

**flowPIM®1, 600V**
**Maximum Ratings / Höchstzulässige Werte**

| Parameter | Condition | Symbol | Datasheet values<br>max. | Unit |
|-----------|-----------|--------|--------------------------|------|
|-----------|-----------|--------|--------------------------|------|

**Input Rectifier Bridge  
Gleichrichter**

|                                                                            |                                                                          |           |                                   |                  |
|----------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------|-----------------------------------|------------------|
| Repetitive peak reverse voltage<br>Periodische Rückw. Spitzensperrspannung |                                                                          | $V_{RRM}$ | 1600                              | V                |
| Forward current per diode<br>Dauergrenzstrom                               | DC current $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$              | $I_{FAV}$ | 29<br>40, limited by nr. of wires | A                |
| Surge forward current<br>Stoßstrom Grenzwert                               | $t_p=10\text{ms}$ $T_j=25^\circ\text{C}$                                 | $I_{FSM}$ | 200                               | A                |
| $I^2t$ -value<br>Grenzlastintegral                                         | $t_p=10\text{ms}$ $T_j=25^\circ\text{C}$                                 | $I^2t$    | 200                               | A <sup>2</sup> s |
| Power dissipation per Diode<br>Verlustleistung pro Diode                   | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$ | $P_{tot}$ | 35<br>53                          | W                |

**Transistor Inverter  
Transistor Wechselrichter**

|                                                                         |                                                                          |             |                                     |    |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------|-------------------------------------|----|
| Collector-emitter break down voltage<br>Kollektor-Emitter-Sperrspannung |                                                                          | $V_{CE}$    | 600                                 | V  |
| DC collector current<br>Kollektor-Dauergleichstrom                      | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$ | $I_C$       | 12,6<br>16, limited by nr. of wires | A  |
| Repetitive peak collector current<br>Periodischer Kollektorspitzenstrom | $t_p=1\text{ms}$ $T_h=80^\circ\text{C}$                                  | $I_{cpuls}$ | 25,2                                | A  |
| Power dissipation per IGBT<br>Verlustleistung pro IGBT                  | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$ | $P_{tot}$   | 32<br>48                            | W  |
| Gate-emitter peak voltage<br>Gate-Emitter-Spitzenspannung               |                                                                          | $V_{GE}$    | $\pm 20$                            | V  |
| SC withstand time<br>Kurzschlußverhalten                                | $T_j \leq 150^\circ\text{C}$ $V_{GE}=15\text{V}$<br>$V_{CE}=600\text{V}$ | $t_{SC}$    | 10                                  | us |

**Diode Inverter  
Diode Wechselrichter**

|                                                              |                                                                          |           |                                     |   |
|--------------------------------------------------------------|--------------------------------------------------------------------------|-----------|-------------------------------------|---|
| DC forward current<br>Dauergleichstrom                       | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$ | $I_F$     | 13,8<br>16, limited by nr. of wires | A |
| Repetitive peak forward current<br>Periodischer Spitzenstrom | $t_p=1\text{ms}$ $T_h=80^\circ\text{C}$                                  | $I_{FRM}$ | 27,6                                | A |
| Power dissipation per Diode<br>Verlustleistung pro Diode     | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$ | $P_{tot}$ | 21<br>32                            | W |

**Transistor BRC  
Transistor BRC**

|                                                                         |                                                                               |             |                                                          |    |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------|----------------------------------------------------------|----|
| Collector-emitter break down voltage<br>Kollektor-Emitter-Sperrspannung |                                                                               | $V_{CE}$    | 600                                                      | V  |
| DC collector current<br>Kollektor-Dauergleichstrom                      | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$      | $I_C$       | 8, limited by nr. of wires<br>8, limited by nr. of wires | A  |
| Repetitive peak collector current<br>Periodischer Kollektorspitzenstrom | $t_p=1\text{ms}$ $T_h=80^\circ\text{C}$                                       | $I_{cpuls}$ | 18                                                       | A  |
| Power dissipation per IGBT<br>Verlustleistung pro IGBT                  | $T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$<br>$T_c=80^\circ\text{C}$      | $P_{tot}$   | 28<br>43                                                 | W  |
| Gate-emitter peak voltage<br>Gate-Emitter-Spitzenspannung               |                                                                               | $V_{GE}$    | $\pm 20$                                                 | V  |
| SC withstand time<br>Kurzschlußverhalten                                | $T_j \leq 150^\circ\text{C}$ $V_{GE}=15\text{V}$<br>$V_{CE}=600/1200\text{V}$ | $t_{SC}$    | 10                                                       | us |

**flowPIM®1, 600V**
**Maximum Ratings / Höchstzulässige Werte**

| Parameter | Condition | Symbol | Datasheet values<br>max. | Unit |
|-----------|-----------|--------|--------------------------|------|
|-----------|-----------|--------|--------------------------|------|

**Diode BRC**
**Diode BRC**

|                                                              |                                                                                |           |                                                          |   |
|--------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|----------------------------------------------------------|---|
| DC forward current<br>Dauergleichstrom                       | $T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$<br>$T_c=80^{\circ}\text{C}$ | $I_F$     | 8, limited by nr. of wires<br>8, limited by nr. of wires | A |
| Repetitive peak forward current<br>Periodischer Spitzenstrom | $t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$                                      | $I_{FRM}$ | 24                                                       | A |
| Power dissipation per Diode<br>Verlustleistung pro Diode     | $T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$<br>$T_c=80^{\circ}\text{C}$ | $P_{tot}$ | 21<br>32                                                 | W |

**Thermal properties**
**Thermische Eigenschaften**

|                                              |  |            |            |                    |
|----------------------------------------------|--|------------|------------|--------------------|
| max. Chip temperature<br>max. Chiptemperatur |  | $T_{jmax}$ | 150        | $^{\circ}\text{C}$ |
| Storage temperature<br>Lagertemperatur       |  | $T_{stg}$  | -40...+125 | $^{\circ}\text{C}$ |
| Operation temperature<br>Betriebstemperatur  |  | $T_{op}$   | -40...+125 | $^{\circ}\text{C}$ |

**Insulation properties**
**Modulisation**

|                                          |                 |          |          |     |
|------------------------------------------|-----------------|----------|----------|-----|
| Insulation voltage<br>Isolationsspannung | $t=1\text{min}$ | $V_{is}$ | 4000     | Vdc |
| Creepage distance<br>Kriechstrecke       |                 |          | min 12,7 | mm  |
| Clearance<br>Luftstrecke                 |                 |          | min 12,7 | mm  |

**flowPIM®1, 600V**
**Characteristic values/ Charakteristische Werte**

| Description | Symbol | Conditions |                                  |                                            |                                                                  |                                                                | Datasheet values |     |     | Unit |
|-------------|--------|------------|----------------------------------|--------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------|------------------|-----|-----|------|
|             |        | T(°C)      | Other conditions<br>(Rgon-Rgoff) | V <sub>GE</sub> (V)<br>V <sub>GS</sub> (V) | V <sub>R</sub> (V)<br>V <sub>CE</sub> (V)<br>V <sub>DS</sub> (V) | I <sub>C</sub> (A)<br>I <sub>F</sub> (A)<br>I <sub>d</sub> (A) | Min              | Typ | Max |      |

**Input Rectifier Bridge**
**Gleichrichter**

|                                                                                          |                   |                      |                                               |  |      |    |     |      |      |      |
|------------------------------------------------------------------------------------------|-------------------|----------------------|-----------------------------------------------|--|------|----|-----|------|------|------|
| Forward voltage<br>Durchlaßspannung                                                      | V <sub>F</sub>    | T <sub>J</sub> =25°C |                                               |  |      | 30 | 0,8 | 1,24 | 1,4  | V    |
| Threshold voltage (for power loss calc. only)<br>Schleusenspannung                       | V <sub>to</sub>   | T <sub>J</sub> =25°C |                                               |  |      | 30 |     | 0,92 |      | V    |
| Slope resistance (for power loss calc. only)<br>Ersatzwiderstand                         | r <sub>t</sub>    | T <sub>J</sub> =25°C |                                               |  |      | 30 |     | 10   |      | mOhm |
| Reverse current<br>Sperrstrom                                                            | I <sub>r</sub>    | T <sub>J</sub> =25°C |                                               |  | 1200 |    |     |      | 0,01 | mA   |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | R <sub>thJH</sub> |                      | Thermal grease<br>thickness≤50um              |  |      |    |     | 2    |      | K/W  |
| Thermal resistance chip to case per chip<br>Wärmewiderstand Chip-Gehäuse pro Chip        | R <sub>thJC</sub> |                      | Wärmeleitpaste<br>Dicke≤50um λ =<br>0,61 W/mK |  |      |    |     | 1,3  |      | K/W  |

**Transistor Inverter, inductive load**
**Transistor Wechselrichter**

|                                                                                          |                      |                                               |                                               |    |     |        |     |            |      |     |
|------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------|-----------------------------------------------|----|-----|--------|-----|------------|------|-----|
| Gate emitter threshold voltage<br>Gate-Schwellenspannung                                 | V <sub>GE(th)</sub>  | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | V <sub>CE</sub> =V <sub>GE</sub>              |    |     | 0,0004 | 4,5 | 5,5        | 6,5  | V   |
| Collector-emitter saturation voltage<br>Kollektor-Emitter Sättigungsspannung             | V <sub>CE(sat)</sub> | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C |                                               | 15 |     | 10     | 1,6 | 1,9<br>2,2 | 2,6  | V   |
| Collector-emitter cut-off incl.FRED<br>Kollektor-Emitter Reststrom inkl.FRED             | I <sub>CES</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C |                                               | 0  | 600 |        |     |            | 0,06 | mA  |
| Gate-emitter leakage current<br>Gate-Emitter Reststrom                                   | I <sub>GES</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =150°C |                                               | 25 | 0   |        |     |            | 120  | nA  |
| Integrated Gate resistor<br>Integrierter Gate Widerstand                                 | R <sub>gint</sub>    |                                               |                                               |    |     |        |     |            |      | Ohm |
| Turn-on delay time<br>Einschaltverzögerungszeit                                          | t <sub>d(on)</sub>   | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=56 Ohm                                   | 15 | 300 | 10     |     | 24         |      | ns  |
| Rise time<br>Anstiegszeit                                                                | t <sub>r</sub>       | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=56 Ohm                                   | 15 | 300 | 10     |     | 21         |      | ns  |
| Turn-off delay time<br>Abschaltverzögerungszeit                                          | t <sub>d(off)</sub>  | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgoff=28 Ohm                                  | 15 | 300 | 10     |     | 210        |      | ns  |
| Fall time<br>Fallzeit                                                                    | t <sub>f</sub>       | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgoff=28 Ohm                                  | 15 | 300 | 10     |     | 65         |      | ns  |
| Turn-on energy loss per pulse<br>Einschaltverlustenergie pro Puls                        | E <sub>on</sub>      | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=56 Ohm                                   | 15 | 300 | 10     |     | 0,281      |      | mWs |
| Turn-off energy loss per pulse<br>Abschaltverlustenergie pro Puls                        | E <sub>off</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgoff=28 Ohm                                  | 15 | 300 | 10     |     | 0,378      |      | mWs |
| Input capacitance<br>Eingangskapazität                                                   | C <sub>ies</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | f=1MHz                                        | 0  | 25  |        |     | 0,45       |      | nF  |
| Output capacitance<br>Ausgangskapazität                                                  | C <sub>oss</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | f=1MHz                                        | 0  | 25  |        |     |            |      | nF  |
| Reverse transfer capacitance<br>Rückwirkungskapazität                                    | C <sub>rss</sub>     | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | f=1MHz                                        | 0  | 25  |        |     | 0,04       |      | nF  |
| Gate charge<br>Gate Ladung                                                               | Q <sub>Gate</sub>    | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C |                                               | 15 | 300 |        |     | 39         |      | nC  |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | R <sub>thJH</sub>    |                                               | Thermal grease<br>thickness≤50um              |    |     |        |     | 2,4        |      | K/W |
| Thermal resistance chip to case per chip<br>Wärmewiderstand Chip-Gehäuse pro Chip        | R <sub>thJC</sub>    |                                               | Wärmeleitpaste<br>Dicke≤50um<br>λ = 0,61 W/mK |    |     |        |     | 1,6        |      | K/W |

**flowPIM®1, 600V**
**Characteristic values/ Charakteristische Werte**

| Description                                                                              | Symbol   | Conditions          |                                               |                  |                           |                         | Datasheet values |              |       | Unit |
|------------------------------------------------------------------------------------------|----------|---------------------|-----------------------------------------------|------------------|---------------------------|-------------------------|------------------|--------------|-------|------|
|                                                                                          |          | T(C°)               | Other conditions<br>(Rgon-Rgoff)              | VGE(V)<br>VGS(V) | VR(V)<br>VCE(V)<br>VDS(V) | IC(A)<br>IF(A)<br>Id(A) | Min              | Typ          | Max   |      |
| Diode Inverter                                                                           |          |                     |                                               |                  |                           |                         |                  |              |       |      |
| Diode Wechselrichter                                                                     |          |                     |                                               |                  |                           |                         |                  |              |       |      |
| Diode forward voltage<br>Durchlaßspannung                                                | VF       | Tj=25°C<br>Tj=125°C |                                               |                  |                           | 10                      | 1                | 1,79<br>1,44 | 2,2   | V    |
| Peak reverse recovery current<br>Rückstromspitze                                         | IRM      | Tj=25°C<br>Tj=125°C | Rgon=56 Ohm                                   | 15               | 300                       | 10                      |                  | 10,3         |       | A    |
| Reverse recovery time<br>Sperrverzögerungszeit                                           | trr      | Tj=25°C<br>Tj=125°C | Rgon=56 Ohm                                   | 15               | 300                       | 10                      |                  | 103          |       | ns   |
| Reverse recovered charge<br>Sperrverzögerungsladung                                      | Qrr      | Tj=25°C<br>Tj=125°C | Rgon=56 Ohm                                   | 15               | 300                       | 10                      |                  | 480          |       | uC   |
| Reverse recovered energy<br>Sperrverzögerungsenergie                                     | Erec     | Tj=25°C<br>Tj=125°C | Rgon=56 Ohm                                   | 15               | 300                       | 10                      |                  | 0,057        |       | mWs  |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | RthJH    |                     | Thermal grease<br>thikness≤50um               |                  |                           |                         |                  | 3,4          |       | K/W  |
| Thermal resistance chip to case per chip<br>Wärmewiderstand Chip-Gehäuse pro Chip        | RthJC    |                     | Warmeleitpaste<br>Dicke≤50um<br>λ = 0,61 W/mK |                  |                           |                         |                  | 2,25         |       | K/W  |
| Transistor BRC                                                                           |          |                     |                                               |                  |                           |                         |                  |              |       |      |
| Transistor BRC                                                                           |          |                     |                                               |                  |                           |                         |                  |              |       |      |
| Gate emitter threshold voltage<br>Gate-Schwellenspannung                                 | VGE(th)  | Tj=25°C<br>Tj=125°C | VCE=VGE                                       |                  |                           | 0,0002                  | 3                | 4            | 5     | V    |
| Collector-emitter saturation voltage<br>Kollektor-Emitter Sättigungsspannung             | VCE(sat) | Tj=25°C<br>Tj=125°C |                                               | 15               |                           | 8                       | 1,5              | 2,3<br>2,6   | 3     | V    |
| Collector-emitter cut-off<br>Kollektor-Emitter Reststrom                                 | ICES     | Tj=25°C<br>Tj=125°C |                                               | 0                | 600                       |                         |                  |              | 0,03  | mA   |
| Gate-emitter leakage current<br>Gate-Emitter Reststrom                                   | IGES     | Tj=25°C<br>Tj=150°C |                                               | 25               | 0                         |                         |                  |              | 120   | nA   |
| Integrated Gate resistor<br>Integrirter Gate Widerstand                                  | Rgint    |                     |                                               |                  |                           |                         |                  |              |       | Ohm  |
| Turn-on delay time<br>Einschaltverzögerungszeit                                          | td(on)   | Tj=25°C<br>Tj=125°C | Rgon=48 Ohm                                   | 15               | 300                       | 8                       |                  | 13           |       | ns   |
| Rise time<br>Anstiegszeit                                                                | tr       | Tj=25°C<br>Tj=125°C | Rgon=48 Ohm                                   | 15               | 300                       | 8                       |                  | 15           |       | ns   |
| Turn-off delay time<br>Abschaltverzögerungszeit                                          | td(off)  | Tj=25°C<br>Tj=125°C | Rgoff=24 Ohm                                  | 15               | 300                       | 8                       |                  | 130          |       | ns   |
| Fall time<br>Fallzeit                                                                    | tf       | Tj=25°C<br>Tj=125°C | Rgoff=24 Ohm                                  | 15               | 300                       | 8                       |                  | 34           |       | ns   |
| Turn-on energy loss per pulse<br>Einschaltverlustenergie pro Puls                        | Eon      | Tj=25°C<br>Tj=125°C | Rgon=48 Ohm                                   | 15               | 300                       | 8                       |                  | 0,159        |       | mWs  |
| Turn-off energy loss per pulse<br>Abschaltverlustenergie pro Puls                        | Eoff     | Tj=25°C<br>Tj=125°C | Rgoff=24 Ohm                                  | 15               | 300                       | 8                       |                  | 0,161        |       | mWs  |
| Input capacitance<br>Eingangskapazität                                                   | Ciss     | Tj=25°C<br>Tj=125°C | f=1MHz                                        | 0                | 25                        |                         |                  | 0,35         | 0,42  | nF   |
| Output capacitance<br>Ausgangskapazität                                                  | Coss     | Tj=25°C<br>Tj=125°C | f=1MHz                                        | 0                | 25                        |                         |                  | 0,038        | 0,046 | nF   |
| Reverse transfer capacitance<br>Rückwirkungskapazität                                    | Crss     | Tj=25°C<br>Tj=125°C | f=1MHz                                        | 0                | 25                        |                         |                  | 0,023        | 0,028 | nF   |
| Gate charge<br>Gate Ladung                                                               | QGate    | Tj=25°C<br>Tj=125°C |                                               | 15               | 480                       | 6                       |                  | 32           | 42    | nC   |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | RthJH    |                     | Thermal grease<br>thikness≤50um               |                  |                           |                         |                  | 2,5          |       | K/W  |
| Thermal resistance chip to case per chip<br>Wärmewiderstand Chip-Gehäuse pro Chip        | RthJC    |                     | Warmeleitpaste<br>Dicke≤50um<br>λ = 0,61 W/mK |                  |                           |                         |                  | 1,65         |       | K/W  |

**flowPIM®1, 600V**
**Characteristic values/ Charakteristische Werte**

| Description | Symbol | Conditions |                                  |                                            |                                                                  |                                                                | Datasheet values |     |     | Unit |
|-------------|--------|------------|----------------------------------|--------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------|------------------|-----|-----|------|
|             |        | T(°C)      | Other conditions<br>(Rgon-Rgoff) | V <sub>GE</sub> (V)<br>V <sub>GS</sub> (V) | V <sub>R</sub> (V)<br>V <sub>CE</sub> (V)<br>V <sub>DS</sub> (V) | I <sub>C</sub> (A)<br>I <sub>F</sub> (A)<br>I <sub>d</sub> (A) | Min              | Typ | Max |      |

**Diode BRC**
**Diode BRC**

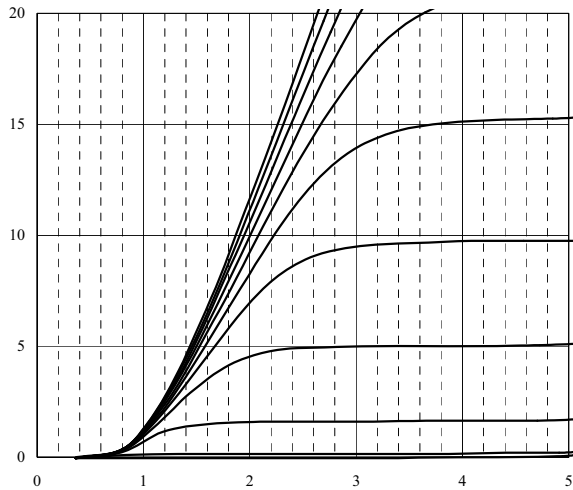
|                                                                                          |                   |                                               |                                               |    |     |   |   |             |      |     |
|------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------|-----------------------------------------------|----|-----|---|---|-------------|------|-----|
| Diode forward voltage<br>Durchlaßspannung                                                | V <sub>F</sub>    | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C |                                               |    |     | 8 | 1 | 1,7<br>1,35 | 2,2  | V   |
| Reverse current<br>Sperrstrom                                                            | I <sub>r</sub>    | T <sub>J</sub> =25°C                          |                                               |    | 600 |   |   |             | 0,06 | µA  |
| Peak reverse recovery current<br>Rückstromspitze                                         | I <sub>RM</sub>   | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=48 Ohm                                   | 15 | 300 | 8 |   | 13,2        |      | A   |
| Reverse recovery time<br>Sperrverzögerungszeit                                           | t <sub>rr</sub>   | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=48 Ohm                                   | 15 | 300 | 8 |   | 73          |      | ns  |
| Reverse recovered charge<br>Sperrverzögerungsladung                                      | Q <sub>rr</sub>   | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=48 Ohm                                   | 15 | 300 | 8 |   | 0,46        |      | µC  |
| Reverse recovered energy<br>Sperrverzögerungsenergie                                     | E <sub>rec</sub>  | T <sub>J</sub> =25°C<br>T <sub>J</sub> =125°C | Rgon=48 Ohm                                   | 15 | 300 | 8 |   | 0,07        |      | mWs |
| Thermal resistance chip to heatsink per chip<br>Wärmewiderstand Chip-Kühlkörper pro Chip | R <sub>thJH</sub> |                                               | Thermal grease<br>thickness≤50µm              |    |     |   |   | 3,4         |      | K/W |
| Thermal resistance chip to case per chip<br>Wärmewiderstand Chip-Gehäuse pro Chip        | R <sub>thJC</sub> |                                               | Wärmeleitpaste<br>Dicke≤50µm<br>λ = 0,61 W/mK |    |     |   |   | 2,25        |      | K/W |

**NTC-Thermistor**
**NTC-Widerstand**

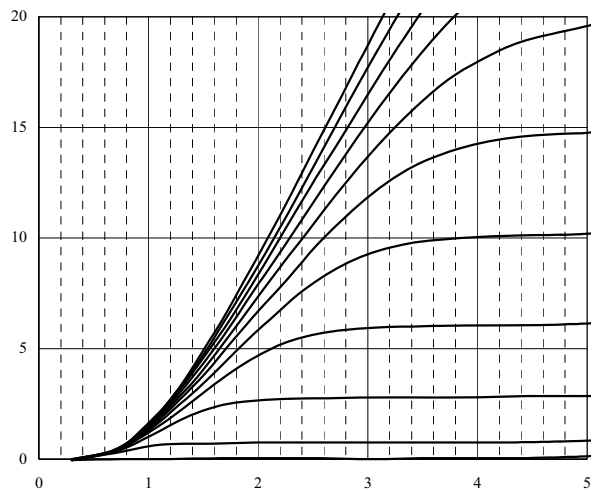
|                                                                        |                       |          |          |  |  |  |     |      |     |      |
|------------------------------------------------------------------------|-----------------------|----------|----------|--|--|--|-----|------|-----|------|
| Rated resistance<br>Nennwiderstand                                     | R <sub>25</sub>       | TC=25°C  | Tol. ±5% |  |  |  | 4,2 | 4,7  | 5,3 | kOhm |
| Deviation of R100<br>Abweichung von R100                               | D <sub>R/R</sub>      | TC=100°C |          |  |  |  |     | 2,56 |     | %/K  |
| Power dissipation given Epcos-Typ<br>Verlustleistung Epcos-Typ angeben | P                     | TC=25°C  |          |  |  |  |     | 210  |     | mW   |
| B-value<br>B-Wert                                                      | B <sub>(25/100)</sub> |          | Tol. ±3% |  |  |  |     | 3530 |     | K    |

flowPIM®1, 600V

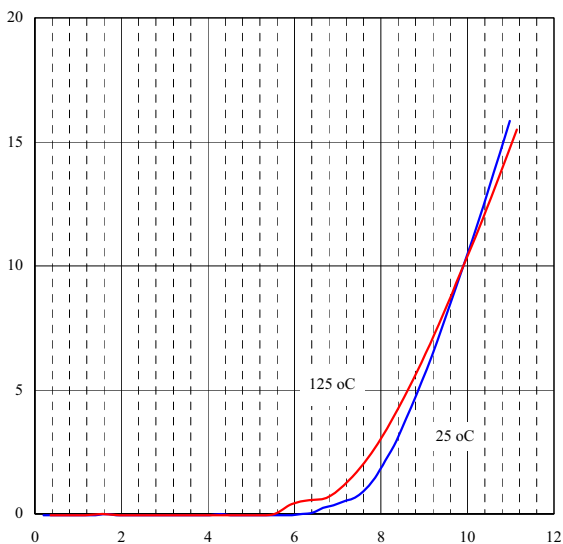
## Output inverter

**Figure 1. Typical output characteristics**
*Output inverter IGBT*
 $I_C = f(V_{CE})$ 

parameter:  $t_p = 250 \text{ us}$ 
 $T_j = 25 \text{ °C}$ 

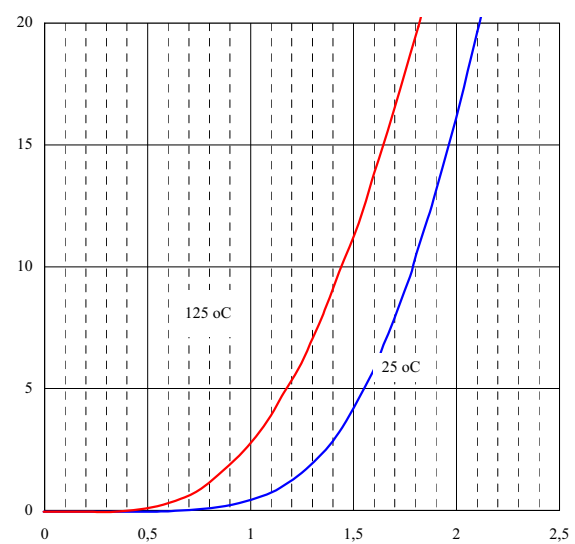
V<sub>GE</sub> parameter: from: 6 V to 16 V  
in 1 V steps

**Figure 2. Typical output characteristics**
*Output inverter IGBT*
 $I_C = f(V_{CE})$ 

parameter:  $t_p = 250 \text{ us}$ 
 $T_j = 125 \text{ °C}$ 

V<sub>GE</sub> parameter: from: 6 V to 16 V  
in 1 V steps

**Figure 3. Typical transfer characteristics**
*Output inverter IGBT*
 $I_C = f(V_{GE})$ 

parameter:  $t_p = 250 \text{ us}$ 

V<sub>CE</sub> = 11 V

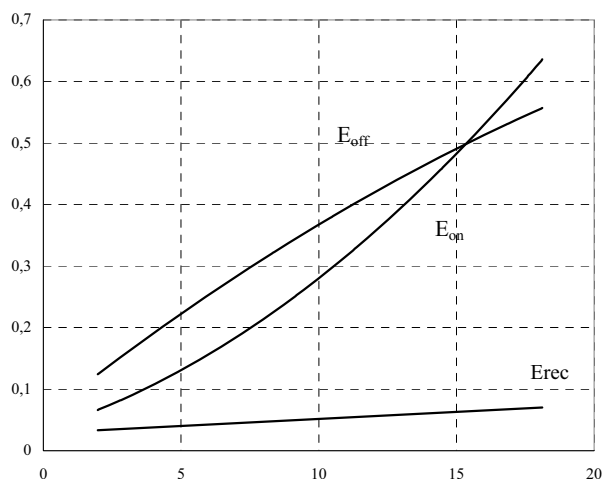
**Figure 4. Typical diode forward current as a function of forward voltage**
*Output inverter FRED*
 $I_F = f(V_F)$ 

parameter:  $t_p = 250 \text{ us}$

## Output inverter

**Figure 5. Typical switching energy losses as a function of collector current**

Output inverter IGBT

$$E = f(I_c)$$



inductive load,  $T_j = 125^\circ\text{C}$

$V_{CE} = 300\text{ V}$

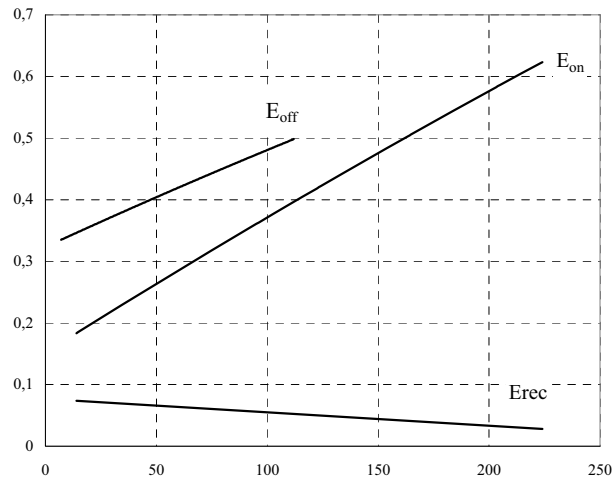
$V_{GE} = 15\text{ V}$

$R_{Gon} = 2 \cdot R_{Goff} = 56\text{ }\Omega$

**Figure 6. Typical switching energy losses as a function of gate resistor**

Output inverter IGBT

$$E = f(R_G)$$



inductive load,  $T_j = 125^\circ\text{C}$

$V_{CE} = 300\text{ V}$

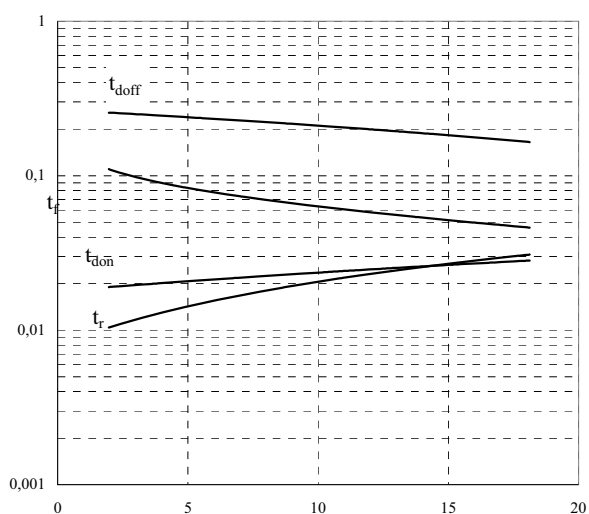
$V_{GE} = 15\text{ V}$

$I_c = 10\text{ A}$

**Figure 7. Typical switching times as a function of collector current**

Output inverter IGBT

$$t = f(I_c)$$



inductive load,  $T_j = 125^\circ\text{C}$

$V_{CE} = 300\text{ V}$

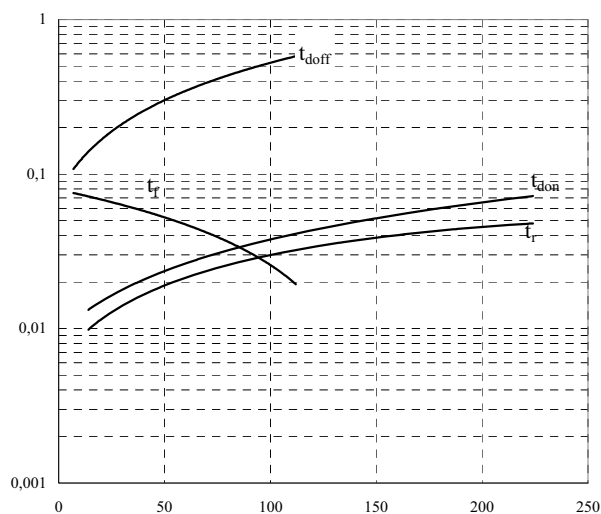
$V_{GE} = 15\text{ V}$

$R_{Gon} = 2 \cdot R_{Goff} = 56\text{ }\Omega$

**Figure 8. Typical switching times as a function of gate resistor**

Output inverter IGBT

$$t = f(R_G)$$



inductive load,  $T_j = 125^\circ\text{C}$

$V_{CE} = 300\text{ V}$

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

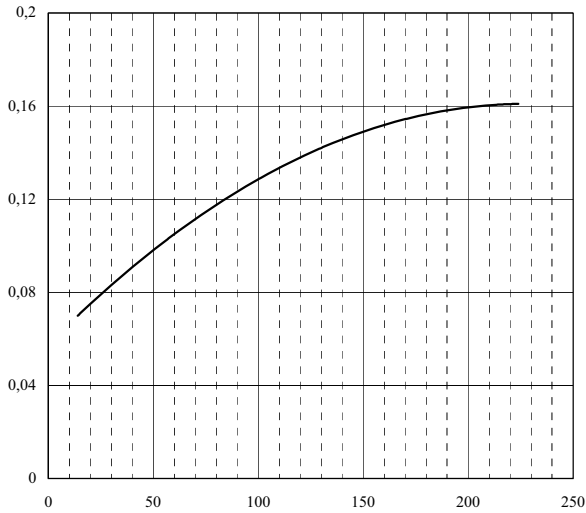
$I_c = 10\text{ A}$

flowPIM<sup>®</sup>1, 600V

## Output inverter

**Figure 9. Typical reverse recovery time as a function of IGBT turn on gate resistor**

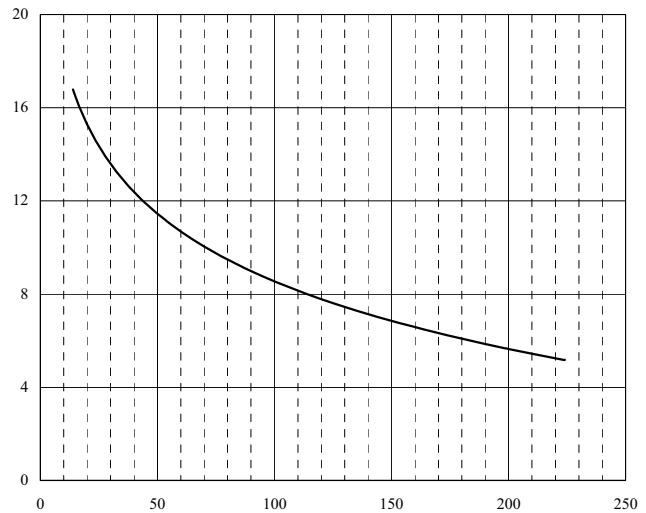
Output inverter FRED diode  
 $t_{rr} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$   
 $V_R = 300\text{ V}$   
 $I_F = 10\text{ A}$

**Figure 10. Typical reverse recovery current as a function of IGBT turn on gate resistor**

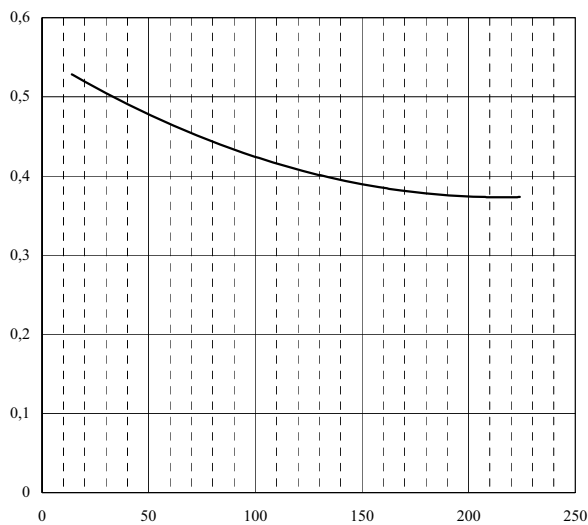
Output inverter FRED diode  
 $I_{RRM} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$   
 $V_R = 300\text{ V}$   
 $I_F = 10\text{ A}$

**Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor**

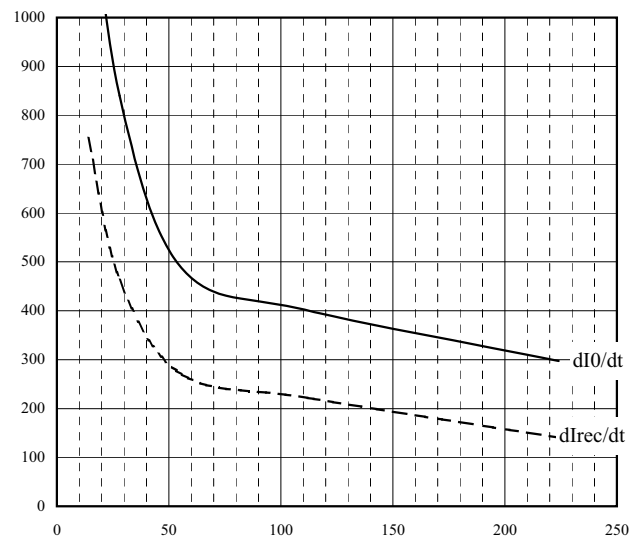
Output inverter FRED diode  
 $Q_{rr} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$   
 $V_R = 300\text{ V}$   
 $I_F = 10\text{ A}$

**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  
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$

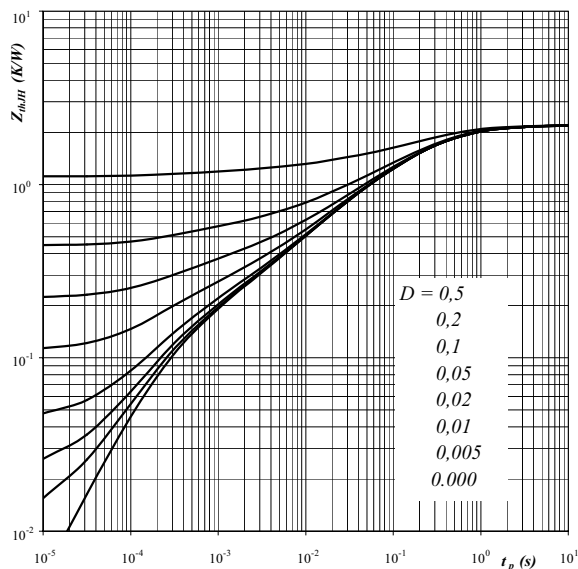


$T_j = 125\text{ }^{\circ}\text{C}$   
 $V_R = 300\text{ V}$   
 $I_F = 10\text{ A}$

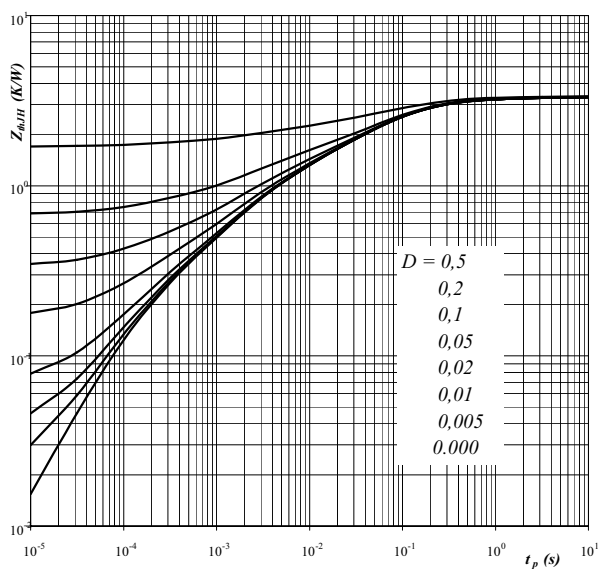
flowPIM®1, 600V

## Output inverter

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


Parameter:  $D = t_p / T$  RthJH 2,2 K/W

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


Parameter:  $D = t_p / T$  RthJH= 3,4 K/W

### IGBT thermal model values

| R (C/W) | Tau (s) |
|---------|---------|
| 0,04    | 6,7E+01 |
| 0,18    | 2,1E+00 |
| 0,77    | 3,5E-01 |
| 0,70    | 7,8E-02 |
| 0,33    | 1,1E-02 |
| 0,12    | 1,0E-03 |
| 0,07    | 1,9E-04 |

### FRED thermal model values

| R (C/W) | Tau (s) |
|---------|---------|
| 0,10    | 1,2E+02 |
| 0,16    | 1,6E+00 |
| 0,84    | 1,8E-01 |
| 1,09    | 4,6E-02 |
| 0,64    | 6,9E-03 |
| 0,42    | 1,3E-03 |
| 0,16    | 1,4E-04 |

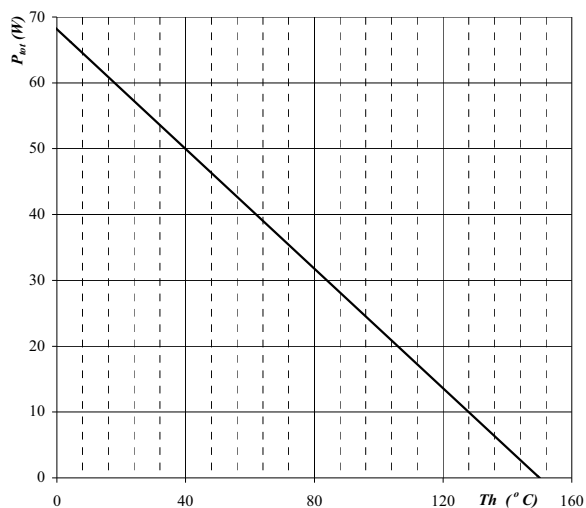
flowPIM<sup>®</sup>1, 600V

## Output inverter

**Figure 15. Power dissipation as a function of heatsink temperature**

Output inverter IGBT

$$P_{tot} = f(T_h)$$

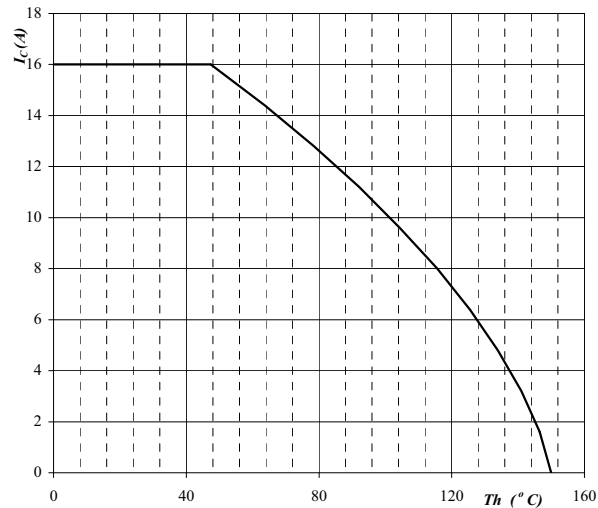


parameter:  $T_j = 150^{\circ}\text{C}$

**Figure 16. Collector current as a function of heatsink temperature**

Output inverter IGBT

$$I_c = f(T_h)$$



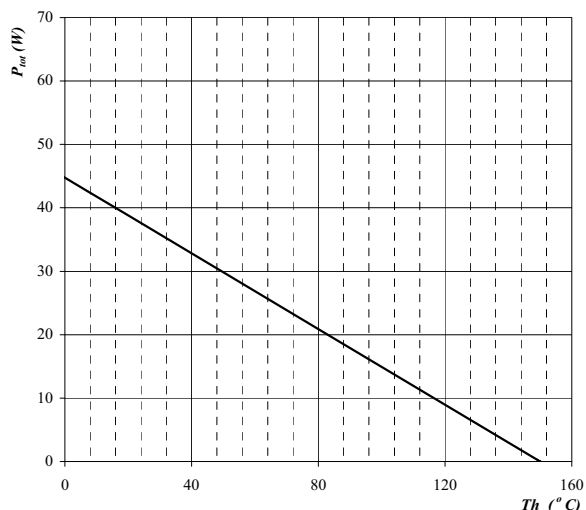
parameter:  $T_j = 150^{\circ}\text{C}$

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

**Figure 17. Power dissipation as a function of heatsink temperature**

Output inverter FRED

$$P_{tot} = f(T_h)$$

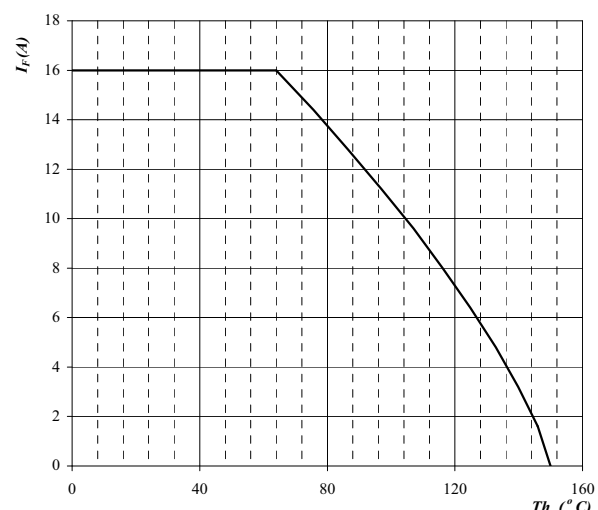


parameter:  $T_j = 150^{\circ}\text{C}$

**Figure 18. Forward current as a function of heatsink temperature**

Output inverter FRED

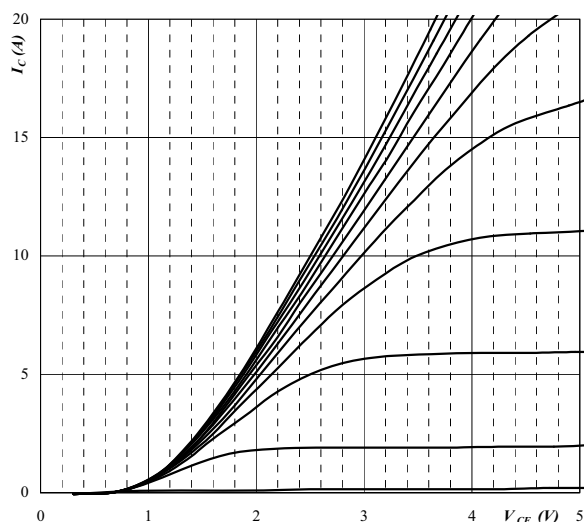
$$I_F = f(T_h)$$



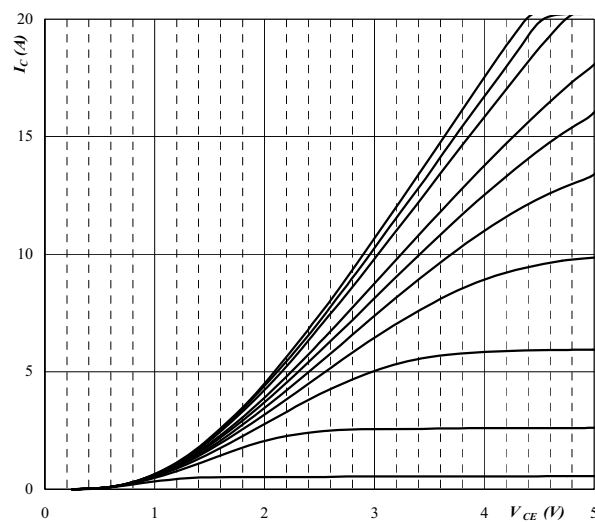
parameter:  $T_j = 150^{\circ}\text{C}$

flowPIM®1, 600V

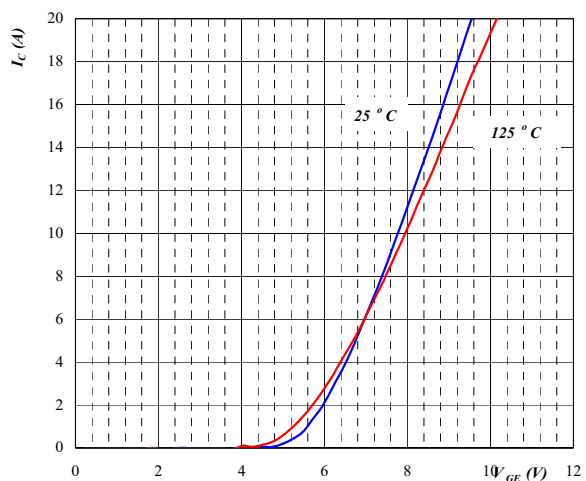
## Brake

**Figure 19. Typical output characteristics**
*Brake IGBT*
 $I_C = f(V_{CE})$ 


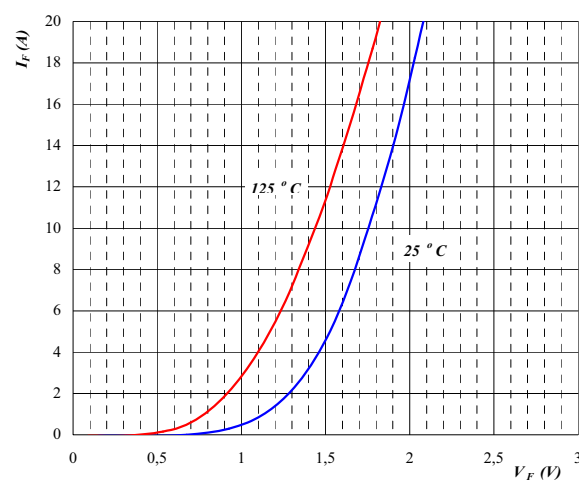
parameter:  $t_p = 250 \text{ us}$   $T_j = 25 \text{ °C}$   
 $V_{GE}$  parameter: from: 5 V to 15 V  
in 1 V steps

**Figure 20. Typical output characteristics**
*Brake IGBT*
 $I_C = f(V_{CE})$ 


parameter:  $t_p = 250 \text{ us}$   $T_j = 125 \text{ °C}$   
 $V_{GE}$  parameter: from: 5 V to 15 V  
in 1 V steps

**Figure 21. Typical transfer characteristics**
*Brake IGBT*
 $I_C = f(V_{GE})$ 


parameter:  $t_p = 250 \text{ us}$   $V_{CE} = 10 \text{ V}$

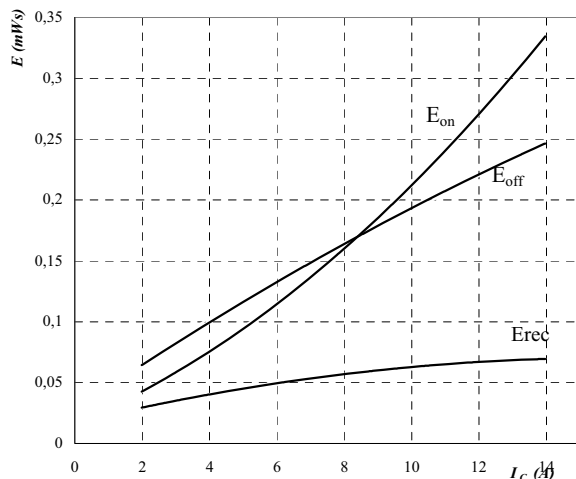
**Figure 22. Typical diode forward current as a function of forward voltage**
*Brake FRED*
 $I_F = f(V_F)$ 


parameter:  $t_p = 250 \text{ us}$

## Brake

**Figure 23. Typical switching energy losses as a function of collector current**  
Brake IGBT

$E = f(I_c)$



inductive load,  $T_j = 125^\circ\text{C}$

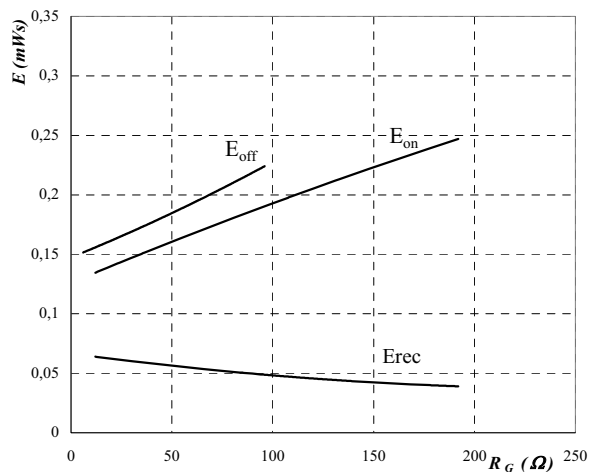
$V_{CE} = 300\text{ V}$

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

$R_{Gon} = 2 \cdot R_{Goff} = 48\text{ }\Omega$

**Figure 24. Typical switching energy losses as a function of gate resistor**  
Brake IGBT

$E = f(R_G)$



inductive load,  $T_j = 125^\circ\text{C}$

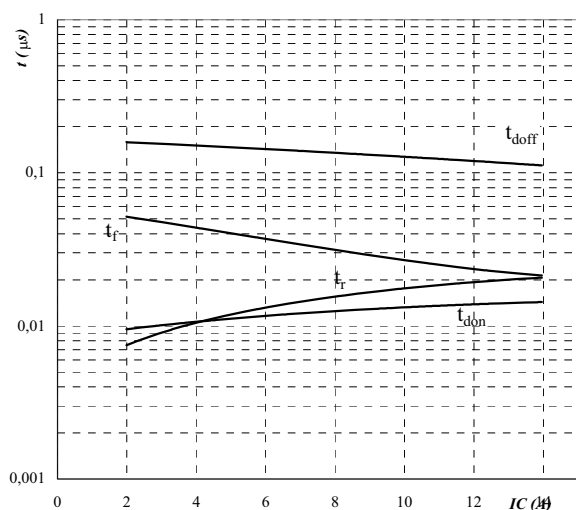
$V_{CE} = 300\text{ V}$

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

$I_c = 8\text{ A}$

**Figure 25. Typical switching times as a function of collector current**  
Brake IGBT

$t = f(I_c)$



inductive load,  $T_j = 125^\circ\text{C}$

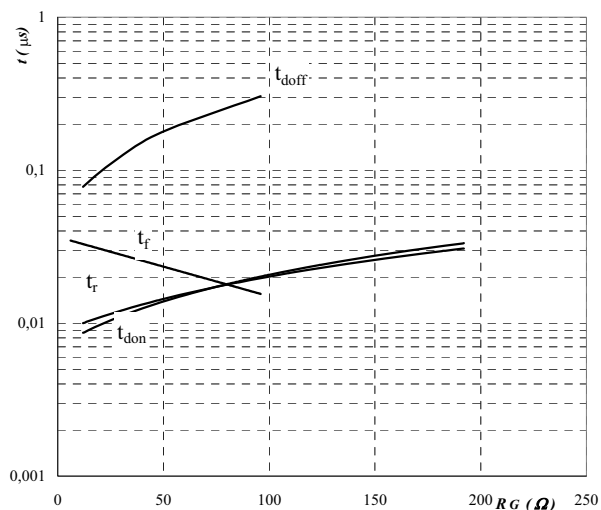
$V_{CE} = 300\text{ V}$

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

$R_{Gon} = 2 \cdot R_{Goff} = 48\text{ }\Omega$

**Figure 26. Typical switching times as a function of gate resistor**  
Brake IGBT

$t = f(R_G)$



inductive load,  $T_j = 125^\circ\text{C}$

$V_{CE} = 300\text{ V}$

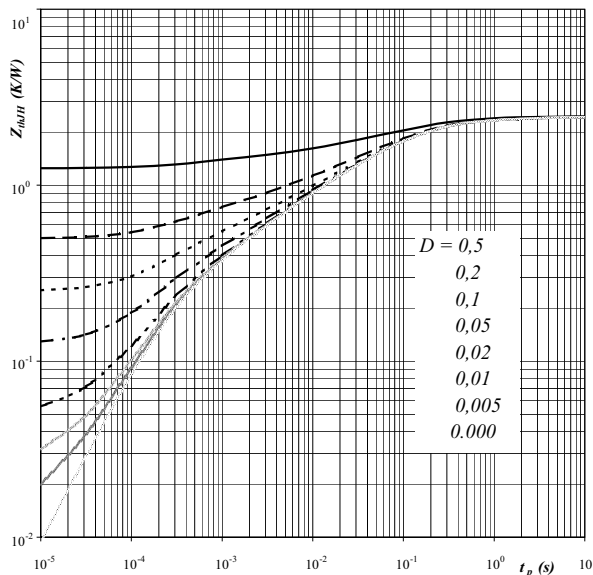
$V_{GE} = 15\text{ V}$

$I_c = 8\text{ A}$

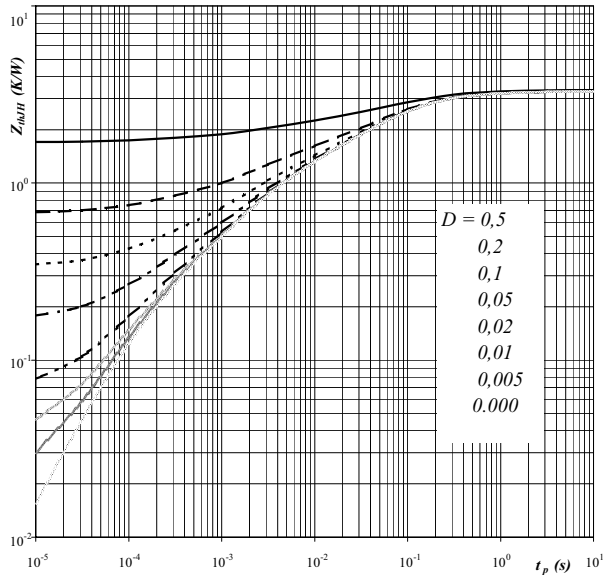
flowPIM®1, 600V

## Brake

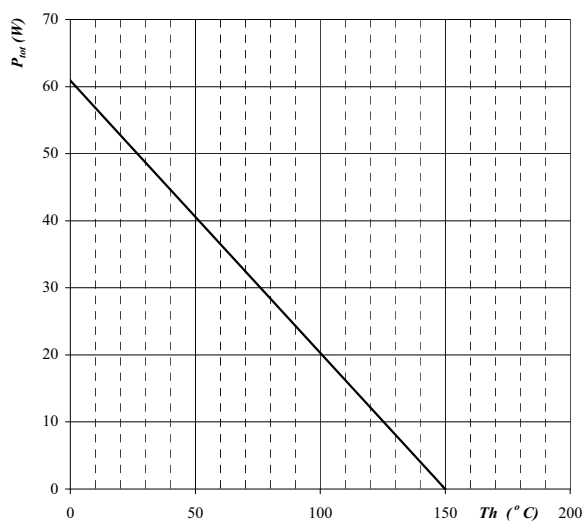
**Figure 27. IGBT transient thermal impedance as a function of pulse width**  
 $Z_{thJH} = f(t_p)$


Parameter:  $D = t_p / T$   $R_{thJH} = 2,5 \text{ K/W}$ 

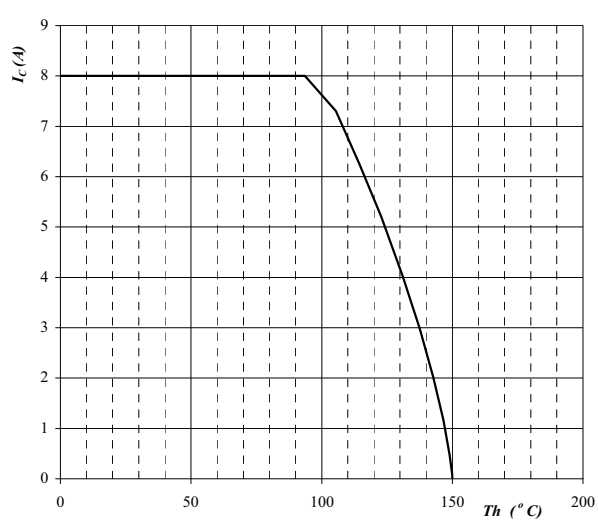
**Figure 28. FRED transient thermal impedance as a function of pulse width**  
 $Z_{thJH} = f(t_p)$


Parameter:  $D = t_p / T$   $R_{thJH} = 3,4 \text{ K/W}$ 

**Figure 29. Power dissipation as a function of heatsink temperature**  
*Brake IGBT*  
 $P_{tot} = f(T_h)$


parameter:  $T_j = 150^\circ\text{C}$ 

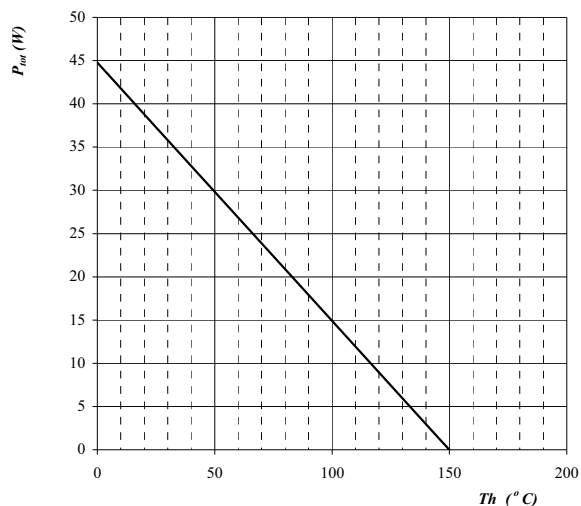
**Figure 30. Collector current as a function of heatsink temperature**  
*Brake IGBT*  
 $I_c = f(T_h)$


parameter:  $T_j = 150^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$

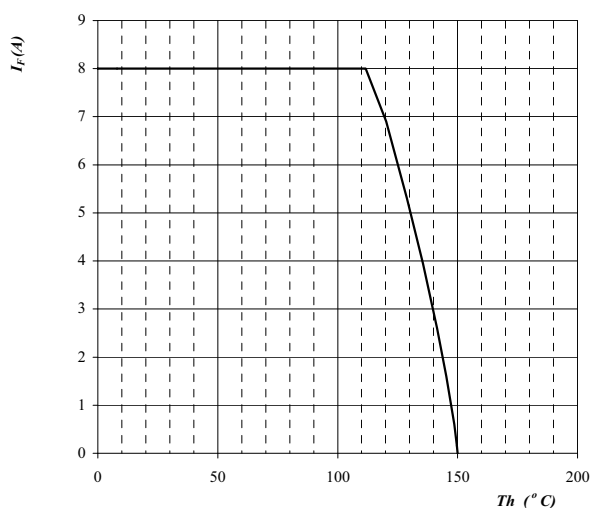
flowPIM<sup>®</sup>1, 600V

## Brake

**Figure 31. Power dissipation as a function of heatsink temperature**

*Brake FRED*
 $P_{tot} = f(T_h)$ 

parameter:  $T_j = 150^{\circ}\text{C}$ 

**Figure 32. Forward current as a function of heatsink temperature**

*Brake FRED*
 $I_F = f(T_h)$ 

parameter:  $T_j = 150^{\circ}\text{C}$

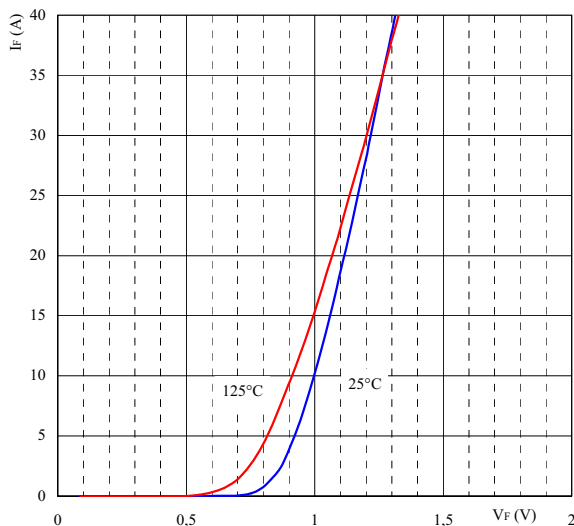
flowPIM<sup>®</sup>1, 600V

## Input rectifier bridge

**Figure 33. Typical diode forward current as a function of forward voltage**

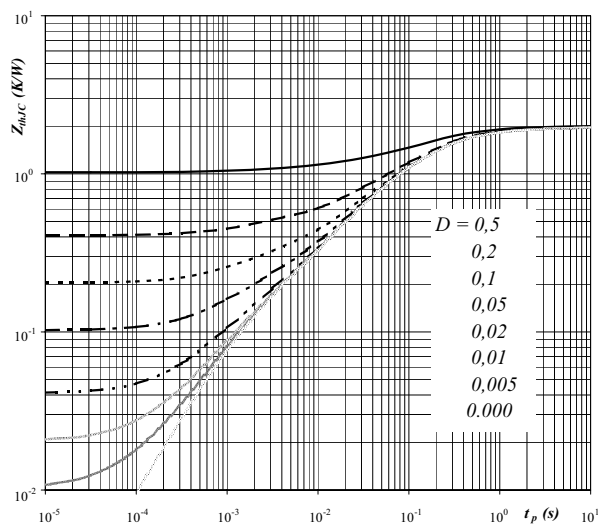
Rectifier diode

$$I_F = f(V_F)$$


parameter:  $t_p = 250 \text{ us}$ 

**Figure 34. Diode transient thermal impedance as a function of pulse width**

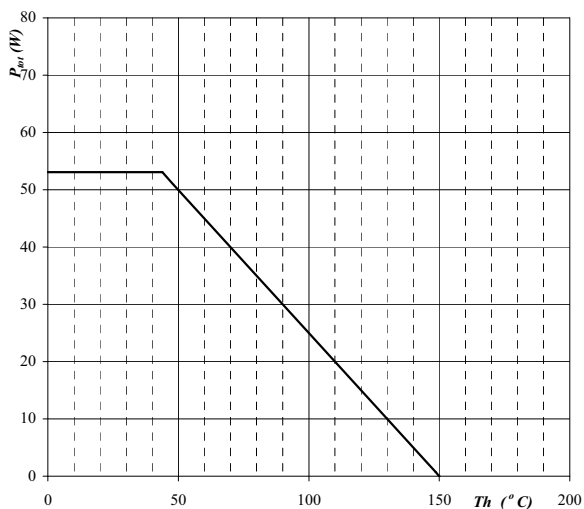
$$Z_{thJC} = f(t_p)$$


Parameter:  $D = t_p / T$ 
 $R_{thJH} = 2.0 \text{ K/W}$ 

**Figure 35. Power dissipation as a function of heatsink temperature**

Rectifier diode

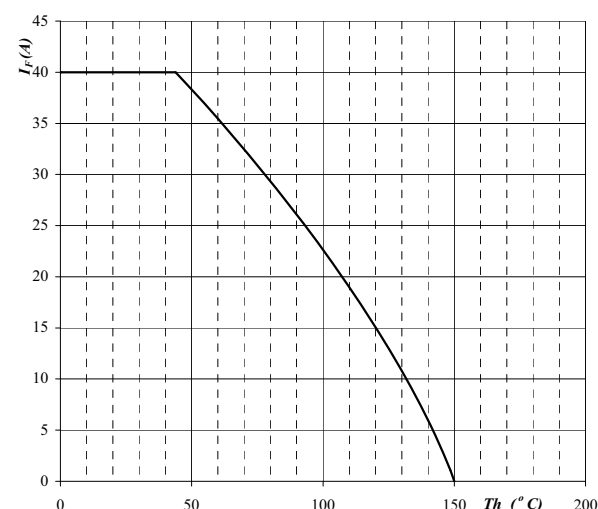
$$P_{tot} = f(T_h)$$


parameter:  $T_j = 150^\circ\text{C}$ 

**Figure 36. Forward current as a function of heatsink temperature**

Rectifier diode

$$I_F = f(T_h)$$


parameter:  $T_j = 150^\circ\text{C}$

flowPIM®1, 600V

## Thermistor

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

$$R_T = f(T)$$

