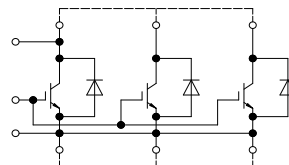


IHM-B モジュール ソフトスイッチング トレンチIGBT4内蔵
IHM-B module with soft-switching Trench-IGBT4

暫定データ / Preliminary Data



external connection
(to be done)

$V_{CES} = 1700V$
 $I_{C\ nom} = 1800A / I_{CRM} = 3600A$

一般応用

- ハイパワーコンバータ
- モーター駆動

電気的特性

- 拡張された動作温度 $T_{vj\ op}$
- 低 V_{CEsat} 飽和電圧
- $T_{vj\ op} = 150^{\circ}C$

機械的特性

- 4 kV AC 1分 絶縁耐圧
- CTI(比較トラッキング指数) >400のモジュールパッケージ
- 長い縁面/空間距離
- 高いパワー密度
- IHM Bハウジング
- 銅ベースプレート

Typical Applications

- High Power Converters
- Motor Drives

Electrical Features

- Extended Operation Temperature $T_{vj\ op}$
- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$

Mechanical Features

- 4 kV AC 1min Insulation
- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power Density
- IHM B Housing
- Copper Base Plate

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 |

| | | |
|-----------------|---------------------------------|----------------------|
| prepared by: WB | date of publication: 2013-11-11 | |
| approved by: PL | revision: 2.2 | UL approved (E83335) |



暫定データ
Preliminary Data

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 | $T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | $I_{C\text{nom}}$ | 1800 | 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} | 3600 | A |
| トータル損失 Total power dissipation | $T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | P_{tot} | 11,5 | kW |
| 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 | $I_C = 1800\text{A}, V_{GE} = 15\text{V}$ $I_C = 1800\text{A}, V_{GE} = 15\text{V}$ $I_C = 1800\text{A}, V_{GE} = 15\text{V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{sat}}$ | 1,90 2,30 2,40 | 2,25 | V V V |
| ゲート・エミッタ間しきい値電圧 Gate threshold voltage | $I_C = 72,0\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$ | | V_{GEth} | 5,2 5,8 | 6,4 | V |
| ゲート電荷量 Gate charge | $V_{GE} = -15\text{V} \dots +15\text{V}$ | | Q_G | 19,0 | | μC |
| 内蔵ゲート抵抗 Internal gate resistor | $T_{vj} = 25^{\circ}\text{C}$ | | R_{Gint} | 1,1 | | 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} | 145 | | 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} | 4,75 | | 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} | | 5,0 | 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} | | 400 | nA |
| ターンオン遅れ時間 (誘導負荷) Turn-on delay time, inductive load | $I_C = 1800\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,68\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{don} | 0,66 0,72 0,73 | | μs μs μs |
| ターンオン上昇時間 (誘導負荷) Rise time, inductive load | $I_C = 1800\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,68\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_r | 0,16 0,17 0,17 | | μs μs μs |
| ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load | $I_C = 1800\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 0,8\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_{doff} | 1,25 1,35 1,40 | | μs μs μs |
| ターンオフ下降時間 (誘導負荷) Fall time, inductive load | $I_C = 1800\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 0,8\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | t_f | 0,27 0,41 0,46 | | μs μs μs |
| ターンオンスイッチング損失 Turn-on energy loss per pulse | $I_C = 1800\text{A}, V_{CE} = 900\text{V}, L_S = 50\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 11000\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,68\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{on} | 390 510 560 | | mJ mJ mJ |
| ターンオフスイッチング損失 Turn-off energy loss per pulse | $I_C = 1800\text{A}, V_{CE} = 900\text{V}, L_S = 50\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3000\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 0,8\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{off} | 470 620 660 | | 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} | 7500 | | 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} | | 13,0 | K/kW |
| 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} | 6,80 | | K/kW |
| 動作温度 Temperature under switching conditions | | | $T_{vj\text{op}}$ | -40 | 150 | $^{\circ}\text{C}$ |

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|-----------------|---------------------------------|
| prepared by: WB | date of publication: 2013-11-11 |
| approved by: PL | revision: 2.2 |



暫定データ
Preliminary Data

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 | 1800 | A |
| ピーク繰返し順電流 Repetitive peak forward current | $t_P = 1 \text{ ms}$ | I_{FRM} | 3600 | 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 | 590 555 | kA^2s kA^2s |
| 最大損失 Maximum power dissipation | $T_{vj} = 125^{\circ}\text{C}$ | P_{RQM} | 1800 | kW |
| 最小ターンオン時間 Minimum turn-on time | | $t_{on \text{ min}}$ | 10,0 | μs |

電気的特性 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---------------------|----------------------|------|---|
| 順電圧 Forward voltage | $I_F = 1800 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 1800 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 1800 \text{ A}, V_{GE} = 0 \text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | 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 | $I_F = 1800 \text{ A}, -di_F/dt = 11000 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | I_{RM} | 1800 2100 2250 | | A A A |
| 逆回復電荷量 Recovered charge | $I_F = 1800 \text{ A}, -di_F/dt = 11000 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | Q_r | 430 725 830 | | μC μC μC |
| 逆回復損失 Reverse recovery energy | $I_F = 1800 \text{ A}, -di_F/dt = 11000 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900 \text{ V}$ $V_{GE} = -15 \text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ | E_{rec} | 250 470 540 | | 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} | | 21,5 | K/kW |
| 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 $\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | 7,40 | | K/kW |
| 動作温度 Temperature under switching conditions | | | $T_{vj \text{ op}}$ | -40 | 150 | $^{\circ}\text{C}$ |

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|-----------------|---------------------------------|
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暫定データ
Preliminary Data

モジュール / Module

| | | | | | |
|---|--|---------------------|--------------------------------|------|---------|
| 絶縁耐圧 Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | V _{ISOL} | 4,0 | | 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 | | 32,2 32,2 | | 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 | | 19,1 19,1 | | mm |
| 相対トラッキング指数 Comperative tracking index | | CTI | > 400 | | |
| | | | min. | typ. | max. |
| 内部インダクタンス Stray inductance module | | L _{sCE} | 6,0 | | nH |
| パワーターミナル・チップ間抵抗 Module lead resistance, terminals - chip | T _c = 25°C, /スイッチ / per switch | R _{CC+EE'} | 0,12 | | mΩ |
| 保存温度 Storage temperature | | T _{stg} | -40 | 150 | °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 M6 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 M6 - Mounting according to valid application note | M | 4,25 | - | 5,75 Nm |
| 主端子ネジ締め付けトルク Terminal connection torque | 取り付けネジ M4 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 M4 - Mounting according to valid application note | M | 1,8 | - | 2,1 Nm |
| | 取り付けネジ M8 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 M8 - Mounting according to valid application note | | 8,0 | - | 10 Nm |
| | | | | | |
| 質量 Weight | | G | 1900 | | g |

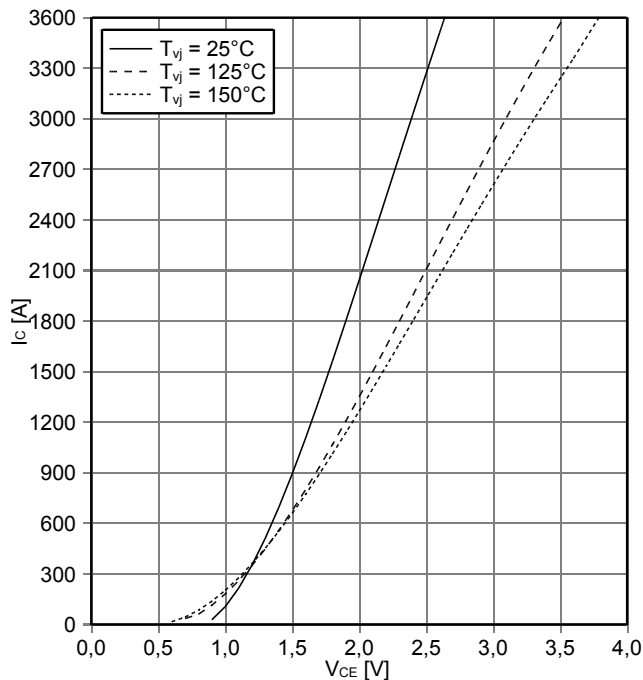
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暫定データ
Preliminary Data

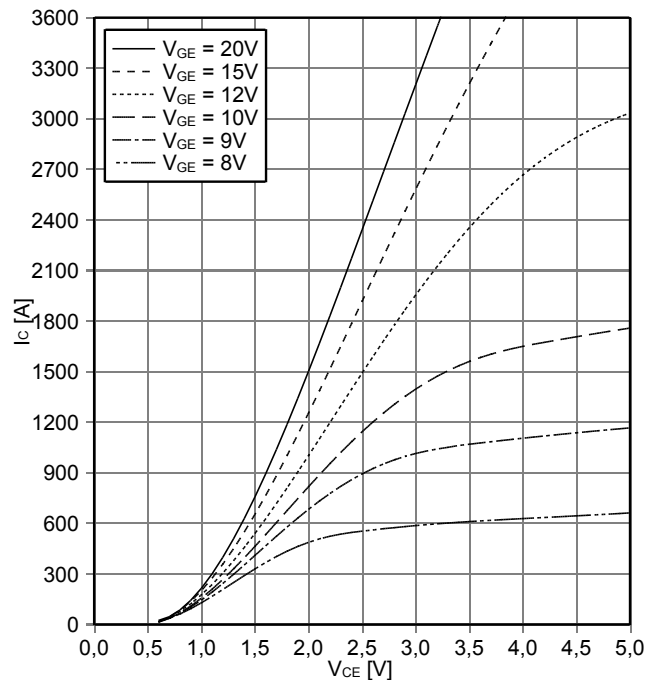
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)

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



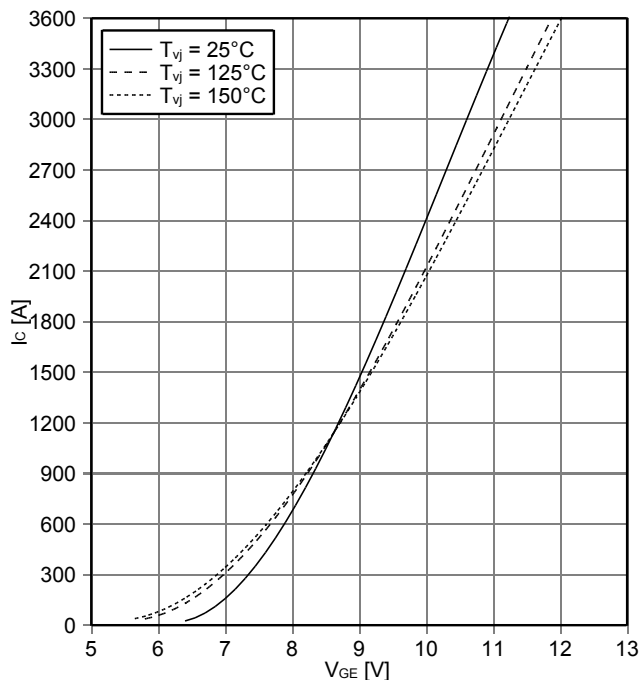
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)

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



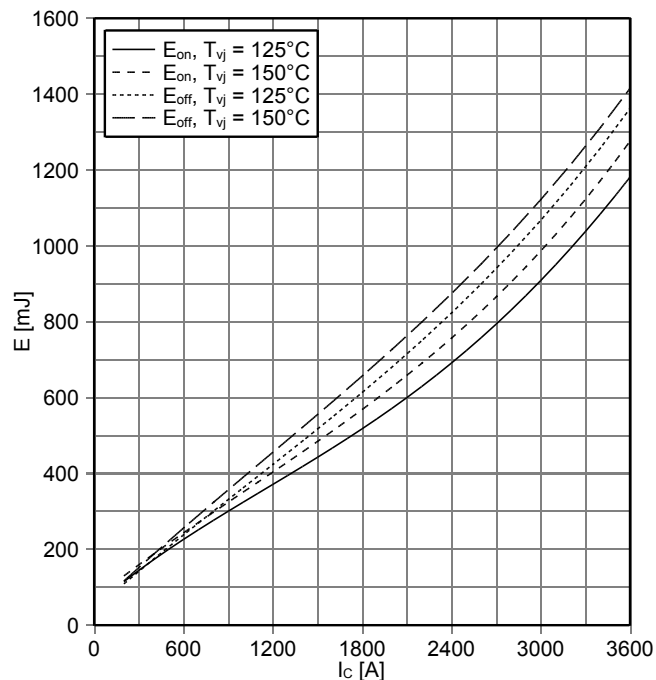
伝達特性 IGBT- インバータ (Typical)
transfer characteristic IGBT, Inverter (typical)

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



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

$E_{on} = f(I_C), E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 0.68\ \Omega, R_{Goff} = 0.8\ \Omega, V_{CE} = 900\text{ V}$



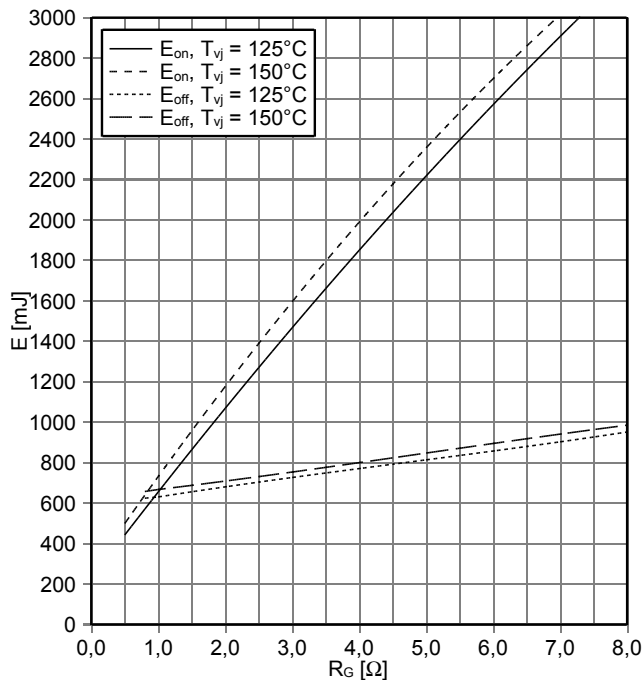
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| prepared by: WB | date of publication: 2013-11-11 |
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暫定データ
Preliminary Data

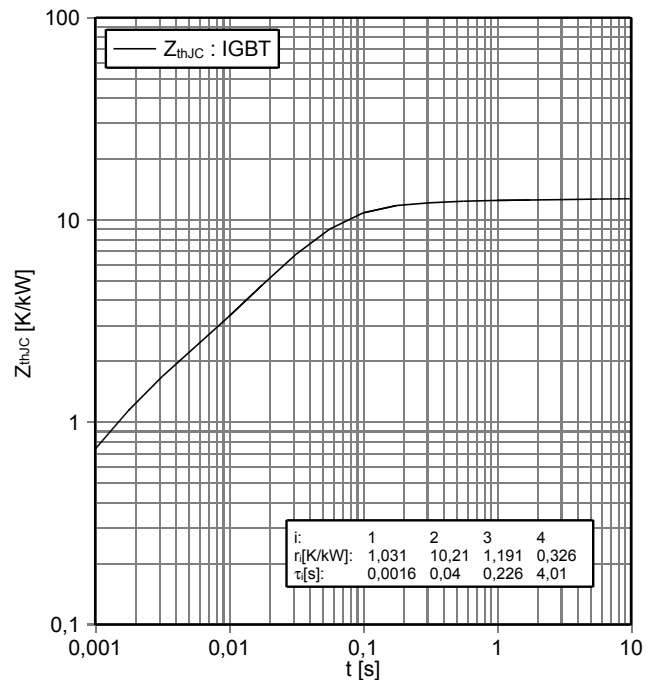
スイッチング損失 IGBT- インバータ (Typical)
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}, I_C = 1800\text{ A}, V_{CE} = 900\text{ V}$



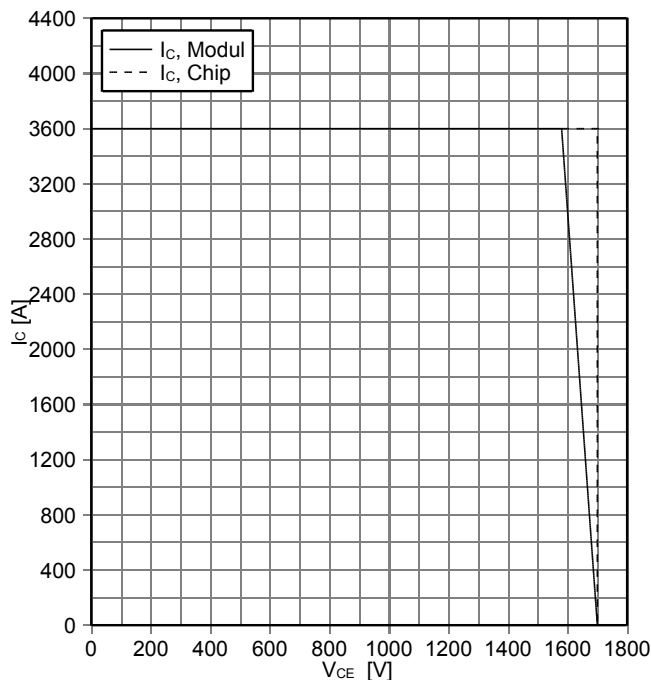
過渡熱インピーダンス IGBT- インバータ
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



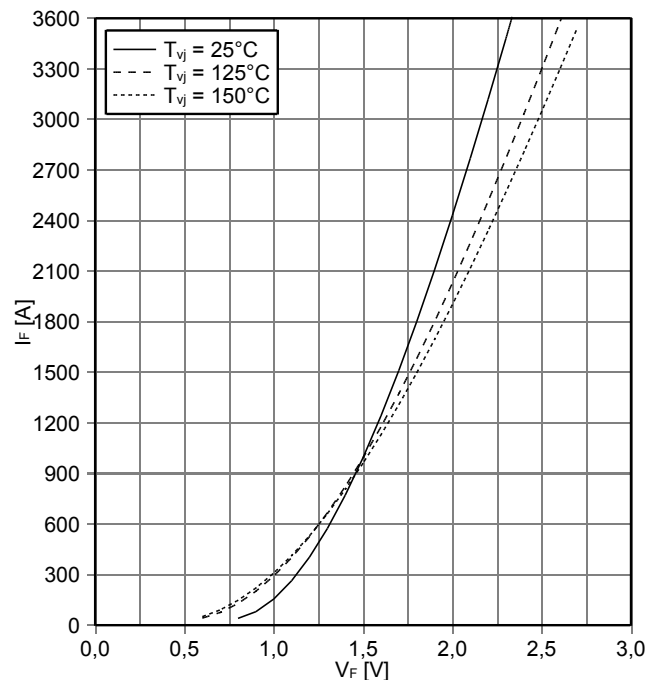
逆バイアス安全動作領域 IGBT- インバータ (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.8\ \Omega, T_{vj} = 150^\circ\text{C}$



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

$I_F = f(V_F)$



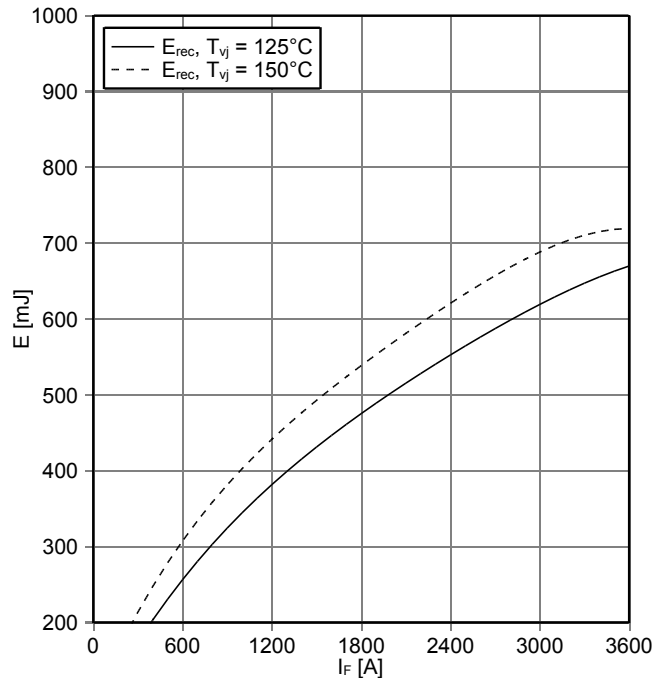
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| prepared by: WB | date of publication: 2013-11-11 |
| approved by: PL | revision: 2.2 |



暫定データ
Preliminary Data

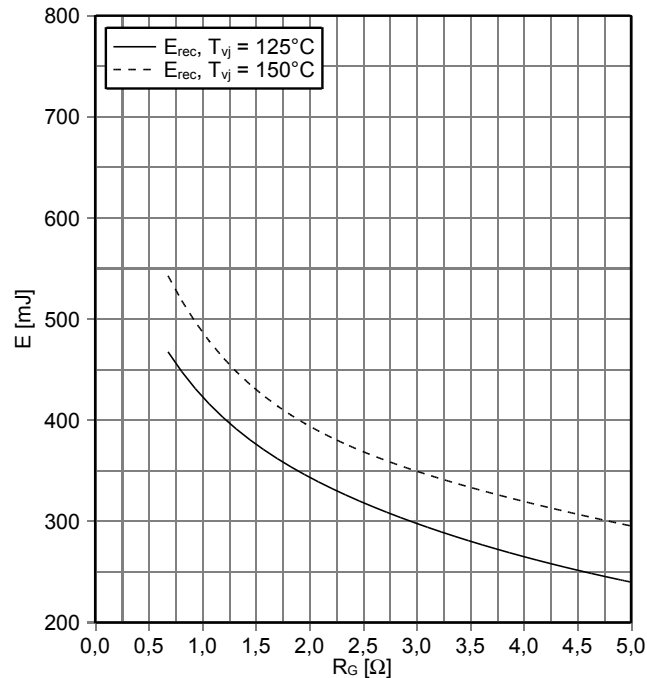
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.68 \Omega, V_{CE} = 900 V$



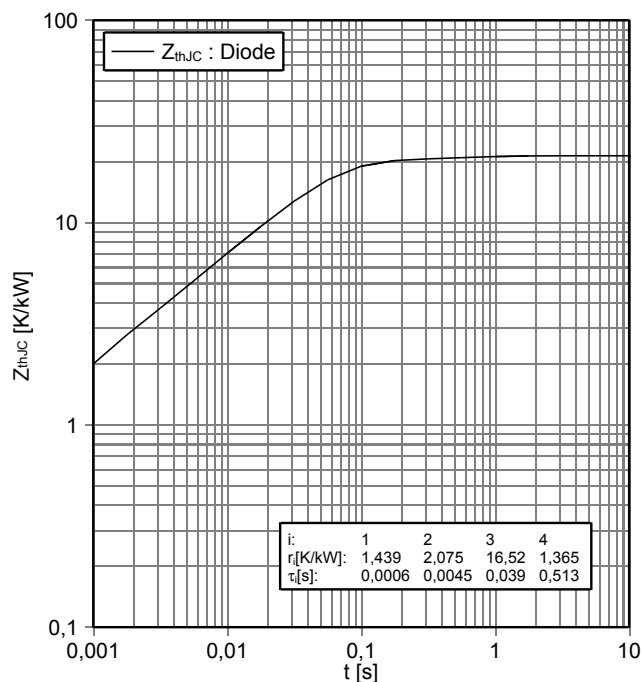
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 1800 A, V_{CE} = 900 V$



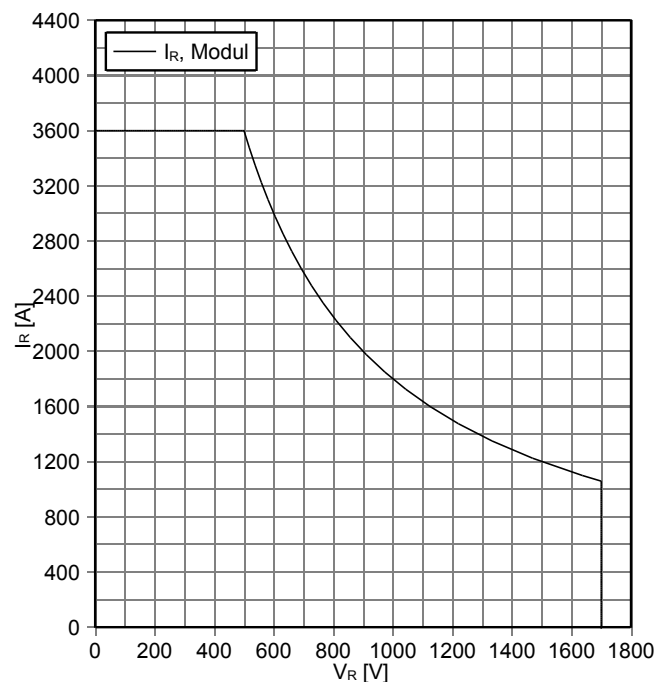
過渡熱インピーダンス Diode、インバータ
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



安全動作領域 Diode、インバータ (SOA)
safe operation area Diode, Inverter (SOA)

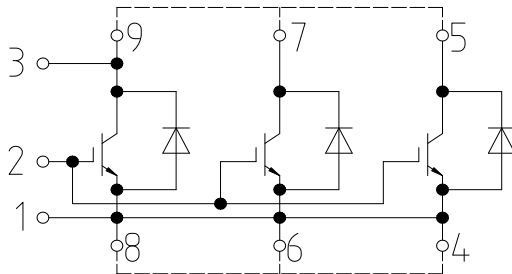
$I_R = f(V_R)$
 $T_{vj} = 150^\circ C$



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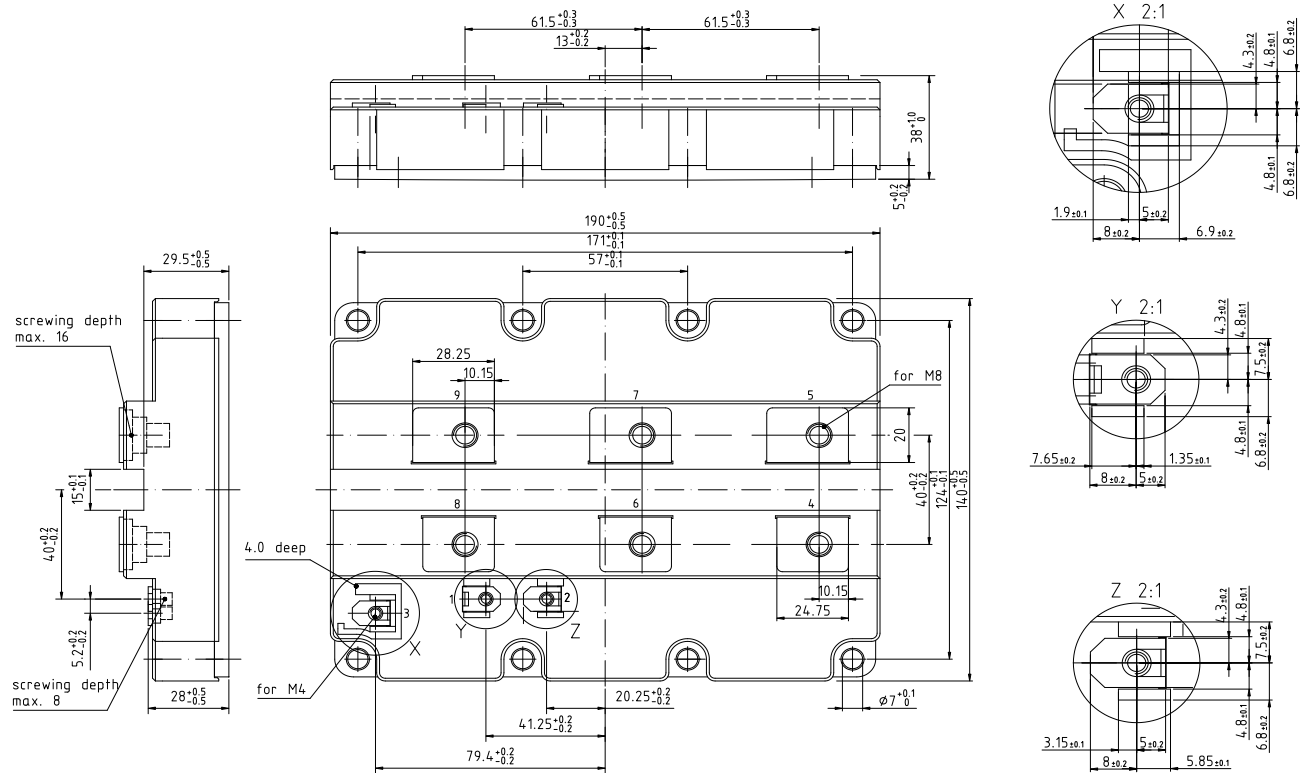
暫定データ
Preliminary Data

回路図 / circuit_diagram_headline



external connection
(to be done)

パッケージ概要 / package outlines



| | |
|-----------------|---------------------------------|
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