



# PRTR5V0U2X

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

Rev. 01 — 22 September 2005

Product data sheet

## 1. Product profile

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### 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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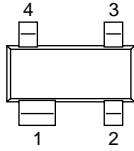
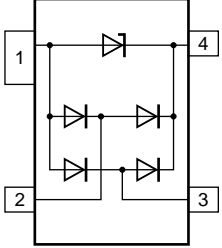
### 1.4 Quick reference data

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	$V_{CC}$		

006aaa482

## 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 <sup>[1]</sup>
PRTR5V0U2X	*R1

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

## 5. Limiting values

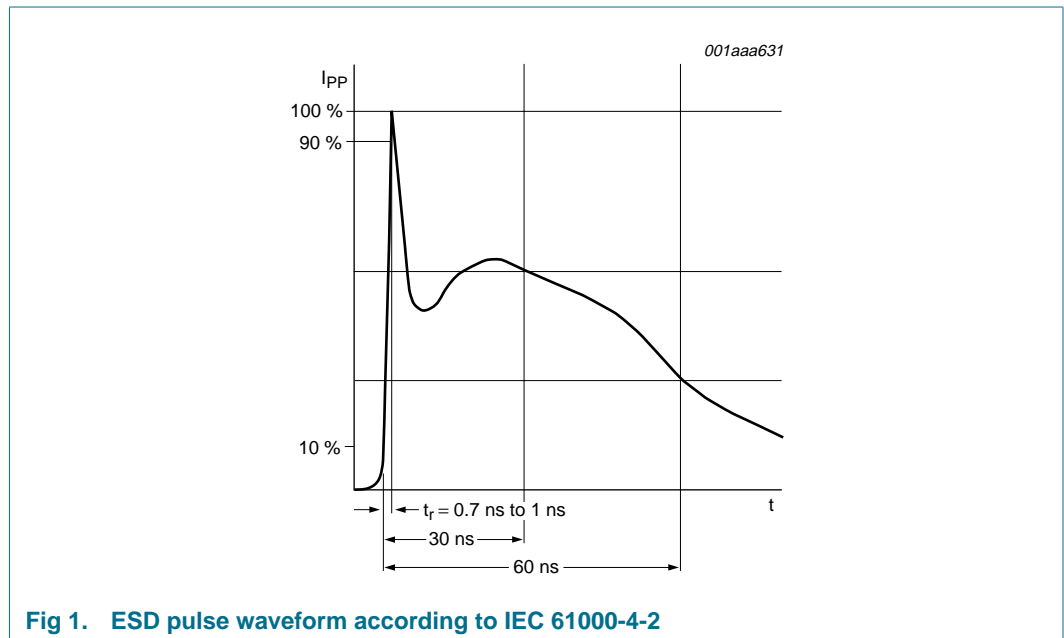
**Table 5: Limiting values**

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)



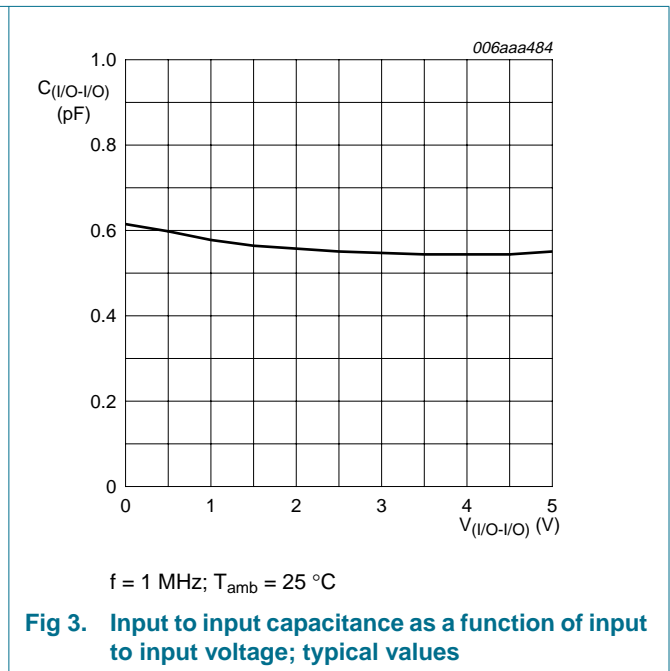
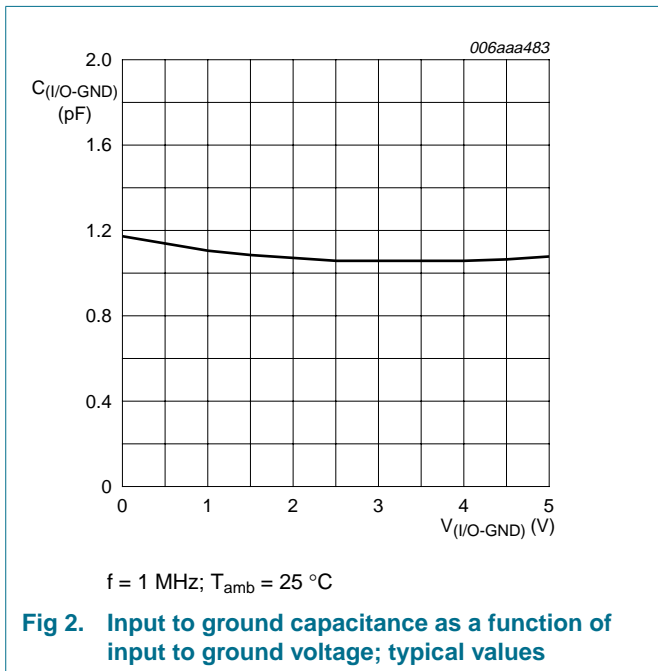
**Fig 1. ESD pulse waveform according to IEC 61000-4-2**

## 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



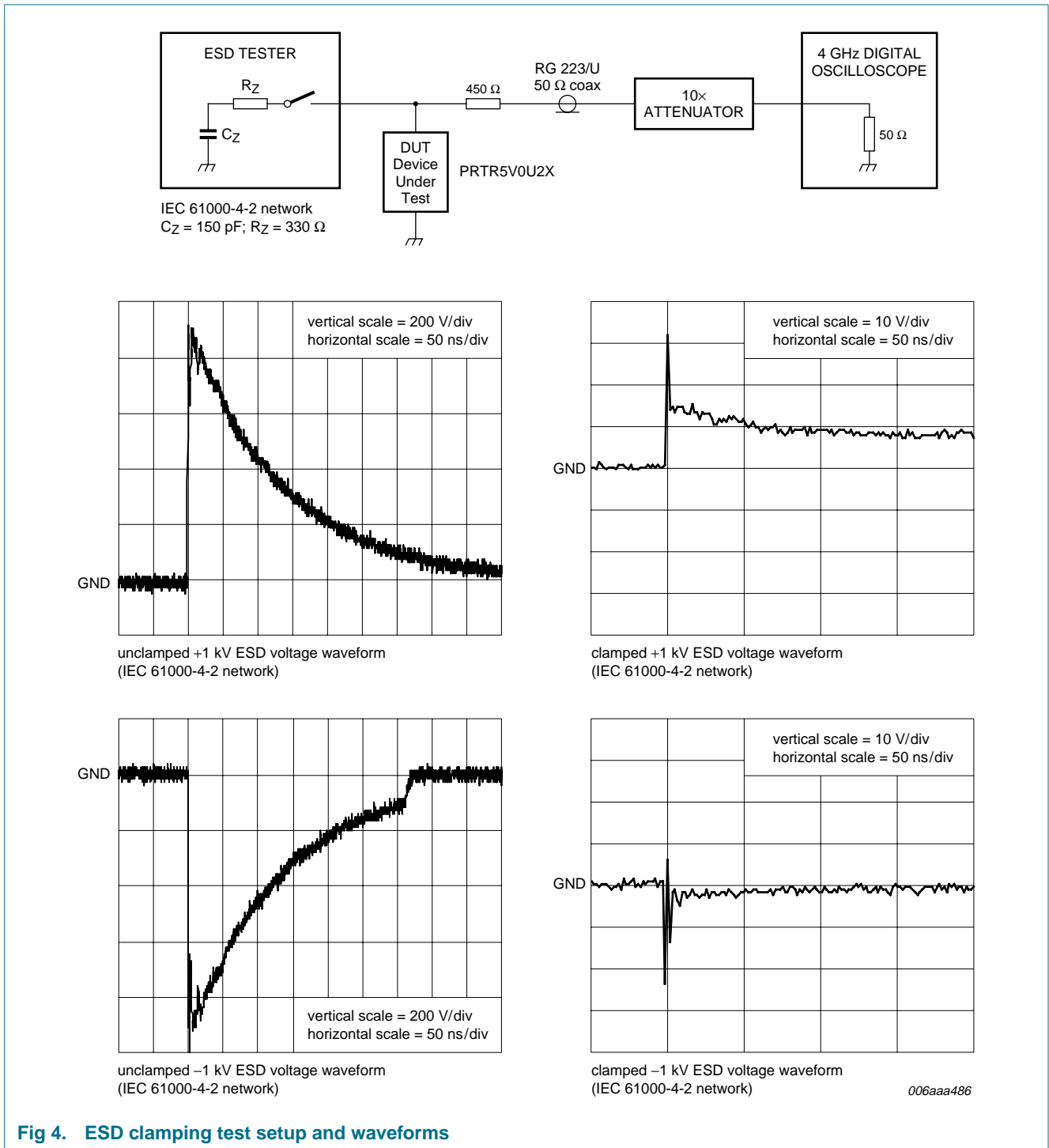


Fig 4. ESD clamping test setup and waveforms

## 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.

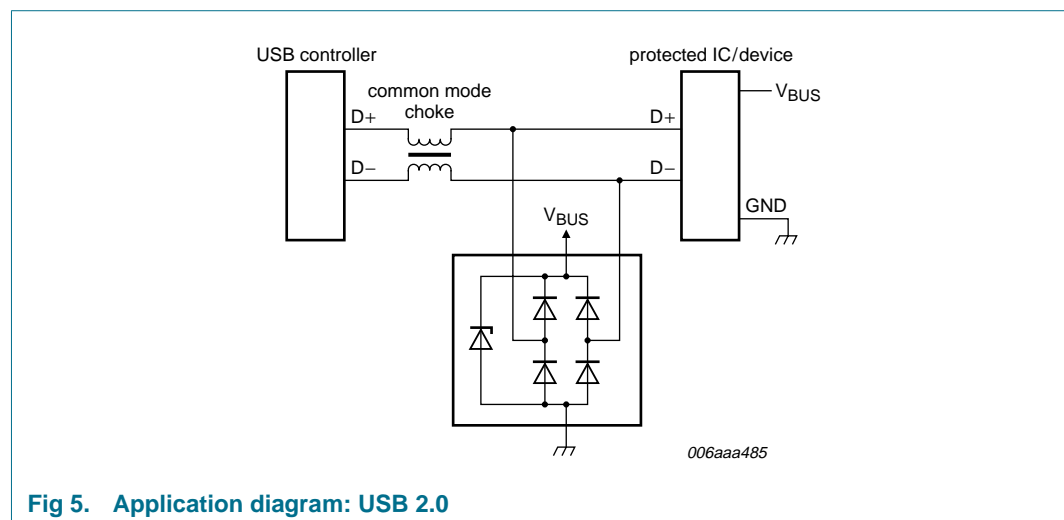


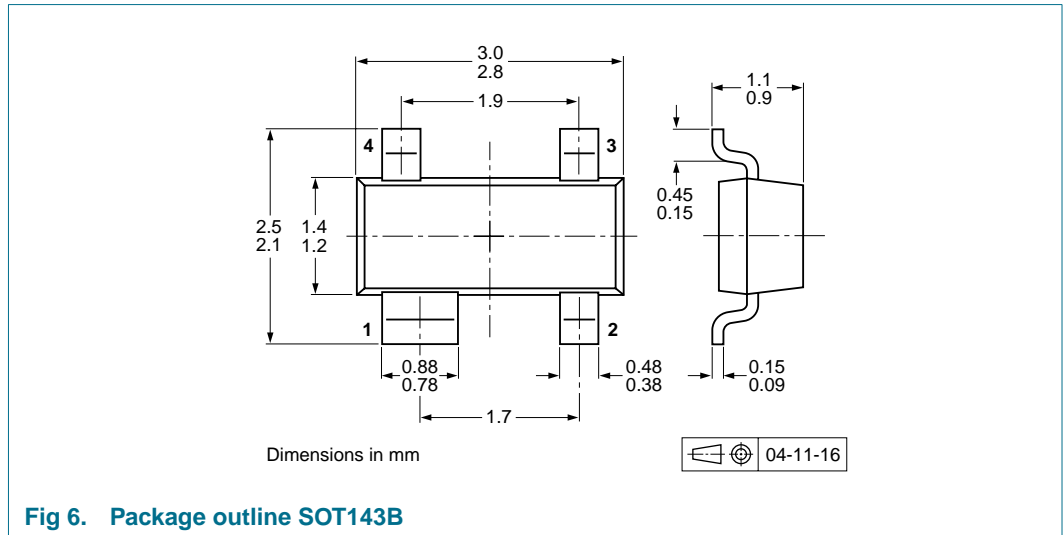
Fig 5. Application diagram: USB 2.0

### 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 <sup>[1]</sup>	Product status <sup>[2] [3]</sup>	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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**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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