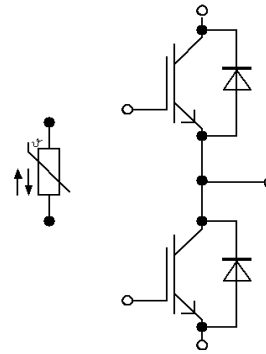
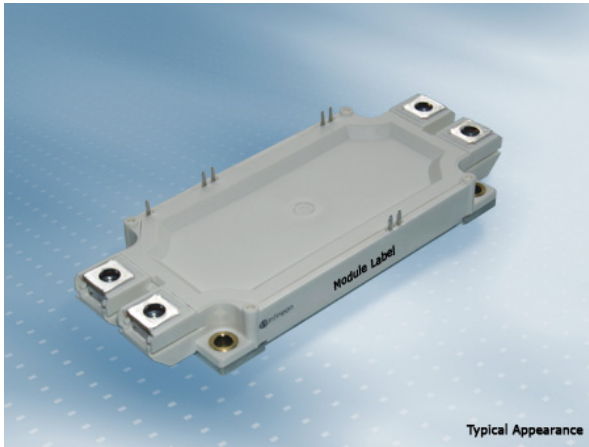


EconoDUAL™3 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管 带有温度检测NTC  
 EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC



$V_{CES} = 1200V$   
 $I_{C\ nom} = 600A / I_{CRM} = 1200A$

### 潜在应用

- UPS系统
- 伺服驱动器
- 大功率变流器
- 电机传动
- 风力发电机

### Potential Applications

- UPS systems
- Servo drives
- High power converters
- Motor drives
- Wind turbines

### 电气特性

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

### Electrical Features

- $T_{vj\ op} = 150^{\circ}C$
- $V_{CESat}$  with positive temperature coefficient
- Low  $V_{CESat}$

### 机械特性

- 标准封装
- 绝缘的基板
- 高功率密度

### Mechanical Features

- Standard housing
- Isolated base plate
- High power density

## 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<br>Collector-emitter voltage       | $T_{vj} = 25^{\circ}\text{C}$                                 | $V_{CES}$         | 1200  | V |
| 连续集电极直流电流<br>Continuous DC collector current   | $T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | $I_{C\text{nom}}$ | 600   | A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P = 1\text{ ms}$   | $I_{CRM}$         | 1200  | A |
| 栅极 - 发射极峰值电压<br>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<br>Collector-emitter saturation voltage | $I_C = 600\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 600\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 600\text{ A}, V_{GE} = 15\text{ V}$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{sat}}$ | 1,75<br>2,00<br>2,05 | 2,10   | V<br>V<br>V                                     |
| 栅极阈值电压<br>Gate threshold voltage                      | $I_C = 23,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$  |   | $V_{GEth}$         | 5,20                 | 5,80   | 6,40 V  |
| 栅极电荷<br>Gate charge                                   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$  |   | $Q_G$              | 4,40                 |        | $\mu\text{C}$                                   |
| 内部栅极电阻<br>Internal gate resistor                      | $T_{vj} = 25^{\circ}\text{C}$   |   | $R_{Gint}$         | 1,2                  |        | $\Omega$  |
| 输入电容<br>Input capacitance                             | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{ies}$          | 37,0                 |        | nF  |
| 反向传输电容<br>Reverse transfer capacitance                | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{res}$          | 2,05                 |        | nF  |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current      | $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$  |   | $I_{CES}$          |                      | 3,0    | mA  |
| 栅极-发射极漏电流<br>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)<br>Turn-on delay time, inductive load    | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,5\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{don}$          | 0,16<br>0,21<br>0,21 |        | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 上升时间(电感负载)<br>Rise time, inductive load               | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,5\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$              | 0,09<br>0,09<br>0,10 |        | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 关断延迟时间(电感负载)<br>Turn-off delay time, inductive load   | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,5\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{doff}$         | 0,48<br>0,61<br>0,65 |        | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 下降时间(电感负载)<br>Fall time, inductive load               | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,5\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$              | 0,07<br>0,11<br>0,12 |        | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 开通损耗能量(每脉冲)<br>Turn-on energy loss per pulse          | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 5100\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Gon} = 1,5\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$           | 62,5<br>83,0<br>90,0 |        | mJ<br>mJ<br>mJ                                  |
| 关断损耗能量(每脉冲)<br>Turn-off energy loss per pulse         | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3700\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$          | 47,0<br>72,0<br>79,5 |        | mJ<br>mJ<br>mJ                                  |
| 短路数据<br>SC data                                       | $V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$<br>$V_{CE\max} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$                                   |   | $I_{SC}$           | 2400                 |        | A   |
| 结 - 外壳热阻<br>Thermal resistance, junction to case      | 每个 IGBT / per IGBT  |   | $R_{thJC}$         |                      | 0,0473 | K/W   |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink    | 每个 IGBT / per IGBT<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$  |   | $R_{thCH}$         | 0,0304               |        | K/W   |
| 在开关状态下温度<br>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<br>Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$  | $V_{RRM}$ | 1200           | V  |
| 连续正向直流电流<br>Continuous DC forward current   |  | $I_F$     | 600            | A  |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P = 1 \text{ ms}$   | $I_{FRM}$ | 1200           | A  |
| $I^2t$ -值<br>$I^2t$ - value                 | $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$<br>$V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I^2t$    | 40000<br>37500 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

### 特征值 / Characteristic Values

|  |   |   | min.               | typ. | max.                 |        |   |
|--|---|---|--------------------|------|----------------------|--------|---|
| 正向电压<br>Forward voltage                            | $I_F = 600 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 600 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 600 \text{ A}, V_{GE} = 0 \text{ V}$           | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_F$              |      | 1,65<br>1,65<br>1,65 | 2,10   | V<br>V<br>V                                     |
| 反向恢复峰值电流<br>Peak reverse recovery current          | $I_F = 600 \text{ A}, -di_F/dt = 5100 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$           |      | 290<br>420<br>450    |        | A<br>A<br>A                                     |
| 恢复电荷<br>Recovered charge                           | $I_F = 600 \text{ A}, -di_F/dt = 5100 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$              |      | 62,0<br>115<br>130   |        | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| 反向恢复损耗 (每脉冲)<br>Reverse recovery energy            | $I_F = 600 \text{ A}, -di_F/dt = 5100 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$          |      | 22,0<br>44,0<br>51,0 |        | mJ<br>mJ<br>mJ                                  |
| 结 - 外壳热阻<br>Thermal resistance, junction to case   | 每个二极管 / per diode   |   | $R_{thJC}$         |      |                      | 0,0767 | K/W   |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |   | $R_{thCH}$         |      |                      | 0,0474 | K/W   |
| 在开关状态下温度<br>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<br>Rated resistance    | $T_{NTC} = 25^{\circ}\text{C}$                                 | $R_{25}$     |      | 5,00 |      | $\text{k}\Omega$ |
| R100 偏差<br>Deviation of R100 | $T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493 \Omega$          | $\Delta R/R$ | -5   |      | 5    | %                |
| 耗散功率<br>Power dissipation    | $T_{NTC} = 25^{\circ}\text{C}$                                 | $P_{25}$     |      |      | 20,0 | mW               |
| B-值<br>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<br>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<br>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.

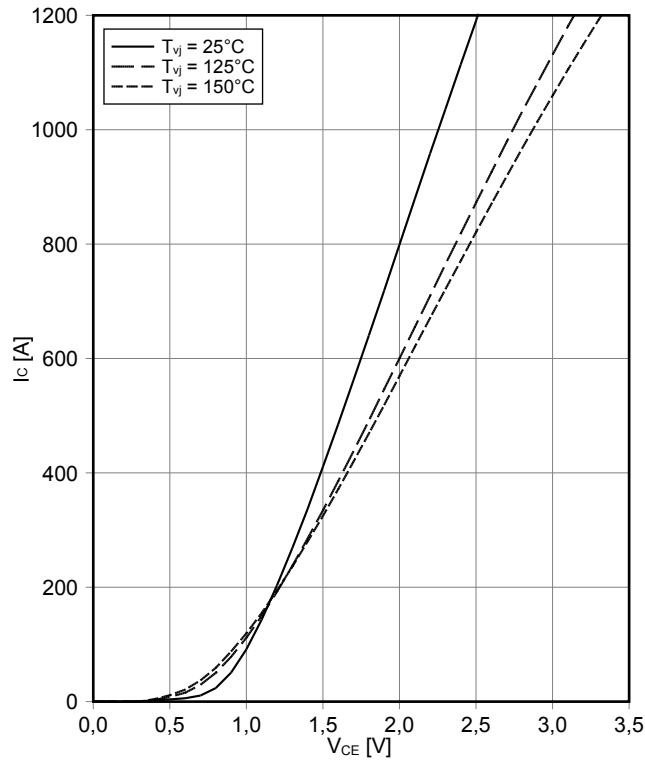
## 模块 / Module

|   |  |                     |                                |      |         |
|---|--|---------------------|--------------------------------|------|---------|
| 绝缘测试电压<br>Isolation test voltage                          | RMS, f = 50 Hz, t = 1 min  | V <sub>ISOL</sub>   | 3,4                            |      | kV      |
| 模块基板材料<br>Material of module baseplate                    |  |                     | Cu                             |      |         |
| 内部绝缘<br>Internal isolation                                | 基本绝缘 (class 1, IEC 61140)<br>basic insulation (class 1, IEC 61140)             |                     | Al <sub>2</sub> O <sub>3</sub> |      |         |
| 爬电距离<br>Creepage distance                                 | 端子至散热器 / terminal to heatsink<br>端子至端子 / terminal to terminal                  |                     | 14,5<br>13,0                   |      | mm      |
| 电气间隙<br>Clearance   | 端子至散热器 / terminal to heatsink<br>端子至端子 / terminal to terminal                  |                     | 12,5<br>10,0                   |      | mm      |
| 相对电痕指数<br>Comperative tracking index                      |  | CTI                 | > 200                          |      |         |
|   |  |                     | min.                           | typ. | max.    |
| 杂散电感, 模块<br>Stray inductance module                       |  | L <sub>SCE</sub>    |                                | 20   | nH      |
| 模块引线电阻, 端子-芯片<br>Module lead resistance, terminals - chip | T <sub>c</sub> = 25°C, 每个开关 / per switch                                       | R <sub>CC+EE'</sub> |                                | 1,00 | mΩ      |
| 储存温度<br>Storage temperature                               |  | T <sub>stg</sub>    | -40                            |      | 125 °C  |
| 模块安装的安装扭矩<br>Mounting torque for modul mounting           | 螺丝 M5 根据相应的应用手册进行安装<br>Screw M5 - Mounting according to valid application note | M                   | 3,00                           |      | 6,00 Nm |
| 端子联接扭矩<br>Terminal connection torque                      | 螺丝 M6 根据相应的应用手册进行安装<br>Screw M6 - Mounting according to valid application note | M                   | 3,0                            | -    | 6,0 Nm  |
| 重量<br>Weight  |  | G                   |                                | 345  | g       |

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

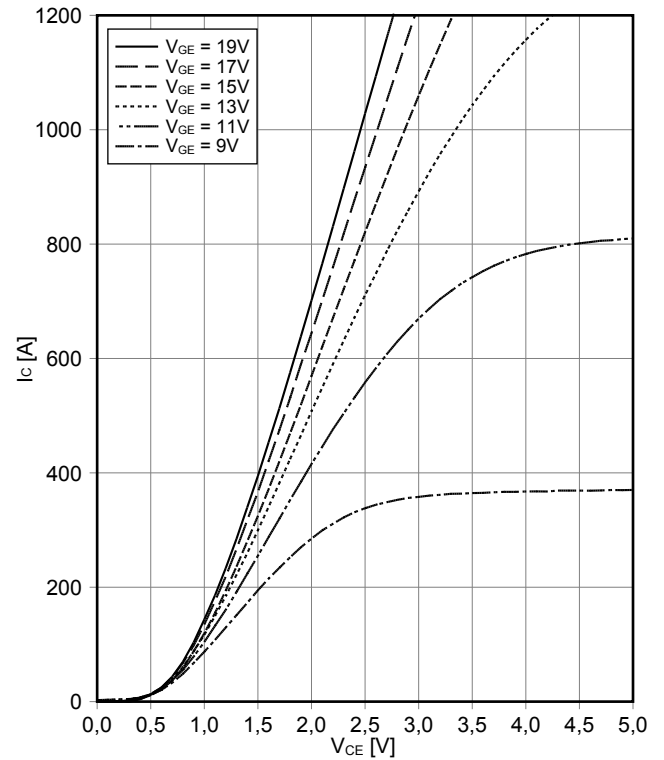
$I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

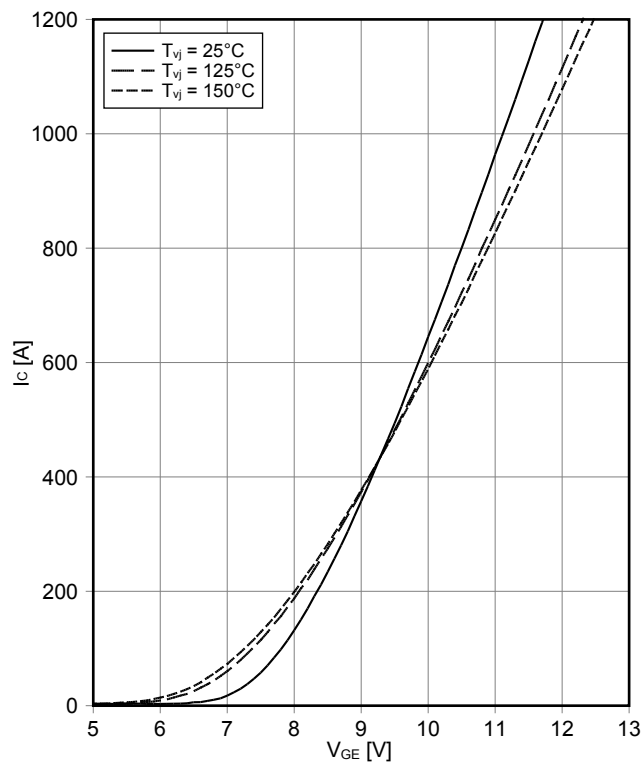
$I_C = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

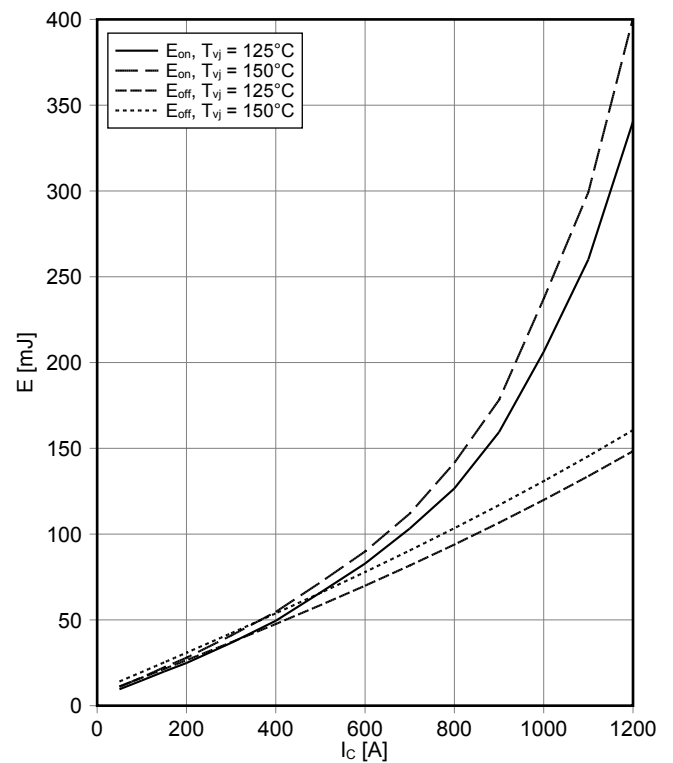
$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)

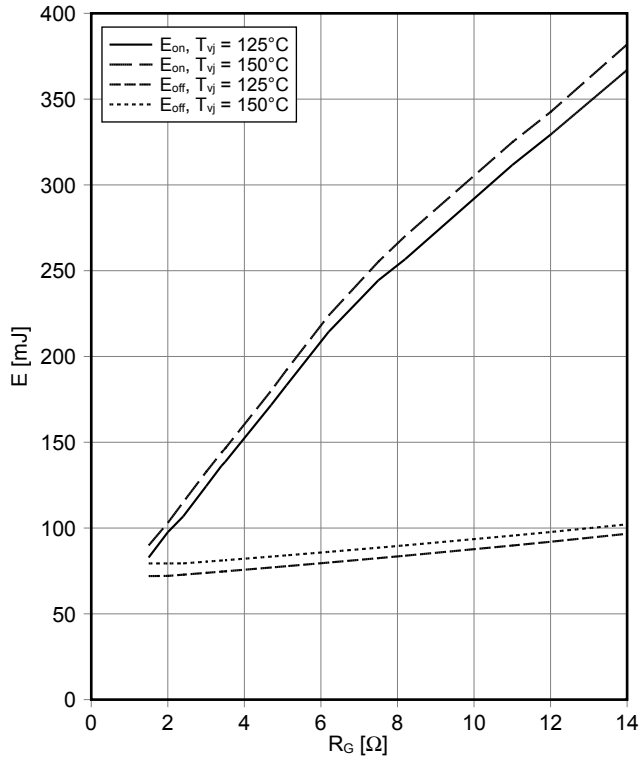
switching losses IGBT, Inverter (typical)

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



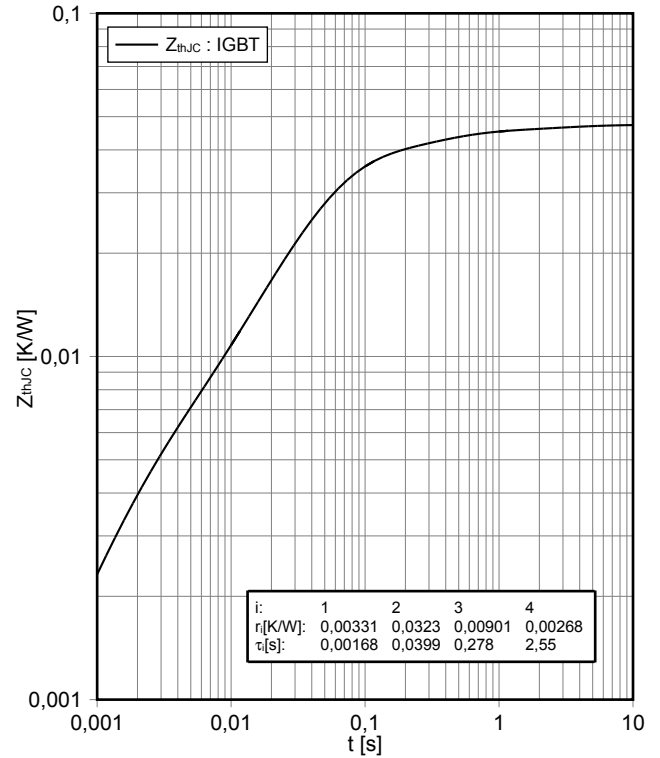
开关损耗 IGBT, 逆变器 (典型)  
**switching losses IGBT, Inverter (typical)**

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



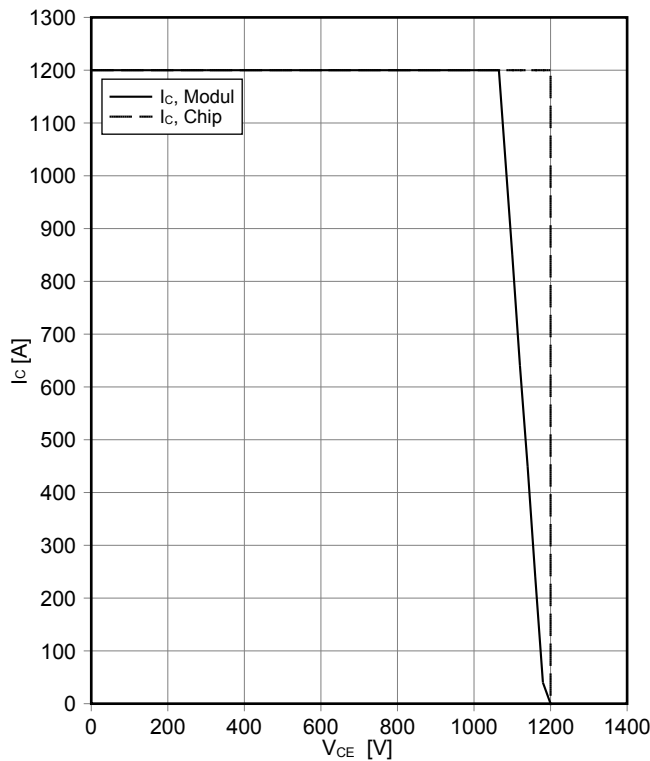
瞬态热阻抗 IGBT, 逆变器  
**transient thermal impedance IGBT, Inverter**

$Z_{thJC} = f(t)$



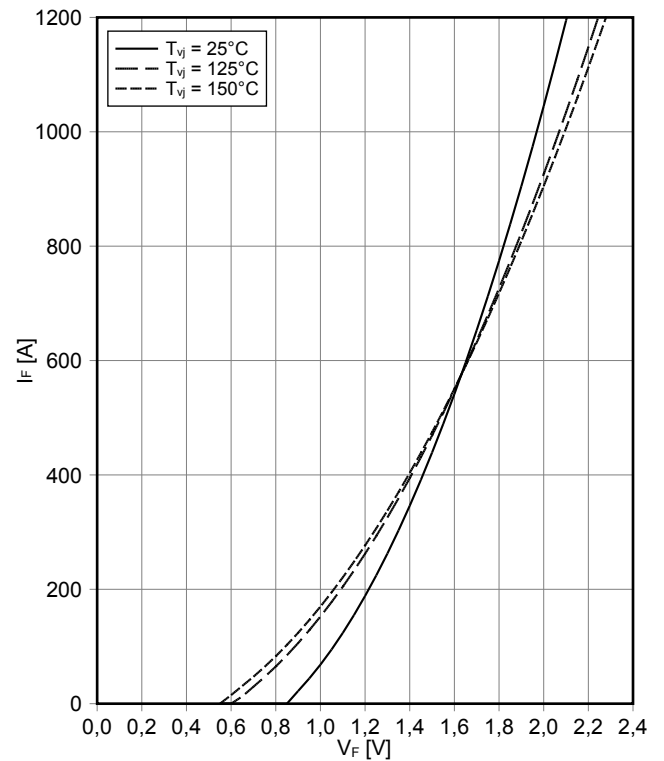
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
**reverse bias safe operating area IGBT, Inverter (RBSOA)**

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



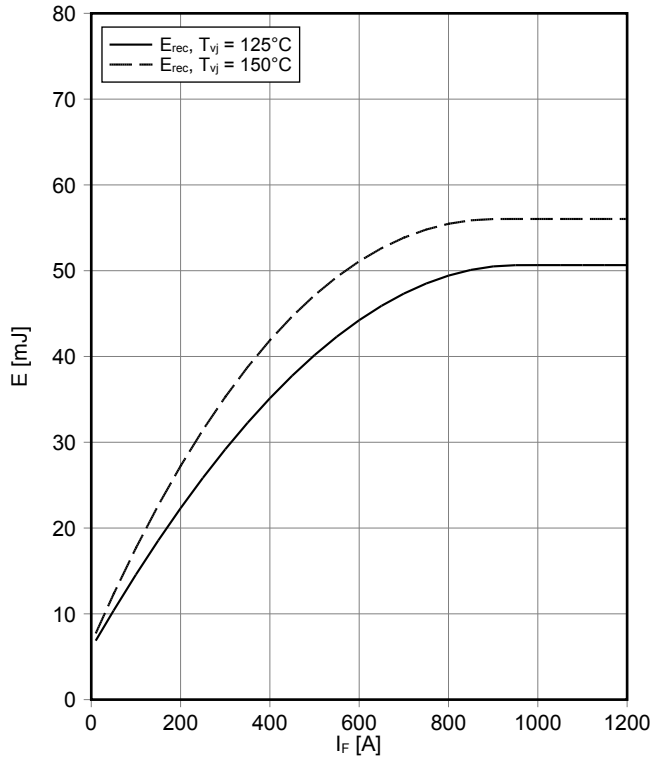
正向偏压特性 二极管, 逆变器 (典型)  
**forward characteristic of Diode, Inverter (typical)**

$I_F = f(V_F)$



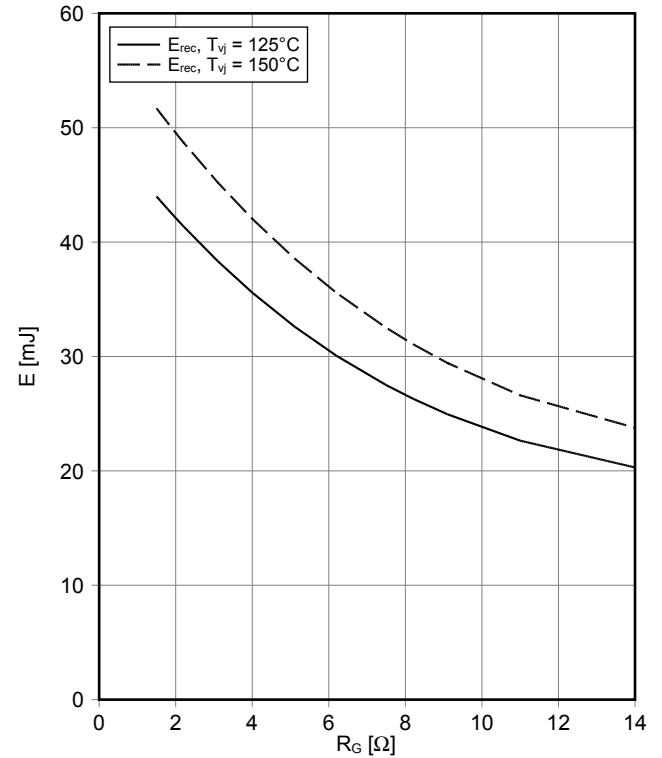
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.5 \Omega, V_{CE} = 600 V$



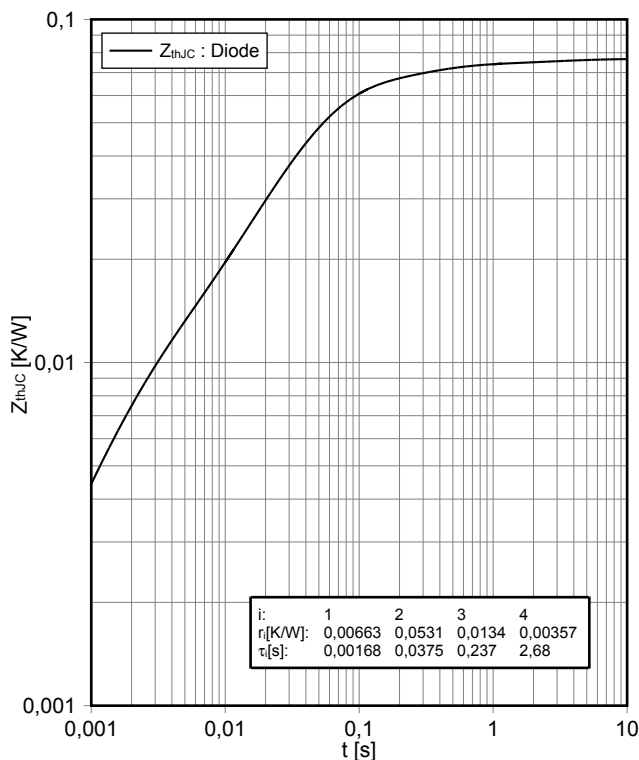
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

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



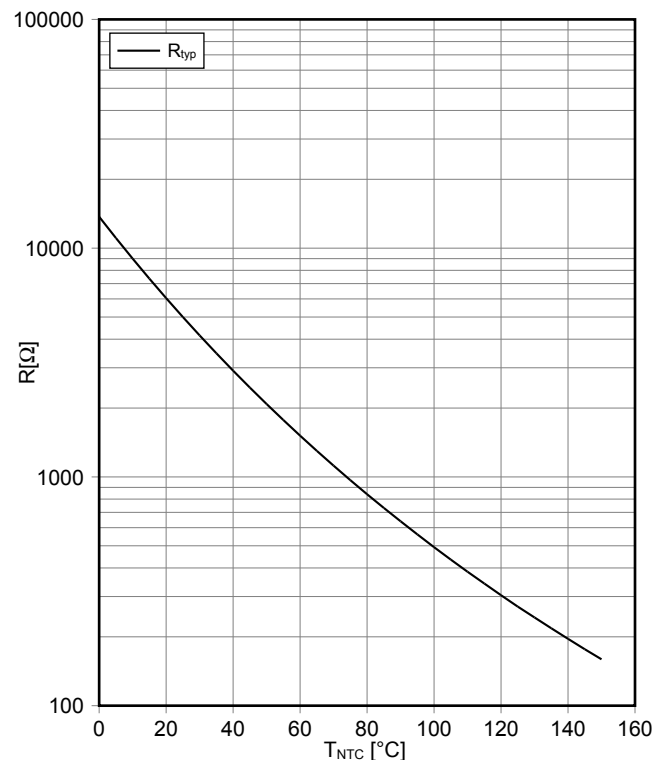
瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

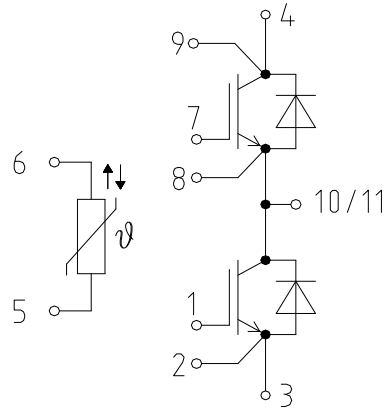


负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)

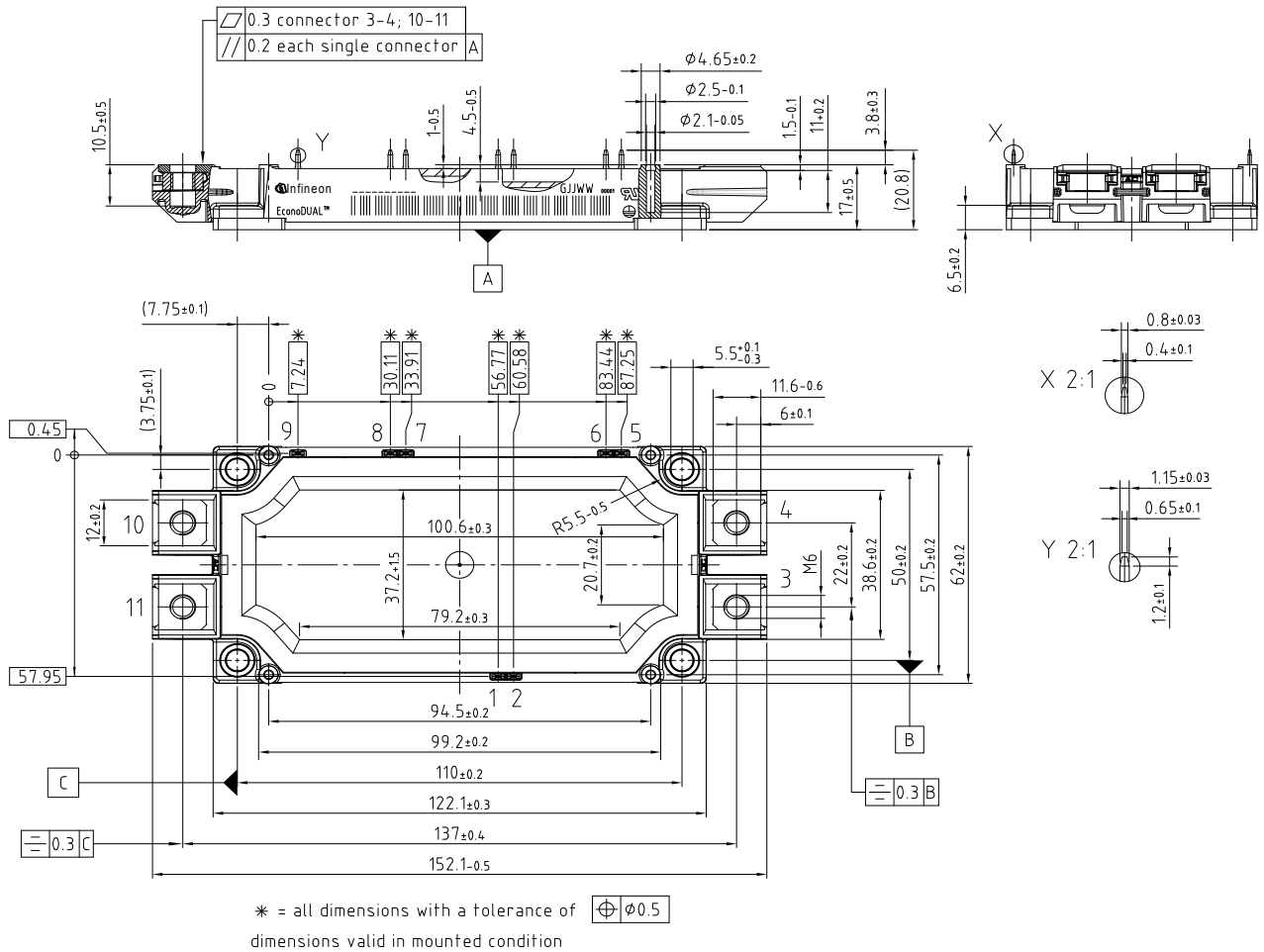
$R = f(T)$



## 接线图 / Circuit diagram



## 封装尺寸 / Package outlines





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