SEMIKRON

## Absolute Maximum Ratings

$T_{case}$ = 25 °C, unless otherwise specified

| Symbol | Conditions | Values | Units |
|---|---|---|---|
| **IGBT** | | | |
| $V_{CES}$ | | 1200 | V |
| $I_C$ | $T_{case}$ = 25 (80) °C | 520 (380) | A |
| $I_{CRM}$ | $T_{case}$ = 25 (80) °C, $t_p$ =1 ms | 1040 (760) | A |
| $V_{GES}$ | | ± 20 | V |
| $T_{vj}$, ($T_{stg}$) | $T_{OPERATION} \leq T_{stg}$ | – 40 ... +150 (125) | °C |
| $V_{isol}$ | AC, 1 min. | 4000 | V |
| **Inverse Diode** | | | |
| $I_{FAV}$ = – $I_C$ | $T_{case}$ = 25 (80) °C | 390 (260) | A |
| $I_{FRM}$ | $T_{case}$ = 25 (80) °C, $t_p$ < 1 ms | 1040 (760) | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin.; $T_j$ = 150 °C | 2900 | A |
| **Freewheeling Diode** | | | |
| $I_{FAV}$ = – $I_C$ | $T_{case}$ = 25 (80) °C | | A |
| $I_{FRM}$ | $T_{case}$ = 25 (80) °C, $t_p$ < 1 ms | | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin.; $T_j$ = 150 °C | | A |

## Characteristics

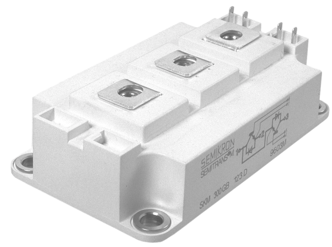
$T_{case}$ = 25 °C, unless otherwise specified

| Symbol | Conditions | min. | typ. | max. | Units |
|---|---|---|---|---|---|
| **IGBT** | | | | | |
| $V_{GE(TO)}$ | $V_{GE} = V_{CE}$, $I_C$ = 12 mA | 4,5 | 5,5 | 6,45 | V |
| $I_{CES}$ | $V_{GE}$ = 0, $V_{CE} = V_{CES}$, $T_j$ = 25 (125) °C | | | tbd | mA |
| $V_{CE(TO)}$ | $T_j$ = 25 (125) °C | | 1,0 (0,9) | 1,15 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V, $T_j$ = 25 (125) °C | | 3,3 (4,7) | 4,2 (tbd) | mΩ |
| $V_{CE(sat)}$ | $I_C$ = 300 A, $V_{GE}$ = 15 V, chip level | | 2,0 (2,3) | 2,4 | V |
| $C_{ies}$ | | | 26 | | nF |
| $C_{oes}$ | $V_{GE}$ = 0, $V_{CE}$ = 25 V, f = 1 MHz | | 3 | | nF |
| $C_{res}$ | | | 3 | | nF |
| $L_{CE}$ | | | | 20 | nH |
| $R_{CC'+EE'}$ | resistance, terminal-chip 25 (125) °C | | 0,35 (0,5) | | mΩ |
| | under following conditions: | | | | |
| $t_{d(on)}$ | $V_{CC}$ = 600 V, $I_C$ = 300 A, | | 110 | | ns |
| $t_r$ | $R_{Gon} = R_{Goff}$ = 5 Ω, $T_j$ = 125 °C, | | 60 | | ns |
| $t_{d(off)}$ | $V_{GE}$ ± 15 V | | 800 | | ns |
| $t_f$ | | | 60 | | ns |
| $E_{on}$ ($E_{off}$) | | | 32 (31) | | mJ |
| **Inverse Diode** | under following conditions: | | | | |
| $V_F = V_{EC}$ | $I_F$ = 300 A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | | 2,0 (1,8) | 2,5 | V |
| $V_{T(TO)}$ | $T_j$ = 25 (125) °C | | 1,1 (tbd) | 1,2 | V |
| $r_T$ | $T_j$ = 25 (125) °C | | 3 (tbd) | 4,3(tbd) | mΩ |
| $I_{RRM}$ | $I_F$ = 300 A; $T_j$ = 125 °C | | 176 | | A |
| $Q_{rr}$ | di/dt = 2400 A/µs | | 40 | | µC |
| $E_{rr}$ | $V_{GE}$ = 0 V | | 6 | | mJ |
| **FWD** | under following conditions: | | | | |
| $V_F = V_{EC}$ | $I_F$ = A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | | | | V |
| $V_{TO}$ | $T_j$ = 25 (125) °C | | | | V |
| $r_T$ | $T_j$ = 25 (125) °C | | | | mΩ |
| $I_{RRM}$ | $I_F$ = A; $T_j$ = 125 °C | | | | A |
| $Q_{rr}$ | $V_{GE}$ = 0 V | | | | µC |
| $E_{rr}$ | | | | | mJ |
| **Thermal Characteristics** | | | | | |
| $R_{th(j-c)}$ | per IGBT | | | 0,055 | K/W |
| $R_{th(j-c)D}$ | per Inverse Diode | | | 0,125 | K/W |
| $R_{th(j-c)FD}$ | per FWD | | | | K/W |
| $R_{th(c-s)}$ | per module | | | 0,038 | K/W |
| **Mechanical Data** | | | | | |
| $M_s$ | to heatsink (M6) | 3 | | 5 | Nm |
| $M_t$ | for terminals (M5) | 2,5 | | 5 | Nm |
| w | | | | 325 | g |

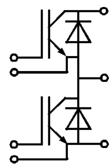
## SEMITRANS™ M SPT IGBT Module

## SKM 400 GB 128 D

Preliminary Data



SEMITRANS 3



GB

### Features

- Homogeneous Si
- SPT = Soft-Punch-Through technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_C$

### Typical Applications

- AC inverter drives
- UPS
- Electronic welders $f_{sw}$ up to 20 kHz

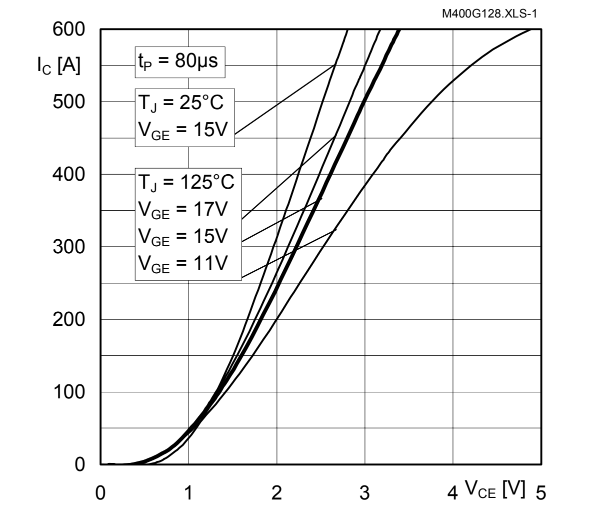



Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

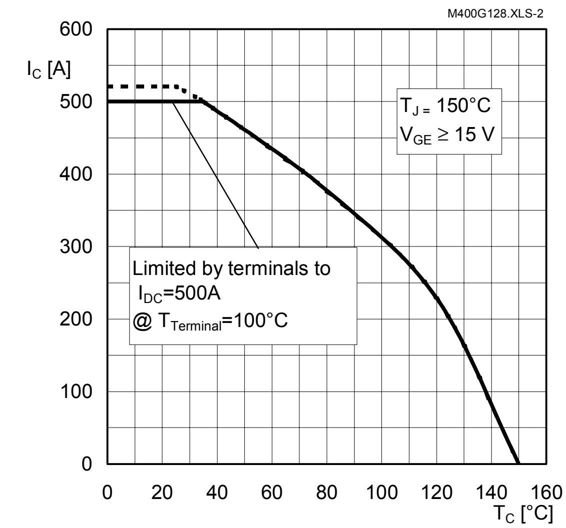



Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

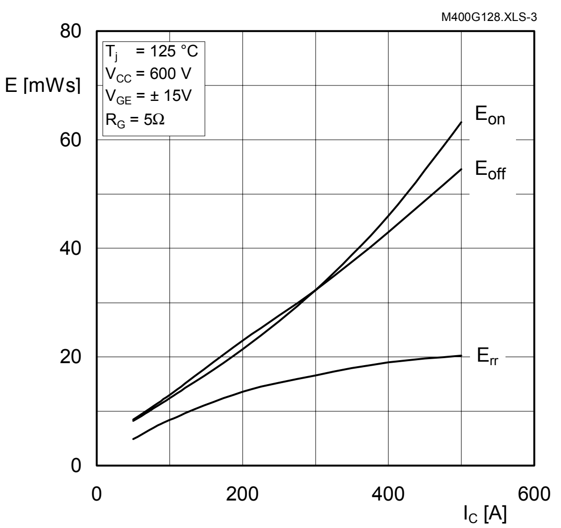



Fig. 3 Typ. turn-on /-off energy = f ($I_C$)

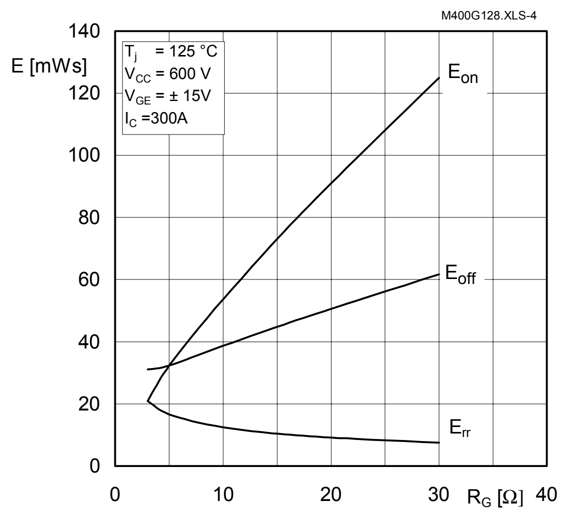



Fig. 4 Typ. turn-on /-off energy = f ($R_G$)

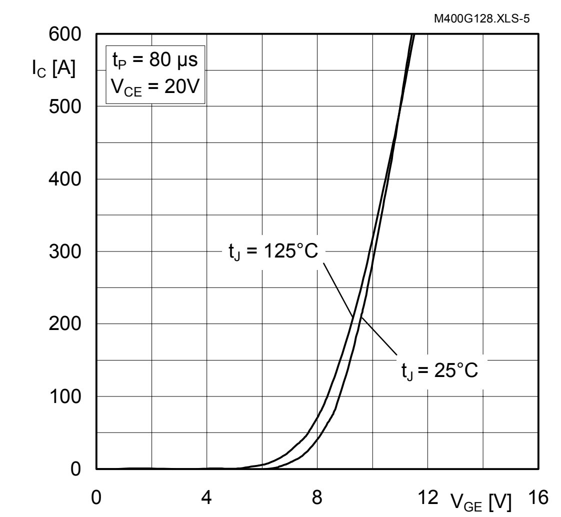



Fig. 5 Typ. transfer characteristic

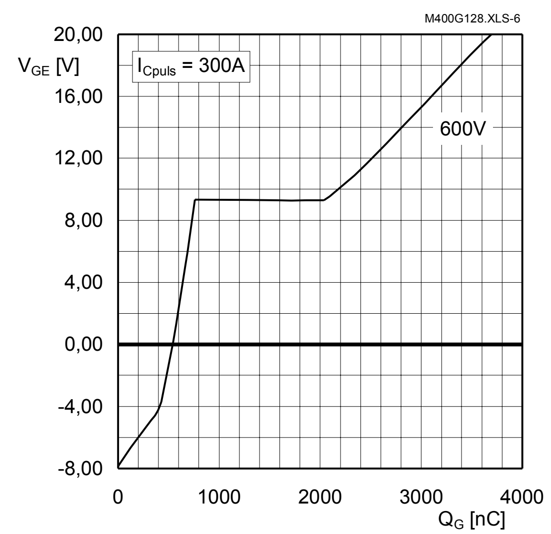



Fig. 6 Typ. gate charge characteristic

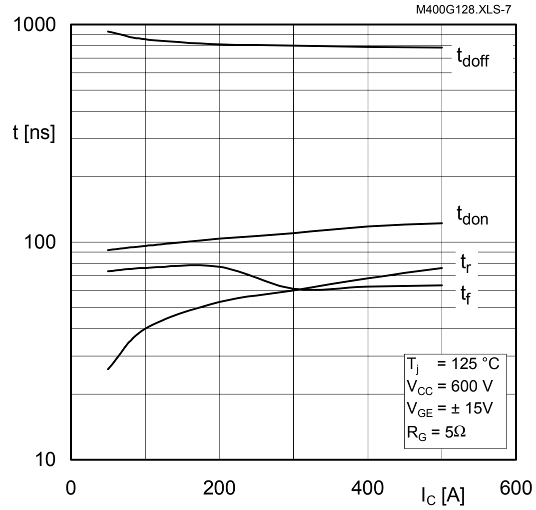



Fig. 7 Typ. switching times vs. $I_C$

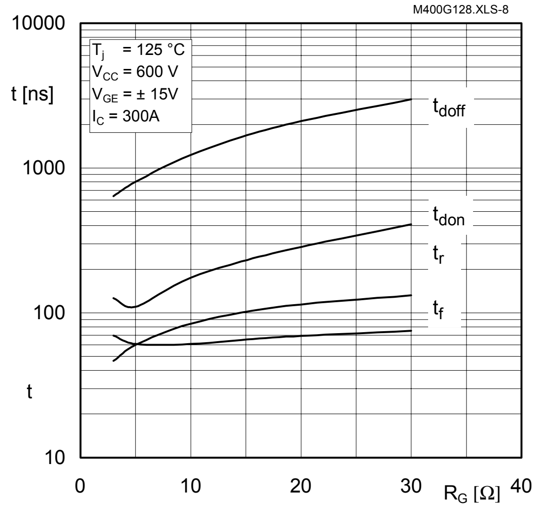



Fig. 8 Typ. switching times vs. gate resistor $R_G$

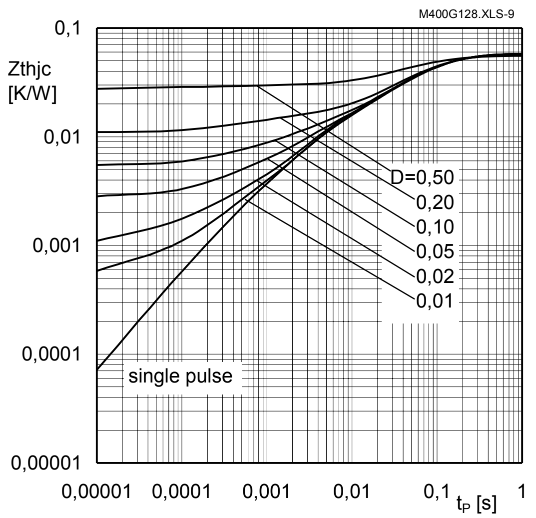



Fig. 9 Transient thermal impedance of IGBT $Z_{thp(j-c)} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

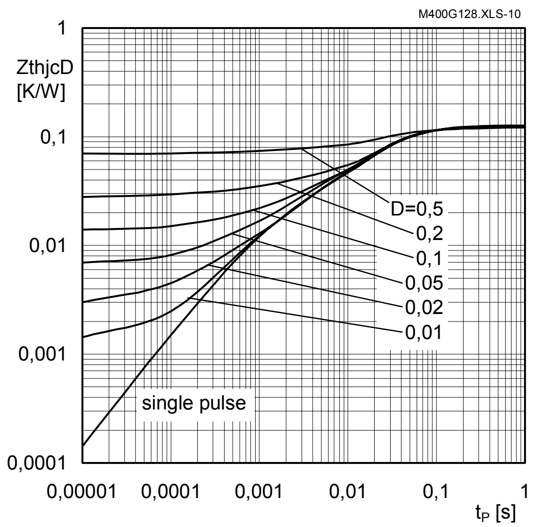



Fig. 10 Transient thermal impedance of FWD $Z_{thp(j-c)D} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

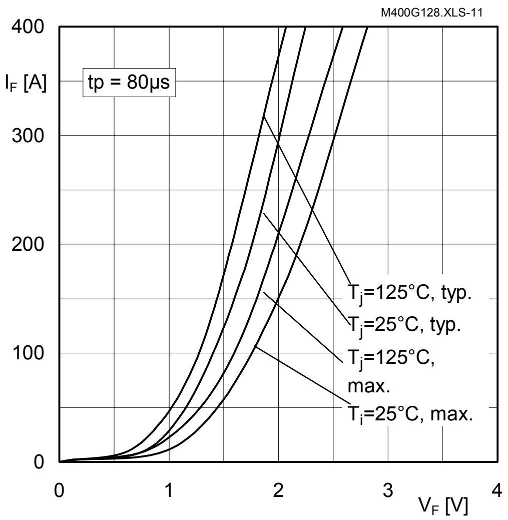



Fig. 11 CAL diode forward characteristic

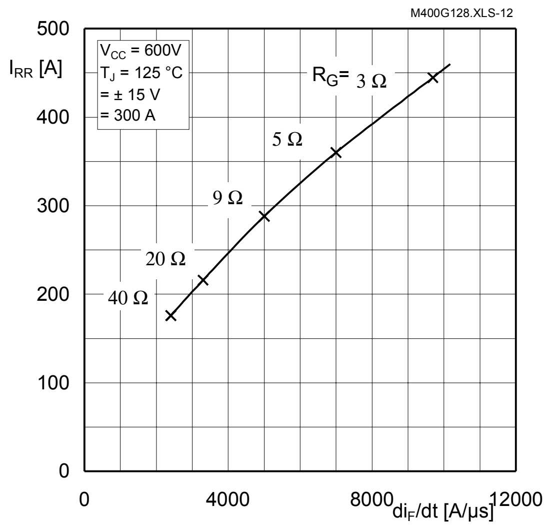



Fig. 12 Typ. CAL diode peak reverse recovery current

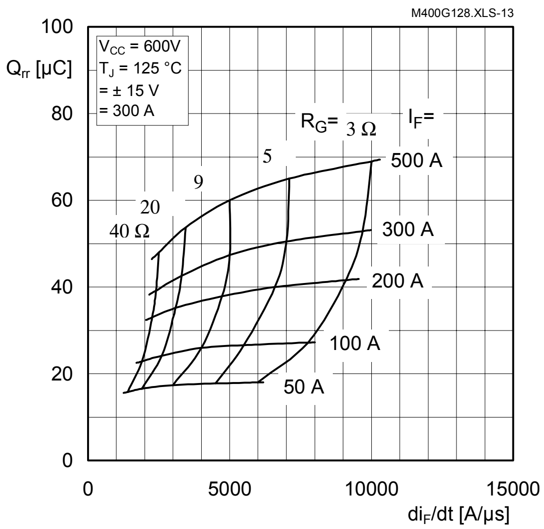



Fig. 13 Typ. CAL diode recovered charge

**This is an electrostatic discharge sensitive device (ESDS).**

**Please observe the international standard IEC 60747-1, Chapter IX.**

| | | |
|---|---|---|
| Packing Unit | 12 pcs | SEMIBOX D |
| Mounting Kit | 10 pcs | Ident-No. 33321100 |

| i = | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $R_i$ | 0,00001 | 0,02246 | 0,021438 | 0,006629 | 0,001484 | 0,002961 |
| $\tau_i$ | 347,4354 | 0,072702 | 0,039387 | 0,018429 | 0,018429 | 0,000559 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{i\,D}$ | 0,000005 | 0,066997 | 0,046663 | 0,000456 | 0,0010814 | – |
| $\tau_{i\,D}$ | 138,9741 | 0,030895 | 0,010267 | 0,00984 | 0,000881 | – |

Transient thermal impedance analytic elements

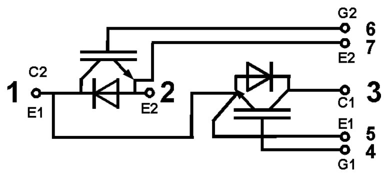
**SEMITRANS 3**

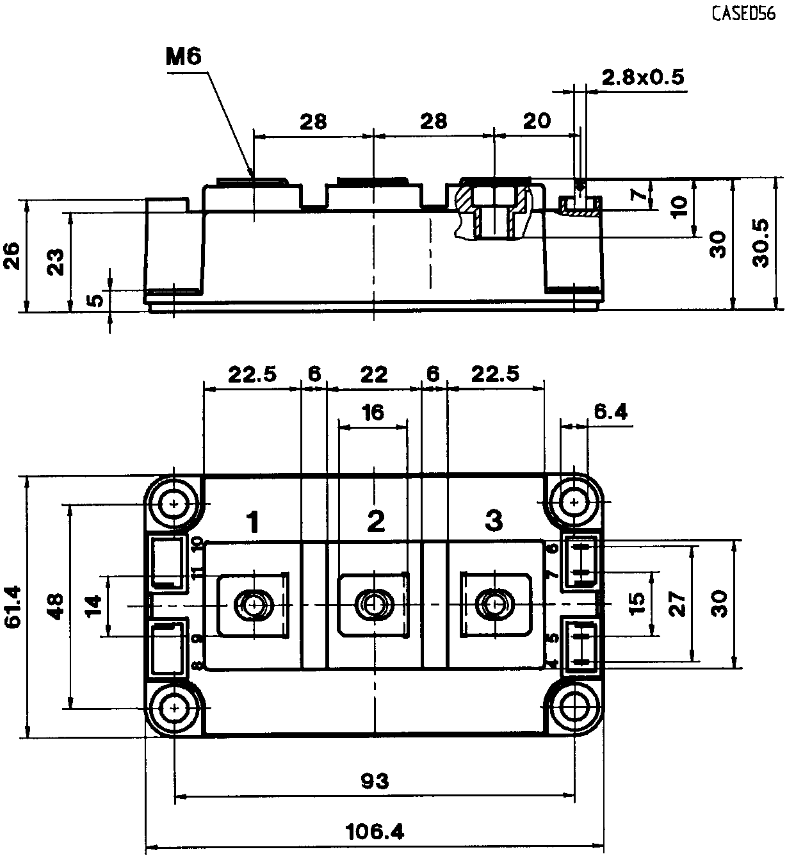
Case D 56

UL Recognized

File no. E 63 532

**SKM 400 GB 128 D**




Dimensions in mm

Case outline and circuit diagrams