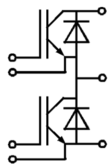
SEMIKRON

SEMITRANS® M
Low Loss IGBT Modules

SKM 150 GB 124 D

SEMITRANS 3



GB

Absolute Maximum Ratings		Values	
Symbol	**Conditions** [1)]		**Units**
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/65 °C	190 / 150	A
I_{CM}	T_{case} = 25/65 °C; t_p = 1 ms	380 / 300	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	800	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	150 / 100	A
$I_{FM} = –I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	380 / 300	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	1100	A
I^2t	t_p = 10 ms; T_j = 150 °C	6000	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 = 4 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0 } T_j = 25 °C	–	0,2	2	mA
	$V_{CE} = V_{CES}$ } T_j = 125 °C	–	9	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	1	µA
V_{CEsat}	I_C = 100 A { V_{GE} = 15 V; }	–	2,1(2,4)	2,45(2,85)	V
V_{CEsat}	I_C = 150 A { T_j = 25 (125) °C }	–	2,6(3,1)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 100 A	54	–	–	S
C_{CHC}	per IGBT	–	–	700	pF
C_{ies}	} V_{GE} = 0	–	6,5	8,5	nF
C_{oes}	} V_{CE} = 25 V	–	1000	1500	pF
C_{res}	} f = 1 MHz	–	500	600	pF
L_{CE}		–	–	20	nH
$t_{d(on)}$	V_{CC} = 600 V	–	50	–	ns
t_r	V_{GE} = –15 V / +15 V[3)]	–	35	–	ns
$t_{d(off)}$	I_C = 100 A, ind. load	–	420	–	ns
t_f	$R_{Gon} = R_{Goff}$ = 8 Ω	–	60	–	ns
E_{on}[5)]	T_j = 125 °C	–	12	–	mWs
E_{off}[5)]		–	13	–	mWs
Inverse Diode [8)]					
$V_F = V_{EC}$	I_F = 100 A { V_{GE} = 0 V; }	–	2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 150 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)]	–	–	11	mΩ
I_{RRM}	I_F = 100 A; T_j = 125 °C[2)]	–	58	–	A
Q_{rr}	I_F = 100 A; T_j = 125 °C[2)]	–	12	–	µC
Thermal characteristics					
R_{thjc}	per IGBT	–	–	0,15	°C/W
R_{thjc}	per diode	–	–	0,25	°C/W
R_{thch}	per module	–	–	0,038	°C/W

Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure (NPT-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 → B 6 – 147

- 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, $–di_F/dt$ = 1000 A/µs, V_{GE} = 0 V
3) Use V_{GEoff} = –5... –15 V
5) See fig. 2 + 3; R_{goff} = 8 Ω
8) CAL = Controlled Axial Lifetime Technology

Cases and mech. data
→ B 6 – 148

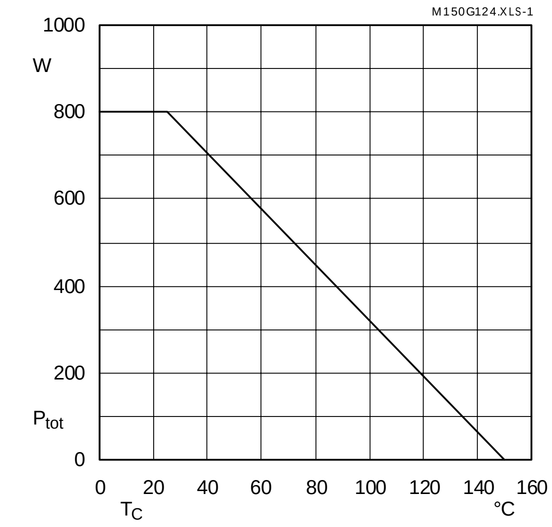


Fig. 1 Rated power dissipation P_{tot} = f (T_C)

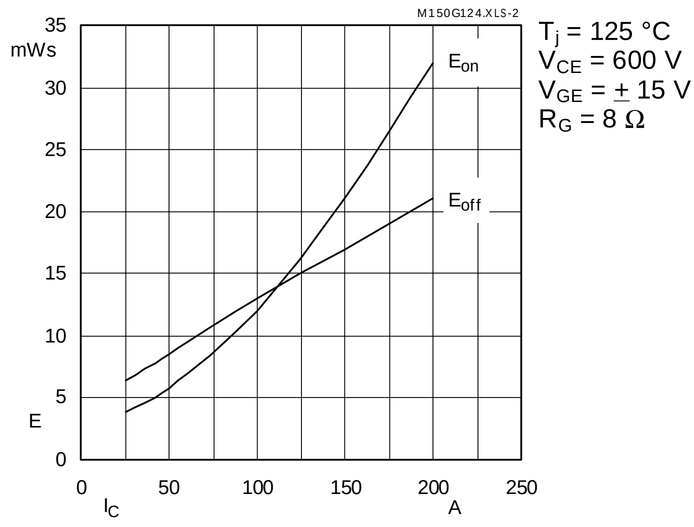


Fig. 2 Turn-on /-off energy = f (I_C)

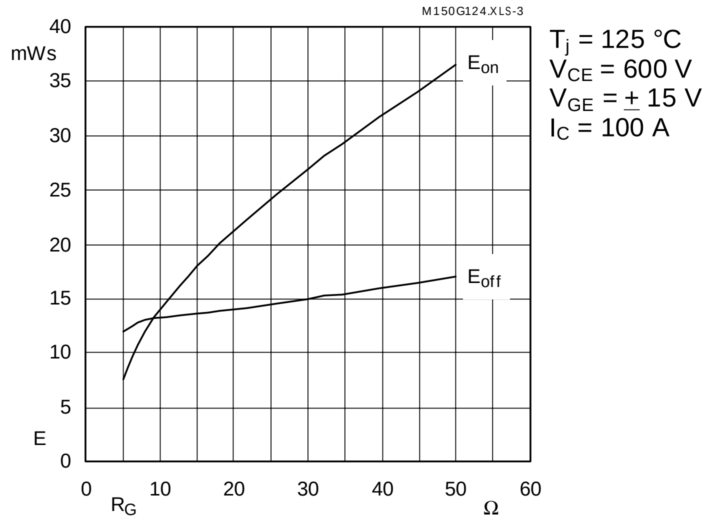


Fig. 3 Turn-on /-off energy = f (R_G)

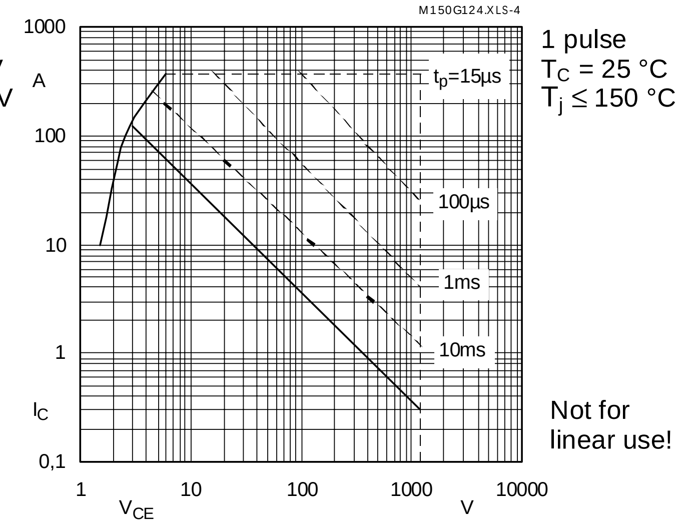


Fig. 4 Maximum safe operating area (SOA) I_C = f (V_{CE})

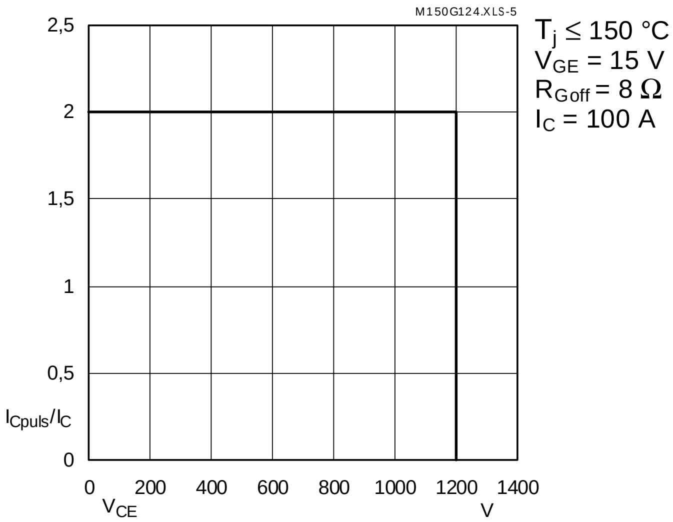


Fig. 5 Turn-off safe operating area (RBSOA)

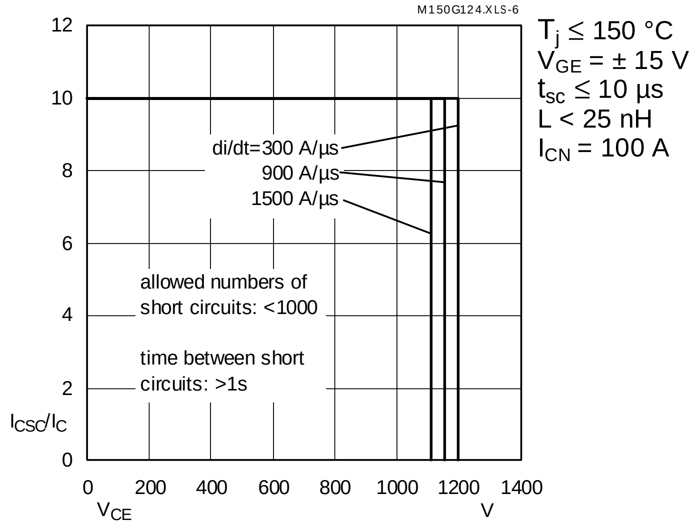


Fig. 6 Safe operating area at short circuit I_C = f (V_{CE})

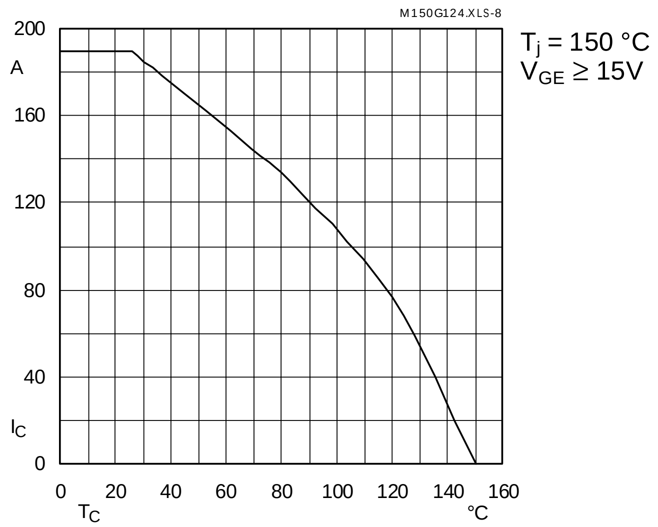


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

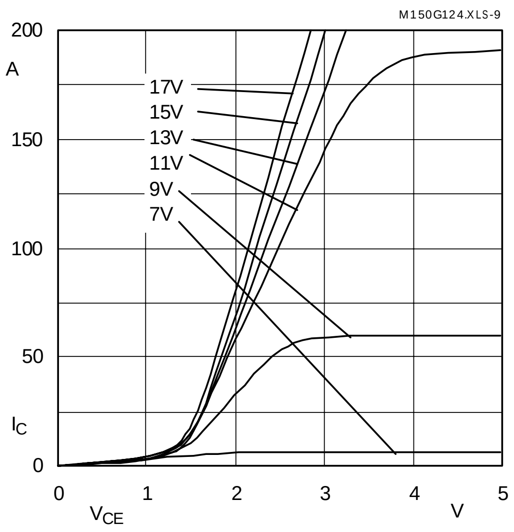


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

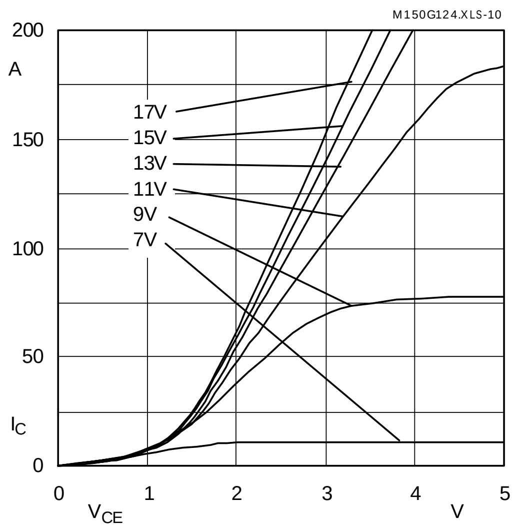


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

typ.: $r_{CE(Tj)} = 0{,}008 + 0{,}000025\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0115 + 0{,}000035\ (T_j - 25)$ [Ω]

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

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

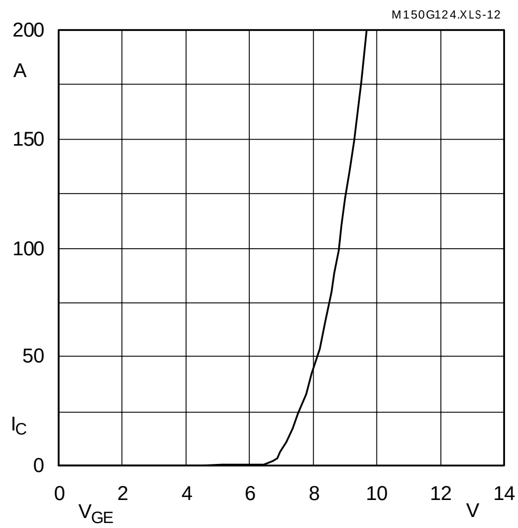


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

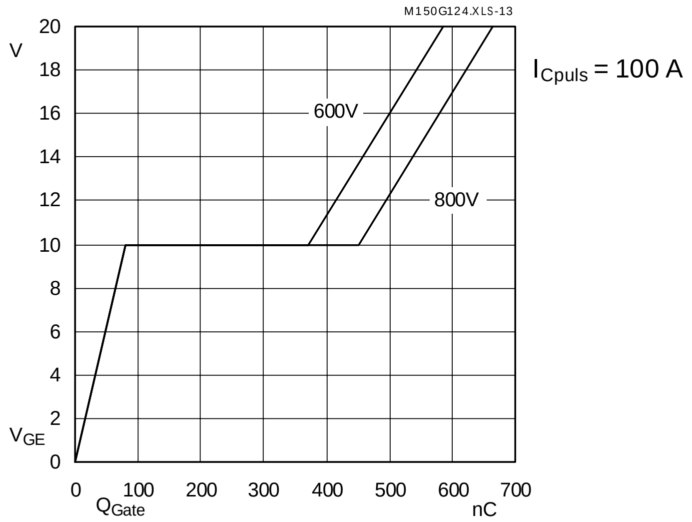


Fig. 13 Typ. gate charge characteristic

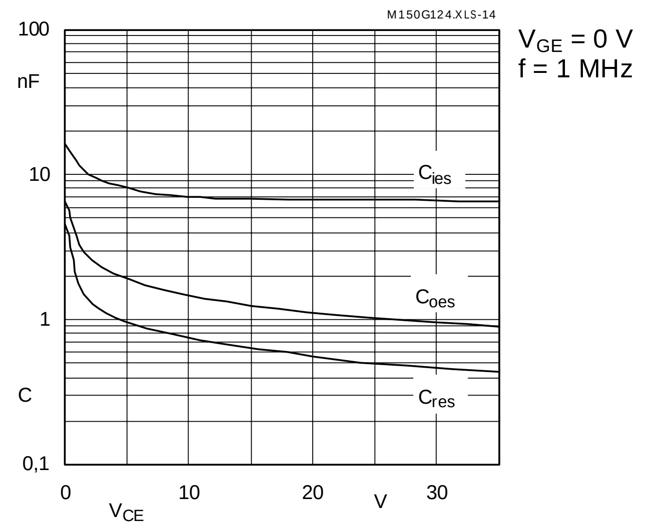


Fig. 14 Typ. capacitances vs.V_{CE}

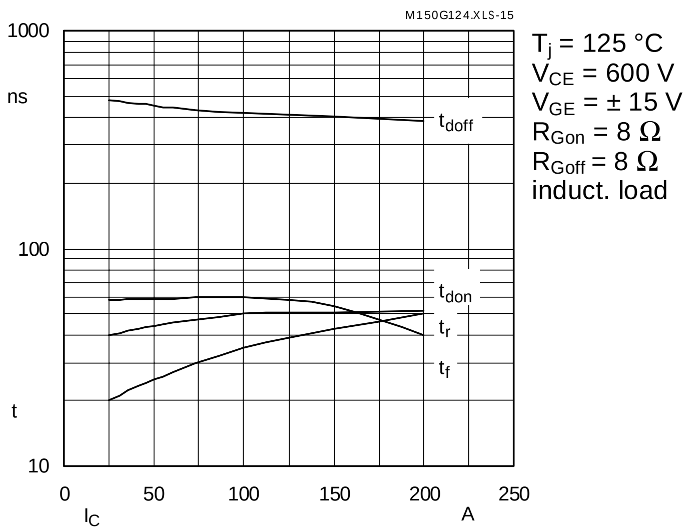


Fig. 15 Typ. switching times vs. I_C

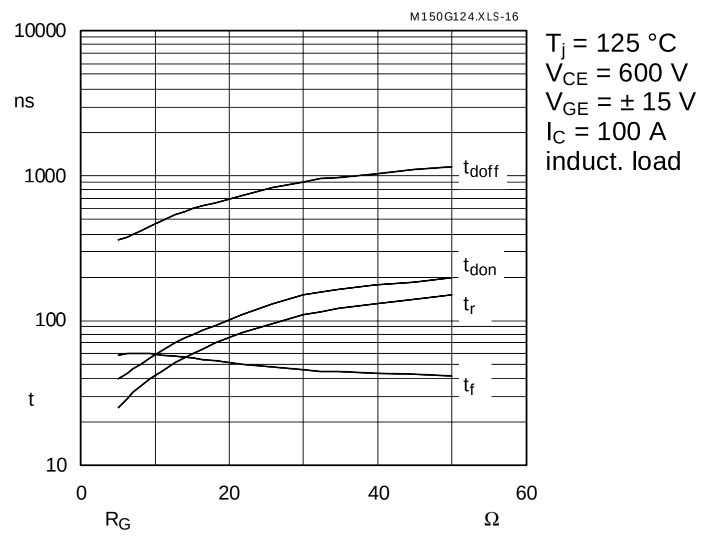


Fig. 16 Typ. switching times vs. gate resistor R_G

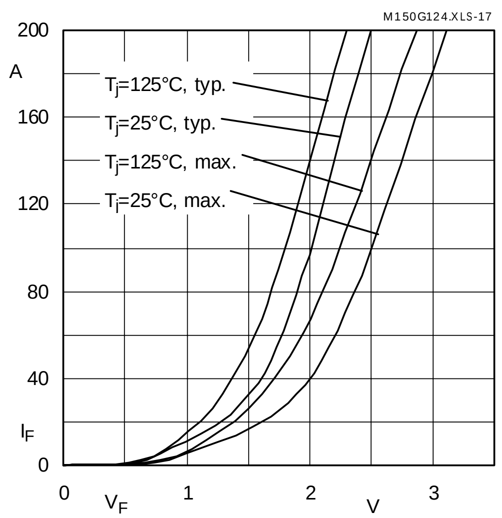


Fig. 17 Typ. CAL diode forward characteristic

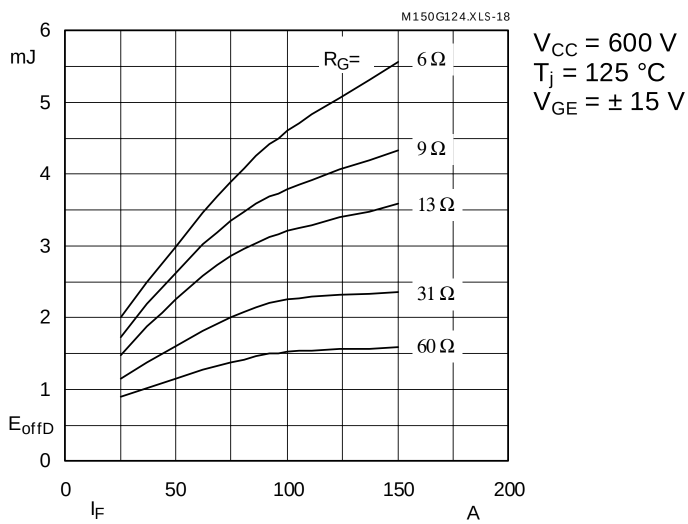


Fig. 18 Diode turn-off energy dissipation per pulse

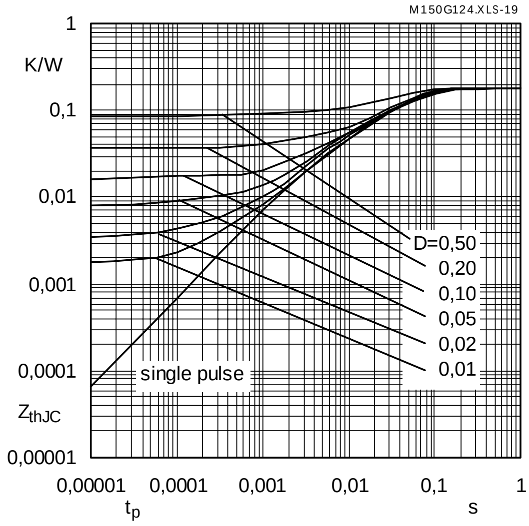


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

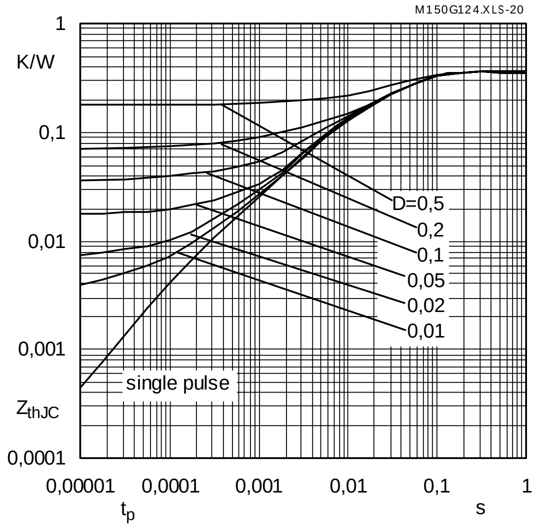


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

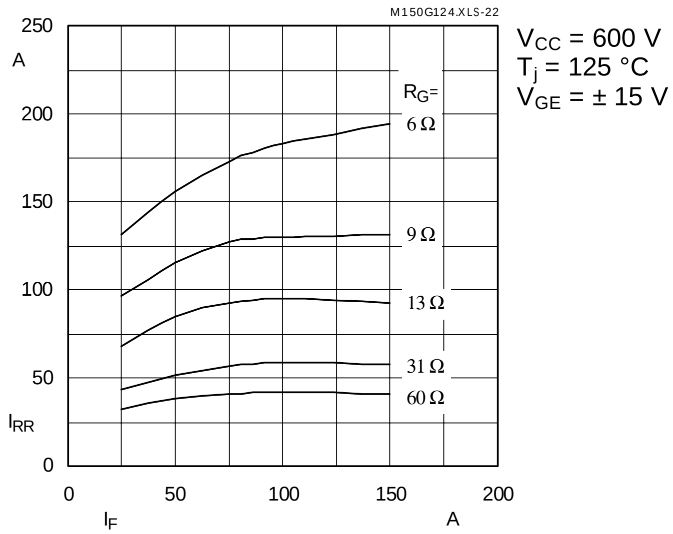


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

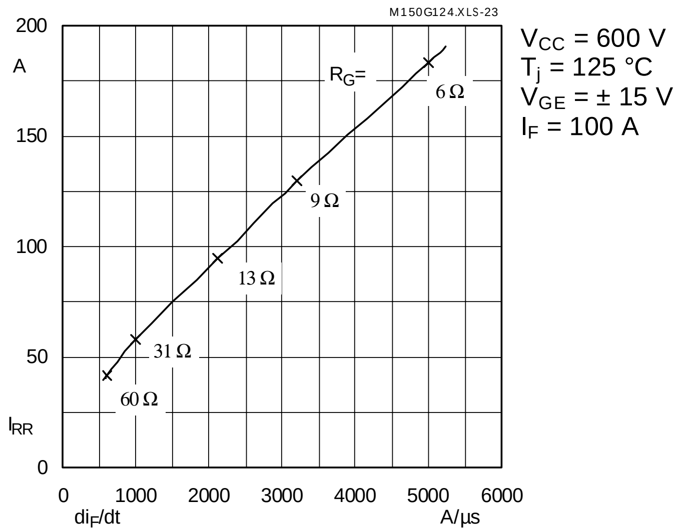


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

Typical Applications include

Switched mode power supplies
DC servo and robot drives
Inverters
AC motor speed control
Inductive heating
General power switching applications
Electronic (also portable) welders
Pulse frequencies above 15 kHz

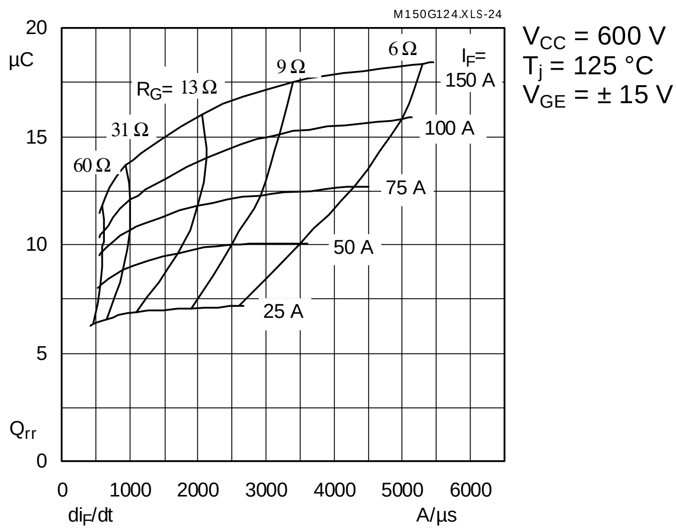


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

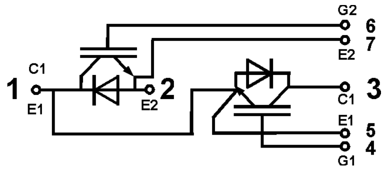
SEMITRANS 3

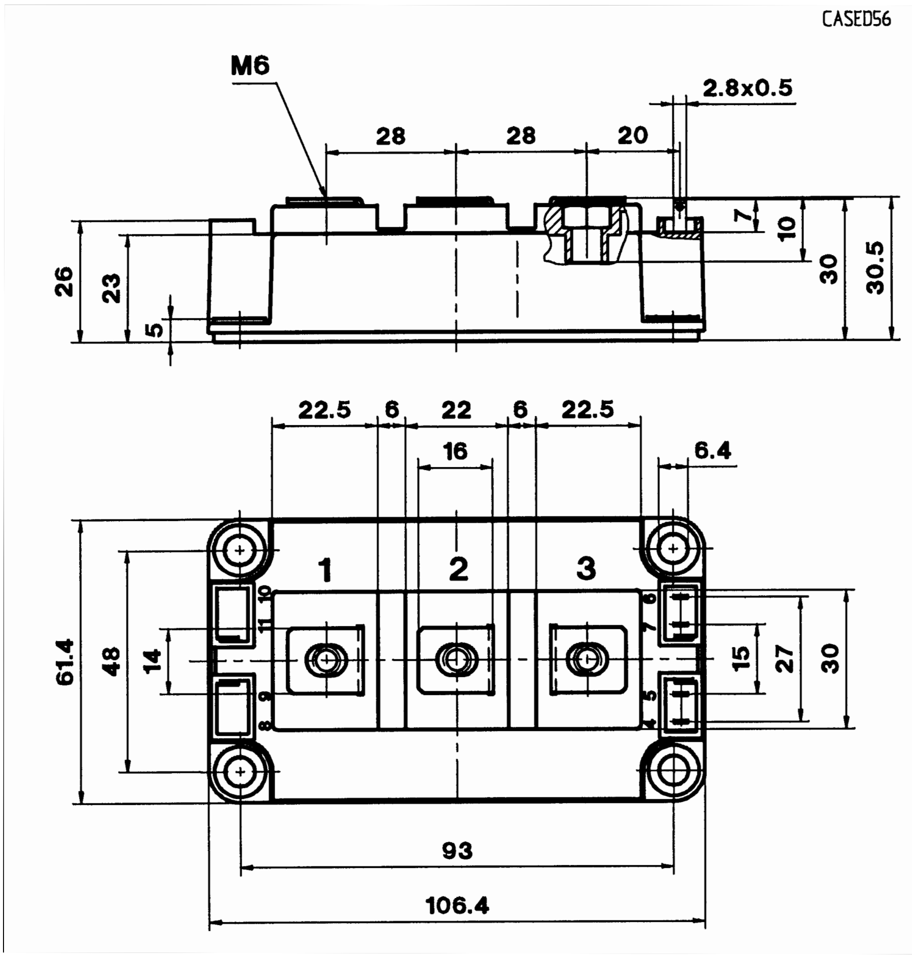
Case D 56

UL Recognized

File no. E 63 532

SKM 150 GB 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)	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.

Three devices are supplied in one SEMIBOX B 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.

