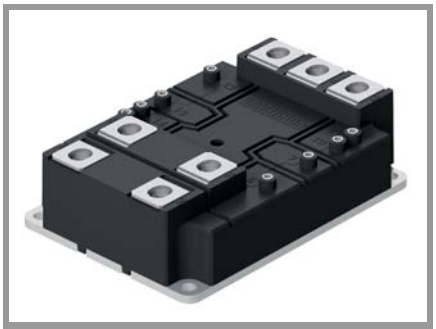
SKM1700MB20R4S2I4



SEMITRANS® 20

SiC MOSFET Module

SKM1700MB20R4S2I4

Features*

- Full Silicon Carbide (SiC) power module
- 4th generation SiC MOSFETs
- Optimized for fast switching and lowest power losses
- Insulated copper baseplate using DBC (Direct Bonded Copper) substrate
- Improved thermal performance with Silicon Nitride (Si_3N_4) ceramic
- UL recognized, file no. E63532

Typical Applications

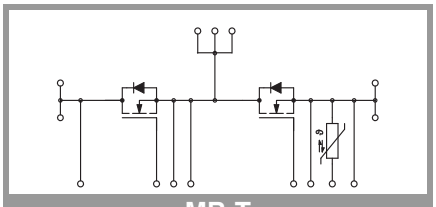
- High frequency power supplies
- AC inverters

Remarks

- Case temperature limited to T_c= 125 °C max.
- Recommended T_{jop}= -40 …+ 150 °C
- Recommended turn-off / turn-on gate voltage V_{GS} = -2 V/+18 V

Footnotes

[1] max DC current limited by terminals to 1000A



MB-T

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
MOSFET				
V_{DSS}	T_j = 25 °C		2000	V
I_D	T_j = 175 °C	T_c = 25 °C	1585 [1]	A
		T_c = 80 °C	1261 [1]	A
I_{DM}	P_W ≤ 10µs, Duty cycle ≤ 1%		4480	A
V_{GS}	Transient Gate - Source voltage (t < 300ns)		-5 ... 23	V
T_j			-40 ... 175	°C
Integrated body diode				
I_{SM}	P_W ≤ 1.5 µs, Duty cycle ≤ 5%		1658	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		6100	A

Absolute Maximum Ratings			
Symbol	**Conditions**	**Values**	**Unit**
Module			
$I_{t(RMS)}$		1000	A
T_{stg}	module without TIM	-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min	4000	V

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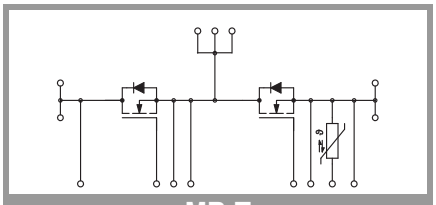


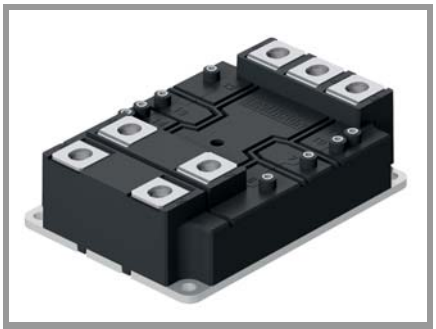
MB-T

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
MOSFET						
$V_{GS(th)}$	V_{DS} = 10 V, I_D = 1120 mA		3	4	5	V
I_{DSS}	V_{GS} = 0 V, V_{DS} = 2000 V, T_j = 25 °C				11.2	mA
I_{GSS}	V_{GS} = 21 V, V_{DS} = 0 V				400	nA
$R_{DS(on)}$	V_{GS} = 18 V, I_D = 924 A, chiplevel	T_j = 25 °C		0.79	1.04	mΩ
		T_j = 150 °C		2.00		mΩ
C_{iss}	V_{GS} = 0 V, V_{DS} = 1500 V, f = 0.1 MHz	T_j = 25 °C		183.4		nF
C_{oss}		T_j = 25 °C		3.28		nF
C_{rss}		T_j = 25 °C		0.14		nF
R_{Gint}	T_j = 25 °C			0.6		Ω
Q_G	V_{GS} = 18 V/-2 V, V_{DS} = 1500 V, I_D = 924 A			7196		nC
$t_{d(on)}$	V_{DD} = 1300 V, I_D = 1000 A, V_{GS} = -2 / +18 V, R_{Gon} = 0.75 Ω, R_{Goff} = 1.3 Ω, di/dt_{on} = 26 kA/µs, di/dt_{off} = 18 kA/µs, dv/dt_{on} = 41 kV/µs, dv/dt_{off} = 13 kV/µs, L_s = 18 nH	T_j = 150 °C		203		ns
t_r		T_j = 150 °C		53		ns
$t_{d(off)}$		T_j = 150 °C		811		ns
t_f		T_j = 150 °C		68		ns
E_{on}		T_j = 150 °C		77		mJ
E_{off}		T_j = 150 °C		108		mJ
$R_{th(j-c)}$	per MOSFET				0.019	K/W
$R_{th(c-s)}$	per MOSFET, P12 (reference)			0.006		K/W
$R_{th(c-s)}$	per MOSFET, HP-PCM			0.004		K/W
Integrated body diode						
$V_F = V_{SD}$	$-I_D$ = 924 A, V_{GS} = -2 V, chiplevel	T_j = 25 °C		3.80		V
		T_j = 150 °C		4.00		V
V_{F0}	chiplevel	T_j = 25 °C		2.25		V
		T_j = 150 °C		2.29		V
r_F	chiplevel	T_j = 25 °C		1.68		mΩ
		T_j = 150 °C		1.85		mΩ
t_{rr}	V_{DD} = 1300 V, $-I_D$ = 1000 A, V_{GS} = -2 V, R_{Gon} = 0.75 Ω	T_j = 150 °C		50		ns
Q_{rr}		T_j = 150 °C		13.2		µC
I_{rr}		T_j = 150 °C		475		A
E_{rr}		T_j = 150 °C		9.7		mJ

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Module						
L_{DS}	Between D_1 (main) and S_2 (main			10	12	nH
$R_{DD'+SS'}$	measured per switch, $R_{D\ AUX\ D'}$ + $R_{S\ AUX\ S'}$	T_C = 25 °C		0.258		mΩ
		T_C = 125 °C		0.387		mΩ
$R_{th(c-s)1}$	per switch			0.003		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, P12 (reference)			0.0049		K/W
$R_{th(c-s)}$	including thermal coupling, T_s underneath module, HP-PCM			0.0033		K/W
M_s	to heat sink M6		4		6	Nm
M_t		to terminals M3	0.9		1.1	Nm
		to terminals M8	9		11	Nm
w				1200		g



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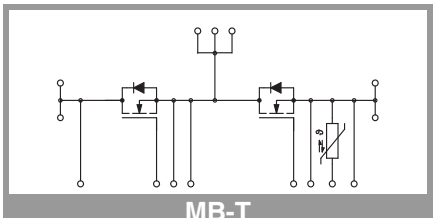
Footnotes

[1)] max DC current limited by terminals to 1000A

Characteristics					
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
Temperature Sensor					
R_{100}	T_c=100°C		493.3 ± 5%		Ω
$B_{25/100}$	$R_{(T)}=R_{100}*\exp[B_{25/100}*(1/T-1/T_{100})]$, T[K];		3480 ± 1%		K



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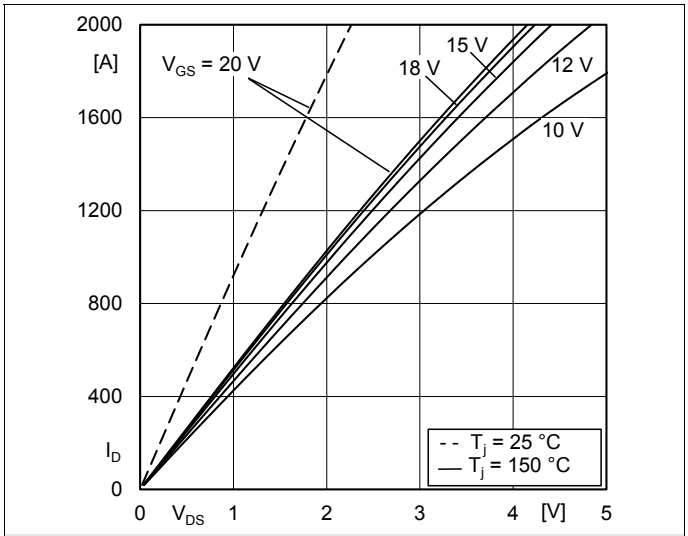


Fig.1: Typ. MOSFET forward output characteristic, incl. $R_{DD'+SS'}$

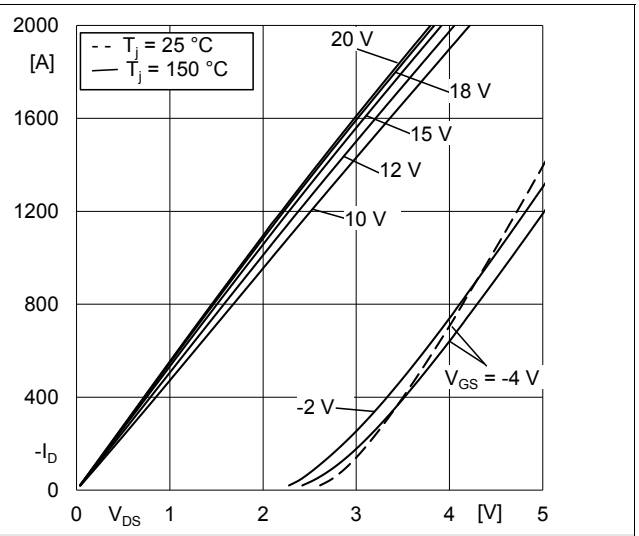


Fig. 1a: Typ. MOSFET reverse output characteristics, incl. $R_{DD'+SS'}$

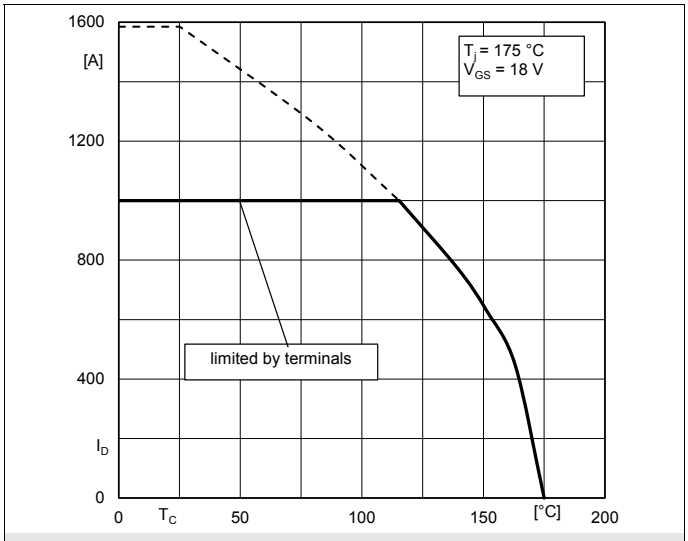


Fig. 2: MOSFET rated current vs. Temperature $I_D=f(T_c)$

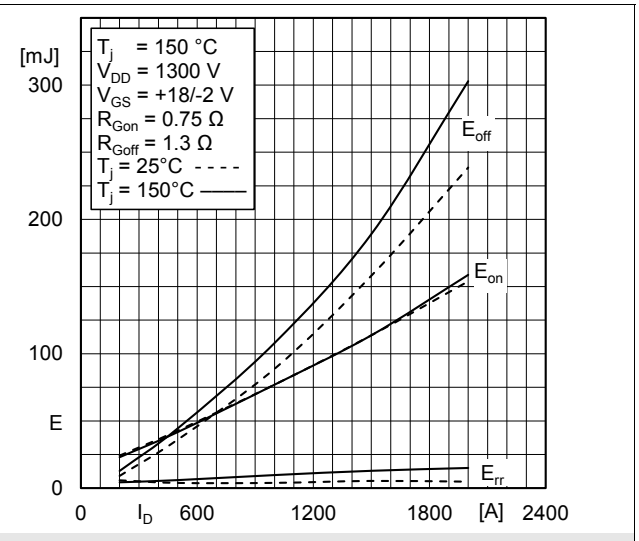


Fig. 3: Typ. MOSFET switching energy E = f (I_D)

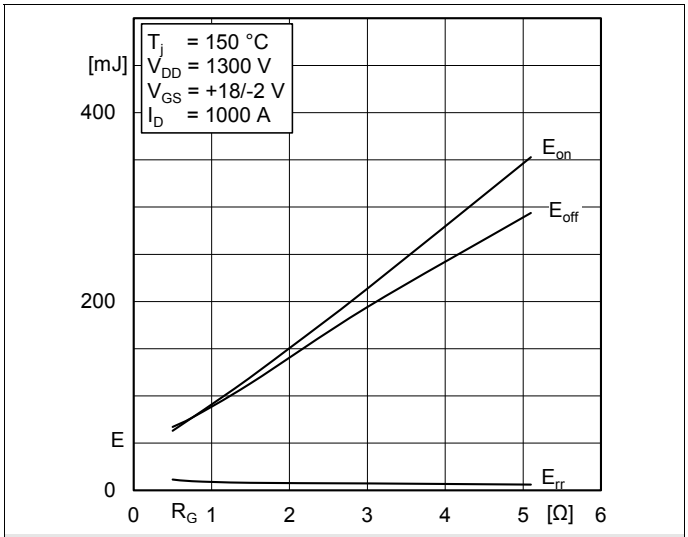


Fig. 4: Typ. MOSFET switching energy E = f (R_G)

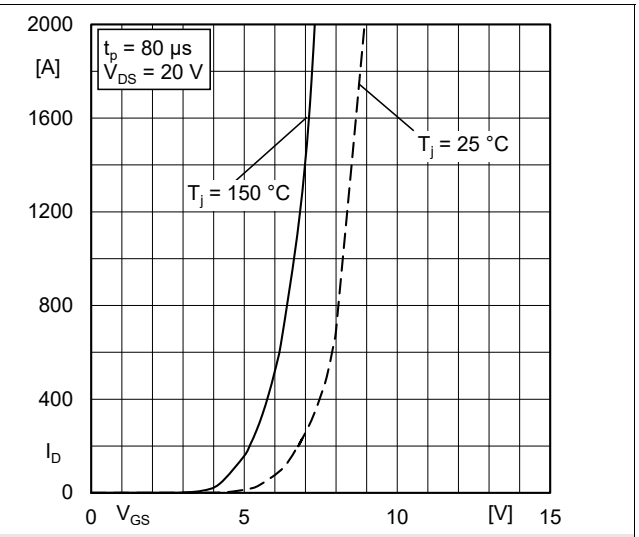


Fig. 5: Typ. MOSFET transfer characteristic

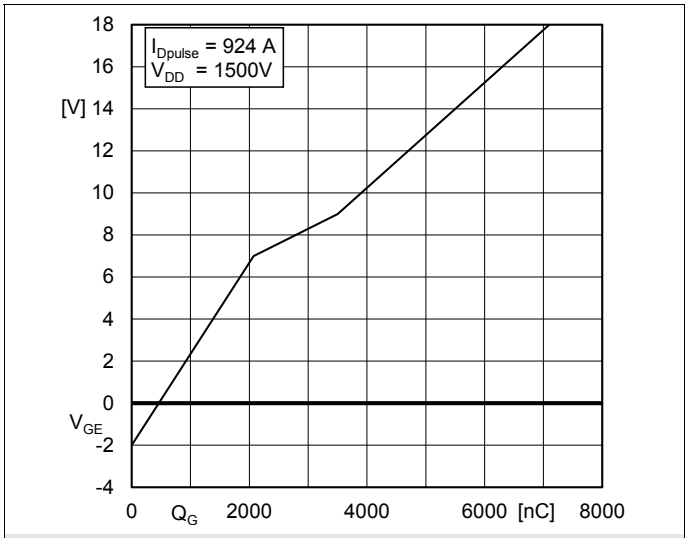


Fig. 6: Typ. MOSFET gate charge characteristic

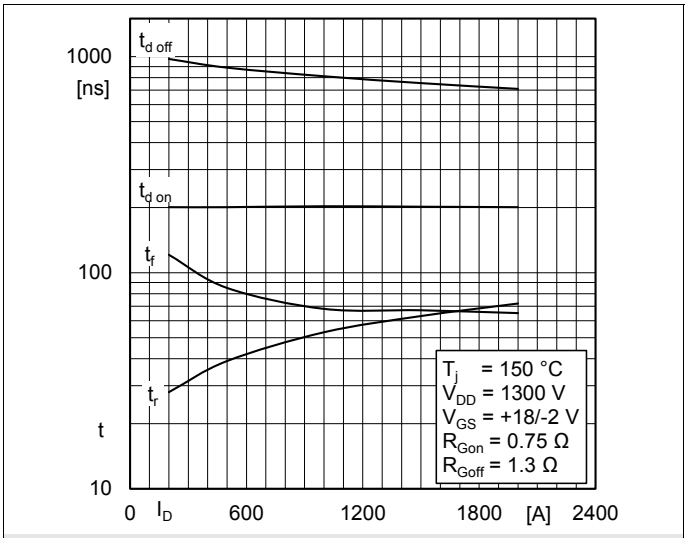


Fig. 7: Typ. MOSFET switching times t = f (I_D)

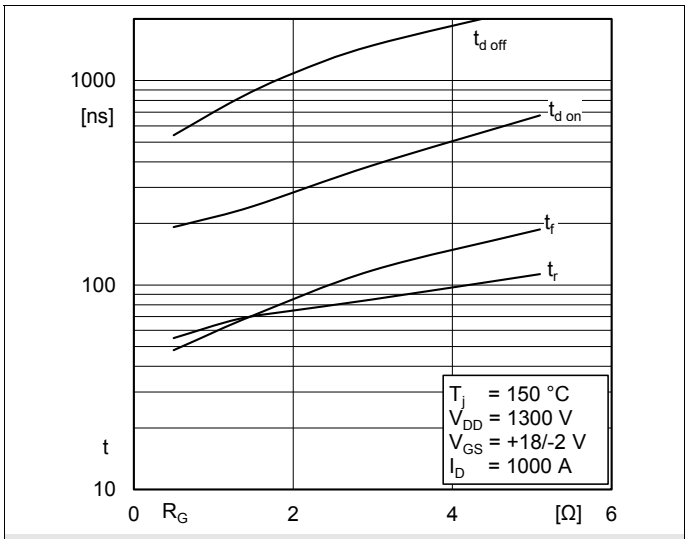


Fig. 8: Typ. MOSFET switching times t = f (R_G)

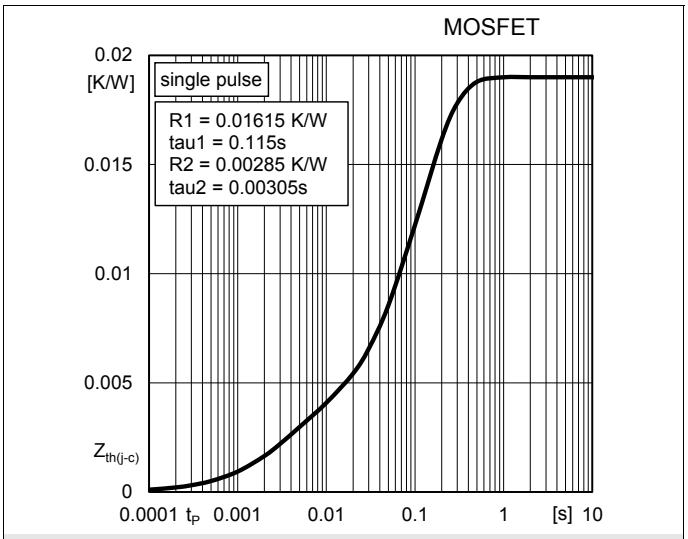
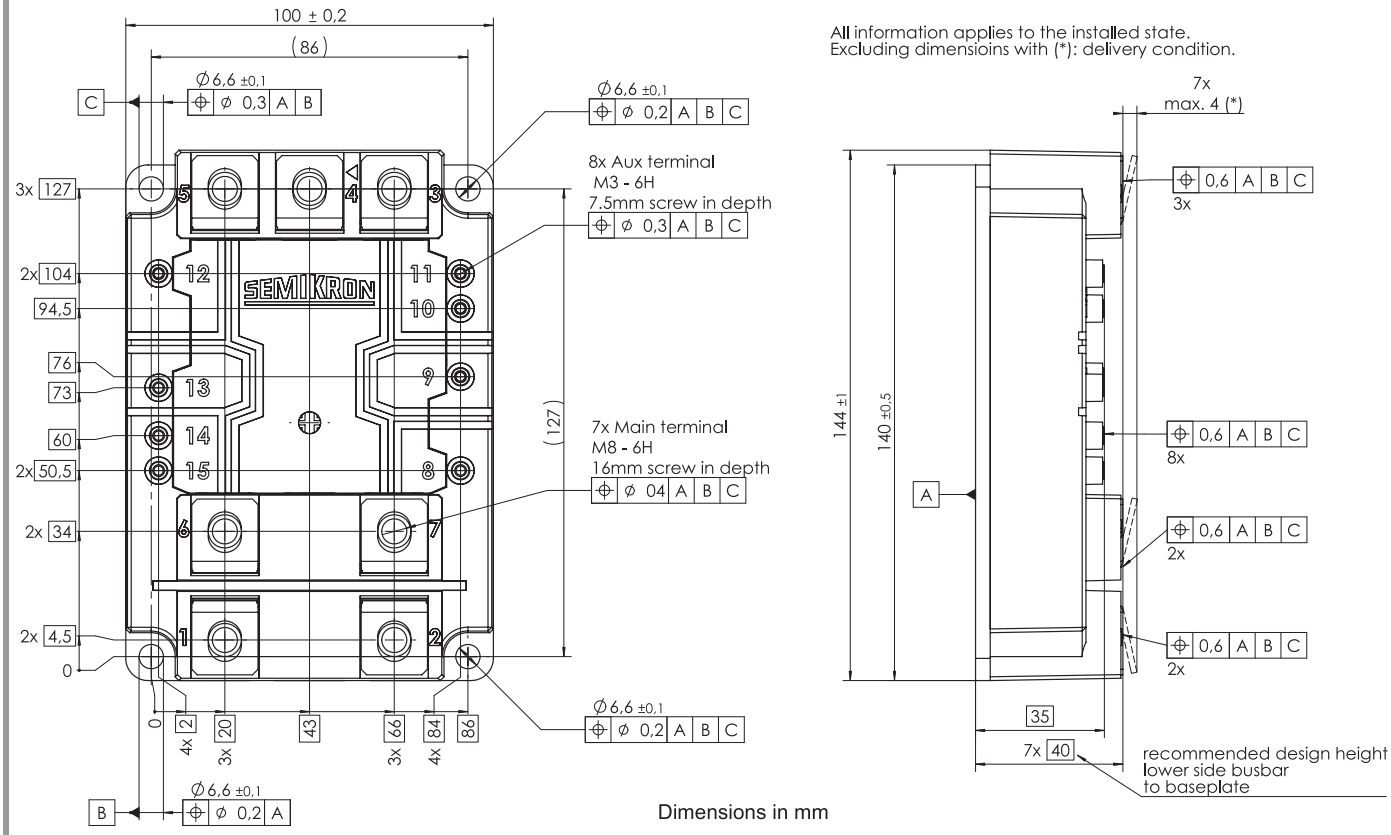
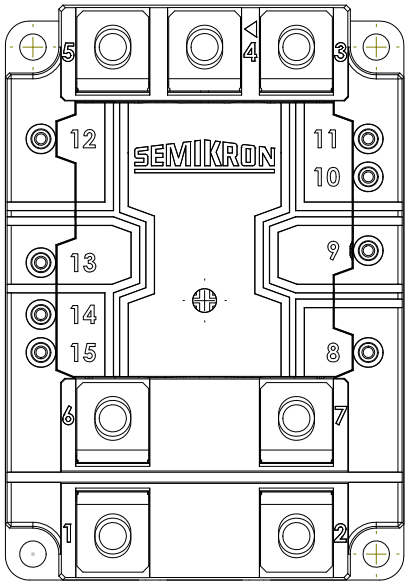
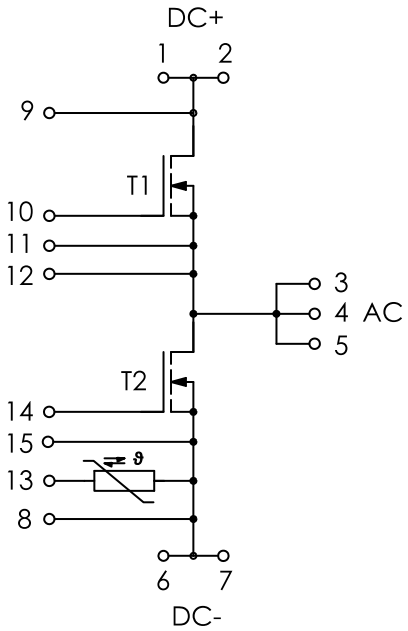


Fig. 9: Transient thermal impedance



Dimensions in mm





Terminal	Description
1	DC+ /D1 main
2	DC+ / D1 main
3	AC
4	AC
5	AC
6	DC- / S2-main
7	DC- / S2-main
8	T1
9	D1-aux
10	G1 (=top)
11	S1-aux
12	D2-aux
13	T2
14	G2 (=bottom)
15	S2-aux

main = main power terminals
aux = auxiliary terminals

MB-T

IMPORTANT INFORMATION AND WARNINGS

This is an electrostatic discharge sensitive device (ESDS) according to international standard IEC 61340.

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