

SKiM429GD17E44F



SKiM® 93

Trench IGBT Modules

SKiM429GD17E44F

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 $6 \times I_C$
- Integrated temperature sensor

Typical Applications*

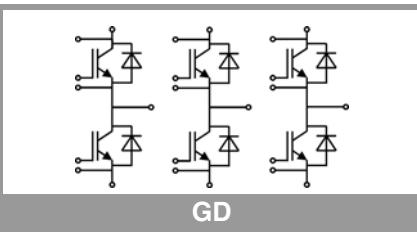
- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives

Remarks

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

| Absolute Maximum Ratings | | Values | Unit |
|--------------------------|--|-------------|---------------|
| Symbol | Conditions | | |
| Inverter - IGBT | | | |
| V_{CES} | $T_j = 25^\circ C$ | 1700 | V |
| I_C | $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$ | 608 | A |
| | $T_j = 175^\circ C$ | 489 | A |
| I_C | $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$ | 789 | A |
| | $T_j = 175^\circ C$ | 639 | A |
| I_{Cnom} | | 420 | A |
| I_{CRM} | $I_{CRM} = 3 \times I_{Cnom}$ | 1260 | A |
| V_{GES} | | -20 ... 20 | V |
| t_{psc} | $V_{CC} = 1000 \text{ V}$ $V_{GE} \leq 15 \text{ V}$ $V_{CES} \leq 1700 \text{ V}$ | 10 | μs |
| T_j | | -40 ... 175 | $^\circ C$ |
| Inverse - Diode | | | |
| I_F | $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$ | 394 | A |
| | $T_j = 175^\circ C$ | 308 | A |
| I_F | $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$ | 482 | A |
| | $T_j = 175^\circ C$ | 379 | A |
| I_{Fnom} | | 450 | A |
| I_{FRM} | $I_{FRM} = 2 \times I_{Fnom}$ | 900 | A |
| I_{FSM} | $t_p = 10 \text{ ms, sin } 180^\circ, T_j = 150^\circ C$ | 2322 | A |
| T_j | | -40 ... 175 | $^\circ C$ |
| Module | | | |
| $I_{t(RMS)}$ | $T_{terminal} = 80^\circ C$ | 700 | A |
| T_{stg} | | -40 ... 125 | $^\circ C$ |
| V_{isol} | AC sinus 50 Hz, $t = 1 \text{ min}$ | 3000 | V |

| Symbol | Conditions | min. | typ. | max. | Unit |
|------------------------|---|-------|------|------|---------------------|
| Characteristics | | | | | |
| $V_{CE(sat)}$ | $I_C = 420 \text{ A}$ $V_{GE} = 15 \text{ V}$ chiplevel | 1.90 | 2.25 | 2.45 | V |
| | | | | 2.25 | V |
| V_{CEO} | chiplevel | 1.10 | 1.20 | 1.10 | V |
| | | | | 1.00 | V |
| r_{CE} | $V_{GE} = 15 \text{ V}$ chiplevel | 1.90 | 2.5 | 2.5 | $m\Omega$ |
| | | | | 3.0 | $m\Omega$ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}, I_C = 16.8 \text{ mA}$ | 5.2 | 5.8 | 6.4 | V |
| I_{CES} | $V_{GE} = 0 \text{ V}, V_{CE} = 1700 \text{ V}, T_j = 25^\circ C$ | 0.15 | 0.5 | 0.5 | mA |
| C_{ies} | $V_{CE} = 25 \text{ V}$ $f = 1 \text{ MHz}$ | 33 | | | nF |
| C_{oes} | $V_{GE} = 0 \text{ V}$ $f = 1 \text{ MHz}$ | 1.38 | | | nF |
| C_{res} | $f = 1 \text{ MHz}$ | 1.08 | | | nF |
| Q_G | $V_{GE} = -8 \text{ V} \dots +15 \text{ V}$ | 3360 | | | nC |
| R_{Gint} | $T_j = 25^\circ C$ | 2.7 | | | Ω |
| $t_{d(on)}$ | $V_{CC} = 1200 \text{ V}$ $I_C = 420 \text{ A}$ | 498 | | | ns |
| t_r | $R_{G\text{ on}} = 2.2 \Omega$ | 62 | | | ns |
| E_{on} | $R_{G\text{ off}} = 2.2 \Omega$ | 178 | | | mJ |
| $t_{d(off)}$ | $di/dt_{on} = 7450 \text{ A}/\mu\text{s}$ $di/dt_{off} = 1920 \text{ A}/\mu\text{s}$ | 922 | | | ns |
| t_f | $T_j = 150^\circ C$ | 220 | | | ns |
| E_{off} | $V_{GE} = +15/-15 \text{ V}$ | 189 | | | mJ |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$ | 0.079 | | | K/W |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$ | 0.051 | | | K/W |





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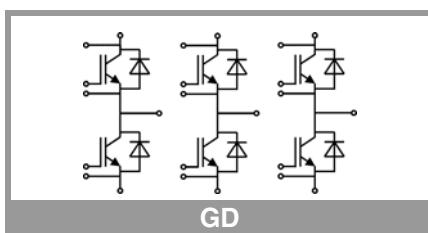
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| Characteristics | | Symbol | Conditions | min. | typ. | max. | Unit | | | | | | |
|---------------------------|---|--------|---------------------|------|----------------|------|-----------|--|--|--|--|--|--|
| | | | | | | | | | | | | | |
| Inverse - Diode | | | | | | | | | | | | | |
| $V_F = V_{EC}$ | $I_F = 420 A$ $V_{GE} = 0 V$ chiplevel | | $T_j = 25^\circ C$ | | 1.93 | 2.32 | V | | | | | | |
| | | | $T_j = 150^\circ C$ | | 2.04 | 2.43 | V | | | | | | |
| V_{FO} | chiplevel | | $T_j = 25^\circ C$ | | 1.32 | 1.56 | V | | | | | | |
| | | | $T_j = 150^\circ C$ | | 1.08 | 1.22 | V | | | | | | |
| r_F | chiplevel | | $T_j = 25^\circ C$ | | 1.46 | 1.80 | $m\Omega$ | | | | | | |
| | | | $T_j = 150^\circ C$ | | 2.3 | 2.9 | $m\Omega$ | | | | | | |
| I_{RRM} | $I_F = 420 A$ $di/dt_{off} = 7630 A/\mu s$ | | $T_j = 150^\circ C$ | | 577 | | A | | | | | | |
| Q_{rr} | $V_{GE} = +15/-15 V$ | | $T_j = 150^\circ C$ | | 150 | | μC | | | | | | |
| E_{rr} | $V_{CC} = 1200 V$ | | $T_j = 150^\circ C$ | | 119 | | mJ | | | | | | |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=0.8 W/(mK)$ | | | | 0.169 | | K/W | | | | | | |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=2.5 W/(mK)$ | | | | 0.125 | | K/W | | | | | | |
| Module | | | | | | | | | | | | | |
| L_{CE} | | | | | 10 | 15 | nH | | | | | | |
| $R_{CC+EE'}$ | measured per switch | | $T_s = 25^\circ C$ | | 0.3 | | $m\Omega$ | | | | | | |
| | | | $T_s = 125^\circ C$ | | 0.5 | | $m\Omega$ | | | | | | |
| W | | | | | 1042 | | g | | | | | | |
| Temperature Sensor | | | | | | | | | | | | | |
| R_{100} | $T_r=100^\circ C$ ($R_{25}=1000\Omega$) | | | | $1670 \pm 1\%$ | | Ω | | | | | | |
| $R(T)$ | $R(T)=1k\Omega[1+A(T-25^\circ C)+B(T-25^\circ C)^2]$, $A = 7.64 \times 10^{-3}^\circ C^{-1}$, $B = 1.73 \times 10^{-5}^\circ C^{-2}$ | | | | | | | | | | | | |



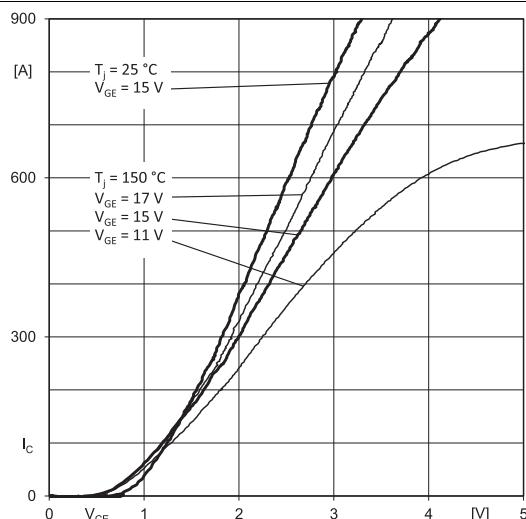


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

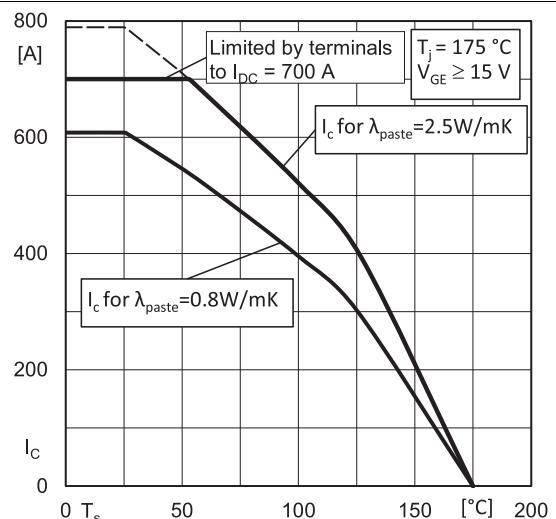


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

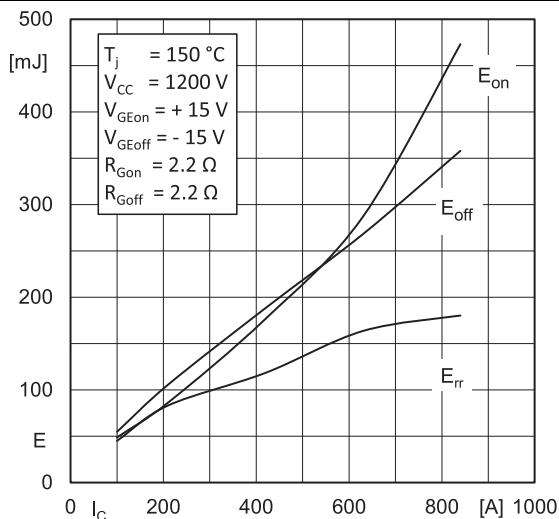


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

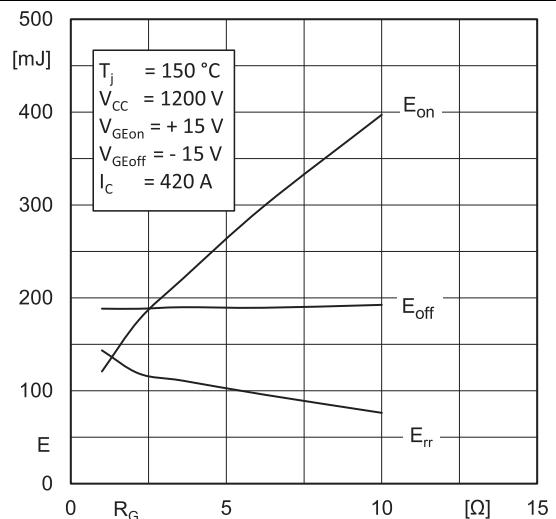


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

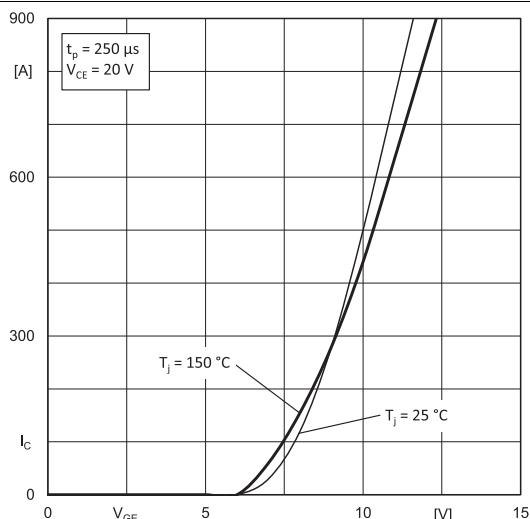


Fig. 5: Typ. transfer characteristic

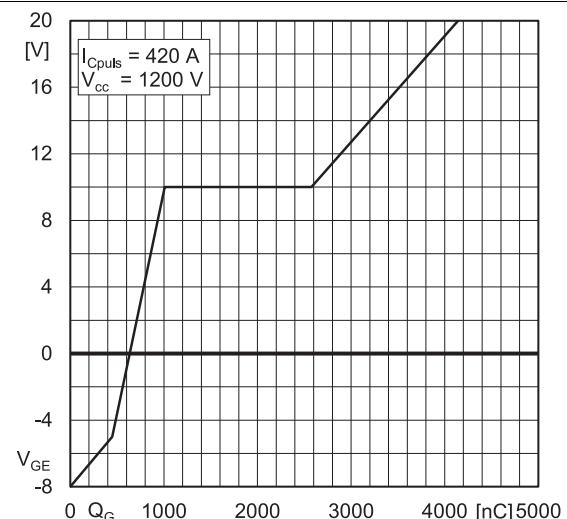


Fig. 6: Typ. gate charge characteristic

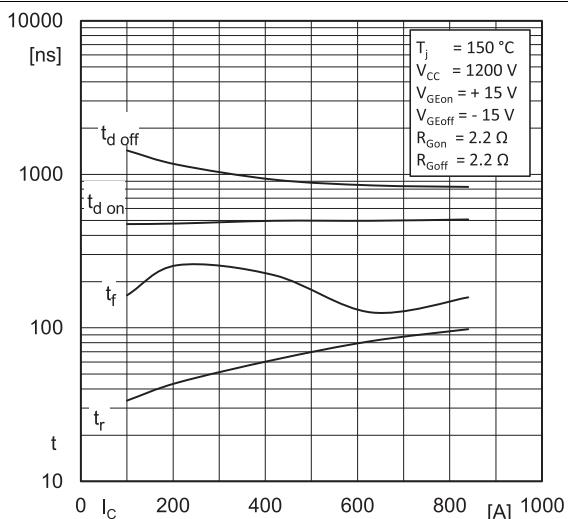


Fig. 7: Typ. switching times vs. I_C

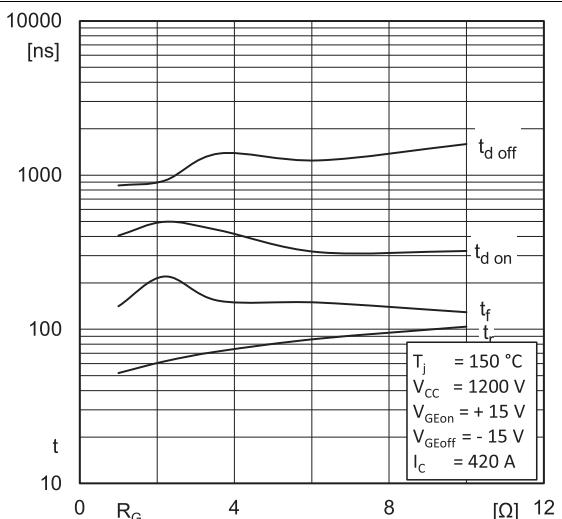


Fig. 8: Typ. switching times vs. gate resistor R_G

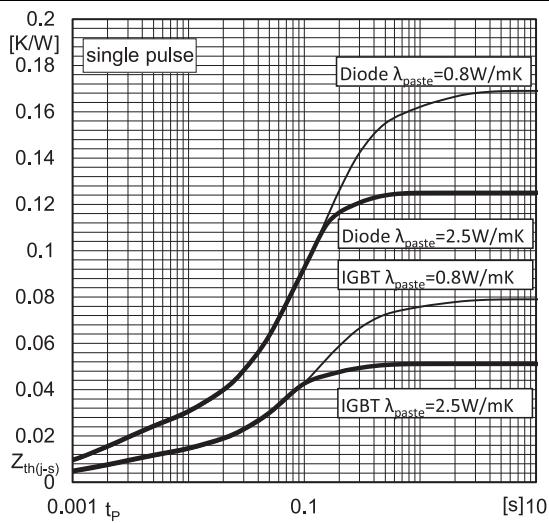


Fig. 9: Typ. transient thermal impedance

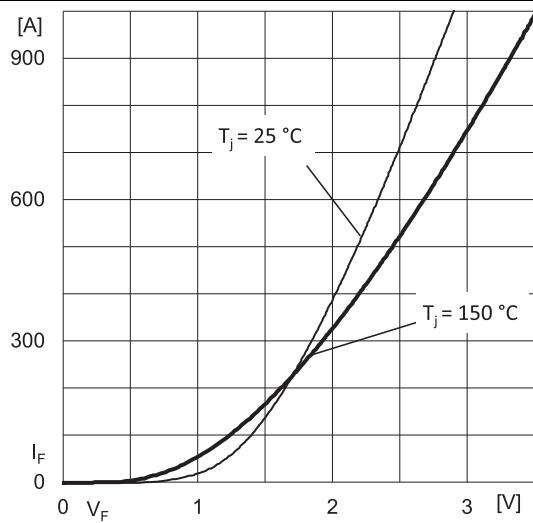


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

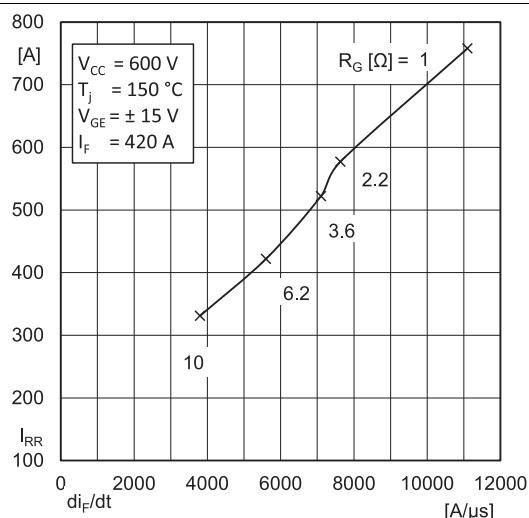


Fig. 11: Typ. CAL diode peak reverse recovery current

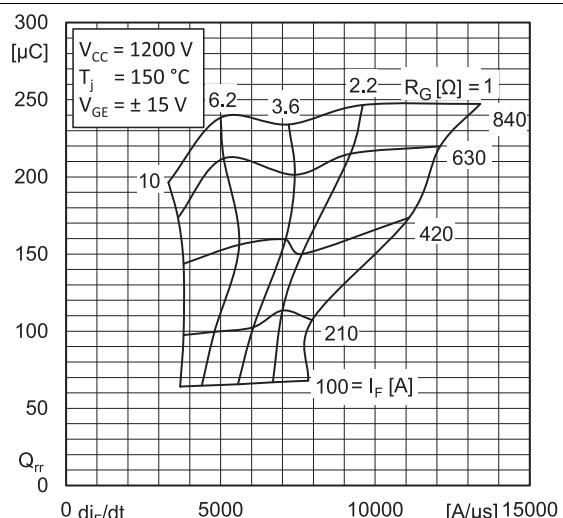
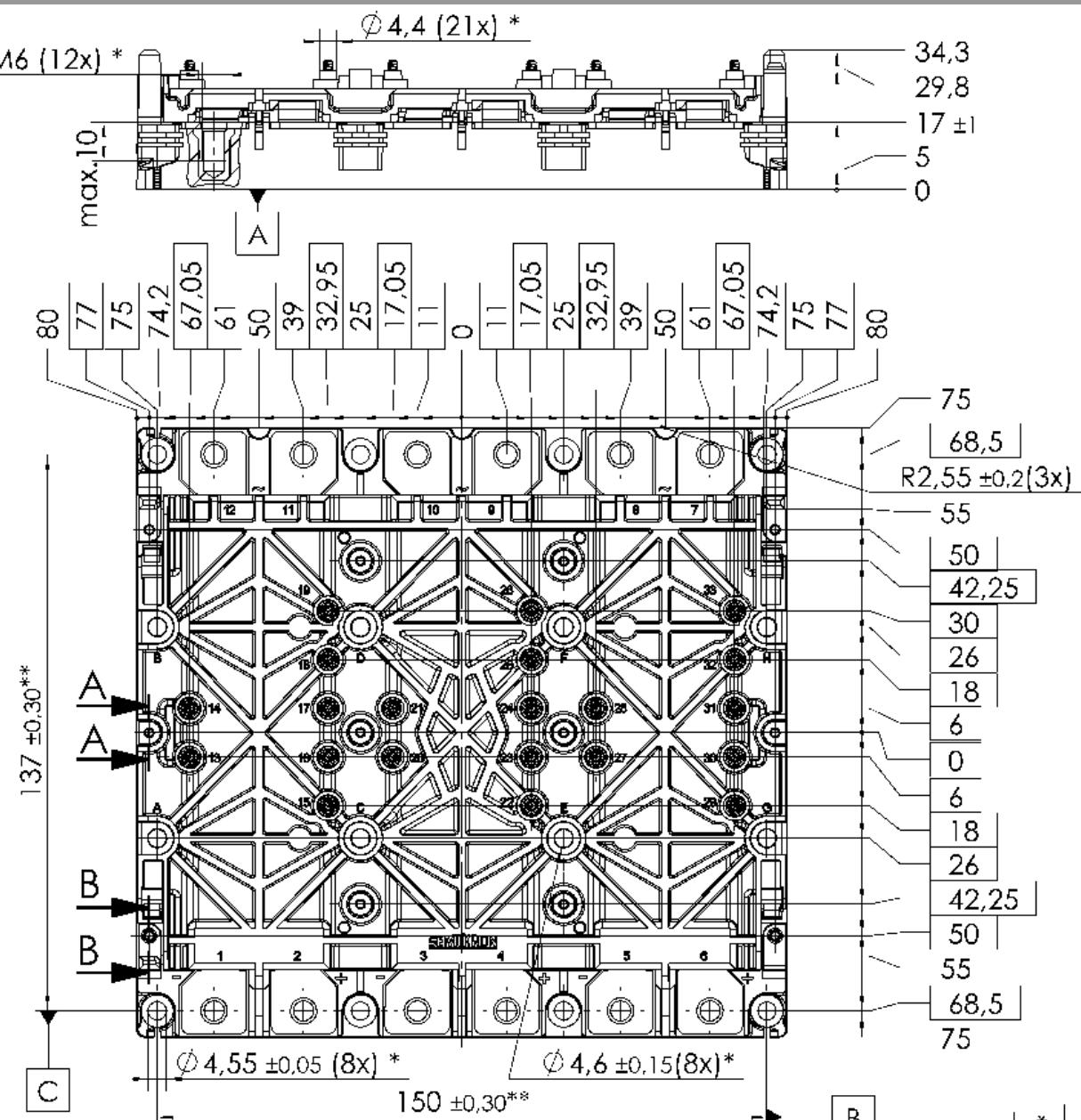


Fig. 12: Typ. CAL diode recovery charge

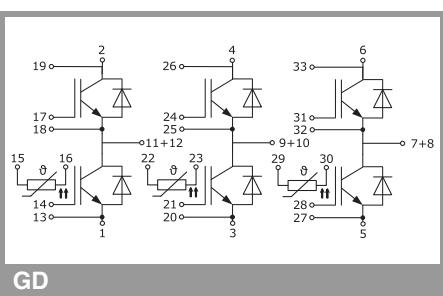


* all pos. dimensions
valid when mounted

$\odot \phi 0,9$ A B C

** valid for the outer 4 inserts

General Tolerances DIN ISO 2768-m
PCB spring landing pad = $\phi 3,5 \pm 0,2$



GD

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

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