SEMIKRON

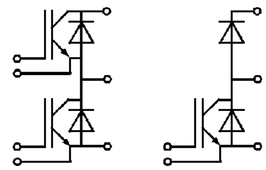
Absolute Maximum Ratings		Values	
Symbol	Conditions [1)]	... 123 D	Units
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/80 °C	50 / 40	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	100 / 80	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	310	W
T_j, (T_{stg})		– 40 . . .+150 (125)	°C
V_{isol}	AC, 1 min.	2 500	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Diodes			
$I_F = -I_C$	T_{case} = 25/80 °C	50 / 40	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	100 / 80	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	550	
I^2t	t_p = 10 ms; T_j = 150 °C	1500	A^2s

Characteristics					
Symbol	Conditions [1)]	min.	typ.	max.	Units
$V_{(BR)CES}$	V_{GE} = 0, I_C = 1 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 } T_j = 25 °C	–	0,3	1	mA
	$V_{CE} = V_{CES}$ } T_j = 125 °C	–	3	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	200	nA
V_{CEsat}	I_C = 40 A { V_{GE} = 15 V;	–	2,5(3,1)	3(3,7)	V
V_{CEsat}	I_C = 50 A } T_j = 25 (125) °C	–	2,7(3,5)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 40 A		30	–	S
C_{CHC}	per IGBT	–	–	350	pF
C_{ies}	} V_{GE} = 0	–	3300	4000	pF
C_{oes}	} V_{CE} = 25 V	–	500	600	pF
C_{res}	} f = 1 MHz	–	220	300	pF
L_{CE}		–	–	30	nH
$t_{d(on)}$	} V_{CC} = 600 V	–	70	–	ns
t_r	} V_{GE} = + 15 V / - 15 V[3)]	–	60	–	ns
$t_{d(off)}$	} I_C = 40 A, ind. load	–	400	–	ns
t_f	} $R_{Gon} = R_{Goff}$ = 27 Ω	–	45	–	ns
E_{on} [5)]	} T_j = 125 °C	–	7	–	mWs
E_{off} [5)]		–	4,5	–	mWs
Diodes [8)]					
$V_F = V_{EC}$	I_F = 40 A { V_{GE} = 0 V;	–	1,85(1,6)	2,2	V
$V_F = V_{EC}$	I_F = 50 A } 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	–	–	22	mΩ
I_{RRM}	I_F = 40 A; T_j = 25 (125) °C[2)]	–	23(35)	–	A
Q_{rr}	I_F = 40 A; T_j = 25 (125) °C[2)]	–	2,3(7)	–	µC
Thermal Characteristics					
R_{thjc}	per IGBT	–	–	0,4	°C/W
R_{thjc}	per diode	–	–	0,7	°C/W
R_{thch}	per module	–	–	0,05	°C/W

SEMITRANS® M
IGBT Modules

SKM 50 GB 123 D
SKM 50 GAL 123 D

SEMITRANS 2



GB **GAL**

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 - 85**

- Three phase inverter drives
- 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} = 27 Ω
8) CAL = Controlled Axial Lifetime Technology.

Case and mech. data → **B 6 - 86**
SEMITRANS 2

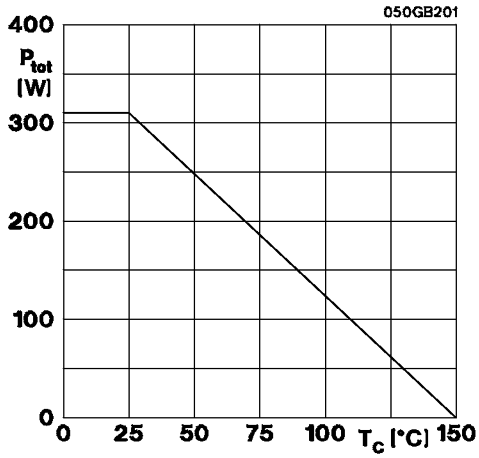
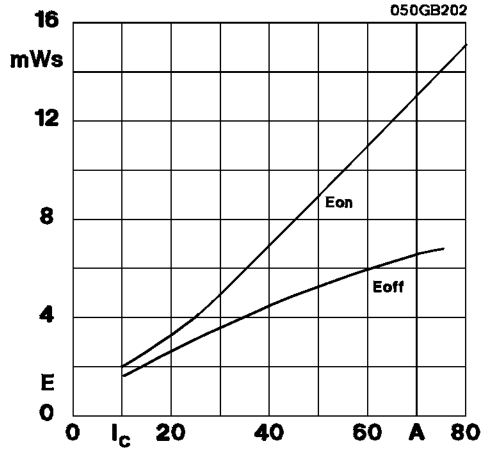
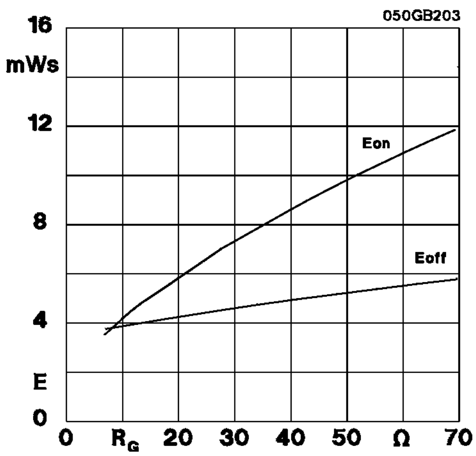


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



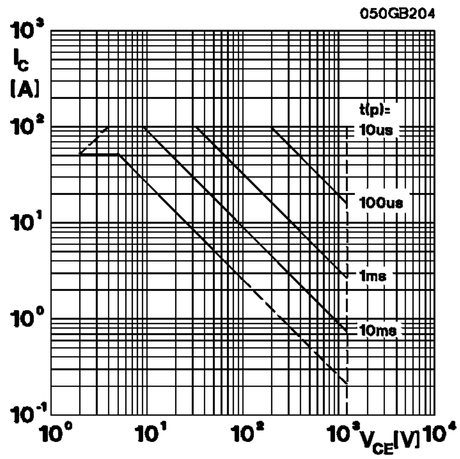
T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_G = 27 Ω

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



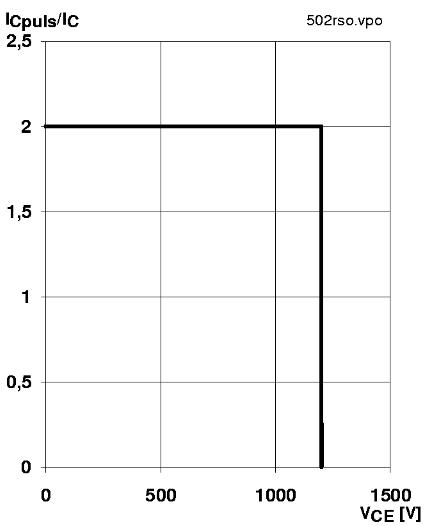
T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
I_C = 40 A

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



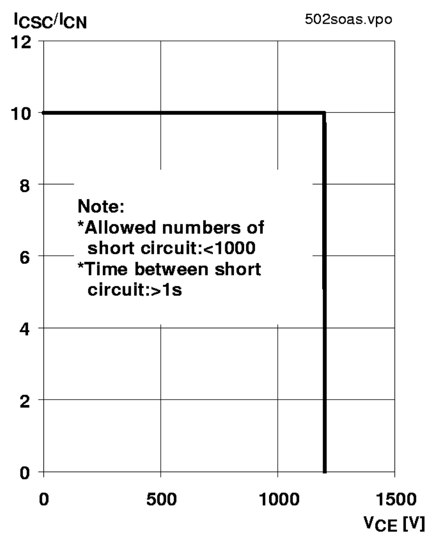
1 pulse
T_C = 25 °C
$T_j \leq$ 150 °C

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



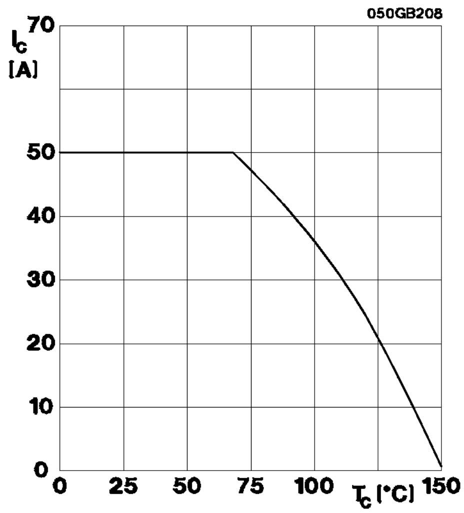
$T_j \leq$ 150 °C
V_{GE} = ± 15 V
R_{Goff} = 27 Ω
I_C = 40 A

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



$T_j \leq$ 150 °C
V_{GE} = ± 15 V
$t_{sc} \leq$ 10 µs
L < 25 nH
I_{CN} = 40 A

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



T_j = 150 °C
$V_{GE} \geq$ 15 V

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

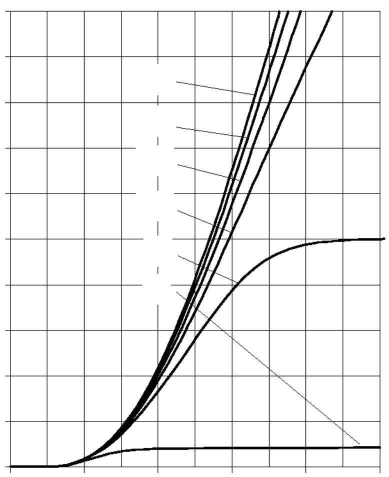


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

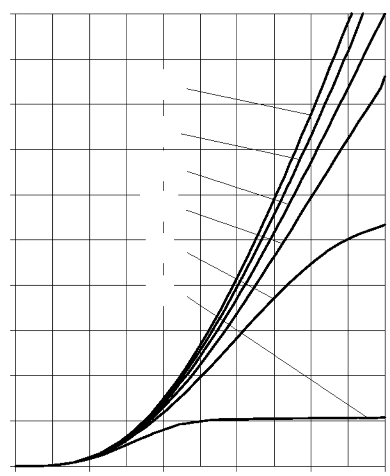


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

typ.: $r_{CE(Tj)} = 0{,}02 + 0{,}00008\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}03 + 0{,}00010\ (T_j - 25)$ [Ω]

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

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

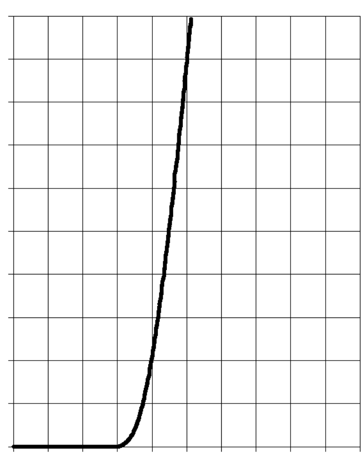
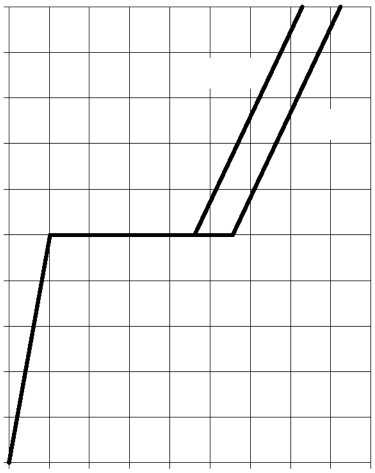
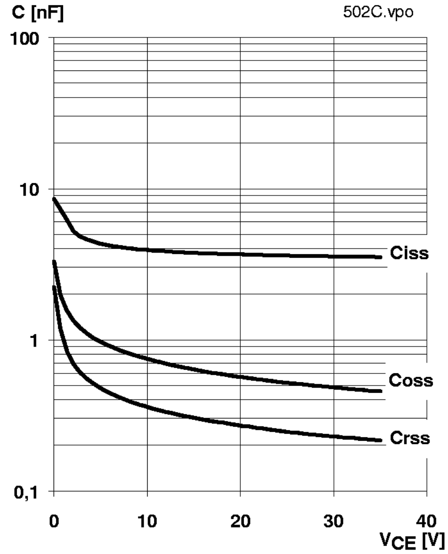


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V



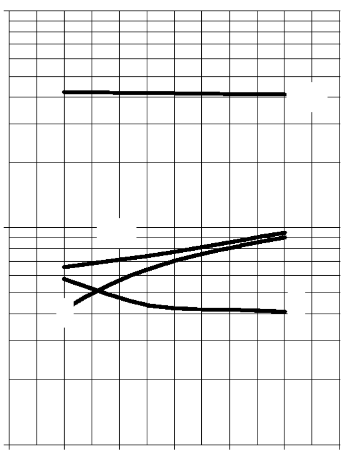
I_{Cpuls} = 50 A

Fig. 13 Typ. gate charge characteristic



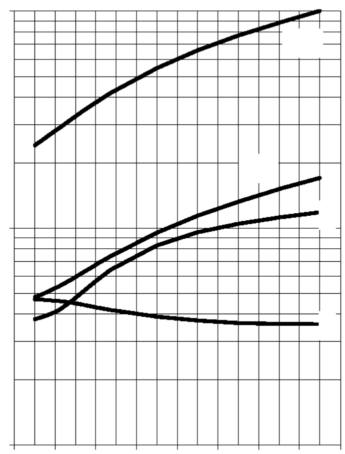
V_{GE} = 0 V
f = 1 MHZ

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



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_{Gon} = 27 Ω
R_{Goff} = 27 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 = 40 A
induct. load

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

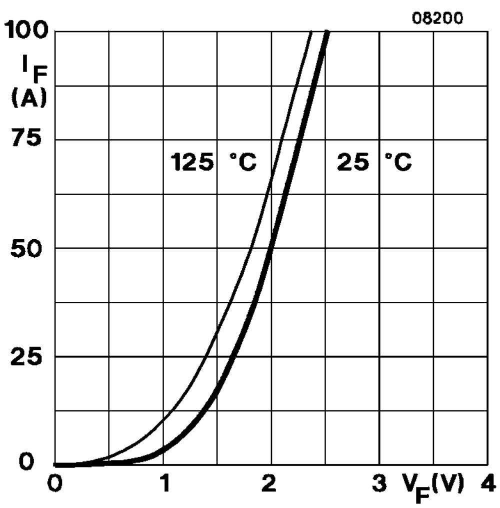


Fig. 17 Typ. CAL diode forward characteristic

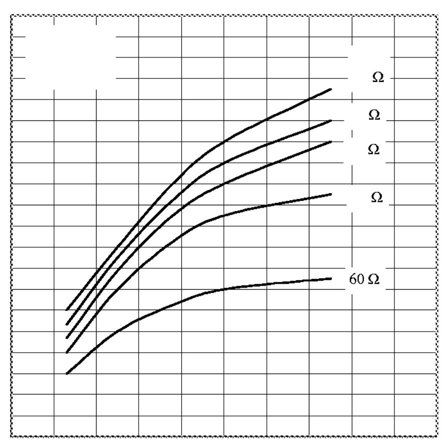


Fig. 18 Diode turn-off energy dissipation per pulse

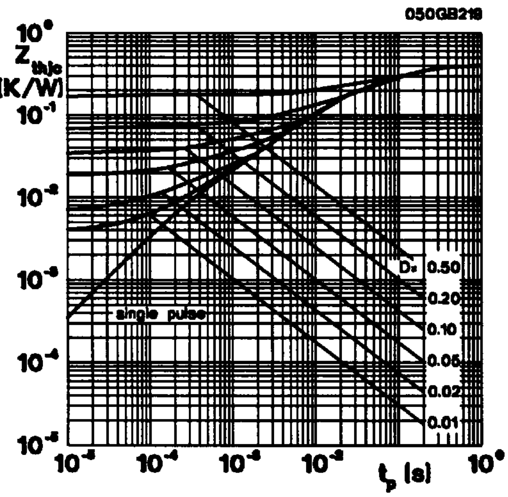


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

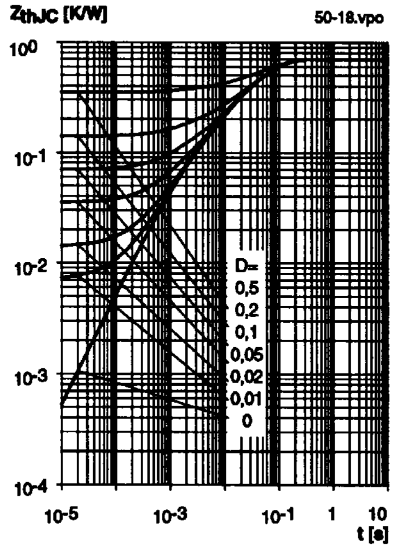


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$;$D = t_p / t_c = t_p \cdot f$

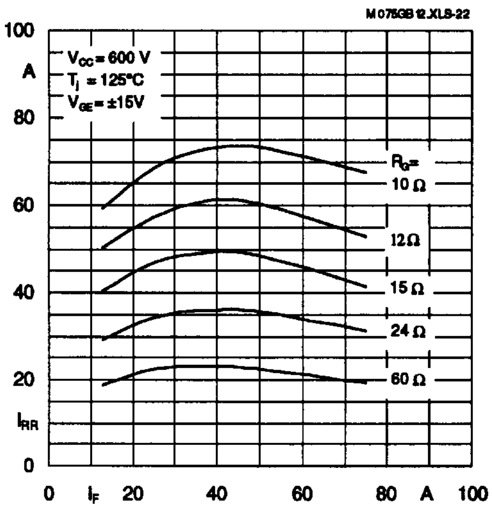


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F, R_G)$

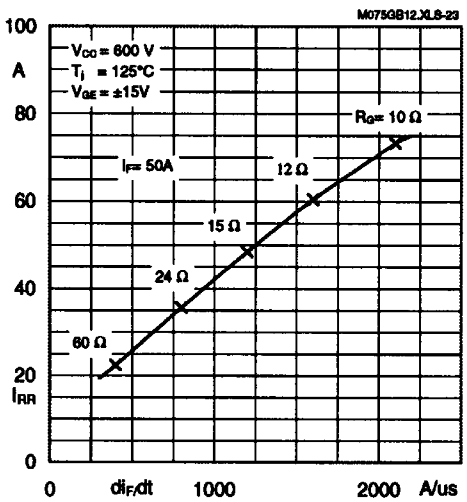


Fig. 23 Typ CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

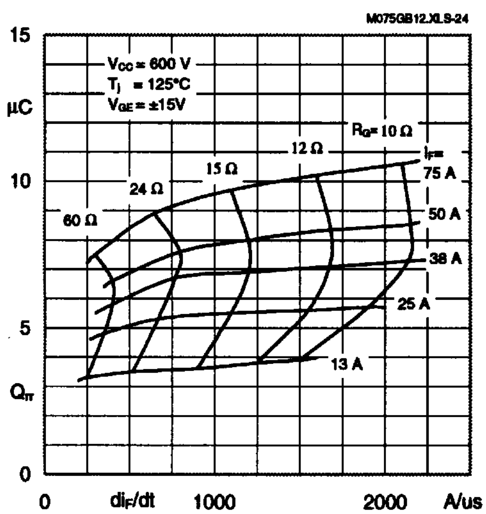


Fig. 24 Typ. CAL diode recovery charge

Typical Applications include

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

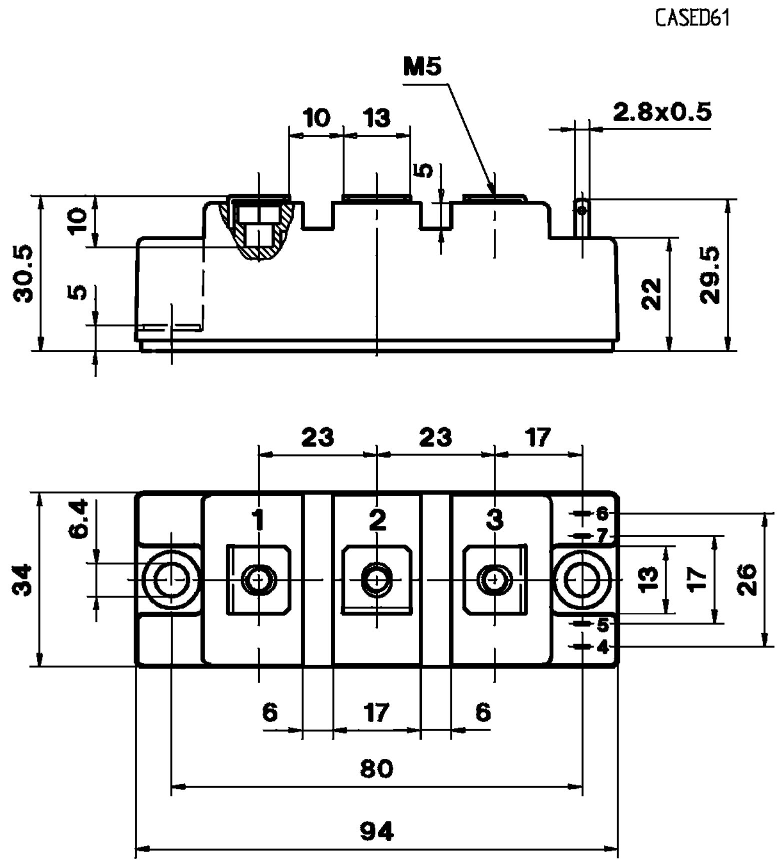
SEMITRANS 2

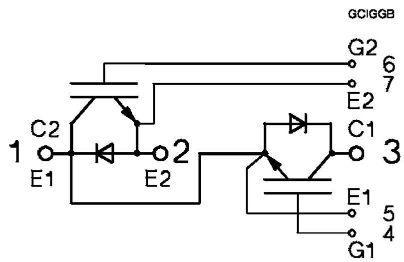
Case D 61

UL Recognized

File no. E 63 532

SKM 50 GB 123 D

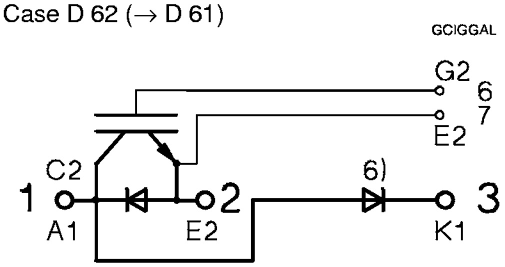




Dimensions in mm

SKM 50 GAL 123 D

Case D 62 (→ 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)
Larger packaging units of 20 or 42 pieces are used if suitable
Accessories → B 6 – 4.
SEMIBOX → C – 1.

