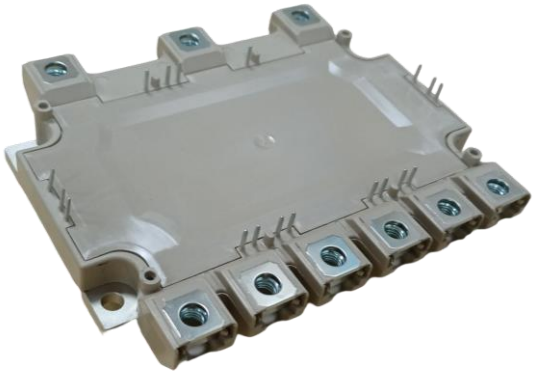
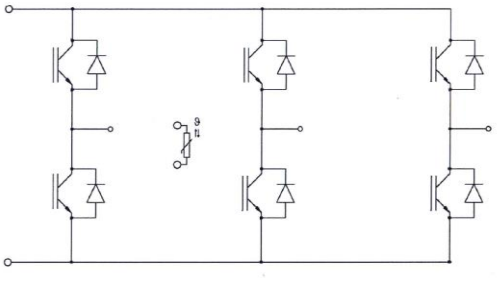
A3 package: 750V 600A IGBT module





等效电路图
Equivalent Circuit Schematic

Features:

- 750V 600A, $V_{CE(sat)}$ =1.4V@25℃
- High RBSOA capability
- Micro pattern trench/FS technology
- Low switching losses
- High SC capability
- Direct Cooled Base Plate with PinFin

产品特性:

- 750V 600A, $V_{CE(sat)}$ = 1.4V@25℃
- 高 RBSOA 能力
- 微沟槽/场终止技术
- 低开关损耗
- 高短路能力
- 直接冷却 PinFin 基板

Typical Applications：

- Automotive Applications
- Motor Drives
- Inverters

典型应用：

- 汽车应用
- 电机驱动
- 逆变器

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}	750	V
Continuous DC collector current 集电极连续直流电流		$I_{C\ nom}$	600	A
	T_C=65℃,$T_{vj\ max}$=175℃	I_C	670	A
Repetitive peak collector current 集电极可重复峰值电流	t_p=1ms	I_{CRM}	1200	A
Total power dissipation 功率损耗	T_C=25℃,$T_{vj\ max}$=175℃	P_{tot}	1456	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 集电极-发射极饱和压降	I_C=600A，V_{GE}=15V I_C=600A，V_{GE}=15V	T_{vj}=25℃ T_{vj}=150℃	V_{CEsat}	-	1.40 1.60		V
Gate threshold voltage 门极阈值电压	V_{CE}=V_{GE}，I_C=8mA	T_{vj}=25℃	V_{GEth}	5.00	6.00	7.00	V
Internal gate resistor 内置门极电阻		T_{vj}=25℃	R_{Gint}	-	0.70	-	Ω
Input capacitance 输入电容	V_{CE}=25V，V_{GE}=0V，f=100kHz	T_{vj}=25℃	C_{ies}	-	TBD	-	nF
Reverse transfer capacitance 反向传输电容	V_{CE}=25V，V_{GE}=0V，f=100kHz	T_{vj}=25℃	C_{res}	-	TBD	-	nF
Gate charge 门极电荷	V_{GE}=±15V		Q_G	-	TBD	-	μC
Collector-emitter cut-off current 集电极-发射极关断漏电流	V_{CE}=750V,V_{GE}=0V	T_{vj}=25℃	I_{CES}	-	-	1.0	mA
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=600A,V_{CE}=400V V_{GE}= -8V/15V R_{Gon}=2.0Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	t_{don}	-	150 172 189	-	ns
Rise time, inductive load 上升时间，感性负载	I_C=600A,V_{CE}=400V V_{GE}= -8V/15V R_{Gon}=2.0Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	t_r	-	90 104 108	-	ns
Turn-off delay time, inductive load 关断延迟时间，感性负载	I_C=600A，V_{CE}=400V V_{GE}= -8V/15V R_{Goff}=12Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	t_{doff}	-	988 1042 1060	-	ns
Fall time, inductive load 下降时间，感性负载	I_C=600A，V_{CE}=400V V_{GE}= -8V/15V R_{Goff}=12Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	t_f	-	117 112 114	-	ns
Turn-on energy loss per pulse 开通损耗	I_C=600A，V_{CE}=400V V_{GE}= -8V/15V R_{Gon}=2.0Ω,	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	E_{on}	-	22.4 28.4 32.9	-	mJ
Turn-off energy loss per pulse 关断损耗	I_C=600A,V_{CE}=400V V_{GE}= -8V/15V R_{Goff} =12Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	E_{off}	-	51.7 56.0 58.0	-	mJ
SC data 短路耐量	V_{CC}=400V，V_{GE}= -8V/15V, V_{CEmax}=V_{CES}-L_{sCE}·di/dt	T_{vj}=150℃	t_{psc}	6	-	-	μs

Thermal resistance, junction to cooling fluid 结-散热器热阻	Per IGBT/单个 IGBT	R_{thJF}	-	0.103	-	K/W
Temperature under switching conditions 工作温度	t_{op} continuous	$T_{vj\ op}$	-40	-	150	℃

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}	750		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	I_{FRM}=2×I_F	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	T_{vj}=25℃ T_{vj}=150℃	V_F	-	1.50 1.42	-	V
Reverse recovery time 反向恢复时间	I_F=600A, V_R=400V di_F/dt=3968A/us(T_{vj}=150℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	t_{rr}	-	148 217 319	-	ns
Peak reverse recovery current 反向恢复峰值电流	I_F=600A, V_R=400V di_F/dt=3968A/us(T_{vj}=150℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	I_{RM}	-	232 272 280	-	A
Recovery charge 反向恢复电荷	I_F=600A, V_R=400V di_F/dt=3968A/us(T_{vj}=150℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	Q_R	-	17.5 29.8 34.9	-	μC
Reverse recovery energy 反向恢复损耗	I_F=600A, V_R=400V di_F/dt=3968A/us(T_{vj}=150℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃	E_{rec}	-	4.4 7.5 8.8	-	mJ
Thermal resistance, junction to cooling fluid 结-散热器热阻	Per FRD/单个 FRD		R_{thJF}	-	0.165	-	K/W
Temperature under switching conditions 工作温度	t_{op} continuous		$T_{vj\ op}$	-40	-	150	℃

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}=493.3Ω	△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

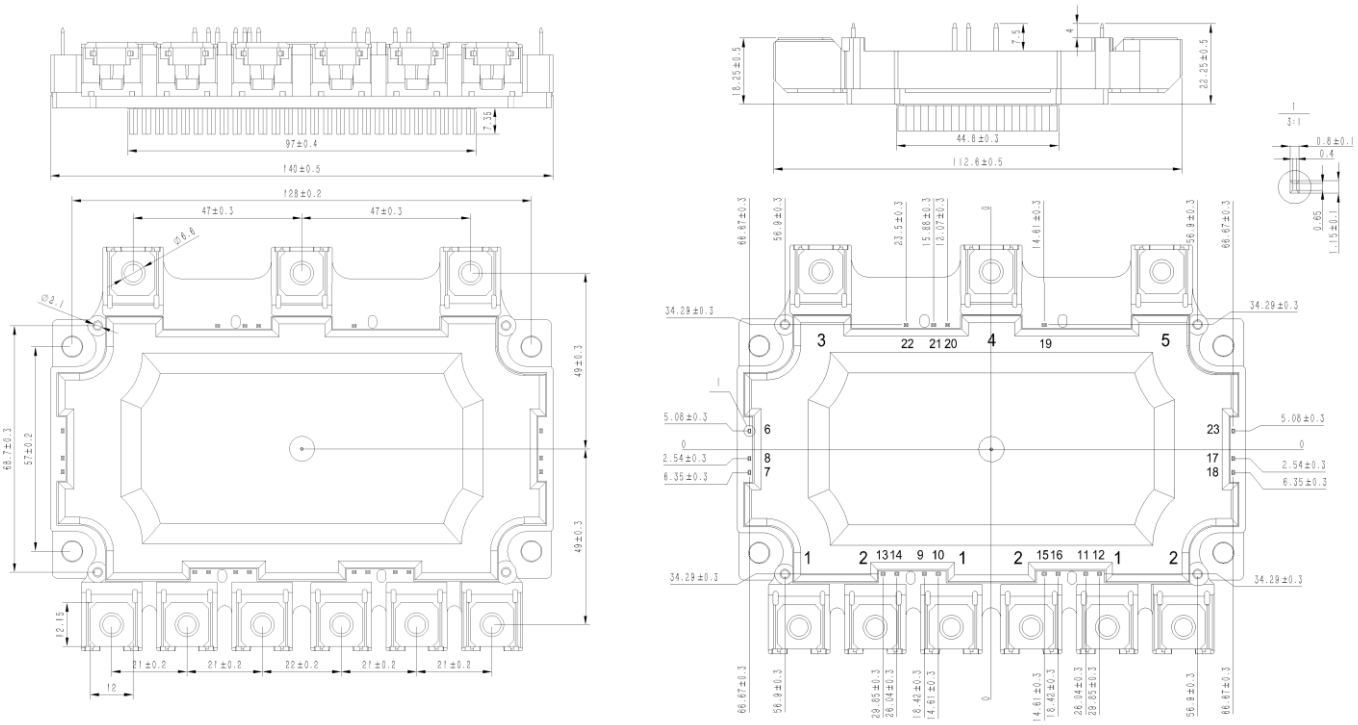
Module / 模块

Isolation test voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}		3		KV
Material of module baseplate 模块底板材料				Cu		
Internal isolation 内部绝缘				Si_3N_4		
Creepage distance 爬电距离	Terminal to heatsink Terminal to terminal			12.0 6.1		mm
Clearance 电气间隙	Terminal to heatsink Terminal to terminal			12.0 6.1		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}	-	15	-	nH
Module lead resistance，terminals-chip 模块引脚电阻，端子-芯片	T_C=25℃，Per Switch	$R_{CC'+EE'}$	-	1.0	-	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 Baseplate to heatsink	M	3.0	-	6.0	Nm
Terminal connection torque 功率端子连接力矩	Screw M6 / M6 螺丝	M	3.0	-	6.0	Nm
Weight 重量		G	-	685	-	g

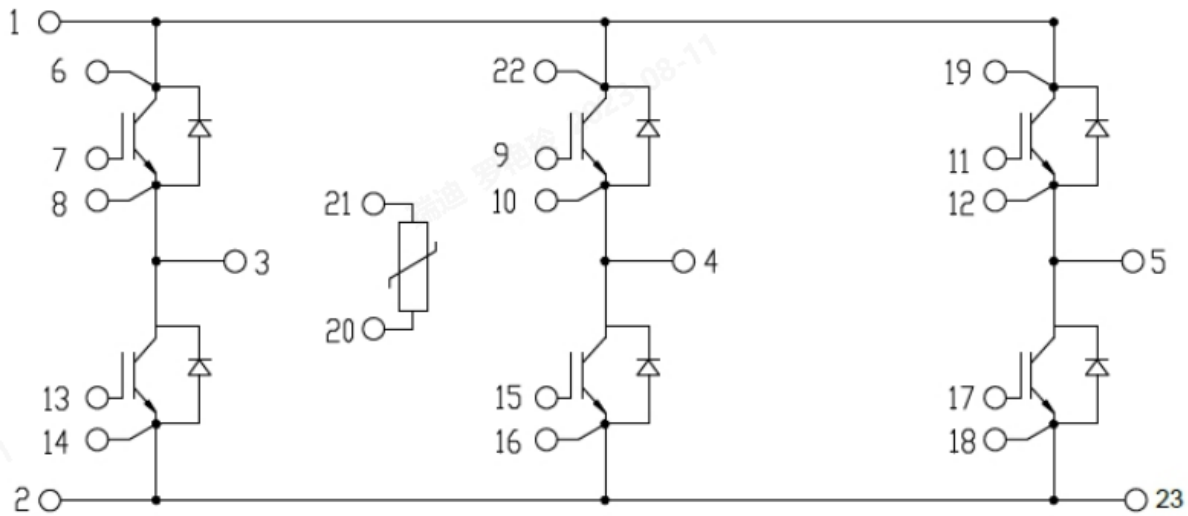
1) Terminal impedance is not included.
不包含端子阻抗。
2) CTI is about 200.
CTI 约等于 200。

Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位

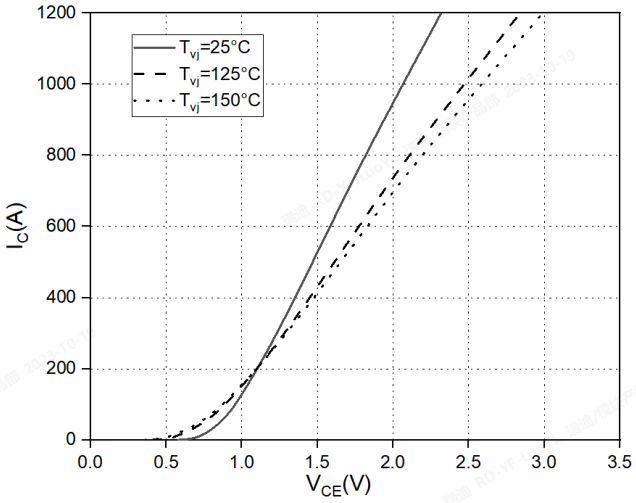


Internal Circuit / 内部电路

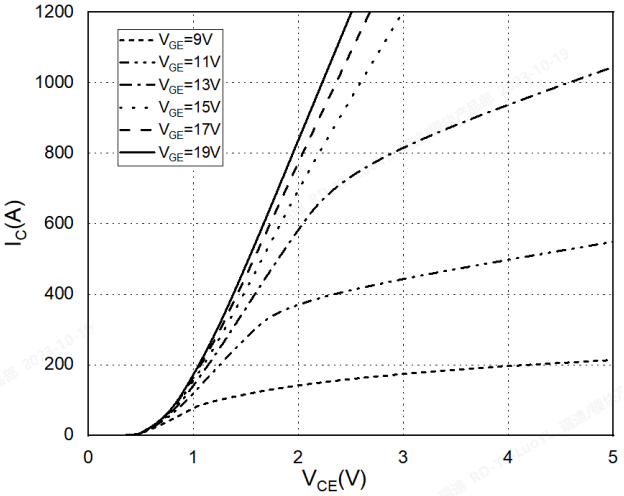


Circuit Diagram / 曲线图

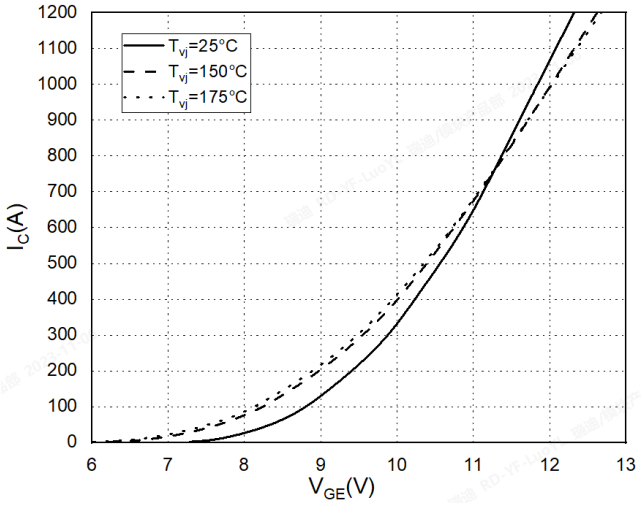
Output chanracteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 输出特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_C=f(V_{CE}),V_{GE}=15V$



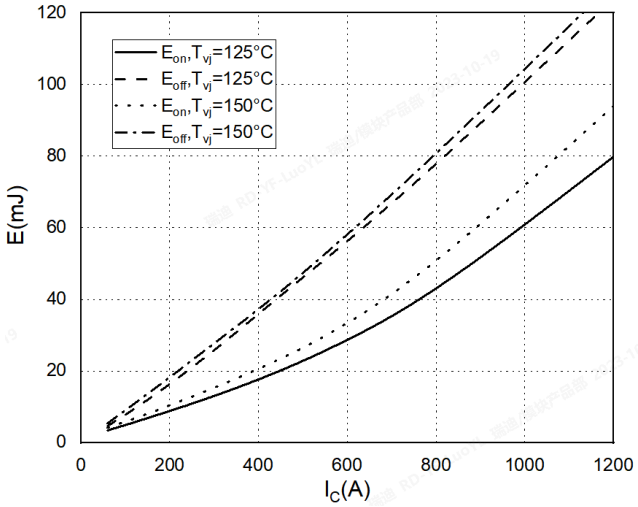
Output characteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 输出特性，逆变（Tj=150℃），包含 $R_{CC'+EE'}$
$I_C=f(V_{CE}),T_{vj}=150℃$



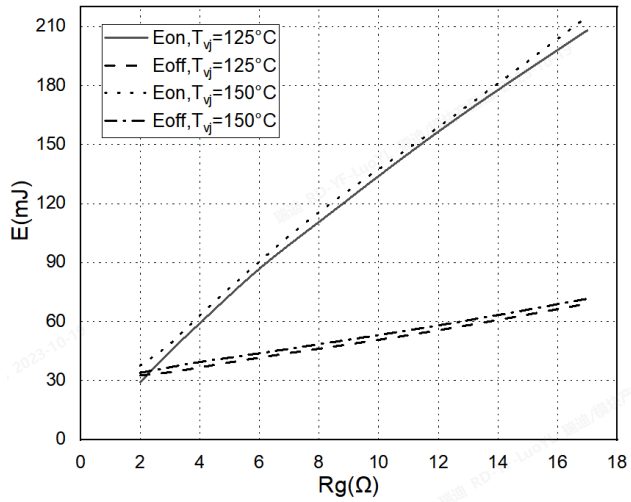
Transfer characteristic IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 传输特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_C=f(V_{GE}),V_{CE}=20V$



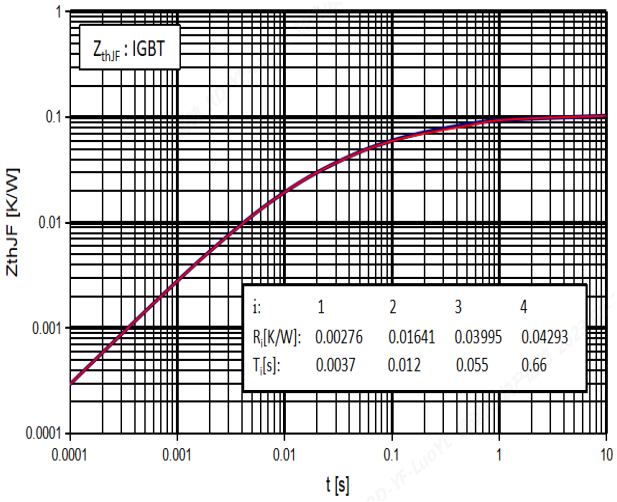
Switching losses IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 开关损耗，逆变（典型值），包含 $R_{CC'+EE'}$
$E=f(I_C)$，V_{GE}=+15V/-8V，
$R_{Gon}=2Ω$，$R_{Goff}=12Ω$，$V_{CE}=400V$



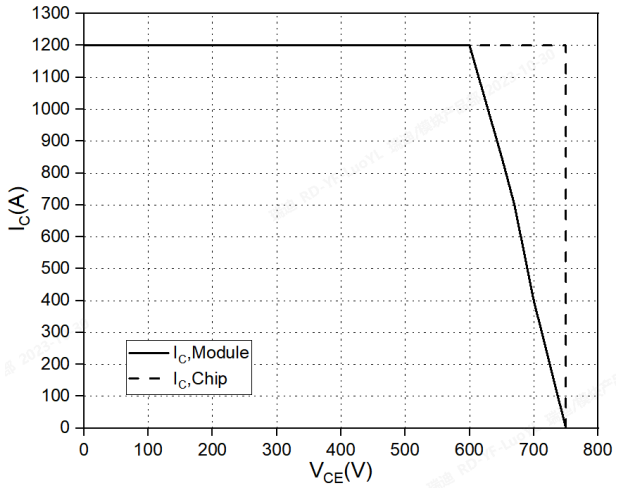
Switching losses IGBT,Inverter(typical), Inclusive $R_{CC'+EE'}$
IGBT 开关损耗，逆变（典型值），包含 $R_{CC'+EE'}$
$E_{on}=f(R_G)$, $E_{off}=f(R_G)$),
V_{GE}=+15V/-8V, I_C=600A, V_{CE}=400V



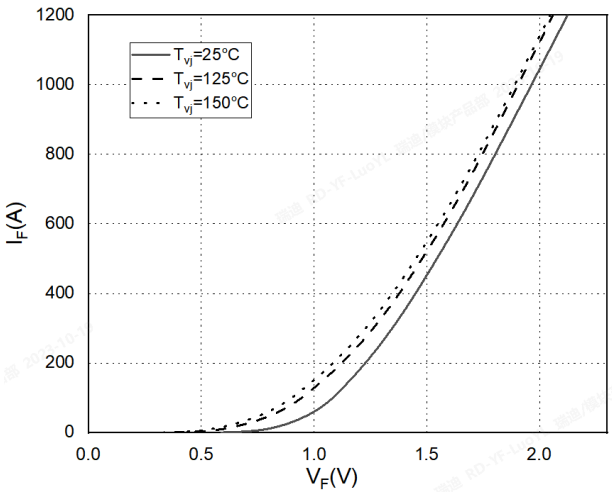
Transient thermal impedance IGBT, Inerter
IGBT 瞬态热阻，逆变
$Z_{thJC}=f(t)$



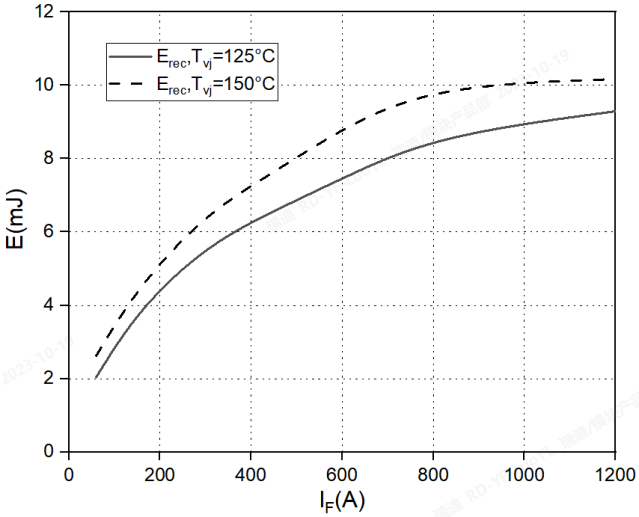
Reverse bias safe operating area IGBT, Inverter(RBSOA)
IGBT 反向安全工作区，逆变(RBSOA)
$I_C=f(V_{CE})$,V_{GE}=+15V/-8V, R_{Goff}=12Ω, Tvj = 150°C



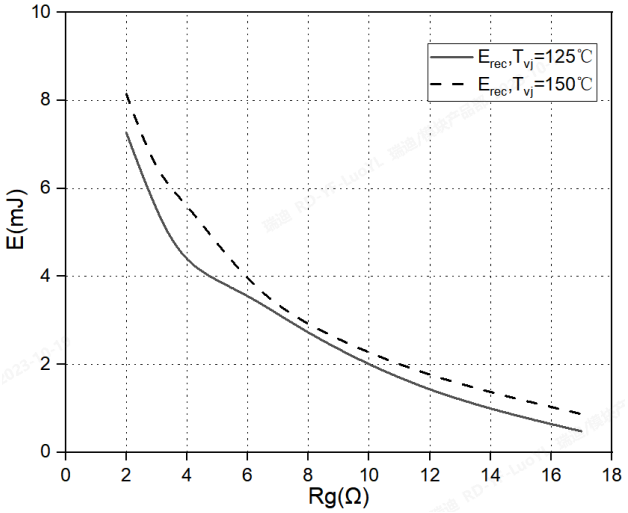
Forward characteristic FRD, Inverter(typical), Inclusive $R_{CC'+EE'}$
FRD 正向特性，逆变（典型值）,包含 $R_{CC'+EE'}$
$I_F=f(V_F)$



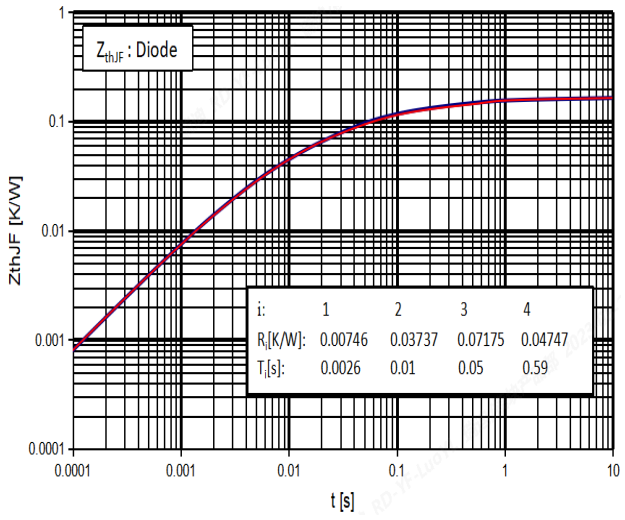
Swiching losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$
FRD 开关损耗，逆变（典型值）,包含 $R_{CC'+EE'}$
$E_{rec}=f(I_F),R_{Gon}=12\Omega,V_{CE}=400V$



Swiching losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$
FRD 开关损耗，逆变（典型值）,包含 $R_{CC'+EE'}$
$E_{rec}=f(R_G),I_F=600A,V_{CE}=400V$



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



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