V_{DRM}	= 2200	V
$I_{T(AV)M}$	= 862	A
$I_{T(RMS)}$	= 1354	A
I_{TSM}	= 12×10^3	A
$V_{(T0)}$	= 1	V
r_T	= 0.404	mW

Phase Control Thyristor

5STP 09D2201

Doc. No. 5SYA1059-01 March 05

- **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 09D2201	5STP 09D2001	5STP 09D1801
V_{DRM}, V_{RRM}	f = 50 Hz, t_p = 10 ms	2200 V	2000 V	1800 V
dV/dt_{crit}	Exp. to 1470 V, T_{vj} = 125°C	1000 V/µs		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward leakage current	I_{DRM}	V_{DRM}, T_{vj} = 125°C			70	mA
Reverse leakage current	I_{RRM}	V_{RRM}, T_{vj} = 125°C			70	mA

Mechanical data

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		8	10	12	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				0.26	kg
Surface creepage distance	D_S		25			mm
Air strike distance	D_a		14			mm

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

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°C			862	A
RMS on-state current	$I_{T(RMS)}$				1354	A
Peak non-repetitive surge current	I_{TSM}	tp = 10 ms, T_{vj} = 125 °C, $V_D = V_R$ = 0 V			12×10^3	A
Limiting load integral	I^2t				720×10^3	A^2s
Peak non-repetitive surge current	I_{TSM}	tp = 8.3 ms, T_{vj} = 125 °C, $V_D = V_R$ = 0 V			12.8×10^3	A
Limiting load integral	I^2t				680×10^3	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	I_T = 1500 A, T_{vj} = 125 °C			1.6	V
Threshold voltage	$V_{(T0)}$	I_T = 1000 A - 3500 A, T_{vj}= 125 °C			1	V
Slope resistance	r_T				0.404	mΩ
Holding current	I_H	T_{vj} = 25 °C		170		mA
		T_{vj} = 125 °C		90		mA
Latching current	I_L	T_{vj} = 25 °C		450		mA
		T_{vj} = 125 °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 °C, $I_T = I_{T(AV)}$,	Cont. f = 50 Hz			200	A/µs
Critical rate of rise of on-state current	di/dt_{crit}	$V_D \le$ 1470 V, I_{FG} = 2 A, t_r = 0.3 µs	Cont. f = 1 Hz			1000	A/µs
Circuit-commutated turn-off time	t_q	T_{vj} = 125°C, I_{TRM} = 1500 A, V_R = 200 V, di_T/dt = -12.5 A/µs, $V_D \le 0.67 \cdot V_{DRM}$, dv_D/dt = 50V/µs			200		µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	T_{vj} = 125°C, I_{TRM} = 1500 A, V_R = 200 V, di_T/dt = -12.5 A/µs		1600		µAs
Gate turn-on delay time	t_{gd}	$V_D = 0.4 \cdot V_{RM}$, I_{FG} = 2 A, t_r = 0.3 µs, T_{vj} = 25 °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 °C			4	V
		T_{vj} = 25 °C			3	
		T_{vj} = 125 °C	0.25		2	
Gate-trigger current	I_{GT}	T_{vj} = -40 °C			500	mA
		T_{vj} = 25 °C			250	
		T_{vj} = 125 °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 F_m = 8...12 kN			32	K/kW
	$R_{th(j-c)A}$	Anode-side cooled F_m = 8...12 kN			52	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled F_m = 8...12 kN			83	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled F_m = 8...12 kN			7.5	K/kW
	$R_{th(c-h)}$	Single-side cooled F_m = 8...12 kN			15	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
$R_{th\,i}$(K/kW)	13.070	8.030	8.200	2.700
τ_i(s)	0.4857	0.2162	0.0762	0.0043

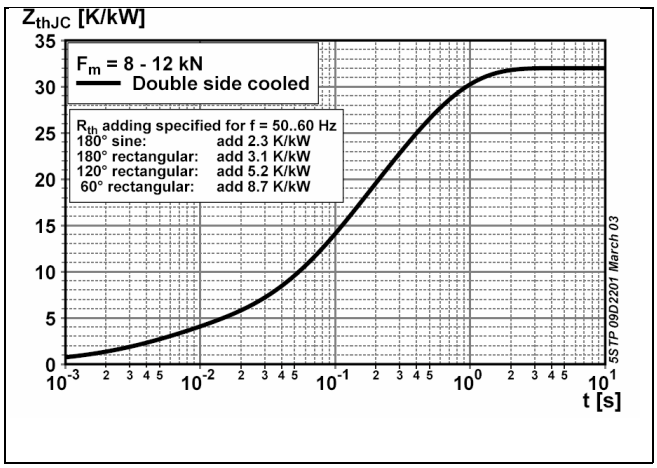

Fig. 1 Transient thermal impedance junction-to case.

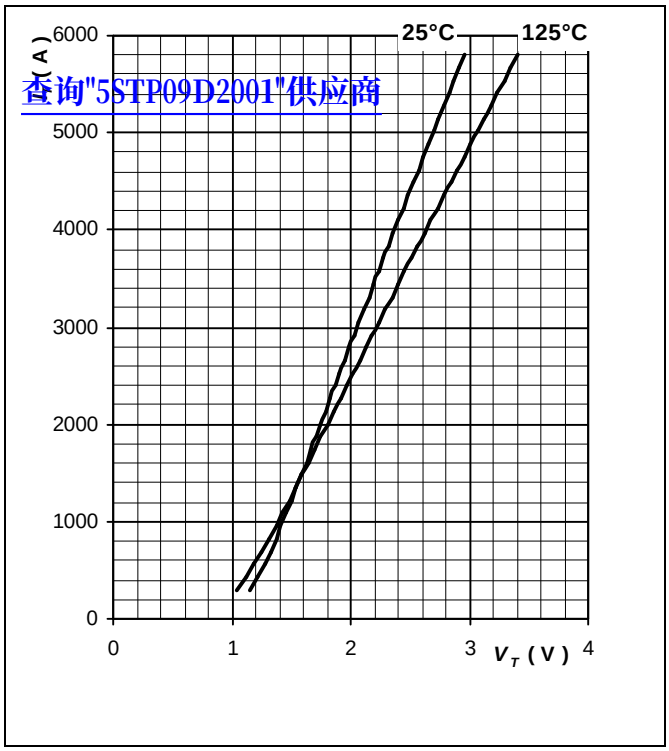

Fig. 2 Max. on-state voltage characteristics

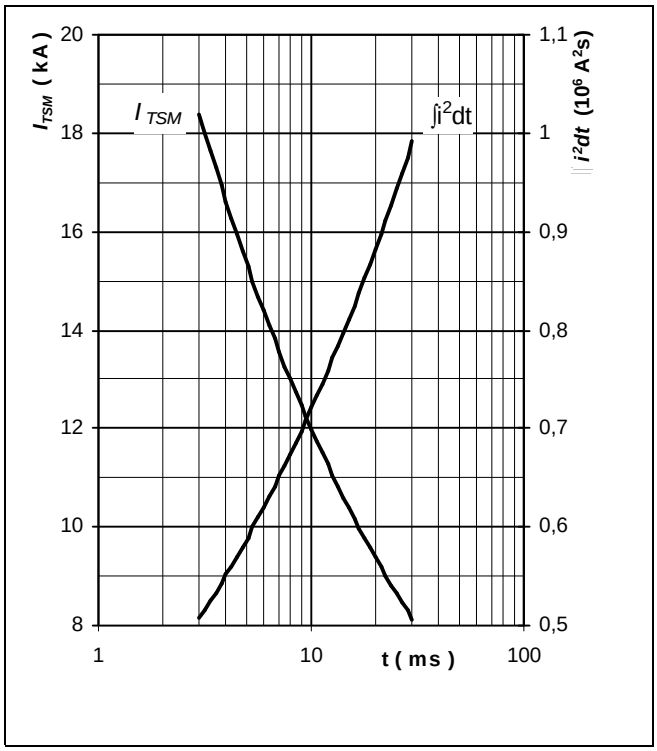

Fig. 3 Surge forward current vs. pulse length. Half sine wave, single pulse, V_R = 0 V

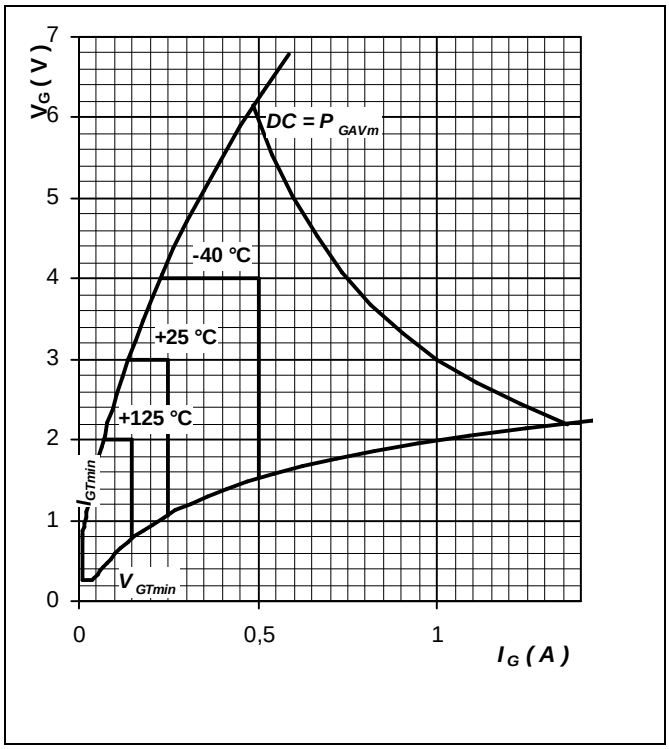

Fig. 4 Gate trigger characteristics

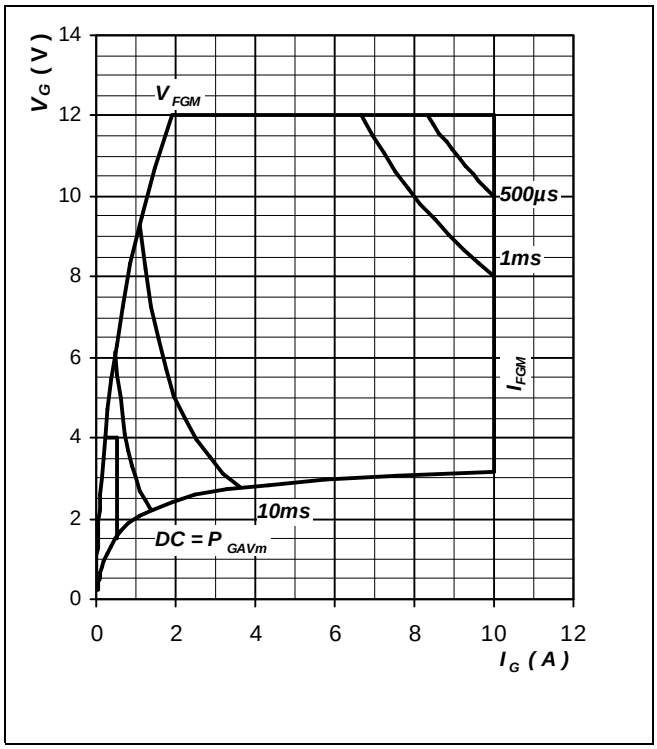

Fig. 5 Gate trigger characteristics

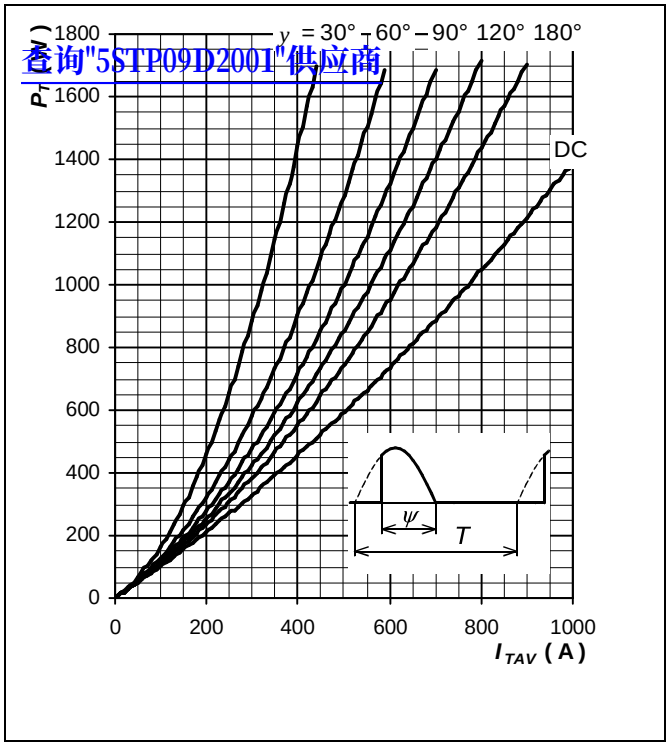

Fig. 6 Forward power loss vs. average forward current, sine waveform, f = 50 Hz, T = 1/f

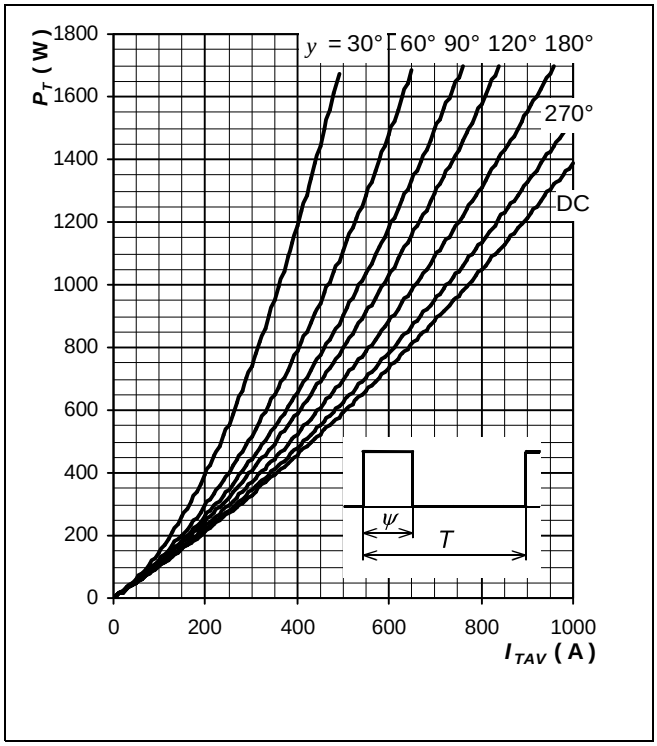

Fig. 7 Forward power loss vs. average forward current, square waveform, f = 50 Hz, T = 1/f

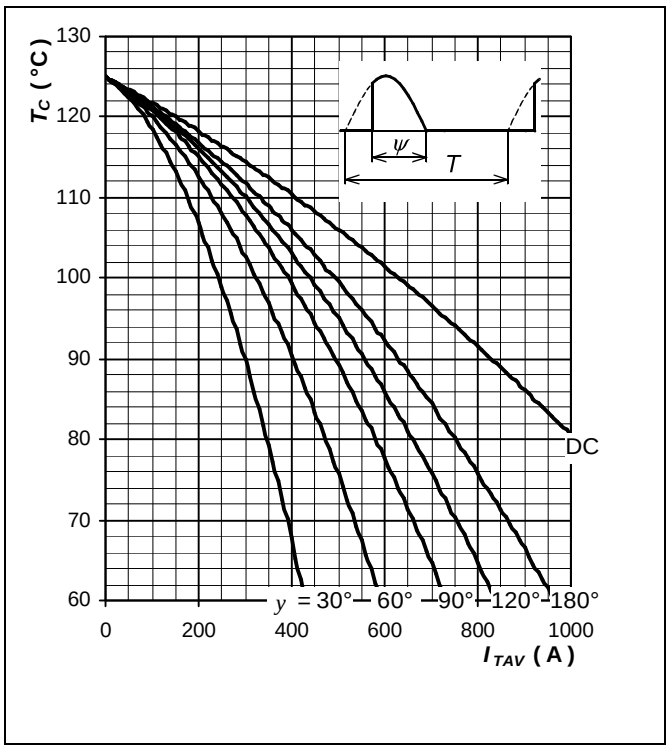

Fig. 8 Max. case temperature vs.average forward current, sine waveform, f = 50Hz, T = 1/f

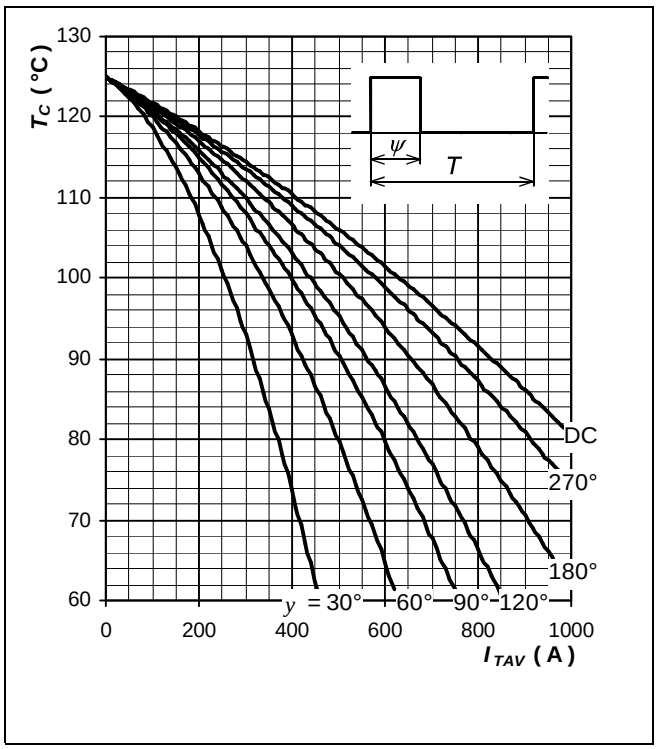

Fig. 9 Max. case temperature vs.average forward current, square waveform, f = 50Hz, T = 1/f

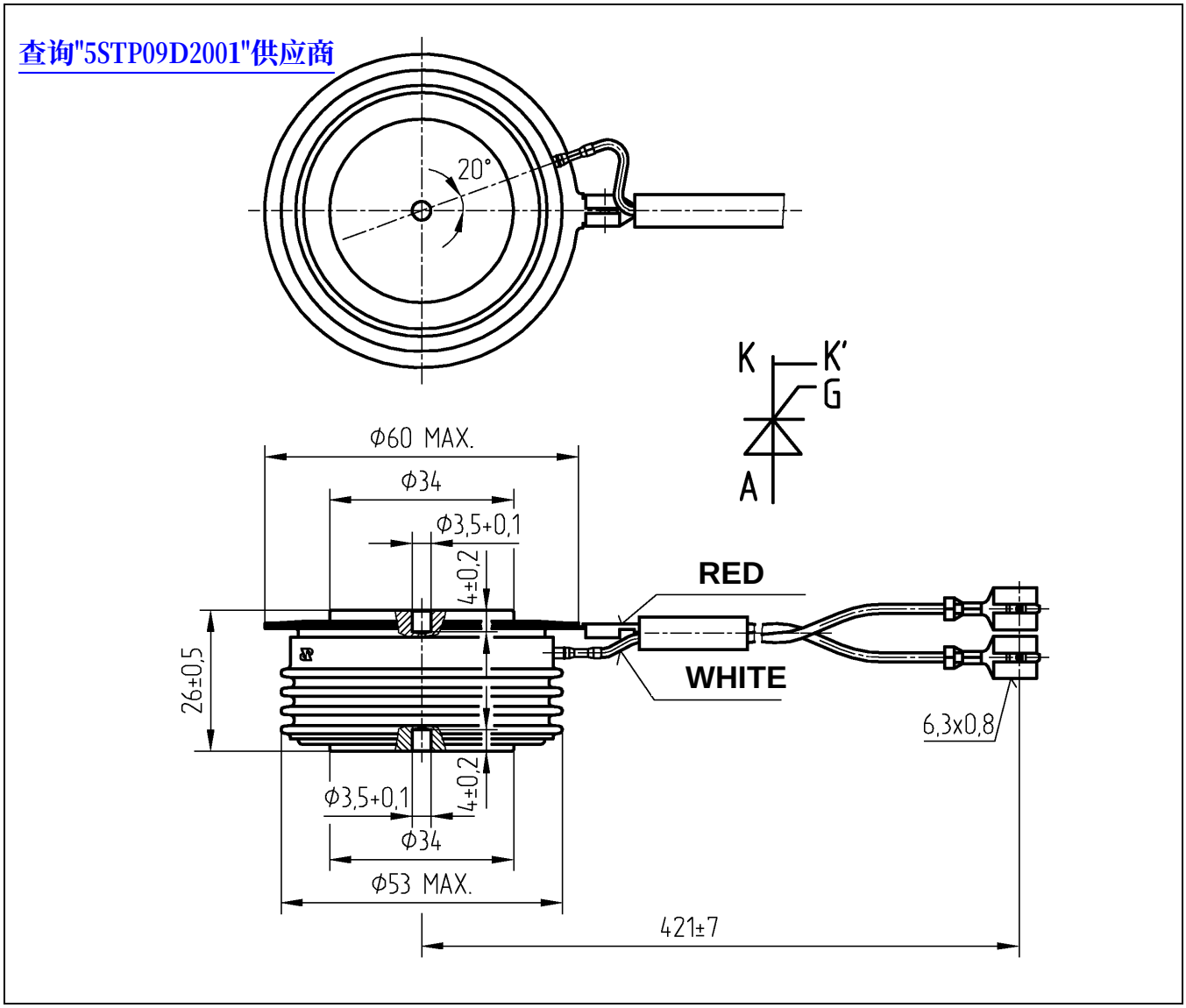

Fig. 10 Device Outline Drawing.

Related application notes:

Doc. Nr	Titel
5SYA2020	Design of RC-Snubber for Phase Control Applications
5SYA2034	Gate-drive Recommendations for PCT's
5SYA 2036	Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors

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