



SEMITRANS™ 4

## Low Loss IGBT Modules

SKM 500GA124D

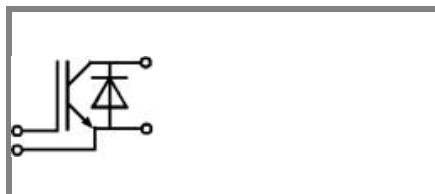
Preliminary Data

### Features

- MOS input (voltage controlled)
- N channel, homogeneous Si-structure (NPT-IGBT)
- High short circuit capability, self limiting to  $6 \times I_{Cnom}$
- Fast & soft invese CAL diodes
- Isolated copper baseplate using DCB Direct Copper Bonding Technology without hard mould
- Large clearance (9 mm) and creepage distances (13 mm)

### Typical Applications

- Switched mode power supplies
- Three phase inverters for AC motor speed control
- Pulse frequencies also above 10 kHz



GA

| Absolute Maximum Ratings |                                                    | $T_c = 25\text{ °C}$ , unless otherwise specified |       |
|--------------------------|----------------------------------------------------|---------------------------------------------------|-------|
| Symbol                   | Conditions                                         | Values                                            | Units |
| <b>IGBT</b>              |                                                    |                                                   |       |
| $V_{CES}$                |                                                    | 1200                                              | V     |
| $I_C$                    | $T_c = 25\text{ (80) °C}$                          | 700 (500)                                         | A     |
| $I_{CRM}$                | $t_p = 1\text{ ms}$                                | 800                                               | A     |
| $V_{GES}$                |                                                    | $\pm 20$                                          | V     |
| $T_{vj}$ ( $T_{stg}$ )   | $T_{OPERATION} \leq T_{stg}$                       | - 40 ... + 150 (125)                              | °C    |
| $V_{isol}$               | AC, 1 min.                                         | 2500                                              | V     |
| <b>Inverse diode</b>     |                                                    |                                                   |       |
| $I_F$                    | $T_c = 25\text{ (80) °C}$                          | 500 (350)                                         | A     |
| $I_{FRM}$                | $t_p = 1\text{ ms}$                                | 800                                               | A     |
| $I_{FSM}$                | $t_p = 10\text{ ms}$ ; sin.; $T_j = 150\text{ °C}$ | 3600                                              | A     |

| Characteristics                |                                                                                | $T_c = 25\text{ °C}$ , unless otherwise specified |             |             |       |
|--------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------|-------------|-------------|-------|
| Symbol                         | Conditions                                                                     | min.                                              | typ.        | max.        | Units |
| <b>IGBT</b>                    |                                                                                |                                                   |             |             |       |
| $V_{GE(th)}$                   | $V_{GE} = V_{CE}$ , $I_C = 16\text{ mA}$                                       | 4,5                                               | 5,5         | 6,5         | V     |
| $I_{CES}$                      | $V_{GE} = 0$ , $V_{CE} = V_{CES}$ , $T_j = 25\text{ (125) °C}$                 |                                                   | 0,1         | 0,3         | mA    |
| $V_{CE(TO)}$                   | $T_j = 25\text{ (125) °C}$                                                     |                                                   | 1,1 (1,1)   | 1,25 (1,25) | V     |
| $r_{CE}$                       | $V_{GE} = 15\text{ V}$ , $T_j = 25\text{ (125) °C}$                            |                                                   | 2,5 (3,25)  | 3 (4)       | mΩ    |
| $V_{CE(sat)}$                  | $I_{Cnom} = 400\text{ A}$ , $V_{GE} = 15\text{ V}$ , chip level                |                                                   | 2,1 (2,4)   | 2,45 (2,85) | V     |
| $C_{ies}$                      | under following conditions                                                     |                                                   | 26          | 40          | nF    |
| $C_{oes}$                      | $V_{GE} = 0$ , $V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$                     |                                                   | 4           | 5,2         | nF    |
| $C_{res}$                      |                                                                                |                                                   | 2           | 2,6         | nF    |
| $L_{CE}$                       |                                                                                |                                                   |             | 20          | nH    |
| $R_{CC'+EE'}$                  | res., terminal-chip $T_c = 25\text{ (125) °C}$                                 |                                                   | 0,18 (0,22) |             | mΩ    |
| $t_{d(on)}$                    | $V_{CC} = 600\text{ V}$ , $I_{Cnom} = 400\text{ A}$                            |                                                   | 100         | 600         | ns    |
| $t_r$                          | $R_{Gon} = R_{Goff} = 3\text{ Ω}$ , $T_j = 125\text{ °C}$                      |                                                   | 75          | 340         | ns    |
| $t_{d(off)}$                   | $V_{GE} = \pm 15\text{ V}$                                                     |                                                   | 660         | 1100        | ns    |
| $t_f$                          |                                                                                |                                                   | 82          | 125         | ns    |
| $E_{on} (E_{off})$             |                                                                                |                                                   | 39 (57)     |             | mJ    |
| <b>Inverse diode</b>           |                                                                                |                                                   |             |             |       |
| $V_F = V_{EC}$                 | $I_{Fnom} = 400\text{ A}$ ; $V_{GE} = 0\text{ V}$ ; $T_j = 25\text{ (125) °C}$ |                                                   | 2 (1,8)     | 2,5         | V     |
| $V_{(TO)}$                     | $T_j = 125\text{ ( ) °C}$                                                      |                                                   |             | 1,2         | V     |
| $r_T$                          | $T_j = 125\text{ ( ) °C}$                                                      |                                                   |             | 3           | mΩ    |
| $I_{RRM}$                      | $I_{Fnom} = 400\text{ A}$ ; $T_j = 25\text{ ( 125 ) °C}$                       |                                                   | 180         |             | A     |
| $Q_{rr}$                       | $di/dt = A/\mu s$                                                              |                                                   | 52          |             | μC    |
| $E_{rr}$                       | $V_{GE} = V$                                                                   |                                                   |             |             | mJ    |
| <b>Thermal characteristics</b> |                                                                                |                                                   |             |             |       |
| $R_{th(j-c)}$                  | per IGBT                                                                       |                                                   |             | 0,041       | K/W   |
| $R_{th(j-c)D}$                 | per Inverse Diode                                                              |                                                   |             | 0,09        | K/W   |
| $R_{th(c-s)}$                  | per module                                                                     |                                                   |             | 0,038       | K/W   |
| <b>Mechanical data</b>         |                                                                                |                                                   |             |             |       |
| $M_s$                          | to heatsink M6                                                                 | 3                                                 |             | 5           | Nm    |
| $M_t$                          | to terminals M6, M4                                                            |                                                   |             |             | Nm    |
| w                              |                                                                                |                                                   |             | 330         | g     |

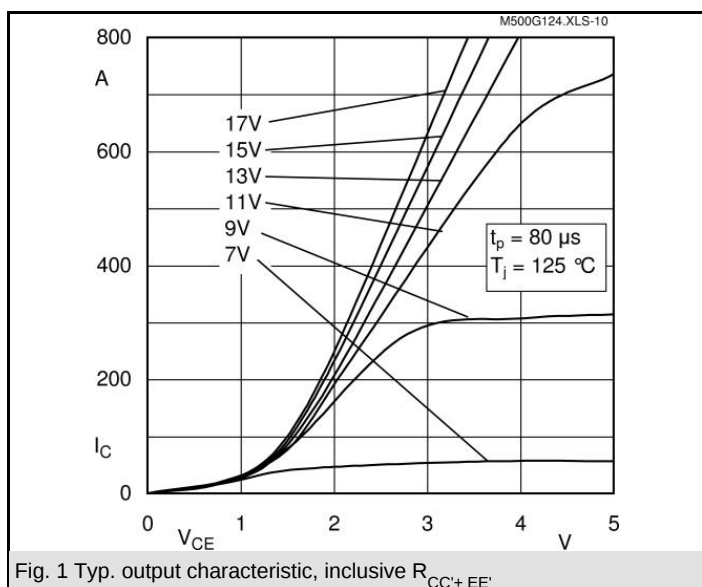


Fig. 1 Typ. output characteristic, inclusive  $R_{CC'+EE'}$

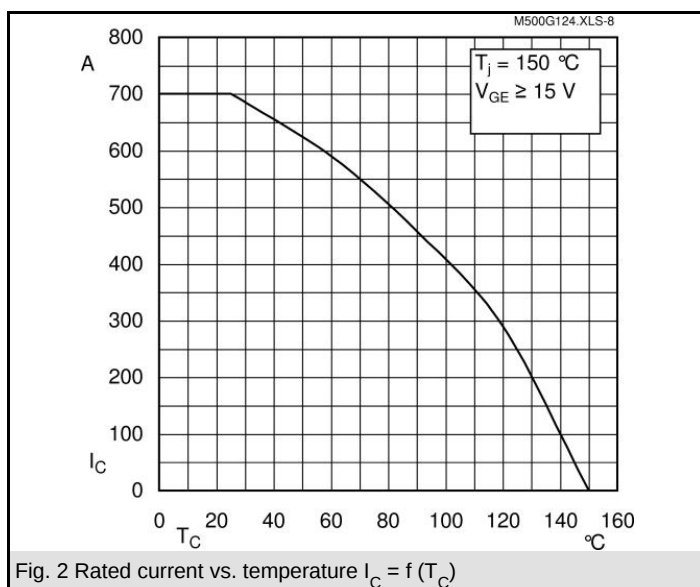


Fig. 2 Rated current vs. temperature  $I_C = f(T_C)$

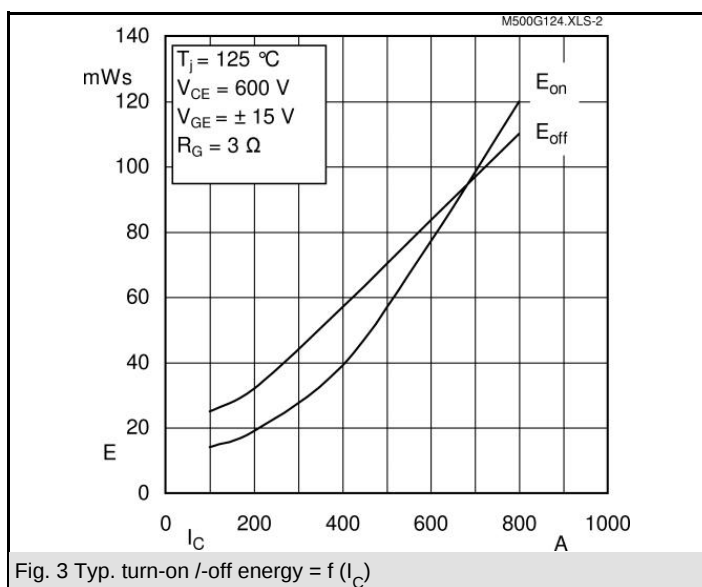


Fig. 3 Typ. turn-on /off energy =  $f(I_C)$

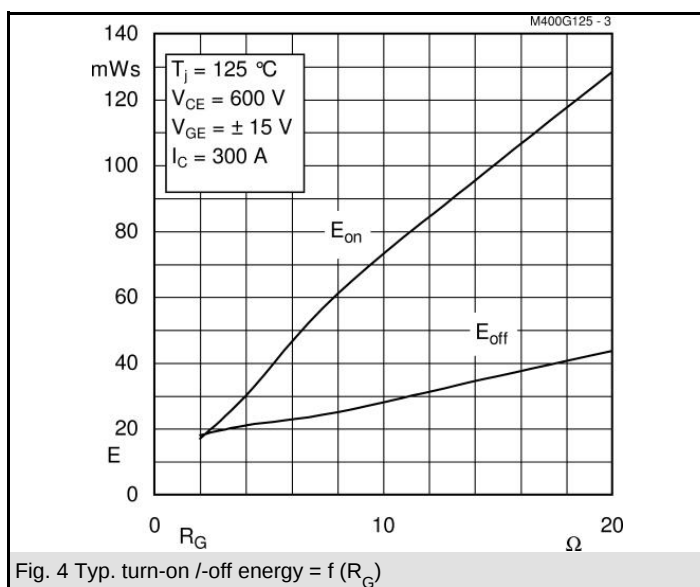


Fig. 4 Typ. turn-on /off energy =  $f(R_G)$

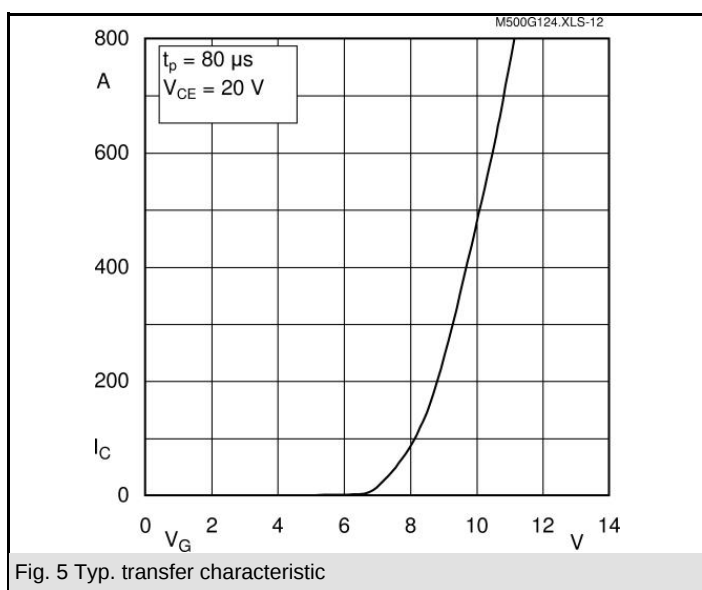


Fig. 5 Typ. transfer characteristic

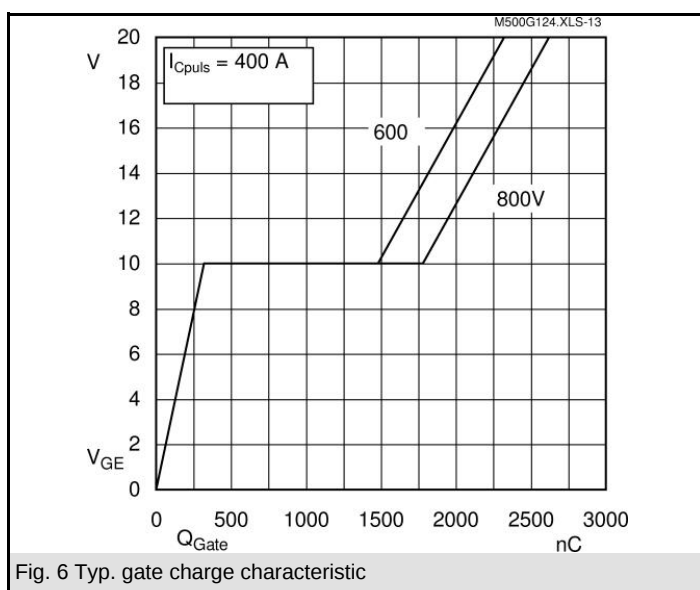
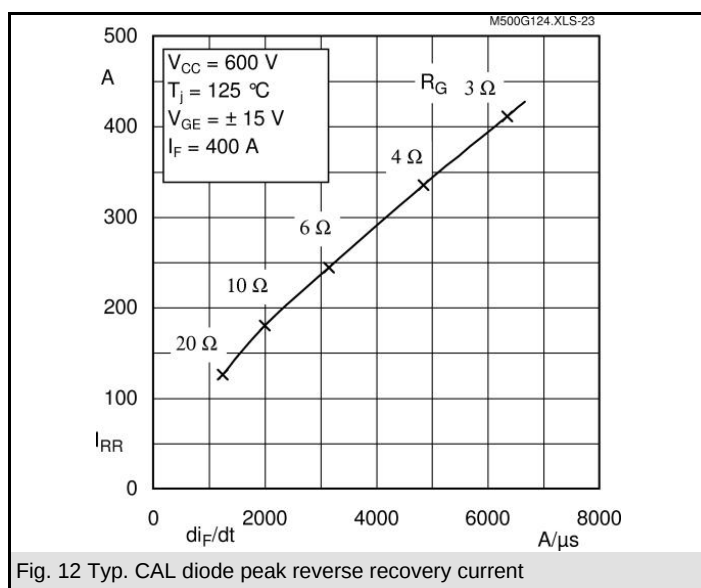
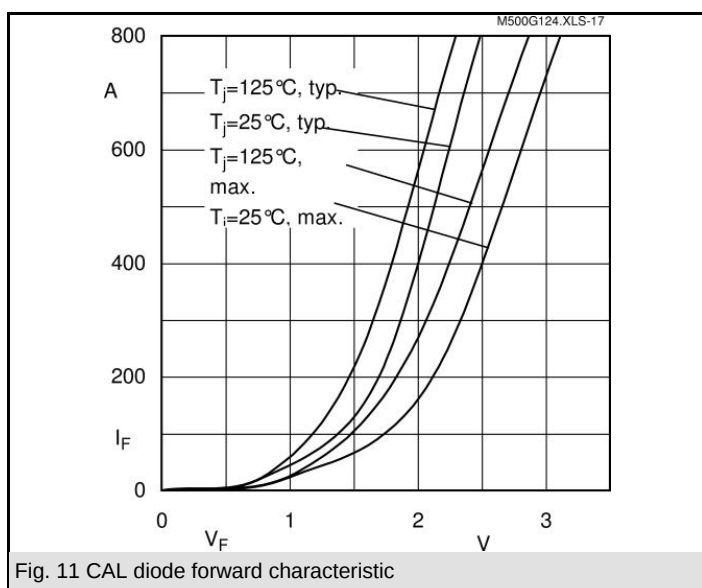
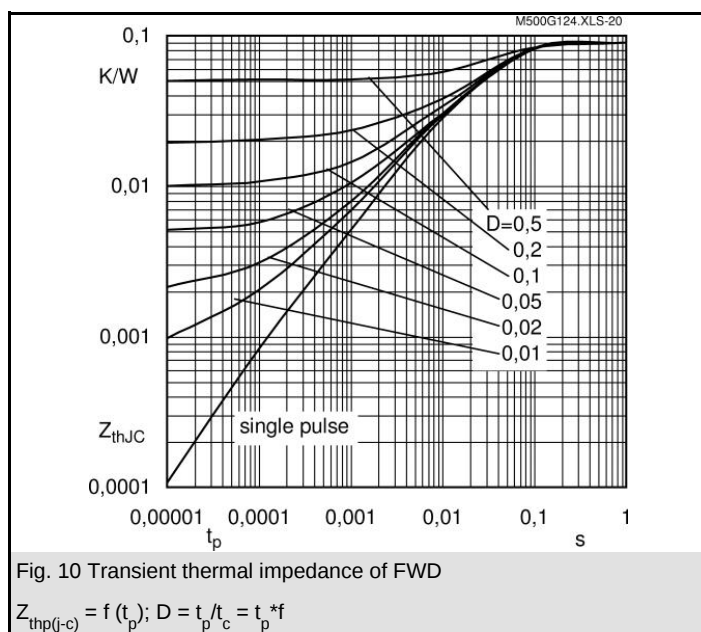
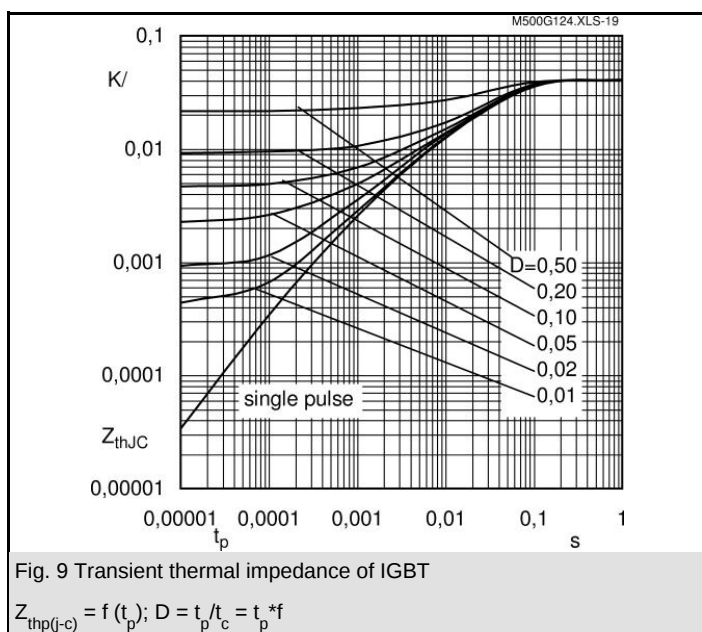
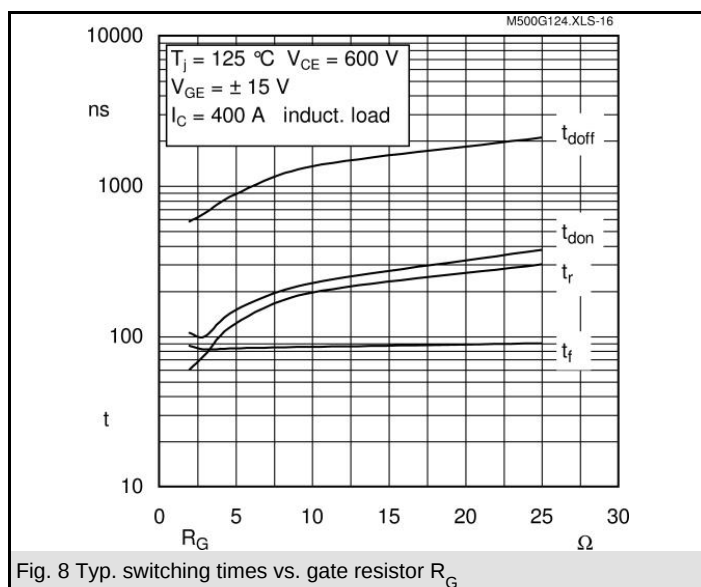
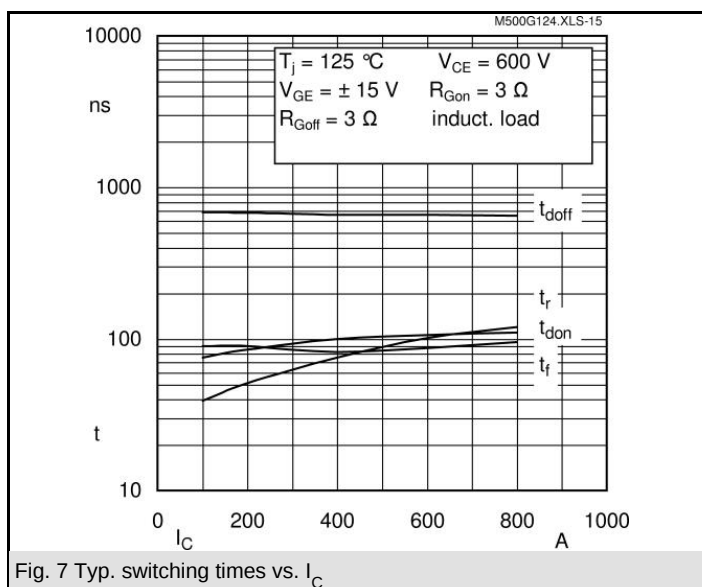
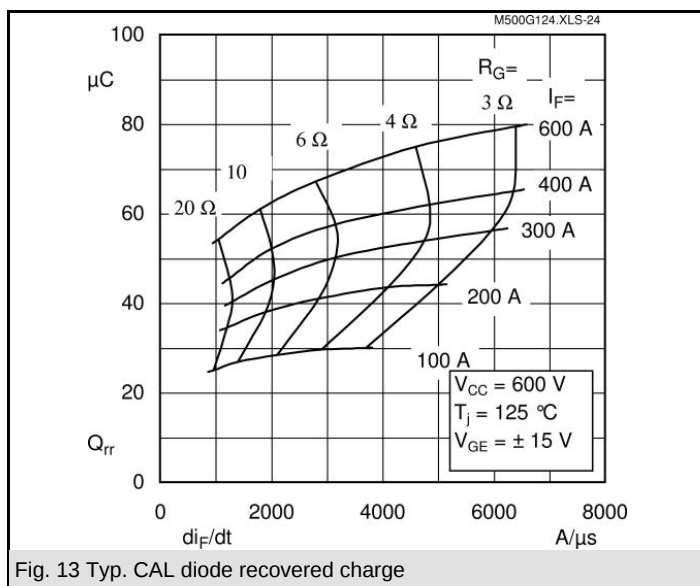


Fig. 6 Typ. gate charge characteristic

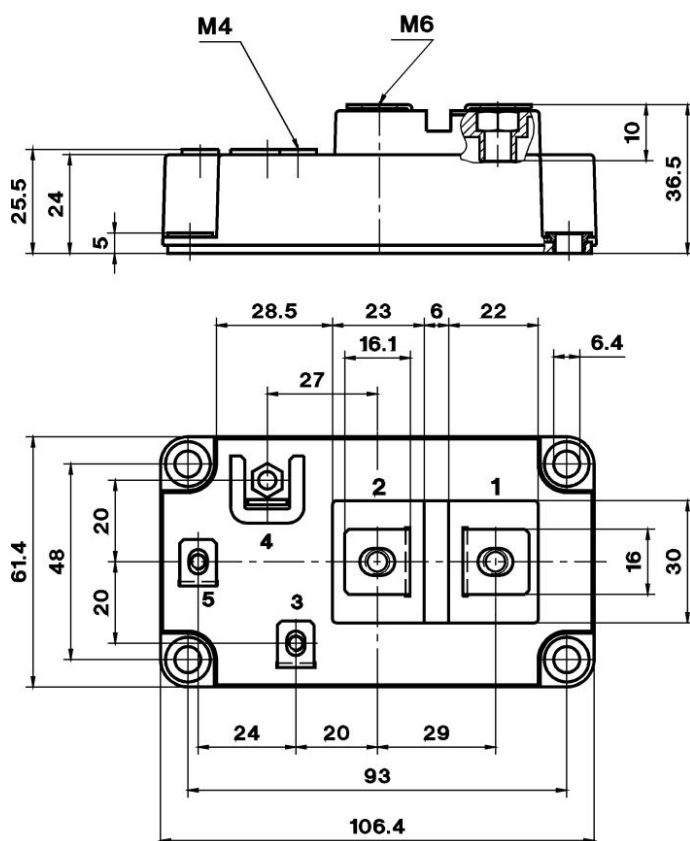




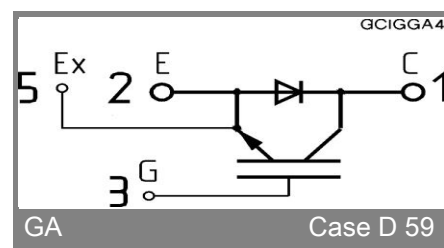
UL Recognized  
File no. E 63 532

Dimensions in mm

CASED59



Case D 59



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

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