# SEMiX453GB12E4s


**SEMiX® 3s**

Trench IGBT Modules

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### Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

### Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

### Remarks

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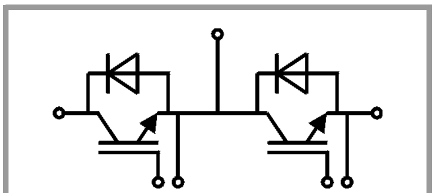

GB

| Absolute Maximum Ratings | | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Unit** |
| **IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 683 | A |
| | | $T_c$ = 80 °C | 526 | A |
| $I_{Cnom}$ | | | 450 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3x$I_{Cnom}$ | | 1350 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V<br>$V_{GE}$ ≤ 20 V<br>$V_{CES}$ ≤ 1200 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse diode** | | | | |
| $I_F$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 544 | A |
| | | $T_c$ = 80 °C | 407 | A |
| $I_{Fnom}$ | | | 450 | A |
| $I_{FRM}$ | $I_{FRM}$ = 3x$I_{Fnom}$ | | 1350 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 25 °C | | 2430 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | $T_{terminal}$ = 80 °C | | 600 | A |
| $T_{stg}$ | | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50Hz, t = 1 min | | 4000 | V |

| Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 450 A<br>$V_{GE}$ = 15 V<br>chiplevel | $T_j$ = 25 °C | | 1.8 | 2.05 | V |
| | | $T_j$ = 150 °C | | 2.2 | 2.4 | V |
| $V_{CE0}$ | | $T_j$ = 25 °C | | 0.8 | 0.9 | V |
| | | $T_j$ = 150 °C | | 0.7 | 0.8 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V | $T_j$ = 25 °C | | 2.2 | 2.6 | mΩ |
| | | $T_j$ = 150 °C | | 3.3 | 3.6 | mΩ |
| $V_{GE(th)}$ | $V_{GE}$=$V_{CE}$, $I_C$ = 18 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V<br>$V_{CE}$ = 1200 V | $T_j$ = 25 °C | | 0.1 | 0.3 | mA |
| | | $T_j$ = 150 °C | | | | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V<br>$V_{GE}$ = 0 V | f = 1 MHz | | 27.9 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 1.74 | | nF |
| $C_{res}$ | | f = 1 MHz | | 1.53 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 2550 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 1.67 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V<br>$I_C$ = 450 A<br>$V_{GE}$ = ±15 V<br>$R_{G\ on}$ = 1.9 Ω<br>$R_{G\ off}$ = 1.9 Ω<br>di/dt$_{on}$ = 4000 A/µs<br>di/dt$_{off}$ = 5000 A/µs | $T_j$ = 150 °C | | 336 | | ns |
| $t_r$ | | $T_j$ = 150 °C | | 80 | | ns |
| $E_{on}$ | | $T_j$ = 150 °C | | 45 | | mJ |
| $t_{d(off)}$ | | $T_j$ = 150 °C | | 615 | | ns |
| $t_f$ | | $T_j$ = 150 °C | | 130 | | ns |
| $E_{off}$ | | $T_j$ = 150 °C | | 66.5 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0.065 | K/W |

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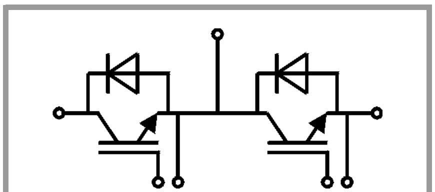
| **Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| **Inverse diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 450 A<br>$V_{GE}$ = 0 V<br>chip | $T_j$ = 25 °C | | 2.1 | 2.46 | V |
| | | $T_j$ = 150 °C | | 2.1 | 2.4 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | 1.1 | 1.3 | 1.5 | V |
| | | $T_j$ = 150 °C | 0.7 | 0.9 | 1.1 | V |
| $r_F$ | | $T_j$ = 25 °C | 1.4 | 1.9 | 2.1 | mΩ |
| | | $T_j$ = 150 °C | 2.2 | 2.6 | 2.8 | mΩ |
| $I_{RRM}$ | $I_F$ = 450 A<br>di/dt$_{off}$ = 5000 A/µs<br>$V_{GE}$ = -15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 350 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 70 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 28 | | mJ |
| $R_{th(j-c)}$ | per diode | | | | 0.11 | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 20 | | nH |
| $R_{CC'+EE'}$ | res., terminal-chip | $T_C$ = 25 °C | | 0.7 | | mΩ |
| | | $T_C$ = 125 °C | | 1 | | mΩ |
| $R_{th(c-s)}$ | per module | | | 0.04 | | K/W |
| $M_s$ | to heat sink (M5) | | 3 | | 5 | Nm |
| $M_t$ | | to terminals (M6) | 2.5 | | 5 | Nm |
| | | | | | | Nm |
| w | | | | | 300 | g |
| **Temperatur Sensor** | | | | | | |
| $R_{100}$ | $T_c$=100°C ($R_{25}$=5 kΩ) | | | 493 ± 5% | | Ω |
| $B_{100/125}$ | $R_{(T)}=R_{100}exp[B_{100/125}(1/T-1/T_{100})]$; T[K]; | | | 3550<br>±2% | | K |



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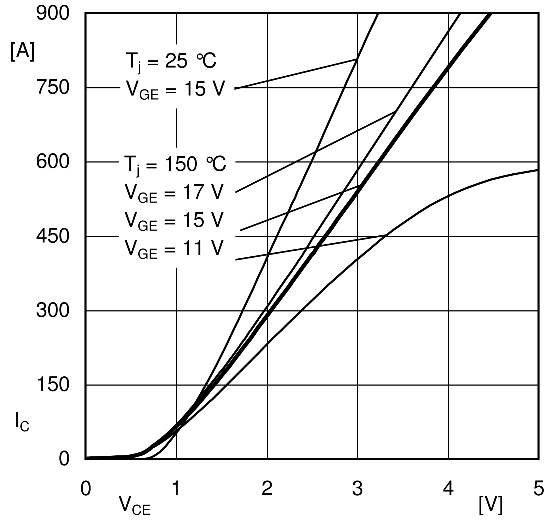



Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

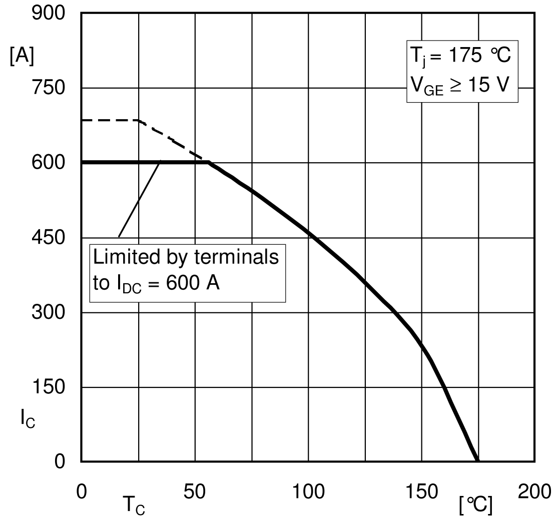



Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

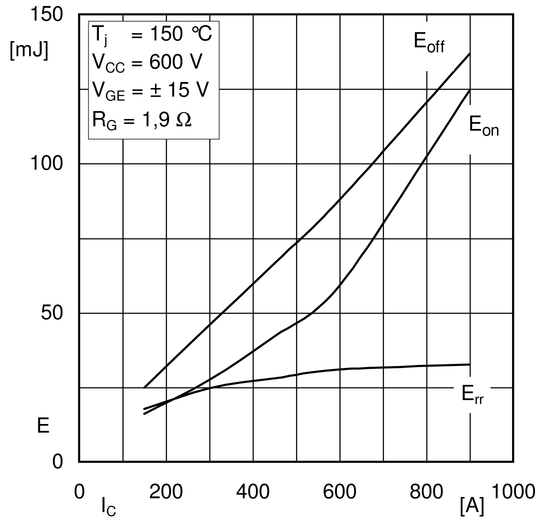



Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

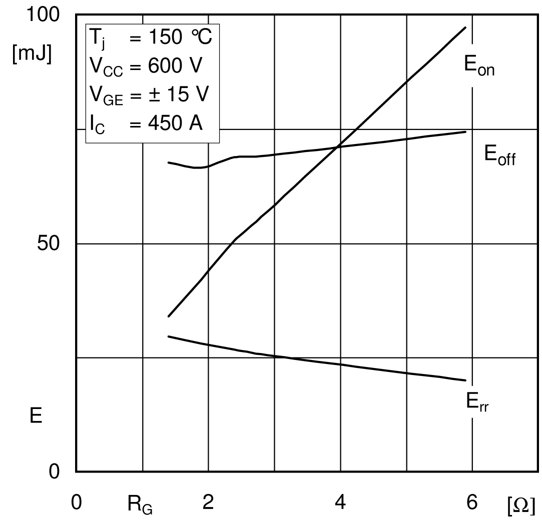



Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

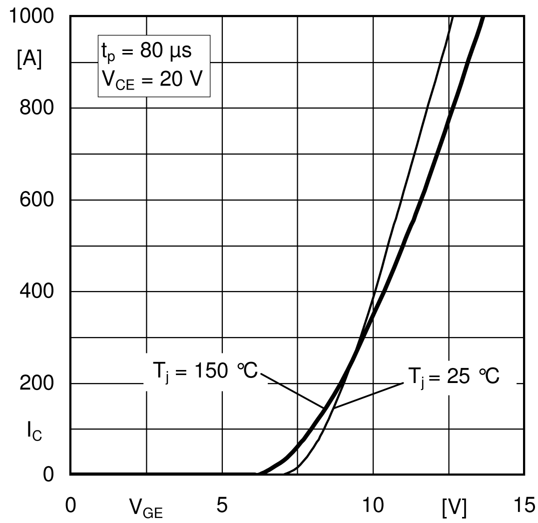



Fig. 5: Typ. transfer characteristic

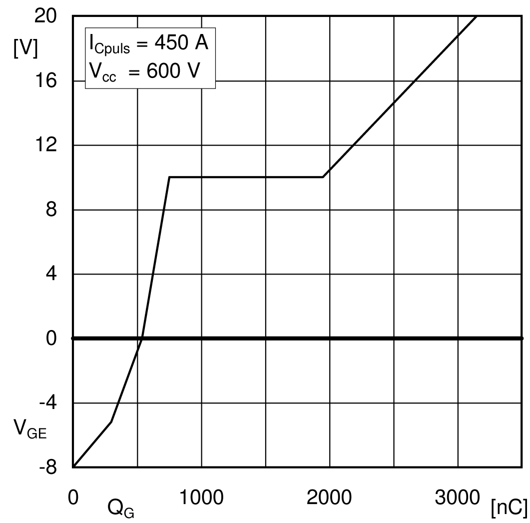



Fig. 6: Typ. gate charge characteristic

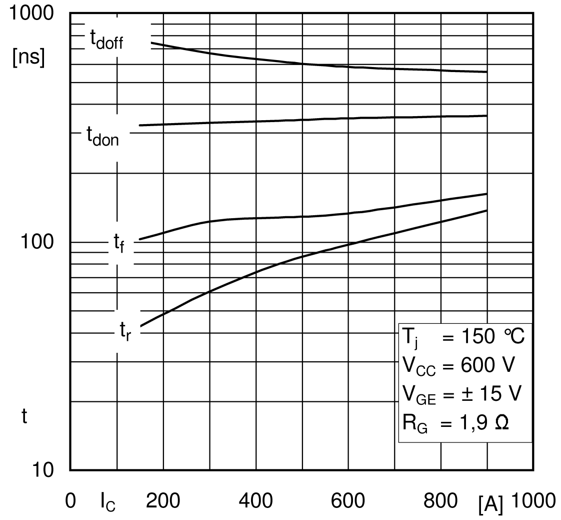



Fig. 7: Typ. switching times vs. $I_C$

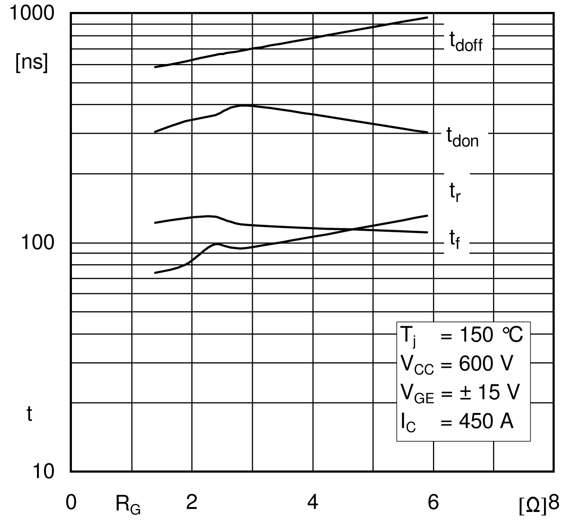



Fig. 8: Typ. switching times vs. gate resistor $R_G$

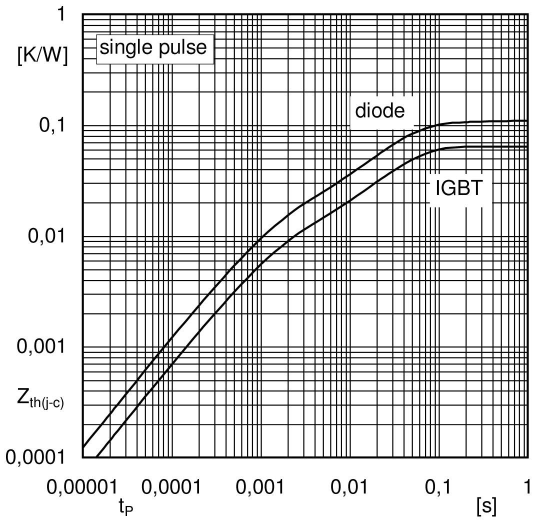



Fig. 9: Typ. transient thermal impedance

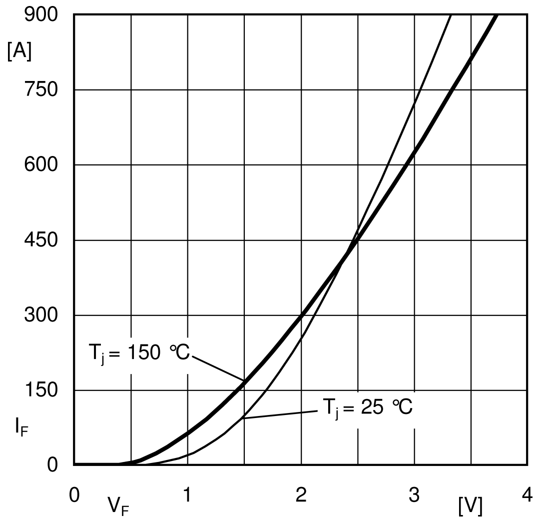



Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

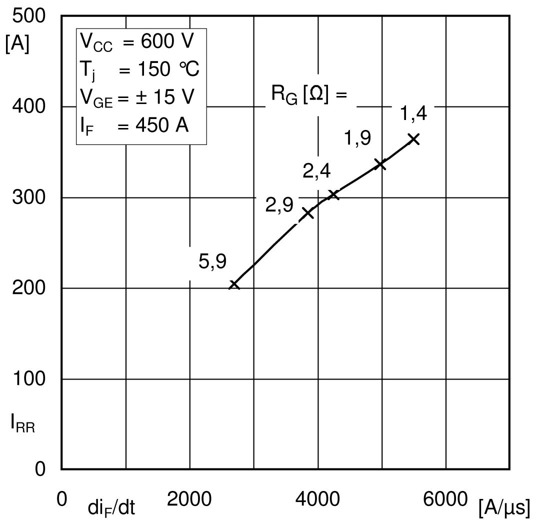



Fig. 11: Typ. CAL diode peak reverse recovery current

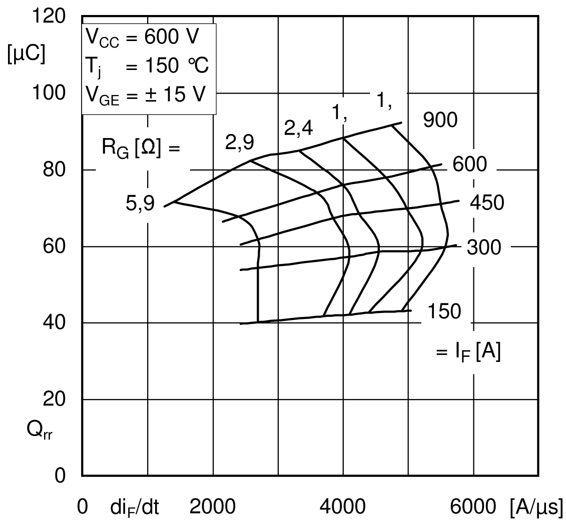
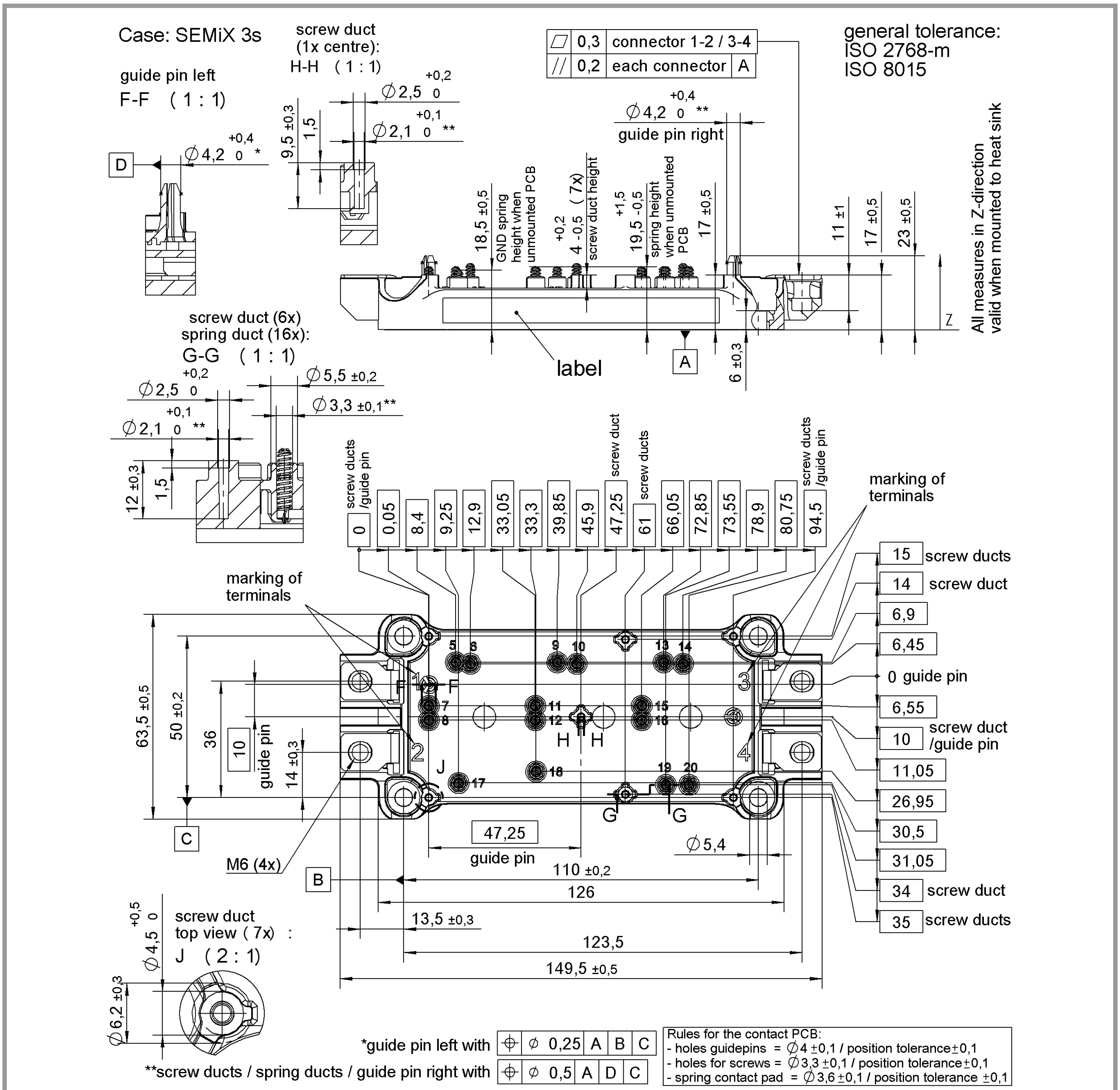



Fig. 12: Typ. CAL diode recovery charge

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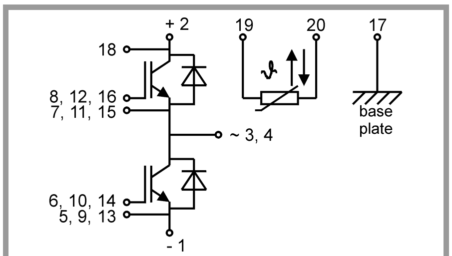


spring configuration

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 staff.