SEMIKRON

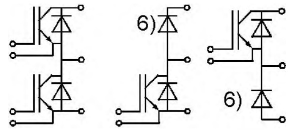
Absolute Maximum Ratings Symbol	Conditions [1]	Values		Units
V_{CES}		1200		V
V_{CGR}	R_{GE} = 20 kΩ	1200		V
I_C	T_{case} = 25/80 °C	150 / 100		A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	300 / 200		A
V_{GES}		± 20		V
P_{tot}	per IGBT, T_{case} = 25 °C	800		W
T_j, (T_{stg})		– 40 . . .+150 (125)		°C
V_{isol}	AC, 1 min.	2 500 [7]		V
humidity	DIN 40 040	Class F		
climate	DIN IEC 68 T.1	55/150/56		
Inverse Diode			FWD [6]	
I_F = – I_C	T_{case} = 25/80 °C	150 / 100	200 / 135	A
I_{FM} = – I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	300 / 200	300 / 200	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	1100	1450	A
I^2t	t_p = 10 ms; T_j = 150 °C	6000	10500	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 = 4 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0, V_{CE} = V_{CES}; T_j = 25 °C	–	0,2	2	mA
	T_j = 125 °C	–	9		mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	1	µA
V_{CEsat}	I_C = 100 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,5(3,1	3(3,7)	V
V_{CEsat}	I_C = 150 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	3(3,8)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 100 A	54	–	–	S
C_{CHC}	per IGBT	–	–	700	pF
C_{ies}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz	–	6,5	8,5	nF
C_{oes}		–	1000	1500	pF
C_{res}		–	500	600	pF
L_{CE}		–	–	20	nH
$t_{d(on)}$	V_{CC} = 600 V; V_{GE} = + 15 V; - 15 V[3]; I_C = 100 A, ind. load; R_{Gon} = R_{Goff} = 6,8 Ω; T_j = 125 °C	–	160	320	ns
t_r		–	80	160	ns
$t_{d(off)}$		–	400	520	ns
t_f		–	70	100	ns
E_{on} [5]		–	13	–	mWs
E_{off} [5]		–	11	–	mWs
Inverse Diode [8]					
V_F = V_{EC}	I_F = 100 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0(1,8)	2,5	V
V_F = V_{EC}	I_F = 150 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	–	8	11	mΩ
I_{RRM}	I_F = 100 A; T_j = 25 (125) °C[2]	–	35(50)	–	A
Q_{rr}	I_F = 100 A; T_j = 25 (125) °C[2]	–	5(14)	–	µC
FWD of types "GAL", "GAR" [8]					
V_F = V_{EC}	I_F = 100 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	1,85(1,6)	2,2	V
V_F = V_{EC}	I_F = 150 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	–	5	7	mΩ
I_{RRM}	I_F = 100 A; T_j = 25 (125) °C[2]	–	40(65)	–	A
Q_{rr}	I_F = 100 A; T_j = 25 (125) °C[2]	–	5(15)	–	µC
Thermal Characteristics					
R_{thjc}	per IGBT	–	–	0,16	°C/W
R_{thjc}	per diode / FWD "GAL; GAR"	–	–	0,30/0,25	°C/W
R_{thch}	per module	–	–	0,038	°C/W

SEMITRANS® M IGBT Modules

SKM 150 GB 123 D
SKM 150 GAL 123 D [6]
SKM 150 GAR 123 D [6]

SEMITRANS 3



GB **GAL** **GAR**

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 (12 mm) and creepage distances (20 mm).

Typical Applications: → B 6 - 63

- 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 = 1000 A/µs, V_{GE} = 0 V
3) Use V_{GEoff} = -5 ... -15 V
5) See fig. 2 + 3; R_{Goff} = 6,8 Ω
6) The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 200 GB 123 D
7) V_{isol} = 4000 V_{rms} on request
8) CAL = Controlled Axial Lifetime Technology.

Cases and mech. data → B6 - 64 SEMITRANS 3

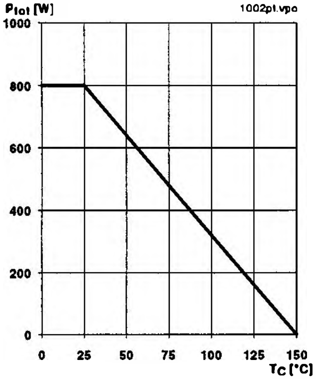
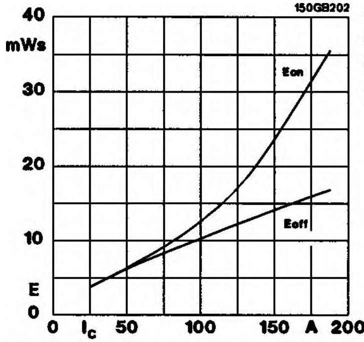
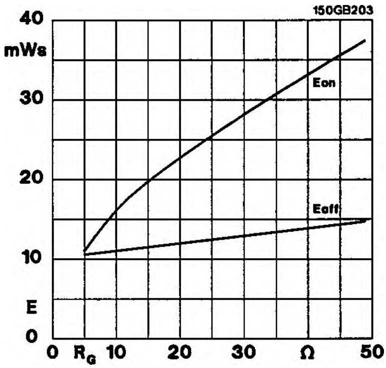


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



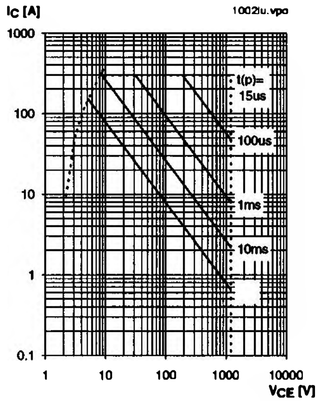
$T_j = 125$ °C
$V_{CE} = 600$ V
$V_{GE} = \pm 15$ V
$R_G = 6{,}8\ \Omega$

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



$T_j = 125$ °C
$V_{CE} = 600$ V
$V_{GE} = \pm 15$ V
$I_C = 100$ A

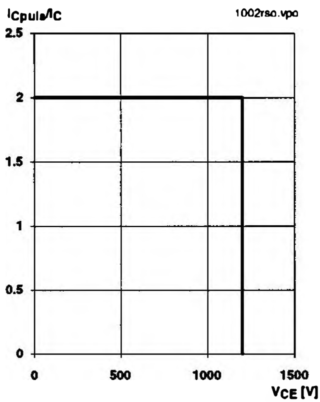
Fig. 3 Turn-on /-off energy = f (R_G)



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

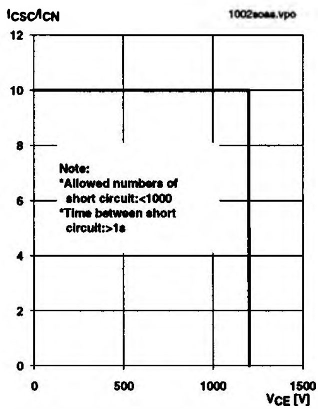
Not for linear use

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



$T_j \leq 150$ °C
$V_{GE} = 15$ V
$R_{g(off)} = 6{,}8\ \Omega$
$I_C = 100$A

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



$T_j \leq 150$ °C
$V_{GE} = \pm 15$ V
$t_{sc} \leq 10$ µs
$L < 25$ nH
$I_{CN} = 100$A

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

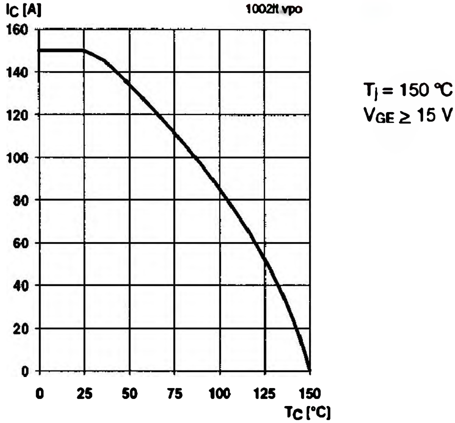


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

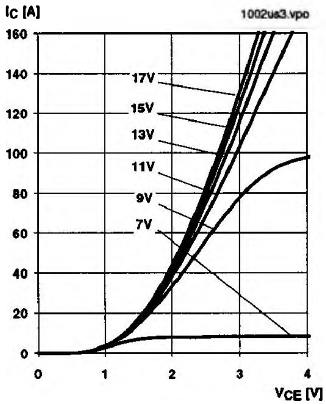


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

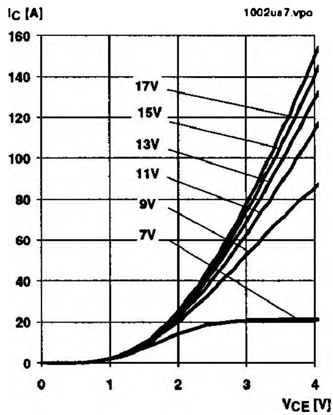


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

$r_{CE(Tj)} = 0{,}010 + 0{,}00004\,(T_j - 25)$ [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

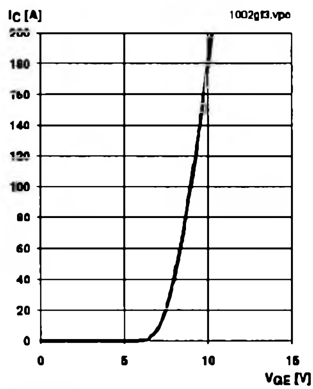


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

I_{Cpuls} = 100 A

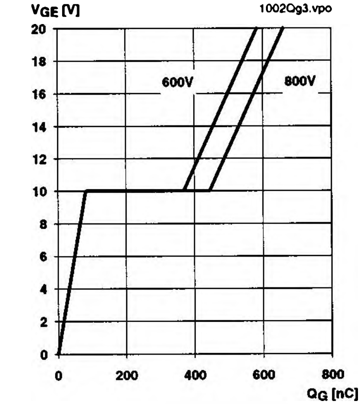


Fig. 13 Typ. gate charge characteristic

V_{GE} = 0 V
f = 1 MHZ

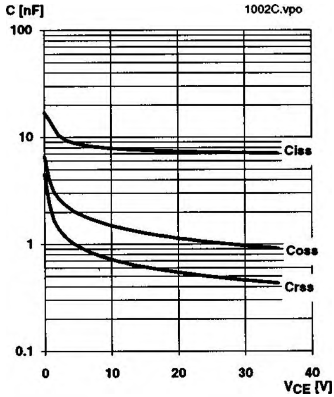


Fig. 14 Typ. capacitances vs. V_{CE}

T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_{gon} = 6,8 Ω
R_{goff} = 6,8 Ω
induct. load

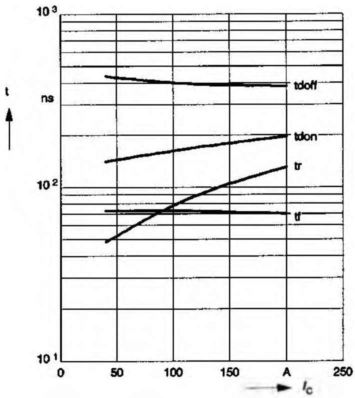


Fig. 15 Typ. switching times vs. I_C

T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
I_C = 100 A
induct. load

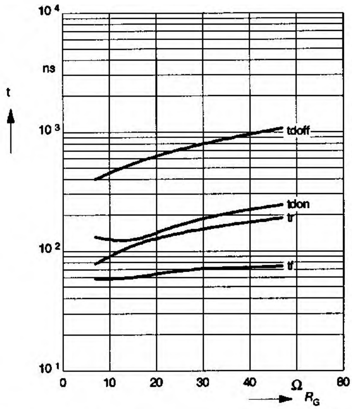


Fig. 16 Typ. switching times vs. gate resistor R_G

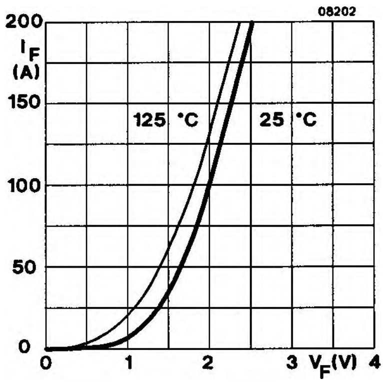


Fig. 17 Typ. CAL diode forward characteristic

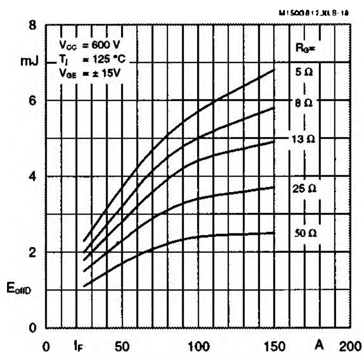


Fig. 18 Diode turn-off energy dissipation per pulse

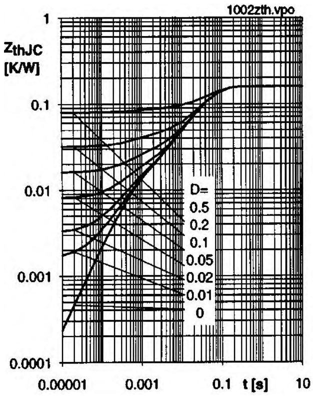


Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

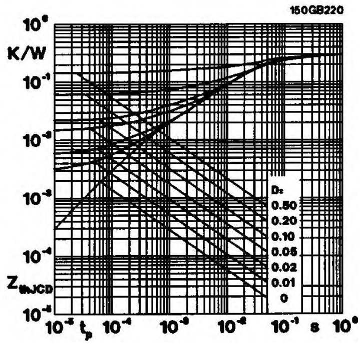


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

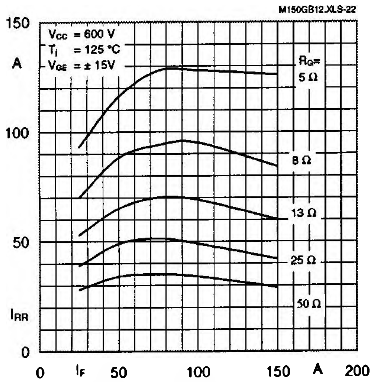


Fig. 22 Typ. CALdiode reverse recovery current $I_{RR} = f(I_F; R_G)$

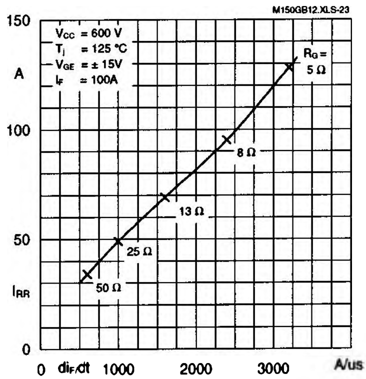


Fig. 23 Typ. CAL diode reverse recovery current $I_{RR} = f(di_F/dt)$

Typical Applications include

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

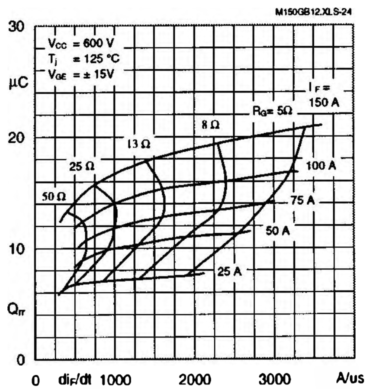
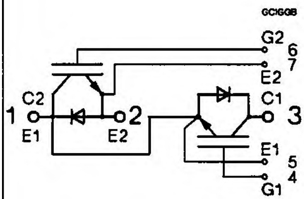
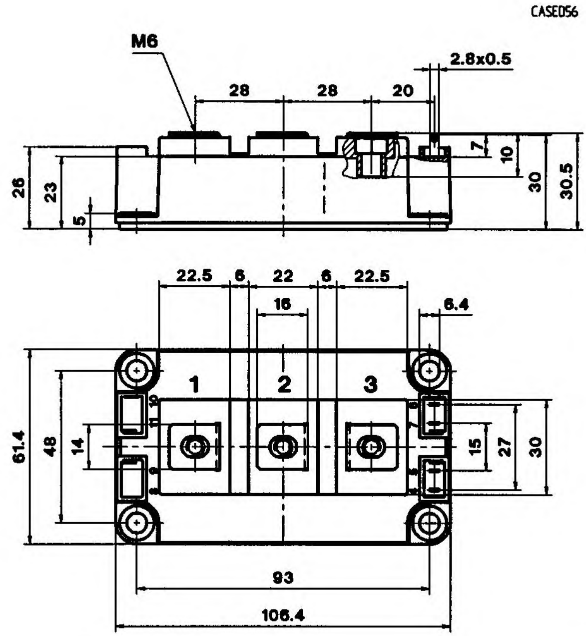


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

SEMITRANS 3
Case D 56
UL Recognized
File no. E 63 532

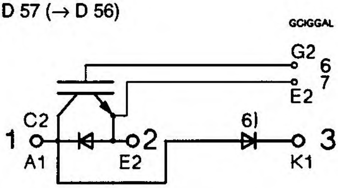
SKM 150 GB 123 D
SKM 150 GB 173 D



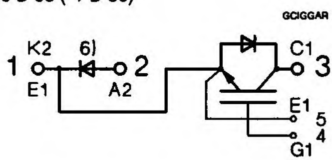


Dimensions in mm

SKM 150 GAL 123 D
Case D 57 (→ D 56)



SKM 150 GAR 123 D
Case D 58 (→ D 56)



Case outline and circuit diagrams

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	(M6)	2,5	–	5	Nm
	for terminals US Units		22	–	44	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	420	g

[6] Freewheeling diode → page B 6 - 59, remark 6.

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

Three devices are supplied in one SEMIBOX B without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 3). Larger packing units of 12 and 20 pieces are used if suitable
Accessories → page B 6 - 4.
SEMIBOX → page C - 1.

