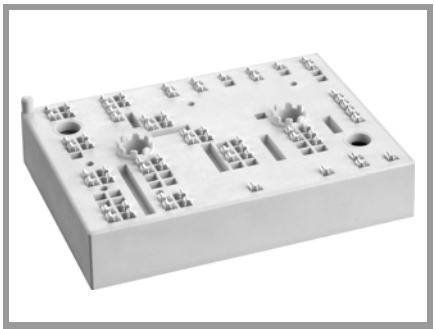


MiniSKiiP® 3

Sixpack

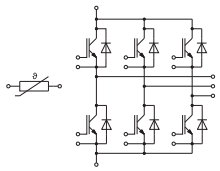
**SKiiP 38AC176V2**

### Features*

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

### 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)
- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information



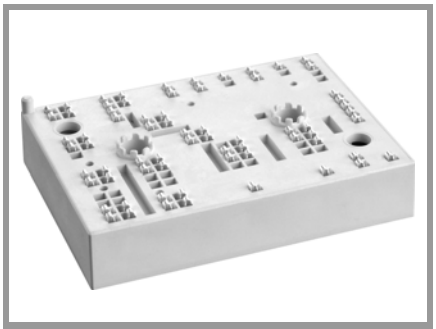
AC

**Absolute Maximum Ratings**

| Symbol | Conditions | | Values | Unit |
|---|---|---|---|---|
| **Inverter - IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1700 | V |
| $I_C$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 118 | A |
| | | $T_s$ = 70 °C | 95 | A |
| $I_C$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 152 | A |
| | | $T_s$ = 70 °C | 123 | A |
| $I_{Cnom}$ | | | 100 | A |
| $I_{CRM}$ | | | 200 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 1000 V $V_{GE}$ ≤ 20 V $V_{CES}$ ≤ 1700 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse - Diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1700 | V |
| $I_F$ | $\lambda_{paste}$=0.8 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 115 | A |
| | | $T_s$ = 70 °C | 89 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 142 | A |
| | | $T_s$ = 70 °C | 111 | A |
| $I_{FRM}$ | | | 300 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 860 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C, 20 A per spring | | 120 | A |
| $T_{stg}$ | module without TIM | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50 Hz, t = 1 min | | 2500 | V |

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Inverter - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 100 A $V_{GE}$ = 15 V chiplevel | $T_j$ = 25 °C | | 2.00 | 2.40 | V |
| | | $T_j$ = 150 °C | | 2.45 | 2.90 | V |
| $V_{CE0}$ | chiplevel | $T_j$ = 25 °C | | 1.00 | 1.20 | V |
| | | $T_j$ = 150 °C | | 0.90 | 1.10 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V chiplevel | $T_j$ = 25 °C | | 10 | 12 | mΩ |
| | | $T_j$ = 150 °C | | 16 | 18 | mΩ |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 4 mA | | 5.2 | 5.8 | 6.4 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1700 V, $T_j$ = 25 °C | | | | 1 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V $V_{GE}$ = 0 V | f = 1 MHz | | 8.82 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.37 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.29 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 934 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 4.8 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 900 V $I_C$ = 100 A $R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω $di/dt_{on}$ = 3000 A/µs $di/dt_{off}$ = 600 A/µs dv/dt = 4500 V/µs $V_{GE}$ = +15/-15 V $L_s$ = 40 nH | $T_j$ = 150 °C | | 160 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 35 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 23.8 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 580 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 150 | | ns |
| $E_{off}$ | | $T_j$ = 150 °C | | 32.2 | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=0.8 W/(mK) | | | 0.38 | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=2.5 W/(mK) | | | 0.25 | | K/W |



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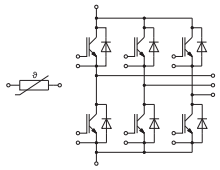
| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverse - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 100 A<br>$V_{GE}$ = 0 V<br>chiplevel | $T_j$ = 25 °C | | 1.76 | 2.10 | V |
| | | $T_j$ = 150 °C | | 1.77 | 2.09 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 1.32 | 1.56 | V |
| | | $T_j$ = 150 °C | | 1.08 | 1.22 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 4.4 | 5.4 | mΩ |
| | | $T_j$ = 150 °C | | 6.9 | 8.7 | mΩ |
| $I_{RRM}$ | $I_F$ = 100 A<br>$di/dt_{off}$ = 4000 A/µs<br>$V_{GE}$ = +15/-15 V<br>$V_{CC}$ = 900 V | $T_j$ = 150 °C | | 226 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 38.5 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 26.2 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.61 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.45 | | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 20 | | nH |
| $M_s$ | to heat sink | | 2 | | 2.5 | Nm |
| w | | | | 82 | | g |
| **Temperature Sensor** | | | | | | |
| $R_{100}$ | $T_r$=100°C ($R_{25}$=1000Ω) | | | 1670 ± 3% | | Ω |
| $R_{(T)}$ | $R_{(T)}$=1000Ω[1+A(T-25°C)+B(T-25°C)$^2$], A = 7.635*10$^{-3}$°C$^{-1}$, B = 1.731*10$^{-5}$°C$^{-2}$ | | | | | |



AC

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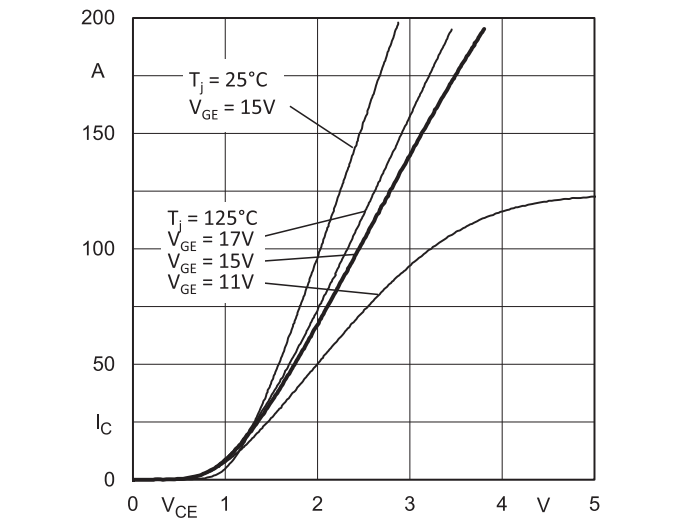


Fig. 1:Typ. output characteristic

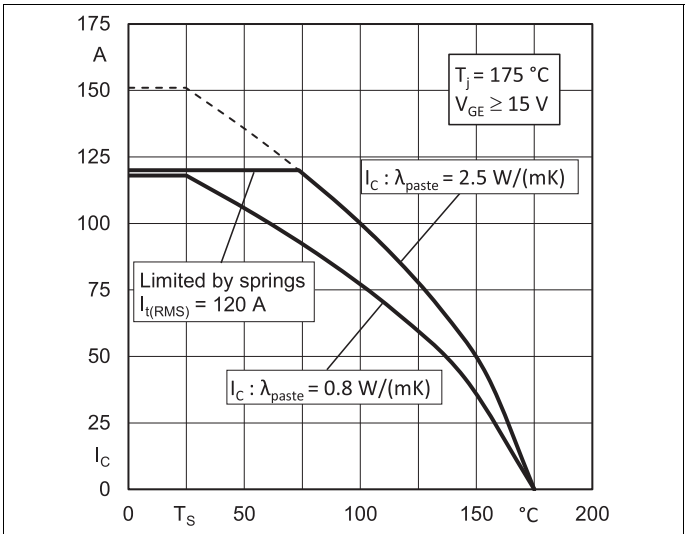


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

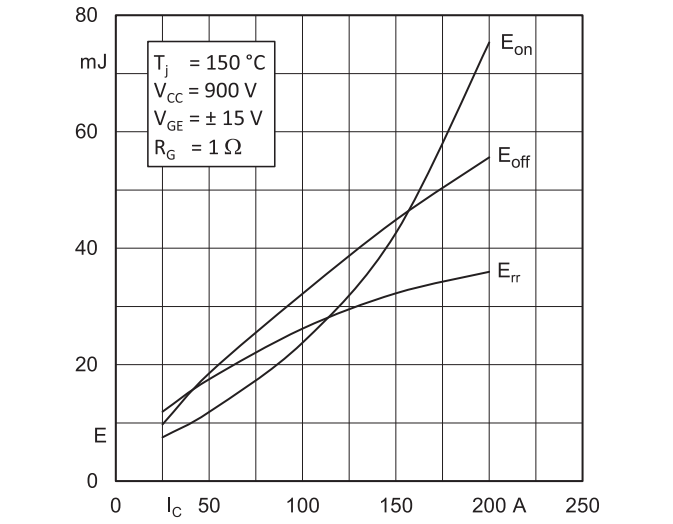


Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

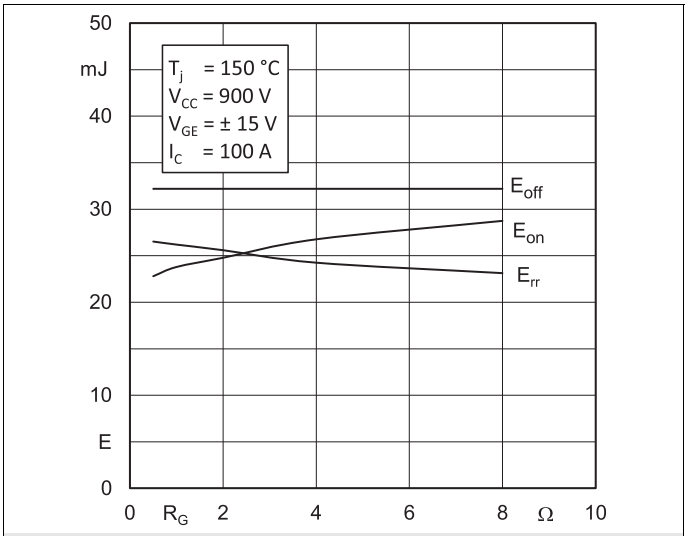


Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

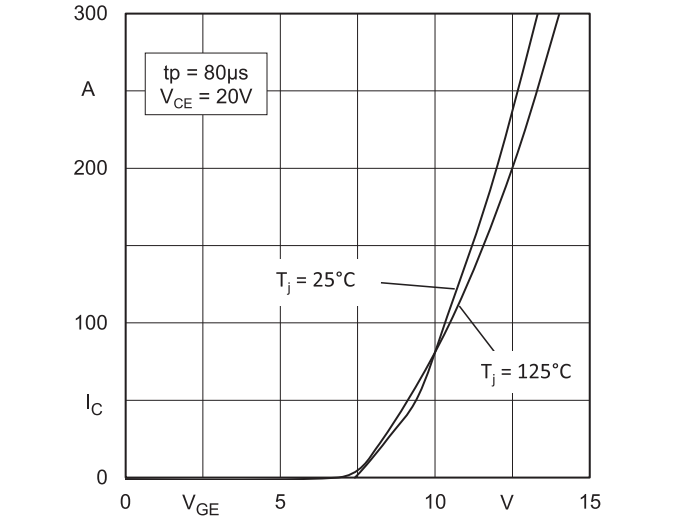


Fig. 5: Typ. transfer characteristic

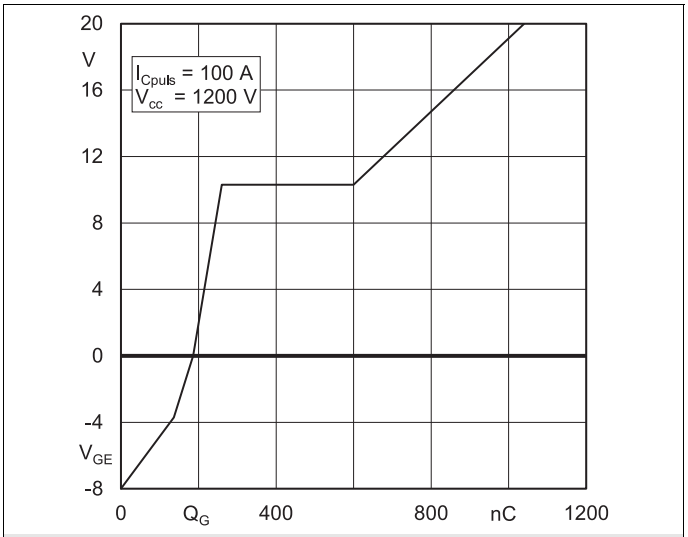


Fig. 6: Typ. gate charge characteristic

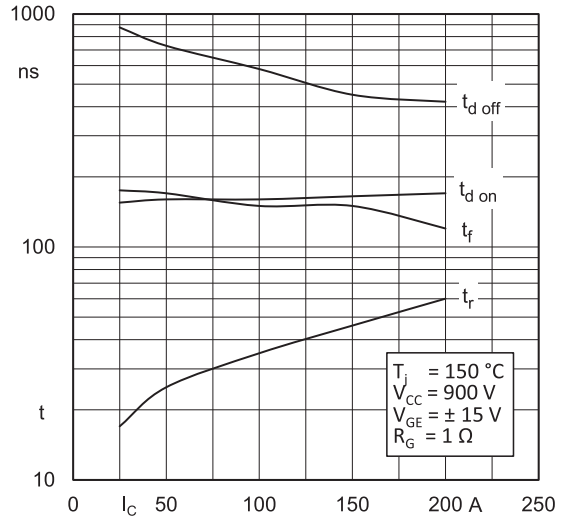


Fig. 7: Typ. switching times vs. $I_C$

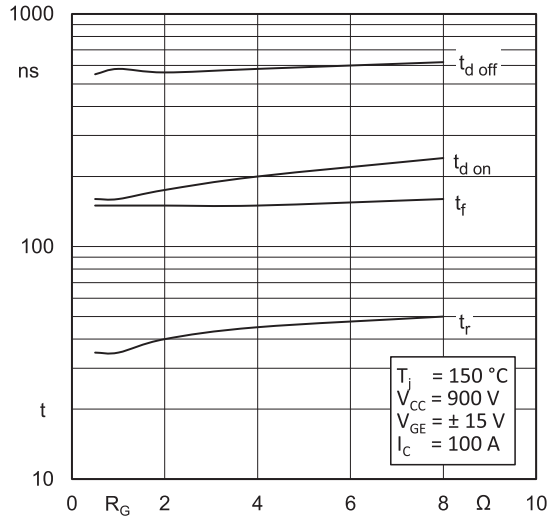


Fig. 8: Typ. switching times vs. gate resistor $R_G$

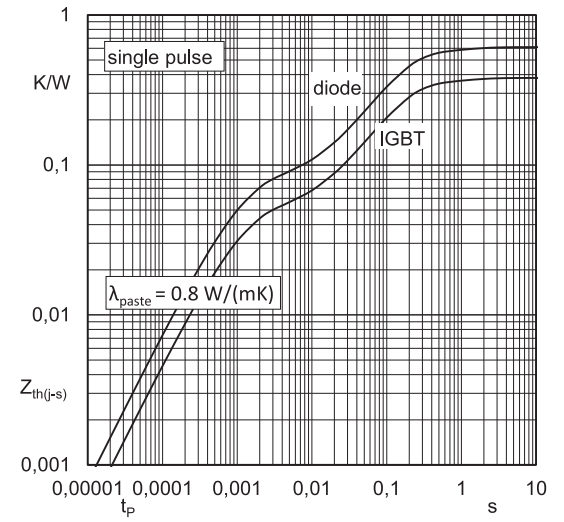


Fig. 9: Typ. transient thermal impedance

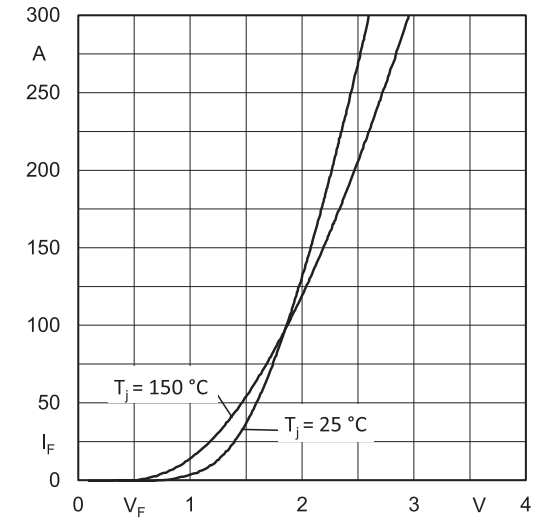


Fig. 10: Typ. CAL diode forward characteristic

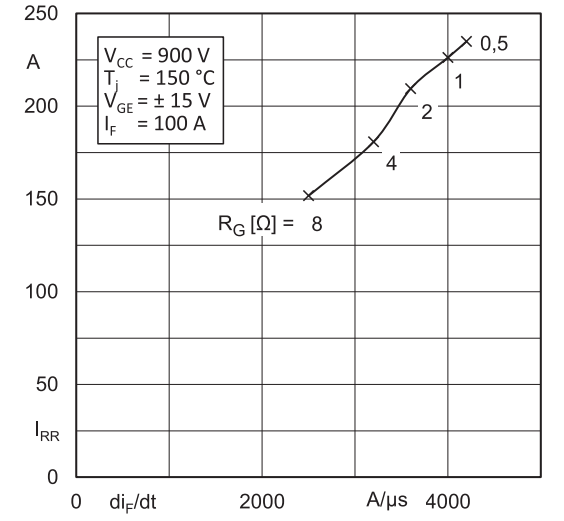


Fig. 11: Typ. CAL diode peak reverse recovery current

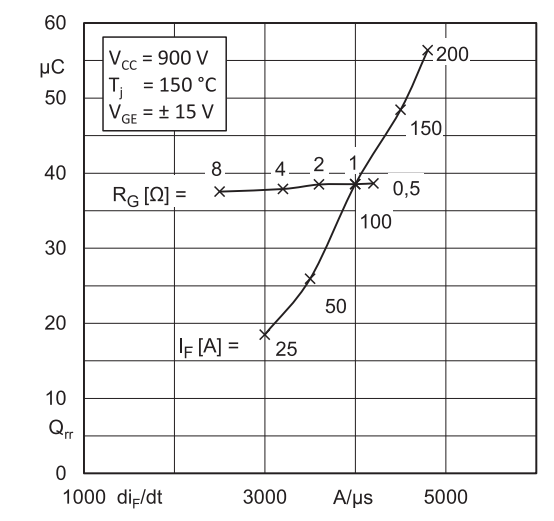


Fig. 12: Typ. CAL diode recovery charge

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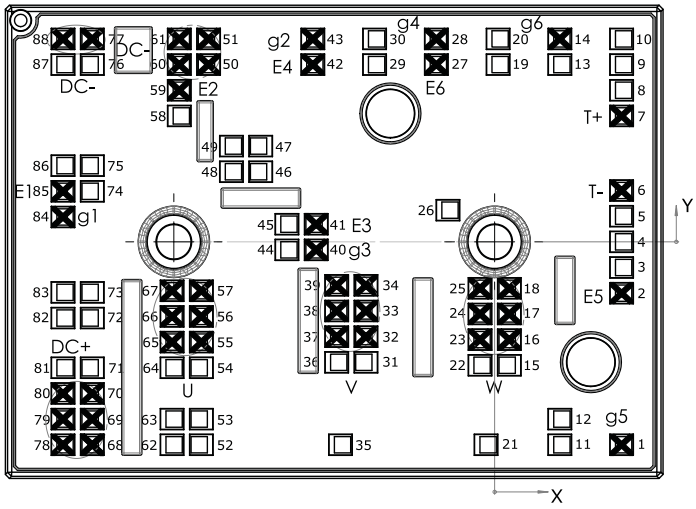
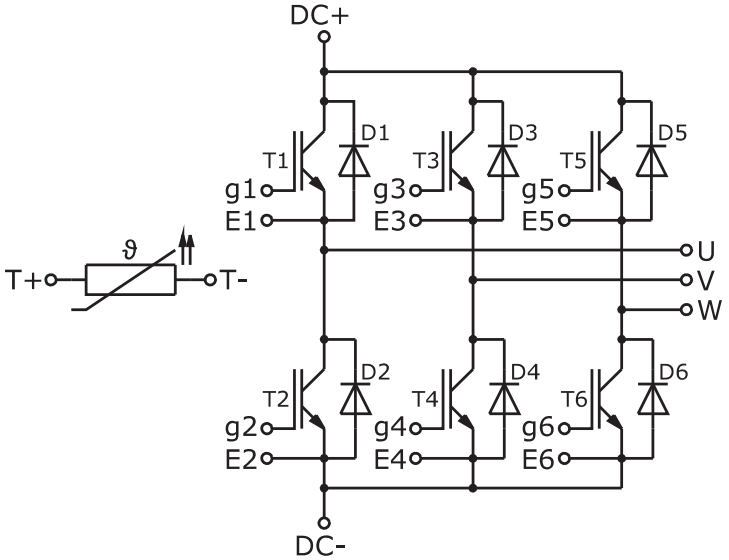
| Pin out | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* |
| 1 | 15,83 | -25,30 | g5 | 31 | -16,05 | -15,02 | | 61 | -39,33 | 25,30 | DC- |
| 2 | 15,83 | -6,40 | E5 | 32 | -16,05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

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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