

EconoDUAL™3 Modul mit schnellem IGBT2 für hochfrequentes Schalten  
EconoDUAL™3 module with fast IGBT2 for high switching frequency

初步数据  
Preliminary Data

IGBT, 逆变器 / IGBT, Inverter

最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
连续集电极直流电流 Continuous DC collector current	$T_C = 75^{\circ}\text{C}, T_{vj\text{max}} = 150^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 150^{\circ}\text{C}$	$I_{C\text{nom}}$ $I_C$	150 225	A A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ms}$	$I_{CRM}$	300	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 150$	$P_{tot}$	1250	W
栅极 - 发射极峰值电压 Gate-emitter peak voltage		$V_{GES}$	+/-20	V

特征值 / Characteristic Values

			min.	typ.	max.	
集电极 - 发射极饱和电压 Collector-emitter saturation voltage	$I_C = 150\text{A}, V_{GE} = 15\text{V}$ $I_C = 150\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$V_{CE\text{sat}}$	3,20 3,85	3,70	V V
栅极阈值电压 Gate threshold voltage	$I_C = 6,00\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{G\text{Eth}}$	4,5	5,5	6,5 V
栅极电荷 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		$Q_G$	1,60		$\mu\text{C}$
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{G\text{int}}$	1,7		$\Omega$
输入电容 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{ies}$	11,0		nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{res}$	0,50		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$		5,0	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		400	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 150\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{on}}$	0,10 0,11		$\mu\text{s}$ $\mu\text{s}$
上升时间(电感负载) Rise time, inductive load	$I_C = 150\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_r$	0,06 0,07		$\mu\text{s}$ $\mu\text{s}$
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 150\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{off}}$	0,53 0,55		$\mu\text{s}$ $\mu\text{s}$
下降时间(电感负载) Fall time, inductive load	$I_C = 150\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_f$	0,03 0,04		$\mu\text{s}$ $\mu\text{s}$
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 150\text{A}, V_{CE} = 600\text{V}, L_S = 80\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 2700\text{A}/\mu\text{s}$ $R_{Gon} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$E_{on}$	9,00 14,5		mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 150\text{A}, V_{CE} = 600\text{V}, L_S = 80\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 6500\text{V}/\mu\text{s}$ $R_{Goff} = 7,5\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$E_{off}$	8,00 11,0		mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{V}, V_{CC} = 900\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\mu\text{s}, T_{vj} = 125^{\circ}\text{C}$		$I_{SC}$	950		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		$R_{thJC}$		0,10	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,03		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40	125	$^{\circ}\text{C}$

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Preliminary Data

二极管, 逆变器 / Diode, Inverter  
最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
连续正向直流电流 Continuous DC forward current		$I_F$	150	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	300	A
I <sup>2</sup> t-值 I <sup>2</sup> t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$	$I^2t$	5500	A <sup>2</sup> s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$V_F$	2,00 1,70	2,40	V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 150\text{ A}, -di_F/dt = 2700\text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$I_{RM}$	105 160		A A
恢复电荷 Recovered charge	$I_F = 150\text{ A}, -di_F/dt = 2700\text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$Q_r$	8,70 24,0		$\mu\text{C}$ $\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 150\text{ A}, -di_F/dt = 2700\text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$E_{rec}$	3,20 8,40		mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		$R_{thJC}$		0,25	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,05		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	125	$^{\circ}\text{C}$

负温度系数热敏电阻 / NTC-Thermistor

特征值 / Characteristic Values

			min.	typ.	max.	
额定电阻值 Rated resistance	$T_C = 25^{\circ}\text{C}$		$R_{25}$	5,00		k $\Omega$
R100 偏差 Deviation of R100	$T_C = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$		$\Delta R/R$	-5	5	%
耗散功率 Power dissipation	$T_C = 25^{\circ}\text{C}$		$P_{25}$		20,0	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		$B_{25/50}$	3375		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		$B_{25/80}$	3411		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		$B_{25/100}$	3433		K

根据应用手册标定

Specification according to the valid application note.

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模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	2,5		kV
模块基板材料 Material of module baseplate			Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al <sub>2</sub> O <sub>3</sub>		
爬电距离 Creepage distance	端子- 散热片 / terminal to heatsink 端子- 端子 / terminal to terminal		14,5 13,0		mm
电气间隙 Clearance	端子- 散热片 / terminal to heatsink 端子- 端子 / terminal to terminal		12,5 10,0		mm
相对电痕指数 Comperative tracking index		CTI	> 225		
			min.	typ.	max.
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个模块 / per module $\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$	R <sub>thCH</sub>	0,009		K/W
杂散电感, 模块 Stray inductance module		L <sub>sCE</sub>	20		nH
模块引线电阻, 端子-芯片 Module lead resistance, terminals - chip	T <sub>C</sub> = 25°C, 每个开关 / per switch	R <sub>CC+EE'</sub>	1,10		mΩ
储存温度 Storage temperature		T <sub>stg</sub>	-40	125	°C
模块安装的安装扭矩 Mounting torque for modul mounting	螺丝 M5 根据相应的应用手册进行安装 Screw M5 - Mounting according to valid application note	M	3,00	-	6,00 Nm
端子联接扭矩 Terminal connection torque	螺丝 M6 根据相应的应用手册进行安装 Screw M6 - Mounting according to valid application note	M	3,0	-	6,0 Nm
重量 Weight		G	340		g

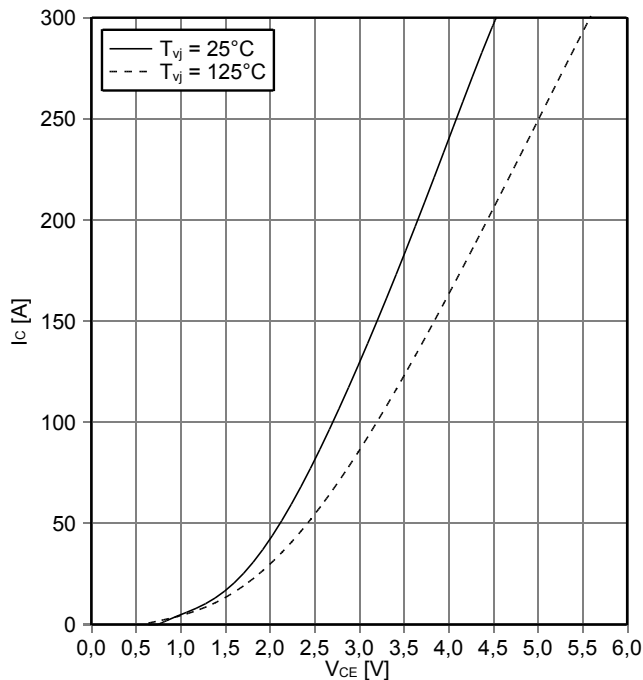
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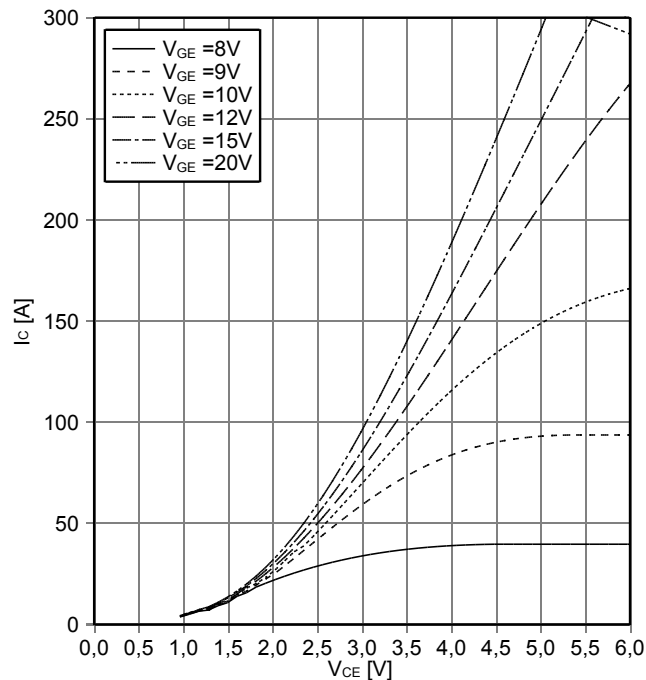
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



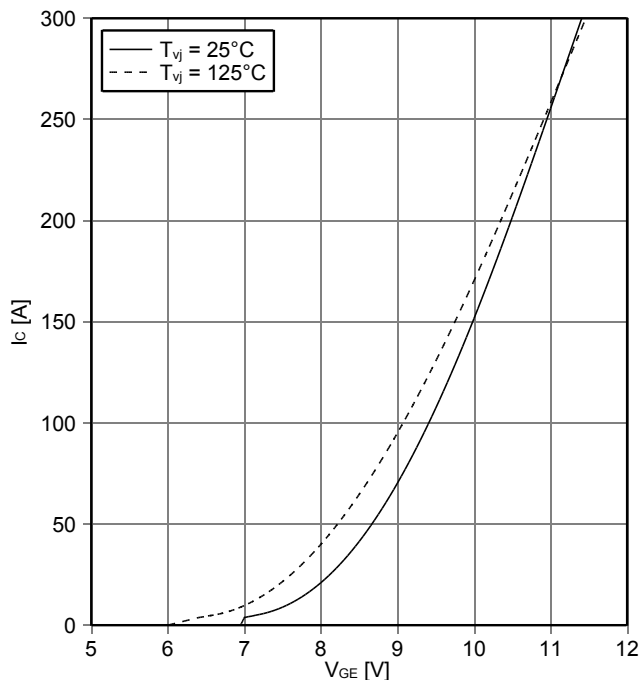
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$   
 $T_{vj} = 125^\circ\text{C}$



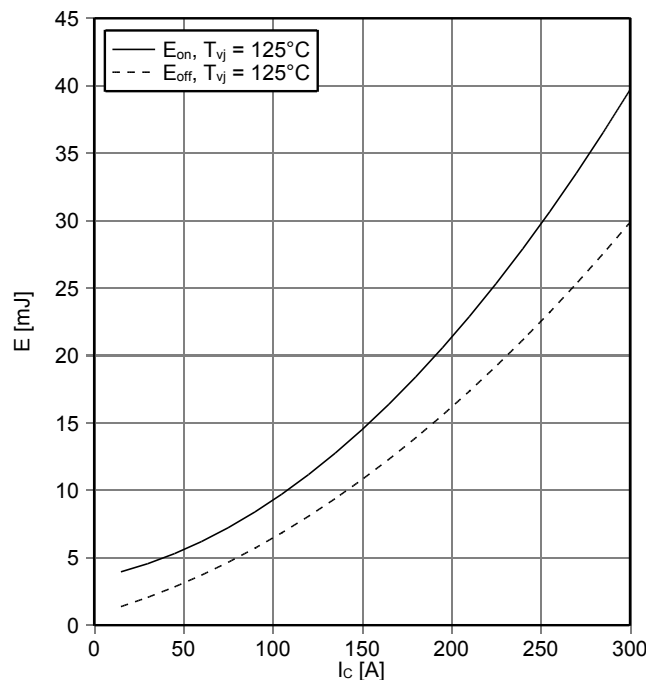
传输特性 IGBT, 逆变器 (典型)  
transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C), E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 7.5\ \Omega, R_{Goff} = 7.5\ \Omega, V_{CE} = 600\text{ V}$

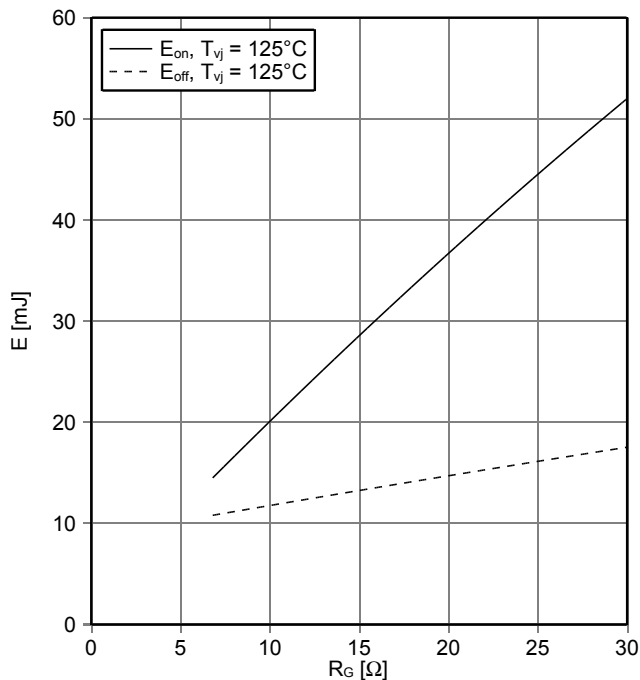


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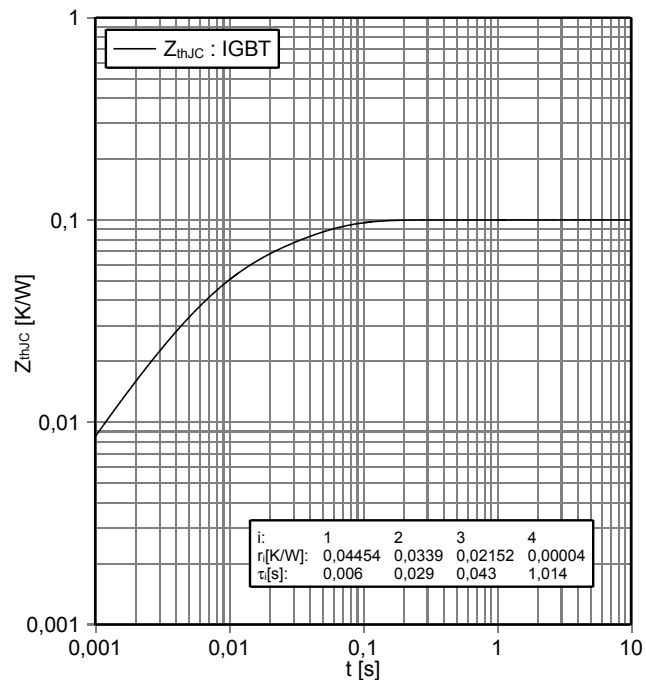
开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 150\text{ A}, V_{CE} = 600\text{ V}$



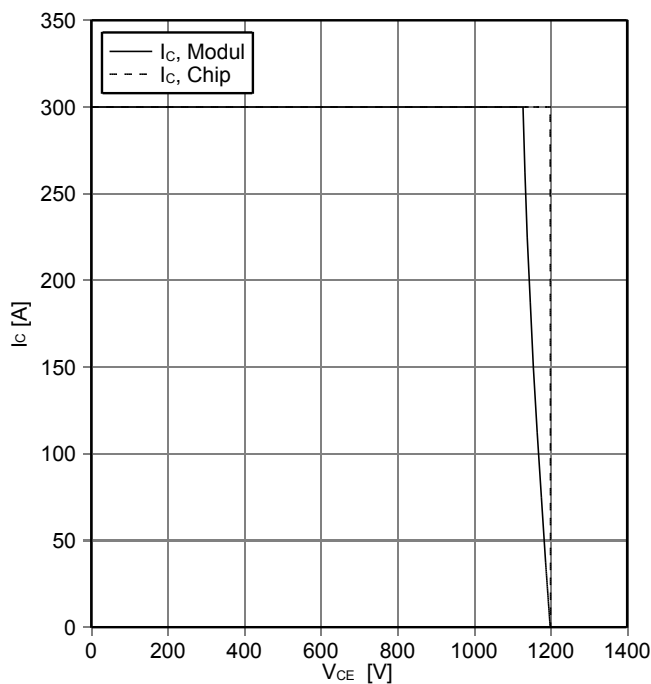
瞬态热阻抗 IGBT, 逆变器  
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



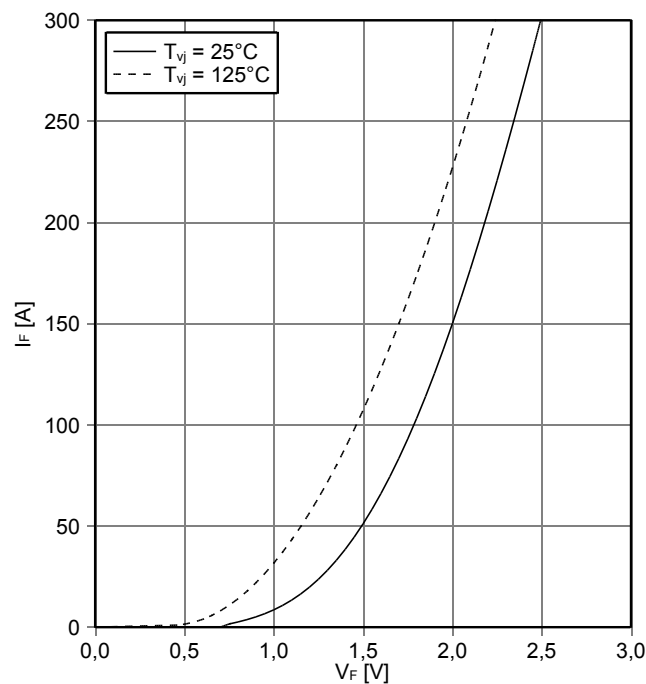
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 7.5\ \Omega, T_{vj} = 125^\circ\text{C}$



正向偏压特性 二极管, 逆变器 (典型)  
forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$

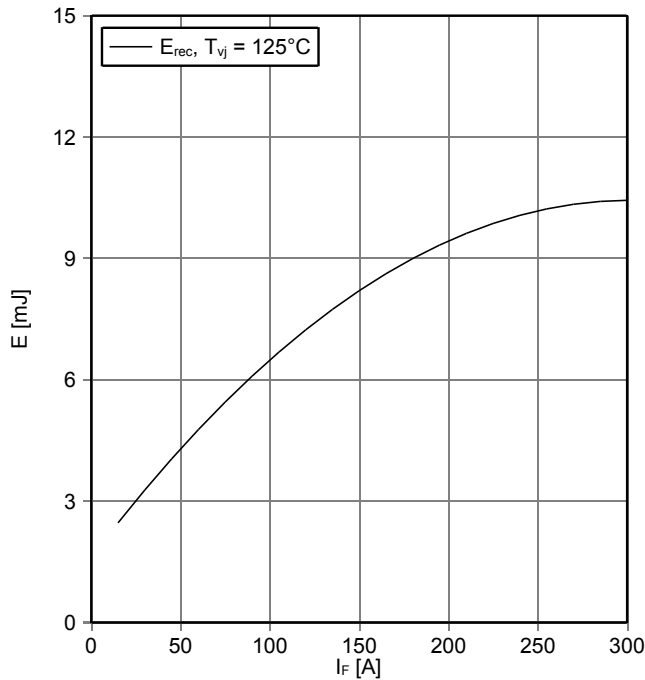


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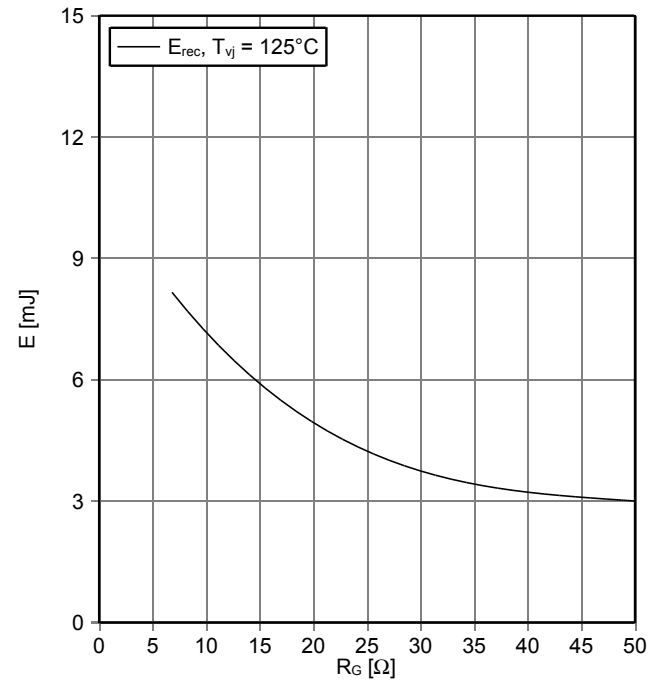
开关损耗 二极管, 逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 7.5 \Omega, V_{CE} = 600 V$



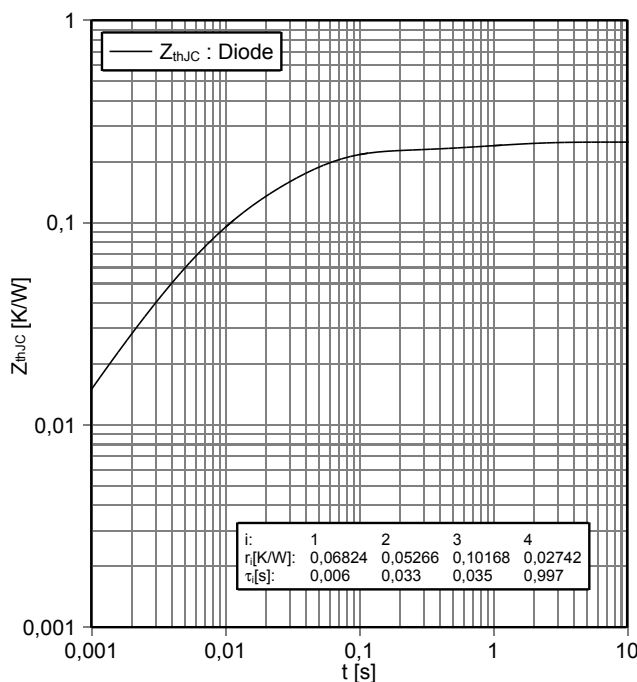
开关损耗 二极管, 逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 150 A, V_{CE} = 600 V$



瞬态热阻抗 二极管, 逆变器  
transient thermal impedance Diode, Inverter

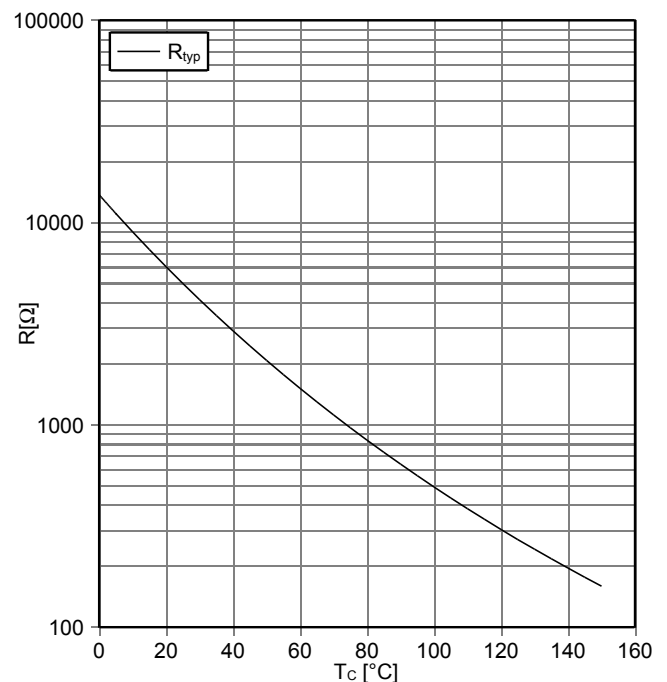
$Z_{thJC} = f(t)$



i:	1	2	3	4
f[K/W]:	0,06824	0,05266	0,10168	0,02742
τ[s]:	0,006	0,033	0,035	0,997

负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)

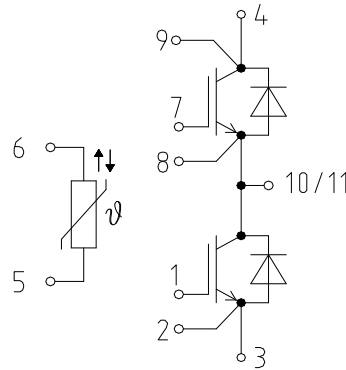
$R = f(T)$



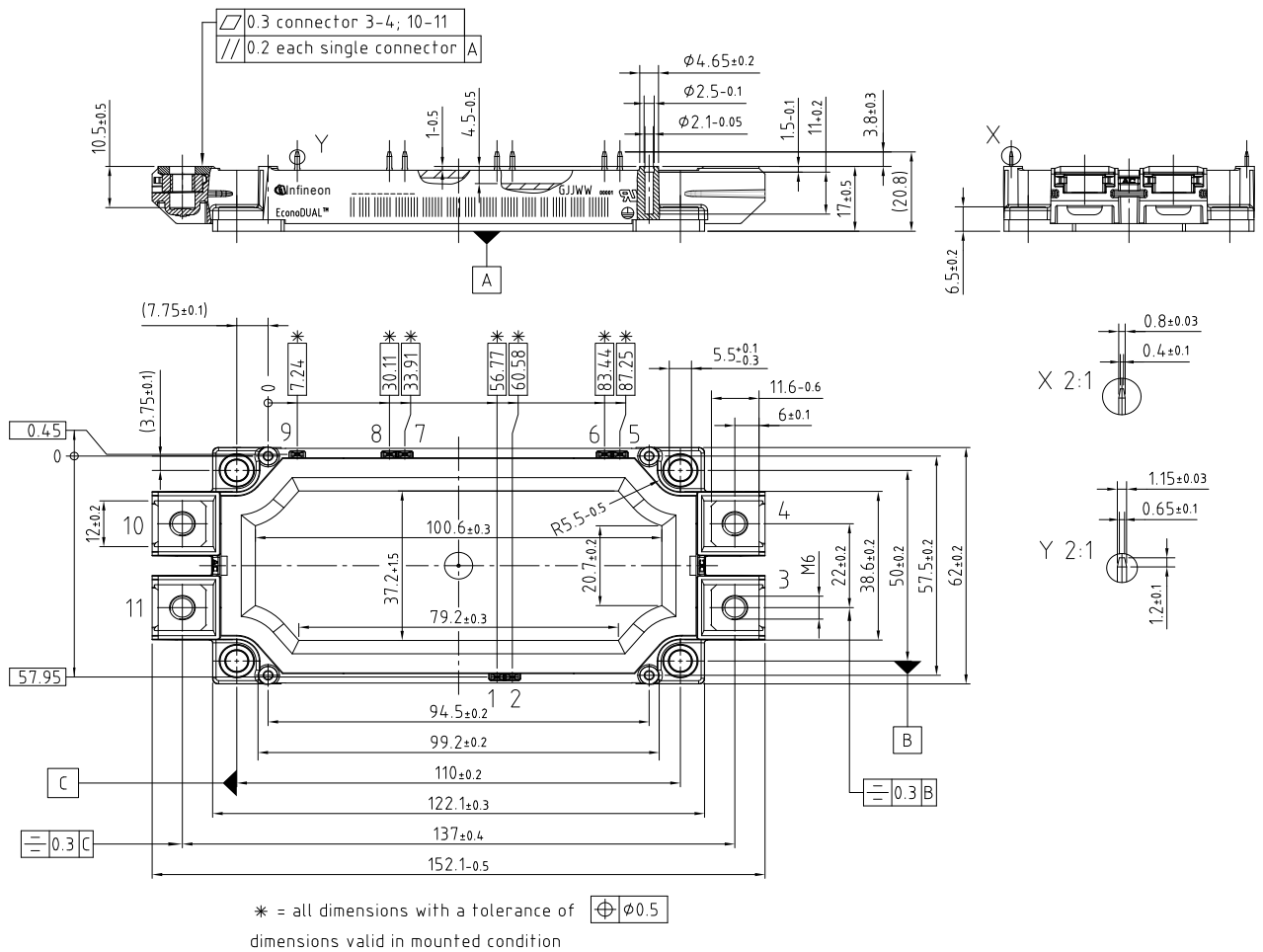
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接线图 / circuit\_diagram\_headline



封装尺寸 / package outlines



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**使用条件和条款**

**使用条件和条款**

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- to perform joint Risk and Quality Assessments;

- the conclusion of Quality Agreements;

- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.

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