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	IEC-EN 60721-3-3		
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	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

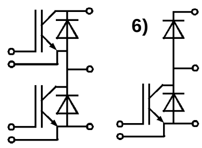
Characteristics					
Symbol	Conditions [1]	min.	typ.	max.	Units
$V_{(BR)CES}$	V_{GE} = 0, I_C = 4 mA	≥ V_{CES}	–	–	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 4 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0, $V_{CE} = V_{CES}$; T_j = 25 °C	–	0,2	0,4	mA
	V_{GE} = 0, $V_{CE} = V_{CES}$; T_j = 125 °C	–	9	–	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	0,3	µA
V_{CEsat}	I_C = 100 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,1(2,4)	2,45(2,85)	V
V_{CEsat}	I_C = 150 A; V_{GE} = 15 V; T_j = 25 (125) °C	–	2,6(3,1)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 100 A	40	–	–	S
C_{CHC}	per IGBT	–	–	350	pF
C_{ies}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz	–	6,5	8,5	nF
C_{oes}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz	–	1000	1500	pF
C_{res}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz	–	500	600	pF
L_{CE}		–	–	25	nH
$t_{d(on)}$	V_{CC} = 600 V; V_{GE} = –15 V / +15 V[3]; I_C = 100 A, ind. load; $R_{Gon} = R_{Goff}$ = 8 Ω; T_j = 125 °C	–	110	–	ns
t_r		–	50	–	ns
$t_{d(off)}$		–	470	–	ns
t_f		–	60	–	ns
E_{on} [5]		–	14	–	mWs
E_{off} [5]		–	13	–	mWs
Inverse Diode and FWD of type „GAL“[6)8)]					
$V_F = V_{EC}$	I_F = 100 A; V_{GE} = 0 V; T_j = 25 (125) °C	–	2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 150 A; V_{GE} = 0 V; 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 DN
SKM 145 GAL 124 DN

Preliminary Data

SEMITRANS 2N (low inductance)



GB **GAL**

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} = 8 Ω
6) The free-wheeling diode of the GAL type has the data of the inverse diode.
8) CAL = Controlled Axial Lifetime Technology

Cases and mech. data → **page 6**

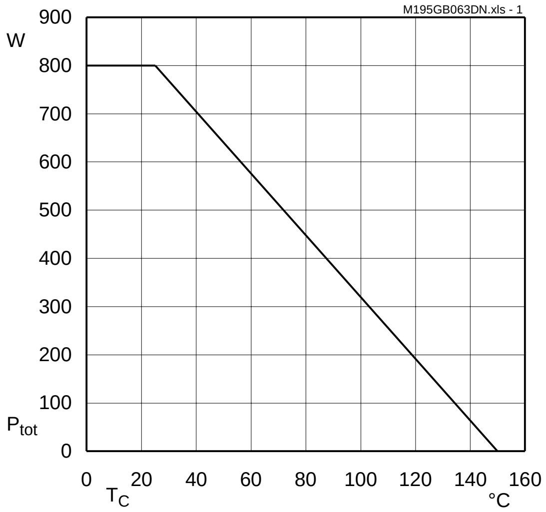
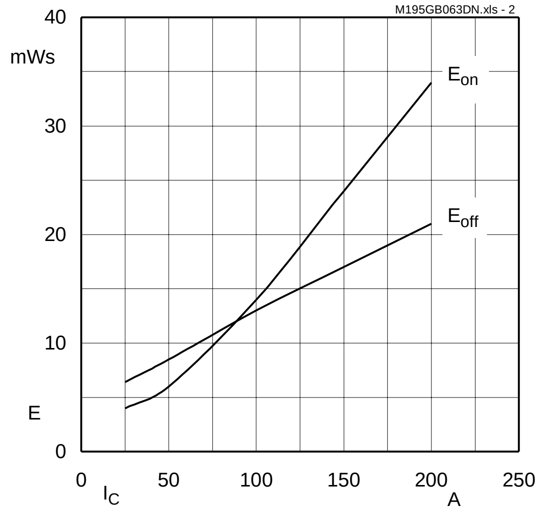
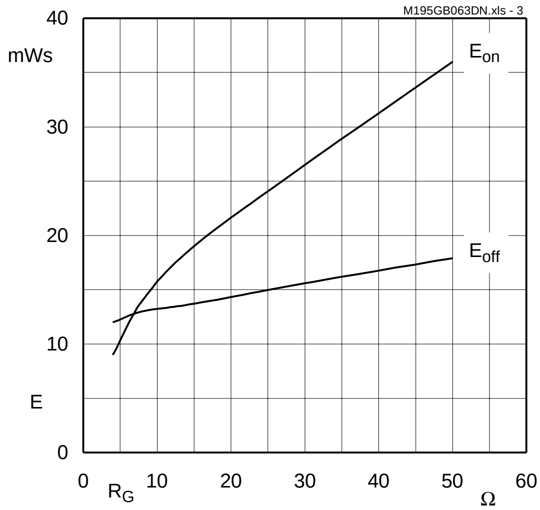


Fig. 1 Rated power dissipation P_{tot} = f (T_C)



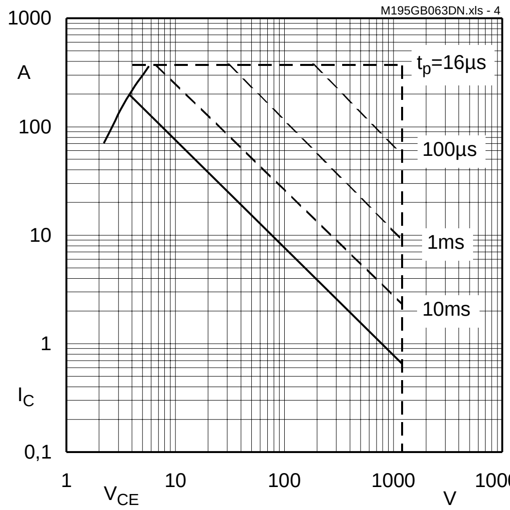
T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
R_G = 8 Ω

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



T_j = 125 °C
V_{CE} = 600 V
V_{GE} = ± 15 V
I_C = 100 A

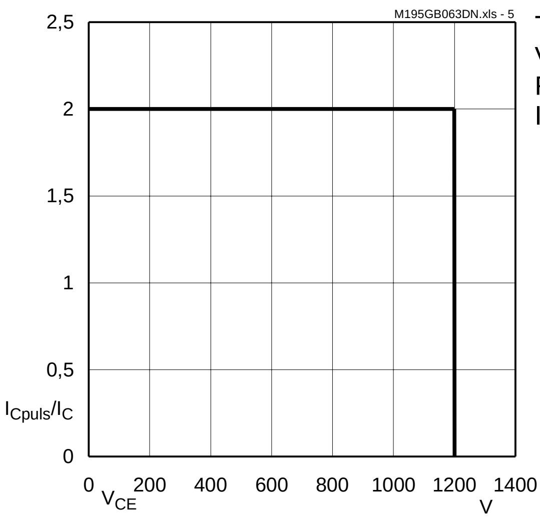
Fig. 3 Turn-on /-off energy = f (R_G)



1 pulse
T_C = 25 °C
T_j ≤ 150 °C

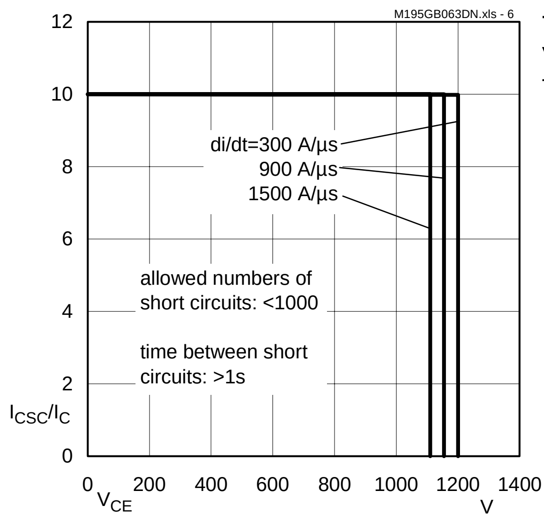
Not for linear use

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



T_j ≤ 150 °C
V_{GE} = 15 V
R_{Goff} = 8 Ω
I_C = 100 A

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



T_j ≤ 150 °C
V_{GE} = ± 15 V
t_{sc} ≤ 10 µs
L < 25 nH
I_C = 100 A

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

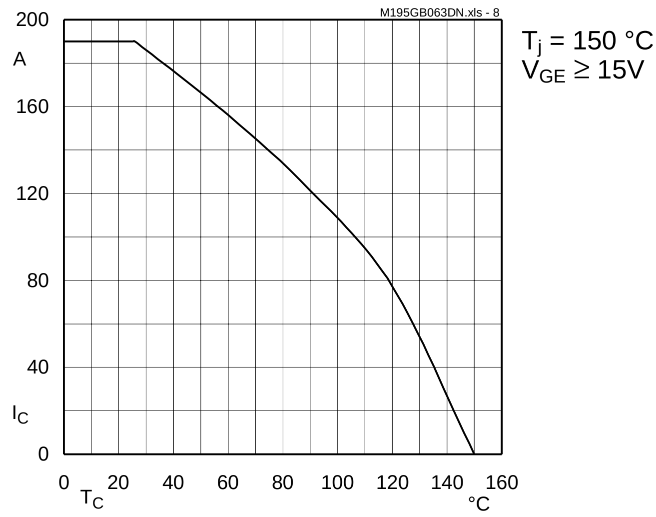


Fig. 8 Rated current vs. temperature $I_C = f\ (T_C)$

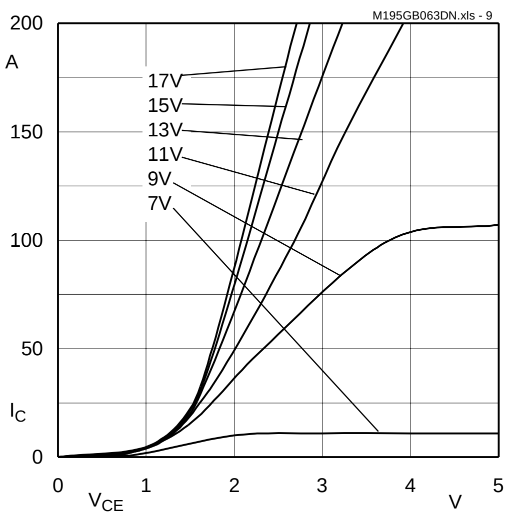


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

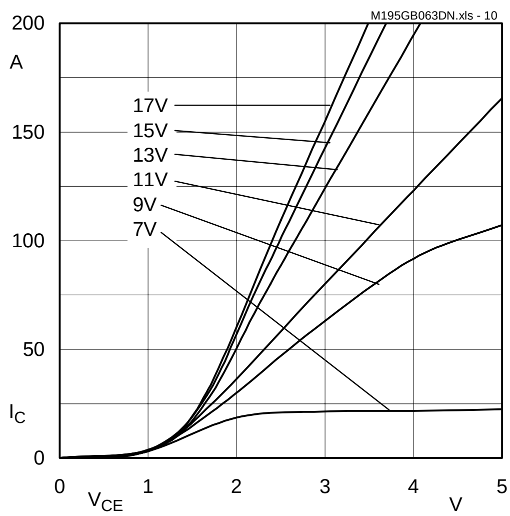


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

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

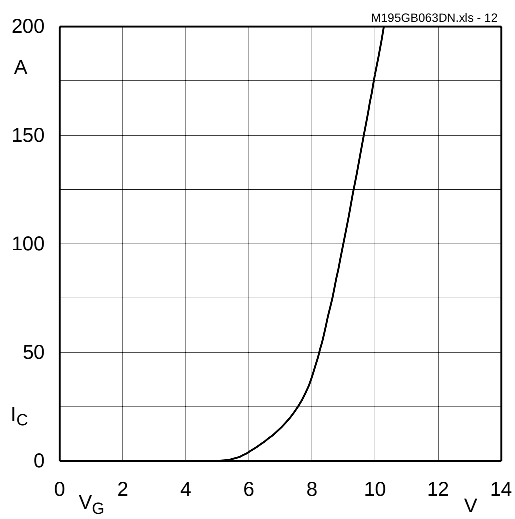


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

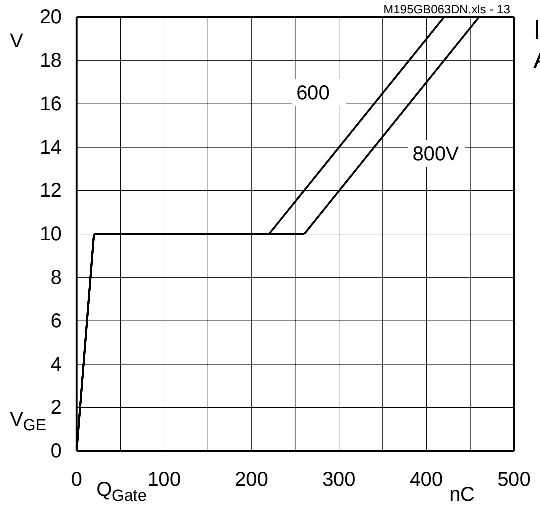


Fig. 13 Typ. gate charge characteristic

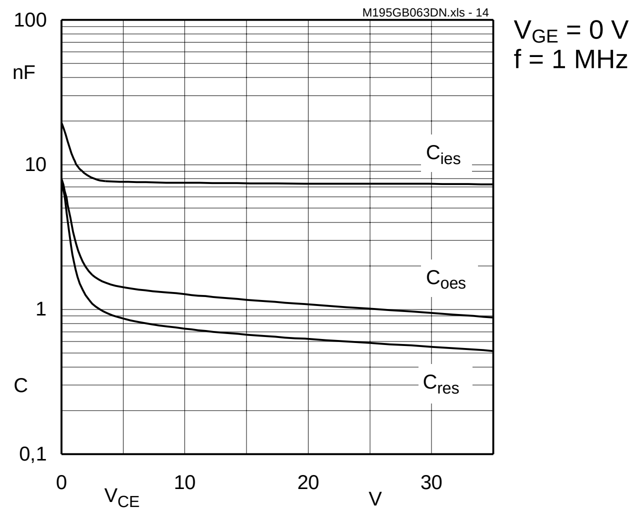


Fig. 14 Typ. capacitances vs.V_{CE}

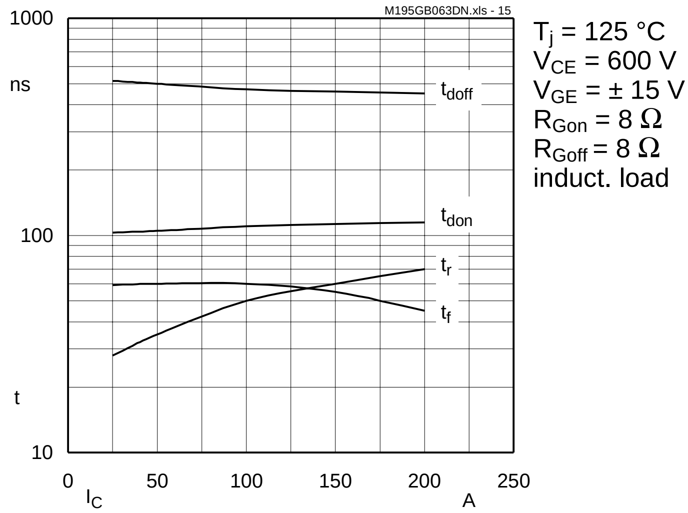


Fig. 15 Typ. switching times vs. I_C

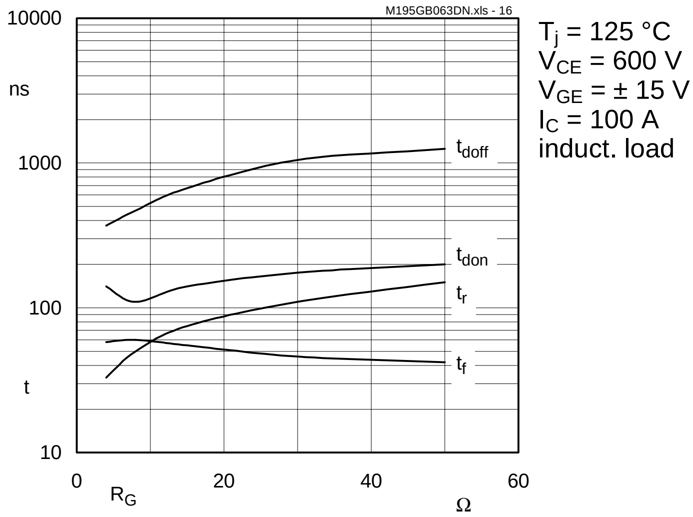


Fig. 16 Typ. switching times vs. gate resistor R_G

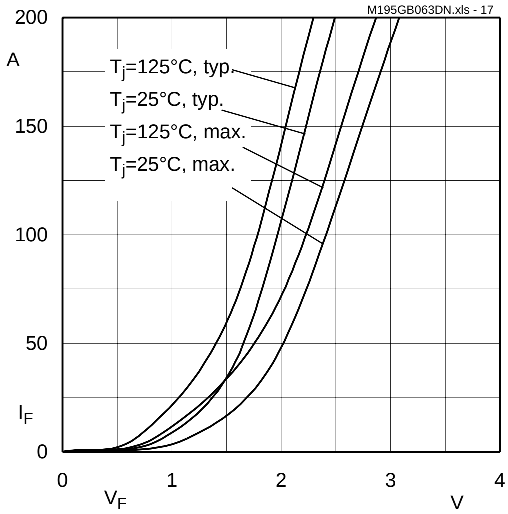


Fig. 17 Typ. CAL diode forward characteristic

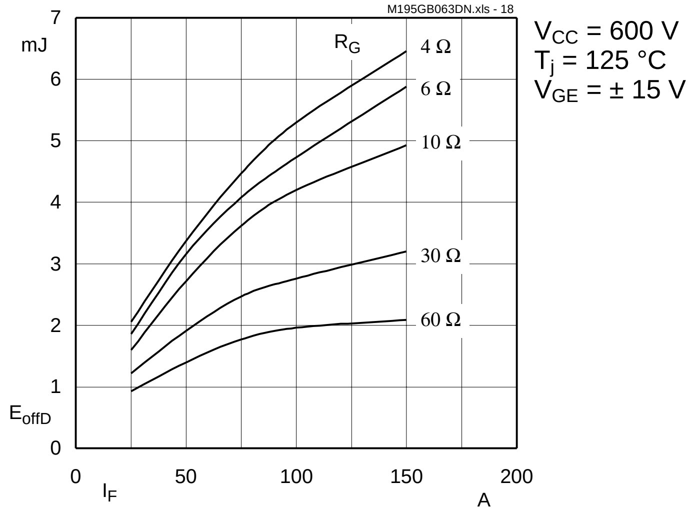
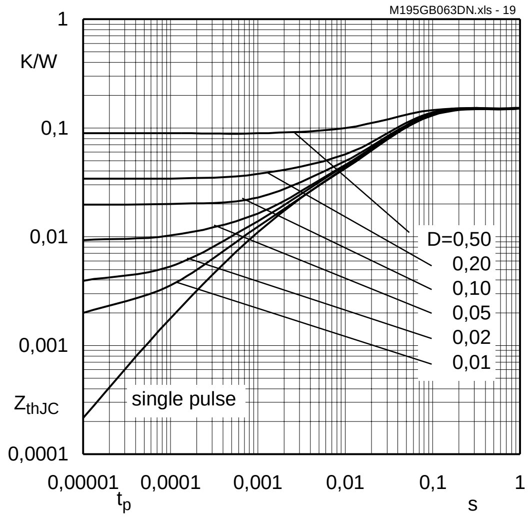


Fig. 18 Diode turn-off energy dissipation per pulse



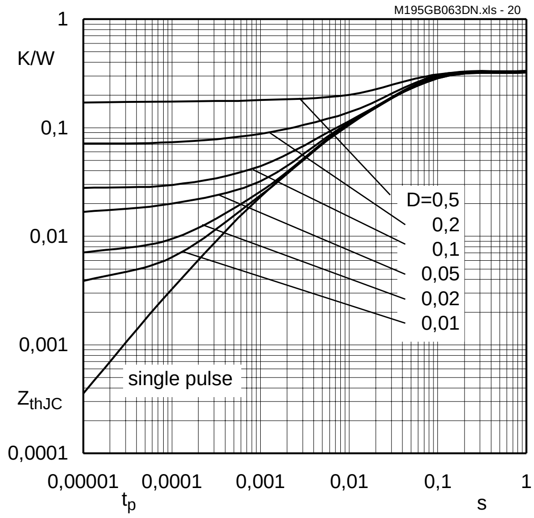
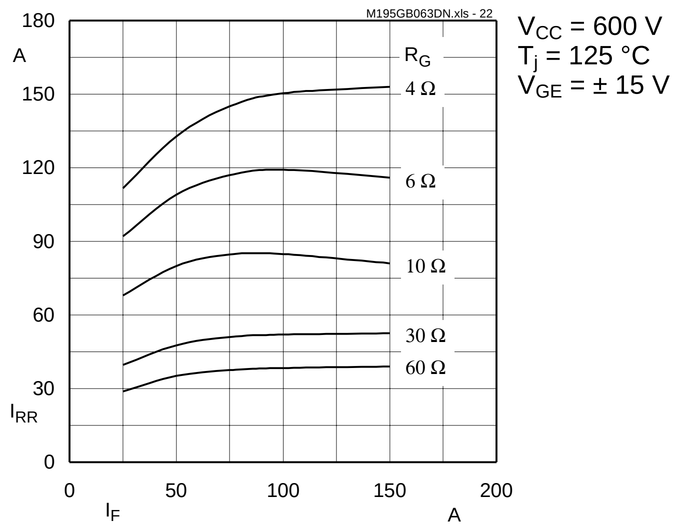


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

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



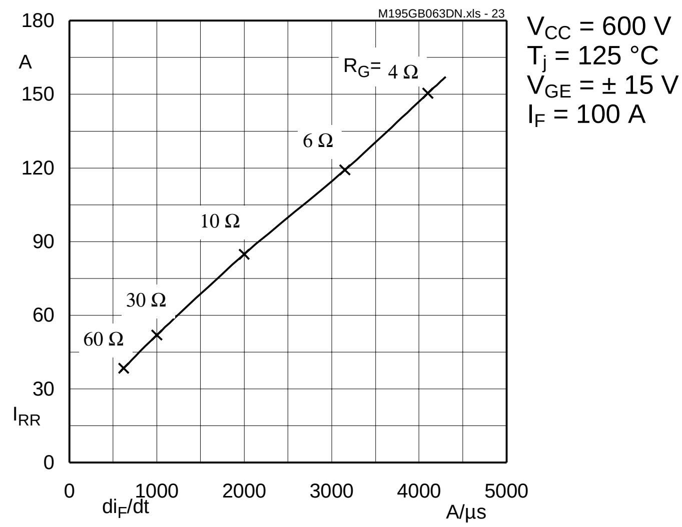


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

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

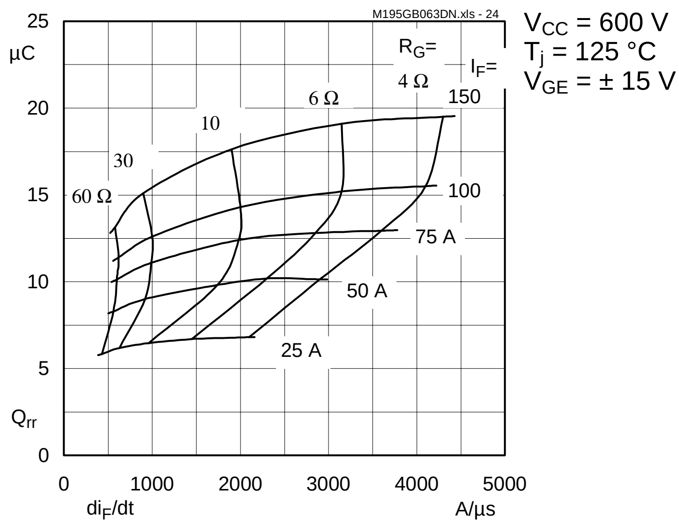


Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

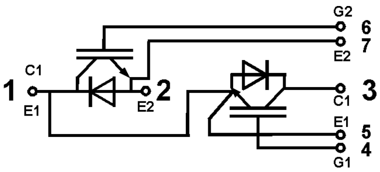
SEMITRANS 2N (low inductance)

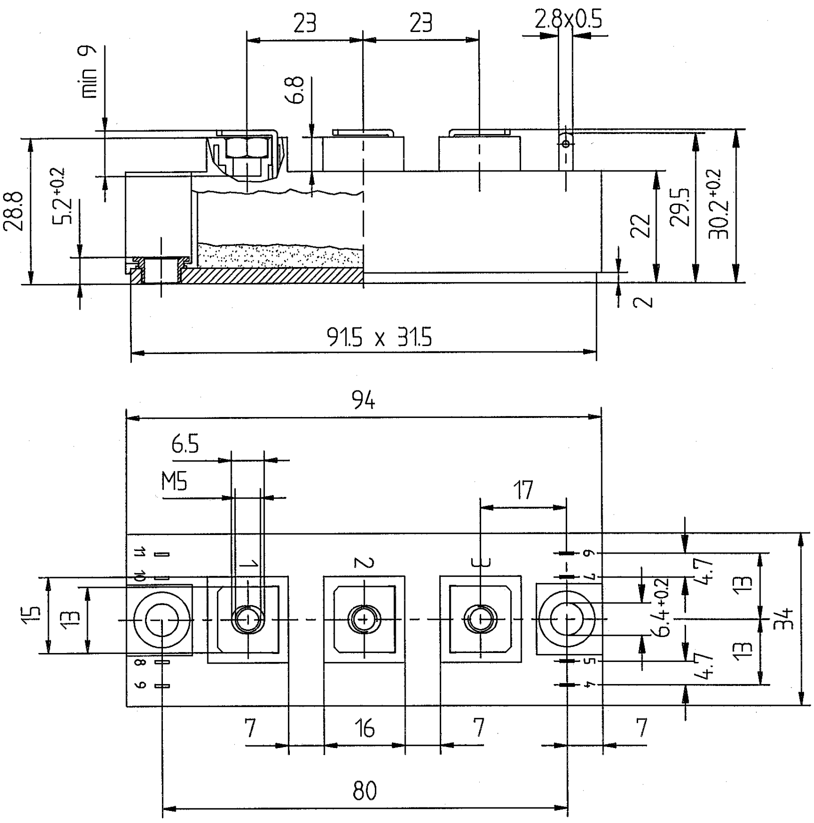
Case D 93

UL Recognized

File no. E 63 532

SKM 145 GB 124 DN

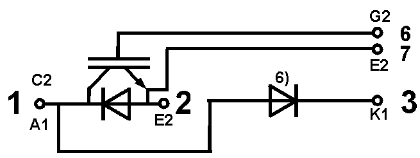




Dimensions in mm

SKM 145 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.