

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V _{CES}		1200	V
V _{CGR}	R _{GE} = 20 kΩ	1200	V
I _C	T _{case} = 25/80 °C	190 / 130	A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	380 / 260	A
V _{GES}		± 20	V
P _{tot}	per IGBT, T _{case} = 25 °C	780	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“ ⁽⁶⁾⁸⁾			
I _F = -I _C	T _{case} = 25/80 °C	120 / 95	A
I _{FM} = -I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	380 / 260	A
I _{FSM}	t _p = 10 ms; sin.; T _j = 150 °C	1100	A
I ² t	t _p = 10 ms; T _j = 150 °C	6000	A ² s

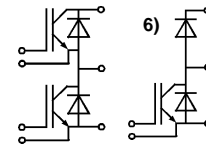
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
V _{(BR)CES}	V _{GE} = 0, I _C = 4 mA	≥ V _{CES}	-	-	V
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 4 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _j = 25 °C	-	0,2	0,4	mA
	V _{CE} = V _{CES} } T _j = 125 °C	-	9	-	mA
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	-	-	0,3	μA
V _{CESat}	I _C = 100 A } V _{GE} = 15 V;	-	2,1(2,4)	2,45(2,85)	V
V _{CESat}	I _C = 150 A } 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	-	6,5	8,5	nF
C _{oes}	V _{CE} = 25 V	-	1000	1500	pF
C _{res}	f = 1 MHz	-	500	600	pF
L _{CE}		-	-	25	nH
t _{d(on)}	V _{CC} = 600 V	-	110	-	ns
t _r	V _{GE} = -15 V / +15 V ³⁾	-	50	-	ns
t _{d(off)}	I _C = 100 A, ind. load	-	470	-	ns
t _f	R _{Gon} = R _{Goff} = 8 Ω	-	60	-	ns
E _{on} ⁵⁾	T _j = 125 °C	-	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;	-	2,0(1,8)	2,5	V
V _F = V _{EC}	I _F = 150 A } 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 _R RM	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	-	-	0,16	°C/W
R _{thjc}	per diode	-	-	0,32	°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



SEMITRANS 2N (low inductance)



GB GAL

Features

- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- High short circuit capability, self limiting to 6 * I_{cnom}
- 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
- DC servo and robot drives
- Inverters
- DC choppers
- AC motor speed control
- UPS Uninterruptable power supplies
- General power switching applications

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

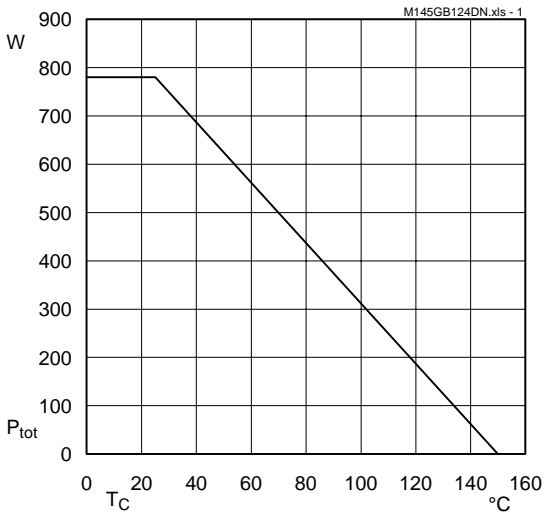
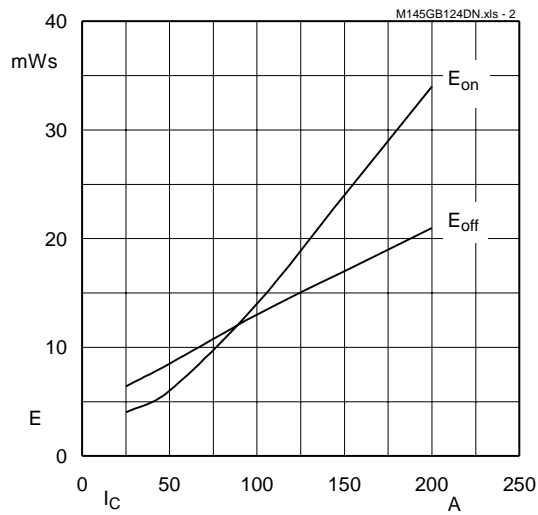
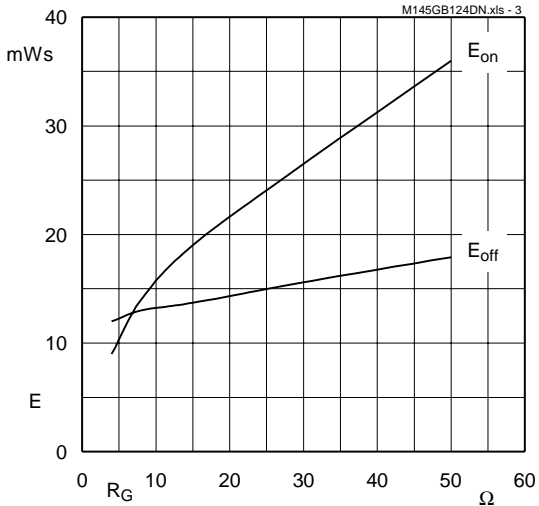


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



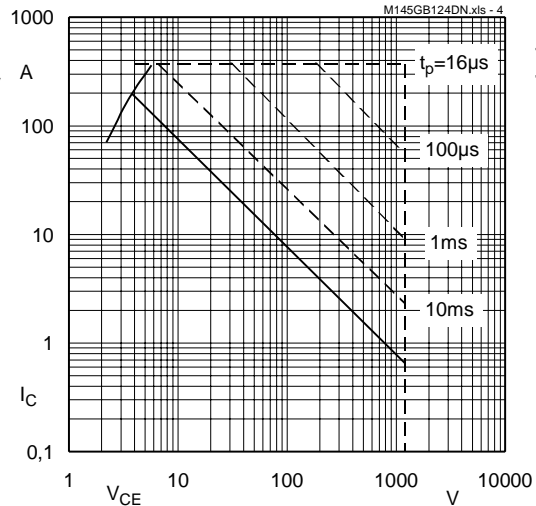
$T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_G = 8\text{ }\Omega$

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



$T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_C = 100\text{ A}$

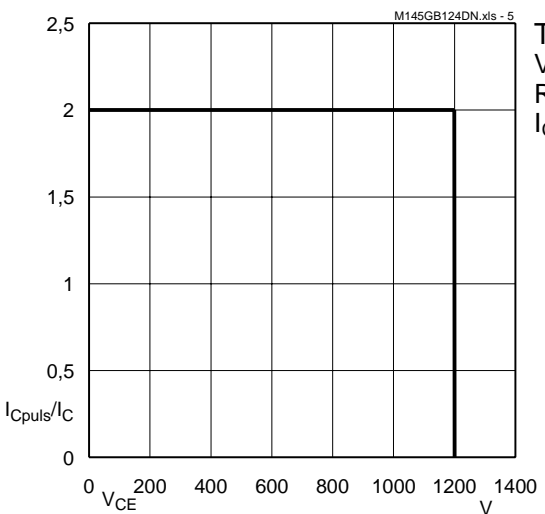
Fig. 3 Turn-on /-off energy $= f(R_G)$



1 pulse
 $T_C = 25\text{ }^\circ\text{C}$
 $T_j \leq 150\text{ }^\circ\text{C}$

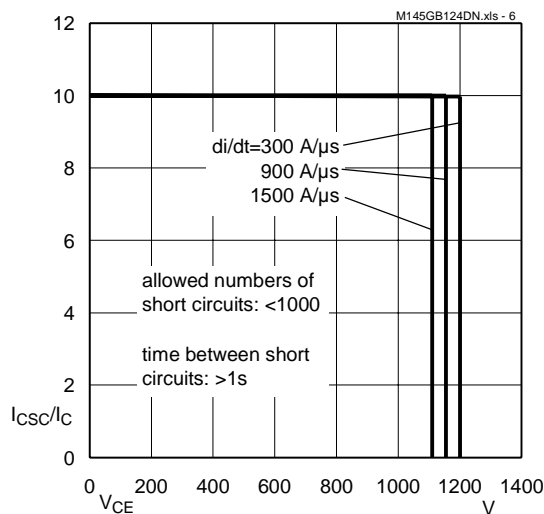
Not for linear use

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



$T_j \leq 150\text{ }^\circ\text{C}$
 $V_{GE} = 15\text{ V}$
 $R_{Goff} = 8\text{ }\Omega$
 $I_C = 100\text{ A}$

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



$T_j \leq 150\text{ }^\circ\text{C}$
 $V_{GE} = \pm 15\text{ V}$
 $t_{sc} \leq 10\text{ }\mu\text{s}$
 $L < 25\text{ nH}$
 $I_C = 100\text{ A}$

allowed numbers of short circuits: <1000
 time between short circuits: >1s

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

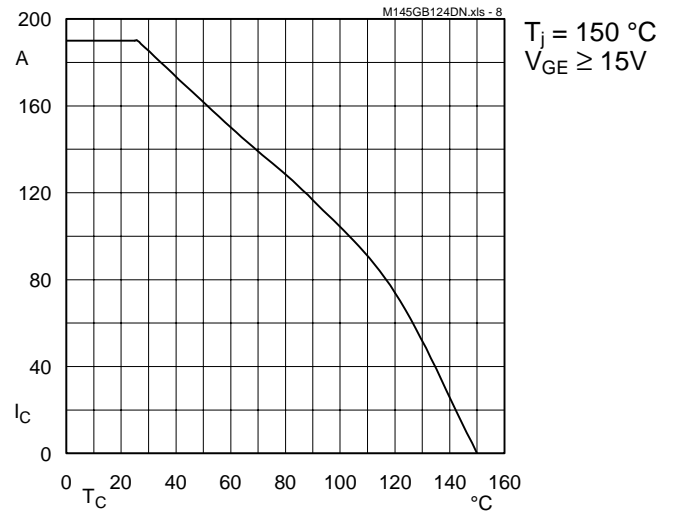


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

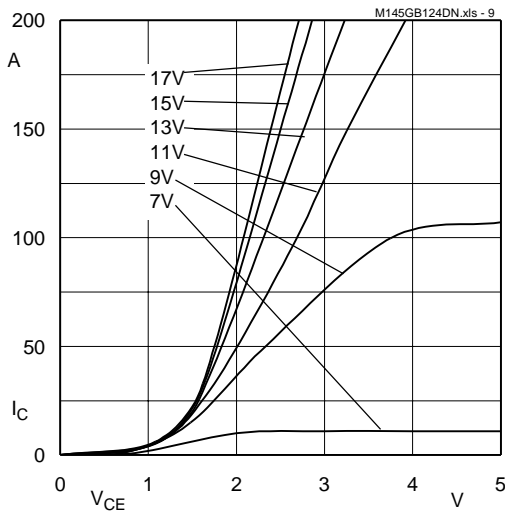


Fig. 9 Typ. output characteristic, $t_p = 80 \mu s$; $25 \text{ }^\circ\text{C}$

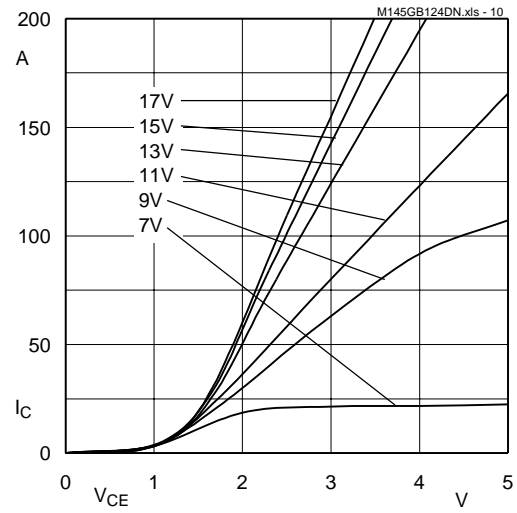


Fig. 10 Typ. output characteristic, $t_p = 80 \mu s$; $125 \text{ }^\circ\text{C}$

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

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

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

$$\text{typ.: } r_{\text{CE(Tj)}} = 0,008 + 0,000025 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{\text{CE(Tj)}} = 0,012 + 0,000035 (T_j - 25) \text{ [\Omega]}$$

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

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

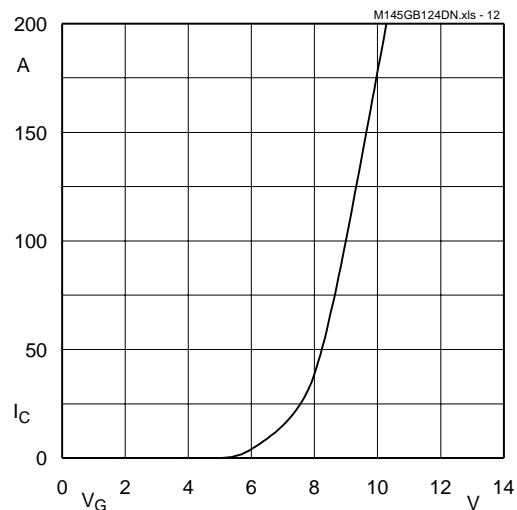


Fig. 12 Typ. transfer characteristic, $t_p = 80 \mu s$; $V_{\text{CE}} = 20 \text{ V}$

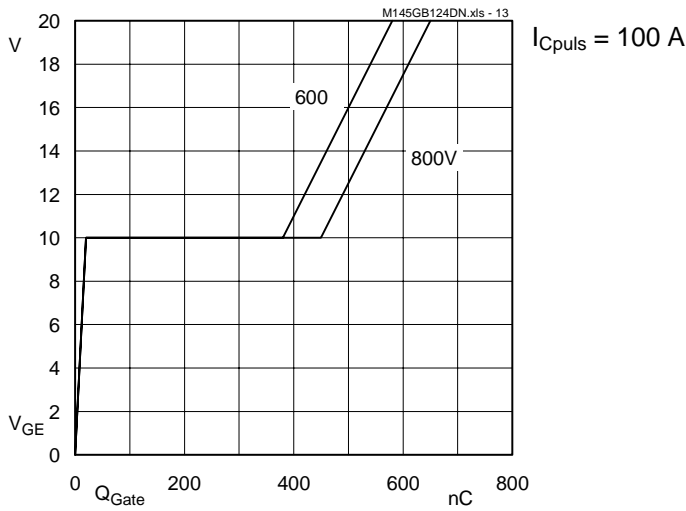


Fig. 13 Typ. gate charge characteristic

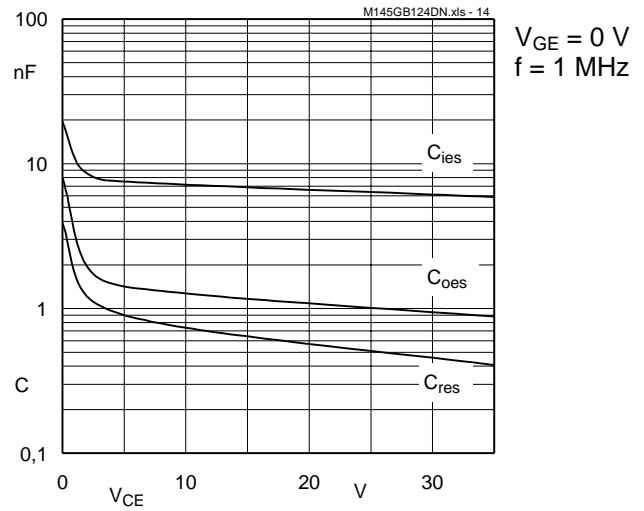


Fig. 14 Typ. capacitances vs. V_{CE}

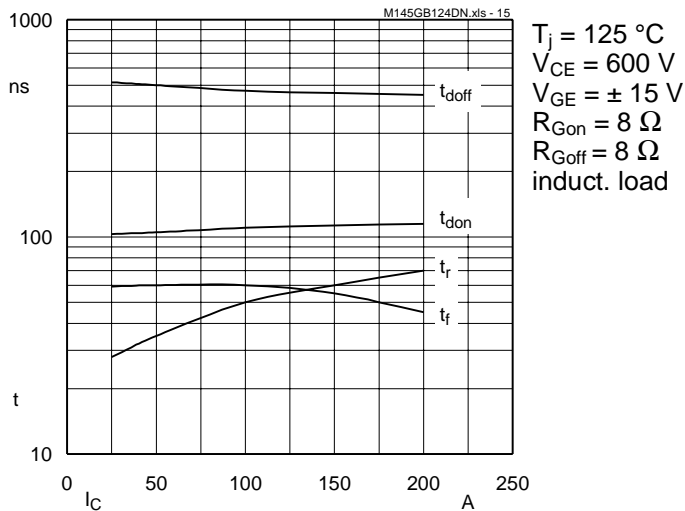


Fig. 15 Typ. switching times vs. I_C

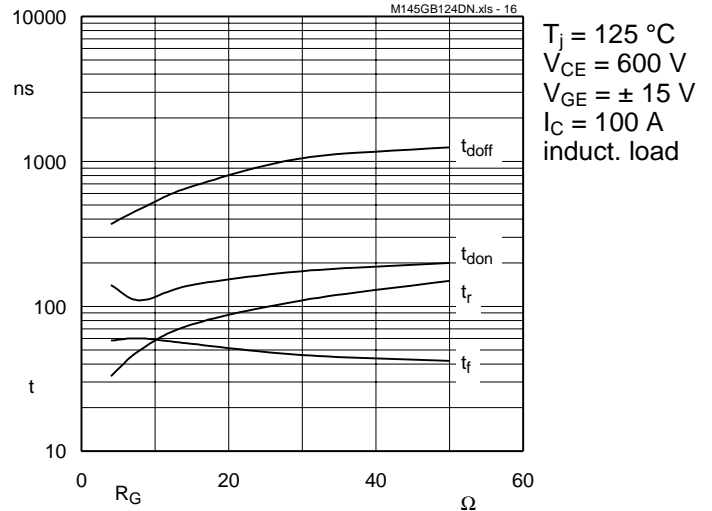


Fig. 16 Typ. switching times vs. gate resistor R_G

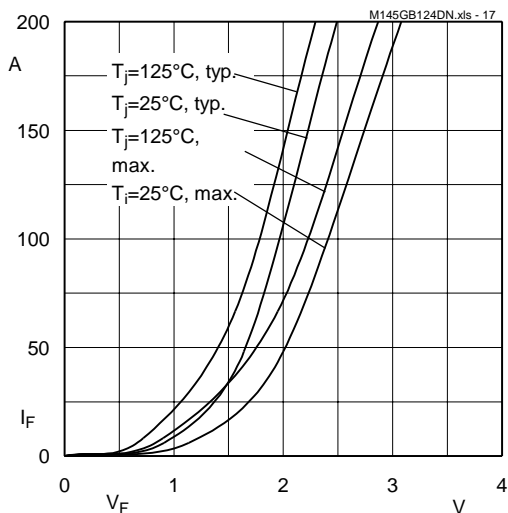


Fig. 17 Typ. CAL diode forward characteristic

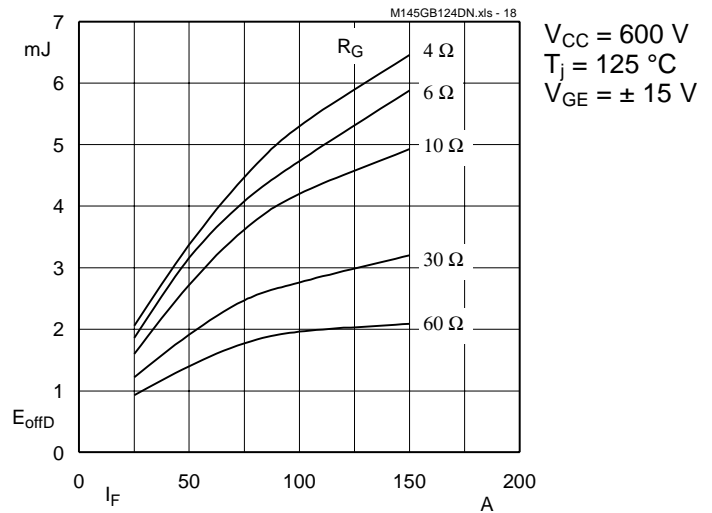


Fig. 18 Diode turn-off energy dissipation per pulse

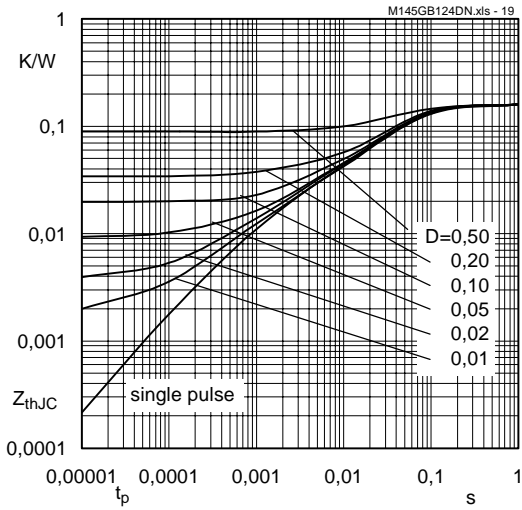


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

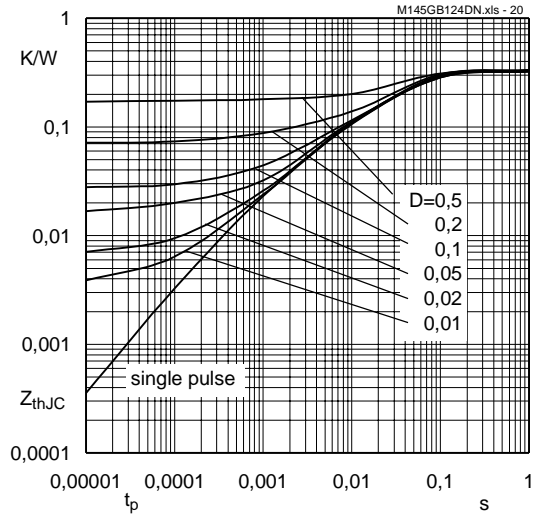


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

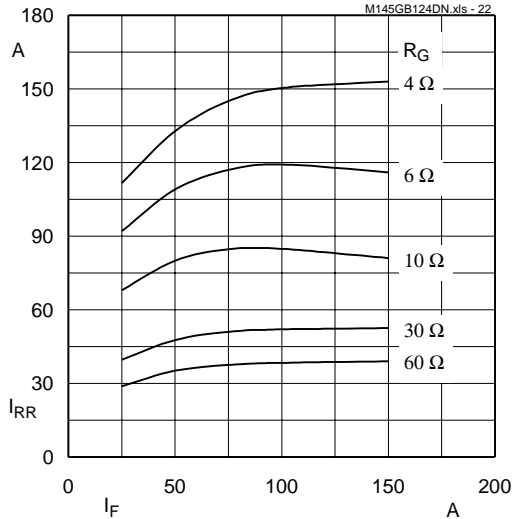


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

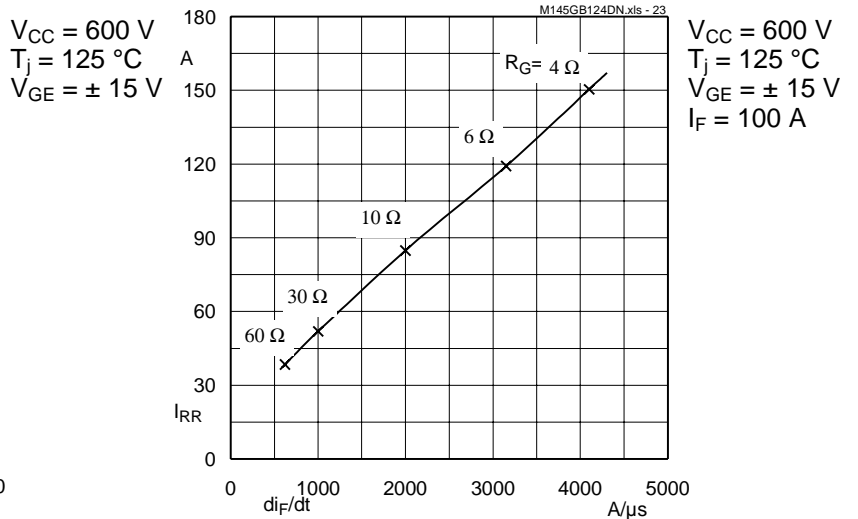


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

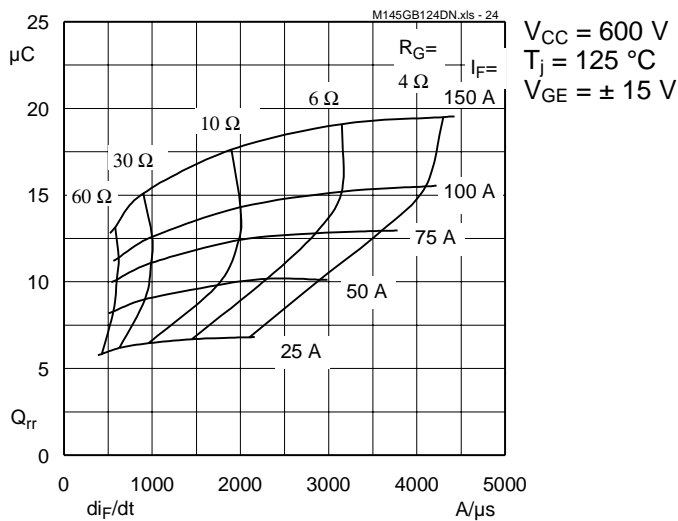


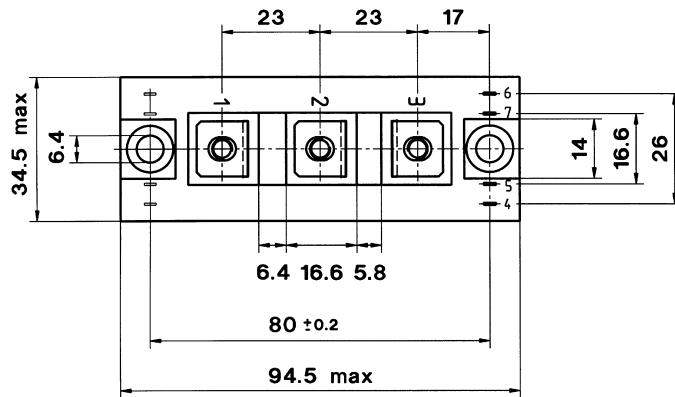
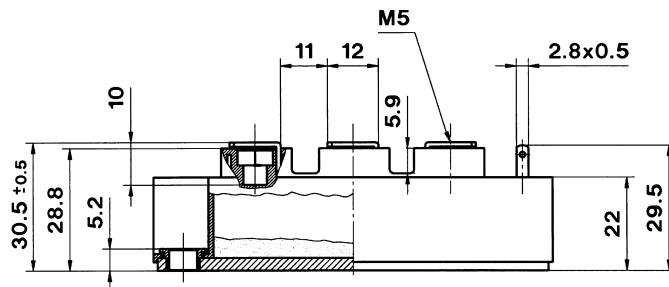
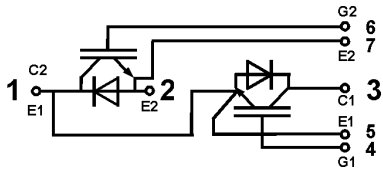
Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

SEMITRANS 2N (low inductance)

Case D 93
 UL Recognized
 File no. E 63 532

CASED93

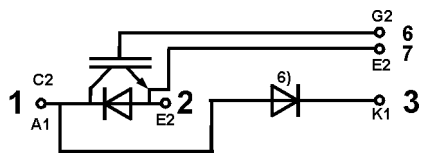
SKM 145 GB 124 DN



Dimensions in mm

SKM 145 GAL 124 DN

Case D 94 (→ D 93)



Case outline and circuit diagrams

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