

V_{DRM}	=	2800 V
I_{TAVM}	=	1512 A
I_{TRMS}	=	2375 A
I_{TSM}	=	23.6×10^3 A
$V_{(T0)}$	=	1.036 V
r_T	=	0.283 m Ω

Phase Control Thyristor

5STP 16F2801

Doc. No. 5SYA1064-01 March 03

- Low on-state and switching losses
- Designed for traction, energy and industrial applications
- Optimum power handling capability

Blocking

Maximum rated values ¹⁾

Symbol	Conditions	5STP 16F2801	5STP 16F2601	5STP 16F2401
V_{DRM}, V_{RRM}	f = 50 Hz, $t_p = 10$ ms	2800 V	2600 V	2400 V
dV/dt_{crit}	Exp. to $0.67 \times V_{DRM}, T_{vj} = 125^\circ\text{C}$	1000 V/ μs		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward leakage current	I_{DRM}	$V_{DRM}, T_{vj} = 125^\circ\text{C}$			150	mA
Reverse leakage current	I_{RRM}	$V_{RRM}, T_{vj} = 125^\circ\text{C}$			150	mA

Mechanical data

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		20	22	24	kN
Acceleration	a	Device unclamped			50	m/s ²
Acceleration	a	Device clamped			100	m/s ²

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	m			0.48		kg
Surface creepage distance	D_S		25			mm
Air strike distance	D_a		13			mm

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

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On-state*Maximum rated values ¹⁾*

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, $T_c = 70^\circ\text{C}$			1512	A
RMS on-state current	$I_{T(RMS)}$				2375	A
Peak non-repetitive surge current	I_{TSM}	$t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			23.6×10^3	A
Limiting load integral	I^2t				2.785×10^6	A^2s
Peak non-repetitive surge current	I_{TSM}	$t_p = 8.3\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			25.2×10^3	A
Limiting load integral	I^2t				2.64×10^6	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	$I_T = 2000\text{ A}$, $T_{vj} = 125^\circ\text{C}$			1.6	V
Threshold voltage	$V_{(TO)}$	$I_T = 1900\text{ A} - 5800\text{ A}$, $T_{vj} = 125^\circ\text{C}$			1.036	V
Slope resistance	r_T				0.283	$\text{m}\Omega$
Holding current	I_H	$T_{vj} = 25^\circ\text{C}$		170		mA
		$T_{vj} = 125^\circ\text{C}$		90		mA
Latching current	I_L	$T_{vj} = 25^\circ\text{C}$		450		mA
		$T_{vj} = 125^\circ\text{C}$		350		mA

Switching*Maximum rated values ¹⁾*

Parameter	Symbol	Conditions	min	typ	max	Unit
Critical rate of rise of on-state current	di/dt_{crit}	$T_{vj} = 125^\circ\text{C}$, $I_T = I_{T(AV)}$, Cont. $f = 50\text{ Hz}$			200	$\text{A}/\mu\text{s}$
Critical rate of rise of on-state current	di/dt_{crit}	$V_D \leq 0.67 V_{DRM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.3\ \mu\text{s}$ Cont. $f = 1\text{ Hz}$			1000	$\text{A}/\mu\text{s}$
Circuit-commutated turn-off time	t_q	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -12.5\text{ A}/\mu\text{s}$, $V_D \leq 0.67 \cdot V_{DRM}$, $dV_D/dt = 50\text{ V}/\mu\text{s}$,		200		μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -12.5\text{ A}/\mu\text{s}$		2600		μAs
Gate turn-on delay time	t_{gd}	$V_D = 0.4 \cdot V_{DRM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.3\ \mu\text{s}$, $T_{vj} = 25^\circ\text{C}$			2	μs

Triggering

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward gate voltage	V_{FGM}				12	V
Peak forward gate current	I_{FGM}				10	A
Peak reverse gate voltage	V_{RGM}				10	V
Mean forward gate power	$P_{G(AV)}$				3	W

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate-trigger voltage	V_{GT}	$T_{vj} = -40\text{ °C}$			4	V
		$T_{vj} = 25\text{ °C}$			3	
		$T_{vj} = 125\text{ °C}$	0.25		2	
Gate-trigger current	I_{GT}	$T_{vj} = -40\text{ °C}$			500	mA
		$T_{vj} = 25\text{ °C}$			250	
		$T_{vj} = 125\text{ °C}$	10		150	

Thermal

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T_{vj}		-40		125	°C
Storage temperature range	T_{stg}		-40		125	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(j-c)}$	Double-side cooled			16	K/kW
	$R_{th(j-c)A}$	Anode-side cooled			25	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled			45	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled			4	K/kW
	$R_{th(c-h)}$	Single-side cooled			8	K/kW

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
R_i (K/kW)	5.500	7.240	2.000	1.340
τ_i (s)	0.4653	0.1533	0.0375	0.0034

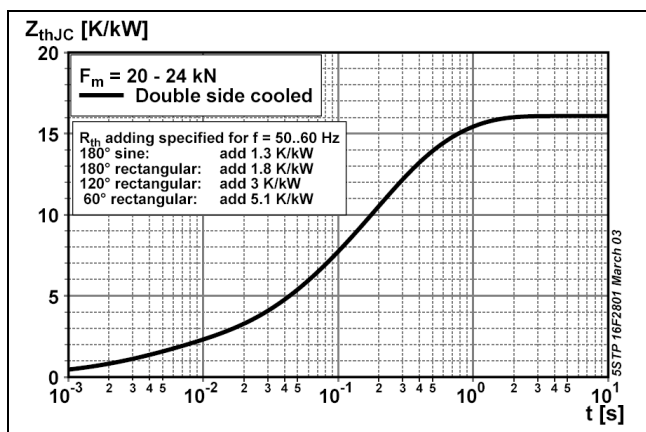


Fig. 1 Transient thermal impedance junction-to-case.

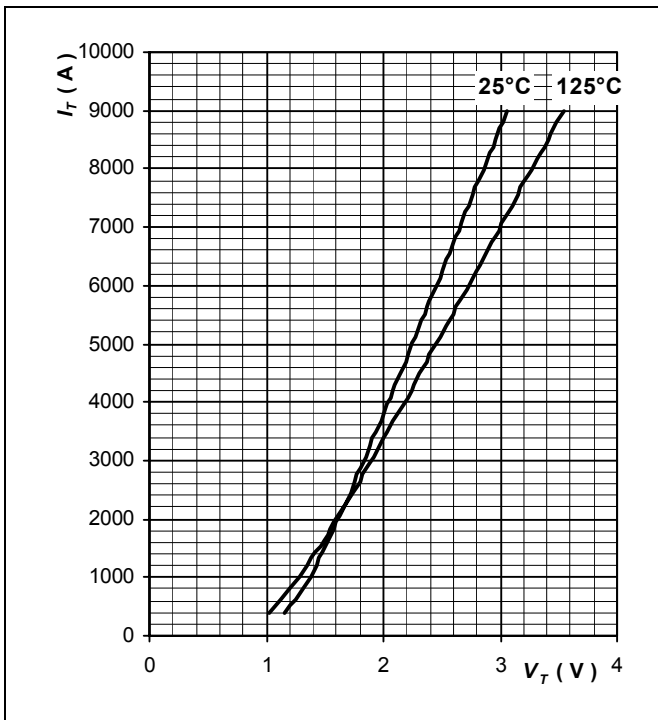


Fig. 2 Max. on-state voltage characteristics

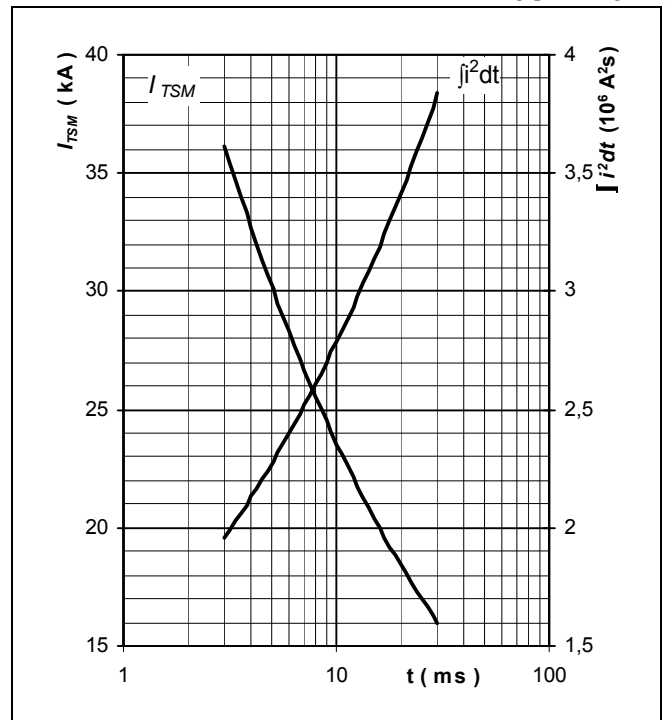


Fig. 3 Surge forward current vs. pulse length. Half sine wave, single pulse, $V_R = 0$ V

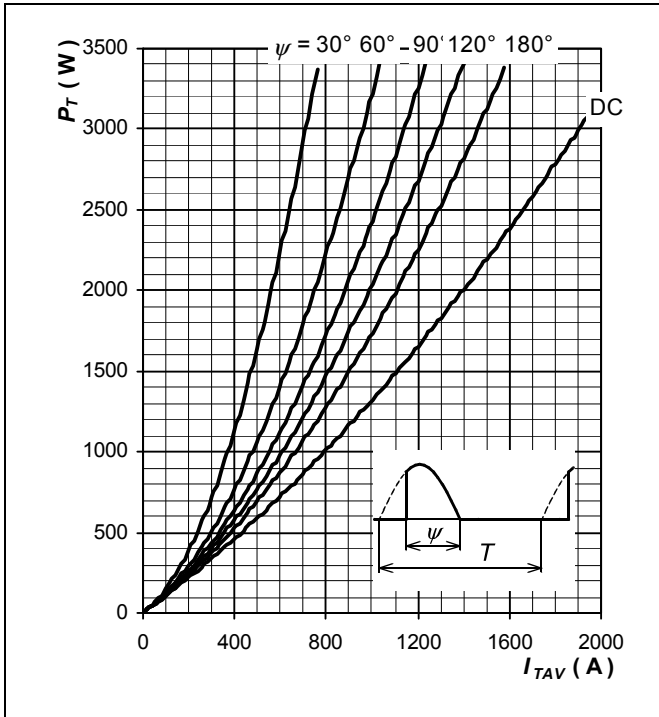


Fig. 4 Forward power loss vs. average forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

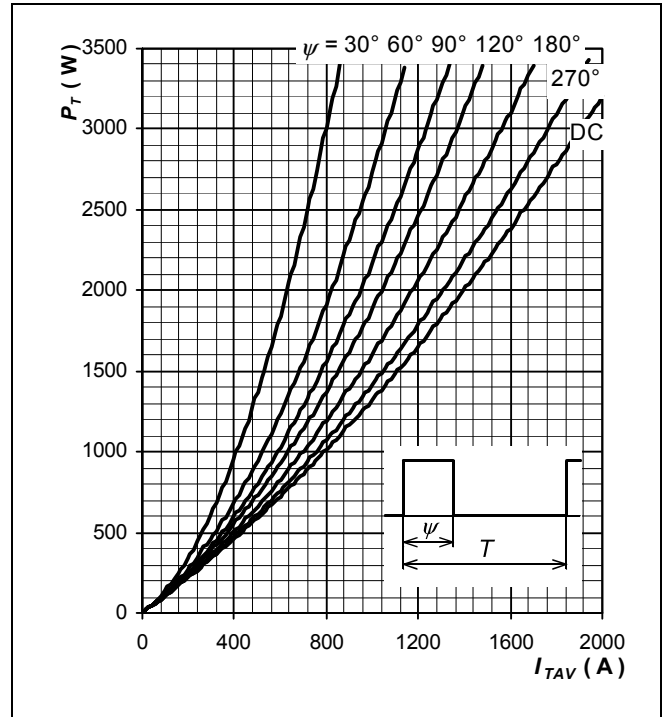


Fig. 5 Forward power loss vs. average forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

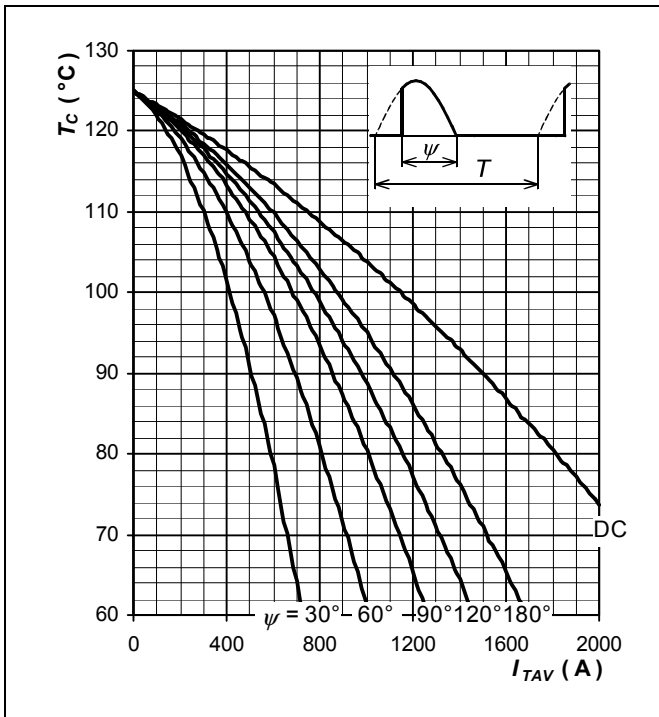


Fig. 6 Max. case temperature vs. average forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

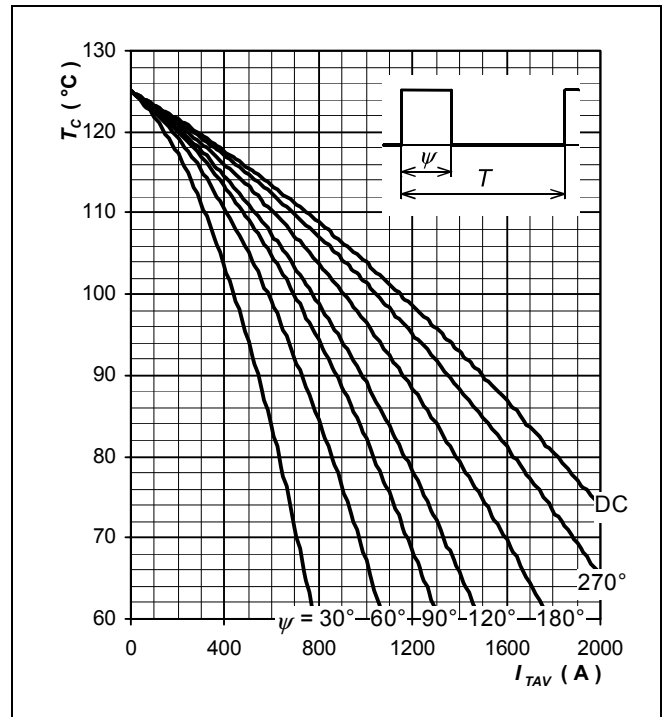


Fig. 7 Max. case temperature vs. average forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

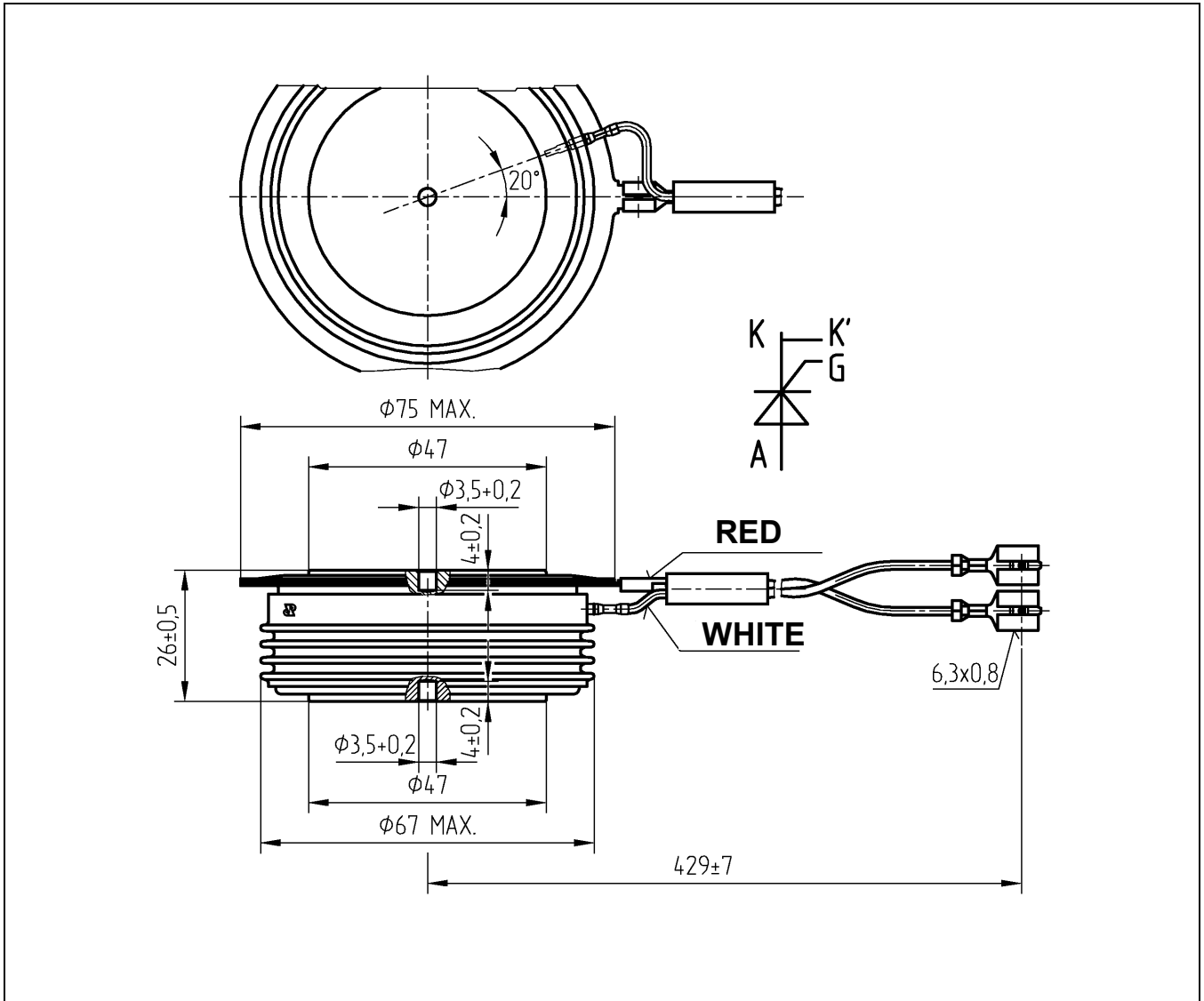


Fig. 8 Device Outline Drawing.

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