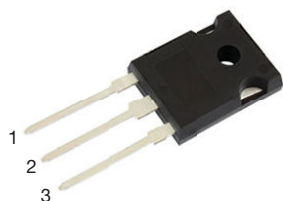
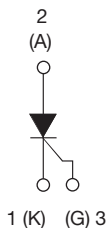


# Thyristor High Voltage, Phase Control SCR, 40 A



TO-247AD 3L



## FEATURES

- AEC-Q101 qualified meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- Easy control peak current at charger power up to reduce passive / electromechanical components
- 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-40TPS... high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

### PRIMARY CHARACTERISTICS

$I_{T(AV)}$	35 A
$V_{DRM}/V_{RRM}$	1200 V
$V_{TM}$	1.45 V
$I_{GT}$	150 mA
$T_J$	-40 °C to +150 °C
Package	TO-247AD 3L
Circuit configuration	Single SCR

### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$	Sinusoidal waveform	35	A
$I_{RMS}$		55	
$V_{RRM}/V_{DRM}$		1200	V
$I_{TSM}$		600	A
$V_T$	40 A, $T_J = 25\text{ °C}$	1.45	V
dv/dt		1000	V/μs
di/dt		100	A/μs
$T_J$		-40 to +150	°C

### VOLTAGE RATINGS

PART NUMBER	$V_{RRM} / V_{DRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	$I_{RRM} / I_{DRM}$ AT 150 °C mA
VS-40TPS12LHM3	1200	1300	20

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average on-state current	I <sub>T(AV)</sub>	T <sub>C</sub> = 104 °C, 180° conduction half sine wave		35	A
Maximum continuous RMS on-state current as AC switch	I <sub>T(RMS)</sub>			55	
Maximum peak, one-cycle non-repetitive surge current	I <sub>TSM</sub>	10 ms sine pulse, rated V <sub>RRM</sub> applied	Initial T <sub>J</sub> = T <sub>J</sub> max.	500	
		10 ms sine pulse, no voltage reapplied		600	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	10 ms sine pulse, rated V <sub>RRM</sub> applied		1250	A <sup>2</sup> s
		10 ms sine pulse, no voltage reapplied		1760	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reapplied		17 600	A <sup>2</sup> √s
Low level value of threshold voltage	V <sub>T(TO)1</sub>	T <sub>J</sub> = 125 °C		1.02	V
High level value of threshold voltage	V <sub>T(TO)2</sub>			1.23	
Low level value of on-state slope resistance	r <sub>t1</sub>			9.74	mΩ
High level value of on-state slope resistance	r <sub>t2</sub>			7.50	
Maximum peak on-state voltage	V <sub>TM</sub>	110 A, T <sub>J</sub> = 25 °C		1.85	V
Maximum rate of rise of turned-on current	di/dt	T <sub>J</sub> = 25 °C		100	A/μs
Maximum holding current	I <sub>H</sub>	Anode supply = 6 V, resistive load, initial T <sub>J</sub> = 1 A, I <sub>T</sub> = 25 °C		300	mA
Maximum latching current	I <sub>L</sub>	Anode supply = 6 V, resistive load, T <sub>J</sub> = 25 °C		350	
Maximum reverse and direct leakage current	I <sub>RRM</sub> /I <sub>DRM</sub>	T <sub>J</sub> = 25 °C	V <sub>R</sub> = rated V <sub>RRM</sub> /V <sub>DRM</sub>	0.5	
		T <sub>J</sub> = 150 °C		20	
Maximum rate of rise of off-state voltage	dv/dt	T <sub>J</sub> = 150 °C, linear to 80 % V <sub>DRM</sub> , R <sub>g</sub> - k = 100 Ω		1000	V/μs

**TRIGGERING**

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak gate power	P <sub>GM</sub>			10	W
Maximum average gate power	P <sub>G(AV)</sub>			2.5	
Maximum peak gate current	I <sub>GM</sub>			2.5	A
Maximum peak negative gate voltage	-V <sub>GM</sub>			10	V
Maximum required DC gate voltage to trigger	V <sub>GT</sub>	T <sub>J</sub> = -40 °C	Anode supply = 6 V resistive load	2.0	V
		T <sub>J</sub> = 25 °C		1.7	
		T <sub>J</sub> = 150 °C		1.2	
Maximum required DC gate current to trigger	I <sub>GT</sub>	T <sub>J</sub> = -40 °C	Anode supply = 6 V resistive load	200	mA
		T <sub>J</sub> = 25 °C		150	
		T <sub>J</sub> = 150 °C		70	
Maximum DC gate voltage not to trigger	V <sub>GD</sub>	T <sub>J</sub> = 125 °C, V <sub>DRM</sub> = rated value		0.25	V
Maximum DC gate current not to trigger	I <sub>GD</sub>			6	mA



THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-40 to +150	°C
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	0.6	°C/W
Maximum thermal resistance, junction to ambient	$R_{thJA}$		40	
Maximum thermal resistance, case to heat sink	$R_{thCS}$	Mounting surface, smooth and greased	0.2	
Approximate weight			6	g
			0.21	oz.
Mounting torque	minimum		6 (5)	kgf · cm
	maximum		12 (10)	(lbf · in)
Marking device		Case style TO-247AD 3L	40TPS12LH	

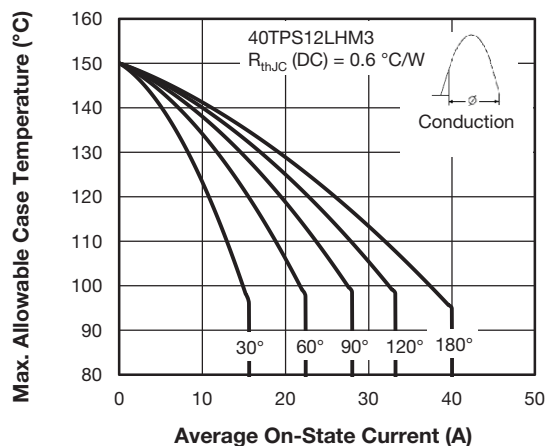


Fig. 1 - Current Rating Characteristics

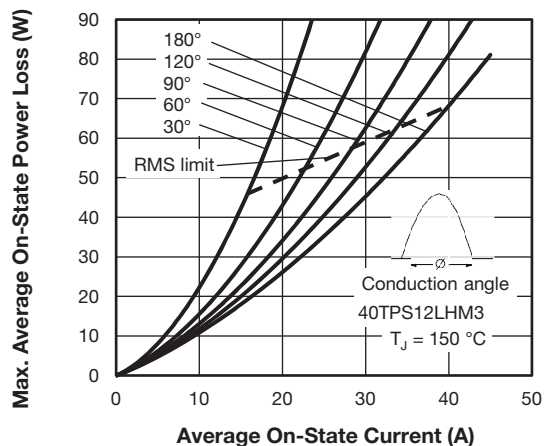


Fig. 3 - On-State Power Loss Characteristics

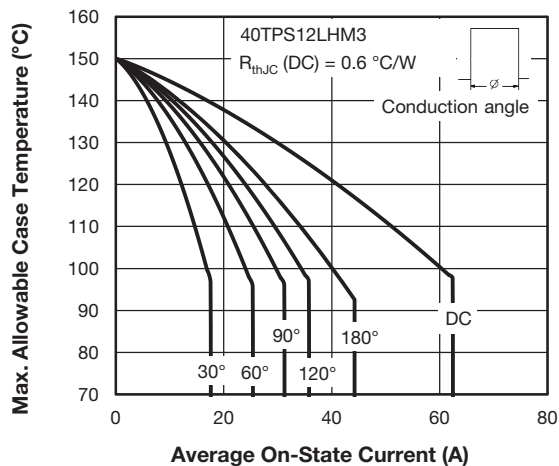


Fig. 2 - Current Rating Characteristics

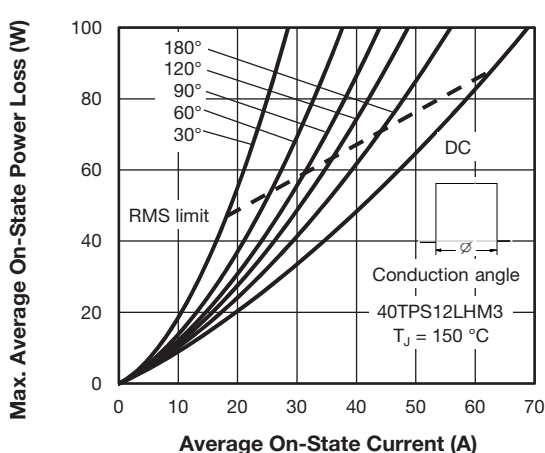


Fig. 4 - On-State Power Loss Characteristics

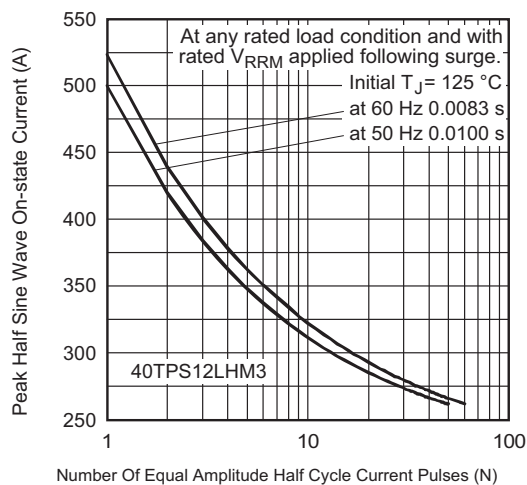


Fig. 5 - Maximum Non-Repetitive Surge Current

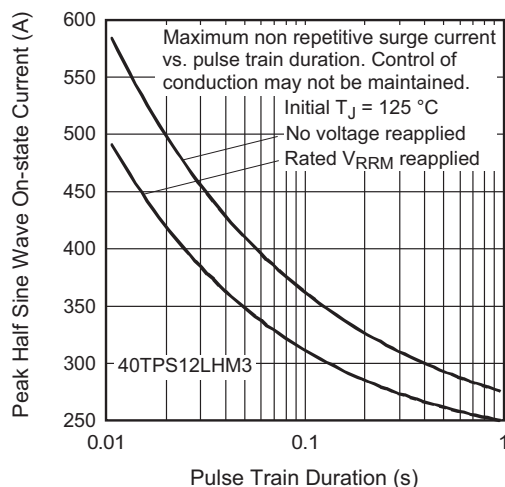


Fig. 6 - Maximum Non-Repetitive Surge Current

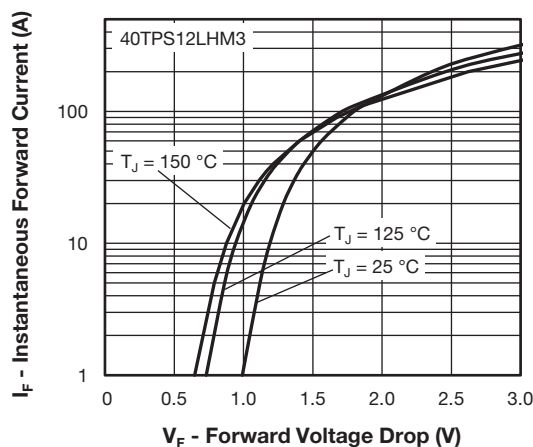


Fig. 7 - On-State Voltage Drop Characteristics

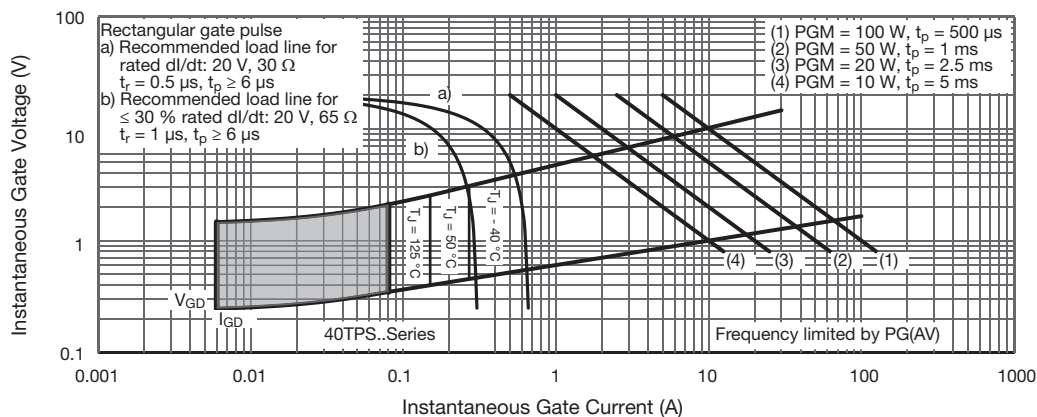
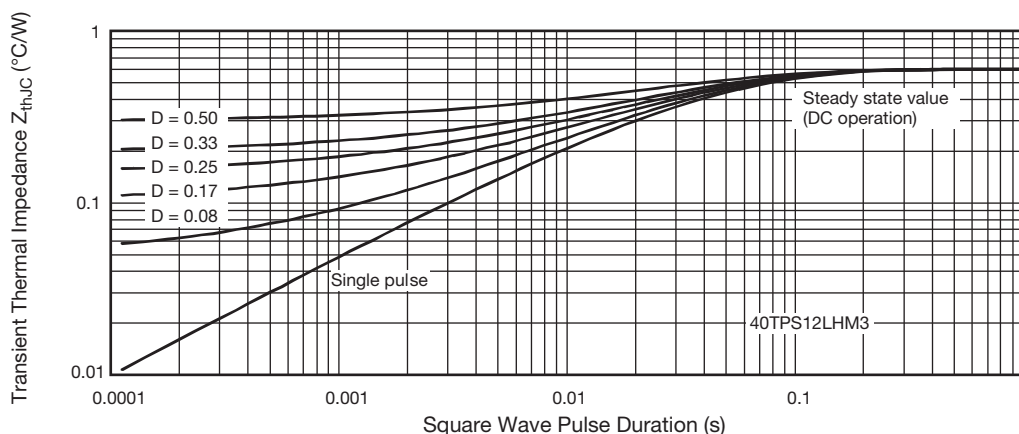


Fig. 8 - Gate Characteristics


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

## ORDERING INFORMATION TABLE

Device code	VS-	40	T	P	S	12	A	L	H	M3
	1	2	3	4	5	6	7	8	9	10
1	Vishay Semiconductors product									
2	Current rating (40 = 40 A)									
3	Circuit configuration: T = thyristor									
4	Package: P = TO-247									
5	Type of silicon: S = standard recovery rectifier									
6	Voltage ratings ————— 12 = 1200 V									
7	<ul style="list-style-type: none"> <li>A = Low Igt selection 40 mA maximum</li> <li>None = standard Igt selection</li> </ul>									
8	L = long leads									
9	H = AEC-Q101 qualified									
10	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-40TPS12LHM3	25	500	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-247AD 3L	<a href="http://www.vishay.com/doc?95626">www.vishay.com/doc?95626</a>
Part marking information	TO-247AD 3L	<a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a>



### TO-247AD 3L

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209	
A1	2.21	2.59	0.087	0.102	
A2	1.50	2.49	0.059	0.098	
b	0.99	1.40	0.039	0.055	
b1	0.99	1.35	0.039	0.053	
b2	1.65	2.39	0.065	0.094	
b3	1.65	2.34	0.065	0.092	
b4	2.59	3.43	0.102	0.135	
b5	2.59	3.38	0.102	0.133	
c	0.38	0.89	0.015	0.035	
c1	0.38	0.84	0.015	0.033	
D	19.71	20.70	0.776	0.815	3
D1	13.08	-	0.515	-	4

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	0.51	1.30	0.020	0.051	
E	15.29	15.87	0.602	0.625	3
E1	13.46	-	0.53	-	
e	5.46 BSC		0.215 BSC		
$\phi K$	0.254		0.010		
L	19.81	20.32	0.780	0.800	
L1	3.71	4.29	0.146	0.169	
$\phi P$	3.56	3.66	0.14	0.144	
$\phi P1$	-	6.98	-	0.275	
Q	5.31	5.69	0.209	0.224	
R	4.52	5.49	0.178	0.216	
S	5.51 BSC		0.217 BSC		

#### Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- $\phi P$  to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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