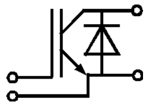
SEMITRANS® M
Low Loss IGBT Modules

SKM 500 GA 124 D

SEMITRANS 4



GA

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	700 / 500	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	1400 / 1000	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	3000	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	2500	V
humidity	DIN 40040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
$I_F = –I_C$	T_{case} = 25/80 °C	500 / 350	A
$I_{FM} = –I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	1400 / 1000	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	3600	A
I^2t	t_p = 10 ms; T_j = 150 °C	64 800	A^2s

Characteristics

Symbol	Conditions [1]	min.	typ.	max.	Units
$V_{(BR)CES}$	V_{GE} = 0, I_C = 6 mA	≥ V_{CES}	–	–	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 16 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0 } T_j = 25 °C	–	–	10	mA
	$V_{CE} = V_{CES}$ } T_j = 125 °C	–	15	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	1	µA
V_{CEsat}	I_C = 400 A { V_{GE} = 15 V;	–	2,1(2,4)	2,45(2,85)	V
V_{CEsat}	I_C = 500 A { T_j = 25 (125) °C	–	2,5(2,8)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 400 A	216	150	–	S
C_{CHC}		–	–	1500	pF
C_{ies}	} V_{GE} = 0	–	26	40	nF
C_{oes}	} V_{CE} = 25 V	–	4	5,2	nF
C_{res}	} f = 1 MHz	–	2	2,6	nF
L_{CE}		–	–	20	nH
$t_{d(on)}$	} V_{CC} = 600 V	–	100	600	ns
t_r	} V_{GE} = –15 V / +15 V [3]	–	75	340	ns
$t_{d(off)}$	} I_C = 400 A, ind. load	–	660	1100	ns
t_f	} $R_{Gon} = R_{Goff}$ = 3 Ω	–	82	125	ns
E_{on}	} T_j = 125 °C	–	39	–	mWs
E_{off}		–	57	–	mWs
Inverse Diode [8]					
$V_F = V_{EC}$	I_F = 400 A { V_{GE} = 0 V;	–	2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 500 A { 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	–	–	3	mΩ
I_{RRM}	I_F = 400 A; T_j = 25 (125) °C [2]	–	180	–	A
Q_{rr}	I_F = 400 A; T_j = 25 (125) °C [2]	–	52	–	µC
Thermal characteristics					
R_{thjc}	per IGBT	–	–	0,041	°C/W
R_{thjc}	per diode D	–	–	0,09	°C/W
R_{thch}	per module	–	–	0,038	°C/W

Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure (NPT-Non punch through-IGBT)
- 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 without hard mould
- Large clearance (12 mm) and creepage distances (20 mm)

Typical Applications

- Switching (not for linear use)
- 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
[8] CAL = Controlled Axial Lifetime Technology.

Cases and mech. data → page 6 SEMITRANS 4

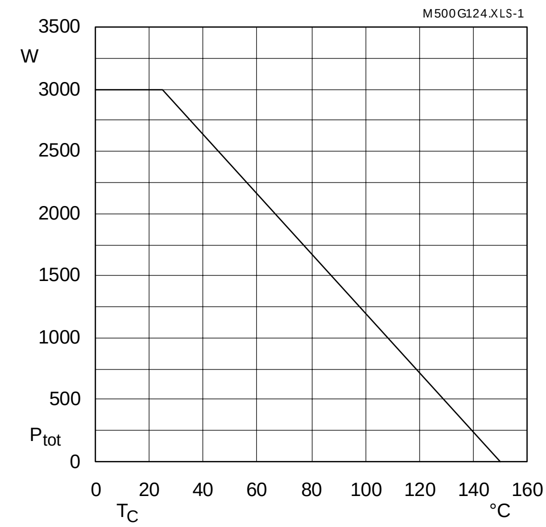


Fig. 1 Rated power dissipation P_{tot} = f (T_C)

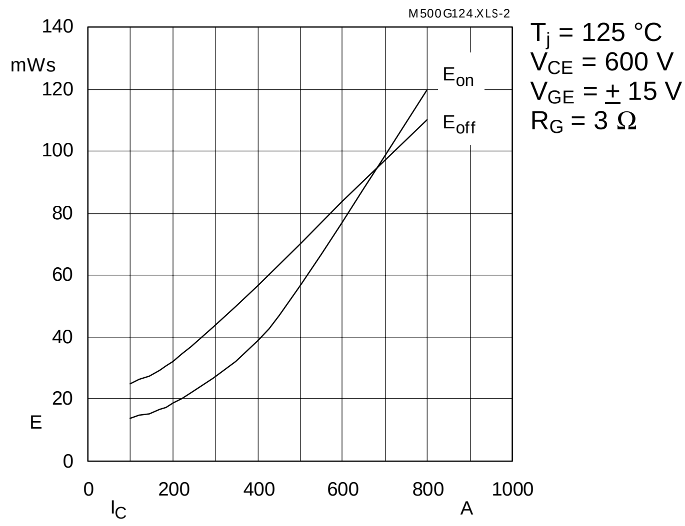


Fig. 2 Turn-on /-off energy = f (I_C)

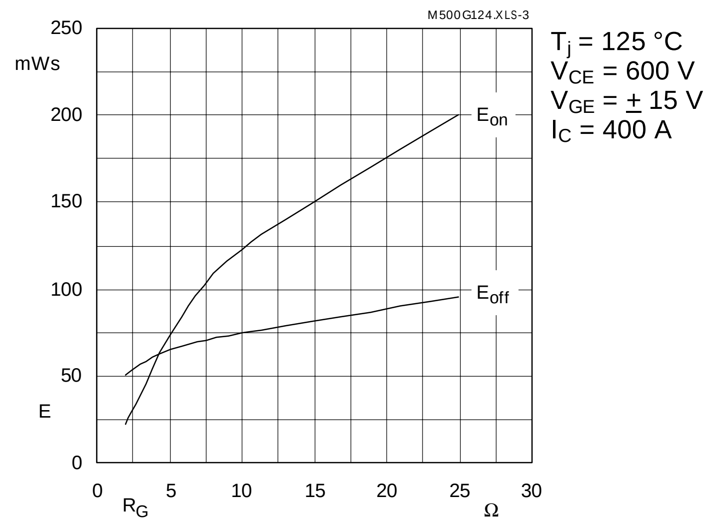


Fig. 3 Turn-on /-off energy = f (R_G)

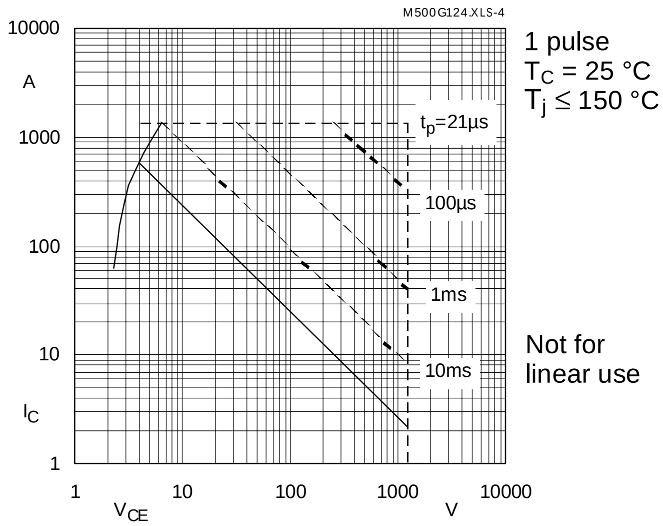


Fig. 4 Maximum safe operating area (SOA) I_C = f (V_{CE})

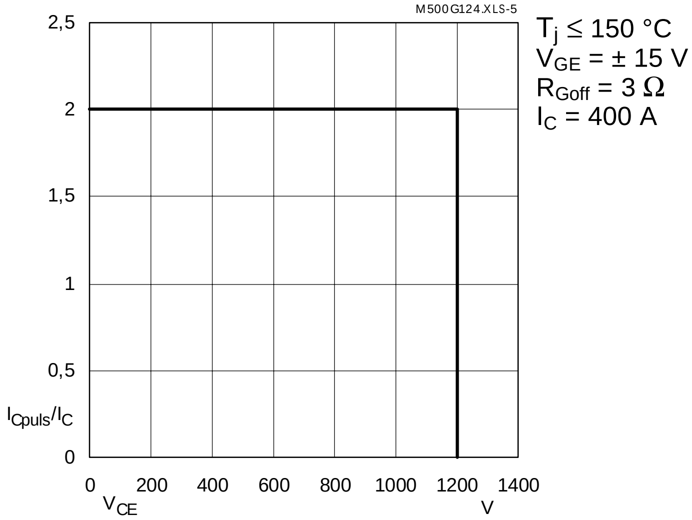


Fig. 5 Turn-off safe operating area (RBSOA)

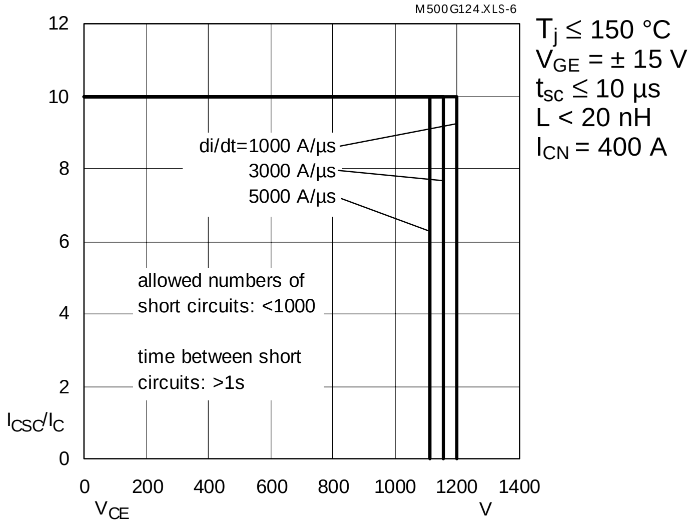


Fig. 6 Safe operating area at short circuit I_C = f (V_{CE})

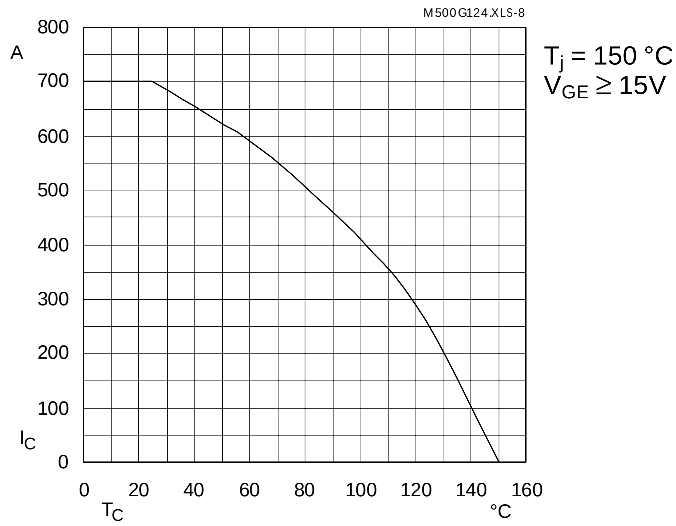


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

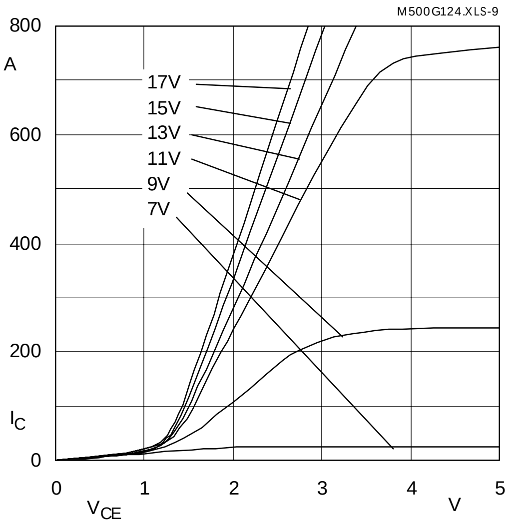


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

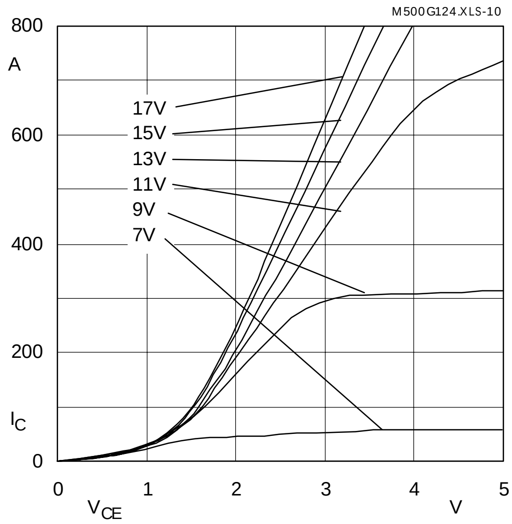


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

$V_{CE(TO)(Tj)} \leq 1{,}3 + 0{,}005\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}0020 + 0{,}000006\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0029 + 0{,}000009\ (T_j - 25)$ [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

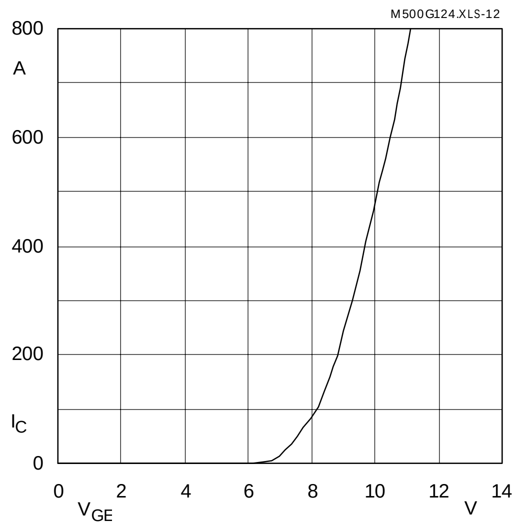


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

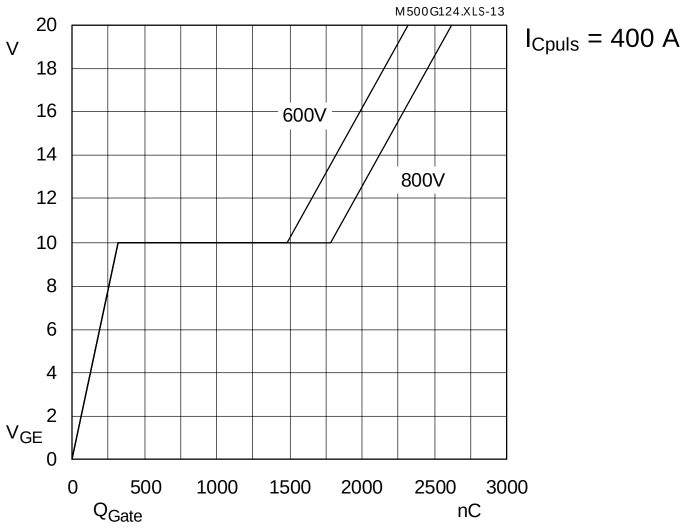


Fig. 13 Typ. gate charge characteristic

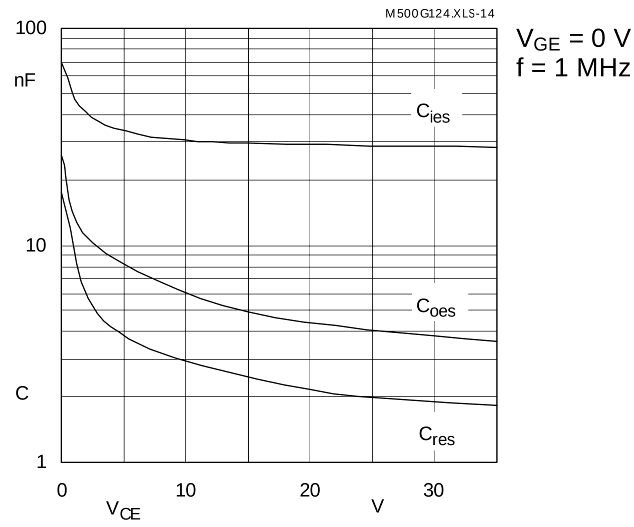


Fig. 14 Typ. capacitances vs.V_{CE}

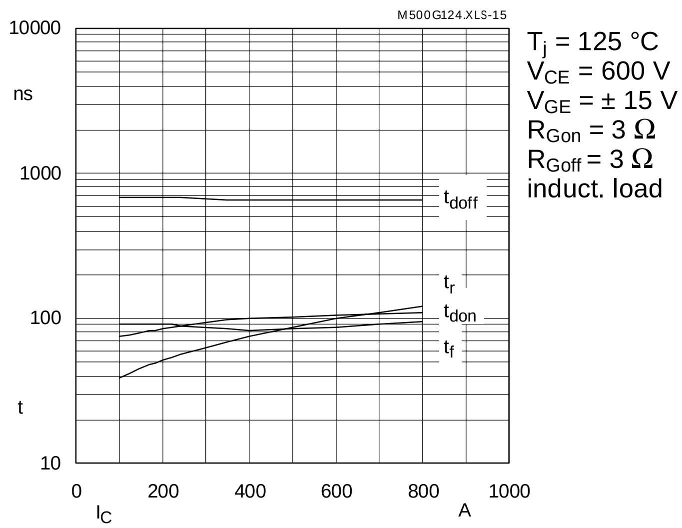


Fig. 15 Typ. switching times vs. I_C

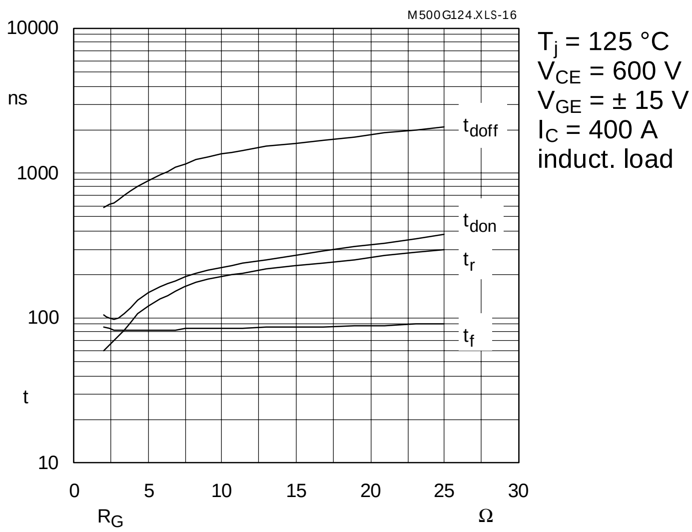


Fig. 16 Typ. switching times vs. gate resistor R_G

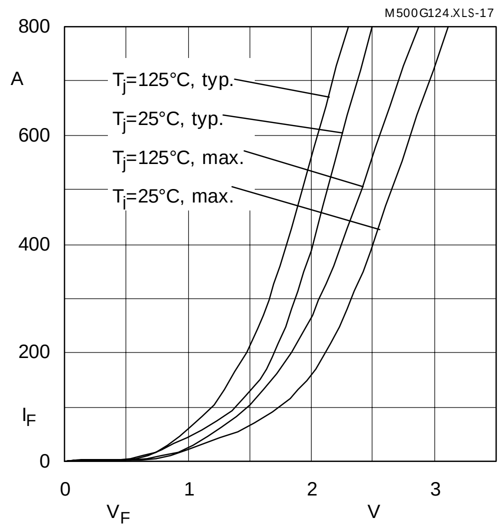


Fig. 17 Typ. CAL diode forward characteristic

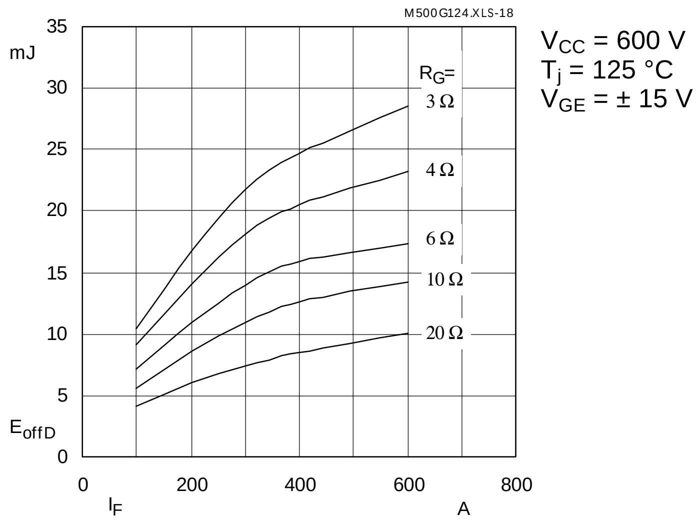


Fig. 18 Diode turn-off energy dissipation per pulse

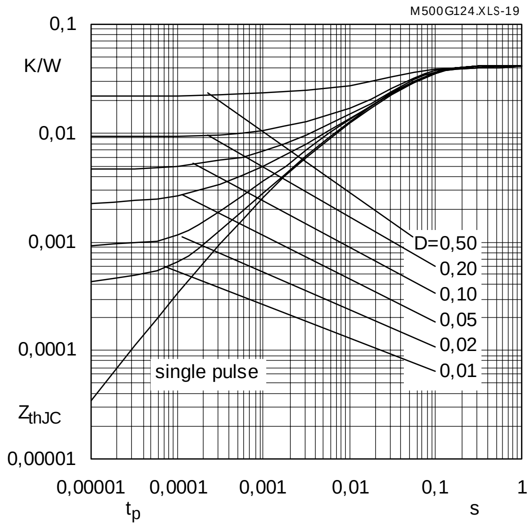


Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

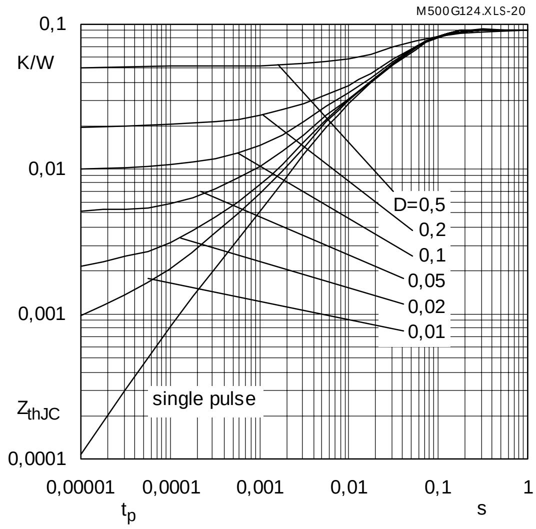


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

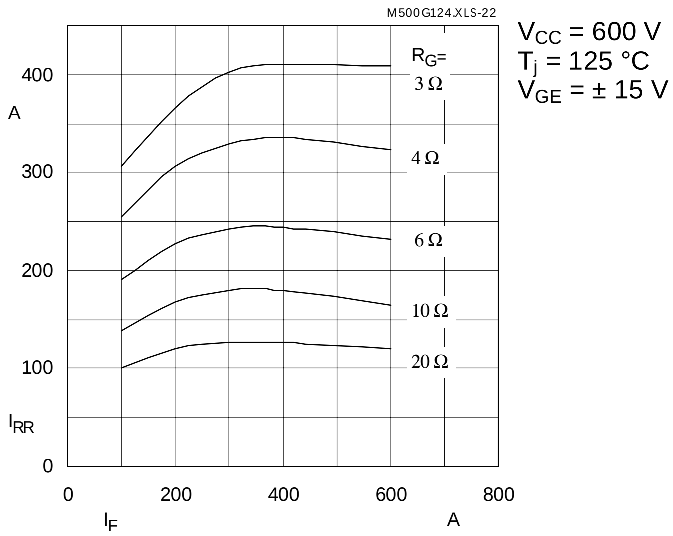


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

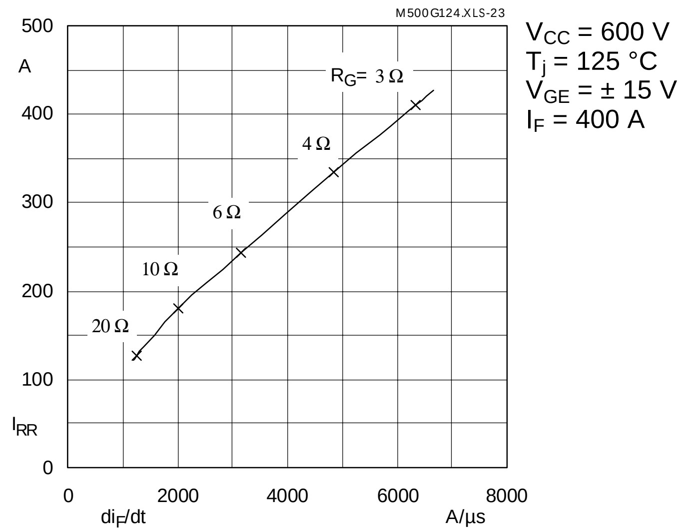


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt; R_G)$

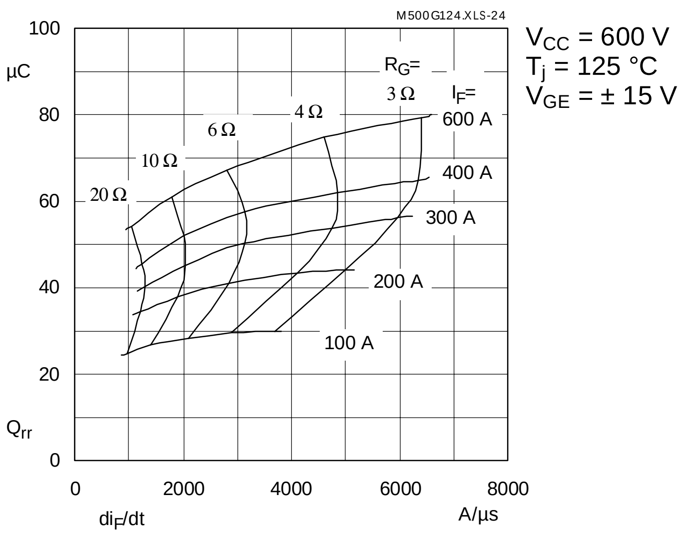


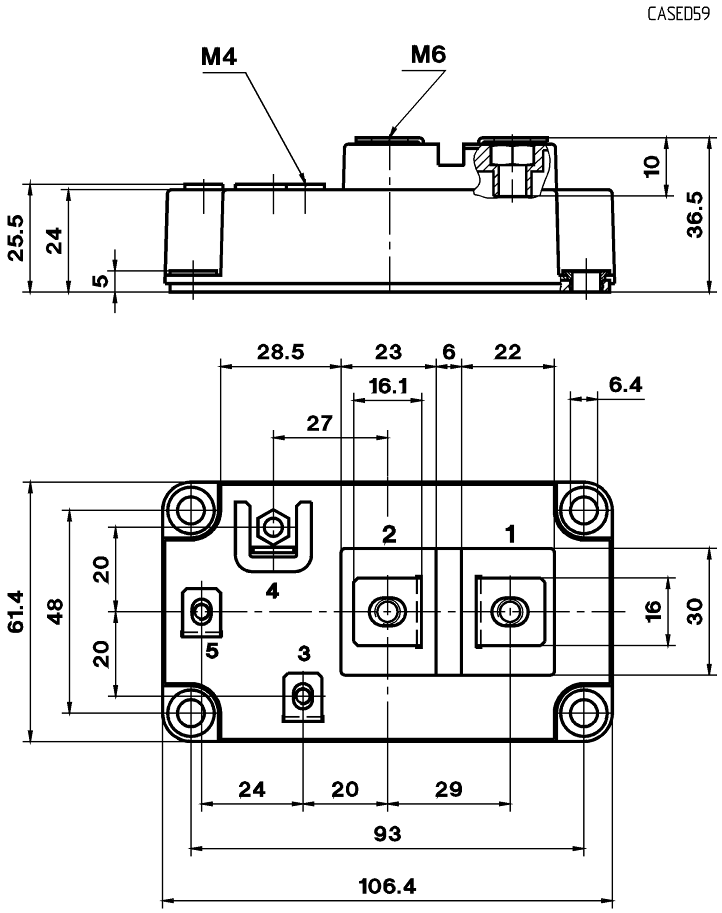
Fig. 24 Typ. CAL diode recovered charge
$Q_{RR} = f(di_F/dt; I_F; R_G)$

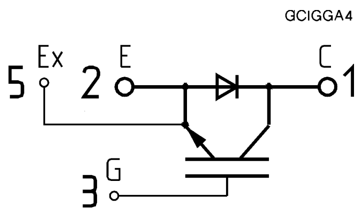
SEMITRANS 4

Case D 59

UL Recognized
File no. E 63 532

SKM 500 GA 124 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/M4)	2,5/1,1	–	5/2	Nm
	for terminals, US Units		22/10	–	44/18	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	330	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 4)

Larger packing units of 12 or 20 pieces are used if suitable

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

