

关键参数		Key Parameters	
V_{DS}		3300	V
$R_{DS(on)}$	Typ.	2.00	mΩ
I_D	Max.	1000	A
I_{DM}	Max.	2000	A

典型应用	Typical Applications
● 牵引传动	Traction Drives
● 电机控制	Motor Controllers
● 智能电网	Smart Grid
● 高可靠性逆变器	High Reliability Inverters

特点	Features
● AlSiC 基板	AlSiC Baseplate
● AlN 衬板	AlN Substrates
● 低开关损耗	Low Switching Losses
● 低感设计	Low Inductive Design

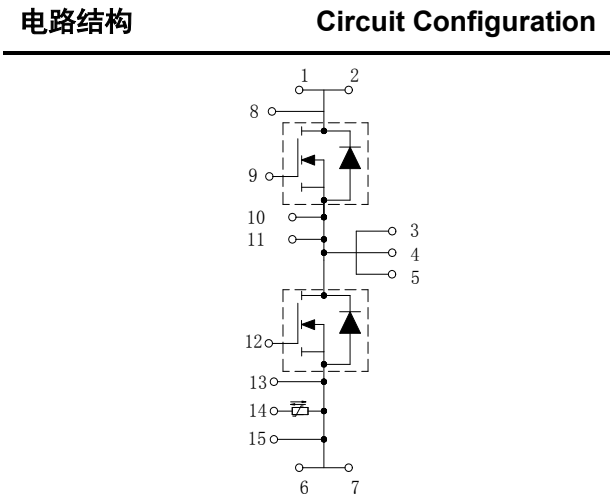


图 1. 电路结构

Fig. 1 Circuit configuration

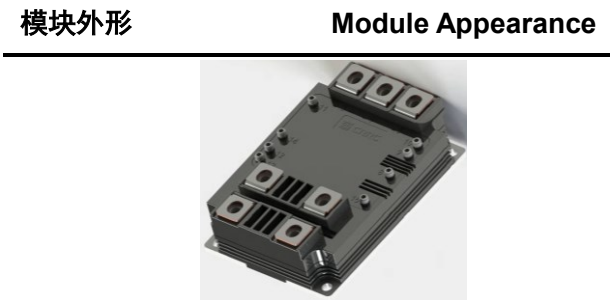


图 2. 模块外形

Fig. 2 Module appearance

模块标签说明	Module Label Code Instruction	
	数据位置 Data position	数据内容 Content of data
	1--8	模块批次号 Module batch number
	9--12	模块序列号 Module serial number

最大额定值

Absolute Maximum Ratings

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	数值 Value	单位 Unit
V_{DS}	漏源极电压 Drain-source voltage	$V_{GS} = 0V, T_C = 25\text{ }^{\circ}\text{C}$	3300	V
V_{GS}	栅源峰值电压 Gate-source voltage	$T_C = 25\text{ }^{\circ}\text{C}$	-10/+20	V
V_{GSOP}	栅源电压 Gate-source voltage		-5/+15	V
I_D	直流漏极电流 DC drain current	$T_C = 75\text{ }^{\circ}\text{C}, T_{vj\text{ max}} = 175\text{ }^{\circ}\text{C}$	1000	A
I_{DM}	漏极峰值电流 Peak drain current	$t_P = 1\text{ms}$	2000	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_C = 25\text{ }^{\circ}\text{C}, T_{vj\text{ max}} = 175\text{ }^{\circ}\text{C}$	6.33	KW
V_{isol}	绝缘电压(模块) Isolation voltage – per module	短接所有端子，端子与基板间施加电压 (Connected terminals to baseplate), AC RMS, 1 min, 50Hz, $T_C = 25\text{ }^{\circ}\text{C}$	6000	V
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. $V_1 = 3500V, V_2 = 2600V, 50\text{Hz RMS}$	10	pC

热和机械数据

Thermal & Mechanical Data

参数 Symbol	说明 Explanation	值 Value	单位 Unit
爬电距离 Creepage distance	端子-散热器 Terminal to heatsink	38	mm
	端子-端子 Terminal to terminal	30	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	32	mm
	端子-端子 Terminal to terminal	9.5	mm
相对漏电起痕指数 CTI (Comparative tracking index)		>600	

热和机械数据

Thermal & Mechanical Data

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$R_{th(J-C) MOSFET}$	MOSFET 热阻 Thermal resistance – MOSFET			23.7		K / kW
$R_{th(C-H)}$	接触热阻(模块) Thermal resistance – case to heatsink (per module)	安装力矩 5Nm, 导热脂 1W/m·K Mounting torque 5Nm, with mounting grease 1W/m·K		27.5		K / kW
$T_{vj op}$	工作结温 Operating junction temperature		-40		175	°C
T_{stg}	存储温度 Storage temperature range		-40		175	°C
M	安装力矩 Screw torque	安装紧固用 – M6 Mounting – M6	3		6	Nm
		电路互连用 – M8 Electrical connections – M8	5		7	Nm
		电路互连用 – M3 Electrical connections – M3	0.9		1.1	Nm

电特性值

Electrical Characteristics

除非特别声明，否则 $T_C = 25\text{ }^{\circ}\text{C}$

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
I_{DSS}	零栅压漏极电流 Zero gate voltage drain current	$V_{GS} = 0V, V_{DS} = V_{DSS}$			1.6	mA
		$V_{GS} = 0V, V_{DS} = V_{DSS}, T_{vj} = 150\text{ }^{\circ}\text{C}$			3.2	mA
		$V_{GS} = 0V, V_{DS} = V_{DSS}, T_{vj} = 175\text{ }^{\circ}\text{C}$			5.0	mA
I_{GSS}	栅极漏电流 Gate leakage current	$V_{GS} = -10/+20V, V_{DS} = 0V$			3.2	μA
$V_{GS(th)}$	栅极-源极阈值电压 Gate threshold voltage	$I_D = 80\text{mA}, V_{DS} = 10V$	2.4	3.0	3.6	V
$R_{DS(on)}^{(*1)}$	漏极-源极通态电阻 Drain-source on-state resistance	$V_{GS} = 15V, I_D = 1000A$		2.00		m Ω
		$V_{GS} = 15V, I_D = 1000A, T_{vj} = 150\text{ }^{\circ}\text{C}$		3.56		m Ω
		$V_{GS} = 15V, I_D = 1000A, T_{vj} = 175\text{ }^{\circ}\text{C}$		3.96		m Ω
g_{fs}	跨导 Forward transconductance	$V_{DS} = 20V, I_D = 1000A$		352		S
$V_{SD}^{(*1)}$	二极管正向电压 Diode forward voltage	$I_{SD} = 1000A, V_{GS}^{(*2)} = -5V$		5.80		V
		$I_{SD} = 1000A, V_{GS} = -5V, T_{vj} = 150\text{ }^{\circ}\text{C}$		5.20		V
		$I_{SD} = 1000A, V_{GS} = -5V, T_{vj} = 175\text{ }^{\circ}\text{C}$		5.10		V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 175\text{ }^{\circ}\text{C}, V_{DD} = 2000V,$ $V_{GS} \leq 15V, t_p \leq 3\mu\text{s}, R_{G(ON)} = 2.4\Omega,$ $V_{DS(max)} = V_{DSS} - L^{(*3)} \times di/dt,$ IEC 60747-8		9000		A

注意:
Note:

- (*1) 表示该参数的测试点为辅助母排端子 (*1) indicates it is measured at the auxiliary busbar terminal),
- (*2) 图 14 中也提供了 V_{GS} 为 15V 条件下的 V_{SD} . (*2) V_{SD} with $V_{GS}=15V$ is also provided in figure 14.)
- (*3)表示 L 是电路杂散电感加上 L_{sDS} (*3) indicates L is the circuit stray inductance plus L_{sDS}).

电特性值

Electrical Characteristics

除非特别声明，否则 $T_C = 25\text{ }^{\circ}\text{C}$ $T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{iss}	输入电容 Input capacitance	$V_{DS} = 10V, V_{GS} = 0V,$ $f = 50kHz$		216		nF
Q_g	栅极电荷 Gate charge	$V_{DS} = 2000V, I_D = 1000A,$ $V_{GS} = -5/+15V$		7.16		μC
C_{rss}	反向传输电容 Reverse transfer capacitance	$V_{DS} = 10V, V_{GS} = 0V,$ $f = 50kHz$		0.71		nF
L_{sDS}	模块电感 Module inductance			12		nH
$R_{DD'+SS'}$	模块引线电阻，端子-芯片 Module lead resistance, terminal-chip			0.4		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor	$V_{GS} = 0V$		1.9		Ω

电特性值
Electrical Characteristics

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions		最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_D = 1000A$, $V_{DS} = 2000V$, $V_{GS} = -5/+15V$, $R_{G(OFF)} = 4.7\Omega$, $L_S = 60nH$, $dv/dt = 9364V/\mu s$ ($T_{vj} = 175\text{ }^{\circ}C$).	$T_{vj} = 25\text{ }^{\circ}C$		1173		ns
			$T_{vj} = 150\text{ }^{\circ}C$		1621		
			$T_{vj} = 175\text{ }^{\circ}C$		1702		
t_f	下降时间 Fall time		$T_{vj} = 25\text{ }^{\circ}C$		257		ns
			$T_{vj} = 150\text{ }^{\circ}C$		352		
			$T_{vj} = 175\text{ }^{\circ}C$		370		
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25\text{ }^{\circ}C$		480		mJ
			$T_{vj} = 150\text{ }^{\circ}C$		560		
			$T_{vj} = 175\text{ }^{\circ}C$		568		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$T_{vj} = 25\text{ }^{\circ}C$		1122		ns	
		$T_{vj} = 150\text{ }^{\circ}C$		783			
		$T_{vj} = 175\text{ }^{\circ}C$		767			
t_r	上升时间 Rise time	$T_{vj} = 25\text{ }^{\circ}C$		626		ns	
		$T_{vj} = 150\text{ }^{\circ}C$		414			
		$T_{vj} = 175\text{ }^{\circ}C$		389			
E_{ON}	开通损耗 Turn-on energy loss	$T_{vj} = 25\text{ }^{\circ}C$		1186		mJ	
		$T_{vj} = 150\text{ }^{\circ}C$		808			
		$T_{vj} = 175\text{ }^{\circ}C$		790			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25\text{ }^{\circ}C$		10		μC	
		$T_{vj} = 150\text{ }^{\circ}C$		51			
		$T_{vj} = 175\text{ }^{\circ}C$		66			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25\text{ }^{\circ}C$		150		A	
		$T_{vj} = 150\text{ }^{\circ}C$		265			
		$T_{vj} = 175\text{ }^{\circ}C$		309			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25\text{ }^{\circ}C$		3		mJ	
		$T_{vj} = 150\text{ }^{\circ}C$		40			
		$T_{vj} = 175\text{ }^{\circ}C$		54			

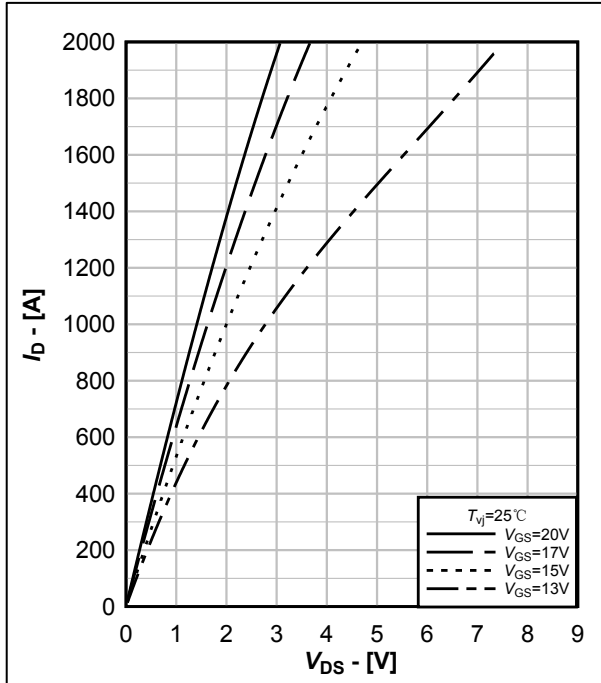


图 3. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

Fig.3 Typical MOSFET output characteristics, $I_D = f(V_{DS})$

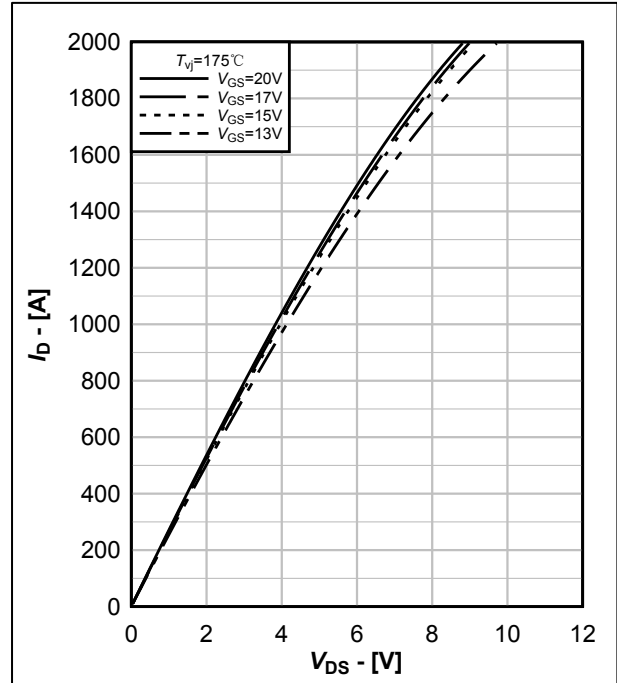


图 4. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

Fig.4 Typical MOSFET output characteristics, $I_D = f(V_{DS})$

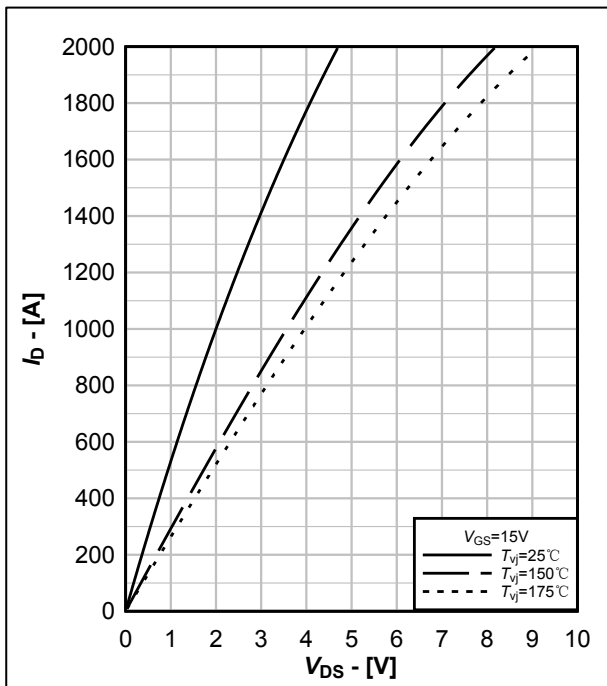


图 5. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

Fig.5 Typical MOSFET output characteristics, $I_D = f(V_{DS})$

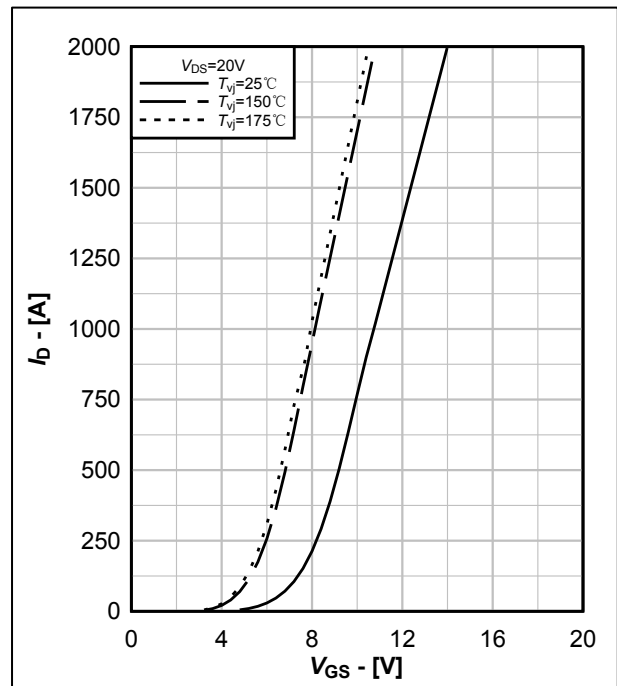


图 6. MOSFET 传输特性典型曲线, $I_D = f(V_{GS})$

Fig.6 Typical MOSFET transfer characteristics, $I_D = f(V_{GS})$

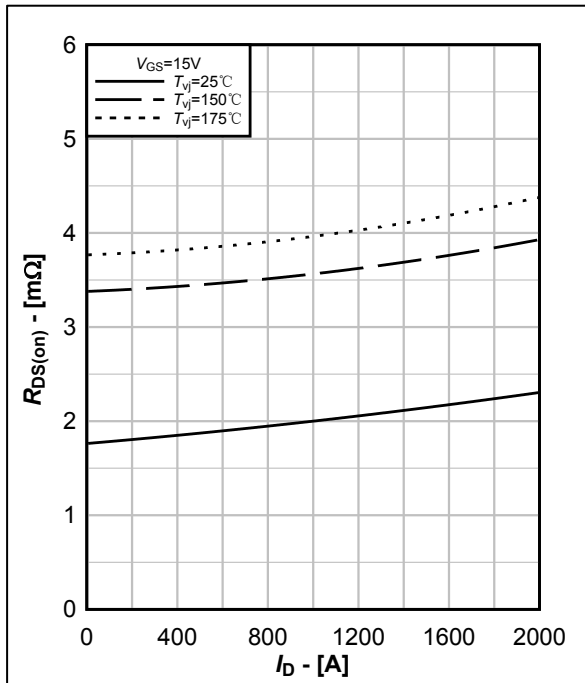


图 7. 导通电阻典型曲线, $R_{DS(on)} = f(I_D)$

Fig.7 Typical On-Resistance characteristics, $R_{DS(on)} = f(I_D)$

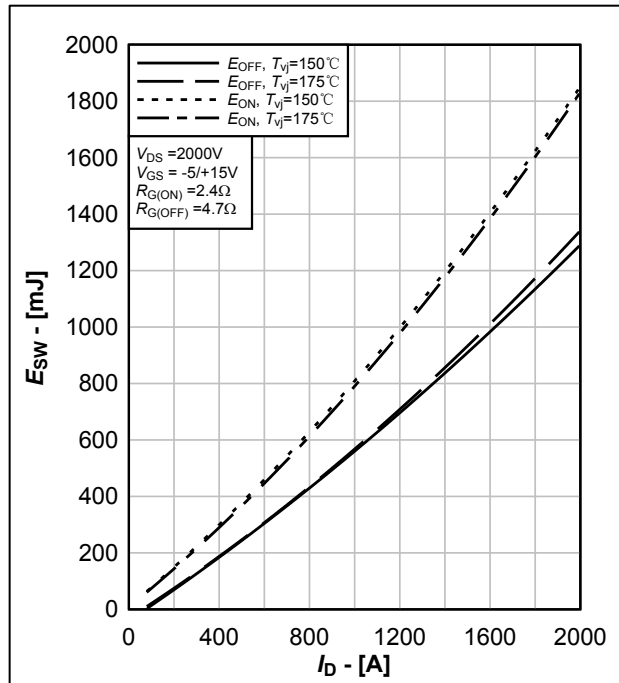


图 8. MOSFET 开关损耗典型曲线, $E_{on} = f(I_D)$, $E_{off} = f(I_D)$

Fig.8 Typical MOSFET switching energy, $E_{on} = f(I_D)$, $E_{off} = f(I_D)$

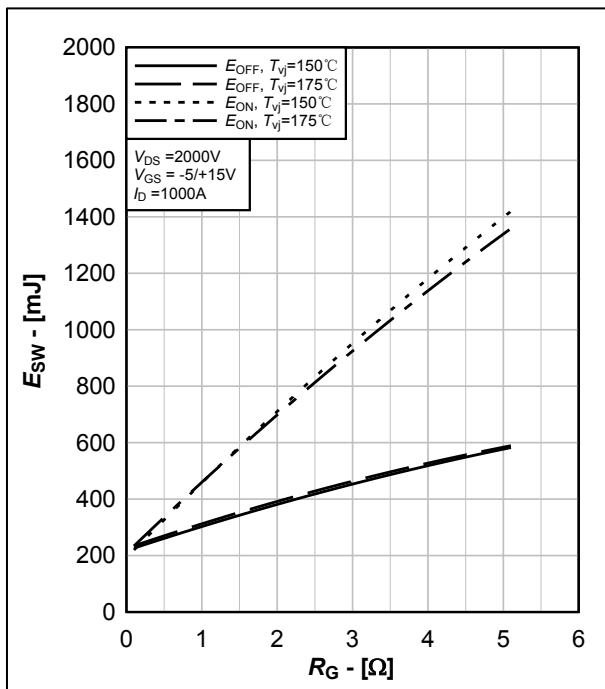


图 9. MOSFET 开关损耗典型曲线, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

Fig.9 Typical MOSFET switching energy, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

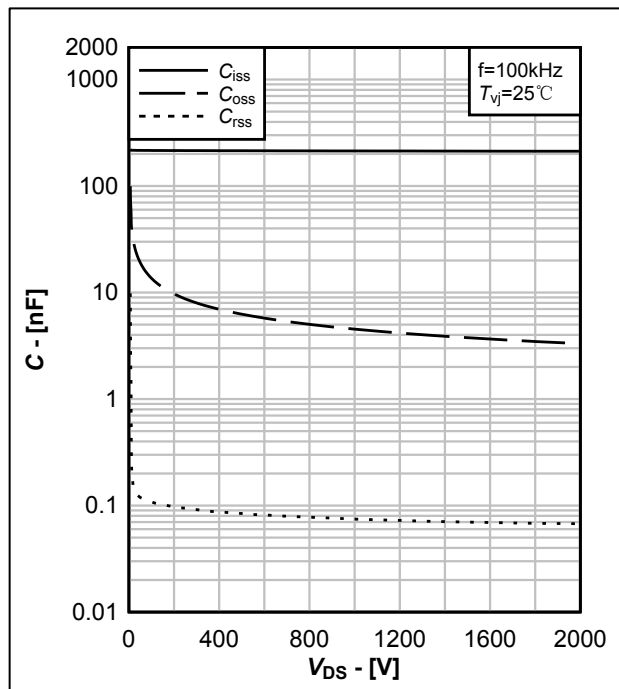


图 10. 电容特性典型曲线, $C = f(V_{DS})$

Fig.10 Typical capacity characteristic, $C = f(V_{DS})$

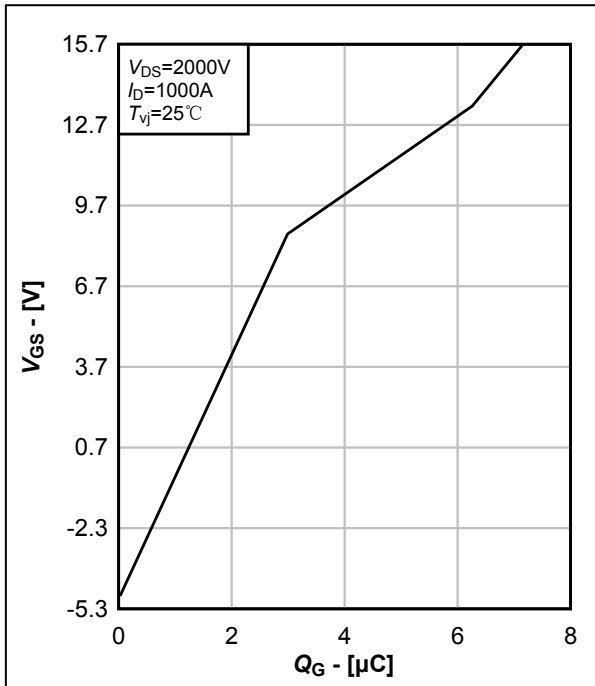


图 11. 栅极电荷特性典型曲线, $V_{GS} = f(Q_G)$

Fig.11 Typical gate charge characteristic, $V_{GS} = f(Q_G)$

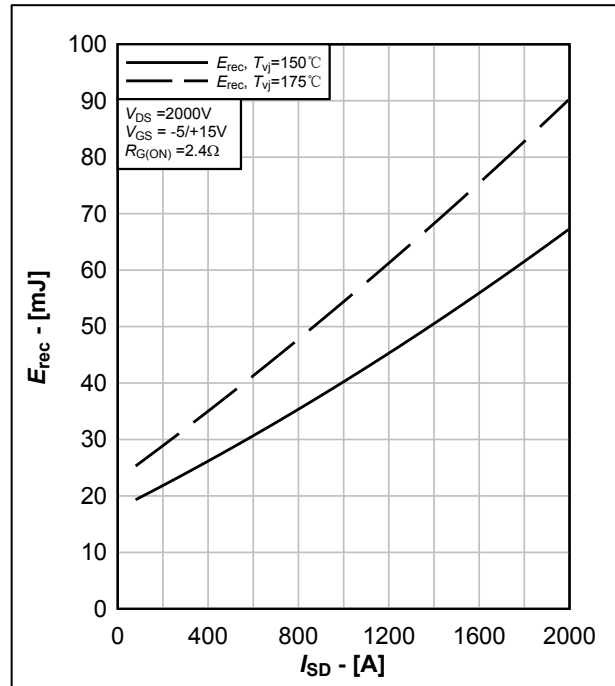


图 12. 体二极管反向恢复损耗典型曲线, $E_{rec} = f(I_{SD})$

Fig.12 Typical body diode switching loss E_{rec} , $E_{rec} = f(I_{SD})$

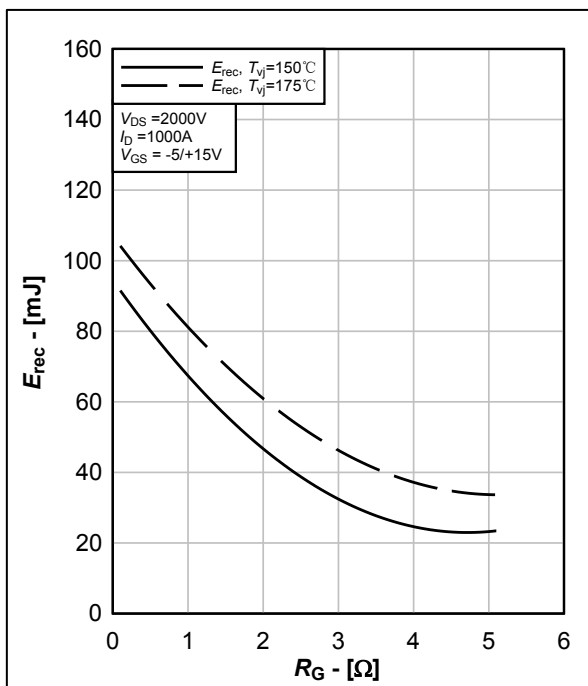


图 13. 体二极管反向恢复损耗典型曲线, $E_{rec} = f(R_G)$

Fig.13 Typical body diode switching loss E_{rec} , $E_{rec} = f(R_G)$

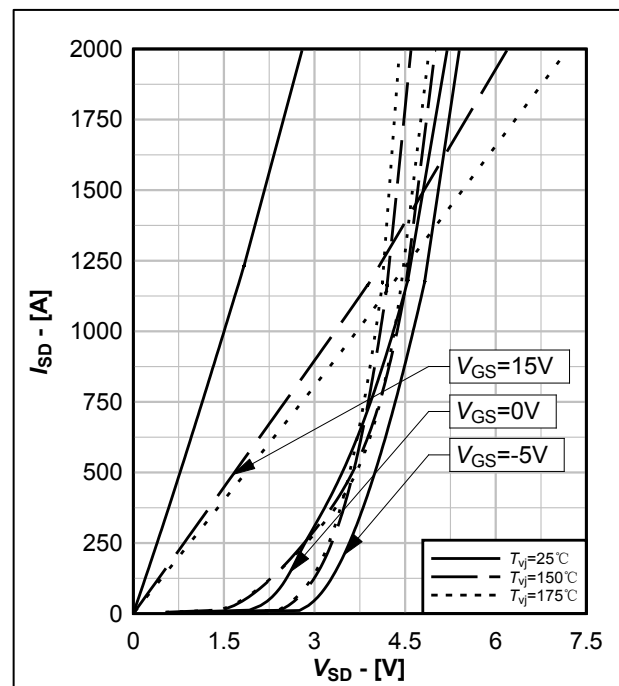


图 14. 体二极管及第三象限输出特性典型曲线, $I_{SD} = f(V_{SD})$

Fig.14 Typical body diode output and 3rd quadrant characteristic,
 $I_{SD} = f(V_{SD})$

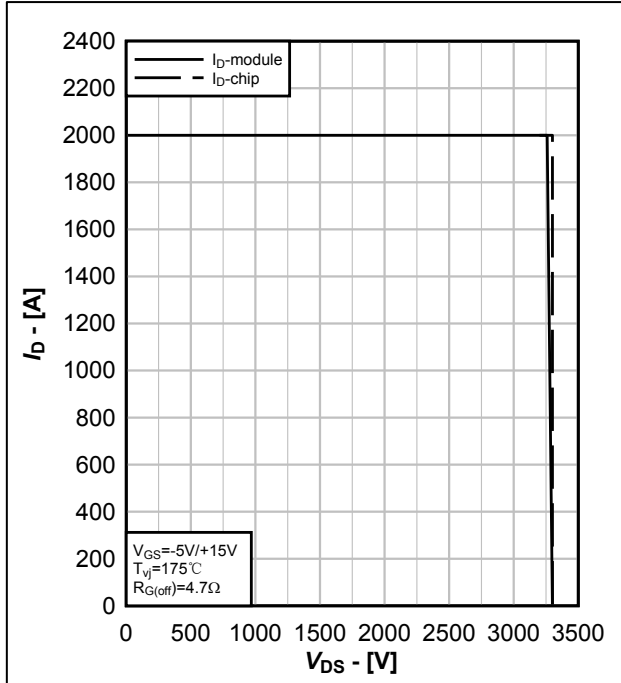


图 15. MOSFET 反偏安全工作区, $I_D = f(V_{DS})$

Fig.15 Reverse bias safe operating area of MOSFET, $I_D = f(V_{DS})$

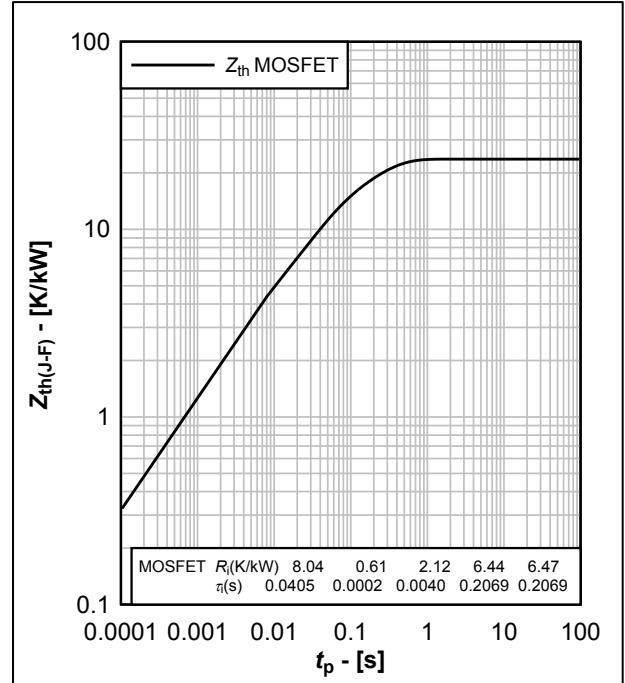
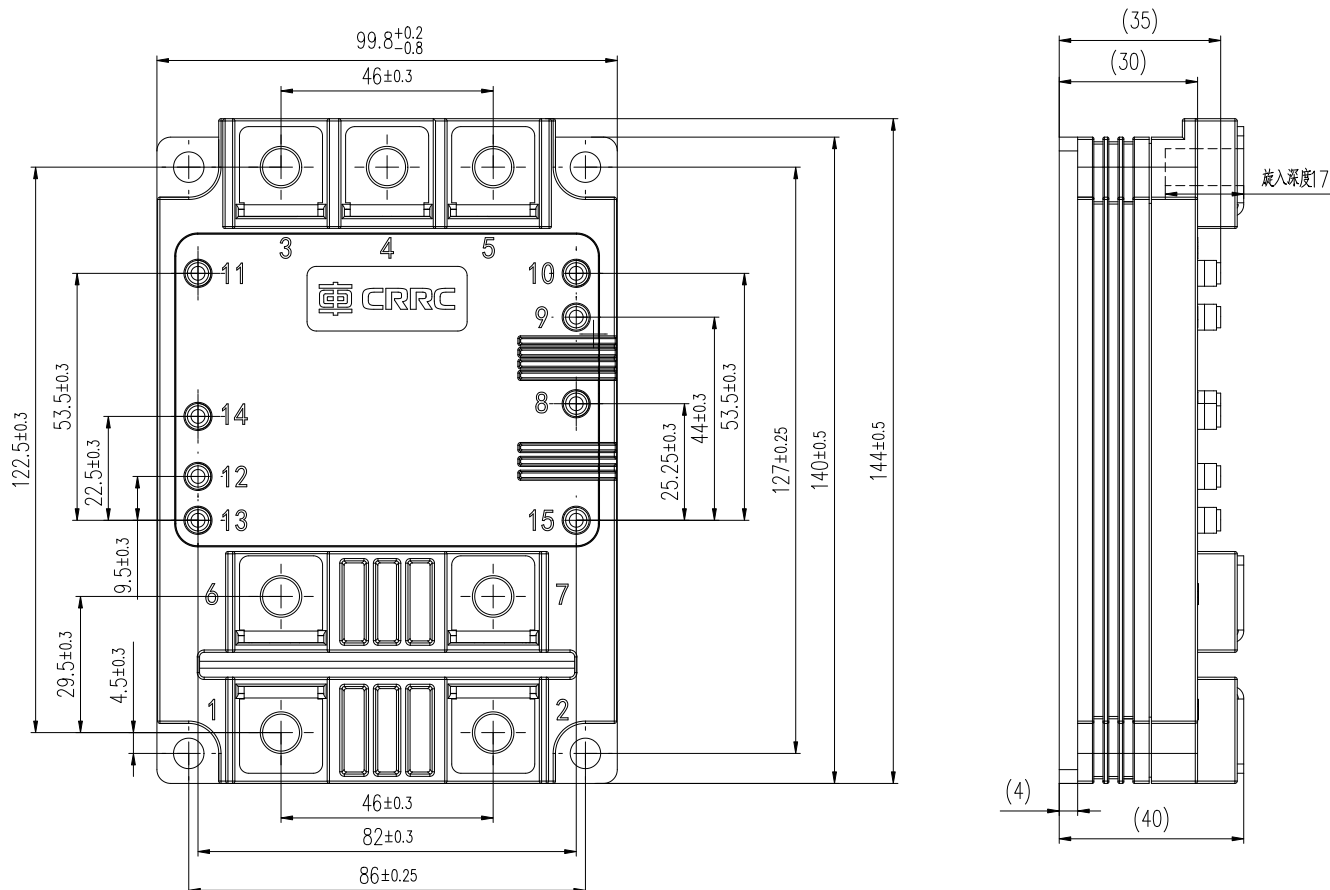


图 16. 瞬态热阻抗曲线, $Z_{th(J-F)} = f(t_p)$

Fig.16 Transient thermal impedance, $Z_{th(J-F)} = f(t_p)$



重量 Weight: 800g 模块外观类型 Module outline code: X2

图 17. 模块外观尺寸

Fig. 17 Module outlines

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