Inverter Grade Thyristors (Stud Version), 175 A

TO-209AB (TO-93)

FEATURES

- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- Guaranteed high dI/dt
- High surge current capability
- Low thermal impedance
- High speed performance
- Compression bonding
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

TYPICAL APPLICATIONS

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

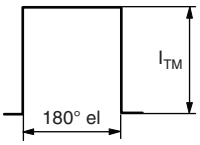
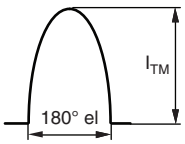
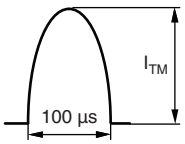
PRODUCT SUMMARY	
$I_{T(AV)}$	175 A
V_{DRM}/V_{RRM}	1000 V, 1200 V
V_{TM}	2.07 V
I_{TSM} at 50 Hz	4680 A
I_{TSM} at 60 Hz	4900 A
I_{GT}	200 mA
T_J	-40 °C to 125 °C
Package	TO-209AB (TO-93)
Diode variation	Single SCR

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		175	A
	T_C	85	°C
$I_{T(RMS)}$		275	A
I_{TSM}	50 Hz	4680	
	60 Hz	4900	
I^2t	50 Hz	110	kA^2s
	60 Hz	100	
V_{DRM}/V_{RRM}		1000 to 1200	V
t_q	Range	15 to 25	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
VS-ST173S	10	1000	1100	40
	12	1200	1300	

CURRENT CARRYING CAPABILITY

FREQUENCY							UNITS
50 Hz	500	320	790	550	4510	3310	A
400 Hz	450	290	810	540	1970	1350	
1000 Hz	330	190	760	490	1050	680	
2500 Hz	170	80	510	300	480	280	
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/µs
Case temperature	60	85	60	85	60	85	°C
Equivalent values for RC circuit	47/0.22		47/0.22		47/0.22		Ω/µF

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			175	A
					85	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 75 °C case temperature			275	A
Maximum peak, one half cycle, non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	4680	
		t = 8.3 ms			4900	
		t = 10 ms	100 % V_{RRM} reapplied		3940	
		t = 8.3 ms			4120	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		110	kA^2s
		t = 8.3 ms			100	
		t = 10 ms	100 % V_{RRM} reapplied		77	
		t = 8.3 ms			71	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied			1100	$kA^2\sqrt{s}$
Maximum peak on-state voltage	V_{TM}	I_{TM} = 600 A, $T_J = T_J$ maximum, t_p = 10 ms sine wave pulse			2.07	V
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			1.55	
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.58	
Low level value of forward slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.87	mΩ
High level value of forward slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.82	
Maximum holding current	I_H	T_J = 25 °C, I_T > 30 A			600	mA
Typical latching current	I_L	T_J = 25 °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} = Rated V_{DRM} I_{TM} = 2 x dI/dt	1000	A/µs
Typical delay time		t_d	T_J = 25 °C, V_{DM} = Rated V_{DRM}, I_{TM} = 50 A DC, t_p = 1 µs Resistive load, gate pulse: 10 V, 5 Ω source	1.1	µs
Maximum turn-off time	minimum	t_q	$T_J = T_J$ maximum, I_{TM} = 300 A, commutating dI/dt = 20 A/µs V_R = 50 V, t_p = 500 µs, dV/dt: See table in device code	15	
	maximum			25	

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/µs
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	$T_J = T_J$ maximum, rated V_{DRM}/V_{RRM} applied	40	mA

TRIGGERING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, f = 50 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, $t_p \leq 5$ ms	10	A
Maximum peak positive gate voltage	+ V_{GM}		20	V
Maximum peak negative gate voltage	- V_{GM}		5	
Maximum DC gate currrent required to trigger	I_{GT}	T_J = 25 °C, V_A = 12 V, R_a = 6 Ω	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 junction operating 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	0.105	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	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

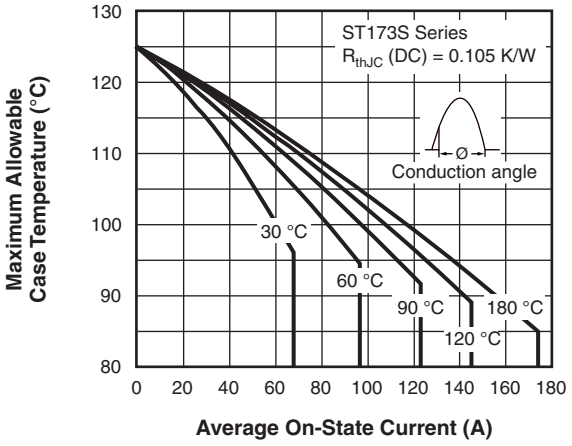


Fig. 1 - Current Ratings Characteristics

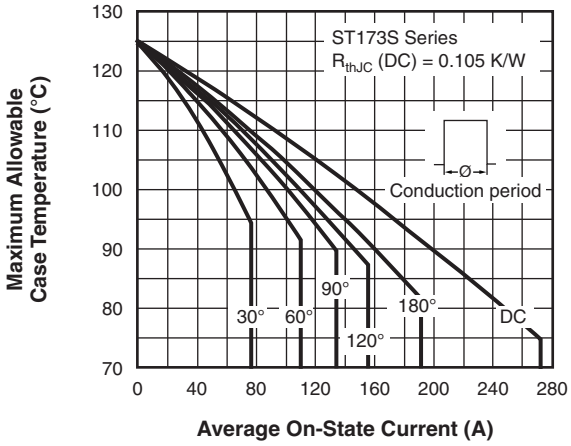
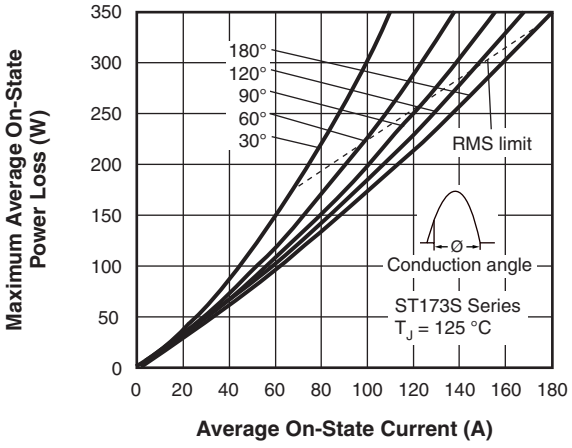


Fig. 2 - Current Ratings Characteristics



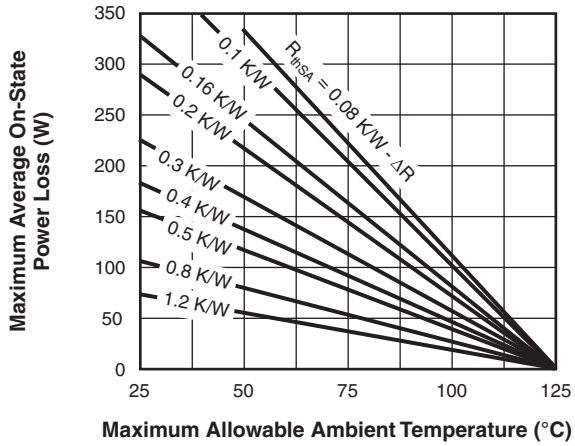
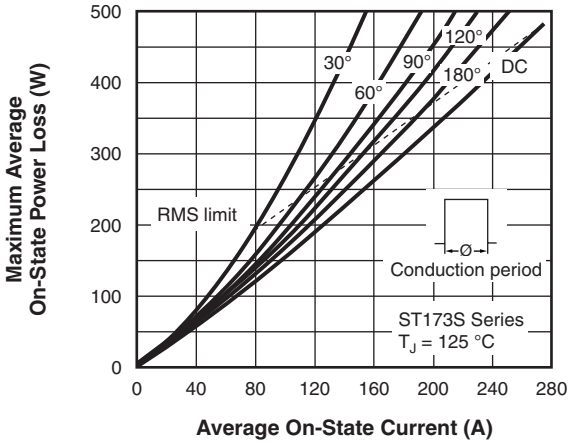


Fig. 3 - On-State Power Loss Characteristics



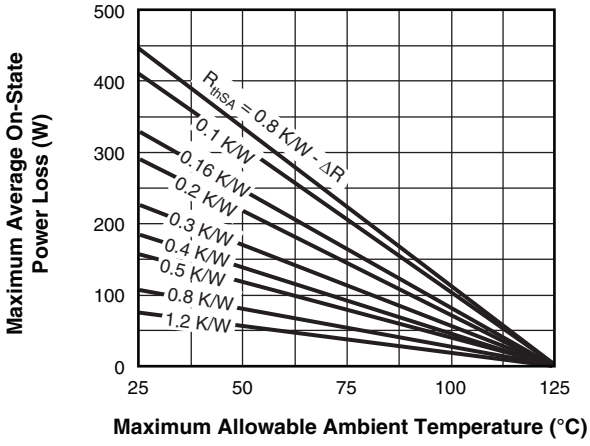


Fig. 4 - On-State Power Loss Characteristics

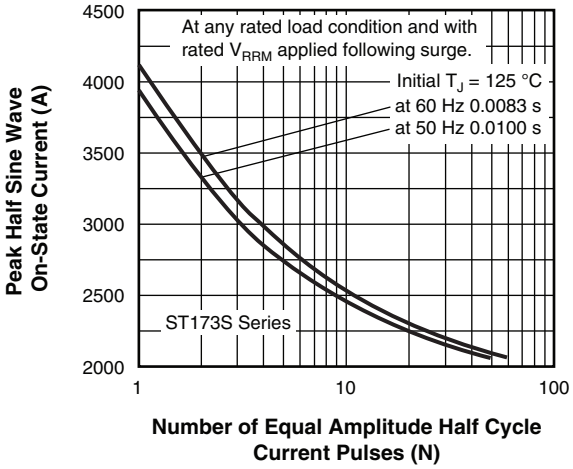


Fig. 5 - Maximum Non-Repetitive Surge Current

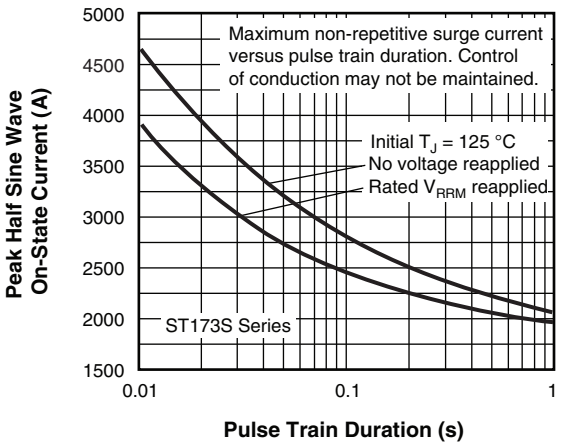


Fig. 6 - Maximum Non-Repetitive Surge Current

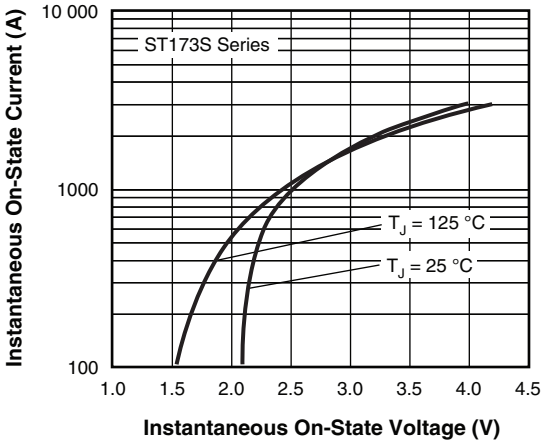


Fig. 7 - On-State Voltage Drop Characteristics

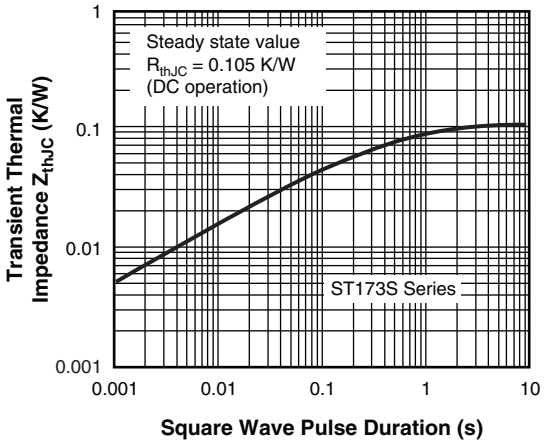


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

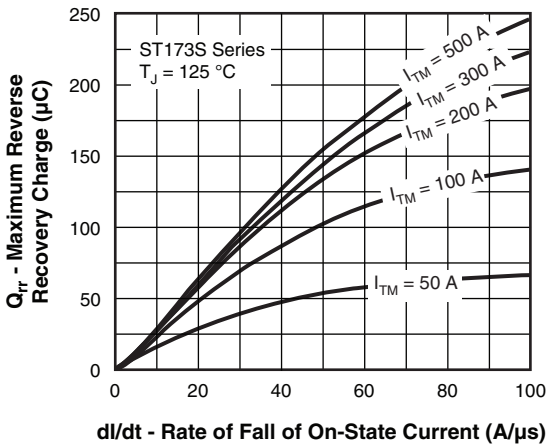


Fig. 9 - Reverse Recovered Current Characteristics

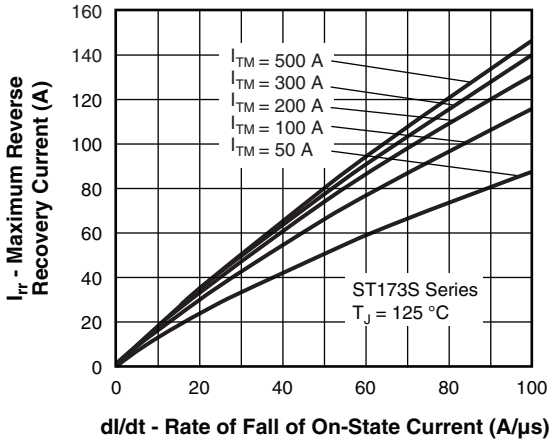


Fig. 10 - Reverse Recovery Current Characteristics

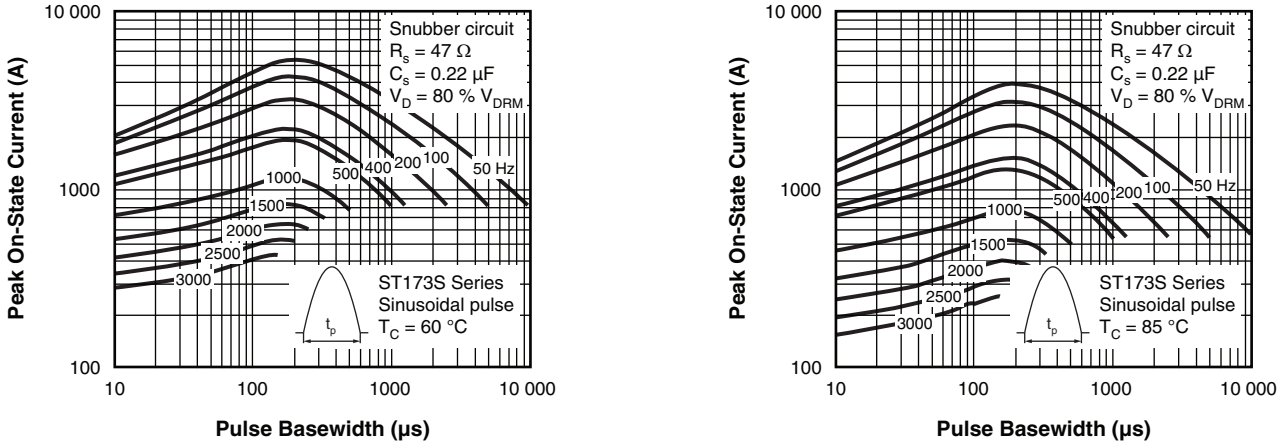


Fig. 11 - Frequency Characteristics

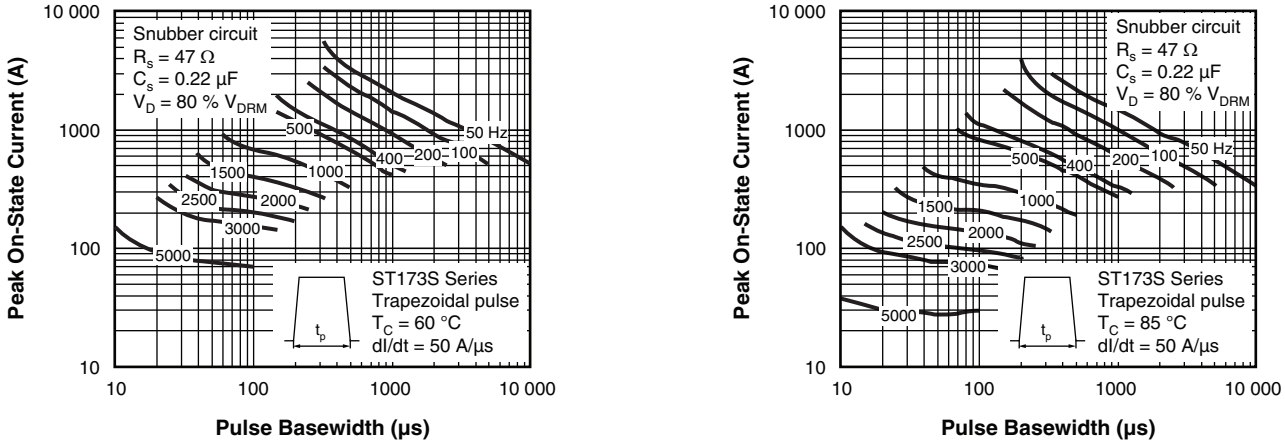


Fig. 12 - Frequency Characteristics

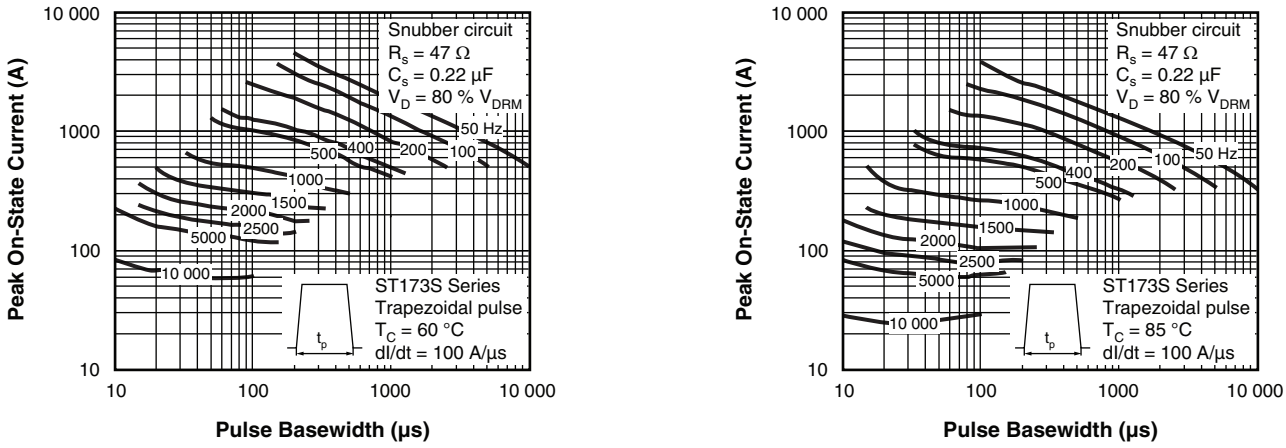


Fig. 13 - Frequency Characteristics

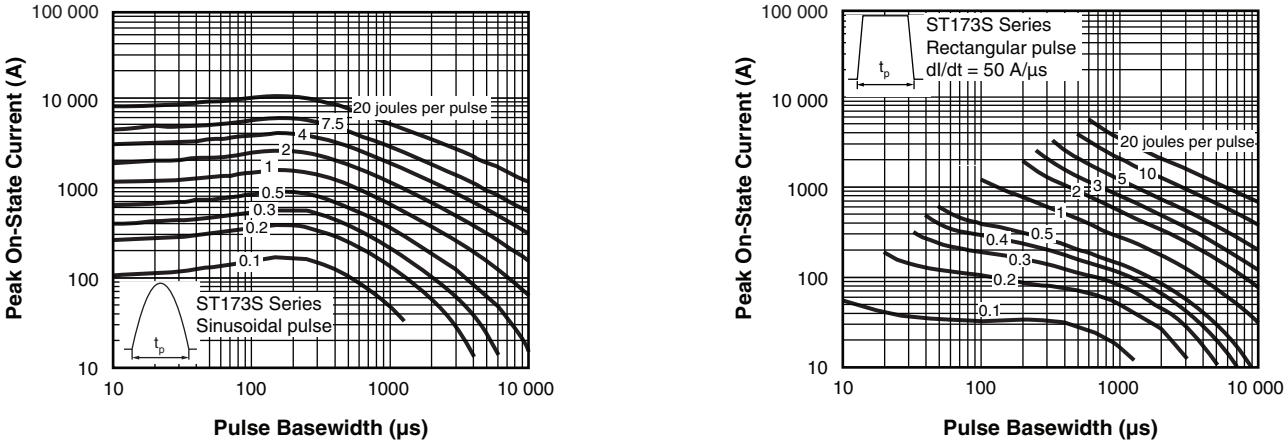


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

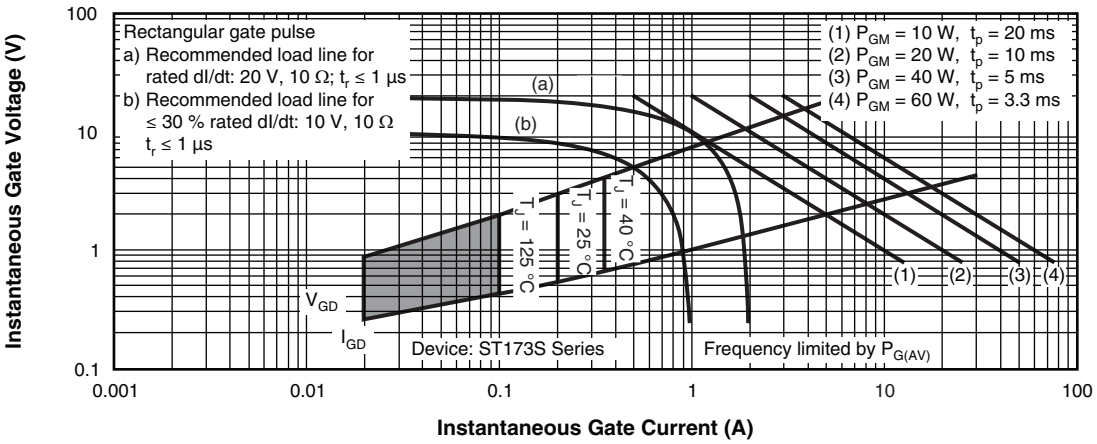


Fig. 15 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	ST	17	3	S	12	P	F	K	0	-
1	2	3	4	5	6	7	8	9	10	11

1 - Vishay Semiconductors product

2 - Thyristor

3 - Essential part number

4 - 3 = Fast turn-off

5 - S = Compression bonding stud

6 - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)

7 - P = Stud base 3/4" 16UNF-2A

M = Stud base metric threads M16 x 1.5

8 - Reapplied dV/dt code (for t_q test condition)

9 - t_q code

10 - 0 = Eyelet terminals
(gate and aux. cathode leads)

1 = Fast-on terminals
(gate and aux. cathode leads)

2 = Flag terminals (for cathode and gate terminals)

11 - Critical dV/dt:
- None = 500 V/µs (standard value)
- L = 1000 V/µs (special selection)

dV/dt - t_q combinations available

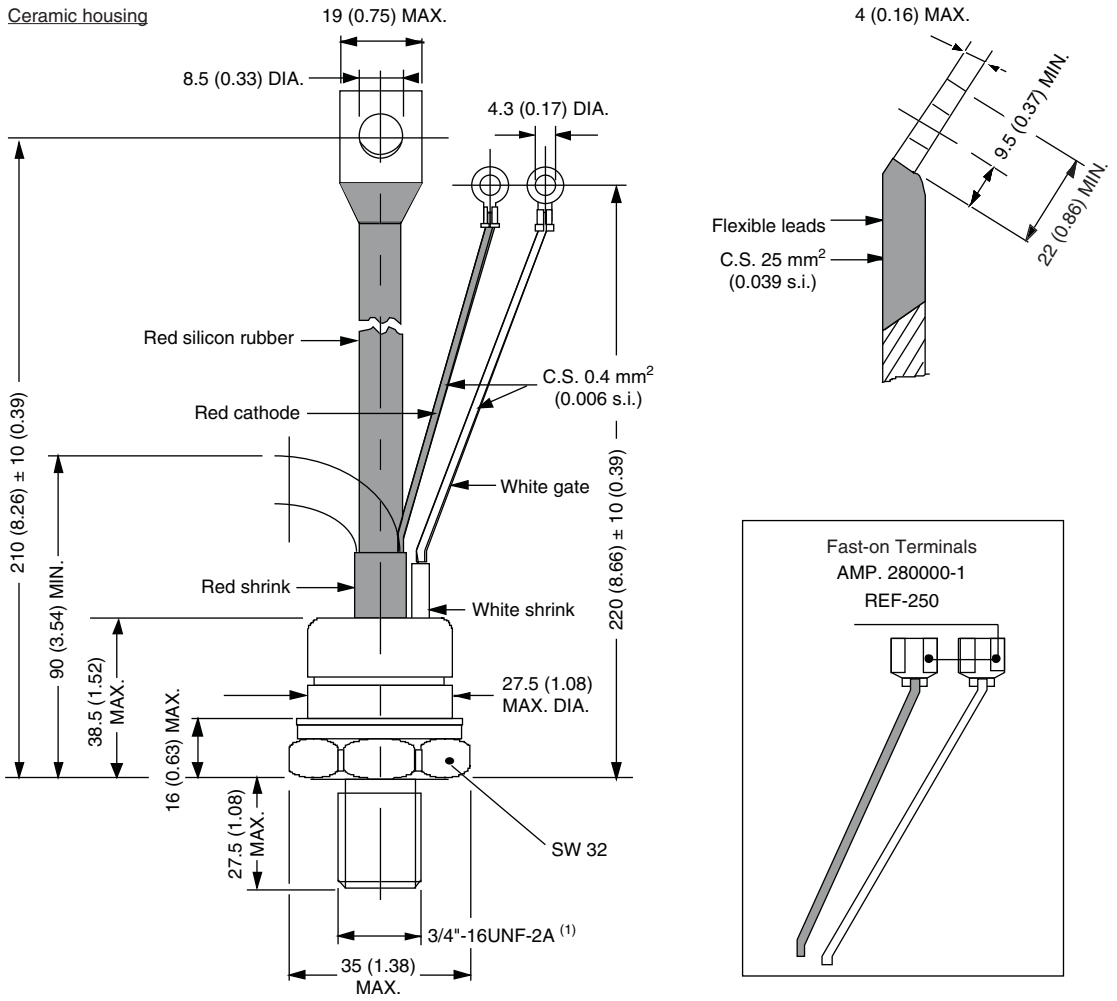
	dV/dt (V/µs)	20	50	100	**200**	400
t_q (µs)	15	CL	-	-	-	-
	18	CP	DP	EP	**FP***	-
	20	CK	DK	EK	**FK***	HK
	25	CJ	DJ	EJ	FJ	HJ
	30	-	DH	EH	FH	HH

* Standard part number.
All other types available only on request.

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95079

TO-209AB (TO-93)

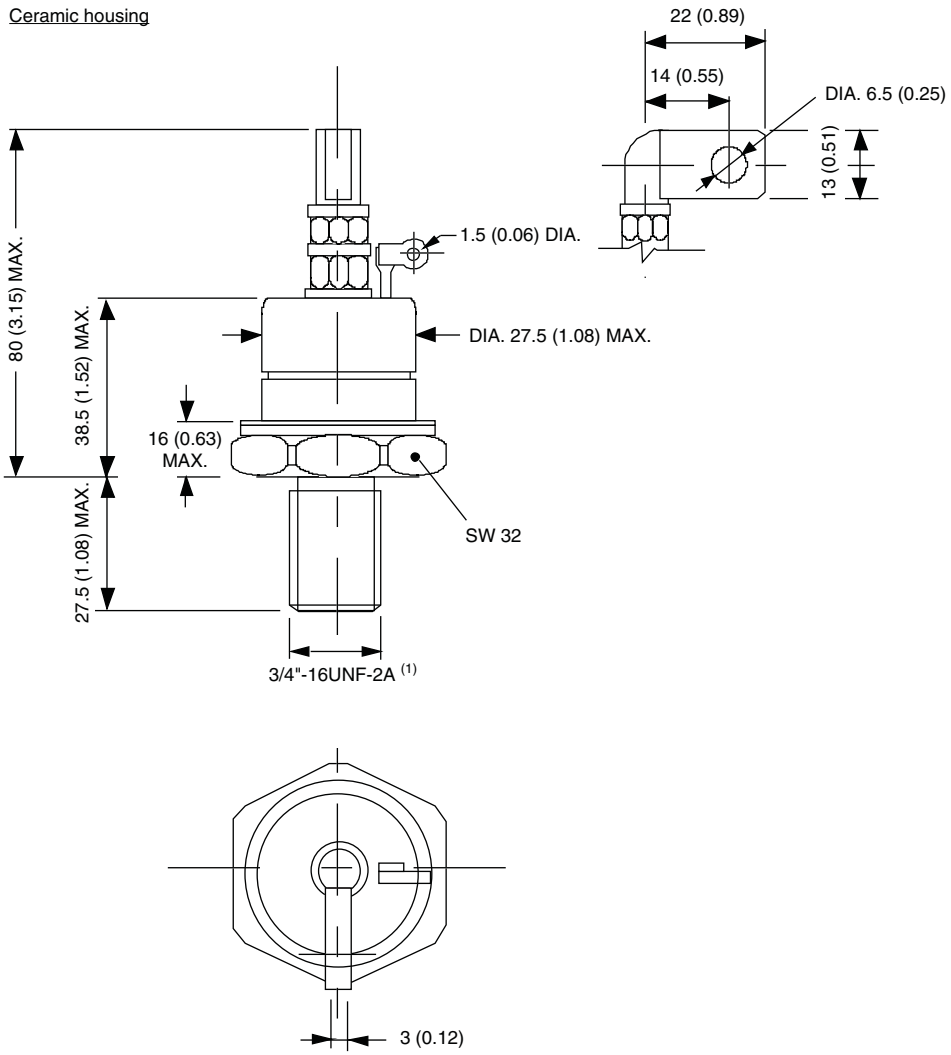
DIMENSIONS - TO-209AB (TO-93) in millimeters (inches)



Note

(1) For metric device: M16 x 1.5 - length 21 (0.83) maximum

DIMENSIONS - TO-209AB (TO-93) FLAG TERMINALS in millimeters (inches)



Note

(2) For metric device: M16 x 1.5 - length 21 (0.83) maximum

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