

# SEMiX303GB12Vs



SEMiX® 3s

## SEMiX303GB12Vs

### Features

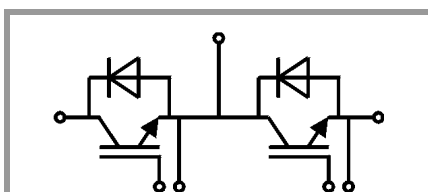
- Homogeneous Si
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

### Typical Applications\*

- AC inverter drives
- UPS
- Electronic Welding

### Remarks

- Case temperature limited to  $T_C=125^\circ\text{C}$  max.
- Product reliability results are valid for  $T_J=150^\circ\text{C}$
- Dynamic values apply to the following combination of resistors:  
 $R_{Gon,main} = 1,0 \Omega$   
 $R_{Goff,main} = 1,0 \Omega$   
 $R_{G,X} = 2,2 \Omega$   
 $R_{E,X} = 1,0 \Omega$



GB

| Absolute Maximum Ratings |                                                                                |                         |             |      |
|--------------------------|--------------------------------------------------------------------------------|-------------------------|-------------|------|
| Symbol                   | Conditions                                                                     |                         | Values      | Unit |
| IGBT                     |                                                                                |                         |             |      |
| V <sub>CES</sub>         | T <sub>j</sub> = 25 °C                                                         |                         | 1200        | V    |
| I <sub>C</sub>           | T <sub>j</sub> = 175 °C                                                        | T <sub>c</sub> = 25 °C  | 448         | A    |
|                          |                                                                                | T <sub>c</sub> = 80 °C  | 342         | A    |
| I <sub>Cnom</sub>        |                                                                                |                         | 300         | A    |
| I <sub>CRM</sub>         | I <sub>CRM</sub> = 3xI <sub>Cnom</sub>                                         |                         | 900         | A    |
| V <sub>GES</sub>         |                                                                                |                         | -20 ... 20  | V    |
| t <sub>psc</sub>         | V <sub>CC</sub> = 720 V<br>V <sub>GE</sub> ≤ 15 V<br>V <sub>CES</sub> ≤ 1200 V | T <sub>j</sub> = 125 °C | 10          | μs   |
| T <sub>j</sub>           |                                                                                |                         | -40 ... 175 | °C   |
| Inverse diode            |                                                                                |                         |             |      |
| I <sub>F</sub>           | T <sub>j</sub> = 175 °C                                                        | T <sub>c</sub> = 25 °C  | 327         | A    |
|                          |                                                                                | T <sub>c</sub> = 80 °C  | 244         | A    |
| I <sub>Fnom</sub>        |                                                                                |                         | 300         | A    |
| I <sub>FRM</sub>         | I <sub>FRM</sub> = 3xI <sub>Fnom</sub>                                         |                         | 900         | A    |
| I <sub>FSM</sub>         | t <sub>p</sub> = 10 ms, sin 180°, T <sub>j</sub> = 25 °C                       |                         | 1485        | A    |
| T <sub>j</sub>           |                                                                                |                         | -40 ... 175 | °C   |
| Module                   |                                                                                |                         |             |      |
| I <sub>t(RMS)</sub>      | T <sub>terminal</sub> = 80 °C                                                  |                         | 600         | A    |
| T <sub>stg</sub>         |                                                                                |                         | -40 ... 125 | °C   |
| V <sub>isol</sub>        | AC sinus 50Hz, t = 1 min                                                       |                         | 4000        | V    |

| Characteristics      |                                                                                                         |                         |      |      |      |      |
|----------------------|---------------------------------------------------------------------------------------------------------|-------------------------|------|------|------|------|
| Symbol               | Conditions                                                                                              |                         | min. | typ. | max. | Unit |
| IGBT                 |                                                                                                         |                         |      |      |      |      |
| V <sub>CE(sat)</sub> | I <sub>C</sub> = 300 A                                                                                  | T <sub>j</sub> = 25 °C  |      | 1.75 | 2.2  | V    |
|                      | V <sub>GE</sub> = 15 V<br>chipelevel                                                                    | T <sub>j</sub> = 150 °C |      | 2.2  | 2.5  | V    |
| V <sub>CE0</sub>     |                                                                                                         | T <sub>j</sub> = 25 °C  |      | 0.94 | 1.04 | V    |
|                      |                                                                                                         | T <sub>j</sub> = 150 °C |      | 0.88 | 0.98 | V    |
| r <sub>CE</sub>      | V <sub>GE</sub> = 15 V                                                                                  | T <sub>j</sub> = 25 °C  |      | 2.7  | 3.9  | mΩ   |
|                      |                                                                                                         | T <sub>j</sub> = 150 °C |      | 4.4  | 5.1  | mΩ   |
| V <sub>GE(th)</sub>  | V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> = 12 mA                                               |                         | 5.5  | 6    | 6.5  | V    |
| I <sub>CES</sub>     | V <sub>GE</sub> = 0 V                                                                                   | T <sub>j</sub> = 25 °C  |      | 0.1  | 0.3  | mA   |
|                      | V <sub>CE</sub> = 1200 V                                                                                | T <sub>j</sub> = 150 °C |      |      |      | mA   |
| C <sub>ies</sub>     | V <sub>CE</sub> = 25 V<br>V <sub>GE</sub> = 0 V                                                         | f = 1 MHz               |      | 18.0 |      | nF   |
| C <sub>oes</sub>     |                                                                                                         | f = 1 MHz               |      | 1.77 |      | nF   |
| C <sub>res</sub>     |                                                                                                         | f = 1 MHz               |      | 1.77 |      | nF   |
| Q <sub>G</sub>       | V <sub>GE</sub> = - 8 V...+ 15 V                                                                        |                         |      | 3300 |      | nC   |
| R <sub>Gint</sub>    | T <sub>j</sub> = 25 °C                                                                                  |                         |      | 2.50 |      | Ω    |
| t <sub>d(on)</sub>   | V <sub>CC</sub> = 600 V                                                                                 | T <sub>j</sub> = 150 °C |      | 470  |      | ns   |
| t <sub>r</sub>       | I <sub>C</sub> = 300 A                                                                                  | T <sub>j</sub> = 150 °C |      | 72   |      | ns   |
| E <sub>on</sub>      | V <sub>GE</sub> = ±15 V                                                                                 | T <sub>j</sub> = 150 °C |      | 26.5 |      | mJ   |
| t <sub>d(off)</sub>  | R <sub>G on</sub> = 2.1 Ω                                                                               | T <sub>j</sub> = 150 °C |      | 665  |      | ns   |
| t <sub>f</sub>       | R <sub>G off</sub> = 2.1 Ω                                                                              | T <sub>j</sub> = 150 °C |      | 109  |      | ns   |
| E <sub>off</sub>     | di/dt <sub>on</sub> = 4200 A/μs<br>di/dt <sub>off</sub> = 2600 A/μs<br>du/dt <sub>off</sub> = 6600 V/μs | T <sub>j</sub> = 150 °C |      | 36.3 |      | mJ   |
| R <sub>th(j-c)</sub> | per IGBT                                                                                                |                         |      |      | 0.1  | K/W  |

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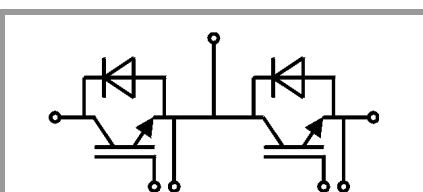
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### Remarks

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| Characteristics                  |                                                                                               |                         |             |      |      |      |
|----------------------------------|-----------------------------------------------------------------------------------------------|-------------------------|-------------|------|------|------|
| Symbol                           | Conditions                                                                                    |                         | min.        | typ. | max. | Unit |
| Inverse diode                    |                                                                                               |                         |             |      |      |      |
| V <sub>F</sub> = V <sub>EC</sub> | I <sub>F</sub> = 300 A                                                                        | T <sub>j</sub> = 25 °C  |             | 2.2  | 2.52 | V    |
|                                  | V <sub>GE</sub> = 0 V<br>chip                                                                 | T <sub>j</sub> = 150 °C |             | 2.2  | 2.5  | V    |
| V <sub>F0</sub>                  |                                                                                               | T <sub>j</sub> = 25 °C  | 1.1         | 1.3  | 1.5  | V    |
|                                  |                                                                                               | T <sub>j</sub> = 150 °C | 0.7         | 0.9  | 1.1  | V    |
| r <sub>F</sub>                   |                                                                                               | T <sub>j</sub> = 25 °C  | 2.7         | 3.0  | 3.4  | mΩ   |
|                                  |                                                                                               | T <sub>j</sub> = 150 °C | 3.5         | 4.2  | 4.6  | mΩ   |
| I <sub>RRM</sub>                 | I <sub>F</sub> = 300 A                                                                        | T <sub>j</sub> = 150 °C | 283         |      |      | A    |
| Q <sub>rr</sub>                  | di/dt <sub>off</sub> = 4600 A/μs                                                              | T <sub>j</sub> = 150 °C | 52          |      |      | μC   |
| E <sub>rr</sub>                  | V <sub>GE</sub> = -15 V<br>V <sub>CC</sub> = 600 V                                            | T <sub>j</sub> = 150 °C | 21.4        |      |      | mJ   |
| R <sub>th(j-c)</sub>             | per diode                                                                                     |                         | 0.19        |      |      | K/W  |
| Module                           |                                                                                               |                         |             |      |      |      |
| L <sub>CE</sub>                  |                                                                                               |                         | 20          |      |      | nH   |
| R <sub>CC'+EE'</sub>             | res., terminal-chip                                                                           | T <sub>C</sub> = 25 °C  | 0.7         |      |      | mΩ   |
|                                  |                                                                                               | T <sub>C</sub> = 125 °C | 1           |      |      | mΩ   |
| R <sub>th(c-s)</sub>             | per module                                                                                    |                         | 0.04        |      |      | K/W  |
| M <sub>s</sub>                   | to heat sink (M5)                                                                             |                         | 3           | 5    |      | Nm   |
| M <sub>t</sub>                   |                                                                                               | to terminals (M6)       | 2.5         | 5    |      | Nm   |
|                                  |                                                                                               |                         |             | Nm   |      |      |
| w                                |                                                                                               |                         | 300         |      |      | g    |
| Temperatur Sensor                |                                                                                               |                         |             |      |      |      |
| R <sub>100</sub>                 | T <sub>c</sub> =100°C (R <sub>25</sub> =5 kΩ)                                                 |                         | 493 ± 5%    |      |      | Ω    |
| B <sub>100/125</sub>             | R <sub>(T)</sub> =R <sub>100</sub> exp[B <sub>100/125</sub> (1/T-1/T <sub>100</sub> )]; T[K]; |                         | 3550<br>±2% |      |      | K    |



GB

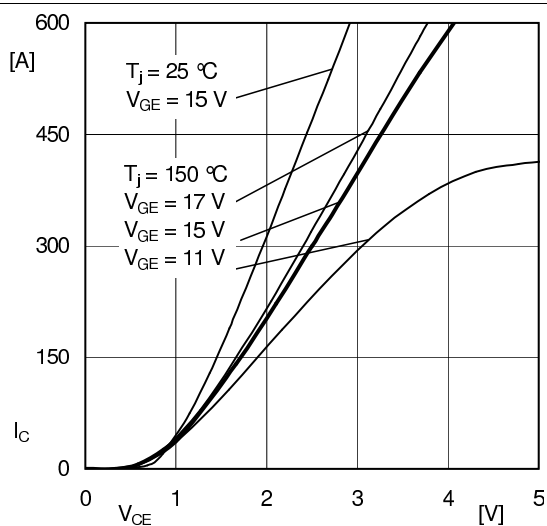


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

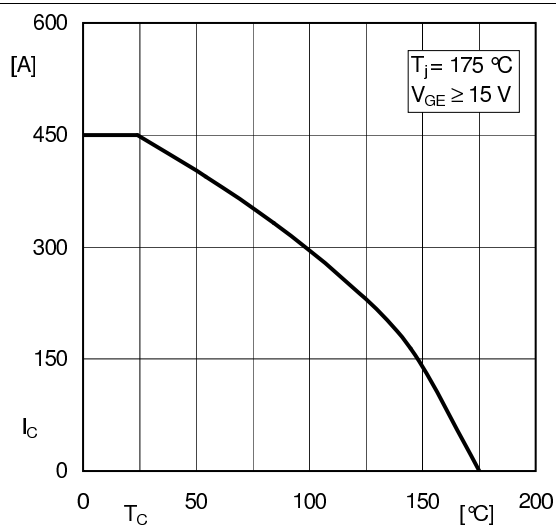


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

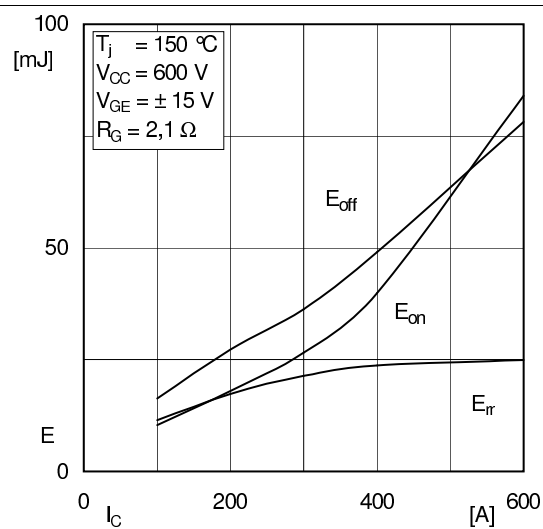


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

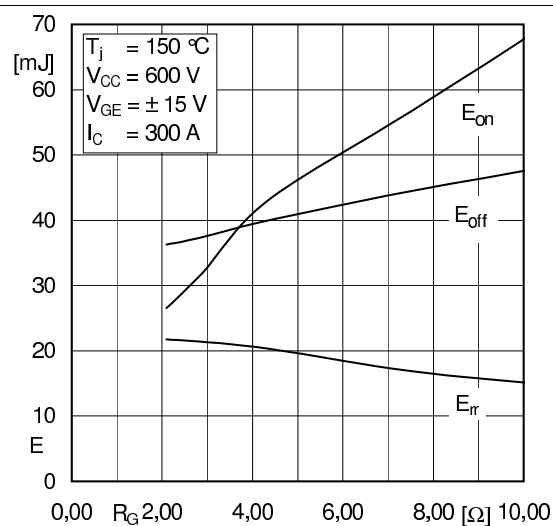


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

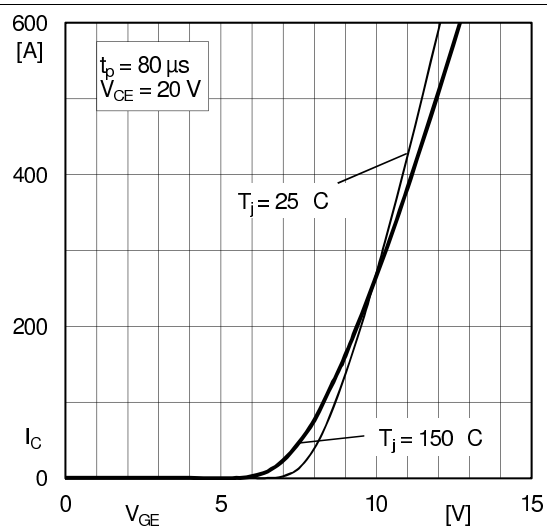


Fig. 5: Typ. transfer characteristic

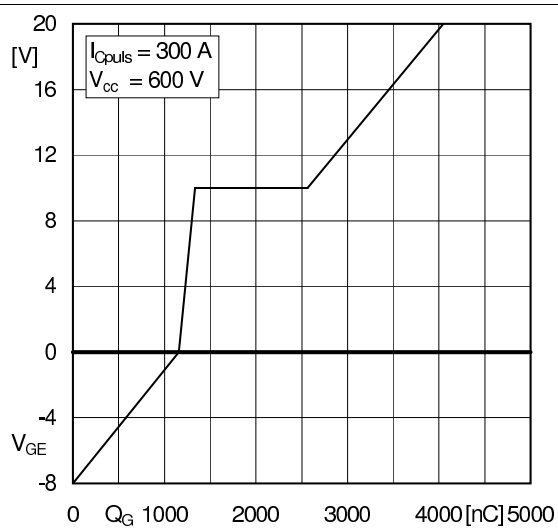


Fig. 6: Typ. gate charge characteristic

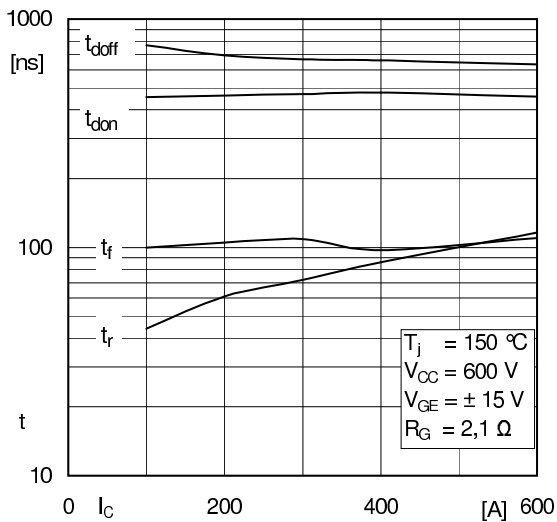


Fig. 7: Typ. switching times vs.  $I_C$

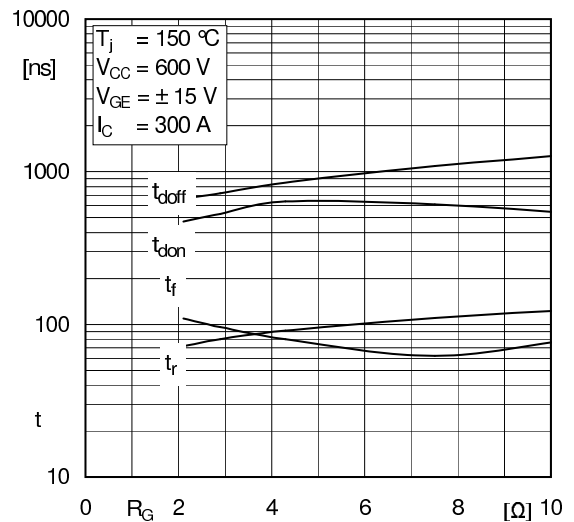


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

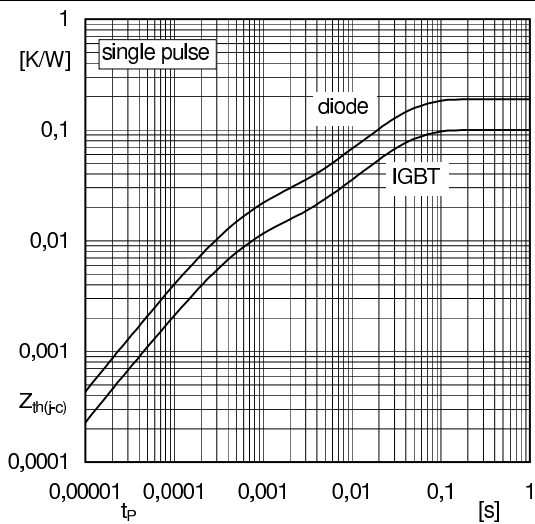


Fig. 9: Typ. transient thermal impedance

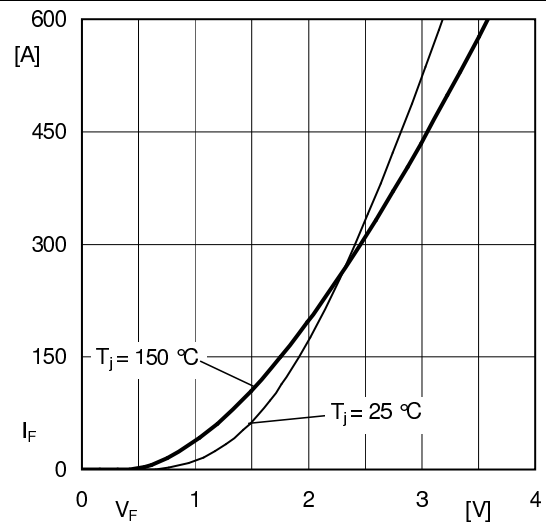


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC'+EE'}$

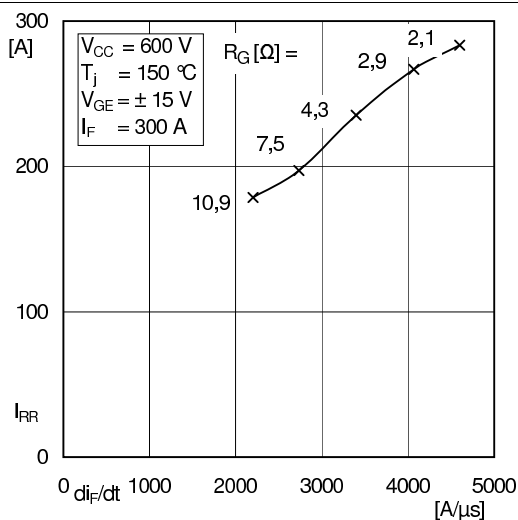


Fig. 11: Typ. CAL diode peak reverse recovery current

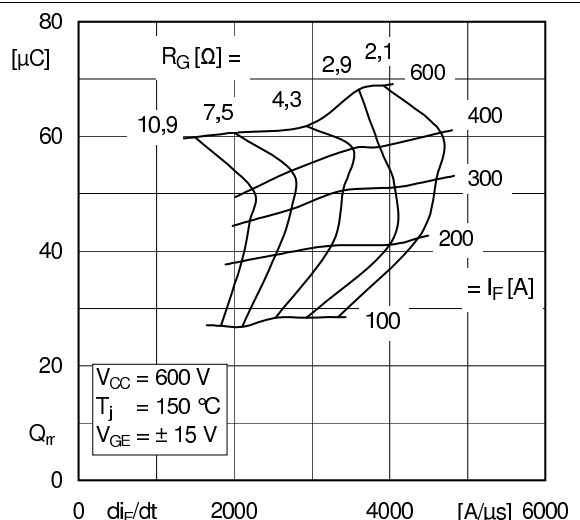


Fig. 12: Typ. CAL diode recovery charge

