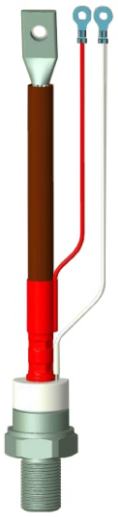
Phase Control Thyristors (Stud Version), 230A

FEATURES

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-209AB (TO-93),
- Lead (Pb)-free
- Compression bonded encapsulation for heavy duty operation such as severe thermal cycling
- Designed and qualified for industrial level

TYPICAL APPLICATIONS

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



TO-209AB(TO-93)

PRODUCT SUMMARY	
$I_{T(AV)}$	230A
V_{DRM}/V_{RRM}	400V to 2000V
V_{TM}	1.55V
I_{GT}	120mA
T_J	-40°C to 125°C
Package	TO-209AB (TO-93)
Diode variation	Single SCR

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNIT
$I_{T(AV)}$		230	A
	T_c	85	°C
$I_{T(RMS)}$		360	A
I_{TSM}	50 HZ	5700	A
	60 HZ	5970	
I^2t	50 HZ	163	kA^2s
	60 HZ	148	
V_{DRM}/V_{RRM}		400 to 2000	V
t_q	Typical	100	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 REVERSE VOLTAGE V	I_{DRM}/I_{RRM}, MAXIMUM AT $T_J = T_J$ MAXIMUM mA
230PTxxSC	04	400	500	30
	08	800	900	
	12	1200	1300	
	16	1600	1700	
	20	2000	2100	

FORWARD CONDUCTION						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**			**VALUES**	**UNIT**
Maximum average current at heatsink temperature	$I_{T(AV)}$	180° conduction, half sine wave			230	A
					85	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 78°C case temperature			360	A
Maximum peak, one cycle non-reptitive surge current	I_{TSM}	t = 10ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	5700	A
		t = 8.3ms			5970	
		t = 10ms	100%V_{RRM} reapplied		4790	
		t = 8.3ms			5010	
Maximum I^2t for fusing	I^2t	t = 10ms	No voltage reapplied		163	kA^2s
		t = 8.3ms			148	
		t = 10ms	100%V_{RRM} reapplied		115	
		t = 8.3ms			104	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied			1625	$kA^2\sqrt{s}$
Low level value of threshold voltage	$V_{T(TO)1}$	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.92	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.98	
Low level value on-state slope resistance	r_{t1}	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.88	mΩ
High level value on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.81	
Maximum on-state voltage	V_{TM}	I_{pk} = 720A, $T_J = T_J$ maximum, t_p = 10 ms sine pulse			1.55	V
Maximum holding current	I_H	T_J = 25°C, anode supply 12V resistive load			200	mA
Maximum (Typical) latching current	I_L				300(200)	

SWITCHING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNIT**
Maximum non-repetitive rate of rise of turned-on current	dI/dt	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J$ maximum, anode voltage ≤ 80% V_{DRM}	1000	A/μs
Typical delay time	t_d	Gate current 1A, dI_g/dt = 1 A/μs V_D = 0.67 V_{DRM}, T_J = 25°C	1.0	μs
Typical turn-off time	t_q	I_{TM} = 300A, $T_J = T_J$ maximum, dI/dt = 20A/μs. V_R = 50V, dV/dt = 20 V/μs, gate 0 V 100Ω, tp = 500μs	100	

BLOCKING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNIT**
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	30	mA

TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNIT
				TYP.	MAX.	
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms		10		W
Maximum average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, f = 50 Hz, d% = 50		2		
Maximum peak positive gate current	I_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms		3		A
Maximum peak positive gate voltage	$+V_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms		20		V
Maximum peak negative gate voltage	$-V_{GM}$			5		
DC gate current required to trigger	I_{GT}	T_J = -40°C	Maximum required gate current/voltage are the lowest value which will trigger all units 12V anode to cathode applied	140	-	mA
		T_J = 25°C		70	120	
		T_J = 125°C		30	-	
DC gate voltage required to trigger	V_{GT}	T_J = -40°C		1.8	-	V
		T_J = 25°C		1.2	2.0	
		T_J = 125°C		0.8	-	
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

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum operating junction temperature range	T_J		-40 to 125	°C
Maximum storage temperature range	T_{stg}		-40 to 150	
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	0.10	K/W
Maximum thermal resistance, case to heatsink	R_{thC-hs}	Mounting surface, smooth, flat and greased	0.04	
Mounting force, ±10%		Non-lubricated threads	31(275)	N.m (lbf.in)
		Lubricated threads	24.5(210)	
Approximate weight			280	g
Case style		TO-209AB (TO-93)		

△ R_{thJC} CONDUCTION				
CONDUCTION ANGEL	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDUCTIONS	UNITS
180°	0.016	0.012	$T_J = T_J$ maximum	K/W
120°	0.019	0.020		
90°	0.025	0.027		
60°	0.036	0.037		
30°	0.060	0.060		

Note

• The table above shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

Fig.1 Current ratings characteristics

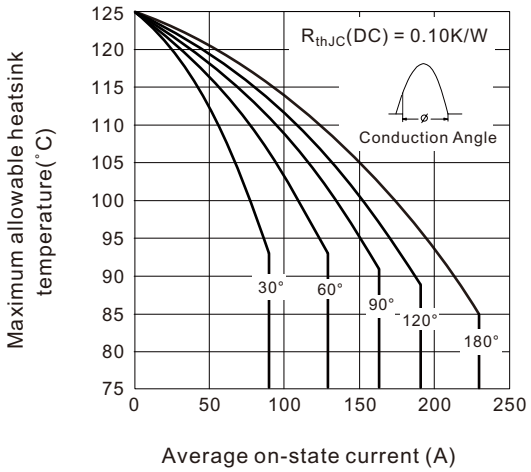


Fig.2 Current ratings characteristics

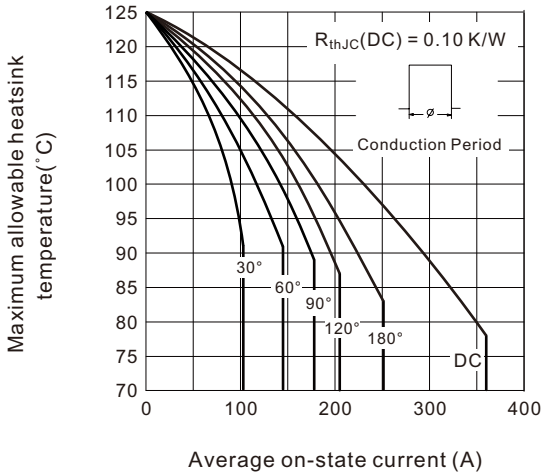


Fig.3 On-state power loss characteristics

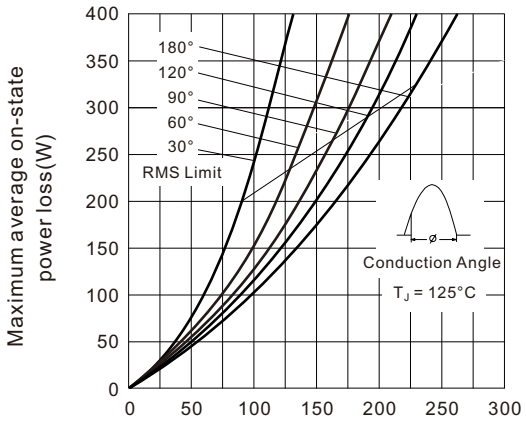


Fig.4 On-state power loss characteristics

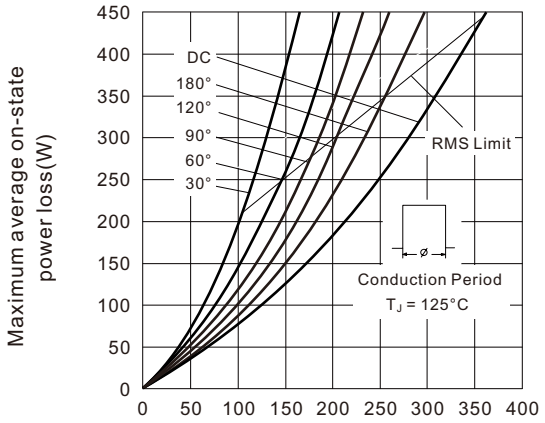


Fig.5 Maximum non-repetitive surge current single and double side cooled

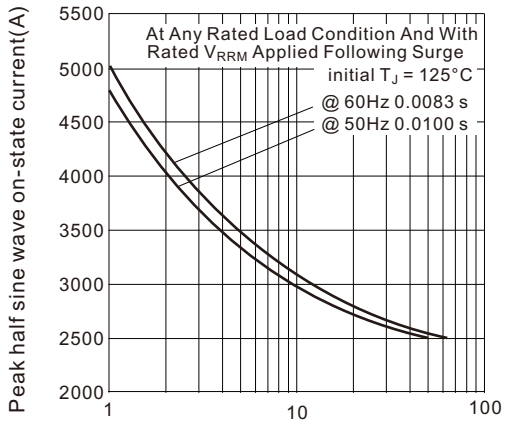


Fig.6 Maximum non-repetitive surge current single and double side cooled

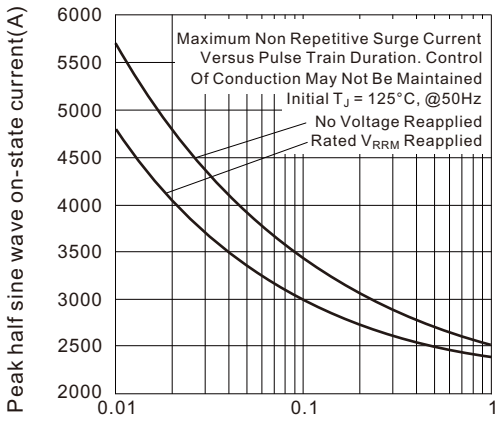


Fig.7 On-state voltage drop characteristcs

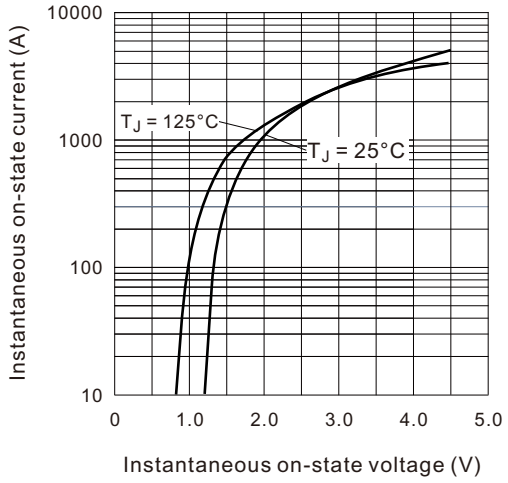


Fig.8 Thermal Impedance Z_{thJC} characteristics

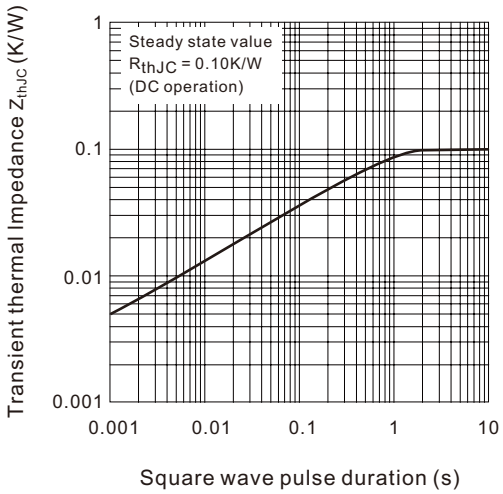
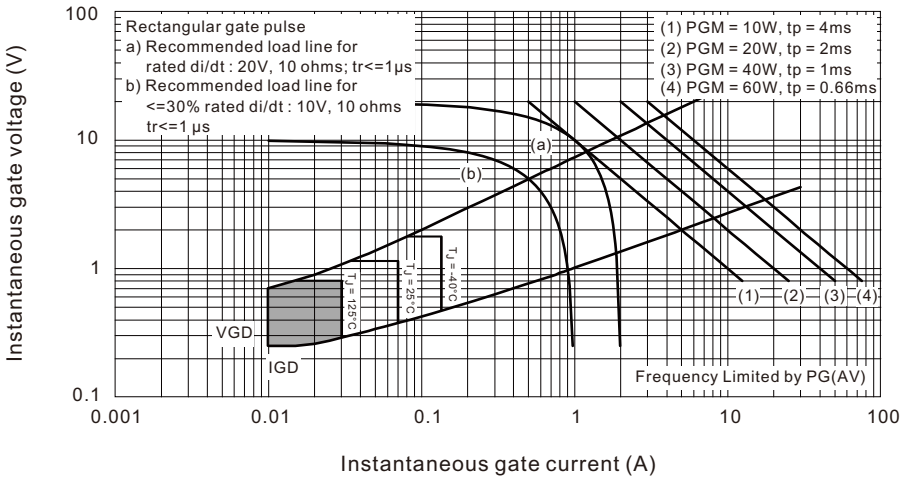


Fig.9 Gate characteristics



ORDERING INFORMATION TABLE

Device code

230	PT	16	S	C
1	2	3	4	5

1 - Maximum average on-state current $I_{T(AV)}$, 230 for 230A

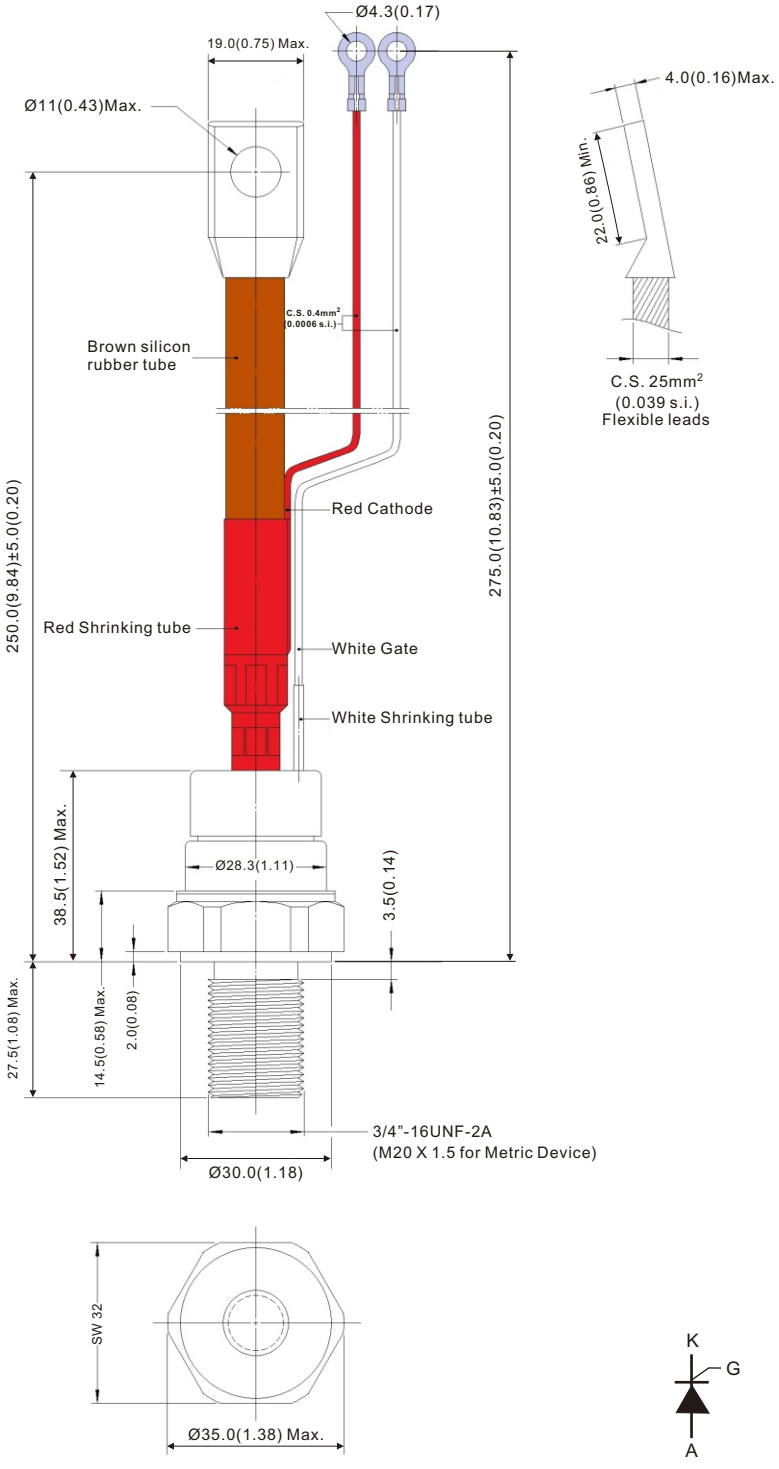
2 - PT = Phase Control Thyristors

3 - Voltage code, cold × 100 = V_{RRM}/V_{RRM}

4 - S = Stud product

5 - C = TO-209AB (TO-93), pressure contact type (Compression bonded)

TO-209AB (TO-93) Ceramic Housing
(Inner Pressure Contact Structure)



All dimensions in millimeters(inches)