

Inverter Grade Thyristors (Stud Version), 175 A



TO-93 (TO-209AB)

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


RoHS
COMPLIANT

PRIMARY CHARACTERISTICS

$I_{T(AV)}$	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
T_C	85 °C
Package	TO-93 (TO-209AB)
Circuit configuration	Single SCR

TYPICAL APPLICATIONS

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

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 ² s
	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
400 Hz	450	290	810	540
1000 Hz	330	190	760	490
2500 Hz	170	80	510	300
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
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
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 75 °C case temperature	85	°C
Maximum peak, one half cycle, non-repetitive surge current	I_{TSM}	$t = 10$ ms $t = 8.3$ ms $t = 10$ ms $t = 8.3$ ms No voltage reapplied 100 % V_{RRM} reapplied Sinusoidal half wave, initial $T_J = T_J$ maximum	4680 4900 3940 4120	A
Maximum I^2t for fusing	I^2t	$t = 10$ ms $t = 8.3$ ms $t = 10$ ms $t = 8.3$ ms No voltage reapplied 100 % V_{RRM} reapplied	110 100 77 71	kA ² s
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied	1100	kA ² √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	$V_{T(TO)1}$	$(16.7 \% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum	1.55	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum	1.58	
Low level value of forward slope resistance	r_{t1}	$(16.7 \% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum	0.87	mΩ
High level value of forward slope resistance	r_{t2}	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ 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, $V_{DRM} = \text{Rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$	1000	A/μs
Typical delay time	t_d	$T_J = 25$ °C, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 50$ A DC, $t_p = 1$ μs Resistive load, gate pulse: 10 V, 5 Ω source	1.1	μs
Maximum turn-off time	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 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/ 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	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 current required to trigger	I_{GT}	$T_J = 25^\circ\text{C}$, $V_A = 12$ 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 junction operating 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	0.105	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth, flat and greased	0.04	
Mounting torque, $\pm 10\%$		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-93 (TO-209AB)	

 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

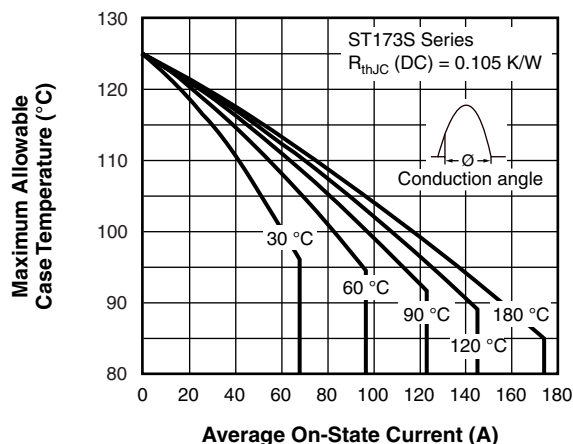


Fig. 1 - Current Ratings Characteristics

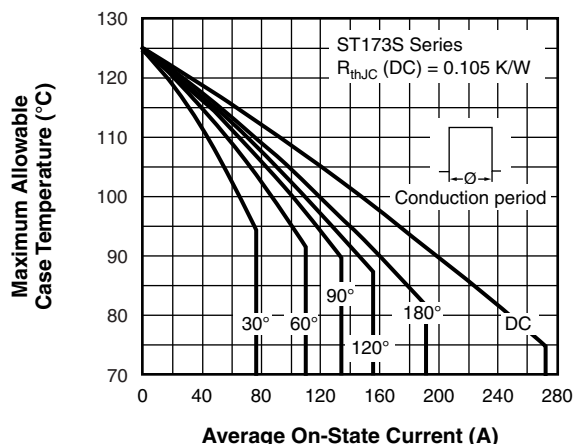


Fig. 2 - Current Ratings Characteristics

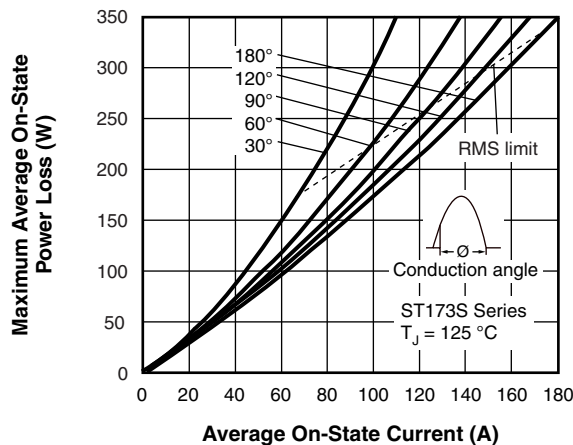


Fig. 3 - On-State Power Loss Characteristics

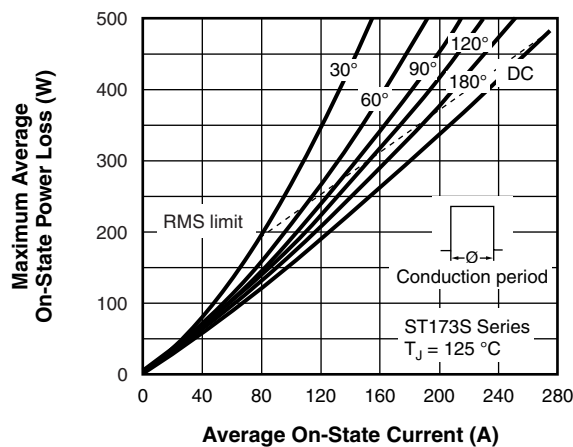
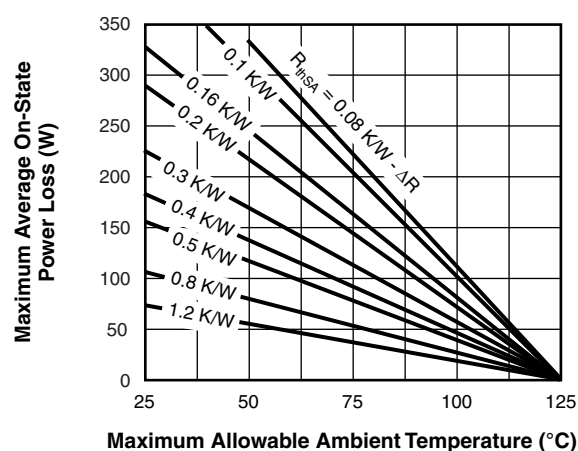
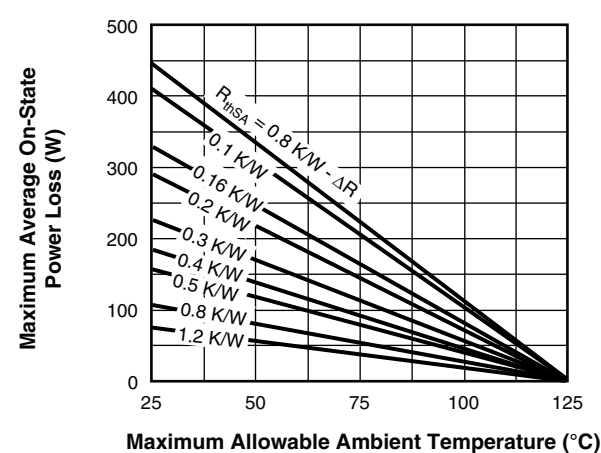


Fig. 4 - On-State Power Loss Characteristics



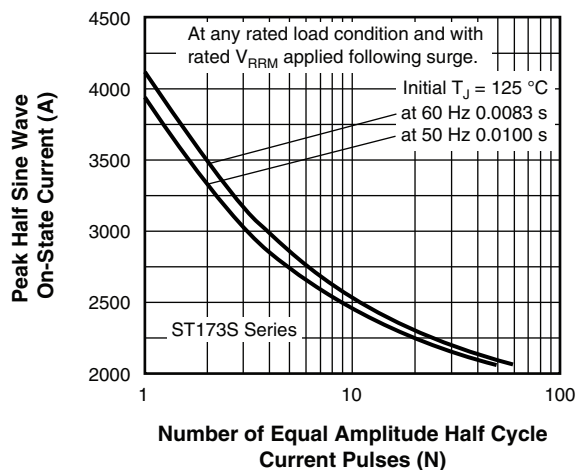


Fig. 5 - Maximum Non-Repetitive Surge Current

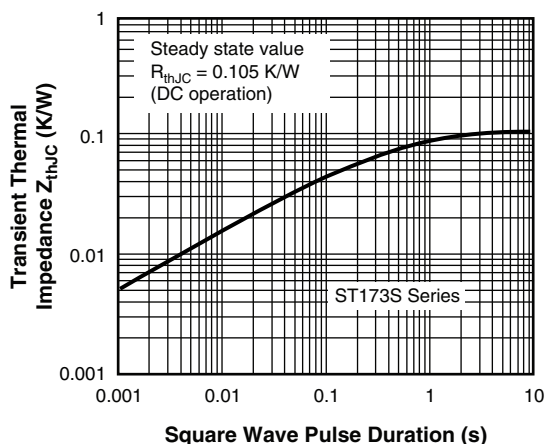


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

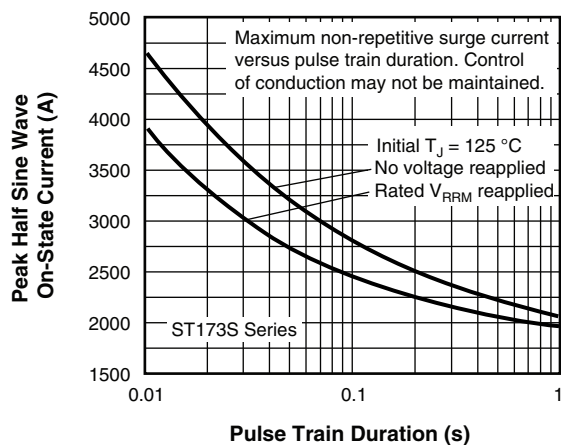


Fig. 6 - Maximum Non-Repetitive Surge Current

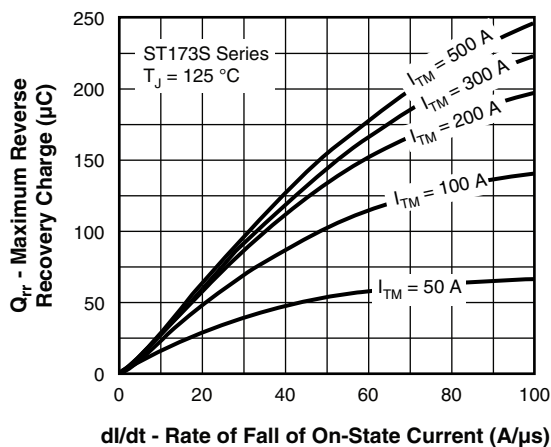


Fig. 9 - Reverse Recovered Current Characteristics

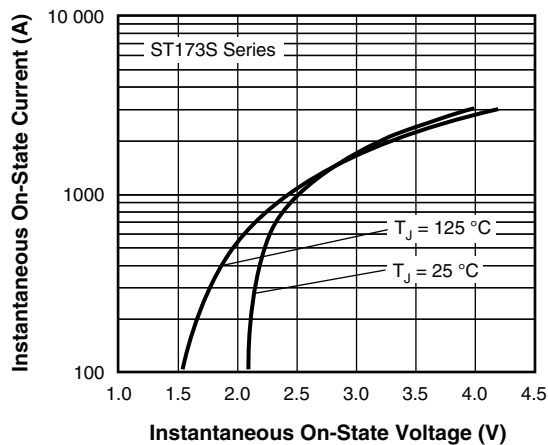


Fig. 7 - On-State Voltage Drop Characteristics

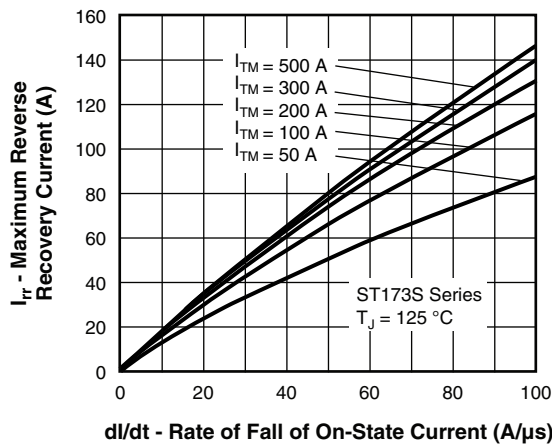


Fig. 10 - Reverse Recovery Current Characteristics

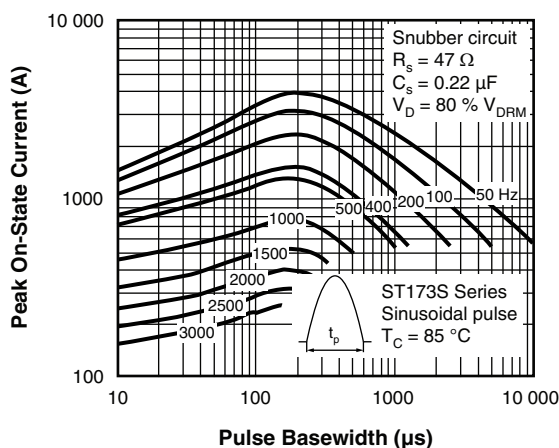
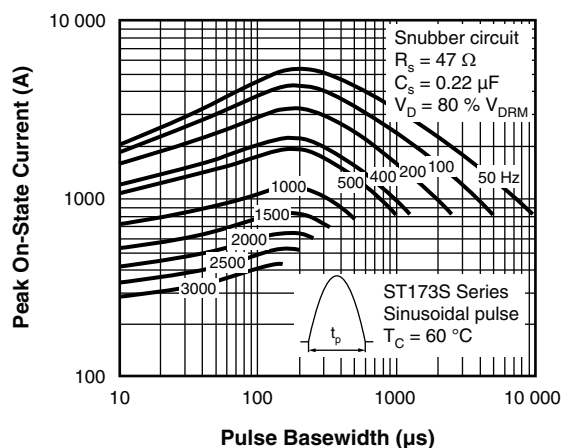


Fig. 11 - Frequency Characteristics

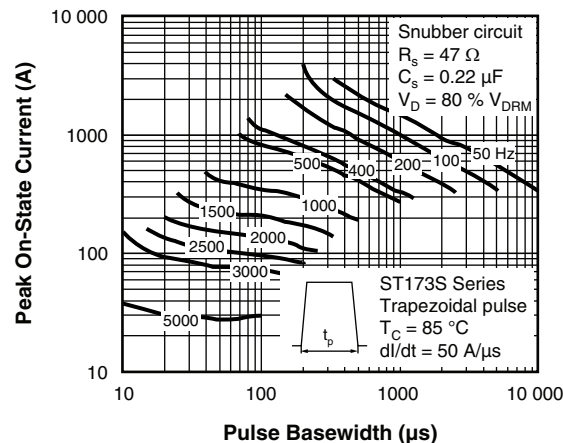
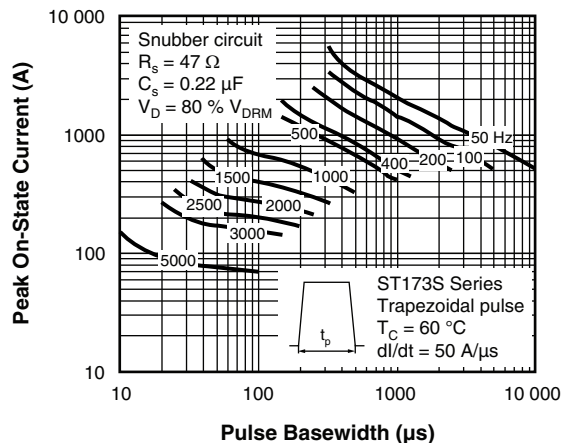


Fig. 12 - Frequency Characteristics

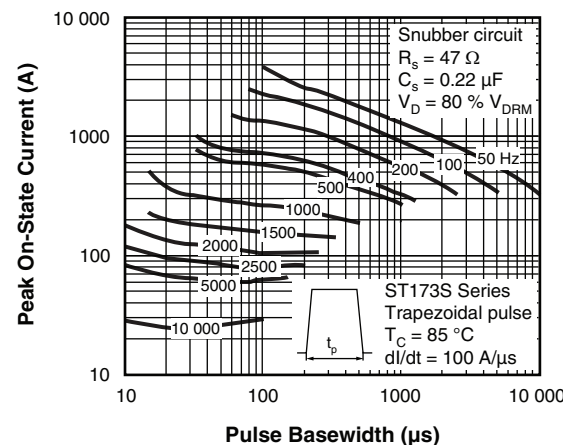
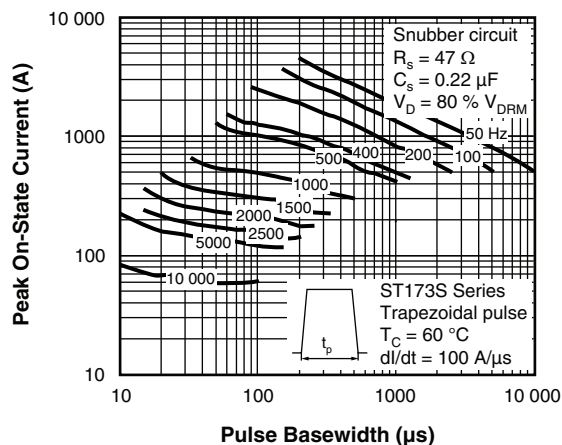


Fig. 13 - Frequency Characteristics

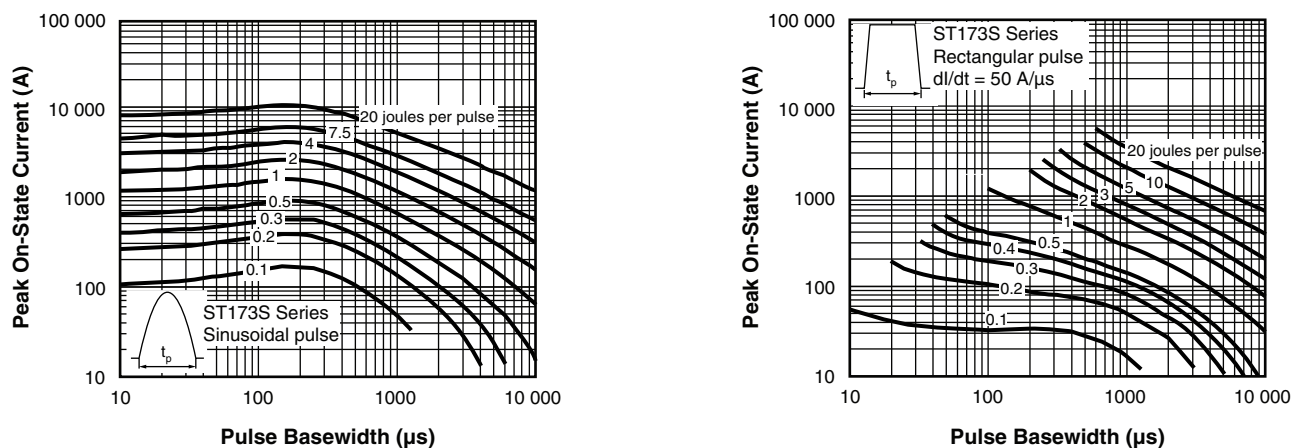


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

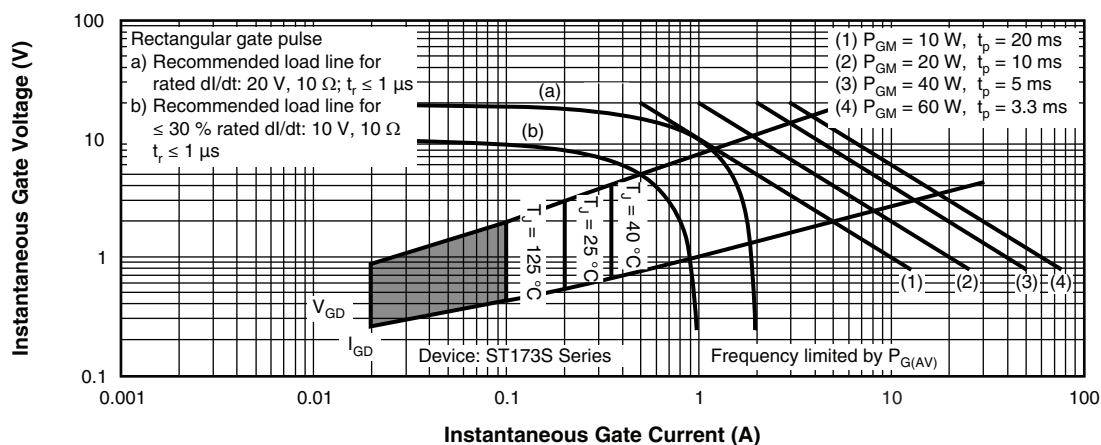


Fig. 15 - Gate Characteristics

**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/ μ s (standard value)
 - L = 1000 V/ μ s (special selection)

dV/dt - t_q combinations available					
dV/dt (V/ μ s)	20	50	100	200	400
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.

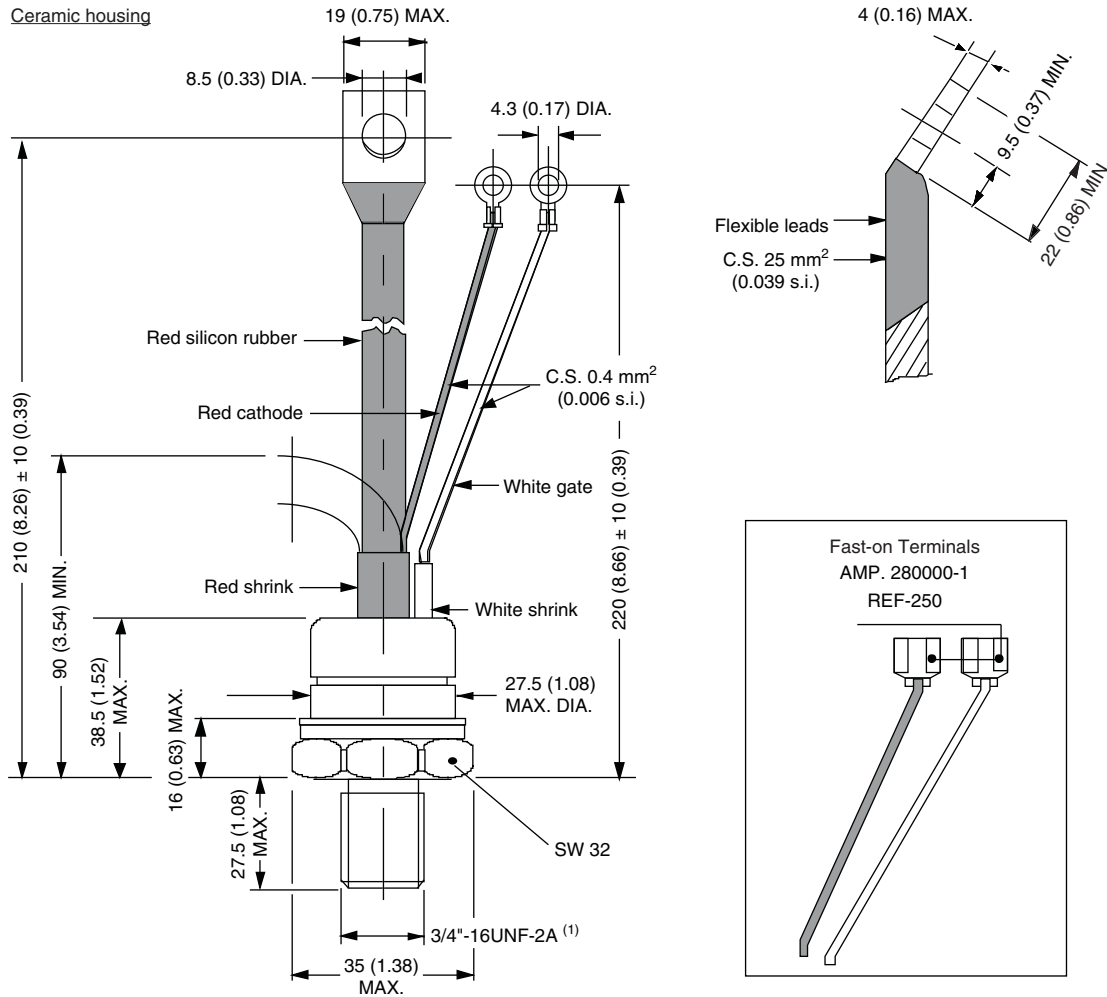
LINKS TO RELATED DOCUMENTS

Dimensions

www.vishay.com/doc?95079

TO-209AB (TO-93)

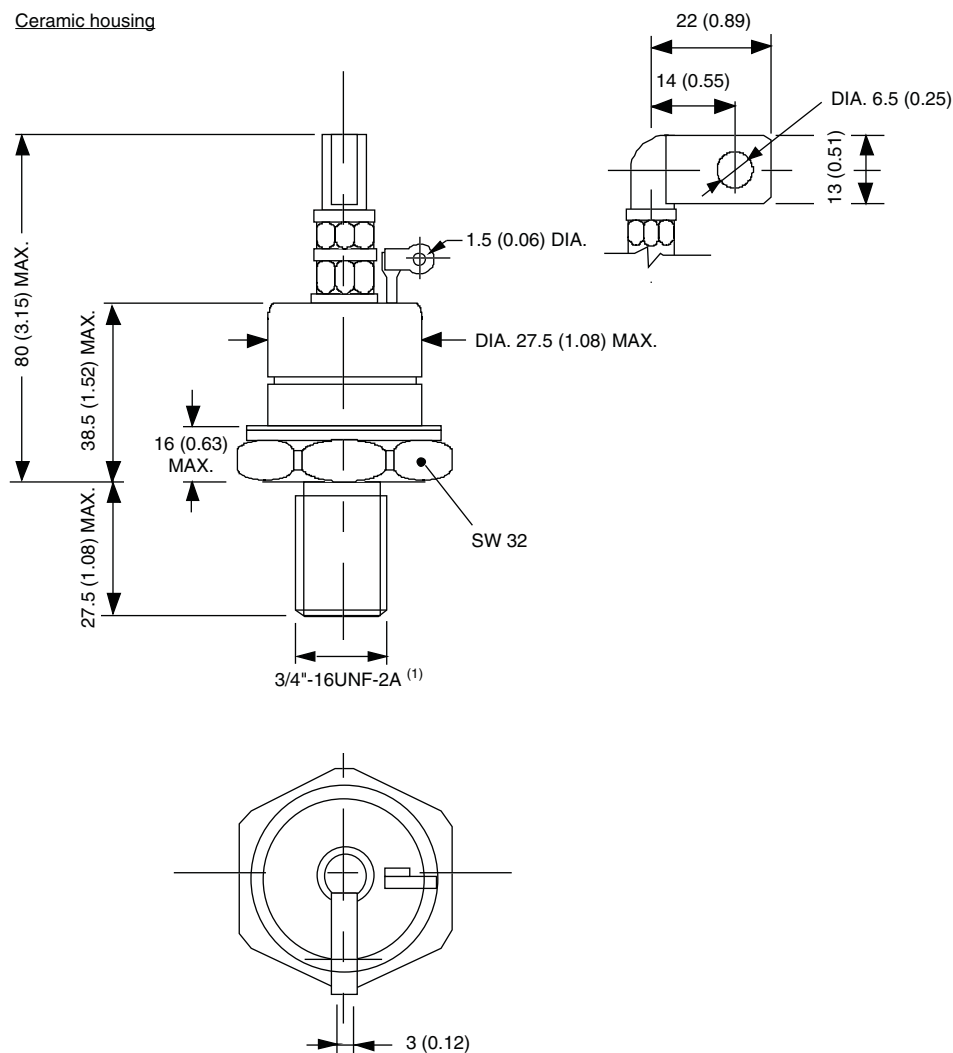
DIMENSIONS - TO-209AB (TO-93) in millimeters (inches)



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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