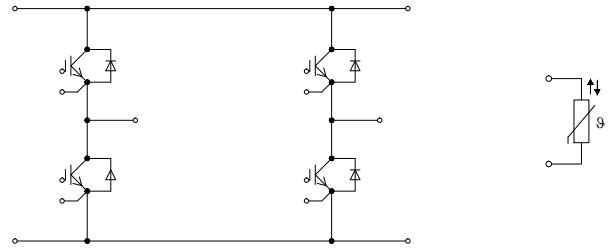


EconoPACK™3 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管 带有温度检测NTC
 EconoPACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC



Typical appearance



$V_{CES} = 1700V$
 $I_{C\ nom} = 200A / I_{CRM} = 400A$

典型应用

- 大功率变流器
- 中压变流器

电气特性

- 低 V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- 沟槽栅IGBT4
- V_{CEsat} 带正温度系数

机械特性

- 集成NTC温度传感器
- 绝缘的基板
- 焊接技术
- 标准封装

Typical Applications

- High power converters
- Medium voltage converters

Electrical Features

- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4
- V_{CEsat} with positive temperature coefficient

Mechanical Features

- Integrated NTC temperature sensor
- Isolated base plate
- Solder contact technology
- Standard housing

Module Label Code

Barcode Code 128



DMX - Code



Content of the Code

Content of the Code	Digit
Module Serial Number	1 - 5
Module Material Number	6 - 11
Production Order Number	12 - 19
Datecode (Production Year)	20 - 21
Datecode (Production Week)	22 - 23

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}	1700	V
连续集电极直流电流 Continuous DC collector current	$T_C = 95^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	200	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	400	A
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	$I_C = 200\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 200\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 200\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,95 2,35 2,45	2,30	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 4,00\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,35	5,80	6,25 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	2,40		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	3,8		Ω
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}	18,0		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}	0,58		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1700\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$		I_{CES}		1,0	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}		100	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,21 0,22 0,23		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,03 0,04 0,04		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,43 0,57 0,61		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,24 0,45 0,55		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 5500\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	41,5 59,5 64,0		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 200\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3100\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	34,0 57,5 66,0		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	900		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		0,130	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}	0,0835		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40	150	$^{\circ}\text{C}$

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}	1700	V
连续正向直流电流 Continuous DC forward current		I_F	200	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1 \text{ ms}$	I_{FRM}	400	A
I^2t -值 I^2t - value	$V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	5100 4200	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 200 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 200 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 200 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,80 1,90 1,95	2,20	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 200 \text{ A}, -di_F/dt = 5500 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	375 390 390		A A A
恢复电荷 Recovered charge	$I_F = 200 \text{ A}, -di_F/dt = 5500 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	51,0 88,5 99,0		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 200 \text{ A}, -di_F/dt = 5500 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	27,0 51,5 58,5		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		0,256	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode $\lambda_{Paste} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	0,101		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40	150	$^{\circ}\text{C}$

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	$T_{NTC} = 25^{\circ}\text{C}$	R_{25}		5,00		$\text{k}\Omega$
R100 偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$	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.

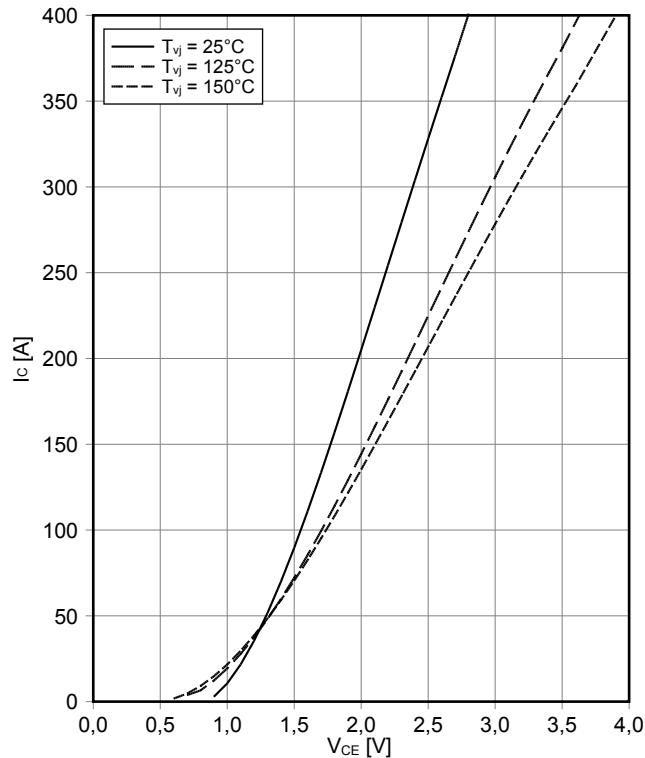
模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	3,4		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 ₂ O ₃		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		10,0		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		7,5		mm
相对电痕指数 Comperative tracking index		CTI	> 200		
			min.	typ.	max.
杂散电感, 模块 Stray inductance module		L _{sCE}		18	nH
储存温度 Storage temperature		T _{stg}	-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
重量 Weight		G		300	g

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

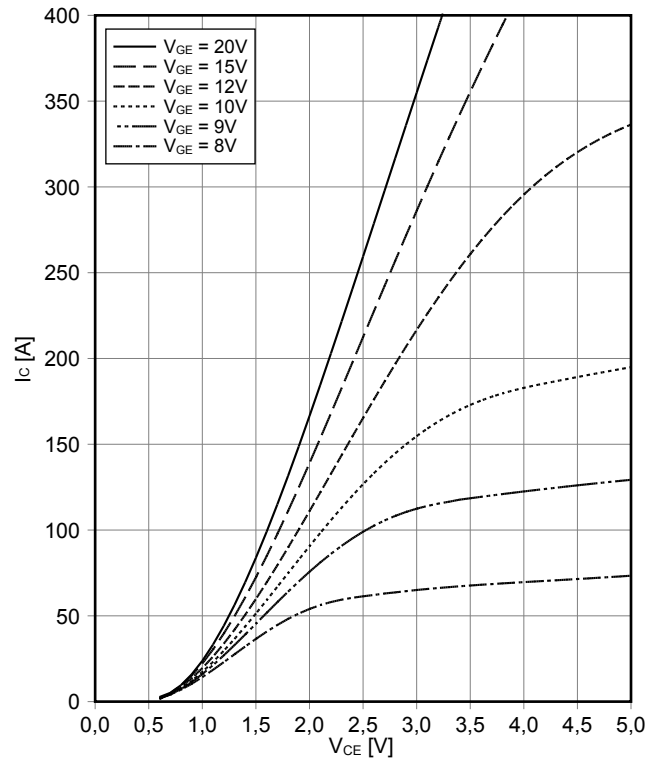
$I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

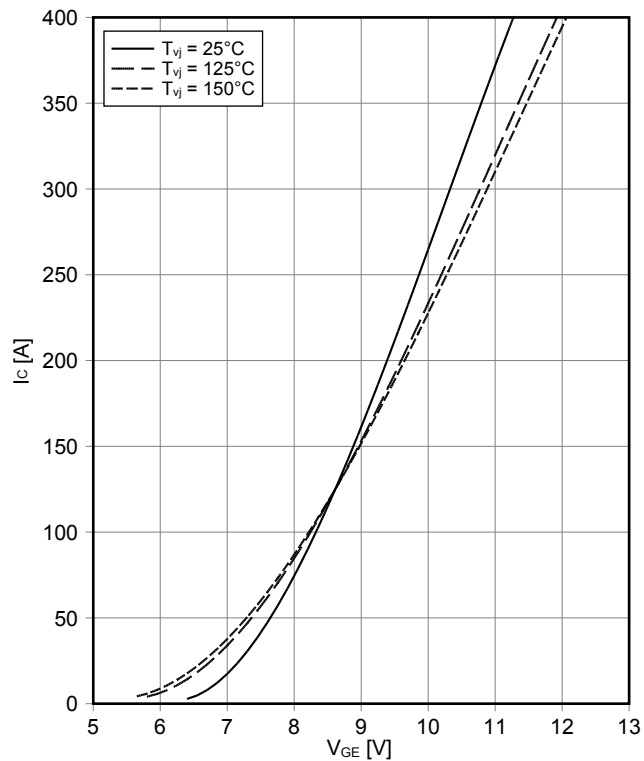
$I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

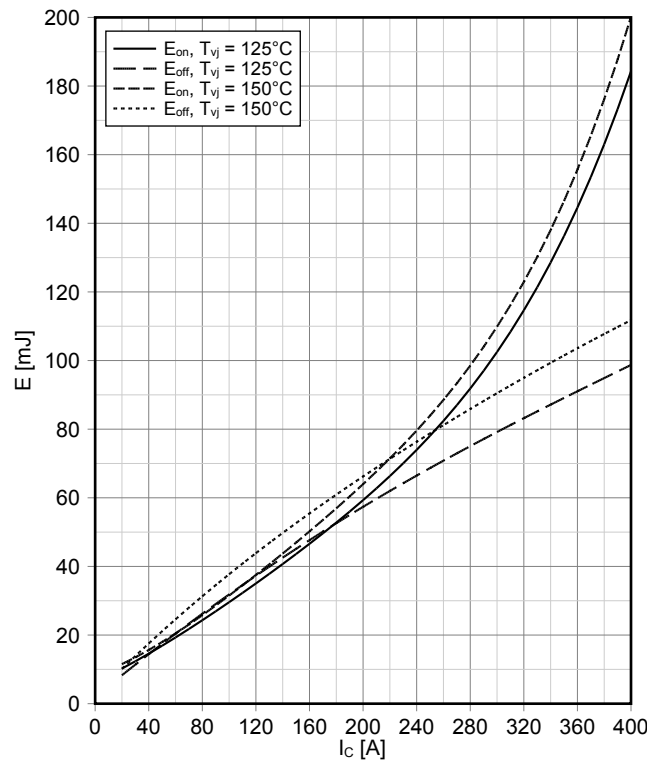
$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)

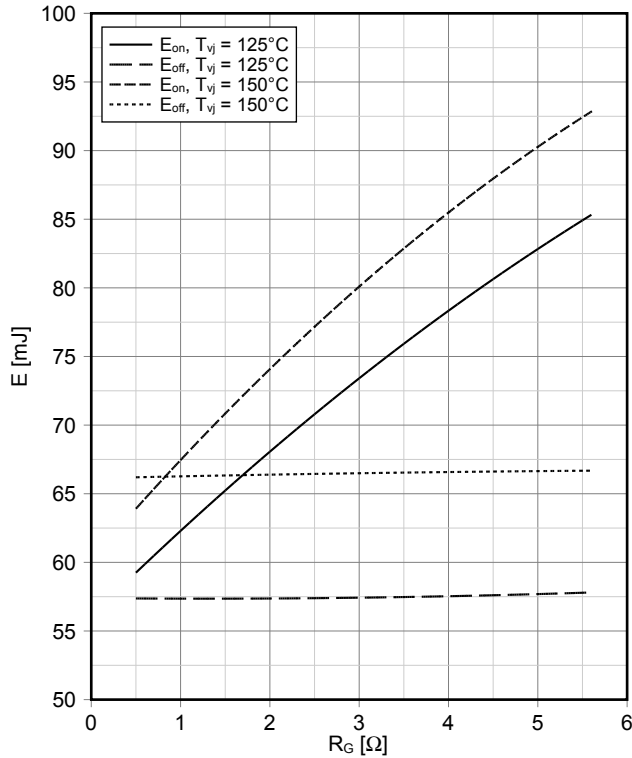
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.51\ \Omega$, $R_{Goff} = 0.51\ \Omega$, $V_{CE} = 900\text{ V}$

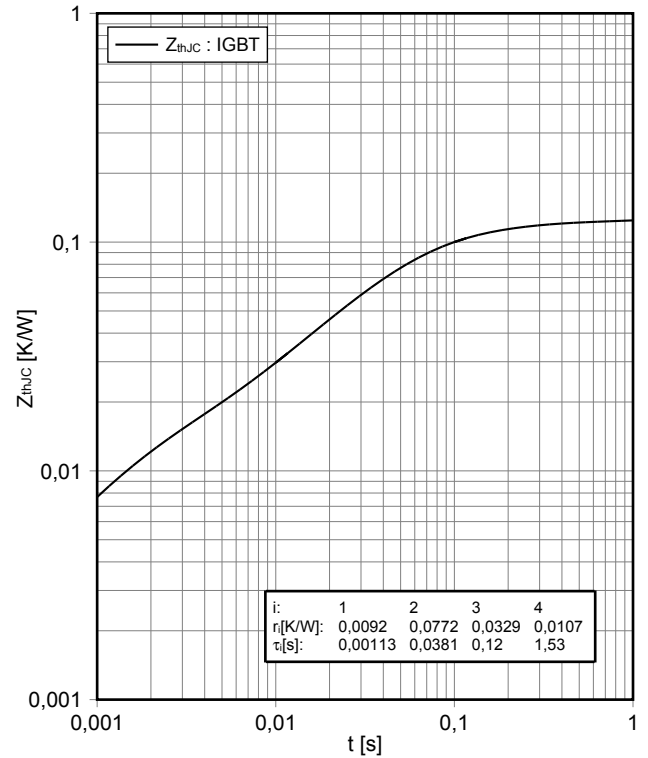


开关损耗 IGBT, 逆变器 (典型)
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}, I_C = 200\text{ A}, V_{CE} = 900\text{ V}$

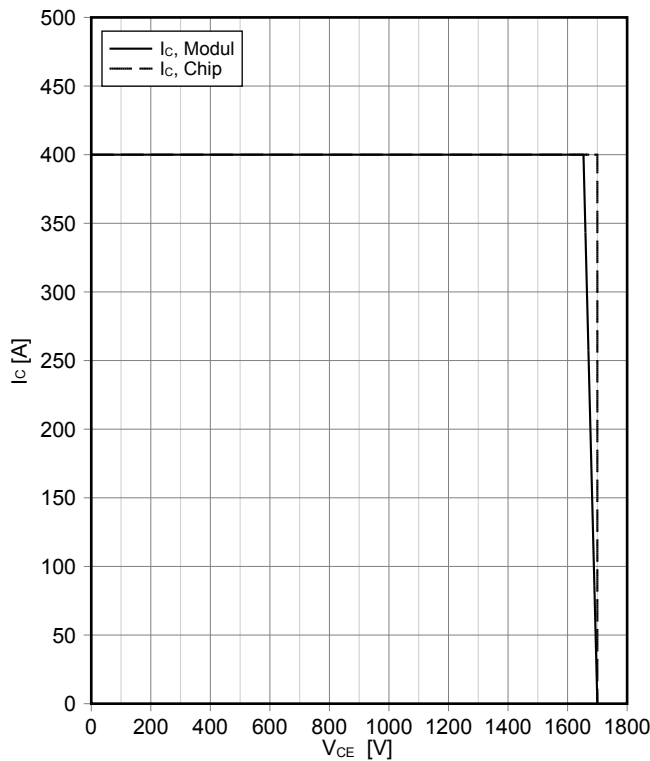


瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$

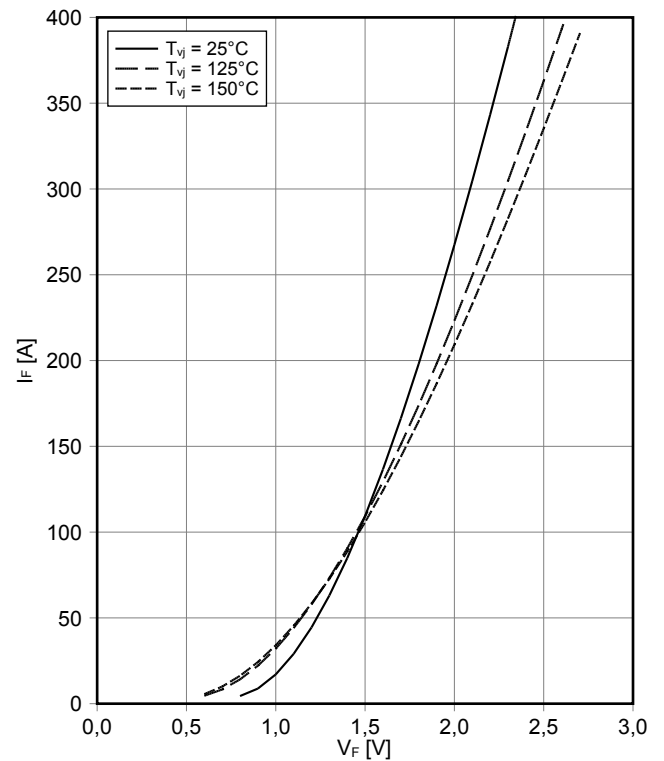


反偏安全工作区 IGBT, 逆变器 (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega, T_{vj} = 150^\circ\text{C}$

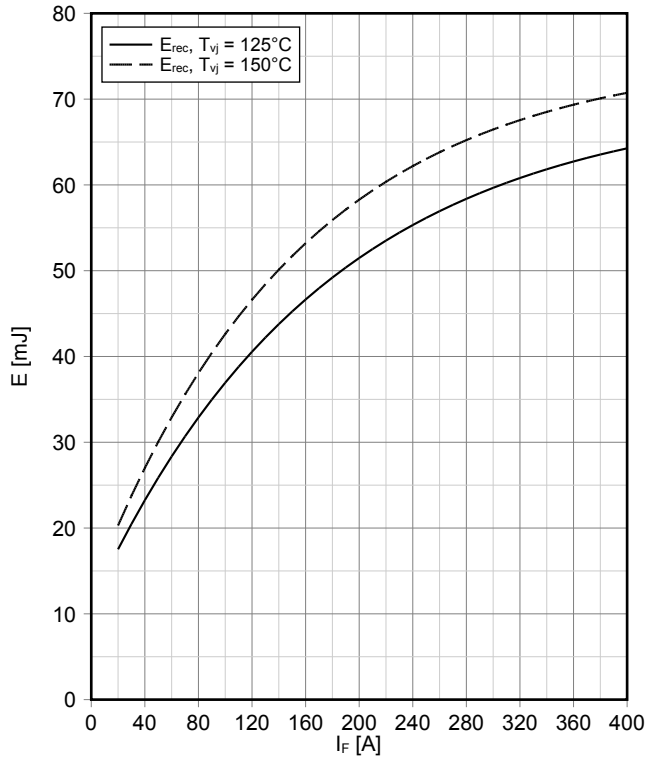


正向偏压特性 二极管, 逆变器 (典型)
forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



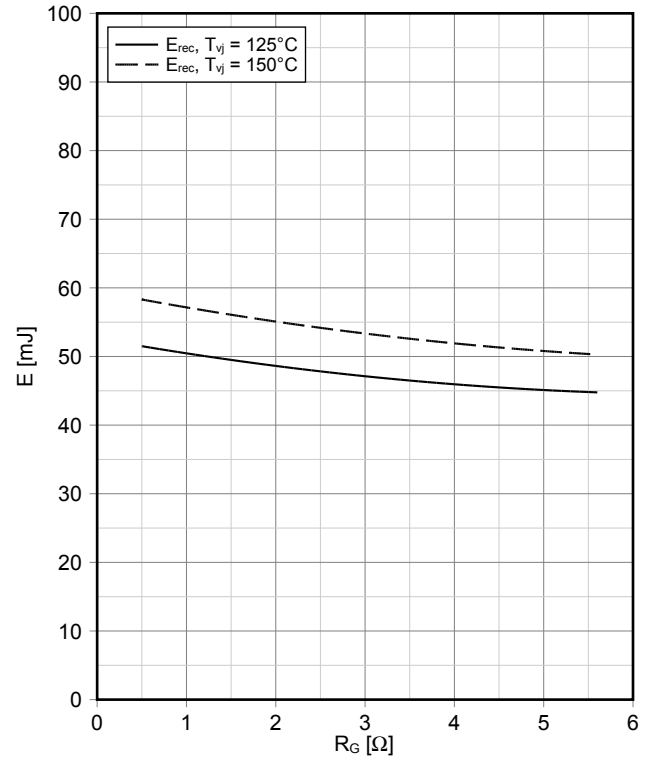
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.51 \Omega, V_{CE} = 900 V$



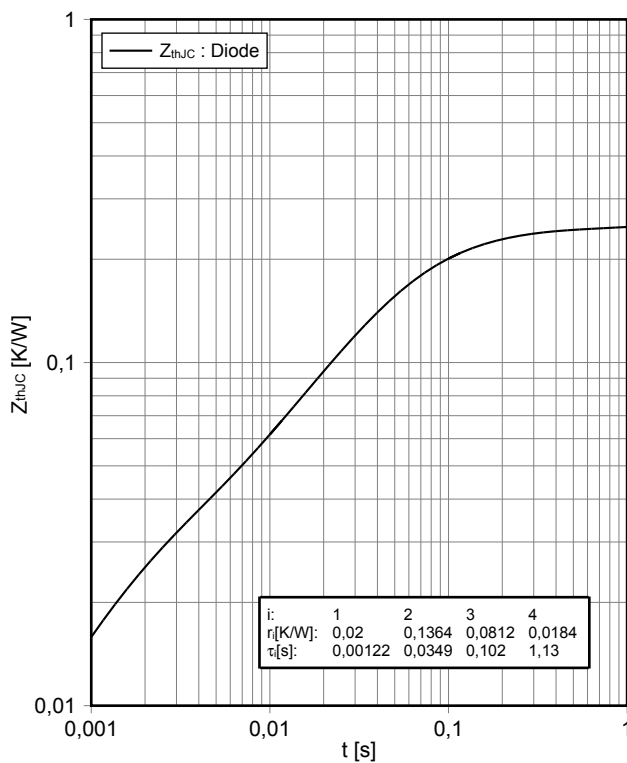
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 200 A, V_{CE} = 900 V$



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

$Z_{thJC} = f(t)$

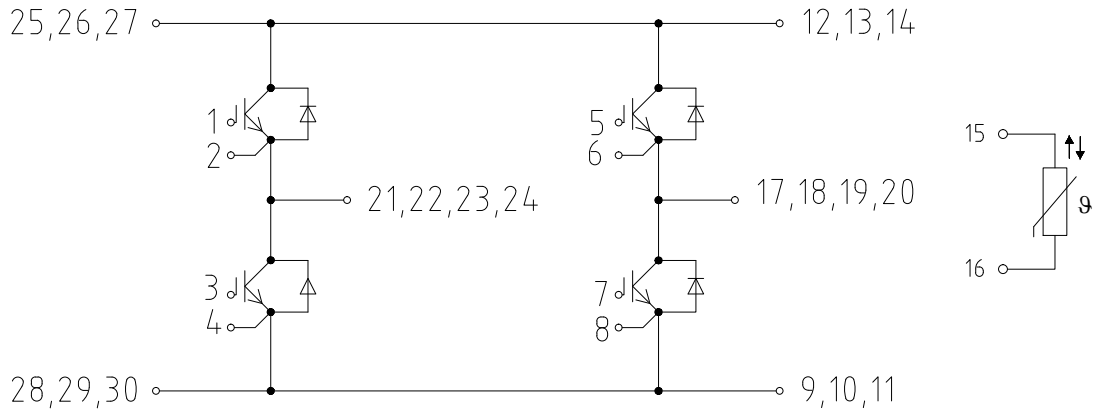


负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)

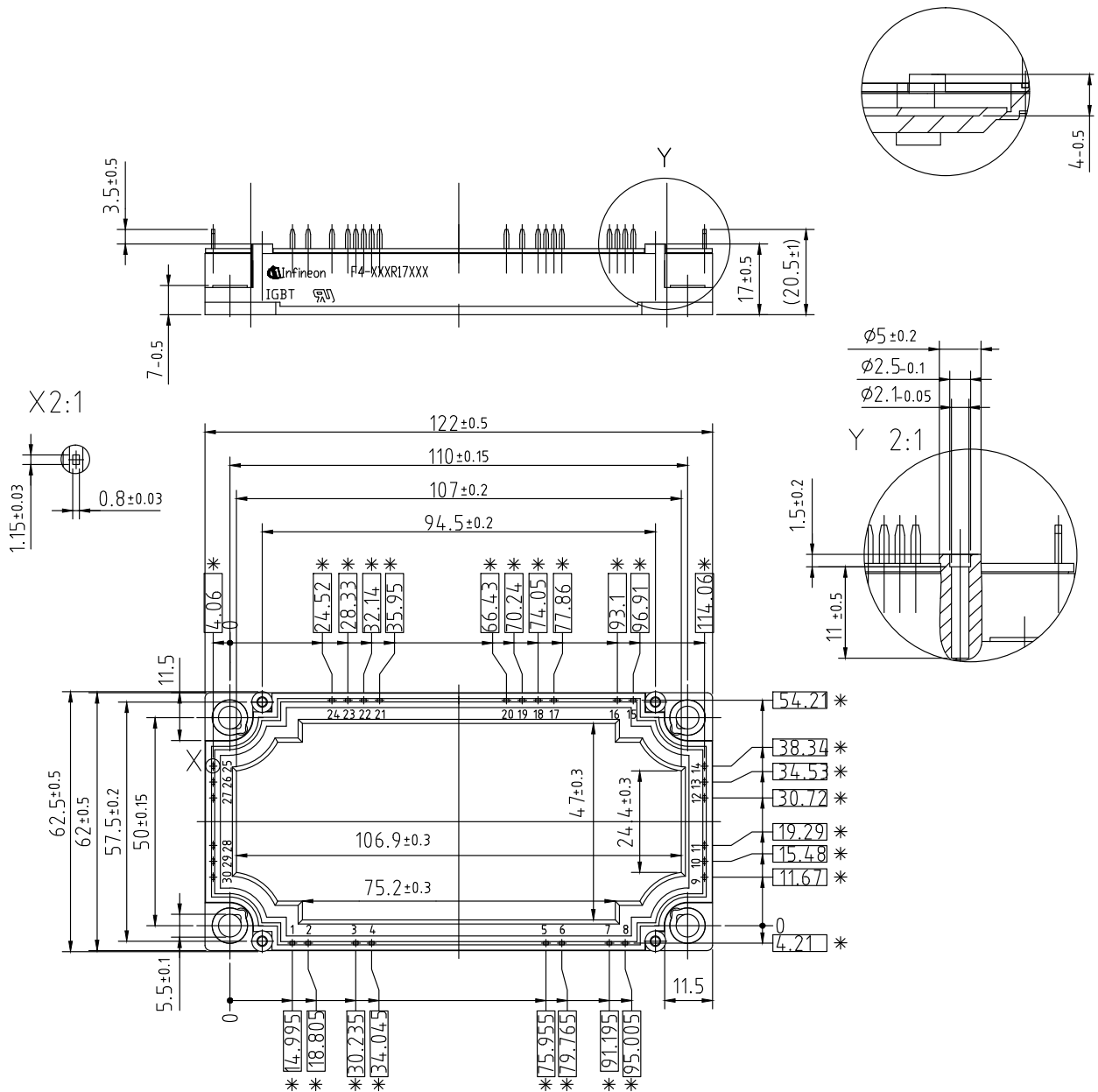
$R = f(T)$



接线图 / Circuit diagram



封装尺寸 / Package outlines



* = alle Maße mit einer Toleranz von ± 0.5
 * = all dimensions with tolerance of ± 0.5

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Edition 2017-06-29

Published by
Infineon Technologies AG
81726 München, Germany

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