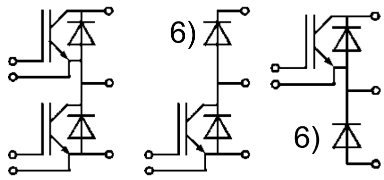
SEMITRANS® M IGBT Modules

SKM 75 GB 123 D
SKM 75 GAL 123 D 6)
SKM 75 GAR 123 D 6)

SEMITRANS 2



Absolute Maximum Ratings Symbol	Conditions 1)	Values		Units
V_{CES}		1200		V
V_{CGR}	R_{GE} = 20 kΩ	1200		V
I_C	T_{case} = 25/80 °C	75 / 60		A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	150 / 120		A
V_{GES}		± 20		V
P_{tot}	per IGBT, T_{case} = 25 °C	460		W
T_j, (T_{stg})		– 40 . . .+150 (125)		°C
V_{isol}	AC, 1 min.	2 500		V
humidity	IEC 60721-3-3	Class 3K7/IE32		
climate	IEC 68 T.1	40/125/56		
Inverse Diode			FWD 6)	
I_F= – I_C	T_{case} = 25/80 °C	75 / 50	95 / 65	A
I_{FM}= – I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	150 / 120	150 / 120	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	550	720	A
I^2t	t_p = 10 ms; T_j = 150 °C	1500	2600	A^2s

Characteristics Symbol	Conditions 1)	min.	typ.	max.	Units
$V_{(BR)CES}$	V_{GE} = 0, I_C = 4 mA	≥ V_{CES}	–	–	V
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 2 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0, V_{CE} = V_{CES}; T_j = 25 °C	–	0,8	1	mA
	V_{GE} = 0, V_{CE} = V_{CES}; T_j = 125 °C	–	3,5	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	200	nA
V_{CEsat}	I_C = 50 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,5(3,1)	3(3,7)	V
V_{CEsat}	I_C = 75 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	3(3,8)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 50 A	23	40	–	S
C_{CHC}	per IGBT	–	–	350	pF
C_{ies}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz	–	3,3	4,3	nF
C_{oes}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz	–	500	600	pF
C_{res}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz	–	220	300	pF
L_{CE}		–	–	30	nH
$t_{d(on)}$	V_{CC} = 600 V; V_{GE} = + 15 V, - 15 V 3); I_C = 50 A, ind. load; R_{Gon} = R_{Goff} = 22 Ω; T_j = 125 °C	–	44	100	ns
t_r		–	56	100	ns
$t_{d(off)}$		–	380	500	ns
t_f		–	70	100	ns
E_{on} 5)		–	8	–	mWs
E_{off} 5)		–	5	–	mWs
Inverse Diode 8)					
V_F = V_{EC}	I_F = 50 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0(1,8)	2,5	V
V_F = V_{EC}	I_F = 75 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,25 (2,1)	–	V
V_{TO}	T_j = 125 °C	–	–	1,2	V
r_T	T_j = 125 °C	–	18	22	mΩ
I_{RRM}	I_F = 50 A; T_j = 25 (125) °C 2)	–	23(35)	–	A
Q_{rr}	I_F = 50 A; T_j = 25 (125) °C 2)	–	2,3(7)	–	µC
FWD of types “GAL” and “GAR” 8)					
V_F = V_{EC}	I_F = 50 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	1,85(1,6)	2,2	V
V_F = V_{EC}	I_F = 75 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0(1,8)	–	V
V_{TO}	T_j = 125 °C	–	–	1,2	V
r_T	T_j = 125 °C	–	12	15	mΩ
I_{RRM}	I_F = 50 A; T_j = 25 (125) °C 2)	–	27(40)	–	A
Q_{rr}	I_F = 50 A; T_j = 25 (125) °C 2)	–	2,5(8)	–	µC
Thermal Characteristics					
R_{thjc}	per IGBT	–	–	0,27	°C/W
R_{thjc}	per diode / FWD “GAL	–	–	0,60/0,50	°C/W
R_{thch}	per module	–	–	0,05	°C/W

Features

- MOS input (voltage controlled)
- N channel, Homogeneous Si
- Low inductance case
- 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 Technology
- Large clearance (10 mm) and creepage distances (20 mm).

Typical Applications: → B 6 - 91

- Switching (not for linear use)

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 V
3) Use V_{GEoff} = -5 ... -15 V
5) See fig. 2 + 3; R_{Goff} = 22 Ω
6) The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 100 GB 123 D
8) CAL = Controlled Axial Lifetime Technology.

Cases and mech. data **→ B6 - 92**
SEMITRANS 2

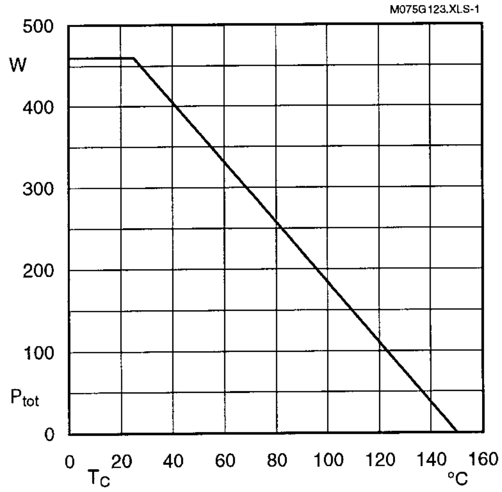
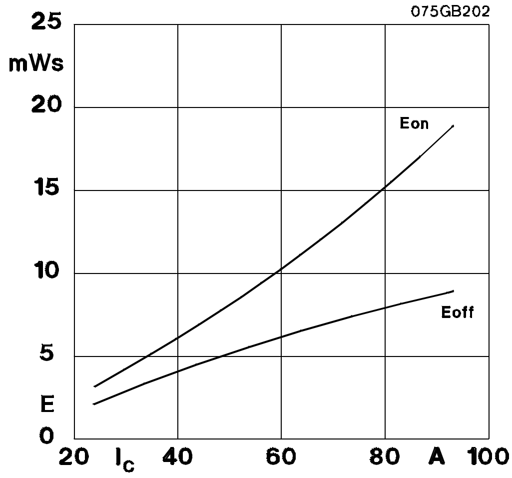
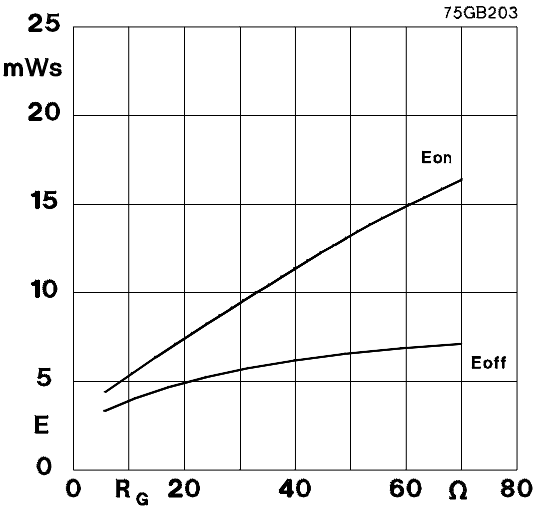


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



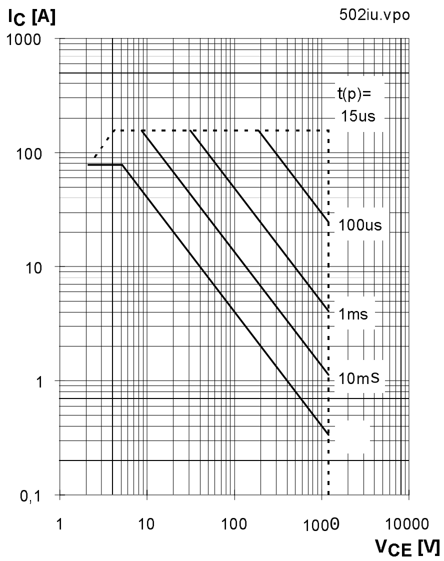
T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_G = 22 Ω

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



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
I_C = 50 A

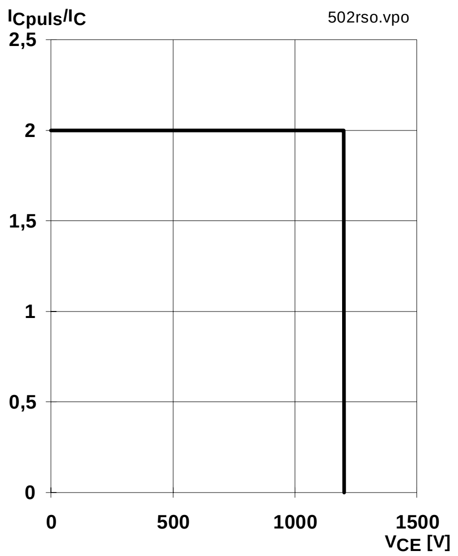
Fig. 3 Turn-on /-off energy = f (R_G)



1 pulse
T_C = 25 °C
T_j ≤ 150 °C

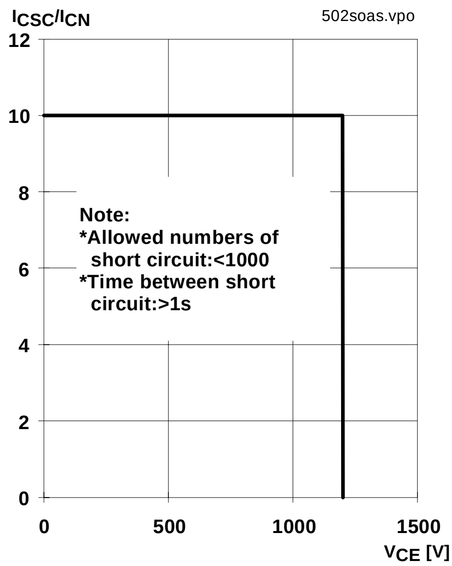
Not for
linear use

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



T_j ≤ 150 °C
V_{GE} = 15 V
R_{Goff} = 22 Ω
I_C = 50 A

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



T_j ≤ 150 °C
V_{GE} = ± 15 V
t_{sc} ≤ 10 µs
L < 25 nH
I_{CN} = 50 A

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

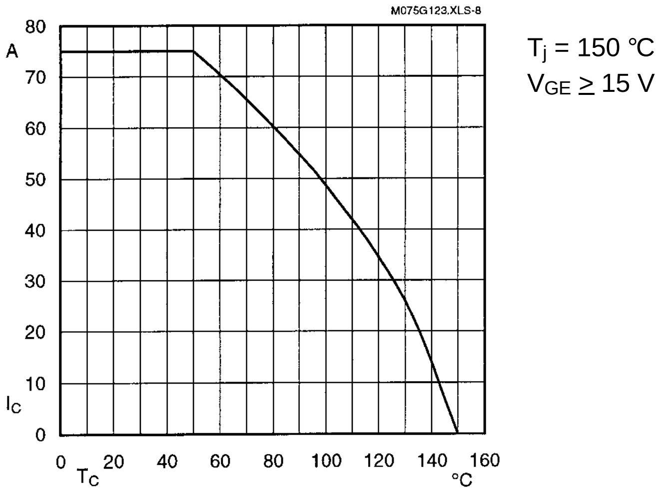


Fig. 7 Short circuit current vs. turn-on gate voltage

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

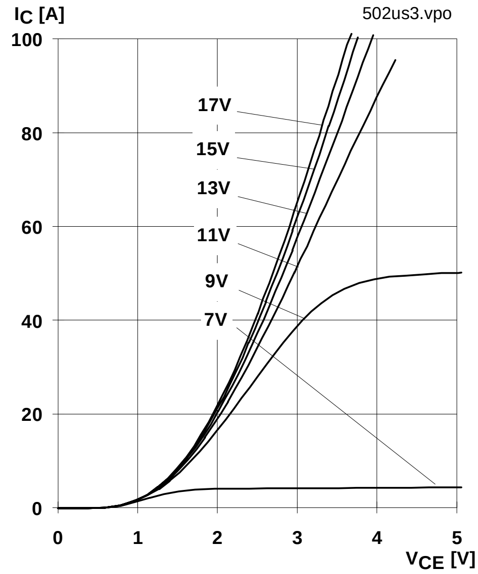


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

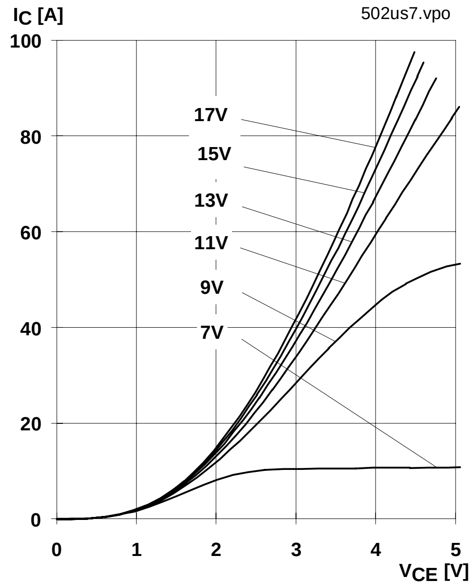


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

$V_{CE(TO)(Tj)} \leq 1{,}5 + 0{,}002\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}020 + 0{,}00008\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}030 + 0{,}00010\ (T_j - 25)$ [Ω]

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

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

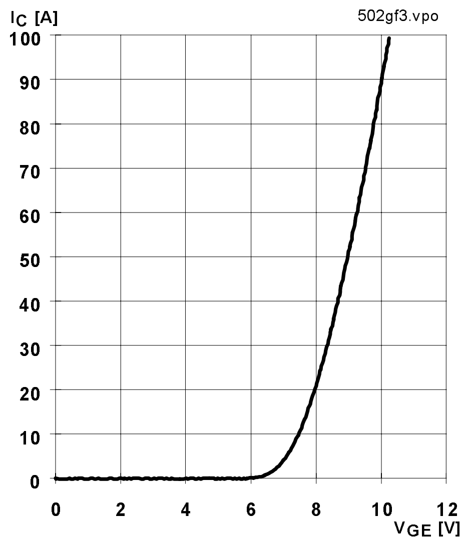
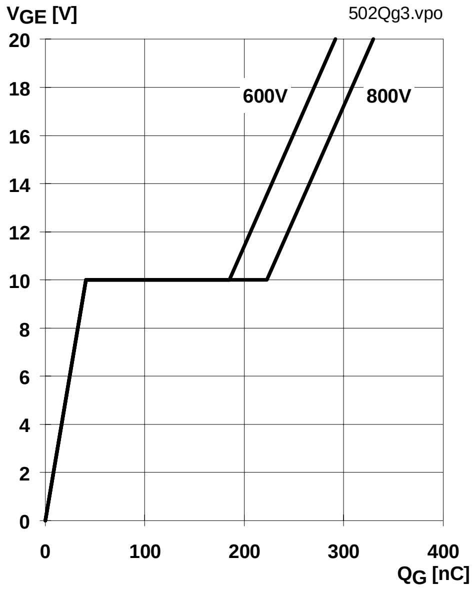
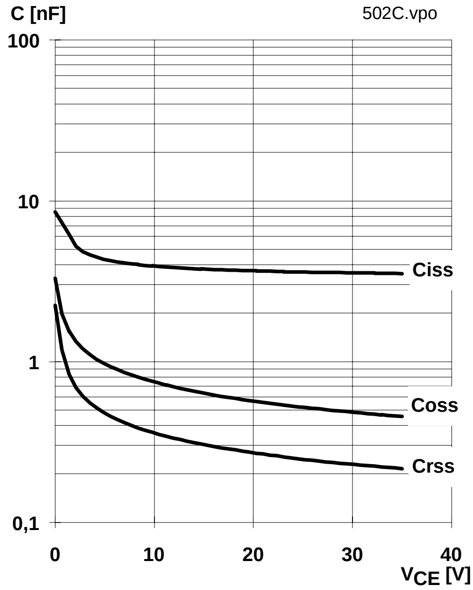


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V



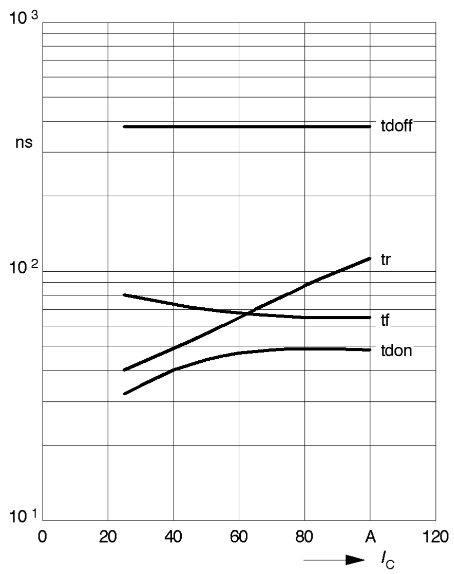
I_{Cpuls} = 50 A

Fig. 13 Typ. gate charge characteristic



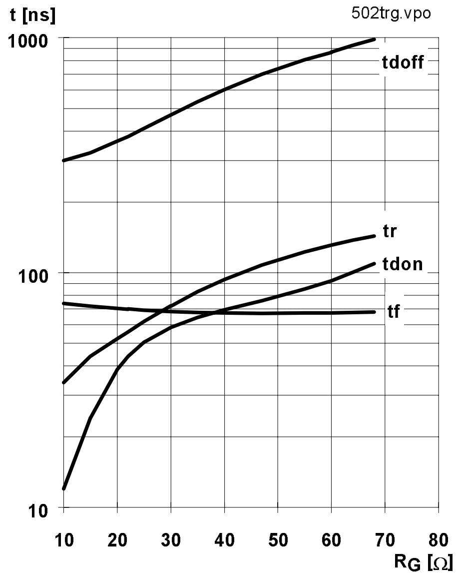
V_{GE} = 0 V
f = 1 MHZ

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



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_{Gon} = 22 Ω
R_{Goff} = 22 Ω
induct. load

Fig. 15 Typ. switching times vs. I_C



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
I_C = 50 A
induct. load

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

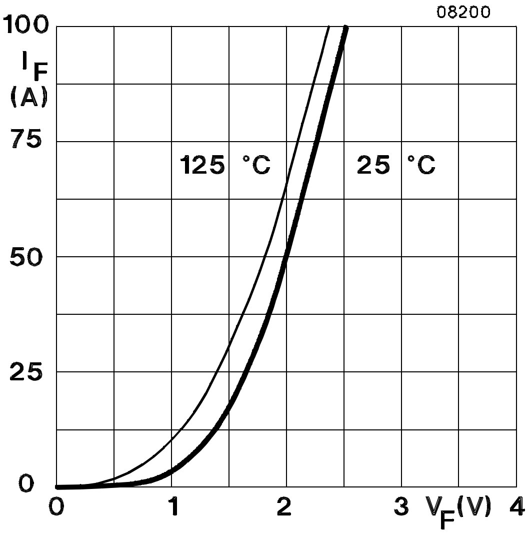


Fig. 17 Typ. CAL diode forward characteristic

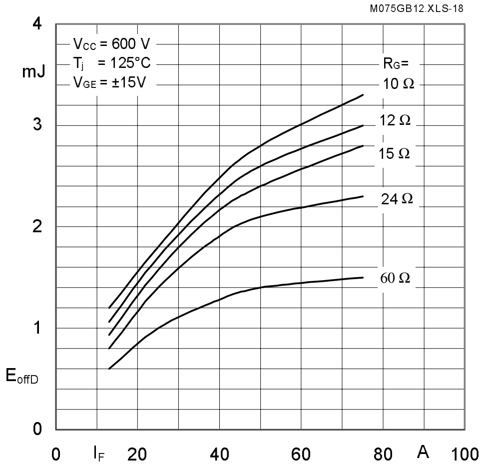


Fig. 18 Diode turn-off energy dissipation per pulse

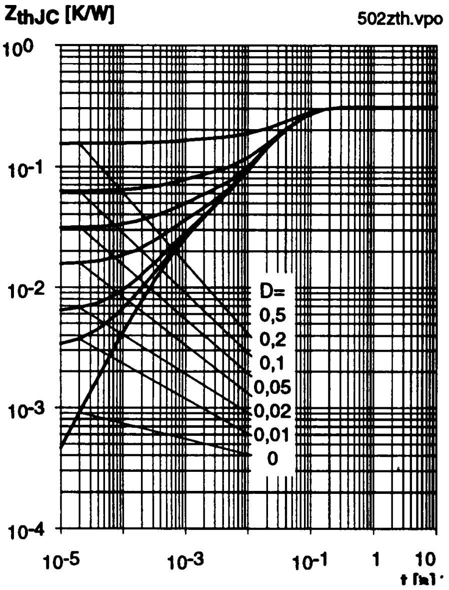


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

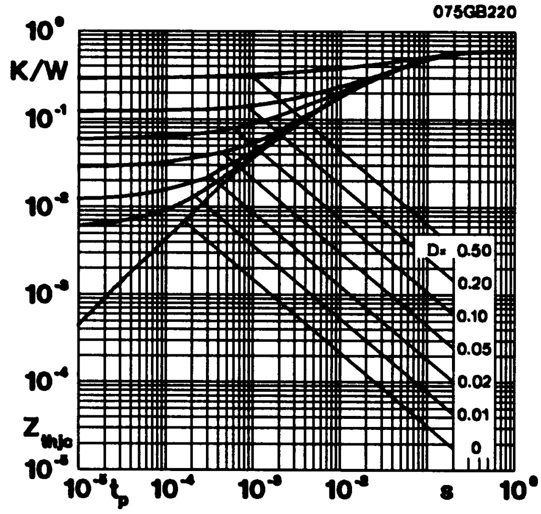


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

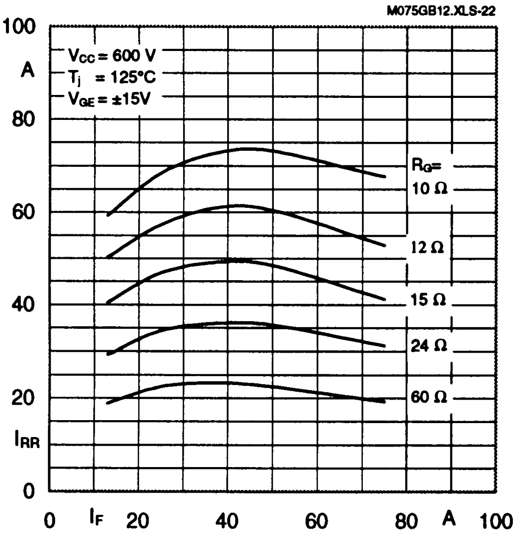


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

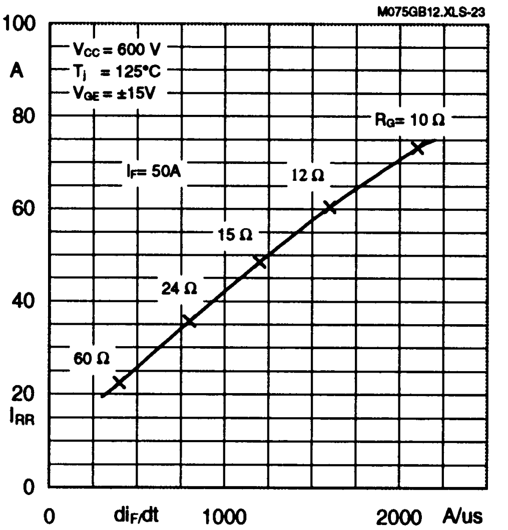


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

Typical Applications include

Switched mode power supplies
DC servo and robot drives
Inverters
DC choppers (versions GAL)
AC motor speed control
Inductive heating
UPS Uninterruptable power supplies
General power switching applications
Electronic (also portable) welders
Pulse frequencies also above 15 kHz

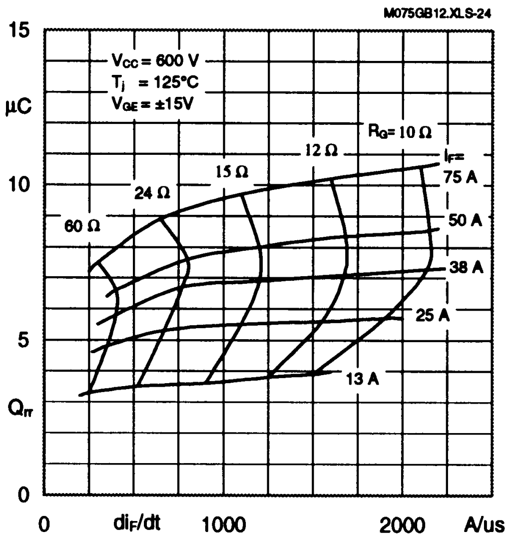


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

SEMITRANS 2

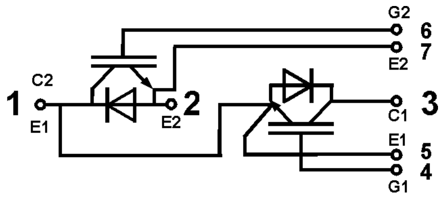
Case D 61

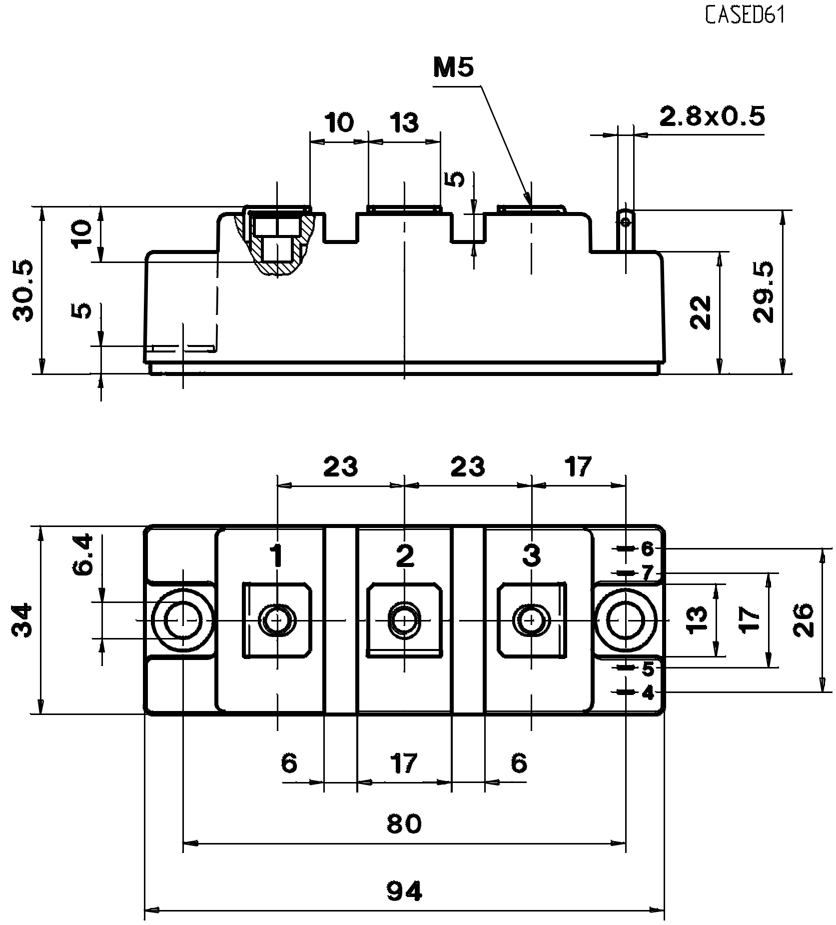
UL Recognized

File no. E 63 532

SKM 75 GB 123 D

SKM 75 GB 173 D

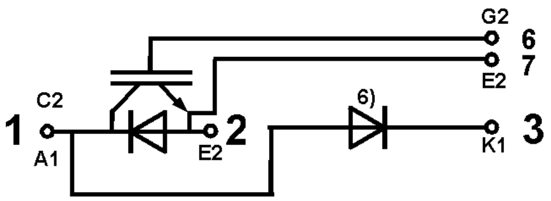




Dimensions in mm

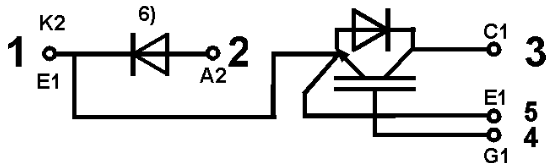
SKM 75 GAL 123 D

Case D 62 (→ D 61)



SKM 75 GAR 123 D

Case D 63 (→ D 61)



Case outline and circuit diagrams

Mechanical Data					
Symbol	**Conditions**	**Values** min.	typ.	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

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)
Accessories → B 6 – 4.
SEMIBOX → C – 1.
Larger packing units of 20 pieces are used if suitable.

[6)] Freewheeling diode → B 6 – 87, remark 6.

