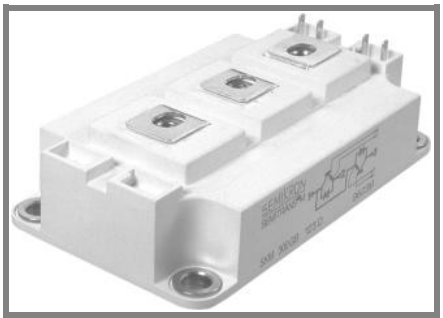
# SKM 400GB128D...



**SEMITRANS® 3**

## SPT IGBT Module

**SKM 400GB128D**

**SKM 400GAL128D**

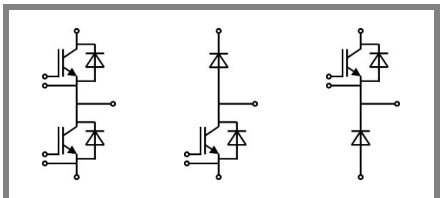
**SKM 400GAR128D**

### Features

- Homogeneous Si
- SPT = Soft-Puch-Through technology
- $V_{CEsat}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_c$

### Typical Applications

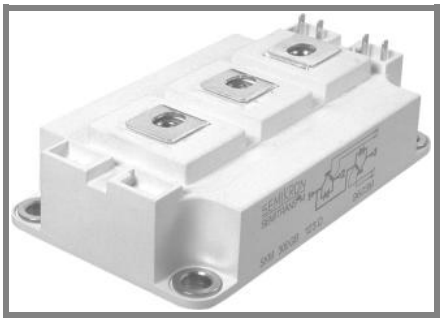
- AC inverter drives
- UPS
- Electronic welders at $f_{sw}$ up to 20kHz



**GB** **GAL** **GAR**

| **Absolute Maximum Ratings** | | | $T_c$ = 25 °C, unless otherwise specified | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Units** |
| **IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $T_j$ = 150 °C | $T_c$ = 25 °C | 565 | A |
| | | $T_c$ = 80 °C | 400 | A |
| $I_{CRM}$ | $I_{CRM}$=2x$I_{Cnom}$ | | 600 | A |
| $V_{GES}$ | | | ± 20 | V |
| $t_{psc}$ | $V_{CC}$ = 600 V; $V_{GE} \leq$ 20 V; $V_{CES}$ < 1200 V | $T_j$ = 125 °C | 10 | µs |
| **Inverse Diode** | | | | |
| $I_F$ | $T_j$ = 150 °C | $T_{case}$ = 25 °C | 390 | A |
| | | $T_{case}$ = 80 °C | 260 | A |
| $I_{FRM}$ | $I_{FRM}$=2x$I_{Fnom}$ | | 600 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin. | $T_j$ = 150 °C | 2880 | A |
| **Freewheeling Diode** | | | | |
| $I_F$ | $T_j$ = 150 °C | $T_{case}$ = 25 °C | 390 | A |
| | | $T_{case}$ = 80 °C | 260 | A |
| $I_{FRM}$ | $I_{FRM}$=2x$I_{Fnom}$ | | 600 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin | $T_j$ = 150 °C | 2880 | A |
| **Module** | | | | |
| $I_{t(RMS)}$ | | | 500 | A |
| $T_{vj}$ | | | - 40 ... + 150 | °C |
| $T_{stg}$ | | | - 40 ... + 125 | °C |
| $V_{isol}$ | AC, 1 min. | | 4000 | V |

| **Characteristics** | | | $T_c$ = 25 °C, unless otherwise specified | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Units** |
| **IGBT** | | | | | | |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 12 mA | | 4,5 | 5,5 | 6,45 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = $V_{CES}$ | $T_j$ = 25 °C | | 0,2 | 0,6 | mA |
| $V_{CE0}$ | | $T_j$ = 25 °C | | 1 | 1,15 | V |
| | | $T_j$ = 125 °C | | 0,9 | 1,05 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V | $T_j$ = 25°C | | 3 | 4 | mΩ |
| | | $T_j$ = 125°C | | 4 | 5 | mΩ |
| $V_{CE(sat)}$ | $I_{Cnom}$ = 300 A, $V_{GE}$ = 15 V | $T_j$ = 25°C$_{chiplev.}$ | | 1,9 | 2,35 | V |
| | | $T_j$ = 125°C$_{chiplev.}$ | | 2,1 | 2,55 | V |
| $C_{ies}$ | $V_{CE}$ = 25, $V_{GE}$ = 0 V | f = 1 MHz | | 26 | | nF |
| $C_{oes}$ | | | | 3 | | nF |
| $C_{res}$ | | | | 3 | | nF |
| $Q_G$ | $V_{GE}$ = -8V - +20V | | | 3700 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 1,25 | | Ω |
| $t_{d(on)}$ | $R_{Gon}$ = 4,7 Ω | $V_{CC}$ = 600V | | 110 | | ns |
| $t_r$ | | $I_{Cnom}$= 300A | | 60 | | ns |
| $E_{on}$ | | $T_j$ = 125 °C | | 32 | | mJ |
| $t_{d(off)}$ | $R_{Goff}$ = 4,7 Ω | $V_{GE}$ = ± 15V | | 800 | | ns |
| $t_f$ | | | | 60 | | ns |
| $E_{off}$ | | | | 31 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0,055 | K/W |



**SEMITRANS® 3**

## SPT IGBT Module

**SKM 400GB128D**

**SKM 400GAL128D**

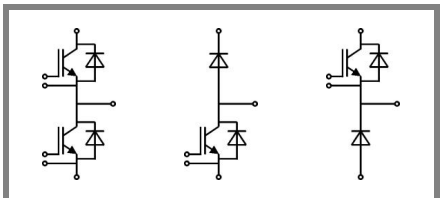
**SKM 400GAR128D**

### Features

- Homogeneous Si
- SPT = Soft-Puch-Through technology
- $V_{CEsat}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_c$

### Typical Applications

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



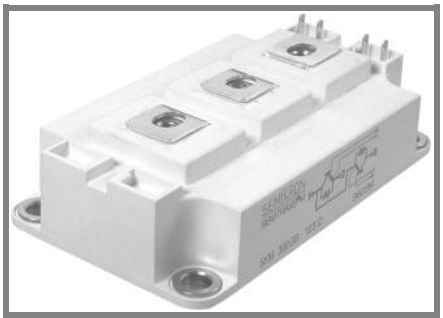
**GB** **GAL** **GAR**

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Units** |
| **Inverse Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_{Fnom}$ = 300 A; $V_{GE}$ = 0 V | $T_j$ = 25 °$C_{chiplev.}$ | | 2 | 2,5 | V |
| | | $T_j$ = 125 °$C_{chiplev.}$ | | 1,8 | | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1,1 | 1,2 | V |
| $r_F$ | | $T_j$ = 25 °C | | 3 | 4,3 | mΩ |
| $I_{RRM}$ | $I_{Fnom}$ = 300 A | $T_j$ = 125 °C | | 176 | | A |
| $Q_{rr}$ | di/dt = 2400 A/µs | | | 40 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V; $V_{CC}$ = 600 V | | | 16 | | mJ |
| $R_{th(j-c)D}$ | per diode | | | | 0,125 | K/W |
| **FWD** | | | | | | |
| $V_F = V_{EC}$ | $I_{Fnom}$ = 300 A; $V_{GE}$ = 0 V | $T_j$ = 25 °$C_{chiplev.}$ | | 2 | 2,5 | V |
| | | $T_j$ = 125 °$C_{chiplev.}$ | | 1,8 | | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1,1 | 1,2 | V |
| $r_F$ | | $T_j$ = 25 °C | | 3 | 4,3 | V |
| $I_{RRM}$ | $I_{Fnom}$ = 300 A | $T_j$ = 125 °C | | 176 | | A |
| $Q_{rr}$ | di/dt = 2400 A/µs | | | 40 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V; $V_{CC}$ = 600 V | | | 16 | | mJ |
| $R_{th(j-c)D}$ | per diode | | | | 0,125 | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 15 | 20 | nH |
| $R_{CC'+EE'}$ | res., terminal-chip | $T_{case}$= 25 °C | | 0,35 | | mΩ |
| | | $T_{case}$= 125 °C | | 0,5 | | mΩ |
| $R_{th(c-s)}$ | per module | | | | 0,038 | K/W |
| $M_s$ | to heat sink M6 | | 3 | | 5 | Nm |
| $M_t$ | to terminals M6 | | 2,5 | | 5 | Nm |
| w | | | | | 325 | g |

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

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.



**SEMITRANS® 3**

## SPT IGBT Module

**SKM 400GB128D**

**SKM 400GAL128D**

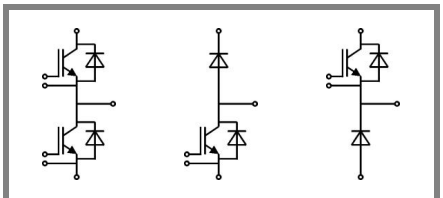
**SKM 400GAR128D**

### Features

- Homogeneous Si
- SPT = Soft-Puch-Through technology
- $V_{CEsat}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_c$

### Typical Applications

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



**GB** **GAL** **GAR**

| $Z_{th}$ Symbol | Conditions | Values | Units |
|---|---|---|---|
| **$Z_{th(j-c)I}$** | | | |
| $R_i$ | i = 1 | 37 | mk/W |
| $R_i$ | i = 2 | 14 | mk/W |
| $R_i$ | i = 3 | 3,45 | mk/W |
| $R_i$ | i = 4 | 0,55 | mk/W |
| $tau_i$ | i = 1 | 0,0744 | s |
| $tau_i$ | i = 2 | 0,0078 | s |
| $tau_i$ | i = 3 | 0,0024 | s |
| $tau_i$ | i = 4 | 0,0002 | s |
| **$Z_{th(j-c)D}$** | | | |
| $R_i$ | i = 1 | 75 | mk/W |
| $R_i$ | i = 2 | 38 | mk/W |
| $R_i$ | i = 3 | 10,6 | mk/W |
| $R_i$ | i = 4 | 1,4 | mk/W |
| $tau_i$ | i = 1 | 0,0386 | s |
| $tau_i$ | i = 2 | 0,0201 | s |
| $tau_i$ | i = 3 | 0,001 | s |
| $tau_i$ | i = 4 | 0,003 | s |

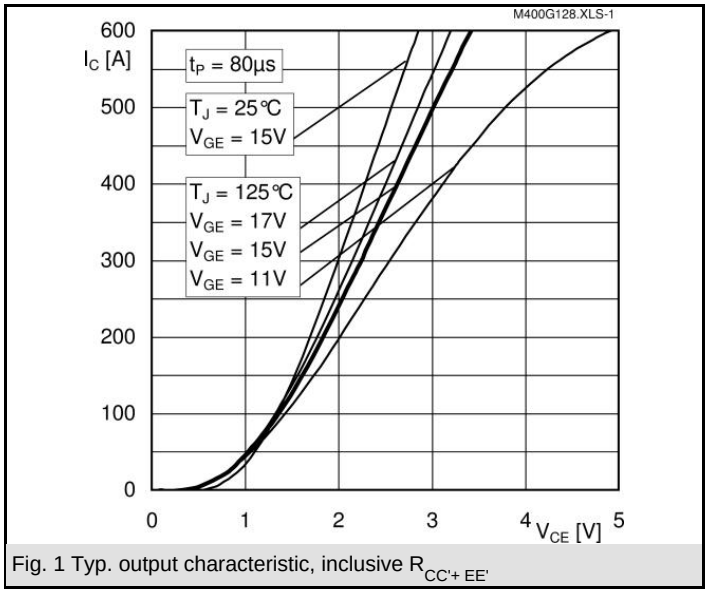



Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

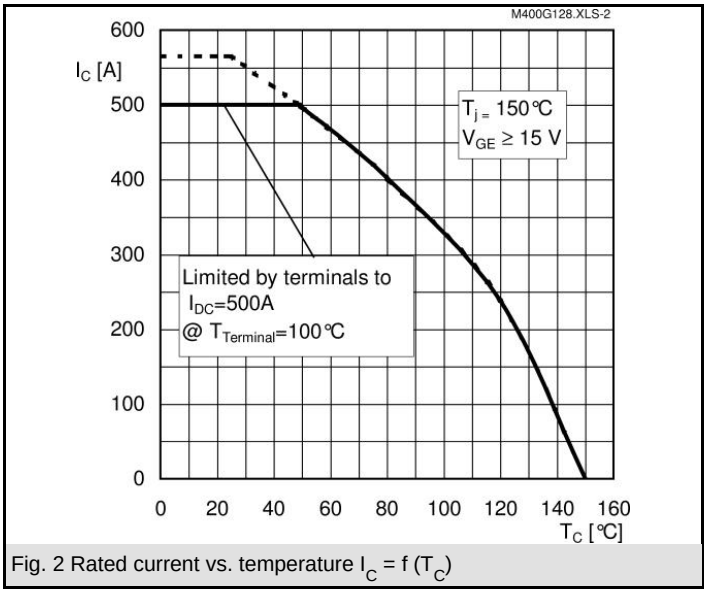



Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

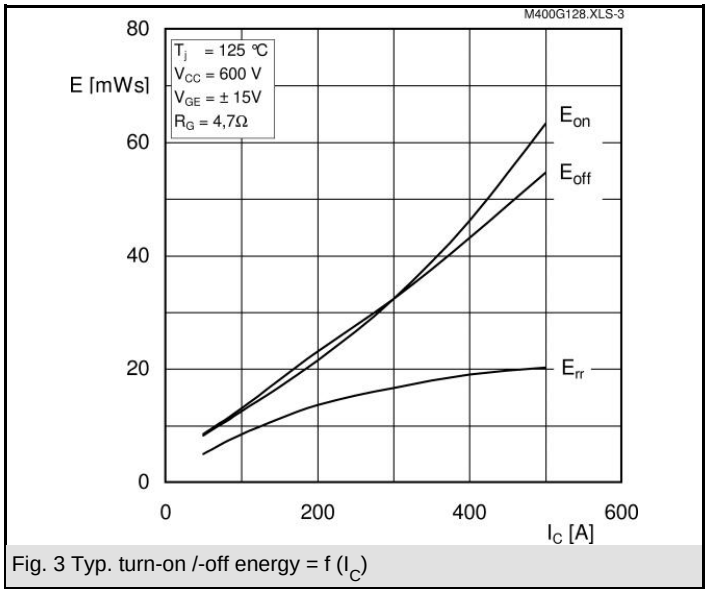



Fig. 3 Typ. turn-on /-off energy = f ($I_C$)

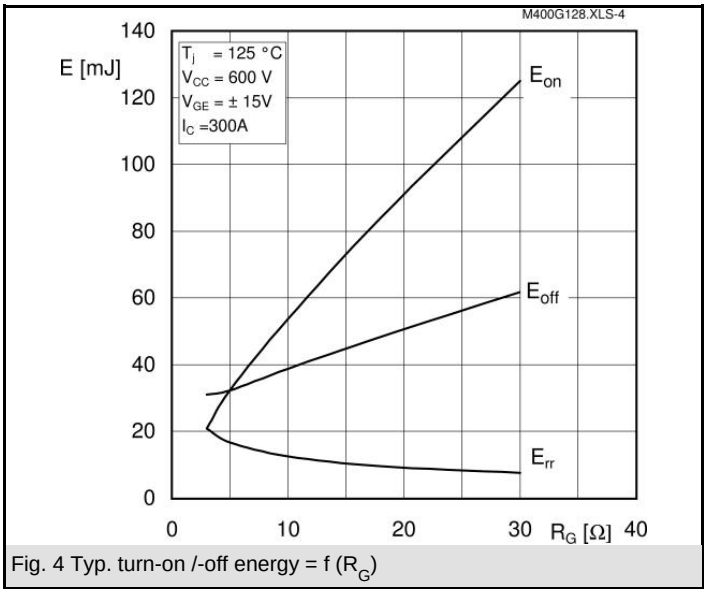



Fig. 4 Typ. turn-on /-off energy = f ($R_G$)

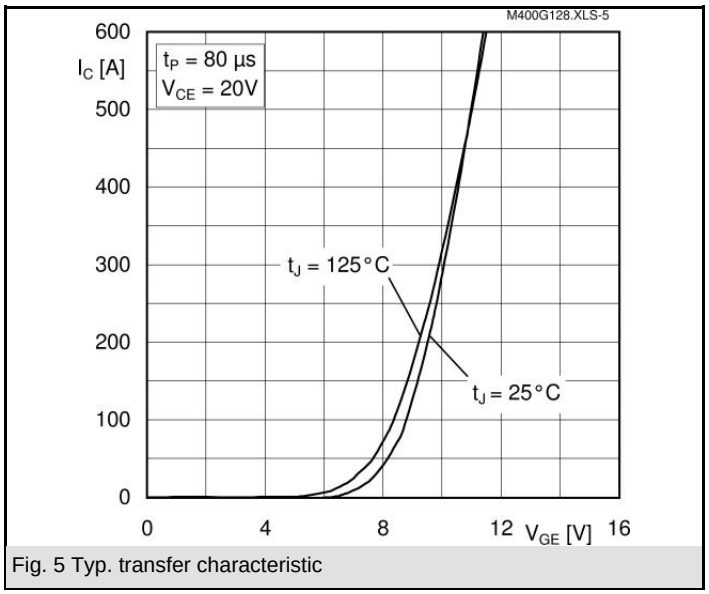



Fig. 5 Typ. transfer characteristic

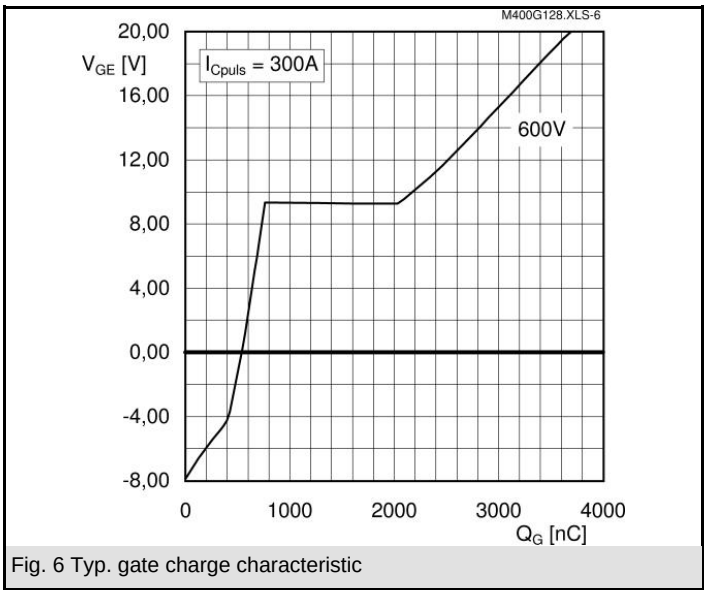



Fig. 6 Typ. gate charge characteristic

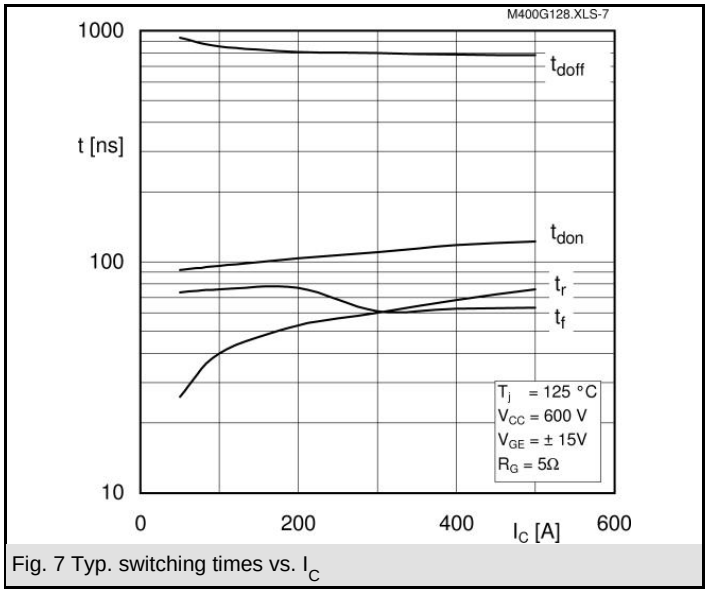



Fig. 7 Typ. switching times vs. $I_C$

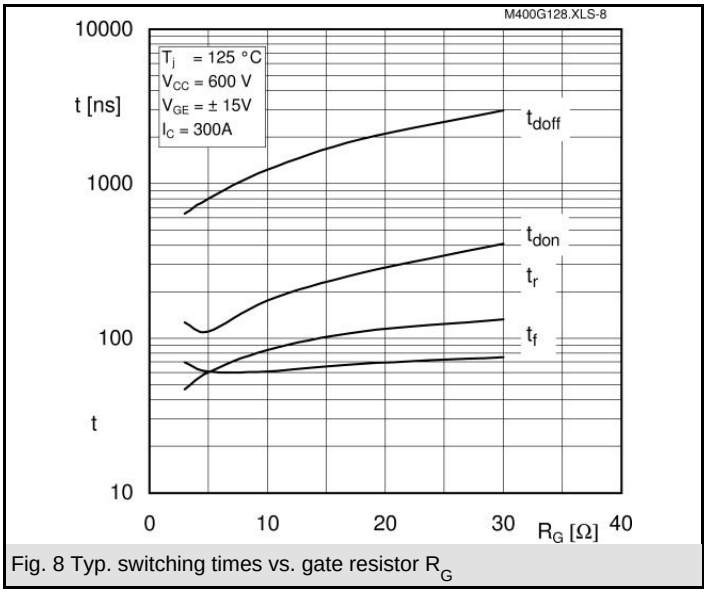



Fig. 8 Typ. switching times vs. gate resistor $R_G$

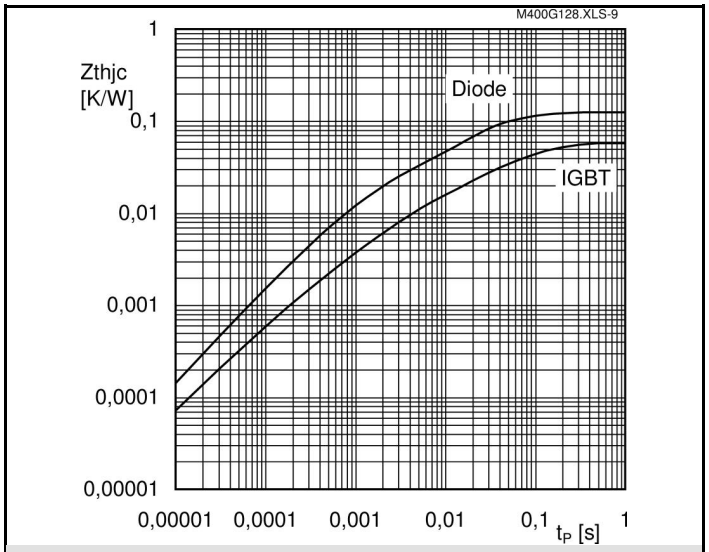



Fig. 9 Transient thermal impedance

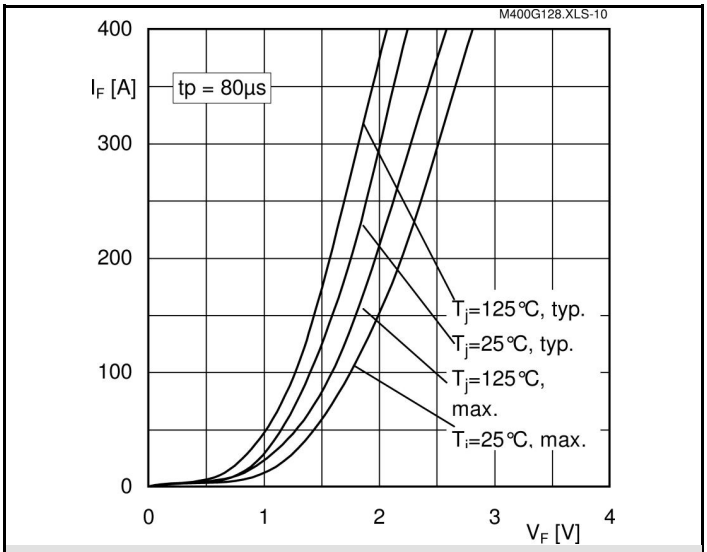



Fig. 10 CAL diode forward characteristic

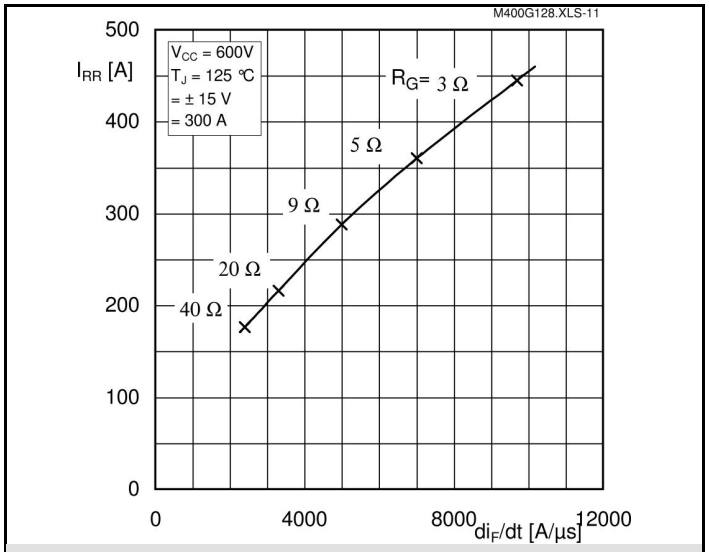



Fig. 11 Typ. CAL diode peak reverse recovery current

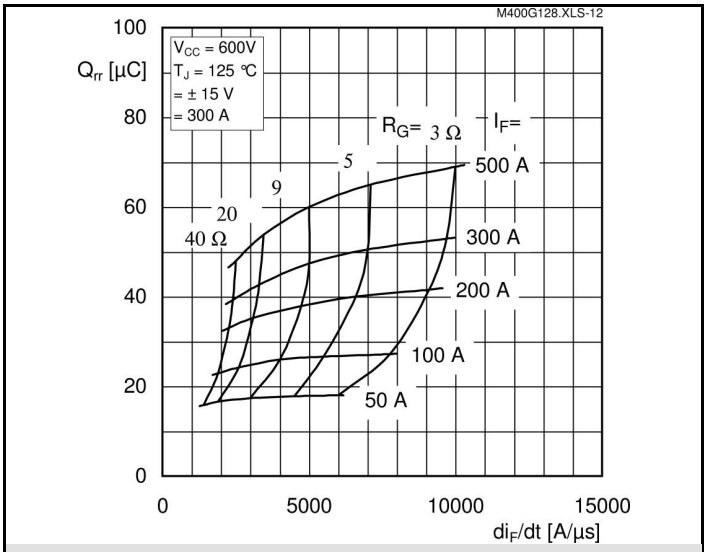
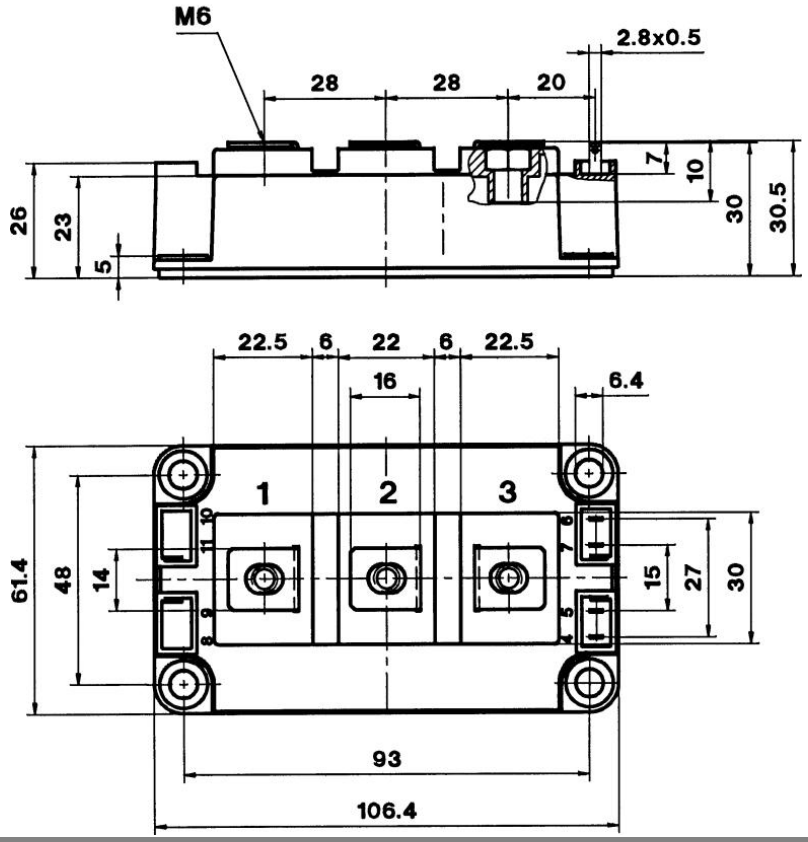



Fig. 12 Typ. CAL diode peak reverse recovery charge

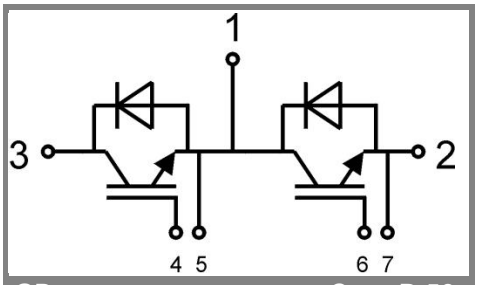
 

UL Recognized File 63 532

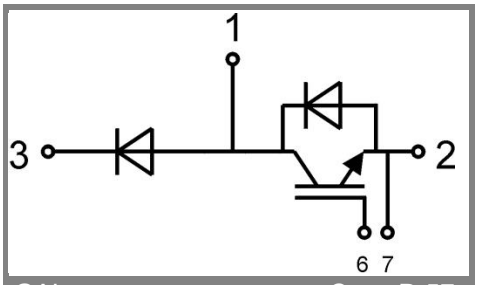
CASED56



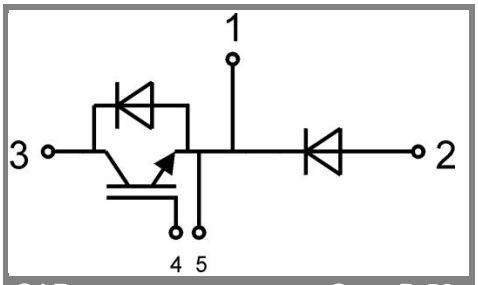

Case D 56




GB Case D 56




GAL Case D 57




GAR Case D 58