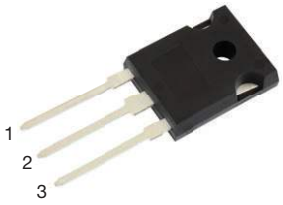
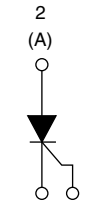
Thyristor High Voltage, Phase Control SCR, 50 A



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

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

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

DESCRIPTION

The VS-50TPS12 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching, and phase control applications.

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	50 A
V_{DRM}/V_{RRM}	1200 V
V_{TM} (typ.)	1.2 V
I_{GT} (typ.)	45 mA
T_J max.	150 °C
Package	TO-247AD 3L
Circuit configuration	Single SCR

MAJOR RATINGS AND CHARACTERISTICS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	V_{RRM} / V_{DRM}		1200	V
On-state voltage	V_T	50 A, T_J = 125 °C	1.2	
Average rectified forward current	$I_{T(AV)}$		50	A
Maximum continuous RMS on-state current	I_{RMS}		79	
Non-repetitive peak surge current	I_{TSM}		630	
Maximum rate of rise	dv/dt		1000	V/µs
Operating junction and storage temperature range	T_J, T_{Stg}		-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-50TPS12LHM3	1200	1300	70

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS		TYP.	MAX.	UNITS
Maximum average on-state current	$I_{T(AV)}$	T_C = 112 °C, 180° conduction half sine wave		-	50	A
Maximum continuous RMS on-state current as AC switch	$I_{T(RMS)}$			-	79	
Peak, one-cycle non-repetitive surge current	I_{TSM}	10 ms sine pulse, rated V_{RRM} applied	Initial $T_J = T_J$ maximum	-	530	
		10 ms sine pulse, no voltage reapplied		-	630	
I^2t for fusing	I^2t	10 ms sine pulse, rated V_{RRM} applied		-	1405	A^2s
		10 ms sine pulse, no voltage reapplied		-	1986	
$I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied, T_J = 125 °C		-	19 850	$A^2\sqrt{s}$
Low level value of threshold voltage	$V_{T(TO)1}$	T_J = 125 °C		-	0.89	V
High level value of threshold voltage	$V_{T(TO)2}$			-	0.97	
Low level value of on-state slope resistance	r_{t1}			-	6.77	mΩ
High level value of on-state slope resistance	r_{t2}			-	6.32	
On-state voltage	V_T	50 A, T_J = 25 °C		1.2	1.32	V
		100 A, T_J = 25 °C		1.4	1.6	
Rate of rise of turned-on current	di/dt	T_J = 25 °C		-	150	A/µs
Holding current	I_H	Anode supply = 6 V, resistive load, T_J = 25 °C		-	300	mA
Latching current	I_L			-	350	
Reverse and direct leakage current	I_{RRM}/I_{DRM}	T_J = 25 °C		-	0.05	
		T_J = 150 °C		-	70	
Rate of rise of off-state voltage	dv/dt	$T_J = T_J$ maximum, linear to 80 % V_{DRM}, R_g-k = 100 Ω		-	1000	V/µs

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS		TYP.	MAX.	UNITS
Peak gate power	P_{GM}	10 ms sine pulse, no voltage reapplied		-	10	W
Average gate power	$P_{G(AV)}$			-	2.5	
Peak gate current	I_{GM}			-	2.5	A
Peak negative gate voltage	$-V_{GM}$			-	10	V
Required DC gate voltage to trigger	V_{GT}	T_J = -40 °C	Anode supply = 6 V resistive load	-	1.6	
		T_J = 25 °C		-	1.5	
		T_J = 150 °C		-	1	
Required DC gate to trigger	I_{GT}	T_J = -40 °C	Anode supply = 6 V resistive load	-	160	mA
		T_J = 25 °C		45	100	
		T_J = 150 °C		-	60	
DC gate voltage not to trigger	V_{GD}	T_J = 150 °C, V_{DRM} = rated value		-	0.2	V
DC gate current not to trigger	I_{GD}			-	3	mA

SWITCHING

PARAMETER	SYMBOL	TEST CONDITIONS	TYP.	MAX.	UNITS
Turn-on time	t_{gt}	I_T = 50 A, V_D = 50 % V_{DRM}, I_{gt} = 300 mA, T_J = 25 °C	1.5	-	µs
Turn-off time	t_q	I_T = 50 A, V_D = 80 % V_{DRM}, dV/dt = 20 V/µs, t_p = 200 µs I_{gt} = 100 mA, dI/dt = 10 A/µs, V_R = 100 V, T_J = 150 °C	92	-	

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER		SYMBOL	TEST CONDITIONS	TYP.	MAX.	UNITS
Maximum junction and storage temperature range		T_J, T_{Stg}		-40	150	°C
Maximum thermal resistance, junction to case		R_{thJC}		-	0.35	°C/W
Maximum thermal resistance, junction to ambient		R_{thJA}		-	40	
Typical thermal resistance, case to heatsink		R_{thCS}	Mounting surface, smooth, and greased	0.2	-	
Mounting torque	minimum			6 (5)		kgf · cm (lbf · in)
	maximum			12 (10)		
Marking device			Case style Super TO-247AD 3L	50TPS12LH		

$\Delta R_{thJ\text{-}HS}$ CONDUCTION PER JUNCTION											
DEVICE	SINE HALF-WAVE CONDUCTION					RECTANGULAR WAVE CONDUCTION					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
VS-50TPS12LHM3	0.143	0.166	0.208	0.299	0.490	0.099	0.168	0.223	0.311	0.494	°C/W

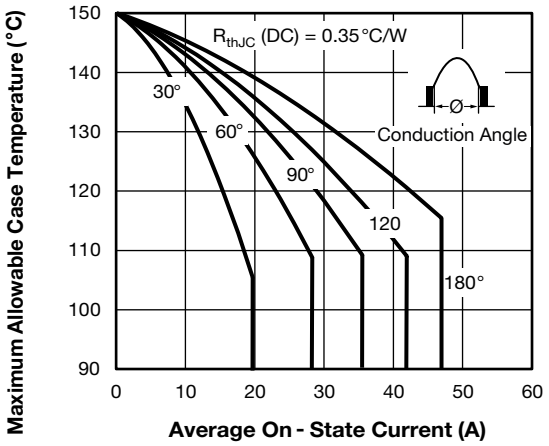


Fig. 1 - Current Rating Characteristics

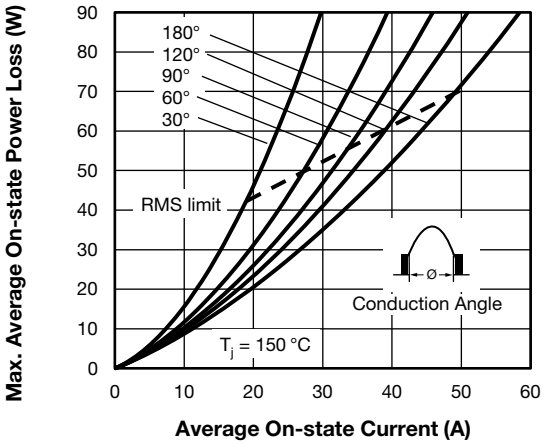


Fig. 3 - On-State Power Loss Characteristics

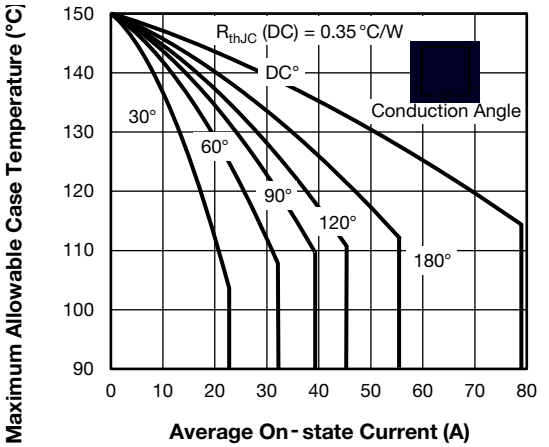


Fig. 2 - Current Rating Characteristics

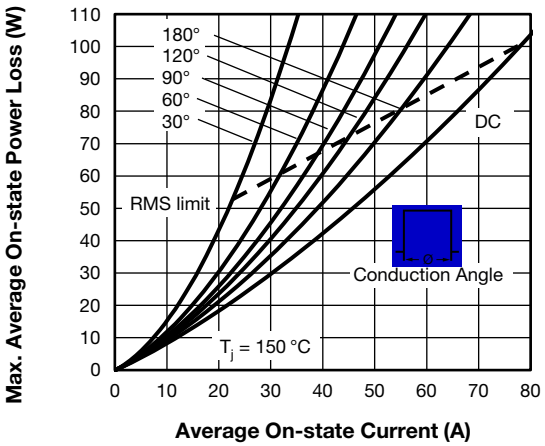


Fig. 4 - On-State Power Loss Characteristics

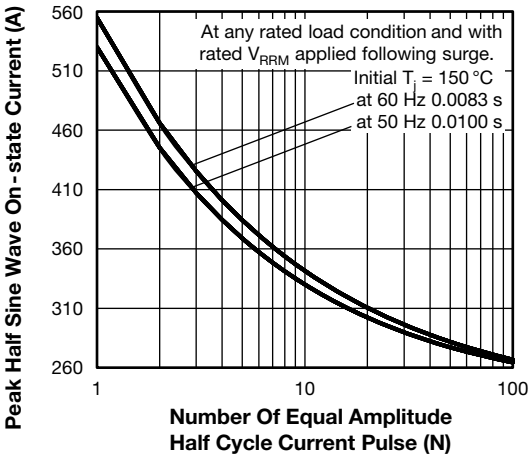


Fig. 5 - Maximum Non-Repetitive Surge Current

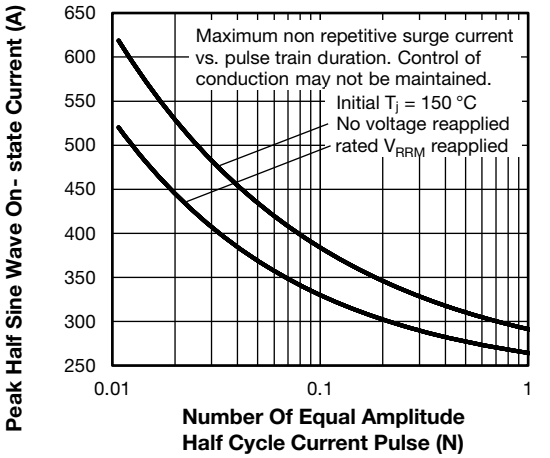


Fig. 6 - Maximum Non-Repetitive Surge Current

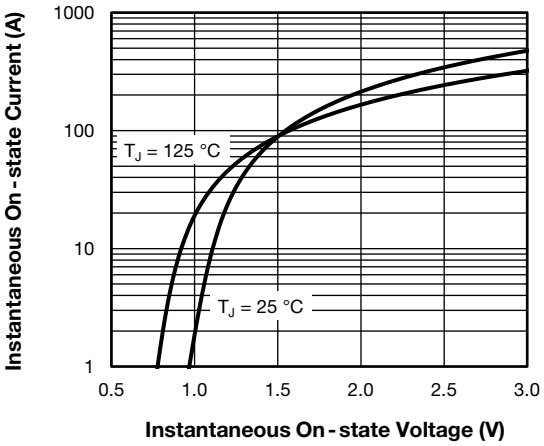


Fig. 7 - On-State Voltage Drop Characteristics

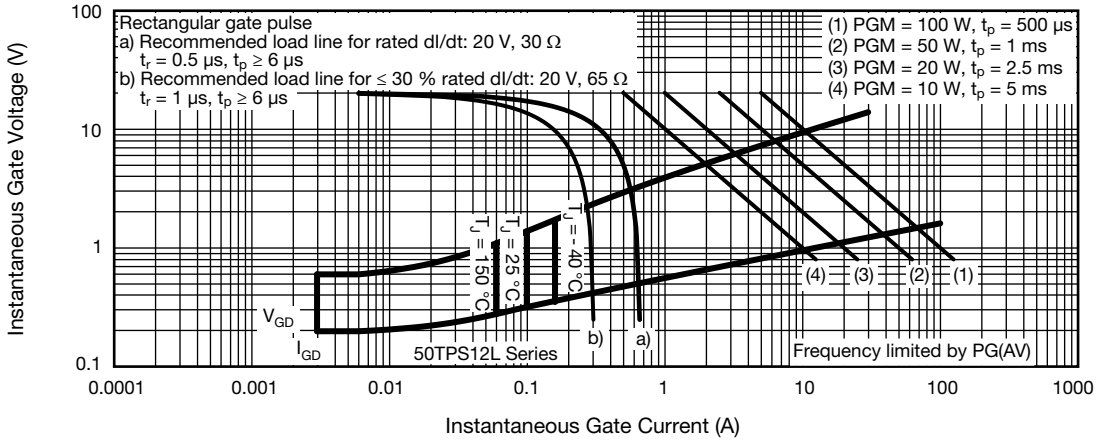


Fig. 8 - Gate Characteristics

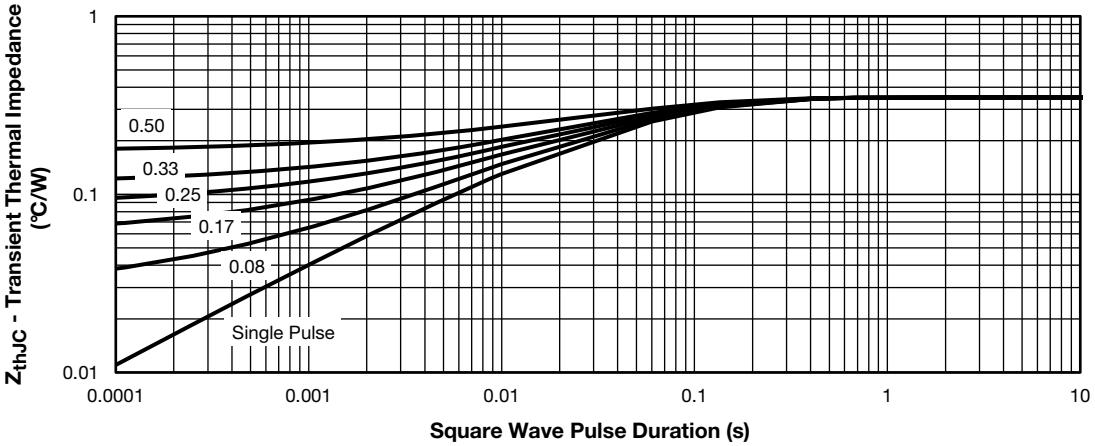


Fig. 9 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	50	T	P	S	12	L	H	M3
1	2	3	4	5	6	7	8	9

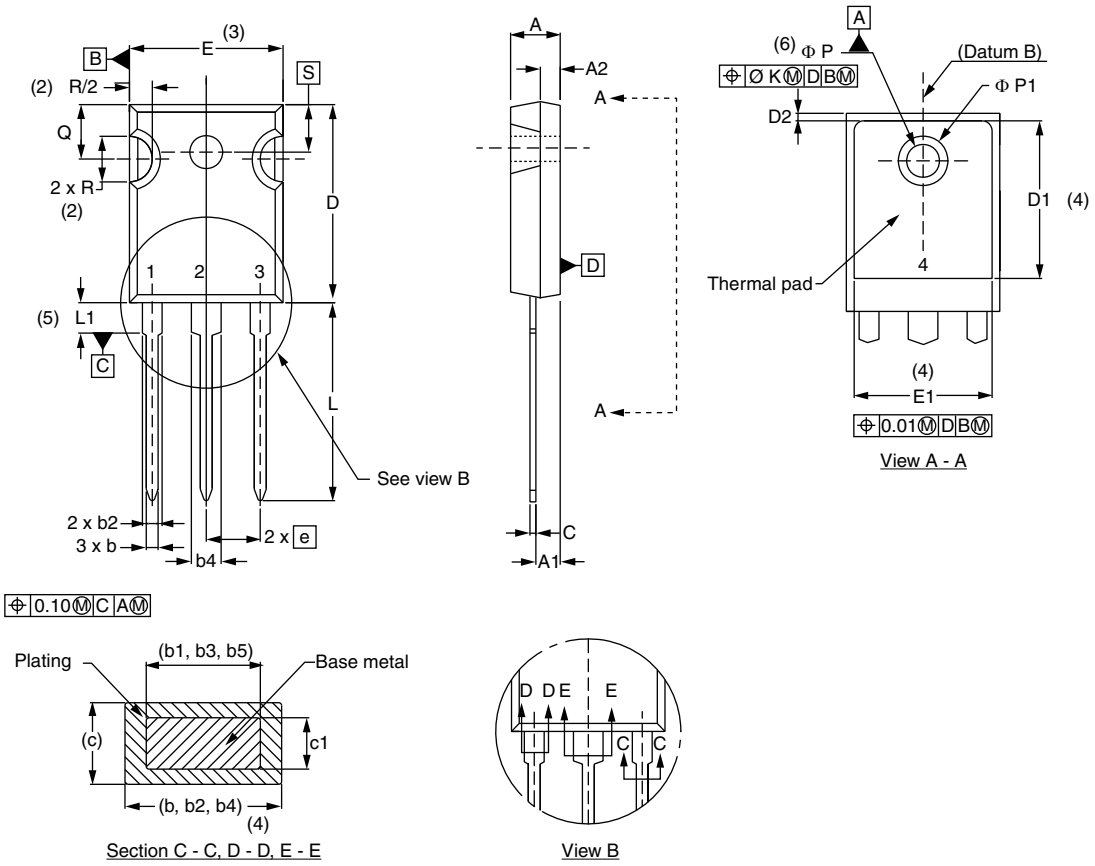
1 - Vishay Semiconductors product
2 - Current code (50 = 50 A)
3 - Circuit configuration:
T = thyristor
4 - P = TO-247AD package
5 - Type of silicon:
S = standard recovery rectifier
6 - Voltage code (12 = 1200 V)
7 - Package L = long lead
8 - H = AEC-Q101 qualified
9 - M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

ORDERING INFORMATION (example)			
PREFERRED P/N	**QUANTITY PER TUBE**	**MINIMUM ORDER QUANTITY**	**PACKAGING DESCRIPTION**
VS-50TPS12LHM3	25	contact factory	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-247AD 3L	www.vishay.com/doc?95626
Part marking information	TO-247AD 3L	www.vishay.com/doc?95007

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		
Ø K	0.254		0.010		
L	19.81	20.32	0.780	0.800	
L1	3.71	4.29	0.146	0.169	
Ø P	3.56	3.66	0.14	0.144	
Ø 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

(1) Dimensioning and tolerancing per ASME Y14.5M-1994
(2) Contour of slot optional
(3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
(4) Thermal pad contour optional with dimensions D1 and E1
(5) Lead finish uncontrolled in L1
(6) Ø 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")
(7) 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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