

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V _{CES}		600	V
V _{CGR}	R _{GE} = 20 kΩ	600	V
I _C	T _{case} = 25/80 °C	250 / 190	A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	500 / 380	A
V _{GES}		± 20	V
P _{tot}	per IGBT, T _{case} = 25 °C	960	W
T _J , (T _{stg})		-40 ... +150 (125)	°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 °C	200 / 140	A
I _{FM} = -I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	500 / 380	A
I _{FSM}	t _p = 10 ms; sin.; T _J = 150 °C	1 400	A
I ² t	t _p = 10 ms; T _J = 150 °C	9800	A ² s

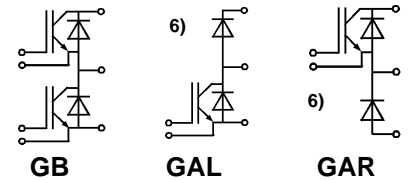
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
V _{(BR)CES}	V _{GE} = 0, I _C = 4 mA	≥ V _{CES}	-	-	V
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 4 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _J = 25 °C	-	0,2	-	mA
	V _{CE} = V _{CES} } T _J = 125 °C	-	7	-	mA
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	-	-	0,3	μA
V _{CEsat}	I _C = 200 A } V _{GE} = 15 V;	-	2,1(2,4)	2,5(2,8)	V
	T _J = 25 (125) °C }	-	-	-	V
g _{fs}	V _{CE} = 20 V, I _C = 200 A	40	-	-	S
C _{CHC}	per IGBT	-	-	350	pF
C _{ies}	V _{GE} = 0	-	11,2	-	nF
C _{oes}	V _{CE} = 25 V	-	1250	-	pF
C _{res}	f = 1 MHz	-	750	-	pF
L _{CE}	(terminal 2 - 3)	-	-	25	nH
t _{d(on)}	V _{CC} = 300 V	-	120	-	ns
t _r	V _{GE} = +15 V / -15 V ³⁾	-	85	-	ns
t _{d(off)}	I _C = 200 A, ind. load	-	460	-	ns
t _f	R _{Gon} = R _{Goff} = 8 Ω	-	50	-	ns
E _{on}	T _J = 125 °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 A } V _{GE} = 0 V;	-	1,45(1,35)	1,7	V
V _F = V _{EC}	I _F = 200 A } T _J = 25 (125) °C }	-	1,55(1,55)	1,9	V
V _{TO}	T _J = 125 °C	-	-	0,9	V
r _t	T _J = 125 °C	-	4	5,5	mΩ
I _{RRM}	I _F = 200 A; T _J = 125 °C ²⁾	-	75	-	A
Q _{rr}	I _F = 200 A; T _J = 125 °C ²⁾	-	13	-	μC
Thermal characteristics					
R _{thjc}	per IGBT	-	-	0,13	°C/W
R _{thjc}	per diode	-	-	0,3	°C/W
R _{thch}	per module	-	-	0,05	°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 °C, unless otherwise specified

²⁾ I_F = -I_C, V_R = 300 V, -di_F/dt = 1500 A/μs, V_{GE} = 0 V

³⁾ Use V_{GEoff} = -5 ... -15 V

⁴⁾ For switch-off of 2 * I_{CN} = 400 A use R_{goff} ≥ 12 Ω.

For switch-off of short circuit use R_{goff} ≥ 25 Ω.

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

⁸⁾ CAL = Controlled Axial Lifetime Technology

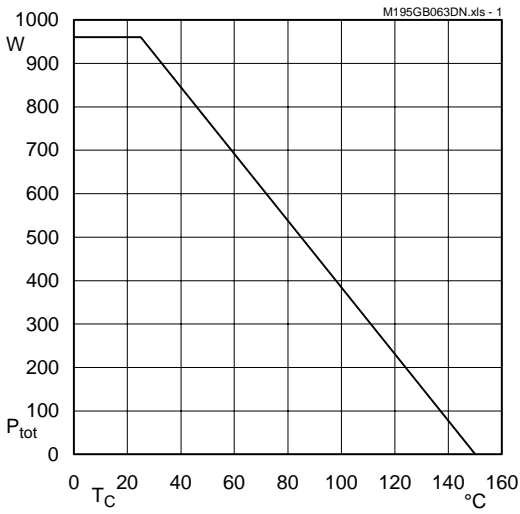


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

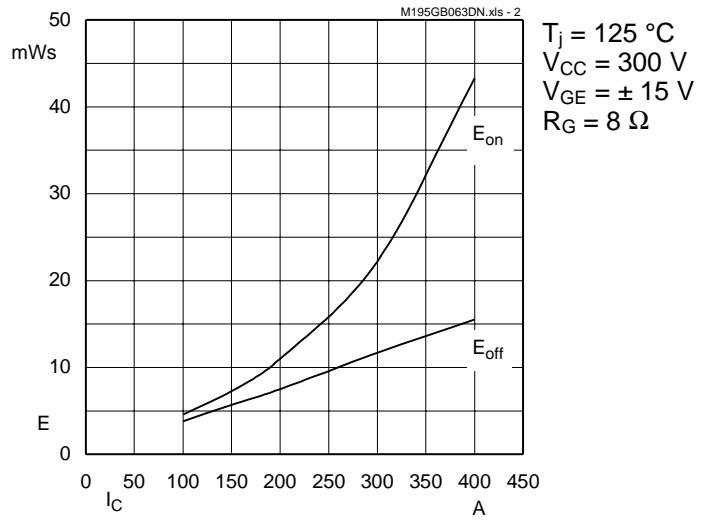


Fig. 2 Turn-on /-off energy $E = f(I_C)$

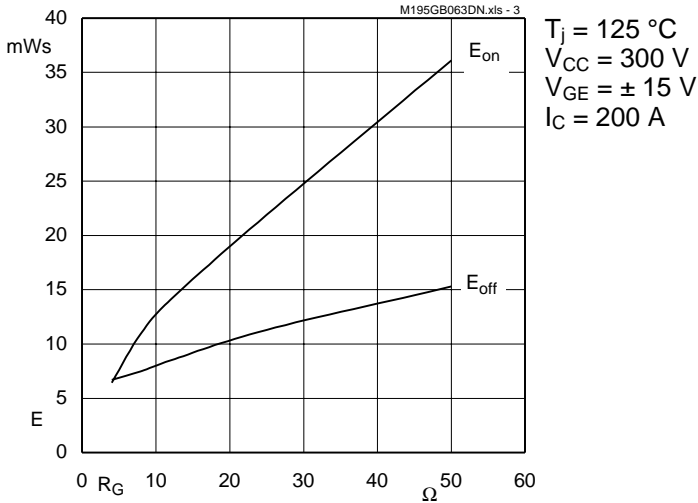


Fig. 3 Turn-on /-off energy $E = f(R_G)$

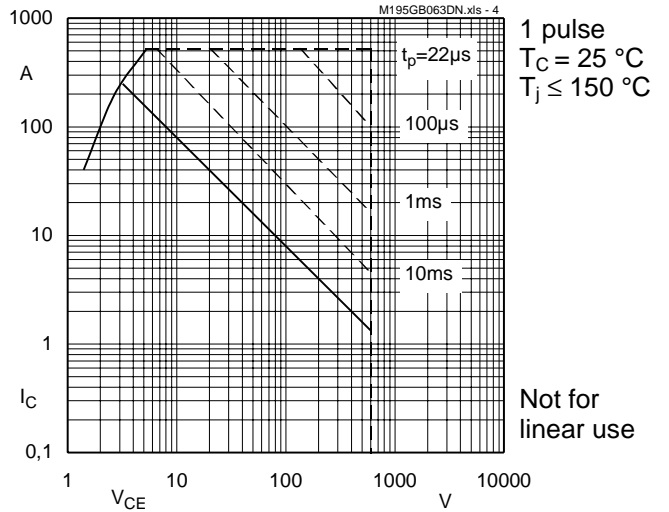


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

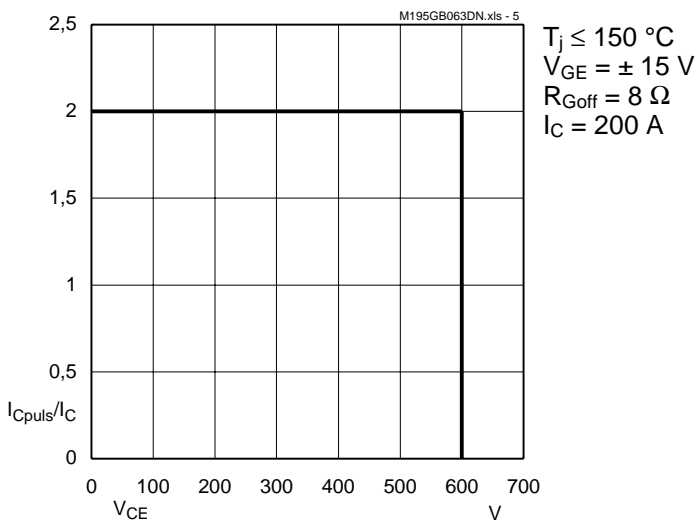


Fig. 5 Turn-off safe operating area (RBSOA)

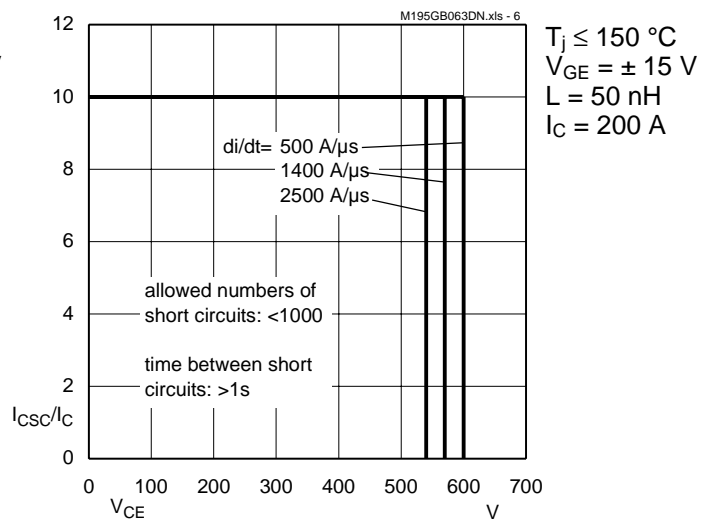


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

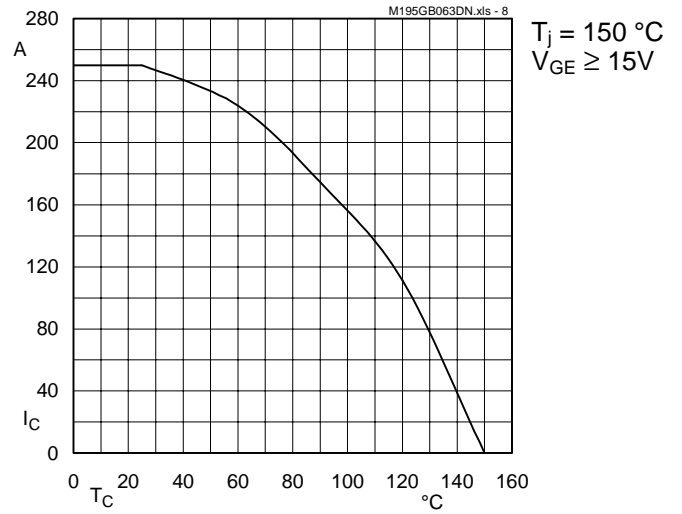


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

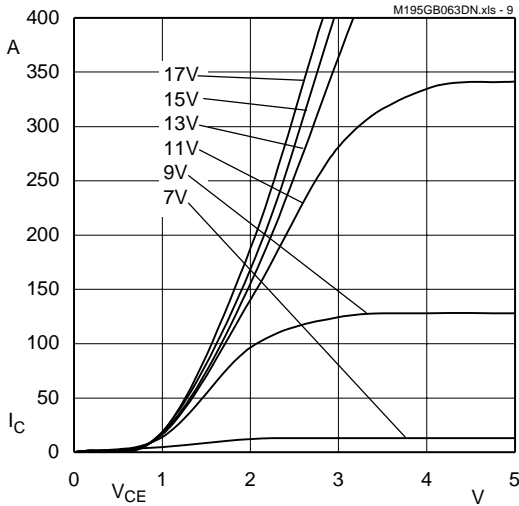


Fig. 9 Typ. output characteristic, $t_p = 250\text{ }\mu\text{s}$; $T_j = 25\text{ }^\circ\text{C}$

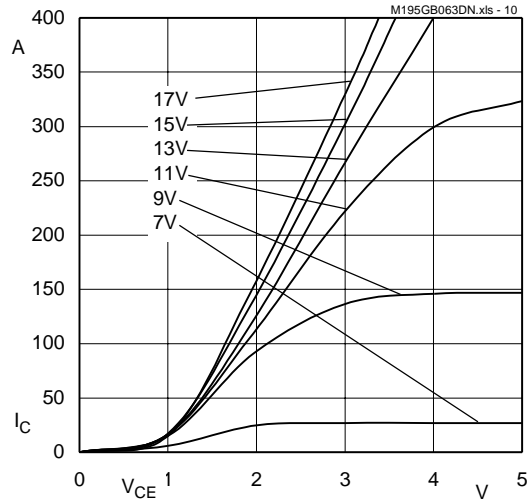


Fig. 10 Typ. output characteristic, $t_p = 250\text{ }\mu\text{s}$; $T_j = 125\text{ }^\circ\text{C}$

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

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

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

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

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

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

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

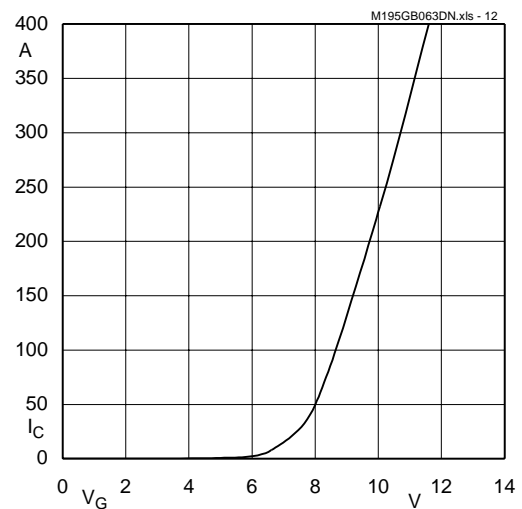


Fig. 12 Typ. transfer characteristic, $t_p = 250\text{ }\mu\text{s}$; $V_{\text{CE}} = 20\text{ V}$

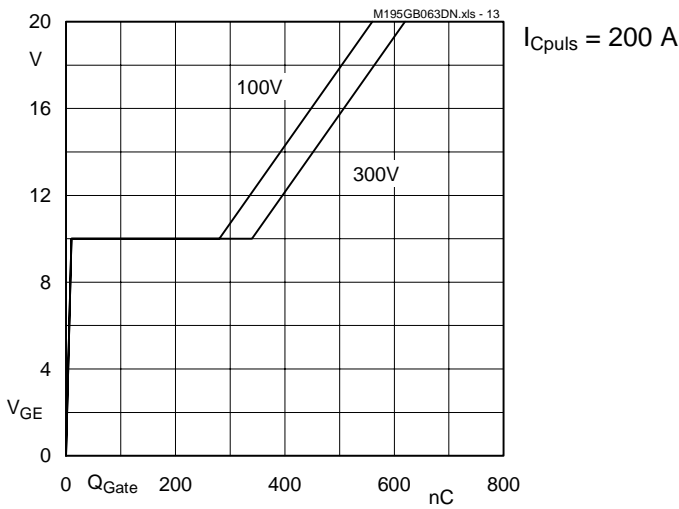


Fig. 13 Typ. gate charge characteristic

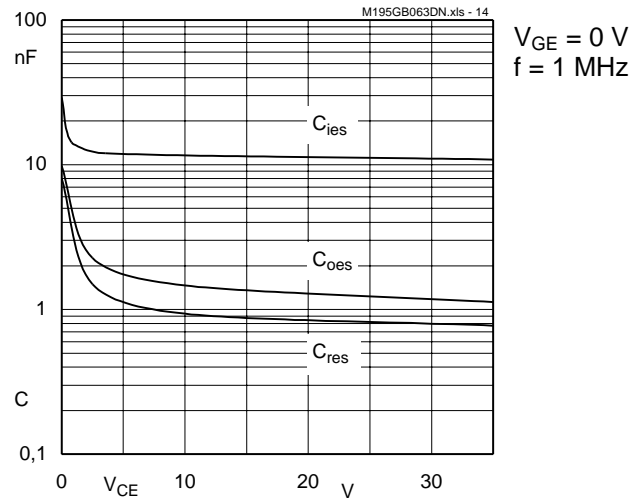


Fig. 14 Typ. capacitances vs. V_{CE}

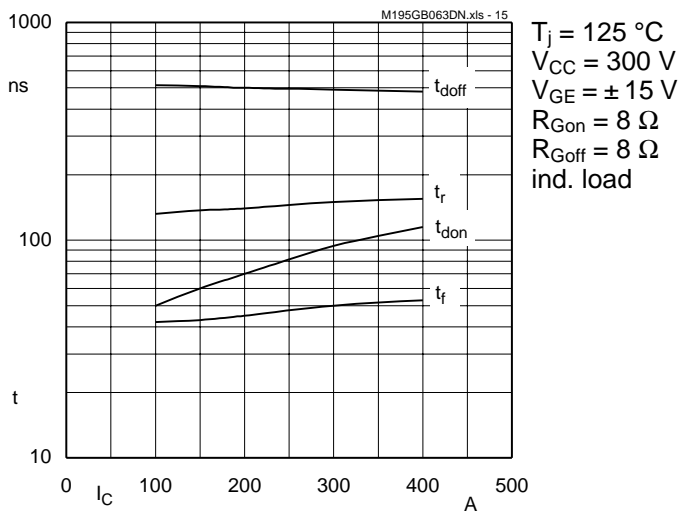


Fig. 15 Typ. switching times vs. I_C

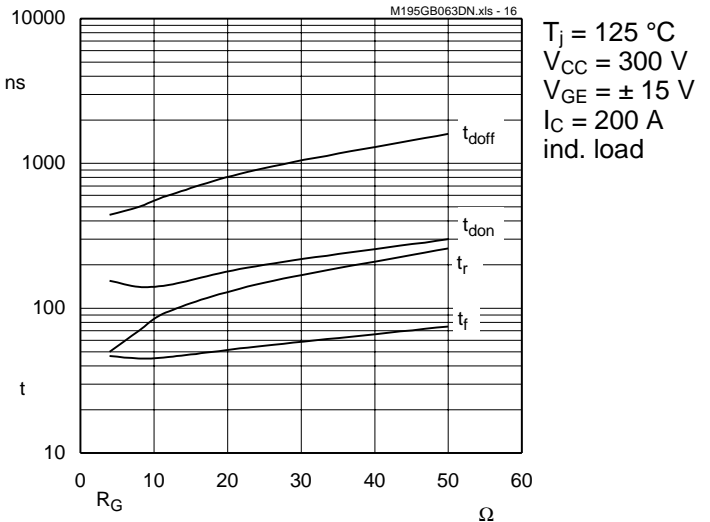


Fig. 16 Typ. switching times vs. gate resistor R_G

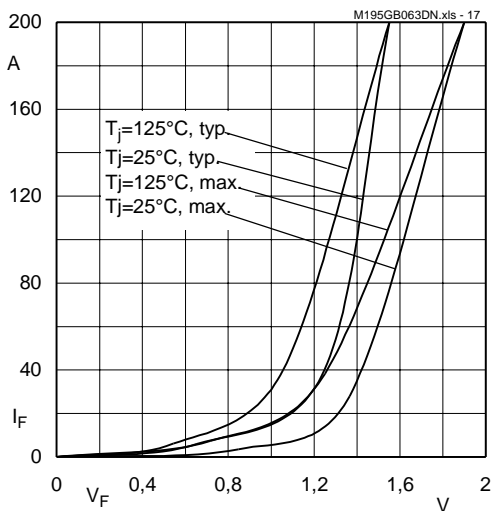


Fig. 17 Typ. CAL diode forward characteristic

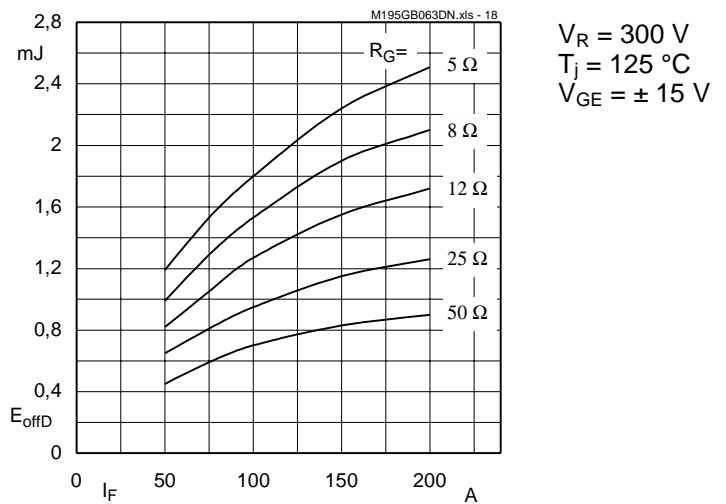


Fig. 18 Diode turn-off energy dissipation per pulse

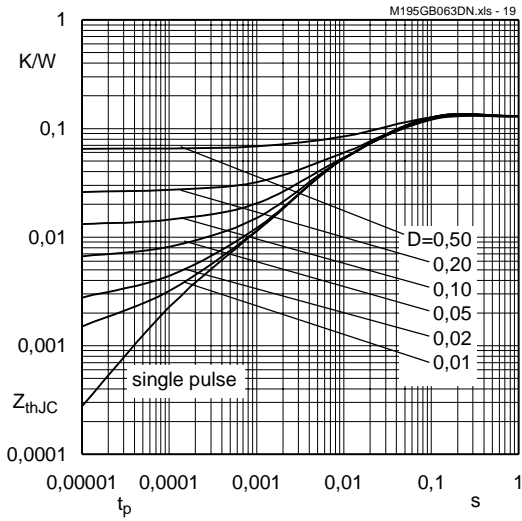


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

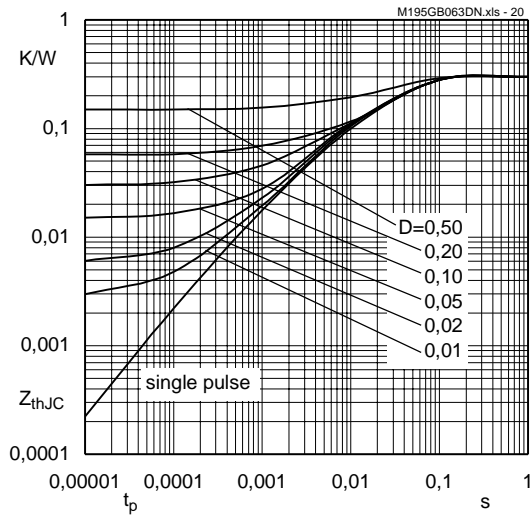


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

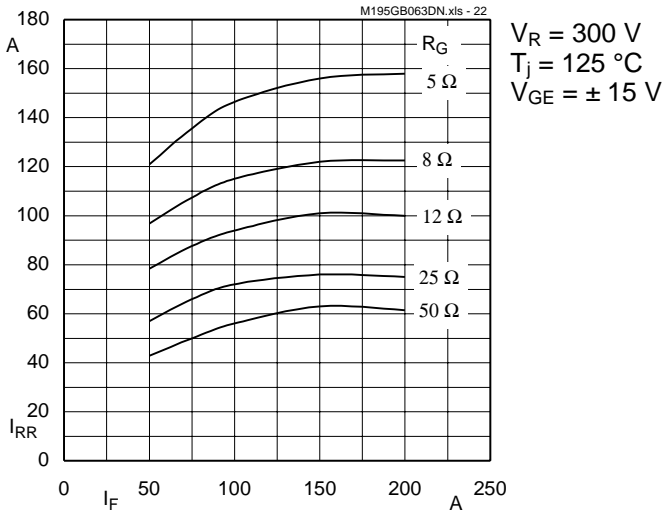


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

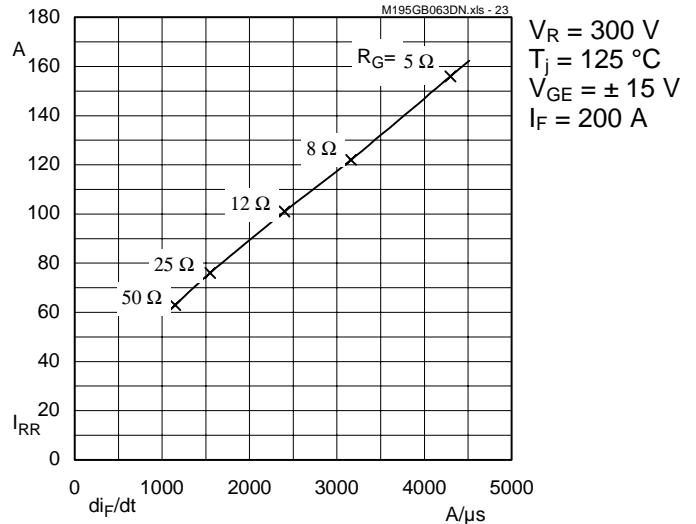


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

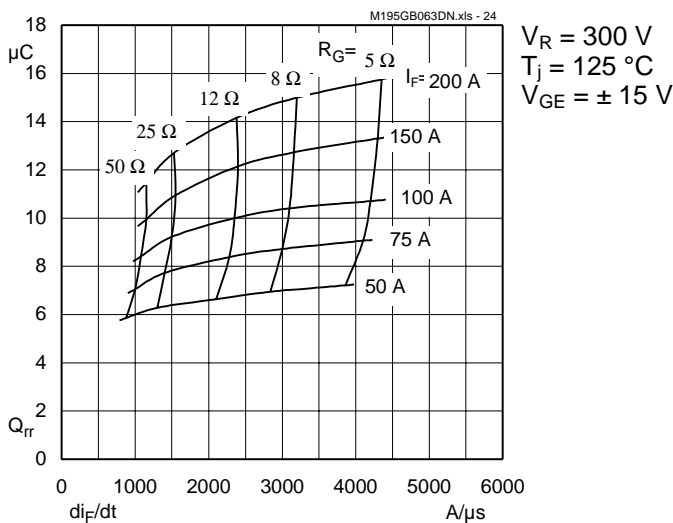


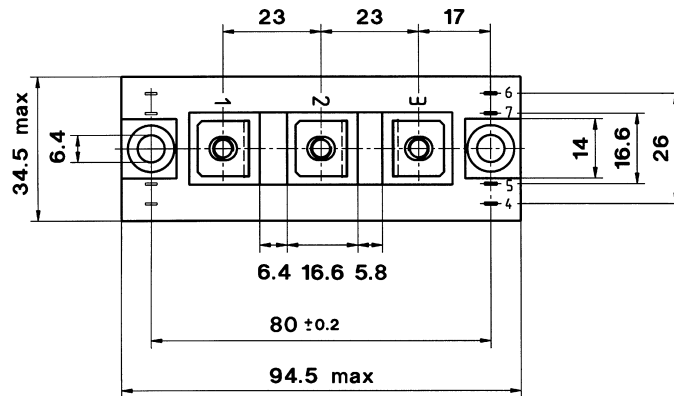
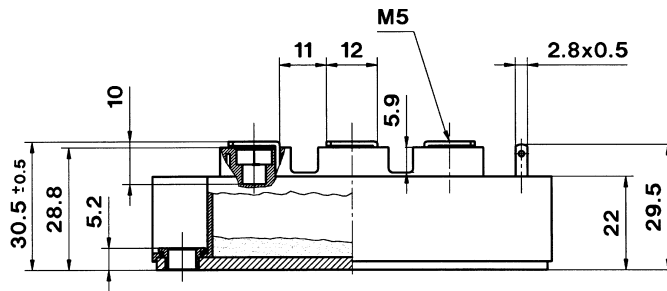
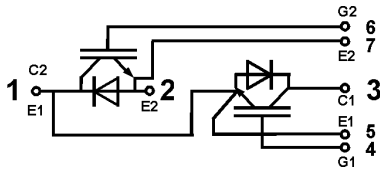
Fig. 24 Typ. CAL diode recovered charge

SEMITRANS 2N (low inductance)

Case D 93
 UL Recognized
 File no. E 63 532

CASED93

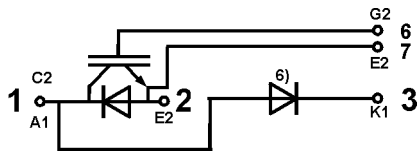
SKM 195 GB 063 DN



Dimensions in mm

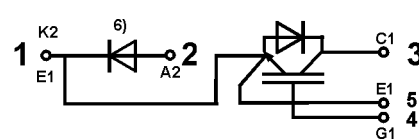
SKM 195 GAL 063 DN

Case D 94 (→ D 93)



SKM 195 GAR 063 DN

Case D 95 (→ D 93)



Case outline and circuit diagrams

Mechanical Data			Values			Units
Symbol	Conditions		min.	typ.	max.	
M ₁	to heatsink, SI Units to heatsink, US Units	(M6)	3 27	—	5 44	Nm lb.in.
M ₂	for terminals, SI Units for terminals, US Units	(M5)	2,5 22	—	5 44	Nm 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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