

# PRTR5V0U2AX

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

Rev. 02 — 21 December 2006

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 high-speed data lines or high frequency signal lines from the damage caused by ESD and other transients.

PRTR5V0U2AX 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 high-speed data lines or high frequency signal lines
- Ultra low input/output to ground capacitance:  $C_{(I/O-GND)} = 1.8 \text{ pF}$
- ESD protection up to 12 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

1.4 Quick reference data

Table 1. Quick reference data

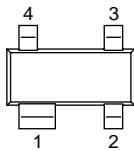
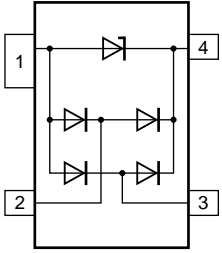
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage		-	-	5.5	V
$C_{(I/O-GND)}$	input/output to ground capacitance	$f = 1 \text{ MHz};$ $V_{(I/O-GND)} = 0 \text{ V}$	[1] -	1.8	-	pF
$C_{sup}$	supply pin to ground capacitance	$f = 1 \text{ MHz};$ $V_{CC} = 0 \text{ V}$	[2] -	16	-	pF

[1] Measured from pin 2 and 3 to ground

[2] Measured from pin 4 to ground

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		
	Name	Description	Version
PRTR5V0U2AX	-	plastic surface-mounted package; 4 leads	SOT143B

4. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PRTR5V0U2AX	*AE

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

## 5. Limiting values

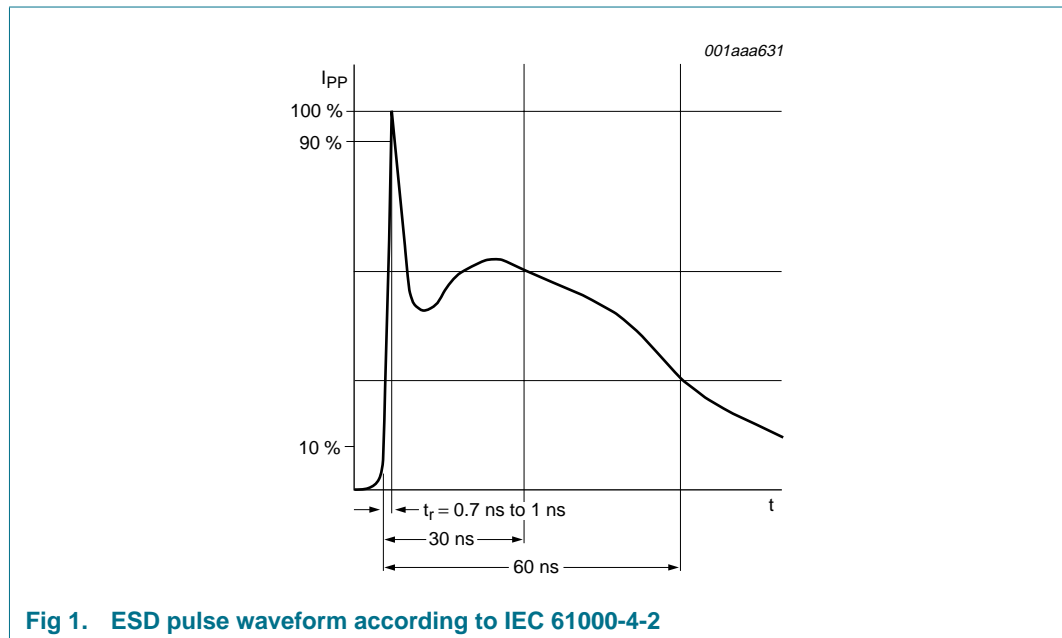
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
T <sub>amb</sub>	ambient temperature		-40	+85	°C
T <sub>stg</sub>	storage temperature		-55	+125	°C

**Table 6. ESD standards compliance**

Standard	Conditions
IEC 61000-4-2; level 4 (ESD)	> 12 kV (contact)



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

6. Characteristics

**Table 7. Characteristics**

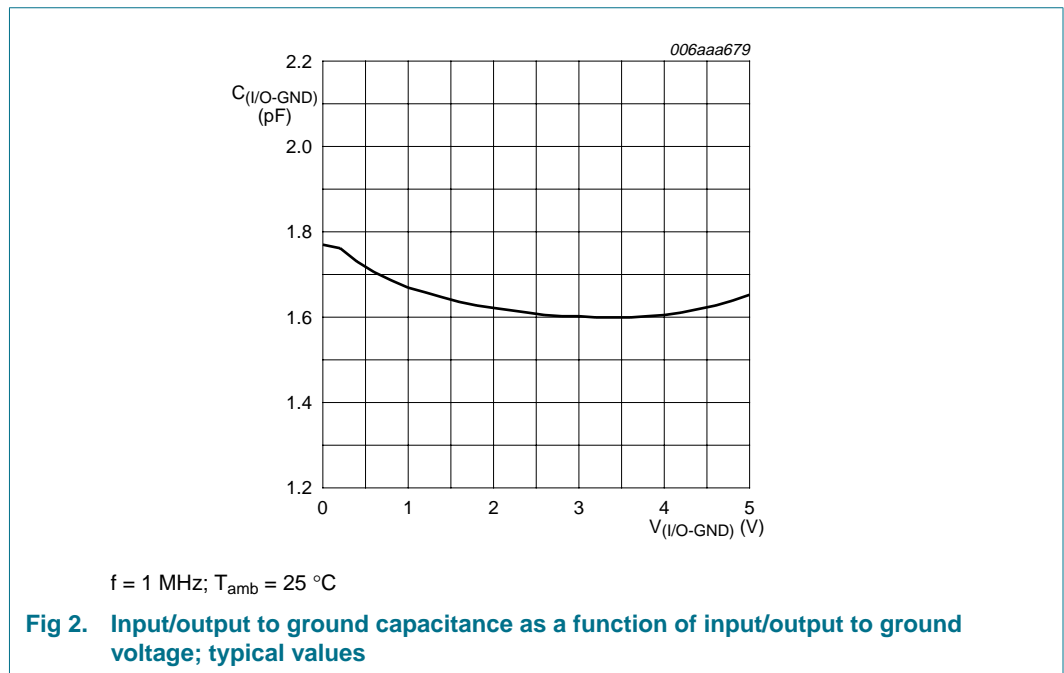
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>RWM</sub>	reverse standoff voltage		-	-	5.5	V
I <sub>R</sub>	reverse current	V <sub>R</sub> = 3 V	[1] -	< 1	100	nA
V <sub>BR</sub>	breakdown voltage		[2] 6	-	9	V
C <sub>(I/O-GND)</sub>	input/output to ground capacitance	f = 1 MHz; V <sub>(I/O-GND)</sub> = 0 V	[3] -	1.8	-	pF
C <sub>sup</sub>	supply pin to ground capacitance	f = 1 MHz; V <sub>CC</sub> = 0 V	[2] -	16	-	pF
V <sub>F</sub>	forward voltage		-	0.7	-	V

[1] Measured from pin 2, 3 and 4 to ground

[2] Measured from pin 4 to ground

[3] Measured from pin 2 and 3 to ground



## 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 1.8 pF, the NXP PRTR5V0U2AX offers IEC 61000-4-2, level 4 compliant ESD protection.

The PRTR5V0U2AX 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.

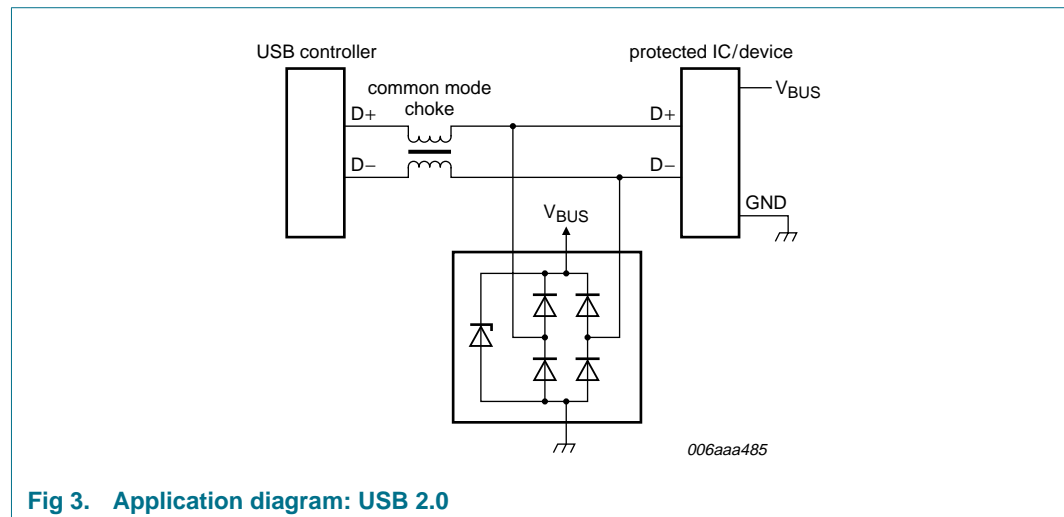


Fig 3. Application diagram: USB 2.0

### 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 PRTR5V0U2AX as close to the input terminal or connector as possible.
2. The path length between the PRTR5V0U2AX 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. Test information

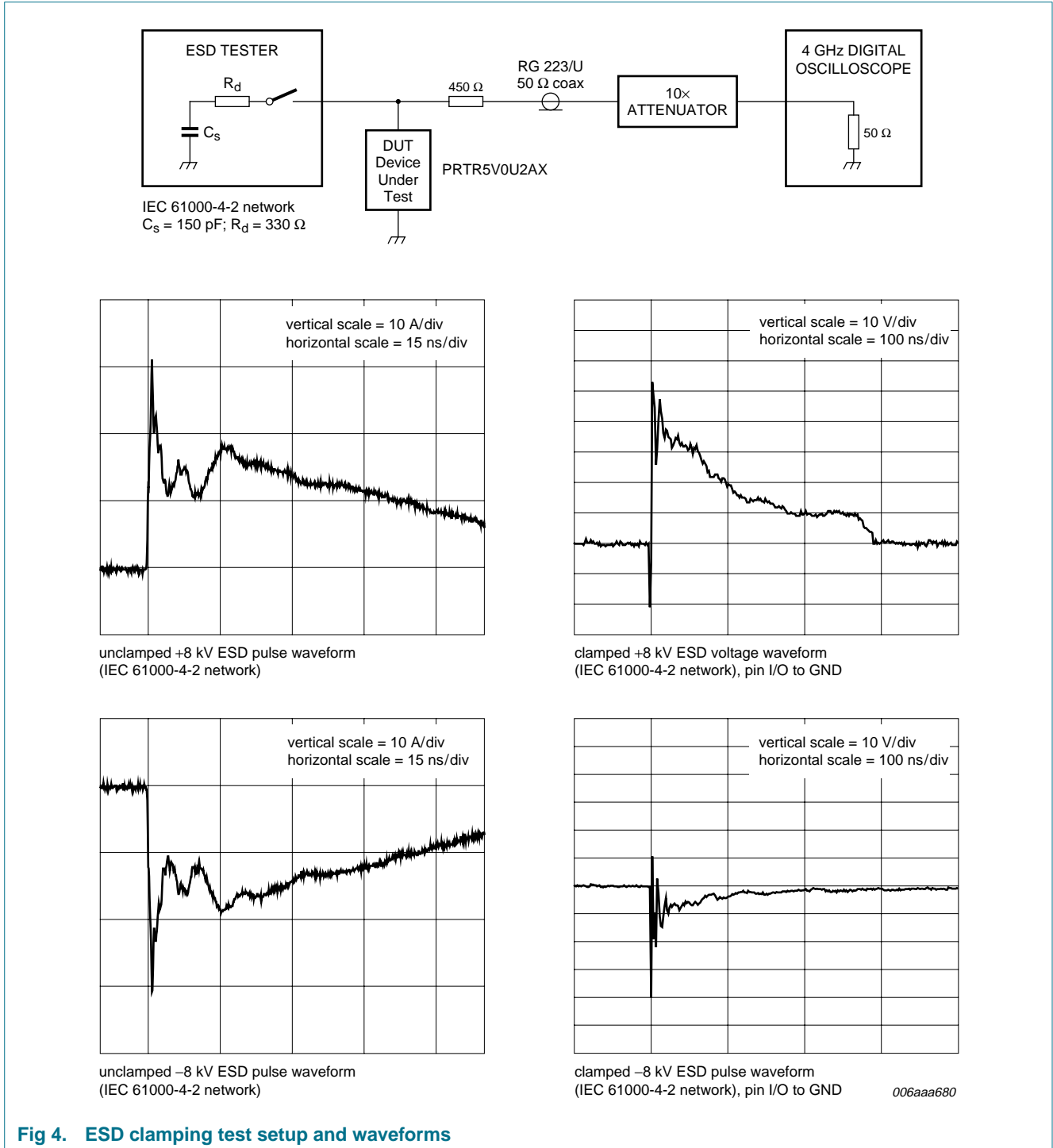


Fig 4. ESD clamping test setup and waveforms

## 9. Package outline

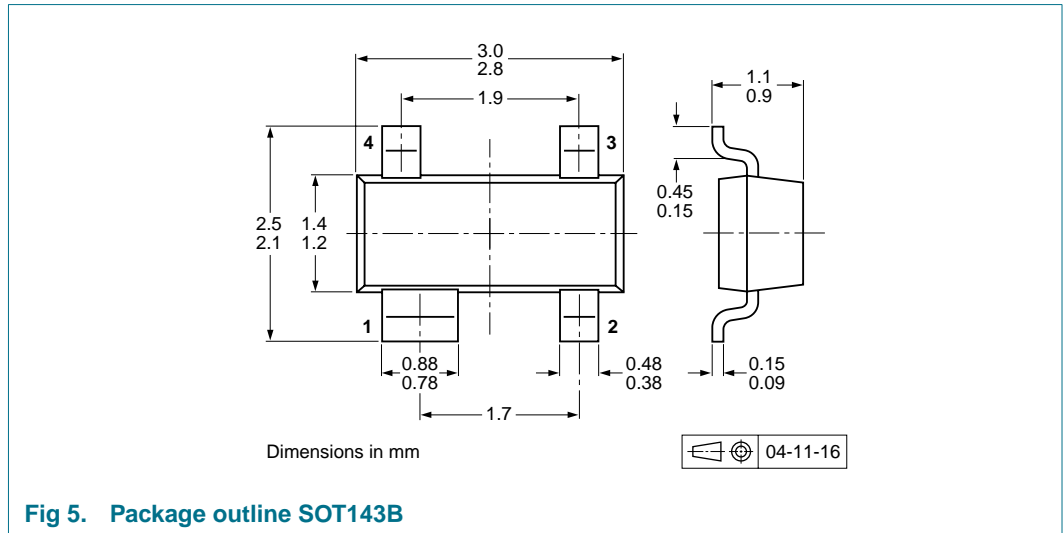


Fig 5. Package outline SOT143B

## 10. Packing information

Table 8. Packing methods

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

Type number	Package	Description	Packing quantity	
			3000	10000
PRTR5V0U2AX	SOT143B	4 mm pitch, 8 mm tape and reel	-215	-235

[1] For further information and the availability of packing methods, see [Section 13](#).

## 11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PRTR5V0U2AX_2	20061221	Product data sheet	-	PRTR5V0U2AX_1
Modifications:		<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• <a href="#">Figure 4</a>: updated</li></ul>		
PRTR5V0U2AX_1	20060522	Product data sheet	-	-



## 12. Legal information

### 12.1 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.

[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.nxp.com>.

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