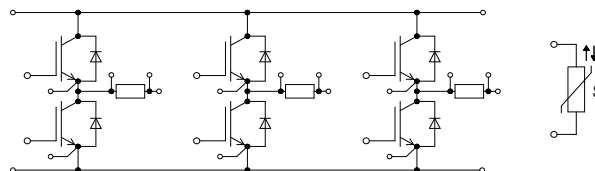
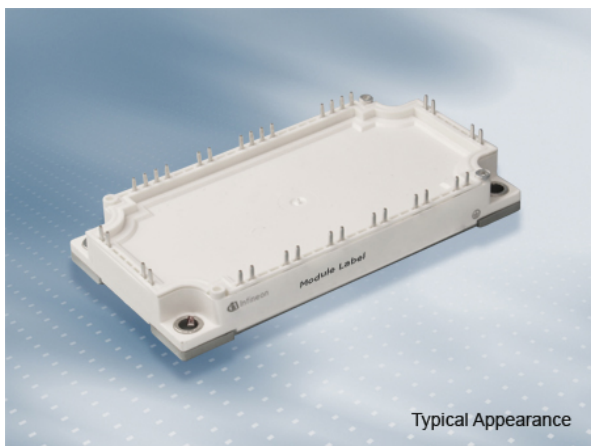


MIPAQ™base 模块 采用第四代沟槽栅/场终止IGBT和HE型发射机控制二极管 带有电流采样电阻  
MIPAQ™base module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and current sense shunt

## 初步数据 / Preliminary Data



$V_{CES} = 1200V$   
 $I_{C\ nom} = 100A / I_{CRM} = 200A$

## 典型应用

- 电机传动
- 伺服驱动器

## 电气特性

- 低开关损耗
- $T_{vj\ op} = 150^{\circ}C$
- 低  $V_{CEsat}$

## 机械特性

- 高功率周次和温度周次能力
- 绝缘的基板
- 铜基板
- 标封装

## Typical Applications

- Motor Drives
- Servo Drives

## Electrical Features

- Low Switching Losses
- $T_{vj\ op} = 150^{\circ}C$
- Low  $V_{CEsat}$

## Mechanical Features

- High Power and Thermal Cycling Capability
- Isolated Base Plate
- Copper Base Plate
- Standard Housing

## 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 |

|                 |                                 |  |
|-----------------|---------------------------------|--|
| prepared by: CM | date of publication: 2013-03-06 |  |
| approved by: MS | revision: 2.0                   |  |

初步数据  
Preliminary Data

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   | $T_C = 95^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 100   | A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P = 1\text{ ms}$                                      | $I_{CRM}$          | 200   | A |
| 总损耗<br>Total power dissipation                 | $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $P_{tot}$          | 515   | W |
| 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 | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 100\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                                          | $T_{vj} = 25^{\circ}\text{C}$<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                      | $I_C = 4,00\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                            |                                                                                                   | $V_{G\text{Eth}}$   | 5,2                   | 5,8  | 6,4 V                                           |
| 栅极电荷<br>Gate charge                                   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                                                      |                                                                                                   | $Q_G$               | 0,80                  |      | $\mu\text{C}$                                   |
| 内部栅极电阻<br>Internal gate resistor                      | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                                                   |                                                                                                   | $R_{G\text{int}}$   | 7,5                   |      | $\Omega$                                        |
| 输入电容<br>Input capacitance                             | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                      |                                                                                                   | $C_{ies}$           | 6,30                  |      | nF                                              |
| 反向传输电容<br>Reverse transfer capacitance                | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                      |                                                                                                   | $C_{res}$           | 0,27                  |      | nF                                              |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current      | $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                      |                                                                                                   | $I_{CES}$           |                       | 1,0  | mA                                              |
| 栅极-发射极漏电流<br>Gate-emitter leakage current             | $V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                        |                                                                                                   | $I_{GES}$           |                       | 100  | nA                                              |
| 开通延迟时间(电感负载)<br>Turn-on delay time, inductive load    | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,6\text{ }\Omega$                                                                                      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ on}}$   | 0,16<br>0,17<br>0,18  |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 上升时间(电感负载)<br>Rise time, inductive load               | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,6\text{ }\Omega$                                                                                      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$               | 0,025<br>0,03<br>0,03 |      | $\mu\text{s}$<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   | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,6\text{ }\Omega$                                                                                     | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ off}}$  | 0,37<br>0,45<br>0,48  |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 下降时间(电感负载)<br>Fall time, inductive load               | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,6\text{ }\Omega$                                                                                     | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$               | 0,06<br>0,11<br>0,13  |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| 开通损耗(每脉冲)<br>Turn-on energy loss per pulse            | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}, L_S = 40\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 3700\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$R_{Gon} = 1,6\text{ }\Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$            | 4,00<br>6,50<br>7,50  |      | mJ<br>mJ<br>mJ                                  |
| 关断损耗(每脉冲)<br>Turn-off energy loss per pulse           | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}, L_S = 40\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3400\text{ V}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$R_{Goff} = 1,6\text{ }\Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$           | 7,60<br>11,0<br>12,5  |      | mJ<br>mJ<br>mJ                                  |
| 短路数据<br>SC data                                       | $V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$<br>$V_{CE\text{ max}} = V_{CES} - L_{SCE} \cdot di/dt$<br>$t_P \leq 10\text{ }\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$                       |                                                                                                   | $I_{SC}$            | 400                   |      | A                                               |
| 结 - 壳热阻<br>Thermal resistance, junction to case       | 每个 IGBT / per IGBT                                                                                                                                                                              |                                                                                                   | $R_{thJC}$          |                       | 0,29 | K/W                                             |
| 壳 - 散热器热阻<br>Thermal resistance, case to heatsink     | 每个 IGBT / per IGBT<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$                                              |                                                                                                   | $R_{thCH}$          | 0,086                 |      | K/W                                             |

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revision: 2.0

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<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   |                                                                                                                                              | $I_F$     | 100          | A                                            |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P = 1\text{ ms}$                                                                                                                          | $I_{FRM}$ | 200          | 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>$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I_{2t}$  | 1550<br>1500 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

特征值 / Characteristic Values

|                                                   |                                                                                                                                                     |                                                                                                   | min.       | typ.                 | max. |                                                 |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|----------------------|------|-------------------------------------------------|
| 正向电压<br>Forward voltage                           | $I_F = 100\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$                 | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_F$      | 1,70<br>1,65<br>1,65 | 2,15 | V<br>V<br>V                                     |
| 反向恢复峰值电流<br>Peak reverse recovery current         | $I_F = 100\text{ A}, -di_F/dt = 3400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$   | 150<br>160<br>165    |      | A<br>A<br>A                                     |
| 恢复电荷<br>Recovered charge                          | $I_F = 100\text{ A}, -di_F/dt = 3400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$      | 9,60<br>17,0<br>19,0 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| 反向恢复损耗 (每脉冲)<br>Reverse recovery energy           | $I_F = 100\text{ A}, -di_F/dt = 3400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$  | 4,10<br>7,00<br>8,00 |      | mJ<br>mJ<br>mJ                                  |
| 结 - 壳热阻<br>Thermal resistance, junction to case   | 每个二极管 / per diode                                                                                                                                   |                                                                                                   | $R_{thJC}$ |                      | 0,50 | K/W                                             |
| 壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$ |                                                                                                   | $R_{thCH}$ | 0,15                 |      | K/W                                             |

电流取样电阻 / Shunt

|                                                    |                                           |            | min. | typ. | max. |                    |
|----------------------------------------------------|-------------------------------------------|------------|------|------|------|--------------------|
| 额定电阻值<br>Rated resistance                          | $T_c = 20^{\circ}\text{C}$                | $R_{20}$   |      | 1,50 |      | m $\Omega$         |
| 温度系数 (tcr)<br>Temperature coefficient (tcr)        | $20^{\circ}\text{C} - 60^{\circ}\text{C}$ |            |      | < 30 |      | ppm/K              |
| 电流取样电阻工作温度<br>Operation temperature shunt-resistor |                                           | $T_{vjop}$ |      |      | 200  | $^{\circ}\text{C}$ |
| 结 - 壳热阻<br>Thermal resistance; junction to case    |                                           | $R_{thJC}$ |      |      | 8,7  | K/W                |

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    | $T_c = 25^{\circ}\text{C}$                                    | $R_{25}$     |      | 5,00 |      | k $\Omega$ |
| R100 偏差<br>Deviation of R100 | $T_c = 100^{\circ}\text{C}, R_{100} = 493\text{ }\Omega$      | $\Delta R/R$ | -5   |      | 5    | %          |
| 耗散功率<br>Power dissipation    | $T_c = 25^{\circ}\text{C}$                                    | $P_{25}$     |      |      | 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.

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: CM | date of publication: 2013-03-06 |
| approved by: MS | revision: 2.0                   |

初步数据  
Preliminary Data

模块 / Module

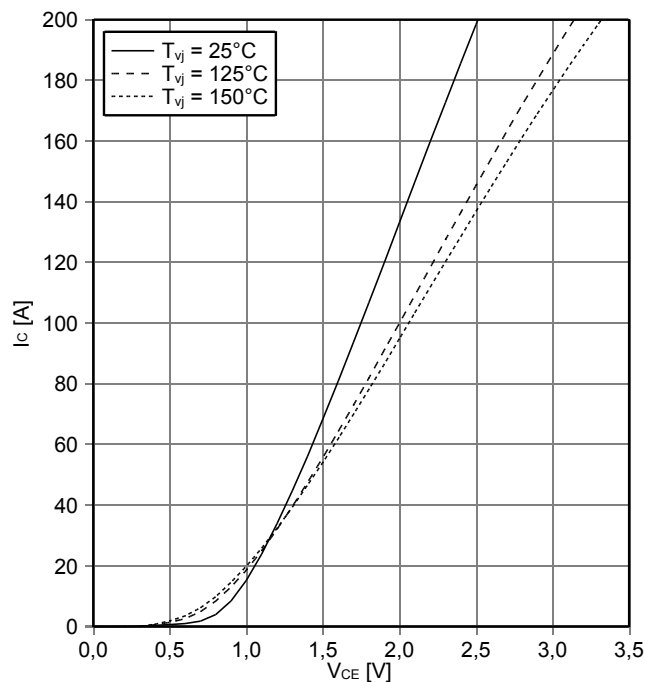
|                                                          |                                                                                                                                       |                      |                                |           |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------|-----------|
| 绝缘测试电压<br>Isolation test voltage                         | RMS, f = 50 Hz, t = 1 min                                                                                                             | V <sub>ISOL</sub>    | 2,5                            | kV        |
| 模块基板材料<br>Material of module baseplate                   |                                                                                                                                       |                      | Cu                             |           |
| 内部绝缘材料<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                                | 如何与取得联系- 散热片 / terminal to heatsink<br>如何与取得联系- 如何与取得联系 / terminal to terminal                                                        |                      | 10,0                           | mm        |
| 电气间隙<br>Clearance                                        | 如何与取得联系- 散热片 / terminal to heatsink<br>如何与取得联系- 如何与取得联系 / terminal to terminal                                                        |                      | 7,5                            | mm        |
| 相对电痕指数<br>Comperative tracking index                     |                                                                                                                                       | CTI                  | > 200                          |           |
| min. typ. max.                                           |                                                                                                                                       |                      |                                |           |
| 壳 - 散热器热阻<br>Thermal resistance, case to heatsink        | 每个模块 / per module<br>$\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$ | R <sub>thCH</sub>    | 0,009                          | K/W       |
| 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> | 1,80                           | mΩ        |
| 最大结温<br>Maximum junction temperature                     | 逆变器,制动-斩波器 / inverter, brake-chopper                                                                                                  | T <sub>vj max</sub>  | 175                            | °C        |
| 在开关状态下温度<br>Temperature under switching conditions       | 逆变器,制动-斩波器 / inverter, brake-chopper                                                                                                  | T <sub>vj op</sub>   | -40                            | 150 °C    |
| 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 |
| 重量<br>Weight                                             |                                                                                                                                       | G                    | 300                            | g         |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: CM | date of publication: 2013-03-06 |
| approved by: MS | revision: 2.0                   |

初步数据  
Preliminary Data

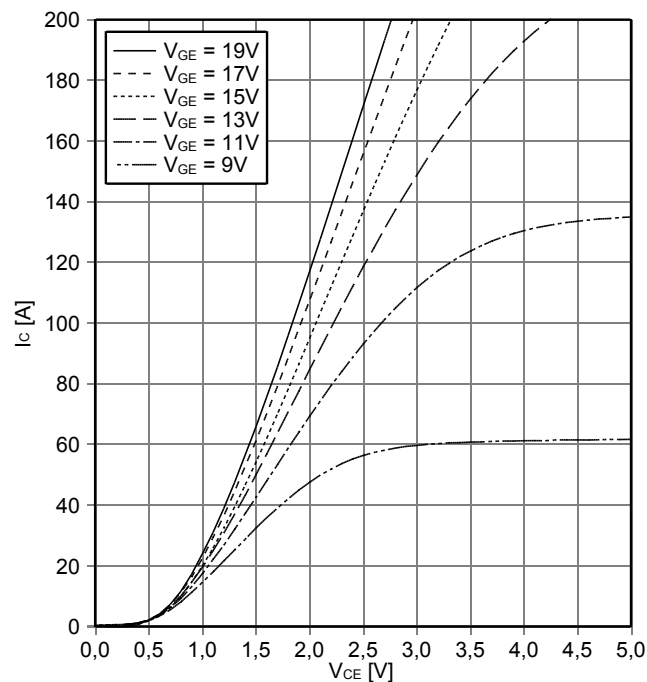
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



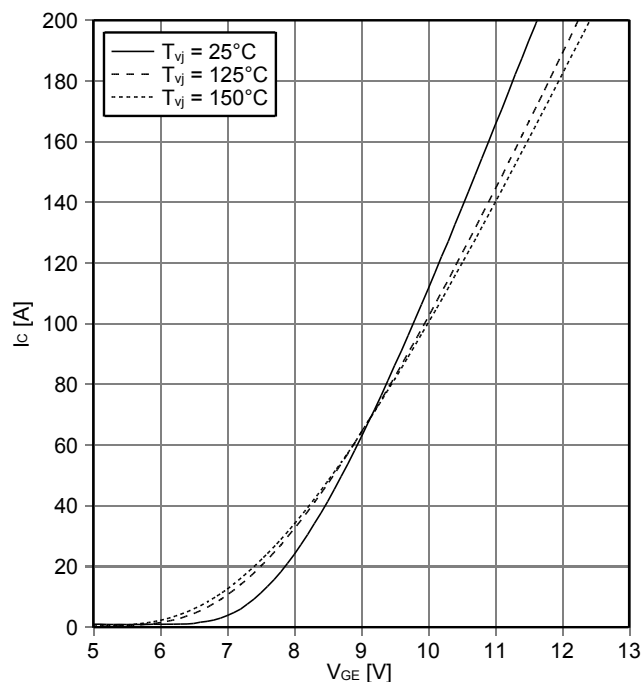
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

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



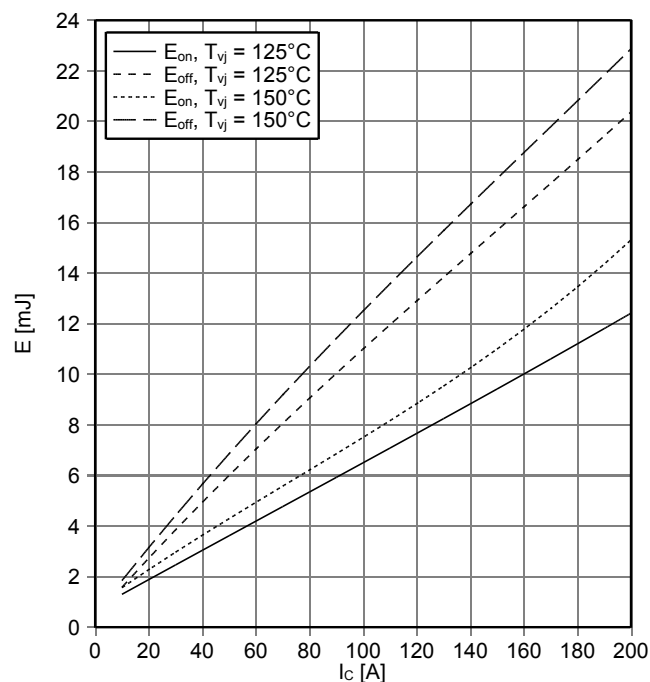
传输特性 IGBT, 逆变器 (典型)  
transfer characteristic IGBT, Inverter (typical)

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



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

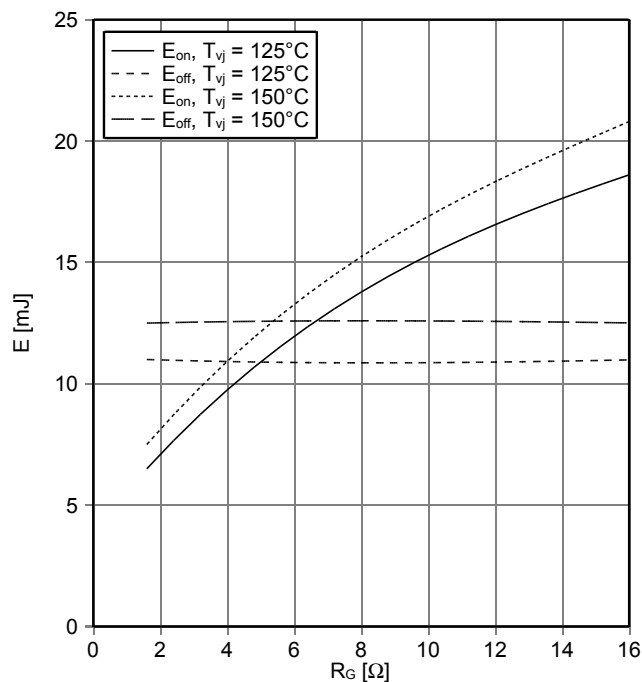
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 1.6\ \Omega$ ,  $R_{Goff} = 1.6\ \Omega$ ,  $V_{CE} = 600\text{ V}$



初步数据  
Preliminary Data

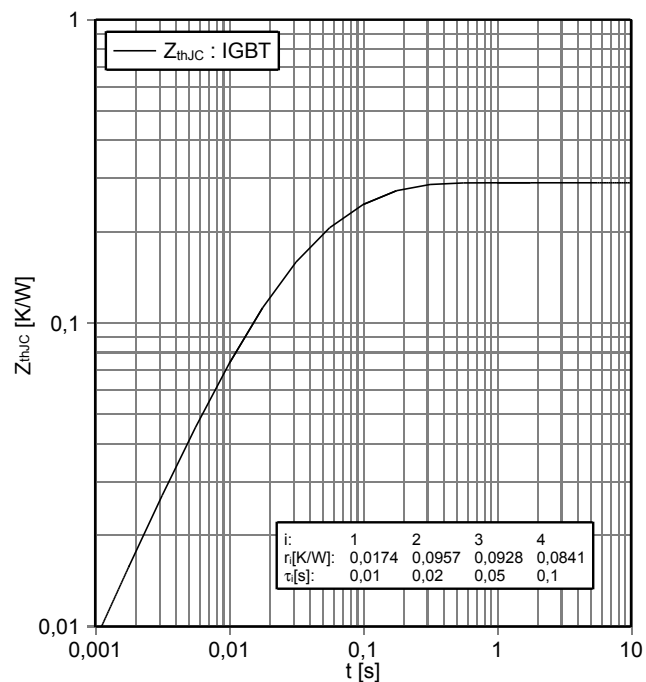
开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 100\text{ A}$ ,  $V_{CE} = 600\text{ V}$



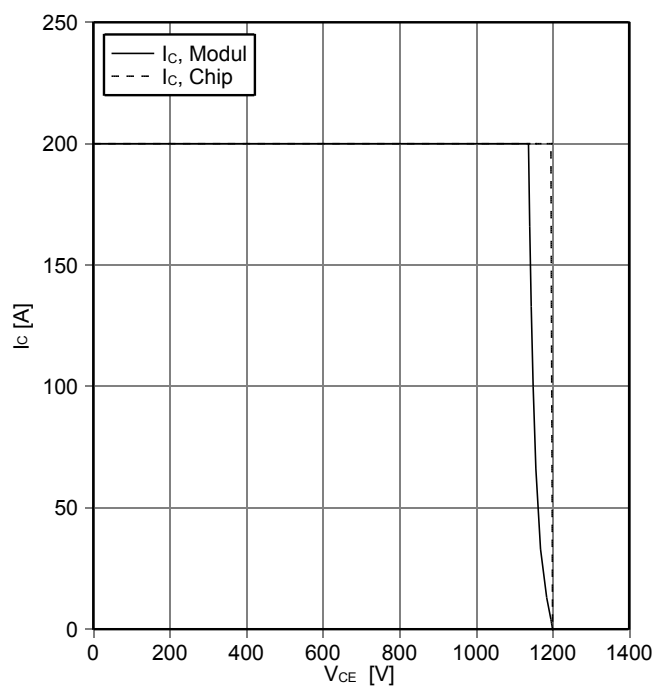
瞬态热阻抗 IGBT, 逆变器  
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



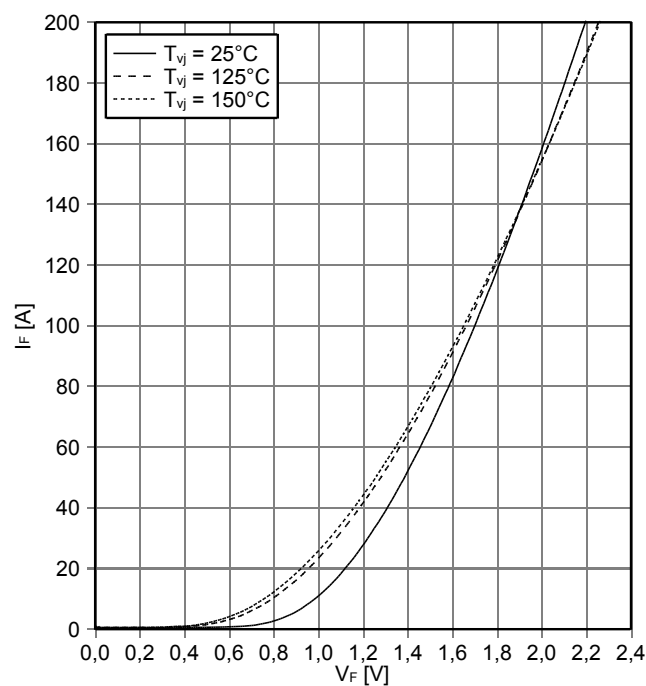
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 1.6\text{ Ω}$ ,  $T_{vj} = 150^\circ\text{C}$



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

$I_F = f(V_F)$



prepared by: CM

date of publication: 2013-03-06

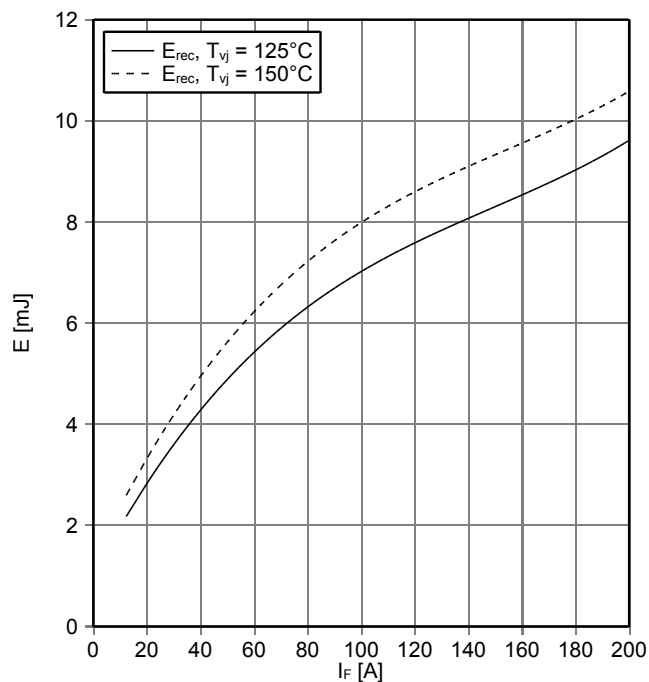
approved by: MS

revision: 2.0

初步数据  
Preliminary Data

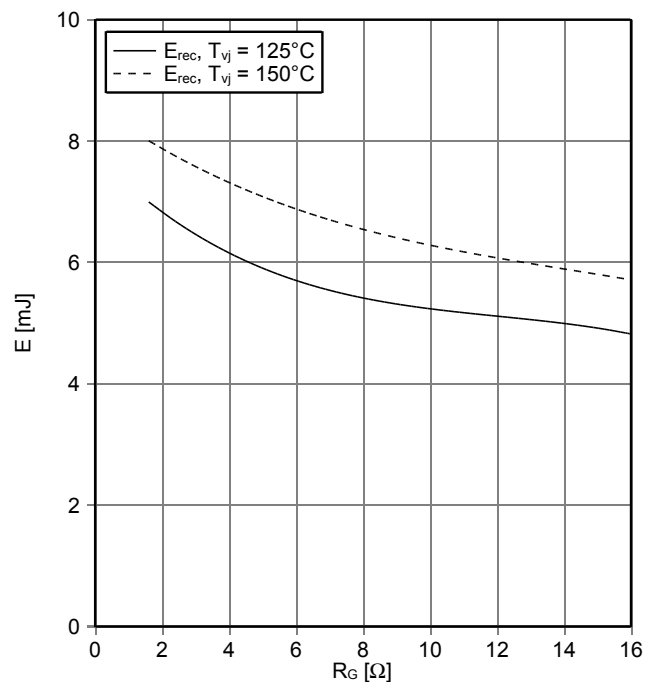
开关损耗 二极管, 逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.6 \Omega$ ,  $V_{CE} = 600 V$



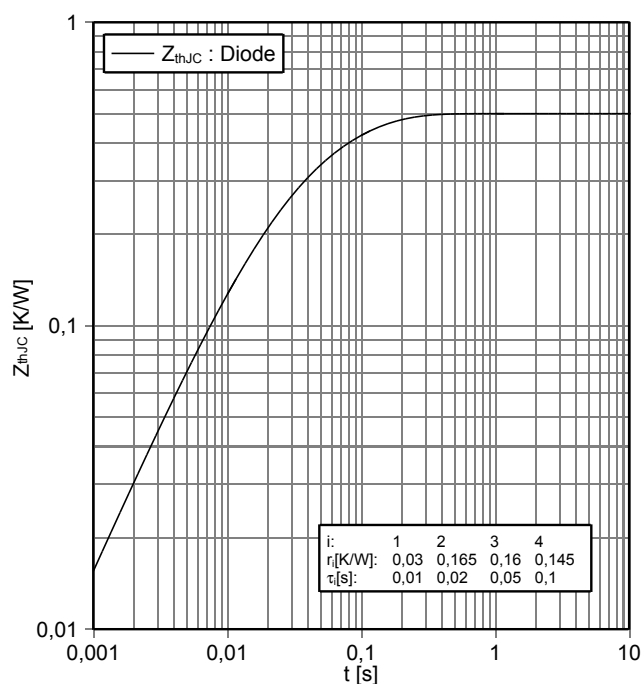
开关损耗 二极管, 逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 100 A$ ,  $V_{CE} = 600 V$



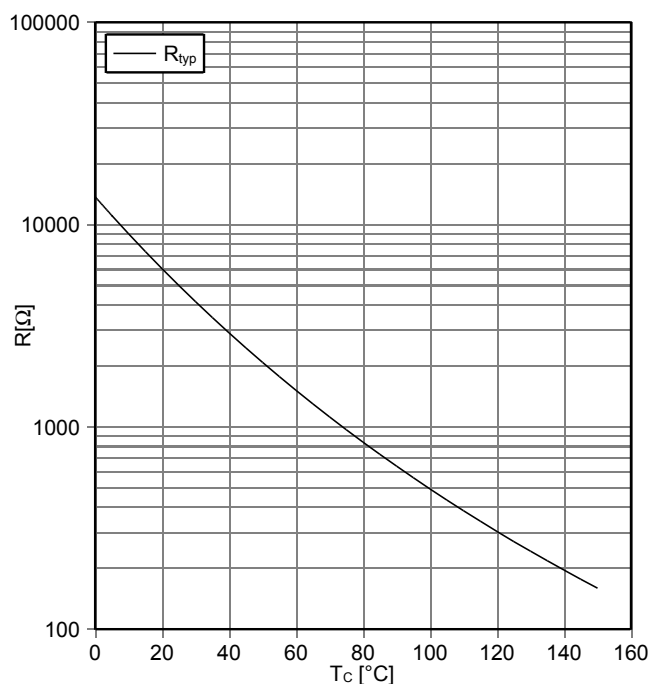
瞬态热阻抗 二极管, 逆变器  
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

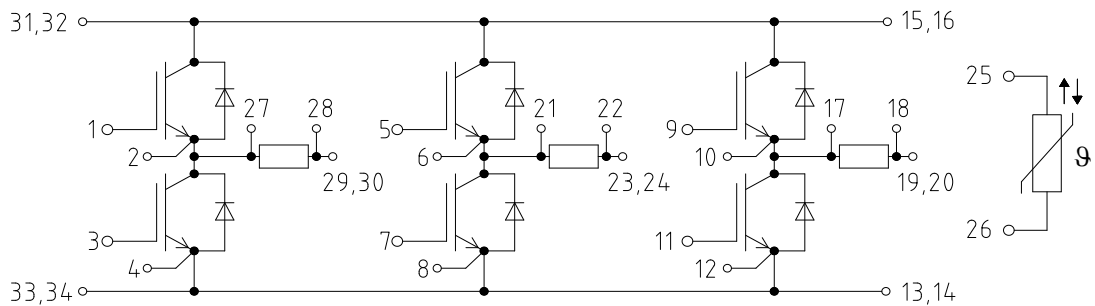


负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)

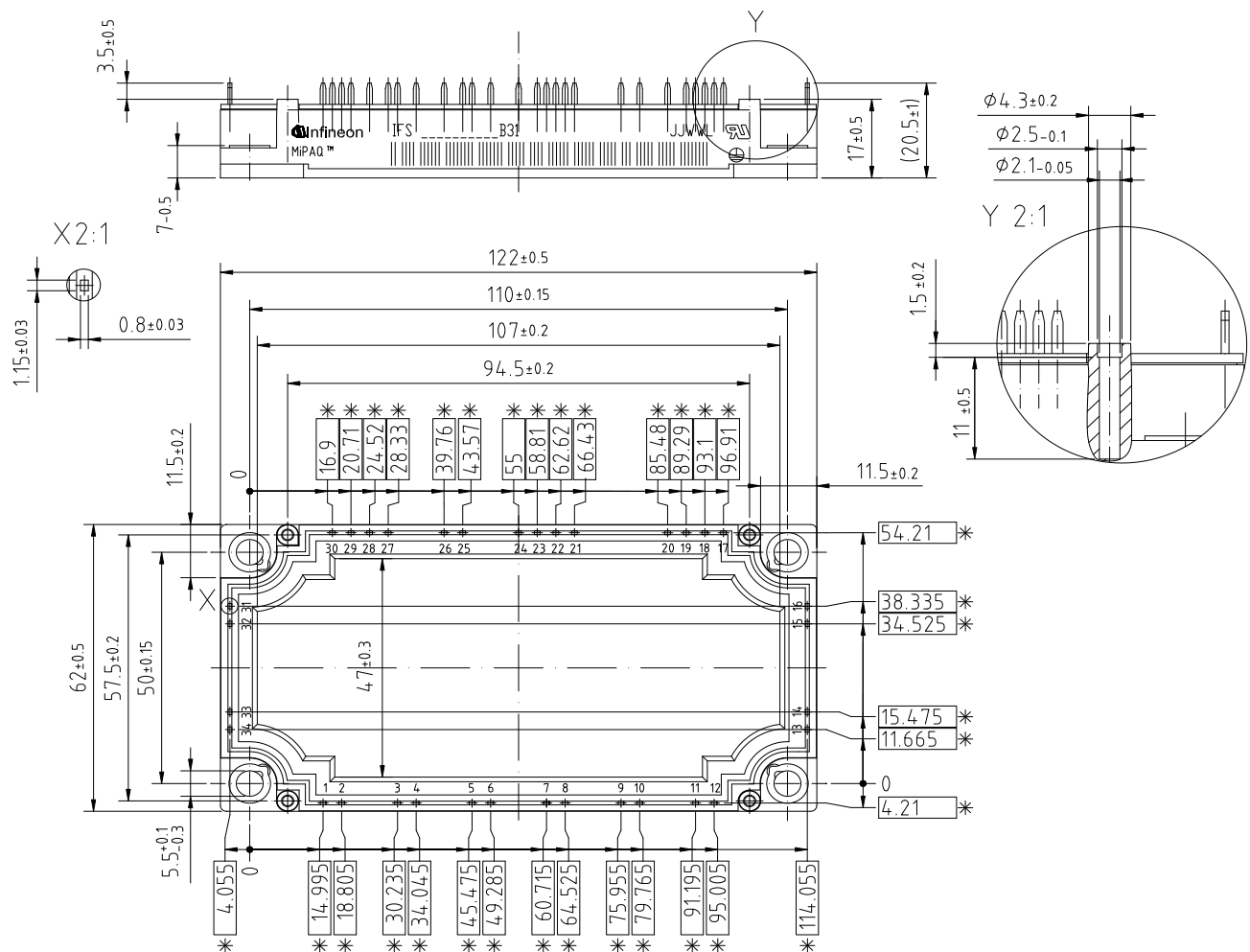
$R = f(T)$



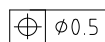
### 接线图 / circuit\_diagram\_headline



## 封裝尺寸 / package outlines



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



|                 |                                 |
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