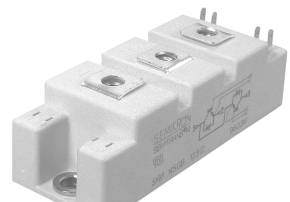
SEMIKRON

Absolute Maximum Ratings		Values	
Symbol	Conditions 1)		Units
V_{CES}		1700	V
V_{CGR}	R_{GE} = 20 kΩ	1700	V
I_C	T_{case} = 25/80 °C	110 / 75	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	220 / 150	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	625	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	4000	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode 8)			
$I_F = –I_C$	T_{case} = 25/80 °C	80 / 50	A
$I_{FM} = –I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	200 / 150	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	720	A
I^2t	t_p = 10 ms; T_j = 150 °C	2600	A^2s

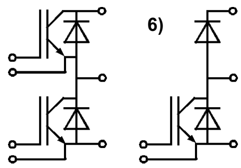
Characteristics					
Symbol	Conditions 1)	min.	typ.	max.	Units
$V_{(BR)CES}$	V_{GE} = 0, I_C = 1,4 mA	≥ V_{CES}	–	–	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 6 mA	4,8	5,5	6,2	V
I_{CES}	V_{GE} = 0; T_j = 25 °C	–	0,1	1	mA
	$V_{CE} = V_{CES}$; T_j = 125 °C	–		15	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	400	nA
V_{CEsat}	I_C = 75 A; V_{GE} = 15 V;	–	3,4(4,4)	3,9(5)	V
	I_C = 100 A; T_j = 25 (125) °C	–	3,8(5,5)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 75 A	27	–	–	S
C_{CHC}	per IGBT	–	–	200	pF
C_{ies}	V_{GE} = 0	–	11	–	nF
C_{oes}	V_{CE} = 25 V	–	1	–	nF
C_{res}	f = 1 MHz	–	0,28	–	nF
L_{CE}		–	–	30	nH
$t_{d(on)}$	V_{CC} = 1200 V	–	40	–	ns
t_r	V_{GE} = –15 V / +15 V	–	45	–	ns
$t_{d(off)}$	I_C = 75 A, ind. load	–	400	–	ns
t_f	$R_{Gon} = R_{Goff}$ = 10 Ω	–	56	–	ns
E_{on}	T_j = 125 °C	–	35	–	mWs
E_{off}		–	21	–	mWs
Inverse Diode 8)					
$V_F = V_{EC}$	I_F = 75 A; V_{GE} = 0 V;	–	2,2(2,0)	2,7(2,3)	V
$V_F = V_{EC}$	I_F = 100 A; T_j = 25 (125) °C	–	2,45(2,25)	–	V
V_{TO}	T_j = 125 °C	–	1,3	1,5	V
r_t	T_j = 125 °C	–	9	13	mΩ
I_{RRM}	I_F = 75 A; T_j = 25 (125) °C 2)	–	38(51)	–	A
Q_{rr}	I_F = 75 A; T_j = 25 (125) °C 2)	–	8(19)	–	µC
FWD of type “GAL” 6) 8)					
	V_{GE} = 0 V;	–			
$V_F = V_{EC}$	I_F = 100 A; T_j = 25 (125) °C	–	2,2(1,9)	2,7(2,4)	V
V_{TO}	T_j = 125 °C	–	1,2	1,5	V
r_t	T_j = 125 °C	–	7	9	mΩ
t_{rr}	I_F = 100 A; T_j = 25 (125) °C 2)	–	50(70)	–	µs
Q_{rr}	I_F = 100 A; T_j = 25 (125) °C 2)	–	10(27)	–	µC
Thermal characteristics					
R_{thjc}	per IGBT	–	–	0,2	°C/W
R_{thjc}	per diode / FWD “GAL”	–	–	0,63/0,4	°C/W
R_{thch}	per module	–	–	0,05	°C/W

SEMITRANS® M IGBT Modules

SKM 100 GB 173 D
SKM 100 GAL 173 D 6)



SEMITRANS 2



GB GAL

Features

- N channel, Homogeneous Si
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to 6 * I_{cnom}
- Latch-up free
- Fast & soft inverse CAL diodes 8)
- Isolated copper baseplate using DCB Direct Copper Bonding
- Large clearance (10 mm) and creepage distances (20 mm)

Typical Applications

- AC inverter driveson 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, $–di_F/dt$ = 800 A/µs, V_{GE} = 0 V
6) The free-wheeling diode of the GAL type has the data of the inverse diode of SKM 150 GB 173 D
8) CAL = Controlled Axial Lifetime Technology

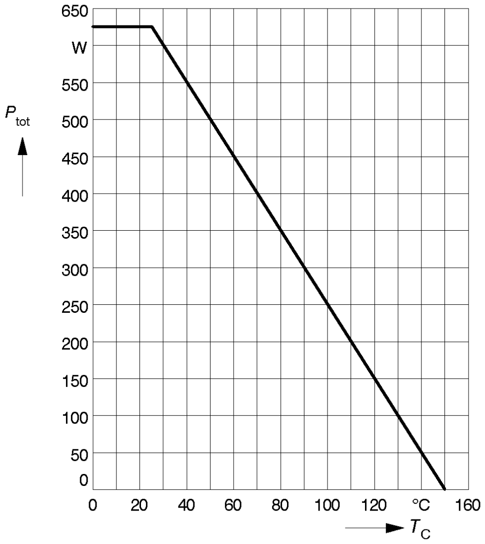
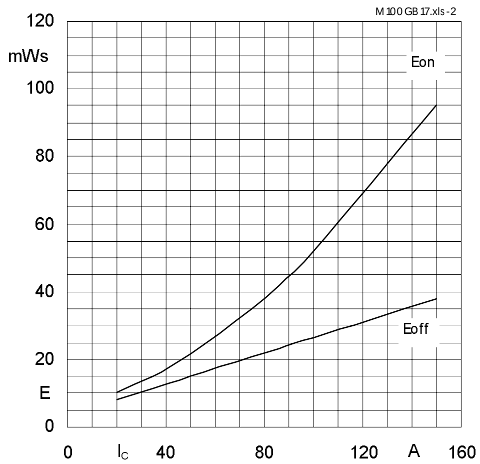
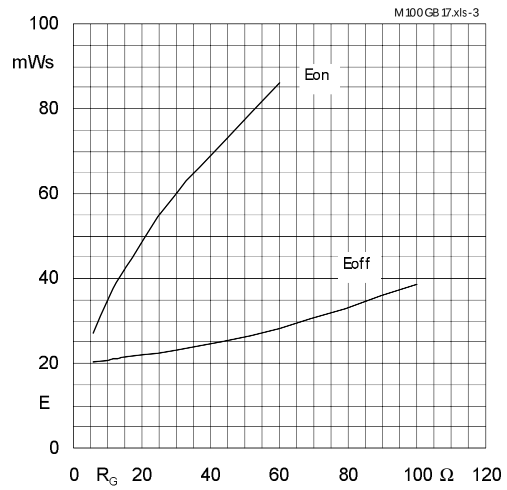


Fig. 1 Rated power dissipation P_{tot} = f (T_C)



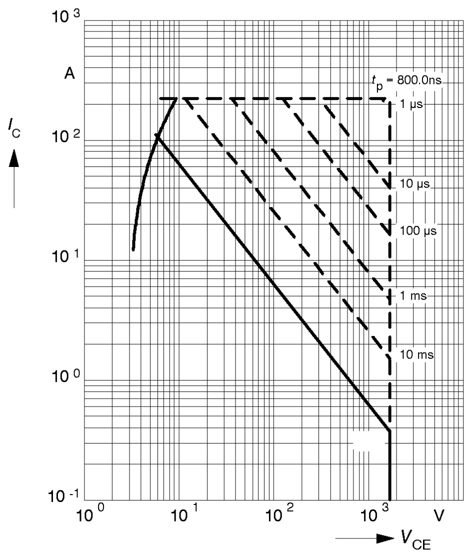
T_j = 125 °C
V_{CE} = 1200 V
V_{GE} = ± 15 V
R_G = 10Ω

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



T_j = 125 °C
V_{CE} = 1200 V
V_{GE} = ± 15 V
I_C = 75 A

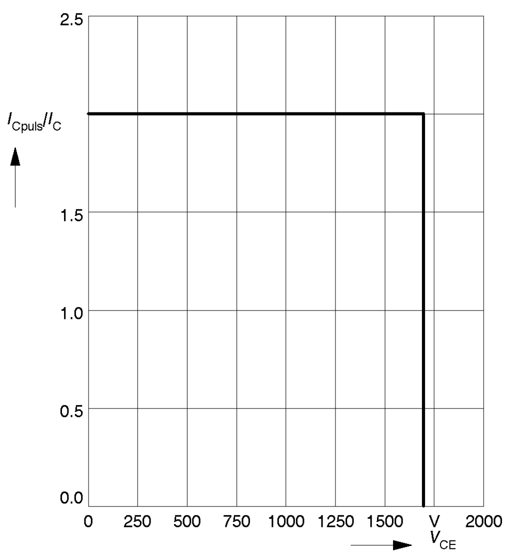
Fig. 3 Turn-on /-off energy = f (R_G)



1 pulse
T_C = 25 °C
$T_j \leq$ 150 °C

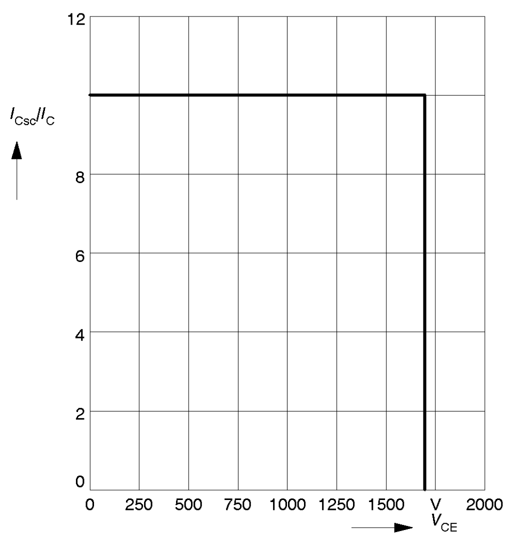
Not recommended for linear duty

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



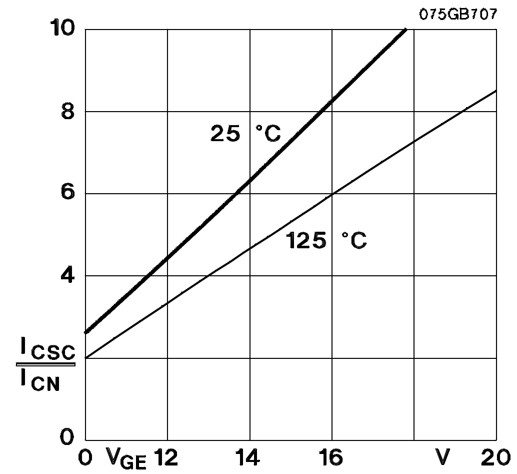
$T_j \leq$ 150 °C
V_{GE} = ± 15 V
R_{Goff} = 10 Ω
I_C = 75 A

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



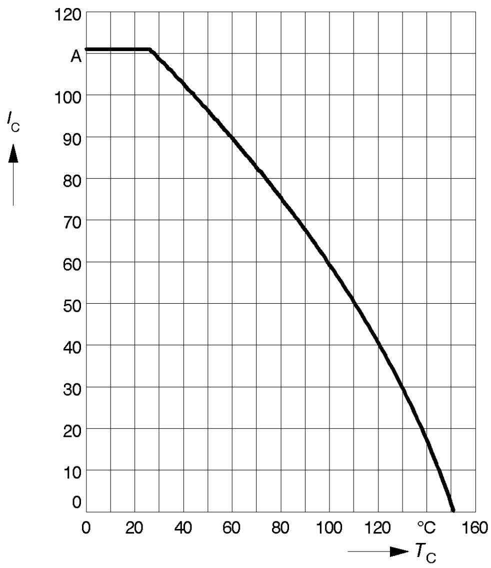
$T_j \leq$ 150 °C
V_{GE} = ± 15 V
$t_{sc} \leq$ 10 µs
L_{ext} < 50 nH
I_C = 75 A

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



V_C = 1200 V
$I_C = I_{CN}$ = 75 A
t_p = 10 µs
$L_{ext} \leq$ 25 nH
R_{Gon} = 10 Ω
R_{Goff} = 10 Ω

Fig. 7 Short circuit current vs. turn-on gate voltage



T_j = 150 °C
$V_{GE} \geq$ 15 V

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

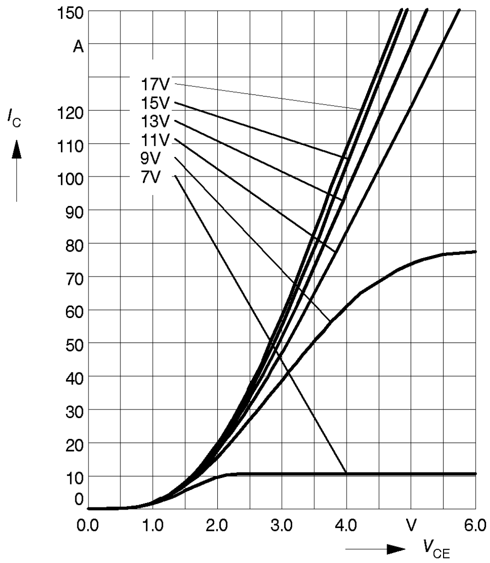


Fig. 9 Typ. output characteristic, t_p = 80 µs; T_j = 25 °C

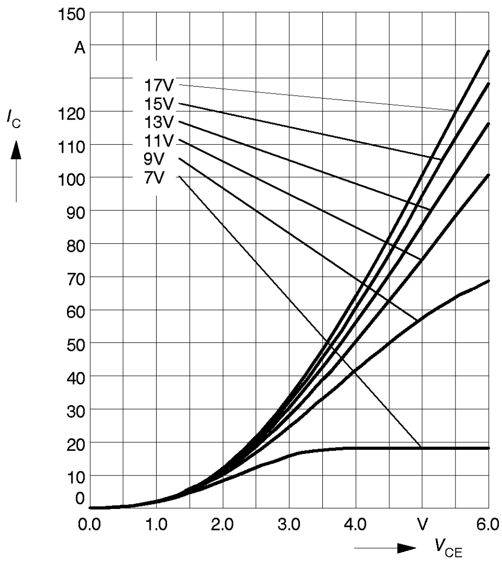


Fig. 10 Typ. output characteristic, t_p = 80 µs; T_j = 125 °C

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

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

$V_{CE(TO)(Tj)} \leq 1,9 + 0,003\ (T_j - 25)$ [V]

$r_{CE(Tj)} = 0,023 + 0,00007\ (T_j - 25)$ [Ω]

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

Fig. 11 Typ. saturation characteristic (IGBT)
Calculation elements and equations

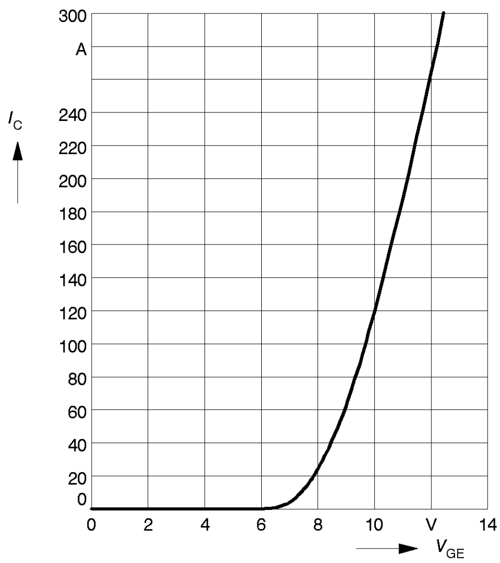


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

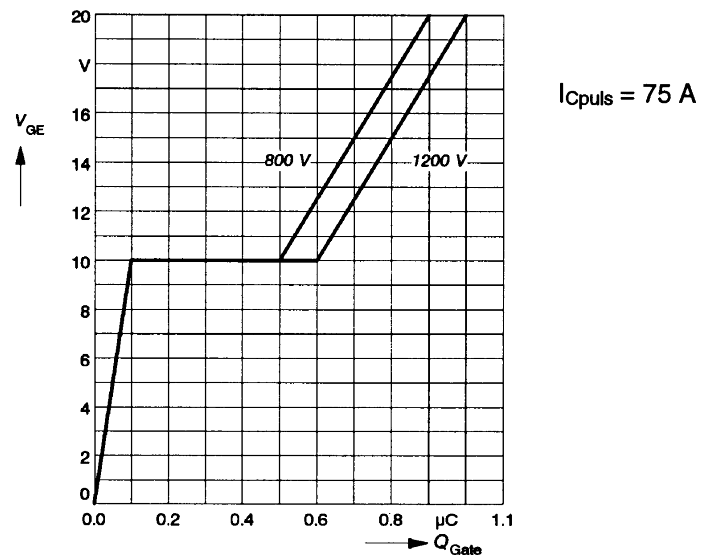


Fig. 13 Typ. gate charge characteristic

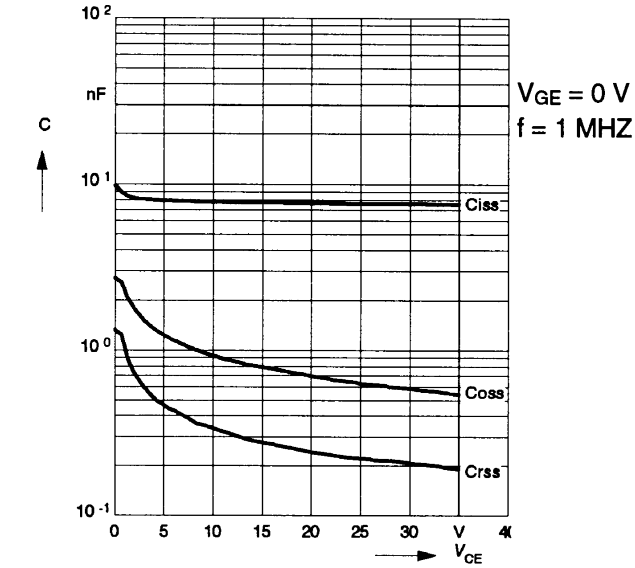


Fig. 14 Typ. capacitances vs.V_{CE}

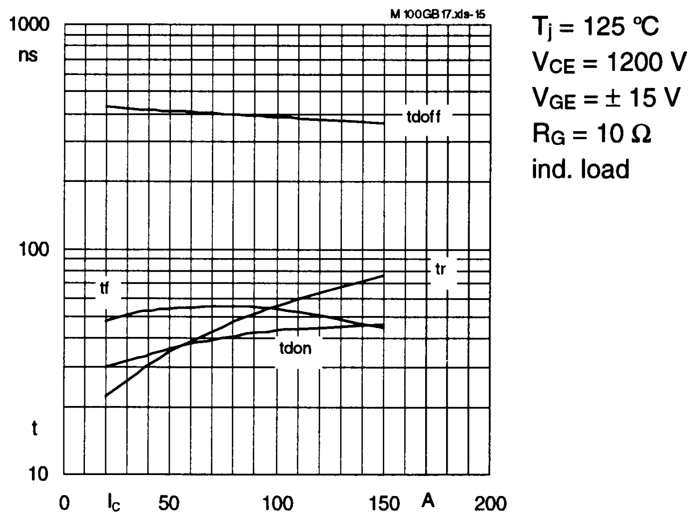


Fig. 15 Typ. switching times vs. I_C

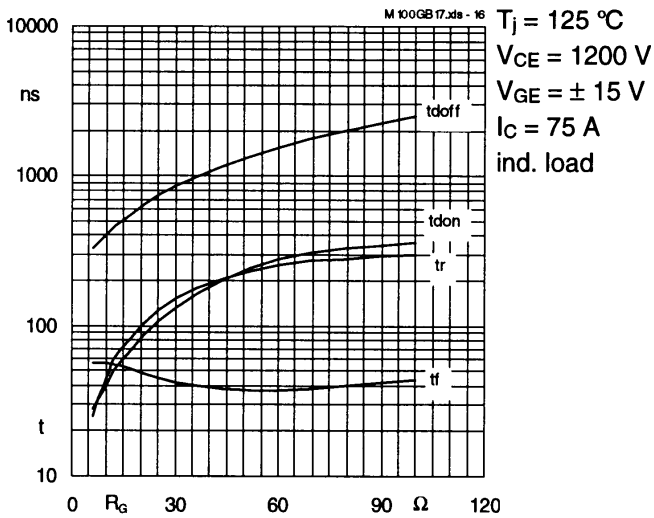


Fig. 16 Typ. switching times vs. R_G

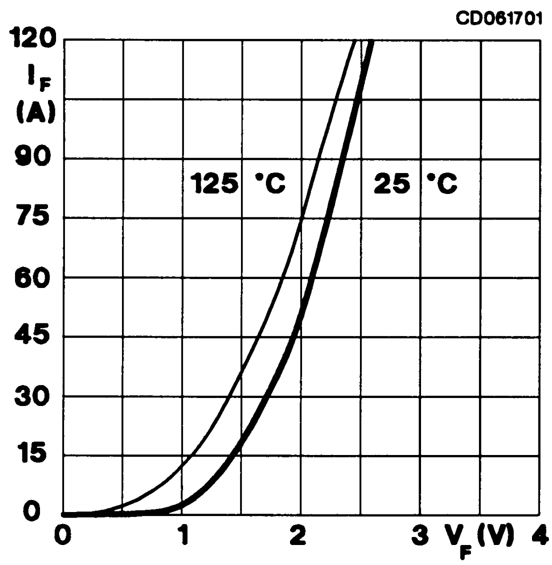


Fig. 17 Typ. CAL diode forward characteristic

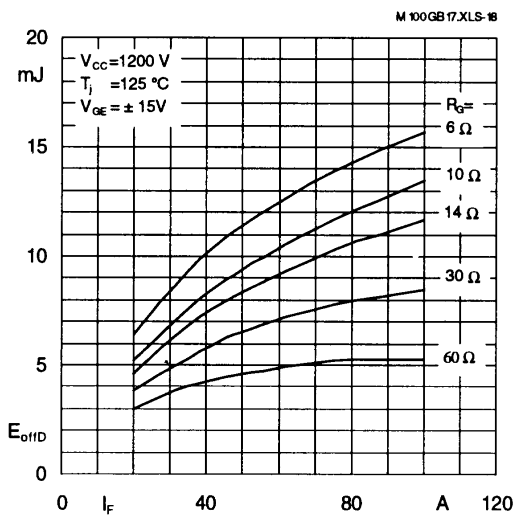


Fig. 18 Typ. Diode turn-off energy dissipation per pulse

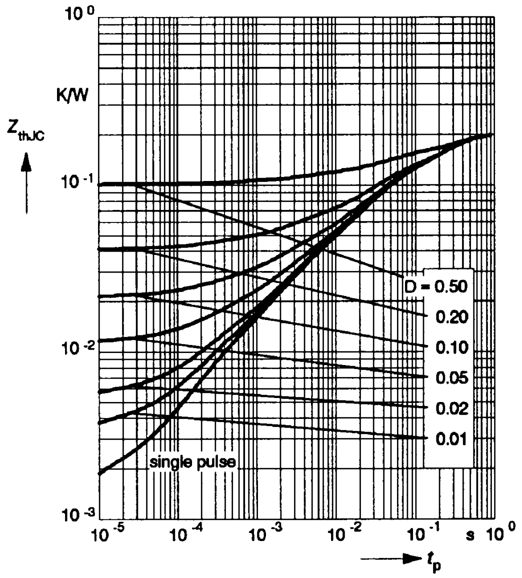


Fig. 19 Transient thermal impedance of IGBT: $Z_{thjc} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

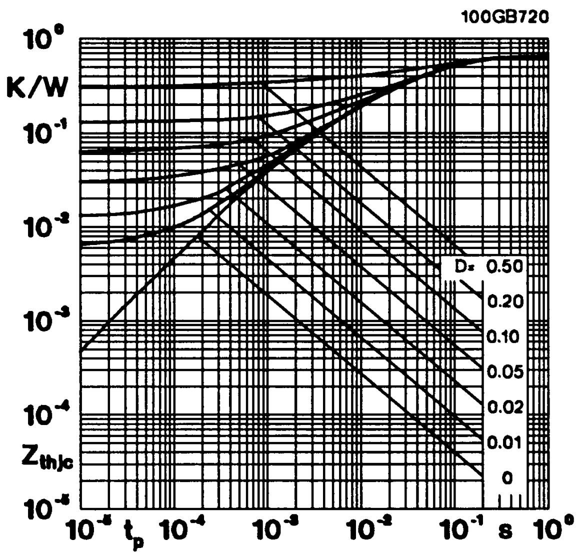


Fig. 20 Transient thermal impedance of inverse diode: $Z_{thjcD} = f(t_p)$

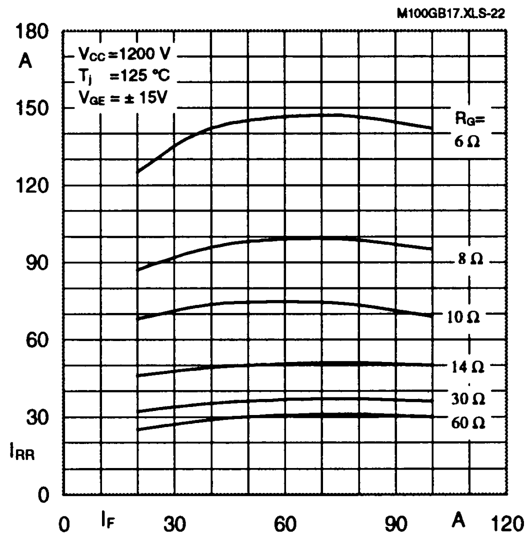


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

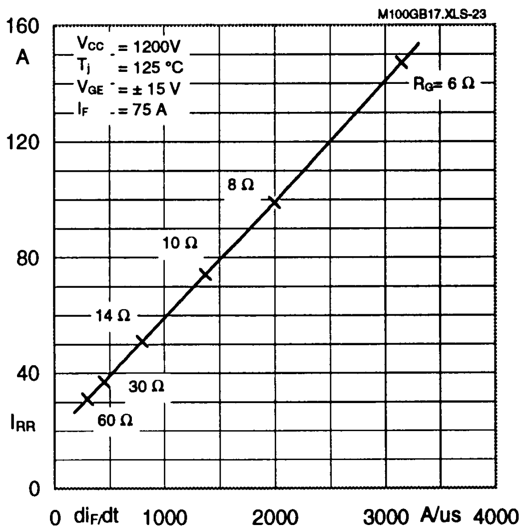


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

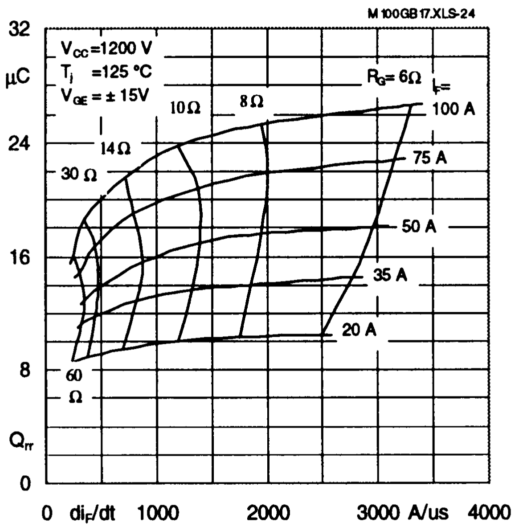
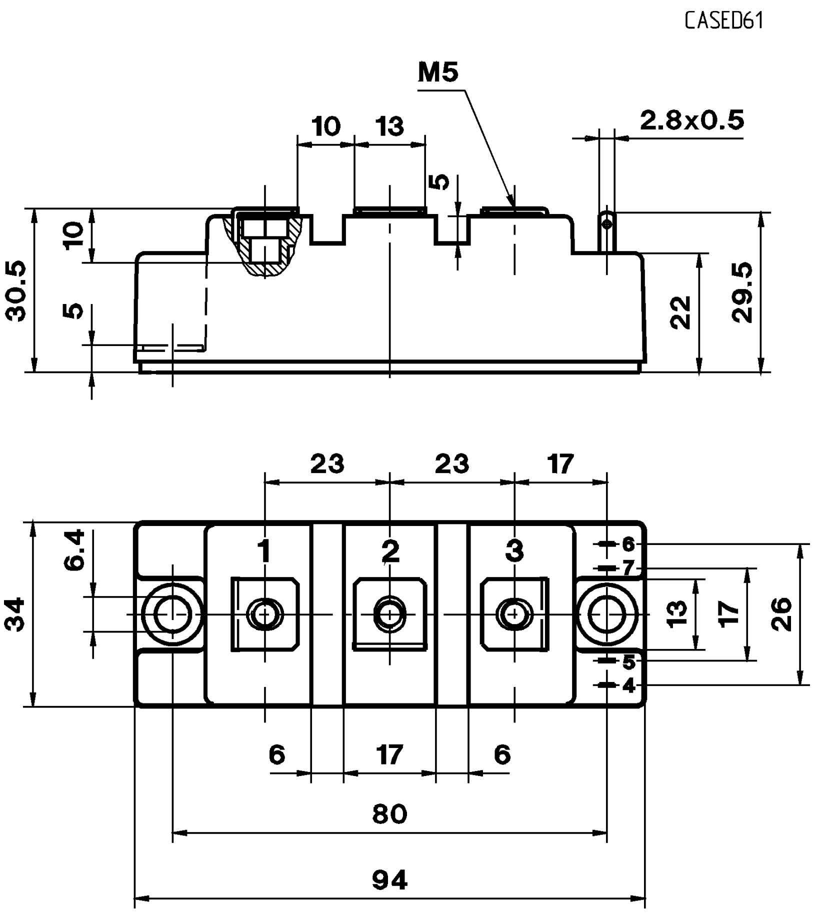
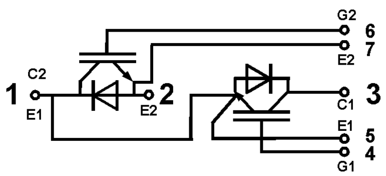


Fig. 24 Typ. CAL diode recovered charge Qrr

SEMITRANS 2
Case D 61
UL Recognized
File no. E 63 532

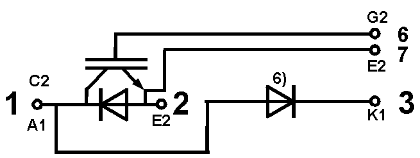
SKM 100 GB 173 D





Dimensions in mm

SKM 100 GAL 173 D
Case D 62 (→ D 61)



Case outline and circuit diagram

Mechanical Data

Symbol	Conditions		Values min.	Values typ.	Values max.	Units
M_1	to heatsink, SI Units	(M6)	3	–	5	Nm
	to heatsink, US Units		27	–	44	lb.in.
M_2	for terminals, SI Units	(M5)	2,5	–	5	Nm
	for terminals, US Units		22	–	44	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	160	g

6) Freewheeling diode → page B 6 – 47, remark 6.

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

Eight devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 2)

Larger packing units of 20 or 42 pieces are used if suitable

