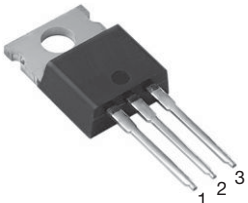
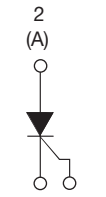
Thyristor High Voltage, Phase Control SCR, 40 A



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

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 °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 °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 °C		1.6	V
Low level value of on-state slope resistance	r_t	T_J = 140 °C		11.4	mΩ
Low level value of threshold voltage	$V_{T(TO)}$			0.96	V
Maximum reverse and direct leakage current	I_{RRM}/I_{DRM}	T_J = 25 °C	V_R = Rated V_{RRM}/V_{DRM}	0.5	mA
		T_J = 140 °C		12	
Holding current	I_H	Anode supply = 6 V, resistive load, initial I_T = 1 A, T_J = 25 °C		100	
Maximum latching current	I_L	Anode supply = 6 V, resistive load, T_J = 25 °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 = 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	
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 °C	35	mA
Maximum required DC gate voltage to trigger	V_{GT}	Anode supply = 6 V, resistive load, T_J = 25 °C	1.3	V
Maximum DC gate voltage not to trigger	V_{GD}	T_J = 140 °C, V_{DRM} = 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 °C	0.9	µs
Typical reverse recovery time	t_{rr}	T_J = 140 °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	°C
Maximum thermal resistance, junction to case		R_{thJC}	DC operation	0.8	°C/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	

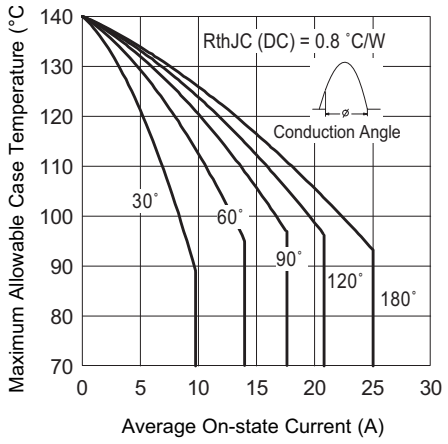


Fig. 1 - Current Rating Characteristics

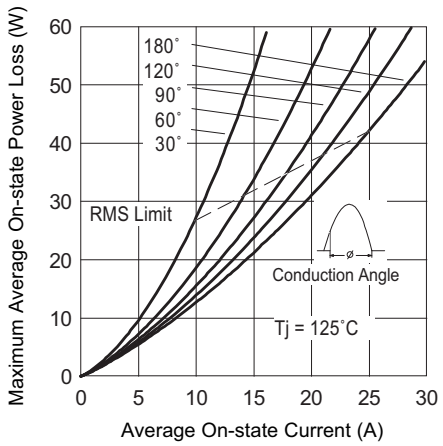


Fig. 3 - On-State Power Loss Characteristics

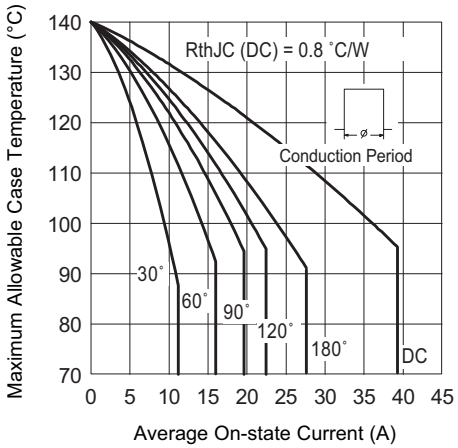


Fig. 2 - Current Rating Characteristics

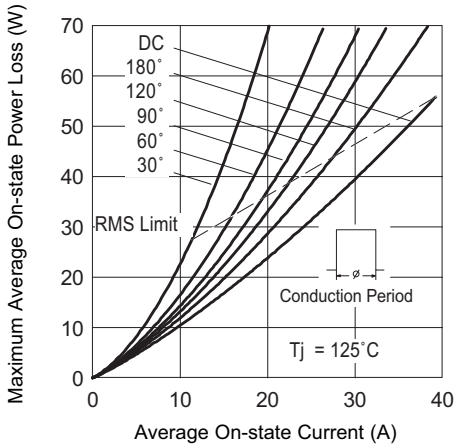


Fig. 4 - On-State Power Loss Characteristics

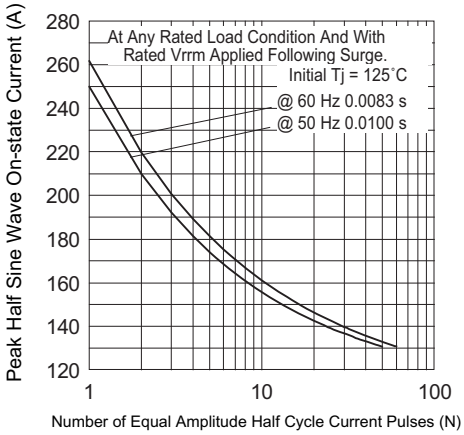


Fig. 5 - Maximum Non-Repetitive Surge Current

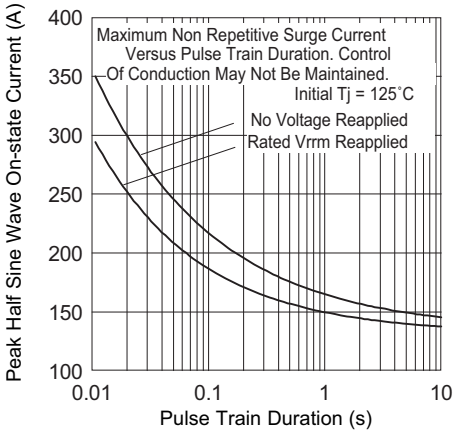


Fig. 6 - Maximum Non-Repetitive Surge Current

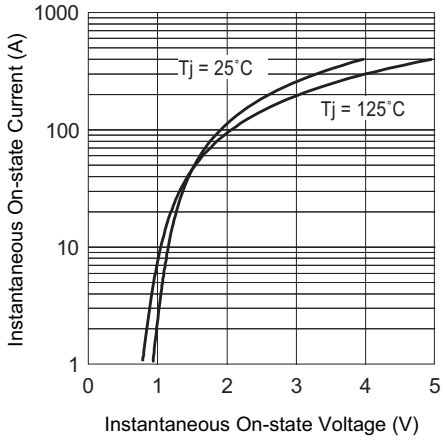


Fig. 7 - On-State Voltage Drop Characteristics

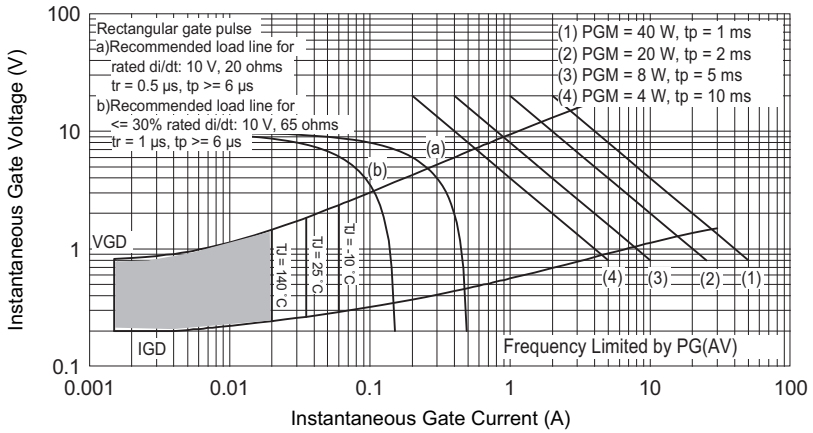


Fig. 8 - Gate Characteristics

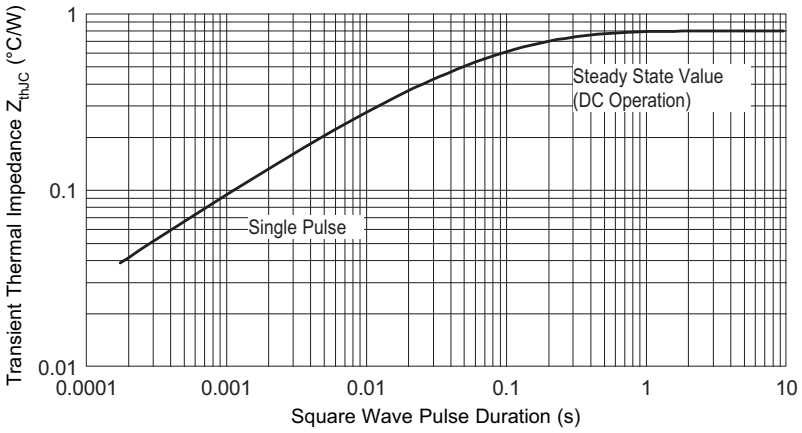


Fig. 9 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	40	T	T	S	12	H	M3
1	2	3	4	5	6	7	8

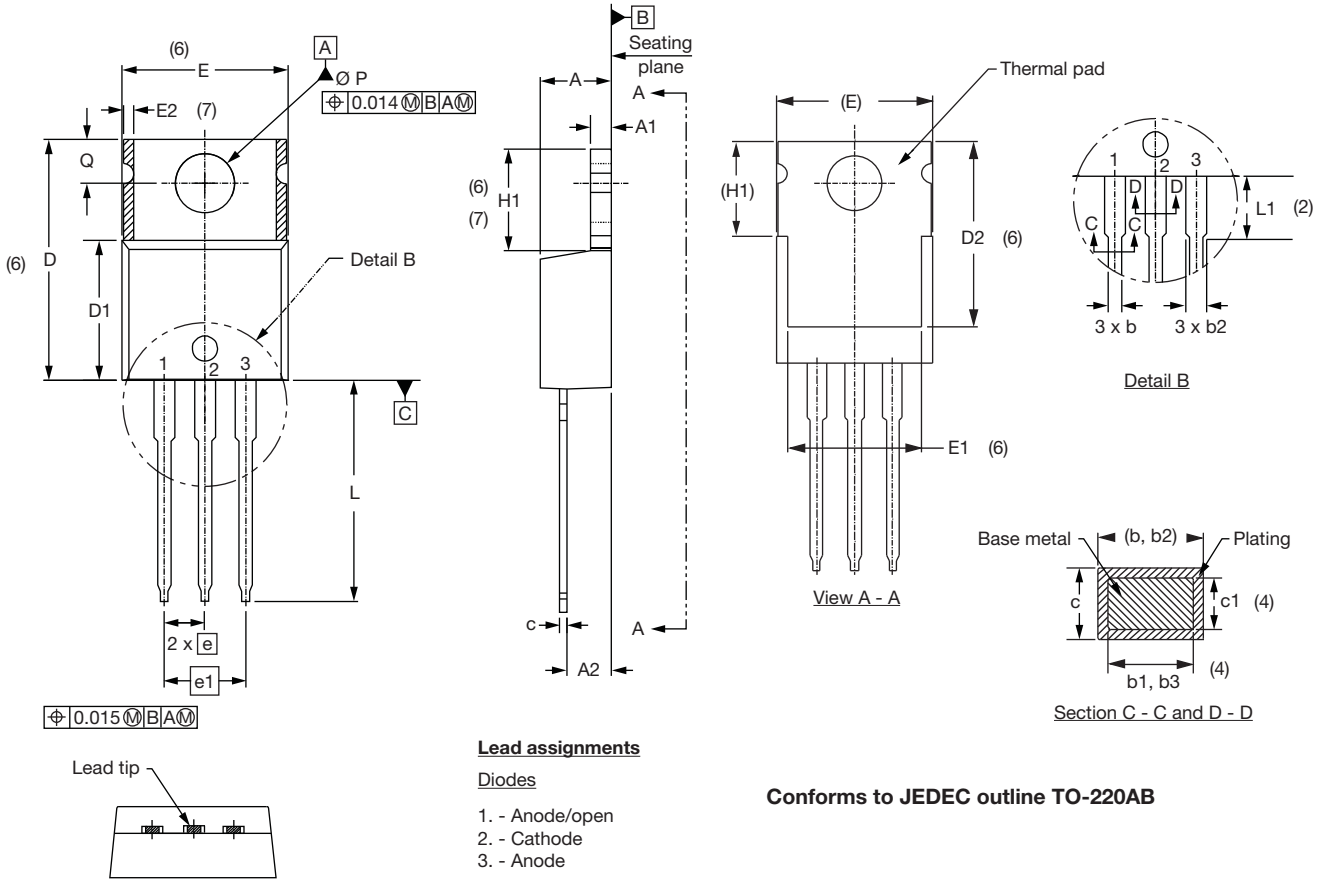
1 - Vishay Semiconductors product
2 - Current rating, RMS value
3 - Circuit configuration:
T = single thyristor
4 - Package:
T = TO-220
5 - Type of silicon:
S = standard recovery rectifier
6 - Voltage rating (12 = 1200 V)
7 - H = AEC-Q101 qualified
8 - Environmental digit:
M3 = halogen-free, RoHS-compliant,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

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

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95222
Part marking information TO-220AB	www.vishay.com/doc?95028

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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
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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