# SKM350MB120SCH17

**SEMITRANS® 3**

## SiC MOSFET Module

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### Features*

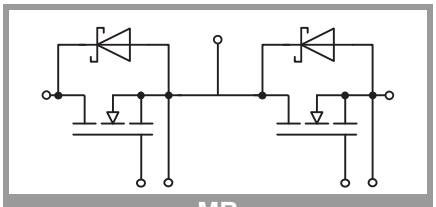
- Full Silicon Carbide (SiC) power module
- High reliability 2nd Generation SiC MOSFETs
- Optimized for fast switching and lowest power losses
- High humidity robustness (HV-H3TRB proof)
- External SiC Schottky Barrier Diode embedded
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Improved thermal performances with Aluminium Nitride (AlN) substrate
- UL recognized, file no. E63532

### Typical Applications

- High frequency power supplies
- AC inverters
- Traction APU
- EV Chargers
- Industrial Test Systems

### Remarks

- Case temperature limited to $T_C$ = 125°C max.
- Recommended $T_{jop}$ = -40 ... +150°C
- Gate-Source SURGE VOLTAGE ($t_{surge}$<300ns), $V_{GS\_surge}$ = -10V ... +26V



**MB**

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **MOSFET** | | | | |
| $V_{DSS}$ | | | 1200 | V |
| $I_D$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 478 | A |
| | | $T_c$ = 80 °C | 380 | A |
| $I_{DM}$ | | | 1280 | A |
| $I_{DRM}$ | | | 904 | A |
| $V_{GS}$ | | | -6 ... 22 | V |
| $T_j$ | | | -40 ... 175 | °C |
| **Integrated body diode** | | | | |
| $I_{FM}$ | | | 1280 | A |
| $I_{FRM}$ | | | 904 | A |

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **Inverse diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_F$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 187 | A |
| | | $T_c$ = 80 °C | 143 | A |
| $I_{Fnom}$ | | | 100 | A |
| $I_{FRM}$ | | | 300 | A |
| $I_{FSM}$ | $t_p$ = 8.3 ms, sin 180°, $T_j$ = 25 °C | | 373 | A |
| $T_j$ | | | -40 ... 175 | °C |

| Absolute Maximum Ratings | | | |
|---|---|---|---|
| **Symbol** | **Conditions** | **Values** | **Unit** |
| **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 |

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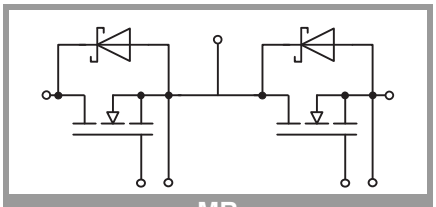

**MB**

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **MOSFET** | | | | | | |
| $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA, $T_j$ = 25 °C | | 1200 | | | V |
| $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 71.2 mA | | 1.6 | | 4 | V |
| $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 1200 V, $T_j$ = 25 °C | | | | 2 | mA |
| $I_{GSS}$ | $V_{GS}$ = 22 V, $V_{DS}$ = 0 V | | | | 800 | nA |
| $R_{DS(on)}$ | $V_{GS}$ = 18 V<br>$I_D$ = 176 A<br>chiplevel | $T_j$ = 25 °C | | 5.6 | 7.0 | mΩ |
| | | $T_j$ = 150 °C | | 9.5 | | mΩ |
| $C_{iss}$ | $V_{GS}$ = 0 V<br>$V_{DS}$ = 800 V<br>f = 1 MHz | $T_j$ = 25 °C | | 34.5 | | nF |
| $C_{oss}$ | | $T_j$ = 25 °C | | 1.10 | | nF |
| $C_{rss}$ | | $T_j$ = 25 °C | | 0.15 | | nF |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 0.6 | | Ω |
| $Q_G$ | $V_{DD}$=600V, $V_{GS}$=-5 ... 20V, $I_D$ = 350 A | | | 1850 | | nC |
| $t_{d(on)}$ | $V_{DD}$ = 600 V<br>$I_D$ = 175 A<br>$V_{GS}$ = -5 ... 20 V<br>$R_{Gon}$ = 0.5 Ω<br>$R_{Goff}$ = 0.5 Ω<br>di/$dt_{on}$ = 13.5 kA/µs<br>di/$dt_{off}$ = 7.1 kA/µs<br>dv/$dt_{on}$ = 10.5 kV/µs<br>dv/$dt_{off}$ = 28 kV/µs | $T_j$ = 150 °C | | 64 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 10 | | ns |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 183 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 33 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 1.69 | | mJ |
| $E_{off}$ | | $T_j$ = 150 °C | | 1.31 | | mJ |
| $R_{th(j-c)}$ | per MOSFET | | | | 0.055 | K/W |
| $R_{th(c-s)}$ | per MOSFET ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.03 | | K/W |

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Inverse diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 100 A | $T_j$ = 25 °C | | 1.40 | 1.60 | V |
| | chiplevel | $T_j$ = 150 °C | | 1.80 | 2.10 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 0.95 | 1.05 | V |
| | | $T_j$ = 150 °C | | 0.80 | 0.90 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 4.5 | 5.5 | mΩ |
| | | $T_j$ = 150 °C | | 10.0 | 12 | mΩ |
| $C_j$ | parallel to $C_{oss}$, f = 1 MHz, $V_R$ = 800 V, $T_j$ = 25 °C | | | 0.42 | | nF |
| $Q_c$ | $V_R$ = 800 V, di/$dt_{off}$ = 500 A/µs, $T_j$ = 25 °C | | | 0.33 | | µC |
| $R_{th(j-c)}$ | per diode | | | | 0.24 | K/W |
| $R_{th(c-s)}$ | per diode ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.076 | | K/W |

 

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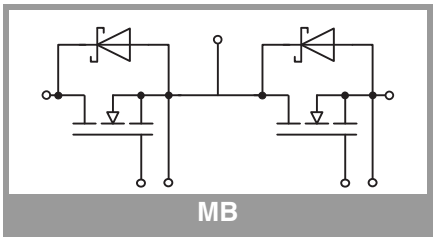


**MB**

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Module** | | | | | | |
| $L_{DS}$ | | | | 15 | | nH |
| $R_{DD'+SS'}$ | measured per switch | $T_C$ = 25 °C | | 0.55 | | mΩ |
| | | $T_C$ = 125 °C | | 0.85 | | mΩ |
| $R_{th(c-s)1}$ | calculated without thermal coupling ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.011 | | K/W |
| $R_{th(c-s)2}$ | including thermal coupling, $T_s$ underneath module ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.015 | | K/W |
| $M_s$ | to heat sink M6 | | 3 | | 5 | Nm |
| $M_t$ | | to terminals M6 | 2.5 | | 5 | Nm |
| | | | | | | Nm |
| w | | | | | 325 | g |

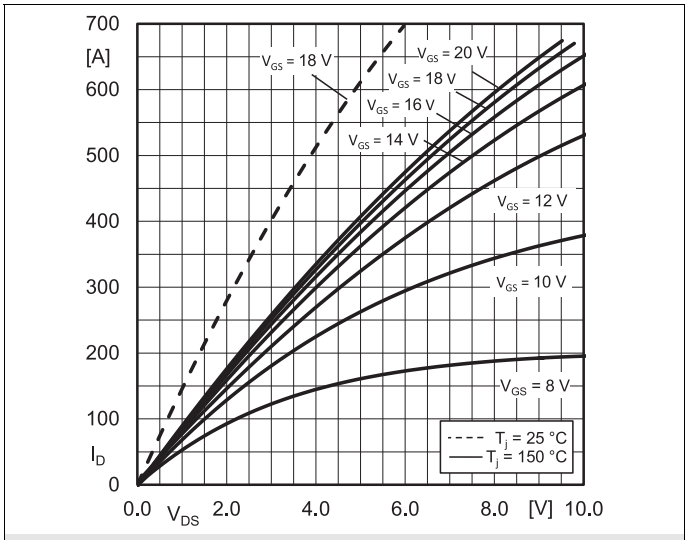



Fig.1: Typ. MOSFET forward output characteristic, incl. $R_{DD'+SS'}$

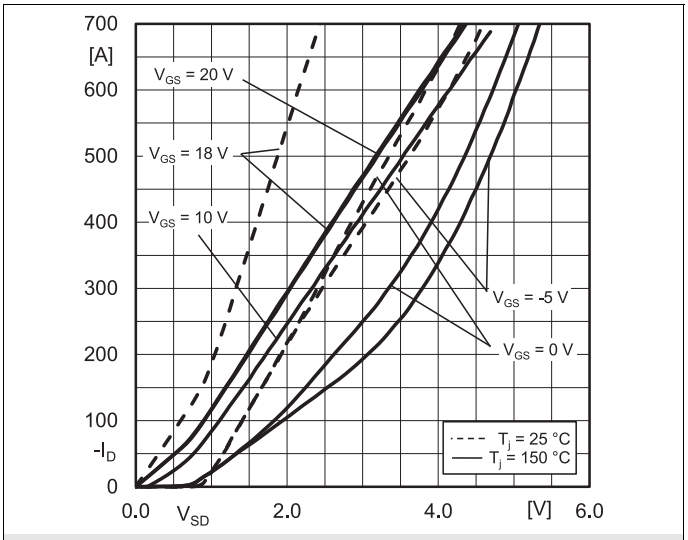



Fig. 2: Typ. reverse output characteristic, incl. $R_{DD'+SS'}$

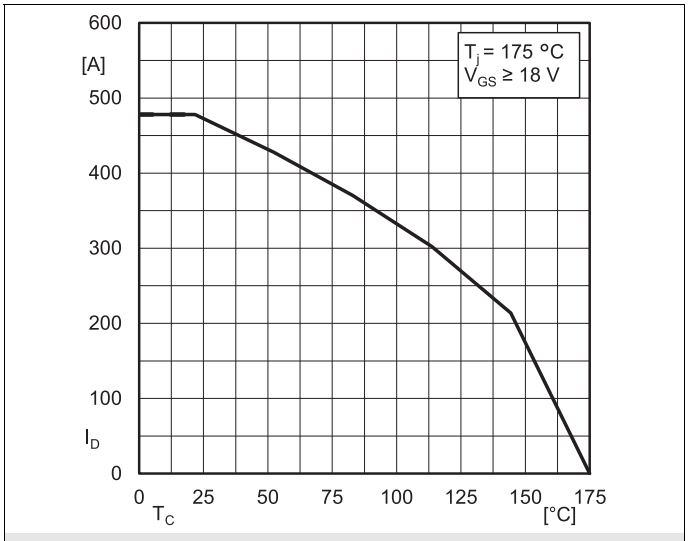



Fig. 3: Rated current vs. temperature $I_D = f(T_C)$

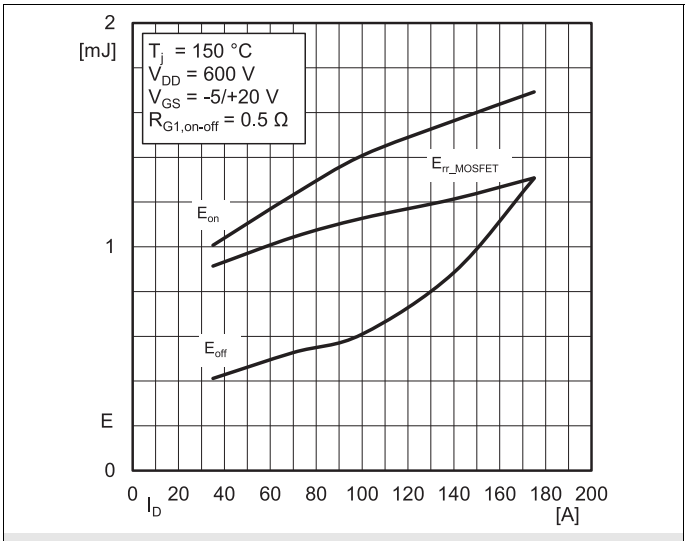



Fig. 4: Typ. switching energy $E = f(I_D)$ at $R_{G1}$

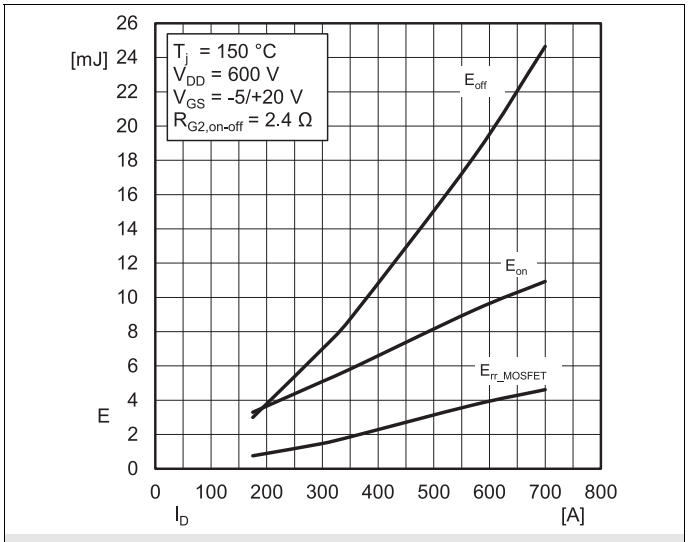



Fig. 5: Typ. switching energy $E = f(I_D)$ at $R_{G2}$

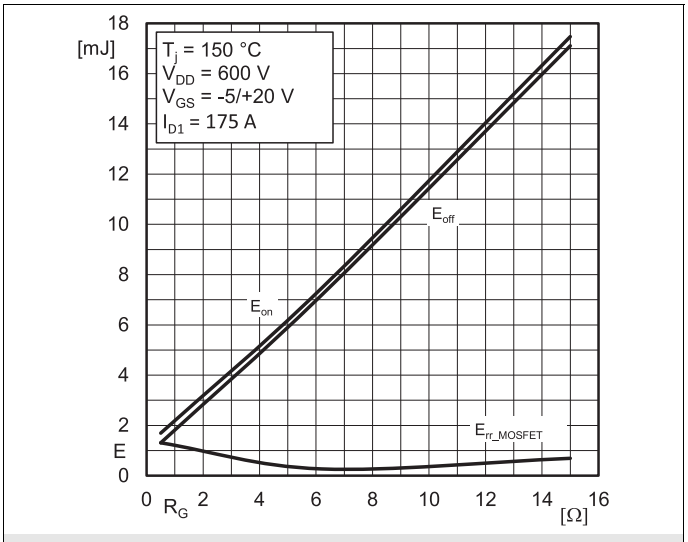



Fig. 6: Typ. switching energy $E = f(R_G)$ at $I_{D1}$

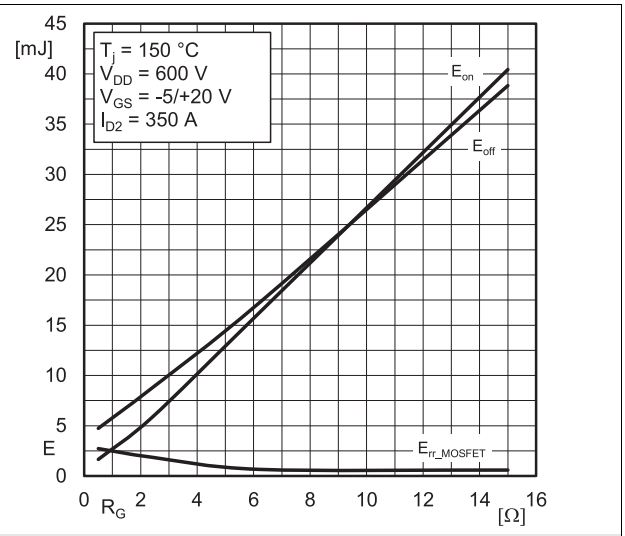



Fig. 7: Typ. switching energy E = f ($R_G$) at $I_{D2}$

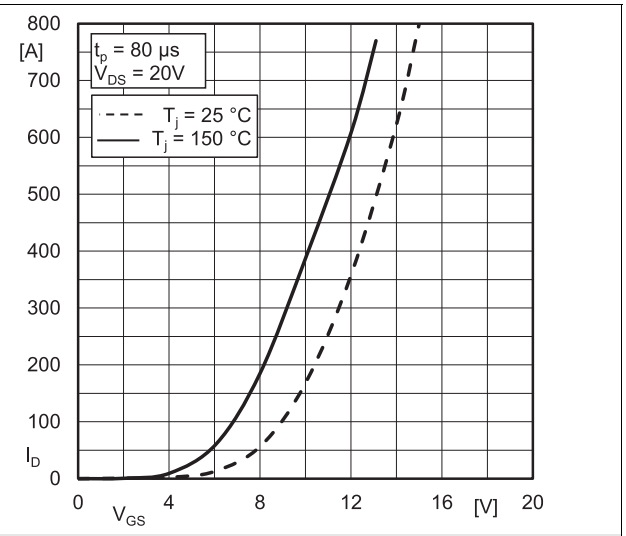



Fig. 8: Typ. MOSFET transfer characteristic

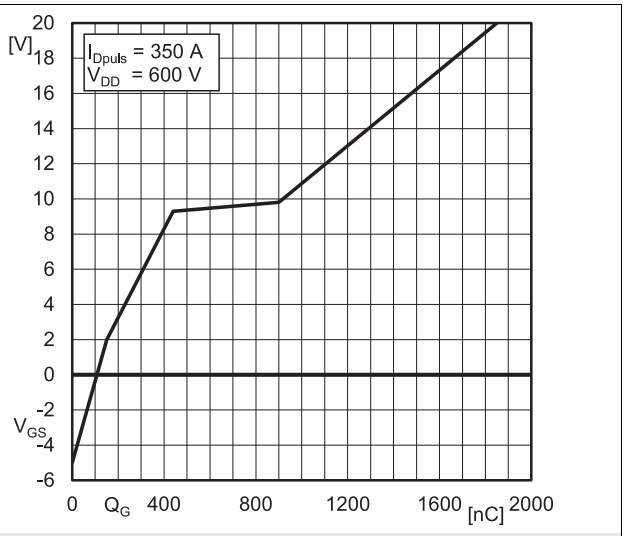



Fig. 9: Typ. gate charge characteristic

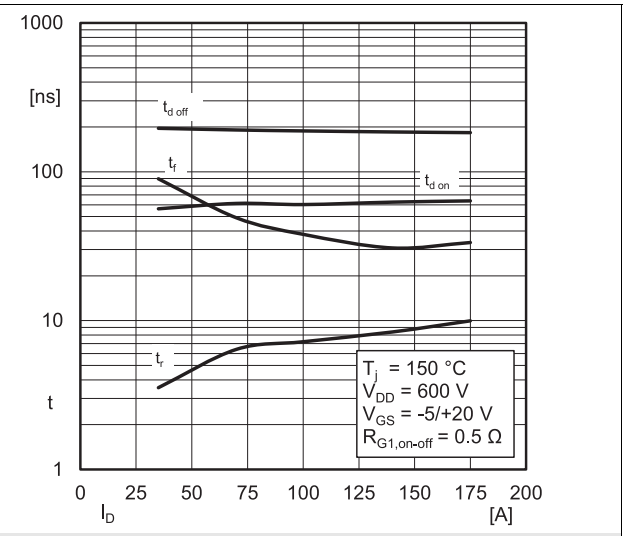



Fig. 10:Typ. switching times t = f ($I_D$) at $R_{G1}$

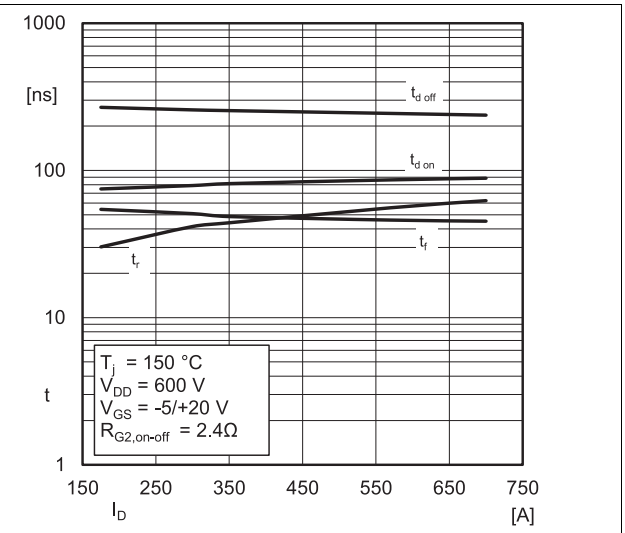



Fig. 11: Typ. switching times t = f ($I_D$) at $R_{G2}$

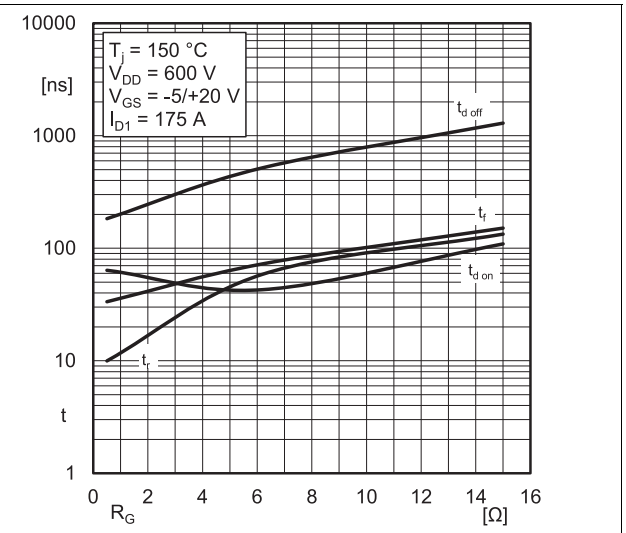



Fig. 12: Typ. switching times t = f ($R_G$) at $I_{D1}$

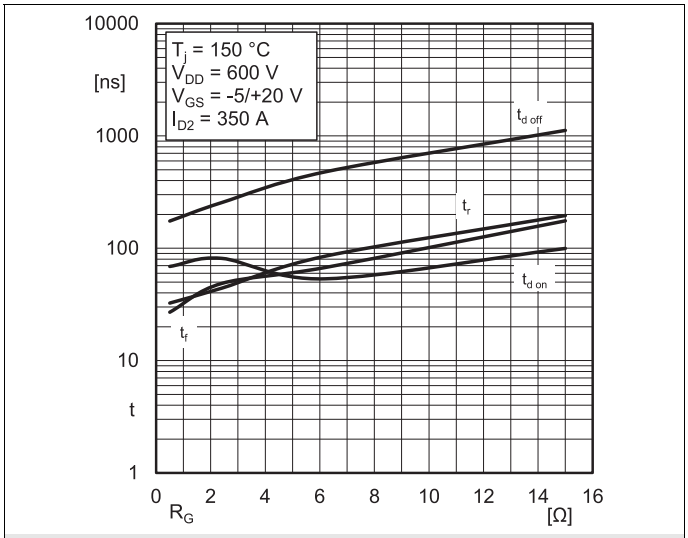



Fig. 13: Typ. switching times t = f ($R_G$) at $I_{D2}$

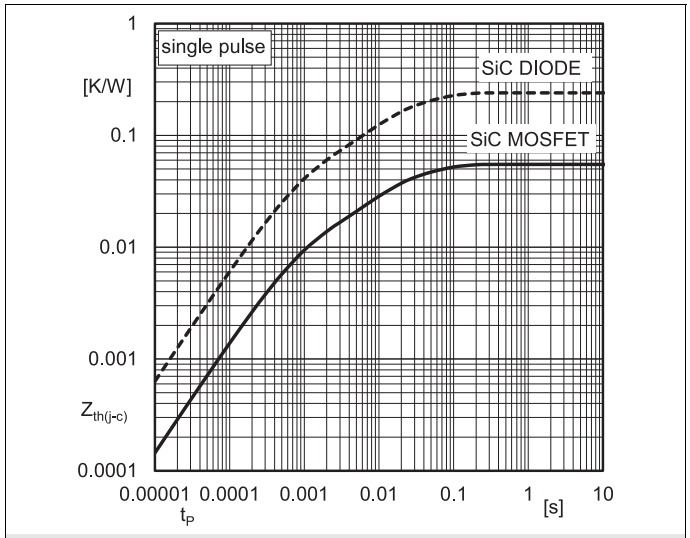



Fig. 14: Transient thermal impedance

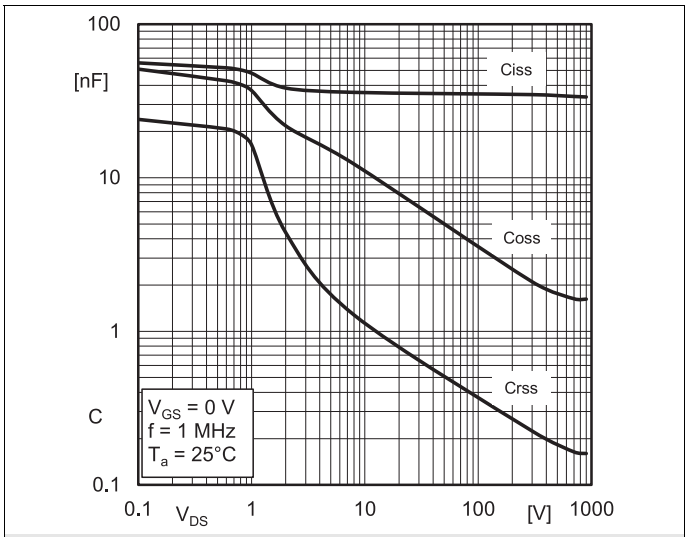
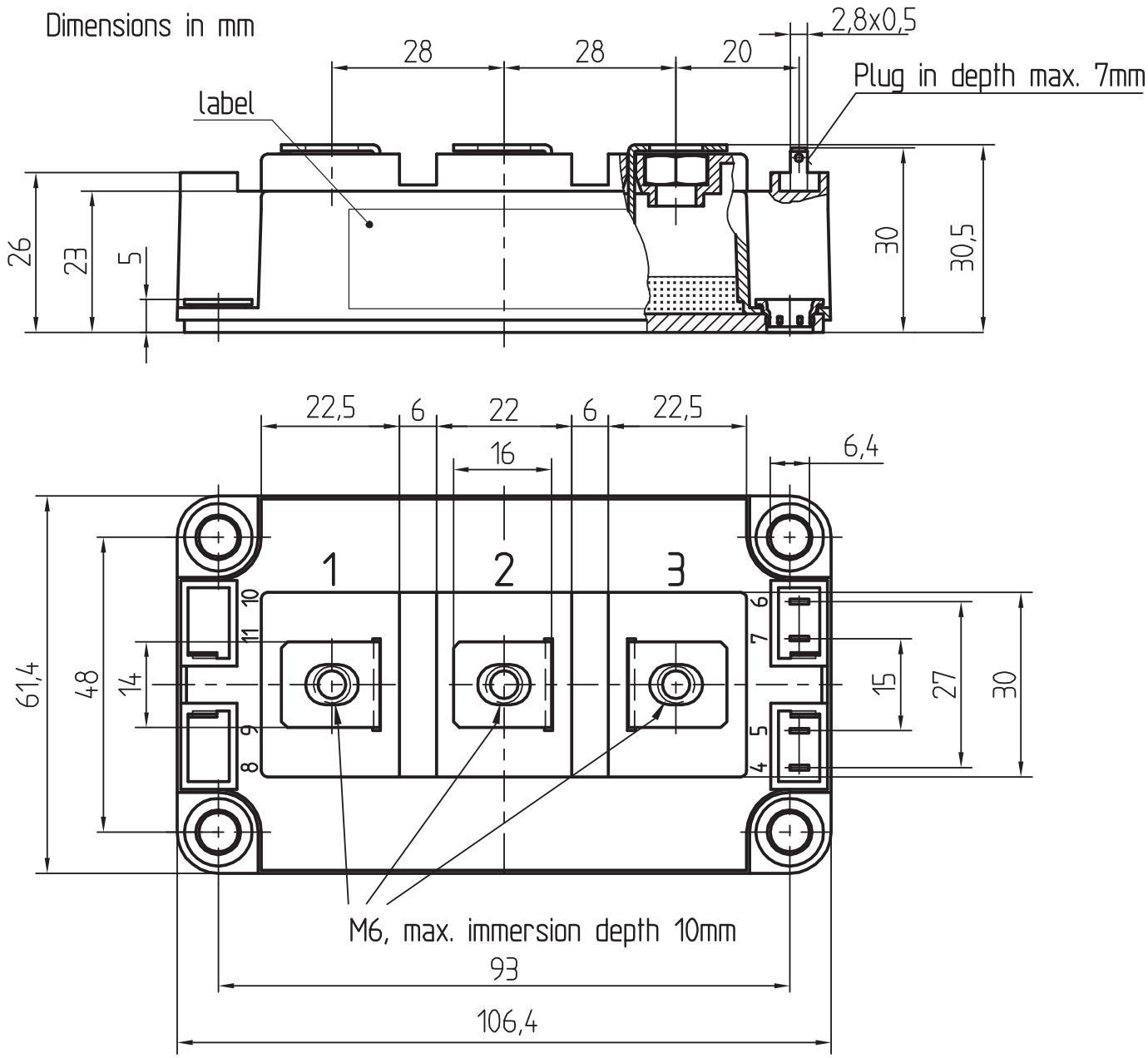



Fig. 19: Capacitances vs. drain-source voltage

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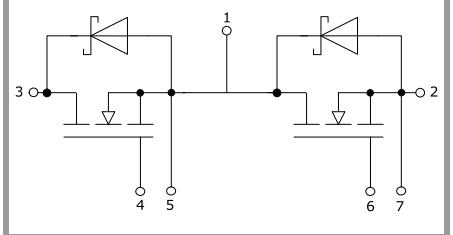


**MB**

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

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