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	290 / 200	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	580 / 400	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	1250	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	2500	V
humidity			
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode and FWD of type „GAL“[6] [8]			
$I_F = -I_C$	T_{case} = 25/80 °C	240 / 170	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	580 / 400	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	1450	A
I^2t	t_p = 10 ms; T_j = 150 °C	10 500	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 = 6 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0 } T_j = 25 °C	–	0,2	0,4	mA
	$V_{CE} = V_{CES}$ } T_j = 125 °C	–	12	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	0,3	µA
V_{CEsat}	I_C = 150 A { V_{GE} = 15 V; }	–	2,1(2,4)	2,45(2,85)	V
V_{CEsat}	I_C = 200 A { T_j = 25 (125) °C }	–	2,5(3,0)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 150 A	62	–	–	S
C_{CHC}	per IGBT	–	–	350	pF
C_{ies}	} V_{GE} = 0	–	11	15	nF
C_{oes}	} V_{CE} = 25 V	–	1,6	2	nF
C_{res}	} f = 1 MHz	–	0,8	1	nF
L_{CE}		–	–	25	nH
$t_{d(on)}$	} V_{CC} = 600 V	–	75	–	ns
t_r	} V_{GE} = +15 V / -15 V[3]	–	50	–	ns
$t_{d(off)}$	} I_C = 150 A, ind. load	–	520	–	ns
t_f	} $R_{Gon} = R_{Goff}$ = 7Ω	–	50	–	ns
E_{on}	} T_j = 125 °C	–	21	–	mWs
E_{off}		–	19	–	mWs
Inverse Diode and FWD of type „GAL“[6] [8]					
$V_F = V_{EC}$	I_F = 150 A { V_{GE} = 0 V; }	–	2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 200 A { T_j = 25 (125) °C }	–	2,25(2,05)	–	V
V_{TO}	T_j = 125 °C [2]	–	1,1	1,2	V
r_t	T_j = 125 °C [2]	–	–	7	mΩ
I_{RRM}	I_F = 150 A; T_j = 125 °C[2]	–	78	–	A
Q_{rr}	I_F = 150 A; T_j = 125 °C[2]	–	19,5	–	µC
Thermal characteristics					
R_{thjc}	per IGBT	–	–	0,10	°C/W
R_{thjc}	per diode	–	–	0,18	°C/W
R_{thch}	per module	–	–	0,05	°C/W

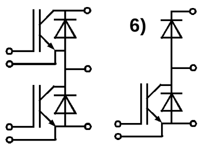
[1] T_{case} = 25 °C, unless otherwise specified
[2] $I_F = -I_C$, V_R = 600 V, $-di_F/dt$ = 1500 A/µs, V_{GE} = 0 V
[3] Use V_{GEoff} = –5... –15 V
[6] The free-wheeling diodes of the GAL type have the data of the inverse diodes.
[8] CAL = Controlled Axial Lifetime Technology

SEMITRANS® M
Low Loss IGBT Modules

SKM 195 GB 124 DN
SKM 195 GAL 124 DN

Preliminary Data

SEMITRANS 2N (low inductance)



GB **GAL**

Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure NPT-IGBT (Non punch through)
- Low saturation voltage
- Low inductance case
- 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 (10 mm) and creepage distances (20 mm)

Typical Applications → page 5

- Switching (not for linear use)
- Inverter drives
- UPS

Cases and mech. data → page 6

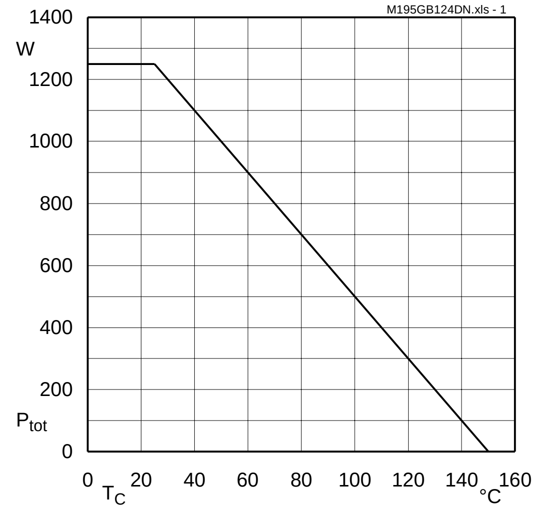


Fig. 1 Rated power dissipation P_{tot} = f (T_C)

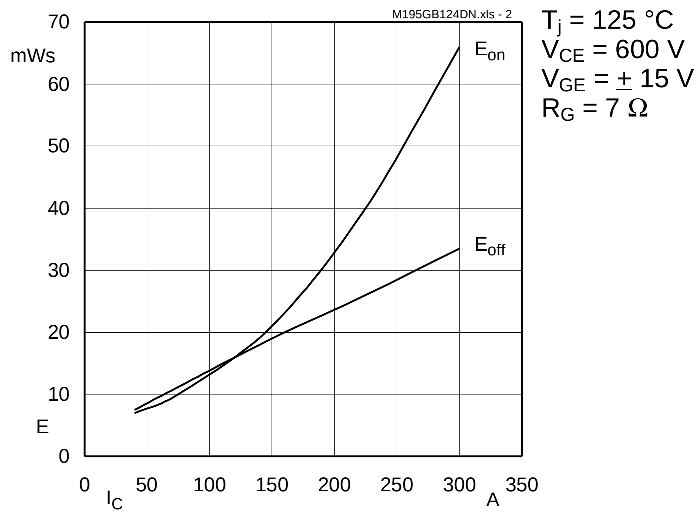


Fig. 2 Turn-on /-off energy = f (I_C)

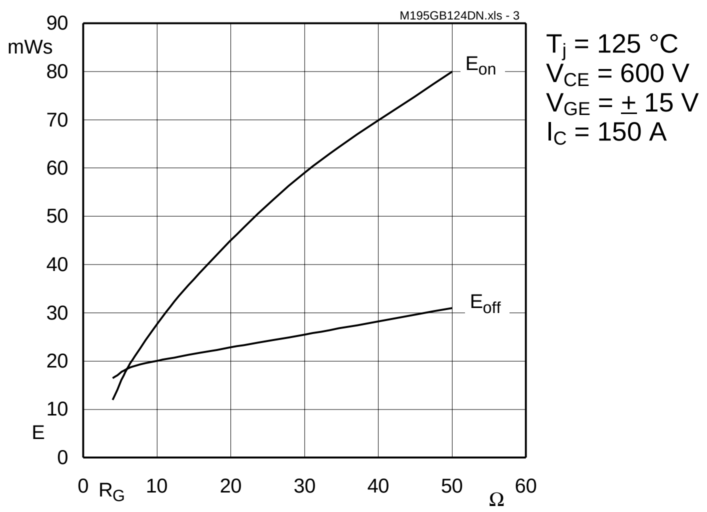


Fig. 3 Turn-on /-off energy = f (R_G)

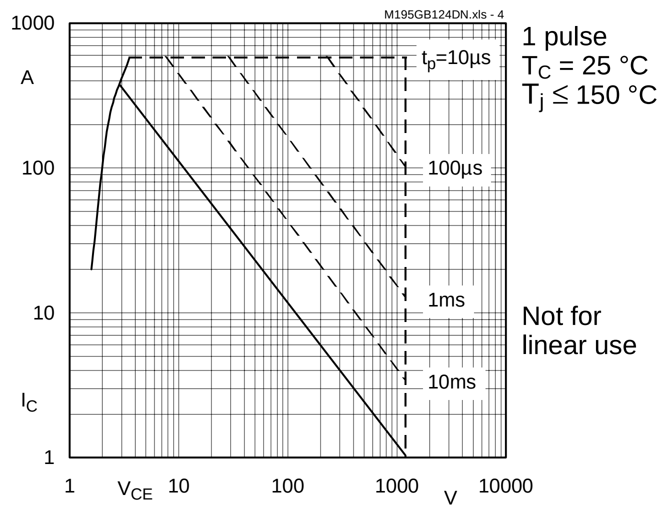


Fig. 4 Maximum safe operating area (SOA) I_C = f (V_{CE})

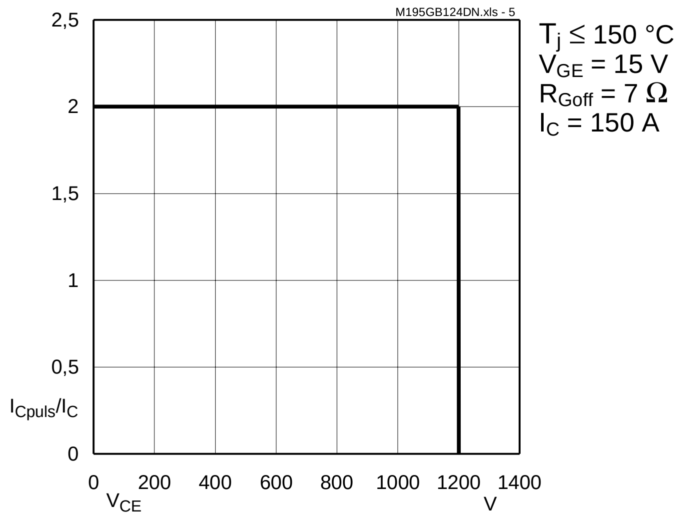


Fig. 5 Turn-off safe operating area (RBSOA)

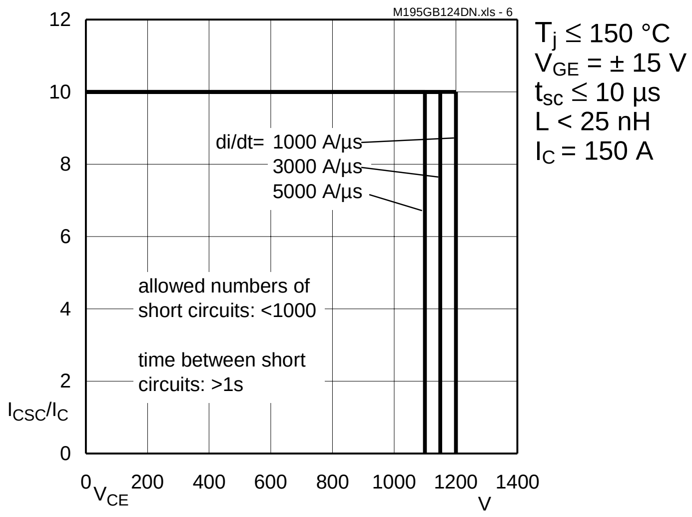


Fig. 6 Safe operating area at short circuit I_C = f (V_{CE})

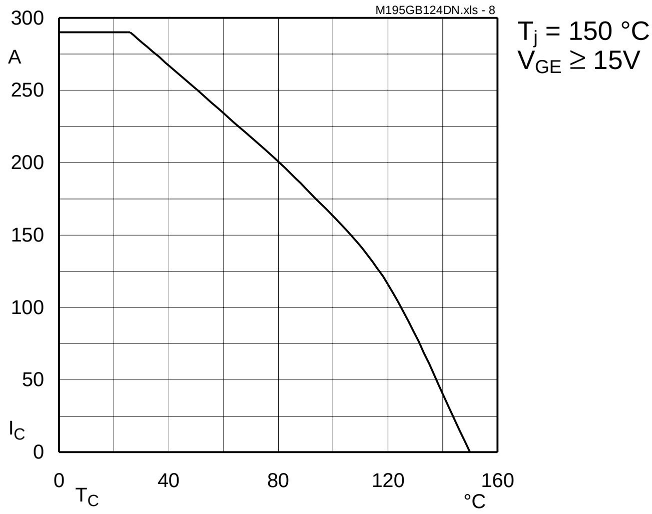


Fig. 8 Rated current vs. temperature $I_C = f\,(T_C)$

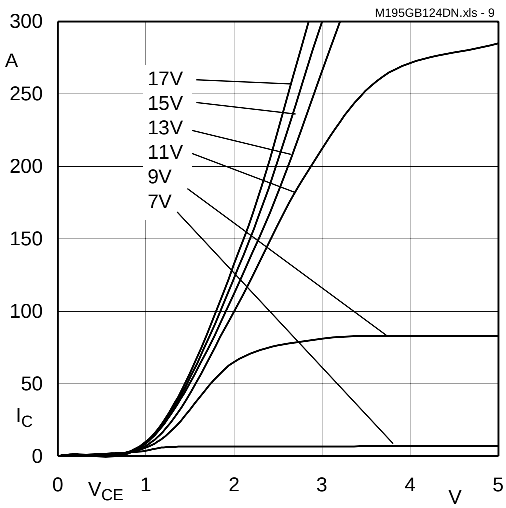


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

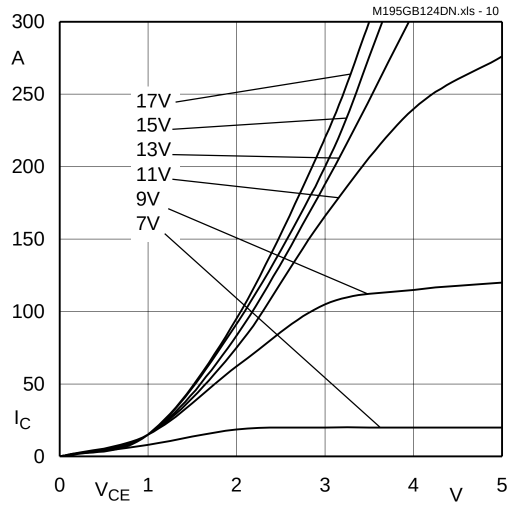


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

typ.: $r_{CE(Tj)} = 0{,}0053 + 0{,}000017\,(T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0077 + 0{,}000023\,(T_j - 25)$ [Ω]

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

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

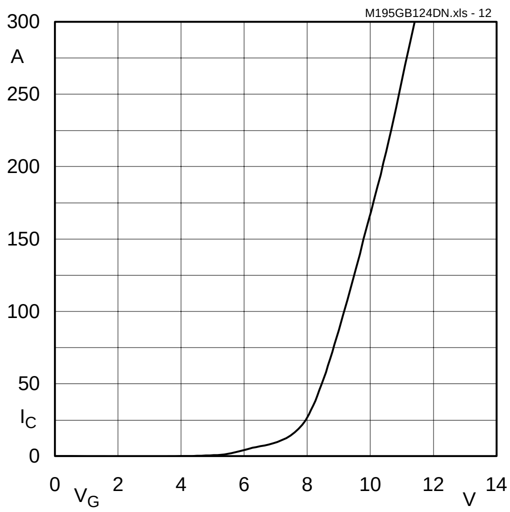


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

I:\MARKETIN\FRAMEDAT\datbl\B06-igbt\195GB124DN.fm

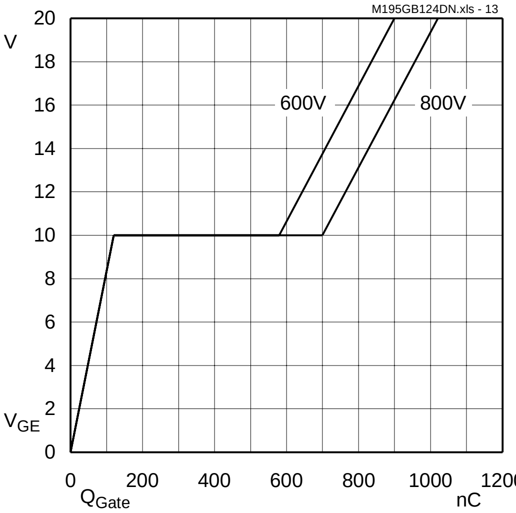


Fig. 13 Typ. gate charge characteristic

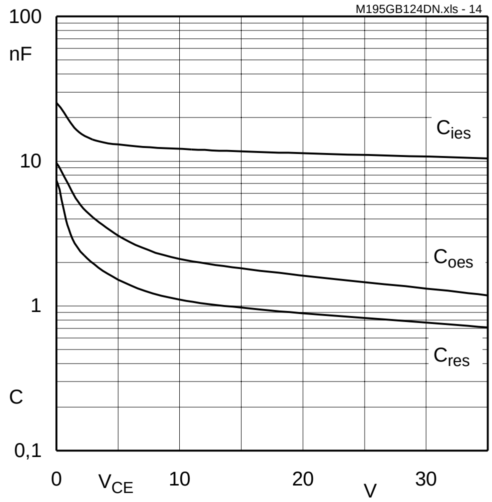


Fig. 14 Typ. capacitances vs. V_{CE}

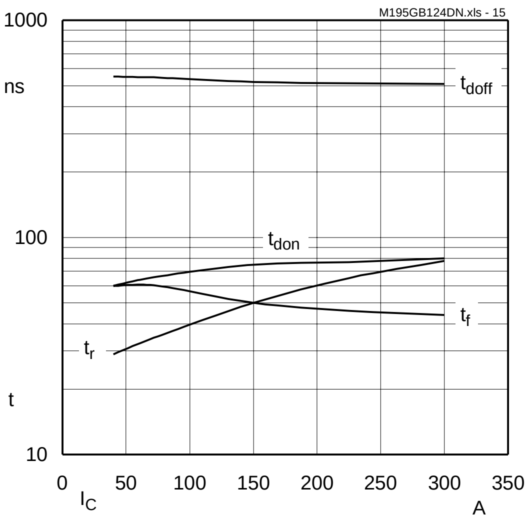


Fig. 15 Typ. switching times vs. I_C

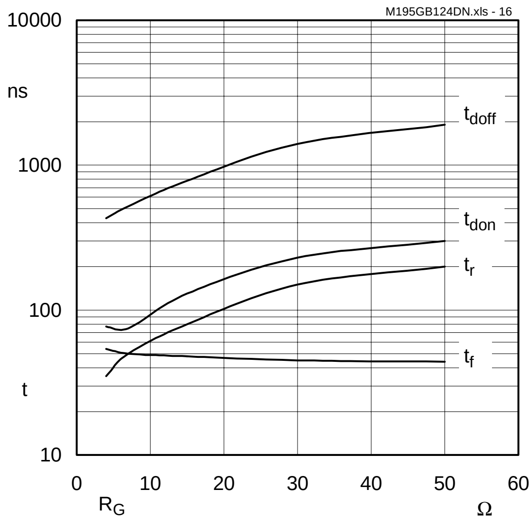


Fig. 16 Typ. switching times vs. gate resistor R_G

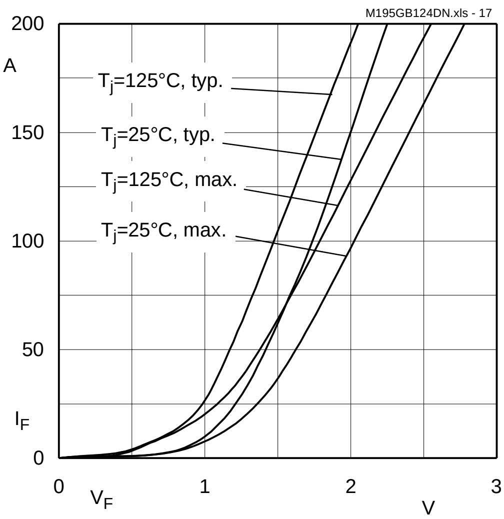


Fig. 17 Typ. CAL diode forward characteristic

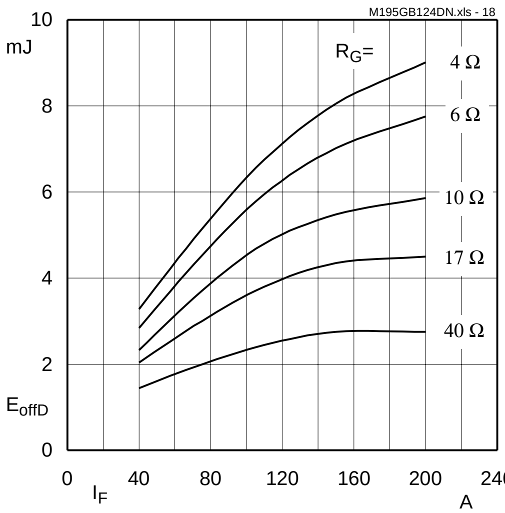


Fig. 18 Diode turn-off energy dissipation per pulse

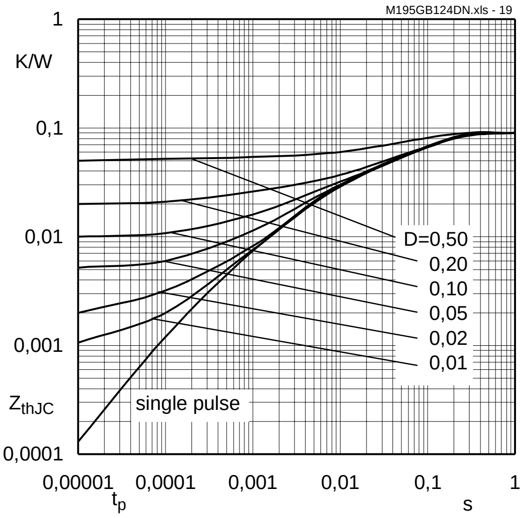


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

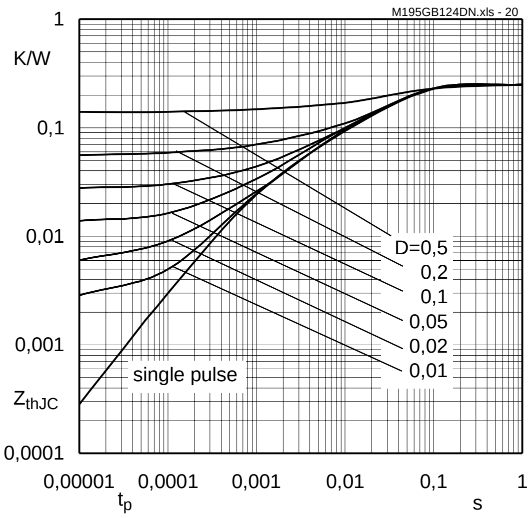


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

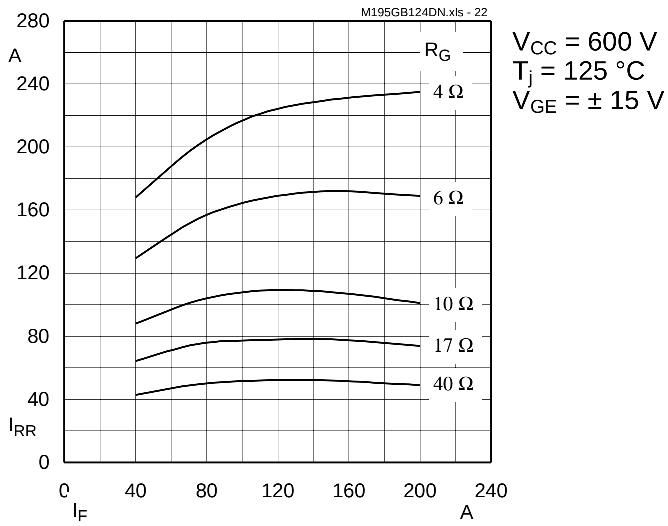


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

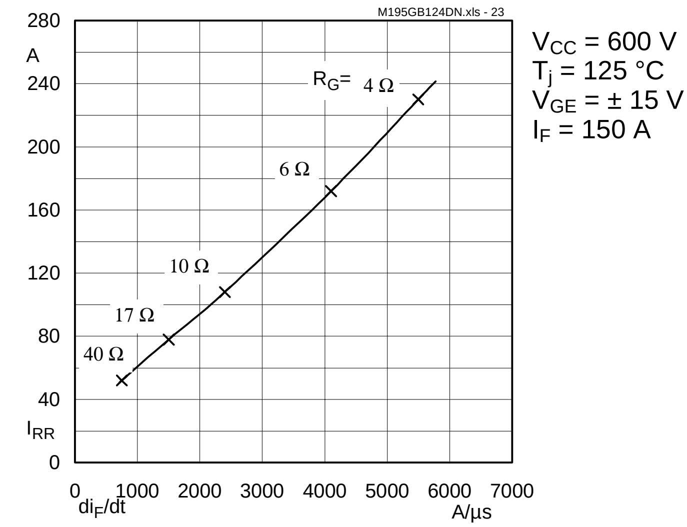


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

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
Electronic (also portable) welders

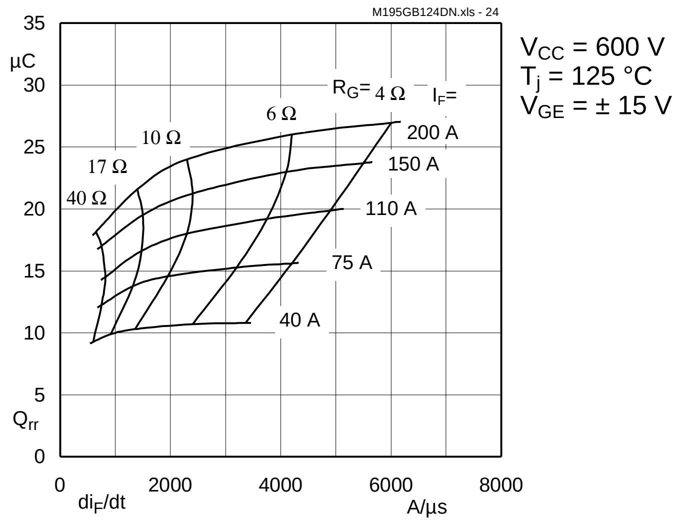


Fig. 24 Typ. CAL diode recovered charge

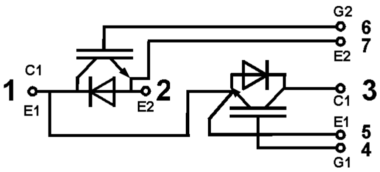
SEMITRANS 2N (low inductance)

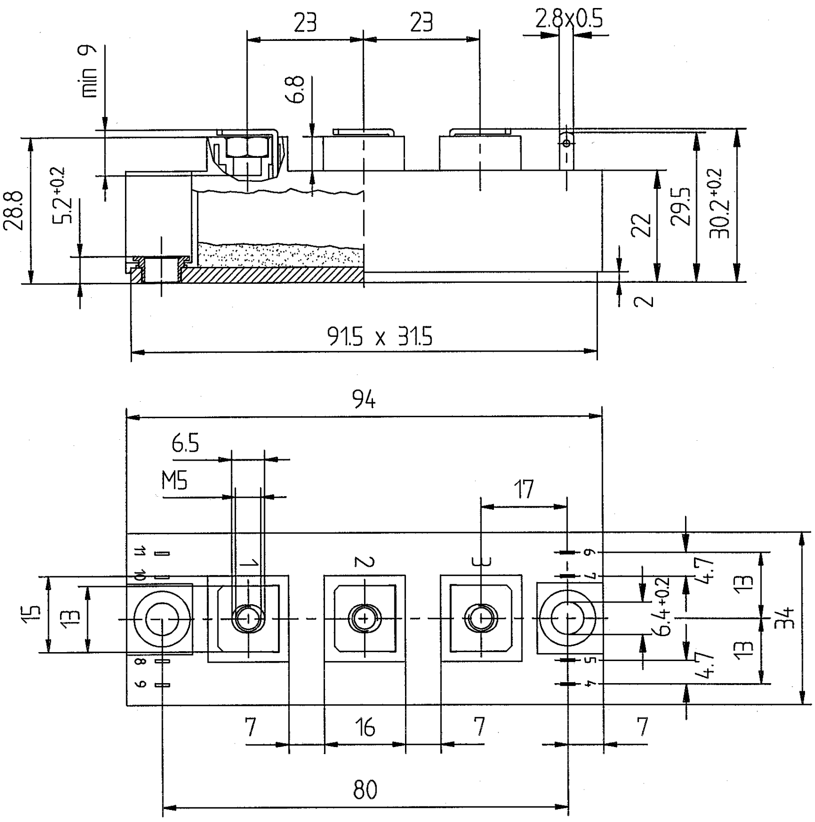
Case D 93

UL Recognized

File no. E 63 532

SKM 195 GB 124 DN

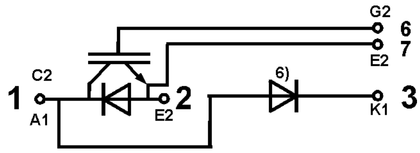




Dimensions in mm

SKM 195 GAL 124 DN

Case D 94 (→ D 93)



Case outline and circuit diagrams

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 pieces are used if suitable

Accessories → SEMIKRON Book ´99 page B 6 – 4

SEMIBOX → SEMIKRON Book ´99 page C - 1.

