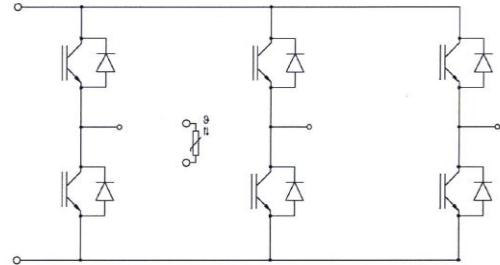


A1 package: 750V 600A IGBT module



等效电路图
Equivalent Circuit Schematic

Features:

- 750V 400A, $V_{CE(sat)} = 1.4V @ 25^{\circ}C$
- High RBSOA capability
- Micro pattern trench/FS technology
- Low switching losses
- High SC capability

产品特性:

- 750V 400A, $V_{CE(sat)} = 1.4V @ 25^{\circ}C$
- 高 RBSOA 能力
- 微沟槽/场终止技术
- 低开关损耗
- 高短路能力

Typical Applications:

- Automotive Applications
- Motor Drives

典型应用:

- 汽车应用
- 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	$T_{vj}=25^{\circ}\text{C}$	V_{CES}	750	V
Continuous DC collector current 集电极连续直流电流		$I_{C\text{ nom}}$	600	A
	$T_C=65^{\circ}\text{C}, T_{vj\text{ max}}=175^{\circ}\text{C}$	I_C	669.9	A
Repetitive peak collector current 集电极可重复峰值电流	$t_p=1\text{ms}$	I_{CRM}	1200	A
Total power dissipation 功率损耗	$T_C=25^{\circ}\text{C}, T_{vj\text{ max}}=175^{\circ}\text{C}$	P_{tot}	1829	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-发射极饱和电压	$I_C=600\text{A}, V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	V_{CESat}	-	1.40 1.60	V	
Gate threshold voltage 门极阈值电压	$V_{CE}=V_{GE}, I_C=6.4\text{mA}$	$T_{vj}=25^{\circ}\text{C}$	V_{GEth}	5.00	6.00	7.00	V
Internal gate resistor 内置门极电阻		$T_{vj}=25^{\circ}\text{C}$	R_{Gint}	-	0.70	-	Ω
Input capacitance 输入电容	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=100\text{kHz}$	$T_{vj}=25^{\circ}\text{C}$	C_{ies}	-	TBD	-	nF
Reverse transfer capacitance 反向传输电容	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=100\text{kHz}$	$T_{vj}=25^{\circ}\text{C}$	C_{res}	-	TBD	-	nF
Gate charge 门极电荷	$V_{GE}=\pm 15\text{V}$		Q_G	-	TBD	-	μC
Collector-emitter cut-off current 集电极-发射极关断漏电流	$V_{CE}=750\text{V}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$	I_{CES}	-	-	1.0	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	$I_C=450\text{A}, V_{CE}=400\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$	$T_{vj}=25^{\circ}\text{C}$	t_{don}	-	121	-	ns
		$T_{vj}=150^{\circ}\text{C}$		-	145		
		$T_{vj}=175^{\circ}\text{C}$		-	147		
Rise time, inductive load 上升时间, 感性负载	$I_C=450\text{A}, V_{CE}=400\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$	$T_{vj}=25^{\circ}\text{C}$	t_r	-	63.5	-	ns
		$T_{vj}=150^{\circ}\text{C}$		-	72.0		
		$T_{vj}=175^{\circ}\text{C}$		-	76.0		
Turn-off delay time, inductive load 关断延迟时间, 感性负载	$I_C=450\text{A}, V_{CE}=400\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Goff}=12\Omega$	$T_{vj}=25^{\circ}\text{C}$	t_{doff}	-	1044	-	ns
		$T_{vj}=150^{\circ}\text{C}$		-	1127		
		$T_{vj}=175^{\circ}\text{C}$		-	1151		
Fall time, inductive load 下降时间, 感性负载	$I_C=450\text{A}, V_{CE}=400\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Goff}=12\Omega$	$T_{vj}=25^{\circ}\text{C}$	t_f	-	103	-	ns
		$T_{vj}=150^{\circ}\text{C}$		-	101		
		$T_{vj}=175^{\circ}\text{C}$		-	108		
Turn-on energy loss per pulse 开通损耗	$I_C=450\text{A}, V_{CE}=400\text{V}, L_o=30\text{nH}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$	$T_{vj}=25^{\circ}\text{C}$	E_{on}	-	13.9	-	mJ
		$T_{vj}=150^{\circ}\text{C}$		-	16.4		
		$T_{vj}=175^{\circ}\text{C}$		-	17.5		
Turn-off energy loss per pulse 关断损耗	$I_C=450\text{A}, V_{CE}=400\text{V}, L_o=30\text{nH}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Goff}=12\Omega$	$T_{vj}=25^{\circ}\text{C}$	E_{off}	-	31.5	-	mJ
		$T_{vj}=150^{\circ}\text{C}$		-	34.4		
		$T_{vj}=175^{\circ}\text{C}$		-	36.0		
SC data 短路耐受	$V_{CC}=400\text{V}, V_{GE}=-8\text{V}/15\text{V},$ $V_{CE\text{ max}}=V_{CES}-L_{sC}\cdot di/dt$	$T_{vj}=150^{\circ}\text{C}$	t_{psc}	6	-	-	μs

Thermal resistance, junction to case 结-壳热阻	Per IGBT/单个 IGBT	R_{thJC}	-	0.082	-	K/W
Temperature under switching conditions 工作温度	t_{op} continuous	$T_{vj op}$	-40	-	150	°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	$T_{vj}=25^{\circ}\text{C}$	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	$I_{FRM}=2 \times I_F$	I_{FRM}	1200	A

Characteristic Values / 性能参数

			min.	typ.	max.		
Forward voltage ¹⁾ 正向通态压降	$I_F=600\text{A}, V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	V_F	-	1.50 1.42	-	V
Peak reverse recovery current 反向恢复峰值电流	$I_F=450\text{A}, V_R=400\text{V}$ $-di_F/dt=4365\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_{GE}=-8\text{V}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	I_{RM}	-	282 366 390	-	A
Recovery charge 反向恢复电荷	$I_F=450\text{A}, V_R=400\text{V}$ $-di_F/dt=4365\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_{GE}=-8\text{V}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	Q_R	-	23.8 41.1 46.8	-	μC
Reverse recovery energy 反向恢复损耗	$I_F=450\text{A}, V_R=400\text{V}$ $-di_F/dt=4365\text{A}/\mu\text{s}(T_{vj}=150^{\circ}\text{C})$ $V_{GE}=-8\text{V}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	E_{rec}	-	6.3 12.4 14.6	-	mJ
Thermal resistance, junction to case 结-壳热阻	Per FRD/单个 FRD		R_{thJC}	-	0.157	-	K/W
Temperature under switching conditions 工作温度	t_{op} continuous		$T_{vj op}$	-40	-	150	°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	$T_{NTC}=100^{\circ}\text{C}, R_{100}=493.3\Omega$		$\Delta R/R$	-5	-	5	%
Power dissipation 功率耗散	$T_{NTC}=25^{\circ}\text{C}$		P_{25}	-	-	20	mW
B-value B 值	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		$B_{25/50}$	-	3375	-	K
	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		$B_{25/80}$	-	3414	-	K
	$R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		$B_{25/100}$	-	3436	-	K

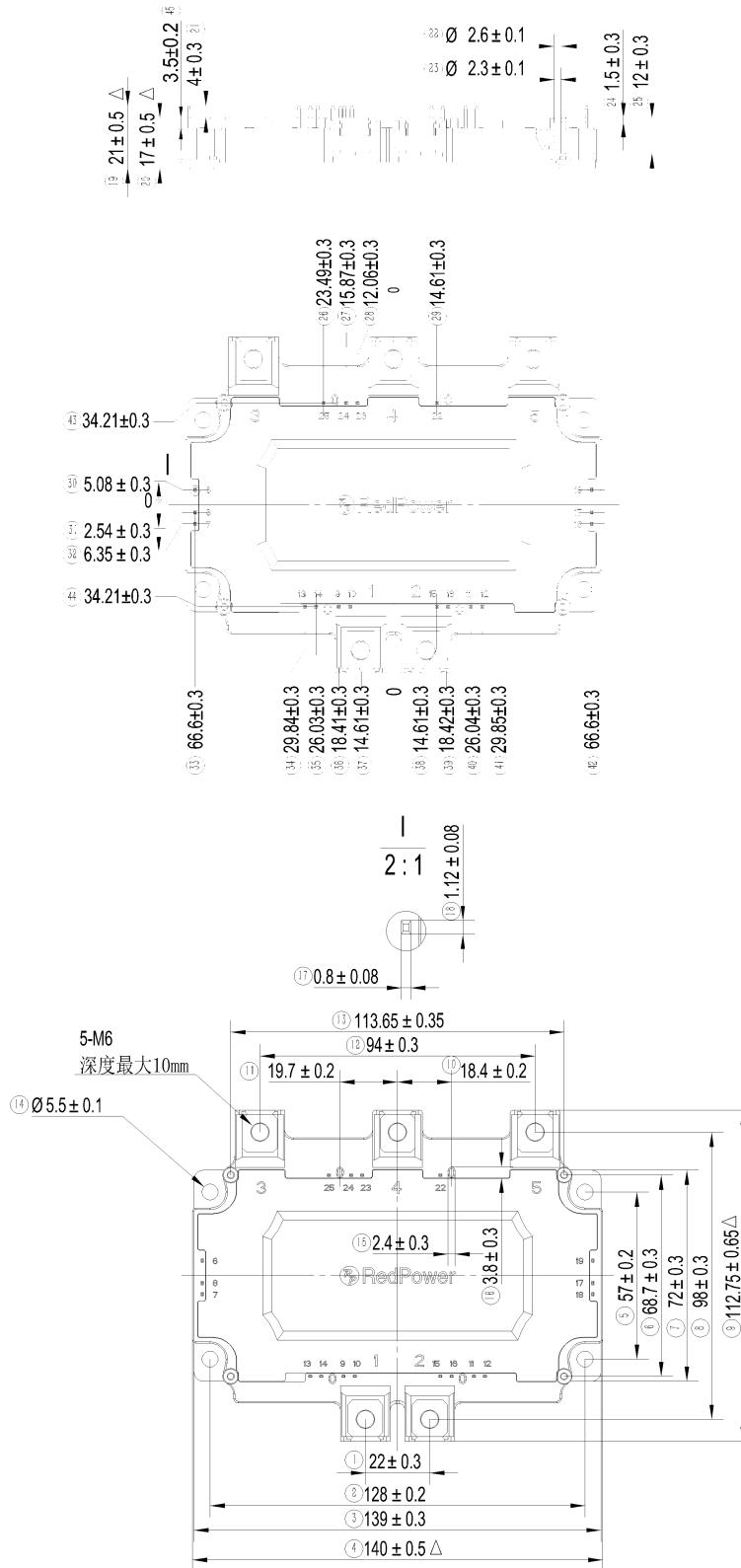
Module / 模块

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			Al_2O_3/ZrO_2			
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}	-	20	-	nH
Module lead resistance, terminals- chip 模块引脚电阻, 端子-芯片	$T_c=25^\circ C$, Per Switch	$R_{CC'+EE'}$	-	1.0	-	m Ω
Storage temperature 贮存温度		T_{stg}	-40	-	125	$^\circ C$
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	-	470	-	g

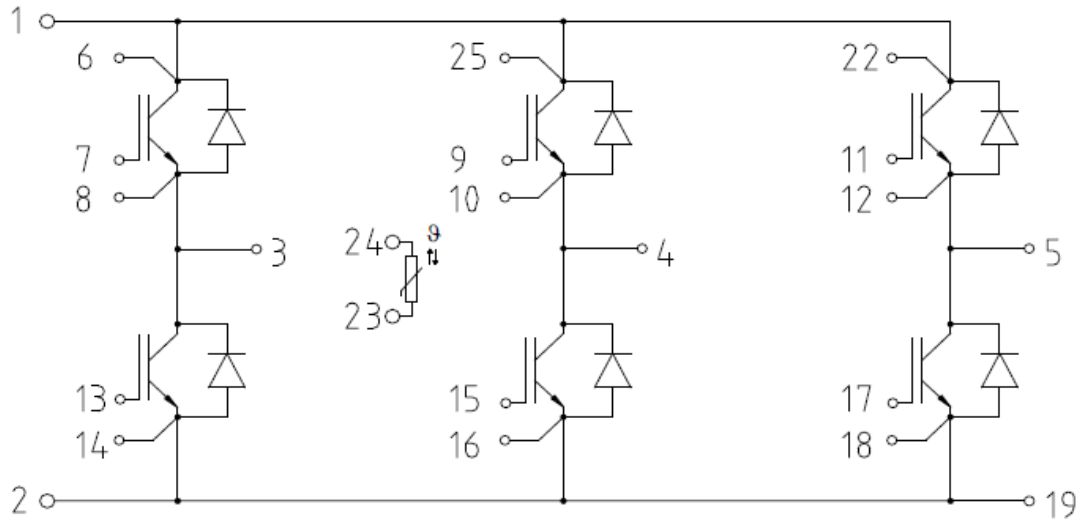
- 1) Terminal impedance is not included.
不包含端子阻抗。
- 2) CTI is about 200.
CTI 约等于 200。

Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位

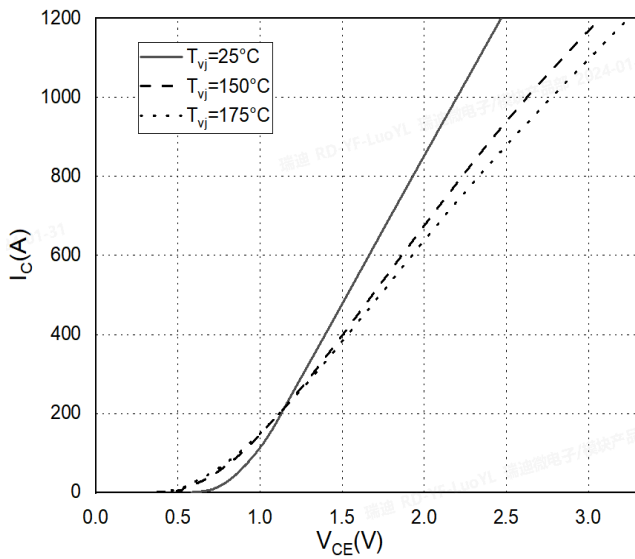


Internal Circuit / 内部电路

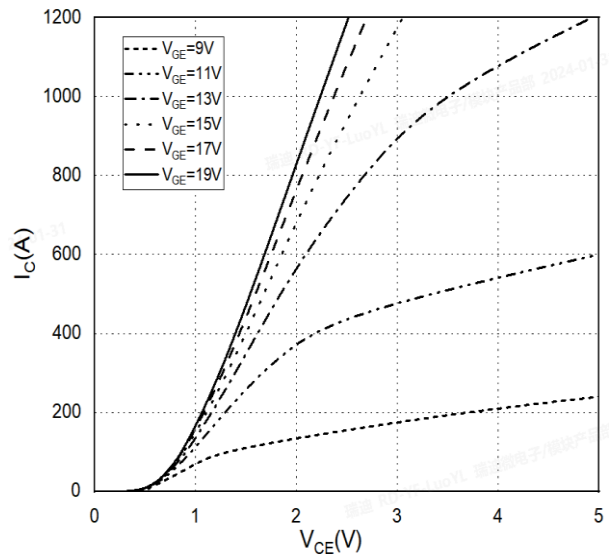


Circuit Diagram / 曲线图

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

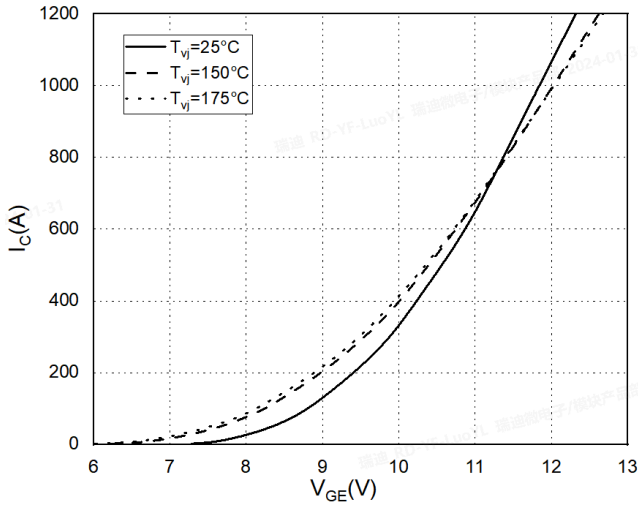


Output characteristic IGBT, Inverter (typical), Inclusive R_{CC+EE}
 IGBT 输出特性, 逆变 ($T_j = 150^\circ C$), 包含 R_{CC+EE}
 $I_c = f(V_{CE}), T_j = 150^\circ C$



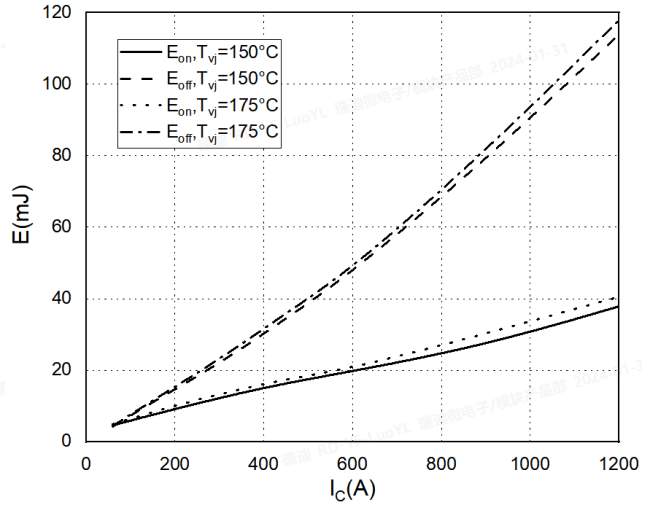
Transfer characteristic IGBT, Inverter (typical), Inclusive R_{CC+EE}

IGBT 传输特性, 逆变 (典型值), 包含 R_{CC+EE}
 $I_C=f(V_{GE}), V_{CE}=15V$



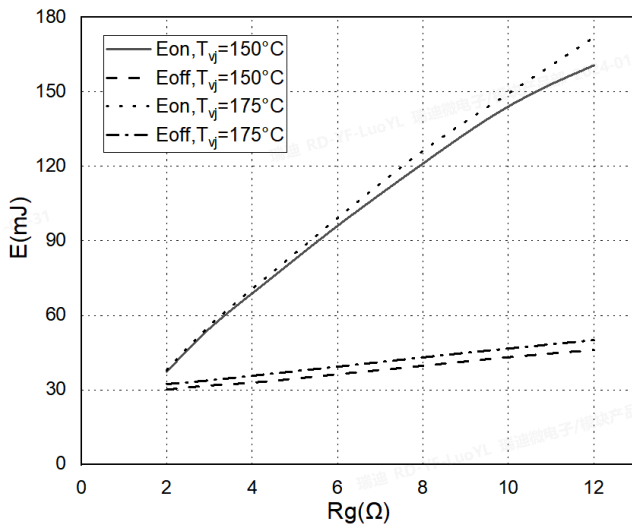
Switching losses IGBT, Inverter (typical), Inclusive R_{CC+EE}

IGBT 开关损耗, 逆变 (典型值), 包含 R_{CC+EE}
 $E=f(I_C), V_{GE}=+15V/-8V,$
 $R_{Gon}=1.5\Omega, R_{Goff}=12\Omega, V_{CE}=400V$



Switching losses IGBT, Inverter (typical), Inclusive R_{CC+EE}

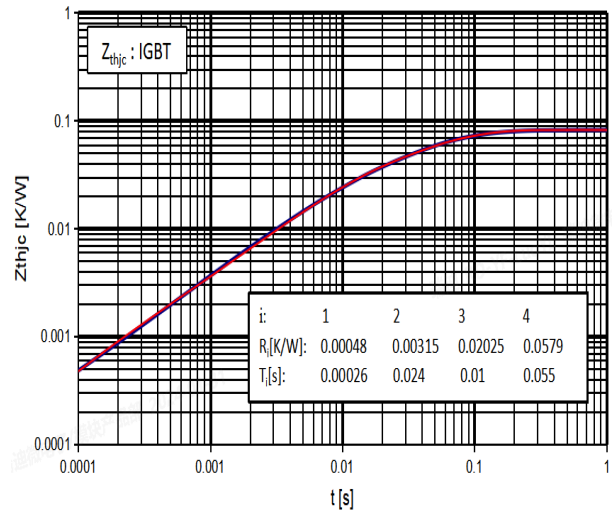
IGBT 开关损耗, 逆变 (典型值), 包含 R_{CC+EE}
 $E=f(R_G), V_{GE}=+15V/-8V, I_C=450A, V_{CE}=400V$



Transient thermal impedance IGBT, Inverter

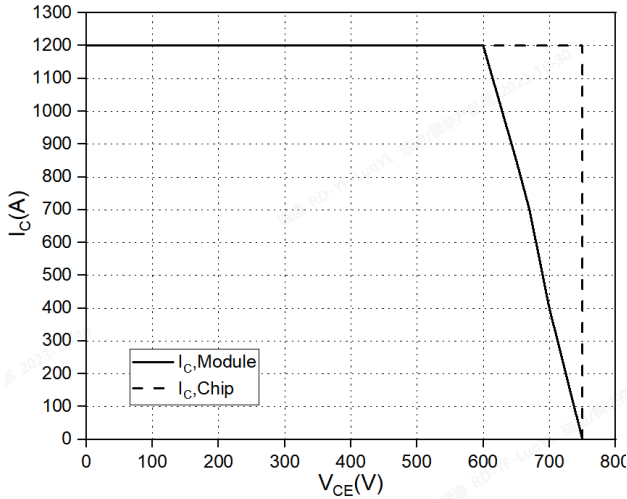
IGBT 瞬态热阻, 逆变

$Z_{thJC}=f(t)$



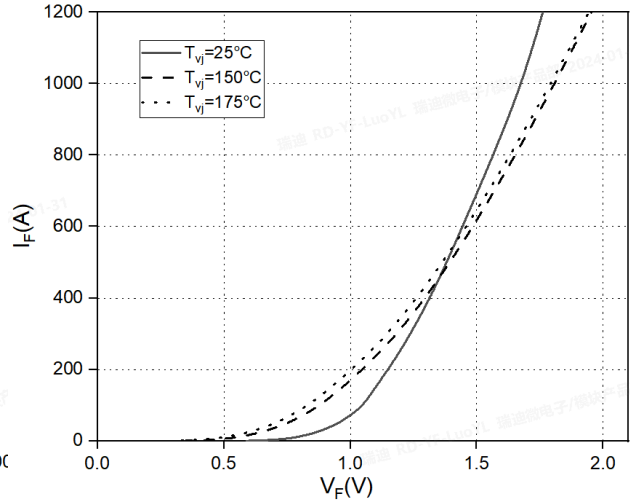
Reverse bias safe operating area IGBT, Inverter(RBSOA)

IGBT 反向安全工作区, 逆变(RBSOA)
 $I_C=f(V_{CE}), V_{GE}=+15V/-8V, R_{Goff}=12\Omega, T_j=150^\circ C$



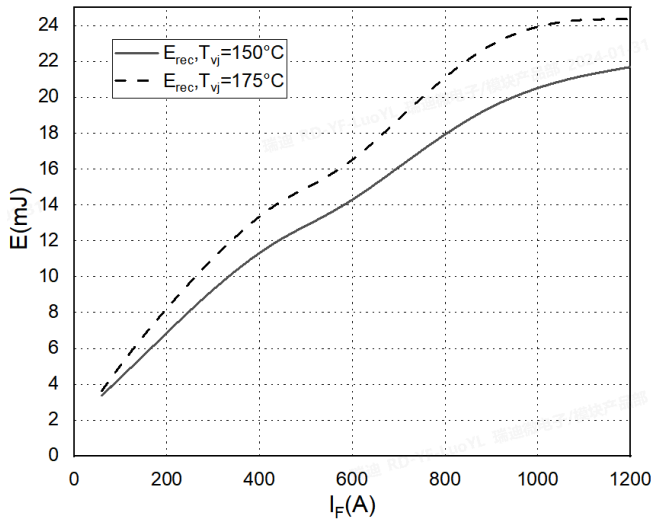
Forward characteristic FRD, Inverter(typical), Inclusive $R_{CC'+EE'}$

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



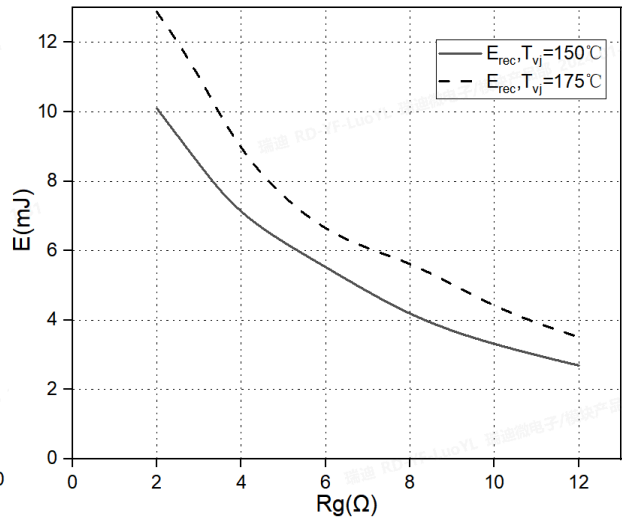
Switching Losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$

FRD 开关损耗, 逆变 (典型值), 包含 $R_{CC'+EE'}$
 $E_{rec}=f(I_F), R_{Gon}=1.5\Omega, V_{CE}=400V$



Output characteristic Erec, Inverter(typical), Inclusive $R_{CC'+EE'}$

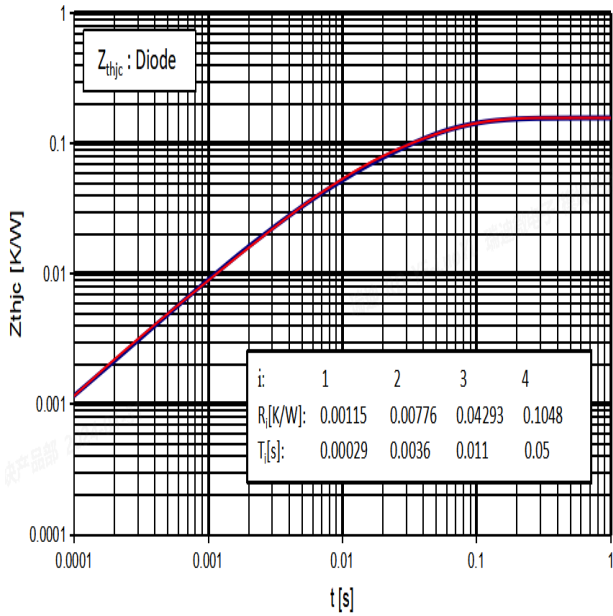
FRD 输出特性, 逆变 (典型值), 包含 $R_{CC'+EE'}$
 $E_{rec}=f(R_g)$



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

$R=f(T)$

