



**THE DATASHEET OF
PTVS36VS1UTR,115**





PTVSxS1UTR series

High-temperature 400 W Transient Voltage Suppressor

Rev. 1 — 11 October 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 in high-temperature applications.

1.2 Features and benefits

- Rated peak pulse power:
 $P_{PPM} = 400 \text{ W}$ (350 W for 3V3)
- Reverse standoff voltage range:
 $V_{RWM} = 3.3 \text{ V}$ to 64 V
- Reverse current: $I_{RM} = 0.001 \mu\text{A}$
- Very low package height: 1 mm
- High temperature stability $T_j \leq 185 \text{ }^\circ\text{C}$
- Small plastic package suitable for surface-mounted design
- AEC-Q101 qualified

1.3 Applications

- Power supply protection
- Automotive application
- Industrial application
- Power management
- High-temperature applications

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 PTVS3V3S1UTR: $P_{PPM} = 350 \text{ W}$

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 |
| PTVSxS1UTR 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 |
|--------------|--------------|--------------|--------------|
| PTVS3V3S1UTR | C2 | PTVS20VS1UTR | CL |
| PTVS5V0S1UTR | C3 | PTVS22VS1UTR | CM |
| PTVS6V0S1UTR | C4 | PTVS24VS1UTR | CN |
| PTVS6V5S1UTR | C5 | PTVS26VS1UTR | CP |
| PTVS7V0S1UTR | C6 | PTVS28VS1UTR | CR |
| PTVS7V5S1UTR | C7 | PTVS30VS1UTR | CS |
| PTVS8V0S1UTR | C8 | PTVS33VS1UTR | CT |
| PTVS8V5S1UTR | C9 | PTVS36VS1UTR | CU |
| PTVS9V0S1UTR | CA | PTVS40VS1UTR | CV |
| PTVS10VS1UTR | CB | PTVS43VS1UTR | CW |
| PTVS11VS1UTR | CC | PTVS45VS1UTR | CX |
| PTVS12VS1UTR | CD | PTVS48VS1UTR | CY |
| PTVS13VS1UTR | CE | PTVS51VS1UTR | CZ |
| PTVS14VS1UTR | CF | PTVS54VS1UTR | D1 |
| PTVS15VS1UTR | CG | PTVS58VS1UTR | D2 |
| PTVS16VS1UTR | CH | PTVS60VS1UTR | D3 |
| PTVS17VS1UTR | CJ | PTVS64VS1UTR | D4 |
| PTVS18VS1UTR | CK | - | - |

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 | | - | 185 | °C |
| T_{amb} | ambient temperature | | -55 | +185 | °C |
| T_{stg} | storage temperature | | -65 | +185 | °C |

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

[2] For PTVS3V3S1UTR: $P_{PPM} = 350$ 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; level 4 (contact discharge) | [1] - | 30 | kV |

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

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 3B (human body model) | > 8 kV |

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 cm².

[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

[4] Soldering point of cathode tab.

7. Characteristics

Table 9. Characteristics per type; PTVS3V3S1UTR to PTVS7V0S1UTR

$T_j = 25\text{ °C}$ unless otherwise specified.

| Type number PTVSxxx S1UTR | Reverse standoff voltage V_{RWM} (V) | Breakdown voltage V_{BR} (V) | | | Reverse leakage current I_{RM} (μ A) | | | Clamping voltage V_{CL} (V) | | Temperature coefficient S_Z (mV/K) |
|---------------------------------|---|-----------------------------------|------|------|--|-----|---------------------------------------|-------------------------------|---------------|---|
| | | $I_R = 10\text{ mA}$ | | | at V_{RWM} | | at V_{RWM} $T_j = 150\text{ °C}$ | Max | I_{PPM} (A) | $I_Z = 5\text{ mA}$ |
| | | Min | Typ | Max | Typ | Max | Typ | | | Typ |
| 3V3 | 3.3 | 5.20 | 5.60 | 6.00 | 5 | 600 | 17 | 8.0 | 43.8 | -1.0 |
| 5V0 | 5.0 | 6.40 | 6.70 | 7.00 | 5 | 400 | 17 | 9.2 | 43.5 | 2.5 |
| 6V0 | 6.0 | 6.67 | 7.02 | 7.37 | 5 | 400 | 17 | 10.3 | 38.8 | 3.2 |
| 6V5 | 6.5 | 7.22 | 7.60 | 7.98 | 5 | 250 | 17 | 11.2 | 35.7 | 3.6 |
| 7V0 | 7.0 | 7.78 | 8.20 | 8.60 | 3 | 100 | 9 | 12.0 | 33.3 | 4.3 |

Table 10. Characteristics per type; PTVS7V5S1UTR to PTVS64VS1UTR

 $T_j = 25\text{ °C}$ unless otherwise specified.

| Type number PTVSxxx S1UTR | Reverse standoff voltage V_{RWM} (V) | Breakdown voltage V_{BR} (V) | | | Reverse leakage current I_{RM} (μ A) | | | Clamping voltage V_{CL} (V) | | Temperature coefficient S_Z (mV/K) |
|---------------------------------|---|-----------------------------------|-------|-------|--|-----|---------------------------------------|-------------------------------|---------------|---|
| | | $I_R = 1\text{ mA}$ | | | at V_{RWM} | | at V_{RWM} $T_j = 150\text{ °C}$ | Max | I_{PPM} (A) | $I_Z = 5\text{ mA}$ |
| | Max | Min | Typ | Max | Typ | Max | Typ | | | Typ |
| 7V5 | 7.5 | 8.33 | 8.77 | 9.21 | 0.2 | 50 | 2 | 12.9 | 31.0 | 5.0 |
| 8V0 | 8.0 | 8.89 | 9.36 | 9.83 | 0.03 | 25 | 2 | 13.6 | 29.4 | 5.5 |
| 8V5 | 8.5 | 9.44 | 9.92 | 10.40 | 0.01 | 10 | 0.5 | 14.4 | 27.8 | 6.5 |
| 9V0 | 9.0 | 10.00 | 10.55 | 11.10 | 0.005 | 5 | 0.5 | 15.4 | 26.0 | 7.1 |
| 10V | 10 | 11.10 | 11.70 | 12.30 | 0.005 | 2.5 | 0.5 | 17.0 | 23.5 | 8.1 |
| 11V | 11 | 12.20 | 12.85 | 13.50 | 0.005 | 2.5 | 0.5 | 18.2 | 22.0 | 9.2 |
| 12V | 12 | 13.30 | 14.00 | 14.70 | 0.005 | 2.5 | 0.5 | 19.9 | 20.1 | 10.3 |
| 13V | 13 | 14.40 | 15.15 | 15.90 | 0.001 | 0.1 | 0.5 | 21.5 | 18.6 | 11.4 |
| 14V | 14 | 15.60 | 16.40 | 17.20 | 0.001 | 0.1 | 0.5 | 23.2 | 17.2 | 13.2 |
| 15V | 15 | 16.70 | 17.60 | 18.50 | 0.001 | 0.1 | 0.5 | 24.4 | 16.4 | 14.1 |
| 16V | 16 | 17.80 | 18.75 | 19.70 | 0.001 | 0.1 | 0.5 | 26.0 | 15.4 | 15.9 |
| 17V | 17 | 18.90 | 19.90 | 20.90 | 0.001 | 0.1 | 0.5 | 27.6 | 14.5 | 16.4 |
| 18V | 18 | 20.00 | 21.00 | 22.10 | 0.001 | 0.1 | 0.5 | 29.2 | 13.7 | 18.5 |
| 20V | 20 | 22.20 | 23.35 | 24.50 | 0.001 | 0.1 | 0.5 | 32.4 | 12.3 | 20.0 |
| 22V | 22 | 24.40 | 25.60 | 26.90 | 0.001 | 0.1 | 0.5 | 35.5 | 11.3 | 23.8 |
| 24V | 24 | 26.70 | 28.10 | 29.50 | 0.001 | 0.1 | 0.5 | 38.9 | 10.3 | 24.9 |
| 26V | 26 | 28.90 | 30.40 | 31.90 | 0.001 | 0.1 | 0.5 | 42.1 | 9.5 | 29.1 |
| 28V | 28 | 31.10 | 32.80 | 34.40 | 0.001 | 0.1 | 0.5 | 45.4 | 8.8 | 30.6 |
| 30V | 30 | 33.30 | 35.10 | 36.80 | 0.001 | 0.1 | 0.5 | 48.4 | 8.3 | 34.4 |
| 33V | 33 | 36.70 | 38.70 | 40.60 | 0.001 | 0.1 | 0.5 | 53.3 | 7.5 | 37.5 |
| 36V | 36 | 40.00 | 42.10 | 44.20 | 0.001 | 0.1 | 0.5 | 58.1 | 6.9 | 42.3 |
| 40V | 40 | 44.40 | 46.80 | 49.10 | 0.001 | 0.1 | 0.5 | 64.5 | 6.2 | 48.1 |
| 43V | 43 | 47.80 | 50.30 | 52.80 | 0.001 | 0.1 | 0.5 | 69.4 | 5.8 | 51.6 |
| 45V | 45 | 50.00 | 52.65 | 55.30 | 0.001 | 0.1 | 0.5 | 72.7 | 5.5 | 55.2 |
| 48V | 48 | 53.30 | 56.10 | 58.90 | 0.001 | 0.1 | 0.5 | 77.4 | 5.2 | 58.2 |
| 51V | 51 | 56.70 | 59.70 | 62.70 | 0.001 | 0.1 | 0.5 | 82.4 | 4.9 | 62.5 |
| 54V | 54 | 60.00 | 63.15 | 66.30 | 0.001 | 0.1 | 0.5 | 87.1 | 4.6 | 66.1 |
| 58V | 58 | 64.40 | 67.80 | 71.20 | 0.001 | 0.1 | 0.5 | 93.6 | 4.3 | 71.4 |
| 60V | 60 | 66.70 | 70.20 | 73.70 | 0.001 | 0.1 | 0.5 | 96.8 | 4.1 | 74.1 |
| 64V | 64 | 71.10 | 74.85 | 78.60 | 0.001 | 0.1 | 0.5 | 103.0 | 3.9 | 80.0 |

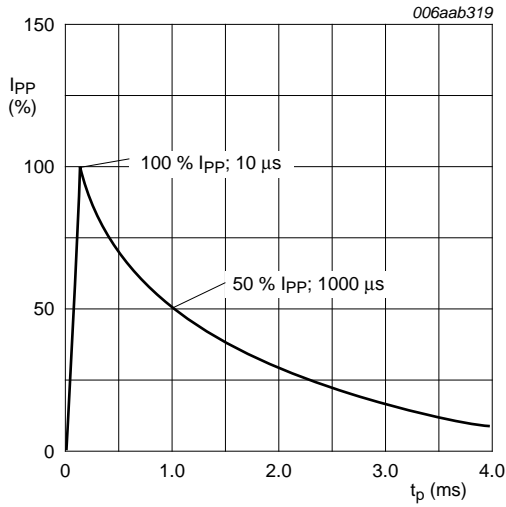


Fig 1. 10/1000 μ s pulse waveform according to IEC 61643-321

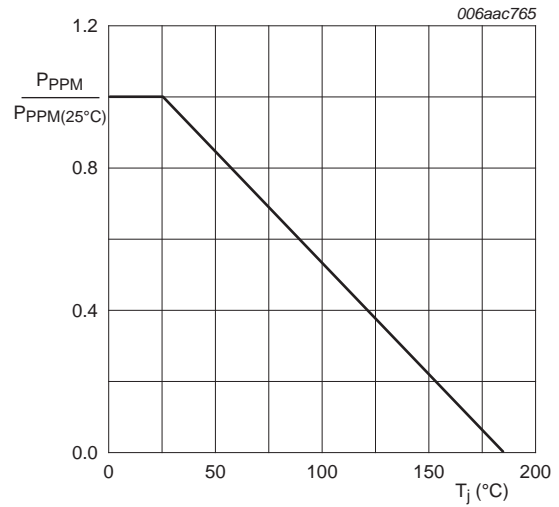
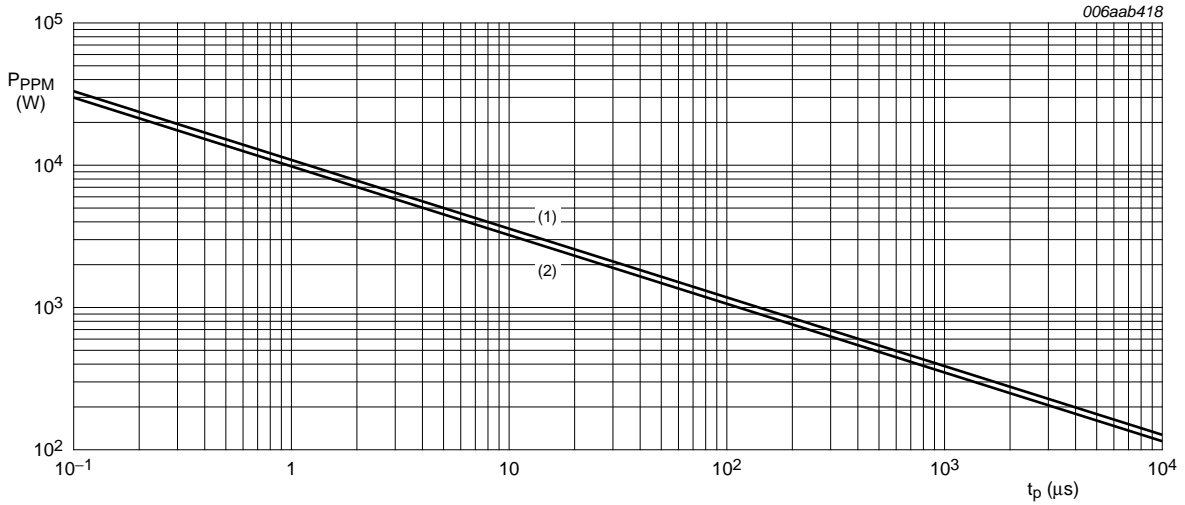


Fig 2. Relative variation of rated peak pulse power as a function of junction temperature; typical values



$T_{amb} = 25^\circ C$
 (1) PTVS5V0S1UTR to PTVS64VS1UTR
 (2) PTVS3V3S1UTR

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



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

10. Packing information

Table 11. Packing methods

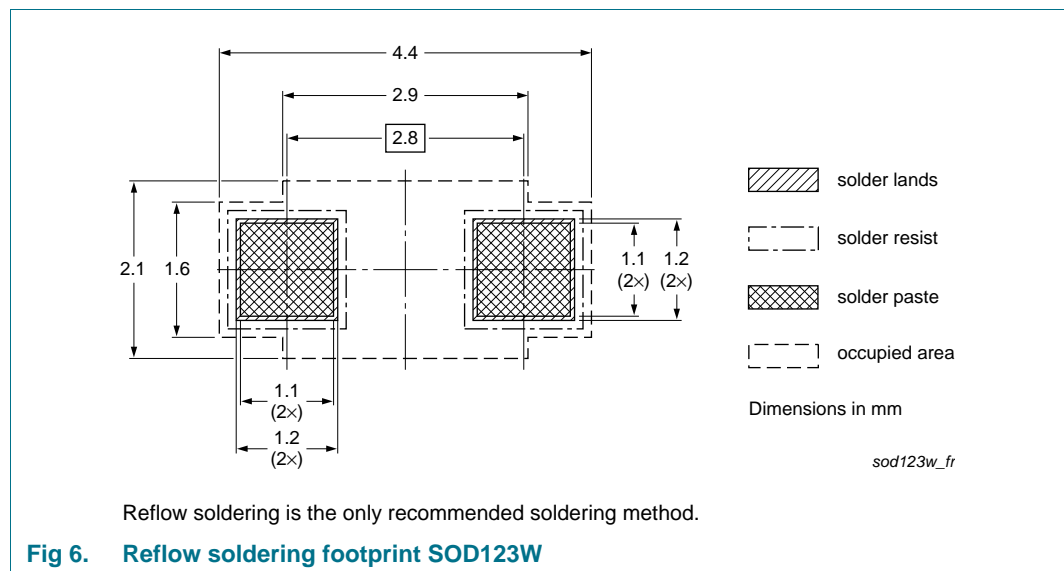
The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

| Type number ^[2] | Package | Description | Packing quantity |
|----------------------------|---------|--------------------------------|------------------|
| PTVSxS1UTR series | SOD123W | 4 mm pitch, 8 mm tape and reel | 3000 |
| | | | -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



12. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------|--------------|--------------------|---------------|------------|
| PTVSXS1UTR_SER v.1 | 20111011 | Product data sheet | - | - |

13. Legal information

13.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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