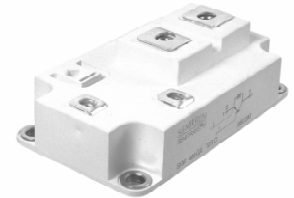


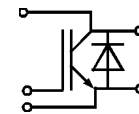
Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V _{CES}		1200	V
V _{CGR}	R _{GE} = 20 kΩ	1200	V
I _C	T _{case} = 25/85 °C	600 / 400	A
I _{CM}	T _{case} = 25/85 °C; t _p = 1 ms	1200 / 800	A
V _{GES}		± 20	V
P _{tot}	per IGBT, T _{case} = 25 °C	2750	W
T _j , (T _{stg})		-40 ... +150 (125)	°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	390 / 260	A
I _{FM} = -I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	1200 / 800	A
I _{FSM}	t _p = 10 ms; sin.; T _j = 150 °C	2900	A
I ² t	t _p = 10 ms; T _j = 150 °C	42000	A ² s

SEMITRANS® M Low Loss IGBT Modules

SKM 400 GA 124 D



SEMITRANS 4



GA

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 dependance
- 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

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 = 12 mA ³	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _j = 25 °C V _{CE} = V _{CES} } T _j = 125 °C	-	0,4	3	mA
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	-	-	1	µA
V _{CESat}	I _C = 300 A } V _{GE} = 15 V; I _C = 400 A } T _j = 25 (125) °C	-	2,1(2,4)	2,45(2,85)	V
V _{CESat}	I _C = 400 A } T _j = 25 (125) °C	-	2,5(3,0)	-	V
g _{fs}	V _{CE} = 20 V, I _C = 300 A	124	-	-	S
C _{CHC}	per IGBT	-	1300	1500	pF
C _{ies}	V _{GE} = 0	-	22	30	nF
C _{oes}	V _{CE} = 25 V	-	3,3	4	nF
C _{res}	f = 1 MHz	-	1,2	1,6	nF
L _{CE}		-	-	20	nH
t _{d(on)}	V _{CC} = 600 V	-	89	-	ns
t _r	V _{GE} = -15 V / +15 V ³⁾	-	77	-	ns
t _{d(off)}	I _C = 300 A, ind. load	-	690	-	ns
t _f	R _{Gon} = R _{Goff} = 5 Ω	-	70	-	ns
E _{on}	T _j = 125 °C	-	36	-	mWs
E _{off}		-	42	-	mWs
Inverse Diode ⁸⁾					
V _F = V _{EC}	I _F = 300 A } V _{GE} = 0 V; I _F = 400 A } T _j = 25 (125) °C	-	2,0(1,8)	2,5	V
V _F = V _{EC}	I _F = 400 A } T _j = 25 (125) °C	-	2,25(2,05)	-	V
V _{TO}	T _j = 125 °C	-	-	1,2	V
r _t	T _j = 125 °C	-	-	3,5	mΩ
I _R RM	I _F = 300 A; T _j = 125 °C ²⁾	-	154	-	A
Q _{rr}	I _F = 300 A; T _j = 125 °C ²⁾	-	37	-	µC
Thermal characteristics					
R _{thjc}	per IGBT	-	-	0,045	°C/W
R _{thjc}	per diode D	-	-	0,125	°C/W
R _{thch}	per module	-	-	0,038	°C/W

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

→ B 6 – 194

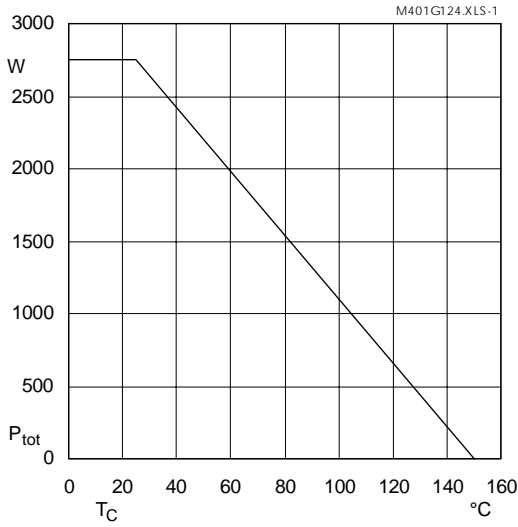


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

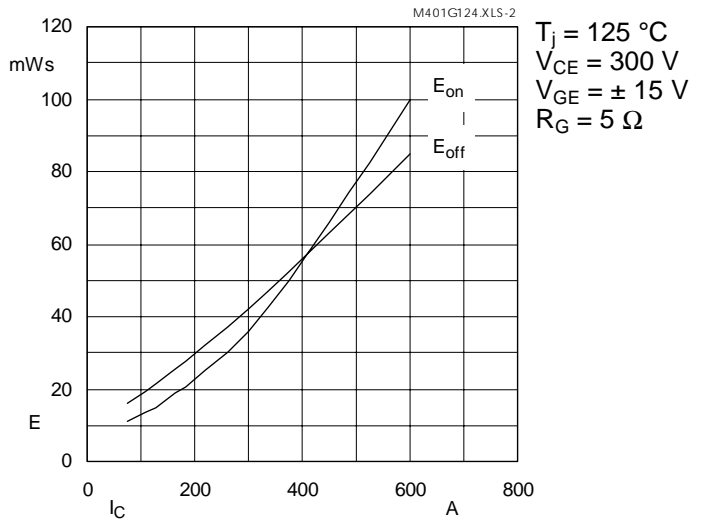


Fig. 2 Turn-on /-off energy $= f(I_C)$

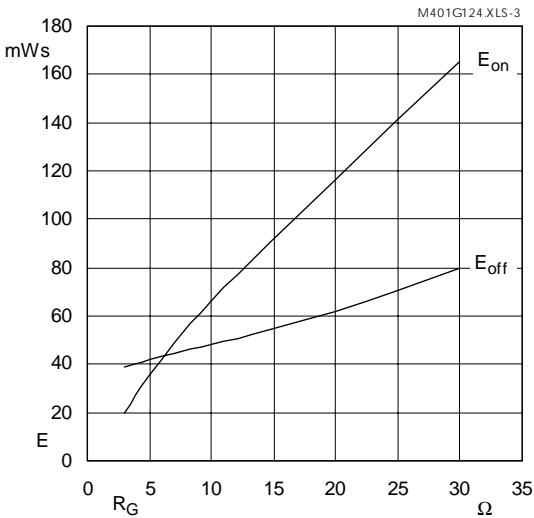


Fig. 3 Turn-on /-off energy $= f(R_G)$

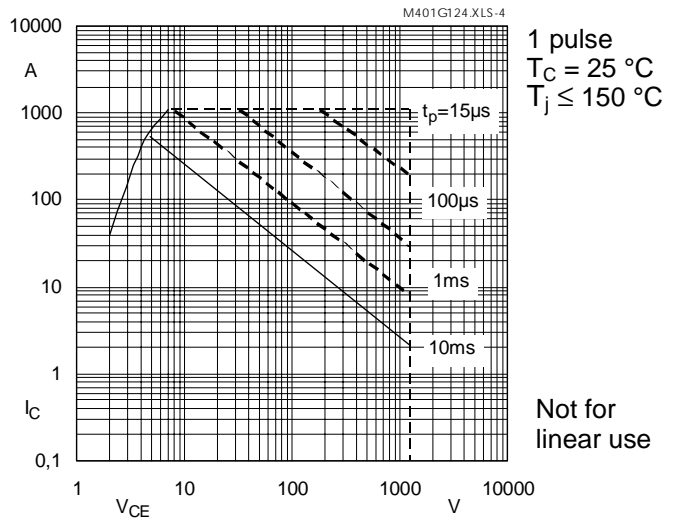


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

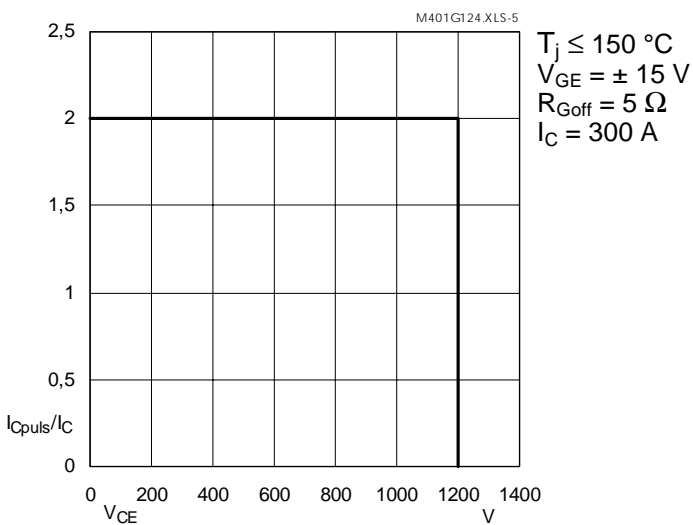


Fig. 5 Turn-off safe operating area (RBSOA)

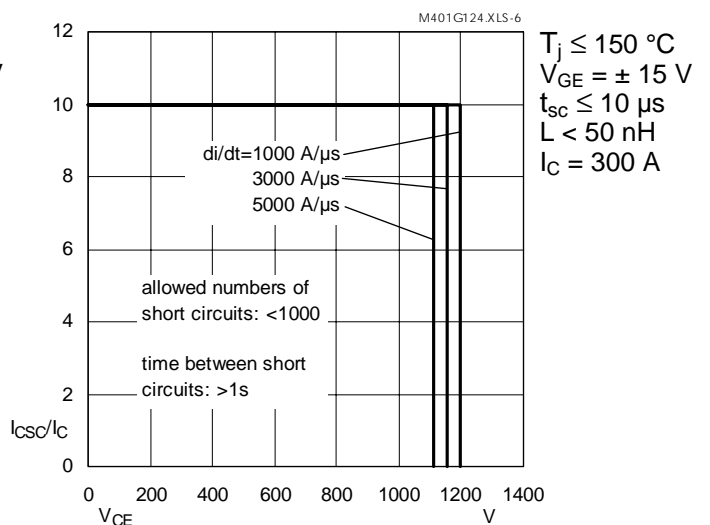


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

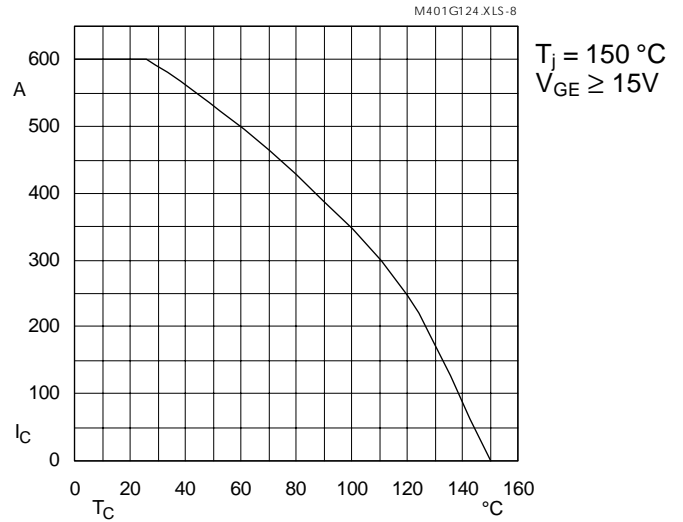


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

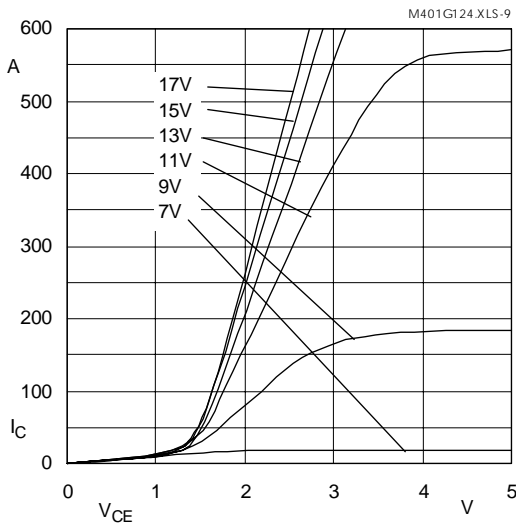


Fig. 9 Typ. output characteristic, $t_p = 250 \mu s$; $T_j = 25 \text{ }^\circ\text{C}$

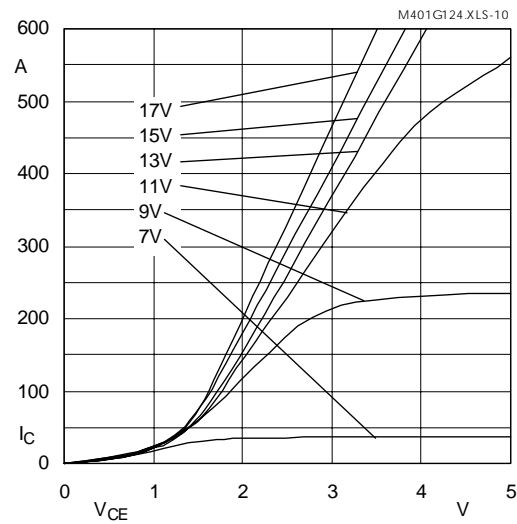


Fig. 10 Typ. output characteristic, $t_p = 250 \mu s$; $T_j = 125 \text{ }^\circ\text{C}$

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

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

$$V_{\text{CE(TO)(T}_j)} \leq 1,3 + 0,0005 (T_j - 25) \text{ [V]}$$

$$\text{typ.: } r_{\text{CE(T}_j)} = 0,0027 + 0,000008 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{\text{CE(T}_j)} = 0,0038 + 0,000012 (T_j - 25) \text{ [\Omega]}$$

$$\text{valid for } V_{\text{GE}} = +15 \frac{+2}{-1} \text{ [V]; } I_{\text{C}} \geq 0,3 I_{\text{Cn}}$$

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

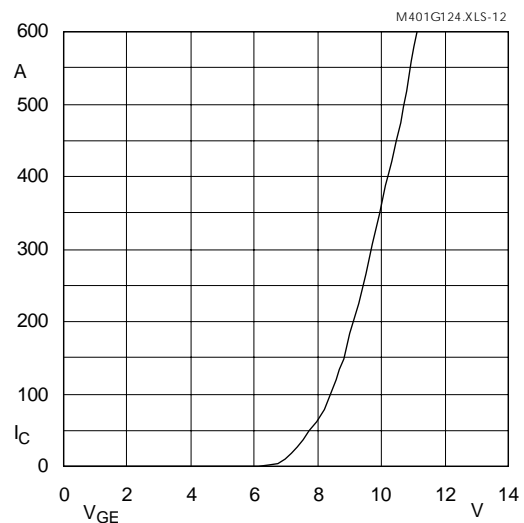


Fig. 12 Typ. transfer characteristic, $t_p = 250 \mu s$; $V_{\text{CE}} = 20 \text{ V}$

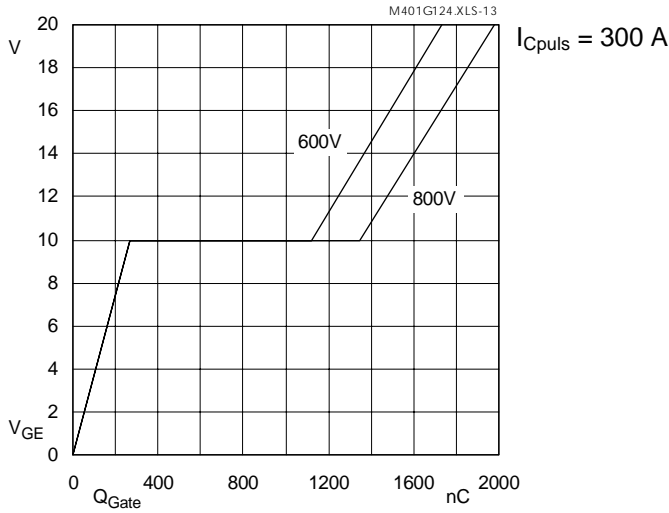


Fig. 13 Typ. gate charge characteristic

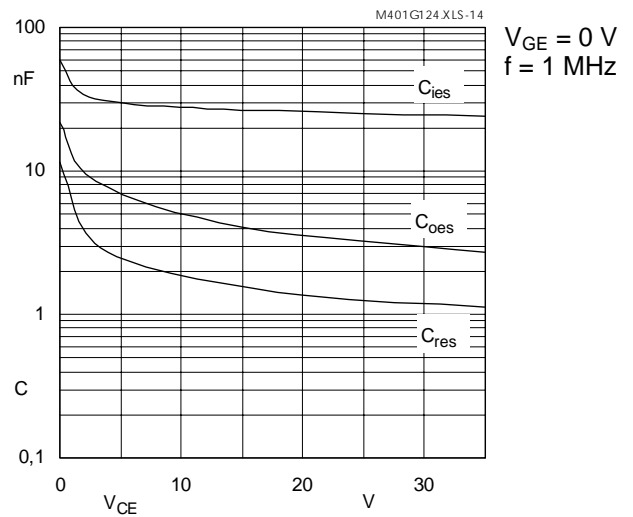


Fig. 14 Typ. capacitances vs. V_{CE}

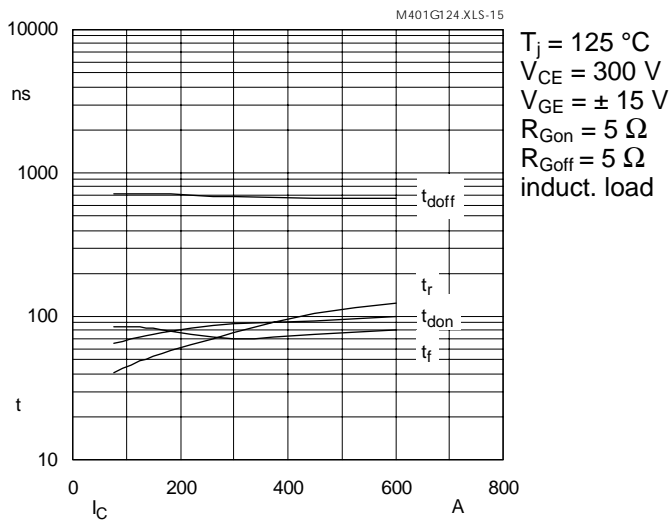


Fig. 15 Typ. switching times vs. I_C

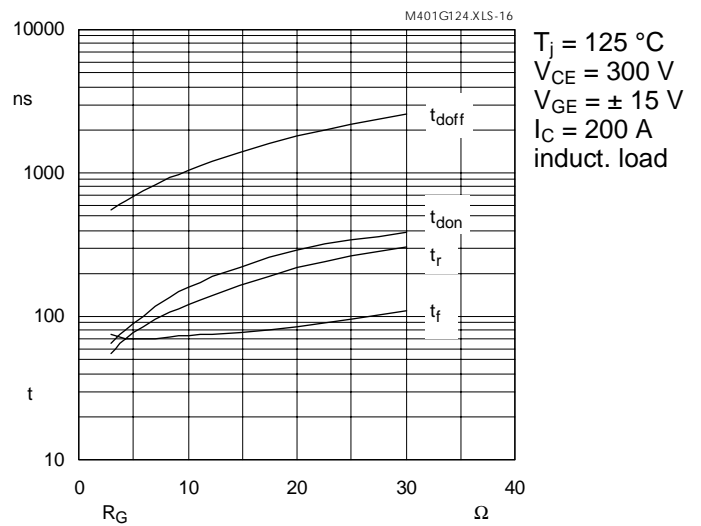


Fig. 16 Typ. switching times vs. gate resistor R_G

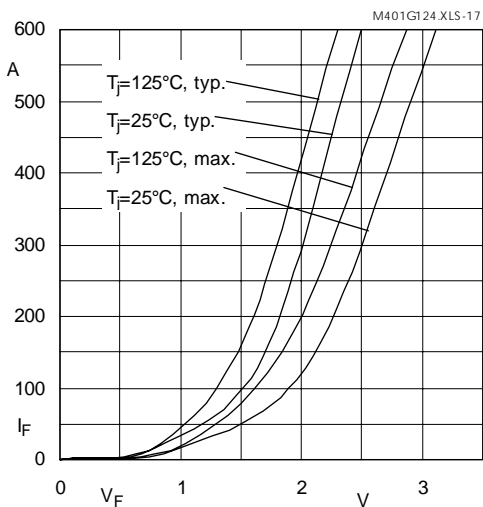


Fig. 17 Typ. CAL diode forward characteristic

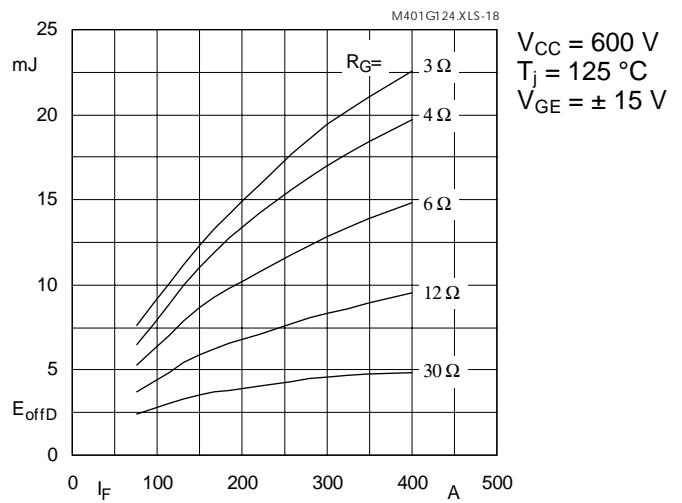


Fig. 18 Diode turn-off energy dissipation per pulse

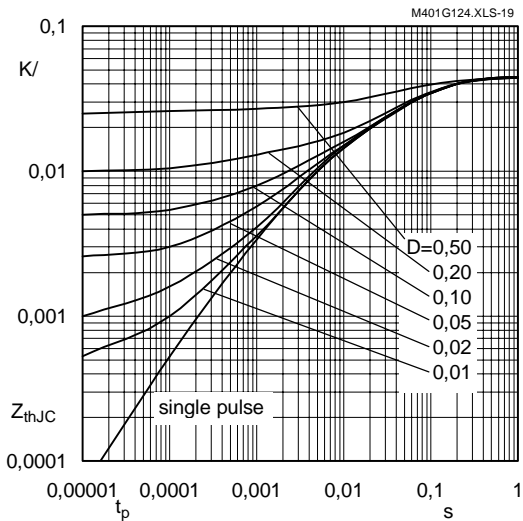


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

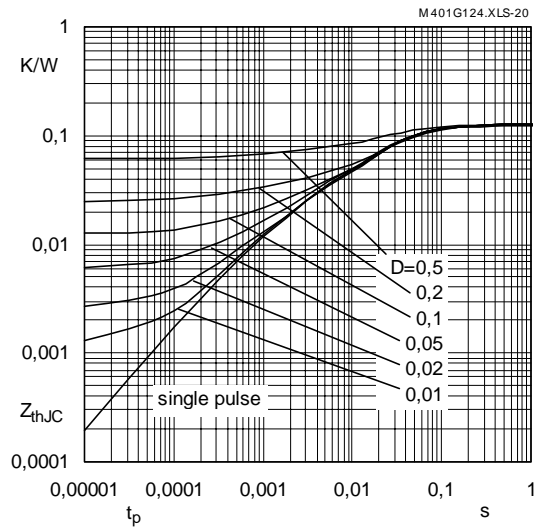


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

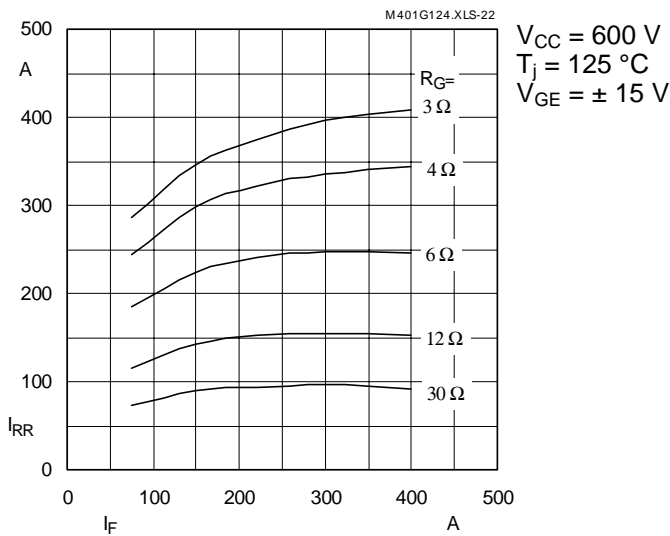


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

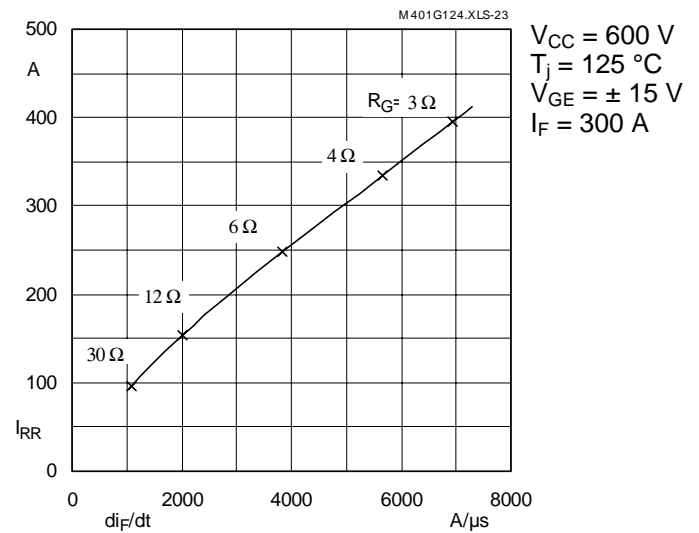


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

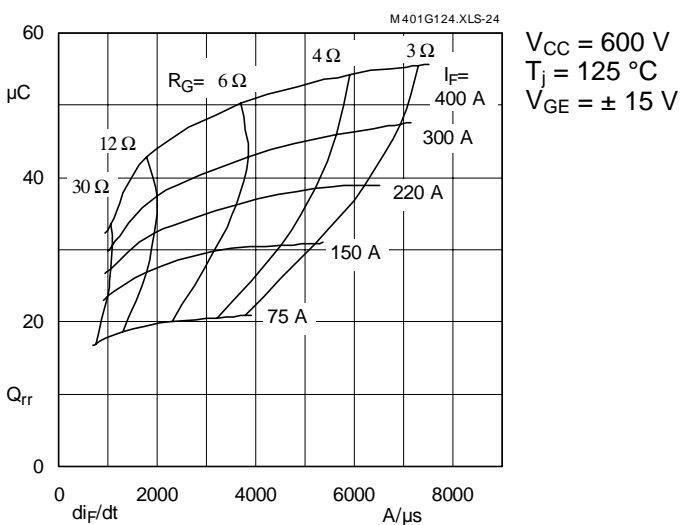


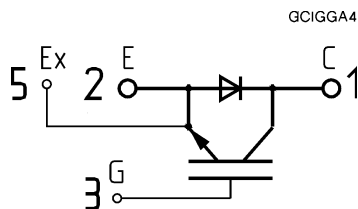
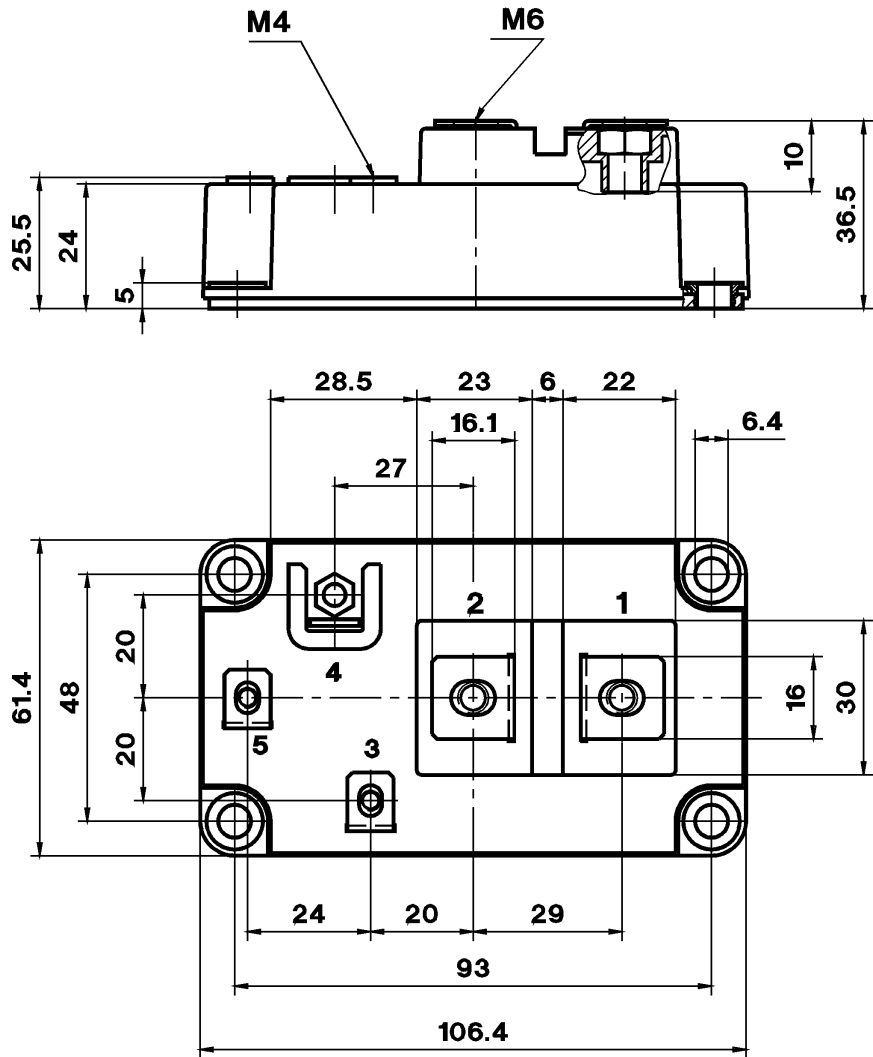
Fig. 24 Typ. CAL diode recovered charge

SEMITRANS 4

Case D 59

UL Recognized
File no. E 63 532

CASED59



Dimensions in mm

Case outline and circuit diagram

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/M4)	2,5/1,1 22/10	—	5/2 44/18	Nm 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 B 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 → B 6 – 4
SEMIBOX → C – 1.