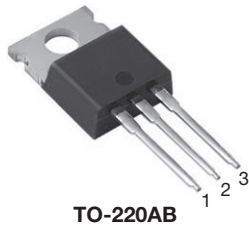
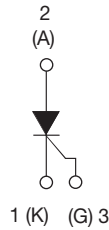


## Thyristor High Voltage, Phase Control SCR, 40 A



TO-220AB



### FEATURES

- Easy control peak current at charger power up to reduce passive / electromechanical components
- Flexible solution for reliable AC power rectification
- Meets JESD 201 class 1A whisker test
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- On-board and off-board EV/HEV battery chargers
- Renewable energy inverters

### DESCRIPTION

The VS-40TTS12HM3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	25 A
$V_{DRM}/V_{RRM}$	1200 V
$V_{TM}$	1.6 V
$I_{GT}$	35 mA
$T_J$	-40 °C to 140 °C
Package	TO-220AB
Circuit configuration	Single SCR

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$	Sinusoidal waveform	25	A
$I_{RMS}$		40	
$V_{RRM}/V_{DRM}$		1200	V
$I_{TSM}$		350	A
$V_T$	$T_J = 25\text{ °C}$	1.6	V
dV/dt		500	V/μs
dI/dt		150	A/μs
$T_J$		-40 to +140	°C

VOLTAGE RATINGS			
PART NUMBER	$V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE V	$V_{DRM}$ , MAXIMUM PEAK DIRECT VOLTAGE V	$T_J$ °C
VS-40TTS12HM3	1200	1200	-25 to +140



ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Maximum average on-state current	$I_{T(AV)}$	$T_C = 93\text{ }^\circ\text{C}$ , 180° conduction half sine wave	25	A	
Maximum RMS on-state current	$I_{RMS}$		40		
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	10 ms sine pulse, rated $V_{RRM}$ applied	300		
		10 ms sine pulse, no voltage reapplied	350		
Maximum $I^2t$ for fusing	$I^2t$	10 ms sine pulse, rated $V_{RRM}$ applied	450	$A^2s$	
		10 ms sine pulse, no voltage reapplied	630		
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied	6300	$A^2\sqrt{s}$	
Maximum on-state voltage	$V_{TM}$	80 A, $T_J = 25\text{ }^\circ\text{C}$	1.6	V	
Low level value of on-state slope resistance	$r_t$	$T_J = 140\text{ }^\circ\text{C}$	11.4	$m\Omega$	
Low level value of threshold voltage	$V_{T(TO)}$		0.96	V	
Maximum reverse and direct leakage current	$I_{RRM}/I_{DRM}$	$V_R = \text{Rated } V_{RRM}/V_{DRM}$	$T_J = 25\text{ }^\circ\text{C}$	0.5	mA
			$T_J = 140\text{ }^\circ\text{C}$	12	
Holding current	$I_H$	Anode supply = 6 V, resistive load, initial $I_T = 1$ A, $T_J = 25\text{ }^\circ\text{C}$	100		
Maximum latching current	$I_L$	Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$	200		
Maximum rate of rise of off-state voltage	$dV/dt$	$T_J = T_{J \text{ max.}}$ , linear to $80\text{ }^\circ\text{C}$ , $V_{DRM} = R_g - k = \text{Open}$	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, $T_J = 25\text{ }^\circ\text{C}$	35	mA
Maximum required DC gate voltage to trigger	$V_{GT}$	Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$	1.3	V
Maximum DC gate voltage not to trigger	$V_{GD}$	$T_J = 140\text{ }^\circ\text{C}$ , $V_{DRM} = \text{Rated value}$	0.2	
Maximum DC gate current not to trigger	$I_{GD}$		1.5	mA

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Typical turn-on time	$t_{gt}$	$T_J = 25\text{ }^\circ\text{C}$	0.9	$\mu s$
Typical reverse recovery time	$t_{rr}$	$T_J = 140\text{ }^\circ\text{C}$	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 140	$^{\circ}\text{C}$
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	0.8	$^{\circ}\text{C}/\text{W}$
Maximum thermal resistance, junction to ambient	$R_{thJA}$		60	
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth, and greased	0.5	
Approximate weight			2	g
			0.07	oz.
Mounting torque	minimum		6 (5)	kgf · cm (lbf · in)
	maximum		12 (10)	
Marking device		Case style TO-220AB	40TTS12H	

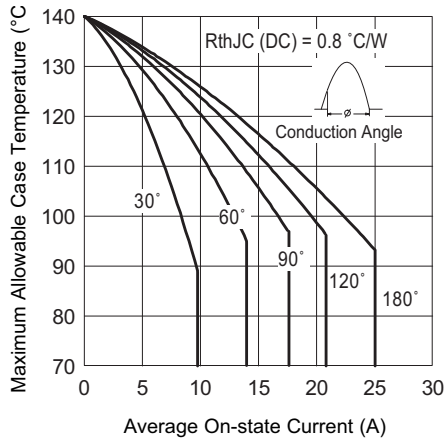


Fig. 1 - Current Rating Characteristics

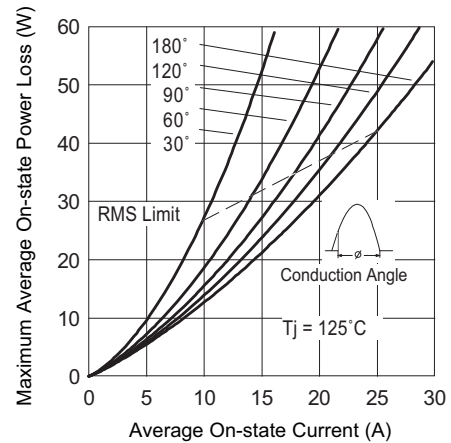


Fig. 3 - On-State Power Loss Characteristics

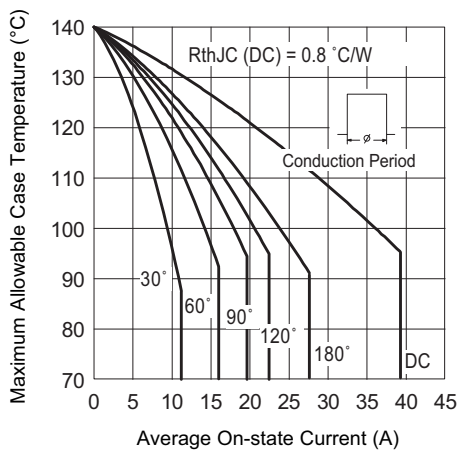


Fig. 2 - Current Rating Characteristics

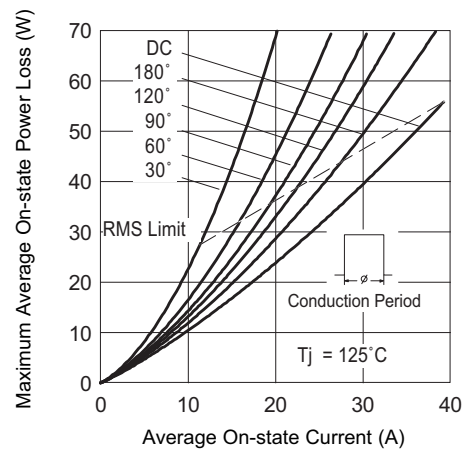


Fig. 4 - On-State Power Loss Characteristics

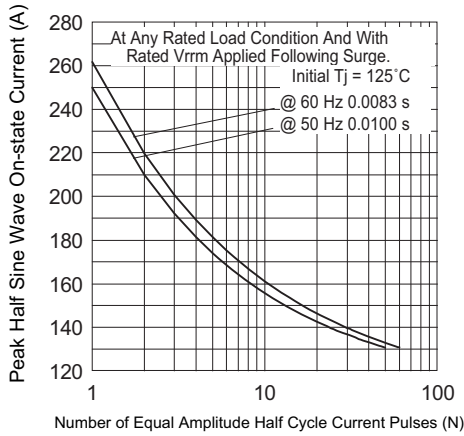


Fig. 5 - Maximum Non-Repetitive Surge Current

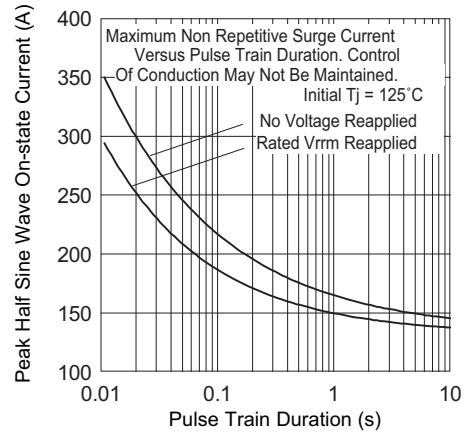


Fig. 6 - Maximum Non-Repetitive Surge Current

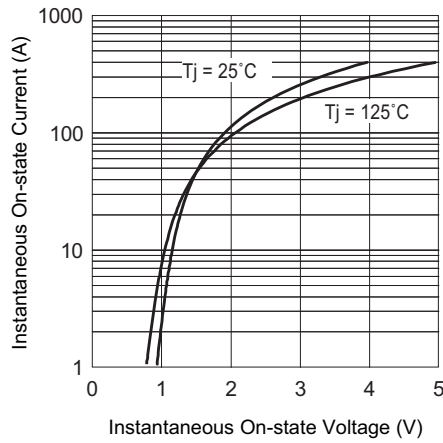


Fig. 7 - On-State Voltage Drop Characteristics

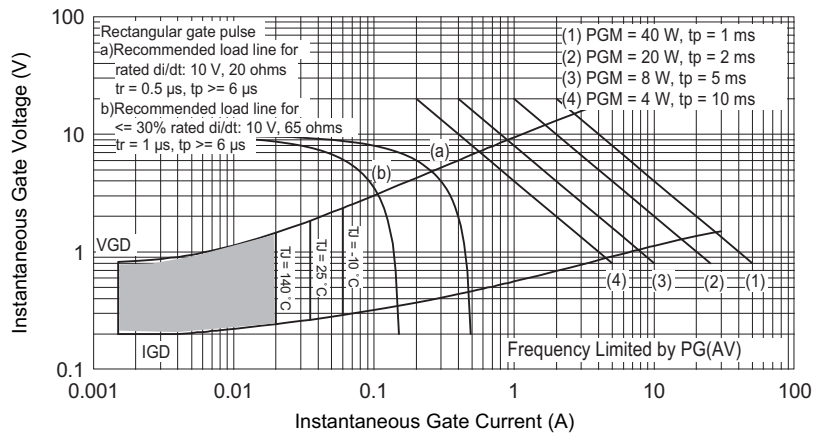


Fig. 8 - Gate Characteristics

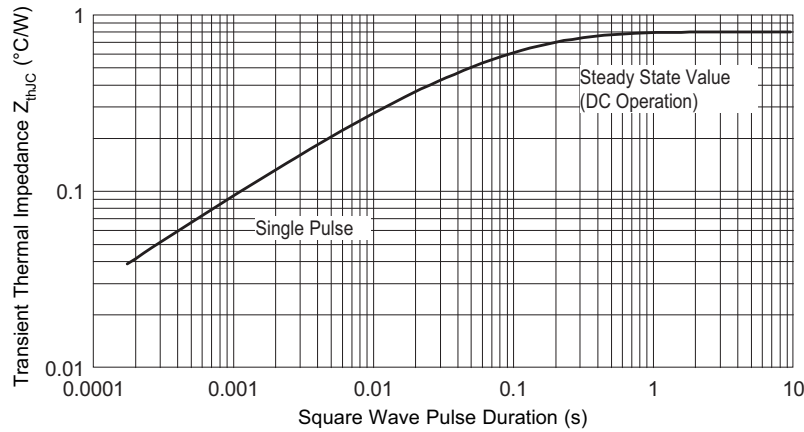


Fig. 9 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>40</b>	<b>T</b>	<b>T</b>	<b>S</b>	<b>12</b>	<b>H</b>	<b>M3</b>
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Vishay Semiconductors product
- 2** - Current rating, RMS value
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = TO-220
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage rating (12 = 1200 V)
- 7** - H = AEC-Q101 qualified
- 8** - Environmental digit:  
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

<b>ORDERING INFORMATION</b> (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-40TTS12HM3	50	1000	Antistatic plastic tubes

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a>
Part marking information	TO-220AB <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a>

## TO-220AB

**DIMENSIONS** in millimeters and inches



**Lead assignments**

**Diodes**

- 1 - Anode/open
- 2 - Cathode
- 3 - Anode

Conforms to JEDEC outline TO-220AB

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	2.56	2.92	0.101	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	15.25	0.585	0.600	3
D1	8.38	9.02	0.330	0.355	
D2	11.68	12.88	0.460	0.507	6
E	10.11	10.51	0.398	0.414	3, 6
E1	6.86	8.89	0.270	0.350	6
E2	-	0.76	-	0.030	7
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, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
Ø P	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	
θ	90° to 93°		90° to 93°		

**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) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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