



PRTR5V0U2X

Ultra low capacitance double rail-to-rail ESD protection diode in SOT143B

Rev. 01 — 22 September 2005

Product data sheet

1. Product profile

1.1 General description

Ultra low capacitance double rail-to-rail ElectroStatic Discharge (ESD) protection diode in a small SOT143B Surface Mounted Device (SMD) plastic package designed to protect two Hi-Speed data lines or high frequency signal lines from the damage caused by ESD and other transients.

PRTR5V0U2X incorporates two pairs of ultra low capacitance rail-to-rail diodes as well as an additional ESD protection diode to ensure signal line protection even if no supply voltage is available.

1.2 Features

- ESD protection of two Hi-Speed data lines or high frequency signal lines
- Ultra low input to ground capacitance: $C_{(I/O-GND)} = 1 \text{ pF}$
- ESD protection up to 8 kV
- IEC 61000-4-2, level 4 (ESD)
- Very low clamping voltage due to an integrated additional ESD protection diode
- Very low leakage current
- Small 4 lead SOT143B SMD plastic package

1.3 Applications

- USB 2.0 ports
- Digital Video Interface (DVI) / High Definition Multimedia Interface (HDMI) interfaces
- Mobile and cordless phones
- Personal Digital Assistants (PDA)
- Digital cameras
- Wide Area Network (WAN) / Local Area Network (LAN) systems
- PCs, notebooks, printers and other PC peripherals

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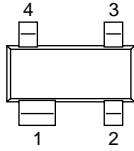
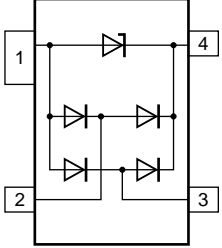
1.4 Quick reference data

Table 1: Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|----------------------------------------------------|--------------------------------------------------------|-----|-----|-----|------|
| V_{RWM} | reverse stand-off voltage | | - | - | 5.5 | V |
| $C_{(I/O-GND)}$ | input to ground capacitance; pin 2 and 3 to ground | $f = 1 \text{ MHz}$; $V_{(I/O-GND)} = 0 \text{ V}$ | - | 1 | - | pF |
| C_{sup} | supply capacitance; pin 4 to ground | $f = 1 \text{ MHz}$; $V_{CC} = 0 \text{ V}$ | - | 16 | - | pF |

2. Pinning information

Table 2: Pinning

| Pin | Description | Simplified outline | Symbol |
|-----|-------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 | GND |  |  |
| 2 | I/O 1 | | |
| 3 | I/O 2 | | |
| 4 | V_{CC} | | |

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3. Ordering information

Table 3: Ordering information

| Type number | Package | | Version |
|-------------|---------|------------------------------------------|---------|
| | Name | Description | |
| PRTR5V0U2X | - | plastic surface mounted package; 4 leads | SOT143B |

4. Marking

Table 4: Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PRTR5V0U2X | *R1 |

- [1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

5. Limiting values

Table 5: Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|---------------------|------------|-----|------|------|
| T_{amb} | ambient temperature | | -40 | +85 | °C |
| T_{stg} | storage temperature | | -55 | +125 | °C |

Table 6: ESD standards compliance

| Standard | Conditions |
|------------------------------|------------------|
| IEC 61000-4-2; level 4 (ESD) | > 8 kV (contact) |

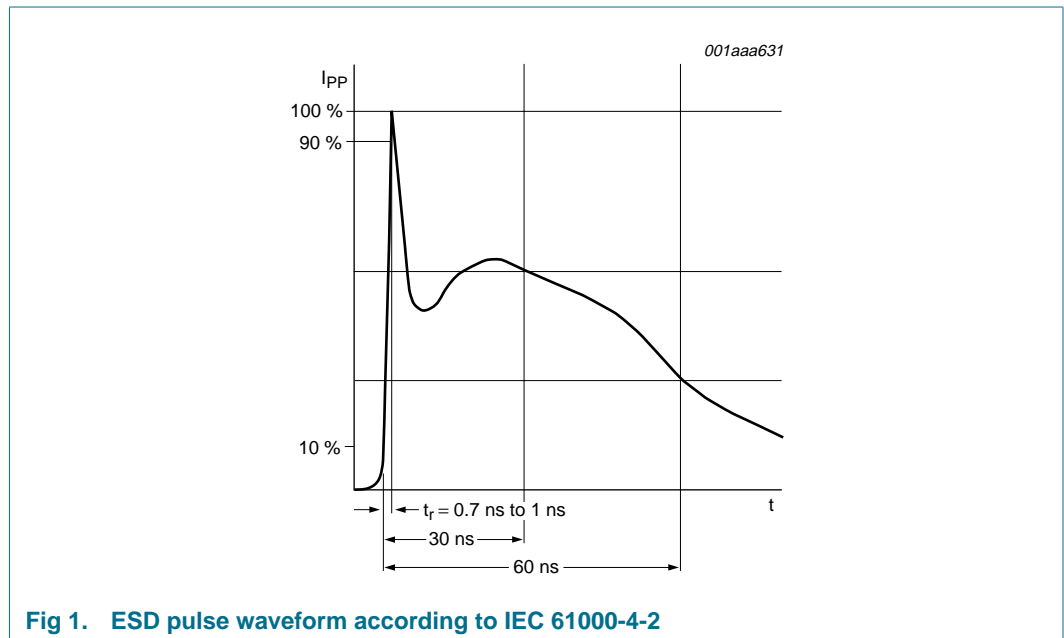


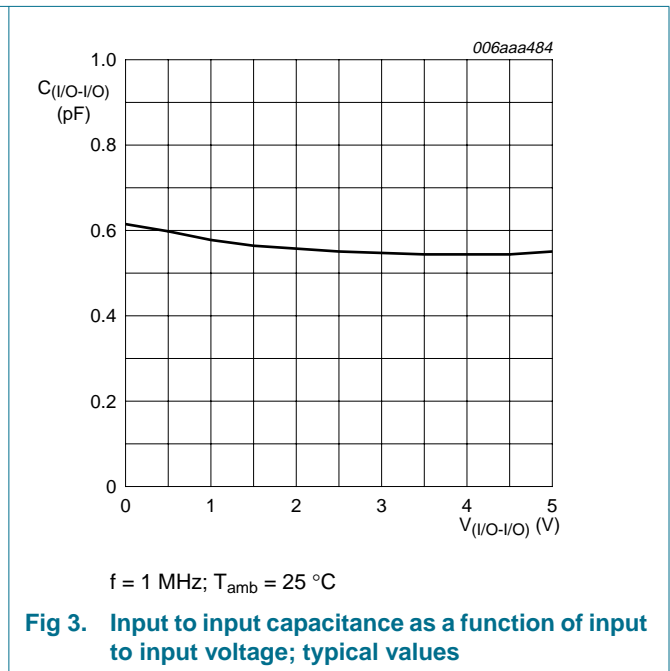
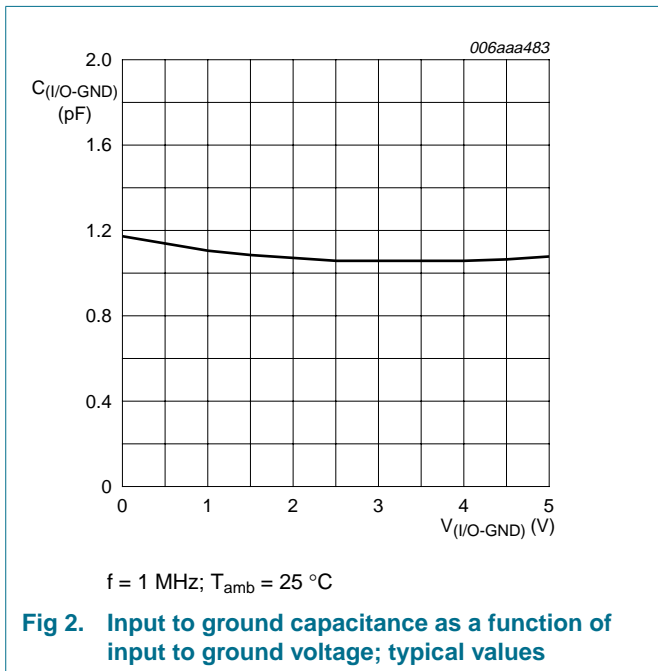
Fig 1. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

Table 7: Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|----------------------------------------------------|------------------------------------------------|-----|-----|-----|------|
| V_{RWM} | reverse stand-off voltage | | - | - | 5.5 | V |
| I_R | reverse current; pin 2, 3 and 4 to ground | $V_R = 3\text{ V}$ | - | < 1 | 100 | nA |
| V_{BR} | breakdown voltage; pin 4 to ground | | 6 | - | 9 | V |
| $C_{(I/O-GND)}$ | input to ground capacitance; pin 2 and 3 to ground | $f = 1\text{ MHz}; V_{(I/O-GND)} = 0\text{ V}$ | - | 1 | - | pF |
| $C_{(I/O-I/O)}$ | input to input capacitance; pin 2 to pin 3 | $f = 1\text{ MHz}; V_{(I/O-I/O)} = 0\text{ V}$ | - | 0.6 | - | pF |
| C_{sup} | supply capacitance; pin 4 to ground | $f = 1\text{ MHz}; V_{CC} = 0\text{ V}$ | - | 16 | - | pF |
| V_F | forward voltage | | - | 0.7 | - | V |



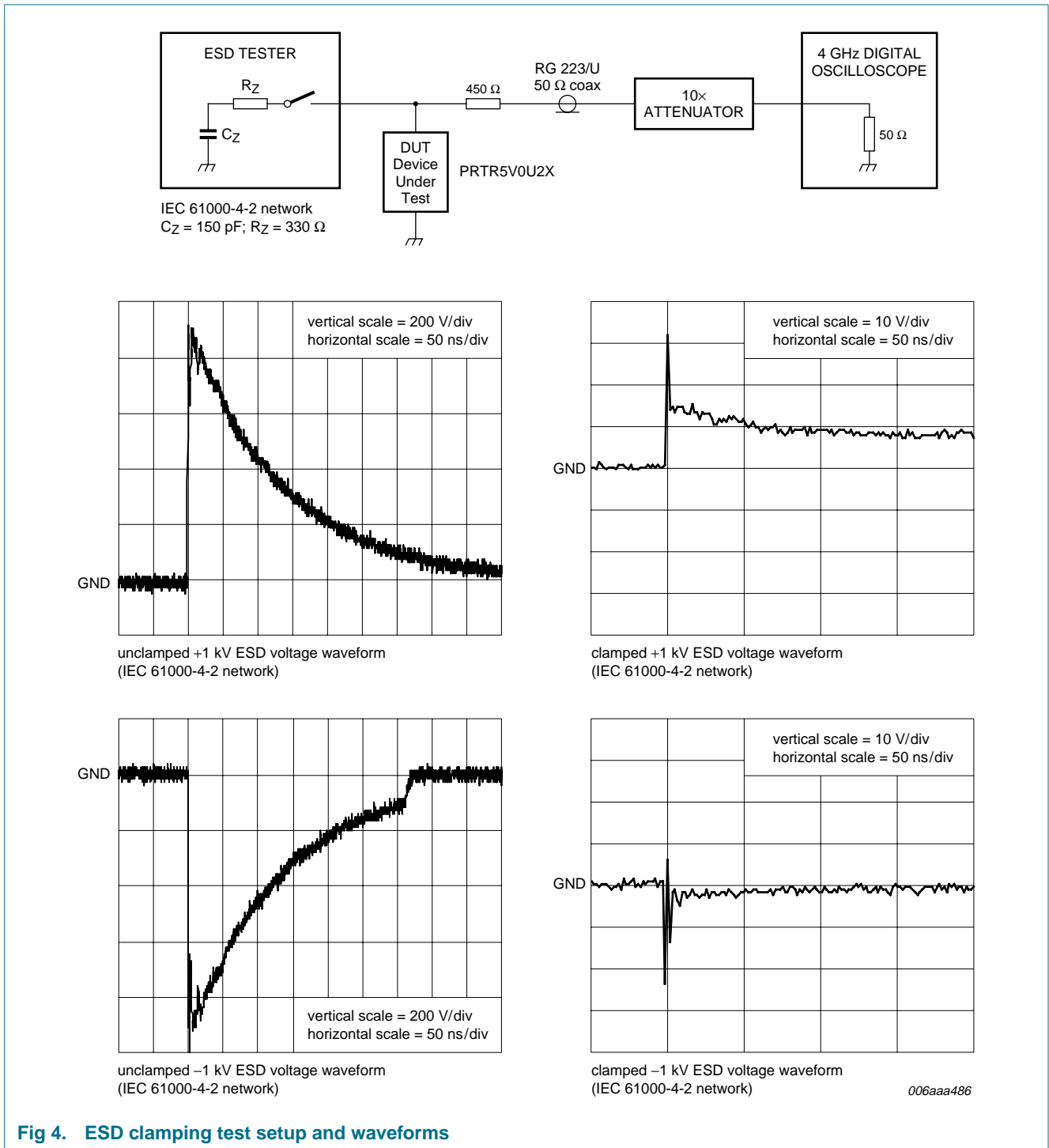


Fig 4. ESD clamping test setup and waveforms

7. Application information

Handling data rates up to 480 Mbit/s, USB 2.0 interfaces require ESD protection devices with an extremely low line capacitance in order to avoid signal distortion.

With a capacitance of only 1 pF, the Philips PRTR5V0U2X offers IEC 61000-4-2, level 4 compliant ESD protection.

The PRTR5V0U2X integrates two ultra-low capacitance rail-to-rail ESD protection diodes and an additional ESD protection diode in a small 4 lead SOT143B package.

The additional ESD protection diode connected between ground and V_{CC} prevents charging of the supply.

To achieve the maximum ESD protection level, no additional external capacitors are required.

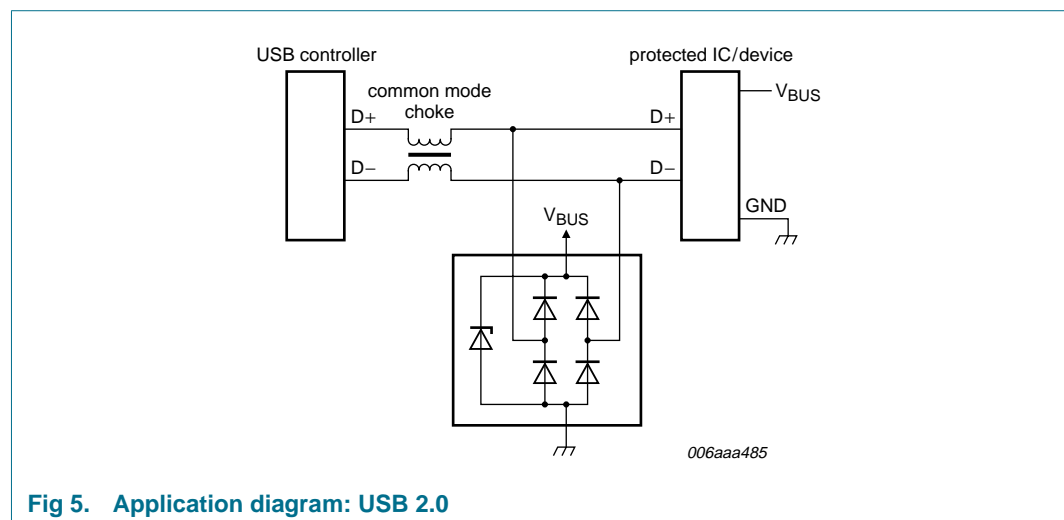


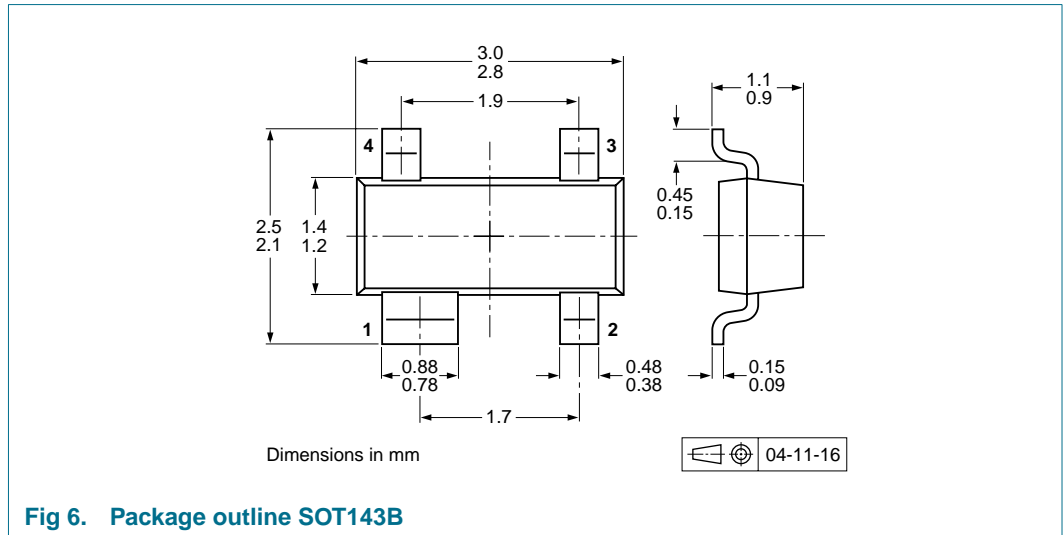
Fig 5. Application diagram: USB 2.0

Circuit board layout and protection device placement

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

1. Place the PRTR5V0U2X as close to the input terminal or connector as possible.
2. The path length between the PRTR5V0U2X and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all printed-circuit board conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Ground planes should be used whenever possible. For multilayer printed-circuit boards, use ground vias.

8. Package outline



9. Packing information

Table 8: Packing methods

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

| Type number | Package | Description | Packing quantity | |
|-------------|---------|--------------------------------|------------------|-------|
| | | | 3000 | 10000 |
| PRTR5V0U2X | SOT143B | 4 mm pitch, 8 mm tape and reel | -215 | -235 |

[1] For further information and the availability of packing methods, see [Section 15](#).

10. Revision history

Table 9: Revision history

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|--------------|--------------|--------------------|---------------|----------------|------------|
| PRTR5V0U2X_1 | 20050922 | Product data sheet | - | 9397 750 15163 | - |

11. Data sheet status

| Level | Data sheet status ^[1] | Product status ^{[2] [3]} | Definition |
|-------|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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16. Contents

| | | |
|-----------|--------------------------------------|----------|
| 1 | Product profile | 1 |
| 1.1 | General description | 1 |
| 1.2 | Features | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 2 |
| 2 | Pinning information | 2 |
| 3 | Ordering information | 2 |
| 4 | Marking | 2 |
| 5 | Limiting values | 3 |
| 6 | Characteristics | 4 |
| 7 | Application information | 6 |
| 8 | Package outline | 7 |
| 9 | Packing information | 7 |
| 10 | Revision history | 8 |
| 11 | Data sheet status | 9 |
| 12 | Definitions | 9 |
| 13 | Disclaimers | 9 |
| 14 | Trademarks | 9 |
| 15 | Contact information | 9 |



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Date of release: 22 September 2005
Document number: 9397 750 15163

Published in The Netherlands