

SKM300GB12F4



SEMITRANS® 3

High Speed IGBT4 Modules

SKM300GB12F4

Features*

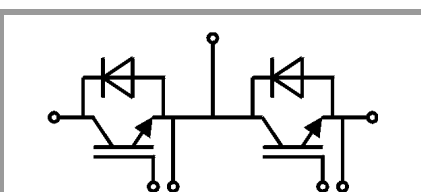
- High speed trench and field-stop IGBT
- CAL4 ultra-fast = soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- For higher switching frequencies above 15kHz
- UL recognized, file no. E63532

Typical Applications

- UPS
- Electronic welders
- Inductive heating
- Switched mode power supplies

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$



GB

| Absolute Maximum Ratings | | | | |
|--------------------------|--|---------------------------|------------------|---------------|
| Symbol | Conditions | Values | Unit | |
| IGBT | | | | |
| V_{CES} | $T_j = 25^\circ\text{C}$ | 1200 | V | |
| I_C | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 380 | A |
| | | $T_c = 80^\circ\text{C}$ | 289 | A |
| I_{Cnom} | | 300 | A | |
| I_{CRM} | $I_{CRM} = 2 \times I_{Cnom}$ | 600 | A | |
| V_{GES} | | -20 ... 20 | V | |
| t_{psc} | $V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$ $R_{G\ on/off} \geq 3\ \Omega$ | $T_j = 150^\circ\text{C}$ | 10 | μs |
| T_j | | -40 ... 175 | $^\circ\text{C}$ | |
| Inverse diode | | | | |
| V_{RRM} | $T_j = 25^\circ\text{C}$ | 1200 | V | |
| I_F | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 334 | A |
| | | $T_c = 80^\circ\text{C}$ | 245 | A |
| I_{Fnom} | | 300 | A | |
| I_{FRM} | $I_{FRM} = 2 \times I_{Fnom}$ | 600 | A | |
| I_{FSM} | $t_p = 10\text{ ms}$, $\sin 180^\circ$, $T_j = 25^\circ\text{C}$ | 1548 | A | |
| T_j | | -40 ... 175 | $^\circ\text{C}$ | |
| Module | | | | |
| $I_{t(RMS)}$ | | 500 | A | |
| T_{stg} | module without TIM | -40 ... 125 | $^\circ\text{C}$ | |
| V_{isol} | AC sinus 50 Hz, $t = 1\text{ min}$ | 4000 | V | |

| Characteristics | | | | | |
|-----------------|---|---------------------------|------|------|------------------|
| Symbol | Conditions | min. | typ. | max. | Unit |
| IGBT | | | | | |
| $V_{CE(sat)}$ | $I_C = 300\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | 2.06 | 2.42 | V |
| | | $T_j = 150^\circ\text{C}$ | 2.60 | 2.96 | V |
| V_{CE0} | chipelevel | $T_j = 25^\circ\text{C}$ | 1.10 | 1.28 | V |
| | | $T_j = 150^\circ\text{C}$ | 0.95 | 1.13 | V |
| r_{CE} | $V_{GE} = 15\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | 3.2 | 3.8 | $\text{m}\Omega$ |
| | | $T_j = 150^\circ\text{C}$ | 5.5 | 6.1 | $\text{m}\Omega$ |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}$, $I_C = 10.4\text{ mA}$ | 5.2 | 5.8 | 6.4 | V |
| I_{CES} | $V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_j = 25^\circ\text{C}$ | | | 4.0 | mA |
| C_{ies} | $V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$ | $f = 1\text{ MHz}$ | 17.6 | | nF |
| C_{oes} | | $f = 1\text{ MHz}$ | 1.16 | | nF |
| C_{res} | | $f = 1\text{ MHz}$ | 0.94 | | nF |
| Q_G | $V_{GE} = -8\text{ V} \dots +15\text{ V}$ | | 1700 | | nC |
| R_{Gint} | $T_j = 25^\circ\text{C}$ | | 1.9 | | Ω |
| $t_{d(on)}$ | $V_{CC} = 600\text{ V}$ $I_C = 300\text{ A}$ | $T_j = 150^\circ\text{C}$ | 100 | | ns |
| t_r | $V_{GE} = +15/-15\text{ V}$ | $T_j = 150^\circ\text{C}$ | 45 | | ns |
| E_{on} | $R_{G\ on} = 2\ \Omega$ | $T_j = 150^\circ\text{C}$ | 16.5 | | mJ |
| $t_{d(off)}$ | $R_{G\ off} = 2\ \Omega$ | $T_j = 150^\circ\text{C}$ | 390 | | ns |
| t_f | $di/dt_{on} = 6600\text{ A}/\mu\text{s}$ $di/dt_{off} = 3600\text{ A}/\mu\text{s}$ | $T_j = 150^\circ\text{C}$ | 73 | | ns |
| E_{off} | $dv/dt = 4700\text{ V}/\mu\text{s}$ | $T_j = 150^\circ\text{C}$ | 24 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | 0.11 | K/W |
| $R_{th(c-s)}$ | per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$) | | 0.05 | | K/W |



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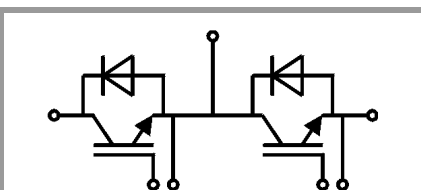
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| Characteristics | | | min. | typ. | max. | Unit |
|----------------------|---|---------------------------|------|--------|------|---------------|
| Symbol | Conditions | | | | | |
| Inverse diode | | | | | | |
| $V_F = V_{EC}$ | $I_F = 300\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 2.43 | 2.80 | V |
| | | $T_j = 150^\circ\text{C}$ | | 2.30 | 2.65 | V |
| V_{F0} | chipelevel | $T_j = 25^\circ\text{C}$ | | 1.51 | 1.75 | V |
| | | $T_j = 150^\circ\text{C}$ | | 1.16 | 1.40 | V |
| r_F | chipelevel | $T_j = 25^\circ\text{C}$ | | 3.1 | 3.5 | m Ω |
| | | $T_j = 150^\circ\text{C}$ | | 3.8 | 4.2 | m Ω |
| I_{RRM} | $I_F = 300\text{ A}$ | $T_j = 150^\circ\text{C}$ | | 375 | | A |
| Q_{rr} | $di/dt_{off} = 6600\text{ A}/\mu\text{s}$ | $T_j = 150^\circ\text{C}$ | | 42 | | μC |
| E_{rr} | $V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$ | $T_j = 150^\circ\text{C}$ | | 16 | | mJ |
| $R_{th(j-c)}$ | per diode | | | | 0.17 | K/W |
| $R_{th(c-s)}$ | per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$) | | | 0.051 | | K/W |
| Module | | | | | | |
| L_{CE} | | | | 15 | | nH |
| R_{CC+EE} | measured per switch | $T_c = 25^\circ\text{C}$ | | 0.55 | | m Ω |
| | | $T_c = 125^\circ\text{C}$ | | 0.85 | | m Ω |
| $R_{th(c-s)1}$ | calculated without thermal coupling | | | 0.0126 | | K/W |
| $R_{th(c-s)2}$ | including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$) | | | 0.020 | | K/W |
| M_s | to heat sink M6 | | 3 | | 5 | Nm |
| M_t | | | 2.5 | | 5 | Nm |
| | to terminals M6 | | | | | |
| | | | | - | | Nm |
| w | | | | | 325 | g |



GB

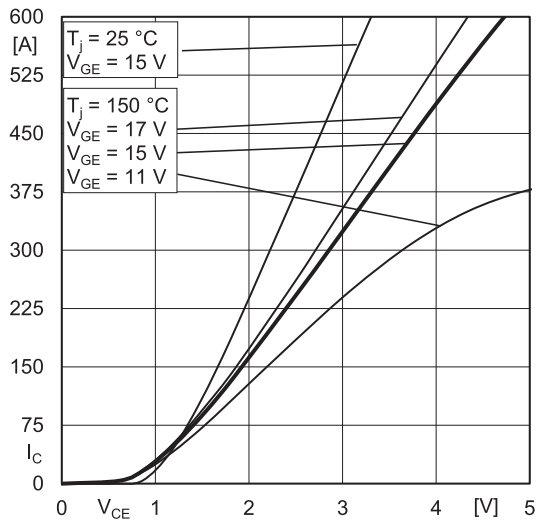


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

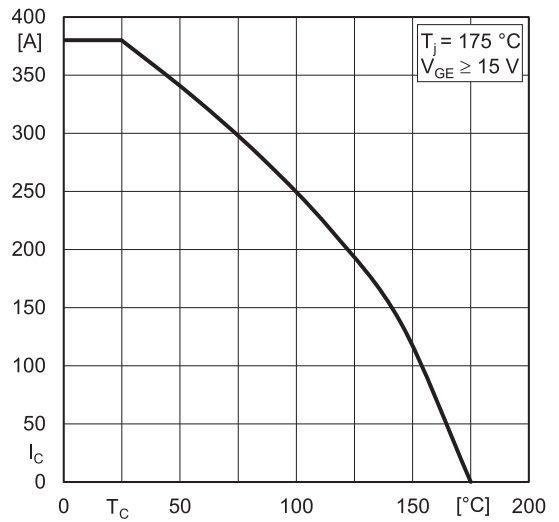


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

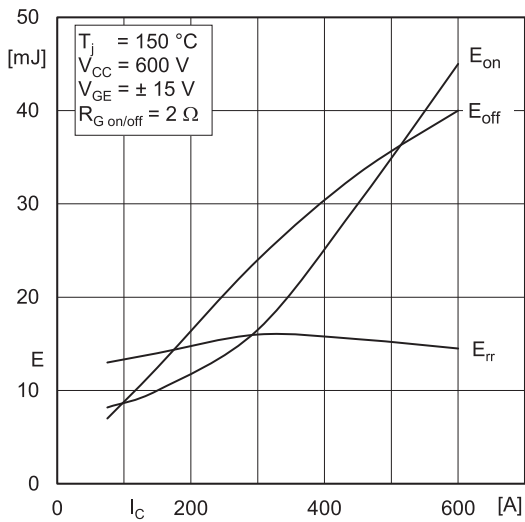


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

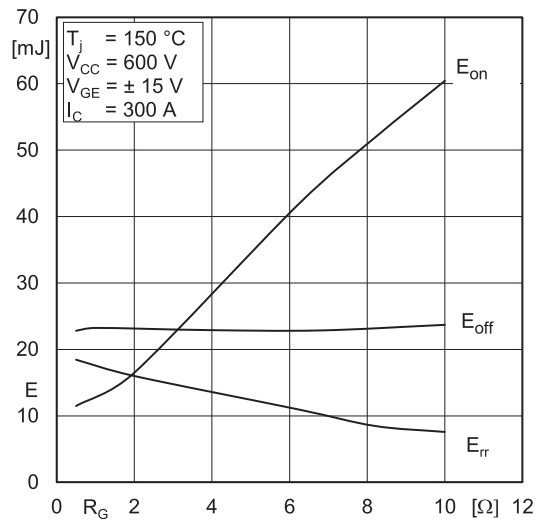


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

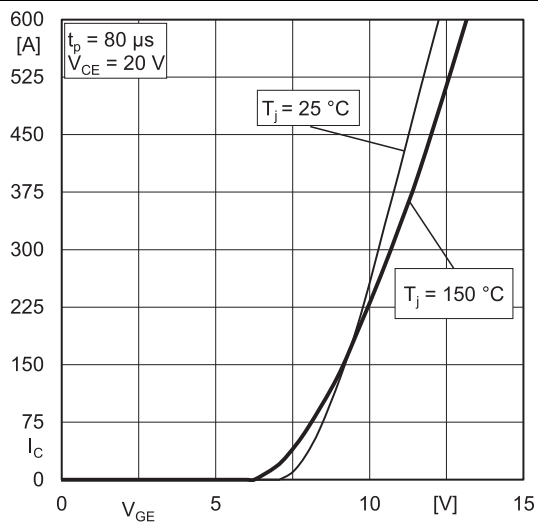


Fig. 5: Typ. transfer characteristic

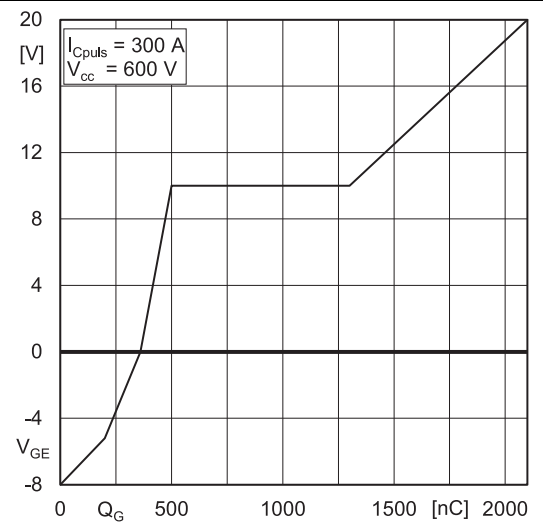


Fig. 6: Typ. gate charge characteristic

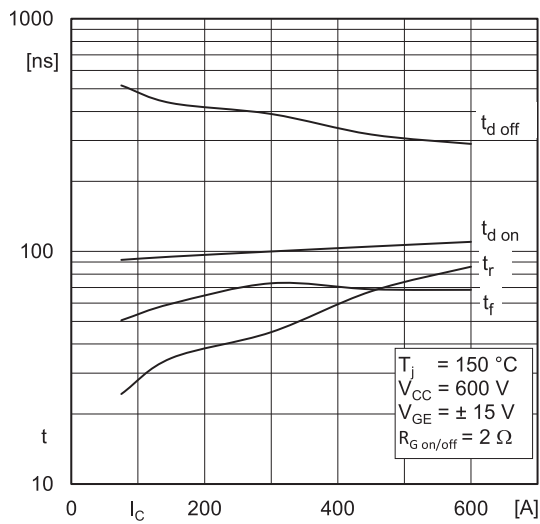


Fig. 7: Typ. switching times vs. I_C

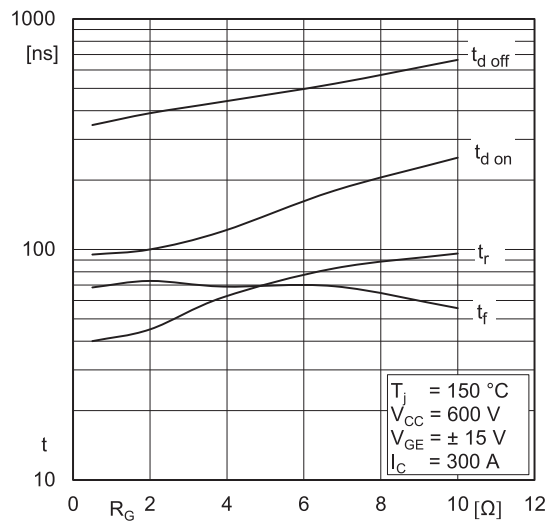


Fig. 8: Typ. switching times vs. gate resistor R_G

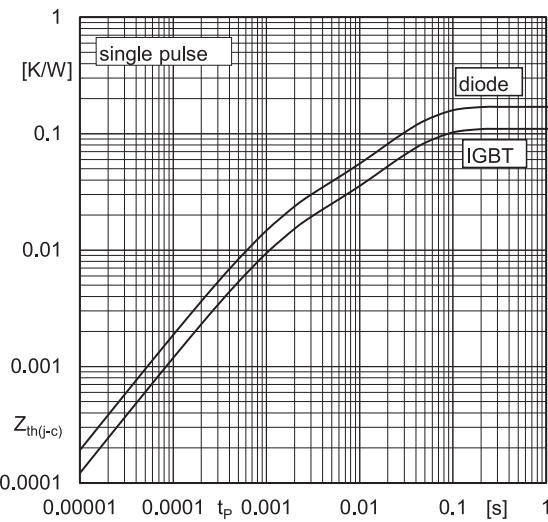


Fig. 9: Transient thermal impedance

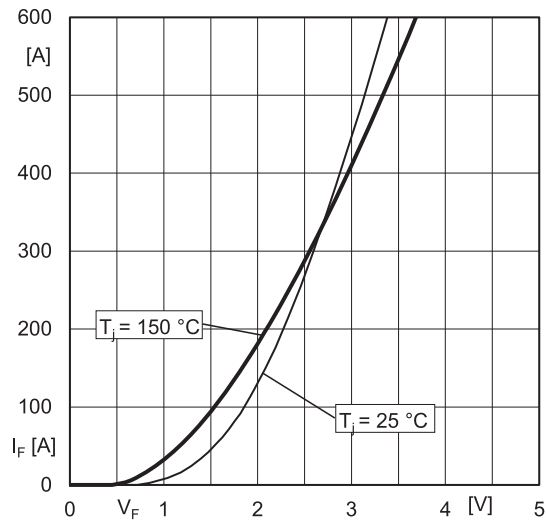


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

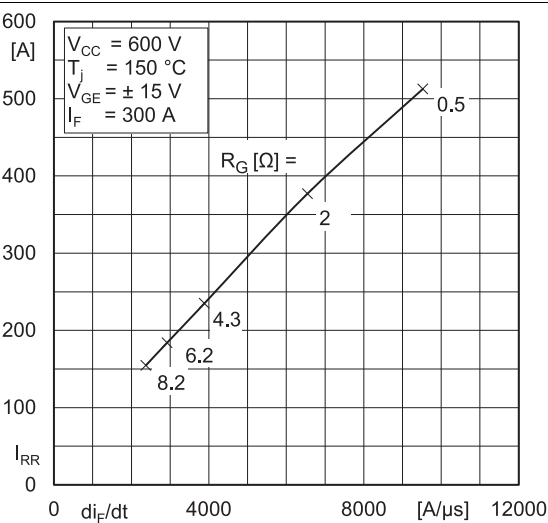


Fig. 11: Typ. CAL diode peak reverse recovery current

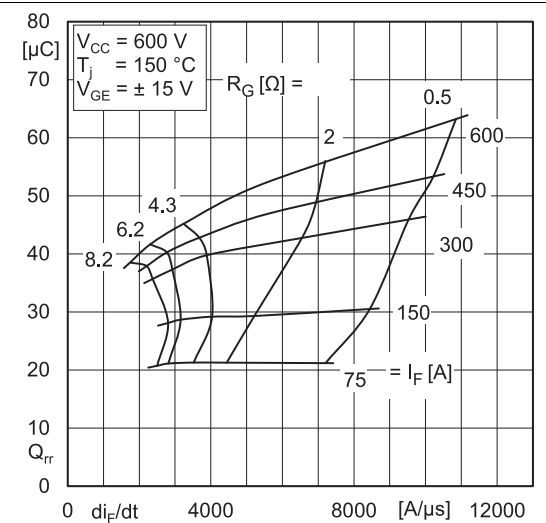


Fig. 12: Typ. CAL diode peak reverse recovery charge

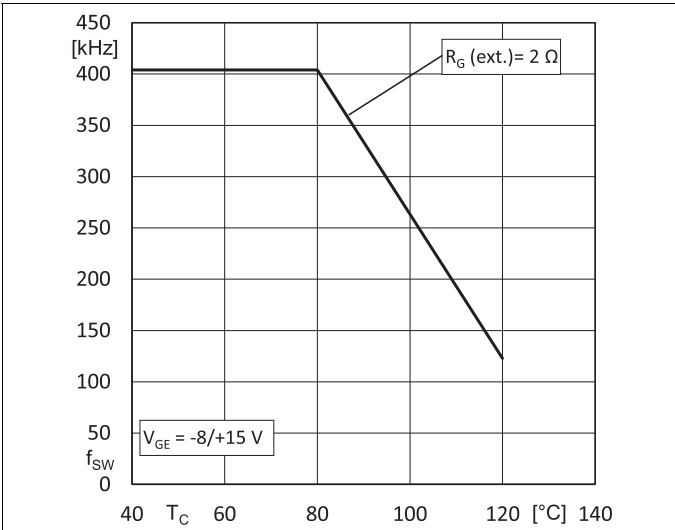
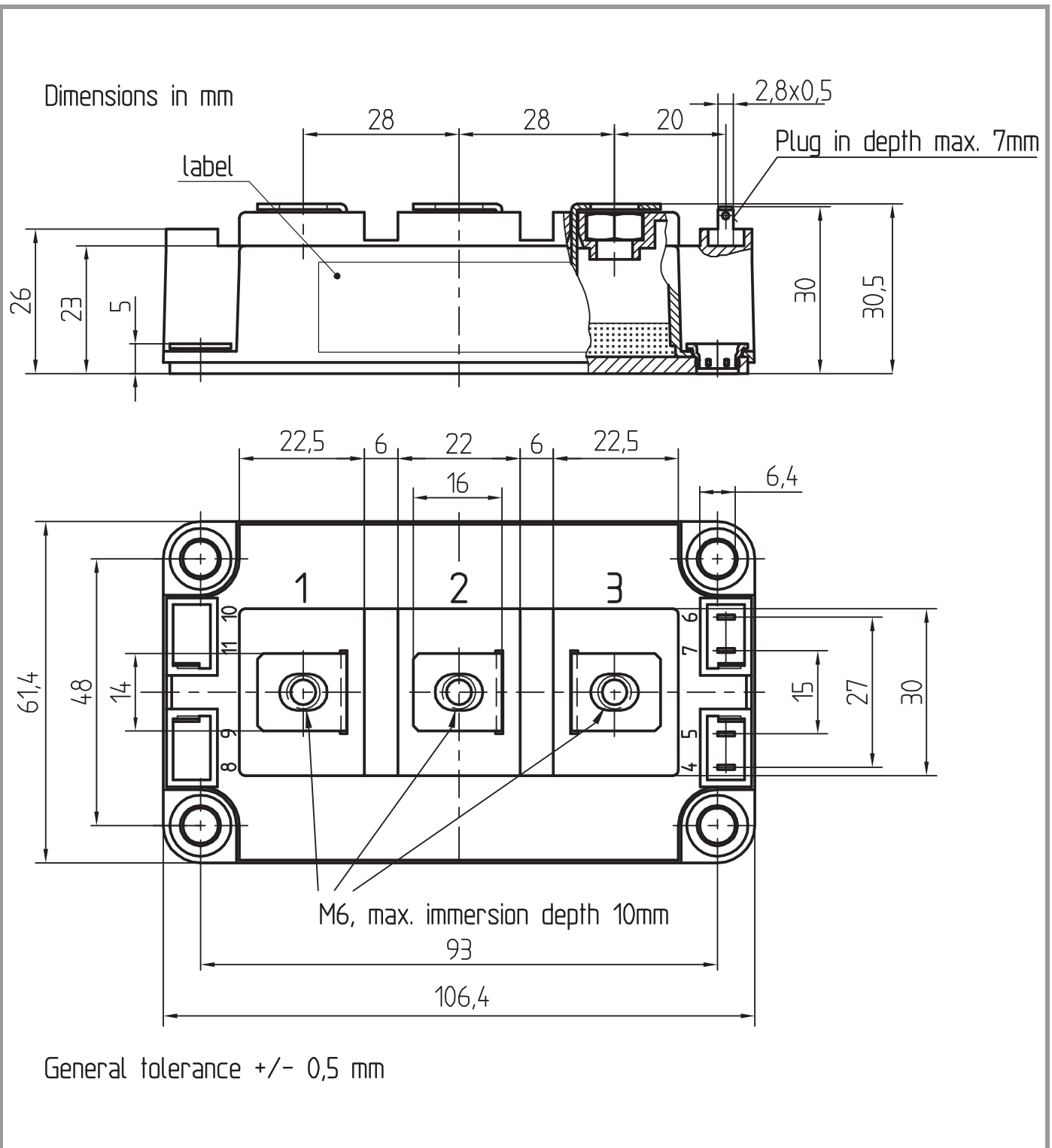
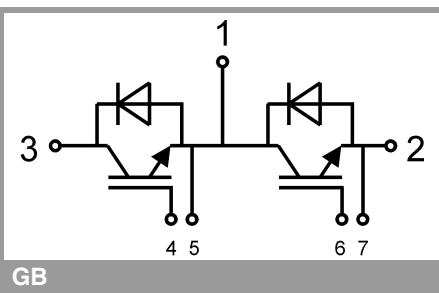


Fig. 13: Max. switching frequency vs. case temperature
 $f_{sw} = f(T_c)$

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

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