

## Phase Control Thyristors (Hockey PUK Version), 500 A


**TO-200AB (A-PUK)**

### FEATURES

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AB (A-PUK)
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### TYPICAL APPLICATIONS

- DC motor controls
- Controlled DC power supplies
- AC controllers

### PRODUCT SUMMARY

Package	TO-200AB (A-PUK)
Diode variation	Single SCR
$I_{T(AV)}$	500 A
$V_{DRM}/V_{RRM}$	400 V, 600 V
$V_{TM}$	1.36 V
$I_{GT}$	90 mA
$T_J$	-40 °C to 125 °C

### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		500	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		960	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	7850	A
	60 Hz	8220	
$I^2t$	50 Hz	308	kA <sup>2</sup> s
	60 Hz	281	
$V_{DRM}/V_{RRM}$		400 to 600	V
$t_q$	Typical	100	μs
$T_J$		- 40 to 125	°C

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	$I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST280C..C	04	400	500	30
	06	600	700	



ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at heatsink temperature	I <sub>T(AV)</sub>	180° conduction, half sine wave double side(single side) cooled			500 (185)	A
					55 (85)	°C
Maximum RMS on-state current	I <sub>T(RMS)</sub>	DC at 25 °C heatsink temperature double side cooled			960	A
Maximum peak, one-cycle non-repetitive surge current	I <sub>TSM</sub>	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	7850	
		t = 8.3 ms			8220	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		6600	
		t = 8.3 ms			6900	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied		308	kA <sup>2</sup> s
		t = 8.3 ms			281	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		218	
		t = 8.3 ms			200	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 to 10 ms, no voltage reapplied			3080	kA <sup>2</sup> √s
Low level value of threshold voltage	V <sub>T(TO)1</sub>	(16.7 % × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> maximum			0.84	V
High level value of threshold voltage	V <sub>T(TO)2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			0.88	
Low level value of on-state slope resistance	r <sub>t1</sub>	(16.7 % × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> maximum			0.50	mΩ
High level value of on-state slope resistance	r <sub>t2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			0.47	
Maximum on-state voltage	V <sub>TM</sub>	I <sub>pk</sub> = 1050 A, T <sub>J</sub> = 125 °C, t <sub>p</sub> = 10 ms sine pulse			1.36	V
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply 12 V resistive load			600	mA
Maximum (typical) latching current	I <sub>L</sub>				1000 (300)	

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned-on current	$di/dt$	Gate drive 20 V, 20 Ω, $t_r \leq 1$ μs $T_J = T_J$ maximum, anode voltage $\leq 80$ % $V_{DRM}$	1000	A/μs
Typical delay time	$t_d$	Gate current 1 A, $di_g/dt = 1$ A/μs $V_d = 0.67$ % $V_{DRM}$ , $T_J = 25$ °C	1.0	μs
Typical turn-off time	$t_q$	$I_{TM} = 300$ A, $T_J = T_J$ maximum, $di/dt = 20$ A/μs, $V_R = 50$ V, $dV/dt = 20$ V/μs, gate 0 V 100 Ω, $t_p = 500$ μs	100	

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	$dV/dt$	$T_J = T_J$ maximum linear to 80 % rated $V_{DRM}$	500	V/μs
Maximum peak reverse and off-state leakage current	$I_{RRM}, I_{DRM}$	$T_J = T_J$ maximum, rated $V_{DRM}/V_{RRM}$ applied	30	mA



TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		10.0		W
Maximum average gate power	P <sub>G(AV)</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50		2.0		
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		3.0		A
Maximum peak positive gate voltage	+ V <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		20		V
Maximum peak negative gate voltage	- V <sub>GM</sub>			5.0		
DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = - 40 °C	Maximum required gate trigger/ current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied	180	-	mA
		T <sub>J</sub> = 25 °C		90	150	
		T <sub>J</sub> = 125 °C		40	-	
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 40 °C		2.9	-	V
		T <sub>J</sub> = 25 °C		1.8	3.0	
		T <sub>J</sub> = 125 °C		1.2	-	
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V <sub>BRM</sub> anode to cathode applied	10		mA
DC gate voltage not to trigger	V <sub>GD</sub>			0.30		V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction temperature range	$T_J$		- 40 to 125	°C
Maximum storage temperature range	$T_{Stg}$		- 40 to 150	
Maximum thermal resistance, junction to heatsink	$R_{thJ-hs}$	DC operation single side cooled	0.17	K/W
		DC operation double side cooled	0.08	
Maximum thermal resistance, case to heatsink	$R_{thC-hs}$	DC operation single side cooled	0.033	
		DC operation double side cooled	0.017	
Mounting force, $\pm 10$ %			4900 (500)	N (kg)
Approximate weight			50	g
Case style		See dimensions - link at the end of datasheet	TO-200AB (A-PUK)	

$\Delta R_{thJC}$ CONDUCTION						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.016	0.016	0.011	0.011	T <sub>J</sub> = T <sub>J</sub> maximum	K/W
120°	0.019	0.019	0.019	0.019		
90°	0.024	0.024	0.026	0.026		
60°	0.035	0.035	0.036	0.037		
30°	0.060	0.060	0.060	0.061		

**Note**

- The table above shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC

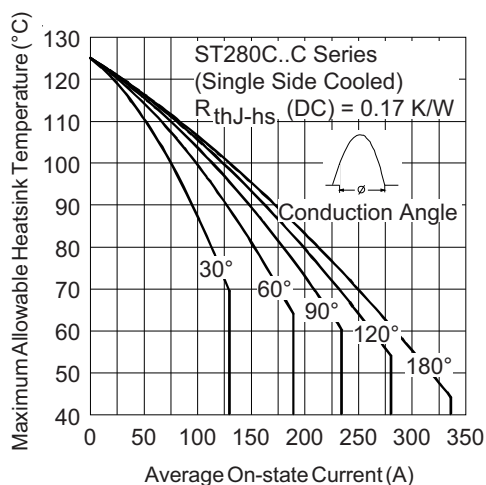


Fig. 1 - Current Ratings Characteristics

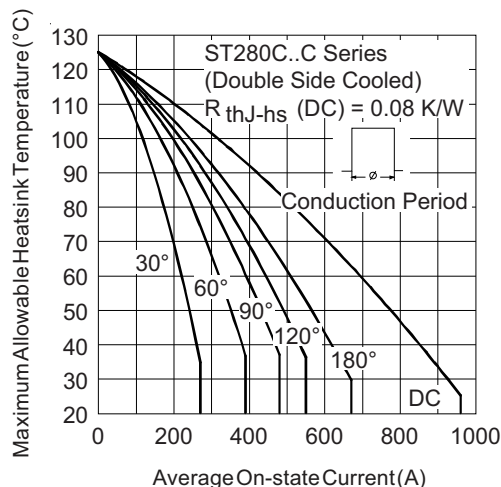


Fig. 4 - Current Ratings Characteristics

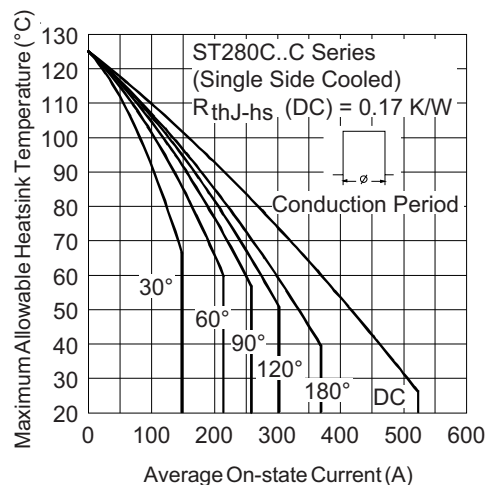


Fig. 2 - Current Ratings Characteristics

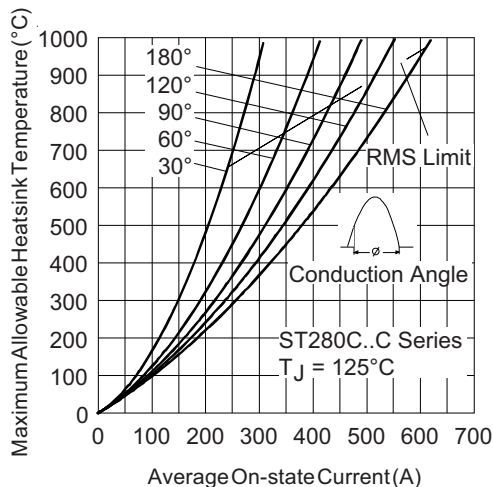


Fig. 5 - On-State Power Loss Characteristics

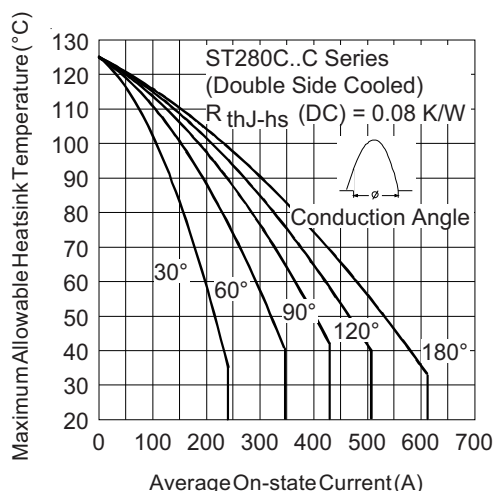


Fig. 3 - Current Ratings Characteristics

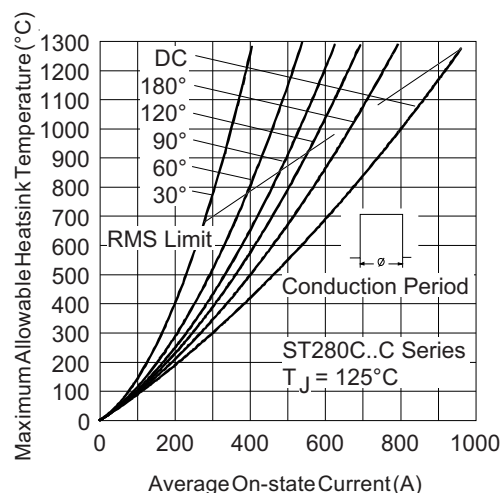


Fig. 6 - On-State Power Loss Characteristics

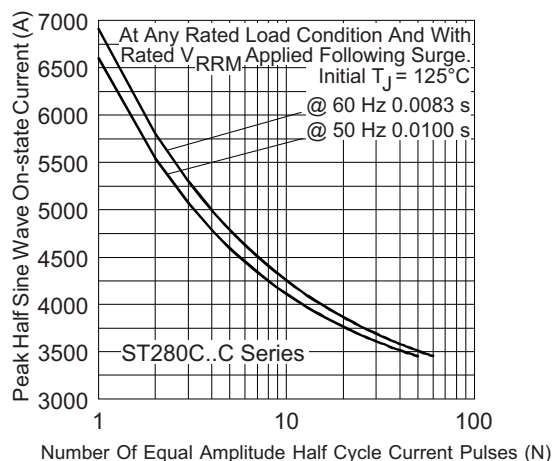


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

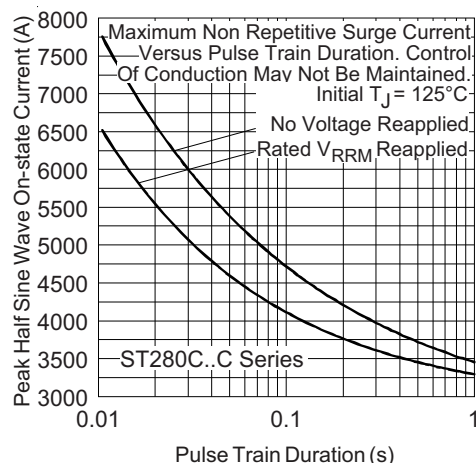


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

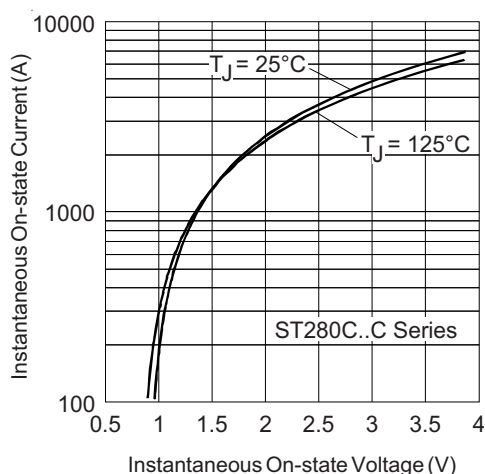


Fig. 9 - On-State Voltage Drop Characteristics

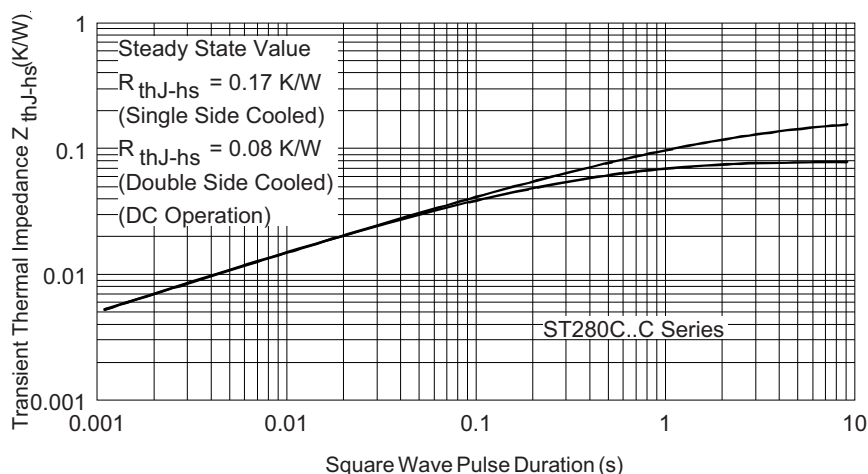


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

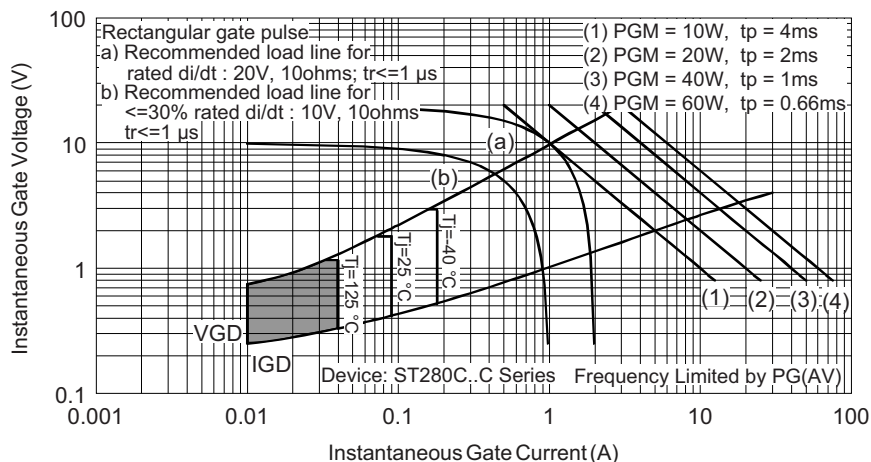


Fig. 11 - Gate Characteristics

## ORDERING INFORMATION TABLE

Device code	VS-	ST	28	0	C	06	C	1	-
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- |   |  |
|---|--|
| 1 | - Vishay Semiconductors product  |
| 2 | - Thyristor  |
| 3 | - Essential part number  |
| 4 | - 0 = Converter grade  |
| 5 | - C = Ceramic PUK  |
| 6 | - Voltage code: code x 100 = $V_{RRM}$ (see Voltage Ratings table)   |
| 7 | - C = PUK case TO-200AB (A-PUK)  |
| 8 | - 0 = Eyelet terminals (gate and auxiliary cathode unsoldered leads)<br>1 = Fast-on terminals (gate and auxiliary cathode unsoldered leads)<br>2 = Eyelet terminals (gate and auxiliary cathode soldered leads)<br>3 = Fast-on terminals (gate and auxiliary cathode soldered leads) |
| 9 | - Critical $dV/dt$ : • None = 500 V/ $\mu s$ (standard selection)<br>• L = 1000 V/ $\mu s$ (special selection)   |

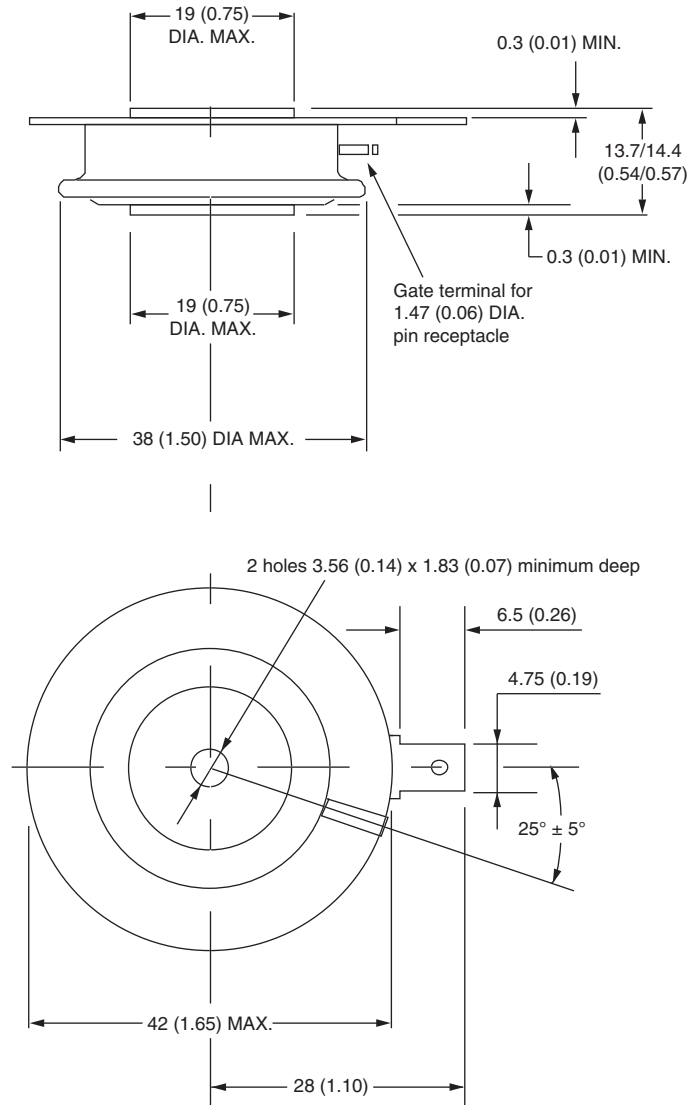
### LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?95074">www.vishay.com/doc?95074</a>
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## TO-200AB (A-PUK)

### DIMENSIONS in millimeters (inches)

Anode to gate  
Creepage distance: 7.62 (0.30) minimum  
Strike distance: 7.12 (0.28) minimum



Quote between upper and lower pole pieces has to be considered after application of mounting force (see thermal and mechanical specification)



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