SEMIKRON

Absolute Maximum Ratings

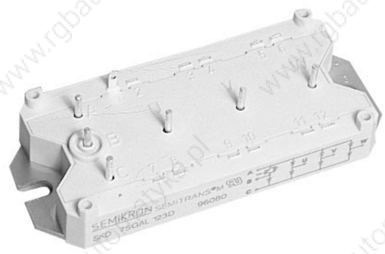
Symbol	Conditions [1]	Values	Units
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/80 °C	100 / 90	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	200 / 180	A
V_{GES}		± 20	V
P_{tot}	per IGBT/D1/D8, T_{case}=25 °C	690 / 125 / 125	W
T_j, (T_{stg})		– 40 . . .+150 (125)	°C
V_{isol}	AC, 1 min.	2 500	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	

Diodes [9]		D1-6 [9]	D7	D8	Units
I_F	T_{case} = 80 °C		30	30	A
I_{FM}= – I_{CM}	T_{case} = 80 °C; t_p = 1 ms		60	60	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	720	350	350	A
I^2t	t_p = 10 ms; T_j = 150 °C	2600	600	600	A^2s

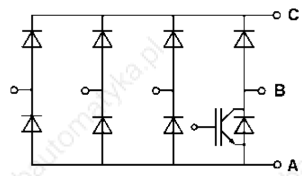
Characteristics

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 = 2 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0, V_{CE} = V_{CES}; T_j = 25 °C	–	0,8	1,5	mA
	V_{GE} = 0, V_{CE} = V_{CES}; T_j = 125 °C	–	6	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	300	nA
V_{CEsat}	I_C = 75 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,5(3,1)	3(3,7)	V
V_{CEsat}	I_C = 100 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,8(3,6)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 75 A	31	–	–	S
C_{CHC}	per IGBT	–	–	350	pF
C_{ies}	V_{GE} = 0, V_{CE} = 25 V, f = 1 MHz	–	5	6,6	nF
C_{oes}		–	720	900	pF
C_{res}		–	380	500	pF
$t_{d(on)}$	V_{CC} = 600 V; V_{GE} = + 15 V / - 15 V [3]; I_C = 75 A, ind. load; R_{Gon} = R_{Goff} = 15 Ω; T_j = 125 °C	–	30	60	ns
t_r		–	70	140	ns
$t_{d(off)}$		–	450	600	ns
t_f		–	70	100	ns
E_{on}		–	10	–	mWs
E_{off}		–	8	–	mWs
Inverse Diode D7 [8] of brake chopper					
V_F = V_{EC}	I_F = 25 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0(1,8)	2,5	V
V_F = V_{EC}	I_F = 40 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,2(2,1)	–	V
V_{TO}	T_j = 125 °C	–	1,1	1,2	V
r_T	T_j = 125 °C	–	25	44	mΩ
I_{RRM}	I_F = 25 A; T_j = 25 (125) °C [2]	–	(25)	–	A
Q_{rr}	I_F = 25 A; T_j = 25 (125) °C [2]	–	2(4,5)	–	µC
FWD D8 of "GAL" brake chopper [8]					
V_F = V_{EC}	I_F = 25 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0 (1,8)	2,5	V
V_F = V_{EC}	I_F = 40 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,3 (2,1)	–	V
V_{TO}	T_j = 125 °C	–	–	1,2	V
r_T	T_j = 125 °C	–	25	44	mΩ
I_{RRM}	I_F = 25 A; T_j = 25 (125) °C [2]	–	19(25)	–	A
Q_{rr}	I_F = 25 A; T_j = 25 (125) °C [2]	–	1,5(4,5)	–	µC
Thermal Characteristics					
R_{thjc}	per IGBT / diode D1..6 [9]	–	–	0,18 / 1	°C/W
R_{thjc}	per diode D7 / D8	–	–	1,0 / 1,0	°C/W
R_{thch}	per module / diode; IGBT	–	–	0,05 / 0,4	°C/W

SEMITRANS® M
IGBT Modules
SKD 100 GAL 123 D
Input bridge B6U with brake chopper



7D-Pack = 7 Diodes Pack



SKD 100 GAL

Features

- Round main terminals (2 mm ∅)
- Easy drilling of PCB
- Input diodes glass passivated
- 1400 V PIV
- High I^2t rating (inrush current)
- IGBT is latch-up free, homogeneous NPT silicon-structure
- High short circuit capability, self limiting to 6 * I_{cnom}
- Fast & soft CAL diodes [8]
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (9 mm) and creepage distances (13 mm).

Typical Applications:

Input rectifier bridge (B6U) with brake chopper for PWM inverter drives using SEMITRANS SKM 75GD123D

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

8) CAL = Controlled Axial Lifetime Technology.

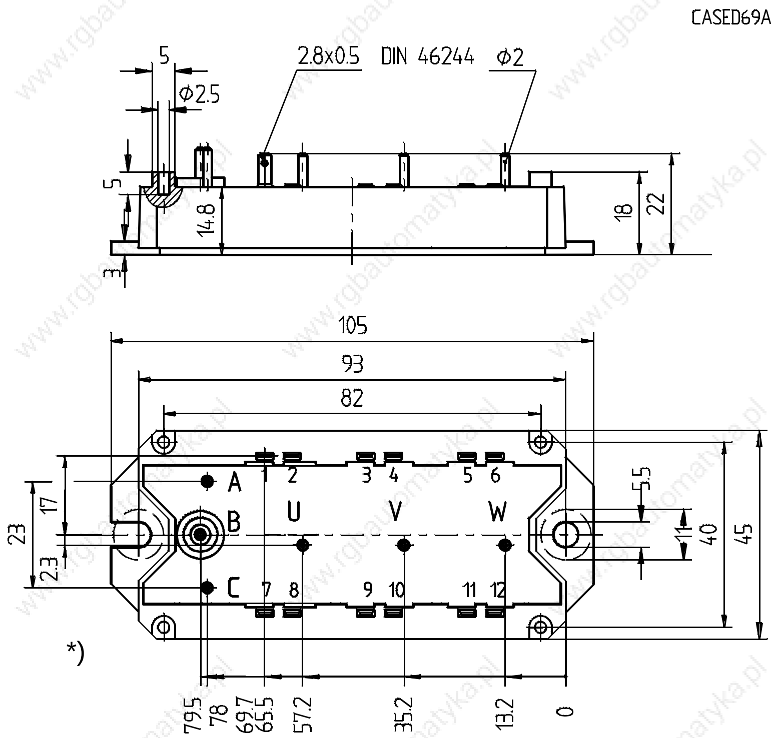
9) **Data D1 - D6, case and mech. data → B 6 – 232**

SEMITRANS

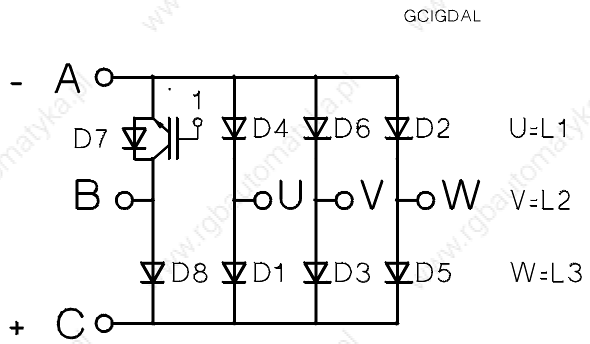
7D-Pack = Seven Diodes Pack

(Sixpack modified)

Case D 69 A



*) Plastic collar around pin B for UL creepage distance of > 12,7 mm



Dimensions in mm

Case outline and circuit diagram

Characteristics continued **Symbol**	**Conditions** [1]	**Values** min.	typ.	max.	**Units**
Input	Bridge Rectifier D1...D6				
V_{RRM}		1400	–	–	V
I_D	T_{case} = 80 °C;	–	–	100	A
V_F	T_{vj} = 25 °C; I_F = 75 A	–	–	1,45	V
V_{TO}	T_{vj} = 150 °C	–	–	0,8	V
r_T	T_{vj} = 150 °C	–	–	8,5	mΩ
R_{thjc}	D1...D6			1,0	K/W
T_{solder}	> 5 s, max. 15 sec. (transfer)	–	180	250	°C
Mechanical Data					
M1	to heatsink, SI Units (M5)	4	–	5	Nm
	to heatsink, US Units	35	–	44	lb.in.
a		–	–	5x9,81	m/s^2
w		–	–	175	g

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

Two devices are supplied in one SEMIBOX A without mounting hardware.
Larger Packing units (≥ 10) are used if suitable.
SEMIBOX → C - 1.

For the IGBT use diagrams of type SKM 100 GB 123 D → B 6 - 112 etc.

For diodes D7/D8 use diode diagrams of type SKM 40 GD 123 D, → B 6 - 72

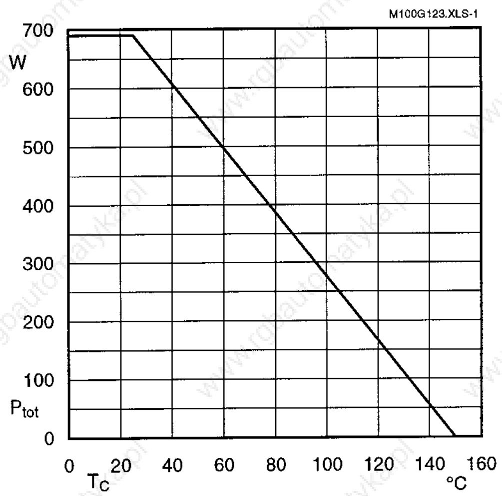
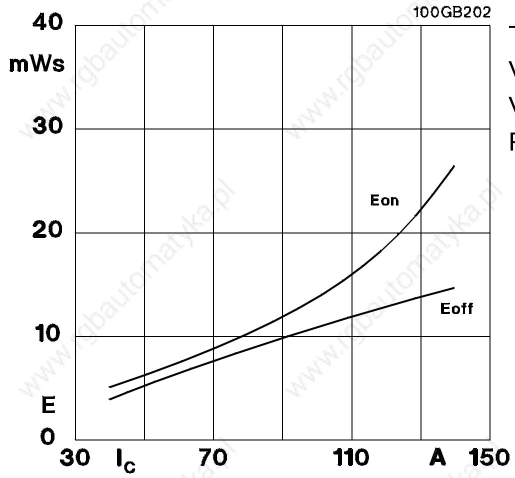
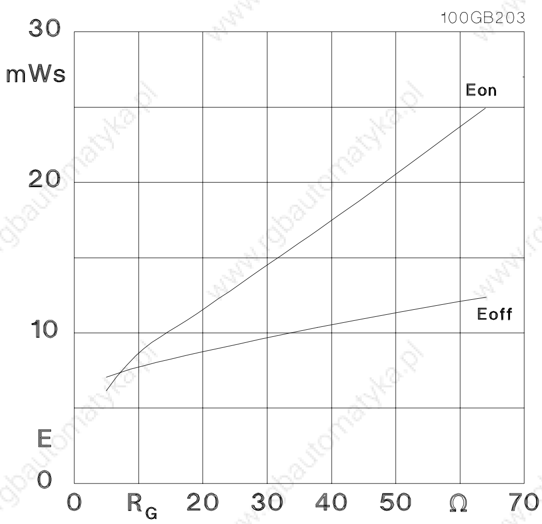


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



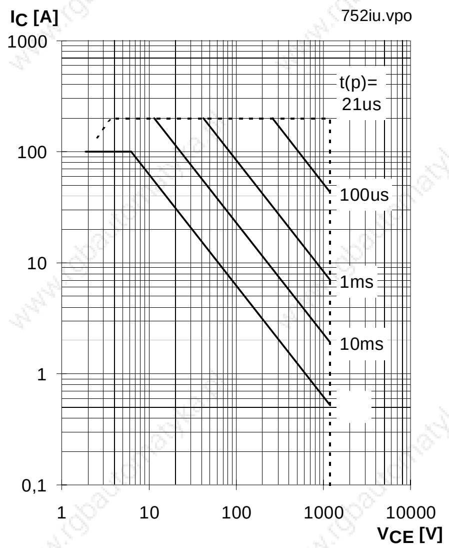
$T_j = 125$ °C
$V_{CE} = 600$ V
$V_{GE} = \pm 15$ V
$R_G = 15\ \Omega$

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



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

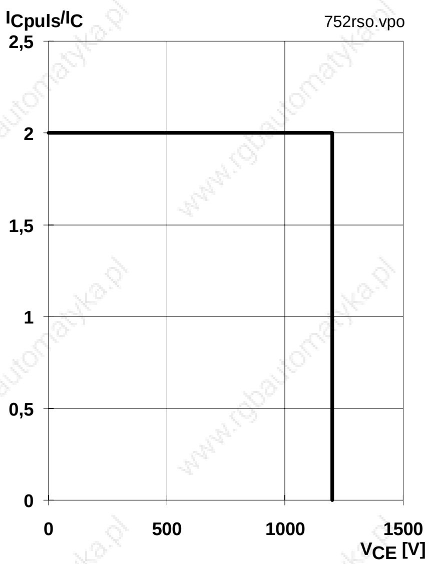
Fig. 3 Turn-on /-off energy = f (R_G)



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

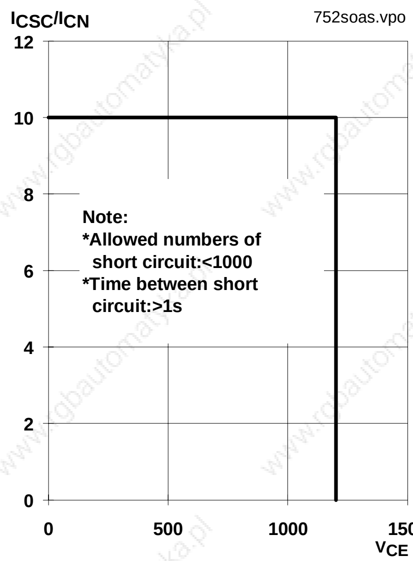
Not for linear use

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



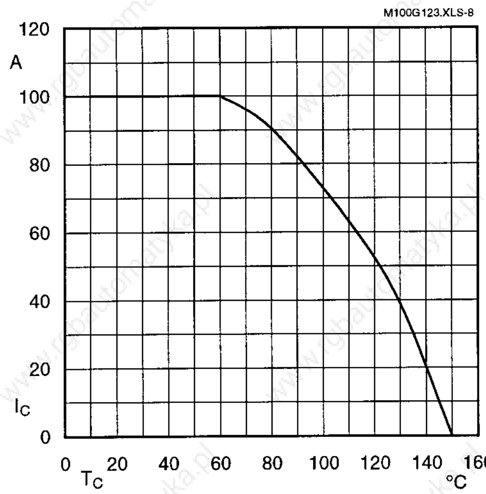
$T_j \leq 150$ °C
$V_{GE} = 15$ V
$R_{Goff} = 15\ \Omega$
$I_C = 75$ A

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
$I_{CN} = 75$ 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 $I_C = f\ (T_C)$

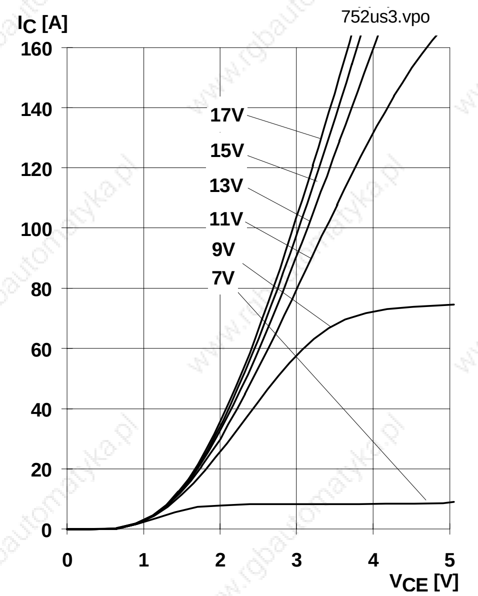


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

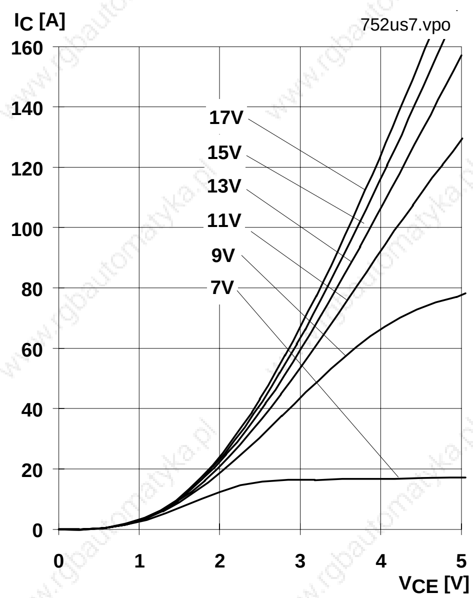


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

typ.: $r_{CE(Tj)} = 0{,}013 + 0{,}00005\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}020 + 0{,}00007\ (T_j - 25)$ [Ω]

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

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

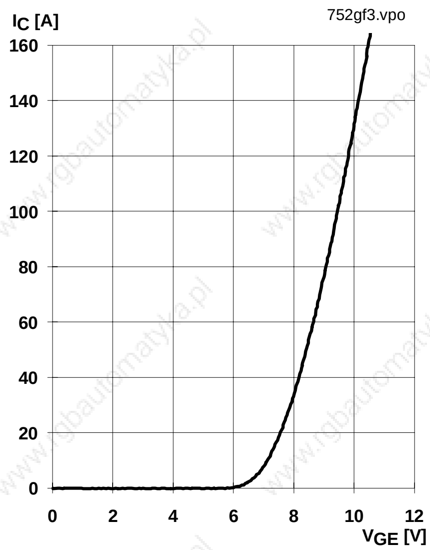
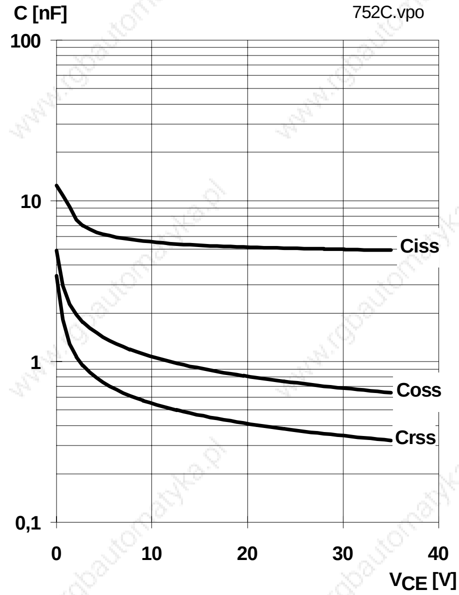


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

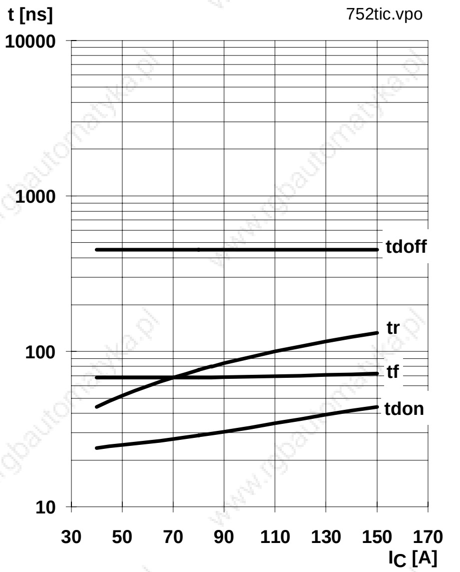
I_{Cpuls} = 75 A

Fig. 13 Typ. gate charge characteristic



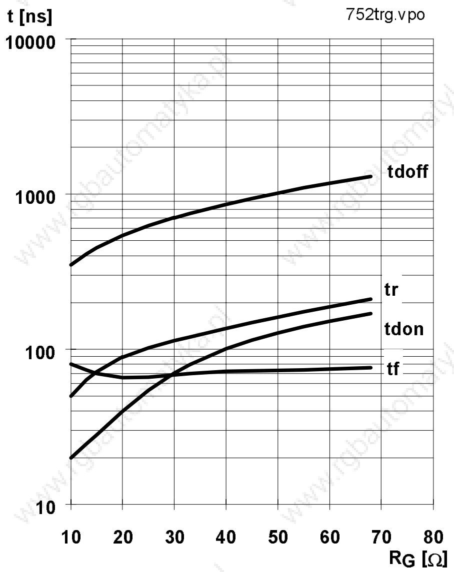
V_{GE} = 0 V
f = 1 MHZ

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



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_{Gon} = 15 Ω
R_{Goff} = 15 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 = 75 A
induct. load

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

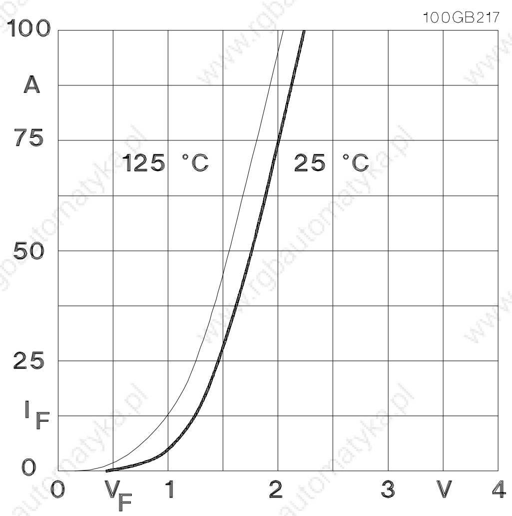


Fig. 17 Typ. CAL diode forward characteristic

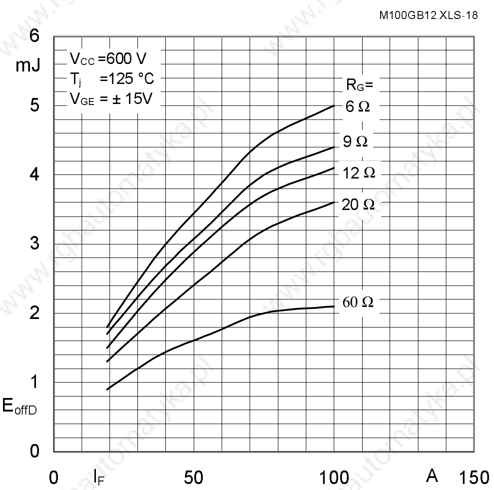


Fig. 18 Diode turn-off energy dissipation per pulse

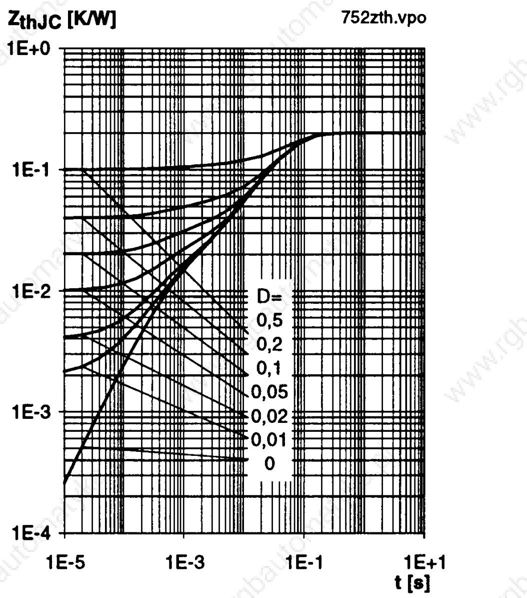


Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

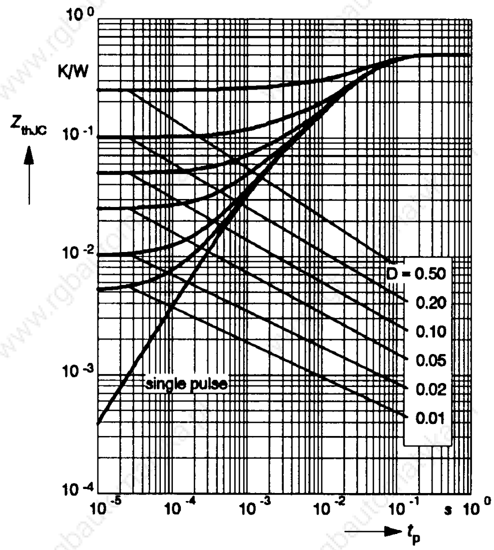


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

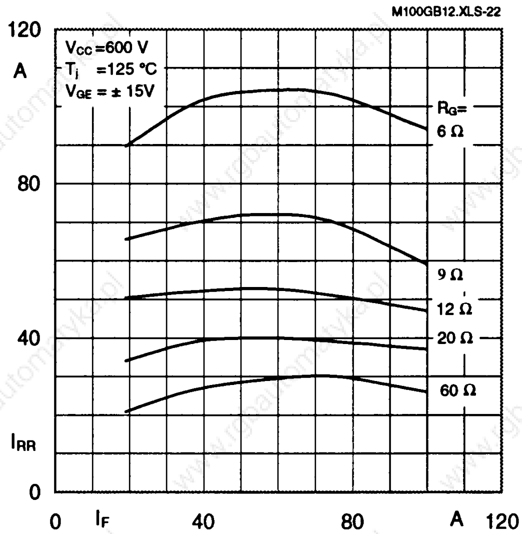


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

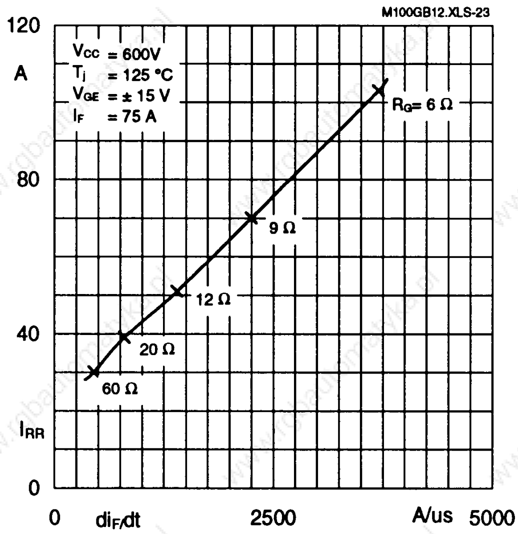


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

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

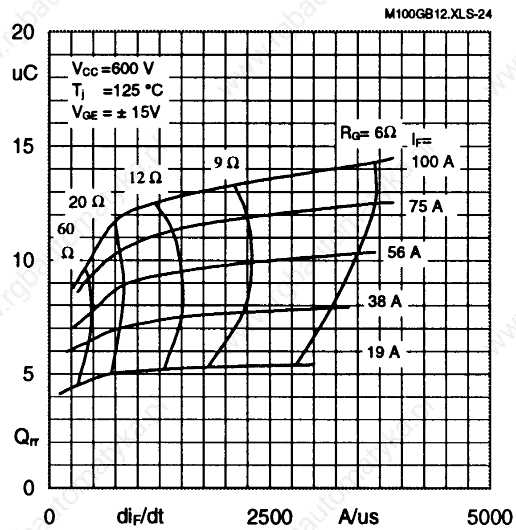


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$