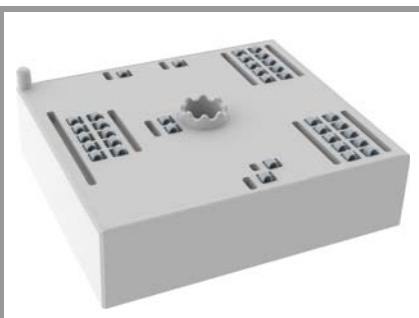


# SKiiP 24GB12T7V1



MiniSKiiP® 2 Dual

## Half-Bridge

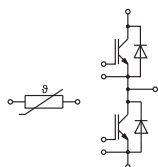
### SKiiP 24GB12T7V1

#### Features\*

- 1200V Generation 7 IGBTs (T7)
- 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  $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for  $T_j \leq 150^\circ\text{C}$ ;  $T_{j,op} > 150^\circ\text{C}$  during overload (Details see AN19-002)
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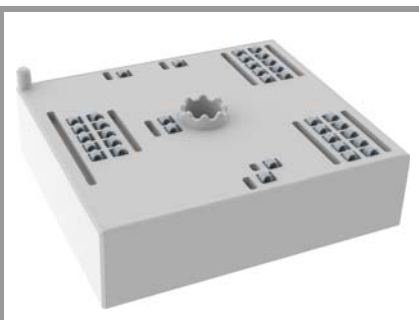
GB

#### Absolute Maximum Ratings

| Symbol                 | Conditions   | Values                    | Unit             |
|------------------------|--|---------------------------|------------------|
| <b>Inverter - IGBT</b> |  |                           |                  |
| $V_{CES}$              | $T_j = 25^\circ\text{C}$   | 1200                      | V                |
| $I_C$                  | $\lambda_{paste}=0.8\text{ W/(mK)}$  | $T_s = 70^\circ\text{C}$  | A                |
|                        | $T_j = 175^\circ\text{C}$  | $T_s = 100^\circ\text{C}$ | A                |
| $I_C$                  | $\lambda_{paste}=2.5\text{ W/(mK)}$  | $T_s = 70^\circ\text{C}$  | A                |
|                        | $T_j = 175^\circ\text{C}$  | $T_s = 100^\circ\text{C}$ | A                |
| $I_{Cnom}$             |  | 150                       | A                |
| $I_{CRM}$              |  | 300                       | A                |
| $V_{GES}$              |  | -20 ... 20                | V                |
| $t_{psc}$              | $V_{CC} = 800\text{ V}$<br>$V_{GE} \leq 15\text{ V}$<br>$V_{CES} \leq 1200\text{ V}$ | $T_j = 175^\circ\text{C}$ | $\mu\text{s}$    |
| $T_j$                  |  | -40 ... 175               | $^\circ\text{C}$ |
| <b>Inverse - Diode</b> |  |                           |                  |
| $V_{RRM}$              | $T_j = 25^\circ\text{C}$   | 1200                      | V                |
| $I_F$                  | $\lambda_{paste}=0.8\text{ W/(mK)}$  | $T_s = 70^\circ\text{C}$  | A                |
|                        | $T_j = 175^\circ\text{C}$  | $T_s = 100^\circ\text{C}$ | A                |
| $I_F$                  | $\lambda_{paste}=2.5\text{ W/(mK)}$  | $T_s = 70^\circ\text{C}$  | A                |
|                        | $T_j = 175^\circ\text{C}$  | $T_s = 100^\circ\text{C}$ | A                |
| $I_{FRM}$              |  | 300                       | A                |
| $I_{FSM}$              | $t_p = 10\text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$                        | 774                       | A                |
| $T_j$                  |  | -40 ... 175               | $^\circ\text{C}$ |
| <b>Module</b>          |  |                           |                  |
| $I_{t(RMS)}$           | $T_{terminal} = 80^\circ\text{C}, 20\text{ A per spring}$                            | 200                       | A                |
| $T_{stg}$              | module without TIM   | -40 ... 125               | $^\circ\text{C}$ |
| $V_{isol}$             | AC sinus 50 Hz, $t = 1\text{ min}$   | 2500                      | V                |

#### Characteristics

| Symbol                 | Conditions  | min.                      | typ.  | max. | Unit             |
|------------------------|---|---------------------------|-------|------|------------------|
| <b>Inverter - IGBT</b> |   |                           |       |      |                  |
| $V_{CE(sat)}$          | $I_C = 150\text{ A}$  | $T_j = 25^\circ\text{C}$  | 1.55  | 1.70 | V                |
|                        | $V_{GE} = 15\text{ V}$  | $T_j = 150^\circ\text{C}$ | 1.73  | 1.88 | V                |
|                        | chiplevel   | $T_j = 175^\circ\text{C}$ | 1.77  | 1.92 | V                |
| $V_{CE0}$              |   | $T_j = 25^\circ\text{C}$  | 1.00  | 1.05 | V                |
|                        | chiplevel   | $T_j = 150^\circ\text{C}$ | 0.80  | 0.85 | V                |
|                        |   | $T_j = 175^\circ\text{C}$ | 0.75  | 0.80 | V                |
| $r_{CE}$               | $V_{GE} = 15\text{ V}$  | $T_j = 25^\circ\text{C}$  | 3.7   | 4.3  | $\text{m}\Omega$ |
|                        | chiplevel   | $T_j = 150^\circ\text{C}$ | 6.2   | 6.9  | $\text{m}\Omega$ |
|                        |   | $T_j = 175^\circ\text{C}$ | 6.8   | 7.5  | $\text{m}\Omega$ |
| $V_{GE(th)}$           | $V_{GE} = V_{CE}, I_C = 3.4\text{ mA}$                                | 5.15                      | 5.8   | 6.45 | V                |
| $I_{CES}$              | $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$ |                           |       | 1.5  | mA               |
| $C_{ies}$              | $V_{CE} = 25\text{ V}$  | $f = 1\text{ MHz}$        | 30.20 |      | nF               |
| $C_{oes}$              | $V_{GE} = 0\text{ V}$   | $f = 1\text{ MHz}$        | 0.39  |      | nF               |
| $C_{res}$              |   | $f = 1\text{ MHz}$        | 1.08  |      | nF               |
| $Q_G$                  | $V_{GE} = -8\text{ V} \dots +15\text{ V}$                             |                           | 2100  |      | nC               |
| $R_{Gint}$             | $T_j = 25^\circ\text{C}$  |                           | 1.0   |      | $\Omega$         |



MiniSKiiP® 2 Dual

## Half-Bridge

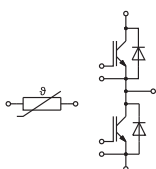
### SKiiP 24GB12T7V1

#### Features\*

- 1200V Generation 7 IGBTs (T7)
- 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  $T_C = T_S = 125\text{ °C}$
- Product reliability results valid for  $T_j \leq 150\text{ °C}$ ;  $T_{j,op} > 150\text{ °C}$  during overload (Details see AN19-002)
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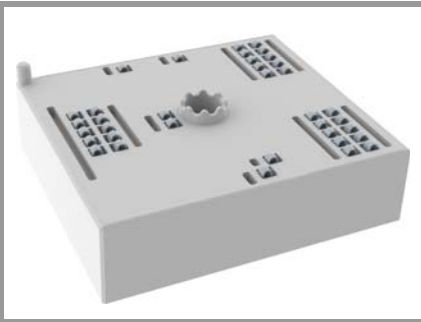


GB

| Characteristics        |  |                       |      |      |      |
|------------------------|--|-----------------------|------|------|------|
| Symbol                 | Conditions   | min.                  | typ. | max. | Unit |
| <b>Inverter - IGBT</b> |  |                       |      |      |      |
| $t_{d(on)}$            | $V_{CC} = 600\text{ V}$<br>$I_C = 150\text{ A}$<br>$R_{G\ on} = 1.1\ \Omega$<br>$R_{G\ off} = 1.1\ \Omega$<br>$V_{GE} = +15/-15\text{ V}$                  | $T_j = 25\text{ °C}$  | 173  |      | ns   |
|                        |  | $T_j = 150\text{ °C}$ | 181  |      | ns   |
|                        |  | $T_j = 175\text{ °C}$ | 179  |      | ns   |
| $t_r$                  |  | $T_j = 25\text{ °C}$  | 32   |      | ns   |
|                        |  | $T_j = 150\text{ °C}$ | 37   |      | ns   |
|                        |  | $T_j = 175\text{ °C}$ | 39   |      | ns   |
| $E_{on}$               | $T_j = 25\text{ °C}$<br>$T_j = 150\text{ °C}$<br>$T_j = 175\text{ °C}$   |                       | 6.3  |      | mJ   |
|                        |  |                       | 11   |      | mJ   |
|                        |  |                       | 12   |      | mJ   |
| $t_{d(off)}$           |  | $T_j = 25\text{ °C}$  | 347  |      | ns   |
|                        |  | $T_j = 150\text{ °C}$ | 437  |      | ns   |
|                        |  | $T_j = 175\text{ °C}$ | 462  |      | ns   |
| $t_f$                  | $@\ T_j = 150\text{ °C}$ :<br>$di/dt_{on} = 5650\text{ A}/\mu\text{s}$<br>$di/dt_{off} = 1530\text{ A}/\mu\text{s}$<br>$dv/dt = 3730\text{ V}/\mu\text{s}$ | $T_j = 25\text{ °C}$  | 67   |      | ns   |
|                        |  | $T_j = 150\text{ °C}$ | 103  |      | ns   |
|                        |  | $T_j = 175\text{ °C}$ | 130  |      | ns   |
| $E_{off}$              |  | $T_j = 25\text{ °C}$  | 10   |      | mJ   |
|                        |  | $T_j = 150\text{ °C}$ | 17   |      | mJ   |
|                        |  | $T_j = 175\text{ °C}$ | 18   |      | mJ   |
| $R_{th(j-s)}$          | per IGBT, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$   |                       | 0.4  |      | K/W  |
| $R_{th(j-s)}$          | per IGBT, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$   |                       | 0.32 |      | K/W  |

| Characteristics        |  |                       |      |      |               |
|------------------------|--|-----------------------|------|------|---------------|
| Symbol                 | Conditions   | min.                  | typ. | max. | Unit          |
| <b>Inverse - Diode</b> |  |                       |      |      |               |
| $V_F = V_{EC}$         | $I_F = 150\text{ A}$<br>$V_{GE} = 0\text{ V}$<br>chipelevel                    | $T_j = 25\text{ °C}$  | 2.17 | 2.49 | V             |
|                        |  | $T_j = 150\text{ °C}$ | 2.11 | 2.42 | V             |
|                        |  | $T_j = 175\text{ °C}$ | 1.96 | 2.27 | V             |
| $V_{F0}$               | chipelevel   | $T_j = 25\text{ °C}$  | 1.30 | 1.50 | V             |
|                        |  | $T_j = 150\text{ °C}$ | 0.90 | 1.10 | V             |
|                        |  | $T_j = 175\text{ °C}$ | 0.82 | 0.98 | V             |
| $r_F$                  | chipelevel   | $T_j = 25\text{ °C}$  | 5.8  | 6.6  | m $\Omega$    |
|                        |  | $T_j = 150\text{ °C}$ | 8.1  | 8.8  | m $\Omega$    |
|                        |  | $T_j = 175\text{ °C}$ | 7.6  | 8.6  | m $\Omega$    |
| $I_{RRM}$              | $I_F = 150\text{ A}$<br>$V_{GE} = +15/-15\text{ V}$<br>$V_{CC} = 600\text{ V}$ | $T_j = 25\text{ °C}$  | 197  |      | A             |
|                        |  | $T_j = 150\text{ °C}$ | 228  |      | A             |
|                        |  | $T_j = 175\text{ °C}$ | 256  |      | A             |
| $Q_{rr}$               |  | $T_j = 25\text{ °C}$  | 13   |      | $\mu\text{C}$ |
|                        |  | $T_j = 150\text{ °C}$ | 26   |      | $\mu\text{C}$ |
|                        |  | $T_j = 175\text{ °C}$ | 25   |      | $\mu\text{C}$ |
| $E_{rr}$               | $@\ T_j = 150\text{ °C}$ :<br>$di/dt_{off} = 5550\text{ A}/\mu\text{s}$        | $T_j = 25\text{ °C}$  | 5    |      | mJ            |
|                        |  | $T_j = 150\text{ °C}$ | 11   |      | mJ            |
|                        |  | $T_j = 175\text{ °C}$ | 12   |      | mJ            |
| $R_{th(j-s)}$          | per Diode, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$                        |                       | 0.5  |      | K/W           |
| $R_{th(j-s)}$          | per Diode, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$                        |                       | 0.4  |      | K/W           |
| <b>Module</b>          |  |                       |      |      |               |
| $L_{CE}$               |  |                       | 20   |      | nH            |
| $M_s$                  | to heat sink   | 2                     |      | 2.5  | Nm            |
| w                      |  |                       | 50   |      | g             |

# SKiiP 24GB12T7V1



MiniSKiiP® 2 Dual

| Characteristics           |   |      |                |      |          |
|---------------------------|---|------|----------------|------|----------|
| Symbol                    | Conditions  | min. | typ.           | max. | Unit     |
| <b>Temperature Sensor</b> |   |      |                |      |          |
| $R_{100}$                 | $T_c=100^{\circ}\text{C}$ ( $R_{25}=5\text{ k}\Omega$ )           |      | $493 \pm 5\%$  |      | $\Omega$ |
| $B_{100/125}$             | $R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$ ; $T[\text{K}]$ |      | $3550 \pm 2\%$ |      | K        |

## Half-Bridge

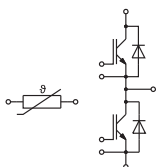
### SKiiP 24GB12T7V1

#### Features\*

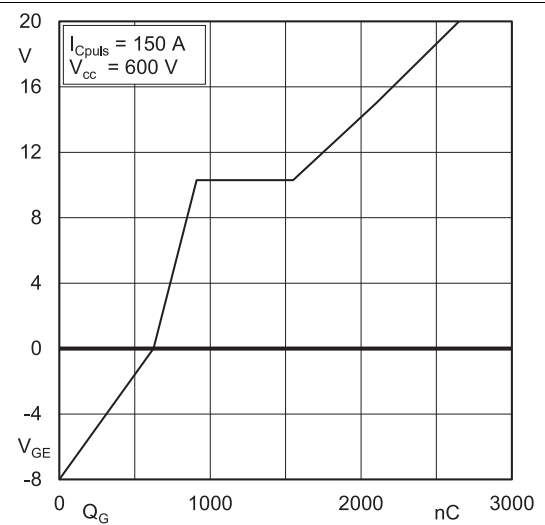
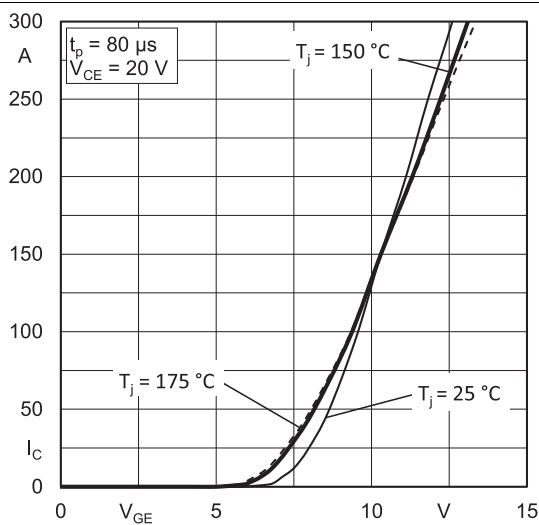
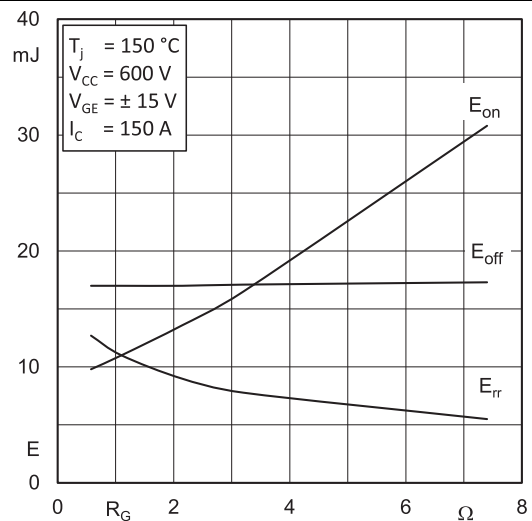
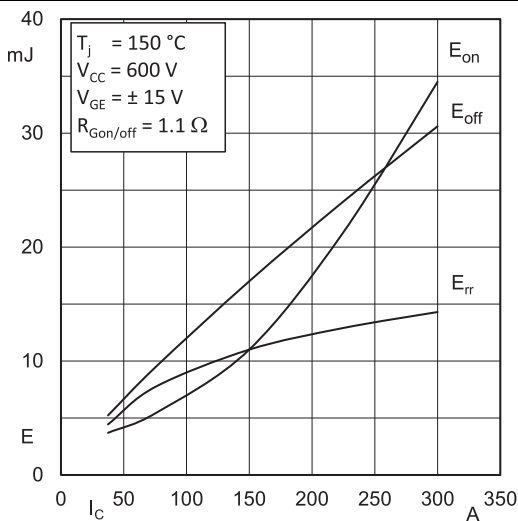
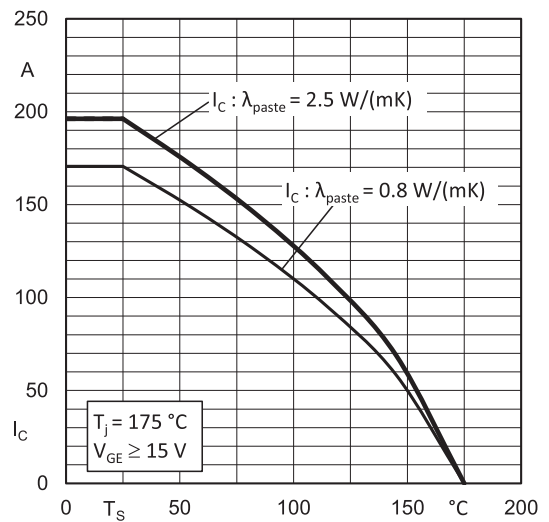
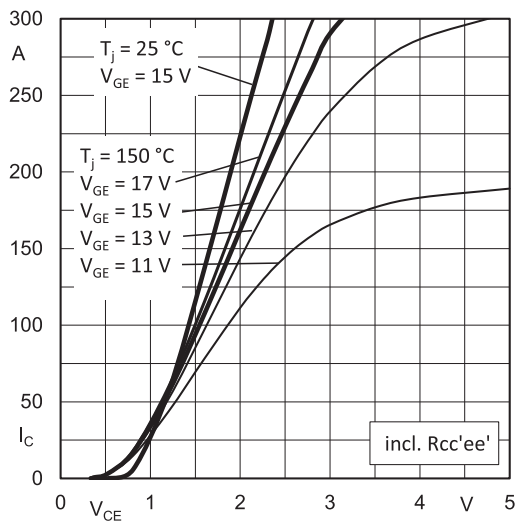
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- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
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#### Remarks

- )Max. case temperature limited to  $T_C=TS=125^{\circ}\text{C}$
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GB



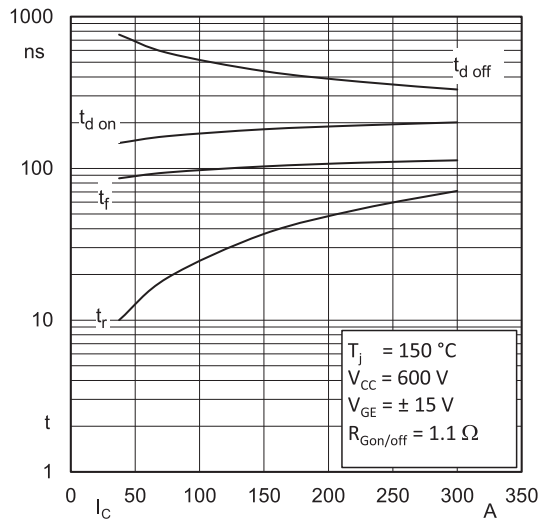


Fig. 7: Typ. switching times vs.  $I_C$

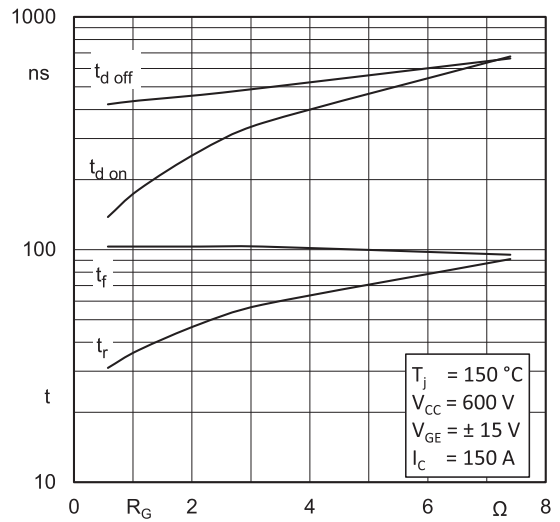


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

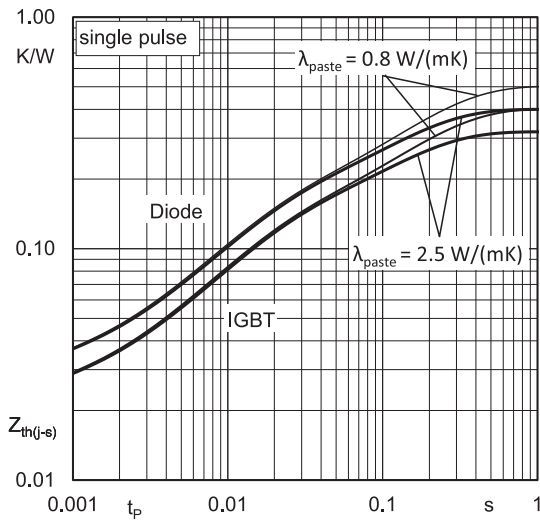


Fig. 9: Typ. transient thermal impedance

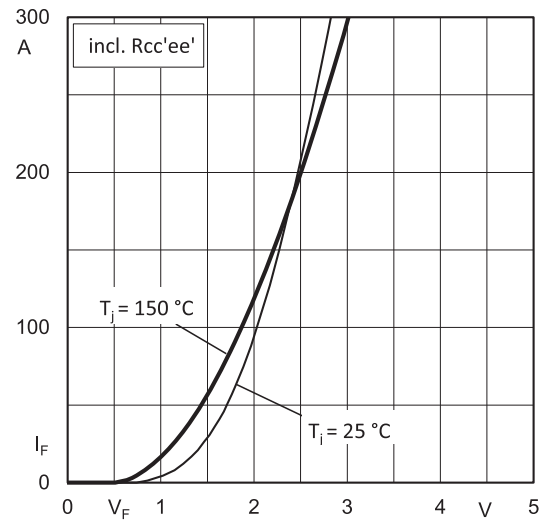


Fig. 10: Typ. CAL diode forward characteristic

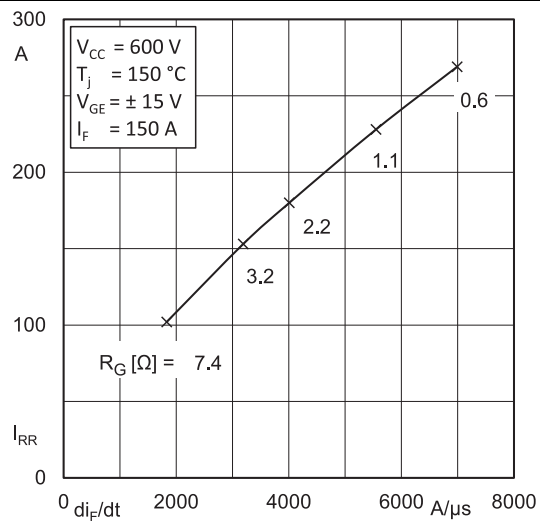


Fig. 11: Typ. CAL diode peak reverse recovery current

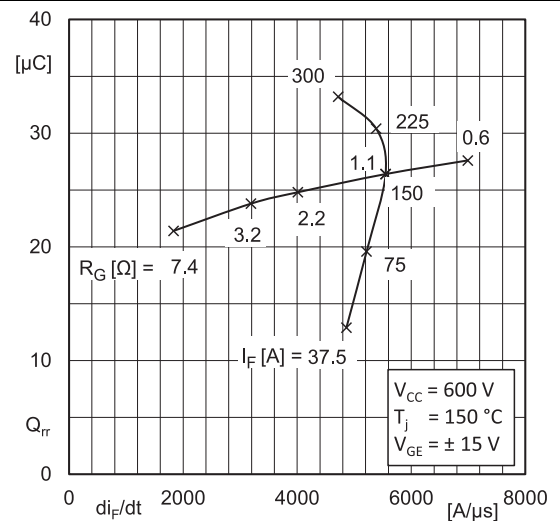
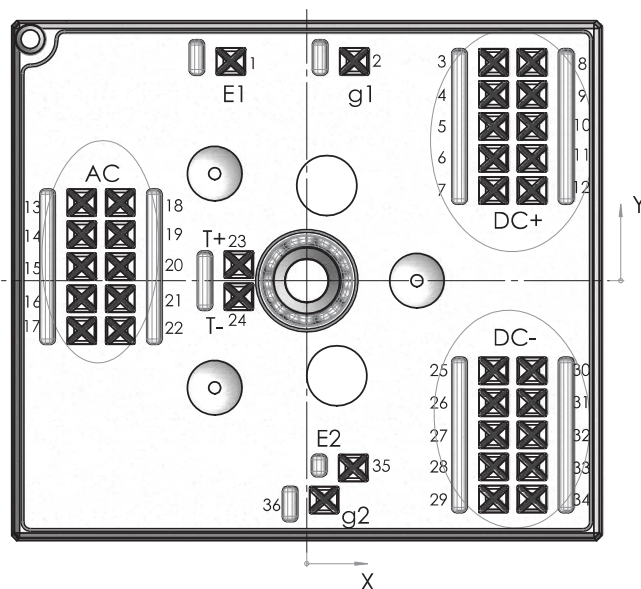


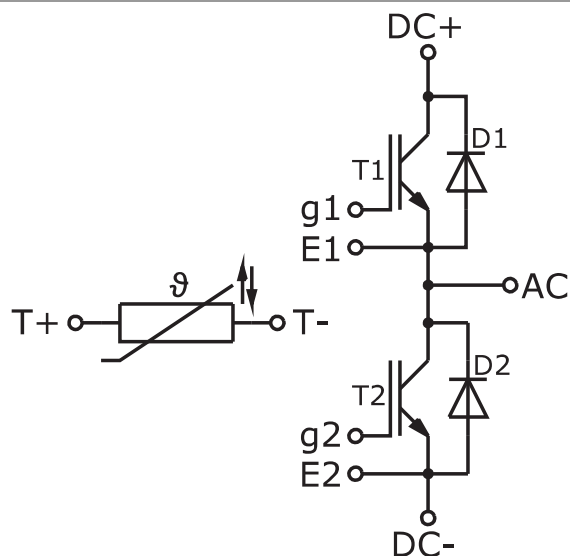
Fig. 12: Typ. CAL diode recovery charge

| Pin out |        |      |          |     |        |       |          |
|---------|--------|------|----------|-----|--------|-------|----------|
| Pin     | X      | Y    | Function | Pin | X      | Y     | Function |
| 1       | -7,58  | 21,9 | E1       | 19  | -18,62 | 4,6   | AC       |
| 2       | 4,72   | 21,9 | g1       | 20  | -18,62 | 1,4   | AC       |
| 3       | 18,62  | 21,8 | DC+      | 21  | -18,62 | -1,8  | AC       |
| 4       | 18,62  | 18,6 | DC+      | 22  | -18,62 | -5    | AC       |
| 5       | 18,62  | 15,4 | DC+      | 23  | -6,78  | 1,6   | T+       |
| 6       | 18,62  | 12,2 | DC+      | 24  | -6,78  | -1,6  | T-       |
| 7       | 18,62  | 9    | DC+      | 25  | 18,62  | -9    | DC-      |
| 8       | 22,48  | 21,8 | DC+      | 26  | 18,62  | -12,2 | DC-      |
| 9       | 22,48  | 18,6 | DC+      | 27  | 18,62  | -15,4 | DC-      |
| 10      | 22,48  | 15,4 | DC+      | 28  | 18,62  | -18,6 | DC-      |
| 11      | 22,48  | 12,2 | DC+      | 29  | 18,62  | -21,8 | DC-      |
| 12      | 22,48  | 9    | DC+      | 30  | 22,48  | -9    | DC-      |
| 13      | -22,48 | 7,8  | AC       | 31  | 22,48  | -12,2 | DC-      |
| 14      | -22,48 | 4,6  | AC       | 32  | 22,48  | -15,4 | DC-      |
| 15      | -22,48 | 1,4  | AC       | 33  | 22,48  | -18,6 | DC-      |
| 16      | -22,48 | -1,8 | AC       | 34  | 22,48  | -21,8 | DC-      |
| 17      | -22,48 | -5   | AC       | 35  | 4,62   | -18,7 | E2       |
| 18      | -18,62 | 7,8  | AC       | 36  | 1,72   | -21,9 | q2       |

all values in mm



Pinout and Dimensions



Pinout

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

## **\*IMPORTANT INFORMATION AND WARNINGS**

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