PRELIMINARY DATASHEET JUNE 2021

5STP 18F1810

Phase control thyristor

- Patented free-floating silicon technology
- Low on-state losses
- Designed for energy and industrial applications
- Optimum power handling capability

Applications

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

Key parameters

- V_{DRM}, V_{RRM} = 1800 V
- I_{TAVm} = 1 780 A
- I_{TSM} = 21 000 A
- V_{TO} = 0.923 V
- r_T = 0.188 mΩ

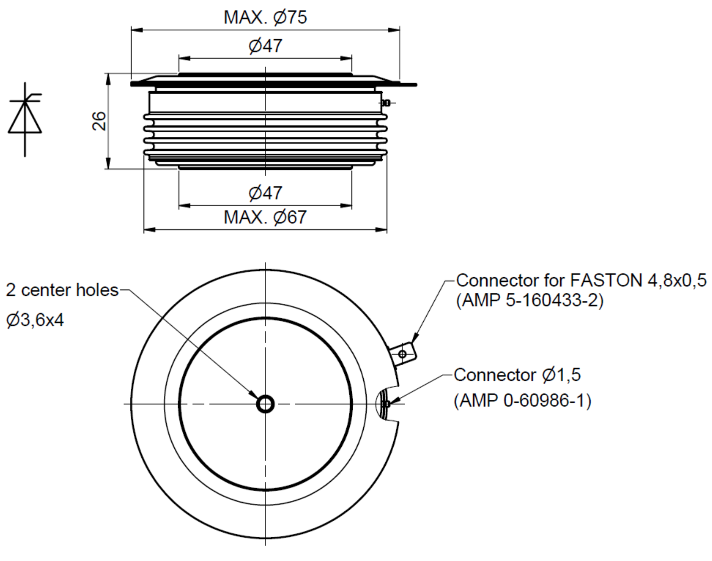
Types

	V_{DRM}, V_{RRM}
5STP 18F1810	1 800 V
Conditions	T_j = -40 ÷ 125 °C, half sine waveform, f = 50 Hz, note 1

Mechanical data

F_m	Mounting force	22 ± 2	kN
m	Weight	0.45	kg
a	Acceleration resistance	50	m/s^2
D_s	Surface creepage distance	25	mm
D_a	Air strike distance	14	mm

Fig. 1 Case



Maximum ratings			Maximum limits	Unit
V_{DRM}, V_{RRM}	**Repetitive peak reverse and off-state voltage** T_j = -40 ÷ 125 °C, note 1		**1800**	V
I_{DM}	**Peak off-state current**	$V_D = V_{DRM}$	**200**	mA
I_{RM}	**Peak reverse current**	$V_R = V_{RRM}$	**200**	mA
I_{TAVm}	**Average on-state current** half sine waveform, f = 50 Hz	T_c = 70 °C	**1780**	A
I_{TRMS}	**RMS on-state current** half sine waveform, f = 50 Hz	T_c = 70 °C	**2790**	A
I_{TSM}	**Non repetitive peak surge current** half sine pulse, $V_D = V_R$ = 0 V	t_p = 8.3 ms	**22,400**	A
		t_p = 10 ms	**21,000**	
I^2t	**Limiting load integral** half sine pulse, $V_D = V_R$ = 0 V	t_p = 8.3 ms	**2 080,000**	A^2s
		t_p = 10 ms	**2 205,000**	
$(di_T/dt)_{cr}$	**Critical rate of rise of on-state current** $I_T = I_{TAVm}$, half sine waveform, V_D = 2/3 V_{DRM}, t_r = 0.3 µs, I_{GT} = 2 A	f = 50 Hz	**200**	A/µs
		f = 1 Hz	**1000**	
$(dv_D/dt)_{cr}$	**Critical rate of rise of off-state voltage** V_D = 2/3 V_{DRM}		**1000**	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_{STG}	**Storage temperature range**		**-40 ÷ 140**	

Unless otherwise specified Tj = 125 °C
Note 1: De-rating factor of 0.13% VRRM or VDRM per °C is applicable for Tj below 25 °C

On-state characteristics		Value			Unit
		min	typ	max	
V_{T0}	**Threshold voltage**			**0.923**	V
r_T	**Slope resistance** I_{T1} = 1000 A, I_{T2} = 3000 A			**0.188**	mΩ
V_{TM}	**Maximum peak on-state voltage** I_{TM} = 2 000 A			**1.300**	V

Unless otherwise specified Tj = 125 °C

On-state characteristics model

Analytical function for maximum on-state characteristic
$$V_T = A + B \cdot I_T + C \cdot ln(I_T + 1) + D \cdot \sqrt{I_T}$$

T_{vi}	A	B	C	D
25°C	$85.83 \cdot 10^{-3}$	$54.12 \cdot 10^{-6}$	$139.9 \cdot 10^{-3}$	$2.254 \cdot 10^{-3}$
125°C	$195.3 \cdot 10^{-3}$	$115.4 \cdot 10^{-6}$	$107.9 \cdot 10^{-3}$	$1.183 \cdot 10^{-3}$

Characteristics			Value			Unit
			min	typ	max	
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				**3.0**	μs
t_q	**Turn-off time** I_T = 2 000 A, di_T/dt = -1.5 A/μs, V_R = 200 V, V_D = 2/3 V_{DRM}, dv_D/dt = 20 V/μs			**100**		μs
Q_{rr}	**Recovered charge** the same conditions as at t_q			**1400**		μC
I_{rrM}	**Reverse recovery maximum current** the same conditions as at t_q			**50**		A
I_H	**Holding current**	T_j = 25 °C		**150**		mA
		T_j = 125 °C		**130**		
I_L	**Latching current**	T_j = 25 °C		**600**		mA
		T_j = 125 °C		**370**		
V_{GT}	**Gate trigger voltage** V_D = 12V, I_T = 4 A	T_j = -40 °C			**4**	V
		T_j = 25 °C			**3**	
		T_j = 125 °C	**0.25**		**2**	
I_{GT}	**Gate trigger current** V_D = 12V, I_T = 4 A	T_j = -40 °C			**1000**	mA
		T_j = 25 °C			**500**	
		T_j = 125 °C	**10**		**300**	

Unless otherwise specified Tj = 125 °C

Thermal parameters			Value	Unit
R_{thjc}	**Thermal resistance junction to case**	double side cooling	**17.0**	K/kW
		anode side cooling	**33.0**	
		cathode side cooling	**35.0**	
R_{thch}	**Thermal resistance case to heatsink**	double side cooling	**4.0**	K/kW
		single side cooling	**8.0**	

Transient thermal impedance

Analytical function for transient thermal impedance

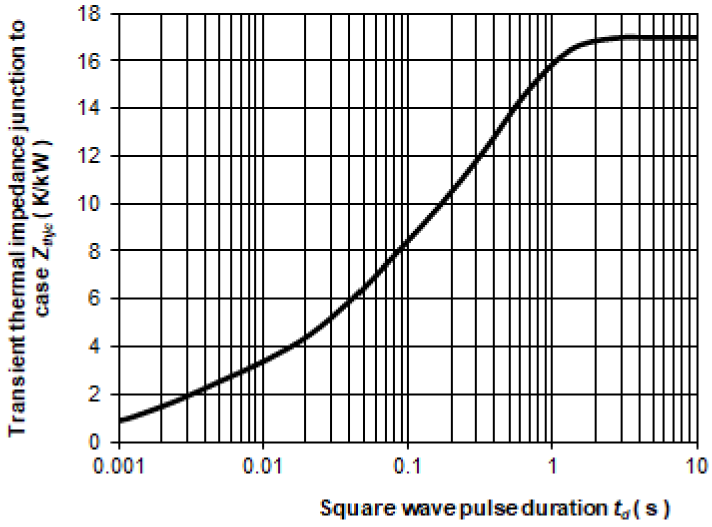
$$Z_{thjc} = \sum_{i=1}^{4} R_i(1 - exp(-t/\tau_i))$$

i	1	2	3	4
τ_i (s)	0.4413	0.0425	0.0026	0.0003
R_i(K/kW)	10.082	4.659	2.167	0.091

Correction for periodic waveforms

180°	sine	1.5	K/kW
180°	rectangular	2.0	K/kW
120°	rectangular	3.0	K/kW
60°	rectangular	5.0	K/kW

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



On-state and surge characteristics

Fig. 3 Maximum on-state characteristics

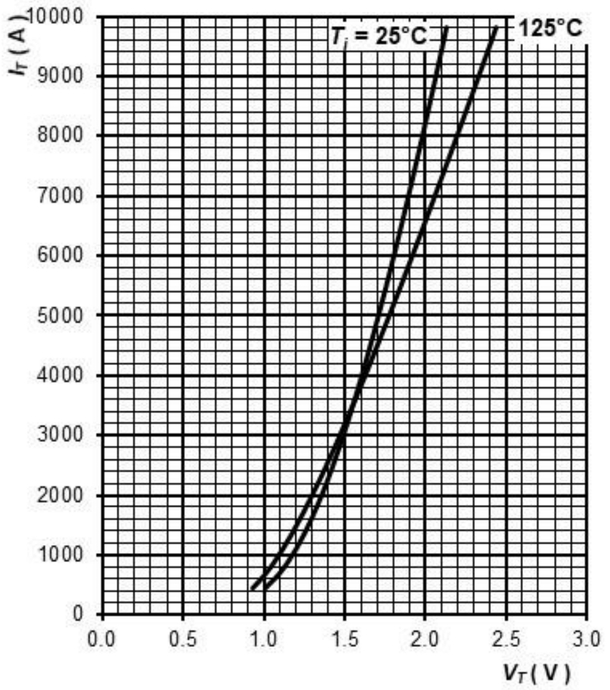
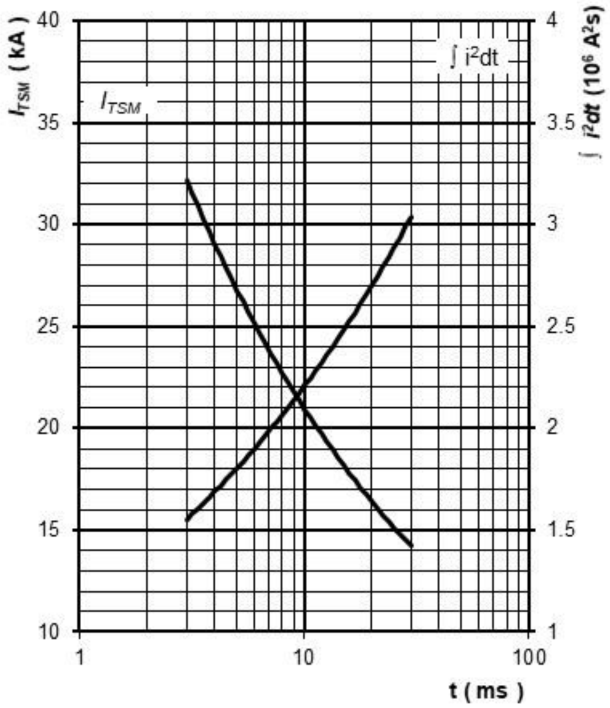


Fig. 4 Surge on-state current vs. pulse length, half sine wave, single pulse, $V_D = V_R = 0$ V, $T_j = T_j$max



Gate trigger characteristics

Fig. 5 Gate trigger characteristics

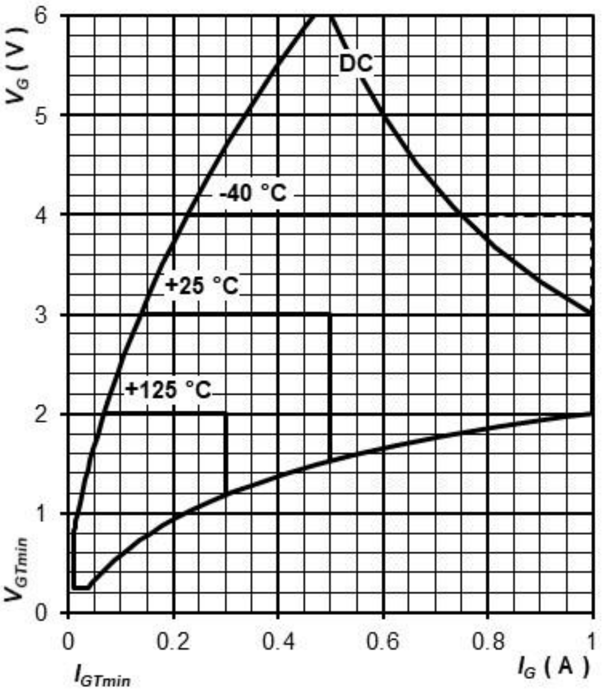
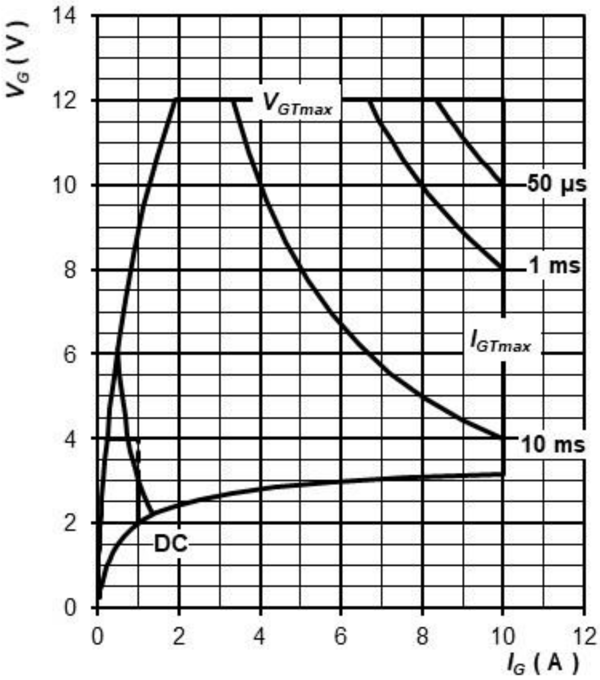


Fig. 6 Maximum peak gate power loss



Power loss and maximum case temperature characteristics

Fig. 7 On-state power loss vs. average on-state current, sine waveform, f = 50 Hz, T = 1/f

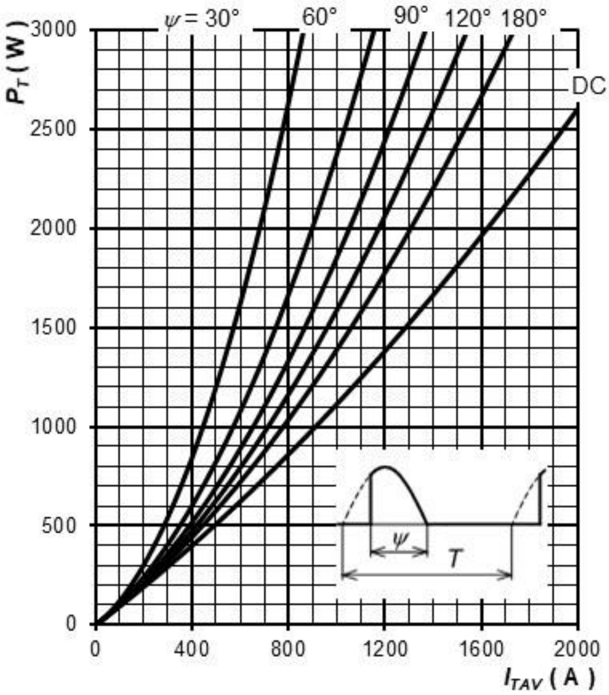


Fig. 8 On-state power loss vs. average on-state current, square waveform, f = 50 Hz, T = 1/f

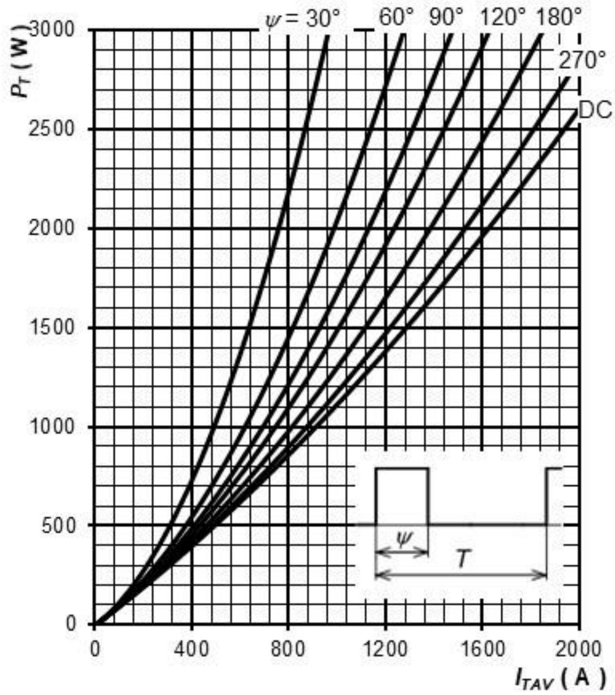


Fig. 9 Max. case temperature vs. aver. on-state current, sine waveform, f = 50 Hz, T = 1/f

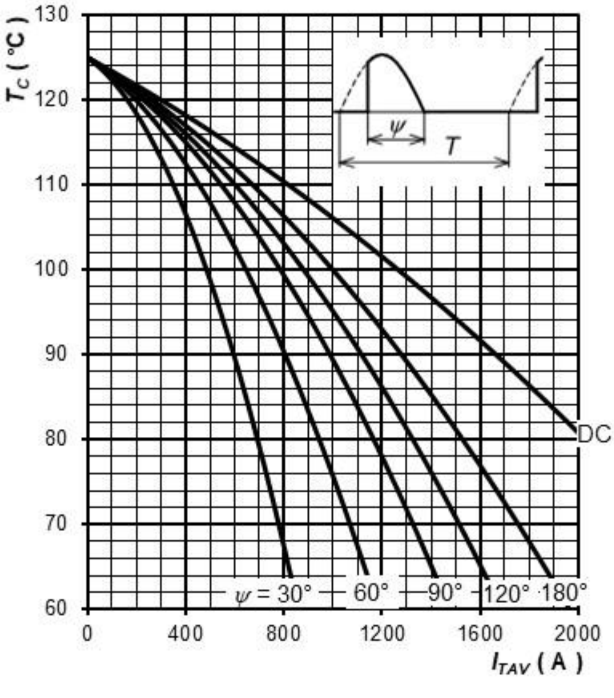
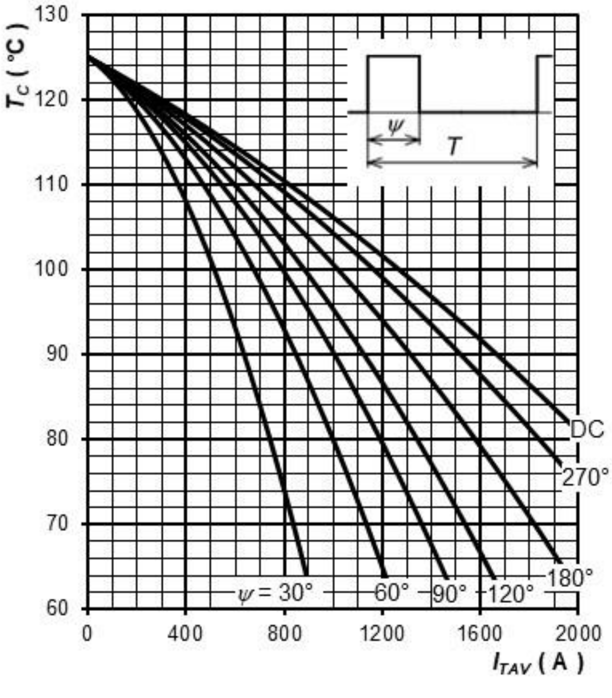


Fig. 10 Max. case temperature vs. aver. on-state current, square waveform, f = 50 Hz, T = 1/f



Note 2: Figures number 7 ÷ 10 have been calculated without considering any turn-on and turn-off losses. They are valid for f = 50 or 60 Hz operation.

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