
# PTVSxP1UP series

## 600 W Transient Voltage Suppressor

Rev. 2 — 6 January 2011 Product data sheet

## 1. Product profile

### 1.1 General description

600 W unidirectional Transient Voltage Suppressor (TVS) in a SOD128 small and flat lead Surface-Mounted Device (SMD) plastic package, designed for transient overvoltage protection.

### 1.2 Features and benefits

- Rated peak pulse power: $P_{PPM}$ = 600 W
- Reverse standoff voltage range: $V_{RWM}$ = 3.3 V to 64 V
- Reverse current: $I_{RM}$ = 0.001 μA
- Very low package height: 1 mm
- Small plastic package suitable for surface-mounted design
- 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] | - | - | 600 | W |
| $V_{RWM}$ | reverse standoff voltage | | | 3.3 | - | 64 | V |

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

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## 2. Pinning information

**Table 2. Pinning**

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





[1] The marking bar indicates the cathode.

## 3. Ordering information

**Table 3. Ordering information**

| Type number[1] | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PTVSxP1UP series | - | plastic surface-mounted package; 2 leads | SOD128 |

[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 |
|---|---|---|---|
| PTVS3V3P1UP | AJ | PTVS20VP1UP | B3 |
| PTVS5V0P1UP | AK | PTVS22VP1UP | B4 |
| PTVS6V0P1UP | AL | PTVS24VP1UP | B5 |
| PTVS6V5P1UP | AM | PTVS26VP1UP | B6 |
| PTVS7V0P1UP | AN | PTVS28VP1UP | B7 |
| PTVS7V5P1UP | AP | PTVS30VP1UP | B8 |
| PTVS8V0P1UP | AQ | PTVS33VP1UP | B9 |
| PTVS8V5P1UP | AR | PTVS36VP1UP | BA |
| PTVS9V0P1UP | AS | PTVS40VP1UP | BB |
| PTVS10VP1UP | AT | PTVS43VP1UP | BC |
| PTVS11VP1UP | AU | PTVS45VP1UP | BD |
| PTVS12VP1UP | AV | PTVS48VP1UP | BE |
| PTVS13VP1UP | AW | PTVS51VP1UP | BF |
| PTVS14VP1UP | AX | PTVS54VP1UP | BG |
| PTVS15VP1UP | AY | PTVS58VP1UP | BH |
| PTVS16VP1UP | AZ | PTVS60VP1UP | BJ |
| PTVS17VP1UP | B1 | PTVS64VP1UP | BK |
| PTVS18VP1UP | B2 | - | - |

# 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] | - | 600 | 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 | | - | 100 | 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).

**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 |

# 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] | - | - | 200 | K/W |
| | | | [2] | - | - | 120 | K/W |
| | | | [3] | - | - | 60 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | [4] | - | - | 12 | 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; PTVS3V3P1UP to PTVS7V0P1UP**

*$T_j$ = 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) |
| PTVS3V3P1UP | 3.3 | 5.20 | 5.60 | 6.00 | 5 | 600 | 8.0 | 75.0 |
| PTVS5V0P1UP | 5.0 | 6.40 | 6.70 | 7.00 | 5 | 400 | 9.2 | 65.2 |
| PTVS6V0P1UP | 6.0 | 6.67 | 7.02 | 7.37 | 5 | 400 | 10.3 | 58.3 |
| PTVS6V5P1UP | 6.5 | 7.22 | 7.60 | 7.98 | 5 | 250 | 11.2 | 53.6 |
| PTVS7V0P1UP | 7.0 | 7.78 | 8.20 | 8.60 | 3 | 100 | 12.0 | 50.0 |

**Table 10. Characteristics per type; PTVS7V5P1UP to PTVS64VP1UP**

*$T_j$ = 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) |
| PTVS7V5P1UP | 7.5 | 8.33 | 8.77 | 9.21 | 0.2 | 50 | 12.9 | 46.5 |
| PTVS8V0P1UP | 8.0 | 8.89 | 9.36 | 9.83 | 0.03 | 25 | 13.6 | 44.1 |
| PTVS8V5P1UP | 8.5 | 9.44 | 9.92 | 10.40 | 0.01 | 10 | 14.4 | 41.7 |
| PTVS9V0P1UP | 9.0 | 10.00 | 10.55 | 11.10 | 0.005 | 5 | 15.4 | 39.0 |
| PTVS10VP1UP | 10 | 11.10 | 11.70 | 12.30 | 0.005 | 2.5 | 17.0 | 35.3 |
| PTVS11VP1UP | 11 | 12.20 | 12.85 | 13.50 | 0.005 | 2.5 | 18.2 | 33.0 |
| PTVS12VP1UP | 12 | 13.30 | 14.00 | 14.70 | 0.005 | 2.5 | 19.9 | 30.2 |
| PTVS13VP1UP | 13 | 14.40 | 15.15 | 15.90 | 0.001 | 0.1 | 21.5 | 27.9 |
| PTVS14VP1UP | 14 | 15.60 | 16.40 | 17.20 | 0.001 | 0.1 | 23.2 | 25.9 |
| PTVS15VP1UP | 15 | 16.70 | 17.60 | 18.50 | 0.001 | 0.1 | 24.4 | 24.6 |
| PTVS16VP1UP | 16 | 17.80 | 18.75 | 19.70 | 0.001 | 0.1 | 26.0 | 23.1 |
| PTVS17VP1UP | 17 | 18.90 | 19.90 | 20.90 | 0.001 | 0.1 | 27.6 | 21.7 |
| PTVS18VP1UP | 18 | 20.00 | 21.00 | 22.10 | 0.001 | 0.1 | 29.2 | 20.5 |
| PTVS20VP1UP | 20 | 22.20 | 23.35 | 24.50 | 0.001 | 0.1 | 32.4 | 18.5 |
| PTVS22VP1UP | 22 | 24.40 | 25.60 | 26.90 | 0.001 | 0.1 | 35.5 | 16.9 |
| PTVS24VP1UP | 24 | 26.70 | 28.10 | 29.50 | 0.001 | 0.1 | 38.9 | 15.4 |
| PTVS26VP1UP | 26 | 28.90 | 30.40 | 31.90 | 0.001 | 0.1 | 42.1 | 14.3 |
| PTVS28VP1UP | 28 | 31.10 | 32.80 | 34.40 | 0.001 | 0.1 | 45.4 | 13.2 |
| PTVS30VP1UP | 30 | 33.30 | 35.10 | 36.80 | 0.001 | 0.1 | 48.4 | 12.4 |
| PTVS33VP1UP | 33 | 36.70 | 38.70 | 40.60 | 0.001 | 0.1 | 53.3 | 11.3 |
| PTVS36VP1UP | 36 | 40.00 | 42.10 | 44.20 | 0.001 | 0.1 | 58.1 | 10.3 |
| PTVS40VP1UP | 40 | 44.40 | 46.80 | 49.10 | 0.001 | 0.1 | 64.5 | 9.3 |

**Table 10. Characteristics per type; PTVS7V5P1UP to PTVS64VP1UP** *…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) |
| PTVS43VP1UP | 43 | 47.80 | 50.30 | 52.80 | 0.001 | 0.1 | 69.4 | 8.6 |
| PTVS45VP1UP | 45 | 50.00 | 52.65 | 55.30 | 0.001 | 0.1 | 72.7 | 8.3 |
| PTVS48VP1UP | 48 | 53.30 | 56.10 | 58.90 | 0.001 | 0.1 | 77.4 | 7.8 |
| PTVS51VP1UP | 51 | 56.70 | 59.70 | 62.70 | 0.001 | 0.1 | 82.4 | 7.3 |
| PTVS54VP1UP | 54 | 60.00 | 63.15 | 66.30 | 0.001 | 0.1 | 87.1 | 6.9 |
| PTVS58VP1UP | 58 | 64.40 | 67.80 | 71.20 | 0.001 | 0.1 | 93.6 | 6.4 |
| PTVS60VP1UP | 60 | 66.70 | 70.20 | 73.70 | 0.001 | 0.1 | 96.8 | 6.2 |
| PTVS64VP1UP | 64 | 71.10 | 74.85 | 78.60 | 0.001 | 0.1 | 103.0 | 5.8 |

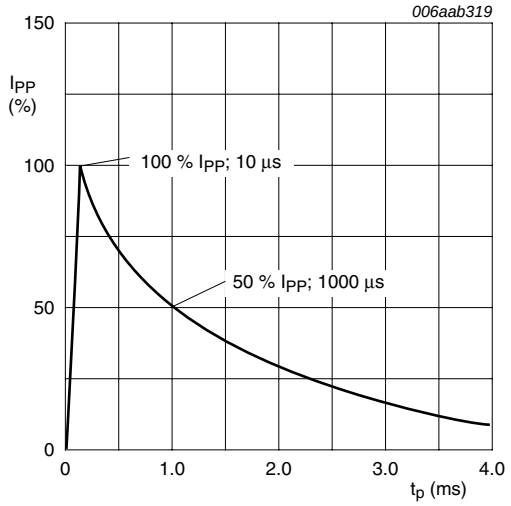



**Fig 1. 10/1000 µs pulse waveform according to IEC 61643-321**

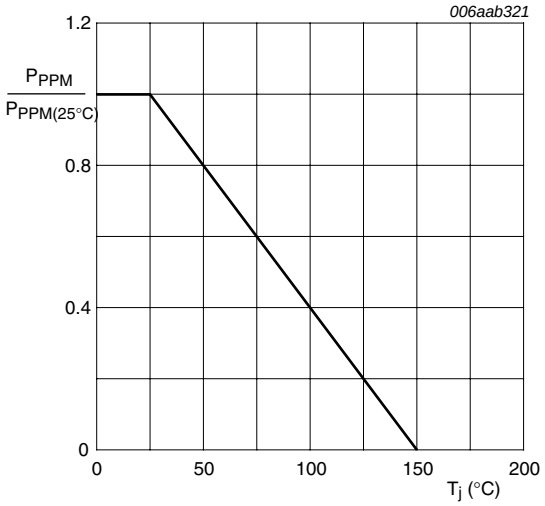
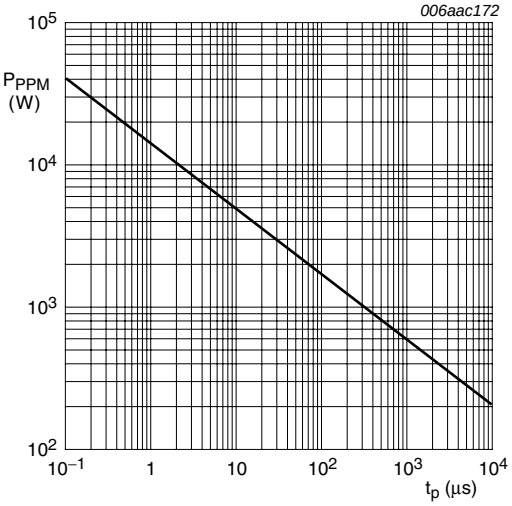
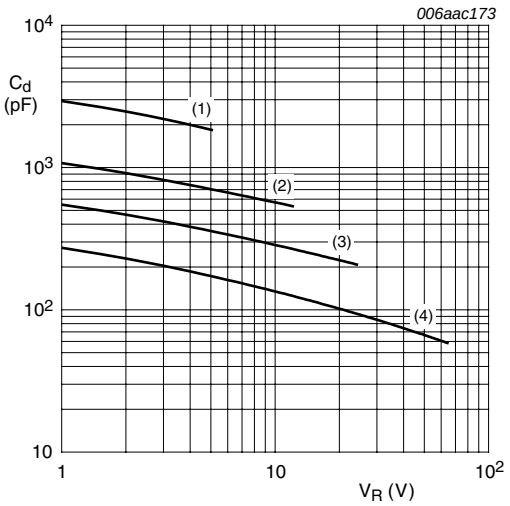



**Fig 2. Relative variation of rated peak pulse power as a function of junction temperature; typical values**




$T_{amb}$ = 25 °C

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




$T_{amb}$ = 25 °C; f = 1 MHz

(1) PTVS5V0P1UP

(2) PTVS12VP1UP

(3) PTVS24VP1UP

(4) PTVS64VP1UP

**Fig 4. Diode capacitance as a function of reverse voltage; typical values**

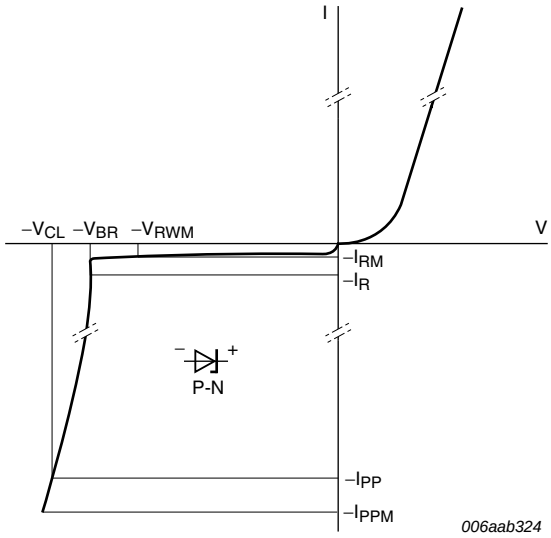



**Fig 5. V-I characteristics for a unidirectional TVS protection diode**

# 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

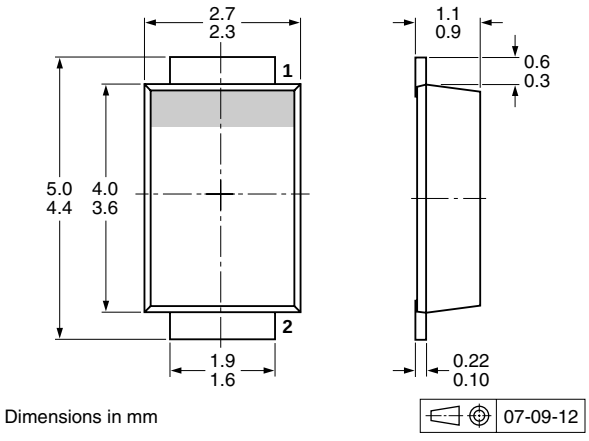



**Fig 6. Package outline SOD128**

# 10. Packing information

**Table 11. Packing methods**

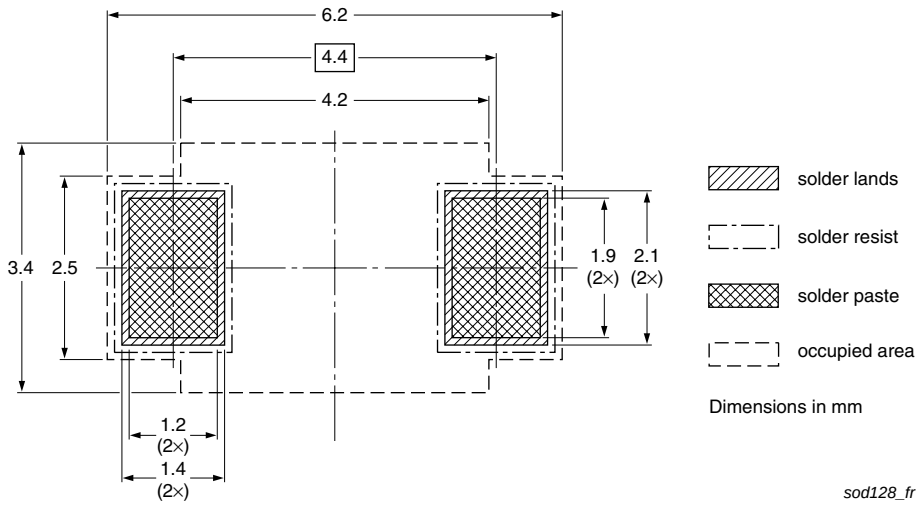
*The indicated -xxx are the last three digits of the 12NC ordering code.*[1]

| Type number[2] | Package | Description | Packing quantity |
|---|---|---|---|
| | | | 3000 |
| PTVSxP1UP series | SOD128 | 4 mm pitch, 12 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 7. Reflow soldering footprint SOD128**

## 12. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PTVSXP1UP_SER v.2 | 20110106 | Product data sheet | - | PTVSXP1UP_SER v.1 |
| Modifications: | • Table 6 “ESD maximum ratings”: added.<br>• Section 13 “Legal information”: updated. | | | |
| PTVSXP1UP_SER v.1 | 20100527 | 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. |
| 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.

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

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## 15. Contents





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