

## PHASE CONTROL THYRISTORS

## Stud Version

### Features

- Center amplifying gate
- Hermetic metal case with ceramic insulator
- International standard case TO-209AE (TO-118)
- Threaded studs UNF 3/4 - 16UNF2A or ISO M24x1.5
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

# 330A

### Typical Applications

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

### Major Ratings and Characteristics

Parameters	ST330S	Units
$I_{T(AV)}$	330	A
@ $T_C$	75	°C
$I_{T(RMS)}$	520	A
$I_{TSM}$ @ 50Hz	9000	A
@ 60Hz	9420	A
$I^2t$ @ 50Hz	405	KA <sup>2</sup> s
@ 60Hz	370	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 1600	V
$t_q$ typical	100	μs
$T_J$	- 40 to 125	°C



case style  
TO-209AE (TO-118)

**ELECTRICAL SPECIFICATIONS**

## Voltage Ratings

Type number	Voltage Code	$V_{\text{DRM}}/V_{\text{RRM}}$ , max. repetitive peak and off-state voltage V	$V_{\text{RSM}}$ , maximum non-repetitive peak voltage V	$I_{\text{DRM}}/I_{\text{RRM}}$ max. @ $T_J = T_J \text{ max}$ mA
ST330S	04	400	500	50
	08	800	900	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

## On-state Conduction

Parameter	ST330S	Units	Conditions
$I_{\text{T(AV)}}$ Max. average on-state current @ Case temperature	330	A	180° conduction, half sine wave
	75	°C	
$I_{\text{T(RMS)}}$ Max. RMS on-state current	520	A	DC @ 62°C case temperature
$I_{\text{TSM}}$ Max. peak, one-cycle non-repetitive surge current	9000	A	t = 10ms No voltage
	9420		t = 8.3ms reapplied
	7570		t = 10ms 100% $V_{\text{RRM}}$
	7920		t = 8.3ms reapplied
$I^2t$ Maximum $I^2t$ for fusing	405	KA <sup>2</sup> s	t = 10ms No voltage
	370		t = 8.3ms reapplied
	287		t = 10ms 100% $V_{\text{RRM}}$
	262		t = 8.3ms reapplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	4050	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reapplied
$V_{\text{T(TO)1}}$ Low level value of threshold voltage	0.91	V	$(16.7\% \times \pi \times I_{\text{T(AV)}} < I < \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
$V_{\text{T(TO)2}}$ High level value of threshold voltage	0.92		$(I > \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
$r_{\text{t1}}$ Low level value of on-state slope resistance	0.58	mΩ	$(16.7\% \times \pi \times I_{\text{T(AV)}} < I < \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
$r_{\text{t2}}$ High level value of on-state slope resistance	0.57		$(I > \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
$V_{\text{TM}}$ Max. on-state voltage	1.51	V	$I_{\text{pk}} = 1040\text{A}, T_J = T_J \text{ max}, t_p = 10\text{ms}$ sine pulse
$I_{\text{H}}$ Maximum holding current	600	mA	$T_J = 25^\circ\text{C}$ , anode supply 12V resistive load
$I_{\text{L}}$ Typical latching current	1000		

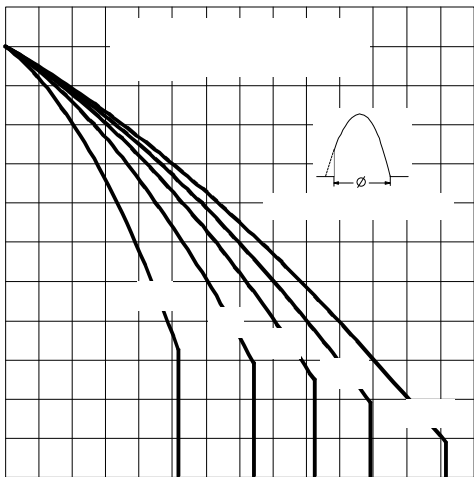


Fig. 1 - Current Ratings Characteristics

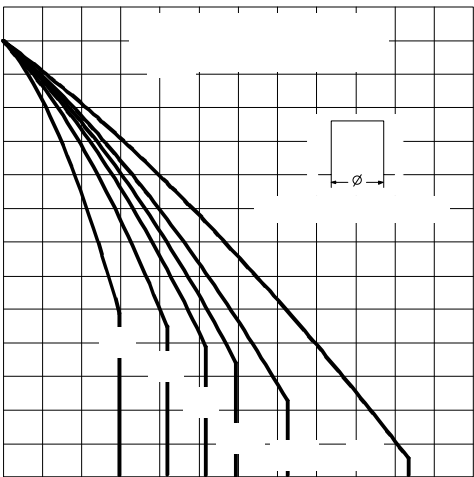


Fig. 2 - Current Ratings Characteristics

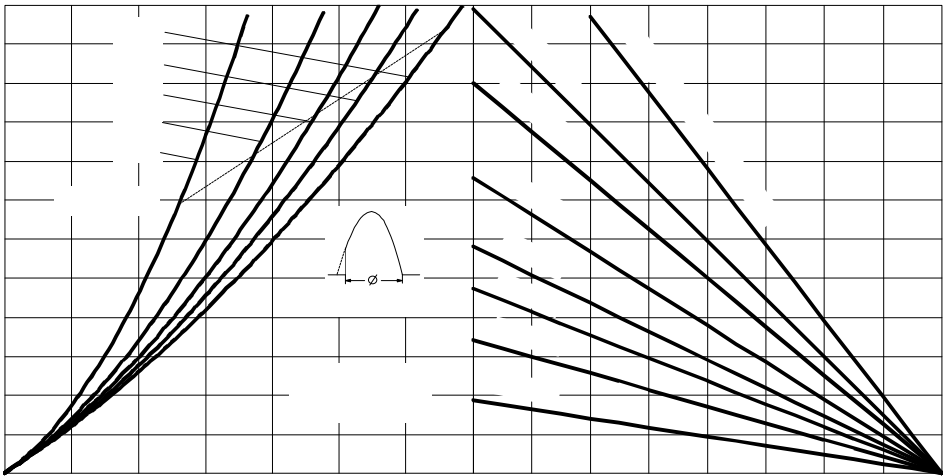


Fig. 3 - On-state Power Loss Characteristics

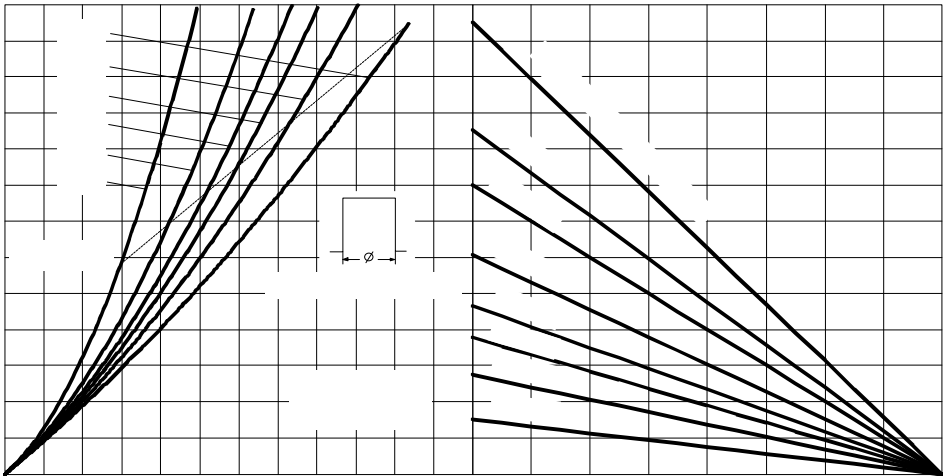


Fig. 4 - On-state Power Loss Characteristics

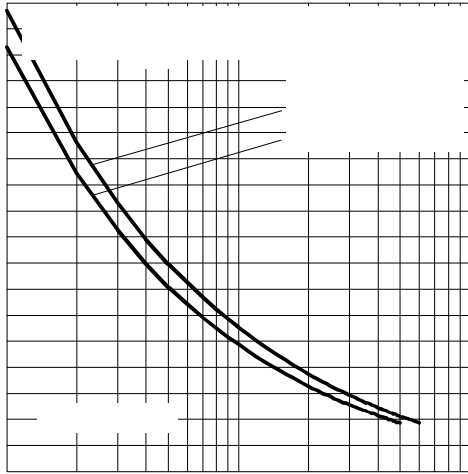


Fig. 5 - Maximum Non-Repetitive Surge Current

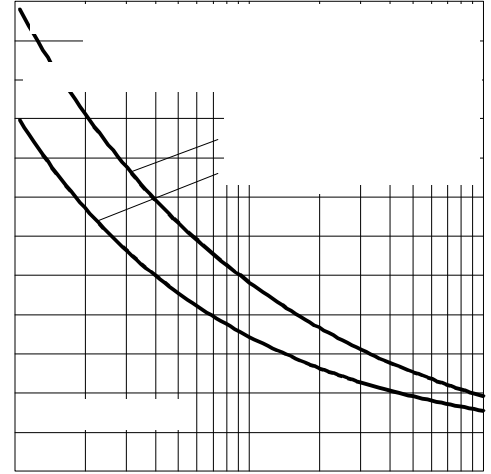


Fig. 6 - Maximum Non-Repetitive Surge Current

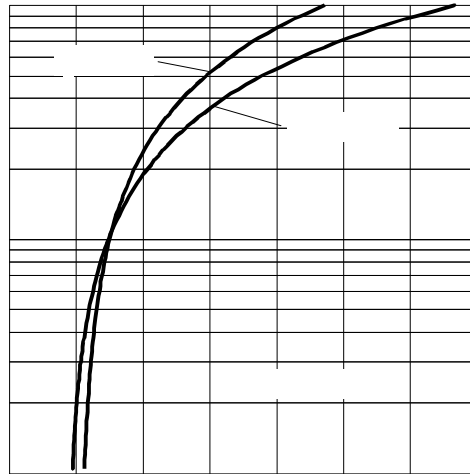


Fig. 7 - On-state Voltage Drop Characteristics

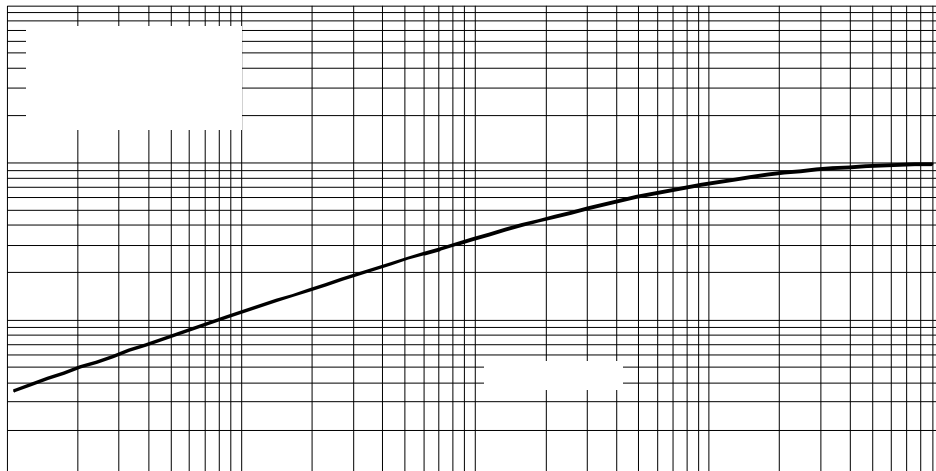


Fig. 8 - Thermal Impedance  $Z_{th,IC}$  Characteristic

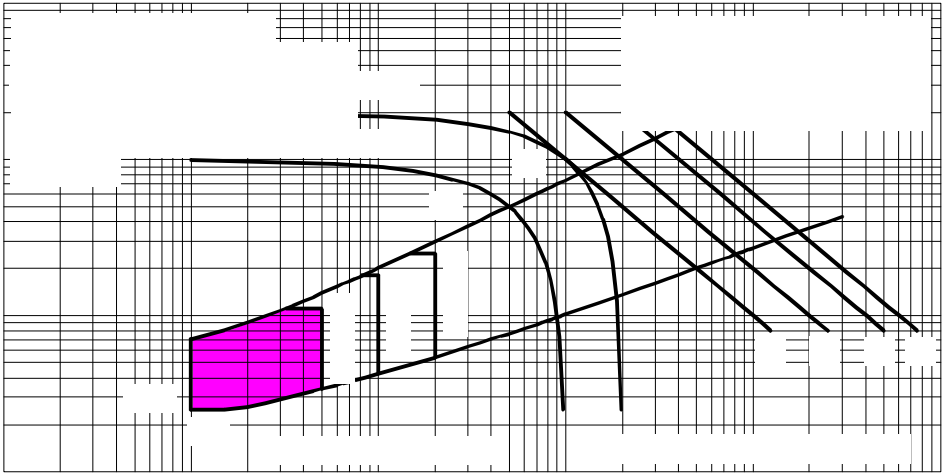


Fig. 9 - Gate Characteristics

## Switching

Parameter	ST330S	Units	Conditions
di/dt    Max. non-repetitive rate of rise of turned-on current	1000	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J \text{ max}$ , anode voltage $\leq 80\% V_{DRM}$
$t_d$ Typical delay time	1.0	μs	Gate current A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$
$t_q$ Typical turn-off time	100		$I_{TM} = 550A$ , $T_J = T_J \text{ max}$ , $di/dt = 40A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

## Blocking

Parameter	ST330S	Units	Conditions
dv/dt    Maximum critical rate of rise of off-state voltage	500	V/μs	$T_J = T_J \text{ max}$ . linear to 80% rated $V_{DRM}$
$I_{RRM}$ Max. peak reverse and off-state leakage current $I_{DRM}$	50	mA	$T_J = T_J \text{ max}$ , rated $V_{DRM}/V_{RRM}$ applied

## Triggering

Parameter		ST330S		Units	Conditions
P <sub>GM</sub>	Maximum peak gate power	10.0		W	T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms
P <sub>G(AV)</sub>	Maximum average gate power	2.0			T <sub>J</sub> = T <sub>J</sub> max, f = 50Hz, d% = 50
I <sub>GM</sub>	Max. peak positive gate current	3.0		A	T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms
+V <sub>GM</sub>	Maximum peak positive gate voltage	20		V	T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms
-V <sub>GM</sub>	Maximum peak negative gate voltage	5.0			
I <sub>GT</sub>	DC gate current required to trigger	TYP.	MAX.	mA	T <sub>J</sub> = - 40°C T <sub>J</sub> = 25°C T <sub>J</sub> = 125°C  Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
		200	-		
		100	200		
		50	-		
V <sub>GT</sub>	DC gate voltage required to trigger	2.5	-	V	T <sub>J</sub> = - 40°C T <sub>J</sub> = 25°C T <sub>J</sub> = 125°C
		1.8	3.0		
		1.1	-		
I <sub>GD</sub>	DC gate current not to trigger	10		mA	T <sub>J</sub> = T <sub>J</sub> max  Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V <sub>DRM</sub> anode-to-cathode applied
V <sub>GD</sub>	DC gate voltage not to trigger	0.25		V	

## Thermal and Mechanical Specification

Parameter	ST330S	Units	Conditions
T <sub>J</sub> Max. operating temperature range	-40 to 125	°C	
T <sub>stg</sub> Max. storage temperature range	-40 to 150		
R <sub>thJC</sub> Max. thermal resistance, junction to case	0.10	K/W	DC operation
R <sub>thCS</sub> Max. thermal resistance, case to heatsink	0.03		Mounting surface, smooth, flat and greased
T Mounting torque, ± 10%	48.5 (425)	Nm (lbf-in)	Non lubricated threads
wt Approximate weight	535	g	
Case style	TO - 209AE (TO-118)		See Outline Table

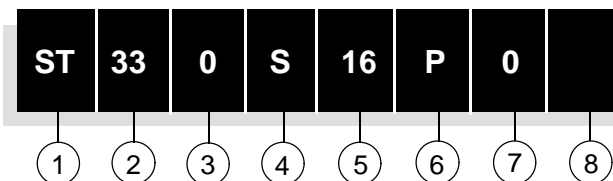
 $\Delta R_{thJC}$  Conduction

(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.011	0.008	K/W	T <sub>J</sub> = T <sub>J</sub> max.
120°	0.013	0.014		
90°	0.017	0.018		
60°	0.025	0.026		
30°	0.041	0.041		

## Ordering Information Table

## Device Code



- 1** - Thyristor
- 2** - Essential part number
- 3** - 0 = Converter grade
- 4** - S = Compression bonding Stud
- 5** - Voltage code: Code x 100 = V<sub>RRM</sub> (See Voltage Rating Table)
- 6** - P = Stud base 16UNF threads  
M = Stud base metric threads (M24 x 1.5)
- 7** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)  
1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)  
3 = Threaded top terminal 3/8" 24UNF-2A
- 8** - Critical dv/dt: None = 500V/μsec (Standard selection)  
L = 1000V/μsec (Special selection)

Outline Table

