## SEMITRANS® 3

Trench IGBT Modules

**SKM600GB07E3**

Target Data

### Features

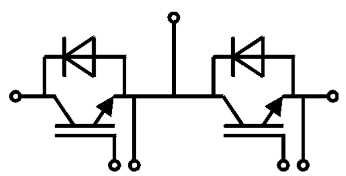
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x Icnom
- Fast & soft inverse CAL diodes
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated gate resistor

### Typical Applications*

- AC inverter drives
- UPS

### Remarks

- Case temperature limited to $T_c$ = 125°C max.
- Recommended $T_{op}$ = -40 ... +150°C
- Product reliability results valid for $T_j$ = 150°C
- Use of soft $R_G$ necessary



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| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 650 | V |
| $I_C$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 758 | A |
| | | $T_c$ = 80 °C | 571 | A |
| $I_{Cnom}$ | | | 600 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3x$I_{Cnom}$ | | 1800 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 360 V<br>$V_{GE}$ ≤ 15 V<br>$V_{CES}$ ≤ 650 V | $T_j$ = 150 °C | 6 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 650 | V |
| $I_F$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 770 | A |
| | | $T_c$ = 80 °C | 562 | A |
| $I_{Fnom}$ | | | 600 | A |
| $I_{FRM}$ | $I_{FRM}$ = 2x$I_{Fnom}$ | | 1200 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 25 °C | | 4320 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | | | 500 | A |
| $T_{stg}$ | module without TIM | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50 Hz, t = 1 min | | 4000 | V |

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 600 A<br>$V_{GE}$ = 15 V<br>chiplevel | $T_j$ = 25 °C | | 1.45 | 1.90 | V |
| | | $T_j$ = 150 °C | | 1.70 | 2.10 | V |
| $V_{CE0}$ | chiplevel | $T_j$ = 25 °C | | 0.90 | 1.00 | V |
| | | $T_j$ = 150 °C | | 0.82 | 0.90 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V<br>chiplevel | $T_j$ = 25 °C | | 0.92 | 1.50 | mΩ |
| | | $T_j$ = 150 °C | | 1.47 | 2.00 | mΩ |
| $V_{GE(th)}$ | $V_{GE}$=$V_{CE}$, $I_C$ = 9.6 mA | | 5.1 | 5.8 | 6.4 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V, $T_j$ = 25 °C | | | | 0.5 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V<br>$V_{GE}$ = 0 V | f = 1 MHz | | 37.0 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 2.32 | | nF |
| $C_{res}$ | | f = 1 MHz | | 1.10 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 4800 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 0.5 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 300 V<br>$I_C$ = 600 A<br>$V_{GE}$ = +15/-15 V | $T_j$ = 150 °C | | 215 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 78 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 4.7 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 1110 | | ns |
| $t_f$ | di/dt$_{on}$ = 7620 A/µs<br>di/dt$_{off}$ = 660 A/µs<br>du/dt = 1330 V/µs | $T_j$ = 150 °C | | 100 | | ns |
| $E_{off}$ | | $T_j$ = 150 °C | | 37 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0.08 | K/W |
| $R_{th(c-s)}$ | per IGBT ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.033 | | K/W |
| $R_{th(c-s)}$ | per IGBT, pre-applied phase change material | | | 0.021 | | K/W |


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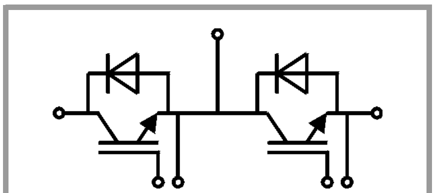

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| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverse diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 600 A<br>$V_{GE}$ = 0 V<br>chiplevel | $T_j$ = 25 °C | | 1.40 | 1.76 | V |
| | | $T_j$ = 150 °C | | 1.39 | 1.77 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 1.04 | 1.24 | V |
| | | $T_j$ = 150 °C | | 0.85 | 0.99 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 0.60 | 0.88 | mΩ |
| | | $T_j$ = 150 °C | | 0.89 | 1.31 | mΩ |
| $I_{RRM}$ | $I_F$ = 600 A<br>$di/dt_{off}$ = 4940 A/µs<br>$V_{GE}$ = ±15 V<br>$V_{CC}$ = 300 V | $T_j$ = 150 °C | | 390 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 54 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 9.3 | | mJ |
| $R_{th(j-c)}$ | per diode | | | | 0.104 | K/W |
| $R_{th(c-s)}$ | per diode ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.038 | | K/W |
| $R_{th(c-s)}$ | per diode, pre-applied phase change material | | | 0.028 | | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 15 | | nH |
| $R_{CC'+EE'}$ | measured per switch | $T_C$ = 25 °C | | 0.55 | | mΩ |
| | | $T_C$ = 125 °C | | 0.85 | | mΩ |
| $Rth_{(c-s)1}$ | calculated without thermal coupling | | | 0.009 | | K/W |
| $Rth_{(c-s)2}$ | including thermal coupling, Ts underneath module ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.014 | | K/W |
| $Rth_{(c-s)2}$ | including thermal coupling, Ts underneath module, pre-applied phase change material | | | 0.01 | | K/W |
| $M_s$ | to heat sink M6 | | 3 | | 5 | Nm |
| $M_t$ | | to terminals M6 | 2.5 | | 5 | Nm |
| | | | | | | Nm |
| w | | | | | 325 | g |

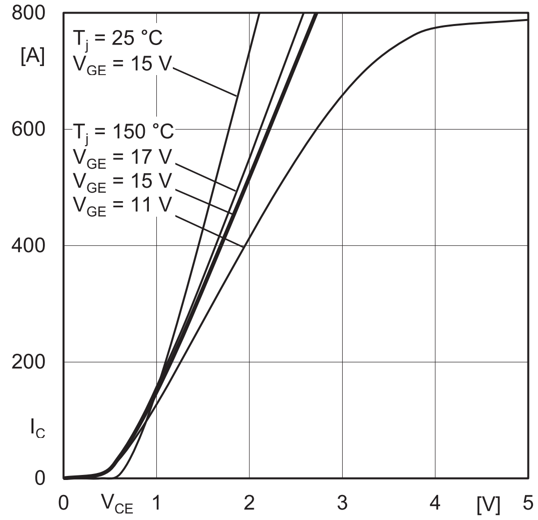



Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

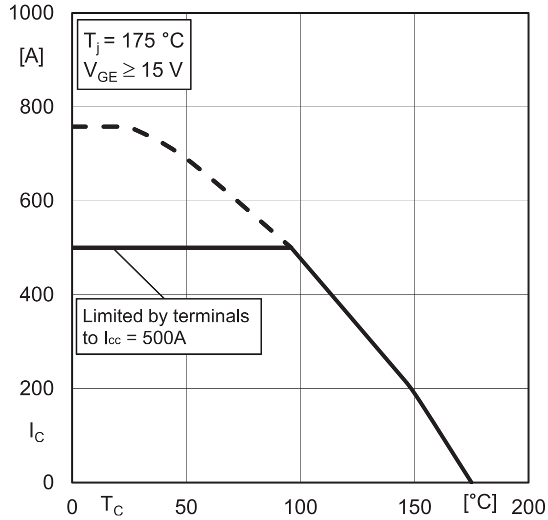



Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

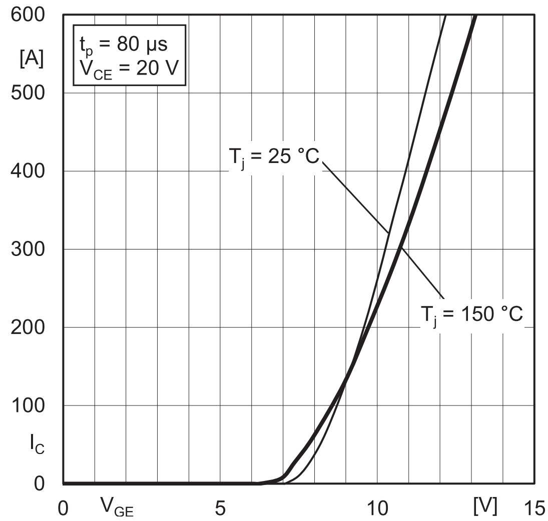



Fig. 5: Typ. transfer characteristic

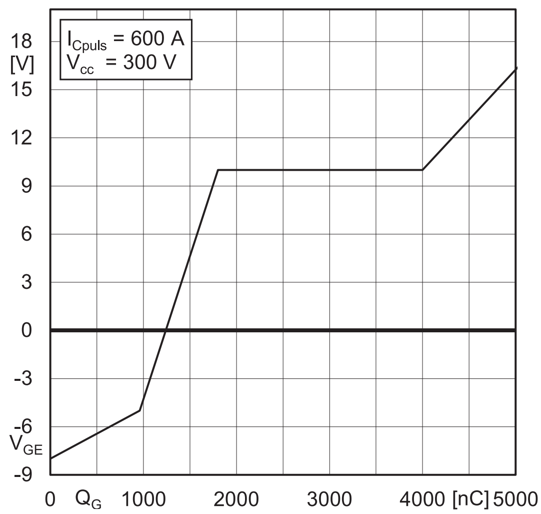



Fig. 6: Typ. gate charge characteristic

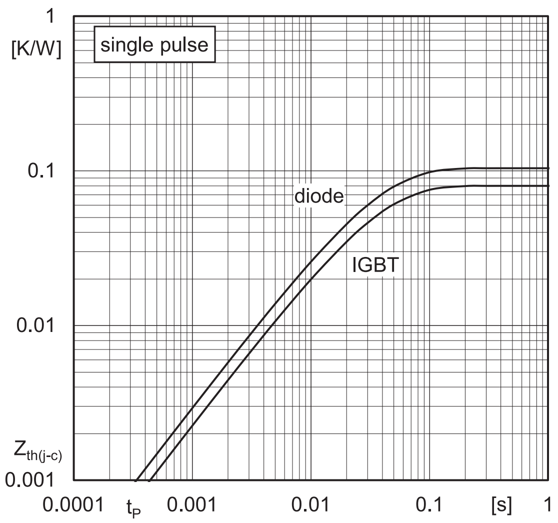



Fig. 9: Transient thermal impedance

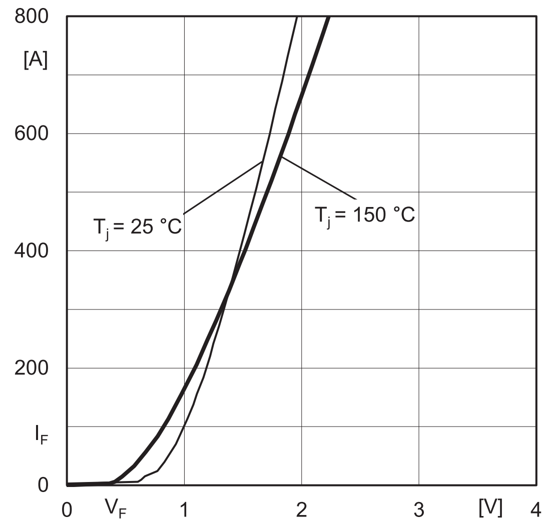



Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

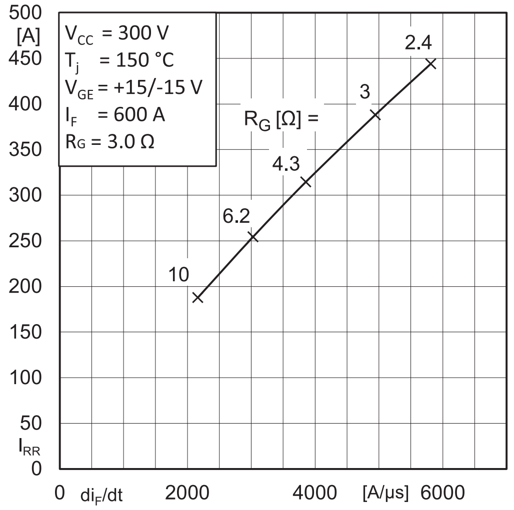



Fig. 11: CAL diode peak reverse recovery current

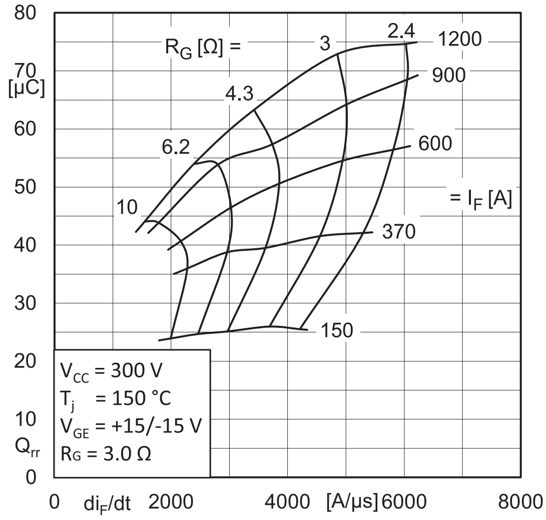
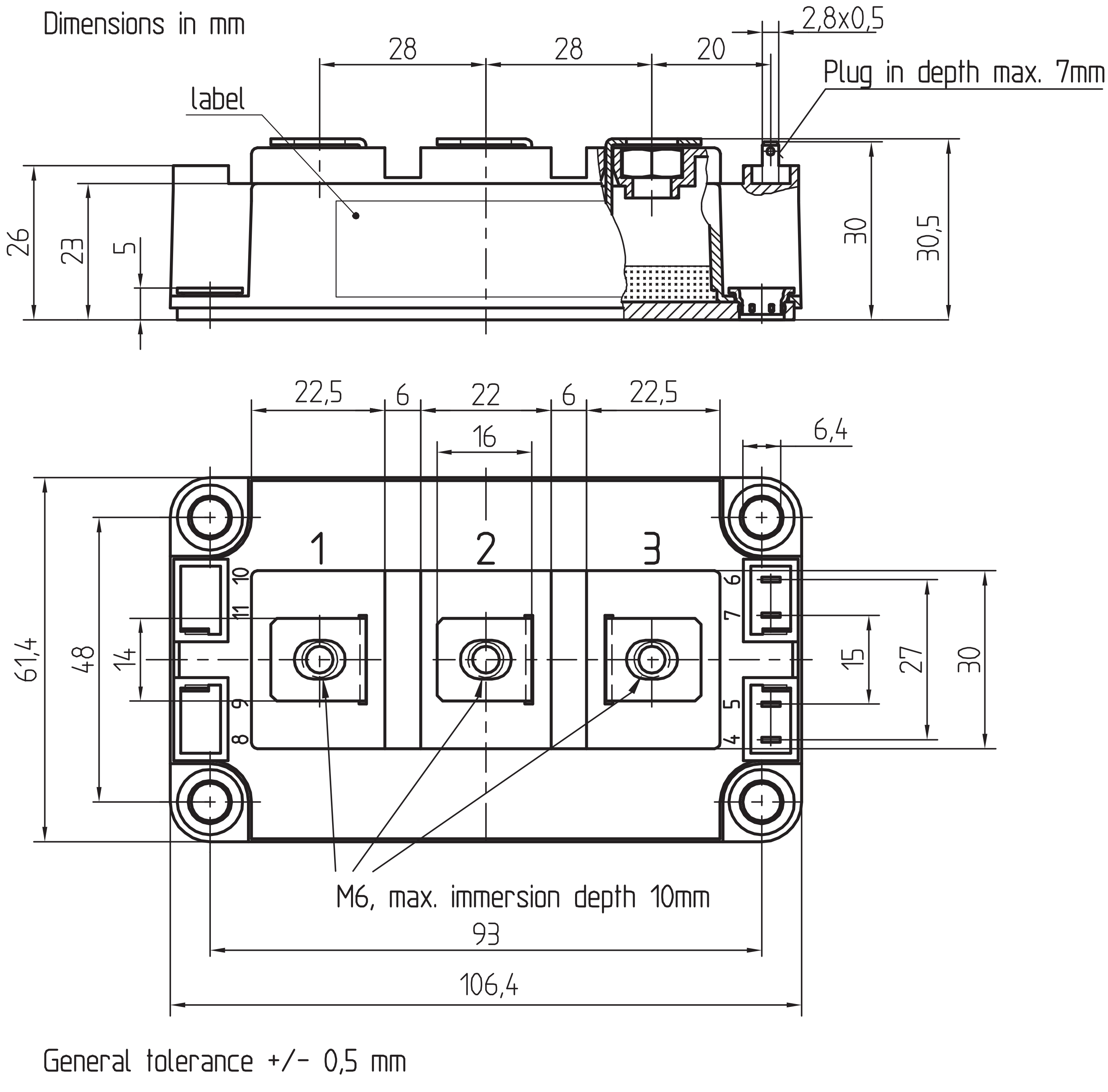



Fig. 12: Typ. CAL diode peak reverse recovery charge

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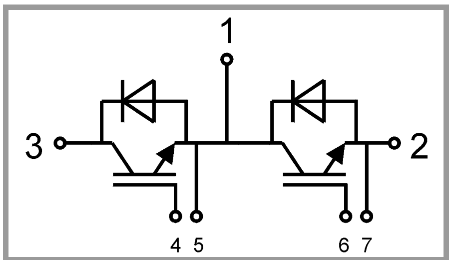


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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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