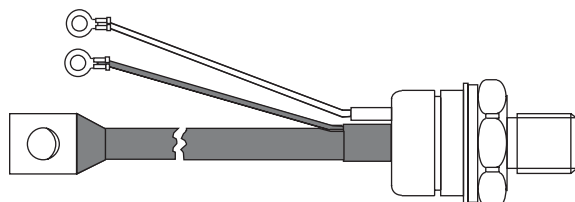


Phase Control Thyristors (Stud Version), 230 A



TO-209AB (TO-93)

FEATURES

- Center amplifying gate
- International standard case TO-209AB (TO-93)
- Hermetic metal case with ceramic insulator
(Also available with glass-metal seal up to 1200 V)
- Compression bonded encapsulation for heavy duty operations such as severe thermal cycling
- Lead (Pb)-free
- Designed and qualified for industrial level



RoHS
COMPLIANT

PRODUCT SUMMARY

$I_{T(AV)}$	230 A
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TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		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 ² s
	60 Hz	149	
V_{DRM}/V_{RRM}		400 to 1600	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 VOLTAGE V	I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST230S	04	400	500	30
	08	800	900	
	12	1200	1300	
	16	1600	1700	

ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at case 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-repetitive surge current	I _{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T _J = T _J maximum	5700	
		t = 8.3 ms			5970	
		t = 10 ms	100 % V _{RRM} reapplied		4800	
		t = 8.3 ms			5000	
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reapplied		163	kA ² s
		t = 8.3 ms		148		
		t = 10 ms	100 % V _{RRM} reapplied	115		
		t = 8.3 ms		105		
Maximum I ² √t for fusing	I ² √t	t = 0.1 to 10 ms, no voltage reapplied			1630	kA ² √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 of 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 of 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} = 720 A, 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 12 V resistive load			600	mA
Maximum (typical) latching current	I _L				1000 (300)	

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

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
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		UNITS
				TYP.	MAX.	
Maximum peak gate power	P _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		10.0		W
Maximum average gate power	P _{G(AV)}	T _J = T _J maximum, f = 50 Hz, d% = 50		2.0		
Maximum peak positive gate current	I _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		3.0		A
Maximum peak positive gate voltage	+ V _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		20		V
Maximum peak negative gate voltage	- V _{GM}			5.0		
DC gate current required to trigger	I _{GT}	T _J = - 40 °C	Maximum required gate trigger/current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied	180	-	mA
		T _J = 25 °C		90	150	
		T _J = 125 °C		40	-	
DC gate voltage required to trigger	V _{GT}	T _J = - 40 °C		2.9	-	V
		T _J = 25 °C		1.8	3.0	
		T _J = 125 °C		1.2	-	
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		

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
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 torque, ± 10 %		Non-lubricated threads	31 (275)	N · m (lbf · in)
		Lubricated threads	24.5 (210)	
Approximate weight			280	g
Case style		See dimensions - link at the end of datasheet	TO-209AB (TO-93)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	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

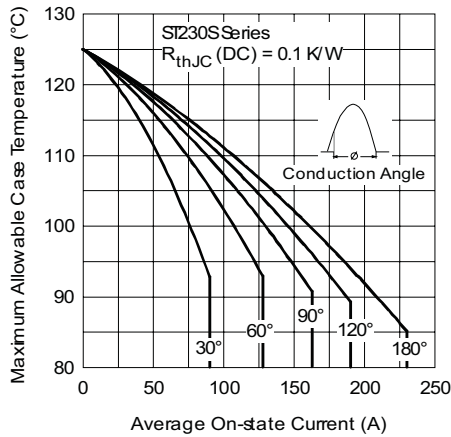


Fig. 1 - Current Ratings Characteristics

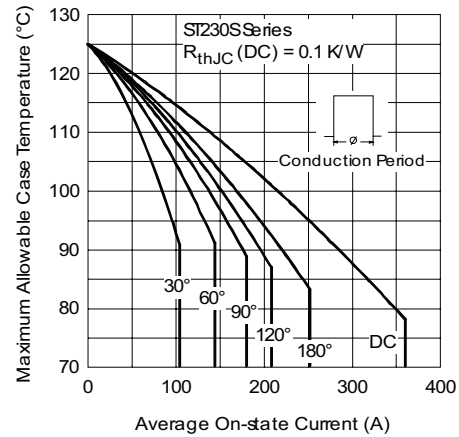


Fig. 2 - Current Ratings Characteristics

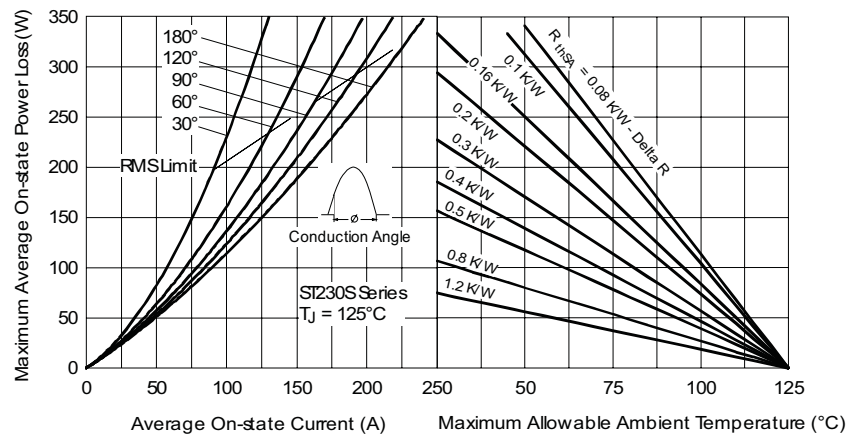


Fig. 3 - On-State Power Loss Characteristics

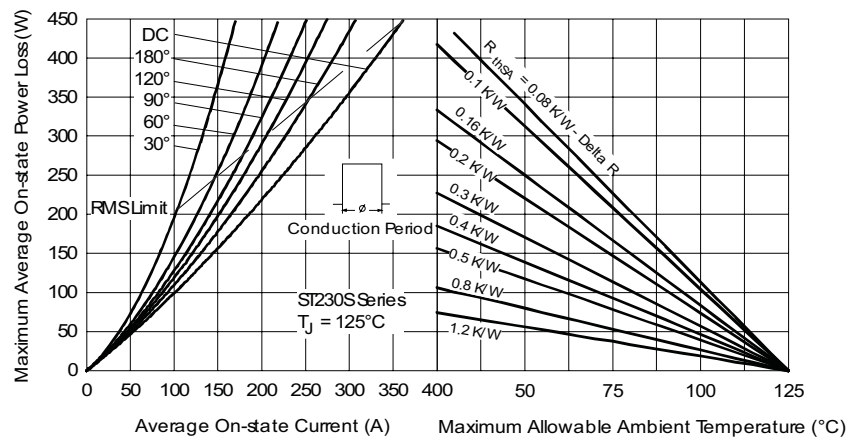


Fig. 4 - On-State Power Loss Characteristics

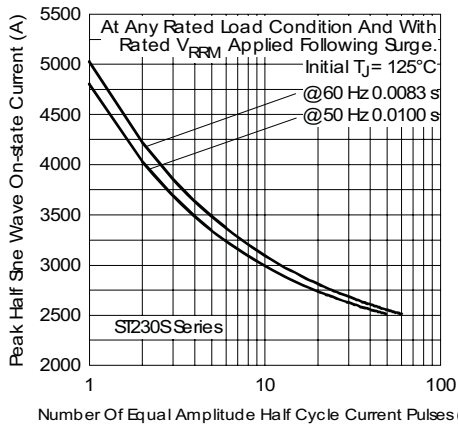


Fig. 5 - Maximum Non-Repetitive Surge Current

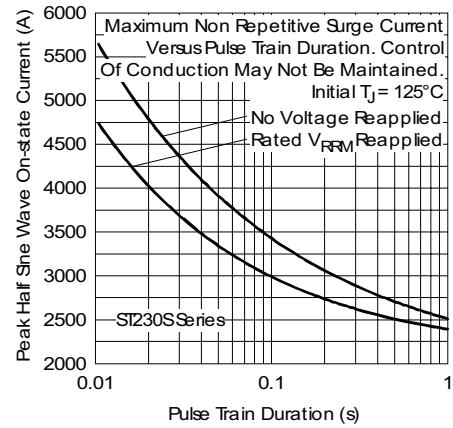


Fig. 6 - Maximum Non-Repetitive Surge Current

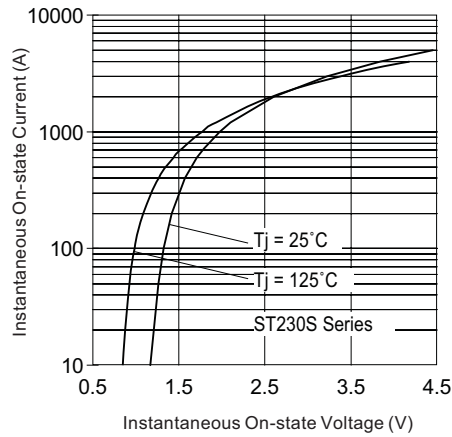


Fig. 7 - On-State Voltage Drop Characteristics

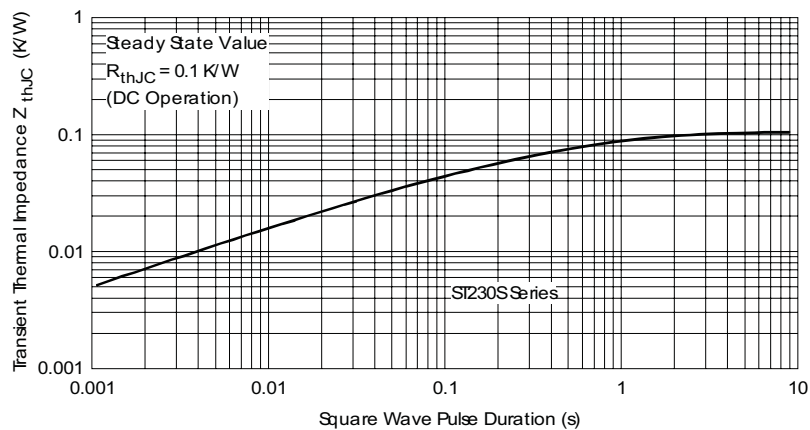


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

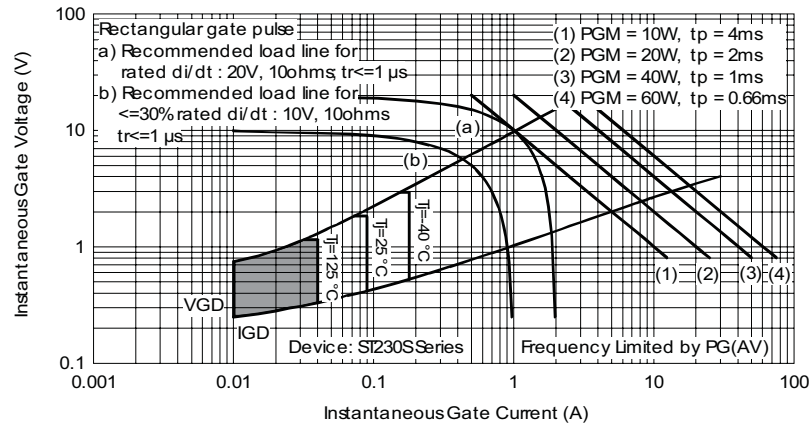


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	ST	23	0	S	16	P	0	V	PbF
	1	2	3	4	5	6	7	8	9
1	- Thyristor								
2	- Essential part number								
3	- 0 = Converter grade								
4	- S = Compression bonding stud								
5	- Voltage code x 100 = V_{RRM} (see Voltage Ratings table)								
6	- P = Stud base 3/4"-16UNF2A threads								
7	- 0 = Eyelet terminals (gate and auxiliary cathode leads) 1 = Fast-on terminals (gate and auxiliary cathode leads)								
8	- • V = Glass-metal seal (only up to 1200 V) • None = Ceramic housing (over 1200 V)								
9	- Lead (Pb)-free								

Note: For metric device M16 x 1.5 contact factory

LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95077



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