

IMZ120R140M1H

英飞凌 CoolSiC™ 1200V SiC 沟槽 MOSFET

碳化硅 MOSFET

特性

- 开关损耗非常低
- 无拐点导通特性
- 基准栅极阈值电压, $V_{GS(th)} = 4.5V$
- 0V 关断栅极电压, 实现简单便捷的栅极驱动
- 完全可控的 dV/dt
- 坚固的体二极管, 适用于硬换向
- 关断损耗不受温度影响
- 用于优化开关性能的检测引脚

优点

- 提高效率
- 实现更高的频率
- 增加功率密度
- 减少冷却工作量
- 降低系统复杂性和成本

潜在应用

- 能源生产
 - 光伏组串逆变器和光伏优化器
- 工业供电
 - 工业级不间断电源 (UPS)
 - 工业开关电源
- 基础设施 – 充电
 - 充电器

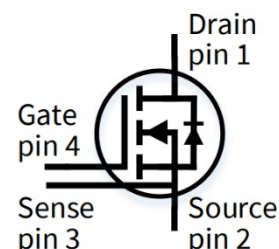
产品验证

符合 JEDEC47/20/22 相关测试的工业应用要求

注: 源极引脚和检测引脚不可互换, 互换可能会导致故障

表 1 主要性能及封装参数

Type	V_{DS}	I_D	$R_{DS(on)}$	$T_{vj,max}$	Marking	Package
		$T_C = 25^\circ C, R_{th(j-c,max)}$	$T_{vj} = 25^\circ C, I_D = 6A, V_{GS} = 18V$			
IMZ120R140M1H	1200V	19A	140mΩ	175°C	12M1H140	PG-TO247-4



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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最大额定值

1 最大额定值

注意：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%。

表 2 最大额定值

Parameter	Symbol	Value	Unit
Drain-source voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{DS}	1200	V
DC drain current for $R_{th(j-c,max)}$, limited by T_{vjmax} , $V_{GS} = 18\text{V}$, $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	I_D	19 13	A
Pulsed drain current, t_p limited by T_{vjmax} , $V_{GS} = 18\text{V}$	$I_{D,pulse1}$	32	A
DC body diode forward current for $R_{th(j-c,max)}$, limited by T_{vjmax} , $V_{GS} = 0\text{V}$ $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	I_{SD}	21 12	A
Pulsed body diode current, t_p limited by T_{vjmax}	$I_{SD,pulse1}$	32	A
Gate-source voltage ² Max transient voltage, < 1% duty cycle Recommended turn-on gate voltage Recommended turn-off gate voltage	V_{GS} $V_{GS,on}$ $V_{GS,off}$	-7... 23 15... 18 0	V
Short-circuit withstand time $V_{DD} = 800\text{V}$, $V_{DS,peak} < 1200\text{V}$, $V_{GS,on} = 15\text{V}$, $T_{j,start} = 25^{\circ}\text{C}$	t_{SC}	3	μs
Power dissipation, limited by T_{vjmax} $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	P_{tot}	94 47	W
Virtual junction temperature	T_{vj}	-55... 175	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55... 150	$^{\circ}\text{C}$
Soldering temperature, wave soldering only allowed at leads, 1.6mm (0.063 in.) from case for 10 s	T_{sold}	260	$^{\circ}\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

¹ 经过设计验证

² **重要提示：**正、负栅源电压的选择会影响器件的长期性能。为确保设备在计划使用寿命内正常运行，请务必研读 [《应用笔记AN2018-09》](#) 中描述的设计指南。

热阻

2 热阻

表 3

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET/body diode thermal resistance, junction – case	$R_{th(j-c)}$		-	1.2	1.6	K/W
Thermal resistance, junction – ambient	$R_{th(j-a)}$	leaded	-	-	62	K/W

电气特性

3 电气特性

3.1 静态特性

表 4 静态特性 (测于 $T_{vj} = 25^{\circ}\text{C}$ 时, 除非另有规定)

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 18\text{V}, I_D = 6\text{A}, T_{vj} = 25^{\circ}\text{C}$	-	140	189	mΩ
		$T_{vj} = 100^{\circ}\text{C}$	-	178	-	
		$T_{vj} = 175^{\circ}\text{C}$	-	265	-	
		$V_{GS} = 15\text{V}, I_D = 6\text{A}, T_{vj} = 25^{\circ}\text{C}$	-	180	239	
Body diode forward voltage	V_{SD}	$V_{GS} = 0\text{V}, I_{SD} = 6\text{A}, T_{vj} = 25^{\circ}\text{C}$	-	4.1	5.2	V
		$T_{vj} = 100^{\circ}\text{C}$	-	4.0	-	
		$T_{vj} = 175^{\circ}\text{C}$	-	3.9	-	
Gate-source threshold voltage	$V_{GS(th)}$	(tested after 1 ms pulse at $V_{GS} = 20\text{V}$)				V
		$I_D = 2.5\text{mA}, V_{DS} = V_{GS}, T_{vj} = 25^{\circ}\text{C}$	3.5	4.5	5.7	
		$T_{vj} = 175^{\circ}\text{C}$	-	3.6	-	
Zero gate voltage drain current	I_{DSS}	$V_{GS} = 0\text{V}, V_{DS} = 1200\text{V}, T_{vj} = 25^{\circ}\text{C}$	-	0.3	140	μA
		$T_{vj} = 175^{\circ}\text{C}$	-	0.9	-	
Gate-source leakage current	I_{GSS}	$V_{GS} = 23\text{V}, V_{DS} = 0\text{V}$	-	-	100	nA
		$V_{GS} = -7\text{V}, V_{DS} = 0\text{V}$	-	-	-100	nA
Transconductance	g_{fs}	$V_{DS} = 20\text{V}, I_D = 6\text{A}$	-	3	-	S
Internal gate resistance	$R_{G,int}$	$f = 1\text{MHz}, V_{AC} = 25\text{mV}$	-	14	-	Ω

电气特性

3.2 动态特性

表 5 动态特性（测于 $T_{vj} = 25^{\circ}\text{C}$ ，除非另有规定）

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Input capacitance	C_{iss}	$V_{DD} = 800\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}, V_{AC} = 25\text{mV}$	-	454	-	pF
Output capacitance	C_{oss}		-	25	-	
Reverse capacitance	C_{rss}		-	3	-	
C_{oss} stored energy	E_{oss}		-	9	-	μJ
Total gate charge	Q_G	$V_{DD} = 800\text{V}, I_D = 6\text{A},$ $V_{GS} = 0/18\text{V}, \text{turn-on pulse}$	-	13	-	nC
Gate to source charge	$Q_{GS,pl}$		-	4	-	
Gate to drain charge	Q_{GD}		-	3	-	

电气特性

3.3 开关特性

表 6 开关特性，感性负载⁴

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET Characteristics, $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$V_{DD} = 800\text{V}$, $I_D = 6\text{A}$, $V_{GS} = 0/18\text{V}$, $R_{G,\text{ext}} = 2\Omega$, $L_{\sigma} = 40\text{nH}$, diode: body diode at $V_{GS} = 0\text{V}$ see Fig. E	-	5	-	ns
Rise time	t_r		-	2	-	
Turn-off delay time	$t_{d(\text{off})}$		-	10.3	-	
Fall time	t_f		-	11.6	-	
Turn-on energy	E_{on}		-	62	-	μJ
Turn-off energy	E_{off}		-	12	-	
Total switching energy	E_{tot}		-	74	-	
Body Diode Characteristics, $T_{vj} = 25^{\circ}\text{C}$						
Diode reverse recovery charge	Q_{rr}	$V_{DD} = 800\text{V}$, $I_{SD} = 6\text{A}$, V_{GS} at diode = 0V , $di_t/dt = 1000\text{A}/\mu\text{s}$, Q_{rr} includes also Q_C , see Fig. C	-	100	-	nC
Diode peak reverse recovery current	I_{rrm}		-	2	-	A
MOSFET Characteristics, $T_{vj} = 175^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$V_{DD} = 800\text{V}$, $I_D = 6\text{A}$, $V_{GS} = 0/18\text{V}$, $R_{G,\text{ext}} = 2\Omega$, $L_{\sigma} = 40\text{nH}$, diode: body diode at $V_{GS} = 0\text{V}$ see Fig. E	-	5	-	ns
Rise time	t_r		-	4.4	-	
Turn-off delay time	$t_{d(\text{off})}$		-	10.3	-	
Fall time	t_f		-	11.6	-	
Turn-on energy	E_{on}		-	88	-	μJ
Turn-off energy	E_{off}		-	13.5	-	
Total switching energy	E_{tot}		-	101.5	-	
Body Diode Characteristics, $T_{vj} = 175^{\circ}\text{C}$						
Diode reverse recovery charge	Q_{rr}	$V_{DD} = 800\text{V}$, $I_{SD} = 6\text{A}$, V_{GS} at diode = 0V , $di_t/dt = 1000\text{A}/\mu\text{s}$, Q_{rr} includes also Q_C , see Fig. C	-	125	-	nC
Diode peak reverse recovery current	I_{rrm}		-	3	-	A

⁴ 该芯片技术的特征斜率高达200 kV/ μs 。测量的 dV/dt 受到测量测试设置和封装的限制。

电气特性图

4 电气特性图

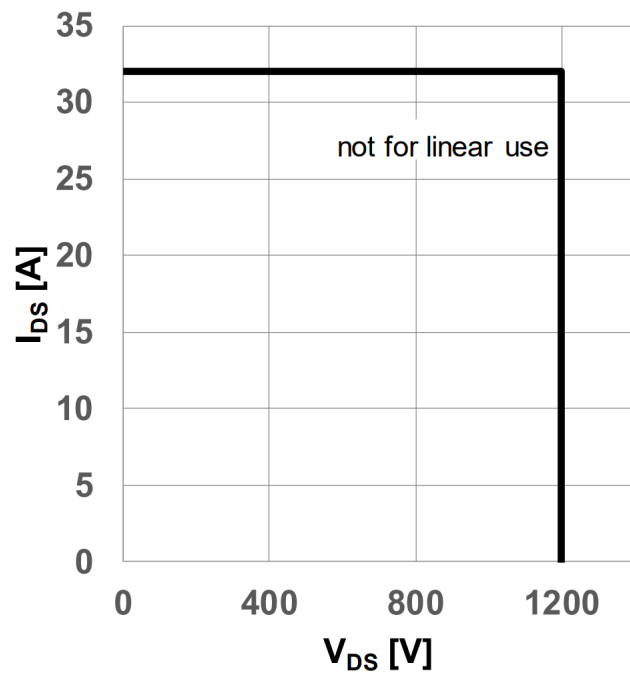


Figure 1 Safe operating area (SOA)
($V_{GS} = 0/18V$, $T_c = 25^\circ C$, $T_j \leq 175^\circ C$)

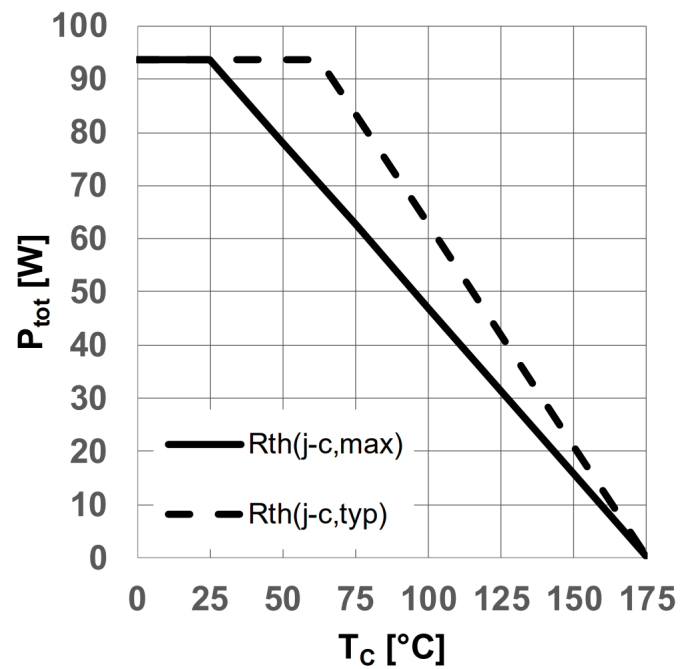


Figure 2 Power dissipation as a function of case temperature limited by bond wire
($P_{tot} = f(T_c)$)

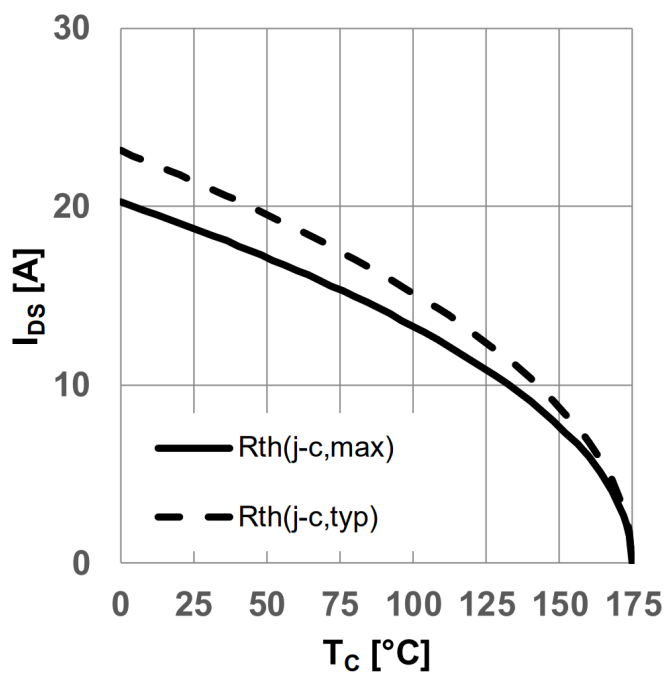


Figure 3 Maximum DC drain to source current as a function of case temperature limited by bond wire ($I_{DS} = f(T_c)$)

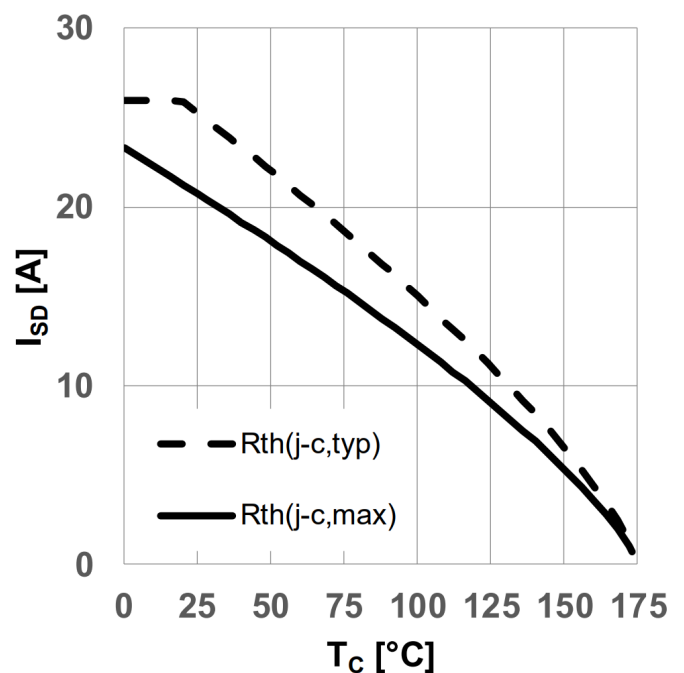


Figure 4 Maximum source to drain current as a function of case temperature limited by bond wire ($I_{SD} = f(T_c)$, $V_{GS} = 0V$)

电气特性图

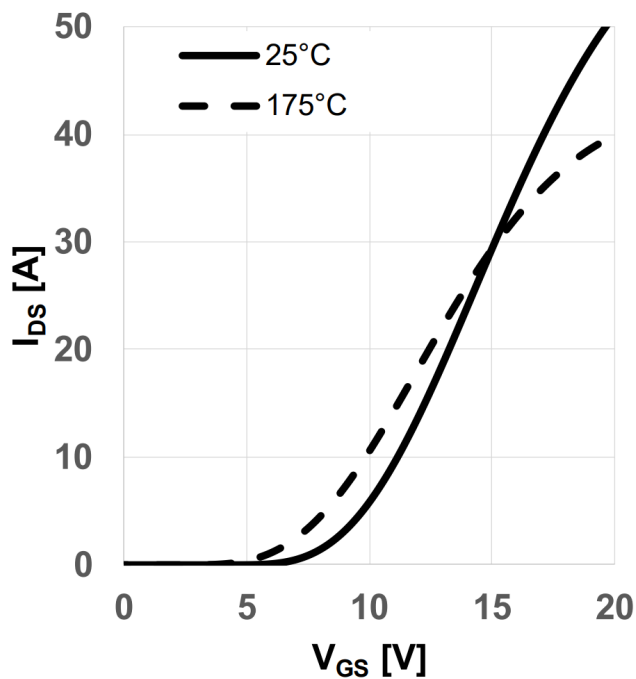


Figure 5 Typical transfer characteristic
 $(I_{DS} = f(V_{GS}), V_{DS} = 20V, t_P = 20\mu s)$

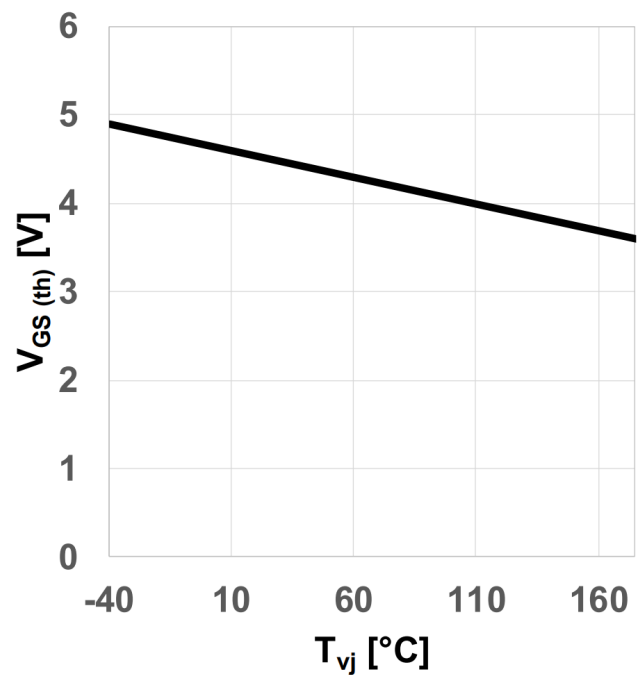


Figure 6 Typical gate-source threshold voltage as a function of junction temperature
 $(V_{GS(th)} = f(T_{vj}), I_{DS} = 2.5mA, V_{GS} = V_{DS})$

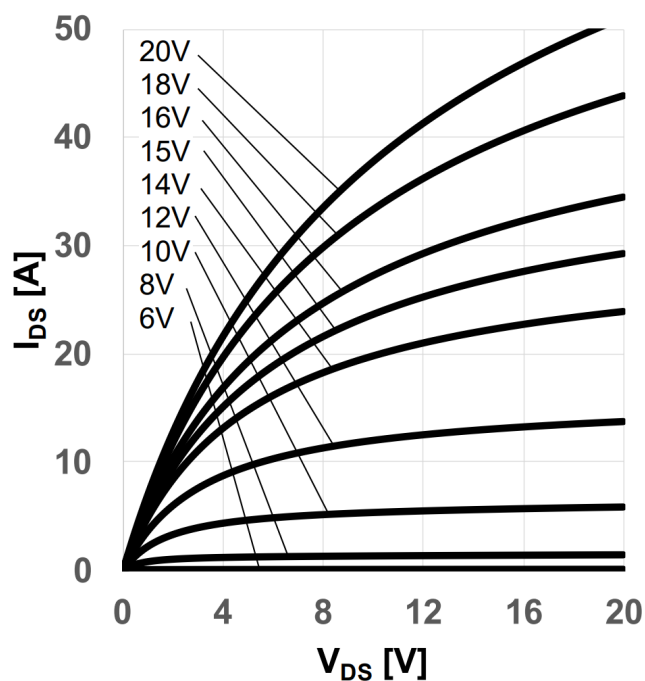


Figure 7 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 25^\circ C, t_P = 20\mu s)$

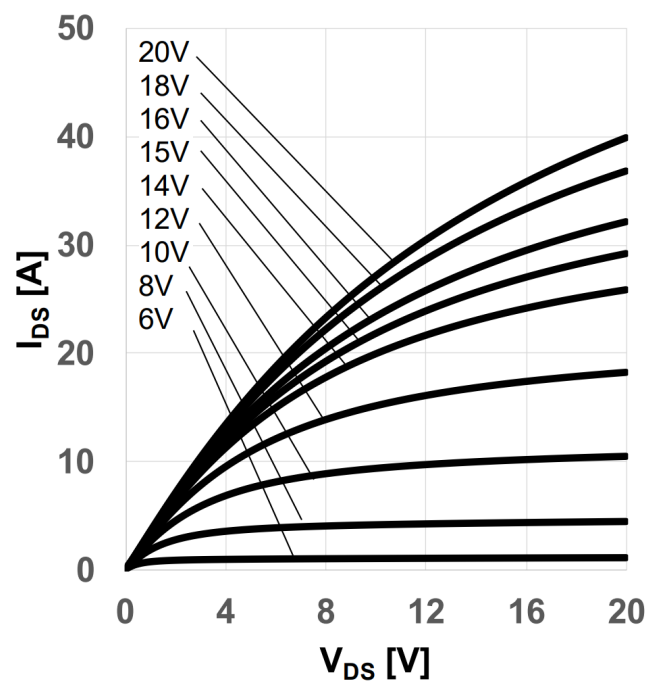


Figure 8 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 175^\circ C, t_P = 20\mu s)$

电气特性图

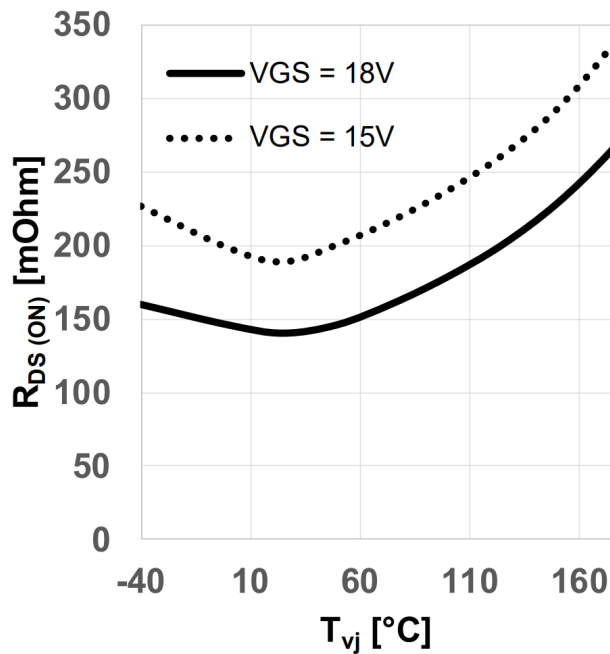


Figure 9 Typical on-resistance as a function of junction temperature
 $(R_{DS(on)} = f(T_{vj}), I_{DS} = 6A)$

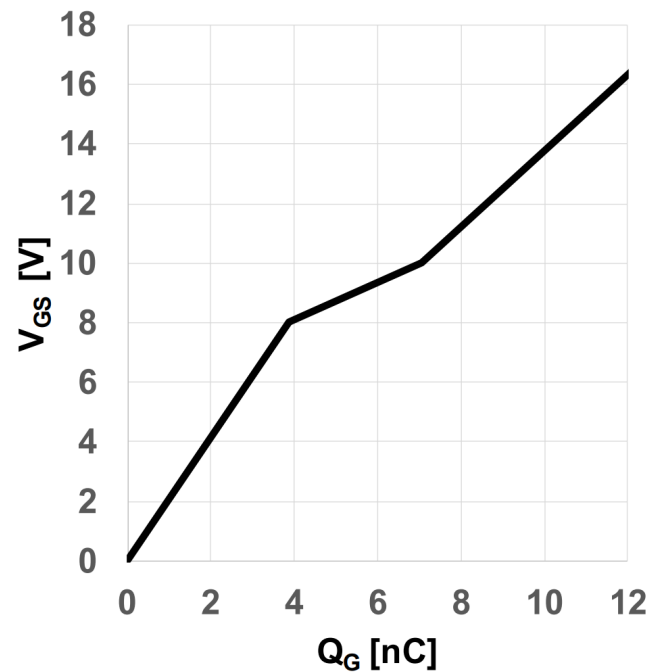


Figure 10 Typical gate charge
 $(V_{GS} = f(Q_G), I_{DS} = 6A, V_{DS} = 800V, \text{turn-on pulse})$

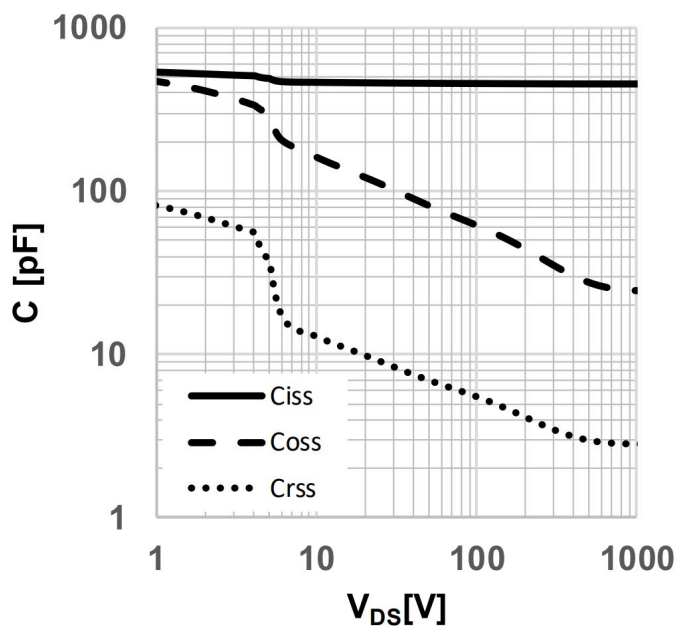


Figure 11 Typical capacitance as a function of drain-source voltage
 $(C = f(V_{DS}), V_{GS} = 0V, f = 1MHz)$

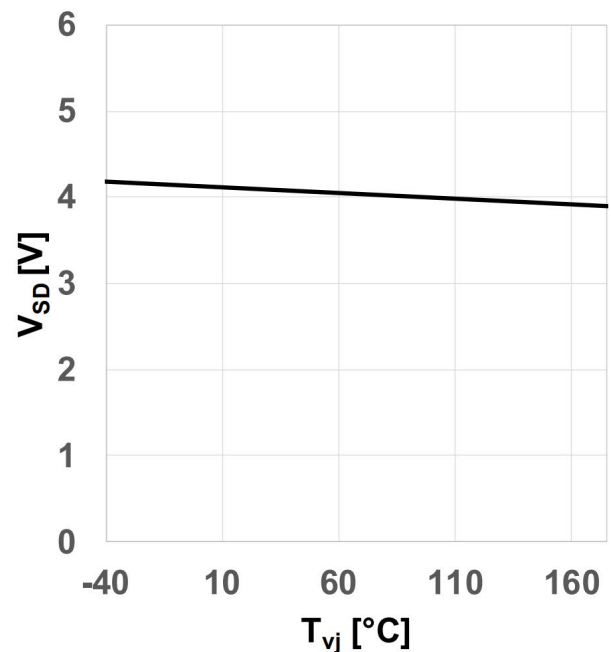


Figure 12 Typical body diode forward voltage as function of junction temperature
 $(V_{SD} = f(T_{vj}), V_{GS} = 0V, I_{SD} = 6A)$

电气特性图

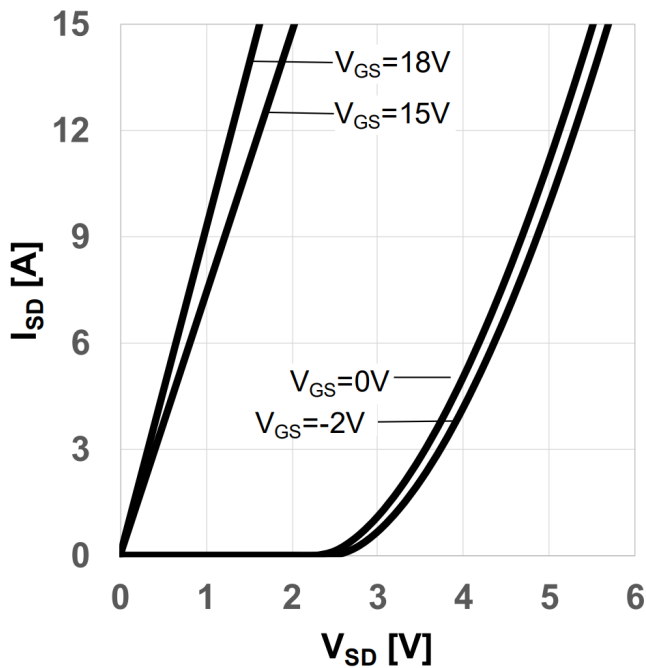


Figure 13 Typical body diode forward current as function of forward voltage, V_{GS} as parameter

($I_{SD} = f(V_{SD})$, $T_{vj} = 25^\circ\text{C}$, $t_P = 20\mu\text{s}$)

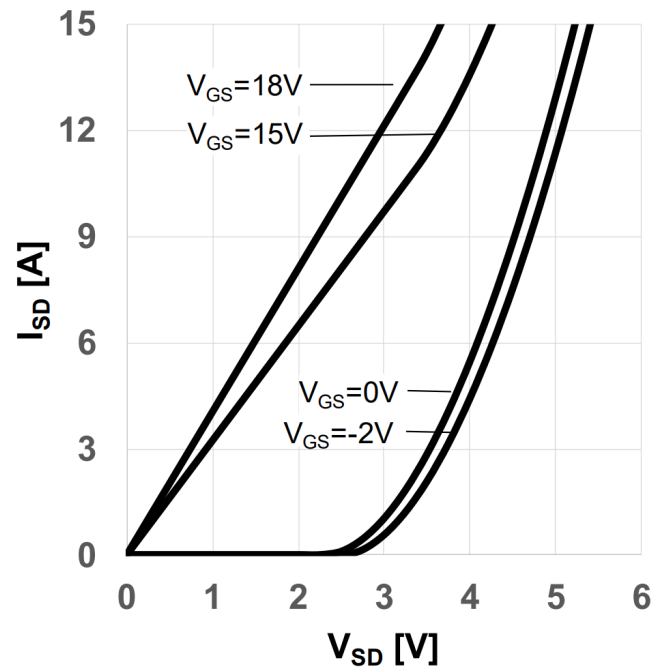


Figure 14 Typical body diode forward current as function of forward voltage, V_{GS} as parameter

($I_{SD} = f(V_{SD})$, $T_{vj} = 175^\circ\text{C}$, $t_P = 20\mu\text{s}$)

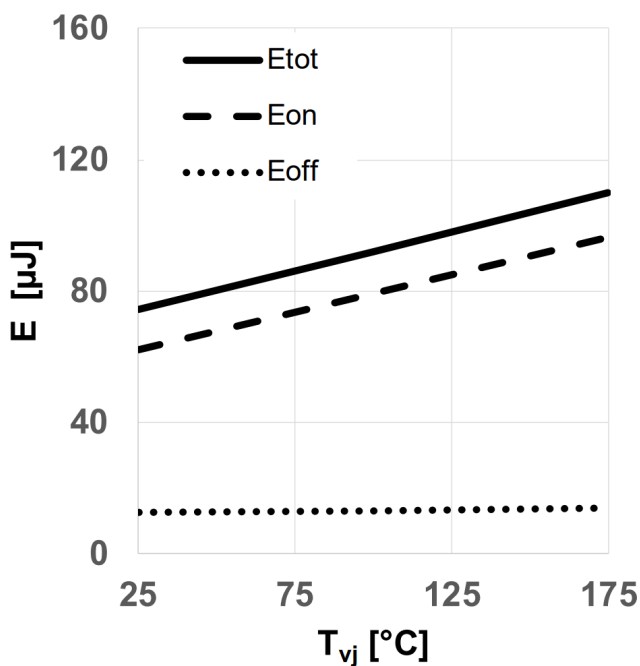


Figure 15 Typical switching energy losses as a function of junction temperature

($E = f(T_{vj})$, $V_{DD} = 800\text{V}$, $V_{GS} = 0\text{V}/18\text{V}$, $R_{G,ext} = 2\Omega$, $I_D = 6\text{A}$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0\text{V}$)

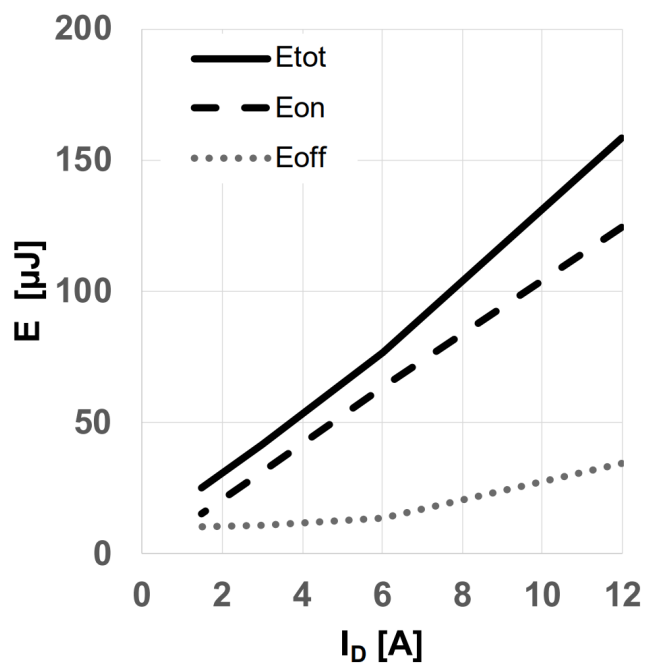


Figure 16 Typical switching energy losses as a function of drain-source current

($E = f(I_{DS})$, $V_{DD} = 800\text{V}$, $V_{GS} = 0\text{V}/18\text{V}$, $R_{G,ext} = 2\Omega$, $T_{vj} = 175^\circ\text{C}$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0\text{V}$)

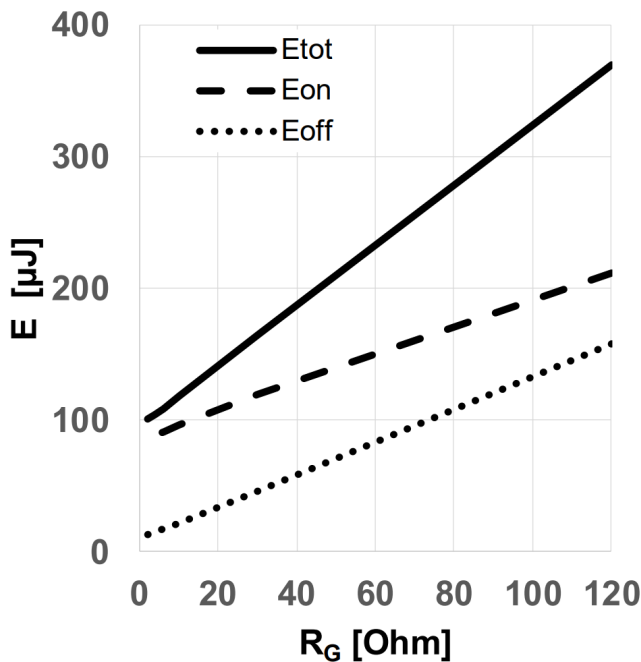


Figure 17 Typical switching energy losses as a function of gate resistance
 $(E = f(R_{G,ext}), V_{DD} = 800V, V_{GS} = 0V/18V,$
 $I_D = 6A, T_{vj} = 175^\circ C, \text{ind. load, test circuit in Fig. E, diode: body diode at } V_{GS} = 0V)$

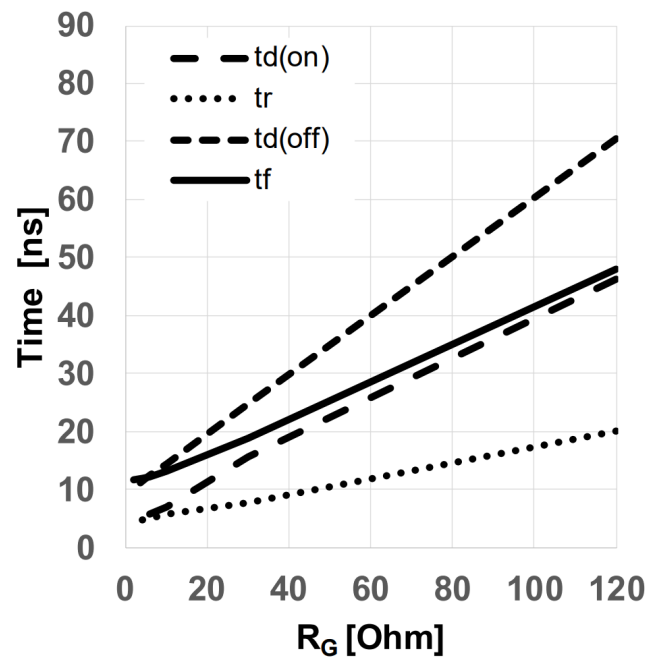


Figure 18 Typical switching times as a function of gate resistor
 $(t = f(R_{G,ext}), V_{DD} = 800V, V_{GS} = 0V/18V,$
 $I_D = 6A, T_{vj} = 175^\circ C, \text{ind. load, test circuit in Fig. E, diode: body diode at } V_{GS} = 0V)$

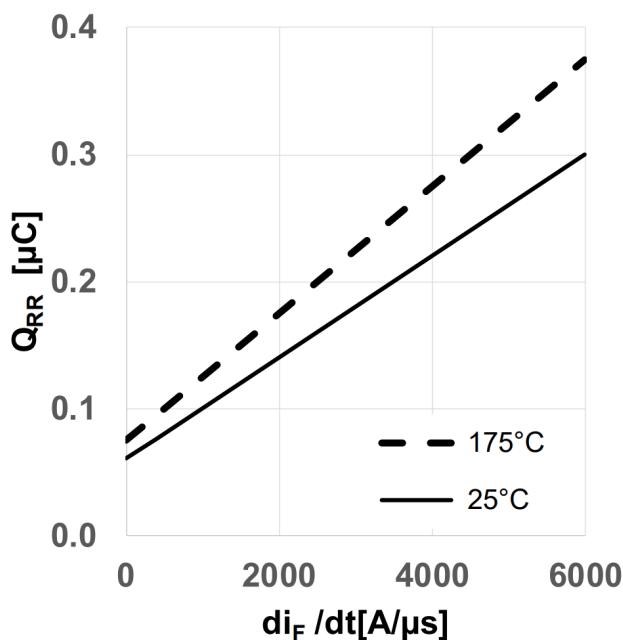


Figure 19 Typical reverse recovery charge as a function of diode current slope
 $(Q_{rr} = f(di_F/dt), V_{DD} = 800V, V_{GS} = 0V/18V,$
 $I_D = 6A, \text{ind. load, test circuit in Fig. E, body diode at } V_{GS} = 0V)$

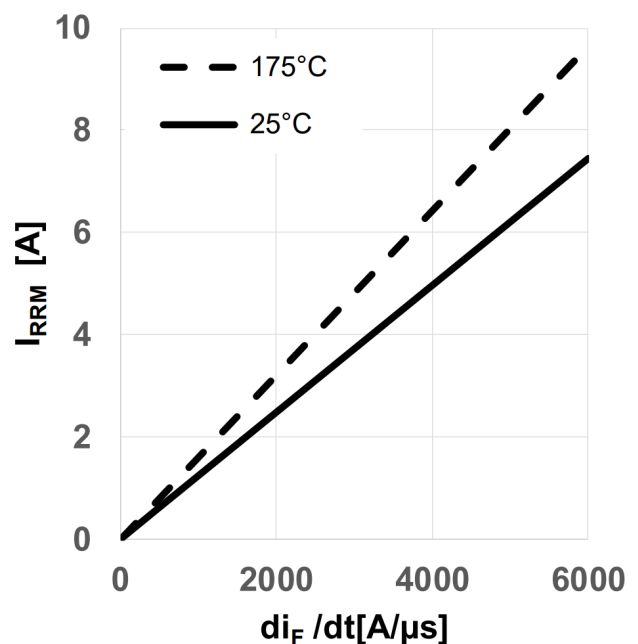


Figure 20 Typical reverse recovery current as a function of diode current slope
 $(I_{rrm} = f(di_F/dt), V_{DD} = 800V, V_{GS} = 0V/18V,$
 $I_D = 6A, \text{ind. load, test circuit in Fig. E, body diode at } V_{GS} = 0V)$

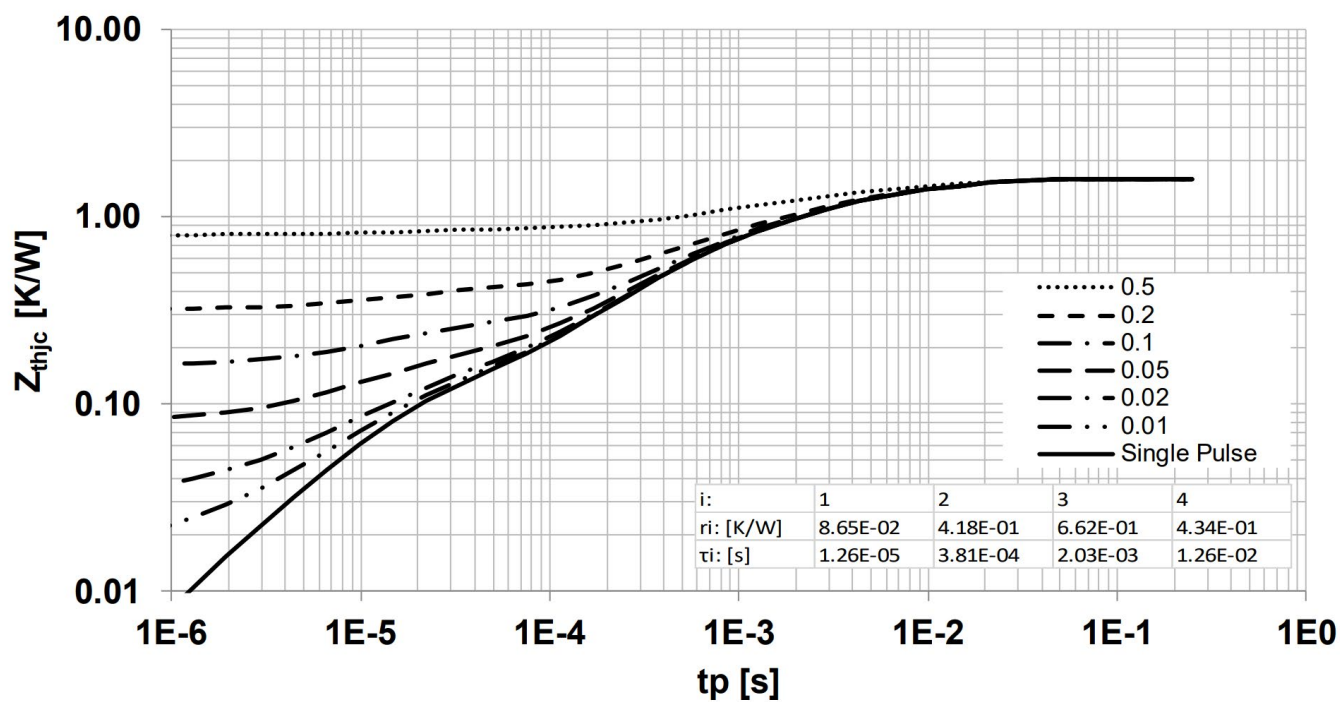


Figure 21 Max. transient thermal resistance (MOSFET/diode)
($Z_{th(j-c,max)} = f(t_p)$, parameter $D = t_p/T$, thermal equivalent circuit in Fig. D)

封装图

5 封装图

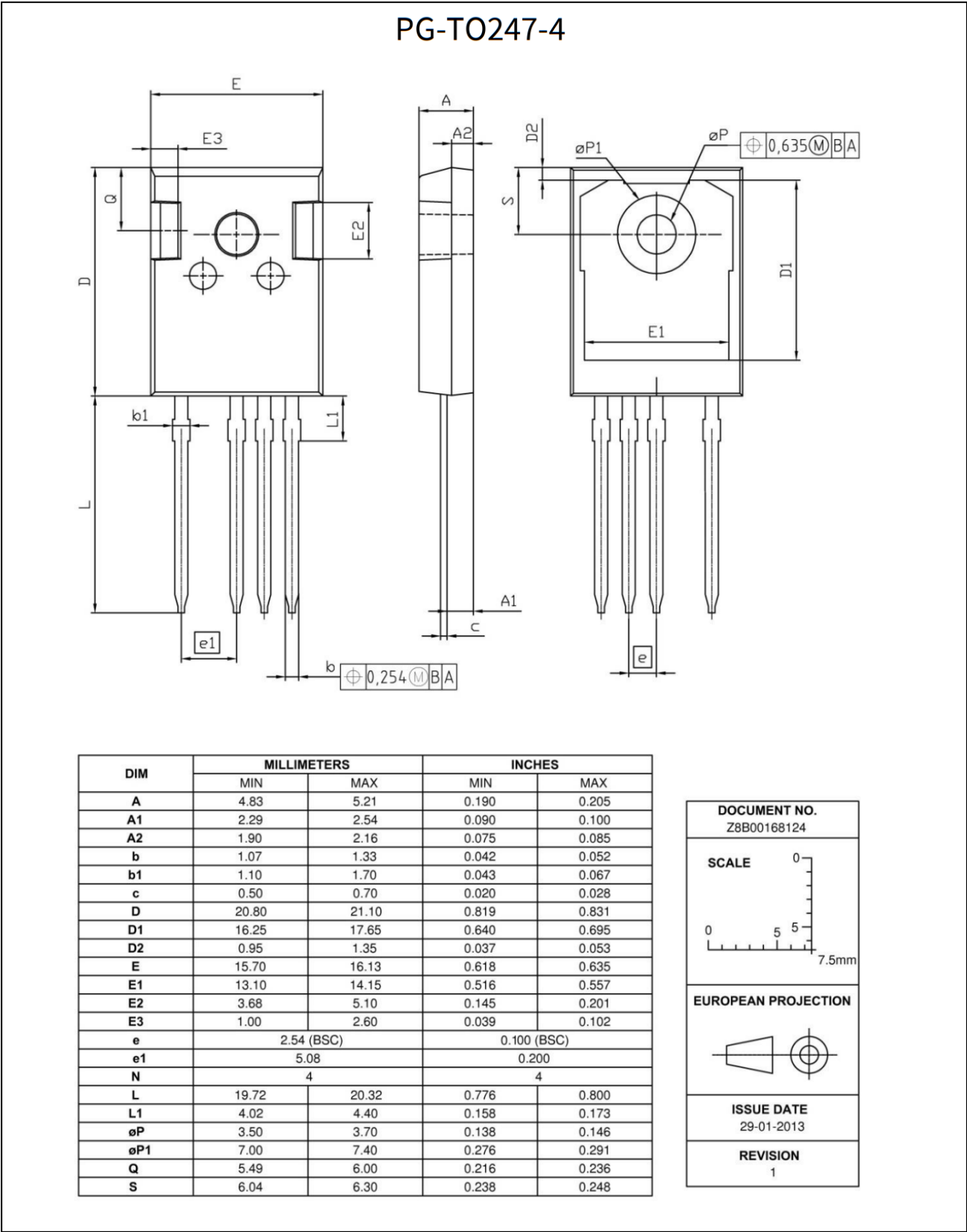


图 22 封装图

测试条件

6 测试条件

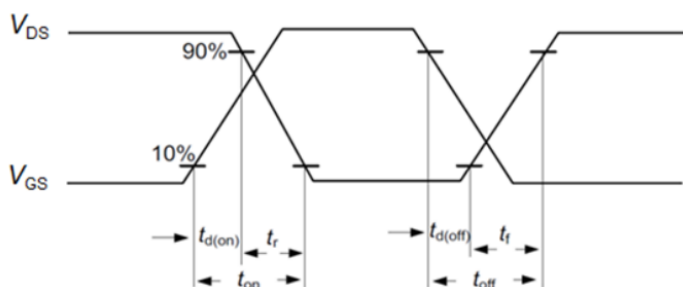


Figure A. Definition of switching times

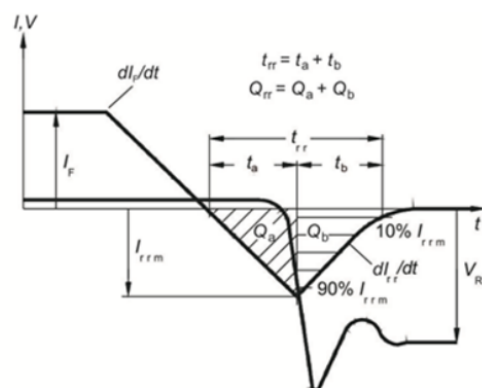


Figure C. Definition of diode switching characteristics

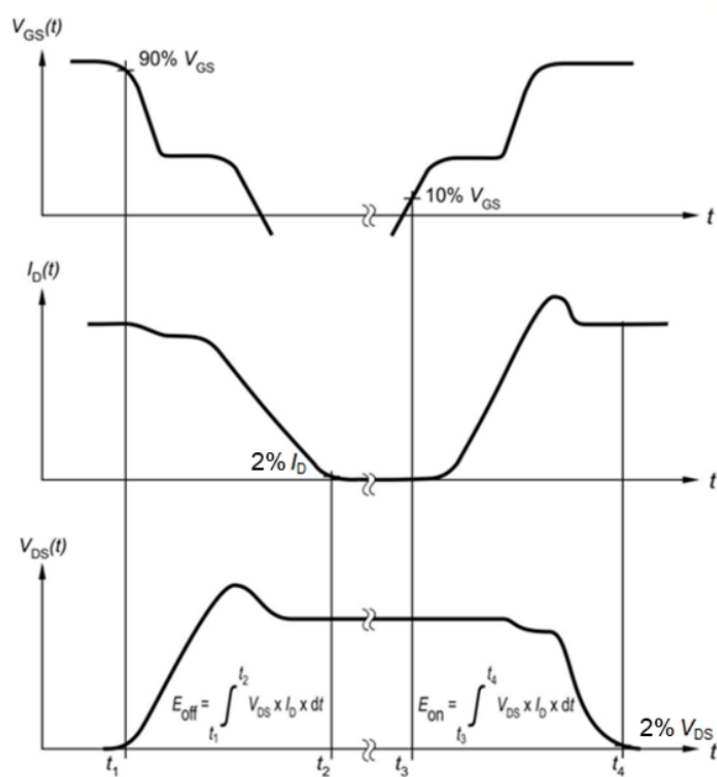


Figure B. Definition of switching losses

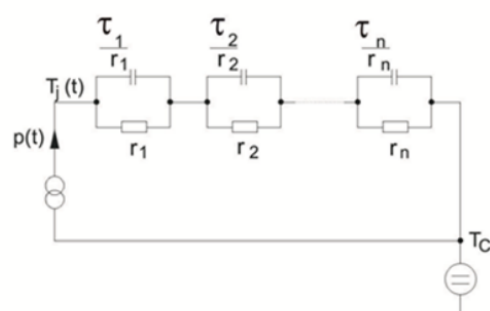


Figure D. Thermal equivalent circuit

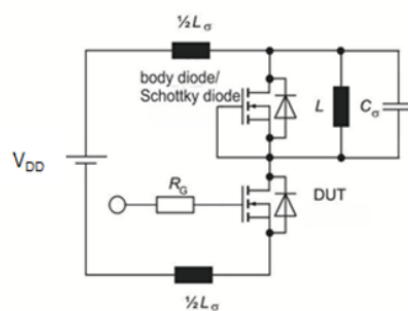


Figure E. Dynamic test circuit

Parasitic inductance L_{σ} ,
parasitic capacitance C_{σ} ,

图 23 测试条件

修订记录

修订记录

Document version	Date of release	Description of changes
2.0	2019-08-22	Final Datasheet
2.1	2019-12-10	<ul style="list-style-type: none">Move the short circuit time from dynamic characteristics table 5 to maximum ratings table 2.Update the Figure 12, 13, 14 the body diode forward voltage.
2.2	2020-12-11	Correction of circuit symbol on page 1

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