

## Phase Control Thyristors (Hockey PUK Version), 790 A



TO-200AC (B-PUK)

### FEATURES

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AC (B-PUK)
- 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 control
- Controlled DC power supplies
- AC controllers

### PRODUCT SUMMARY

Package	TO-200AC (B-PUK)
Diode variation	Single SCR
$I_{T(AV)}$	790 A
$V_{DRM}/V_{RRM}$	2000 V, 2200 V, 2400 V
$V_{TM}$	2.07 V
$I_{GT}$	100 mA
$T_J$	-40 °C to 125 °C

### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		790	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		1557	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	10 100	A
	60 Hz	10 700	
$I^2t$	50 Hz	510	kA <sup>2</sup> s
	60 Hz	475	
$V_{DRM}/V_{RRM}$		2000 to 2400	V
$t_q$	Typical	200	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-ST650C..L	20	2000	2100	80
	22	2200	2300	
	24	2400	2500	



<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		790 (324)	A
				55 (85)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled		1857	
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reapplied	10 100	A
		t = 8.3 ms		10 700	
		t = 10 ms	100 % $V_{RRM}$ reapplied	8600	
		t = 8.3 ms		9150	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reapplied	510	kA <sup>2</sup> s
		t = 8.3 ms		475	
		t = 10 ms	100 % $V_{RRM}$ reapplied	370	
		t = 8.3 ms		347	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied		5100	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		1.04	V
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.13	
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		0.61	mΩ
High level value of on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.35	
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 1700$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		2.07	V
Maximum holding current	$I_H$	$T_J = 25$ °C, anode supply 12 V resistive load		600	mA
Typical latching current	$I_L$			1000	

<b>SWITCHING</b>					
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
Maximum turn-off time	$t_q$	$I_{TM} = 750$ A, $T_J = T_J$ maximum, $dI/dt = 60$ A/μs $V_R = 50$ , $dV/dt = 20$ V/μs, Gate 0 V 100 Ω, $t_p = 500$ μs		200	

<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		80	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	$+V_{GM}$			20		
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	200	-	mA
		$T_J = 25$ °C		100	200	
		$T_J = 125$ °C		50	-	
DC gate voltage required to trigger	$V_{GT}$	$T_J = -40$ °C		2.5	-	V
		$T_J = 25$ °C		1.8	3.0	
		$T_J = 125$ °C		1.1	-	
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		0.073	K/W
		DC operation double side cooled		0.031	
Maximum thermal resistance, case to heatsink	$R_{thC-hs}$	DC operation single side cooled		0.011	
		DC operation double side cooled		0.006	
Mounting force, $\pm 10$ %				14 700 (1500)	N (kg)
Approximate weight				255	g
Case style		See dimensions - link at the end of datasheet		TO-200AC (B-PUK)	

<b><math>\Delta R_{thJ-hs}</math> CONDUCTION</b>						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	Single Side	Double Side	Single Side	Double Side		
180°	0.009	0.009	0.006	0.006	$T_J = T_J$ maximum	K/W
120°	0.011	0.011	0.011	0.011		
90°	0.014	0.014	0.015	0.015		
60°	0.020	0.020	0.021	0.021		
30°	0.036	0.036	0.036	0.036		

**Note**

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

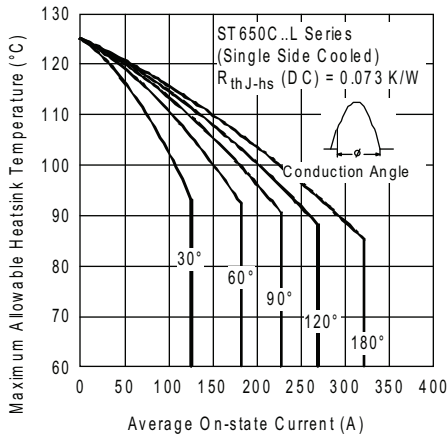


Fig. 1 - Current Ratings Characteristics

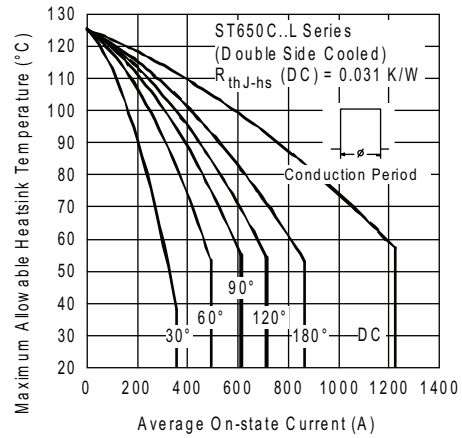


Fig. 4 - Current Ratings Characteristics

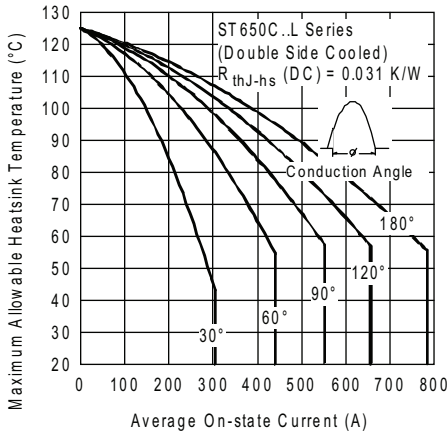


Fig. 2 - Current Ratings Characteristics



Fig. 5 - On-State Power Loss Characteristics

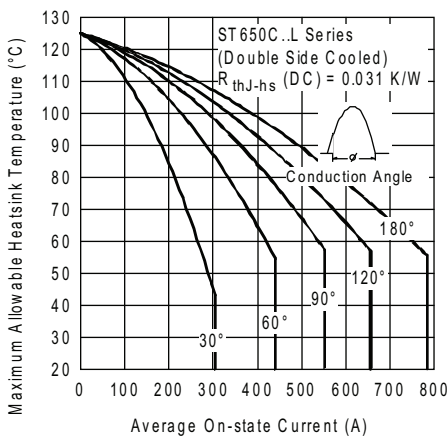


Fig. 3 - Current Ratings Characteristics



Fig. 6 - On-State Power Loss Characteristics

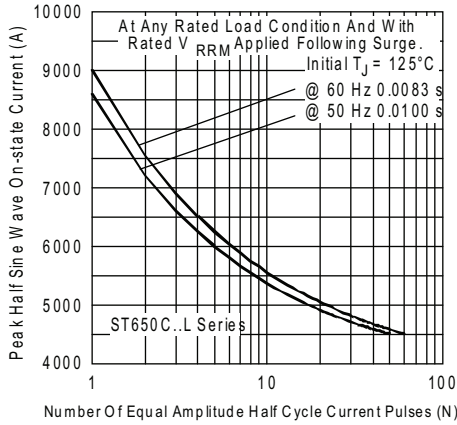


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

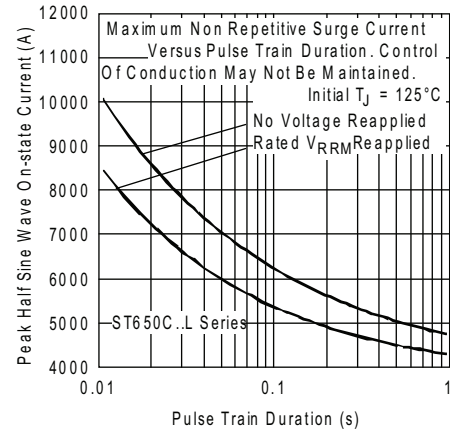


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

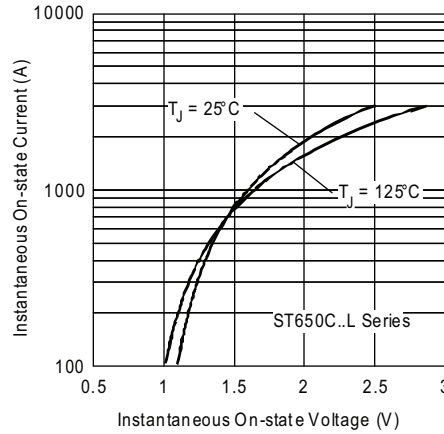


Fig. 9 - On-State Voltage Drop Characteristics

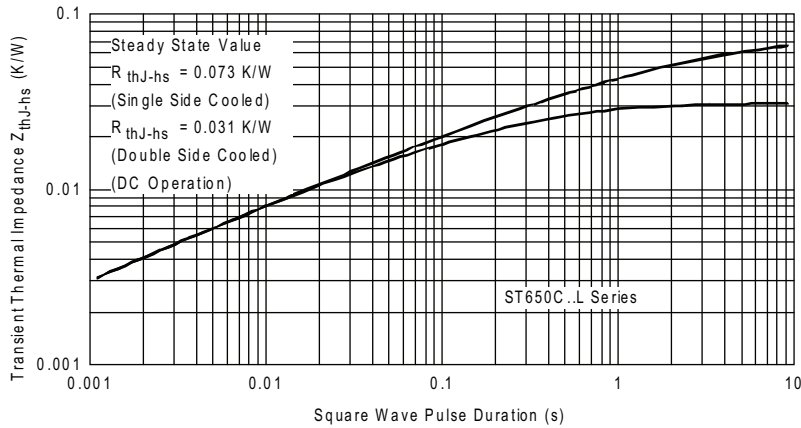


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics



Fig. 11 - Gate Characteristics

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>ST</b>	<b>65</b>	<b>0</b>	<b>C</b>	<b>24</b>	<b>L</b>	<b>1</b>	<b>-</b>
	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>	-	L = PUK case TO-200AC (B-PUK)	<b>8</b>	-	0 = Eyelet terminals (gate and auxiliary cathode unsoldered leads)	<b>1</b>	-	Fast-on terminals (gate and auxiliary cathode unsoldered leads)
	<b>2</b>	-	Eyelet terminals (gate and auxiliary cathode soldered leads)	<b>3</b>	-	Fast-on terminals (gate and auxiliary cathode soldered leads)	<b>9</b>	-	Critical $dV/dt$ : • None = 500 V/ $\mu$ s (standard selection)
	<b>L</b>	-	L = 1000 V/ $\mu$ s (special selection)						

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95076">www.vishay.com/doc?95076</a>
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## TO-200AC (B-PUK)

**DIMENSIONS** in millimeters (inches)

Creepage distance: 36.33 (1.430) minimum  
 Strike distance: 17.43 (0.686) 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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