

International  
**IR** Rectifier

## ST230C..C SERIES

PHASE CONTROL THYRISTORS

Hockey Puk Version

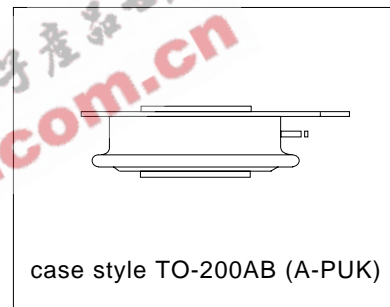
### Features

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

410A

### Typical Applications

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



### Major Ratings and Characteristics

Parameters	ST230C..C	Units
$I_{T(AV)}$	410	A
@ $T_{hs}$	55	°C
$I_{T(RMS)}$	780	A
@ $T_{hs}$	25	°C
$I_{TSM}$	@ 50Hz	5700 A
	@ 60Hz	5970 A
$I^2t$	@ 50Hz	163 KA <sup>2</sup> s
	@ 60Hz	149 KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 2000	V
$t_q$	typical	100 μs
$T_J$	- 40 to 125	°C

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Bulletin I25162 rev. D 04/03

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### 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
ST230C..C	04	400	500	30
	08	800	900	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	
	18	1800	1900	
	20	2000	2100	

#### On-state Conduction

Parameter	ST230C..C	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	410 (165)	A	180° conduction, half sine wave double side (single side) cooled	
	55 (85)	°C		
$I_{T(RMS)}$ Max. RMS on-state current	780	A	DC @ 25°C heatsink temperature double side cooled	
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	5700		t = 10ms	No voltage reappplied
	5970		t = 8.3ms	reappplied
	4800		t = 10ms	100% $V_{RRM}$
$I^2t$ Maximum $I^2t$ for fusing	5000	t = 8.3ms	reappplied	
	163	t = 10ms	No voltage reappplied	
		t = 8.3ms	reappplied	
	148	t = 10ms	100% $V_{RRM}$	
115	t = 8.3ms	reappplied		
105				
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	1630	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied	
$V_{T(TO)1}$ Low level value of threshold voltage	0.92	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	0.98		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$r_{t1}$ Low level value of on-state slope resistance	0.88	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	0.81		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$V_{TM}$ Max. on-state voltage	1.69	V	$I_{pk} = 880A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse	
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load	
$I_L$ Max. (typical) latching current	1000 (300)			

#### Switching

Parameter	ST230C..C	Units	Conditions
$di/dt$ Max. non-repetitive rate of rise of turned-on current	1000	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J$ 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	100		$I_{TM} = 300A$ , $T_J = T_J$ max, $di/dt = 20A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

Blocking

Parameter	ST230C..C	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ $\mu$ s	$T_J = T_J$ max. linear to 80% rated $V_{DRM}$
$I_{DRM}$ $I_{RRM}$ Max. peak reverse and off-state leakage current	30	mA	$T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied

Triggering

Parameter	ST230C..C	Units	Conditions
$P_{GM}$ Maximum peak gate power	10.0	W	$T_J = T_J$ max, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	2.0		$T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$
$I_{GM}$ Max. peak positive gate current	3.0	A	$T_J = T_J$ max, $t_p \leq 5$ ms
$+V_{GM}$ Maximum peak positive gate voltage	20	V	$T_J = T_J$ max, $t_p \leq 5$ ms
$-V_{GM}$ Maximum peak negative gate voltage	5.0		
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	180	-	
	90	150	
$V_{GT}$ DC gate voltage required to trigger	2.9	-	$T_J = -40^\circ\text{C}$
	1.8	3.0	$T_J = 25^\circ\text{C}$
	1.2	-	$T_J = 125^\circ\text{C}$
$I_{GD}$ DC gate current not to trigger	10	mA	$T_J = T_J$ max 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	

Thermal and Mechanical Specification

Parameter	ST230C..C	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	$^\circ\text{C}$	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJ-hs}$ Max. thermal resistance, junction to heatsink	0.17	K/W	DC operation single side cooled
	0.08		DC operation double side cooled
$R_{thC-hs}$ Max. thermal resistance, case to heatsink	0.033	K/W	DC operation single side cooled
	0.017		DC operation double side cooled
F Mounting force, $\pm 10\%$	4900	N	
	(500)	(Kg)	
wt Approximate weight	50	g	
Case style	TO-200AB(A-PUK)		See Outline Table

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### $\Delta R_{thJ-hs}$ Conduction

(The following table shows the increment of thermal resistance  $R_{thJ-hs}$  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°	0.015	0.017	0.011	0.011	K/W	$T_J = T_{J \text{ max.}}$
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		

### Ordering Information Table

Device Code	
<b>1</b>	- Thyristor
<b>2</b>	- Essential part number
<b>3</b>	- 0 = Converter grade
<b>4</b>	- C = Ceramic Puk
<b>5</b>	- Voltage code: Code x 100 = $V_{RRM}$ (See Voltage Rating Table)
<b>6</b>	- C = Puk Case TO-200AB (A-PUK)
<b>7</b>	- 0 = Eyelet terminals (Gate and Auxiliary Cathode Unsoldered Leads) 1 = Fast-on terminals (Gate and Auxiliary Cathode Unsoldered Leads) 2 = Eyelet terminals (Gate and Auxiliary Cathode Soldered Leads) 3 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)
<b>8</b>	- Critical dv/dt: None = 500V/ $\mu$ sec (Standard selection) L = 1000V/ $\mu$ sec (Special selection)

Outline Table

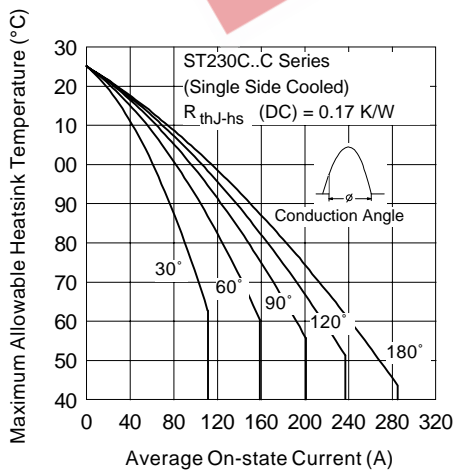
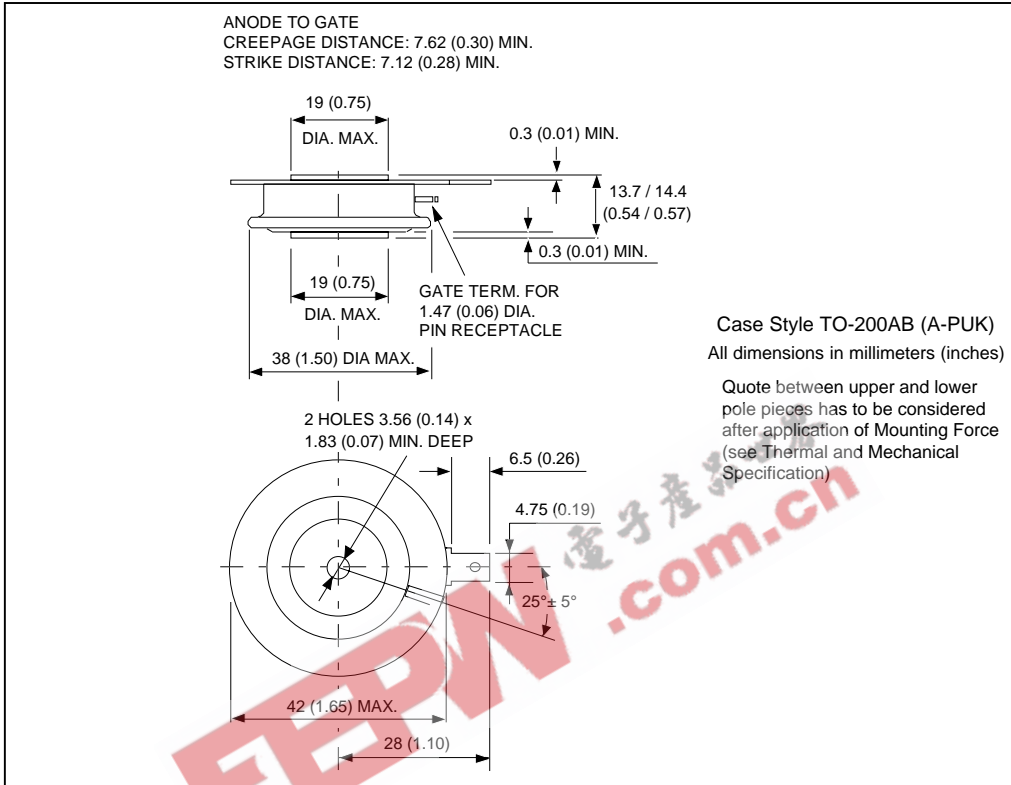


Fig. 1 - Current Ratings Characteristics

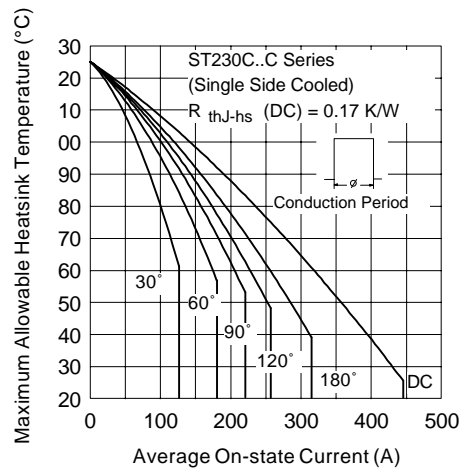


Fig. 2 - Current Ratings Characteristics

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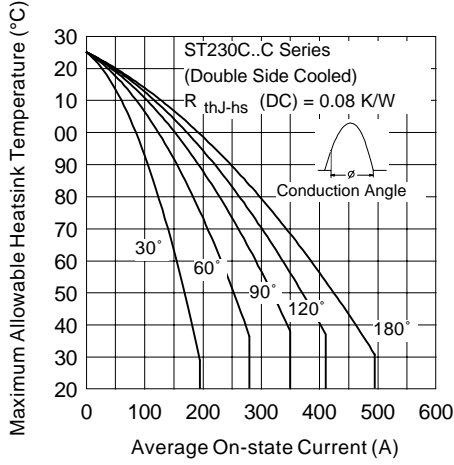


Fig. 3 - Current Ratings Characteristics

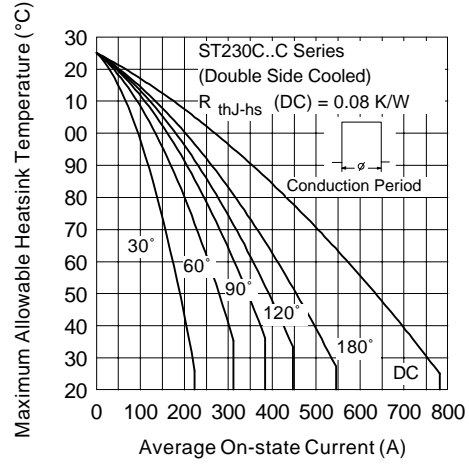


Fig. 4 - Current Ratings Characteristics

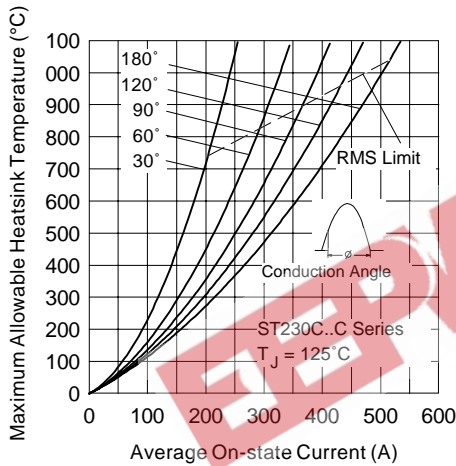


Fig. 5 - On-state Power Loss Characteristics

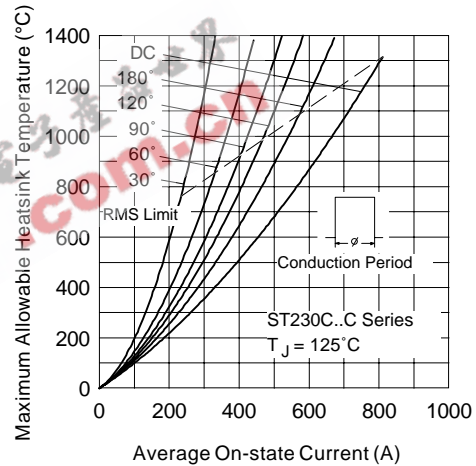


Fig. 6 - On-state Power Loss Characteristics

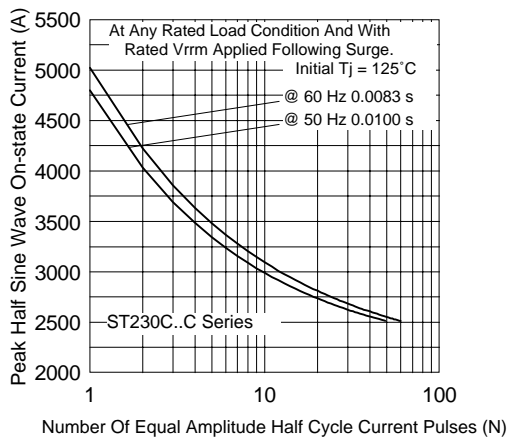


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

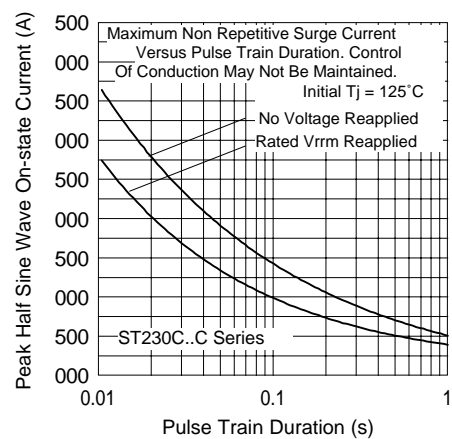


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

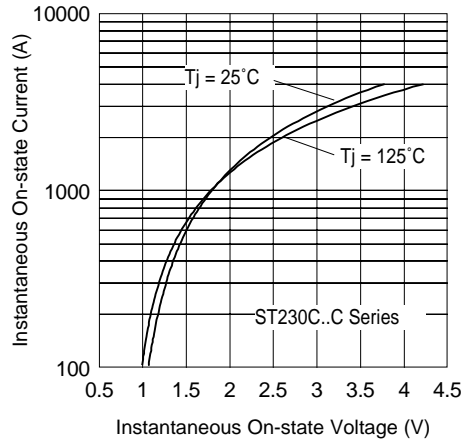


Fig. 9 - On-state Voltage Drop Characteristics

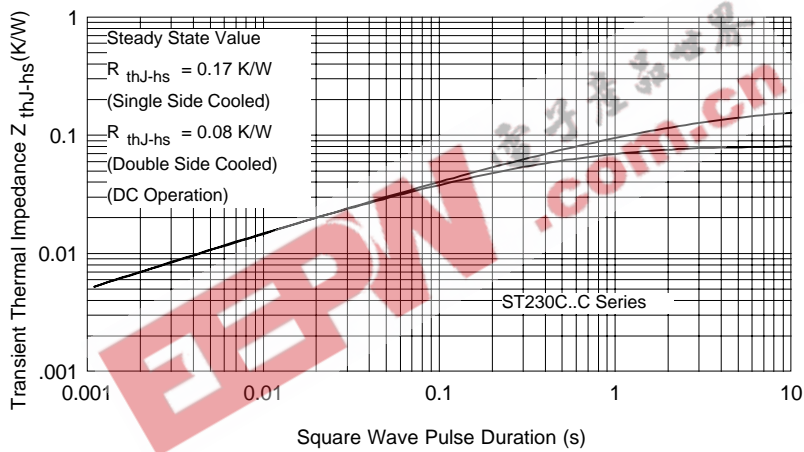


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

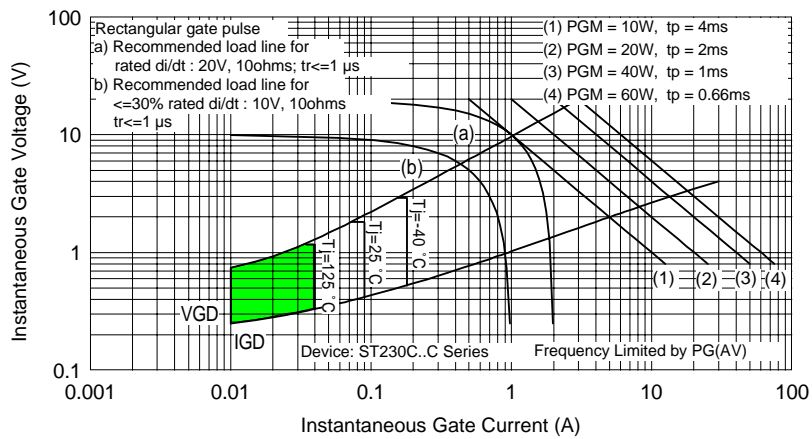


Fig. 11 - Gate Characteristics

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Data and specifications subject to change without notice.  
This product has been designed and qualified for Industrial Level.  
Qualification Standards can be found on IR's Web site.

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