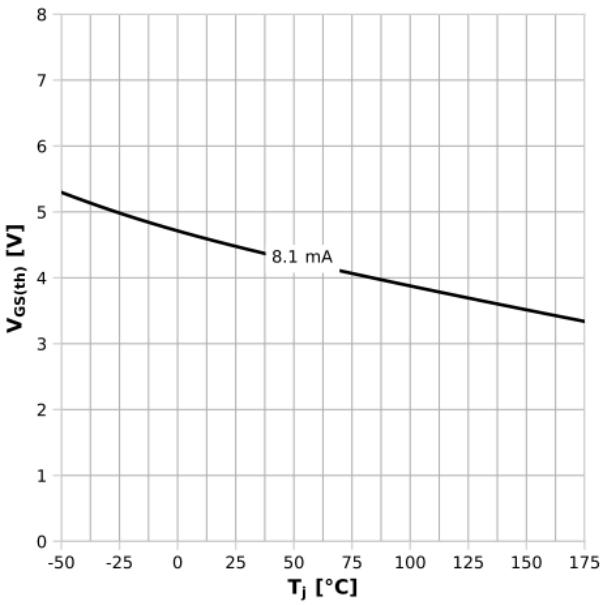
Diagram 17: Typ. Qoss output charge	Diagram 18: Typ. gate threshold voltage
	
$Q_{oss}=f(V_{DS})$	$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

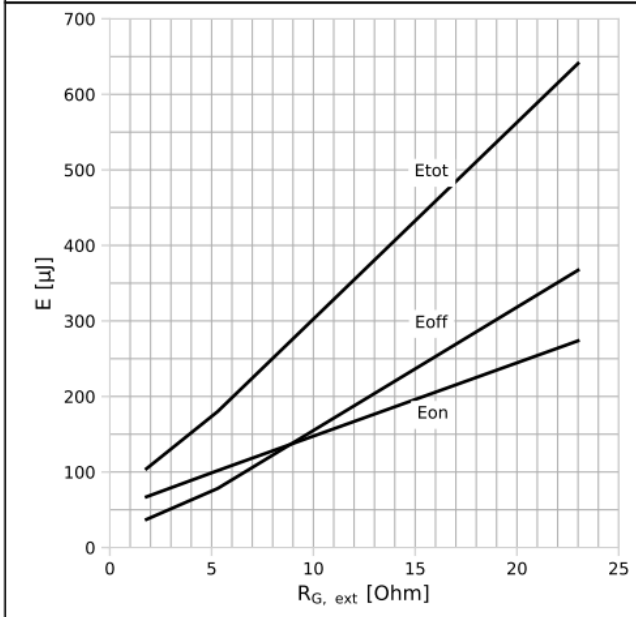
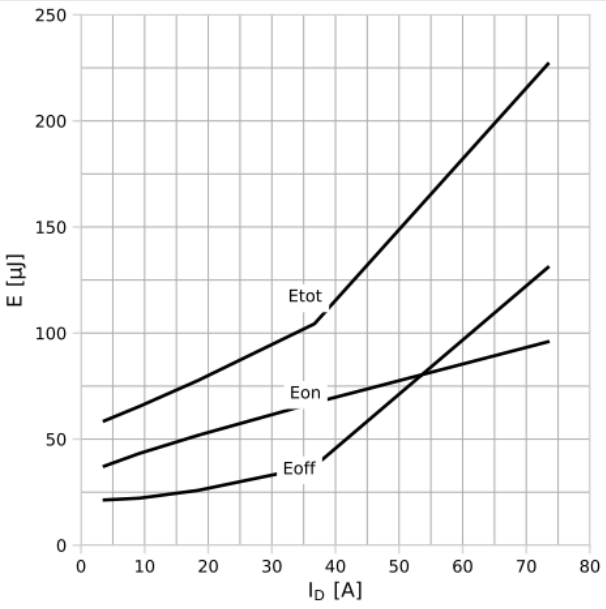
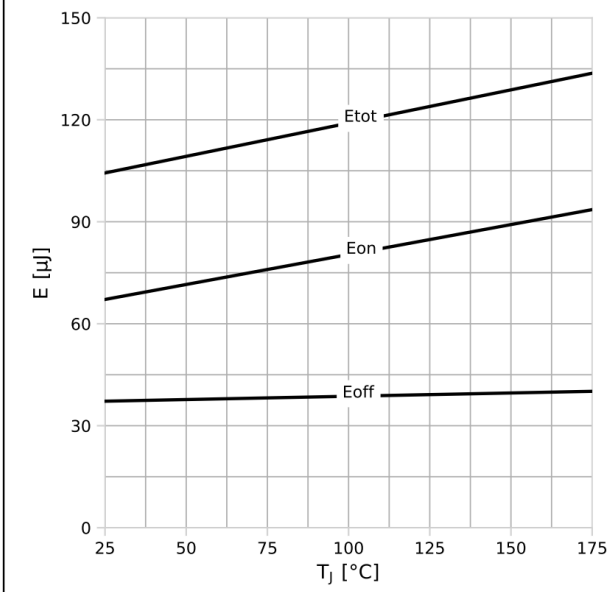
Diagram 19: Typ. Switching Losses vs R_{Gext}	Diagram 20: Typ. Switching Losses vs switching current
	
V_{DD}=500 V; I_D=36.7 A; T_J=25°C	V_{DD}=500 V; $R_{G,ext}$=1.8 Ohm; T_J=25°C

Diagram 21: Typ. Switching Losses vs T_J



V_{DD}=500 V; $R_{G,ext}$=1.8 Ohm; I_D=36.7 A

6 测试电路

表 9 体二极管特性

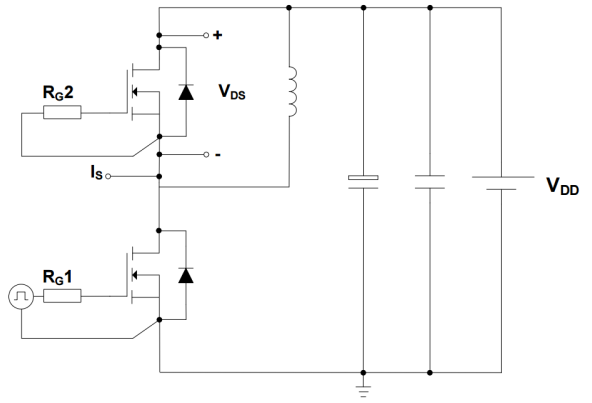
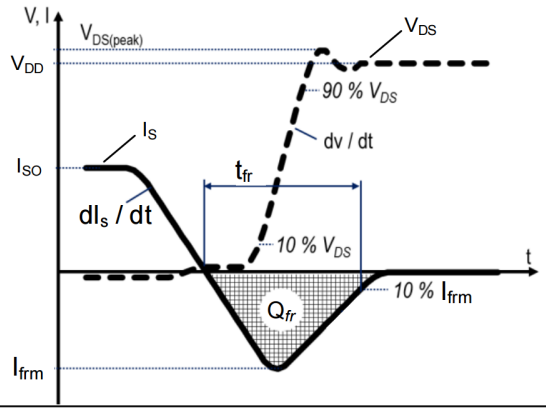
Test circuit for body diode characteristics	Body diode recovery waveform
	

表 10 开关时间

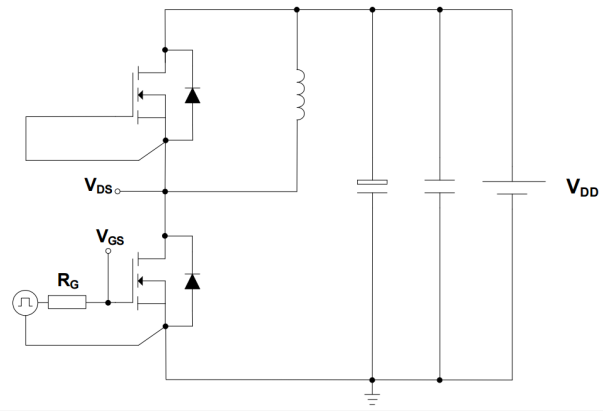
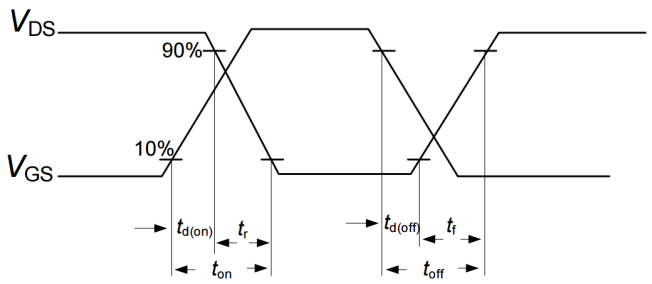
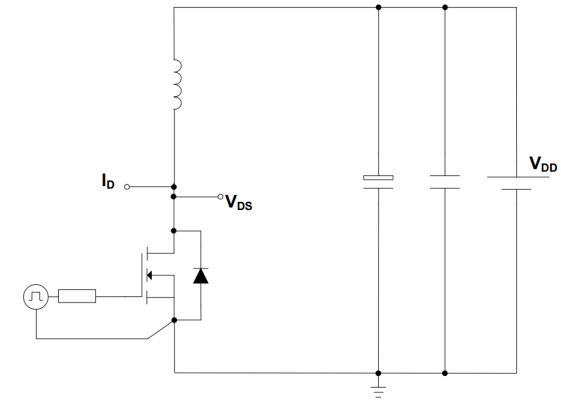
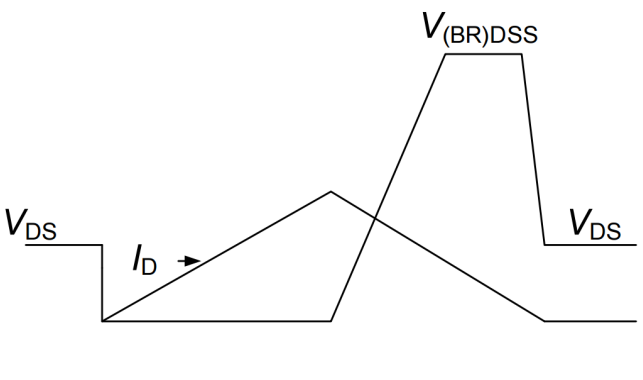
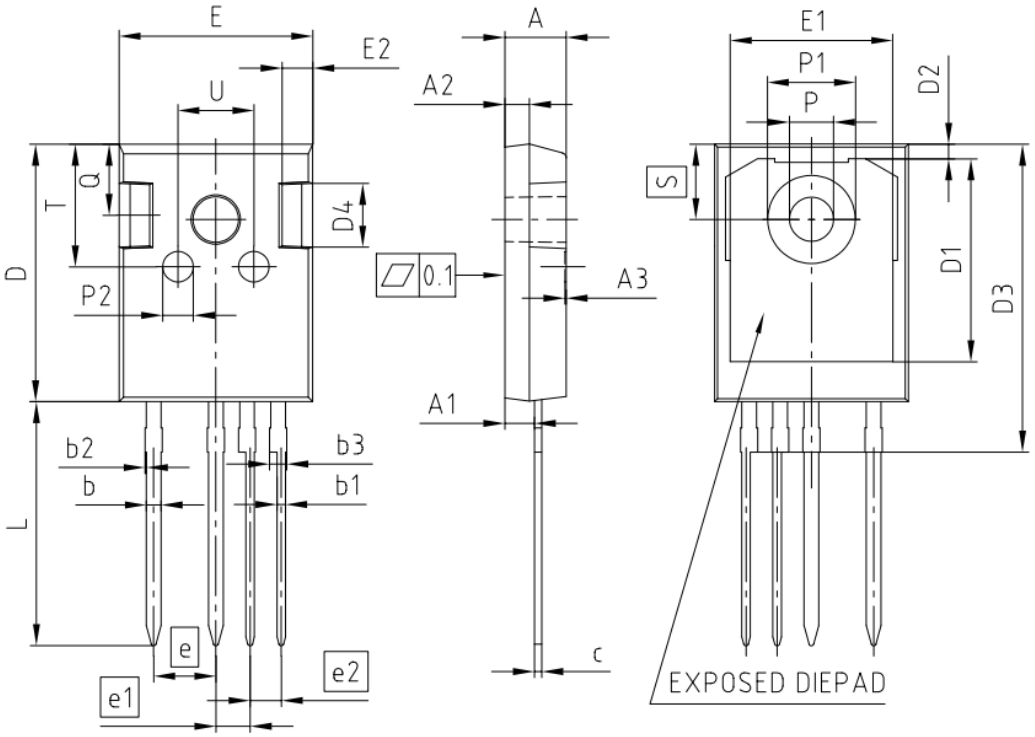
Switching times test circuit for inductive load	Switching times waveform
	

表 11 非钳位感性负载

Unclamped inductive load test circuit	Unclamped inductive waveform
	

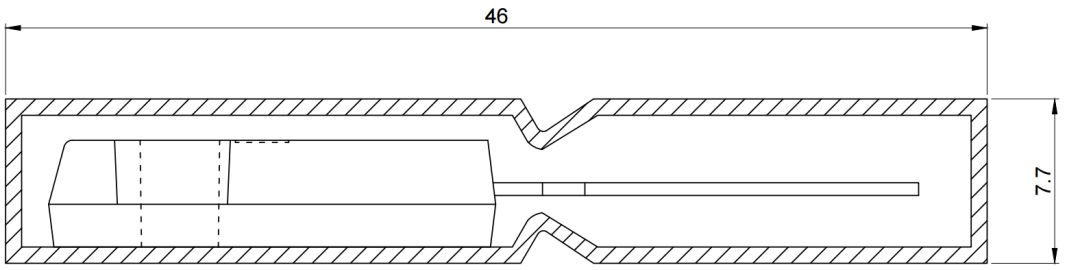
7 封装外形



NOTES:
DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

PACKAGE - GROUP NUMBER:	PG-TO247-4-U02				
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	E	15.70	15.90
A1	2.31	2.51	E1	13.10	13.50
A2	1.90	2.10	E2	2.40	2.60
A3	0.05	0.25	e	5.08	
b	1.10	1.30	e1	2.79	
b1	0.65	0.79	e2	2.54	
b2	---	0.20	N	4	
b3	1.34	1.44	L	19.80	20.10
c	0.58	0.66	øP	3.50	3.70
D	20.90	21.10	øP1		7.40
D1	16.25	16.85	øP2	2.40	2.60
D2	1.05	1.35	Q	5.60	6.00
D3	24.97	25.27	S	6.15	
D4	4.90	5.10	T	9.80	10.20
			U	6.00	6.40

图 1　　PG-TO 247 - 4 外形图，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 2　　PG- TO 247 - 4 包装型号，尺寸单位为毫米

8 附录A

表 12 相关链接

- IFX CoolSiC CoolSiC™ 汽车功率器件 750 V G2 网页
- IFX CoolSiC CoolSiC™ 汽车功率器件 750 V G2 应用笔记
- IFX CoolSiC CoolSiC™ 汽车功率器件 750 V G2 仿真模型
- IFX 设计工具

修订记录

AIMZA75R025M2H

Revision 2025-12-22, Rev. 1. 0

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-12-22	Release of final version

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