

## Inverter Grade Thyristors (Hockey PUK Version), 330 A


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

- Metal case with ceramic insulator
- All diffused design
- Center amplifying gate
- Guaranteed high  $dV/dt$
- International standard case A-PUK (TO-200AB)
- Guaranteed high  $dI/dt$
- High surge current capability
- Low thermal impedance
- High speed performance
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**
**PRIMARY CHARACTERISTICS**

Package	A-PUK (TO-200AB)
Circuit configuration	Single SCR
$I_{T(AV)}$	330 A
$V_{DRM}/V_{RRM}$	1000 V, 1200 V
$V_{TM}$	2.07 V
$I_{TSM}$ at 50 Hz	4680 A
$I_{TSM}$ at 60 Hz	4900 A
$I_{GT}$	200 mA
$T_C/T_{hs}$	55 °C

**TYPICAL APPLICATIONS**

- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

**MAJOR RATINGS AND CHARACTERISTICS**

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		330	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		610	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	4680	A
	60 Hz	4900	
$i^2t$	50 Hz	110	kA <sup>2</sup> s
	60 Hz	100	
$V_{DRM}/V_{RRM}$		1000 to 1200	V
$t_q$	Range	15 to 30	μs
$T_J$		-40 to 125	°C

**ELECTRICAL SPECIFICATIONS**
**VOLTAGE RATINGS**

TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	$I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-ST173C..C	10	1000	1100	40
	12	1200	1300	



CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	760	660	1200	1030	5570	4920	A
400 Hz	730	590	1260	1080	2800	2460	
1000 Hz	600	490	1200	1030	1620	1390	
2500 Hz	350	270	850	720	800	680	
Recovery voltage $V_r$	50		50		50		V
Voltage before turn-on $V_d$	$V_{DRM}$		$V_{DRM}$		$V_{DRM}$		
Rise of on-state current $di/dt$	50		-		-		A/µs
Heatsink temperature	40	55	40	55	40	55	°C
Equivalent values for RC circuit	47/0.22		47/0.22		47/0.22		Ω/µF

ON-STATE CONDUCTION					
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		330 (120)	A
				55 (85)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled		610	A
Maximum peak, one half cycle, non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reapplied	4680	
			t = 8.3 ms	100 % $V_{RRM}$ reapplied	
		t = 10 ms	Sinusoidal half wave, initial $T_J = T_J$ maximum		
				t = 8.3 ms	4120
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reapplied	110	kA <sup>2</sup> s
			t = 8.3 ms	100 % $V_{RRM}$ reapplied	
		t = 10 ms	77		
			t = 8.3 ms	71	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied		1100	kA <sup>2</sup> √s
Maximum peak on-state voltage	$V_{TM}$	$I_{TM} = 600$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse		2.07	V
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		1.55	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.61	
Low level value of forward slope resistance	$r_{t1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.87	mΩ
High level value of forward slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.77	
Maximum holding current	$I_H$	$T_J = 25$ °C, $I_T > 30$ A		600	mA
Typical latching current	$I_L$	$T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_G = 1$ A		1000	

SWITCHING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum non-repetitive rate of rise of turned on current	$di/dt$	$T_J = T_J$ maximum, $V_{DRM} = \text{rated } V_{DRM}$ , $I_{TM} = 2 \times di/dt$		1000	A/µs
Typical delay time	$t_d$	$T_J = 25$ °C, $V_{DM} = \text{rated } V_{DRM}$ , $I_{TM} = 50$ A DC, $t_p = 1$ µs Resistive load, gate pulse: 10 V, 5 Ω source		1.1	µs
Maximum turn-off time	minimum	$t_q$	$T_J = T_J$ maximum, $I_{TM} = 300$ A, commutating $di/dt = 20$ A/µs $V_R = 50$ V, $t_p = 500$ µs, $dV/dt$ : see table in device code	15	
	maximum			30	



<b>BLOCKING</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	dV/dt	T <sub>J</sub> = T <sub>J</sub> maximum, linear to 80 % V <sub>DRM</sub> , higher value available on request	500	V/μs
Maximum peak reverse and off-state leakage current	I <sub>RRM</sub> , I <sub>DRM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> /V <sub>RRM</sub> applied	40	mA

<b>TRIGGERING</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50	60	W
Maximum average gate power	P <sub>G(AV)</sub>		10	
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms	10	A
Maximum peak positive gate voltage	+ V <sub>GM</sub>		20	V
Maximum peak negative gate voltage	- V <sub>GM</sub>		5	
Maximum DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = 25 °C, V <sub>A</sub> = 12 V, R <sub>a</sub> = 6 Ω	200	mA
Maximum DC gate voltage required to trigger	V <sub>GT</sub>		3	V
Maximum DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> applied	20	mA
Maximum DC gate voltage not to trigger	V <sub>GD</sub>		0.25	V

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction temperature range	T <sub>J</sub>		-40 to 125	°C
Maximum storage temperature range	T <sub>Stg</sub>		-40 to 150	
Maximum thermal resistance, junction to heatsink	R <sub>thJ-hs</sub>	DC operation single side cooled	0.17	K/W
		DC operation double side cooled	0.08	
Maximum thermal resistance, case to heatsink	R <sub>thC-hs</sub>	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	A-PUK (TO-200AB)	

<b>ΔR<sub>thJ-hs</sub> CONDUCTION</b>						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.015	0.016	0.011	0.011	T <sub>J</sub> = T <sub>J</sub> 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	0.037		
30°	0.060	0.060	0.060	0.061		

**Note**

- The table above shows the increment of thermal resistance R<sub>thJ-hs</sub> when devices operate at different conduction angles than DC

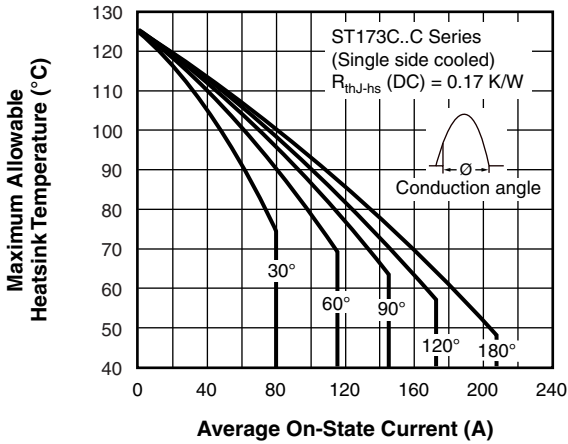


Fig. 1 - Current Ratings Characteristics

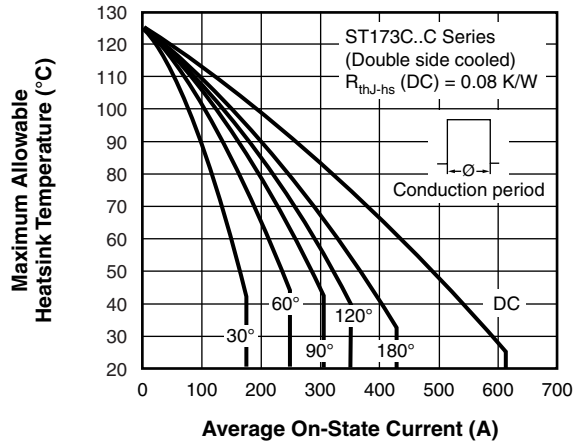


Fig. 4 - Current Ratings Characteristics

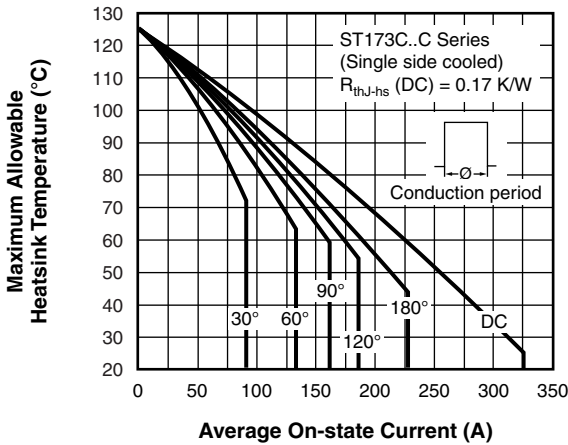


Fig. 2 - Current Ratings Characteristics

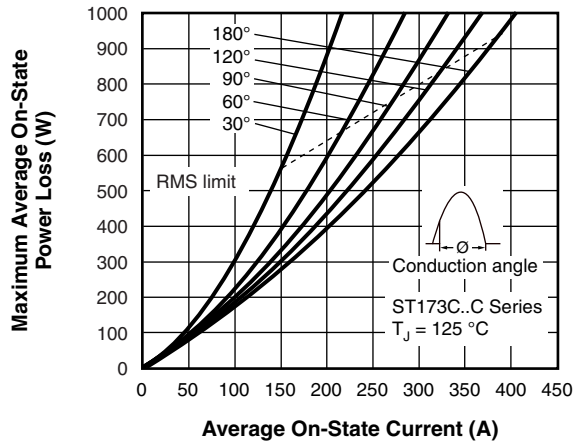


Fig. 5 - On-State Power Loss Characteristics

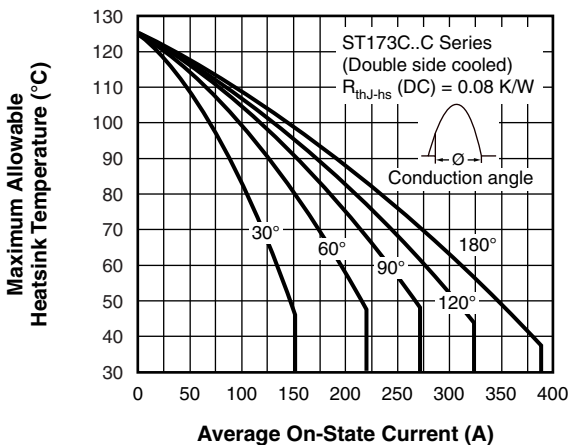


Fig. 3 - Current Ratings Characteristics

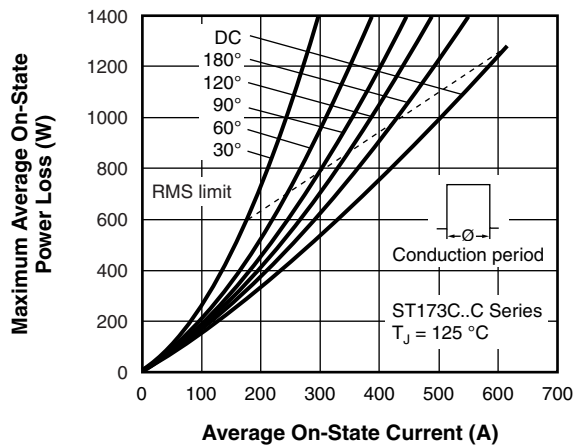


Fig. 6 - On-State Power Loss Characteristics

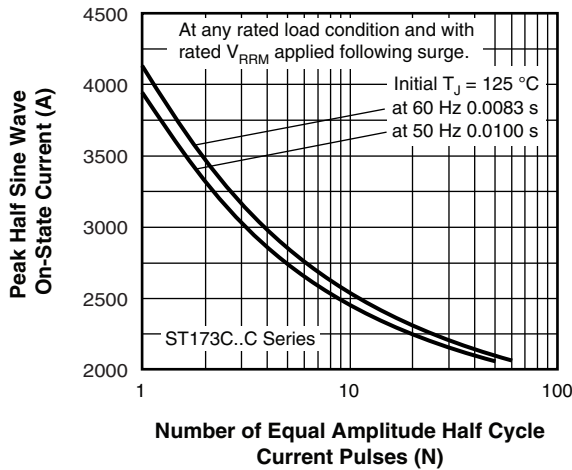


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

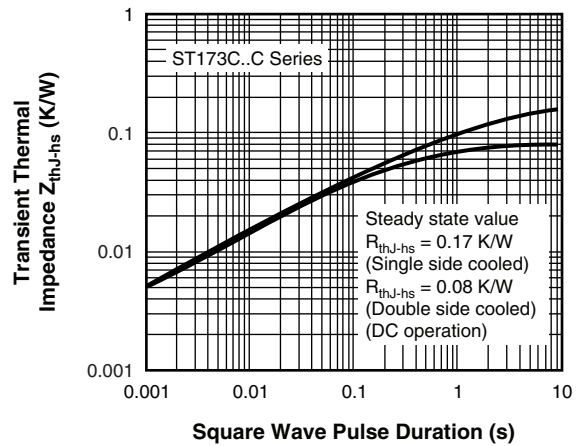


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

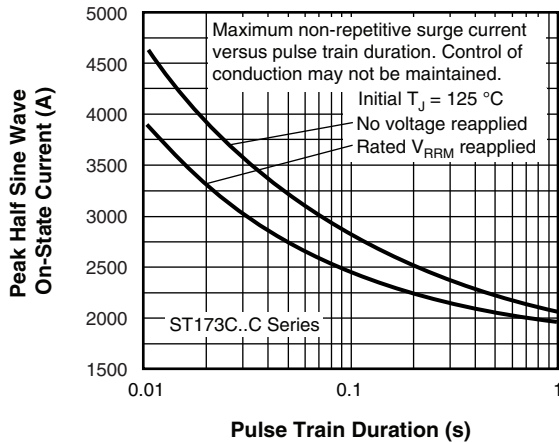


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

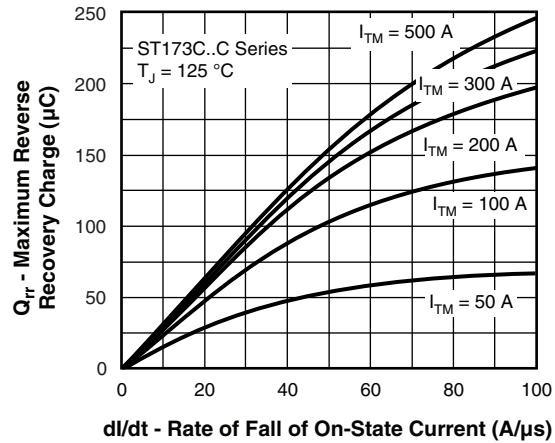


Fig. 11 - Reverse Recovered Charge Characteristics

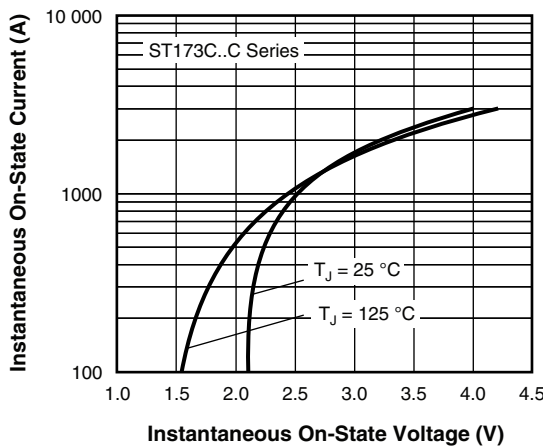


Fig. 9 - On-State Voltage Drop Characteristics

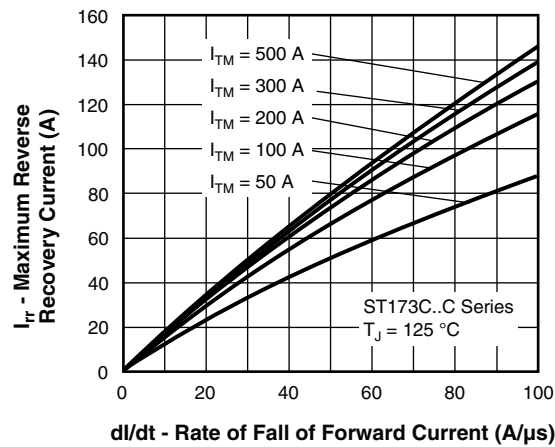


Fig. 12 - Reverse Recovered Current Characteristics

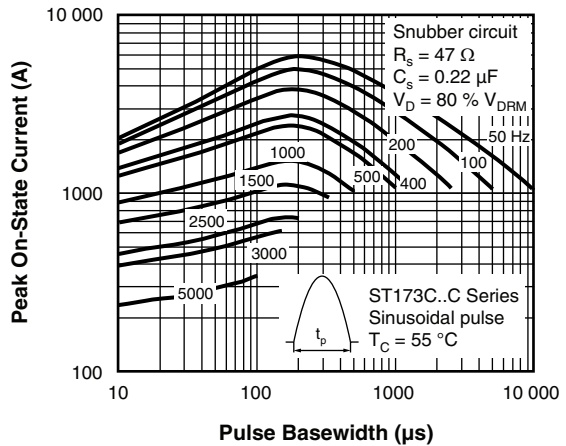
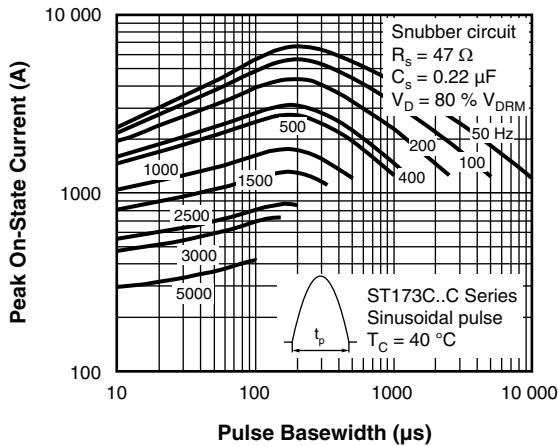


Fig. 13 - Frequency Characteristics

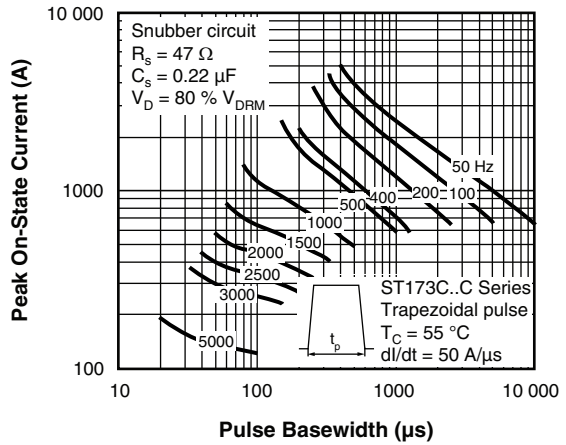
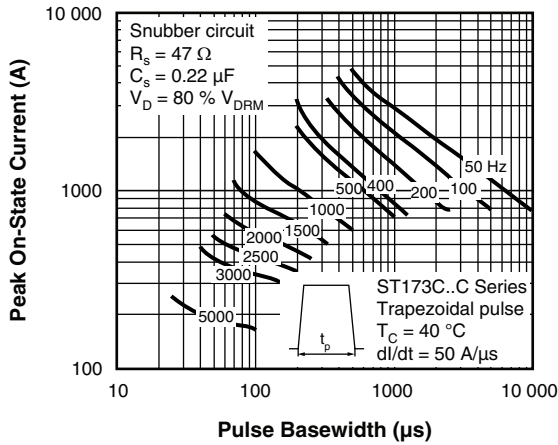


Fig. 14 - Frequency Characteristics

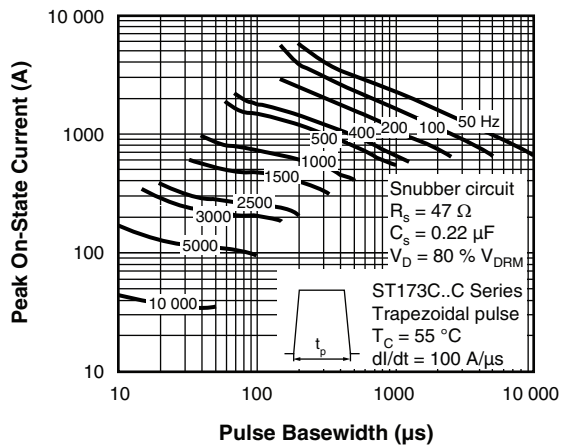
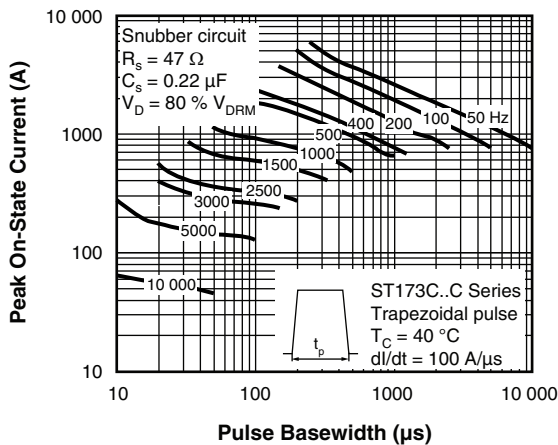


Fig. 15 - Frequency Characteristics

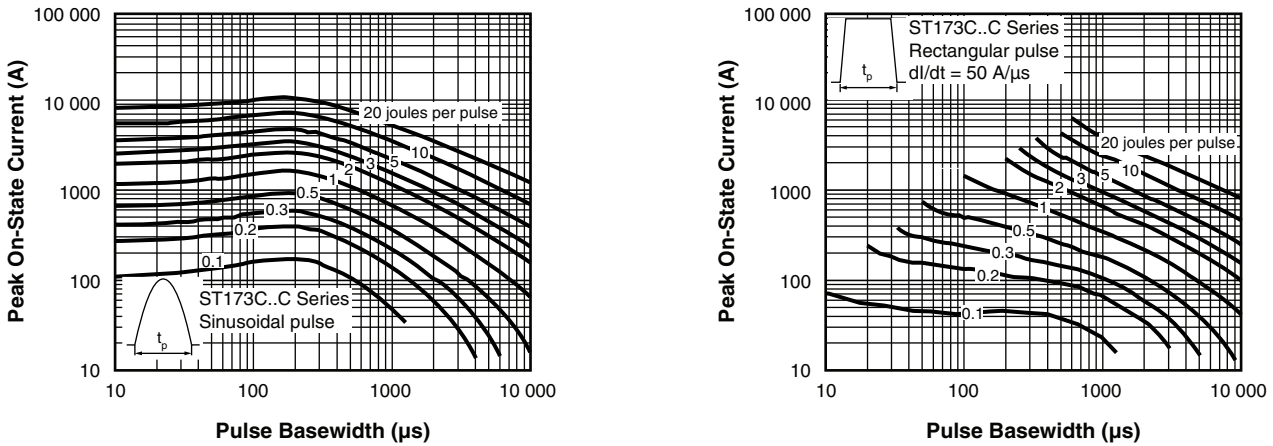


Fig. 16 - Maximum On-State Energy Power Loss Characteristics

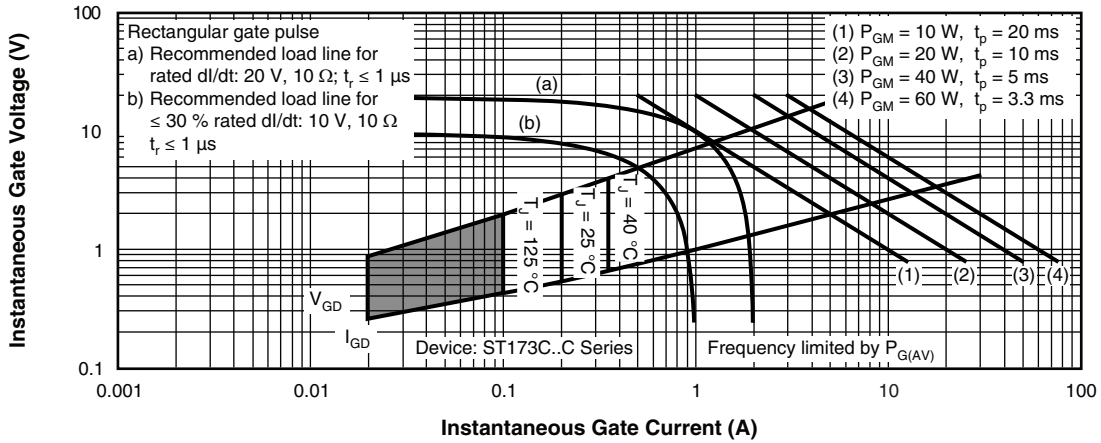
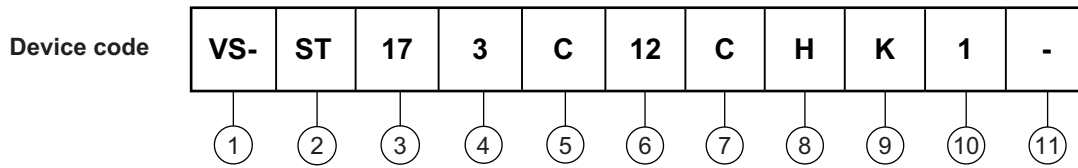


Fig. 17 - Gate Characteristics



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part number
- 4** - 3 = fast turn-off
- 5** - C = ceramic PUK
- 6** - Voltage code x 100 =  $V_{RRM}$  (see Voltage Ratings table)
- 7** - C = PUK case A-PUK (TO-200AB)
- 8** - Reapplied dV/dt code (for  $t_q$  test condition)
- 9** -  $t_q$  code
- 10** - 0 = eyelet terminals  
(gate and aux. cathode unsoldered leads)  
1 = fast-on terminals  
(gate and aux. cathode unsoldered leads)  
2 = eyelet terminals  
(gate and aux. cathode soldered leads)  
3 = fast-on terminals  
(gate and aux. cathode soldered leads)
- 11** - Critical dV/dt:
  - None = 500 V/ $\mu$ s (standard value)
  - L = 1000 V/ $\mu$ s (special selection)

dV/dt - $t_q$ combinations available					
dV/dt (V/ $\mu$ s)	20	50	100	200	400
$t_q$ ( $\mu$ s)	15	CL	--	--	--
	18	CP	DP	EP	<b>FP</b> *
	20	CK	DK	EK	<b>FK</b> *
	25	CJ	DJ	EJ	FJ
	30	--	DH	EH	FH

\* Standard part number.  
All other types available only on request.

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95074">www.vishay.com/doc?95074</a>

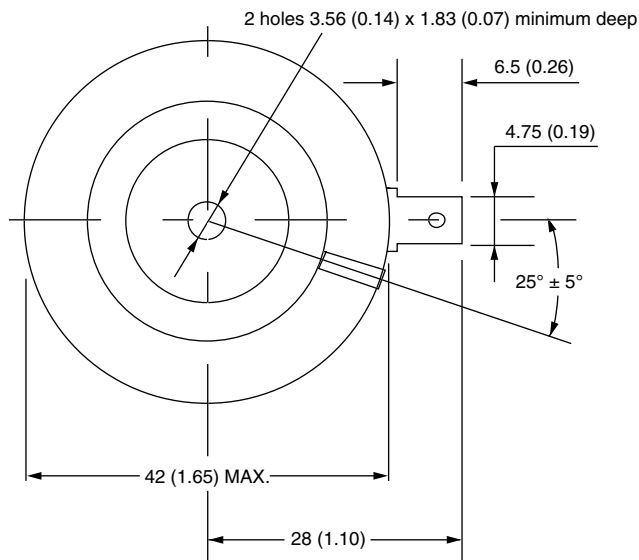
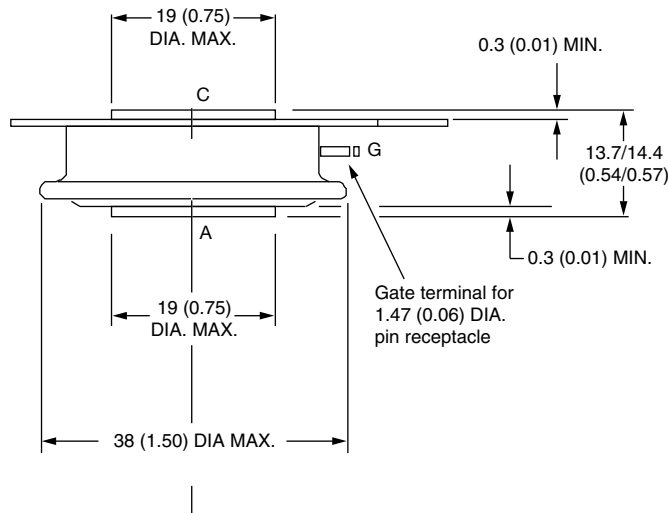




## A-PUK (TO-200AB)

### 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)



## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.