

Bulletin I25162 rev. C 01/00

International
IOR 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)

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 ² s
	@ 60Hz 149	KA ² s
V_{DRM}/V_{RRM}	400 to 1600	V
t_q typical	100	μs
T_J	- 40 to 125	°C

410A



case style TO-200AB (A-PUK)



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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	

On-state Conduction

Parameter	ST230C..C	Units	Conditions
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	410 (165) 55 (85)	A °C	180° conduction, half sine wave double side (single side) cooled
$I_{T(RMS)}$ Max. RMS on-state current	780		DC @ 25°C heatsink temperature double side cooled
I_{TSM} Max. peak, one-cycle non-repetitive surge current	5700 5970 4800 5000	A	t = 10ms No voltage t = 8.3ms reapplied t = 10ms 100% V_{RRM} t = 8.3ms reapplied
I^2t Maximum I^2t for fusing	163 148 115 105	KA ² s	t = 10ms No voltage t = 8.3ms reapplied t = 10ms 100% V_{RRM} 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% x π x $I_{T(AV)}$) < I < π x $I_{T(AV)}$, $T_J = T_J$ max.
$V_{T(TO)2}$ High level value of threshold voltage	0.98		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.
r_{t1} Low level value of on-state slope resistance	0.88	mΩ	(16.7% x π x $I_{T(AV)}$) < I < π x $I_{T(AV)}$, $T_J = T_J$ max.
r_{t2} High level value of on-state slope resistance	0.81		(I > π x $I_{T(AV)}$), $T_J = T_J$ 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/ μ s	$T_J = T_J \text{ max. linear to } 80\% \text{ rated } V_{DRM}$
I_{DRM} I_{RRM} Max. peak reverse and off-state leakage current	30	mA	$T_J = T_J \text{ max, rated } V_{DRM}/V_{RRM} \text{ applied}$

Triggering

Parameter		ST230C..C		Units	Conditions
P _{GM}	Maximum peak gate power	10.0		W	T _J = T _J max, t _p ≤ 5ms
P _{G(AV)}	Maximum average gate power	2.0			T _J = T _J max, f = 50Hz, d% = 50
I _{GM}	Max. peak positive gate current	3.0		A	T _J = T _J max, t _p ≤ 5ms
+V _{GM}	Maximum peak positive gate voltage	20		V	T _J = T _J max, t _p ≤ 5ms
-V _{GM}	Maximum peak negative gate voltage	5.0			
I _{GT}	DC gate current required to trigger	TYP.	MAX.	mA	T _J = - 40°C T _J = 25°C T _J = 125°C Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
		180	-		
		90	150		
		40	-		
V _{GT}	DC gate voltage required to trigger	2.9	-	V	T _J = - 40°C T _J = 25°C T _J = 125°C
		1.8	3.0		
		1.2	-		
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 0.08	K/W	DC operation single side cooled DC operation double side cooled
R_{thC-hs} Max. thermal resistance, case to heatsink	0.033 0.017	K/W	DC operation single side cooled 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

ST230C..C Series

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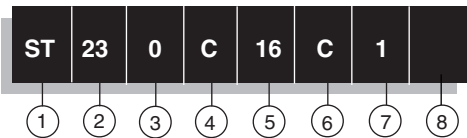
ΔR_{thJ-hs} Conduction

(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



- 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

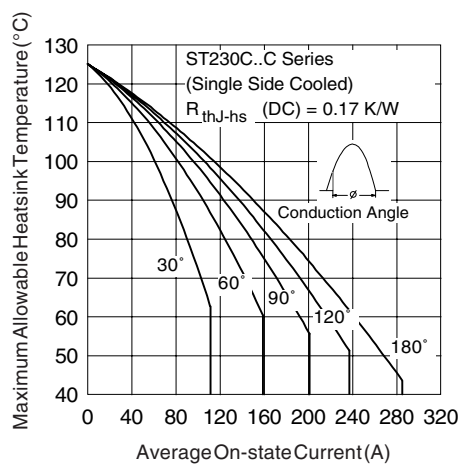
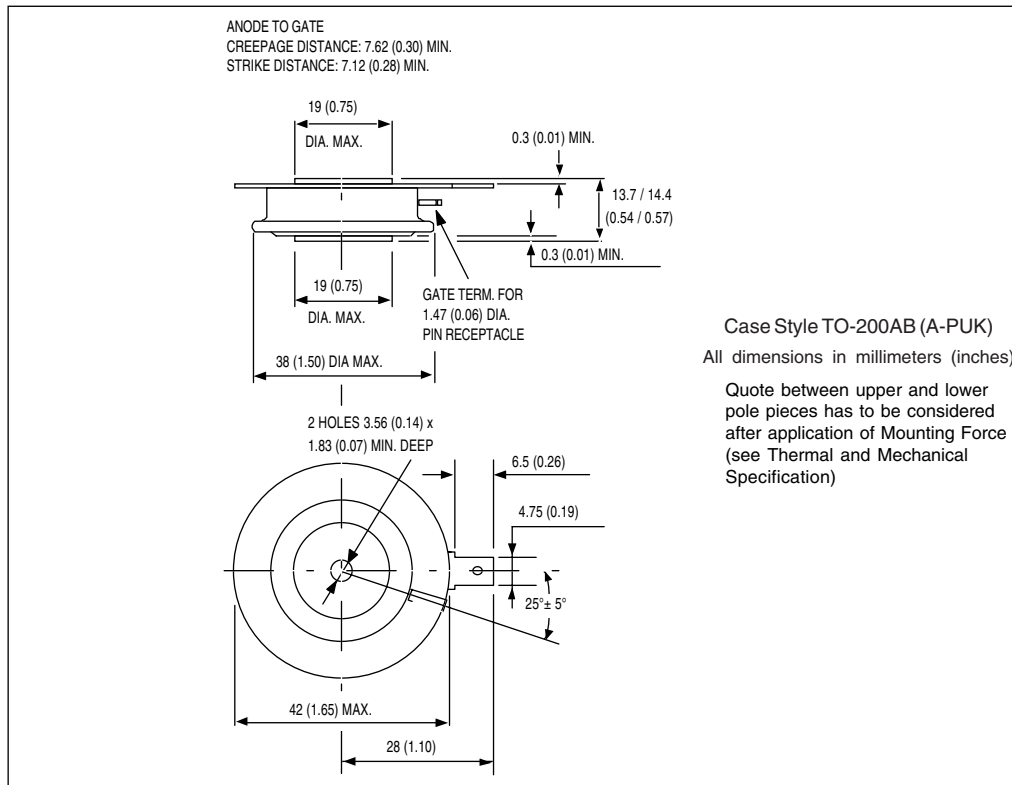


Fig. 1 - Current Ratings Characteristics

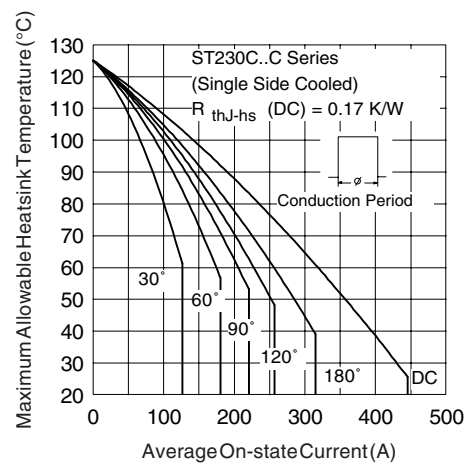


Fig. 2 - Current Ratings Characteristics

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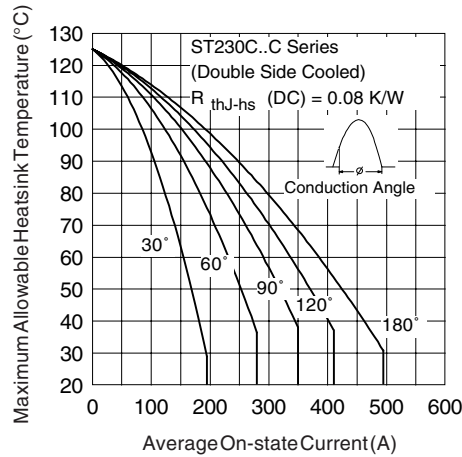


Fig. 3 - Current Ratings Characteristics

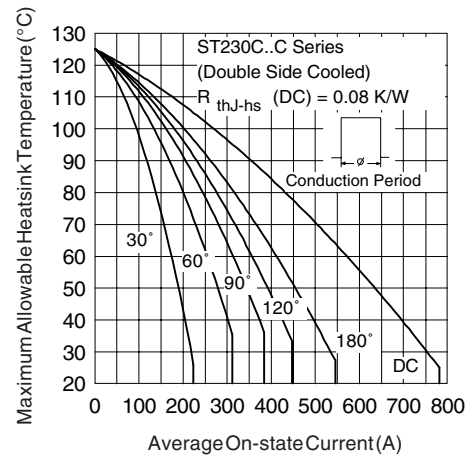


Fig. 4 - Current Ratings Characteristics

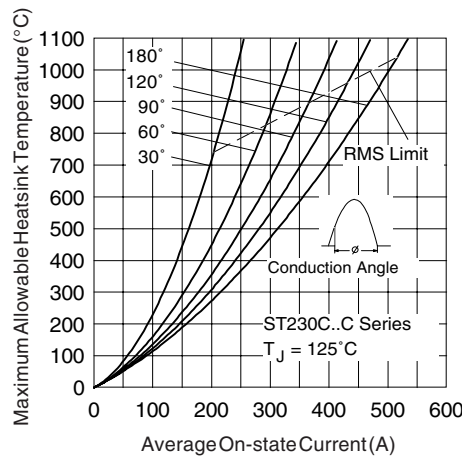


Fig. 5 - On-state Power Loss Characteristics

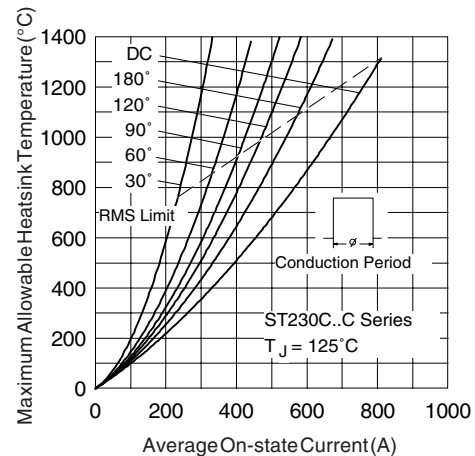


Fig. 6 - On-state Power Loss Characteristics

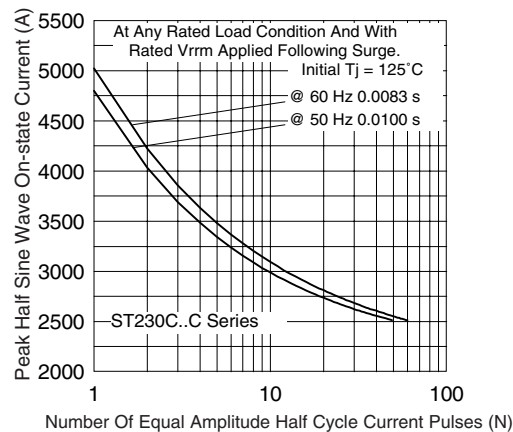


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

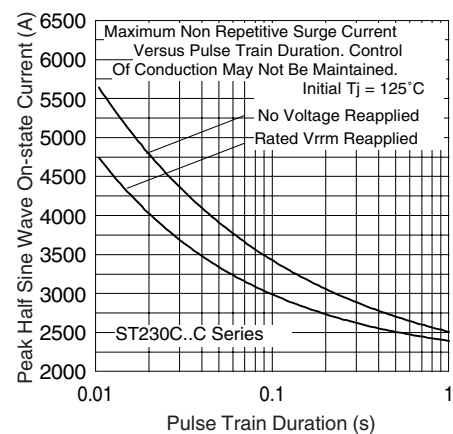


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

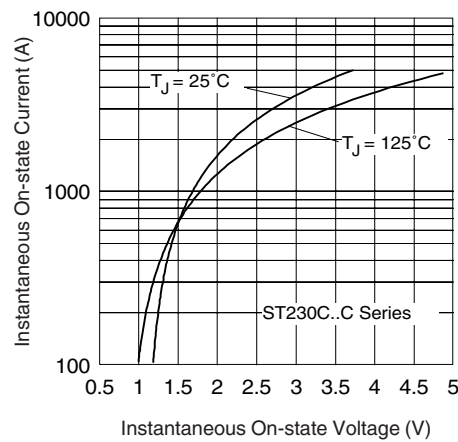


Fig. 9 - On-state Voltage Drop Characteristics

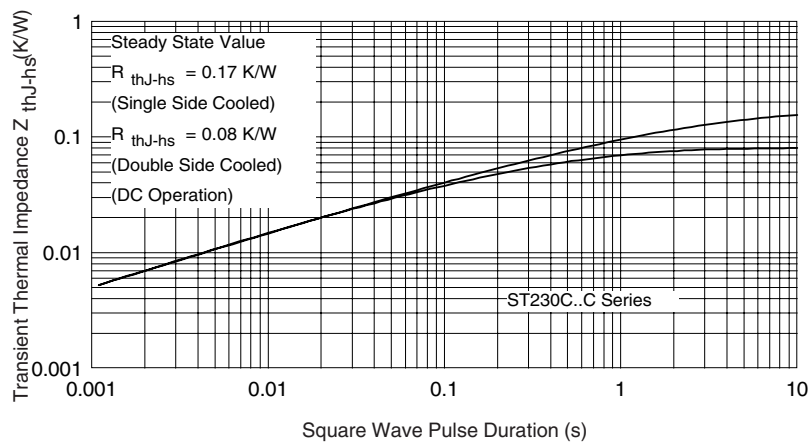


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

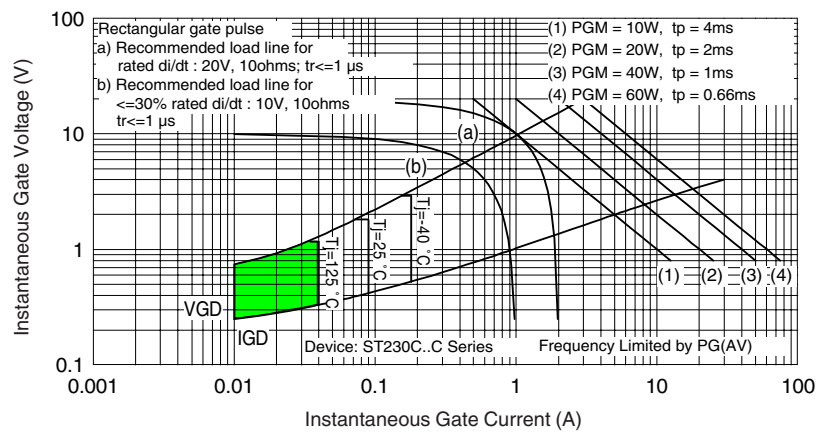


Fig. 11 - Gate Characteristics