

IGBT-Wechselrichter / IGBT-inverter

Vorläufige Daten / preliminary data

Höchstzulässige Werte / maximum rated values

| | | | | |
|--|--|-----------------------|--------------|--------|
| Kollektor-Emitter-Sperrspannung collector-emitter voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{CES} | 1700 | V |
| Kollektor-Dauergleichstrom DC-collector current | $T_C = 80^{\circ}\text{C}, T_{vj} = 150^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj} = 150^{\circ}\text{C}$ | $I_{C\ nom}$ I_C | 1200 1600 | A A |
| Periodischer Kollektor Spitzenstrom repetitive peak collector current | $t_p = 1\ \text{ms}$ | I_{CRM} | 2400 | A |
| Gesamt-Verlustleistung total power dissipation | $T_C = 25^{\circ}\text{C}, T_{vj} = 150^{\circ}\text{C}$ | P_{tot} | 5,95 | kW |
| Gate-Emitter-Spitzenspannung gate-emitter peak voltage | | V_{GES} | +/-20 | V |

Charakteristische Werte / characteristic values

| | | | min. | typ. | max. | |
|--|--|---|---------------|--------------|------|--------------------------------|
| Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage | $I_C = 1200\ \text{A}, V_{GE} = 15\ \text{V}$ $I_C = 1200\ \text{A}, V_{GE} = 15\ \text{V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | $V_{CE\ sat}$ | 2,00 2,40 | 2,45 | V V |
| Gate-Schwellenspannung gate threshold voltage | $I_C = 48,0\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$ | | V_{GEth} | 5,2 | 5,8 | 6,4 V |
| Gateladung gate charge | $V_{GE} = -15\ \text{V} \dots +15\ \text{V}$ | | Q_G | 14,0 | | μC |
| Interner Gatewiderstand internal gate resistor | $T_{vj} = 25^{\circ}\text{C}$ | | R_{Gint} | 1,6 | | Ω |
| 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} | 110 | | 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} | 3,50 | | nF |
| Kollektor-Emitter Reststrom collector-emitter cut-off current | $V_{CE} = 1700\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$ | | I_{CES} | | 5,0 | 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} | | 400 | nA |
| Einschaltverzögerungszeit (ind. Last) turn-on delay time (inductive load) | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Gon} = 1,2\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | $t_{d\ on}$ | 0,74 0,80 | | μs μs |
| Anstiegszeit (induktive Last) rise time (inductive load) | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Gon} = 1,2\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | t_r | 0,20 0,25 | | μs μs |
| Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load) | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | $t_{d\ off}$ | 1,45 1,80 | | μs μs |
| Fallzeit (induktive Last) fall time (inductive load) | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | t_f | 0,18 0,30 | | μs μs |
| Einschaltverlustenergie pro Puls turn-on energy loss per pulse | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, L_s = 50\ \text{nH}$ $R_{Gon} = 1,2\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | E_{on} | 240 350 | | mJ mJ |
| Abschaltverlustenergie pro Puls turn-off energy loss per pulse | $I_C = 1200\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, L_s = 50\ \text{nH}$ $R_{Goff} = 1,5\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | E_{off} | 305 445 | | mJ mJ |
| Kurzschlußverhalten SC data | $t_p \leq 10\ \mu\text{s}, V_{GE} \leq 15\ \text{V}$ $T_{vj} = 125^{\circ}\text{C}, V_{CC} = 1000\ \text{V}, V_{CEmax} = V_{CES} - L_s \cdot di/dt$ | | I_{SC} | 4800 | | A |
| Innerer Wärmewiderstand thermal resistance, junction to case | pro IGBT per IGBT | | R_{thJC} | | 21,0 | K/kW |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | pro IGBT / per IGBT $\lambda_{Paste} = 1\ \text{W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\ \text{W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | 17,0 | | K/kW |

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| prepared by: Martin Wölz | date of publication: 2004-5-24 |
| approved by: Christoph Lübke | revision: 2.0 |

**Vorläufige Daten
preliminary data**

Diode-Wechselrichter / diode-inverter

Höchstzulässige Werte / maximum rated values

| | | | | |
|---|--|-----------|------|-----------------------|
| Periodische Spitzensperrspannung repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{RRM} | 1700 | V |
| Dauergleichstrom DC forward current | | I_F | 1200 | A |
| Periodischer Spitzenstrom repetitive peak forward current | $t_p = 1\text{ ms}$ | I_{FRM} | 2400 | A |
| Grenzlastintegral I^2t - value | $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | I^2t | 240 | kA^2s |

Charakteristische Werte / characteristic values

| | | | min. | typ. | max. | |
|---|---|---|------------|--------------|------|--------------------------------|
| Durchlassspannung forward voltage | $I_F = 1200\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1200\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | V_F | 1,80 1,90 | 2,20 | V V |
| Rückstromspitze peak reverse recovery current | $I_F = 1200\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s}$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | I_{RM} | 1150 1250 | | A A |
| Sperrverzögerungsladung recovered charge | $I_F = 1200\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s}$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | Q_r | 305 510 | | μC μC |
| Abschaltenergie pro Puls reverse recovery energy | $I_F = 1200\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s}$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ | E_{rec} | 190 340 | | mJ mJ |
| Innerer Wärmewiderstand thermal resistance, junction to case | pro Diode per diode | | R_{thJC} | | 48,0 | K/kW |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | pro Diode / per diode $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$ | | R_{thCH} | 39,0 | | K/kW |

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Modul / module

| | | | | | |
|--|--|--|--------------------------------|--------------|--------------|
| Isolations-Prüfspannung insulation test voltage | RMS, f = 50 Hz, t = 1 min. | V _{ISO} | 3,4 | | kV |
| Material Modulgrundplatte material of module baseplate | | | Cu | | |
| Material für innere Isolation material for internal insulation | | | Al ₂ O ₃ | | |
| Kriechstrecke creepage distance | Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal | | 32,2 32,2 | | mm |
| Luftstrecke clearance distance | Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal | | 19,1 19,1 | | mm |
| Vergleichszahl der Kriechwegbildung comparative tracking index | | CTI | > 400 | | |
| | | | min. | typ. | max. |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | pro Modul / per module $\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ | R _{thCH} | | 6,00 | K/kW |
| Modulinduktivität stray inductance module | | L _{sCE} | | 25 | nH |
| Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip | T _C = 25°C, pro Schalter / per switch | R _{CC'+EE'} R _{AA'+CC'} | | 0,37 0,37 | mΩ |
| Höchstzulässige Sperrschichttemperatur maximum junction temperature | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper | T _{vj max} | | | 150 °C |
| Temperatur im Schaltbetrieb temperature under switching conditions | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper | T _{vj op} | -40 | | 125 °C |
| Lagertemperatur storage temperature | | T _{stg} | -40 | | 125 °C |
| Anzugsdrehmoment f. mech. Befestigung mounting torque | Schraube / screw M6 | M | 4,25 | - | 5,75 Nm |
| Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque | Schraube / screw M4 Schraube / screw M8 | M | 1,8 8,0 | - - | 2,1 10 Nm |
| Gewicht weight | | G | | 1500 | g |

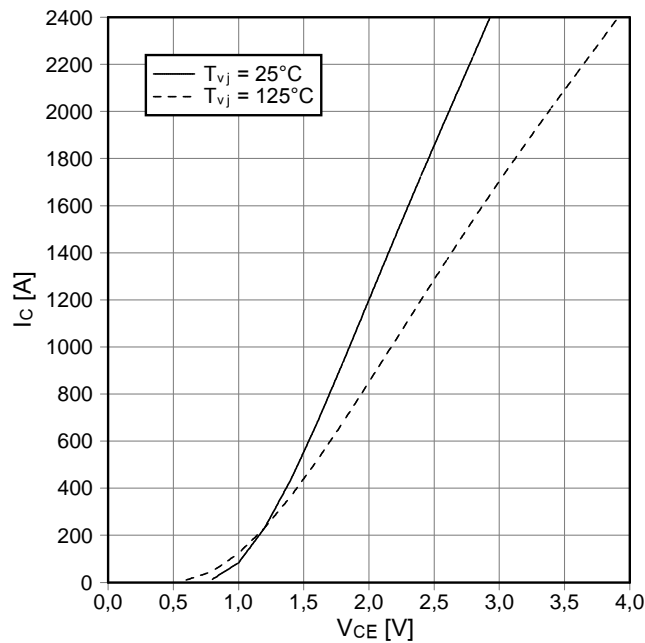
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This technical information specifies semiconductor devices but guarantees no characteristics. It is valid with the appropriate technical explanations.

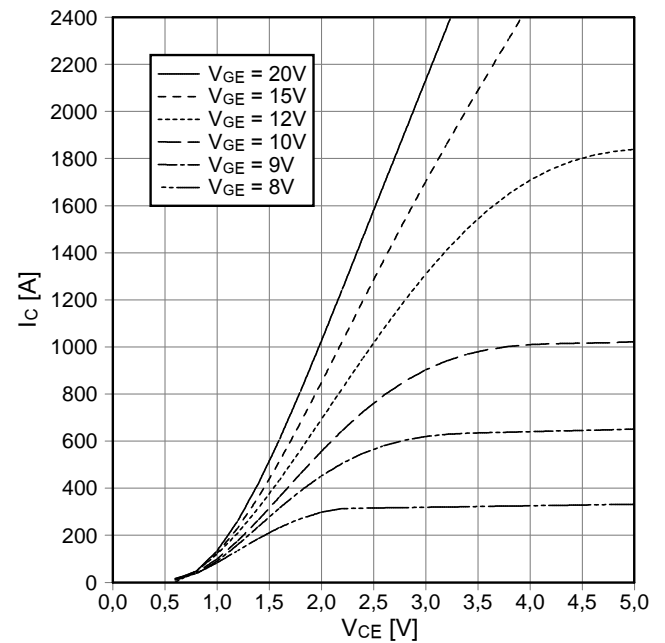
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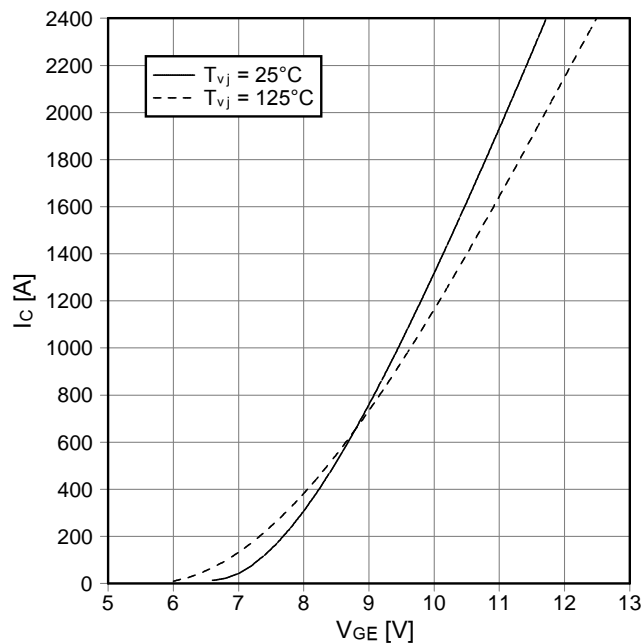
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



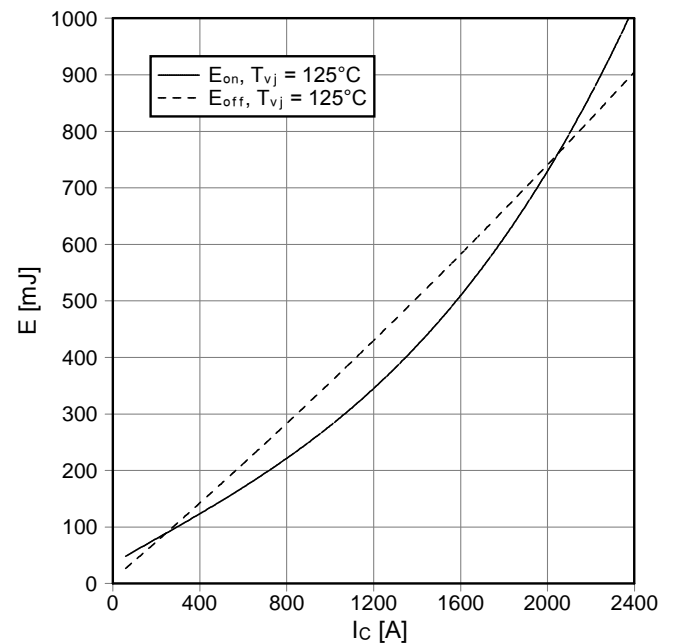
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



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



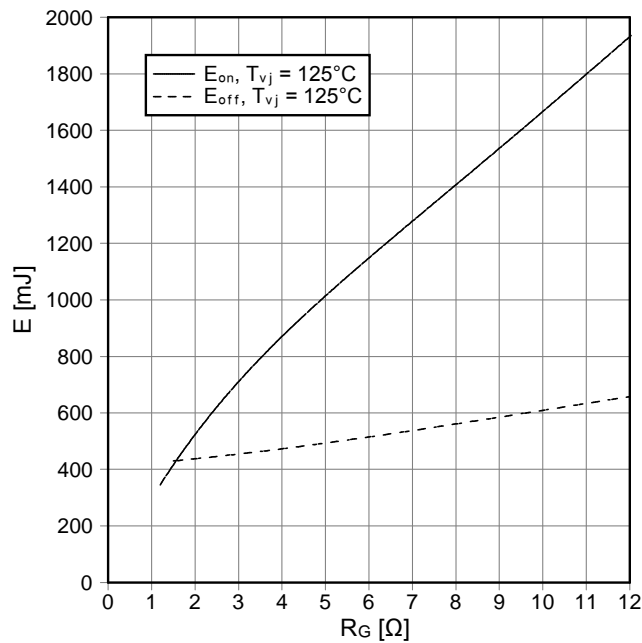
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_c)$, $E_{off} = f(I_c)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 1,2\ \Omega$, $R_{Goff} = 1,5\ \Omega$, $V_{CE} = 900\text{ V}$



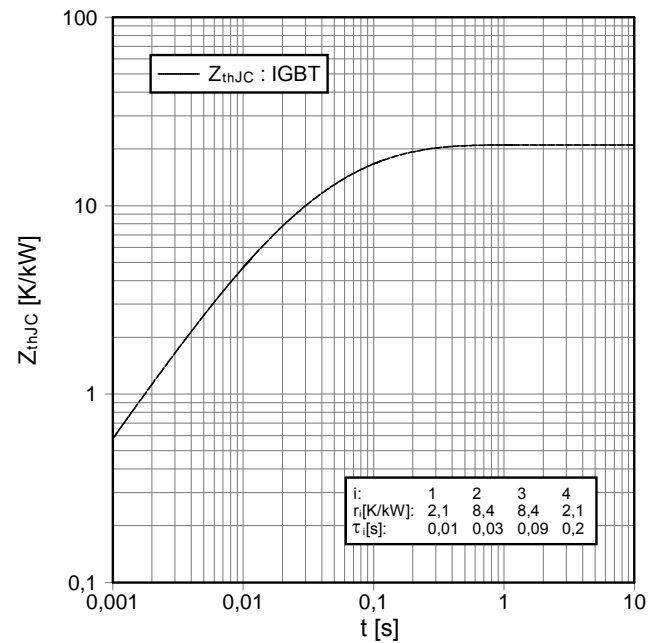
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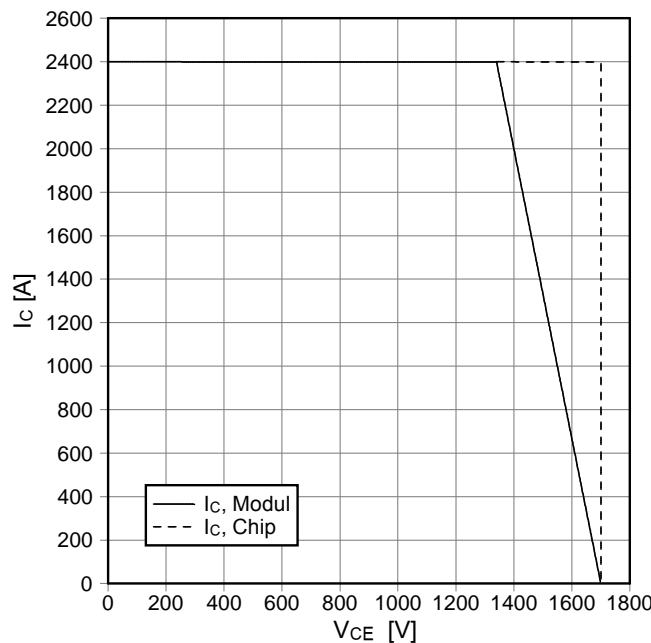
Schaltverluste IGBT-Wechsel. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 1200\text{ A}$, $V_{CE} = 900\text{ V}$



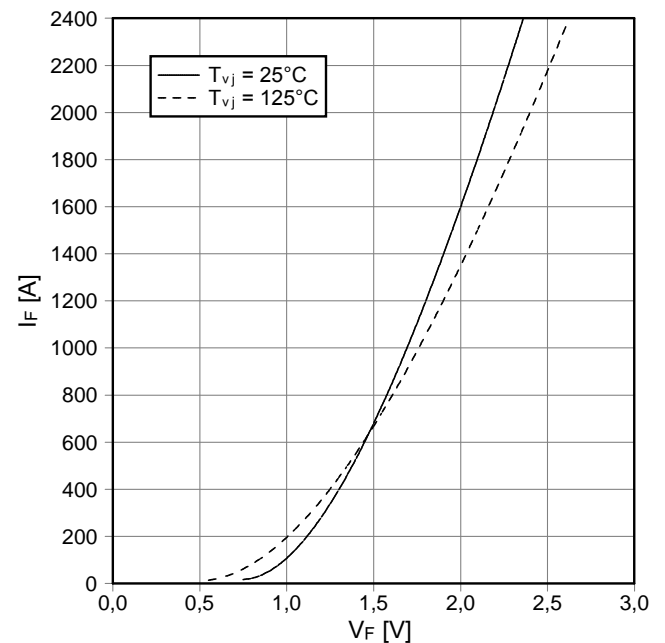
Transienter Wärmewiderstand IGBT-Wechsel.
transient thermal impedance IGBT-inverter
 $Z_{thJC} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 1,5\ \Omega$, $T_{vj} = 125^\circ\text{C}$



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

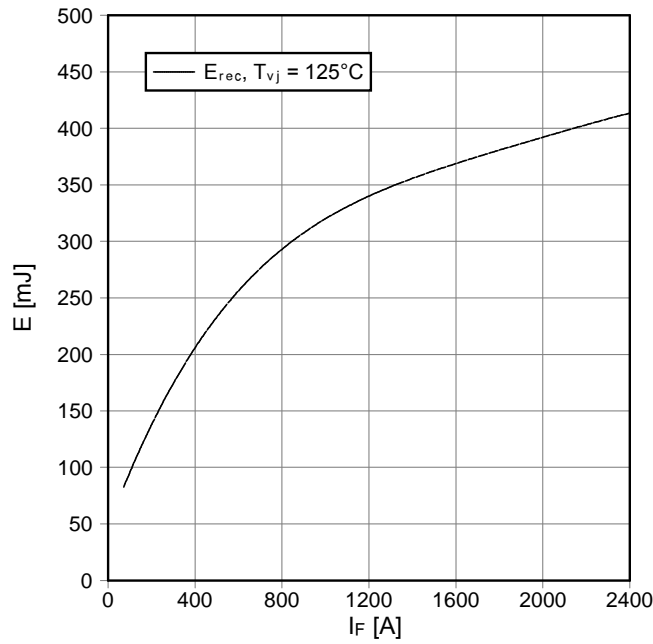


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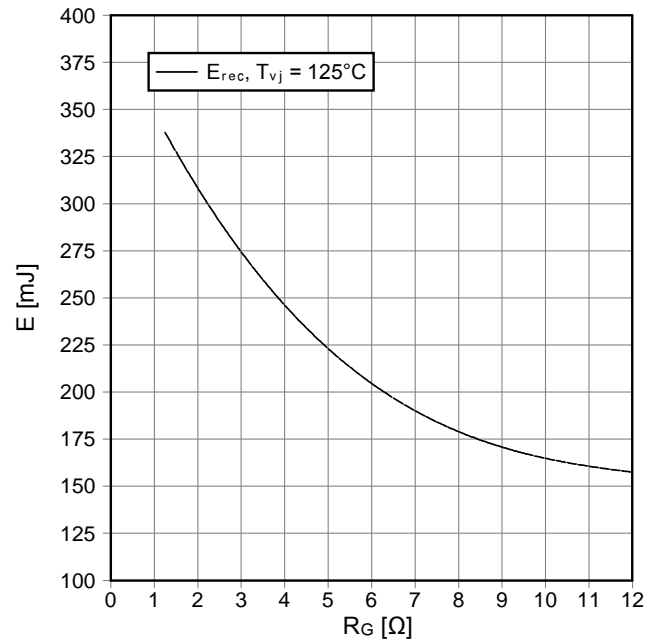
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 1,2 \Omega, V_{CE} = 900 V$



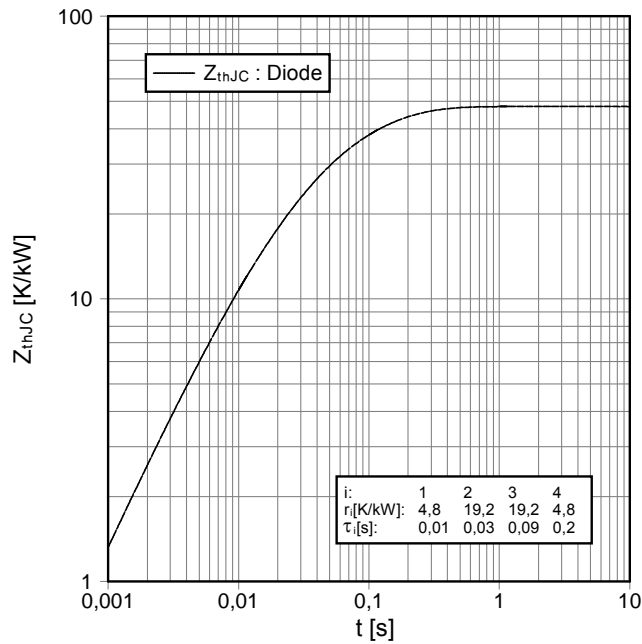
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 1200 A, V_{CE} = 900 V$



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

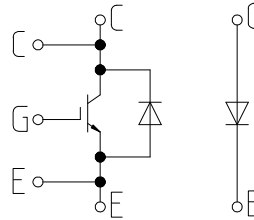
$Z_{thJC} = f(t)$



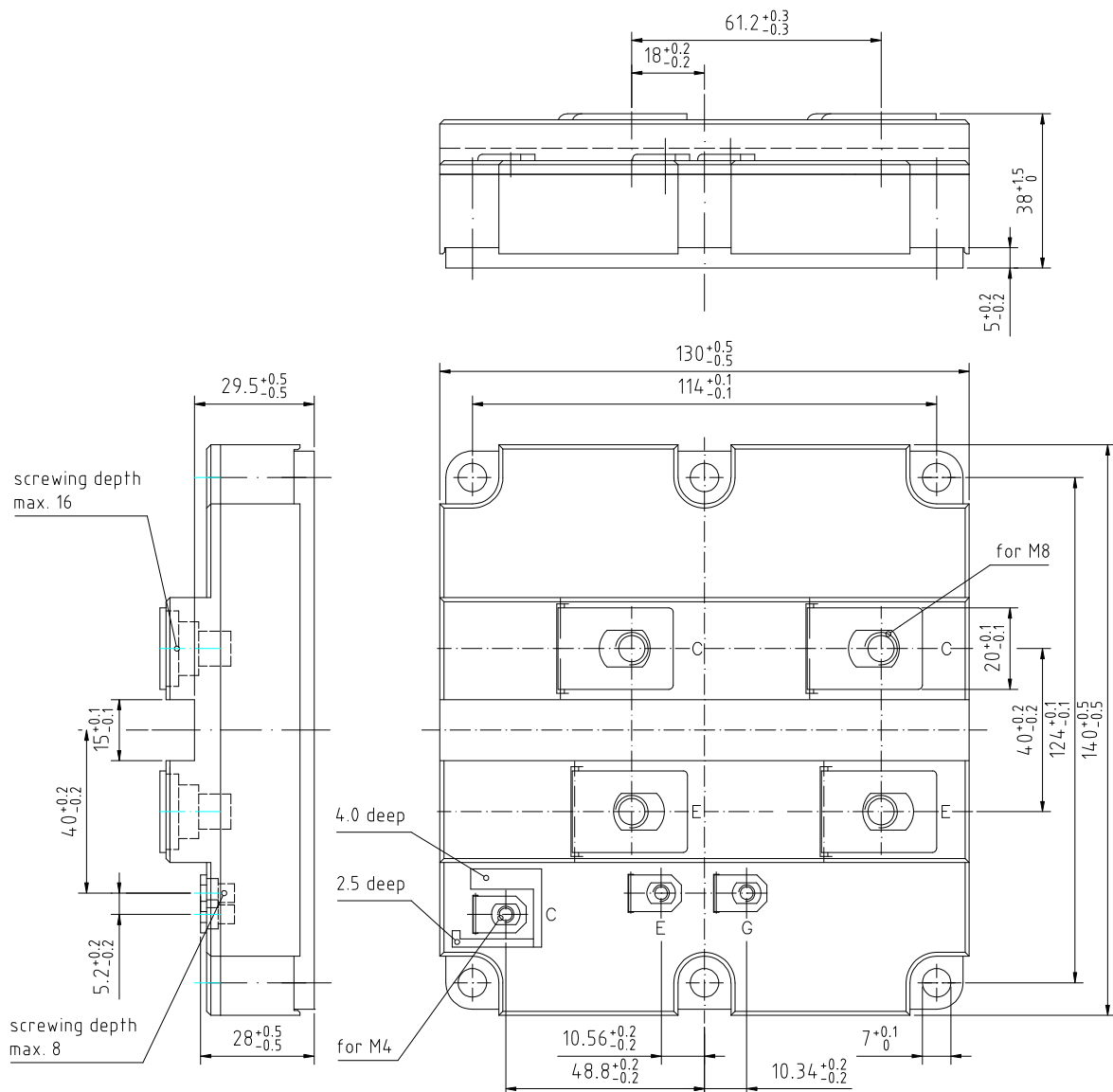
| i: | 1 | 2 | 3 | 4 |
|---------------|------|------|------|-----|
| r_i [K/kW]: | 4,8 | 19,2 | 19,2 | 4,8 |
| τ_i [s]: | 0,01 | 0,03 | 0,09 | 0,2 |

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Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



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