

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

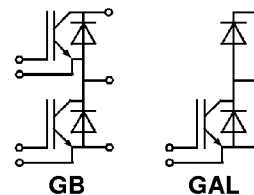
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
$V_{(BR)CES}$	$V_{GE} = 0, I_C = 1 \text{ mA}$	$\geq V_{CES}$	—	—	V
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 2 \text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0 \quad \left. \begin{array}{l} T_J = 25 \text{ }^\circ\text{C} \\ V_{CE} = V_{CES} \quad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

SEMITRANS® M IGBT Modules

SKM 50 GB 123 D SKM 50 GAL 123 D



SEMITRANS 2



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 $6 \cdot I_{cnom}$
- Latch-up free
- Fast & soft inverse CAL diodes⁸⁾
- 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⁾ $T_{case} = 25 \text{ }^\circ\text{C}$, unless otherwise specified

²⁾ $I_F = -I_C, V_R = 600 \text{ V}, -di_F/dt = 800 \text{ A}/\mu\text{s}, V_{GE} = 0 \text{ V}$

³⁾ Use $V_{GEoff} = -5 \dots -15 \text{ V}$

⁵⁾ See fig. 2 + 3; $R_{Goff} = 27 \text{ } \Omega$

⁸⁾ CAL = Controlled Axial Lifetime Technology.

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

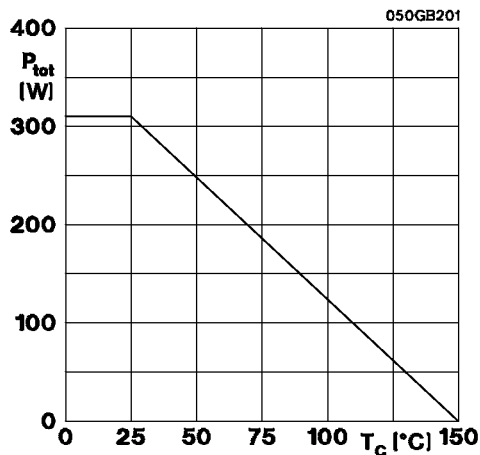


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

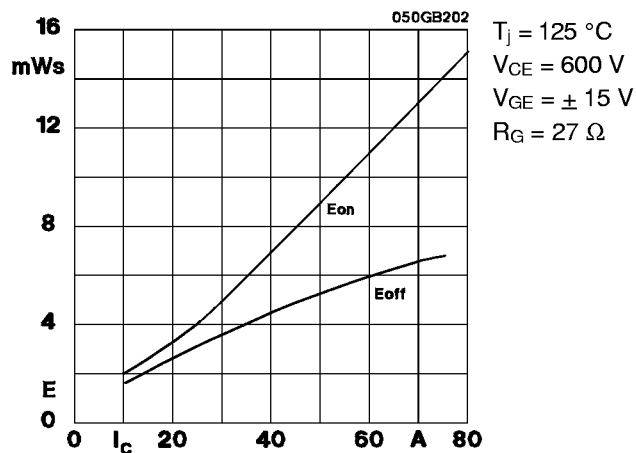


Fig. 2 Turn-on /-off energy $= f(I_C)$

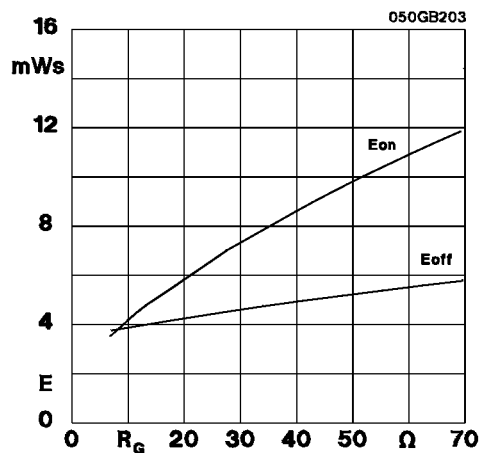


Fig. 3 Turn-on /-off energy $= f(R_G)$

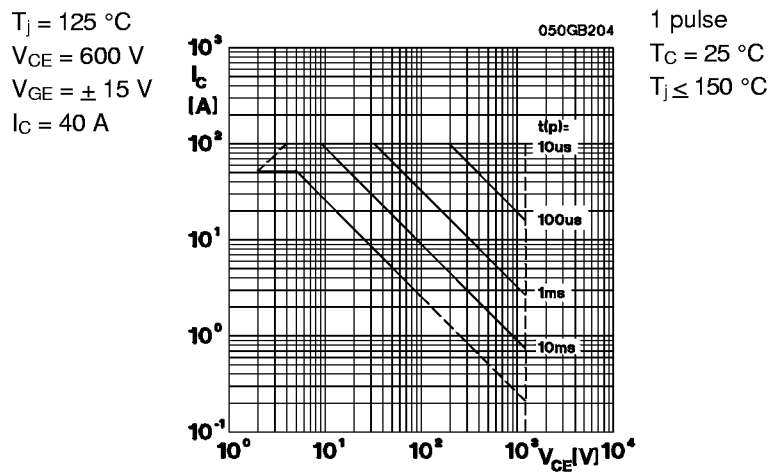


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

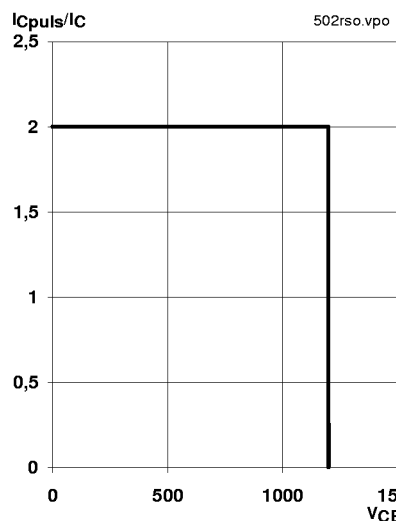


Fig. 5 Turn-off safe operating area (RBSOA)

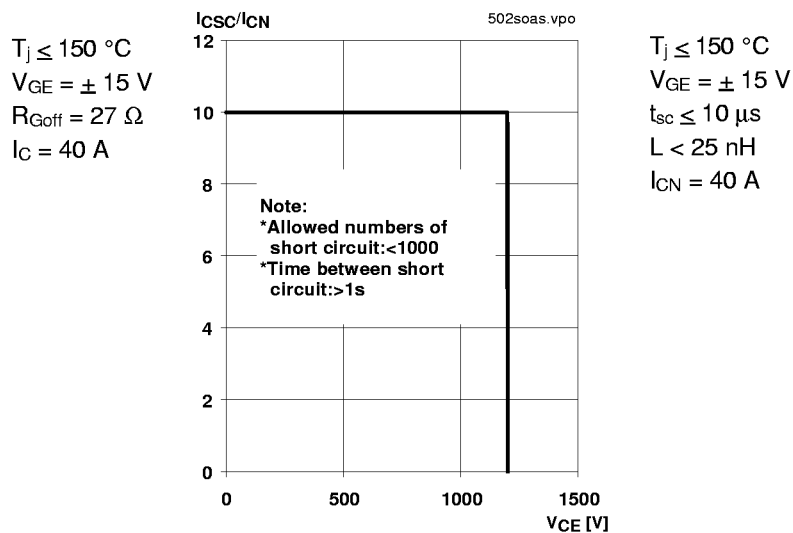


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

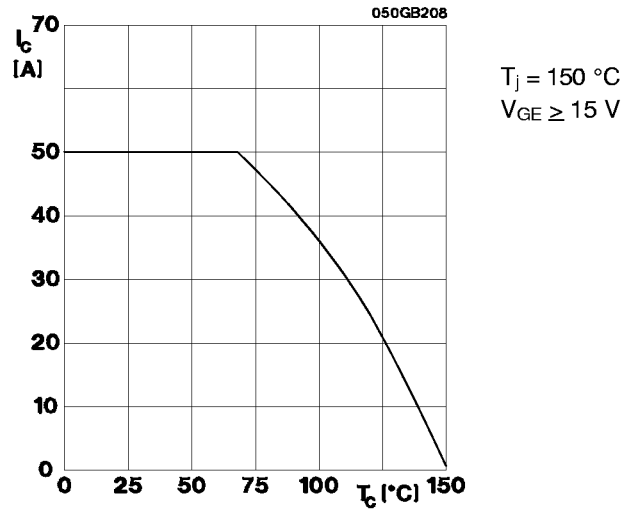


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

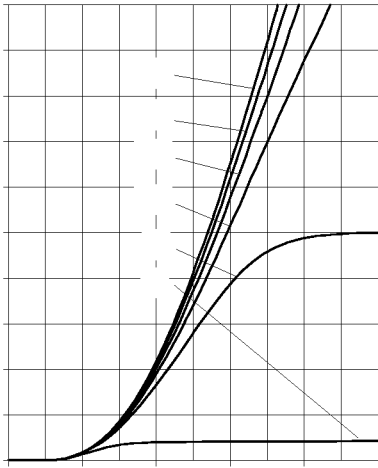


Fig. 9 Typ. output characteristic, $t_p = 80\text{ μs}$; 25 °C

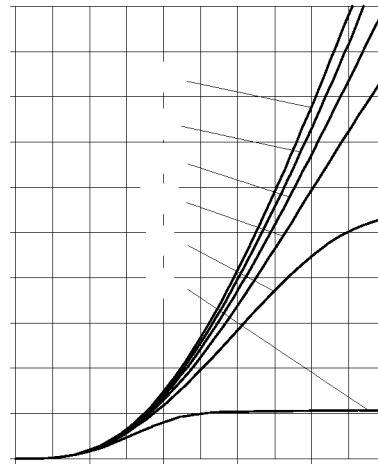


Fig. 10 Typ. output characteristic, $t_p = 80\text{ μs}$; 125 °C

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

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

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

$$\text{typ.: } r_{CE(T_J)} = 0,02 + 0,00008 (T_J - 25) \text{ [}\Omega\text{]}$$

$$\text{max.: } r_{CE(T_J)} = 0,03 + 0,00010 (T_J - 25) \text{ [}\Omega\text{]}$$

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

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

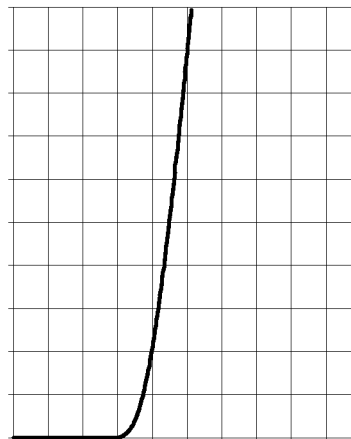


Fig. 12 Typ. transfer characteristic, $t_p = 80\text{ μs}$; $V_{CE} = 20\text{ V}$

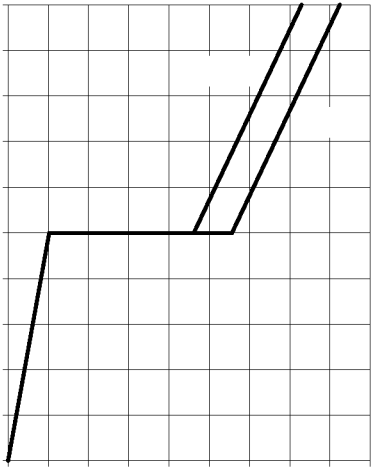


Fig. 13 Typ. gate charge characteristic

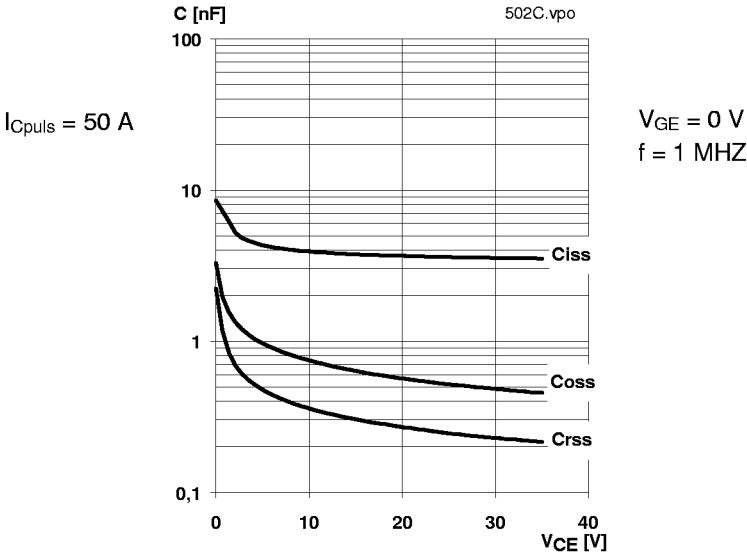


Fig. 14 Typ. capacitances vs. V_{CE}

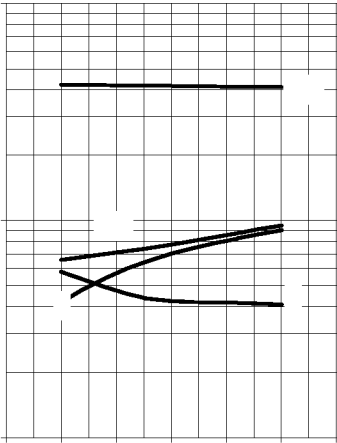


Fig. 15 Typ. switching times vs. I_C

$T_j = 125\text{ }^{\circ}\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_{Gon} = 27\text{ }\Omega$
 $R_{Goff} = 27\text{ }\Omega$
induct. load

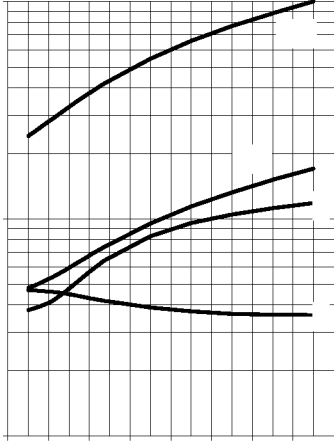


Fig. 16 Typ. switching times vs. gate resistor R_G

$T_j = 125\text{ }^{\circ}\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_C = 40\text{ A}$
induct. load

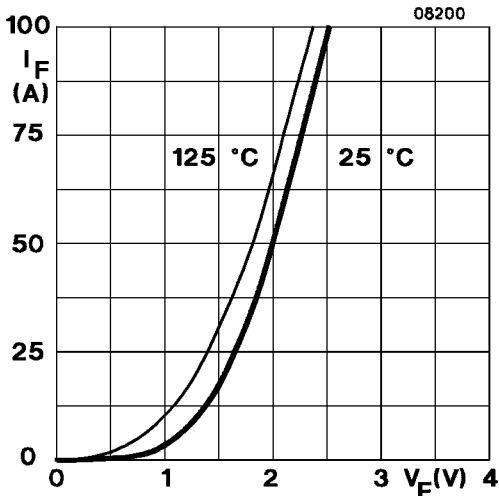


Fig. 17 Typ. CAL diode forward characteristic

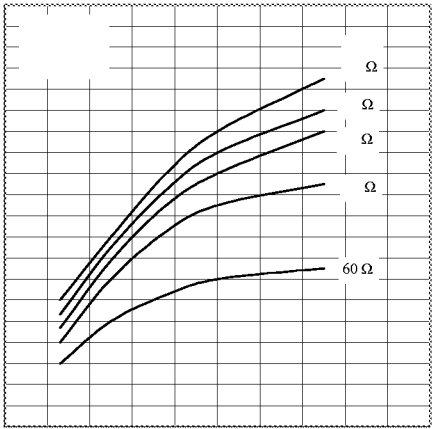


Fig. 18 Diode turn-off energy dissipation per pulse

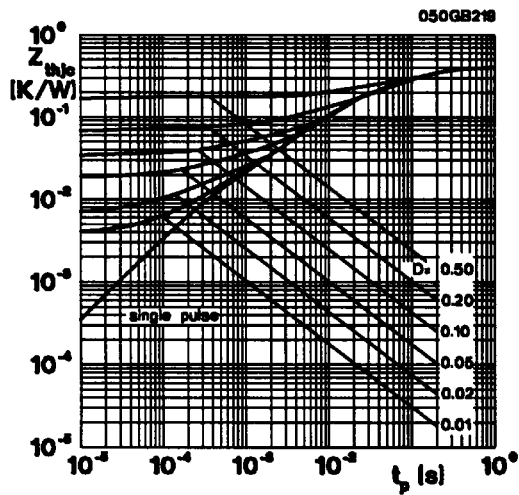


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

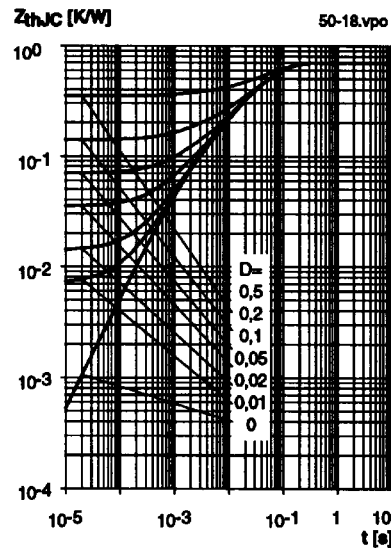


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

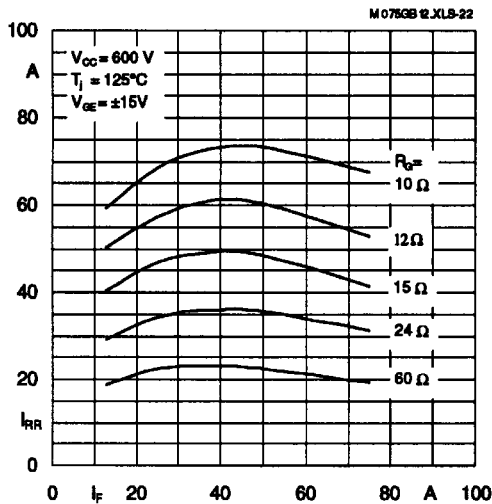


Fig. 22 Typ. CAL diode peak reverse recovery current
 $I_{RR} = f(I_F, R_G)$

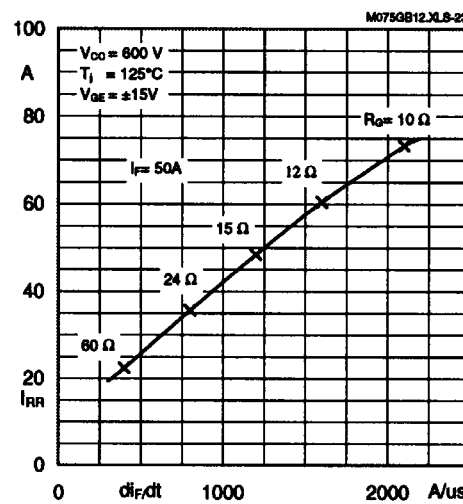


Fig. 23 Typ CAL diode peak reverse recovery current
 $I_{RR} = f(di/dt)$

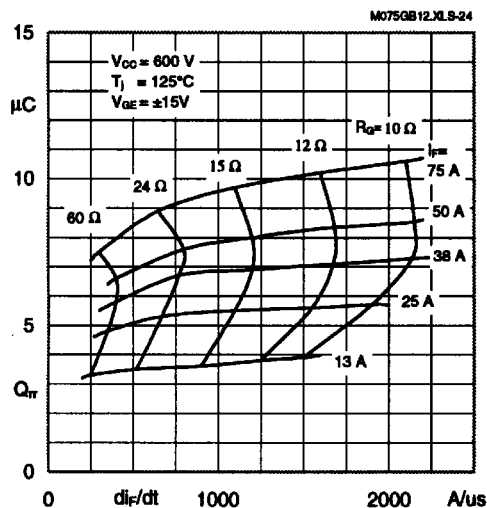


Fig. 24 Typ. CAL diode recovery charge

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

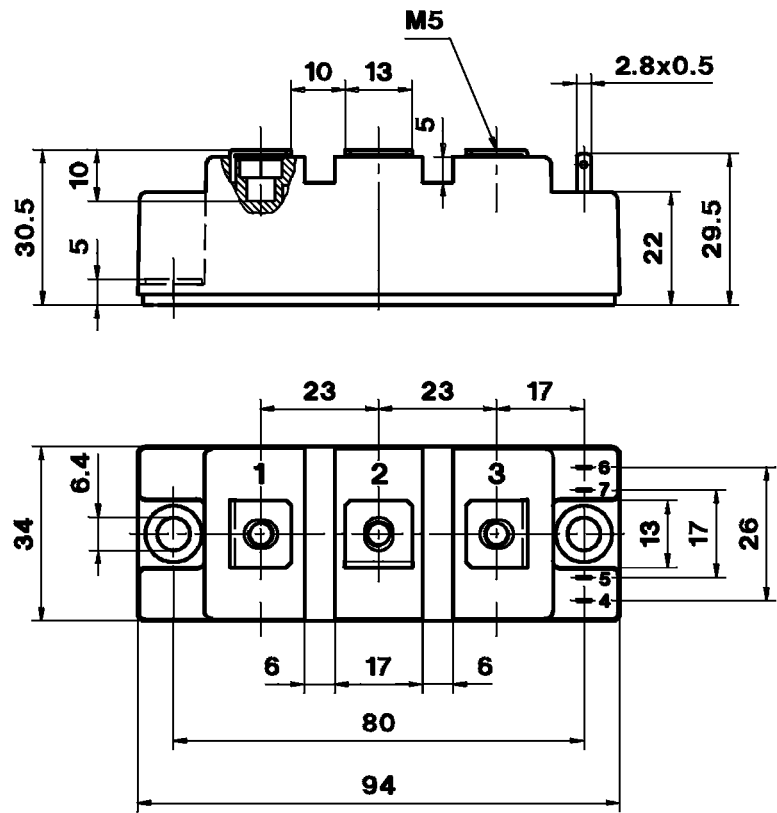
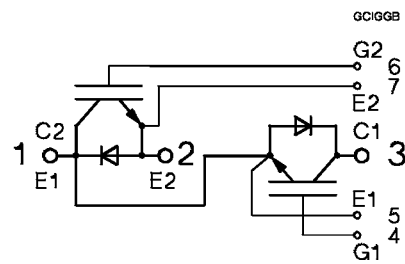
Case D 61

UL Recognized

File no. E 63 532

SKM 50 GB 123 D

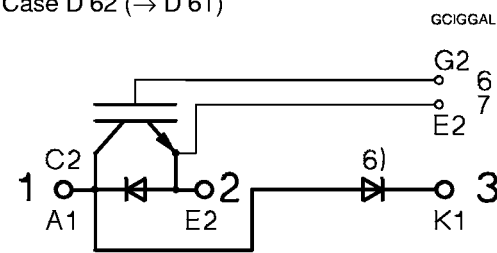
CASED61



Dimensions in mm

SKM 50 GAL 123 D

Case D 62 (→ D 61)



Case outline and circuit diagrams

Mechanical Data			Values			Units
Symbol	Conditions		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 (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.