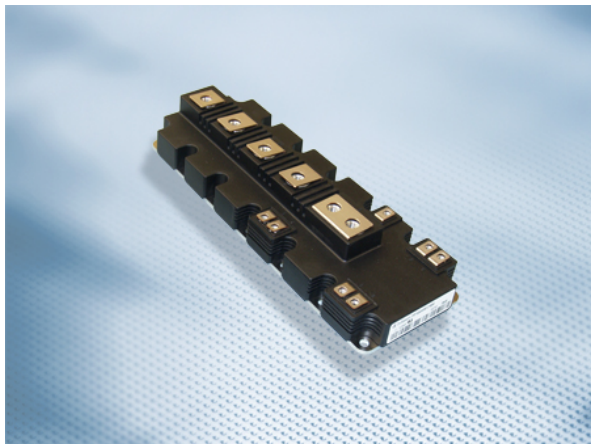


PrimePACK™3 Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled Diode
PrimePACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode



$V_{CES} = 1200V$
 $I_{C\ nom} = 1400A / I_{CRM} = 2800A$

Typische Anwendungen

- Hochleistungsumrichter
- Motorantriebe
- Windgeneratoren

Elektrische Eigenschaften

- Hohe Kurzschlussrobustheit
- Hohe Stoßstromfestigkeit
- Hohe Stromdichte
- $T_{vj\ op} = 150^{\circ}C$
- V_{CESat} mit positivem Temperaturkoeffizienten

Mechanische Eigenschaften

- 4 kV AC 1min Isolationsfestigkeit
- Gehäuse mit CTI > 400
- Große Luft- und Kriechstrecken
- Integrierter NTC Temperatur Sensor
- RoHS konform
- Thermisches Interface Material bereits aufgetragen

Typical Applications

- High power converters
- Motor drives
- Wind turbines

Electrical Features

- High short-circuit capability
- High surge current capability
- High current density
- $T_{vj\ op} = 150^{\circ}C$
- V_{CESat} with positive temperature coefficient

Mechanical Features

- 4 kV AC 1min insulation
- Package with CTI > 400
- High creepage and clearance distances
- Integrated NTC temperature sensor
- RoHS compliant
- Pre-applied Thermal Interface Material

Module Label Code

Barcode Code 128



DMX - Code



Content of the Code

| | Digit |
|----------------------------|---------|
| Module Serial Number | 1 - 5 |
| Module Material Number | 6 - 11 |
| Production Order Number | 12 - 19 |
| Datecode (Production Year) | 20 - 21 |
| Datecode (Production Week) | 22 - 23 |

| | | |
|-----------------|---------------------------------|----------------------|
| prepared by: SM | date of publication: 2016-09-06 | |
| approved by: RN | revision: V3.2 | UL approved (E83335) |



IGBT, Wechselrichter / IGBT, Inverter
Höchstzulässige Werte / Maximum Rated Values

| | | | | |
|--|---|--------------------|-------|---|
| Kollektor-Emitter-Sperrspannung Collector-emitter voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{CES} | 1200 | V |
| Kollektor-Dauergleichstrom Continuous DC collector current | $T_H = 60^{\circ}\text{C}, T_{vj\text{ max}} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 1400 | A |
| Periodischer Kollektor-Spitzenstrom Repetitive peak collector current | $t_P = 1\text{ ms}$ | I_{CRM} | 2800 | A |
| 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 | $I_C = 1400\text{ A}, V_{GE} = 15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 1,75 | 2,05 | V | |
| | $I_C = 1400\text{ A}, V_{GE} = 15\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | | 2,05 | 2,40 | V | |
| | $I_C = 1400\text{ A}, V_{GE} = 15\text{ V}$ | $T_{vj} = 150^{\circ}\text{C}$ | | 2,15 | 2,50 | V | |
| | | | $V_{CE\text{ sat}}$ | | | | |
| Gate-Schwellenspannung Gate threshold voltage | $I_C = 49,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$ | | V_{GEth} | 5,00 | 5,80 | 6,50 | V |
| Gateladung Gate charge | $V_{GE} = -15\text{ V} \dots +15\text{ V}$ | | | Q_G | 9,60 | | μC |
| Interner Gatewiderstand Internal gate resistor | $T_{vj} = 25^{\circ}\text{C}$ | | | R_{Gint} | 0,8 | | 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} | 82,0 | | 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} | 4,60 | | nF |
| Kollektor-Emitter-Reststrom 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 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, induktive Last Turn-on delay time, inductive load | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 0,20 | | μs | |
| | $V_{GE} = \pm 15\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | | 0,21 | | μs | |
| | $R_{Gon} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 0,21 | | μs | |
| | | | t_{don} | | | | |
| Anstiegszeit, induktive Last Rise time, inductive load | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 0,12 | | μs | |
| | $V_{GE} = \pm 15\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | | 0,13 | | μs | |
| | $R_{Gon} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 0,13 | | μs | |
| | | | t_r | | | | |
| Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 0,87 | | μs | |
| | $V_{GE} = \pm 15\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | | 0,95 | | μs | |
| | $R_{Goff} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 0,97 | | μs | |
| | | | t_{doff} | | | | |
| Fallzeit, induktive Last Fall time, inductive load | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 0,20 | | μs | |
| | $V_{GE} = \pm 15\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | | 0,23 | | μs | |
| | $R_{Goff} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 0,23 | | μs | |
| | | | t_f | | | | |
| Einschaltverlustenergie pro Puls Turn-on energy loss per pulse | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 65,0 | | mJ | |
| | $V_{GE} = \pm 15\text{ V}, di/dt = 8600\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ | $T_{vj} = 125^{\circ}\text{C}$ | | 80,0 | | mJ | |
| | $R_{Gon} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 95,0 | | mJ | |
| | | | E_{on} | | | | |
| Abschaltverlustenergie pro Puls Turn-off energy loss per pulse | $I_C = 1400\text{ A}, V_{CE} = 600\text{ V}, L_S = 30\text{ nH}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 215 | | mJ | |
| | $V_{GE} = \pm 15\text{ V}, du/dt = 2500\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ | $T_{vj} = 125^{\circ}\text{C}$ | | 280 | | mJ | |
| | $R_{Goff} = 1,0\ \Omega$ | $T_{vj} = 150^{\circ}\text{C}$ | | 305 | | mJ | |
| | | | E_{off} | | | | |
| Kurzschlußverhalten SC data | $V_{GE} \leq 15\text{ V}, V_{CE} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ | $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | | I_{SC} | 5600 | | A |
| Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink | pro IGBT / per IGBT valid with IFX pre-applied thermal interface material | | | R_{thJH} | | 30,5 | K/kW |
| Temperatur im Schaltbetrieb Temperature under switching conditions | | | | $T_{vj\text{ op}}$ | -40 | 150 | $^{\circ}\text{C}$ |

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Diode, Wechselrichter / Diode, Inverter

Höchstzulässige Werte / Maximum Rated Values

| | | | | |
|---|--|-----------|------------|--|
| Periodische Spitzensperrspannung Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$ | V_{RRM} | 1200 | V |
| Dauergleichstrom Continuous DC forward current | | I_F | 1400 | A |
| Periodischer Spitzenstrom Repetitive peak forward current | $t_P = 1\text{ ms}$ | I_{FRM} | 2800 | A |
| Grenzlastintegral I^2t - value | $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | I^2t | 165 160 | kA^2s kA^2s |
| Spitzenverlustleistung Maximum power dissipation | $T_{vj} = 125^{\circ}\text{C}$ | P_{RQM} | 1400 | kW |

Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|--|--|--------------------------------|-----------|------|------|--------------------|
| Durchlassspannung Forward voltage | $I_F = 1400\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$ | | 1,90 | 2,30 | V |
| | $I_F = 1400\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | V_F | 1,85 | 2,25 | V |
| | $I_F = 1400\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 150^{\circ}\text{C}$ | | 1,80 | 2,20 | V |
| Rückstromspitze Peak reverse recovery current | $I_F = 1400\text{ A}, -di_F/dt = 8600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ | $T_{vj} = 25^{\circ}\text{C}$ | | 780 | | A |
| | $V_R = 600\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | I_{RM} | 1000 | | A |
| | $V_{GE} = -15\text{ V}$ | $T_{vj} = 150^{\circ}\text{C}$ | | 1050 | | A |
| Sperrverzögerungsladung Recovered charge | $I_F = 1400\text{ A}, -di_F/dt = 8600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ | $T_{vj} = 25^{\circ}\text{C}$ | | 135 | | μC |
| | $V_R = 600\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | Q_r | 235 | | μC |
| | $V_{GE} = -15\text{ V}$ | $T_{vj} = 150^{\circ}\text{C}$ | | 270 | | μC |
| Abschaltenergie pro Puls Reverse recovery energy | $I_F = 1400\text{ A}, -di_F/dt = 8600\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ | $T_{vj} = 25^{\circ}\text{C}$ | | 70,0 | | mJ |
| | $V_R = 600\text{ V}$ | $T_{vj} = 125^{\circ}\text{C}$ | E_{rec} | 110 | | mJ |
| | $V_{GE} = -15\text{ V}$ | $T_{vj} = 150^{\circ}\text{C}$ | | 130 | | mJ |
| Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink | pro Diode / per diode valid with IFX pre-applied thermal interface material | R_{thJH} | | | 54,1 | K/kW |
| Temperatur im Schaltbetrieb Temperature under switching conditions | | $T_{vj\text{ op}}$ | -40 | | 150 | $^{\circ}\text{C}$ |

NTC-Widerstand / NTC-Thermistor

Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|--|---|--------------|------|------|------|------------------|
| Nennwiderstand Rated resistance | $T_{NTC} = 25^{\circ}\text{C}$ | R_{25} | | 5,00 | | $\text{k}\Omega$ |
| Abweichung von R100 Deviation of R100 | $T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$ | $\Delta R/R$ | -5 | | 5 | % |
| Verlustleistung Power dissipation | $T_{NTC} = 25^{\circ}\text{C}$ | P_{25} | | | 20,0 | mW |
| B-Wert 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 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 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.

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Modul / Module

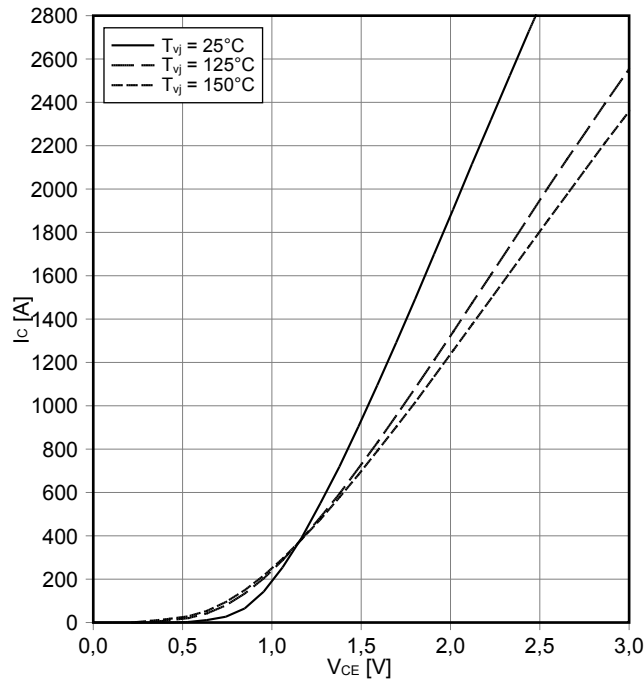
| | | | | | |
|--|--|----------------------|--------------------------------|--------|--------------|
| Isolations-Prüfspannung Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | V _{ISOL} | 4,0 | | kV |
| Material Modulgrundplatte Material of module baseplate | | | Cu | | |
| Innere Isolation Internal isolation | Basisisolierung (Schutzklasse 1, EN61140) basic insulation (class 1, IEC 61140) | | Al ₂ O ₃ | | |
| Kriechstrecke Creepage distance | Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal | | 33,0 33,0 | | mm |
| Luftstrecke Clearance | Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal | | 19,0 19,0 | | mm |
| Vergleichszahl der Kriechwegbildung Comperative tracking index | | CTI | > 400 | | |
| | | | min. | typ. | max. |
| Modulstreuintduktivität Stray inductance module | | L _{sCE} | | 10 | nH |
| Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip | T _H = 25°C, pro Schalter / per switch | R _{CC'+EE'} | | 0,20 | mΩ |
| Lagertemperatur Storage temperature | | T _{stg} | -40 | | 125 °C |
| Höchstzulässige Bodenplattenbetriebstemperatur Maximum baseplate operation temperature | | T _{BPmax} | | | 125 °C |
| Anzugsdrehmoment f. Modulmontage Mounting torque for modul mounting | Schraube M5 - Montage gem. gültiger Applikationsschrift Screw M5 - Mounting according to valid application note | M | 3,00 | | 6,00 Nm |
| Anzugsdrehmoment f. elektr. Anschlüsse Terminal connection torque | Schraube M4 - Montage gem. gültiger Applikationsschrift Screw M4 - Mounting according to valid application note Schraube M8 - Montage gem. gültiger Applikationsschrift Screw M8 - Mounting according to valid application note | M | 1,8 8,0 | - - | 2,1 10 Nm |
| Gewicht Weight | | G | | 1200 | g |

Lagerung und Transport von Modulen mit TIM: siehe AN2012-07
Storage and shipment of modules with TIM: see AN2012-07

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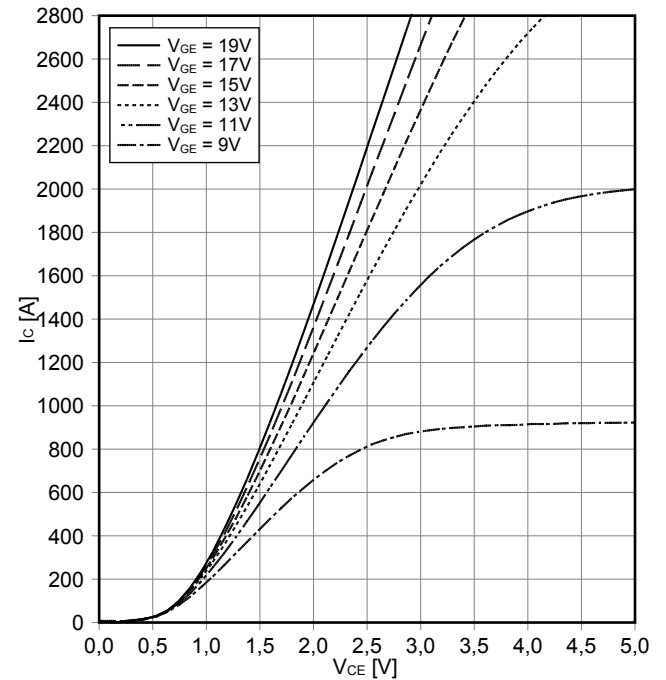
Ausgangskennlinie IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

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



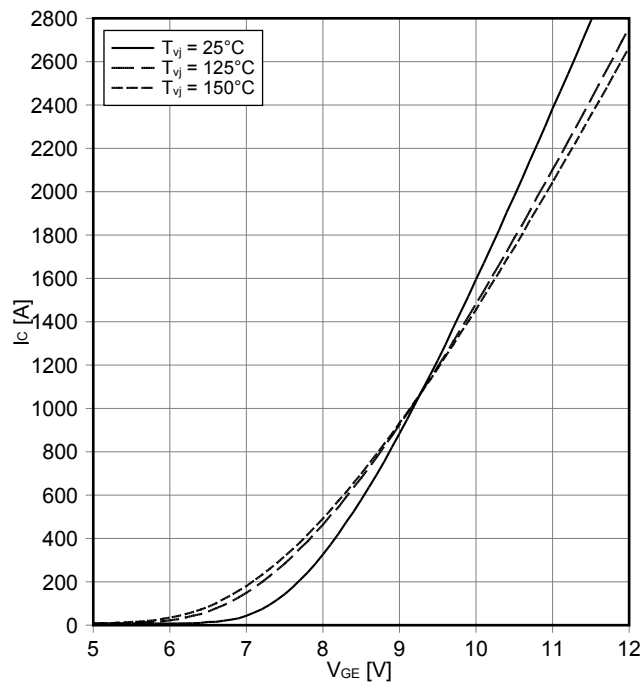
Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

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



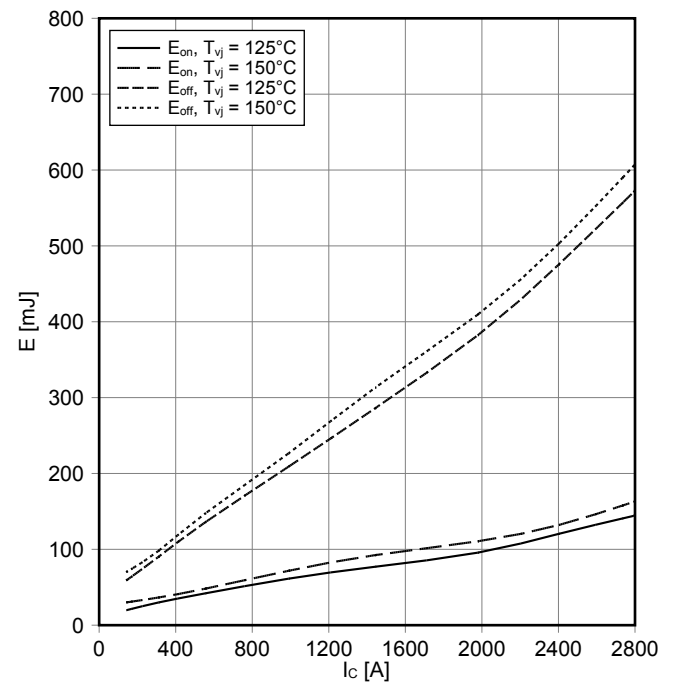
Übertragungscharakteristik IGBT, Wechselrichter (typisch)
transfer characteristic IGBT, Inverter (typical)

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



Schaltverluste IGBT, Wechselrichter (typisch)
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C), E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1\ \Omega, R_{Goff} = 1\ \Omega, V_{CE} = 600\text{ V}$

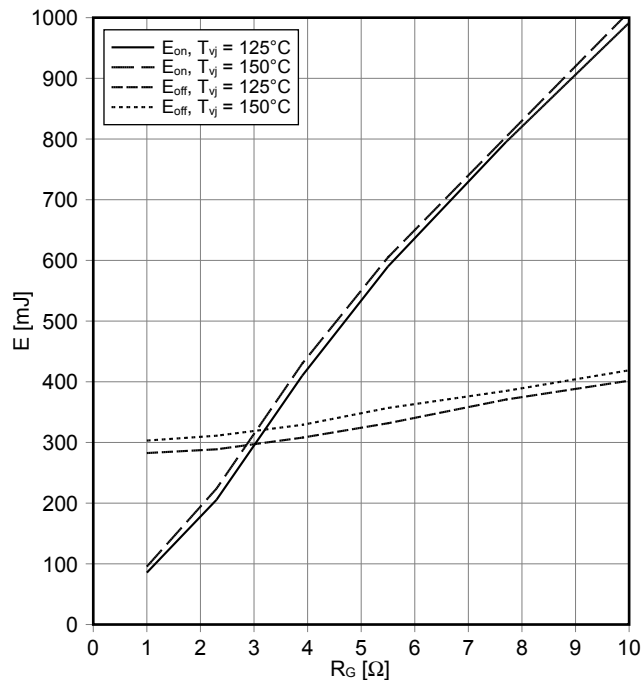


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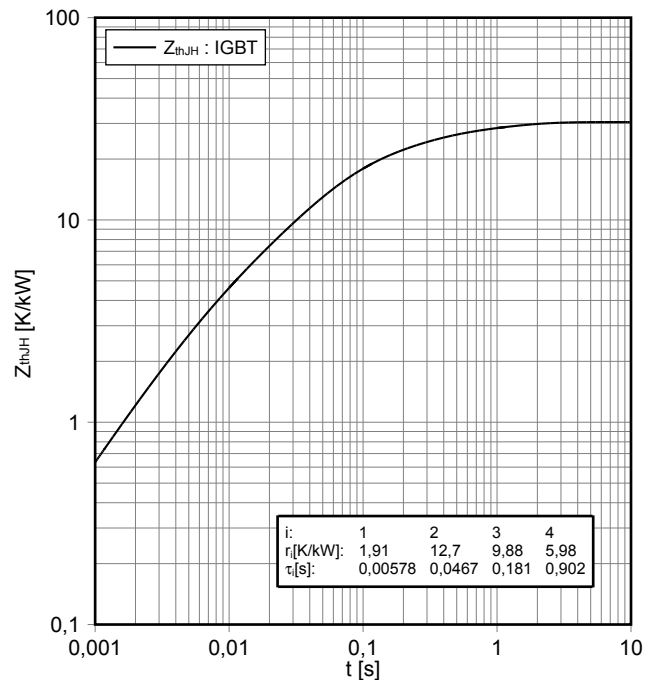
Schaltverluste IGBT, Wechselrichter (typisch)
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}, I_C = 1400 \text{ A}, V_{CE} = 600 \text{ V}$



Transienter Wärmewiderstand IGBT, Wechselrichter
transient thermal impedance IGBT, Inverter

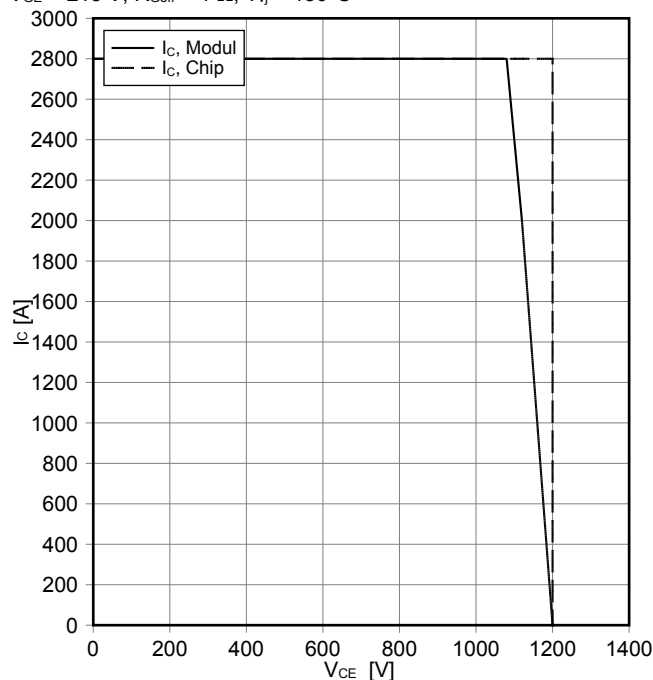
$Z_{thJH} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter
(RBSOA)

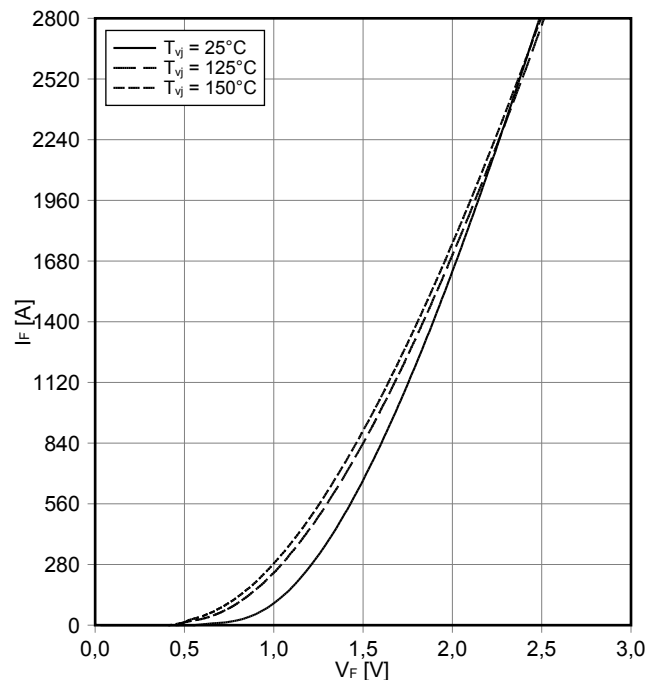
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}, R_{Goff} = 1 \Omega, T_{vj} = 150^\circ\text{C}$



Durchlasskennlinie der Diode, Wechselrichter (typisch)
forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$

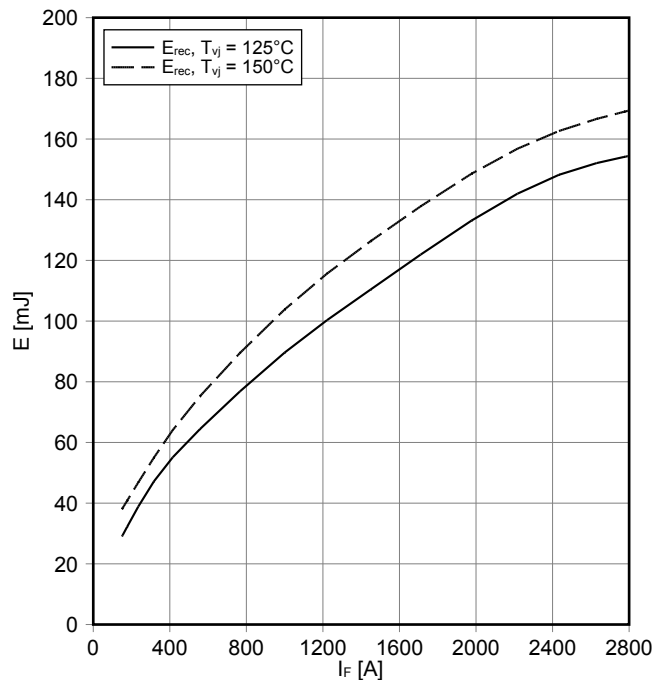


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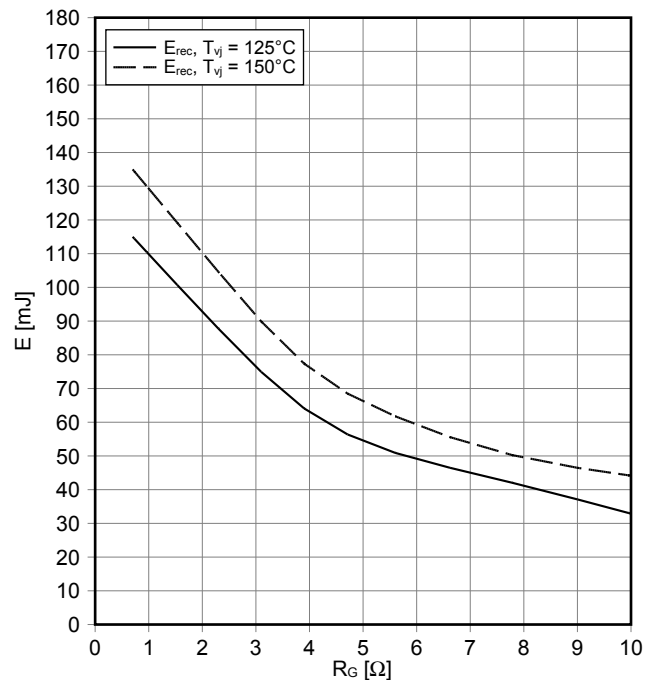
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 1 \Omega, V_{CE} = 600 V$



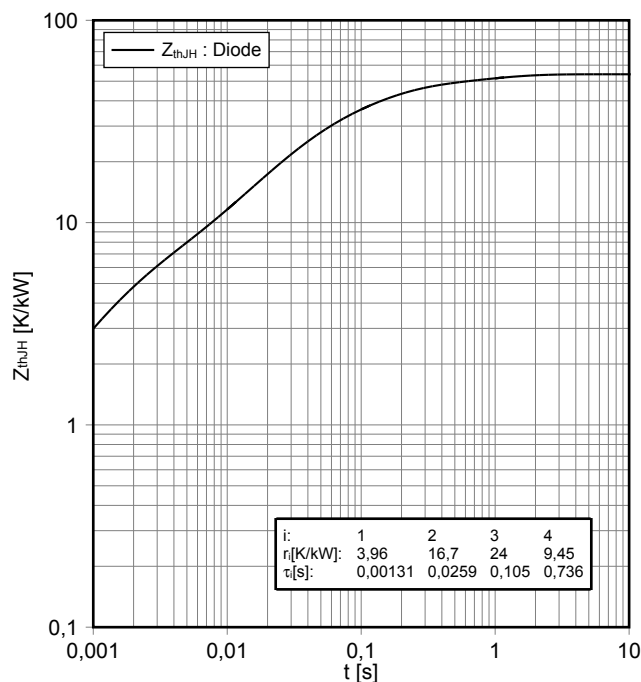
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 1400 A, V_{CE} = 600 V$



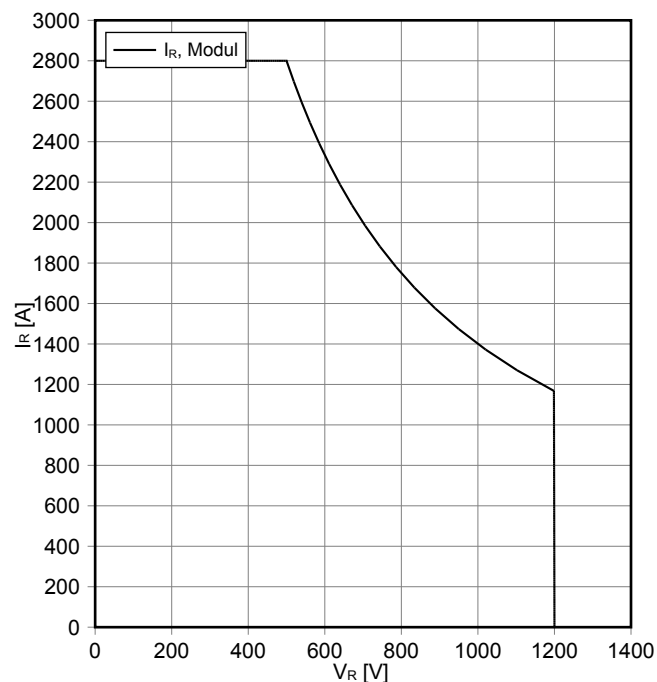
Transienter Wärmewiderstand Diode, Wechselrichter
transient thermal impedance Diode, Inverter

$Z_{thJH} = f(t)$



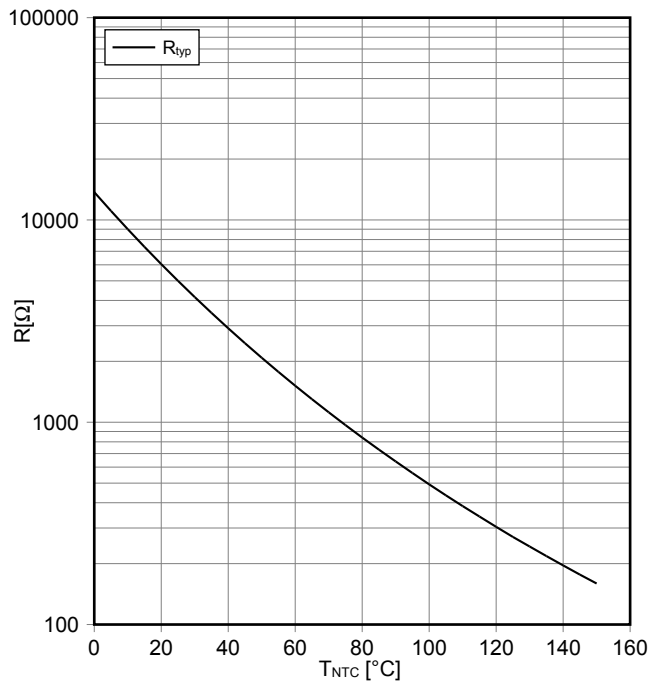
Sicherer Arbeitsbereich Diode, Wechselrichter (SOA)
safe operation area Diode, Inverter (SOA)

$I_R = f(V_R)$
 $T_{vj} = 150^\circ C$



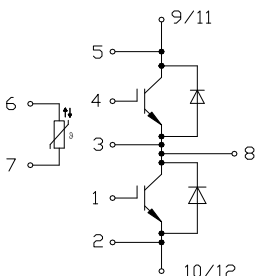
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NTC-Widerstand-Temperaturkennlinie (typisch)
NTC-Thermistor-temperature characteristic (typical)
 $R = f(T)$

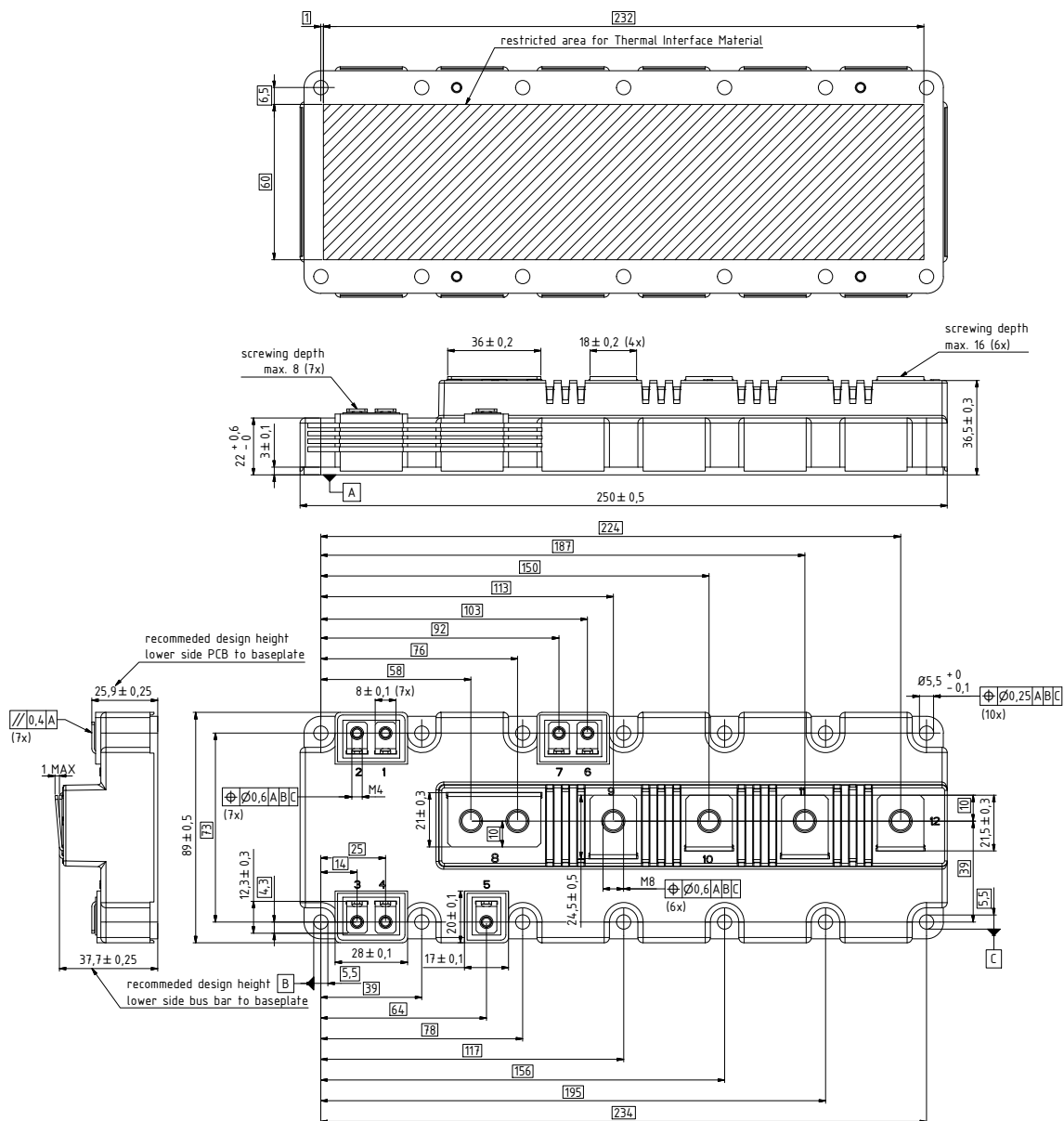


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Schaltplan / Circuit diagram



Gehäuseabmessungen / Package outlines



| | |
|-----------------|---------------------------------|
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