

International
IR Rectifier

ST230C..C SERIES

PHASE CONTROL THYRISTORS

Hockey Puk Version

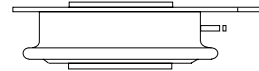
Features

- 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



case style TO-200AB (A-PUK)

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 ² s
	@ 60Hz 149	KA ² 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	
	5970		t = 8.3ms	reapplied	
	4800		t = 10ms	100% V_{RRM}	
	5000		t = 8.3ms	reapplied	
I^2t Maximum I^2t for fusing	163	KA ² s	t = 10ms	No voltage	Sinusoidal half wave, Initial $T_J = T_J$ max.
	148		t = 8.3ms	reapplied	
	115		t = 10ms	100% V_{RRM}	
	105		t = 8.3ms	reapplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	1630	KA ² √s	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$ 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, $di_g/dt = 1A/\mu s$ $V_g = 0.67\% V_{DRM}$, $T_J = 25^\circ C$
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/ μ s	$T_J = T_J \text{ max. linear to } 80\% \text{ rated } V_{\text{DRM}}$
I_{DRM} I_{RRM} Max. peak reverse and off-state leakage current	30	mA	$T_J = T_J \text{ max, rated } V_{\text{DRM}}/V_{\text{RRM}}$ applied

Triggering

Parameter	ST230C..C	Units	Conditions
P_{GM} Maximum peak gate power	10.0	W	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$P_{\text{G(AV)}}$ Maximum average gate power	2.0		$T_J = T_J \text{ max, } f = 50 \text{ Hz, } d\% = 50$
I_{GM} Max. peak positive gate current	3.0	A	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$+V_{\text{GM}}$ Maximum peak positive gate voltage	20	V	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$-V_{\text{GM}}$ 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	-	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	1.8	3.0	
	1.2	-	
I_{GD} DC gate current not to trigger	10	mA	$T_J = T_J \text{ max}$ 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		
$R_{\text{thJ-hs}}$ Max. thermal resistance, junction to heatsink	0.17	K/W	DC operation single side cooled
	0.08		DC operation double side cooled
$R_{\text{thC-hs}}$ 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 (500)	N (Kg)	
wt Approximate weight	50	g	
Case style	TO-200AB (A-PUK)		See Outline Table

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ΔR_{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

ST	23	0	C	20	C	1	
①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Thyristor
- 2** - Essential part number
- 3** - 0 = Converter grade
- 4** - C = Ceramic Puk
- 5** - Voltage code: Code x 100 = V_{RRM} (See Voltage Rating Table)
- 6** - C = Puk Case TO-200AB (A-PUK)
- 7** - 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)
- 8** - Critical dv/dt: None = 500V/ μ sec (Standard selection)
 L = 1000V/ μ sec (Special selection)

Outline Table

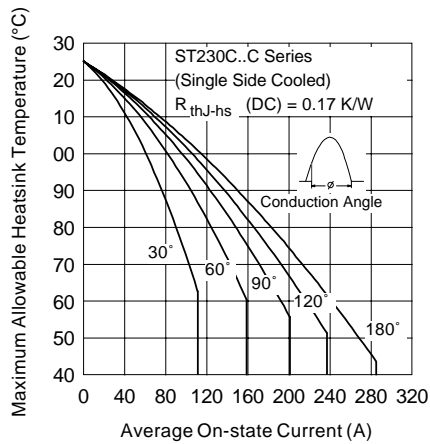
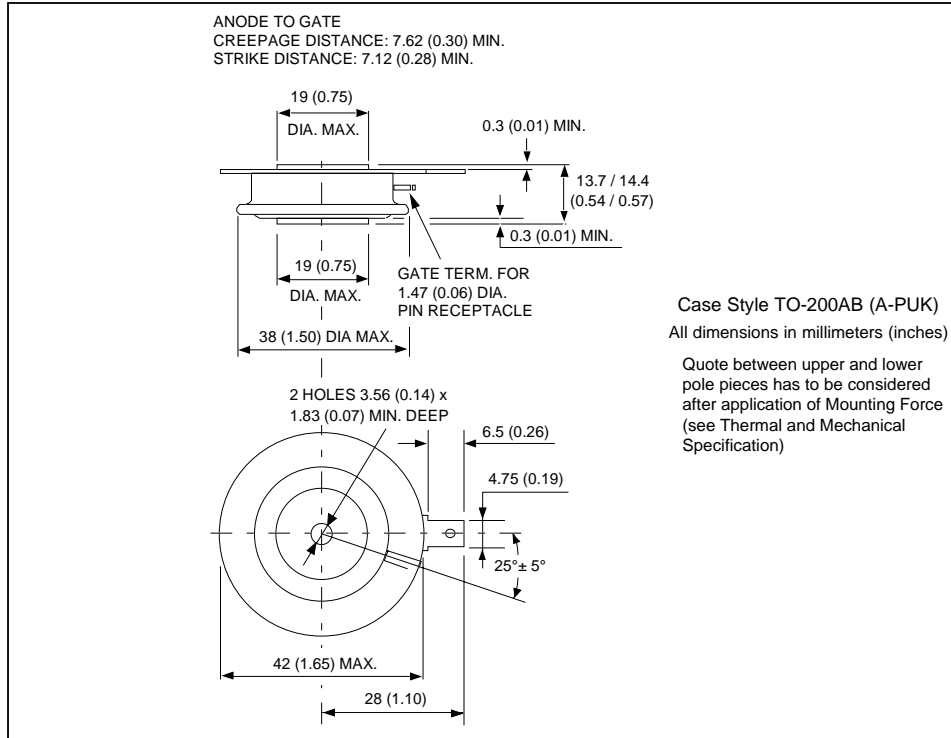


Fig. 1 - Current Ratings Characteristics

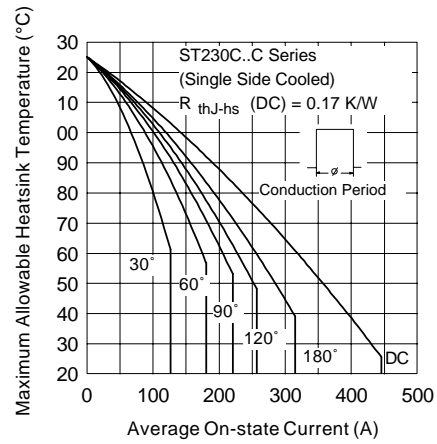


Fig. 2 - Current Ratings Characteristics

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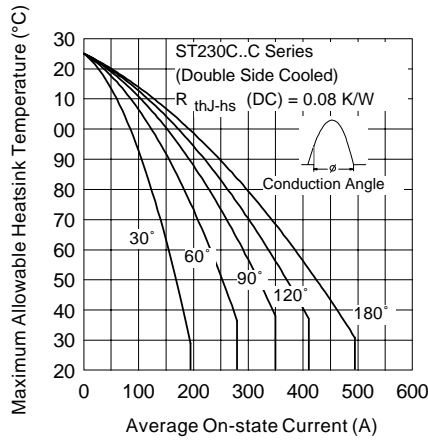


Fig. 3 - Current Ratings Characteristics

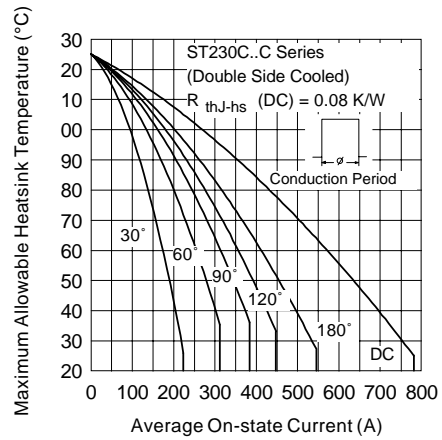


Fig. 4 - Current Ratings Characteristics

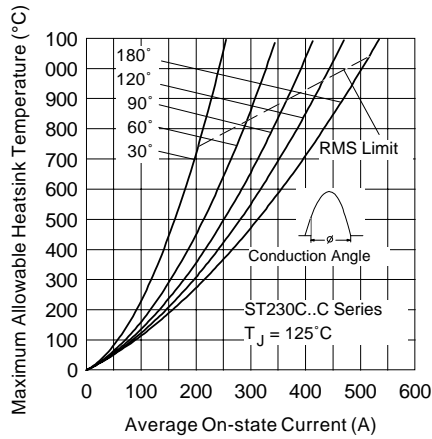


Fig. 5 - On-state Power Loss Characteristics

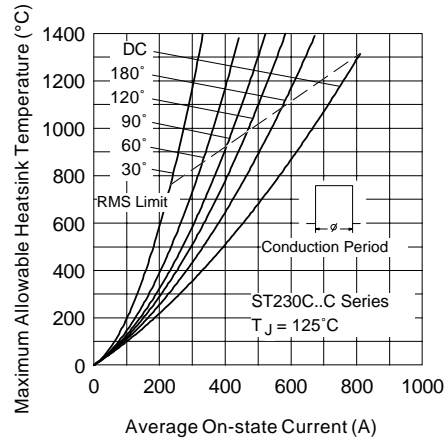


Fig. 6 - On-state Power Loss Characteristics

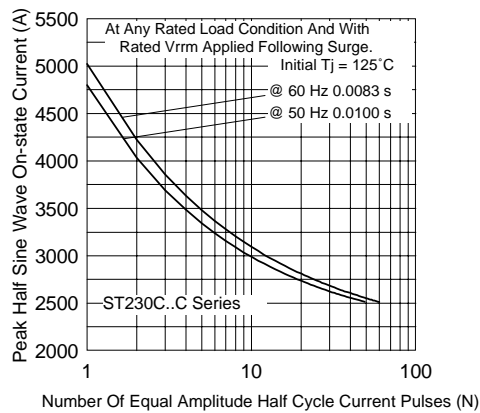


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

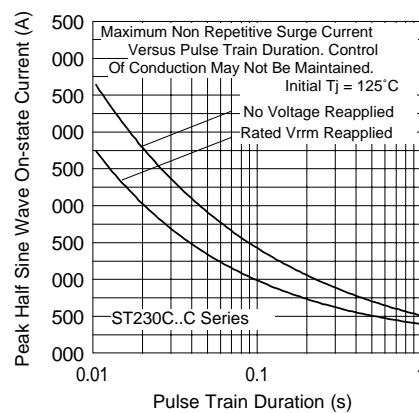


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

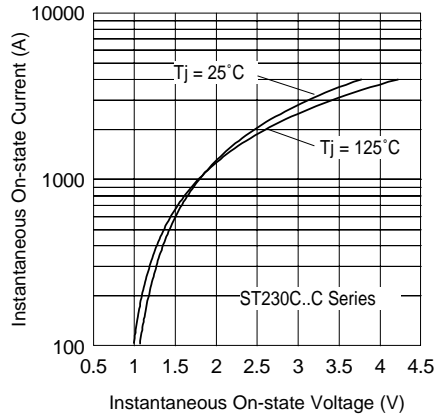


Fig. 9 - On-state Voltage Drop Characteristics

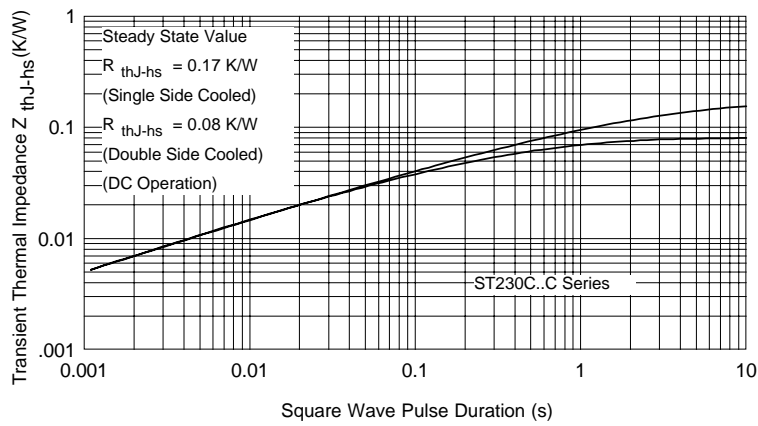


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

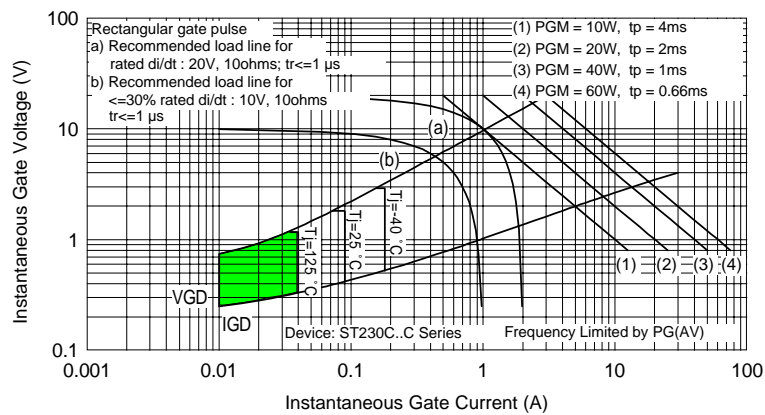


Fig. 11 - Gate Characteristics

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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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