

**Vorläufige Daten  
preliminary data**

**IGBT-Wechselrichter / IGBT-inverter**

**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                       | $T_C = 70^{\circ}\text{C}$<br>$T_C = 25^{\circ}\text{C}$ | $I_{C\text{ nom}}$<br>$I_C$ | 50<br>70 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_p = 1\text{ ms}$ , $T_C = 70^{\circ}\text{C}$         | $I_{CRM}$                   | 100      | A      |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^{\circ}\text{C}$                               | $P_{tot}$                   | 355      | 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 | $I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$<br>$I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$ , $T_{vj} = 125^{\circ}\text{C}$   | $V_{CE\text{ sat}}$ |      | 3,20<br>3,85 | 3,75 | V<br>V                         |
| Gate-Schwellenspannung<br>gate threshold voltage                             | $I_C = 2,00\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25^{\circ}\text{C}$  | $V_{GEth}$          | 4,5  | 5,5          | 6,5  | V                              |
| Gateladung<br>gate charge  | $V_{GE} = -15\text{ V} \dots +15\text{ V}$  | $Q_G$               |      | 0,60         |      | $\mu\text{C}$                  |
| Interner Gatewiderstand<br>internal gate resistor                            | $T_{vj} = 25^{\circ}\text{C}$   | $R_{Gint}$          |      | 5,0          |      | $\Omega$                       |
| Eingangskapazität<br>input capacitance                                       | $f = 1\text{ MHz}$ , $T_{vj} = 25^{\circ}\text{C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$   | $C_{ies}$           |      | 3,40         |      | nF                             |
| Rückwirkungskapazität<br>reverse transfer capacitance                        | $f = 1\text{ MHz}$ , $T_{vj} = 25^{\circ}\text{C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$   | $C_{res}$           |      | 0,21         |      | nF                             |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current             | $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$  | $I_{CES}$           |      |              | 5,0  | mA                             |
| Gate-Emitter Reststrom<br>gate-emitter leakage current                       | $V_{CE} = 0\text{ V}$ , $V_{GE} = 20\text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$  | $I_{GES}$           |      |              | 400  | nA                             |
| Einschaltverzögerungszeit (ind. Last)<br>turn-on delay time (inductive load) | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$                          | $t_{d\text{ on}}$   |      | 0,12<br>0,13 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit (induktive Last)<br>rise time (inductive load)                  | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$                          | $t_r$               |      | 0,05<br>0,06 |      | $\mu\text{s}$<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>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$                        | $t_{d\text{ off}}$  |      | 0,31<br>0,36 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit (induktive Last)<br>fall time (inductive load)                      | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$                        | $t_f$               |      | 0,02<br>0,03 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$ , $L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$   | $E_{on}$            |      | 6,00         |      | mJ<br>mJ                       |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$ , $L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 25^{\circ}\text{C}$<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 13\ \Omega$ , $T_{vj} = 125^{\circ}\text{C}$ | $E_{off}$           |      | 2,50         |      | mJ<br>mJ                       |
| Kurzschlußverhalten<br>SC data   | $t_p \leq 10\ \mu\text{s}$ , $V_{GE} \leq 15\text{ V}$<br>$T_{vj} \leq 125^{\circ}\text{C}$ , $V_{CC} = 900\text{ V}$ , $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$   | $I_{SC}$            |      | 300          |      | A                              |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case              | pro IGBT<br>per IGBT  | $R_{thJC}$          |      |              | 0,35 | 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                                 | $V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 1250 | A <sup>2</sup> s |

**Charakteristische Werte / characteristic values**

|   |  |            | min. | typ.         | max. |                                |
|---|--|------------|------|--------------|------|--------------------------------|
| Durchlassspannung<br>forward voltage                            | $I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$<br>$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^{\circ}\text{C}$  | $V_F$      |      | 2,00<br>1,70 | 2,55 | V<br>V                         |
| Rückstromspitze<br>peak reverse recovery current                | $I_F = 50 \text{ A}, -di_F/dt = 1300 \text{ A}/\mu\text{s}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$ | $I_{RM}$   |      | 28,0<br>41,0 |      | A<br>A                         |
| Sperrverzögerungsladung<br>recovered charge                     | $I_F = 50 \text{ A}, -di_F/dt = 1300 \text{ A}/\mu\text{s}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$ | $Q_r$      |      | 3,00<br>8,50 |      | $\mu\text{C}$<br>$\mu\text{C}$ |
| Abschaltenergie pro Puls<br>reverse recovery energy             | $I_F = 50 \text{ A}, -di_F/dt = 1300 \text{ A}/\mu\text{s}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$<br>$V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$ | $E_{rec}$  |      | 1,10<br>3,10 |      | mJ<br>mJ                       |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case | pro Diode<br>per diode   | $R_{thJC}$ |      |              | 0,70 | 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 $R_{100}$ | $T_C = 100^{\circ}\text{C}, R_{100} = 493 \Omega$             | $\Delta R/R$ | -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          |

|                             |                                |
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# Technische Information / technical information

IGBT-Module  
IGBT-modules

## F4-50R12KS4

power electronics in motion  
**eupec**

### 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  |                      | 7,50                           |      | mm      |
| Vergleichszahl der Kriechwegbildung<br>comparative tracking index                            |  | CTI                  | > 225                          |      |         |
|  |  |                      | min.                           | typ. | max.    |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink                            | pro Modul / per module<br>$\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ | R <sub>thCH</sub>    |                                | 0,02 | K/W     |
| Modulinduktivität<br>stray inductance module   |  | L <sub>sCE</sub>     |                                | 30   | nH      |
| Modulleitungswiderstand,<br>Anschlüsse - Chip<br>module lead resistance,<br>terminals - chip | T <sub>C</sub> = 25°C, pro Schalter / per switch   | R <sub>CC'+EE'</sub> |                                | 2,20 | mΩ      |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature                       |  | T <sub>vj max</sub>  |                                |      | 150 °C  |
| Temperatur im Schaltbetrieb<br>temperature under switching conditions                        |  | T <sub>vj op</sub>   | -40                            |      | 125 °C  |
| Lagertemperatur<br>storage temperature   |  | T <sub>stg</sub>     | -40                            |      | 125 °C  |
| Anzugsdrehmoment f. mech. Befestigung<br>mounting torque                                     | Schraube / screw M5  | M                    | 3,00                           | -    | 6,00 Nm |
| Gewicht<br>weight  |  | G                    |                                | 180  | g       |

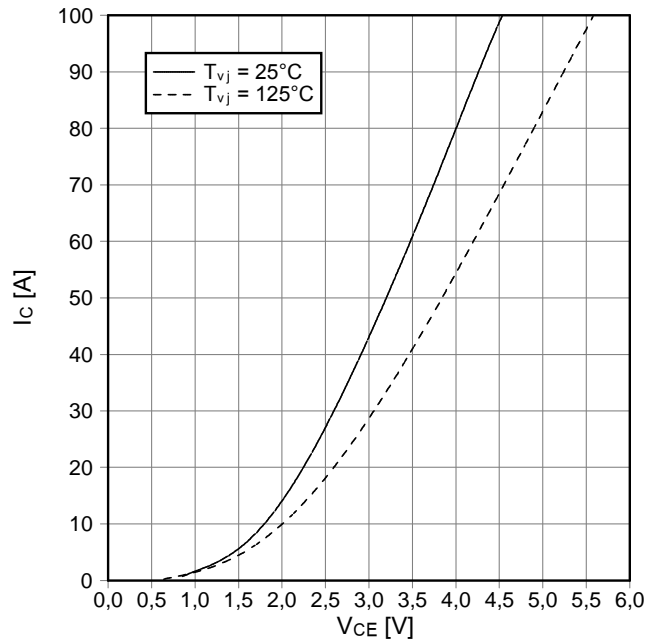
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**This technical information specifies semiconductor devices but guarantees no characteristics. It is valid with the appropriate technical explanations.**

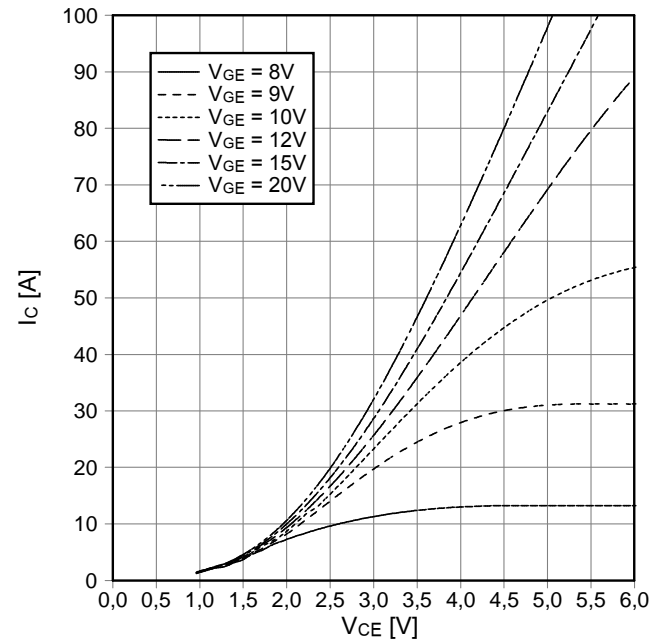
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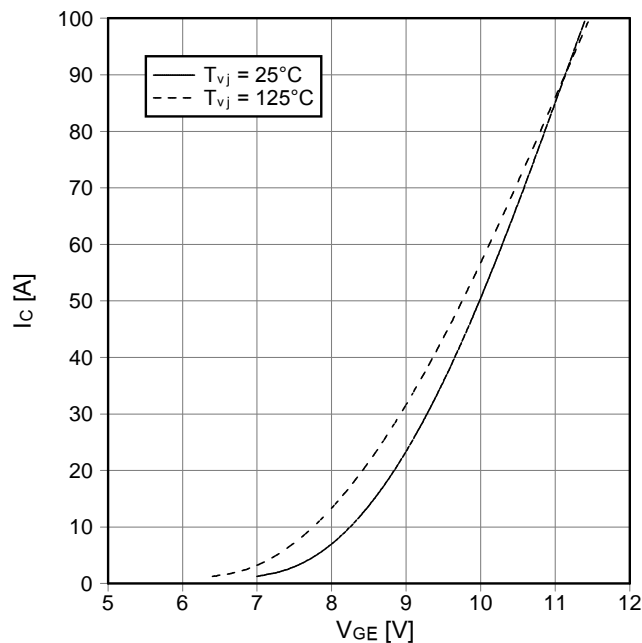
**Ausgangskennlinie IGBT-Wechselr. (typisch)**  
output characteristic IGBT-inverter (typical)  
 $I_c = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



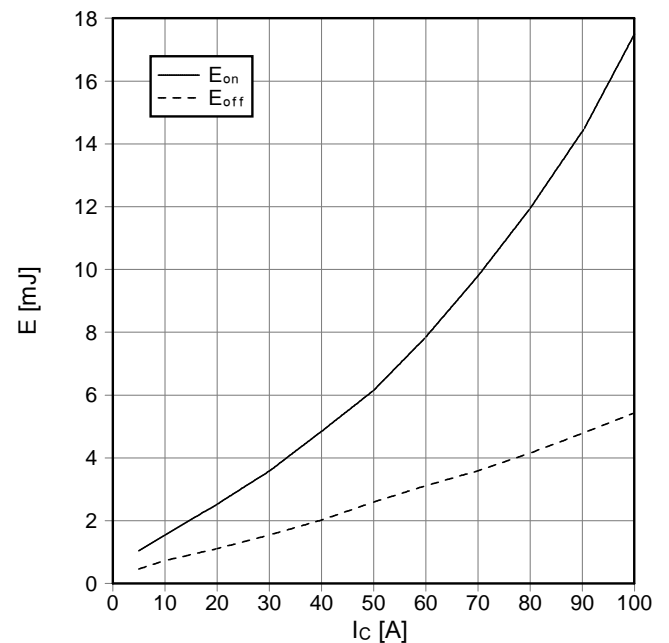
**Ausgangskennlinienfeld IGBT-Wechselr. (typisch)**  
output characteristic IGBT-inverter (typical)  
 $I_c = f(V_{CE})$   
 $T_{vj} = 125^\circ\text{C}$



**Übertragungscharakteristik IGBT-Wechselr. (typisch)**  
transfer characteristic IGBT-inverter (typical)  
 $I_c = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



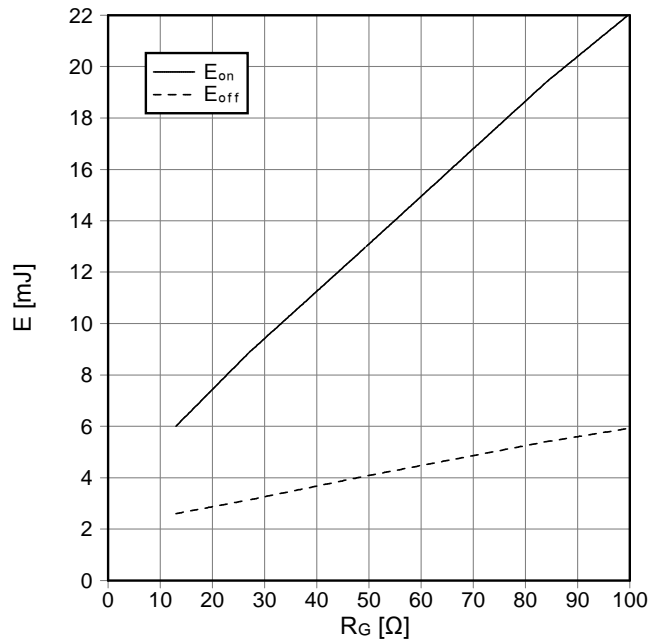
**Schaltverluste IGBT-Wechselr. (typisch)**  
switching losses IGBT-inverter (typical)  
 $E_{on} = f(I_c)$ ,  $E_{off} = f(I_c)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 13\ \Omega$ ,  $R_{Goff} = 13\ \Omega$ ,  $V_{CE} = 600\text{ V}$ ,  
 $T_{vj} = 125^\circ\text{C}$



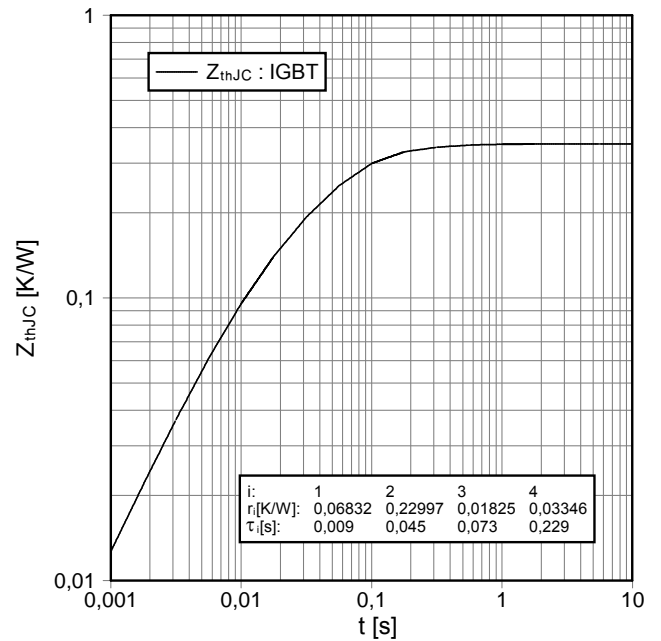
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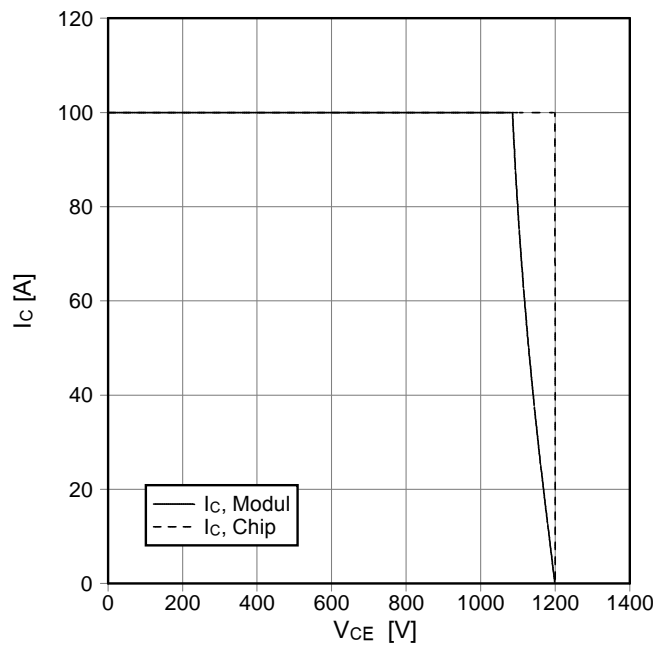
**Schaltverluste IGBT-Wechselr. (typisch)**  
switching losses IGBT-inverter (typical)  
 $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 50\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $T_{vj} = 125^\circ\text{C}$



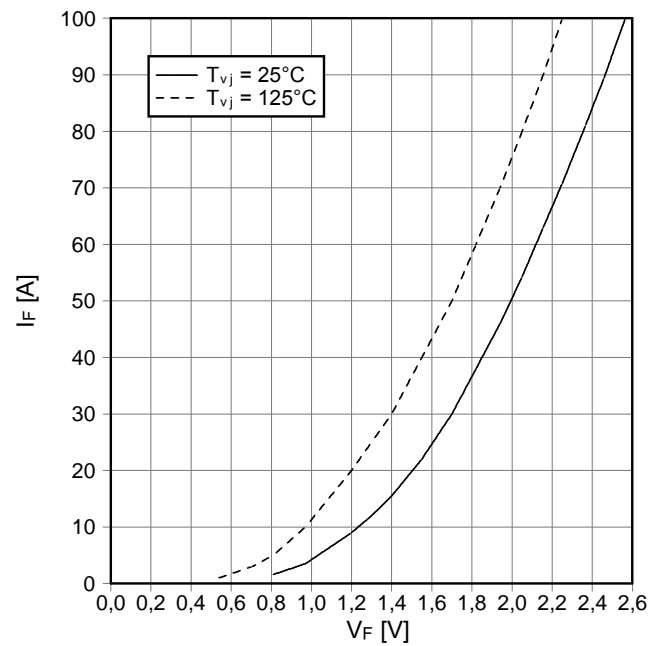
**Transienter Wärmewiderstand IGBT-Wechselr.**  
transient thermal impedance IGBT-inverter  
 $Z_{thJC} = f(t)$



**Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)**  
reverse bias safe operating area IGBT-inv. (RBSOA)  
 $I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 13\ \Omega$ ,  $T_{vj} = 125^\circ\text{C}$



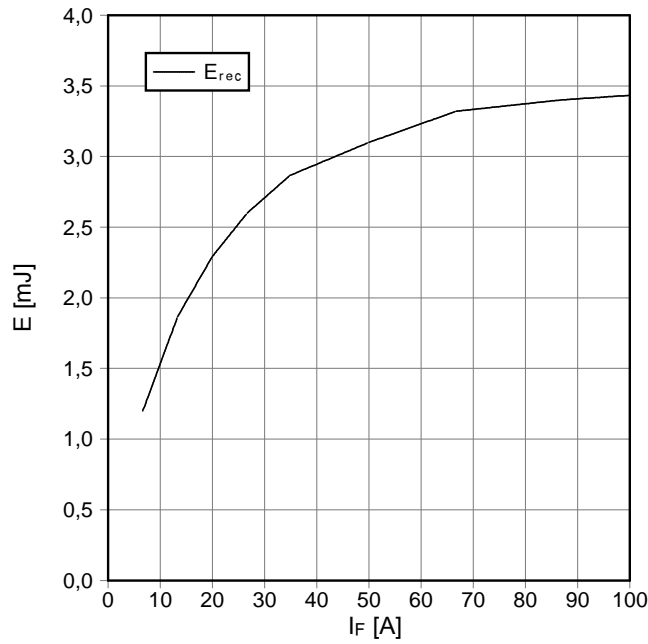
**Durchlaßkennlinie der Diode-Wechselr. (typisch)**  
forward characteristic of diode-inverter (typical)  
 $I_F = f(V_F)$



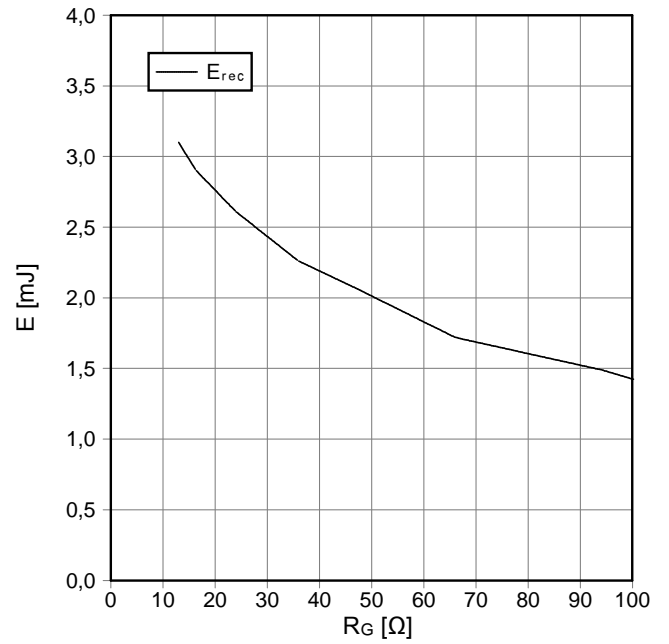
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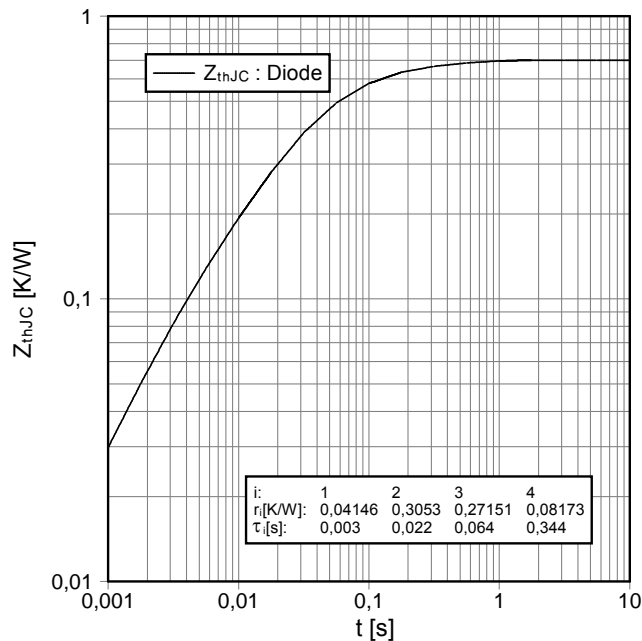
Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 13 \Omega$ ,  $V_{CE} = 600 V$ ,  $T_{vj} = 125^\circ C$



Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)  
 $E_{rec} = f(R_G)$   
 $I_F = 50 A$ ,  $V_{CE} = 600 V$ ,  $T_{vj} = 125^\circ C$

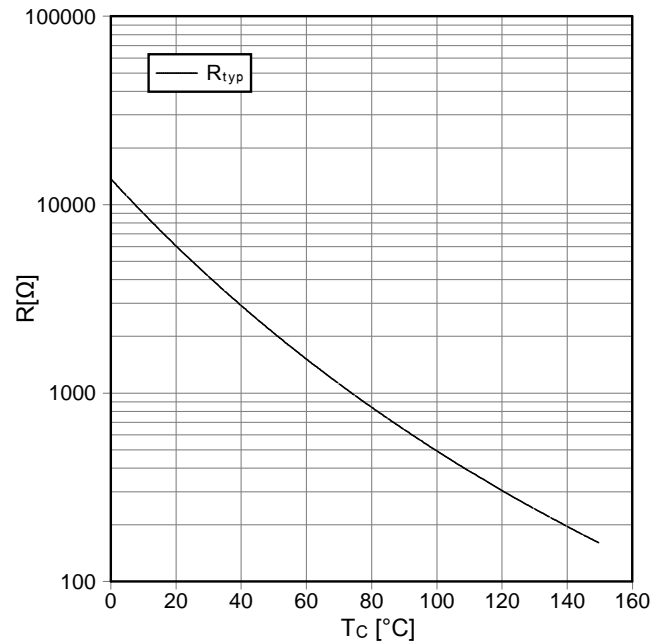


Transienter Wärmewiderstand Diode-Wechselr.  
transient thermal impedance diode-inverter  
 $Z_{thJC} = f(t)$



| i:                    | 1       | 2      | 3       | 4       |
|-----------------------|---------|--------|---------|---------|
| r <sub>i</sub> [K/W]: | 0,04146 | 0,3053 | 0,27151 | 0,08173 |
| τ <sub>i</sub> [s]:   | 0,003   | 0,022  | 0,064   | 0,344   |

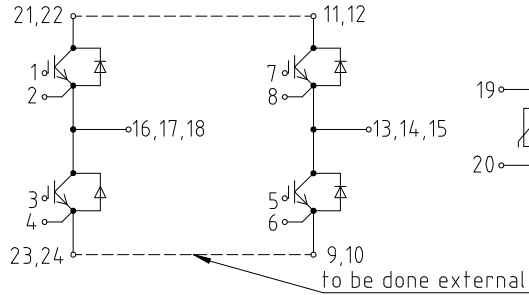
NTC-Temperaturkennlinie (typisch)  
NTC-temperature characteristic (typical)  
 $R = f(T)$



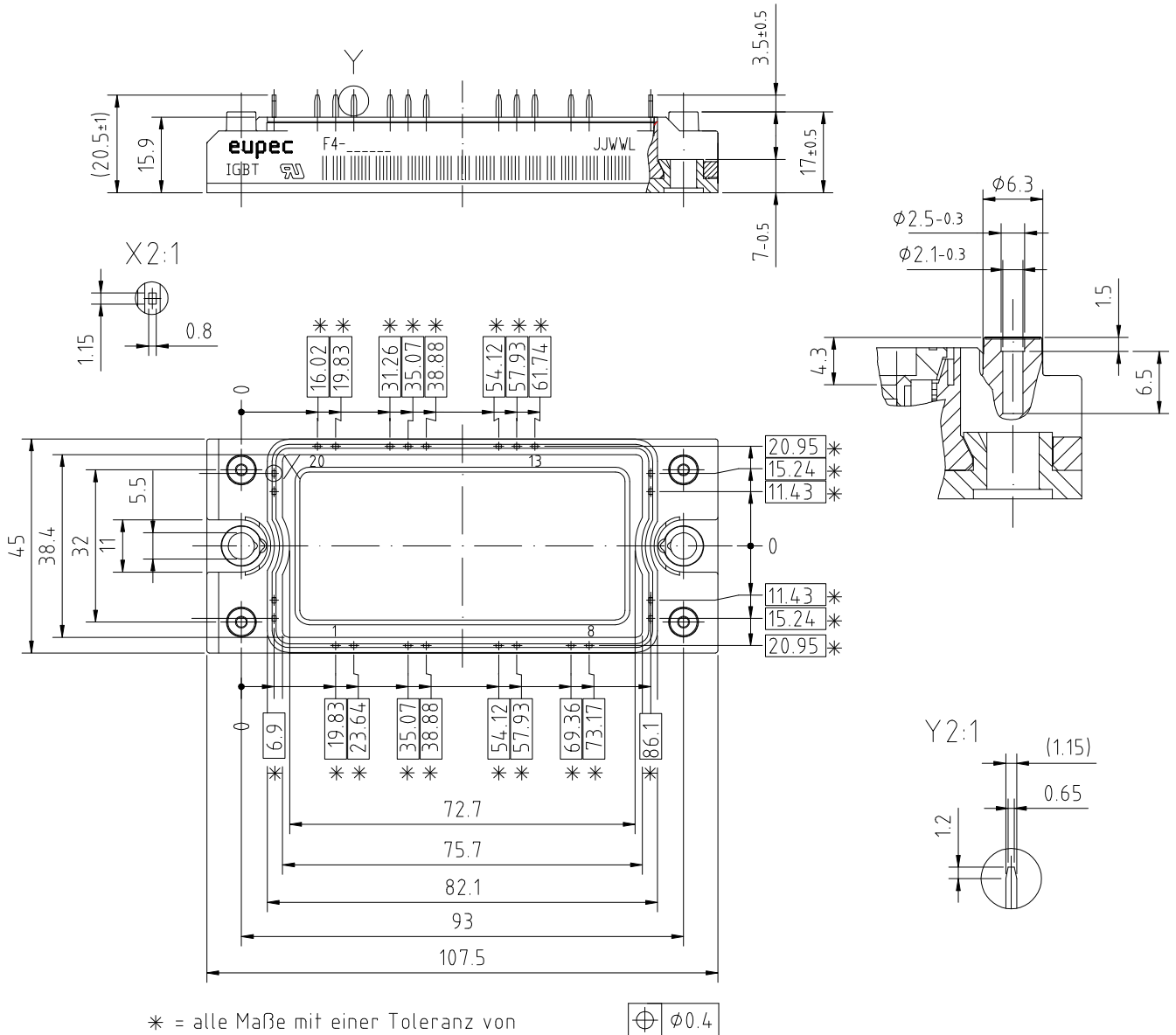
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### Schaltplan / circuit diagram



### Gehäuseabmessungen / package outlines



|                             |                                |
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