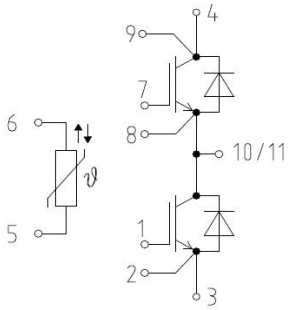
M series package: 1200V 450A IGBT module Datasheet



等效电路图
Equivalent Circuit Schematic

Features:

- V_{CES} = 1200V
- $I_{C\ nom}$ = 450A / I_{CRM} = 900A
- High RBSOA capability
- 1200V 450A, $V_{CE(sat)}$ =1.50V@25℃
- Low Losses：
  - E_{on} =35.0mJ@175℃
  - E_{off} =56.9mJ@175℃
  - E_{rec} =33.0mJ@175℃
- MPT Gate Technology

产品特性:

- 集电极发射极电压达 1200V
- 集电极重复峰值电流达 900A
- 高 RBSOA 能力
- 1200V 450A, $V_{CE(sat)}$ = 1.50V@25℃
- 低损耗：
  - E_{on} =35.0mJ@175℃
  - E_{off} =56.9mJ@175℃
  - E_{rec} =33.0mJ@175℃
- 微沟槽栅/场终止技术

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℃	V_{CES}	1200	V
Continuous DC Collector Current 连续集电极直流电流		$I_{C\ nom}$	450	A
	Tc=100℃, T_{vjmax}≤175℃	I_C	540	A
Repetitive Peak Collector Current 集电极可重复峰值电流	t_p 受限于 $T_{vj\ op}$	I_{CRM}	900	A
Total Power Dissipation 功率损耗	T_C=25℃, $T_{vj\ max}$=175℃	P_{tot}	2344	W
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=450A,V_{GE}=15V	T_{vj}=25℃ T_{vj}=150℃ T_{vj}=175℃	V_{CEsat}	1.40	1.50 1.76 1.84	1.70	V
Gate Threshold Voltage 门极阈值电压	V_{CE}=V_{GE},I_C=24mA,T_{vj}=25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge 门极电荷	V_{GE}=-10V/15V,V_{CE}=600V		Q_G	-	4.1	-	μC
Internal Gate Resistor 内置门极电阻	T_{vj}=25℃		R_{Gint}	-	1.05	-	Ω
Input Capacitance 输入电容	f=100kHz,T_{vj}=25℃,V_{CE}=25V,V_{GE}=0V		C_{ies}	-	106	-	nF
Output Capacitance 输出电容	f=100kHz,T_{vj}=25℃,V_{CE}=25V,V_{GE}=0V		C_{oes}	-	1.96	-	nF
Reverse Transfer Capacitance 反向传输电容	f=100kHz,T_{vj}=25℃,V_{CE}=25V,V_{GE}=0V		C_{res}	-	0.28	-	nF
Collector-emitter Cutoff Current 集电极-发射极关断漏电流	V_{CE}=1200V,V_{GE}=0V,T_{vj}=25℃		I_{CES}	-	-	100	μA
Gate-emitter Leakage Current 门极-发射极漏电流	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		I_{GES}	-	-	500	nA
Turn-on Delay Time, Inductive Load 开通延迟时间，感性负载	I_C=450A,V_{CE}=600V V_{GE}=-8V/15V R_{Gon}=0.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{don}	-	186 192 195 217	-	ns
Rise Time, Inductive Load 上升时间，感性负载	I_C=450A,V_{CE}=600V V_{GE}=-8V/15V R_{Gon}=0.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_r	-	54 64 67 85	-	ns
Turn-off Delay Time, Inductive Load 关断延迟时间，感性负载	I_C=450A,V_{CE}=600V V_{GE}=-8V/15V R_{Goff}=1Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{doff}	-	435 485 492 553	-	ns
Fall Time, Inductive Load 下降时间，感性负载	I_C=450A,V_{CE}=600V V_{GE}=-8V/15V,R_{Goff}=1Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_f	-	123 191 203 210	-	ns

Turn-on Energy Loss per Pulse 开通损耗	I_C=450A,V_{CE}=600V,L_σ=30nH V_{GE}=-8V/15V,R_{Gon}=0.5Ω di/dt=4200A/μs(Tvj=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{on}	-	18.4 27.5 31.2 35.0	-	mJ
Turn-off energy Loss per Pulse 关断损耗	I_C=450A,V_{CE}=600V,L_σ=30nH V_{GE}=-8V/15V,R_{Goff}=1Ω du/dt=6300V/μs(Tvj=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{off}	-	33.4 46.4 50.4 56.9	-	mJ
SC Data 短路耐量	V_{GE}=-8V/15V V_{CC}=600V	t_P≤10μs,T_{vj}=25℃ t_P≤10μs,T_{vj}=150℃ t_P≤10μs,T_{vj}=175℃	I_{sc}	-	2700 2100 2000	-	A
Thermal Resistance, Junction to Case 结-外壳热阻	Per IGBT/单个 IGBT		R_{thJC}	-	0.064	-	K/W
Thermal Resistance, Case to Heatsink 外壳-散热器热阻	Per IGBT/单个 IGBT λ_{grease} =1W/(m·K)		R_{thCH}	-	0.019	-	K/W
Temperature under Switching Conditions[2)] 工作温度			$T_{vj\ op}$	-40	-	175	℃

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℃	V_{RRM}	1200	V
Continuous DC Forward Current 可连续正向直流电流		I_{Fnom}	450	A
Repetitive Peak Forward Current 可重复正向峰值电流	t_p 受限于 $T_{vj\ op}$	I_{FRM}	900	A

Characteristic Values / 性能参数

				min.	typ.	max	
Forward Voltage[1)] 正向通态压降	I_F=450A，V_{GE}=0V	T_{vj}=25℃ T_{vj}=150℃ T_{vj}=175℃	V_F	1.5	1.95 1.92 1.82	2.40	V
Peak Reverse Recovery Current 反向恢复峰值电流	I_F=450A,V_R=600V -di$_F$/dt=5600A/μs(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	I_{RM}	-	302 358 374 390	-	A
Recovery Charge 反向恢复电荷	I_F=450A,V_R=600V -di$_F$/dt=5600A/μs(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	Q_R	-	21.3 42.1 50.0 56.0	-	μC
Reverse Recovery Energy 反向恢复损耗	I_F=450A,V_R=600V -di$_F$/dt=5600A/μs(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{rec}	-	11.3 22.5 27.7 33.0	-	mJ
Thermal Resistance, Junction to Case 结-壳热阻	Per FRD/单个 FRD		R_{thJC}	-	0.092	-	K/W
Thermal Resistance, Case to Heatsink 外壳-散热器热阻	Per FRD/单个 FRD λ_{grease} =1W/(m·K)		R_{thCH}	-	0.021	-	K/W

Temperature under Switching Conditions[2)] 工作温度		$T_{vj\ op}$	-40	-	175	℃

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℃	R_{25}	-	5	-	KΩ
Deviation of R100 R100 偏移值	T_{NTC}=100℃，R_{100}=465Ω	△R/R	-7.3	-	7.3	%
Power Dissipation 功率耗散	T_{NTC}=25℃	P_{25}	-	-	10	mW
B-Value B 值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$	-	3380	-	K
	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$	-	3470	-	K
	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$	$B_{25/100}$	-	3520	-	K

Module / 模块

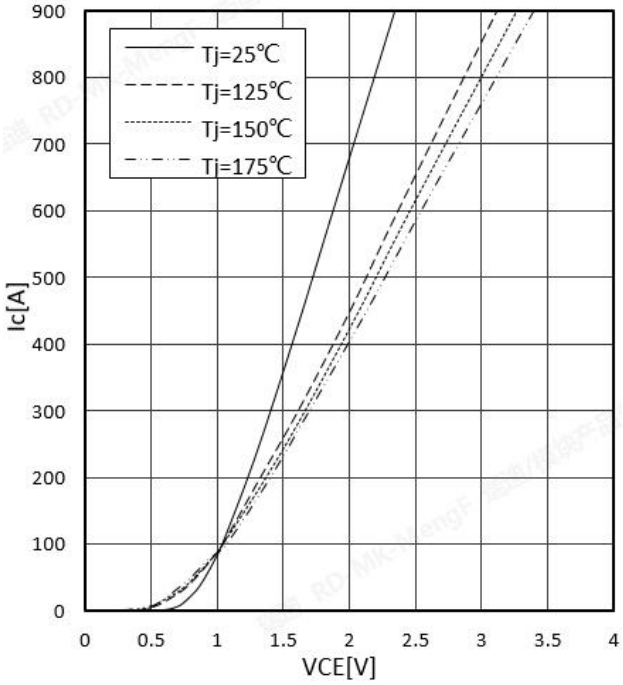
Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz	V_{ISOL}	3.0		kV
Isolation Test Voltage of NTC NTC 绝缘测试电压	RMS, f=50Hz	$V_{ISOL(NTC)}$	3.0		kV
Material of Module Baseplate 模块底板材料			Cu		
Internal Isolation 内部绝缘			ZTA		
Creepage Distance 爬电距离	Terminal to heatsink, min Terminal to terminal, min		14.7 15.1		mm
Clearance 电气间隙	Terminal to heatsink, min Terminal to terminal, min		9.6 12.5		mm
Comparative Tracking Index 相对漏电起痕指数		CTI	＞200		

			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℃，Per Switch	$R_{CC'+EE'}$	-	0.8	-	mΩ
Storage Temperature 贮存温度		T_{stg}	-40	-	125	℃
Mounting Torque for Module Mounting 模块安装力矩	Screw M5 / M5 螺丝	M	4.0	-	6.0	Nm
Mounting Torque for Terminal Mounting 功率端子安装力矩	Screw M6 / M6 螺丝	M	4.0	-	6.0	Nm
Weight 重量		G	-	345	-	g

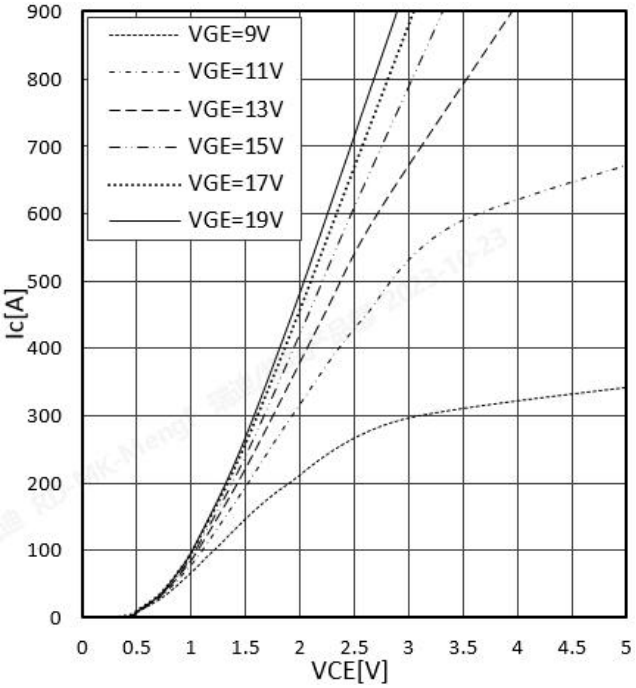
1) Terminal impedance is not included.
不包含端子阻抗。
2) $T_{vj\ op}$ > 150°C is allowed for operation at overload conditions.
过载条件下允许工作的温度 $T_{vj\ op}$ > 150°C。

Circuit Diagram / 曲线图

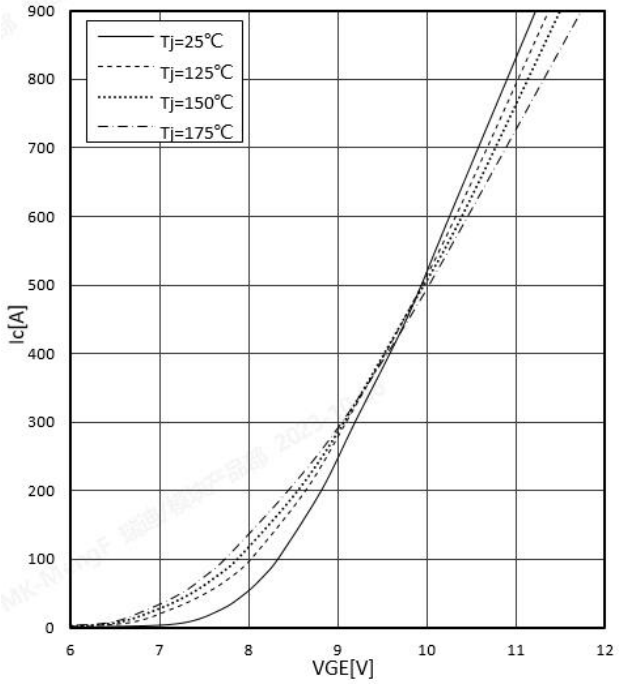
Output characteristic IGBT, Inverter (typical),
输出特性 IGBT，逆变器（典型值）
$I_C=f(V_{CE}), V_{GE}=15V$



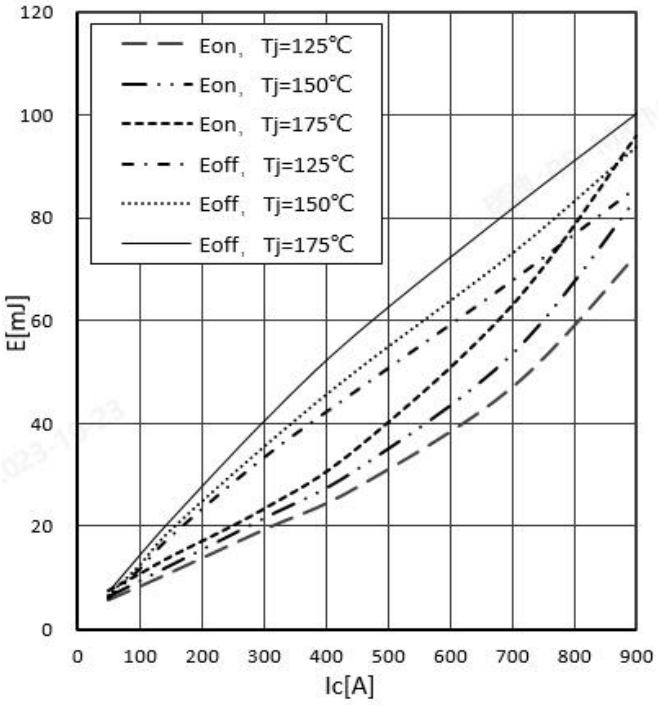
Output characteristic IGBT, Inverter (typical)
输出特性 IGBT，逆变器（典型值）
$I_C=f(V_{CE}), T_{vj}=175℃$



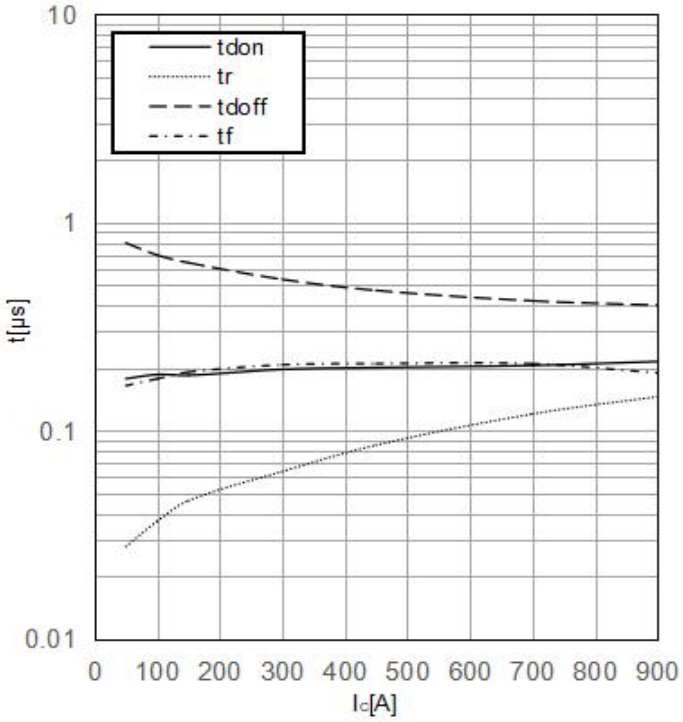
Transfer characteristic IGBT, Inverter (typical)
传输特性 IGBT ，逆变器（典型值）
$I_C=f(V_{GE}), V_{CE}=20V$



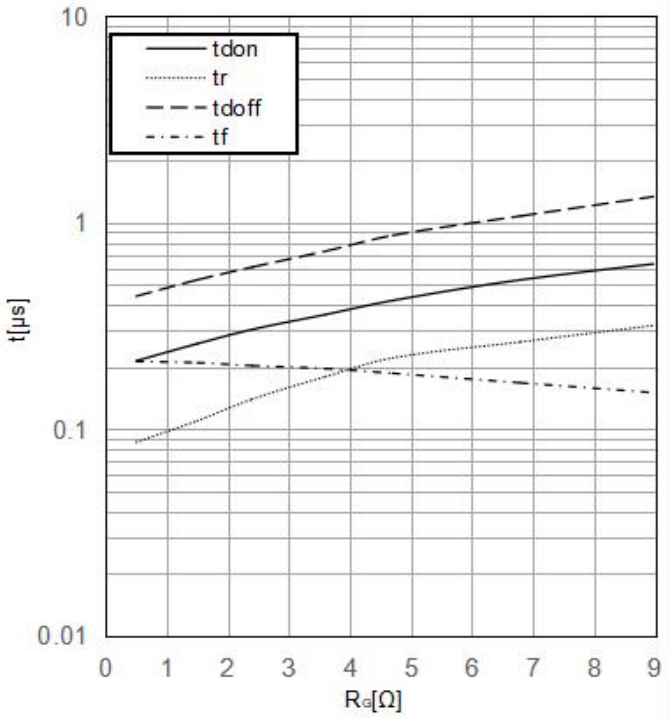
Switching losses IGBT, Inverter (Typical)
开关损耗 IGBT，逆变器（典型值）
$E_{on}=f(I_C)$, $E_{off}=f(I_C)$
$V_{GE}=+15V/-8V$, $R_{Gon}=0.5\Omega$, $R_{Goff}=1\Omega$, $V_{CC}=600V$



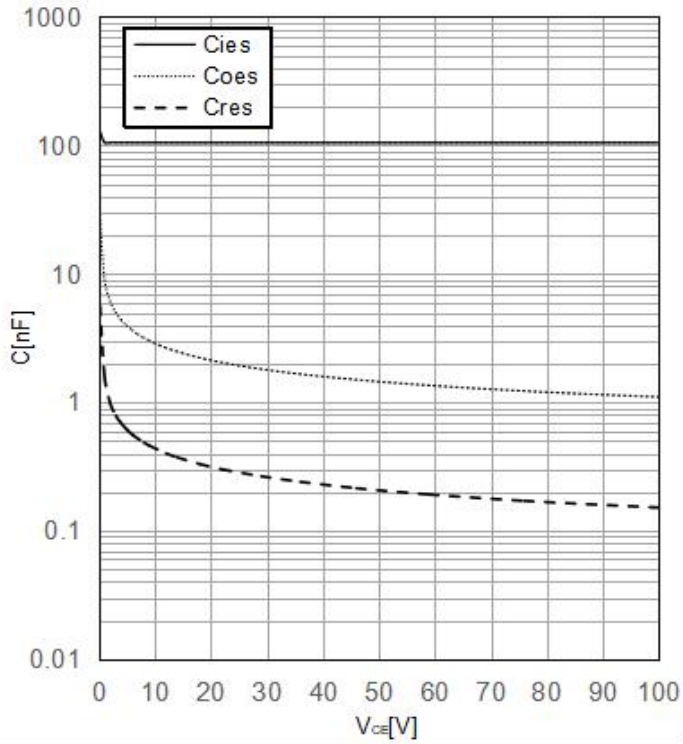
Switching time IGBT, Inverter (typical)
开关时间 IGBT，逆变器（典型值）
t=f(I_C)
R_{goff}=1Ω, R_{gon}=0.5Ω, V_{GE}=+15V/-8V, V_{CE}=600V, T_{vj}=175℃



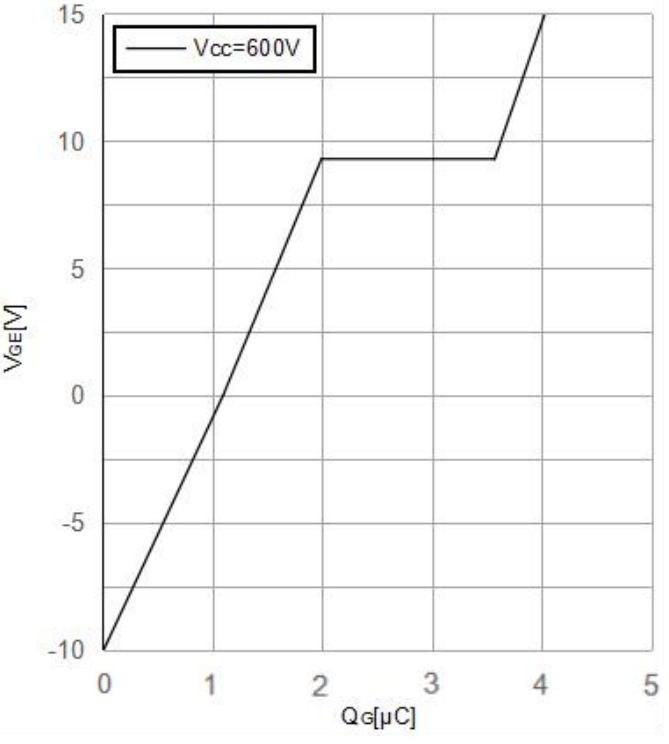
Switching time IGBT, Inverter (typical)
开关时间 IGBT，逆变器（典型值）
t=f(R_G)
V_{GE}=+15V/-8V, Ic=450A, V_{CE}=600V, T_{vj}=175℃



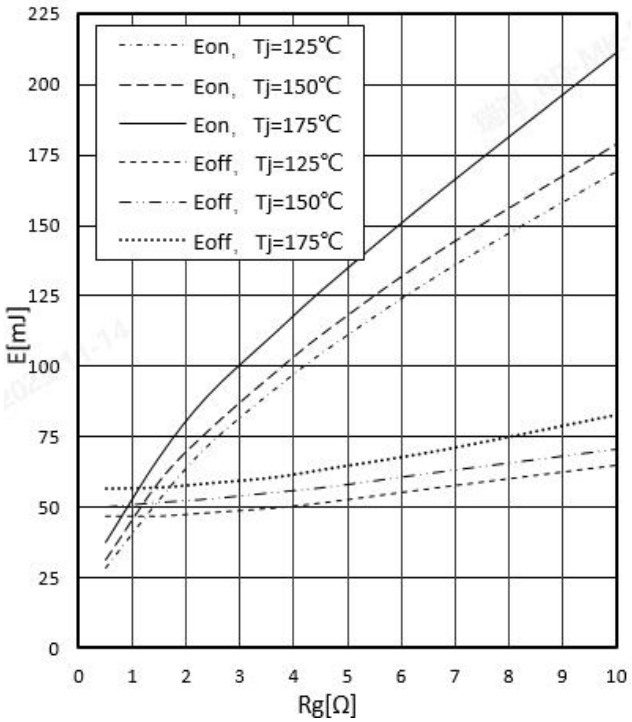
Capacitance characteristic IGBT, Inverter
电容特性 IGBT，逆变器
C=f (V_{CE})
f=100kHz,, V_{GE}=0V, T_{vj}=25℃



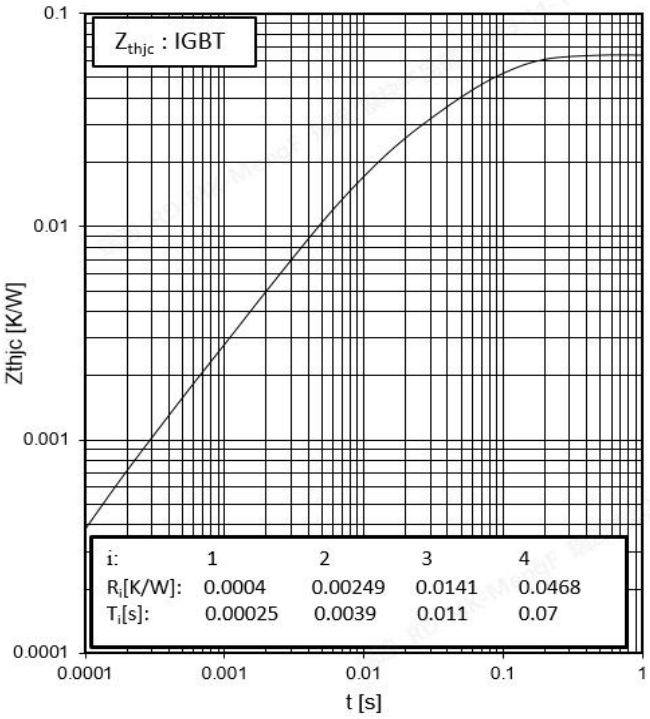
Gate Charge characteristic IGBT, Inverter
栅极电荷特性 IGBT，逆变器
V_{GE}=f (Q_G)
Ic=450A, T_{vj}=25℃



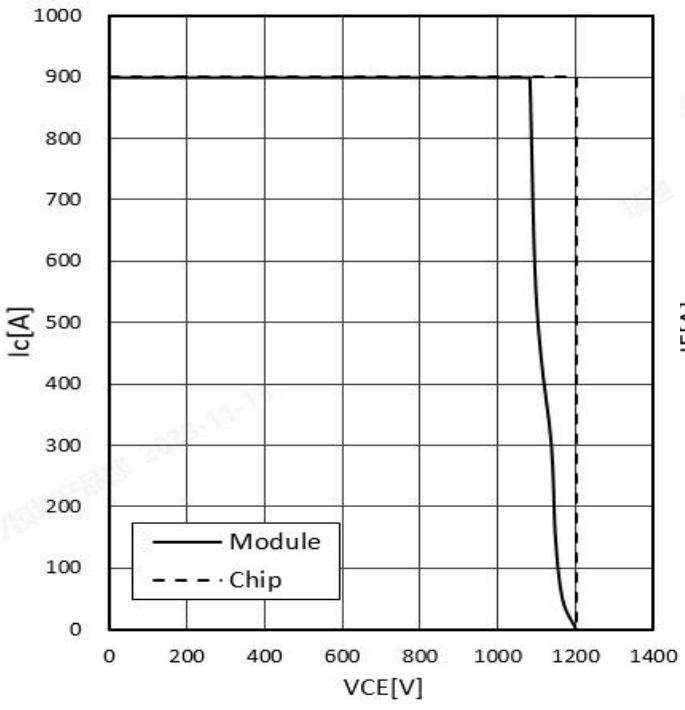
Switching losses IGBT, Inverter (Typical)
开关损耗 IGBT，逆变器（典型值）
$E_{on}=f(R_G)$, $E_{off}=f(R_G)$,
V_{GE}=+15V/-8V, Ic=450A, V_{CE}=600V



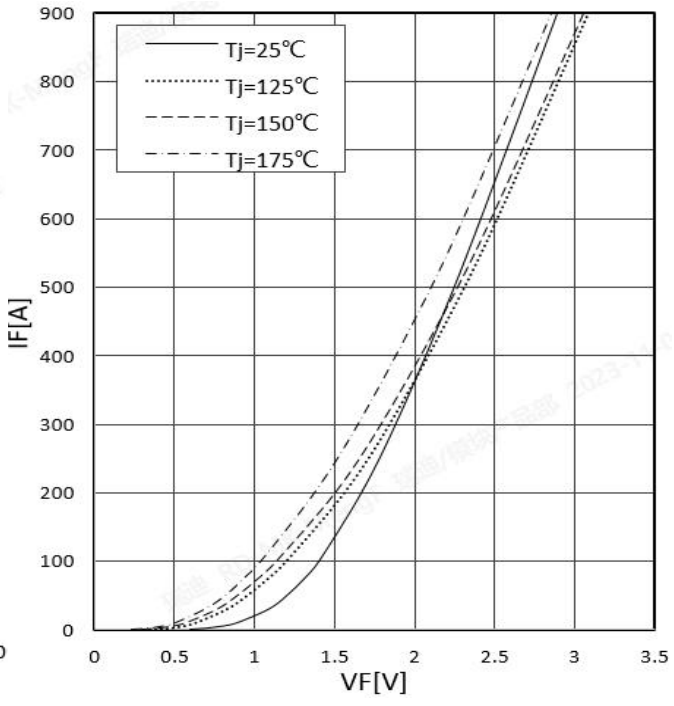
Transient thermal impedance IGBT, Inerter
瞬态热阻 IGBT，逆变器
$Z_{thJC}=f(t)$



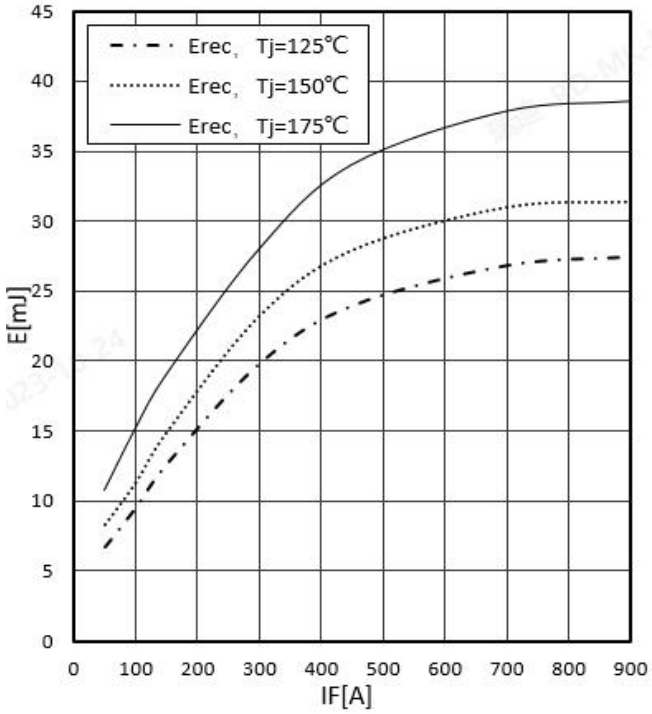
Reverse bias safe operating area IGBT, Inverter(RBSOA)
反向安全工作区 IGBT，逆变器(RBSOA)
$Ic=f(V_{CE})$
V_{GE}=+15V/-8V, R_{Goff}=1Ω, T_{vj}=175℃



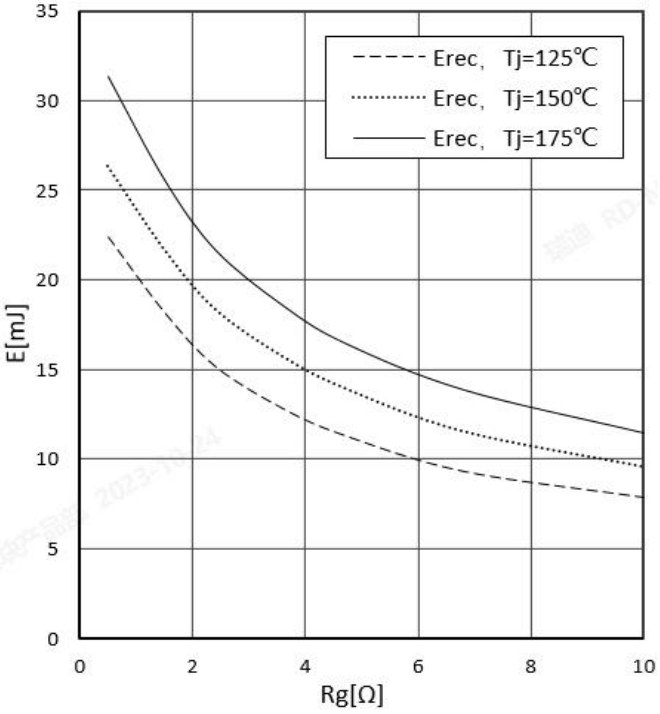
Forward characteristic of Diode, Inverter(typical)
正向偏压特性 二极管，逆变器（典型值）
$I_F=f(V_F)$



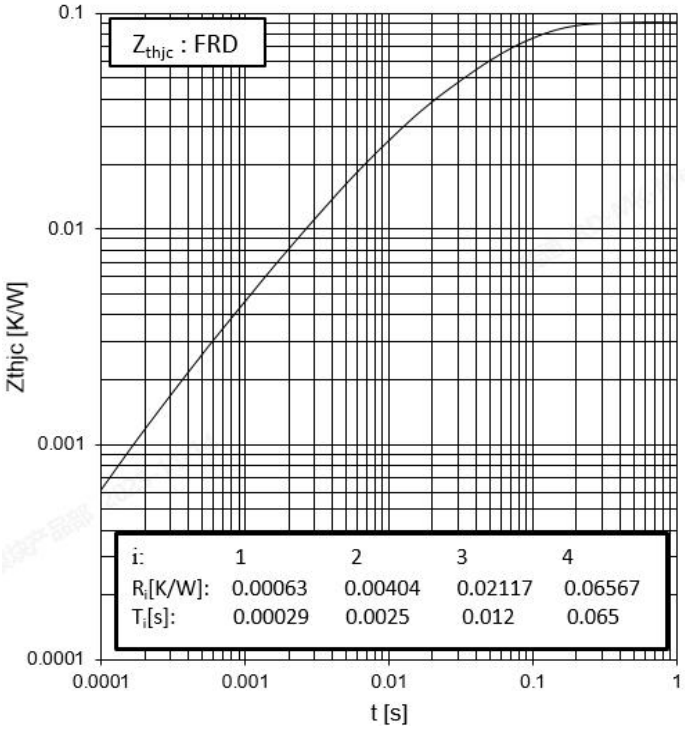
Switching losses Diode, Inverter (typical)
开关损耗 二极管，逆变器（典型值）
$E_{rec}=f(I_F)$,
$R_{gon}=0.5\,\Omega$, $V_{CE}=600V$



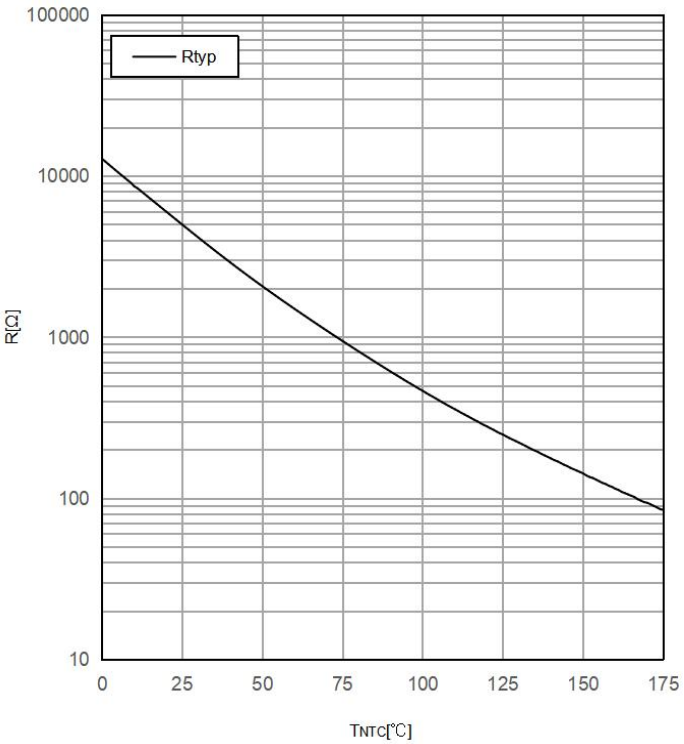
Switching losses Diode, Inverter (typical)
开关损耗 二极管，逆变器（典型值）
$E_{rec}=f(R_G)$,
$I_F=450A$, $V_{CE}=600V$



Transient thermal impedance Diode, Inerter
瞬态热阻抗 二极管，逆变器
$Z_{thJC}=f(t)$

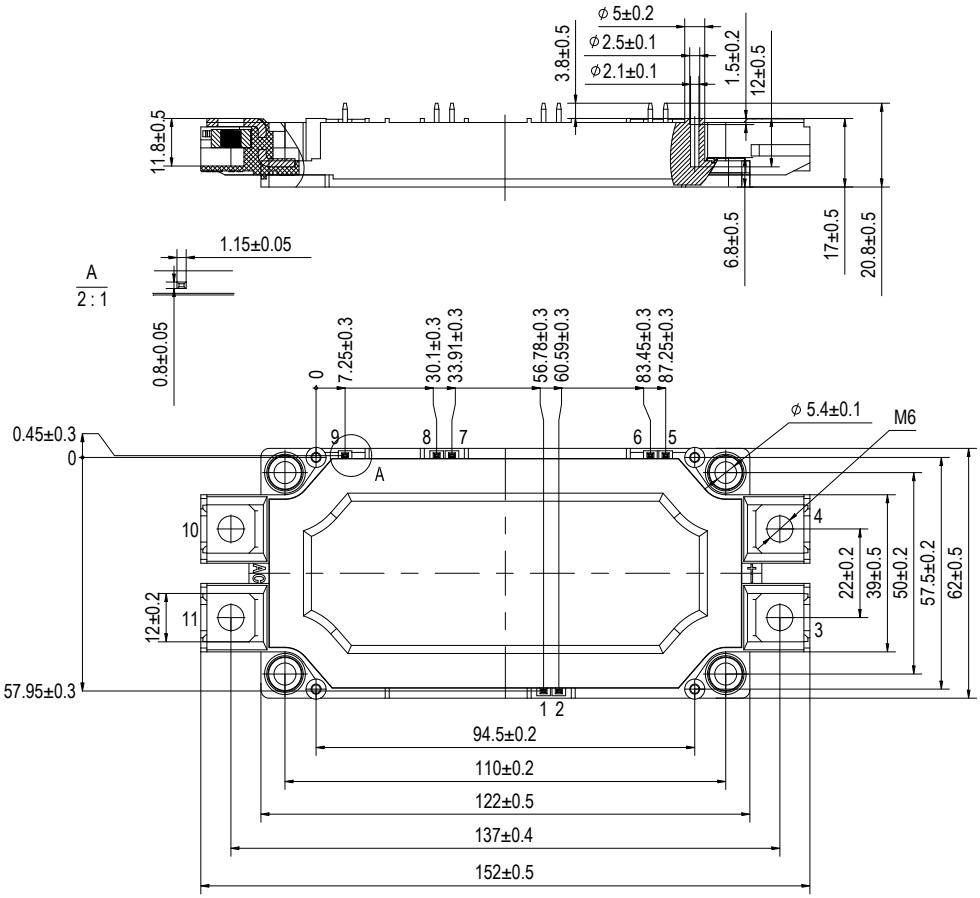


NTC-Thermistor-temperature characteristic(typical)
负温度系数热敏电阻 温度特性
$R=f(T)$



Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位



Internal Circuit / 内部电路