# Technische Information / Technical Information

IGBT-Module
IGBT-Modules

# FF 200 R17 KE3

eupec

**vorläufige Daten**
**preliminary data**

## Höchstzulässige Werte / Maximum rated values

### Elektrische Eigenschaften / Electrical properties

| | | | | |
|---|---|---|---|---|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage | $T_{vj}$ = 25°C | $V_{CES}$ | 1.700 | V |
| Kollektor-Dauergleichstrom<br>DC-collector current | $T_C$ = 80 °C<br>$T_C$ = 25 °C | $I_{C,nom.}$<br>$I_C$ | 200<br>390 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collctor current | $t_P$ = 1 ms, $T_C$ = 80°C | $I_{CRM}$ | 400 | A |
| Gesamt-Verlustleistung<br>total power dissipation | $T_C$=25°C, Transistor | $P_{tot}$ | 1250 | W |
| Gate-Emitter-Spitzenspannung<br>gate-emitter peak voltage | | $V_{GES}$ | +/- 20V | V |
| Dauergleichstrom<br>DC forward current | | $I_F$ | 200 | A |
| Periodischer Spitzenstrom<br>repetitive peak forw. current | tp = 1 ms | $I_{FRM}$ | 400 | A |
| Grenzlastintegral der Diode<br>$I^2t$ - value, Diode | $V_R$ = 0V, $t_p$ = 10ms, $T_{vj}$ = 125°C | $I^2t$ | 5,4 | k $A^2$s |
| Isolations-Prüfspannung<br>insulation test voltage | RMS, f = 50 Hz, t = 1 min. | $V_{ISOL}$ | 3,4 | kV |

## Charakteristische Werte / Characteristic values

| Transistor / Transistor | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Kollektor-Emitter Sättigungsspannung<br>collector-emitter saturation voltage | $I_C$ = 200A, $V_{GE}$ = 15V, $T_{vj}$ = 25°C<br>$I_C$ = 200A, $V_{GE}$ = 15V, $T_{vj}$ = 125°C | $V_{CE\ sat}$ | -<br>- | 2,0<br>2,4 | 2,45<br>- | V<br>V |
| Gate-Schwellenspannung<br>gate threshold voltage | $I_C$ = 8mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | $V_{GE(th)}$ | 5,2 | 5,8 | 6,4 | V |
| Gateladung<br>gate charge | $V_{GE}$ = -15V ... +15V | $Q_G$ | - | 1,2 | - | µC |
| Eingangskapazität<br>input capacitance | f = 1MHz,$T_{vj}$ = 25°C,$V_{CE}$ = 25V, $V_{GE}$ = 0V | $C_{ies}$ | - | 17 | - | nF |
| Rückwirkungskapazität<br>reverse transfer capacitance | f = 1MHz,$T_{vj}$ = 25°C,$V_{CE}$ = 25V, $V_{GE}$ = 0V | $C_{res}$ | - | 0,6 | - | nF |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current | $V_{CE}$ = 1700V, $V_{GE}$ = 0V, $T_{vj}$ = 25°C | $I_{CES}$ | - | - | 5 | mA |
| Gate-Emitter Reststrom<br>gate-emitter leakage current | $V_{CE}$ = 0V, $V_{GE}$ = 20V, $T_{vj}$ = 25°C | $I_{GES}$ | - | - | 400 | nA |

| | |
|---|---|
| prepared by: Alfons Wiesenthal | date of publication: 2002-07-15 |
| approved by: Christoph Lübke; 2002-07-15 | revision: 2.0 |

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## Charakteristische Werte / Characteristic values

| Transistor / Transistor | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Einschaltverzögerungszeit (ind. Last)<br>turn on delay time (inductive load) | $I_C$ =200A, $V_{CE}$ = 900V | | | | | |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 25°C | $t_{d,on}$ | - | 0,25 | - | µs |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 125°C | | - | 0,30 | - | µs |
| Anstiegszeit (induktive Last)<br>rise time (inductive load) | $I_C$ = 200A, $V_{CE}$ = 900V | | | | | |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 25°C | $t_r$ | - | 0,10 | - | µs |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 125°C | | - | 0,10 | - | µs |
| Abschaltverzögerungszeit (ind. Last)<br>turn off delay time (inductive load) | $I_C$ = 200A, $V_{CE}$ = 900V | | | | | |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 25°C | $t_{d,off}$ | - | 0,85 | - | µs |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 125°C | | - | 1,00 | - | µs |
| Fallzeit (induktive Last)<br>fall time (inductive load) | $I_C$ = 200A, $V_{CE}$ = 900V | | | | | |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 25°C | $t_f$ | - | 0,12 | - | µs |
| | $V_{GE}$ = ±15V, $R_G$ = 6,8Ω, $T_{vj}$ = 125°C | | - | 0,20 | - | µs |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse | $I_C$ = 200A, $V_{CE}$ = 900V, $V_{GE}$ = ±15V | | | | | |
| | $R_G$ = 6,8Ω, $T_{vj}$ = 125°C, $L_\sigma$ = 60nH | $E_{on}$ | - | 80 | - | mJ |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse | $I_C$ =200A, $V_{CE}$ = 900V, $V_{GE}$ = ±15V | | | | | |
| | $R_G$ = 6,8Ω, $T_{vj}$ = 125°C, $L_\sigma$ = 60nH | $E_{off}$ | - | 65 | - | mJ |
| Kurzschlußverhalten<br>SC Data | $t_P \leq$ 10µsec, $V_{GE} \leq$ 15V | | | | | |
| | $T_{Vj} \leq$125°C, $V_{CC}$=1000V, $V_{CEmax}$=$V_{CES}$ -$L_{\sigma CE}$ ·di/dt | $I_{SC}$ | - | 740 | - | A |
| Modulinduktivität<br>stray inductance module | Anschlüsse / terminals: 2 - 3 | $L_{\sigma CE}$ | - | 20 | - | nH |
| Modulleitungswiderstand, Anschlüsse - Chip<br>module lead resistance, terminals - chip | $T_C$=25°C, pro Zweig / per arm | $R_{CC'+EE'}$ | - | 0,60 | - | mΩ |

## Charakteristische Werte / Characteristic values

| Diode / Diode | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Durchlaßspannung<br>forward voltage | $I_F$ = 200A, $V_{GE}$ = 0V, $T_{vj}$ = 25°C | $V_F$ | - | 1,8 | 2,2 | V |
| | $I_F$ = 200A, $V_{GE}$ = 0V, $T_{vj}$ = 125°C | | - | 1,9 | - | V |
| Rückstromspitze<br>peak reverse recovery current | $I_F$ = 200A, - $di_F$/dt = 2600A/µs | | | | | |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 25°C | $I_{RM}$ | - | 220 | - | A |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 125°C | | - | 230 | - | A |
| Sperrverzögerungsladung<br>recovered charge | $I_F$ = 200A, - $di_F$/dt = 2600A/µs | | | | | |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 25°C | $Q_r$ | - | 50 | - | µC |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 125°C | | - | 85 | - | µC |
| Abschaltenergie pro Puls<br>reverse recovery energy | $I_F$ = 200A, - $di_F$/dt = 2600A/µs | | | | | |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 25°C | $E_{rec}$ | - | 25 | - | mJ |
| | $V_R$ = 900V, $V_{GE}$ = -15V, $T_{vj}$ = 125°C | | - | 50 | - | mJ |

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## Thermische Eigenschaften / Thermal properties

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Innerer Wärmewiderstand<br>thermal resistance, junction to case | Transistor / transistor, DC | $R_{thJC}$ | - | - | 0,10 | K/W |
| | Diode/Diode, DC | | - | - | 0,16 | K/W |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Modul / per module<br>$\lambda_{Paste}$ = 1 W/m*K / $\lambda_{grease}$ = 1 W/m*K | $R_{thCK}$ | - | 0,01 | - | K/W |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature | | $T_{vj\ max}$ | - | - | 150 | °C |
| Betriebstemperatur<br>operation temperature | | $T_{vjop}$ | -40 | - | 125 | °C |
| Lagertemperatur<br>storage temperature | | $T_{stg}$ | -40 | - | 125 | °C |

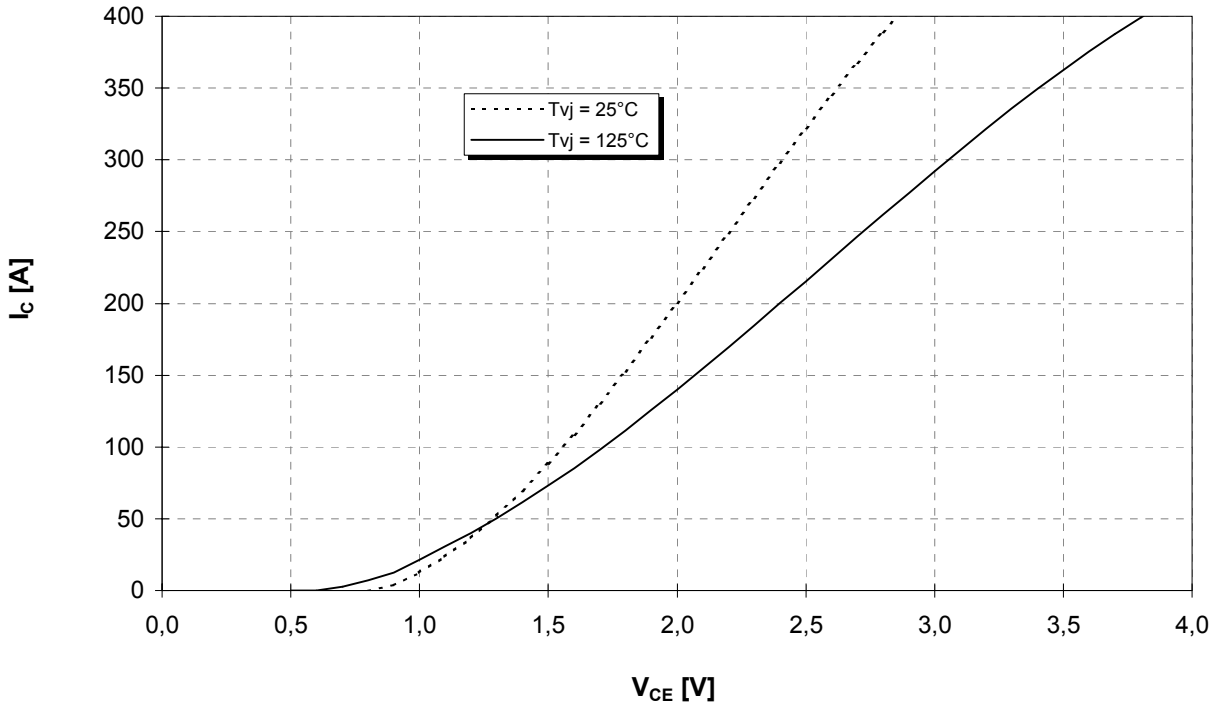
## Mechanische Eigenschaften / Mechanical properties

| | | | | | | |
|---|---|---|---|---|---|---|
| Gehäuse, siehe Anlage<br>case, see appendix | | | | | | |
| Innere Isolation<br>internal insulation | | | | $Al_2O_3$ | | |
| Kriechstrecke<br>creepage distance | | | | 20 | | mm |
| Luftstrecke<br>clearance | | | | 11 | | mm |
| CTI<br>comperative tracking index | | | | 425 | | |
| Anzugsdrehmoment f. mech. Befestigung<br>mounting torque | Schraube / screw M6 | M | 3 | - | 6 | Nm |
| Anzugsdrehmoment f. elektr. Anschlüsse<br>terminal connection torque | Anschlüsse / terminals M6 | M | 2,5 | - | 5 | Nm |
| Gewicht<br>weight | | G | | 340 | | g |

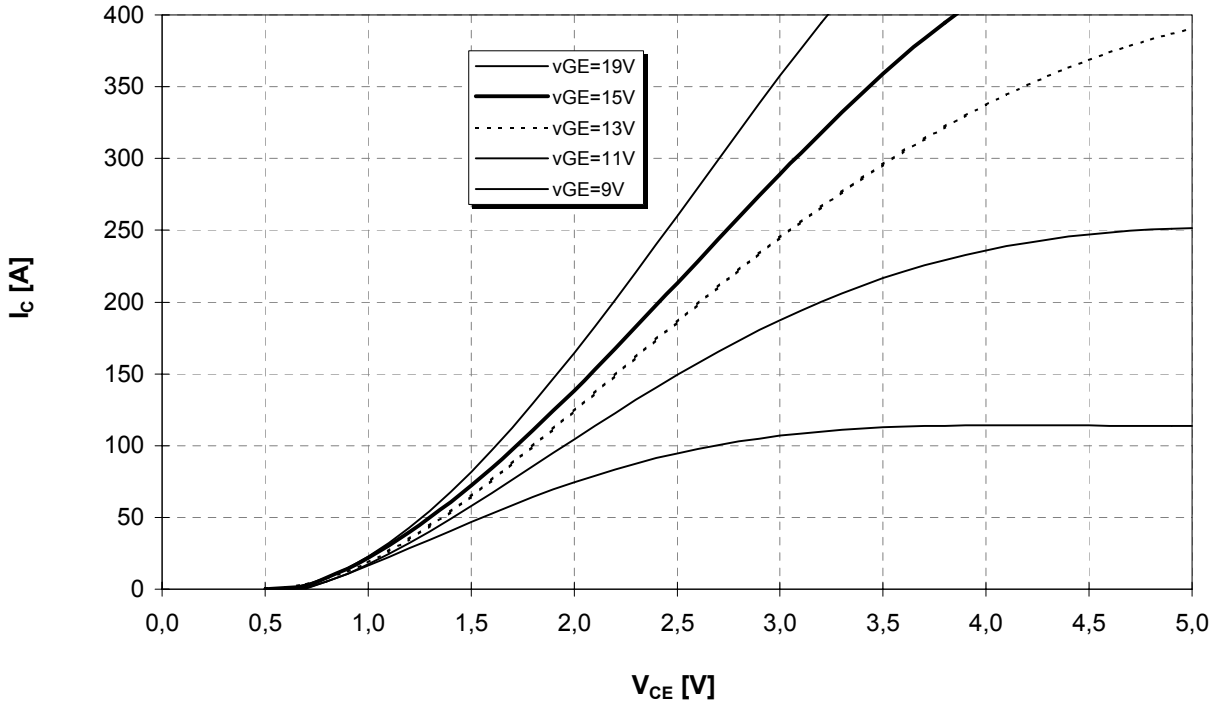
Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert.
Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.
This technical information specifies semiconductor devices but promises no characteristics. It is
valid in combination with the belonging technical notes.

**vorläufige Daten**
**preliminary data**

**Ausgangskennlinie (typisch)** $I_C = f(V_{CE})$
**Output characteristic (typical)** $V_{GE} = 15V$




**Ausgangskennlinienfeld (typisch)** $I_C = f(V_{CE})$
**Output characteristic (typical)** $T_{vj} = 125°C$



**vorläufige Daten**
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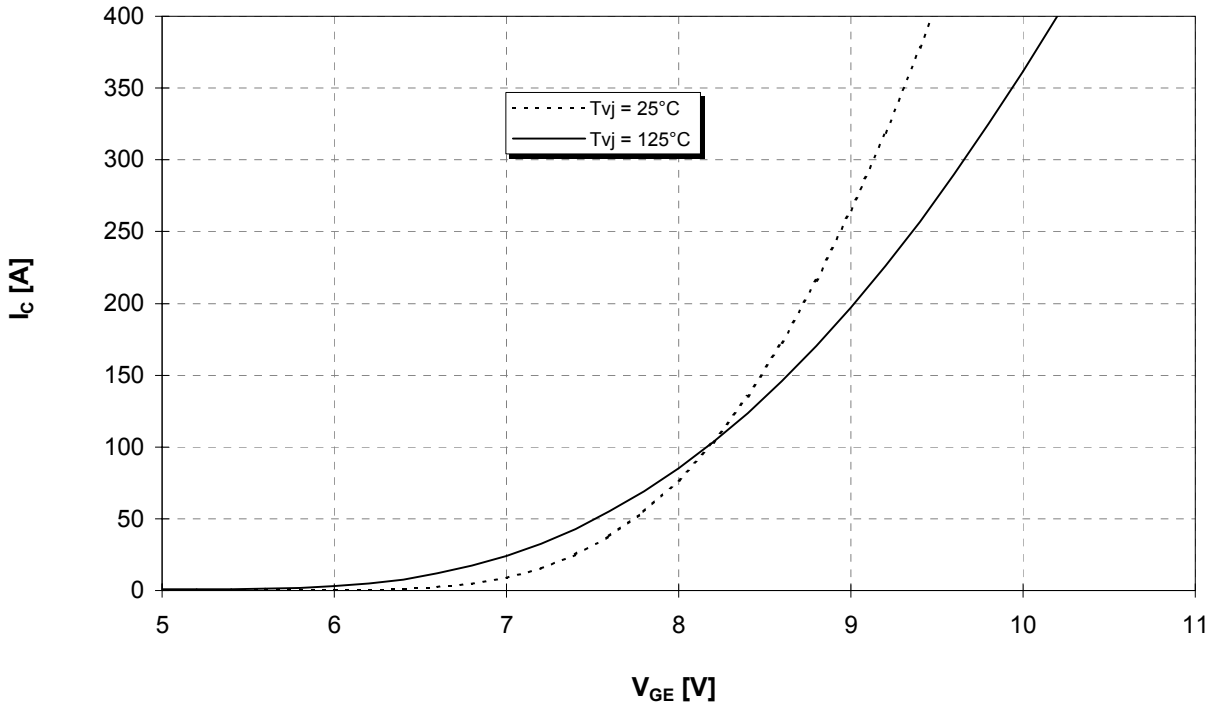
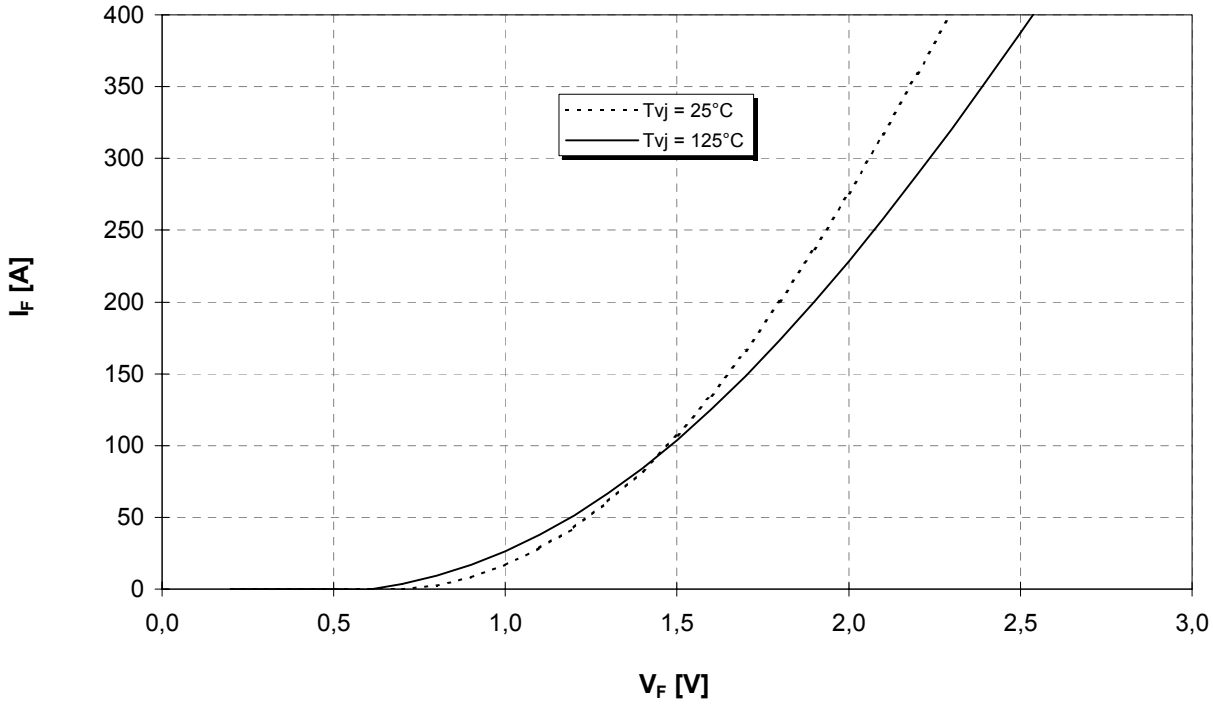
**Übertragungscharakteristik (typisch)** $I_C = f(V_{GE})$
**Transfer characteristic (typical)** $V_{CE} = 20V$




**Durchlaßkennlinie der Inversdiode (typisch)** $I_F = f(V_F)$
**Forward characteristic of inverse diode (typical)**



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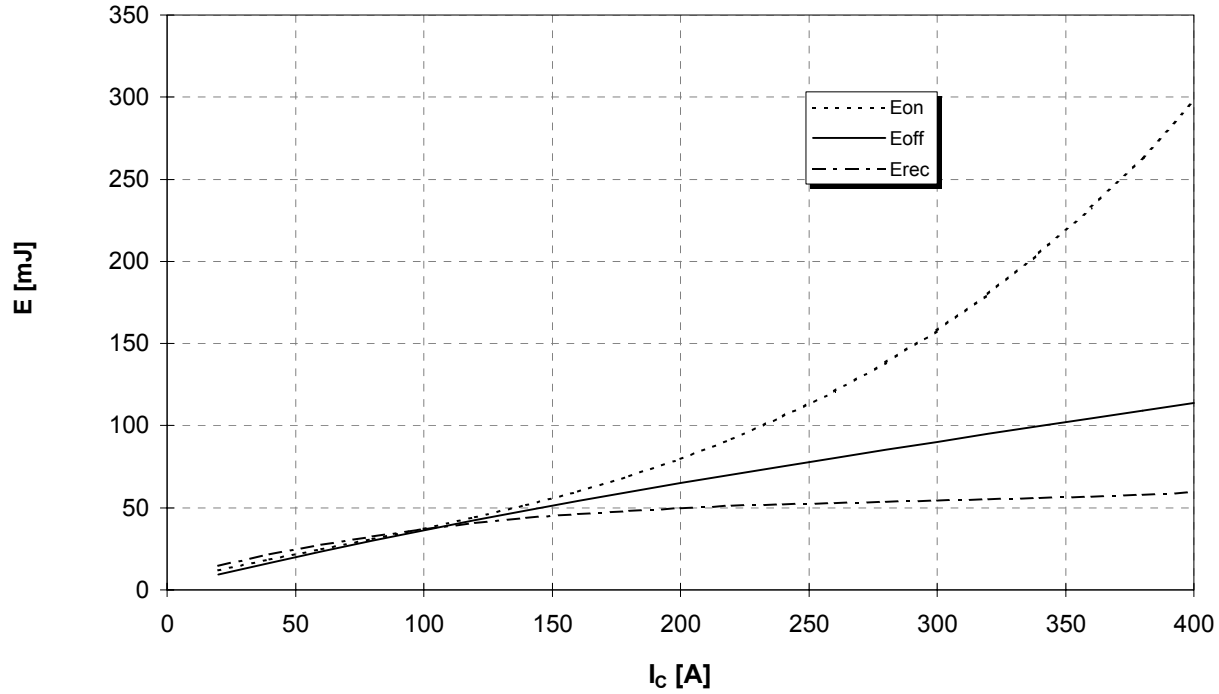
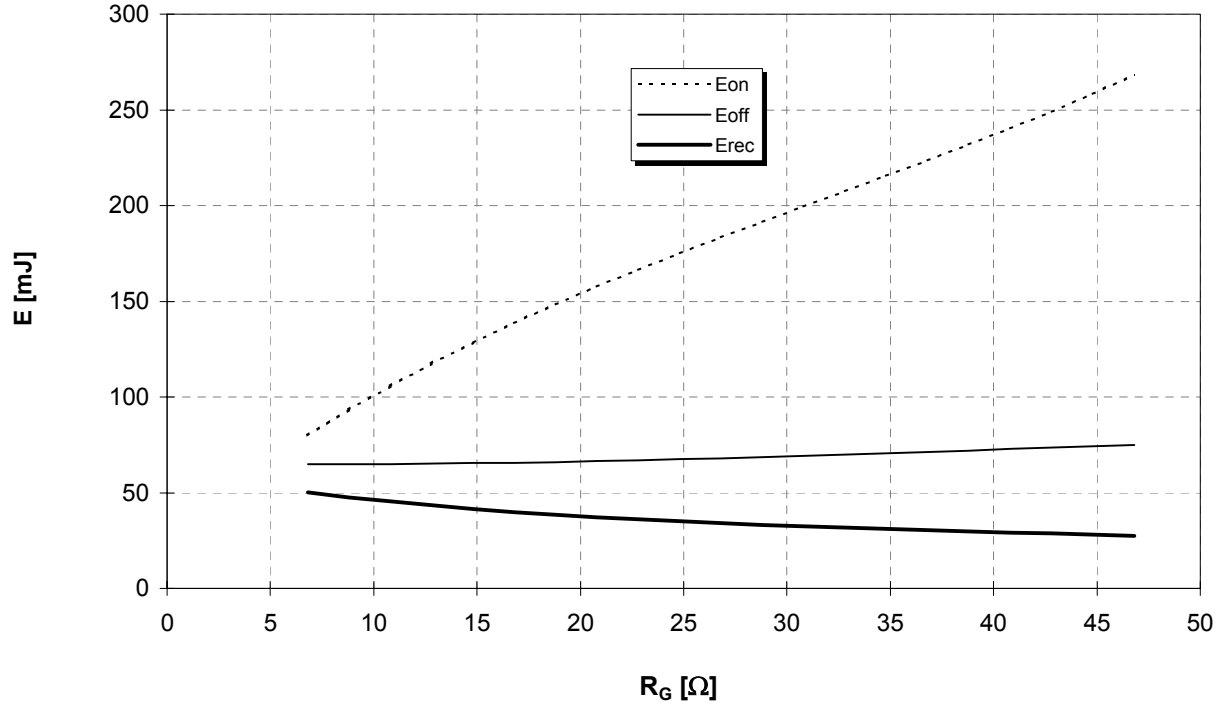
**Schaltverluste (typisch)** $E_{on} = f(I_C)$ , $E_{off} = f(I_C)$ , $E_{rec} = f(I_C)$
**Switching losses (typical)** $V_{GE} = \pm 15V$, $R_{gon} = R_{goff} = 6{,}8\Omega$, $V_{CE} = 900V$, $T_{vj} = 125°C$




**Schaltverluste (typisch)** $E_{on} = f(R_G)$ , $E_{off} = f(R_G)$ , $E_{rec} = f(R_G)$
**Switching losses (typical)** $V_{GE} = \pm 15V$, $I_C = 200A$ , $V_{CE} = 900V$ , $T_j = 125°C$



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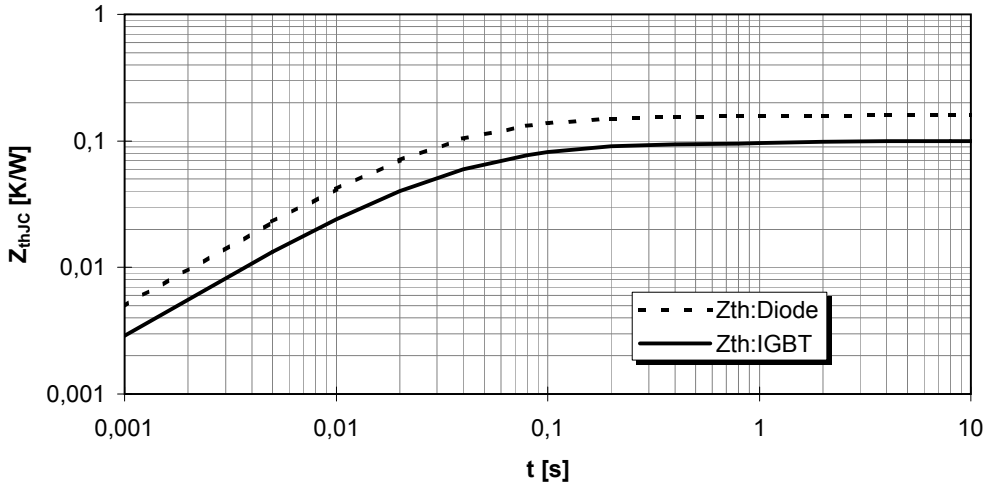
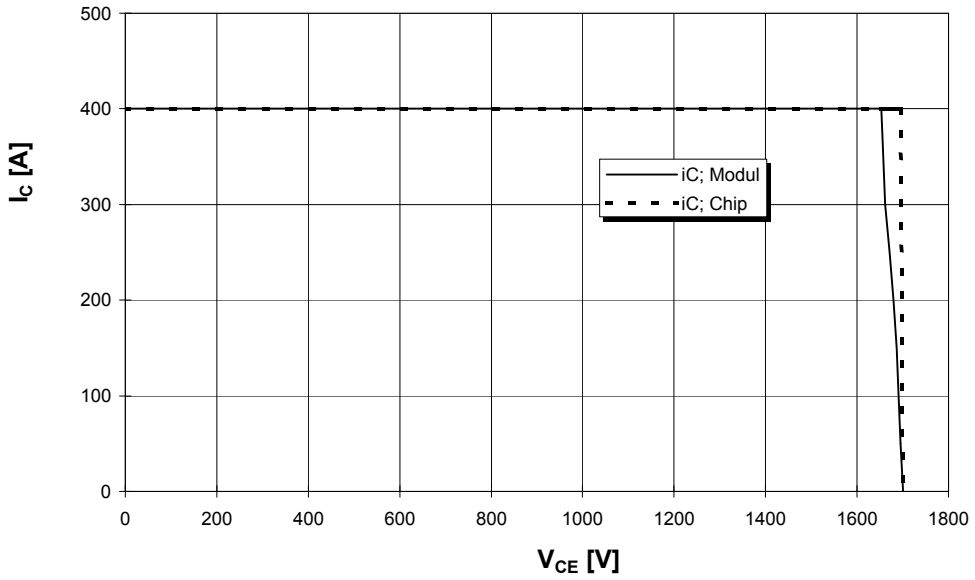
**Transienter Wärmewiderstand** $Z_{thJC} = f(t)$
**Transient thermal impedance**




| i | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $r_i$ [K/kW] | : IGBT | 25,45 | 37,61 | 29,04 | 7,899 |
| $\tau_i$ [s] | : IGBT | 0,01565 | 0,03977 | 0,07521 | 1,443 |
| $r_i$ [K/kW] | : Diode | 54,22 | 60,17 | 38,1 | 7,509 |
| $\tau_i$ [s] | : Diode | 0,02103 | 0,03011 | 0,08672 | 1,1583 |

**Sicherer Arbeitsbereich (RBSOA)**
**Reverse bias safe operation area (RBSOA)** $V_{GE} = \pm 15V$, $R_G = 6{,}8Ohm$, $T_{vj} = 125°C$



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