

Absolute Maximum Ratings		Values		Units
Symbol	Conditions ¹⁾			
V _{CES}		1200		V
V _{CGR}	R _{GE} = 20 kΩ	1200		V
I _C	T _{case} = 25/80 °C	300 / 220		A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	600 / 440		A
V _{GES}		± 20		V
P _{tot}	per IGBT, T _{case} = 25 °C	1660		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		
Inverse Diode		FWD ⁶⁾		
I _F = - I _C	T _{case} = 25/80 °C	260 / 180	350 / 230	A
I _{FM} = - I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	600 / 440	600 / 440	A
I _{FSM}	t _p = 10 ms; sin.; T _j = 150 °C	2200	2900	A
I _t ²	t _p = 10 ms; T _j = 150 °C	24200	42000	A ² s

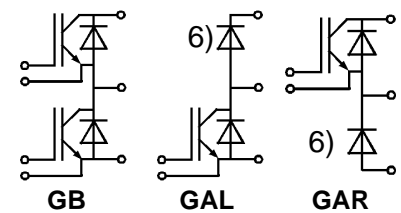
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
V _{(BR)CES}	V _{GE} = 0, I _C = 4 mA	≥ V _{CES}	-	-	V
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 8 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _j = 25 °C	-	3	4,5	mA
		V _{CE} = V _{CES} } T _j = 125 °C	-	15	-
I _{GES}	V _{GE} = 20 V, V _{CE} = 0		-	-	0,4
V _{CEsat}	I _C = 200 A } V _{GE} = 15 V;	-	2,5(3,1)	3(3,7)	V
V _{CEsat}	I _C = 300 A } T _j = 25 (125) °C	-	3(3,8)	-	V
g _{fs}	V _{CE} = 20 V, I _C = 200 A	108	150	-	S
C _{CHC}	per IGBT	-	-	700	pF
C _{ies}	} V _{GE} = 0 } V _{CE} = 25 V } f = 1 MHz	-	18	24	nF
C _{oes}		-	2,5	3,2	nF
C _{res}		-	1,0	1,3	nF
L _{CE}		-	-	20	nH
t _{d(on)}	} V _{CC} = 600 V } V _{GE} = + 15 V / - 15 V ³⁾ } I _C = 200 A, ind. load } R _{Gon} = R _{Goff} = 4,7 Ω } T _j = 125 °C	-	250	400	ns
t _r		-	90	160	ns
t _{d(off)}		-	550	700	ns
t _f		-	70	100	ns
E _{on} ⁵⁾		-	28	-	mWs
E _{off} ⁵⁾		-	26	-	mWs
Inverse Diode ⁸⁾					
V _F = V _{EC}	I _F = 200 A } V _{GE} = 0 V;	-	2,0(1,8)	2,5	V
V _F = V _{EC}	I _F = 300 A } T _j = 25 (125) °C	-	2,25(2,1)	-	V
V _{TO}	T _j = 125 °C ²⁾	-	1,1	1,2	V
r _T	T _j = 125 °C ²⁾	-	3	5,5	mΩ
I _R RM	I _F = 200 A; T _j = 25 (125) °C ²⁾	-	70(105)	-	A
Q _{rr}	I _F = 200 A; T _j = 25 (125) °C ²⁾	-	10(26)	-	μC
FWD of type "GAL" and "GAR" ^{8) 6)}					
V _F = V _{EC}	I _F = 200 A } V _{GE} = 0 V;	-	1,9(1,7)	2,4	V
V _F = V _{EC}	I _F = 300 A } T _j = 25 (125) °C	-	2,1(1,8)	-	V
V _{TO}	T _j = 125 °C	-	-	1,2	V
r _T	T _j = 125 °C	-	3	3,5	mΩ
I _R RM	I _F = 200 A; T _j = 25 (125) °C ²⁾	-	80(140)	-	ns
Q _{rr}	I _F = 200 A; T _j = 25 (125) °C ²⁾	-	10(34)	-	μC
Thermal Characteristics					
R _{thjc}	per IGBT	-	-	0,075	°C/W
R _{thjc}	per diode / FWD ⁶⁾	-	-	0,18/0,15	°C/W
R _{thch}	per module	-	-	0,038	°C/W

SEMITRANS® M IGBT Modules

SKM 300 GB 123 D
SKM 300 GAL 123 D ⁶⁾
SKM 300 GAR 123 D ⁶⁾



SEMITRANS 3



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 diodes⁸⁾
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (12 mm) and creepage distances (20 mm).

Typical Applications: → B6-153

- Switching, not for linear use
- AC-inverter drives
- UPS

¹⁾ T_{case} = 25 °C, unless otherwise specified

²⁾ I_F = - I_C, V_R = 600 V, - di_F/dt = 2000 A/μs, V_{GE} = 0 V

³⁾ Use V_{GEoff} = -5 ... -15 V

⁵⁾ see fig. 2 + 3; R_{Goff} = 4,7 Ω

⁶⁾ The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 400 GA 123 D

⁸⁾ CAL = Controlled Axial Lifetime Technology.

Cases and mech. data → B6-174 SEMITRANS 3

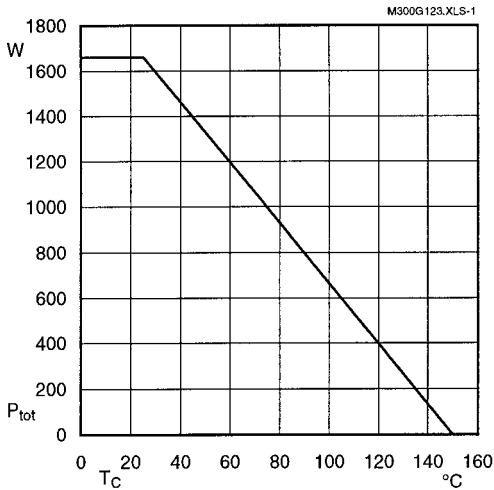


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

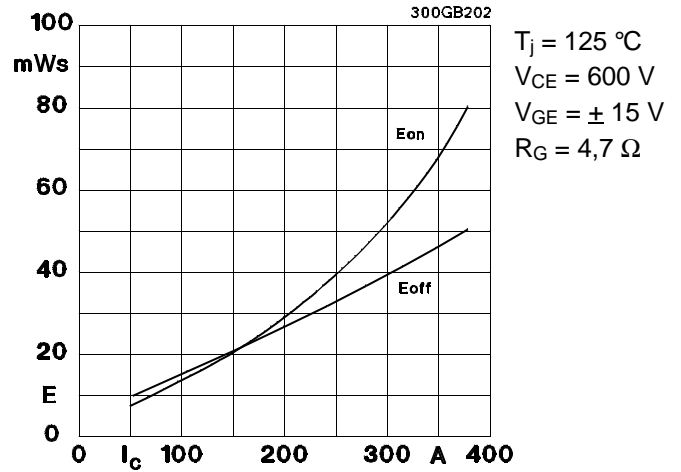


Fig. 2 Turn-on /-off energy = $f(I_C)$

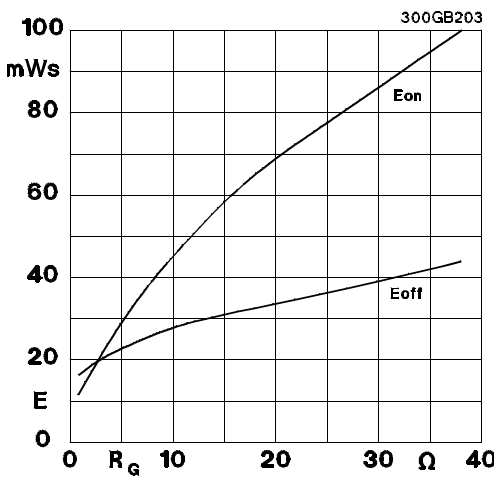


Fig. 3 Turn-on /-off energy = $f(R_G)$

$T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_C = 200\text{ A}$

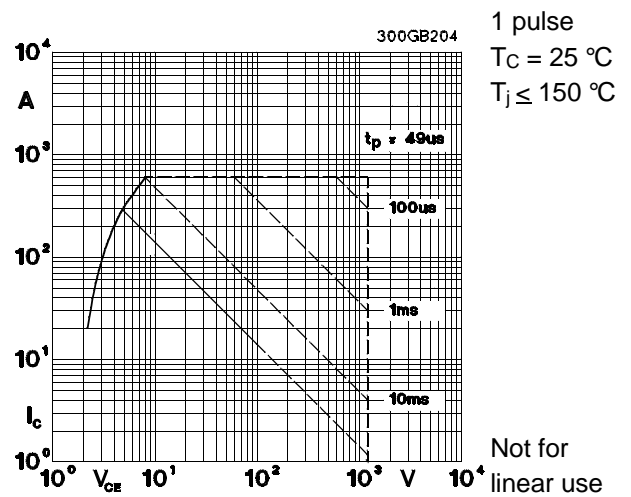


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

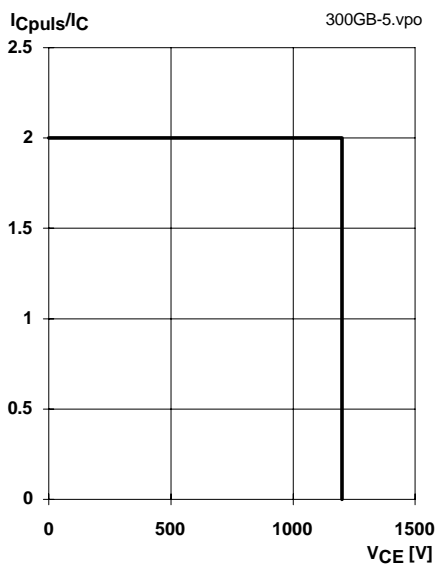


Fig. 5 Turn-off safe operating area (RBSOA)

$T_j \leq 150\text{ }^\circ\text{C}$
 $V_{GE} = 15\text{ V}$
 $R_{Goff} = 4,7\ \Omega$
 $I_C = 200\text{ A}$

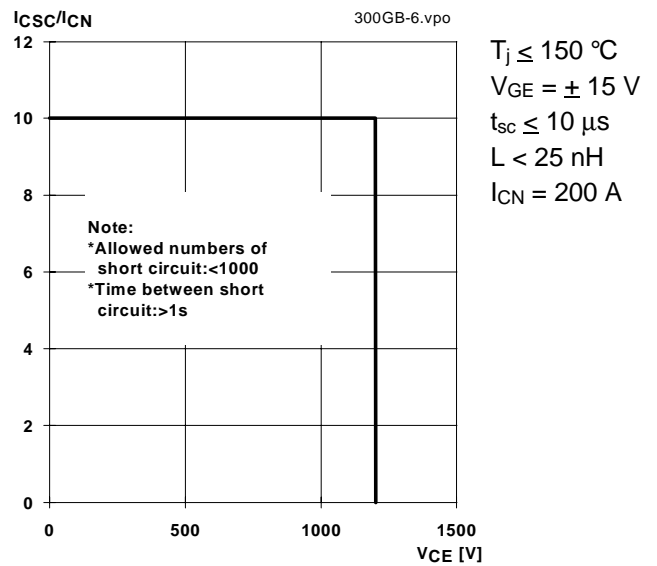


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

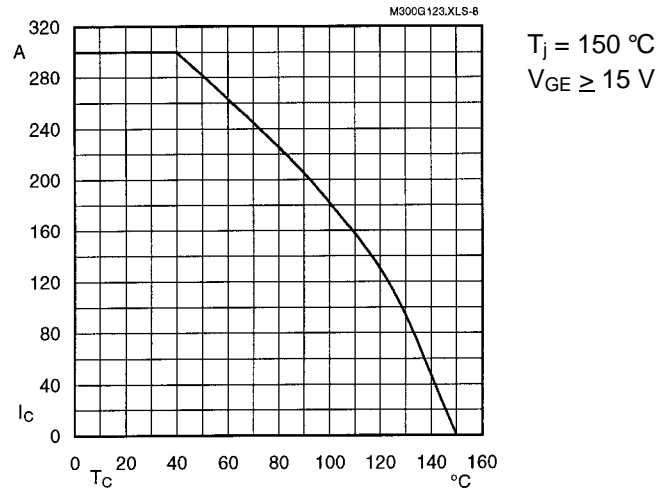


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

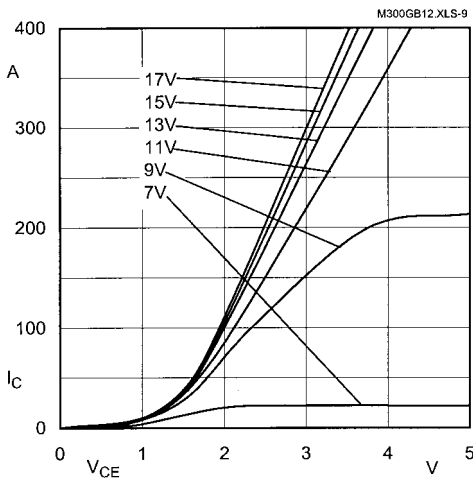


Fig. 9 Typ. output characteristic, $t_p = 80\text{ }\mu\text{s}$; $25\text{ }^\circ\text{C}$

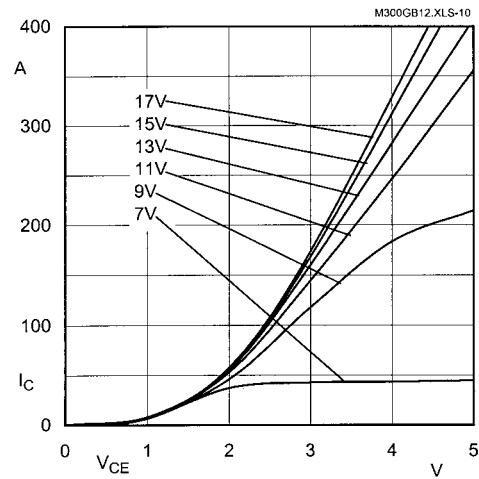


Fig. 10 Typ. output characteristic, $t_p = 80\text{ }\mu\text{s}$; $125\text{ }^\circ\text{C}$

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

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

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

$$\text{typ.: } r_{CE(T_j)} = 0,005 + 0,00002 (T_j - 25) \text{ } [\Omega]$$

$$\text{max.: } r_{CE(T_j)} = 0,0075 + 0,000025 (T_j - 25) \text{ } [\Omega]$$

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

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

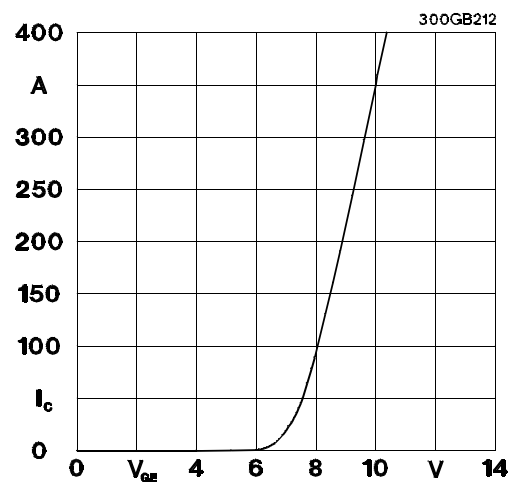


Fig. 12 Typ. transfer characteristic, $t_p = 80\text{ }\mu\text{s}$; $V_{CE} = 20\text{ V}$

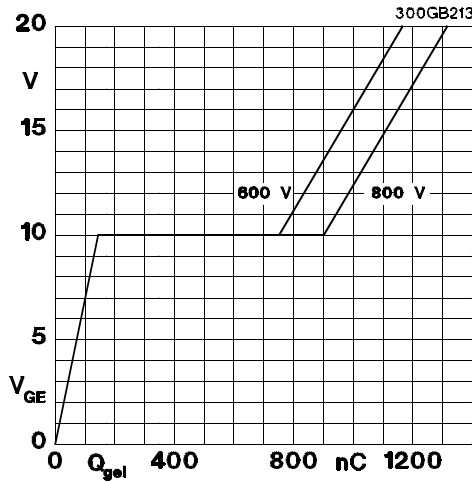
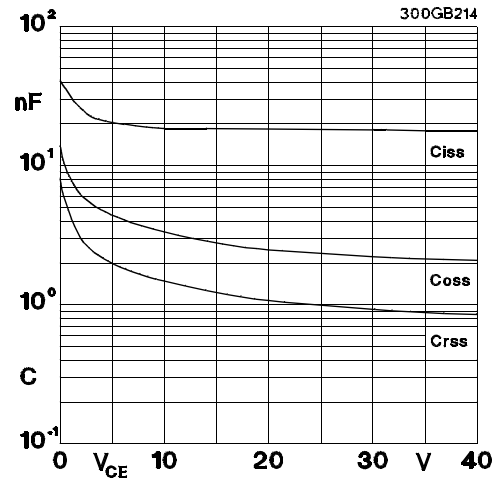


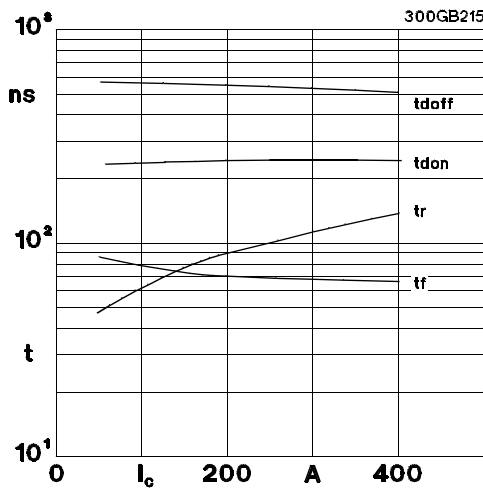
Fig. 13 Typ. gate charge characteristic

$I_{Cpuls} = 300 \text{ A}$



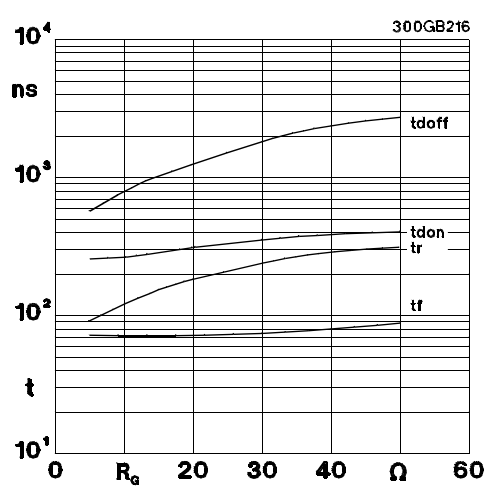
$V_{GE} = 0 \text{ V}$
 $f = 1 \text{ MHz}$

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



$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{Gon} = 4,7 \text{ } \Omega$
 $R_{Goff} = 4,7 \text{ } \Omega$
induct. load

Fig. 15 Typ. switching times vs. I_c



$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 200 \text{ A}$
induct. load

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

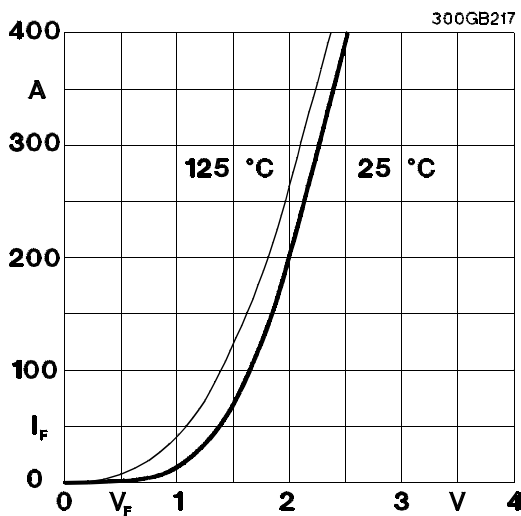


Fig. 17 Typ. CAL diode forward characteristic

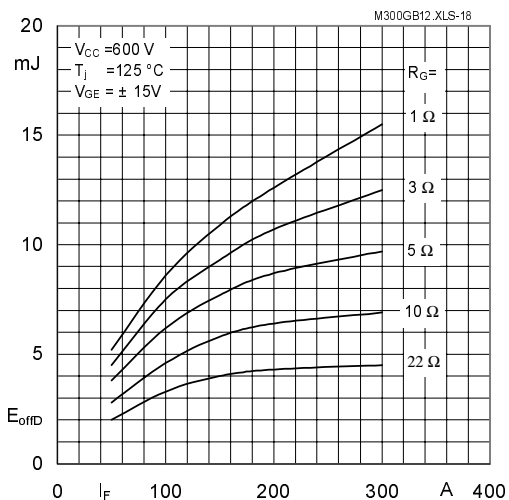


Fig. 18 Diode turn-off energy dissipation per pulse

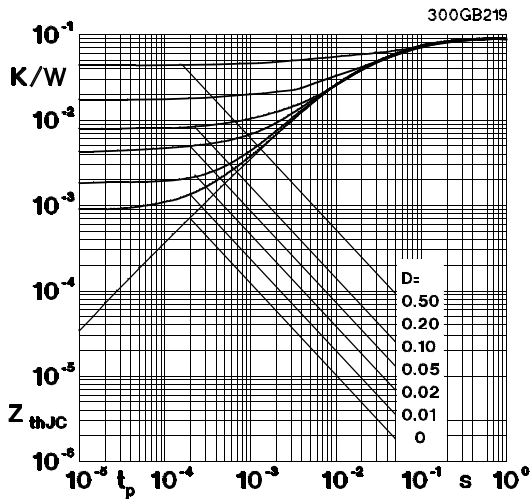


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

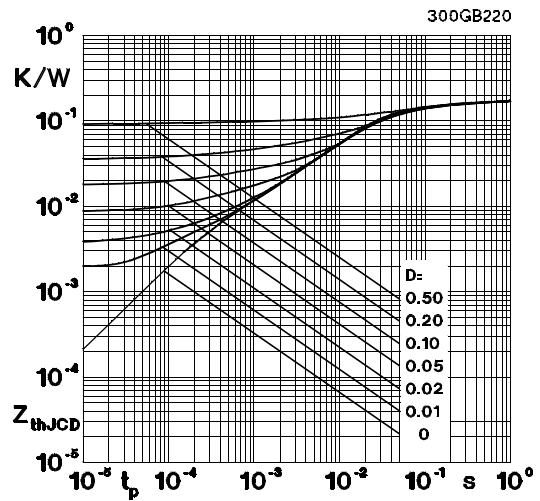


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJCD} = f(t_p)$;

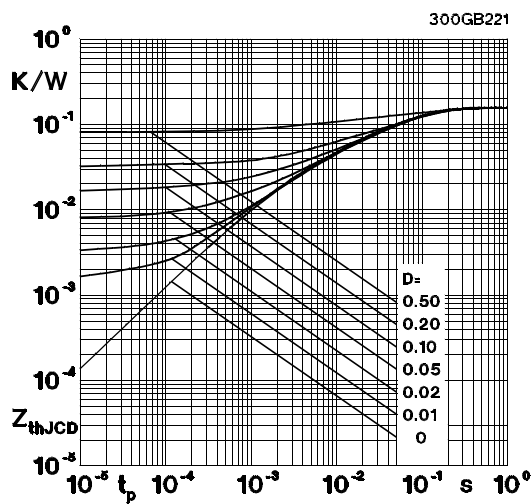


Fig. 21 Transient thermal impedance of the freewheeling diode
 $Z_{thJCD} \rightarrow B 6 - 169, \text{ rem. } 6)$

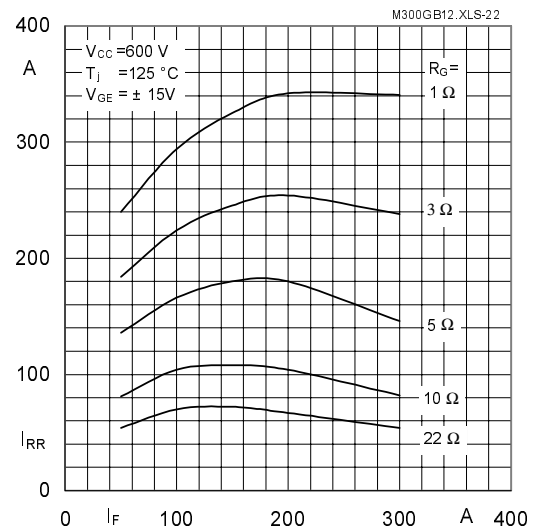


Fig. 22 Typ CAL diode reverse recovery current
 $I_{RR} = f(I_F; R_G)$

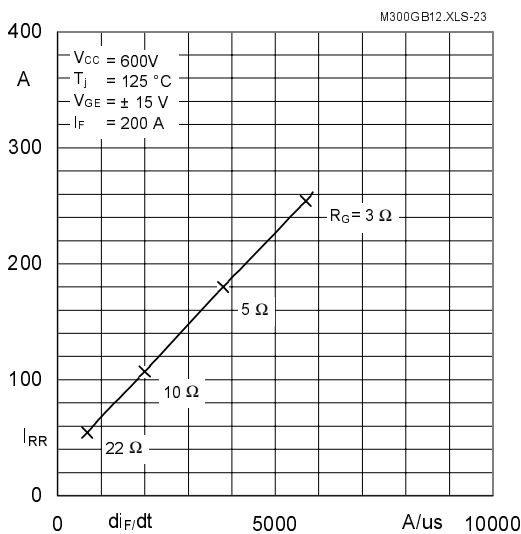


Fig. 23 Typ. CAL diode reverse recovery current
 $I_{RR} = f(di_F/dt; R_G)$

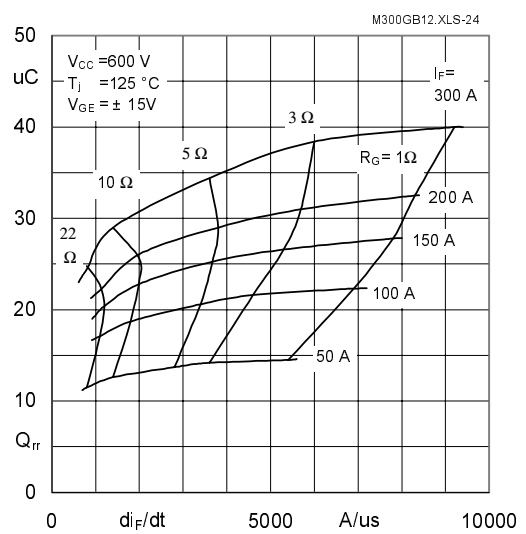
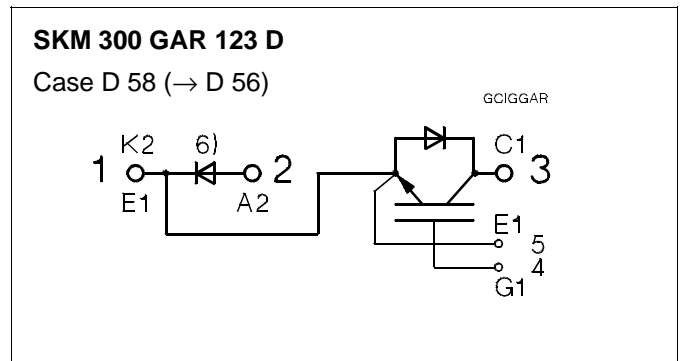
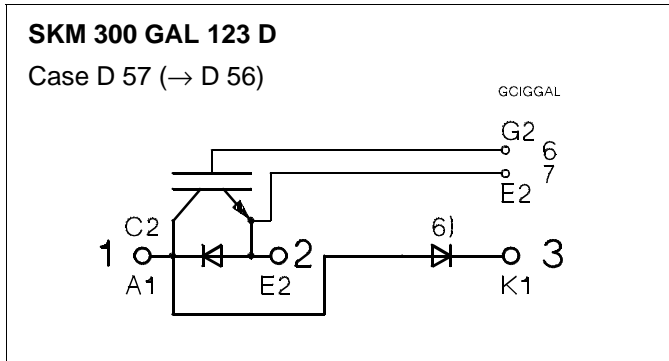
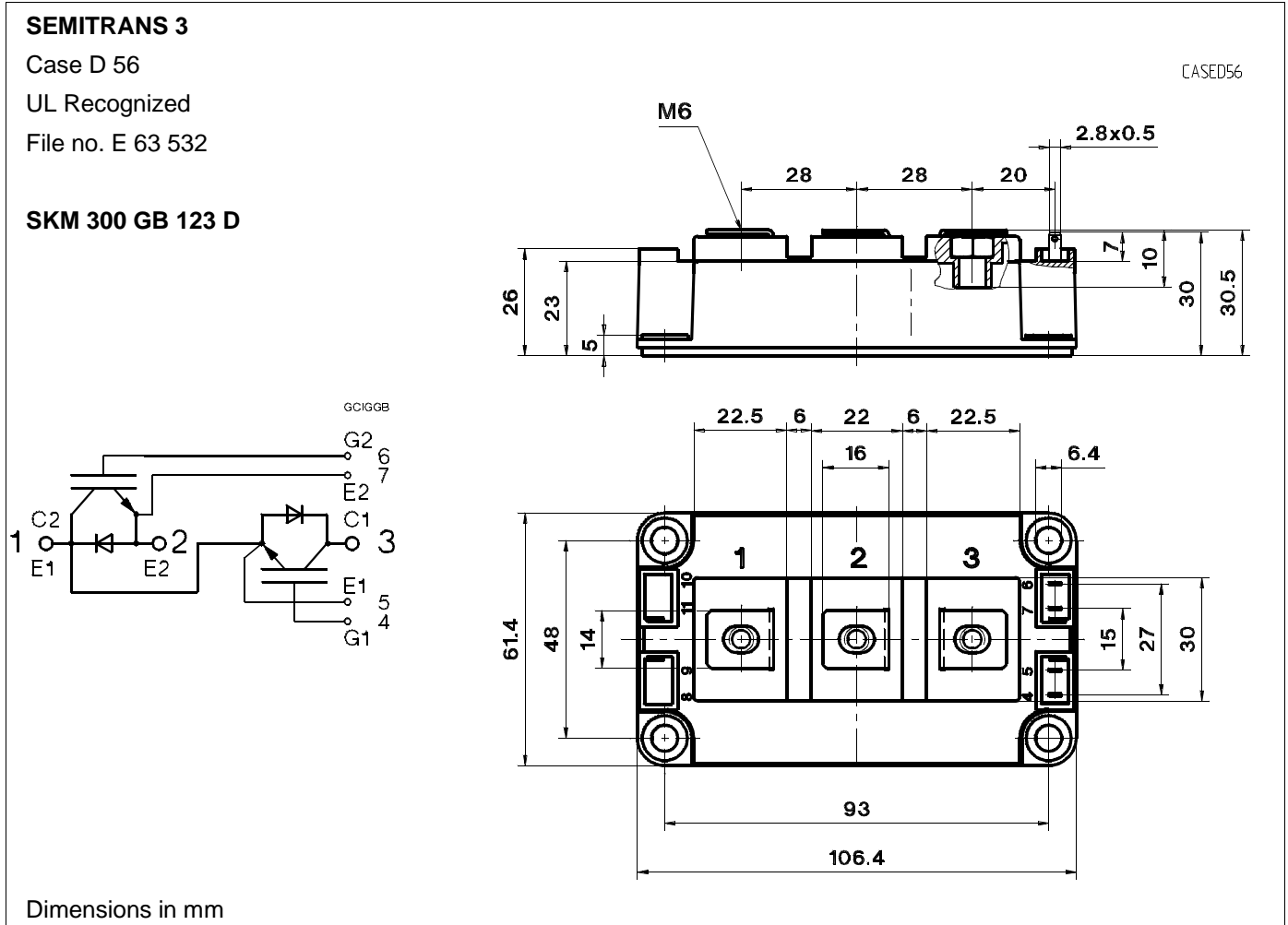


Fig. 24 Typ. CAL diode recovered charge
 $Q_{rr} = f(di_F/dt; I_F; R_G)$



Case outline and circuit diagrams

Mechanical Data			Values			Units
Symbol	Conditions		min.	typ.	max.	
M ₁	to heatsink, SI Units to heatsink, US Units	(M6)	3 27	—	5 44	Nm lb.in.
M ₂	for terminals, SI Units for terminals US Units	(M6)	2,5 22	—	5 44	Nm lb.in.
a			—	—	5x9,81	m/s ²
w			—	—	325	g

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 A 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 → B 6 - 4.
 SEMIBOX → C - 1.

⁶⁾ Freewheeling diode → B 6 - 169, remark 6.