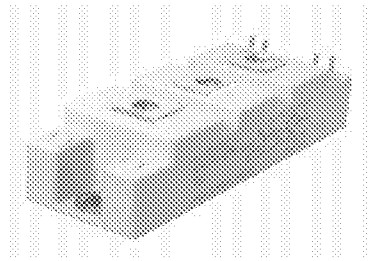


Absolute Maximum Ratings		Values ... 123 D	Units
Symbol	Conditions <sup>1)</sup>		
V <sub>CES</sub>		1200	V
V <sub>CGR</sub>	R <sub>GE</sub> = 20 kΩ	1200	V
I <sub>C</sub>	T <sub>case</sub> = 25/80 °C	50 / 40	A
I <sub>CM</sub>	T <sub>case</sub> = 25/80 °C; t <sub>p</sub> = 1 ms	100 / 80	A
V <sub>GES</sub>		± 20	V
P <sub>tot</sub>	per IGBT, T <sub>case</sub> = 25 °C	310	W
T <sub>J</sub> , (T <sub>stg</sub> )		- 40 ... +150 (125)	°C
V <sub>isol</sub>	AC, 1 min.	2 500	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
<b>Diodes</b>			
I <sub>F</sub> = - I <sub>C</sub>	T <sub>case</sub> = 25/80 °C	50 / 40	A
I <sub>FM</sub> = - I <sub>CM</sub>	T <sub>case</sub> = 25/80 °C; t <sub>p</sub> = 1 ms	100 / 80	A
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms; sin.; T <sub>J</sub> = 150 °C	550	
I <sup>2</sup> t	t <sub>p</sub> = 10 ms; T <sub>J</sub> = 150 °C	1500	A <sup>2</sup> s

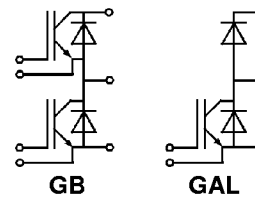
Characteristics		min.	typ.	max.	Units
Symbol	Conditions <sup>1)</sup>				
V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0, I <sub>C</sub> = 1 mA	≥ V <sub>CES</sub>	-	-	V
V <sub>GE(th)</sub>	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 2 mA	4,5	5,5	6,5	V
I <sub>CES</sub>	V <sub>GE</sub> = 0 } T <sub>J</sub> = 25 °C	-	0,3	1	mA
	V <sub>CE</sub> = V <sub>CES</sub> } T <sub>J</sub> = 125 °C	-	3	-	mA
I <sub>GES</sub>	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0	-	-	200	nA
V <sub>CEsat</sub>	I <sub>C</sub> = 40 A } V <sub>GE</sub> = 15 V;	-	2,5(3,1)	3(3,7)	V
V <sub>CEsat</sub>	I <sub>C</sub> = 50 A } T <sub>J</sub> = 25 (125) °C	-	2,7(3,5)	-	V
g <sub>fs</sub>	V <sub>CE</sub> = 20 V, I <sub>C</sub> = 40 A	-	30	-	S
C <sub>CHC</sub>	per IGBT	-	-	350	pF
C <sub>ies</sub>	V <sub>GE</sub> = 0	-	3300	4000	pF
C <sub>oes</sub>	V <sub>CE</sub> = 25 V	-	500	600	pF
C <sub>res</sub>	f = 1 MHz	-	220	300	pF
L <sub>CE</sub>		-	-	30	nH
t <sub>d(on)</sub>	V <sub>CC</sub> = 600 V	-	70	-	ns
t <sub>r</sub>	V <sub>GE</sub> = + 15 V / - 15 V <sup>3)</sup>	-	60	-	ns
t <sub>d(off)</sub>	I <sub>C</sub> = 40 A, ind. load	-	400	-	ns
t <sub>f</sub>	R <sub>Gon</sub> = R <sub>Goff</sub> = 27 Ω	-	45	-	ns
E <sub>on</sub> <sup>5)</sup>	T <sub>J</sub> = 125 °C	-	7	-	mWs
E <sub>off</sub> <sup>5)</sup>		-	4,5	-	mWs
<b>Diodes <sup>8)</sup></b>					
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 40 A } V <sub>GE</sub> = 0 V;	-	1,85(1,6)	2,2	V
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 50 A } T <sub>J</sub> = 25 (125) °C	-	2,0(1,8)	-	V
V <sub>TO</sub>	T <sub>J</sub> = 125 °C	-	-	1,2	V
r <sub>T</sub>	T <sub>J</sub> = 125 °C	-	-	22	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 40 A; T <sub>J</sub> = 25 (125) °C <sup>2)</sup>	-	23(35)	-	A
Q <sub>rr</sub>	I <sub>F</sub> = 40 A; T <sub>J</sub> = 25 (125) °C <sup>2)</sup>	-	2,3(7)	-	μC
<b>Thermal Characteristics</b>					
R <sub>thjc</sub>	per IGBT	-	-	0,4	°C/W
R <sub>thjc</sub>	per diode	-	-	0,7	°C/W
R <sub>thch</sub>	per module	-	-	0,05	°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 \* I<sub>cnom</sub>
- Latch-up free
- Fast & soft inverse CAL diodes<sup>8)</sup>
- 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<sub>case</sub> = 25 °C, unless otherwise specified

2) I<sub>F</sub> = - I<sub>C</sub>, V<sub>R</sub> = 600 V, - di<sub>F</sub>/dt = 800 A/μs, V<sub>GE</sub> = 0 V

3) Use V<sub>GEoff</sub> = -5 ... -15 V

5) See fig. 2 + 3; R<sub>Goff</sub> = 27 Ω

8) CAL = Controlled Axial Lifetime Technology.

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

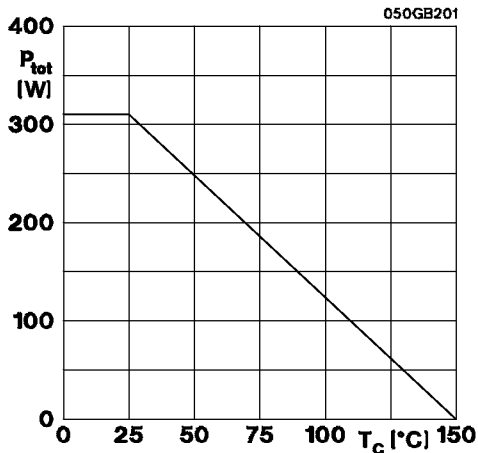


Fig. 1 Rated power dissipation  $P_{tot} = f(T_c)$

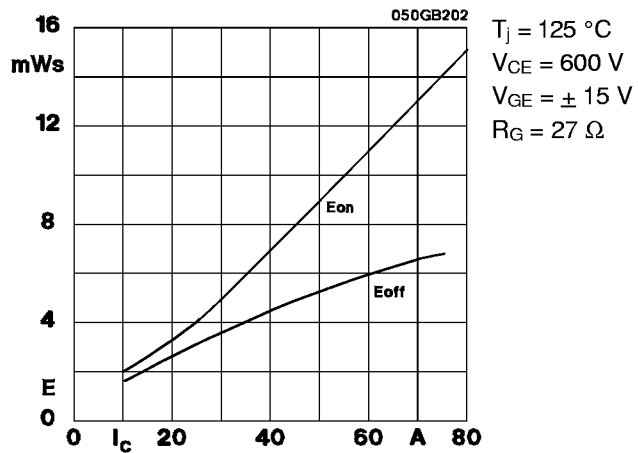


Fig. 2 Turn-on /-off energy =  $f(I_c)$

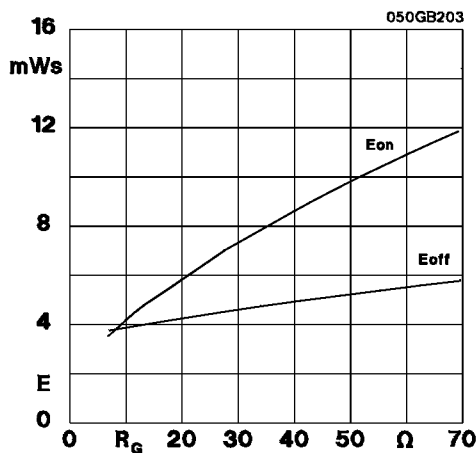


Fig. 3 Turn-on /-off energy =  $f(R_G)$

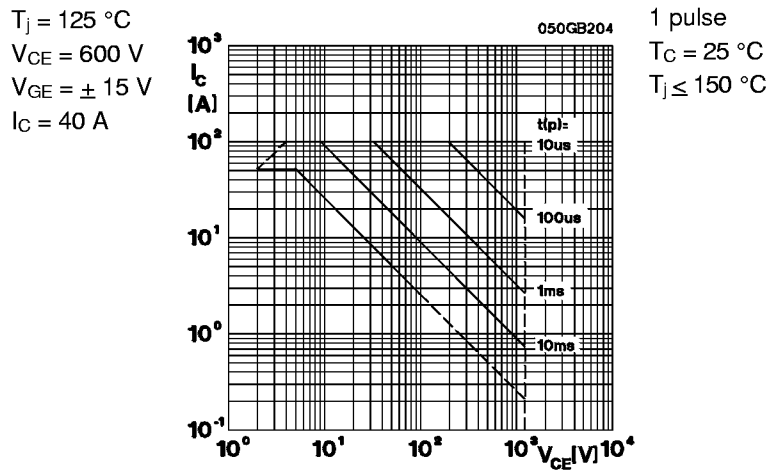


Fig. 4 Maximum safe operating area (SOA)  $I_c = f(V_{CE})$

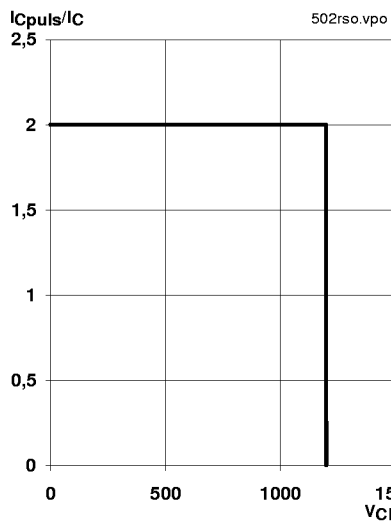


Fig. 5 Turn-off safe operating area (RBSOA)

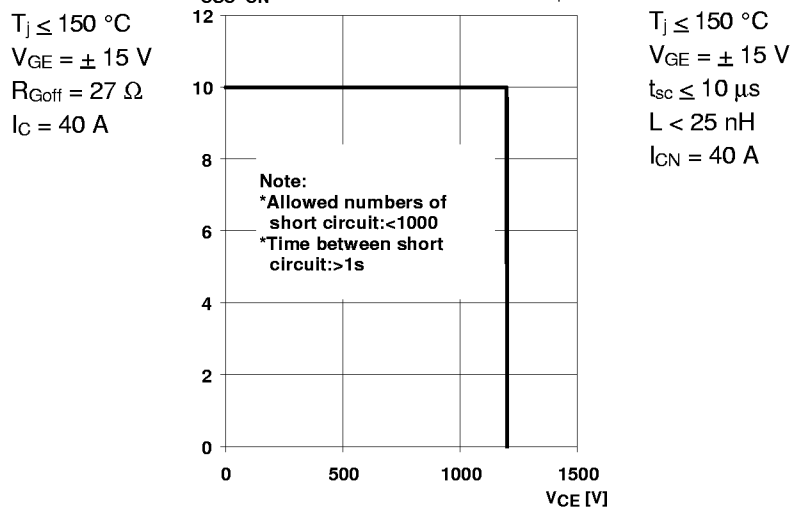


Fig. 6 Safe operating area at short circuit  $I_c = f(V_{CE})$

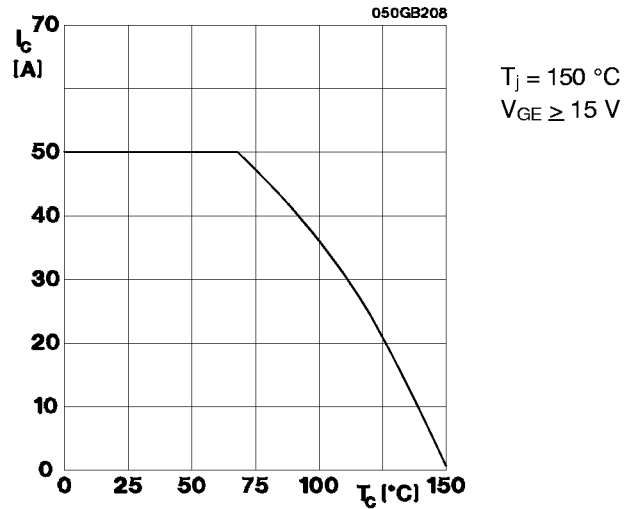


Fig. 8 Rated current vs. temperature  $I_c = f(T_c)$

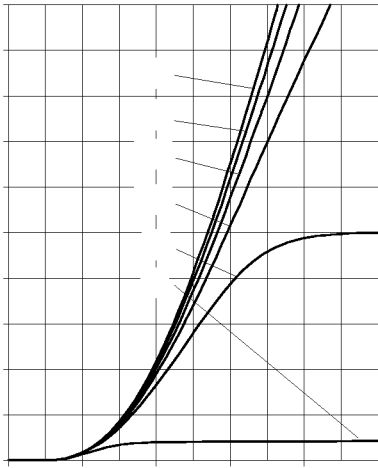


Fig. 9 Typ. output characteristic,  $t_p = 80\text{ μs}$ ;  $25\text{ °C}$

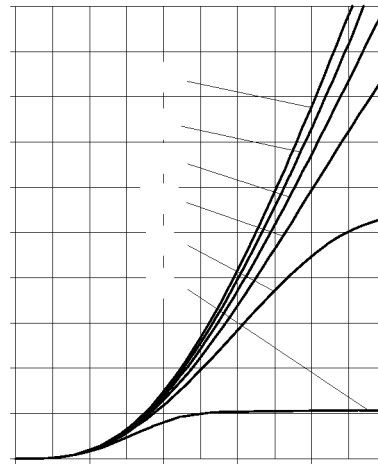


Fig. 10 Typ. output characteristic,  $t_p = 80\text{ μs}$ ;  $125\text{ °C}$

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

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

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

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

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

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

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

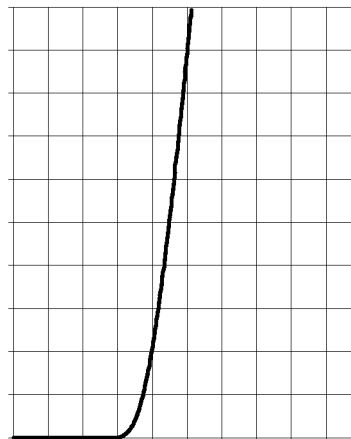


Fig. 12 Typ. transfer characteristic,  $t_p = 80\text{ μs}$ ;  $V_{\text{CE}} = 20\text{ V}$

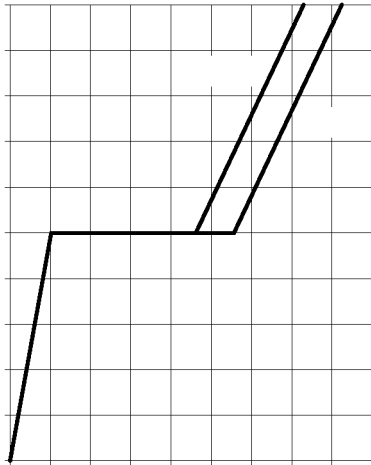


Fig. 13 Typ. gate charge characteristic

$I_{Cpuls} = 50 \text{ A}$

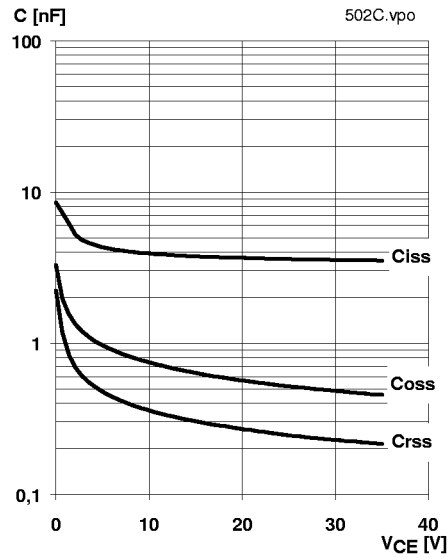


Fig. 14 Typ. capacitances vs.  $V_{CE}$

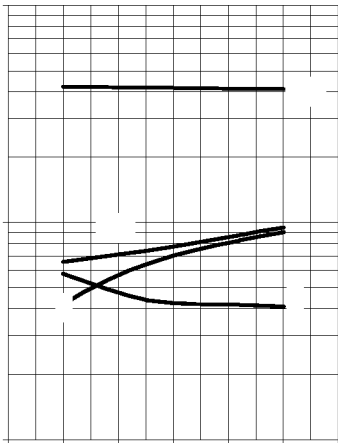


Fig. 15 Typ. switching times vs.  $I_C$

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

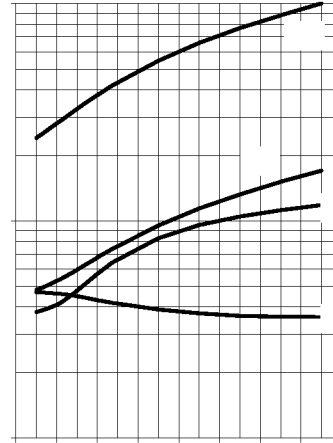


Fig. 16 Typ. switching times vs. gate resistor  $R_G$

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

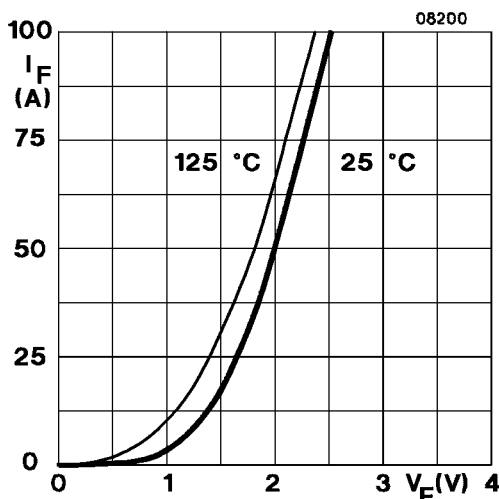


Fig. 17 Typ. CAL diode forward characteristic

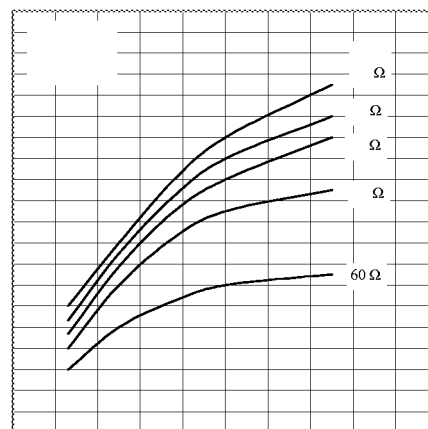


Fig. 18 Diode turn-off energy dissipation per pulse

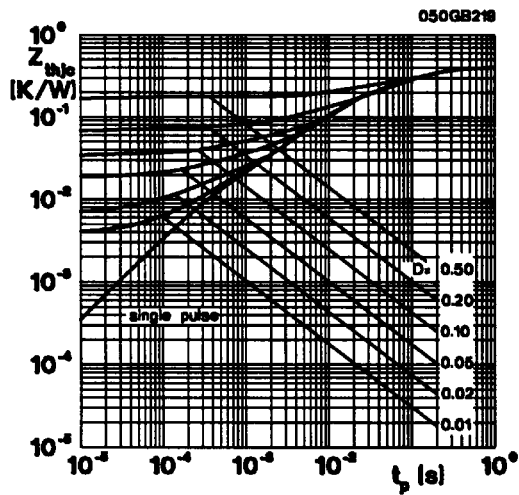


Fig. 19 Transient thermal impedance of IGBT  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

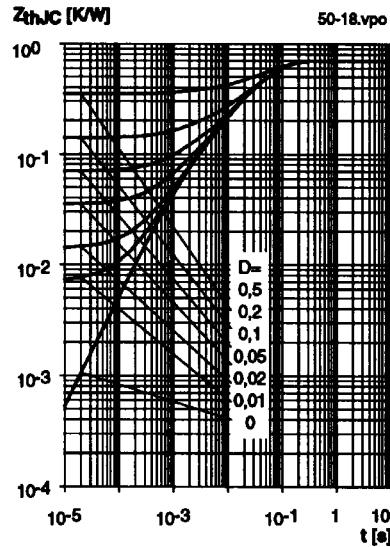


Fig. 20 Transient thermal impedance of inverse CAL diodes  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

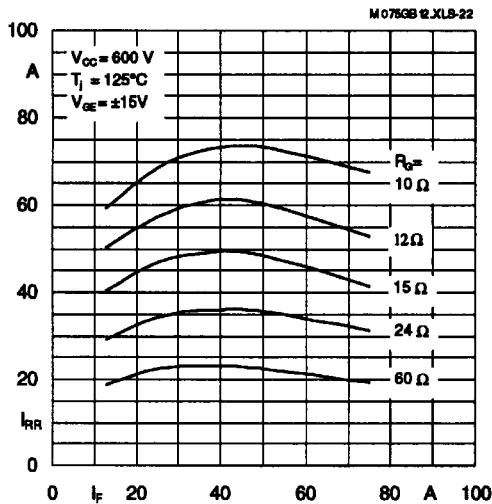


Fig. 22 Typ. CAL diode peak reverse recovery current  
 $I_{RR} = f(I_F, R_G)$

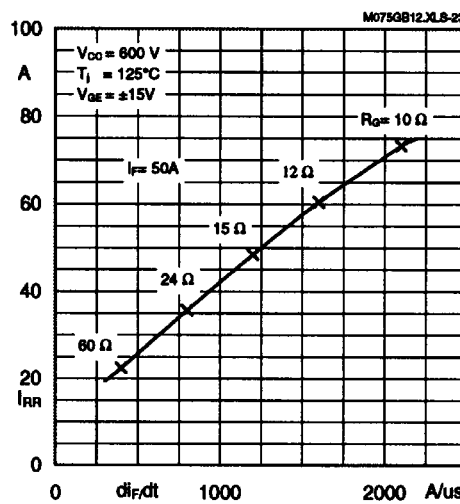


Fig. 23 Typ. CAL diode peak reverse recovery current  
 $I_{RR} = f(di/dt)$

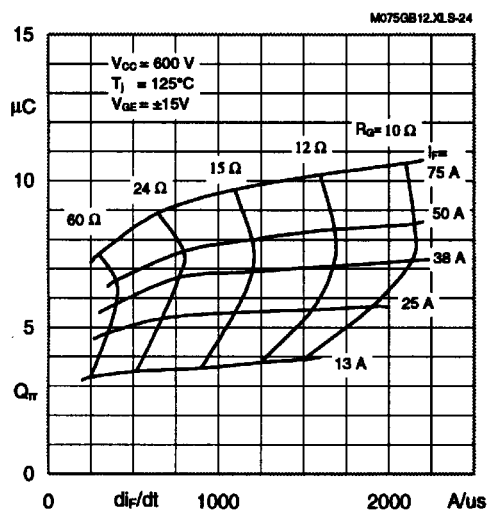


Fig. 24 Typ. CAL diode recovery charge

### 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**

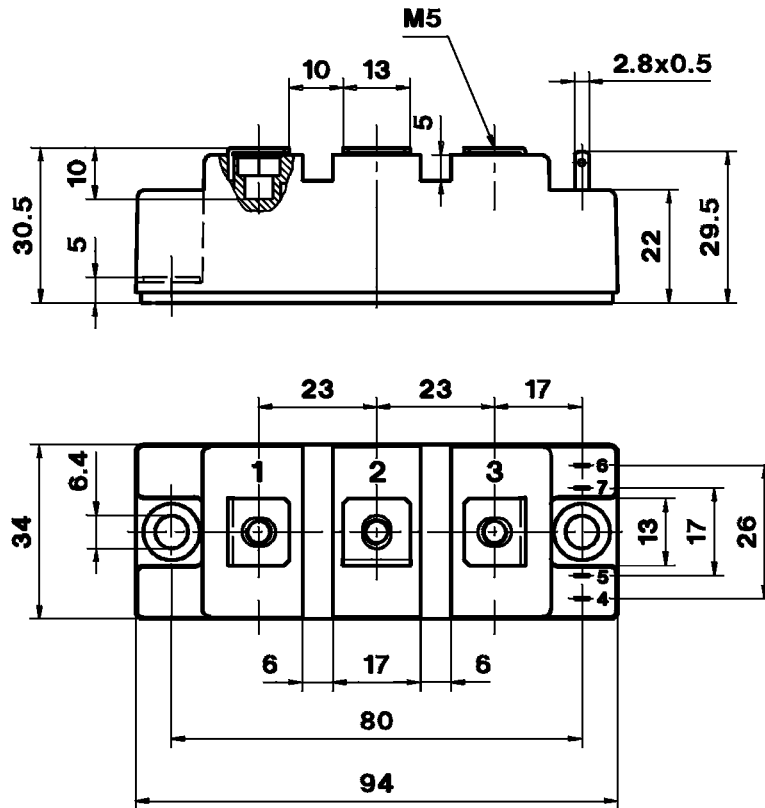
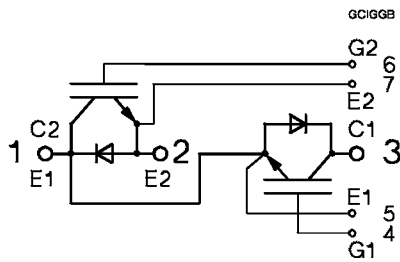
Case D 61

UL Recognized

File no. E 63 532

**SKM 50 GB 123 D**

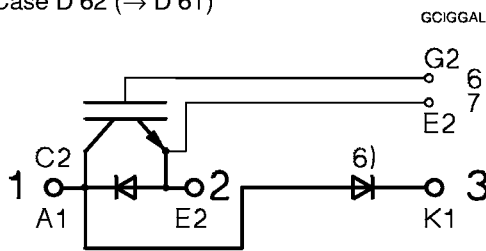
CASED61



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 <sub>1</sub>	to heatsink, SI Units to heatsink, US Units	(M6)	3 27	—	5 44	Nm lb.in.
M <sub>2</sub>	for terminals, SI Units for terminals US Units	(M5)	2,5 22	—	5 44	Nm lb.in.
a			—	—	5x9,81	m/s <sup>2</sup>
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.