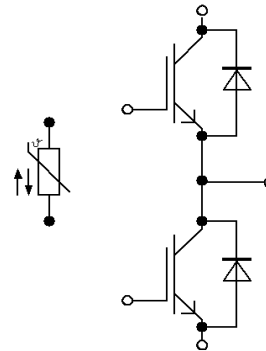
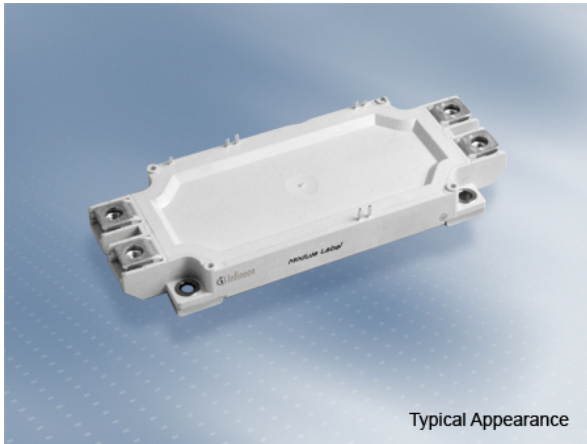


EconoDUAL™3 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管 带有温度检测NTC
 EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC



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

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 Collector-emitter voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{CES} | 1200 | V |
| 连续集电极直流电流 Continuous DC collector current | $T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | I_{CDC} | 600 | A |
| 集电极重复峰值电流 Repetitive peak collector current | $t_P = 1\text{ ms}$ | I_{CRM} | 1200 | A |
| 栅极 - 发射极峰值电压 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 Collector-emitter saturation voltage | $I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | 1,75 2,00 2,05 | 2,10 | V V V |
| 栅极阈值电压 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 Gate charge | $V_{GE} = -15 / 15\text{ V}$ | | Q_G | 4,40 | | μC |
| 内部栅极电阻 Internal gate resistor | $T_{vj} = 25^{\circ}\text{C}$ | | R_{Gint} | 1,2 | | Ω |
| 输入电容 Input capacitance | $f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | | C_{ies} | 37,0 | | nF |
| 反向传输电容 Reverse transfer capacitance | $f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | | C_{res} | 2,05 | | nF |
| 集电极-发射极截止电流 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 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) Turn-on delay time, inductive load | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{don} | 0,16 0,21 0,21 | | μs μs μs |
| 上升时间(电感负载) Rise time, inductive load | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_r | 0,09 0,09 0,10 | | μs μs μs |
| 关断延迟时间(电感负载) Turn-off delay time, inductive load | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{doff} | 0,48 0,61 0,65 | | μs μs μs |
| 下降时间(电感负载) Fall time, inductive load | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_f | 0,07 0,11 0,12 | | μs μs μs |
| 开通损耗能量(每脉冲) Turn-on energy loss per pulse | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $di/dt = 5100\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{on} | 62,5 83,0 90,0 | | mJ mJ mJ |
| 关断损耗能量(每脉冲) Turn-off energy loss per pulse | $I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $du/dt = 3700\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{off} | 47,0 72,0 79,5 | | mJ mJ mJ |
| 短路数据 SC data | $V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | | I_{SC} | 2400 | | A |
| 结 - 外壳热阻 Thermal resistance, junction to case | 每个 IGBT / per IGBT | | R_{thJC} | | 0,0473 | K/W |
| 外壳 - 散热器热阻 Thermal resistance, case to heatsink | 每个 IGBT / per IGBT $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | | 0,0304 | K/W |
| 在开关状态下温度 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 Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{RRM} | 1200 | 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 | $t_P = 1 \text{ ms}$ | I_{FRM} | 1200 | A |
| I^2t -值 I^2t - value | $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | I^2t | 40000 37500 | A^2s A^2s |

特征值 / Characteristic Values

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

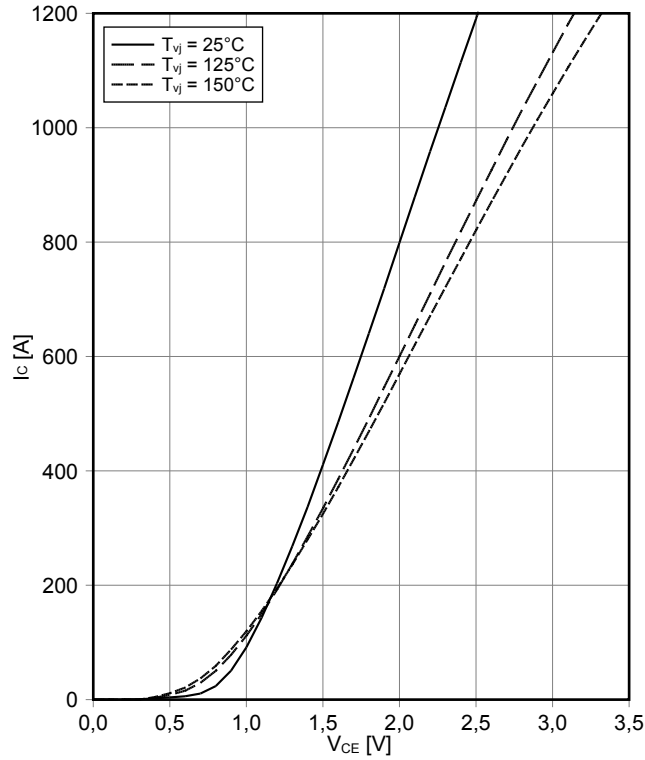
模块 / Module

| | | | | | |
|--|--|---------------------|--------------------------------|------|------|
| 绝缘测试电压 Isolation test voltage | RMS, f = 50 Hz, t = 1 min | V _{ISOL} | 3,4 | | kV |
| 模块基板材料 Material of module baseplate | | | Cu | | |
| 内部绝缘 Internal isolation | 基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140) | | Al ₂ O ₃ | | |
| 爬电距离 Creepage distance | 端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal | | 15,0 13,0 | | mm |
| 电气间隙 Clearance | 端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal | | 12,5 10,0 | | mm |
| 相对电痕指数 Comperative tracking index | | CTI | > 200 | | |
| 相对温度指数 (电) RTI Elec. | 住房 housing | RTI | 140 | | °C |
| | | | min. | typ. | max. |
| 杂散电感,模块 Stray inductance module | | L _{sCE} | 20 | | nH |
| 模块引线电阻,端子-芯片 Module lead resistance, terminals - chip | T _c = 25°C, 每个开关 / per switch | R _{CC+EE'} | 1,00 | | mΩ |
| 储存温度 Storage temperature | | T _{stg} | -40 | 125 | °C |
| 模块安装的安装扭矩 Mounting torque for modul mounting | 螺丝 M5 根据相应的应用手册进行安装 Screw M5 - Mounting according to valid application note | M | 3,00 | 6,00 | Nm |
| 端子联接扭矩 Terminal connection torque | 螺丝 M6 根据相应的应用手册进行安装 Screw M6 - Mounting according to valid application note | M | 3,0 | 6,0 | Nm |
| 重量 Weight | | G | 345 | | g |

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

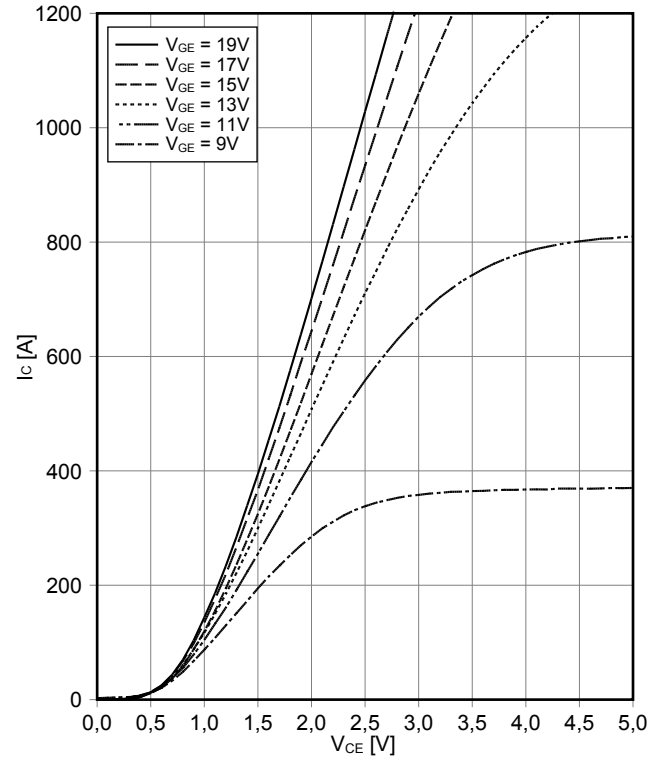
$I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

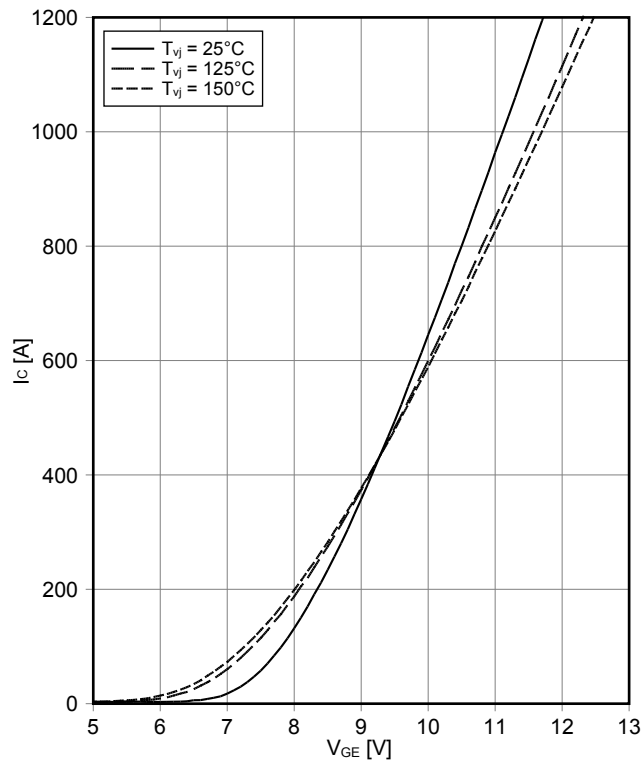
$I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

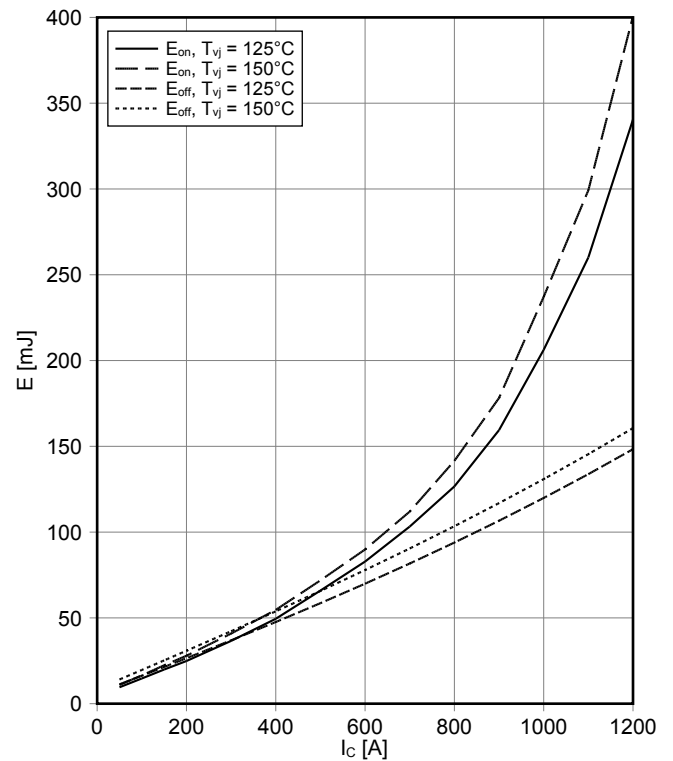
$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)

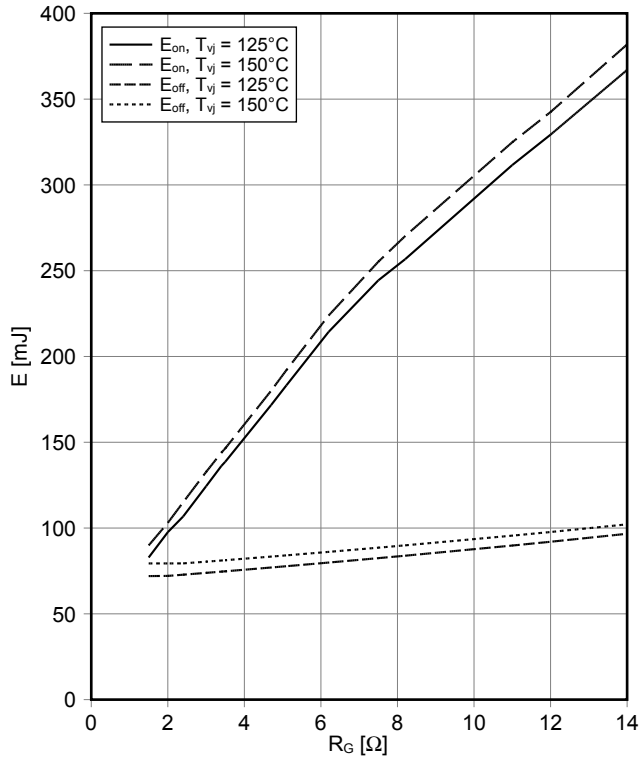
switching losses IGBT, Inverter (typical)

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

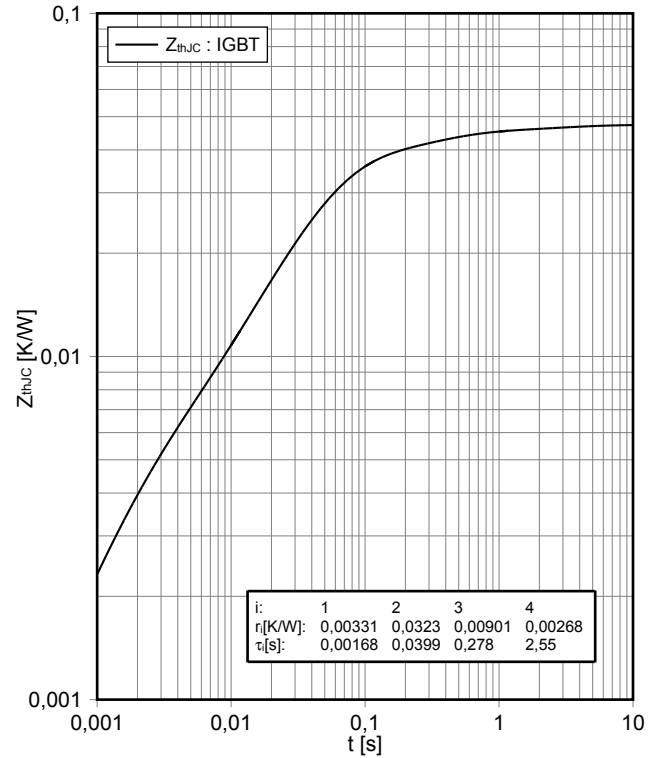


开关损耗 IGBT, 逆变器 (典型)
switching losses IGBT, Inverter (typical)

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

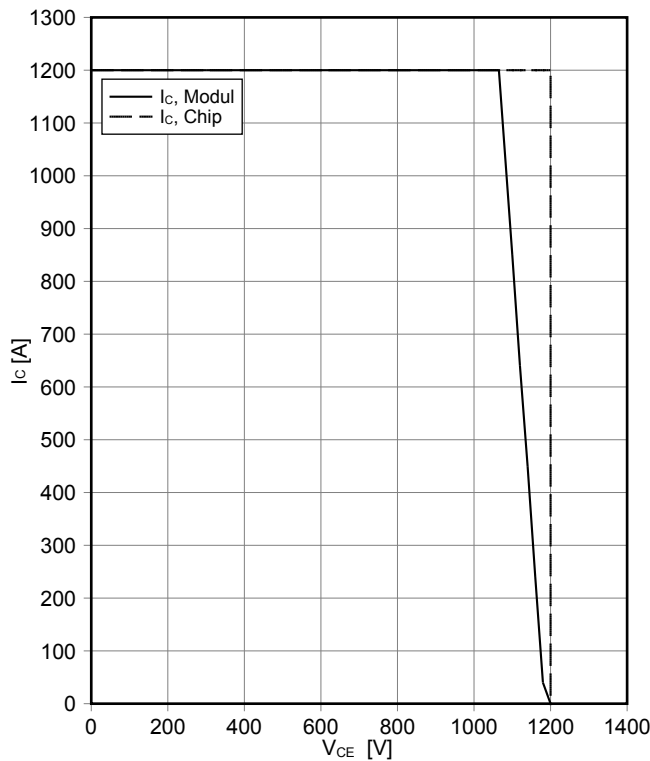


瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$

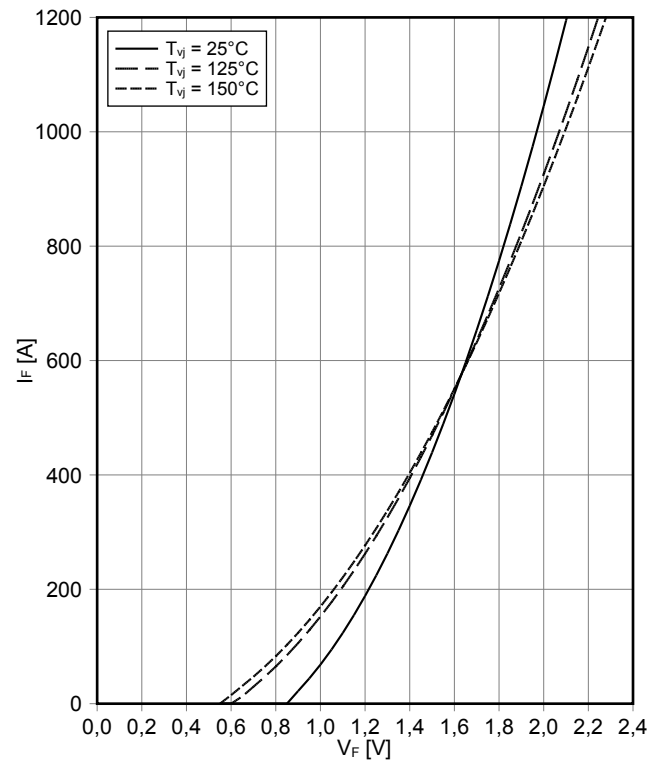


反偏安全工作区 IGBT, 逆变器 (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

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

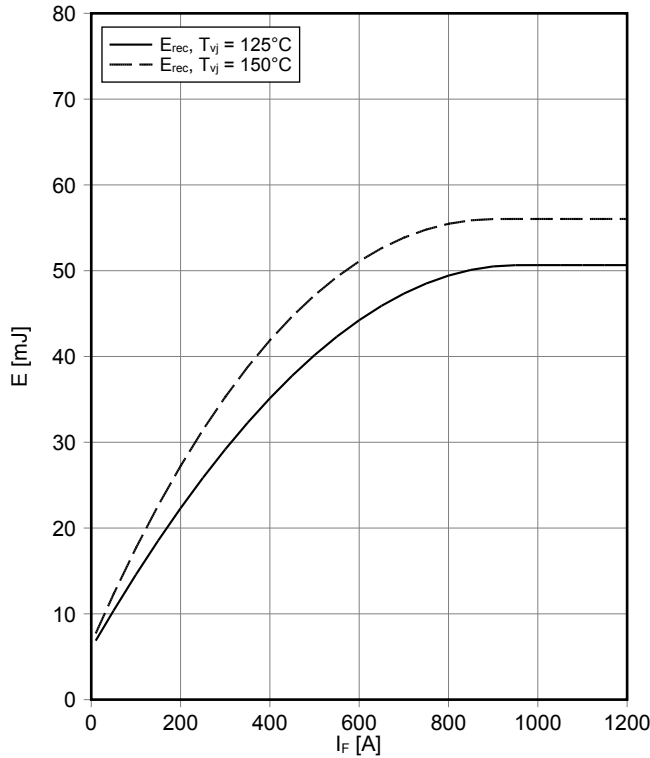


正向偏压特性 二极管, 逆变器 (典型)
forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



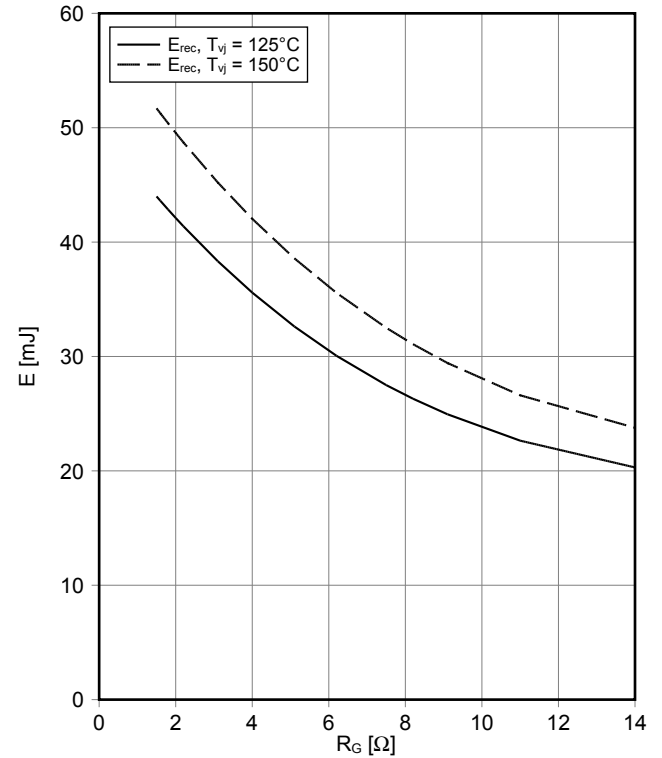
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)

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



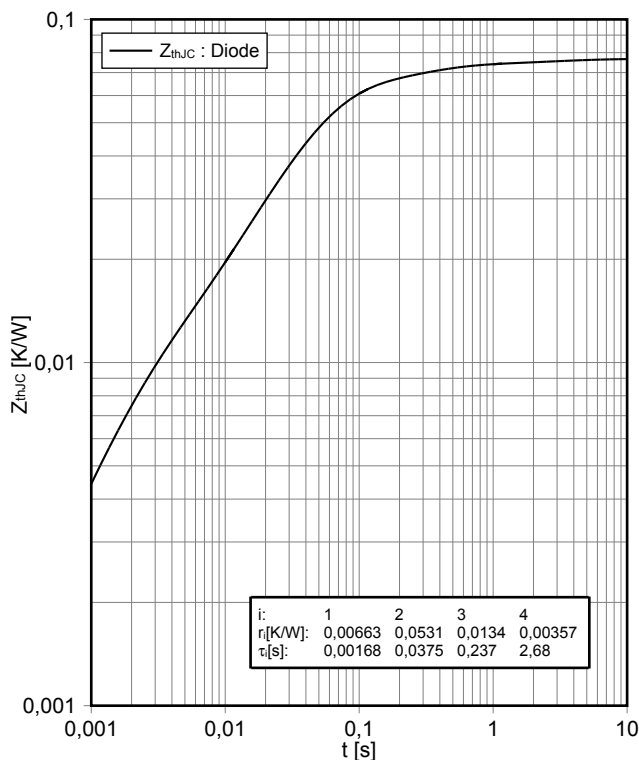
开关损耗 二极管,逆变器 (典型)
switching losses Diode, Inverter (typical)

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



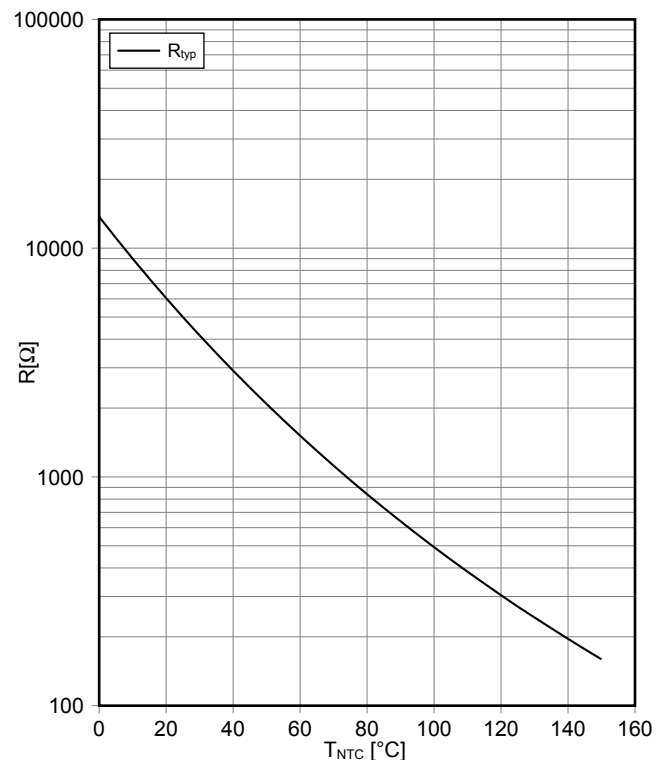
瞬态热阻抗 二极管,逆变器
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

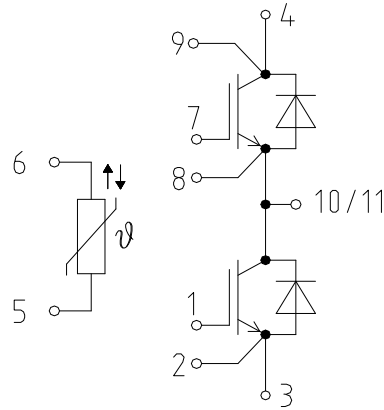


负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)

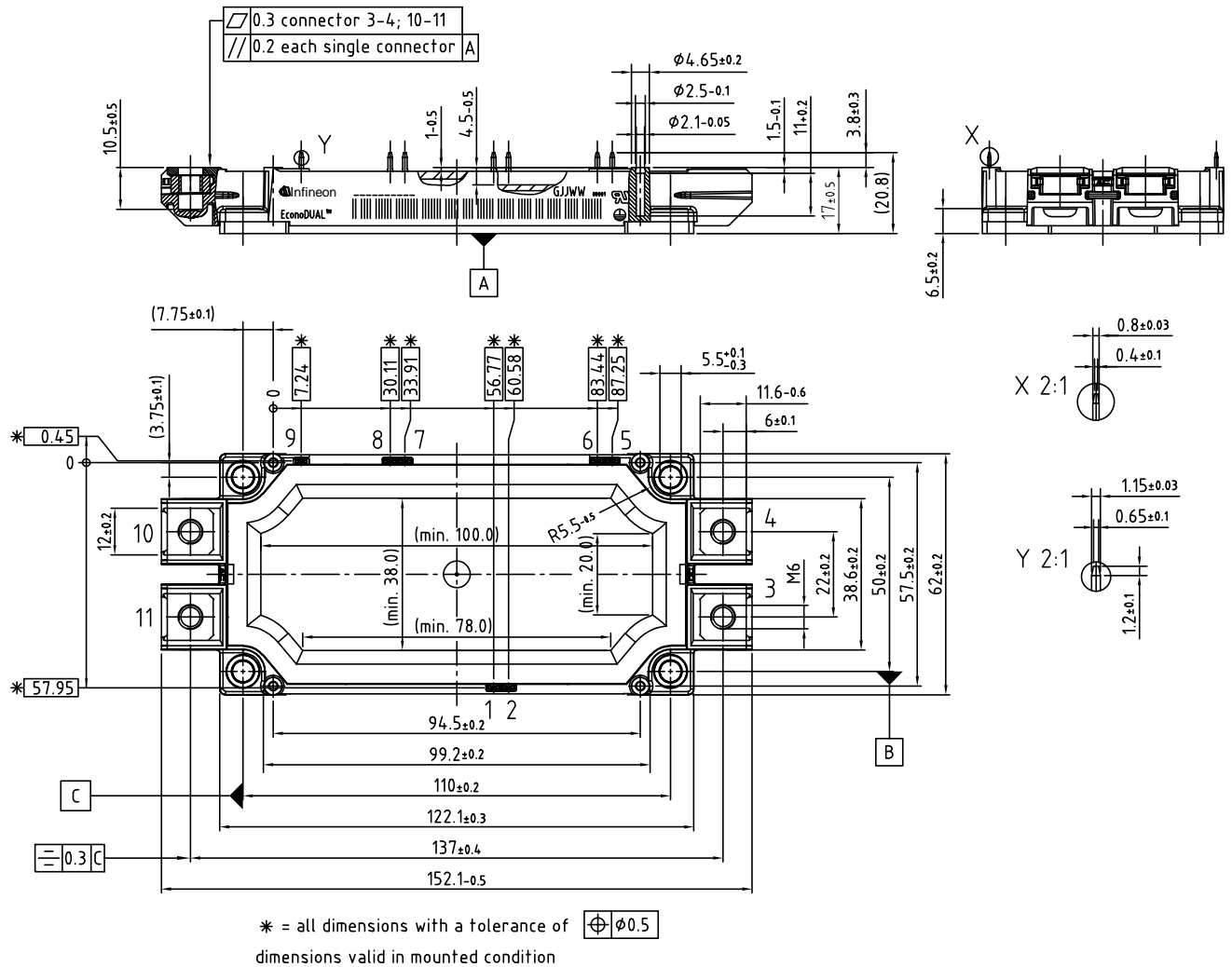
$R = f(T)$



接线图 / Circuit diagram



封装尺寸 / Package outlines



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