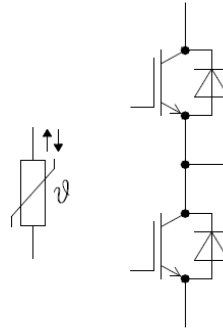


M series package: 1200V600A IGBT module

Datasheet



等效电路图

Equivalent Circuit Schematic

Features:

- 1200V 600A, $V_{CE(sat)} = 1.5\text{ V}@25^\circ\text{C}$
- MPT Gate Technology
- Low Losses
- High RBSOA capability
- Low reverse-recovery losses

产品特性:

- 1200V 600A, $V_{CE(sat)} = 1.5\text{ V}@25^\circ\text{C}$
- 微沟槽栅/场终止技术
- 低损耗
- 高 RBSOA 能力
- 低反向恢复损耗

Typical Applications:

- Motor Drives
- Solar Applications
- UPS Systems
- Energy Storage

典型应用:

- 电机驱动
- 光伏应用
- UPS 系统
- 储能

IGBT, Inverter / IGBT，逆变部分

Maximum Rated Values / 最大标称参数

Collector-emitter Voltage 集电极-发射极电压	$T_{vj}=25^{\circ}\text{C}$	V_{CES}	1200	V
Continuous DC collector current 集电极连续直流电流	$T_c=25^{\circ}\text{C}, T_{vjmax}\leq 175^{\circ}\text{C}$	$I_{C\ nom}$	600	A
	$T_c=100^{\circ}\text{C}, T_{vjmax}\leq 175^{\circ}\text{C}$	I_C	732	A
Repetitive Peak collector current 集电极可重复峰值电流	$t_p=1\text{ms}$	I_{CRM}	1200	A
Gate-emitter peak voltage 门极-发射极峰值电压		V_{GES}	± 20	V

Characteristic Values / 性能参数

			min.	typ.	max.	
Collector-emitter saturation Voltage ¹⁾ 集电极-发射极饱和压降	$I_C=600\text{A}, V_{GE}=15\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	V_{CESat}	1.40	1.50 1.77 1.79	1.70	V
Gate Threshold Voltage 门极阈值电压	$V_{CE}=V_{GE}, I_C=24\text{mA}, T_{vj}=25^{\circ}\text{C}$	V_{GEth}	5.0	6.0	7.0	V
Gate Charge 门极电荷	$V_{GE}=15\text{V/-}8\text{V}, V_{CE}=600\text{V}$	Q_G	-	5.7		μC
Internal Gate Resistor 内置门极电阻	$T_{vj}=25^{\circ}\text{C}$	R_{Gint}	-	0.43		Ω
Input Capacitance 输入电容	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C},$ $f=100\text{KHz}$	C_{ies}	-	128		nF
Reverse Transfer Capacitance 反向传输电容	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C},$ $f=100\text{KHz}$	C_{res}	-	0.80		nF
Collector-emitter Cutoff Current 集电极-发射极关断漏电流	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$	I_{CES}	-	-	1	mA
Gate-emitter Leakage Current 门极-发射极漏电流	$V_{CE}=0\text{V}, V_{GE}=20\text{V}, T_{vj}=25^{\circ}\text{C}$	I_{GES}	-	-	500	nA
Turn-on Delay Time, Inductive Load 开通延迟时间, 感性负载	$I_C=600\text{A}, V_{CE}=600\text{V}$ $V_{GE}=15\text{V/-}8\text{V}$ $R_{Gon}=0.5\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_{don}	-	214 229 230 246	-	ns
Rise Time, Inductive Load 上升时间, 感性负载	$I_C=600\text{A}, V_{CE}=600\text{V}$ $V_{GE}=15\text{V/-}8\text{V}$ $R_{Gon}=0.5\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_r	-	67 78 81 84	-	ns
Turn-off Delay Time, Inductive Load 关断延迟时间, 感性负载	$I_C=600\text{A}, V_{CE}=600\text{V}$ $V_{GE}=15\text{V/-}8\text{V}$ $R_{Goff}=3.3\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_{doff}	-	680 737 742 819	-	ns
Fall Time, Inductive Load 下降时间, 感性负载	$I_C=600\text{A}, V_{CE}=600\text{V}$ $V_{GE}=15\text{V/-}8\text{V}$ $R_{Goff}=3.3\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_f	-	92 169 185 201	-	ns
Turn-on energy loss per pulse 开通损耗	$I_C=600\text{A}, V_{CE}=600\text{V}$ $V_{GE}=15\text{V/-}8\text{V}$ $R_{Gon}=0.5\Omega, L_{\sigma}=35\text{nH}$ $di/dt=6900(T_{vj}=175^{\circ}\text{C})$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	E_{on}	-	38.30 52.44 60.13 68.37	-	mJ

Turn-off energy loss per pulse 关断损耗	$I_C=600A, V_{CE}=600V$ $V_{GE}=15V/-8V$ $R_{Gon}=0.5\Omega, L_\sigma=35nH$ $dv/dt=6900(T_{vj}=175^\circ C)$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	E_{off}	-	51.80 70.13 75.27 76.94	-	mJ
SC Data 短路耐量	$V_{CE}=600V, tp=10\mu s$ $V_{GE}=15V/-8V, tp=10\mu s$ $tp=10\mu s, T_{vj}=175^\circ C$	$T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	I_{sc}	-	3400 2700 2200	-	A
Thermal Resistance, Junction to Case 结-壳热阻	Per IGBT		R_{thJC}		0.051		K/W
Temperature under switching conditions 工作温度			$T_{vj op}$	-40		150	$^\circ C$

Diode, Inverter / 二极管, 逆变部分

Maximum Rated Values / 最大标称参数

Repetitive peak reverse voltage 可重复反向峰值电压	$T_{vj}=25^\circ C$	V_{RRM}	1200	V
Continuous DC Forward Current 可连续正向直流电流		I_{Fnom}	600	A
Repetitive Peak Forward Current 可重复正向峰值电流	$t_p=1ms$	I_{FRM}	1200	A

Characteristic Values / 性能参数

			min.	typ.	max.	
Forward Voltage ¹⁾ 正向通态压降	$I_F=600A, V_{GE}=0V$ $I_F=600A, V_{GE}=0V$ $I_F=600A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	V_F	1.50 2.12 2.02 1.91	2.40	V
Peak Reverse Recovery Current 反向恢复峰值电流	$I_F=600A, V_R=600V$ $-di_F/dt=6900A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	I_{RM}	- 264 296 304 416	-	A
Recovery Charge 反向恢复电荷	$I_F=600A, V_R=600V$ $-di_F/dt=6900A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	Q_R	- 19.1 35.8 64.0 87.5	-	μC
Reverse Recovery Energy 反向恢复损耗	$I_F=600A, V_R=600V$ $-di_F/dt=6900A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	E_{rec}	- 11.7 20.7 25.4 41.8	-	mJ
Thermal Resistance, Junction to Case 结-壳热阻	Per FRD		R_{thJC}	-	0.065	K/W
Temperature under switching conditions 工作温度			$T_{vj op}$	-40	-	150 $^\circ C$

NTC-Thermistor/ NTC-热敏电阻

Characteristic Values / 性能参数

			min.	typ.	max.	
Rated Resistance 标称电阻	$T_{NTC}=25^{\circ}\text{C}$	R_{25}		5		K Ω
Deviation of R100 R100 偏移值	$T_{NTC}=100^{\circ}\text{C}$, $R_{100}=465\Omega$	$\Delta R/R$	-7.3		7.3	%
Power Dissipation 功率耗散	$T_{NTC}=25^{\circ}\text{C}$	P_{25}			10	mW
B-Value B 值	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$	$B_{25/50}$		3380		K
	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$	$B_{25/80}$		3470		K
	$R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$	$B_{25/100}$		3520		K

Module / 模块

Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}	3		KV
Material of Module Baseplate 模块底板材料			Cu		
Internal Isolation 内部绝缘			ZTA		
Creepage Distance 爬电距离	Terminal to heatsink Terminal to terminal		14.5 13		mm
Clearance 电气间隙	Terminal to heatsink Terminal to terminal		12.5 10		mm
Comparative Tracking Index 相对漏电起痕指数		CTI	200 ²⁾		

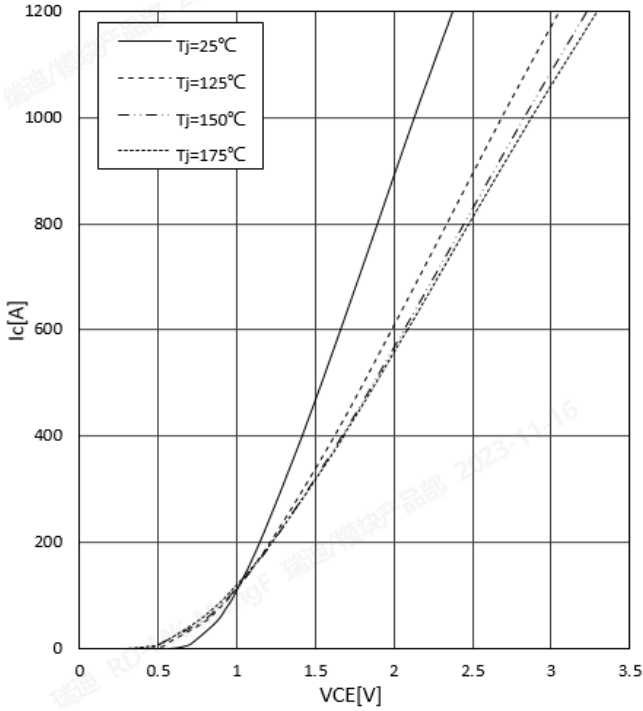
			min.	typ.	max.	
Stray Inductance Module 模块杂散电感		L_{SCE}		20		nH
Module Lead Resistance, Terminals-Chip 模块引脚电阻, 端子-芯片	$T_c=25^{\circ}\text{C}$, Per Switch	$R_{CC'+EE'}$		0.83		m Ω
Storage Temperature 贮存温度		T_{stg}	-40		125	$^{\circ}\text{C}$
Mounting Torque for Module Mounting 模块安装力矩	Screw M5 / M5 螺丝	M	3.0		6.0	Nm
Power terminal installation torque 功率端子安装扭矩	Screw M6 / M6 螺丝	M	3.0		6.0	Nm
Weight 重量		G		345		g

- 1) Terminal impedance is not included.
不包含端子阻抗。
- 2) CTI is about 200.
CTI 约等于 200。

Circuit Diagram / 曲线图

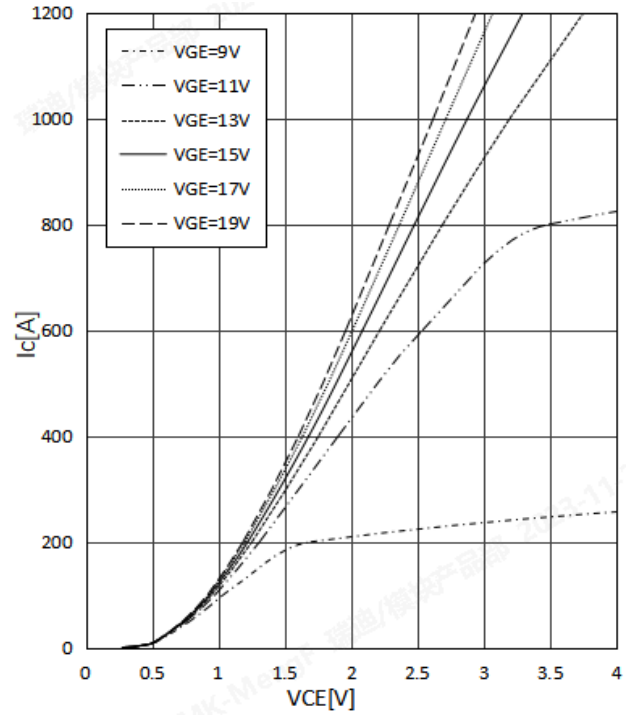
Output characteristic IGBT, Inverter (typical),
输出特性 IGBT, 逆变器 (典型值)

$I_c = f(V_{CE}), V_{GE} = 15V$



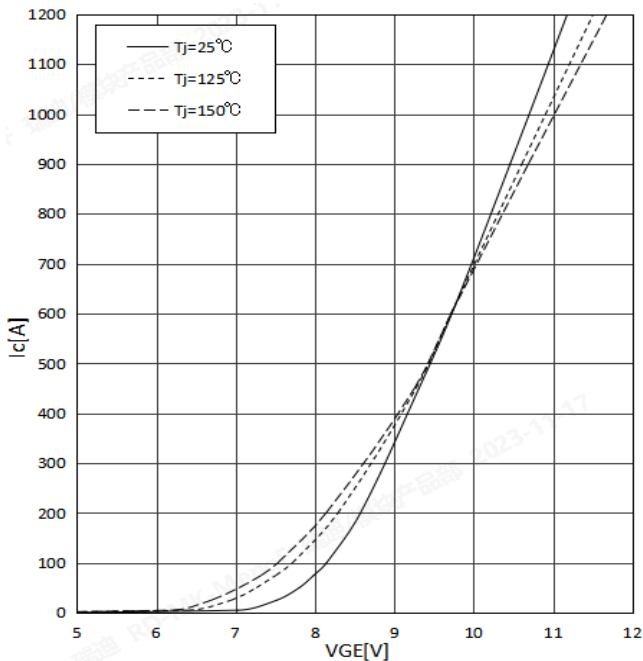
Output characteristic IGBT, Inverter (typical)
输出特性 IGBT, 逆变器 (典型值)

$I_c = f(V_{CE}), T_{vj} = 175^\circ C$



Transfer characteristic IGBT, Inverter (typical)
传输特性 IGBT, 逆变器 (典型值)

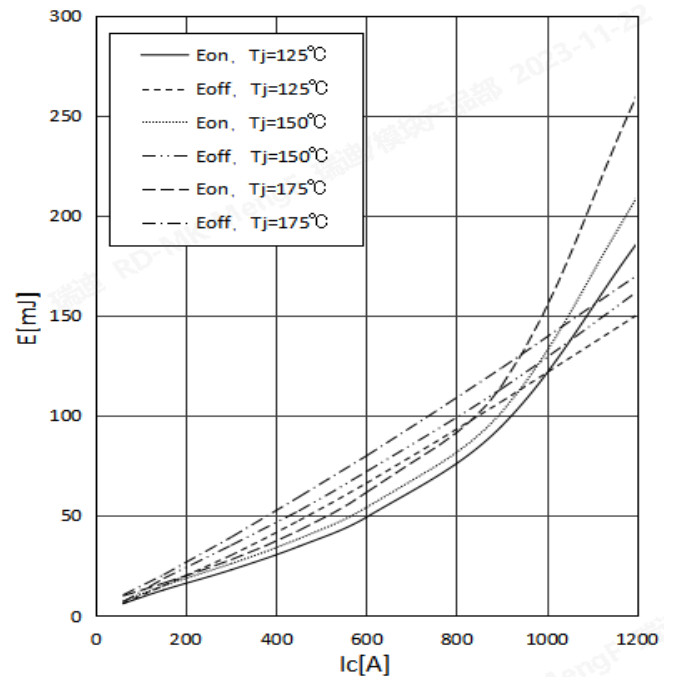
$I_c = f(V_{GE}), V_{CE} = 20V$



Switching losses IGBT, Inverter (Typical)
开关损耗 IGBT, 逆变器 (典型值)

$E_{on} = f(I_c), E_{off} = f(I_c)$

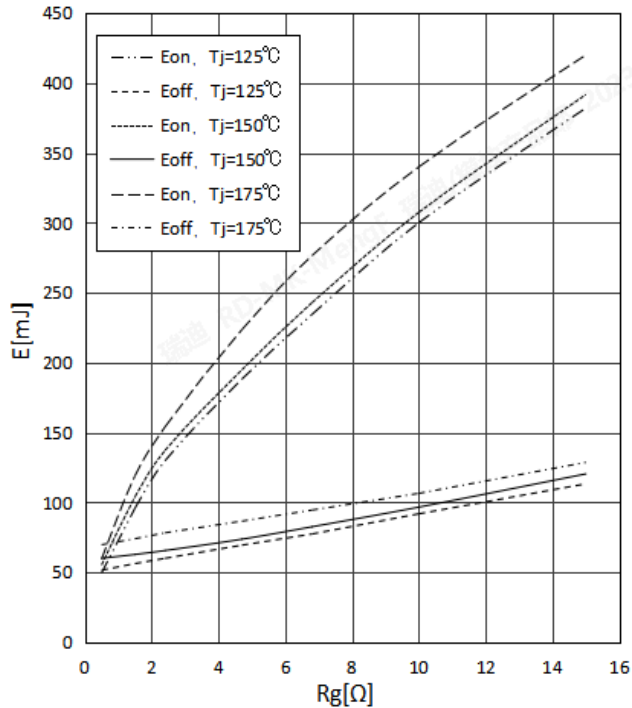
$V_{GE} = +15V / -8V, R_{Gon} = 0.5 \Omega, R_{Goff} = 3.3 \Omega, V_{CC} = 600V$



Switching losses IGBT, Inverter (Typical)

开关损耗 IGBT, 逆变器 (典型值)

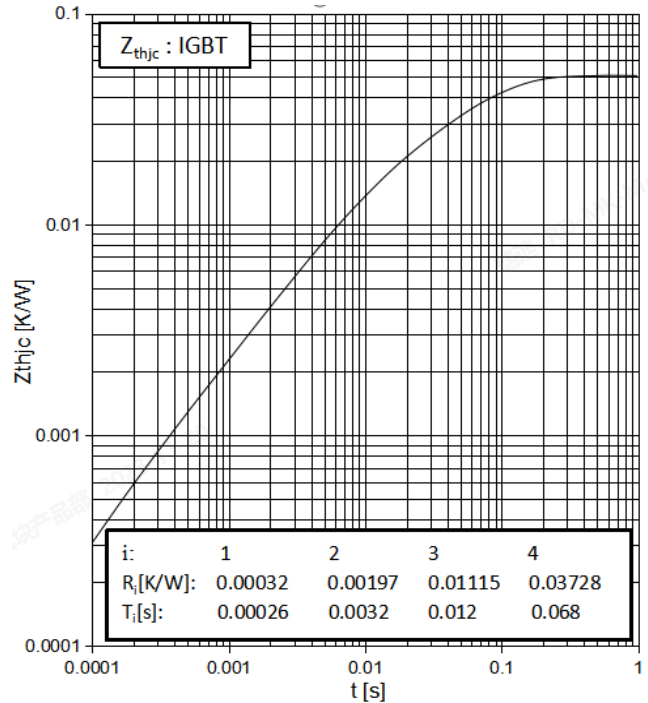
$E_{on}=f(R_g)$, $E_{off}=f(R_g)$,
 $V_{GE}=+15V/-8V$, $I_c=600A$, $V_{CE}=600V$



Transient thermal impedance IGBT, Inverter

瞬态热阻 IGBT, 逆变器

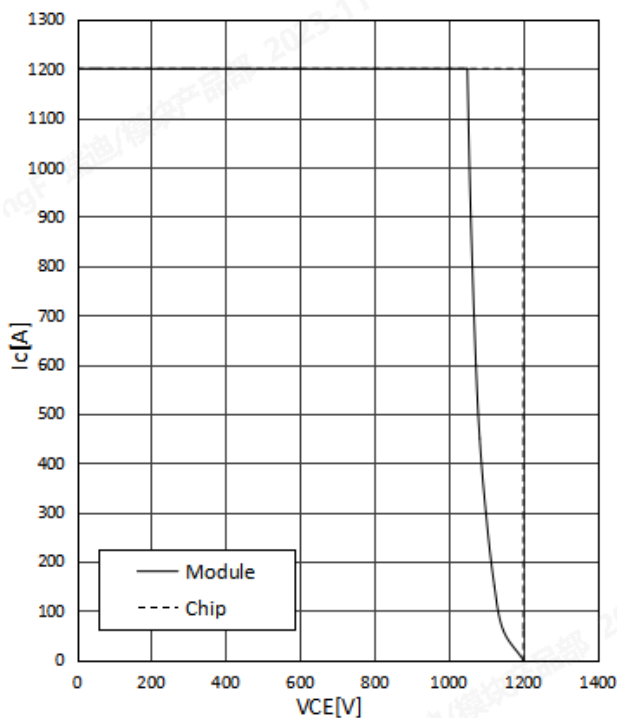
$Z_{thJC}=f(t)$



Reverse bias safe operating area IGBT, Inverter (RBSOA)

反向安全工作区 IGBT, 逆变器 (RBSOA)

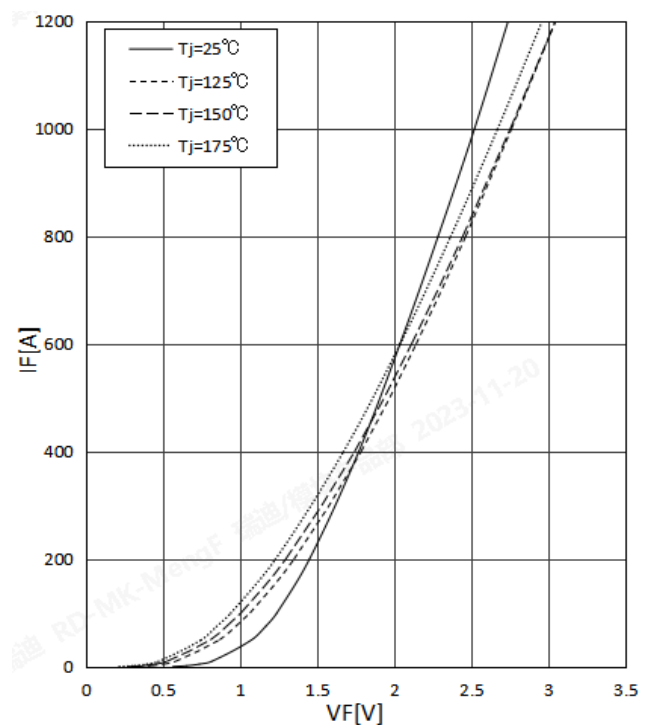
$I_c=f(V_{CE})$
 $V_{GE}=+15V/-8V$, $R_{Goff}=3.3\Omega$, $T_{vj}=175^\circ C$



Forward characteristic of Diode, Inverter (typical)

正向偏压特性 二极管, 逆变器 (典型值)

$I_F=f(V_F)$

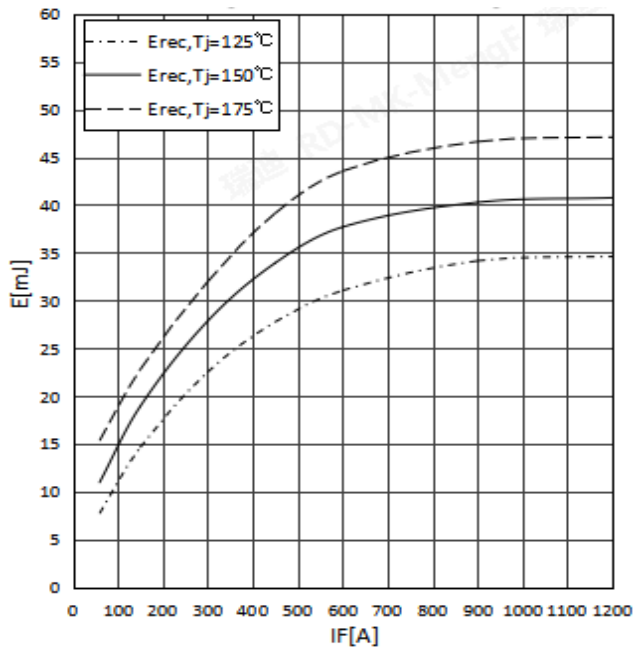


Switching losses Diode, Inverter (typical)

开关损耗 二极管, 逆变器 (典型值)

$E_{rec}=f(I_F)$,

$R_{gon}=1.5\ \Omega$, $V_{CE}=600V$

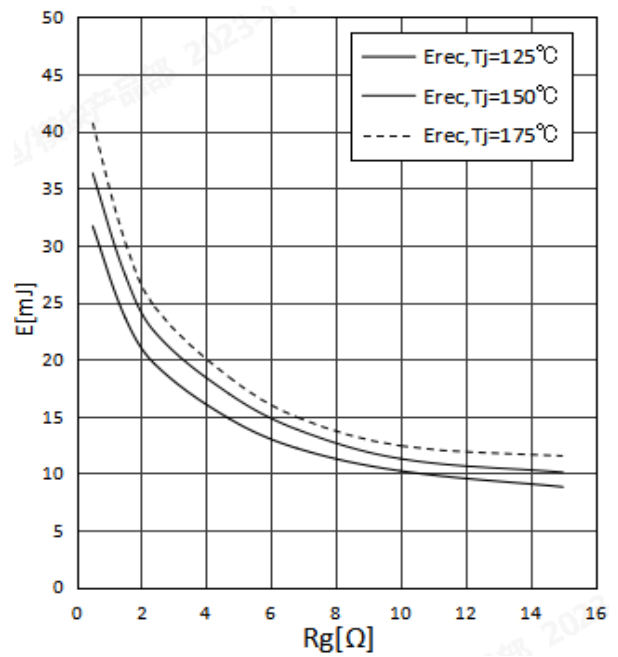


Switching losses Diode, Inverter (typical)

开关损耗 二极管, 逆变器 (典型值)

$E_{rec}=f(R_g)$,

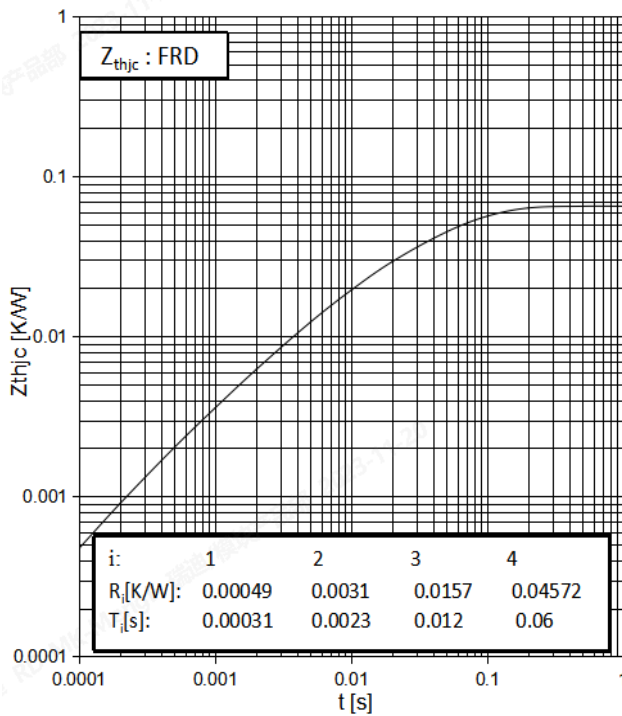
$I_F=600A$, $V_{CE}=600V$



Transient thermal impedance Diode, Inverter

瞬态热阻抗 二极管, 逆变器

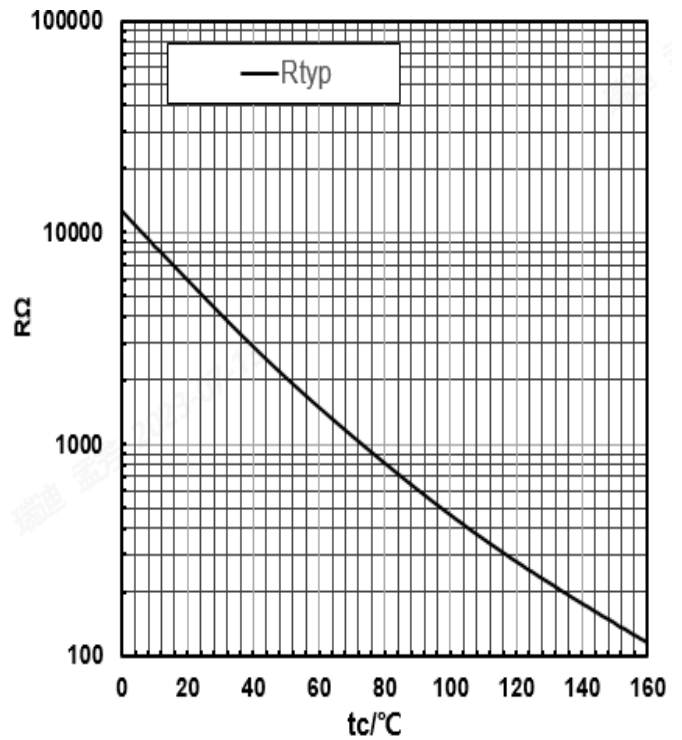
$Z_{thjc}=f(t)$



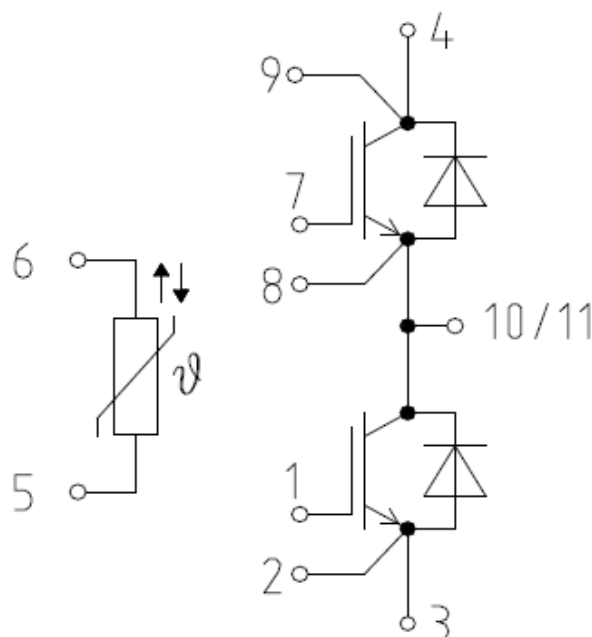
NTC-Thermistor-temperature characteristic (typical)

负温度系数热敏电阻 温度特性

$R=f(T)$



Circuit diagram/ 接线图



Package outlines / 封装尺寸

Dimensions in Millimeters / 毫米为单位

