

Data sheet TS-T/343/21 Aug 22

5STP 18F1810

Phase control thyristor

- $V_{DRM}, V_{RRM} = 1800\text{ V}$
- $I_{TAVm} = 1780\text{ A}$
- $I_{TSM} = 21000\text{ A}$
- $V_{T0} = 0.923\text{ V}$
- $r_T = 0.188\text{ m}\Omega$
- Patented free-floating silicon technology
- Low on-state losses
- Designed for energy and industrial applications
- Optimum power handling capability



Maximum rated values ¹⁾

Parameter	Symbol	Conditions	Min.	Max.	Unit
Repetitive peak off-state and reverse voltage	V_{DRM}, V_{RRM}	$T_j = -40 \div 125\text{ }^\circ\text{C}$ ²⁾		1800	V
Peak off-state current	I_{DM}	$V_D = V_{DRM}$		200	mA
Peak reverse current	I_{RM}	$V_R = V_{RRM}$		200	mA
Average on-state current	I_{TAVm}	half sine waveform, $f = 50\text{ Hz}$	$T_c = 70\text{ }^\circ\text{C}$	1780	A
RMS on-state current	I_{TRMS}	half sine waveform, $f = 50\text{ Hz}$	$T_c = 70\text{ }^\circ\text{C}$	2790	A
Non repetitive peak surge current	I_{TSM}	half sine pulse, $V_D = V_R = 0\text{ V}$	$t_p = 8.3\text{ ms}$	22400	A
			$t_p = 10\text{ ms}$	21000	A
Limiting load integral	I^2t	half sine pulse, $V_D = V_R = 0\text{ V}$	$t_p = 8.3\text{ ms}$	2080000	A ² s
			$t_p = 10\text{ ms}$	2205000	A ² s
Critical rate of rise of on-state current	$(di_T/dt)_{cr}$	$I_T = I_{TAVm}$, half sine waveform, $V_D = 2/3 V_{DRM}$, $I_{GM} = 2\text{ A}$, $t_r = 0.3\text{ }\mu\text{s}$	$f = 50\text{ Hz}$	200	A/ μs
			$f = 1\text{ Hz}$	1000	
Critical rate of rise of off-state voltage	$(dv_D/dt)_{cr}$	$V_D = 2/3 V_{DRM}$		1000	V/ μs
Maximum average gate power losses	P_{GAVm}			3	W
Peak gate current	I_{FGM}			10	A
Peak gate voltage	V_{FGM}			12	V
Reverse peak gate voltage	V_{RGM}			10	V
Operating temperature range	$T_{jmin} - T_{jmax}$		-40	125	$^\circ\text{C}$
Storage temperature range	T_{STG}		-40	140	$^\circ\text{C}$

Unless otherwise specified $T_j = 125\text{ }^\circ\text{C}$

¹⁾ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

²⁾ De-rating factor of 0.13% V_{RRM} or V_{DRM} per $^\circ\text{C}$ is applicable for T_j below $25\text{ }^\circ\text{C}$

Characteristic values

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Threshold voltage	V_{T0}	$I_{T1} = 1000 \text{ A}, I_{T2} = 3000 \text{ A}$			0.923	V
Slope resistance	r_T				0.188	m Ω
Maximum peak on-state voltage	V_{TM}	$I_{TM} = 2000 \text{ A}$			1.300	V
Holding current	I_H		$T_j = 25 \text{ }^\circ\text{C}$	150		mA
			$T_j = 125 \text{ }^\circ\text{C}$	130		mA
Latching current	I_L		$T_j = 25 \text{ }^\circ\text{C}$	600		mA
			$T_j = 125 \text{ }^\circ\text{C}$	370		mA
Gate trigger voltage	V_{GT}		$T_j = -40 \text{ }^\circ\text{C}$		4	V
			$T_j = 25 \text{ }^\circ\text{C}$		3	V
			$T_j = 125 \text{ }^\circ\text{C}$	0.25	2	V
Gate trigger current	I_{GT}	$V_D = 12 \text{ V}, I_T = 4 \text{ A}$	$T_j = -40 \text{ }^\circ\text{C}$		1000	mA
			$T_j = 25 \text{ }^\circ\text{C}$		500	mA
			$T_j = 125 \text{ }^\circ\text{C}$	10	300	mA
Delay time	t_{gd}	$T_j = 25 \text{ }^\circ\text{C}, V_D = 0.4 V_{DRM}, I_{TM} = I_{TAVM}, I_{GM} = 2 \text{ A}, t_r = 0.3 \text{ } \mu\text{s}$			3.0	μs
Turn-off time	t_q	$I_T = 2000 \text{ A}, di_T/dt = -1.5 \text{ A}/\mu\text{s}, V_R = 200 \text{ V}, V_D = 2/3 V_{DRM}, dv_D/dt = 20 \text{ V}/\mu\text{s}$		100		μs
Recovered charge	Q_{rr}	the same conditions as at t_q		1400		μC
Reverse recovery maximum current	I_{rRM}	the same conditions as at t_q		50		A

Unless otherwise specified $T_j = 125 \text{ }^\circ\text{C}$

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Mechanical properties

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Mounting force	F_m		20	22	24	kN
Mass	m			0.45		kg
Acceleration resistance	a				50	m/s^2
Surface creepage distance	D_s		25			mm
Air strike distance	D_a		14			mm

Mechanical drawing

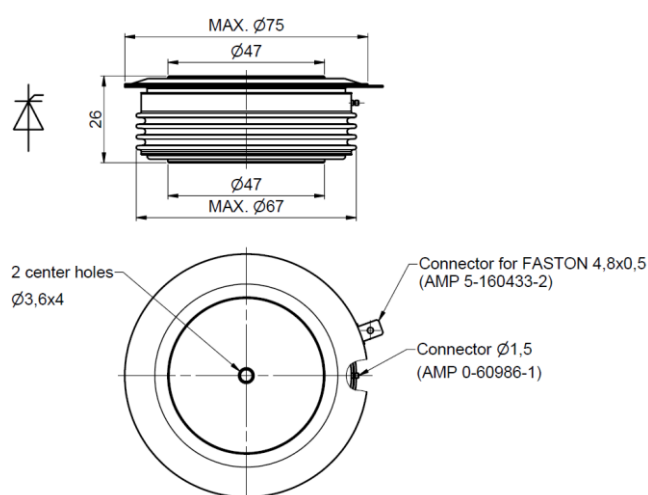


Fig. 1 Case

Note: all dimensions are shown in millimeters

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Thermal properties

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance junction to case	R_{thjc}	double side cooling			17.0	K/kW
		anode side cooling			33.0	
		cathode side cooling			35.0	
Thermal resistance case to heatsink	R_{thch}	double side cooling			4.0	
		single side cooling			8.0	

Analytical function for transient thermal impedance

$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i (1 - e^{-t/\tau_i})$$

i	1	2	3	4
τ_i (s)	0.4413	0.0425	0.0026	0.0003
R_i (K/kW)	10.08	4.66	2.17	0.09

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

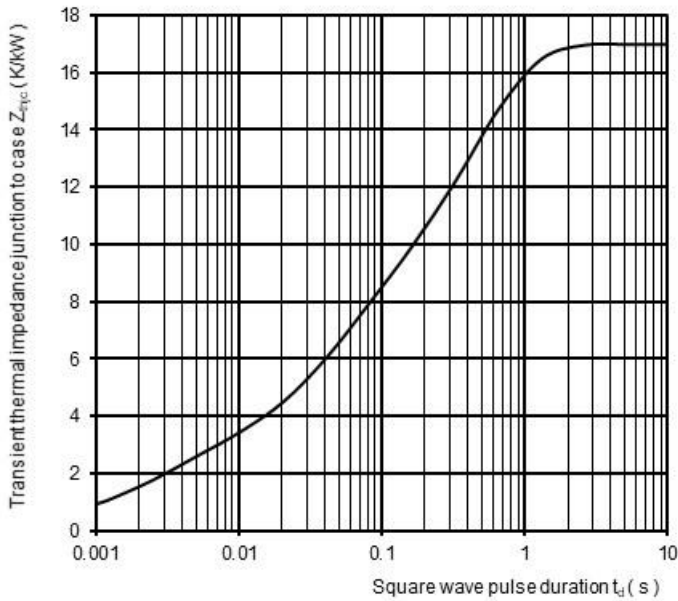


Fig. 2 Dependence transient thermal impedance junction to case on square pulse

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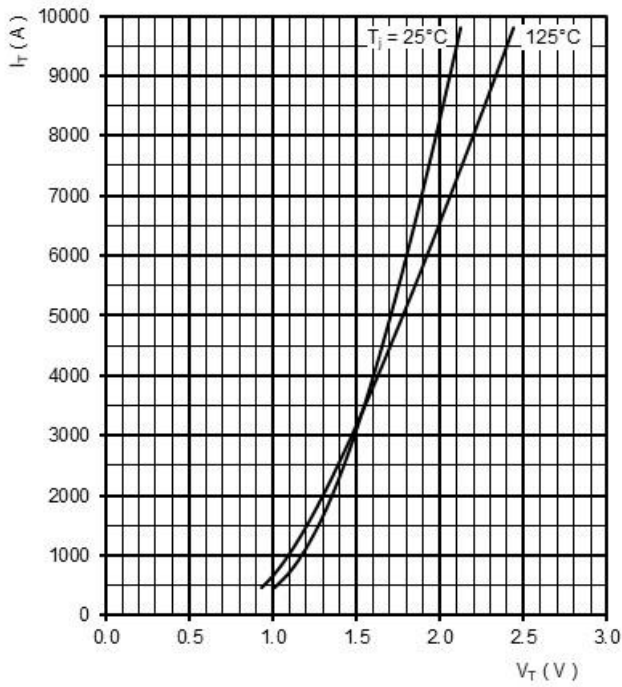
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On-state and surge characteristics



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_{vj}	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	$195.3 \cdot 10^{-3}$	$115.4 \cdot 10^{-6}$	$107.9 \cdot 10^{-3}$	$1.183 \cdot 10^{-3}$

Fig. 3 Maximum on-state characteristics

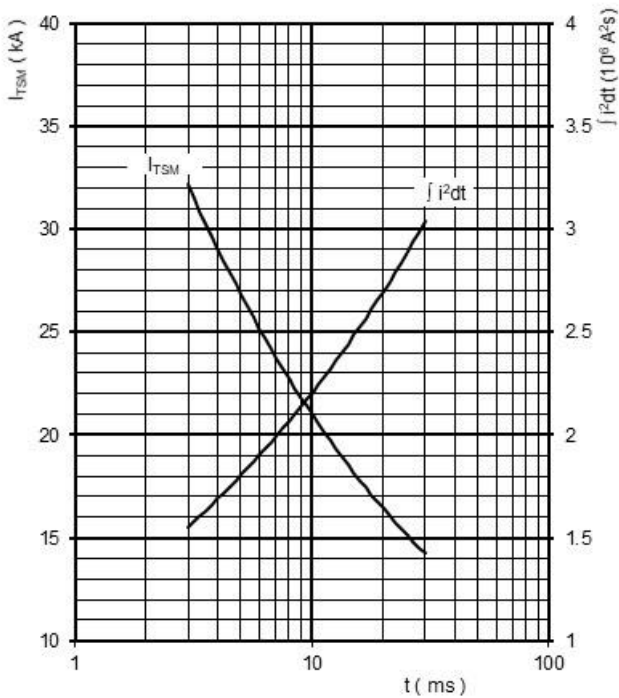


Fig. 4 Surge on-state current vs. pulse length, half sine wave, single pulse, $V_D = V_R = 0$ V, $T_j = T_{jmax}$

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Gate trigger characteristics

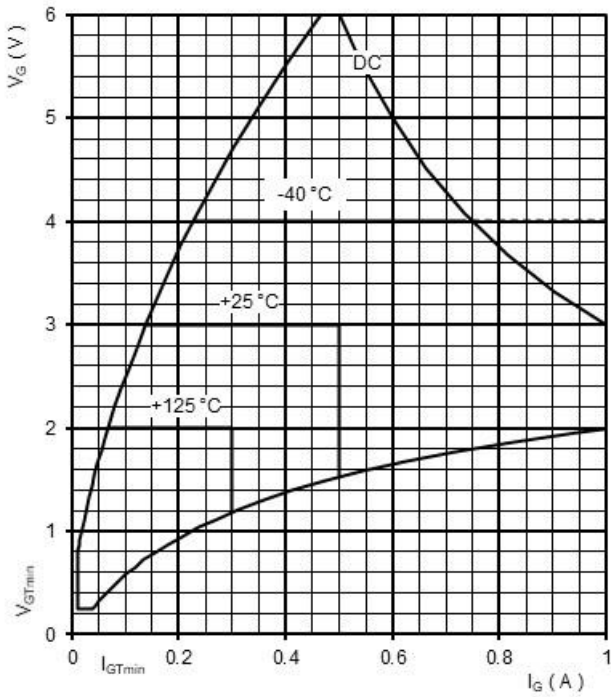


Fig. 5 Gate trigger characteristics

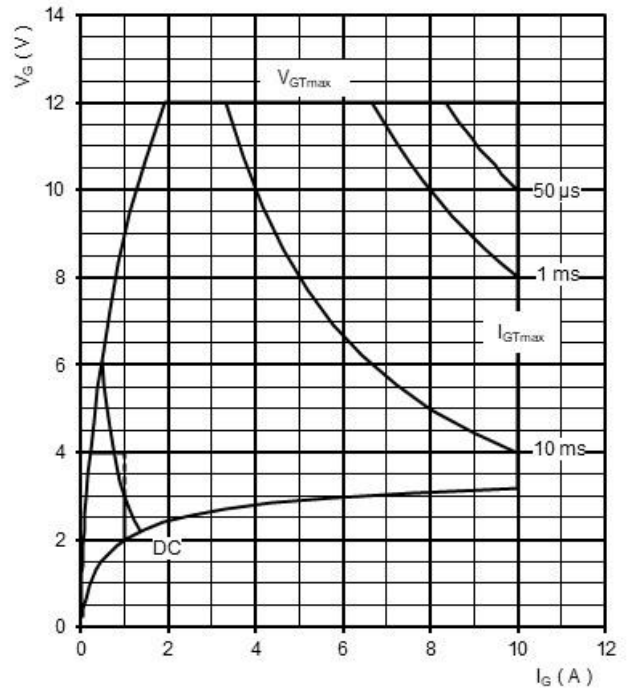


Fig. 6 Maximum peak gate power loss

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Power loss and maximum case temperature characteristics

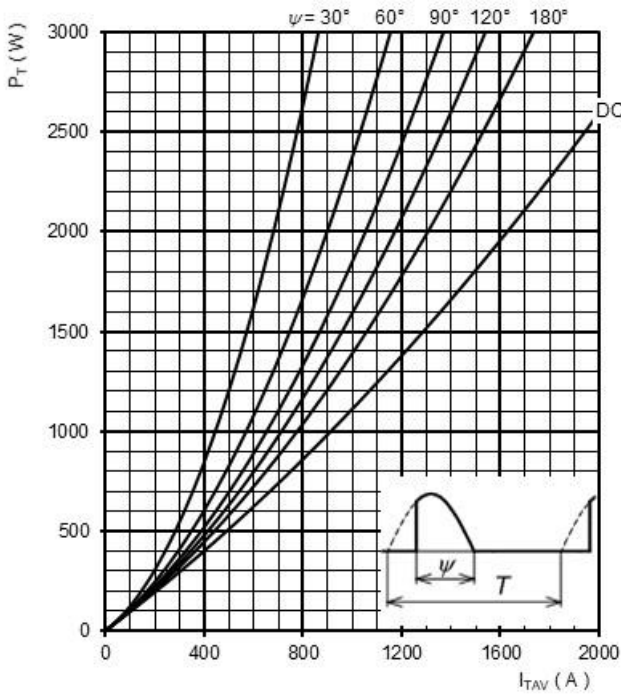


Fig. 7 On-state power loss vs. average on-state current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

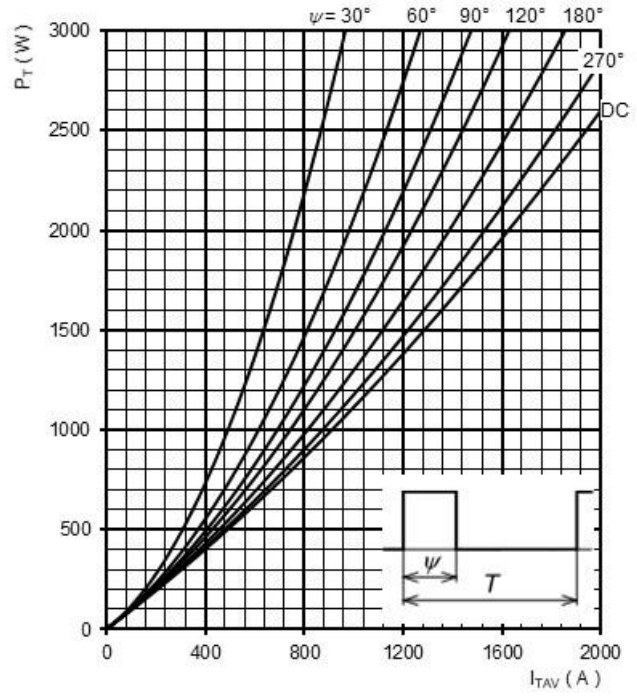


Fig. 8 On-state power loss vs. average on-state current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

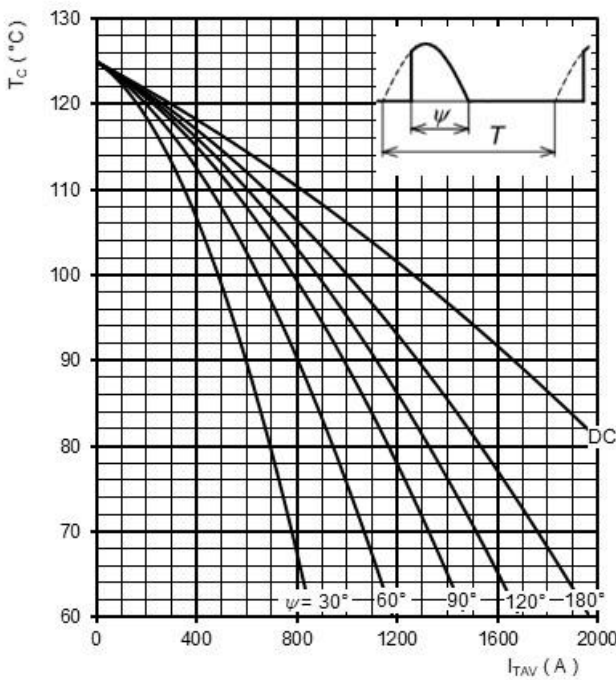


Fig. 9 Max. case temperature vs. aver. on-state current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

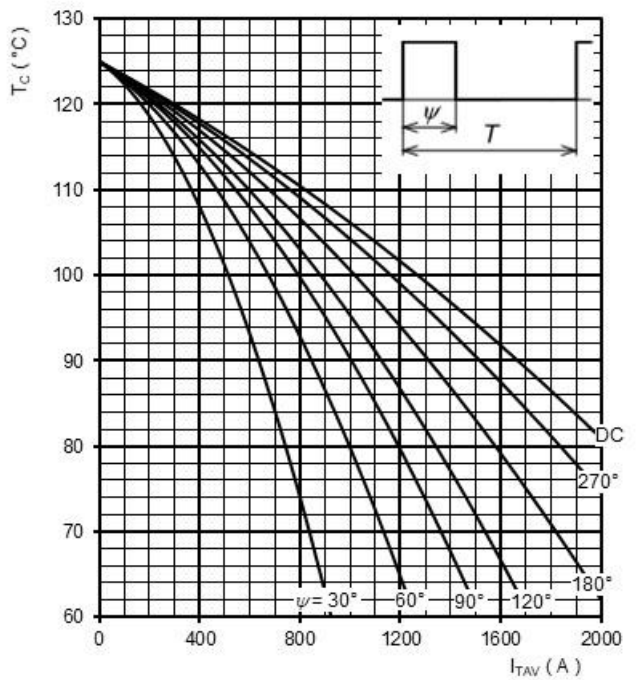


Fig. 10 Max. case temperature vs. aver. on-state current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

Note: 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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