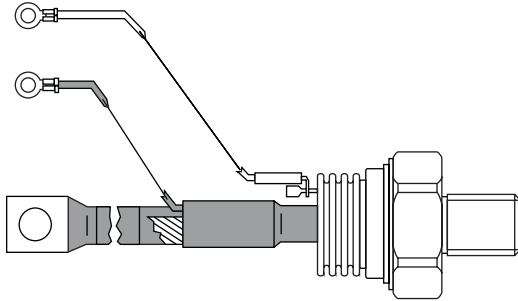


Inverter Grade Thyristors (Stud Version), 330 A



TO-209AE (TO-118)

FEATURES

- Center amplifying gate
- High surge current capability
- Low thermal impedance
- High speed performance
- Compression bonding
- Lead (Pb)-free
- Designed and qualified for industrial level


**RoHS
COMPLIANT**
PRODUCT SUMMARY

$I_{T(AV)}$	330 A
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TYPICAL APPLICATIONS

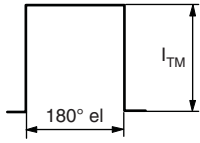
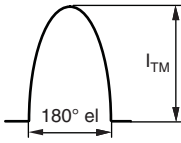
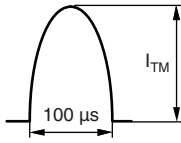
- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		330	A
	T_C	75	°C
$I_{T(RMS)}$		518	A
I_{TSM}	50 Hz	11 000	
	60 Hz	11 520	
I^2t	50 Hz	605	kA ² s
	60 Hz	550	
V_{DRM}/V_{RRM}		400 to 800	V
t_q		15	μs
T_J		- 40 to 125	°C

ELECTRICAL SPECIFICATIONS
VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	V_{DRM}/V_{RRM} , MAXIMUM REPETITIVE PEAK VOLTAGE V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST333S	04	400	500	50
	08	800	900	

CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	840	600	1280	1040	5430	4350	A
400 Hz	650	450	1280	910	2150	1560	
1000 Hz	430	230	1090	730	1080	720	
2500 Hz	140	60	490	250	400	190	
Recovery voltage V_R	50		50		50		V
Voltage before turn-on V_D	V_{DRM}		V_{DRM}		V_{DRM}		
Rise of on-state current di/dt	50		-		-		A/ μ s
Case temperature	50	75	50	75	50	75	$^{\circ}$ C
Equivalent values for RC circuit	10/0.47		10/0.47		10/0.47		Ω/μ F

ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at case temperature	$I_{T(AV)}$	180 $^{\circ}$ conduction, half sine wave			330	A
					75	$^{\circ}$ C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 63 $^{\circ}$ C case temperature			518	A
Maximum peak, one half cycle, non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	11 000	
		t = 8.3 ms			11 520	
		t = 10 ms	100 % V_{RRM} reappplied		9250	
		t = 8.3 ms			9700	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reappplied		605	kA 2 s
		t = 8.3 ms			550	
		t = 10 ms	100 % V_{RRM} reappplied		430	
		t = 8.3 ms			390	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reappplied			6050	kA $^2\sqrt{s}$
Maximum peak on-state voltage	V_{TM}	$I_{TM} = 1810$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse			1.96	V
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			0.91	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.92	
Low level value of forward slope resistance	r_{f1}	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.58	m Ω
High level value of forward slope resistance	r_{f2}	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.58	
Maximum holding current	I_H	$T_J = 25$ $^{\circ}$ C, $I_T > 30$ A			600	mA
Typical latching current	I_L	$T_J = 25$ $^{\circ}$ C, $V_A = 12$ V, $R_a = 6$ Ω , $I_G = 1$ A			1000	



SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned-on current	di/dt	$T_J = T_J$ maximum, $V_{DRM} = \text{Rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$	1000	A/ μ s
Typical delay time	t_d	$T_J = 25^\circ\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 50 \text{ A DC}$, $t_p = 1 \mu\text{s}$ Resistive load, gate pulse: 10 V, 5 Ω source	1.0	μ s
Maximum turn-off time	t_q	$T_J = T_J$ maximum, $I_{TM} = 550 \text{ A}$, commutating $di/dt = 40 \text{ A}/\mu\text{s}$ $V_R = 50 \text{ V}$, $t_p = 500 \mu\text{s}$, $dV/dt = 200 \text{ V}/\mu\text{s}$	15	

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 % V_{DRM} , higher value available on request	500	V/ μ s
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
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $f = 50 \text{ Hz}$, $d\% = 50$	60	W
Maximum average gate power	$P_{G(AV)}$		10	
Maximum peak positive gate current	I_{GM}	$T_J = T_J$ maximum, $t_p \leq 5 \text{ ms}$	10	A
Maximum peak positive gate voltage	+ V_{GM}		20	
Maximum peak negative gate voltage	- V_{GM}		5	
Maximum DC gate current required to trigger	I_{GT}	$T_J = 25^\circ\text{C}$, $V_A = 12 \text{ V}$, $R_a = 6 \Omega$	200	mA
Maximum DC gate voltage required to trigger	V_{GT}		3	V
Maximum DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum, rated V_{DRM} applied	20	mA
Maximum 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	$^\circ\text{C}$
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, $\pm 10\%$		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_{thJ-hs} 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_{thJ-hs} when devices operate at different conduction angles than DC

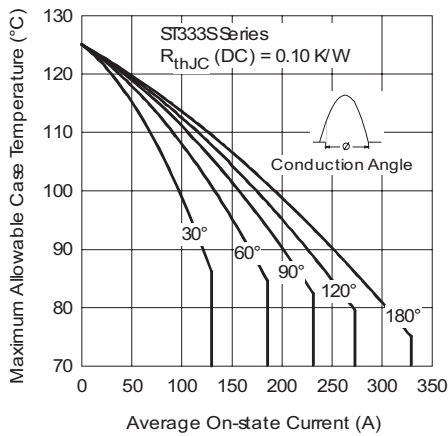


Fig. 1 - Current Ratings Characteristics

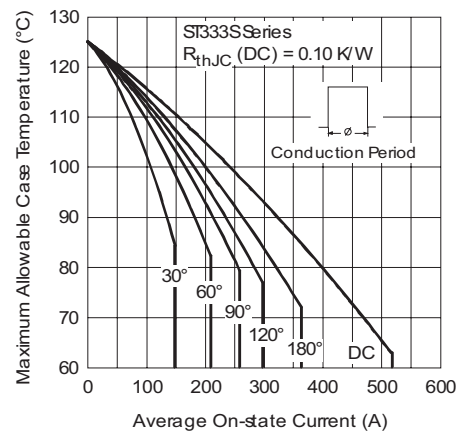


Fig. 2 - Current Ratings Characteristics

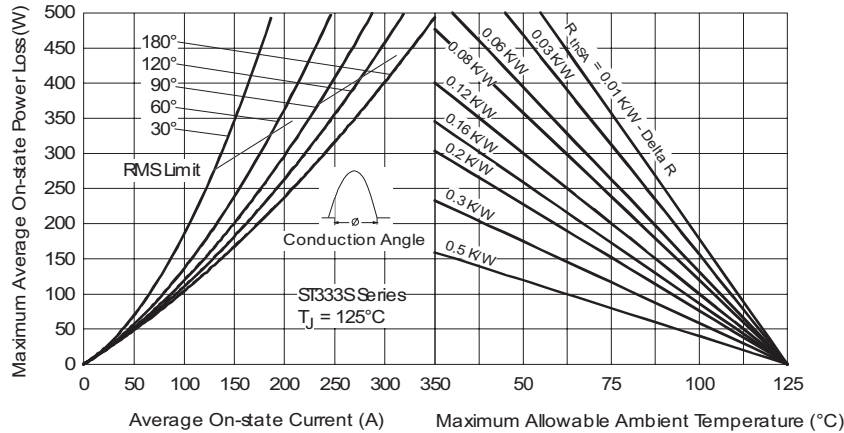


Fig. 3 - On-State Power Loss Characteristics

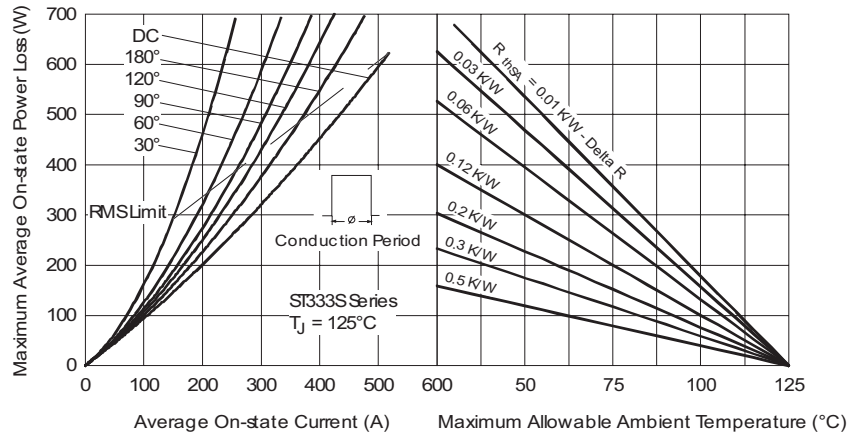


Fig. 4 - On-State Power Loss Characteristics

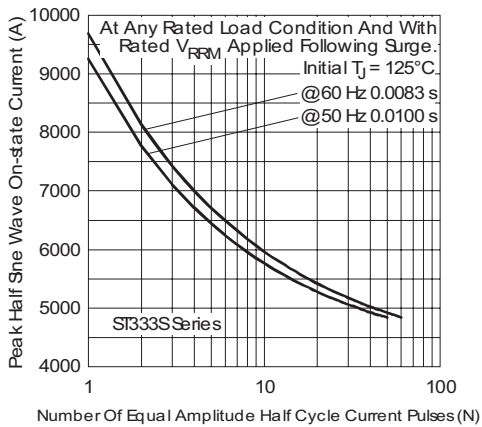


Fig. 5 - Maximum Non-Repetitive Surge Current

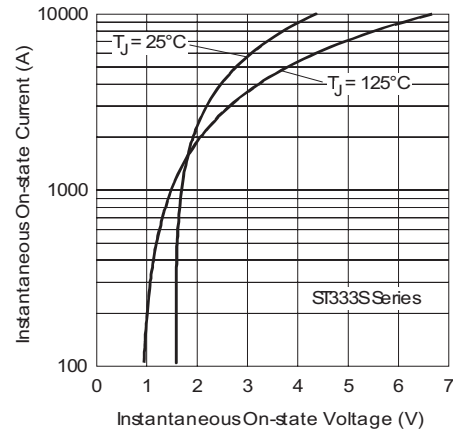


Fig. 7 - On-State Voltage Drop Characteristics

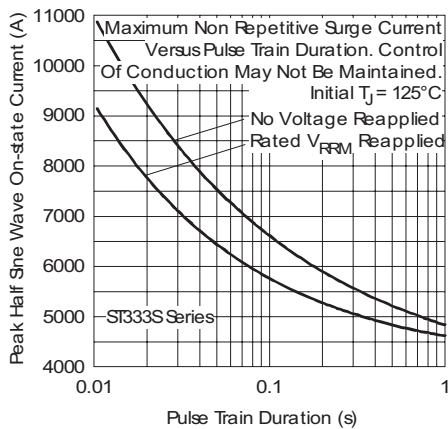


Fig. 6 - Maximum Non-Repetitive Surge Current

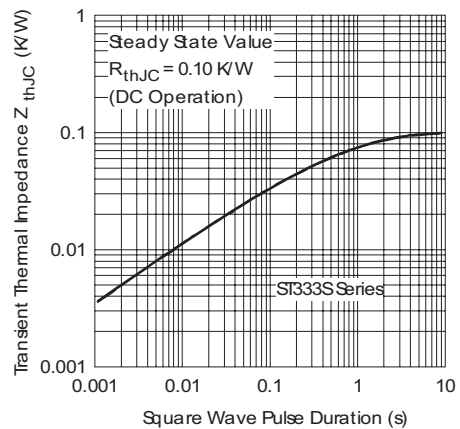


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

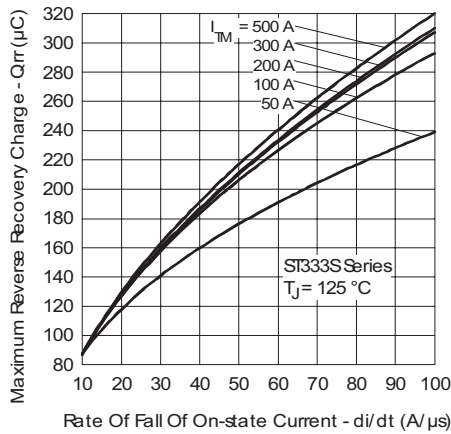


Fig. 9 - Reverse Recovered Charge Characteristics

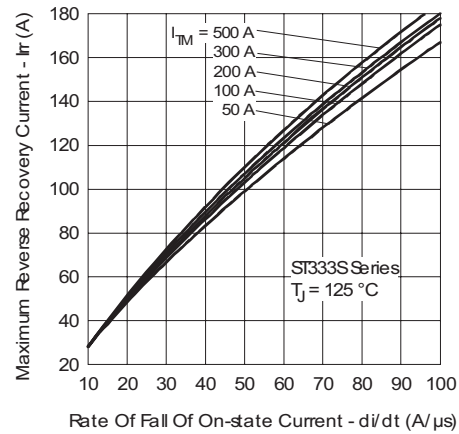


Fig. 10 - Reverse Recovery Current Characteristics

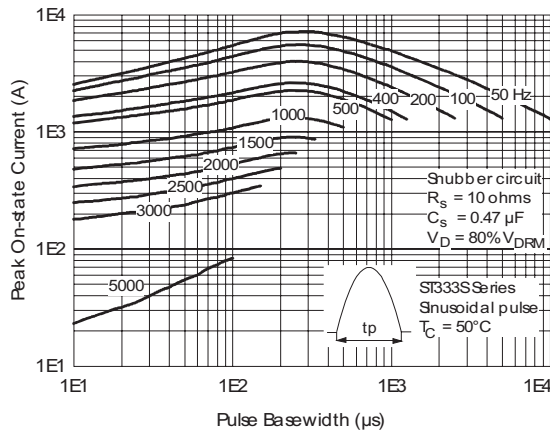


Fig. 11 - Frequency Characteristics

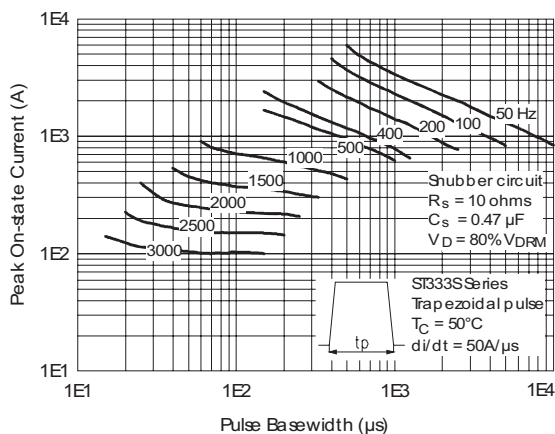
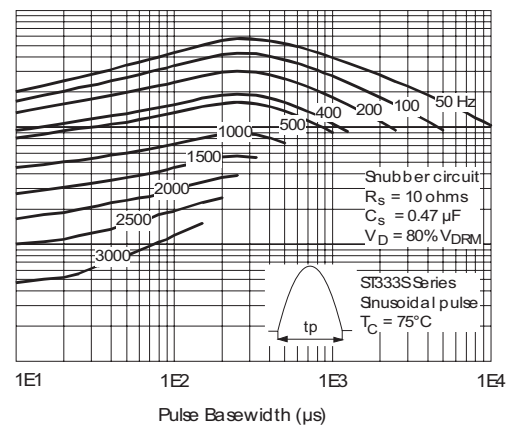
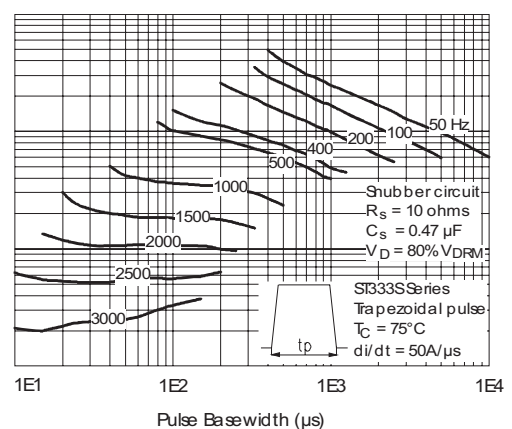


Fig. 12 - Frequency Characteristics



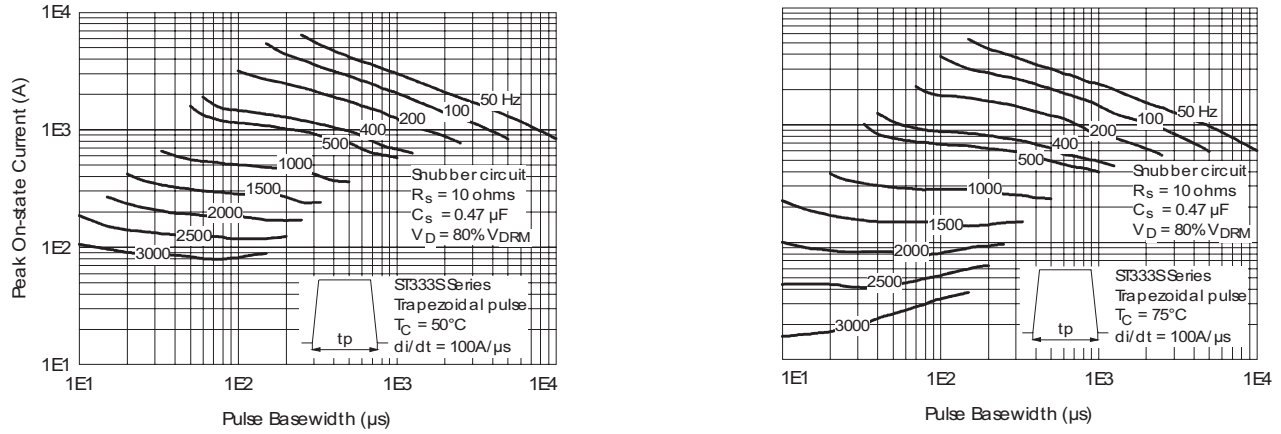


Fig. 13 - Frequency Characteristics

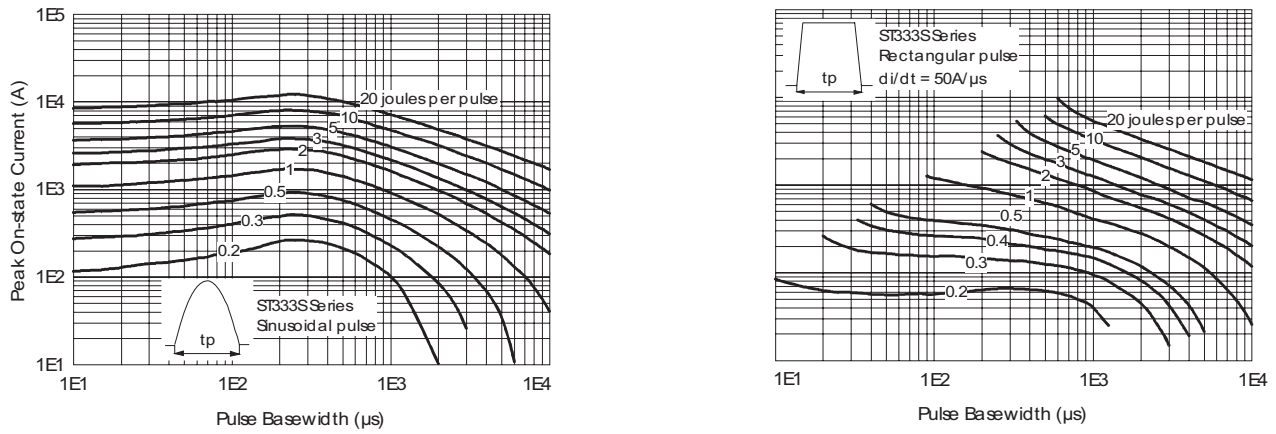


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

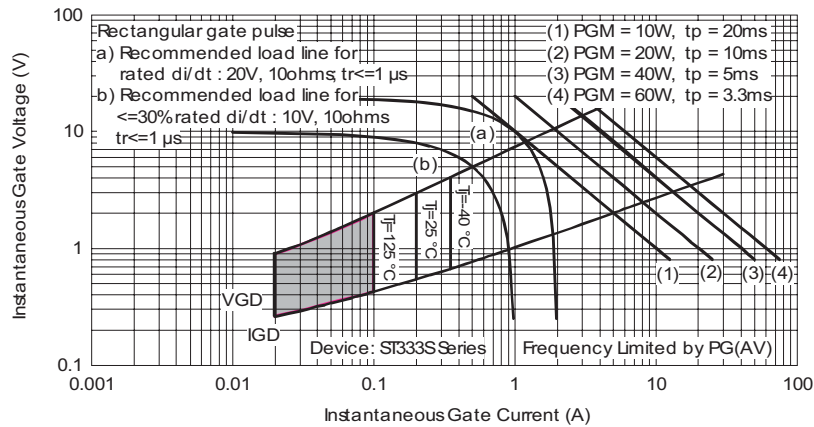


Fig. 15 - Gate Characteristics

ST333SP Series

Vishay High Power Products Inverter Grade Thyristors
(Stud Version), 330 A



ORDERING INFORMATION TABLE

Device code	ST	33	3	S	08	P	F	L	0	P
	1	2	3	4	5	6	7	8	9	10

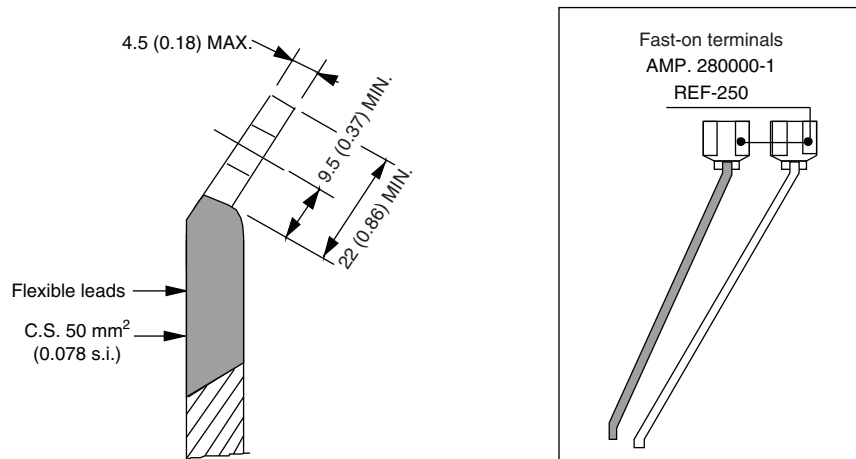
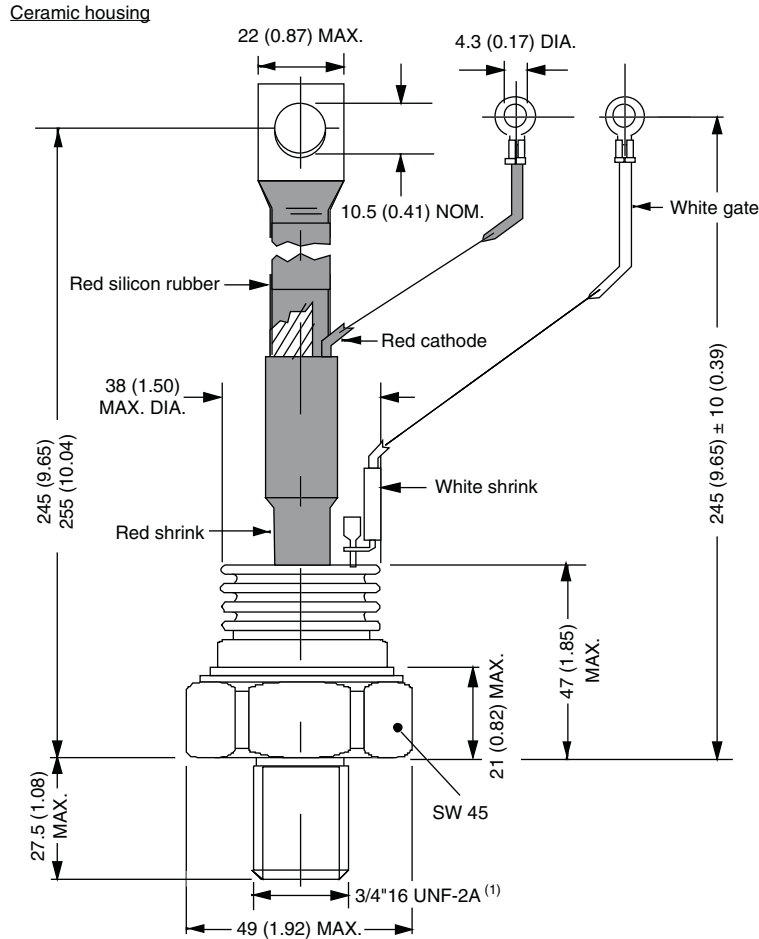
- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn-off
- 4** - S = Compression bonding stud
- 5** - Voltage code x 100 = V_{RRM}
(see Voltage Ratings table)
- 6** - P = Stud base 3/4" 16UNF-2A
- 7** - Reapplied dV/dt code (for t_q test condition) $F = 200 \text{ V}/\mu\text{s}$
- 8** - t_q code ($L = 15 \mu\text{s}$)
- 9** - 0 = Eyelet terminals
(gate and auxiliary cathode leads)
1 = Fast-on terminals
(gate and auxiliary cathode leads)
- 10** - Lead (Pb)-free

Note: For metric device M24 x 1.5 contact factory

LINKS TO RELATED DOCUMENTS	
Dimensions	http://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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