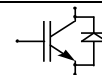


# Technische Information / Technical Information

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### Elektrische Eigenschaften / Electrical properties

#### Höchstzulässige Werte / Maximum rated values

##### Diode Gleichrichter/ Diode Rectifier

|                                                                            |                                                                                                     |             |            |                                              |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------|------------|----------------------------------------------|
| Periodische Rückw. Spitzensperrspannung<br>repetitive peak reverse voltage |                                                                                                     | $V_{RRM}$   | 1600       | V                                            |
| Durchlaßstrom Grenzeffektivwert<br>RMS forward current per chip            |                                                                                                     | $I_{FRMSM}$ | 40         | A                                            |
| Dauergleichstrom<br>DC forward current                                     | $T_C = 80^\circ\text{C}$                                                                            | $I_d$       | 20         | A                                            |
| Stoßstrom Grenzwert<br>surge forward current                               | $t_p = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$<br>$t_p = 10\text{ ms}, T_{vj} = 150^\circ\text{C}$ | $I_{FSM}$   | 300<br>230 | A<br>A                                       |
| Grenzlastintegral<br>$I^2t$ - value                                        | $t_p = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$<br>$t_p = 10\text{ ms}, T_{vj} = 150^\circ\text{C}$ | $I^2t$      | 450<br>260 | $\text{A}^2\text{s}$<br>$\text{A}^2\text{s}$ |

##### Transistor Wechselrichter/ Transistor Inverter

|                                                                          |                                                      |                       |          |        |
|--------------------------------------------------------------------------|------------------------------------------------------|-----------------------|----------|--------|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             |                                                      | $V_{CES}$             | 600      | V      |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 80^\circ\text{C}$<br>$T_C = 25^\circ\text{C}$ | $I_{C,nom.}$<br>$I_C$ | 20<br>35 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$          | $I_{CRM}$             | 40       | A      |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^\circ\text{C}$                             | $P_{tot}$             | 130      | W      |
| Gate-Emitter-Spitzenspannung<br>gate-emitter peak voltage                |                                                      | $V_{GES}$             | +/- 20V  | V      |

##### Diode Wechselrichter/ Diode Inverter

|                                                            |                                                                  |           |     |                      |
|------------------------------------------------------------|------------------------------------------------------------------|-----------|-----|----------------------|
| Dauergleichstrom<br>DC forward current                     | $T_C = 80^\circ\text{C}$                                         | $I_F$     | 20  | A                    |
| Periodischer Spitzenstrom<br>repetitive peak forw. current | $t_p = 1\text{ ms}$                                              | $I_{FRM}$ | 40  | A                    |
| Grenzlastintegral<br>$I^2t$ - value                        | $V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$ | $I^2t$    | 130 | $\text{A}^2\text{s}$ |

##### Transistor Brems-Chopper/ Transistor Brake-Chopper

|                                                                          |                                                      |                       |          |        |
|--------------------------------------------------------------------------|------------------------------------------------------|-----------------------|----------|--------|
| Kollektor-Emitter-Sperrspannung<br>collector-emitter voltage             |                                                      | $V_{CES}$             | 600      | V      |
| Kollektor-Dauergleichstrom<br>DC-collector current                       | $T_C = 80^\circ\text{C}$<br>$T_C = 25^\circ\text{C}$ | $I_{C,nom.}$<br>$I_C$ | 10<br>20 | A<br>A |
| Periodischer Kollektor Spitzenstrom<br>repetitive peak collector current | $t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$          | $I_{CRM}$             | 20       | A      |
| Gesamt-Verlustleistung<br>total power dissipation                        | $T_C = 25^\circ\text{C}$                             | $P_{tot}$             | 80       | W      |
| Gate-Emitter-Spitzenspannung<br>gate-emitter peak voltage                |                                                      | $V_{GES}$             | +/- 20V  | V      |

##### Diode Brems-Chopper/ Diode Brake-Chopper

|                                                            |                          |           |    |   |
|------------------------------------------------------------|--------------------------|-----------|----|---|
| Dauergleichstrom<br>DC forward current                     | $T_C = 80^\circ\text{C}$ | $I_F$     | 10 | A |
| Periodischer Spitzenstrom<br>repetitive peak forw. current | $t_p = 1\text{ ms}$      | $I_{FRM}$ | 20 | A |

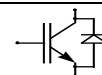
|                             |                                 |
|-----------------------------|---------------------------------|
| prepared by: Andreas Schulz | date of publication: 17.09.1999 |
| approved by: M. Hierholzer  | revision: 3                     |

# Technische Information / Technical Information

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### Modul Isolation/ Module Isolation

|                                                    |                                                          |                   |     |    |
|----------------------------------------------------|----------------------------------------------------------|-------------------|-----|----|
| Isolations-Prüfspannung<br>insulation test voltage | RMS, f = 50 Hz, t = 1 min.<br>NTC connected to Baseplate | V <sub>ISOL</sub> | 2,5 | kV |
|----------------------------------------------------|----------------------------------------------------------|-------------------|-----|----|

## Elektrische Eigenschaften / Electrical properties

### Charakteristische Werte / Characteristic values

| Diode Gleichrichter/ Diode Rectifier                                         |                                                  | min.                 |   | typ. |      | max. |  |
|------------------------------------------------------------------------------|--------------------------------------------------|----------------------|---|------|------|------|--|
| Durchlaßspannung<br>forward voltage                                          | T <sub>vj</sub> = 150°C, I <sub>F</sub> = 20 A   | V <sub>F</sub>       | - | 1    | 1,05 | V    |  |
| Schleusenspannung<br>threshold voltage                                       | T <sub>vj</sub> = 150°C                          | V <sub>(TO)</sub>    | - | -    | 0,8  | V    |  |
| Ersatzwiderstand<br>slope resistance                                         | T <sub>vj</sub> = 150°C                          | r <sub>T</sub>       | - | -    | 10,5 | mΩ   |  |
| Sperrstrom<br>reverse current                                                | T <sub>vj</sub> = 150°C, V <sub>R</sub> = 1600 V | I <sub>R</sub>       | - | 2    | -    | mA   |  |
| Modul Leitungswiderstand, Anschlüsse-Chip<br>lead resistance, terminals-chip | T <sub>C</sub> = 25°C                            | R <sub>AA'+CC'</sub> | - | 8    | -    | mΩ   |  |

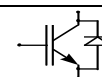
| Transistor Wechselrichter/ Transistor Inverter                               |                                                                                                                                                | min.                |     | typ. |      | max. |  |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----|------|------|------|--|
| Kollektor-Emitter Sättigungsspannung<br>collector-emitter saturation voltage | V <sub>GE</sub> = 15V, T <sub>vj</sub> = 25°C, I <sub>C</sub> = 20 A                                                                           | V <sub>CE sat</sub> | -   | 1,95 | 2,45 | V    |  |
|                                                                              | V <sub>GE</sub> = 15V, T <sub>vj</sub> = 125°C, I <sub>C</sub> = 20 A                                                                          |                     | -   | 2,2  | -    | V    |  |
| Gate-Schwellenspannung<br>gate threshold voltage                             | V <sub>CE</sub> = V <sub>GE</sub> , T <sub>vj</sub> = 25°C, I <sub>C</sub> = 0,5 mA                                                            | V <sub>GE(TO)</sub> | 4,5 | 5,5  | 6,5  | V    |  |
| Eingangskapazität<br>input capacitance                                       | f = 1MHz, T <sub>vj</sub> = 25°C<br>V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V                                                              | C <sub>ies</sub>    | -   | 1,1  | -    | nF   |  |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current             | V <sub>GE</sub> = 0V, T <sub>vj</sub> = 25°C, V <sub>CE</sub> = 600 V                                                                          | I <sub>CES</sub>    | -   | 0,7  | 500  | μA   |  |
|                                                                              | V <sub>GE</sub> = 0V, T <sub>vj</sub> = 125°C, V <sub>CE</sub> = 600 V                                                                         |                     | -   | 1,0  | -    | mA   |  |
| Gate-Emitter Reststrom<br>gate-emitter leakage current                       | V <sub>CE</sub> = 0V, V <sub>GE</sub> = 20V, T <sub>vj</sub> = 25°C                                                                            | I <sub>GES</sub>    | -   | -    | 300  | nA   |  |
| Einschaltverzögerungszeit (ind. Last)<br>turn on delay time (inductive load) | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | t <sub>d,on</sub>   | -   | 50   | -    | ns   |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 25°C, R <sub>G</sub> = 47 Ohm                                                                        |                     |     |      |      |      |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
| Anstiegszeit (induktive Last)<br>rise time (inductive load)                  | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | t <sub>r</sub>      | -   | 50   | -    | ns   |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 25°C, R <sub>G</sub> = 47 Ohm                                                                        |                     |     |      |      |      |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
| Abschaltverzögerungszeit (ind. Last)<br>turn off delay time (inductive load) | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | t <sub>d,off</sub>  | -   | 250  | -    | ns   |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 25°C, R <sub>G</sub> = 47 Ohm                                                                        |                     |     |      |      |      |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
| Fallzeit (induktive Last)<br>fall time (inductive load)                      | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | t <sub>f</sub>      | -   | 30   | -    | ns   |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 25°C, R <sub>G</sub> = 47 Ohm                                                                        |                     |     |      |      |      |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
| Einschaltverlustenergie pro Puls<br>turn-on energy loss per pulse            | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | E <sub>on</sub>     | -   | 0,9  | -    | mWs  |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
|                                                                              | L <sub>S</sub> = 75 nH                                                                                                                         |                     |     |      |      |      |  |
| Abschaltverlustenergie pro Puls<br>turn-off energy loss per pulse            | I <sub>C</sub> = I <sub>Nenn</sub> , V <sub>CC</sub> = 300 V                                                                                   | E <sub>off</sub>    | -   | 0,7  | -    | mWs  |  |
|                                                                              | V <sub>GE</sub> = ±15V, T <sub>vj</sub> = 125°C, R <sub>G</sub> = 47 Ohm                                                                       |                     |     |      |      |      |  |
|                                                                              | L <sub>S</sub> = 75 nH                                                                                                                         |                     |     |      |      |      |  |
| Kurzschlußverhalten<br>SC Data                                               | t <sub>p</sub> ≤ 10μs, V <sub>GE</sub> ≤ 15V, R <sub>G</sub> = 47 Ohm<br>T <sub>vj</sub> ≤ 125°C, V <sub>CC</sub> = 360 V<br>dI/dt = 1200 A/μs | I <sub>SC</sub>     | -   | 80   | -    | A    |  |

# Technische Information / Technical Information

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### Elektrische Eigenschaften / Electrical properties

#### Charakteristische Werte / Characteristic values

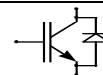
|                                                                              |                                                                                                                                                    |                 | min. | typ.         | max.      |            |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|--------------|-----------|------------|
| Modulinduktivität<br>stray inductance module                                 |                                                                                                                                                    | $L_{\sigma CE}$ | -    | -            | 100       | nH         |
| Modul Leitungswiderstand, Anschlüsse-Chip<br>lead resistance, terminals-chip | $T_C = 25^\circ C$                                                                                                                                 | $R_{CC'+EE'}$   | -    | 11           | -         | mΩ         |
| <b>Diode Wechselrichter/ Diode Inverter</b>                                  |                                                                                                                                                    |                 | min. | typ.         | max.      |            |
| Durchlaßspannung<br>forward voltage                                          | $V_{GE} = 0V, T_{vj} = 25^\circ C, I_F = 20 A$<br>$V_{GE} = 0V, T_{vj} = 125^\circ C, I_F = 20 A$                                                  | $V_F$           | -    | 1,25<br>1,2  | 1,7<br>-  | V<br>V     |
| Rückstromspitze<br>peak reverse recovery current                             | $I_F = I_{Nenn}, -di_F/dt = 700A/\mu s$<br>$V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$<br>$V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$ | $I_{RM}$        | -    | 20<br>25     | -<br>-    | A<br>A     |
| Sperrverzögerungsladung<br>recovered charge                                  | $I_F = I_{Nenn}, -di_F/dt = 700A/\mu s$<br>$V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$<br>$V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$ | $Q_r$           | -    | 1,7<br>2,7   | -<br>-    | μAs<br>μAs |
| Abschaltenergie pro Puls<br>reverse recovery energy                          | $I_F = I_{Nenn}, -di_F/dt = 700A/\mu s$<br>$V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$<br>$V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$ | $E_{RQ}$        | -    | 0,35<br>0,55 | -<br>-    | mWs<br>mWs |
| <b>Transistor Brems-Chopper/ Transistor Brake-Chopper</b>                    |                                                                                                                                                    |                 | min. | typ.         | max.      |            |
| Kollektor-Emitter Sättigungsspannung<br>collector-emitter saturation voltage | $V_{GE} = 15V, T_{vj} = 25^\circ C, I_C = 10,0 A$<br>$V_{GE} = 15V, T_{vj} = 125^\circ C, I_C = 10,0 A$                                            | $V_{CE sat}$    | -    | 1,95<br>2,2  | 2,35<br>- | V<br>V     |
| Gate-Schwellenspannung<br>gate threshold voltage                             | $V_{CE} = V_{GE}, T_{vj} = 25^\circ C, I_C = 0,35mA$                                                                                               | $V_{GE(TO)}$    | 4,5  | 5,5          | 6,5       | V          |
| Eingangskapazität<br>input capacitance                                       | $f = 1MHz, T_{vj} = 25^\circ C$<br>$V_{CE} = 25 V, V_{GE} = 0 V$                                                                                   | $C_{ies}$       | -    | 0,6          | -         | nF         |
| Kollektor-Emitter Reststrom<br>collector-emitter cut-off current             | $V_{GE} = 0V, T_{vj} = 25^\circ C, V_{CE} = 600 V$<br>$V_{GE} = 0V, T_{vj} = 125^\circ C, V_{CE} = 600 V$                                          | $I_{CES}$       | -    | 0,5<br>0,8   | 500<br>-  | μA<br>mA   |
| Gate-Emitter Reststrom<br>gate-emitter leakage current                       | $V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$                                                                                                   | $I_{GES}$       | -    | -            | 300       | nA         |
| <b>Diode Brems-Chopper/ Diode Brake-Chopper</b>                              |                                                                                                                                                    |                 | min. | typ.         | max.      |            |
| Durchlaßspannung<br>forward voltage                                          | $T_{vj} = 25^\circ C, I_F = 10,0 A$<br>$T_{vj} = 125^\circ C, I_F = 10,0 A$                                                                        | $V_F$           | -    | 1,25<br>1,2  | 1,75<br>- | V<br>V     |
| <b>NTC-Widerstand/ NTC-Thermistor</b>                                        |                                                                                                                                                    |                 | min. | typ.         | max.      |            |
| Nennwiderstand<br>rated resistance                                           | $T_C = 25^\circ C$                                                                                                                                 | $R_{25}$        | -    | 5            | -         | kΩ         |
| Abweichung von $R_{100}$<br>deviation of $R_{100}$                           | $T_C = 100^\circ C, R_{100} = 493 \Omega$                                                                                                          | $\Delta R/R$    | -5   |              | 5         | %          |
| Verlustleistung<br>power dissipation                                         | $T_C = 25^\circ C$                                                                                                                                 | $P_{25}$        |      |              | 20        | mW         |
| B-Wert<br>B-value                                                            | $R_2 = R_1 \exp [B(1/T_2 - 1/T_1)]$                                                                                                                | $B_{25/50}$     |      | 3375         |           | K          |

# Technische Information / Technical Information

IGBT-Module  
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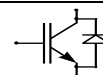


### Thermische Eigenschaften / Thermal properties

|                                                                        |                                |            | min. | typ. | max. |     |
|------------------------------------------------------------------------|--------------------------------|------------|------|------|------|-----|
| Innerer Wärmewiderstand<br>thermal resistance, junction to case        | Gleichr. Diode/ Rectif. Diode  | $R_{thJC}$ | -    | -    | 1    | K/W |
|                                                                        | Trans. Wechr./ Trans. Inverter |            | -    | -    | 1    | K/W |
|                                                                        | Diode Wechr./ Diode Inverter   |            | -    | -    | 1,5  | K/W |
|                                                                        | Trans. Bremse/ Trans. Brake    |            | -    | -    | 1,5  | K/W |
|                                                                        | Diode Bremse/ Diode Brake      |            | -    | -    | 2,3  | K/W |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink      | Gleichr. Diode/ Rectif. Diode  | $R_{thCK}$ | -    | 0,08 | -    | K/W |
|                                                                        | Trans. Wechr./ Trans. Inverter |            | -    | 0,04 | -    | K/W |
|                                                                        | Diode Wechr./ Diode Inverter   |            | -    | 0,08 | -    | K/W |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature |                                | $T_{vj}$   | -    | -    | 150  | °C  |
| Betriebstemperatur<br>operation temperature                            |                                | $T_{op}$   | -40  | -    | 125  | °C  |
| Lagertemperatur<br>storage temperature                                 |                                | $T_{stg}$  | -40  | -    | 125  | °C  |

### Mechanische Eigenschaften / Mechanical properties

|                                                          |  |   |           |    |
|----------------------------------------------------------|--|---|-----------|----|
| Innere Isolation<br>internal insulation                  |  |   | $Al_2O_3$ |    |
| CTI<br>comperative tracking index                        |  |   | 225       |    |
| Anzugsdrehmoment f. mech. Befestigung<br>mounting torque |  | M | 3<br>±10% | Nm |
| Gewicht<br>weight                                        |  | G | 180       | g  |

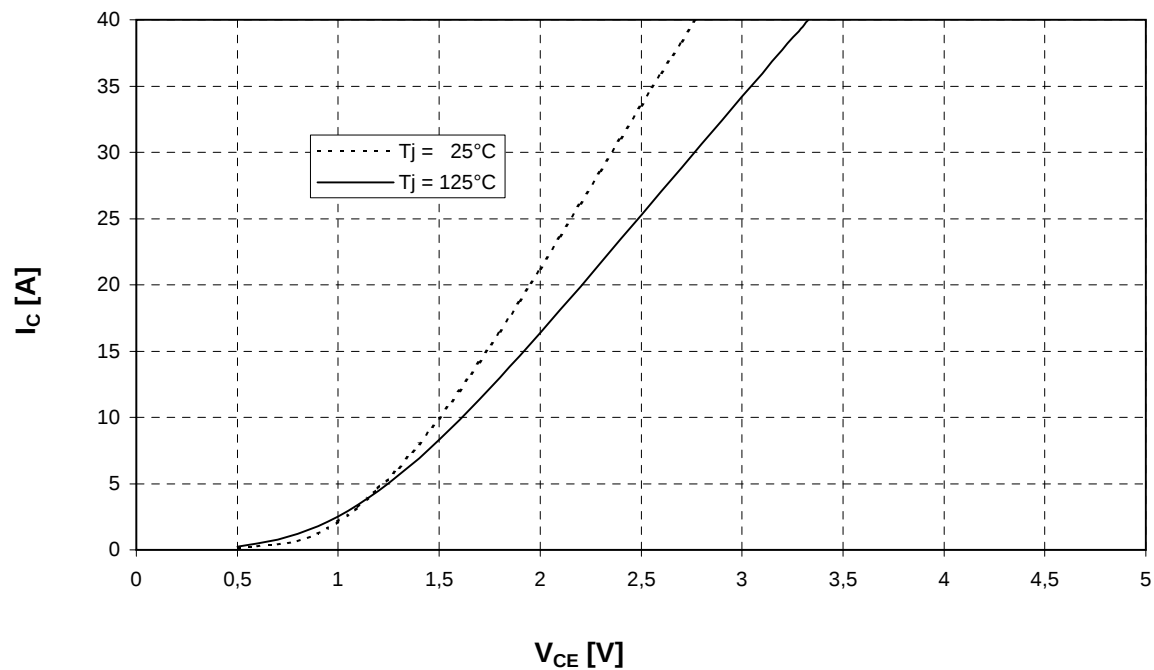


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

$$I_c = f(V_{CE})$$

$$V_{GE} = 15 \text{ V}$$

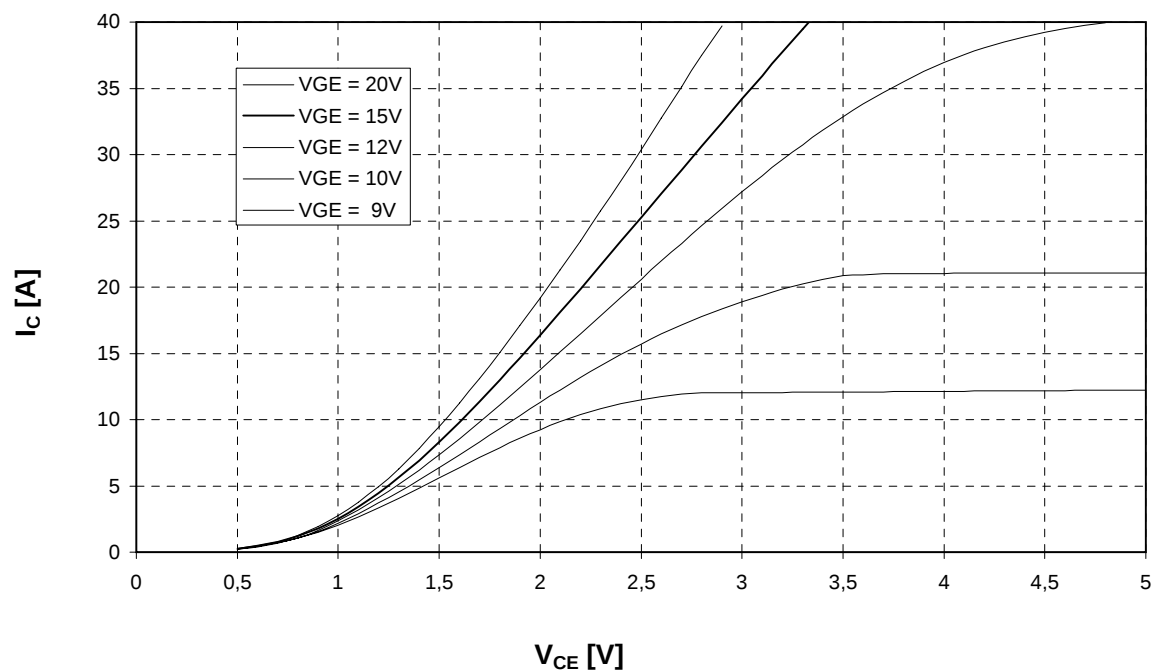


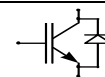
Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

$$I_c = f(V_{CE})$$

$$T_{vj} = 125^\circ\text{C}$$



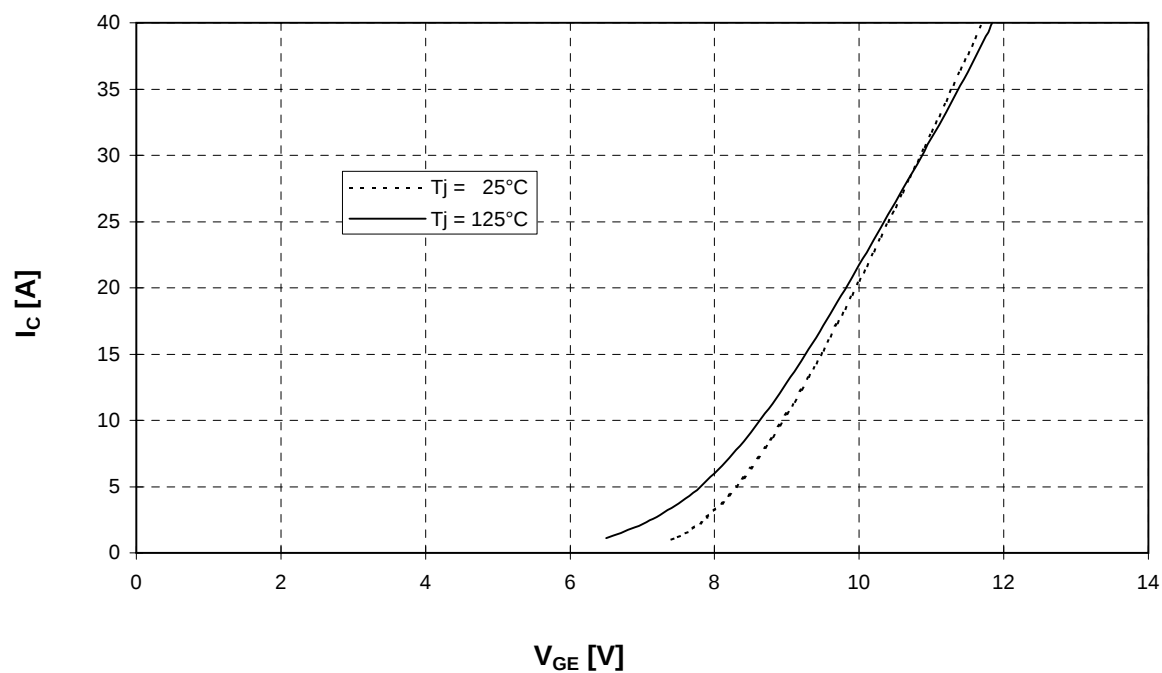


Übertragungscharakteristik Wechselr. (typisch)

Transfer characteristic Inverter (typical)

$$I_c = f(V_{GE})$$

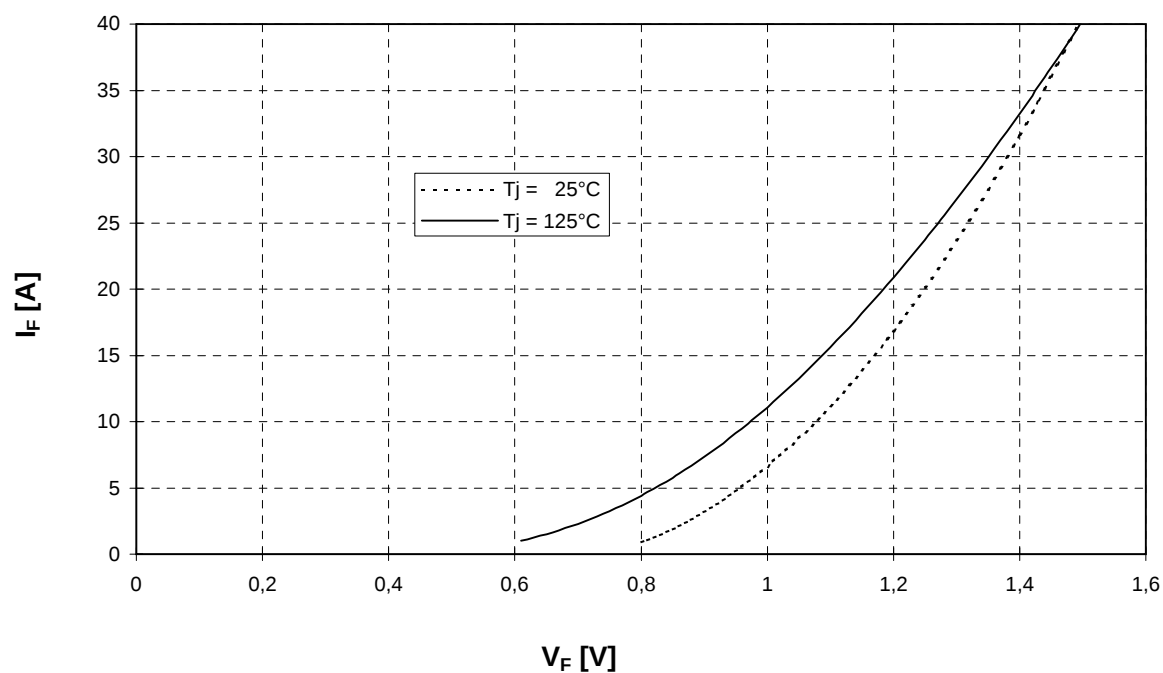
$$V_{CE} = 20 \text{ V}$$

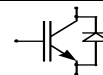


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)

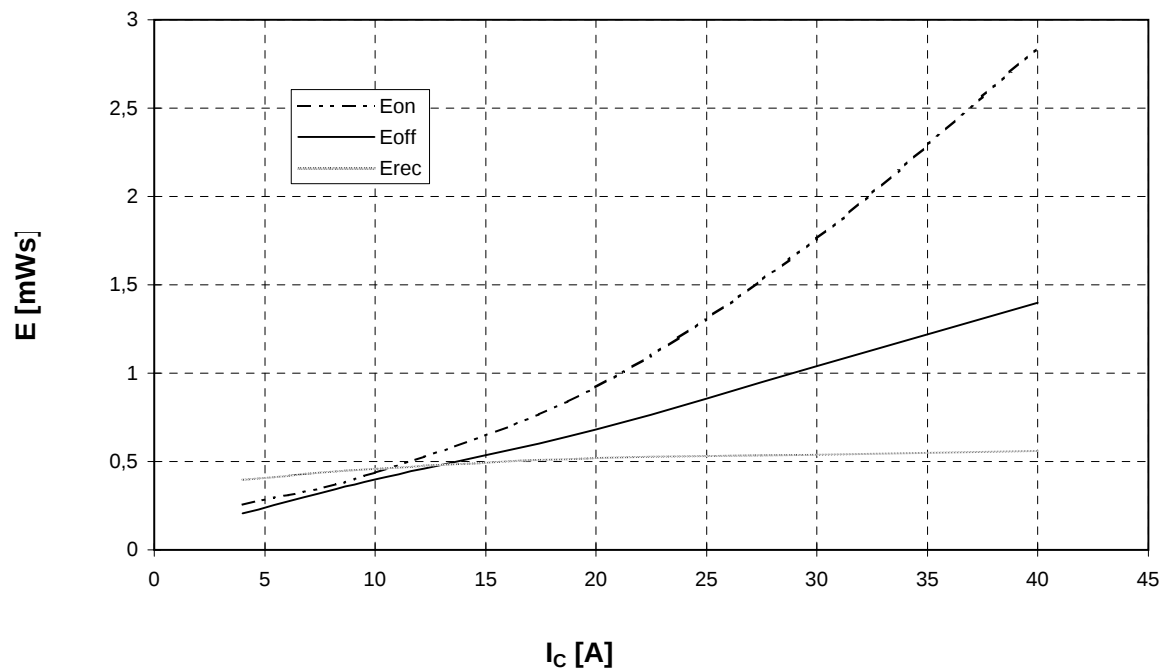
Forward characteristic of FWD Inverter (typical)

$$I_F = f(V_F)$$

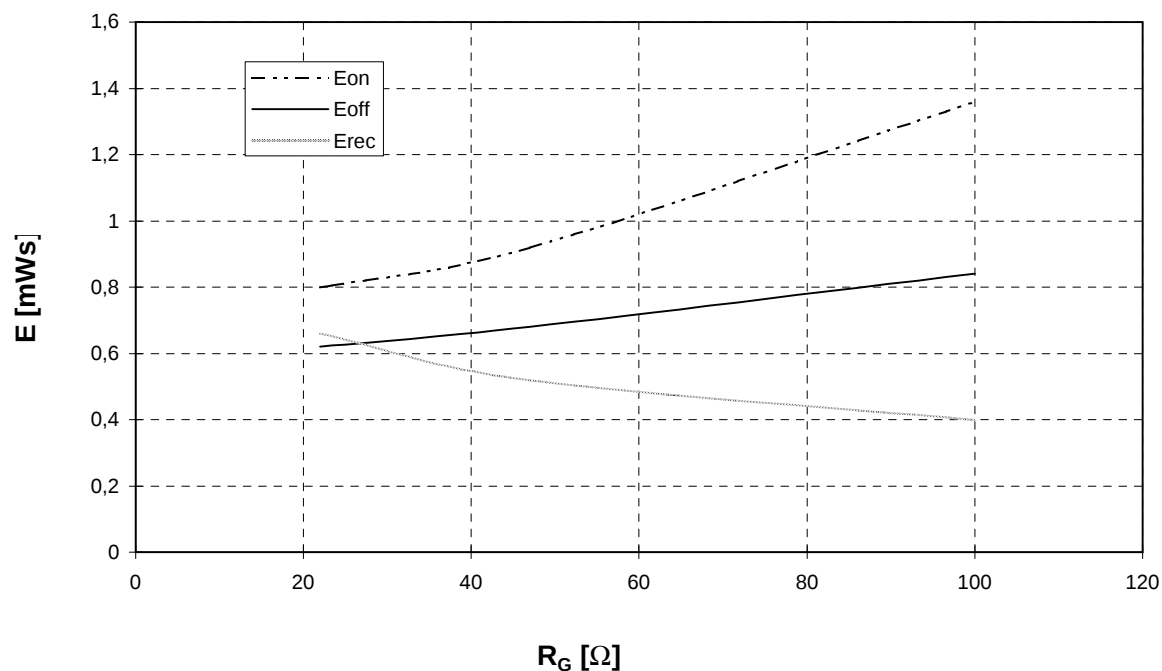


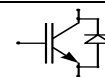


Schaltverluste Wechselr. (typisch)  $E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$ ,  $E_{rec} = f(I_C)$   $V_{CC} = 300\text{ V}$   
Switching losses Inverter (typical)  $T_j = 125^\circ\text{C}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = R_{Goff} = 47\text{ Ohm}$



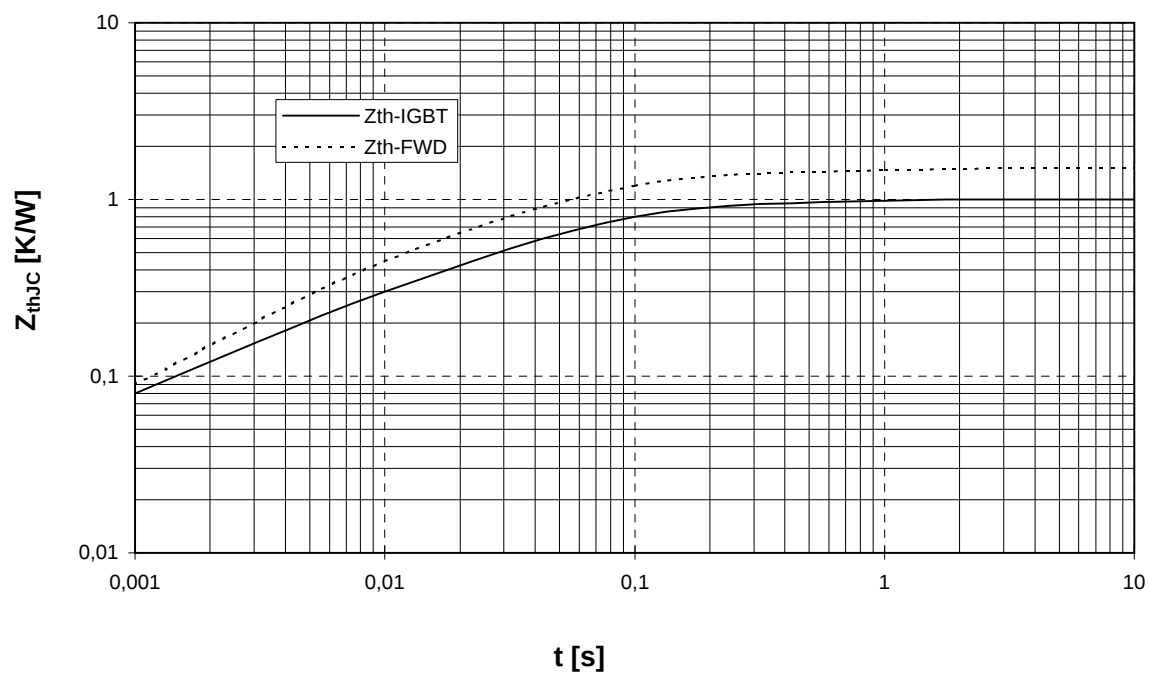
Schaltverluste Wechselr. (typisch)  $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$ ,  $E_{rec} = f(R_G)$   
Switching losses Inverter (typical)  $T_j = 125^\circ\text{C}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = I_{nenn}$ ,  $V_{CC} = 300\text{ V}$





Transienter Wärmewiderstand Wechsell.  
Transient thermal impedance Inverter

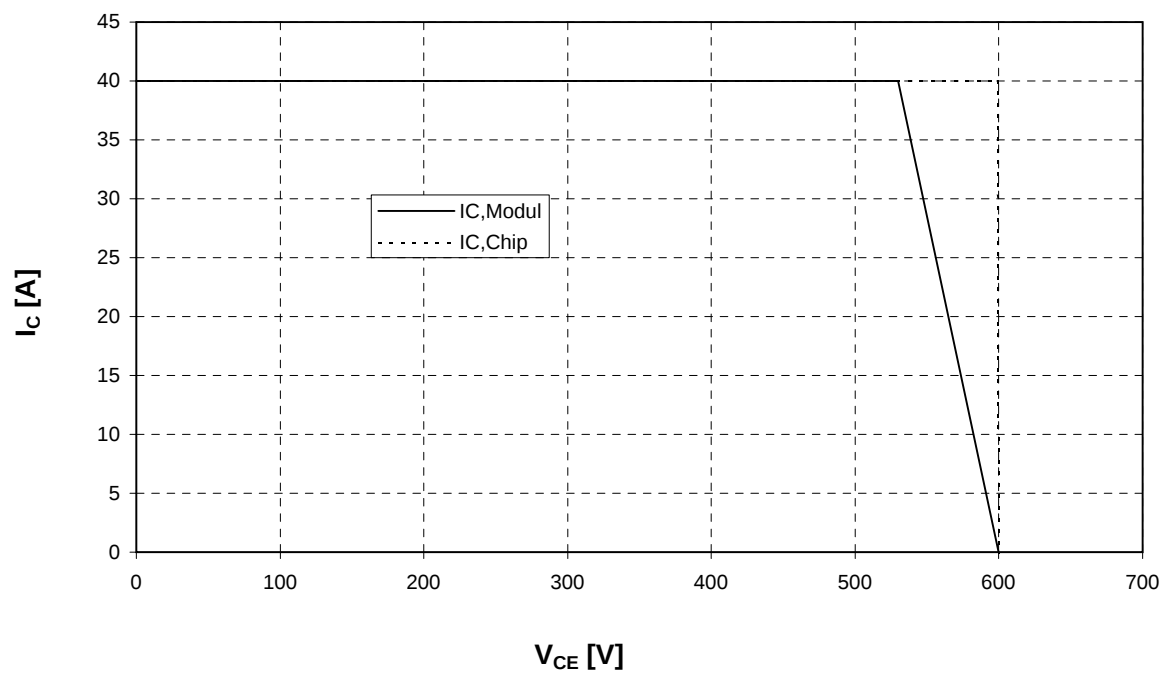
$$Z_{thJC} = f(t)$$

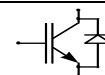


Sicherer Arbeitsbereich Wechsell. (RBSOA)

$$I_c = f(V_{CE})$$

Reverse bias safe operating area Inverter (RBSOA)  $T_{vj} = 125^\circ\text{C}$ ,  $V_{GE} = \pm 15\text{V}$ ,  $R_G = 47\ \Omega$



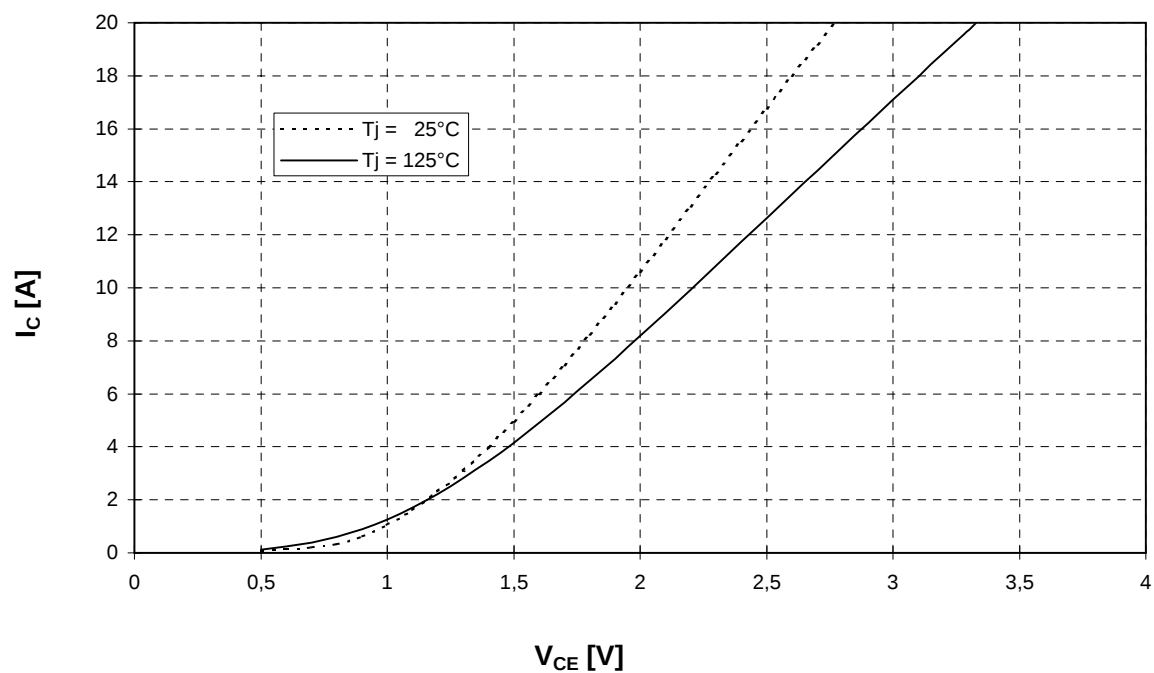


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

$d = f(V_{CE})$

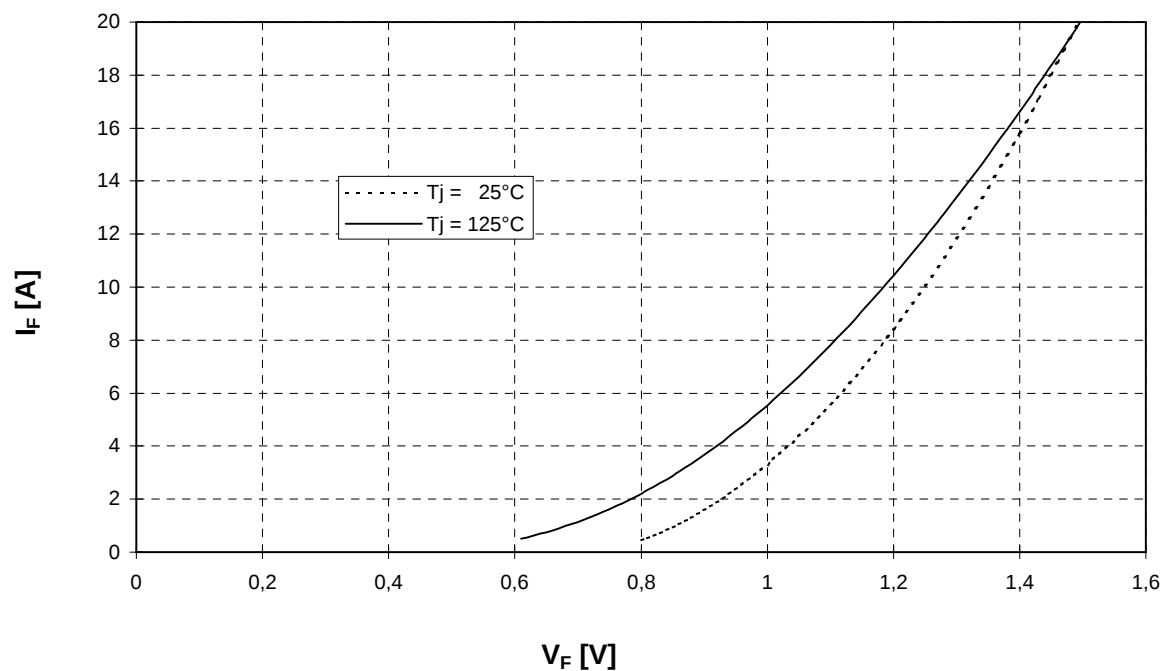
Output characteristic brake-chopper-IGBT (typical)

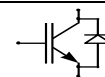
$V_{GE} = 15 \text{ V}$



Durchlaßkennlinie der Brems-Chopper-Diode (typisch)  $d = f(V_F)$

Forward characteristic of brake-chopper-FWD (typical)

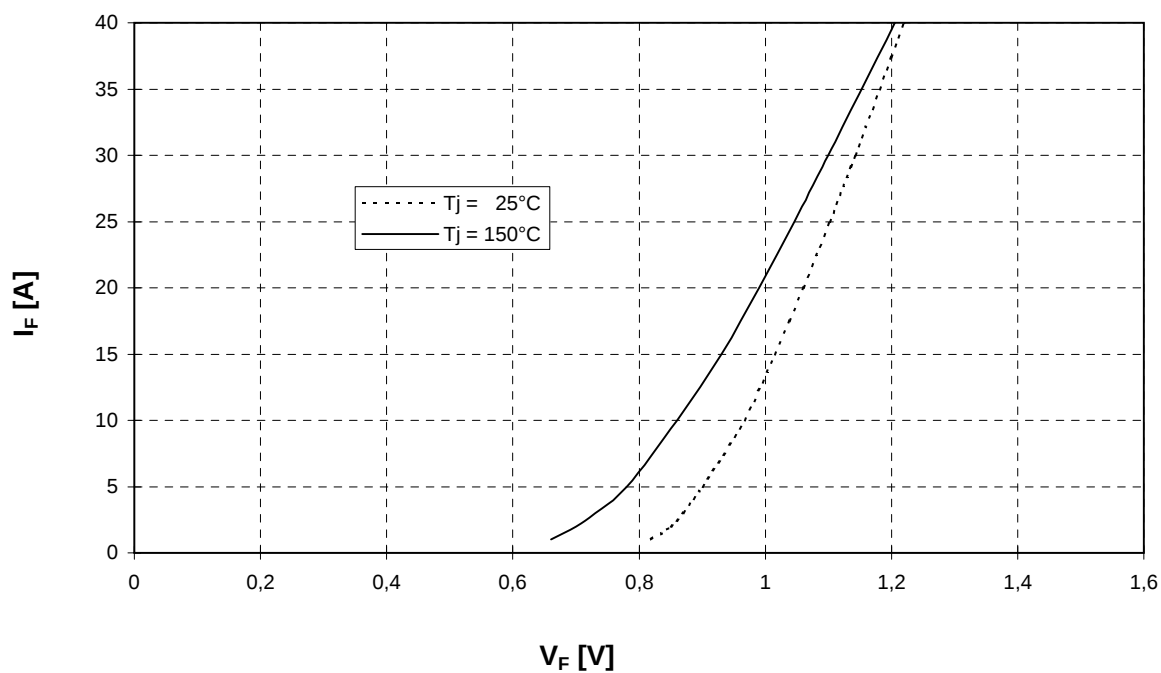




Durchlaßkennlinie der Gleichrichterdiode (typisch)

$$I_F = f(V_F)$$

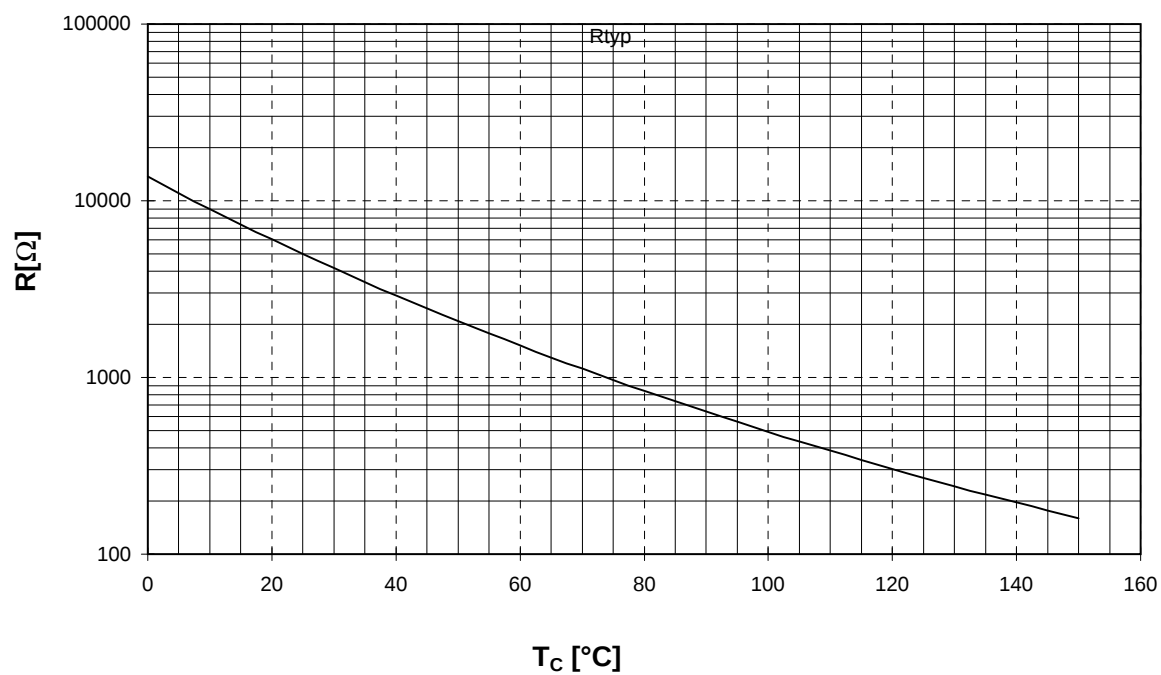
Forward characteristic of Rectifier Diode (typical)

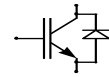


NTC- Temperaturkennlinie (typisch)

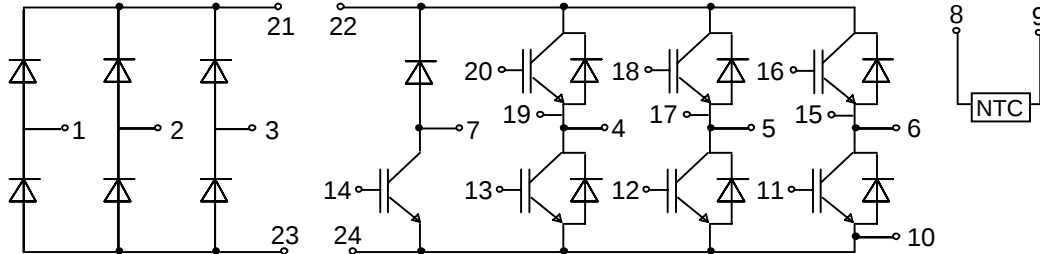
$$R = f(T)$$

NTC- temperature characteristic (typical)

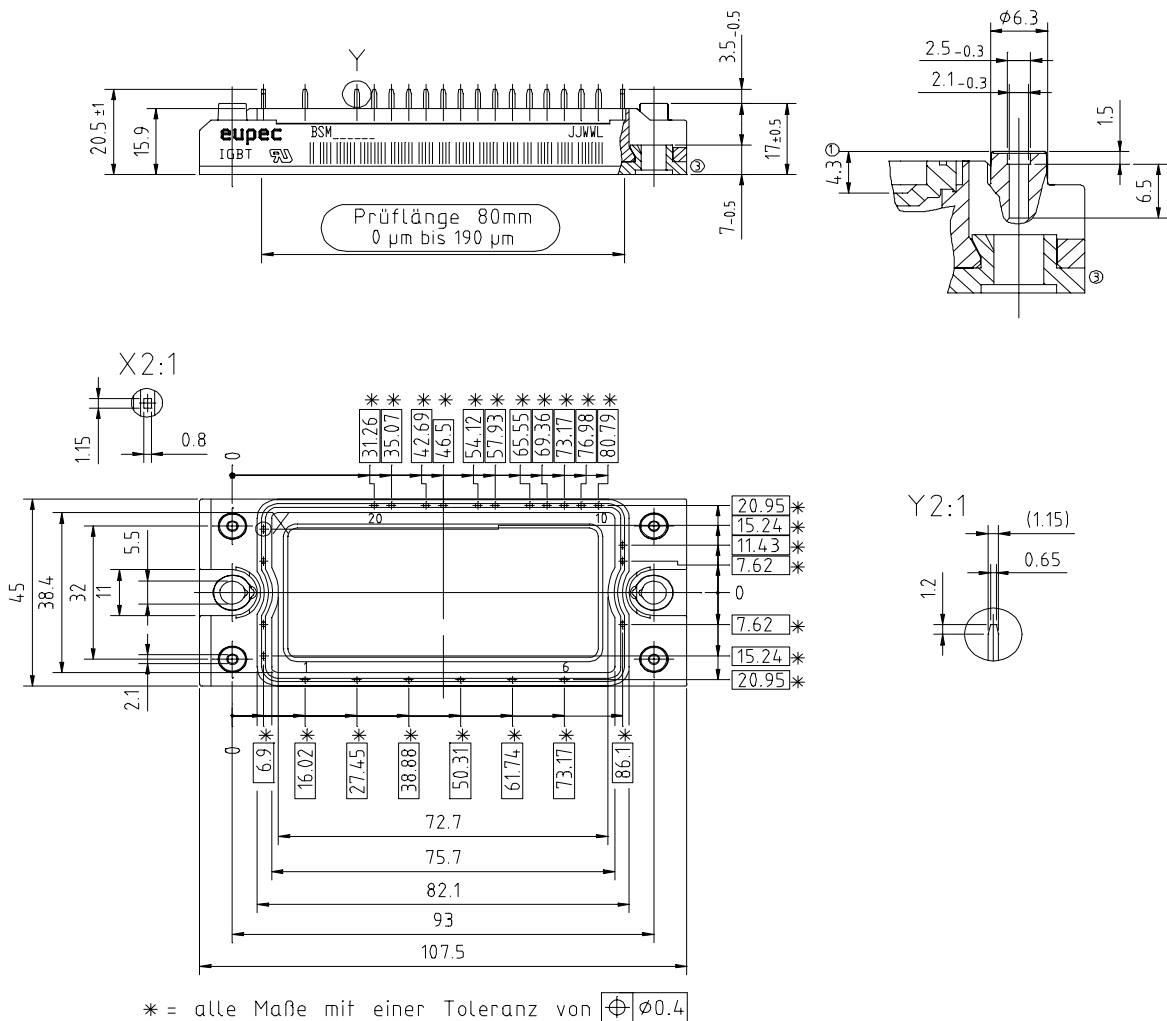




## Schaltplan/ Circuit diagram



## Gehäuseabmessungen/ Package outlines



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