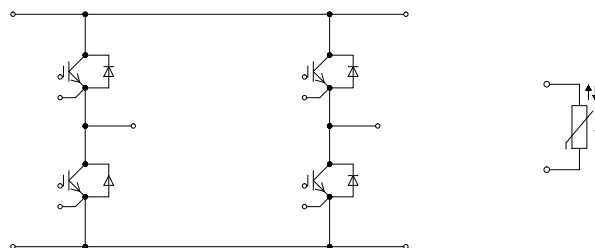


EconoPACK™3 モジュール トレンチ/フィールドストップ IGBT4 and エミッターコントロール diode内蔵 and NTCサーミスタ

EconoPACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC



Typical appearance



$V_{CES} = 1700V$
 $I_{C\ nom} = 200A / I_{CRM} = 400A$

一般応用

- ハイパワーコンバータ
- 中圧コンバータ

電気的特性

- 低 V_{CESat} 飽和電圧
- $T_{vj\ op} = 150^{\circ}C$
- トレンチ IGBT 4
- 正温度特性を持った V_{CESat} 飽和電圧

機械的特性

- 内蔵されたNTCサーミスタ
- 絶縁されたベースプレート
- 半田接合技術
- 標準ハウジング

Typical Applications

- High power converters
- Medium voltage converters

Electrical Features

- Low V_{CESat}
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4
- V_{CESat} with positive temperature coefficient

Mechanical Features

- Integrated NTC temperature sensor
- Isolated base plate
- Solder contact technology
- 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 |

IGBT- インバータ / IGBT, Inverter 最大定格 / Maximum Rated Values

| | | | | |
|--|--|-------------------|-------|---|
| コレクタ・エミッタ間電圧 Collector-emitter voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{CES} | 1700 | V |
| 連続DCコレクタ電流 Continuous DC collector current | $T_C = 95^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$ | $I_{C\text{nom}}$ | 200 | A |
| 繰り返しピークコレクタ電流 Repetitive peak collector current | $t_P = 1\text{ms}$ | I_{CRM} | 400 | A |
| ゲート・エミッタ間ピーク電圧 Gate-emitter peak voltage | | V_{GES} | +/-20 | V |

電気的特性 / Characteristic Values

| | | min. | typ. | max. | |
|---|---|---|--------------------|----------------------|---|
| コレクタ・エミッタ間飽和電圧 Collector-emitter saturation voltage | $I_C = 200\text{A}, V_{GE} = 15\text{V}$ $I_C = 200\text{A}, V_{GE} = 15\text{V}$ $I_C = 200\text{A}, V_{GE} = 15\text{V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{sat}}$ | 1,95 2,35 2,45 | 2,30 V V V |
| ゲート・エミッタ間しきい値電圧 Gate threshold voltage | $I_C = 4,00\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$ | | V_{GEth} | 5,35 | 5,80 6,25 V |
| ゲート電荷量 Gate charge | $V_{GE} = -15\text{V} \dots +15\text{V}$ | | Q_G | 2,40 | μC |
| 内蔵ゲート抵抗 Internal gate resistor | $T_{vj} = 25^{\circ}\text{C}$ | | R_{Gint} | 3,8 | Ω |
| 入力容量 Input capacitance | $f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$ | | C_{ies} | 18,0 | nF |
| 帰還容量 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} | 0,58 | nF |
| コレクタ・エミッタ間遮断電流 Collector-emitter cut-off current | $V_{CE} = 1700\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$ | | I_{CES} | | 1,0 mA |
| ゲート・エミッタ間漏れ電流 Gate-emitter leakage current | $V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$ | | I_{GES} | | 100 nA |
| ターンオン遅れ時間 (誘導負荷) Turn-on delay time, inductive load | $I_C = 200\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{don} | 0,21 0,22 0,23 | μs μs μs |
| ターンオン上昇時間 (誘導負荷) Rise time, inductive load | $I_C = 200\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_r | 0,03 0,04 0,04 | μs μs μs |
| ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load | $I_C = 200\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{doff} | 0,43 0,57 0,61 | μs μs μs |
| ターンオフ下降時間 (誘導負荷) Fall time, inductive load | $I_C = 200\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_f | 0,24 0,45 0,55 | μs μs μs |
| ターンオンスイッチング損失 Turn-on energy loss per pulse | $I_C = 200\text{A}, V_{CE} = 900\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 5500\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{on} | 41,5 59,5 64,0 | mJ mJ mJ |
| ターンオフスイッチング損失 Turn-off energy loss per pulse | $I_C = 200\text{A}, V_{CE} = 900\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3100\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 0,51\Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{off} | 34,0 57,5 66,0 | mJ mJ mJ |
| 短絡電流 SC data | $V_{GE} \leq 15\text{V}, V_{CC} = 1000\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | | I_{SC} | 900 | A |
| ジャンクション・ケース間熱抵抗 Thermal resistance, junction to case | IGBT部 (1素子当り) / per IGBT | | R_{thJC} | | 0,130 K/W |
| ケース・ヒートシンク間熱抵抗 Thermal resistance, case to heatsink | IGBT部 (1素子当り) / per IGBT $\lambda_{\text{Paste}} = 1\text{W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | 0,0835 | K/W |
| 動作温度 Temperature under switching conditions | | | $T_{vj\text{op}}$ | -40 | 150 $^{\circ}\text{C}$ |

Diode、インバータ / Diode, Inverter 最大定格 / Maximum Rated Values

| | | | | |
|--|--|-----------|--------------|--|
| ピーク繰返し逆電圧 Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{RRM} | 1700 | V |
| 連続DC電流 Continuous DC forward current | | I_F | 200 | A |
| ピーク繰返し順電流 Repetitive peak forward current | $t_P = 1\text{ ms}$ | I_{FRM} | 400 | A |
| 電流二乗時間積 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 | 5100 4200 | A^2s A^2s |

電気的特性 / Characteristic Values

| | | min. | typ. | max. | |
|---|---|---|--------------------|----------------------|---|
| 順電圧 Forward voltage | $I_F = 200\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 200\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 200\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | V_F | 1,80 1,90 1,95 | 2,20 V V V |
| ピーク逆回復電流 Peak reverse recovery current | $I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | I_{RM} | 375 390 390 | A A A |
| 逆回復電荷量 Recovered charge | $I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | Q_r | 51,0 88,5 99,0 | μC μC μC |
| 逆回復損失 Reverse recovery energy | $I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{rec} | 27,0 51,5 58,5 | mJ mJ mJ |
| ジャンクション・ケース間熱抵抗 Thermal resistance, junction to case | /Diode (1 素子当り) / per diode | | R_{thJC} | | 0,256 K/W |
| ケース・ヒートシンク間熱抵抗 Thermal resistance, case to heatsink | /Diode (1 素子当り) / per diode $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | 0,101 | K/W |
| 動作温度 Temperature under switching conditions | | | $T_{vj\text{ op}}$ | -40 | 150 $^{\circ}\text{C}$ |

NTC-サーミスタ / NTC-Thermistor

電気的特性 / Characteristic Values

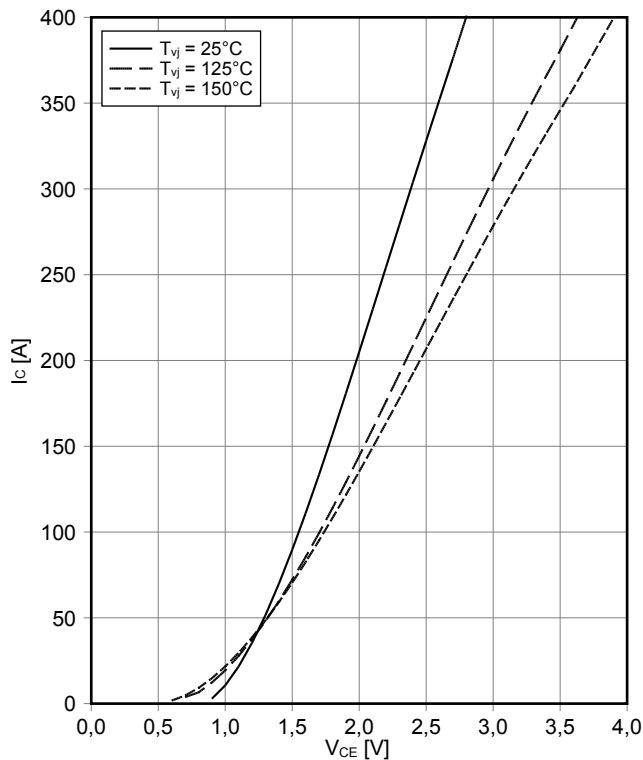
| | | min. | typ. | max. | |
|------------------------------|---|--------------|------|------|------------|
| 定格抵抗値 Rated resistance | $T_{NTC} = 25^{\circ}\text{C}$ | R_{25} | 5,00 | | k Ω |
| R100の偏差 Deviation of R100 | $T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$ | $\Delta R/R$ | -5 | 5 | % |
| 損失 Power dissipation | $T_{NTC} = 25^{\circ}\text{C}$ | P_{25} | | 20,0 | mW |
| B-定数 B-value | $R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$ | $B_{25/50}$ | 3375 | | K |
| B-定数 B-value | $R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$ | $B_{25/80}$ | 3411 | | K |
| B-定数 B-value | $R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$ | $B_{25/100}$ | 3433 | | K |

適切なアプリケーションノートによる仕様
Specification according to the valid application note.

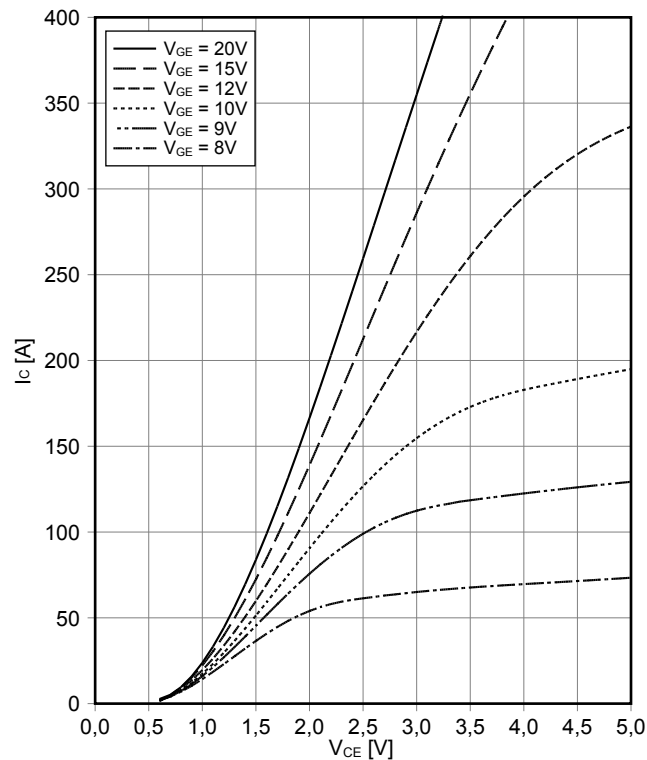
モジュール / Module

| | | | | | |
|---|--|-------------------|--------------------------------|------|---------|
| 絶縁耐圧 Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | V _{ISOL} | 3,4 | | kV |
| ベースプレート材質 Material of module baseplate | | | Cu | | |
| 内部絶縁 Internal isolation | 基礎絶縁 (クラス1, IEC 61140) basic insulation (class 1, IEC 61140) | | Al ₂ O ₃ | | |
| 沿面距離 Creepage distance | 連絡方法 - ヒートシンク / terminal to heatsink 連絡方法 - 連絡方法 / terminal to terminal | | 10,0 | | mm |
| 空間距離 Clearance | 連絡方法 - ヒートシンク / terminal to heatsink 連絡方法 - 連絡方法 / terminal to terminal | | 7,5 | | mm |
| 相対トラッキング指数 Comperative tracking index | | CTI | > 200 | | |
| | | | min. | typ. | max. |
| 内部インダクタンス Stray inductance module | | L _{sCE} | | 18 | nH |
| 保存温度 Storage temperature | | T _{stg} | -40 | | 125 °C |
| 取り付けネジ締め付けトルク Mounting torque for modul mounting | 取り付けネジ M5 適切なアプリケーションノートによるマウンティング Screw M5 - Mounting according to valid application note | M | 3,00 | | 6,00 Nm |
| 質量 Weight | | G | | 300 | g |

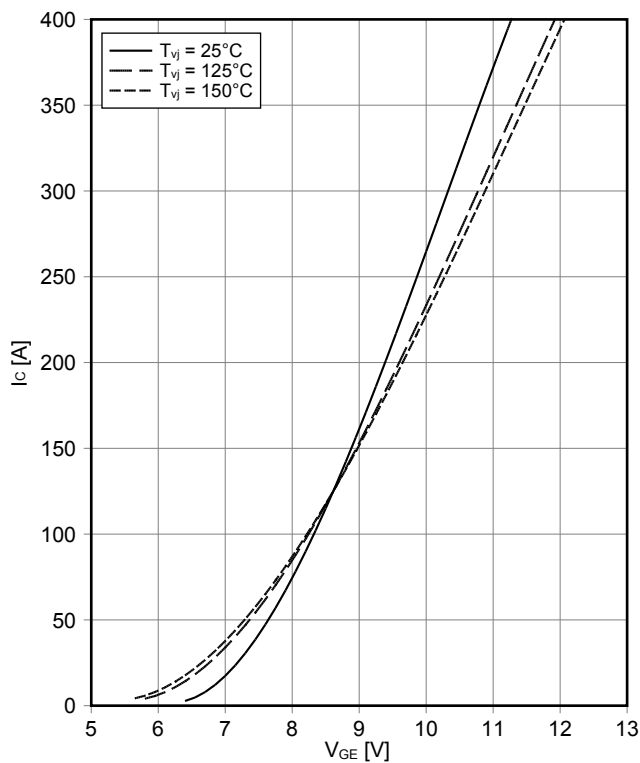
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)
 $I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



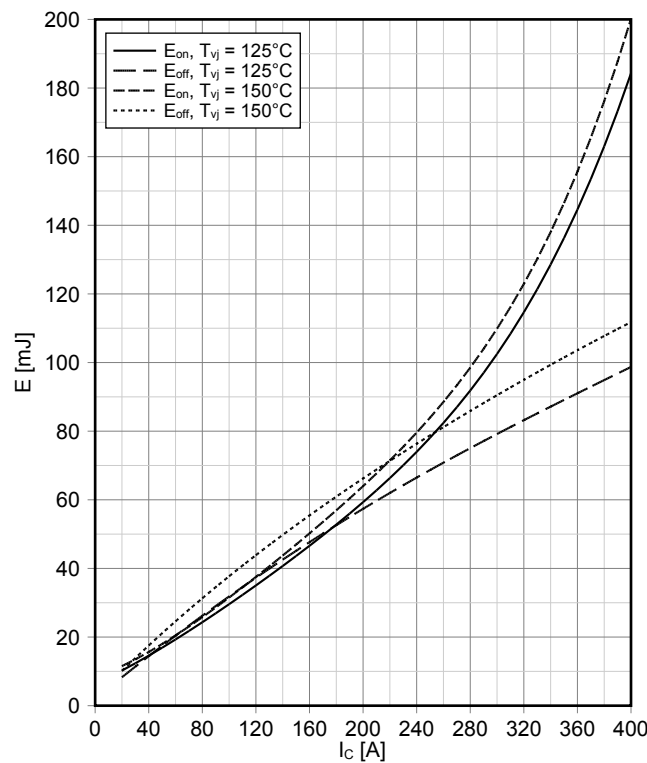
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)
 $I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



伝達特性 IGBT- インバータ (Typical)
transfer characteristic IGBT, Inverter (typical)
 $I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$

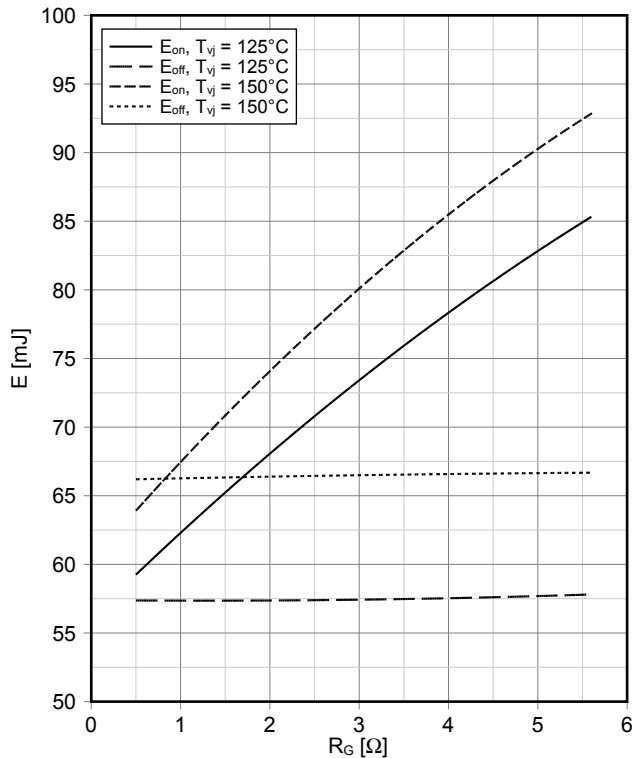


スイッチング損失 IGBT- インバータ (Typical)
switching losses IGBT, Inverter (typical)
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.51\ \Omega$, $R_{Goff} = 0.51\ \Omega$, $V_{CE} = 900\text{ V}$



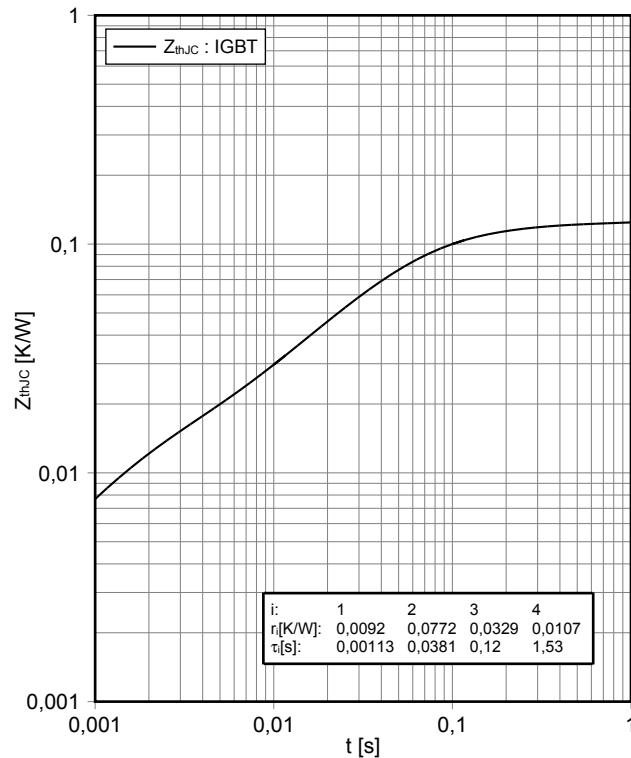
スイッチング損失 IGBT- インバータ (Typical)
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 200\text{ A}$, $V_{CE} = 900\text{ V}$



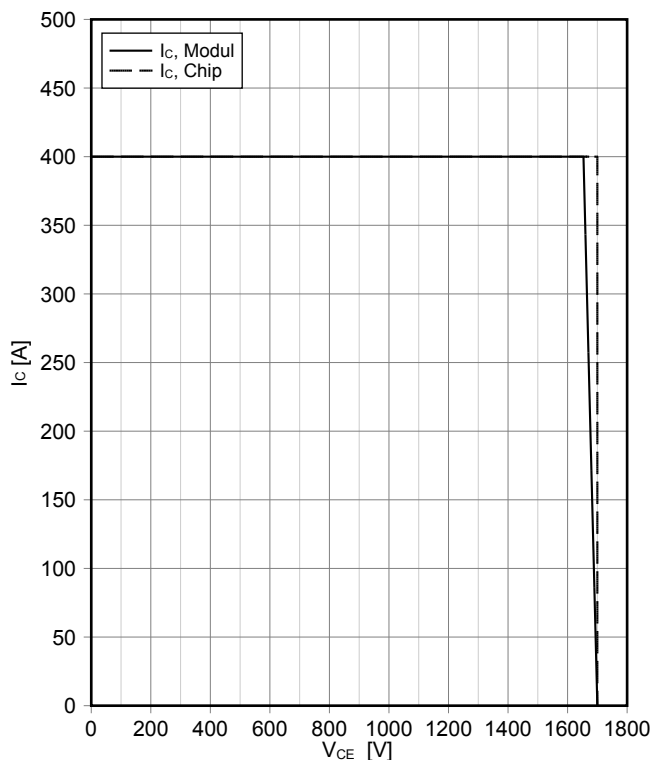
過渡熱インピーダンス IGBT- インバータ
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



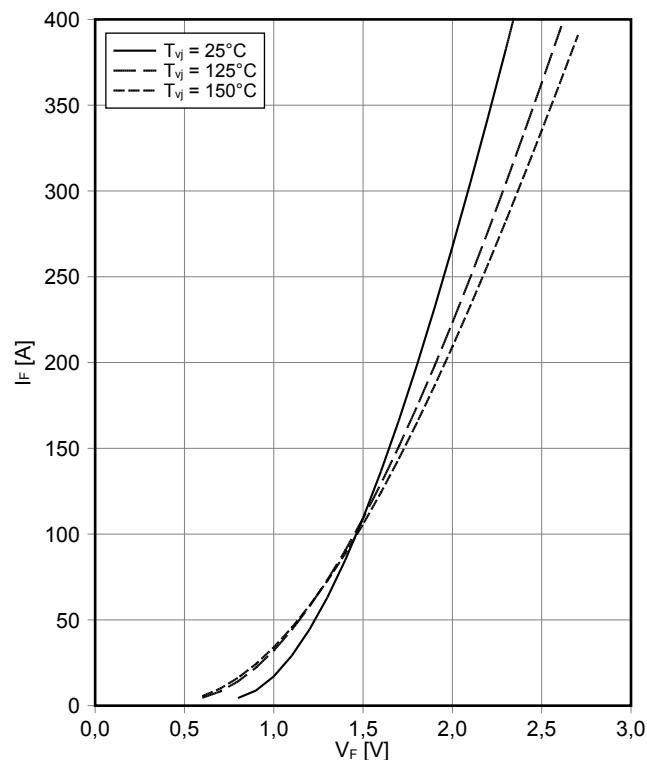
逆バイアス安全動作領域 IGBT- インバータ (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 0.51\ \Omega$, $T_{vj} = 150^\circ\text{C}$



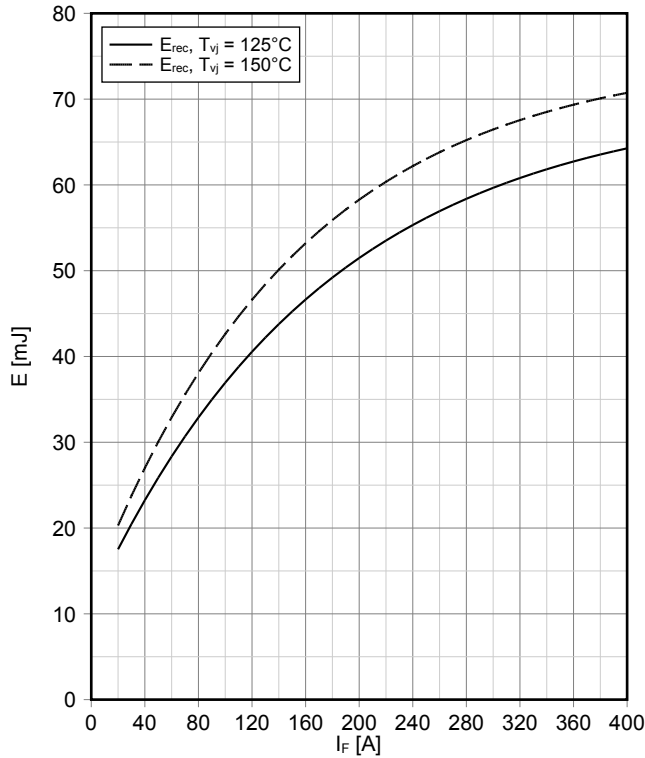
順電圧特性 Diode、インバータ (typical)
forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



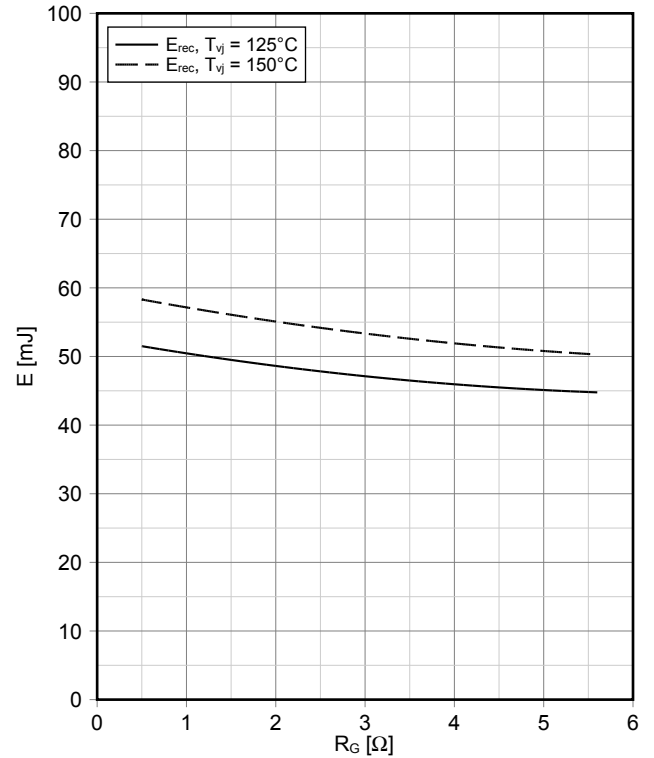
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.51 \Omega, V_{CE} = 900 V$



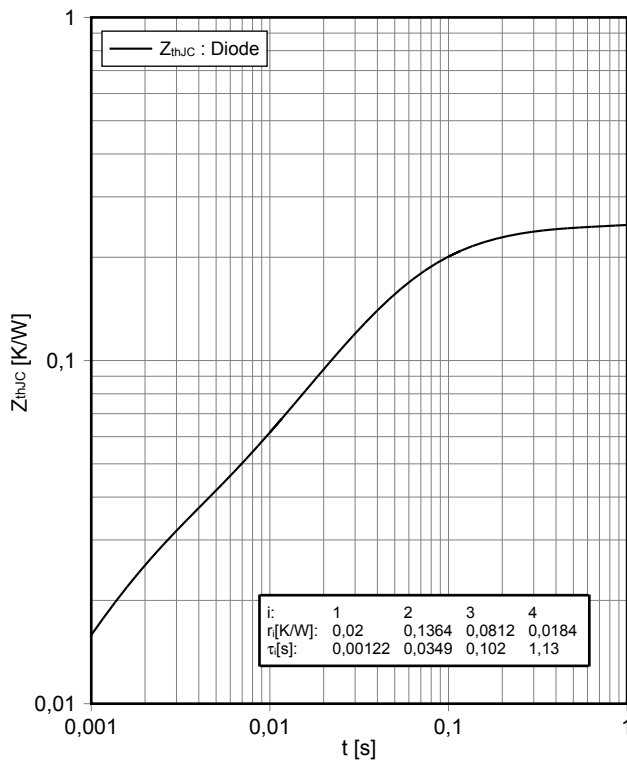
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 200 A, V_{CE} = 900 V$



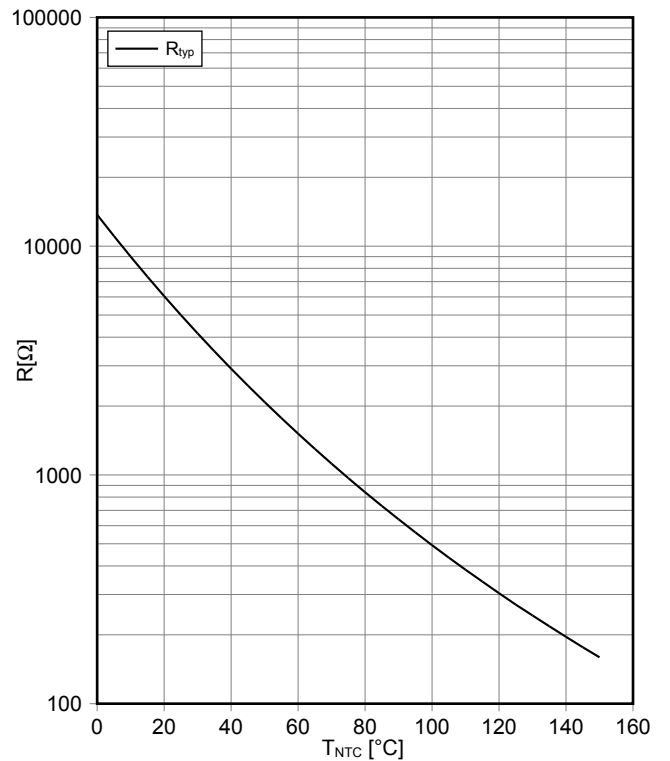
過渡熱インピーダンス Diode、インバータ
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

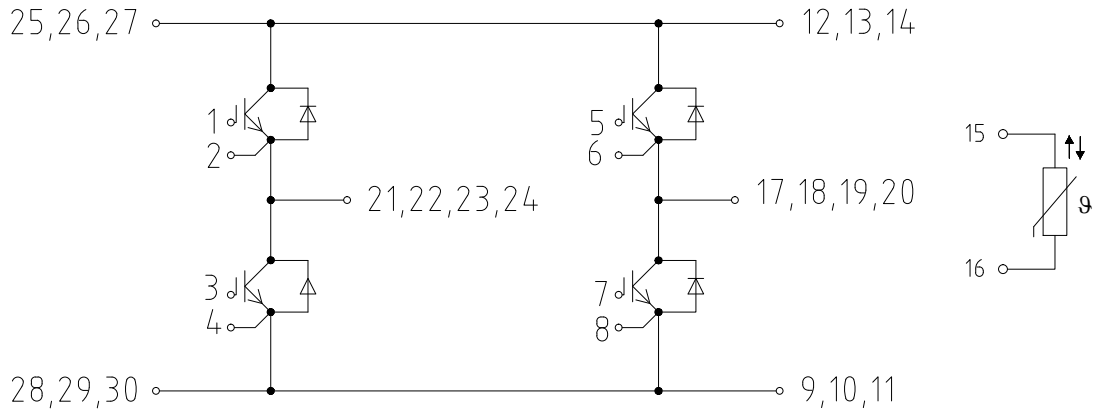


NTC-サーミスタ サーミスタの温度特性
NTC-Thermistor-temperature characteristic (typical)

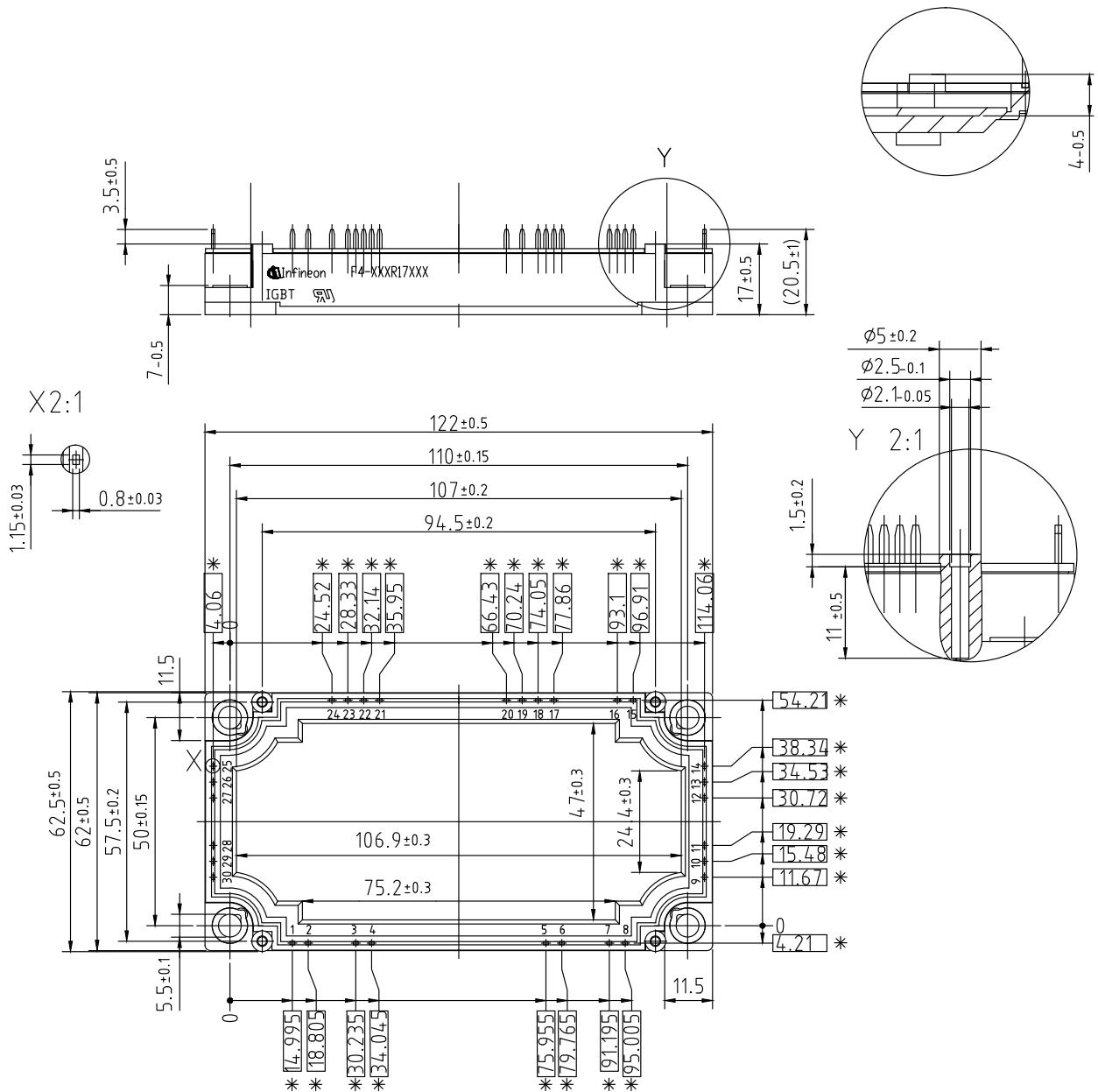
$R = f(T)$



回路図 / Circuit diagram



パッケージ概要 / Package outlines



* = alle Maße mit einer Toleranz von ± 0.5
 * = all dimensions with tolerance of ± 0.5