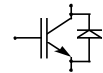


Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FZ 1000 R 25 KF1

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vorläufige Daten
preliminary data

Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

| | | | | |
|--|--|--------------|---------|-----------------------|
| Kollektor-Emitter-Sperrspannung collector-emitter voltage | | V_{CES} | 2500 | V |
| Kollektor-Dauergleichstrom DC-collector current | $T_C = 80^\circ\text{C}$ | $I_{C,nom.}$ | 1000 | A |
| | $T_C = 25^\circ\text{C}$ | I_C | 1700 | A |
| Periodischer Kollektor Spitzenstrom repetitive peak collector current | $t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$ | I_{CRM} | 2000 | A |
| Gesamt-Verlustleistung total power dissipation | $T_C=25^\circ\text{C}$, Transistor | P_{tot} | 10,4 | kW |
| Gate-Emitter-Spitzenspannung gate-emitter peak voltage | | V_{GES} | +/- 20V | V |
| Dauergleichstrom DC forward current | | I_F | 1000 | A |
| Periodischer Spitzenstrom repetitive peak forw. current | $t_p = 1\text{ ms}$ | I_{FRM} | 2000 | A |
| Grenzlastintegral der Diode I^2t - value, Diode | $V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$ | I^2t | 400 | kA^2s |
| Isolations-Prüfspannung insulation test voltage | RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$ | V_{ISOL} | 5 | kV |

Charakteristische Werte / Characteristic values

Transistor / Transistor

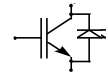
| | | | min. | typ. | max. | |
|--|---|---------------------|------|------|------|---------------|
| Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage | $I_C = 1000\text{A}, V_{GE} = 15\text{V}, T_{vj} = 25^\circ\text{C}$ | $V_{CE\text{ sat}}$ | - | 3,0 | 3,6 | V |
| | $I_C = 1000\text{A}, V_{GE} = 15\text{V}, T_{vj} = 125^\circ\text{C}$ | | - | 3,85 | - | V |
| Gate-Schwellenspannung gate threshold voltage | $I_C = 80\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^\circ\text{C}$ | $V_{GE(th)}$ | 4,3 | 5,3 | 6,3 | V |
| Gateladung gate charge | $V_{GE} = -15\text{V} \dots +15\text{V}$ | Q_G | - | 16 | - | μC |
| Eingangskapazität input capacitance | $f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$ | C_{ies} | - | 120 | - | nF |
| Rückwirkungskapazität 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} | - | - | - | nF |
| Kollektor-Emitter Reststrom collector-emitter cut-off current | $V_{CE} = 2500\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^\circ\text{C}$ | I_{CES} | - | 0,2 | - | mA |
| | $V_{CE} = 2500\text{V}, V_{GE} = 0\text{V}, T_{vj} = 125^\circ\text{C}$ | | - | 40 | - | mA |
| Gate-Emitter Reststrom gate-emitter leakage current | $V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^\circ\text{C}$ | I_{GES} | - | - | 600 | nA |

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approved by: Chr. Lübke; 14.06.00

revision: 2



vorläufige Daten
preliminary data

Charakteristische Werte / Characteristic values

Transistor / Transistor

| | | | min. | typ. | max. | |
|--|---|-------------|------|------|------|------------|
| Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load) | $I_C = 1000A, V_{CE} = 1200V$ | $t_{d,on}$ | - | 0,85 | - | μs |
| | $V_{GE} = \pm 15V, R_G = 1,4\Omega, T_{vj} = 25^\circ C,$ $V_{GE} = \pm 15V, R_G = 1,4\Omega, T_{vj} = 125^\circ C$ | | | 0,85 | | |
| Anstiegszeit (induktive Last) rise time (inductive load) | $I_C = 1000A, V_{CE} = 1200V$ | t_r | - | 0,2 | - | μs |
| | $V_{GE} = \pm 15V, R_G = 1,4\Omega, T_{vj} = 25^\circ C,$ $V_{GE} = \pm 15V, R_G = 1,4\Omega, T_{vj} = 125^\circ C$ | | | 0,2 | | |
| Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load) | $I_C = 1000A, V_{CE} = 1200V$ | $t_{d,off}$ | - | 2,2 | - | μs |
| | $V_{GE} = \pm 15V, R_G = 2,7\Omega, T_{vj} = 25^\circ C,$ $V_{GE} = \pm 15V, R_G = 2,7\Omega, T_{vj} = 125^\circ C$ | | | 2,2 | | |
| Fallzeit (induktive Last) fall time (inductive load) | $I_C = 1000A, V_{CE} = 1200V$ | t_f | - | 0,2 | - | μs |
| | $V_{GE} = \pm 15V, R_G = 2,7\Omega, T_{vj} = 25^\circ C,$ $V_{GE} = \pm 15V, R_G = 2,7\Omega, T_{vj} = 125^\circ C$ | | | 0,2 | | |
| Einschaltverlustenergie pro Puls turn-on energy loss per pulse | $I_C = 1000A, V_{CE} = 1200V, V_{GE} = \pm 15V$ $R_G = 1,4\Omega, T_{vj} = 125^\circ C, L_S = 60nH$ | E_{on} | - | 1300 | - | mWs |
| Abschaltverlustenergie pro Puls turn-off energy loss per pulse | $I_C = 1000A, V_{CE} = 1200V, V_{GE} = \pm 15V$ $R_G = 2,7\Omega, T_{vj} = 125^\circ C, L_S = 60nH$ | E_{off} | - | 1000 | - | mWs |
| Kurzschlußverhalten SC Data | $t_p \leq 10\mu sec, V_{GE} \leq 15V$ $T_{vj} \leq 125^\circ C, V_{CC} = 1200V, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ | I_{SC} | - | 4000 | - | A |
| Modulinduktivität stray inductance module | | L_{sCE} | - | 12 | - | nH |
| Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip | | R_{CC+EE} | - | 0,19 | - | m Ω |

Diode / Diode

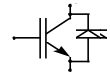
| | | | min. | typ. | max. | |
|---|---|-----------|------|------|------|----------|
| Durchlaßspannung forward voltage | $I_F = 1000A, V_{GE} = 0V, T_{vj} = 25^\circ C$ | V_F | - | 2,2 | 2,8 | V |
| | $I_F = 1000A, V_{GE} = 0V, T_{vj} = 125^\circ C$ | | | 2,25 | - | V |
| Rückstromspitze peak reverse recovery current | $I_F = 1000A, -di_F/dt = 6000A/\mu s$ | I_{RM} | - | 1050 | - | A |
| | $V_R = 1200V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 1200V, V_{GE} = -10V, T_{vj} = 125^\circ C$ | | | 1200 | - | A |
| Sperrverzögerungsladung recovered charge | $I_F = 1000A, -di_F/dt = 6000A/\mu s$ | Q_r | - | 540 | - | μAs |
| | $V_R = 1200V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 1200V, V_{GE} = -10V, T_{vj} = 125^\circ C$ | | | 1000 | - | μAs |
| Abschaltenergie pro Puls reverse recovery energy | $I_F = 1000A, -di_F/dt = 6000A/\mu s$ | E_{rec} | - | 400 | - | mWs |
| | $V_R = 1200V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 1200V, V_{GE} = -10V, T_{vj} = 125^\circ C$ | | | 800 | - | mWs |

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FZ 1000 R 25 KF1

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vorläufige Daten
preliminary data

Thermische Eigenschaften / Thermal properties

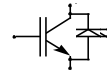
| | | | min. | typ. | max. | |
|--|--|------------|------|-------|-------|-----|
| Innerer Wärmewiderstand thermal resistance, junction to case | Transistor / transistor, DC | R_{thJC} | - | - | 0,012 | K/W |
| | Diode/Diode, DC | | - | - | 0,024 | K/W |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | pro Modul / per Module $d_{paste} \leq 100\mu m / d_{grease} \leq 100\mu m$ | R_{thCK} | - | 0,006 | - | K/W |
| Höchstzulässige Sperrschichttemperatur maximum junction temperature | | T_{vj} | - | - | 150 | °C |
| Betriebstemperatur operation temperature | | T_{op} | -40 | - | 125 | °C |
| Lagertemperatur storage temperature | | T_{stg} | -40 | - | 125 | °C |

Mechanische Eigenschaften / Mechanical properties

| | | | | | |
|--|--------------|----|--|--------|----|
| Gehäuse, siehe Anlage case, see appendix | | | | | |
| Innere Isolation internal insulation | | | | AlN | |
| Kriechstrecke creepage distance | | | | 32 | mm |
| Luftstrecke clearance | | | | 19,1 | mm |
| CTI comperative tracking index | | | | >400 | |
| Anzugsdrehmoment f. mech. Befestigung mounting torque | | M1 | | 5 | Nm |
| Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque | terminals M4 | M2 | | 2 | Nm |
| | terminals M8 | | | 8 - 10 | Nm |
| Gewicht weight | | G | | 1000 | g |

Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

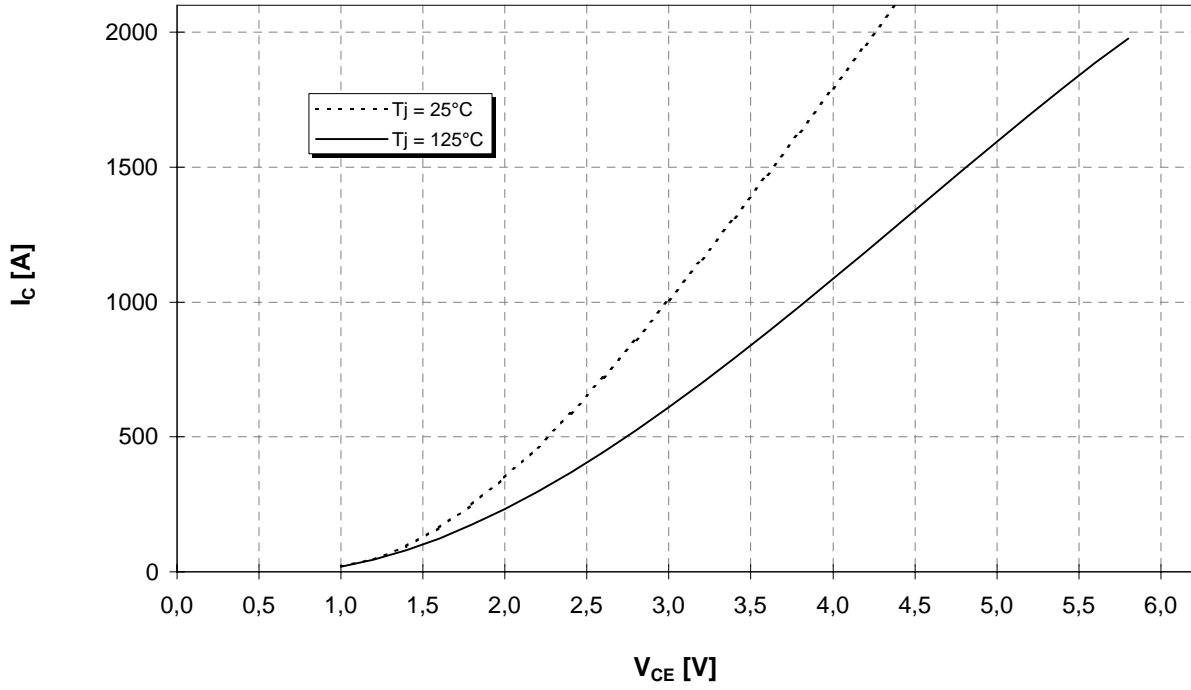
This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.



vorläufige Daten
preliminary data

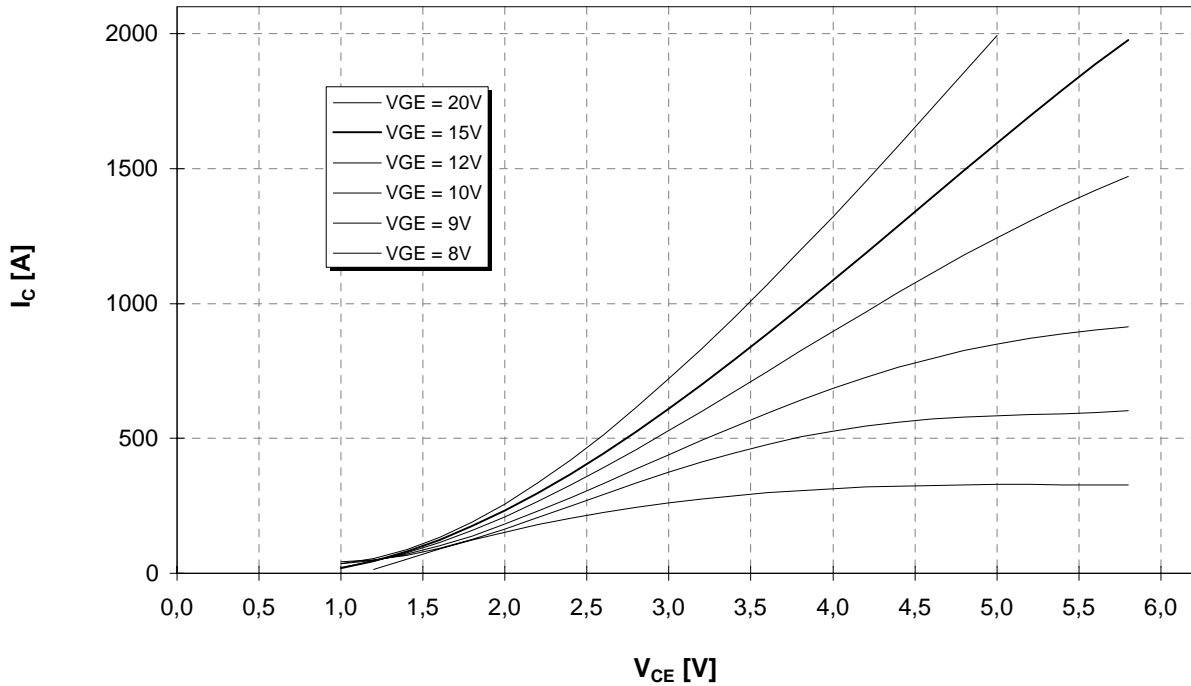
Ausgangskennlinie (typisch)
Output characteristic (typical)

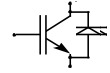
$I_C = f(V_{CE})$
 $V_{GE} = 15V$



Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 125°C$

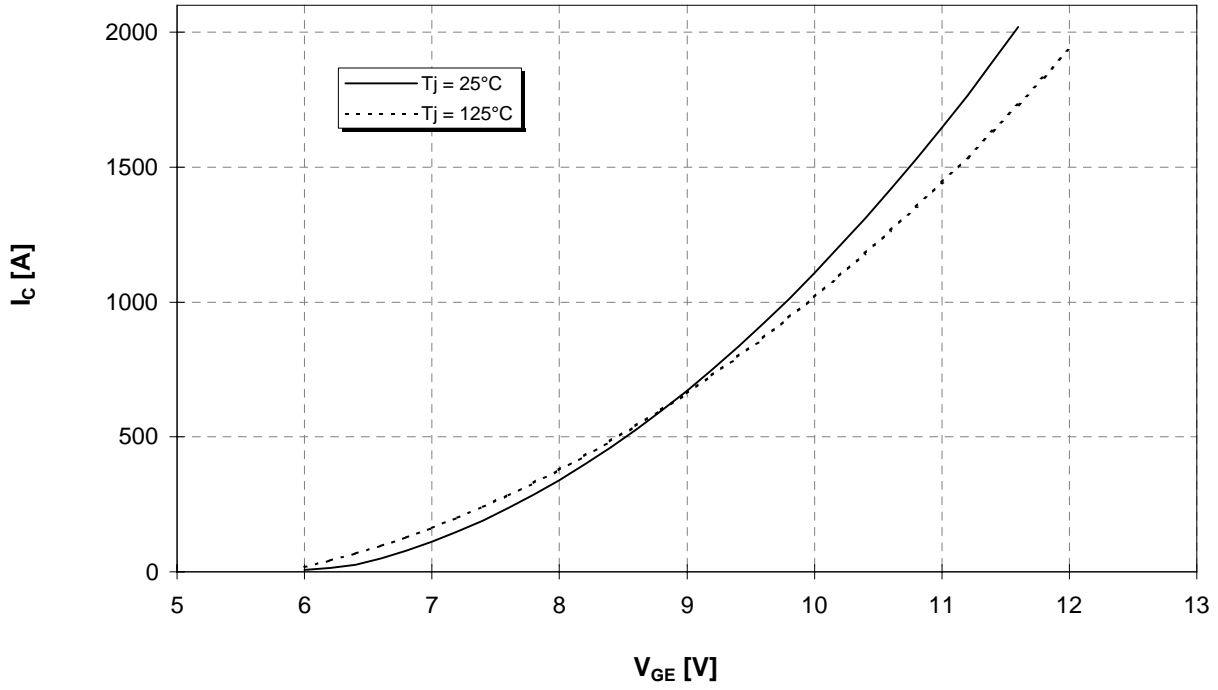




vorläufige Daten
preliminary data

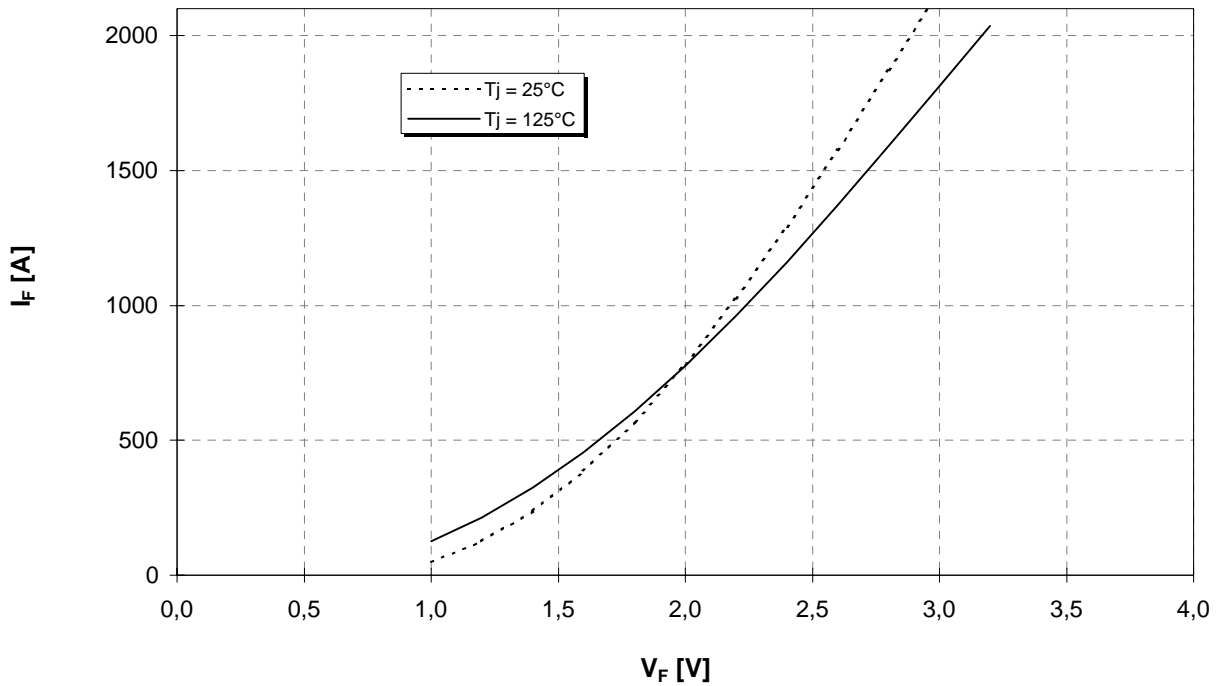
Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

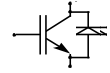
$I_C = f(V_{GE})$
 $V_{CE} = 10V$



Durchlaßkennlinie der Inversdiode (typisch)
Forward characteristic of inverse diode (typical)

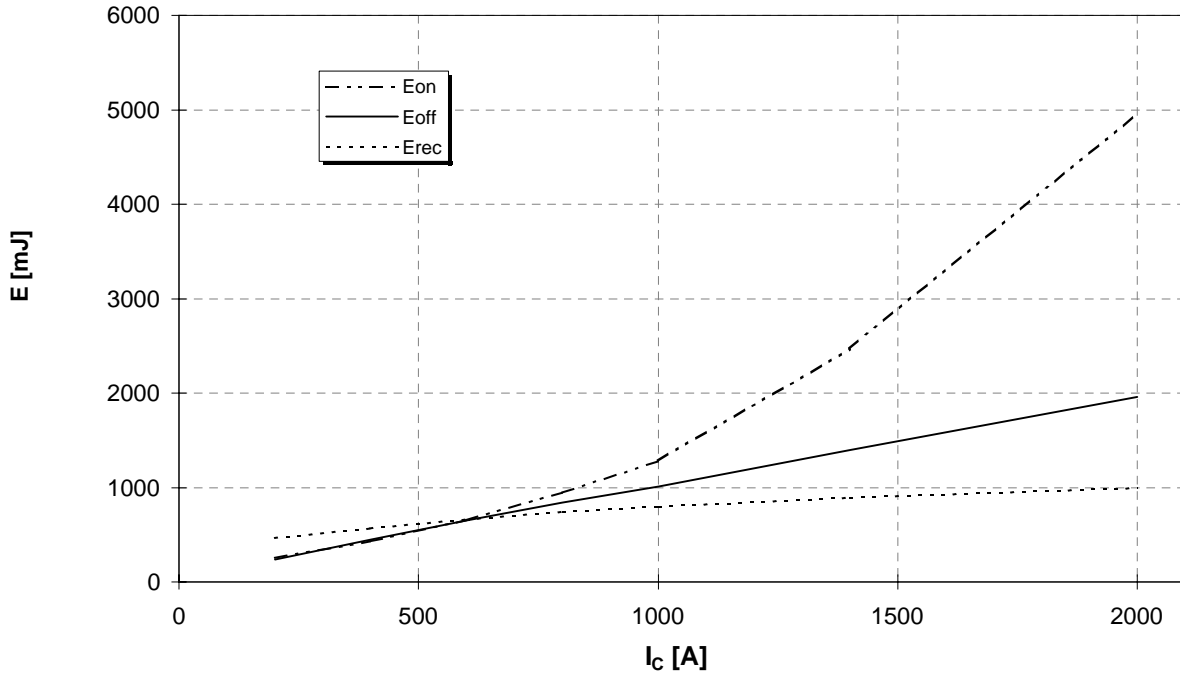
$I_F = f(V_F)$



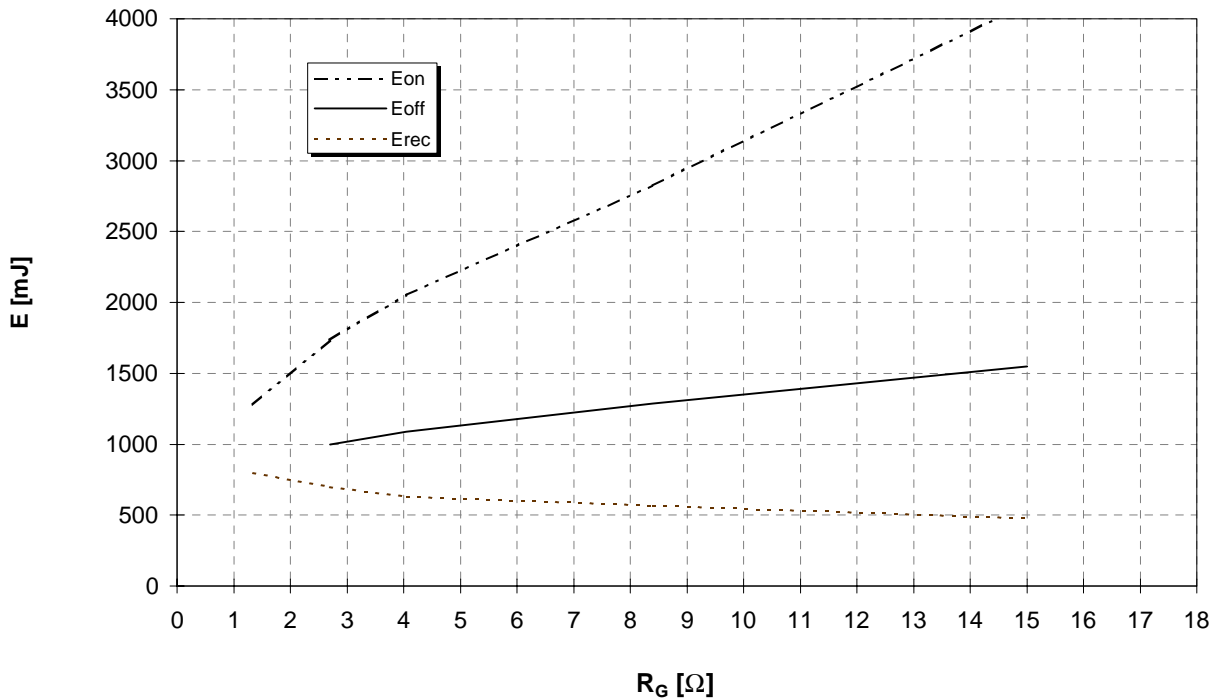


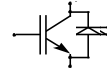
vorläufige Daten
preliminary data

Schaltverluste (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$
 Switching losses (typical) $R_{gon}=1,4\Omega$, $R_{goff}=2,7\Omega$, $V_{GE}=\pm 15V$, $V_{CE} = 1200V$, $T_j = 125^\circ C$, $L_S = 60nH$



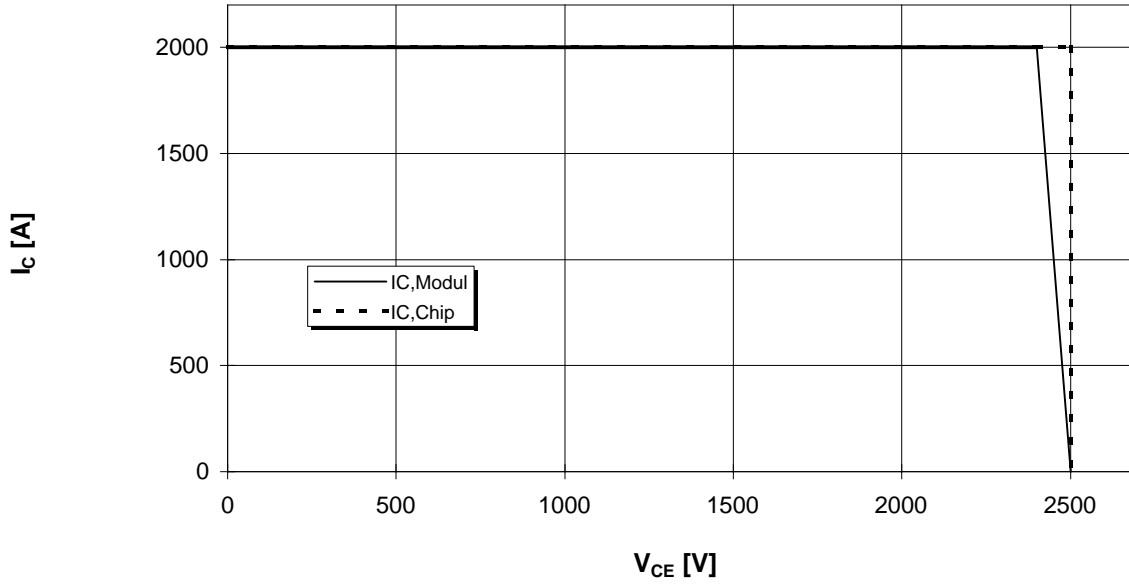
Schaltverluste (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
 Switching losses (typical) $I_C = 1000A$, $V_{CE} = 1200V$, $V_{GE}=\pm 15V$, $T_j = 125^\circ C$, $L_S = 60nH$



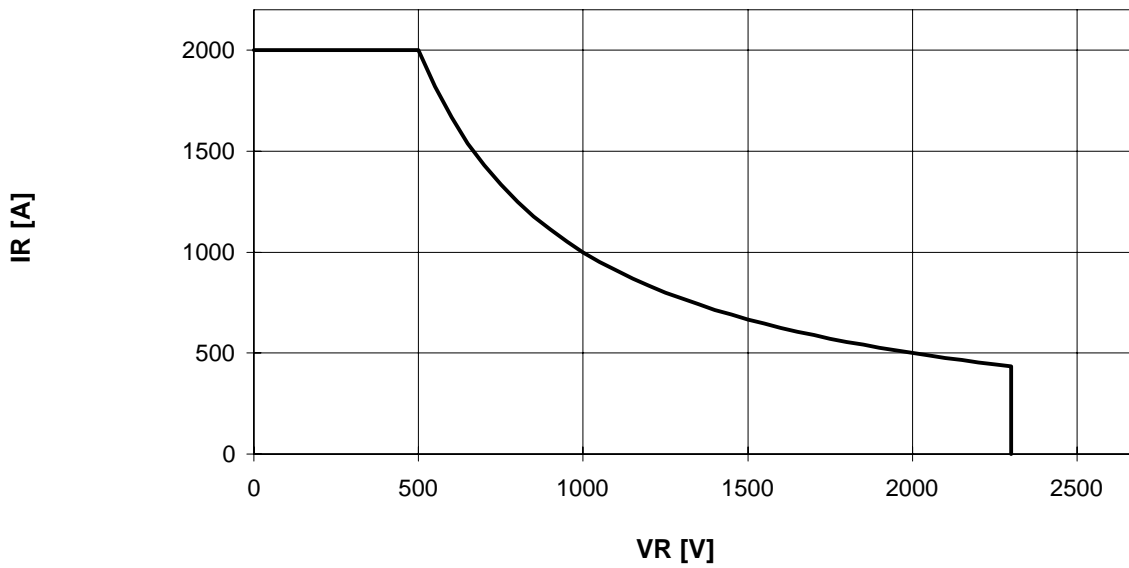


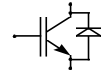
vorläufige Daten
preliminary data

Sicherer Arbeitsbereich (RBSOA)
Reverse bias safe operation area (RBSOA) $R_g = 2,7 \text{ Ohm}, T_{vj} = 125^\circ\text{C}$



Sicherer Arbeitsbereich Diode (SOA)
safe operation area Diode (SOA) $T_{vj} = 125^\circ\text{C}$

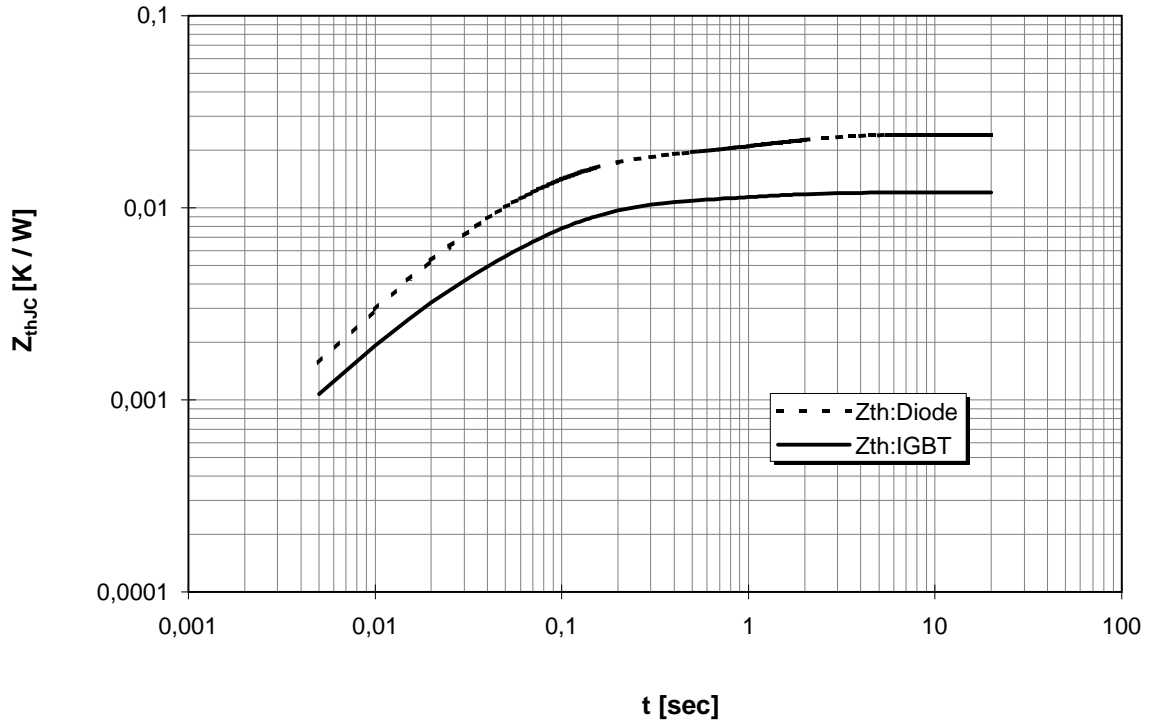




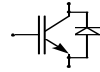
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preliminary data

Transienter Wärmewiderstand
Transient thermal impedance

$$Z_{thJC} = f(t)$$

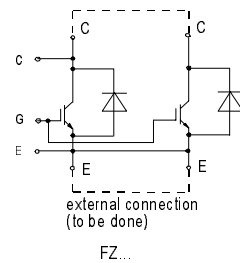
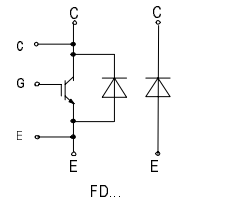
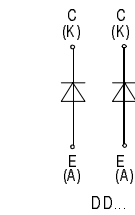
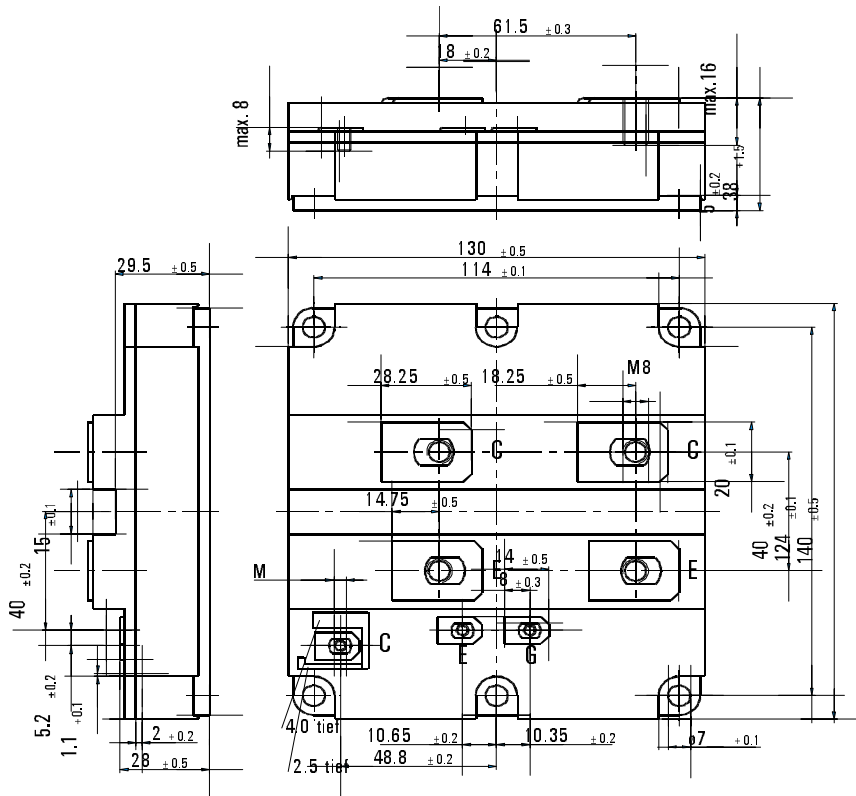


| i | 1 | 2 | 3 | 4 |
|------------------------|-------|-------|-------|------|
| r_i [K/kW] : IGBT | 1,35 | 3,3 | 5,55 | 1,8 |
| τ_i [sec] : IGBT | 0,011 | 0,052 | 0,103 | 0,95 |
| r_i [K/kW] : Diode | 3,15 | 7,5 | 6,75 | 6,6 |
| τ_i [sec] : Diode | 0,025 | 0,056 | 0,1 | 1,31 |



vorläufige Daten
preliminary data

Äußere Abmessungen und Schaltbild /
external dimensions and circuit diagram



IH4