

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V_{CES}		600	V
V_{CGR}	$R_{GE} = 20 \text{ k}\Omega$	600	V
I_C	$T_{case} = 25/80 \text{ }^\circ\text{C}$	250 / 190	A
I_{CM}	$T_{case} = 25/80 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	500 / 380	A
V_{GES}		± 20	V
P_{tot}	per IGBT, $T_{case} = 25 \text{ }^\circ\text{C}$	960	W
$T_J, (T_{stg})$		$-40 \dots +150 (125)$	$^\circ\text{C}$
V_{isol}	AC, 1 min.	2 500	V
humidity	IEC 60721-3-3	class 3K7/IE32	
climate	IEC 68 T.1	40/125/56	
Inverse Diode and FWD of type "GAL, GAR" ^(6) 8)			
$I_F = -I_C$	$T_{case} = 25/80 \text{ }^\circ\text{C}$	200 / 140	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	500 / 380	A
I_{FSM}	$t_p = 10 \text{ ms}; \sin.; T_J = 150 \text{ }^\circ\text{C}$	1 400	A
I^2t	$t_p = 10 \text{ ms}; T_J = 150 \text{ }^\circ\text{C}$	9800	A^2s

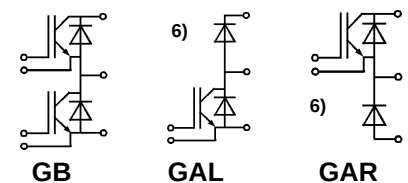
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
$V_{(BR)CES}$	$V_{GE} = 0, I_C = 4 \text{ mA}$	$\geq V_{CES}$	—	—	V
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 4 \text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0 \quad \left. \begin{matrix} T_J = 25 \text{ }^\circ\text{C} \\ T_J = 125 \text{ }^\circ\text{C} \end{matrix} \right\}$	—	0,2	—	mA
	$V_{CE} = V_{CES}$	—	7	—	mA
I_{GES}	$V_{GE} = 20 \text{ V}, V_{CE} = 0$	—	—	0,3	μA
V_{CESat}	$I_C = 200 \text{ A} \quad \left. \begin{matrix} V_{GE} = 15 \text{ V}; \\ T_J = 25 (125) \text{ }^\circ\text{C} \end{matrix} \right\}$	—	2,1(2,4)	2,5(2,8)	V
		—	—	—	V
g_{fs}	$V_{CE} = 20 \text{ V}, I_C = 200 \text{ A}$	40	—	—	S
C_{CHC}	per IGBT	—	—	350	pF
C_{ies}	$V_{GE} = 0$	—	11,2	—	nF
C_{oes}	$V_{CE} = 25 \text{ V}$	—	1250	—	pF
C_{res}	$f = 1 \text{ MHz}$	—	750	—	pF
L_{CE}	(terminal 2 - 3)	—	—	25	nH
$t_{d(on)}$	$V_{CC} = 300 \text{ V}$	—	120	—	ns
t_r	$V_{GE} = +15 \text{ V} / -15 \text{ V}^{(3)}$	—	85	—	ns
$t_{d(off)}$	$I_C = 200 \text{ A}, \text{ind. load}$	—	460	—	ns
t_f	$R_{Gon} = R_{Goff} = 8 \text{ } \Omega$	—	50	—	ns
E_{on}	$T_J = 125 \text{ }^\circ\text{C}$	—	11,5	—	mWs
E_{off}		—	7,5	—	mWs
Inverse Diode and FWD of type "GAL, GAR" ^(6) 8)					
$V_F = V_{EC}$	$I_F = 150 \text{ A} \quad \left\{ \begin{matrix} V_{GE} = 0 \text{ V}; \\ T_J = 25 (125) \text{ }^\circ\text{C} \end{matrix} \right\}$	—	1,45(1,35)	1,7	V
$V_F = V_{EC}$	$I_F = 200 \text{ A}$	—	1,55(1,55)	1,9	V
V_{TO}	$T_J = 125 \text{ }^\circ\text{C}$	—	—	0,9	V
r_t	$T_J = 125 \text{ }^\circ\text{C}$	—	4	5,5	$\text{m}\Omega$
I_{RRM}	$I_F = 200 \text{ A}; T_J = 125 \text{ }^\circ\text{C}^{(2)}$	—	75	—	A
Q_{rr}	$I_F = 200 \text{ A}; T_J = 125 \text{ }^\circ\text{C}^{(2)}$	—	13	—	μC
Thermal characteristics					
R_{thjc}	per IGBT	—	—	0,13	$^\circ\text{C/W}$
R_{thjc}	per diode	—	—	0,3	$^\circ\text{C/W}$
R_{thch}	per module	—	—	0,05	$^\circ\text{C/W}$

SEMITRANS® M Superfast NPT-IGBT Modules

SKM 195 GB 063 DN
SKM 195 GAL 063 DN ⁶⁾
SKM 195 GAR 063 DN ⁶⁾



SEMITRANS 2N (low inductance)



Features

- N channel, homogeneous Silicon structure (NPT-Non-Punch-through IGBT)
- Low tail current with low temperature dependence
- High short circuit capability, self limiting
- Pos. temp. coeff. of V_{CESat}
- Low inductance case
- Fast & soft inverse CAL diodes ⁸⁾
- Without hard mould
- Large clearance (10 mm) and creepage distances (20 mm)

Typical Applications

- Switching (not for linear use)
- Switched mode power supplies
- AC inverter drives
- UPS uninterruptable power supplies

¹⁾ $T_{case} = 25 \text{ }^\circ\text{C}$, unless otherwise specified

²⁾ $I_F = -I_C, V_R = 300 \text{ V}, -di_F/dt = 1500 \text{ A}/\mu\text{s}, V_{GE} = 0 \text{ V}$

³⁾ Use $V_{GEoff} = -5 \dots -15 \text{ V}$

⁴⁾ For switch-off of $2 * I_{CN} = 400 \text{ A}$ use $R_{goff} \geq 12 \text{ } \Omega$.
For switch-off of short circuit use $R_{goff} \geq 25 \text{ } \Omega$.

⁶⁾ The free-wheeling diodes of the GAL type have the data of the inverse diodes.

⁸⁾ CAL = Controlled Axial Lifetime Technology

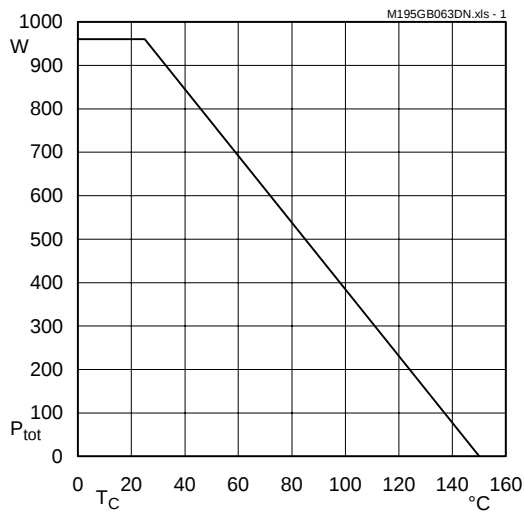


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

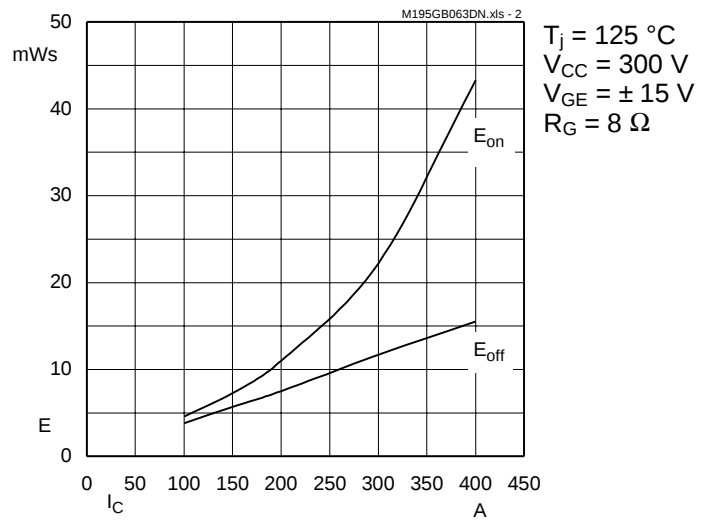


Fig. 2 Turn-on /off energy $= f(I_C)$

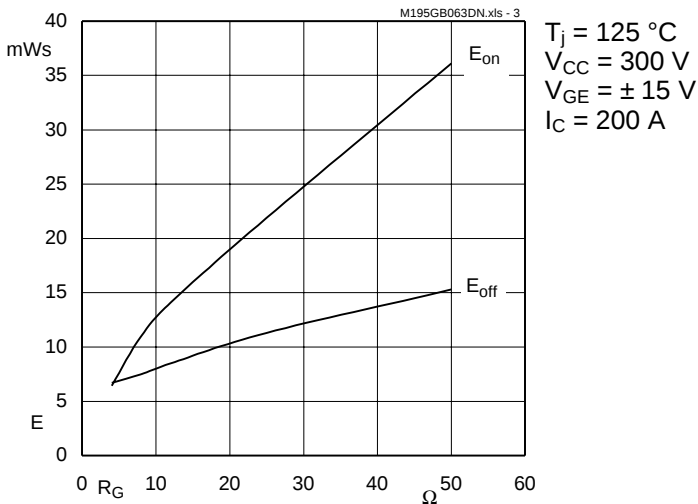


Fig. 3 Turn-on /off energy $= f(R_G)$

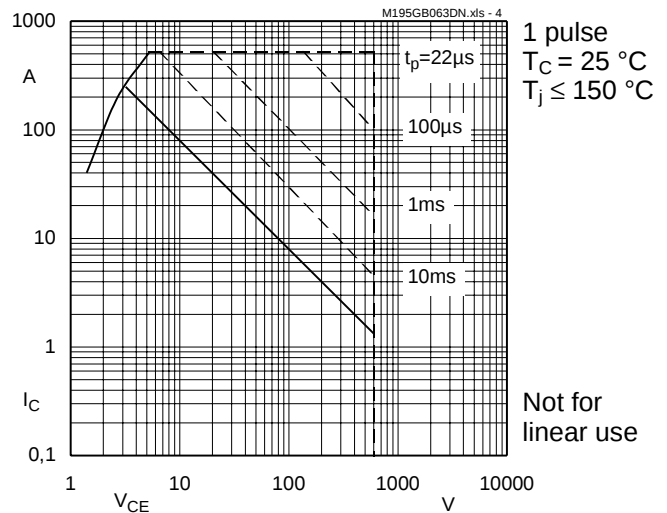


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

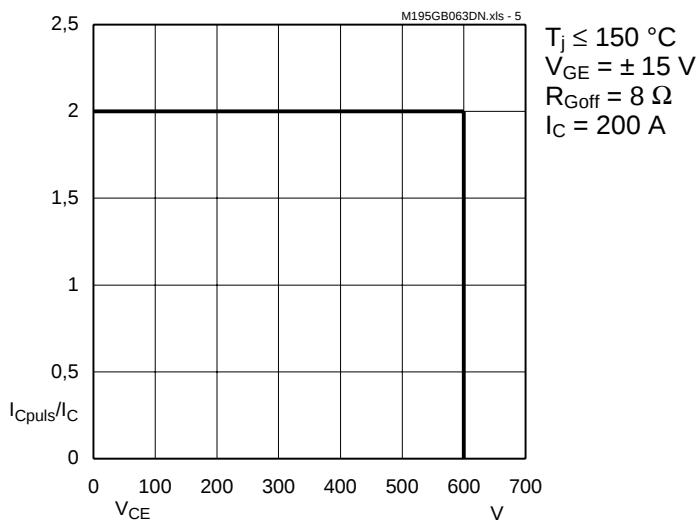


Fig. 5 Turn-off safe operating area (RBSOA)

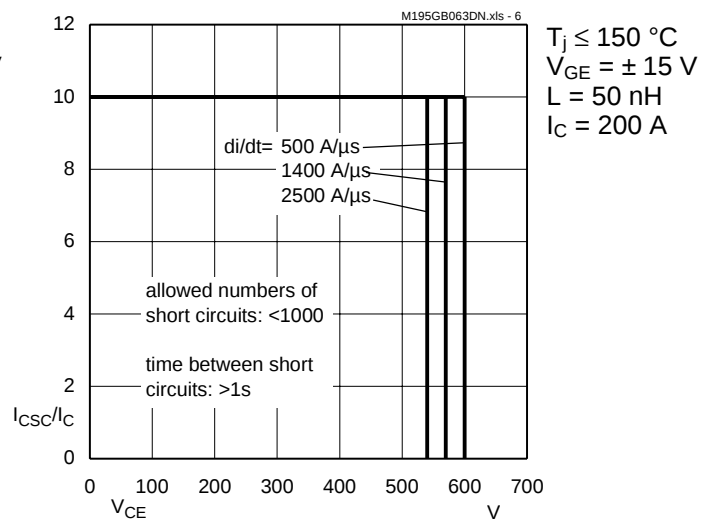
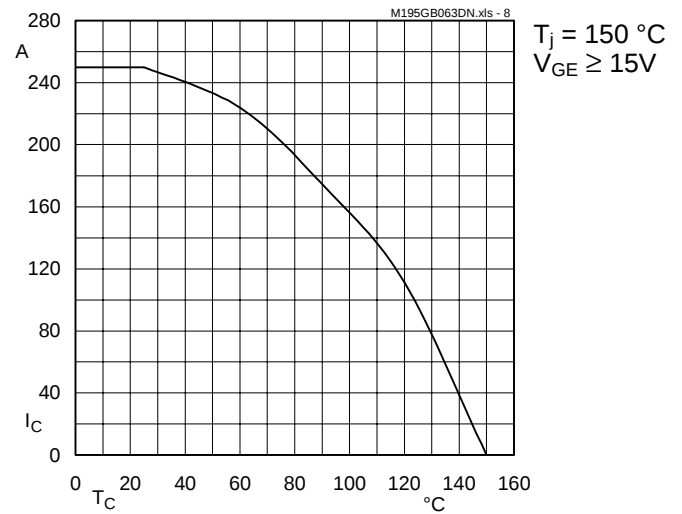
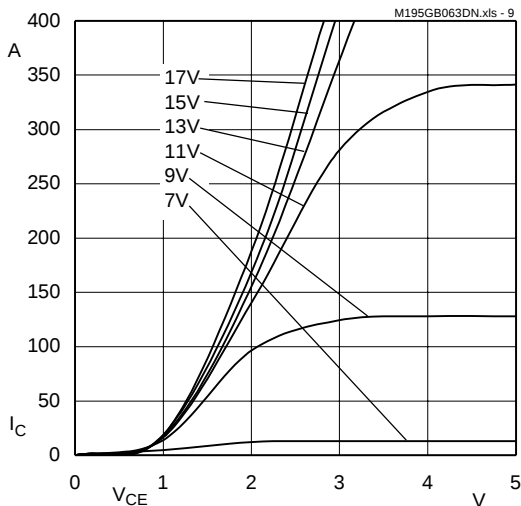
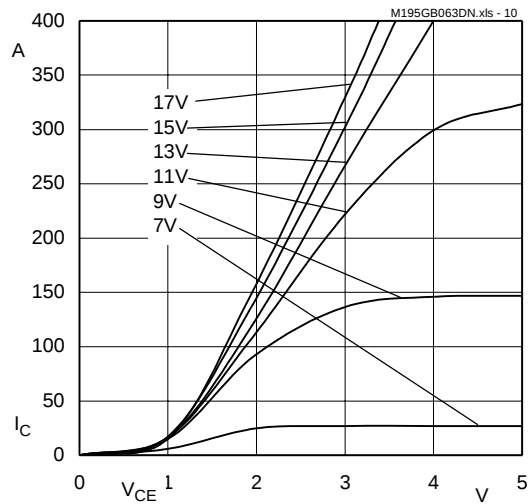


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

Fig. 8 Rated current vs. temperature $I_C = f(T_C)$ Fig. 9 Typ. output characteristic, $t_p = 250$ μs; $T_j = 25$ °CFig. 10 Typ. output characteristic, $t_p = 250$ μs; $T_j = 125$ °C

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

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

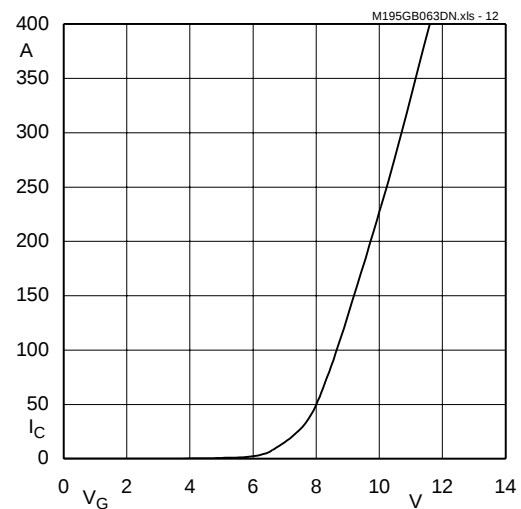
$$V_{\text{CE(TO)}(T_j)} \leq 1,2 - 0,001 (T_j - 25) \text{ [V]}$$

$$\text{typ.: } r_{\text{CE}(T_j)} = 0,0045 + 0,00002 (T_j - 25) \text{ [}\Omega\text{]}$$

$$\text{max.: } r_{\text{CE}(T_j)} = 0,0065 + 0,00002 (T_j - 25) \text{ [}\Omega\text{]}$$

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

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

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

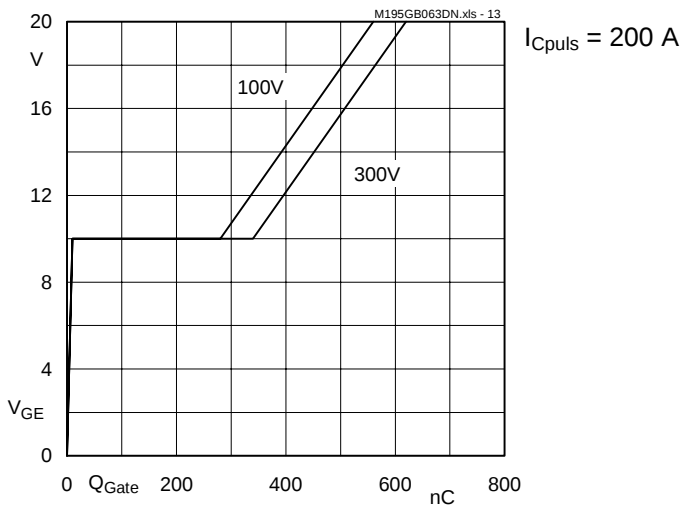


Fig. 13 Typ. gate charge characteristic

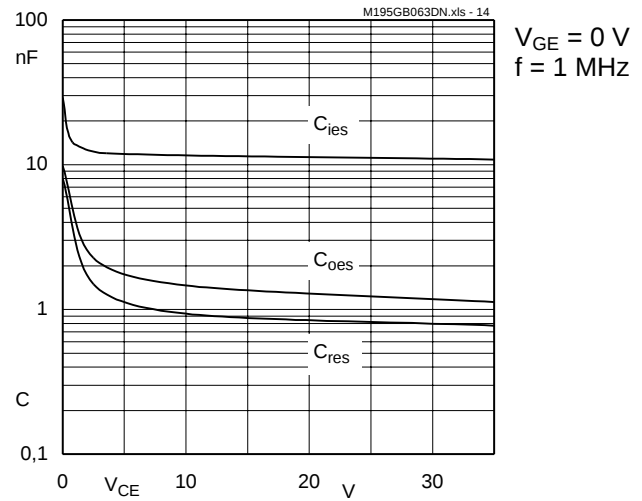


Fig. 14 Typ. capacitances vs. V_{CE}

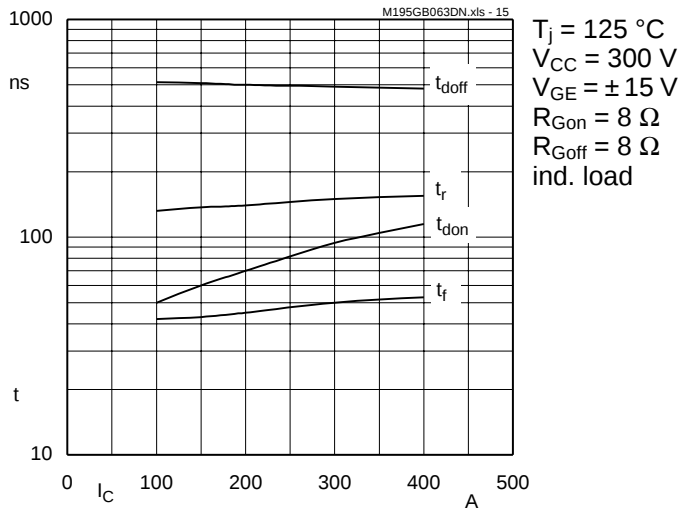


Fig. 15 Typ. switching times vs. I_C

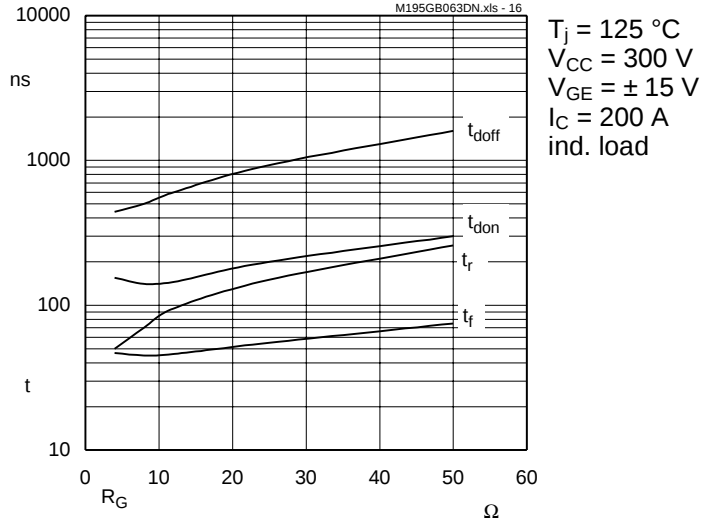


Fig. 16 Typ. switching times vs. gate resistor R_G

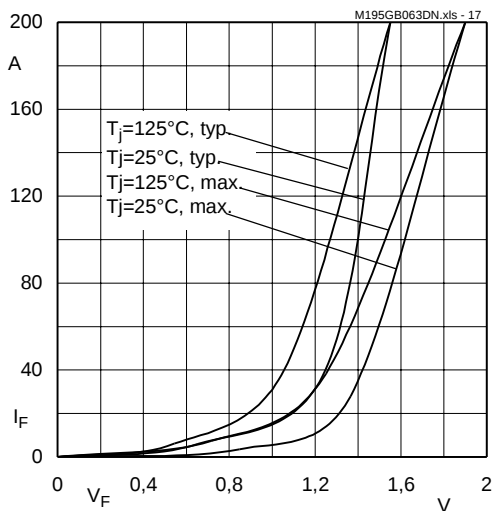


Fig. 17 Typ. CAL diode forward characteristic

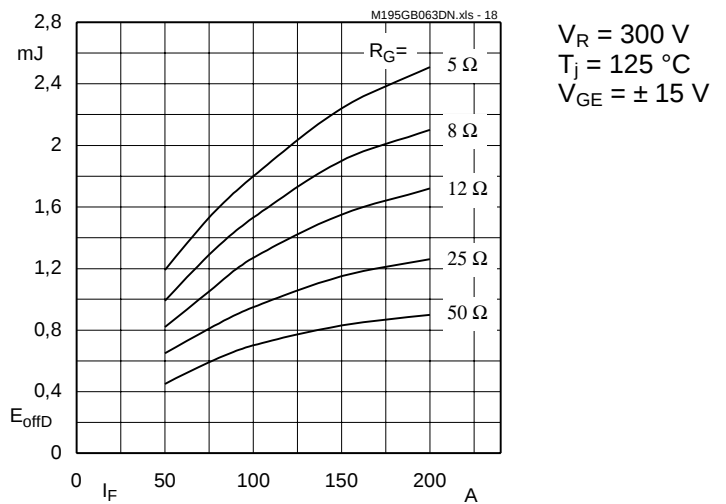


Fig. 18 Diode turn-off energy dissipation per pulse

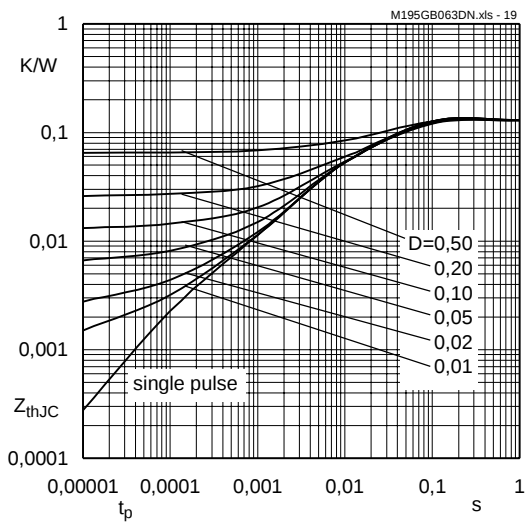


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

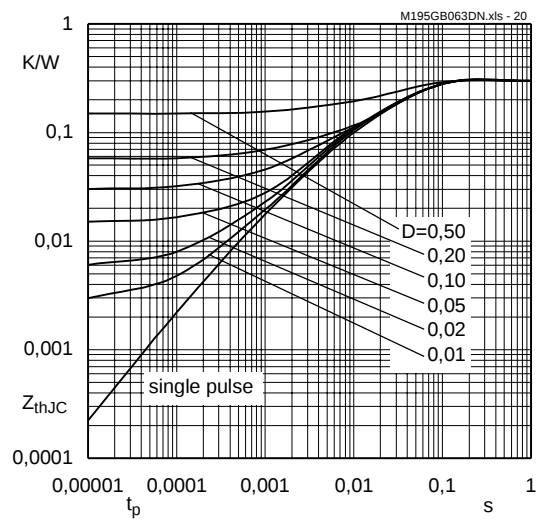


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

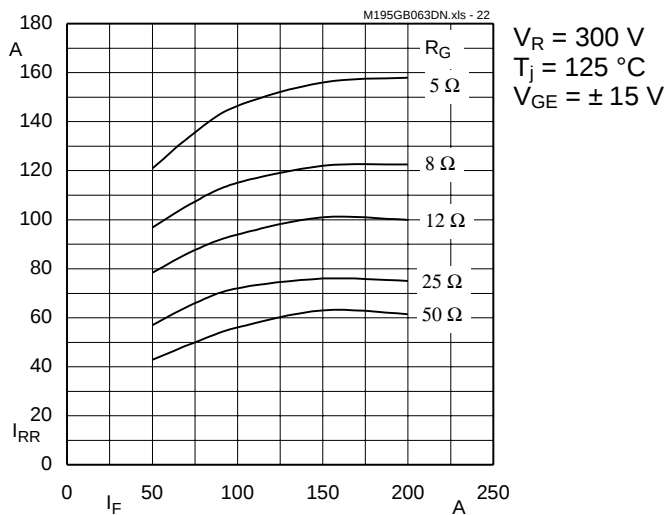


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

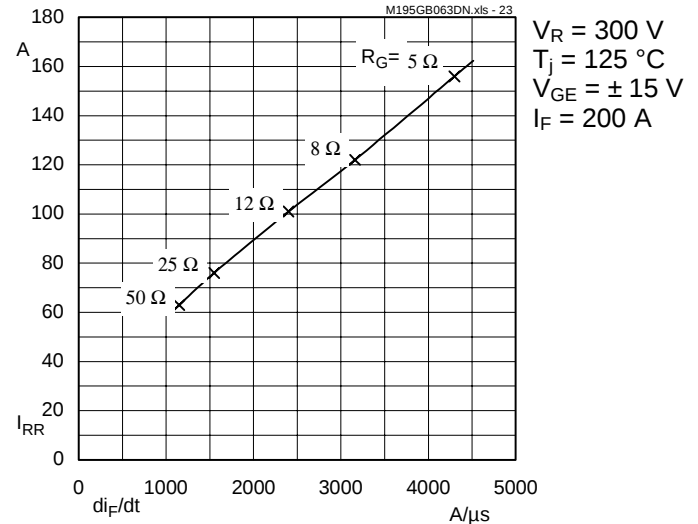


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

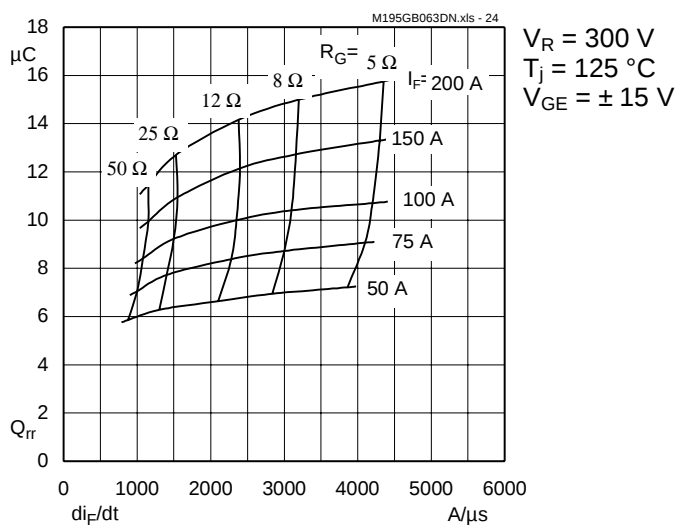
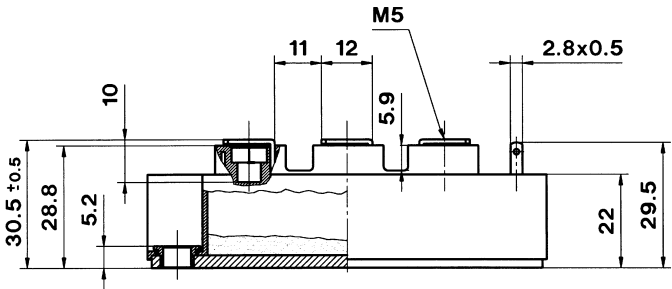
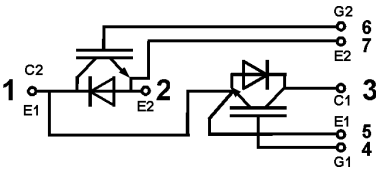


Fig. 24 Typ. CAL diode recovered charge

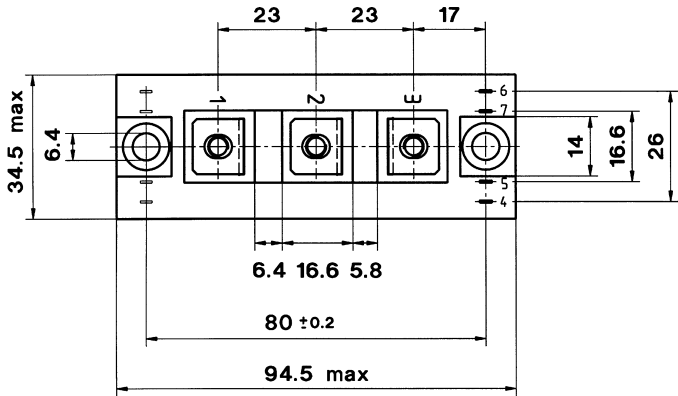
SEMITRANS 2N (low inductance)

Case D 93
UL Recognized
File no. E 63 532

SKM 195 GB 063 DN



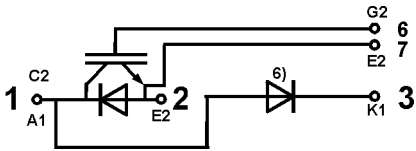
CASED93



Dimensions in mm

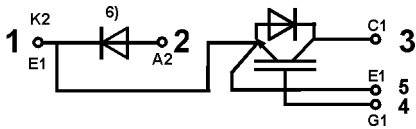
SKM 195 GAL 063 DN

Case D 94 (→ D 93)



SKM 195 GAR 063 DN

Case D 95 (→ D 93)



Case outline and circuit diagrams

Mechanical Data						Units
Symbol	Conditions		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

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