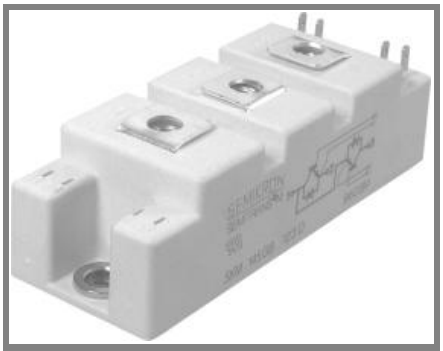
# SKM 145GB176D ...



**SEMITRANS® 2**

## Trench IGBT Modules

**SKM 145GB176D**

**SKM 145GAL176D**

### Features

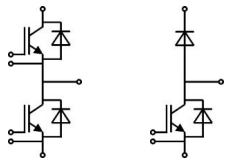
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_C$

### Typical Applications

- AC inverter drives mains 575 - 750 V AC
- Public transport (auxiliary systems

### Remarks

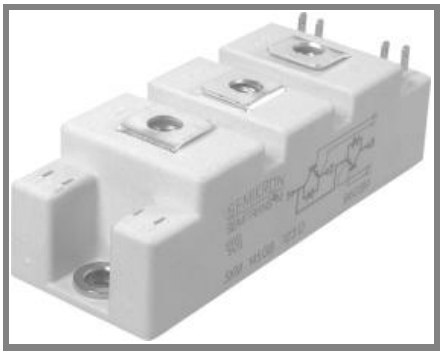
- Take care of over-voltage caused by stray inductances.
- Short circuit: Soft $R_G$ necessary!



**GB** **GAL**

| **Absolute Maximum Ratings** | $T_{case}$ = 25°C, unless otherwise specified | | | |
|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | **Units** |
| **IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1700 | V |
| $I_C$ | $T_j$ = 150 °C | $T_{case}$ = 25 °C | 160 | A |
| | | $T_{case}$ = 80 °C | 120 | A |
| $I_{CRM}$ | $I_{CRM}$=2x$I_{Cnom}$ | | 200 | A |
| $V_{GES}$ | | | ± 20 | V |
| $t_{psc}$ | $V_{CC}$ = 1200 V; $V_{GE} \leq$ 20 V; $V_{CES}$ < 1700 V | $T_j$ = 125 °C | 10 | µs |
| **Inverse Diode** | | | | |
| $I_F$ | $T_j$ = 150 °C | $T_{case}$ = 25 °C | 140 | A |
| | | $T_{case}$ = 80 °C | 100 | A |
| $I_{FRM}$ | $I_{FRM}$=2x$I_{Fnom}$ | | 200 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin. | $T_j$ = 150 °C | 1400 | A |
| **Freewheeling Diode** | | | | |
| $I_F$ | $T_j$ = 150 °C | $T_{case}$ = 25 °C | 140 | A |
| | | $T_{case}$ = 80 °C | 100 | A |
| $I_{FRM}$ | $I_{FRM}$=2x$I_{Fnom}$ | | 200 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin. | $T_j$ = 150 °C | 1400 | A |
| **Module** | | | | |
| $I_{t(RMS)}$ | | | 200 | A |
| $T_{vj}$ | | | - 40 ... +150 | °C |
| $T_{stg}$ | | | - 40 ... +125 | °C |
| $V_{isol}$ | AC, 1 min. | | 4000 | V |

| **Characteristics** | $T_{case}$ = 25°C, unless otherwise specified | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **min.** | **typ.** | **max.** | **Units** |
| **IGBT** | | | | | | |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 3,5 mA | | 5,2 | 5,8 | 6,4 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = $V_{CES}$ | $T_j$ = 25 °C | | 0,1 | 0,3 | mA |
| $V_{CE0}$ | | $T_j$ = 25 °C | | 1 | 1,2 | V |
| | | $T_j$ = 125 °C | | 0,9 | 1,1 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V | $T_j$ = 25°C | | 10 | 12,5 | mΩ |
| | | $T_j$ = 125°C | | 15 | | mΩ |
| $V_{CE(sat)}$ | $I_{Cnom}$ = 100 A, $V_{GE}$ = 15 V | $T_j$ = 25°C$_{chiplev.}$ | | 2 | 2,45 | V |
| | | $T_j$ = 125°C$_{chiplev.}$ | | 2,4 | | V |
| $C_{ies}$ | $V_{CE}$ = 25, $V_{GE}$ = 0 V | f = 1 MHz | | 7,1 | | nF |
| $C_{oes}$ | | | | 0,37 | | nF |
| $C_{res}$ | | | | 0,29 | | nF |
| $Q_G$ | $V_{GE}$ = -8V...+15V | | | 800 | | nC |
| $t_{d(on)}$ | $R_{Gon}$ = 1 Ω | $V_{CC}$ = 1200V | | 250 | | ns |
| $t_r$ | | $I_C$= 100A | | 32 | | ns |
| $E_{on}$ | | $T_j$ = 125 °C | | 60 | | mJ |
| $t_{d(off)}$ | $R_{Goff}$ = 1 Ω | $V_{GE}$ = ± 15 V | | 630 | | ns |
| $t_f$ | | | | 145 | | ns |
| $E_{off}$ | | | | 38 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0,19 | K/W |



**SEMITRANS® 2**

## Trench IGBT Modules

**SKM 145GB176D**

**SKM 145GAL176D**

### Features

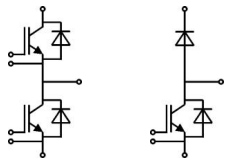
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_C$

### Typical Applications

- AC inverter drives mains 575 - 750 V AC
- Public transport (auxiliary systems

### Remarks

- Take care of over-voltage caused by stray inductances.
- Short circuit: Soft $R_G$ necessary!



**GB** **GAL**

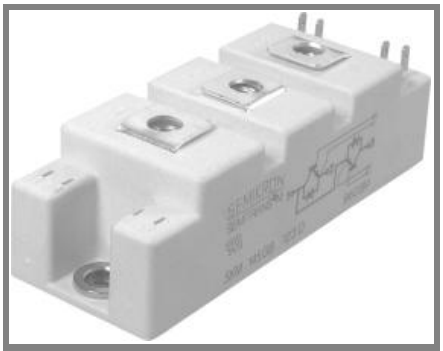
**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Units |
|---|---|---|---|---|---|---|
| **Inverse Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_{Fnom}$ = 100 A; $V_{GE}$ = 0 V | $T_j$ = 25 °C$_{chiplev.}$ | | 1,6 | 1,9 | V |
| | | $T_j$ = 125 °C$_{chiplev.}$ | | 1,6 | 1,9 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1,1 | 1,3 | V |
| | | $T_j$ = 125 °C | | 0,9 | 1,1 | V |
| $r_F$ | | $T_j$ = 25 °C | | 5 | 6 | mΩ |
| | | $T_j$ = 125 °C | | 7 | 8 | mΩ |
| $I_{RRM}$ | $I_F$ = 100 A | $T_j$ = 125 °C | | 77 | | A |
| $Q_{rr}$ | di/dt = 2450 A/µs | | | 39,5 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V; $V_{CC}$ = 1200 V | | | 27,5 | | mJ |
| $R_{th(j-c)D}$ | per diode | | | | 0,36 | K/W |
| **Freewheeling Diode** | | | | | | |
| $V_F = V_{EC}$ | $I_{Fnom}$ = 100 A; $V_{GE}$ = 0 V | $T_j$ = 25 °C$_{chiplev.}$ | | 1,6 | 1,9 | V |
| | | $T_j$ = 125 °C$_{chiplev.}$ | | 1,6 | 1,9 | V |
| $V_{F0}$ | | $T_j$ = 25 °C | | 1,1 | 1,3 | V |
| | | $T_j$ = 125 °C | | 0,9 | 1,1 | V |
| $r_F$ | | $T_j$ = 25 °C | | 5 | 6 | V |
| | | $T_j$ = 125 °C | | 7 | 8 | V |
| $I_{RRM}$ | $I_F$ = 100 A | $T_j$ = 125 °C | | 77 | | A |
| $Q_{rr}$ | di/dt = 2450 A/µs | | | 39,5 | | µC |
| $E_{rr}$ | $V_{GE}$ = -15 V; $V_{CC}$ = 1200 V | | | 27,5 | | mJ |
| $R_{th(j-c)FD}$ | per diode | | | | 0,36 | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | | 30 | nH |
| $R_{CC'+EE'}$ | res., terminal-chip | $T_{case}$= 25 °C | | 0,75 | | mΩ |
| | | $T_{case}$= 125 °C | | 1 | | mΩ |
| $R_{th(c-s)}$ | per module | | | | 0,05 | K/W |
| $M_s$ | to heat sink M6 | | 3 | | 5 | Nm |
| $M_t$ | to terminals M5 | | 2,5 | | 5 | Nm |
| w | | | | | 160 | g |

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

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.



**SEMITRANS® 2**

## Trench IGBT Modules

**SKM 145GB176D**

**SKM 145GAL176D**

### Features

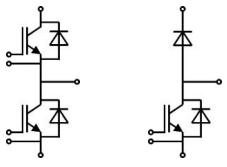
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x $I_C$

### Typical Applications

- AC inverter drives mains 575 - 750 V AC
- Public transport (auxiliary systems

### Remarks

- Take care of over-voltage caused by stray inductances.
- Short circuit: Soft $R_G$ necessary!



**GB** **GAL**

| $Z_{th}$ Symbol | Conditions | Values | Units |
|---|---|---|---|
| **$Z_{th(j-c)I}$** | | | |
| $R_i$ | i = 1 | 115 | mk/W |
| $R_i$ | i = 2 | 38,5 | mk/W |
| $R_i$ | i = 3 | 5,7 | mk/W |
| $R_i$ | i = 4 | 0,8 | mk/W |
| $tau_i$ | i = 1 | 0,0306 | s |
| $tau_i$ | i = 2 | 0,0852 | s |
| $tau_i$ | i = 3 | 0,004 | s |
| $tau_i$ | i = 4 | 0,0003 | s |
| **$Z_{th(j-c)D}$** | | | |
| $R_i$ | i = 1 | 190 | mk/W |
| $R_i$ | i = 2 | 80 | mk/W |
| $R_i$ | i = 3 | 25 | mk/W |
| $R_i$ | i = 4 | 5 | mk/W |
| $tau_i$ | i = 1 | 0,0475 | s |
| $tau_i$ | i = 2 | 0,0163 | s |
| $tau_i$ | i = 3 | 0,0011 | s |
| $tau_i$ | i = 4 | 0,0002 | s |

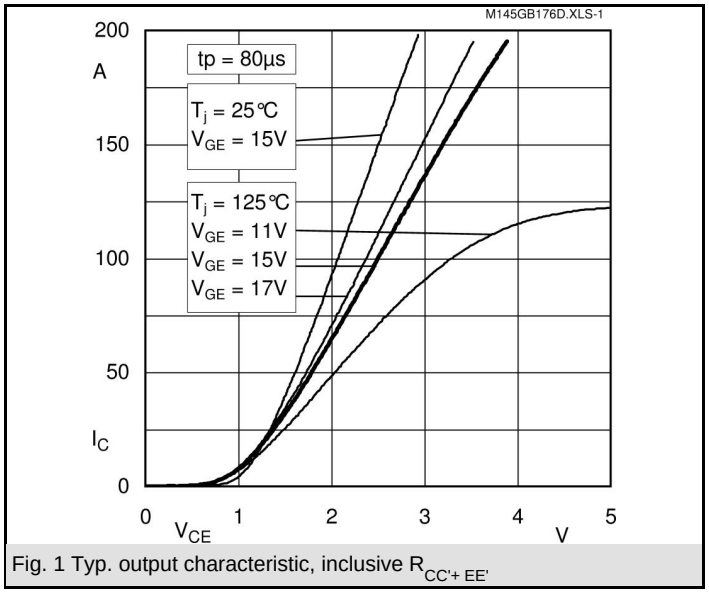



Fig. 1 Typ. output characteristic, inclusive $R_{CC'+ EE'}$

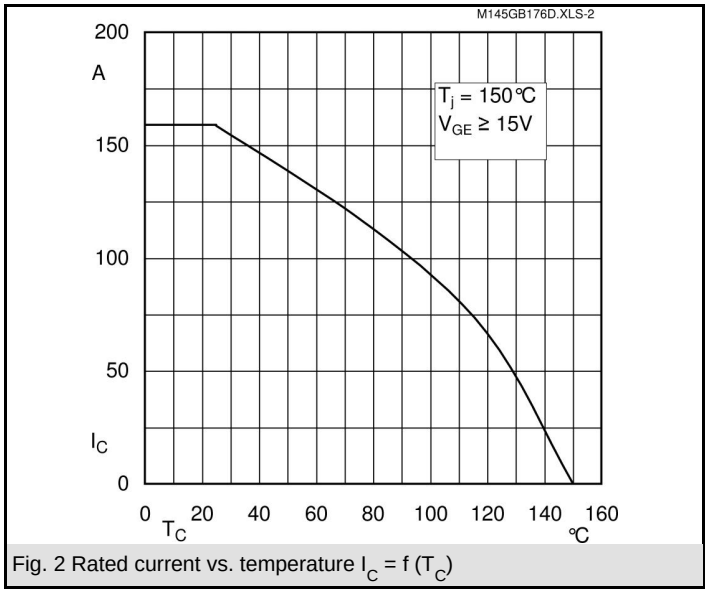



Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

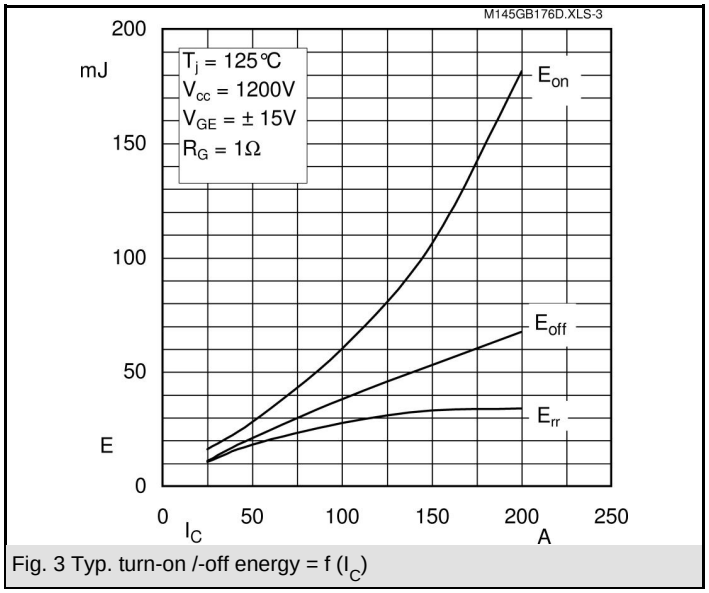



Fig. 3 Typ. turn-on /-off energy = f ($I_C$)

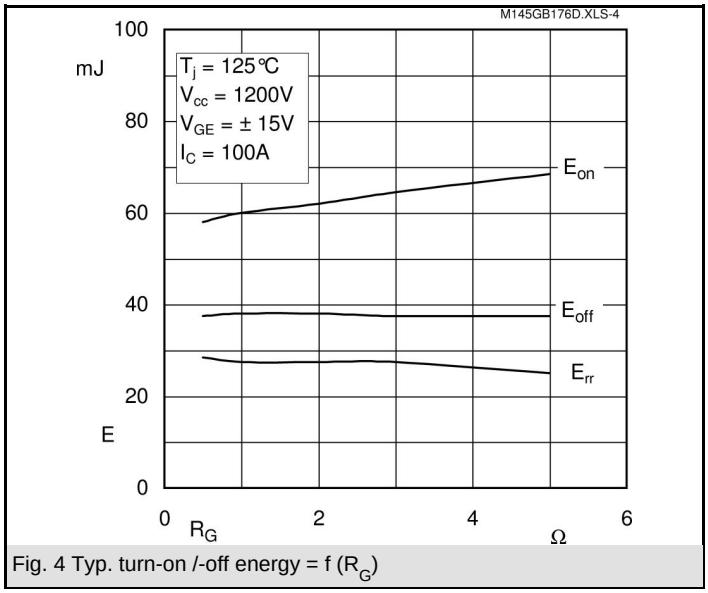



Fig. 4 Typ. turn-on /-off energy = f ($R_G$)

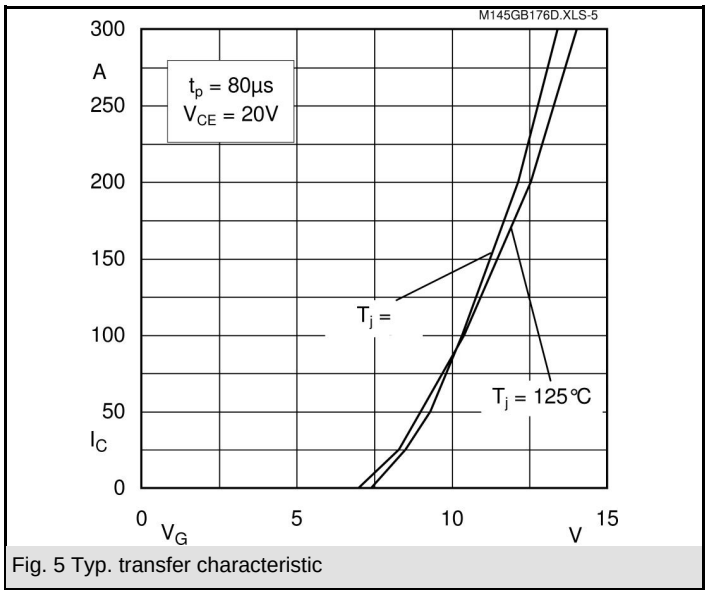



Fig. 5 Typ. transfer characteristic

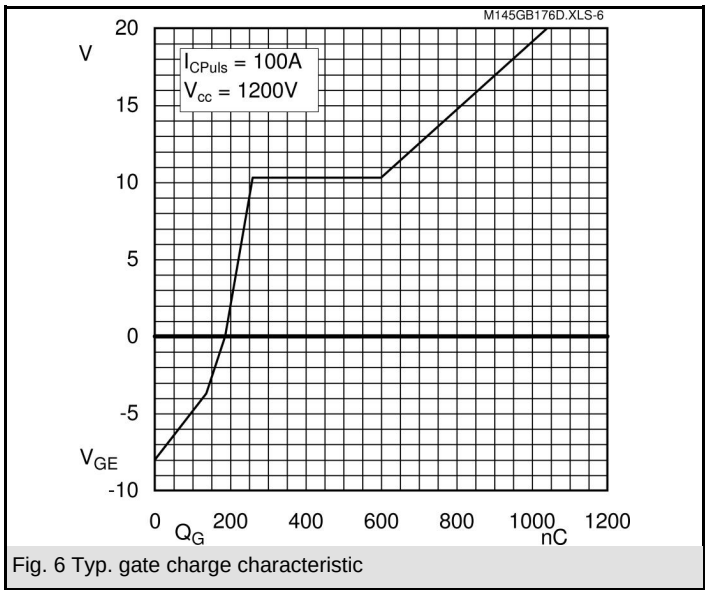



Fig. 6 Typ. gate charge characteristic

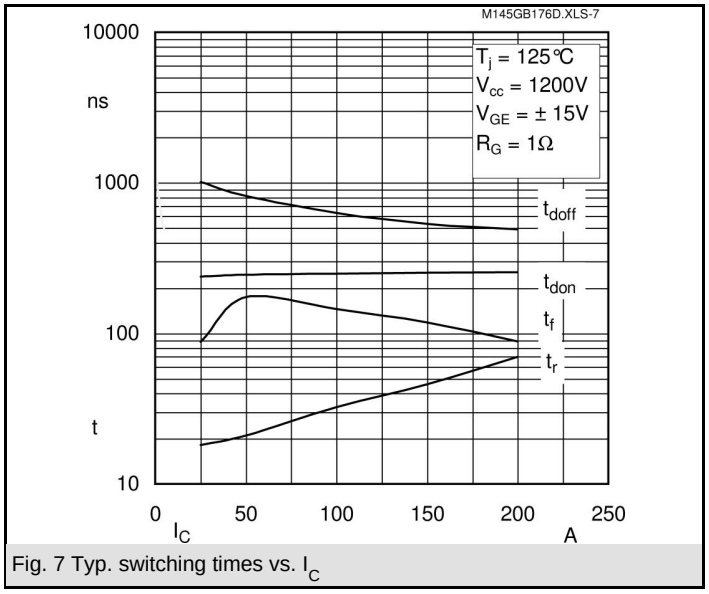



Fig. 7 Typ. switching times vs. $I_C$

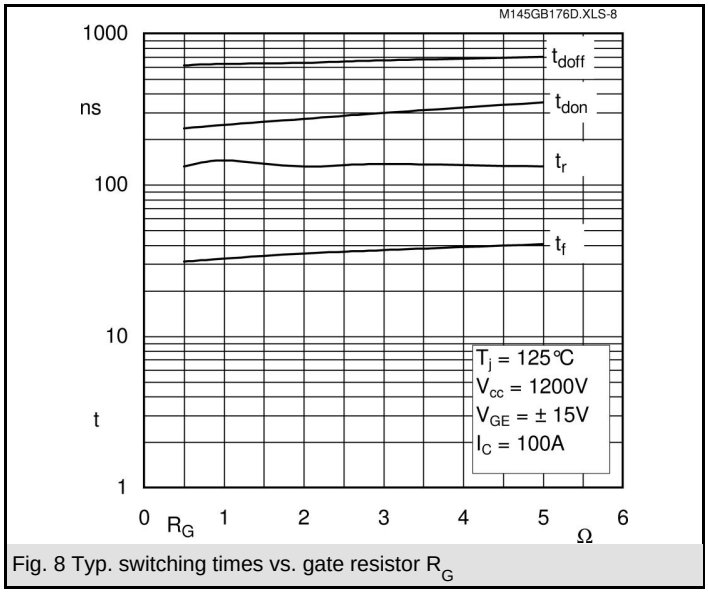



Fig. 8 Typ. switching times vs. gate resistor $R_G$

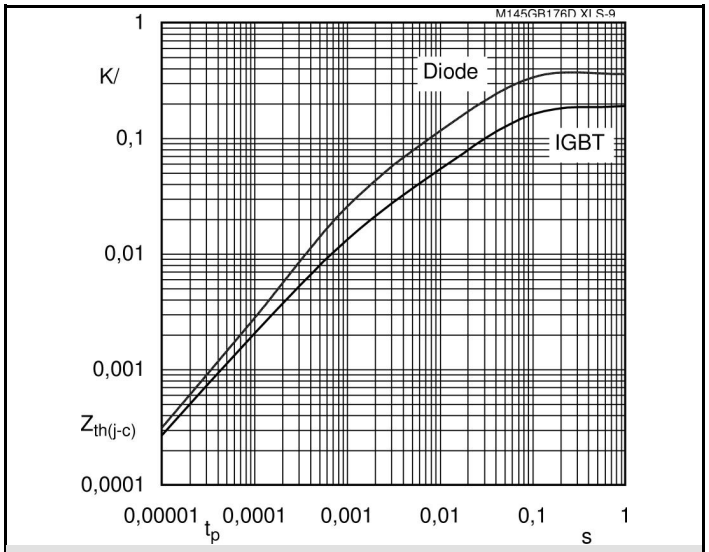



Fig. 9 Transient thermal impedance of IGBT and Diode

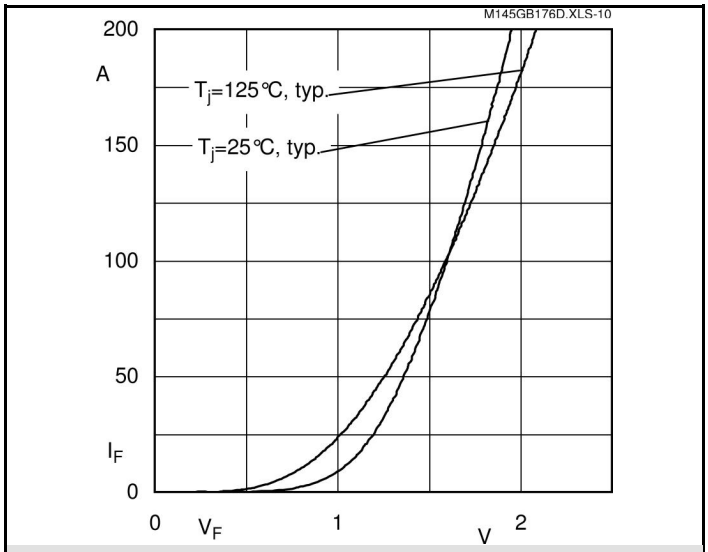



Fig. 10 CAL diode forward characteristic

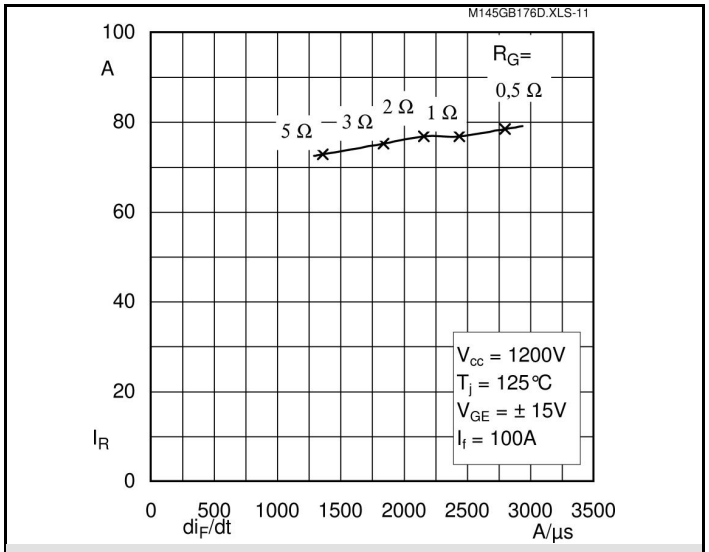



Fig. 11 Typ. CAL diode peak reverse recovery current

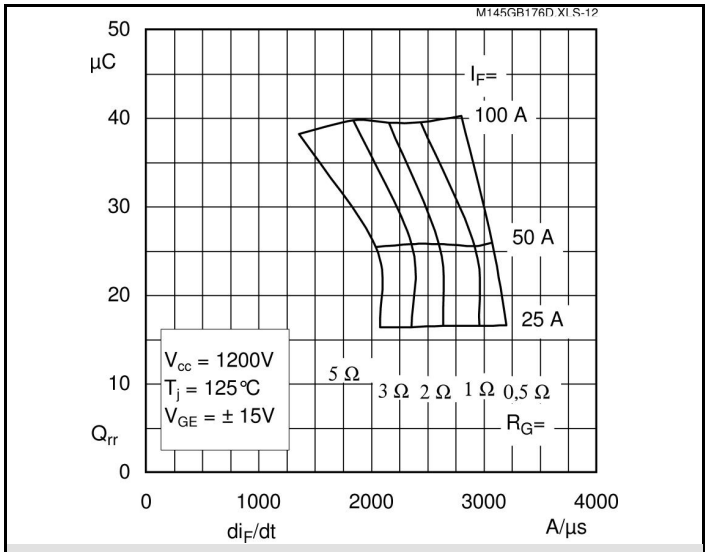
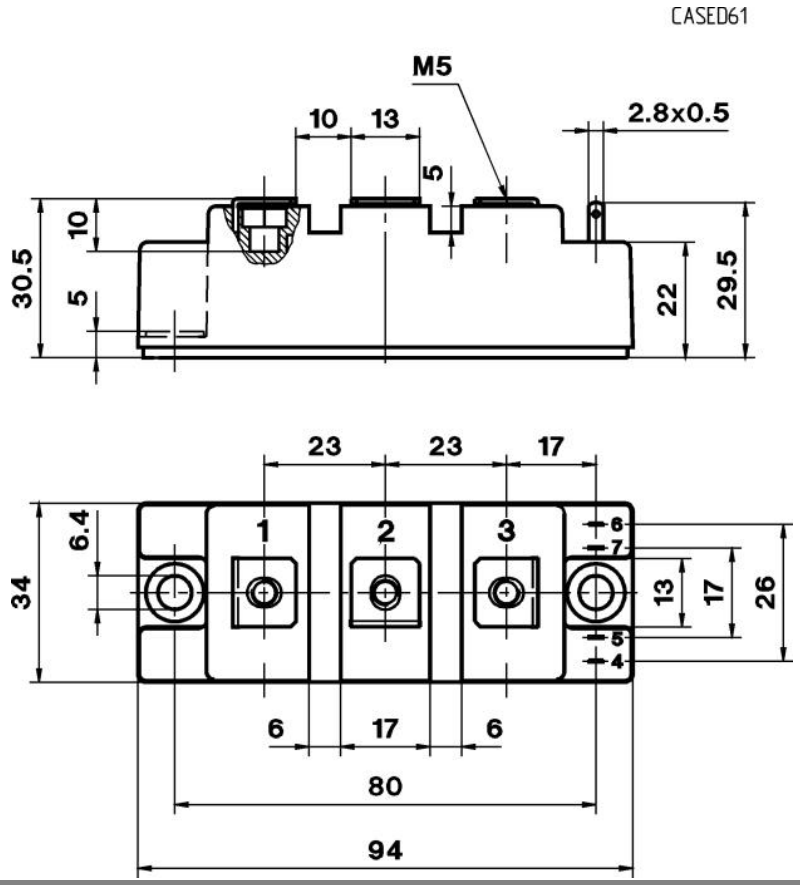


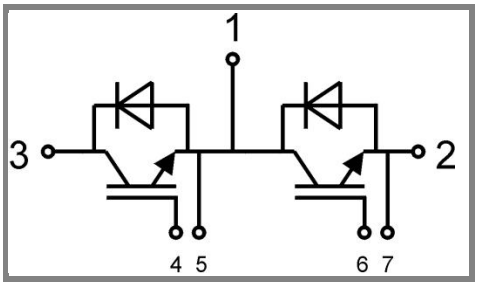

Fig. 12 Typ. CAL diode recovered charge

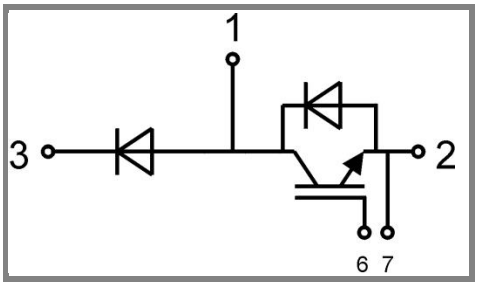
UL Recognized File no. E 63 532




Case D 61




GB Case D 61




GAL Case D 62