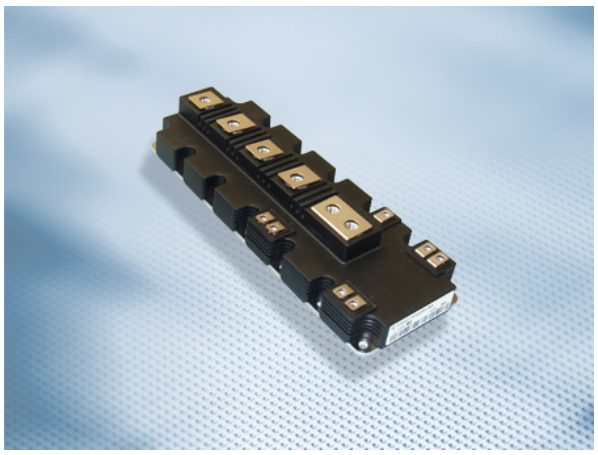
# 技术信息 / Technical Information

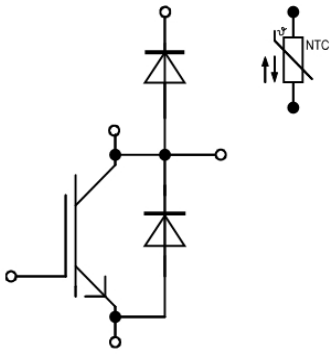
IGBT-模块
IGBT-modules

# DF1000R17IE4D_B2

PrimePACK™3 模块 带有温度检测NTC
PrimePACK™3 module and NTC

**初步数据 / Preliminary Data**






$V_{CES}$ = 1700V
$I_{C\ nom}$ = 1000A / $I_{CRM}$ = 2000A

**典型应用**
- 三电平应用
- 斩波应用
- 辅助逆变器
- 大功率变流器
- 电机传动
- 牵引变流器
- 风力发电机

**Typical Applications**
- 3-Level-Applications
- Chopper Applications
- Auxiliary Inverters
- High Power Converters
- Motor Drives
- Traction Drives
- Wind Turbines

**电气特性**
- 提高工作结温 $T_{vj\ op}$
- 高直流电压稳定性
- 高电流密度
- 低开关损耗
- 低 $V_{CEsat}$
- $T_{vj\ op}$ = 150°C
- 增大的二极管针对反馈运行模式

**Electrical Features**
- Extended Operation Temperature $T_{vj\ op}$
- High DC Stability
- High Current Density
- Low Switching Losses
- Low $V_{CEsat}$
- $T_{vj\ op}$ = 150°C
- Enlarged Diode for regenerative operation

**机械特性**
- 封装的 CTI > 400
- 高爬电距离和电气间隙
- 高功率循环和温度循环能力
- 高功率密度

**Mechanical Features**
- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power and Thermal Cycling Capability
- High Power Density

## Module Label Code

**Barcode Code 128**

Sample
00000123456000000000000

**DMX - 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: TA | date of publication: 2013-11-05 | |
| approved by: MS | revision: 2.1 | |

**初步数据**
**Preliminary Data**

## IGBT, 斩波器 / IGBT-Chopper

### 最大额定值 / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| 集电极 - 发射极电压<br>Collector-emitter voltage | $T_{vj}$ = 25°C | $V_{CES}$ | | 1700 | V |
| 连续集电极直流电流<br>Continuous DC collector current | $T_C$ = 100°C, $T_{vj\,max}$ = 175°C<br>$T_C$ = 25°C, $T_{vj\,max}$ = 175°C | $I_{C\,nom}$<br>$I_C$ | | 1000<br>1390 | A<br>A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P$ = 1 ms | $I_{CRM}$ | | 2000 | A |
| 总功率损耗<br>Total power dissipation | $T_C$ = 25°C, $T_{vj\,max}$ = 175°C | $P_{tot}$ | | 6,25 | kW |
| 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 | $I_C$ = 1000 A, $V_{GE}$ = 15 V<br>$I_C$ = 1000 A, $V_{GE}$ = 15 V<br>$I_C$ = 1000 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_{CE\,sat}$ | | 2,00<br>2,35<br>2,45 | 2,45<br>2,80 | V<br>V<br>V |
| 栅极阈值电压<br>Gate threshold voltage | $I_C$ = 36,0 mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | | $V_{GEth}$ | 5,2 | 5,8 | 6,4 | V |
| 栅极电荷<br>Gate charge | $V_{GE}$ = -15 V ... +15 V | | $Q_G$ | | 10,0 | | µC |
| 内部栅极电阻<br>Internal gate resistor | $T_{vj}$ = 25°C | | $R_{Gint}$ | | 1,8 | | Ω |
| 输入电容<br>Input capacitance | f = 1 MHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | $C_{ies}$ | | 81,0 | | nF |
| 反向传输电容<br>Reverse transfer capacitance | f = 1 MHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | $C_{res}$ | | 2,60 | | nF |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current | $V_{CE}$ = 1700 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | | $I_{CES}$ | | | 5,0 | mA |
| 栅极-发射极漏电流<br>Gate-emitter leakage current | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25°C | | $I_{GES}$ | | | 400 | nA |
| 开通延迟时间(电感负载)<br>Turn-on delay time, inductive load | $I_C$ = 1000 A, $V_{CE}$ = 900 V<br>$V_{GE}$ = ±15 V<br>$R_{Gon}$ = 0,3 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,on}$ | | 0,66<br>0,70<br>0,71 | | µs<br>µs<br>µs |
| 上升时间(电感负载)<br>Rise time, inductive load | $I_C$ = 1000 A, $V_{CE}$ = 900 V<br>$V_{GE}$ = ±15 V<br>$R_{Gon}$ = 0,3 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0,10<br>0,11<br>0,12 | | µs<br>µs<br>µs |
| 关断延迟时间(电感负载)<br>Turn-off delay time, inductive load | $I_C$ = 1000 A, $V_{CE}$ = 900 V<br>$V_{GE}$ = ±15 V<br>$R_{Goff}$ = 1,2 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,off}$ | | 1,15<br>1,30<br>1,35 | | µs<br>µs<br>µs |
| 下降时间(电感负载)<br>Fall time, inductive load | $I_C$ = 1000 A, $V_{CE}$ = 900 V<br>$V_{GE}$ = ±15 V<br>$R_{Goff}$ = 1,2 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0,25<br>0,48<br>0,56 | | µs<br>µs<br>µs |
| 开通损耗能量 (每脉冲)<br>Turn-on energy loss per pulse | $I_C$ = 1000 A, $V_{CE}$ = 900 V, $L_S$ = 30 nH<br>$V_{GE}$ = ±15 V, di/dt = 8900 A/µs ($T_{vj}$ = 150°C)<br>$R_{Gon}$ = 0,3 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 260<br>365<br>415 | | mJ<br>mJ<br>mJ |
| 关断损耗能量 (每脉冲 )<br>Turn-off energy loss per pulse | $I_C$ = 1000 A, $V_{CE}$ = 900 V, $L_S$ = 30 nH<br>$V_{GE}$ = ±15 V, du/dt = 2800 V/µs ($T_{vj}$ = 150°C)<br>$R_{Goff}$ = 1,2 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 210<br>315<br>345 | | mJ<br>mJ<br>mJ |
| 短路数据<br>SC data | $V_{GE}$ ≤ 15 V, $V_{CC}$ = 1000 V<br>$V_{CEmax}$ = $V_{CES}$ -$L_{sCE}$ ·di/dt | $t_P$ ≤ 10 µs, $T_{vj}$ = 150°C | $I_{SC}$ | | 4000 | | A |
| 结 - 外壳热阻<br>Thermal resistance, junction to case | 每个 IGBT / per IGBT | | $R_{thJC}$ | | | 24,0 | K/kW |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个 IGBT / per IGBT<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | | $R_{thCH}$ | | 10,0 | | K/kW |
| 在开关状态下温度<br>Temperature under switching conditions | | | $T_{vj\,op}$ | -40 | | 150 | °C |

初步数据
Preliminary Data

## Diode-斩波器 / Diode-Chopper

### 最大额定值 / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| 反向重复峰值电压<br>Repetitive peak reverse voltage | $T_{vj}$ = 25°C | $V_{RRM}$ | | 1700 | V |
| 连续正向直流电流<br>Continuous DC forward current | | $I_F$ | | 1000 | A |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | | 2000 | A |
| I2t-值<br>I²t - value | $V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 125°C<br>$V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 150°C | I²t | | 185<br>175 | kA²s<br>kA²s |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $I_F$ = 1000 A, $V_{GE}$ = 0 V<br>$I_F$ = 1000 A, $V_{GE}$ = 0 V<br>$I_F$ = 1000 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_F$ | | 1,70<br>1,70<br>1,70 | 2,15 | V<br>V<br>V |
| 反向恢复峰值电流<br>Peak reverse recovery current | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 1300<br>1400<br>1450 | | A<br>A<br>A |
| 恢复电荷<br>Recovered charge | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 285<br>460<br>520 | | µC<br>µC<br>µC |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 145<br>260<br>295 | | mJ<br>mJ<br>mJ |
| 结 - 外壳热阻<br>Thermal resistance, junction to case | 每个二极管 / per diode | | $R_{thJC}$ | | | 35,0 | K/kW |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | | $R_{thCH}$ | | 15,0 | | K/kW |
| 在开关状态下温度<br>Temperature under switching conditions | | | $T_{vj\,op}$ | -40 | | 150 | °C |

**初步数据**
**Preliminary Data**

## 反向二极管 / Diode, Reverse

### 最大额定值 / Maximum Rated Values

| | | | | |
|---|---|---|---|---|
| 反向重复峰值电压<br>Repetitive peak reverse voltage | $T_{vj}$ = 25°C | $V_{RRM}$ | 1700 | V |
| 连续正向直流电流<br>Continuous DC forward current | | $I_F$ | 1000 | A |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | 2000 | A |
| I2t-值<br>I²t - value | $V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 125°C<br>$V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 150°C | I²t | 185<br>175 | kA²s<br>kA²s |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $I_F$ = 1000 A, $V_{GE}$ = 0 V<br>$I_F$ = 1000 A, $V_{GE}$ = 0 V<br>$I_F$ = 1000 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_F$ | | 1,70<br>1,70<br>1,70 | 2,15 | V<br>V<br>V |
| 反向恢复峰值电流<br>Peak reverse recovery current | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 1300<br>1400<br>1450 | | A<br>A<br>A |
| 恢复电荷<br>Recovered charge | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 285<br>460<br>520 | | µC<br>µC<br>µC |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy | $I_F$ = 1000 A, - $di_F/dt$ = 8900 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 900 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 145<br>260<br>295 | | mJ<br>mJ<br>mJ |
| 结 - 外壳热阻<br>Thermal resistance, junction to case | 每个二极管 / per diode | | $R_{thJC}$ | | | 35,0 | K/kW |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | | $R_{thCH}$ | | 15,0 | | K/kW |
| 在开关状态下温度<br>Temperature under switching conditions | | | $T_{vj\,op}$ | -40 | | 150 | °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 | $T_C$ = 25°C | $R_{25}$ | | 5,00 | | kΩ |
| R100 偏差<br>Deviation of R100 | $T_C$ = 100°C, $R_{100}$ = 493 Ω | ΔR/R | -5 | | 5 | % |
| 耗散功率<br>Power dissipation | $T_C$ = 25°C | $P_{25}$ | | | 20,0 | mW |
| B-值<br>B-value | $R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$ | $B_{25/50}$ | | 3375 | | K |
| B-值<br>B-value | $R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$ | $B_{25/80}$ | | 3411 | | K |
| B-值<br>B-value | $R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$ | $B_{25/100}$ | | 3433 | | K |

根据应用手册标定
Specification according to the valid application note.

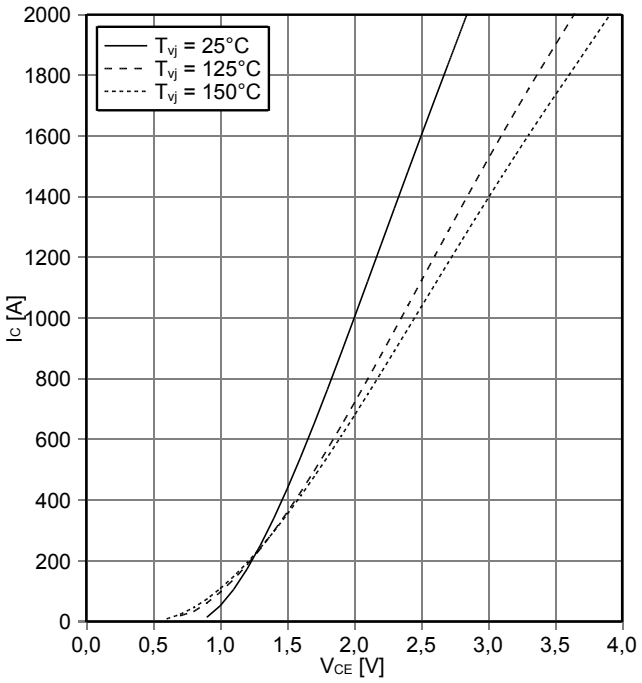
初步数据
Preliminary Data

## 模块 / Module

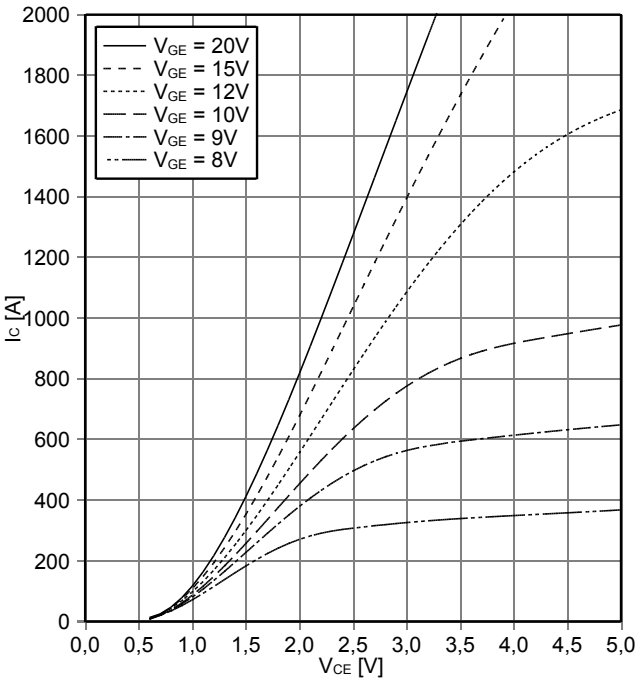
| | | | | | | |
|---|---|---|---|---|---|---|
| 绝缘测试电压<br>Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | $V_{ISOL}$ | | 4,0 | | kV |
| 模块基板材料<br>Material of module baseplate | | | | Cu | | |
| 内部绝缘<br>Internal isolation | 基本绝缘 (class 1, IEC 61140)<br>basic insulation (class 1, IEC 61140) | | | $Al_2O_3$ | | |
| 爬电距离<br>Creepage distance | 端子- 散热片 / terminal to heatsink<br>端子- 端子 / terminal to terminal | | | 33,0<br>33,0 | | mm |
| 电气间隙<br>Clearance | 端子- 散热片 / terminal to heatsink<br>端子- 端子 / terminal to terminal | | | 19,0<br>19,0 | | mm |
| 相对电痕指数<br>Comperative tracking index | | CTI | | > 400 | | |
| | | | min. | typ. | max. | |
| 杂散电感,模块<br>Stray inductance module | | $L_{sCE}$ | | 10 | | nH |
| 模块引线电阻,端子-芯片<br>Module lead resistance, terminals - chip | $T_C$ = 25°C, 每个开关 / per switch | $R_{CC'+EE'}$ | | 0,20 | | mΩ |
| 储存温度<br>Storage temperature | | $T_{stg}$ | -40 | | 150 | °C |
| 模块安装的安装扭距<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 |
| 端子联接扭距<br>Terminal connection torque | 螺丝 M4 根据相应的应用手册进行安装<br>Screw M4 - Mounting according to valid application note<br>螺丝 M8 根据相应的应用手册进行安装<br>Screw M8 - Mounting according to valid application note | M | 1,8<br><br>8,0 | -<br><br>- | 2,1<br><br>10 | Nm<br><br>Nm |
| 重量<br>Weight | | G | | 1200 | | g |

初步数据
**Preliminary Data**

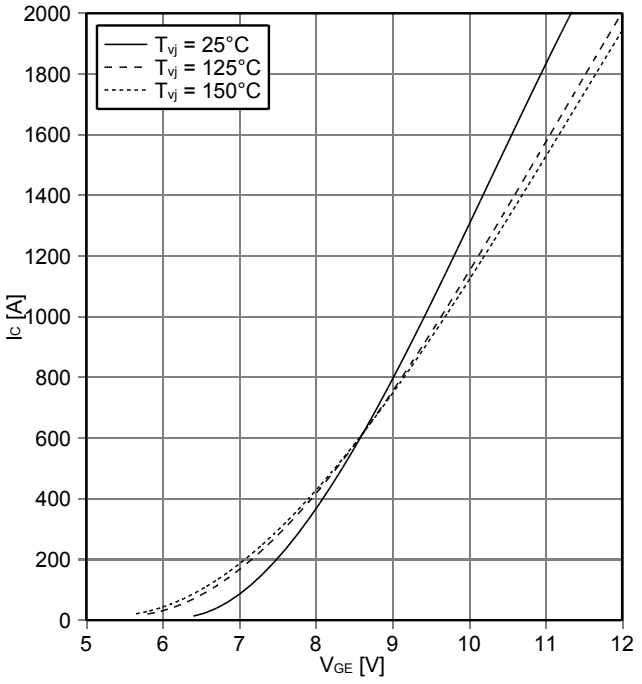
**输出特性 IGBT, 斩波器 （典型)**
**output characteristic IGBT-Chopper (typical)**
$I_C = f(V_{CE})$
$V_{GE}$ = 15 V



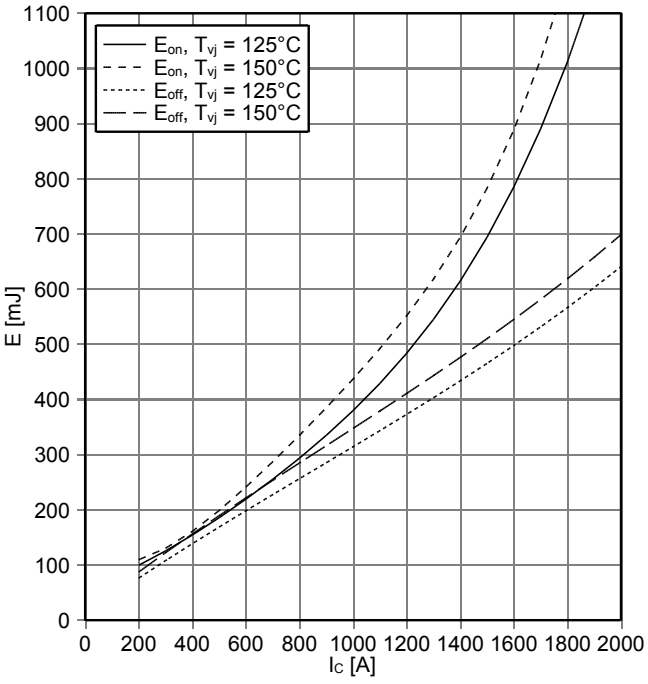

**输出特性 IGBT, 斩波器 （典型)**
**output characteristic IGBT-Chopper (typical)**
$I_C = f(V_{CE})$
$T_{vj}$ = 150°C




**传输特性 IGBT, 斩波器 (典型)**
**transfer characteristic IGBT-Chopper (typical)**
$I_C = f(V_{GE})$
$V_{CE}$ = 20 V



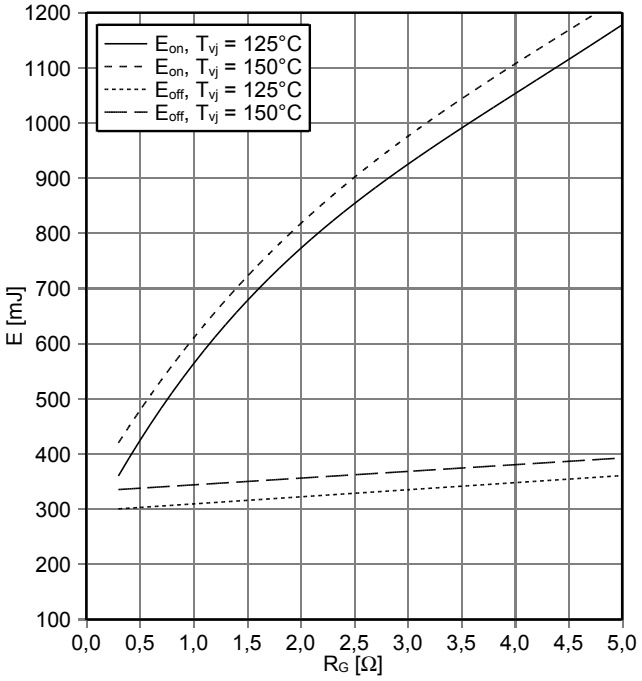

**开关损耗 IGBT, 斩波器 （典型)**
**switching losses IGBT-Chopper (typical)**
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 0.3 Ω, $R_{Goff}$ = 1.2 Ω, $V_{CE}$ = 900 V



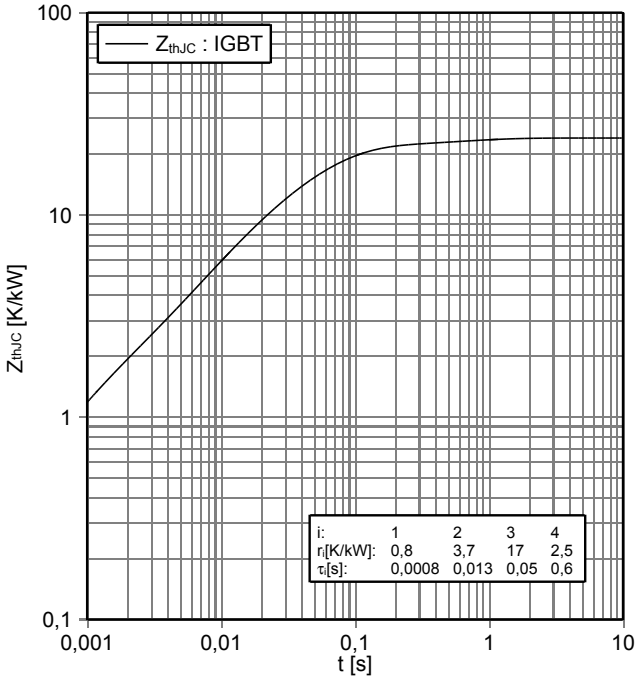

| | |
|---|---|
| prepared by: TA | date of publication: 2013-11-05 |
| approved by: MS | revision: 2.1 |

初步数据
Preliminary Data

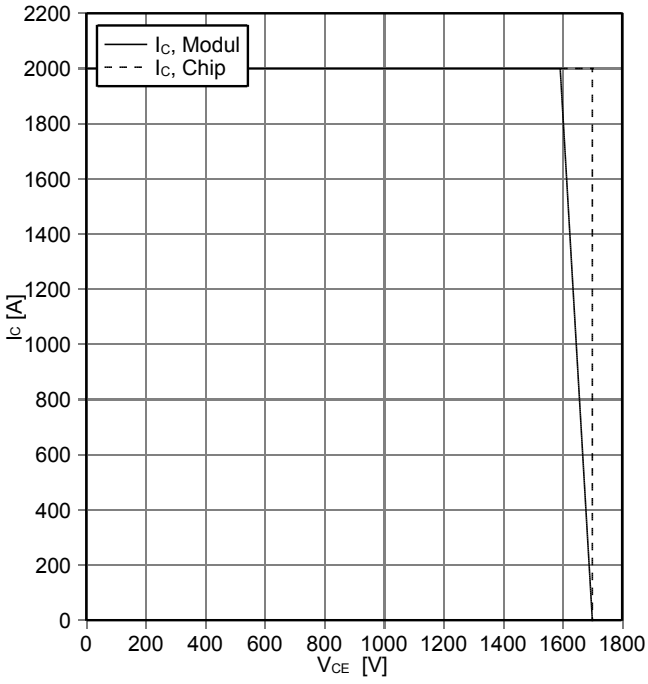
**开关损耗 IGBT, 斩波器 （典型)**
**switching losses IGBT-Chopper (typical)**
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE}$ = ±15 V, $I_C$ = 1000 A, $V_{CE}$ = 900 V



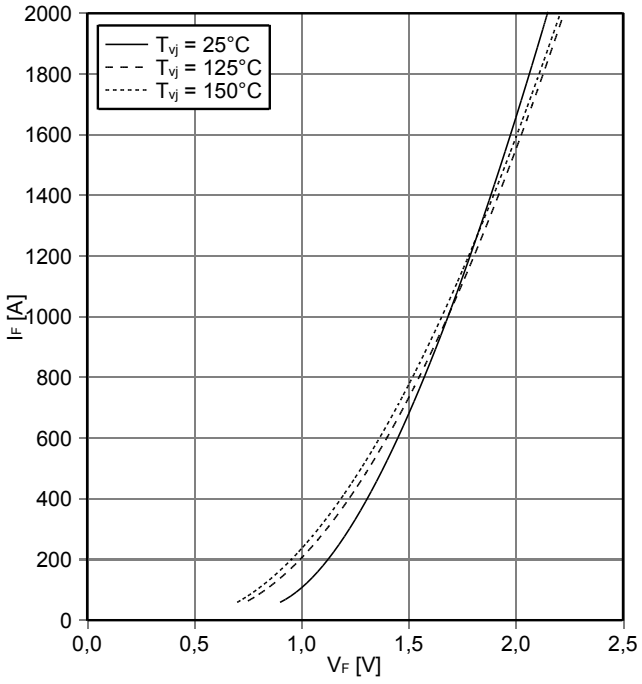

**瞬态热阻抗 IGBT, 斩波器**
**transient thermal impedance IGBT-Chopper**
$Z_{thJC} = f(t)$




**反偏安全工作区 IGBT, 斩波器 （RBSOA）**
**reverse bias safe operating area IGBT-Chopper (RBSOA)**
$I_C = f(V_{CE})$
$V_{GE}$ = ±15 V, $R_{Goff}$ = 1.2 Ω, $T_{vj}$ = 150°C



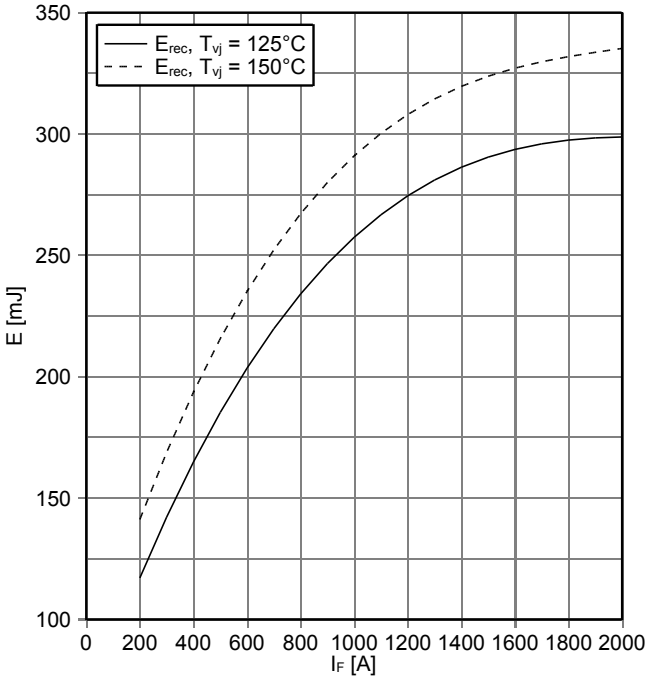

**正向偏压特性 Diode-斩波器 （典型)**
**forward characteristic of Diode-Chopper (typical)**
$I_F = f(V_F)$



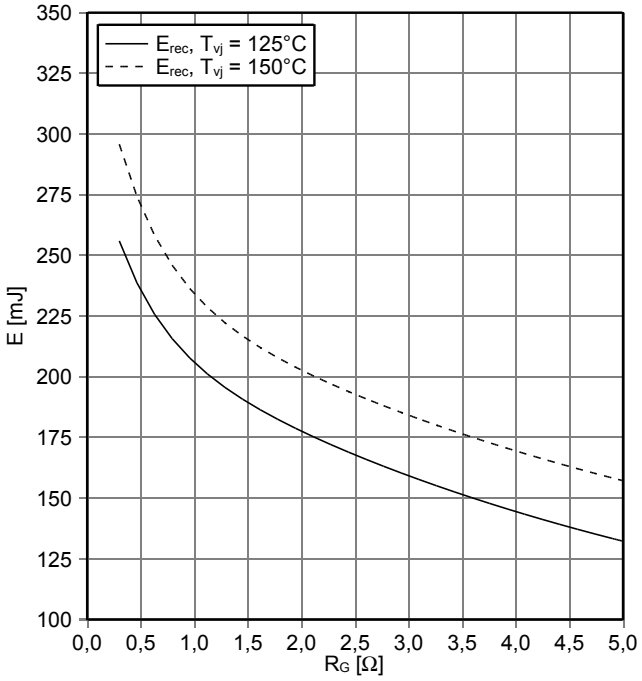

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初步数据
**Preliminary Data**

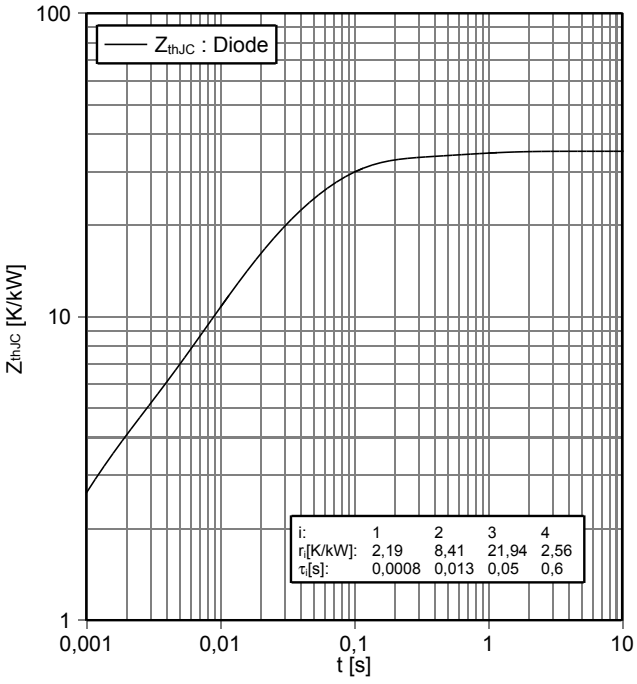
**开关损耗 Diode-斩波器 （典型)**
**switching losses Diode-Chopper (typical)**
$E_{rec} = f(I_F)$
$R_{Gon} = 0.3\ \Omega$, $V_{CE} = 900$ V



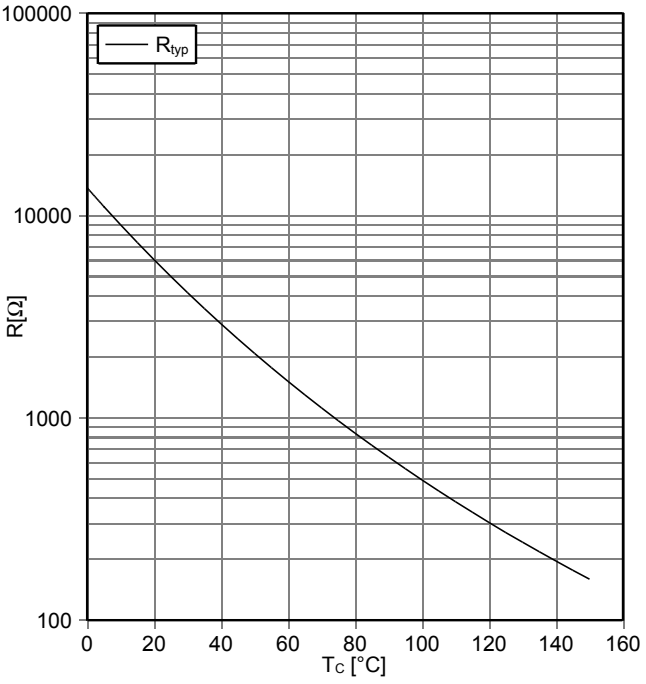

**开关损耗 Diode-斩波器 （典型)**
**switching losses Diode-Chopper (typical)**
$E_{rec} = f(R_G)$
$I_F = 1000$ A, $V_{CE} = 900$ V




**瞬态热阻抗 Diode-斩波器**
**transient thermal impedance Diode-Chopper**
$Z_{thJC} = f(t)$



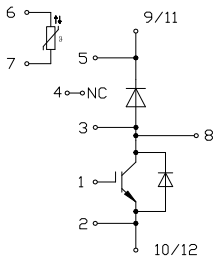

**负温度系数热敏电阻 温度特性**
**NTC-Thermistor-temperature characteristic (typical)**
$R = f(T)$



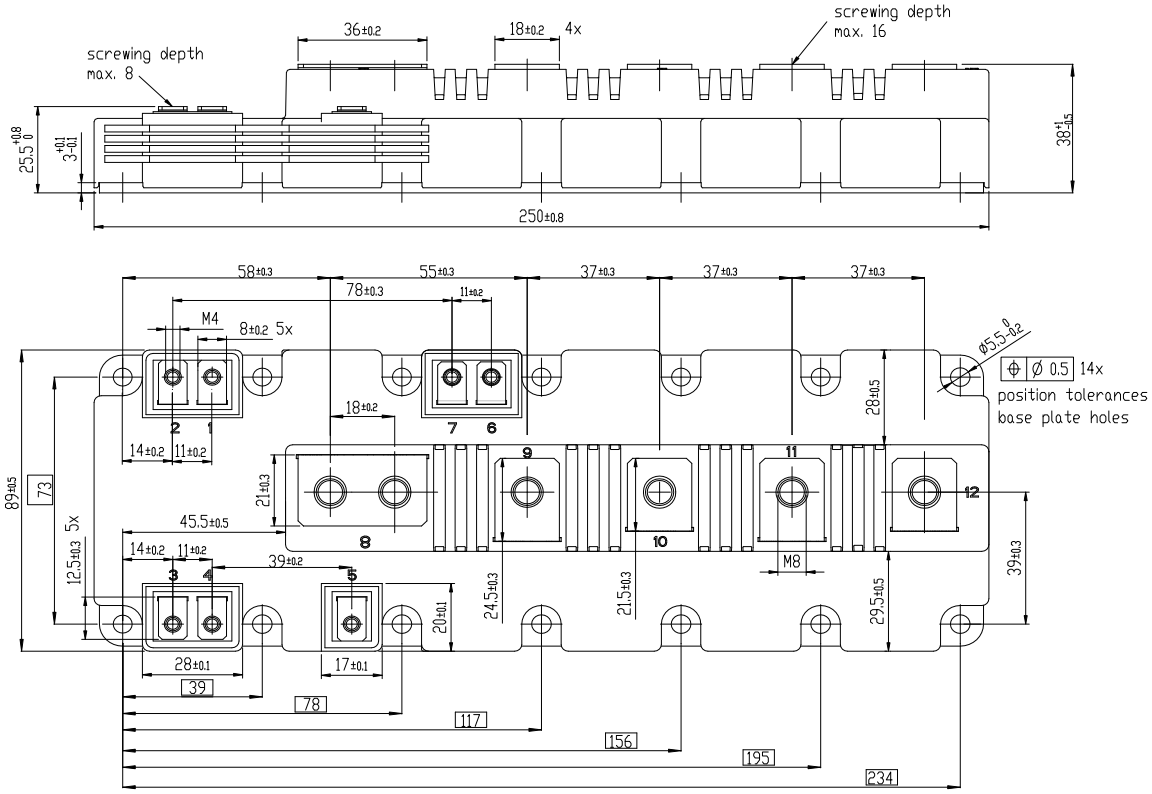

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初步数据
Preliminary Data

## 接线图 / circuit_diagram_headline




## 封装尺寸 / package outlines




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**初步数据**
**Preliminary Data**

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使用条件和条款
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