CAS300M12BM2

1.2kV, 5.0 mΩ All-Silicon Carbide Half-Bridge Module

C2M MOSFET and Z-Rec™ Diode

V_{DS}	1.2 kV
$E_{sw, Total @ 300A}$	12.0 mJ
$R_{DS(on)}$	5.0 mΩ

Features

- Ultra Low Loss 非常低的损耗
- High-Frequency Operation 高频运行
- Zero Reverse Recovery Current from Diode 二极管零反向恢复电流
- Zero Turn-off Tail Current from MOSFET 零关断电流
- Normally-off, Fail-safe Device Operation 自动防故障装置运行
- Ease of Paralleling 易于并联
- Copper Baseplate and Aluminum Nitride Insulator
  铜底板 氮化铝 绝缘体

Package 62mm x 106mm x 30mm

System Benefits

- Enables Compact and Lightweight Systems 使高集成度和轻质量系统成为可能
- High Efficiency Operation 高效率运行
- Mitigates Over-voltage Protection 降低过压保护
- Reduced Thermal Requirements 降低热要求
- Reduced System Cost 降低系统成本

Applications

- Induction Heating 感应加热
- Motor Drives 电机驱动
- Solar and Wind Inverters 太阳能或风能逆变器
- UPS and SMPS 不间断电源或开关电源
- Traction 牵引装置

Part Number	Package	Marking
CAS300M12BM2	Half-Bridge Module	CAS300M12BM2

Maximum Ratings (T_C = 25˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Notes
V_{DSmax}	Drain - Source Voltage	1.2	kV		
V_{GSmax}	Gate - Source Voltage	-10/+25	V	Absolute Maximum values	
V_{GSop}	Gate - Source Voltage	-5/20	V	Recommended Operational Values	
I_D	Continuous Drain Current	404	A	V_{GS} = 20 V, T_C = 25 ˚C	Fig. 24
		285		V_{GS} = 20 V, T_C = 90 ˚C	
$I_{D(pulse)}$	Pulsed Drain Current	1500	A	Pulse width t_P = 200 µs Repetition rate limited by T_{jmax}, T_C = 25˚C	
T_{Jmax}	Junction Temperature	150	˚C		
T_C , T_{STG}	Case and Storage Temperature Range	-40 to +125	˚C		
V_{isol}	Case Isolation Voltage	4.0	kV	AC, 50 Hz , 1 min	
L_{Stray}	Stray Inductance	14	nH	正负电压接口 Measured between terminals 2 and 3	
P_D	Power Dissipation	1660	W	T_C = 25 ˚C, T_J = 150 ˚C	Fig. 23

Electrical Characteristics (T_c = 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain - Source Breakdown Voltage	1.2			kV	V_{GS}, = 0 V, I_D = 1 mA	
$V_{GS(th)}$	Gate Threshold Voltage 最高结温时	1.8	2.3		V	V_{DS} = 10 V, I_D = 15 mA	Fig 7
I_{DSS}	Zero Gate Voltage Drain Current 门极电压为0时漏极电流		500	2000	μA	V_{DS} = 1.2 kV, V_{GS} = 0V 温度越高 漏极电流越大 载流子运动越剧烈	
			1000			V_{DS} = 1.2 kV,V_{GS} = 0V, T_J = 150 °C	
I_{GSS}	Gate-Source Leakage Current 栅源极漏电流		1	100	nA	V_{GS} = 20 V, V_{DS} = 0V 充电最后时刻 漏电流很小	
$R_{DS(on)}$	On State Resistance 最小导通电阻情况：25摄氏度 20V		5.0	5.7	mΩ	V_{GS} = 20 V, I_{DS} = 300 A	Fig. 4, 5, 6
			8.6	9.8		V_{GS} = 20 V, I_{DS} = 300 A, T_J = 150 °C	
g_{fs}	Transconductance 传输阻抗		94.8		S	V_{DS} = 20 V, I_{DS} = 300 A	Fig. 8
			93.3			V_{DS} = 20 V, I_D = 300 A, T_J = 150 °C	
C_{iss}	Input Capacitance		11.7		nF	V_{DS} = 600 V, f = 200 kHz, V_{AC} = 25 mV	Fig. 16, 17
C_{oss}	Output Capacitance		2.55				
C_{rss}	Reverse Transfer Capacitance		0.07				
E_{on}	Turn-On Switching Energy		6.05		mJ	V_{DD} = 600 V, V_{GS} = -5V/+20V I_D = 300 A, $R_{G(ext)}$ = 2.5 Ω Note: IEC 60747-8-4 Definitions	Fig. 19, 20
E_{Off}	Turn-Off Switching Energy		5.95		mJ		
$R_{G\ (int)}$	Internal Gate Resistance 芯片内部导通电阻		3.0		Ω	f = 200 kHz, V_{AC} = 25 mV	
Q_{GS}	Gate-Source Charge		166		nC	V_{DD}= 800 V, V_{GS} = -5V/+20V, I_D= 300 A, Per JEDEC24 pg 27	Fig. 15
Q_{GD}	Gate-Drain Charge		475				
Q_G	Total Gate Charge		1025				
$t_{d(on)}$	Turn-on delay time		76		ns	V_{DD} = 600V, V_{GS} = -5/+20V, I_D = 300 A, $R_{G(ext)}$ = 2.5 Ω, Timing relative to V_{DS} Note: IEC 60747-8-4, pg 83 Inductive load	Fig. 25
t_r	Rise Time		68		ns		
$t_{d(off)}$	Turn-off delay time		168		ns		
t_f	Fall Time		43		ns		

Free-Wheeling SiC Schottky Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage		1.7	2.0	V	I_F = 300 A, V_{GS} = 0	Fig. 9, 10, 11
			2.2	2.5		I_F = 300 A, T_J = 150 °C, V_{GS} = 0	
Q_C	Total Capacitive Charge		3.2		μC		

Note: The reverse recovery is purely capacitive

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
R_{thJCM}	Thermal Resistance Juction-to-Case for MOSFET		0.070	0.075	°C/W	T_c = 90 °C, P_D = 150 W	Fig. 27, 28
R_{thJCD}	Thermal Resistance Juction-to-Case for Diode		0.073	0.076		T_c = 90 °C, P_D = 130 W	

Additional Module Data

Symbol	Parameter	Max.	Unit	Test Condtion
W	Weight	300	g	
M	Mounting Torque	5	Nm	To heatsink and terminals
	Clearance Distance	12	mm	Terminal to terminal
	Creepage Distance	30	mm	Terminal to terminal
		40	mm	Terminal to baseplate

Typical Performance

输出特性

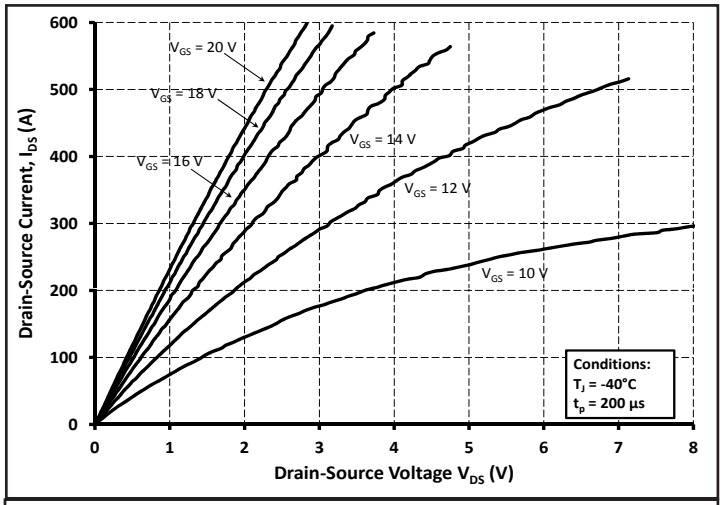


Figure 1. Typical Output Characteristics T_J = -40 °C

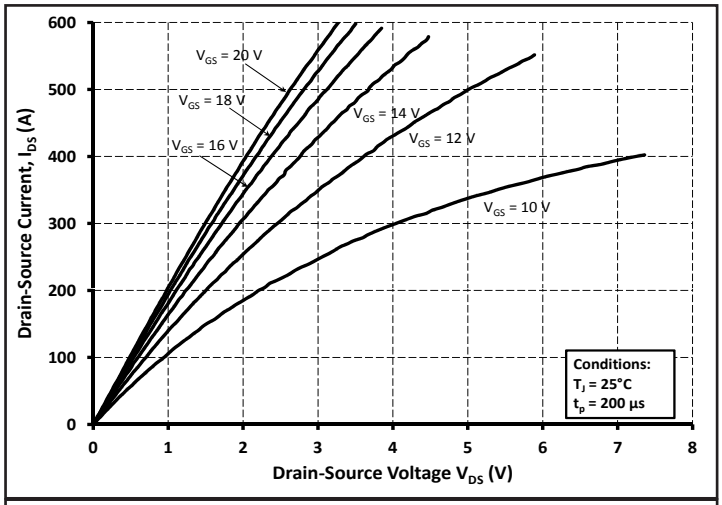


Figure 2. Typical Output Characteristics T_J = 25 °C

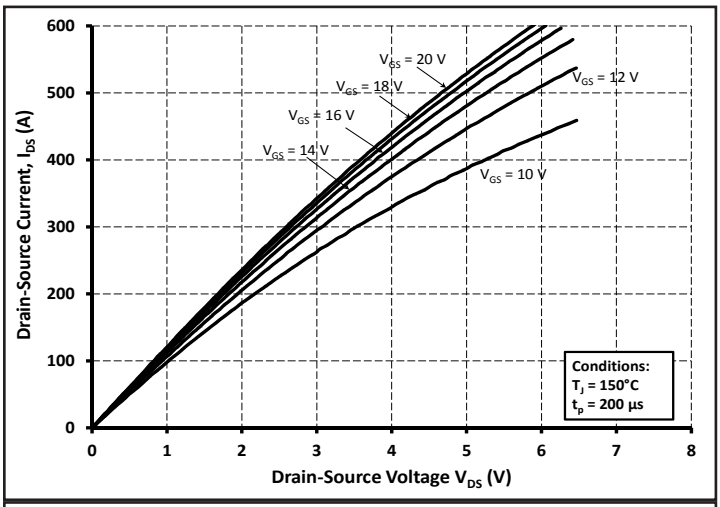
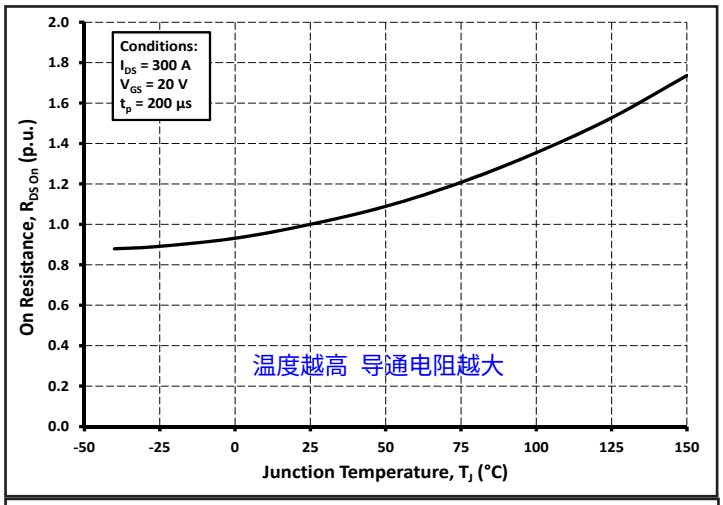


Figure 3. Typical Output Characteristics T_J = 150 °C



规范化的导通电阻 以25°C时为单位1

Figure 4. Normalized On-Resistance vs. Temperature

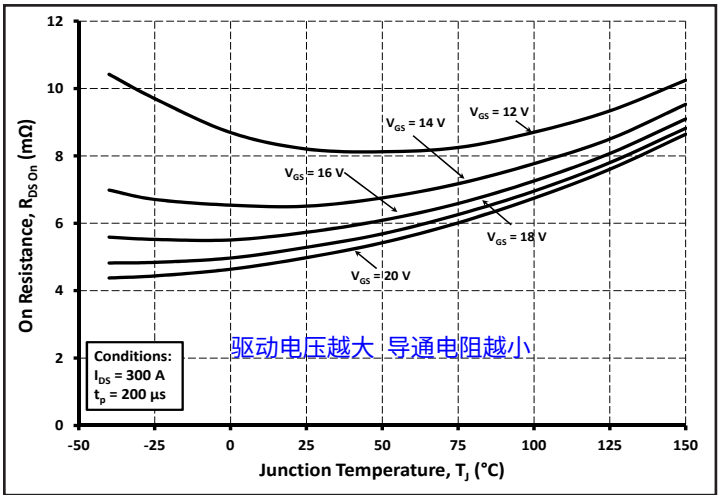


Figure 5. Typical On-Resistance vs. Temperature for Various Gate-Source Voltage

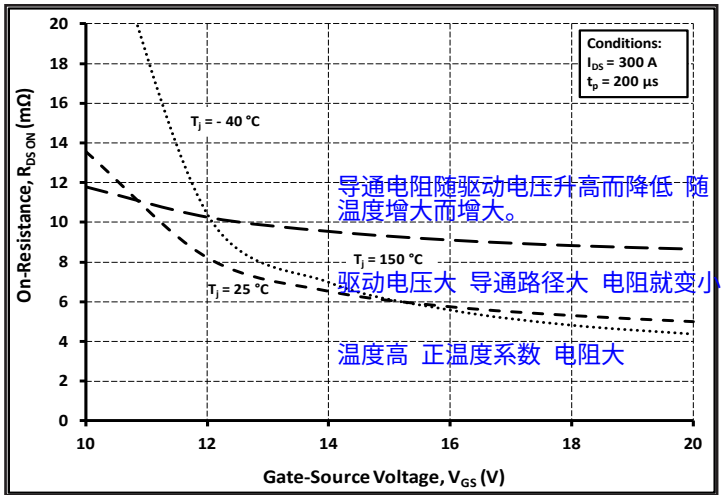


Figure 6. Typical On-Resistance vs. Gate Voltage

Typical Performance

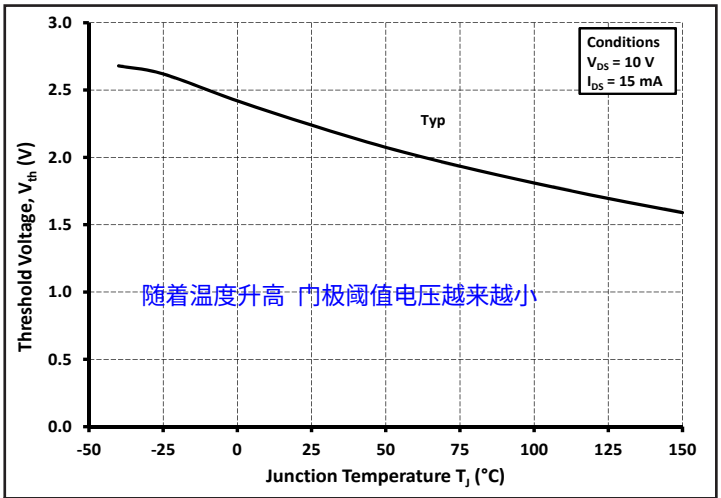


Figure 7. Threshold Voltage vs. Temperature

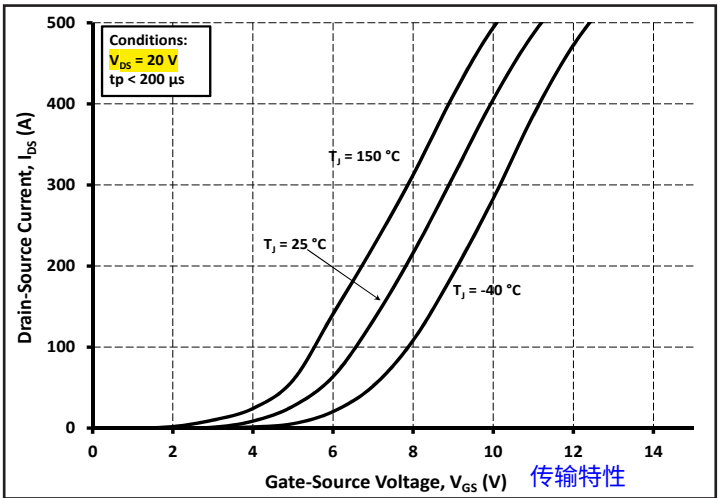


Figure 8. Transfer Characteristic for Various Junction Temperatures

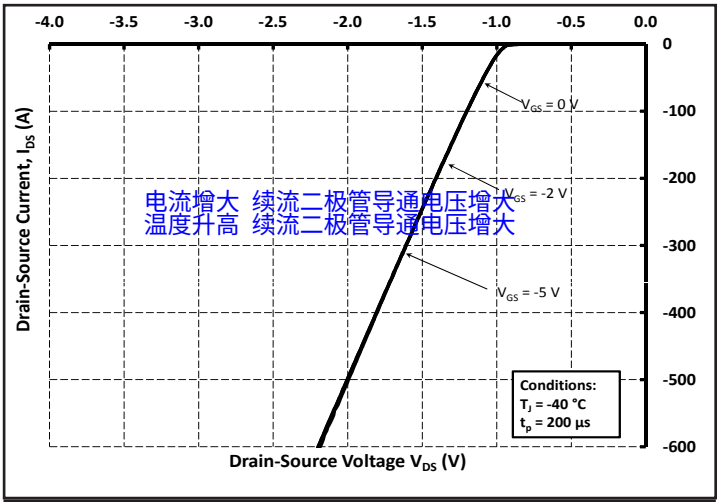


Figure 9. Diode Characteristic at -40 °C

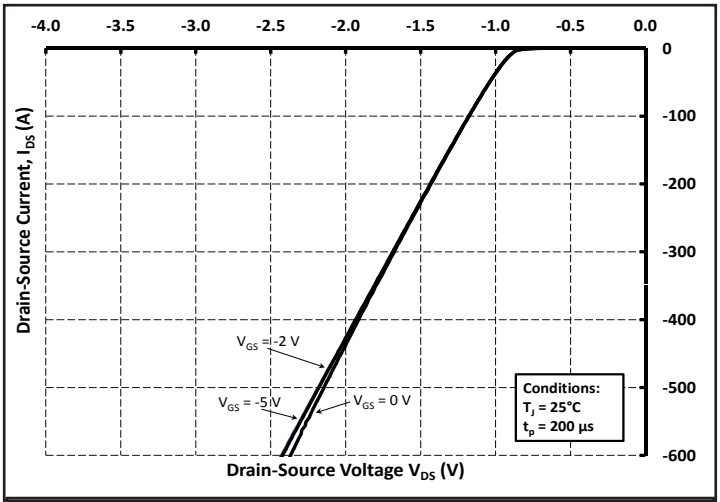


Figure 10. Diode Characteristic at 25 °C

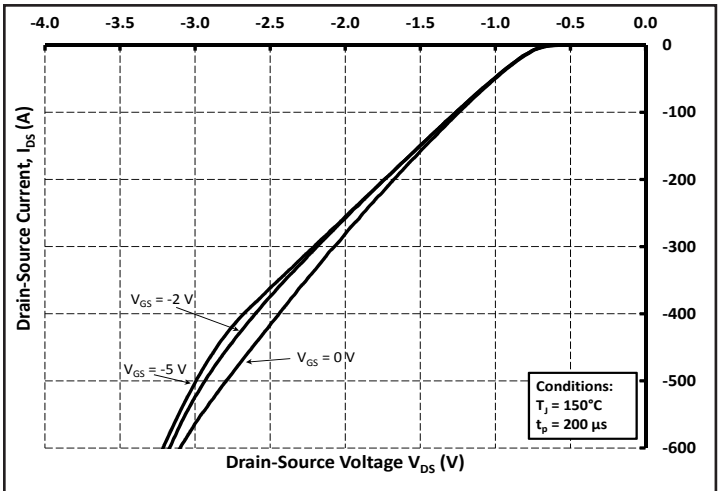


Figure 11. Diode Characteristic at 150 °C

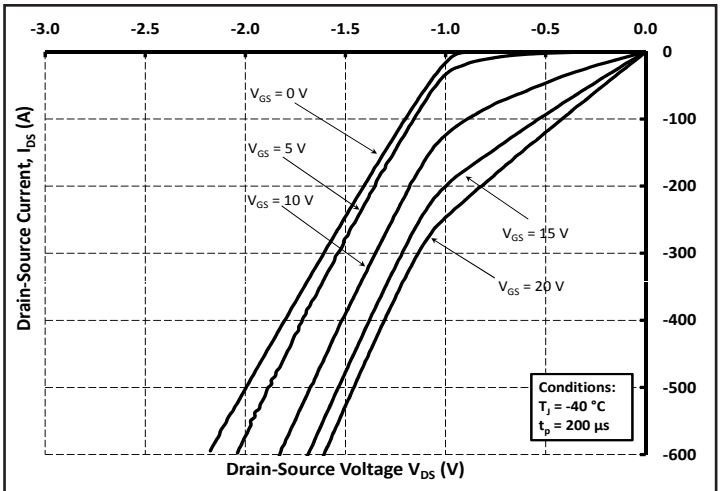


Figure 12. 3rd Quadrant Characteristic at -40 °C

Typical Performance

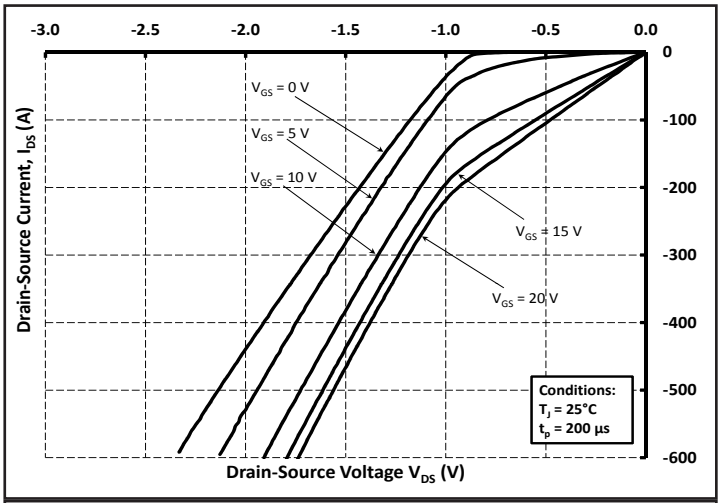


Figure 13. 3rd Quadrant Characteristic at 25 °C

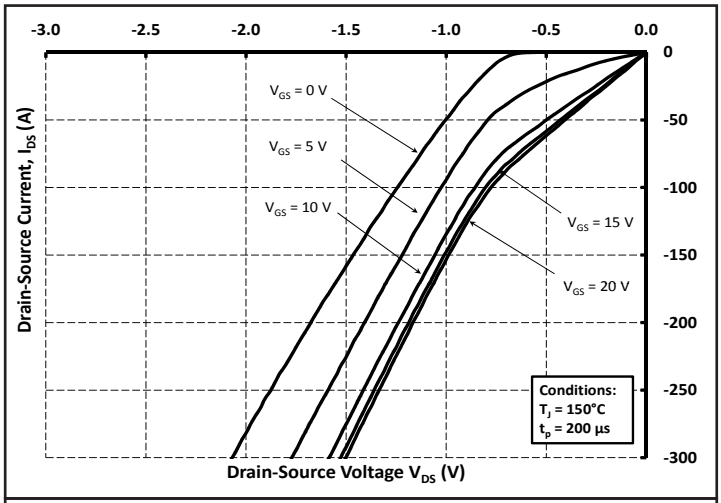


Figure 14. 3rd Quadrant Characteristic at 150 °C

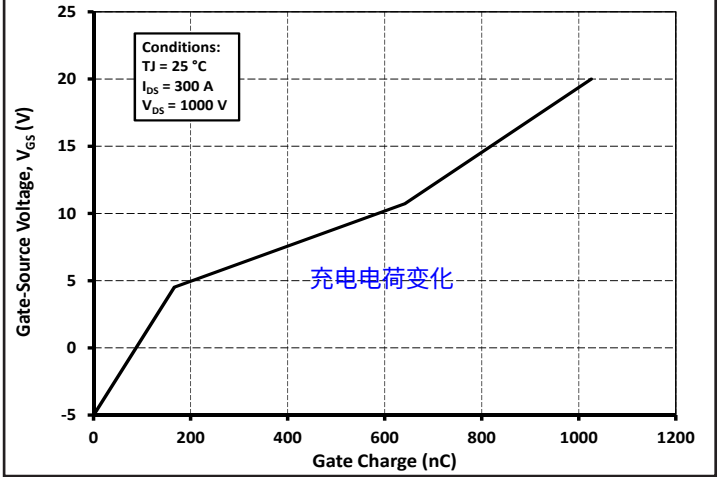


Figure 15. Typical Gate Charge Characteristics

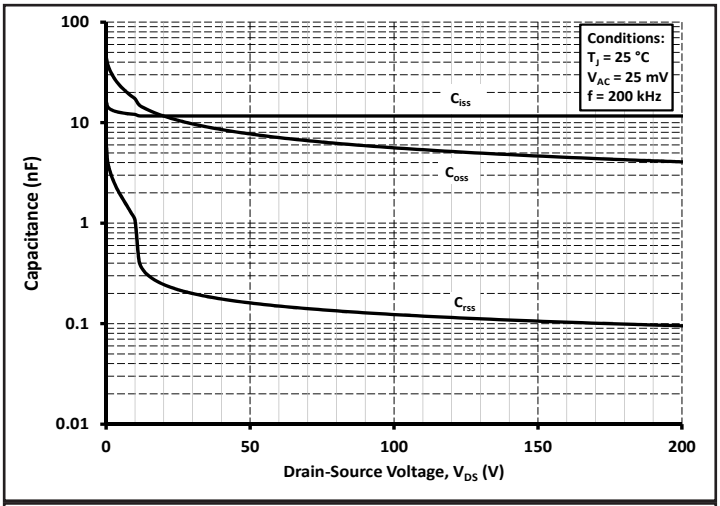


Figure 16. Typical Capacitances vs. Drain-Source Voltage (0 - 200 V)

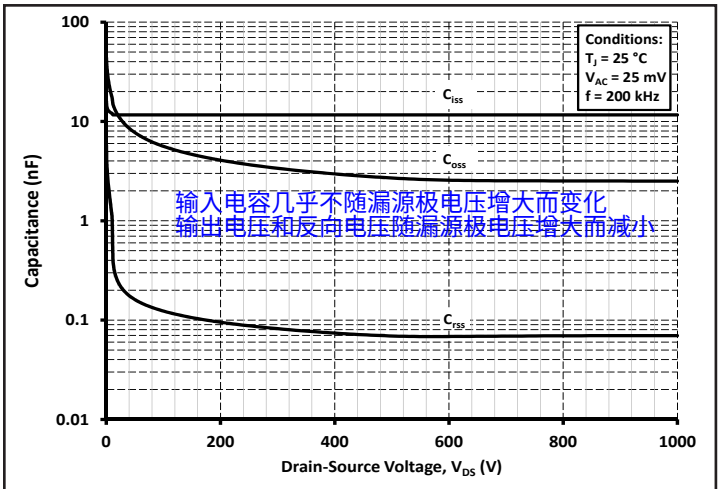


Figure 17. Typical Capacitances vs. Drain-Source Voltage (0 - 1 kV)

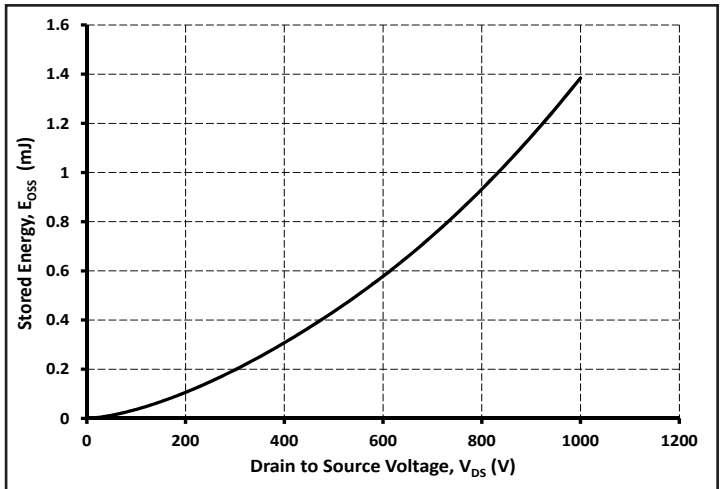


Figure 18. Typical Output Capacitor Stored Energy

Typical Performance

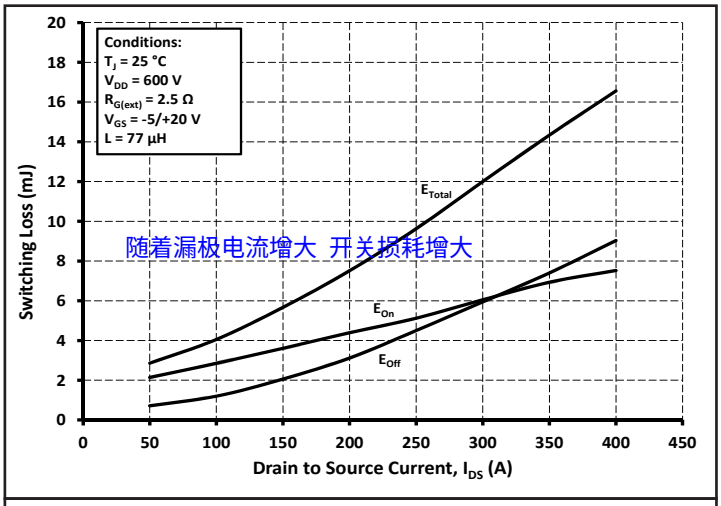


Figure 19. Inductive Switching Energy vs. Drain Current For V_{DS} = 600V, R_G = 2.5 Ω

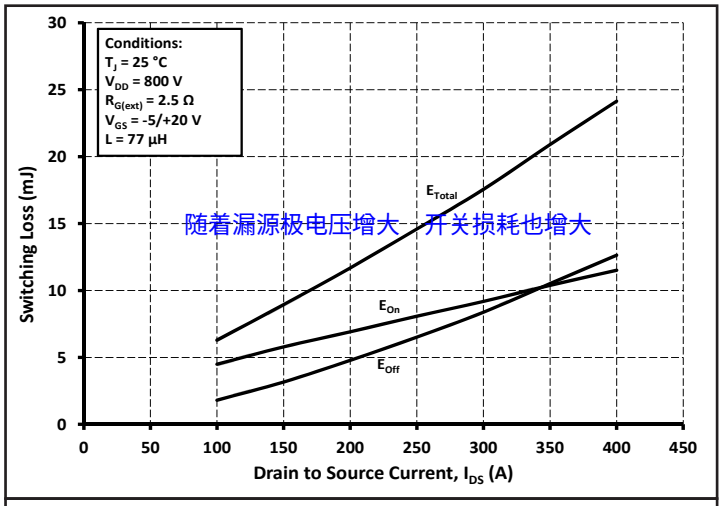


Figure 20. Inductive Switching Energy vs. Drain Current For V_{DS} = 800 V, R_G = 2.5 Ω

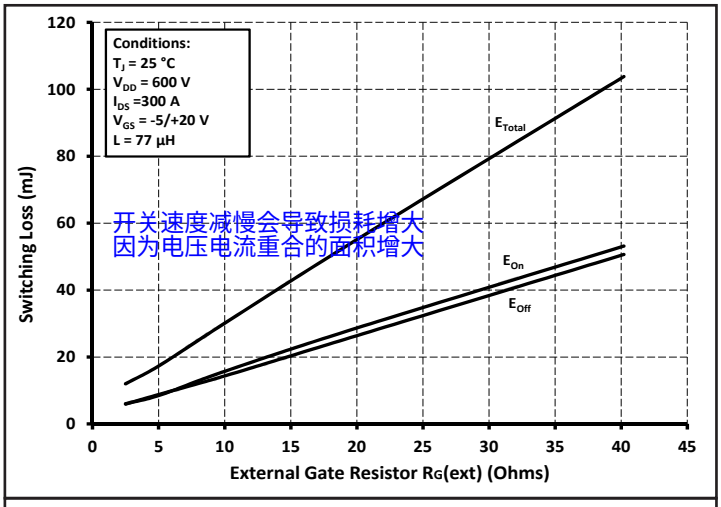


Figure 21. Inductive Switching Energy vs. $R_{G(ext)}$

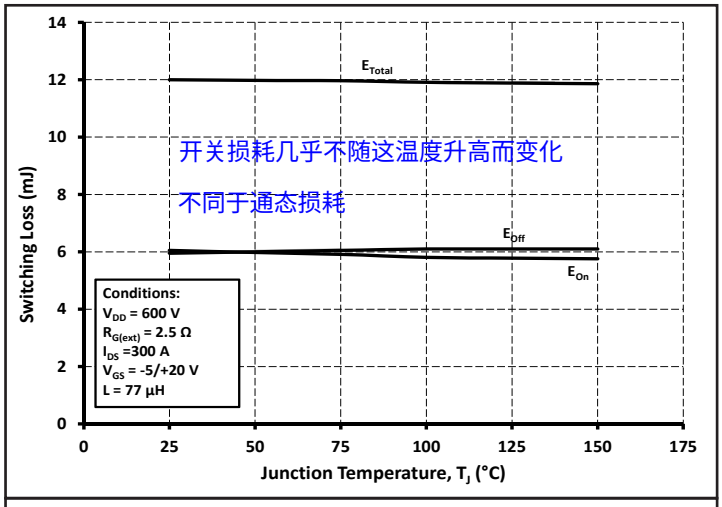


Figure 22. Inductive Switching Energy vs. Temperature

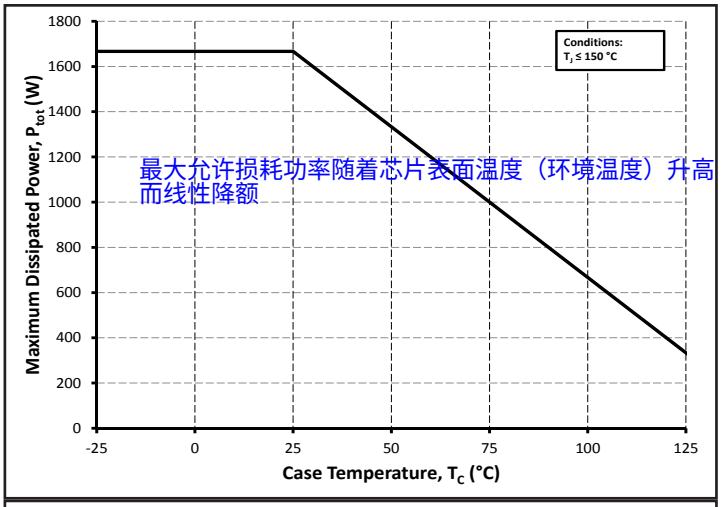


Figure 23. Maximum Power Dissipation (MOSFET) Derating vs Case Temperature

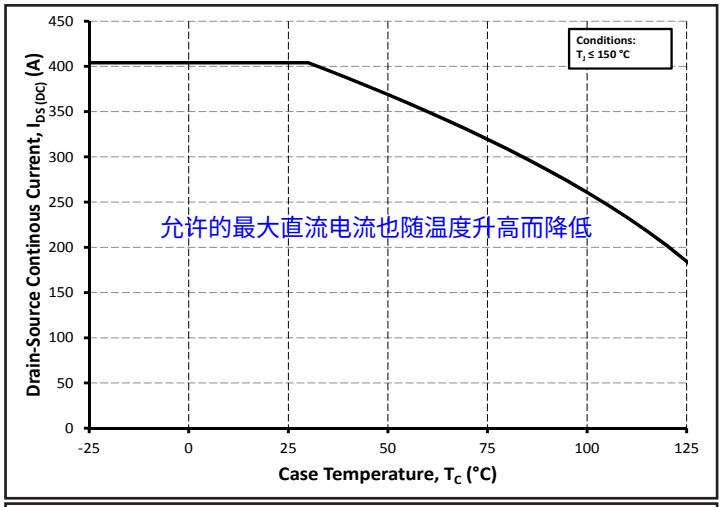


Figure 24. Continous Drain Current Derating vs Case Temperature

Typical Performance

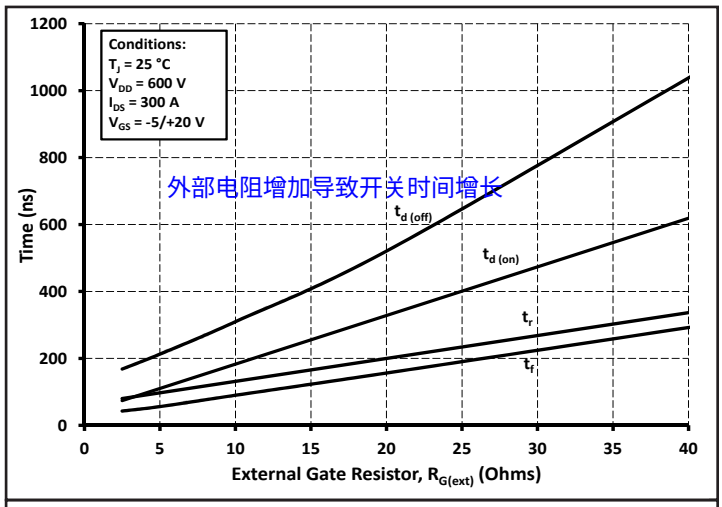


Figure 25. Timing vs. $R_{G(ext)}$

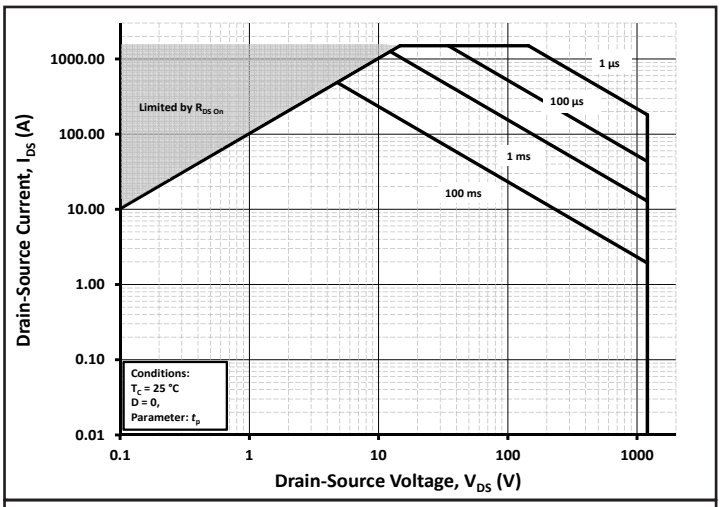


Figure 26. Continous Drain Current Derating vs Case Temperature

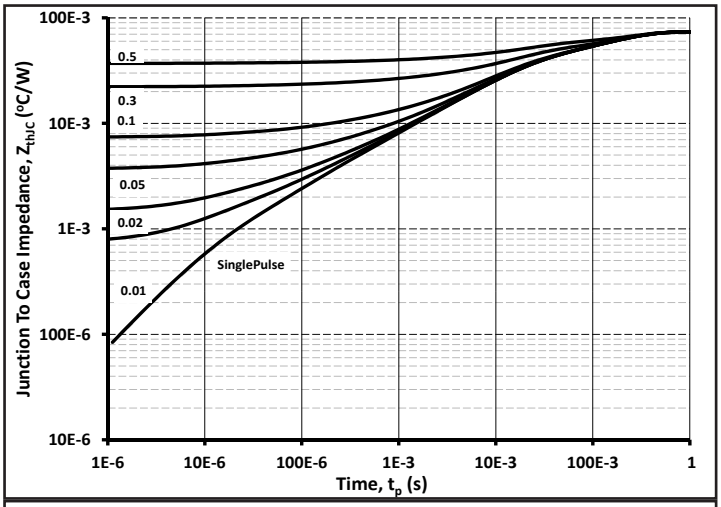


Figure 27. MOSFET Junction to Case Thermal Impedance

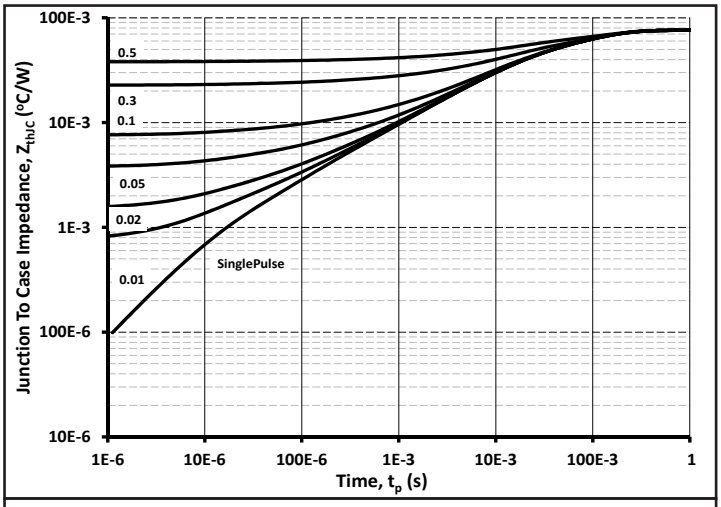
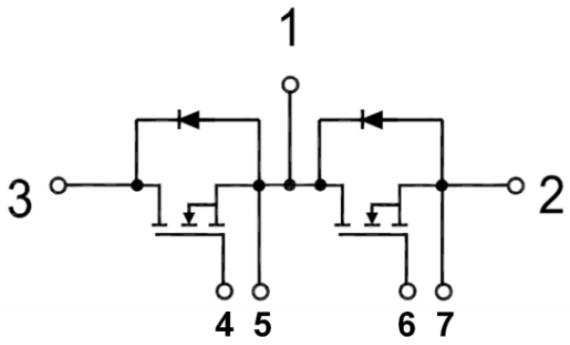
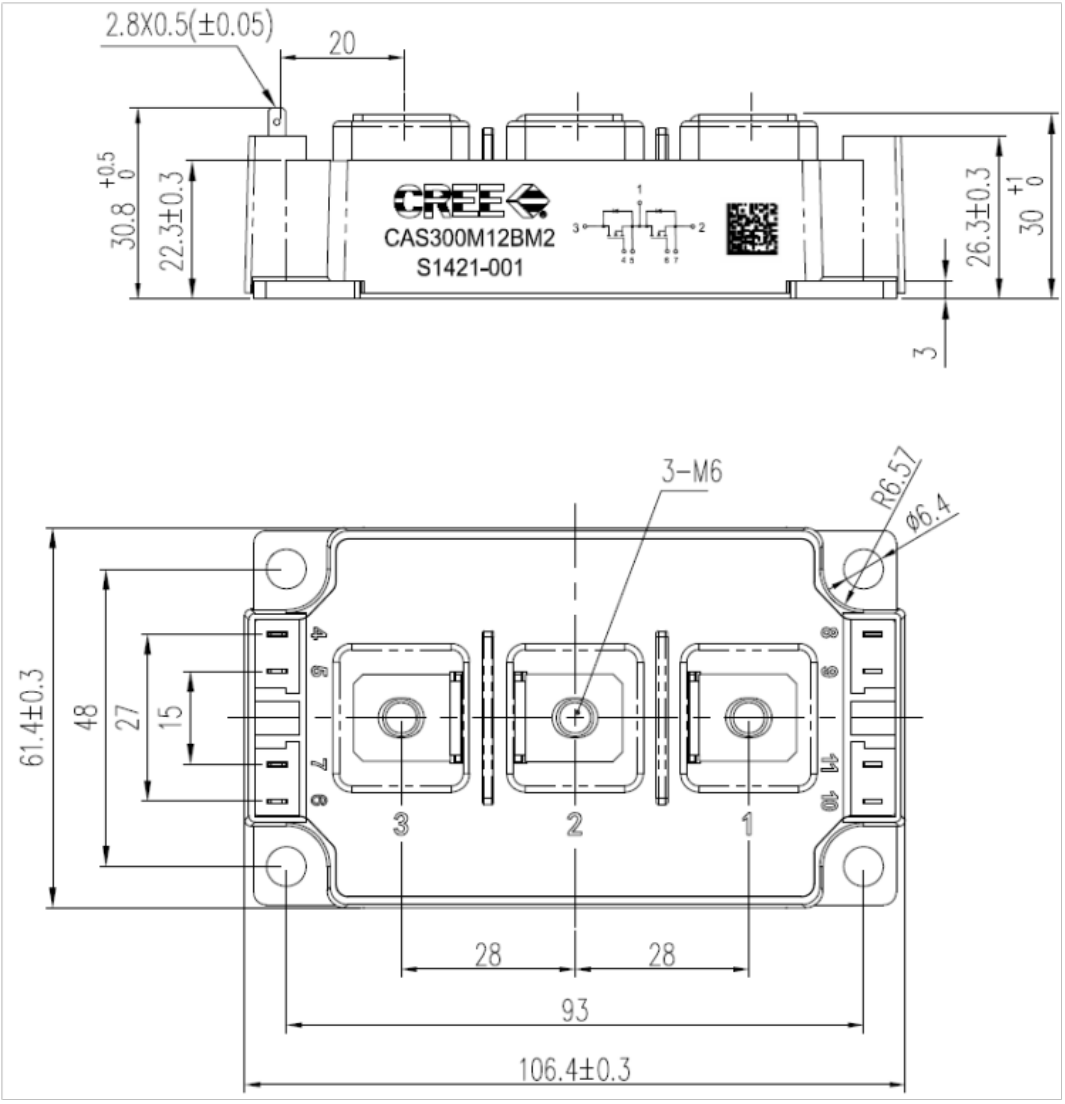


Figure 28. Diode Junction to Case Thermal Impedance

Schematic



Package Dimensions (mm)



Notes

- **RoHS Compliance**
  The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree representative or from the Product Documentation sections of www.cree.com.

- **REACh Compliance**
  REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future,please contact a Cree representative to insure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

- This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, air traffic control systems.

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