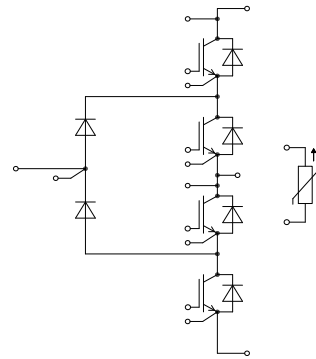
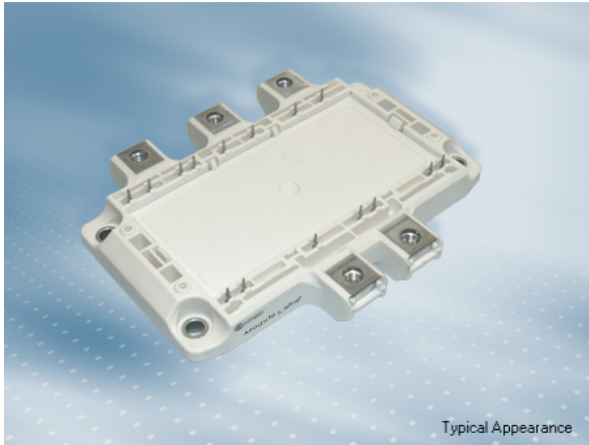


EconoPACK™4 模块 采用第四代沟槽栅/场终止IGBT4和第四代发射极控制二极管 带有pressfit预涂导热材料  
 EconoPACK™4 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and PressFIT / pre-applied Thermal Interface Material

### 初步数据 / Preliminary Data



$V_{CES} = 650V$   
 $I_{C\ nom} = 300A / I_{CRM} = 600A$

### 典型应用

- 三电平应用

### Typical Applications

- 3-level-applications

### 电气特性

- 增加阻断电压至650V
- 提高工作结温  $T_{vj\ op}$
- $T_{vj\ op} = 150^{\circ}C$
- 沟槽栅IGBT4
- $V_{CESat}$  带正温度系数

### Electrical Features

- Increased blocking voltage capability up to 650V
- Extended operating temperature  $T_{vj\ op}$
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4
- $V_{CESat}$  with positive temperature coefficient

### 机械特性

- 4 kV 交流 1分钟 绝缘
- 高机械坚固性
- 集成NTC温度传感器
- 绝缘的基板
- 标准封装
- 预涂导热介质

### Mechanical Features

- 4 kV AC 1min insulation
- High mechanical robustness
- Integrated NTC temperature sensor
- Isolated base plate
- 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

## 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	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	650	V
集电极电流 Implemented collector current		$I_{CN}$	300	A
连续集电极直流电流 Continuous DC collector current	$T_H = 25^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	280	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ms}$	$I_{CRM}$	600	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	$I_C = 280\text{A}, V_{GE} = 15\text{V}$ $I_C = 280\text{A}, V_{GE} = 15\text{V}$ $I_C = 280\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,50 1,65 1,70	1,75	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 4,80\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{G\text{Eth}}$	5,00	5,80	6,50 V
栅极电荷 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		$Q_G$	3,00		$\mu\text{C}$
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{G\text{int}}$	1,0		$\Omega$
输入电容 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{\text{ies}}$	18,5		nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{\text{res}}$	0,57		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 650\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$		1,0	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		400	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 280\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{on}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{on}}$	0,09 0,11 0,12		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
上升时间(电感负载) Rise time, inductive load	$I_C = 280\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{on}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,05 0,06 0,06		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 280\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{off}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{off}}$	0,49 0,52 0,53		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
下降时间(电感负载) Fall time, inductive load	$I_C = 280\text{A}, V_{CE} = 300\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{off}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,05 0,07 0,07		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 280\text{A}, V_{CE} = 300\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 3300\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{G\text{on}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{\text{on}}$	1,30 1,90 2,40		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 280\text{A}, V_{CE} = 300\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3300\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{G\text{off}} = 2,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{\text{off}}$	13,0 16,0 17,0		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{V}, V_{CC} = 360\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 10\mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ $t_P \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$	$I_{SC}$	1500 1200		A 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		$R_{th\text{JH}}$		0,250	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40	150	$^{\circ}\text{C}$

**初步数据**  
**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	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	650	V
正向电流 Implemented forward current		$I_{FN}$	300	A
连续正向直流电流 Continuous DC forward current		$I_F$	280	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	600	A
I <sup>2</sup> t-值 I <sup>2</sup> t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I <sup>2</sup> t	6000 5600	A <sup>2</sup> s A <sup>2</sup> s

**特征值 / Characteristic Values**

				min.	typ.	max.	
正向电压 Forward voltage	$I_F = 280\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 280\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 280\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$		1,50 1,45 1,40	1,90	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$		130 190 200		A A A
恢复电荷 Recovered charge	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$		9,00 20,0 23,0		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$		3,25 5,90 6,80		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		$R_{thJH}$			0,369	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, 三电平 / Diode, 3-Level**  
**最大额定值 / Maximum Rated Values**

反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	650	V
正向电流 Implemented forward current		$I_{FN}$	300	A
连续正向直流电流 Continuous DC forward current		$I_F$	280	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	600	A
I <sup>2</sup> t-值 I <sup>2</sup> t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I <sup>2</sup> t	6000 5600	A <sup>2</sup> s A <sup>2</sup> s

**特征值 / Characteristic Values**

				min.	typ.	max.	
正向电压 Forward voltage	$I_F = 280\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 280\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 280\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$		1,50 1,45 1,40	1,90	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$		130 190 200		A A A
恢复电荷 Recovered charge	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$		9,00 20,0 23,0		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 280\text{ A}, -di_F/dt = 3300\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$		3,25 5,90 6,80		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		$R_{thJH}$			0,369	K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

## 初步数据 Preliminary Data

### 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 $\Omega$
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

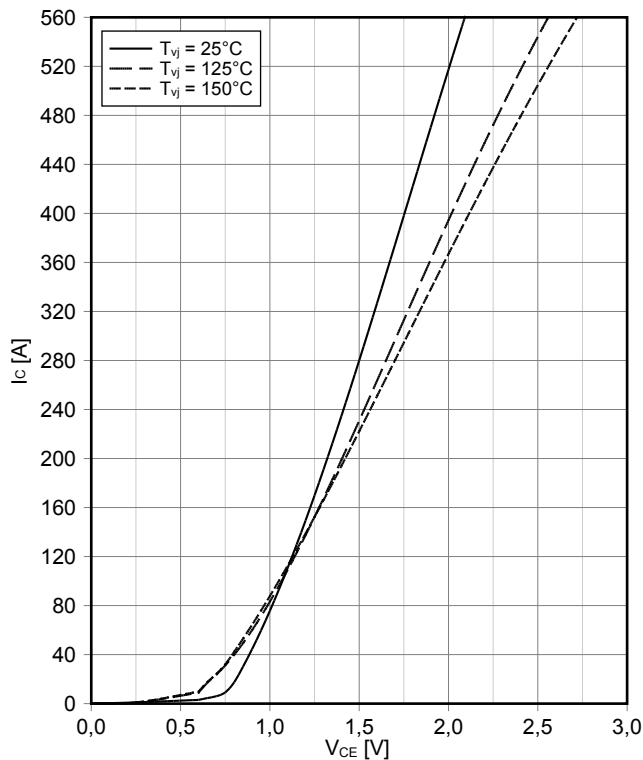
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	$V_{ISOL}$		4,0		kV
模块基板材料 Material of module baseplate				Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)			$\text{Al}_2\text{O}_3$		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			25,0 12,5		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			11,0 7,0		mm
相对电痕指数 Comperative tracking index		CTI		> 200		
min. typ. max.						
杂散电感,模块 Stray inductance module		$L_{sCE}$		45		nH
储存温度 Storage temperature		$T_{stg}$	-40		125	$^{\circ}\text{C}$
最高基板工作温度 Maximum baseplate operation temperature		$T_{BPmax}$			125	$^{\circ}\text{C}$
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		400		g

Lagerung und Transport von Modulen mit TIM => siehe AN2012-07  
Storage and shipment of modules with TIM => see AN2012-07

## 初步数据 Preliminary Data

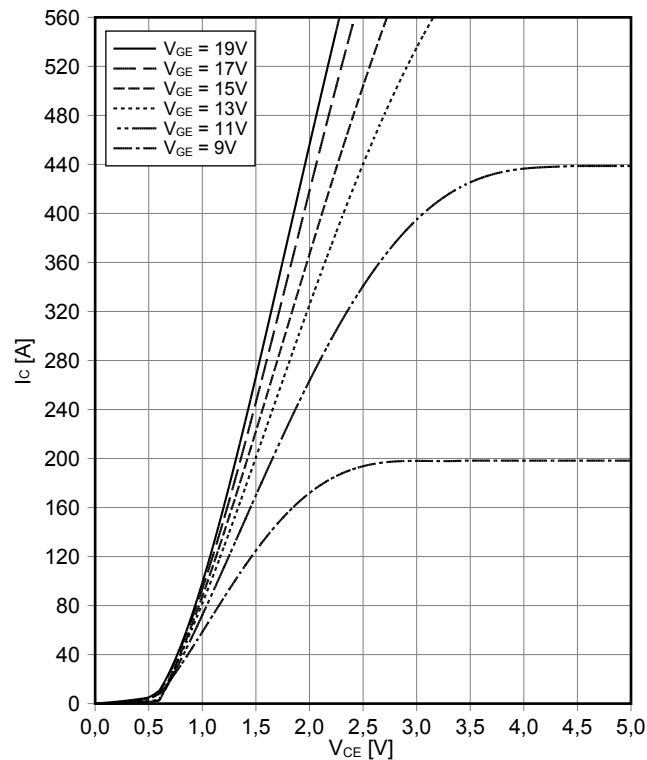
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



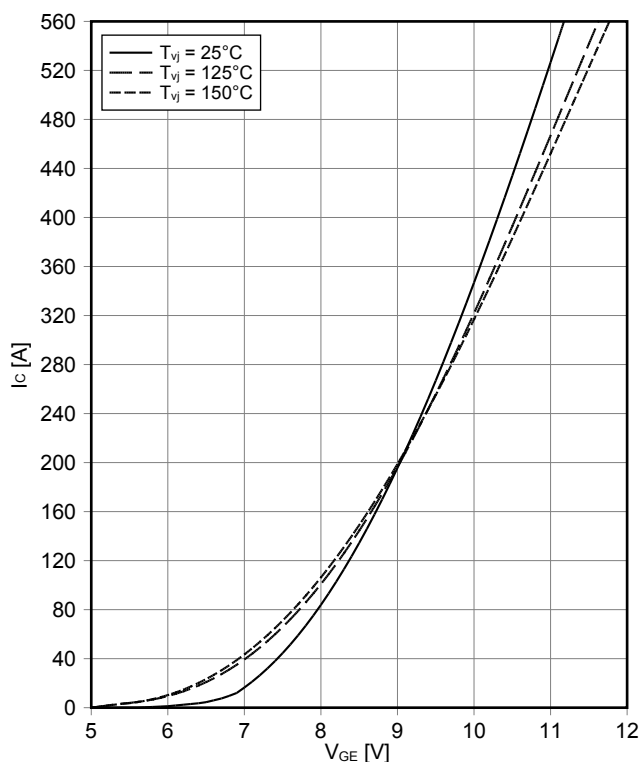
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



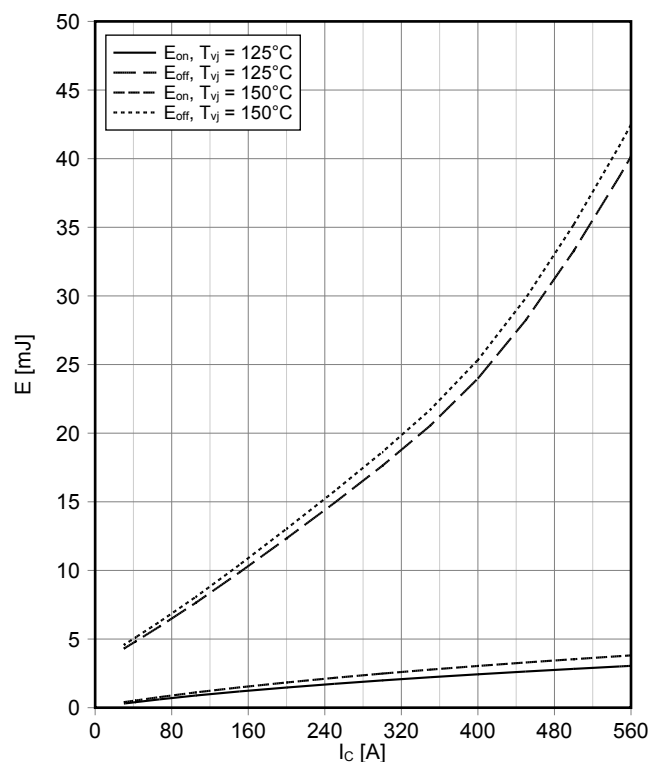
传输特性 IGBT, 逆变器 (典型)  
transfer characteristic IGBT, Inverter (typical)

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



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

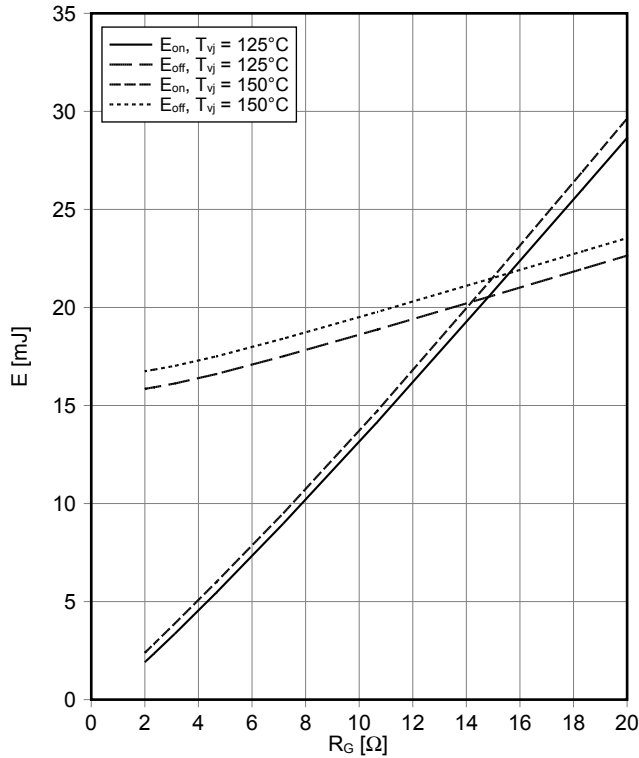
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 2\ \Omega$ ,  $R_{Goff} = 2\ \Omega$ ,  $V_{CE} = 300\text{ V}$



## 初步数据 Preliminary Data

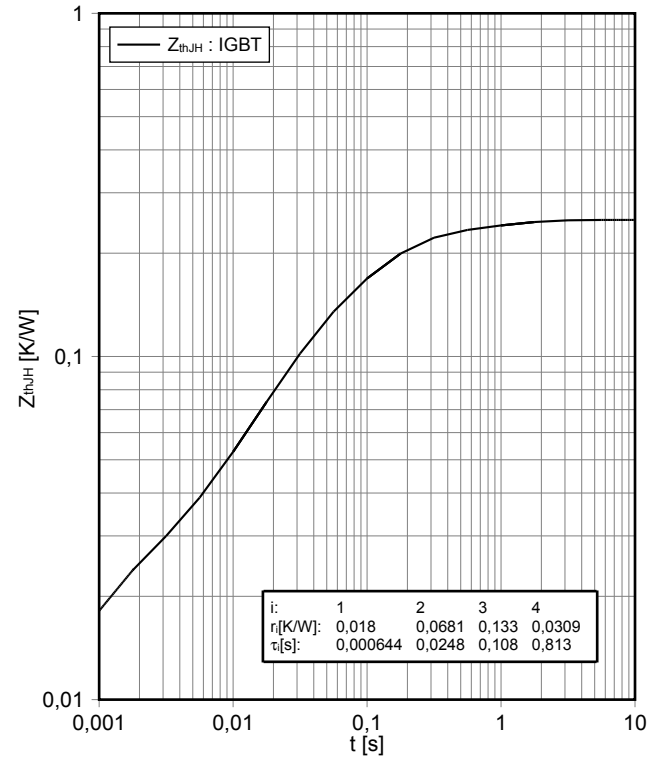
### 开关损耗 IGBT, 逆变器 (典型) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 280\text{ A}, V_{CE} = 300\text{ V}$



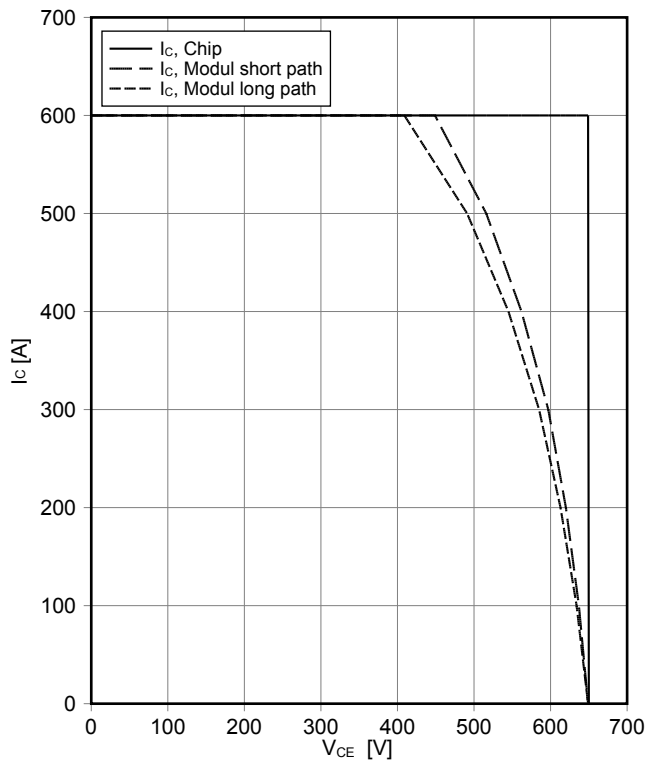
### 瞬态热阻抗 IGBT, 逆变器 transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



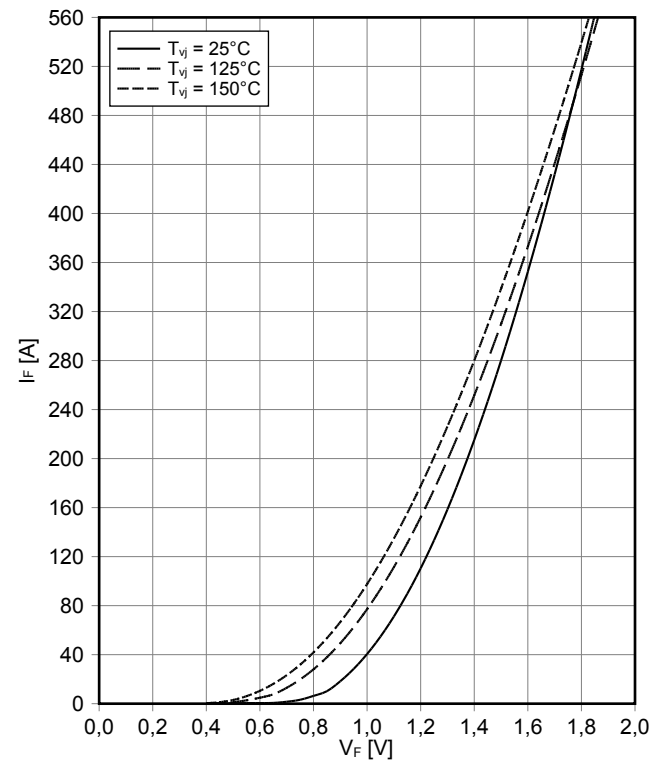
### 反偏安全工作区 IGBT, 逆变器 (RBSOA) reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 2\ \Omega, T_{vj} = 150^\circ\text{C}$



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

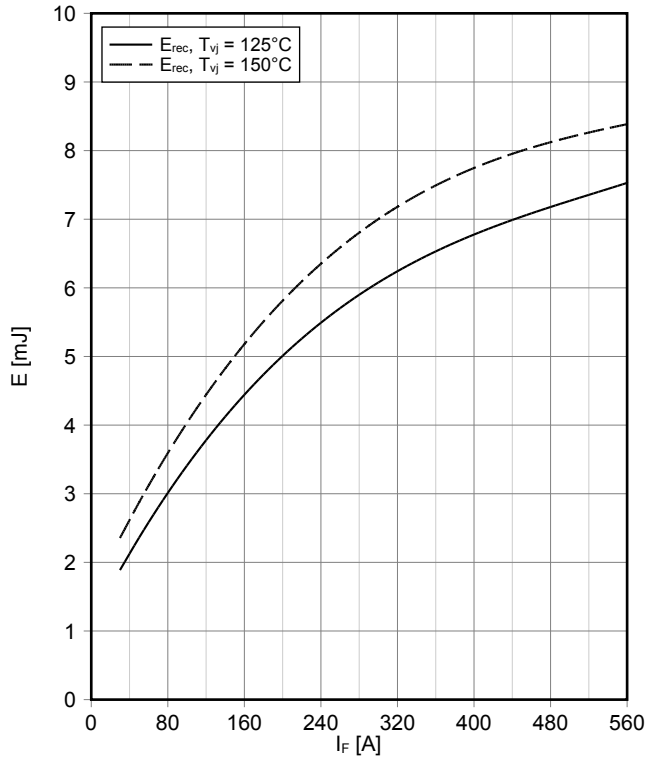
$I_F = f(V_F)$



## 初步数据 Preliminary Data

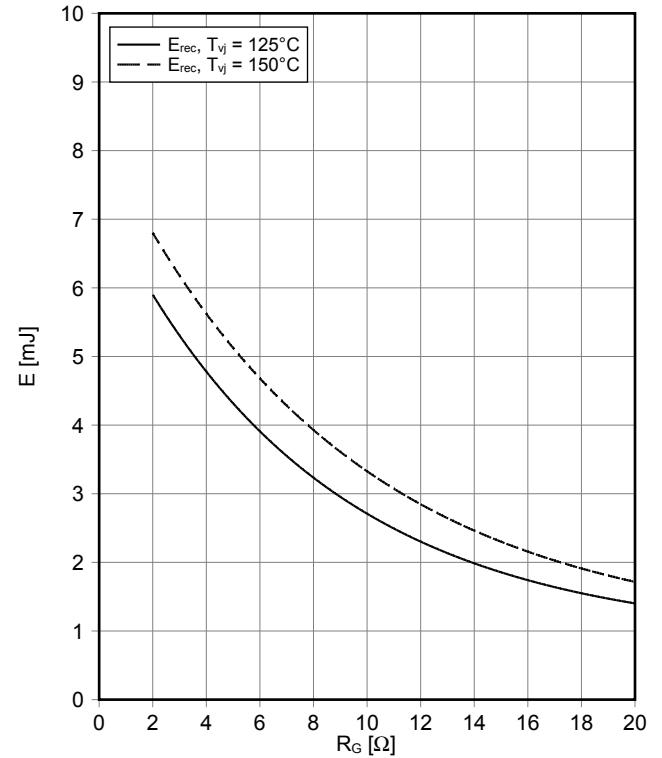
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 2 \Omega, V_{CE} = 300 V$



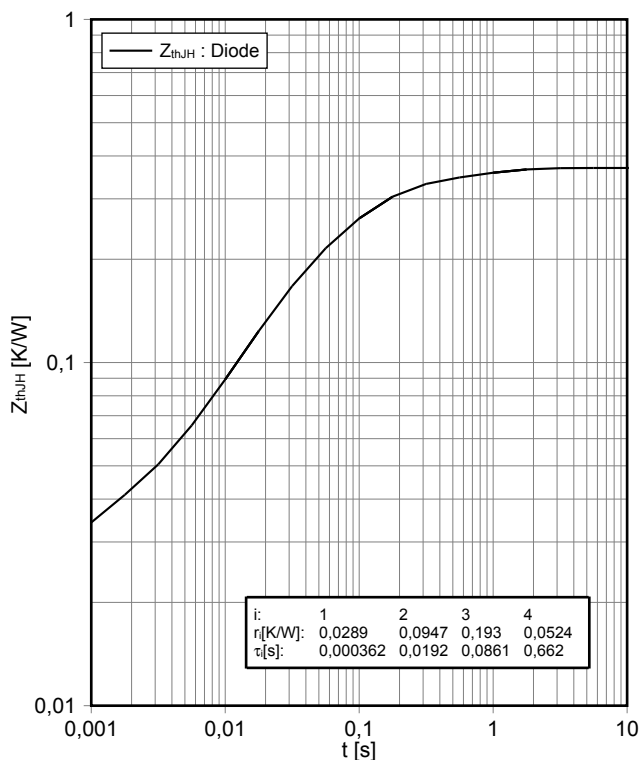
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 280 A, V_{CE} = 300 V$



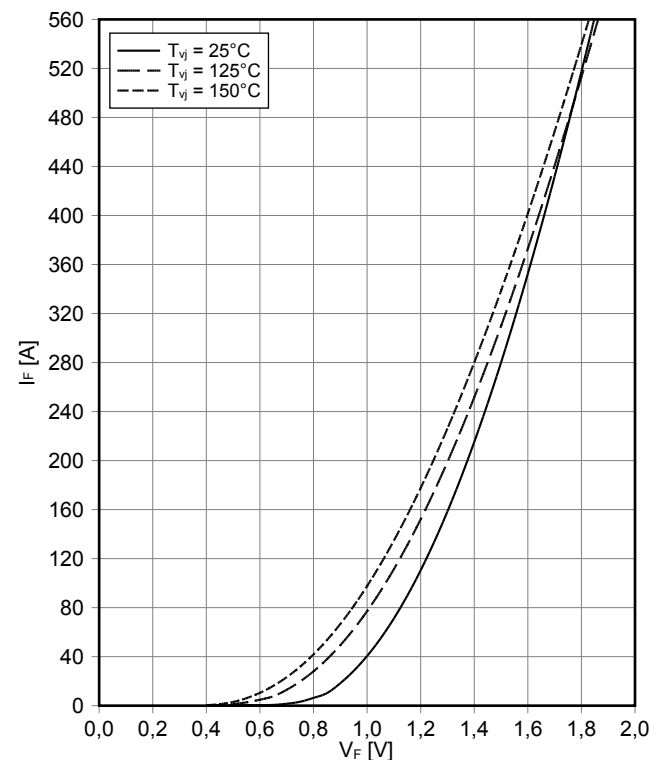
瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter

$Z_{thJH} = f(t)$



正向偏压特性 二极管,三电平 (典型)  
forward characteristic of Diode, 3-Level (typical)

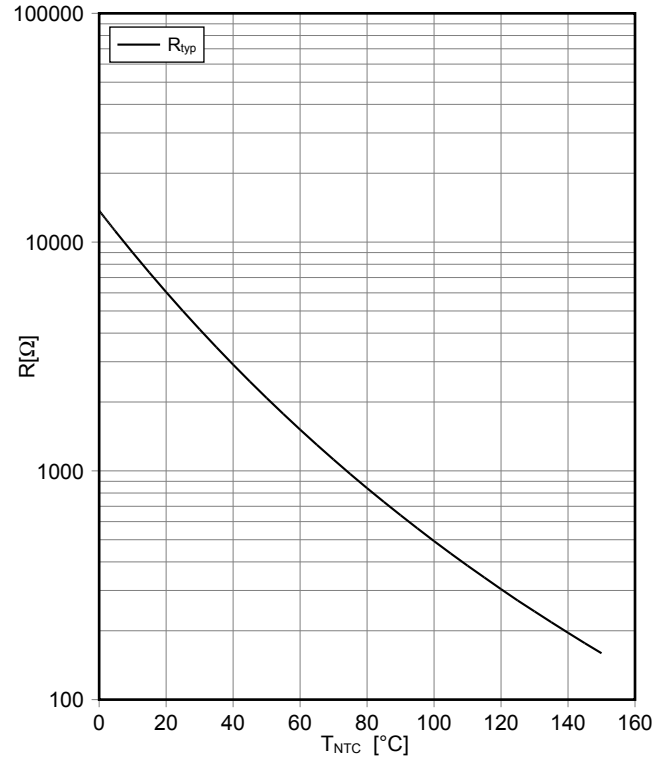
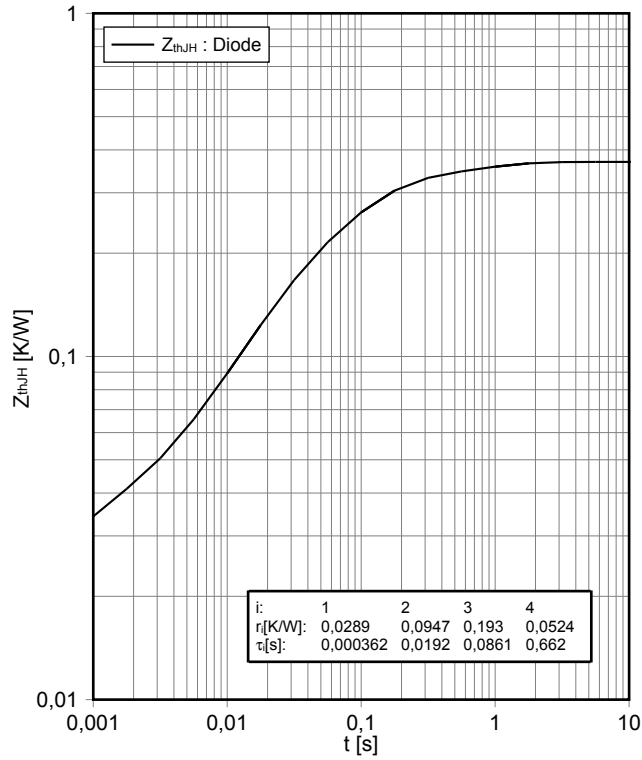
$I_F = f(V_F)$



## 初步数据 Preliminary Data

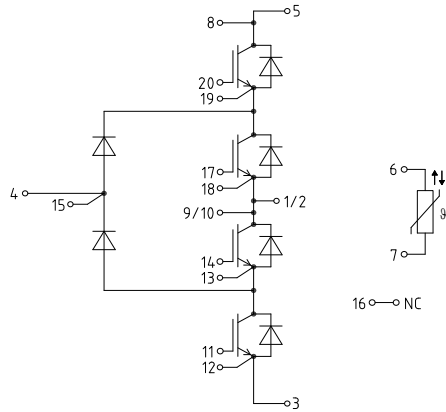
瞬态热阻抗 二极管, 三电平  
transient thermal impedance Diode, 3-Level  
 $Z_{thJH} = f(t)$

负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)  
 $R = f(T)$

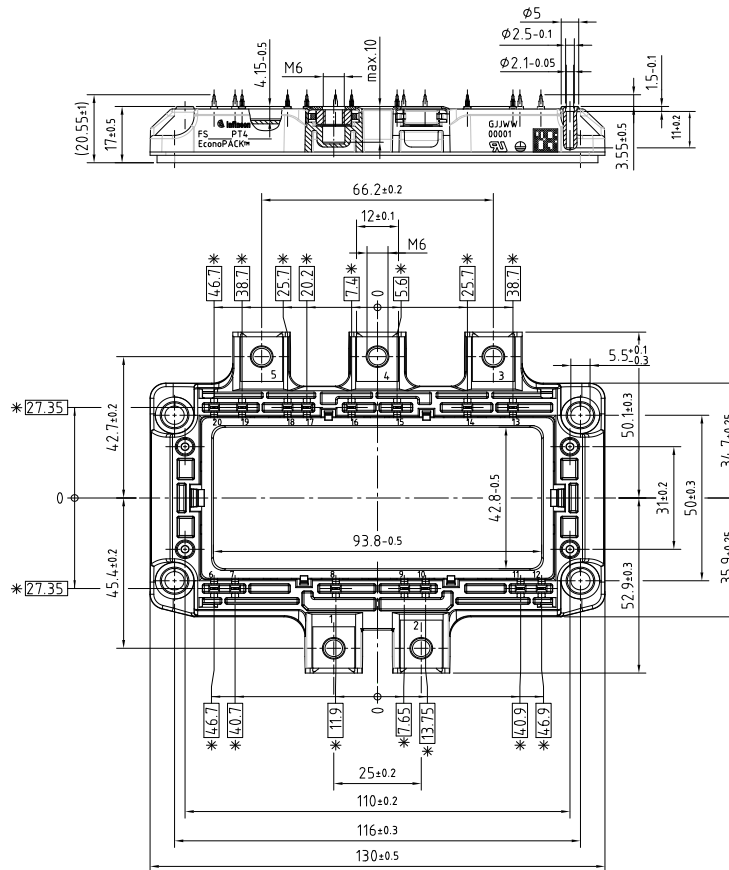




## 接线图 / Circuit diagram

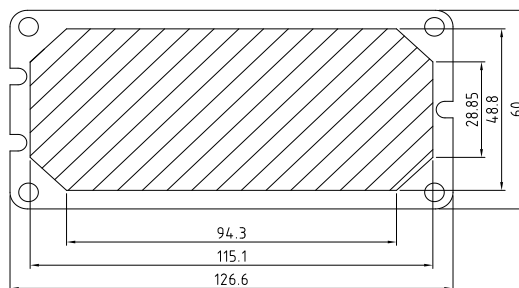


## 封装尺寸 / Package outlines



\* = alle Maße mit einer Toleranz von  $\pm 0.4$   
 \* = all dimensions with tolerance of  $\pm 0.4$

Maße im aufgeschraubtem Zustand gemessen  
 dimensions valid in mounted condition



restricted area for Thermal Interface Material