

1. Product Features

1.1 Electrical features

- $V_{CES}=1200V$
- $I_{C\ nom}=50A / I_{CRM}=100A$
- 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 with brake system
- Uninterruptible power supply
- AC and DC servo drive amplifier

3. Description

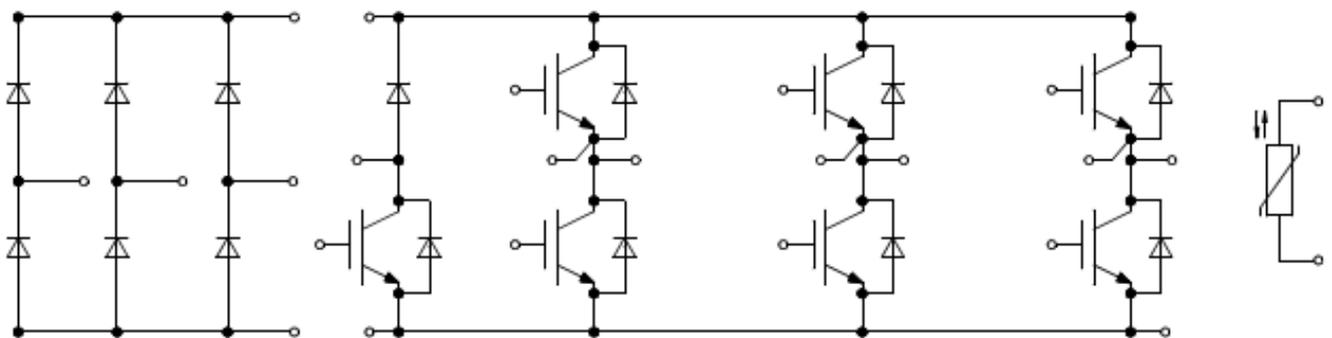


Figure 2 3 Phase Bridge +Rectifier+Brake

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	$T_C = 100^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_{C\ nom}$	50	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1\ \text{ms}$	I_{CRM}	100	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	P_{tot}	300	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	$I_C = 50\ \text{A}, V_{GE} = 15\ \text{V}$	$V_{CE,sat}$		$T_{vj} = 25^{\circ}\text{C}$	1.67	V
				$T_{vj} = 125^{\circ}\text{C}$	1.92	V
				$T_{vj} = 150^{\circ}\text{C}$	2.00	V
Gate threshold voltage 栅极阈值电压	$I_C = 1.5\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE,th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	Q_G		0.44		μC
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		2.20		Ω
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}		6.15		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}		0.08		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	$I_C = 50\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 6.8\ \Omega$	$t_{d,on}$		$T_{vj} = 25^{\circ}\text{C}$	0.13	μs
				$T_{vj} = 125^{\circ}\text{C}$	0.14	μs
				$T_{vj} = 150^{\circ}\text{C}$	0.14	μs
Rise time, inductive load 上升时间	$I_C = 50\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G,on} = 6.8\ \Omega$	t_r		$T_{vj} = 25^{\circ}\text{C}$	0.06	μs
				$T_{vj} = 125^{\circ}\text{C}$	0.07	μs
				$T_{vj} = 150^{\circ}\text{C}$	0.07	μs

(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	$I_C = 50A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 6.8\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.24		us
		$T_{vj} = 125^\circ C$			0.27		us
		$T_{vj} = 150^\circ C$			0.28		us
Fall time, inductive load 下降时间	$I_C = 50A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 6.8\Omega$	$T_{vj} = 25^\circ C$	t_f		0.28		us
		$T_{vj} = 125^\circ C$			0.46		us
		$T_{vj} = 150^\circ C$			0.48		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 50A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, di/dt = 1570A/\mu s$ $R_{G,on} = 6.8\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{on}		6.83		mJ
		$T_{vj} = 125^\circ C$			9.00		mJ
		$T_{vj} = 150^\circ C$			9.78		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 50A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, dv/dt = 5265V/\mu s$ $R_{G,off} = 6.8\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{off}		3.37		mJ
		$T_{vj} = 125^\circ C$			4.86		mJ
		$T_{vj} = 150^\circ C$			5.28		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}		350		A
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,jc}$			0.50	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	50	A
Repetitive peak forward current 正向重复峰值电流	$t_P = 1ms$	I_{FRM}	100	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 50A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	V_F		2.01		V
		$T_{vj} = 125^\circ C$			2.09		V
		$T_{vj} = 150^\circ C$			2.06		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	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$		59.1		A
	$V_{GE} = -15V, -di_F/dt = 1450 A/\mu s$	$T_{vj} = 125^\circ C$	I_{RM}	68.2		A
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$		70.9		A
Recovered charge 恢复电荷	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$		3.61		μC
	$V_{GE} = -15V, -di_F/dt = 1450 A/\mu s$	$T_{vj} = 125^\circ C$	Q_r	6.29		μC
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$		7.38		μC
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$		0.50		mJ
	$V_{GE} = -15V, -di_F/dt = 1450 A/\mu s$	$T_{vj} = 125^\circ C$	E_{rec}	1.21		mJ
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$		1.59		mJ
Thermal resistance, junction to case 结-外壳热阻	Per diode	$R_{th,JC}$			0.54	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	$V_F = 1.2, T_{vj} = 150^\circ C$	I_F	50	A
Surge forward current 正向浪涌电流	$t_p = 10 ms, T_{vj} = 150^\circ C$	I_{FSM}	320	A
I^2t - value I^2t -值	$t_p = 10 ms, T_{vj} = 150^\circ C$	I^2t	510	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		1.10		V
Reverse current 反向电流	$T_{vj} = 150^\circ C, V_R = 1600 V$	I_R		1.00		mA
Thermal resistance, junction to case 结-外壳热阻	Per diode	$R_{th,JC}$			0.63	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	$T_C = 100^{\circ}\text{C}, T_{vj\ max} = 150^{\circ}\text{C}$	$I_{C\ nom}$	50	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1\ \text{ms}$	I_{CRM}	100	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	P_{tot}	300	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	$I_C = 50\ \text{A}, V_{GE} = 15\ \text{V}$	$V_{CE, sat}$		$T_{vj} = 25^{\circ}\text{C}$	1.67	V
				$T_{vj} = 125^{\circ}\text{C}$	1.92	V
				$T_{vj} = 150^{\circ}\text{C}$	2.00	V
Gate threshold voltage 栅极阈值电压	$I_C = 1.5\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE, th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	Q_G		0.44		μC
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		2.20		Ω
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}		6.15		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}		0.08		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	$I_C = 50\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G, on} = 6.8\ \Omega$	$t_{d, on}$		$T_{vj} = 25^{\circ}\text{C}$	0.03	μs
				$T_{vj} = 125^{\circ}\text{C}$	0.03	μs
				$T_{vj} = 150^{\circ}\text{C}$	0.03	μs
Rise time, inductive load 上升时间	$I_C = 50\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = +15/-15\ \text{V}$ $R_{G, on} = 6.8\ \Omega$	t_r		$T_{vj} = 25^{\circ}\text{C}$	0.03	μs
				$T_{vj} = 125^{\circ}\text{C}$	0.03	μs
				$T_{vj} = 150^{\circ}\text{C}$	0.03	μs

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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	$I_C = 50A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 6.8\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.17		us
		$T_{vj} = 125^\circ C$			0.20		us
		$T_{vj} = 150^\circ C$			0.21		us
Fall time, inductive load 下降时间	$I_C = 50A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 6.8\Omega$	$T_{vj} = 25^\circ C$	t_f		0.27		us
		$T_{vj} = 125^\circ C$			0.46		us
		$T_{vj} = 150^\circ C$			0.50		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 50A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, di/dt = 1550A/\mu s$ $R_{G,on} = 6.8\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{on}		3.95		mJ
		$T_{vj} = 125^\circ C$			4.61		mJ
		$T_{vj} = 150^\circ C$			4.84		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 50A, V_{CE} = 600V, L_s = 30nH$ $V_{GE} = +15/-15V, dv/dt = 5480V/\mu s$ $R_{G,off} = 6.8\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{off}		3.65		mJ
		$T_{vj} = 125^\circ C$			5.56		mJ
		$T_{vj} = 150^\circ C$			5.80		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}		350		A
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,jc}$			0.50	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	50	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1\text{ ms}$	I_{FRM}	100	A

8.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^\circ C$	V_F		2.01		V
		$T_{vj} = 125^\circ C$			2.09		V
		$T_{vj} = 150^\circ C$			2.06		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	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$	I_{RM}		71.6		A
	$V_{GE} = -15V, -di_F/dt = 1280 A/\mu s$	$T_{vj} = 125^\circ C$			71.9		A
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$			72.1		A
Recovered charge 恢复电荷	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$	Q_r		3.83		μC
	$V_{GE} = -15V, -di_F/dt = 1280 A/\mu s$	$T_{vj} = 125^\circ C$			6.26		μC
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$			7.00		μC
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 50A, V_R = 600V$	$T_{vj} = 25^\circ C$	E_{rec}		0.69		mJ
	$V_{GE} = -15V, -di_F/dt = 1280 A/\mu s$	$T_{vj} = 125^\circ C$			1.31		mJ
	$R_{G,on} = 6.8\Omega (T_{vj}=150^\circ C)$	$T_{vj} = 150^\circ C$			1.68		mJ
Thermal resistance, junction to case 结—外壳热阻	Per diode		$R_{th,JC}$			0.64	K/W

9. NTC-Thermistor

9.1 Characteristic value

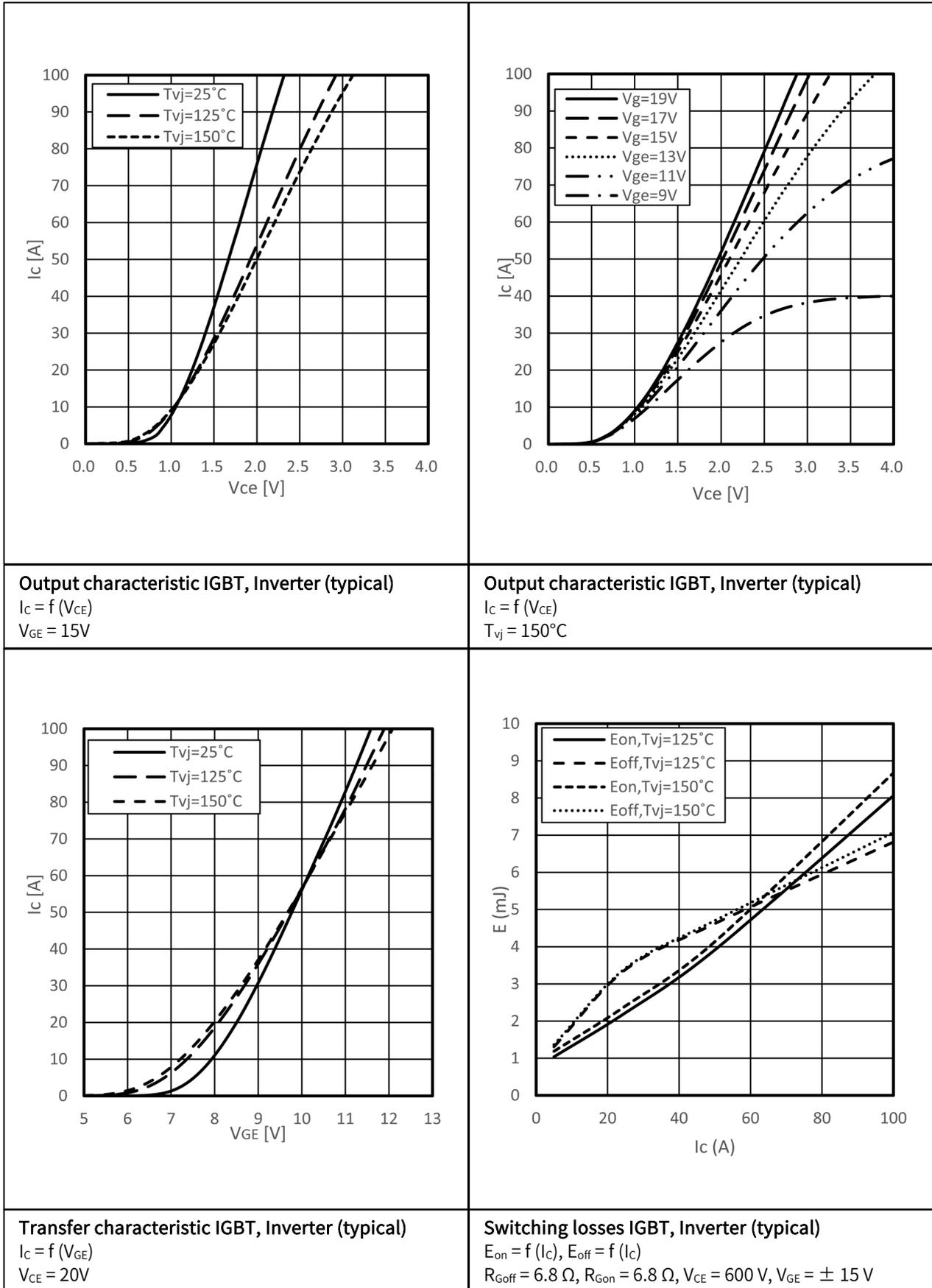
Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Rated resistance 额定电阻值	$T_C = 25^\circ C$		R_{25}		5.00		K Ω
Power dissipation 耗散功耗	$T_C = 25^\circ C$		P_{25}			20	mW
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$		B_{25}/B_{50}		3400		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/75}(1/T_2 - 1/(298, 15K))]$		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

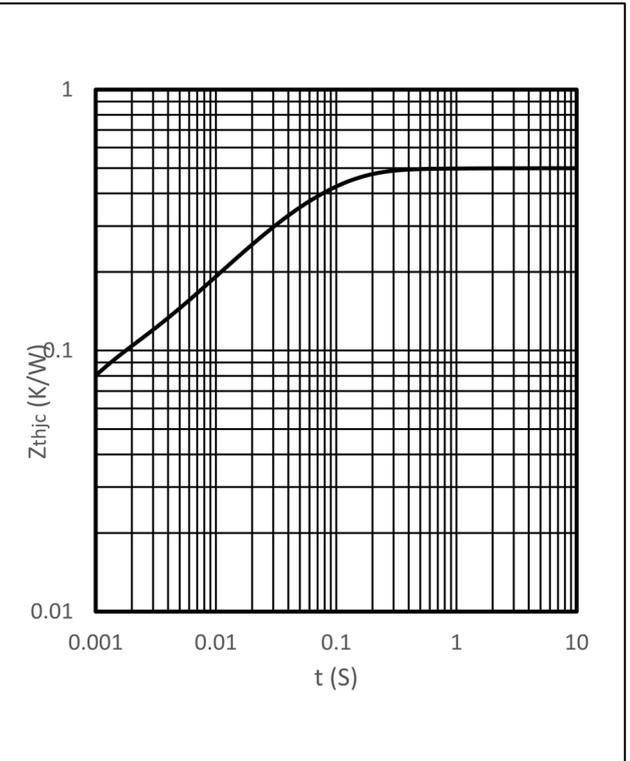
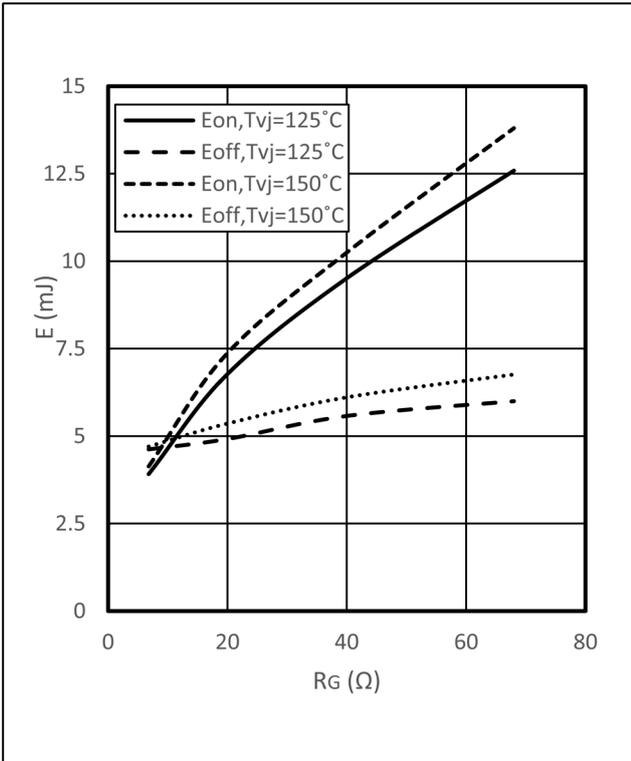
10. Module

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}		60		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

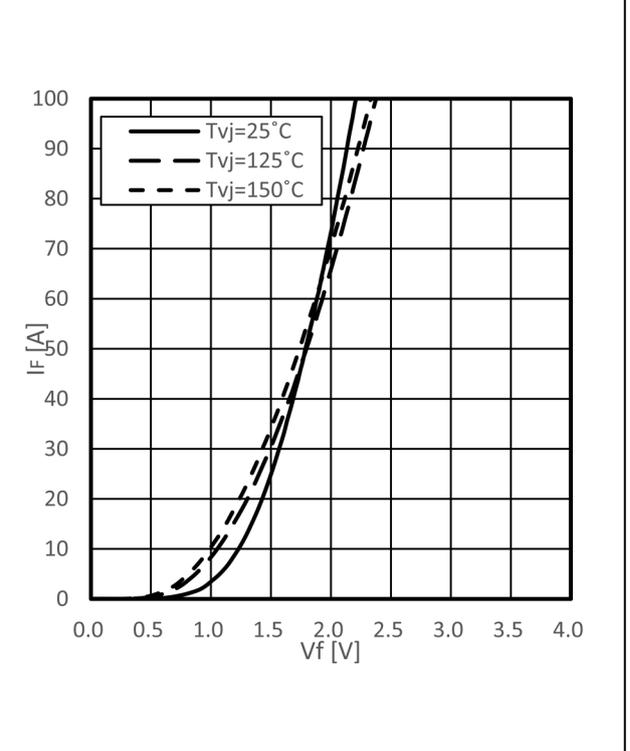
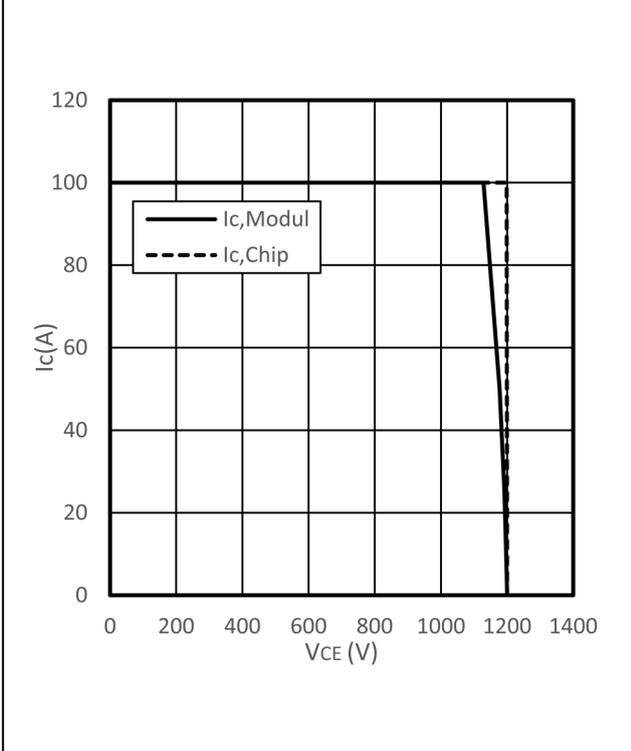
11. Characteristics diagrams





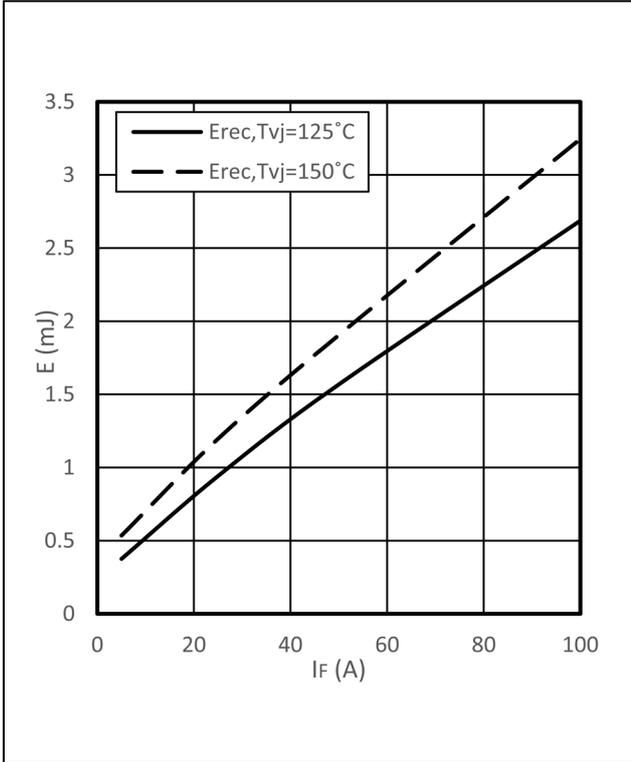
Switching losses IGBT, Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $I_C = 50\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$

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



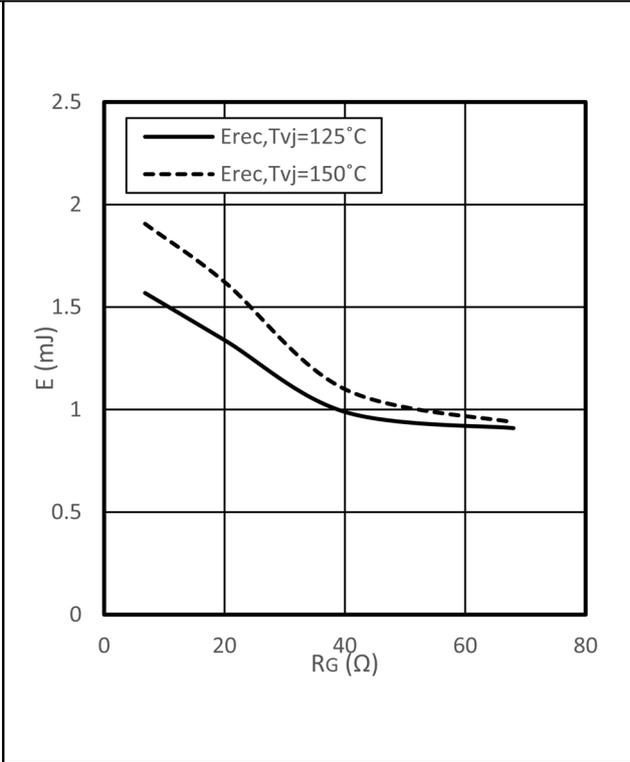
Reverse bias safe operating area IGBT, Inverter (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$, $R_{Goff} = 6.8\ \Omega$, $T_{vj} = 150^\circ\text{C}$

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



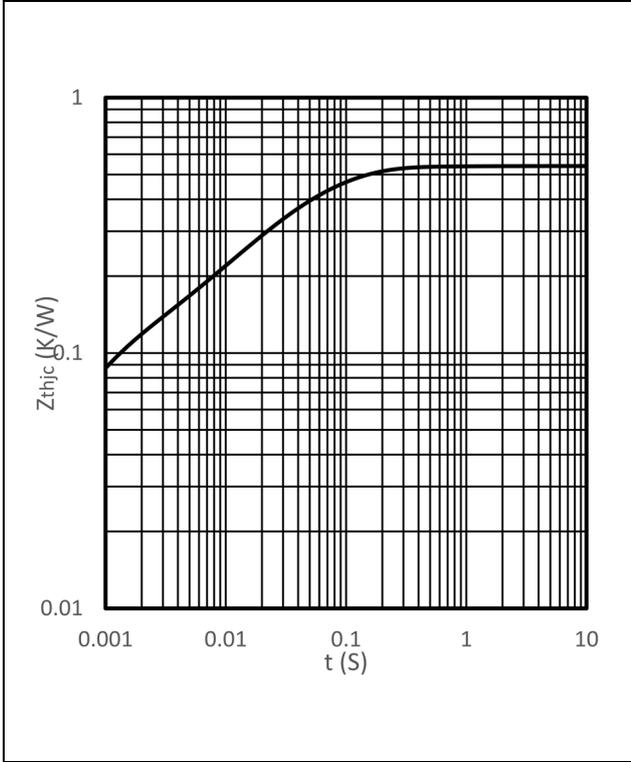
Switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 6.8 \Omega, V_{CE} = 600 V$



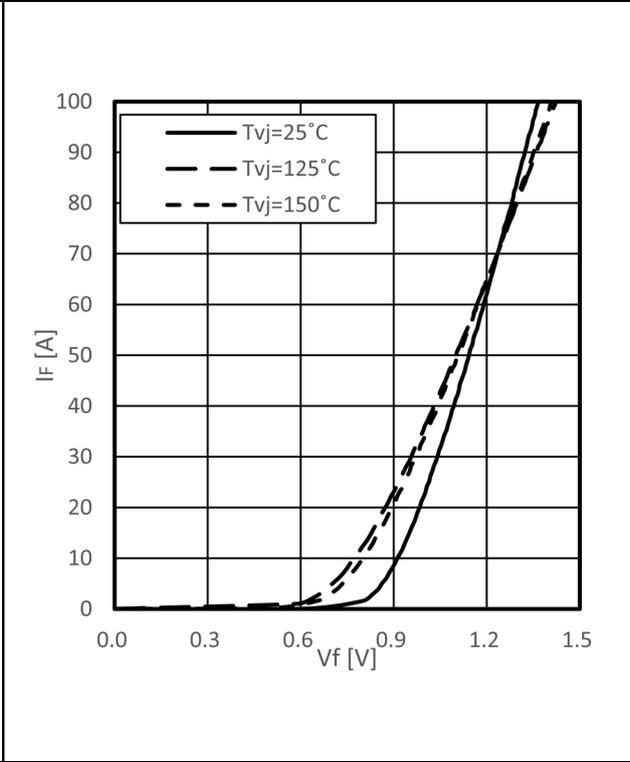
Switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 50 A, V_{CE} = 600 V$



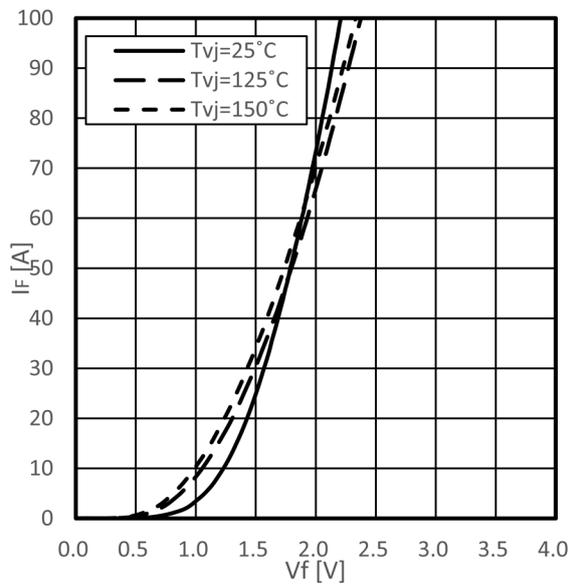
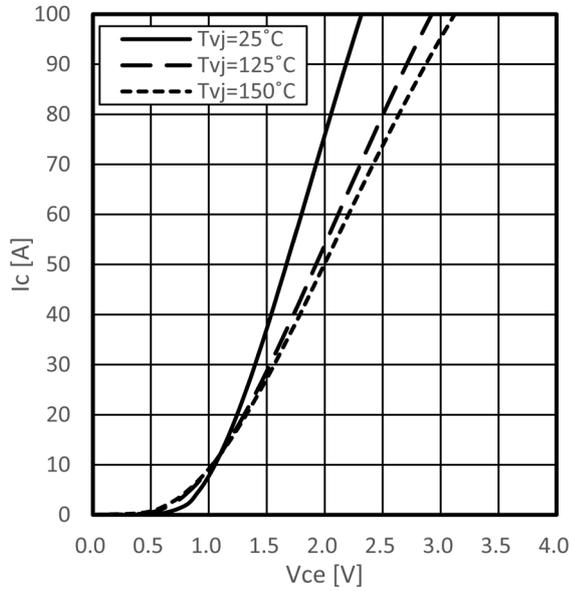
Transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



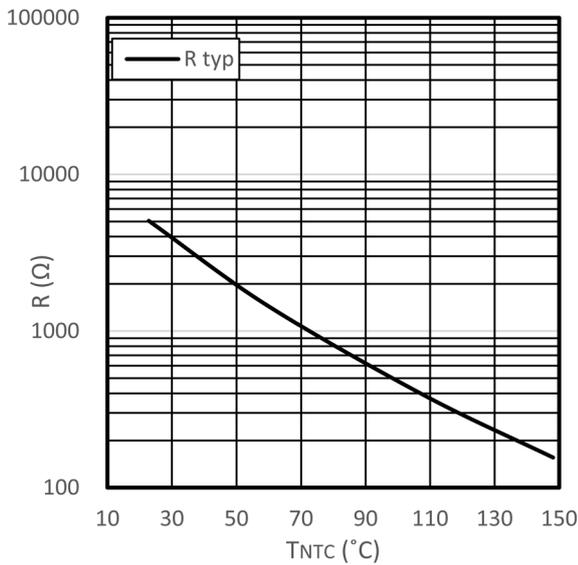
Forward characteristic of Diode, Rectifier (typical)

$I_F = f(V_F)$



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)
 $R = f(T_{NTC})$

12. Circuit Diagram

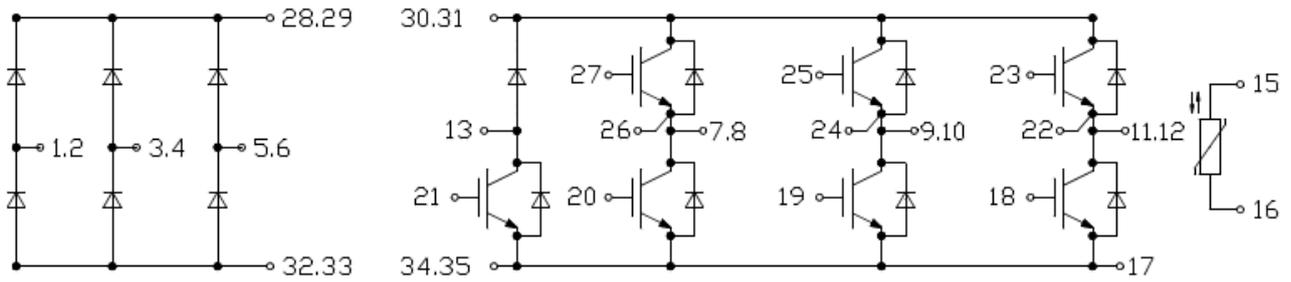


Figure 3

13. Package Outlines

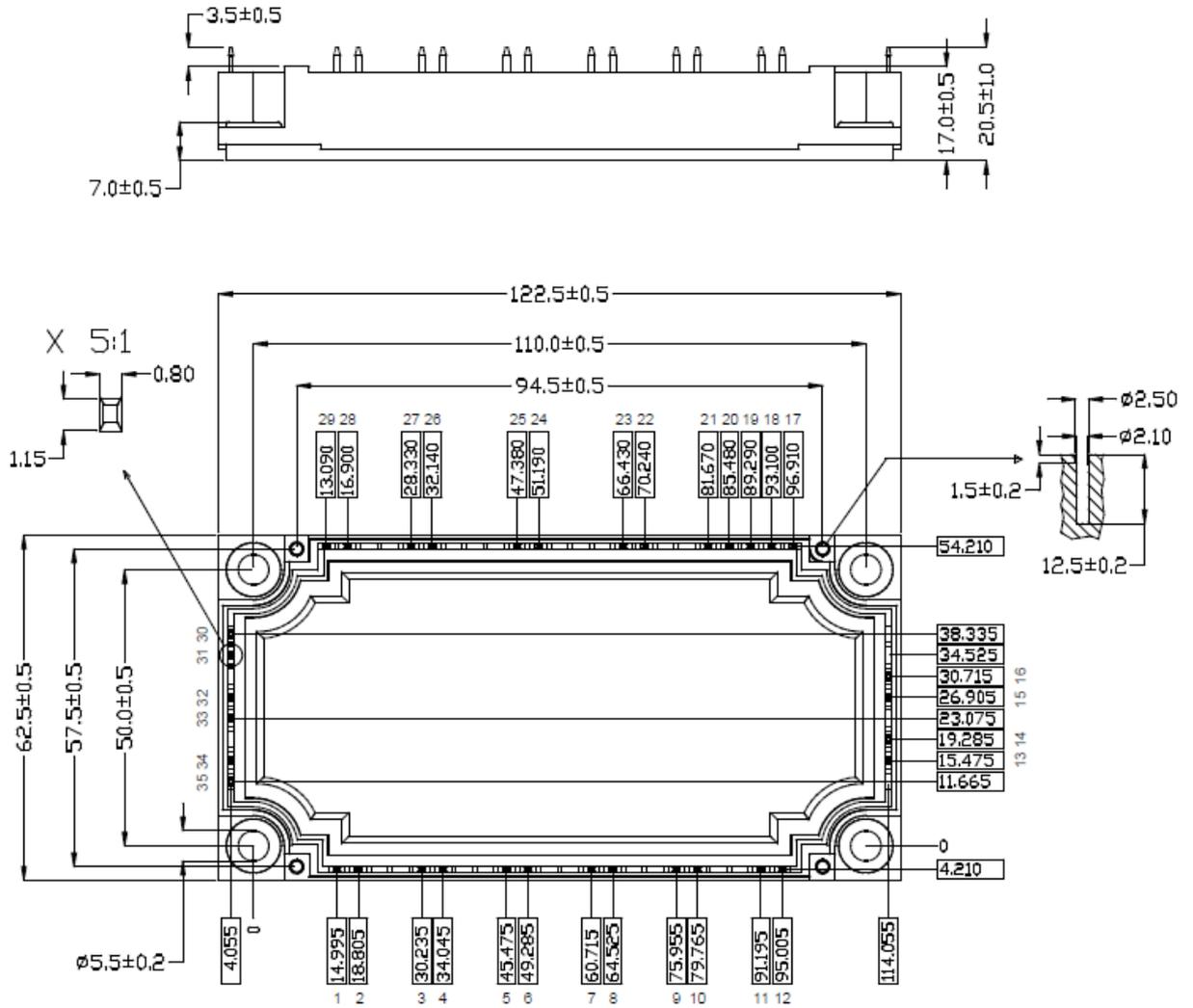


Figure 4