

英飞凌碳化硅 MOSFET

英飞凌CoolSiC™ MOSFET 750 V G2

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 $R_{DS(on)} \times Q_{fr}$
- 出色的 $R_{DS(on)} \times Q_{oss}$ 和 $R_{DS(on)} \times Q_G$
- 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

- 电动汽车充电基础设施
- 太阳能光伏逆变器和不间断电源
- 储能和电池化成
- 通信和服务器 SMPS
- 固态继电器和断路器

产品验证

通过 JEDEC 相关测试。

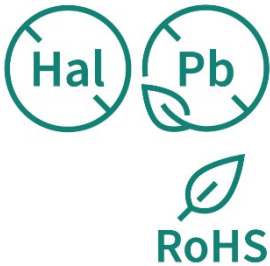
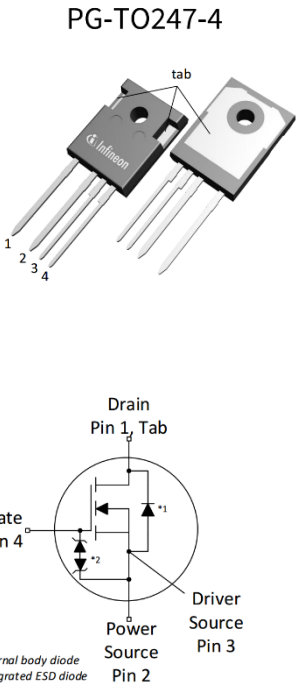
请注意：源引脚和驱动器源引脚不可互换。交换可能会导致故障。对于并联 MOSFET 器件，通常建议将栅极电阻串联在驱动源而非栅极上。

表 1 主要性能参数

Parameter	Value	Unit
V_{DSS} over full $T_{j,range}$	750	V
$R_{DS(on),typ}$	50	mΩ
$R_{DS(on),max}$	65	mΩ
$Q_{G,typ}$	24	nC
$I_{D,pulse}$	115	A
$Q_{oss,typ}$ @ 500 V	52	nC
$E_{oss,typ}$ @ 500 V	9.2	μJ

Part number	Package	Marking	Related links
IMZA75R050M2H	PG-TO247-4	75R050M2	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）。



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1 最大额定值

除非另有规定， $T_j = 25^\circ\text{C}$ 。

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%。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, $T_j = -55^\circ\text{C}$ to 175°C
Continuous DC drain current ¹⁾	I_{DDC}	-	-	32	A	$T_c = 25^\circ\text{C}$
				23		$T_c = 100^\circ\text{C}$
Peak drain current ²⁾	I_{DM}	-	-	115	A	$T_c = 25^\circ\text{C}$, $V_{\text{GS}} = 18\text{ V}$
Avalanche energy, single pulse	E_{AS}	-	-	106	mJ	$I_D = 3.9\text{ A}$, $V_{\text{DD}} = 50\text{ V}$; see table 11
Avalanche energy, repetitive	E_{AR}			0.57		
Avalanche current, single pulse	I_{AS}	-	-	3.9	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	200	V/ns	$V_{\text{DS}} = 0 \dots 500\text{ V}$
Gate source voltage (static) ³⁾	V_{GS}	-7	-	23	V	-
Gate source voltage (transient)	V_{GS}	-11	-	25	V	$t_p \leq 500\text{ ns}$, duty cycle $\leq 1\%$
Power dissipation	P_{tot}	-	-	122	W	$T_c = 25^\circ\text{C}$
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	-
Operating junction temperature	T_j			175		
Extended operating junction temperature ⁴⁾	T_j	-	-	200	$^\circ\text{C}$	$\leq 100\text{ h}$ in the application lifetime
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous reverse drain current ¹⁾	I_{SDC}	-	-	32	A	$V_{\text{GS}} = 18\text{ V}$, $T_c = 25^\circ\text{C}$
				27		$V_{\text{GS}} = 0\text{ V}$, $T_c = 25^\circ\text{C}$
Peak reverse drain current ²⁾	I_{SM}	-	-	115	A	$T_c = 25^\circ\text{C}$, $t_p \leq 250\text{ ns}$
				32.0		$T_c = 25^\circ\text{C}$
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms} , $T_c = 25^\circ\text{C}$, $t = 1\text{ min}$

1) 受 $T_{j,\text{max}}$ 限制。

2) 脉冲宽度 t_{pulse} 受 $T_{j,\text{max}}$ 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 ΔT 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	$R_{th(j-c)}$	-	0.88	1.23	°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, $T_j = 25^\circ\text{C}$

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	$V_{GS} = 0\text{ V}, I_D = 0.38\text{ mA}$
Gate threshold voltage ⁶⁾	$V_{GS(th)}$	3.5	4.5	5.6	V	$V_{DS} = V_{GS}, I_D = 3.8\text{ mA}, T_j = 25^\circ\text{C}$
		-	3.3	-		$V_{DS} = V_{GS}, I_D = 3.8\text{ mA}, T_j = 175^\circ\text{C}$
Zero gate voltage drain current	I_{DSS}	-	1	75	μA	$V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}, T_j = 25^\circ\text{C}$
			10	-		$V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}, T_j = 175^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	-	1	μA	$V_{GS} = 23\text{ V}, V_{DS} = 0\text{ V}, T_j = 25^\circ\text{C}$
				-1		$V_{GS} = -7\text{ V}, V_{DS} = 0\text{ V}, T_j = 25^\circ\text{C}$
Forward transconductance	g_{fs}	-	11.0	-	S	$I_D = 17.2\text{ A}, V_{DS} = 20\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	65.0	-	$\text{m}\Omega$	$V_{GS} = 15\text{ V}, I_D = 17.2\text{ A}, T_j = 25^\circ\text{C}$
			50.0	65.0		$V_{GS} = 18\text{ V}, I_D = 17.2\text{ A}, T_j = 25^\circ\text{C}$
			45.0	-		$V_{GS} = 20\text{ V}, I_D = 17.2\text{ A}, T_j = 25^\circ\text{C}$
Drain-source on-state resistance ⁷⁾	$R_{DS(on)}$	-	79.5	104.0	$\text{m}\Omega$	$V_{GS} = 18\text{ V}, I_D = 17.2\text{ A}, T_j = 150^\circ\text{C}$
Drain-source on-state resistance	$R_{DS(on)}$	-	90.0	-	$\text{m}\Omega$	$V_{GS} = 18\text{ V}, I_D = 17.2\text{ A}, T_j = 175^\circ\text{C}$
Internal gate resistance	$R_{G,int}$	-	4.1	-	Ω	$f = 1\text{ MHz}$

5) 作为异常运行条件下的稳健性测量, 不建议用于正常运行。

6) 在 $V_{GS} = +20\text{ V}$ 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) 由设计指定, 未经过生产测试。

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}	-	865	-	pF	$V_{GS} = 0\text{ V}, V_{DS} = 500\text{ V}, f = 250\text{ kHz}$
Reverse transfer capacitance	C_{rss}		4.4	-		
Output capacitance ⁸⁾	C_{oss}		59	77		
Output charge ⁸⁾	Q_{oss}	-	52	67	nC	calculation based on C_{oss}
Effective output capacitance, energy related ⁹⁾	$C_{o(er)}$	-	74	-	pF	$V_{GS} = 0\text{ V},$ $V_{DS} = 0 \dots 500\text{ V}$
Effective output capacitance, time related ¹⁰⁾	$C_{o(tr)}$	-	104	-	pF	$I_D = \text{constant}, V_{GS} = 0\text{ V},$ $V_{DS} = 0 \dots 500\text{ V}$

表 6 动态特性

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Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	$V_{DD} = 500\text{ V}$, $V_{GS} = 0/18\text{ V}$, $I_D = 17.2\text{ A}$, $R_{G,ext} = 1.8\text{ }\Omega$, $L_{stray} = 15\text{ nH}$; see table 10
Rise time	t_r		6		ns	
Turn-off delay time	$t_{d(off)}$		14		ns	
Fall time	t_f		6		ns	
Turn-ON switching losses ¹¹⁾	E_{on}		36		μJ	
Turn-OFF switching losses ¹¹⁾	E_{off}		17		μJ	
Total switching losses ¹¹⁾	E_{tot}		52		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。根据 IEC 60747-8 标准，通过特性验证参数。

表 7 栅极电荷特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Plateau gate to source charge	$Q_{GS(pl)}$	-	6.2	-	nC	$V_{DD} = 500\text{ V}$, $I_D = 17.2\text{ A}$, $V_{GS} = 0\text{ to }18\text{ V}$
Gate to drain charge	Q_{GD}		5.1			
Total gate charge	Q_G		24			

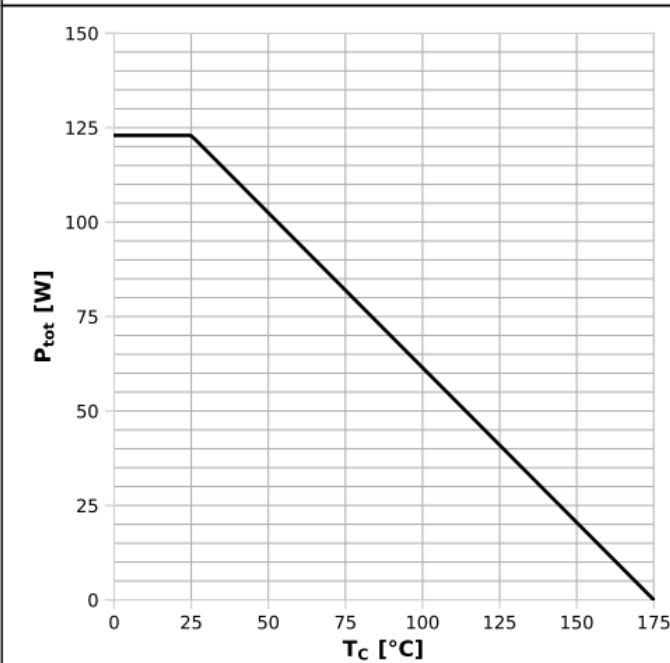
表 8 反向二极管特性

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source reverse voltage	V_{SD}	-	4.1	5.0	V	$V_{GS} = 0\text{ V}$, $I_S = 17.2\text{ A}$, $T_J = 25^\circ\text{C}$
			3.8	-		$V_{GS} = 0\text{ V}$, $I_S = 17.2\text{ A}$, $T_J = 175^\circ\text{C}$
MOSFET forward recovery time	t_{fr}	-	6	-	ns	$V_{DD} = 500\text{ V}$, $I_S = 17.2\text{ A}$, $di_S/dt = 4000\text{ A}/\mu\text{s}$; see table 9
MOSFET forward recovery charge ¹²⁾	Q_{fr}		55		nC	
MOSFET peak forward recovery current	I_{frm}		18		A	

12) Q_{fr} 包括 Q_{oss}

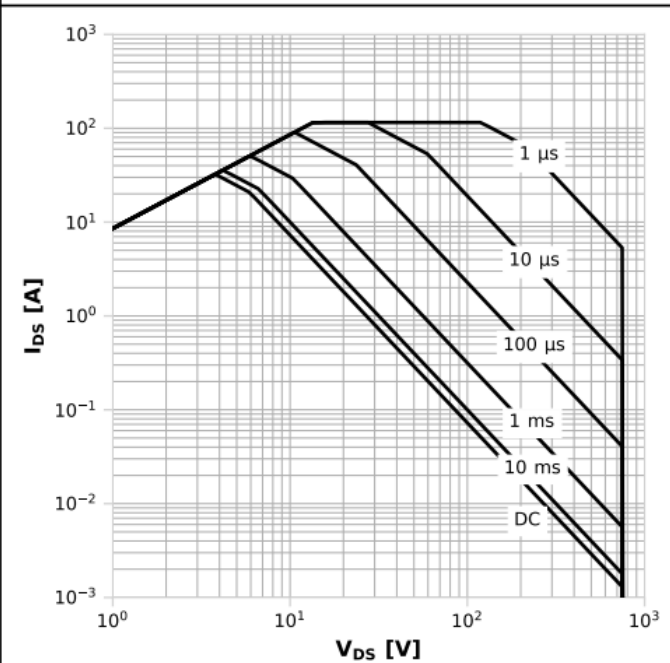
5 电气特性图

Diagram 1: Power dissipation



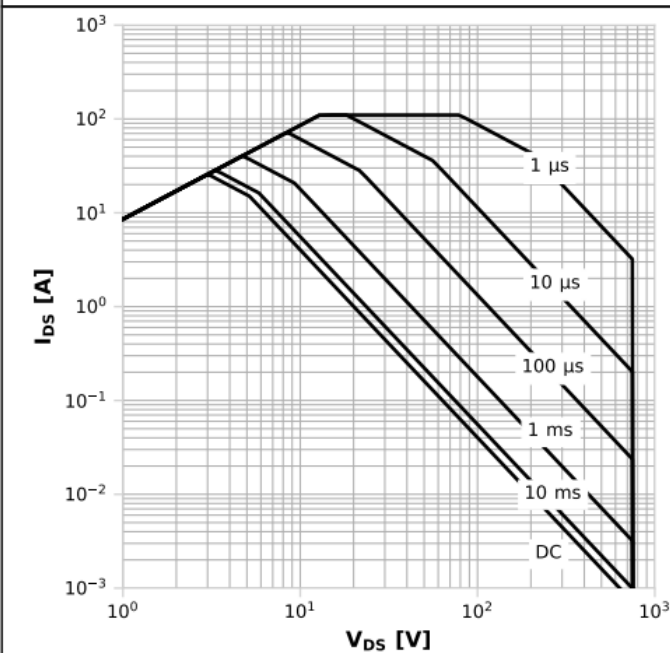
$$P_{\text{tot}} = f(T_c)$$

Diagram 2: Safe operating area



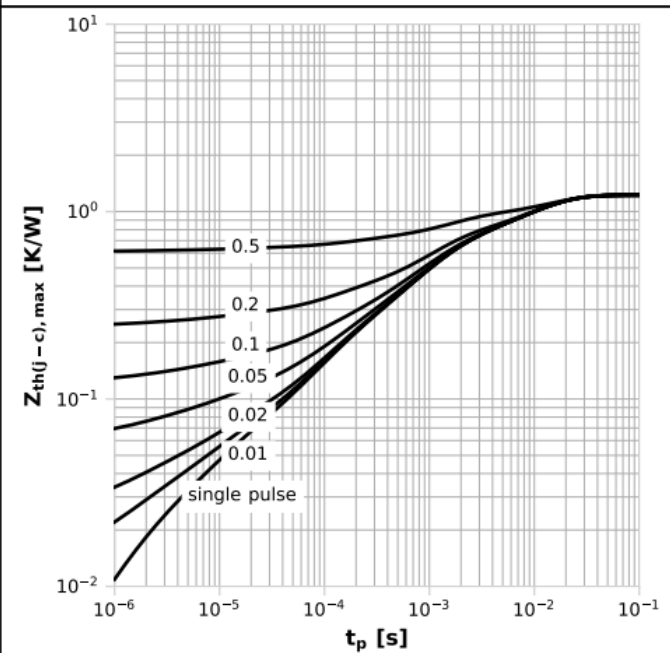
$$I_{\text{DS}} = f(V_{\text{DS}}); T_c = 25^\circ\text{C}; D = 0; \text{parameter: } t_p$$

Diagram 3: Safe operating area



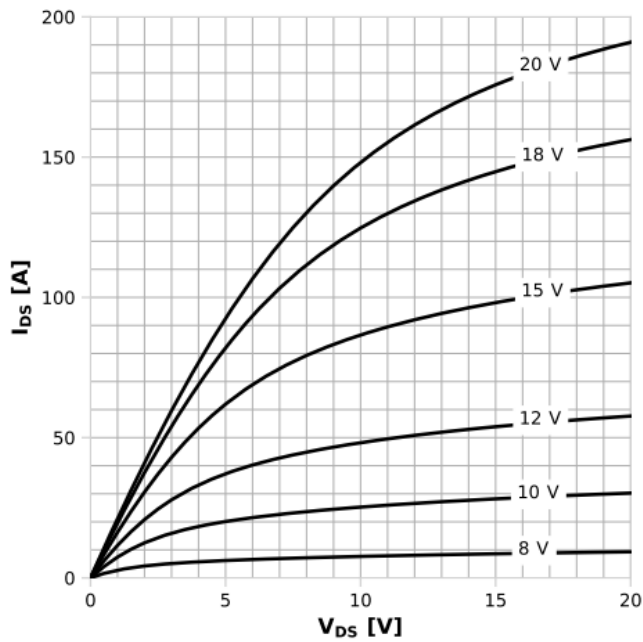
$$I_{\text{DS}} = f(V_{\text{DS}}); T_c = 80^\circ\text{C}; D = 0; \text{parameter: } t_p$$

Diagram 4: Max. transient thermal impedance



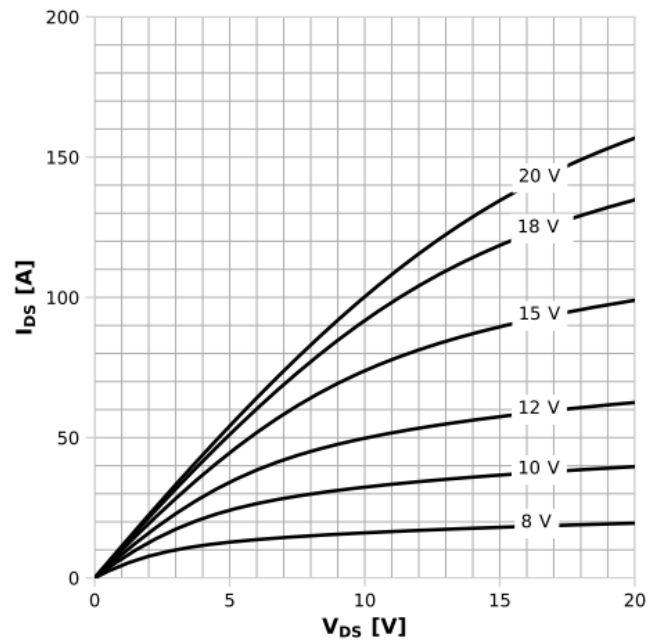
$$Z_{\text{th(j-c), max}} = f(t_p); \text{parameter: } D = t_p/T$$

Diagram 5: Typ. output characteristics



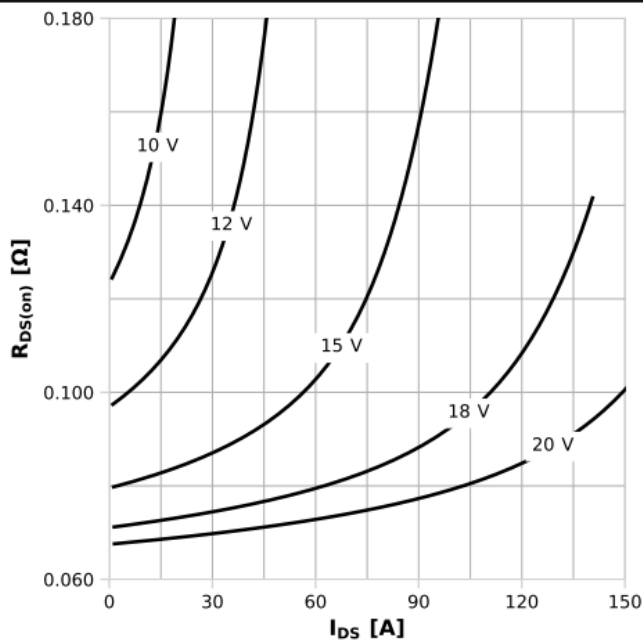
$I_{DS}=f(V_{DS})$; $T_j=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



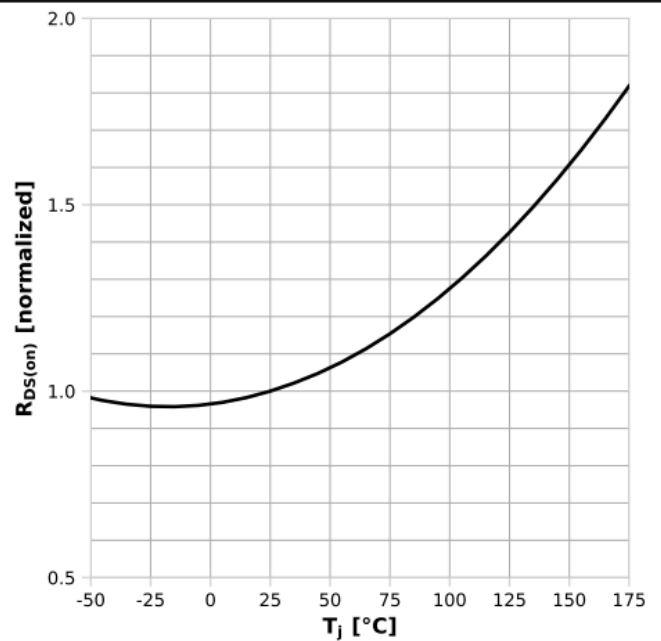
$I_{DS}=f(V_{DS})$; $T_j=175^{\circ}\text{C}$; parameter: V_{GS}

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



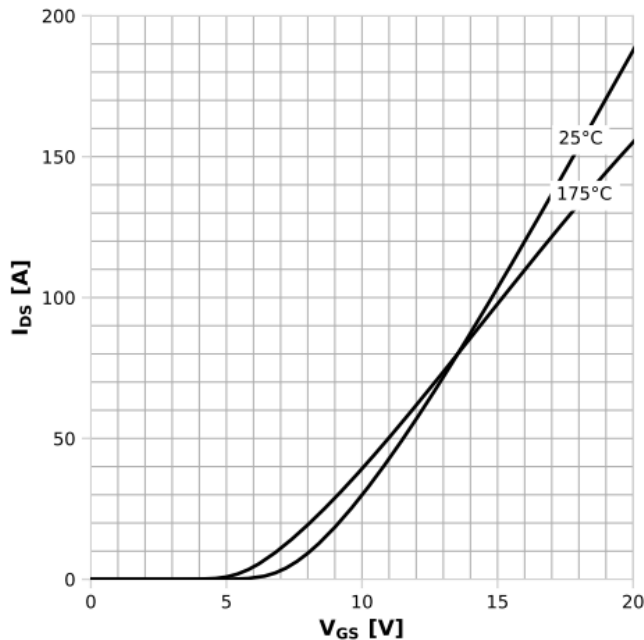
$R_{DS(on)}=f(I_{DS})$; $T_j=125^{\circ}\text{C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



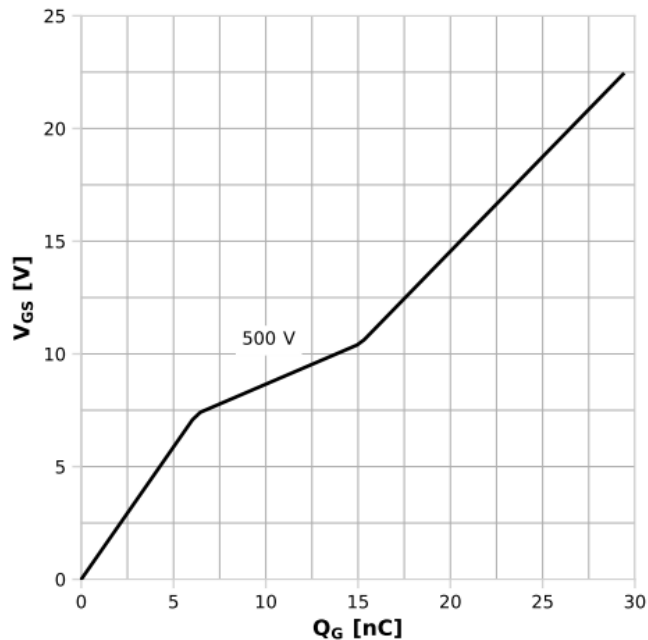
$R_{DS(on)}=f(T_j)$; $I_D=17.2\text{ A}$; $V_{GS}=18\text{ V}$

Diagram 9: Typ. transfer characteristics



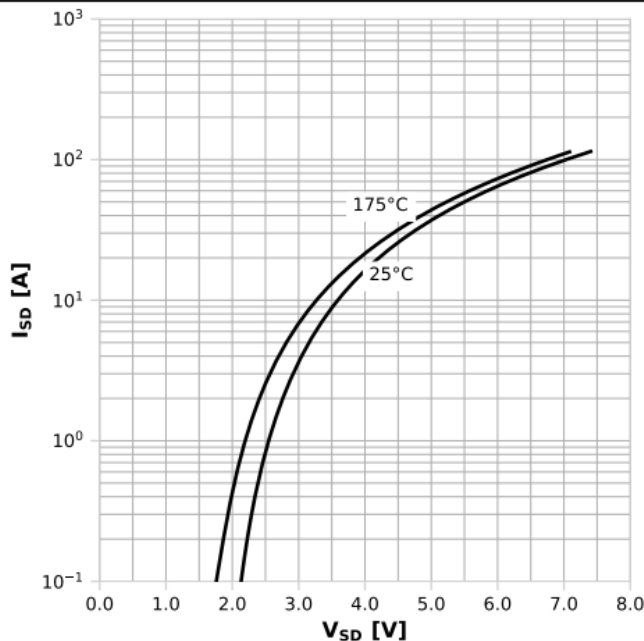
$I_{DS}=f(V_{GS})$; $V_{DS}=20$ V; parameter: T_j

Diagram 10: Typ. gate charge



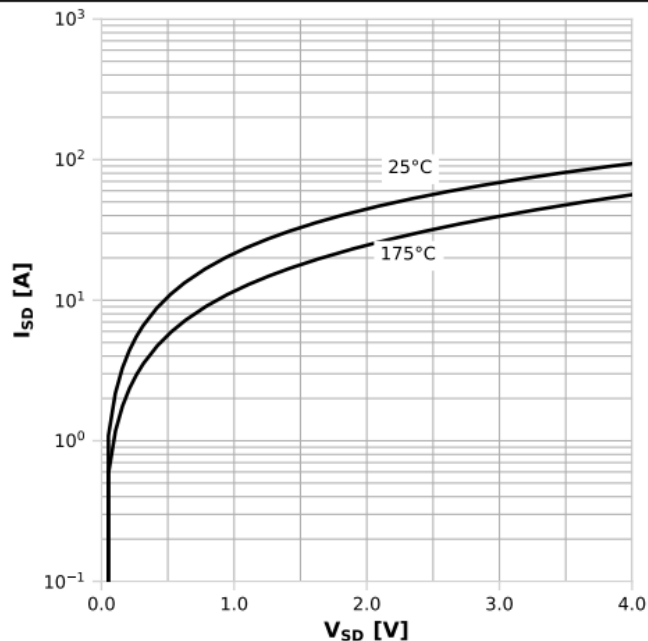
$V_{GS}=f(Q_G)$; $I_D=17.2$ A pulsed; parameter: V_{DD}

Diagram 11: Typ. reverse drain current characteristics



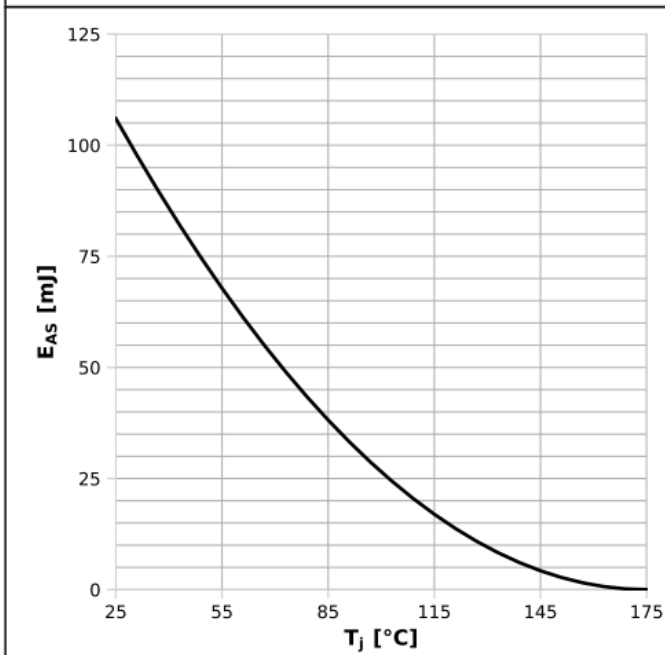
$I_{SD}=f(V_{SD})$; $V_{GS}=0$ V; parameter: T_j

Diagram 12: Typ. reverse drain current characteristics



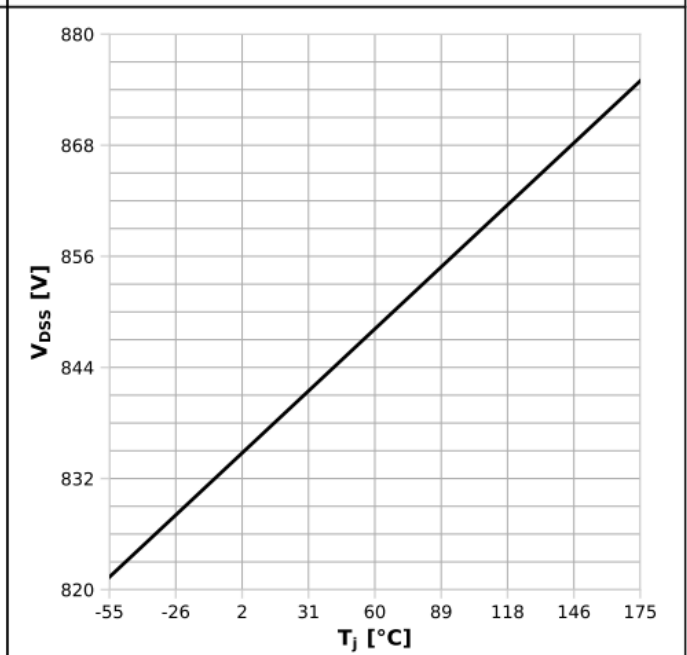
$I_{SD}=f(V_{SD})$; $V_{GS}=18$ V; parameter: T_j

Diagram 13: Avalanche energy



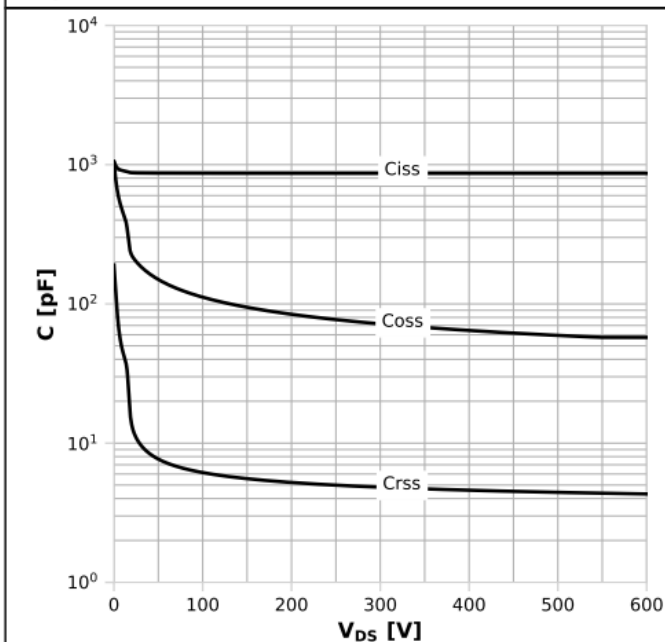
$E_{AS}=f(T_J); I_D=3.9\text{ A}; V_{DD}=50\text{ V}$

Diagram 14: Drain-source breakdown voltage



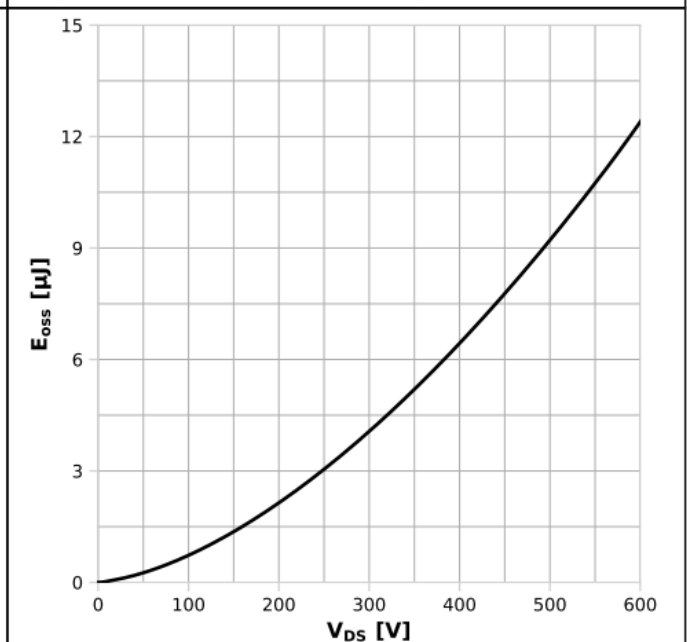
$V_{DSS}=f(T_J); I_D=0.38\text{ mA}$

Diagram 15: Typ. capacitances



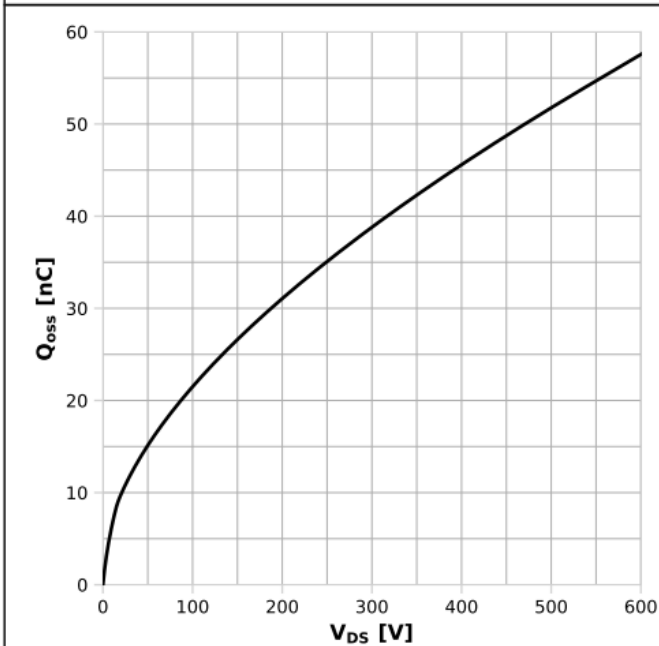
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=250\text{ kHz}$

Diagram 16: Typ. Coss stored energy



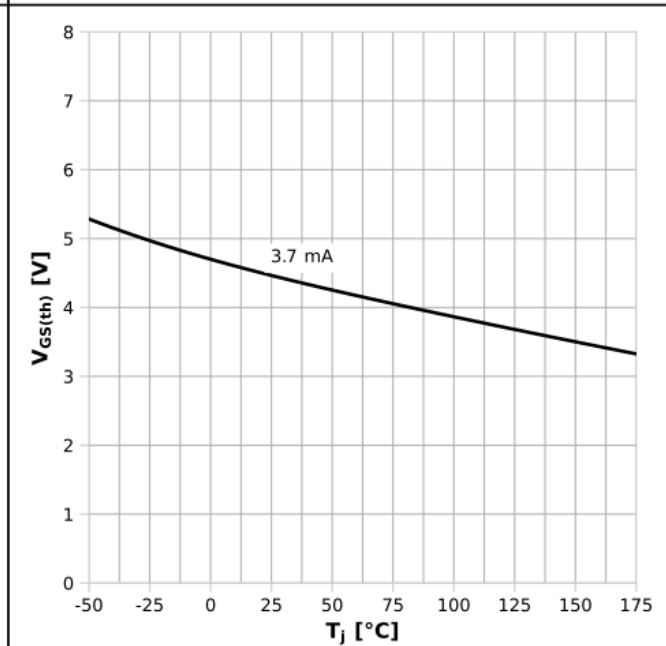
$E_{oss}=f(V_{DS})$

Diagram 17: Typ. Qoss output charge



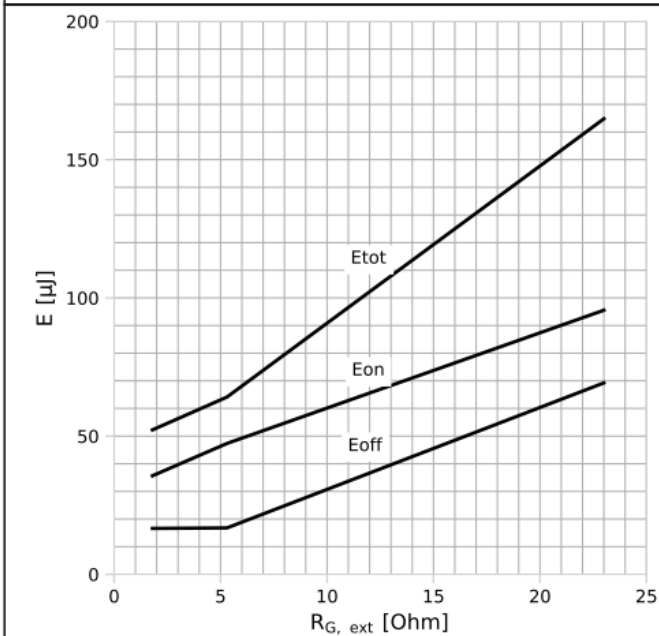
$$Q_{oss}=f(V_{DS})$$

Diagram 18: Typ. gate threshold voltage



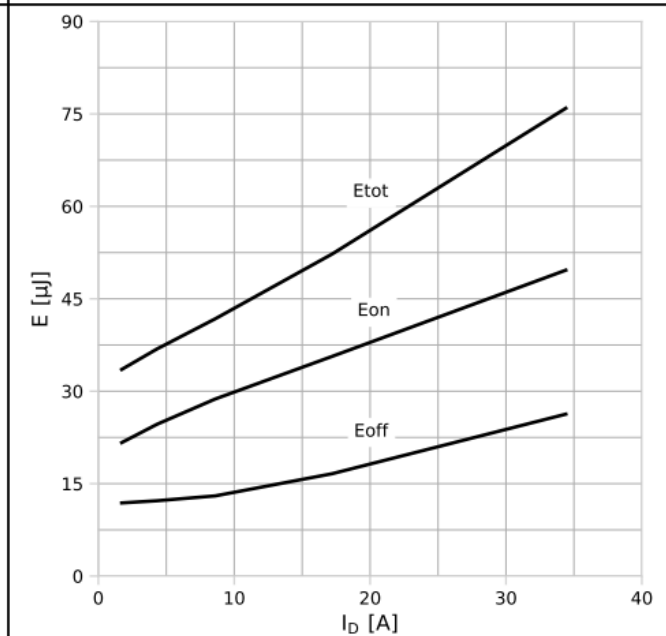
$$V_{GS(th)}=f(T_j), V_{GS}=V_{DS}; \text{ parameter: } I_D$$

Diagram 19: Typ. Switching Losses vs R_{G,ext}



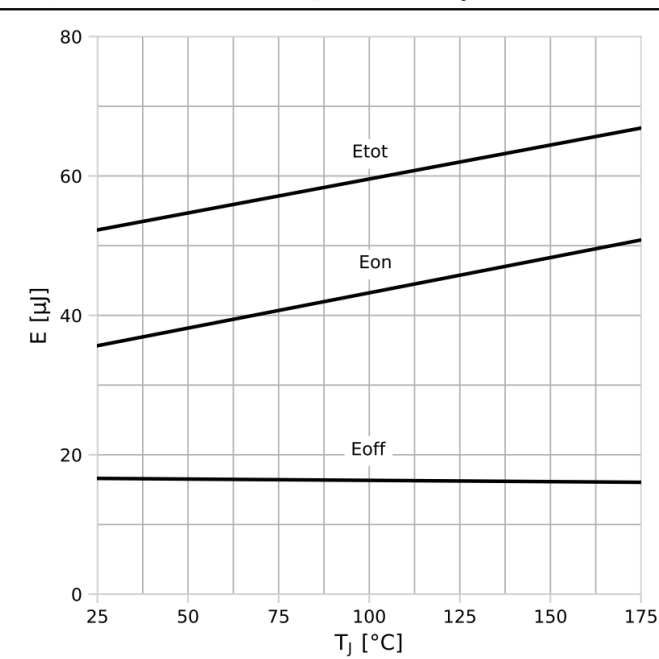
$$V_{DD}=500 \text{ V}; I_D=17.2 \text{ A}; T_J=25^\circ\text{C}$$

Diagram 20: Typ. Switching Losses vs switching current



$$V_{DD}=500 \text{ V}; R_{G,ext}=1.8 \text{ Ohm}; T_J=25^\circ\text{C}$$

Diagram 21: Typ. Switching Losses vs T_J



$V_{DD}=500\text{ V}$; $R_{G,ext}=1.8\text{ Ohm}$; $I_D=17.2\text{ A}$

6 测试电路

表 9 体二极管特性

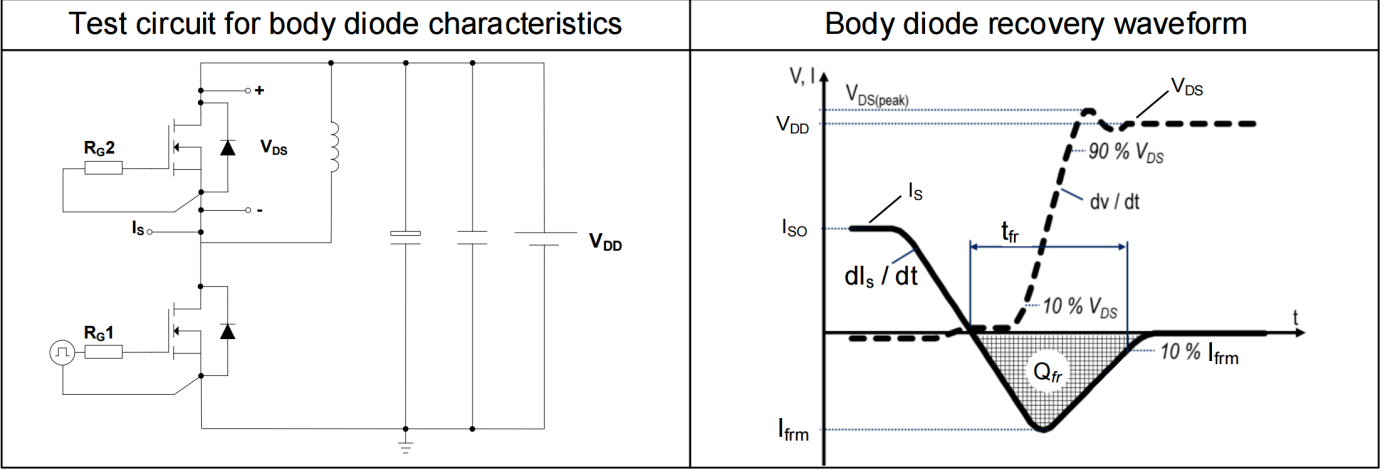


表 10 开关时间

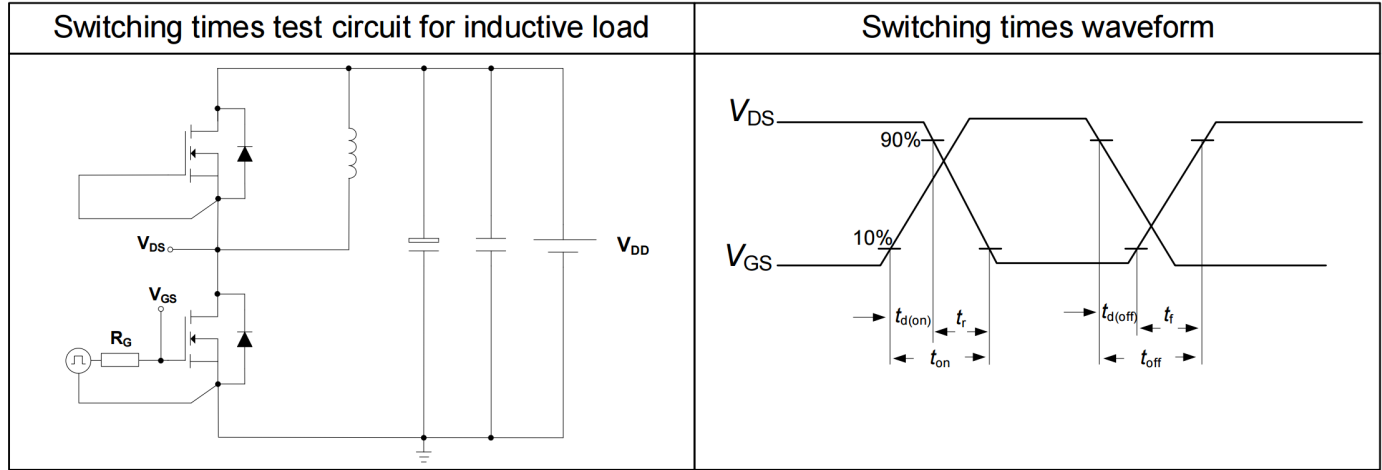
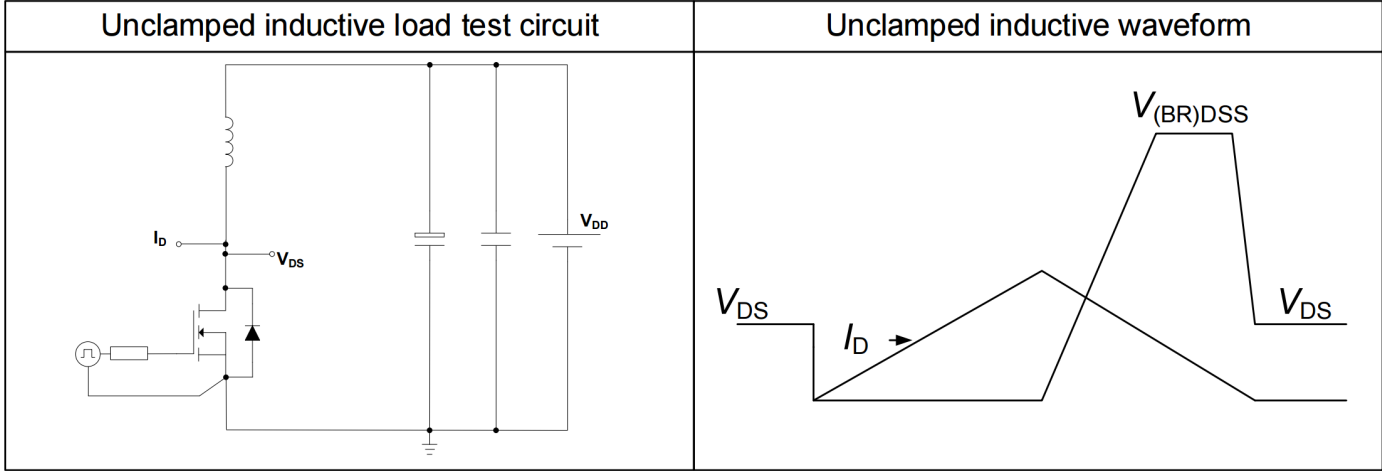
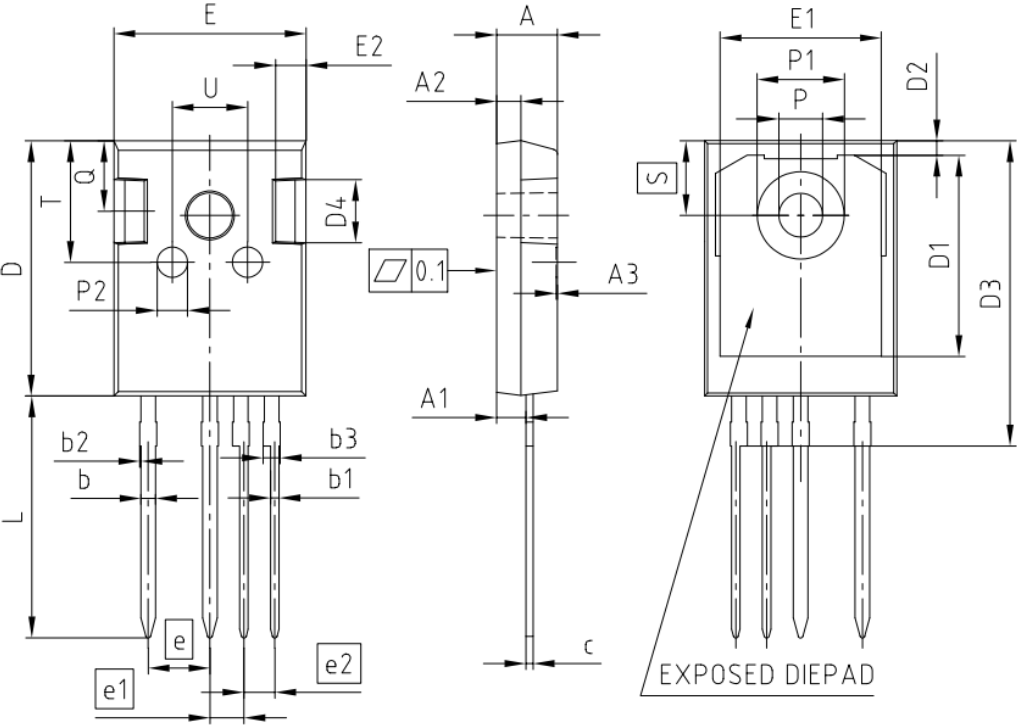


表 11 非钳位感性负载



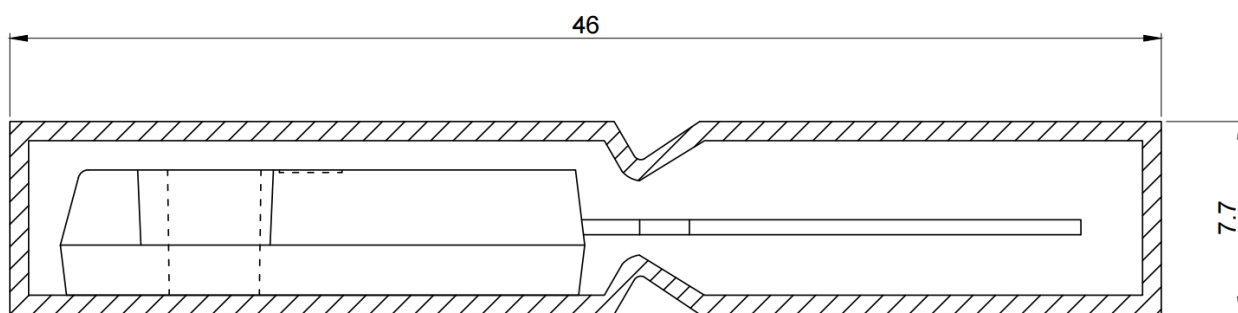
7 封装外形



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™ MOSFET 750 V G2 网页](#)
- [IFX CoolSiC CoolSiC™ MOSFET 750 V G2 网页](#)
- [IFX CoolSiC CoolSiC™ MOSFET 750 V G2 仿真模型](#)
- [IFX 设计工具](#)

修订记录

IMZA75R050M2H

Revision 2025-12-19, Rev. 1. 0

Previous revisions

Revision	Date	Subjects (major changes since last revision)
1.0	2025-12-19	Release of final version

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