

Phase Control Thyristors (Stud Version), 330 A



TO- 209AE (TO-118)

PRODUCT SUMMARY	
$I_{T(AV)}$	330 A
V_{DRM}/V_{RRM}	400 V, 2000 V
V_{TM}	1.52 V
I_{GT}	200 mA
T_J	-40 °C to 125 °C
Package	TO-209AE (TO-118)
Diode variation	Single SCR

FEATURES

- Center amplifying gate
- International standard case TO-209AE (TO-118)
- Hermetic metal case with ceramic insulator
- Compression bonded encapsulation for heavy duty operations such as severe thermal cycling
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		330	A
	T_C	75	°C
$I_{T(RMS)}$		520	A
I_{TSM}	50 Hz	9000	
	60 Hz	9420	
I^2t	50 Hz	405	kA ² s
	60 Hz	370	
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 VOLTAGE V	I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-ST330S	04	400	500	50
	08	800	900	
	12	1200	1300	
	16	1600	1700	
	20	2000	2100	



ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° conduction, half sine wave		330	A
				75	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 75 °C case temperature		520	
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	9000	A
		t = 8.3 ms		9420	
		t = 10 ms	100 % V_{RRM} reapplied	7570	
		t = 8.3 ms		7920	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	405	kA ² s
		t = 8.3 ms		370	
		t = 10 ms	100 % V_{RRM} reapplied	287	
		t = 8.3 ms		262	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied		4050	kA ² √s
Low level value of threshold voltage	$V_{T(TO)1}$	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum		0.834	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > $\pi \times I_{T(AV)}$, $T_J = T_J$ maximum		0.898	
Low level value of on-state slope resistance	r_{t1}	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum		0.687	mΩ
High level value of on-state slope resistance	r_{t2}	(I > $\pi \times I_{T(AV)}$, $T_J = T_J$ maximum		0.636	
Maximum on-state voltage	V_{TM}	$I_{pk} = 1000$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		1.52	V
Maximum holding current	I_H	$T_J = 25$ °C, anode supply 12 V resistive load		600	mA
Typical latching current	I_L			1000	

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, $t_r \leq 1$ μs $T_J = T_J$ maximum, anode voltage ≤ 80 % V_{DRM}		1000	A/μs
Typical delay time	t_d	Gate current A, $di_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM} , $T_J = 25$ °C		1.0	μs
Typical turn-off time	t_q	$I_{TM} = 550$ A, $T_J = T_J$ maximum, $di/dt = 40$ A/μs, $V_R = 50$ V, $dV/dt = 20$ V/μs, gate 0 V 100 Ω, $t_p = 500$ 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		50	mA



TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ 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, $t_p \leq 5$ ms		3.0		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	$-V_{GM}$			5.0		
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	200	-	mA
		$T_J = 25$ °C		100	200	
		$T_J = 125$ °C		50	-	
DC gate voltage required to trigger	V_{GT}	$T_J = -40$ °C		2.5	-	V
		$T_J = 25$ °C		1.8	3	
		$T_J = 125$ °C		1.1	-	
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	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	0.03	
Mounting torque, ± 10 %		Non-lubricated threads	48.5 (425)	N · m (lbf · in)
Approximate weight			535	g
Case style		See dimension - link at the end of datasheet	TO-209AE (TO-118)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.011	0.008	$T_J = T_J$ maximum	K/W
120°	0.013	0.014		
90°	0.017	0.018		
60°	0.025	0.026		
30°	0.041	0.042		

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

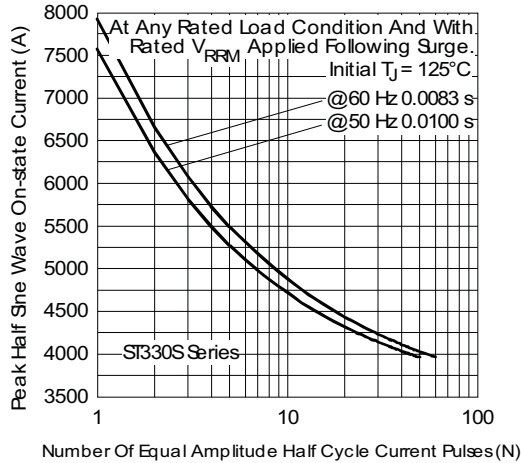


Fig. 5 - Maximum Non-Repetitive Surge Current

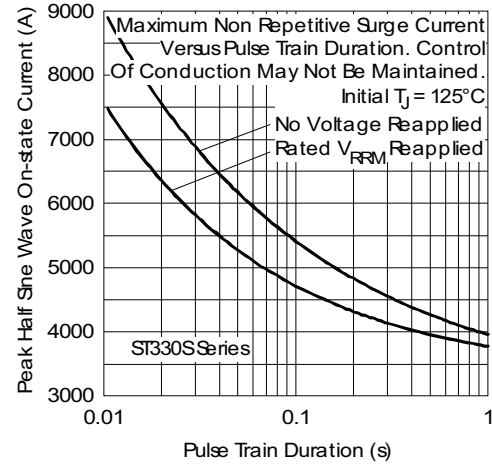


Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 7 - On-State Voltage Drop Characteristics



Fig. 8 - Thermal Impedance Z_{thJC} Characteristics



Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

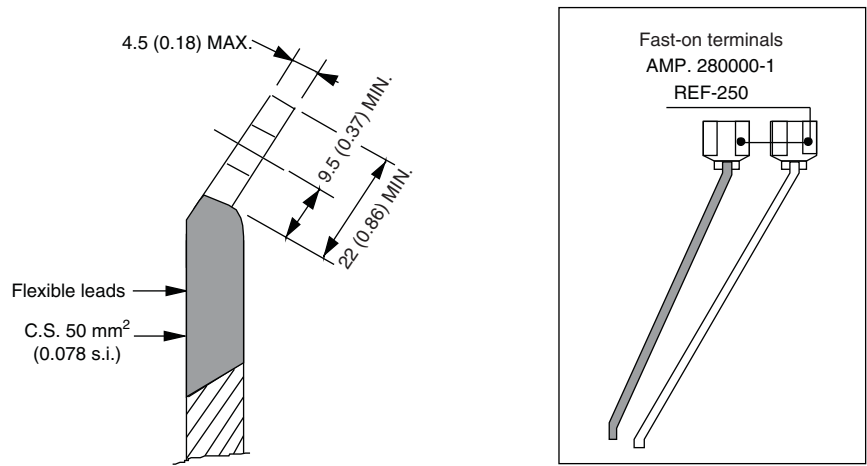
Device code	VS-	ST	33	0	S	16	P	0	PbF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part number
- 4** - 0 = Converter grade
- 5** - S = Compression bonding stud
- 6** - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
- 7** - P = Stud base 3/4"-16UNF-2A threads
- 8** - 0 = Eyelet terminals (gate and auxiliary cathode leads)
1 = Fast-on terminals (gate and auxiliary cathode leads)
- 9** - None = Standard production
- PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95080

TO-209AE (TO-118)

DIMENSIONS in millimeters (inches)



Note

⁽¹⁾ For metric device: M24 x 1.5 - length 21 (0.83) maximum



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