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Data sheet TS-TV/344/21 Aug 22

5STP 16F2810

Phase control thyristor

- V_{DRM}, V_{RRM} = 2800 V
- I_{TAVm} = 1500 A
- I_{TSM} = 18000 A
- V_{T0} = 0.956 V
- r_T = 0.297 mΩ
- 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 ÷ 125 °C [2)]			2800	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 Hz	T_c = 70 °C		1500	A
RMS on-state current	I_{TRMS}	half sine waveform, f = 50 Hz	T_c = 70 °C		2360	A
Non repetitive peak surge current	I_{TSM}	half sine pulse, $V_D = V_R$ = 0 V	t_p = 8.3 ms		19200	A
			t_p = 10 ms		18000	A
Limiting load integral	I^2t	half sine pulse, $V_D = V_R$ = 0 V	t_p = 8.3 ms		1530000	A^2s
			t_p = 10 ms		1620000	A^2s
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 A, t_r = 0.3 µs	f = 50 Hz		200	A/µs
			f = 1 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	°C
Storage temperature range	T_{STG}			-40	140	°C

Unless otherwise specified T_j = 125 °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 °C is applicable for T_j below 25 °C

Characteristic values

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Threshold voltage	V_{T0}	I_{T1} = 800 A, I_{T2} = 2400 A				0.956	V
Slope resistance	r_T					0.297	mΩ
Maximum peak on-state voltage	V_{TM}	I_{TM} = 2000 A				1.550	V
Holding current	I_H		T_j = 25 °C		160		mA
			T_j = 125 °C		130		mA
Latching current	I_L		T_j = 25 °C		900		mA
			T_j = 125 °C		400		mA
Gate trigger voltage	V_{GT}	V_D = 12V, I_T = 4 A	T_j = -40 °C			4	V
			T_j = 25 °C			3	V
			T_j = 125 °C	0.25		2	V
Gate trigger current	I_{GT}		T_j = -40 °C			1000	mA
			T_j = 25 °C			500	mA
			T_j = 125 °C	10		300	mA
Delay time	t_{gd}	T_j = 25 °C, V_D = 0.4 V_{DRM}, I_{TM} = I_{TAVm}, I_{GM} = 2 A, t_r = 0.3 µs				3.0	µs
Turn-off time	t_q	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			120		µs
Recovered charge	Q_{rr}	the same conditions as at t_q			2000		µC
Reverse recovery maximum current	I_{rrM}	the same conditions as at t_q			55		A

Unless otherwise specified T_j = 125 °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

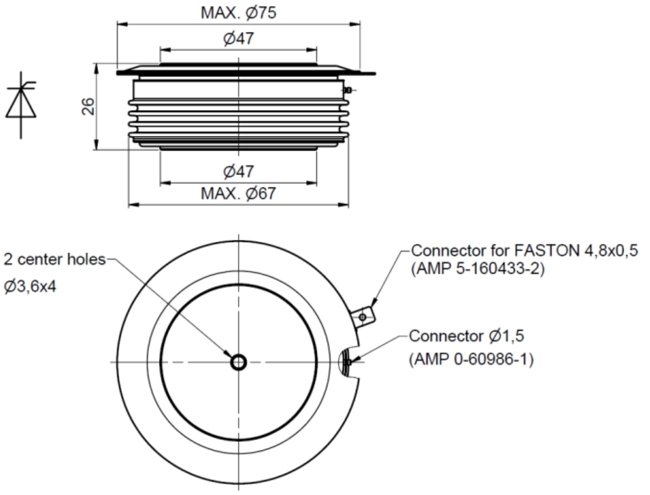

Fig. 1 Case

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	

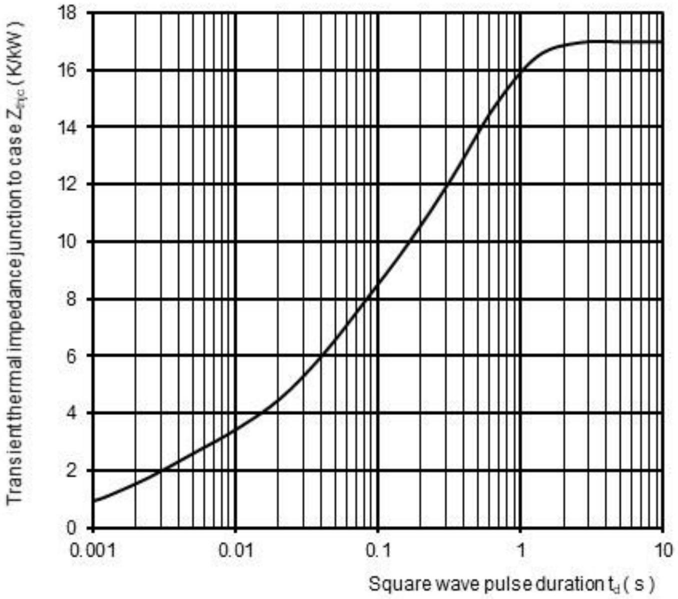

Fig. 2 Dependence transient thermal impedance junction to case on square pulse

Analytical function for transient thermal impedance

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

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

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On-state and surge characteristics

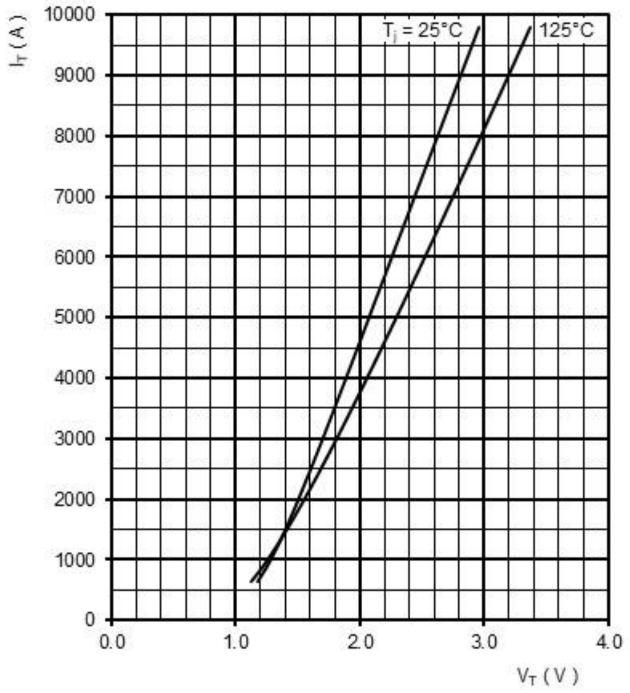

Fig. 3 Maximum on-state characteristics

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	$-99.38 \cdot 10^{-3}$	$221.6 \cdot 10^{-6}$	$221.2 \cdot 10^{-3}$	$-11.52 \cdot 10^{-3}$
125°C	$165.4 \cdot 10^{-3}$	$206.3 \cdot 10^{-6}$	$125.9 \cdot 10^{-3}$	$334.3 \cdot 10^{-6}$

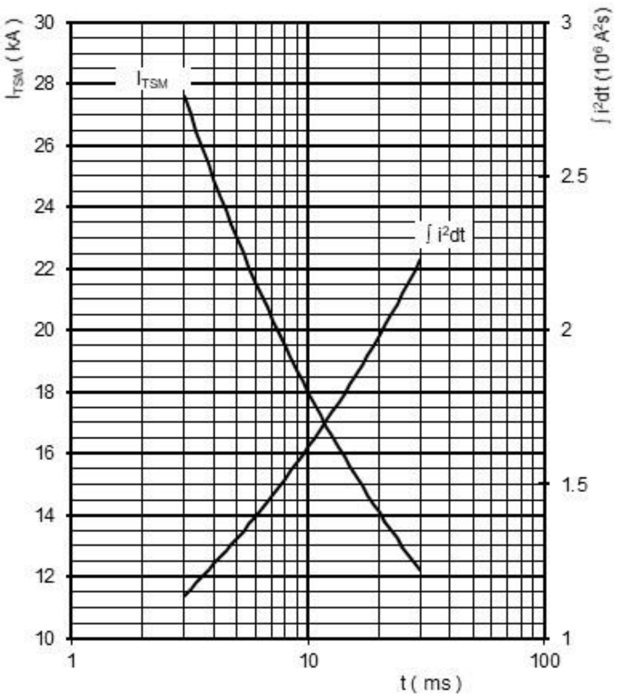

Fig. 4 Surge on-state current vs. pulse length, half sine wave, single pulse, $V_D = V_R = 0$ V, $T_j = T_{jmax}$

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Gate trigger characteristics

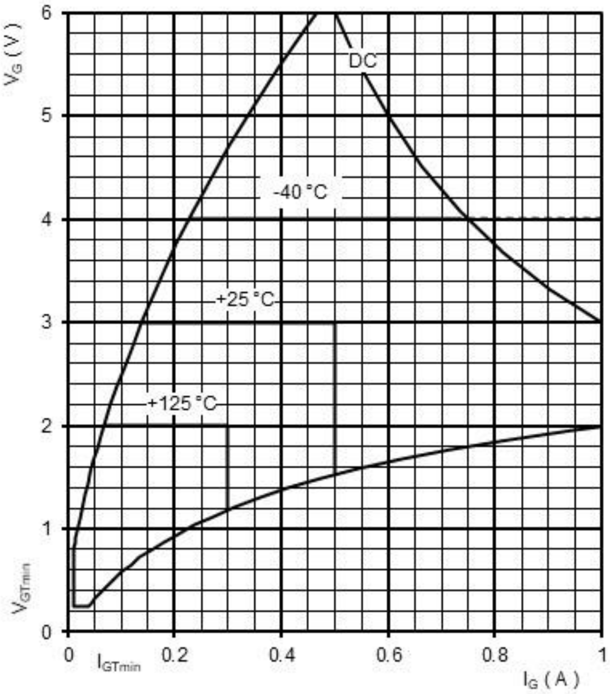

Fig. 5 Gate trigger characteristics

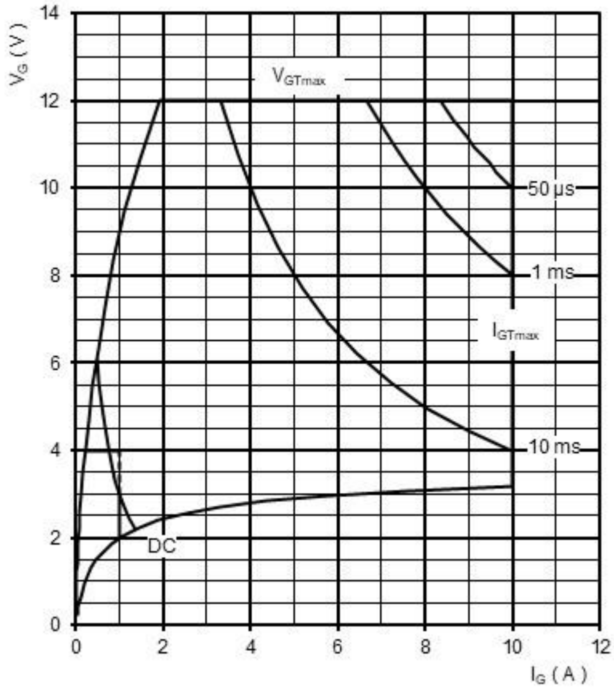

Fig. 6 Maximum peak gate power loss

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Power loss and maximum case temperature characteristics

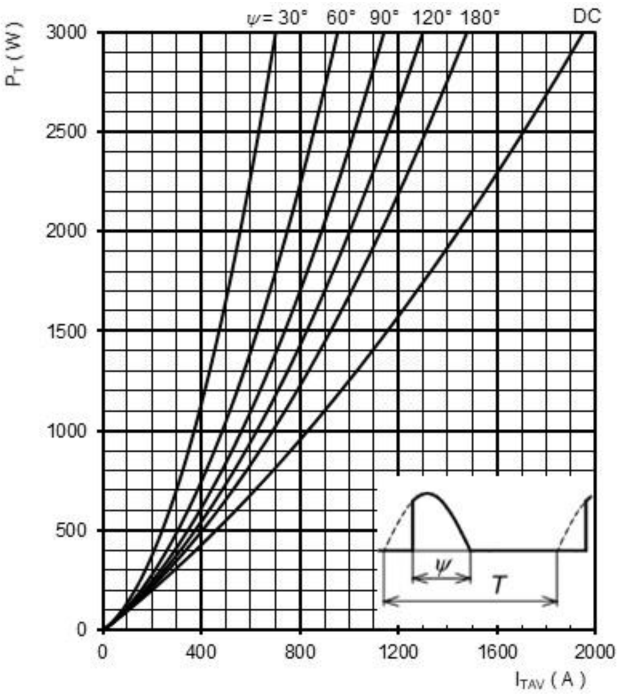

Fig. 7 On-state power loss vs. average on-state current,
sine waveform, f = 50 Hz, T = 1/f

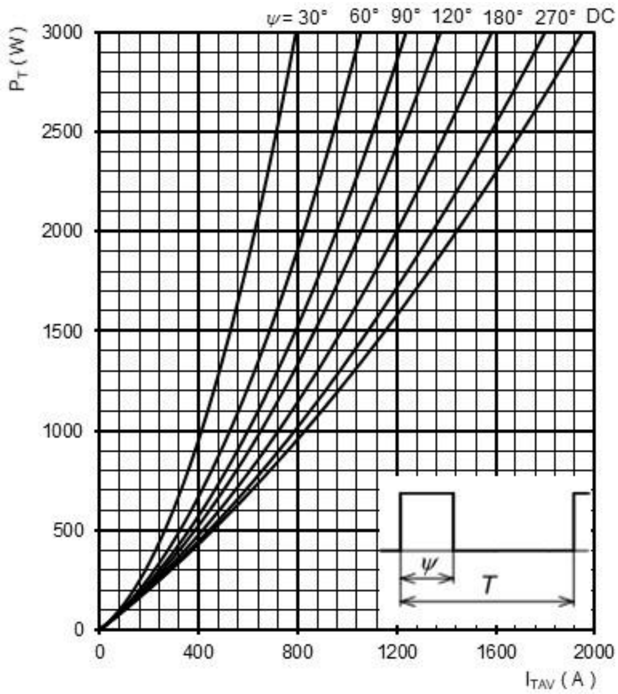

Fig. 8 On-state power loss vs. average on-state current,
square waveform, f = 50 Hz, T = 1/f

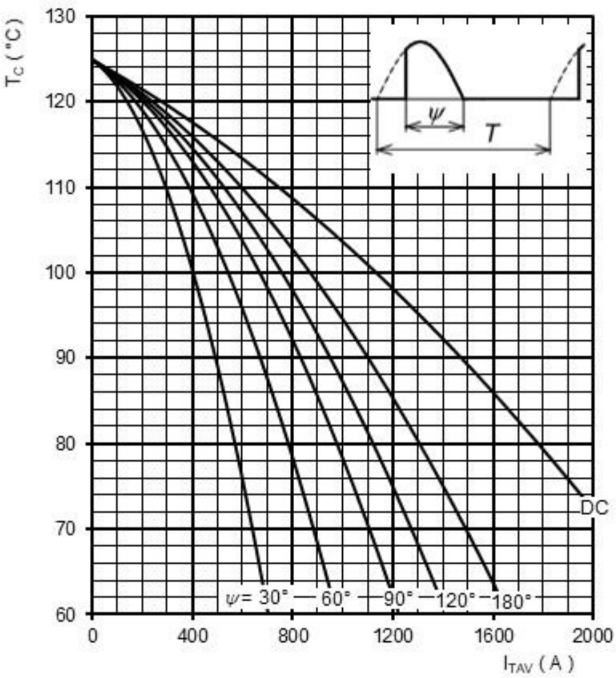

Fig. 9 Max. case temperature vs. aver. on-state current,
sine waveform, f = 50 Hz, T = 1/f

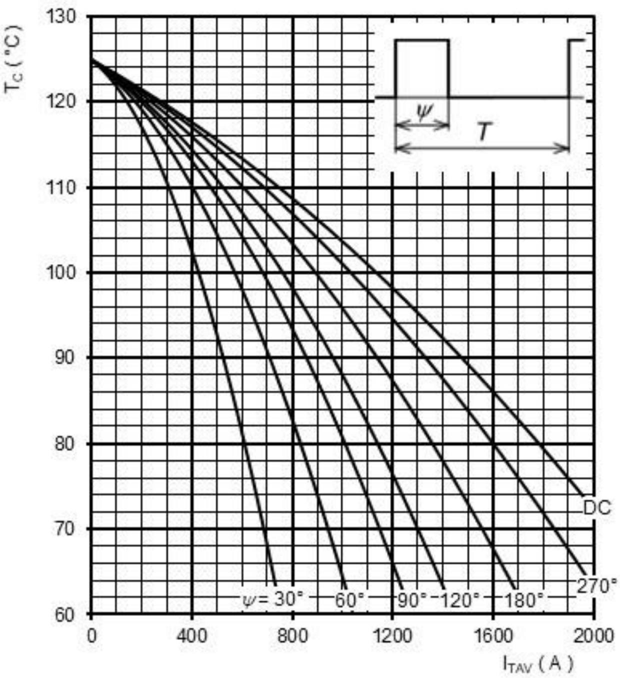

Fig. 10 Max. case temperature vs. aver. on-state current,
square waveform, f = 50 Hz, T = 1/f

Note: 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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