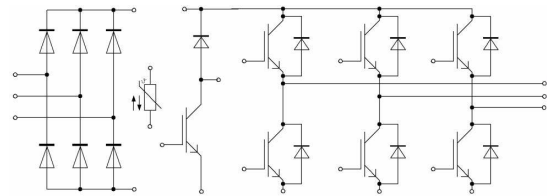


EasyPIM™ Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled 4 Diode und NTC  
EasyPIM™ module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and NTC

**Vorläufige Daten / preliminary data**



**V<sub>CEs</sub> = 1200V**  
**I<sub>C nom</sub> = 15A / I<sub>CRM</sub> = 30A**

**Typische Anwendungen**

- Hilfsumrichter
- Klimaanlage
- Motorantriebe

**Typical Applications**

- Auxiliary Inverters
- Airconditions
- Motor Drives

**Elektrische Eigenschaften**

- Niedrige Schaltverluste
- Trench IGBT 4
- V<sub>CEsat</sub> mit positivem Temperaturkoeffizienten
- niedriges V<sub>CEsat</sub>

**Electrical Features**

- Low Switching Losses
- Trench IGBT 4
- V<sub>CEsat</sub> with positive Temperature Coefficient
- Low V<sub>CEsat</sub>

**Mechanische Eigenschaften**

- Al<sub>2</sub>O<sub>3</sub> Substrat für kleinen thermischen Widerstand
- Kompaktes Design
- Lötverbindungs Technologie
- Robuste Montage durch integrierte Befestigungsklammern

**Mechanical Features**

- Al<sub>2</sub>O<sub>3</sub> Substrate for Low Thermal Resistance
- Compact Design
- Solder Contact Technology
- Rugged mounting due to integrated mounting clamps

**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 |

|                 |                                 |                      |
|-----------------|---------------------------------|----------------------|
| prepared by: DK | date of publication: 2009-10-30 | material no: 29257   |
| approved by: MB | revision: 2.2                   | UL approved (E83335) |

# Technische Information / technical information

IGBT-Module  
IGBT-modules

# FP15R12W1T4



**Vorläufige Daten**  
**preliminary data**

## IGBT-Wechselrichter / IGBT-inverter

### Höchstzulässige Werte / maximum rated values

|  |   |                             |          |        |
|--|---|-----------------------------|----------|--------|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             | $T_{vj} = 25^{\circ}\text{C}$   | $V_{CES}$                   | 1200     | V      |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 100^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$<br>$T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $I_{C\text{ nom}}$<br>$I_C$ | 15<br>28 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_P = 1\text{ ms}$   | $I_{CRM}$                   | 30       | A      |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$  | $P_{tot}$                   | 130      | 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 | $I_C = 15\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 15\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 15\text{ A}, V_{GE} = 15\text{ V}$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | 1,85<br>2,15<br>2,25    | 2,25 | V<br>V<br>V                                     |
| Gate-Schwellenspannung<br>gate threshold voltage                             | $I_C = 0,48\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$  |   | $V_{GEth}$          | 5,2<br>5,8              | 6,4  | V   |
| Gateladung<br>gate charge  | $V_{GE} = -15\text{ V} \dots +15\text{ V}$  |   | $Q_G$               | 0,12                    |      | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>internal gate resistor                            | $T_{vj} = 25^{\circ}\text{C}$   |   | $R_{Gint}$          | 0,0                     |      | $\Omega$  |
| Eingangskapazität<br>input capacitance                                       | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{ies}$           | 0,89                    |      | nF  |
| Rückwirkungskapazität<br>reverse transfer capacitance                        | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$  |   | $C_{res}$           | 0,03                    |      | nF  |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current             | $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$  |   | $I_{CES}$           |                         | 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 (ind. Last)<br>turn-on delay time (inductive load) | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 39\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ on}}$   | 0,055<br>0,055<br>0,055 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit (induktive Last)<br>rise time (inductive load)                  | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 39\ \Omega$  | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$               | 0,059<br>0,065<br>0,065 |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit (ind. Last)<br>turn-off delay time (inductive load) | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 39\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d\text{ off}}$  | 0,195<br>0,275<br>0,28  |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit (induktive Last)<br>fall time (inductive load)                      | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 39\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$               | 0,145<br>0,19<br>0,215  |      | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}, L_s = 50\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, di/dt = 550\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$R_{Gon} = 39\ \Omega$   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$            | 1,30<br>1,75<br>1,95    |      | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | $I_C = 15\text{ A}, V_{CE} = 600\text{ V}, L_s = 50\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}, du/dt = 3500\text{ V}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$<br>$R_{Goff} = 39\ \Omega$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$           | 0,83<br>1,20<br>1,35    |      | mJ<br>mJ<br>mJ                                  |
| Kurzschlussverhalten<br>SC data  | $V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$                                |   | $I_{SC}$            | 55                      |      | A   |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case              | pro IGBT / per IGBT   |   | $R_{thJC}$          | 1,05                    | 1,15 | K/W   |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink            | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$   |   | $R_{thCH}$          | 1,05                    |      | K/W   |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: DK | date of publication: 2009-10-30 |
| approved by: MB | revision: 2.2                   |

# Technische Information / technical information

IGBT-Module  
IGBT-modules

# FP15R12W1T4



## Vorläufige Daten preliminary data

### Diode-Wechselrichter / diode-inverter

#### Höchstzulässige Werte / maximum rated values

|   |  |           |              |  |
|---|--|-----------|--------------|--|
| Periodische Spitzensperrspannung<br>repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$  | $V_{RRM}$ | 1200         | V  |
| Dauergleichstrom<br>DC forward current                              |  | $I_F$     | 15           | A  |
| Periodischer Spitzenstrom<br>repetitive peak forward current        | $t_p = 1\text{ ms}$  | $I_{FRM}$ | 30           | A  |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$<br>$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ | $I^2t$    | 16,0<br>14,0 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

#### Charakteristische Werte / characteristic values

|   |   |                                | min. | typ. | max. |               |
|---|---|--------------------------------|------|------|------|---------------|
| Durchlassspannung<br>forward voltage                              | $I_F = 15\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 25^{\circ}\text{C}$  |      | 2,00 | 2,65 | V             |
|   | $I_F = 15\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 2,10 |      | V             |
|   | $I_F = 15\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 150^{\circ}\text{C}$ |      | 2,10 |      | V             |
| Rückstromspitze<br>peak reverse recovery current                  | $I_F = 15\text{ A}, -di_F/dt = 550\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 13,0 |      | A             |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 12,0 |      | A             |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 12,0 |      | A             |
| Sperrverzögerungsladung<br>recovered charge                       | $I_F = 15\text{ A}, -di_F/dt = 550\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 1,20 |      | $\mu\text{C}$ |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 2,05 |      | $\mu\text{C}$ |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 2,40 |      | $\mu\text{C}$ |
| Abschaltenergie pro Puls<br>reverse recovery energy               | $I_F = 15\text{ A}, -di_F/dt = 550\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 0,37 |      | mJ            |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 0,68 |      | mJ            |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 0,80 |      | mJ            |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode / per diode   | $R_{thJC}$                     |      | 1,75 | 1,90 | K/W           |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$ | $R_{thCH}$                     |      | 1,30 |      | K/W           |

### Diode-Gleichrichter / diode-rectifier

#### Höchstzulässige Werte / maximum rated values

|   |  |             |      |                      |
|---|--|-------------|------|----------------------|
| Periodische Rückw. Spitzensperrspannung<br>repetitive peak reverse voltage          | $T_{vj} = 25^{\circ}\text{C}$                      | $V_{RRM}$   | 1600 | V                    |
| Durchlassstrom Grenzeffektivwert pro Dio.<br>forward current RMS maximum per diode  | $T_C = 80^{\circ}\text{C}$                         | $I_{FRMSM}$ | 30   | A                    |
| Gleichrichter Ausgang Grenzeffektivstrom<br>maximum RMS current at Rectifier output | $T_C = 80^{\circ}\text{C}$                         | $I_{RMSM}$  | 30   | A                    |
| Stoßstrom Grenzwert<br>surge forward current  | $t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$  | $I_{FSM}$   | 300  | A                    |
|   | $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ |             | 245  | A                    |
| Grenzlastintegral<br>$I^2t$ - value   | $t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$  | $I^2t$      | 450  | $\text{A}^2\text{s}$ |
|   | $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$ |             | 300  | $\text{A}^2\text{s}$ |

#### Charakteristische Werte / characteristic values

|   |   |            | min. | typ. | max. |     |
|---|---|------------|------|------|------|-----|
| Durchlassspannung<br>forward voltage                              | $T_{vj} = 150^{\circ}\text{C}, I_F = 15\text{ A}$   | $V_F$      |      | 0,85 |      | V   |
| Sperrstrom<br>reverse current                                     | $T_{vj} = 150^{\circ}\text{C}, V_R = 1600\text{ V}$   | $I_R$      |      | 1,00 |      | mA  |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode<br>per diode  | $R_{thJC}$ |      | 1,20 | 1,35 | K/W |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$ | $R_{thCH}$ |      | 1,15 |      | K/W |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: DK | date of publication: 2009-10-30 |
| approved by: MB | revision: 2.2                   |

# Technische Information / technical information

IGBT-Module  
IGBT-modules

# FP15R12W1T4



**Vorläufige Daten**  
**preliminary data**

## IGBT-Brems-Chopper / IGBT-brake-chopper

### Höchstzulässige Werte / maximum rated values

|  |   |                     |          |        |
|--|---|---------------------|----------|--------|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             | $T_{vj} = 25^{\circ}\text{C}$   | $V_{CES}$           | 1200     | V      |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 100^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$<br>$T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ | $I_{Cnom}$<br>$I_C$ | 15<br>28 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_P = 1 \text{ ms}$  | $I_{CRM}$           | 30       | A      |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$  | $P_{tot}$           | 130      | 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 | $I_C = 15 \text{ A}, V_{GE} = 15 \text{ V}$<br>$I_C = 15 \text{ A}, V_{GE} = 15 \text{ V}$<br>$I_C = 15 \text{ A}, V_{GE} = 15 \text{ V}$ | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $V_{CE \text{ sat}}$ | 1,85<br>2,15<br>2,25 | 2,25                    | V<br>V<br>V |   |
| Gate-Schwellenspannung<br>gate threshold voltage                             | $I_C = 0,48 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$   |   | $V_{GEth}$           | 5,2                  | 5,8                     | 6,4         | V   |
| Gateladung<br>gate charge  | $V_{GE} = -15 \text{ V} \dots +15 \text{ V}$  |   | $Q_G$                |                      | 0,12                    |             | $\mu\text{C}$                                   |
| Interner Gatewiderstand<br>internal gate resistor                            | $T_{vj} = 25^{\circ}\text{C}$   |   | $R_{Gint}$           |                      | 0,00                    |             | $\Omega$  |
| Eingangskapazität<br>input capacitance                                       | $f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$   |   | $C_{ies}$            |                      | 0,89                    |             | nF  |
| Rückwirkungskapazität<br>reverse transfer capacitance                        | $f = 1 \text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$   |   | $C_{res}$            |                      | 0,03                    |             | nF  |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current             | $V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$  |   | $I_{CES}$            |                      |                         | 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 (ind. Last)<br>turn-on delay time (inductive load) | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Gon} = 43 \Omega$                                      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d \text{ on}}$   |                      | 0,065<br>0,065<br>0,065 |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Anstiegszeit (induktive Last)<br>rise time (inductive load)                  | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Gon} = 43 \Omega$                                      | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_r$                |                      | 0,06<br>0,065<br>0,065  |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Abschaltverzögerungszeit (ind. Last)<br>turn-off delay time (inductive load) | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Goff} = 43 \Omega$                                     | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{d \text{ off}}$  |                      | 0,21<br>0,28<br>0,285   |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Fallzeit (induktive Last)<br>fall time (inductive load)                      | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Goff} = 43 \Omega$                                     | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_f$                |                      | 0,17<br>0,20<br>0,225   |             | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}, L_s = 50 \text{ nH}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Gon} = 43 \Omega$                 | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{on}$             |                      | 1,35<br>1,80<br>2,00    |             | mJ<br>mJ<br>mJ                                  |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | $I_C = 15 \text{ A}, V_{CE} = 600 \text{ V}, L_s = 50 \text{ nH}$<br>$V_{GE} = \pm 15 \text{ V}$<br>$R_{Goff} = 43 \Omega$                | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $E_{off}$            |                      | 0,85<br>1,20<br>1,35    |             | mJ<br>mJ<br>mJ                                  |
| Kurzschlussverhalten<br>SC data  | $V_{GE} \leq 15 \text{ V}, V_{CC} = 800 \text{ V}$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$   | $t_P \leq 10 \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$   | $I_{SC}$             |                      | 55                      |             | A   |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case              | pro IGBT / per IGBT   |   | $R_{thJC}$           |                      | 1,05                    | 1,15        | K/W   |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink            | pro IGBT / per IGBT<br>$\lambda_{Paste} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$                 |   | $R_{thCH}$           |                      | 1,05                    |             | K/W   |

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**Vorläufige Daten**  
**preliminary data**

**Diode-Brems-Chopper / Diode-brake-chopper**

**Höchstzulässige Werte / maximum rated values**

|   |  |           |      |                      |
|---|--|-----------|------|----------------------|
| Periodische Spitzensperrspannung<br>repetitive peak reverse voltage | $T_{vj} = 25^{\circ}\text{C}$  | $V_{RRM}$ | 1200 | V                    |
| Dauergleichstrom<br>DC forward current                              |  | $I_F$     | 10   | A                    |
| Periodischer Spitzenstrom<br>repetitive peak forw. current          | $t_p = 1\text{ ms}$  | $I_{FRM}$ | 20   | A                    |
| Grenzlastintegral<br>$I^2t$ - value                                 | $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | $I^2t$    | 16,0 | $\text{A}^2\text{s}$ |

**Charakteristische Werte / characteristic values**

|   |   |                                | min. | typ. | max. |               |
|---|---|--------------------------------|------|------|------|---------------|
| Durchlassspannung<br>forward voltage                              | $I_F = 10\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 25^{\circ}\text{C}$  |      | 1,75 | 2,25 | V             |
|   | $I_F = 10\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 1,75 |      | V             |
|   | $I_F = 10\text{ A}, V_{GE} = 0\text{ V}$  | $T_{vj} = 150^{\circ}\text{C}$ |      | 1,75 |      | V             |
| Rückstromspitze<br>peak reverse recovery current                  | $I_F = 10\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 12,0 |      | A             |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 10,0 |      | A             |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 8,00 |      | A             |
| Sperrverzögerungsladung<br>recovered charge                       | $I_F = 10\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 0,90 |      | $\mu\text{C}$ |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 1,70 |      | $\mu\text{C}$ |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 1,90 |      | $\mu\text{C}$ |
| Abschaltenergie pro Puls<br>reverse recovery energy               | $I_F = 10\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$   | $T_{vj} = 25^{\circ}\text{C}$  |      | 0,24 |      | mJ            |
|   | $V_R = 600\text{ V}$  | $T_{vj} = 125^{\circ}\text{C}$ |      | 0,52 |      | mJ            |
|   | $V_{GE} = -15\text{ V}$   | $T_{vj} = 150^{\circ}\text{C}$ |      | 0,59 |      | mJ            |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case   | pro Diode / per diode   | $R_{thJC}$                     |      | 1,75 | 1,90 | K/W           |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$ | $R_{thCH}$                     |      | 1,30 |      | K/W           |

**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 |      | k $\Omega$ |
| Abweichung von $R_{100}$<br>deviation of $R_{100}$ | $T_C = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$            | $\Delta R/R$ | -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.

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# Technische Information / technical information

IGBT-Module  
IGBT-modules

## FP15R12W1T4



### Vorläufige Daten preliminary data

#### Modul / module

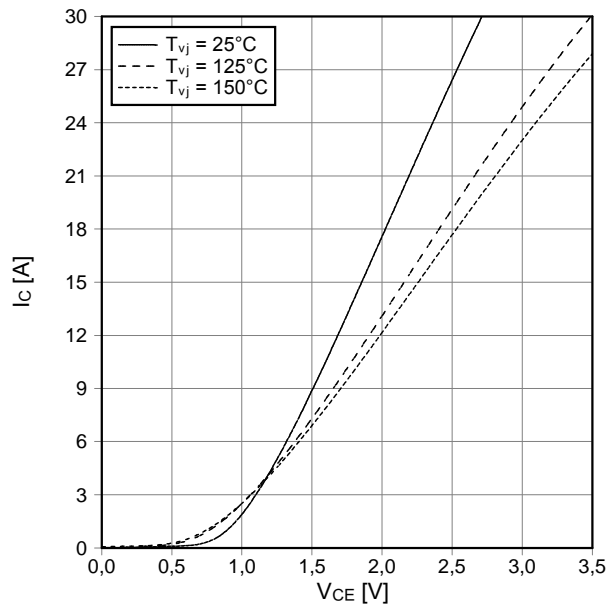
|  |   |                                |                                |              |          |
|--|---|--------------------------------|--------------------------------|--------------|----------|
| Isolations-Prüfspannung<br>insulation test voltage   | RMS, f = 50 Hz, t = 1 min   | $V_{ISOL}$                     | 2,5                            |              | kV       |
| Material für innere Isolation<br>material for internal insulation                            |   |                                | Al <sub>2</sub> O <sub>3</sub> |              |          |
| Kriechstrecke<br>creepage distance   | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal |                                | 11,5<br>6,3                    |              | mm       |
| Luftstrecke<br>clearance distance  | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal |                                | 10,0<br>5,0                    |              | mm       |
| Vergleichszahl der Kriechwegbildung<br>comparative tracking index                            |   | CTI                            | > 200                          |              |          |
|  |   |                                | min.                           | typ.         | max.     |
| Modulinduktivität<br>stray inductance module   |   | $L_{sCE}$                      |                                | 30           | nH       |
| Modulleitungswiderstand,<br>Anschlüsse - Chip<br>module lead resistance,<br>terminals - chip | $T_C = 25^\circ\text{C}$ , pro Schalter / per switch                                    | $R_{CC'+EE'}$<br>$R_{AA'+CC'}$ |                                | 8,00<br>6,00 | mΩ       |
| Höchstzulässige Sperschichttemperatur<br>maximum junction temperature                        | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper<br>Gleichrichter / rectifier    | $T_{vj\ max}$                  |                                | 175<br>150   | °C<br>°C |
| Temperatur im Schaltbetrieb<br>temperature under switching conditions                        | Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper<br>Gleichrichter / rectifier    | $T_{vj\ op}$                   | -40<br>-40                     | 150<br>150   | °C<br>°C |
| Lagertemperatur<br>storage temperature   |   | $T_{stg}$                      | -40                            | 125          | °C       |
| Anpresskraft für mech. Bef. pro Feder<br>mounting force per clamp                            |   | F                              | 20                             | -            | 50 N     |
| Gewicht<br>weight  |   | G                              |                                | 24           | g        |

Der Strom im Dauerbetrieb ist auf 30A effektiv pro Anschlusspin begrenzt.  
The current under continuous operation is limited to 30A rms per connector pin.

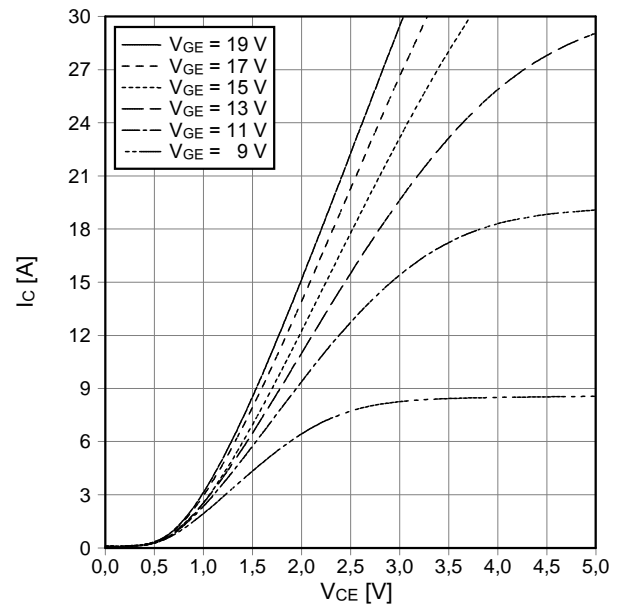
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**Vorläufige Daten**  
**preliminary data**

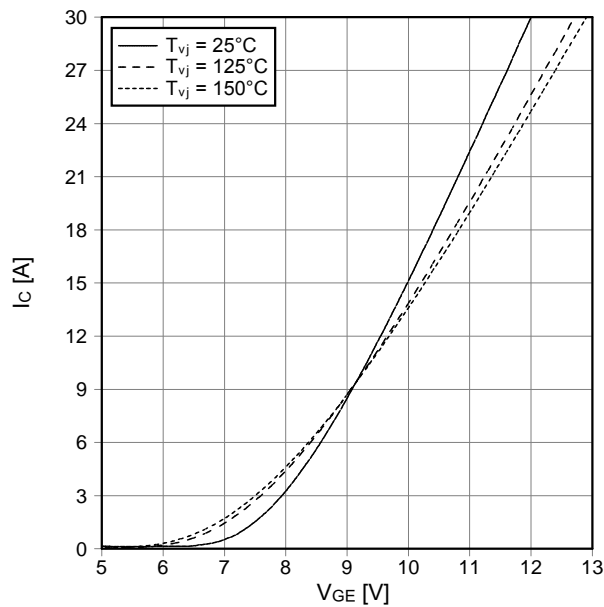
**Ausgangskennlinie IGBT-Wechselr. (typisch)**  
**output characteristic IGBT-inverter (typical)**  
 $I_c = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



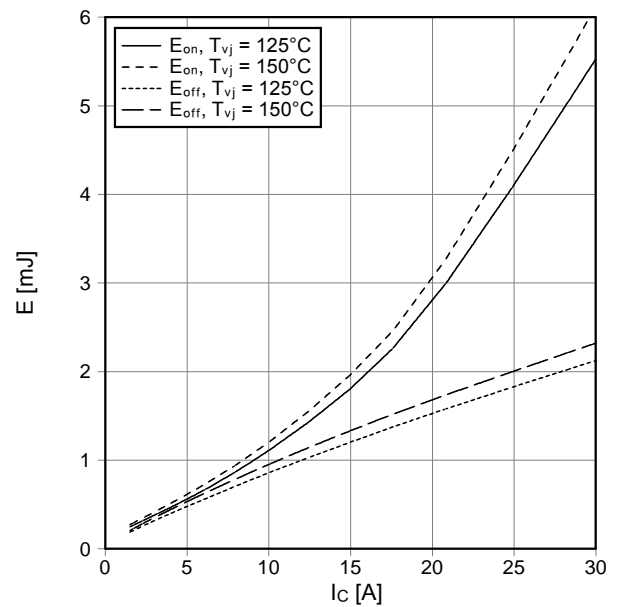
**Ausgangskennlinienfeld IGBT-Wechselr. (typisch)**  
**output characteristic IGBT-inverter (typical)**  
 $I_c = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$



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



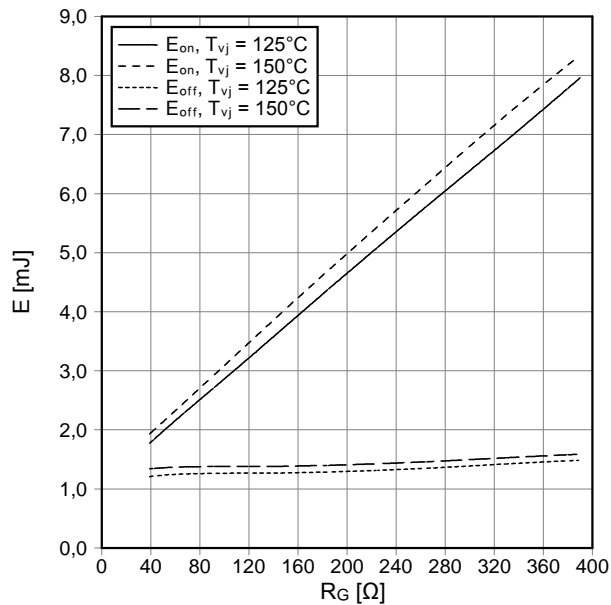
**Schaltverluste IGBT-Wechselr. (typisch)**  
**switching losses IGBT-inverter (typical)**  
 $E_{on} = f(I_c)$ ,  $E_{off} = f(I_c)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 39\ \Omega$ ,  $R_{Goff} = 39\ \Omega$ ,  $V_{CE} = 600\text{ V}$



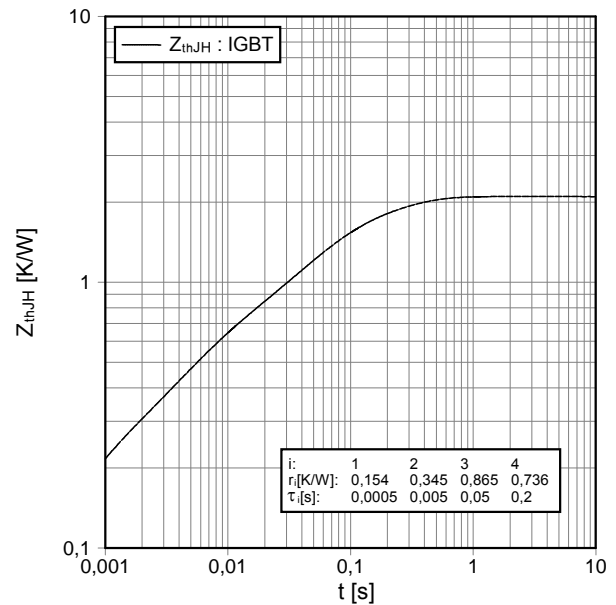
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**Vorläufige Daten**  
**preliminary data**

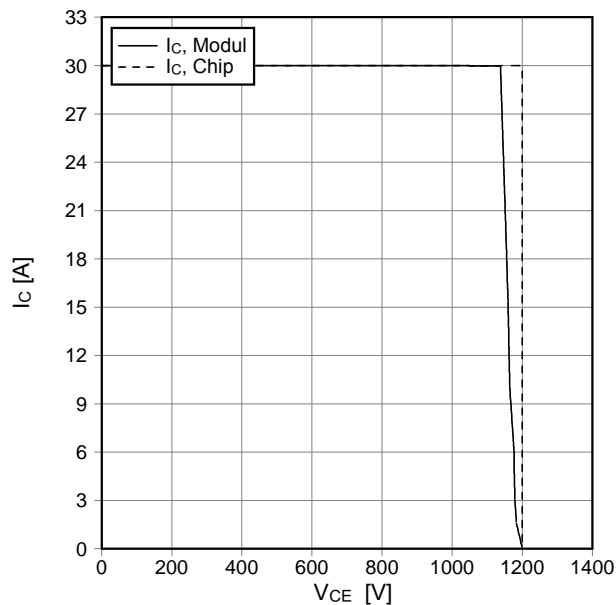
**Schaltverluste IGBT-Wechselr. (typisch)**  
**switching losses IGBT-Inverter (typical)**  
 $E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_c = 15\text{ A}, V_{CE} = 600\text{ V}$



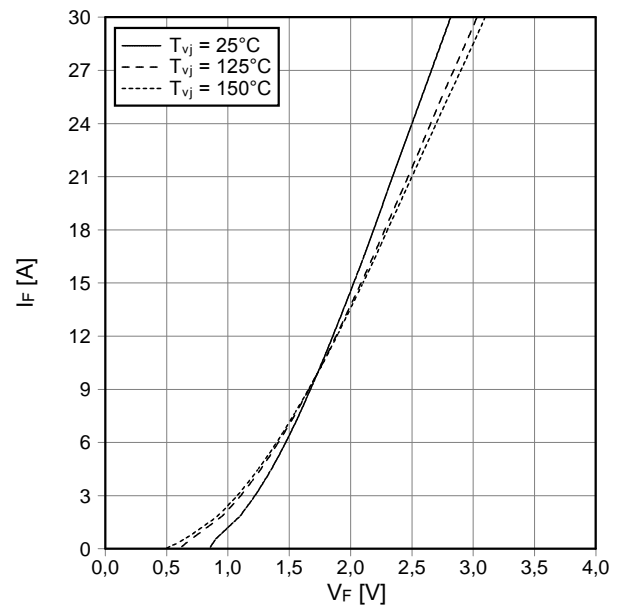
**Transienter Wärmewiderstand IGBT-Wechselr.**  
**transient thermal impedance IGBT-inverter**  
 $Z_{thJH} = f(t)$



**Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)**  
**reverse bias safe operating area IGBT-inv. (RBSOA)**  
 $I_c = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 39\ \Omega, T_{vj} = 150^\circ\text{C}$



**Durchlasskennlinie der Diode-Wechselr. (typisch)**  
**forward characteristic of diode-inverter (typical)**  
 $I_F = f(V_F)$



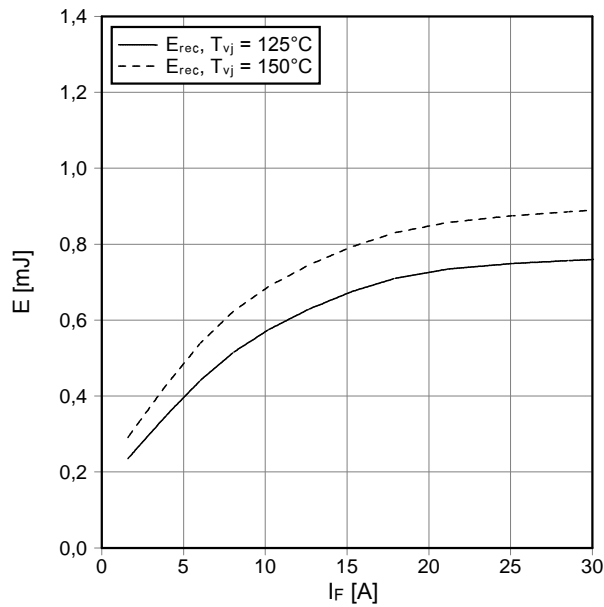
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Vorläufige Daten  
preliminary data

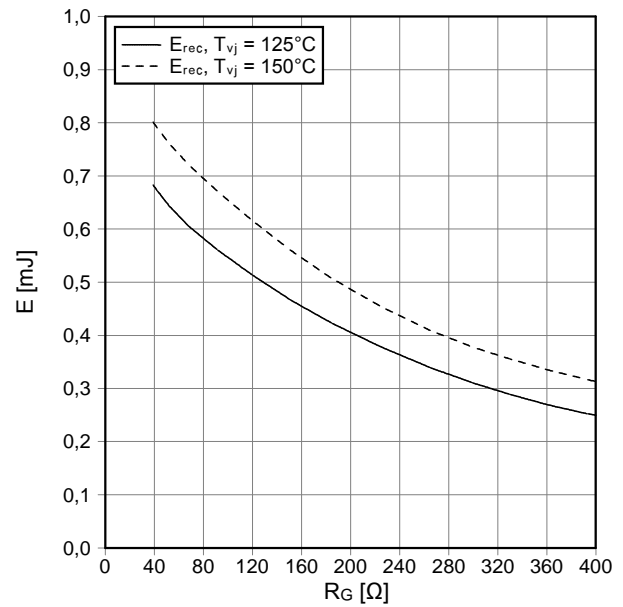
Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 39 \Omega, V_{CE} = 600 V$



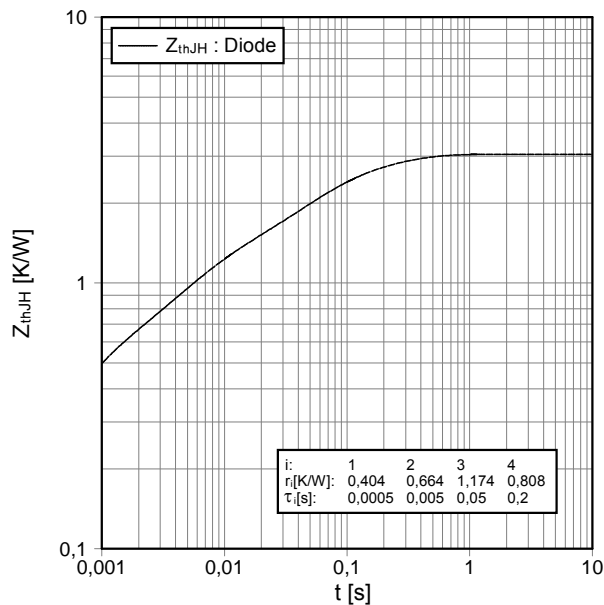
Schaltverluste Diode-Wechselr. (typisch)  
switching losses diode-inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 15 A, V_{CE} = 600 V$



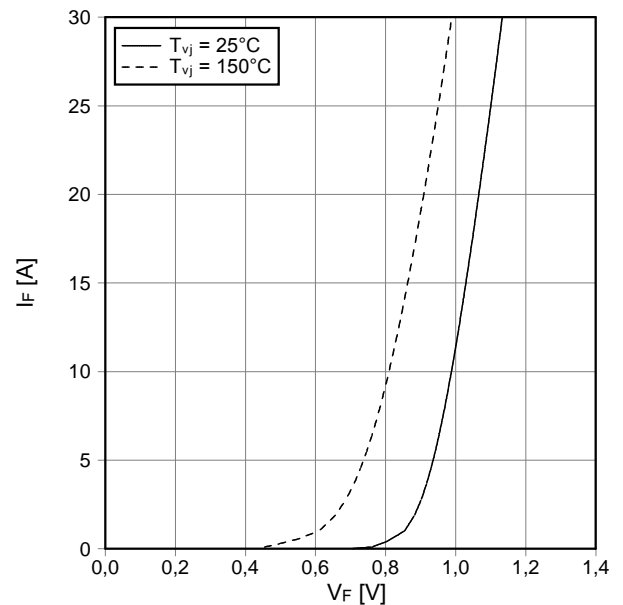
Transienter Wärmewiderstand Diode-Wechselr.  
transient thermal impedance diode-inverter

$Z_{thJH} = f(t)$



Durchlasskennlinie der Diode-Gleichrichter (typisch)  
forward characteristic of diode-rectifier (typical)

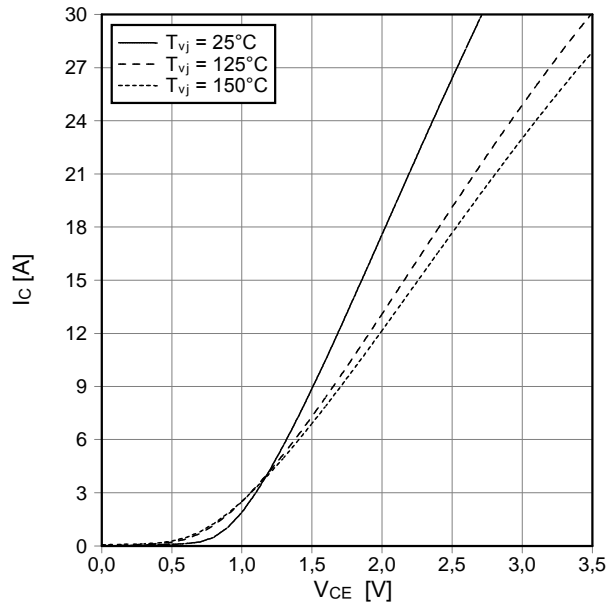
$I_F = f(V_F)$



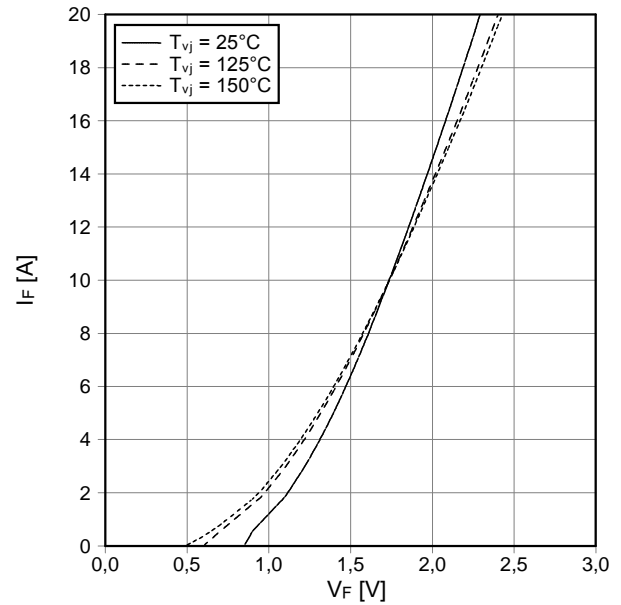
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Vorläufige Daten  
preliminary data

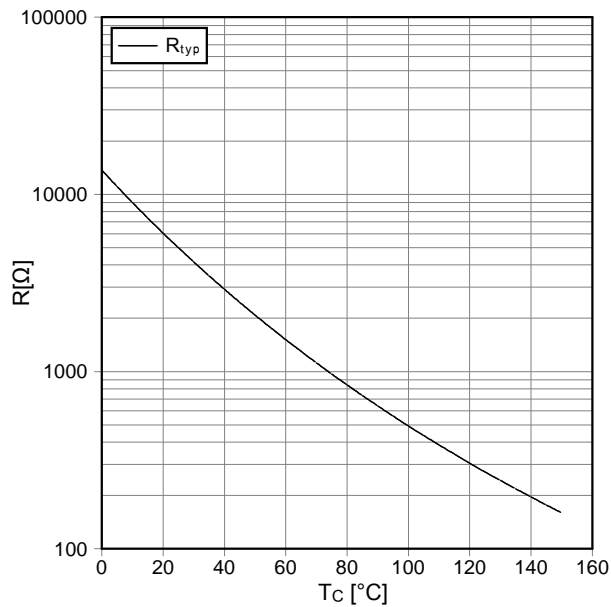
Ausgangskennlinie IGBT-Brems-Chopper (typisch)  
output characteristic IGBT-brake-chopper (typical)  
 $I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



Durchlasskennlinie der Diode-Brems-Chopper (typisch)  
forward characteristic of Diode-brake-chopper (typical)  
 $I_F = f(V_F)$

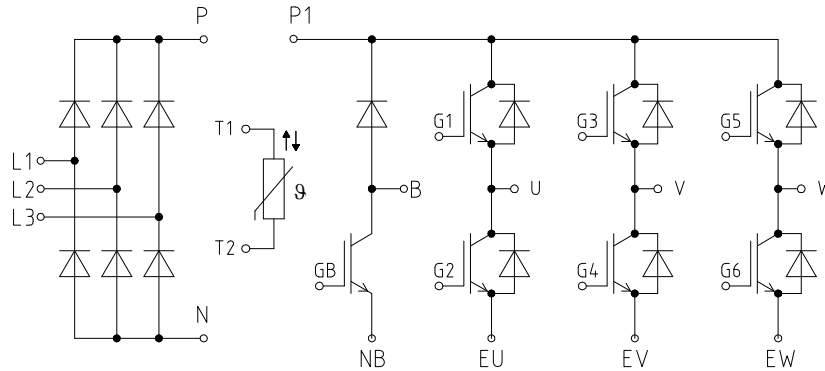


NTC-Temperaturkennlinie (typisch)  
NTC-temperature characteristic (typical)  
 $R = f(T)$

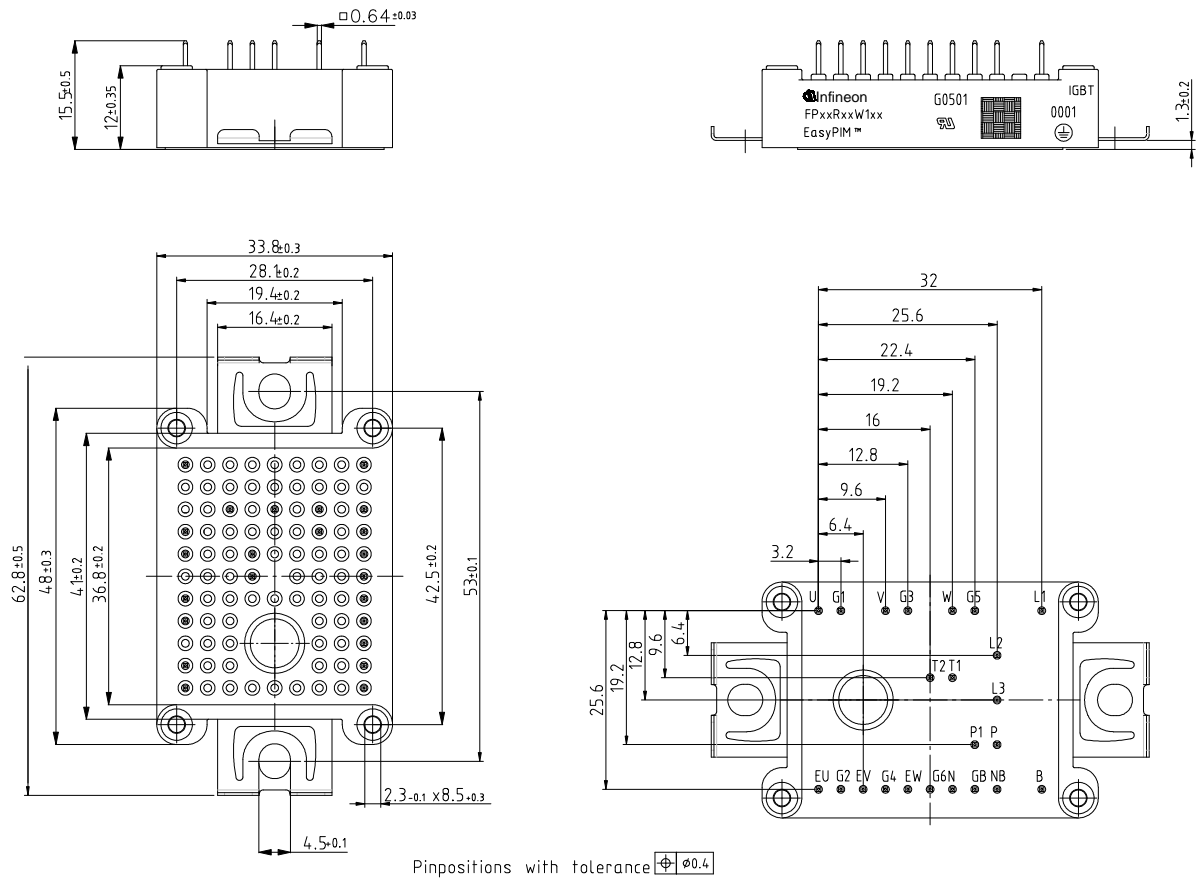


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**Schaltplan / circuit diagram**



**Gehäuseabmessungen / package outlines**



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