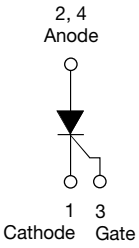
Thyristor Surface Mount Phase Control SCR, 16 A

D²PAK (TO-263AB)



FEATURES

- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified according JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Input rectification (soft start)
- Vishay input diodes, switches and output rectifiers which are in identical package outlines

DESCRIPTION

The VS-16TTS16S-M3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 125 °C junction temperature.

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	10 A
V_{DRM}/V_{RRM}	1600 V
V_{TM}	1.4 V
I_{GT}	60 mA
T_J	-40 °C to +125 °C
Package	D²PAK (TO-263AB)
Circuit configuration	Single SCR

OUTPUT CURRENT IN TYPICAL APPLICATIONS			
APPLICATIONS	SINGLE-PHASE BRIDGE	THREE-PHASE BRIDGE	UNITS
NEMA FR-4 or G-10 glass fabric-based epoxy with 4 oz. (140 µm) copper	2.5	3.5	A
Aluminum IMS, R_{thCA} = 15 °C/W	6.3	9.5	
Aluminum IMS with heatsink, R_{thCA} = 5 °C/W	14.0	18.5	

Note

- T_A = 55 °C, T_J = 125 °C, footprint 300 mm²

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$	Sinusoidal waveform	10	A
I_{RMS}		16	
V_{RRM}/V_{DRM}		1600	V
I_{TSM}		200	A
V_T	10 A, T_J = 25 °C	1.4	V
dV/dt		500	V/µs
dI/dt		150	A/µs
T_J		-40 to +125	°C

VOLTAGE RATINGS			
PART NUMBER	V_{RRM}, MAXIMUM PEAK REVERSE VOLTAGE V	V_{DRM}, MAXIMUM PEAK DIRECT VOLTAGE V	I_{RRM}/I_{DRM} AT 125 °C mA
VS-16TTS16S-M3	1600	1600	10

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES TYP.	VALUES MAX.	UNITS
Maximum average on-state current	$I_{T(AV)}$	T_C = 93 °C, 180° conduction, half sine wave		10		A
Maximum RMS on-state current	I_{RMS}			16		A
Maximum peak, one-cycle, non-repetitive surge current	I_{TSM}	10 ms sine pulse, rated V_{RRM} applied		170		A
		10 ms sine pulse, no voltage reapplied		200		A
Maximum I^2t for fusing	I^2t	10 ms sine pulse, rated V_{RRM} applied		144		A^2s
		10 ms sine pulse, no voltage reapplied		200		A^2s
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied		2000		$A^2\sqrt{s}$
Maximum on-state voltage drop	V_{TM}	10 A, T_J = 25 °C		1.4		V
On-state slope resistance	r_t	T_J = 125 °C		24.0		mΩ
Threshold voltage	$V_{T(TO)}$			1.1		V
Maximum reverse and direct leakage current	I_{RM}/I_{DM}	T_J = 25 °C	V_R = rated V_{RRM}/V_{DRM}	0.5		mA
		T_J = 125 °C		10		mA
Holding current	I_H	Anode supply = 6 V, resistive load, initial I_T = 1 A, T_J = 25 °C		100	150	mA
Maximum latching current	I_L	Anode supply = 6 V, resistive load, T_J = 25 °C		200		mA
Maximum rate of rise of off-state voltage	dV/dt	T_J = T_J max. linear to 80 % V_{DRM} = R_g - k = open		500		V/µs
Maximum rate of rise of turned-on current	dI/dt			150		A/µs

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P_{GM}		8.0	W
Maximum average gate power	$P_{G(AV)}$		2.0	W
Maximum peak positive gate current	+ I_{GM}		1.5	A
Maximum peak negative gate voltage	- V_{GM}		10	V
Maximum required DC gate current to trigger	I_{GT}	Anode supply = 6 V, resistive load, T_J = - 10 °C	90	mA
		Anode supply = 6 V, resistive load, T_J = 25 °C	60	mA
		Anode supply = 6 V, resistive load, T_J = 125 °C	35	mA
Maximum required DC gate voltage to trigger	V_{GT}	Anode supply = 6 V, resistive load, T_J = - 10 °C	3.0	V
		Anode supply = 6 V, resistive load, T_J = 25 °C	2.0	V
		Anode supply = 6 V, resistive load, T_J = 125 °C	1.0	V
Maximum DC gate voltage not to trigger	V_{GD}	T_J = 125 °C, V_{DRM} = rated value	0.25	V
Maximum DC gate current not to trigger	I_{GD}		2.0	mA

SWITCHING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Typical turn-on time	t_{gt}	T_J = 25 °C	0.9	µs
Typical reverse recovery time	t_{rr}	T_J = 125 °C	4	µs
Typical turn-off time	t_q		110	µs

THERMAL - MECHANICAL SPECIFICATIONS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum junction and storage temperature range	T_J, T_{Stg}		-40 to +125	°C
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	1.3	°C/W
Typical thermal resistance, junction to ambient	R_{thJA}	PCB mount (1)	40	°C/W
Approximate weight			2	g
			0.07	oz.
Marking device		Case style D^2PAK (TO-263AB)	16TTS16S	

Note

(1) When mounted on 1" square (650 mm^2) PCB of FR-4 or G-10 material 4 oz. (140 µm) copper 40 °C/W.
For recommended footprint and soldering techniques refer to application note #AN-994

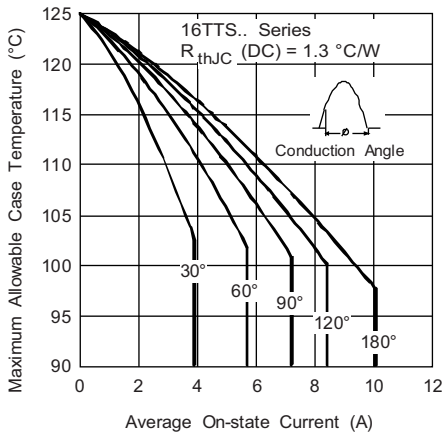


Fig. 1 - Current Rating Characteristics

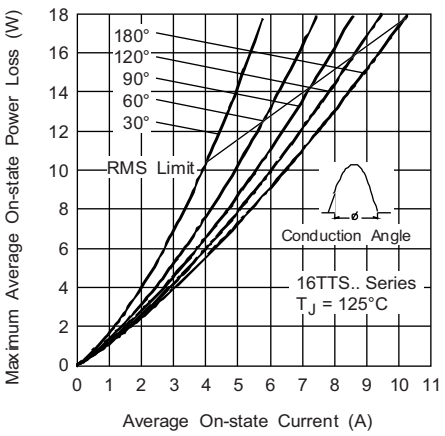


Fig. 3 - On-State Power Loss Characteristics

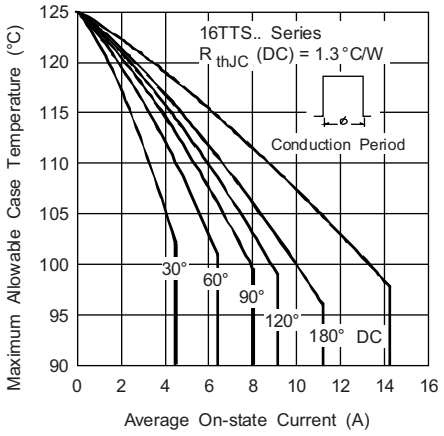


Fig. 2 - Current Rating Characteristics

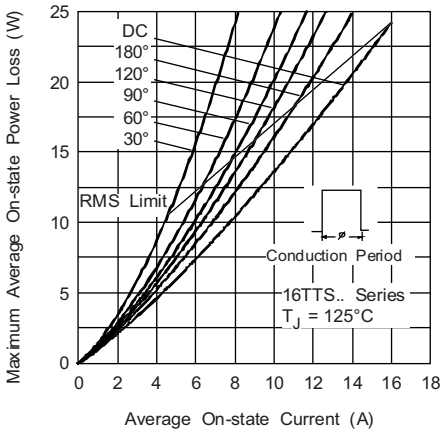


Fig. 4 - On-State Power Loss Characteristics

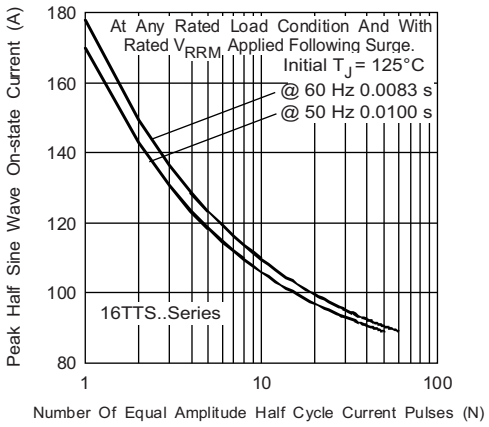


Fig. 5 - Maximum Non-Repetitive Surge Current

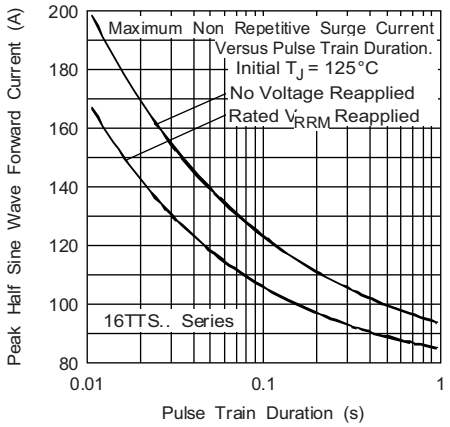


Fig. 6 - Maximum Non-Repetitive Surge Current

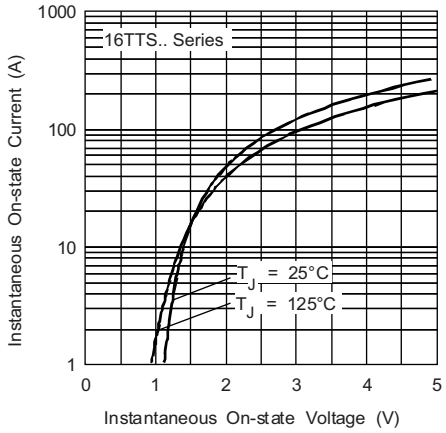


Fig. 7 - On-State Voltage Drop Characteristics

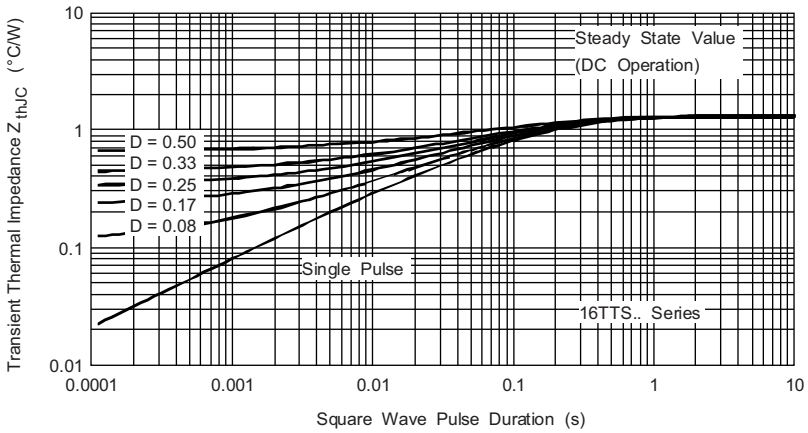


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

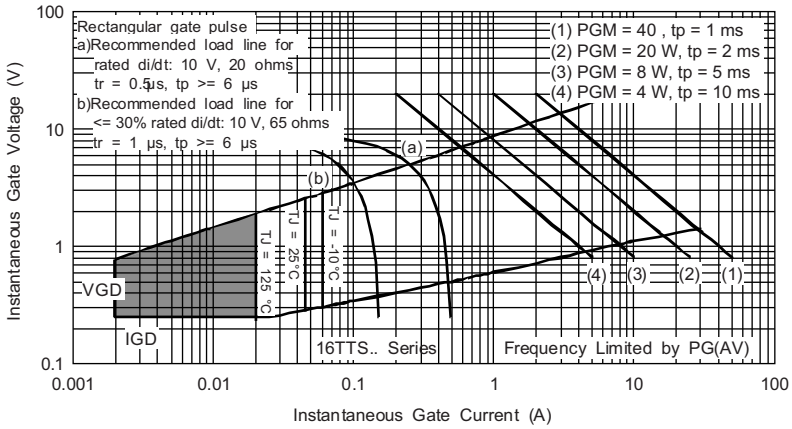


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	16	T	T	S	16	S	TRL	-M3
1	2	3	4	5	6	7	8	9

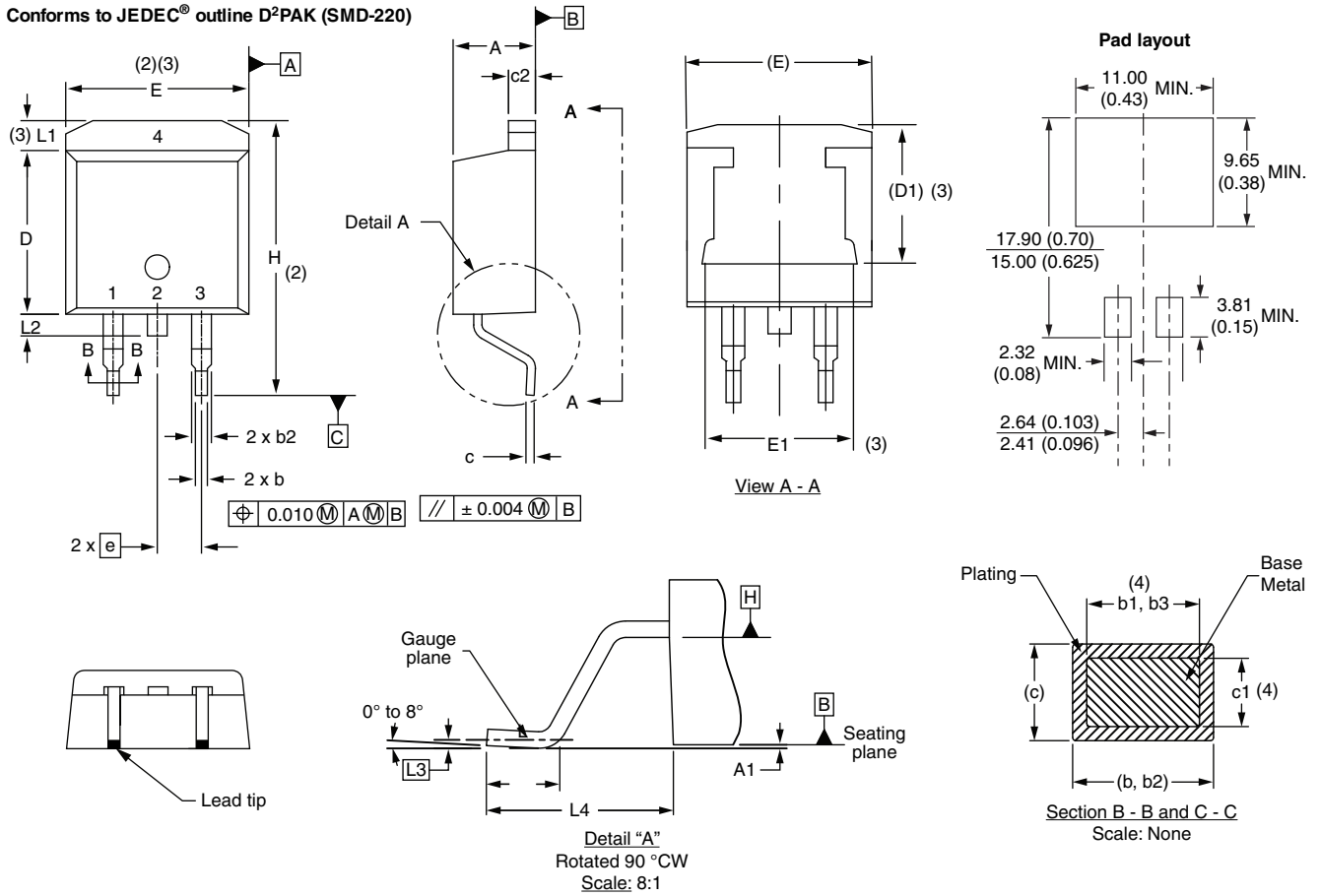
- **1** - Vishay Semiconductors product
- **2** - Current rating
- **3** - Circuit configuration:
  T = single thyristor
- **4** - Package:
  T = D^2PAK (TO-263AB)
- **5** - Type of silicon:
  S = standard recovery rectifier
- **6** - Voltage rating: Voltage code x 100 = V_{RRM} (16 = 1600 V)
- **7** - S = surface mountable
- **8** - • None = tube
  • TRL = tape and reel (left oriented)
  • TRR = tape and reel (right oriented)
- **9** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

ORDERING INFORMATION (Example)		
PREFERRED P/N	**BASE QUANTITY**	**PACKAGING DESCRIPTION**
VS-16TTS16S-M3	50	Antistatic plastic tubes
VS-16TTS16STRL-M3	800	13" diameter plastic tape and reel
VS-16TTS16STRR-M3	800	13" diameter plastic tape and reel

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?96164
Part marking information	www.vishay.com/doc?95444
Packaging information	www.vishay.com/doc?96424

D^2PAK

DIMENSIONS in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	0.00	0.254	0.000	0.010	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65	0.335	0.380	2

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D1	6.86	8.00	0.270	0.315	3
E	9.65	10.67	0.380	0.420	2, 3
E1	7.90	8.80	0.311	0.346	3
e	2.54 BSC		0.100 BSC		
H	14.61	15.88	0.575	0.625	
L	1.78	2.79	0.070	0.110	
L1	-	1.65	-	0.066	3
L2	1.27	1.78	0.050	0.070	
L3	0.25 BSC		0.010 BSC		
L4	4.78	5.28	0.188	0.208	

Notes

(1) Dimensioning and tolerancing per ASME Y14.5 M-1994

(2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body

(3) Thermal pad contour optional within dimension E, L1, D1 and E1

(4) Dimension b1 and c1 apply to base metal only

(5) Datum A and B to be determined at datum plane H

(6) Controlling dimension: inches

(7) Outline conforms to JEDEC® outline TO-263AB

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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

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.