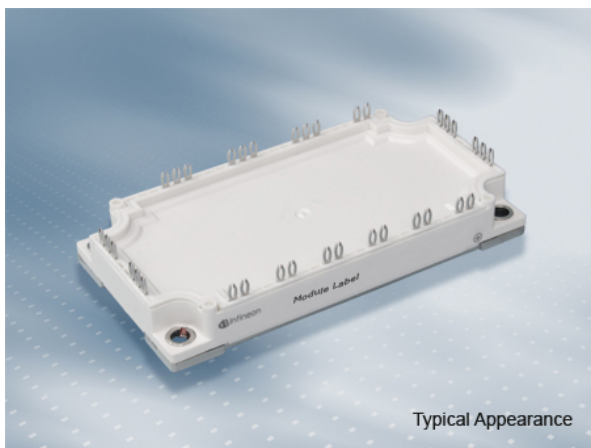


EconoPACK™3 Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled 4 Diode und PressFIT / NTC  
EconoPACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and PressFIT / NTC

**Vorläufige Daten / Preliminary Data**



$V_{CES} = 650V$   
 $I_{C\ nom} = 150A / I_{CRM} = 300A$

**Typische Anwendungen**

- Motorantriebe

**Elektrische Eigenschaften**

- Erhöhte Sperrspannungsfestigkeit auf 650V
- Hohe Kurzschlussrobustheit, selbstlimitierender Kurzschlussstrom
- Trench IGBT 4
- $T_{vj\ op} = 150^{\circ}C$

**Mechanische Eigenschaften**

- Integrierter NTC Temperatur Sensor
- Kupferbodenplatte
- PressFIT Verbindungstechnik
- Standardgehäuse

**Typical Applications**

- Motor Drives

**Electrical Features**

- Increased blocking voltage capability to 650V
- High Short Circuit Capability, Self Limiting Short Circuit Current
- Trench IGBT 4
- $T_{vj\ op} = 150^{\circ}C$

**Mechanical Features**

- Integrated NTC temperature sensor
- Copper Base Plate
- PressFIT Contact Technology
- Standard Housing

**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: AS | date of publication: 2013-11-05 |                      |
| approved by: RS | revision: 2.0                   | UL approved (E83335) |



**Vorläufige Daten  
Preliminary Data**

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

|  |   |                    |       |   |
|--|---|--------------------|-------|---|
| Kollektor-Emitter-Sperrspannung<br>Collector-emitter voltage             | $T_{vj} = 25^{\circ}\text{C}$                                       | $V_{CES}$          | 650   | V |
| Kollektor-Dauergleichstrom<br>Continuous DC collector current            | $T_C = 55^{\circ}\text{C}, T_{vj\text{ max}} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$ | 150   | A |
| Periodischer Kollektor-Spitzenstrom<br>Repetitive peak collector current | $t_P = 1\text{ ms}$   | $I_{CRM}$          | 300   | A |
| Gesamt-Verlustleistung<br>Total power dissipation                        | $T_C = 25^{\circ}\text{C}, T_{vj\text{ max}} = 175^{\circ}\text{C}$ | $P_{tot}$          | 430   | 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    | $I_C = 150\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 150\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 150\text{ A}, V_{GE} = 15\text{ V}$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $V_{CE\text{ sat}}$ | 1,55<br>1,70<br>1,75 | 1,95 | V<br>V<br>V |   |
| Gate-Schwellenspannung<br>Gate threshold voltage                                | $I_C = 2,40\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$  |   | $V_{GEth}$          | 5,0                  | 5,8  | 6,5         | V   |
| Gateladung<br>Gate charge   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$  |   | $Q_G$               | 1,50                 |      |             | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>Internal gate resistor                               | $T_{vj} = 25^{\circ}\text{C}$   |   | $R_{Gint}$          | 2,0                  |      |             | $\Omega$  |
| Eingangskapazität<br>Input capacitance  | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{ies}$           | 9,30                 |      |             | nF  |
| Rückwirkungskapazität<br>Reverse transfer capacitance                           | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{res}$           | 0,285                |      |             | nF  |
| Kollektor-Emitter-Reststrom<br>Collector-emitter cut-off current                | $V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$   |   | $I_{CES}$           |                      |      | 1,0         | 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, induktive Last<br>Turn-on delay time, inductive load | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 3,3\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $t_{don}$           | 0,12<br>0,14<br>0,14 |      |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit, induktive Last<br>Rise time, inductive load                       | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 3,3\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $t_r$               | 0,03<br>0,04<br>0,04 |      |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit, induktive Last<br>Turn-off delay time, inductive load | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 3,3\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $t_{doff}$          | 0,34<br>0,37<br>0,38 |      |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit, induktive Last<br>Fall time, inductive load                           | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 3,3\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $t_f$               | 0,06<br>0,07<br>0,07 |      |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>Turn-on energy loss per pulse               | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 5400\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Gon} = 3,3\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $E_{on}$            | 0,94<br>1,50<br>1,65 |      |             | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>Turn-off energy loss per pulse               | $I_C = 150\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3800\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Goff} = 3,3\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $E_{off}$           | 5,75<br>7,40<br>7,85 |      |             | mJ<br>mJ<br>mJ                                  |
| Kurzschlußverhalten<br>SC data  | $V_{GE} \leq 15\text{ V}, V_{CC} = 360\text{ V}$<br>$V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$   | $t_P \leq 10\ \mu\text{s}, T_{vj} = 25^{\circ}\text{C}$<br>$t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | $I_{SC}$            | 720<br>570           |      |             | A<br>A  |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case       | pro IGBT / per IGBT   |   | $R_{thJC}$          |                      |      | 0,35        | K/W   |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$   |   | $R_{thCH}$          |                      |      | 0,085       | K/W   |
| Temperatur im Schaltbetrieb<br>Temperature under switching conditions           |   |   | $T_{vj\text{ op}}$  | -40                  |      | 150         | $^{\circ}\text{C}$                              |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |

**Vorläufige Daten  
Preliminary Data**

**Diode, Wechselrichter / Diode, Inverter**

**Höchstzulässige Werte / Maximum Rated Values**

|   |  |           |              |  |
|---|--|-----------|--------------|--|
| Periodische Spitzensperrspannung<br>Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$  | $V_{RRM}$ | 650          | V  |
| Dauergleichstrom<br>Continuous DC forward current                   |  | $I_F$     | 150          | A  |
| Periodischer Spitzenstrom<br>Repetitive peak forward current        | $t_P = 1\text{ ms}$  | $I_{FRM}$ | 300          | A  |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$<br>$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I^2t$    | 2050<br>1950 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

**Charakteristische Werte / Characteristic Values**

|   |  |   | min.               | typ.                 | max. |   |
|---|--|---|--------------------|----------------------|------|---|
| Durchlassspannung<br>Forward voltage  | $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 150\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 150\text{ A}, V_{GE} = 0\text{ V}$        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_F$              | 1,55<br>1,50<br>1,45 | 1,95 | V<br>V<br>V                                     |
| Rückstromspitze<br>Peak reverse recovery current                                | $I_F = 150\text{ A}, -di_F/dt = 5400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 300\text{ V}$<br>$V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$           | 150<br>180<br>185    |      | A<br>A<br>A                                     |
| Sperrverzögerungsladung<br>Recovered charge                                     | $I_F = 150\text{ A}, -di_F/dt = 5400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 300\text{ V}$<br>$V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$              | 7,00<br>13,0<br>15,0 |      | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| Abschaltenergie pro Puls<br>Reverse recovery energy                             | $I_F = 150\text{ A}, -di_F/dt = 5400\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$V_R = 300\text{ V}$<br>$V_{GE} = -15\text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$          | 1,95<br>3,50<br>3,95 |      | mJ<br>mJ<br>mJ                                  |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case       | pro Diode / per diode  |   | $R_{thJC}$         |                      | 0,60 | K/W   |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$    |   | $R_{thCH}$         | 0,15                 |      | K/W   |
| Temperatur im Schaltbetrieb<br>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<br>Rated resistance       | $T_C = 25^{\circ}\text{C}$                                    |  | $R_{25}$     | 5,00 |      | $\text{k}\Omega$ |
| Abweichung von R100<br>Deviation of R100 | $T_C = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$            |  | $\Delta R/R$ | -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                |
| B-Wert<br>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<br>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.

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |



**Vorläufige Daten  
Preliminary Data**

**Modul / Module**

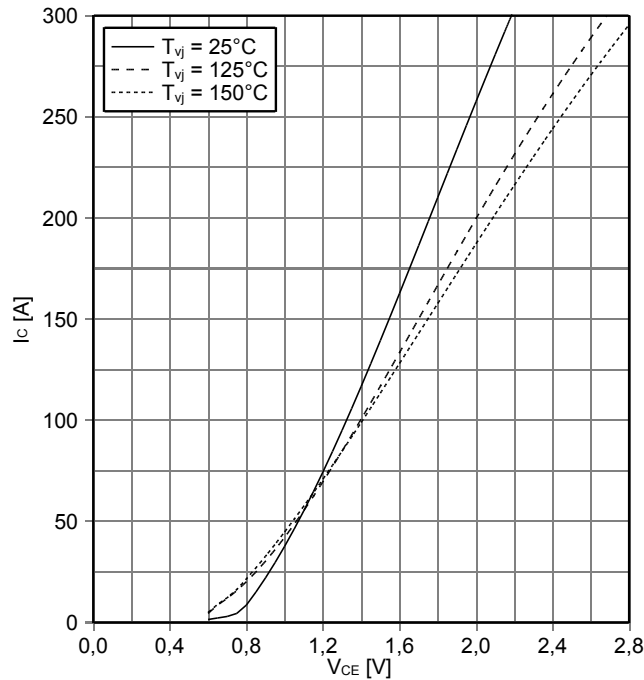
|  |  |                     |                                |     |         |
|--|--|---------------------|--------------------------------|-----|---------|
| Isolations-Prüfspannung<br>Isolation test voltage                                      | RMS, f = 50 Hz, t = 1 min.   | V <sub>ISOL</sub>   | 2,5                            |     | kV      |
| Material Modulgrundplatte<br>Material of module baseplate                              |  |                     | Cu                             |     |         |
| Innere Isolation<br>Internal isolation   | Basisisolierung (Schutzklasse 1, EN61140)<br>basic insulation (class 1, IEC 61140)   |                     | 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   | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal  |                     | 7,5                            |     | mm      |
| Vergleichszahl der Kriechwegbildung<br>Comperative tracking index                      |  | CTI                 | > 200                          |     |         |
|  |  |                     | min.    typ.    max.           |     |         |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink        | pro Modul / per module<br>$\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$ | R <sub>thCH</sub>   | 0,009                          |     | K/W     |
| Modulstreuintuktivität<br>Stray inductance module                                      |  | L <sub>sCE</sub>    | 21                             |     | nH      |
| Modulleitungswiderstand, Anschlüsse - Chip<br>Module lead resistance, terminals - chip | T <sub>c</sub> = 25°C, pro Schalter / per switch   | R <sub>CC+EE'</sub> | 1,80                           |     | mΩ      |
| Lagertemperatur<br>Storage temperature   |  | T <sub>stg</sub>    | -40                            | 125 | °C      |
| Anzugsdrehmoment f. Modulmontage<br>Mounting torque for modul mounting                 | Schraube M5 - Montage gem. gültiger Applikationsschrift<br>Screw M5 - Mounting according to valid application note                         | M                   | 3,00                           | -   | 6,00 Nm |
| Gewicht<br>Weight  |  | G                   | 300                            |     | g       |

|                 |                                 |
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| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |

**Vorläufige Daten**  
**Preliminary Data**

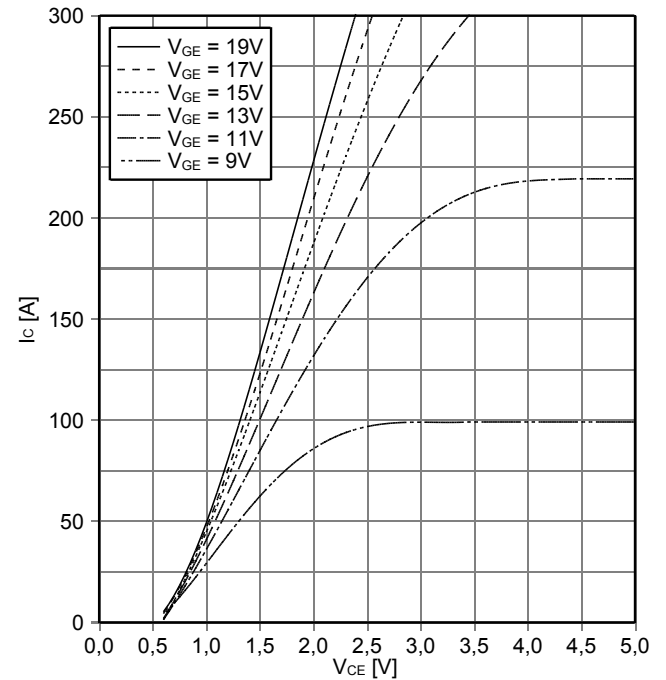
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



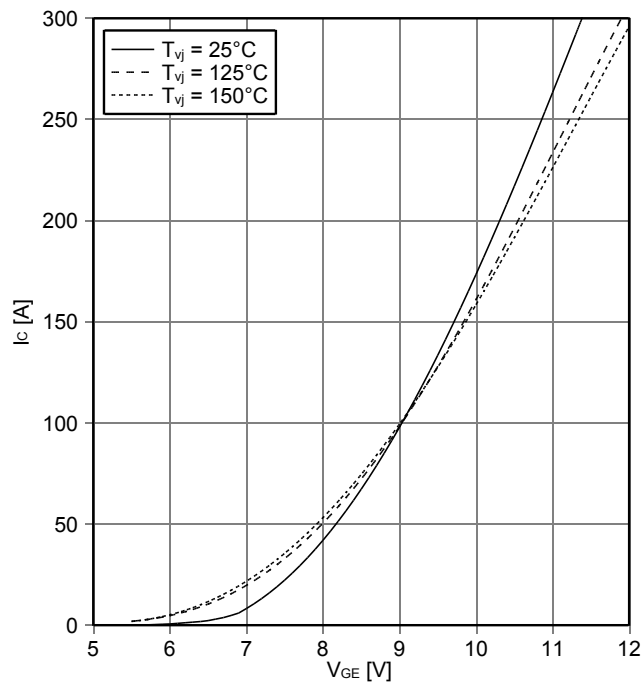
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



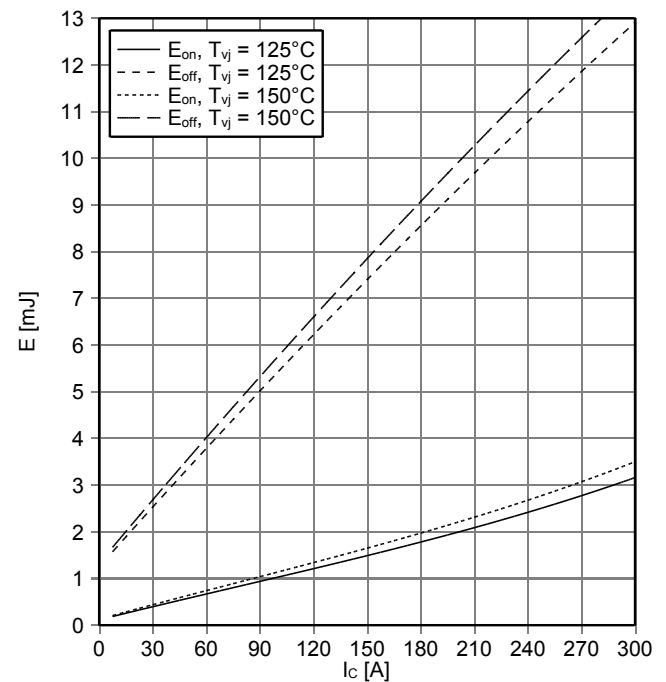
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
**transfer characteristic IGBT, Inverter (typical)**

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



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

$E_{on} = f(I_C), E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 3.3\ \Omega, R_{Goff} = 3.3\ \Omega, V_{CE} = 300\text{ V}$



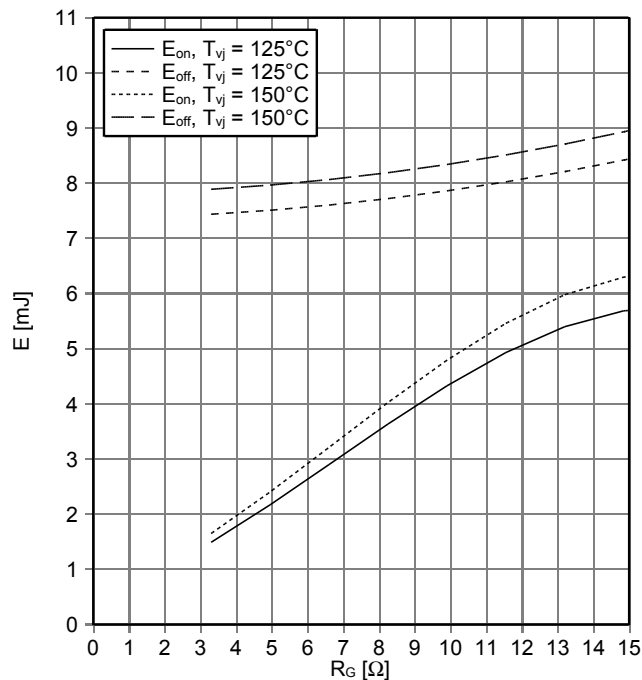
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| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |



**Vorläufige Daten  
Preliminary Data**

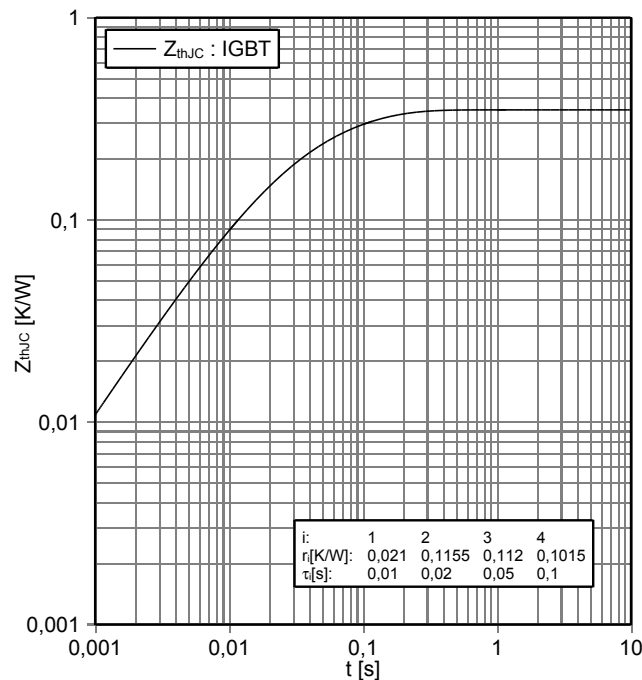
**Schaltverluste IGBT, Wechselrichter (typisch)  
switching losses IGBT, Inverter (typical)**

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 150\text{ A}, V_{CE} = 300\text{ V}$



**Transienter Wärmewiderstand IGBT, Wechselrichter  
transient thermal impedance IGBT, Inverter**

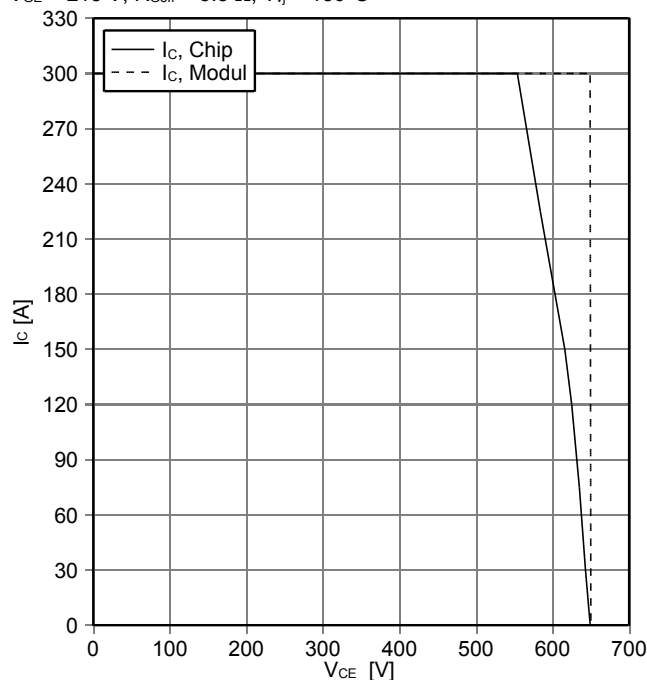
$Z_{thJC} = f(t)$



**Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter  
(RBSOA)**

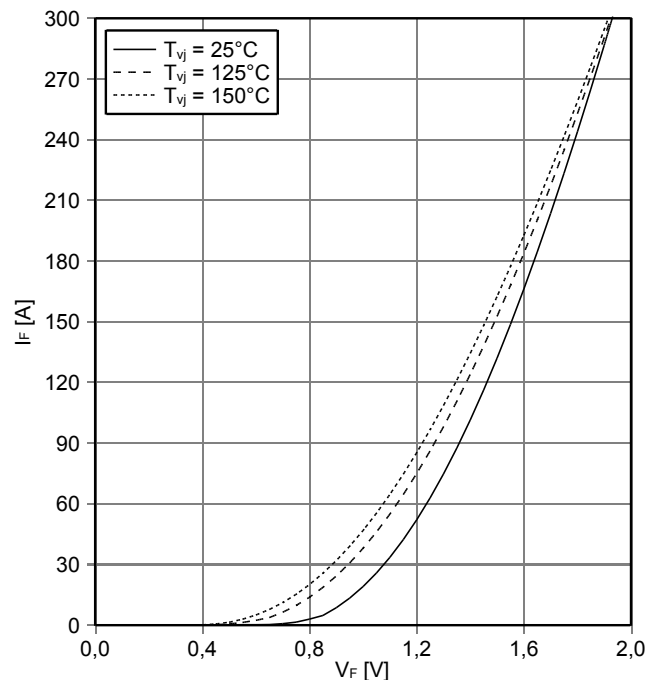
**reverse bias safe operating area IGBT, Inverter (RBSOA)**

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 3.3\ \Omega, T_{vj} = 150^\circ\text{C}$



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

$I_F = f(V_F)$



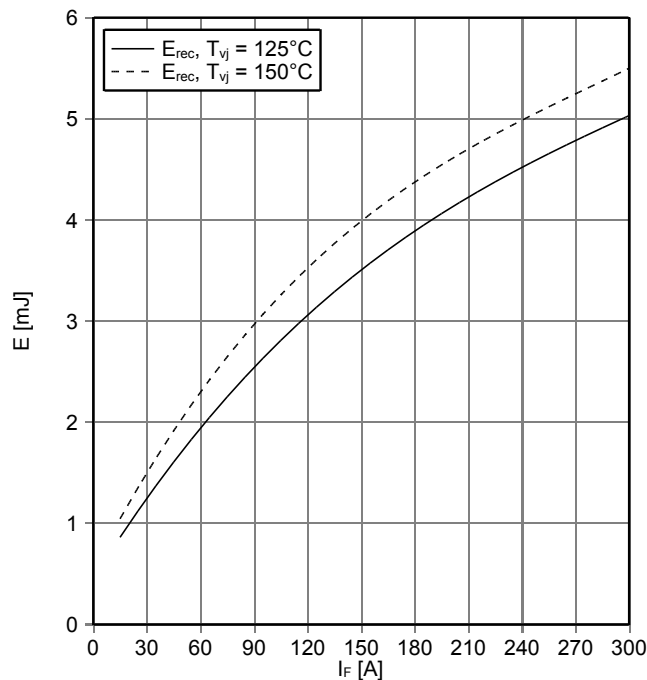
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|-----------------|---------------------------------|
| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |



**Vorläufige Daten  
Preliminary Data**

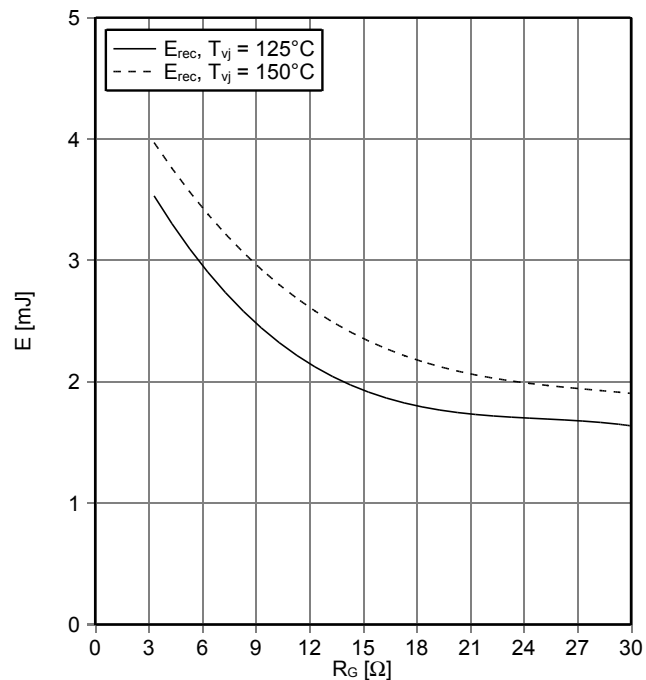
**Schaltverluste Diode, Wechselrichter (typisch)  
switching losses Diode, Inverter (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 3.3 \Omega, V_{CE} = 300 V$



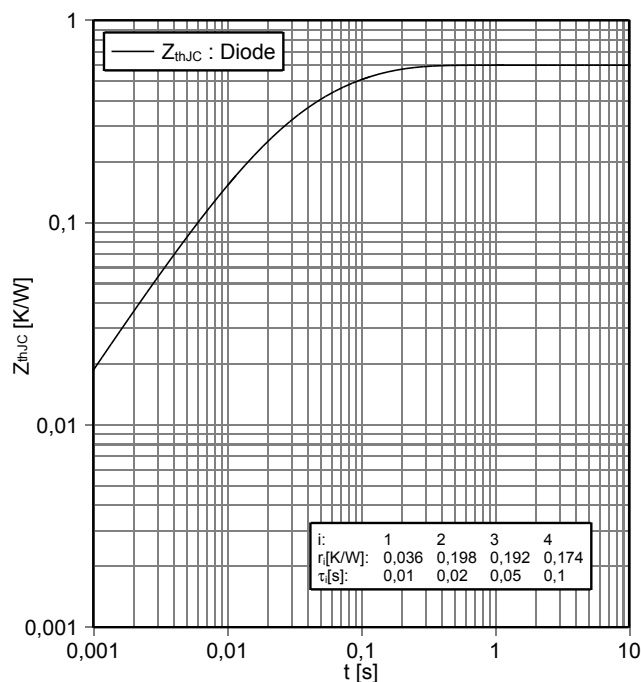
**Schaltverluste Diode, Wechselrichter (typisch)  
switching losses Diode, Inverter (typical)**

$E_{rec} = f(R_G)$   
 $I_F = 150 A, V_{CE} = 300 V$



**Transienter Wärmewiderstand Diode, Wechselrichter  
transient thermal impedance Diode, Inverter**

$Z_{thJC} = f(t)$



**NTC-Widerstand-Temperaturkennlinie (typisch)  
NTC-Thermistor-temperature characteristic (typical)**

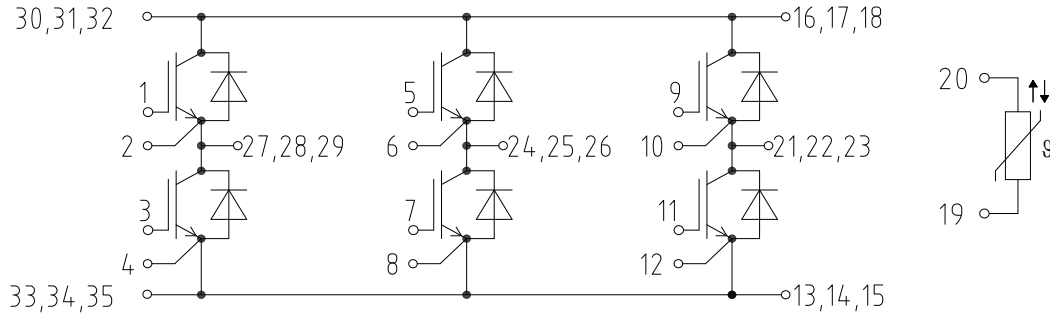
$R = f(T)$



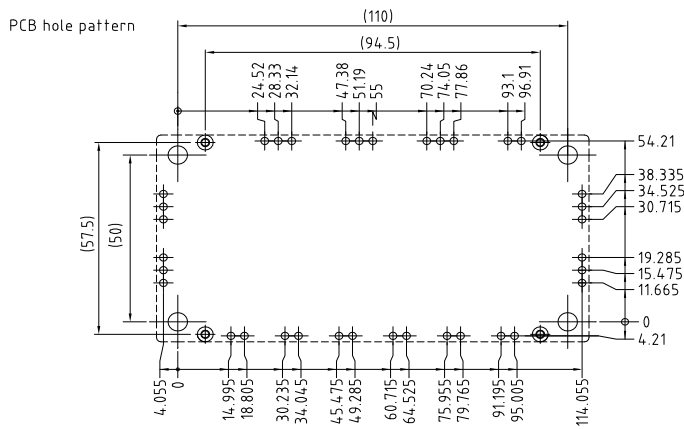
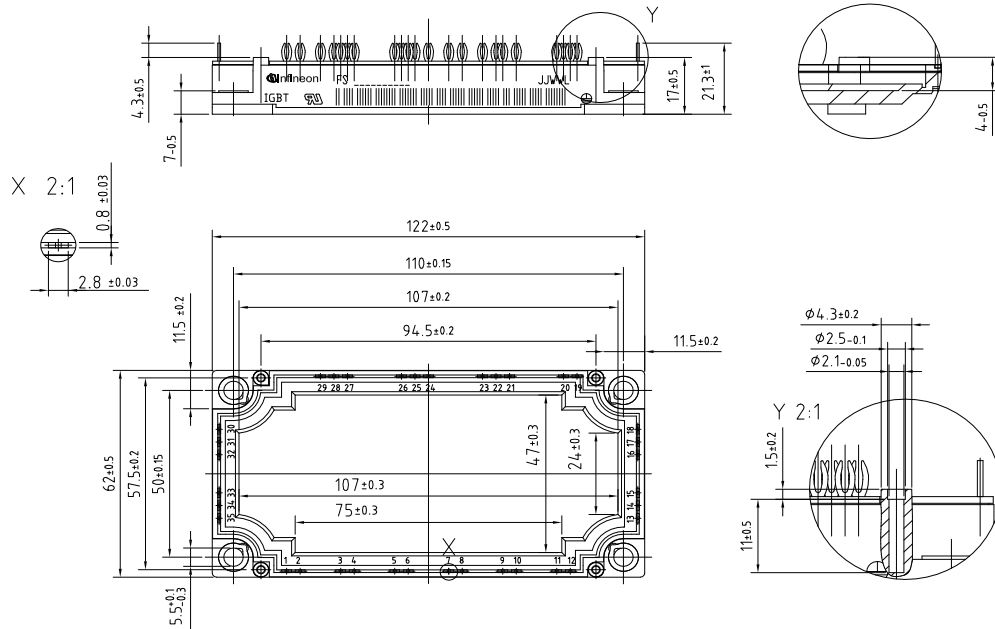
|                 |                                 |
|-----------------|---------------------------------|
| prepared by: AS | date of publication: 2013-11-05 |
| approved by: RS | revision: 2.0                   |

Vorläufige Daten  
Preliminary Data

Schaltplan / circuit\_diagram\_headline



Gehäuseabmessungen / package outlines



- Tolerance of PCB hole pattern  $\pm \phi 0.1$
- hole specifications see AN 2007-09
- Diameters of plated holes  $\phi$  2.14mm - 2.29mm
- Diameter of drill  $\phi$  2.35mm

|                 |                                 |
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