# SKiM306GD12E4 V2

**SKiM® 63**

## Trench IGBT Modules

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### Features

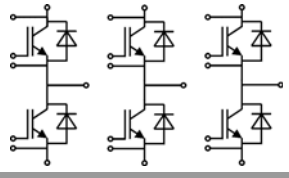
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Insulated by $Al_2O_3$ DBC (Direct Bonded Copper) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to 6 x $I_C$
- Integrated temperature sensor

### Typical Applications*

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives

### Remarks

- Case temperature limited to $T_s$ = 125°C max; $T_c = T_s$ (for baseplateless modules)
- Recommended $T_{op}$ = -40 … +150°C



**GD**

**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) | $T_s$ = 25 °C | 410 | A |
| | $T_j$ = 175 °C | $T_s$ = 70 °C | 333 | A |
| $I_C$ | $\lambda_{paste}$=2.5 W/(mK) | $T_s$ = 25 °C | 485 | A |
| | $T_j$ = 175 °C | $T_s$ = 70 °C | 396 | A |
| $I_{Cnom}$ | | | 300 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3 x $I_{Cnom}$ | | 900 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V<br>$V_{GE} \leq$ 15 V<br>$V_{CES} \leq$ 1200 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse - Diode** | | | | |
| $I_F$ | $\lambda_{paste}$=0.8 W/(mK) | $T_s$ = 25 °C | 305 | A |
| | $T_j$ = 175 °C | $T_s$ = 70 °C | 242 | A |
| $I_F$ | $\lambda_{paste}$=2.5 W/(mK) | $T_s$ = 25 °C | 371 | A |
| | $T_j$ = 175 °C | $T_s$ = 70 °C | 297 | A |
| $I_{Fnom}$ | | | 300 | A |
| $I_{FRM}$ | $I_{FRM}$ = 3 x $I_{Fnom}$ | | 900 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 150 °C | | 1620 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C, | | 700 | A |
| $T_{stg}$ | | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50 Hz, t = 1 min | | 2500 | V |

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Inverter - IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 300 A<br>$V_{GE}$ = 15 V<br>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<br>chiplevel | $T_j$ = 25 °C | | 3.5 | 4.0 | mΩ |
| | | $T_j$ = 150 °C | | 5.2 | 5.5 | mΩ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$, $I_C$ = 12 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V, $T_j$ = 25 °C | | | 0.1 | 0.36 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V<br>$V_{GE}$ = 0 V | f = 1 MHz | | 17.6 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 1.16 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.94 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 1700 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 2.5 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V<br>$I_C$ = 300 A<br>$R_{G\ on}$ = 1 Ω<br>$R_{G\ off}$ = 1 Ω<br>$di/dt_{on}$ = 6590 A/µs<br>$di/dt_{off}$ = 4000 A/µs<br>$V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 252 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 44 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 19 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 506 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 70 | | ns |
| $E_{off}$ | | $T_j$ = 150 °C | | 39 | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=0.8 W/(mK) | | | 0.116 | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}$=2.5 W/(mK) | | | 0.086 | | K/W |

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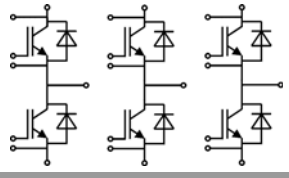


**GD**

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Inverse - Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 300 A | $T_j$ = 25 °C | | 2.14 | 2.46 | V |
| | chiplevel | $T_j$ = 150 °C | | 2.07 | 2.38 | 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 | | 2.8 | 3.2 | mΩ |
| | | $T_j$ = 150 °C | | 3.9 | 4.3 | mΩ |
| $I_{RRM}$ | $I_F$ = 300 A<br>$di/dt_{off}$ = 8000 A/µs<br>$V_{GE}$ = +15/-15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 448 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 47 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 21 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=0.8 W/(mK) | | | 0.218 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}$=2.5 W/(mK) | | | 0.159 | | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 9 | 13 | nH |
| $R_{CC'+EE'}$ | measured per switch | $T_s$ = 25 °C | | 0.3 | | mΩ |
| | | $T_s$ = 125 °C | | 0.5 | | mΩ |
| w | | | | 761 | | g |
| **Temperature Sensor** | | | | | | |
| $R_{100}$ | $T_r$=100°C ($R_{25}$=1000Ω) | | | 1670 ± 1% | | Ω |
| R(T) | R(T)=1kΩ[1+A(T-25°C)+B(T-25°C)$^2$], A = 7.64*10$^{-3}$°C$^{-2}$, B = 1.73*10$^{-5}$°C$^{-2}$ | | | | | |

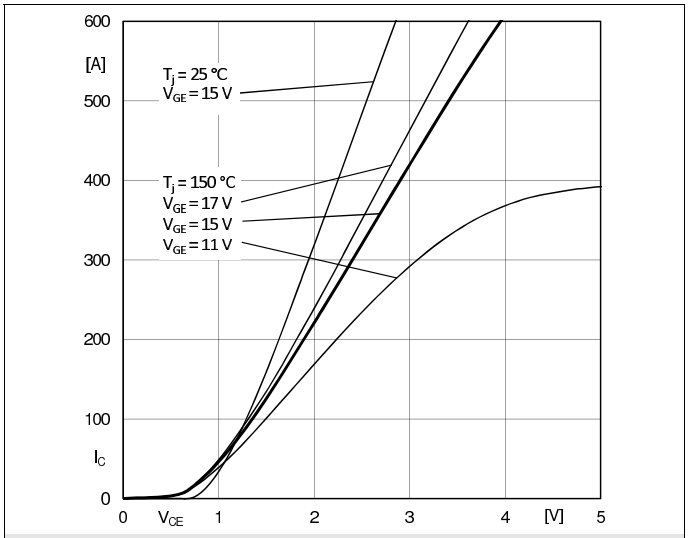



Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

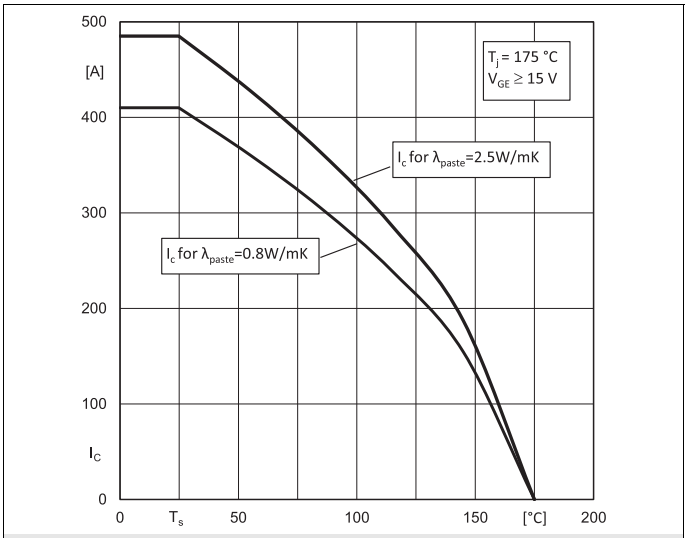



Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

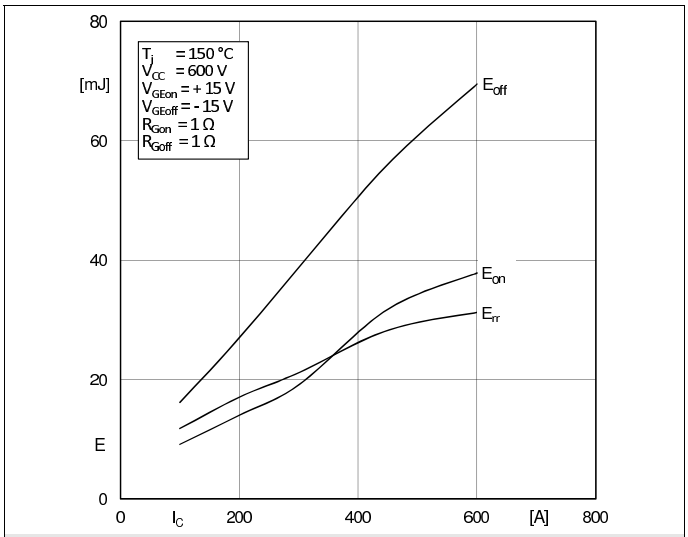



Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

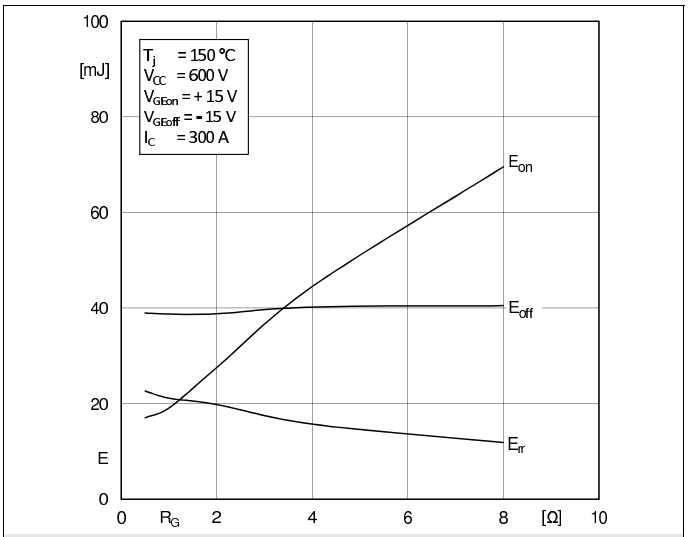



Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

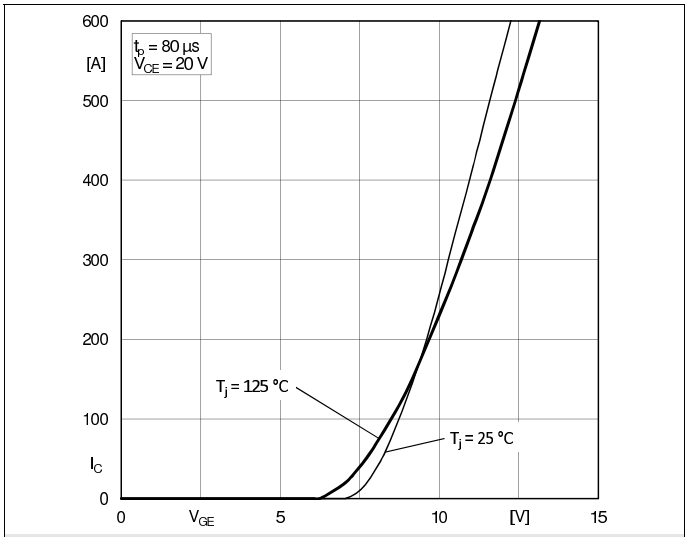



Fig. 5: Typ. transfer characteristic

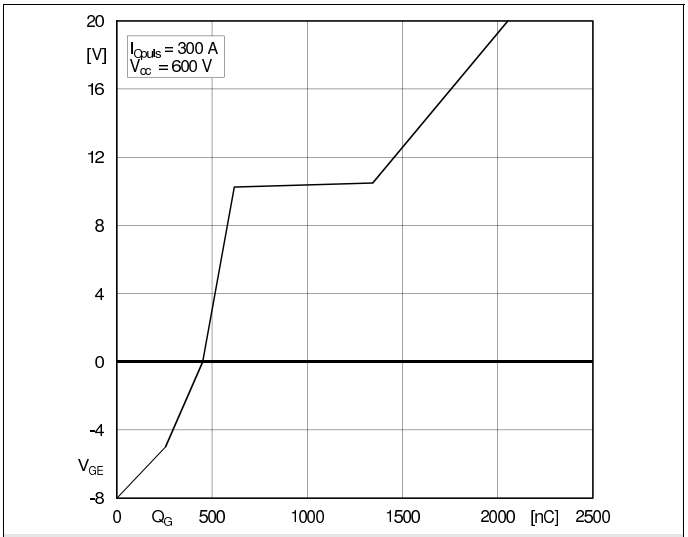



Fig. 6: Typ. gate charge characteristic

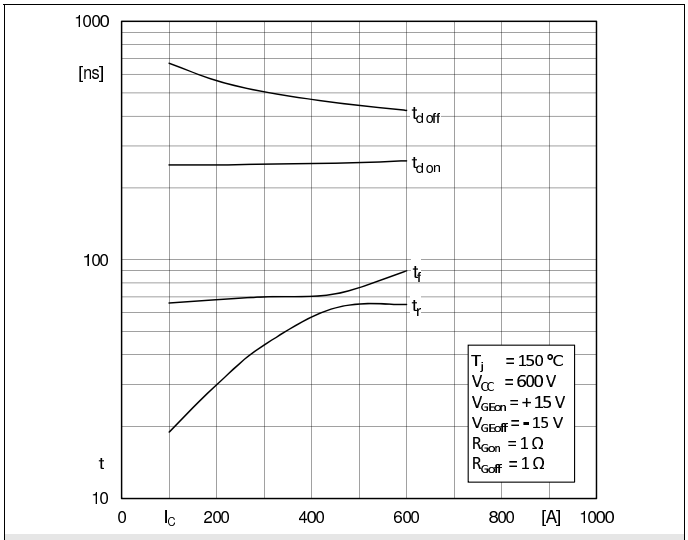



Fig. 7: Typ. switching times vs. $I_C$

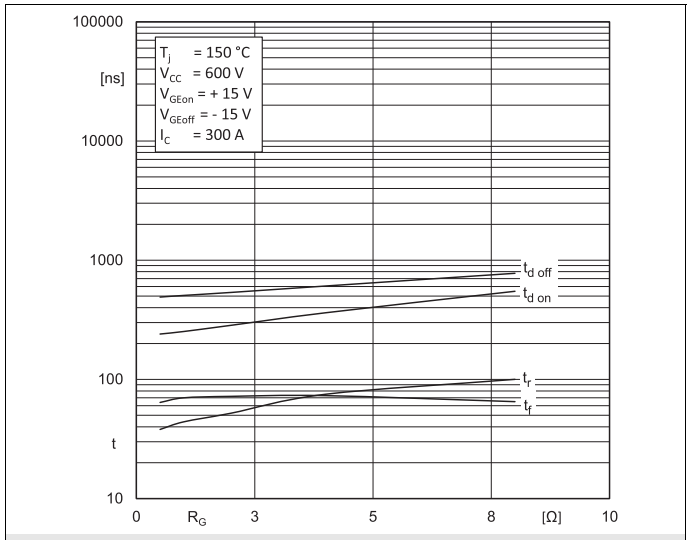



Fig. 8: Typ. switching times vs. gate resistor $R_G$

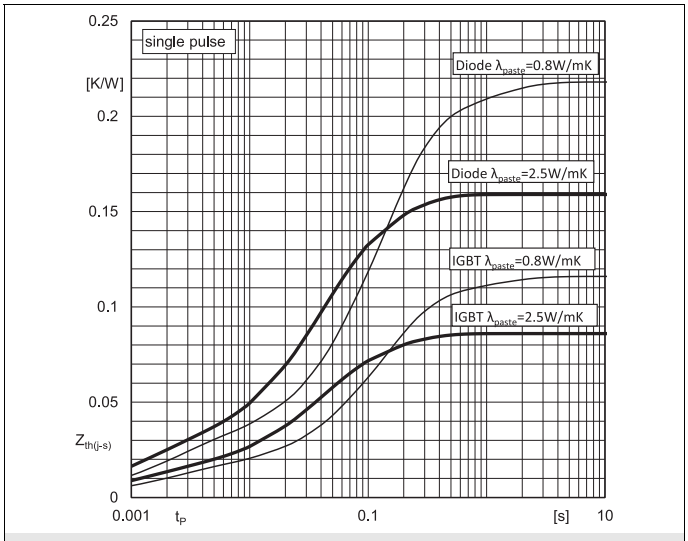



Fig. 9: Typ. transient thermal impedance

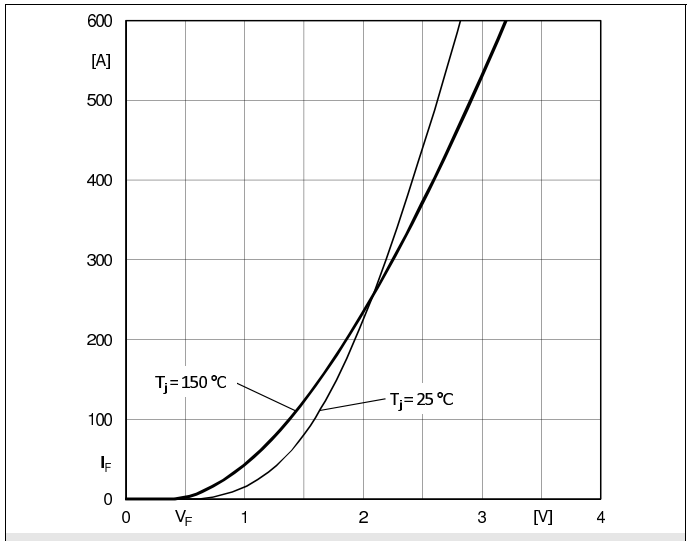



Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

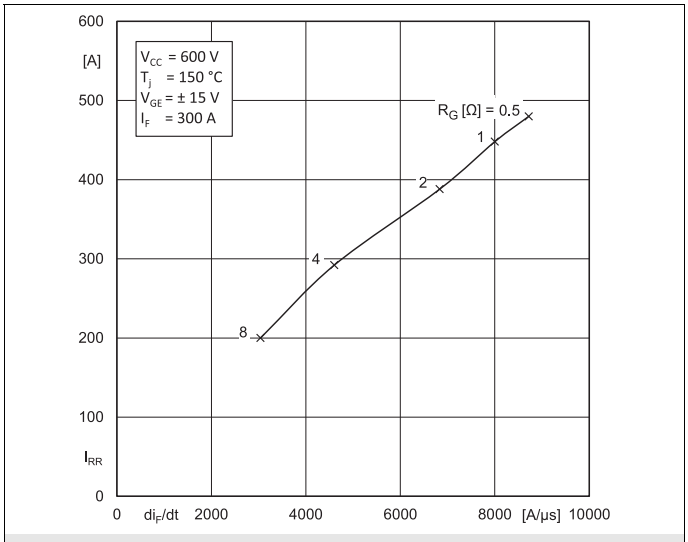



Fig. 11: Typ. CAL diode peak reverse recovery current

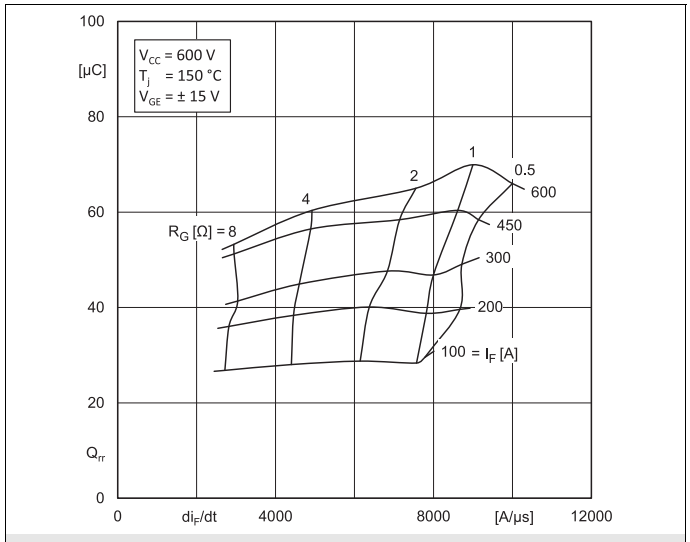
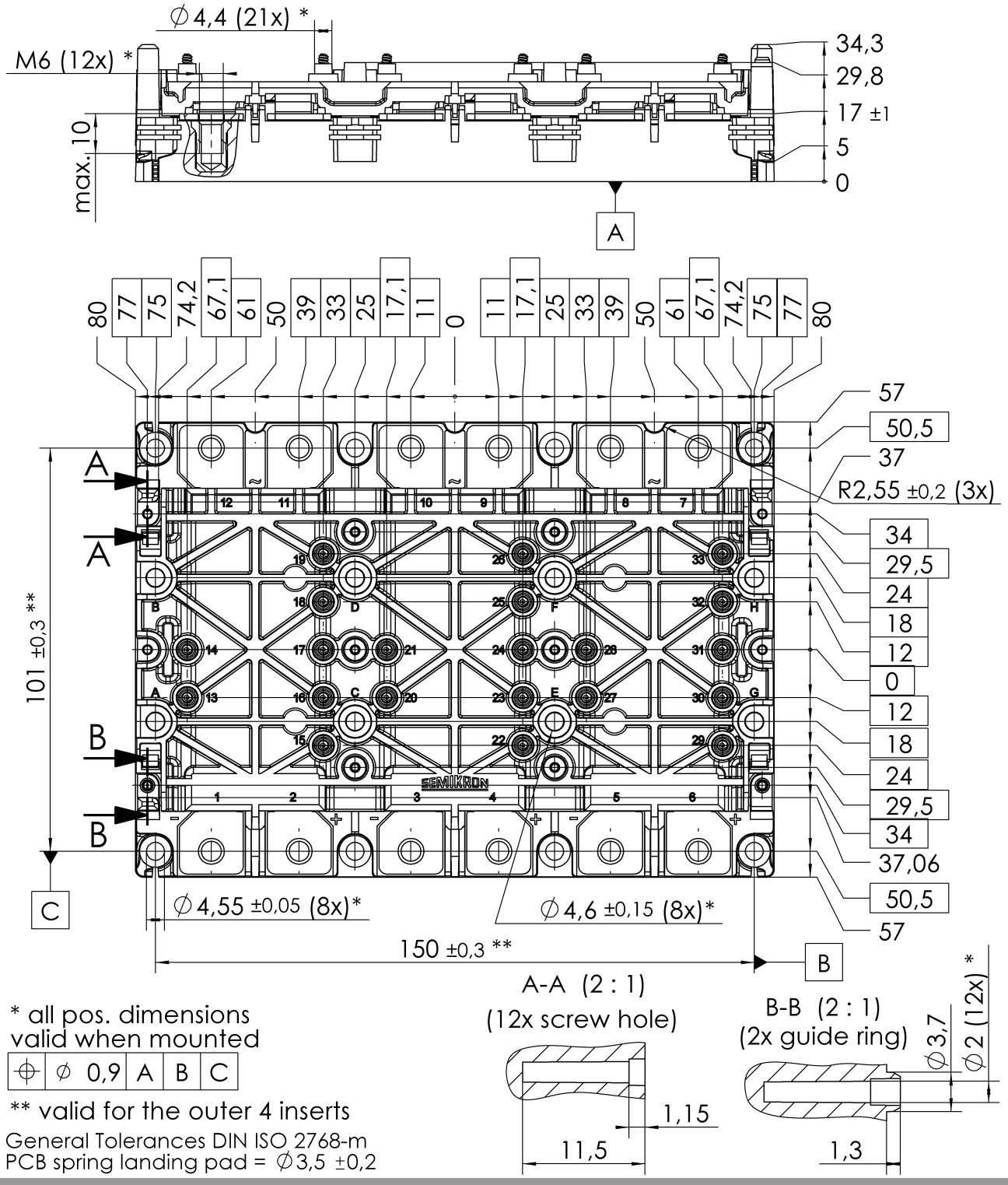
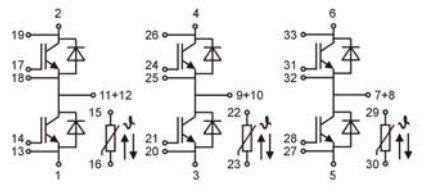



Fig. 12: Typ. CAL diode recovery charge


∅4,4 (21x) *
M6 (12x) *
max.10
34,3
29,8
17 ±1
5
0
A
80 77 75 74,2 67,1 61 50 39 33 25 17,1 11 0 11 17,1 25 33 39 50 61 67,1 74,2 75 77 80
57
50,5
37
R2,55 ±0,2 (3x)
34
29,5
24
18
12
0
12
18
24
29,5
34
37,06
50,5
57
101 ±0,3 **
∅4,55 ±0,05 (8x)*
∅4,6 ±0,15 (8x)*
150 ±0,3 **
B
A-A (2 : 1)
(12x screw hole)
1,15
11,5
B-B (2 : 1)
(2x guide ring)
∅3,7
∅2 (12x) *
1,3
* all pos. dimensions valid when mounted
∅ 0,9 A B C
** valid for the outer 4 inserts
General Tolerances DIN ISO 2768-m
PCB spring landing pad = ∅3,5 ±0,2



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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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