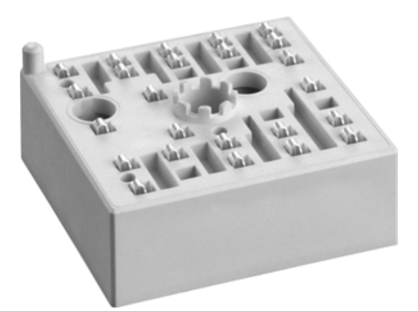
# SKiiP 12NAB12T4V1



MiniSKiiP® 1

**SKiiP 12NAB12T4V1**

## Features

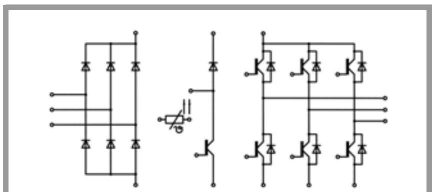
- Trench 4 IGBT´s
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised file no. E63532

## Typical Applications*

- Inverter up to 12 kVA
- Typical motor power 5,5 kW

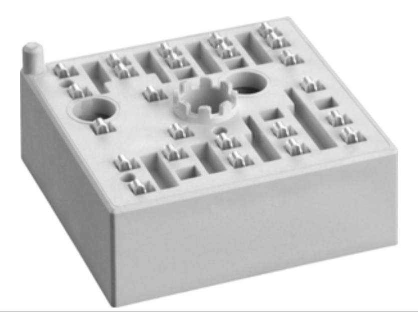
## Remarks

- $V_{CEsat}$ , $V_F$= chip level value
- Case temp. limited to $T_C$= 125°C max. (for baseplateless modules $T_C = T_S$)
- product rel. results valid for Tj≤150 (recomm. Top = -40 ... +150°C)



NAB

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **Inverter - IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $T_j$ = 150 °C | $T_s$ = 25 °C | 18 | A |
| | | $T_s$ = 70 °C | 18 | A |
| $I_C$ | $T_j$ = 175 °C | $T_s$ = 25 °C | 18 | A |
| | | $T_s$ = 70 °C | 18 | A |
| $I_{Cnom}$ | | | 15 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3 x $I_{Cnom}$ | | 45 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V<br>$V_{GE}$ ≤ 15 V<br>$V_{CES}$ ≤ 1200 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Chopper - IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $T_j$ = 150 °C | $T_s$ = 25 °C | 18 | A |
| | | $T_s$ = 70 °C | 18 | A |
| $I_C$ | $T_j$ = 175 °C | $T_s$ = 25 °C | 18 | A |
| | | $T_s$ = 70 °C | 18 | A |
| $I_{Cnom}$ | | | 15 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3 x $I_{Cnom}$ | | 45 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V<br>$V_{GE}$ ≤ 15 V<br>$V_{CES}$ ≤ 1200 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_F$ | $T_j$ = 150 °C | $T_s$ = 25 °C | 21 | A |
| | | $T_s$ = 70 °C | 16 | A |
| $I_F$ | $T_j$ = 175 °C | $T_s$ = 25 °C | 23 | A |
| | | $T_s$ = 70 °C | 18 | A |
| $I_{Fnom}$ | | | 15 | A |
| $I_{FRM}$ | $I_{FRM}$ = 3 x $I_{Fnom}$ | | 45 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 65 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Freewheeling - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_F$ | $T_j$ = 150 °C | $T_s$ = 25 °C | 22 | A |
| | | $T_s$ = 70 °C | 16 | A |
| $I_F$ | $T_j$ = 175 °C | $T_s$ = 25 °C | 22 | A |
| | | $T_s$ = 70 °C | 22 | A |
| $I_{Fnom}$ | | | 15 | A |
| $I_{FRM}$ | $I_{FRM}$ = 3 x $I_{Fnom}$ | | 45 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 65 | A |
| $T_j$ | | | -40 ... 175 | °C |



MiniSKiiP® 1

**SKiiP 12NAB12T4V1**

### Features

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- Highly reliable spring contacts for electrical connections
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### Typical Applications*

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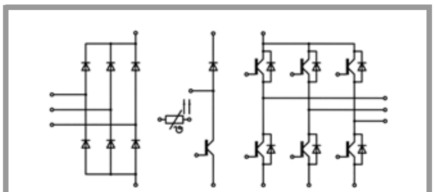
- Typical motor power 5,5 kW

### Remarks

- $V_{CEsat}$ , $V_F$= chip level value
- Case temp. limited to $T_C$= 125°C max. (for baseplateless modules $T_C = T_S$)
- product rel. results valid for Tj≤150 (recomm. Top = -40 ... +150°C)

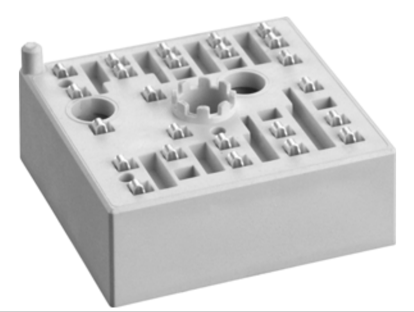


NAB

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **Rectifier - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1600 | V |
| $I_F$ | $T_s$ = 25 °C, $T_j$ = 150 °C | | 39 | A |
| $I_{Fnom}$ | | | 8 | A |
| $I_{FSM}$ | 10 ms sin 180° | $T_j$ = 25 °C | 220 | A |
| | | $T_j$ = 150 °C | 200 | A |
| $I^2t$ | 10 ms sin 180° | $T_j$ = 25 °C | 242 | $A^2s$ |
| | | $T_j$ = 150 °C | 200 | $A^2s$ |
| $T_j$ | | | -40 ... 150 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C, 20A per spring | | 20 | A |
| $T_{stg}$ | | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50Hz, 1 min | | 2500 | V |

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverter - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 15 A, $V_{GE}$ = 15 V, chiplevel | $T_j$ = 25 °C | | 1.85 | 2.10 | V |
| | | $T_j$ = 150 °C | | 2.25 | 2.45 | V |
| $V_{CE0}$ | | $T_j$ = 25 °C | | 0.8 | 0.9 | V |
| | | $T_j$ = 150 °C | | 0.7 | 0.8 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V | $T_j$ = 25 °C | | 70 | 80 | mΩ |
| | | $T_j$ = 150 °C | | 103 | 110 | mΩ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$ V, $I_C$ = 1 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V | $T_j$ = 25 °C | | 0.1 | 0.3 | mA |
| | | | | | | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | f = 1 MHz | | 0.90 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.08 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.06 | | nF |
| $Q_G$ | - 8 V...+ 15 V | | | 85 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 0.00 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V, $I_C$ = 15 A, $R_{G\,on}$ = 16 Ω, $R_{G\,off}$ = 16 Ω | $T_j$ = 150 °C | | 15 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 25 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 1.4 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 260 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 75 | | ns |
| $E_{off}$ | $V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 1.3 | | mJ |
| $R_{th(j-s)}$ | per IGBT | | | 1.3 | | K/W |
| **Chopper - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 15 A, $V_{GE}$ = 15 V, chiplevel | $T_j$ = 25 °C | | 1.85 | 2.10 | V |
| | | $T_j$ = 150 °C | | 2.25 | 2.45 | V |
| $V_{CE0}$ | | $T_j$ = 25 °C | | 0.8 | 0.9 | V |
| | | $T_j$ = 150 °C | | 0.7 | 0.8 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V | $T_j$ = 25 °C | | 70 | 80 | mΩ |
| | | $T_j$ = 150 °C | | 103 | 110 | mΩ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$ V, $I_C$ = 1 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V | $T_j$ = 25 °C | | 0.1 | 0.3 | mA |
| | | $T_j$ = 150 °C | | | | mA |
| $Q_G$ | - 8 V...+ 15 V | | | 85 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 0.00 | | Ω |



MiniSKiiP® 1

**SKiiP 12NAB12T4V1**

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### Remarks

- $V_{CEsat}$ , $V_F$= chip level value
- Case temp. limited to $T_C$= 125°C max. (for baseplateless modules $T_C = T_S$)
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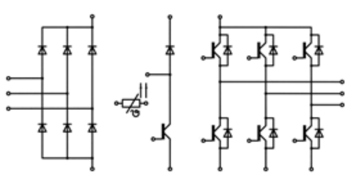


NAB

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Chopper - IGBT** | | | | | | |
| $t_{d(on)}$ | $V_{CC}$ = 600 V | $T_j$ = 150 °C | | 15 | | ns |
| $t_r$ | $I_C$ = 15 A | $T_j$ = 150 °C | | 25 | | ns |
| $E_{on}$ | $R_{G\ on}$ = 16 Ω | $T_j$ = 150 °C | | 1.4 | | mJ |
| $t_{d(off)}$ | $R_{G\ off}$ = 16 Ω | $T_j$ = 150 °C | | 260 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 75 | | ns |
| $E_{off}$ | $V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 1.3 | | mJ |
| $R_{th(j-s)}$ | per IGBT | | | 1.3 | | K/W |
| **Inverse - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 15 A | $T_j$ = 25 °C | | 2.40 | 2.7 | V |
| | $V_{GE}$ = 0 V chiplevel | $T_j$ = 150 °C | | 2.4 | 2.8 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1.3 | 1.5 | V |
| | | $T_j$ = 150 °C | | 0.9 | 1.1 | V |
| $r_F$ | | $T_j$ = 25 °C | | 72 | 81 | mΩ |
| | | $T_j$ = 150 °C | | 103 | 111 | mΩ |
| $I_{RRM}$ | $I_F$ = 15 A | $T_j$ = 150 °C | | 28 | | A |
| $Q_{rr}$ | $di/dt_{off}$ = 1180 A/µs | $T_j$ = 150 °C | | 2.6 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 1.1 | | mJ |
| $R_{th(j-s)}$ | per Diode | | | 1.92 | | K/W |
| **Freewheeling - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 15 A | $T_j$ = 25 °C | | 2.4 | 2.7 | V |
| | $V_{GE}$ = 0 V chiplevel | $T_j$ = 150 °C | | 2.4 | 2.8 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1.3 | 1.5 | V |
| | | $T_j$ = 150 °C | | 0.9 | 1.1 | V |
| $r_F$ | | $T_j$ = 25 °C | | 72 | 81 | mΩ |
| | | $T_j$ = 150 °C | | 103 | 111 | mΩ |
| $I_{RRM}$ | $I_F$ = 15 A | $T_j$ = 150 °C | | 28 | | A |
| $Q_{rr}$ | $di/dt_{off}$ = 1180 A/µs | $T_j$ = 150 °C | | 2.6 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 1.1 | | mJ |
| $R_{th(j-s)}$ | per Diode | | | 1.92 | | K/W |
| **Rectifier - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 8 A | $T_j$ = 25 °C | | 1 | 1.21 | V |
| | $V_{GE}$ = 0 V chiplevel | $T_j$ = 125 °C | | | 1.1 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | | 1.0 | V |
| | | $T_j$ = 125 °C | | | 0.8 | V |
| $r_F$ | | $T_j$ = 25 °C | | 15 | 29 | mΩ |
| | | $T_j$ = 125 °C | | | 34 | mΩ |
| $R_{th(j-s)}$ | per Diode | | | 1.5 | | K/W |
| **Module** | | | | | | |
| $M_s$ | to heat sink | | 2 | | 2.5 | Nm |
| w | | | | 35 | | g |
| **Temperatur Sensor** | | | | | | |
| $R_{100}$ | $T_r$ = 100 °C, tolerance = 3 % | | | 1670 ± 3% | | Ω |
| R(T) | $R(T)=1000\Omega[1+A(T-25°C)+B(T-25°C)^2]$, $A = 7.635 \cdot 10^{-3}$ °C$^{-1}$, $B = 1.731 \cdot 10^{-5}$ °C$^{-2}$ | | | | | |

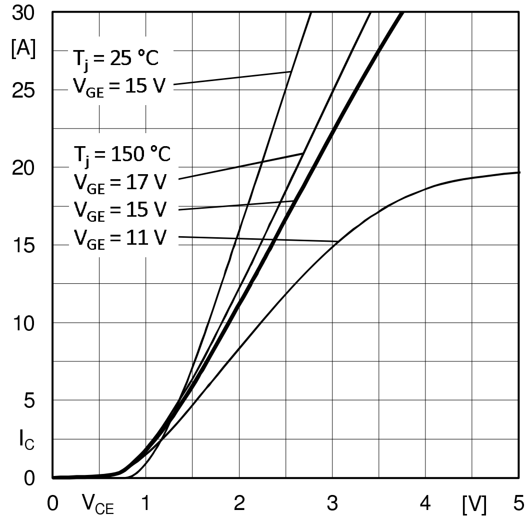



Fig. 1: Typ. output characteristic

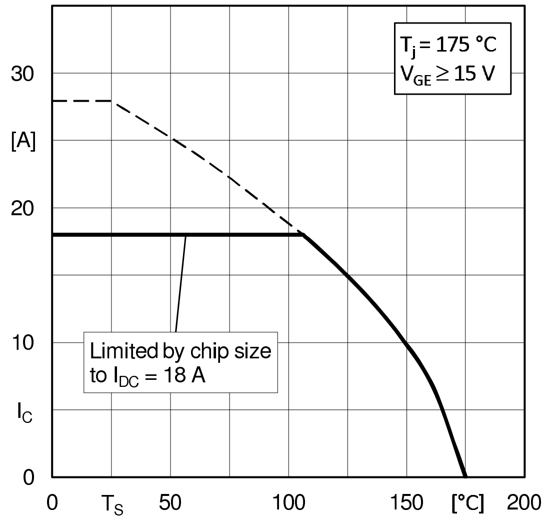



Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

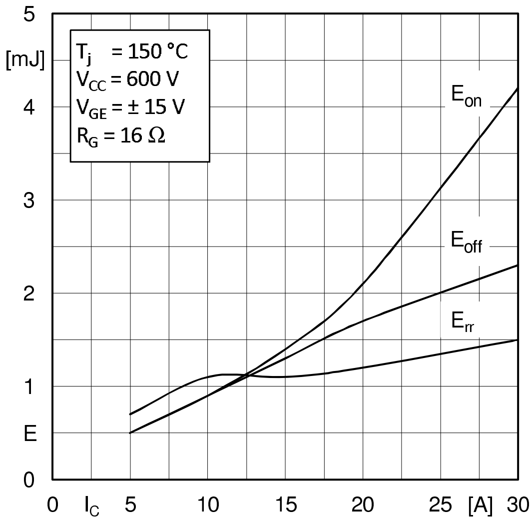



Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

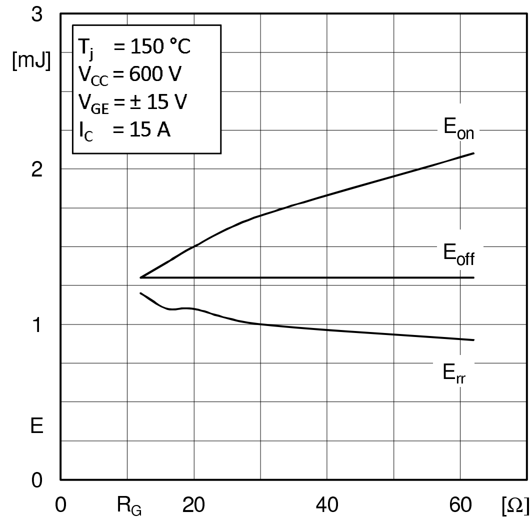



Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

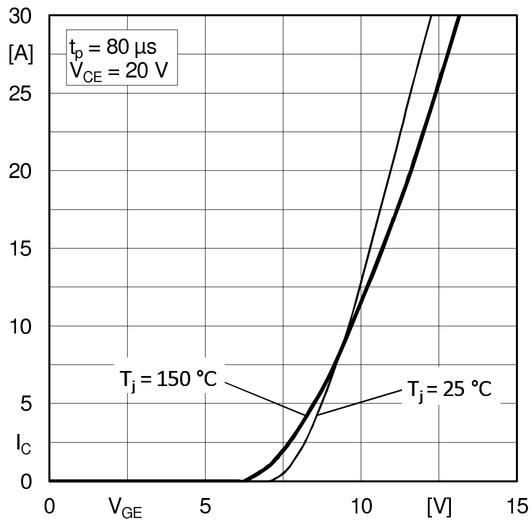



Fig. 5: Typ. transfer characteristic

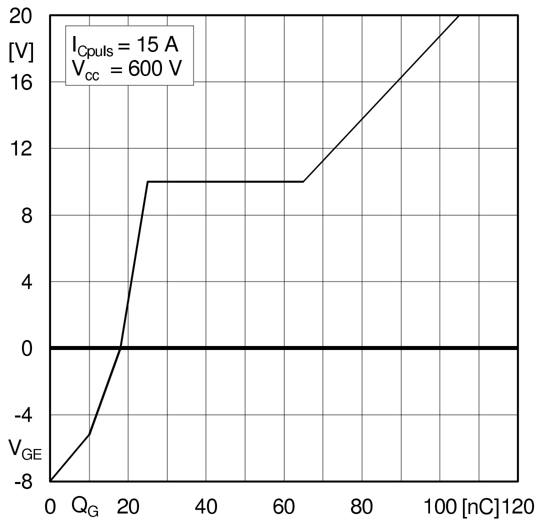



Fig. 6: Typ. gate charge characteristic

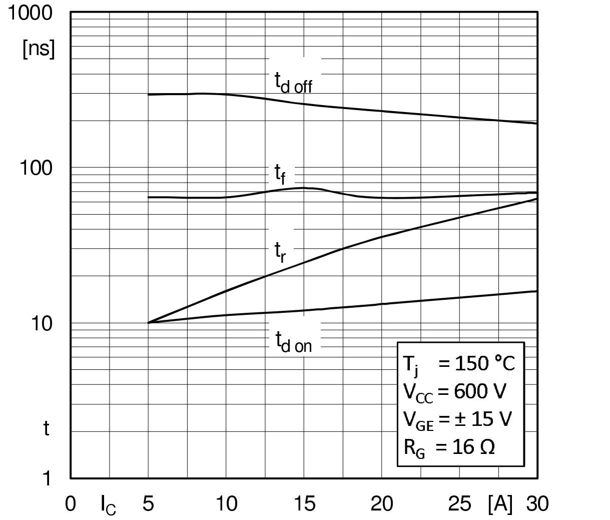



Fig. 7: Typ. switching times vs. $I_C$

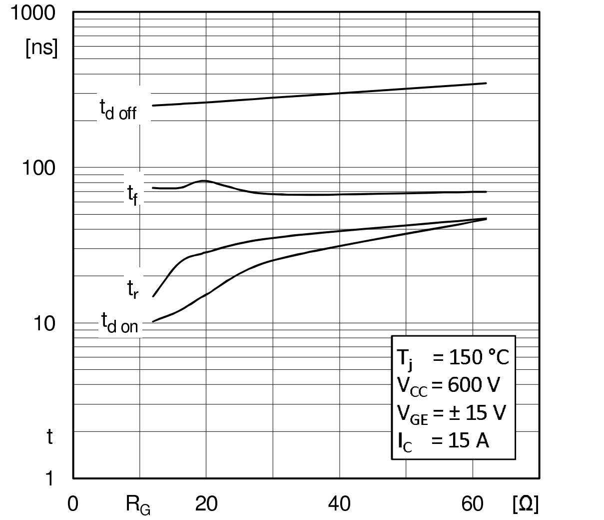



Fig. 8: Typ. switching times vs. gate resistor $R_G$

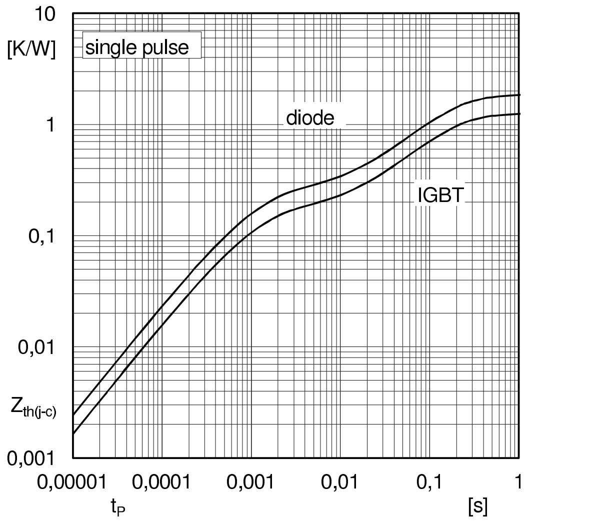



Fig. 9: Transient thermal impedance of IGBT and Diode

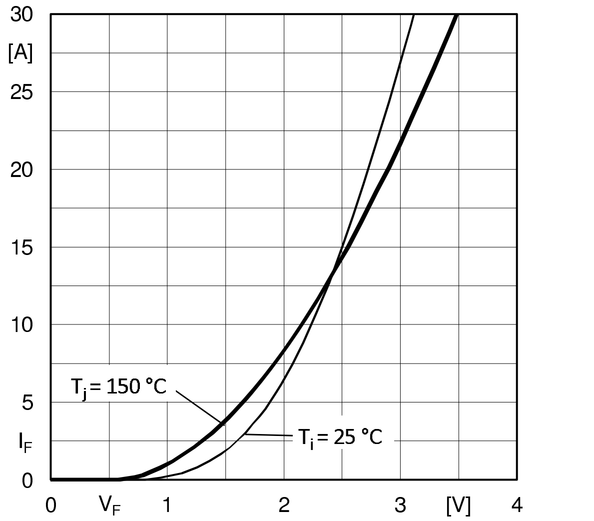



Fig. 10: CAL diode forward characteristic

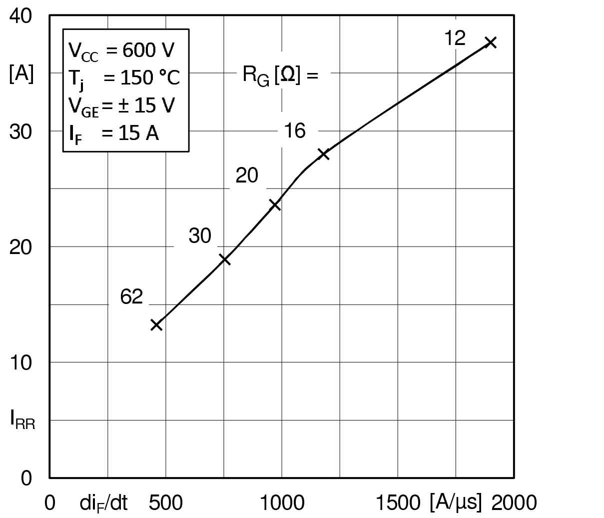



Fig. 11: Typ. CAL diode peak reverse recovery current

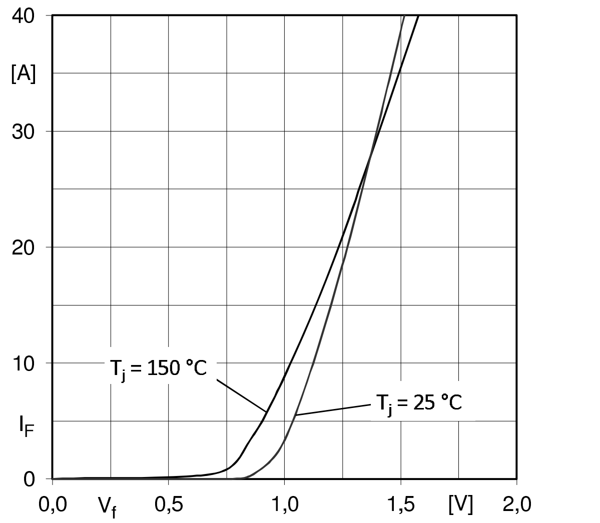
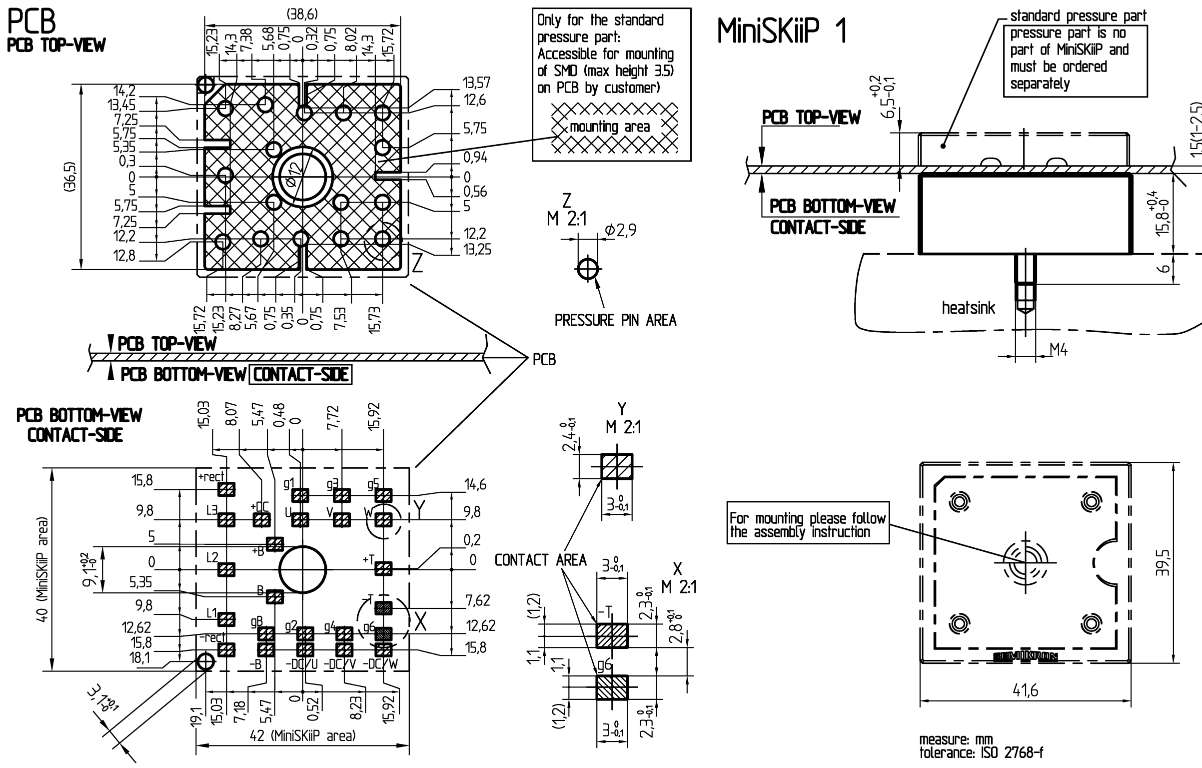
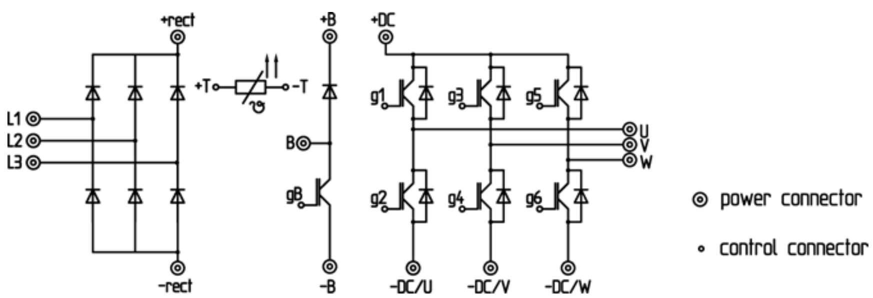



Fig. 12: Typ. input bridge forward characteristic






pinout, dimensions




pinout

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.