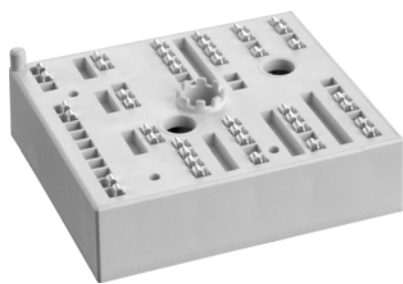


# SKiiP 28ANB18V3



MiniSKiiP® 2

3-phase bridge rectifier +  
brake chopper

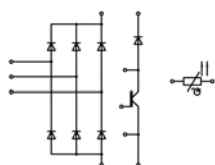
## SKiiP 28ANB18V3

### Features

- Trench IGBTs
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

### Remarks

- Max. case temperature limited to  $T_C=125^{\circ}\text{C}$
- Product reliability results valid for  $T_j \leq 150^{\circ}\text{C}$  (recommended  $T_{j,op} = -40 \dots +150^{\circ}\text{C}$ )
- IGBT 1: brake chopper IGBT
- Diode 1: brake chopper diode
- Diode 4: rectifier diode
- The distance between terminals of temperature sensor and –rect is not sufficient for basic insulation



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### Absolute Maximum Ratings

| Symbol            | Conditions                                                                      |                         | Values      | Unit |
|-------------------|---------------------------------------------------------------------------------|-------------------------|-------------|------|
| IGBT 1            |                                                                                 |                         |             |      |
| V <sub>CES</sub>  | T <sub>j</sub> = 25 °C                                                          |                         | 1700        | V    |
| I <sub>C</sub>    | T <sub>j</sub> = 150 °C                                                         | T <sub>s</sub> = 25 °C  | 115         | A    |
|                   |                                                                                 | T <sub>s</sub> = 70 °C  | 88          | A    |
| I <sub>C</sub>    | T <sub>j</sub> = 175 °C                                                         | T <sub>s</sub> = 25 °C  | 128         | A    |
|                   |                                                                                 | T <sub>s</sub> = 70 °C  | 104         | A    |
| I <sub>Cnom</sub> |                                                                                 |                         | 100         | A    |
| I <sub>CRM</sub>  | I <sub>CRM</sub> = 2 x I <sub>Cnom</sub>                                        |                         | 200         | A    |
| V <sub>GES</sub>  |                                                                                 |                         | -20 ... 20  | V    |
| t <sub>psc</sub>  | V <sub>CC</sub> = 1200 V<br>V <sub>GE</sub> ≤ 20 V<br>V <sub>CES</sub> ≤ 1700 V | T <sub>j</sub> = 150 °C | 10          | μs   |
| T <sub>j</sub>    |                                                                                 |                         | -40 ... 175 | °C   |

### Absolute Maximum Ratings

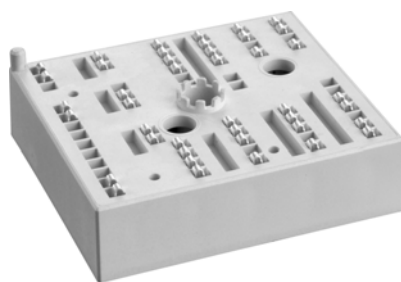
| Symbol            | Conditions                               |                        | Values      | Unit |
|-------------------|------------------------------------------|------------------------|-------------|------|
| Diode 1           |                                          |                        |             |      |
| V <sub>RRM</sub>  | T <sub>j</sub> = 25 °C                   |                        | 1700        | V    |
| I <sub>F</sub>    | T <sub>j</sub> = 150 °C                  | T <sub>s</sub> = 25 °C | 105         | A    |
|                   |                                          | T <sub>s</sub> = 70 °C | 76          | A    |
| I <sub>F</sub>    | T <sub>j</sub> = 175 °C                  | T <sub>s</sub> = 25 °C | 119         | A    |
|                   |                                          | T <sub>s</sub> = 70 °C | 93          | A    |
| I <sub>Fnom</sub> |                                          |                        | 150         | A    |
| I <sub>FRM</sub>  | I <sub>FRM</sub> = 2 x I <sub>Fnom</sub> |                        | 300         | A    |
| I <sub>FSM</sub>  | 10 ms, sin 180°, T <sub>j</sub> = 150 °C |                        | 860         | A    |
| T <sub>j</sub>    |                                          |                        | -40 ... 175 | °C   |

### Absolute Maximum Ratings

| Symbol            | Conditions                                |                        | Values      | Unit             |
|-------------------|-------------------------------------------|------------------------|-------------|------------------|
| Diode 4           |                                           |                        |             |                  |
| V <sub>RRM</sub>  |                                           |                        | 1800        | V                |
| I <sub>F</sub>    | T <sub>j</sub> = 150 °C                   | T <sub>s</sub> = 25 °C | 139         | A                |
|                   |                                           | T <sub>s</sub> = 70 °C | 98          | A                |
| I <sub>Fnom</sub> | DC current                                |                        | 88          | A                |
| I <sub>FSM</sub>  | 10 ms, sin 180°, T <sub>j</sub> = 150 °C  |                        | 890         | A                |
| I <sup>2</sup> t  | 10 ms, sin. 180°, T <sub>j</sub> = 150 °C |                        | 3900        | A <sup>2</sup> s |
| T <sub>j</sub>    |                                           |                        | -40 ... 150 | °C               |

### Absolute Maximum Ratings

| Symbol        | Conditions                                            | Values      | Unit               |
|---------------|-------------------------------------------------------|-------------|--------------------|
| <b>Module</b> |                                                       |             |                    |
| $I_{t(RMS)}$  | $T_{terminal} = 80^{\circ}\text{C}$ , 20 A per spring | 80          | A                  |
| $T_{stg}$     |                                                       | -40 ... 125 | $^{\circ}\text{C}$ |
| $V_{isol}$    | AC sinus 50 Hz, $t = 1\text{ min}$                    | 2500        | V                  |



MiniSKiiP® 2

## 3-phase bridge rectifier + brake chopper

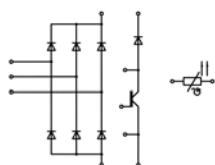
### SKiiP 28ANB18V3

#### Features

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- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

#### Remarks

- Max. case temperature limited to  $T_C=125^\circ\text{C}$
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- IGBT 1: brake chopper IGBT
- Diode 1: brake chopper diode
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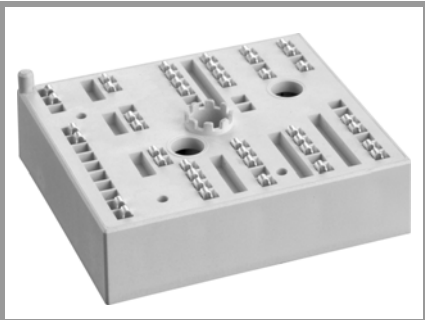
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| Characteristics      |                                                            |                         |      |      |      |      |
|----------------------|------------------------------------------------------------|-------------------------|------|------|------|------|
| Symbol               | Conditions                                                 |                         | min. | typ. | max. | Unit |
| IGBT 1               |                                                            |                         |      |      |      |      |
| V <sub>CE(sat)</sub> | I <sub>C</sub> = 100 A                                     | T <sub>j</sub> = 25 °C  |      | 2.00 | 2.40 | V    |
|                      | V <sub>GE</sub> = 15 V<br>chipelevel                       | T <sub>j</sub> = 150 °C |      | 2.45 | 2.90 | V    |
| V <sub>CE0</sub>     | chipelevel                                                 | T <sub>j</sub> = 25 °C  |      | 1    | 1.2  | V    |
|                      |                                                            | T <sub>j</sub> = 150 °C |      | 0.9  | 1.1  | V    |
| r <sub>CE</sub>      | V <sub>GE</sub> = 15 V<br>chipelevel                       | T <sub>j</sub> = 25 °C  |      | 10   | 12   | mΩ   |
|                      |                                                            | T <sub>j</sub> = 150 °C |      | 16   | 18   | mΩ   |
| V <sub>GE(th)</sub>  | V <sub>GE</sub> = V <sub>CE</sub> V, I <sub>C</sub> = 4 mA |                         | 5.2  | 5.8  | 6.4  | V    |
| I <sub>CES</sub>     | V <sub>GE</sub> = 0 V                                      | T <sub>j</sub> = 25 °C  |      | 0.1  | 0.3  | mA   |
|                      | V <sub>CE</sub> = 1700 V                                   |                         |      |      | mA   |      |
| C <sub>ies</sub>     | V <sub>CE</sub> = 25 V<br>V <sub>GE</sub> = 0 V            | f = 1 MHz               |      | 8.82 |      | nF   |
| C <sub>oes</sub>     |                                                            | f = 1 MHz               |      | 0.37 |      | nF   |
| C <sub>res</sub>     |                                                            | f = 1 MHz               |      | 0.29 |      | nF   |
| Q <sub>G</sub>       | - 8 V...+ 15 V                                             |                         |      | 934  |      | nC   |
| R <sub>Gint</sub>    | T <sub>j</sub> = 25 °C                                     |                         |      | 4.8  |      | Ω    |
| t <sub>d(on)</sub>   | V <sub>CC</sub> = 900 V                                    | T <sub>j</sub> = 150 °C |      | 160  |      | ns   |
| t <sub>r</sub>       | I <sub>C</sub> = 100 A                                     | T <sub>j</sub> = 150 °C |      | 35   |      | ns   |
| E <sub>on</sub>      | R <sub>G on</sub> = 1 Ω                                    | T <sub>j</sub> = 150 °C |      | 23   |      | mJ   |
| t <sub>d(off)</sub>  | R <sub>G off</sub> = 1 Ω                                   | T <sub>j</sub> = 150 °C |      | 580  |      | ns   |
| t <sub>f</sub>       | di/dt <sub>on</sub> = 3000 A/μs                            | T <sub>j</sub> = 150 °C |      | 150  |      | ns   |
| E <sub>off</sub>     | di/dt <sub>off</sub> = 600 A/μs                            | T <sub>j</sub> = 150 °C |      | 32.7 |      | mJ   |
|                      | V <sub>GE neg</sub> = -15 V<br>V <sub>GE pos</sub> = 15 V  |                         |      |      |      |      |
| R <sub>th(j-s)</sub> | per IGBT, λ <sub>paste</sub> =0.8 W/K*m                    |                         |      | 0.33 |      | K/W  |

| Characteristics                  |                                          |                         |      |      |      |      |
|----------------------------------|------------------------------------------|-------------------------|------|------|------|------|
| Symbol                           | Conditions                               |                         | min. | typ. | max. | Unit |
| Diode 1                          |                                          |                         |      |      |      |      |
| V <sub>F</sub> = V <sub>EC</sub> | I <sub>F</sub> = 100 A                   | T <sub>j</sub> = 25 °C  |      | 1.8  | 2.1  | V    |
|                                  | V <sub>GE</sub> = 0 V<br>chipelevel      | T <sub>j</sub> = 150 °C |      | 1.8  | 2.1  | V    |
| V <sub>F0</sub>                  | chipelevel                               | T <sub>j</sub> = 25 °C  |      | 1.3  | 1.6  | V    |
|                                  |                                          | T <sub>j</sub> = 150 °C |      | 1.1  | 1.2  | V    |
| r <sub>F</sub>                   | chipelevel                               | T <sub>j</sub> = 25 °C  |      | 4.4  | 5.4  | mΩ   |
|                                  |                                          | T <sub>j</sub> = 150 °C |      | 6.9  | 8.7  | mΩ   |
| I <sub>RRM</sub>                 | I <sub>F</sub> = 100 A                   | T <sub>j</sub> = 150 °C |      | 226  |      | A    |
| Q <sub>rr</sub>                  | di/dt <sub>off</sub> = 4000 A/μs         | T <sub>j</sub> = 150 °C |      | 38.5 |      | μC   |
| E <sub>rr</sub>                  | V <sub>GE</sub> = -15 V                  | T <sub>j</sub> = 150 °C |      | 26.4 |      | mJ   |
| R <sub>th(j-s)</sub>             | per Diode, λ <sub>paste</sub> =0.8 W/K*m |                         |      | 0.58 |      | K/W  |

| Characteristics                  |                                          |                         |      |      |      |      |
|----------------------------------|------------------------------------------|-------------------------|------|------|------|------|
| Symbol                           | Conditions                               |                         | min. | typ. | max. | Unit |
| Diode 4                          |                                          |                         |      |      |      |      |
| V <sub>F</sub> = V <sub>EC</sub> | I <sub>F</sub> = 88 A                    | T <sub>j</sub> = 25 °C  |      | 1.1  | 1.3  | V    |
|                                  | V <sub>GE</sub> = 0 V<br>chiplevel       | T <sub>j</sub> = 125 °C |      | 1    | 1.3  | V    |
| V <sub>F0</sub>                  | chiplevel                                | T <sub>j</sub> = 25 °C  | 0.6  | 0.9  | 1.1  | V    |
|                                  |                                          | T <sub>j</sub> = 125 °C |      | 0.7  | 1    | V    |
| r <sub>F</sub>                   | chiplevel                                | T <sub>j</sub> = 25 °C  |      | 2.3  | 2.6  | mΩ   |
|                                  |                                          | T <sub>j</sub> = 125 °C |      | 3    | 3.3  | mΩ   |
| R <sub>th(j-s)</sub>             | per Diode, λ <sub>paste</sub> =0.8 W/K*m |                         |      | 0.64 |      | K/W  |

# SKiiP 28ANB18V3



MiniSKiiP® 2

3-phase bridge rectifier +  
brake chopper

## SKiiP 28ANB18V3

### Features

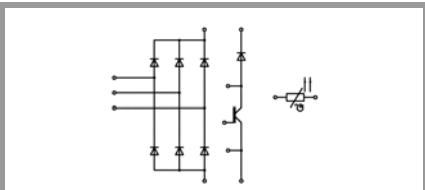
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- IGBT 1: brake chopper IGBT
- Diode 1: brake chopper diode
- Diode 4: rectifier diode
- The distance between terminals of temperature sensor and –rect is not sufficient for basic insulation

| Characteristics    |                                                                                                                                                                                                  |      |                |      |          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|------|----------|
| Symbol             | Conditions                                                                                                                                                                                       | min. | typ.           | max. | Unit     |
| Temperature Sensor |                                                                                                                                                                                                  |      |                |      |          |
| $R_{100}$          | $T_r=100^{\circ}\text{C}$ ( $R_{25}=1000\Omega$ )                                                                                                                                                |      | $1670 \pm 3\%$ |      | $\Omega$ |
| $R(T)$             | $R(T)=1000\Omega[1+A(T-25^{\circ}\text{C})+B(T-25^{\circ}\text{C})^2]$ ,<br>$A = 7.635 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$ ,<br>$B = 1.731 \cdot 10^{-5} \text{ }^{\circ}\text{C}^{-2}$ |      |                |      |          |

| Characteristics |              |      |      |      |      |
|-----------------|--------------|------|------|------|------|
| Symbol          | Conditions   | min. | typ. | max. | Unit |
| Module          |              |      |      |      |      |
| $M_s$           | to heat sink | 2    |      | 2.5  | Nm   |
| w               | weight       |      | 55   |      | g    |



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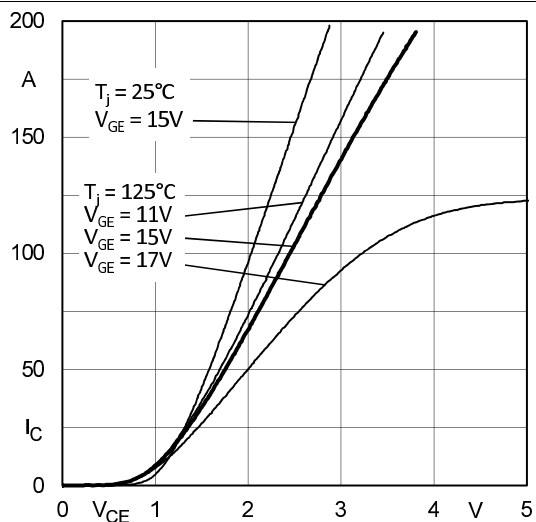


Fig. 1: Typ. output characteristic, inclusive  $R_{CC} + EE'$

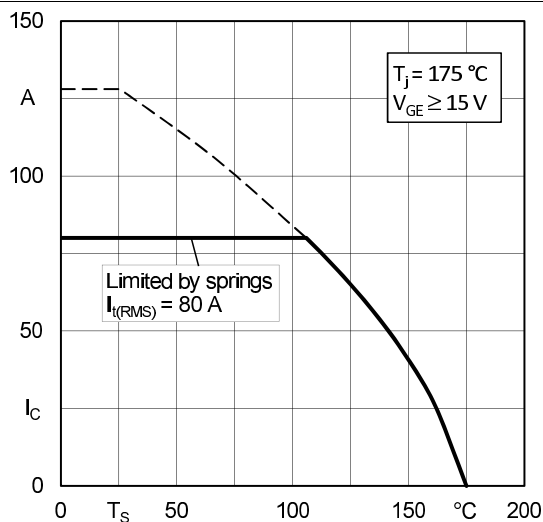


Fig. 2: Typ. rated current vs. temperature  $I_C = f(T_S)$

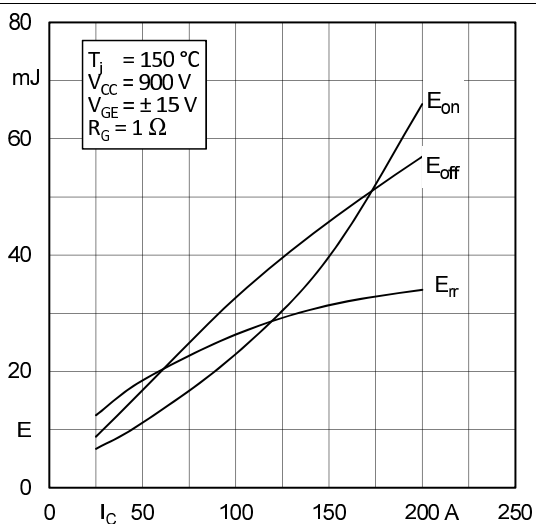


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

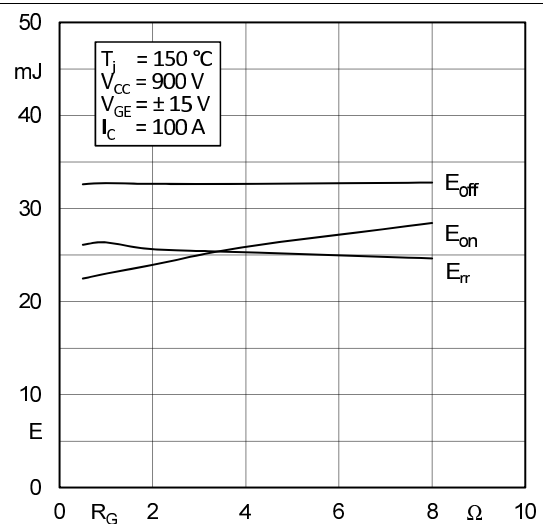


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

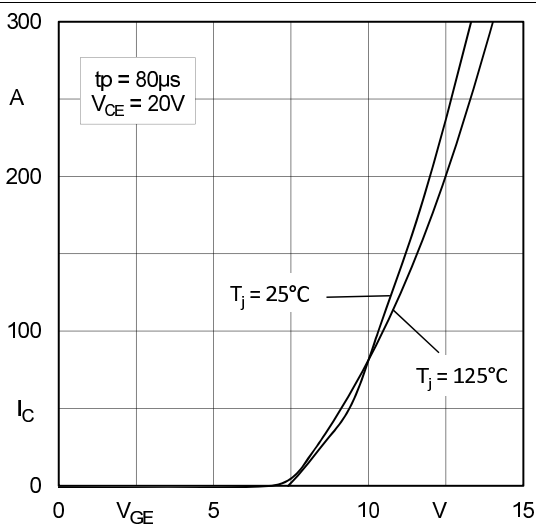


Fig. 5: Typ. transfer characteristic

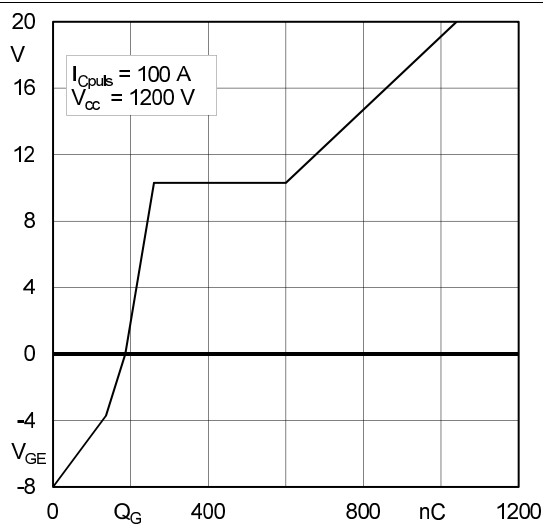


Fig. 6: Typ. gate charge characteristic

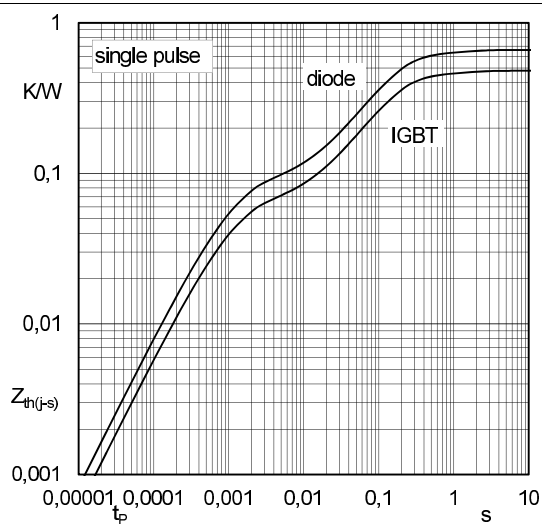


Fig. 7: Transient thermal impedance of IGBT and Diode

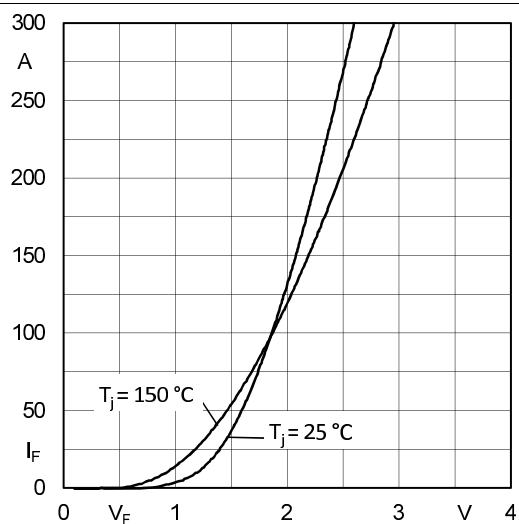


Fig. 8: CAL diode forward characteristic

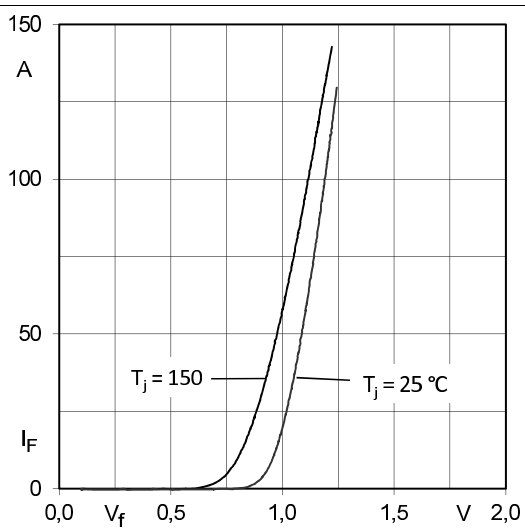


Fig. 9: Typ. input bridge forward characteristic

