

Phase Control Thyristors (Stud Version), 280 A



TO-93 (TO-209AB)


RoHS
COMPLIANT

FEATURES

- Center amplifying gate
- International standard case TO-93 (TO-209AB)
- Hermetic metal case with glass-metal seal insulator
- 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

PRODUCT SUMMARY	
$I_{T(AV)}$	280 A
V_{DRM}/V_{RRM}	400 V, 600 V
V_{TM}	1.28 V
I_{GT}	150 mA
T_J	-40 °C to +125 °C
Package	TO-93 (TO-209AB)
Circuit configuration	Single SCR

TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		280	A
	T_C	85	°C
$I_{T(RMS)}$		440	A
I_{TSM}	50 Hz	7850	
	60 Hz	8220	
I^2t	50 Hz	308	KA ² s
	60 Hz	281	
V_{DRM}/V_{RRM}		400/600	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-ST280S	04	400	500	30
	06	600	700	

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			280	A			
					85	°C			
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 75 °C case temperature			440	A			
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	$t = 10 \text{ ms}$	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	7850				
		$t = 8.3 \text{ ms}$			8220				
		$t = 10 \text{ ms}$	100 % V_{RRM} reapplied		6600				
		$t = 8.3 \text{ ms}$			6900				
Maximum I^2t for fusing	I^2t	$t = 10 \text{ ms}$	No voltage reapplied		310	kA ² s			
		$t = 8.3 \text{ ms}$			220				
		$t = 10 \text{ ms}$	100 % V_{RRM} reapplied		218				
		$t = 8.3 \text{ ms}$			200				
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1 \text{ to } 10 \text{ ms}$, no voltage reapplied			3100	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			0.84	V			
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.88				
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			0.50	mΩ			
High level value of on-state slope resistance	r_{t2}	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.47				
Maximum on-state voltage	V_{TM}	$I_{pk} = 880 \text{ A}$, $T_J = T_J$ maximum, $t_p = 10 \text{ ms}$ sine pulse			1.28	V			
Maximum holding current	I_H	$T_J = 25 \text{ °C}$, anode supply 12 V resistive load			600	mA			
Maximum (typical) latching current	I_L				1000 (300)				

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, $t_r \leq 1 \mu\text{s}$ $T_J = T_J$ maximum, anode voltage $\leq 80 \% V_{DRM}$			1000	A/μs
Typical delay time	t_d	Gate current 1 A, $dl_g/dt = 1 \text{ A}/\mu\text{s}$ $V_d = 0.67 \% V_{DRM}$, $T_J = 25 \text{ °C}$			1.0	μs
Typical turn-off time	t_q	$I_{TM} = 300 \text{ A}$, $T_J = T_J$ maximum, $dl/dt = 20 \text{ A}/\mu\text{s}$, $V_R = 50 \text{ V}$, $dV/dt = 20 \text{ V}/\mu\text{s}$, gate 0 V 100 Ω, $t_p = 500 \mu\text{s}$			100	

BLOCKING						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNIT S
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 TYP. MAX.	UNIT S
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}	$T_J = -40$ °C	Maximum required gate trigger/current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied		180	mA
		$T_J = 25$ °C			90	150
		$T_J = 125$ °C			40	-
DC gate voltage required to trigger	V_{GT}	$T_J = -40$ °C			2.9	V
		$T_J = 25$ °C			1.8	3.0
		$T_J = 125$ °C			1.2	-
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum		Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V_{DRM} anode to cathode applied	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		0.105	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-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

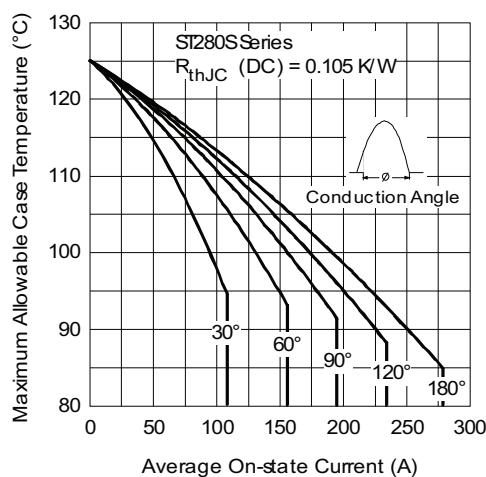


Fig. 1 - Current Ratings Characteristics

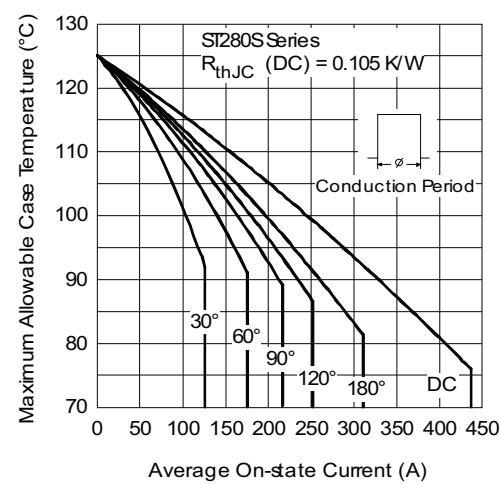


Fig. 2 - Current Ratings Characteristics

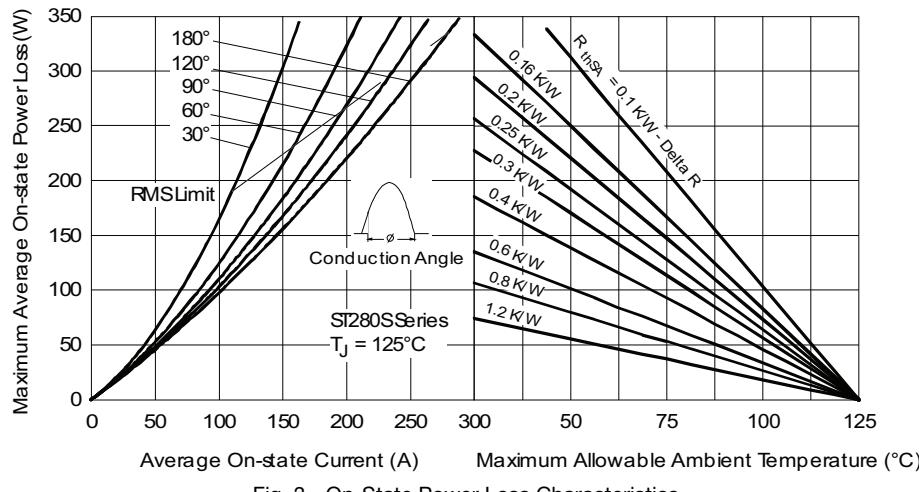


Fig. 3 - On-State Power Loss Characteristics

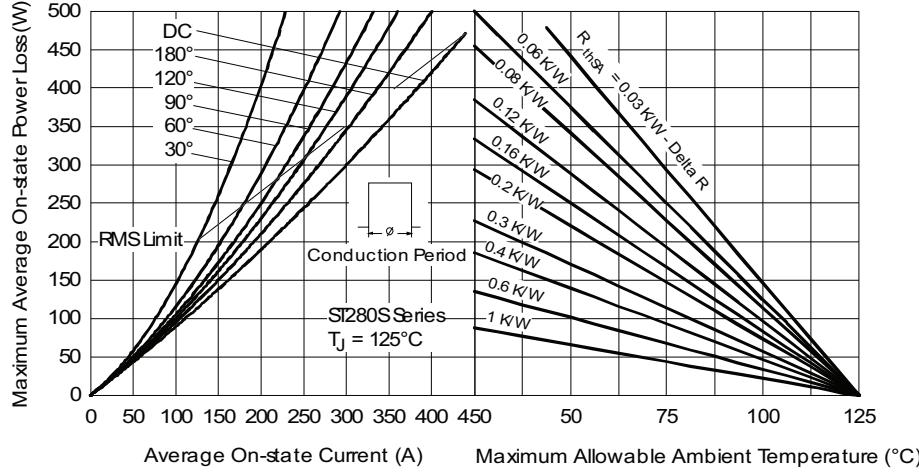


Fig. 4 - On-State Power Loss Characteristics

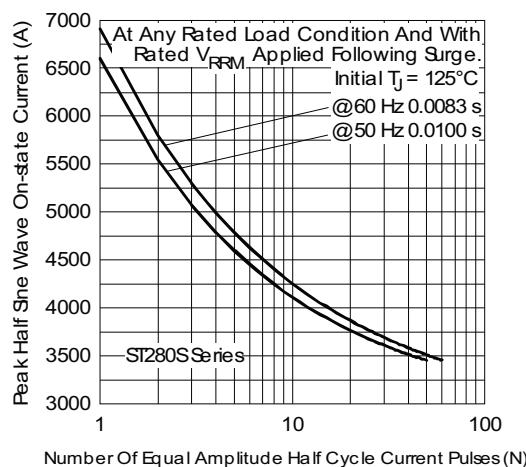


Fig. 5 - Maximum Non-Repetitive Surge Current

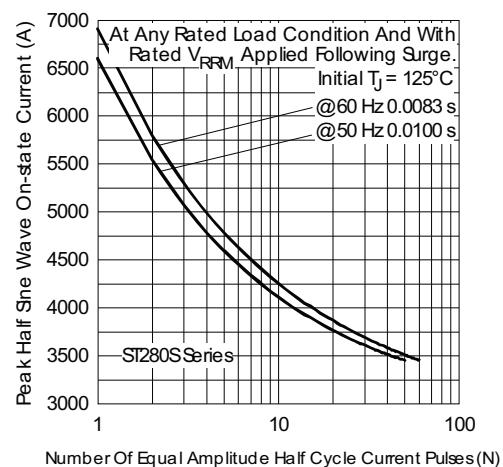


Fig. 6 - Maximum Non-Repetitive Surge Current

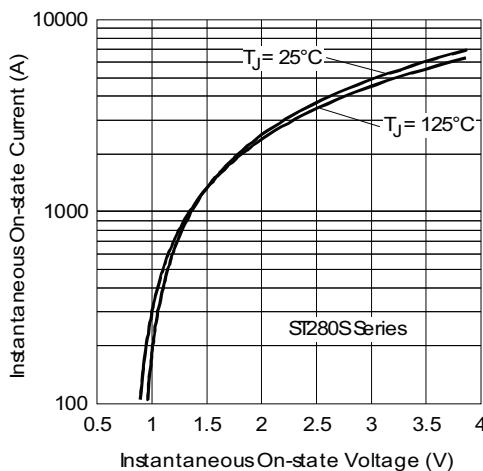


Fig. 7 - On-State Voltage Drop Characteristics

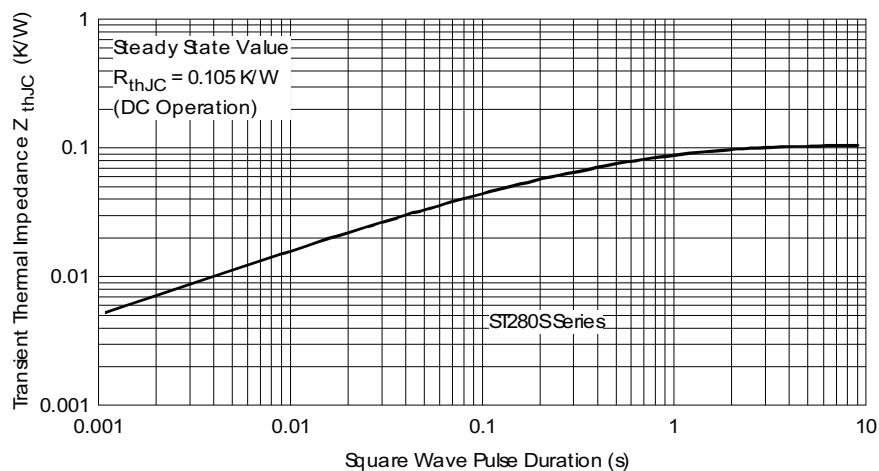


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

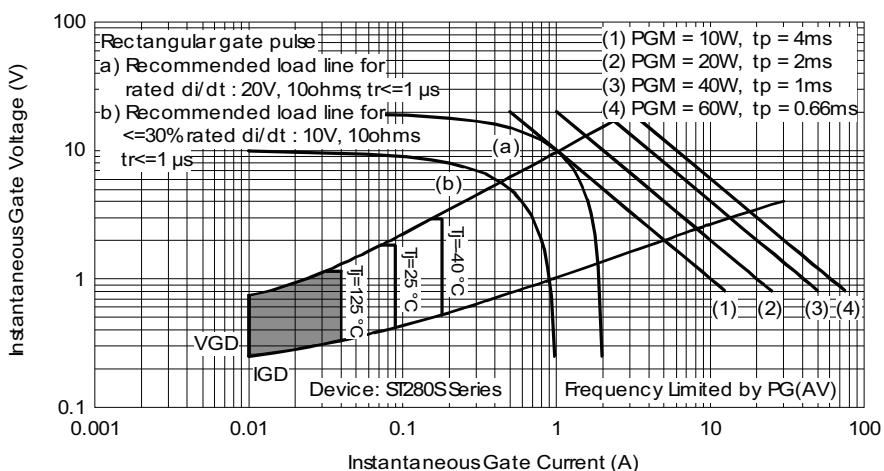


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

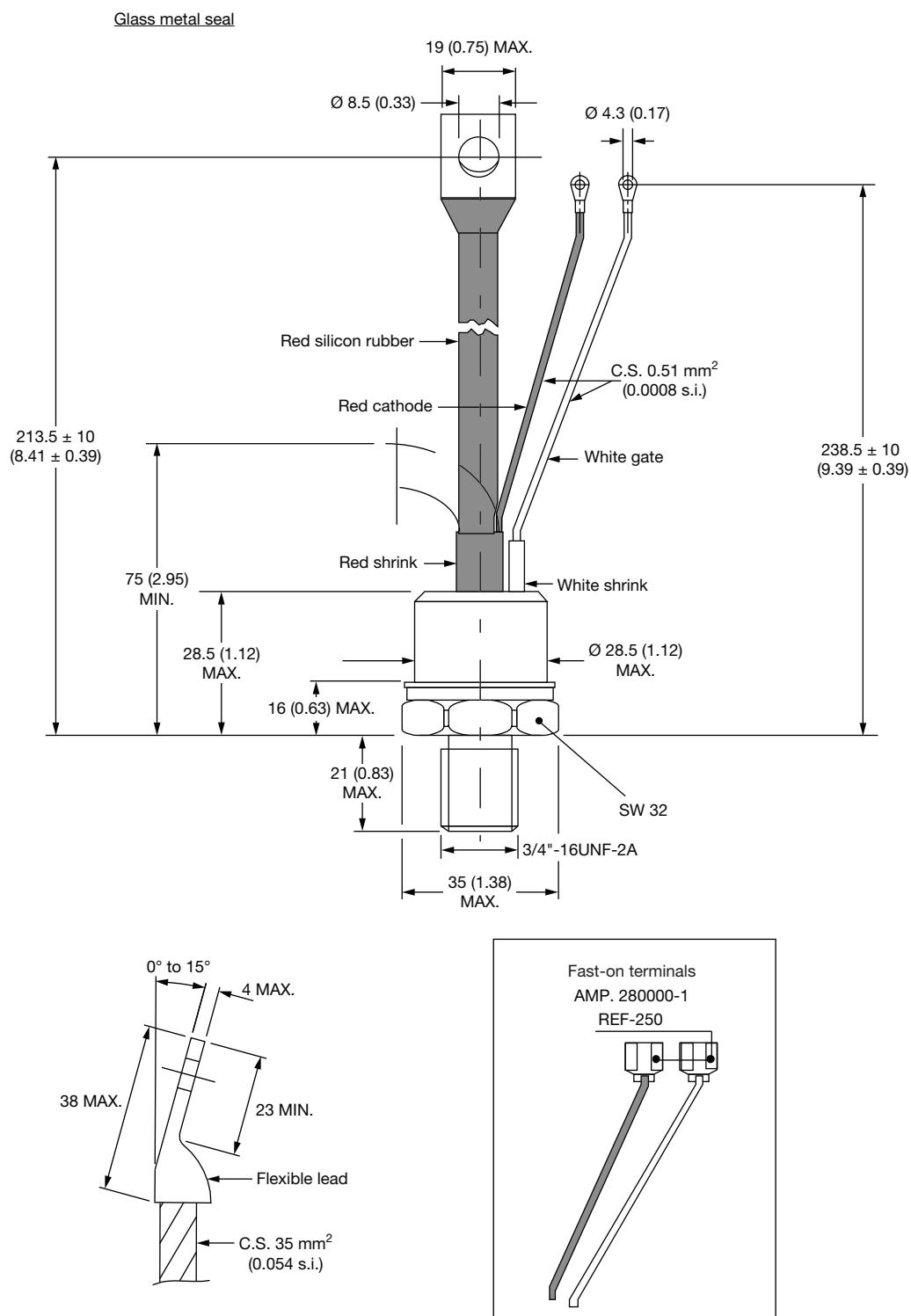
Device code	VS-	ST	28	0	S	06	P	0	V
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- 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
- 8** - 0 = eyelet terminals (gate and auxiliary cathode leads)
1 = fast-on terminals (gate and auxiliary cathode leads)
- 9** - V = glass-metal seal

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95077

TO-209AB (TO-93)

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. 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.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Vishay](#):

[ST280S04P1V](#) [ST280S06P1V](#) [VS-ST280S04P0V](#) [ST280S06P0V](#) [VS-ST280S06P0V](#) [VS-ST280S04P1V](#) [VS-ST280S06P1V](#)