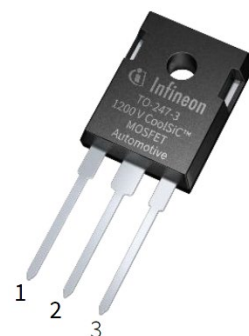
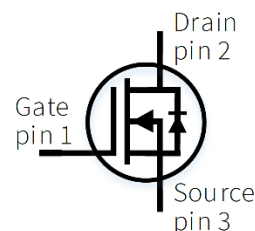


AIMW120R080M1

英飞凌CoolSiC™ 汽车级 1200V SiC 沟槽 MOSFET 1200V G1 碳化硅 MOSFET

特性

- 革命性的半导体材料—碳化硅
- 开关损耗非常低
- 无拐点导通特性
- 与IGBT兼容的驱动电压（导通电压为15V）
- 0V 关断栅极电压
- 基准栅极阈值电压， $V_{GS(th)} = 4.5V$
- 完全可控的 dV/dt
- 换向稳健的体二极管，可用于同步整流
- 关断损耗不受温度影响



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

- 车载充电器/PFC
- 升压器/DC-DC 变换器



产品验证

汽车应用认证。根据 AEC-Q100/101 进行产品验证

表 1 主要性能及封装参数

Type	V_{DS}	I_D ($T_C=25^\circ C$, $R_{th(j-c,max)}$)	$R_{DS(on),typ}$ ($T_{vj}=25^\circ C$, $I_D=13A$, $V_{GS}=15V$)	T_{vjmax}	Marking	Package
AIMW120R080M1	1200V	33A	80mΩ	175°C	A120M1080	PG-T0247-3-41

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

1200V 碳化硅沟槽 MOSFET

目录

特性	1
优点	1
潜在应用	1
产品验证	1
目录	2
1 最大额定值	3
2 热阻抗	4
3 电气特性	5
3.1 静止特性	5
3.2 动态特性	6
3.3 开关特性	7
4 电气特征图	8
5 封装图	14
6 测试条件	15
修订记录	16

最大额定值

1 最大额定值

表 2 最大额定值¹

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} , $V_{GS} = 15\text{V}$, $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	I_D	33 24	A
Pulsed drain current, t_p limited by T_{vjmax} , $V_{GS} = 15\text{V}$	$I_{D,pulse_1}$	74	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}	36 22	A
Pulsed body diode current, t_p limited by T_{vjmax}	$I_{SD,pulse_1}$	38	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... 20 15 0	V
Power dissipation, limited by T_{vjmax} $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	P_{tot}	150 75	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无需进行生产测试。该参数已通过设计/特性分析验证。

²**重要注释：** 正负栅极源电压的选择会影响器件的长期行为。为了确保器件在计划使用寿命内的正常运行，必须考虑[应用说明 AN2018-09](#) 中描述的设计指南。

热阻抗

2 热阻抗

图 3 热阻抗¹

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET/body diode thermal resistance, junction – case	$R_{th(j-c)}$		-	0.8	1	K/W
Thermal resistance, junction – ambient	$R_{th(j-a)}$	leaded	-	-	62	K/W

¹无需进行生产测试。该参数已通过设计/特性分析验证。

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 ²	$R_{DS(on)}$	$V_{GS} = 15\text{V}$, $I_D = 13\text{A}$, $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 100^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- - -	80 98 135	104 - -	mΩ
Body diode forward voltage	V_{SD}	$V_{GS} = 0\text{V}$, $I_{SD} = 13\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 100^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- - -	3.8 3.7 3.6	5.2 - -	V
Gate-source threshold voltage	$V_{GS(th)}$	(tested after 1 ms pulse at $V_{GS} = 20\text{V}$) $I_D = 5.6\text{mA}$, $V_{DS} = V_{GS}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	 3.5 -	 4.5 3.6	 5.7 -	V
Zero gate voltage drain current	I_{DSS}	$V_{GS} = 0\text{V}$, $V_{DS} = 1200\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- -	1 30	180 -	μA
Gate-source leakage current	I_{GSS}	$V_{GS} = 20\text{V}$, $V_{DS} = 0\text{V}$	-	-	100	nA
		$V_{GS} = -7\text{V}$, $V_{DS} = 0\text{V}$	-	-	-100	nA
Transconductance	g_{fs}	$V_{DS} = 20\text{V}$, $I_D = 13\text{A}$	-	7	-	S
Internal gate resistance	$R_{G,int}$	$f = 1\text{MHz}$, $V_{AC} = 25\text{mV}$	-	6	-	Ω

²重要注释：正负栅极源电压的选择会影响器件的长期行为。为了确保器件在计划使用寿命内的正常运行，必须考虑[应用说明 AN2018-09](#)中描述的设计指南。

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}	$V_{DD} = 800\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}, V_{AC} = 25\text{mV}$	-	1060	-	pF
Output capacitance	C_{oss}		-	58	-	
Reverse capacitance	C_{rss}		-	6.5	-	
C_{oss} stored energy	E_{oss}		-	22	-	μJ
Total gate charge	Q_G	$V_{DD} = 800\text{V}, I_D = 13\text{A},$ $V_{GS} = 0/15\text{V}, \text{turn-on pulse}$	-	28	-	nC
Gate to source charge	$Q_{GS,pl}$		-	9	-	
Gate to drain charge	Q_{GD}		-	7	-	
Short-circuit withstand time ³	t_{SC}	$V_{DD} = 800\text{V}, L_{\sigma} = 80\text{nH},$ $R_{G,ext} = 90\text{ohm}, T_{vj} = 175^{\circ}\text{C}$ $V_{GS,on} = 15\text{V}$	-	3	-	μs

³ 经设计验证，可承受 单次短路事件 $V_{GS,on} = 15\text{V}$ 。

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 特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 时

Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800\text{V}, I_D = 13\text{A},$ $V_{GS} = 0/15\text{V}, R_{G,ext} = 2\Omega,$ $L_{\sigma} = 40\text{nH},$ diode: body diode at $V_{GS} = 0\text{V}$ see Fig. E	-	10	-	ns
Rise time	t_r		-	22	-	
Turn-off delay time	$t_{d(off)}$		-	14	-	
Fall time	t_f		-	13	-	
Turn-on energy	E_{on}	see Fig. E	-	210	-	μJ
Turn-off energy	E_{off}		-	82	-	
Total switching energy	E_{tot}		-	292	-	

体二极管特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 时

Diode reverse recovery charge	Q_{rr}	$V_{DD} = 800\text{V}, I_{SD} = 13\text{A},$ V_{GS} at diode = $0\text{V},$ $di_f/dt = 1000\text{A}/\mu\text{s},$ Q_{rr} includes also $Q_C,$ see Fig. C	-	100	-	nC
Diode peak reverse recovery current	I_{rrm}		-	5	-	A

MOSFET 特性， $T_{vj} = 175^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800\text{V}, I_D = 13\text{A},$ $V_{GS} = 0/15\text{V}, R_{G,ext} = 2\Omega,$ $L_{\sigma} = 40\text{nH},$ diode: body diode at $V_{GS} = 0\text{V}$ see Fig. E	-	10	-	ns
Rise time	t_r		-	22	-	
Turn-off delay time	$t_{d(off)}$		-	16	-	
Fall time	t_f		-	14	-	
Turn-on energy	E_{on}	see Fig. E	-	300	-	μJ
Turn-off energy	E_{off}		-	100	-	
Total switching energy	E_{tot}		-	400	-	

体二极管特性，测于 $T_{vj} = 175^{\circ}\text{C}$ 时

Diode reverse recovery charge	Q_{rr}	$V_{DD} = 800\text{V}, I_{SD} = 13\text{A},$ V_{GS} at diode = $0\text{V},$ $di_f/dt = 1000\text{A}/\mu\text{s},$ Q_{rr} includes also $Q_C,$ see Fig. C	-	230	-	nC
Diode peak reverse recovery current	I_{rrm}		-	7	-	A

⁴该芯片技术的特征斜率高达 $200\text{ kV}/\mu\text{s}$ 。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

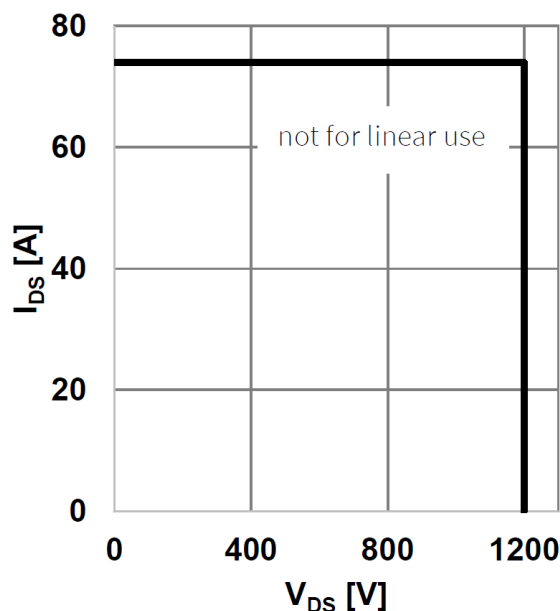


Figure 1 Safe operating area (SOA)
 $(V_{GS} = 0/15V, T_C = 25^\circ C, T_j \leq 175^\circ C)$

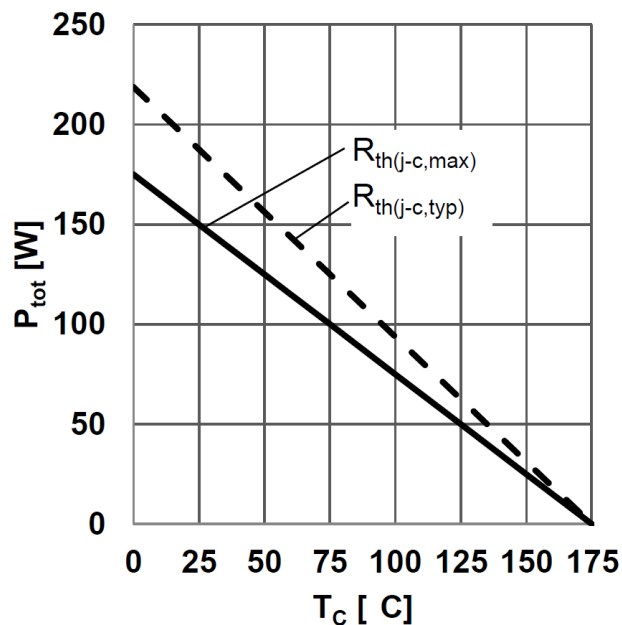


Figure 2 Power dissipation as a function of case temperature limited by bond wire
 $(P_{tot} = f(T_C))$

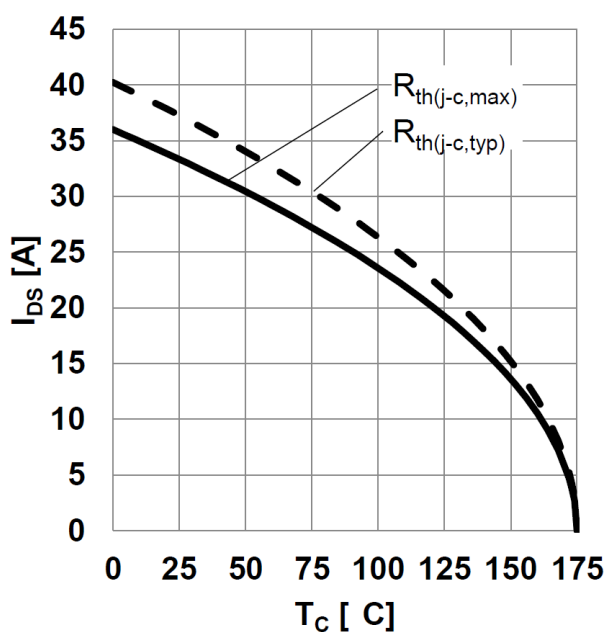


Figure 3 Maximum DC drain to source current as a function of case temperature limited by bond wire
 $(I_{DS} = f(T_C))$

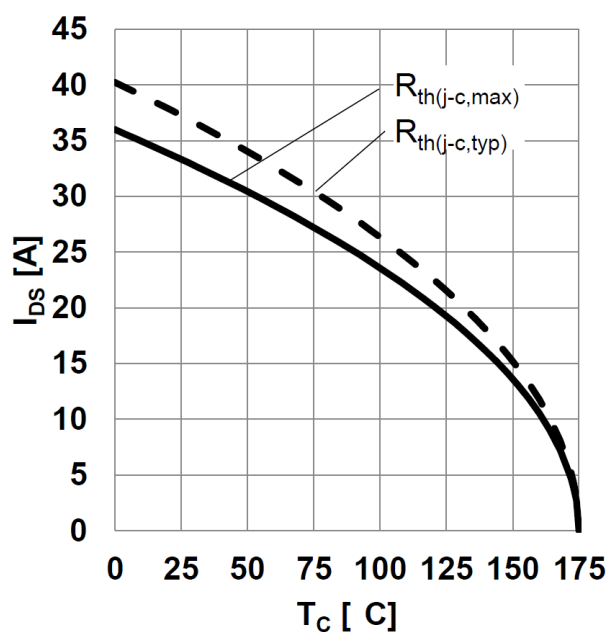


Figure 4 Maximum source to drain current as a function of case temperature limited by bond wire
 $(I_{SD} = f(T_C), V_{GS} = 0V)$

电气特性图

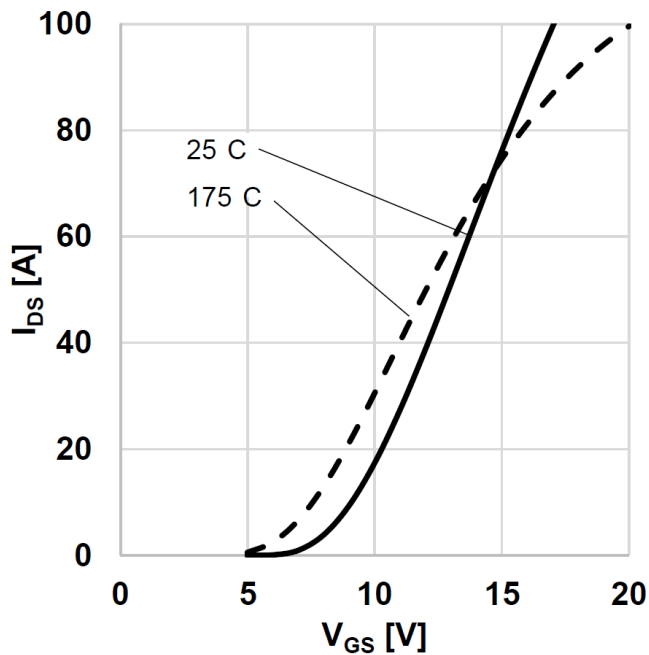


Figure 5 Typical transfer characteristic
 $(I_{DS} = f(V_{GS}), V_{DS} = 20V, t_p = 20\mu s)$

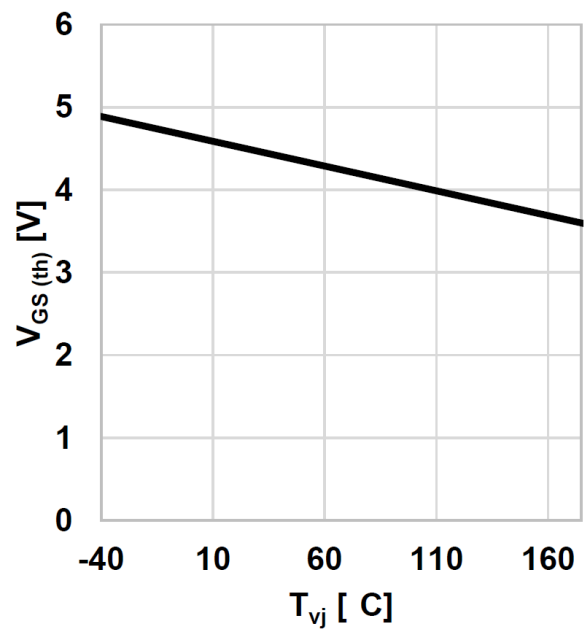


Figure 6 Typical gate-source threshold voltage as a function of junction temperature
 $(V_{GS(th)} = f(T_{vj}), I_{DS} = 5,6mA, V_{GS} = V_{DS})$

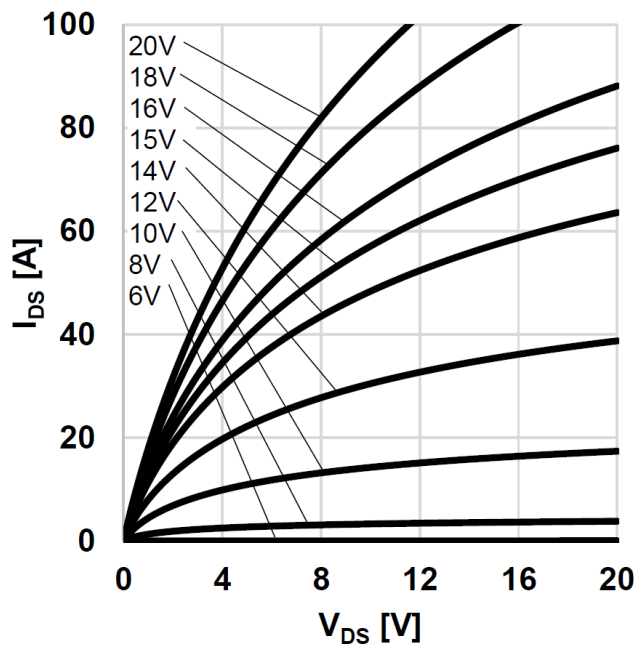


Figure 7 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 25^\circ C, t_p = 20\mu s)$

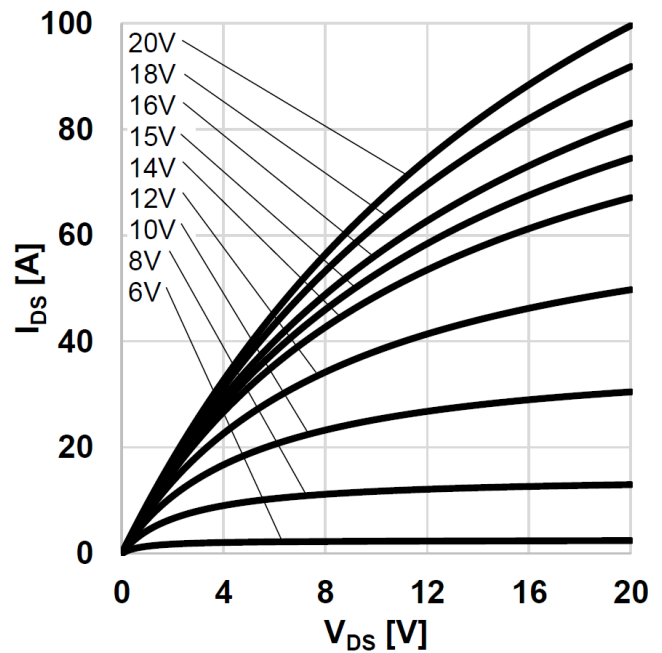


Figure 8 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 175^\circ C, t_p = 20\mu s)$

电气特性图

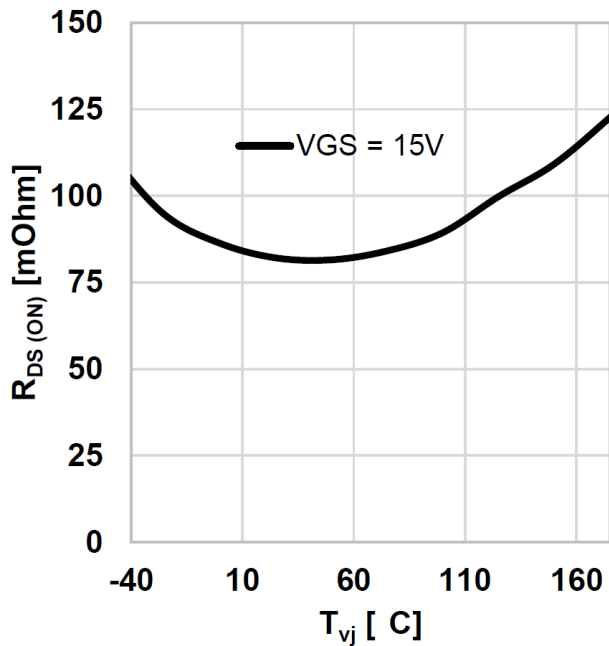


Figure 9 Typical on-resistance as a function of junction temperature
 $(R_{DS(on)} = f(T_{vj}), I_{DS} = 13A)$

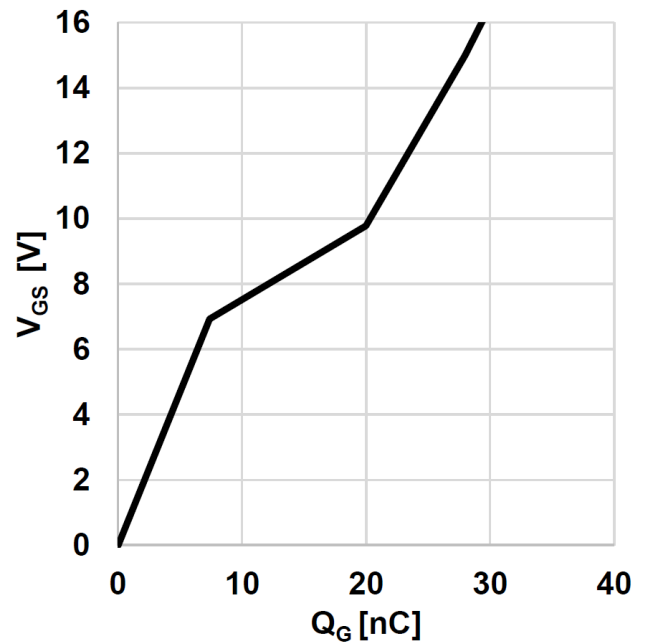


Figure 10 Typical gate charge
 $(V_{GS} = f(Q_G), I_{DS} = 13A, V_{DS} = 800V, \text{turn-on pulse})$

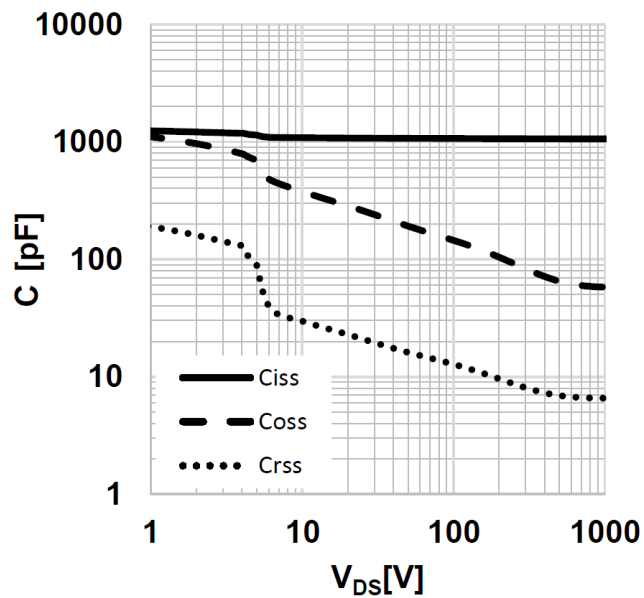


Figure 11 Typical capacitance as a function of drain-source voltage
 $(C = f(V_{DS}), V_{GS} = 0V, f = 1MHz)$

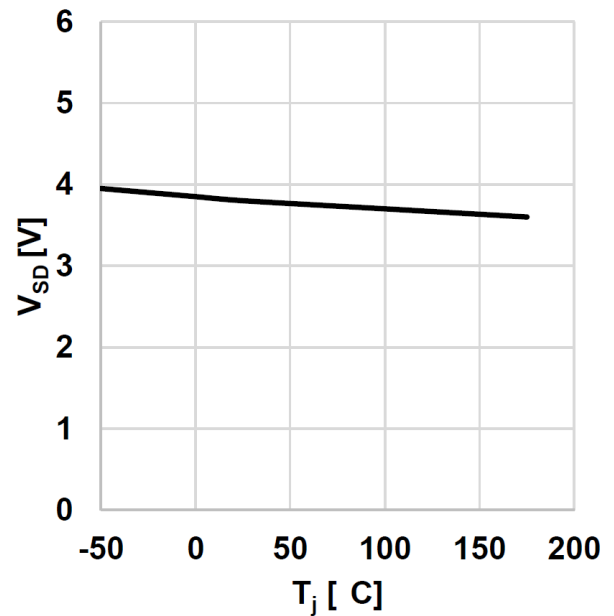


Figure 12 Typical body diode forward voltage as function of junction temperature
 $(V_{SD} = f(T_{vj}), V_{GS} = 0V, I_{SD} = 13A)$

电气特性图

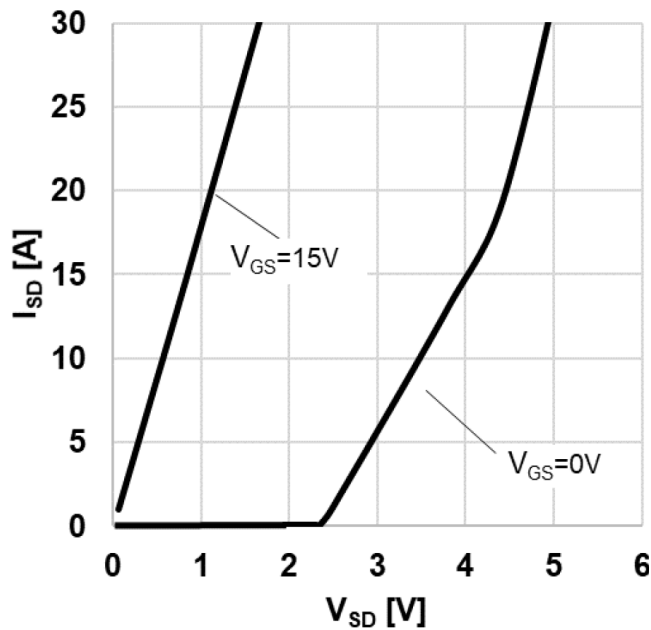


Figure 13 Typical body diode forward current as a function of forward voltage, V_{GS} as parameter

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

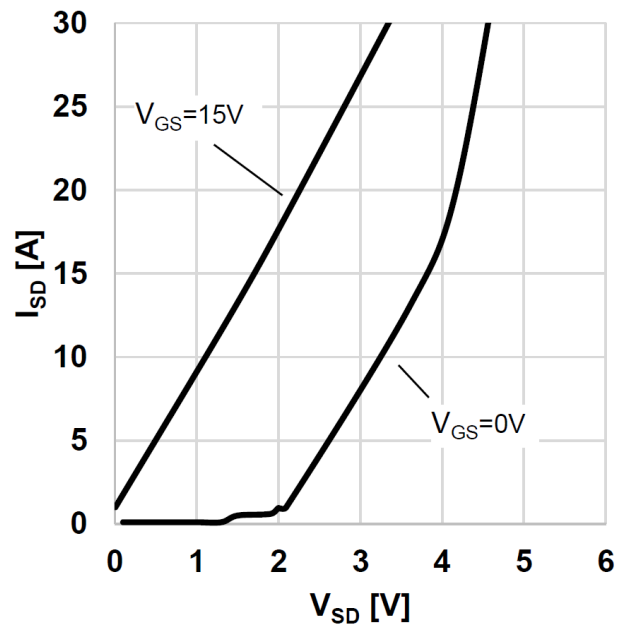


Figure 14 Typical body diode forward current as a function of forward voltage, V_{GS} as parameter

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

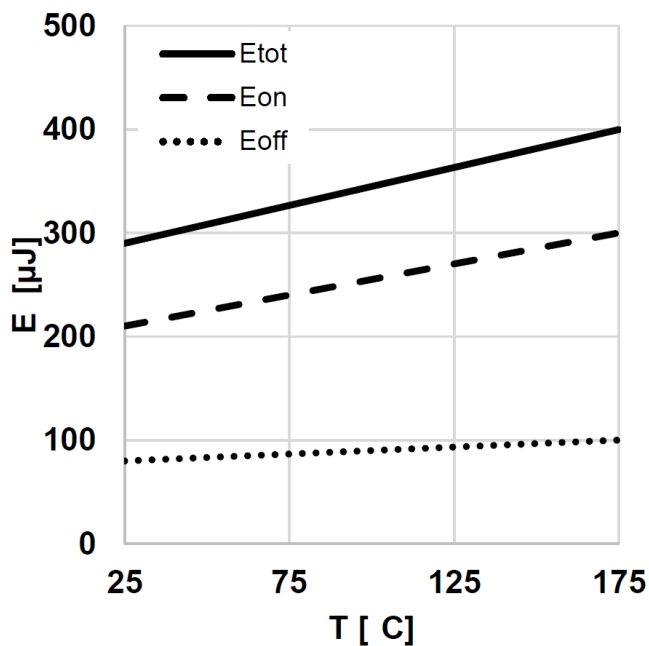


Figure 15 Typical switching energy losses as a function of junction temperature
($E = f(T_{vj})$, $V_{DD} = 800\text{V}$, $V_{GS} = 0\text{V}/15\text{V}$, $R_{G,ext} = 2\Omega$, $I_D = 13\text{A}$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0\text{V}$)

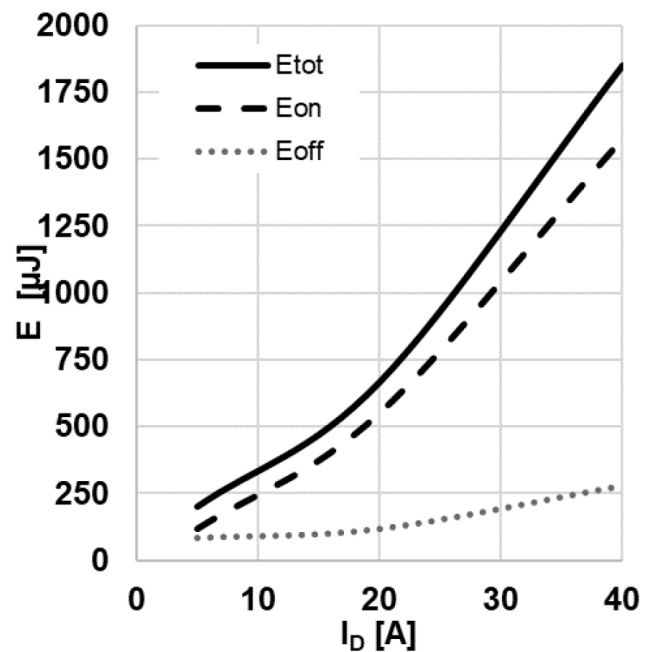


Figure 16 Typical switching energy losses as a function of drain-source current
($E = f(I_{DS})$, $V_{DD} = 800\text{V}$, $V_{GS} = 0\text{V}/15\text{V}$, $R_{G,ext} = 2\Omega$, $T_{vj} = 175^\circ\text{C}$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0\text{V}$)

电气特性图

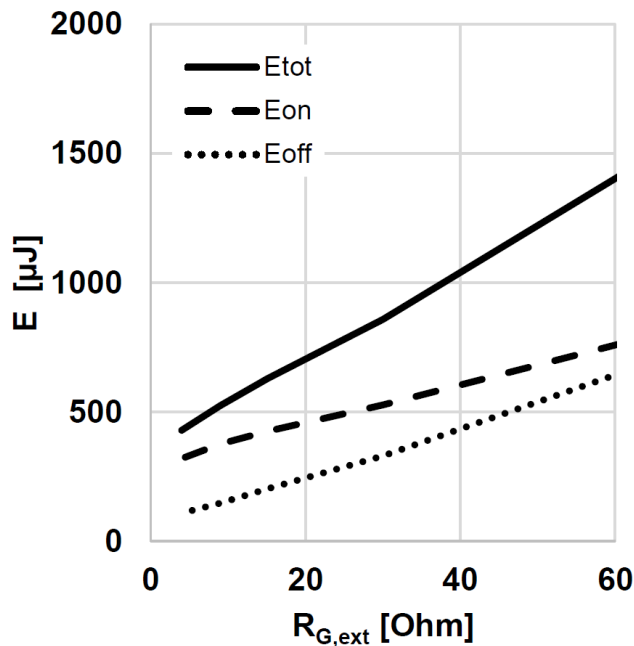


Figure 17 Typical switching energy losses as a function of gate resistance
 $(E = f(R_{G,ext}), V_{DD} = 800V, V_{GS} = 0V/15V, I_D = 13A, T_{vj} = 175^\circ C, \text{ind. load, test circuit in Fig. E, diode: body diode at } V_{GS} = 0V)$

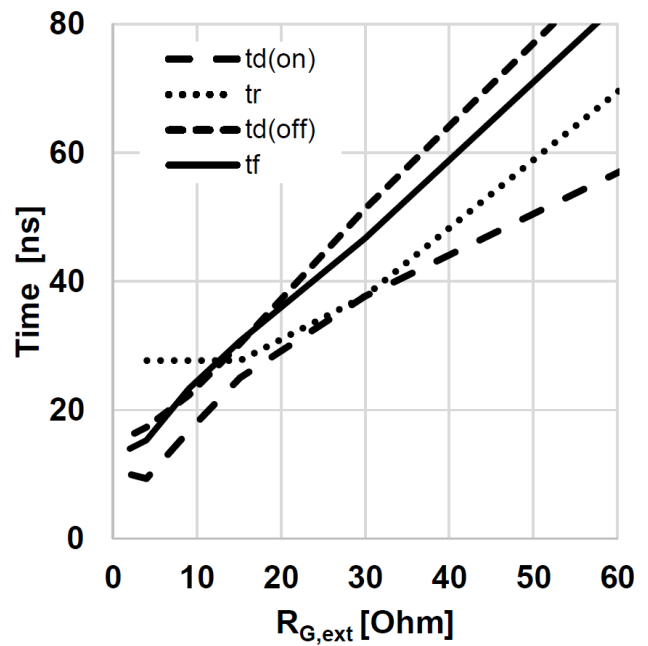


Figure 18 Typical switching times as a function of gate resistor
 $(t = f(R_{G,ext}), V_{DD} = 800V, V_{GS} = 0V/15V, I_D = 13A, T_{vj} = 175^\circ C, \text{ind. load, test circuit in Fig. E, diode: body diode at } V_{GS} = 0V)$

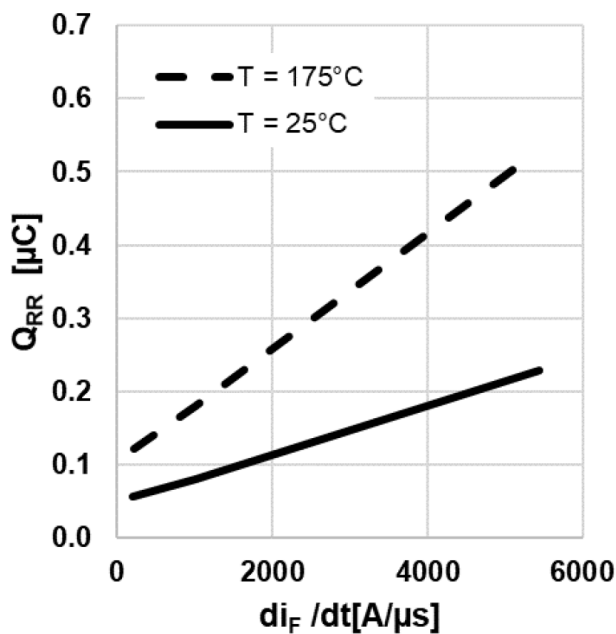


Figure 19 Typical reverse recovery charge as a function of diode current slope
 $(Q_{rr} = f(di_F/dt), V_{DD} = 800V, V_{GS} = 0V/15V, I_D = 13A, \text{ind. load, test circuit in Fig. E, body diode at } V_{GS} = 0V)$

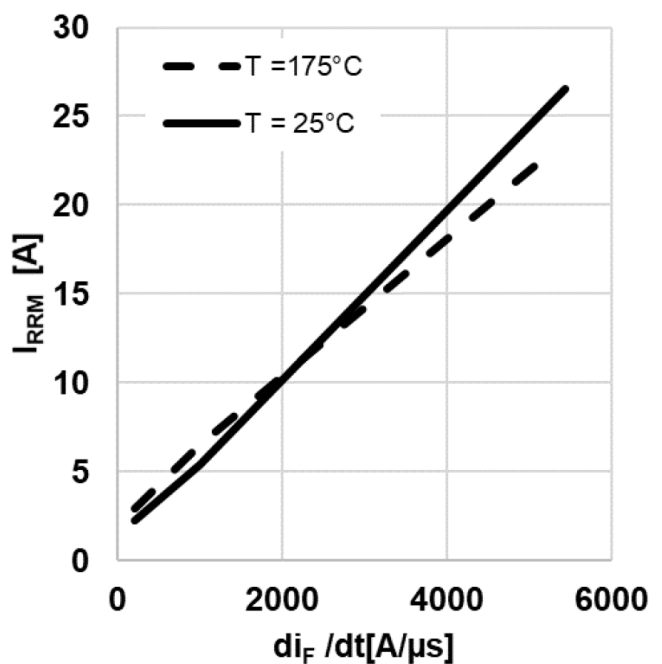


Figure 20 Typical reverse recovery current as a function of diode current slope
 $(I_{rrm} = f(di_F/dt), V_{DD} = 800V, V_{GS} = 0V/15V, I_D = 13A, \text{ind. load, test circuit in Fig. E, body diode at } V_{GS} = 0V)$

电气特性图

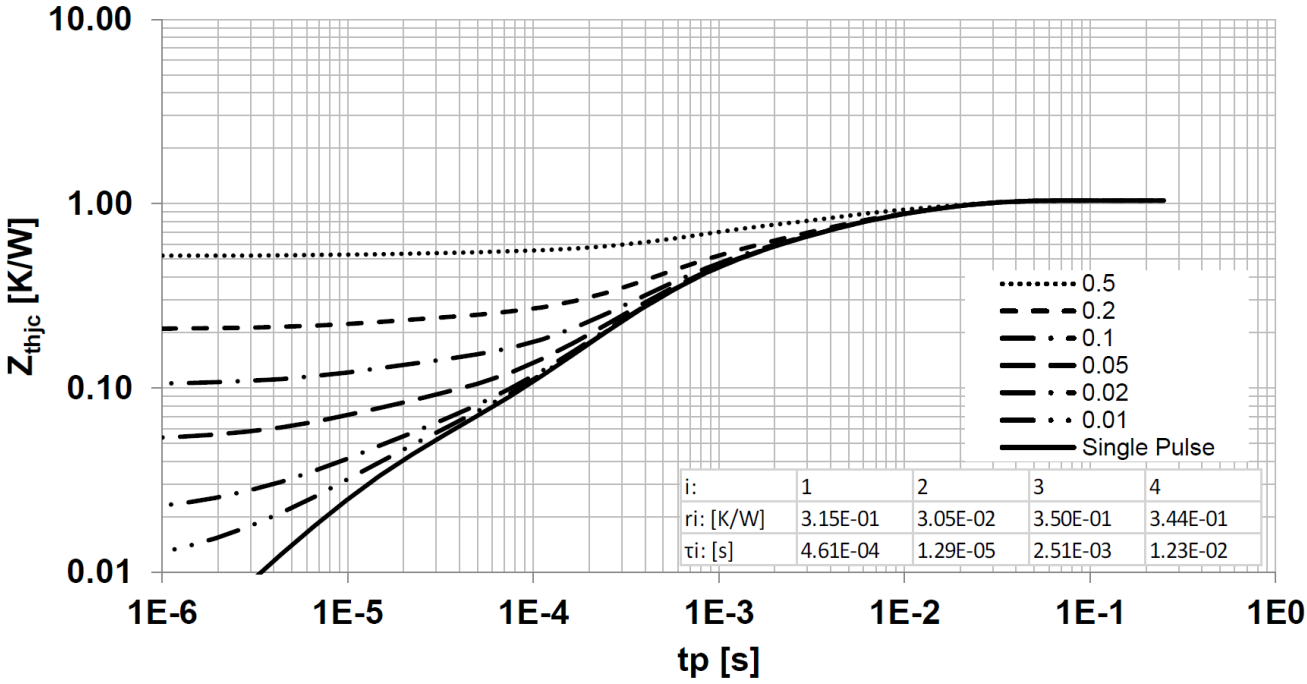


Figure 21 Max. transient thermal resistance (MOSFET/diode)

($Z_{th(j-c,max)} = f(t_p)$, parameter $D = t_p/T$, thermal equivalent circuit in Fig. D)

封装图

5 封装图

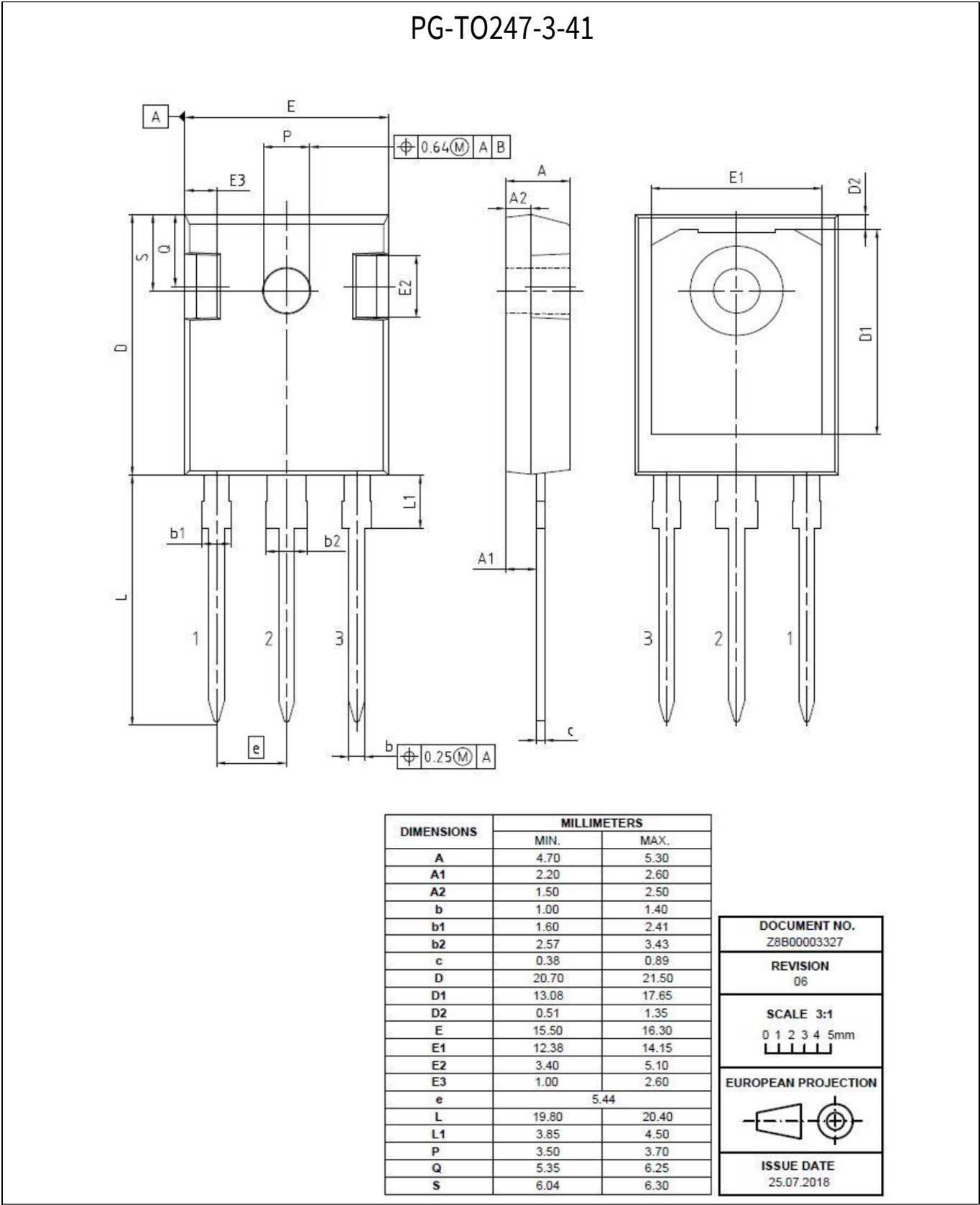


图 22 封装图

测试条件

6 测试条件

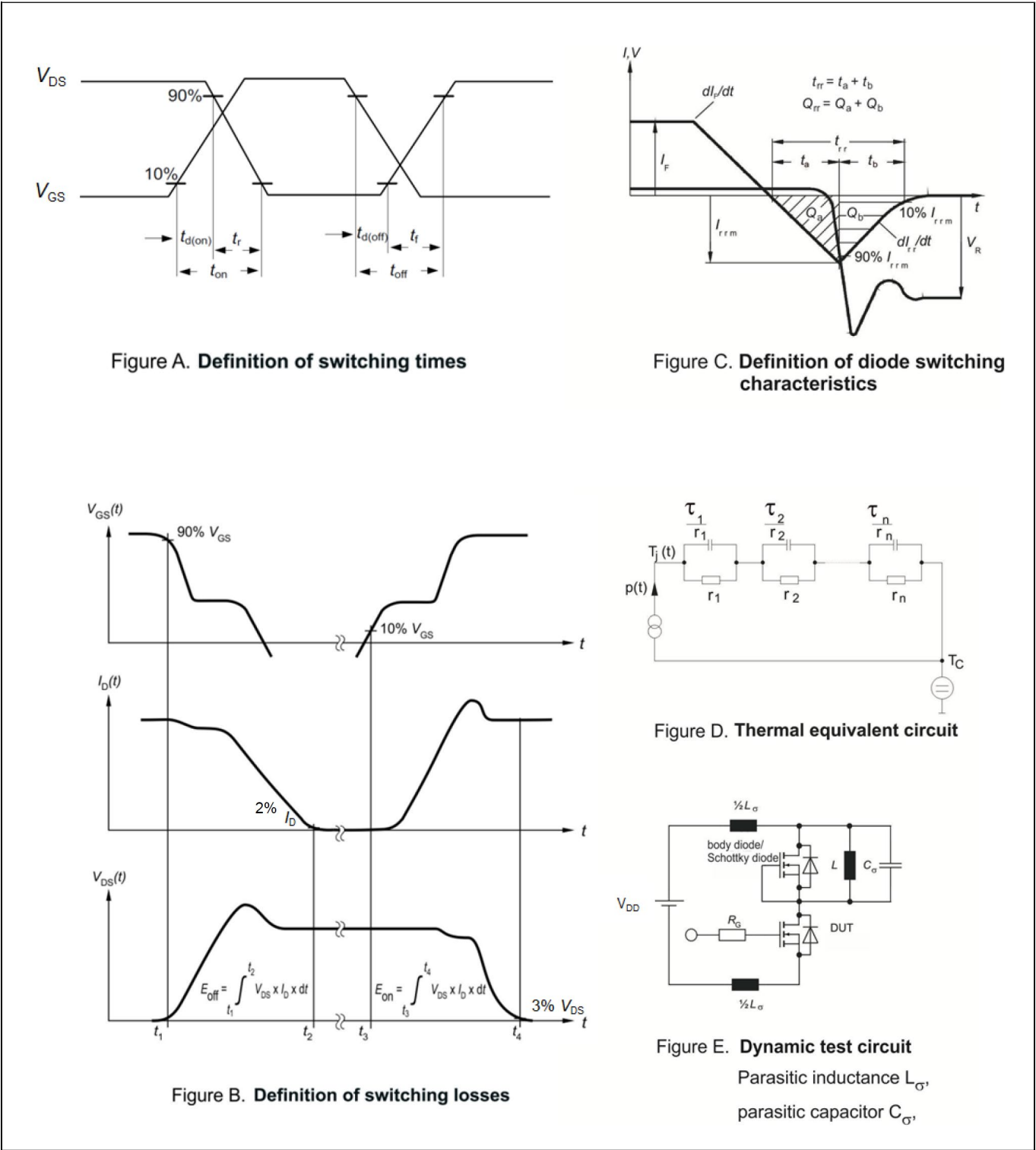


图 23 测试条件

修订记录

修订记录

Document version	Date of release	Description of changes
V01_00	2021-03-09	-
V01_10	2023-01-18	$I_{SD,pulse}$ value adjusted

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