

# Technische Information / technical information

IGBT-Module  
IGBT-modules

## FP50R12KT4\_B11



EconoPIM™2 Modul PressFIT mit Trench/Feldstopp IGBT4 und EmCon4 Diode  
EconoPIM™2 module PressFIT with trench/fieldstop IGBT4 and EmCon4 diode

### IGBT-Wechselrichter / IGBT-inverter

### Vorläufige Daten / preliminary data

#### Höchstzulässige Werte / maximum rated values

|                                                                          |                                                          |                    |       |   |
|--------------------------------------------------------------------------|----------------------------------------------------------|--------------------|-------|---|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             | $T_{vj} = 25^{\circ}\text{C}$                            | $V_{CES}$          | 1200  | V |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 95^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 50    | A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_P = 1\text{ ms}$                                      | $I_{CRM}$          | 100   | A |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $P_{tot}$          | 280   | W |
| Gate-Emitter-Spitzenspannung<br>gate-emitter peak voltage                |                                                          | $V_{GES}$          | +/-20 | V |

#### Charakteristische Werte / characteristic values

|                                                                              |                                                                                                                                                                                               |                                                                                                   | min.                | typ.                 | max. |                                                 |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------|----------------------|------|-------------------------------------------------|
| Kollektor-Emitter Sättigungsspannung<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 | 2,25 | V<br>V<br>V                                     |
| Gate-Schwellenspannung<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                                           |
| Gateladung<br>gate charge                                                    | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                                                    |                                                                                                   | $Q_G$               | 0,38                 |      | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>internal gate resistor                            | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                                                 |                                                                                                   | $R_{Gint}$          | 4,0                  |      | $\Omega$                                        |
| Eingangskapazität<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                                              |
| Rückwirkungskapazität<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                                              |
| Kollektor-Emitter Reststrom<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                                              |
| Gate-Emitter Reststrom<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                                              |
| Einschaltverzögerungszeit (ind. Last)<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>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ on}}$   | 0,16<br>0,17<br>0,17 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit (induktive Last)<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>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$               | 0,03<br>0,04<br>0,04 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit (ind. Last)<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>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ off}}$  | 0,33<br>0,43<br>0,45 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit (induktive Last)<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>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$               | 0,08<br>0,15<br>0,17 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 20\text{ nH}$<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>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$            | 5,70<br>7,70<br>8,40 |      | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | $I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L_S = 20\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3600\text{ V}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>4,30<br>4,80 |      | mJ<br>mJ<br>mJ                                  |
| Kurzschlussverhalten<br>SC data                                              | $V_{GE} \leq 15\text{ V}, V_{CC} = 900\text{ V}$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$<br>$t_P \leq 10\text{ }\mu\text{s}, T_{vj} = 125^{\circ}\text{C}$                             |                                                                                                   | $I_{SC}$            | 180                  |      | A                                               |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case              | pro IGBT / per IGBT                                                                                                                                                                           |                                                                                                   | $R_{thJC}$          |                      | 0,54 | K/W                                             |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink            | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$                                                       |                                                                                                   | $R_{thCH}$          | 0,295                |      | K/W                                             |

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Vorläufige Daten  
preliminary data

## Diode-Wechselrichter / diode-inverter

## Höchstzulässige Werte / maximum rated values

|                                                                     |                                                                              |           |      |                      |
|---------------------------------------------------------------------|------------------------------------------------------------------------------|-----------|------|----------------------|
| Periodische Spitzensperrspannung<br>repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$                                                | $V_{RRM}$ | 1200 | V                    |
| Dauergleichstrom<br>DC forward current                              |                                                                              | $I_F$     | 50   | A                    |
| Periodischer Spitzenstrom<br>repetitive peak forward current        | $t_p = 1 \text{ ms}$                                                         | $I_{FRM}$ | 100  | A                    |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0 \text{ V}$ , $t_p = 10 \text{ ms}$ , $T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 560  | $\text{A}^2\text{s}$ |

## Charakteristische Werte / characteristic values

|                                                                   |                                                                                                                                                           |                                                                                                   |            | min. | typ.                 | max. |                                                 |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|------|----------------------|------|-------------------------------------------------|
| Durchlassspannung<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                                     |
| Rückstromspitze<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>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$   |      | 54,0<br>60,0<br>63,0 |      | A<br>A<br>A                                     |
| Sperrverzögerungsladung<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>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$      |      | 5,50<br>8,80<br>10,0 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| Abschaltenergie pro Puls<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>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$  |      | 1,70<br>3,00<br>3,70 |      | mJ<br>mJ<br>mJ                                  |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode / per diode                                                                                                                                     |                                                                                                   | $R_{thJC}$ |      |                      | 0,81 | K/W                                             |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |                                                                                                   | $R_{thCH}$ |      | 0,44                 |      | K/W                                             |

## Diode-Gleichrichter / diode-rectifier

## Höchstzulässige Werte / maximum rated values

|                                                                                     |                                                                                                                 |             |             |                                              |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------|-------------|----------------------------------------------|
| Periodische Rückw. Spitzensperrspannung<br>repetitive peak reverse voltage          | $T_{vj} = 25^{\circ}\text{C}$                                                                                   | $V_{RRM}$   | 1600        | V                                            |
| Durchlassstrom Grenzeffektivwert pro Dio.<br>forward current RMS maximum per diode  | $T_C = 80^{\circ}\text{C}$                                                                                      | $I_{FRMSM}$ | 70          | A                                            |
| Gleichrichter Ausgang Grenzeffektivstrom<br>maximum RMS current at Rectifier output | $T_C = 80^{\circ}\text{C}$                                                                                      | $I_{RMSM}$  | 80          | A                                            |
| Stoßstrom Grenzwert<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                                       |
| Grenzlastintegral<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>$\text{A}^2\text{s}$ |

## Charakteristische Werte / characteristic values

|                                                                   |                                                                                                                                                           |            |  | min. | typ.  | max. |     |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--|------|-------|------|-----|
| Durchlassspannung<br>forward voltage                              | $T_{vj} = 150^{\circ}\text{C}$ , $I_F = 50 \text{ A}$                                                                                                     | $V_F$      |  |      | 1,05  |      | V   |
| Sperrstrom<br>reverse current                                     | $T_{vj} = 150^{\circ}\text{C}$ , $V_R = 1600 \text{ V}$                                                                                                   | $I_R$      |  |      | 1,00  |      | mA  |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode<br>per diode                                                                                                                                    | $R_{thJC}$ |  |      |       | 0,85 | K/W |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ | $R_{thCH}$ |  |      | 0,465 |      | K/W |

Vorläufige Daten  
preliminary data

## IGBT-Brems-Chopper / IGBT-brake-chopper

## Höchstzulässige Werte / maximum rated values

|                                                                          |                                                           |            |       |   |
|--------------------------------------------------------------------------|-----------------------------------------------------------|------------|-------|---|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             | $T_{vj} = 25^{\circ}\text{C}$                             | $V_{CES}$  | 1200  | V |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 100^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $I_{Cnom}$ | 25    | A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_p = 1 \text{ ms}$                                      | $I_{CRM}$  | 50    | A |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$  | $P_{tot}$  | 160   | W |
| Gate-Emitter-Spitzenspannung<br>gate-emitter peak voltage                |                                                           | $V_{GES}$  | +/-20 | V |

## Charakteristische Werte / characteristic values

|                                                                              |                                                                                                                                                              |                                                                                                   | min.         | typ.                 | max. |                                                 |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------|----------------------|------|-------------------------------------------------|
| Kollektor-Emitter Sättigungsspannung<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>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE sat}$ | 1,85<br>2,15<br>2,25 | 2,25 | V<br>V<br>V                                     |
| Gate-Schwellenspannung<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                                           |
| Gateladung<br>gate charge                                                    | $V_{GE} = -15 \text{ V} \dots +15 \text{ V}$                                                                                                                 |                                                                                                   | $Q_G$        | 0,20                 |      | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>internal gate resistor                            | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                |                                                                                                   | $R_{Gint}$   | 0,00                 |      | $\Omega$                                        |
| Eingangskapazität<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                                              |
| Rückwirkungskapazität<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                                              |
| Kollektor-Emitter Reststrom<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                                              |
| Gate-Emitter Reststrom<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                                              |
| Einschaltverzögerungszeit (ind. Last)<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>$R_{Gon} = 37 \Omega$                                                         | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d on}$   | 0,05<br>0,06<br>0,06 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit (induktive Last)<br>rise time (inductive load)                  | $I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Gon} = 37 \Omega$                                                         | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$        | 0,03<br>0,04<br>0,05 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit (ind. Last)<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>$R_{Goff} = 37 \Omega$                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d off}$  | 0,34<br>0,43<br>0,45 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit (induktive Last)<br>fall time (inductive load)                      | $I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Goff} = 37 \Omega$                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$        | 0,05<br>0,07<br>0,08 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | $I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Gon} = 37 \Omega$                                                         | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$     | 2,00<br>2,65<br>2,90 |      | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | $I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Goff} = 37 \Omega$                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$    | 1,40<br>2,20<br>2,40 |      | mJ<br>mJ<br>mJ                                  |
| Kurzschlussverhalten<br>SC data                                              | $V_{GE} \leq 15 \text{ V}, V_{CC} = 900 \text{ V}$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$<br>$t_p \leq 10 \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ |                                                                                                   | $I_{SC}$     | 90                   |      | A                                               |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case              | pro IGBT<br>per IGBT                                                                                                                                         |                                                                                                   | $R_{thJC}$   |                      | 0,95 | K/W                                             |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink            | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$                      |                                                                                                   | $R_{thCH}$   | 0,52                 |      | K/W                                             |

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Vorläufige Daten  
preliminary data

## Diode-Brems-Chopper / Diode-brake-chopper

## Höchstzulässige Werte / maximum rated values

|                                                                     |                                                                            |           |      |                      |
|---------------------------------------------------------------------|----------------------------------------------------------------------------|-----------|------|----------------------|
| Periodische Spitzenspernspannung<br>repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$                                              | $V_{RRM}$ | 1200 | V                    |
| Dauergleichstrom<br>DC forward current                              |                                                                            | $I_F$     | 15   | A                    |
| Periodischer Spitzenstrom<br>repetitive peak forw. current          | $t_p = 1\text{ ms}$                                                        | $I_{FRM}$ | 30   | A                    |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0\text{ V}$ , $t_p = 10\text{ ms}$ , $T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 48,0 | $\text{A}^2\text{s}$ |

## Charakteristische Werte / characteristic values

|                                                                   |                                                                                                                                                         |                                                                                                   |            | min. | typ.                 | max. |                                                 |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|------|----------------------|------|-------------------------------------------------|
| Durchlassspannung<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 | 2,25 | V<br>V<br>V                                     |
| Rückstromspitze<br>peak reverse recovery current                  | $I_F = 15\text{ A}$ , - $di_F/dt = 1000\text{ A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ )<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>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$   |      | 20,0<br>22,0<br>23,0 |      | A<br>A<br>A                                     |
| Sperrverzögerungsladung<br>recovered charge                       | $I_F = 15\text{ A}$ , - $di_F/dt = 1000\text{ A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ )<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>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$      |      | 1,50<br>2,50<br>2,70 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| Abschaltenergie pro Puls<br>reverse recovery energy               | $I_F = 15\text{ A}$ , - $di_F/dt = 1000\text{ A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ )<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>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$  |      | 0,55<br>0,90<br>1,00 |      | mJ<br>mJ<br>mJ                                  |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode<br>per diode                                                                                                                                  |                                                                                                   | $R_{thJC}$ |      |                      | 1,50 | K/W                                             |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$ |                                                                                                   | $R_{thCH}$ |      | 0,82                 |      | K/W                                             |

## NTC-Widerstand / NTC-thermistor

## Charakteristische Werte / characteristic values

|                                                    |                                                               |              |    | min. | typ. | max. |            |
|----------------------------------------------------|---------------------------------------------------------------|--------------|----|------|------|------|------------|
| Nennwiderstand<br>rated resistance                 | $T_C = 25^{\circ}\text{C}$                                    | $R_{25}$     |    |      | 5,00 |      | k $\Omega$ |
| Abweichung von $R_{100}$<br>deviation of $R_{100}$ | $T_C = 100^{\circ}\text{C}$ , $R_{100} = 493\text{ }\Omega$   | $\Delta R/R$ | -5 |      |      | 5    | %          |
| Verlustleistung<br>power dissipation               | $T_C = 25^{\circ}\text{C}$                                    | $P_{25}$     |    |      |      | 20,0 | mW         |
| B-Wert<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-Wert<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-Wert<br>B-value                                  | $R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$ | $B_{25/100}$ |    |      | 3433 |      | K          |

Angaben gemäß gültiger Application Note.

Specification according to the valid application note.

|                             |                                 |
|-----------------------------|---------------------------------|
| prepared by: Andreas Schulz | date of publication: 2007-11-23 |
| approved by: Robert Severin | revision: 2.1                   |

Vorläufige Daten  
preliminary data

## Modul / module

|                                                                        |                                                                                                                                            |                     |                                |                  |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------|------------------|
| Isolations-Prüfspannung<br>insulation test voltage                     | RMS, f = 50 Hz, t = 1 min.                                                                                                                 | V <sub>ISO</sub>    | 2,5                            | kV               |
| Material Modulgrundplatte<br>material of module baseplate              |                                                                                                                                            |                     | Cu                             |                  |
| Material für innere Isolation<br>material for internal insulation      |                                                                                                                                            |                     | Al <sub>2</sub> O <sub>3</sub> |                  |
| Kriechstrecke<br>creepage distance                                     | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal                                                    |                     | 10,0                           | mm               |
| Luftstrecke<br>clearance distance                                      | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal                                                    |                     | 7,5                            | mm               |
| Vergleichszahl der Kriechwegbildung<br>comparative tracking index      |                                                                                                                                            | CTI                 | > 200                          |                  |
|                                                                        |                                                                                                                                            |                     |                                |                  |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink      | pro Modul / 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. 0,02                      | typ. max. K/W    |
| Modulinduktivität<br>stray inductance module                           |                                                                                                                                            | L <sub>sCE</sub>    | 35                             | nH               |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper<br>Gleichrichter / rectifier                                                       | T <sub>vj max</sub> |                                | 175 °C<br>150 °C |
| Temperatur im Schaltbetrieb<br>temperature under switching conditions  | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper<br>Gleichrichter / rectifier                                                       | T <sub>vj op</sub>  | -40<br>-40                     | 150 °C<br>150 °C |
| Lagertemperatur<br>storage temperature                                 |                                                                                                                                            | T <sub>stg</sub>    | -40                            | 125 °C           |
| Anzugsdrehmoment f. mech. Befestigung<br>mounting torque               | Schraube M5 - Montage gem. gültiger Applikation Note<br>screw M5 - mounting according to valid application note                            | M                   | 3,00                           | - 6,00 Nm        |
| Gewicht<br>weight                                                      |                                                                                                                                            | G                   | 180                            | g                |

prepared by: Andreas Schulz

date of publication: 2007-11-23

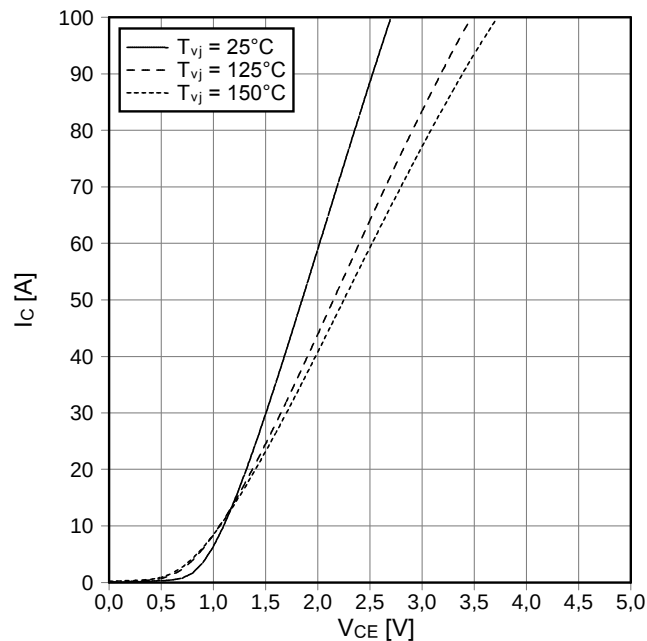
approved by: Robert Severin

revision: 2.1

## Vorläufige Daten preliminary data

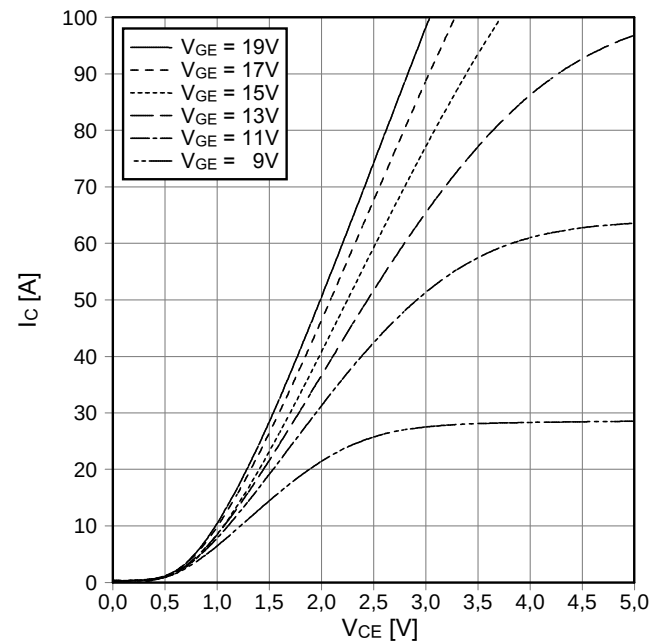
**Ausgangskennlinie IGBT-Wechselr. (typisch)**  
**output characteristic IGBT-inverter (typical)**

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



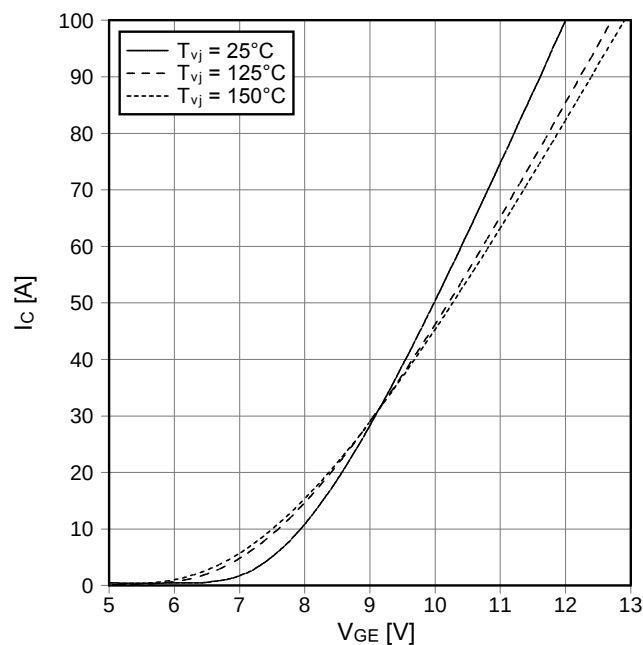
**Ausgangskennlinienfeld IGBT-Wechselr. (typisch)**  
**output characteristic IGBT-inverter (typical)**

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



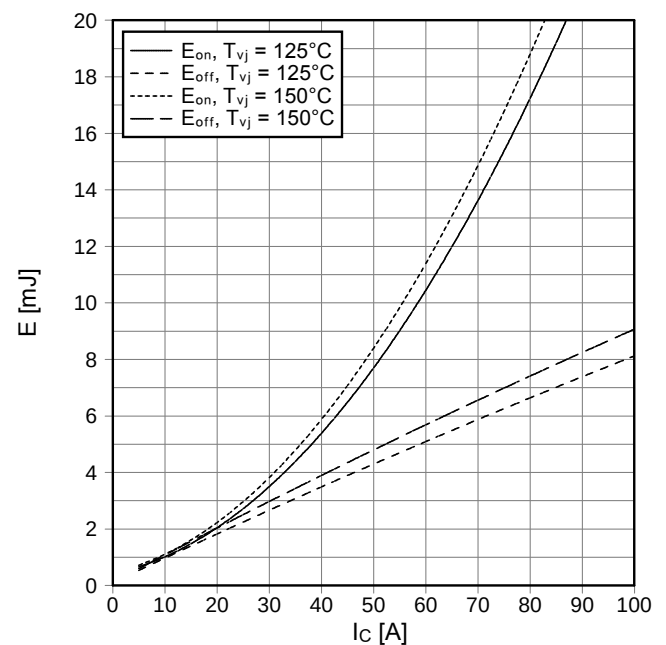
**Übertragungscharakteristik IGBT-Wechselr. (typisch)**  
**transfer characteristic IGBT-inverter (typical)**

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



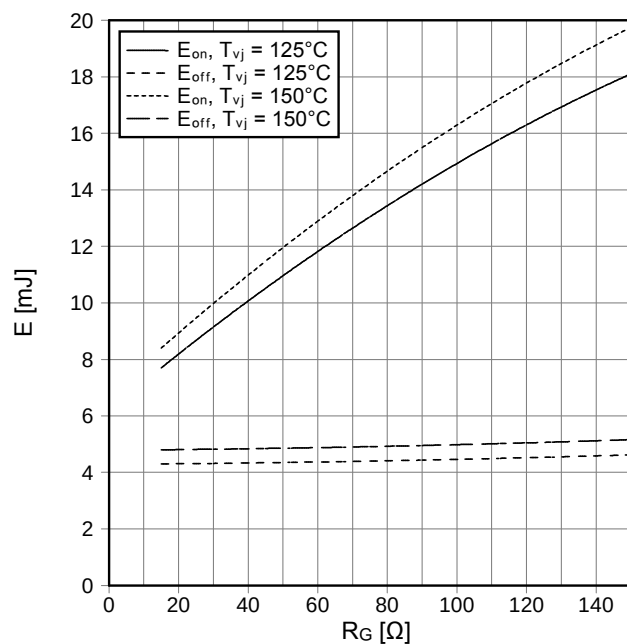
**Schaltverluste IGBT-Wechselr. (typisch)**  
**switching losses IGBT-inverter (typical)**

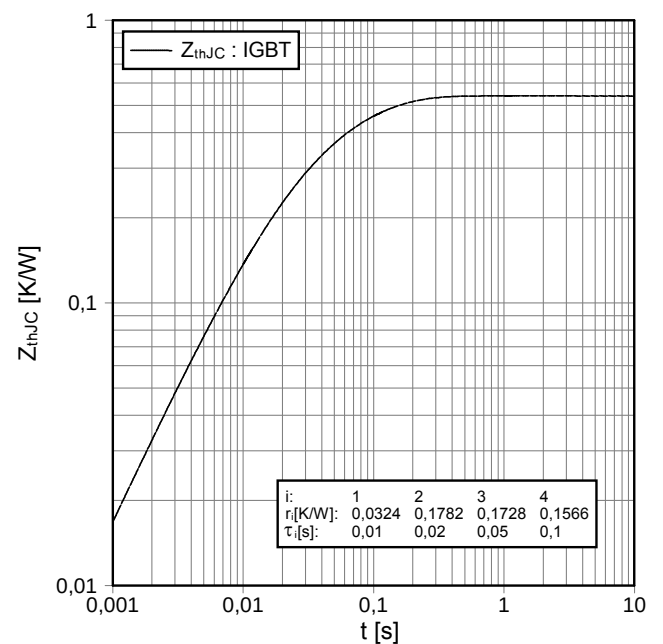
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Gon} = 15 \Omega$ ,  $R_{Goff} = 15 \Omega$ ,  $V_{CE} = 600 \text{ V}$

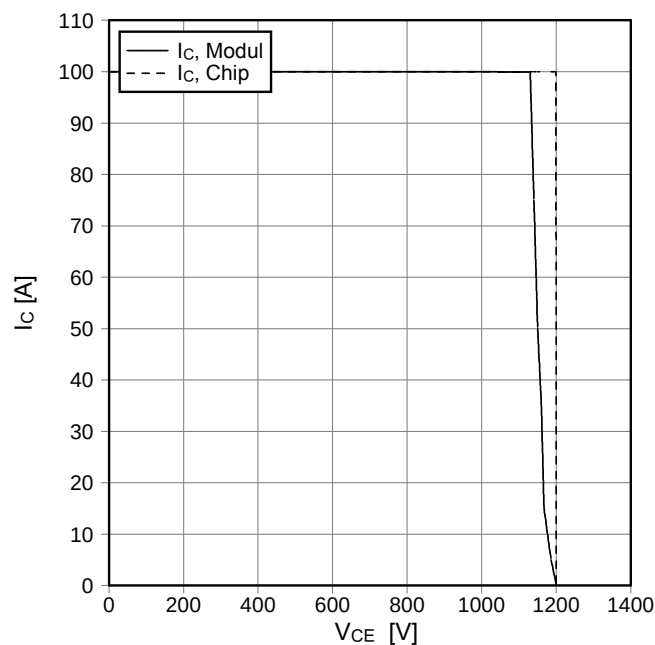


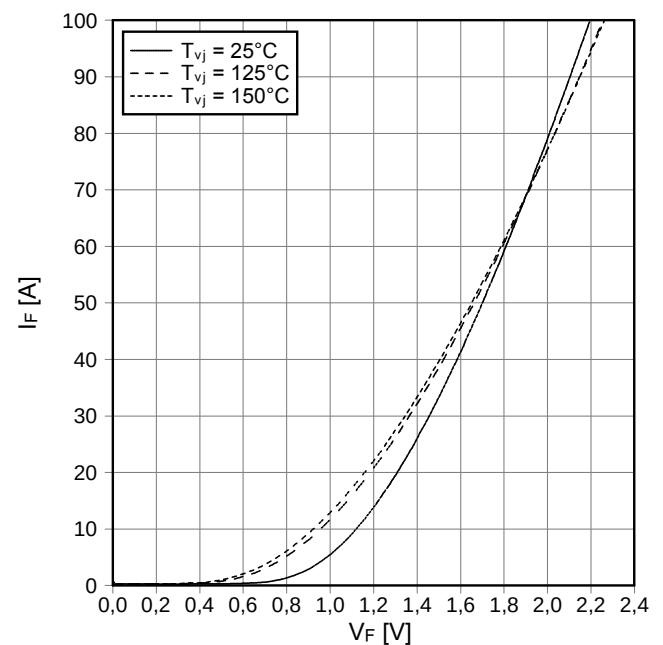
Vorläufige Daten  
preliminary data

Schaltverluste IGBT-Wechselr. (typisch)  
switching losses IGBT-Inverter (typical)

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

Transienter Wärmewiderstand IGBT-Wechselr.  
transient thermal impedance IGBT-inverter

 $Z_{thJC} = f(t)$ 

Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)  
reverse bias safe operating area IGBT-inv. (RBSOA)

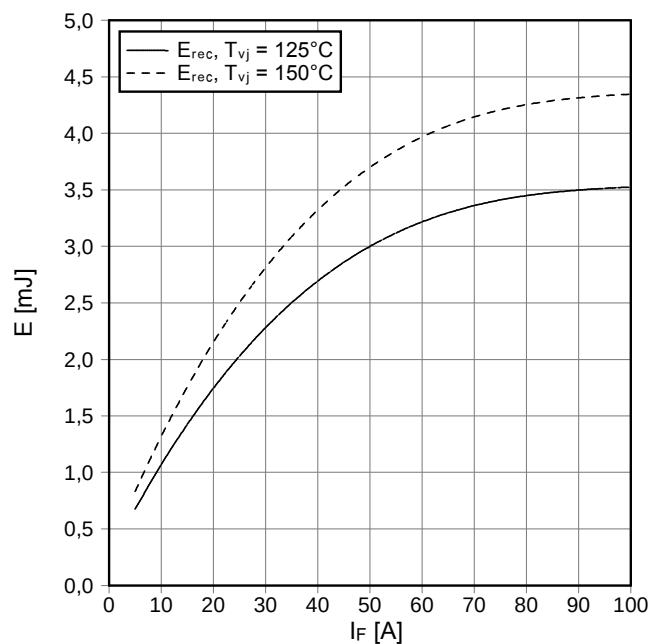
 $I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Goff} = 15 \Omega$ ,  $T_{vj} = 150^\circ\text{C}$ 

Durchlasskennlinie der Diode-Wechselr. (typisch)  
forward characteristic of diode-inverter (typical)

 $I_F = f(V_F)$ 


## Vorläufige Daten preliminary data

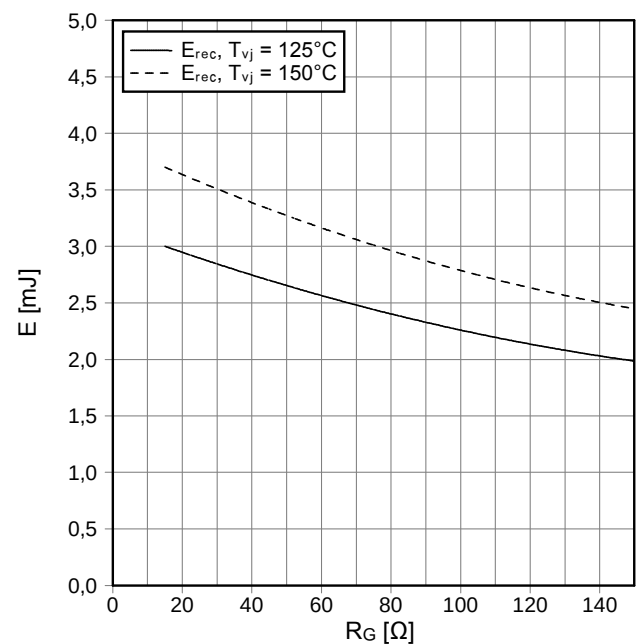
Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)

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



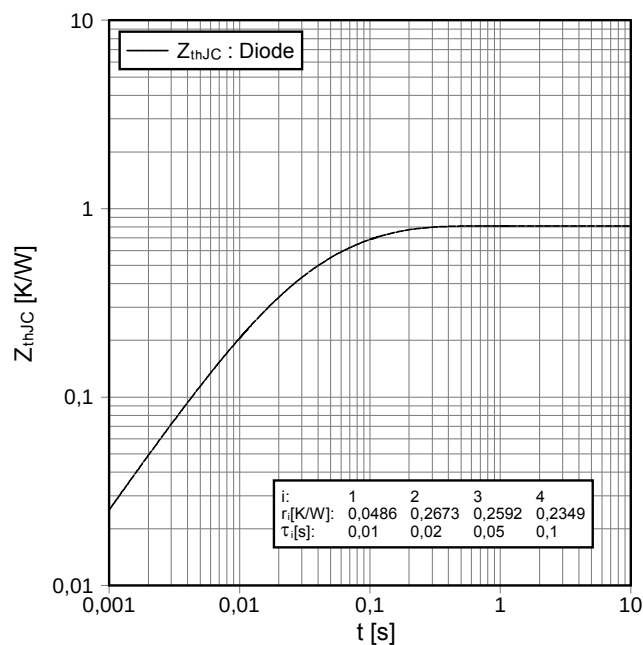
Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)

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



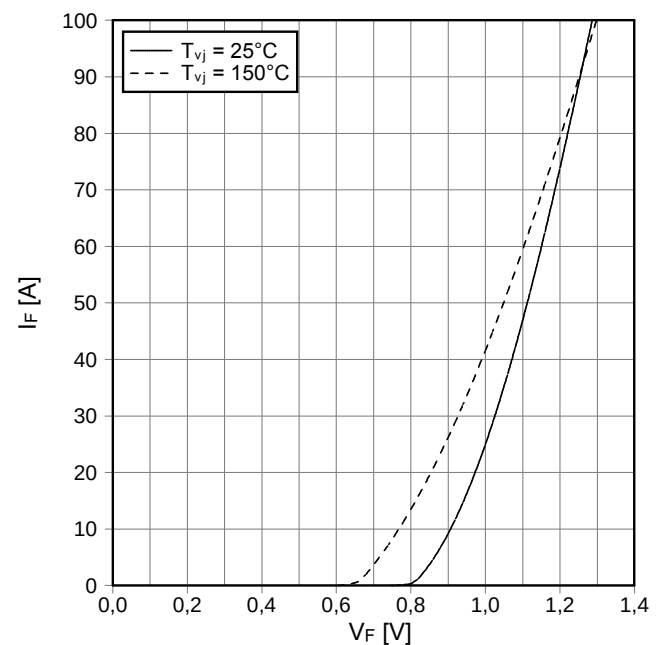
Transienter Wärmewiderstand Diode-Wechselr.  
transient thermal impedance diode-inverter

$Z_{thJC} = f(t)$



Durchlasskennlinie der Diode-Gleichrichter (typisch)  
forward characteristic of diode-rectifier (typical)

$I_F = f(V_F)$

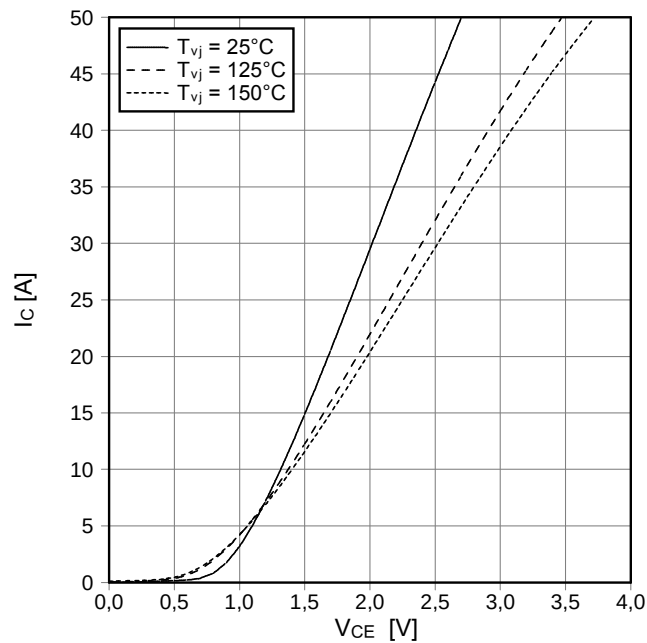




## Vorläufige Daten preliminary data

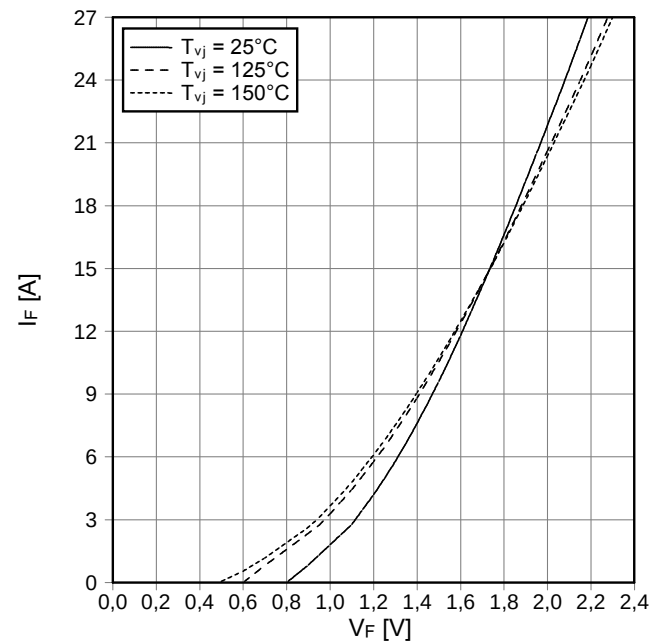
Ausgangskennlinie IGBT-Brems-Chopper (typisch)  
output characteristic IGBT-brake-chopper (typical)

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



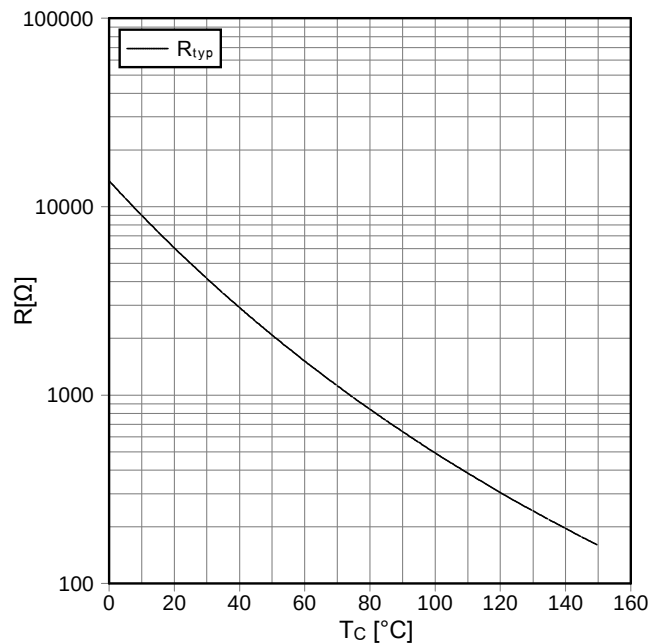
Durchlasskennlinie der Diode-Brems-Chopper (typisch)  
forward characteristic of Diode-brake-chopper (typical)

$I_F = f(V_F)$

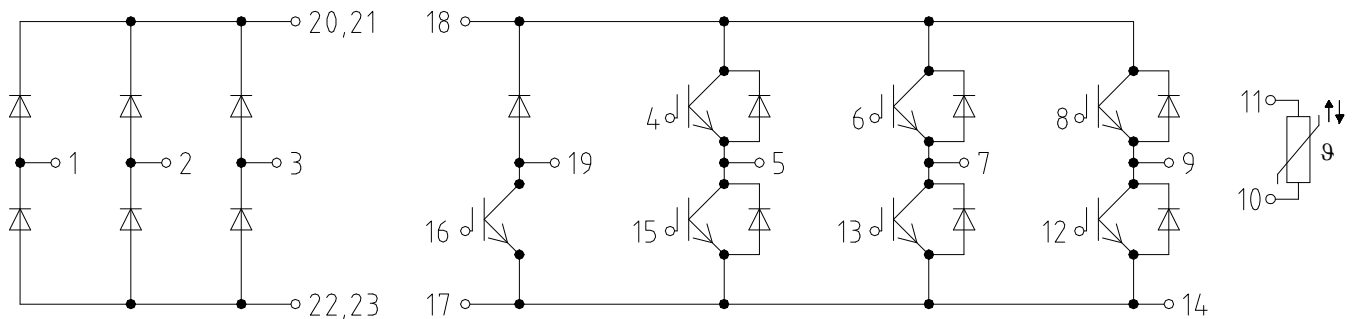


NTC-Temperaturkennlinie (typisch)  
NTC-temperature characteristic (typical)

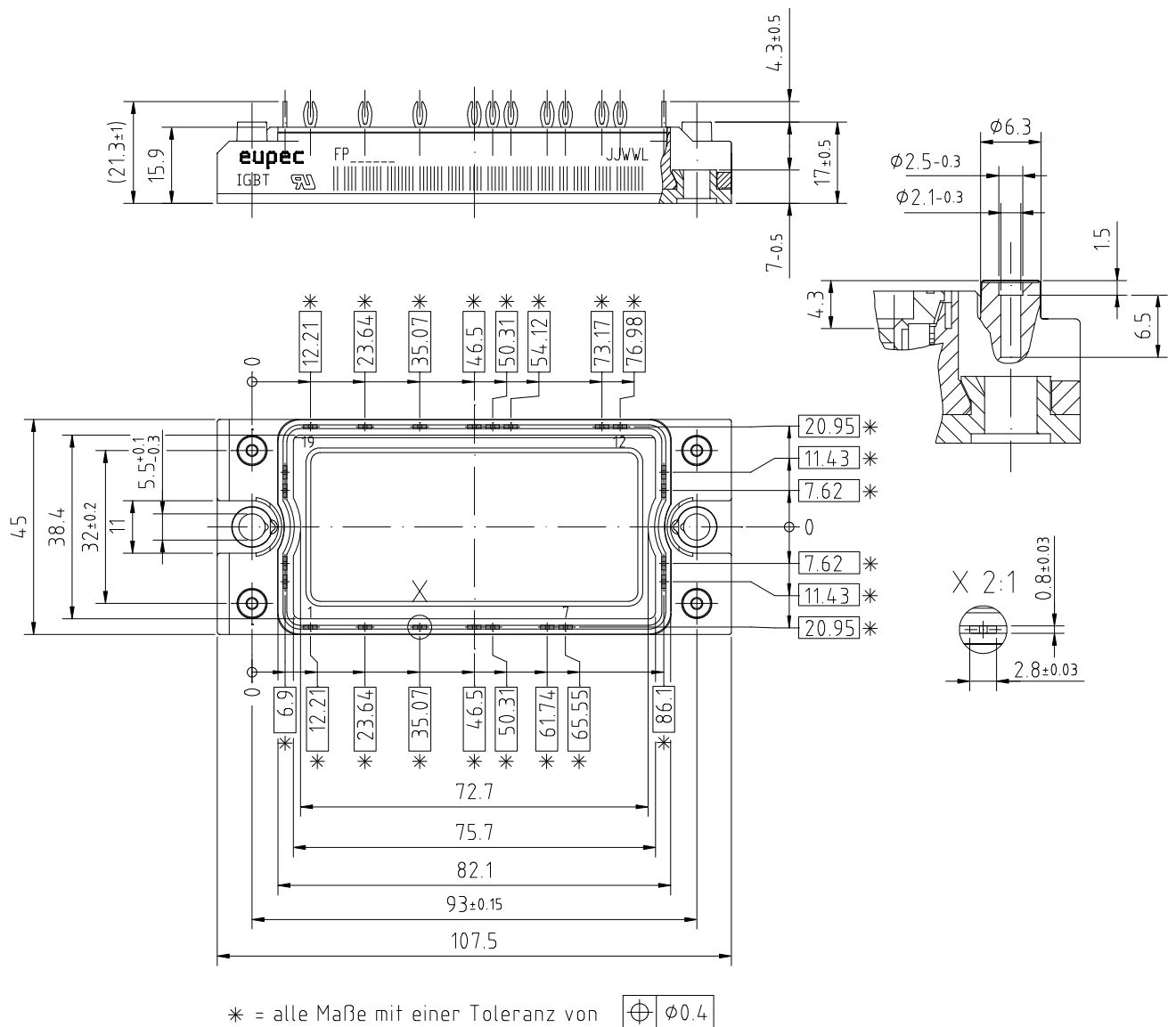
$R = f(T)$



Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



## Vorläufige Daten preliminary data

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