

# SKM300GA12V



SEMITRANS® 4

## SKM300GA12V

### Features

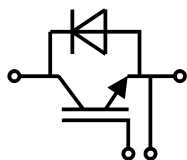
- V-IGBT = 6. Generation Trench V-IGBT (Fuji)
- CAL4 = Soft switching 4. Generation CAL-diode
- Isolated copper baseplate using DBC technology (Direct Copper Bonding)
- UL recognized, file no. E63532
- Increased power cycling capability
- With integrated gate resistor
- Low switching losses at high di/dt

### Typical Applications\*

- AC inverter drives
- UPS
- Electronic welders
- Switched reluctance motor

### Remarks

- Case temperature limited to  $T_c = 125^\circ\text{C}$  max, recomm.  $T_{op} = -40 \dots +150^\circ\text{C}$ , product rel. results valid for  $T_j = 150^\circ$



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| Absolute Maximum Ratings |  |                           |                  |
|--------------------------|--|---------------------------|------------------|
| Symbol                   | Conditions   | Values                    | Unit             |
| <b>IGBT</b>              |  |                           |                  |
| $V_{CES}$                | $T_j = 25^\circ\text{C}$                                     | 1200                      | V                |
| $I_C$                    | $T_j = 175^\circ\text{C}$                                    | $T_c = 25^\circ\text{C}$  | 420              |
|                          |  | $T_c = 80^\circ\text{C}$  | 319              |
| $I_{Cnom}$               |  | 300                       | A                |
| $I_{CRM}$                | $I_{CRM} = 3 \times I_{Cnom}$                                | 900                       | A                |
| $V_{GES}$                |  | -20 ... 20                | V                |
| $t_{psc}$                | $V_{CC} = 720\text{ V}$                                      | $T_j = 125^\circ\text{C}$ | 10               |
|                          | $V_{GE} \leq 20\text{ V}$                                    |                           |                  |
|                          | $V_{CES} \leq 1200\text{ V}$                                 |                           |                  |
| $T_j$                    |  | -40 ... 175               | $^\circ\text{C}$ |
| <b>Inverse diode</b>     |  |                           |                  |
| $I_F$                    | $T_j = 175^\circ\text{C}$                                    | $T_c = 25^\circ\text{C}$  | 353              |
|                          |  | $T_c = 80^\circ\text{C}$  | 264              |
| $I_{Fnom}$               |  | 300                       | A                |
| $I_{FRM}$                | $I_{FRM} = 3 \times I_{Fnom}$                                | 900                       | A                |
| $I_{FSM}$                | $t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$ | 1548                      | A                |
| $T_j$                    |  | -40 ... 175               | $^\circ\text{C}$ |
| <b>Module</b>            |  |                           |                  |
| $I_{t(RMS)}$             | $T_{terminal} = 80^\circ\text{C}$                            | 500                       | A                |
| $T_{stg}$                |  | -40 ... 125               | $^\circ\text{C}$ |
| $V_{isol}$               | AC sinus 50Hz, $t = 1\text{ min}$                            | 4000                      | V                |

| Characteristics |   |                           |       |      |                  |
|-----------------|---|---------------------------|-------|------|------------------|
| Symbol          | Conditions  | min.                      | typ.  | max. | Unit             |
| <b>IGBT</b>     |   |                           |       |      |                  |
| $V_{CE(sat)}$   | $I_C = 300\text{ A}$<br>$V_{GE} = 15\text{ V}$<br>chiplevel | $T_j = 25^\circ\text{C}$  | 1.85  | 2.30 | V                |
|                 |   | $T_j = 150^\circ\text{C}$ | 2.25  | 2.55 | V                |
| $V_{CE0}$       |   | $T_j = 25^\circ\text{C}$  | 0.94  | 1.04 | V                |
|                 |   | $T_j = 150^\circ\text{C}$ | 0.88  | 0.98 | V                |
| $r_{CE}$        | $V_{GE} = 15\text{ V}$                                      | $T_j = 25^\circ\text{C}$  | 3.03  | 4.2  | $\text{m}\Omega$ |
|                 |   | $T_j = 150^\circ\text{C}$ | 4.57  | 5.23 | $\text{m}\Omega$ |
| $V_{GE(th)}$    | $V_{GE} = V_{CE}, I_C = 12\text{ mA}$                       | 5.5                       | 6     | 6.5  | V                |
| $I_{CES}$       | $V_{GE} = 0\text{ V}$<br>$V_{CE} = 1200\text{ V}$           | $T_j = 25^\circ\text{C}$  | 0.1   | 0.3  | $\text{mA}$      |
|                 |   | $T_j = 150^\circ\text{C}$ |       |      | $\text{mA}$      |
| $C_{ies}$       | $V_{CE} = 25\text{ V}$                                      |                           | 18    |      | nF               |
| $C_{oes}$       | $V_{GE} = 0\text{ V}$                                       |                           | 1.77  |      | nF               |
| $C_{res}$       |   |                           | 1.768 |      | nF               |
| $Q_G$           | $V_{GE} = -8\text{ V} \dots +15\text{ V}$                   |                           | 3310  |      | nC               |
| $R_{Gint}$      |   |                           | 2.5   |      | $\Omega$         |
| $t_{d(on)}$     | $V_{CC} = 600\text{ V}$<br>$I_C = 300\text{ A}$             | $T_j = 150^\circ\text{C}$ | 340   |      | ns               |
| $t_r$           | $V_{GE} = \pm 15\text{ V}$                                  | $T_j = 150^\circ\text{C}$ | 48    |      | ns               |
| $E_{on}$        | $R_{Gon} = 2.5\ \Omega$                                     | $T_j = 150^\circ\text{C}$ | 23    |      | mJ               |
| $t_{d(off)}$    | $R_{Goff} = 2.5\ \Omega$                                    | $T_j = 150^\circ\text{C}$ | 576   |      | ns               |
| $t_f$           | $di/dt_{on} = 7700\text{ A}/\mu\text{s}$                    | $T_j = 150^\circ\text{C}$ | 69    |      | ns               |
| $E_{off}$       | $di/dt_{off} = 3500\text{ A}/\mu\text{s}$                   | $T_j = 150^\circ\text{C}$ | 33    |      | mJ               |
|                 | $du/dt_{off} = 7500\text{ V}/\mu\text{s}$                   |                           |       |      |                  |
| $R_{th(j-c)}$   | per IGBT  |                           |       | 0.11 | K/W              |



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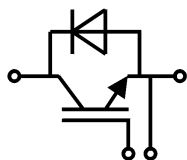
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| Characteristics      |   |                           |      |      |       |               |
|----------------------|---|---------------------------|------|------|-------|---------------|
| Symbol               | Conditions  |                           | min. | typ. | max.  | Unit          |
| <b>Inverse diode</b> |   |                           |      |      |       |               |
| $V_F = V_{EC}$       | $I_F = 300\text{ A}$<br>$V_{GE} = 0\text{ V}$<br>chip | $T_j = 25^\circ\text{C}$  |      | 2.17 | 2.49  | V             |
|                      |   | $T_j = 150^\circ\text{C}$ |      | 2.11 | 2.42  | V             |
| $V_{F0}$             |   | $T_j = 25^\circ\text{C}$  |      | 1.3  | 1.5   | V             |
|                      |   | $T_j = 150^\circ\text{C}$ |      | 0.9  | 1.1   | V             |
| $r_F$                |   | $T_j = 25^\circ\text{C}$  |      | 2.9  | 3.3   | m $\Omega$    |
|                      |   | $T_j = 150^\circ\text{C}$ |      | 4.0  | 4.4   | m $\Omega$    |
| $I_{RRM}$            | $I_F = 300\text{ A}$                                  | $T_j = 150^\circ\text{C}$ |      | 350  |       | A             |
| $Q_{rr}$             | $di/dt_{off} = 8500\text{ A}/\mu\text{s}$             | $T_j = 150^\circ\text{C}$ |      | 45   |       | $\mu\text{C}$ |
| $E_{rr}$             | $V_{GE} = \pm 15\text{ V}$<br>$V_{CC} = 600\text{ V}$ | $T_j = 150^\circ\text{C}$ |      | 21   |       | mJ            |
| $R_{th(j-c)}$        | per diode   |                           |      |      | 0.17  | K/W           |
| <b>Module</b>        |   |                           |      |      |       |               |
| $L_{CE}$             |   |                           |      | 15   | 20    | nH            |
| $R_{CC'+EE'}$        | terminal-chip   | $T_c = 25^\circ\text{C}$  |      | 0.18 |       | m $\Omega$    |
|                      |   | $T_c = 125^\circ\text{C}$ |      | 0.22 |       | m $\Omega$    |
| $R_{th(c-s)}$        | per module  |                           |      | 0.02 | 0.038 | K/W           |
| $M_s$                | to heat sink M6                                       |                           |      | 3    | 5     | Nm            |
| $M_t$                |   | to terminals M6,<br>M4    |      | 2.5  | 5     | Nm            |
|                      |   |                           |      |      |       | Nm            |
| $w$                  |   |                           |      |      | 330   | g             |



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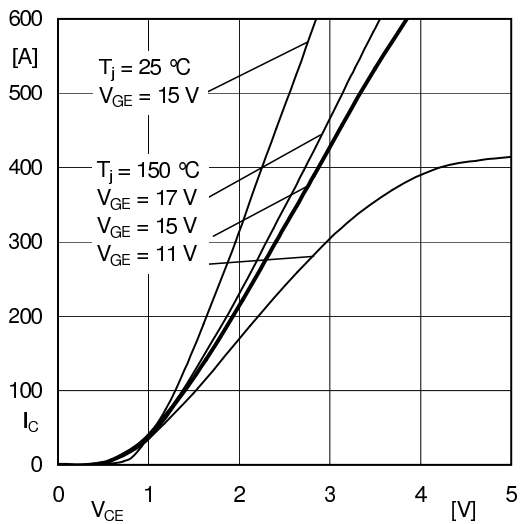


Fig. 1: Typ. output characteristic, inclusive R<sub>CC+EE</sub>

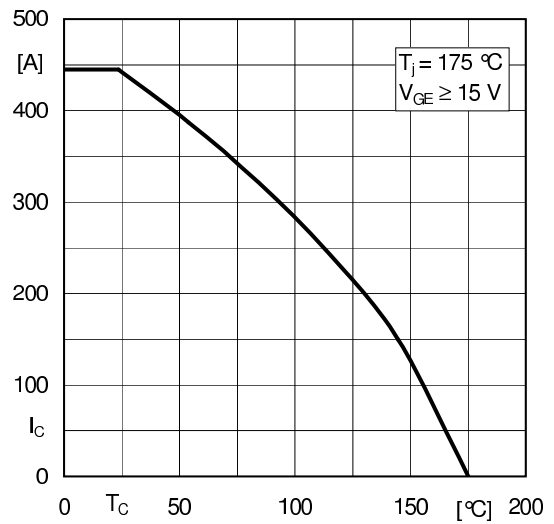


Fig. 2: Rated current vs. temperature I<sub>C</sub> = f(T<sub>C</sub>)

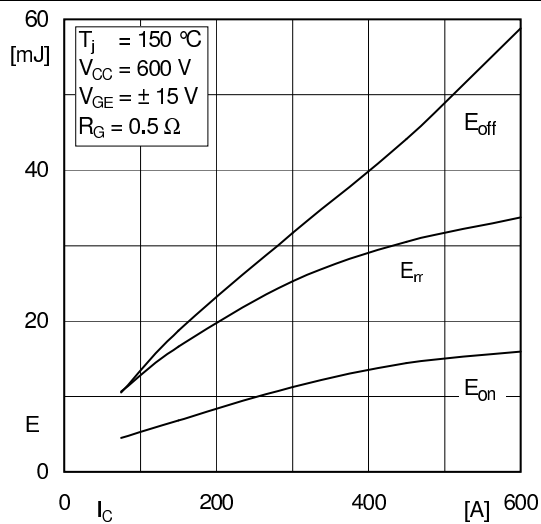


Fig. 3: Typ. turn-on /-off energy = f(I<sub>C</sub>)

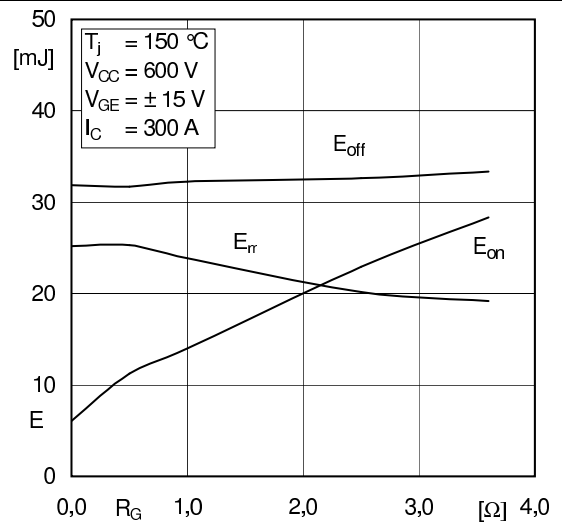


Fig. 4: Typ. turn-on /-off energy = f(R<sub>G</sub>)

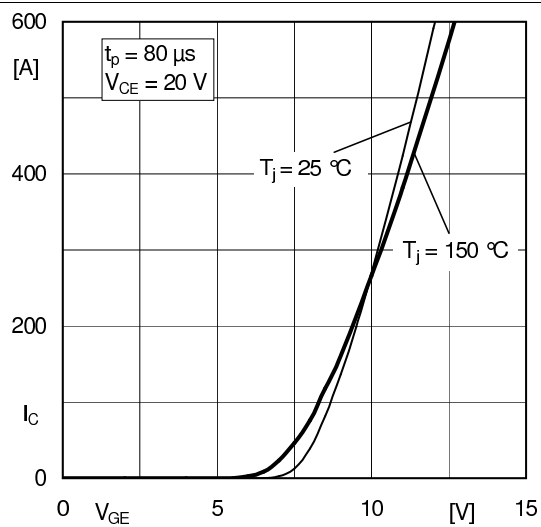


Fig. 5: Typ. transfer characteristic

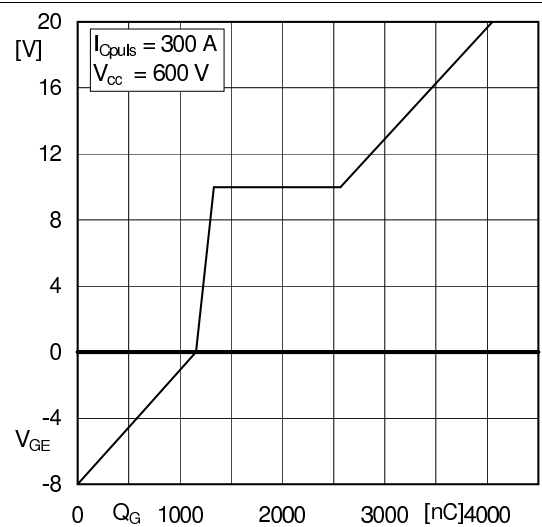


Fig. 6: Typ. gate charge characteristic

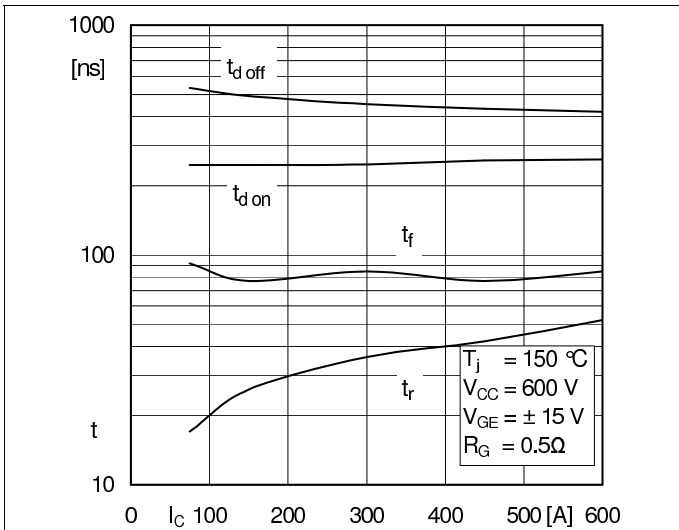


Fig. 7: Typ. switching times vs.  $I_C$

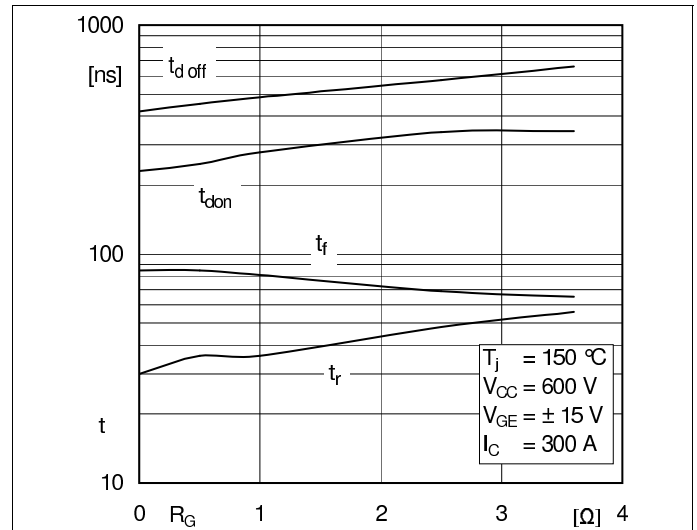


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

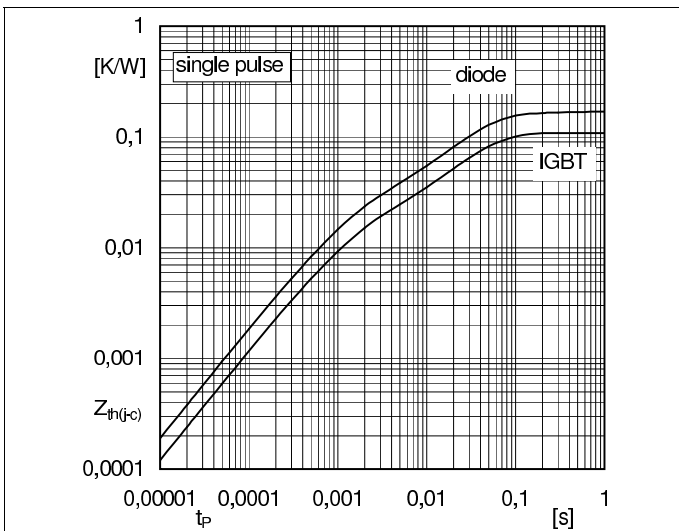


Fig. 9: Transient thermal impedance

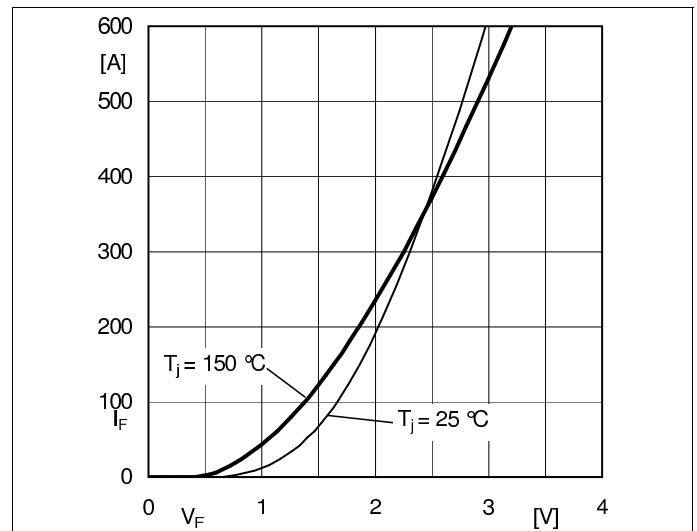


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

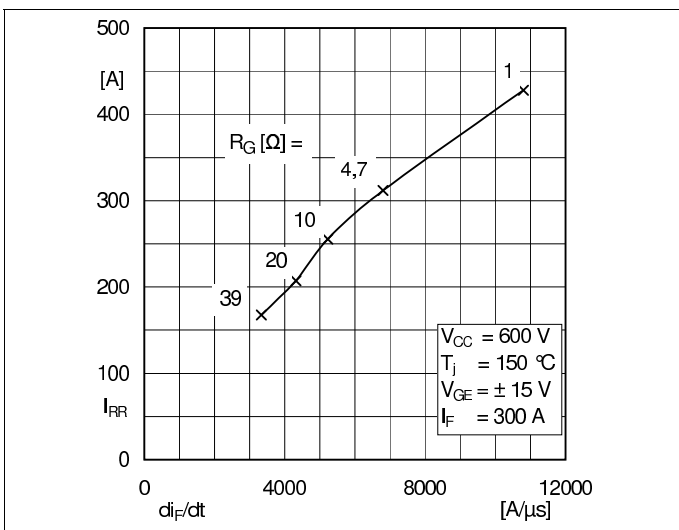


Fig. 11: CAL diode peak reverse recovery current

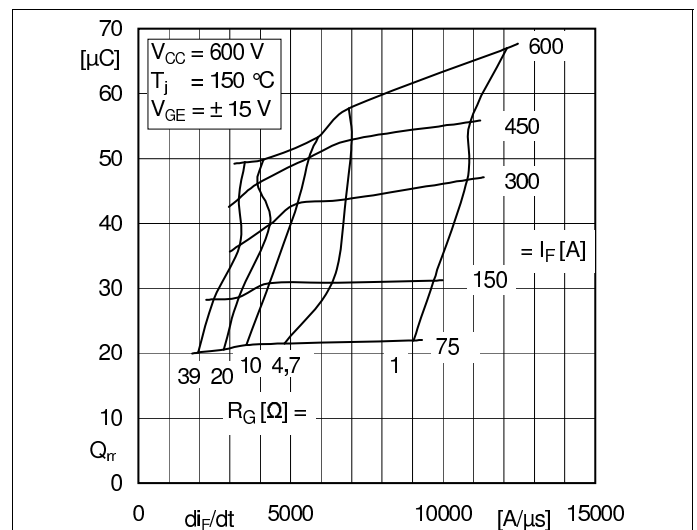


Fig. 12: Typ. CAL diode peak reverse recovery charge

