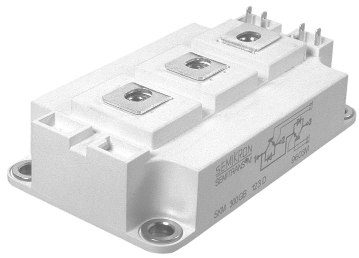
SEMIKRON

| Absolute Maximum Ratings Symbol | Conditions [1] | Values | Units |
|---|---|---|---|
| $V_{CES}$ | | 1700 | V |
| $V_{CGR}$ | $R_{GE}$ = 20 kΩ | 1700 | V |
| $I_C$; $\mathbf{I_{CN}}$ | $T_{case}$ = 25/**80** °C | 250 / 175 | A |
| $I_{CM}$ | $T_{case}$ = 25/80 °C; $t_p$ = 1 ms | 500 / 350 | A |
| $V_{GES}$ | | ± 20 | V |
| $P_{tot}$ | per IGBT, $T_{case}$ = 25 °C | 1250 | W |
| $T_j$, ($T_{stg}$) | | –40 ... +150 (125) | °C |
| $V_{isol}$ | AC, 1 min. [4] | 3400 | V |
| humidity | IEC 60721-3-3 | class 3K7/IE32 | |
| climate | IEC 68 T.1 | 40/125/56 | |
| Inverse Diode [8] | | | |
| $I_F$ = –$I_C$ | $T_{case}$ = 25/80 °C | 300 / 200 | A |
| $I_{FM}$ = –$I_{CM}$ | $T_{case}$ = 25/80 °C; $t_p$ = 1 ms | 500 / 350 | A |
| $I_{FSM}$ | $t_p$ = 10 ms; sin.; $T_j$ = 150 °C | 1450 | A |
| $I^2t$ | $t_p$ = 10 ms; $T_j$ = 150 °C | 10500 | $A^2s$ |

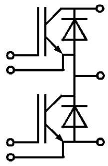
| Characteristics Symbol | Conditions [1] | min. | typ. | max. | Units |
|---|---|---|---|---|---|
| $V_{(BR)CES}$ | $V_{GE}$ = 0, $I_C$ = 6 mA | ≥ $V_{CES}$ | – | – | V |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 5 mA | 4,5 | 5,5 | 6,5 | V |
| $I_{CES}$ | $V_{GE}$ = 0, $V_{CE}$ = $V_{CES}$; $T_j$ = 25 °C | – | 0,1 | 0,4 | mA |
| | $V_{GE}$ = 0, $V_{CE}$ = $V_{CES}$; $T_j$ = 125 °C | – | 4 | – | mA |
| $I_{GES}$ | $V_{GE}$ = 20 V, $V_{CE}$ = 0 | – | – | 100 | nA |
| $V_{CEsat}$ | $I_C$ = 150 A; $V_{GE}$ = 15 V; $T_j$ = 25 (125) °C | – | 2,8(3,2) | 3,3(3,6) | V |
| | $I_C$ = 200 A; $V_{GE}$ = 15 V; $T_j$ = 25 (125) °C | – | 3,1(3,8) | – | V |
| $g_{fs}$ | $V_{CE}$ = 20 V, $I_C$ = 150 A | 54 | 75 | – | S |
| $C_{CHC}$ | per IGBT | – | – | 0,7 | nF |
| $C_{ies}$ | $V_{GE}$ = 0; $V_{CE}$ = 25 V; f = 1 MHz | – | 11 | – | nF |
| $C_{oes}$ | $V_{GE}$ = 0; $V_{CE}$ = 25 V; f = 1 MHz | – | 1,5 | – | nF |
| $C_{res}$ | $V_{GE}$ = 0; $V_{CE}$ = 25 V; f = 1 MHz | – | 0,5 | – | nF |
| $L_{CE}$ | | – | – | 20 | nH |
| $t_{d(on)}$ | $V_{CC}$ = 1200 V; $V_{GE}$ = –15 V / +15 V [3]; $I_C$ = 150 A, ind. load; $R_{Gon}$ = $R_{Goff}$ = 10 Ω | – | 80 | – | ns |
| $t_r$ | (as above) | – | 60 | – | ns |
| $t_{d(off)}$ | (as above) | – | 900 | – | ns |
| $t_f$ | (as above) | – | 80 | – | ns |
| $E_{on}$ | $T_j$ = 125 °C ($V_{CC}$ = 900 V/1200 V) | – | 70/115 | – | mWs |
| $E_{off}$ | $L_S$ = 60 nH ($V_{CC}$ = 900 V/1200 V) | – | 45/75 | – | mWs |
| Inverse Diode [8] | | | | | |
| $V_F$ = $V_{EC}$ | $I_F$ = 150 A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | – | 2,0(1,8) | 2,4 | V |
| $V_F$ = $V_{EC}$ | $I_F$ = 200 A; $V_{GE}$ = 0 V; $T_j$ = 25 (125) °C | – | 2,2(2,0) | 2,6 | V |
| $V_{TO}$ | $T_j$ = 125 °C | – | 1,3 | 1,5 | V |
| $r_t$ | $T_j$ = 125 °C | – | 4 | 5 | mΩ |
| $I_{RRM}$ | $I_F$ = 150 A; $T_j$ = 25 (125) °C [2] | – | 75(140) | – | A |
| $Q_{rr}$ | $I_F$ = 150 A; $T_j$ = 25 (125) °C [2] | – | 20(40) | – | μC |
| Thermal characteristics | | | | | |
| $R_{thjc}$ | per IGBT | – | – | 0,10 | °C/W |
| $R_{thjc}$ | per diode D | – | – | 0,15 | °C/W |
| $R_{thch}$ | per module | – | – | 0,038 | °C/W |

## SEMITRANS® M
## Low Loss IGBT Modules

## SKM 200 GB 174 D



**SEMITRANS 3**



**GB**

### Features

- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- Low inductance case
- High short circuit capability, self limiting
- Fast & soft inverse CAL diodes [8]
- Isolated copper baseplate using DCB Direct Copper Bonding
- Large clearance (13 mm) and creepage distances (20 mm)

### Typical Applications

- AC inverter drives on mains 575 - 750 $V_{AC}$
- DC bus voltage 750 - 1200 $V_{DC}$
- Public transport (auxiliary syst.)
- Switching (not for linear use)

1) $T_{case}$ = 25 °C, unless otherwise specified
2) $I_F$ = – $I_C$, $V_R$ = 1200 V, –$di_F/dt$ = 1500 A/μs, $V_{GE}$ = 0 V
4) Option $V_{isol}$ = 4000V/1 min add suffix „H4“ - on request
8) CAL = Controlled Axial Lifetime Technology

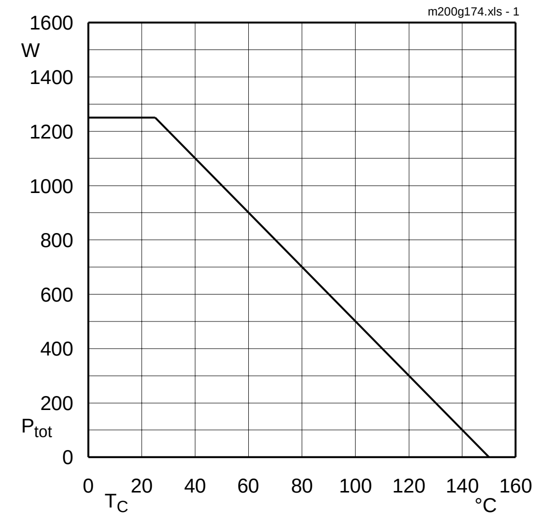



Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

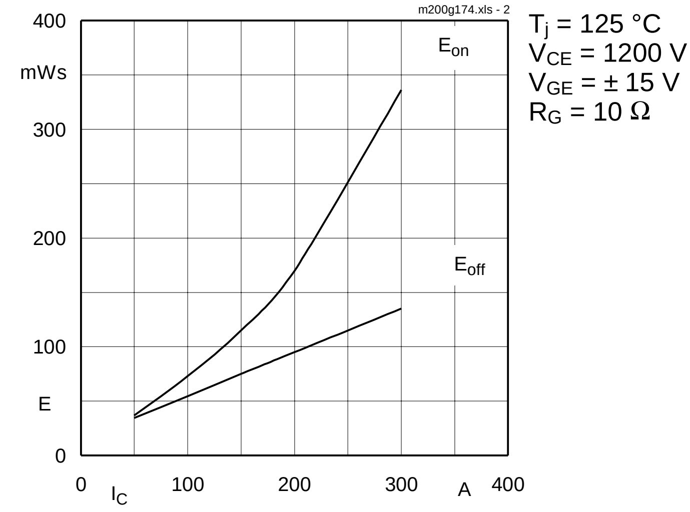



Fig. 2 Turn-on /-off energy = f ($I_C$)

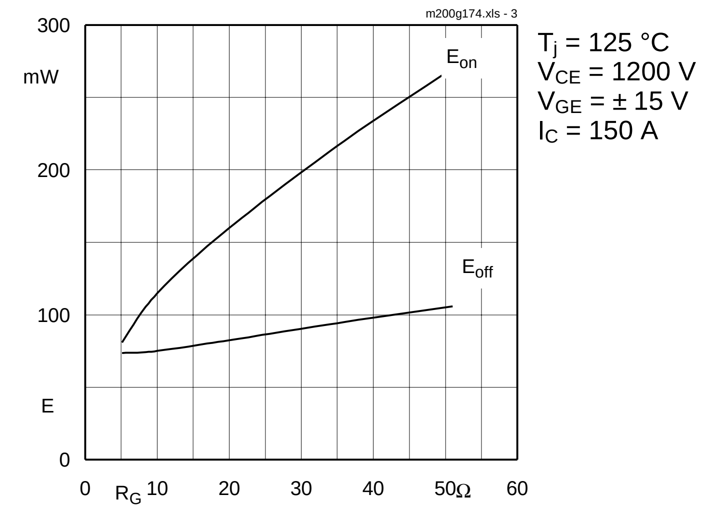



Fig. 3 Turn-on /-off energy = f ($R_G$)

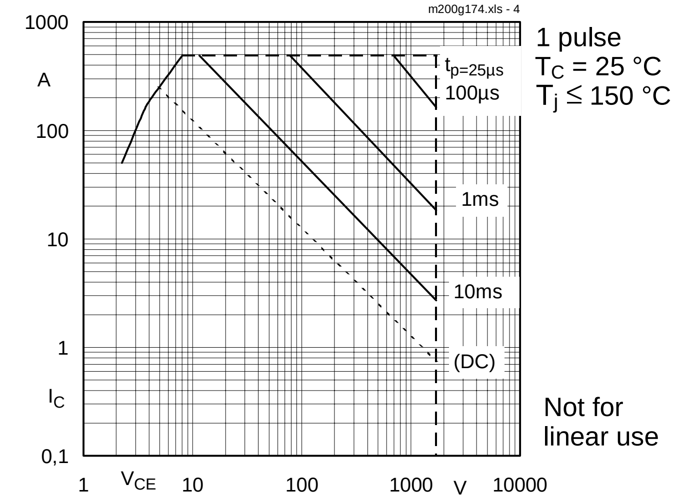



Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

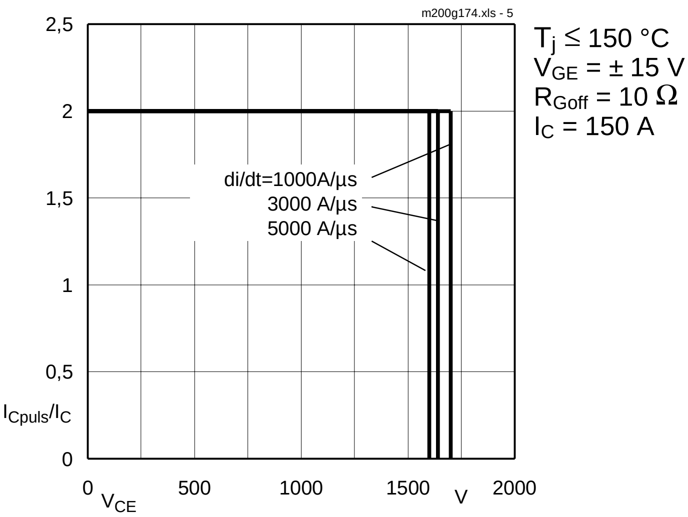



Fig. 5 Turn-off safe operating area (RBSOA)

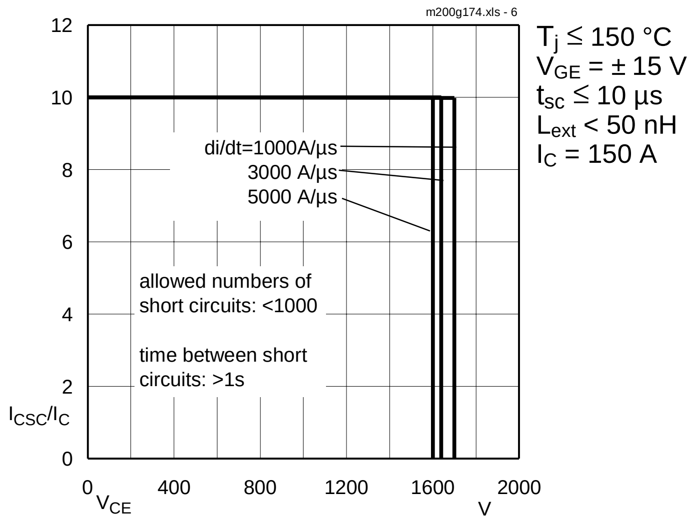



Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$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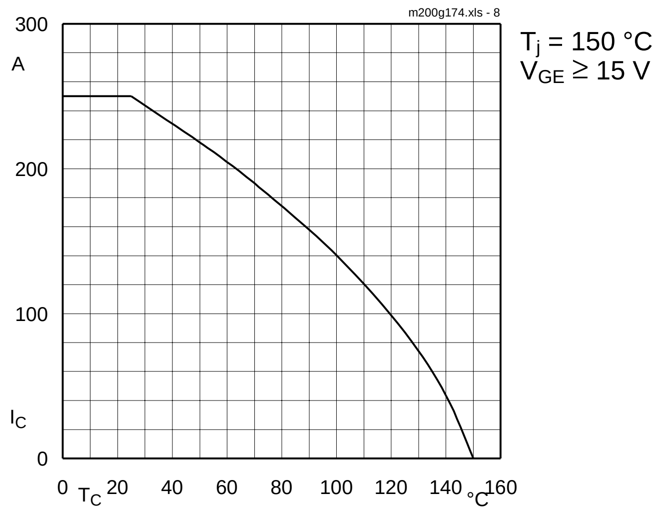



Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

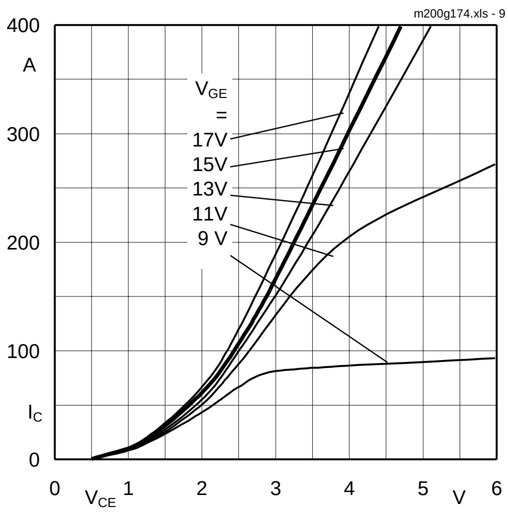



Fig. 9 Typ. output characteristic, $t_p$ = 250 µs; $T_j$ = 25 °C

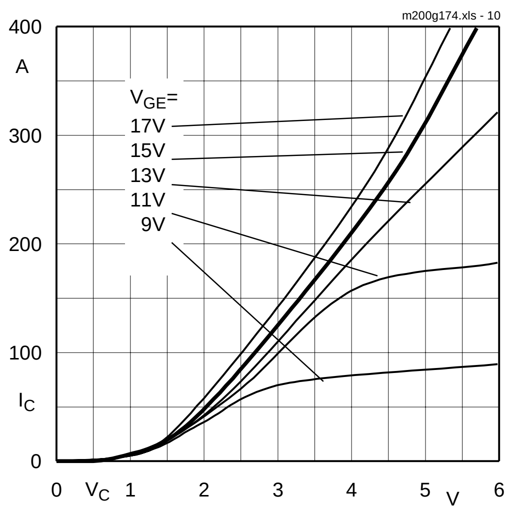



Fig. 10 Typ. output characteristic, $t_p$ = 250 µs; $T_j$ = 125 °C

$P_{cond(t)} = V_{CEsat(t)} \cdot I_{C(t)}$

$V_{CEsat(t)} = V_{CE(TO)(Tj)} + r_{CE(Tj)} \cdot I_{C(t)}$

$V_{CE(TO)(Tj)} \leq 1{,}6 + 0{,}001\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}008 + 0{,}00002\ (T_j - 25)$ [$\Omega$]

max.: $r_{CE(Tj)} = 0{,}011 + 0{,}000017\ (T_j - 25)$ [$\Omega$]

valid for $V_{GE} = +15\ ^{+2}_{-1}$ [V]; $I_C \geq 0{,}3\ I_{Cn}$

Fig. 11 Saturation characteristic (IGBT)
Calculation elements and equations

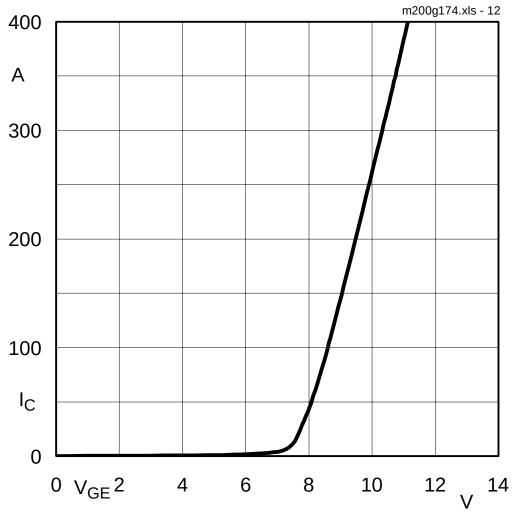



Fig. 12 Typ. transfer characteristic, $t_p$ = 250 µs; $V_{CE}$ = 20 V

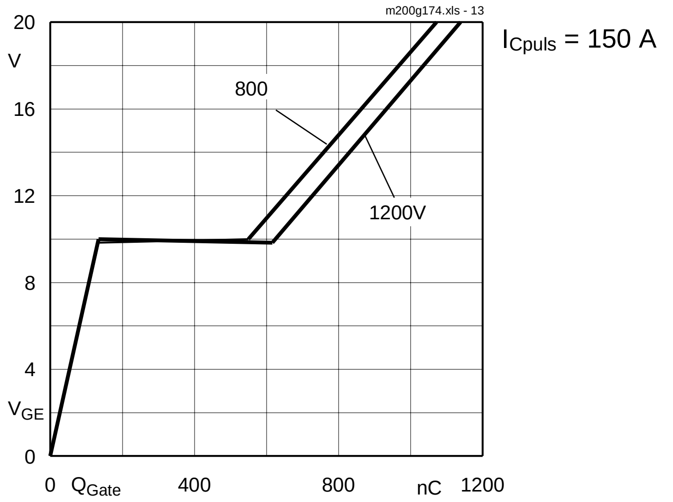



Fig. 13 Typ. gate charge characteristic

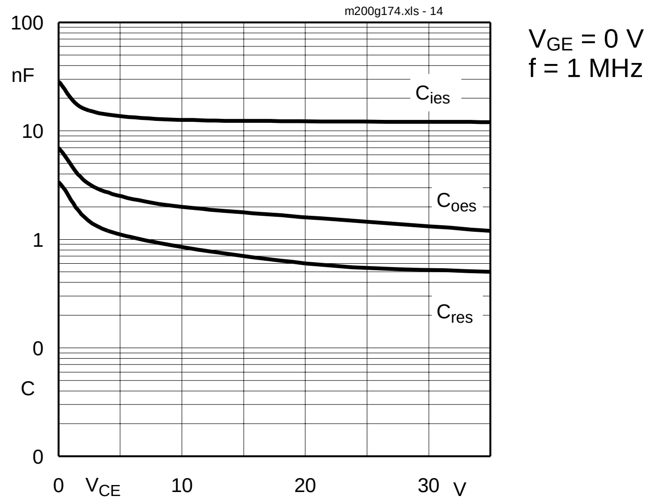



Fig. 14 Typ. capacitances vs.$V_{CE}$

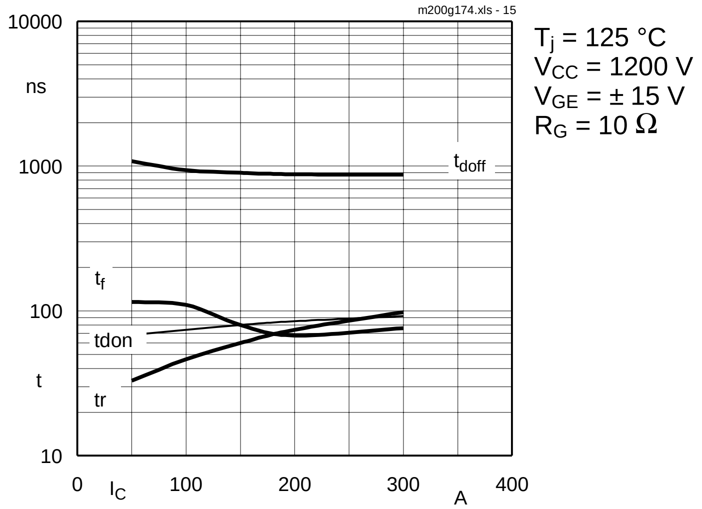



Fig. 15 Typ. switching times vs. $I_C$

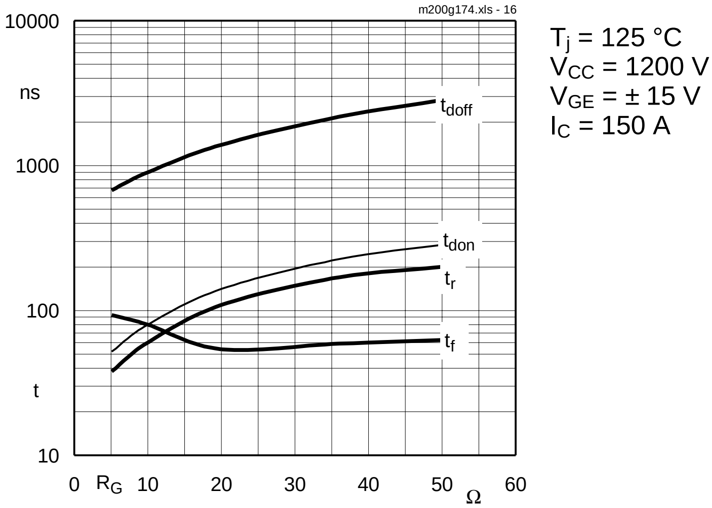



Fig. 16 Typ. switching times vs. gate resistor $R_G$

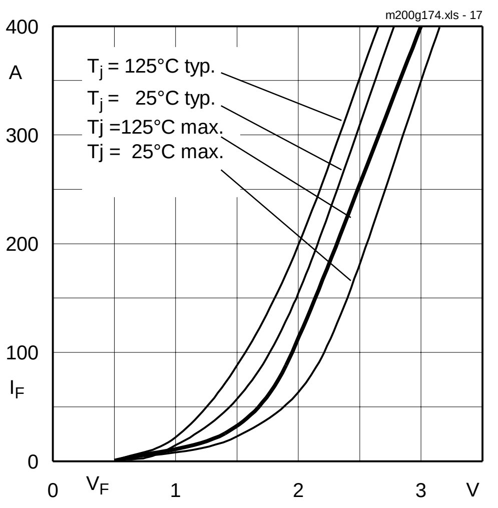



Fig. 17 Typ. CAL diode forward characteristic

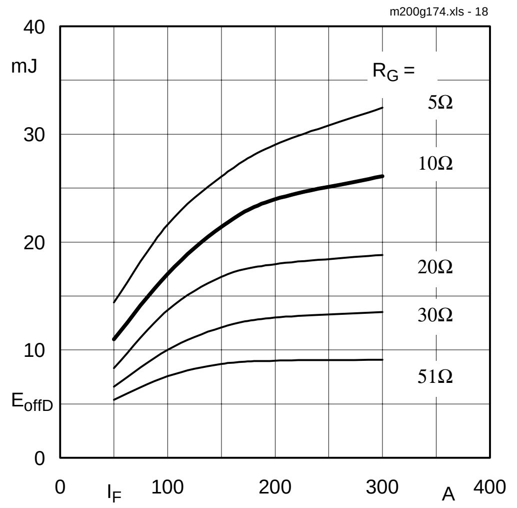
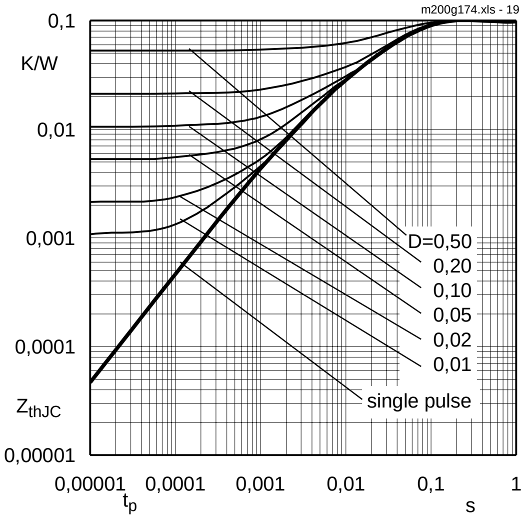



Fig. 18 Diode turn-off energy dissipation per pulse



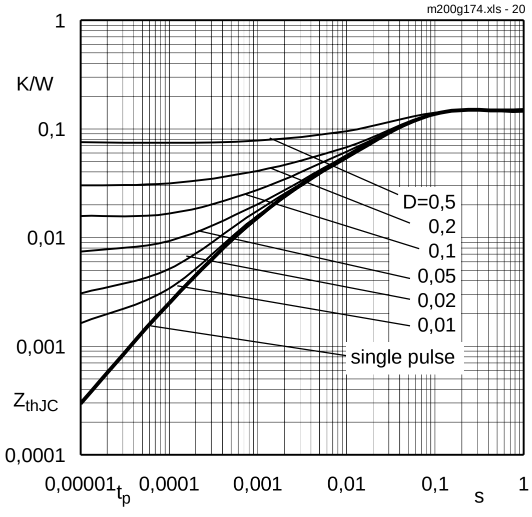
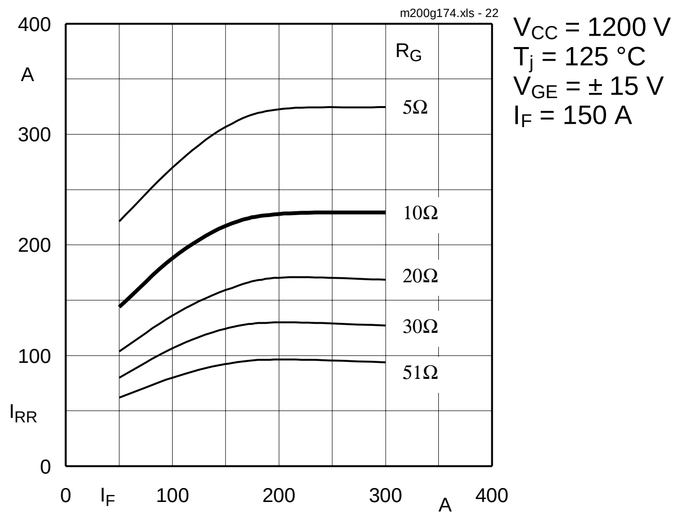




Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$



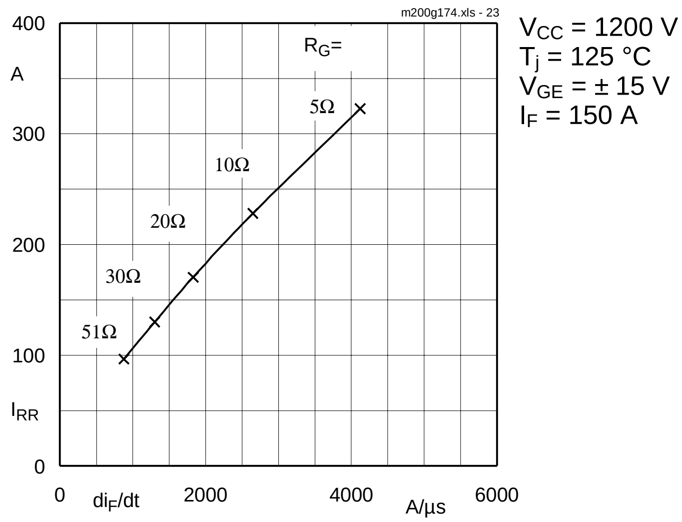




Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

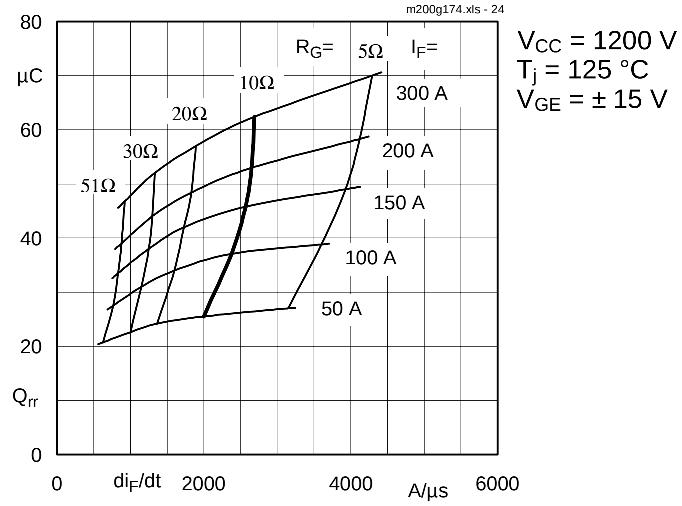
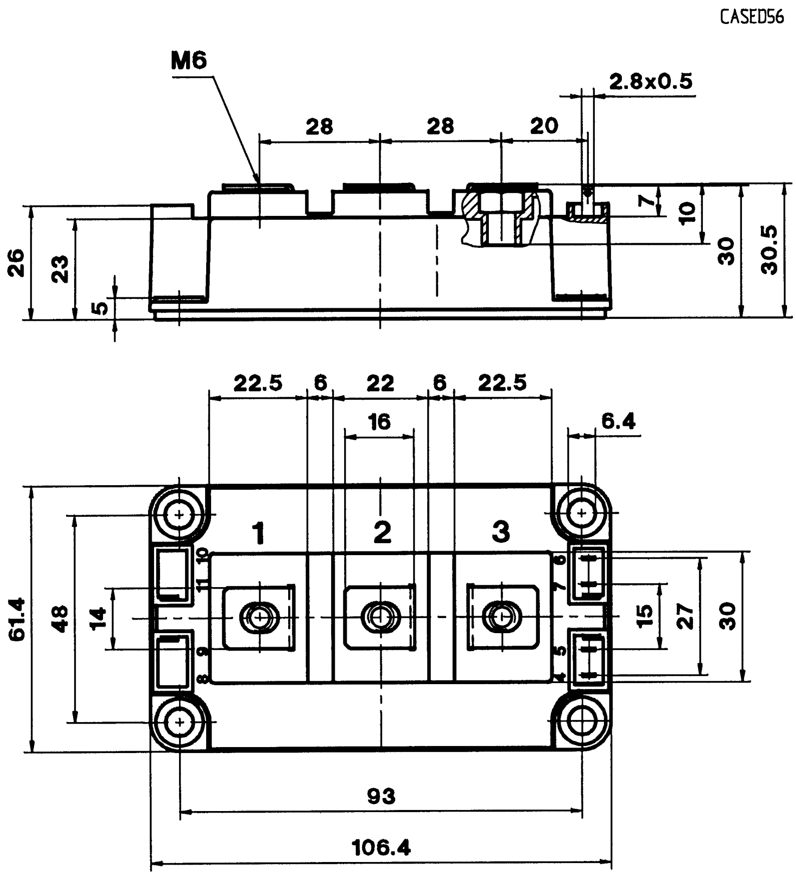


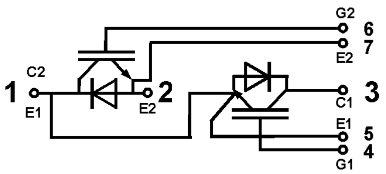

Fig. 24 Typ. CAL diode recovered charge

**SEMITRANS 3**

Case D 56
UL Recognized
File no. E 63 532

**SKM 200 GB 174 D**




Dimensions in mm

Case outline and circuit diagram

| Mechanical Data | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Conditions** | | **Values** | | | **Units** |
| | | | **min.** | **typ.** | **max.** | |
| $M_1$ | to heatsink, SI Units | (M6) | 3 | – | 5 | Nm |
| | to heatsink, US Units | | 27 | – | 44 | lb.in. |
| $M_2$ | for terminals, SI Units | (M6) | 2,5 | – | 5 | Nm |
| | for terminals, US Units | | 22 | – | 44 | lb.in. |
| a | | | – | – | 5x9,81 | $m/s^2$ |
| w | | | – | – | 325 | g |

**This is an electrostatic discharge sensitive device (ESDS). Please observe the international standard IEC 747-1, Chapter IX.**

Twelve devices are supplied in one SEMIBOX D without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 3).