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[VS-ST230C04C0](#)

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[www.vishay.com](http://www.vishay.com)

## VS-ST230C Series

Vishay Semiconductors

### Phase Control Thyristors (Hockey PUK Version), 410 A



TO-200AB (A-PUK)

PRODUCT SUMMARY	
Package	TO-200AB (A-PUK)
Diode variation	Single SCR
$I_{T(AV)}$	410 A
$V_{DRM}/V_{RRM}$	400 V, 800 V, 1200 V, 1400 V, 1600 V, 1800 V, 2000 V
$V_{TM}$	1.69 V
$I_{GT}$	90 mA
$T_J$	-40 °C to 125 °C

#### 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)



#### TYPICAL APPLICATIONS

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

#### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		410	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		780	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	5700	A
	60 Hz	5970	
$I^2t$	50 Hz	163	$kA^2s$
	60 Hz	149	
$V_{DRM}/V_{RRM}$		400 to 2000	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
VS-ST230C..C	04	400	500	30
	08	800	900	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	
	18	1800	1900	
	20	2000	2100	

<b>ABSOLUTE MAXIMUM RATINGS</b>									
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS			
Maximum average on-state current at heatsink temperature	$I_{T(AV)}$	180° conduction, half sine wave double side (single side) cooled			410 (165)	A			
					55 (85)	°C			
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled			780	A			
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	$t = 10 \text{ ms}$	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	5700				
		$t = 8.3 \text{ ms}$			5970				
		$t = 10 \text{ ms}$	100 % $V_{RRM}$ reapplied		4800				
		$t = 8.3 \text{ ms}$			5000				
Maximum $I^2t$ for fusing	$I^2t$	$t = 10 \text{ ms}$	No voltage reapplied		163	kA <sup>2</sup> s			
		$t = 8.3 \text{ ms}$			148				
		$t = 10 \text{ ms}$	100 % $V_{RRM}$ reapplied		115				
		$t = 8.3 \text{ ms}$			105				
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied			1630	kA <sup>2</sup> √s			
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			0.92	V			
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			0.98				
Low level value of on-state slope resistance	$r_{t1}$	$(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			0.88	mΩ			
High level value of on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			0.81				
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 880 \text{ A}$ , $T_J = T_J$ maximum, $t_p = 10 \text{ ms}$ sine pulse			1.69	V			
Maximum holding current	$I_H$	$T_J = 25 \text{ °C}$ , anode supply 12 V resistive load			600	mA			
Maximum (typical) latching current	$I_L$				1000 (300)				

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

<b>BLOCKING</b>						
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



<b>TRIGGERING</b>						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	$P_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms		10.0		W
Maximum average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$		2.0		
Maximum peak positive gate current	$I_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms		3.0		A
Maximum peak positive gate voltage	$+V_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms		20		V
Maximum peak negative gate voltage	$-V_{GM}$			5.0		
DC gate current required to trigger	$I_{GT}$	$T_J = -40$ °C	Maximum required gate trigger/current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied	180	-	
		$T_J = 25$ °C		90	150	mA
		$T_J = 125$ °C		40	-	
DC gate voltage required to trigger	$V_{GT}$	$T_J = -40$ °C		2.9	-	V
		$T_J = 25$ °C		1.8	3.0	
		$T_J = 125$ °C		1.2	-	
DC gate current not to trigger	$I_{GD}$	$T_J = T_J$ maximum	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated $V_{DRM}$ anode to cathode applied	10		mA
DC gate voltage not to trigger	$V_{GD}$			0.25		V

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum operating 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, ± 10 %				4900 (500)	N (kg)
Approximate weight				50	g
Case style		See dimensions - link at the end of datasheet		TO-200AB (A-PUK)	

<b><math>\Delta R_{thJC}</math> CONDUCTION</b>						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.015	0.017	0.011	0.011	$T_J = T_J$ maximum	K/W
120°	0.018	0.019	0.019	0.019		
90°	0.024	0.024	0.026	0.026		
60°	0.035	0.035	0.036	0.036		
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

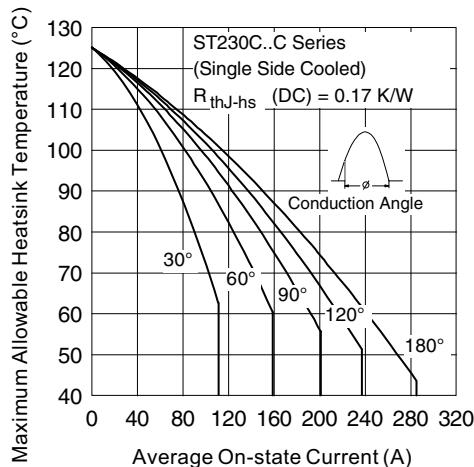


Fig. 1 - Current Ratings Characteristics

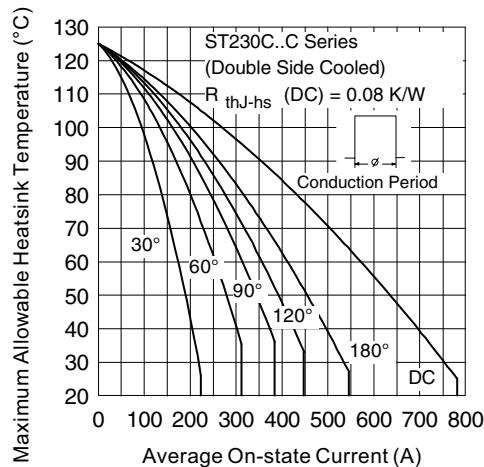


Fig. 4 - Current Ratings Characteristics

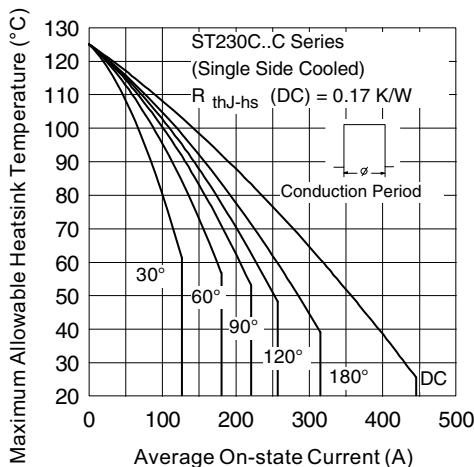


Fig. 2 - Current Ratings Characteristics

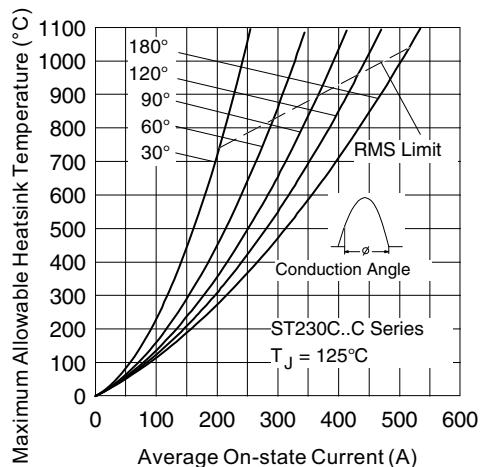


Fig. 5 - On-State Power Loss Characteristics

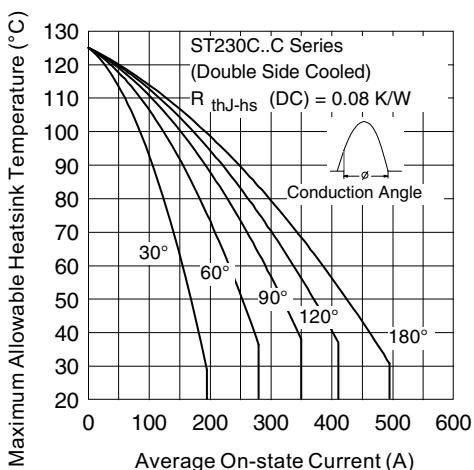


Fig. 3 - Current Ratings Characteristics

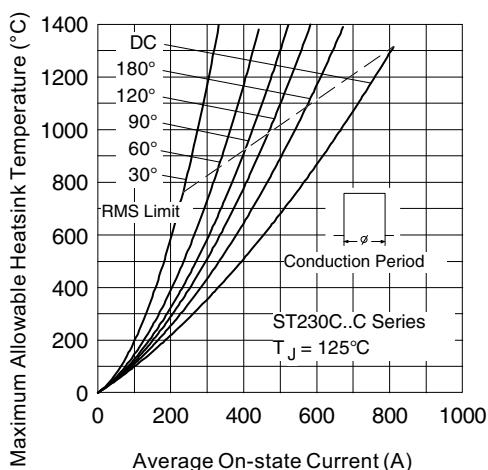


Fig. 6 - On-State Power Loss Characteristics

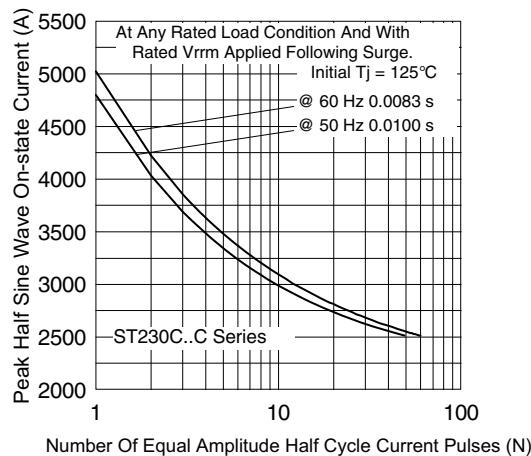


Fig. 7 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

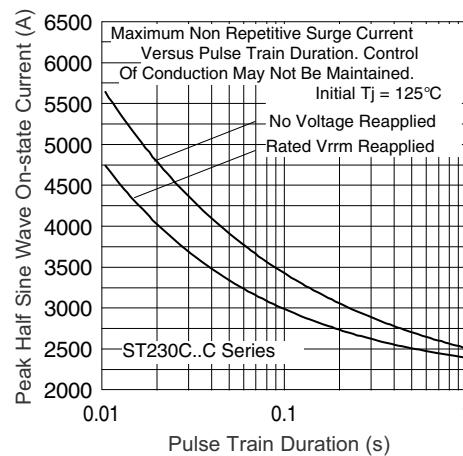


Fig. 8 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

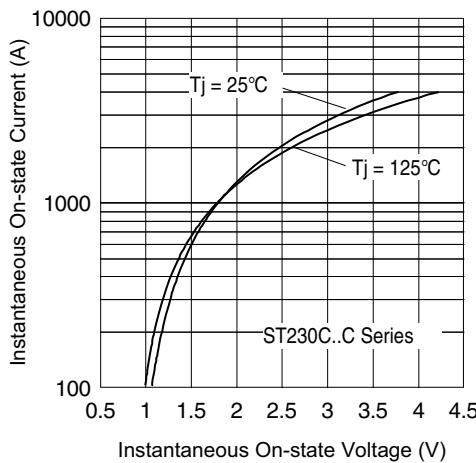


Fig. 9 - On-State Voltage Drop Characteristics

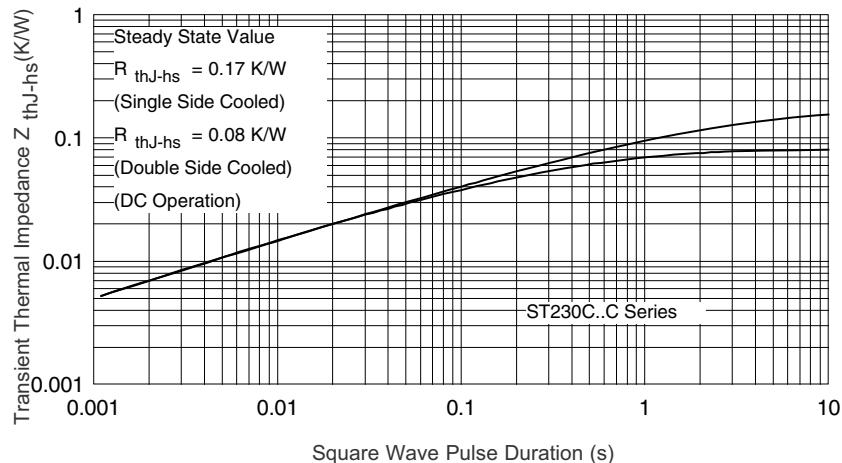


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

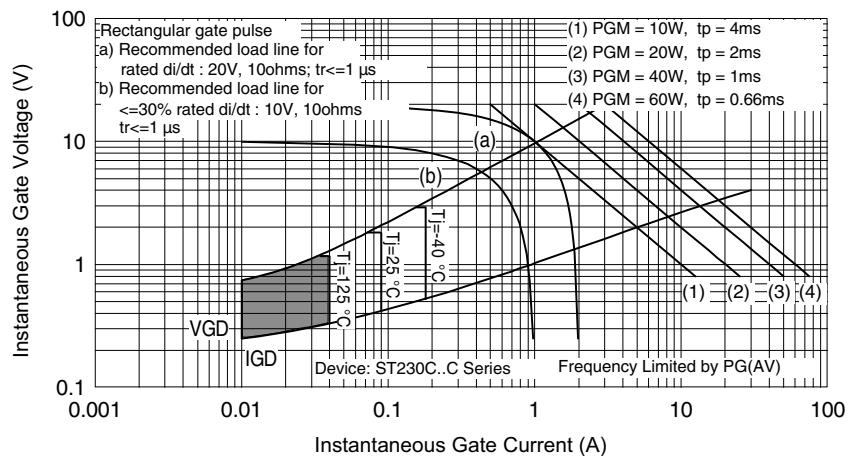


Fig. 11 - Gate Characteristics

### ORDERING INFORMATION TABLE

Device code	VS-	ST	23	0	C	20	C	1	-
	1	2	3	4	5	6	7	8	9

<b>1</b>	- Vishay Semiconductors product
<b>2</b>	- Thyristor
<b>3</b>	- Essential part number
<b>4</b>	- 0 = Converter grade
<b>5</b>	- C = Ceramic PUK
<b>6</b>	- Voltage code x 100 = $V_{RRM}$ (see Voltage Ratings table)
<b>7</b>	- C = PUK case TO-200AB (A-PUK)
<b>8</b>	<ul style="list-style-type: none"> <li>- 0 = Eyelet terminals (gate and auxiliary cathode unsoldered leads)</li> <li>1 = Fast-on terminals (gate and auxiliary cathode unsoldered leads)</li> <li>2 = Eyelet terminals (gate and auxiliary cathode soldered leads)</li> <li>3 = Fast-on terminals (gate and auxiliary cathode soldered leads)</li> </ul>
<b>9</b>	<ul style="list-style-type: none"> <li>- Critical dV/dt: • None = 500 V/μs (Standard selection)</li> <li>• L = 1000 V/μs (Special selection)</li> </ul>

### LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?95074">www.vishay.com/doc?95074</a>
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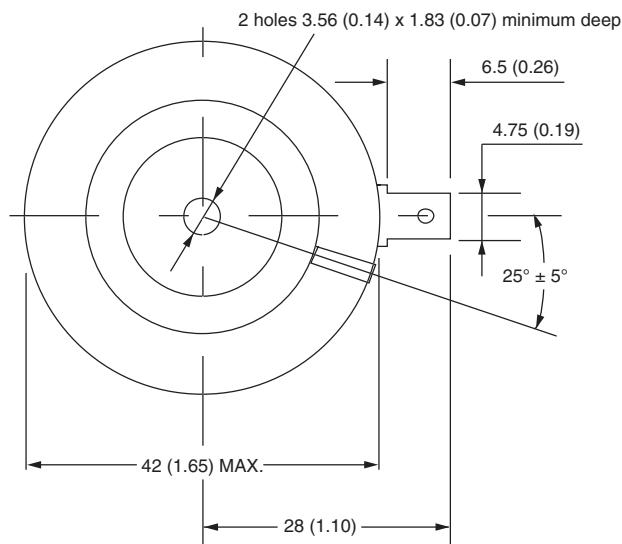
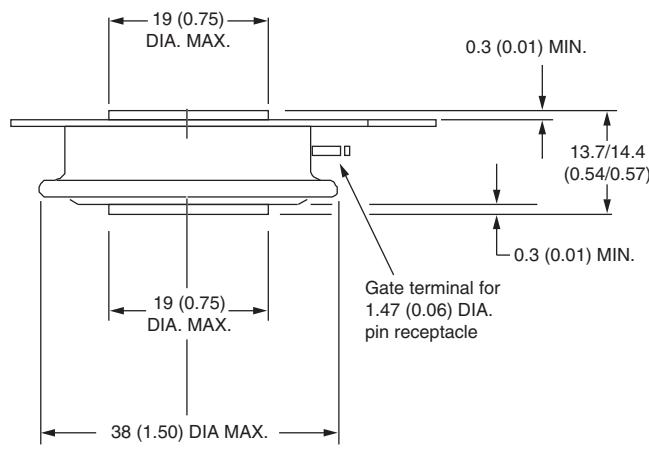
## Outline Dimensions

Vishay Semiconductors

### 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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