

PrimePACK™2 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管  
PrimePACK™2 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode



$V_{CES} = 1200V$   
 $I_{C\ nom} = 900A / I_{CRM} = 1800A$

### 典型应用

- 商业性农用车辆
- 牵引变流器

### 电气特性

- 高短路能力
- 高冲击电流能力
- 高电流密度
- 低开关损耗
- $T_{vj\ op} = 150^{\circ}C$
- $V_{CESat}$  带正温度系数

### 机械特性

- 4 kV 交流 1分钟 绝缘
- 封装的 CTI > 400
- 高爬电距离和电气间隙
- 高机械坚固性
- 集成NTC温度传感器
- 符合RoHS
- 预涂导热介质

### Typical Applications

- Commercial Agriculture Vehicles
- Traction drives

### Electrical Features

- High short-circuit capability
- High surge current capability
- High current density
- Low switching losses
- $T_{vj\ op} = 150^{\circ}C$
- $V_{CESat}$  with positive temperature coefficient

### Mechanical Features

- 4 kV AC 1min insulation
- Package with CTI > 400
- High creepage and clearance distances
- High mechanical robustness
- Integrated NTC temperature sensor
- RoHS compliant
- 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

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**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	$T_H = 60^{\circ}\text{C}, T_{vj\text{ max}} = 175^{\circ}\text{C}$	$I_{C\text{ nom}}$	900	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	1800	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	$I_C = 900\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 900\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 900\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,75 2,05 2,10	2,10 2,45 2,50	V V V	
栅极阈值电压 Gate threshold voltage	$I_C = 33,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,20	5,80	6,40	V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		$Q_G$	6,40			$\mu\text{C}$
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	1,2			$\Omega$
输入电容 Input capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	54,0			nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	3,00			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	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	0,20 0,22 0,22			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
上升时间(电感负载) Rise time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,11 0,12 0,13			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	0,66 0,75 0,79			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
下降时间(电感负载) Fall time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,09 0,14 0,15			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}, L_S = 45\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 5700\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	55,0 70,0 80,0			mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}, L_S = 45\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3200\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	85,0 120 130			mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 900\text{ V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	3600			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		$R_{thJH}$			48,1	K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

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**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		$I_F$	900	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	1800	A
$I^2t$ -值 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	91,0 88,0	kA <sup>2</sup> s kA <sup>2</sup> s

**特征值 / Characteristic Values**

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 900\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 900\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 900\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,90 1,85 1,80	2,40 2,35 2,30	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 900\text{ A}, -di_F/dt = 5700\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	500 660 710		A A A
恢复电荷 Recovered charge	$I_F = 900\text{ A}, -di_F/dt = 5700\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	90,0 150 195		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 900\text{ A}, -di_F/dt = 5700\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	40,0 80,0 90,0		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		$R_{thJH}$		87,2	K/kW
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 $\Omega$
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.

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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>	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		33,0 33,0		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		19,0 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>		18	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>		0,30	mΩ
储存温度 Storage temperature		T <sub>stg</sub>	-40		125 °C
最高基板工作温度 Maximum baseplate operation temperature		T <sub>BPmax</sub>			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 M4 根据相应的应用手册进行安装 Screw M4 - Mounting according to valid application note 螺丝 M8 根据相应的应用手册进行安装 Screw M8 - Mounting according to valid application note	M	1,8 8,0	- -	2,1 10 Nm
重量 Weight		G		825	g

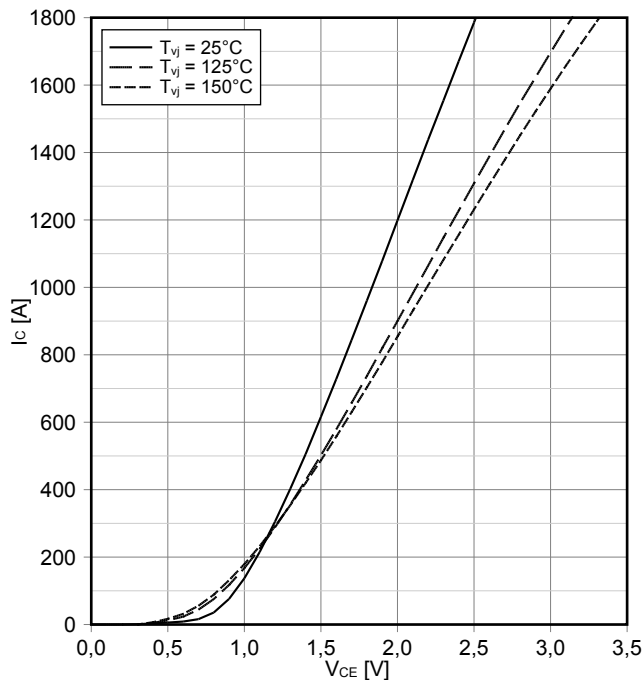
Lagerung und Transport von Modulen mit TIM: siehe AN2012-07  
Storage and shipment of modules with TIM: see AN2012-07

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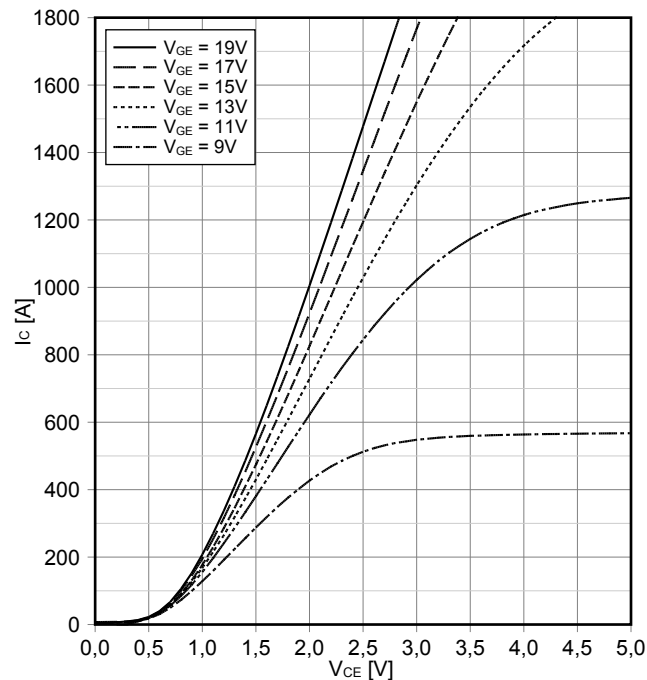
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



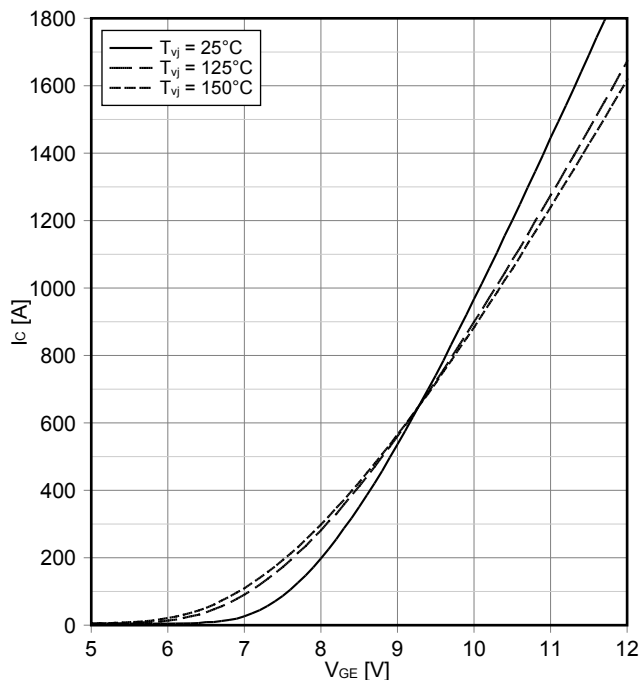
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



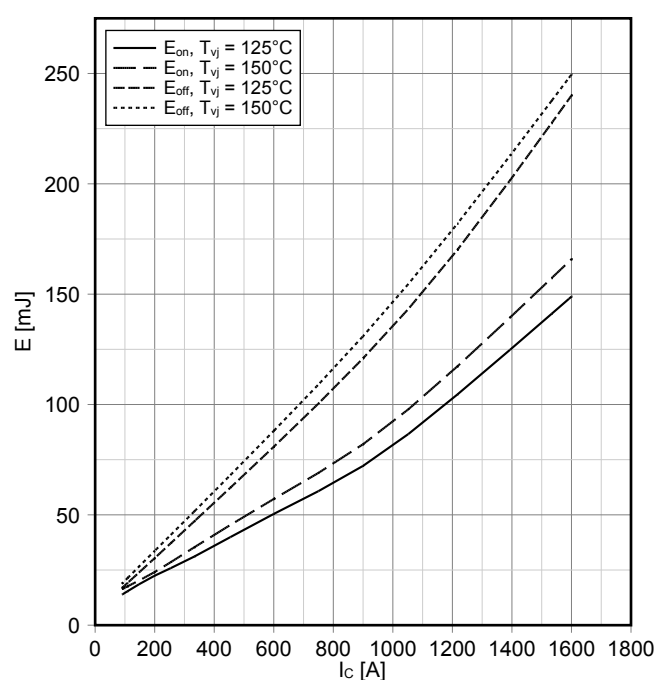
传输特性 IGBT, 逆变器 (典型)  
transfer characteristic IGBT, Inverter (typical)

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



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

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 1.3\ \Omega$ ,  $R_{Goff} = 1.5\ \Omega$ ,  $V_{CE} = 600\text{ V}$

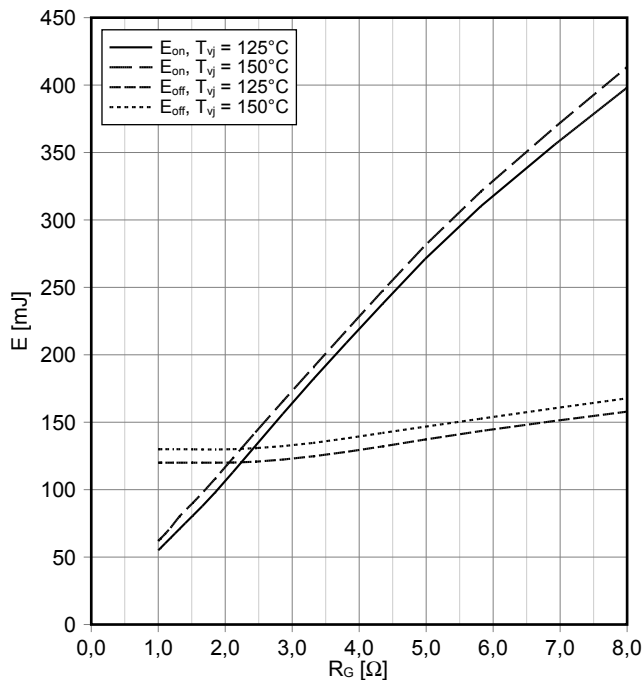


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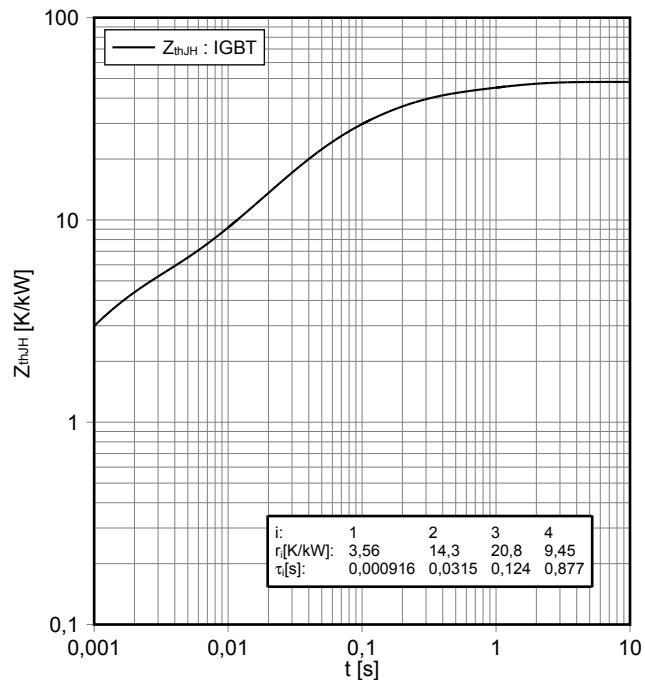
开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 900\text{ A}, V_{CE} = 600\text{ V}$



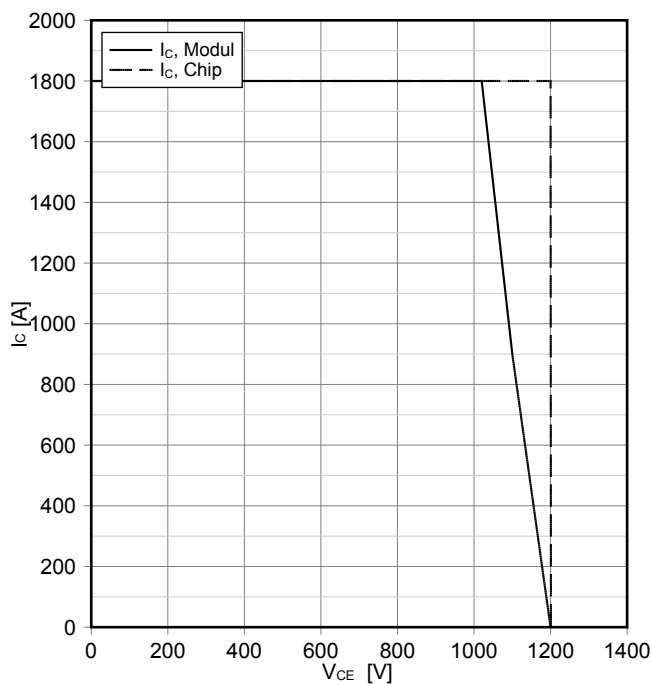
瞬态热阻抗 IGBT, 逆变器  
transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



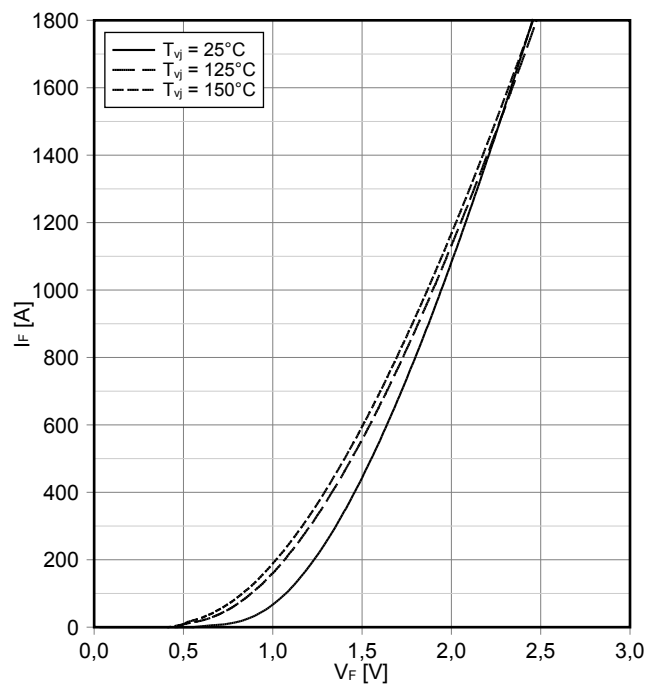
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1.5\ \Omega, T_{vj} = 150^\circ\text{C}$



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

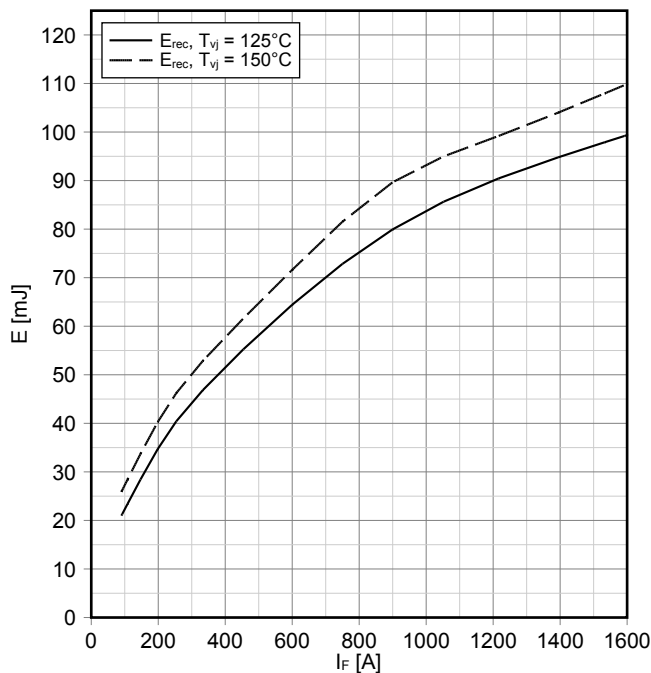
$I_F = f(V_F)$



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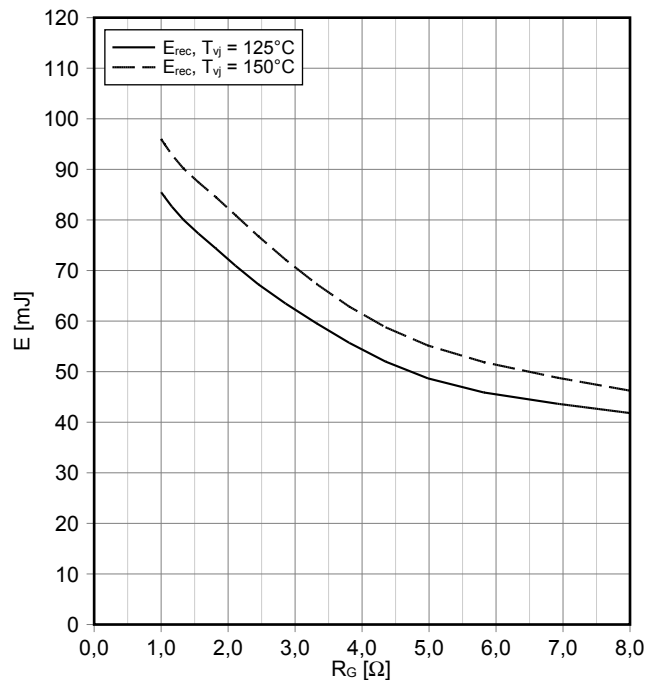
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.3 \Omega, V_{CE} = 600 V$



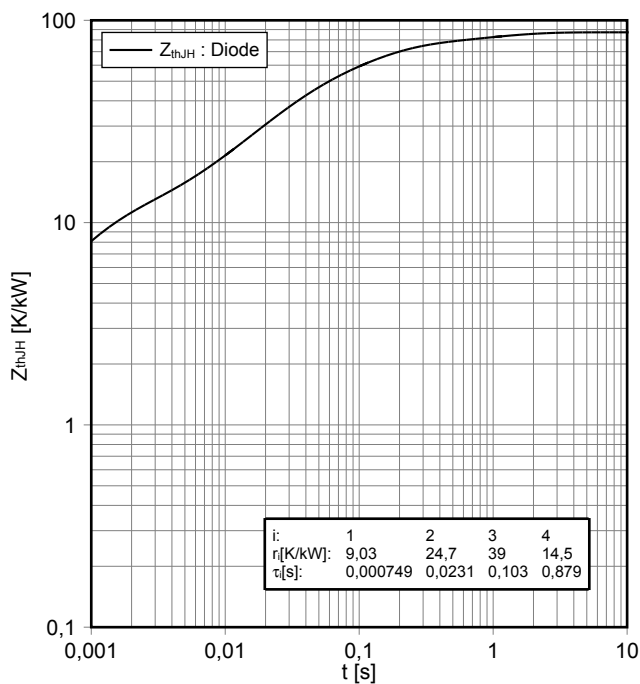
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 900 A, V_{CE} = 600 V$



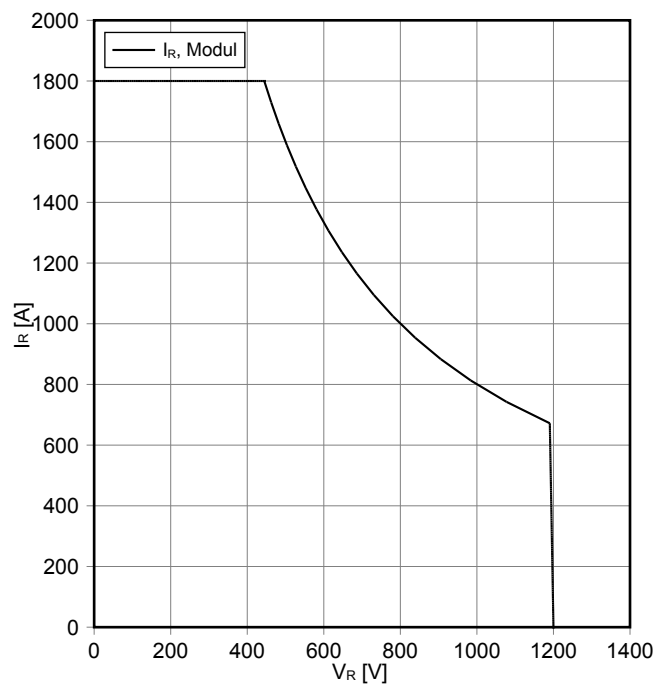
瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter

$Z_{thJH} = f(t)$



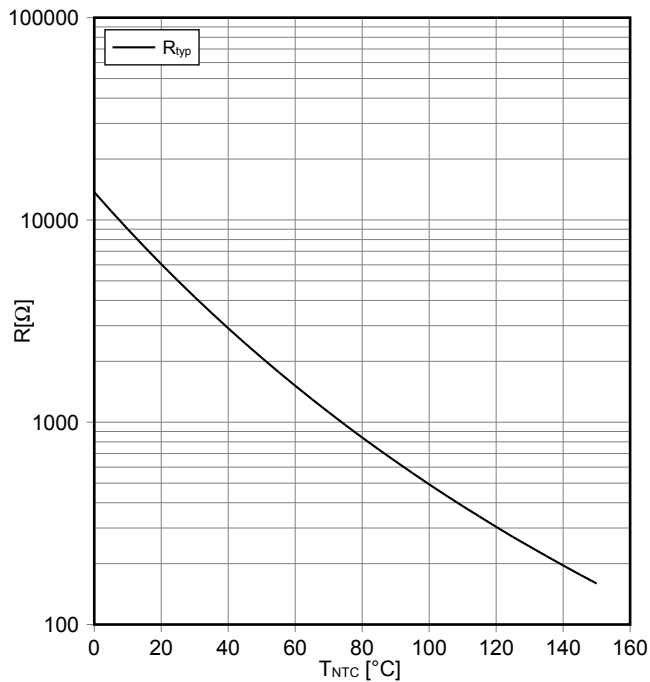
安全工作区 二极管,逆变器 (SOA)  
safe operation area Diode, Inverter (SOA)

$I_R = f(V_R)$   
 $T_{vj} = 150^\circ C$



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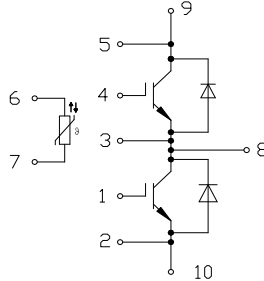
负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)  
 $R = f(T)$



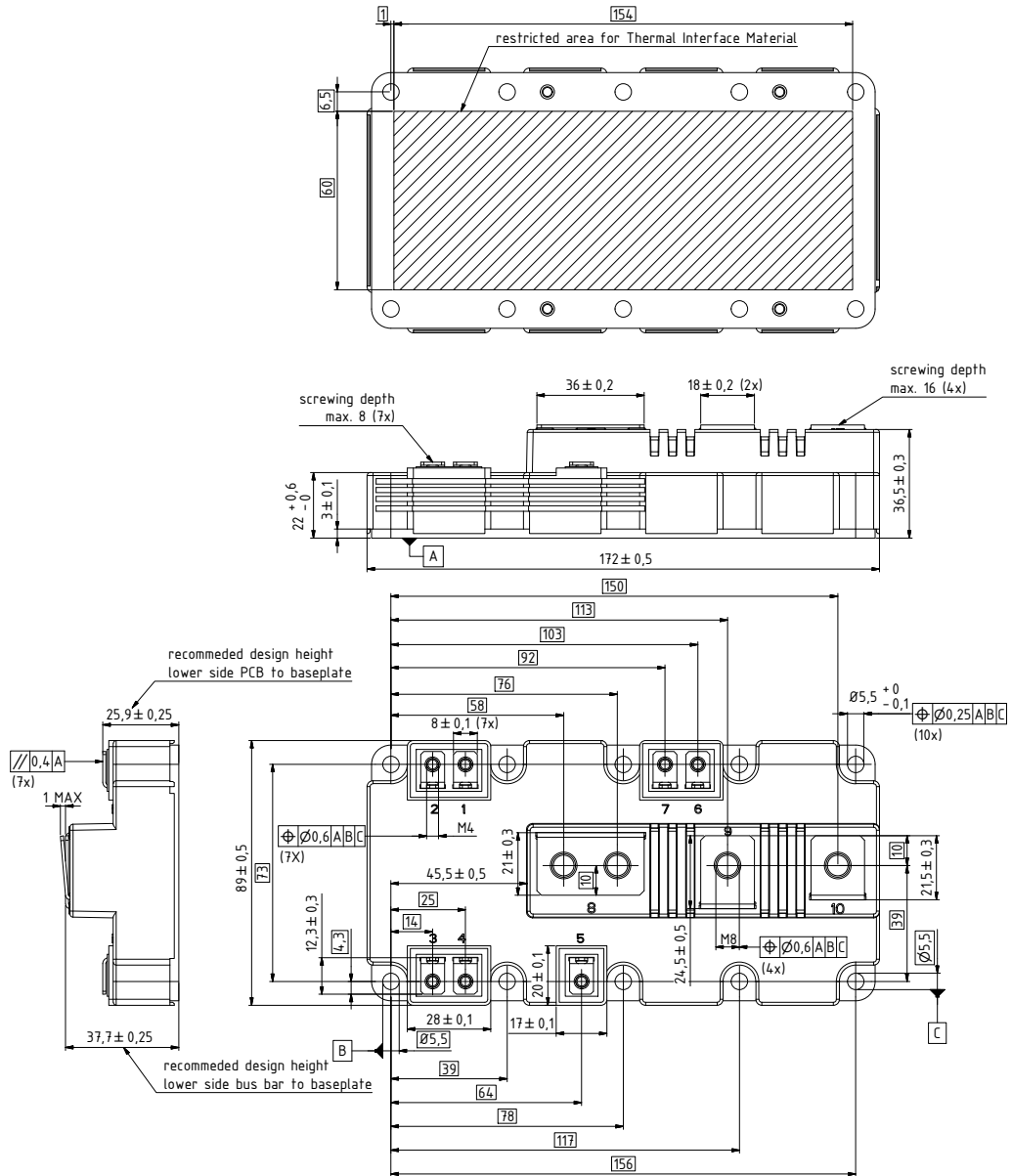
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## 接线图 / Circuit diagram



## 封装尺寸 / Package outlines



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