

## 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<br>Collector-emitter voltage          | $T_{vj} = 25^{\circ}\text{C}$                                | $V_{CES}$          | 1200  | V |
| 連続DCコレクタ電流<br>Continuous DC collector current      | $T_C = 95^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 50    | A |
| 繰り返しピークコレクタ電流<br>Repetitive peak collector current | $t_P = 1\text{ ms}$                                          | $I_{CRM}$          | 100   | A |
| トータル損失<br>Total power dissipation                  | $T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | $P_{\text{tot}}$   | 280   | W |
| ゲート・エミッタ間ピーク電圧<br>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<br>Collector-emitter saturation voltage  | $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$                                                             | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | 1,85<br>2,15<br>2,25    | 2,15 | V<br>V<br>V                                     |
| ゲート・エミッタ間しきい値電圧<br>Gate threshold voltage               | $I_C = 1,70\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                            |                                                                                                   | $V_{GEth}$          | 5,2                     | 5,8  | 6,4 V                                           |
| ゲート電荷量<br>Gate charge                                   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                                                      |                                                                                                   | $Q_G$               | 0,38                    |      | $\mu\text{C}$                                   |
| 内蔵ゲート抵抗<br>Internal gate resistor                       | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                                                   |                                                                                                   | $R_{Gint}$          | 4,0                     |      | $\Omega$                                        |
| 入力容量<br>Input capacitance                               | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                      |                                                                                                   | $C_{ies}$           | 2,80                    |      | nF                                              |
| 帰還容量<br>Reverse transfer capacitance                    | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                      |                                                                                                   | $C_{res}$           | 0,10                    |      | nF                                              |
| コレクタ・エミッタ間遮断電流<br>Collector-emitter cut-off current     | $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                      |                                                                                                   | $I_{CES}$           |                         | 1,0  | mA                                              |
| ゲート・エミッタ間漏れ電流<br>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)<br>Turn-on delay time, inductive load  | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 15\text{ }\Omega$                                                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ on}}$   | 0,06<br>0,07<br>0,07    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオン上昇時間 (誘導負荷)<br>Rise time, inductive load           | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 15\text{ }\Omega$                                                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$               | 0,032<br>0,034<br>0,037 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオフ遅れ時間 (誘導負荷)<br>Turn-off delay time, inductive load | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 15\text{ }\Omega$                                                                                       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ off}}$  | 0,28<br>0,35<br>0,38    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオフ下降時間 (誘導負荷)<br>Fall time, inductive load           | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 15\text{ }\Omega$                                                                                       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$               | 0,11<br>0,23<br>0,25    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオンスイッチング損失<br>Turn-on energy loss per pulse          | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 1400\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Gon} = 15\text{ }\Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$            | 3,50<br>5,20<br>5,70    |      | mJ<br>mJ<br>mJ                                  |
| ターンオフスイッチング損失<br>Turn-off energy loss per pulse         | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3500\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Goff} = 15\text{ }\Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$           | 2,80<br>4,50<br>5,10    |      | mJ<br>mJ<br>mJ                                  |
| 短絡電流<br>SC data                                         | $V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$<br>$V_{CE\text{ max}} = V_{CES} - L_{SCE} \cdot di/dt$<br>$t_P \leq 10\text{ }\mu\text{s}, T_{vj} = 125^{\circ}\text{C}$                       |                                                                                                   | $I_{SC}$            | 180                     |      | A                                               |
| ジャンクション・ケース間熱抵抗<br>Thermal resistance, junction to case | IGBT部 ( 1素子当り ) / per IGBT                                                                                                                                                                      |                                                                                                   | $R_{thJC}$          |                         | 0,54 | K/W                                             |
| ケース・ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink  | IGBT部 ( 1素子当り ) / per IGBT<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$                                    |                                                                                                   | $R_{thCH}$          | 0,135                   |      | K/W                                             |
| 動作温度<br>Temperature under switching conditions          |                                                                                                                                                                                                 |                                                                                                   | $T_{vj\text{ op}}$  | -40                     | 150  | $^{\circ}\text{C}$                              |

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## Diode、インバータ / Diode, Inverter

### 最大定格 / Maximum Rated Values

|                                              |                                                                        |           |      |                      |
|----------------------------------------------|------------------------------------------------------------------------|-----------|------|----------------------|
| ピーク繰返し逆電圧<br>Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$                                          | $V_{RRM}$ | 1200 | V                    |
| 連続DC電流<br>Continuous DC forward current      |                                                                        | $I_F$     | 50   | A                    |
| ピーク繰返し順電流<br>Repetitive peak forward current | $t_P = 1 \text{ ms}$                                                   | $I_{FRM}$ | 100  | A                    |
| 電流二乗時間積<br>$I^2t$ - value                    | $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 560  | $\text{A}^2\text{s}$ |

### 電気的特性 / Characteristic Values

|                                                         |                                                                                                                                                     |                                                                                                   |             | min. | typ.                 | max. |                                                 |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------|------|----------------------|------|-------------------------------------------------|
| 順電圧<br>Forward voltage                                  | $I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$              | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_F$       |      | 1,70<br>1,65<br>1,65 | 2,15 | V<br>V<br>V                                     |
| ピーク逆回復電流<br>Peak reverse recovery current               | $I_F = 50 \text{ A}, -di_F/dt = 1400 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$    |      | 39,0<br>44,0<br>46,5 |      | A<br>A<br>A                                     |
| 逆回復電荷量<br>Recovered charge                              | $I_F = 50 \text{ A}, -di_F/dt = 1400 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$       |      | 5,30<br>7,80<br>9,00 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| 逆回復損失<br>Reverse recovery energy                        | $I_F = 50 \text{ A}, -di_F/dt = 1400 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$   |      | 1,30<br>2,70<br>3,10 |      | mJ<br>mJ<br>mJ                                  |
| ジャンクション・ケース間熱抵抗<br>Thermal resistance, junction to case | /Diode ( 1 素子当り ) / per diode                                                                                                                       |                                                                                                   | $R_{thJC}$  |      |                      | 0,81 | K/W                                             |
| ケース・ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink  | /Diode ( 1 素子当り ) / per diode<br>$\lambda_{Paste} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |                                                                                                   | $R_{thCH}$  |      | 0,20                 |      | K/W                                             |
| 動作温度<br>Temperature under switching conditions          |                                                                                                                                                     |                                                                                                   | $T_{vj op}$ | -40  |                      | 150  | $^{\circ}\text{C}$                              |

## Diode、整流器 / Diode, Rectifier

### 最大定格 / Maximum Rated Values

|                                                        |                                                                                                           |             |             |                                              |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------|-------------|----------------------------------------------|
| ピーク繰返し逆電圧<br>Repetitive peak reverse voltage           | $T_{vj} = 25^{\circ}\text{C}$                                                                             | $V_{RRM}$   | 1600        | V                                            |
| 最大実効順電流/chip<br>Maximum RMS forward current per chip   | $T_C = 80^{\circ}\text{C}$                                                                                | $I_{FRMSM}$ | 70          | A                                            |
| 整流出力の最大実効電流<br>Maximum RMS current at rectifier output | $T_C = 80^{\circ}\text{C}$                                                                                | $I_{RMSM}$  | 80          | A                                            |
| サージ順電流<br>Surge forward current                        | $t_P = 10 \text{ ms}, T_{vj} = 25^{\circ}\text{C}$<br>$t_P = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I_{FSM}$   | 450<br>370  | A<br>A                                       |
| 電流二乗時間積<br>$I^2t$ - value                              | $t_P = 10 \text{ ms}, T_{vj} = 25^{\circ}\text{C}$<br>$t_P = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I^2t$      | 1000<br>685 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

### 電気的特性 / Characteristic Values

|                                                         |                                                                                                                                                     |       |             | min. | typ. | max. |                    |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|------|------|------|--------------------|
| 順電圧<br>Forward voltage                                  | $T_{vj} = 150^{\circ}\text{C}, I_F = 50 \text{ A}$                                                                                                  | $V_F$ |             |      | 1,05 |      | V                  |
| 逆電流<br>Reverse current                                  | $T_{vj} = 150^{\circ}\text{C}, V_R = 1600 \text{ V}$                                                                                                | $I_R$ |             |      | 1,00 |      | mA                 |
| ジャンクション・ケース間熱抵抗<br>Thermal resistance, junction to case | /Diode ( 1 素子当り ) / per diode                                                                                                                       |       | $R_{thJC}$  |      |      | 0,85 | K/W                |
| ケース・ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink  | /Diode ( 1 素子当り ) / per diode<br>$\lambda_{Paste} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |       | $R_{thCH}$  |      | 0,21 |      | K/W                |
| 動作温度<br>Temperature under switching conditions          |                                                                                                                                                     |       | $T_{vj op}$ | -40  |      | 150  | $^{\circ}\text{C}$ |

|                 |                                 |
|-----------------|---------------------------------|
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## IGBT-ブレーキチョッパー / IGBT, Brake-Chopper

### 最大定格 / Maximum Rated Values

|                                                    |                                                                  |                    |       |   |
|----------------------------------------------------|------------------------------------------------------------------|--------------------|-------|---|
| コレクタ・エミッタ間電圧<br>Collector-emitter voltage          | $T_{vj} = 25^{\circ}\text{C}$                                    | $V_{CES}$          | 1200  | V |
| 連続DCコレクタ電流<br>Continuous DC collector current      | $T_C = 100^{\circ}\text{C}$ , $T_{vj\max} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 25    | A |
| 繰り返しピークコレクタ電流<br>Repetitive peak collector current | $t_P = 1\text{ ms}$                                              | $I_{CRM}$          | 50    | A |
| トータル損失<br>Total power dissipation                  | $T_C = 25^{\circ}\text{C}$ , $T_{vj\max} = 175^{\circ}\text{C}$  | $P_{\text{tot}}$   | 160   | W |
| ゲート・エミッタ間ピーク電圧<br>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<br>Collector-emitter saturation voltage  | $I_C = 25\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$I_C = 25\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$I_C = 25\text{ A}$ , $V_{GE} = 15\text{ V}$                                                                 | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | 1,85<br>2,15<br>2,25    | 2,15 | V<br>V<br>V                                     |
| ゲート・エミッタ間しきい値電圧<br>Gate threshold voltage               | $I_C = 0,85\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                   |                                                                                                   | $V_{GEth}$          | 5,2                     | 5,8  | 6,4 V                                           |
| ゲート電荷量<br>Gate charge                                   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                                                                   |                                                                                                   | $Q_G$               | 0,20                    |      | $\mu\text{C}$                                   |
| 内蔵ゲート抵抗<br>Internal gate resistor                       | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                                                                |                                                                                                   | $R_{Gint}$          | 0,0                     |      | $\Omega$                                        |
| 入力容量<br>Input capacitance                               | $f = 1\text{ MHz}$ , $T_{vj} = 25^{\circ}\text{C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                                                          |                                                                                                   | $C_{ies}$           | 1,45                    |      | nF                                              |
| 帰還容量<br>Reverse transfer capacitance                    | $f = 1\text{ MHz}$ , $T_{vj} = 25^{\circ}\text{C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                                                          |                                                                                                   | $C_{res}$           | 0,05                    |      | nF                                              |
| コレクタ・エミッタ間遮断電流<br>Collector-emitter cut-off current     | $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$                                                                                                                             |                                                                                                   | $I_{CES}$           |                         | 1,0  | mA                                              |
| ゲート・エミッタ間漏れ電流<br>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)<br>Turn-on delay time, inductive load  | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 37\text{ }\Omega$                                                                                                  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ on}}$   | 0,05<br>0,06<br>0,06    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオン上昇時間 (誘導負荷)<br>Rise time, inductive load           | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 37\text{ }\Omega$                                                                                                  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$               | 0,052<br>0,055<br>0,055 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオフ遅れ時間 (誘導負荷)<br>Turn-off delay time, inductive load | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 37\text{ }\Omega$                                                                                                 | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ off}}$  | 0,21<br>0,32<br>0,36    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオフ下降時間 (誘導負荷)<br>Fall time, inductive load           | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 37\text{ }\Omega$                                                                                                 | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$               | 0,12<br>0,19<br>0,22    |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| ターンオンスイッチング損失<br>Turn-on energy loss per pulse          | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$ , $L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$ , $di/dt = 250\text{ A}/\mu\text{s}$ ( $T_{vj} = 150^{\circ}\text{C}$ )<br>$R_{Gon} = 37\text{ }\Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$            | 2,20<br>3,50<br>3,60    |      | mJ<br>mJ<br>mJ                                  |
| ターンオフスイッチング損失<br>Turn-off energy loss per pulse         | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$ , $L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$ , $du/dt = 3300\text{ V}/\mu\text{s}$ ( $T_{vj} = 150^{\circ}\text{C}$ )<br>$R_{Goff} = 37\text{ }\Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$           | 1,40<br>2,30<br>2,50    |      | mJ<br>mJ<br>mJ                                  |
| 短絡電流<br>SC data                                         | $V_{GE} \leq 15\text{ V}$ , $V_{CC} = 800\text{ V}$<br>$V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\text{ }\mu\text{s}$ , $T_{vj} = 150^{\circ}\text{C}$                                         |                                                                                                   | $I_{SC}$            | 90                      |      | A                                               |
| ジャンクション・ケース間熱抵抗<br>Thermal resistance, junction to case | IGBT部 ( 1素子当り ) / per IGBT                                                                                                                                                                                   |                                                                                                   | $R_{thJC}$          |                         | 0,95 | K/W                                             |
| ケース・ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink  | IGBT部 ( 1素子当り ) / per IGBT<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$                                                 |                                                                                                   | $R_{thCH}$          | 0,235                   |      | K/W                                             |
| 動作温度<br>Temperature under switching conditions          |                                                                                                                                                                                                              |                                                                                                   | $T_{vj\text{ op}}$  | -40                     | 150  | $^{\circ}\text{C}$                              |

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## Diode、ブレーキチョッパー / Diode, Brake-Chopper

### 最大定格 / Maximum Rated Values

|                                              |                                                                        |           |      |                  |
|----------------------------------------------|------------------------------------------------------------------------|-----------|------|------------------|
| ピーク繰返し逆電圧<br>Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$                                          | $V_{RRM}$ | 1200 | V                |
| 連続DC電流<br>Continuous DC forward current      |                                                                        | $I_F$     | 15   | A                |
| ピーク繰返し順電流<br>Repetitive peak forward current | $t_P = 1 \text{ ms}$                                                   | $I_{FRM}$ | 30   | A                |
| 電流二乗時間積<br>$I^2t$ - value                    | $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 48,0 | A <sup>2</sup> s |

### 電気的特性 / Characteristic Values

|                                                         |                                                                                                                                                     |                                                                                                   | min.        | typ.                 | max. |                                                 |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------|----------------------|------|-------------------------------------------------|
| 順電圧<br>Forward voltage                                  | $I_F = 15 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 15 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 15 \text{ A}, V_{GE} = 0 \text{ V}$              | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_F$       | 1,75<br>1,75<br>1,75 | 2,15 | V<br>V<br>V                                     |
| ピーク逆回復電流<br>Peak reverse recovery current               | $I_F = 15 \text{ A}, -di_F/dt = 250 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$                                    | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$    | 11,0<br>13,5<br>14,0 |      | A<br>A<br>A                                     |
| 逆回復電荷量<br>Recovered charge                              | $I_F = 15 \text{ A}, -di_F/dt = 250 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$                                    | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$       | 1,20<br>2,20<br>2,50 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| 逆回復損失<br>Reverse recovery energy                        | $I_F = 15 \text{ A}, -di_F/dt = 250 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 600 \text{ V}$                                    | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$   | 0,50<br>0,90<br>1,00 |      | mJ<br>mJ<br>mJ                                  |
| ジャンクション・ケース間熱抵抗<br>Thermal resistance, junction to case | /Diode ( 1 素子当り ) / per diode                                                                                                                       |                                                                                                   | $R_{thJC}$  |                      | 1,50 | K/W                                             |
| ケース・ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink  | /Diode ( 1 素子当り ) / per diode<br>$\lambda_{Paste} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |                                                                                                   | $R_{thCH}$  | 0,37                 |      | K/W                                             |
| 動作温度<br>Temperature under switching conditions          |                                                                                                                                                     |                                                                                                   | $T_{vj op}$ | -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<br>Rated resistance    | $T_C = 25^{\circ}\text{C}$                                     | $R_{25}$     |      | 5,00 |      | k $\Omega$ |
| R100の偏差<br>Deviation of R100 | $T_C = 100^{\circ}\text{C}, R_{100} = 493 \Omega$              | $\Delta R/R$ | -5   |      | 5    | %          |
| 損失<br>Power dissipation      | $T_C = 25^{\circ}\text{C}$                                     | $P_{25}$     |      |      | 20,0 | mW         |
| B-定数<br>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<br>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<br>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.

|                 |                                 |
|-----------------|---------------------------------|
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## モジュール / Module

|                                                              |                                                                                                                                         |                                              |                                |                  |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------|------------------|
| 絶縁耐圧<br>Isolation test voltage                               | RMS, f = 50 Hz, t = 1 min.                                                                                                              | V <sub>ISOL</sub>                            | 2,5                            | kV               |
| ベースプレート材質<br>Material of module baseplate                    |                                                                                                                                         |                                              | Cu                             |                  |
| 内部絶縁<br>Internal isolation                                   | 基礎絶縁 (クラス1, IEC 61140)<br>basic insulation (class 1, IEC 61140)                                                                         |                                              | Al <sub>2</sub> O <sub>3</sub> |                  |
| 沿面距離<br>Creepage distance                                    | 連絡方法 - ヒートシンク / terminal to heatsink<br>連絡方法 - 連絡方法 / terminal to terminal                                                              |                                              | 10,0                           | mm               |
| 空間距離<br>Clearance                                            | 連絡方法 - ヒートシンク / terminal to heatsink<br>連絡方法 - 連絡方法 / terminal to terminal                                                              |                                              | 7,5                            | mm               |
| 相対トラッキング指数<br>Comperative tracking index                     |                                                                                                                                         | CTI                                          | > 200                          |                  |
|                                                              |                                                                                                                                         |                                              |                                |                  |
| ケース・ ヒートシンク間熱抵抗<br>Thermal resistance, case to heatsink      | /モジュール / per module<br>$\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$ | R <sub>thCH</sub>                            | min. 0,009                     | typ. max. K/W    |
| 内部インダクタンス<br>Stray inductance module                         |                                                                                                                                         | L <sub>sCE</sub>                             | 40                             | nH               |
| パワーターミナル・ チップ間抵抗<br>Module lead resistance, terminals - chip | T <sub>C</sub> = 25°C, /スイッチ / per switch                                                                                               | R <sub>CC'+EE'</sub><br>R <sub>AA'+CC'</sub> | 4,00<br>3,00                   | mΩ               |
| 最大ジャンクション温度<br>Maximum junction temperature                  | インバータ、ブレーキチョッパ / inverter,<br>brake-chopper<br>整流器 / rectifier                                                                          | T <sub>vj max</sub>                          |                                | 175 °C<br>150 °C |
| 動作温度<br>Temperature under switching conditions               | インバータ、ブレーキチョッパ / inverter,<br>brake-chopper<br>整流器 / rectifier                                                                          | T <sub>vj op</sub>                           | -40<br>-40                     | 150 °C<br>150 °C |
| 保存温度<br>Storage temperature                                  |                                                                                                                                         | T <sub>stg</sub>                             | -40                            | 125 °C           |
| 取り付けネジ締め付けトルク<br>Mounting torque for modul mounting          | 取り付けネジ M5<br>適切なアプリケーションノートによるマウンティング<br>Screw M5 - Mounting according to valid application note                                        | M                                            | 3,00                           | - 6,00 Nm        |
| 質量<br>Weight                                                 |                                                                                                                                         | G                                            | 300                            | g                |

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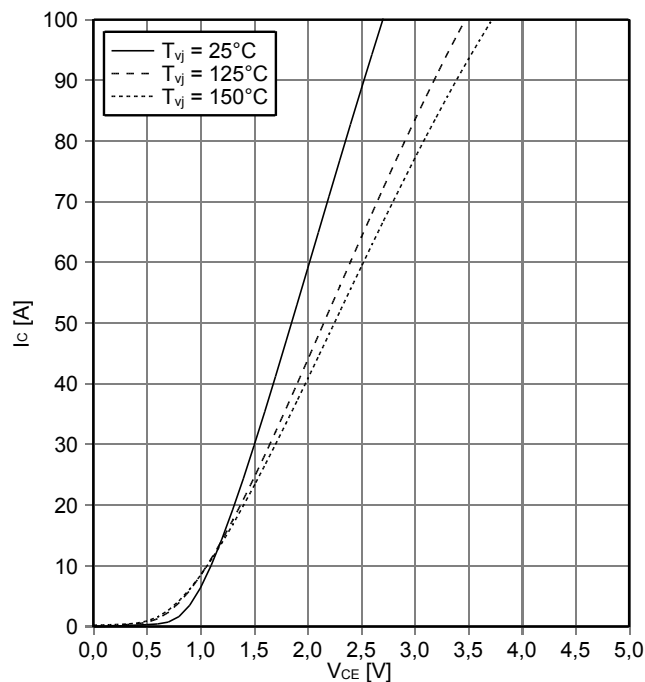
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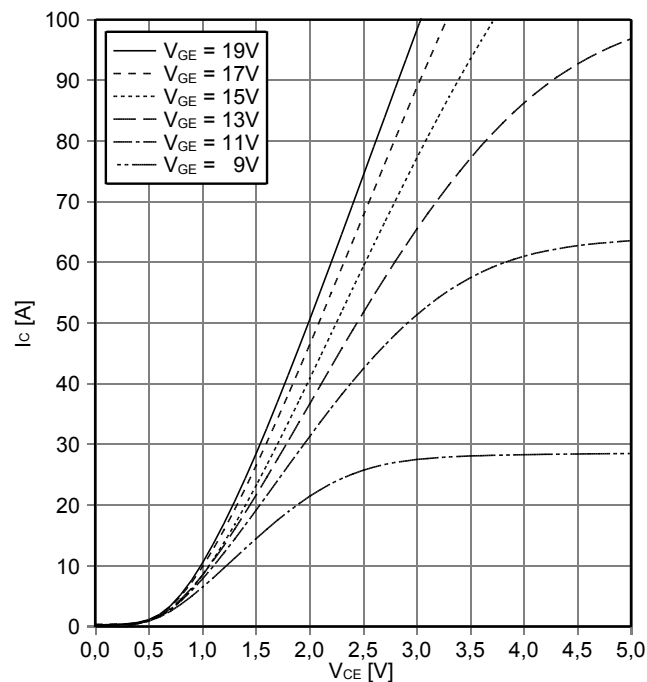
出力特性 IGBT- インバータ (Typical)  
output characteristic IGBT, Inverter (typical)

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



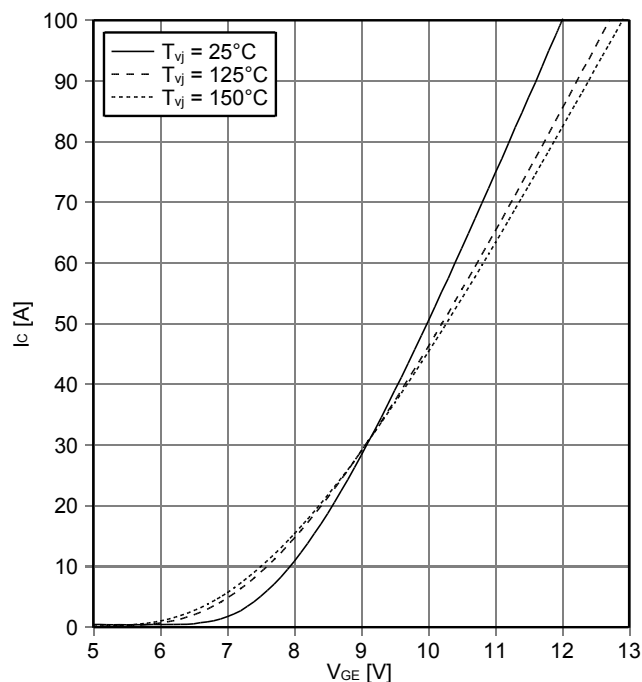
出力特性 IGBT- インバータ (Typical)  
output characteristic IGBT, Inverter (typical)

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



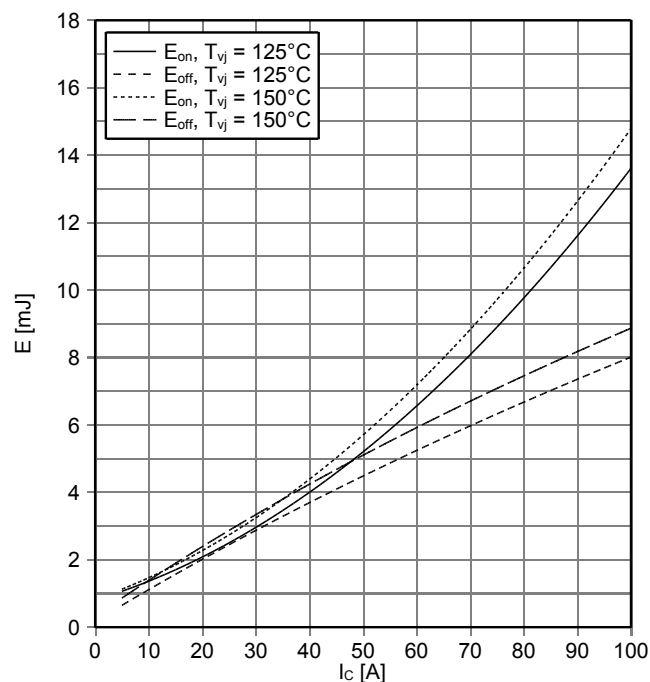
伝達特性 IGBT- インバータ (Typical)  
transfer characteristic IGBT, Inverter (typical)

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



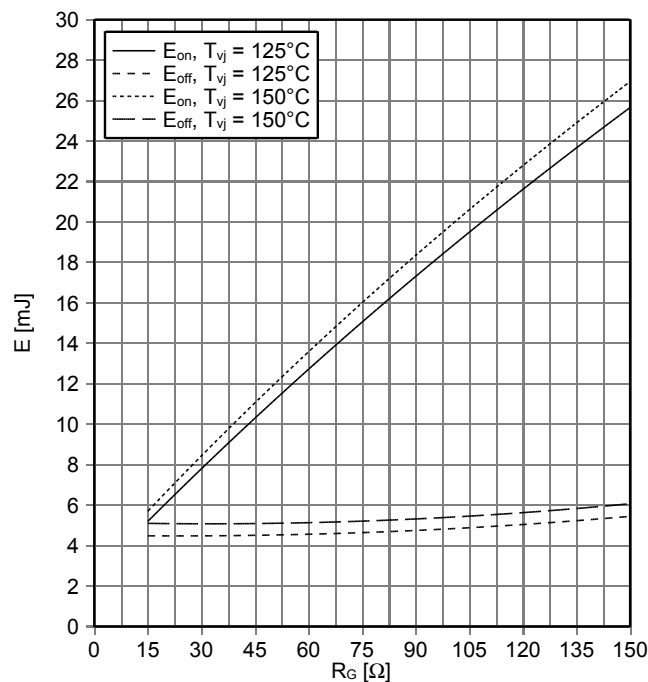
スイッチング損失 IGBT- インバータ (Typical)  
switching losses IGBT, Inverter (typical)

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



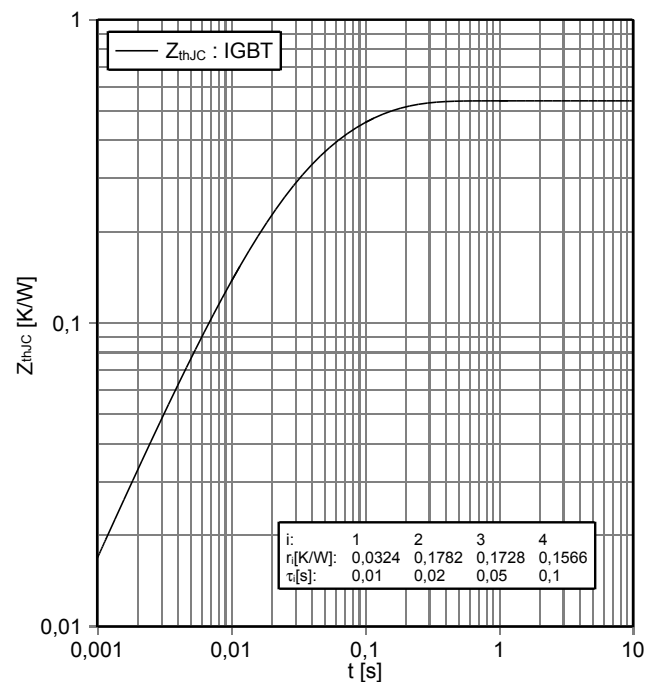
スイッチング損失 IGBT- インバータ (Typical)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $I_C = 50 \text{ A}$ ,  $V_{CE} = 600 \text{ V}$



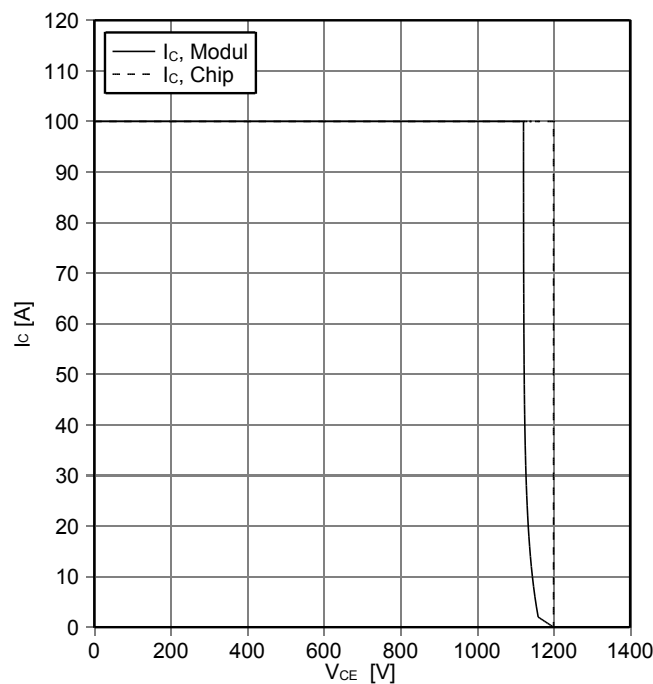
過渡熱インピーダンス IGBT- インバータ  
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



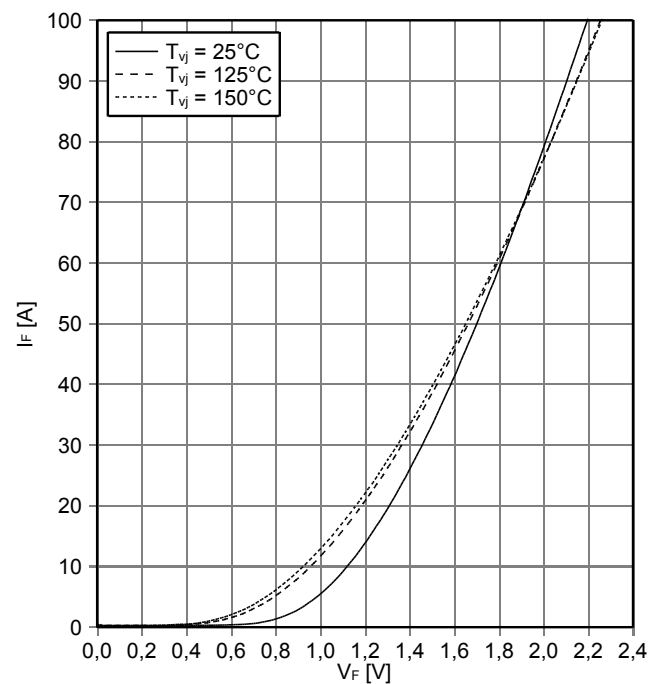
逆バイアス安全動作領域 IGBT- インバータ (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

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



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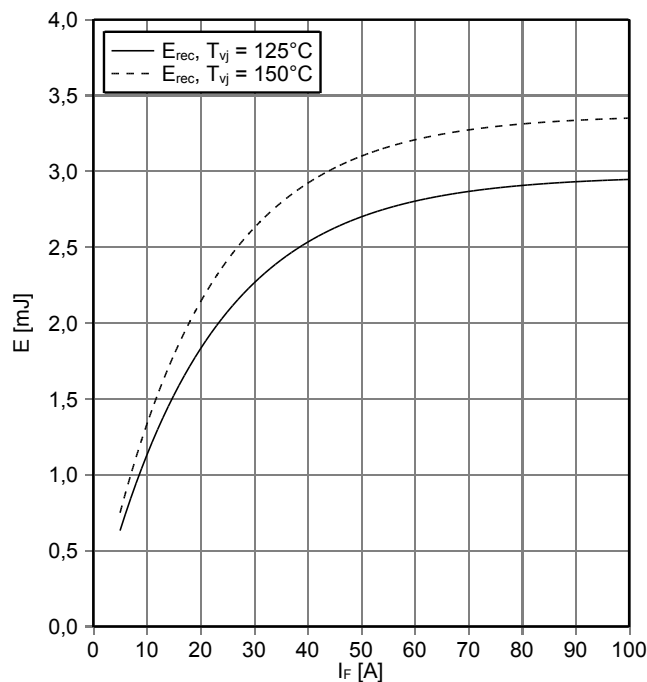
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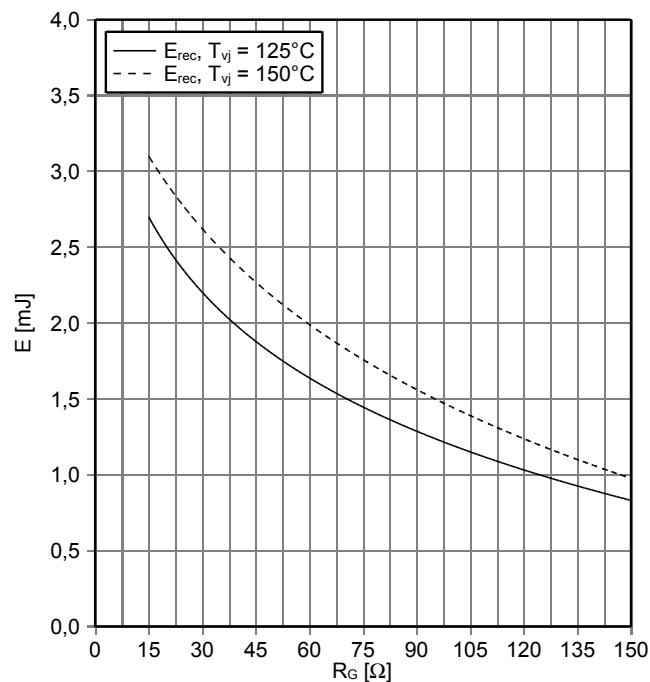
スイッチング損失 Diode、インバータ (Typical)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 15 \Omega$ ,  $V_{CE} = 600 V$



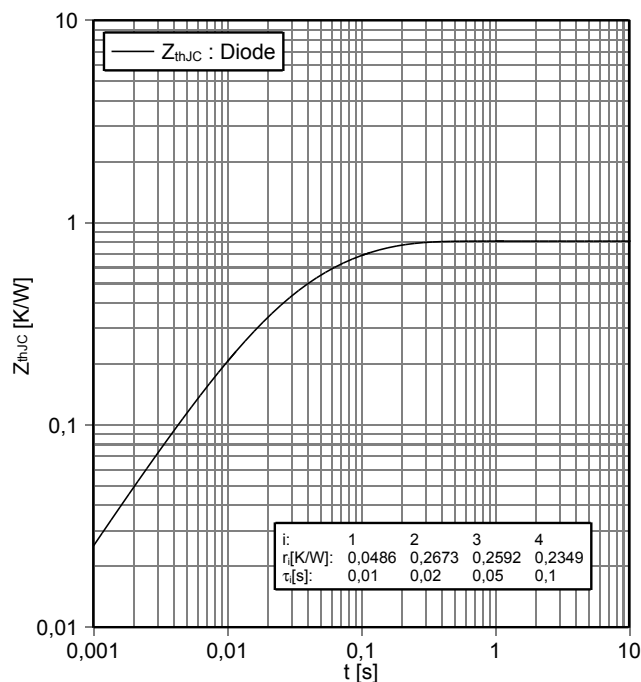
スイッチング損失 Diode、インバータ (Typical)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 50 A$ ,  $V_{CE} = 600 V$



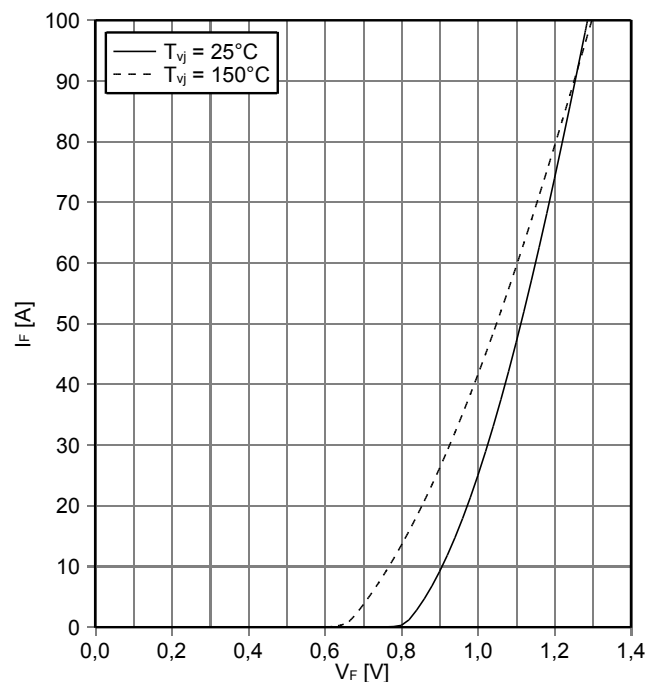
過渡熱インピーダンス Diode、インバータ  
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



順方向特性 Diode、整流器 (典型)  
forward characteristic of Diode, Rectifier (typical)

$I_F = f(V_F)$



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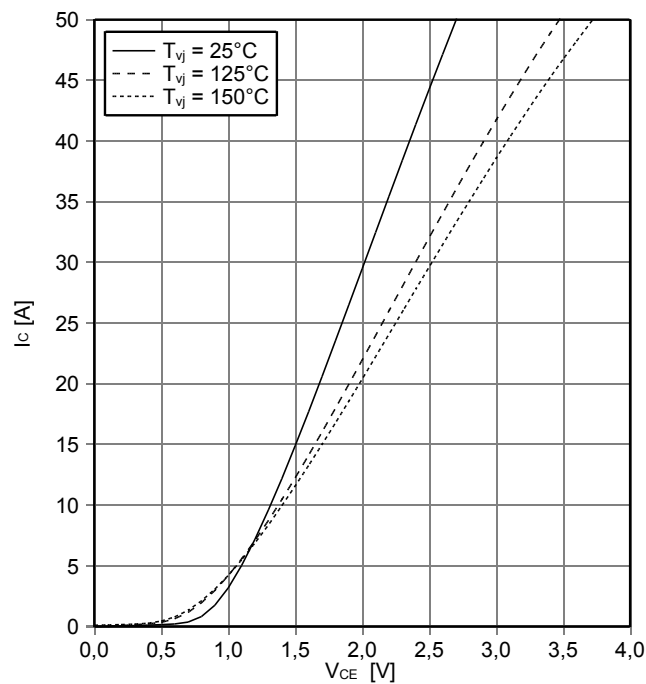
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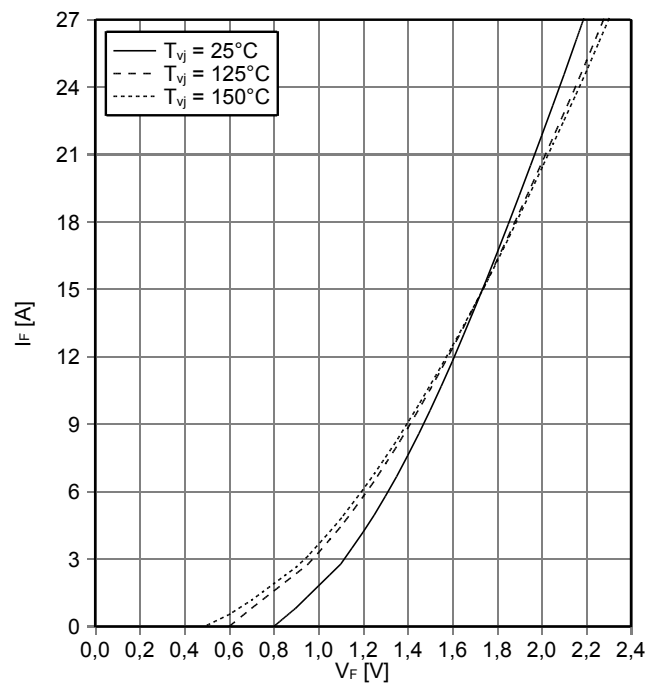
出力特性 IGBT-ブレーキチョッパー (Typical)  
output characteristic IGBT, Brake-Chopper (typical)

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



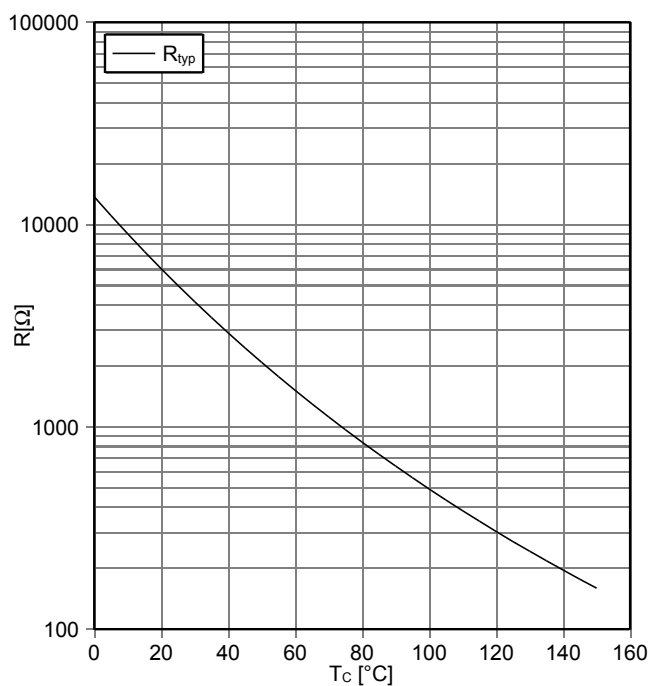
順電圧特性 Diode、ブレーキチョッパー ( typical)  
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$



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

$R = f(T)$



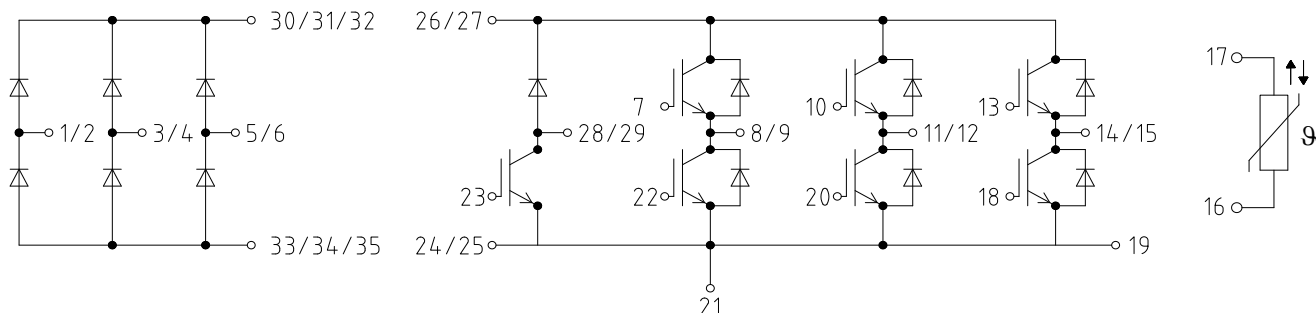
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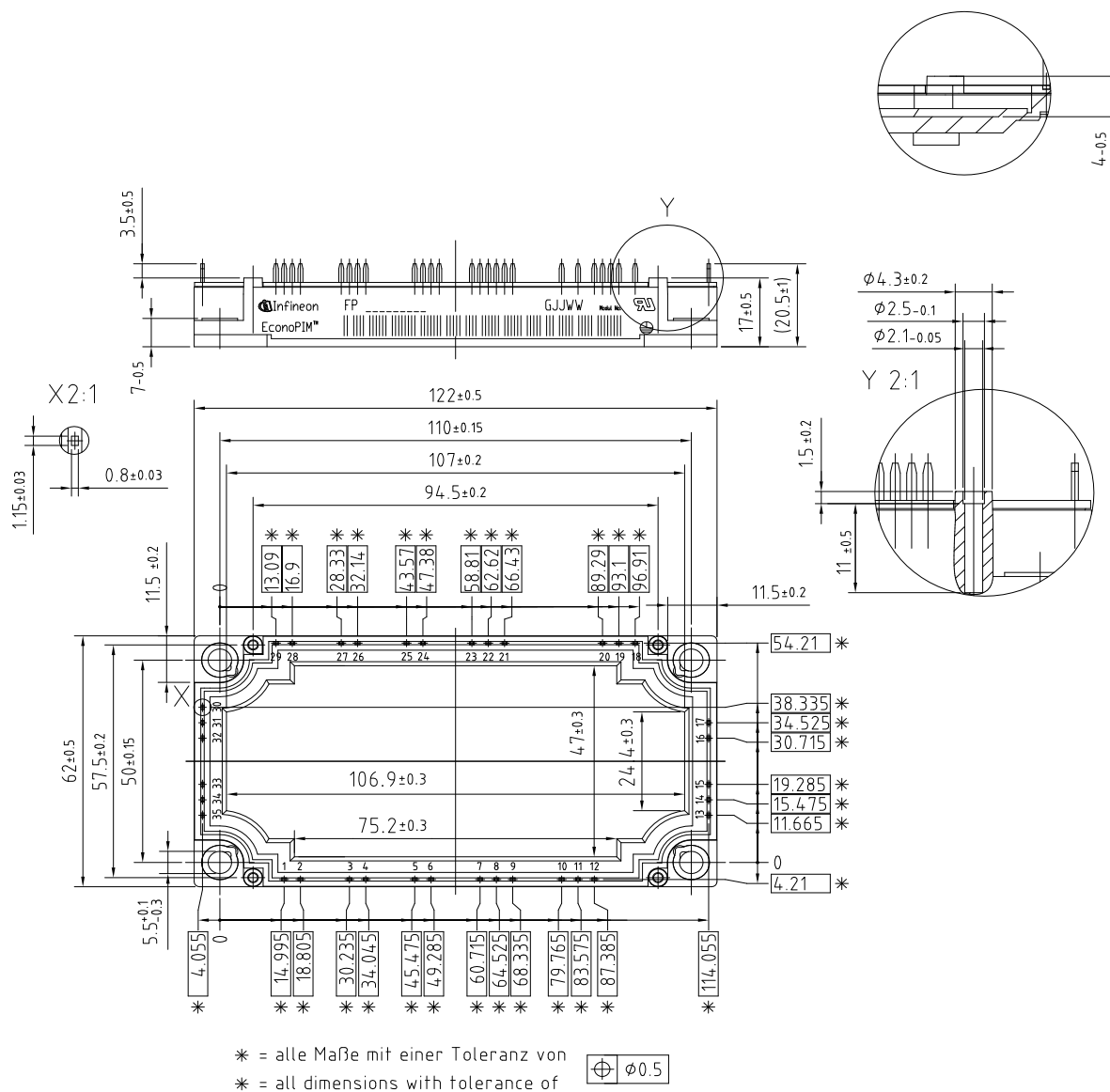
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回路図 / circuit\_diagram\_headline



パッケージ概要 / package outlines



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