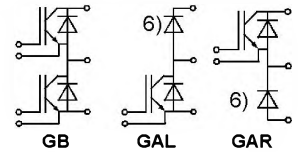


SEMITRANS® M IGBT Modules

SKM 100 GB 123 D
SKM 100 GAL 123 D ⁶⁾
SKM 100 GAR 123 D ⁶⁾



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 - 45
• Switching (not for linear use)

- ¹⁾ $T_{case} = 25^\circ\text{C}$, 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; $R_{Goff} = 15\ \Omega$
- ⁶⁾ The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 150 GB 123 D
- ⁷⁾ $V_{iso} = 4000\text{ V}_{rms}$ on request
- ⁸⁾ CAL = Controlled Active Lifetime Technology.

Cases and mech. data → B6 - 46

Absolute Maximum Ratings		Values	
Symbol	Conditions ¹⁾		Units
V_{CES}		1200	V
V_{CGR}	$R_{GE} = 20\text{ k}\Omega$	1200	V
I_C	$T_{case} = 25/80^\circ\text{C}$	100 / 75	A
I_{CM}	$T_{case} = 25/80^\circ\text{C}$; $t_p = 1\text{ ms}$	200 / 150	A
V_{GES}		± 20	V
P_{tot}	per IGBT, $T_{case} = 25^\circ\text{C}$	625	W
T_{Jp} , (T_{stg})		$-40 \dots +150$ (125)	$^\circ\text{C}$
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			
$I_F = -I_C$	$T_{case} = 25/80^\circ\text{C}$	95 / 65	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80^\circ\text{C}$; $t_p = 1\text{ ms}$	200 / 150	A
I_{FSM}	$t_p = 10\text{ ms}$; $\sin.$; $T_J = 150^\circ\text{C}$	720	A
I^2t	$t_p = 10\text{ ms}$; $T_J = 150^\circ\text{C}$	2600	A ² s

Characteristics		min.	typ.	max.	Units
$V_{I(BR)CES}$	$V_{GE} = 0$, $I_C = 4\text{ mA}$	$\geq V_{CES}$	—	—	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 2\text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0$ } $T_J = 25^\circ\text{C}$ $V_{CE} = V_{CES}$ } $T_J = 125^\circ\text{C}$	—	0,1	1,5	mA
I_{GES}	$V_{GE} = 20\text{ V}$, $V_{CE} = 0$	—	—	300	nA
V_{CESat}	$I_C = 75\text{ A}$, $V_{GE} = 15\text{ V}$; } V_{CEsat} } $I_C = 100\text{ A}$ } $T_J = 25$ (125) $^\circ\text{C}$ }	—	2,5(3,1)	3(3,7)	V
g_{fs}	$V_{CE} = 20\text{ V}$, $I_C = 75\text{ A}$	31	2,8(3,6)	—	V
C_{CHC}	per IGBT	—	—	350	pF
C_{ies}	$V_{GE} = 0$	—	5	6,6	nF
C_{oes}	$V_{CE} = 25\text{ V}$	—	720	900	pF
C_{res}	$f = 1\text{ MHz}$	—	380	500	pF
L_{CE}		—	—	30	nH
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	—	30	60	ns
t_r	$V_{GE} = +15\text{ V}$, $-15\text{ V}^{3)}$	—	70	140	ns
$t_{d(off)}$	$I_C = 75\text{ A}$, ind. load	—	450	600	ns
t_f	$R_{Gon} = R_{Goff} = 15\ \Omega$	—	70	90	ns
$E_{on}^{5)}$	$T_J = 125^\circ\text{C}$	—	10	—	mWs
$E_{off}^{5)}$		—	8	—	mWs
Inverse Diode ⁸⁾					
$V_F = V_{EC}$	$I_F = 75\text{ A}$ } $V_{GE} = 0\text{ V}$; } $V_F = V_{EC}$ } $I_F = 100\text{ A}$ } $T_J = 25$ (125) $^\circ\text{C}$ }	—	2,0(1,8)	2,5	V
V_{TO}	$T_J = 125^\circ\text{C}$	—	—	1,2	V
r_T	$T_J = 125^\circ\text{C}$	—	12	15	m Ω
I_{RRM}	$I_F = 75\text{ A}$; $T_J = 25$ (125) $^\circ\text{C}^{2)}$	—	27(40)	—	A
Q_{rr}	$I_F = 75\text{ A}$; $T_J = 25$ (125) $^\circ\text{C}^{2)}$	—	3(10)	—	μC
FWD of types "GAL", "GAR" ⁸⁾					
$V_F = V_{EC}$	$I_F = 75\text{ A}$ } $V_{GE} = 0\text{ V}$; } $V_F = V_{EC}$ } $I_F = 100\text{ A}$ } $T_J = 25$ (125) $^\circ\text{C}$ }	—	1,85(1,6)	2,2	V
V_{TO}	$T_J = 125^\circ\text{C}$	—	—	1,2	V
r_T	$T_J = 125^\circ\text{C}$	—	9	11	m Ω
I_{RRM}	$I_F = 75\text{ A}$; $T_J = 25$ (125) $^\circ\text{C}^{2)}$	—	30(45)	—	A
Q_{rr}	$I_F = 75\text{ A}$; $T_J = 25$ (125) $^\circ\text{C}^{2)}$	—	3,5(11)	—	μC
Thermal Characteristics					
R_{thjc}	per IGBT	—	—	0,2	$^\circ\text{C}/\text{W}$
R_{thjc}	per diode / FWD "GAL"; "GAR"	—	—	0,50/0,36	$^\circ\text{C}/\text{W}$
R_{thch}	per module	—	—	0,05	$^\circ\text{C}/\text{W}$

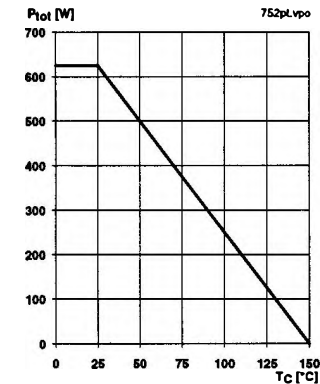


Fig. 1 Rated power dissipation $P_{tot} = f (T_C)$

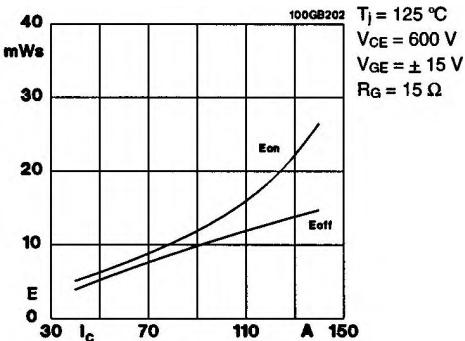


Fig. 2 Turn-on /-off energy = $f (I_C)$

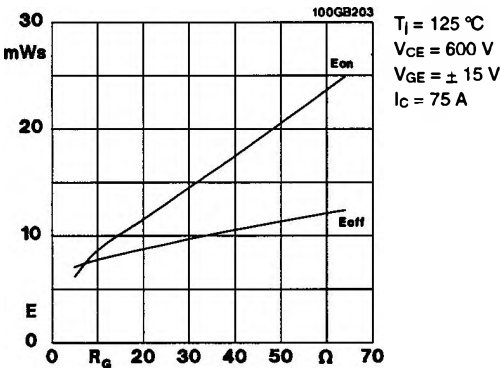


Fig. 3 Turn-on /-off energy = $f (R_G)$

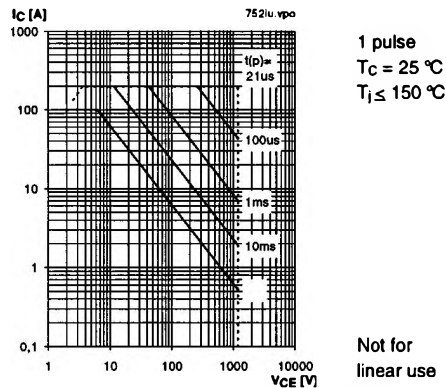


Fig. 4 Maximum safe operating area (SOA) $I_C = f (V_{CE})$

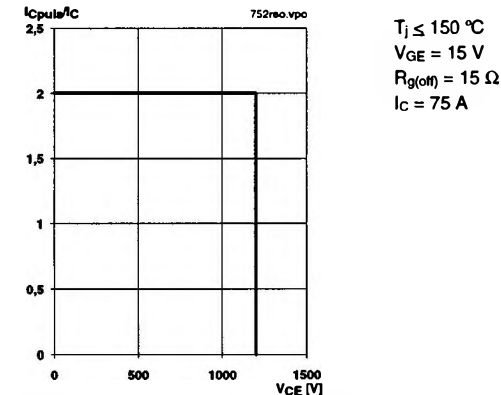


Fig. 5 Turn-off safe operating area (RBSOA)

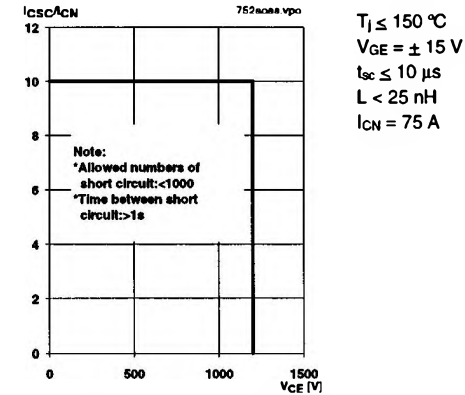


Fig. 6 Safe operating area at short circuit $I_C = f (V_{CE})$

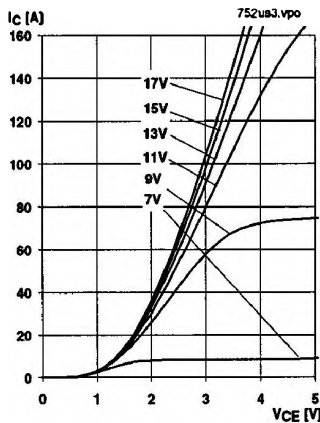


Fig. 9 Typ. output characteristic, $t_p = 80 \mu s$; $25^\circ C$

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

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

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

$$r_{CE(T_J)} = 0,013 + 0,00006 (T_J - 25) [\Omega]$$

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

Fig. 11 Typ. saturation characteristic (IGBT)
Calculation elements and equations

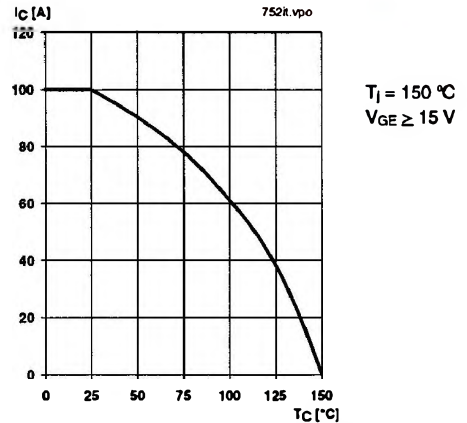


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

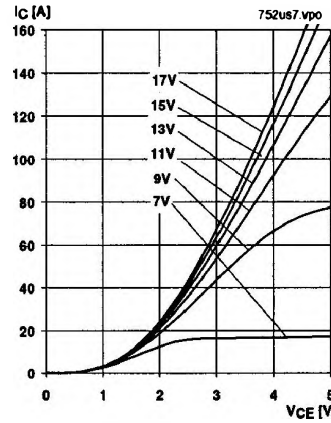


Fig. 10 Typ. output characteristic, $t_p = 80 \mu s$; $125^\circ C$

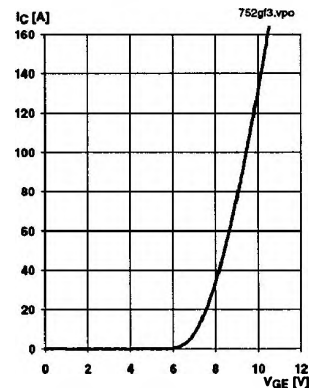


Fig. 12 Typ. transfer characteristic, $t_p = 80 \mu s$; $V_{CE} = 20 V$

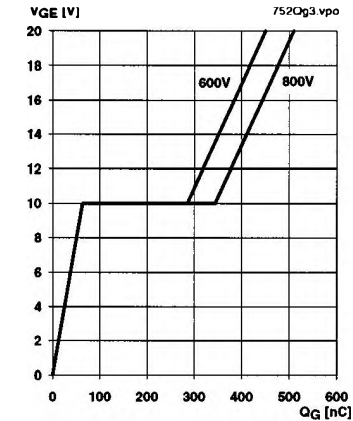


Fig. 13 Typ. gate charge characteristic

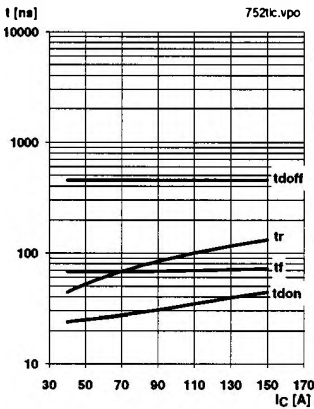


Fig. 15 Typ. switching times vs. I_C

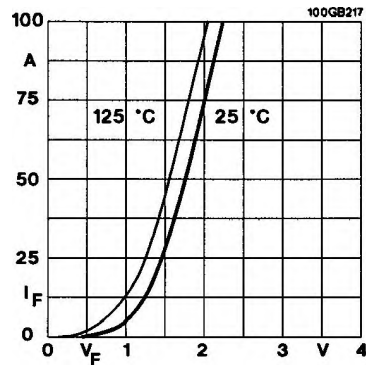


Fig. 17 Typ. CAL diode forward characteristic

$I_{Cpuls} = 75 \text{ A}$

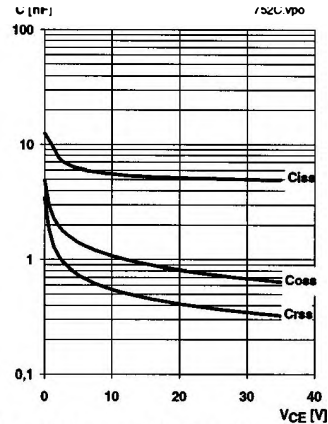


Fig. 14 Typ. capacitances vs. V_{CE}

$V_{GE} = 0 \text{ V}$
 $f = 1 \text{ MHz}$

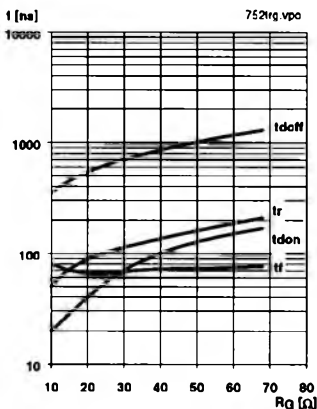


Fig. 16 Typ. switching times vs. gate resistor R_G

$T_j = 125 \text{ °C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 75 \text{ A}$
induct. load

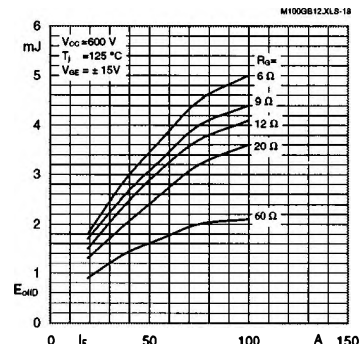


Fig. 18 Diode turn-off energy dissipation per pulse

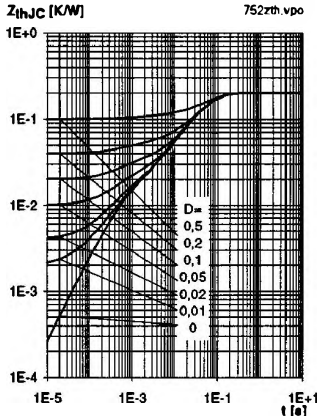


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

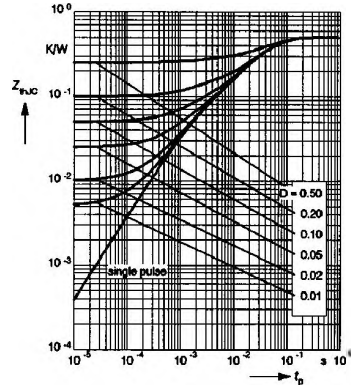


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

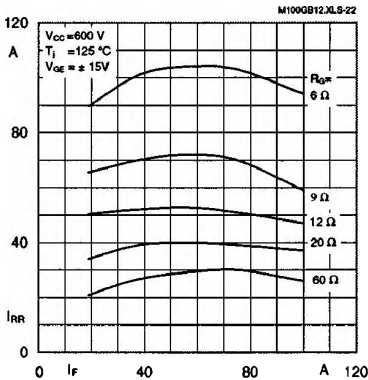


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_r; R_g)$

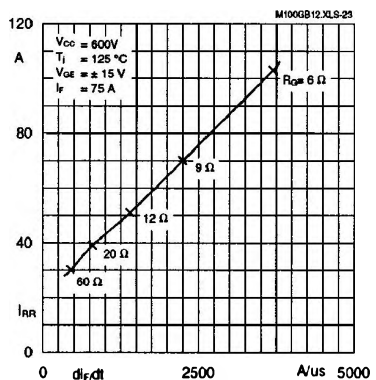


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

Typical Applications

Include

- Switched mode power supplies
- DC servo and robot drives
- Inverters
- DC choppers (versions GAR; 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

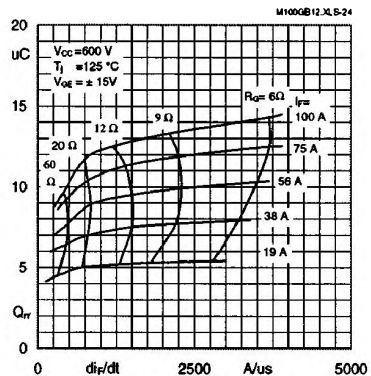
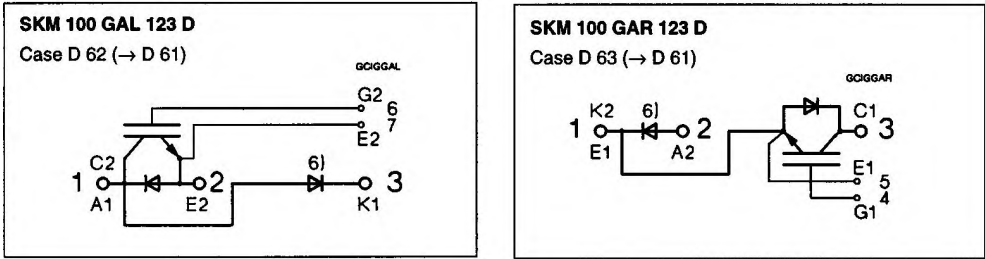
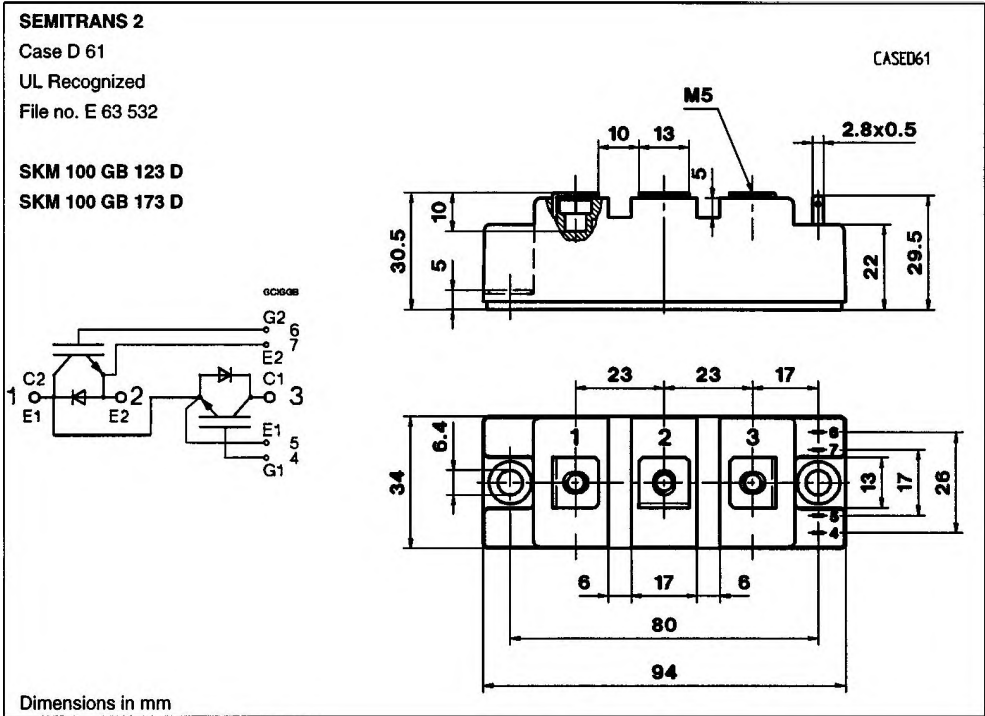


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$



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			—	—	250	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 packing units of 20 and 42 pieces are used if suitable

Accessories → page B 6 - 4.
SEMIBOX → page C - 1.

^{a)} Freewheeling diode → page B 6 - 41, remark 6.