



SEMITRANS® 4

## IGBT Modules

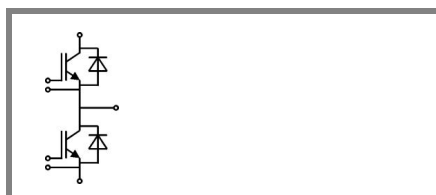
### SKM 400GA123D

#### Features

- MOS input (voltage controlled)
- N channel, homogeneous Si
- Low inductance case
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to  $6 \times I_{Cnom}$
- Latch-up free
- Fast & soft inverse CAL diodes
- Isolated copper baseplate using DBC Direct Copper Bonding Technology
- Large clearance (12 mm) and creepage distances (20 mm)

#### Typical Applications\*

- Switching (not for linear use)



GA

| Absolute Maximum Ratings |                                                                                                       |                           | T <sub>c</sub> = 25 °C, unless otherwise specified |       |
|--------------------------|-------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------|-------|
| Symbol                   | Conditions                                                                                            |                           | Values                                             | Units |
| IGBT                     |                                                                                                       |                           |                                                    |       |
| V <sub>CES</sub>         | T <sub>j</sub> = 25 °C                                                                                |                           | 1200                                               | V     |
| I <sub>C</sub>           | T <sub>j</sub> = 150 °C                                                                               | T <sub>case</sub> = 25 °C | 400                                                | A     |
|                          |                                                                                                       | T <sub>case</sub> = 80 °C | 360                                                | A     |
| I <sub>CRM</sub>         | I <sub>CRM</sub> =2xI <sub>Cnom</sub>                                                                 |                           | 600                                                | A     |
| V <sub>GES</sub>         |                                                                                                       |                           | ± 20                                               | V     |
| t <sub>psc</sub>         | V <sub>CC</sub> = 600 V; V <sub>GE</sub> ≤ 20 V; T <sub>j</sub> = 125 °C<br>V <sub>CES</sub> < 1200 V |                           | 10                                                 | μs    |
| Inverse Diode            |                                                                                                       |                           |                                                    |       |
| I <sub>F</sub>           | T <sub>j</sub> = 150 °C                                                                               | T <sub>case</sub> = 25 °C | 390                                                | A     |
|                          |                                                                                                       | T <sub>case</sub> = 80 °C | 260                                                | A     |
| I <sub>FRM</sub>         | I <sub>FRM</sub> =2xI <sub>Fnom</sub>                                                                 |                           | 600                                                | A     |
| I <sub>FSM</sub>         | t <sub>p</sub> = 10 ms; sin.                                                                          | T <sub>j</sub> = 150 °C   | 2880                                               | A     |
| Module                   |                                                                                                       |                           |                                                    |       |
| I <sub>t(RMS)</sub>      |                                                                                                       |                           | 500                                                | A     |
| T <sub>vj</sub>          |                                                                                                       |                           | - 40 ...+ 150                                      | °C    |
| T <sub>stg</sub>         |                                                                                                       |                           | - 40 ...+ 125                                      | °C    |
| V <sub>isol</sub>        | AC, 1 min.                                                                                            |                           | 2500                                               | V     |

| Characteristics      |                                                            |                                                    | T <sub>c</sub> = 25 °C, unless otherwise specified |       |      |       |
|----------------------|------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|-------|------|-------|
| Symbol               | Conditions                                                 |                                                    | min.                                               | typ.  | max. | Units |
| IGBT                 |                                                            |                                                    |                                                    |       |      |       |
| V <sub>GE(th)</sub>  | V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 12 mA |                                                    | 4,5                                                | 5,5   | 6,5  | V     |
| I <sub>CES</sub>     | V <sub>GE</sub> = 0 V, V <sub>CE</sub> = V <sub>CES</sub>  | T <sub>j</sub> = 25 °C                             |                                                    | 0,1   | 0,3  | mA    |
| V <sub>CE0</sub>     |                                                            | T <sub>j</sub> = 25 °C                             |                                                    | 1,4   | 1,6  | V     |
|                      |                                                            | T <sub>j</sub> = 125 °C                            |                                                    | 1,6   | 1,8  | V     |
| r <sub>CE</sub>      | V <sub>GE</sub> = 15 V                                     | T <sub>j</sub> = 25°C                              |                                                    | 3,66  | 4,66 | mΩ    |
|                      |                                                            | T <sub>j</sub> = 125°C                             |                                                    | 5     | 6,33 | mΩ    |
| V <sub>CE(sat)</sub> | I <sub>Cnom</sub> = 300 A, V <sub>GE</sub> = 15 V          | T <sub>j</sub> = °C <sub>chiplev.</sub>            |                                                    | 2,5   | 3    | V     |
| C <sub>ies</sub>     | V <sub>CE</sub> = 25, V <sub>GE</sub> = 0 V      f = 1 MHz |                                                    |                                                    | 22    | 30   | nF    |
| C <sub>oes</sub>     |                                                            |                                                    |                                                    | 3,3   | 4    | nF    |
| C <sub>res</sub>     |                                                            |                                                    |                                                    | 1,2   | 1,6  | nF    |
| Q <sub>G</sub>       | V <sub>GE</sub> = -8V - +20V                               |                                                    |                                                    | 3000  |      | nC    |
| R <sub>Gint</sub>    | T <sub>j</sub> = °C                                        |                                                    |                                                    | 1,25  |      | Ω     |
| t <sub>d(on)</sub>   | R <sub>Gon</sub> = 3,3 Ω                                   | V <sub>CC</sub> = 600V<br>I <sub>C</sub> = 300A    |                                                    | 200   | 400  | ns    |
| t <sub>r</sub>       |                                                            |                                                    |                                                    | 115   | 220  | ns    |
| E <sub>on</sub>      |                                                            |                                                    |                                                    | 38    |      | mJ    |
| t <sub>d(off)</sub>  | R <sub>Goff</sub> = 3,3 Ω                                  | T <sub>j</sub> = 125 °C<br>V <sub>GE</sub> = ± 15V |                                                    | 720   | 900  | ns    |
| t <sub>f</sub>       |                                                            |                                                    |                                                    | 80    | 100  | ns    |
| E <sub>off</sub>     |                                                            |                                                    |                                                    | 40    |      | mJ    |
| R <sub>th(j-c)</sub> | per IGBT                                                   |                                                    |                                                    | 0,045 |      | K/W   |



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## IGBT Modules

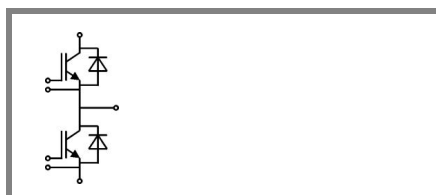
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#### Typical Applications\*

- Switching (not for linear use)



**GA**

| Characteristics           |                                                         |                                       |           |       |       |
|---------------------------|---------------------------------------------------------|---------------------------------------|-----------|-------|-------|
| Symbol                    | Conditions                                              | min.                                  | typ.      | max.  | Units |
| <b>Inverse Diode</b>      |                                                         |                                       |           |       |       |
| $V_F = V_{EC}$            | $I_{F\text{nom}} = 300 \text{ A}; V_{GE} = 0 \text{ V}$ |                                       |           |       |       |
|                           | $T_j = 25^\circ\text{C}_{\text{chiplev.}}$              |                                       | 2         | 2,5   | V     |
|                           | $T_j = 125^\circ\text{C}_{\text{chiplev.}}$             |                                       | 1,8       |       | V     |
| $V_{F0}$                  |                                                         |                                       |           |       |       |
|                           | $T_j = 25^\circ\text{C}$                                |                                       | 1,1       | 1,2   | V     |
|                           | $T_j = 125^\circ\text{C}$                               |                                       |           |       | V     |
| $r_F$                     |                                                         |                                       |           |       |       |
|                           | $T_j = 25^\circ\text{C}$                                |                                       | 3         | 4,3   | mΩ    |
|                           | $T_j = 125^\circ\text{C}$                               |                                       |           |       | mΩ    |
| $I_{RRM}$                 | $I_F = 300 \text{ A}$                                   |                                       | 85        |       | A     |
| $Q_{rr}$                  | $di/dt = 2000 \text{ A}/\mu\text{s}$                    |                                       | 13        |       | μC    |
| $E_{rr}$                  | $V_{GE} = 0 \text{ V}; V_{CC} = 600 \text{ V}$          |                                       |           |       | mJ    |
| $R_{th(j-c)D}$            | per diode                                               |                                       |           | 0,125 | K/W   |
| <b>Freewheeling Diode</b> |                                                         |                                       |           |       |       |
| $V_F = V_{EC}$            | $I_{F\text{nom}} = \text{A}; V_{GE} = \text{V}$         |                                       |           |       | V     |
| $V_{F0}$                  |                                                         |                                       |           |       | V     |
|                           | $T_j = 25^\circ\text{C}$                                |                                       |           |       | V     |
|                           | $T_j = 125^\circ\text{C}$                               |                                       |           |       | V     |
| $r_F$                     |                                                         |                                       |           |       | V     |
|                           | $T_j = 25^\circ\text{C}$                                |                                       |           |       | V     |
|                           | $T_j = 125^\circ\text{C}$                               |                                       |           |       | V     |
| $I_{RRM}$                 | $I_F = \text{A}$                                        |                                       |           |       | A     |
| $Q_{rr}$                  |                                                         |                                       |           |       | μC    |
| $E_{rr}$                  | $V_{GE} = 0 \text{ V}; V_{CC} = 600 \text{ V}$          |                                       |           |       | mJ    |
|                           | per diode                                               |                                       |           |       | K/W   |
| <b>Module</b>             |                                                         |                                       |           |       |       |
| $L_{CE}$                  |                                                         |                                       | 15        | 20    | nH    |
| $R_{CC'+EE'}$             | res., terminal-chip                                     | $T_{\text{case}} = 25^\circ\text{C}$  | 0,18      |       | mΩ    |
|                           |                                                         | $T_{\text{case}} = 125^\circ\text{C}$ | 0,22      |       | 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 (M4)                                    |                                       | 2,5 (1,1) | 5 (2) | Nm    |
| w                         |                                                         |                                       |           | 330   | g     |

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

\* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our personal.

# SKM 400GA123D



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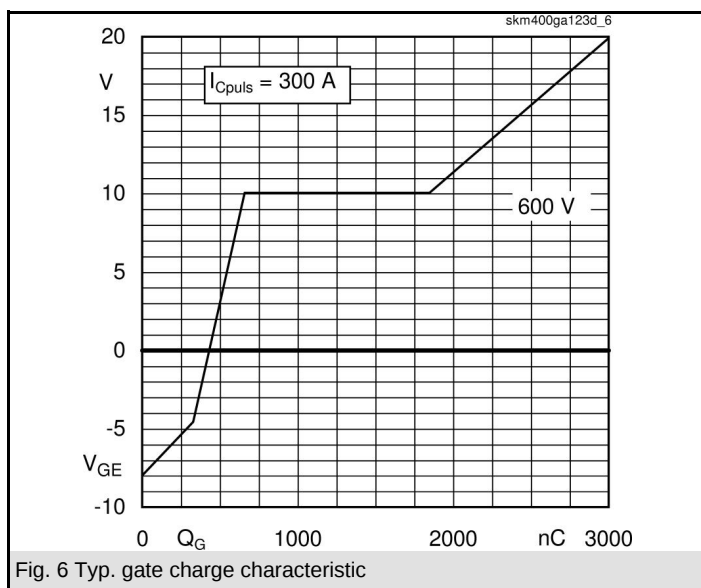
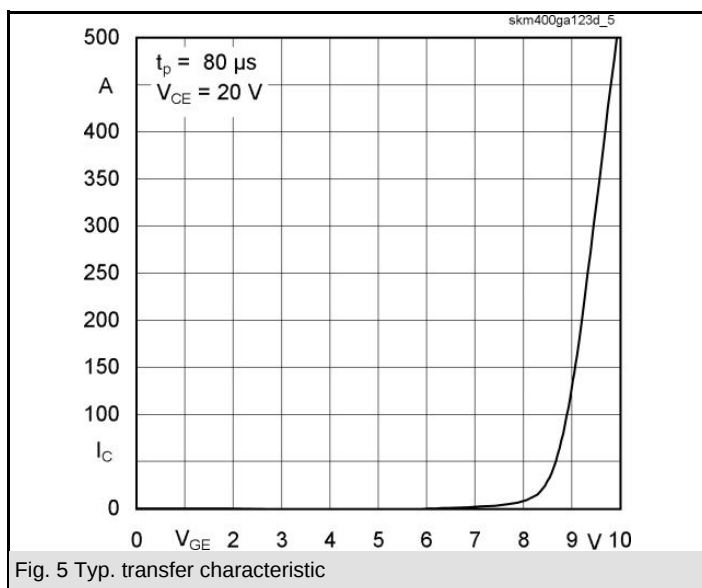
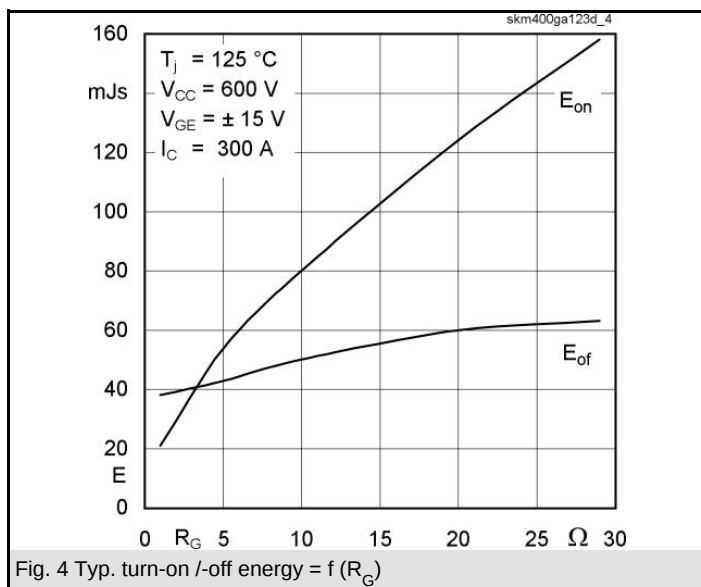
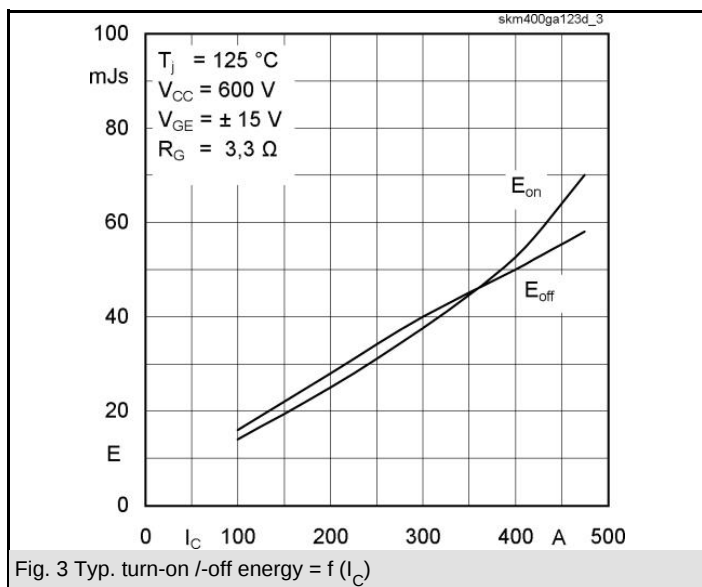
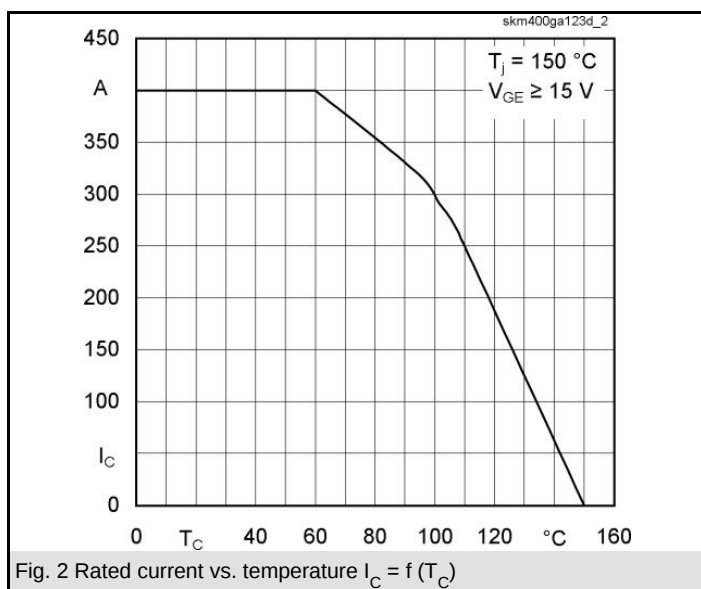
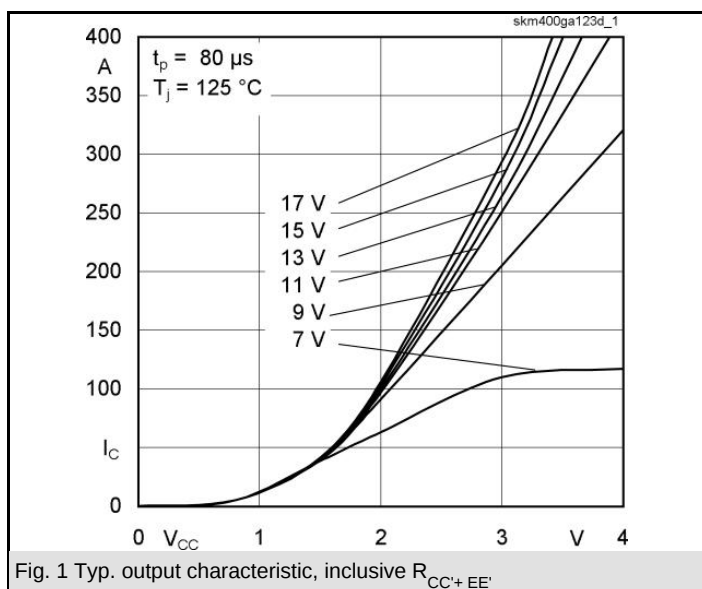
### Typical Applications\*

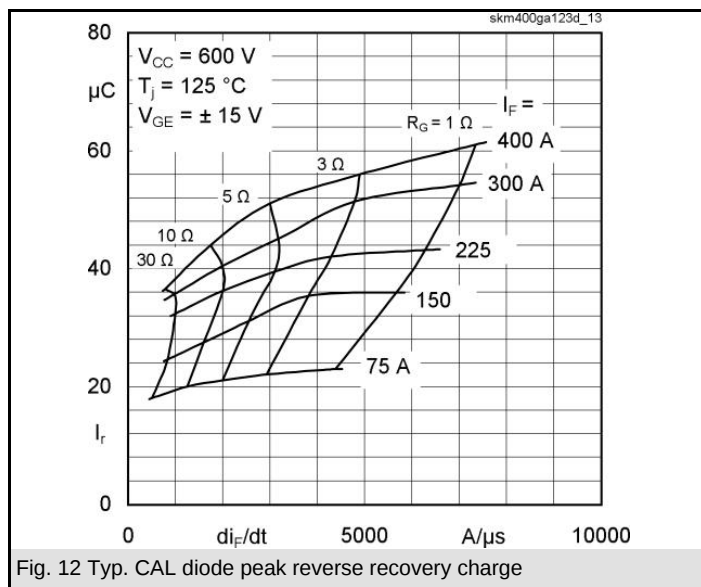
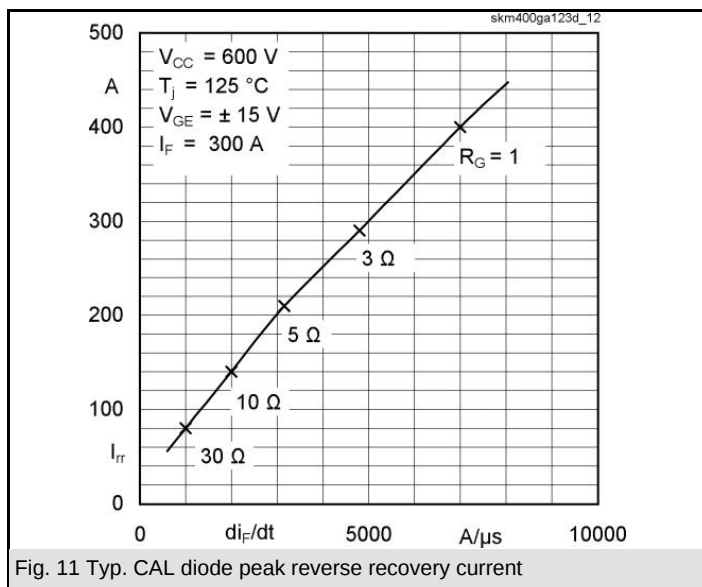
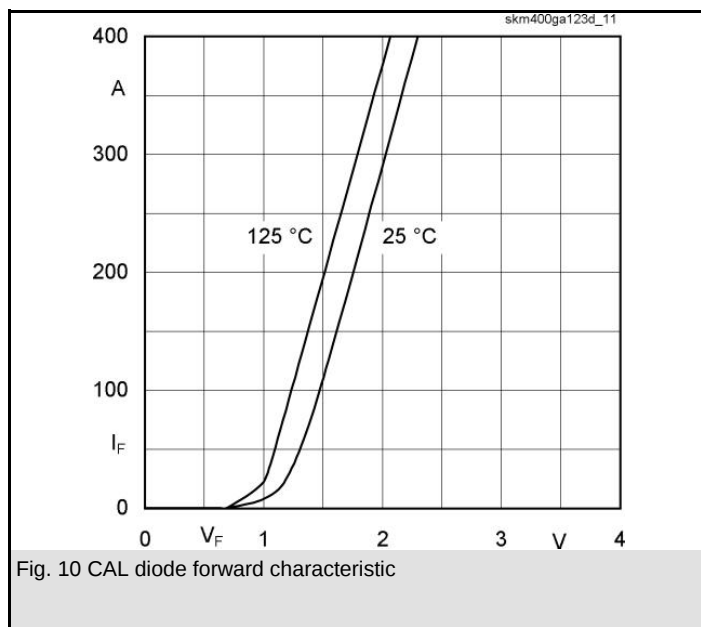
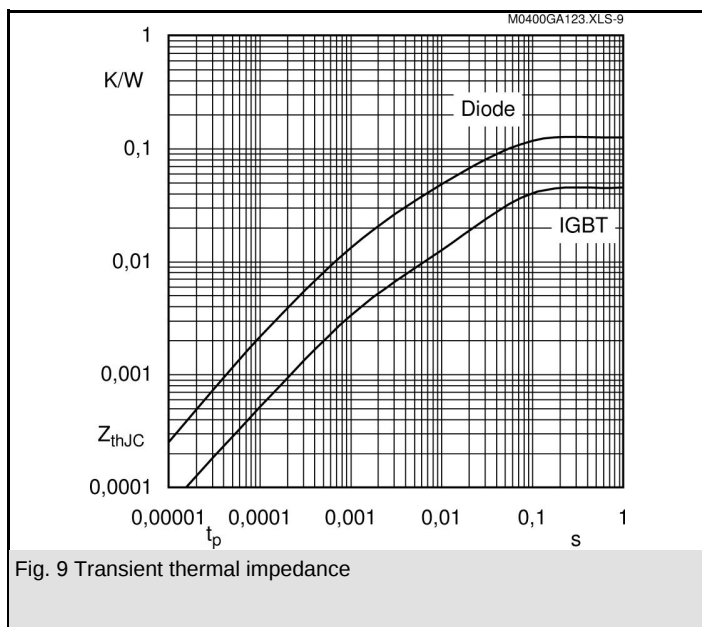
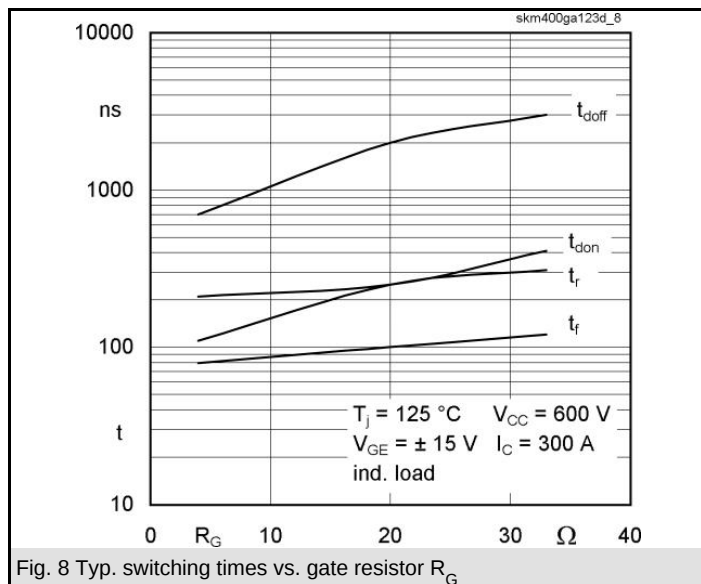
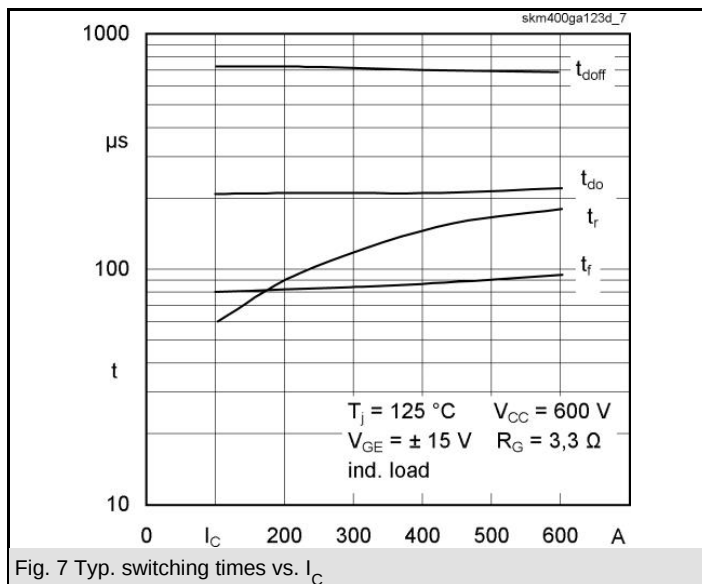
- Switching (not for linear use)



GA

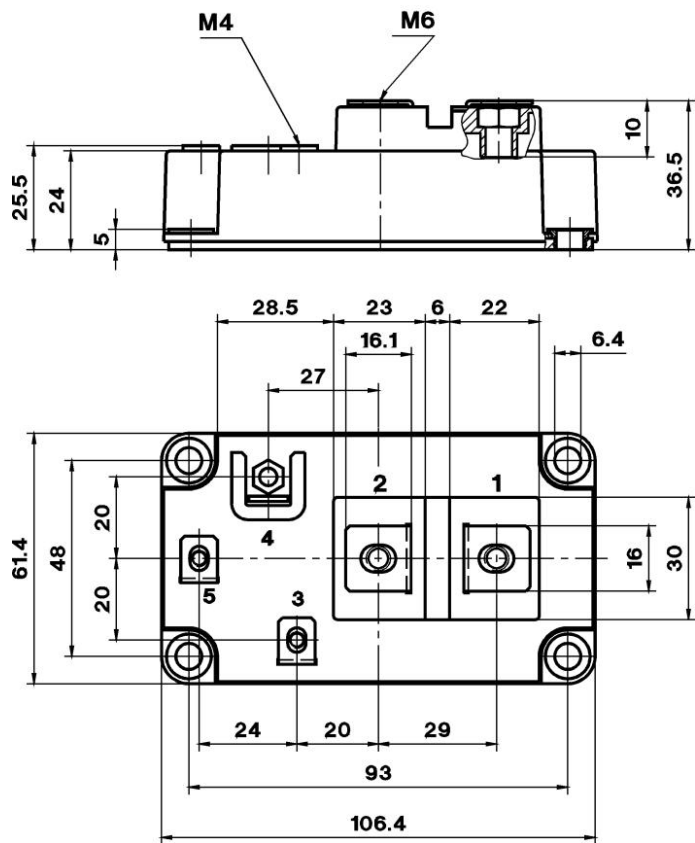
| $Z_{th}$       |            |        |       |
|----------------|------------|--------|-------|
| Symbol         | Conditions | Values | Units |
| $Z_{th(j-c)I}$ |            |        |       |
| $R_i$          | $i = 1$    | 33     | mk/W  |
| $R_i$          | $i = 2$    | 8,8    | mk/W  |
| $R_i$          | $i = 3$    | 2,6    | mk/W  |
| $R_i$          | $i = 4$    | 0,6    | mk/W  |
| $\tau_{u_i}$   | $i = 1$    | 0,05   | s     |
| $\tau_{u_i}$   | $i = 2$    | 0,009  | s     |
| $\tau_{u_i}$   | $i = 3$    | 0,0024 | s     |
| $\tau_{u_i}$   | $i = 4$    | 0,0001 | s     |
| $Z_{th(j-c)D}$ |            |        |       |
| $R_i$          | $i = 1$    | 85     | mk/W  |
| $R_i$          | $i = 2$    | 31     | mk/W  |
| $R_i$          | $i = 3$    | 7,8    | mk/W  |
| $R_i$          | $i = 4$    | 1,2    | mk/W  |
| $\tau_{u_i}$   | $i = 1$    | 0,0537 | s     |
| $\tau_{u_i}$   | $i = 2$    | 0,0086 | s     |
| $\tau_{u_i}$   | $i = 3$    | 0,003  | s     |
| $\tau_{u_i}$   | $i = 4$    | 0,0001 | s     |



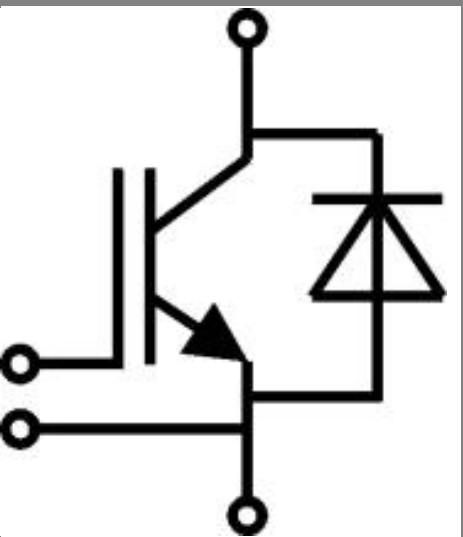


SKM 400GA123D

UL Recognized CSED59 File 63 532



Case D 59



GA Case D 59