# NI600B17E6K4

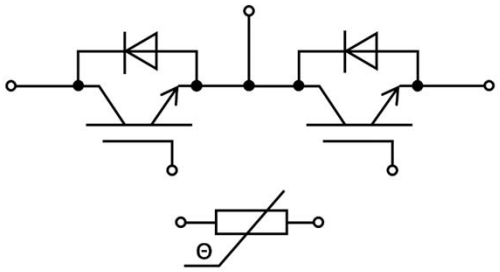
1700V 600A IGBT 模块, E6封装, 内置续流二极管
1700V 600A IGBT Module, E6 Package, with FWD

## 特点 Features

- 1700V 沟槽栅及场截止结构
  1700V Trench Gate & Field Stop Structure
- 高短路耐量
  High Short Circuit Capability
- 低开关损耗
  Low Switching Loss
- 高可靠性
  High Reliability
- 正温度系数
  Positive Temperature Coefficient

## 应用 Applications

- 大功率变流器
  High Power Converters
- 风力发电机
  Wind turbines



## 最大额定值 Maximum Rated Values

| 参数 Parameter | 符号 Symbol | 条件 Condition | 数值 Value | 单位 Unit |
|---|---|---|---|---|
| 集电极-发射极电压 Collector-Emitter Voltage | $V_{CES}$ | $V_{GE}$=0V, $T_{vj}$=25°C | 1700 | V |
| 集电极电流 DC Collector Current | $I_C$ | $T_C$=100°C, $T_{vj,max}$=175°C | 600 | A |
| 集电极峰值电流 Peak Collector Current | $I_{CM}$ | $t_p$=1ms | 1200 | A |
| 栅极-发射极电压 Gate-Emitter Voltage | $V_{GES}$ | | ±20 | V |
| IGBT最大功耗 IGBT Maximum Power Dissipation | $P_D$ | $T_C$=25°C, $T_{vj,max}$=175°C | 3660 | W |
| 反向重复峰值电压 Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}$=25°C | 1700 | V |
| 连续正向直流电流 Continuous DC Forward Current | $I_F$ | | 600 | A |
| 正向重复峰值电流 Repetitive Peak Forward Current | $I_{FRM}$ | $t_p$=1ms | 1200 | A |
| $I^2t$-值 $I^2t$-Value | $I^2t$ | $V_R$=0V, $t_p$=10ms, $T_{vj}$=125°C | 41530 | $A^2s$ |
| IGBT短路耐量 IGBT Short Circuit Withstand Time | $t_{psc}$ | | 10 | μs |
| 最高结温 Maximum Junction Temperature | $T_{vj(max)}$ | | 175 | °C |
| 工作结温 Operating Junction Temperature | $T_{vj(op)}$ | | -40~150 | °C |
| 存储温度范围 Storage Temperature Range | $T_{stg}$ | | -40~125 | °C |

## IGBT特征值 IGBT Characteristics Values*1 ($T_{vj}$=25°C unless otherwise noted)

| 参数 Parameter | 符号 Symbol | 条件 Condition | | 数值 Value Min. | Typ. | Max. | 单位 Unit |
|---|---|---|---|---|---|---|---|
| 集电极-发射极饱和电压 Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=600A, $V_{GE}$=15V | $T_{vj}$=25°C | | 1.80 | 2.20 | V |
| | | | $T_{vj}$=125°C | | 2.20 | | |
| | | | $T_{vj}$=150°C | | 2.30 | | |
| 栅极-发射极开启电压 Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$=24mA, $V_{CE}$=$V_{GE}$ | | 5.5 | 6.0 | 6.5 | V |
| 集电极-发射极截止电流 Collector-Emitter Cut-off Current | $I_{CES}$ | $V_{CE}$=1700V, $V_{GE}$=0V | | | | 1 | mA |
| 栅极-发射极漏电流 Gate-Emitter Leakage Current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | -100 | | 100 | nA |
| 内置栅极电阻 Internal Gate Resistance | $R_{Gint}$ | | | | 1.2 | | Ω |
| 栅极电荷 Gate Charge | $Q_G$ | $V_{GE}$=-15V~+15V | | | 4.5 | | μC |
| 输入电容 Input Capacitance | $C_{ies}$ | $V_{CE}$=25V,$V_{GE}$=0V, f=1MHz | | | 68.5 | | nF |
| 反向传输电容 Reverse Transfer Capacitance | $C_{res}$ | | | | 2.90 | | nF |
| 开通延迟时间 Turn-on Delay Time | $t_{d(on)}$ | $I_C$=600A, $V_{CE}$=900V, $V_{GE}$=±15V, $R_{Gon}$=1Ω, $R_{Goff}$=1Ω, 开通di/dt=3650A/us ($T_{vj}$=150°C) 关断dv/dt=4250V/us ($T_{vj}$=150°C) Inductive Load | $T_{vj}$=25°C | | 160 | | ns |
| | | | $T_{vj}$=125°C | | 180 | | |
| | | | $T_{vj}$=150°C | | 185 | | |
| 上升时间 Rise Time | $t_r$ | | $T_{vj}$=25°C | | 95 | | ns |
| | | | $T_{vj}$=125°C | | 125 | | |
| | | | $T_{vj}$=150°C | | 130 | | |
| 关断延迟时间 Turn-off Delay Time | $t_{d(off)}$ | | $T_{vj}$=25°C | | 595 | | ns |
| | | | $T_{vj}$=125°C | | 645 | | |
| | | | $T_{vj}$=150°C | | 665 | | |
| 下降时间 Fall Time | $t_f$ | | $T_{vj}$=25°C | | 290 | | ns |
| | | | $T_{vj}$=125°C | | 480 | | |
| | | | $T_{vj}$=150°C | | 500 | | |
| 开通损耗 Turn-on Energy Loss | $E_{on}$ | | $T_{vj}$=25°C | | 145 | | mJ |
| | | | $T_{vj}$=125°C | | 210 | | |
| | | | $T_{vj}$=150°C | | 230 | | |
| 关断损耗 Turn-off Energy Loss | $E_{off}$ | | $T_{vj}$=25°C | | 115 | | mJ |
| | | | $T_{vj}$=125°C | | 155 | | |
| | | | $T_{vj}$=150°C | | 170 | | |
| 短路电流 Short Circuit Current | $I_{SC}$ | $V_{GE}$≤15V, $t_{psc}$≤10us, $V_{CC}$=1000V, $T_{vj}$=150°C $V_{CE,max}$=$V_{CES}$-$L_{s(CE)}$ x di/dt | | | 3030 | | A |

*1 IGBT特征值遵从IEC 60747-9。

## 二极管特征值 Diode Characteristics Values*2

| 参数 Parameter | 符号 Symbol | 条件 Condition | | 数值 Value | | | 单位 Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| 正向电压 Forward Voltage | $V_F$ | $I_F$=600A | $T_{vj}$=25°C | | 2.20 | 2.60 | V |
| | | | $T_{vj}$=125°C | | 2.45 | | |
| | | | $T_{vj}$=150°C | | 2.50 | | |
| 反向峰值电流 Peak Reverse Recovery Current | $I_{RM}$ | $I_F$=600A, $V_R$=900V, $V_{GE}$=-15V, $-di_F/dt$=3600A/us ($T_{vj}$=150°C) | $T_{vj}$=25°C | | 335 | | A |
| | | | $T_{vj}$=125°C | | 380 | | |
| | | | $T_{vj}$=150°C | | 390 | | |
| 反向电荷 Reverse Charge | $Q_{rr}$ | | $T_{vj}$=25°C | | 80 | | uC |
| | | | $T_{vj}$=125°C | | 160 | | |
| | | | $T_{vj}$=150°C | | 185 | | |
| 反向恢复损耗 Reverse Recovery Energy Loss | $E_{rec}$ | | $T_{vj}$=25°C | | 40 | | mJ |
| | | | $T_{vj}$=125°C | | 80 | | |
| | | | $T_{vj}$=150°C | | 100 | | |

*2 二极管特征值遵从IEC 60747-2。

## 负温度系数热敏电阻 NTC-Thermistor

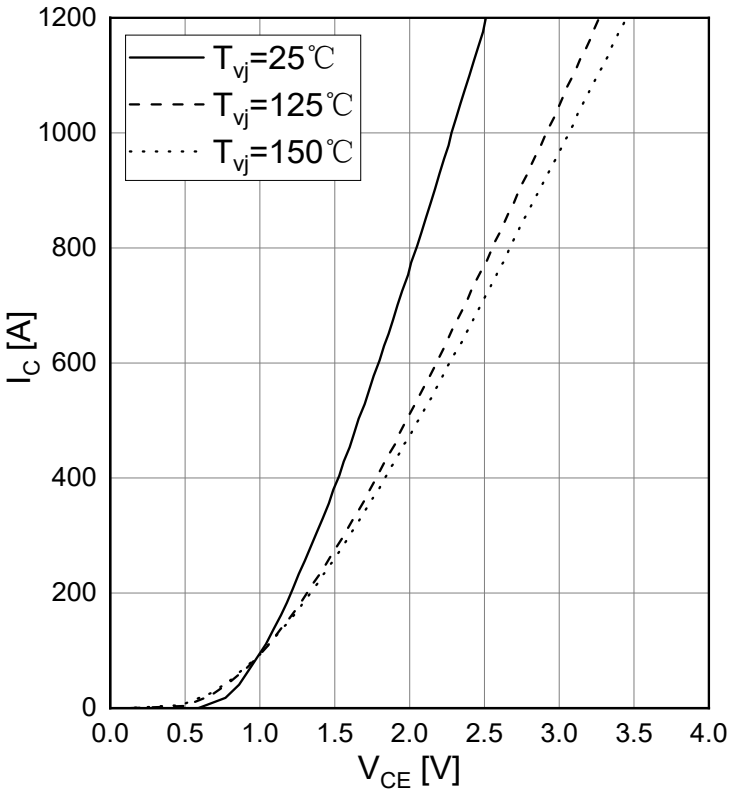
| 参数 Parameter | 符号 Symbol | 条件 Condition | 数值 Value | | | 单位 Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| 额定电阻 Rated Resistance | $R_{25}$ | $T_{NTC}$=25°C | | 5 | | KΩ |
| 功耗 Power Dissipation | $P_{25}$ | $T_{NTC}$=25°C | | | 10 | mW |
| B-值 B-Value | $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$ | | 3380 | | K |

## 封装特性 Package Properties*3

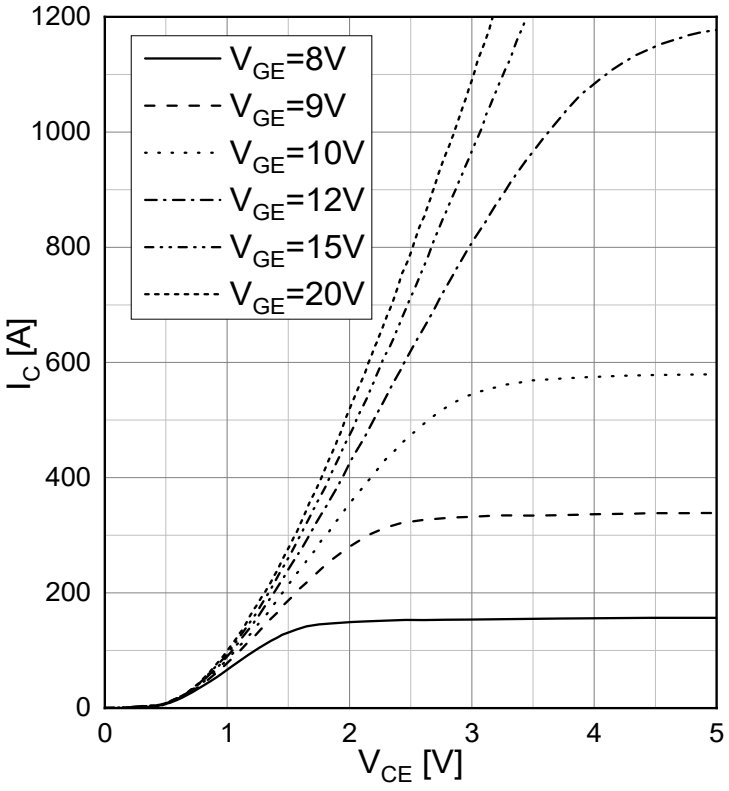
| 参数 Parameter | 符号 Symbol | 条件 Condition | 数值 Value | | | 单位 Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| IGBT 结-壳热阻<br>IGBT Thermal Resistance: Junction to Case | $R_{th(J-C)}$ | 每个IGBT/per IGBT | | | 0.041 | K/W |
| 二极管 结-壳热阻<br>Diode Thermal Resistance: Junction to Case | $R_{th(J-C)}$ | 每个二极管/per Diode | | | 0.060 | K/W |
| IGBT接触热阻<br>IGBT Thermal Resistance: Case to Heatsink | $R_{th(C-H)}$ | 每个IGBT/per IGBT<br>硅脂导热系数$\lambda_{grease}$=1W/(m•K) | | 0.033 | | K/W |
| 二极管接触热阻<br>Diode Thermal Resistance: Case to Heatsink | $R_{th(C-H)}$ | 每个二极管/per Diode<br>硅脂导热系数$\lambda_{grease}$=1W/(m•K) | | 0.037 | | K/W |
| 绝缘耐压<br>Isolation Voltage | $V_{isol}$ | RMS, f=50Hz, t=60s | | 3.4 | | kV |
| 爬电距离<br>Creepage Distance | $d_{cr}$ | 端子到散热器<br>Terminal to Heatsink | | 14 | | mm |
| | | 端子到端子<br>Terminal to Terminal | | 13.5 | | mm |
| 电气间隙<br>Clearance Distance | $d_{cl}$ | 端子到散热器<br>Terminal to Heatsink | | 12.5 | | mm |
| | | 端子到端子<br>Terminal to Terminal | | 10 | | mm |
| 相对漏电起痕指数<br>Comparative Tracking Index | CTI | | | >200 | | |
| 模块寄生电感<br>Module Stray Inductance | $L_{s,\ CE}$ | 每个桥臂/per Switch | | 20 | | nH |
| 模块引线内阻<br>Module Lead Resistance, Terminal to Chip | $R_{CC`+EE`}$ | 每个桥臂/per Switch, $T_C$=25°C | | 1.1 | | mΩ |
| 安装扭矩<br>Mounting Torques | M | 基板至散热器,<br>Baseplate to Heatsink, M5 | 3.0 | | 6.0 | Nm |
| | | 功率端子安装,<br>Power Terminal, M6 | 3.0 | | 6.0 | Nm |
| 模块重量<br>Module Weight | G | | | 345 | | g |

*3 封装特性遵从IEC 60747-15

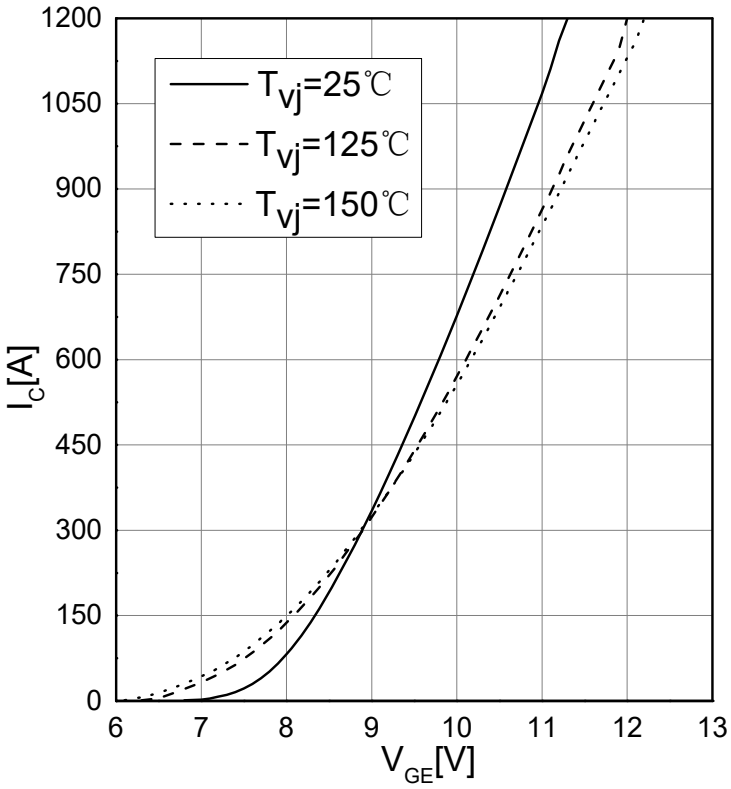
输出特性IGBT
Output Characteristic IGBT
$I_C=f(V_{CE}),V_{GE}=15V$



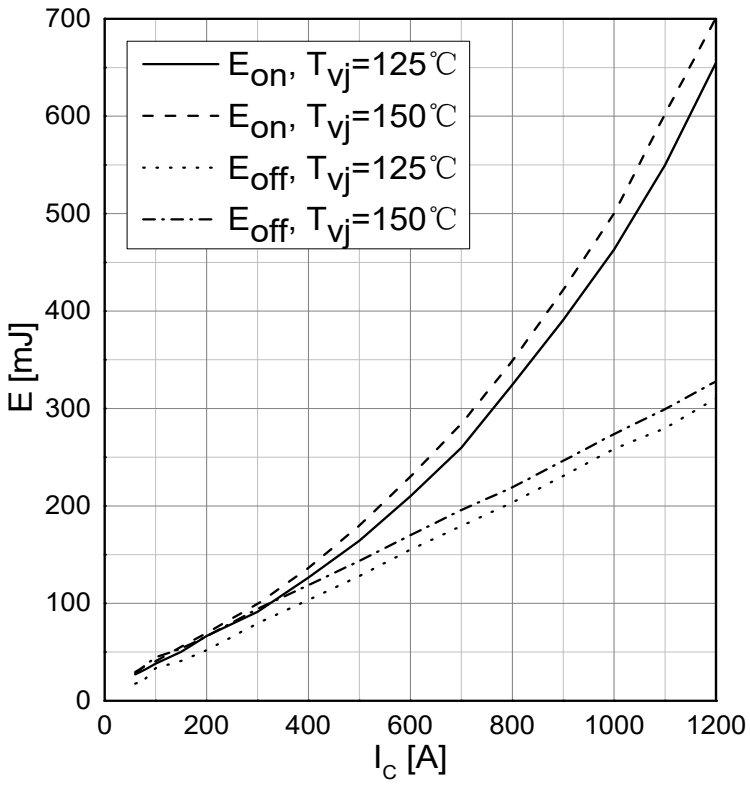

输出特性IGBT
Output Characteristic IGBT
$Ic=f(V_{CE})$, $T_{vj}$=150°C



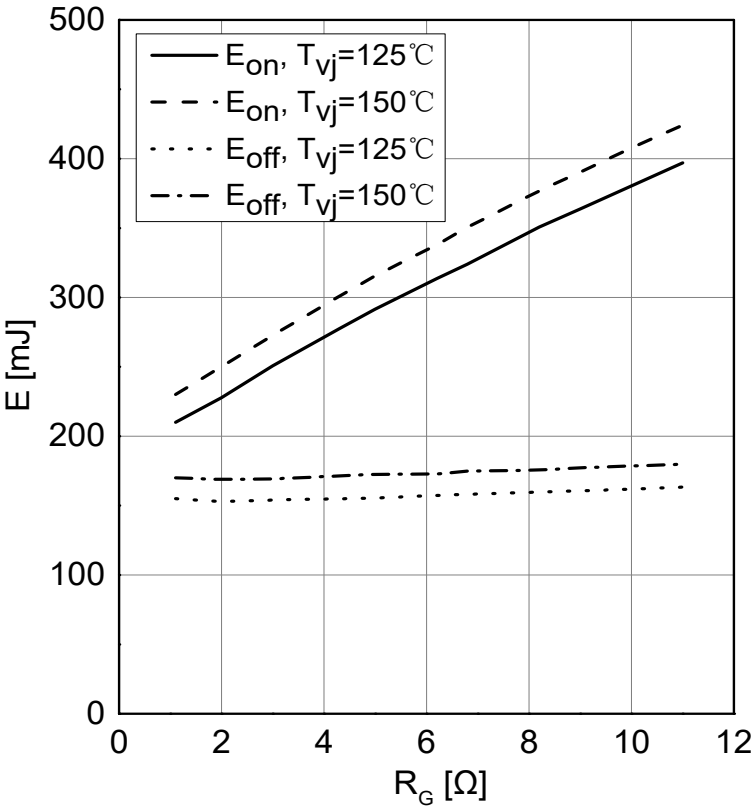

传输特性 IGBT
Transfer Characteristic IGBT
$I_C=f(V_{GE})$, $V_{CE}$=20V



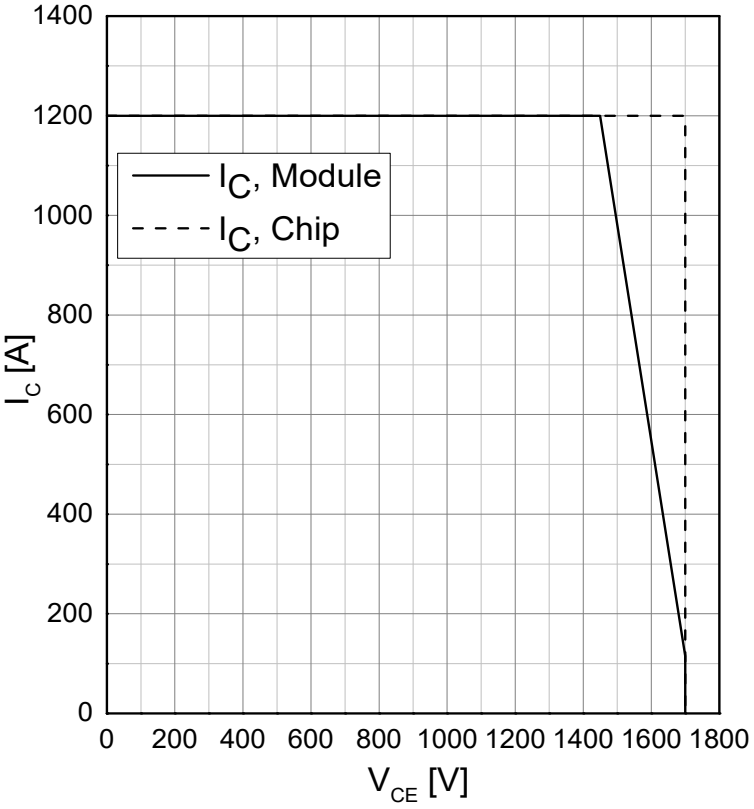

开关损耗 IGBT
Switching Losses IGBT
E=f(Ic)，$V_{GE}$=±15V，$R_{Gon}$=$R_{Goff}$=1.1Ω，$V_{CE}$=900V



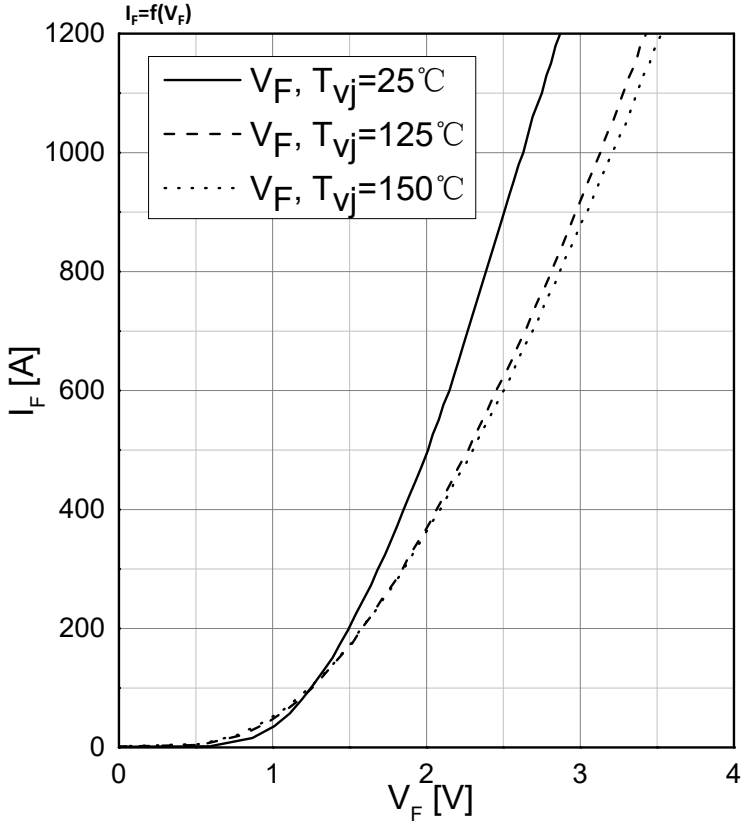
开关损耗IGBT
Switching Losses IGBT
$V_{GE}$=±15V, $I_C$=600A,$V_{CE}$=900V



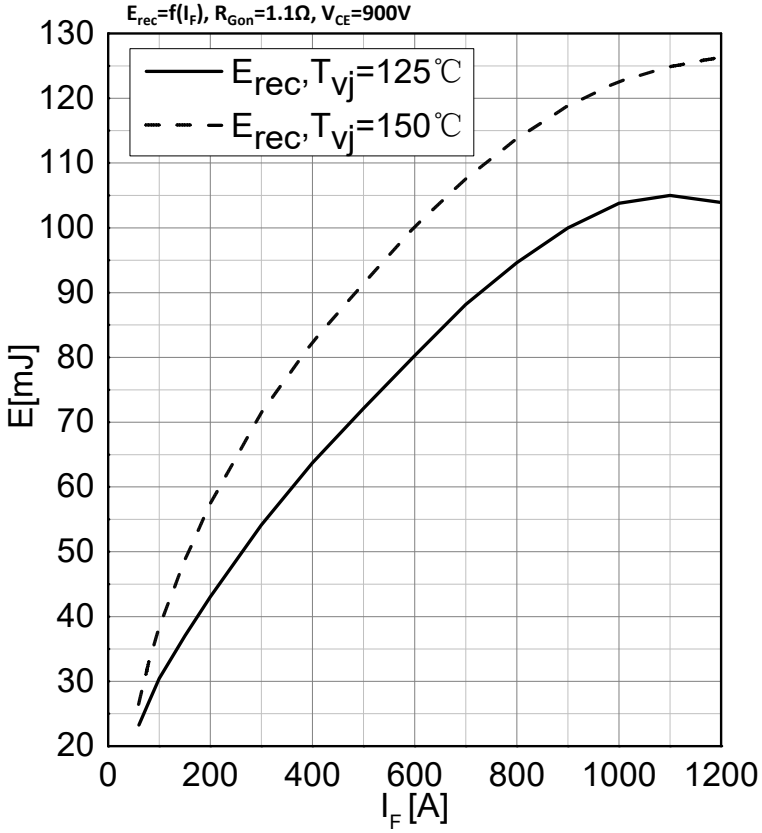

反偏安全工作区 IGBT
Reverse Bias Safe Operating Area IGBT
$V_{GE}$=±15V,$R_{Goff}$=1.1Ω,$T_{vj}$=150°C



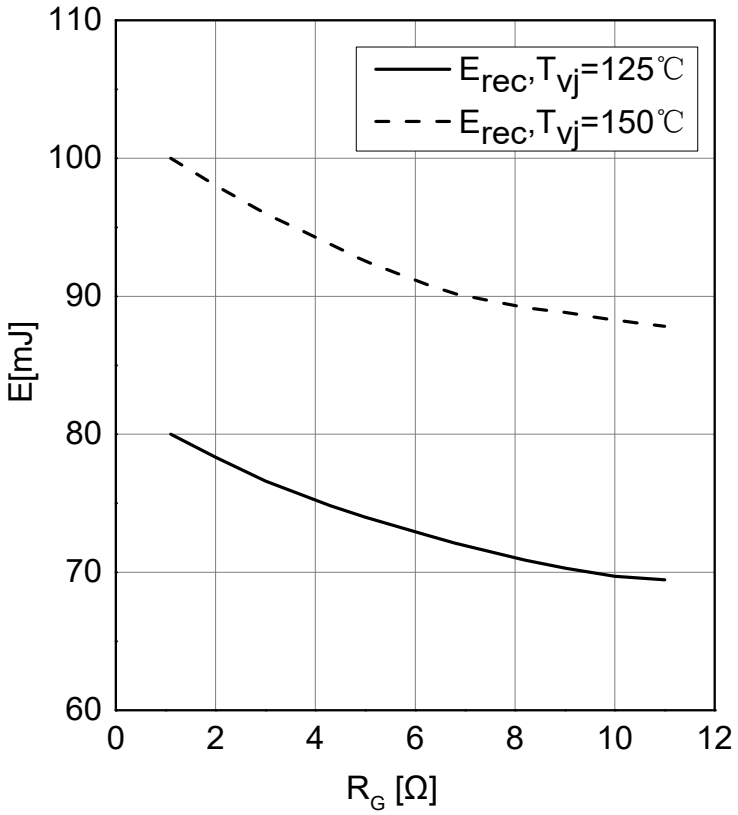

正向特性FRD
Forward Characteristic FRD
$I_F$=f($V_F$)



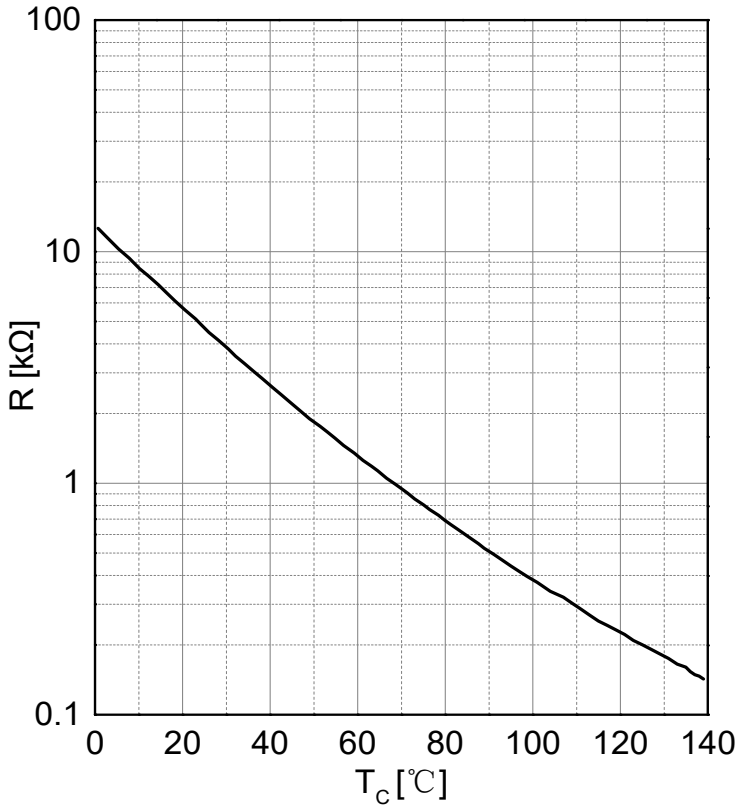

开关损耗 Diode
Switching Losses Diode
$E_{rec}$=f($I_F$), $R_{Gon}$=1.1Ω, $V_{CE}$=900V



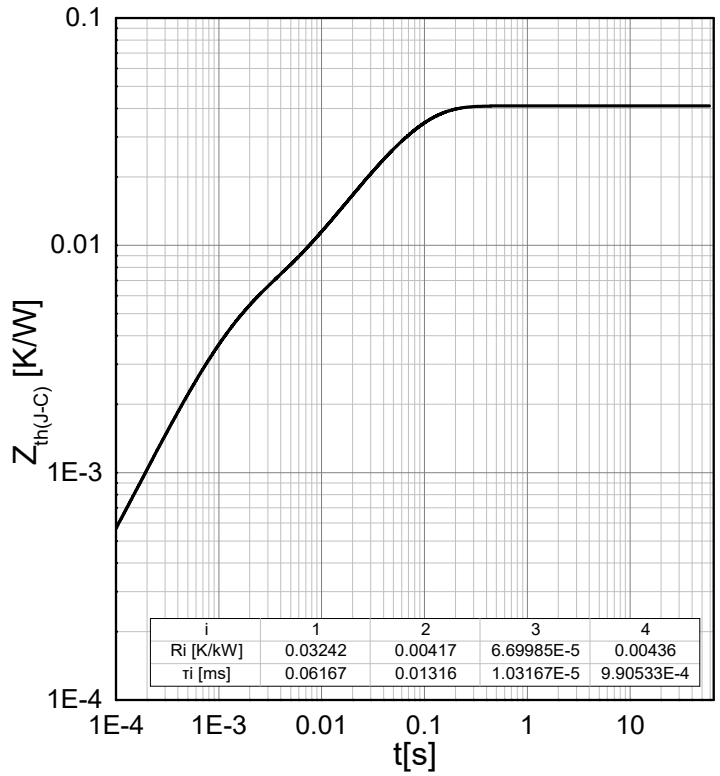
开关损耗Diode
Switching Losses Diode
$E_{rec}=f(R_G),V_{CE}=900V$



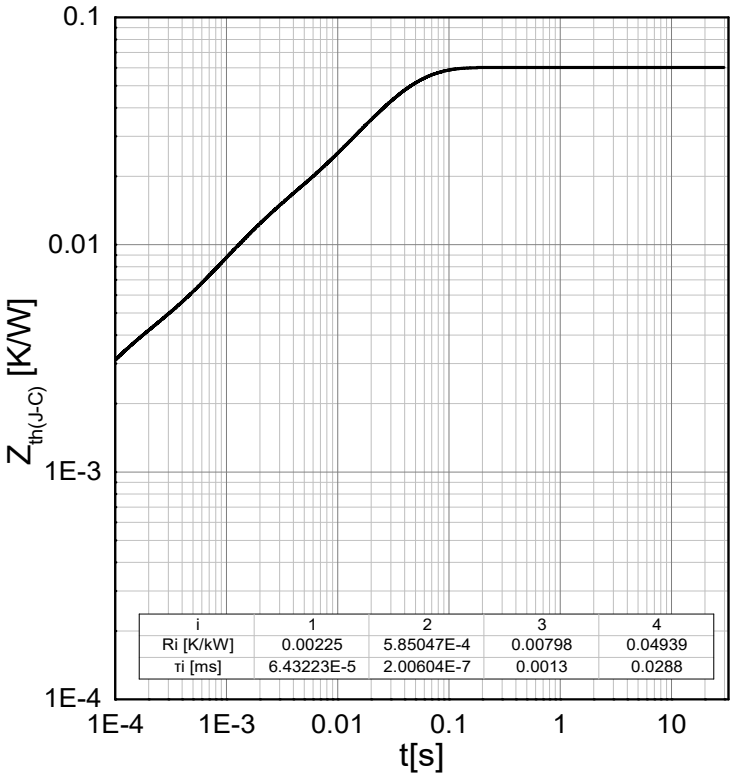

热敏电阻温度特性曲线
NTC Temperature Characteristic



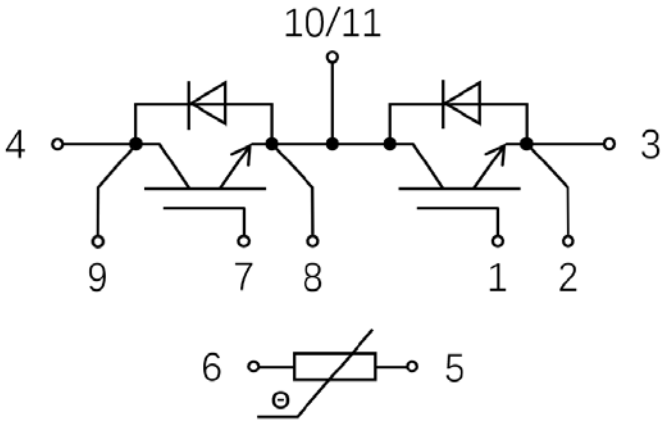

瞬态热阻抗 IGBT
Transient Thermal Impedance IGBT
$Z_{th(J-C)}=f(t)$



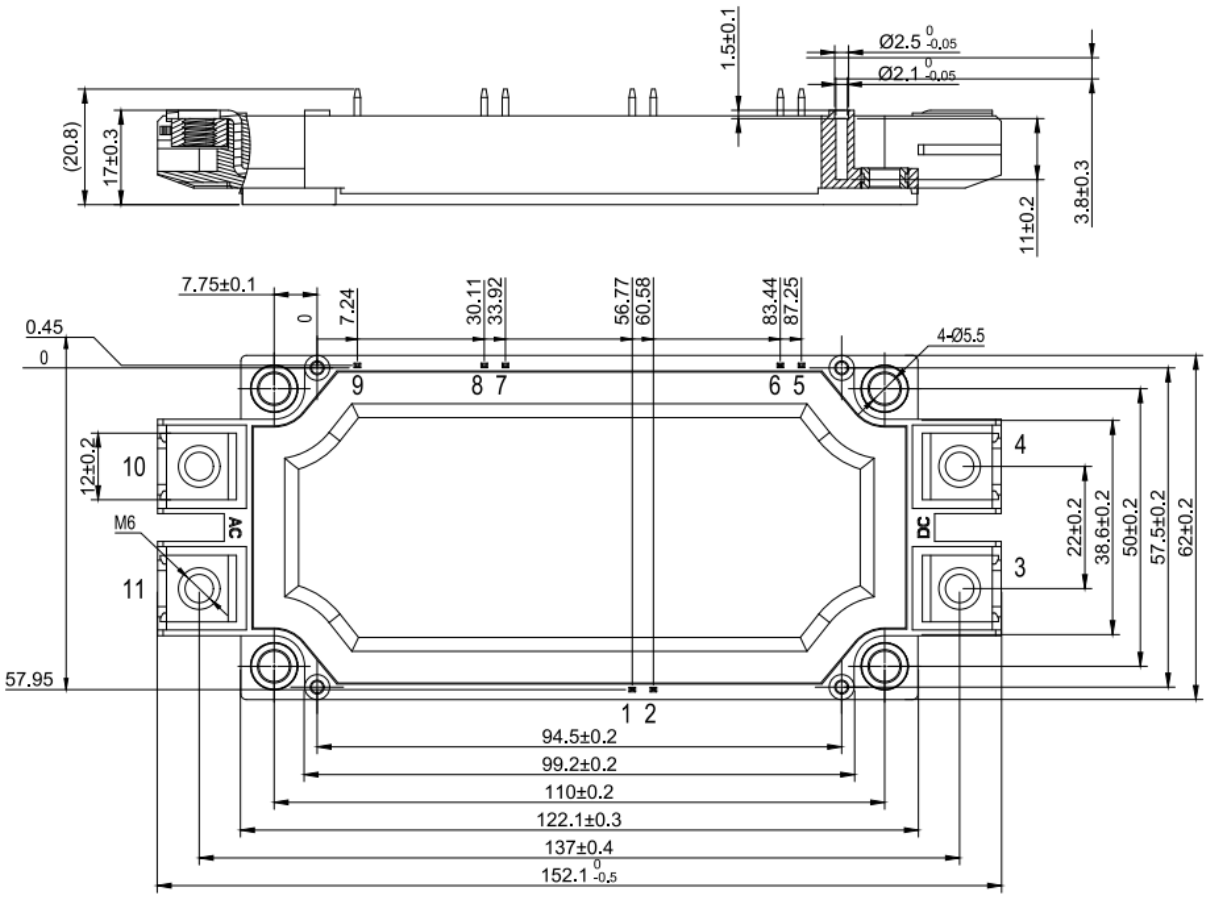

瞬态热阻抗 二极管
Transient Thermal Impedance Diode
$Z_{th(J-C)}=f(t)$



## 电路图 Circuit Diagram




## 外形尺寸 Outline Drawing




## 修订记录 Revision History

| 版本 Version | 日期 Date | 描述 Description |
|---|---|---|
| A0 | 2022-08-17 | 初版 |
| A1 | 2023-01-13 | 正式版 |