5SET 0120M1600

Phase Control Thyristor Module

Properties

- Insulated baseplate by Al_2O_3 ceramic
- Bonded technology
- Industry standard housing

Key Parameters

V_{DRM}, V_{RRM}	=	1 600	V
I_{TAVm}	=	110	A
I_{TSM}	=	1 900	A
V_{TO}	=	0.900	V
r_T	=	3.348	mΩ

Applications

- Controlled line frequency bridge arm
- AC motor soft starters
- DC motor drives

Types

	V_{RRM}
5SET 0120M1600	**1 600 V**
Conditions:	*T_j = -40 ÷ 125 °C, half sine waveform, f = 50 Hz*

Mechanical Data

M_s	**Mounting torque (base - heatsink)**	**5 ± 15 %**	**Nm**
M_t	**Mounting torque (main terminals)**	**3 ± 15 %**	**Nm**
m	**Weight**	**0.1**	**kg**
a	**Acceleration under vibration**	**50**	**m/s²**

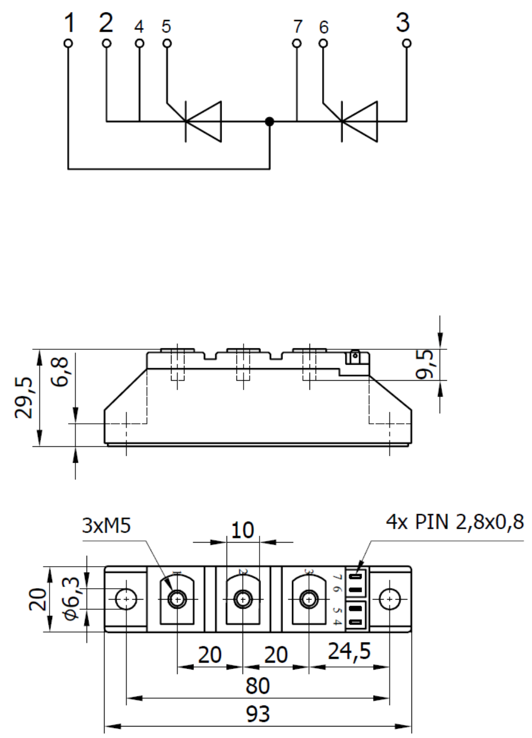

Fig. 1 Case

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Maximum Ratings			*Maximum Limits*	*Unit*
V_{RRM} V_{DRM}	**Repetitive peak reverse and off-state voltage** *T_j = -40 ÷ 125 °C*		**1 600**	**V**
I_{TAVm}	**Average on-state current** *half sine waveform, f = 50 Hz*	*T_c = 70 °C*	**135**	**A**
		T_c = 85 °C	**110**	
		T_c = 100 °C	**80**	
I_{TRMS}	**RMS on-state current** *half sine waveform, f = 50 Hz*	*T_c = 70 °C*	**212**	**A**
		T_c = 85 °C	**172**	
		T_c = 100 °C	**125**	
I_{TSM}	**Peak non-repetitive surge** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**1 900** **2 000**	**A**
I^2t	**Limiting load integral** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**18 000** **17 000**	**A²s**
$(di_T/dt)_{cr}$	**Critical rate of rise of on-state current** *I_T = I_{TAVm}, half sine waveform, f = 50 Hz,* *V_D = 2/3 V_{DRM}, t_r = 0.3 µs, I_{GT} = 2 A*		**150**	**A/µs**
$(dv_D/dt)_{cr}$	**Critical rate of rise of off-state voltage** *V_D = 2/3 V_{DRM}*		**1 000**	**V/µs**
P_{GAVm}	**Maximum average gate power losses**		**3**	**W**
I_{FGM}	**Peak gate current**		**10**	**A**
V_{FGM}	**Peak gate voltage**		**12**	**V**
V_{RGM}	**Reverse peak gate voltage**		**10**	**V**
T_{jmin} - T_{jmax}	**Operating temperature range**		**-40 ÷ 125**	**°C**
T_{stgmin} - T_{stgmax}	**Storage temperature range**		**-40 ÷ 125**	**°C**

Unless otherwise specified T_j = 125 °C

Insulation characteristics		*Value*			*Unit*
		min	*typ*	*max*	
V_{ISOL}	**Isolation voltage** *(base – terminals)* *RMS, sine waveform, f = 50 Hz, T_j = 25 °C, t = 1 min*			**3 600**	**V**

Characteristics			Value			Unit
			min.	typ.	max.	
V_{TM}	**Maximum peak on-state voltage**	I_{TM} = 200 A			**1.570**	**V**
		I_{TM} = 300 A			**1.910**	
V_{T0}	**Threshold voltage**				**0.900**	**V**
r_T	**Slope resistance** I_{T1} = 188 A, I_{T2} = 565 A				**3.348**	**mΩ**
I_{DM}	**Peak off-state current** $V_D = V_{DRM}$				**20**	**mA**
I_{RM}	**Peak reverse current** $V_R = V_{RRM}$				**20**	**mA**
t_{gd}	**Delay time** T_j = 25 °C, V_D = 0.4 V_{DRM}, $I_{TM} = I_{TAVm}$, t_r = 0.3 µs, I_{GT} = 2 A				**2.0**	**µs**
t_q	**Turn-off time** I_T = 300 A, di_T/dt = -50 A/µs, V_R = 100 V, V_D = 2/3 V_{DRM}, dv_D/dt = 50 V/µs			**120**		**µs**
Q_{rr}	**Recovery charge** *the same conditions as at* t_q			**160**		**µC**
I_{rrM}	**Reverse recovery current** *the same conditions as at* t_q			**90**		**A**
I_H	**Holding current**	T_j = 25 °C T_j = 125 °C		**150** **100**		**mA**
I_L	**Latching current**	T_j = 25 °C T_j = 125 °C		**300** **200**		**mA**
V_{GT}	**Gate trigger voltage** V_D = 12V, I_T = 4 A	T_j = - 40 °C T_j = 25 °C T_j = 125 °C	 **0.25**		**4** **3** **2**	**V**
I_{GT}	**Gate trigger current** V_D = 12V, I_T = 4 A	T_j = - 40 °C T_j = 25 °C T_j = 125 °C	 **10**		**1000** **500** **300**	**mA**

Unless otherwise specified T_j = 125 °C

Thermal Parameters			**Value**	**Unit**
R_{thjc}	**Thermal resistance junction to case**	*per arm*	**190.0**	**K/kW**
		per module	**95.0**	
R_{thch}	**Thermal resistance case to heatsink**	*per arm*	**220.0**	**K/kW**
		per module	**110.0**	

Transient Thermal Impedance

Analytical function for transient thermal impedance

$$Z_{thjc} = \sum_{i=1}^{4} R_i (1 - \exp(-t / \tau_i))$$

Correction for periodic waveforms

180°	sine:	11.9	K/kW
120°	sine:	16.1	K/kW
60°	sine:	36.1	K/kW
180°	rectangular:	7.9	K/kW
120°	rectangular:	14.2	K/kW
60°	rectangular:	30.4	K/kW

i	1	2	3	4
τ_i (s)	0.1800	0.0180	0.0005	0.0040
R_i (K/kW)	95.20	53.00	33.00	8.80

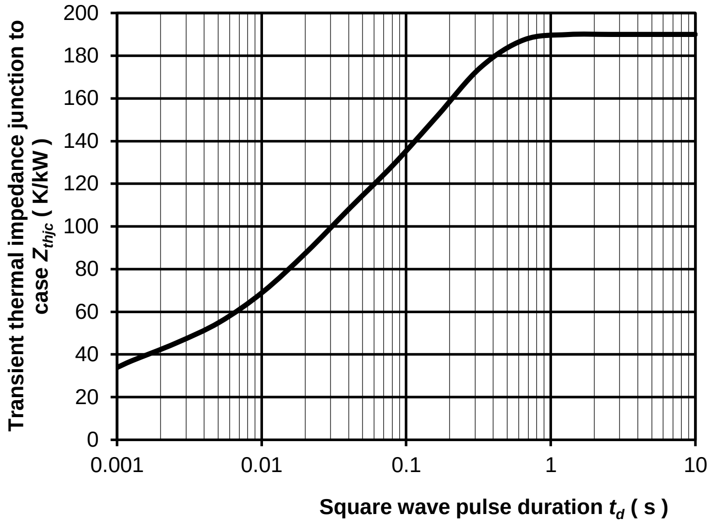

Fig. 2 Dependence transient thermal impedance junction to case on square pulse

On-State Characteristics

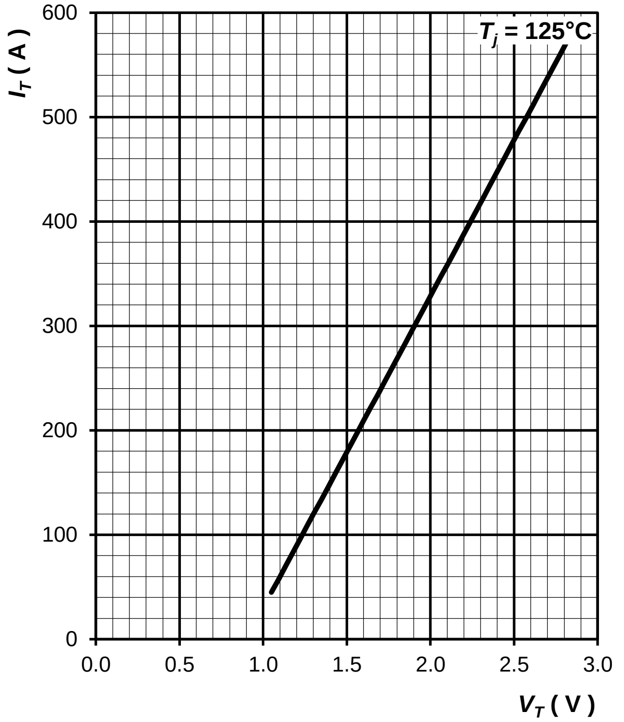

Fig. 3 Maximum on-state characteristics

Gate Trigger Characteristics

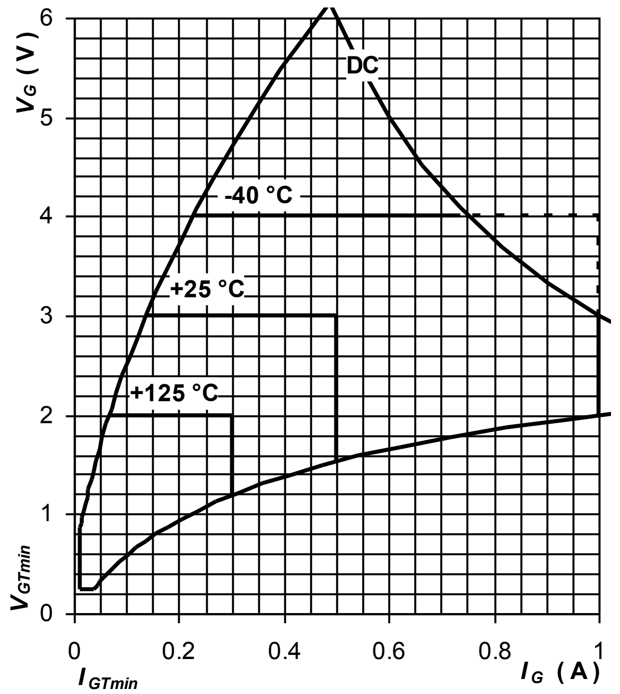

Fig. 4 Gate trigger characteristics

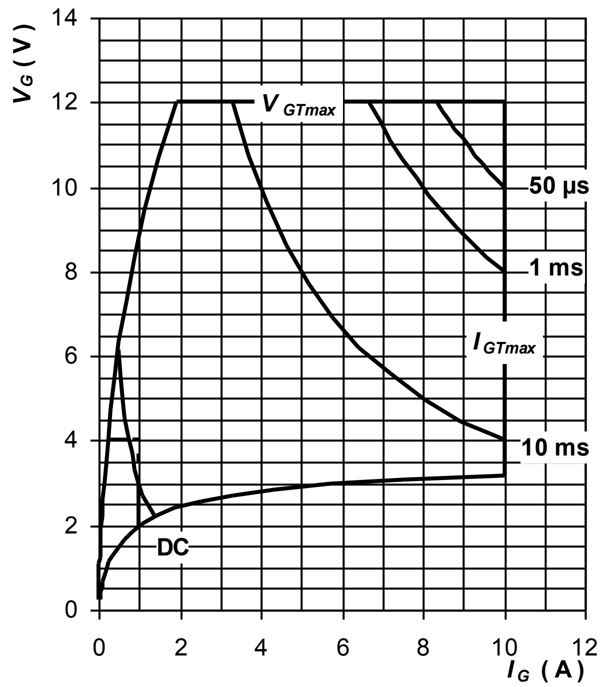

Fig. 5 Maximum peak gate power loss

Surge Characteristics

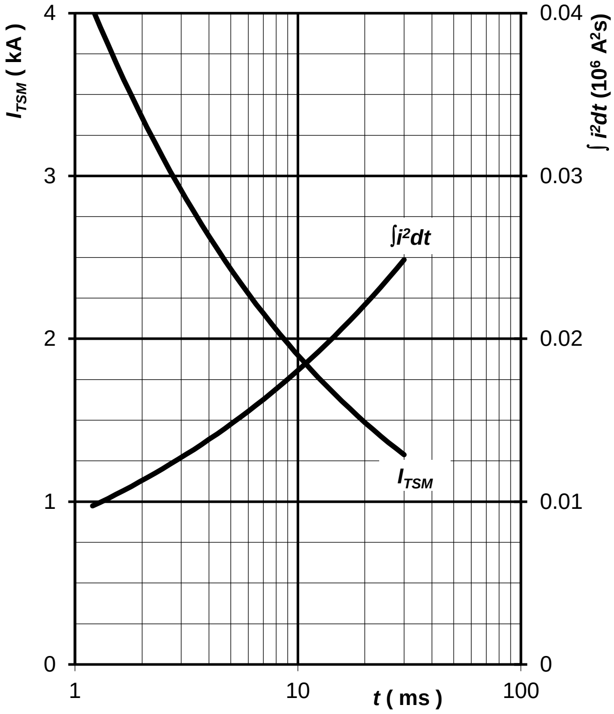

Fig. 6 Surge on-state current vs. pulse length, half sine wave, single pulse, V_R = 0 V, $T_j = T_{jmax}$

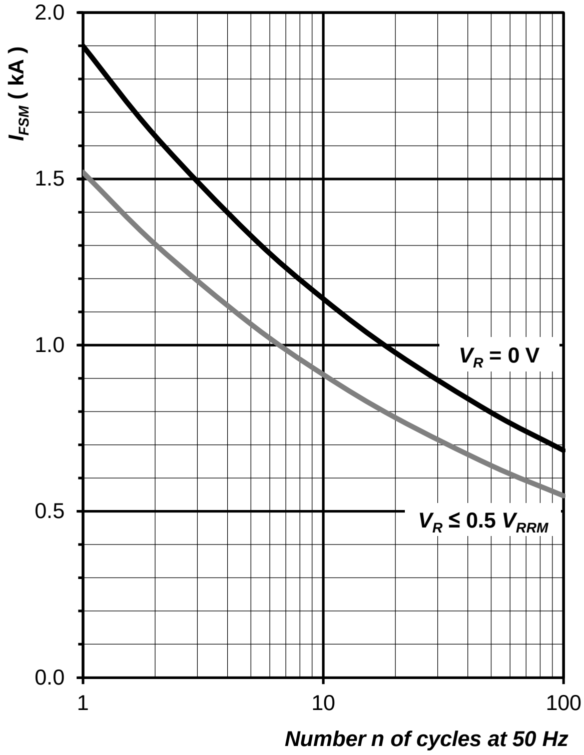

Fig. 7 Surge on-state current vs. number of pulses, half sine wave, $T_j = T_{jmax}$

Power Loss and Maximum Case Temperature Characteristics per Arm

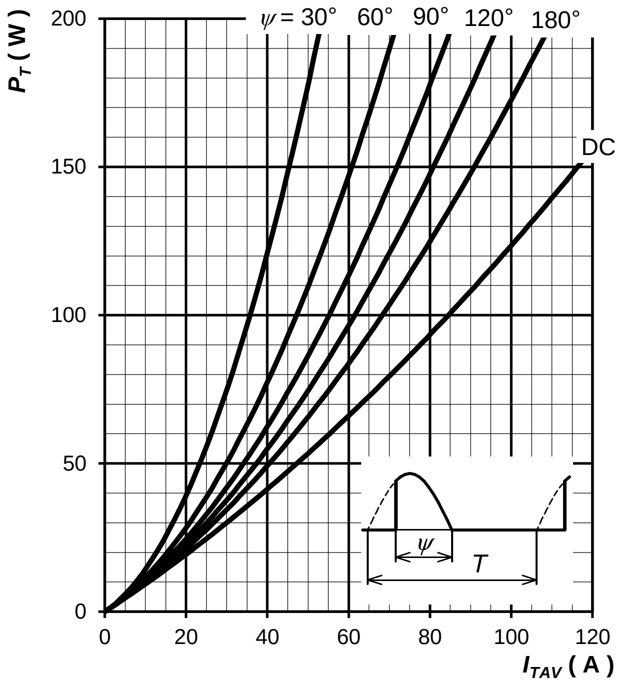

Fig. 8 On-state power loss vs. average on-state current, sine waveform, f = 50 Hz, T = 1/f

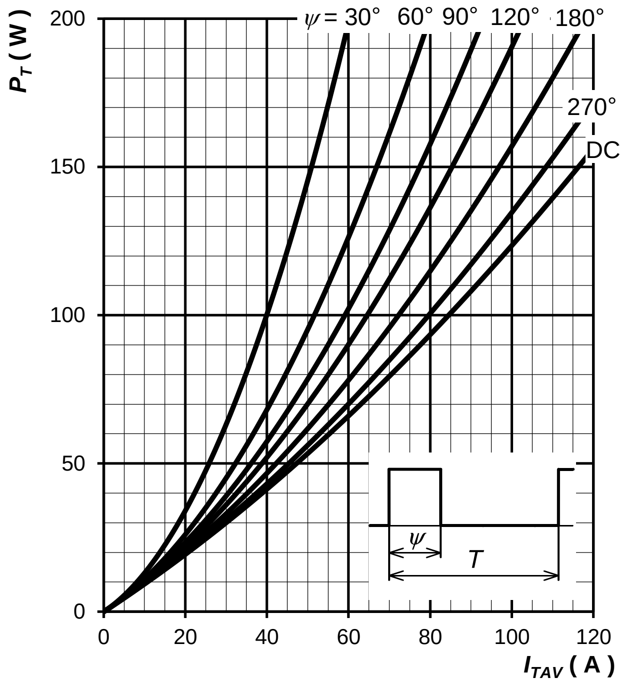

Fig. 9 On-state power loss vs. average on-state current, square waveform, f = 50 Hz, T = 1/f

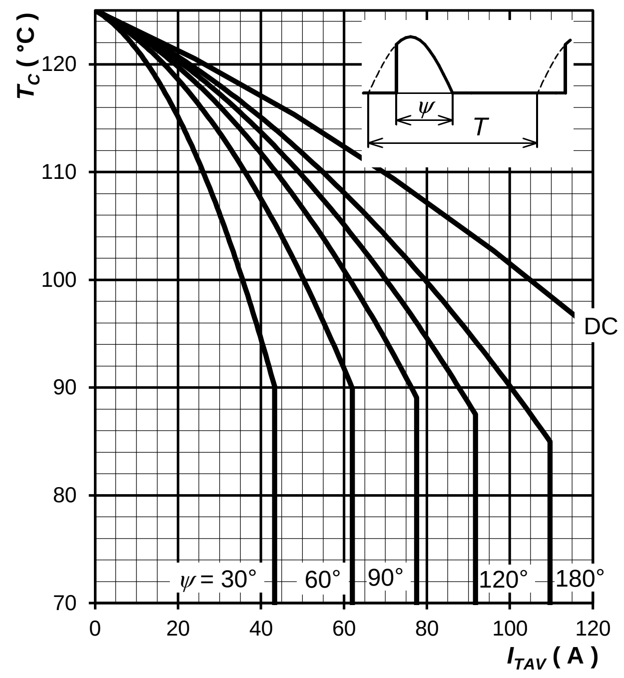

Fig. 10 Max. case temperature vs. aver. on-state current, sine waveform, f = 50 Hz, T = 1/f

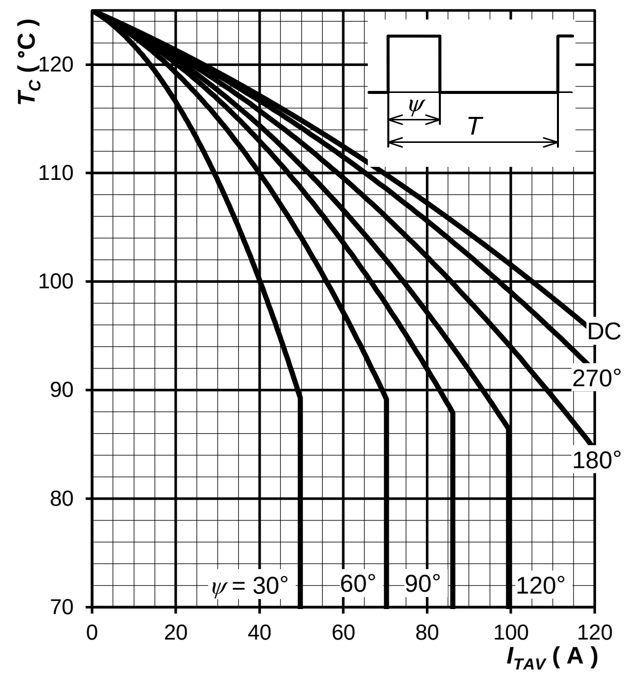

Fig. 11 Max. case temperature vs. aver. on-state current, square waveform, f = 50 Hz, T = 1/f

Note 2: Figures number 8 ÷ 11 have been calculated without considering any turn-on and turn-off losses. They are valid for f = 50 or 60 Hz operation.

Notes: