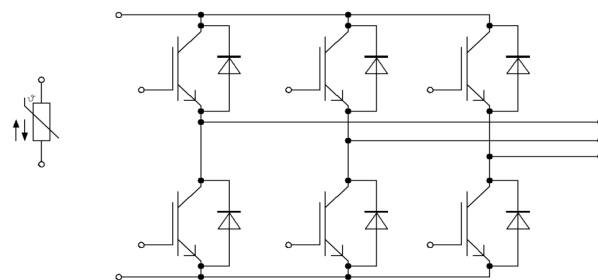
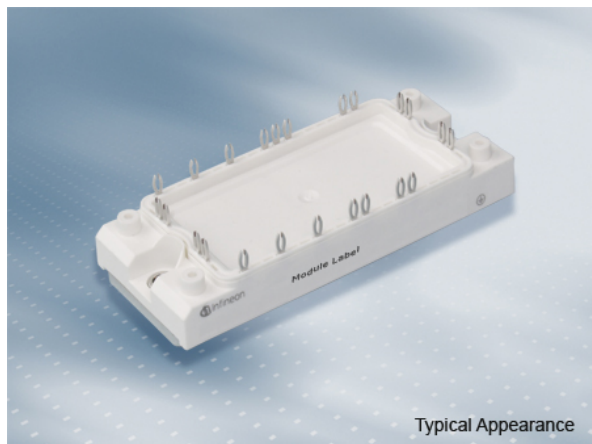


EconoPACK™2 Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled 3 Diode und PressFIT / NTC  
EconoPACK™2 module with Trench/Fieldstop IGBT4 and Emitter Controlled 3 diode and PressFIT / NTC



$V_{CES} = 650V$

$I_{C\ nom} = 100A / I_{CRM} = 200A$

## Typische Anwendungen

- Motorantriebe

## Elektrische Eigenschaften

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

## Mechanische Eigenschaften

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

## Typical Applications

- Motor drives

## Electrical Features

- Increased blocking voltage capability up to 650V
- High short-circuit capability
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4

## 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

| 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 |

**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            | $T_C = 70^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$<br>$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$<br>$I_C$ | 100<br>125 | A<br>A |
| Periodischer Kollektor-Spitzenstrom<br>Repetitive peak collector current | $t_P = 1\text{ ms}$                                                                                                          | $I_{CRM}$                   | 200        | A      |
| 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    | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 100\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                                      | $T_{vj} = 25^{\circ}\text{C}$<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                                | $I_C = 1,60\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                        |                                                                                                                     | $V_{GEth}$          | 5,05                 | 5,80  | 6,45 V                                          |
| Gateladung<br>Gate charge                                                       | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                                                  |                                                                                                                     | $Q_G$               | 1,00                 |       | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>Internal gate resistor                               | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                                               |                                                                                                                     | $R_{Gint}$          | 2,0                  |       | $\Omega$                                        |
| Eingangskapazität<br>Input capacitance                                          | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                  |                                                                                                                     | $C_{ies}$           | 6,20                 |       | nF                                              |
| Rückwirkungskapazität<br>Reverse transfer capacitance                           | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                                                  |                                                                                                                     | $C_{res}$           | 0,19                 |       | 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                          | $V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                                                    |                                                                                                                     | $I_{GES}$           |                      | 100   | nA                                              |
| Einschaltverzögerungszeit, induktive Last<br>Turn-on delay time, inductive load | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}$<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>$T_{vj} = 150^{\circ}\text{C}$                   | $t_{don}$           | 0,07<br>0,08<br>0,08 |       | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit, induktive Last<br>Rise time, inductive load                       | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}$<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>$T_{vj} = 150^{\circ}\text{C}$                   | $t_r$               | 0,02<br>0,02<br>0,02 |       | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit, induktive Last<br>Turn-off delay time, inductive load | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}$<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>$T_{vj} = 150^{\circ}\text{C}$                   | $t_{doff}$          | 0,26<br>0,29<br>0,30 |       | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit, induktive Last<br>Fall time, inductive load                           | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}$<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>$T_{vj} = 150^{\circ}\text{C}$                   | $t_f$               | 0,07<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               | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 5100\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Gon} = 3,3\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $E_{on}$            | 0,33<br>0,77<br>0,88 |       | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>Turn-off energy loss per pulse               | $I_C = 100\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 4000\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$<br>$R_{Goff} = 3,3\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                   | $E_{off}$           | 3,50<br>4,70<br>4,90 |       | 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>$t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ | $I_{SC}$            | 480<br>380           |       | A<br>A                                          |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case       | pro IGBT / per IGBT                                                                                                                                                                         |                                                                                                                     | $R_{thJC}$          |                      | 0,450 | K/W                                             |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1\text{ W}/(\text{m} \cdot \text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m} \cdot \text{K})$                                                   |                                                                                                                     | $R_{thCH}$          | 0,190                |       | K/W                                             |
| Temperatur im Schaltbetrieb<br>Temperature under switching conditions           |                                                                                                                                                                                             |                                                                                                                     | $T_{vj\text{ op}}$  | -40                  | 150   | $^{\circ}\text{C}$                              |

## 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                   |                                                                                                                                              | $I_F$     | 100         | A                                            |
| Periodischer Spitzenstrom<br>Repetitive peak forward current        | $t_P = 1\text{ ms}$                                                                                                                          | $I_{FRM}$ | 200         | A                                            |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$<br>$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I^2t$    | 1100<br>990 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

### Charakteristische Werte / Characteristic Values

|                                                                                 |                                                                                                                                            |                                                                                                   | min.               | typ.                 | max.  |                                                 |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------|----------------------|-------|-------------------------------------------------|
| Durchlassspannung<br>Forward voltage                                            | $I_F = 100\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$<br>$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$        | $T_{vj} = 25^{\circ}\text{C}$<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                                | $I_F = 100\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $I_{RM}$           | 130<br>150<br>160    |       | A<br>A<br>A                                     |
| Sperrverzögerungsladung<br>Recovered charge                                     | $I_F = 100\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $Q_r$              | 4,00<br>8,00<br>10,0 |       | $\mu\text{C}$<br>$\mu\text{C}$<br>$\mu\text{C}$ |
| Abschaltenergie pro Puls<br>Reverse recovery energy                             | $I_F = 100\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<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>$T_{vj} = 150^{\circ}\text{C}$ | $E_{rec}$          | 1,30<br>2,25<br>2,75 |       | mJ<br>mJ<br>mJ                                  |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case       | pro Diode / per diode                                                                                                                      |                                                                                                   | $R_{thJC}$         |                      | 0,800 | K/W                                             |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$  |                                                                                                   | $R_{thCH}$         | 0,150                |       | 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       | $T_{NTC} = 25^{\circ}\text{C}$                                | $R_{25}$     |      | 5,00 |      | $\text{k}\Omega$ |
| Abweichung von R100<br>Deviation of R100 | $T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\text{ }\Omega$  | $\Delta R/R$ | -5   |      | 5    | %                |
| Verlustleistung<br>Power dissipation     | $T_{NTC} = 25^{\circ}\text{C}$                                | $P_{25}$     |      |      | 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.

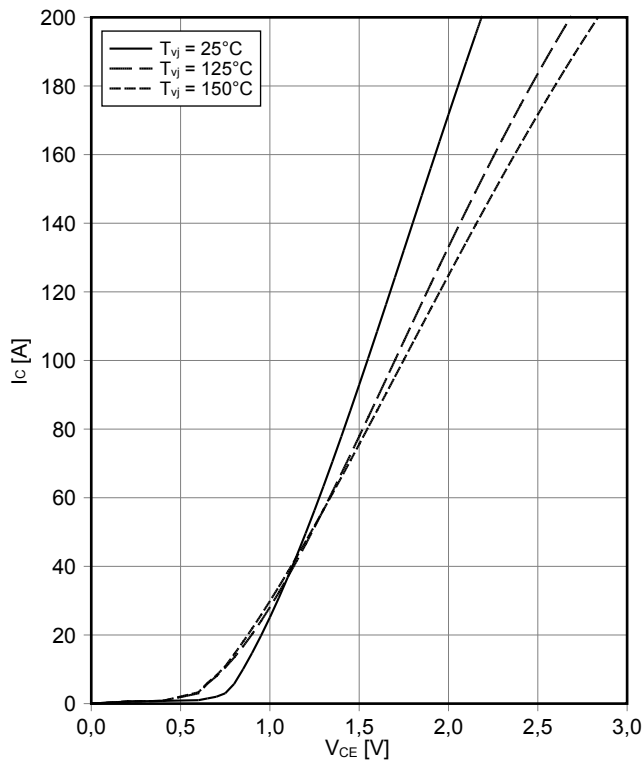
Specification according to the valid application note.

## 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                                                 | Basisisolation (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>    | 0,02                           | K/W     |
| Modulstreuinduktivität<br>Stray inductance module                                      |                                                                                                                                            | L <sub>sCE</sub>     | 19                             | 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                    | 180                            | g       |

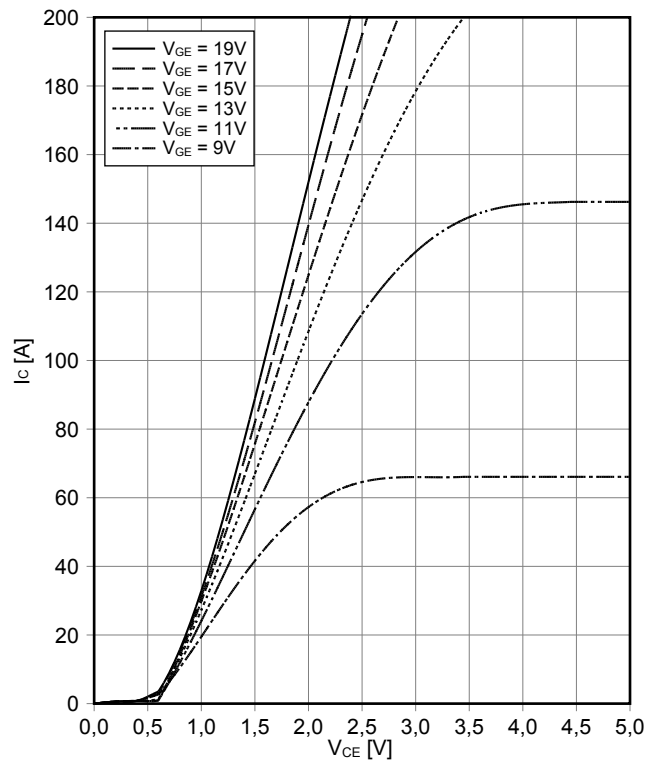
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



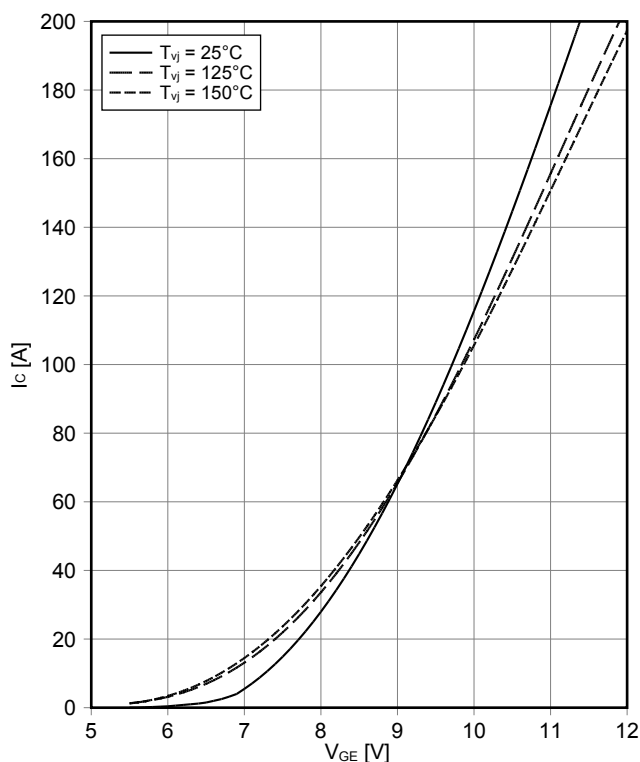
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



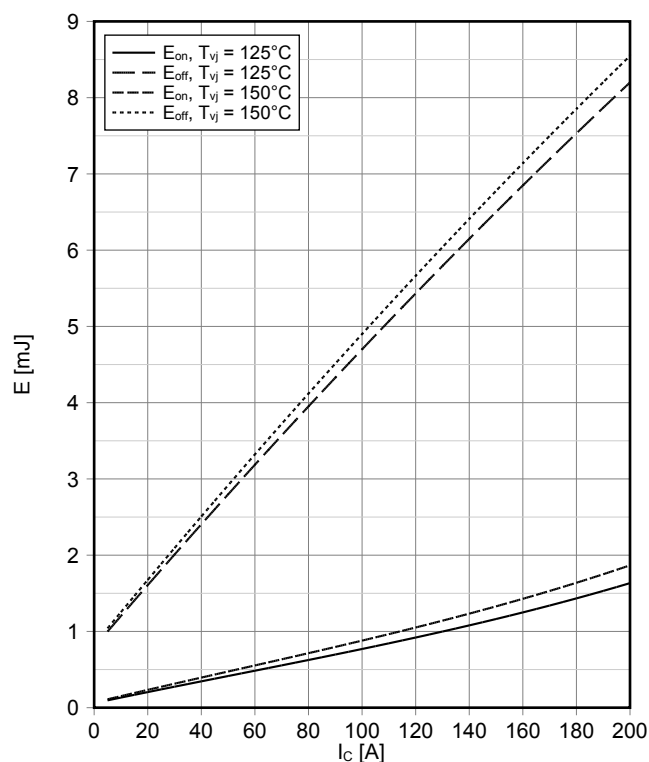
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
**transfer characteristic IGBT, Inverter (typical)**

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



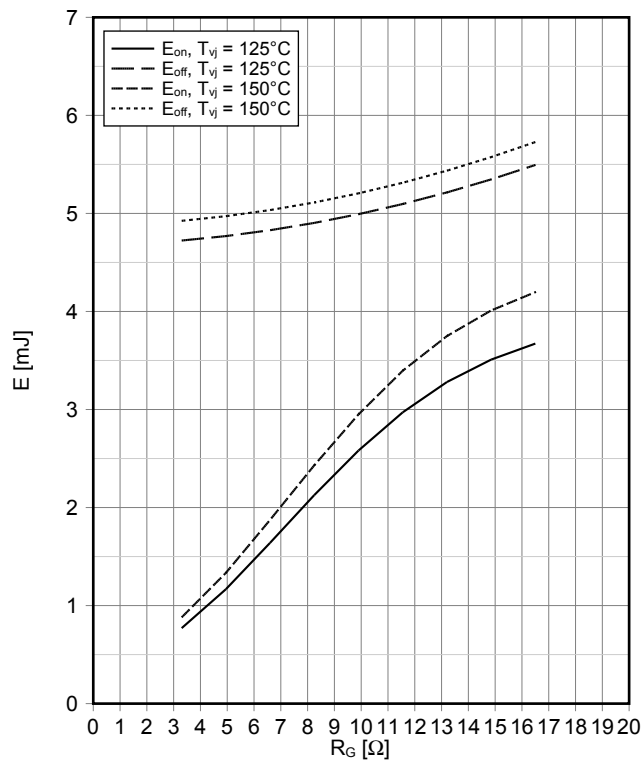
**Schaltverluste IGBT, Wechselrichter (typisch)**  
**switching losses IGBT, Inverter (typical)**

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



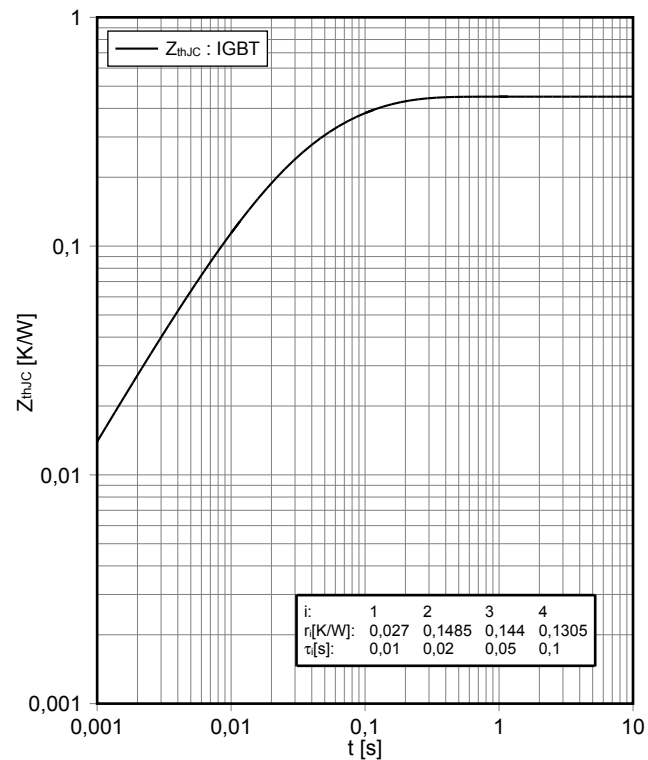
## Schaltverluste IGBT, Wechselrichter (typisch) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $I_C = 100 \text{ A}$ ,  $V_{CE} = 300 \text{ V}$



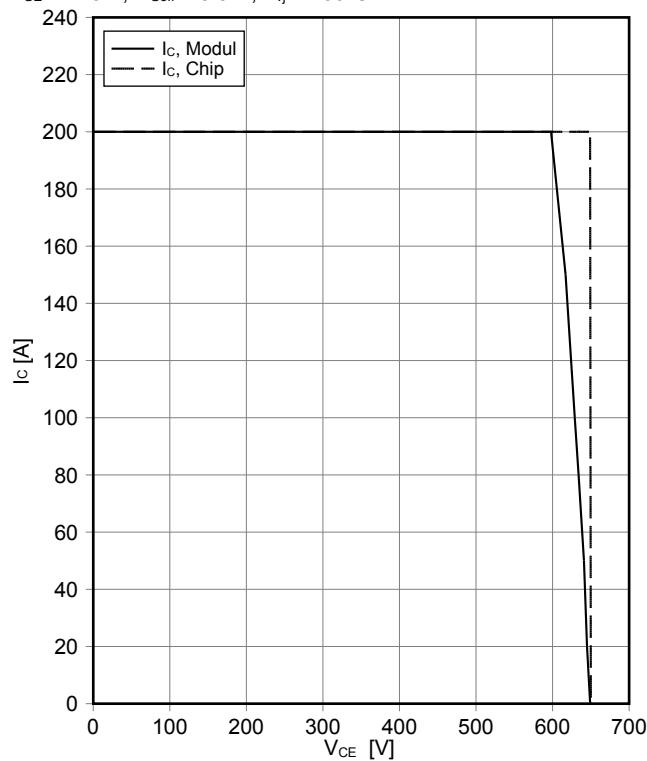
## Transienter Wärmewiderstand IGBT, Wechselrichter transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



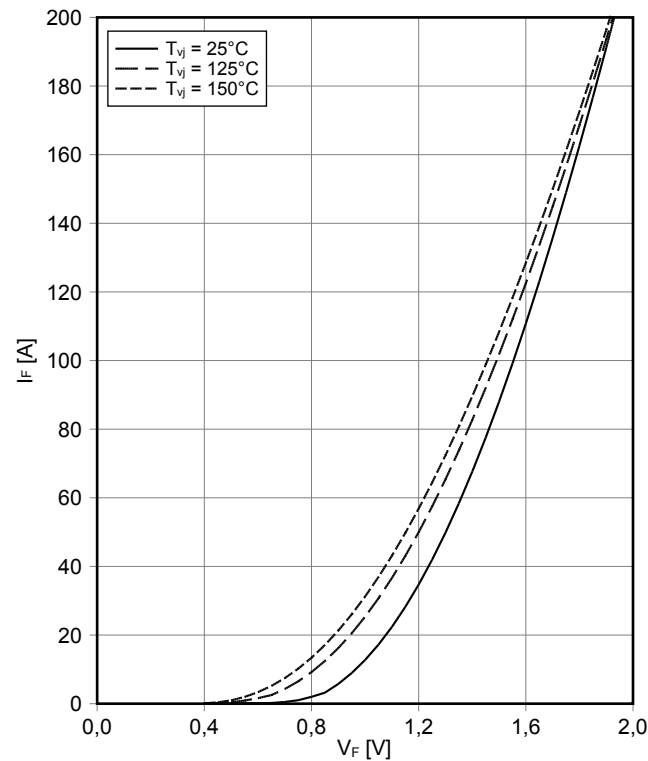
## Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter (RBSOA) reverse bias safe operating area IGBT, Inverter (RBSOA)

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



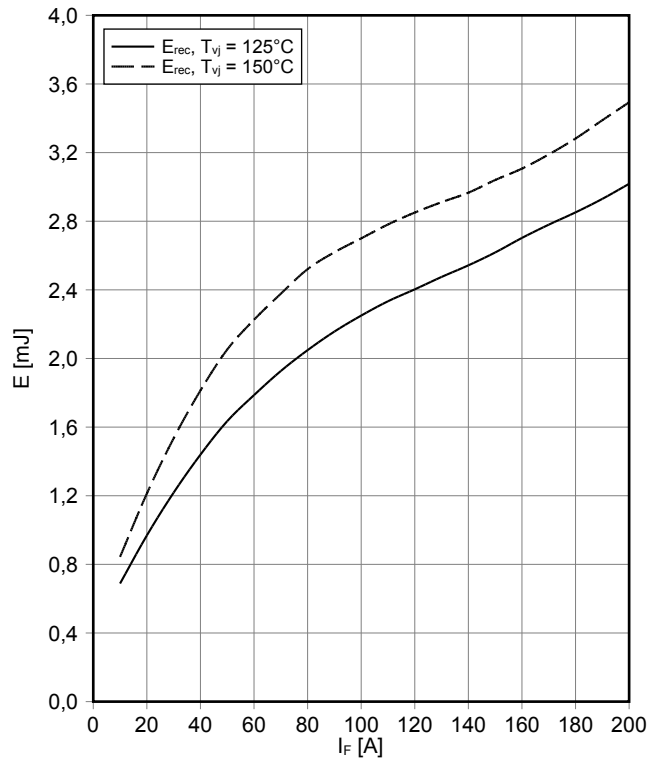
## Durchlasskennlinie der Diode, Wechselrichter (typisch) forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



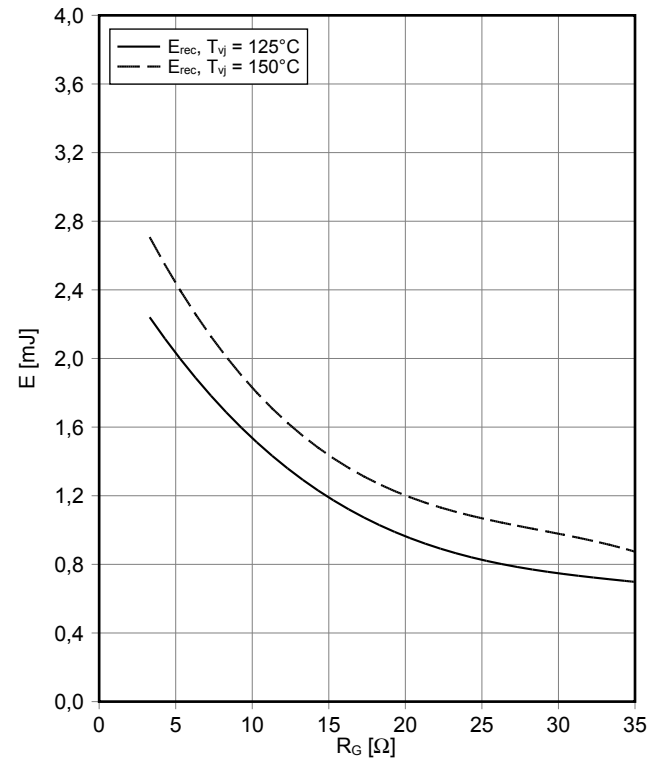
## Schaltverluste Diode, Wechselrichter (typisch) switching losses Diode, Inverter (typical)

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



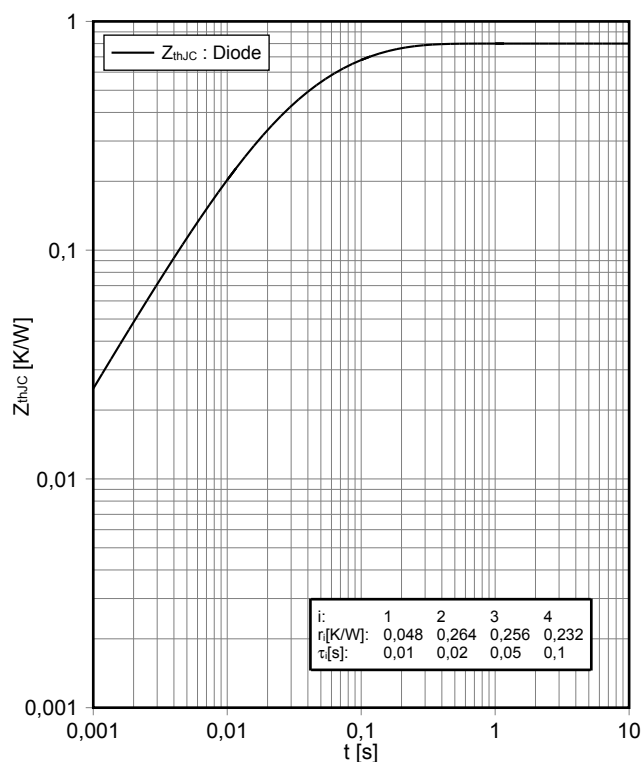
## Schaltverluste Diode, Wechselrichter (typisch) switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 100 A$ ,  $V_{CE} = 300 V$



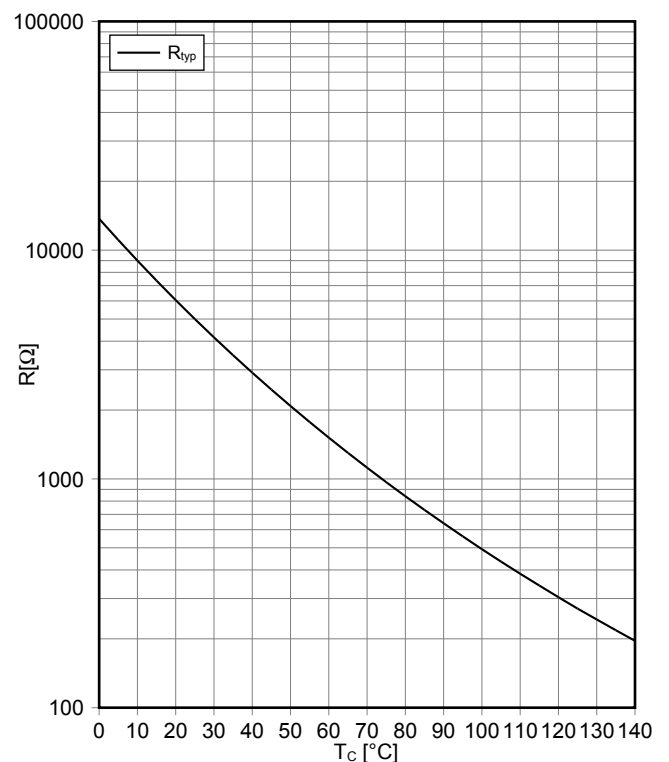
## Transienter Wärmewiderstand Diode, Wechselrichter transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

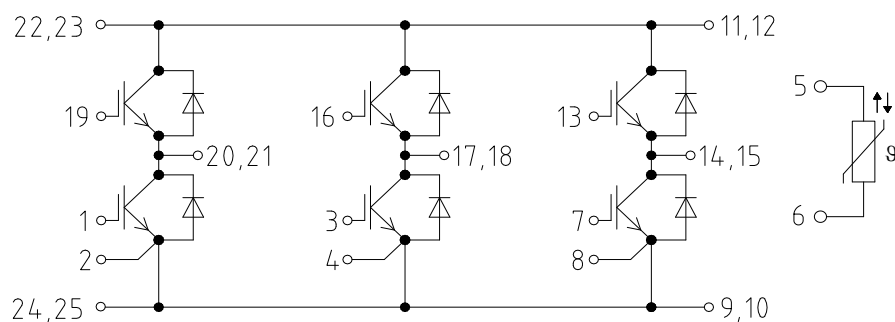


## NTC-Widerstand-Temperaturkennlinie (typisch) NTC-Thermistor-temperature characteristic (typical)

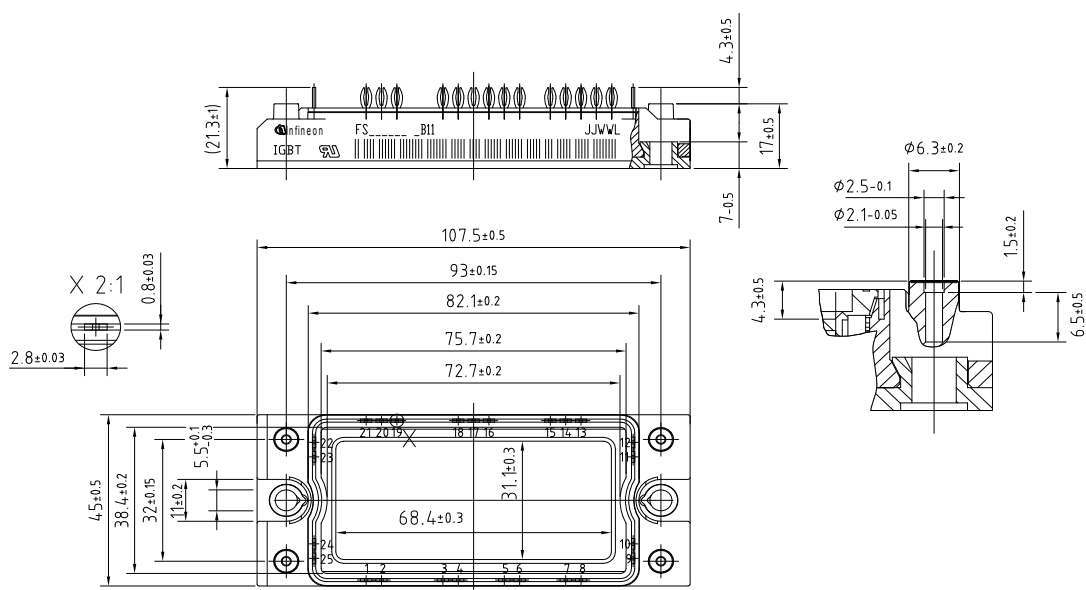
$R = f(T)$



## Gehäuseabmessungen / Package outlines



## Gehäuseabmessungen / Package outlines



Technical drawing of a rectangular plate with dimensions and hole positions. The drawing shows a rectangular plate with a width of 93 and a height of 32. The plate has four holes, two on the left and two on the right. The holes are positioned at 0, 6.9, 19.83, 23.64, 27.45, 42.69, 46.5, 50.31, 65.55, 69.36, 73.17, 86.1, 11.43, 15.24, and 20.95 from the left and right edges. The drawing includes a coordinate system with X and Y axes.

- Tolerance of PCB hole pattern   $\phi 0.1$
- 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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