| Absolute Maximum Ratings<br>Symbol | Conditions [1] | Values<br>... 101 D<br>... 102 D | <br>... 121 D<br>... 122 D | Units |
|---|---|---|---|---|
| $V_{CES}$ | | 1000 | 1200 | V |
| $V_{CGR}$ | $R_{GE}$ = 20 kΩ | 1000 | 1200 | V |
| $I_C$ | $T_{case}$ = 25/80 °C | 200/150 | | A |
| $I_{CM}$ | $T_{case}$ = 25/80 °C | 400/300 | | A |
| $V_{GES}$ | | ± 20 | | V |
| $P_{tot}$ | per IGBT, $T_{case}$ = 25 °C | 1250 | | W |
| $T_j$, $T_{stg}$ | | – 55 . . .+150 | | °C |
| $V_{isol}$ | AC, 1 min | 2 500 | | V |
| humidity | DIN 40 040 | Class F | | |
| climate | DIN IEC 68 T.1 | 55/150/56 | | |
| Inverse Diode | | | | |
| $I_F = -I_C$ | | 200 | | A |
| $I_{FM} = -I_{CM}$ | | 400 | | A |

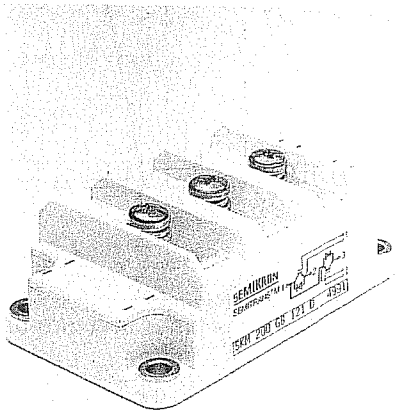
| Characteristics<br>Symbol | Conditions [1] | min. | typ. | max. | Units |
|---|---|---|---|---|---|
| $V_{(BR)CES}$ | $V_{GE}$ = 0, $I_C$ = 2,8 mA | ≥ $V_{CES}$ | – | – | V |
| $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 10 mA | 4,5 | 5,5 | 6,5 | V |
| $I_{CES}$ | $V_{GE}$ = 0, $T_j$ = 25 °C | – | – | 2 | mA |
| | $V_{CE}$ = $V_{CES}$, $T_j$ = 125 °C | – | – | 10 | mA |
| $I_{GES}$ | $V_{GE}$ = 20 V, $V_{CE}$ = 0 | – | – | 100 | nA |
| $V_{CEsat}$ | $V_{GE}$ = 15 V, $T_j$ = 25 °C | – | 3,5 | 4 | V |
| | $I_C$ = 200 A, $T_j$ = 150 °C | – | 4 | 4,8 | V |
| $g_{fs}$ | $V_{CE}$ = 20 V, $I_C$ = 200 A | 66 | 96 | – | S |
| $C_{CHC}$ | per IGBT | – | – | 200 | pF |
| $C_{ies}$ | $V_{GE}$ = 0 | – | 22 | – | nF |
| $C_{oes}$ | $V_{CE}$ = 25 V | – | 1700 | – | pF |
| $C_{res}$ | f = 1 MHz | – | 700 | – | pF |
| $L_{CE}$ | | – | – | 80 | nH |
| $t_{d(on)}$ | $V_{CC}$ = 600 V | – | 190 [3] | – | ns |
| $t_r$ | $V_{GE}$ = 15 V | – | 450 [3] | – | ns |
| $t_{d(off)}$ | $I_C$ = 200 A | – | 1100 [3]/1100 [4] | – | ns |
| $t_f$ | $R_{Gon}$ = $R_{Goff}$ = 3,3 Ω | – | 450 [3]/100 [4] | – | ns |
| $W_{off12}$ [5] | $T_j$ = 125 °C | – | 18 [4] | – | mWs |
| $W_{off23}$ [5] | | – | 9 [4] | – | mWs |
| Inverse Diode ...101 D, ...102 D | | | | | |
| $V_F = V_{EC}$ | $I_F$= 200 A, $V_{GE}$= 0; ($T_j$=125 °C) | – | 2,0 (1,8) | 2,8 | V |
| $t_{rr}$ | $T_j$ = 25 °C [2] | – | – | – | ns |
| | $T_j$ = 125 °C [2] | – | 350 | – | ns |
| $Q_{rr}$ | $T_j$ = 25/125 °C [2] | – | 6/27 | – | µC |
| $f_s$ | $f_s = t_f / (t_{rr} - t_f)$ | – | 1 [2] | – | |
| Inverse Diode ...121 D, ...122 D | | | | | |
| $V_F = V_{EC}$ | $I_F$= 200 A, $V_{GE}$= 0; ($T_j$=125 °C) | – | 2,8 (2,1) | 3,3 | V |
| $t_{rr}$ | $T_j$ = 25 °C [2] | – | – | – | ns |
| | $T_j$ = 125 °C [2] | – | 400 | – | ns |
| $Q_{rr}$ | $T_j$ = 25/125 °C [2] | – | 7,5/30 | – | µC |
| $f_s$ | $f_s = t_f / (t_{rr} - t_f)$ | – | 1 [2] | – | |
| Thermal Characteristics | | | | | |
| $R_{thjc}$ | per IGBT | – | – | 0,1 | °C/W |
| $R_{thjc}$ | per diode | – | – | 0,38 | °C/W |
| $R_{thch}$ | per module | – | – | 0,038 | °C/W |

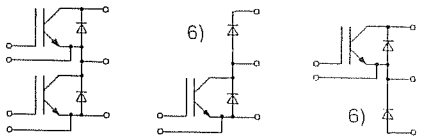
Cases and mechanical data see page B 6 – 142

## SEMITRANS® M
## IGBT Modules

**SKM 200 GB 101 D, 102 D**
**SKM 200 GAL 101D, 102 D** [6]
**SKM 200 GAR 101 D** [6]

**SKM 200 GB 121 D, 122 D**
**SKM 200 GAL 121 D, 122 D** [6]
**SKM 200 GAR 121 D, 122 D** [6]






GB GAL GAR

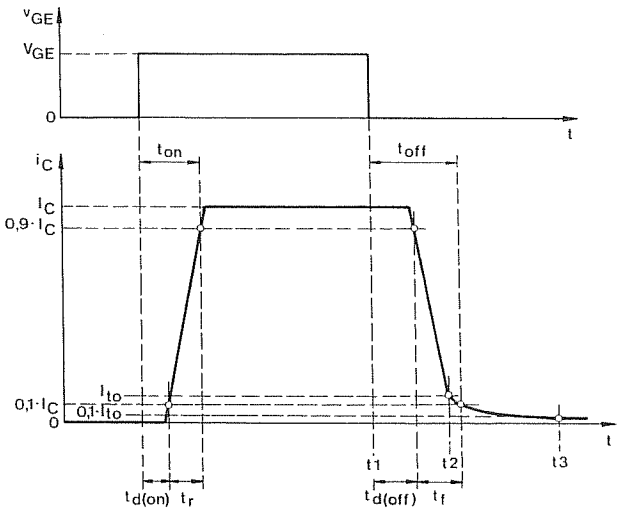
### Features

- MOS input (voltage controlled)
- N channel
- Low saturation voltage
- Very low tail current
- Low temperature sensitivity
- High short circuit capability
- No latch-up
- Fast inverse diodes
- Isolated copper baseplate
- Large clearances and creepage distances
- UL recognized, file no. E 63 532

### Typical Applications

→ page B 6 – 127

1) $T_{case}$ = 25 °C, unless otherwise specified
2) $I_F = -I_C$, $V_R$ = 600 V, $-di_F/dt$ = 800 A/µs, $V_{GE}$ = 0
3) resistive load
4) inductive load
5) see fig. 21; $R_{Goff}$ = 3,4 Ω
6) The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 300 ...




$$W_{off\,12} = \int_{t_1}^{t_2} i_C \cdot V_{CE} \cdot dt$$

$$W_{off\,23} = \int_{t_2}^{t_3} i_C \cdot V_{CE} \cdot dt$$

Fig. 21 Switching times and turn-off energies

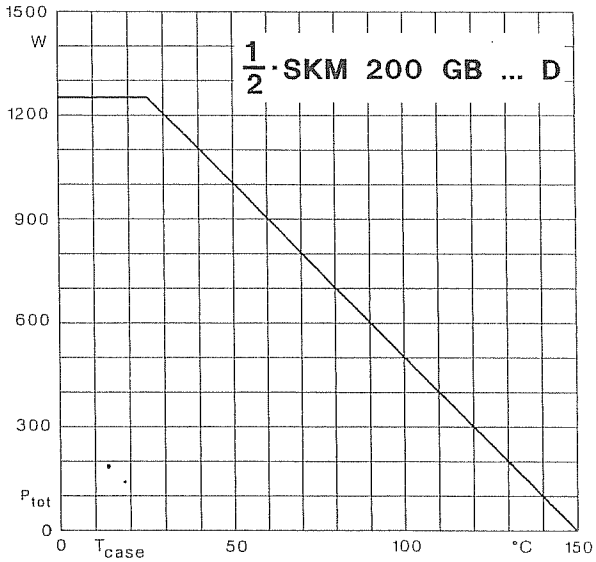



Fig. 22 Rated power dissipation vs. temperature

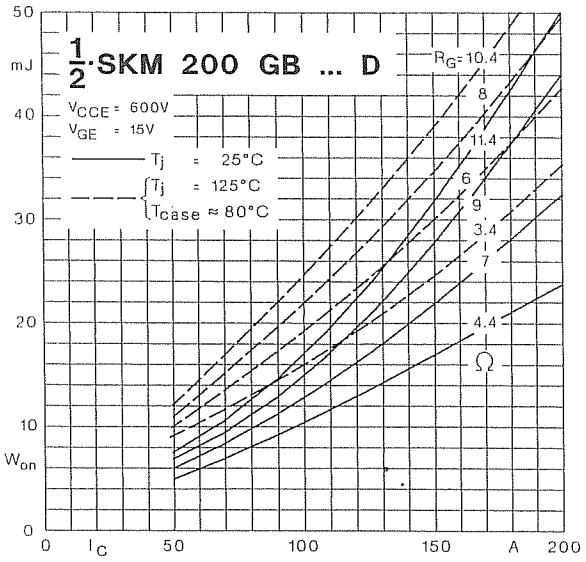



Fig. 23 Turn-on energy dissipation per pulse

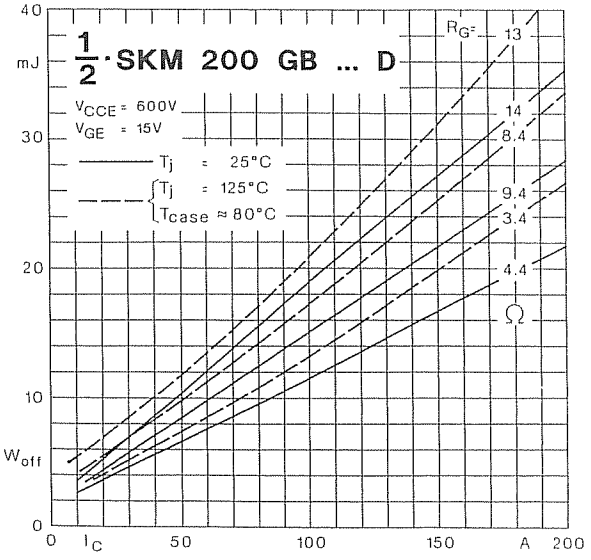



Fig. 24 Turn-off energy dissipation per pulse

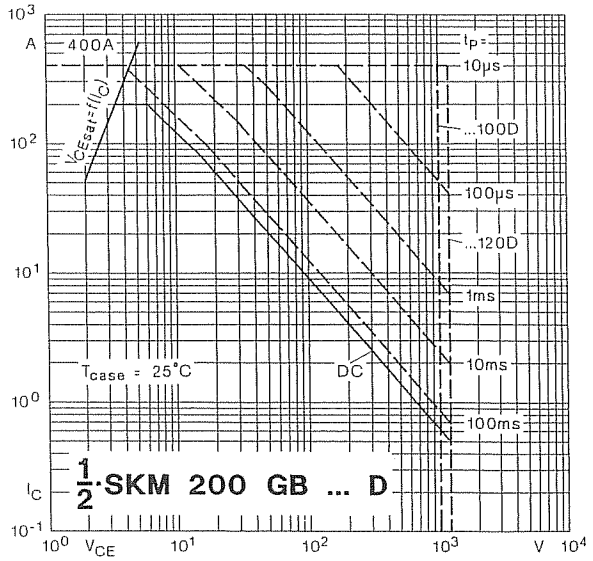



Fig. 25 Maximum safe operating area

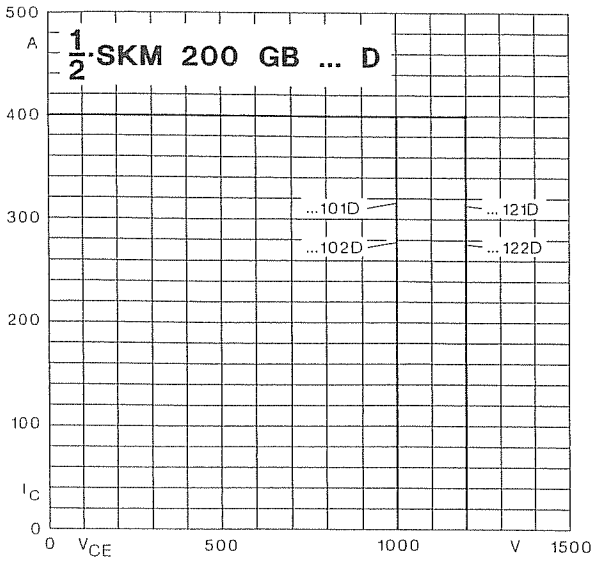



Fig. 26 Turn-off safe operating area

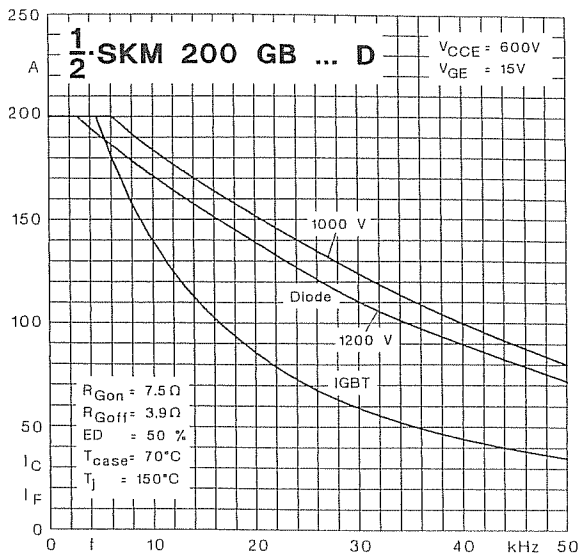



Fig. 27 Rated current vs. pulse frequency

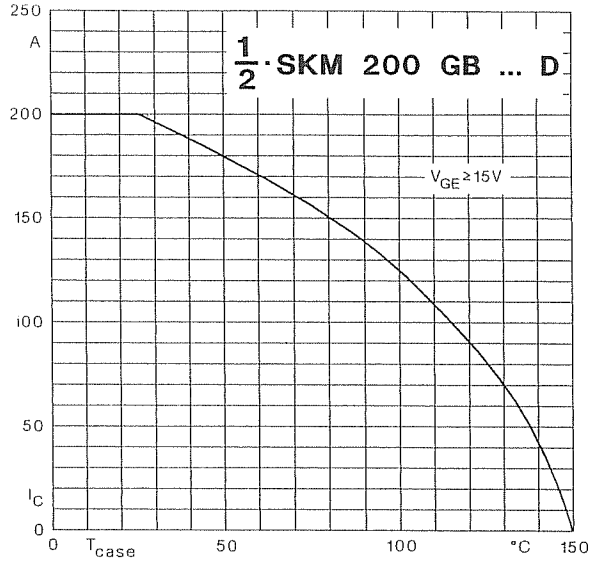



Fig. 28 Rated current vs. temperature

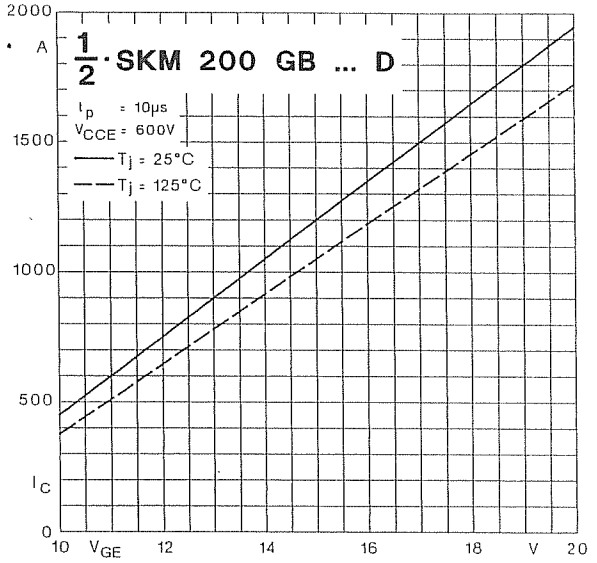



Fig. 29 Short-circuit current vs. turn-on gate voltage

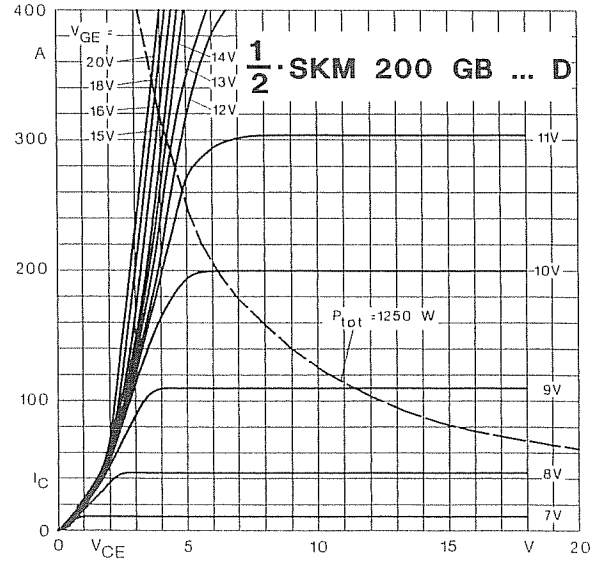



Fig. 30 Output characteristic

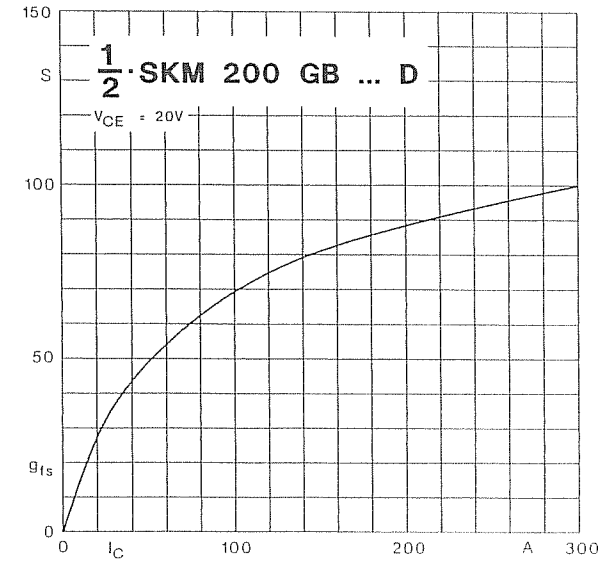



Fig. 31 Forward transconductance

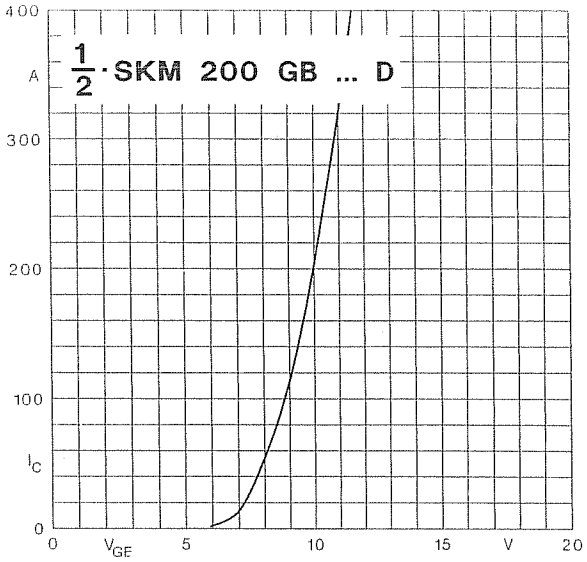



Fig. 32 Transfer characteristic

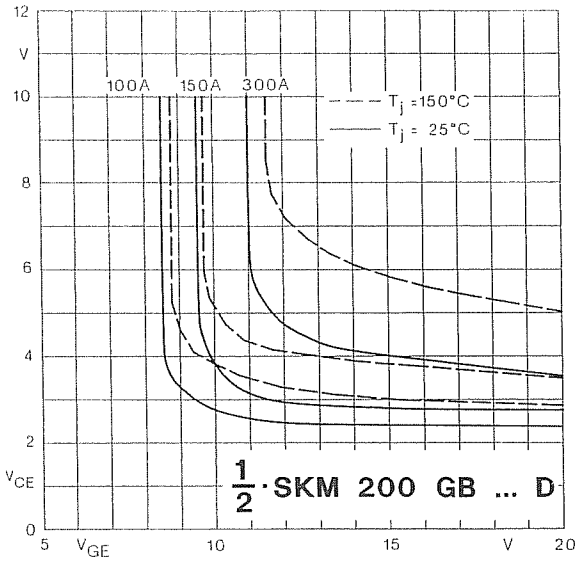



Fig. 33 Saturation characteristics

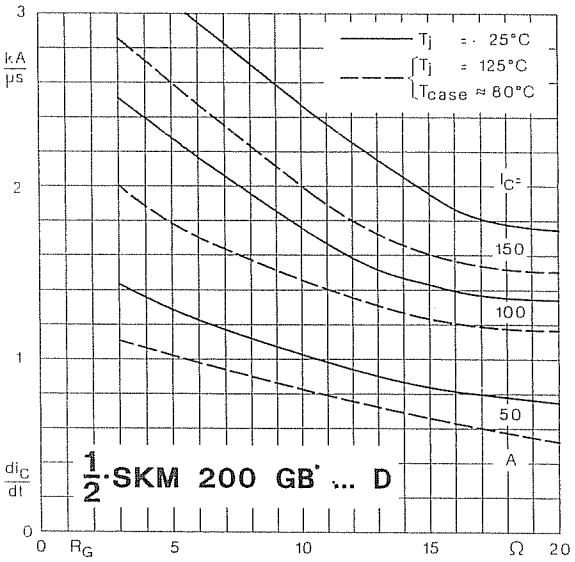



Fig. 34 Rate of rise of collector current

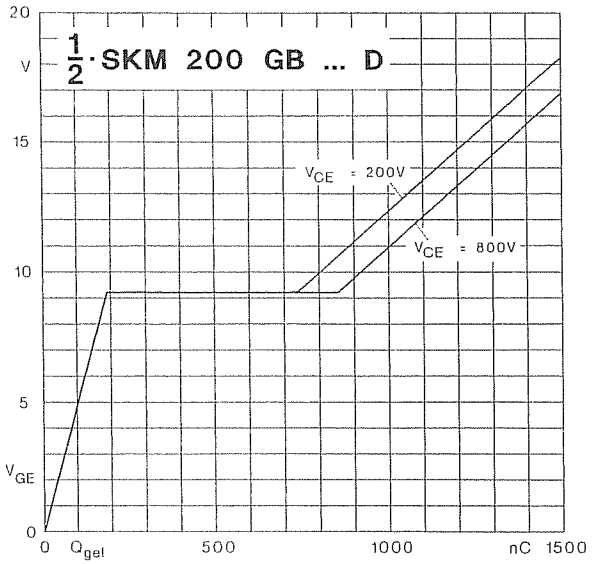



Fig. 35 Gate charge characteristic

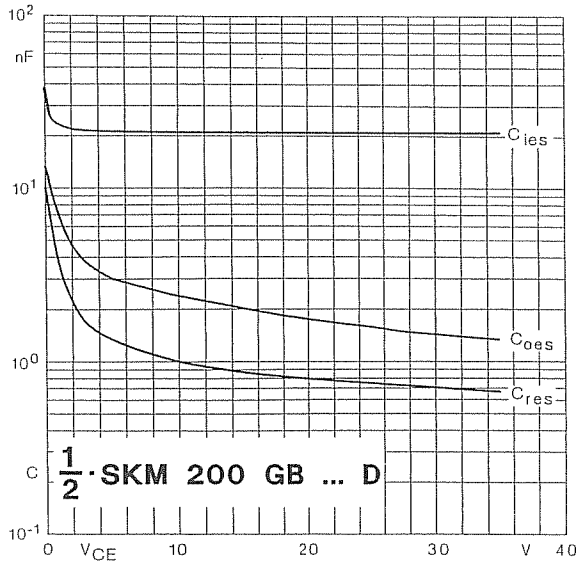



Fig. 36 Capacitances vs. collector-emitter voltage

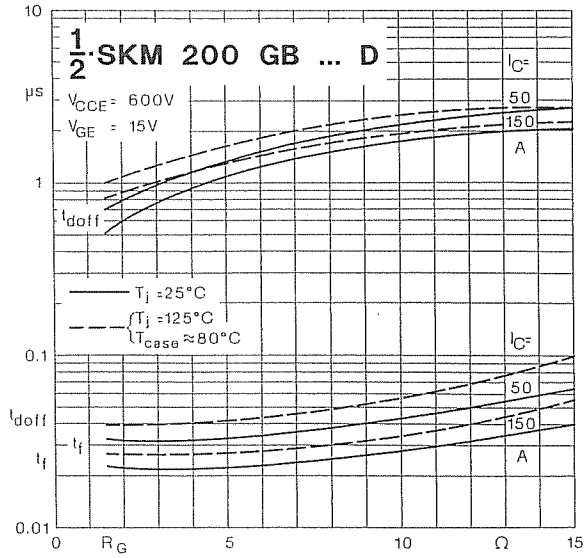



Fig. 37 Switching times vs. gate resistor

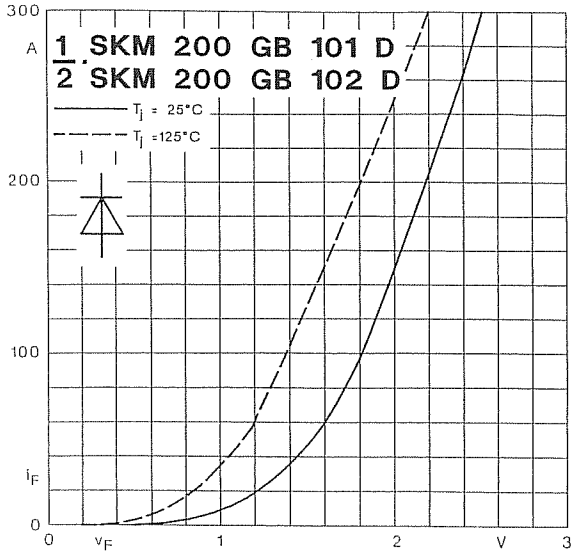



Fig. 38 a Diode forward characteristic

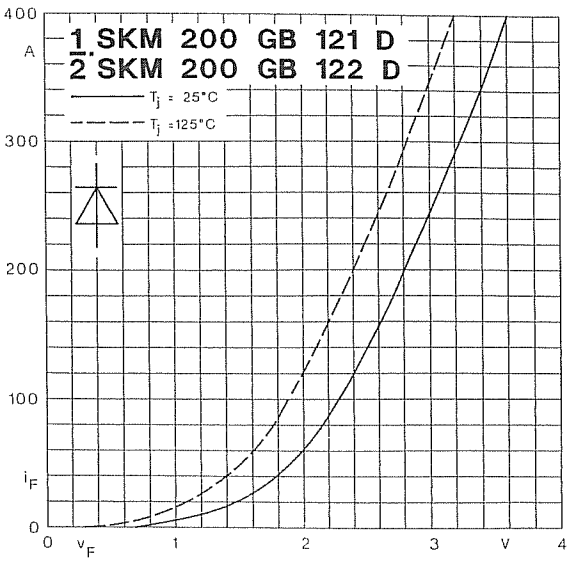



Fig. 38 b Diode forward characteristic

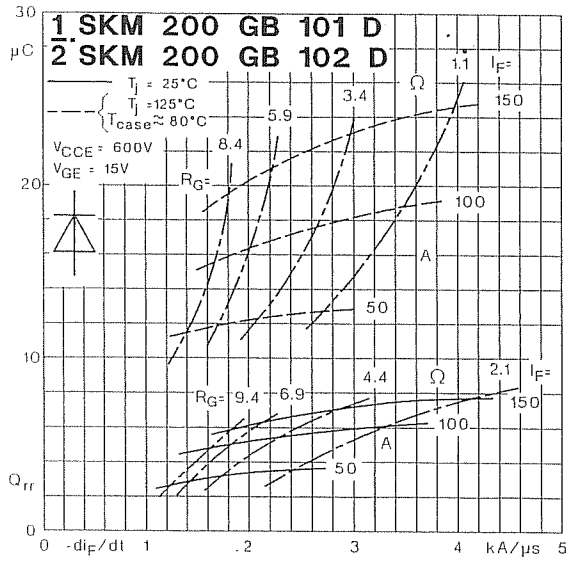



Fig. 39 a Diode recovered charge

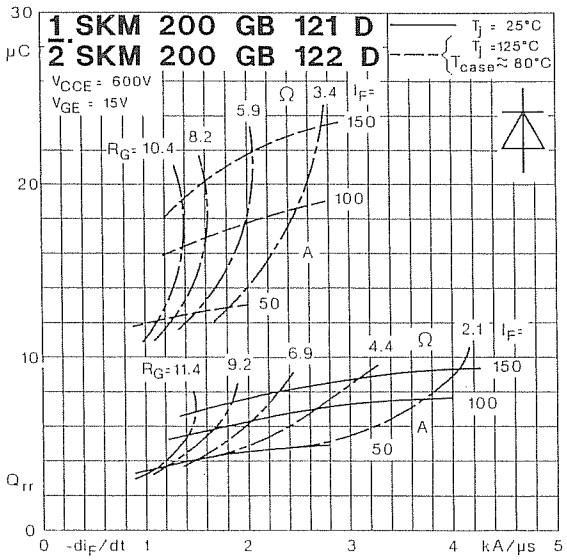



Fig. 39 b Diode recovered charge

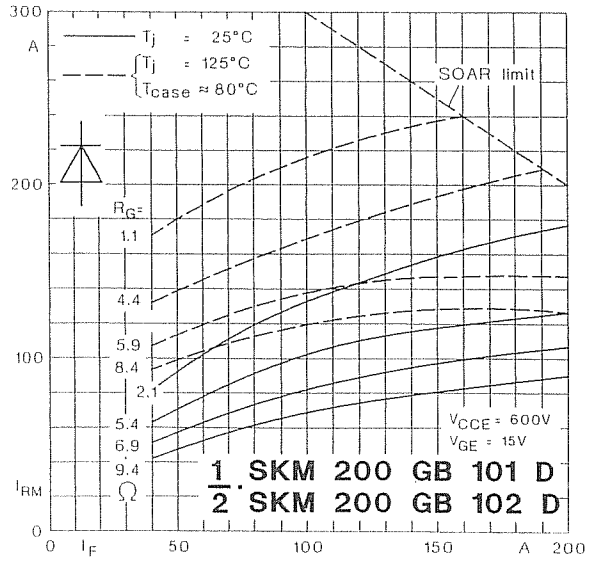



Fig. 40 a Diode peak reverse recovery current ($I_F$)

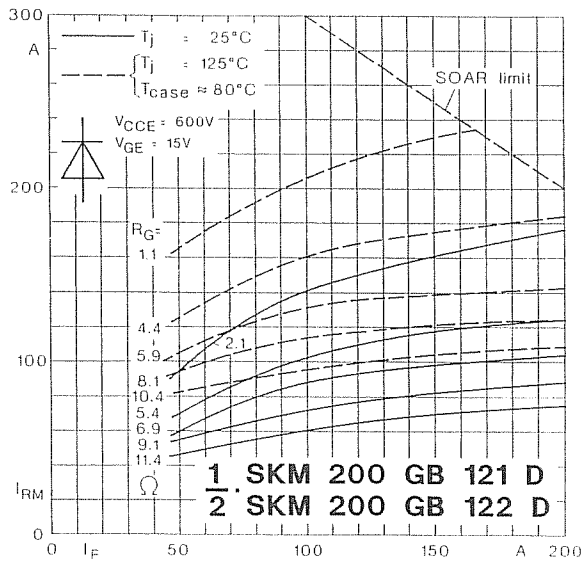



Fig. 40 b Diode peak reverse recovery current ($I_F$)

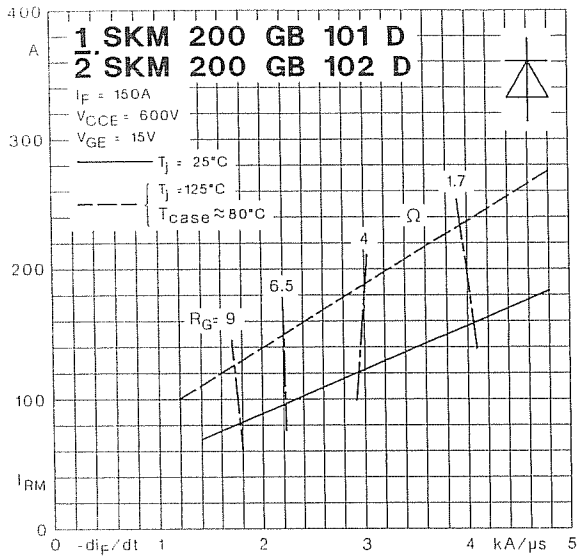



Fig. 41 a Diode peak reverse recovery current (-$di_F/dt$)

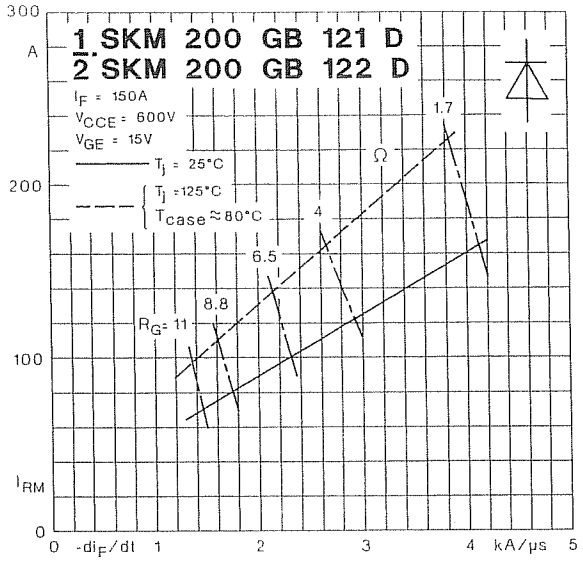



Fig. 41 b Diode peak reverse recovery current (-$di_F/dt$)

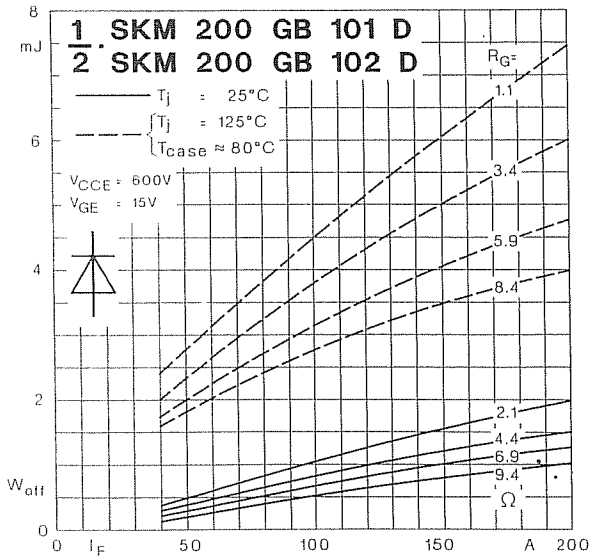



Fig. 42 a Diode turn-off energy dissipation per pulse

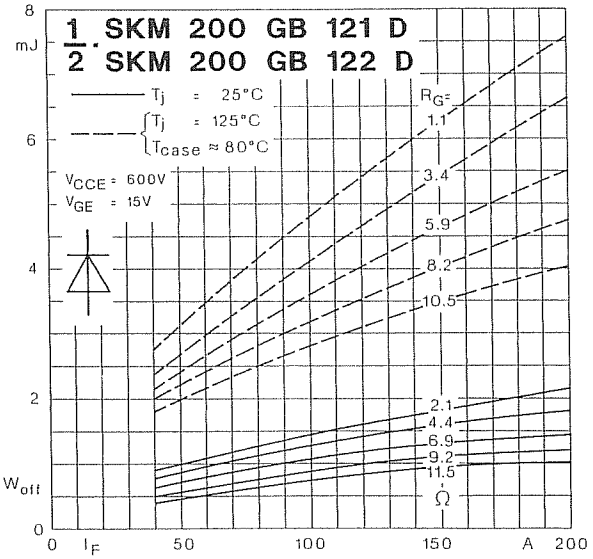



Fig. 42 b Diode turn-off energy dissipation per pulse

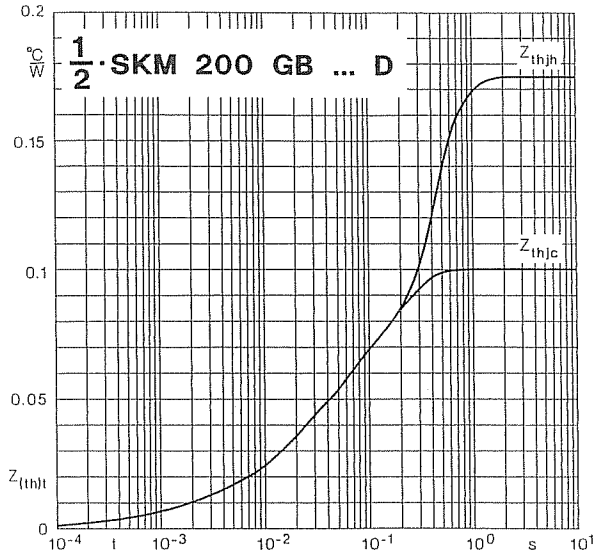



Fig. 51 Transient thermal impedance

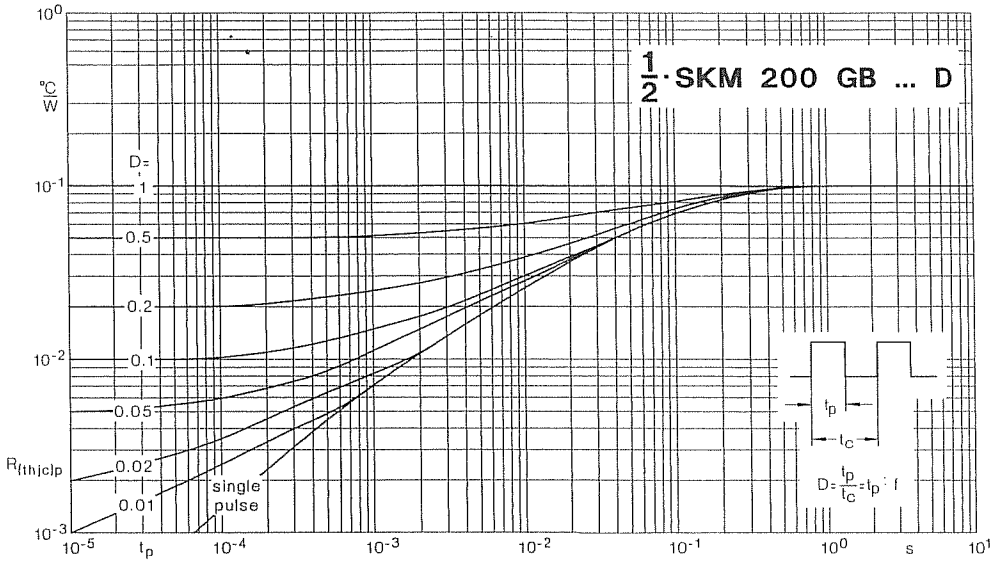
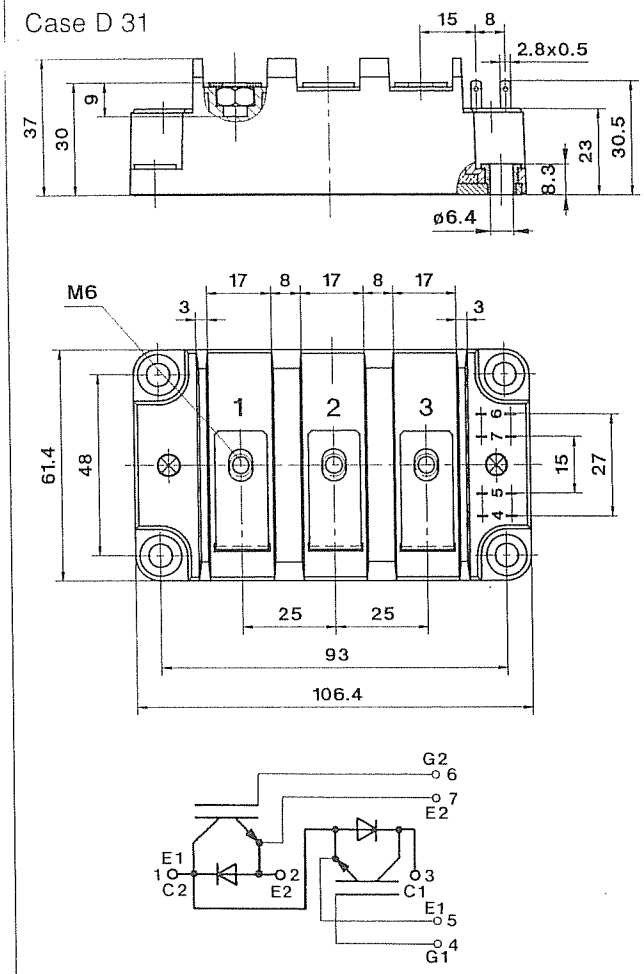
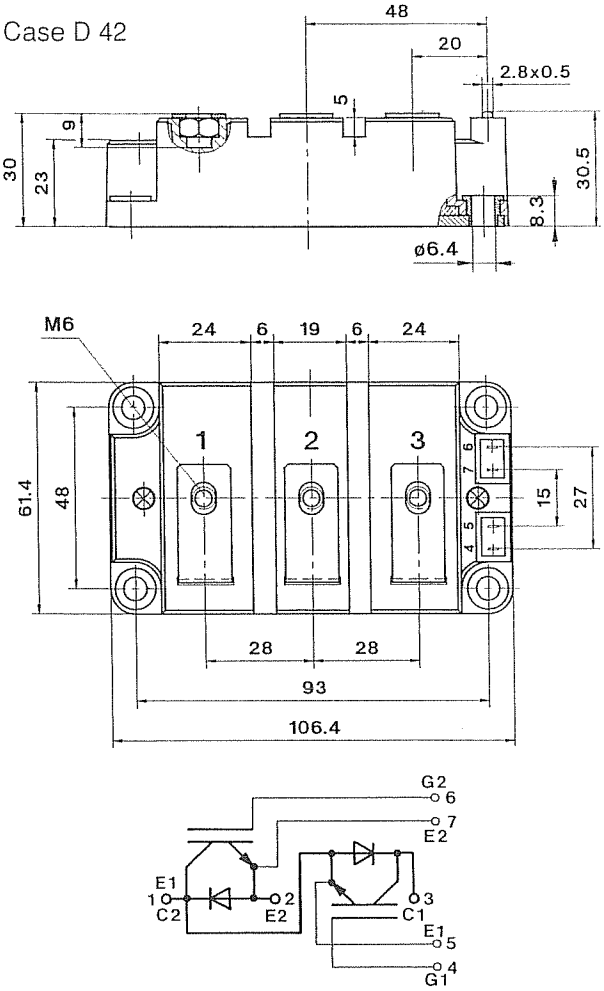



Fig. 52 Thermal impedance under pulse conditions

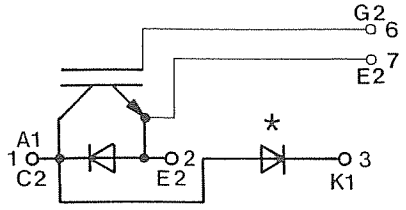
**SKM 200 GB 101 D** UL recognized,
**SKM 200 GB 121 D** file no. E 63 532
Case D 31



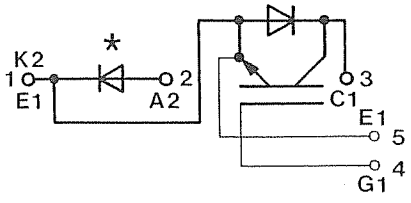

**SKM 200 GB 102 D** UL recognized,
**SKM 200 GB 122 D** file no. E 63 532
Case D 42




**SKM 200 GAL 101 D** **SKM 200 GAL 102 D**
**SKM 200 GAL 121 D** **SKM 200 GAL 122 D**
Case D 35 (→ D 31) Case D 43 (→ D 42)




**SKM 200 GAR 101 D**
**SKM 200 GAR 121 D** **SKM 200 GAR 122 D**
Case D 36 (→ D 31) Case D 44 (→ D 42)




## Mechanical Data

| Symbol | Conditions | Values min. | typ. | max. | Units |
|---|---|---|---|---|---|
| $M_1$ | to heatsink, SI Units | 3 | – | 6 | Nm |
| | to heatsink, US Units | 27 | – | 53 | lb.in. |
| $M_2$ | for terminals, SI Units | 2,5 | – | 5 | Nm |
| | for terminals US Units | 22 | – | 44 | lb.in. |
| a | | – | – | 5x9,81 | $m/s^2$ |
| w | | – | – | 420 | g |

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

*The free-wheeling diode has the data of the inverse diode of SKM 300 ...

Dimensions in mm