

## Thyristor High Voltage, Phase Control SCR, 16 A



RoHS  
COMPLIANT  
HALOGEN  
FREE

### FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- 125 °C max. operating junction temperature
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- Typical usage is in input rectification crowbar (soft start) and AC switch in motor control, UPS, welding, and battery charge

### DESCRIPTION

The VS-16TTS... 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 operating up to 125 °C junction temperature.

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	10 A
$V_{DRM}/V_{RRM}$	800 V, 1200 V
$V_{TM}$	1.4 V
$I_{GT}$	60 mA
$T_J$	-40 °C to 125 °C
Package	TO-220AB 3L
Circuit configuration	Single SCR

OUTPUT CURRENT IN TYPICAL APPLICATIONS			
APPLICATIONS	SINGLE-PHASE BRIDGE	THREE-PHASE BRIDGE	UNITS
Capacitive input filter $T_A = 55^\circ\text{C}$ , $T_J = 125^\circ\text{C}$ , common heatsink of 1 °C/W	13.5	17	A

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$	Sinusoidal waveform	10	A
$I_{RMS}$		16	
$V_{DRM}/V_{RRM}$	Range <sup>(1)</sup>	800, 1200	V
$I_{TSM}$		200	A
$V_T$	10 A, $T_J = 25^\circ\text{C}$	1.4	V
$dV/dt$		500	V/μs
$di/dt$		150	A/μs
$T_J$	Range	-40 to +125	°C

#### Note

<sup>(1)</sup> For higher voltage up to 1600 V contact factory

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-16TTS08-M3	800	800	10
VS-16TTS12-M3	1200	1200	

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNITS
			TYP.	MAX.	
Maximum average on-state current	$I_{T(AV)}$	$T_C = 98^\circ C$ , 180° conduction, half sine wave	10		A
Maximum RMS on-state current	$I_{RMS}$		16		
Maximum peak, one-cycle, non-repetitive surge current	$I_{TSM}$	10 ms sine pulse, rated $V_{RRM}$ applied	170		
		10 ms sine pulse, no voltage reapplied	200		
Maximum $I^2t$ for fusing	$I^2t$	10 ms sine pulse, rated $V_{RRM}$ applied	144		A <sup>2</sup> s
		10 ms sine pulse, no voltage reapplied	200		
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied	2000		$A^2\sqrt{s}$
Maximum on-state voltage drop	$V_{TM}$	10 A, $T_J = 25^\circ C$	1.4		V
On-state slope resistance	$r_t$	$T_J = 125^\circ C$	24.0		$m\Omega$
Threshold voltage	$V_{T(TO)}$		1.1		V
Maximum reverse and direct leakage current	$I_{RM}/I_{DM}$	$T_J = 25^\circ C$	0.5		mA
		$T_J = 125^\circ C$	10		
Holding current	$I_H$	Anode supply = 6 V, resistive load, initial $I_T = 1$ A 16TT808PbF, 16TT812PbF, $T_J = 25^\circ C$	-	150	
Maximum latching current	$I_L$	Anode supply = 6 V, resistive load, $T_J = 25^\circ C$	200		
Maximum rate of rise of off-state voltage	$dV/dt$	$T_J = T_J$ max., linear to 80 °C, $V_{DRM} = R_g - k = \text{Open}$	500		$V/\mu s$
Maximum rate of rise of turned-on current	$dI/dt$		150		$A/\mu s$

**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	
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, $T_J = -65^\circ C$	90	mA
		Anode supply = 6 V, resistive load, $T_J = 25^\circ C$	60	
		Anode supply = 6 V, resistive load, $T_J = 125^\circ C$	35	
Maximum required DC gate voltage to trigger	$V_{GT}$	Anode supply = 6 V, resistive load, $T_J = -65^\circ C$	3.0	V
		Anode supply = 6 V, resistive load, $T_J = 25^\circ C$	2.0	
		Anode supply = 6 V, resistive load, $T_J = 125^\circ C$	1.0	
Maximum DC gate voltage not to trigger	$V_{GD}$	$T_J = 125^\circ C$ , $V_{DRM} = \text{Rated value}$	0.25	mA
Maximum DC gate current not to trigger	$I_{GD}$		2.0	

**SWITCHING**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Typical turn-on time	$t_{gt}$	$T_J = 25^\circ C$	0.9	$\mu s$
Typical reverse recovery time	$t_{rr}$	$T_J = 125^\circ C$	4	
Typical turn-off time	$t_q$		110	

**THERMAL AND 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	
Maximum thermal resistance, junction to ambient	$R_{thJA}$		62	°C/W
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth and greased	0.5	
Approximate weight			2	g
Mounting torque	minimum maximum		0.07	oz.
Marking device		Case style TO-220AB 3L	6 (5) 12 (10)	kgf · cm (lbf · in)
			16TTS08	
			16TTS12	

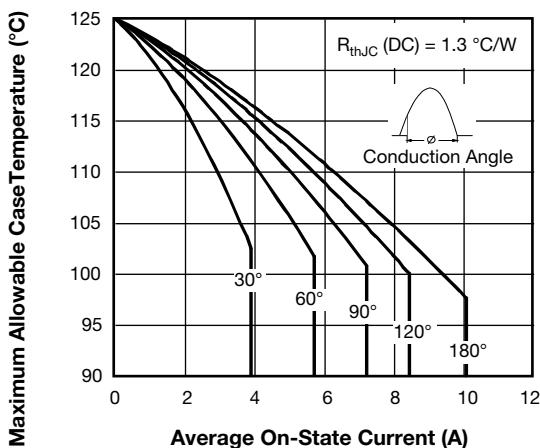


Fig. 1 - Current Rating Characteristics

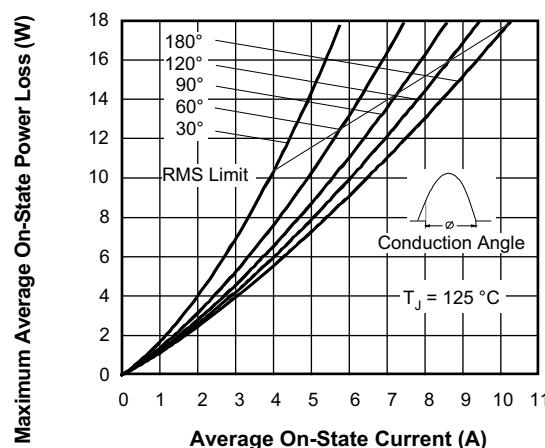


Fig. 3 - On-State Power Loss Characteristics

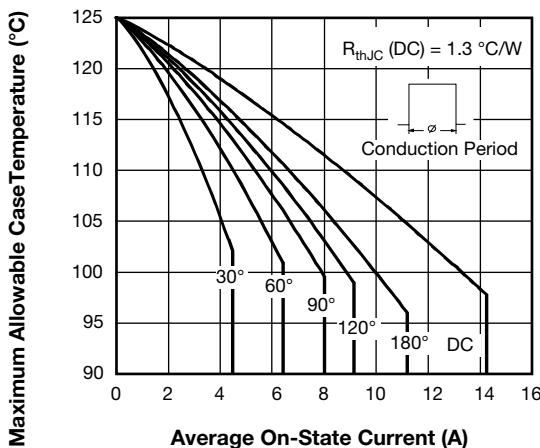


Fig. 2 - Current Rating Characteristics

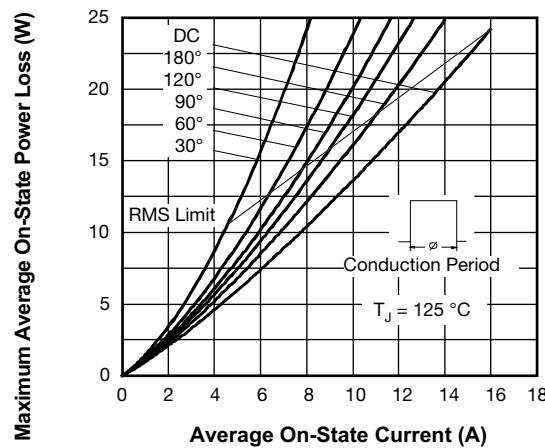


Fig. 4 - On-State Power Loss Characteristics

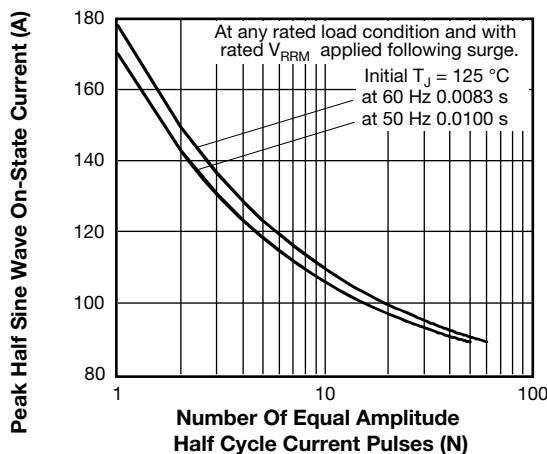


Fig. 5 - Maximum Non-Repetitive Surge Current

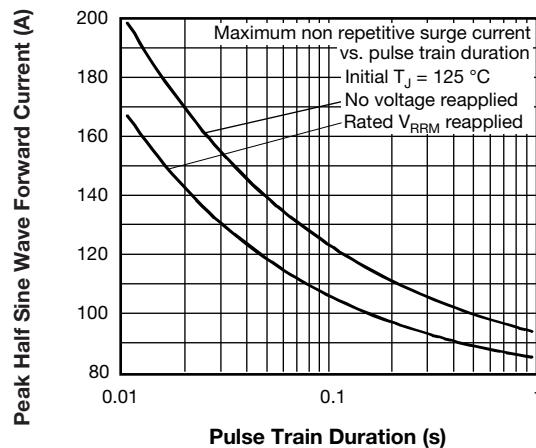


Fig. 6 - Maximum Non-Repetitive Surge Current

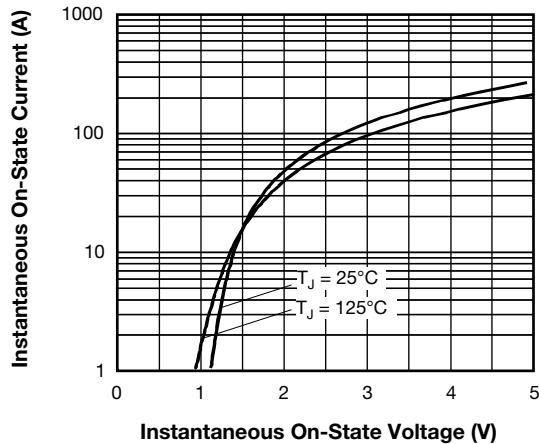


Fig. 7 - On-State Voltage Drop Characteristics

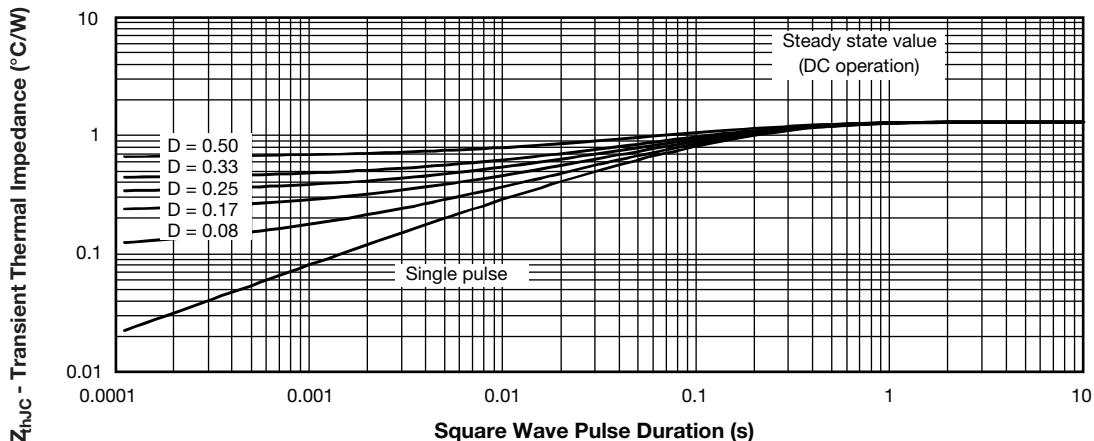


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

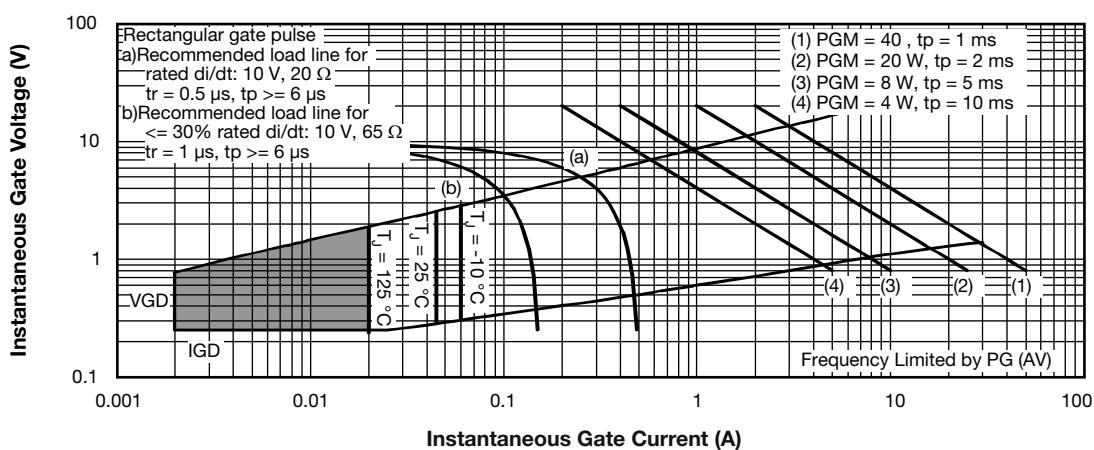


Fig. 9 - Gate Characteristics

## ORDERING INFORMATION TABLE

Device code	VS-	16	T	T	S	12	-M3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

- 1** - Vishay Semiconductors product
- 2** - Current rating
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = TO-220AB
- 5** - Type of silicon:  
S = converter grade
- 6** - Voltage code x 100 =  $V_{RRM}$  →
  - 08 = 800 V
  - 12 = 1200 V
- 7** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

## ORDERING INFORMATION (Example)

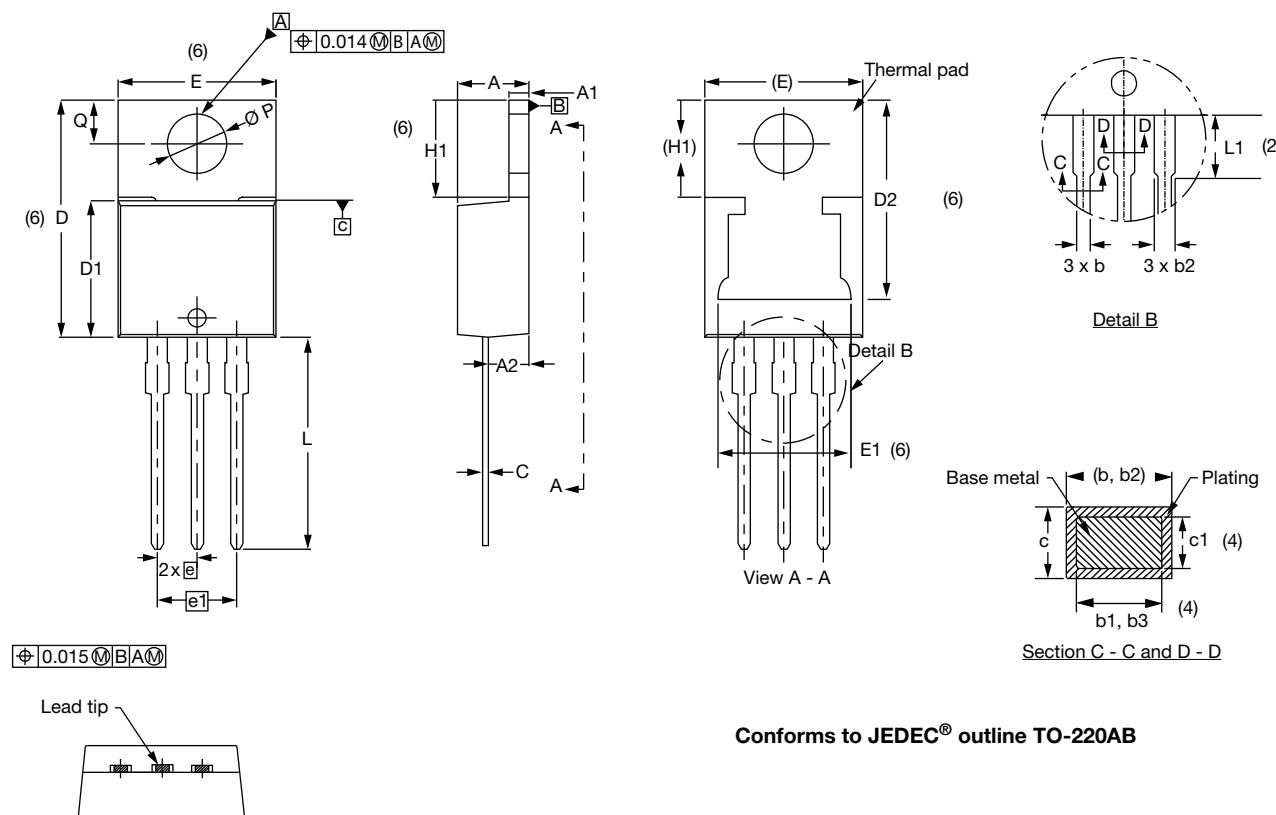
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-16TTS08-M3	50	Antistatic plastic tubes
VS-16TTS12-M3	50	Antistatic plastic tubes

## LINKS TO RELATED DOCUMENTS

Dimensions	<a href="http://www.vishay.com/doc?96154">www.vishay.com/doc?96154</a>
Part marking information	<a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a>

### TO-220AB 3L

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183	
A1	1.14	1.40	0.045	0.055	
A2	2.50	2.92	0.098	0.115	
b	0.69	1.01	0.027	0.040	
b1	0.38	0.97	0.015	0.038	4
b2	1.20	1.73	0.047	0.068	
b3	1.14	1.73	0.045	0.068	4
c	0.36	0.61	0.014	0.024	
c1	0.36	0.56	0.014	0.022	4
D	14.85	15.35	0.585	0.604	3
D1	8.38	9.02	0.330	0.355	

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	11.68	13.30	0.460	0.524	6, 7
E	10.11	10.51	0.398	0.414	3, 6
E1	6.86	8.89	0.270	0.350	6
e	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
ØP	3.54	3.91	0.139	0.154	
Q	2.60	3.00	0.102	0.118	

#### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1, 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 outermost extremes of the plastic body
- (4) Dimension b1, b3, and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2, and E1
- (7) Outline conforms to JEDEC® TO-220, except D2

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