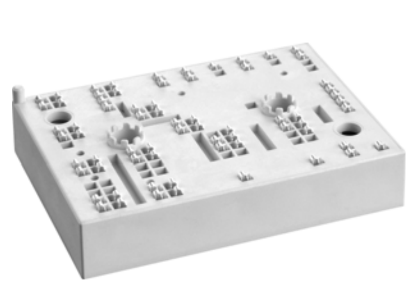


MiniSKiiP® 3

Converter-Inverter-Brake (CIB)

**SKiiP 37NAB12T4V10**

### Features*

- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

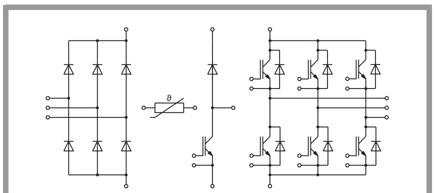
### Typical Applications

- Inverter up to 36 kVA
- Typical motor power 22 kW

### Remarks

- Max. case temperature limited to $T_C$=125°C
- Product reliability results valid for $T_j$≤150°C (recommended $T_{j,op}$=-40...+150°C)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet. Please refer to both documents for further information

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **Inverter - IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 90 | A |
| | | $T_s$ = 70 °C | 73 | A |
| $I_C$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 106 | A |
| | | $T_s$ = 70 °C | 86 | A |
| $I_{Cnom}$ | | | 75 | A |
| $I_{CRM}$ | | | 225 | 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 |
| $I_C$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 90 | A |
| | | $T_s$ = 70 °C | 73 | A |
| $I_C$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 106 | A |
| | | $T_s$ = 70 °C | 86 | A |
| $I_{Cnom}$ | | | 75 | A |
| $I_{CRM}$ | | | 225 | 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 |
| $I_F$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 83 | A |
| | | $T_s$ = 70 °C | 66 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 95 | A |
| | | $T_s$ = 70 °C | 76 | A |
| $I_{FRM}$ | | | 150 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 430 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Freewheeling - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_F$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 83 | A |
| | | $T_s$ = 70 °C | 66 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 95 | A |
| | | $T_s$ = 70 °C | 76 | A |
| $I_{FRM}$ | | | 150 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 430 | A |
| $T_j$ | | | -40 ... 175 | °C |



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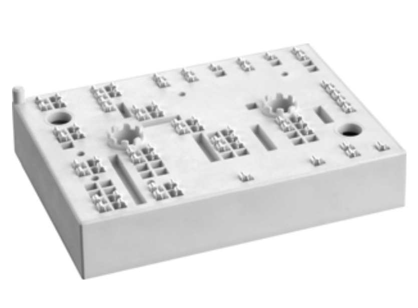

MiniSKiiP® 3

Converter-Inverter-Brake (CIB)

**SKiiP 37NAB12T4V10**

### Features*

- Trench 4 IGBTs
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- Highly reliable spring contacts for electrical connections
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### Typical Applications

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- Typical motor power 22 kW

### Remarks

- Max. case temperature limited to $T_C$=125°C
- Product reliability results valid for $T_j$≤150°C (recommended $T_{j,op}$=-40...+150°C)
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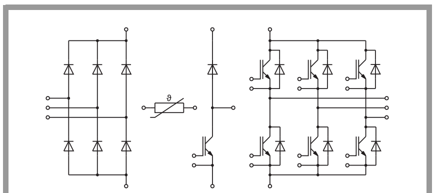

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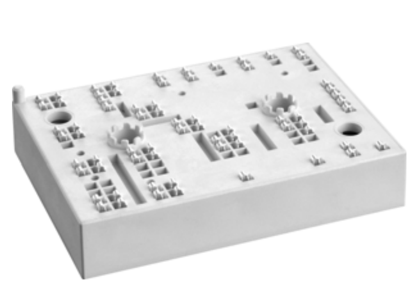
| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **Rectifier - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1600 | V |
| $I_F$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 150 °C | $T_s$ = 25 °C | 93 | A |
| | | $T_s$ = 70 °C | 69 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 150 °C | $T_s$ = 25 °C | 106 | A |
| | | $T_s$ = 70 °C | 78 | A |
| $I_{FSM}$ | $t_p$ = 10 ms sin 180° | $T_j$ = 25 °C | 850 | A |
| | | $T_j$ = 150 °C | 600 | A |
| $i^2t$ | $t_p$ = 10 ms sin 180° | $T_j$ = 25 °C | 3610 | $A^2s$ |
| | | $T_j$ = 150 °C | 1800 | $A^2s$ |
| $T_j$ | | | -40 ... 150 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C, 20 A per spring | | 80 | A |
| $T_{stg}$ | module without TIM | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50 Hz, 1 min | | 2500 | V |

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverter - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 75 A $V_{GE}$ = 15 V chiplevel | $T_j$ = 25 °C | | 1.85 | 2.10 | V |
| | | $T_j$ = 150 °C | | 2.25 | 2.45 | V |
| $V_{CE0}$ | chiplevel | $T_j$ = 25 °C | | 0.80 | 0.90 | V |
| | | $T_j$ = 150 °C | | 0.70 | 0.80 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V chiplevel | $T_j$ = 25 °C | | 14 | 16 | mΩ |
| | | $T_j$ = 150 °C | | 21 | 22 | mΩ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$, $I_C$ = 3 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V, $T_j$ = 25 °C | | | | 1 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V $V_{GE}$ = 0 V | f = 1 MHz | | 4.40 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.29 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.24 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 425 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 10 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V $I_C$ = 75 A $R_{G\,on}$ = 2 Ω $R_{G\,off}$ = 2 Ω | $T_j$ = 150 °C | | 150 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 35 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 9.7 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 355 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 60 | | ns |
| $E_{off}$ | $V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 6.8 | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=0.8 W/(mK) | | | 0.58 | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=2.5 W/(mK) | | | 0.44 | | K/W |



MiniSKiiP® 3

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**SKiiP 37NAB12T4V10**

### Features*

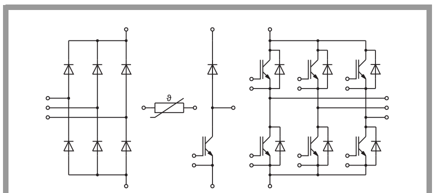
- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

### Typical Applications

- Inverter up to 36 kVA
- Typical motor power 22 kW

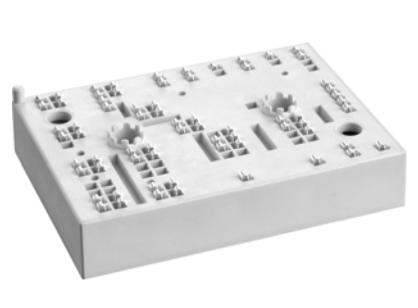
### Remarks

- Max. case temperature limited to $T_C$=125°C
- Product reliability results valid for $T_j$≤150°C (recommended $T_{j,op}$=-40...+150°C)
- MiniSKiiP “Technical Explanations” and “Mounting Instructions” are part of the data sheet. Please refer to both documents for further information



NAB

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Characteristics** | | | | | | |
| **Chopper - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 75 A, $V_{GE}$ = 15 V, chiplevel | $T_j$ = 25 °C | | 1.85 | 2.10 | V |
| | | $T_j$ = 150 °C | | 2.25 | 2.45 | V |
| $V_{CE0}$ | chiplevel | $T_j$ = 25 °C | | 0.80 | 0.90 | V |
| | | $T_j$ = 150 °C | | 0.70 | 0.80 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V, chiplevel | $T_j$ = 25 °C | | 14 | 16 | mΩ |
| | | $T_j$ = 150 °C | | 21 | 22 | mΩ |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 3 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V, $T_j$ = 25 °C | | | | 1 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | f = 1 MHz | | 4.40 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.29 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.24 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 425 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 10.0 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V, $I_C$ = 75 A, $R_{G\,on}$ = 2 Ω, $R_{G\,off}$ = 2 Ω | $T_j$ = 150 °C | | 150 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 35 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 9.7 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 355 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 60 | | ns |
| $E_{off}$ | $V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 6.8 | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=0.8 W/(mK) | | | 0.58 | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=2.5 W/(mK) | | | 0.44 | | K/W |
| **Inverse - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 75 A, $V_{GE}$ = 0 V, chiplevel | $T_j$ = 25 °C | | 2.17 | 2.49 | V |
| | | $T_j$ = 150 °C | | 2.11 | 2.42 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 1.30 | 1.50 | V |
| | | $T_j$ = 150 °C | | 0.90 | 1.10 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 12 | 13 | mΩ |
| | | $T_j$ = 150 °C | | 16 | 18 | mΩ |
| $I_{RRM}$ | $I_F$ = 75 A, $di/dt_{off}$ = 1940 A/µs, $V_{GE}$ = -15 V, $V_{CC}$ = 600 V | $T_j$ = 150 °C | | 62 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 12.6 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 4.9 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.75 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.61 | | K/W |
| **Freewheeling - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 75 A, $V_{GE}$ = 0 V, chiplevel | $T_j$ = 25 °C | | 2.17 | 2.49 | V |
| | | $T_j$ = 150 °C | | 2.11 | 2.42 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 1.30 | 1.50 | V |
| | | $T_j$ = 150 °C | | 0.90 | 1.10 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 12 | 13 | mΩ |
| | | $T_j$ = 150 °C | | 16 | 18 | mΩ |
| $I_{RRM}$ | $I_F$ = 75 A, $di/dt_{off}$ = 1940 A/µs, $V_{GE}$ = -15 V, $V_{CC}$ = 600 V | $T_j$ = 150 °C | | 62 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 12.6 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 4.9 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.75 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.61 | | K/W |



MiniSKiiP® 3

Converter-Inverter-Brake (CIB)

**SKiiP 37NAB12T4V10**

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- Max. case temperature limited to $T_C$=125°C
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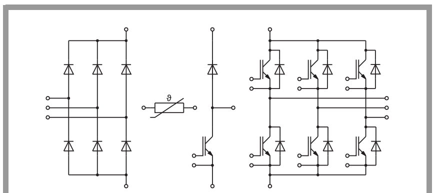


NAB

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Rectifier - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 40 A chiplevel | $T_j$ = 25 °C | | 1.03 | 1.26 | V |
| | | $T_j$ = 125 °C | | 0.94 | 1.16 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 0.88 | 0.98 | V |
| | | $T_j$ = 125 °C | | 0.73 | 0.83 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 3.6 | 7.0 | mΩ |
| | | $T_j$ = 125 °C | | 5.2 | 8.2 | mΩ |
| $I_R$ | $T_j$ = 145 °C, $V_{RRM}$ | | | | 1.1 | mA |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.85 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.7 | | K/W |
| **Module** | | | | | | |
| $M_s$ | to heat sink | | 2 | | 2.5 | Nm |
| w | | | | 82 | | g |
| $L_{CE}$ | | | | - | | nH |
| **Temperature Sensor** | | | | | | |
| $R_{100}$ | $T_r$=100°C ($R_{25}$=1000Ω) | | | 1670 ± 3% | | Ω |
| $R_{(T)}$ | $R_{(T)}=1000\Omega[1+A(T-25°C)+B(T-25°C)^2]$, $A = 7.635 \cdot 10^{-3}°C^{-1}$, $B = 1.731 \cdot 10^{-5}°C^{-2}$ | | | | | |

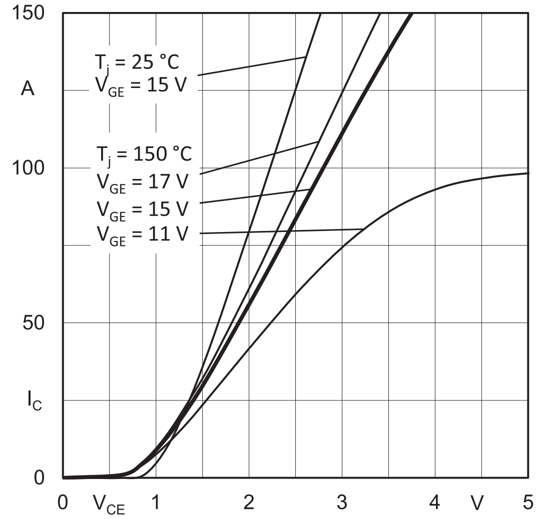



Fig. 1: Typ. output characteristic

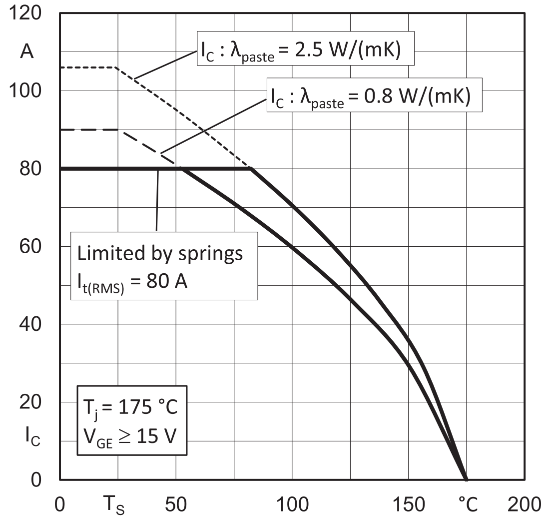



Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

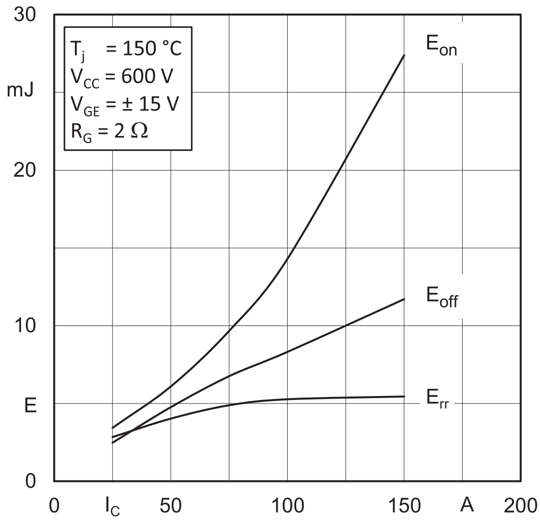



Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

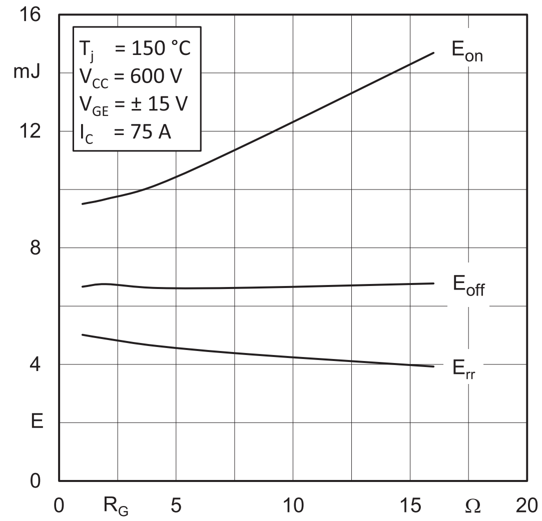



Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

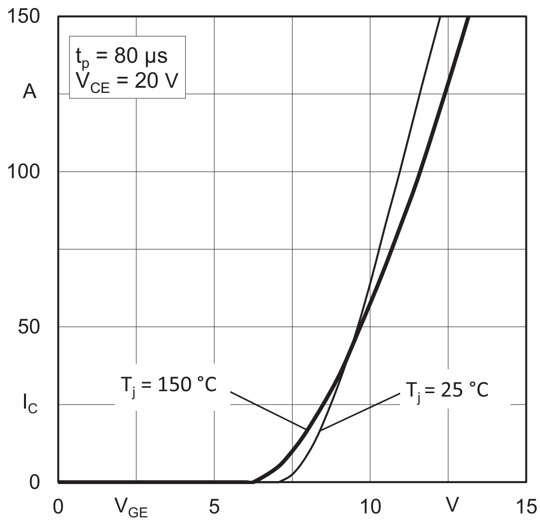



Fig. 5: Typ. transfer characteristic

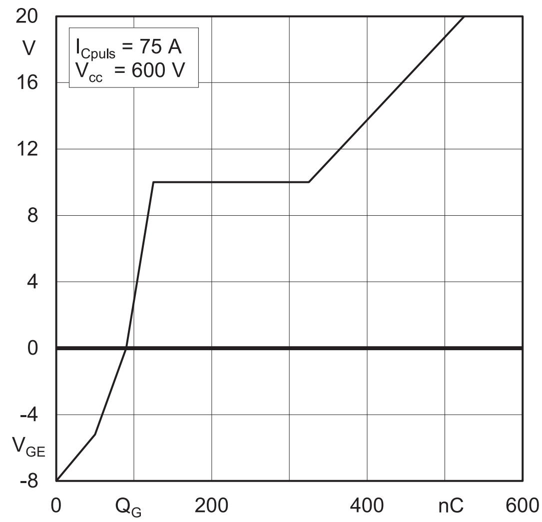



Fig. 6: Typ. gate charge characteristic

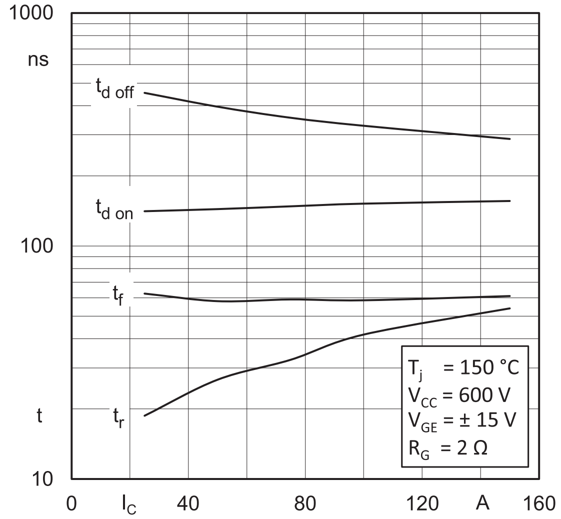



Fig. 7: Typ. switching times vs. $I_C$

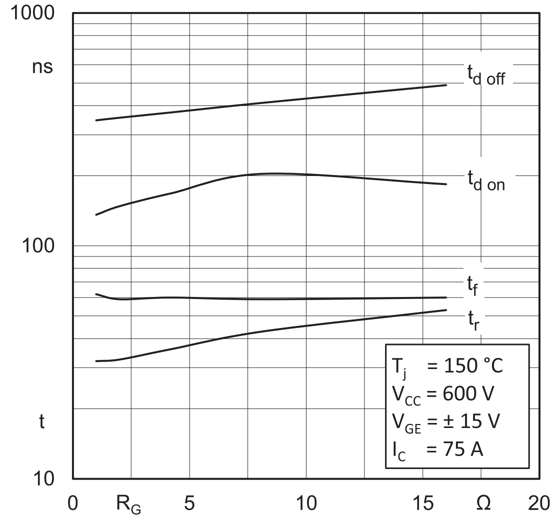



Fig. 8: Typ. switching times vs. gate resistor $R_G$

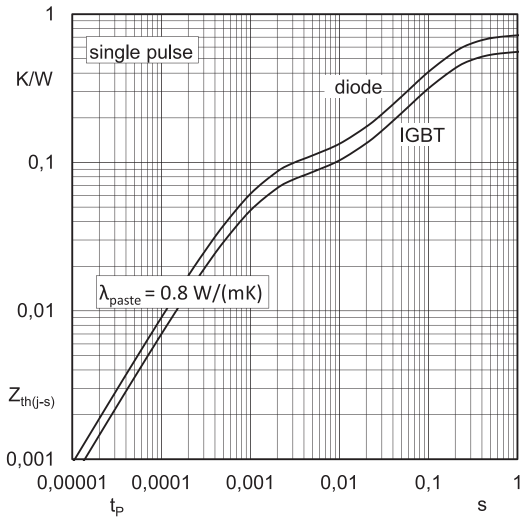



Fig. 9: Typ. transient thermal impedance

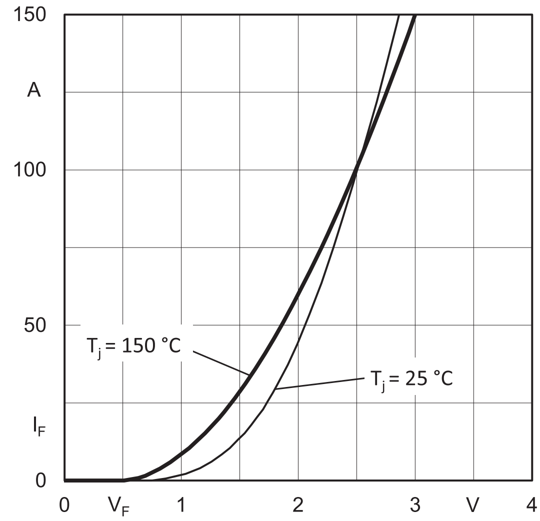



Fig. 10: Typ. CAL diode forward characteristic

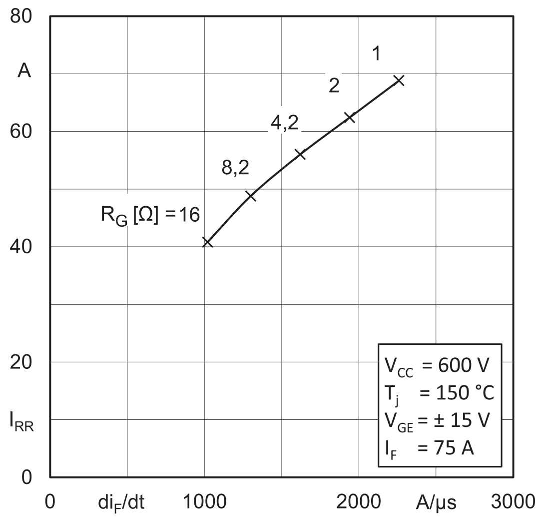



Fig. 11: Typ. CAL diode peak reverse recovery current

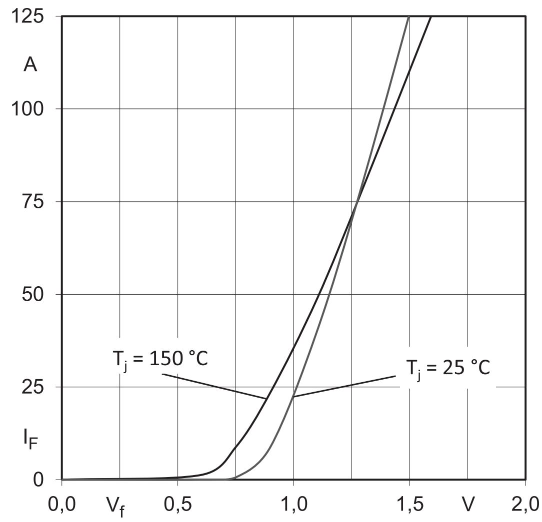
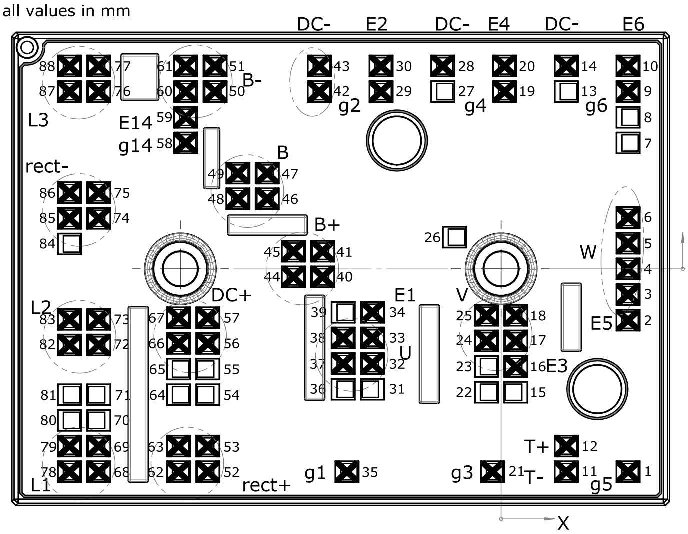



Fig. 12: Typ. input bridge forward characteristic

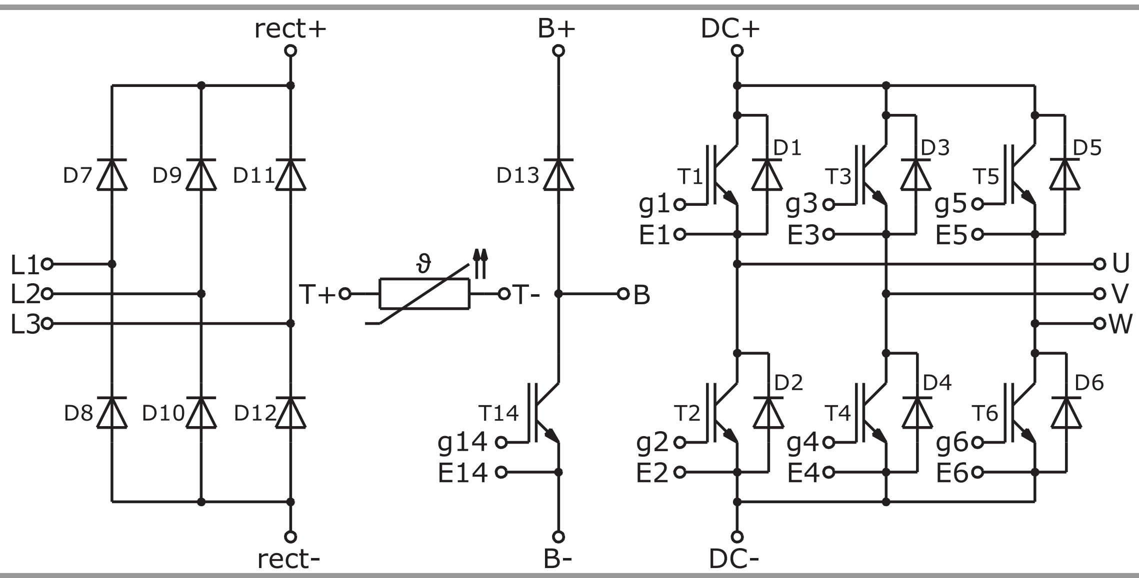
 

| Pin out | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* |
| 1 | 15,83 | -25,30 | g5 | 31 | -16,05 | -15,02 | | 61 | -39,33 | 25,30 | B- |
| 2 | 15,83 | -6,40 | E5 | 32 | -16,05 | -11,82 | U | 62 | -40,23 | -25,30 | rect+ |
| 3 | 15,83 | -3,20 | W | 33 | -16,05 | -8,62 | U | 63 | -40,23 | -22,10 | rect+ |
| 4 | 15,83 | 0 | W | 34 | -16,05 | -5,42 | E1 | 64 | -40,23 | -15,70 | |
| 5 | 15,83 | 3,20 | W | 35 | -19,23 | -25,30 | g1 | 65 | -40,23 | -12,50 | |
| 6 | 15,83 | 6,40 | W | 36 | -19,70 | -15,02 | | 66 | -40,23 | -9,30 | DC+ |
| 7 | 15,83 | 15,70 | | 37 | -19,70 | -11,82 | U | 67 | -40,23 | -6,10 | DC+ |
| 8 | 15,83 | 18,90 | | 38 | -19,70 | -8,62 | U | 68 | -50,18 | -25,30 | L1 |
| 9 | 15,83 | 22,10 | g6 | 39 | -19,70 | -5,42 | | 69 | -50,18 | -22,10 | L1 |
| 10 | 15,83 | 25,30 | E6 | 40 | -22,26 | -1,00 | B+ | 70 | -50,18 | -18,90 | |
| 11 | 8,13 | -25,30 | T- | 41 | -22,26 | 2,20 | B+ | 71 | -50,18 | -15,70 | |
| 12 | 8,13 | -22,10 | T+ | 42 | -22,68 | 22,10 | DC- | 72 | -50,18 | -9,50 | L2 |
| 13 | 8,13 | 22,10 | | 43 | -22,68 | 25,30 | DC- | 73 | -50,18 | -6,30 | L2 |
| 14 | 8,13 | 25,30 | DC- | 44 | -25,91 | -1,00 | B+ | 74 | -50,18 | 6,30 | rect- |
| 15 | 1,83 | -15,39 | | 45 | -25,91 | 2,20 | B+ | 75 | -50,18 | 9,50 | rect- |
| 16 | 1,83 | -12,19 | E3 | 46 | -29,18 | 8,74 | B | 76 | -50,18 | 22,10 | L3 |
| 17 | 1,83 | -8,99 | V | 47 | -29,18 | 11,94 | B | 77 | -50,18 | 25,30 | L3 |
| 18 | 1,83 | -5,79 | V | 48 | -32,83 | 8,74 | B | 78 | -53,83 | -25,30 | L1 |
| 19 | 0,43 | 22,10 | g4 | 49 | -32,83 | 11,94 | B | 79 | -53,83 | -22,10 | L1 |
| 20 | 0,43 | 25,30 | E4 | 50 | -35,68 | 22,10 | B- | 80 | -53,83 | -18,90 | |
| 21 | -1,08 | -25,30 | g3 | 51 | -35,68 | 25,30 | B- | 81 | -53,83 | -15,70 | |
| 22 | -1,83 | -15,39 | | 52 | -36,58 | -25,30 | rect+ | 82 | -53,83 | -9,50 | L2 |
| 23 | -1,83 | -12,19 | | 53 | -36,58 | -22,10 | rect+ | 83 | -53,83 | -6,30 | L2 |
| 24 | -1,83 | -8,99 | V | 54 | -36,58 | -15,70 | | 84 | -53,83 | 3,10 | |
| 25 | -1,83 | -5,79 | V | 55 | -36,58 | -12,50 | | 85 | -53,83 | 6,30 | rect- |
| 26 | -5,83 | 3,95 | | 56 | -36,58 | -9,30 | DC+ | 86 | -53,83 | 9,50 | rect- |
| 27 | -7,28 | 22,10 | | 57 | -36,58 | -6,10 | DC+ | 87 | -53,83 | 22,10 | L3 |
| 28 | -7,28 | 25,30 | DC- | 58 | -39,33 | 15,70 | g14 | 88 | -53,83 | 25,30 | L3 |
| 29 | -14,98 | 22,10 | g2 | 59 | -39,33 | 18,90 | E14 | | | | |
| 30 | -14,98 | 25,30 | E2 | 60 | -39,33 | 22,10 | B- | | | | |

all values in mm




Pinout and Dimensions




Pinout

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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