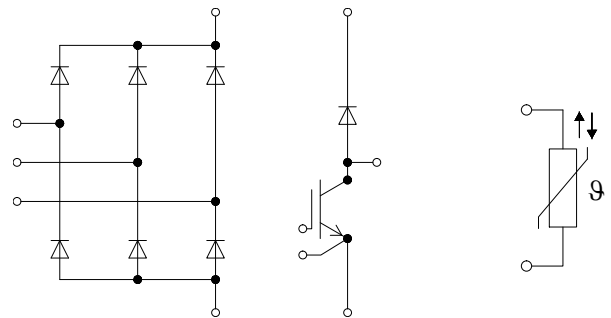
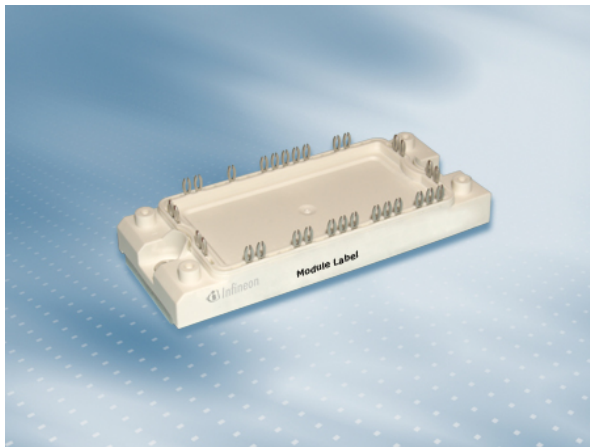


EconoPACK™2 模块 采用第四代沟槽栅/场终止IGBT4和第四代发射极控制二极管 带有pressfit预涂导热材料
 EconoPACK™2 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and PressFIT / pre-applied Thermal Interface Material



$$V_{CES} = 1600V$$

$$I_{C\ nom} = 104A / I_{CRM} = 208A$$

典型应用

- 辅助逆变器
- 空调
- 电机传动
- 伺服驱动器

Typical Applications

- Auxiliary inverters
- Air conditioning
- Motor drives
- Servo drives

电气特性

- $T_{vj\ op} = 150^{\circ}C$

Electrical Features

- $T_{vj\ op} = 150^{\circ}C$

机械特性

- 低热阻的三氧化二铝 (Al_2O_3 衬底
- 高功率密度
- 绝缘的基板
- 紧凑型设计
- PressFIT 压接技术
- 符合RoHS
- 标准封装
- 预涂导热介质

Mechanical Features

- Al_2O_3 substrate with low thermal resistance
- High power density
- Isolated base plate
- Compact design
- PressFIT contact technology
- RoHS compliant
- Standard housing
- Pre-applied Thermal Interface Material

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

二极管,整流器 / Diode, Rectifier

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}	1600	V
最大正向均方根电流(每芯片) Maximum RMS forward current per chip	$T_H = 75^{\circ}\text{C}$	I_{FRMSM}	60	A
最大整流器输出均方根电流 Maximum RMS current at rectifier output	$T_H = 75^{\circ}\text{C}$	I_{RMSM}	104	A
正向浪涌电流 Surge forward current	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I_{FSM}	650 550	A A
I^2t -值 I^2t - value	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	2100 1500	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$T_{vj} = 150^{\circ}\text{C}, I_F = 100\text{ A}$	V_F		1,10		V
阈值电压 Threshold voltage	$T_{vj} = 150^{\circ}\text{C}$	V_{TO}		0,75		V
斜率电阻 Slope resistance	$T_{vj} = 150^{\circ}\text{C}$	r_T		5,50		$\text{m}\Omega$
反向电流 Reverse current	$T_{vj} = 150^{\circ}\text{C}, V_R = 1600\text{ V}$	I_R		5,00		mA
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode valid with IFX pre-applied thermal interface material	R_{thJH}			0,720	K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

IGBT, 制动-斩波器 / IGBT, Brake-Chopper

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	$T_H = 90^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	50	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	100	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	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,85 2,15 2,25	2,15	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 1,70\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,25	5,80	6,35 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	0,38		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	4,0		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}	2,80		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}	0,10		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}		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	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,055 0,06 0,06		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,035 0,04 0,04		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,30 0,35 0,40		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,04 0,06 0,07		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 1200\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	3,60 4,90 5,30		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3500\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 10\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	2,95 4,80 5,40		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$	I_{SC}	180		A
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个 IGBT / per IGBT valid with IFX pre-applied thermal interface material		R_{thJH}		0,660	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，制动-斩波器 / Diode, Brake-Chopper

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	35	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	70	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}	250 220	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 35\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 35\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 35\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F		1,70 1,65 1,65	2,15 V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 35\text{ A}, -di_F/dt = 1200\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}		28,0 37,0 38,0	A A A
恢复电荷 Recovered charge	$I_F = 35\text{ A}, -di_F/dt = 1200\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r		2,90 5,20 5,90	μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 35\text{ A}, -di_F/dt = 1200\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}		1,10 2,00 2,30	mJ mJ mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode valid with IFX pre-applied thermal interface material		R_{thJH}			0,840 K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-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		k Ω
R100 偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\text{ }\Omega$	$\Delta R/R$	-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

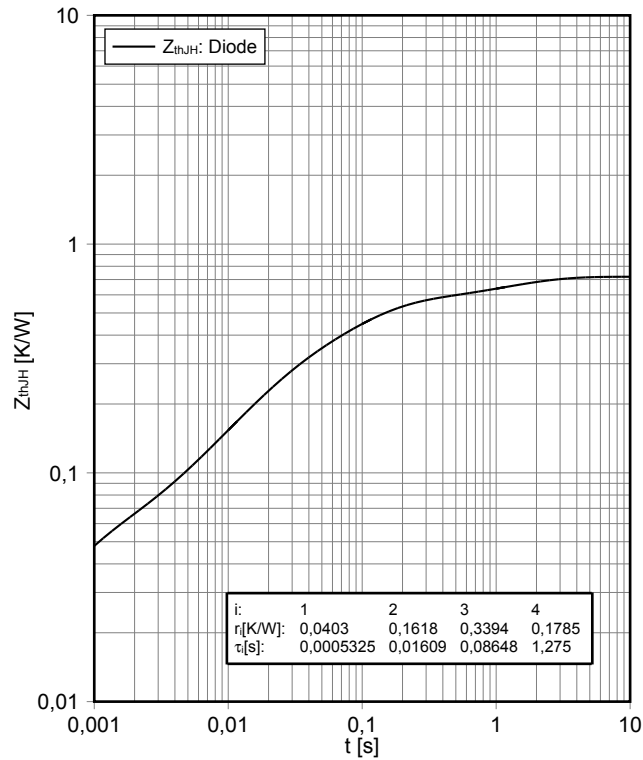
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	2,5	kV	
模块基板材料 Material of module baseplate			Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al ₂ O ₃		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		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}		50	nH
模块引线电阻, 端子-芯片 Module lead resistance, terminals - chip	T _H = 25°C, 每个开关 / per switch	R _{AA'+CC'}		1,80	mΩ
储存温度 Storage temperature		T _{stg}	-40		125 °C
最高基板工作温度 Maximum baseplate operation temperature		T _{BPmax}			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		180	g

Lagerung und Transport von Modulen mit TIM => siehe AN 2012-07
 Storage and shipment of modules with TIM => see AN 2012-07

瞬态热阻抗 二极管,整流器

transient thermal impedance Diode, Rectifier

$Z_{thJH} = f(t)$

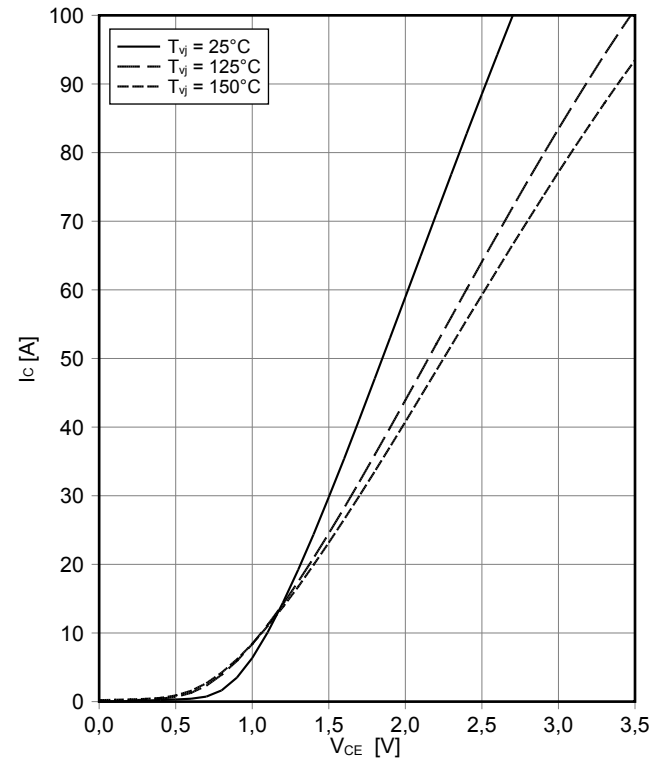


输出特性 IGBT, 制动-斩波器 (典型)

output characteristic IGBT, Brake-Chopper (typical)

$I_C = f(V_{CE})$

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

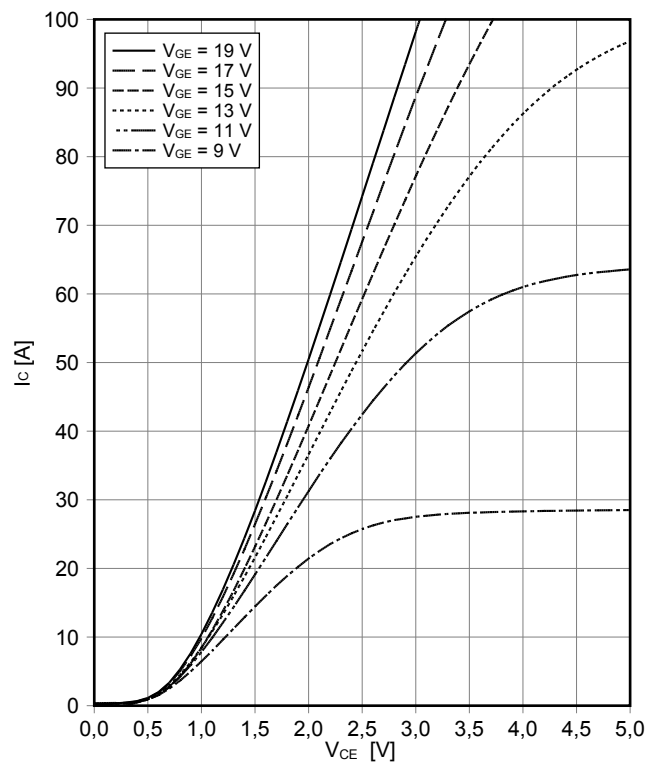


输出特性 IGBT, 制动-斩波器 (典型)

output characteristic IGBT, Brake-Chopper (typical)

$I_C = f(V_{CE})$

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

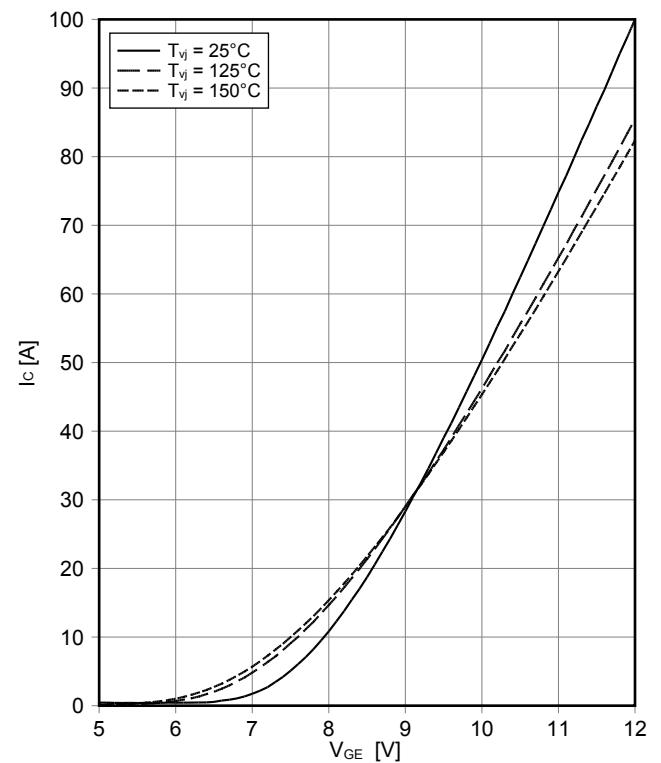


传输特性 IGBT, 制动-斩波器 (典型)

transfer characteristic IGBT, Brake-Chopper (typical)

$I_C = f(V_{GE})$

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

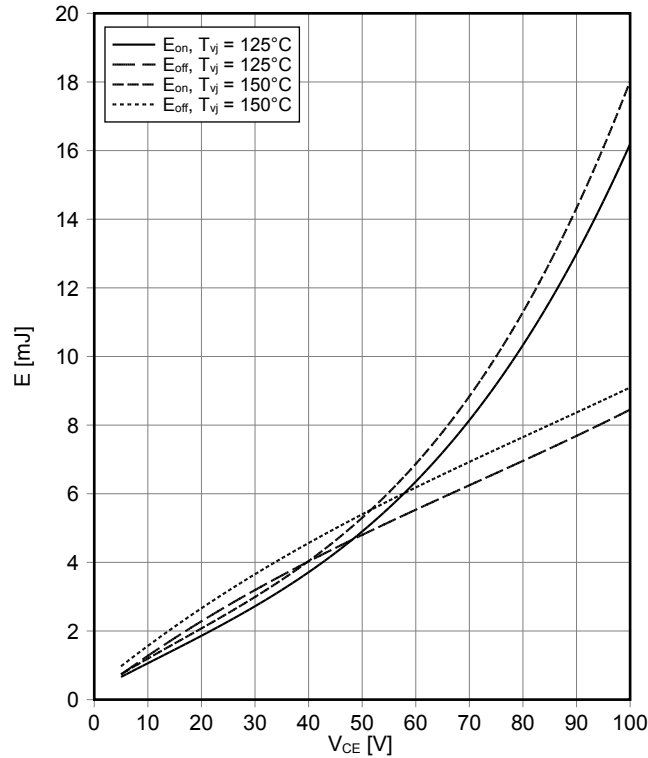


开关损耗 IGBT, 制动-斩波器 (典型)

switching losses IGBT, Brake-Chopper (typical)

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

$$V_{GE} = \pm 15 \text{ V}, R_{Gon} = 10 \Omega, R_{Goff} = 10 \Omega, V_{CE} = 600 \text{ V}$$

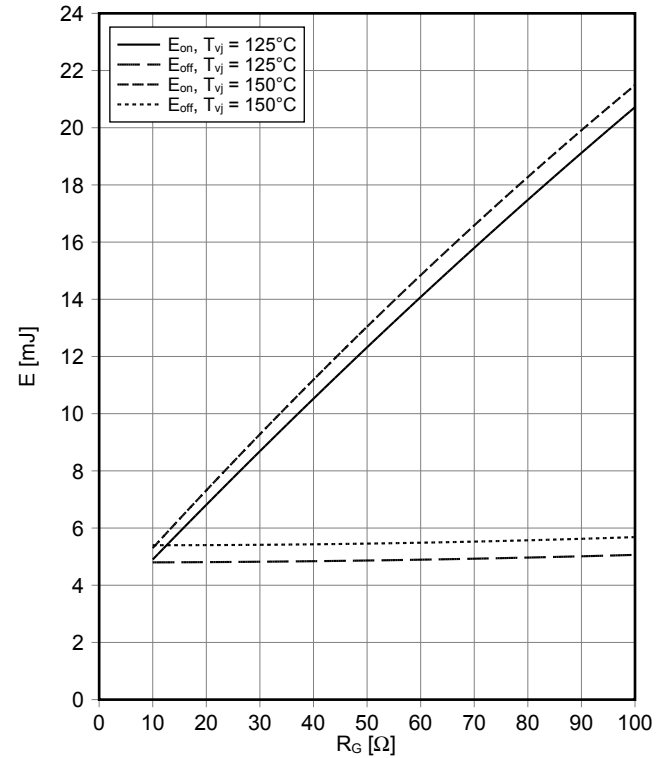


开关损耗 IGBT, 制动-斩波器 (典型)

switching losses IGBT, Brake-Chopper (typical)

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

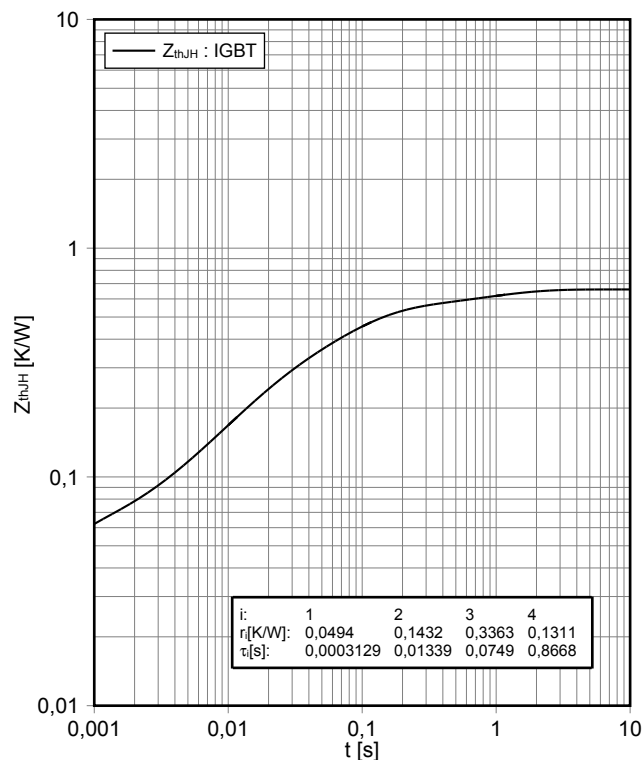
$$V_{GE} = \pm 15 \text{ V}, I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}$$



瞬态热阻抗 IGBT, 制动-斩波器

transient thermal impedance IGBT, Brake-Chopper

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

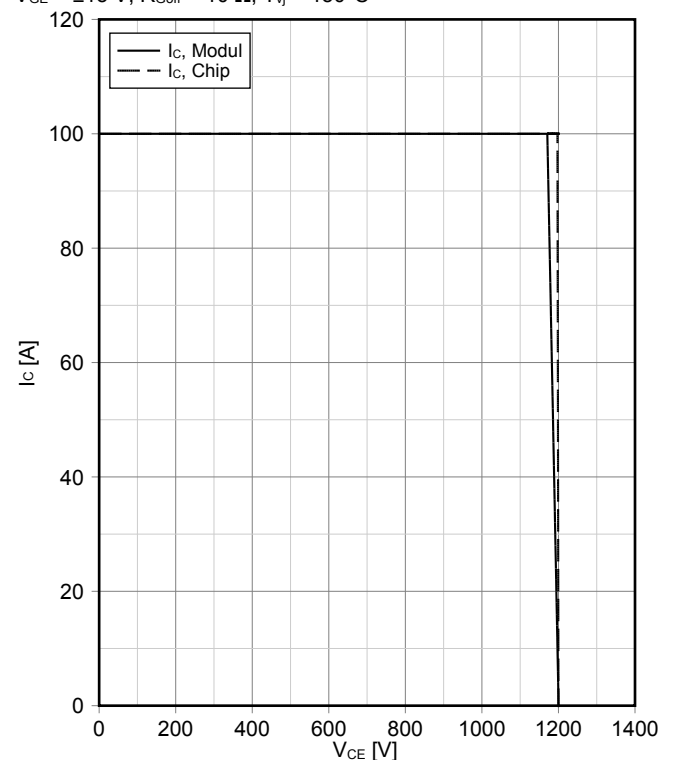


反偏安全工作区 IGBT, 制动-斩波器 (RBSOA)

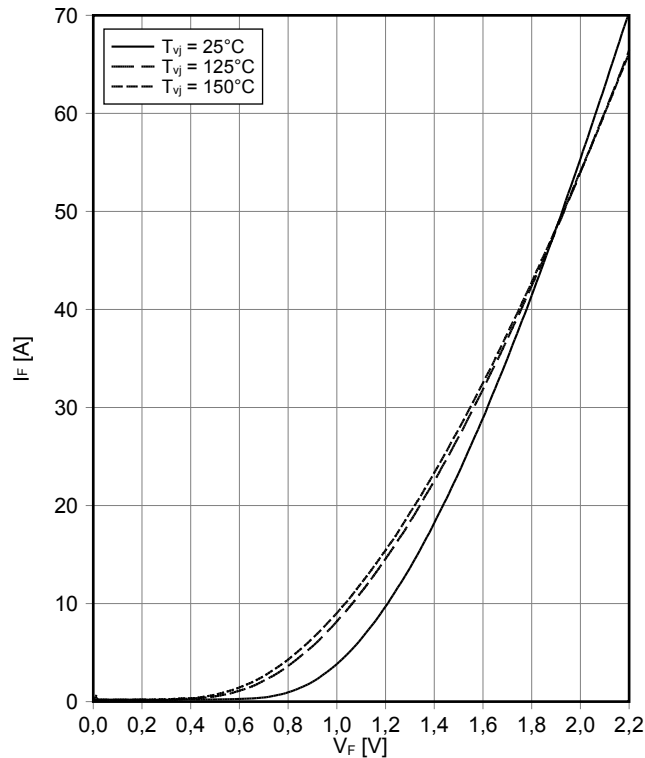
reverse bias safe operating area IGBT, Brake-Chopper (RBSOA)

$$I_C = f(V_{CE})$$

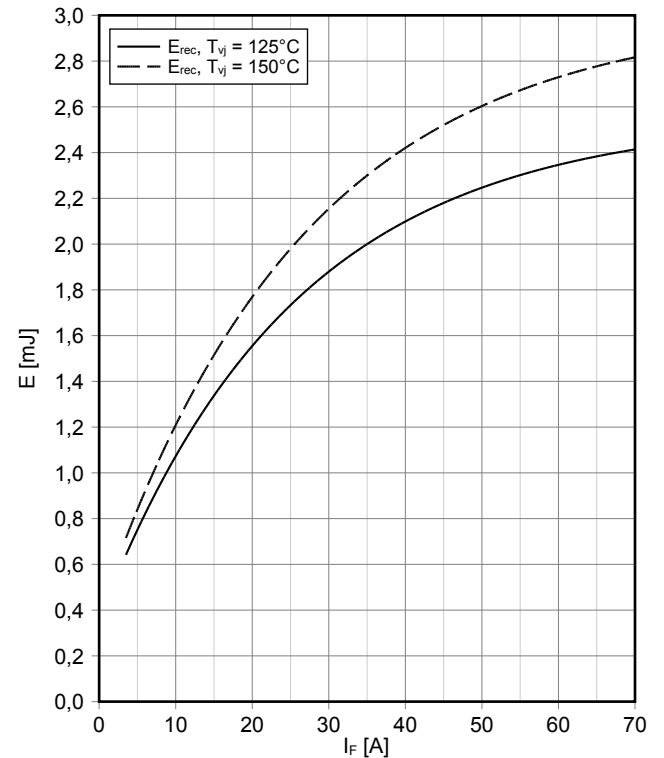
$$V_{GE} = \pm 15 \text{ V}, R_{Goff} = 10 \Omega, T_{vj} = 150^\circ\text{C}$$



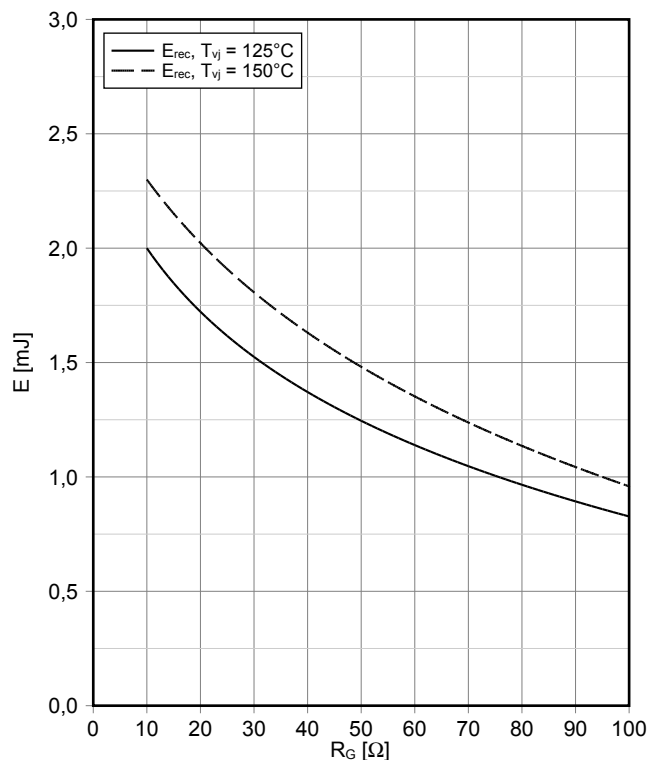
正向偏压特性 二极管, 制动-斩波器 (典型)
forward characteristic of Diode, Brake-Chopper (typical)
 $I_F = f(V_F)$



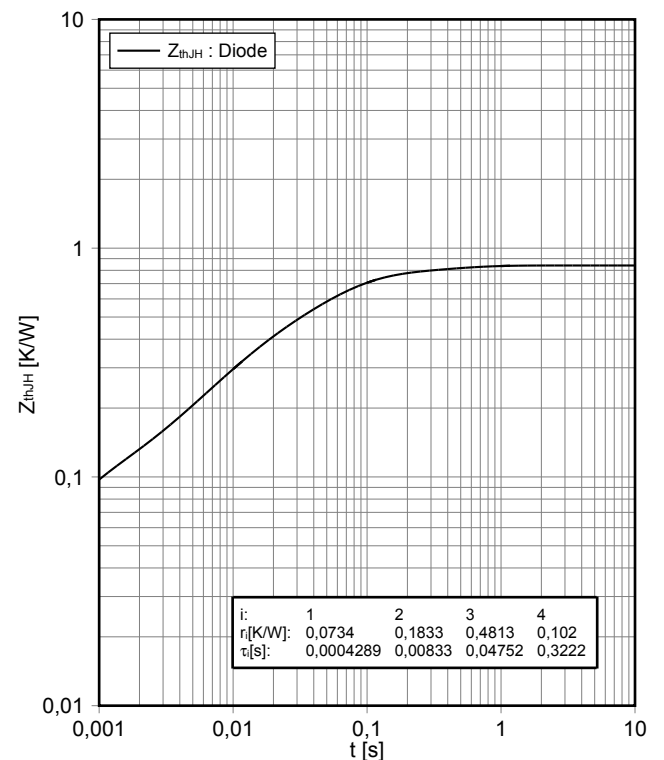
开关损耗 二极管, 制动-斩波器 (典型)
switching losses Diode, Brake-Chopper (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 10\ \Omega$, $V_{CE} = 600\ \text{V}$



开关损耗 二极管, 制动-斩波器 (典型)
switching losses Diode, Brake-Chopper (typical)
 $E_{rec} = f(R_G)$
 $I_F = 35\ \text{A}$, $V_{CE} = 600\ \text{V}$



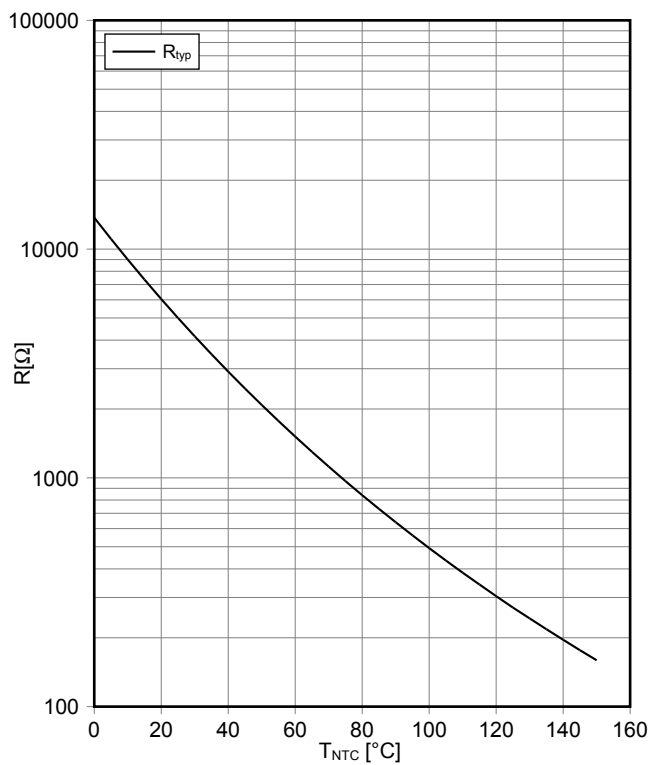
瞬态热阻抗 二极管, 制动-斩波器
transient thermal impedance Diode, Brake-Chopper
 $Z_{thJH} = f(t)$



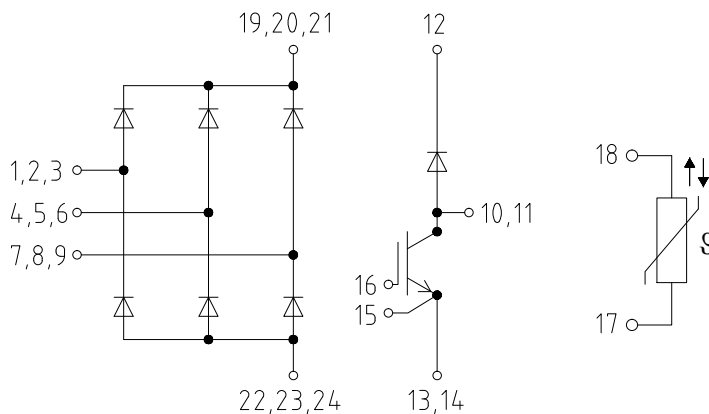
负温度系数热敏电阻 温度特性

NTC-Thermistor-temperature characteristic (typical)

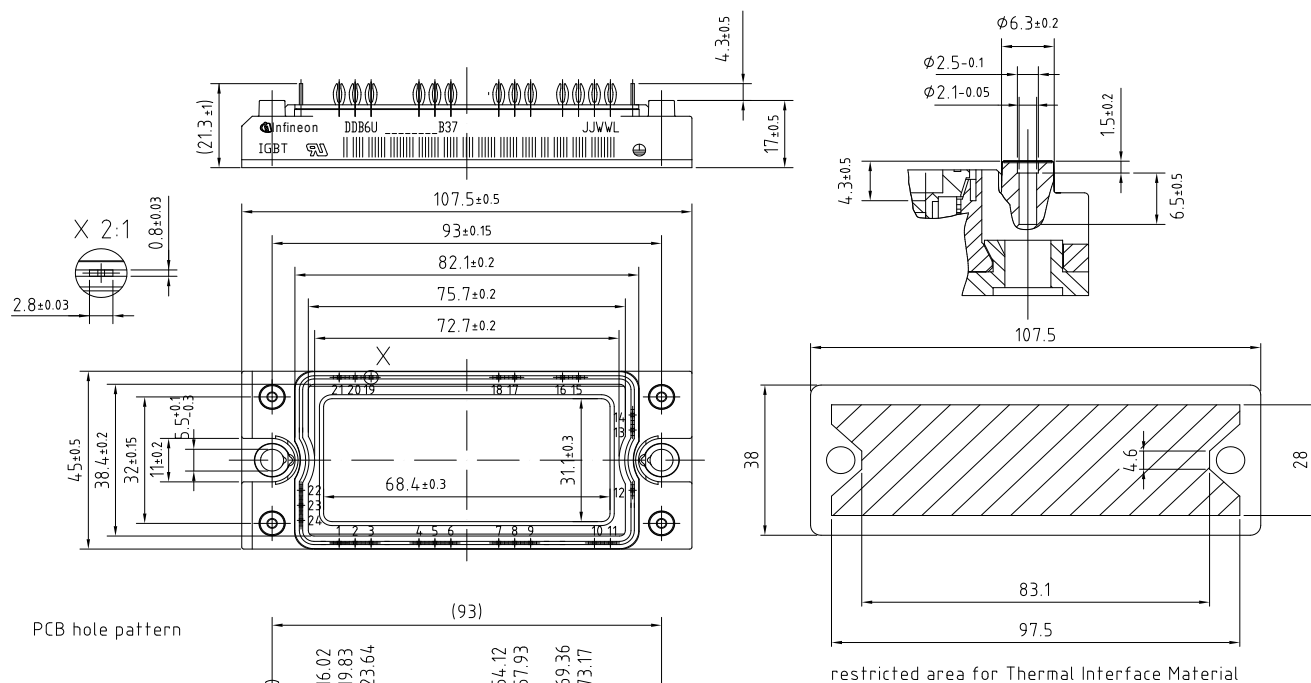
$R = f(T)$



接线图 / Circuit diagram



封装尺寸 / Package outlines



- Tolerance of PCB hole pattern
- hole specifications see AN 2007-09
- Diameters of plated holes $\varnothing$ 2.14mm - 2.29mm
- Diameter of drill $\varnothing$ 2.35mm



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