



# THE DATASHEET OF PTVS16VS1UTR,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

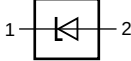
| Symbol    | Parameter                | Conditions | Min | Typ | Max | Unit |
|-----------|--------------------------|------------|-----|-----|-----|------|
| $P_{PPM}$ | rated peak pulse power   | [1][2]     | -   | -   | 400 | W    |
| $V_{RWM}$ | reverse standoff voltage |            | 3.3 | -  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

[1] In accordance with IEC 61643-321 (10/1000  $\mu\text{s}$  current waveform).

[2] For PTVS3V3S1UTR:  $P_{PPM} = 350 \text{ W}$

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline                                                                  | Graphic symbol                                                                      |
|-----|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | cathode     |  |  |
| 2   | anode       |                                                                                     |                                                                                     |

[1] The marking bar indicates the cathode.

## 3. Ordering information

Table 3. Ordering information

| Type number <sup>[1]</sup> | 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<br>Table 9<br>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  $\mu$ 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 |
|------------------|---------------------------------|--------------------------------------------|-----|------|------|
| <b>Per diode</b> |                                 |                                            |     |      |      |
| $V_{ESD}$        | 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                      |
|------------------------------------------|---------------------------------|
| <b>Per diode</b>                         |                                 |
| 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 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, 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<br>PTVSxxx<br>S1UTR | Reverse standoff voltage<br>$V_{RWM}$ (V) | Breakdown voltage<br>$V_{BR}$ (V) |      |      | Reverse leakage current<br>$I_{RM}$ (μA) |     |                                       | Clamping voltage $V_{CL}$ (V) |               | Temperature coefficient<br>$S_Z$ (mV/K) |
|---------------------------------|-------------------------------------------|-----------------------------------|------|------|------------------------------------------|-----|---------------------------------------|-------------------------------|---------------|-----------------------------------------|
|                                 |                                           | $I_R = 10\text{ mA}$              |      |      | at $V_{RWM}$                             |     | at $V_{RWM}$<br>$T_j = 150\text{ °C}$ |                               |               | $I_Z = 5\text{ mA}$                     |
|                                 | Max                                       | Min                               | Typ  | Max  | Typ                                      | Max | Typ                                   | Max                           | $I_{PPM}$ (A) | 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<br>PTVSxxx<br>S1UTR | Reverse<br>standoff<br>voltage<br>$V_{RWM}$ (V) | Breakdown voltage<br>$V_{BR}$ (V) |       |       | Reverse leakage current<br>$I_{RM}$ ( $\mu$ A) |     |                                       | Clamping<br>voltage $V_{CL}$ (V) |               | Temperature<br>coefficient<br>$S_Z$ (mV/K) |
|---------------------------------|-------------------------------------------------|-----------------------------------|-------|-------|------------------------------------------------|-----|---------------------------------------|----------------------------------|---------------|--------------------------------------------|
|                                 |                                                 | $I_R = 1\text{ mA}$               |       |       | at $V_{RWM}$                                   |     | at $V_{RWM}$<br>$T_j = 150\text{ °C}$ |                                  |               | $I_Z = 5\text{ mA}$                        |
|                                 | Max                                             | Min                               | Typ   | Max   | Typ                                            | Max | Typ                                   | Max                              | $I_{PPM}$ (A) | 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                                       |

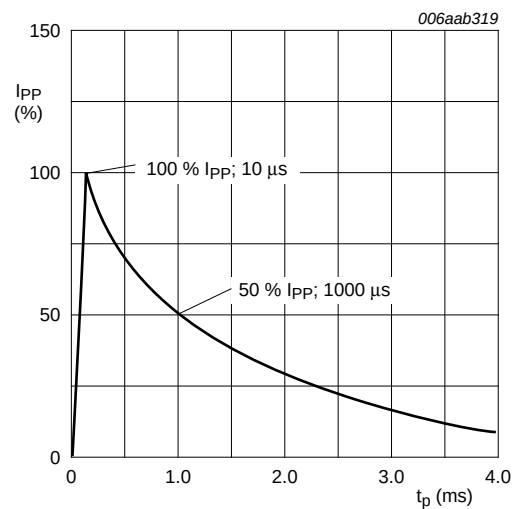


Fig 1. 10/1000  $\mu$ s pulse waveform according to IEC 61643-321

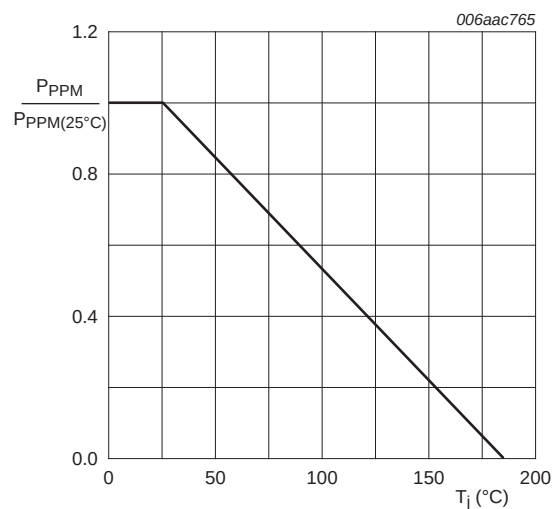
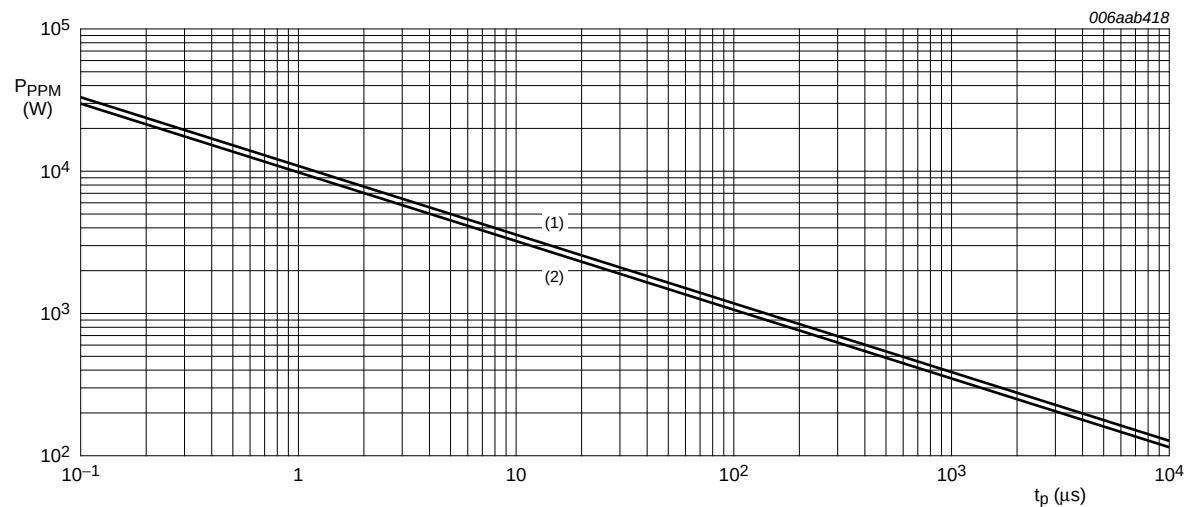
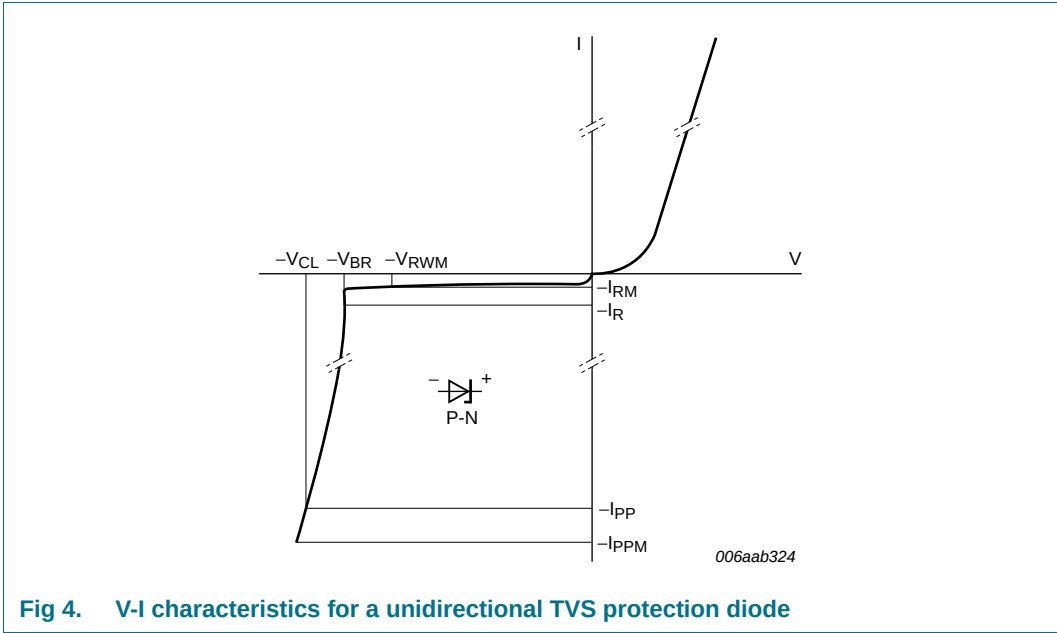


Fig 2. Relative variation of rated peak pulse power as a function of junction temperature; typical values



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

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

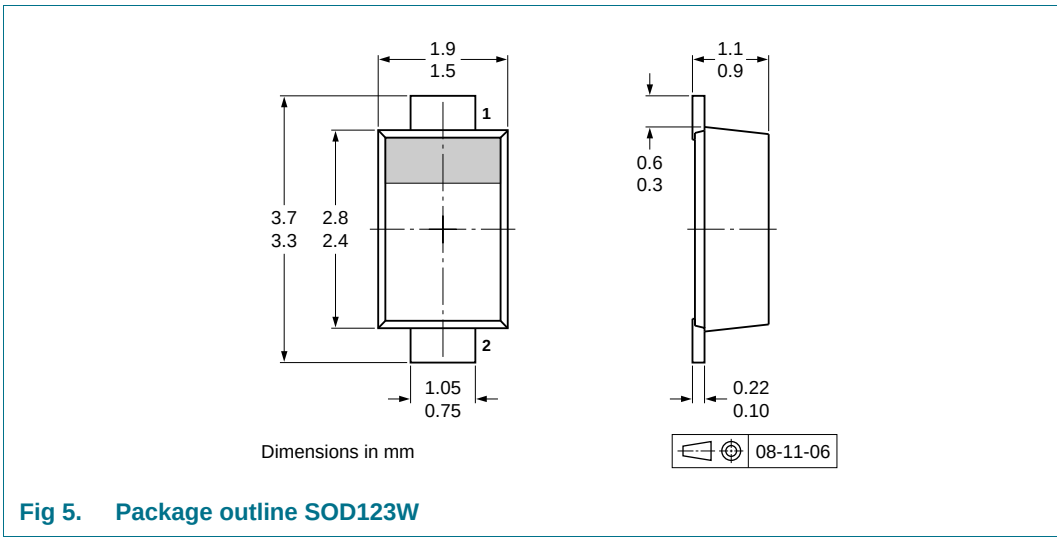


8. Test information

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



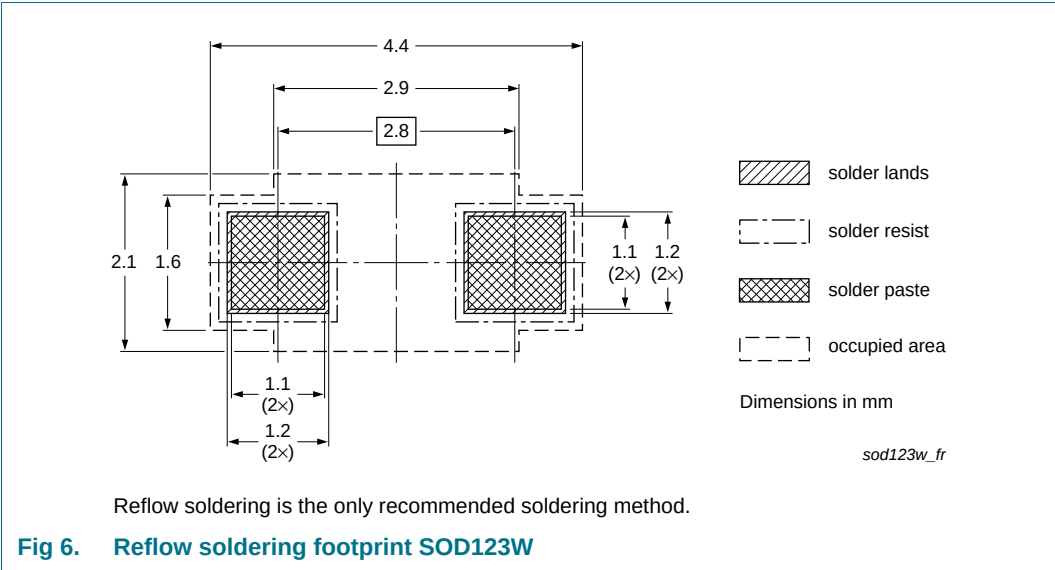
10. Packing information

Table 11. Packing methods  
The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number <sup>[2]</sup> | Package | Description                    | Packing quantity |
|----------------------------|---------|--------------------------------|------------------|
|                            |         |                                | 3000             |
| PTVSxS1UTR 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



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 <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

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## 14. Contact information

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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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