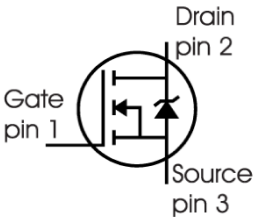
AIMW120R045M1

英飞凌CoolSiC™ 1200V SiC 沟槽 MOSFET 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）
- 关断栅极电压为0V
- 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
- 辅助逆变器

产品验证

汽车应用认证。产品依据AEC-Q100/101进行验证。

表 1 主要性能及封装参数

Type	V_{DS}	I_D (T_C=25°C, $R_{th(j\text{-}c,max)}$)	$R_{DS(on),typ}$ (T_{vj}=25°C, I_D=20A, V_{GS}=15V)	T_{vjmax}	Marking	SP Number	Package
AIMW120R045M1	1200V	52A	45mΩ	175°C	A120M1045	SP002472666	PG-TO247-3-41

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）。

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1 最大额定值

表 2 最大额定值[1]

Parameter	Symbol	Value	Unit
Drain-source voltage, $T_{vj} \geq 25°C$	V_{DSS}	1200	V
DC drain current for $R_{th(j-c,max)}$, limited by T_{vjmax}, V_{GS}=15V $T_C = 25°C$ $T_C = 100°C$	I_D	 52 36	A
Pulsed drain current, t_p limited by T_{vjmax}, V_{GS}= 15V	$I_{D,pulse}$ [1]	130	A
DC body diode forward current for $R_{th(j-c,max)}$, limited by T_{vjmax}, V_{GS}=0V $T_C = 25°C$ $T_C = 100°C$	I_{SD}	 52 28	A
Pulsed body diode current, t_p limited by T_{vjmax}	$I_{SD,pulse}$ [1]	68	A
Gate-source voltage[2] Max transient voltage, < 1% duty cycle Recommended turn-on gate voltage Recommended turn-off gate voltage	 V_{GSS} $V_{GSS,on}$ $V_{GSS,off}$	 -7… 20 15 0	V
Power dissipation, limited by T_{vjmax} $T_C = 25°C$ T_C=100°C	P_{tot}	 228 114	W
Virtual junction temperature	T_{vj}	-40…175	°C
Storage temperature	T_{stg}	-55…150	°C
Soldering temperature, wavesoldering only allowed at leads, 1.6mm (0.063 in.) from case for 10 s	T_{sold}	260	°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。

2 热阻抗

表 3 热阻抗[1]

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET/body diode thermal resistance, junction – case	$R_{th(j-c)}$		-	0.51	0.66	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。

3 电气特性

3.1 静态特性

表 4 静态特性（测于 T_{vj} = 25°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}=15V, I_D=20A, T_{vj} = 25°C T_{vj} = 100°C T_{vj} = 175°C	 - - -	 45 55 75	 59 - -	mΩ
Body Diode forward voltage	V_{SD}	V_{GS}= 0V, I_{SD}=20A T_{vj} = 25°C T_{vj}=100°C T_{vj}=175°C	 - - -	 4.1 4.0 3.9	 5.2 - -	V
Gate-source threshold voltage[2]	$V_{GS(th)}$	*(tested after 1 ms pulse at* V_{GS}=+20 V*)* I_D = 10mA, V_{DS} = V_{GS} T_{vj} = 25°C T_{vj}=175°C	 3.5 -	 4.5 3.6	 5.7 -	V
Zero gate voltage drain current	I_{DSS}	V_{GS} = 0V, V_{DS} = 1200V T_{vj}=25°C T_{vj}=175°C	 - -	 2 50	 200 -	µA
Gate-source leakage current	I_{GSS}	V_{GS} = 20V, V_{DS} = 0V	-	-	120	nA
		V_{GS} = -10V, V_{DS} = 0V	-	-	-120	nA
Transconductance	g_{fs}	V_{DS} = 20V, I_D = 20A	-	11.1	-	S
Internal gate resistance	$R_{G,int}$	f = 1MHz, V_{AC} = 25mV	-	4.5	-	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。

3.2 动态特性

表 5 动态特性（测于 T_{vj} = 25°C，除非另有规定）

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Input capacitance	C_{iss}	V_{DS} = 800V, V_{GS} = 0V, f=1MHz, V_{AC} = 25mV	-	2130	-	pF
Output capacitance	C_{oss}			107		
Reverse capacitance	C_{rss}			11		
C_{oss} stored energy	E_{oss}			44		µJ
Total gate charge	Q_G	V_{DD} = 800V, I_D = 20A, V_{GS} = 0/15V, turn-on pulse	-	57	-	nC
Gate to source charge	$Q_{GS,pl}$			19		
Gate to drain charge	Q_{GD}			13		
Short-circuit withstand time[3]	t_{SC}	V_{DD} = 800V, L_σ = 80nH, $R_{G,ext}$ = 9Ohm, T_{vj} = 175°C $V_{GS,on}$ = 15V	-	3	-	µs

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

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°C时						
Turn-on delay time	$t_{d(on)}$	V_{DD}=800V, I_D=20A, V_{GS}=0V/15V, $R_{G,ext}$=2Ω, L_σ=40nH, diode: body diode at V_{GS}=0V see Fig. E	-	9	-	ns
Rise time	t_r		-	32	-	ns
Turn-off delay time	$t_{d(off)}$		-	17	-	ns
Fall time	t_f		-	13	-	ns
Turn-on energy	E_{on}		-	450	-	µJ
Turn-off energy	E_{off}		-	70	-	µJ
Total switching energy	E_{tot}		-	520	-	µJ
体二极管特性，测于T_{vj} = 25°C 时						
Diode reverse recovery charge	Q_{rr}	V_{DD} = 800V, I_{SD}=20A, V_{GS} at diode=0V, di_f/dt=1000A/µs, Q_{rr} includes also Q_C, see Fig. C	-	0.15	-	µC
Diode peak reverse recovery current	I_{rrm}		-	8	-	A
MOSFET 特性，T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	V_{DD}=800V, I_D=20A, V_{GS}=0V/15V, $R_{G,ext}$=2Ω, L_σ=40nH, diode: body diode at V_{GS}=0V, see Fig. E	-	9	-	ns
Rise time	t_r		-	32	-	ns
Turn-off delay time	$t_{d(off)}$		-	20	-	ns
Fall time	t_f		-	14	-	ns
Turn-on energy	E_{on}		-	490	-	µJ
Turn-off energy	E_{off}		-	75	-	µJ
Total switching energy	E_{tot}		-	565	-	µJ
体二极管特性，测于T_{vj} = 175°C 时						
Diode reverse recovery charge	Q_{rr}	V_{DD} = 800V, I_{SD}=20A, V_{GS} at diode=0V, di_f/dt=1000A/µs, Q_{rr} includes also Q_C, see Fig. C	-	0.25	-	µC
Diode peak reverse recovery current	I_{rrm}		-	10	-	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。

4 电气特性图

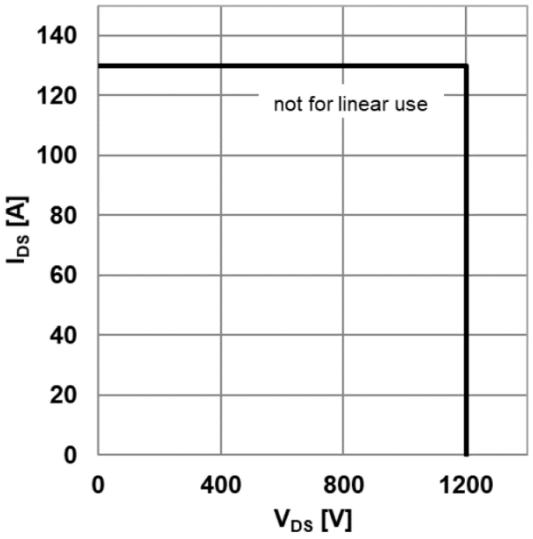


Figure 1 Reverse bias safe operating area (RBSOA) (V_{gs} = 0/15V, T_c = 25°C, T_j < 175°C)

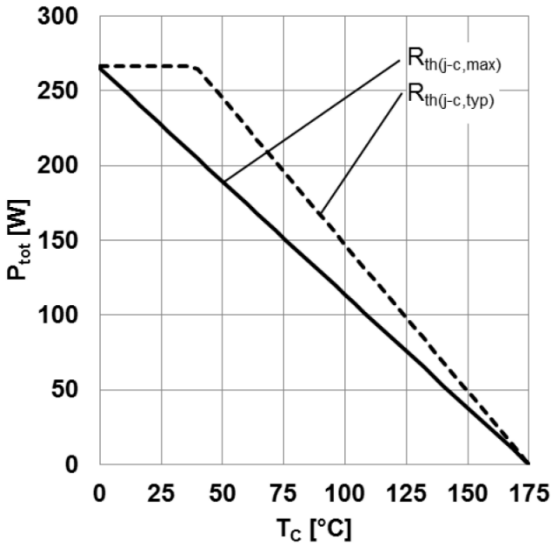


Figure 2 Power dissipation as a function of case temperature limited by bond wire(P_{tot}=f(T_C))

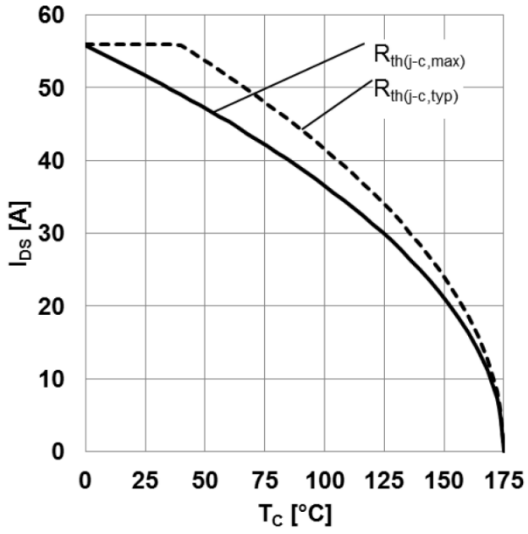


Figure 3 Maximum DC drain to source current as a function of case temperature limited by bond wire (I_{DS}=f(T_C))

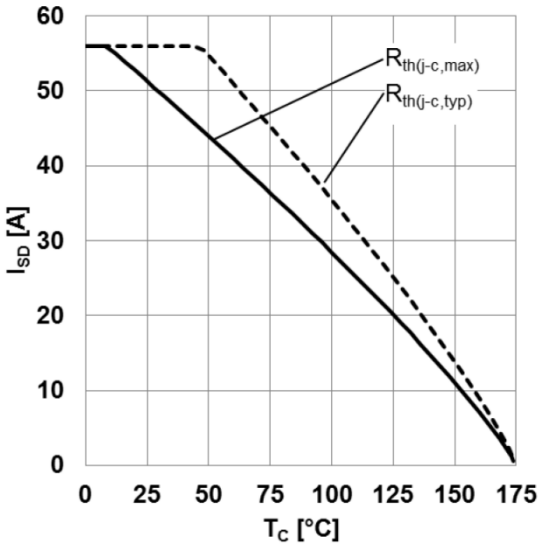


Figure 4 Maximum source to drain current as a function of case temperature limited by bond wire (I_{SD}=f(T_C), V_{GS}=0V)

电气特性图

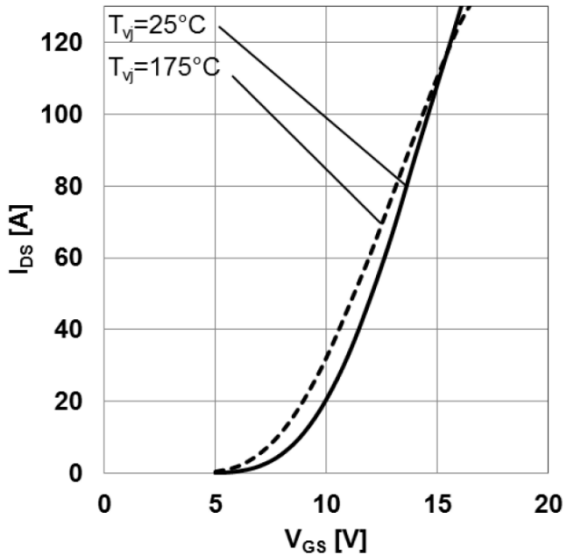


Figure 5 **Typical transfer characteristic** (I_{DS}=f(V_{GS}), V_{DS}=20V, t_P = 20 µs)

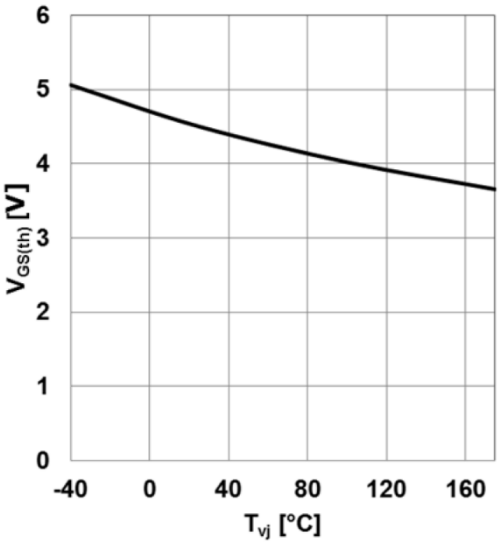


Figure 6 Typical gate-source threshold voltage as a function of junction temperature ($V_{GS(th)}$=f(T_{vj}), I_{DS}=10mA, V_{GS}=V_{DS})

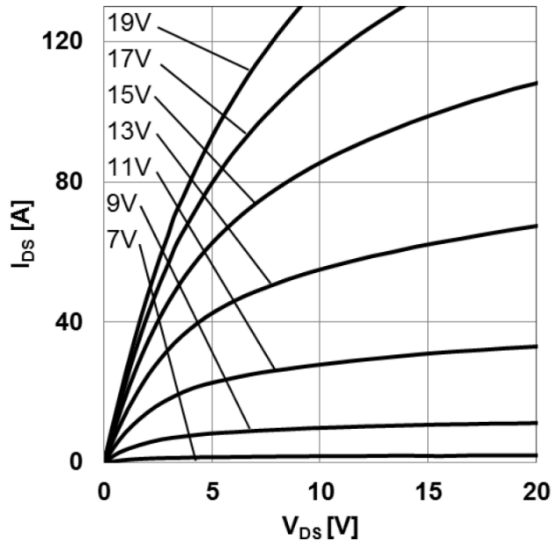


Figure 7 **Typical output characteristic, V_{GS} as parameter** (I_{DS}=f(V_{DS}), T_{vj}=25°C, t_P = 20 µs)

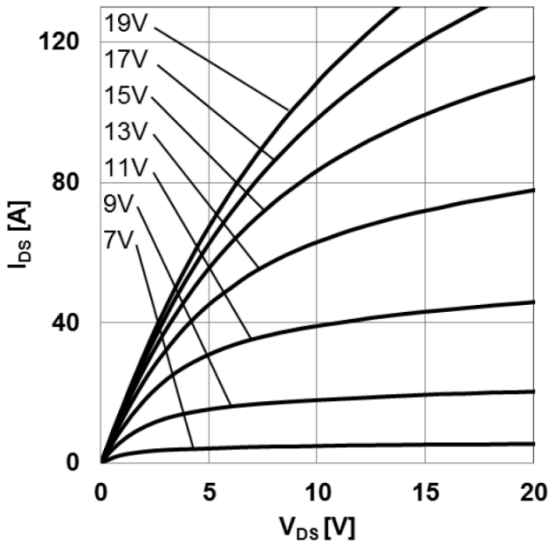


Figure 8 **Typical output characteristic, V_{GS} as parameter** (I_{DS}=f(V_{DS}), T_{vj}=175°C, t_P = 20 µs)

电气特性图

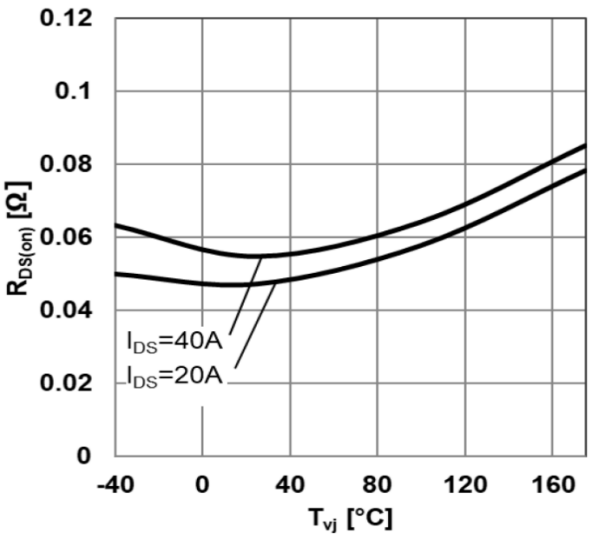


Figure 9 Typical on-resistance as a function of junction temperature ($R_{DS(on)}$=f(T_{vj}), V_{GS}=15V)

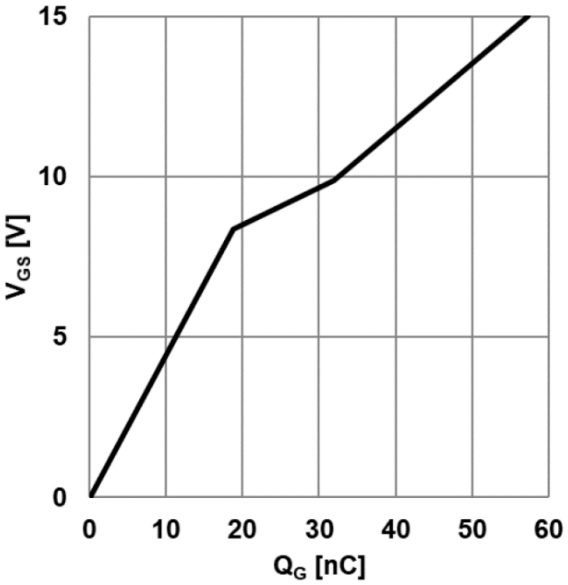


Figure 10 Typical gate charge (V_{GS}=f(Q_G), I_{DS}=20A, V_{DS}=800V, turn-on pulse)

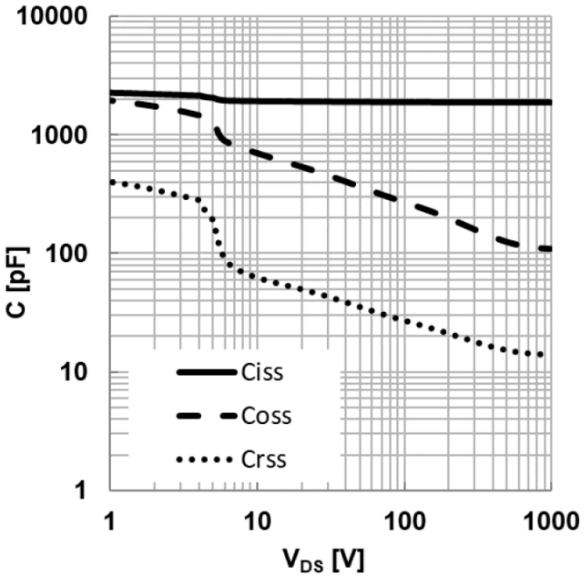


Figure 11 Typical capacitance as a function of drain-source voltage (C=f(V_{DS}), V_{GS}=0V, f=1MHz)

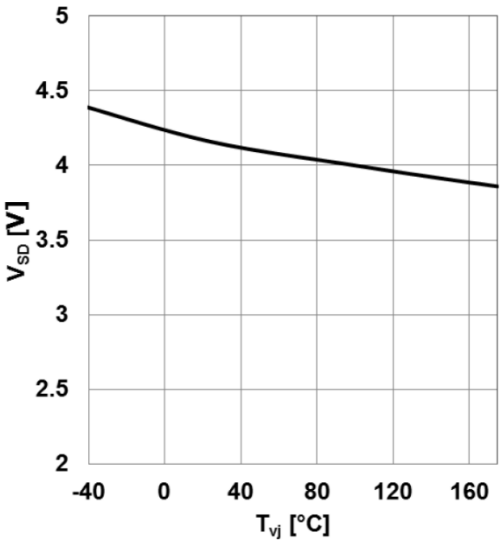


Figure 12 Typical body diode forward voltage as function of junction temperature (V_{SD}=f(T_{vj}), V_{GS}=0V, I_{SD}=20A)

电气特性图

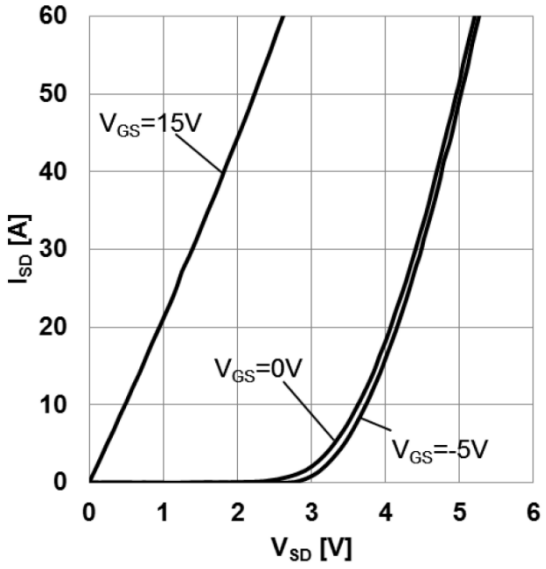


Figure 13 **Typical body diode forward current as function of forward voltage, V_{GS} as parameter** (I_{SD}=f(V_{SD}), T_{vj}=25°C, t_P=20 µs)

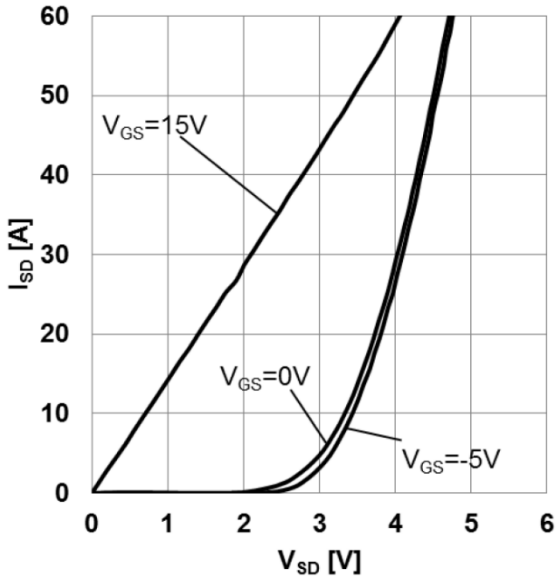


Figure 14 **Typical body diode forward current as function of forward voltage, V_{GS} as parameter** (I_{SD}=f(V_{SD}), T_{vj}=175°C, t_P=20 µs)

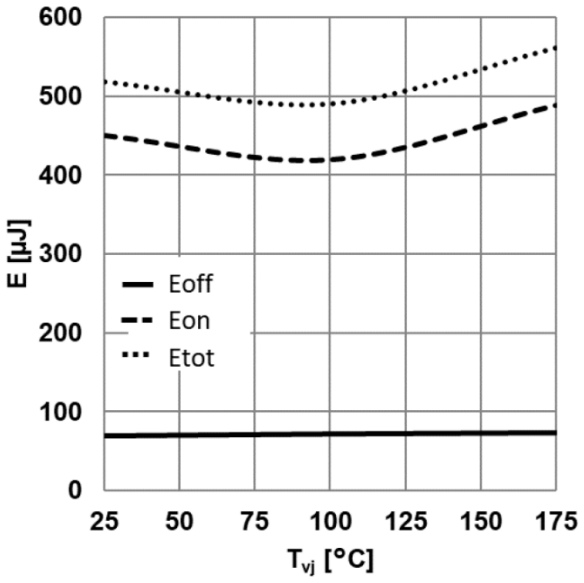


Figure 15 **Typical switching energy losses as a function of junction temperature** (E=f(T_{vj}), V_{DD}=800V, V_{GS}=0V/15V, $R_{G,ext}$=2Ω, I_D=20A, ind. load, test circuit in Fig. E, diode: body diode)

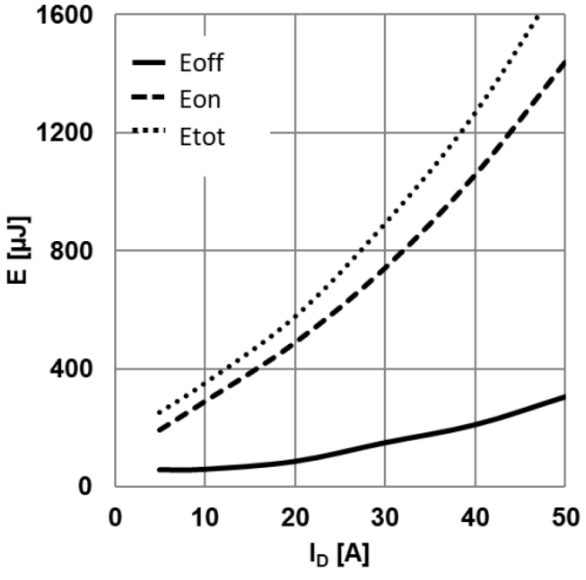


Figure 16 **Typical switching energy losses as a function of drain-source current** (E = f(I_{DS}), V_{DD} = 800V, V_{GS} = 0V/15V, $R_{G,ext}$ = 2Ω, T_{vj} = 175°C, ind. load, test circuit in Fig. E, diode: body diode)

电气特性图

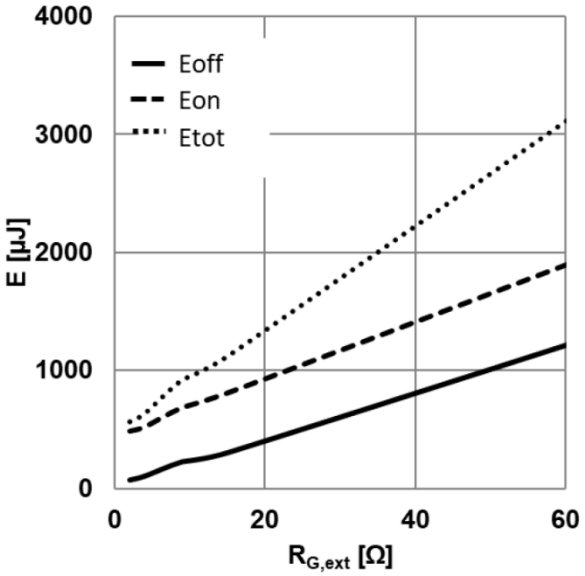


Figure 17 **Typical switching energy losses as a of function of gate resistance** (E=f($R_{G,ext}$), V_{GS}=0V/15V, I_D=20A, T_{vj}=175°C, ind. load, test circuit in Fig. E, diode: body diode)

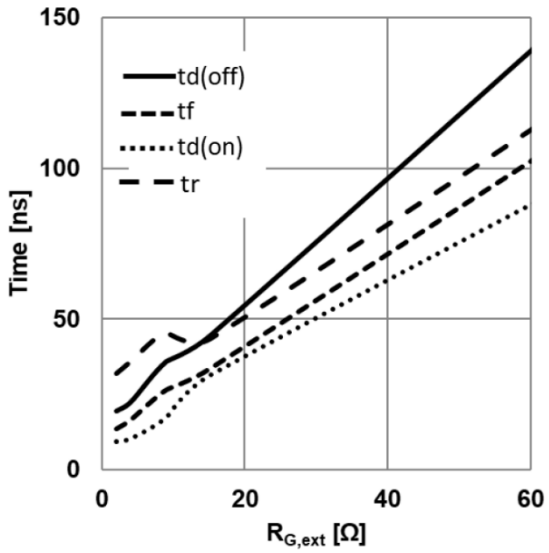


Figure 18 **Typical switching times as a function gate resistor** (t=f($R_{G,ext}$), V_{DD}=800V, V_{DD}=800V, V_{GS}=0V/15V, I_D=20A, T_{vj}=175°C, ind. load, test circuit in Fig. E, diode: body diode)

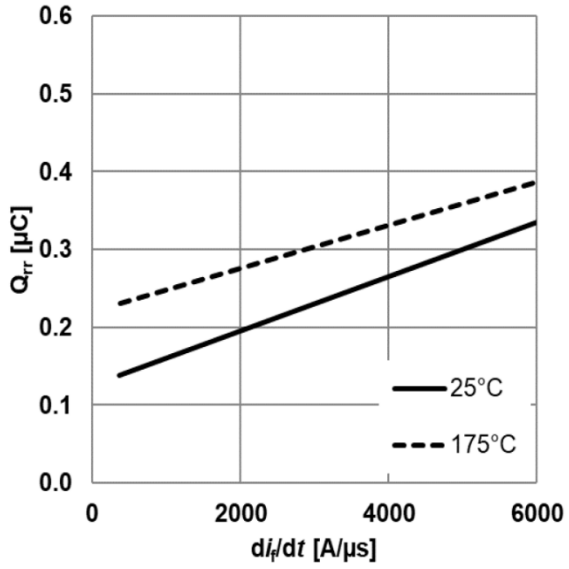


Figure 19 **Typical reverse recovery charge as a function of diode current slope** (Q_{rr}=f(di_f/dt), V_{DD}=800V, I_D=20A, ind. load, test circuit in Fig.E)

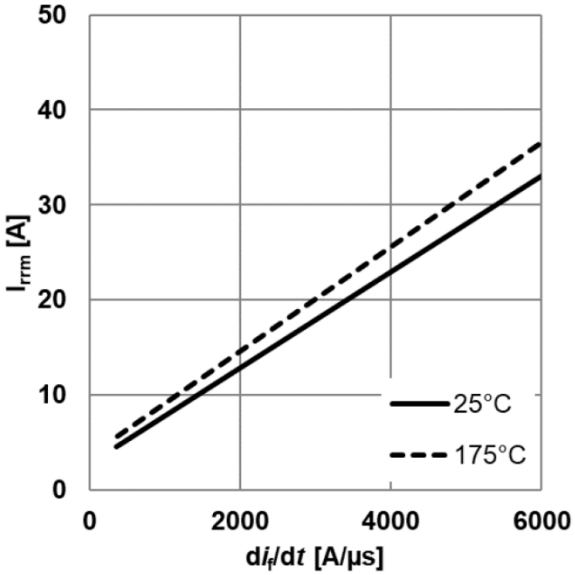


Figure 20 **Typical reverse recovery current as a function of diode current slope** (I_{rrm}=f(di_f/dt), V_{DD}=800V, I_D=20A, ind. load, test circuit in Fig.E)

电气特性图

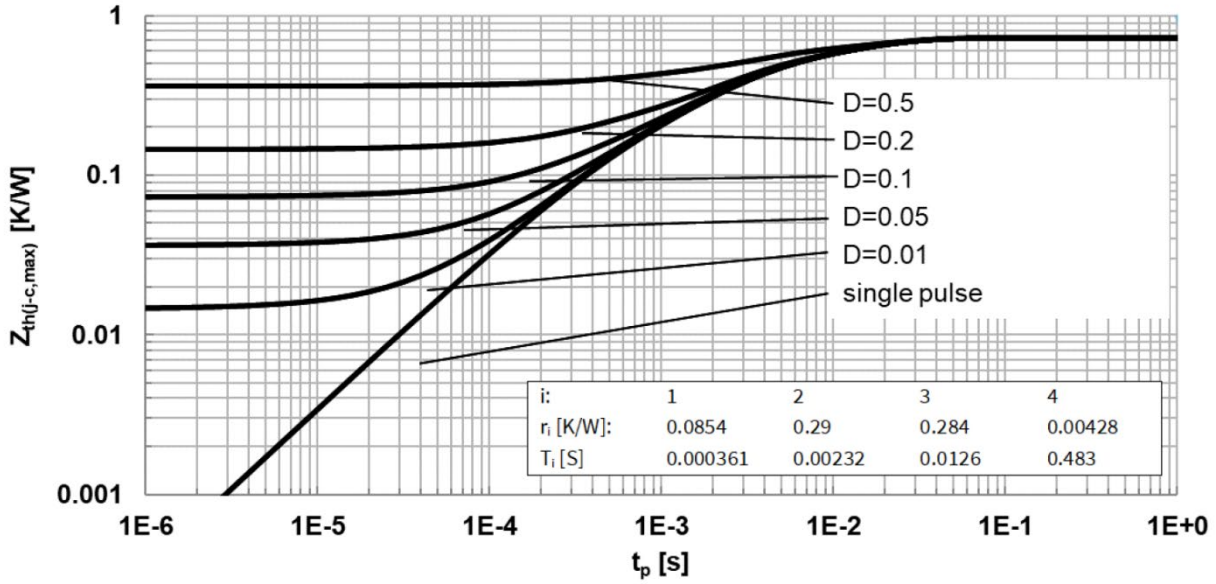
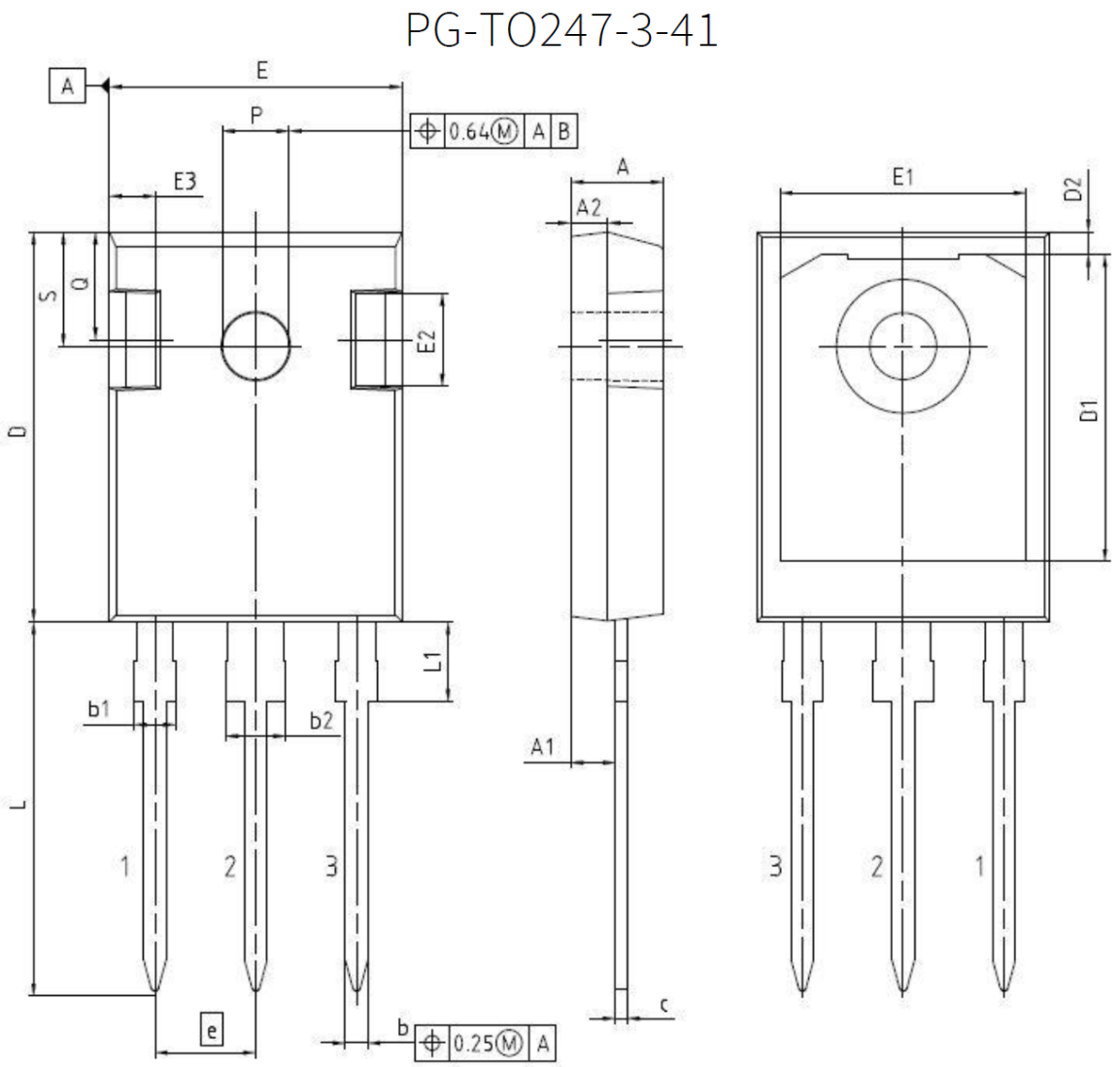


Figure 21 Max. transient thermal resistance (MOSFET/diode)

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

5 封装图



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

DOCUMENT NO.	Z8B00003327
REVISION	06
SCALE 3:1	0 1 2 3 4 5mm
EUROPEAN PROJECTION	
ISSUE DATE	25.07.2018

图 22 封装图

6 测试条件

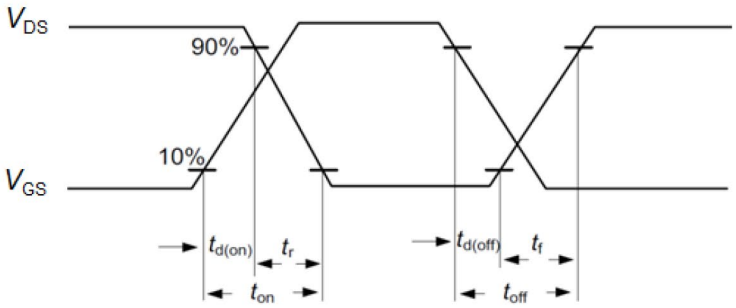


Figure A. **Definition of switching times**

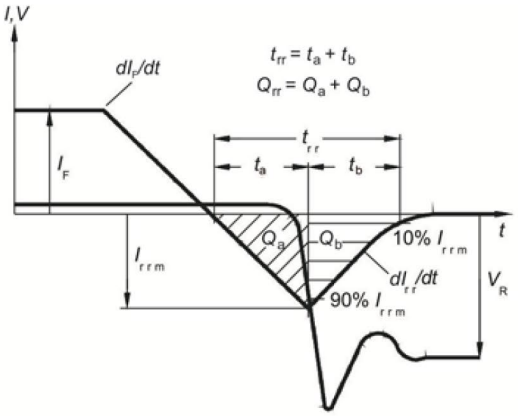


Figure C. **Definition of diode switching characteristics**

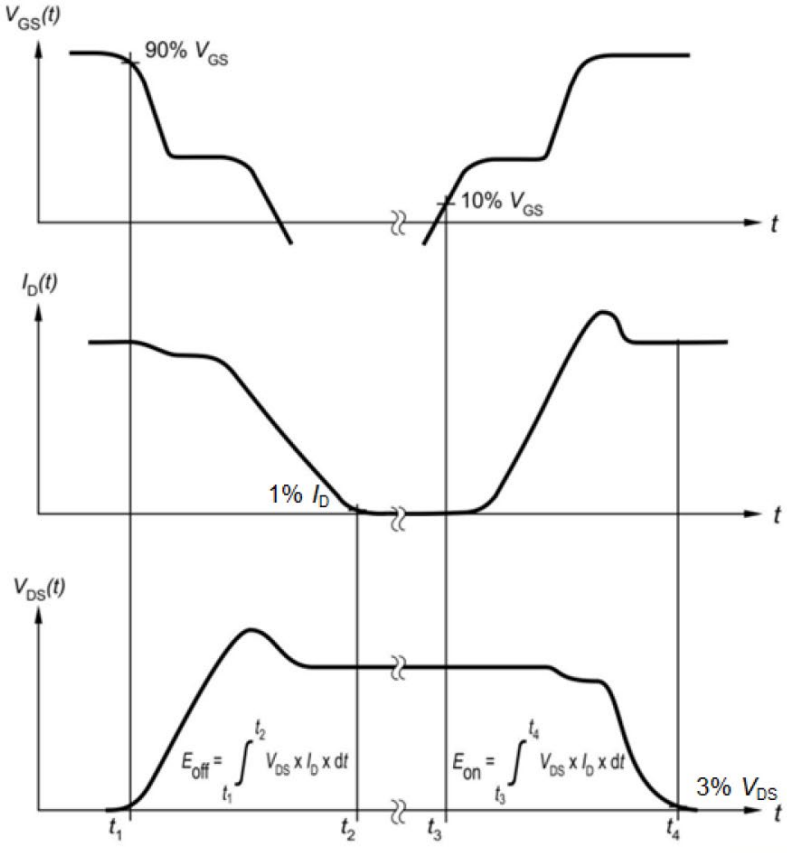


Figure B. **Definition of switching losses**

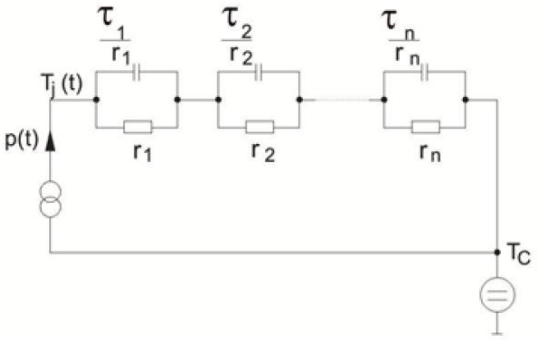


Figure D. **Thermal equivalent circuit**

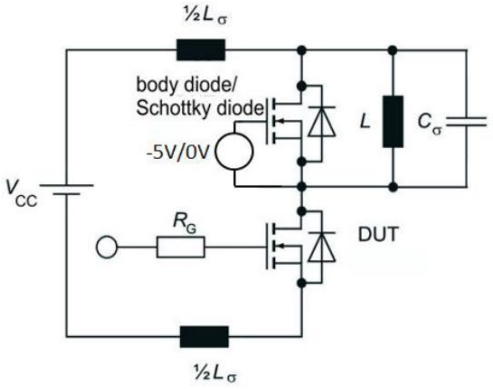


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,

图 23 测试条件

修订记录

自上次修订以来的主要变化

Page or Reference	Description of change
All pages	First release of datasheet V3.0
Page 3	$I_{SD,pulse}$ value adjusted

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