

1. Product Features

1.1 Electrical features

- $V_{CES}=1200V$
- $I_{C\ nom}=900A$ / $I_{CRM}=1800A$
- 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
- Servo drives
- Uninterruptible power supply
- AC and DC servo drive amplifier

3. Description

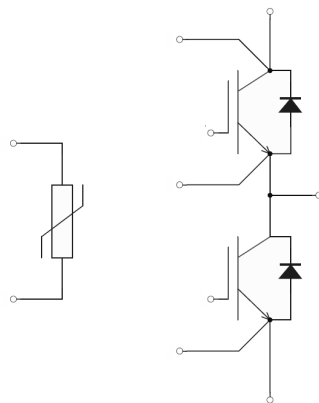


Figure 2 Half Bridge

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}	1200	V
Implemented collector current 集电极电流		I_{CN}	900	A
Continuous DC collector current 连续集电极电流	$T_C = 90^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	580	A
Repetitive peak collector current 集电极峰值电流	t_P limited by $T_{vj\text{op}}$ 1 ms	I_{CRM}	1800	A
Total power dissipation 总功率损耗	$T_C = 25^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	2170	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	$I_C = 900\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$V_{CE,\text{sat}}$		1.80	1.9	V
		$T_{vj} = 125^{\circ}\text{C}$			1.82		V
		$T_{vj} = 150^{\circ}\text{C}$			1.90		V
Gate threshold voltage 栅极阈值电压	$I_C = 34.2\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$		$V_{GE,\text{th}}$	5.0	6.0	6.5	V
Gate charge 栅极电荷	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G		10.78		μC
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$		$R_{G\text{int}}$		0.67		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}		219.3		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}		1.37		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}			300	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 900\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = +15/-15\text{ V}$ $R_{G,\text{on}} = 0.5\Omega$	$T_{vj} = 25^{\circ}\text{C}$	$t_{d,\text{on}}$		0.24		us
		$T_{vj} = 125^{\circ}\text{C}$			0.29		us
		$T_{vj} = 175^{\circ}\text{C}$			0.32		us
Rise time, inductive load 上升时间	$I_C = 900\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = +15/-15\text{ V}$ $R_{G,\text{on}} = 0.5\Omega$	$T_{vj} = 25^{\circ}\text{C}$	t_r		0.12		us
		$T_{vj} = 125^{\circ}\text{C}$			0.14		us
		$T_{vj} = 175^{\circ}\text{C}$			0.16		us

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	$I_C = 900A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 0.5\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.53		us
		$T_{vj} = 125^\circ C$			0.59		us
		$T_{vj} = 175^\circ C$			0.63		us
Fall time, inductive load 下降时间	$I_C = 900A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 0.5\Omega$	$T_{vj} = 25^\circ C$	t_f		0.13		us
		$T_{vj} = 125^\circ C$			0.23		us
		$T_{vj} = 175^\circ C$			0.28		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 900A, V_{CE} = 600V, L_s = 35nH$ $V_{GE} = +15/-15V, di/dt = 4700A/\mu s$ $R_{G,on} = 0.5\Omega (T_{vj} = 175^\circ C)$	$T_{vj} = 25^\circ C$	E_{on}		62.1		mJ
		$T_{vj} = 125^\circ C$			118.5		mJ
		$T_{vj} = 175^\circ C$			182.7		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 900A, V_{CE} = 600V, L_s = 35nH$ $V_{GE} = +15/-15V, dv/dt = 3500V/\mu s$ $R_{G,off} = 0.5\Omega (T_{vj} = 175^\circ C)$	$T_{vj} = 25^\circ C$	E_{off}		87.3		mJ
		$T_{vj} = 125^\circ C$			114.9		mJ
		$T_{vj} = 175^\circ C$			134.5		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC} = 800V,$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8 \mu s,$ $T_{vj} \leq 150^\circ C$	I_{sc}		3800		A
		$t_p \leq 6 \mu s,$ $T_{vj} \leq 175^\circ C$			3500		A
Thermal resistance, junction to case 结—外壳热阻	Per IGBT		$R_{th,JC}$			0.069	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	900	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1 ms$	I_{FRM}	1800	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 900 A, V_{GE} = 0 V$	$T_{vj} = 25^\circ C$	V_F		1.68	2.20	V
		$T_{vj} = 125^\circ C$			1.70		V
		$T_{vj} = 150^\circ C$			1.70		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	$I_F = 900A, V_R = 600V$	$T_{vj} = 25^{\circ}C$	I_{RM}		520		A
	$V_{GE} = -15V, -di_F/dt = 900 A/\mu s$	$T_{vj} = 125^{\circ}C$			620		A
	$(T_{vj}=175^{\circ}C)$	$T_{vj} = 175^{\circ}C$			630		A
Recovered charge 恢复电荷	$I_F = 900A, V_R = 600V$	$T_{vj} = 25^{\circ}C$	Q_r		102.3		μC
	$V_{GE} = -15V, -di_F/dt = 900 A/\mu s$	$T_{vj} = 125^{\circ}C$			191.5		μC
	$(T_{vj}=175^{\circ}C)$	$T_{vj} = 175^{\circ}C$			254.8		μC
Reverse recovery energy 反向恢复损耗（每脉冲）	$I_F = 900A, V_R = 600V$	$T_{vj} = 25^{\circ}C$	E_{rec}		44.0		mJ
	$V_{GE} = -15V, -di_F/dt = 900 A/\mu s$	$T_{vj} = 125^{\circ}C$			78.9		mJ
	$(T_{vj}=175^{\circ}C)$	$T_{vj} = 175^{\circ}C$			102.9		mJ
Thermal resistance, junction to case 结—外壳热阻	Per diode		$R_{th,Jc}$			0.076	K/W

6. NTC-Thermistor

6.1 Characteristic value

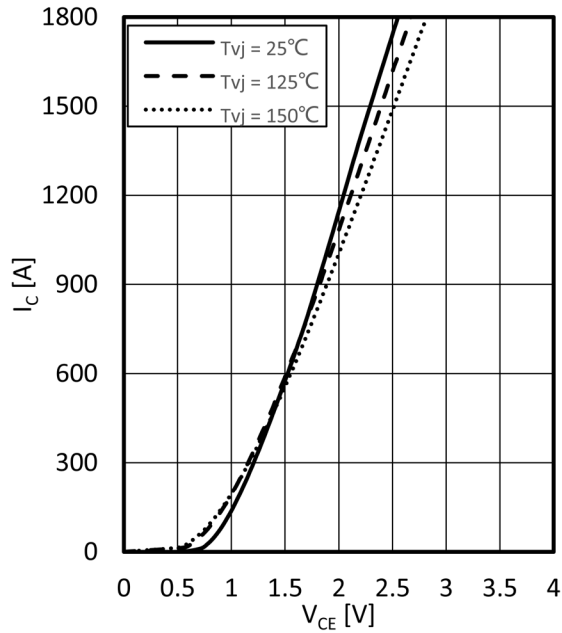
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	$T_c = 25^{\circ}C$	R_{25}		5.00		K Ω
Power dissipation 耗散功耗	$T_c = 25^{\circ}C$	P_{25}			20	mW
B-value B-Z 值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298, 15K))]$	B_{25}/B_{50}		3375		K
B-value B-Z 值	$R_2=R_{25}\exp[B_{25/75}(1/T_2-1/(298, 15K))]$	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}			3500	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

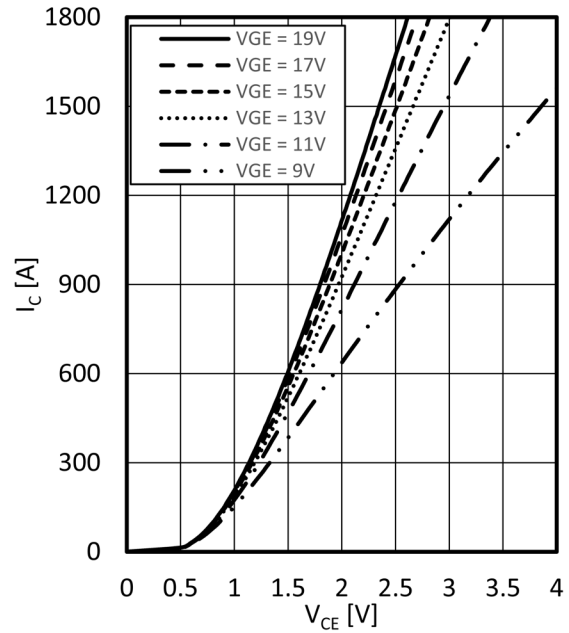
8. Characteristics diagrams



Output characteristic IGBT, Inverter (typical)

$$I_c = f(V_{ce})$$

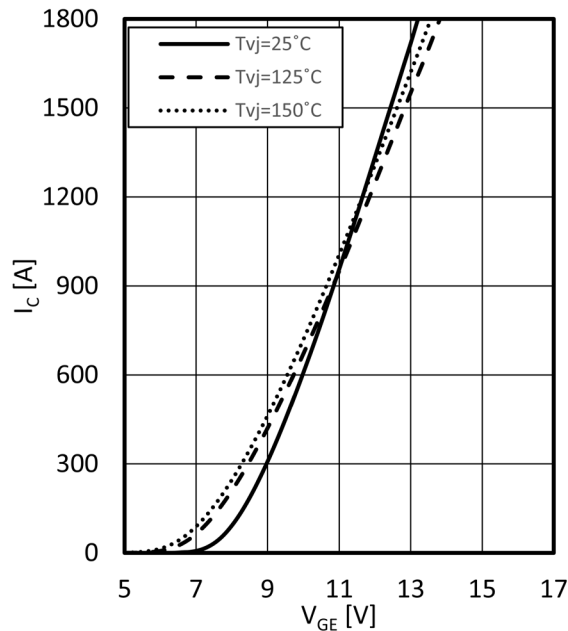
$$V_{GE} = 15\text{V}$$



Output characteristic IGBT, Inverter (typical)

$$I_c = f(V_{ce})$$

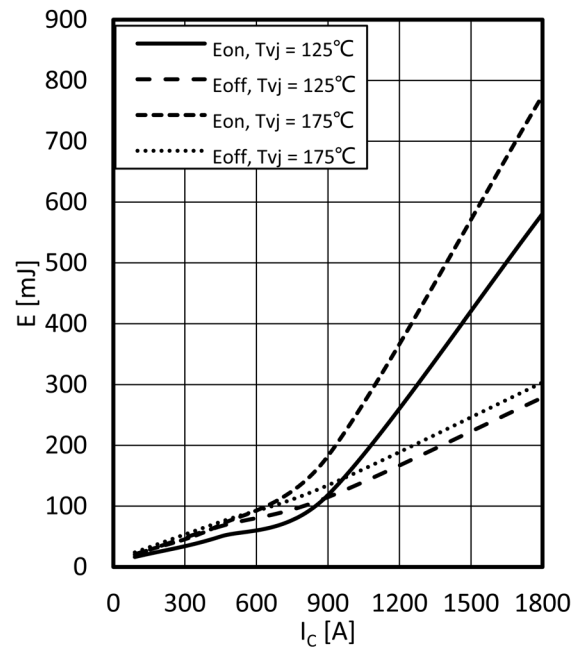
$$T_{vj} = 150^\circ\text{C}$$



Transfer characteristic IGBT, Inverter (typical)

$$I_c = f(V_{GE})$$

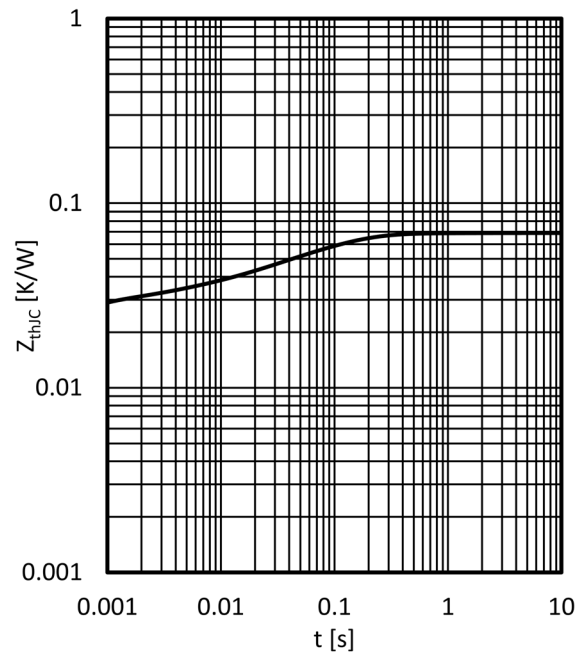
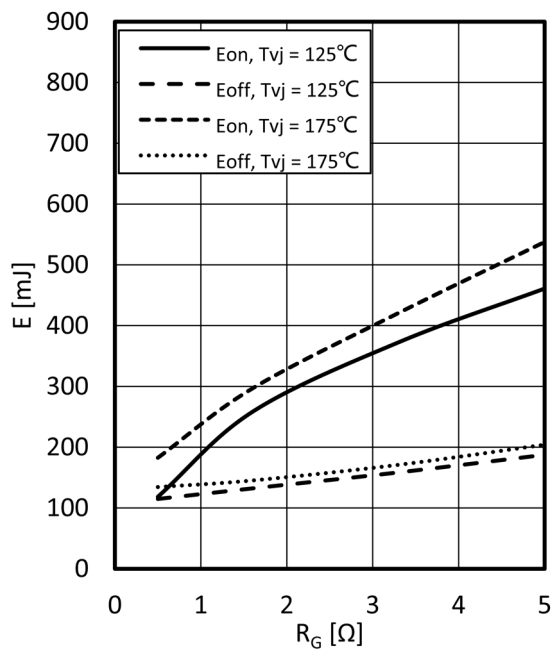
$$V_{ce} = 20\text{V}$$



Switching losses IGBT, Inverter (typical)

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

$$R_{Goff} = 0.5\ \Omega, R_{Gon} = 0.5\ \Omega, V_{ce} = 600\text{V}, V_{GE} = \pm 15\text{V}$$

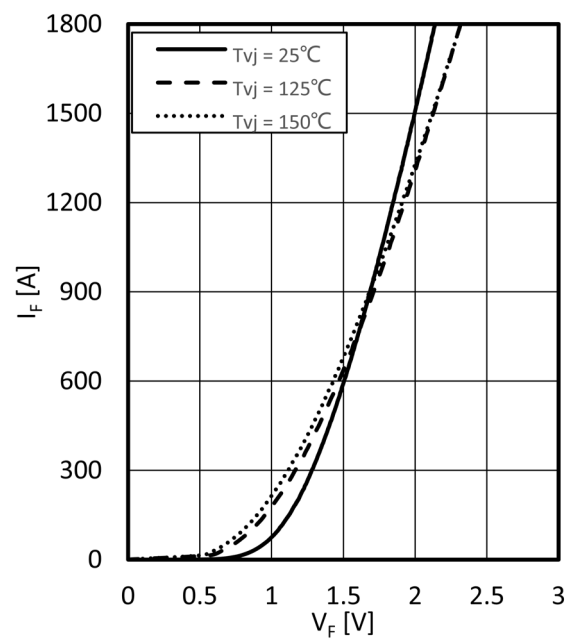
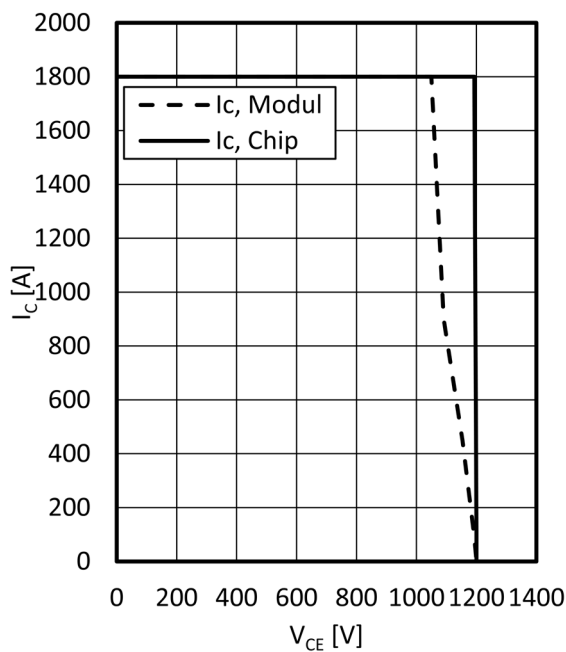


Switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $I_C = 900\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$

Transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$

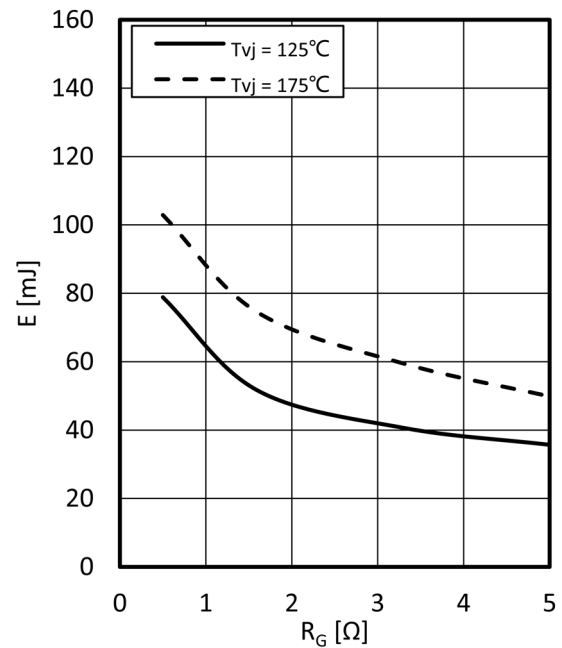
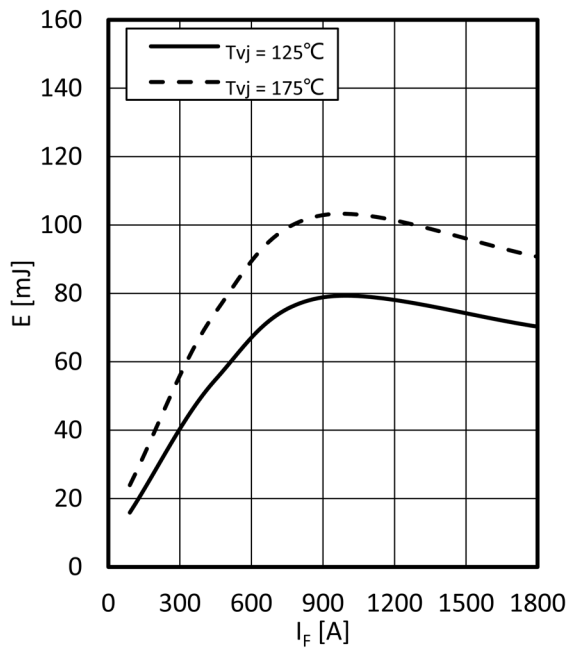


Reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$, $R_{Goff} = 0.5\text{ }\Omega$, $T_{vj} = 175^\circ\text{C}$

Forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



Switching losses Diode, Inverter (typical)

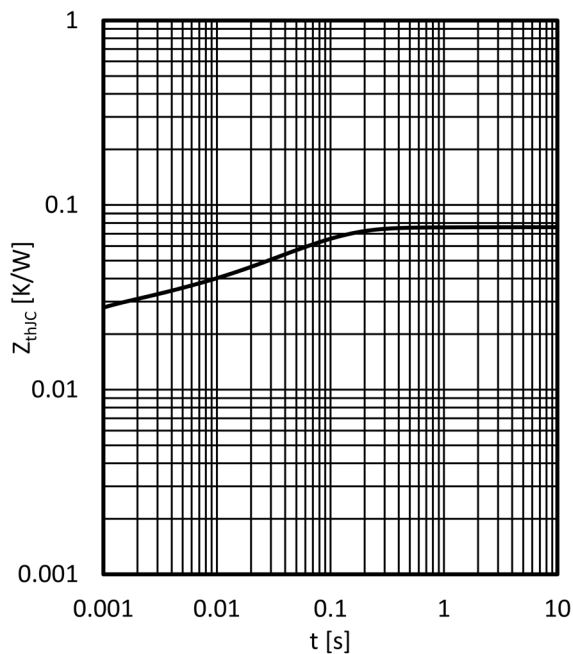
$$E_{rec} = f(I_F)$$

$$R_{Gon} = 15 \Omega, V_{CE} = 600 \text{ V}$$

Switching losses Diode, Inverter (typical)

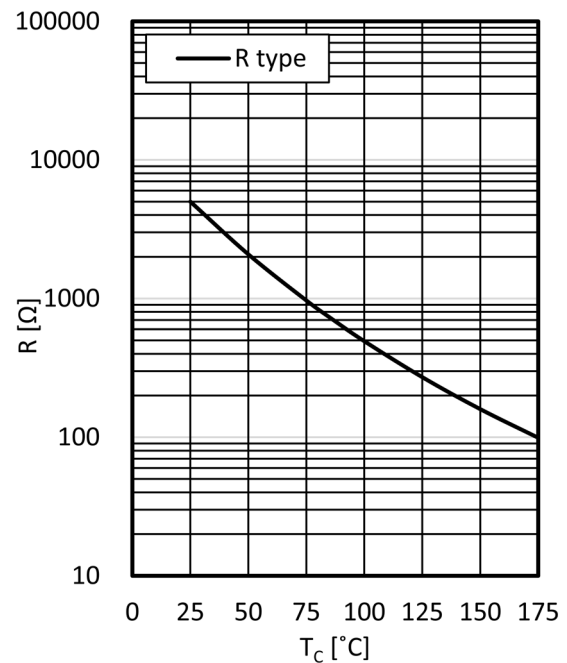
$$E_{rec} = f(R_G)$$

$$I_F = 900 \text{ A}, V_{CE} = 600 \text{ V}$$



Transient thermal impedance Diode, Inverter

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



NTC-Thermistor-temperature characteristic (typical)

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

9. Circuit Diagram

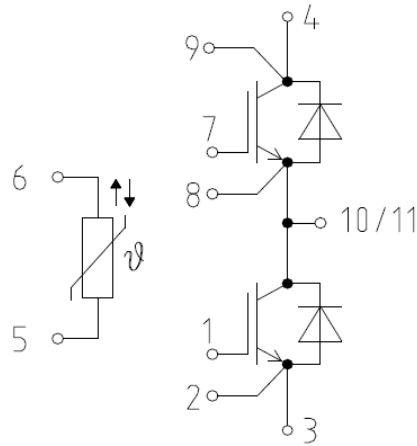


Figure 3

10. Package Outlines

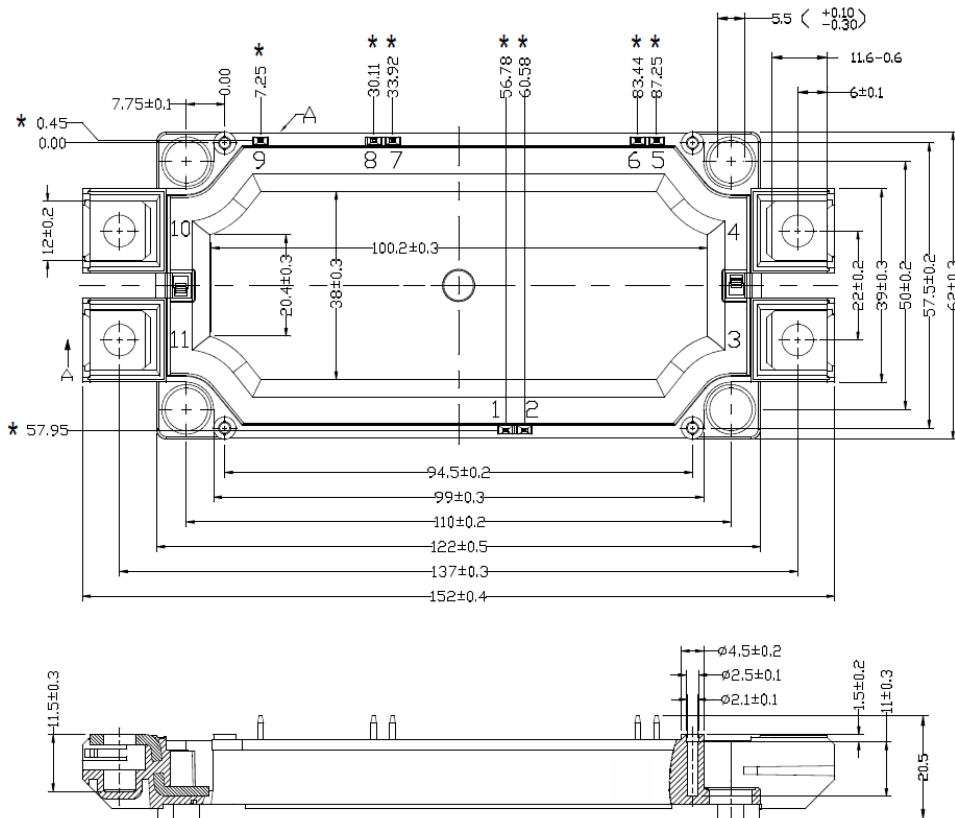


Figure 4