THE DATASHEET OF

PTVS22VS1UR,115

PTVSxS1UR series

400 W Transient Voltage Suppressor

Rev. 3 — 10 January 2011 Product data sheet

1. Product profile

1.1 General description

400 W unidirectional Transient Voltage Suppressor (TVS) in a SOD123W small and flat lead low-profile Surface-Mounted Device (SMD) plastic package, designed for transient overvoltage protection.

1.2 Features and benefits

- Rated peak pulse power: P_{PPM} = 400 W (350 W for 3V3)
- Reverse standoff voltage range: V_{RWM} = 3.3 V to 64 V
- Reverse current: I_{RM} = 0.001 μA
- Small plastic package suitable for surface-mounted design
- Very low package height: 1 mm
- AEC-Q101 qualified

1.3 Applications

- Power supply protection
- Automotive application
- Industrial application
- Power management

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_{PPM}	rated peak pulse power	[1][2]	-	-	400	W
V_{RWM}	reverse standoff voltage		3.3	-	64	V

[1] In accordance with IEC 61643-321 (10/1000 μs current waveform).

[2] For PTVS3V3S1UR: P_{PPM} = 350 W

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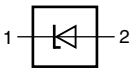
2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
1	cathode	[1]		
2	anode			

006aaa152

[1] The marking bar indicates the cathode.

3. Ordering information

Table 3. Ordering information

Type number[1]	Package		
	Name	Description	Version
PTVSxS1UR series	-	plastic surface-mounted package; 2 leads	SOD123W

[1] The series consists of 35 types with reverse standoff voltages from 3.3 V to 64 V.

4. Marking

Table 4. Marking codes

Type number	Marking code	Type number	Marking code
PTVS3V3S1UR	A1	PTVS20VS1UR	AL
PTVS5V0S1UR	A2	PTVS22VS1UR	AM
PTVS6V0S1UR	A3	PTVS24VS1UR	AN
PTVS6V5S1UR	A4	PTVS26VS1UR	AP
PTVS7V0S1UR	A5	PTVS28VS1UR	AR
PTVS7V5S1UR	A6	PTVS30VS1UR	AS
PTVS8V0S1UR	A7	PTVS33VS1UR	AT
PTVS8V5S1UR	A8	PTVS36VS1UR	AU
PTVS9V0S1UR	A9	PTVS40VS1UR	AV
PTVS10VS1UR	AA	PTVS43VS1UR	AW
PTVS11VS1UR	AB	PTVS45VS1UR	AX
PTVS12VS1UR	AC	PTVS48VS1UR	AY
PTVS13VS1UR	AD	PTVS51VS1UR	AZ
PTVS14VS1UR	AE	PTVS54VS1UR	B1
PTVS15VS1UR	AF	PTVS58VS1UR	B2
PTVS16VS1UR	AG	PTVS60VS1UR	B3
PTVS17VS1UR	AH	PTVS64VS1UR	B4
PTVS18VS1UR	AK	-	-

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5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
P_{PPM}	rated peak pulse power		[1][2]	-	400	W
I_{PPM}	rated peak pulse current		[1]	-	see Table 9 and 10	
I_{FSM}	Non-repetitive peak forward current	single half-sine wave; t_p = 8.3 ms		-	50	A
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−55	+150	°C
T_{stg}	storage temperature			−65	+150	°C

[1] In accordance with IEC 61643-321 (10/1000 μs current waveform).

[2] For PTVS3V3S1UR: P_{PPM} = 350 W

Table 6. ESD maximum ratings

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1][2]	-	30	kV

[1] Device stressed with ten non-repetitive ElectroStatic Discharge (ESD) pulses.

[2] Soldering point of cathode tab.

Table 7. ESD standards compliance

Standard	Conditions
Per diode	
IEC 61000-4-2; level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
MIL-STD-883; class 3 (human body model)	> 4 kV

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6. Thermal characteristics

Table 8. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	220	K/W
			[2]	-	-	130	K/W
			[3]	-	-	70	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[4]	-	-	18	K/W

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

[4] Soldering point of cathode tab.

7. Characteristics

Table 9. Characteristics per type; PTVS3V3S1UR to PTVS7V0S1UR

T_j = 25 °C unless otherwise specified.

Type number	Reverse standoff voltage V_{RWM} (V)	Breakdown voltage V_{BR} (V)			Reverse leakage current I_{RM} (μA)		Clamping voltage V_{CL} (V)	
		I_R = 10 mA			at V_{RWM} (V)			
	Max	Min	Typ	Max	Typ	Max	Max	I_{PPM} (A)
PTVS3V3S1UR	3.3	5.20	5.60	6.00	5	600	8.0	43.8
PTVS5V0S1UR	5.0	6.40	6.70	7.00	5	400	9.2	43.5
PTVS6V0S1UR	6.0	6.67	7.02	7.37	5	400	10.3	38.8
PTVS6V5S1UR	6.5	7.22	7.60	7.98	5	250	11.2	35.7
PTVS7V0S1UR	7.0	7.78	8.20	8.60	3	100	12.0	33.3

Table 10. Characteristics per type; PTVS7V5S1UR to PTVS64VS1UR

T_j = 25 °C unless otherwise specified.

Type number	Reverse standoff voltage V_{RWM} (V)	Breakdown voltage V_{BR} (V)			Reverse leakage current I_{RM} (μA)		Clamping voltage V_{CL} (V)	
		I_R = 1 mA			at V_{RWM} (V)			
	Max	Min	Typ	Max	Typ	Max	Max	I_{PPM} (A)
PTVS7V5S1UR	7.5	8.33	8.77	9.21	0.2	50	12.9	31.0
PTVS8V0S1UR	8.0	8.89	9.36	9.83	0.03	25	13.6	29.4
PTVS8V5S1UR	8.5	9.44	9.92	10.40	0.01	10	14.4	27.8
PTVS9V0S1UR	9.0	10.00	10.55	11.10	0.005	5	15.4	26.0
PTVS10VS1UR	10	11.10	11.70	12.30	0.005	2.5	17.0	23.5
PTVS11VS1UR	11	12.20	12.85	13.50	0.005	2.5	18.2	22.0
PTVS12VS1UR	12	13.30	14.00	14.70	0.005	2.5	19.9	20.1
PTVS13VS1UR	13	14.40	15.15	15.90	0.001	0.1	21.5	18.6

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Table 10. Characteristics per type; PTVS7V5S1UR to PTVS64VS1UR *…continued*

T_j = 25 °C unless otherwise specified.

Type number	Reverse standoff voltage V_{RWM} (V)	Breakdown voltage V_{BR} (V)			Reverse leakage current I_{RM} (μA)		Clamping voltage V_{CL} (V)	
		I_R = 1 mA			at V_{RWM} (V)			
	Max	Min	Typ	Max	Typ	Max	Max	I_{PPM} (A)
PTVS14VS1UR	14	15.60	16.40	17.20	0.001	0.1	23.2	17.2
PTVS15VS1UR	15	16.70	17.60	18.50	0.001	0.1	24.4	16.4
PTVS16VS1UR	16	17.80	18.75	19.70	0.001	0.1	26.0	15.4
PTVS17VS1UR	17	18.90	19.90	20.90	0.001	0.1	27.6	14.5
PTVS18VS1UR	18	20.00	21.00	22.10	0.001	0.1	29.2	13.7
PTVS20VS1UR	20	22.20	23.35	24.50	0.001	0.1	32.4	12.3
PTVS22VS1UR	22	24.40	25.60	26.90	0.001	0.1	35.5	11.3
PTVS24VS1UR	24	26.70	28.10	29.50	0.001	0.1	38.9	10.3
PTVS26VS1UR	26	28.90	30.40	31.90	0.001	0.1	42.1	9.5
PTVS28VS1UR	28	31.10	32.80	34.40	0.001	0.1	45.4	8.8
PTVS30VS1UR	30	33.30	35.10	36.80	0.001	0.1	48.4	8.3
PTVS33VS1UR	33	36.70	38.70	40.60	0.001	0.1	53.3	7.5
PTVS36VS1UR	36	40.00	42.10	44.20	0.001	0.1	58.1	6.9
PTVS40VS1UR	40	44.40	46.80	49.10	0.001	0.1	64.5	6.2
PTVS43VS1UR	43	47.80	50.30	52.80	0.001	0.1	69.4	5.8
PTVS45VS1UR	45	50.00	52.65	55.30	0.001	0.1	72.7	5.5
PTVS48VS1UR	48	53.30	56.10	58.90	0.001	0.1	77.4	5.2
PTVS51VS1UR	51	56.70	59.70	62.70	0.001	0.1	82.4	4.9
PTVS54VS1UR	54	60.00	63.15	66.30	0.001	0.1	87.1	4.6
PTVS58VS1UR	58	64.40	67.80	71.20	0.001	0.1	93.6	4.3
PTVS60VS1UR	60	66.70	70.20	73.70	0.001	0.1	96.8	4.1
PTVS64VS1UR	64	71.10	74.85	78.60	0.001	0.1	103.0	3.9

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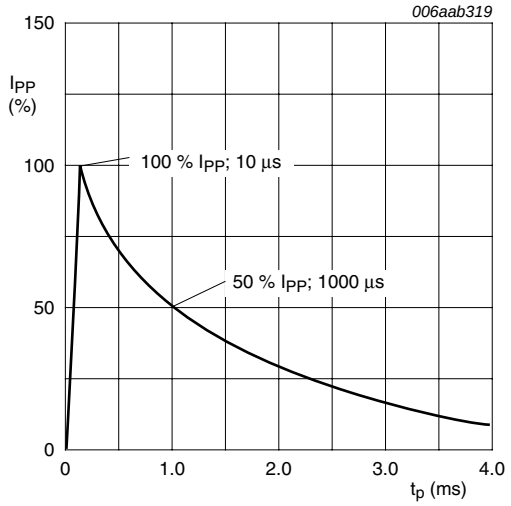


Fig 1. 10/1000 µs pulse waveform according to IEC 61643-321

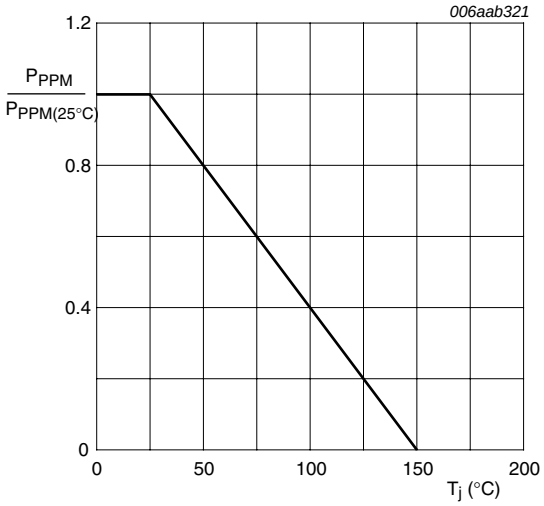
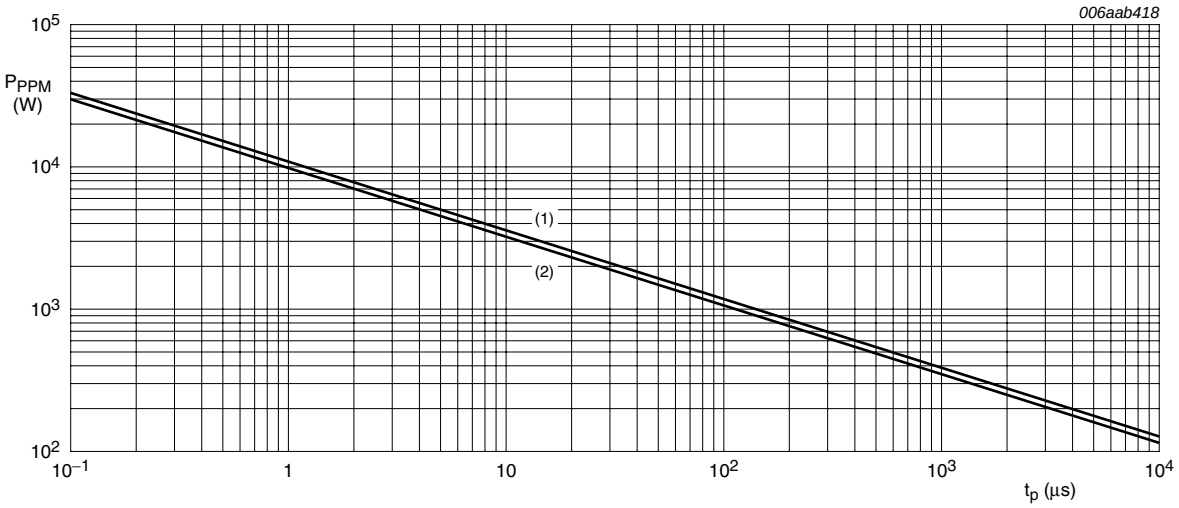


Fig 2. Relative variation of rated peak pulse power as a function of junction temperature; typical values



T_{amb} = 25 °C

(1) PTVS5V0S1UR to PTVS64VS1UR

(2) PTVS3V3S1UR

Fig 3. Rated peak pulse power as a function of pulse duration; typical values

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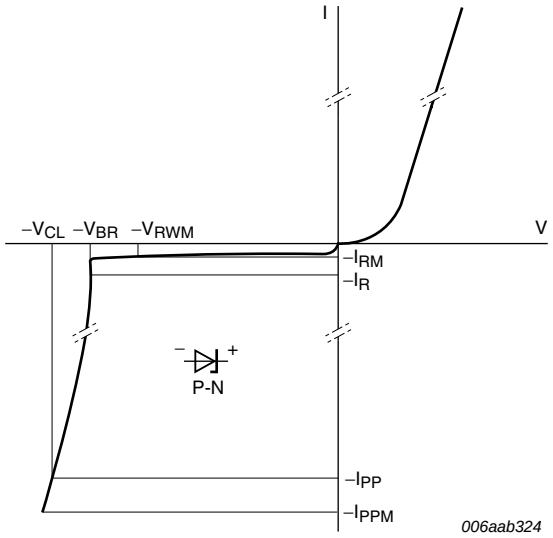

Fig 4. V-I characteristics for a unidirectional TVS protection diode

8. Test information

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline

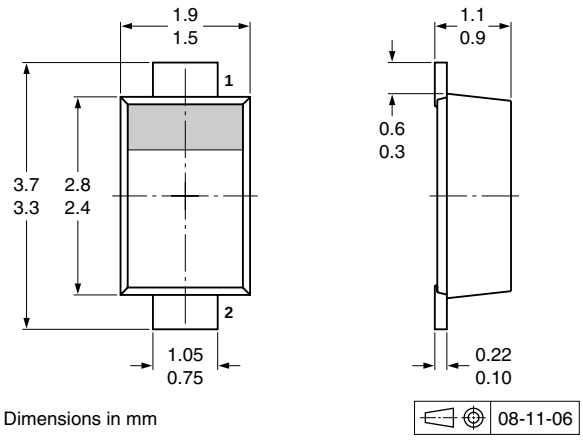

Fig 5. Package outline SOD123W

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10. Packing information

Table 11. Packing methods

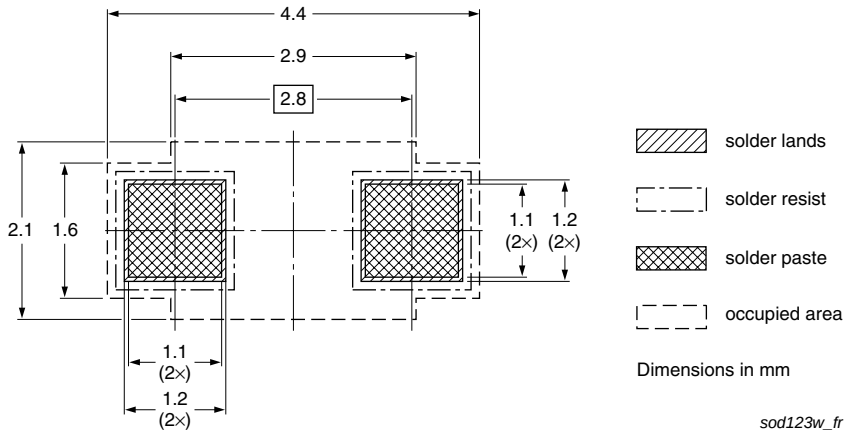
The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number[2]	Package	Description	Packing quantity
			3000
PTVSxS1UR series	SOD123W	4 mm pitch, 8 mm tape and reel	-115

[1] For further information and the availability of packing methods, see Section 14.

[2] The series consists of 35 types with reverse standoff voltages from 3.3 V to 64 V.

11. Soldering



Reflow soldering is the only recommended soldering method.

Fig 6. Reflow soldering footprint SOD123W

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12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PTVSXS1UR_SER v.3	20110110	Product data sheet	-	PTVSXS1UR_SER v.2
Modifications:	• Table 6 and 7: added. • Section 13 “Legal information”: updated.			
PTVSXS1UR_SER v.2	20090910	Product data sheet	-	PTVSXS1UR_SER v.1
PTVSXS1UR_SER v.1	20090202	Product data sheet	-	-

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13. Legal information

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Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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[2] The term 'short data sheet' is explained in section "Definitions".

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