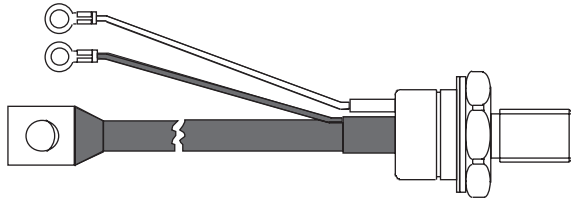


## Inverter Grade Thyristors (Stud Version), 105 A



TO-209AC (TO-94)

**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
- Lead (Pb)-free
- Designed and qualified for industrial level


**RoHS  
COMPLIANT**
**PRODUCT SUMMARY**

$I_{T(AV)}$	105 A
-------------	-------

**TYPICAL APPLICATIONS**

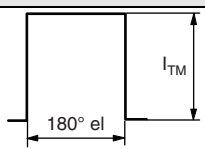
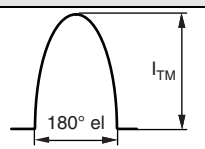
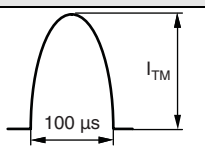
- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

**MAJOR RATINGS AND CHARACTERISTICS**

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		105	A
	$T_C$	85	°C
$I_{T(RMS)}$		165	A
$I_{TSM}$	50 Hz	3000	
	60 Hz	3150	
$I^2t$	50 Hz	45	kA <sup>2</sup> s
	60 Hz	41	
$V_{DRM}/V_{RRM}$		400 to 800	V
$t_q$	Range	10 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
ST103S	04	400	500	30
	08	800	900	

CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	280	180	440	330	4730	3630	A
400 Hz	310	200	470	300	2500	1850	
1000 Hz	320	200	480	310	1530	1090	
2500 Hz	340	210	490	320	840	580	
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	22/0.15		22/0.15		22/0.15		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			105	A
					85	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 76 °C case temperature			165	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	3000	
		t = 8.3 ms			3150	
		t = 10 ms	100 % $V_{RRM}$ reappplied		2530	
		t = 8.3 ms			2650	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reappplied		45	
		t = 8.3 ms			41	
		t = 10 ms	100 % $V_{RRM}$ reappplied		32	
		t = 8.3 ms			29	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reappplied			450	$kA^2\sqrt{s}$
Maximum peak on-state voltage	$V_{TM}$	$I_{TM} = 300$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse			1.73	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			1.32	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			1.35	
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			1.40	mΩ
High level value of forward slope resistance	$r_{f2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum			1.30	
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	



<b>SWITCHING</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned on current	di/dt	T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 2 x di/dt	1000	A/μs
Typical delay time	t <sub>d</sub>	T <sub>J</sub> = 25 °C, V <sub>DM</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 50 A DC, t <sub>p</sub> = 1 μs Resistive load, gate pulse: 10 V, 5 Ω source	0.80	μs
Maximum turn-off time	minimum	T <sub>J</sub> = T <sub>J</sub> maximum, I <sub>TM</sub> = 100 A, commutating di/dt = 10 A/μs V <sub>R</sub> = 50 V, t <sub>p</sub> = 200 μs, dV/dt: See table in device code	10	
	maximum		25	

<b>BLOCKING</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	dV/dt	T <sub>J</sub> = T <sub>J</sub> maximum, linear to 80 % V <sub>DRM</sub> , higher value available on request	500	V/μs
Maximum peak reverse and off-state leakage current	I <sub>RRM</sub> , I <sub>DRM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> /V <sub>RRM</sub> applied	30	mA

<b>TRIGGERING</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50	40	W
Maximum average gate power	P <sub>G(AV)</sub>		5	
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms	5	A
Maximum peak positive gate voltage	+ V <sub>GM</sub>		20	V
Maximum peak negative gate voltage	- V <sub>GM</sub>		5	
Maximum DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = 25 °C, V <sub>A</sub> = 12 V, R <sub>a</sub> = 6 Ω	200	mA
Maximum DC gate voltage required to trigger	V <sub>GT</sub>		3	V
Maximum DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> applied	20	mA
Maximum DC gate voltage not to trigger	V <sub>GD</sub>		0.25	V

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction operating temperature range	T <sub>J</sub>		- 40 to 125	°C
Maximum storage temperature range	T <sub>Stg</sub>		- 40 to 150	
Maximum thermal resistance, junction to case	R <sub>thJC</sub>	DC operation	0.195	K/W
Maximum thermal resistance, case to heatsink	R <sub>thCS</sub>	Mounting surface, smooth, flat and greased	0.08	
Mounting torque, ± 10 %		Non-lubricated threads	15.5 (137)	N · m (lbf · in)
		Lubricated threads	14 (120)	
Approximate weight			130	g
Case style		See dimensions - link at the end of datasheet	TO-209AC (TO-94)	

$\Delta R_{thJC}$ CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.034	0.025	T <sub>J</sub> = T <sub>J</sub> maximum	K/W
120°	0.040	0.042		
90°	0.052	0.056		
60°	0.076	0.079		
30°	0.126	0.127		

**Note**

- The table above shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC

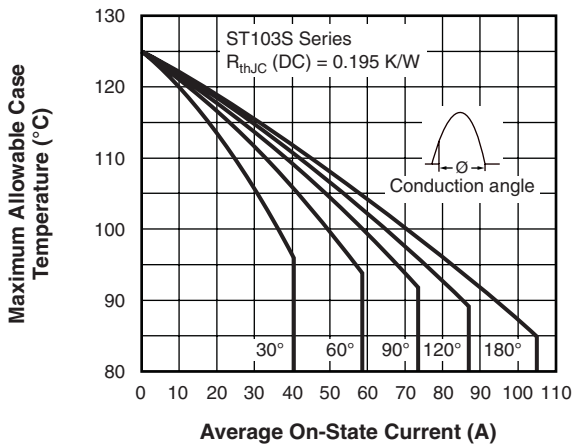


Fig. 1 - Current Ratings Characteristics

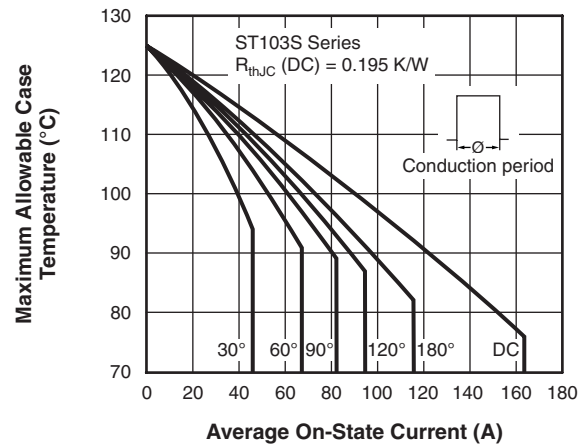


Fig. 2 - Current Ratings Characteristics

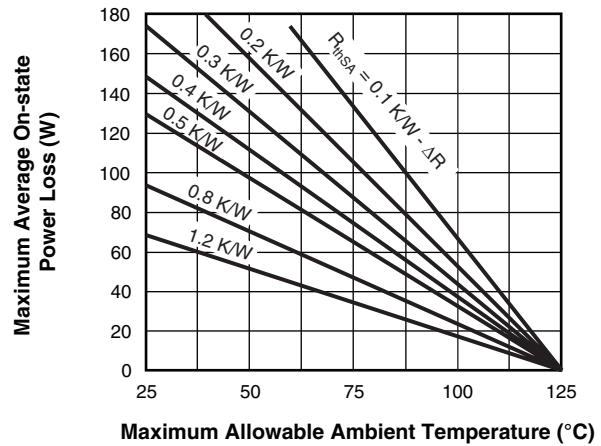
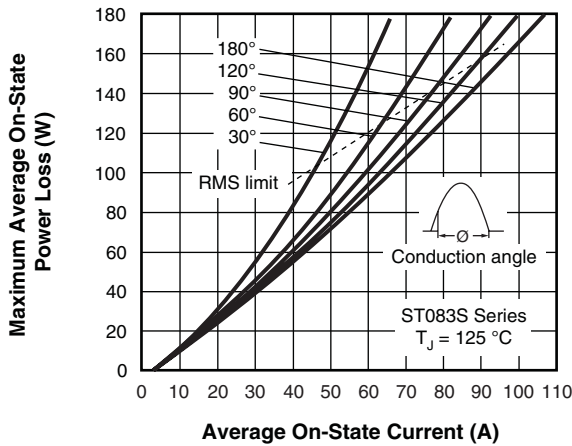


Fig. 3 - On-State Power Loss Characteristics

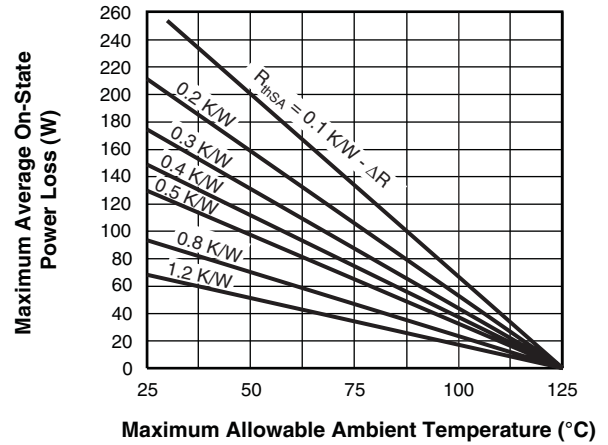
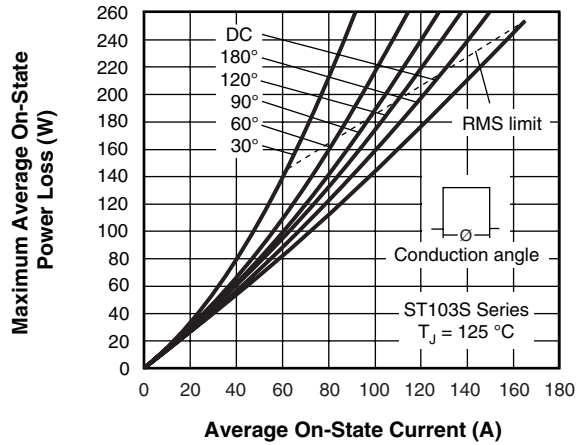


Fig. 4 - On-State Power Loss Characteristics

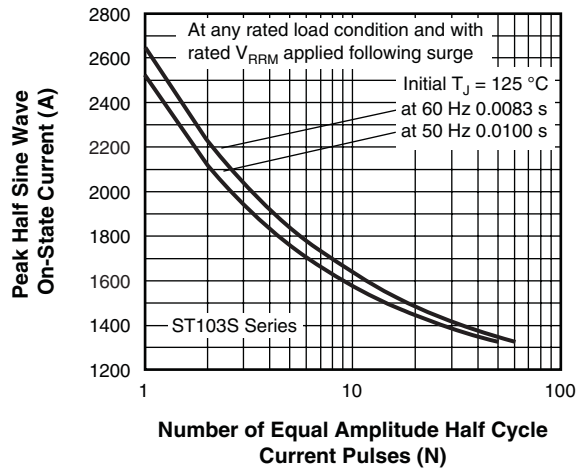


Fig. 5 - Maximum Non-Repetitive Surge Current

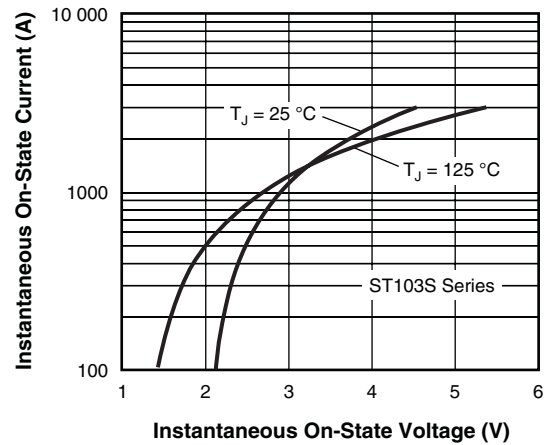


Fig. 7 - On-State Voltage Drop Characteristics

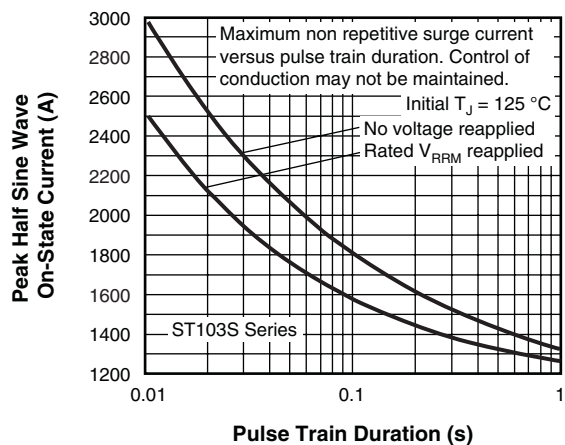


Fig. 6 - Maximum Non-Repetitive Surge Current

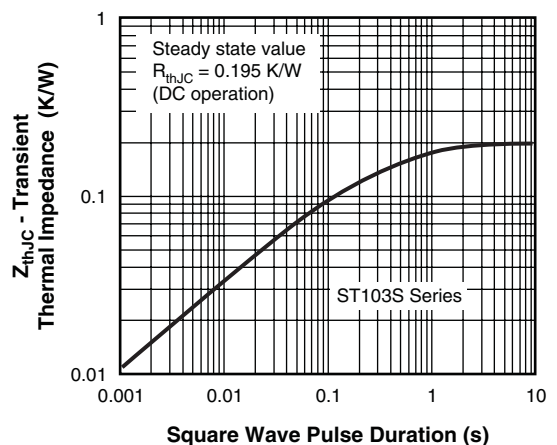


Fig. 8 - Thermal Impedance  $Z_{\theta JC}$  Characteristic

# ST103SP Series



Vishay High Power Products Inverter Grade Thyristors  
(Stud Version), 105 A

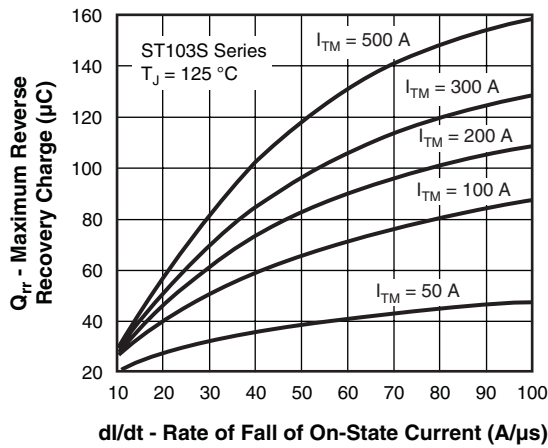


Fig. 9 - Reverse Recovered Charge Characteristics

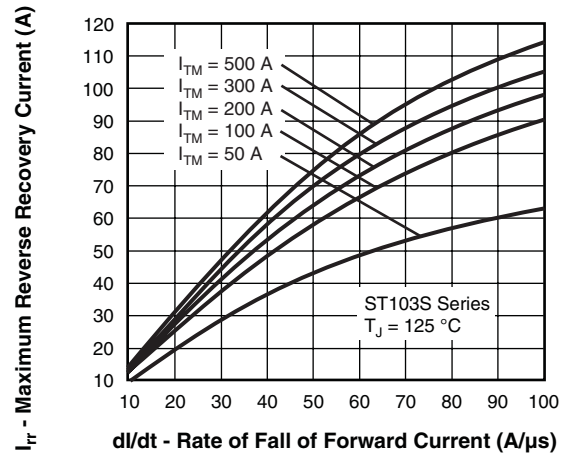


Fig. 10 - Reverse Recovery Current Characteristics

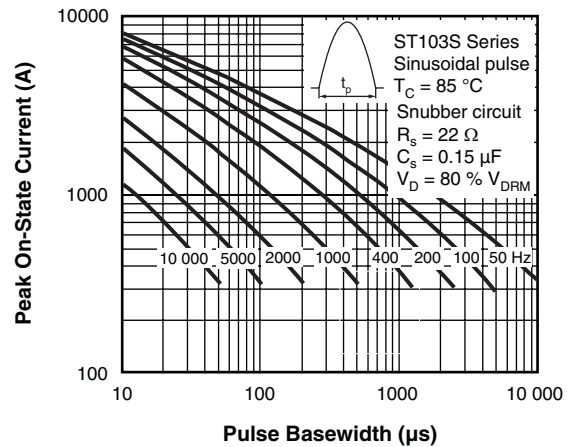
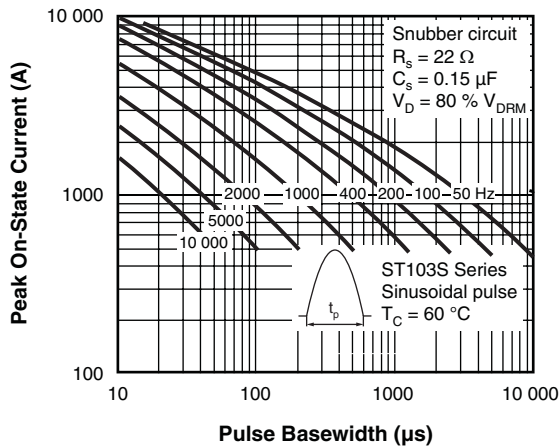


Fig. 11 - Frequency Characteristics

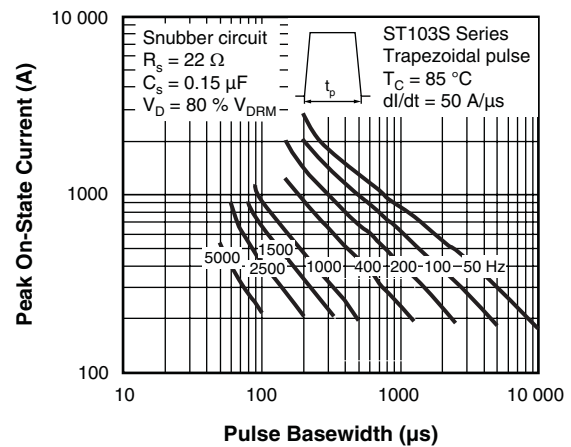
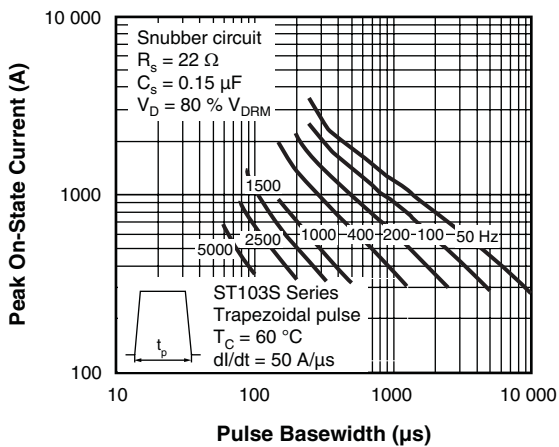


Fig. 12 - Frequency Characteristics

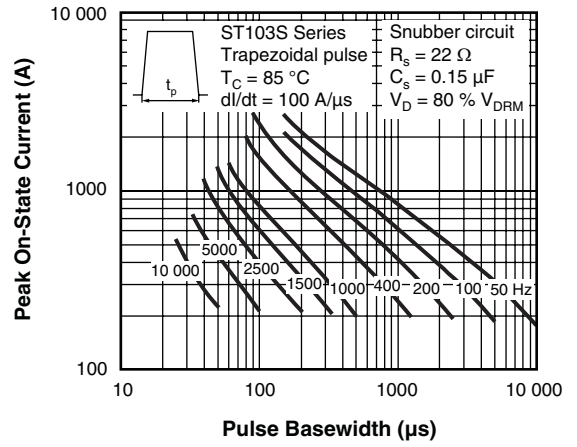
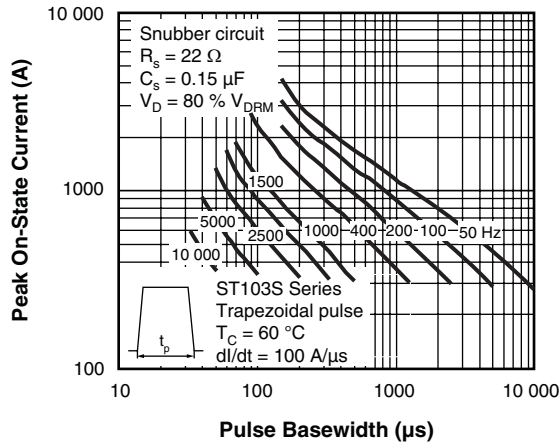


Fig. 13 - Frequency Characteristics

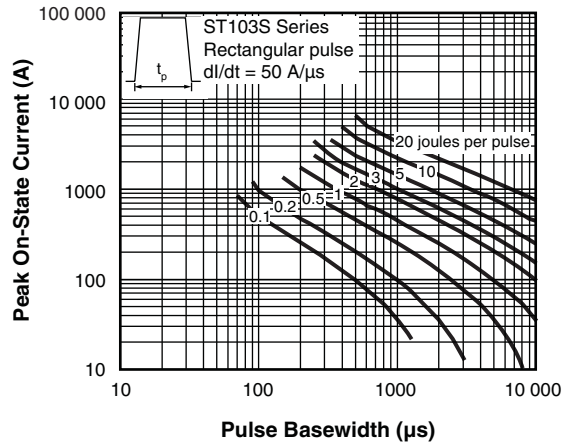
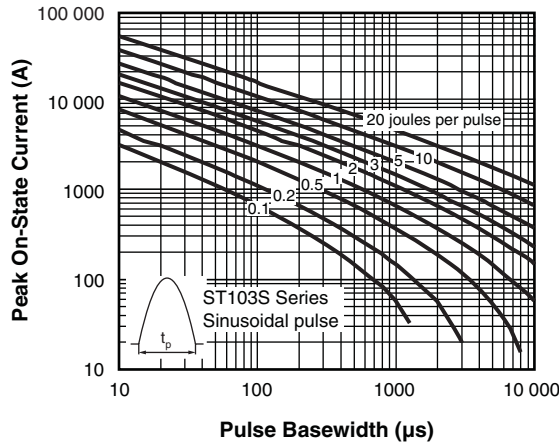


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

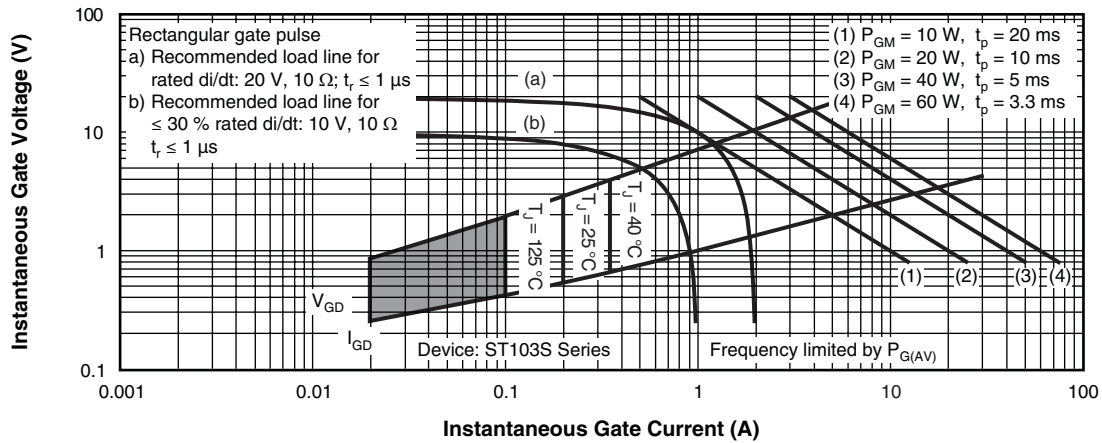


Fig. 15 - Gate Characteristics

# ST103SP Series



Vishay High Power Products Inverter Grade Thyristors  
(Stud Version), 105 A

## ORDERING INFORMATION TABLE

Device code	ST	10	3	S	08	P	F	N	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 1/2"-20UNF-2A
- 7** - Reapplied dV/dt code (for  $t_q$  test conditions)
- 8** -  $t_q$  code
- 9** - 0 = Eyelet terminals  
(gate and aux. cathode leads)  
1 = Fast-on terminals  
(gate and aux. cathode leads)
- 10** - Lead (Pb)-free

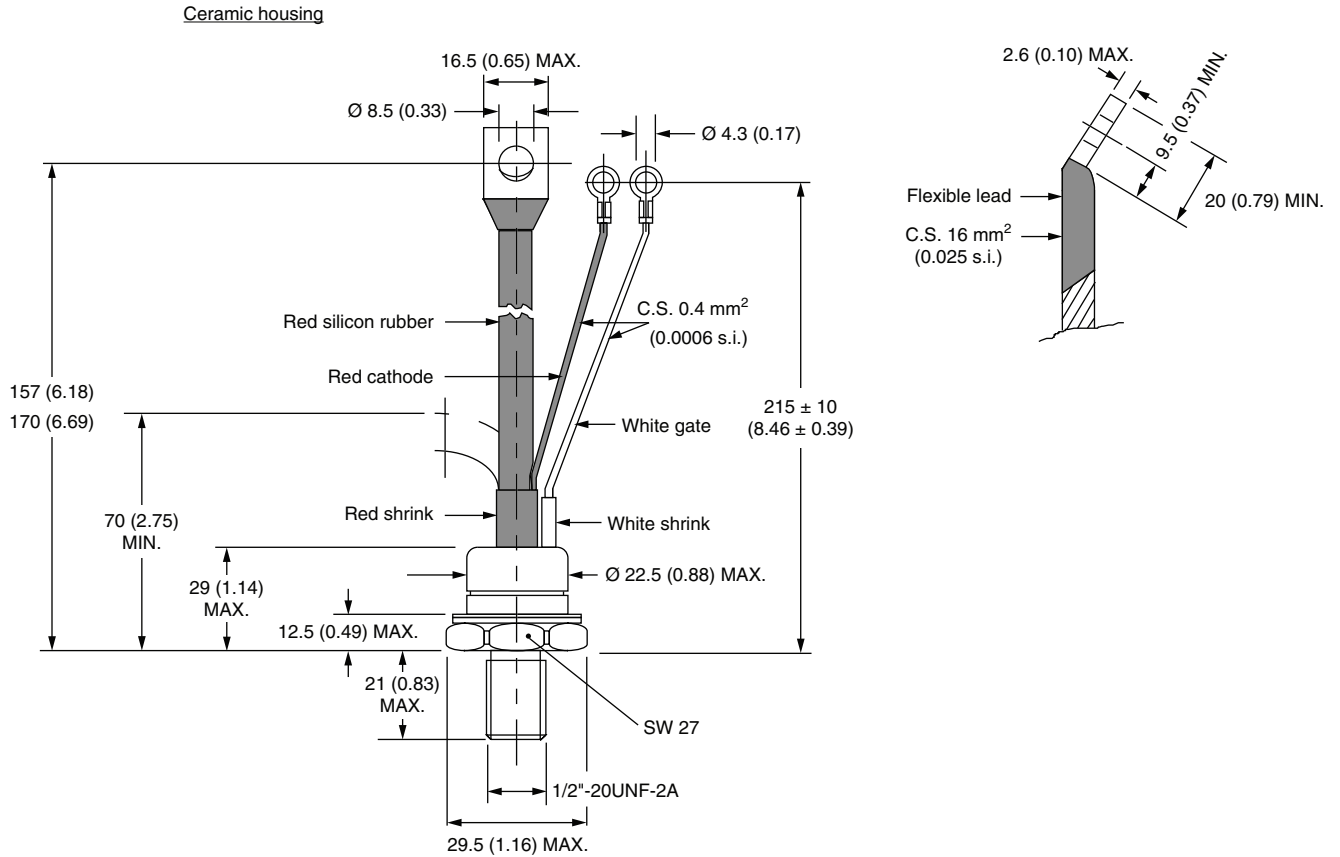
dV/dt - $t_q$ combinations available					
dV/dt (V/ $\mu$ s)	20	50	100	200	400
10	CN	DN	EN	<b>FN*</b>	-
12	CM	DM	EM	FM	HM
15	CL	DL	EL	<b>FL*</b>	HL
18	CP	DP	EP	FP	HP
20	CK	DK	EK	FK	HK
25	-	-	-	-	HJ

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

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95003">http://www.vishay.com/doc?95003</a>

## TO-209AC (TO-94) for ST083S and ST103S Series

**DIMENSIONS** in millimeters (inches)





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**