

## 1. Product Features

### 1.1 Electrical features

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

### 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



Figure1 IGBT Module

## 2. Typical Applications

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

## 3. Description

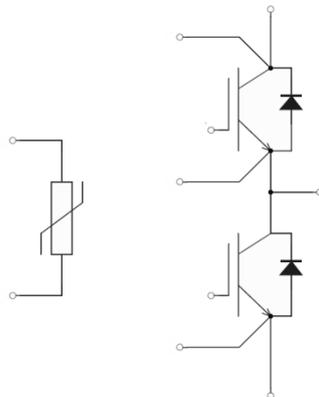


Figure 2 Dual

## 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	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
Continuous DC collector current 连续集电极电流	$T_C = 100^{\circ}\text{C}, T_{vj, \max} = 150^{\circ}\text{C}$	$I_{C \text{ nom}}$	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	$T_C = 25^{\circ}\text{C}, T_{vj, \max} = 175^{\circ}\text{C}$	$P_{\text{tot}}$	1500	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	$I_C = 600 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1.7	1.9	V
		$T_{vj} = 125^{\circ}\text{C}$		1.8		V
		$T_{vj} = 150^{\circ}\text{C}$		1.9		V
Gate threshold voltage 栅极阈值电压	$I_C = 22.8 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE, \text{th}}$	5.0	6.0	6.5	V
Gate charge 栅极电荷	$V_{GE} = -15 \text{ V} \dots +15 \text{ V}$	$Q_G$		7.2		$\mu\text{C}$
Internal gate resistor 内部栅极电阻	$T_{vj} = 25^{\circ}\text{C}$	$R_{G \text{ int}}$		1.0		$\Omega$
Input capacitance 输入电容	$f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$	$C_{\text{ies}}$		146.2		nF
Reverse transfer capacitance 反向传输电容	$f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$	$C_{\text{res}}$		0.913		nF
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$			3	mA
Gate-emitter leakage current 栅极-发射极漏电流	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	$I_{GES}$			400	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 1.6 \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.32		us
		$T_{vj} = 125^{\circ}\text{C}$		0.37		us
		$T_{vj} = 150^{\circ}\text{C}$		0.38		us
Rise time, inductive load 上升时间	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 1.6 \Omega$	$T_{vj} = 25^{\circ}\text{C}$		0.13		us
		$T_{vj} = 125^{\circ}\text{C}$		0.15		us
		$T_{vj} = 150^{\circ}\text{C}$		0.16		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	$I_C = 600A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 1.6\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		0.57		us
		$T_{vj} = 125^\circ C$			0.65		us
		$T_{vj} = 150^\circ C$			0.67		us
Fall time, inductive load 下降时间	$I_C = 600A, V_{CE} = 600V$ $V_{GE} = +15/-15V$ $R_{G,off} = 1.6\Omega$	$T_{vj} = 25^\circ C$	$t_f$		0.11		us
		$T_{vj} = 125^\circ C$			0.22		us
		$T_{vj} = 150^\circ C$			0.19		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 600A, V_{CE} = 600V, L_s=35nH$ $V_{GE} = +15/-15V, di/dt=3070A/\mu s$ $R_{G,on} = 1.6\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{on}$		66.0		mJ
		$T_{vj} = 125^\circ C$			100.0		mJ
		$T_{vj} = 150^\circ C$			109.0		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 600A, V_{CE} = 600V, L_s=35nH$ $V_{GE} = +15/-15V, dv/dt=3260V/\mu s$ $R_{G,off} = 1.6\Omega (T_{vj} = 150^\circ C)$	$T_{vj} = 25^\circ C$	$E_{off}$		52.3		mJ
		$T_{vj} = 125^\circ C$			71.0		mJ
		$T_{vj} = 150^\circ C$			71.0		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC}=600V, t_p \leq 8\mu s, T_{vj} = 150^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		$I_{SC}$		3300		A
Thermal resistance, junction to case 结-外壳热阻	Per IGBT		$R_{th,Jc}$			0.06	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		$I_F$	600	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1\text{ ms}$	$I_{FRM}$	1200	A

### 5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 600\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^\circ C$	$V_F$		1.68	2.20	V
		$T_{vj} = 125^\circ C$			1.70		V
		$T_{vj} = 150^\circ C$			1.75		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	$I_F = 600A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 770 A/\mu s$ ( $T_{vj}=150^\circ C$ )	$T_{vj} = 25^\circ C$ $T_{vj} = 125^\circ C$ $T_{vj} = 150^\circ C$	$I_{RM}$		330 400 420		A A A
Recovered charge 恢复电荷	$I_F = 600A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 770 A/\mu s$ ( $T_{vj}=150^\circ C$ )	$T_{vj} = 25^\circ C$ $T_{vj} = 125^\circ C$ $T_{vj} = 150^\circ C$	$Q_r$		70.1 144.5 160.9		$\mu C$ $\mu C$ $\mu C$
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 600A, V_R = 600V$ $V_{GE} = -15V, -di_F/dt = 770 A/\mu s$ ( $T_{vj}=150^\circ C$ )	$T_{vj} = 25^\circ C$ $T_{vj} = 125^\circ C$ $T_{vj} = 150^\circ C$	$E_{rec}$		28.3 59.8 66.7		mJ mJ mJ
Thermal resistance, junction to case 结-外壳热阻	Per diode		$R_{th,Jc}$			0.085	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

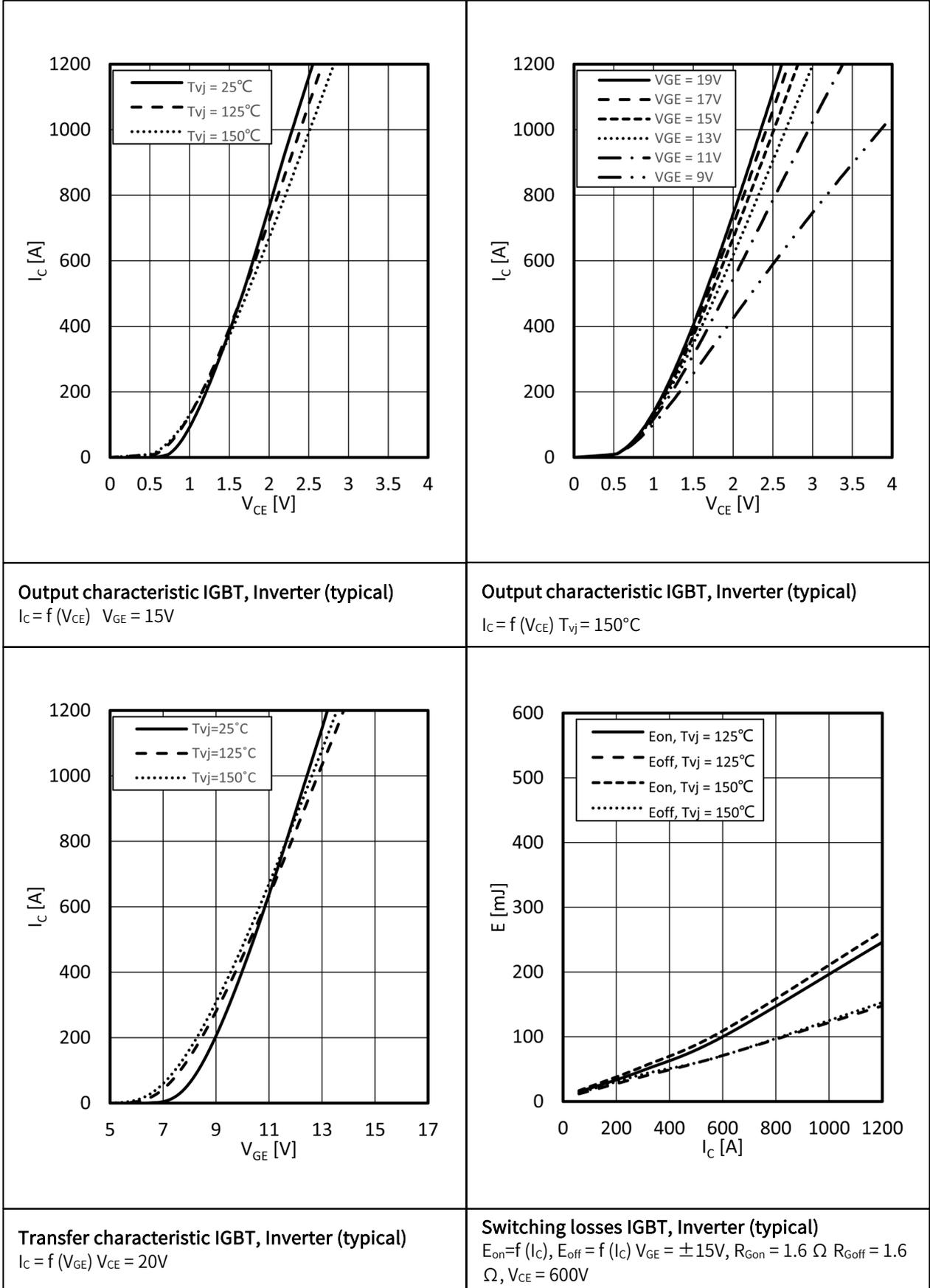
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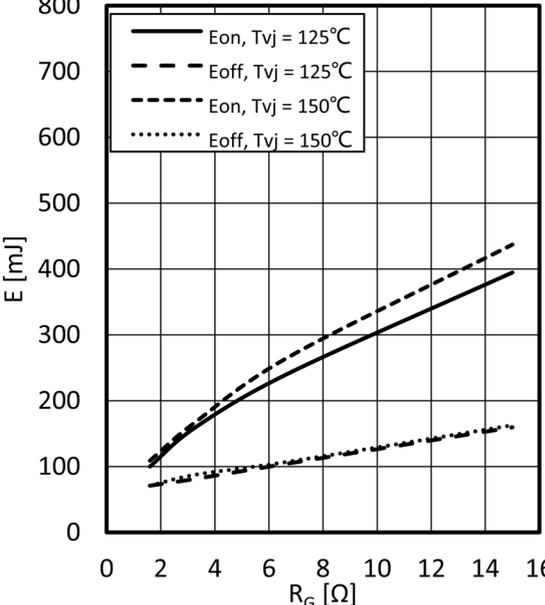
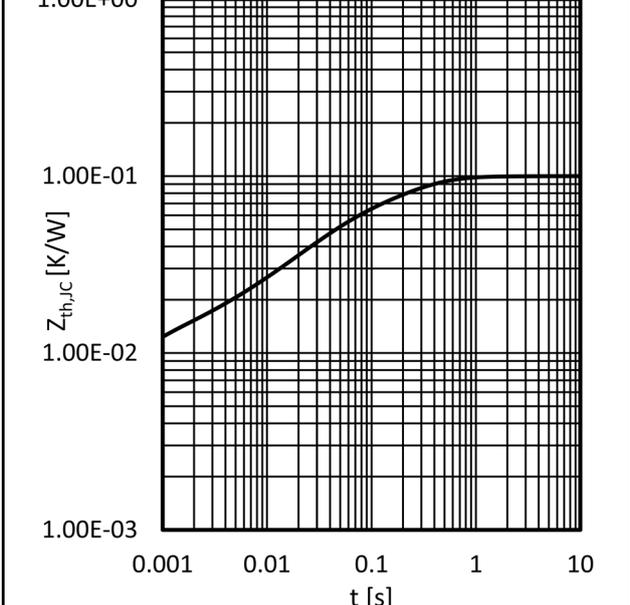
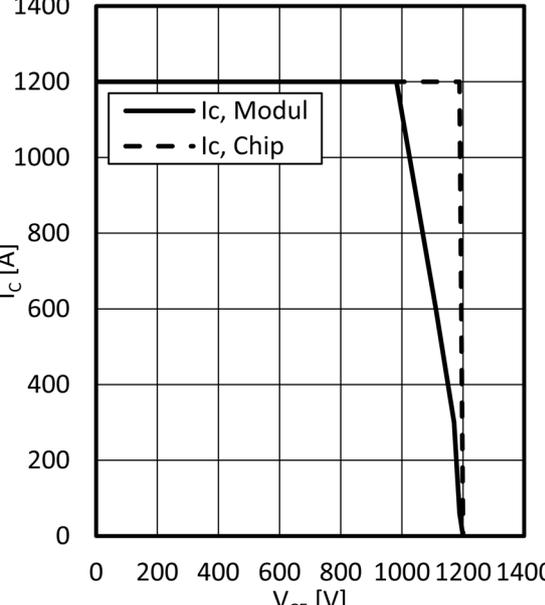
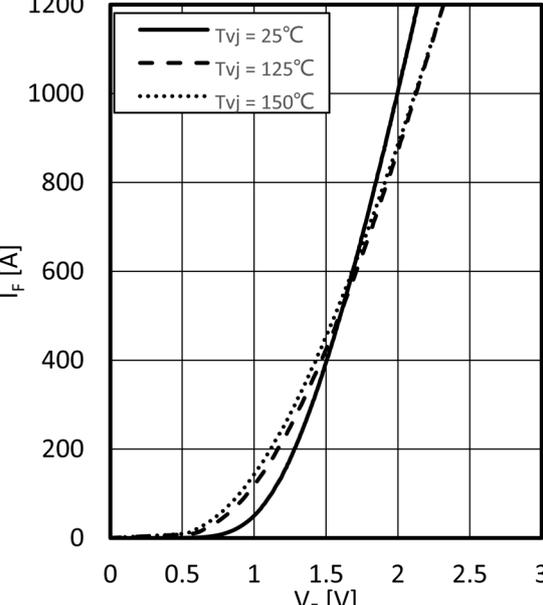
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min	$V_{ISOL}$			2500	V
Stray inductance module 杂散电感		$L_{SCE}$		35		nH

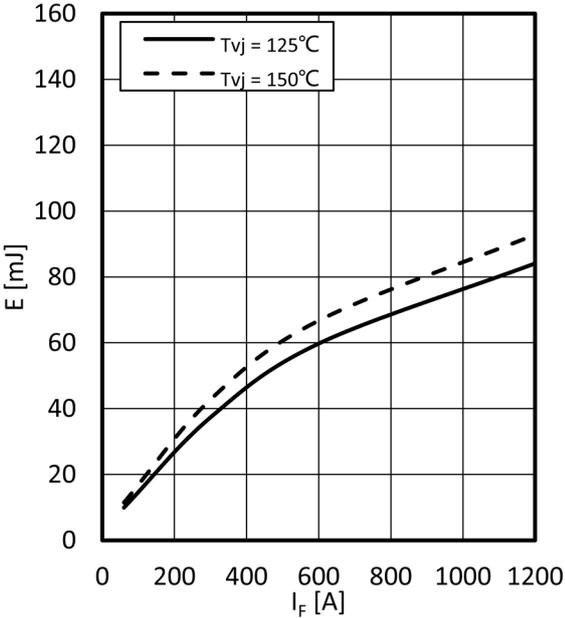
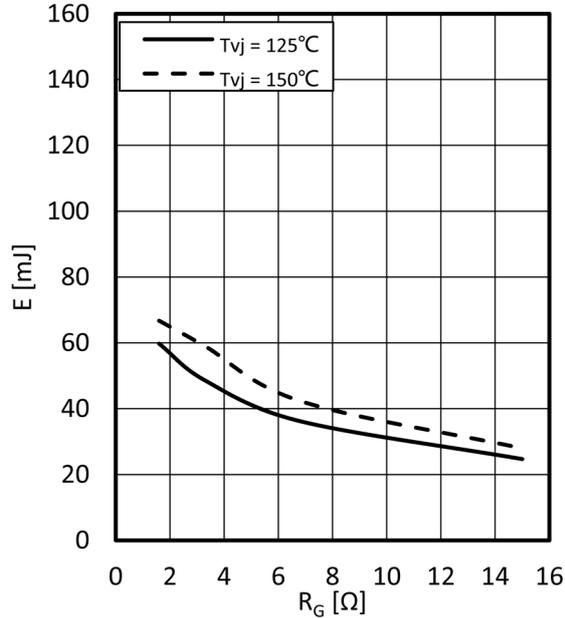
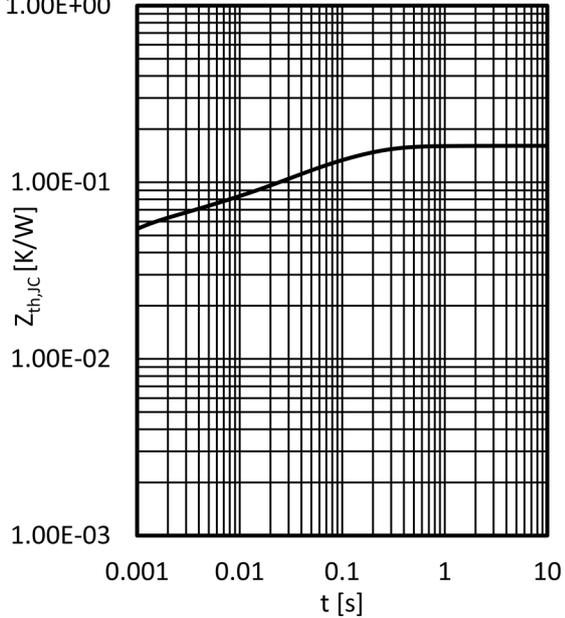
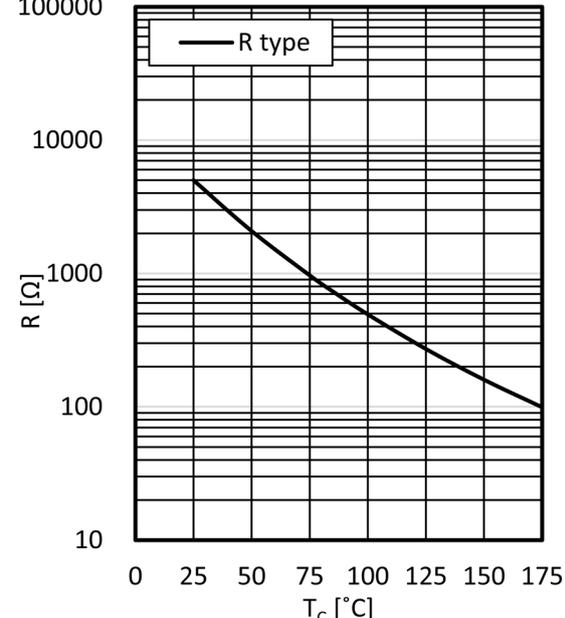
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Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Operation Junction Temperature 结温		$T_{jop}$	-40		150	°C
Storage Temperature Range 存储温度范围		$T_{stg}$	-40		125	°C
Mounting Torque 安装扭矩	Screw M5	M	3		6	N.m
Weight of Module 重量	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

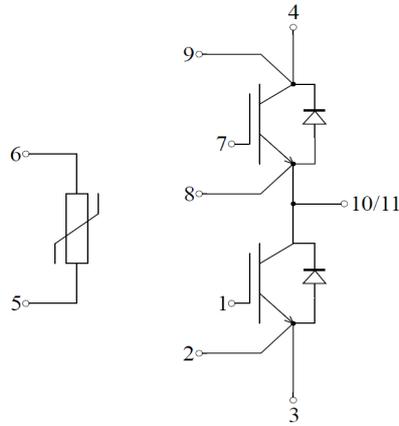
## 8. Characteristics diagrams



 <p>Graph showing switching losses <math>E</math> [mJ] versus gate resistance <math>R_G</math> [Ω]. The y-axis ranges from 0 to 800 mJ, and the x-axis ranges from 0 to 16 Ω. 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 loss with increasing gate resistance.</p>	 <p>Graph showing transient thermal impedance <math>Z_{th,jc}</math> [K/W] versus time <math>t</math> [s]. Both axes are on a logarithmic scale. The y-axis ranges from <math>1.00\text{E-}03</math> to <math>1.00\text{E+}00</math>, and the x-axis ranges from 0.001 to 10 s. The curve shows that <math>Z_{th,jc}</math> increases with time and levels off at approximately 1.0 K/W for <math>t &gt; 1</math> 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 = 600\text{A}</math>, <math>V_{CE} = 600\text{V}</math></p>	<p><b>Transient thermal impedance IGBT, Inverter</b>  <math>Z_{th,jc} = f(t)</math></p>
 <p>Graph showing the Reverse Bias Safe Operating Area (RBSOA). The y-axis is collector current <math>I_C</math> [A] (0 to 1400) and the x-axis is collector-emitter voltage <math>V_{CE}</math> [V] (0 to 1400). Two curves are shown: <math>I_C</math> for the Modul (solid line) and <math>I_C</math> for the Chip (dashed line). Both curves show a constant current region up to approximately 1200 V, followed by a sharp drop to zero at 1400 V.</p>	 <p>Graph showing the forward characteristic of the diode. The y-axis is forward current <math>I_F</math> [A] (0 to 1200) and the x-axis is forward voltage <math>V_F</math> [V] (0 to 3). 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 <math>I_F</math> and <math>V_F</math>.</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} = 1.6\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>

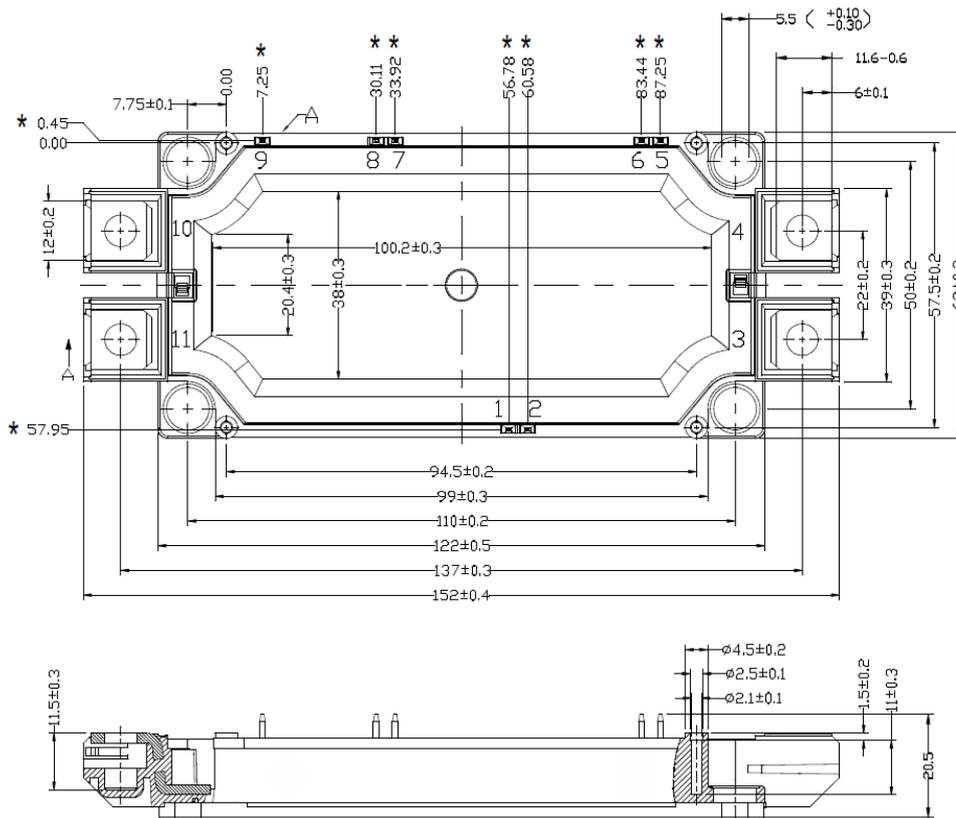
 <p>A line graph showing switching energy E [mJ] on the y-axis (0 to 160) versus forward current I<sub>F</sub> [A] on the x-axis (0 to 1200). Two curves are shown: a solid line for T<sub>vj</sub> = 125°C and a dashed line for T<sub>vj</sub> = 150°C. Both curves show an increasing trend, with the 150°C curve being higher than the 125°C curve.</p>	 <p>A line graph showing switching energy E [mJ] on the y-axis (0 to 160) versus gate resistance R<sub>G</sub> [Ω] on the x-axis (0 to 16). Two curves are shown: a solid line for T<sub>vj</sub> = 125°C and a dashed line for T<sub>vj</sub> = 150°C. Both curves show a decreasing trend, with the 150°C curve being higher than the 125°C curve.</p>
<p><b>Switching losses Diode, Inverter (typical)</b>  <math>E_{rec} = f(I_F) R_{Gon} = 1.6 \Omega, V_{CC} = 600V</math></p>	<p><b>Switching losses Diode, Inverter (typical)</b>  <math>I_F = 600 A, V_{CC} = 600V</math></p>
 <p>A log-log plot showing transient thermal impedance Z<sub>th,jc</sub> [K/W] on the y-axis (1.00E-03 to 1.00E+00) versus time t [s] on the x-axis (0.001 to 10). The curve starts at approximately 0.05 K/W at 0.001 s and rises to about 0.2 K/W at 10 s.</p>	 <p>A semi-log plot showing NTC-thermistor resistance R [Ω] on the y-axis (10 to 100000) versus temperature T<sub>c</sub> [°C] on the x-axis (0 to 175). The curve shows a decreasing trend, starting at approximately 5000 Ω at 25°C and reaching about 100 Ω at 175°C.</p>
<p><b>Transient thermal impedance Diode Inverter</b>  <math>Z_{th,jc} = 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**