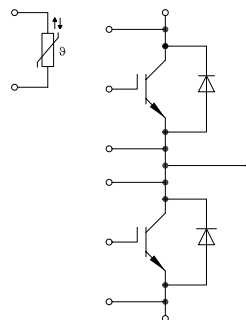


PrimePACK™3+ B-series 模块 采用第五代沟槽栅/场终止IGBT5和第五代发射极控制二极管 带有温度检测NTC和预涂导热介质

PrimePACK™3+ B-series module with Trench/Fieldstop IGBT5, Emitter Controlled 5 diode and NTC / pre-applied Thermal Interface Material



$V_{CES} = 1200V$

$I_{C\ nom} = 1500A / I_{CRM} = 3000A$

#### 潜在应用

- UPS系统
- 大功率变流器
- 太阳能应用
- 电机传动

#### 电气特性

- $T_{vj\ op} = 175^{\circ}C$
- 提高工作结温  $T_{vj\ op}$
- 无与伦比的坚固性
- 沟槽栅IGBT5
- 高短路能力

#### 机械特性

- 封装的 CTI > 400
- 预涂导热介质
- 高功率密度
- 高功率循环和温度循环能力
- 高爬电距离和电气间隙

#### Potential Applications

- UPS systems
- High power converters
- Solar applications
- Motor drives

#### Electrical Features

- $T_{vj\ op} = 175^{\circ}C$
- Extended operating temperature  $T_{vj\ op}$
- Unbeatable robustness
- Trench IGBT 5
- High short-circuit capability

#### Mechanical Features

- Package with CTI > 400
- Pre-applied Thermal Interface Material
- High power density
- High power and thermal cycling capability
- High creepage and clearance distances

### Module Label Code

Barcode Code 128



0000012345600000000000

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	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
连续集电极直流电流 Continuous DC collector current	$T_H = 55^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{CDC}$	1500	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	3000	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	$I_C = 1500\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,70 2,00 2,15	2,15 2,45 2,60	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 41,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,25	5,80	6,35 V
栅极电荷 Gate charge	$V_{GE} = -15 / 15\text{ V}, V_{CE} = 600\text{ V}$		$Q_G$	7,15		$\mu\text{C}$
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	0,6		$\Omega$
输入电容 Input capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	82,0		nF
反向传输电容 Reverse transfer capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	3,25		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	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{don}$	0,26 0,28 0,28		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
上升时间(电感负载) Rise time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_r$	0,16 0,17 0,18		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{doff}$	0,51 0,56 0,59		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
下降时间(电感负载) Fall time, inductive load	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_f$	0,09 0,11 0,13		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}, L_{\sigma} = 30\text{ nH}$ $di/dt = 7900\text{ A}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{on}$	120 180 215		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 1500\text{ A}, V_{CE} = 600\text{ V}, L_{\sigma} = 30\text{ nH}$ $du/dt = 2750\text{ V}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 0,82\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{off}$	155 195 220		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 900\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 175^{\circ}\text{C}$		$I_{SC}$	5600		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		$R_{thJH}$		31,2	K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	175	$^{\circ}\text{C}$

## 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	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
连续正向直流电流 Continuous DC forward current		$I_F$	1500	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	3000	A
$I^2t$ -值 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 175^{\circ}\text{C}$	$I^2t$	575 445	$\text{kA}^2\text{s}$ $\text{kA}^2\text{s}$

## 特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1500\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_F$	1,95 1,85 1,80	2,45 2,30 2,25	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 1500\text{ A}, -di_F/dt = 7900\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$I_{RM}$	745 1000 1150		A A A
恢复电荷 Recovered charge	$I_F = 1500\text{ A}, -di_F/dt = 7900\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$Q_r$	175 300 365		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 1500\text{ A}, -di_F/dt = 7900\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{rec}$	82,0 135 160		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		$R_{thJH}$		47,1	K/kW
在开关状态下温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		175	$^{\circ}\text{C}$

## 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 $\Omega$
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

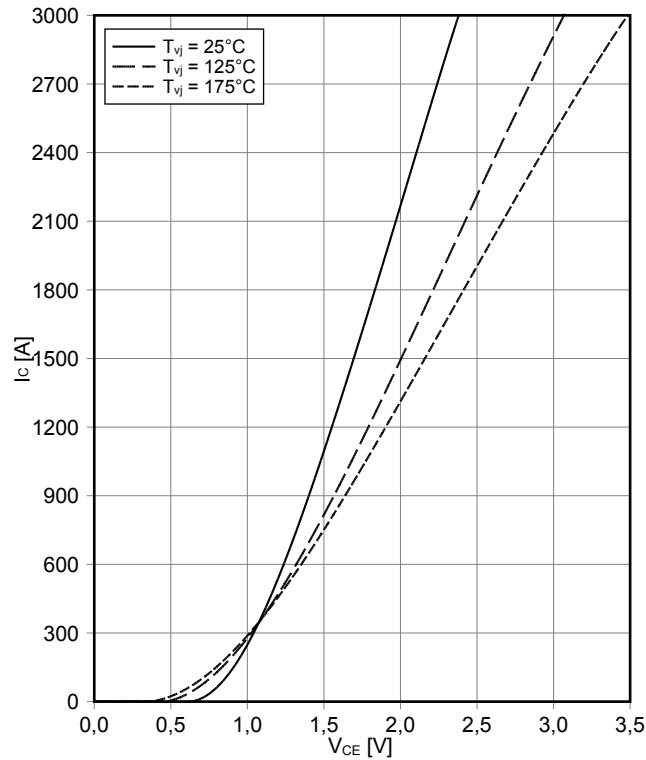
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	4,0	kV	
模块基板材料 Material of module baseplate			Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al <sub>2</sub> O <sub>3</sub>		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		36,0 28,0	mm	
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		21,0 19,0	mm	
相对电痕指数 Comperative tracking index		CTI	> 400		
			min.	typ.	max.
杂散电感,模块 Stray inductance module		L <sub>sCE</sub>		10	nH
模块引线电阻,端子-芯片 Module lead resistance, terminals - chip	T <sub>H</sub> = 25°C, 每个开关 / per switch	R <sub>CC'+EE'</sub> R <sub>AA'+CC'</sub>		0,10 0,09	mΩ
储存温度 Storage temperature		T <sub>stg</sub>	-40		150 °C
最高基板工作温度 Maximum baseplate operation temperature		T <sub>BPmax</sub>			150 °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 M4 根据相应的应用手册进行安装 Screw M4 - Mounting according to valid application note	M	1,8	-	2,1 Nm
	螺丝 M8 根据相应的应用手册进行安装 Screw M8 - Mounting according to valid application note		8,0	-	10 Nm
重量 Weight		G		1400	g

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

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

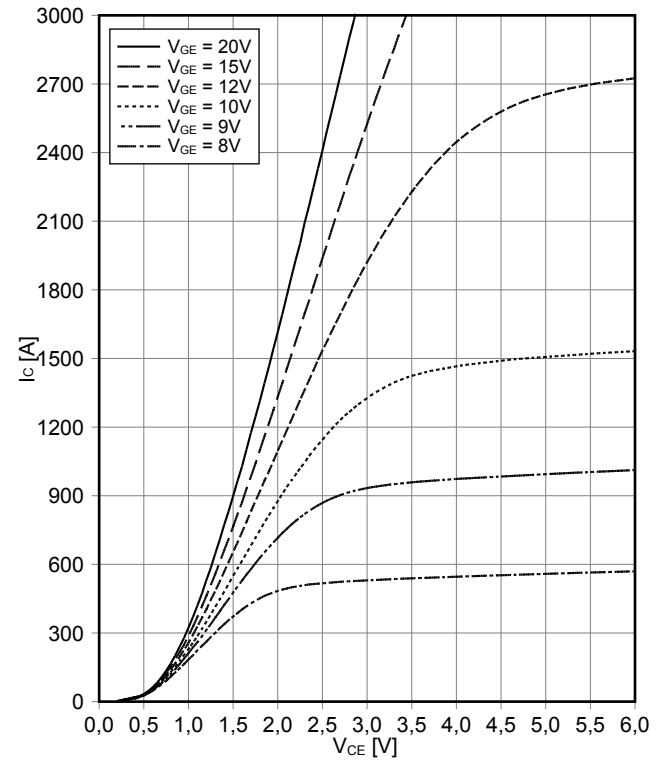
$I_C = f(V_{CE})$   
 $V_{GE} = 15 \text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

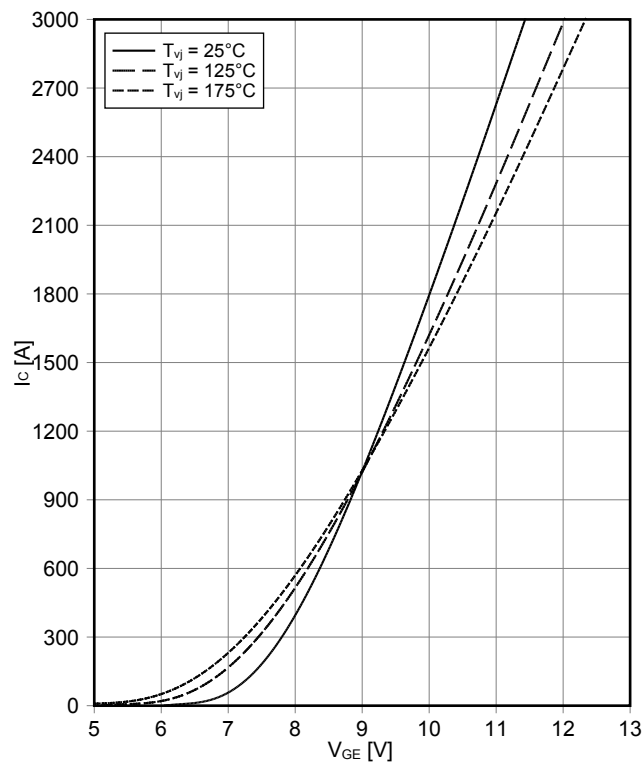
$I_C = f(V_{CE})$   
 $T_{vj} = 175^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

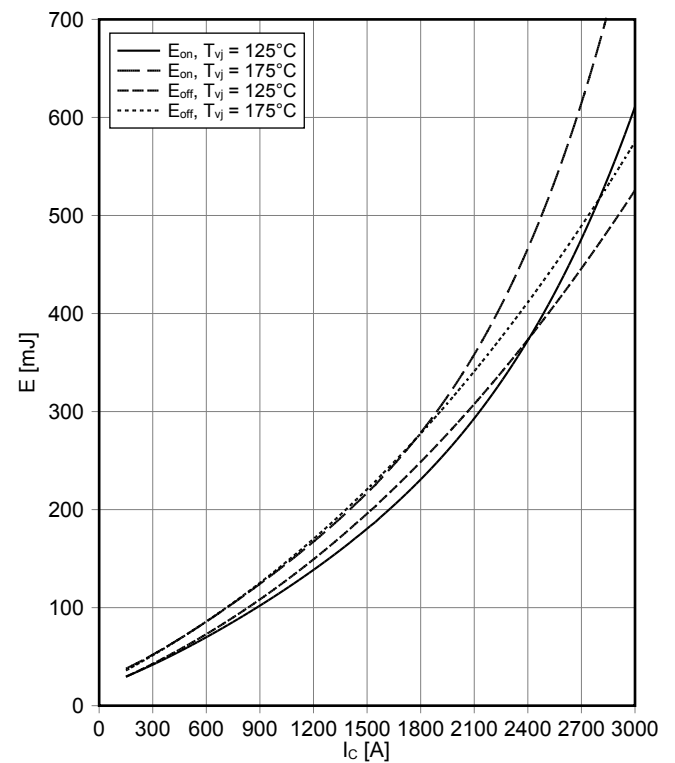
$I_C = f(V_{GE})$   
 $V_{CE} = 20 \text{ V}$



开关损耗 IGBT, 逆变器 (典型)

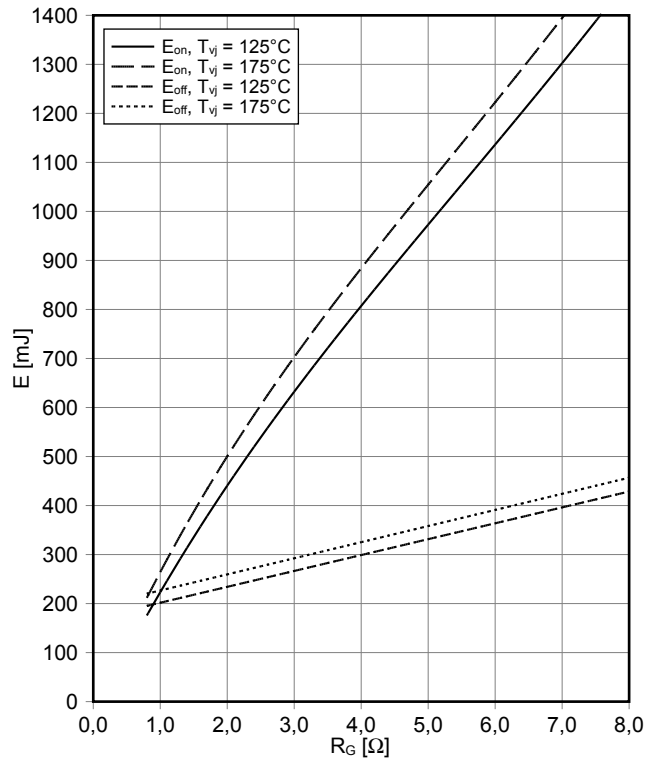
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Gon} = 0.82 \Omega$ ,  $R_{Goff} = 0.82 \Omega$ ,  $V_{CE} = 600 \text{ V}$



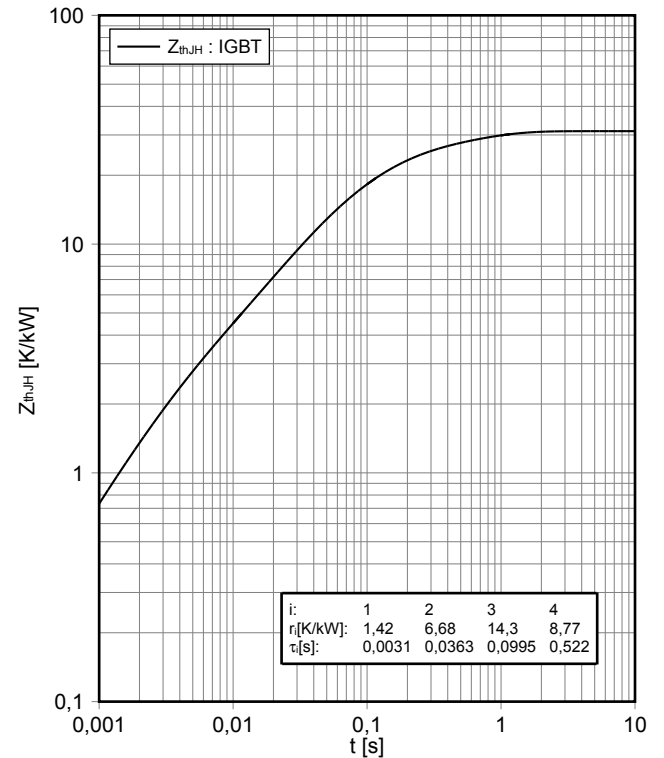
## 开关损耗 IGBT, 逆变器 (典型) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $I_C = 1500 \text{ A}$ ,  $V_{CE} = 600 \text{ V}$



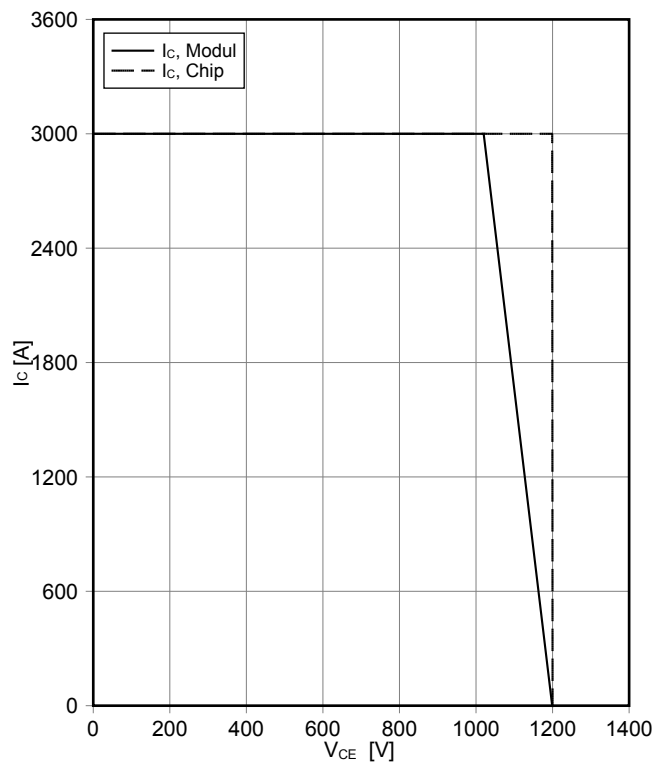
## 瞬态热阻抗 IGBT, 逆变器 transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



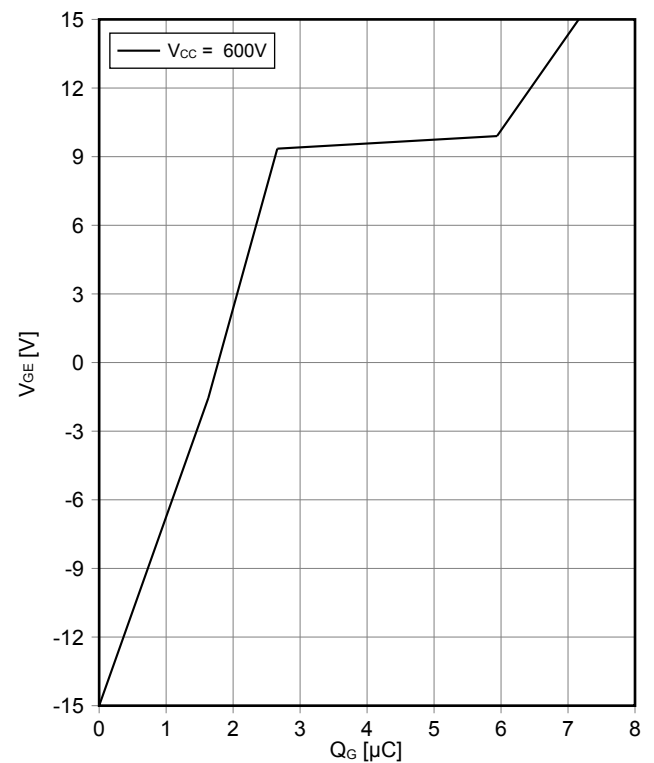
## 反偏安全工作区 IGBT, 逆变器 (RBSOA) reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Goff} = 0.82 \Omega$ ,  $T_{vj} = 175^\circ\text{C}$

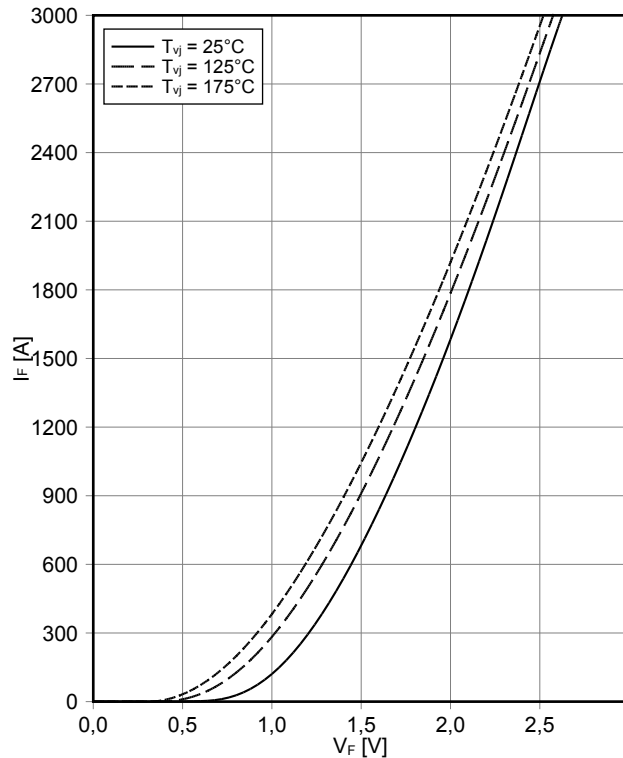


## 栅极电荷特性 IGBT, 逆变器 (典型) gate charge characteristic IGBT, Inverter (typical)

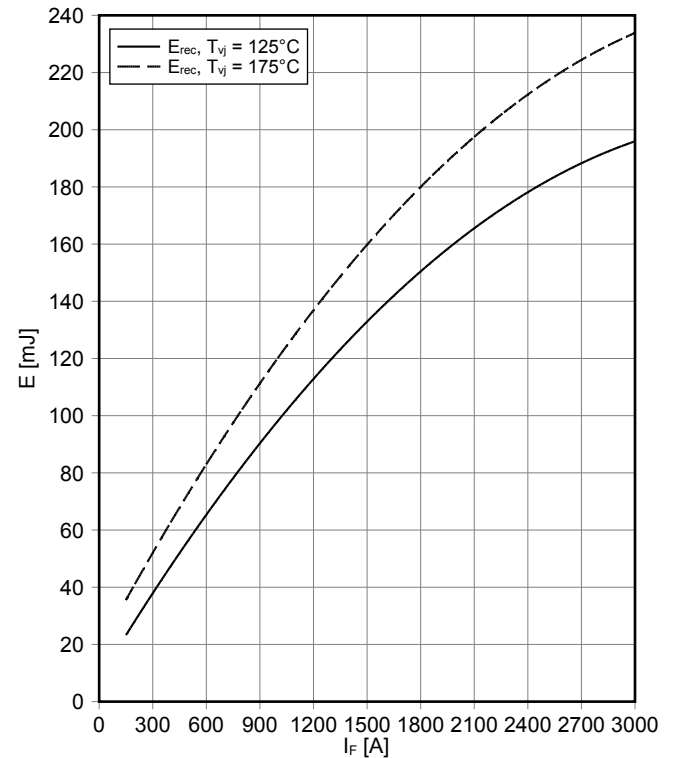
$V_{GE} = f(Q_G)$   
 $I_C = 1500 \text{ A}$ ,  $T_{vj} = 25^\circ\text{C}$



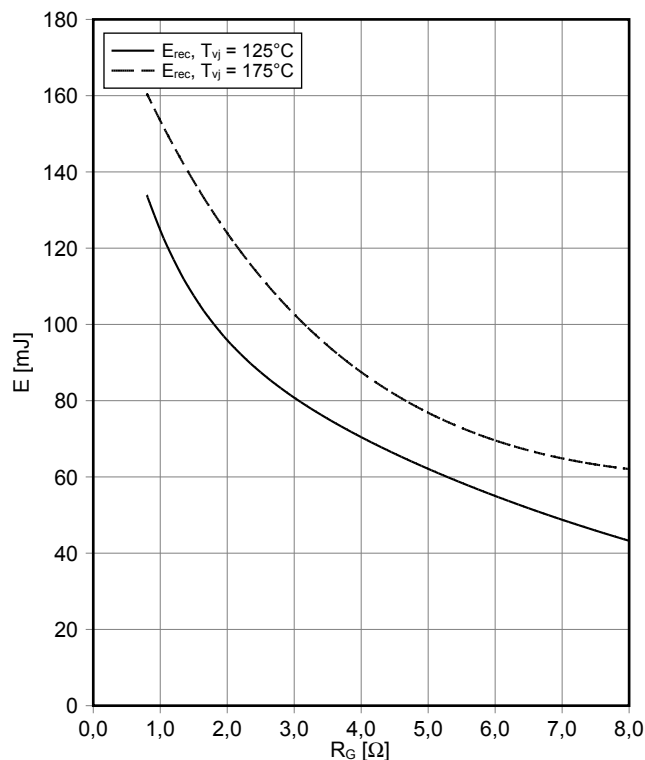
正向偏压特性 二极管,逆变器 (典型)  
forward characteristic of Diode, Inverter (typical)  
 $I_F = f(V_F)$



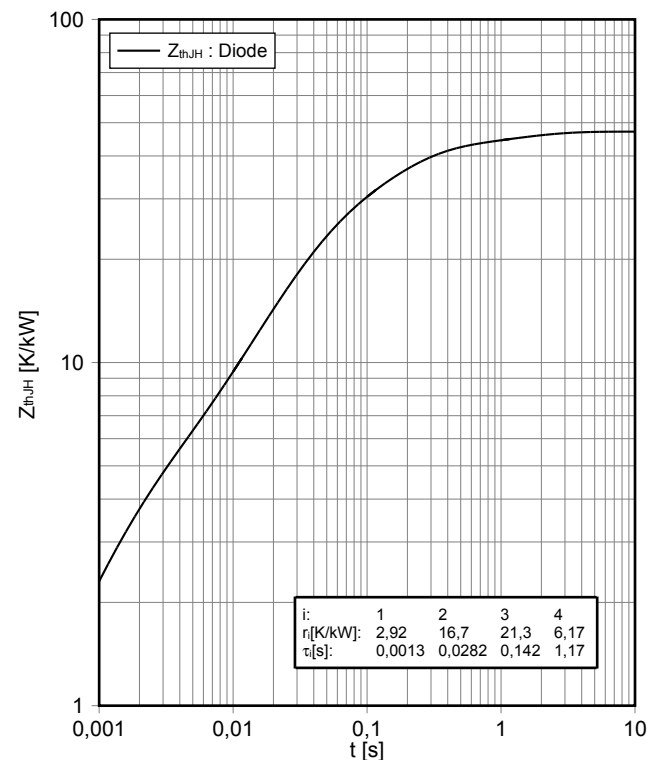
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 0.82 \Omega$ ,  $V_{CE} = 600 \text{ V}$



开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(R_G)$   
 $I_F = 1500 \text{ A}$ ,  $V_{CE} = 600 \text{ V}$



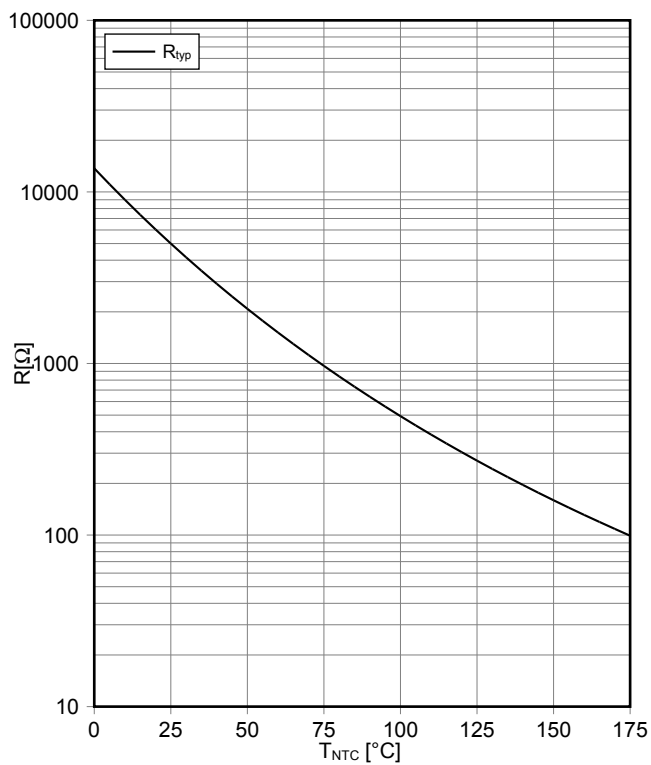
瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter  
 $Z_{thJH} = f(t)$



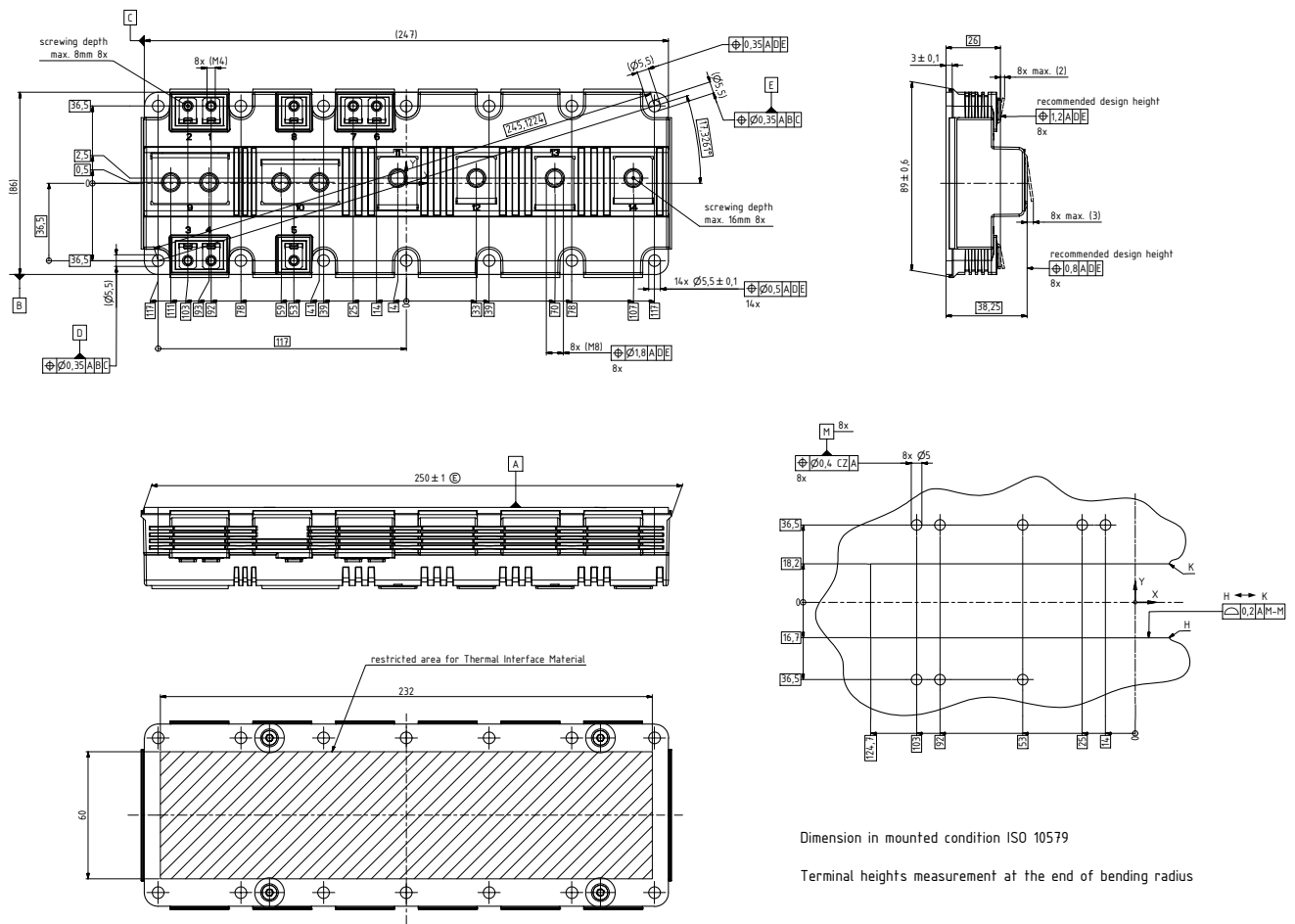
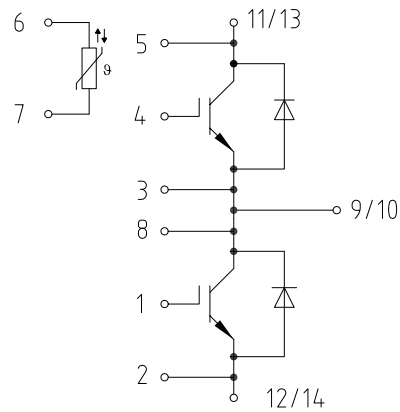
负温度系数热敏电阻 温度特性

NTC-Thermistor-temperature characteristic (typical)

$R = f(T)$







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