

## 1. Product Features

### 1.1 Electrical features

- $V_{CES}=1700V$
- $I_{C\ nom}=450A / I_{CRM}=900A$
- 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

- Integrated NTC temperature sensor
- High power and thermal cycling capability
- $Al_2O_3$  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

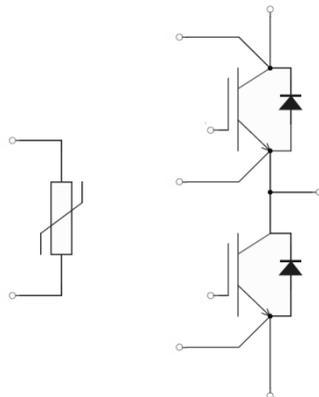


Figure 2 Dual

## 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	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1700	V
Continuous DC collector current 连续集电极电流	$T_c = 100^{\circ}\text{C}, T_{vj, \max} = 150^{\circ}\text{C}$	$I_{C \text{ nom}}$	450	A
Repetitive peak collector current 集电极峰值电流	$t_p = 1 \text{ ms}$	$I_{CRM}$	900	A
Total power dissipation 总功率损耗	$T_c = 25^{\circ}\text{C}, T_{vj, \max} = 175^{\circ}\text{C}$	$P_{\text{tot}}$	1600	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	$I_C = 450 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	1.45	1.65	1.85	V
		$T_{vj} = 125^{\circ}\text{C}$		2.00		V
		$T_{vj} = 150^{\circ}\text{C}$		2.08		V
Gate threshold voltage 栅极阈值电压	$I_C = 3 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE, \text{th}}$	5.0	5.6	6.2	V
Gate charge 栅极电荷	$V_{GE} = -15 \text{ V} \dots +15 \text{ V}$	$Q_G$		5.2		$\mu\text{C}$
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	$R_{G \text{ int}}$		1.2		$\Omega$
Input capacitance 输入电容	$f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$	$C_{\text{ies}}$		72		nF
Reverse transfer capacitance 反向传输电容	$f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$	$C_{\text{res}}$		0.6		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 1700 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$			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	$I_C = 450 \text{ A}, V_{CE} = 900 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 3.3 \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.26		us
		$T_{vj} = 125^{\circ}\text{C}$		0.29		us
		$T_{vj} = 150^{\circ}\text{C}$		0.29		us
Rise time, inductive load 上升时间	$I_C = 450 \text{ A}, V_{CE} = 900 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 3.3 \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.10		us
		$T_{vj} = 125^{\circ}\text{C}$		0.12		us
		$T_{vj} = 150^{\circ}\text{C}$		0.13		us

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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	$I_C = 450A, V_{CE} = 900V$ $V_{GE} = +15/-15V$ $R_{G,off} = 3.3\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.62		us
		$T_{vj} = 125^\circ C$			0.70		us
		$T_{vj} = 150^\circ C$			0.73		us
Fall time, inductive load 下降时间	$I_C = 450A, V_{CE} = 900V$ $V_{GE} = +15/-15V$ $R_{G,off} = 3.3\Omega$	$T_{vj} = 25^\circ C$	$t_f$		0.20		us
		$T_{vj} = 125^\circ C$			0.27		us
		$T_{vj} = 150^\circ C$			0.21		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 450A, V_{CE} = 900V, L_s = 35nH$ $V_{GE} = +15/-15V, di/dt = 2770A/\mu s$ $R_{G,on} = 3.3\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{on}$		78.5		mJ
		$T_{vj} = 125^\circ C$			116.6		mJ
		$T_{vj} = 150^\circ C$			125.5		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 450A, V_{CE} = 900V, L_s = 35nH$ $V_{GE} = +15/-15V, dv/dt = 3900V/\mu s$ $R_{G,off} = 3.3\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{off}$		84.6		mJ
		$T_{vj} = 125^\circ C$			121.5		mJ
		$T_{vj} = 150^\circ C$			137.6		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC} = 900V, t_p \leq 8\mu s, T_{vj} = 150^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		$I_{sc}$		2400		A
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,Jc}$			0.078	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	$T_{vj} = 25^\circ C$	$V_{RRM}$	1700	V
Continuous DC forward current 连续正向直流电流		$I_F$	450	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1ms$	$I_{FRM}$	900	A

### 5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 450A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	$V_F$		1.88		V
		$T_{vj} = 125^\circ C$			2.05		V
		$T_{vj} = 150^\circ C$			2.10		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	$I_F = 450A, V_R = 900V$ $V_{GE} = -15V, -di_F/dt = 2000 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$I_{RM}$		558		A
		$T_{vj} = 125^\circ C$			500		A
		$T_{vj} = 150^\circ C$				500	
Recovered charge 恢复电荷	$I_F = 450A, V_R = 900V$ $V_{GE} = -15V, -di_F/dt = 2000 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$Q_r$		121.5		$\mu C$
		$T_{vj} = 125^\circ C$			160.0		$\mu C$
		$T_{vj} = 150^\circ C$				176.1	
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 450A, V_R = 900V$ $V_{GE} = -15V, -di_F/dt = 2000 A/\mu s$ $(T_{vj}=150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{rec}$		69.6		mJ
		$T_{vj} = 125^\circ C$			93.4		mJ
		$T_{vj} = 150^\circ C$				103.6	
Thermal resistance, junction to case 结—外壳热阻	Per diode		$R_{th,Jc}$			0.152	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 $\Omega$
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

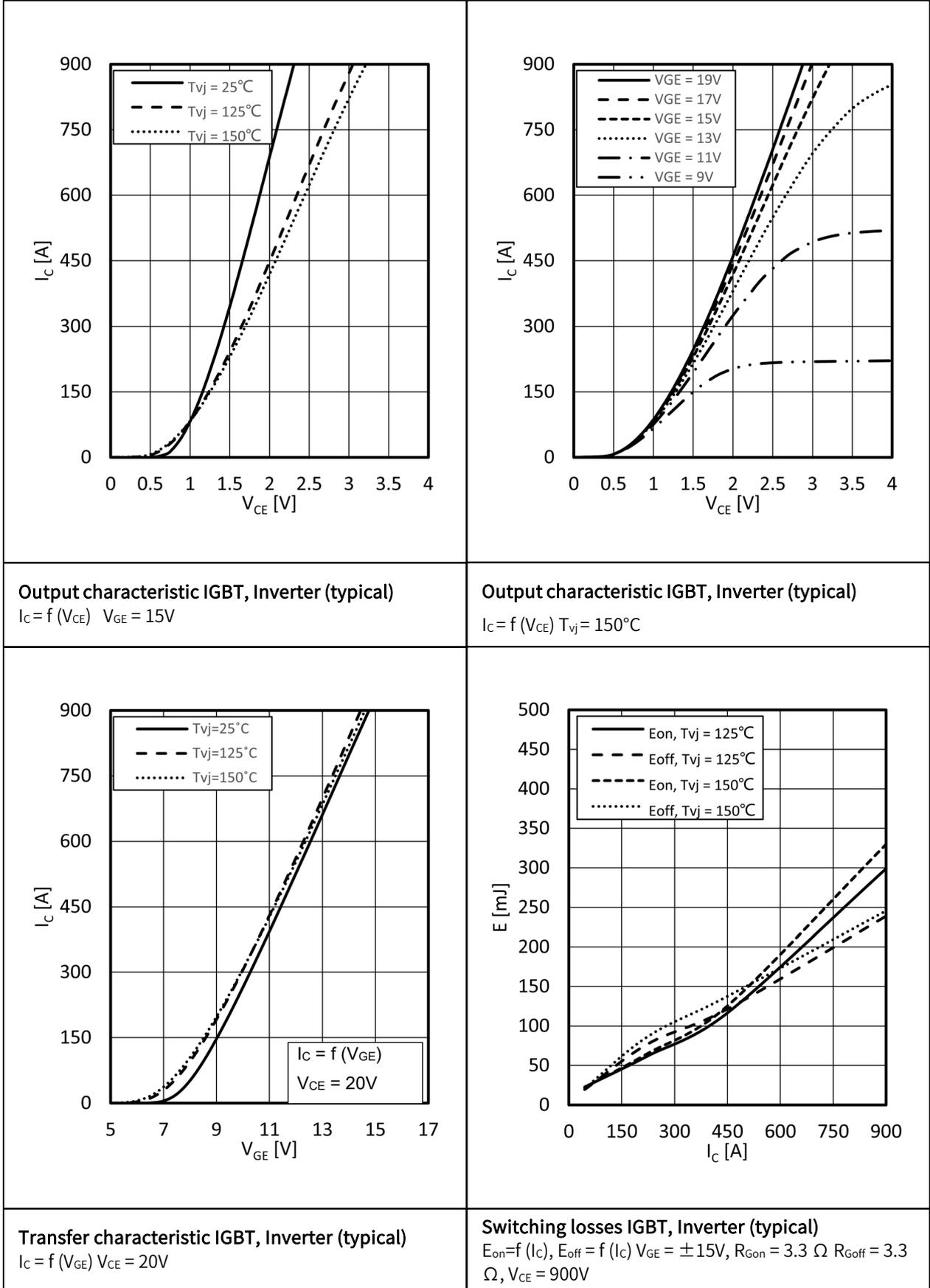
### 7.1 Characteristic value

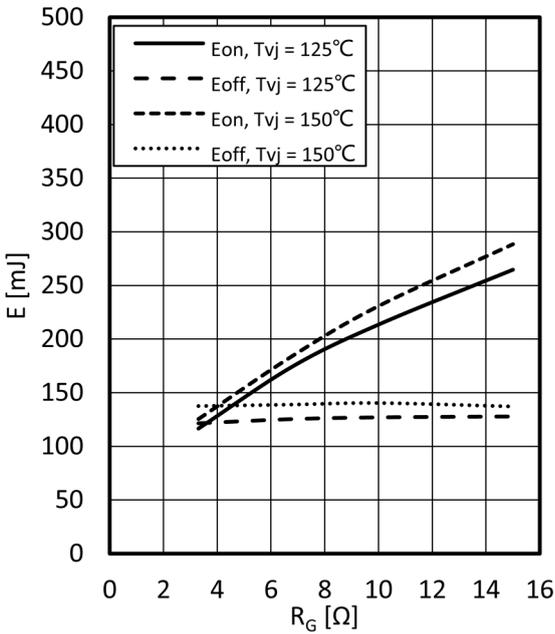
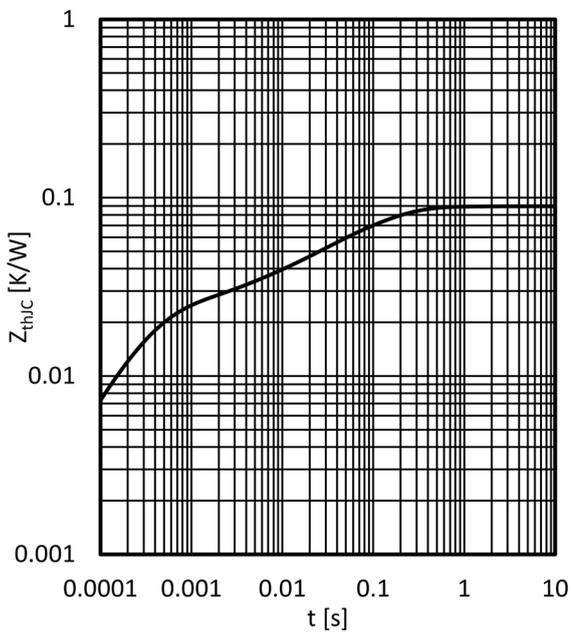
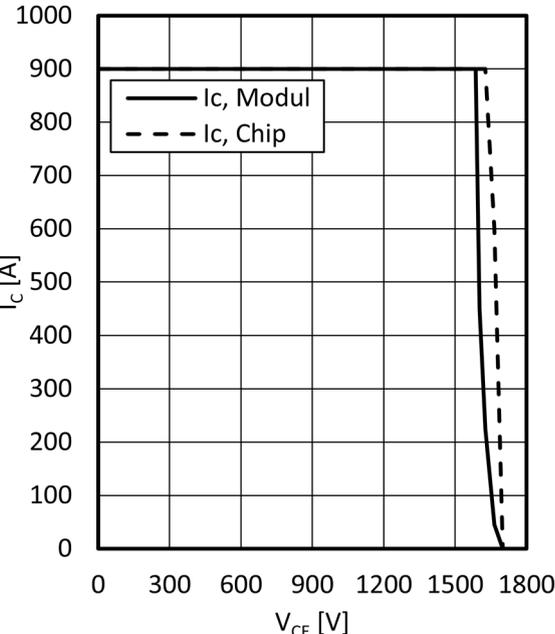
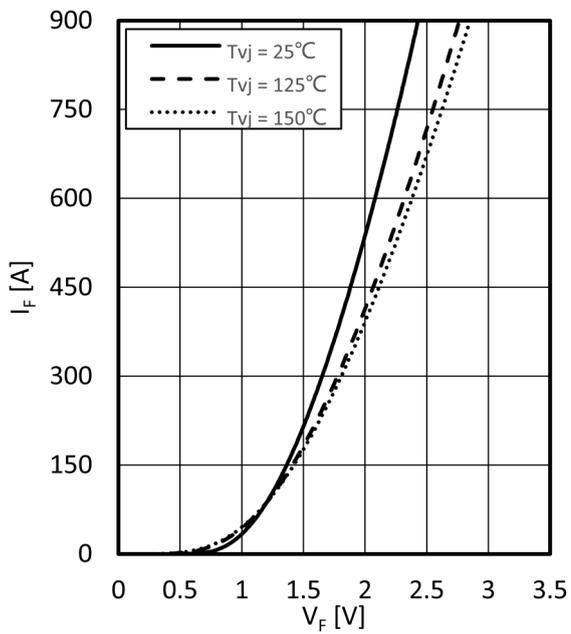
Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min		$V_{ISOL}$			3400	V
Stray inductance module 杂散电感			$L_{SCE}$		35		nH

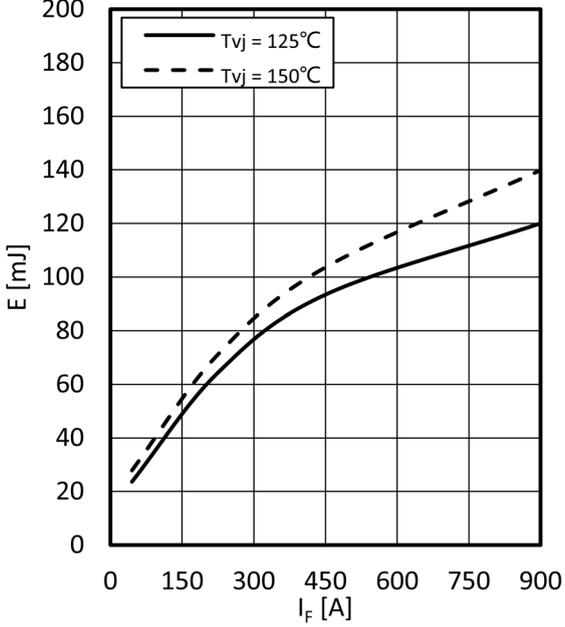
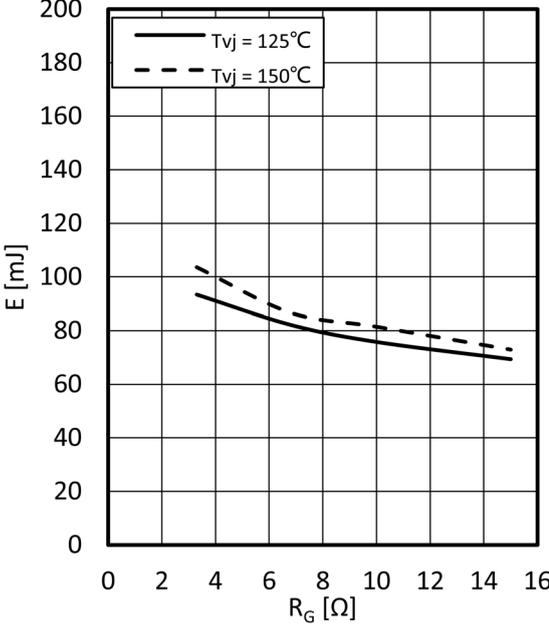
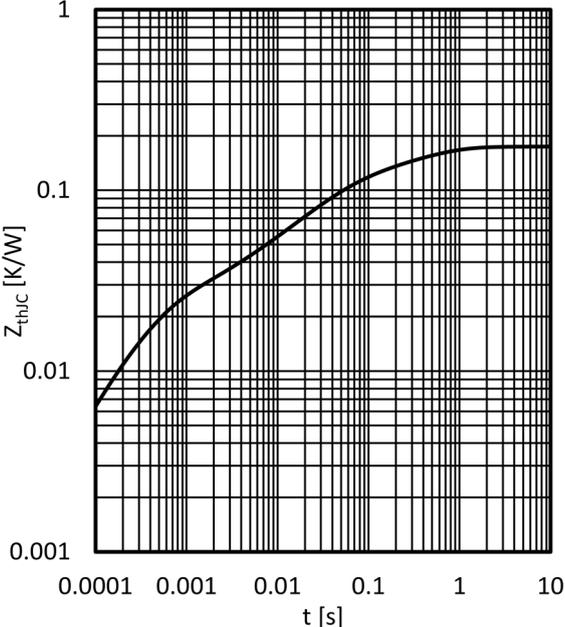
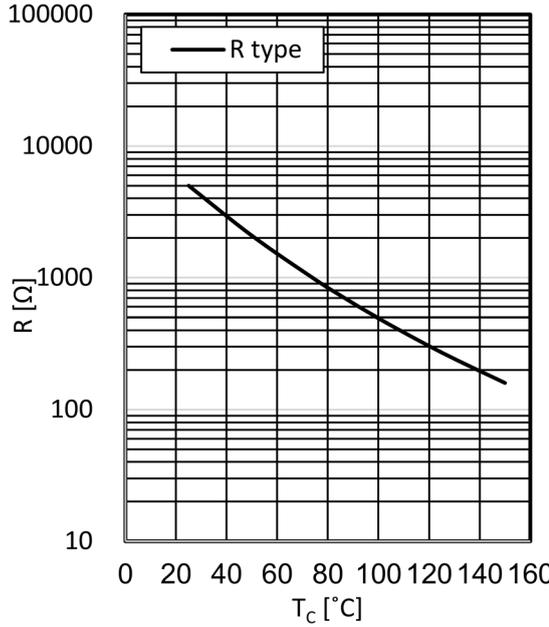
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Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Operation Junction Temperature 结温		$T_{jop}$	-40		150	°C
Storage Temperature Range 存储温度范围		$T_{stg}$	-40		125	°C
Mounting Torque 安装扭矩	Screw M5	M	3		6	N.m
Weight of Module 重量		G		350		g

## 8. Characteristics diagrams



 <p>Graph showing switching energy <math>E</math> [mJ] versus gate resistance <math>R_G</math> [<math>\Omega</math>]. The y-axis ranges from 0 to 500 mJ, and the x-axis ranges from 0 to 16 <math>\Omega</math>. Four curves are shown: <math>E_{on}</math> at <math>T_{vj} = 125^\circ\text{C}</math> (solid line), <math>E_{off}</math> at <math>T_{vj} = 125^\circ\text{C}</math> (dashed line), <math>E_{on}</math> at <math>T_{vj} = 150^\circ\text{C}</math> (dash-dot line), and <math>E_{off}</math> at <math>T_{vj} = 150^\circ\text{C}</math> (dotted line). All curves show an increase in energy with increasing gate resistance.</p>	 <p>Graph showing transient thermal impedance <math>Z_{thJC}</math> [K/W] versus time <math>t</math> [s]. The y-axis is logarithmic from 0.001 to 1 K/W, and the x-axis is logarithmic from 0.0001 to 10 s. The curve shows <math>Z_{thJC}</math> increasing from approximately 0.008 K/W at 0.0001 s to a steady-state value of about 0.09 K/W after 0.1 s.</p>
<p><b>Switching losses IGBT, Inverter (typical)</b>  <math>E_{on} = f(R_G)</math>, <math>E_{off} = f(R_G)</math> <math>V_{GE} = \pm 15\text{V}</math>, <math>I_C = 450\text{A}</math>, <math>V_{CE} = 900\text{V}</math></p>	<p><b>Transient thermal impedance IGBT, Inverter</b>  <math>Z_{thJC} = f(t)</math></p>
 <p>Graph showing reverse bias safe operating area (RBSOA) with collector current <math>I_C</math> [A] versus collector-emitter voltage <math>V_{CE}</math> [V]. The y-axis ranges from 0 to 1000 A, and the x-axis ranges from 0 to 1800 V. Two curves are shown: <math>I_C</math> for the module (solid line) and <math>I_C</math> for the chip (dashed line). Both curves show a constant current region up to approximately 1600 V, followed by a sharp drop to zero.</p>	 <p>Graph showing forward characteristic of the diode with forward current <math>I_F</math> [A] versus forward voltage <math>V_F</math> [V]. The y-axis ranges from 0 to 900 A, and the x-axis ranges from 0 to 3.5 V. Three curves are shown for different temperatures: <math>T_{vj} = 25^\circ\text{C}</math> (solid line), <math>T_{vj} = 125^\circ\text{C}</math> (dashed line), and <math>T_{vj} = 150^\circ\text{C}</math> (dotted line). The curves show an exponential relationship between current and voltage.</p>
<p><b>Reverse bias safe operating area IGBT, Inverter (RBSOA)</b>  <math>I_C = f(V_{CE})</math> <math>V_{GE} = \pm 15\text{V}</math> <math>R_{Goff} = 3.3\Omega</math>, <math>T_{vj} = 150^\circ\text{C}</math></p>	<p><b>Forward characteristic of Diode, Inverter (typical)</b>  <math>I_F = f(V_F)</math></p>

	
<p><b>Switching losses Diode, Inverter (typical)</b>  <math>E_{rec} = f(I_F)</math> <math>R_{Gon} = 3.3 \Omega</math>, <math>V_{CC} = 900V</math></p>	<p><b>Switching losses Diode, Inverter (typical)</b>  <math>E_{rec} = f(R_G)</math> <math>I_F = 450 A</math>, <math>V_{CC} = 900V</math></p>
	
<p><b>Transient thermal impedance Diode Inverter</b>  <math>Z_{thJC} = f(t)</math></p>	<p><b>NTC-Thermistor-temperature characteristic (typical)</b>  <math>R = f(T)</math></p>

### 9. Circuit Diagram

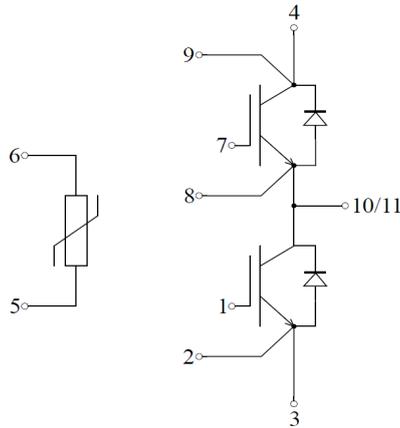


Figure 3

### 10. Package Outlines

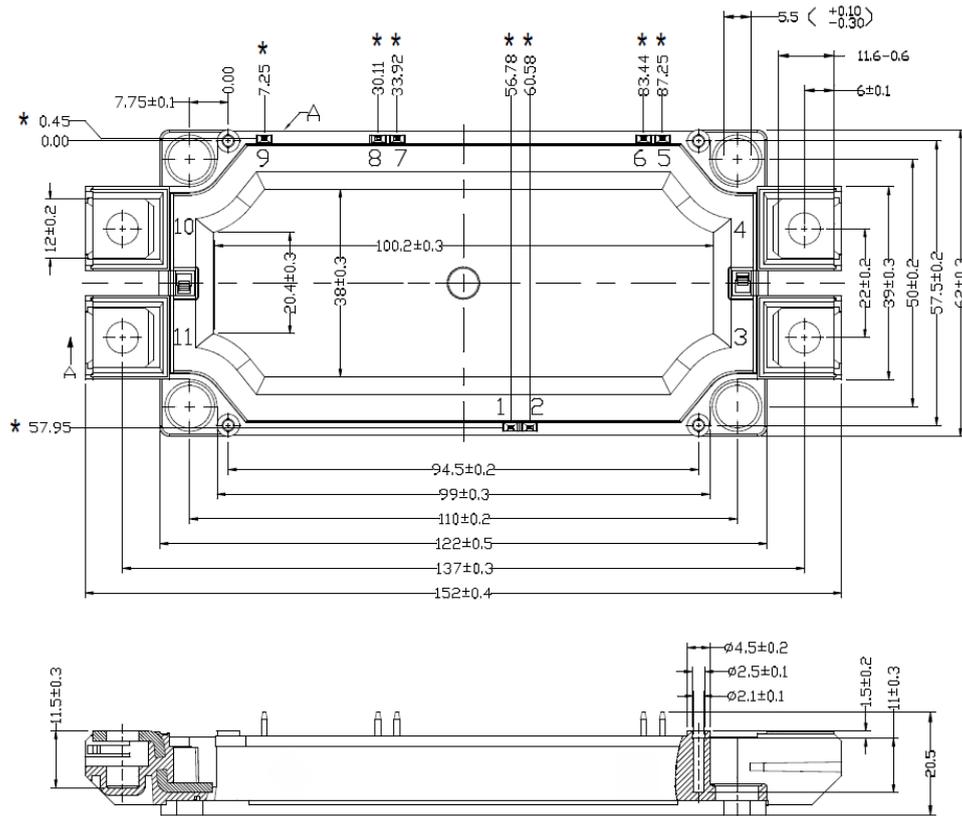


Figure 4