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SEMIKRON

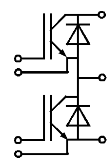
Absolute Maximum Ratings		Values	
Symbol	**Conditions** [1]		**Units**
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/70 °C	190 / 145	A
I_{CM}	T_{case} = 25/70 °C; t_p = 1 ms	380 / 290	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	800	W
T_j, (T_{stg})		–40 ... + 150 (125)	°C
V_{isol}	AC, 1 min.	2 500	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	130 / 90	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	380 / 290	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	–	–	350	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}		–	–	30	nH
$t_{d(on)}$	} V_{CC} = 600 V	–	110	–	ns
t_r	} V_{GE} = –15 V / +15 V [3]	–	50	–	ns
$t_{d(off)}$	} I_C = 100 A, ind. load	–	470	–	ns
t_f	} $R_{Gon} = R_{Goff}$ = 8 Ω	–	60	–	ns
E_{on} [5]	} T_j = 125 °C	–	14	–	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	–	1,1	1,2	V
r_t	T_j = 125 °C	–	–	11	mΩ
I_{RRM}	I_F = 100 A; T_j = 125 °C [2]	–	52	–	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	–	–	0,30	°C/W
R_{thch}	per module	–	–	0,05	°C/W

SEMITRANS® M
Low Loss IGBT Modules

SKM 145 GB 124 D

SEMITRANS 2



GB

Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- Low loss high density chip
- Low tail current
- 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 (10 mm) and creepage distances (20 mm)

Typical Applications: → page 5

- Switching (not for linear use)

[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} = 6,8 Ω
[8] CAL = Controlled Axial Lifetime Technology

Cases and mech. data → page 6

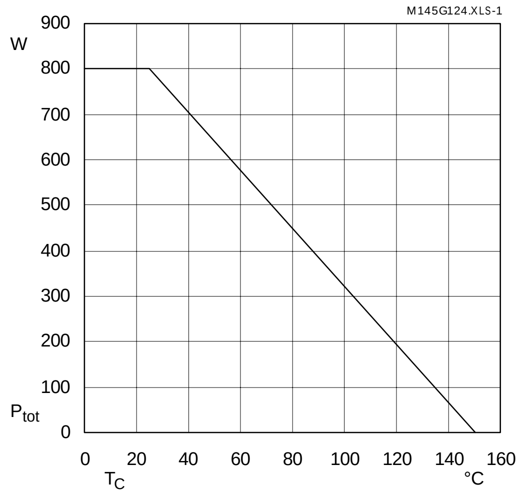


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

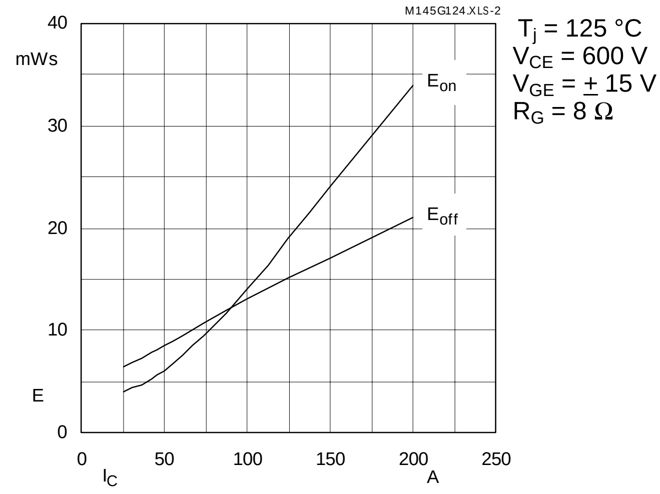


Fig. 2 Turn-on /-off energy = f (I_C)

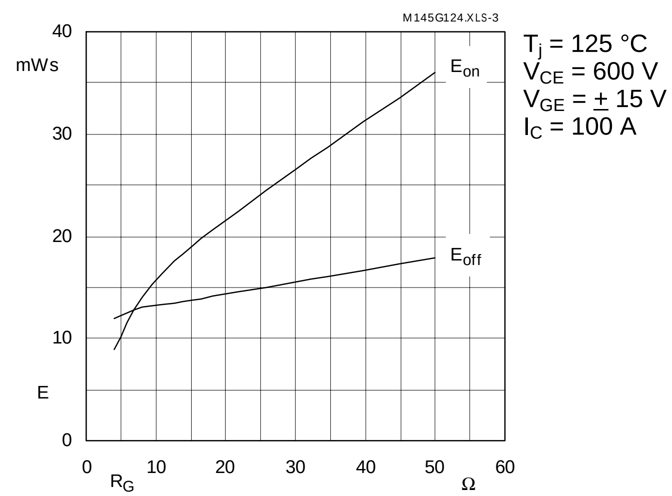


Fig. 3 Turn-on /-off energy = f (R_G)

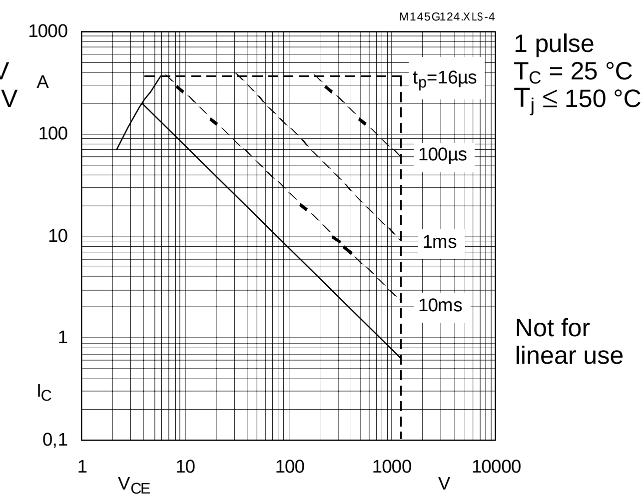


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

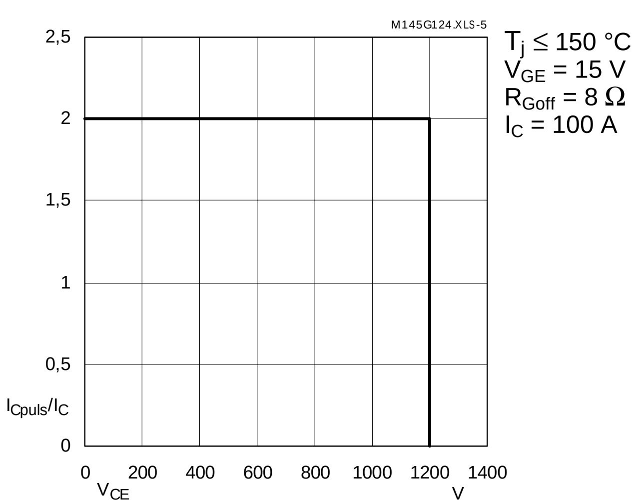


Fig. 5 Turn-off safe operating area (RBSOA)

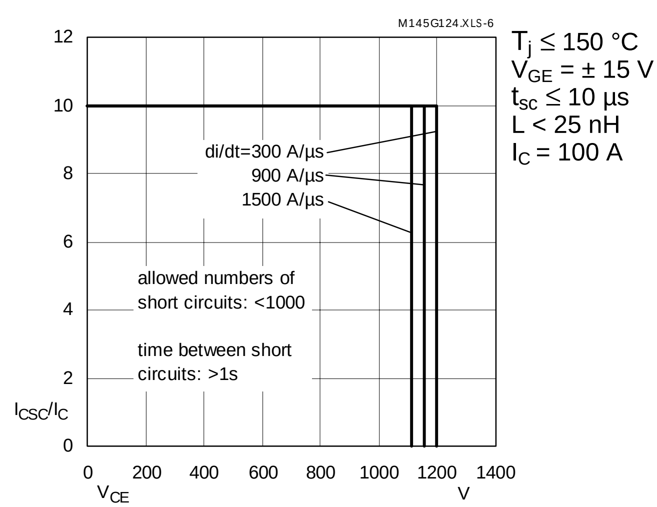


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

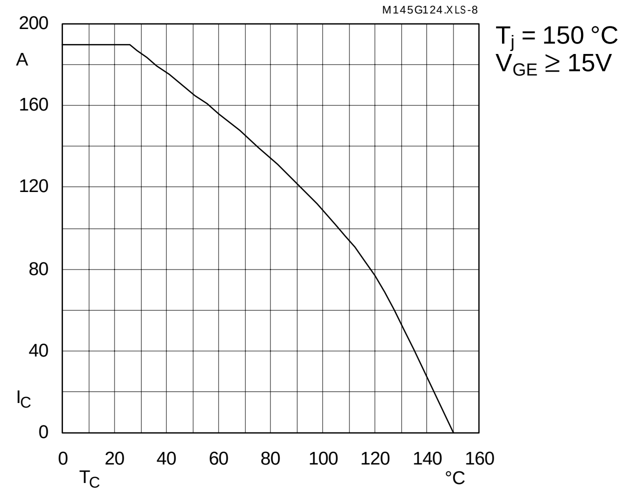


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

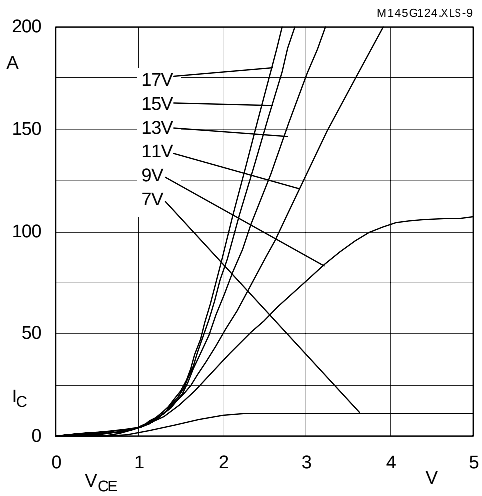


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

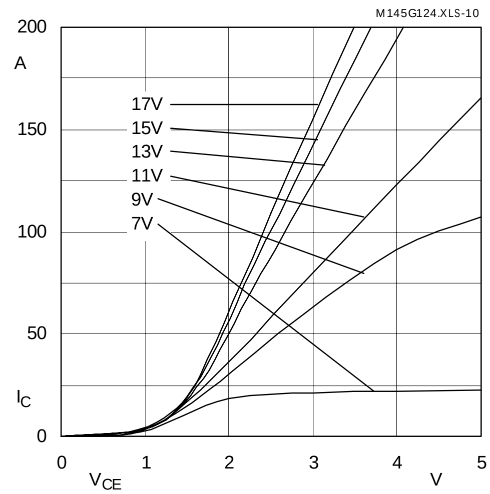


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

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

max.: $r_{CE(Tj)} = 0{,}012 + 0{,}000035\,(T_j - 25)$ [Ω]

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

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

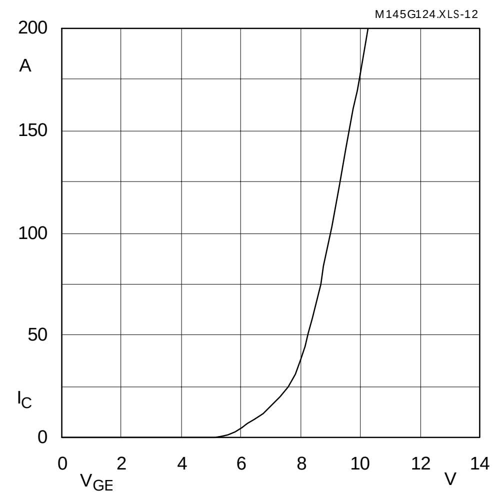


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

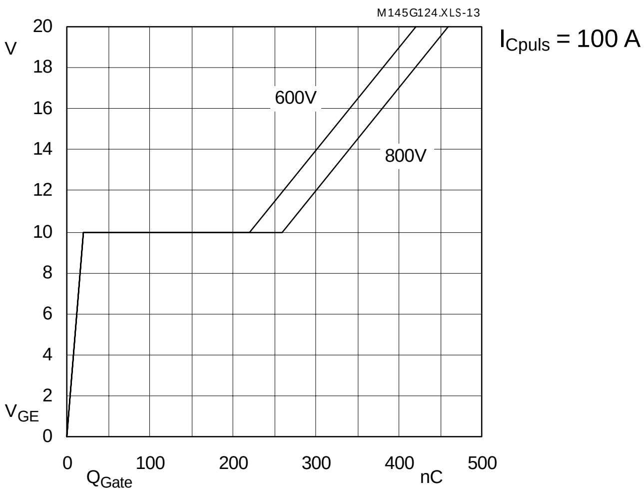


Fig. 13 Typ. gate charge characteristic

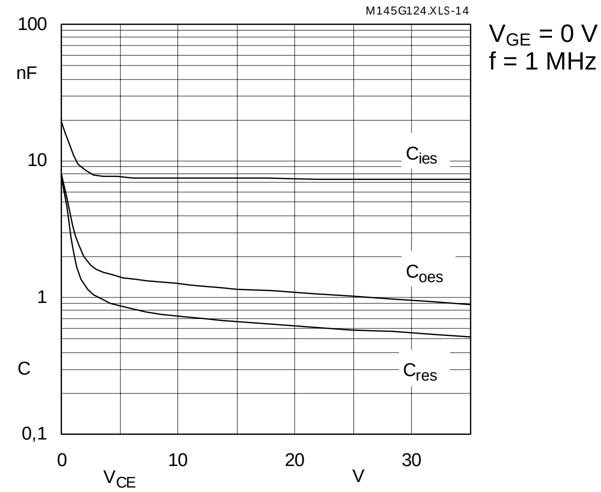


Fig. 14 Typ. capacitances vs.V_{CE}

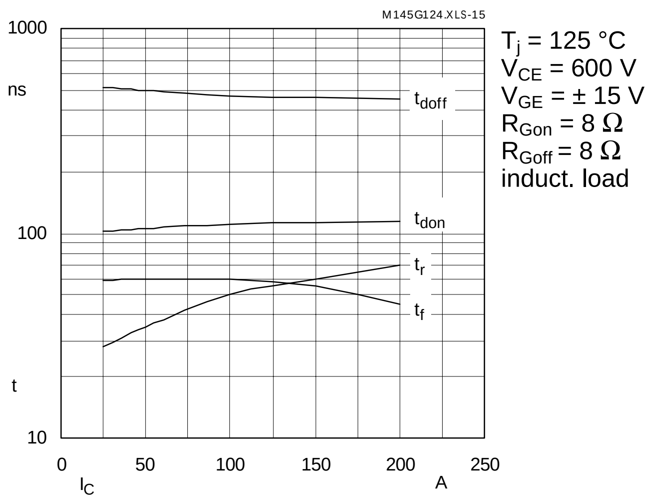


Fig. 15 Typ. switching times vs. I_C

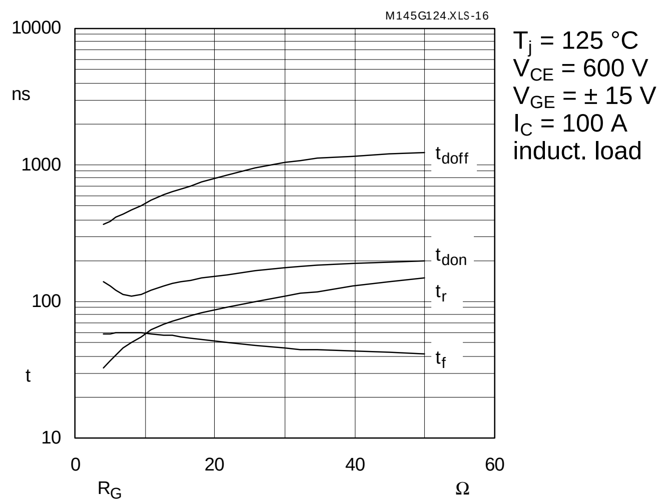


Fig. 16 Typ. switching times vs. gate resistor R_G

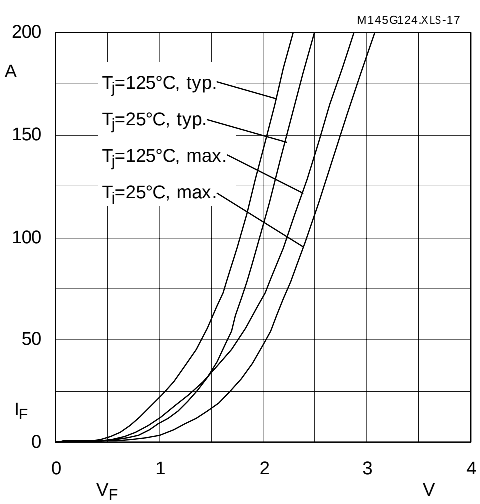


Fig. 17 Typ. CAL diode forward characteristic

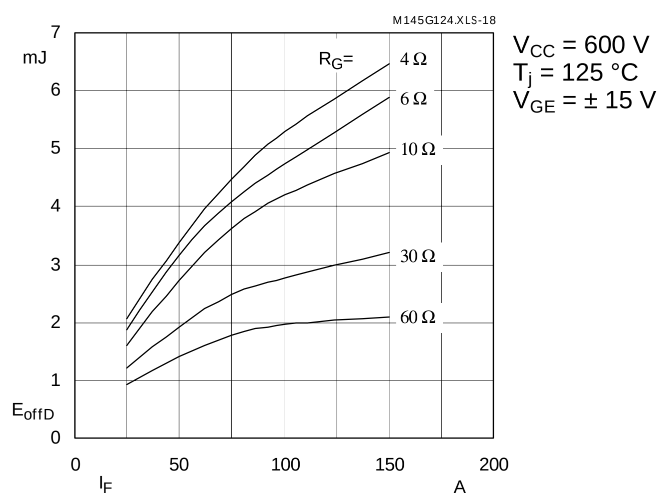
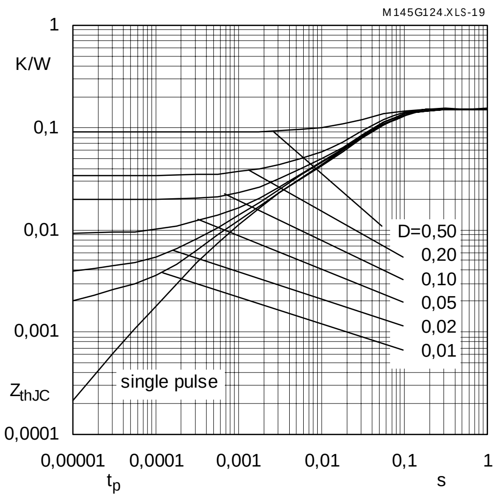


Fig. 18 Diode turn-off energy dissipation per pulse



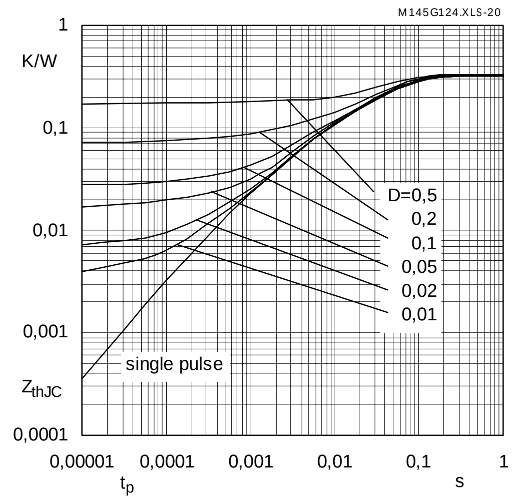
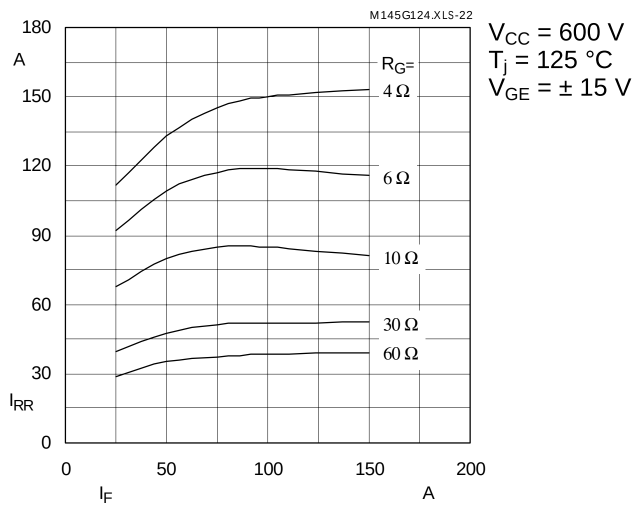


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

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



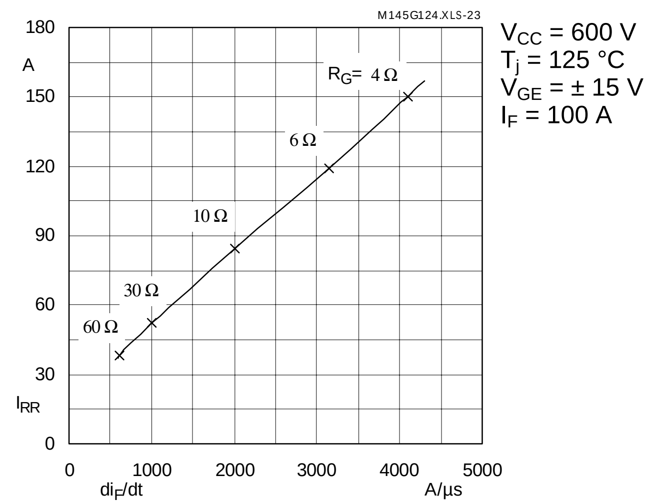


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

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

Typical Applications include

Switched mode power supplies

DC servo and robot drives

Inverters

DC choppers

AC motor speed control

UPS Uninterruptable power supplies

General power switching applications

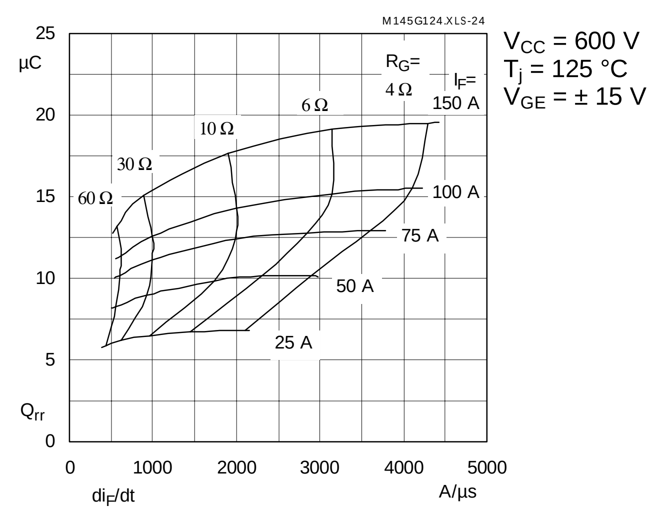


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

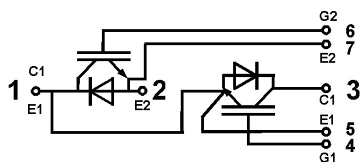
SEMITRANS 2

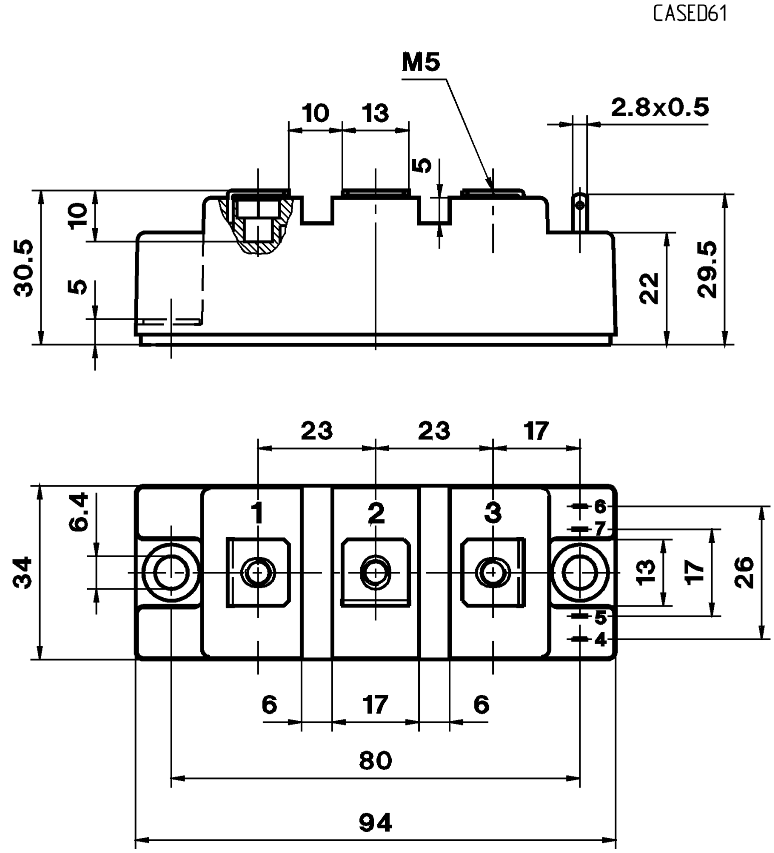
Case D 61

UL Recognized

File no. E 63 532

SKM 145 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	(M5)	2,5	–	5	Nm
	for terminals, US Units		22	–	44	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	160	g

This is an electrostatic discharge sensitive device (ESDS). Please observe the international standard IEC 747-1, Chapter IX.

Eight devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 2)

Larger packing units of 20 or 42 pieces are used if suitable

Accessories → B 6 – 4

SEMIBOX → C – 1.

