

### PHASE CONTROL THYRISTORS

### Hockey Puk Version

#### Features

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AC (B-PUK)

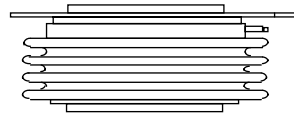
#### Typical Applications

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

#### Major Ratings and Characteristics

Parameters	ST650C..L	Units
$I_{T(AV)}$	790	A
@ $T_{hs}$	55	°C
$I_{T(RMS)}$	1557	A
@ $T_{hs}$	25	°C
$I_{TSM}$	@ 50Hz 10100	A
	@ 60Hz 10700	A
$I^2t$	@ 50Hz 510	KA <sup>2</sup> s
	@ 60Hz 475	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	2000 to 2400	V
$t_q$ typical	200	μs
$T_J$	- 40 to 125	°C

790A



case style TO-200AC (B-PUK)

## ST650C..L Series

Bulletin I25203 rev. B 04/00

International  
 Rectifier

### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

Type number	Voltage Code	$V_{DRM}/V_{RRM}$ , max. repetitive peak and off-state voltage V	$V_{RSM}$ , maximum non-repetitive peak voltage V	$I_{DRM}/I_{RRM}$ max. @ $T_J = T_J$ max mA
ST650C..L	20	2000	2100	80
	22	2200	2300	
	24	2400	2500	

#### On-state Conduction

Parameter	ST650C..L	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	790 (324)	A	180° conduction, half sine wave double side (single side) cooled	
	55 (85)	°C		
$I_{T(RMS)}$ Max. RMS on-state current	1857	A	DC @ 25°C heatsink temperature double side cooled	
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	10100		t = 10ms	No voltage reappplied
	10700		t = 8.3ms	reappplied
	8600		t = 10ms	100% $V_{RRM}$
$I^2t$ Maximum $I^2t$ for fusing	9150	t = 8.3ms	reappplied	
	510	t = 10ms	No voltage reappplied	
		t = 8.3ms	reappplied	
	475	t = 10ms	100% $V_{RRM}$	
370	t = 8.3ms	reappplied		
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	5100	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied	
$V_{T(TO)1}$ Low level value of threshold voltage	1.04	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$V_{T(TO)2}$ High level value of threshold voltage	1.13		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$r_{t1}$ Low level value of on-state slope resistance	0.61	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$r_{t2}$ High level value of on-state slope resistance	0.35		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$V_{TM}$ Max. on-state voltage	2.07	V	$I_{pk} = 1700A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse	
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load	
$I_L$ Typical latching current	1000			

**Switching**

Parameter	ST650C..L	Units	Conditions
di/dt Max. non-repetitive rate of rise of turned-on current	1000	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J \text{ max}$ , anode voltage $\leq 80\% V_{DRM}$
$t_d$ Typical delay time	1.0	μs	Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$
$t_q$ Typical turn-off time	200		$I_{TM} = 750A$ , $T_J = T_J \text{ max}$ , $di/dt = 60A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

**Blocking**

Parameter	ST650C..L	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/μs	$T_J = T_J \text{ max}$ . linear to 80% rated $V_{DRM}$
$I_{DRM}$ $I_{RRM}$ Max. peak reverse and off-state leakage current	80	mA	$T_J = T_J \text{ max}$ , rated $V_{DRM}/V_{RRM}$ applied

**Triggering**

Parameter	ST650C..L		Units	Conditions
$P_{GM}$ Maximum peak gate power	10.0		W	$T_J = T_J \text{ max}$ , $t_p \leq 5ms$
$P_{G(AV)}$ Maximum average gate power	2.0			$T_J = T_J \text{ max}$ , $f = 50Hz$ , $d\% = 50$
$I_{GM}$ Max. peak positive gate current	3.0		A	$T_J = T_J \text{ max}$ , $t_p \leq 5ms$
$+V_{GM}$ Maximum peak positive gate voltage	20		V	$T_J = T_J \text{ max}$ , $t_p \leq 5ms$
$-V_{GM}$ Maximum peak negative gate voltage	5.0			
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	mA	$T_J = -40^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$  Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	200	-		
	100	200		
$V_{GT}$ DC gate voltage required to trigger	2.5	-	V	$T_J = -40^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$
	1.8	3.0		
	1.1	-		
$I_{GD}$ DC gate current not to trigger	10		mA	Max. gate current/voltage not to trigger is the max. value which will not trigger any unit with rated $V_{DRM}$ anode-to-cathode applied
$V_{GD}$ DC gate voltage not to trigger	0.25		V	

# ST650C..L Series

Bulletin I25203 rev. B 04/00

## Thermal and Mechanical Specification

Parameter	ST650C..L	Units	Conditions
T <sub>J</sub> Max. operating temperature range	-40 to 125	°C	
T <sub>stg</sub> Max. storage temperature range	-40 to 150		
R <sub>thJ-hs</sub> Max. thermal resistance, junction to heatsink	0.073 0.031	K/W	DC operation single side cooled DC operation double side cooled
R <sub>thC-hs</sub> Max. thermal resistance, case to heatsink	0.011 0.006	K/W	DC operation single side cooled DC operation double side cooled
F Mounting force, ± 10%	14700 (1500)	N (Kg)	
wt Approximate weight	255	g	
Case style	TO-200AC (B-PUK)		See Outline Table

## ΔR<sub>thJ-hs</sub> Conduction

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

Conduction angle	Sinusoidal conduction		Rectangular conduction		Units	Conditions
	Single Side	Double Side	Single Side	Double Side		
180°	0.009	0.009	0.006	0.006	K/W	T <sub>J</sub> = T <sub>J</sub> max.
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		

## Ordering Information Table

**Device Code**

ST	65	0	C	24	L	1	
①	②	③	④	⑤	⑥	⑦	⑧

3 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)

RRM - See Vishay Rectifier TO-200AC (B-PUK) (Single Cathode Soldered Leads)

1 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)

2 = Eyelet terminals (Gate and Auxiliary Cathode Soldered Leads)

3 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)

Outline Table

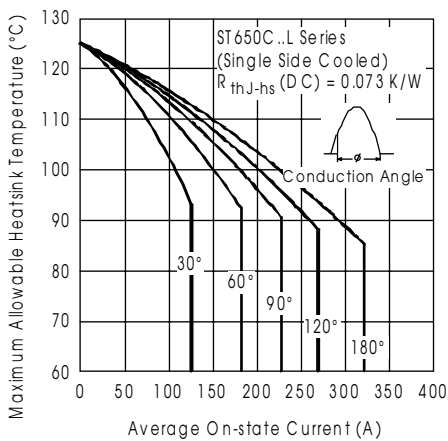
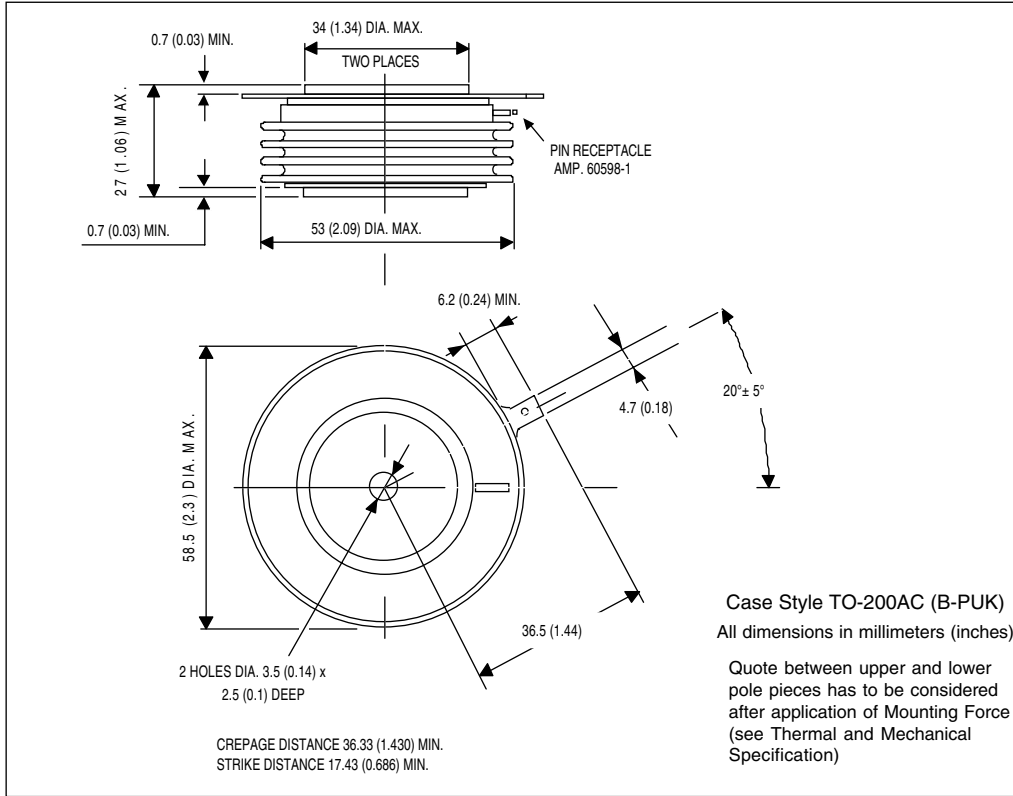


Fig. 1 - Current Ratings Characteristics

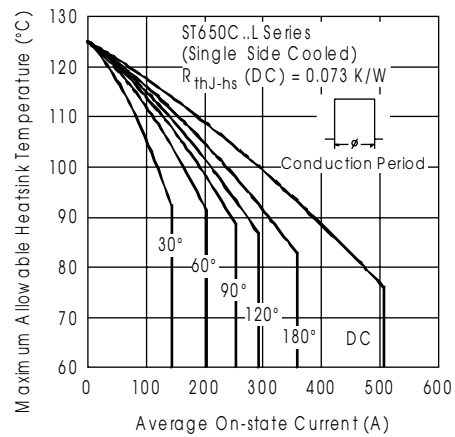


Fig. 2 - Current Ratings Characteristics

# ST650C..L Series

Bulletin I25203 rev. B 04/00

International  
**Rectifier**

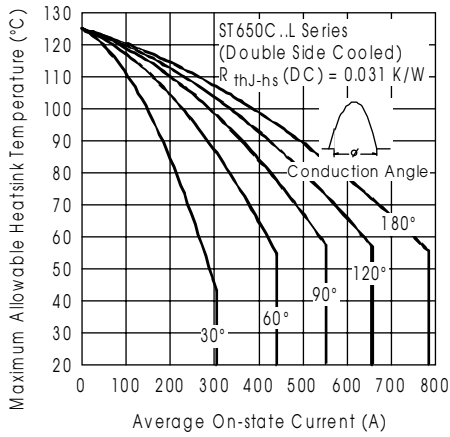


Fig. 3 - Current Ratings Characteristics

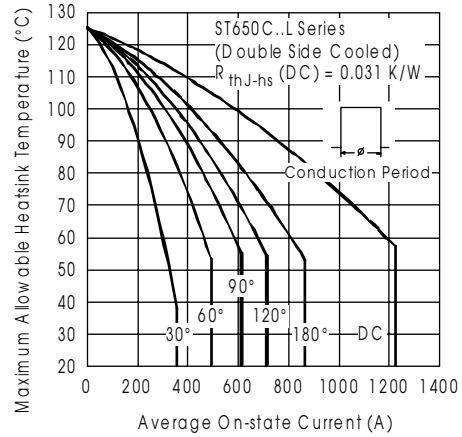


Fig. 4 - Current Ratings Characteristics

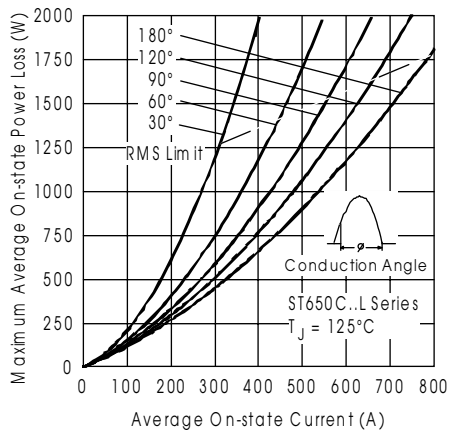


Fig. 5 - On-state Power Loss Characteristics

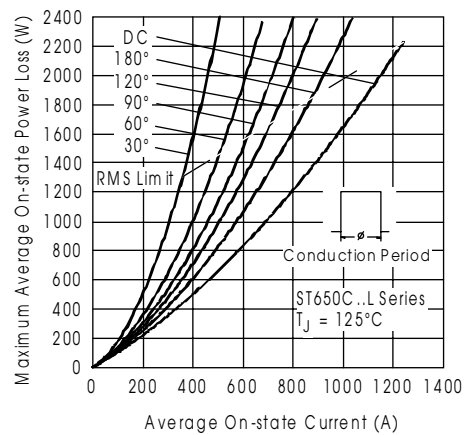


Fig. 6 - On-state Power Loss Characteristics

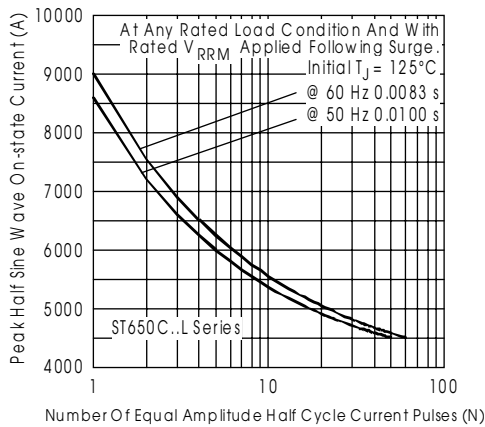


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

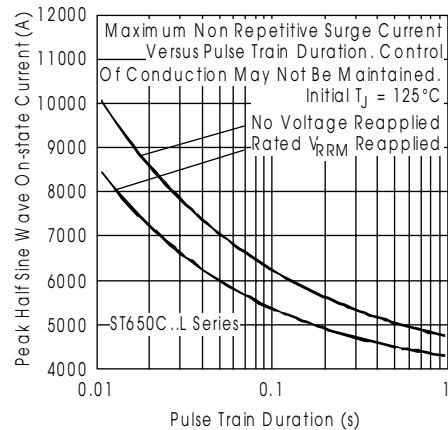


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

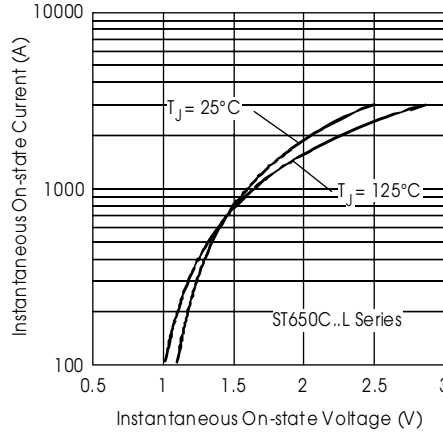


Fig. 9 - On-state Voltage Drop Characteristics

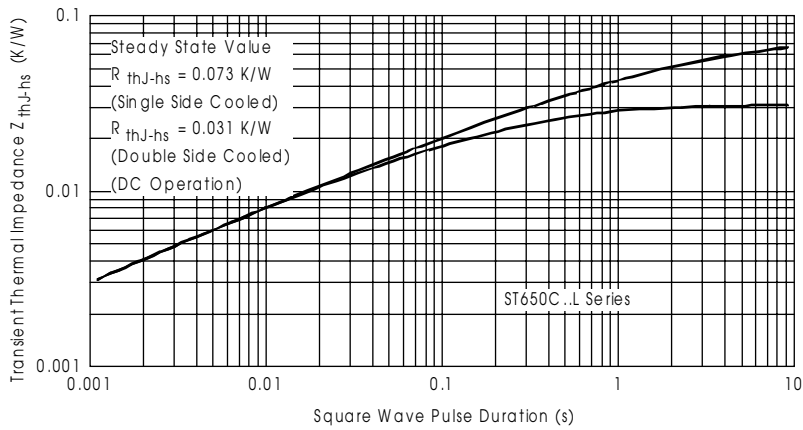


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

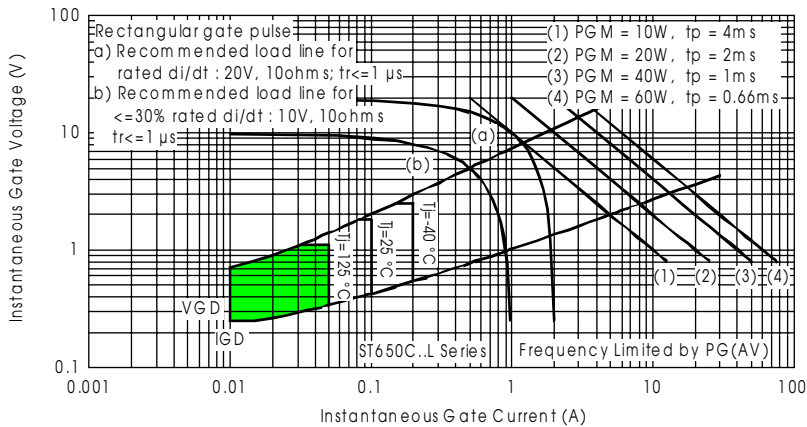


Fig. 11 - Gate Characteristics



## Notice

The products described herein were acquired by Vishay Intertechnology, Inc., as part of its acquisition of International Rectifier's Power Control Systems (PCS) business, which closed in April 2007. Specifications of the products displayed herein are pending review by Vishay and are subject to the terms and conditions shown below.

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.

International Rectifier®, IR®, the IR logo, HEXFET®, HEXSense®, HEXDIP®, DOL®, INTERO®, and POWIRTRAIN® are registered trademarks of International Rectifier Corporation in the U.S. and other countries. All other product names noted herein may be trademarks of their respective owners.