SEMIKRON

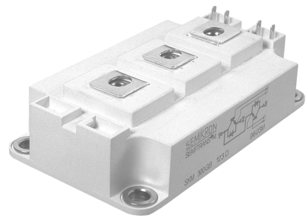
Absolute Maximum Ratings		Values	
Symbol	**Conditions** [1]		**Units**
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/80 °C	300 / 210	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	600 / 420	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	1660	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	2500	V
humidity	IEC 60721-3-3		
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
$I_F = –I_C$	T_{case} = 25/80 °C	260 / 180	A
$I_{FM} = –I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	600 / 420	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	2200	A
I^2t	t_p = 10 ms; T_j = 150 °C	24200	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 = 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		mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0			0,4	µA
V_{CEsat}	I_C = 200 A; V_{GE} = 15 V; T_j = 25 °C		3,3	3,85	V
V_{CEsat}	I_C = 300 A; V_{GE} = 15 V; T_j = 25 °C		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, $R_{Gon} = R_{Goff}$ = 3 Ω, T_j = 125 °C		130		ns
t_r			40		ns
$t_{d(off)}$			460		ns
t_f			30		ns
E_{on} [5]			16		mWs
E_{off} [5]			11		mWs
Inverse Diode [8]					
$V_F = V_{EC}$	I_F = 200 A; V_{GE} = 0 V; T_j = 25 (125) °C		2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 300 A; V_{GE} = 0 V; T_j = 25 (125) °C		2,25(2,1)		V
V_{TO}	T_j = 125 °C		1,1	1,2	V
r_t	T_j = 125 °C		3	5,5	mΩ
I_{RRM}	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
Thermal characteristics					
R_{thjc}	per IGBT			0,075	°C/W
R_{thjc}	per diode			0,18	°C/W
R_{thch}	per module			0,038	°C/W

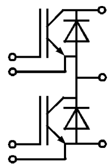
SEMITRANS® M
Superfast IGBT Modules

SKM 300 GB 125 D

Preliminary Data



SEMITRANS 3



GB

Features

- N channel, homogeneous Silicon structure (NPT-Non punch-through IGBT)
- Low inductance case
- **Short tail** current with low temperature dependence
- High short circuit capability, self limiting
- 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

- Switching (not for linear use)
- Switched mode power supplies at f_{sw} > 20 kHz
- Resonant inverters up to 100 kHz
- Silent AC motor speed control (elevators)
- Inductive heating
- Silent UPS Uninterruptable power supplies at f_{sw} > 20 kHz
- Electronic (also portable) welders at f_{sw} > 20 kHz

[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} = 3 Ω
[8] CAL = Controlled Axial Lifetime Technology

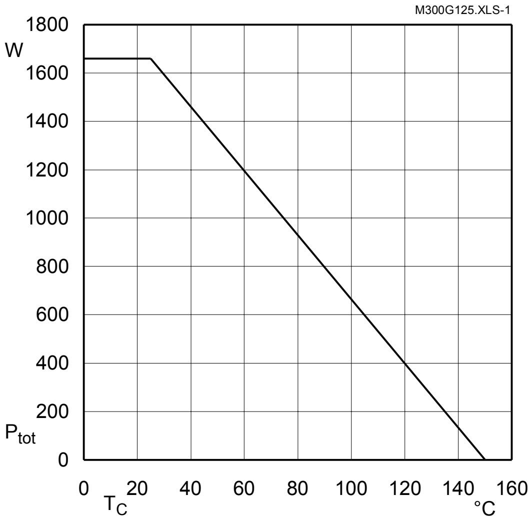


Fig. 1 Rated power dissipation P_{tot} = f (T_C)

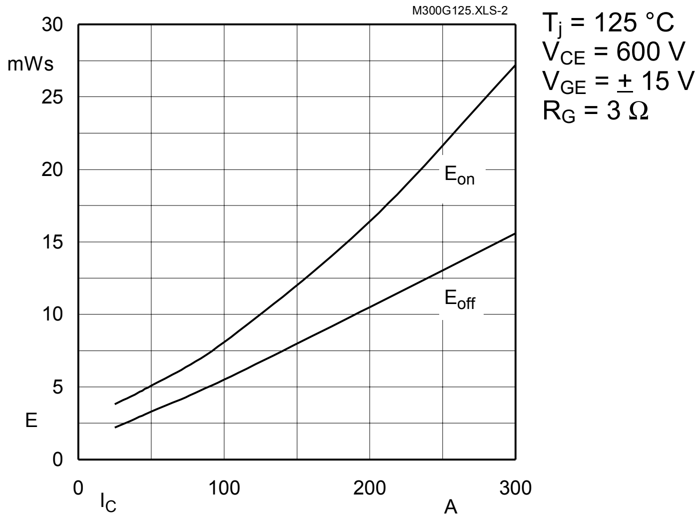


Fig. 2 Turn-on /-off energy = f (I_C)

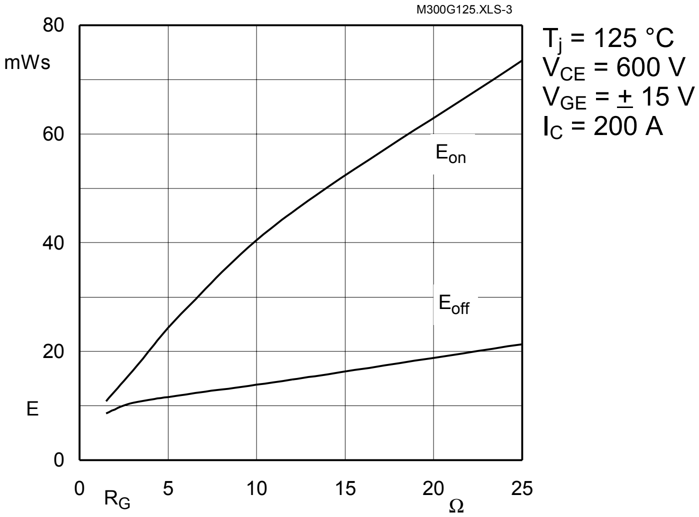


Fig. 3 Turn-on /-off energy = f (R_G)

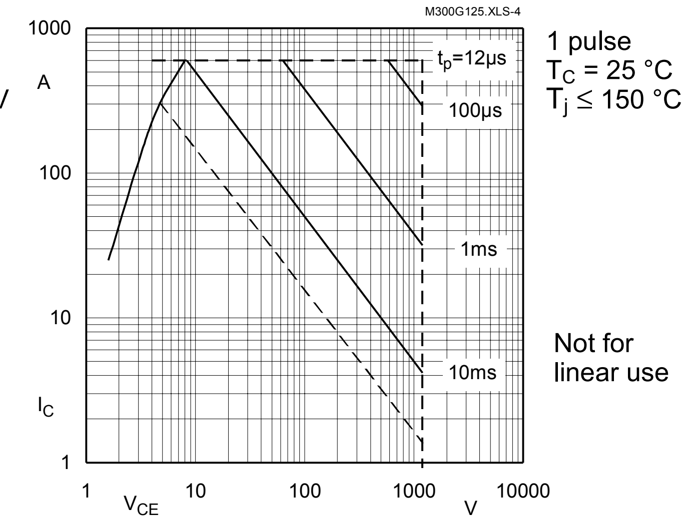


Fig. 4 Maximum safe operating area (SOA) I_C = f (V_{CE})

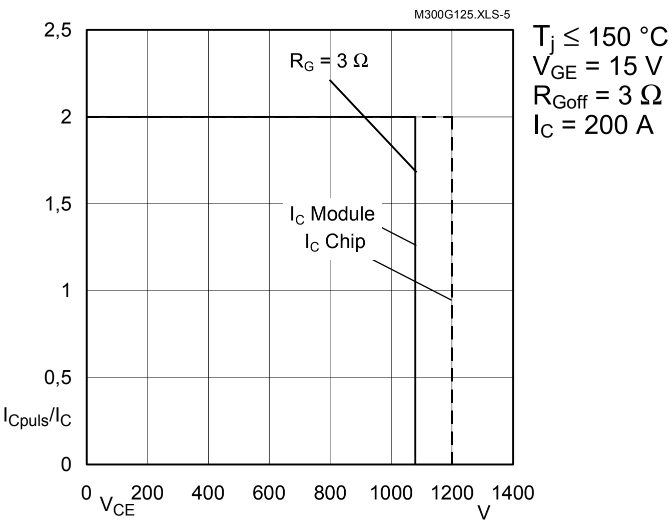


Fig. 5 Turn-off safe operating area (RBSOA)

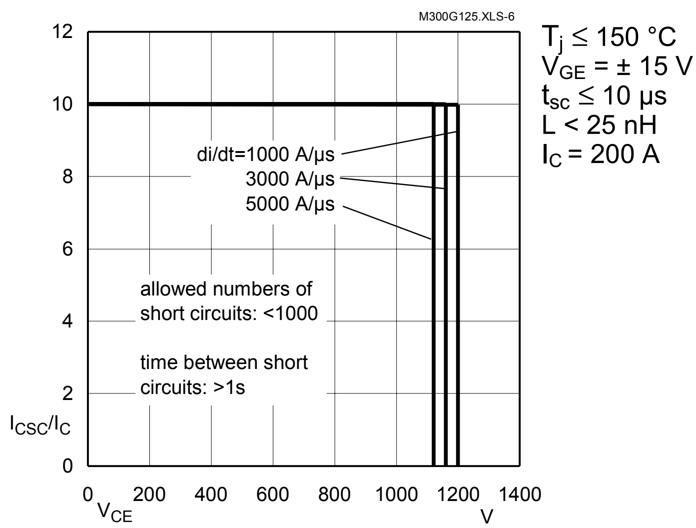


Fig. 6 Safe operating area at short circuit I_C = f (V_{CE})

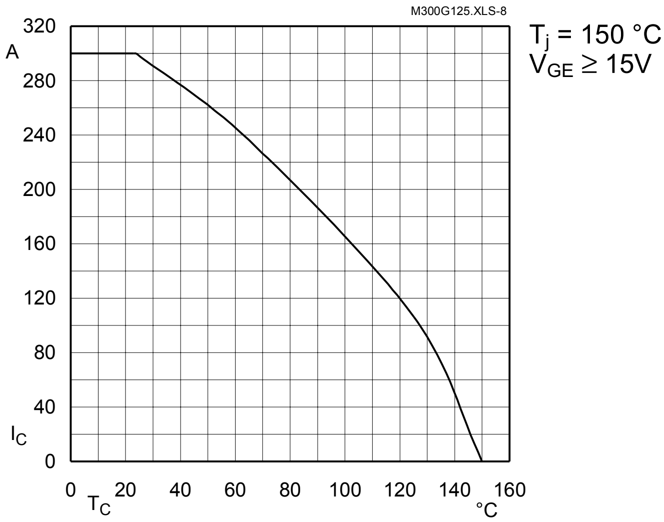


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

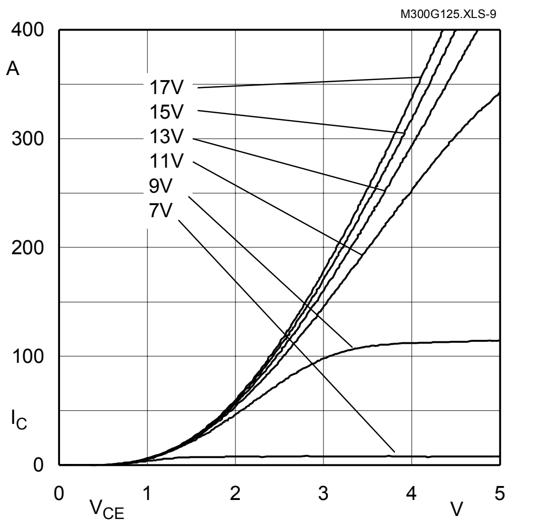


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

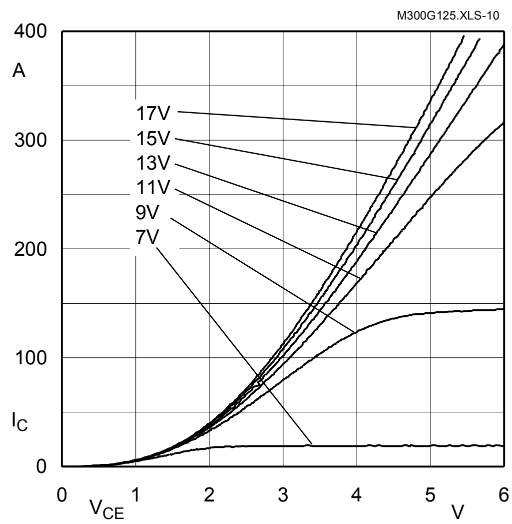


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

$V_{CE(TO)(Tj)} \leq 1{,}4 + 0{,}003\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}0091 + 0{,}000022\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0107 + 0{,}000018\ (T_j - 25)$ [Ω]

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

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

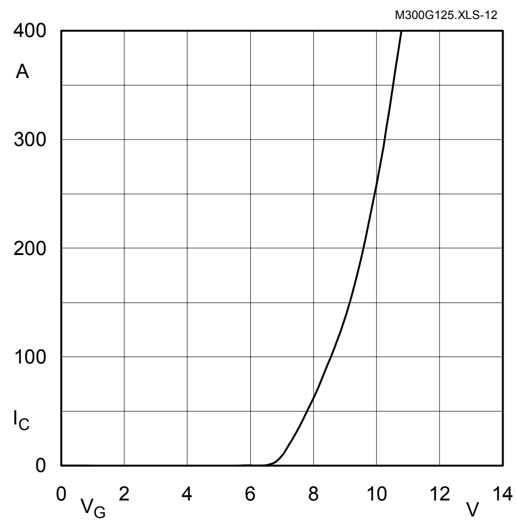


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

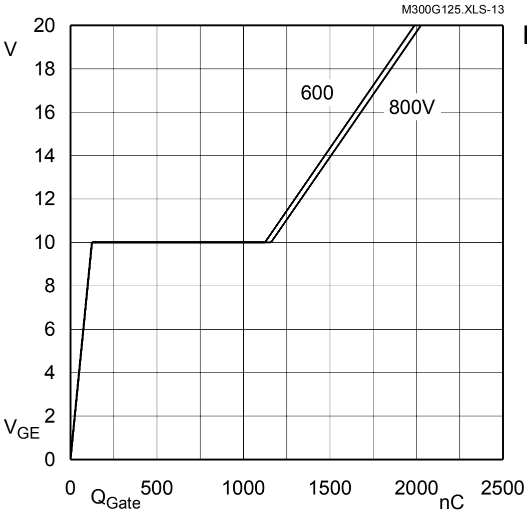


Fig. 13 Typ. gate charge characteristic

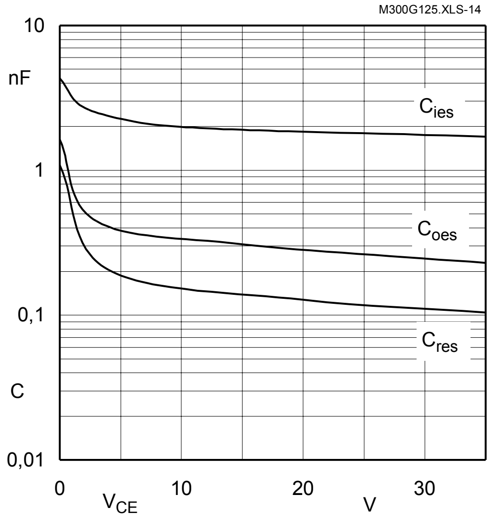


Fig. 14 Typ. capacitances vs.V_{CE}

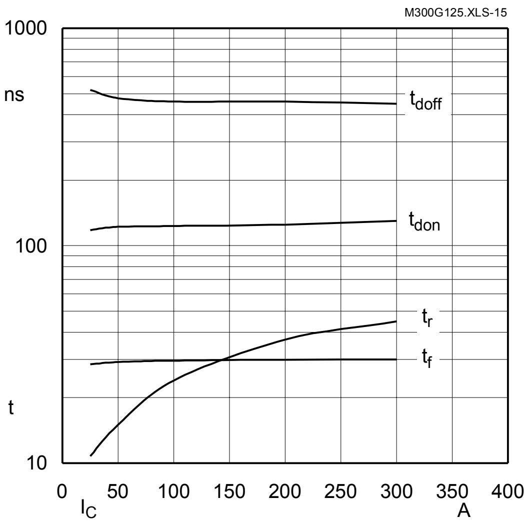


Fig. 15 Typ. switching times vs. I_C

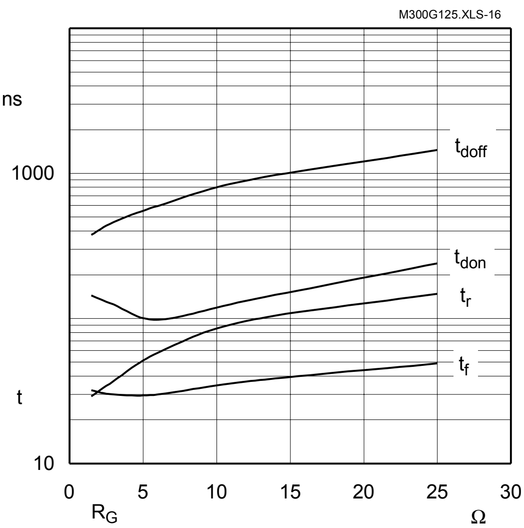


Fig. 16 Typ. switching times vs. gate resistor R_G

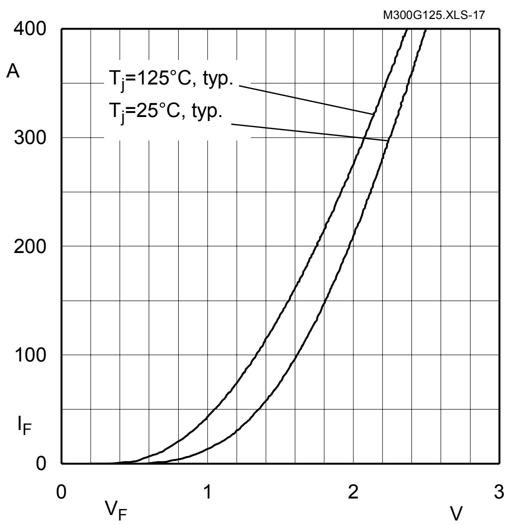


Fig. 17 Typ. CAL diode forward characteristic

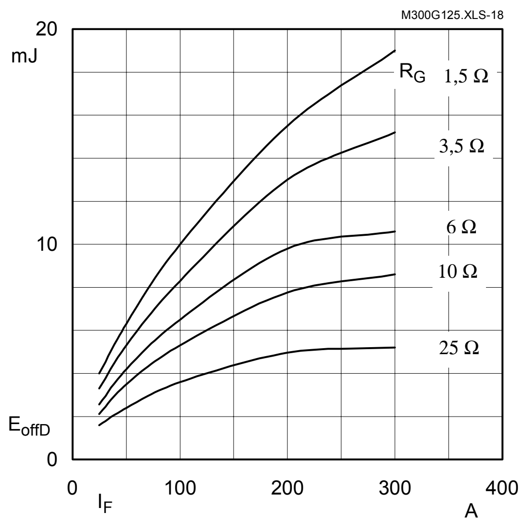


Fig. 18 Diode turn-off energy dissipation per pulse

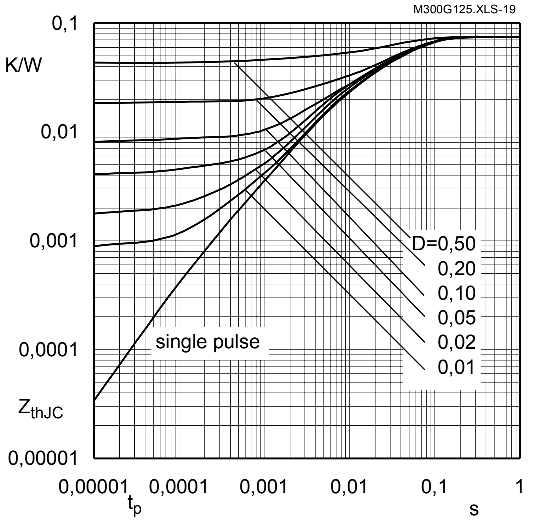


Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

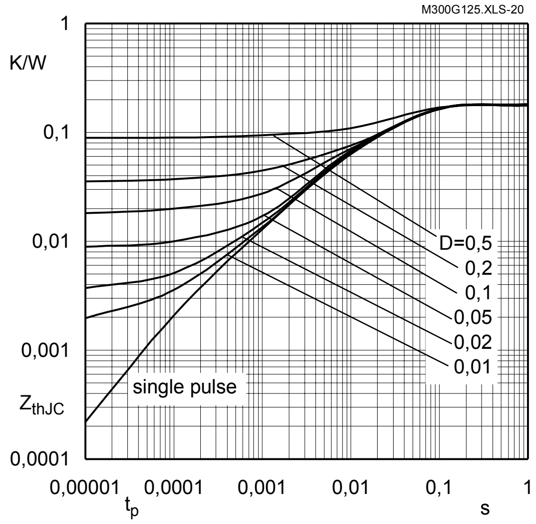


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

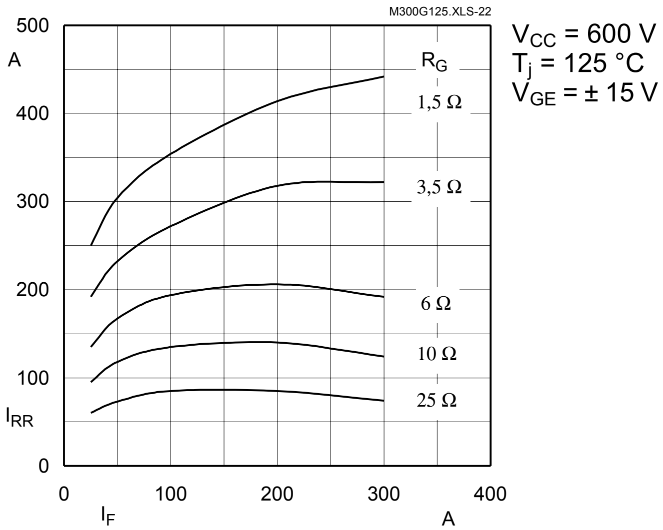


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

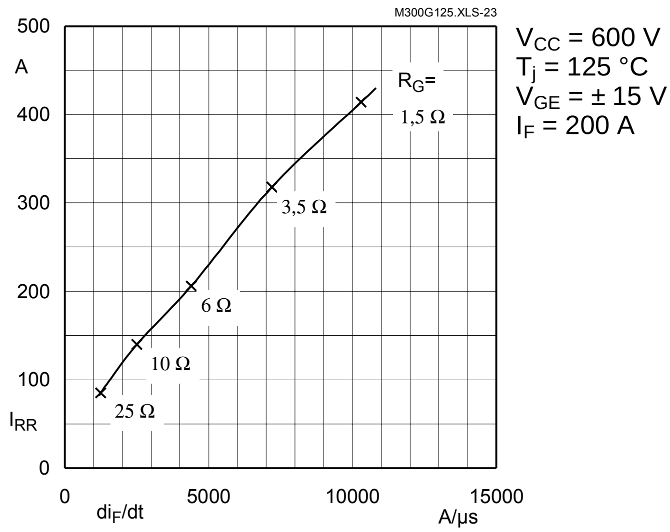


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt; R_G)$

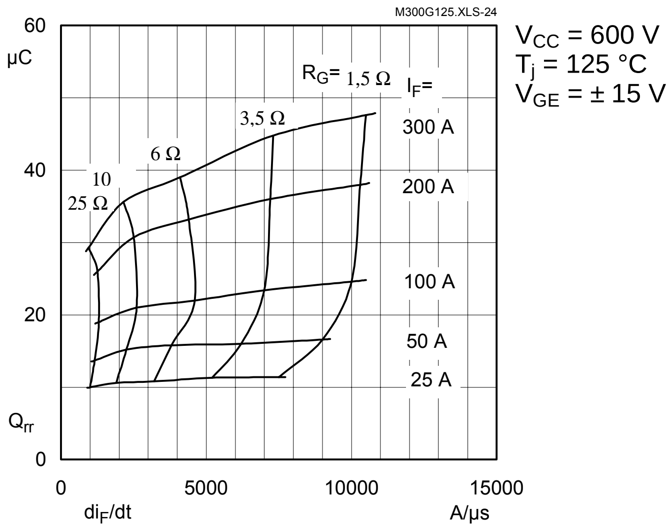


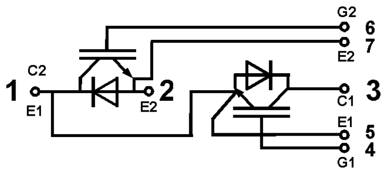
Fig. 24 Typ. CAL diode recovered charge $Q_{RR} = f(di_F/dt; I_F; R_G)$

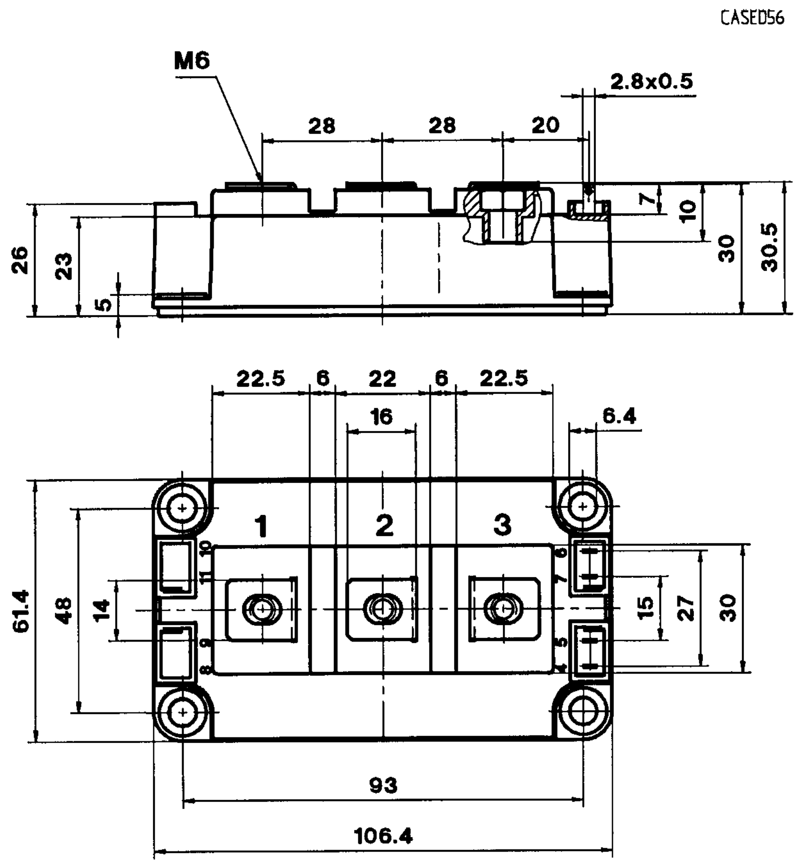
SEMITRANS 3

Case D 56

UL Recognized
File no. E 63 532

SKM 300 GB 125 D





Dimensions in mm

Case outline and circuit diagram

Mechanical Data						
Symbol	**Conditions**		**Values**			**Units**
			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	(M6)	2,5	–	5	Nm
	for terminals, US Units		22	–	44	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.

12 devices are supplied in one SEMIBOX D without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 3).

