

## 1. Product Features

### 1.1 Electrical features

- $V_{CES}=1200V$
- $I_{C\ nom}=200A / I_{CRM}=400A$
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability

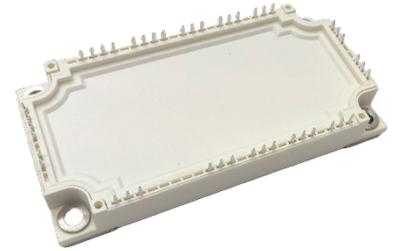


Figure1 IGBT Module

### 1.2 Mechanical features

- $Al_2O_3$  substrate with low thermal resistance
- Copper base plate

## 2. Typical Applications

- Switching mode power supply
- Drive inverters
- Uninterruptible power supply
- AC and DC servo drive amplifier

## 3. Description

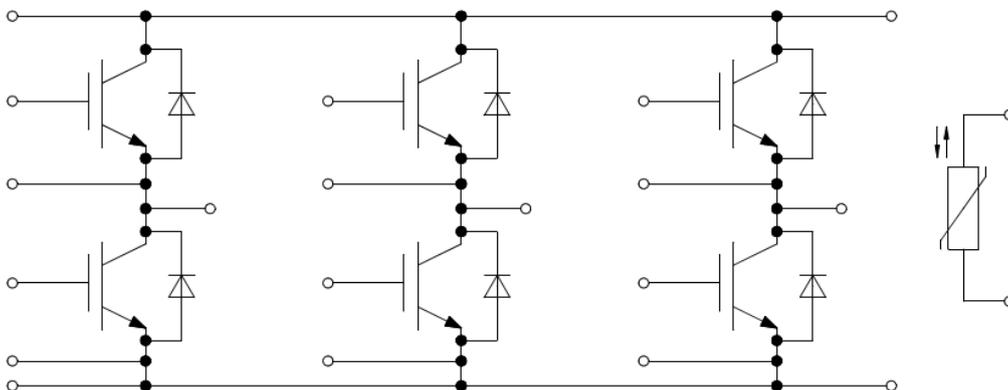


Figure 2 3 Phase Bridge

## 4. IGBT

### 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	$T_C = 72^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_{C\ nom}$	200	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1\ \text{ms}$	$I_{CRM}$	400	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	$P_{tot}$	750	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	$I_C = 200\ \text{A}, V_{GE} = 15\ \text{V}$	$V_{CE,sat}$		$T_{vj} = 25^{\circ}\text{C}$	1.59	V
				$T_{vj} = 125^{\circ}\text{C}$	1.86	V
				$T_{vj} = 150^{\circ}\text{C}$	1.94	V
Gate threshold voltage 栅极阈值电压	$I_C = 6\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE,th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	$Q_G$		1.90		$\mu\text{C}$
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	$R_{Gint}$		1.70		$\Omega$
Input capacitance 输入电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{ies}$		33.4		nF
Reverse transfer capacitance 反向传输电容	$f=1\ \text{MHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\ \text{V}, V_{GE}=0\ \text{V}$	$C_{res}$		0.17		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 1200\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$			1	mA
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	$I_C = 200\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 2.2\ \Omega$	$t_{d,on}$		$T_{vj} = 25^{\circ}\text{C}$	0.12	$\mu\text{s}$
				$T_{vj} = 125^{\circ}\text{C}$	0.14	$\mu\text{s}$
				$T_{vj} = 150^{\circ}\text{C}$	0.15	$\mu\text{s}$
Rise time, inductive load 上升时间	$I_C = 200\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 2.2\ \Omega$	$t_r$		$T_{vj} = 25^{\circ}\text{C}$	0.04	$\mu\text{s}$
				$T_{vj} = 125^{\circ}\text{C}$	0.05	$\mu\text{s}$
				$T_{vj} = 150^{\circ}\text{C}$	0.05	$\mu\text{s}$

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Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	$I_C = 200A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 2.2\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.26		us
		$T_{vj} = 125^\circ C$			0.30		us
		$T_{vj} = 150^\circ C$			0.31		us
Fall time, inductive load 下降时间	$I_C = 200A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 2.2\Omega$	$T_{vj} = 25^\circ C$	$t_f$		0.22		us
		$T_{vj} = 125^\circ C$			0.31		us
		$T_{vj} = 150^\circ C$			0.33		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 200A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, di/dt = 3200A/\mu s$ $R_{G,on} = 2.2\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{on}$		10.3		mJ
		$T_{vj} = 125^\circ C$			17.3		mJ
		$T_{vj} = 150^\circ C$			18.4		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 200A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, dv/dt = 5610V/\mu s$ $R_{G,off} = 2.2\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{off}$		14.3		mJ
		$T_{vj} = 125^\circ C$			20.5		mJ
		$T_{vj} = 150^\circ C$			21.7		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC} = 600V, t_p \leq 8 \mu s, T_{vj} = 150^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$		$I_{sc}$		1407		A
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,jc}$			0.20	K/W

## 5. Diode

### 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		$I_F$	200	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1 ms$	$I_{FRM}$	400	A

### 5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 200 A, V_{GE} = 0 V$	$T_{vj} = 25^\circ C$	$V_F$		1.73		V
		$T_{vj} = 125^\circ C$			1.60		V
		$T_{vj} = 150^\circ C$			1.55		V

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Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	I <sub>F</sub> = 200A, V <sub>R</sub> = 600V V <sub>GE</sub> = -15V, - di <sub>F</sub> /dt = 1240 A/μs (T <sub>vj</sub> =150°C)	T <sub>vj</sub> = 25°C	I <sub>RM</sub>		221		A
		T <sub>vj</sub> = 125°C			261		A
		T <sub>vj</sub> = 150°C			276		A
Recovered charge 恢复电荷	I <sub>F</sub> = 200A, V <sub>R</sub> = 600V V <sub>GE</sub> = -15V, - di <sub>F</sub> /dt = 1240 A/μs (T <sub>vj</sub> =150°C)	T <sub>vj</sub> = 25°C	Q <sub>r</sub>		22.5		μC
		T <sub>vj</sub> = 125°C			43.1		μC
		T <sub>vj</sub> = 150°C			49.2		μC
Reverse recovery energy 反向恢复损耗 (每脉冲)	I <sub>F</sub> = 200A, V <sub>R</sub> = 600V V <sub>GE</sub> = -15V, - di <sub>F</sub> /dt = 1240 A/μs (T <sub>vj</sub> =150°C)	T <sub>vj</sub> = 25°C	E <sub>rec</sub>		8.63		mJ
		T <sub>vj</sub> = 125°C			17.9		mJ
		T <sub>vj</sub> = 150°C			20.8		mJ
Thermal resistance, junction to case 结—外壳热阻	Per diode		R <sub>th,jc</sub>			0.26	K/W

## 6. NTC-Thermistor

### 6.1 Characteristic value

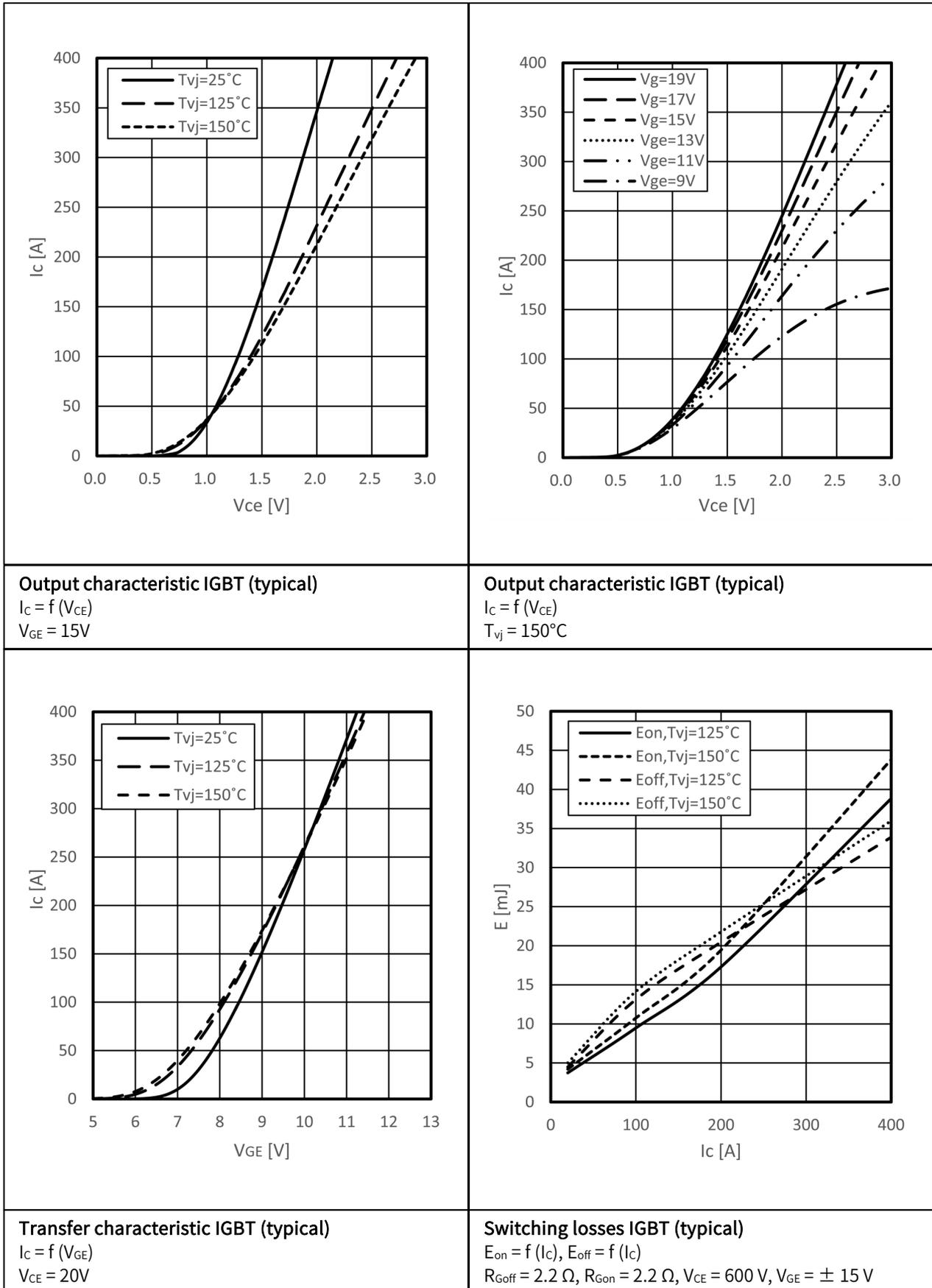
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	T <sub>c</sub> = 25°C	R <sub>25</sub>		5.00		KΩ
Power dissipation 耗散功耗	T <sub>c</sub> = 25°C	P <sub>25</sub>			20	mW
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$	B <sub>25</sub> /B <sub>50</sub>		3375		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/75}(1/T_2 - 1/(298, 15K))]$	B <sub>25</sub> /B <sub>75</sub>		3408		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298, 15K))]$	B <sub>25</sub> /B <sub>100</sub>		3436		K

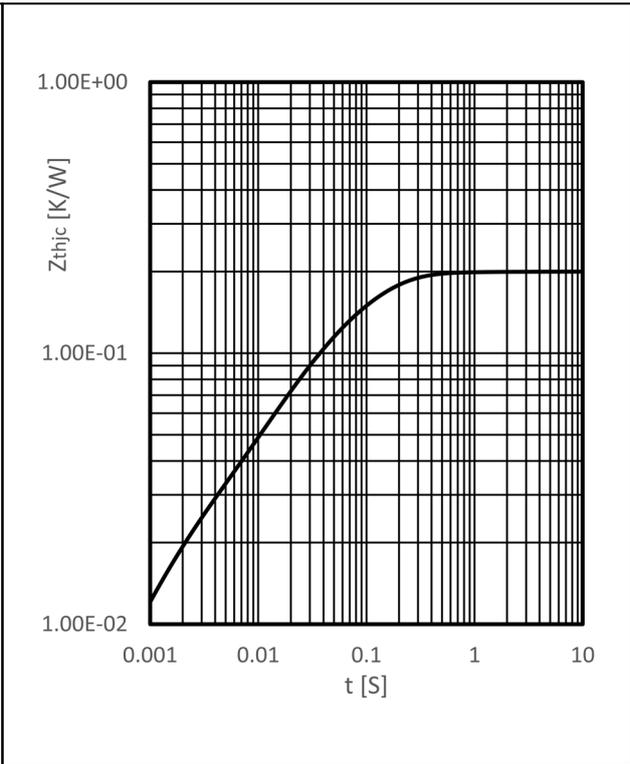
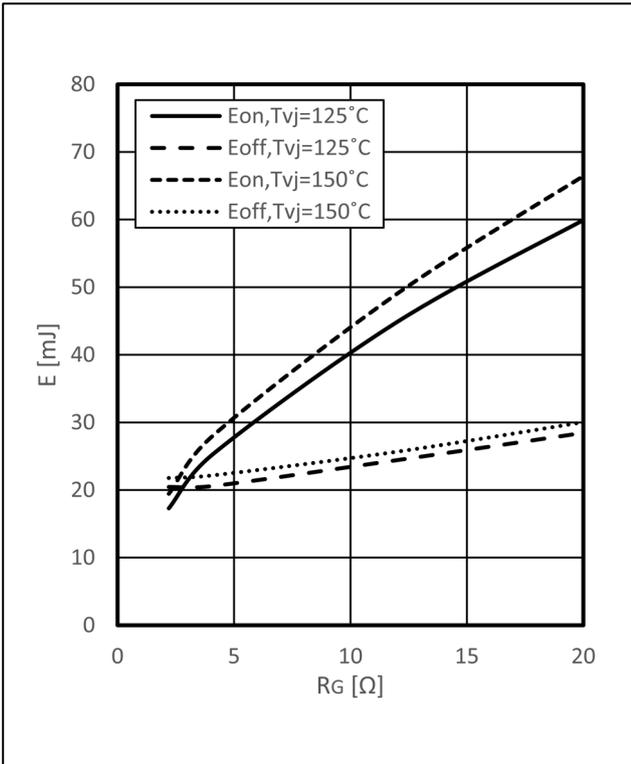
## 7. Module

### 7.1 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	3		6	N.m
Weight of Module 重量		G		300		g

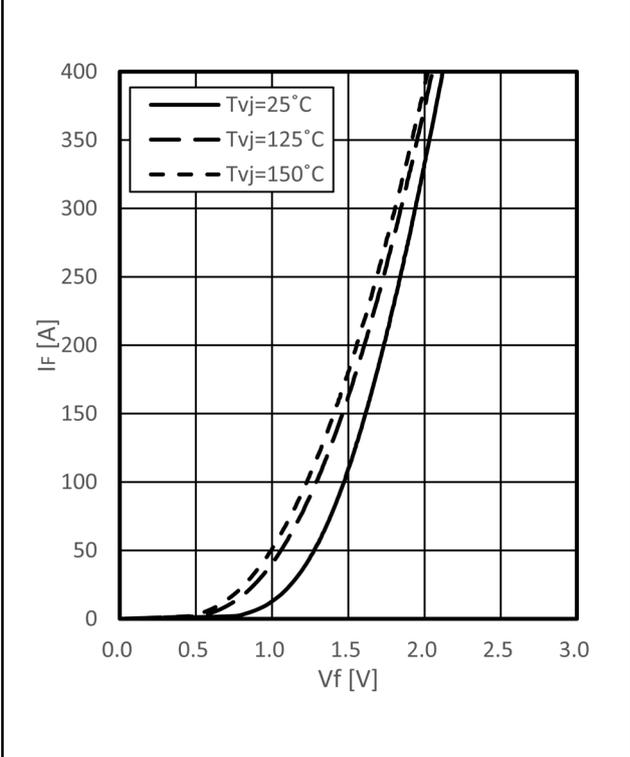
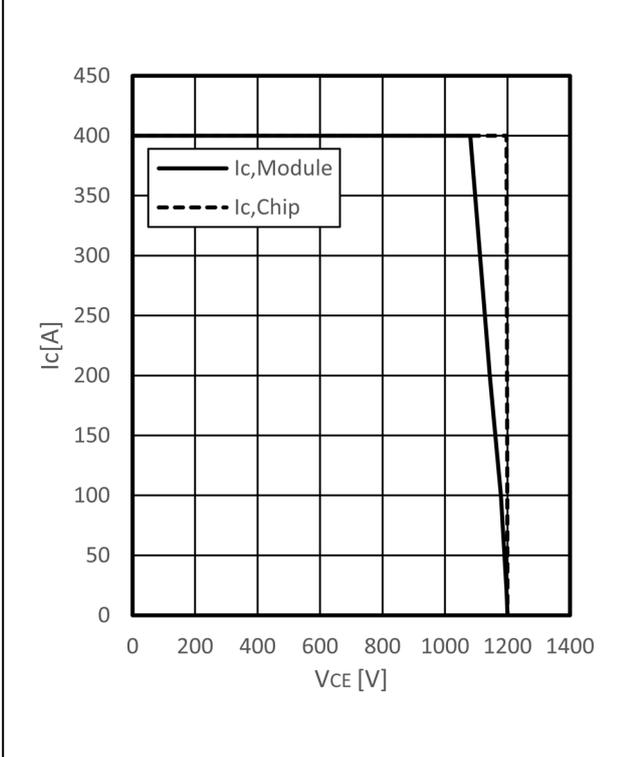
## 8. Characteristics diagrams





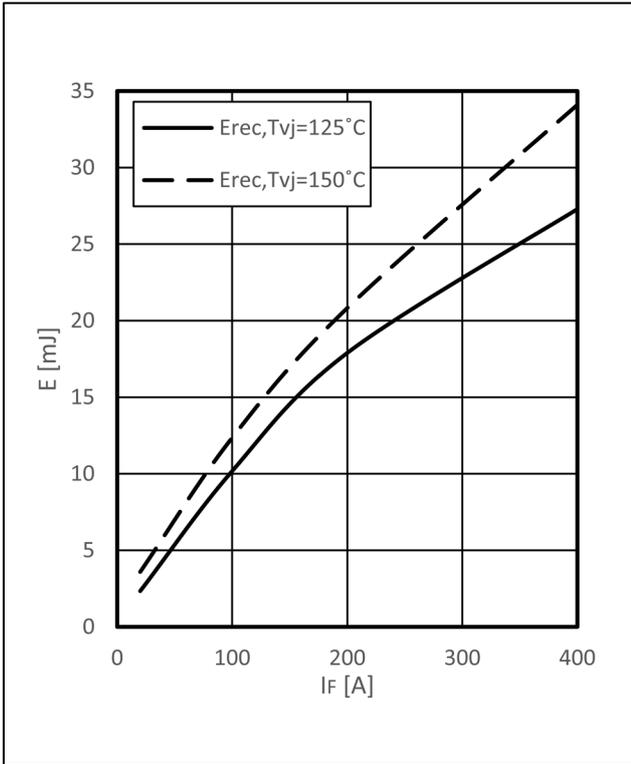
**Switching losses IGBT (typical)**  
 $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $I_C = 200\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$

**Transient thermal impedance IGBT**  
 $Z_{thjC} = f(t)$



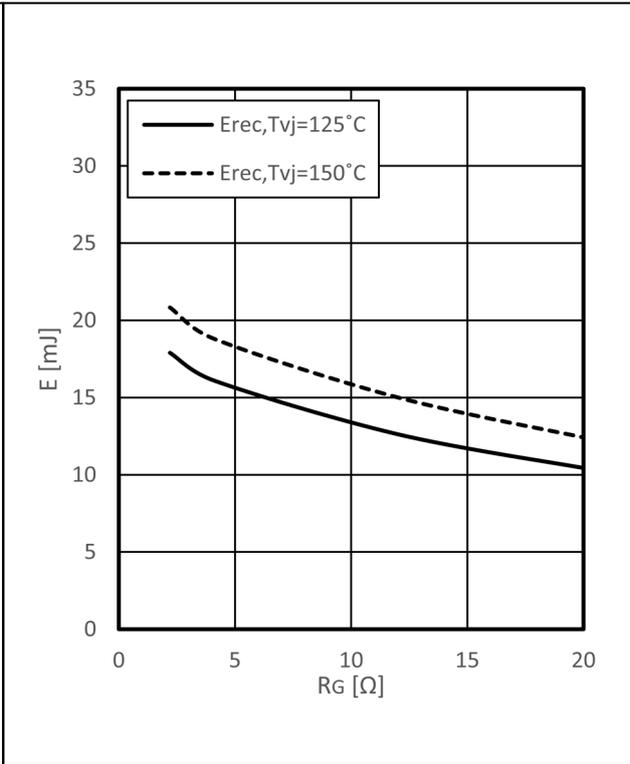
**Reverse bias safe operating area IGBT (RBSOA)**  
 $I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$ ,  $R_{Goff} = 2.2\ \Omega$ ,  $T_{vj} = 150\text{ °C}$

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



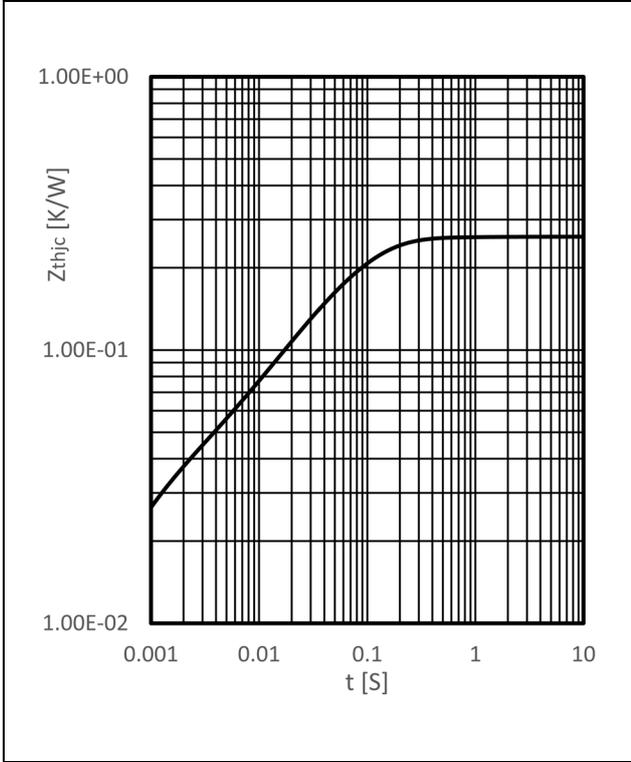
**Switching losses Diode (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 2.2 \Omega, V_{CE} = 600 V$



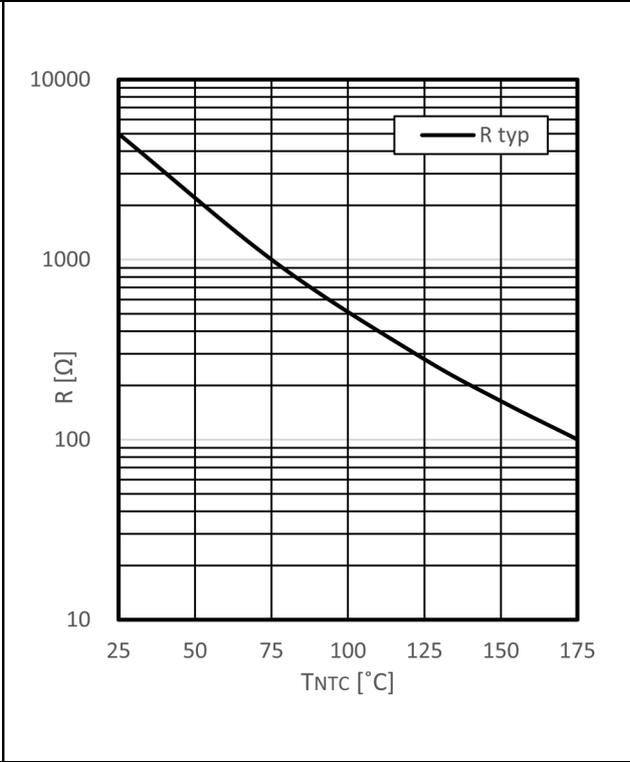
**Switching losses Diode (typical)**

$E_{rec} = f(R_G)$   
 $I_F = 200 A, V_{CE} = 600 V$



**Transient thermal impedance Diode**

$Z_{thjC} = f(t)$



**NTC-Thermistor-temperature characteristic (typical)**

$R = f(T_{NTC})$

