

## 1. Product Features

### 1.1 Electrical features

- $V_{CES}=1200V$
- $I_{C\ nom}=25A / I_{CRM}=50A$
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability

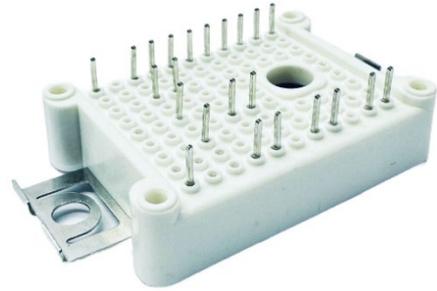


Figure1 IGBT Module

### 1.2 Mechanical features

- $Al_2O_3$  substrate with low thermal resistance

## 2. Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Power supply

## 3. Description

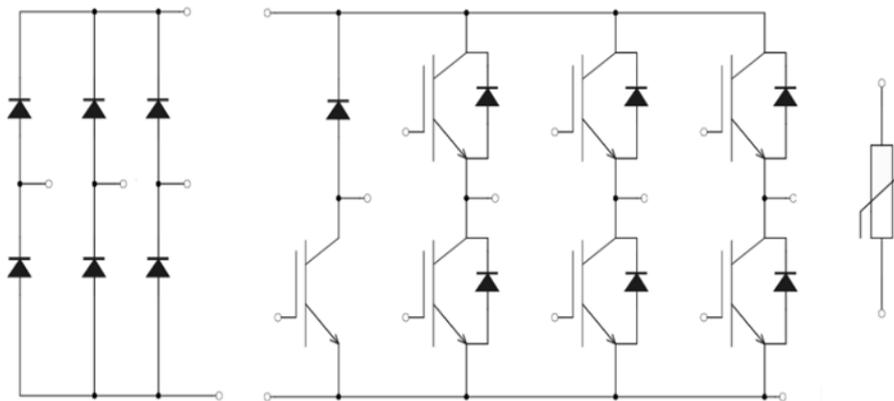


Figure 2 3 Phase Bridge+Brake

## 4. IGBT, Inverter

### 4.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage 集电极—发射极间电压	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
Continuous DC collector current 连续集电极电流	$T_C = 94^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_{C\ nom}$	25	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1\ \text{ms}$	$I_{CRM}$	50	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	$P_{tot}$	140	W
Gate-emitter peak voltage 栅极—发射极峰值电压		$V_{GES}$	+/- 20	V

### 4.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage 集电极—发射极饱和电压	$I_C = 25\ \text{A}, V_{GE} = 15\ \text{V}$	$T_{vj} = 25^{\circ}\text{C}$		1.78		V
		$T_{vj} = 125^{\circ}\text{C}$		2.04		V
		$T_{vj} = 150^{\circ}\text{C}$		2.12		V
Gate threshold voltage 栅极阈值电压	$I_C = 10\ \mu\text{A}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE,th}$		5.8		V
Gate charge 栅极电荷	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	$Q_G$		0.4		$\mu\text{C}$
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	$R_{Gint}$		0		$\Omega$
Input capacitance 输入电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{ies}$		4.77		nF
Reverse transfer capacitance 反向传输电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{res}$		0.02		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 1200\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$			10	$\mu\text{A}$
Gate-emitter leakage current 栅极-发射极漏电流	$V_{CE} = 0\ \text{V}, V_{GE} = 20\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{GES}$			100	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 25\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.09		us
		$T_{vj} = 125^{\circ}\text{C}$		0.10		us
		$T_{vj} = 150^{\circ}\text{C}$		0.10		us
Rise time, inductive load 上升时间	$I_C = 25\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.03		us
		$T_{vj} = 125^{\circ}\text{C}$		0.03		us
		$T_{vj} = 150^{\circ}\text{C}$		0.03		us

(table continues...) 待续

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	$I_C = 25A, V_{CE} = 600V$	$T_{vj} = 25^\circ C$		0.15		us
	$V_{GE} = +15/-15V$	$T_{vj} = 125^\circ C$	$t_{d,off}$	0.19		us
	$R_{G,off} = 10\Omega$	$T_{vj} = 150^\circ C$		0.20		us
Fall time, inductive load 下降时间	$I_C = 25A, V_{CE} = 600V$	$T_{vj} = 25^\circ C$		0.25		us
	$V_{GE} = +15/-15V$	$T_{vj} = 125^\circ C$	$t_f$	0.36		us
	$R_{G,off} = 10\Omega$	$T_{vj} = 150^\circ C$		0.42		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 25A, V_{CE} = 600V, L_s = 30nH$	$T_{vj} = 25^\circ C$	$E_{on}$	1.53		mJ
	$V_{GE} = +15/-15V, di/dt = 670A/\mu s$	$T_{vj} = 125^\circ C$		2.02		mJ
	$R_{G,on} = 10\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 150^\circ C$		2.39		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 25A, V_{CE} = 600V, L_s = 30nH$	$T_{vj} = 25^\circ C$	$E_{off}$	2.05		mJ
	$V_{GE} = +15/-15V, dv/dt = 4750V/\mu s$	$T_{vj} = 125^\circ C$		2.75		mJ
	$R_{G,off} = 10\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 150^\circ C$		3.06		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC} = 800V, t_p \leq 8\mu s, T_{vj} = 150^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$I_{sc}$		96		A
	$V_{GE} \leq 15V, V_{CC} = 800V, t_p \leq 7\mu s, T_{vj} = 175^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$			92		
Thermal resistance, junction to case 结-外壳热阻	Per IGBT	$R_{th,JC}$			1.07	K/W

## 5. Diode, Inverter

### 5.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	$T_{vj} = 25^\circ C$	$V_{RRM}$	1200	V
Continuous DC forward current 连续正向直流电流		$I_F$	25	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1ms$	$I_{FRM}$	50	A

### 5.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 25A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$		2.59		V
		$T_{vj} = 125^\circ C$	$V_F$	2.58		V
		$T_{vj} = 150^\circ C$		2.48		V

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	$I_F = 25A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 1760 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$I_{RM}$		42.7		A
		$T_{vj} = 125^\circ C$			52.2		A
		$T_{vj} = 150^\circ C$				57.1	
Recovered charge 恢复电荷	$I_F = 25A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 1760 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$Q_r$		1.0		$\mu C$
		$T_{vj} = 125^\circ C$			1.6		$\mu C$
		$T_{vj} = 150^\circ C$				2.5	
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 25A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 1760 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{rec}$		0.32		mJ
		$T_{vj} = 125^\circ C$			0.56		mJ
		$T_{vj} = 150^\circ C$				0.88	
Thermal resistance, junction to case 结—外壳热阻	Per diode		$R_{th,Jc}$			1.47	K/W

## 6. Diode, Rectifier

### 6.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	$T_{vj} = 25^\circ C$	$V_{RRM}$	1600	V
Average Rectified Output current 整流器输出均方根电流	$T_{vj} = 150^\circ C$	$I_F$	25	A
Surge forward current 正向浪涌电流	$t_p = 10 ms, T_{vj} = 150^\circ C$	$I_{FSM}$	270	A
$I^2t$ - value $I^2t$ -值	$t_p = 10 ms, T_{vj} = 150^\circ C$	$I^2t$	729	$A^2s$

### 6.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage 正向电压	$T_{vj} = 150^\circ C, I_F = 50 A$	$V_F$		1.00		V
Reverse current 反向电流	$T_{vj} = 150^\circ C, V_R = 1600 V$	$I_R$		1		mA
Thermal resistance, junction to case 结—外壳热阻	Per diode	$R_{thJc}$			1.2	K/W

## 7. IGBT, Brake-Chopper

### 7.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage 集电极—发射极间电压	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
Continuous DC collector current 连续集电极电流	$T_C = 100^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_{C\ nom}$	25	A
Repetitive peak collector current 集电极峰值电流	$t_p = 1\ ms$	$I_{CRM}$	50	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	$P_{tot}$	140	W
Gate-emitter peak voltage 栅极—发射极峰值电压		$V_{GES}$	+/- 20	V

### 7.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage 集电极—发射极饱和电压	$I_C = 25\ \text{A}, V_{GE} = 15\ \text{V}$	$T_{vj} = 25^{\circ}\text{C}$		1.78		V
		$T_{vj} = 125^{\circ}\text{C}$		2.04		V
		$T_{vj} = 150^{\circ}\text{C}$		2.12		V
Gate threshold voltage 栅极阈值电压	$I_C = 10\ \mu\text{A}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE,th}$		5.8		V
Gate charge 栅极电荷	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	$Q_G$		0.4		$\mu\text{C}$
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	$R_{Gint}$		0		$\Omega$
Input capacitance 输入电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{ies}$		4.77		nF
Reverse transfer capacitance 反向传输电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{res}$		0.02		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 1200\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$			10	$\mu\text{A}$
Gate-emitter leakage current 栅极-发射极漏电流	$V_{CE} = 0\ \text{V}, V_{GE} = 20\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{GES}$			100	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 25\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.09		$\mu\text{s}$
		$T_{vj} = 125^{\circ}\text{C}$		0.10		$\mu\text{s}$
		$T_{vj} = 150^{\circ}\text{C}$		0.10		$\mu\text{s}$
Rise time, inductive load 上升时间	$I_C = 25\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.03		$\mu\text{s}$
		$T_{vj} = 125^{\circ}\text{C}$		0.03		$\mu\text{s}$
		$T_{vj} = 150^{\circ}\text{C}$		0.03		$\mu\text{s}$

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	$I_C = 25A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 10\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.15		us
		$T_{vj} = 125^\circ C$			0.19		us
		$T_{vj} = 150^\circ C$			0.20		us
Fall time, inductive load 下降时间	$I_C = 25A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 10\Omega$	$T_{vj} = 25^\circ C$	$t_f$		0.25		us
		$T_{vj} = 125^\circ C$			0.36		us
		$T_{vj} = 150^\circ C$			0.42		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 25A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, di/dt = 670A/\mu s$ $R_{G,on} = 10\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{on}$		1.53		mJ
		$T_{vj} = 125^\circ C$			2.02		mJ
		$T_{vj} = 150^\circ C$			2.39		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 25A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, dv/dt = 4750V/\mu s$ $R_{G,off} = 10\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{off}$		2.05		mJ
		$T_{vj} = 125^\circ C$			2.75		mJ
		$T_{vj} = 150^\circ C$			3.06		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC} = 800V, t_p \leq 8\mu s, T_{vj} = 150^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$		$I_{sc}$		96		A
					$V_{GE} \leq 15V, V_{CC} = 800V, t_p \leq 7\mu s, T_{vj} = 175^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$		
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,Jc}$			1.07	K/W

## 8. Diode, Brake-Chopper

### 8.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	$T_{vj} = 25^\circ C$	$V_{RRM}$	1200	V
Continuous DC forward current 连续正向直流电流		$I_F$	15	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1ms$	$I_{FRM}$	30	A

### 8.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 15A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	$V_F$		2.5		V
		$T_{vj} = 125^\circ C$			2.6		V
		$T_{vj} = 150^\circ C$			2.5		V

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	$I_F = 15A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 275 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	$I_{RM}$		19.7		A
		$T_{vj} = 125^\circ C$			22.7		A
		$T_{vj} = 150^\circ C$			24.1		A
Recovered charge 恢复电荷	$I_F = 15A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 275 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	$Q_r$		0.63		$\mu C$
		$T_{vj} = 125^\circ C$			1.28		$\mu C$
		$T_{vj} = 150^\circ C$			1.79		$\mu C$
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 15A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 275 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	$E_{rec}$		0.13		mJ
		$T_{vj} = 125^\circ C$			0.30		mJ
		$T_{vj} = 150^\circ C$			0.49		mJ
Thermal resistance, junction to case 结-外壳热阻	Per diode		$R_{th,jc}$			1.47	K/W

## 9. NTC-Thermistor

### 9.1 Characteristic value

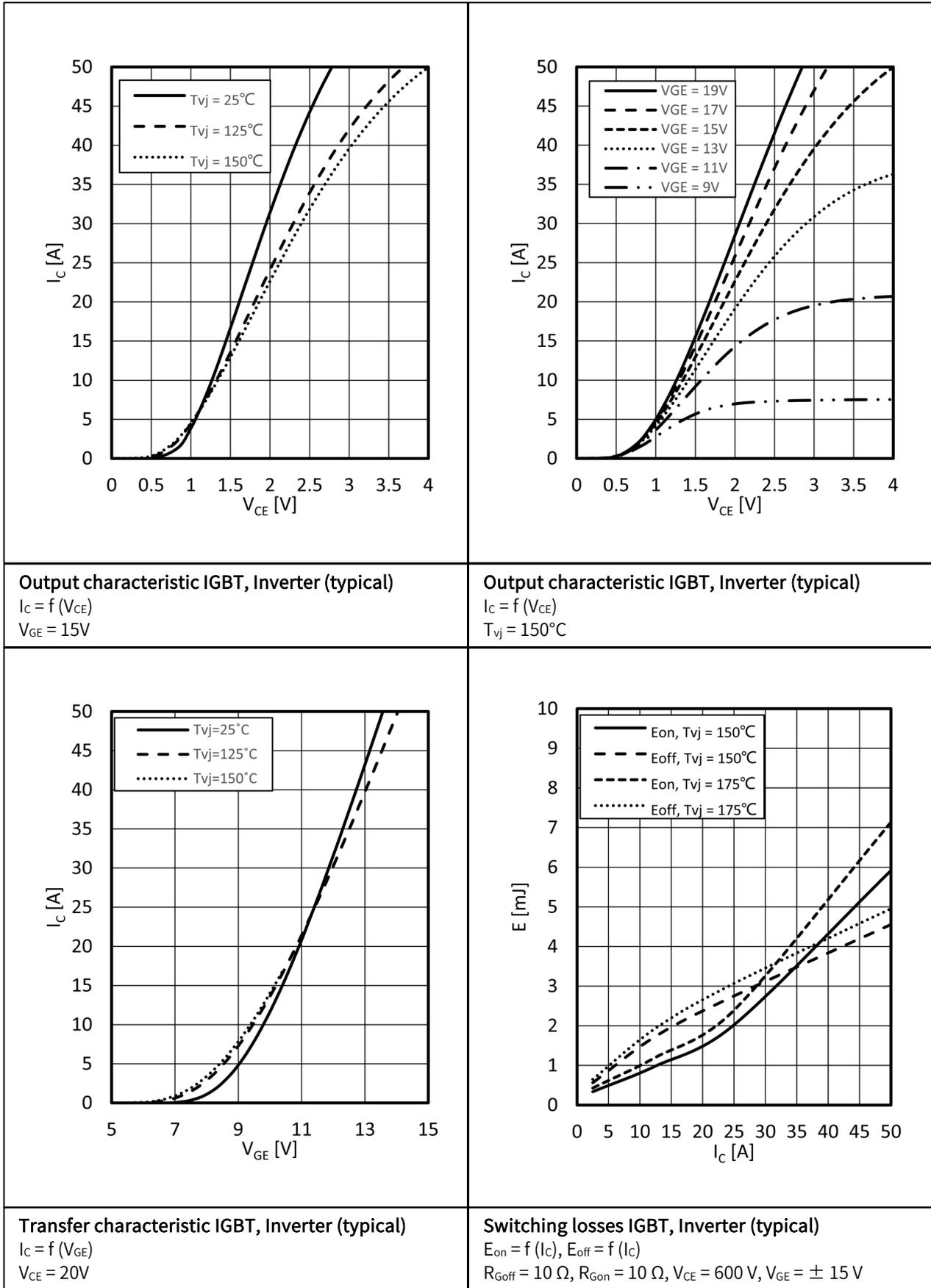
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	$T_C = 25^\circ C$	$R_{25}$		5.00		K $\Omega$
Power dissipation 耗散功耗	$T_C = 25^\circ C$	$P_{25}$			24	mW
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$	$B_{25}/B_{50}$		3400		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/75}(1/T_2 - 1/(298, 15K))]$	$B_{25}/B_{75}$		3430		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298, 15K))]$	$B_{25}/B_{100}$		3445		K

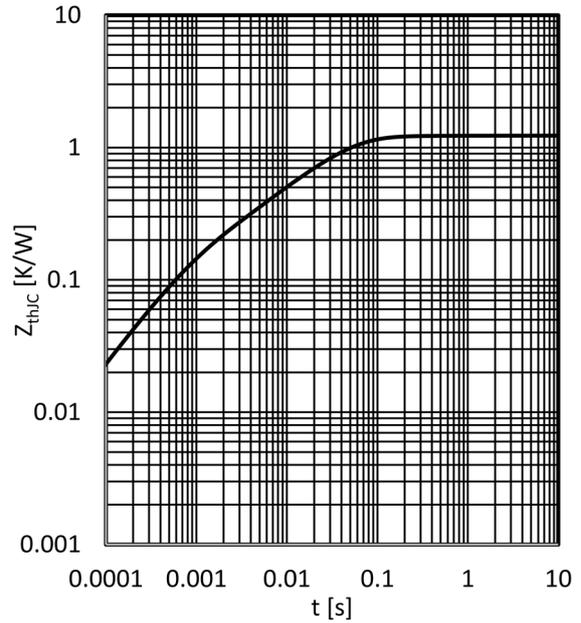
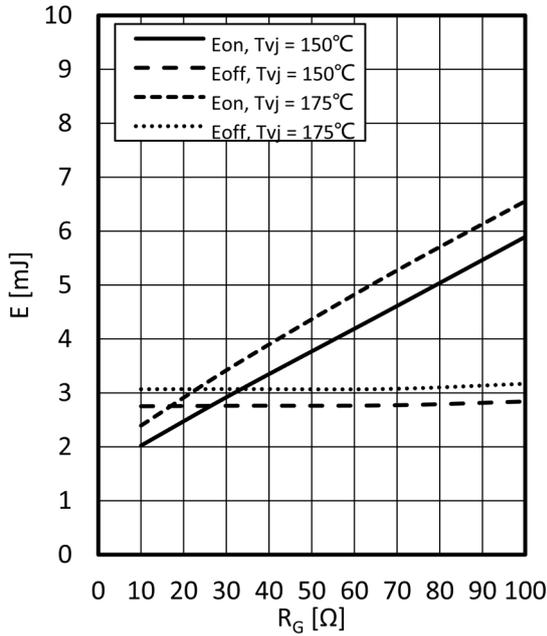
## 10. Module

### 10.1 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min	$V_{ISOL}$			2500	V
Stray inductance module 杂散电感		$L_{SCE}$		30		nH
Operation Junction Temperature 结温		$T_{jop}$	-40		150	°C
Storage Temperature Range 存储温度范围		$T_{stg}$	-40		125	°C
Mounting Torque 安装扭矩	Screw M5	M	2		2.3	N.m
Weight of Module 重量		G		24		g

## 11.Characteristics diagrams





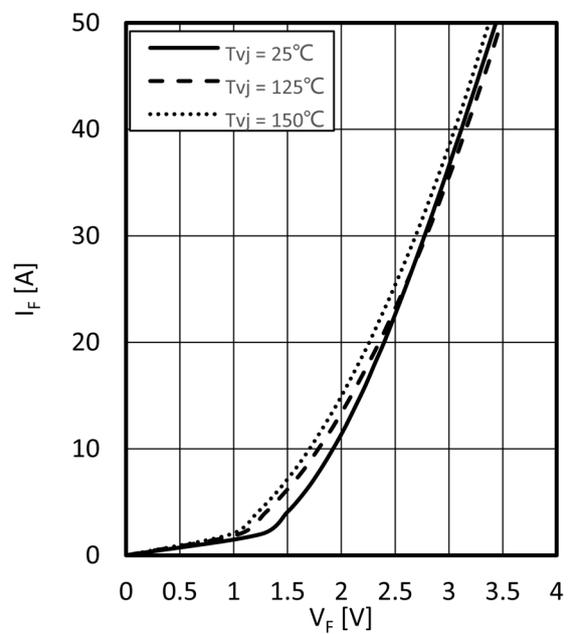
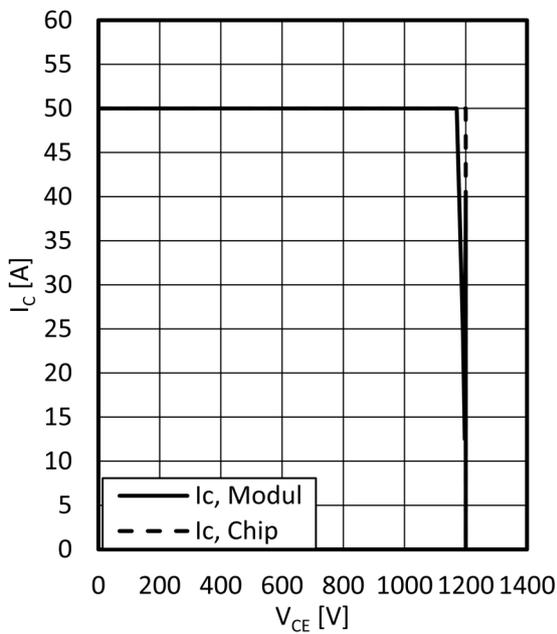
**Switching losses IGBT, Inverter (typical)**

$E_{on} = f(R_G), E_{off} = f(R_G)$

$I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$

**Transient thermal impedance IGBT, Inverter**

$Z_{thJC} = f(t)$



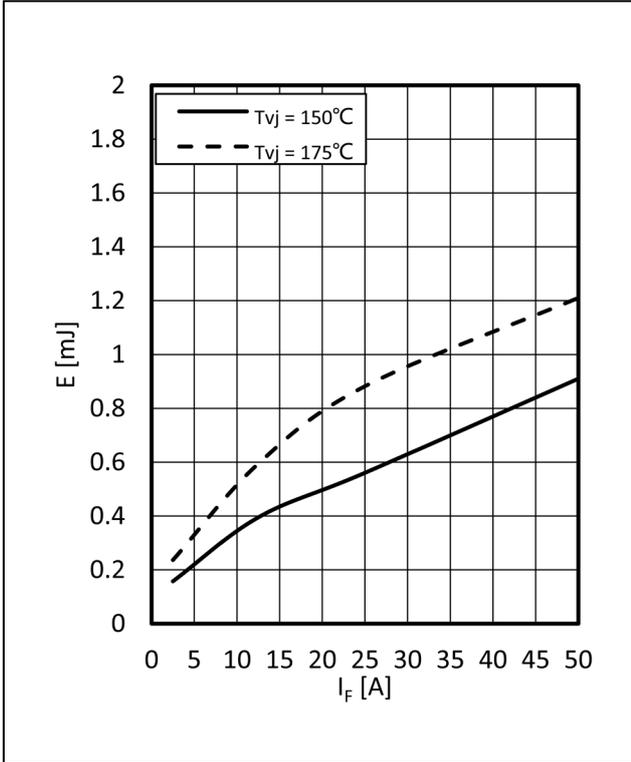
**Reverse bias safe operating area IGBT, Inverter (RBSOA)**

$I_C = f(V_{CE})$

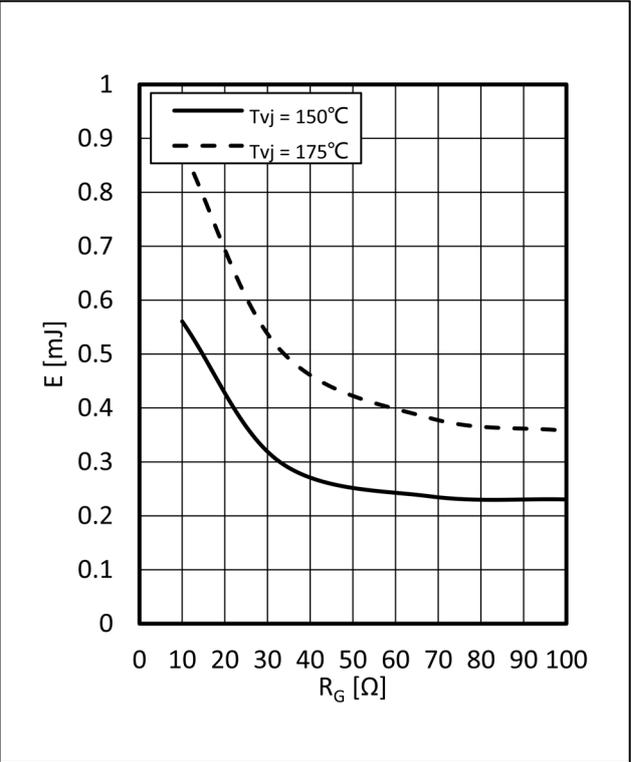
$V_{GE} = 15 \text{ V}, R_{Goff} = 10 \Omega, T_{vj} = 175^\circ\text{C}$

**Forward characteristic of Diode, Inverter (typical)**

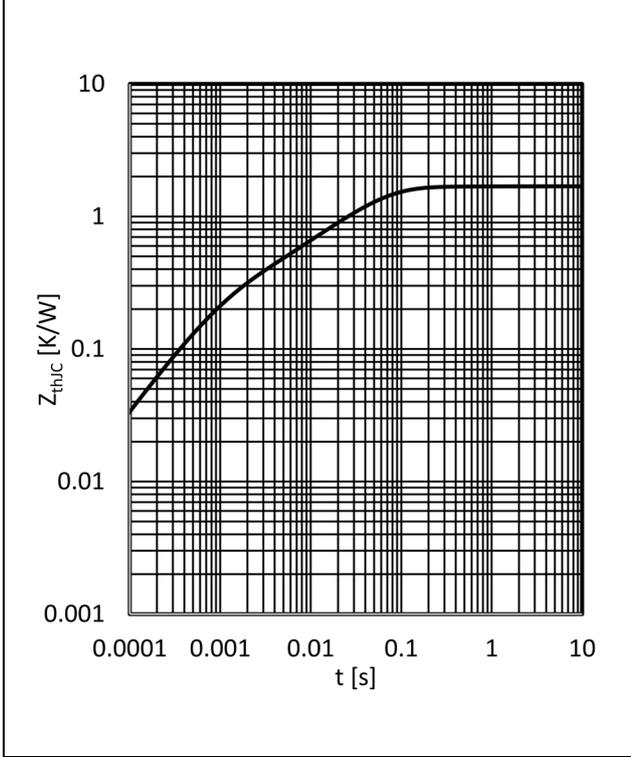
$I_F = f(V_F)$



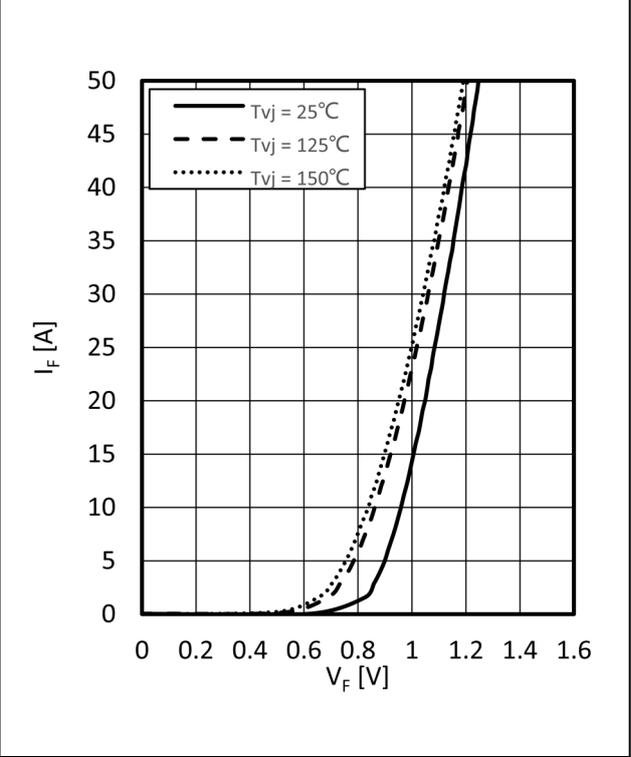
**Switching losses Diode, Inverter (typical)**  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 10 \Omega, V_{CE} = 600 V$



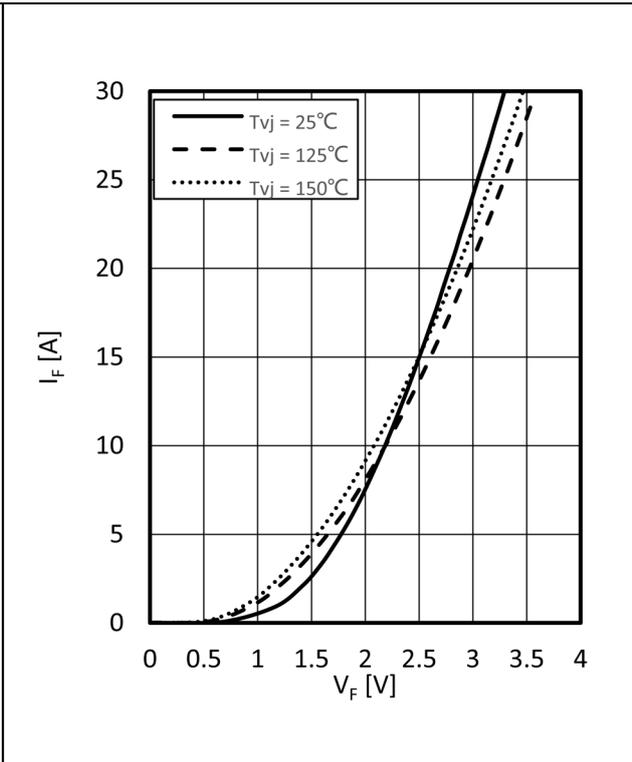
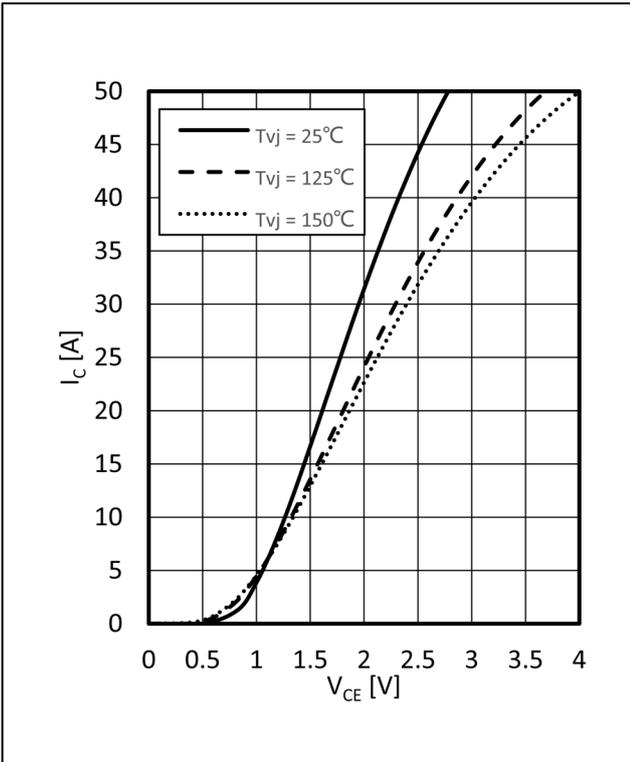
**Switching losses Diode, Inverter (typical)**  
 $E_{rec} = f(R_G)$   
 $I_F = 25 A, V_{CE} = 600 V$



**Transient thermal impedance Diode, Inverter**  
 $Z_{thJC} = f(t)$

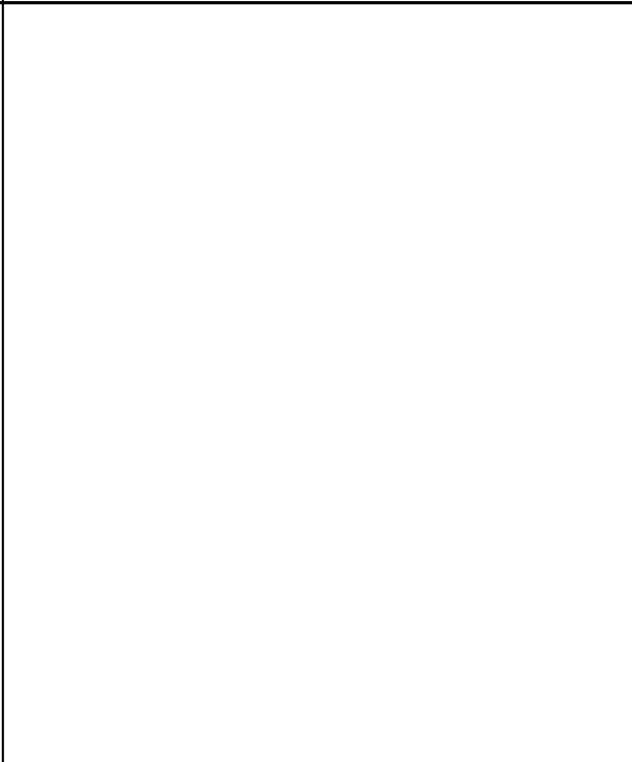
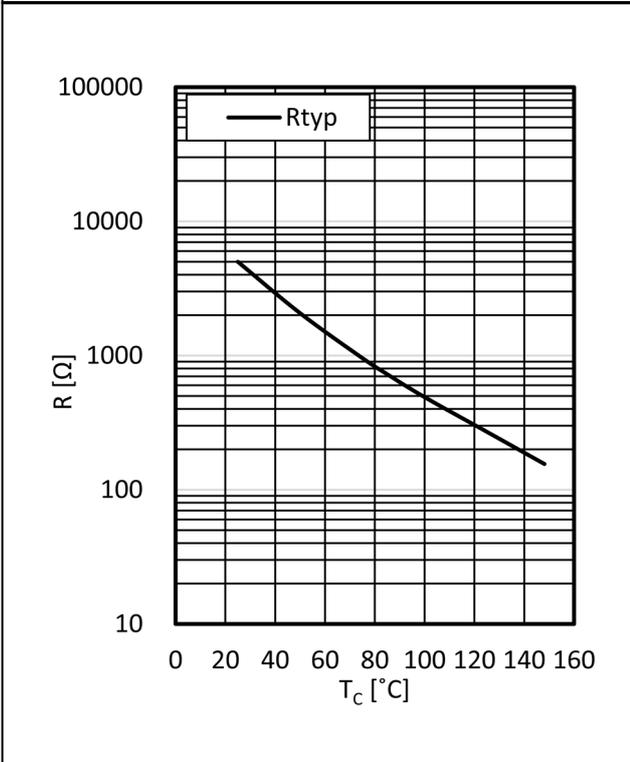


**Forward characteristic of Diode, Rectifier (typical)**  
 $I_F = f(V_F)$



**Output characteristic IGBT, Brake-Chopper (typical)**  
 $I_C = f(V_{CE})$   
 $V_{GE} = 15V$

**Forward characteristic of Diode, Brake-Chopper (typical)**  
 $I_F = f(V_F)$



**NTC-Thermistor-temperature characteristic (typical)**  
 $R = f(T_{NTC})$

