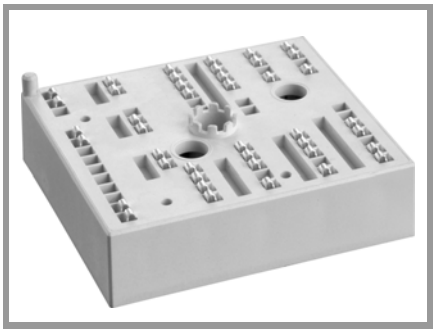
# SKiiP 25AC12T4V1



MiniSKiiP® 2

Sixpack

**SKiiP 25AC12T4V1**

### Features*

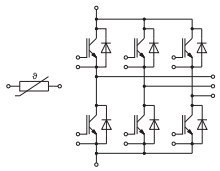
- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

### Typical Applications

- Inverter up to 26 kVA
- Typical motor power 15 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 $T_j \leq 150$ (recomm. $T_{op}$ = -40 … +150°C)



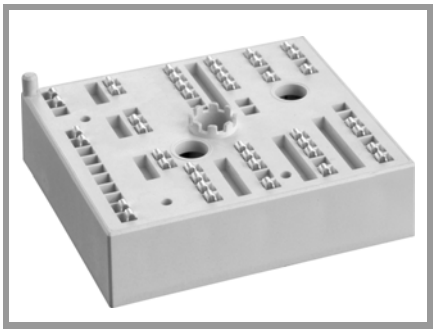
AC

**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 | 68 | A |
| | | $T_s$ = 70 °C | 55 | A |
| $I_C$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 78 | A |
| | | $T_s$ = 70 °C | 64 | A |
| $I_{Cnom}$ | | | 50 | A |
| $I_{CRM}$ | | | 150 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 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 | 60 | A |
| | | $T_s$ = 70 °C | 48 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) $T_j$ = 175 °C | $T_s$ = 25 °C | 68 | A |
| | | $T_s$ = 70 °C | 55 | A |
| $I_{FRM}$ | | | 150 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 270 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C, 20 A per spring | | 100 | 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** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 50 A $V_{GE}$ = 15 V chiplevel | $T_j$ = 25 °C | | 1.85 | 2.10 | V |
| | | $T_j$ = 150 °C | | 2.20 | 2.40 | 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 | | 21 | 24 | mΩ |
| | | $T_j$ = 150 °C | | 30 | 32 | mΩ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$, $I_C$ = 2 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 | | 2.77 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.21 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.16 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 283 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 4.0 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V $I_C$ = 50 A $R_{G\ on}$ = 12 Ω $R_{G\ off}$ = 12 Ω di/dt$_{on}$ = 1300 A/µs di/dt$_{off}$ = 640 A/µs $V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 54 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 36 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 6 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 340 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 70 | | ns |
| $E_{off}$ | | $T_j$ = 150 °C | | 4.5 | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=0.8 W/(mK) | | | 0.71 | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=2.5 W/(mK) | | | 0.56 | | K/W |



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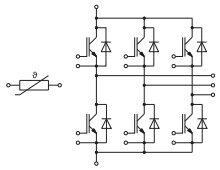

AC

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverse - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 50 A<br>$V_{GE}$ = 0 V<br>chiplevel | $T_j$ = 25 °C | | 2.22 | 2.54 | V |
| | | $T_j$ = 150 °C | | 2.18 | 2.50 | 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 | | 18 | 21 | mΩ |
| | | $T_j$ = 150 °C | | 26 | 28 | mΩ |
| $I_{RRM}$ | $I_F$ = 50 A<br>$di/dt_{off}$ = 1400 A/µs<br>$V_{GE}$ = +15/-15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 51 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 8 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 3.2 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.95 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.78 | | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | - | | nH |
| $M_s$ | to heat sink | | 2 | | 2.5 | Nm |
| w | | | | 55 | | 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$^{-2}$ | | | | | |

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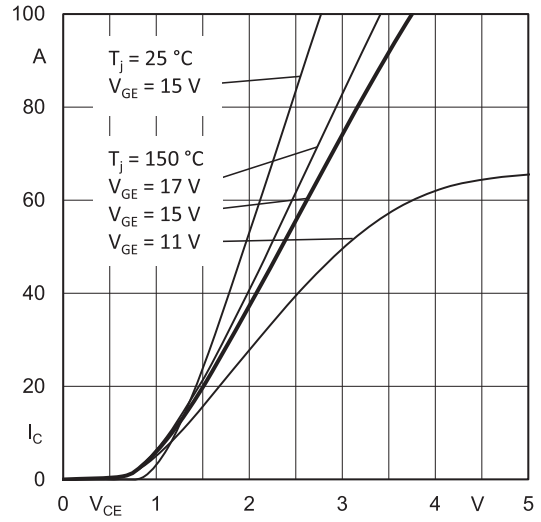


Fig. 1: Typ. output characteristic

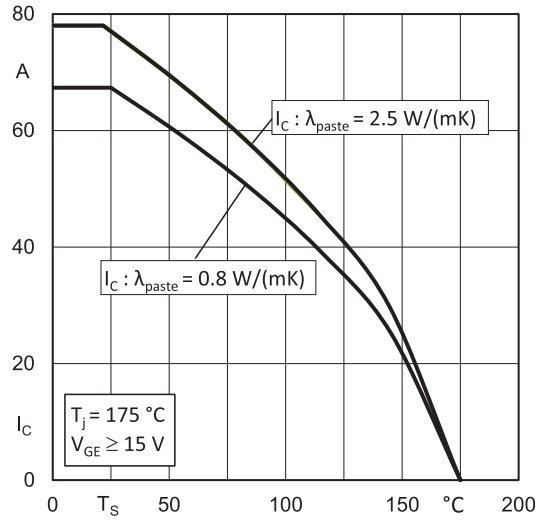


Fig. 2: Rated current vs. temperature $I_C = f(T_S)$

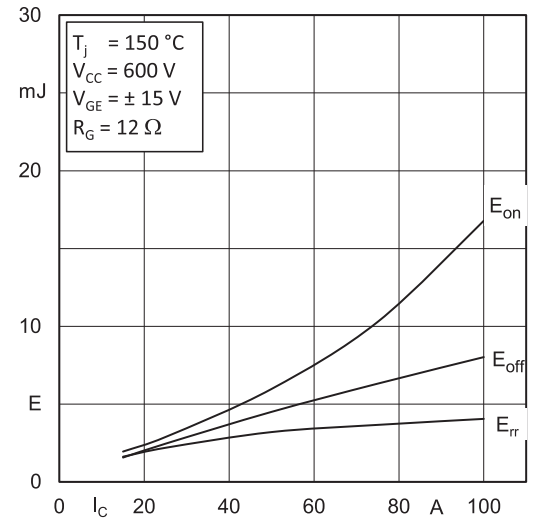


Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

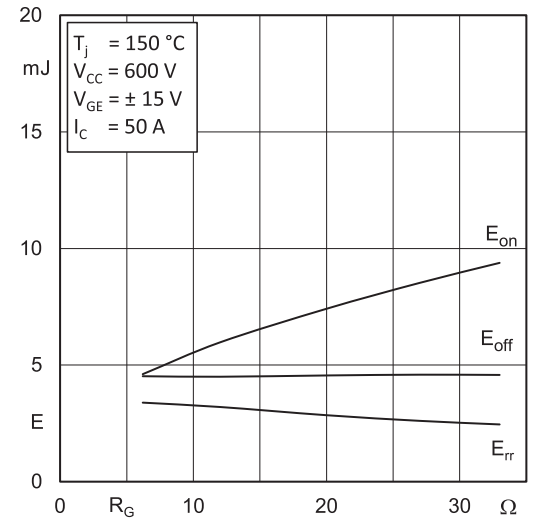


Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

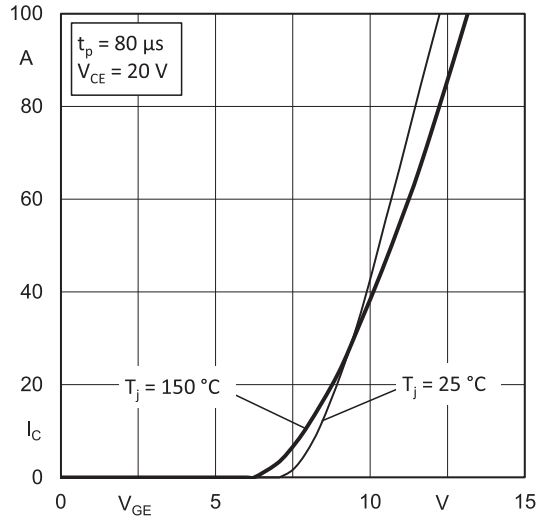


Fig. 5: Typ. transfer characteristic

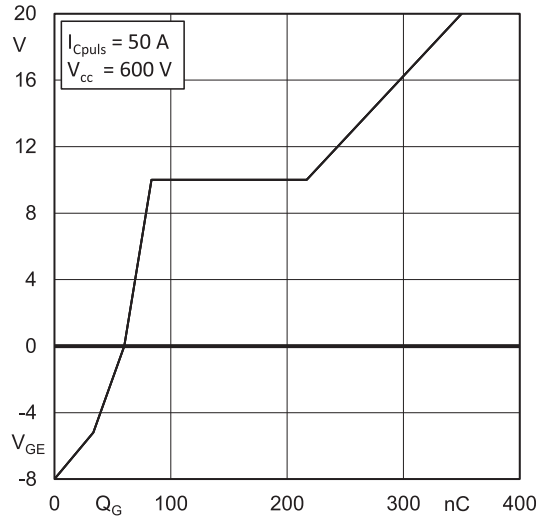


Fig. 6: Typ. gate charge characteristic

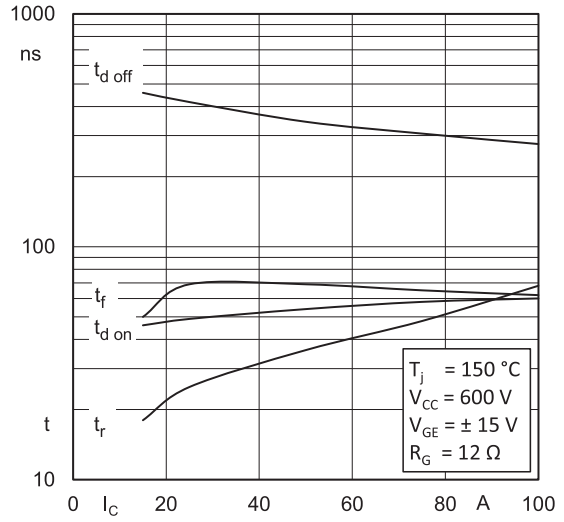


Fig. 7: Typ. switching times vs. $I_C$

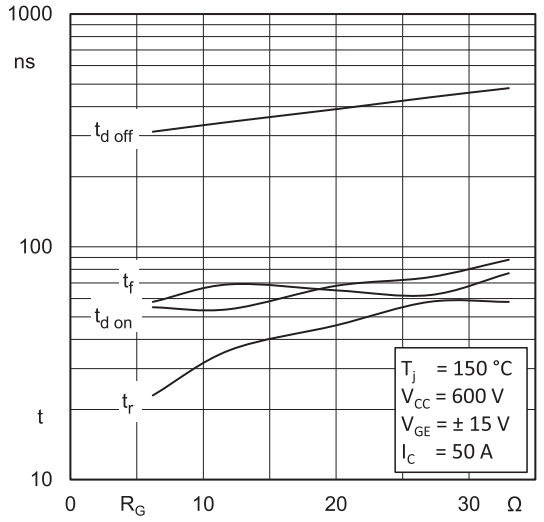


Fig. 8: Typ. switching times vs. gate resistor $R_G$

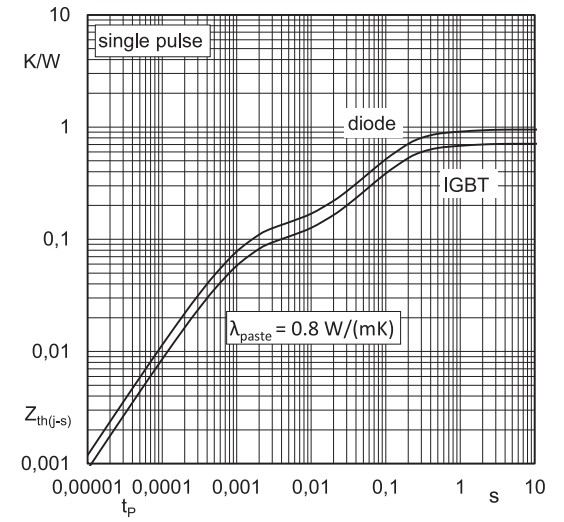


Fig. 9: Typ. transient thermal impedance

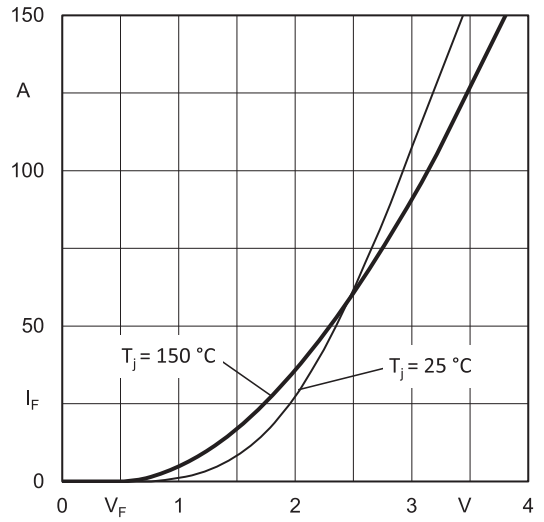


Fig. 10: Typ. CAL diode forward characteristic

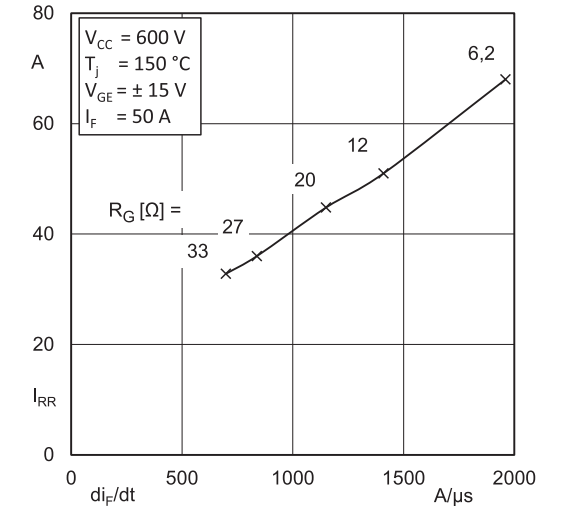


Fig. 11: Typ. CAL diode peak reverse recovery current

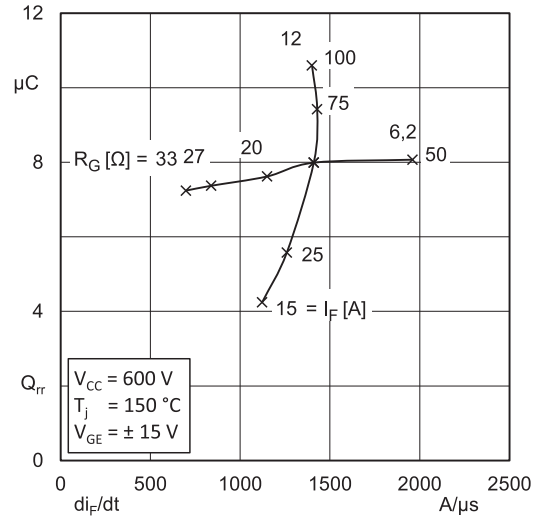


Fig. 12: Typ. CAL diode recovery charge

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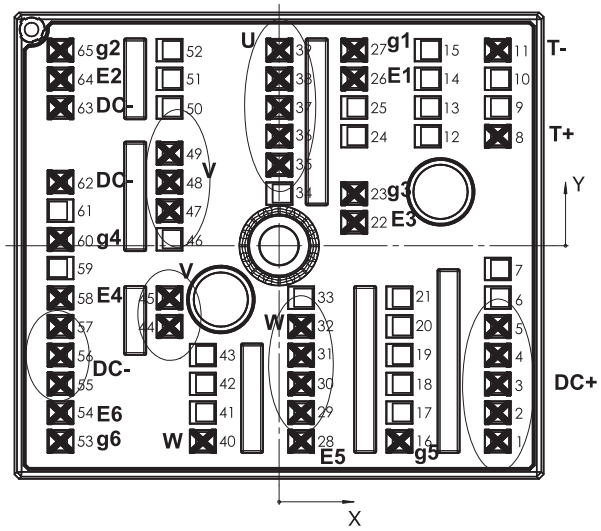
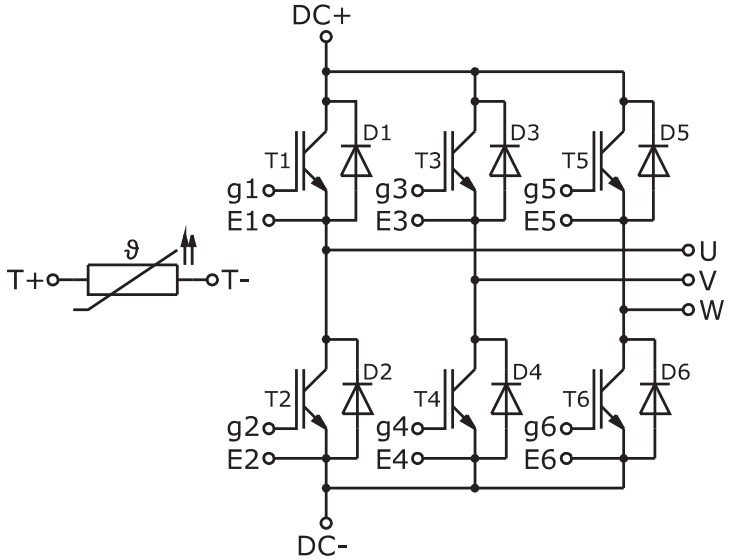
| Pin out | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* | *Pin* | *X* | *Y* | *Function* |
| 1 | 24,38 | -21,80 | DC+ | 23 | 8,38 | 5,80 | g3 | 45 | -12,23 | -5,80 | V |
| 2 | 24,38 | -18,60 | DC+ | 24 | 8,38 | 12,20 | | 46 | -12,23 | 0,70 | |
| 3 | 24,38 | -15,40 | DC+ | 25 | 8,38 | 15,40 | | 47 | -12,23 | 3,90 | V |
| 4 | 24,38 | -12,20 | DC+ | 26 | 8,38 | 18,60 | E1 | 48 | -12,23 | 7,10 | V |
| 5 | 24,38 | -9,00 | DC+ | 27 | 8,38 | 21,80 | g1 | 49 | -12,23 | 10,30 | V |
| 6 | 24,38 | -5,80 | | 28 | 2,46 | -21,80 | E5 | 50 | -12,23 | 15,40 | |
| 7 | 24,38 | -2,60 | | 29 | 2,46 | -18,60 | W | 51 | -12,23 | 18,60 | |
| 8 | 24,38 | 12,20 | T+ | 30 | 2,46 | -15,40 | W | 52 | -12,23 | 21,80 | |
| 9 | 24,38 | 15,40 | | 31 | 2,46 | -12,20 | W | 53 | -24,38 | -21,80 | g6 |
| 10 | 24,38 | 18,60 | | 32 | 2,46 | -9,00 | W | 54 | -24,38 | -18,60 | E6 |
| 11 | 24,38 | 21,80 | T- | 33 | 2,46 | -5,80 | | 55 | -24,38 | -15,40 | DC- |
| 12 | 16,58 | 12,20 | | 34 | 0,03 | 5,80 | | 56 | -24,38 | -12,20 | DC- |
| 13 | 16,58 | 15,40 | | 35 | 0,03 | 9,00 | U | 57 | -24,38 | -9,00 | DC- |
| 14 | 16,58 | 18,60 | | 36 | 0,03 | 12,20 | U | 58 | -24,38 | -5,80 | E4 |
| 15 | 16,58 | 21,80 | | 37 | 0,03 | 15,40 | U | 59 | -24,38 | -2,50 | |
| 16 | 13,42 | -21,80 | g5 | 38 | 0,03 | 18,60 | U | 60 | -24,38 | 0,70 | g4 |
| 17 | 13,42 | -18,60 | | 39 | 0,03 | 21,80 | U | 61 | -24,38 | 3,90 | |
| 18 | 13,42 | -15,40 | | 40 | -8,51 | -21,80 | W | 62 | -24,38 | 7,10 | DC- |
| 19 | 13,42 | -12,20 | | 41 | -8,51 | -18,60 | | 63 | -24,38 | 15,40 | DC- |
| 20 | 13,42 | -9,00 | | 42 | -8,51 | -15,40 | | 64 | -24,38 | 18,60 | E2 |
| 21 | 13,42 | -5,80 | | 43 | -8,51 | -12,20 | | 65 | -24,38 | 21,80 | g2 |
| 22 | 8,38 | 2,60 | E3 | 44 | -12,23 | -9,00 | V | | | | |

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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