# Maximum Ratings / Höchstzulässige Werte

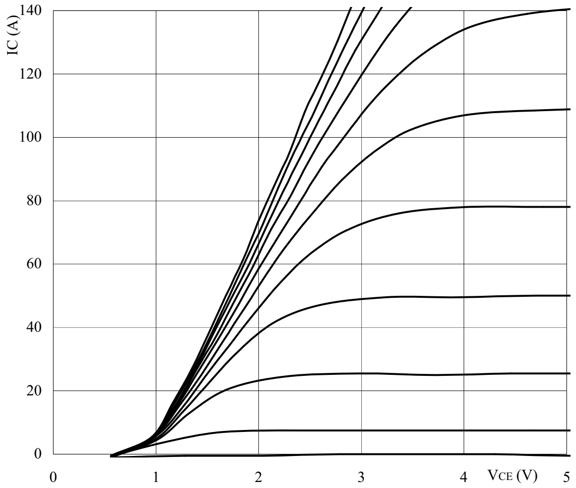
| Parameter | Condition | | Symbol | Datasheet values | Unit |
|---|---|---|---|---|---|
| | | | | max. | |
| **Transistor Inverter**<br>**Transistor Wechselrichter** | | | | | |
| Collector-emitter break down voltage<br>Kollektor-Emitter-Sperrspannung | | | $V_{CE}$ | 1200 | V |
| DC collector current<br>Kollektor-Dauergleichstrom | $T_j$=150°C | $T_h$=80°C,<br>$T_c$=80°C | $I_C$ | 38<br>50 limited by bond | A |
| Repetitive peak collector current<br>Periodischer Kollektorspitzenstrom | $t_p$=1ms | $T_h$=80°C | $I_{cpuls}$ | 76 | A |
| Power dissipation per IGBT<br>Verlustleistung pro IGBT | $T_j$=150°C | $T_h$=80°C<br>$T_c$=80°C | $P_{tot}$ | 68<br>102 | W |
| Gate-emitter peak voltage<br>Gate-Emitter-Spitzenspannung | | | $V_{GE}$ | ±20 | V |
| SC withstand time<br>Kurzschlußverhalten | Tj≤125°C | $V_{GE}$=15V | $t_{SC}$<br>$V_{CC}$ | 10<br>900 | us<br>V |
| **Diode Inverter**<br>**Diode Wechselrichter** | | | | | |
| DC forward current<br>Dauergleichstrom | $T_j$=150°C | $T_h$=80°C,<br>$T_c$=80°C | $I_F$ | 26<br>35,5 | A |
| Repetitive peak forward current<br>Periodischer Spitzenstrom | $t_p$=1ms | $T_h$=80°C | $I_{FRM}$ | 52 | A |
| Power dissipation per Diode<br>Verlustleistung pro Diode | $T_j$=150°C | $T_h$=80°C<br>$T_c$=80°C | $P_{tot}$ | 41<br>62 | W |
| **Thermal properties**<br>**Thermische Eigenschaften** | | | | | |
| max. Chip temperature<br>max. Chiptemperatur | | | $T_{jmax}$ | 150 | °C |
| Storage temperature<br>Lagertemperatur | | | $T_{stg}$ | -40…+125 | °C |
| Operation temperature<br>Betriebstemperatur | | | $T_{op}$ | -40…+125 | °C |
| **Insulation properties**<br>**Modulisolation** | | | | | |
| Insulation voltage<br>Isolationsspannung | | t=1min | $V_{is}$ | 4000 | Vdc |
| Creepage distance<br>Kriechstrecke | | | | min 12,7 | mm |
| Clearance<br>Luftstrecke | | | | min 12,7 | mm |

## Characteristic values

| Description | Symbol | Conditions T(C°) | Other conditions (Rgon-Rgoff) | VGE(V)<br>VGS(V) | VCE(V)<br>VDS(V) | IC(A)<br>IF(A)<br>Id(A) | Datasheet values Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Transistor Inverter, inductive load<br>Transistor Wechselrichter** | | | | | | | | | | |
| Gate emitter threshold voltage<br>Gate-Schwellenspannung | $V_{GE(th)}$ | Tj=25°C<br>Tj=125°C | VCE=VGE | | | 0,002 | 5 | 5,8 | 6,5 | V |
| Collector-emitter saturation voltage<br>Kollektor-Emitter Sättigungsspannung | $V_{CE(sat)}$ | Tj=25°C<br>Tj=125°C | | 15<br>15 | | 50<br>50 | | 1,71<br>1,95 | 2,3 | V |
| Collector-emitter cut-off<br>Kollektor-Emitter Reststrom | $I_{CES}$ | Tj=25°C<br>Tj=125°C | | 0 | 1200 | | | | 0,4<br>6 | mA |
| Gate-emitter leakage current<br>Gate-Emitter Reststrom | $I_{GES}$ | Tj=25°C<br>Tj=125°C | | 30 | 0 | | | | 650 | nA |
| Integrated Gate resistor<br>Integrirter Gate Widerstand | $R_{gint}$ | | | | | | | 4 | | Ohm |
| Turn-on delay time<br>Einschaltverzögerungszeit | $t_{d(on)}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 72 | | ns |
| Rise time<br>Anstiegszeit | $t_r$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 22 | | ns |
| Turn-off delay time<br>Abschaltverzögerungszeit | $t_{d(off)}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 462 | | ns |
| Fall time<br>Fallzeit | $t_f$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 182 | | ns |
| Turn-on energy loss per pulse<br>Einschaltverlustenergie pro Puls | $E_{on}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 4,87 | | mWs |
| Turn-off energy loss per pulse<br>Abschaltverlustenergie pro Puls | $E_{off}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm<br>Rgoff=18 Ohm | ±15 | 600 | 50 | | 5,12 | | mWs |
| Input capacitance<br>Eingangskapazität | $C_{ies}$ | Tj=25°C<br>Tj=125°C | f=1MHz | | | | | 3,6 | | nF |
| Output capacitance<br>Ausgangskapazität | $C_{oss}$ | Tj=25°C<br>Tj=125°C | f=1MHz | | | | | 0,18 | | nF |
| Reverse transfer capacitance<br>Rückwirkungskapazität | $C_{rss}$ | Tj=25°C<br>Tj=125°C | f=1MHz | | | | | 0,16 | | nF |
| Gate charge<br>Gate Ladung | $Q_{Gate}$ | Tj=25°C<br>Tj=125°C | | | | | | 280 | | nC |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | $R_{thJH}$ | Thermal grease thickness≤50um<br>Warmeleitpaste Dicke≤50um, λ = 0,61 W/mK | | | | | | 1,04<br>0,6864 | | K/W |
| Coupled thermal resistance inverter diode-transistor<br>Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor | $R_{thJH}$ | Thermal grease thickness≤50um<br>Warmeleitpaste Dicke≤50um, λ = 0,61 W/mK | | | | | | 0,55 | | K/W |
| **Diode Inverter<br>Diode Wechselrichter** | | | | | | | | | | |
| Diode forward voltage<br>Durchlaßspannung | $V_F$ | Tj=25°C<br>Tj=125°C | | | | 50<br>50 | | 2,35<br>2,04 | 3,35 | V |
| Peak reverse recovery current<br>Rückstromspitze | $I_{RM}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm | ±15 | 600 | 50 | | 109 | | A |
| Reverse recovery time<br>Sperreverzögerungszeit | $t_{rr}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm | ±15 | 600 | 50 | | 60 | | ns |
| Reverse recovered charge<br>Sperrverzögerungsladung | $Q_{rr}$ | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm | ±15 | 600 | 50 | | 8,4 | | uC |
| Reverse recovered energy<br>Sperrverzögerungsenergie | Erec | Tj=25°C<br>Tj=125°C | Rgon=18 Ohm | ±15 | 600 | 50 | | 2,97 | | mWs |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | $R_{thJH}$ | Thermal grease<br>Warmeleitpaste | | | | | | 1,72<br>1,1352 | | K/W |
| Coupled thermal resistance inverter transistor-diode<br>Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode | $R_{thJH}$ | Thermal grease thickness≤50um<br>Warmeleitpaste Dicke≤50um, λ = 0,61 W/mK | | | | | | 0,53 | | K/W |
| **NTC-Thermistor<br>NTC-Widerstand** | | | | | | | | | | |
| Rated resistance<br>Nennwiderstand | $R_{25}$ | Tj=25°C | Tol. ±5% | | | | 4,46 | 4,7 | 4,94 | kOhm |
| Deviation of R100<br>Abweichung von R100 | $D_{R/R}$ | Tc=100°C | R100=435Ohm | | | | | 3 | | %/K |
| Power dissipation given Epcos-Typ<br>Verlustleistung Epcos-Typ angeben | P | Tj=25°C | | | | | | 210 | | mW |
| B-value<br>B-Wert | $B_{(25/100)}$ | Tj=25°C | Tol. ±3% | | | | | 3530 | | K |

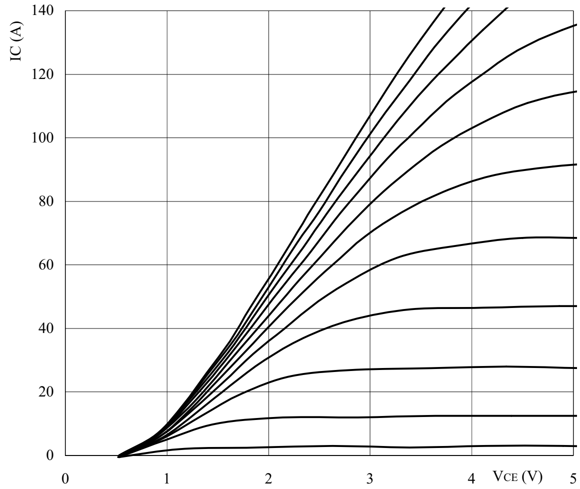
# Output inverter

**Figure 1.** **Typical output characteristics**
*Output inverter IGBT*
Ic= f(VCE)



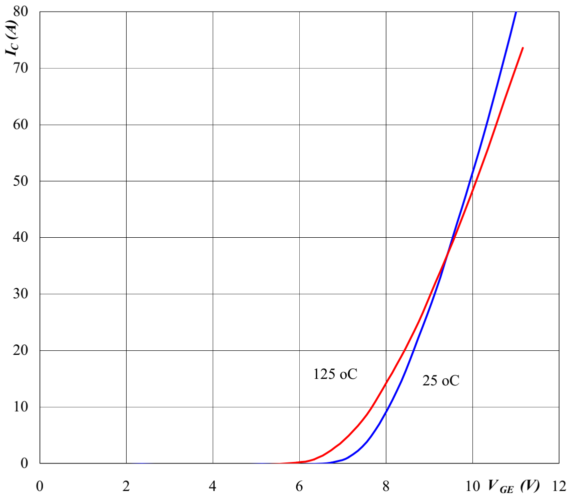

parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

**Figure 2.** **Typical output characteristics**
*Output inverter IGBT*
Ic= f(VCE)



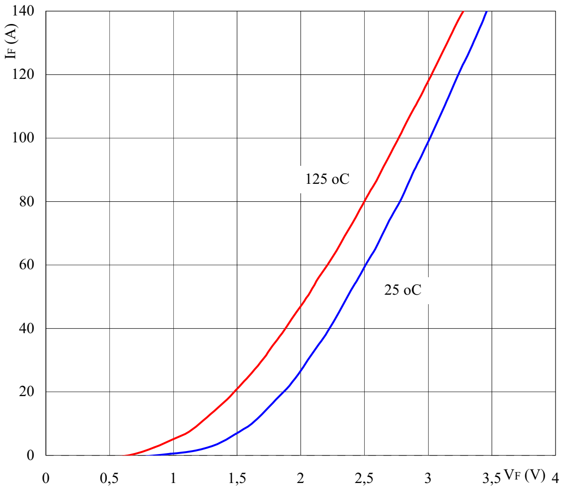

parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

**Figure 3.** **Typical transfer characteristics**
*Output inverter IGBT*
Ic= f(VGE)




parameter: tp = 250 us VCE = 10 V

**Figure 4.** **Typical diode forward current as a function of forward voltage**
*Output inverter FRED* IF=f(VF)

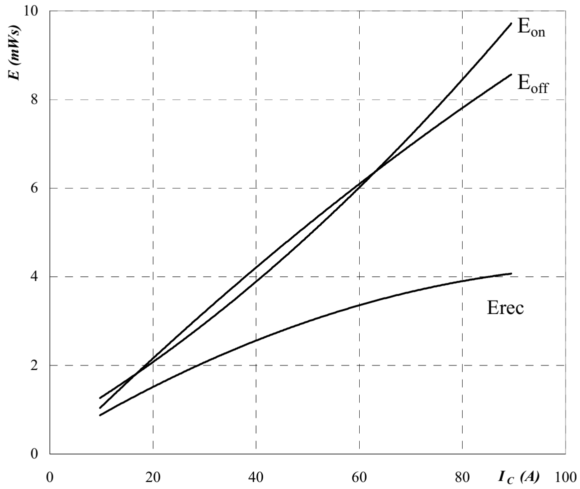



parameter: tp = 250 us

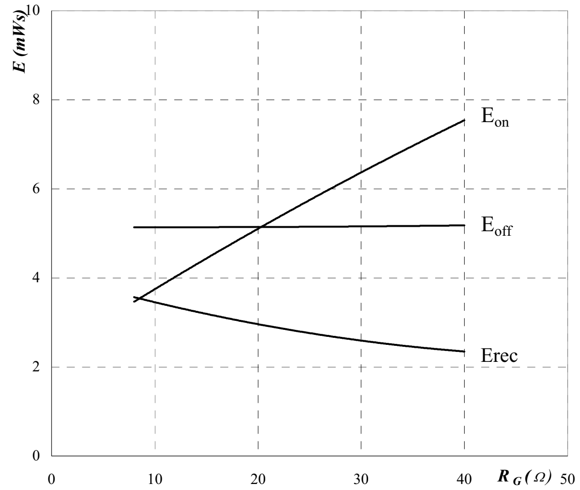
## Output inverter

**Figure 5.** **Typical switching energy losses as a function of collector current**
*Output inverter IGBT*
E = f (Ic)



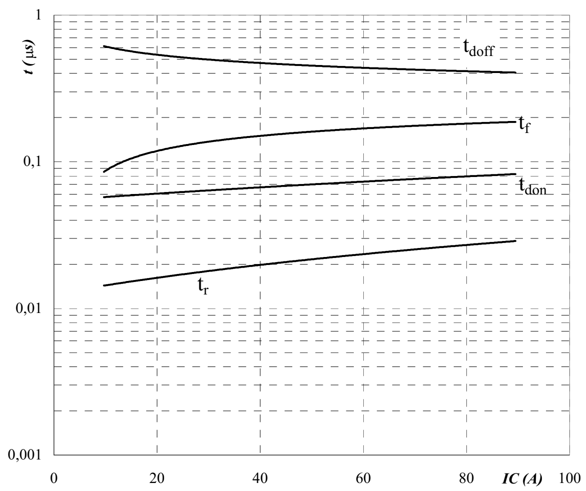

inductive load, Tj = 125 °C
$V_{CE}$ = 600 V
$V_{GE}$= ±15 V
Rgon= 18 Ω
Rgoff= 18 Ω

**Figure 6.** **Typical switching energy losses as a function of gate resistor**
*Output inverter IGBT*
E = f ($R_G$)



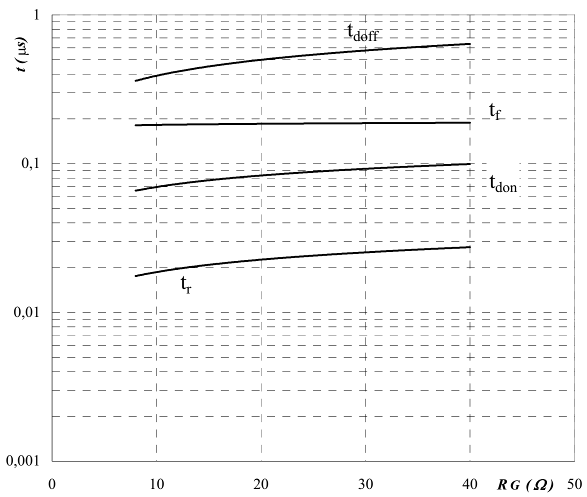

inductive load, Tj = 125 °C
$V_{CE}$ = 600 V
$V_{GE}$= ±15 V
Ic = 50 A

**Figure 7.** **Typical switching times as a function of collector current**
*Output inverter IGBT*
t = f (Ic)




inductive load, Tj = 125 °C
$V_{CE}$ = 600 V
$V_{GE}$= ±15 V
Rgon= 18 Ω
Rgoff= 18 Ω

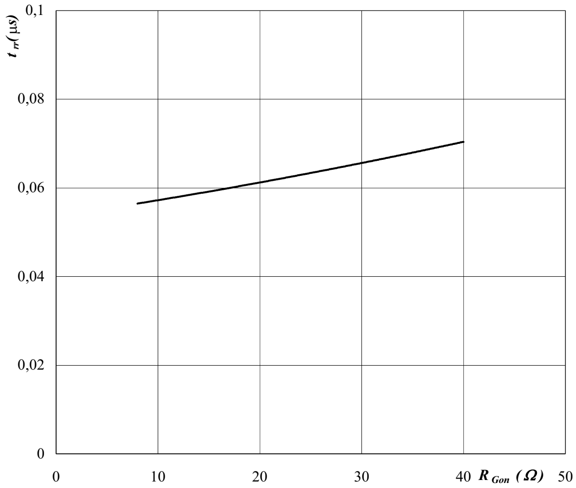
**Figure 8.** **Typical switching times as a function of gate resistor**
*Output inverter IGBT*
t = f ($R_G$)




inductive load, Tj = 125 °C
$V_{CE}$ = 600 V
$V_{GE}$= ±15 V
Ic = 50 A

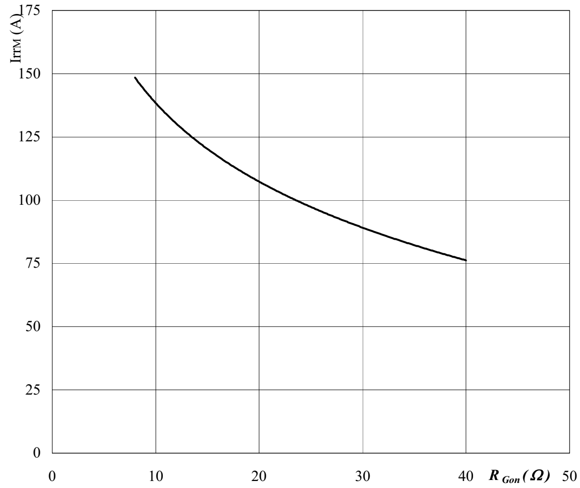
## Output inverter

**Figure 9. Typical reverse recovery time as a function of IGBT turn on gate resistor**
*Output inverter FRED diode*
$t_{rr}$ = f (Rgon)



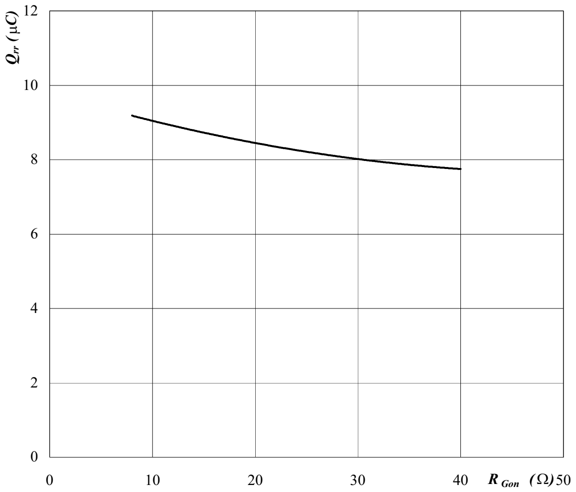

Tj = 125 °C
VR = 600 V
IF= 50 A
VGE= ±15 V

**Figure 10. Typical reverse recovery current as a function of IGBT turn on gate resistor**
*Output inverter FRED diode*
$I_{RRM}$ = f (Rgon)



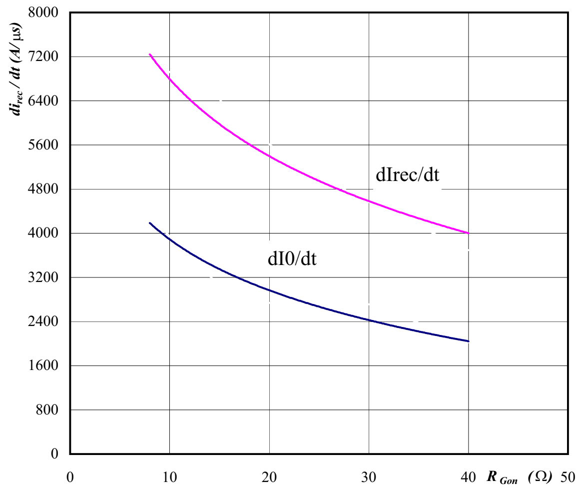

Tj = 125 °C
VR = 600 V
IF= 50 A
VGE= ±15 V

**Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor**
*Output inverter FRED diode*
$Q_{rr}$ = f (Rgon)




Tj = 125 °C
VR = 600 V
IF= 50 A
VGE= ±15 V

**Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor**
*Output inverter FRED diode*
dI0/dt,dIrec/dt= f (Rgon)

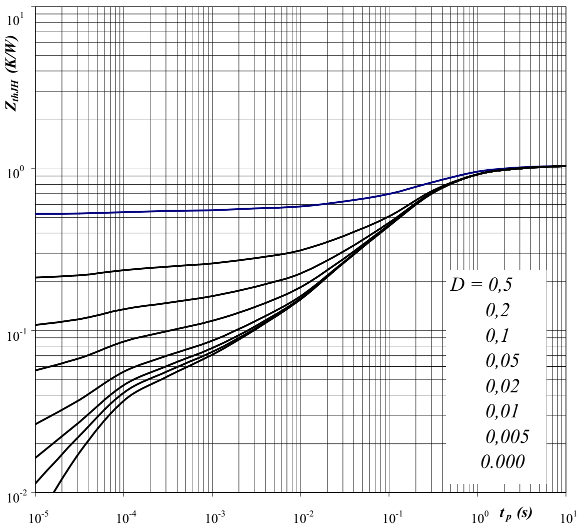



Tj = 125 °C
VR = 600 V
IF= 50 A
VGE= ±15 V

## Output inverter

**Figure 13. IGBT transient thermal impedance as a function of pulse width**
$Z_{th}JH = f(tp)$

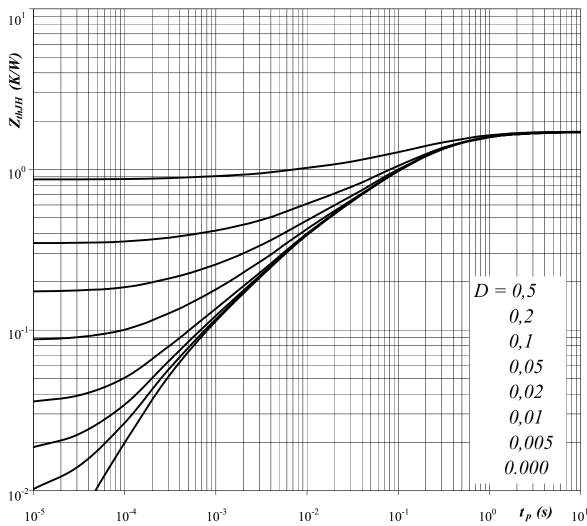



Parameter: D = tp / T RthJH= 1,04 K/W

IGBT thermal model values

| R (C/W) | Tau (s) |
|---|---|
| 0,07 | 5,2E+00 |
| 0,28 | 7,1E-01 |
| 0,50 | 1,9E-01 |
| 0,12 | 2,0E-02 |

**Figure 14. FRED transient thermal impedance as a function of pulse width**
$Z_{th}JH = f(tp)$



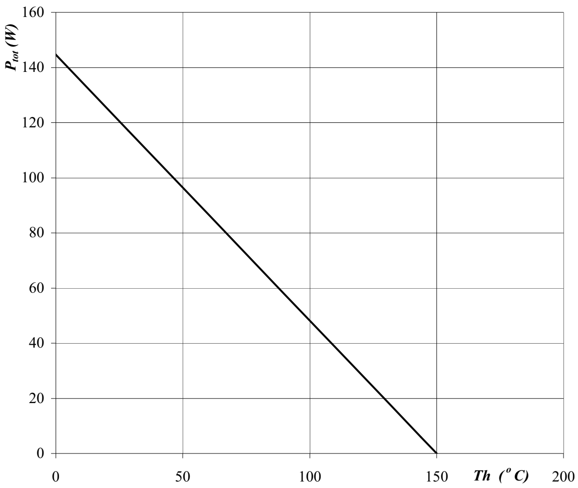

Parameter: D = tp / T RthJH= 1,72 K/W

FRED thermal model values

| R (C/W) | Tau (s) |
|---|---|
| 0,04 | 2,1E+01 |
| 0,25 | 1,1E+00 |
| 0,76 | 2,0E-01 |
| 0,41 | 3,4E-02 |

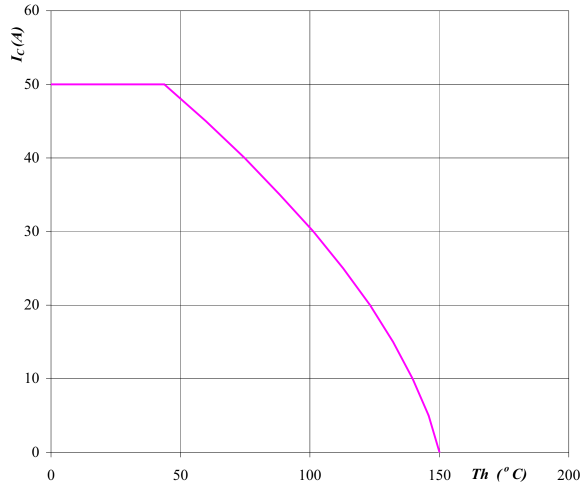
## Output inverter

**Figure 15. Power dissipation as a function of heatsink temperature**
*Output inverter IGBT*
$P_{tot}$ = f (Th)



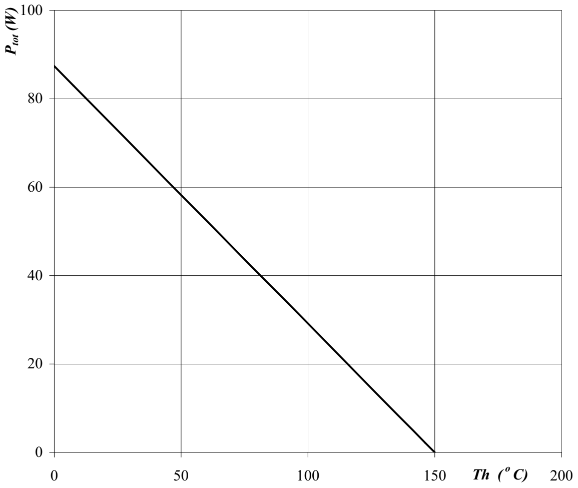

parameter: Tj = 150°C

**Figure 16. Collector current as a function of heatsink temperature**
*Output inverter IGBT*
$I_C$ = f (Th)



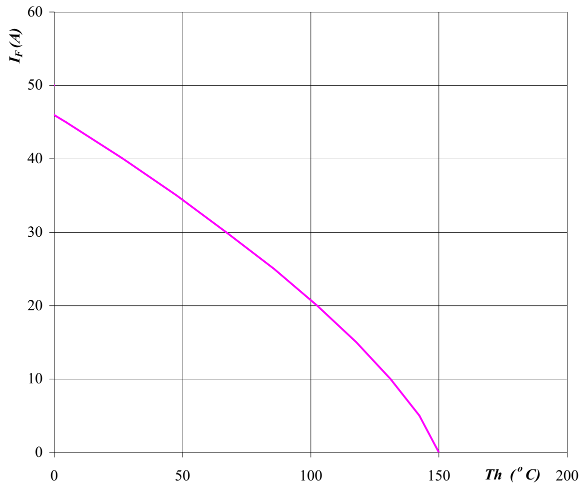

parameter: Tj = 150°C
$V_{GE}$= 15 V

**Figure 17. Power dissipation as a function of heatsink temperature**
*Output inverter FRED*
$P_{tot}$ = f (Th)




parameter: Tj = 150°C

**Figure 18. Forward current as a function of heatsink temperature**
*Output inverter FRED*
$I_F$ = f (Th)




parameter: Tj = 150°C

## Thermistor

**Figure 37. Typical NTC characteristic as a function of temperature**

$R_T = f(T)$