

1. Product Features

1.1 Electrical features

- $V_{CES}=650V$
- $I_{C\ nom}=600A / I_{CRM}=1200A$
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability



Figure 1 IGBT Module

1.2 Mechanical features

- Al_2O_3 substrate with low thermal resistance
- Copper base plate

2. Typical Applications

- Switching mode power supply
- Motor drives
- Uninterruptible power supply
- AC and DC servo drive amplifier

3. Description

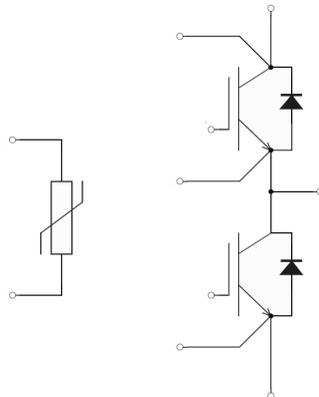


Figure 2 Half Bridge

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}	650	V
Continuous DC collector current 连续集电极电流	$T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	600	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1\text{ms}$	I_{CRM}	1200	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	1455	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	$I_C = 600\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$		2.00		V
		$T_{vj} = 125^{\circ}\text{C}$		2.35		V
		$T_{vj} = 150^{\circ}\text{C}$		2.40		V
Gate threshold voltage 栅极阈值电压	$I_C = 9.6\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE,th}$	5.2	5.65	6.6	V
Gate charge 栅极电荷	$V_{GE} = \pm 15\text{V}$	Q_G		2.47		μC
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		0.57		Ω
Input capacitance 输入电容	$f = 100\text{KHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{ies}		51		nF
Reverse transfer capacitance 反向传输电容	$f = 100\text{KHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{res}		0.69		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 650\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{CES}			3	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}			300	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 600\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = +15/-15\text{V}$ $R_{G,on} = 1.5\Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.104		us
		$T_{vj} = 125^{\circ}\text{C}$		0.113		us
		$T_{vj} = 150^{\circ}\text{C}$		0.118		us
Rise time, inductive load 上升时间	$I_C = 600\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = +15/-15\text{V}$ $R_{G,on} = 1.5\Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.086		us
		$T_{vj} = 125^{\circ}\text{C}$		0.093		us
		$T_{vj} = 150^{\circ}\text{C}$		0.093		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	$I_C = 600A, V_{CE} = 300V$ $V_{GE} = +15/-15V$ $R_{G,off} = 13\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.585		us
		$T_{vj} = 125^\circ C$			0.604		us
		$T_{vj} = 150^\circ C$			0.611		us
Fall time, inductive load 下降时间	$I_C = 600A, V_{CE} = 300V$ $V_{GE} = +15/-15V$ $R_{G,off} = 13\Omega$	$T_{vj} = 25^\circ C$	t_f		0.116		us
		$T_{vj} = 125^\circ C$			0.111		us
		$T_{vj} = 150^\circ C$			0.111		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 600A, V_{CE} = 300V, L_s = 35nH$ $V_{GE} = +15/-15V, di/dt = 5100A/\mu s$ $R_{G,on} = 1.5\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{on}		0.9		mJ
		$T_{vj} = 125^\circ C$			1.0		mJ
		$T_{vj} = 150^\circ C$			3.5		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 600A, V_{CE} = 300V, L_s = 35nH$ $V_{GE} = +15/-15V, dv/dt = 3700V/\mu s$ $R_{G,off} = 13\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	E_{off}		25.1		mJ
		$T_{vj} = 125^\circ C$			26.8		mJ
		$T_{vj} = 150^\circ C$			27.2		mJ
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,Jc}$			0.103	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}	650	V
Continuous DC forward current 连续正向直流电流		I_F	600	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1 ms$	I_{FRM}	1200	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 600 A, V_{GE} = 0 V$	$T_{vj} = 25^\circ C$	V_F		1.53		V
		$T_{vj} = 125^\circ C$			1.62		V
		$T_{vj} = 150^\circ C$			1.62		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	$I_F = 600A, V_R = 300V$ $V_{GE} = -15V, -di_F/dt = 3400 A/\mu s$ $(T_{vj}=150^\circ C)$	I_{RM}		$T_{vj} = 25^\circ C$	260	A
				$T_{vj} = 125^\circ C$	300	A
				$T_{vj} = 150^\circ C$	320	A
Recovered charge 恢复电荷	$I_F = 600A, V_R = 300V$ $V_{GE} = -15V, -di_F/dt = 3400 A/\mu s$ $(T_{vj}=150^\circ C)$	Q_r		$T_{vj} = 25^\circ C$	11.0	μC
				$T_{vj} = 125^\circ C$	36.3	μC
				$T_{vj} = 150^\circ C$	40.7	μC
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 600A, V_R = 300V$ $V_{GE} = -15V, -di_F/dt = 3400 A/\mu s$ $(T_{vj}=150^\circ C)$	E_{rec}		$T_{vj} = 25^\circ C$	2.7	mJ
				$T_{vj} = 125^\circ C$	7.2	mJ
				$T_{vj} = 150^\circ C$	7.8	mJ
Thermal resistance, junction to case 结—外壳热阻	Per diode	$R_{th,Jc}$			0.15	K/W

6. NTC-Thermistor

6.1 Characteristic value

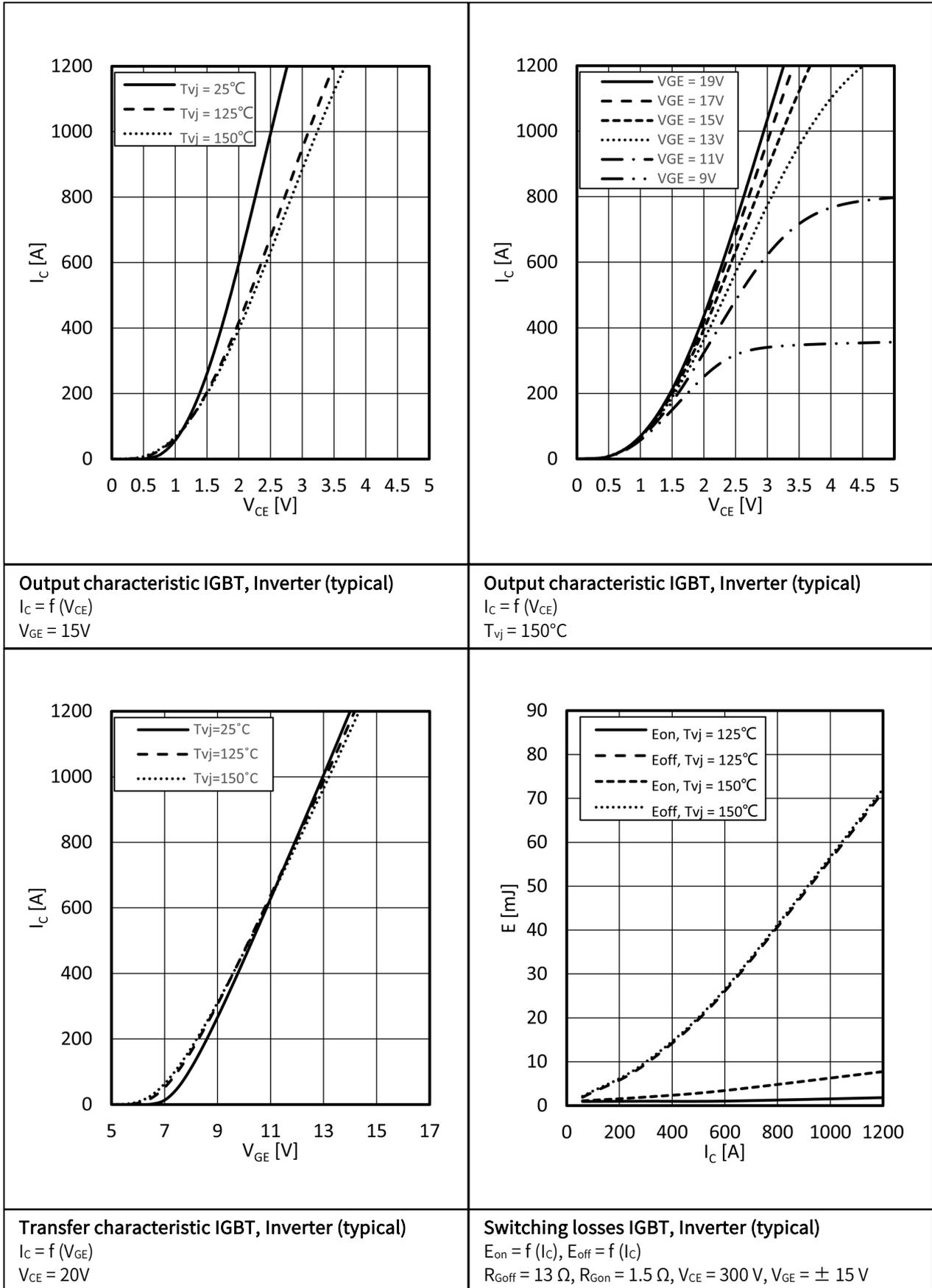
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	$T_c = 25^\circ C$	R_{25}		5.00		K Ω
Power dissipation 耗散功耗	$T_c = 25^\circ C$	P_{25}			20	mW
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$	B_{25}/B_{50}		3375		K
B-value B-Z 值	$R_2 =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

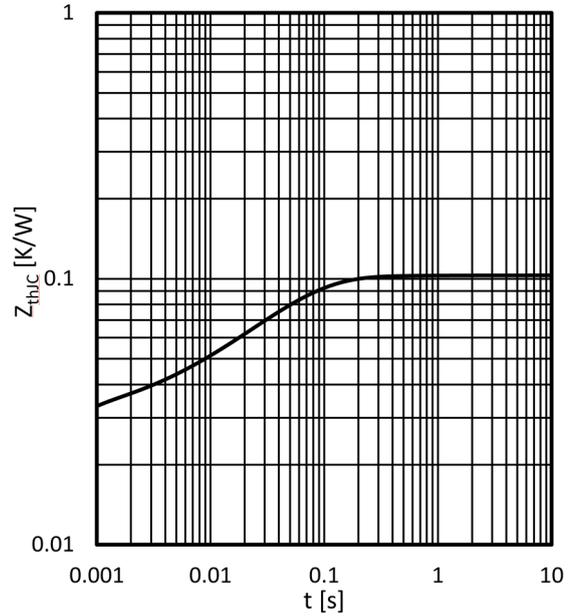
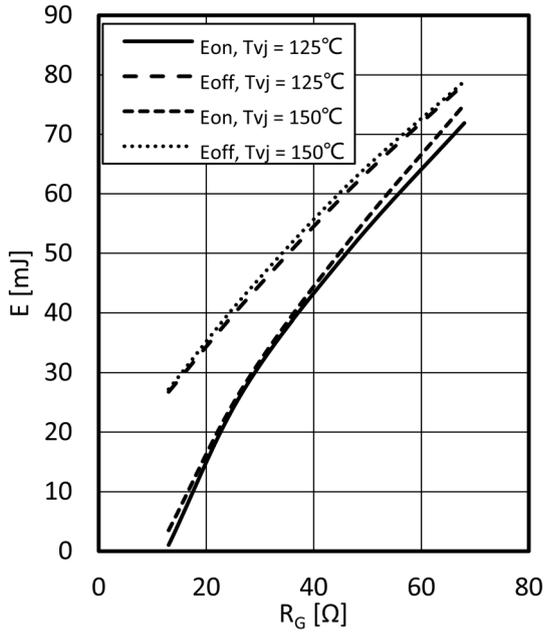
7. Module

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}		20		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		350		g

8. Characteristics diagrams





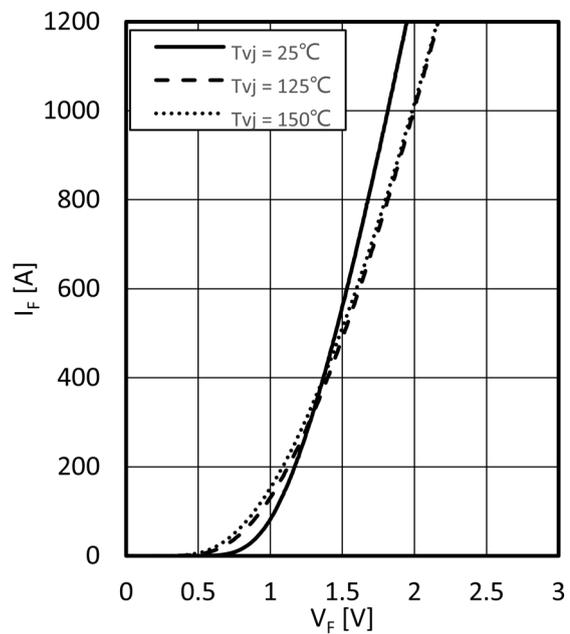
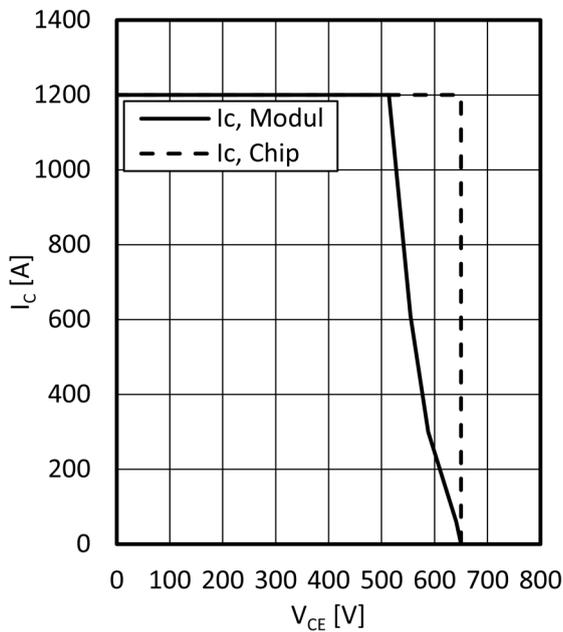
Switching losses IGBT, Inverter (typical)

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

$I_C = 600 \text{ A}, V_{CE} = 300 \text{ V}, V_{GE} = \pm 15 \text{ V}$

Transient thermal impedance IGBT, Inverter

$$Z_{thJC} = f(t)$$



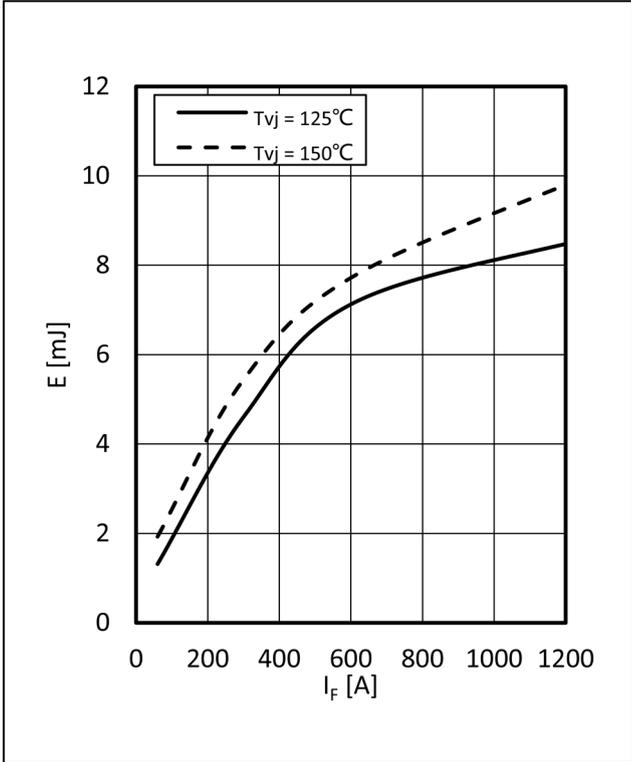
Reverse bias safe operating area IGBT, Inverter (RBSOA)

$$I_C = f(V_{CE})$$

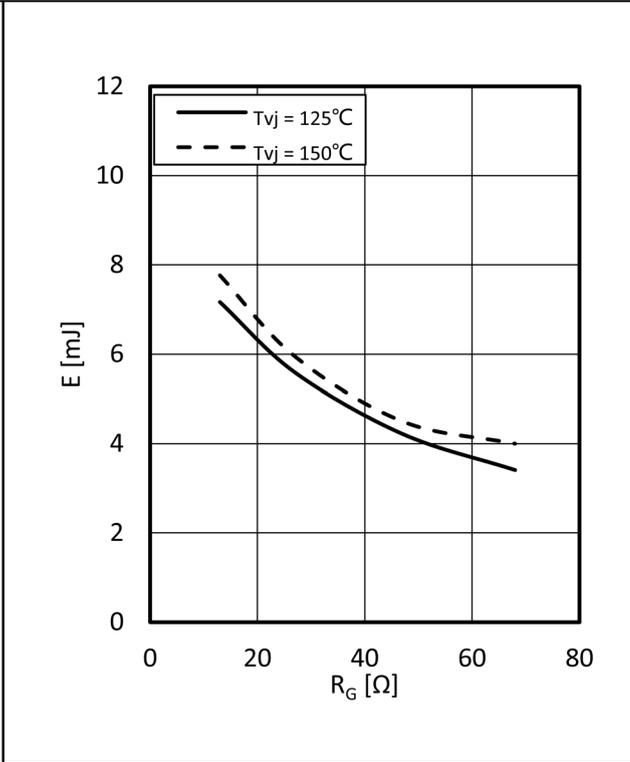
$V_{GE} = 15 \text{ V}, R_{Goff} = 13 \Omega, T_{vj} = 150 \text{ }^\circ\text{C}$

Forward characteristic of Diode, Inverter (typical)

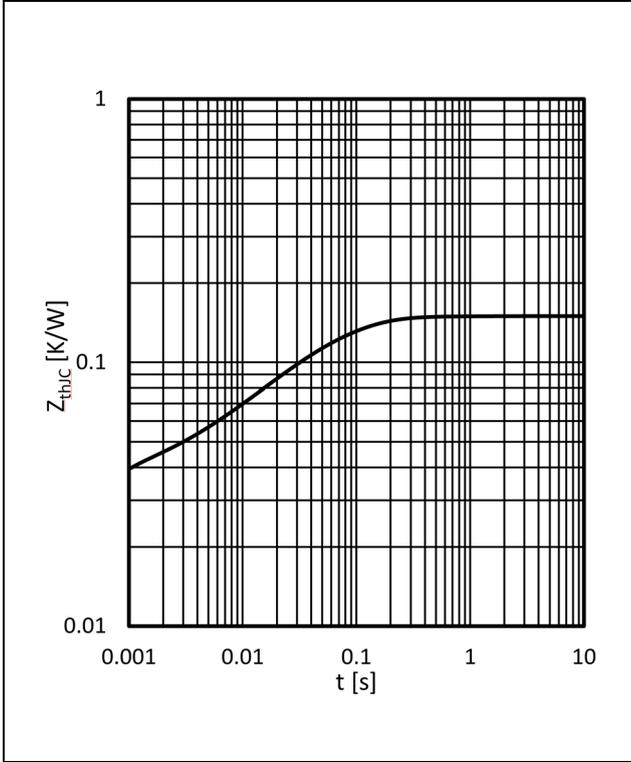
$$I_F = f(V_F)$$



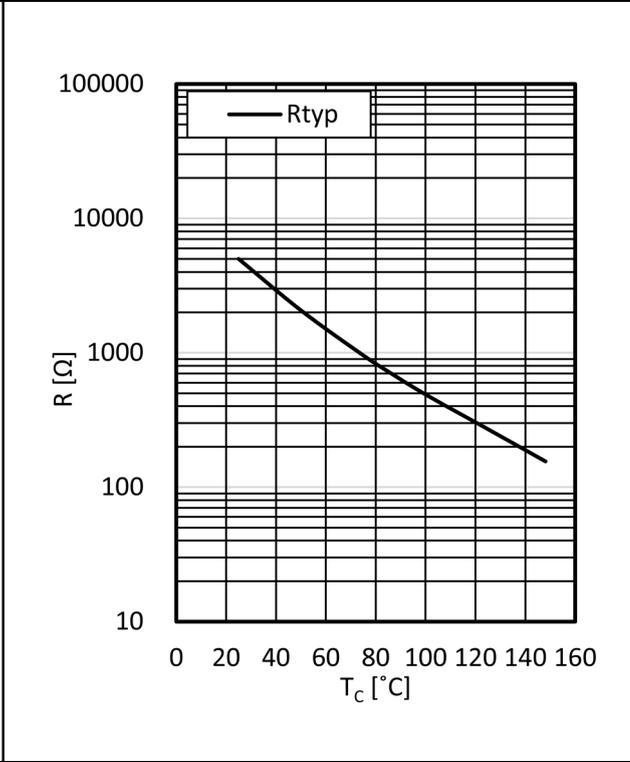
Switching losses Diode, Inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 1.5 \Omega, V_{CE} = 300 V$



Switching losses Diode, Inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 600 A, V_{CE} = 300 V$



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



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

9. Circuit Diagram

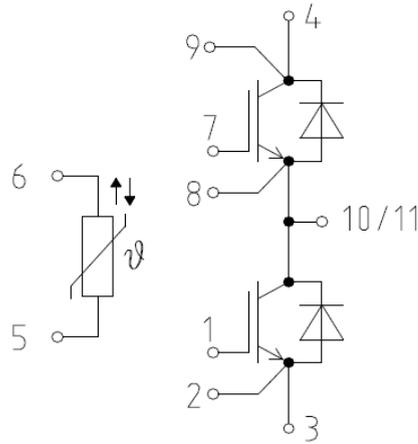


Figure 3

10. Package Outlines

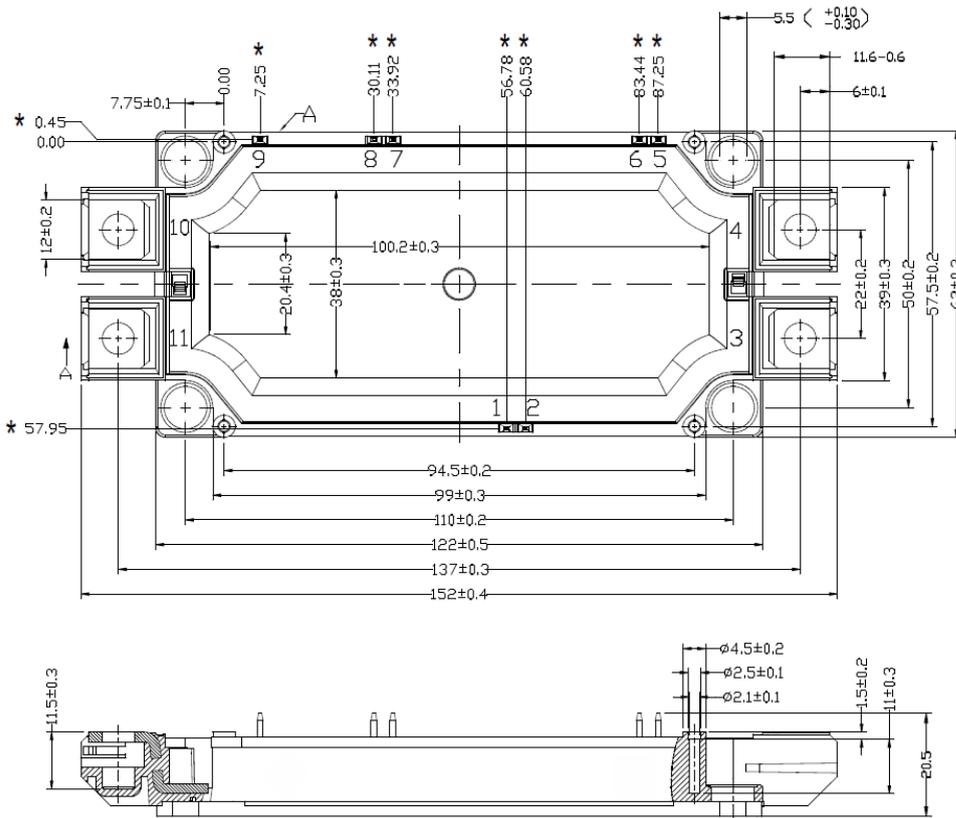


Figure 4