

Absolute Maximum Ratings		Values	Units
Symbol	Conditions <sup>1)</sup>		
$V_{CES}$		1200	V
$V_{CGR}$	$R_{GE} = 20 \text{ k}\Omega$	1200	V
$I_C$	$T_{case} = 25/80 \text{ }^\circ\text{C}$	260 / 180	A
$I_{CM}$	$T_{case} = 25/80 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	520 / 360	A
$V_{GES}$		$\pm 20$	V
$P_{tot}$	per IGBT, $T_{case} = 25 \text{ }^\circ\text{C}$	1040	W
$T_j, (T_{stg})$		-40 ... +150 (125)	$^\circ\text{C}$
$V_{isol}$	AC, 1 min.	2500	V
humidity	IEC 60721-3-3	class 3K7/IE32	
climate	IEC 68 T.1	40/125/56	
Inverse Diode and FWD of type „GAL“ <sup>6 8)</sup>			
$I_F = -I_C$	$T_{case} = 25/80 \text{ }^\circ\text{C}$	200 / 160	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	520 / 360	A
$I_{FSM}$	$t_p = 10 \text{ ms}; \text{sin.}; T_j = 150 \text{ }^\circ\text{C}$	1450	A
$I^2t$	$t_p = 10 \text{ ms}; T_j = 150 \text{ }^\circ\text{C}$	10 500	$\text{A}^2\text{s}$

Characteristics		min.	typ.	max.	Units
Symbol	Conditions <sup>1)</sup>				
$V_{(BR)CES}$	$V_{GE} = 0, I_C = 4 \text{ mA}$	$\geq V_{CES}$	-	-	V
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6 \text{ mA}$	4,5	5,5	6,5	V
$I_{CES}$	$V_{GE} = 0 \left. \begin{array}{l} T_j = 25 \text{ }^\circ\text{C} \\ T_j = 125 \text{ }^\circ\text{C} \end{array} \right\}$	-	0,2	0,4	mA
		-	12	-	mA
$I_{GES}$	$V_{GE} = 20 \text{ V}, V_{CE} = 0$	-	-	0,3	$\mu\text{A}$
$V_{CESat}$	$I_C = 150 \text{ A} \left\{ \begin{array}{l} V_{GE} = 15 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{array} \right\}$	-	2,1(2,4)	2,45(2,85)	V
$V_{CESat}$	$I_C = 200 \text{ A} \left\{ \begin{array}{l} V_{GE} = 15 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{array} \right\}$	-	2,5(3,0)	-	V
$g_{fs}$	$V_{CE} = 20 \text{ V}, I_C = 150 \text{ A}$	62	-	-	S
$C_{CHC}$	per IGBT	-	-	350	pF
$C_{ies}$	$V_{GE} = 0$	-	11	15	nF
$C_{oes}$	$V_{CE} = 25 \text{ V}$	-	1,6	2	nF
$C_{res}$	$f = 1 \text{ MHz}$	-	0,8	1	nF
$L_{CE}$		-	-	25	nH
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	-	70	-	ns
$t_r$	$V_{GE} = +15 \text{ V} / -15 \text{ V}^3)$	-	55	-	ns
$t_{d(off)}$	$I_C = 150 \text{ A}, \text{ind. load}$	-	490	-	ns
$t_f$	$R_{Gon} = R_{Goff} = 7 \Omega$	-	65	-	ns
$E_{on}$	$T_j = 125 \text{ }^\circ\text{C}$	-	26	-	mWs
$E_{off}$		-	23	-	mWs
Inverse Diode and FWD of type „GAL“ <sup>6 8)</sup>					
$V_F = V_{EC}$	$I_F = 150 \text{ A} \left\{ \begin{array}{l} V_{GE} = 0 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{array} \right\}$	-	2,0(1,8)	2,5	V
$V_F = V_{EC}$	$I_F = 200 \text{ A} \left\{ \begin{array}{l} V_{GE} = 0 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{array} \right\}$	-	2,25(2,05)	-	V
$V_{TO}$	$T_j = 125 \text{ }^\circ\text{C}^2)$	-	1,1	1,2	V
$r_t$	$T_j = 125 \text{ }^\circ\text{C}^2)$	-	-	7	$\text{m}\Omega$
$I_{RRM}$	$I_F = 150 \text{ A}; T_j = 125 \text{ }^\circ\text{C}^2)$	-	87	-	A
$Q_{rr}$	$I_F = 150 \text{ A}; T_j = 125 \text{ }^\circ\text{C}^2)$	-	19	-	$\mu\text{C}$
Thermal characteristics					
$R_{thjc}$	per IGBT	-	-	0,12	$^\circ\text{C}/\text{W}$
$R_{thjc}$	per diode	-	-	0,23	$^\circ\text{C}/\text{W}$
$R_{thch}$	per module	-	-	0,05	$^\circ\text{C}/\text{W}$

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

2)  $I_F = -I_C, V_R = 600 \text{ V}, -di_F/dt = 1500 \text{ A}/\mu\text{s}, V_{GE} = 0 \text{ V}$

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

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

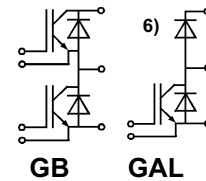
8) CAL = Controlled Axial Lifetime Technology

## SEMITRANS® M Low Loss IGBT Modules

### SKM 195 GB 124 DN SKM 195 GAL 124 DN



### SEMITRANS 2N (low inductance)



### Features

- 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  $6 * I_{cnom}$
- Fast & soft inverse CAL diodes <sup>8)</sup>
- Without hard mould
- Large clearance (10 mm) and creepage distances (20 mm)

### Typical Applications

- Switching (not for linear use)
- 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

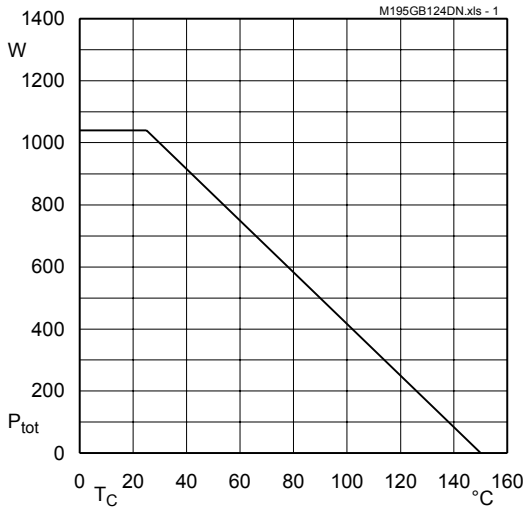


Fig. 1 Rated power dissipation  $P_{tot} = f(T_C)$

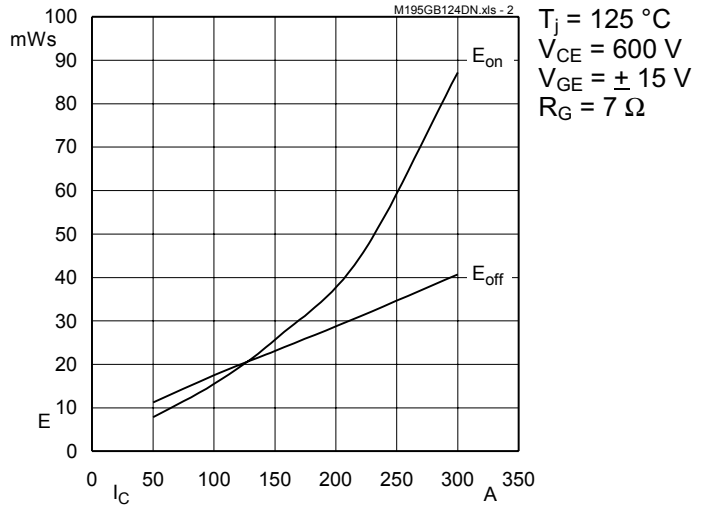


Fig. 2 Turn-on /-off energy  $= f(I_C)$

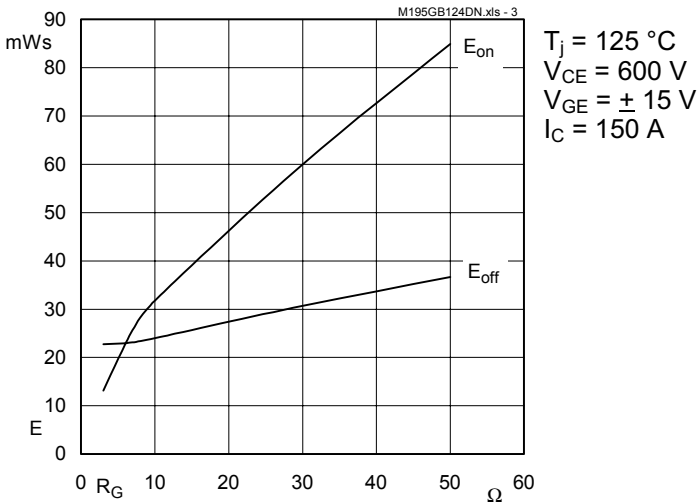


Fig. 3 Turn-on /-off energy  $= f(R_G)$

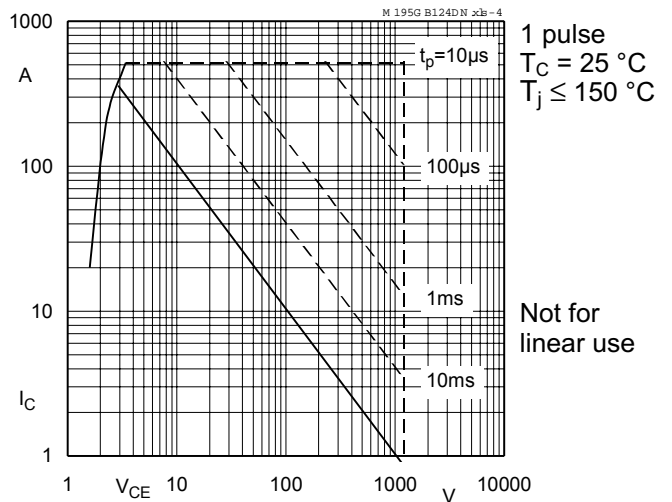


Fig. 4 Maximum safe operating area (SOA)  $I_C = f(V_{CE})$

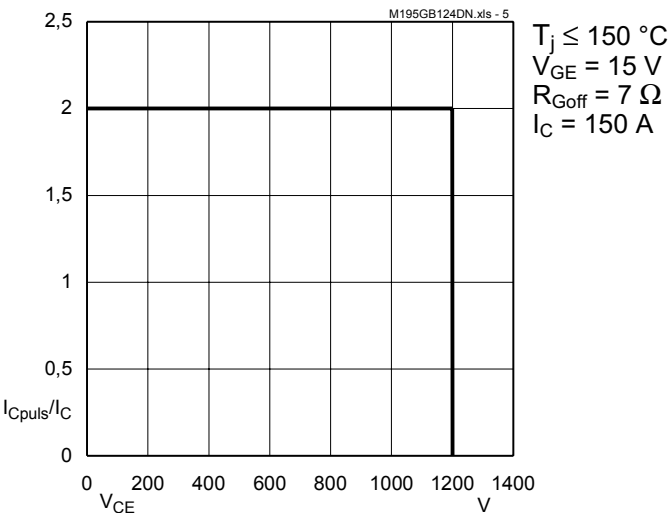


Fig. 5 Turn-off safe operating area (RBSOA)

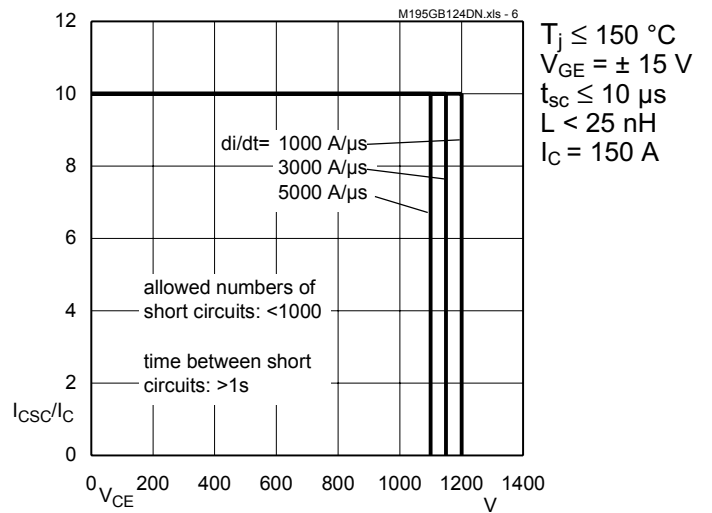


Fig. 6 Safe operating area at short circuit  $I_C = f(V_{CE})$

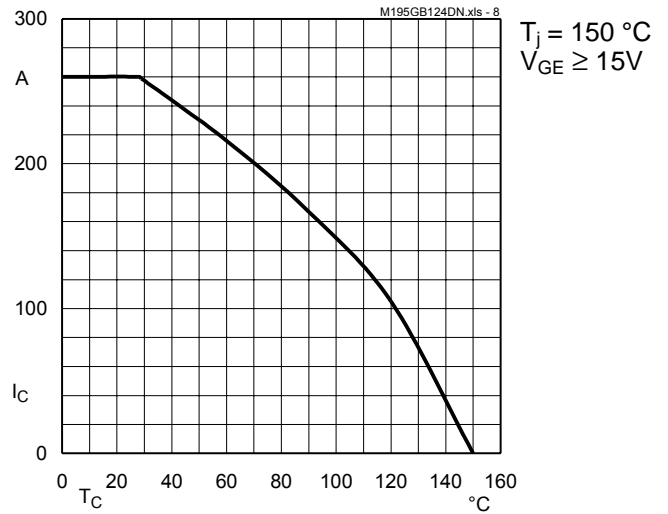


Fig. 8 Rated current vs. temperature  $I_C = f(T_C)$

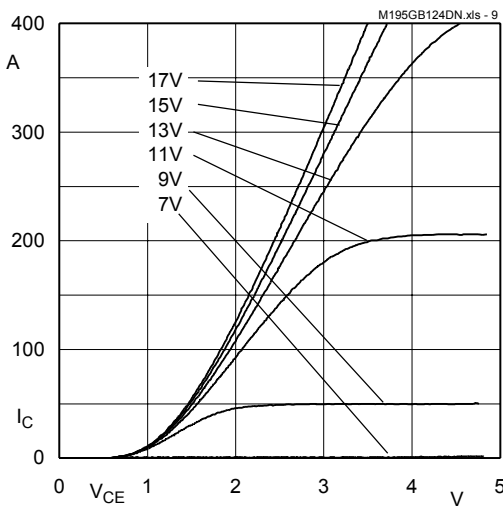


Fig. 9 Typ. output characteristic,  $t_p = 80 \mu s$ ;  $25 \text{ }^\circ\text{C}$

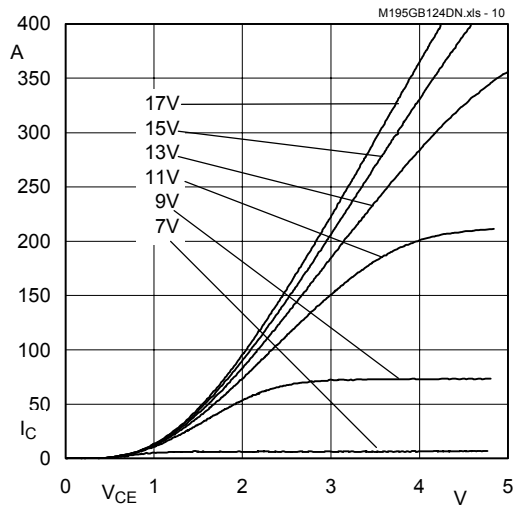


Fig. 10 Typ. output characteristic,  $t_p = 80 \mu s$ ;  $125 \text{ }^\circ\text{C}$

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

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

$$V_{CE(TO)(T_j)} \leq 1,29 + 0,0001 (T_j - 25) \text{ [V]}$$

$$\text{typ.: } r_{CE(T_j)} = 0,0061 + 0,000022 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{CE(T_j)} = 0,0077 + 0,000022 (T_j - 25) \text{ [\Omega]}$$

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

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

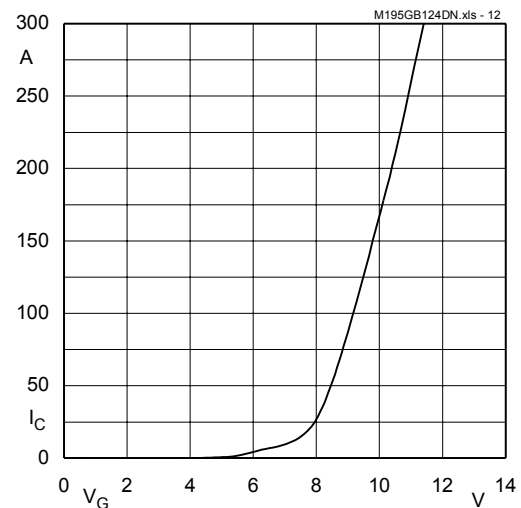


Fig. 12 Typ. transfer characteristic,  $t_p = 80 \mu s$ ;  $V_{CE} = 20 \text{ V}$

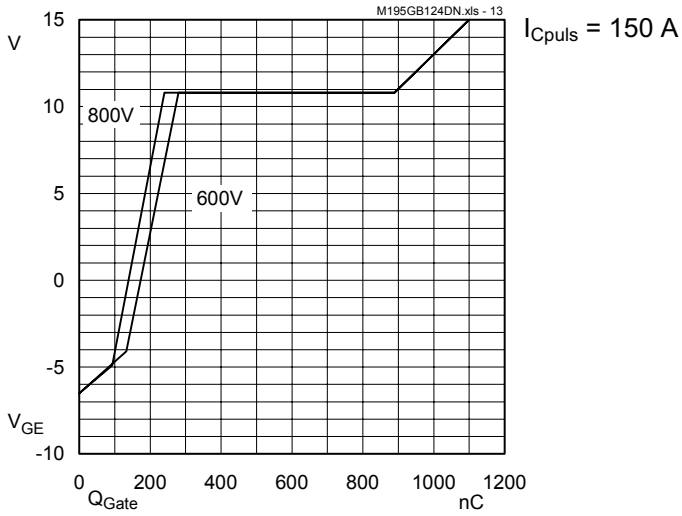


Fig. 13 Typ. gate charge characteristic

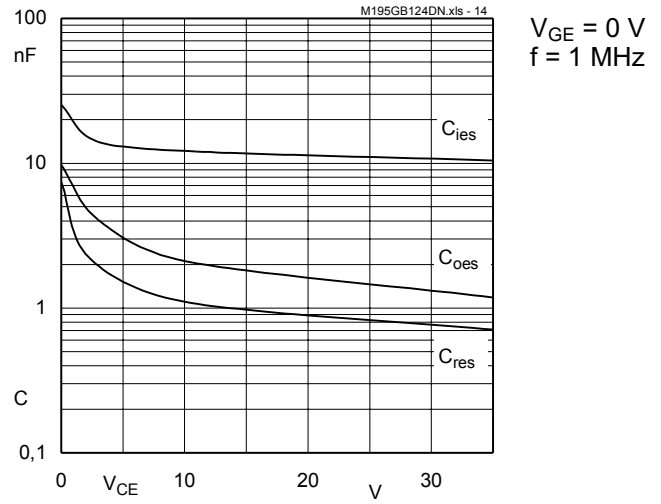


Fig. 14 Typ. capacitances vs.  $V_{CE}$

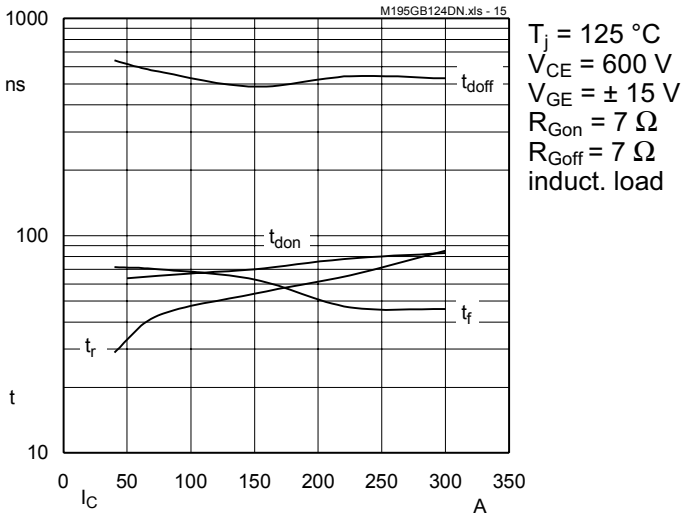


Fig. 15 Typ. switching times vs.  $I_C$

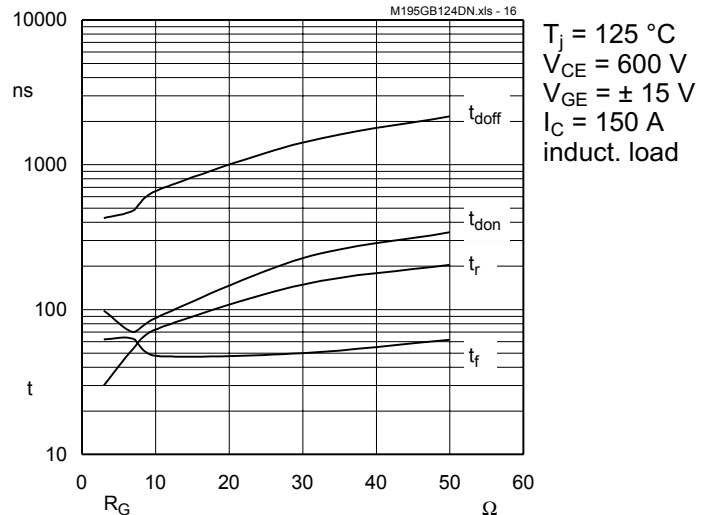


Fig. 16 Typ. switching times vs. gate resistor  $R_G$

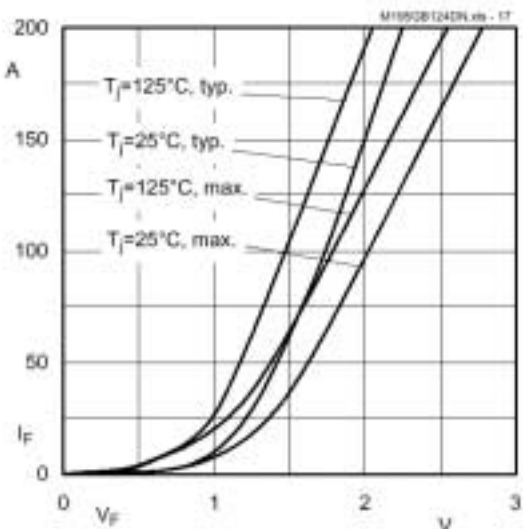


Fig. 17 Typ. CAL diode forward characteristic

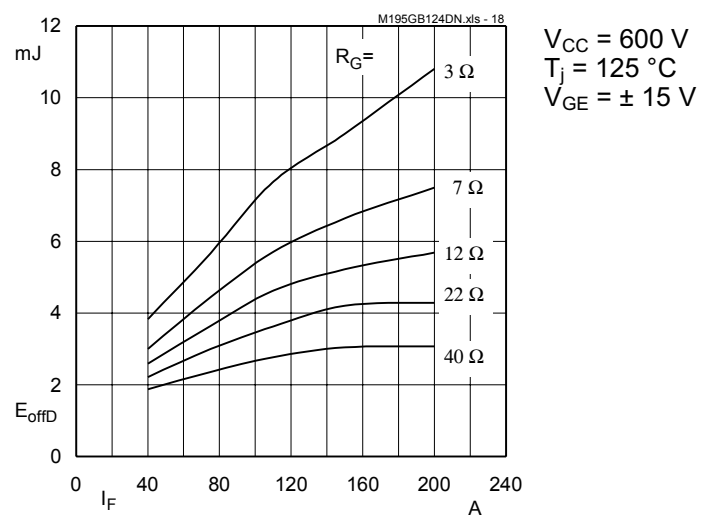


Fig. 18 Diode turn-off energy dissipation per pulse

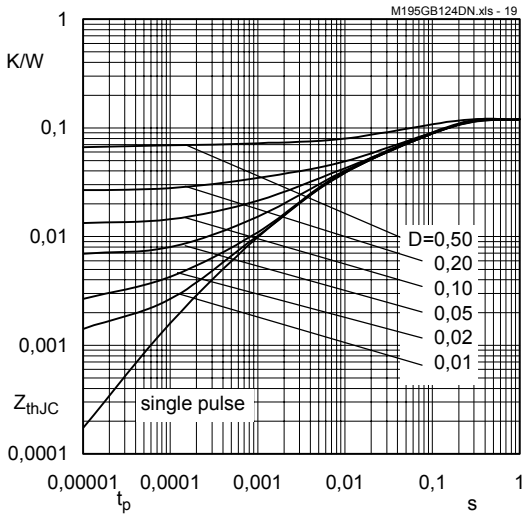


Fig. 19 Transient thermal impedance of IGBT  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

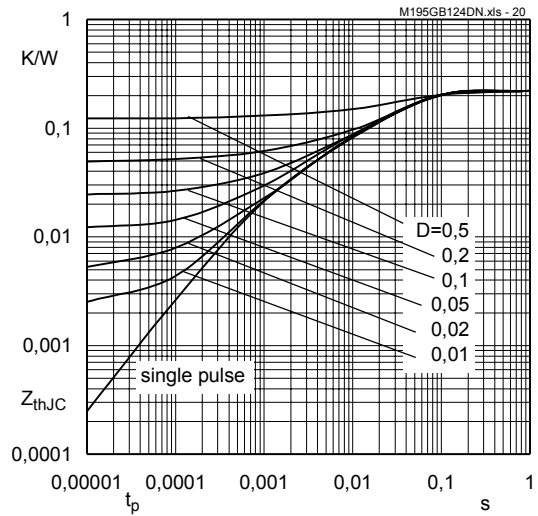
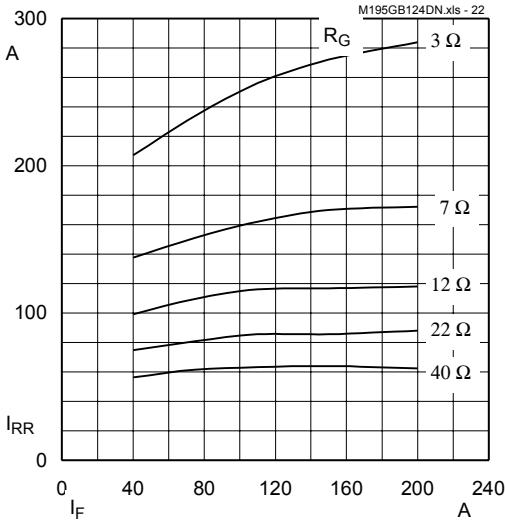
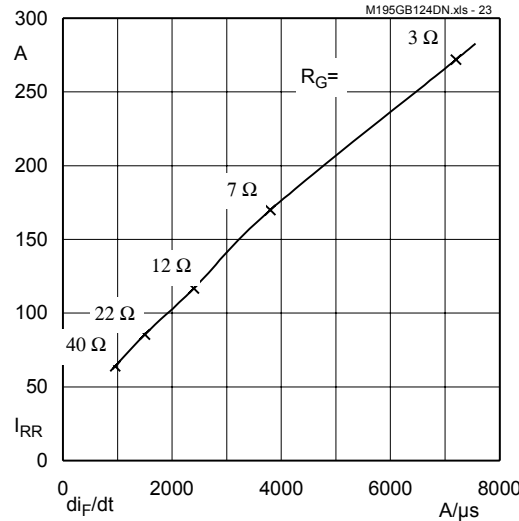


Fig. 20 Transient thermal impedance of inverse CAL diodes  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$



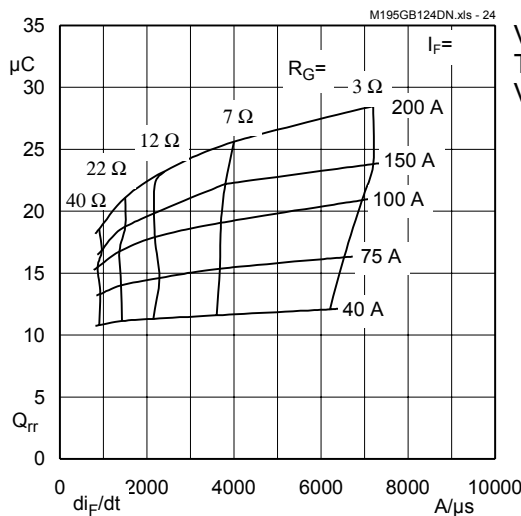
$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$

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



$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_F = 150 \text{ A}$

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



$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$

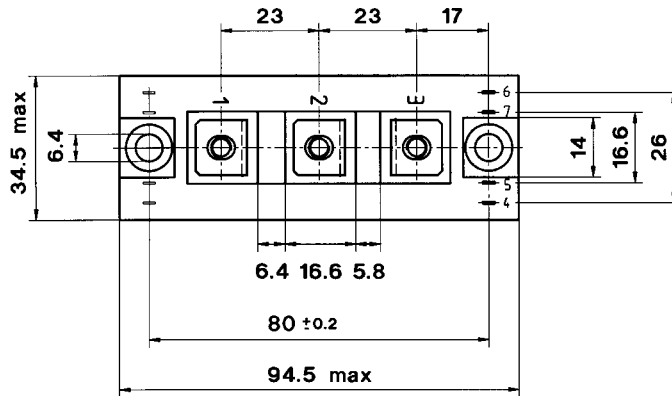
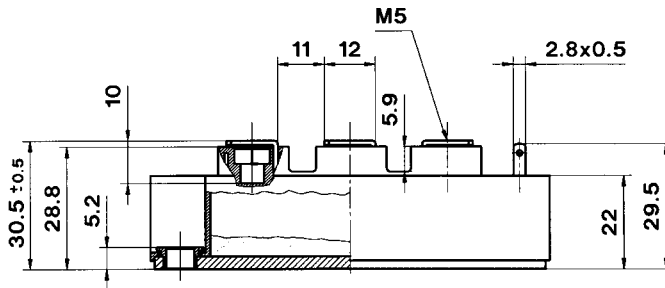
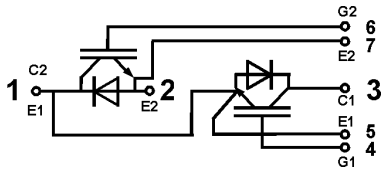
Fig. 24 Typ. CAL diode recovered charge

**SEMITRANS 2N (low inductance)**

Case D 93  
 UL Recognized  
 File no. E 63 532

CASED93

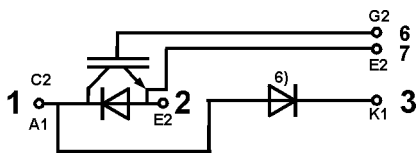
**SKM 195 GB 124 DN**



Dimensions in mm

**SKM 195 GAL 124 DN**

Case D 94 ( → D 93)



Case outline and circuit diagrams

Mechanical Data			Values			Units
Symbol	Conditions		min.	typ.	max.	
M <sub>1</sub>	to heatsink, SI Units to heatsink, US Units	(M6)	3 27	—	5 44	Nm lb.in.
M <sub>2</sub>	for terminals, SI Units for terminals, US Units	(M5)	2,5 22	—	5 44	Nm lb.in.
a			—	—	5x9,81	m/s <sup>2</sup>
w			—	—	160	g

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

Twenty devices are supplied in one SEMIBOX D 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

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.