

关键参数 Key Parameters

V_{DS}		1200	V
$R_{DS(on)}$	Typ.	2.07	mΩ
I_D	Max.	540	A
I_{DM}	Max.	1080	A

典型应用 Typical Applications

- 电动汽车 Automotive Applications
- 混合动力/纯电动车 Hybrid/Electrical Vehicles
- 电机驱动 Motor Drives

特点 Features

- 铜针翅基板 Cu Pin-fin Baseplate
- 低开关损耗 Low Switching Losses
- 低反向恢复损耗 Low Reverse Recovery Loss
- 低感设计 Low Inductive Design
- Si_3N_4 衬板 Si_3N_4 AMB Substrate

电路结构 Circuit Configuration

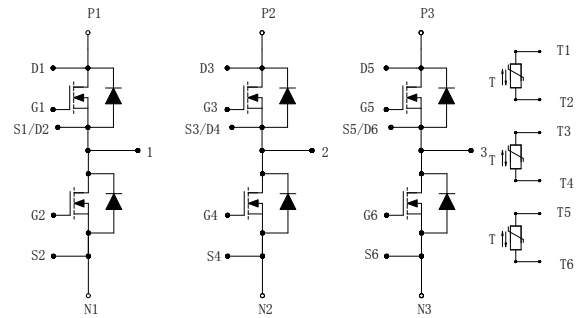


图 1. 电路结构

Fig. 1 Circuit configuration

模块外形 Module Appearance

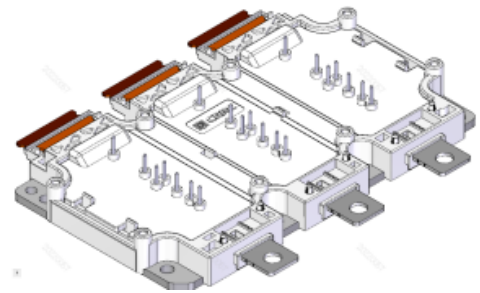


图 2. 模块外形

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	$V_{GS} = 0V, T_C = 25^\circ C$	1200	V
V_{GSmax}	栅源电压 Gate-source voltage	$T_C = 25^\circ C$	-8/+23	V
V_{GSop}	栅源电压 Gate-source voltage	$T_C = 25^\circ C$	-4/+18	V
I_D	额定漏极电流 Rating drain current	$T_F = 65^\circ C, T_{vj\ max} = 175^\circ C$	540	A
I_{DM}	漏极峰值电流 Peak drain current	$t_p = 1ms$	1080	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_F = 65^\circ C, T_{vj\ max} = 175^\circ C$	1068	W
I^2t	二极管 I^2t 值 Diode I^2t	$V_R = 0V, t_p = 10ms, T_{vj} = 175^\circ C$	TBD	kA^2s
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), RMS, $f = 0\ Hz, t = 1\ sec, T_C = 25^\circ C$	4200	V

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	8.5	mm
	端子-端子 Terminal to terminal	6.5	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	4.5	mm
	端子-端子 Terminal to terminal	4.5	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
$R_{th(J-F)}$ MOSFET	MOSFET 热阻 Thermal resistance -MOSFET	冷却液: 50%乙二醇溶液; $\Delta V/\Delta t=10\text{ dm}^3/\text{min}$; $T_F = 65\text{ }^\circ\text{C}$ Cooling Fluid: 50% water / 50% ethylene glycol; $\Delta V/\Delta t=10\text{ dm}^3/\text{min}$; $T_F = 65\text{ }^\circ\text{C}$		103	113	K / kW
ΔP	冷却液流阻 Pressure drop in cooling circuit	冷却液: 50%乙二醇溶液; $\Delta V/\Delta t=10\text{ dm}^3/\text{min}$; $T_F = 25\text{ }^\circ\text{C}$ Cooling Fluid: 50% water / 50% ethylenglycol; $\Delta V/\Delta t=10\text{ dm}^3/\text{min}$; $T_F = 25\text{ }^\circ\text{C}$		50		mbar
P	冷却液最大压力 Maximum pressure in cooling circuit				2.5	bar
$T_{vj\text{ op}}$	工作结温 Operating junction temperature		-40		175	$^\circ\text{C}$
T_{stg}	存储温度 Storage temperature range		-40		125	$^\circ\text{C}$
M	安装力矩 Screw torque	电路互连用- M4 Electrical connections - M5	1.8	2.0	2.2	Nm
		PCB 安装用 PCB Mounting	0.80	0.85	0.90	Nm

热敏电阻数据

NTC-Thermistor 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_{25}	额定电阻值 Rated resistance	$T_C = 25\text{ }^\circ\text{C}$		5		k Ω
$\Delta R/R$	R_{100} 偏差 Deviation of R_{100}	$T_C = 100\text{ }^\circ\text{C}$, $R_{100}=493\Omega$	-5		5	%
P_{25}	耗散功率 Power dissipation	$T_C = 25\text{ }^\circ\text{C}$			20	mW
$B_{25/50}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\text{ K}))]$		3375		K
$B_{25/80}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15\text{ K}))]$		3411		K
$B_{25/100}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\text{ K}))]$		3433		K

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	$V_{GS} = 0V, V_{DS} = V_{DSS}$			100	μA
		$V_{GS} = 0V, V_{DS} = V_{DSS}, T_{vj} = 150\text{ }^{\circ}\text{C}$			500	μA
		$V_{GS} = 0V, V_{DS} = V_{DSS}, T_{vj} = 175\text{ }^{\circ}\text{C}$			1000	μA
I_{GSS}	栅极漏电流 Gate leakage current	$V_{GS} = -8/+23V, V_{DS} = 0V$			500	nA
$V_{GS(th)}$	栅极-源极阈值电压 Gate threshold voltage	$I_D = 60mA, V_{GS} = V_{DS}$	2.2	2.8	3.4	V
$R_{DS(on)}^{(*1)}$	漏极-源极通态电阻 Drain-source on-state resistance	$V_{GS} = 18V, I_D = 540A$		2.07		m Ω
		$V_{GS} = 18V, I_D = 540A, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.55		m Ω
		$V_{GS} = 18V, I_D = 540A, T_{vj} = 175\text{ }^{\circ}\text{C}$		3.22		m Ω
g_{fs}	跨导 Forward transconductance	$V_{DS} = 20V, I_D = 540A$		412		S
$V_{SD}^{(*1)}$	二极管正向电压 Diode forward voltage	$I_{SD} = 540A, V_{GS} = -4V$		4.2		V
		$I_{SD} = 540A, V_{GS} = -4V, T_{vj} = 150\text{ }^{\circ}\text{C}$		4.0		V
		$I_{SD} = 540A, V_{GS} = -4V, T_{vj} = 175\text{ }^{\circ}\text{C}$		3.8		V
I_{SC}	短路电流 Short circuit current	$T_{vj} = 175\text{ }^{\circ}\text{C}, V_{DD} = 850V,$ $V_{GS} \leq 18V, t_p \leq TBD\mu s,$ $V_{DS(max)} = V_{DSS} - L^{(*2)} \times di/dt,$ IEC 60747-8		TBD		KA

注意: 1.(*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),

Note: 2.(*2) 表示 L 是电路杂散电感加上 L_{SDS} (*2) 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	$V_{DS} = 600V, V_{GS} = 0V,$ $f = 100kHz$		38		nF
Q_g	栅极电荷 Gate charge	-4/+18V		1.6		μC
C_{rss}	反向传输电容 Reverse transfer capacitance	$V_{DS} = 600V, V_{GS} = 0V, f$ $=100kHz$		0.09		nF
L_{sDS}	模块电感 Module inductance			7		nH
$R_{DD'+SS'}$	模块引线电阻，端子-芯片 Module lead resistance, terminal-chip			0.7		m Ω
R_{Gint}	内部栅极电阻 Internal gate resistor	$V_{GS}=0V$		1.7		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	$I_D = 700A$, $V_{DS} = 850V$, $V_{GS} = -4/+18V$, $R_{G(OFF)} = 6.3\Omega$, $L_S = 25nH$, $dv/dt = 19160V/\mu s$ ($T_{vj} = 175^\circ C$).	$T_{vj} = 25^\circ C$		194		ns
			$T_{vj} = 150^\circ C$		240		
			$T_{vj} = 175^\circ C$		252		
t_f	下降时间 Fall time		$T_{vj} = 25^\circ C$		80		ns
			$T_{vj} = 150^\circ C$		81		
			$T_{vj} = 175^\circ C$		81		
E_{OFF}	关断损耗 Turn-off energy loss		$T_{vj} = 25^\circ C$		28.34		mJ
			$T_{vj} = 150^\circ C$		29.12		
			$T_{vj} = 175^\circ C$		29.72		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	$T_{vj} = 25^\circ C$		118		ns	
		$T_{vj} = 150^\circ C$		96			
		$T_{vj} = 175^\circ C$		92			
t_r	上升时间 Rise time	$T_{vj} = 25^\circ C$		125		ns	
		$T_{vj} = 150^\circ C$		114			
		$T_{vj} = 175^\circ C$		108			
E_{ON}	开通损耗 Turn-on energy loss	$T_{vj} = 25^\circ C$		54.40		mJ	
		$T_{vj} = 150^\circ C$		60.60			
		$T_{vj} = 175^\circ C$		61.84			
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$T_{vj} = 25^\circ C$		2		μC	
		$T_{vj} = 150^\circ C$		8			
		$T_{vj} = 175^\circ C$		10			
I_{rr}	二极管反向恢复电流 Diode reverse recovery current	$T_{vj} = 25^\circ C$		111		A	
		$T_{vj} = 150^\circ C$		230			
		$T_{vj} = 175^\circ C$		251			
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy	$T_{vj} = 25^\circ C$		0.08		mJ	
		$T_{vj} = 150^\circ C$		0.68			
		$T_{vj} = 175^\circ C$		0.75			

注意: 1.(*) dv/dt : 定义为关断波形电压 V_{DS} 上升段, 40% V_{DS} 至 60% V_{DS} 区间段的斜率((*) dv/dt : Defined as the slope of waveform of 40% V_{DS} to 60% V_{DS} during turn off)
Note: 2.(*) di/dt : 定义为开通波形电流 I_D 上升段, 40% I_D 至 60% I_D 区间段的斜率((*) di/dt : Defined as the slope of waveform of 40% I_D to 60% I_D di/dt during turn on)

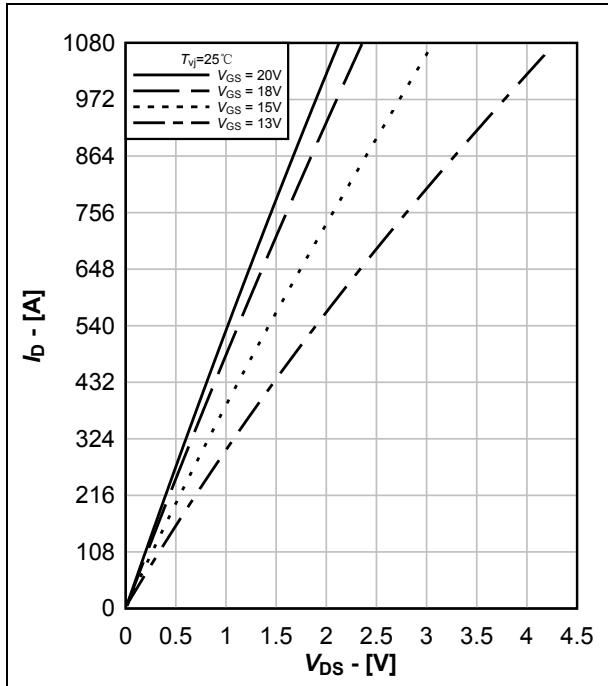


图 3. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

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

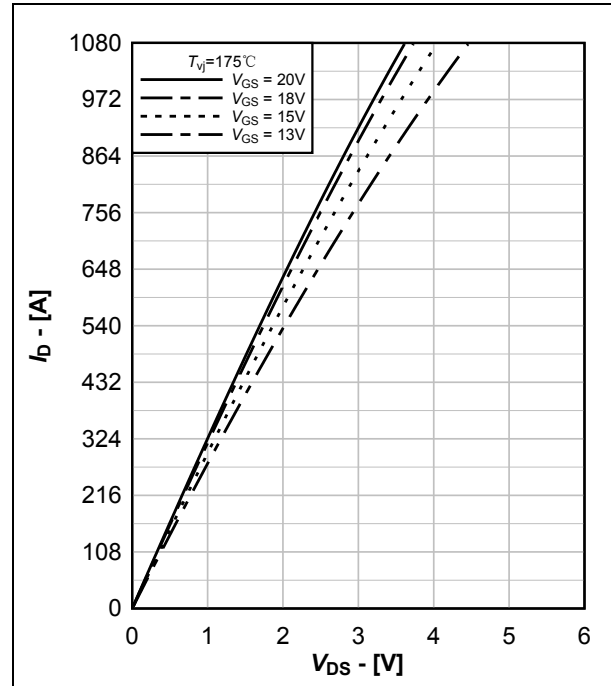


图 4. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

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

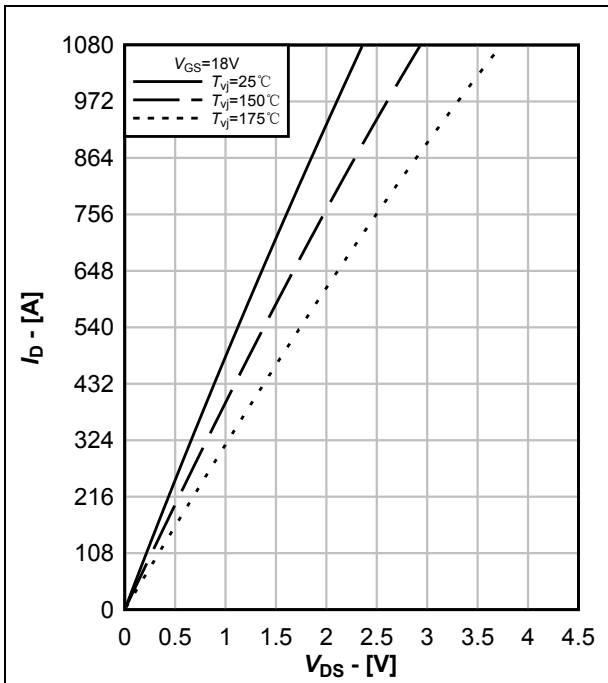


图 5. MOSFET 输出特性典型曲线, $I_D = f(V_{DS})$

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

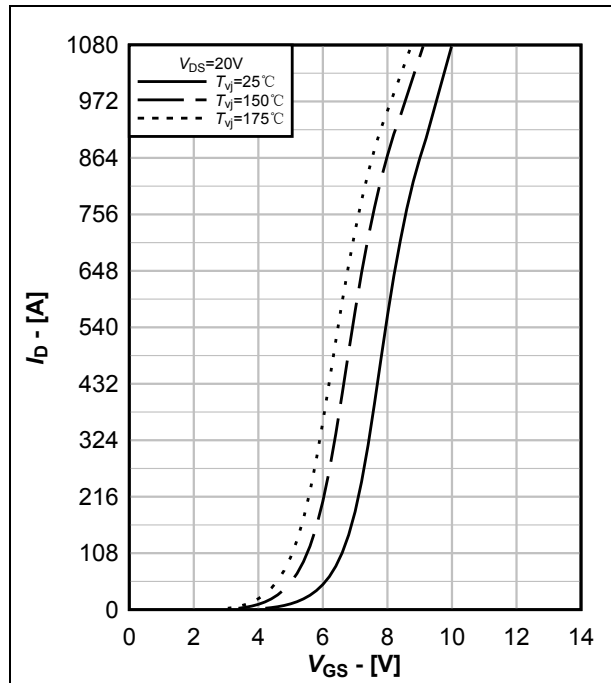


图 6. MOSFET 传输特性典型曲线, $I_D = f(V_{GS})$

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

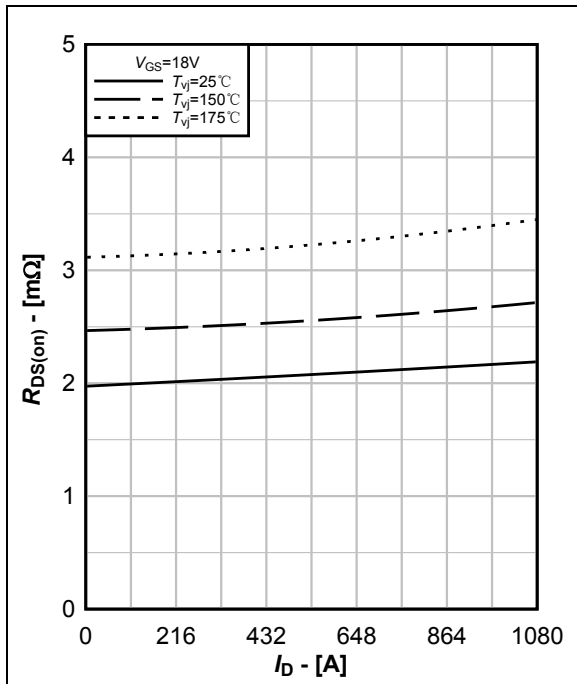

图 7. 导通电阻典型曲线, $R_{DS(on)} = f(I_D)$

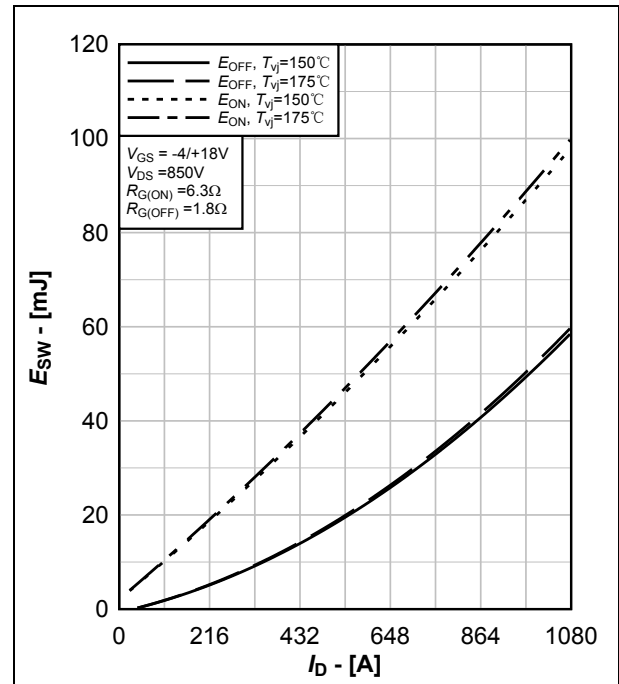
Fig.7 Typical On-Resistance characteristics, $R_{DS(on)} = f(I_D)$

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

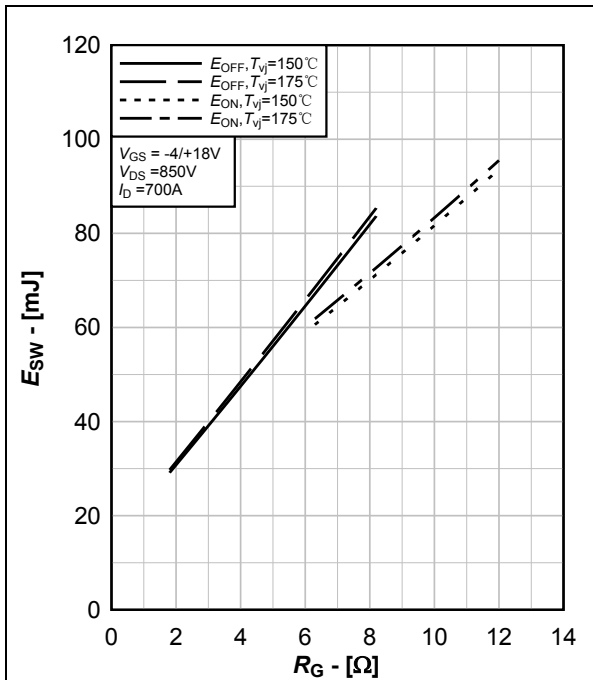
Fig.8 Typical MOSFET switching energy, $E_{on} = f(I_D)$, $E_{off} = f(I_D)$

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

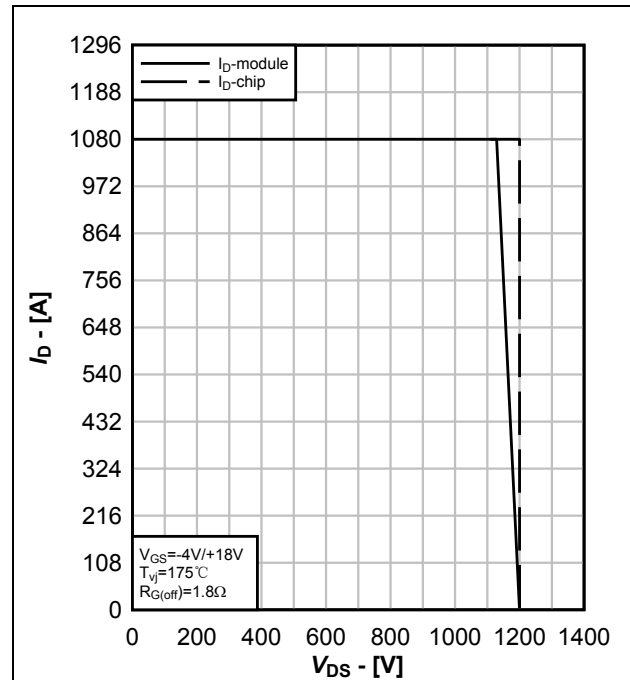
Fig.9 Typical MOSFET switching energy, $E_{on} = f(R_G)$, $E_{off} = f(R_G)$

图 10. MOSFET 反偏安全工作区, $I_D = f(V_{DS})$

Fig.10 Reverse bias safe operating area of MOSFET, $I_D = f(V_{DS})$

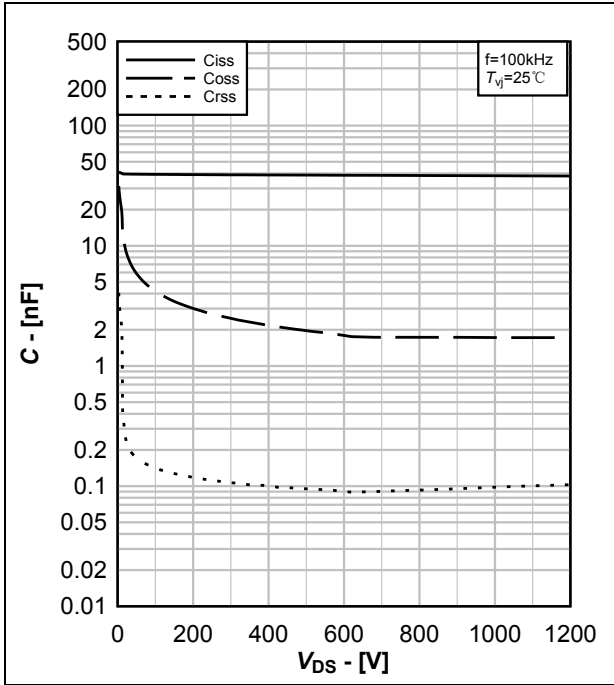


图 11. 电容特性典型曲线, $C = f(V_{DS})$

Fig.11 Typical capacity characteristic, $C = f(V_{DS})$

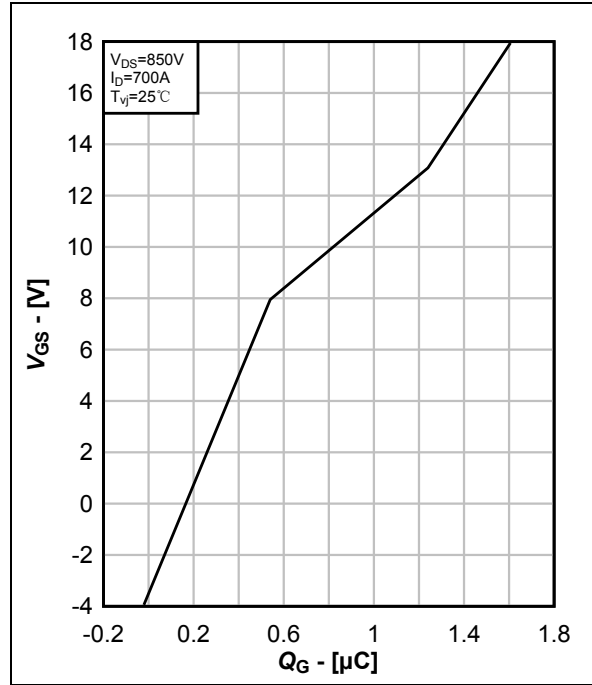


图 12. 栅极电荷特性典型曲线, $V_{GS} = f(Q_G)$

Fig.12 Typical gate charge characteristic, $V_{GS} = f(Q_G)$

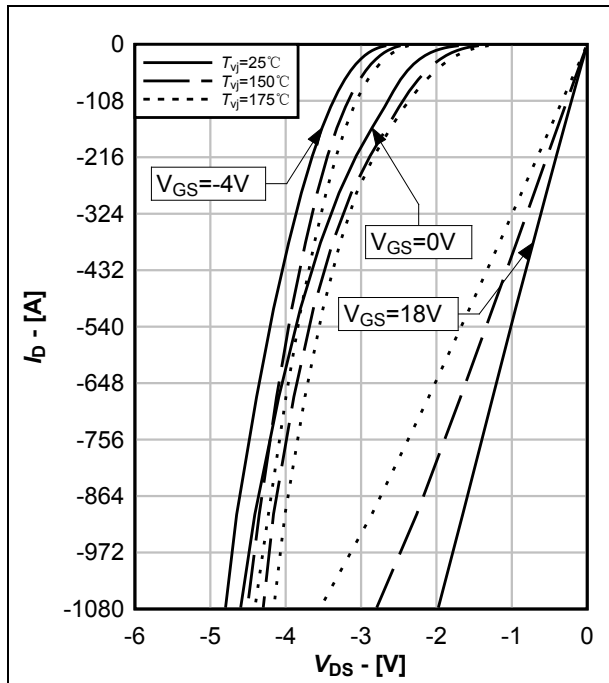


图 13. 体二极管及第三象限输出特性典型曲线, $I_D = f(V_{DS})$

Fig.13 Typical body diode output and 3rd quadrant characteristic,
 $I_D = f(V_{DS})$

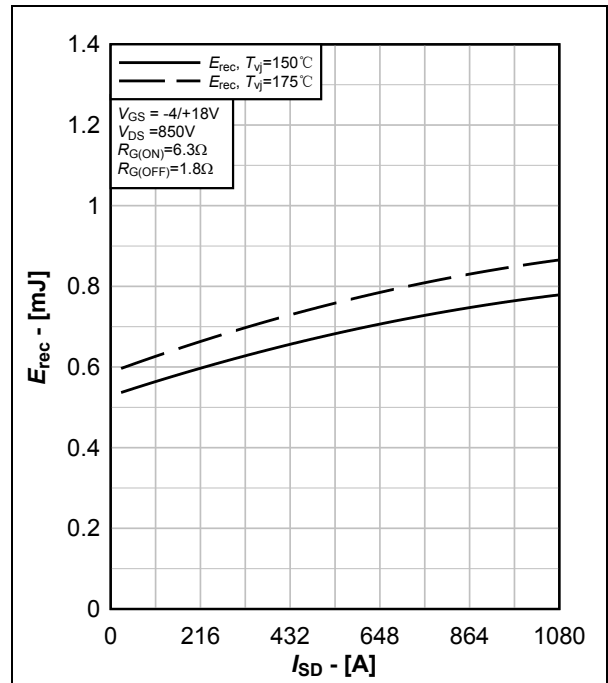


图 14. 体二极管反向恢复损耗典型曲线, $E_{rec} = f(I_{SD})$

Fig.14 Typical body diode switching loss E_{rec} , $E_{rec} = f(I_{SD})$

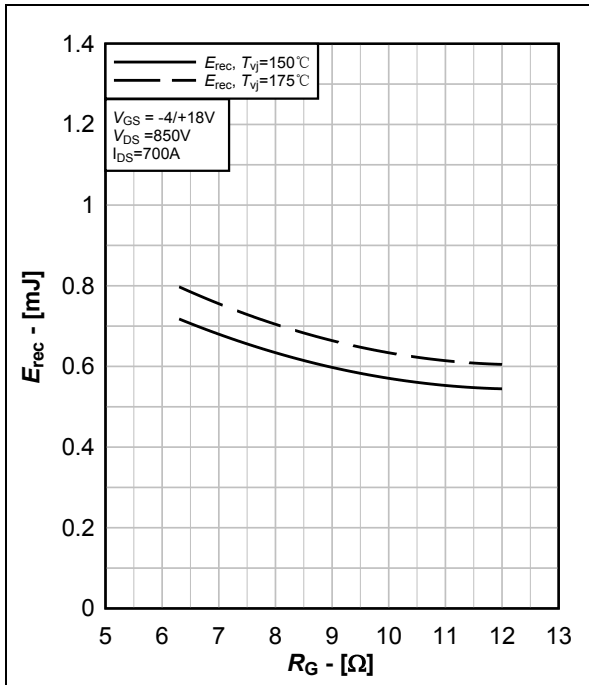


图 15. 体二极管反向恢复损耗典型曲线, $E_{rec}=f(R_G)$

Fig.15 Typical body diode switching loss E_{rec} , $E_{rec}=f(R_G)$

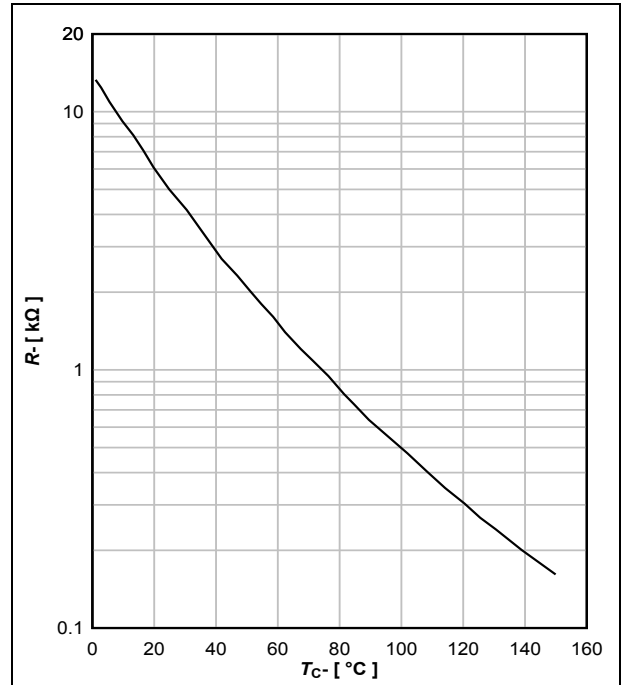


图 16. 热敏电阻典型特性曲线, $R=f(T_C)$

Fig.16 Typical NTC thermistor characteristic, $R=f(T_C)$

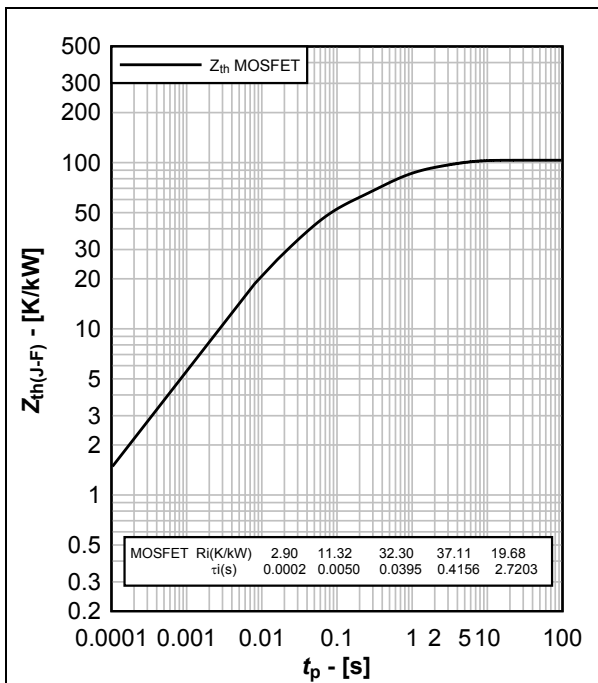
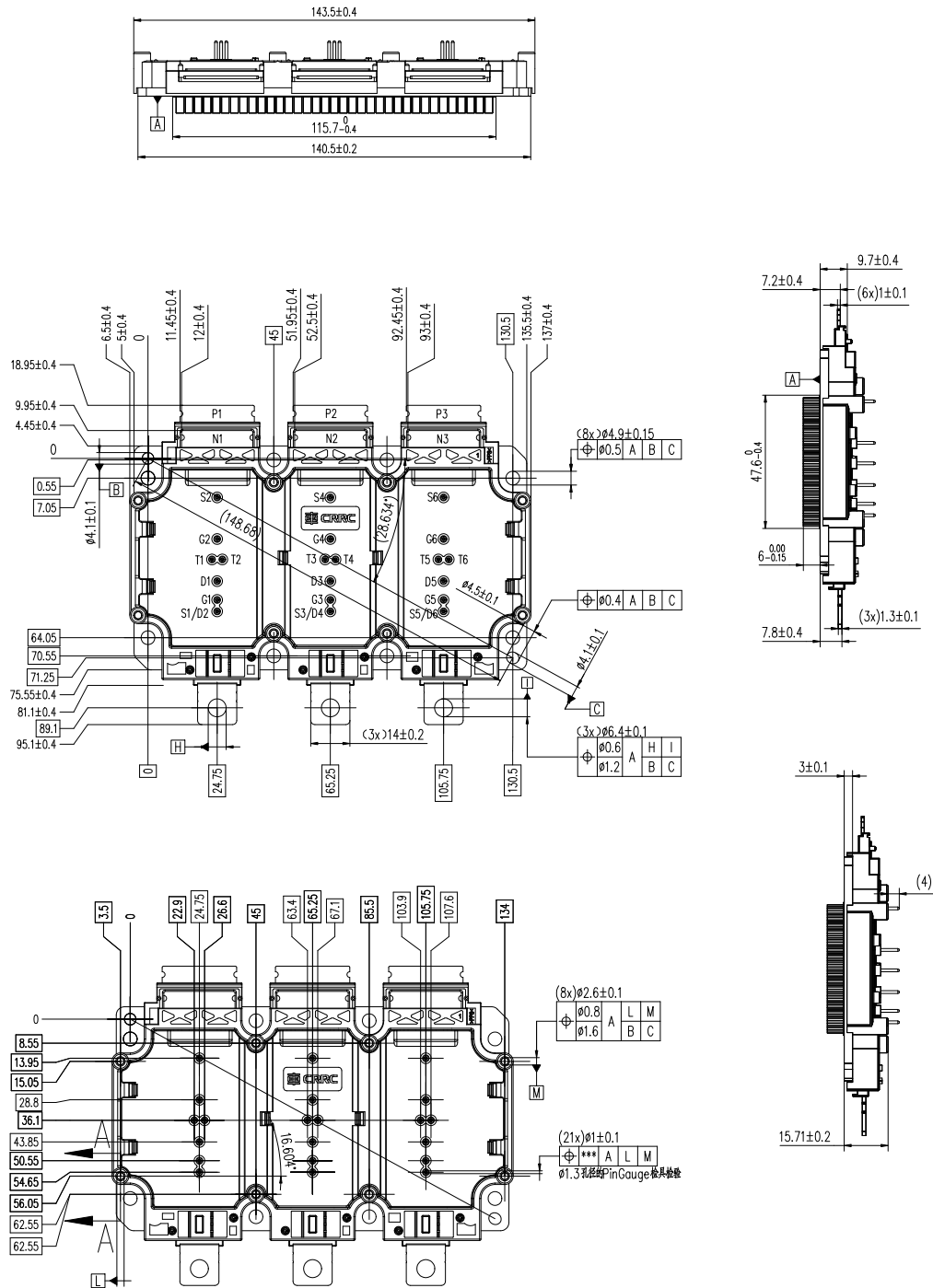


图 17. 瞬态热阻抗曲线, $Z_{th(J-F)}=f(t_p)$

Fig.17 Transient thermal impedance, $Z_{th(J-F)}=f(t_p)$



重量 Weight: 600g 模块外观类型 Module outline code: S7

图 18. 模块外观尺寸

Fig. 18 Module outlines

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

注意: 该器件对静电敏感, 用户须采取 ESD 防护措施。

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