



Phase Control Thyristors (Stud Version), 300 A



TO- 209AE (TO-118)



RoHS COMPLIANT

FEATURES

- Center amplifying gate
- International standard case TO-209AE (TO-118)
- Hermetic metal case with ceramic insulator
- Threaded studs UNF 3/4"-16UNF-2A or ISO M24 x 1.5
- 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

TYPICAL APPLICATIONS

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

PRODUCT SUMMARY	
$I_{T(AV)}$	300 A
V_{DRM}/V_{RRM}	400 V, 2000 V
V_{TM}	1.28 V
I_{GT}	200 mA
T_J	-40 °C to 125 °C
Package	TO-209AE (TO-118)
Diode variation	Single SCR

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		300	A
	T_C	75	°C
$I_{T(RMS)}$		470	A
I_{TSM}	50 Hz	8000	
	60 Hz	8380	
I^2t	50 Hz	320	kA ² s
	60 Hz	292	
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-ST300S	04	400	500	50
	08	800	900	
	12	1200	1300	
	16	1600	1700	
	18	1800	1900	
	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		300	A
				75	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 64 °C case temperature		470	
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	8000	A
		t = 8.3 ms		8380	
		t = 10 ms	100 % V_{RRM} reapplied	6730	
		t = 8.3 ms		7040	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	320	kA ² s
		t = 8.3 ms		292	
		t = 10 ms	100 % V_{RRM} reapplied	226	
		t = 8.3 ms		207	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied		3200	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)		0.97	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > $\pi \times I_{T(AV)}$, $T_J = T_J$ maximum)		0.98	
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)		0.74	mΩ
High level value of on-state slope resistance	r_{t2}	(I > $\pi \times I_{T(AV)}$, $T_J = T_J$ maximum)		0.73	
Maximum on-state voltage	V_{TM}	$I_{pk} = 940$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		1.66	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 1 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		30	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}	Maximum required gate trigger/ current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied	$T_J = -40$ °C	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	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_{thCS}	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 dimensions - 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

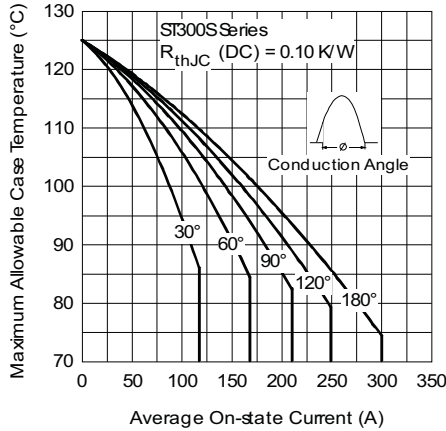


Fig. 1 - Current Ratings Characteristics

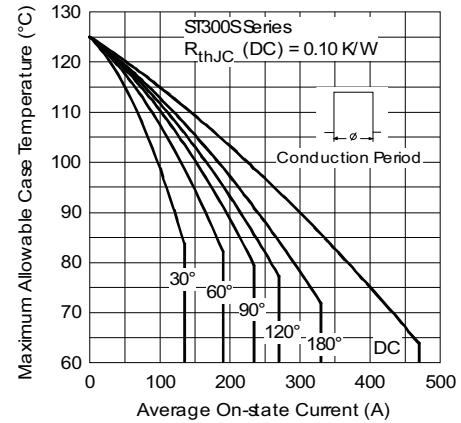


Fig. 2 - Current Ratings Characteristics

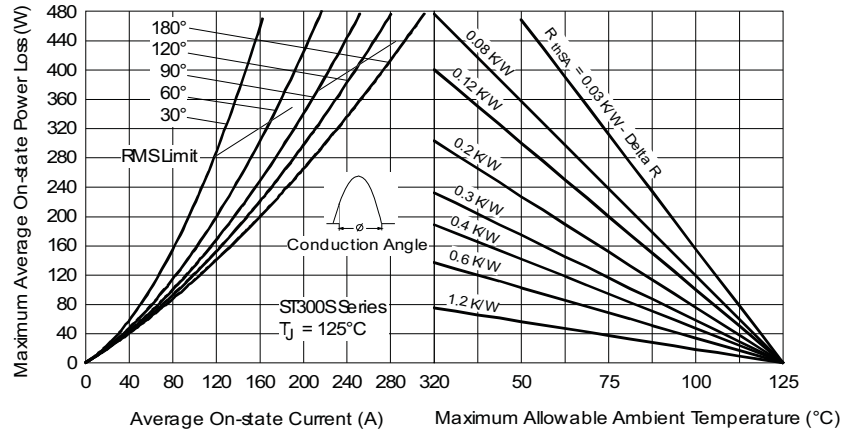


Fig. 3 - On-State Power Loss Characteristics

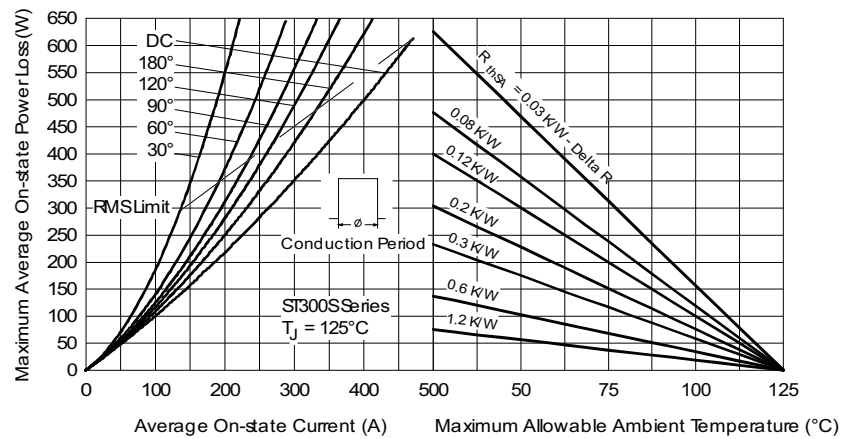


Fig. 4 - On-State Power Loss Characteristics

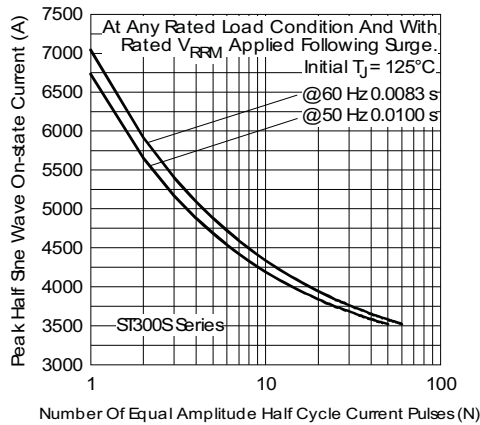


Fig. 5 - Maximum Non-Repetitive Surge Current

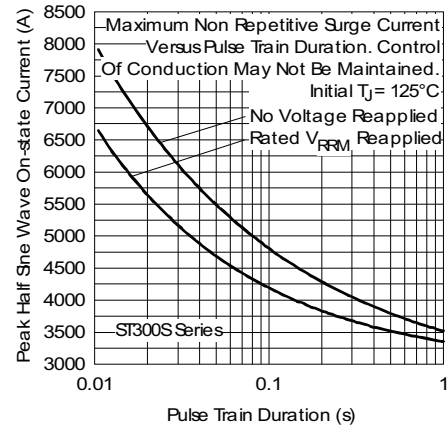


Fig. 6 - Maximum Non-Repetitive Surge Current

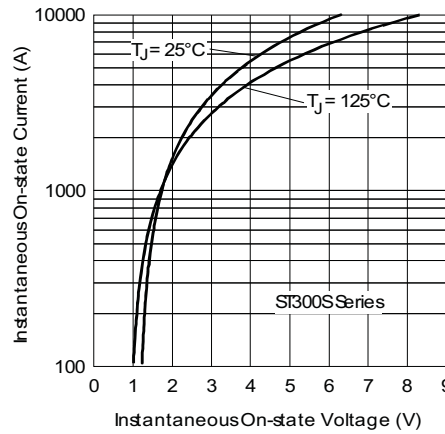


Fig. 7 - On-State Voltage Drop Characteristics

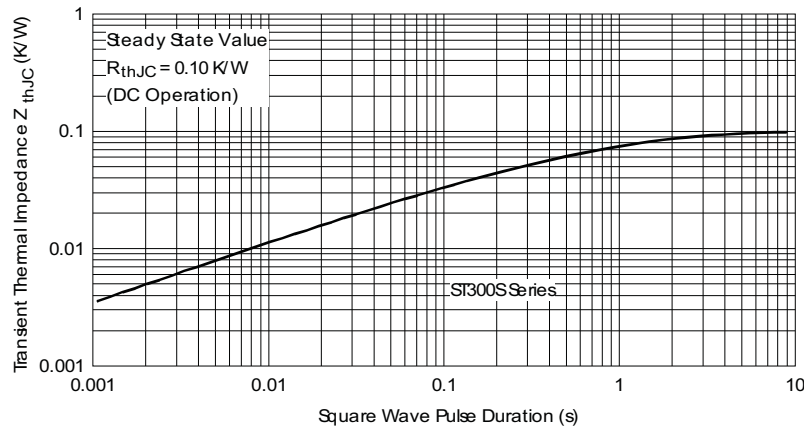


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

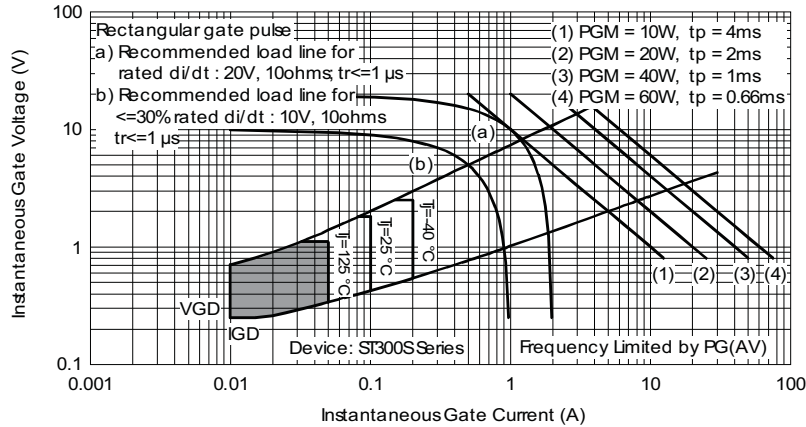


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	ST	30	0	S	20	P	0	-	PbF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

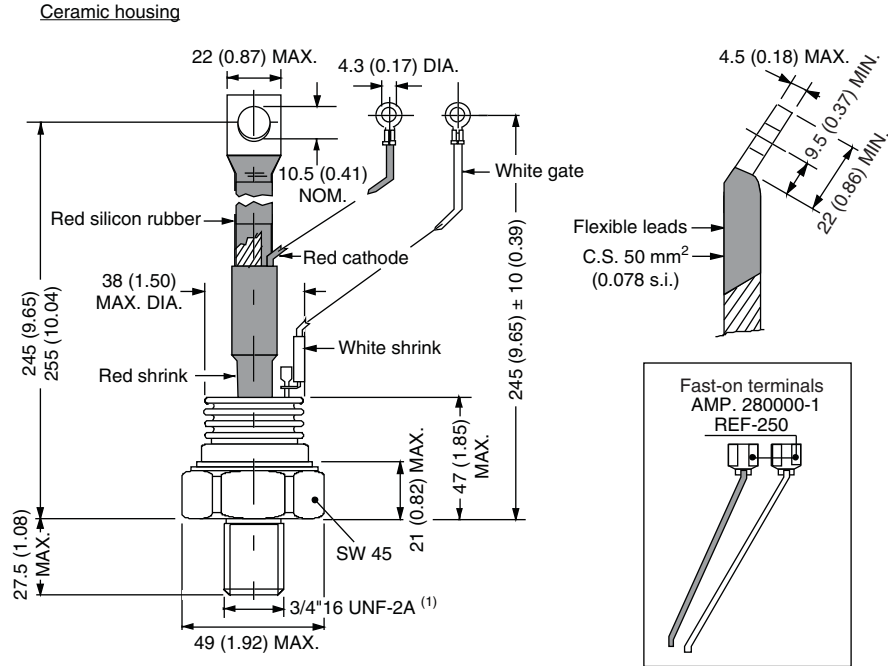
- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part number
- 4** - 0 = Converter grade
- 5** - S = Compression bonding stud
- 6** - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
- 7** - P = Stud base 3/4" 16UNF-2A threads
M = Stud base metric threads (M24 x 1.5)
- 8** - 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
- 9** - Critical dV/dt: • None = 500 V/µs (standard value)
• L = 1000 V/µs (special selection)
- 10** - None = Standard production
- PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95084
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TO-209AE (TO-118)

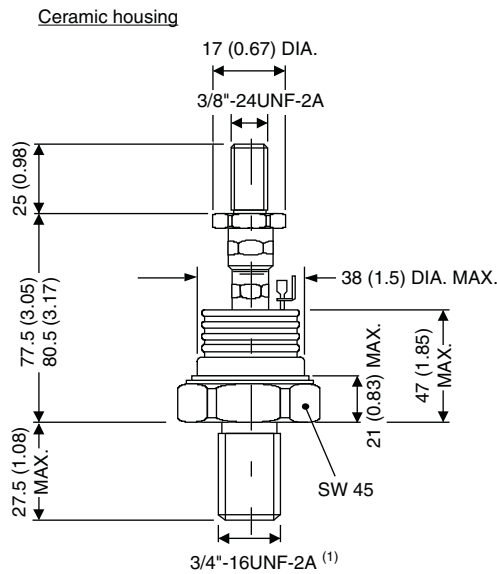
DIMENSIONS - TO-209AE (TO-118) in millimeters (inches)



Note

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

DIMENSIONS - TO-209AE (TO-118) WITH TOP THREAD TERMINAL 3/8" in millimeters (inches)



Note

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



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