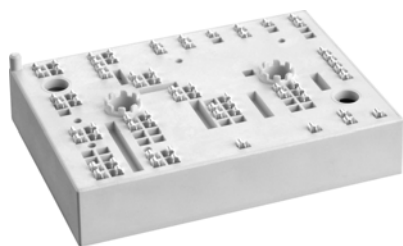


# SKiiP 39AC12T7V1



MiniSKiiP® 3

## Sixpack

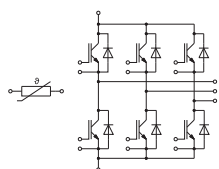
### SKiiP 39AC12T7V1

#### 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

#### 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)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet. Please refer to both documents for further information.
- For storage and case temperature with TIM see document "Technical Explanations Thermal Interface Materials"

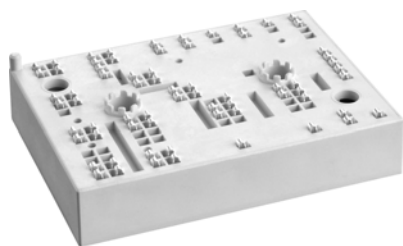


AC

| Absolute Maximum Ratings |                                                                                |                         |             |      |
|--------------------------|--------------------------------------------------------------------------------|-------------------------|-------------|------|
| Symbol                   | Conditions                                                                     |                         | Values      | Unit |
| Inverter - IGBT          |                                                                                |                         |             |      |
| V <sub>CES</sub>         | T <sub>J</sub> = 25 °C                                                         |                         | 1200        | V    |
| I <sub>C</sub>           | P12 (reference)<br>T <sub>J</sub> = 175 °C                                     | T <sub>s</sub> = 70 °C  | 139         | A    |
|                          |                                                                                | T <sub>s</sub> = 100 °C | 112         | A    |
| I <sub>C</sub>           | HPTP<br>T <sub>J</sub> = 175 °C                                                | T <sub>s</sub> = 70 °C  | 163         | A    |
|                          |                                                                                | T <sub>s</sub> = 100 °C | 131         | A    |
| I <sub>Cnom</sub>        |                                                                                |                         | 150         | A    |
| I <sub>CRM</sub>         |                                                                                |                         | 300         | A    |
| V <sub>GES</sub>         |                                                                                |                         | -20 ... 20  | V    |
| t <sub>psc</sub>         | V <sub>CC</sub> = 800 V<br>V <sub>GE</sub> ≤ 15 V<br>V <sub>CES</sub> ≤ 1200 V | T <sub>J</sub> = 175 °C | 7           | μs   |
| T <sub>J</sub>           |                                                                                |                         | -40 ... 175 | °C   |
| Inverse - Diode          |                                                                                |                         |             |      |
| V <sub>RRM</sub>         | T <sub>J</sub> = 25 °C                                                         |                         | 1200        | V    |
| I <sub>F</sub>           | P12 (reference)<br>T <sub>J</sub> = 175 °C                                     | T <sub>s</sub> = 70 °C  | 103         | A    |
|                          |                                                                                | T <sub>s</sub> = 100 °C | 82          | A    |
| I <sub>F</sub>           | HPTP<br>T <sub>J</sub> = 175 °C                                                | T <sub>s</sub> = 70 °C  | 128         | A    |
|                          |                                                                                | T <sub>s</sub> = 100 °C | 102         | A    |
| I <sub>FRM</sub>         |                                                                                |                         | 300         | A    |
| I <sub>FSM</sub>         | t <sub>p</sub> = 10 ms, sin 180°, T <sub>J</sub> = 150 °C                      |                         | 900         | A    |
| T <sub>J</sub>           |                                                                                |                         | -40 ... 175 | °C   |
| Module                   |                                                                                |                         |             |      |
| I <sub>t(RMS)</sub>      | T <sub>terminal</sub> = 80 °C, 20 A per spring                                 |                         | 160         | A    |
| T <sub>stg</sub>         | module without TIM                                                             |                         | -40 ... 125 | °C   |
| V <sub>isol</sub>        | AC sinus 50 Hz, t = 1 min                                                      |                         | 2500        | V    |

| Characteristics      |                                                                         |                         |      |       |      |      |
|----------------------|-------------------------------------------------------------------------|-------------------------|------|-------|------|------|
| Symbol               | Conditions                                                              |                         | min. | typ.  | max. | Unit |
| Inverter - IGBT      |                                                                         |                         |      |       |      |      |
| V <sub>CE(sat)</sub> | I <sub>C</sub> = 150 A                                                  | T <sub>j</sub> = 25 °C  |      | 1.55  | 1.70 | V    |
|                      | V <sub>GE</sub> = 15 V                                                  | T <sub>j</sub> = 150 °C |      | 1.73  | 1.88 | V    |
|                      | chiplevel                                                               | T <sub>j</sub> = 175 °C |      | 1.77  | 1.92 | V    |
| V <sub>CE0</sub>     |                                                                         | T <sub>j</sub> = 25 °C  |      | 1.00  | 1.05 | V    |
|                      | chiplevel                                                               | T <sub>j</sub> = 150 °C |      | 0.80  | 0.85 | V    |
|                      |                                                                         | T <sub>j</sub> = 175 °C |      | 0.75  | 0.80 | V    |
| r <sub>CE</sub>      |                                                                         | T <sub>j</sub> = 25 °C  |      | 3.7   | 4.3  | mΩ   |
|                      | V <sub>GE</sub> = 15 V                                                  | T <sub>j</sub> = 150 °C |      | 6.2   | 6.9  | mΩ   |
|                      | chiplevel                                                               | T <sub>j</sub> = 175 °C |      | 6.8   | 7.5  | mΩ   |
| V <sub>GE(th)</sub>  | V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 3.4 mA             |                         | 5.15 | 5.8   | 6.45 | V    |
| I <sub>CES</sub>     | V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 1200 V, T <sub>j</sub> = 25 °C |                         |      |       | 1.5  | mA   |
| C <sub>ies</sub>     | V <sub>CE</sub> = 25 V<br>V <sub>GE</sub> = 0 V                         | f = 1 MHz               |      | 30.20 |      | nF   |
| C <sub>oes</sub>     |                                                                         | f = 1 MHz               |      | 0.380 |      | nF   |
| C <sub>res</sub>     |                                                                         | f = 1 MHz               |      | 0.108 |      | nF   |
| Q <sub>G</sub>       | V <sub>GE</sub> = - 8V ... + 15 V                                       |                         |      | 2100  |      | nC   |
| R <sub>Gint</sub>    | T <sub>j</sub> = 25 °C                                                  |                         |      | 1.0   |      | Ω    |

# SKiiP 39AC12T7V1



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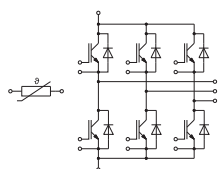
### SKiiP 39AC12T7V1

#### 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

#### 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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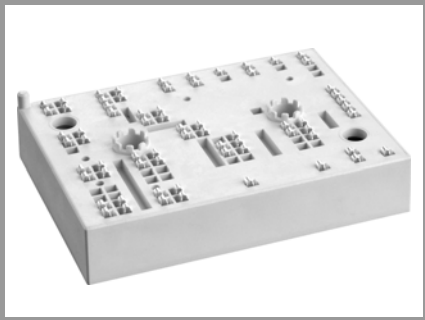


AC

| 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   |
| $E_{on}$               | $R_{G\ on} = 1.1\ \Omega$<br>$R_{G\ off} = 1.1\ \Omega$<br>$V_{GE} = +15/-15\text{ V}$                                                                     | $T_j = 25\text{ °C}$  | 6.9  |      | mJ   |
|                        |                                                                                                                                                            | $T_j = 150\text{ °C}$ | 12   |      | mJ   |
|                        |                                                                                                                                                            | $T_j = 175\text{ °C}$ | 13   |      | 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>$di/dt_{on} = 3970\text{ A}/\mu\text{s}$<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, P12 (reference)                                                                                                                                  |                       | 0.41 |      | K/W  |
| $R_{th(j-s)}$          | per IGBT, HPTP                                                                                                                                             |                       | 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>chiplevel                     | $T_j = 25\text{ °C}$  | 2.14 | 2.46 | V             |
|                        |                                                                                | $T_j = 150\text{ °C}$ | 2.07 | 2.38 | V             |
|                        |                                                                                | $T_j = 175\text{ °C}$ | 1.93 | 2.24 | V             |
| $V_{F0}$               | chiplevel                                                                      | $T_j = 25\text{ °C}$  | 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             |
| $r_F$                  | chiplevel                                                                      | $T_j = 25\text{ °C}$  | 5.6  | 6.4  | m $\Omega$    |
|                        |                                                                                | $T_j = 150\text{ °C}$ | 7.8  | 8.5  | m $\Omega$    |
|                        |                                                                                | $T_j = 175\text{ °C}$ | 7.4  | 8.4  | m $\Omega$    |
| $I_{RRM}$              | $I_F = 150\text{ A}$<br>$V_{GE} = +15/-15\text{ V}$<br>$V_{CC} = 600\text{ V}$ | $T_j = 25\text{ °C}$  | 107  |      | A             |
|                        |                                                                                | $T_j = 150\text{ °C}$ | 145  |      | A             |
|                        |                                                                                | $T_j = 175\text{ °C}$ | 175  |      | A             |
| $Q_{rr}$               |                                                                                | $T_j = 25\text{ °C}$  | 7.4  |      | $\mu\text{C}$ |
|                        |                                                                                | $T_j = 150\text{ °C}$ | 24   |      | $\mu\text{C}$ |
|                        |                                                                                | $T_j = 175\text{ °C}$ | 24.5 |      | $\mu\text{C}$ |
| $E_{rr}$               | $@\ T_j = 150\text{ °C}$ :<br>$di/dt_{off} = 3910\text{ A}/\mu\text{s}$        | $T_j = 25\text{ °C}$  | 2.6  |      | mJ            |
|                        |                                                                                | $T_j = 150\text{ °C}$ | 8.6  |      | mJ            |
|                        |                                                                                | $T_j = 175\text{ °C}$ | 11   |      | mJ            |
| $R_{th(j-s)}$          | per Diode, P12 (reference)                                                     |                       | 0.55 |      | K/W           |
| $R_{th(j-s)}$          | per Diode, HPTP                                                                |                       | 0.4  |      | K/W           |
| <b>Module</b>          |                                                                                |                       |      |      |               |
| $L_{CE}$               |                                                                                |                       | -    |      | nH            |
| $M_s$                  | to heat sink                                                                   | 2                     |      | 2.5  | Nm            |
| w                      |                                                                                |                       | 82   |      | g             |

# SKiiP 39AC12T7V1



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| Characteristics    |                                                                                                                                                                                                     |      |                |      |          |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|------|----------|
| Symbol             | Conditions                                                                                                                                                                                          | min. | typ.           | max. | Unit     |
| Temperature Sensor |                                                                                                                                                                                                     |      |                |      |          |
| $R_{100}$          | $T_r=100^{\circ}\text{C}$ ( $R_{25}=1000\Omega$ )                                                                                                                                                   |      | $1670 \pm 3\%$ |      | $\Omega$ |
| $R_{(T)}$          | $R_{(T)}=1000\Omega[1+A(T-25^{\circ}\text{C})+B(T-25^{\circ}\text{C})^2]$<br>, $A = 7.635 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$ ,<br>$B = 1.731 \cdot 10^{-5} \text{ }^{\circ}\text{C}^{-2}$ |      |                |      |          |

## Sixpack

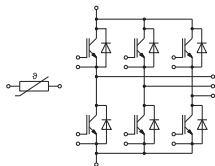
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#### Features\*

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

#### 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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AC

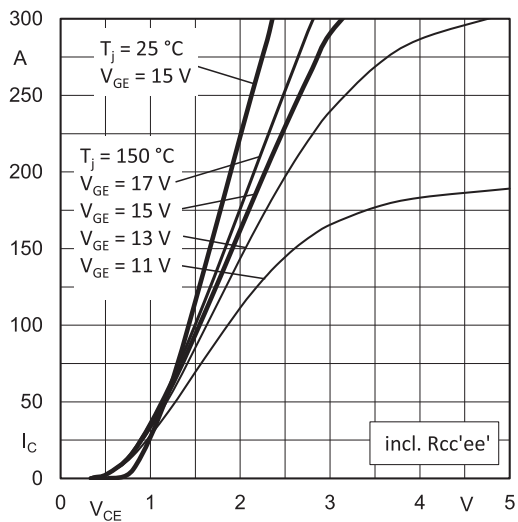


Fig. 1: Typ. output characteristic

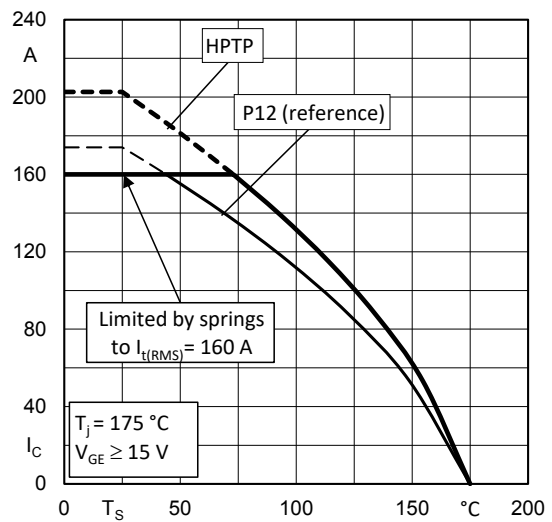


Fig. 2: Rated current vs. temperature  $I_C = f(T_s)$

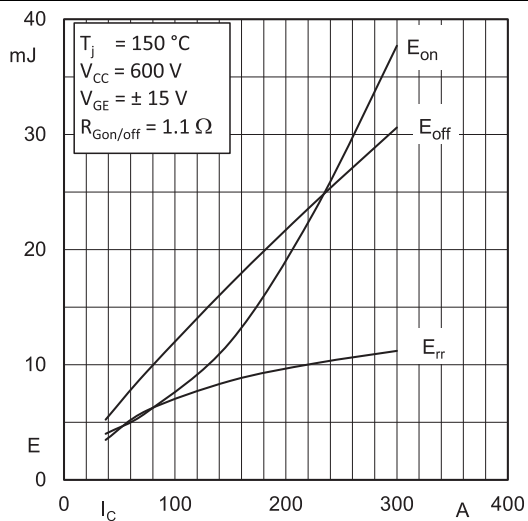


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

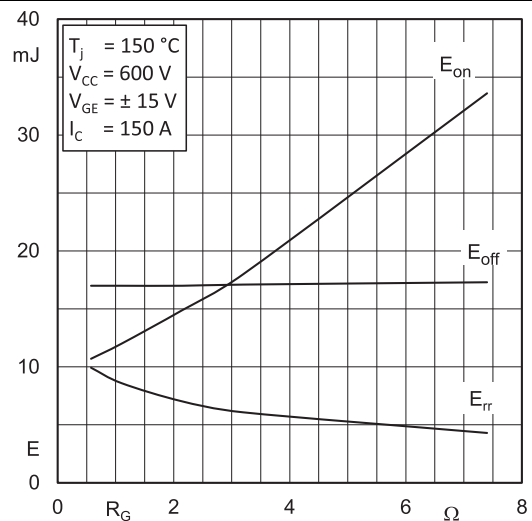


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

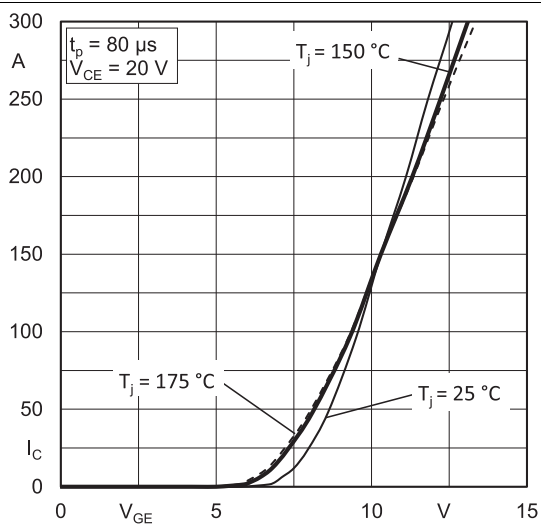


Fig. 5: Typ. transfer characteristic

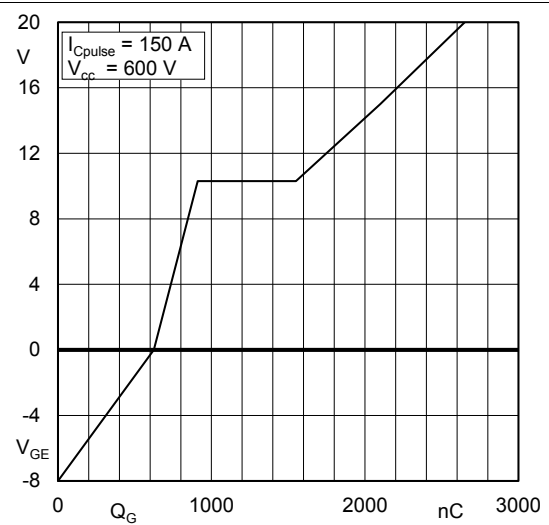


Fig. 6: Typ. gate charge characteristic

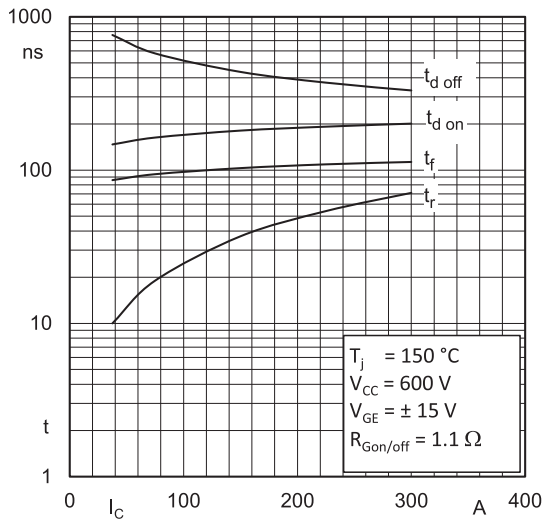


Fig. 7: Typ. switching times vs.  $I_C$

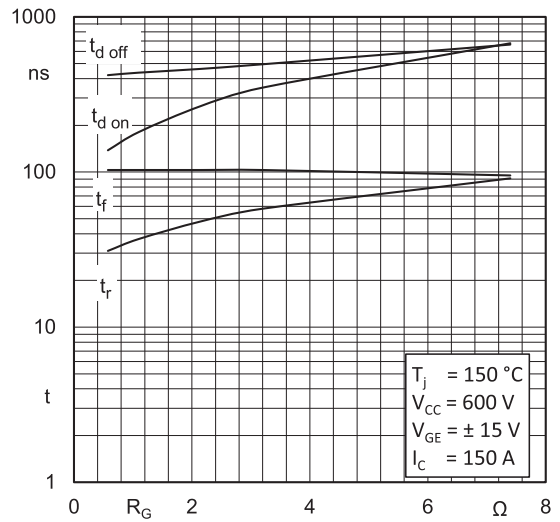


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

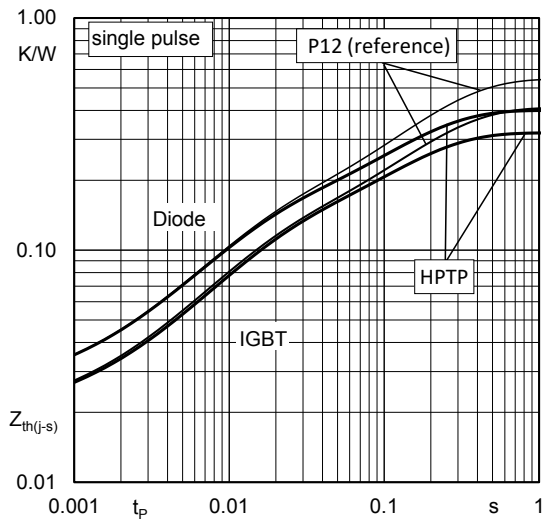


Fig. 9: Typ. transient thermal impedance

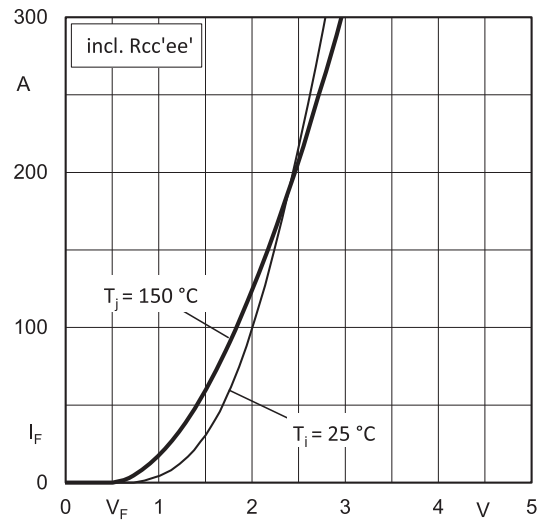


Fig. 10: Typ. CAL diode forward characteristic

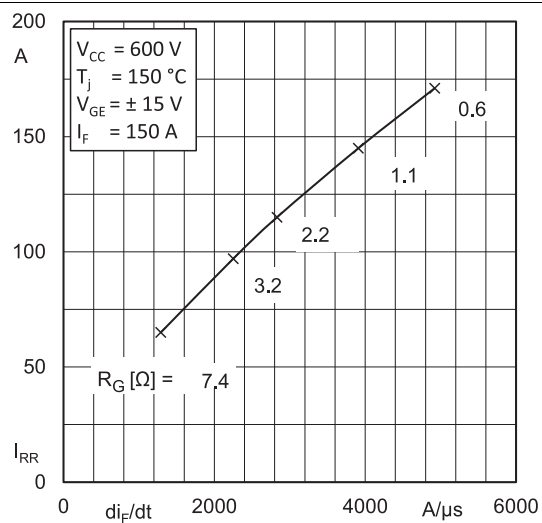


Fig. 11: Typ. CAL diode peak reverse recovery current

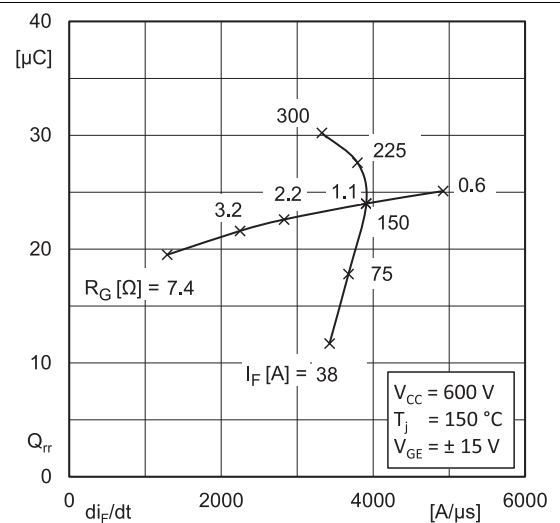
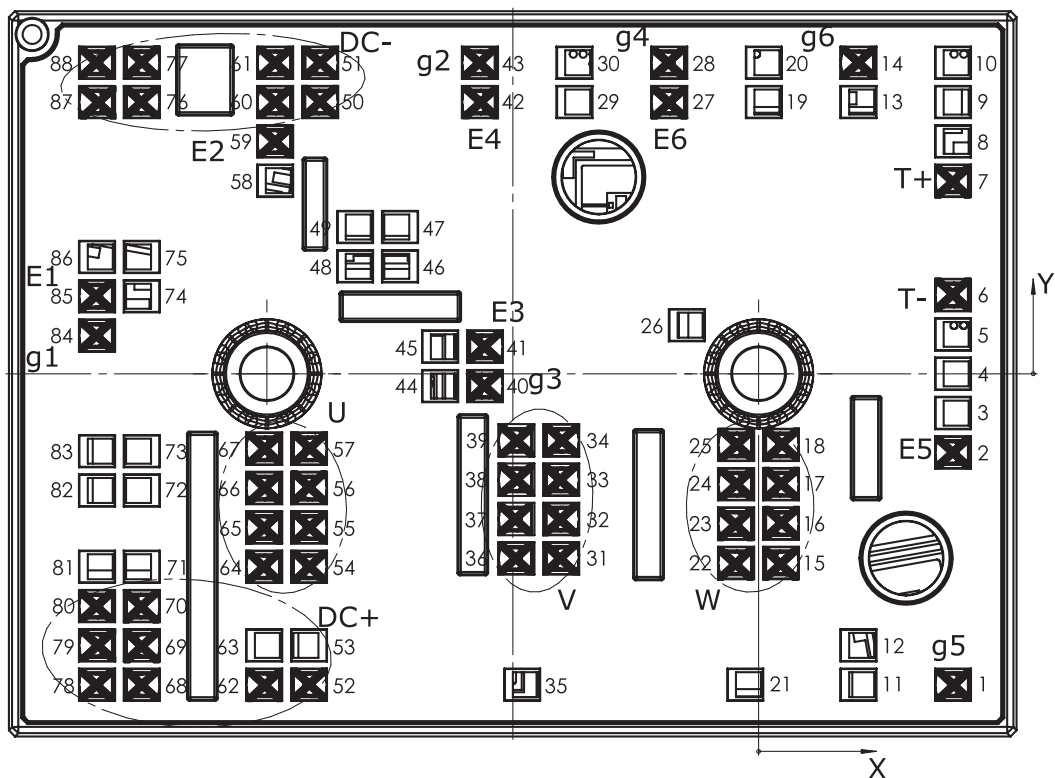


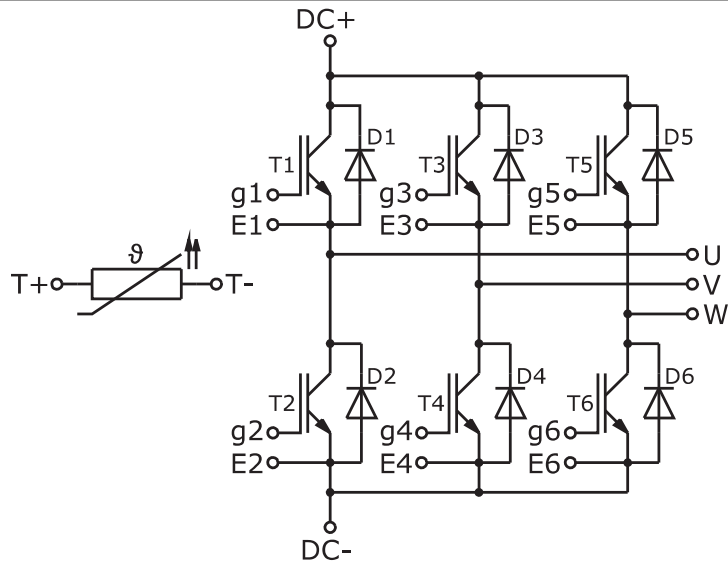
Fig. 12: Typ. CAL diode recovery charge

| 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 | V        | 61  | -39,33 | 25,30  | DC-      |
| 2       | 15,83  | -6,40  | E5       | 32  | -16,05 | -11,82 | V        | 62  | -40,23 | -25,30 | DC+      |
| 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 | U        |
| 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 | V        | 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 | W        | 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  | DC-      |
| 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 | W        | 52  | -36,58 | -25,30 | DC+      | 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 | U        | 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  | DC-      |
| 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

## IMPORTANT INFORMATION AND WARNINGS

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

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