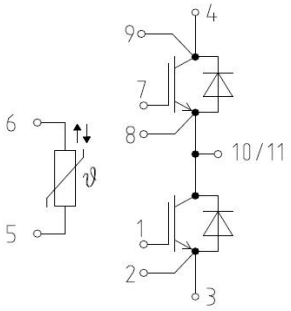
M series package: 1700V600A IGBT module

Preliminary Datasheet



等效电路图
Equivalent Circuit Schematic

Features:

- V_{CES} = 1700V
- $I_{C\ nom}$ = 600A / I_{CRM} = 1200A
- High RBSOA capability
- 1700V 600A, $V_{CE(sat)}$ =1.55V@25℃
- 1700V 600A, V_F=1.70V@25℃
- Low Conduction Losses
- MPT / FS Technology

产品特性:

- 集电极发射极电压达 1700V
- 集电极重复峰值电流达 1200A
- 高 RBSOA 能力
- 1700V 600A, $V_{CE(sat)}$ =1.55V@25℃
- 1700V 600A, V_F=1.70V@25℃
- 低导通损耗
- 微沟槽栅/场终止技术

Typical Applications：

- Static Var Generator
- Middle (High) Voltage Converter
- Wind Turbines
- Motor Drives

典型应用：

- SVG 静止无功发生器
- MVD 中高压级联型变频器
- 风力发电机
- 电机驱动

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}	1700	V
Implemented Collector Current 集电极电流		$I_{C\ nom}$	600	A
Continuous DC Collector Current 集电极连续直流电流	T_C=85℃, T_{vjmax}=175℃	I_C	600	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}	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=600A,V_{GE}=15V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	V_{CEsat}	-	1.55 1.72 1.78 1.83	-	V
Gate Threshold Voltage 门极阈值电压	V_{CE}=V_{GE},I_C=12mA,T_{vj}=25℃		V_{GEth}	-	6.10	-	V
Gate Charge 门极电荷	V_{GE}=-10V/15V,V_{CE}=600V		Q_G	-	5.6	-	μC
Internal Gate Resistor 内置门极电阻	T_{vj}=25℃		R_{Gint}	-	0.25	-	Ω
Input Capacitance 输入电容	f=100kHz,T_{vj}=25℃,V_{CE}=25V,V_{GE}=0V		C_{ies}	-	60.9	-	nF
Reverse Transfer Capacitance 反向传输电容	f=100kHz,T_{vj}=25℃,V_{CE}=25V,V_{GE}=0V		C_{res}	-	0.22	-	nF
Collector-emitter Cutoff Current 集电极-发射极关断漏电流	V_{CE}=1700V,V_{GE}=0V,T_{vj}=25℃		I_{CES}	-	-	1	mA
Gate-emitter Leakage Current 门极-发射极漏电流	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃		I_{GES}	-	-	100	nA
Turn-on Delay Time, Inductive Load 开通延迟时间，感性负载	I_C=600A,V_{CE}=900V V_{GE}=-8V/15V R_{Gon}=1.6Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{don}	-	155 159 163 165	-	ns
Rise Time, Inductive Load 上升时间，感性负载	I_C=600A,V_{CE}=900V V_{GE}=-8V/15V R_{Gon}=1.6Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_r	-	66 63 83 88	-	ns
Turn-off Delay Time, Inductive Load 关断延迟时间，感性负载	I_C=600A,V_{CE}=900V V_{GE}=-8V/15V R_{Goff}=3.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{doff}	-	794 853 881 913	-	ns
Fall Time, Inductive Load 下降时间，感性负载	I_C=600A,V_{CE}=900V V_{GE}=-8V/15V,R_{Goff}=3.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_f	-	399 719 772 860	-	ns
Turn-on Energy Loss per Pulse 开通损耗	I_C=600A,V_{CE}=900V,L_σ=30nH V_{GE}=-8V/15V,R_{Gon}=1.6Ω di/dt=6000A/μs(Tvj=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{on}	-	152 211 230 242	-	mJ

Turn-off energy loss per pulse 关断损耗	I_C=600A,V_{CE}=900V,L_σ=30nH V_{GE}=-8V/15V,R_{Goff}=3.5Ω du/dt=4700V/μs(Tvj=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{off}	-	168 236 248 252	-	mJ
SC Data 短路耐量	V_{GE}=-8V/15V V_{CC}=1000V	t_P≤8μs,T_{vj}=150℃ t_P≤6μs,T_{vj}=175℃	I_{sc}	-	2500 2400	-	A
Thermal Resistance, Junction to Case 结-外壳热阻	Per IGBT/单个 IGBT		R_{thJC}	-	0.047	-	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}	-	0.037	-	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}	1700		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 受限于 $T_{vj\ op}$	I_{FRM}	1200		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}=125℃ T_{vj}=150℃ T_{vj}=175℃	V_F	-	1.70 1.90 1.95 2.00	-	V
Peak Reverse Recovery Current 反向恢复峰值电流	I_F=600A,V_R=900V -di$_F$/dt=5700A/us(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	I_{RM}	-	745 686 688 688	-	A
Recovery Charge 反向恢复电荷	I_F=600A, V_R=900V -di$_F$/dt=5700A/us(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	Q_R	-	100 144 159 172	-	μC
Reverse Recovery Energy 反向恢复损耗	I_F=600A, V_R=900V -di$_F$/dt=5700A/us(T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{rec}	-	57 79 88 95	-	mJ
Thermal Resistance, Junction to Case 结-壳热阻	Per FRD/单个 FRD		R_{thJC}	-	0.062	-	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}	-	0.048	-	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	-5	-	5	%
Power Dissipation 功率耗散	T_{NTC}=25℃	P_{25}	-	-	20	mW
B-Value B 值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$	-	3375	-	K
	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$	-	3414	-	K
	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$	$B_{25/100}$	-	3436	-	K

Module / 模块

Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}	3.4		kV
Isolation Test Voltage of NTC NTC 绝缘测试电压	RMS, f=50Hz, t=1min	$V_{ISOL(NTC)}$	3.4		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		15 12.1		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		

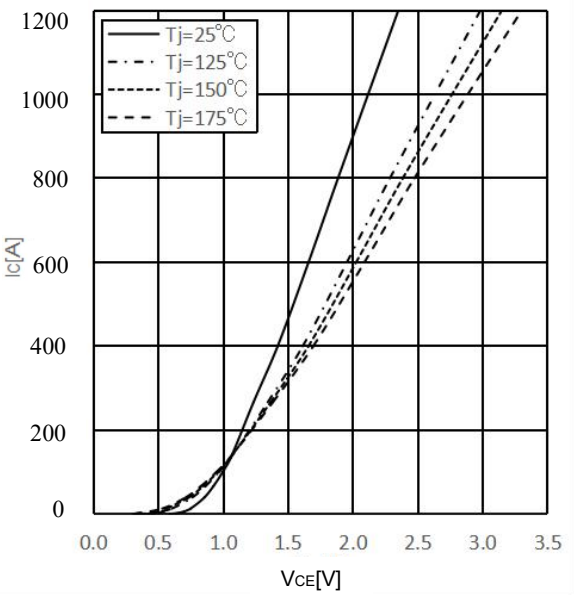
			min.	typ.	max.	
Stray Inductance Module 模块杂散电感		L_{sCE}	-	20	-	nH
Module Lead Resistance，Terminals-Chip 模块引脚电阻，端子-芯片	T_C=25℃，Per Switch	$R_{CC'+EE'}$	-	0.8	-	mΩ
Storage Temperature 贮存温度		T_{stg}	-40	-	125	℃
Mounting Torque for Module Mounting 模块安装力矩	Screw M5 / M5 螺丝	M	3.0	-	6.0	Nm
Mounting Torque for Terminal Mounting 功率端子安装力矩	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。

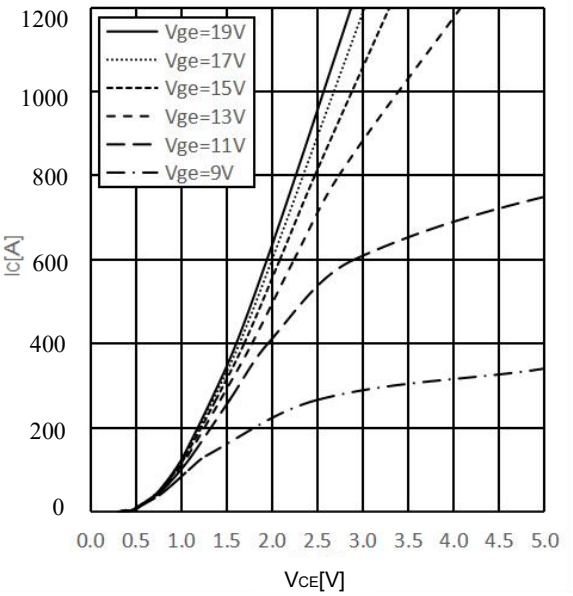
2) $T_{vj\,op}$ > 150°C is allowed for operation at overload conditions.
过载条件下允许工作的温度 $T_{vj\,op}$ > 150°C。

Circuit Diagram / 曲线图

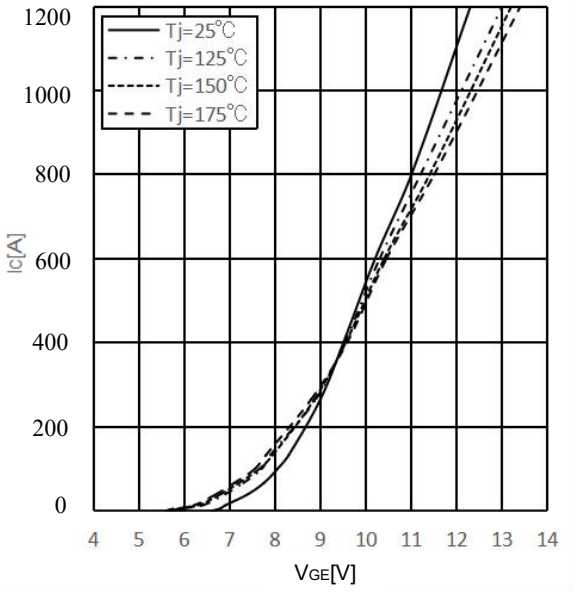
Output chanracteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 输出特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_C=f(V_{CE}),V_{GE}=15V$



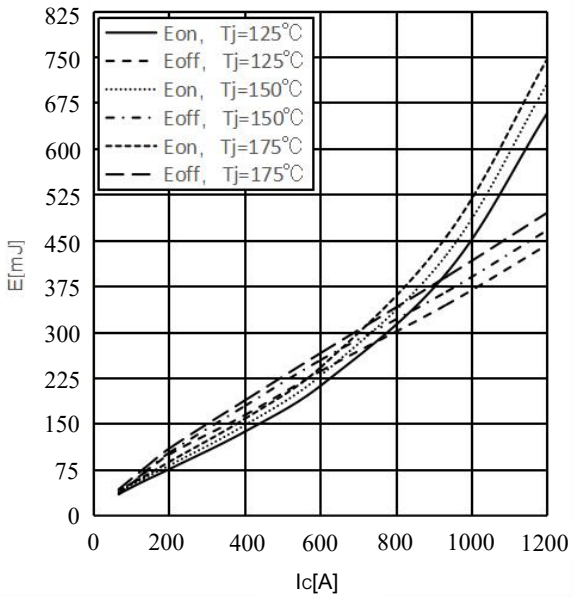
Output characteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 输出特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_C=f(V_{CE}),T_j=175℃$



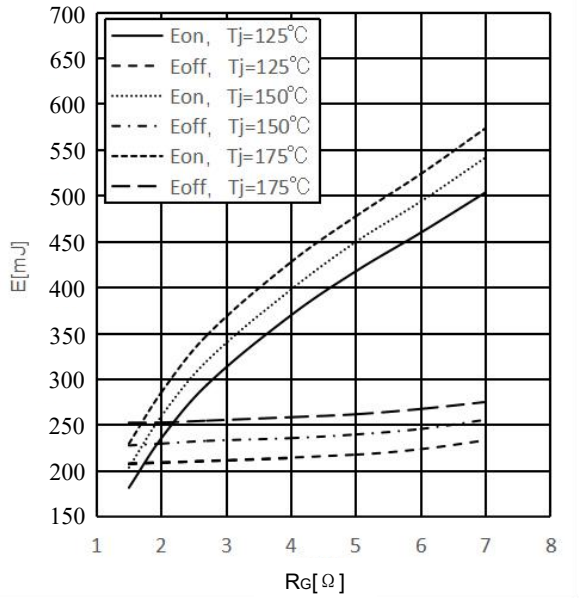
Transfer characteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 传输特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_C=f(V_{GE}),V_{CE}=20V$



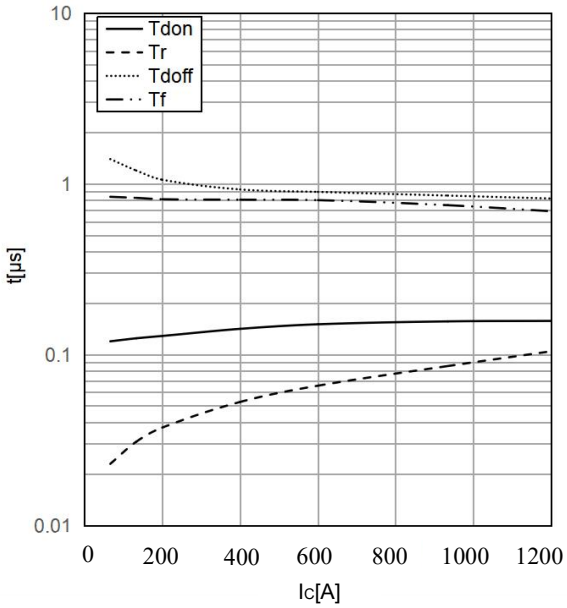
Switching losses IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 开关损耗，逆变（典型值），包含 $R_{CC'+EE'}$
$E=f(I_C)$，V_{GE}=+15V/-8V，
R_{Gon}=1.6Ω，R_{Goff}=3.5Ω，V_{CE}=900V



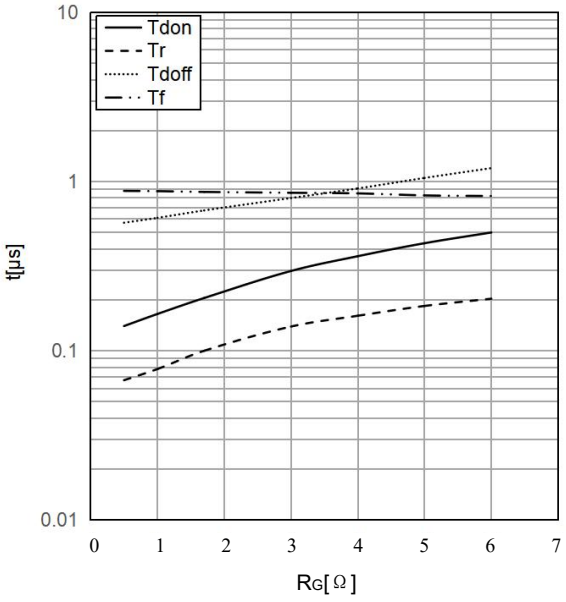
Switching losses IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 开关损耗，逆变（典型值），包含 $R_{CC'+EE'}$
E=f(R_G)，V_{GE}=+15V/-8V，I_C=600A，V_{CE}=900V



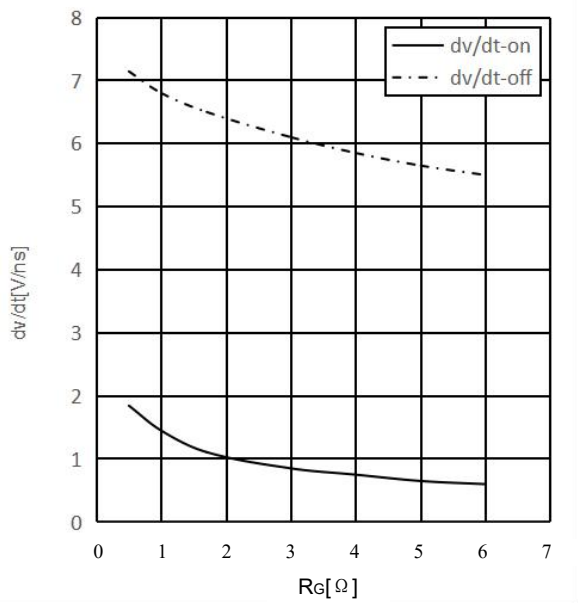
Switching times IGBT,Inverter(typical)
IGBT 开关时间，逆变（典型值）
t_{don}=f(I_C)，t_f=f(I_C)，V_{GE}=+15V/-8V，V_{CE}=900V
R_{Gon}=1.6Ω，R_{Goff}=3.5Ω，Tj=175°C



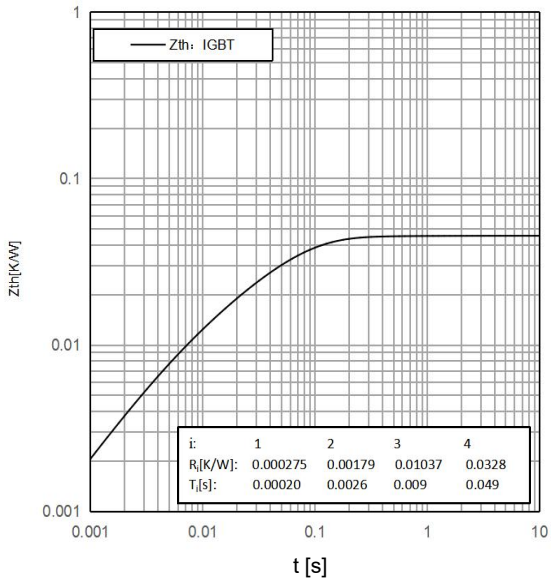
Switching times IGBT,Inverter(typical)
IGBT 开关时间，逆变（典型值）
t_{don}=f(R_G)，t_f=f(R_G)，V_{GE}=+15V/-8V，
I_C=600A，V_{CE}=900V，Tj=175°C



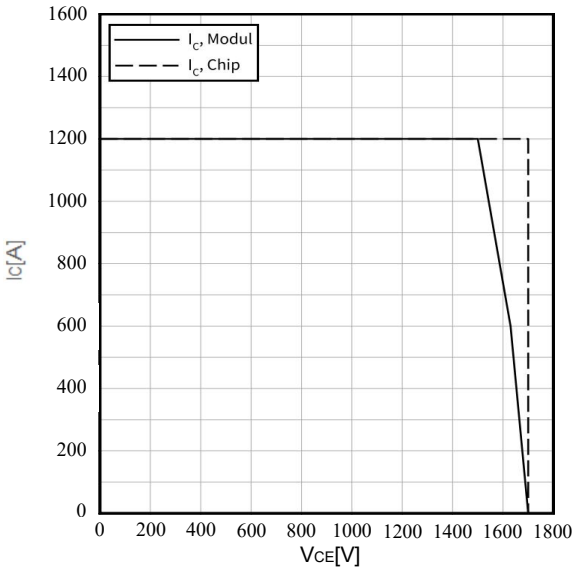
IGBT,Inverter(typical)
IGBT 电压变化斜率，逆变（典型值）
dv/dt=f(R_G)，V_{GE}=+15V/-8V，
I_C=600A，V_{CE}=900V，Tj=25°C



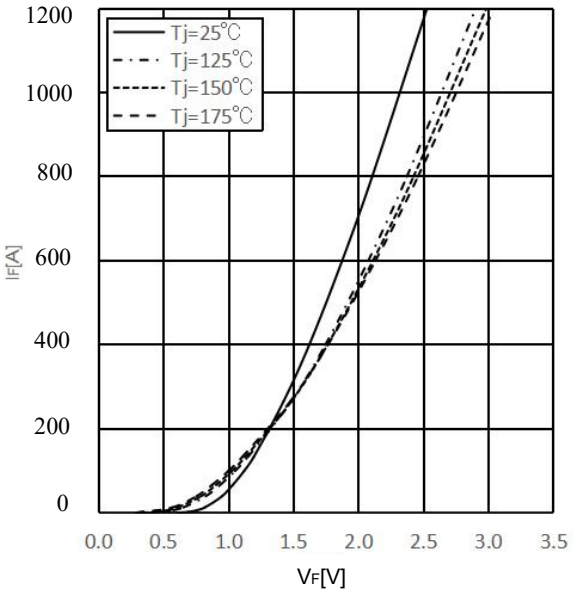
Transient thermal impedance IGBT, Inverter
IGBT 瞬态热阻，逆变
$Z_{thJC}=f(t)$



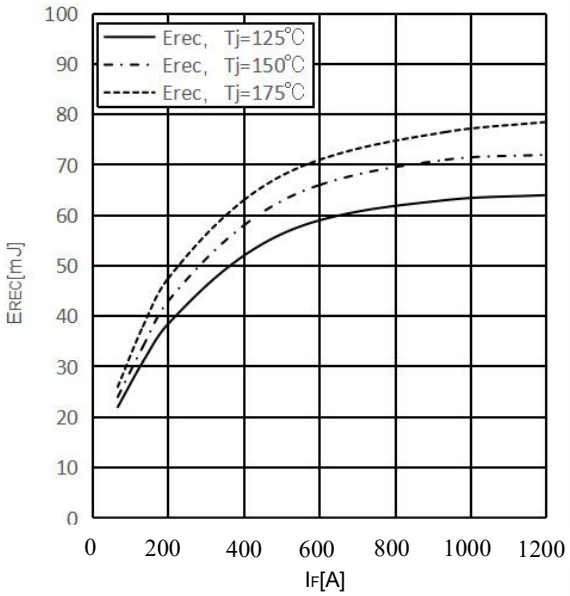
Reverse bias safe operating area IGBT, Inverter(RBSOA)
IGBT 反向安全工作区，逆变(RBSOA)
$I_C=f(V_{CE}),V_{GE}$=+15V/-8V, R_{Goff} = 3.5Ω, Tj = 175°C



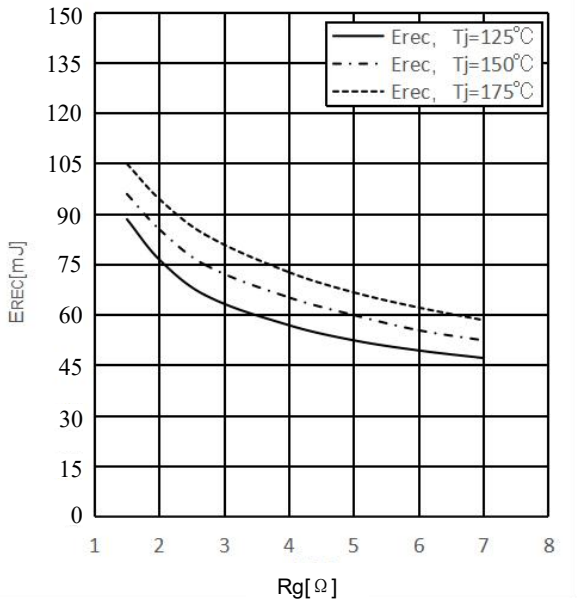
Forward characteristic FRD, Inverter(typical), Inclusiver $R_{CC'+EE'}$
FRD 正向特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_F=f(V_F)$



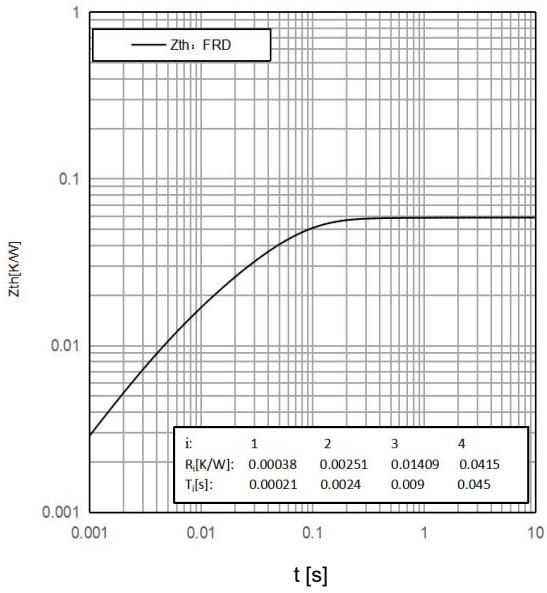
Swiching Losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$
FRD 开关损耗，逆变（典型值），包含 $R_{CC'+EE'}$
$E_{rec}=f(I_F),R_{Gon}$=3.5Ω,V_{CE}=900V



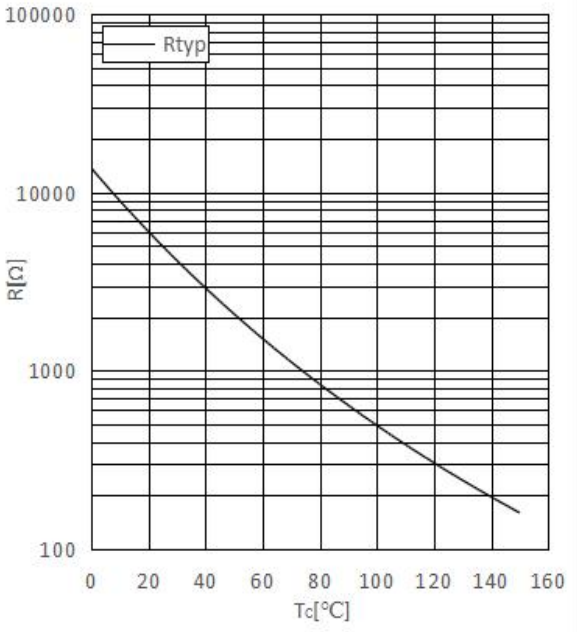
Swiching Losses FRD, Inverter(typical), Inclusive $R_{CC'+EE'}$
FRD 开关损耗，逆变（典型值）,包含 $R_{CC'+EE'}$
$E_{rec}=f(R_g)$



Transient thermal impedance FRD, Inverter
FRD 瞬态热阻，逆变
$Z_{thJC}=f(t)$

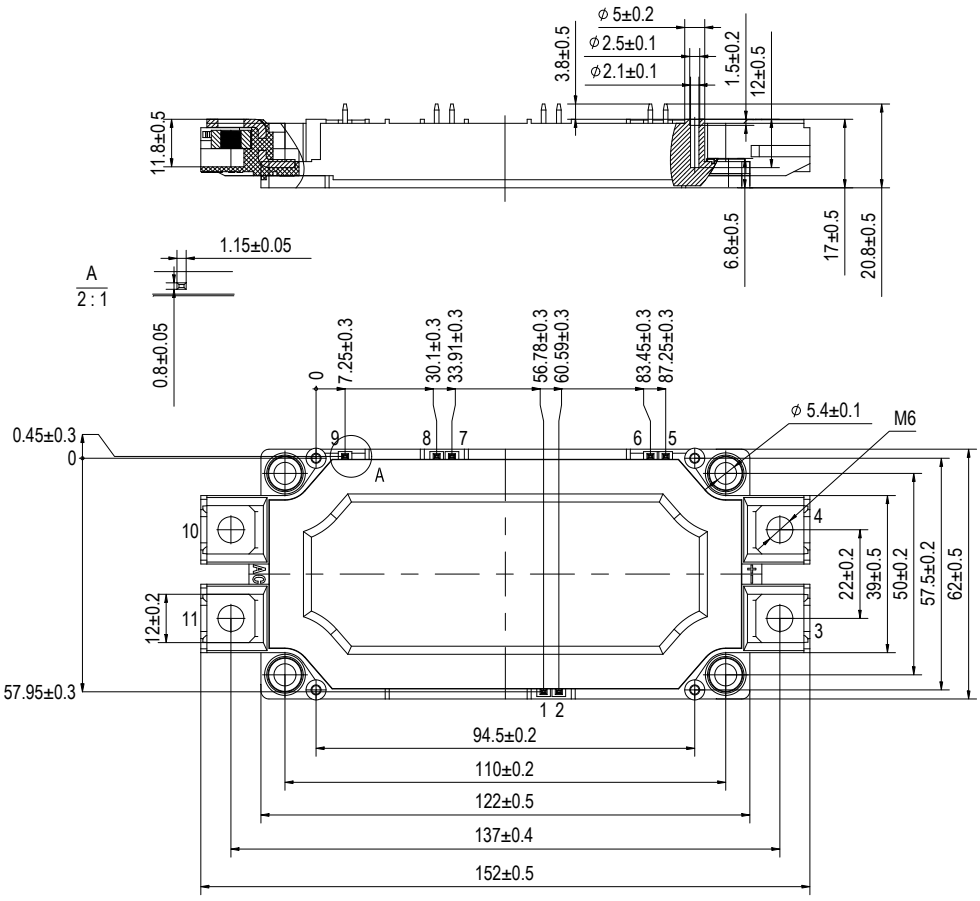


NTC Thermistor temperature characteristic (typical)
NTC 热敏电阻
R=f（T）



Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位



Internal Circuit / 内部电路