

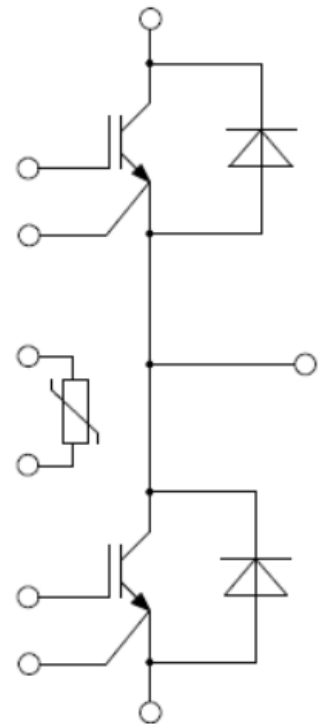
## 1200V, 450A IGBT Module

### ■ 特点/Features

- 低 Vcesat/ Low Vcesat
- 高可靠性和功率密度/High reliability and Power density
- 低开关损耗/Low switching loss

### ■ 应用领域/Applications

- UPS 系统/UPS Systems
- 风力发电机/Wind Tuebines
- 电机传动/Motor Drives



Vces=1200V

Ic nom =450A

## ● IGBT-逆变器/IGBT- Inverter

### 最大额定值/Absolute Max Ratings

符号 Symbol	参数 Parameter	条件 condition	值 Value	单位 Units
$V_{CES}$	Collector-to-Emitter Voltage 集电极-发射极电压	$T_{vj}=25\text{ }^{\circ}\text{C}$	1200	V
$I_{C\text{ nom}}$	Continuous DC collector current 连续集电极直流电流	$T_C = 100^{\circ}\text{C}, T_{vj\text{ max}}=175\text{ }^{\circ}\text{C}$	450	A
$I_{CRM}$	Repetitive peak collector current 集电极重复峰值电流	$t_p=1\text{ms}$	900	A
$P_{total}$	Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\text{ max}}=175\text{ }^{\circ}\text{C}$	2150	W
$V_{GES}$	Gate-Emitter peak voltage 栅极-发射极峰值电压		+/- 20	V

### 特征值/Characteristics Values

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min. 最小	Typ. 典型	Max. 最大	
$V_{CE(sat)}$	Collector-Emitter Saturation voltage 集电极-发射极饱和电压	$V_{GE}=15\text{V}, I_C=450\text{A}, T_{vj}=25^{\circ}\text{C}$	—	1.75	—	V
		$V_{GE}=15\text{V}, I_C=450\text{A}, T_{vj}=150^{\circ}\text{C}$	—	2.05	—	V
$V_{GE(th)}$	Gate threshold voltage 门极开启阈值电压	$V_{GE} = V_{CE}, I_C = 17\text{mA}$	5	5.6	6.2	V
$C_{iss}$	Input capacitance 输入电容	$V_{GE} = 0\text{V}$ $V_{CE} = 25\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $f = 1\text{MHz}$	—	30.5	—	nF
$C_{oss}$	Output capacitance 输出电容		—	2.75	—	nF
$C_{riss}$	Reverse transfer capacitance 反向传输电容		—	1.0	—	nF
$Q_g$	Total gate charge 栅极电荷	$V_{GE} = -15\text{.....}+15\text{V}$	—	1.62	—	$\mu\text{C}$
$R_g$	Internal gate resistor 内部栅极电阻	$T_{vj}=25^{\circ}\text{C}$	—	2.30	—	$\Omega$
$I_{CES}$	Collector-Emitter leakage current 集电极-发射极截止电流	$V_{CE}=1200\text{V},$ $V_{GE} = 0\text{V}, T_{vj}=25^{\circ}\text{C}$	-	-	5.0	mA
$I_{GES}$	Gate-Emitter leakage current 栅极-发射极漏电流	$V_{CE}=0\text{V}, V_{GE} = 20\text{V}, T_{vj}=25^{\circ}\text{C}$	-	-	500	nA
$T_{d(on)}$	Turn-On Delay Time 开通延迟时间	$T_{vj}=25^{\circ}\text{C}, V_{CE}=600\text{V},$ $I_C=450\text{A}, R_g=1.0\text{ohm},$ $V_{GE}=+15\text{V}$	-	180	-	ns
$T_r$	Rise Time 上升时间		-	59	-	ns

$T_{d(off)}$	Turn-Off DelayTime 关断延迟时间	$T_{vj}=150^{\circ}C, V_{CE}=600V,$ $I_c=450A, R_g=1.0\Omega,$ $V_{GE}=+15V$	-	435	-	ns
$T_f$	Turn-Off Fall Time 下降时间		-	82	-	ns
$T_{d(on)}$	Turn-On DelayTime 开通延迟时间		-	187	-	ns
$T_r$	Rise Time 上升时间		-	66	-	ns
$T_{d(off)}$	Turn-Off DelayTime 关断延迟时间		-	504	-	ns
$T_f$	Turn-Off Fall Time 下降时间		-	218	-	ns
$E_{on}$	Turn-on switch loss 开通损耗	$T_{vj}=25^{\circ}C, V_{CE}=600V,$ $I_c=450A, R_g=1.0\Omega,$ $V_{GE}=+15V$	-	21	-	mJ
$E_{off}$	Turn-off switch loss 关断损耗		-	43	-	mJ
$E_{on}$	Turn-on switch loss 开通损耗	$T_{vj}=150^{\circ}C, V_{CE}=600V,$ $I_c=450A, R_g=1.0\Omega,$ $V_{GE}=+15V$	-	36	-	mJ
$E_{off}$	Turn-off switch loss 关断损耗		-	51	-	mJ
$I_{sc}$	Short-circuit current 短路电流	$T_{vj}=25^{\circ}C, V_{GE}=15V,$ $V_{CE}=1000V, t_p < 10\mu s$	-	2400	-	A
$R_{thJC}$	Junction-Case Thermal resistance 结-外壳热阻	-	-	-	0.07	K/W
$T_{vj op}$	Temperature under switching 在开关状态下温度	-	-40	-	150	$^{\circ}C$

## ● 二极管-逆变器/Diode- Inverter

### 最大额定值/Absolute Max Ratings

符号 Symbol	参数 Parameter	条件 condition	值 Value	单位 Units
$V_{RRM}$	Repetitive peak reversevoltage 反向重复峰值电压	$T_{vj}=25^{\circ}C$	1200	V
$I_F$	Continuous DC forward current 连续正向直流电流		450	A
$I_{FRM}$	Repetitive peak forward current 正向重复峰值电流	$T_p=1ms$	900	A

### 特征值/Characteristics Values

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min. 最小	Typ. 典型	Max. 最大	
V <sub>F</sub>	Forward voltage 正向电压	I <sub>F</sub> =450A, T <sub>vj</sub> =25 °C	-	2.32	-	V
		I <sub>F</sub> =450A, T <sub>vj</sub> =150 °C	-	2.40	-	V
I <sub>RM</sub>	Peak reverse recovery current 反向恢复峰值电流	I <sub>F</sub> =450A, V <sub>R</sub> =600V, T <sub>vj</sub> =25 °C	-	243	-	A
Q <sub>r</sub>	Recovery charge 恢复电荷		-	21	-	uC
E <sub>rec</sub>	Reverse recovery energy 反向恢复损耗		-	11	-	mJ
I <sub>RM</sub>	Peak reverse recovery current 反向恢复峰值电流	I <sub>F</sub> =450A, V <sub>R</sub> =600V, T <sub>vj</sub> =150 °C	-	318	-	A
Q <sub>r</sub>	Recovery charge 恢复电荷		-	53	-	uC
E <sub>rec</sub>	Reverse recovery energy 反向恢复损耗		-	24	-	mJ
R <sub>ThJC</sub>	Junction-Case Thermal resistance 结-外壳热阻		-	-	0.05	K/W
T <sub>VJ OP</sub>	Temperature under switching 在开关状态下温度		-40	-	150	°C

### ● 负温度系数热敏电阻/ NTC- Thermistor

#### 特征值/Characteristics Values

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min. 最小	Typ. 典型	Max. 最大	
R <sub>25</sub>	Rated Resistance 额定电阻值	T <sub>C</sub> = 25 °C		5.0		kΩ
ΔR/R	Deviation for R100 R100 偏差	T <sub>C</sub> = 25 °C, R100=493Ω	-5	-	5	%
P <sub>25</sub>	Power dissipation 耗散功率	T <sub>C</sub> = 25 °C	-	20	-	mW
B <sub>25/50</sub>	B-value B-值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$	-	3375	-	K

## ● 模块/Module

### 模块参数/Module parameter

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min. 最小	Typ. 典型	Max. 最大	
V <sub>ISOL</sub>	Isolation voltage 绝缘测试电压	RMS,f=50Hz,t=1min	-	2.5	-	kV
	Material of Base plate 模块基板材料		-	Cu	-	
	Internal Isolation 内部绝缘	Basic insulation (class1,IEC61140)	-	Al <sub>2</sub> O <sub>3</sub>	-	
R <sub>thCH</sub>	Junction to heatsink, Thermal Resistance 外壳-散热器热阻		-	0.009	-	K/W
L <sub>s CE</sub>	Stray induction module 杂散电感,模块		-	25	-	nH
R <sub>CC'+EE'</sub>	Module lead resistance 模块引线电阻,端子-芯片	T <sub>C</sub> = 25 °C	-	1.5	-	mΩ
T <sub>STG</sub>	Storage Temperature 储存温度		-40	-	+150	°C
M	Mounting torque for modul mounting 模块安装的安装扭距	Mounting to heat sink M5	3.0	-	6.0	Nm
	Terminal connection torque 端子联接扭距	Main Terminal M6	3.0	-	6.0	Nm
G	Weigh 重量		-	350	-	g

## ● 特征曲线/ Characteristic Curve

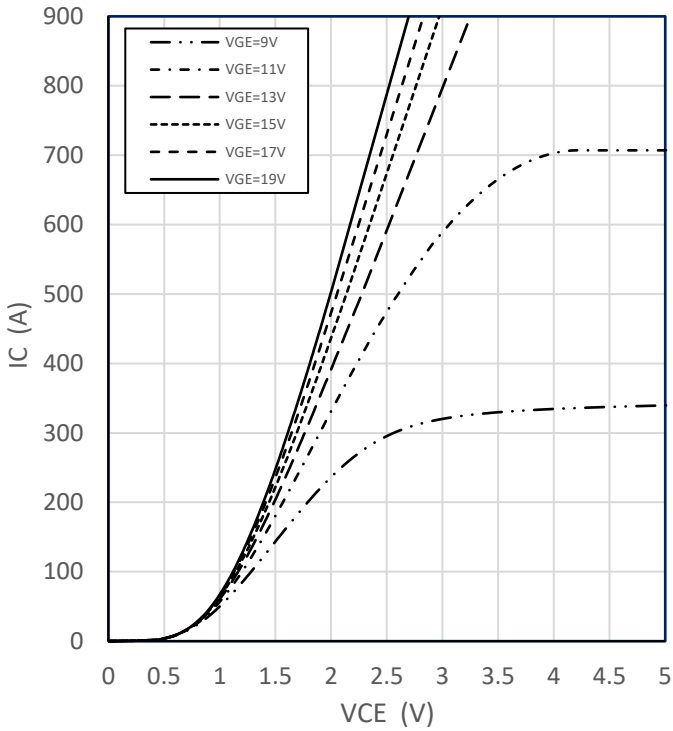


图 1: 输出特性@150°C/ Typical Output Characteristic @150°C

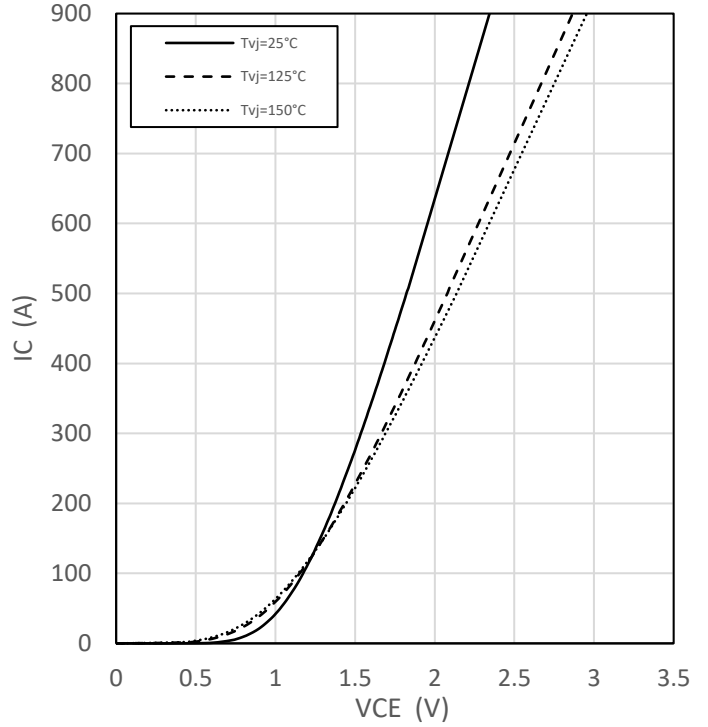


图 2: 输出特性@/ Typical Output Characteristic

$V_{cc}=600V, I_c=450A, V_{ge}=15V, R_g=1.0\Omega$

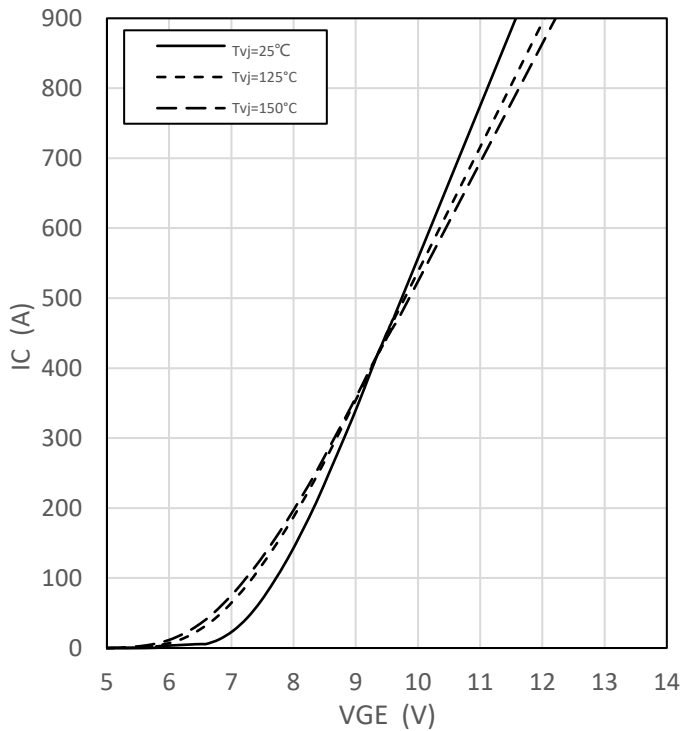


图 3: 传输特性/ Transfer Characteristic

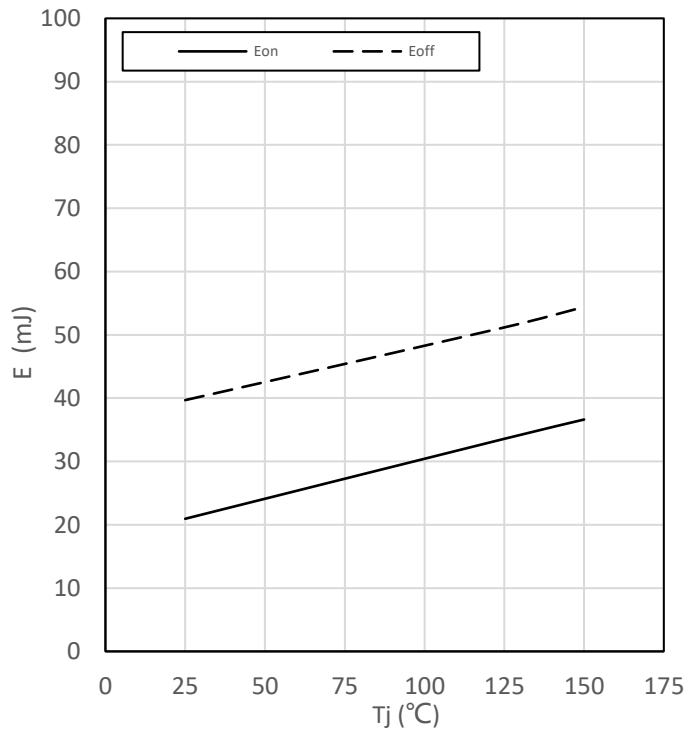


图 4: 动态损耗-温度特性/Typical switching losses as  $T_j$

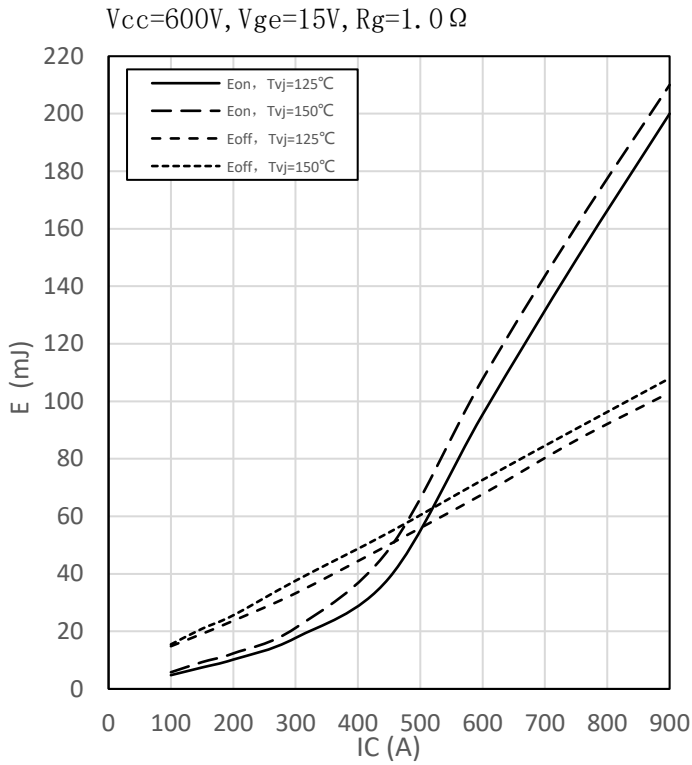


图 5: 动态损耗-电流特性/Typical switching losses as  $I_C$

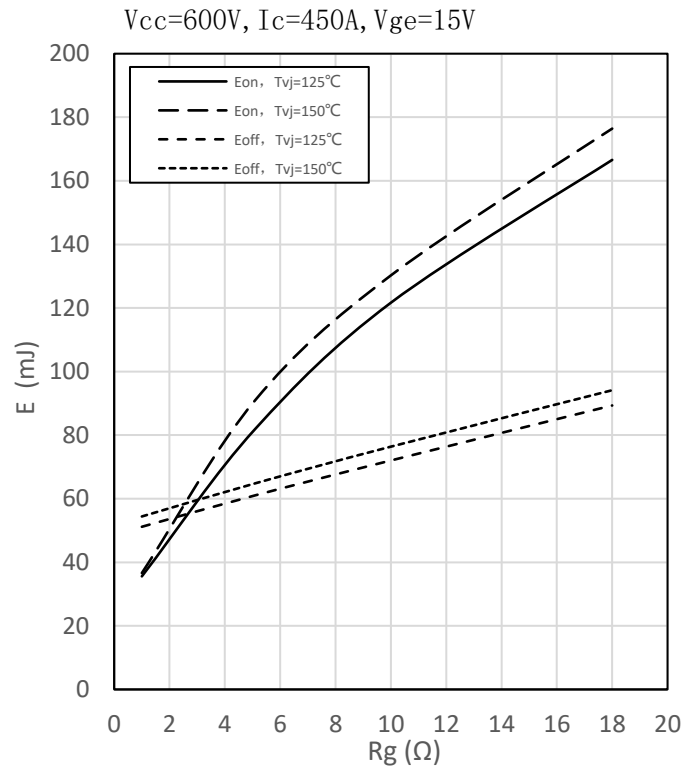


图 6: 动态损耗-门极电阻特性/Typical switching losses as  $R_G$

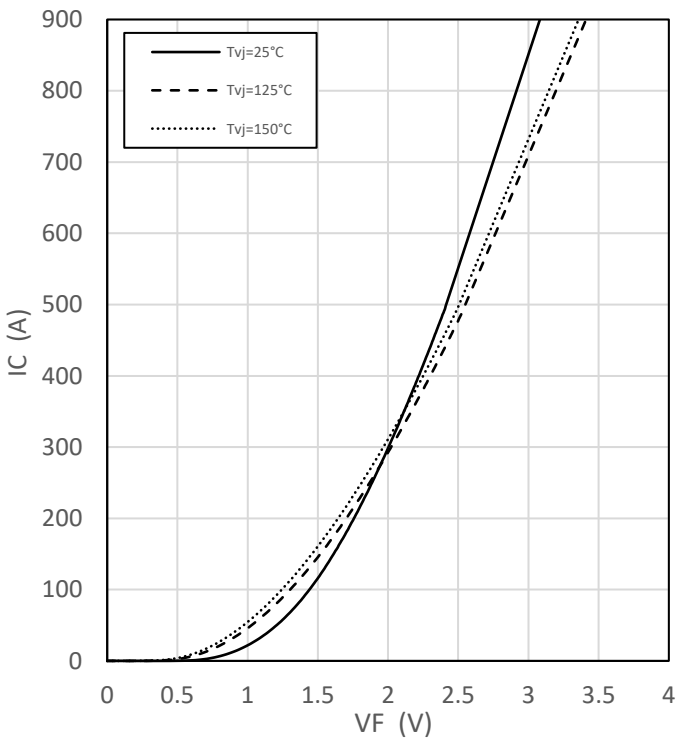


图 7: 二极管压降/Typical  $I_F$  as a function of  $V_F$

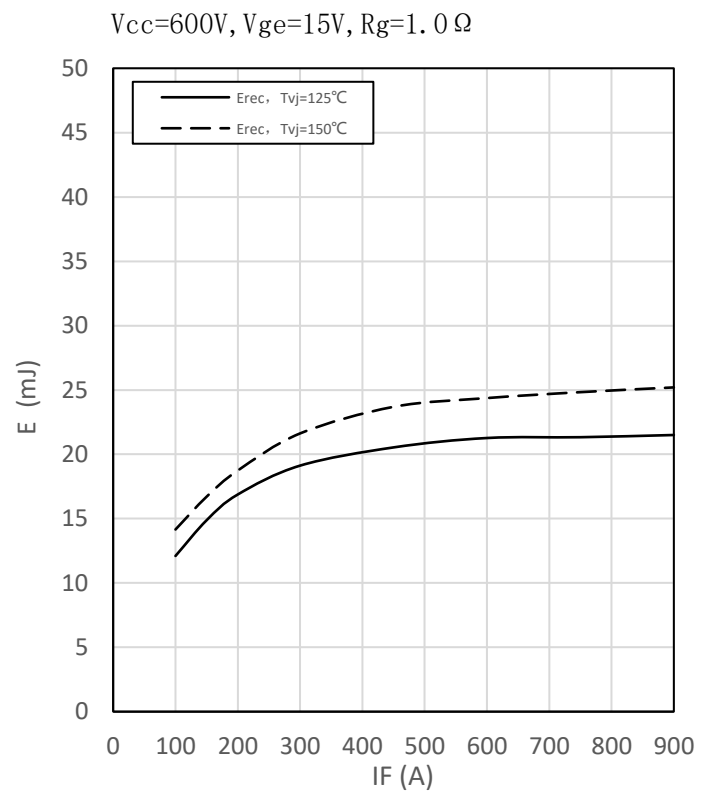


图 8: 反向恢复损耗-电流/Typical  $E_{REC}$  as a function of  $I_C$

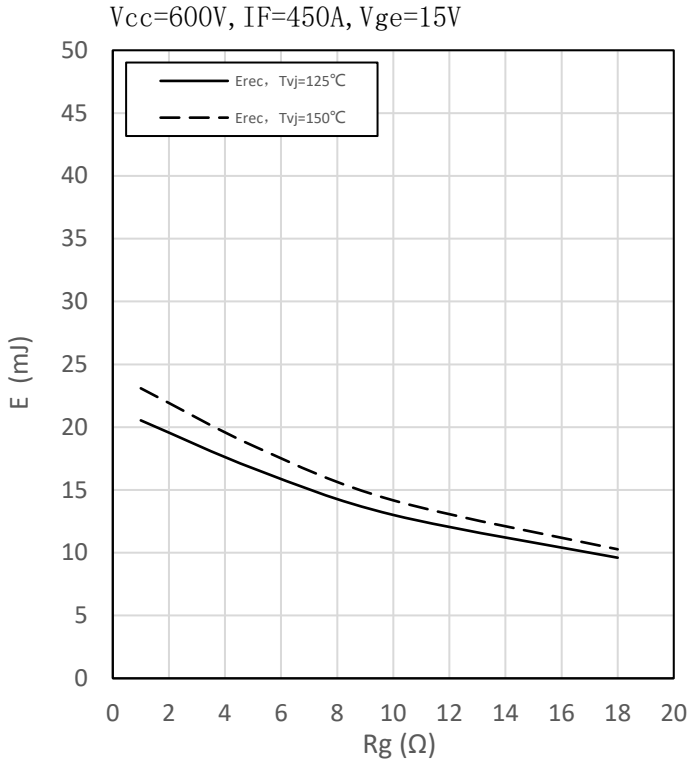


图 9: 反向恢复损耗-门极电阻特性/Typical EREC as a function of R<sub>g</sub>

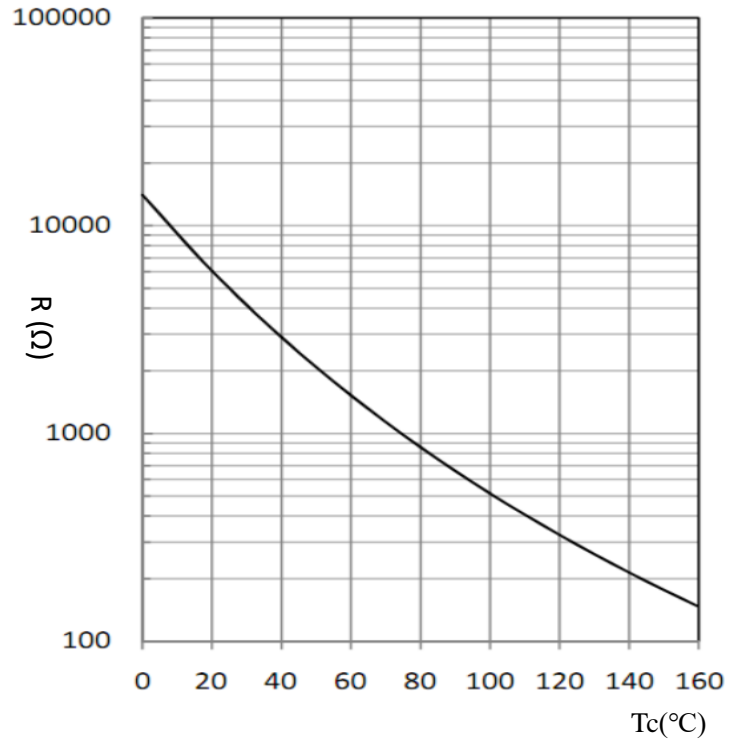


图 10: 热敏电阻特性/NTC Temperature Characteristic

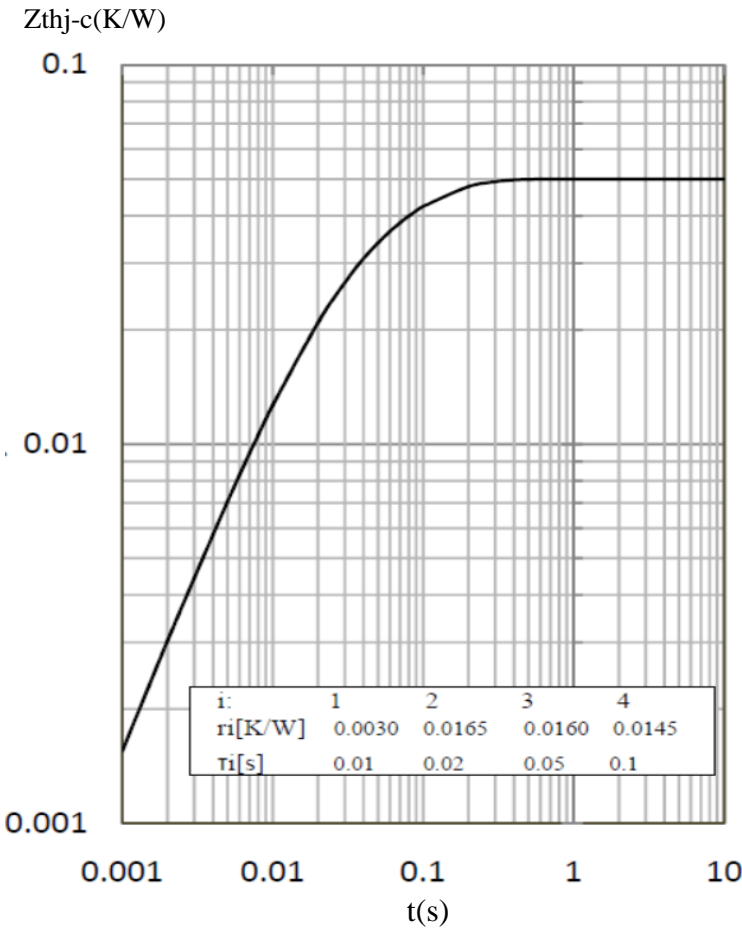


图 11: IGBT 瞬态热阻抗/IGBT Transient Thermal Impedance

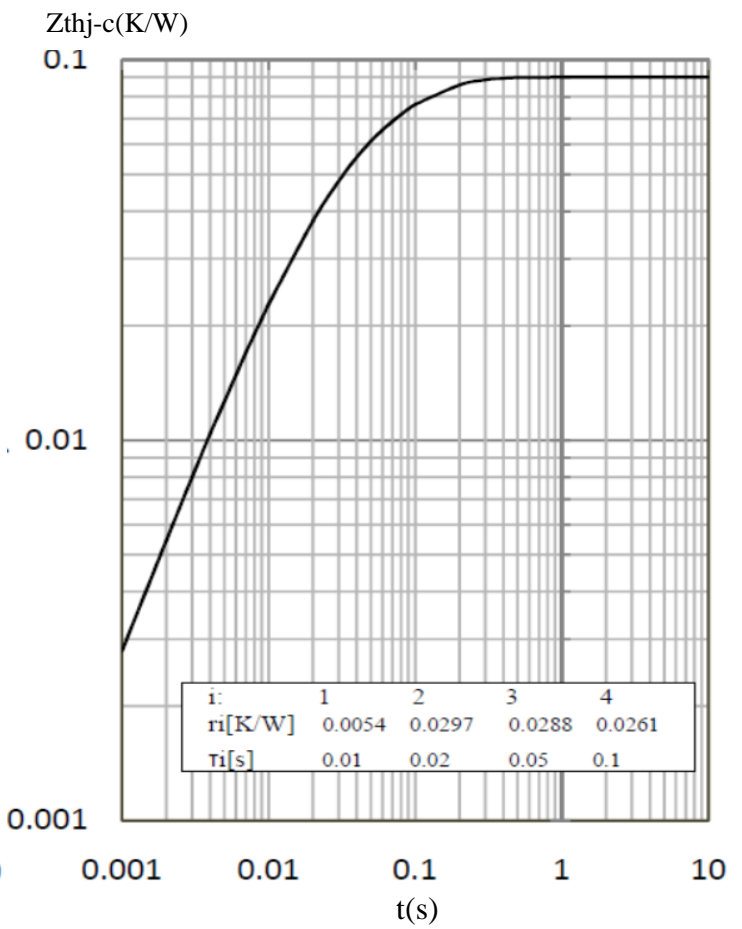


图 12: 二极管瞬态热阻抗/Diode Transient Thermal Impedance





## ● 注意/ Attention

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