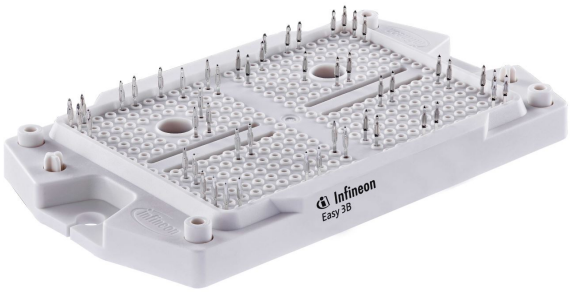
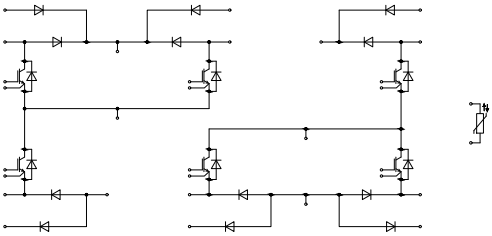
EasyPACK™ 模块 采用第七代沟槽栅/场终止IGBT7和碳化硅二极管 带有pressfit压接管脚和温度检测NTC
EasyPACK™ module with TRENCHSTOP™ IGBT7 and CoolSiC™ Schottky diode and PressFIT / NTC





$V_{CES}$ = 950V
$I_{C\ nom}$ = 100A / $I_{CRM}$ = 200A

潜在应用
- UPS系统
- 三电平应用
- 太阳能应用

**Potential Applications**
- UPS systems
- 3-level-applications
- Solar applications

电气特性
- CoolSiC™ 碳化硅肖特基二极管第5代
- 低开关损耗
- 沟槽栅IGBT7

**Electrical Features**
- CoolSiC™ Schottky diode gen 5
- Low switching losses
- Trenchstop™ IGBT7

机械特性
- PressFIT 压接技术
- 低热阻的三氧化二铝 $Al_2O_3$ 衬底
- 紧凑型设计
- 集成NTC温度传感器

**Mechanical Features**
- PressFIT contact technology
- $Al_2O_3$ substrate with low thermal resistance
- Compact design
- Integrated NTC temperature sensor

## 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 |

## IGBT, 提升 / IGBT, Boost

### 最大额定值 / Maximum Rated Values

| | | | | |
|---|---|---|---|---|
| 集电极 - 发射极电压<br>Collector-emitter voltage | $T_{vj}$ = 25°C | $V_{CES}$ | 950 | V |
| 集电极电流<br>Implemented collector current | | $I_{CN}$ | 100 | A |
| 连续集电极直流电流<br>Continuous DC collector current | $T_H$ = 65°C, $T_{vj\,max}$ = 175°C | $I_{CDC}$ | 70 | A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P$ = 1 ms | $I_{CRM}$ | 200 | 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 | $I_C$ = 25 A, $V_{GE}$ = 15 V | $V_{CE\,sat}$ | | 1,27<br>1,33<br>1,33 | 1,55 | V<br>V<br>V |
| | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | | | | | |
| 栅极阈值电压<br>Gate threshold voltage | $I_C$ = 1,67 mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | $V_{GEth}$ | 4,35 | 5,10 | 5,85 | V |
| 栅极电荷<br>Gate charge | $V_{GE}$ = -15 / 15 V, $V_{CE}$ = 600 V | $Q_G$ | | 0,23 | | µC |
| 内部栅极电阻<br>Internal gate resistor | $T_{vj}$ = 25°C | $R_{Gint}$ | | 1,5 | | Ω |
| 输入电容<br>Input capacitance | f = 100 kHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | $C_{ies}$ | | 6,48 | | nF |
| 反向传输电容<br>Reverse transfer capacitance | f = 100 kHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | $C_{res}$ | | 0,02 | | nF |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current | $V_{CE}$ = 950 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | $I_{CES}$ | | | 0,031 | 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 | $I_{GES}$ | | | 100 | nA |
| 开通延迟时间(电感负载)<br>Turn-on delay time, inductive load | $I_C$ = 25 A, $V_{CE}$ = 500 V, $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,on}$ | | 0,074<br>0,071<br>0,062 | | µs<br>µs<br>µs |
| 上升时间(电感负载)<br>Rise time, inductive load | $I_C$ = 25 A, $V_{CE}$ = 500 V, $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0,013<br>0,015<br>0,015 | | µs<br>µs<br>µs |
| 关断延迟时间(电感负载)<br>Turn-off delay time, inductive load | $I_C$ = 25 A, $V_{CE}$ = 500 V, $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,off}$ | | 0,178<br>0,275<br>0,308 | | µs<br>µs<br>µs |
| 下降时间(电感负载)<br>Fall time, inductive load | $I_C$ = 25 A, $V_{CE}$ = 500 V, $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0,107<br>0,139<br>0,161 | | µs<br>µs<br>µs |
| 开通损耗能量 (每脉冲)<br>Turn-on energy loss per pulse | $I_C$ = 25 A, $V_{CE}$ = 500 V, Lσ = 35 nH, di/dt = 880 A/µs ($T_{vj}$ = 150°C), $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 0,575<br>0,589<br>0,596 | | mJ<br>mJ<br>mJ |
| 关断损耗能量 (每脉冲 )<br>Turn-off energy loss per pulse | $I_C$ = 25 A, $V_{CE}$ = 500 V, Lσ = 35 nH, du/dt = 2700 V/µs ($T_{vj}$ = 150°C), $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 10 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 1,05<br>1,62<br>1,79 | | mJ<br>mJ<br>mJ |
| 短路数据<br>SC data | $V_{GE}$ ≤ 15 V, $V_{CC}$ = 600 V, $V_{CEmax}$ = $V_{CES}$ -$L_{sCE}$ ·di/dt, $t_P$ ≤ 0 µs, $T_{vj}$ = 150°C | $I_{SC}$ | | 300 | | A |
| 结 - 散热器热阻<br>Thermal resistance, junction to heatsink | 每个 IGBT / per IGBT | $R_{thJH}$ | | 0,673 | | K/W |
| 在开关状态下温度<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 150 | °C |

## Diode, 轉換器 / Diode, Boost

### 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 | $V_{RRM}$ | 1200 | V |
| 正向电流<br>Implemented forward current | | $I_{FN}$ | 30 | A |
| 连续正向直流电流<br>Continuous DC forward current | | $I_F$ | 25 | A |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | 60 | 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 | 88,4<br>66,0 | A²s<br>A²s |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $I_F$ = 25 A, $V_{GE}$ = 0 V<br>$I_F$ = 25 A, $V_{GE}$ = 0 V<br>$I_F$ = 25 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_F$ | | 1,32<br>1,55<br>1,70 | 1,85 | V<br>V<br>V |
| 反向恢复峰值电流<br>Peak reverse recovery current | $I_F$ = 25 A, - $di_F/dt$ = 880 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 600 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 16,4<br>16,4<br>16,4 | | A<br>A<br>A |
| 恢复电荷<br>Recovered charge | $I_F$ = 25 A, - $di_F/dt$ = 880 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 600 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 0,74<br>0,74<br>0,74 | | µC<br>µC<br>µC |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy | $I_F$ = 25 A, - $di_F/dt$ = 880 A/µs ($T_{vj}$=150°C)<br>$V_R$ = 600 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 0,249<br>0,249<br>0,249 | | mJ<br>mJ<br>mJ |
| 结 - 散热器热阻<br>Thermal resistance, junction to heatsink | 每个二极管 / per diode | | $R_{thJH}$ | | 0,894 | | K/W |
| 在开关状态下温度<br>Temperature under switching conditions | | | $T_{vj\,op}$ | -40 | | 150 | °C |

## 旁路二极管 / Bypass-Diode

### 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 | $V_{RRM}$ | 1200 | V |
| 最大正向均方根电流(每芯片)<br>Maximum RMS forward current per chip | $T_H$ = 75°C | $I_{FRMSM}$ | 50 | A |
| 最大整流器输出均方根电流<br>Maximum RMS current at rectifier output | $T_H$ = 75°C | $I_{RMSM}$ | 50 | A |
| 正向浪涌电流<br>Surge forward current | $t_p$ = 10 ms, $T_{vj}$ = 25°C<br>$t_p$ = 10 ms, $T_{vj}$ = 110°C | $I_{FSM}$ | 1070<br>957 | A<br>A |
| I2t-值<br>I²t - value | $t_p$ = 10 ms, $T_{vj}$ = 25°C<br>$t_p$ = 10 ms, $T_{vj}$ = 110°C | I²t | 5770<br>4580 | A²s<br>A²s |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $T_{vj}$ = 150°C, $I_F$ = 45 A | $V_F$ | | 0,85 | | V |
| 反向电流<br>Reverse current | $T_{vj}$ = 150°C, $V_R$ = 1200 V | $I_R$ | | 1,00 | | mA |
| 结 - 散热器热阻<br>Thermal resistance, junction to heatsink | 每个二极管 / per diode | $R_{thJH}$ | | 0,870 | | K/W |
| 在开关状态下温度<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 110 | °C |

## 反极性保护二极管 A / Inverse-polarity protection diode A

### 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 | $V_{RRM}$ | 1200 | V |
| 最大正向均方根电流(每芯片)<br>Maximum RMS forward current per chip | $T_H$ = 70°C | $I_{FRMSM}$ | 30 | A |
| 最大整流器输出均方根电流<br>Maximum RMS current at rectifier output | $T_H$ = 70°C | $I_{RMSM}$ | 30 | A |
| 正向浪涌电流<br>Surge forward current | $t_p$ = 10 ms, $T_{vj}$ = 25°C<br>$t_p$ = 10 ms, $T_{vj}$ = 110°C | $I_{FSM}$ | 378<br>326 | A<br>A |
| I2t-值<br>I²t - value | $t_p$ = 10 ms, $T_{vj}$ = 25°C<br>$t_p$ = 10 ms, $T_{vj}$ = 110°C | I²t | 714<br>531 | A²s<br>A²s |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $T_{vj}$ = 150°C, $I_F$ = 15 A | $V_F$ | | 0,89 | | V |
| 反向电流<br>Reverse current | $T_{vj}$ = 150°C, $V_R$ = 1200 V | $I_R$ | | 1,00 | | mA |
| 结 - 散热器热阻<br>Thermal resistance, junction to heatsink | 每个二极管 / per diode | $R_{thJH}$ | | 1,31 | | K/W |
| 在开关状态下温度<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 110 | °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°C | $R_{25}$ | | 5,00 | | kΩ |
| R100 偏差<br>Deviation of R100 | $T_{NTC}$ = 100°C, $R_{100}$ = 493 Ω | ΔR/R | -5 | | 5 | % |
| 耗散功率<br>Power dissipation | $T_{NTC}$ = 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 |

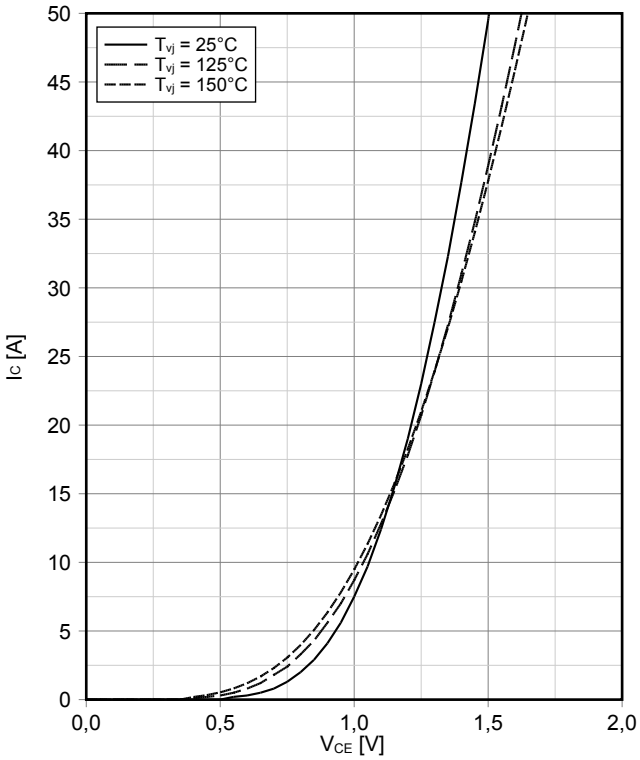
根据应用手册标定
Specification according to the valid application note.

## 模块 / Module

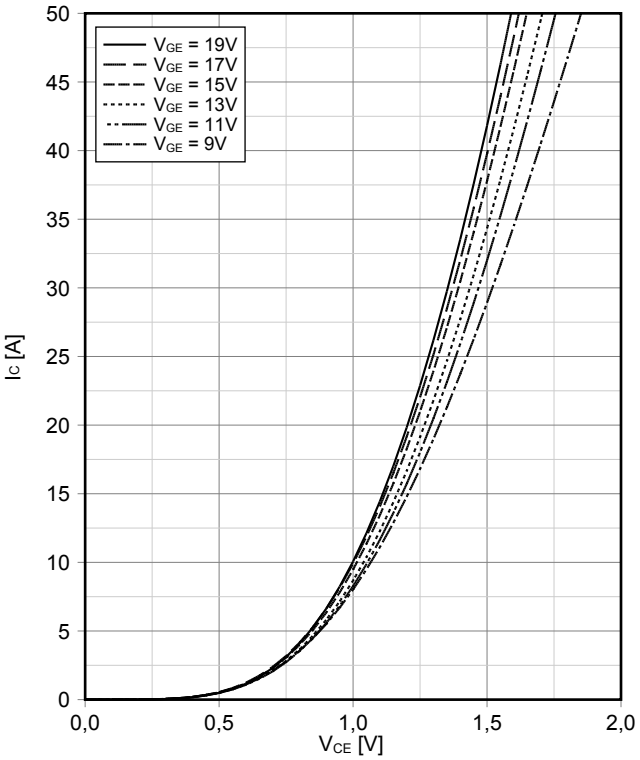
| | | | | | | |
|---|---|---|---|---|---|---|
| 绝缘测试电压<br>Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | $V_{ISOL}$ | | 3,2 | | kV |
| 内部绝缘<br>Internal isolation | 基本绝缘 (class 1, IEC 61140)<br>basic insulation (class 1, IEC 61140) | | | $Al_2O_3$ | | |
| 爬电距离<br>Creepage distance | 端子至散热器 / terminal to heatsink<br>端子至端子 / terminal to terminal | | | 11,2<br>6,8 | | 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 | | | 9,4<br>5,5 | | mm |
| 相对电痕指数<br>Comperative tracking index | | CTI | | > 400 | | |
| 相对温度指数 (电)<br>RTI Elec. | 住房<br>housing | RTI | | 140 | | °C |
| | | | min. | typ. | max. | |
| 杂散电感,模块<br>Stray inductance module | | $L_{sCE}$ | | 20 | | nH |
| 储存温度<br>Storage temperature | | $T_{stg}$ | -40 | | 125 | °C |
| 模块安装的安装扭距<br>Mounting torque for modul mounting | 螺丝 根据相应的应用手册进行安装<br>Screw - Mounting according to valid application note | M | 1,30 | | 1,50 | Nm |
| 重量<br>Weight | | G | | 78 | | g |

IGBT- and diode- RthJH parameters measured with thermal grease of $\lambda_{Paste}$ = 3.3 W/(m·K)
The current under continuous operation is limited to 25 A rms per connector pin.

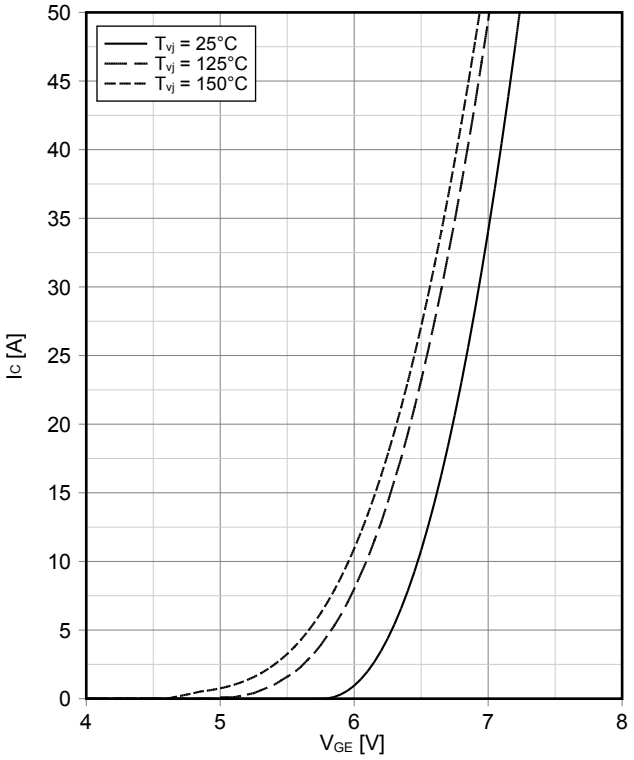
输出特性 IGBT, 提升 （典型）
**output characteristic IGBT, Boost (typical)**
$I_C = f(V_{CE})$
$V_{GE}$ = 15 V



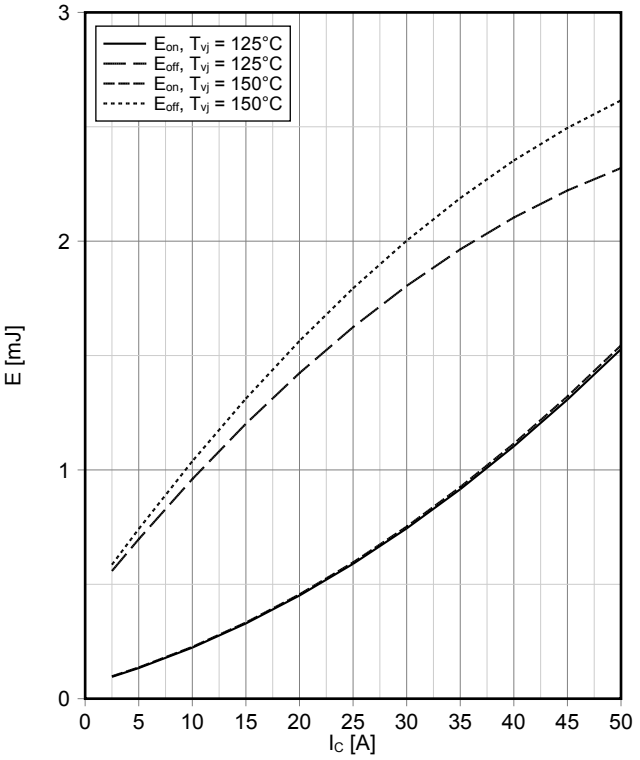

输出特性 IGBT, 提升 （典型）
**output characteristic IGBT, Boost (typical)**
$I_C = f(V_{CE})$
$T_{vj}$ = 150°C



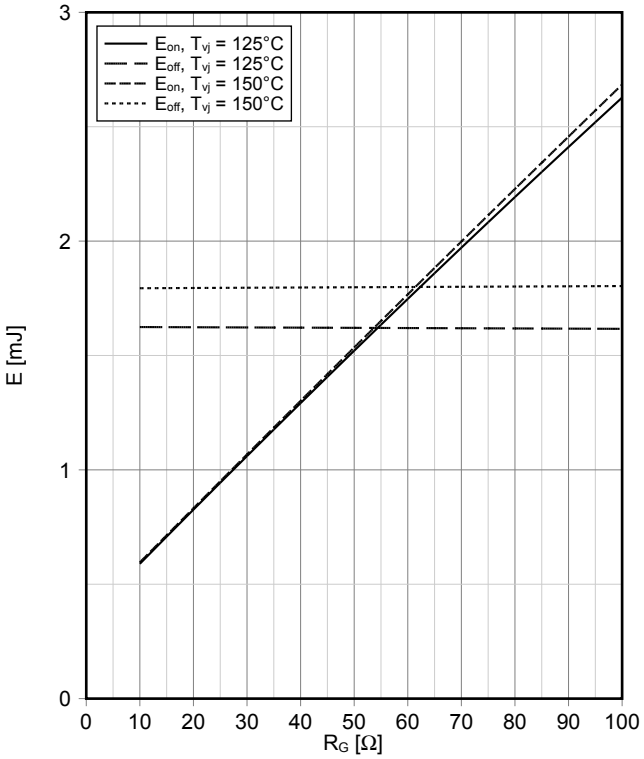

传输特性 IGBT, 提升 (典型)
**transfer characteristic IGBT, Boost (typical)**
$I_C = f(V_{GE})$
$V_{CE}$ = 20 V



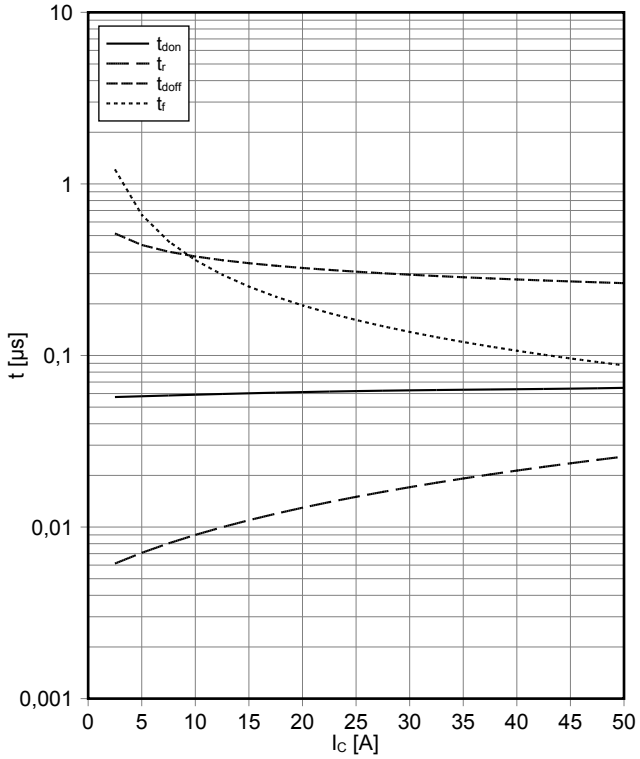

开关损耗 IGBT, 提升 （典型）
**switching losses IGBT, Boost (typical)**
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 10 Ω, $R_{Goff}$ = 10 Ω, $V_{CE}$ = 500 V



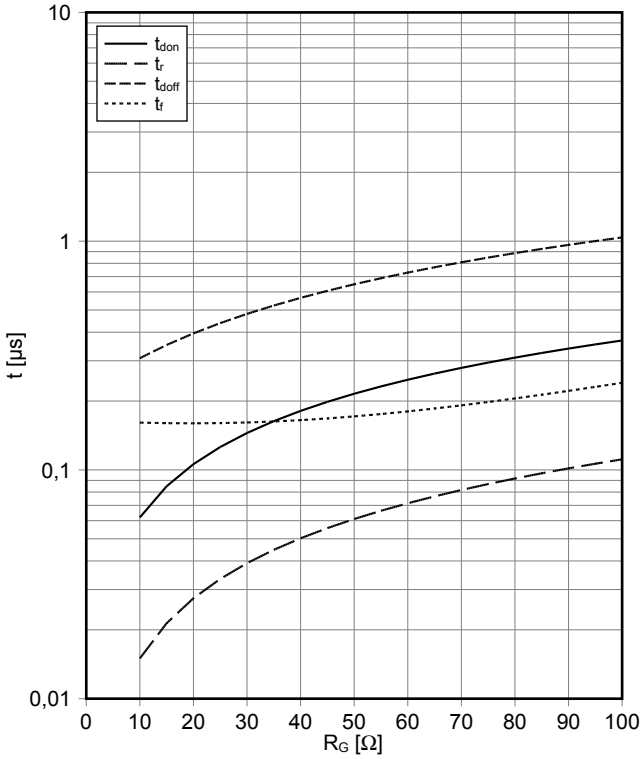
开关损耗 IGBT, 提升 （典型）
**switching losses IGBT, Boost (typical)**
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE}$ = ±15 V, $V_{CE}$ = 500 V, $I_C$ = 25 A



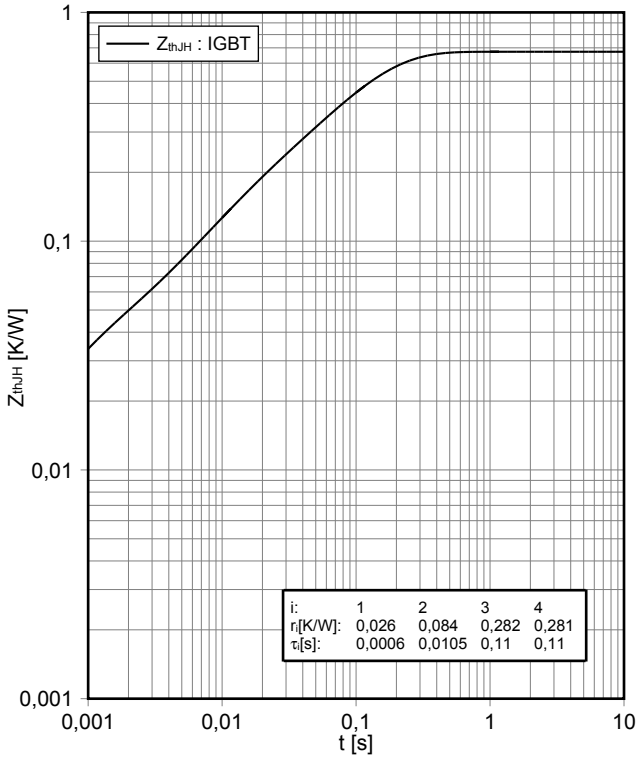

??? IGBT, 提升 （典型）
**switching times IGBT, Boost (typical)**
$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 10 Ω, $R_{Goff}$ = 10 Ω, $V_{CE}$ = 500 V, $T_{vj}$ = 150°C



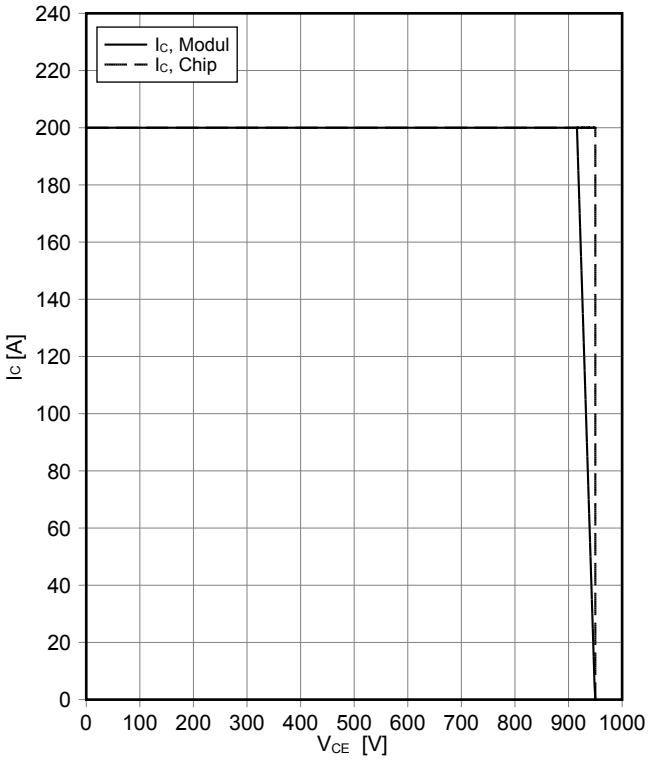

??? IGBT, 提升 （典型）
**switching times IGBT, Boost (typical)**
$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 10 Ω, $R_{Goff}$ = 10 Ω, $V_{CE}$ = 500 V, $I_C$ = 25 A, $T_{vj}$ = 150°C



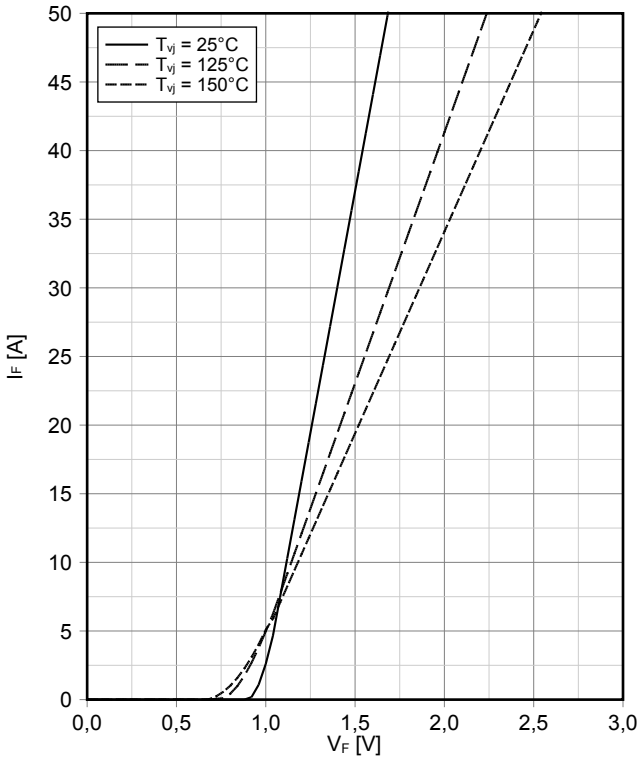

瞬态热阻抗 IGBT, 提升
**transient thermal impedance IGBT, Boost**
$Z_{thJH} = f(t)$



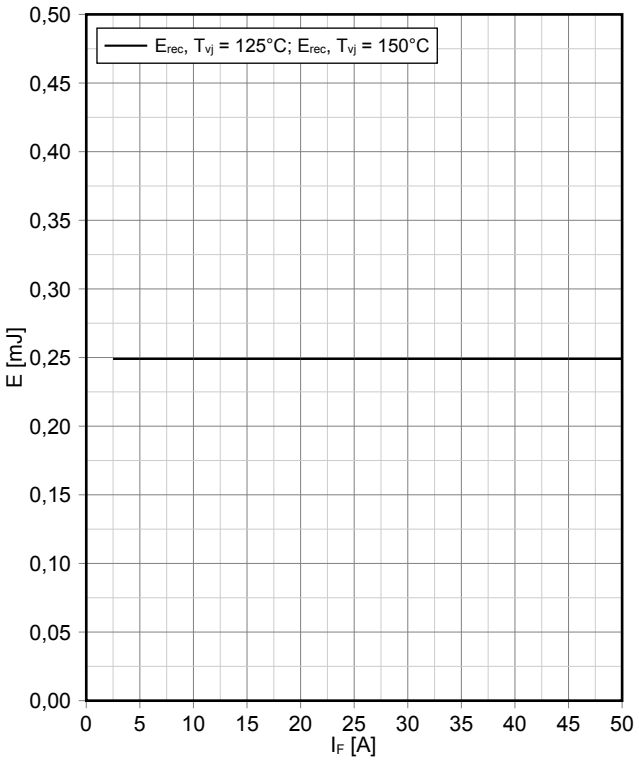
反偏安全工作区 IGBT, 提升 （ RBSOA ）
**reverse bias safe operating area IGBT, Boost (RBSOA)**
$I_C = f(V_{CE})$
$V_{GE} = \pm 15$ V, $R_{Goff} = 10\ \Omega$, $T_{vj} = 150°C$



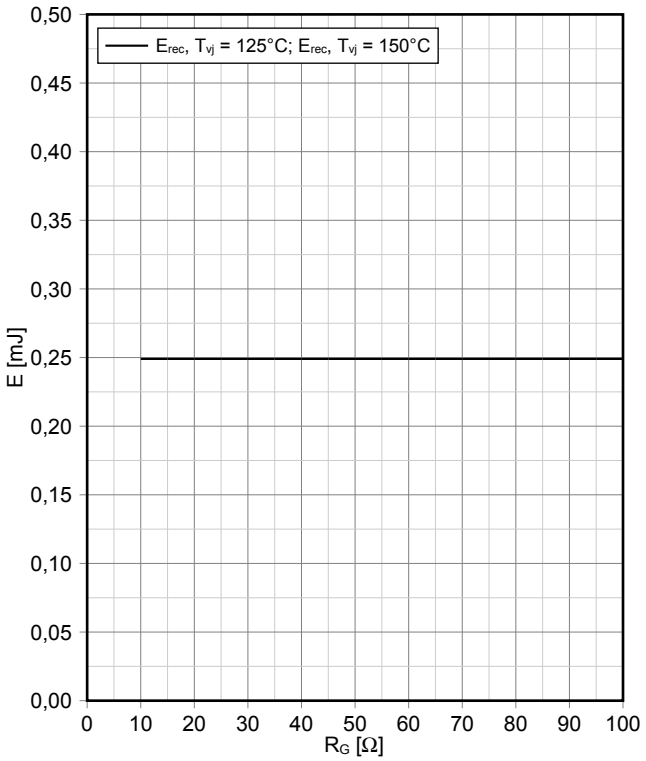

正向偏压特性 Diode, 轉換器 （ 典型）
**forward characteristic of Diode, Boost (typical)**
$I_F = f(V_F)$



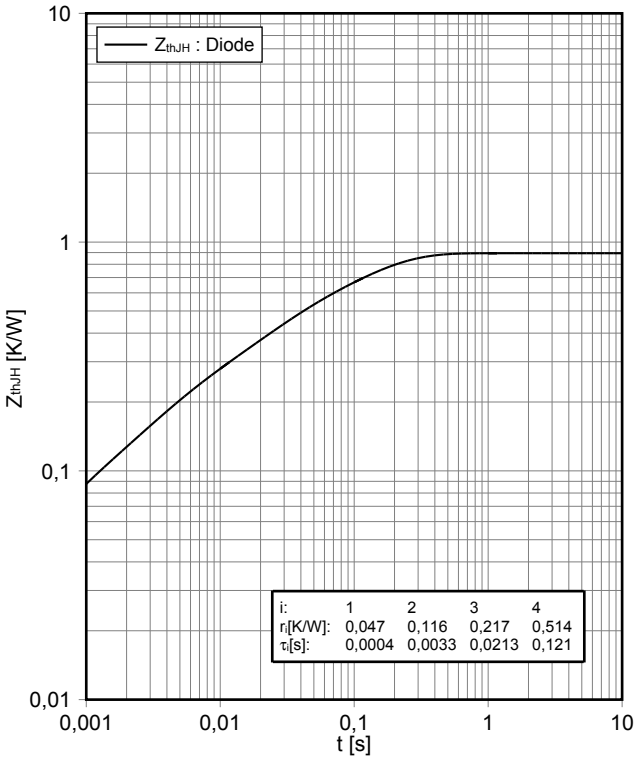

开关损耗 Diode, 轉換器 （ 典型）
**switching losses Diode, Boost (typical)**
$E_{rec} = f(I_F)$
$R_{Gon} = 10\ \Omega$, $V_{CE} = 600$ V



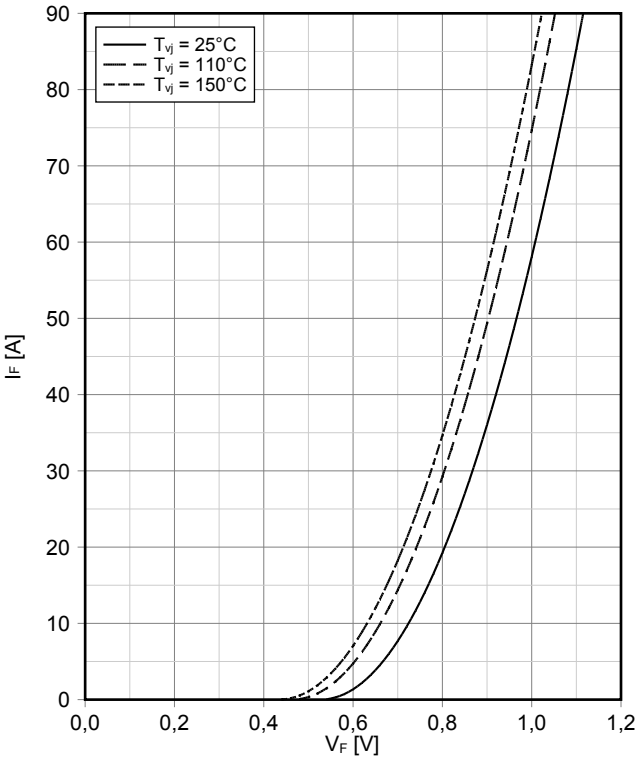

开关损耗 Diode, 轉換器 （ 典型）
**switching losses Diode, Boost (typical)**
$E_{rec} = f(R_G)$
$I_F = 25$ A, $V_{CE} = 600$ V



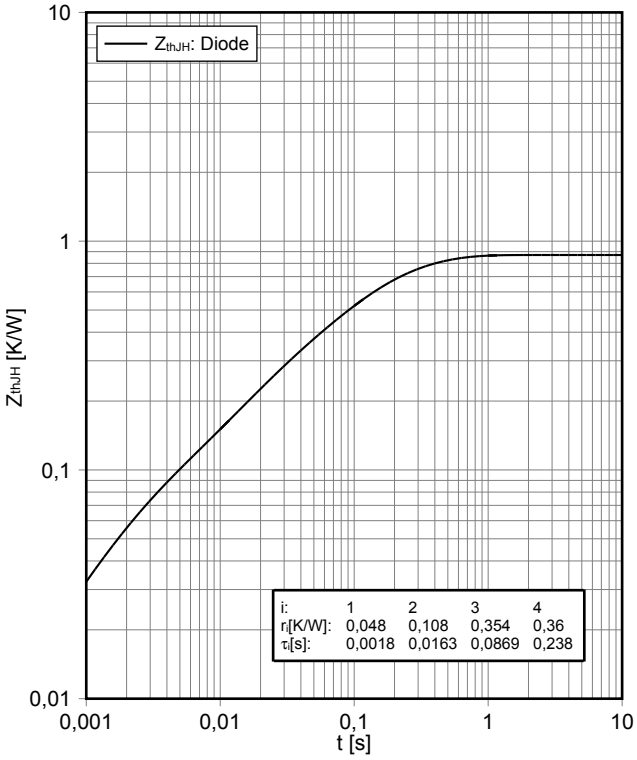
瞬态热阻抗 Diode, 轉換器
**transient thermal impedance Diode, Boost**
$Z_{thJH} = f(t)$



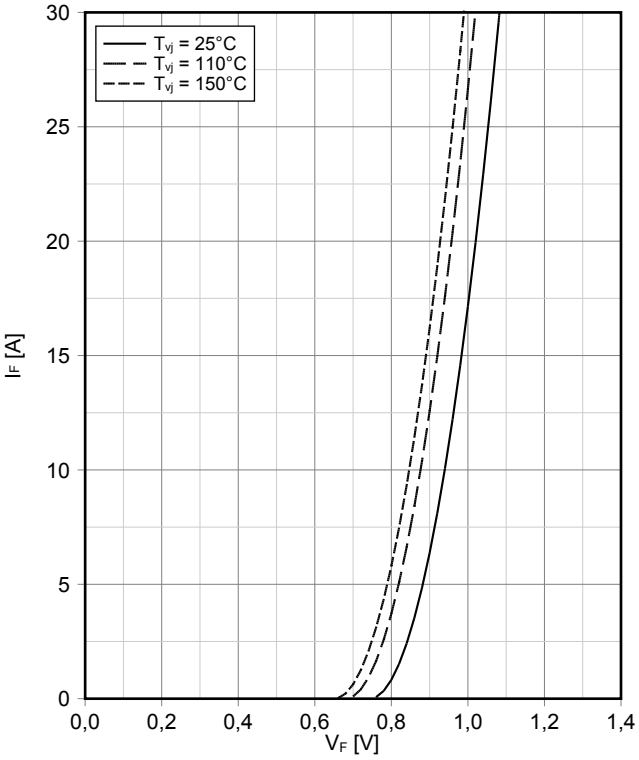

正向偏压特性 旁路二极管（典型）
**forward characteristic of Bypass-Diode (typical)**
$I_F = f(V_F)$



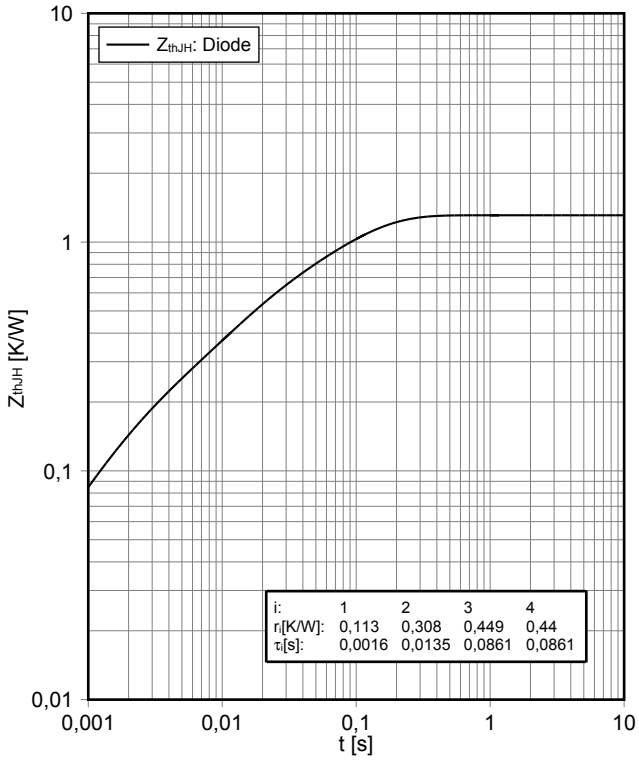

瞬态热阻抗 旁路二极管
**transient thermal impedance Bypass-Diode**
$Z_{thJH} = f(t)$



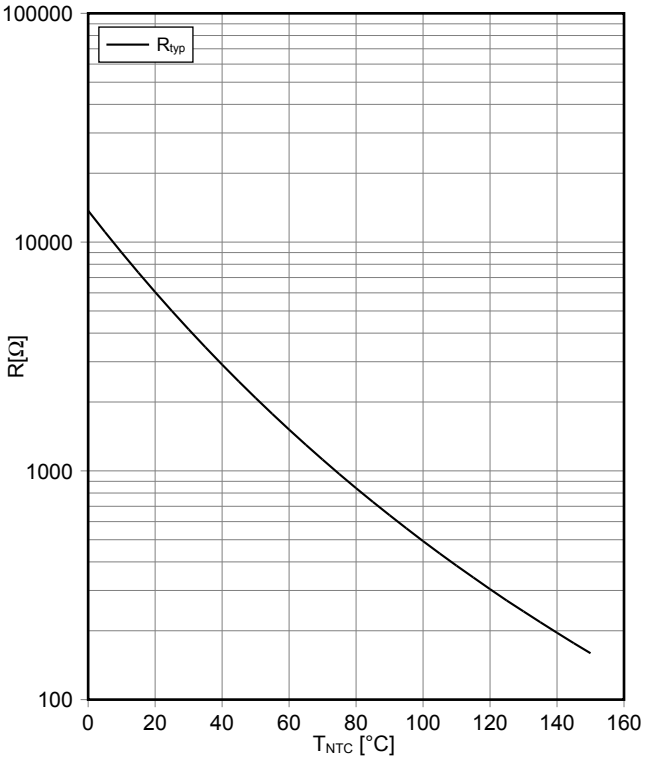

正向偏压特性 反极性保护二极管 A（典型）
**forward characteristic of Inverse-polarity protection diode A (typical)**
$I_F = f(V_F)$



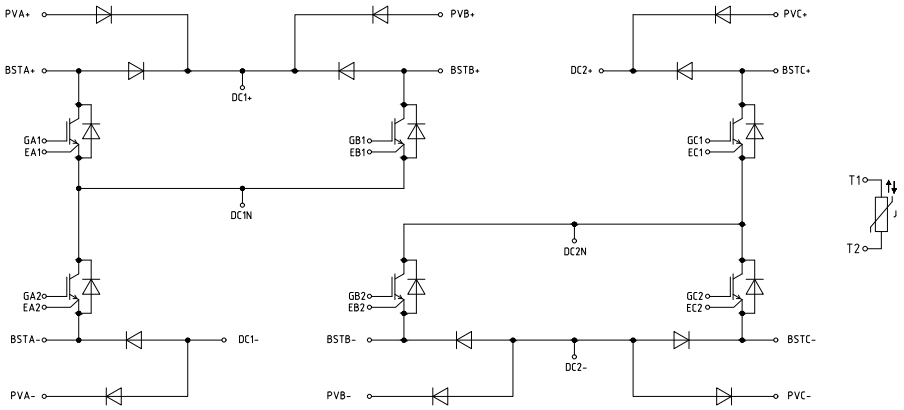
瞬态热阻抗 反极性保护二极管 A
**transient thermal impedance Inverse-polarity protection diode A**
$Z_{thJH} = f(t)$



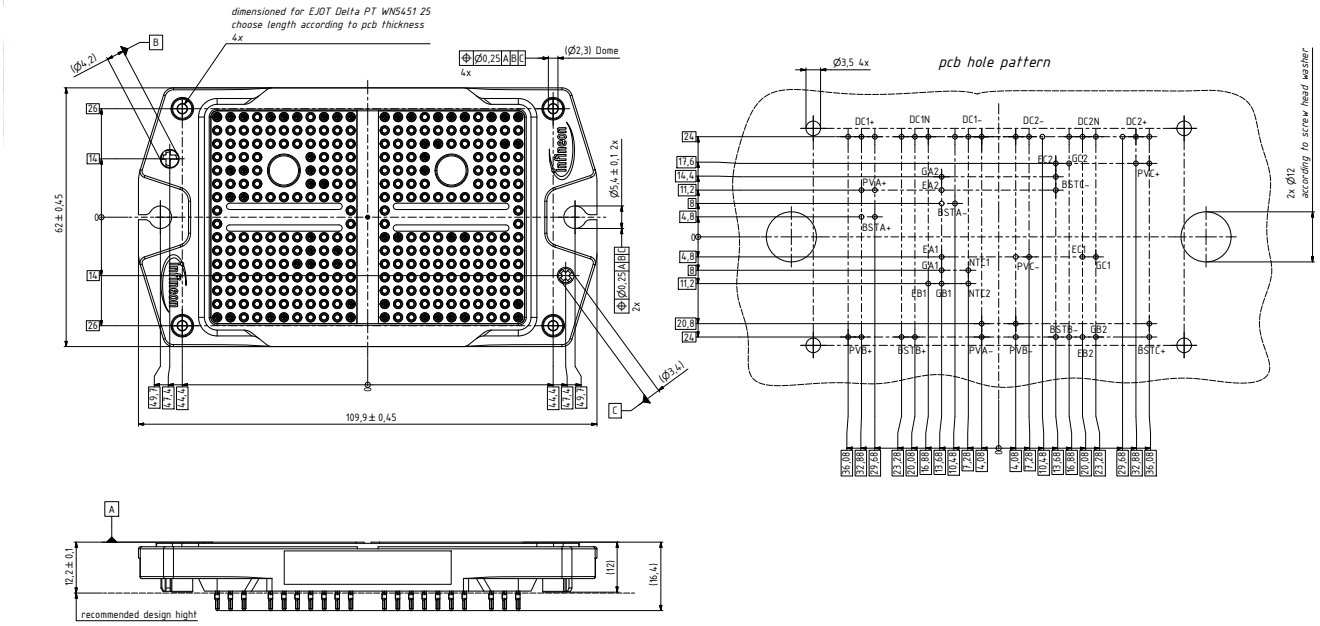

负温度系数热敏电阻 温度特性
**NTC-Thermistor-temperature characteristic (typical)**
$R = f(T)$



## 接线图 / Circuit diagram




## 封装尺寸 / Package outlines



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