PRTR5V0U2AX

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

Rev. 4 — 18 April 2017 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.

The device is designed to protect two high-speed data lines or high-frequency signal lines from the damage caused by ESD and other transients.

PRTR5V0U2AX integrates two ultra low capacitance rail-to-rail diodes and one additional ESD protection diode to ensure signal line protection even if no supply voltage is available.

1.2 Features and benefits

- 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 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 reverse current
- AEC-Q101 qualified
- Small SMD plastic package

1.3 Applications

- USB 2.0 ports
- Digital Video Interface (DVI)
- High-Definition Multimedia Interface (HDMI)
- Mobile phones
- Digital cameras
- WAN/LAN systems
- PC, notebooks, printers and other PC peripherals

1.4 Quick reference data

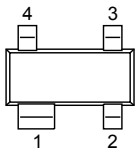
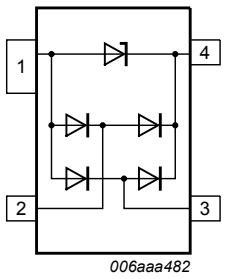
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per channel						
$C_{(I/O-GND)}$	input/output to ground capacitance	f = 1 MHz; $V_{(I/O-GND)}$ = 0 V [1]	-	1.8	-	pF
Zener diode						
V_{RWM}	reverse standoff voltage		-	-	5.5	V
C_{sup}	supply pin to ground capacitance	f = 1 MHz; V_{CC} = 0 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	Symbol	Description	Simplified outline	Graphic symbol
1	GND	ground		
2	I/O 1	input/output 1		
3	I/O 2	input/output 2		
4	V_{CC}	supply voltage		

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 [1]
PRTR5V0U2AX	*AE

[1] * = placeholder for manufacturing site code.

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	+125	°C
T_{stg}	storage temperature		-55	+125	°C

Table 6. ESD standards compliance

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

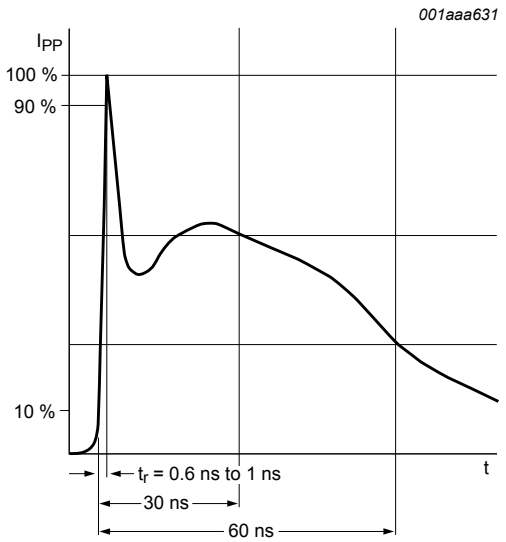


Figure 1. ESD pulse waveform according to IEC 61000-4-2

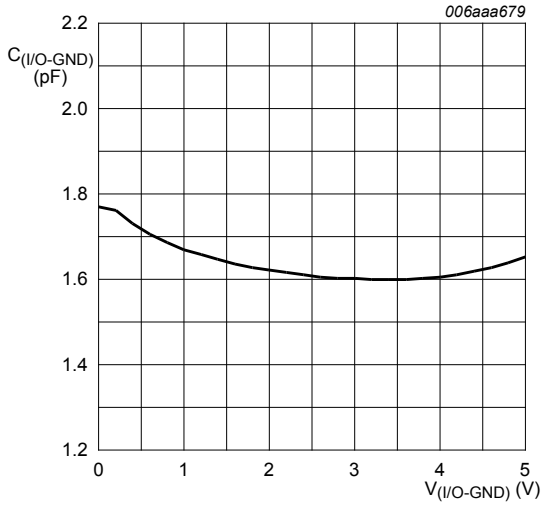
6 Characteristics

Table 7. Characteristics

T_{amb} = 25 °C unless otherwise specified.

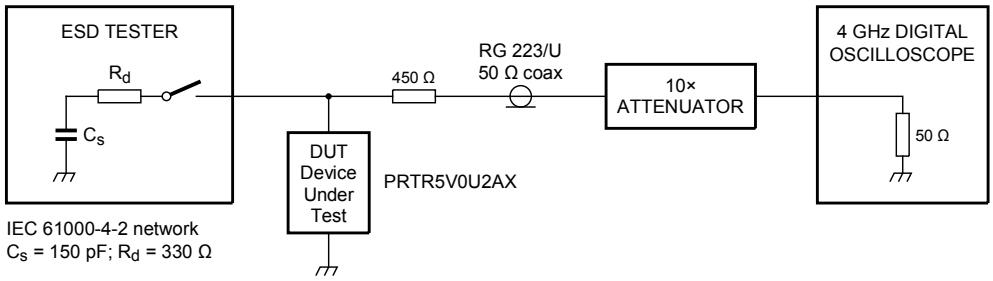
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per channel							
I_R	reverse current	V_R = 3 V	[1]	-	< 1	100	nA
$C_{(I/O-GND)}$	input/output to ground capacitance	f = 1 MHz; $V_{(I/O-GND)}$ = 0 V	[2]	-	1.8	-	pF
V_F	forward voltage	I_F = 1 mA		-	0.7	-	V
Zener diode							
V_{RWM}	reverse standoff voltage			-	-	5.5	V
V_{BR}	breakdown voltage		[3]	6	-	9	V
C_{sup}	supply pin to ground capacitance	f = 1 MHz; V_{CC} = 0 V	[3]	-	16	-	pF

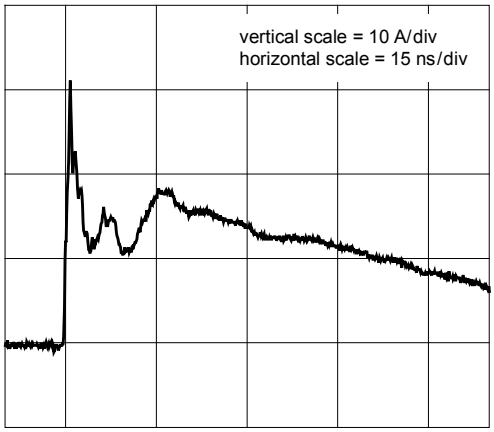
[1] Measured from pin 2, 3 and 4 to ground
[2] Measured from pin 2 and 3 to ground
[3] Measured from pin 4 to ground



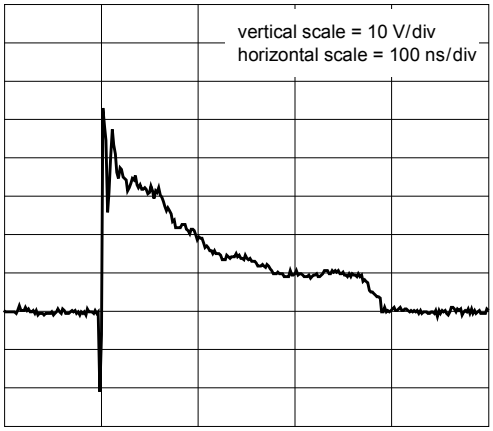
f = 1 MHz; T_{amb} = 25 °C

Figure 2. Input/output to ground capacitance as a function of input/output to groundvoltage; typical values

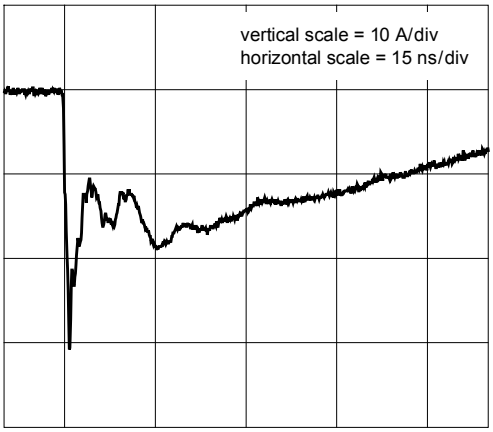




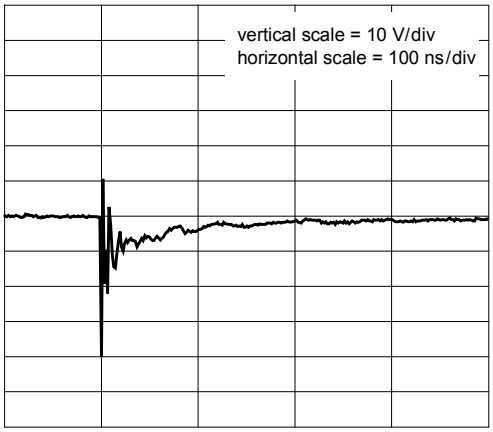
unclamped +8 kV ESD pulse waveform
(IEC 61000-4-2 network)



clamped +8 kV ESD voltage waveform
(IEC 61000-4-2 network), pin I/O to GND



unclamped - 8 kV ESD pulse waveform
(IEC 61000-4-2 network)



clamped - 8 kV ESD pulse waveform
(IEC 61000-4-2 network), pin I/O to GND

006aaa680

Figure 3. 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 1.8 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.

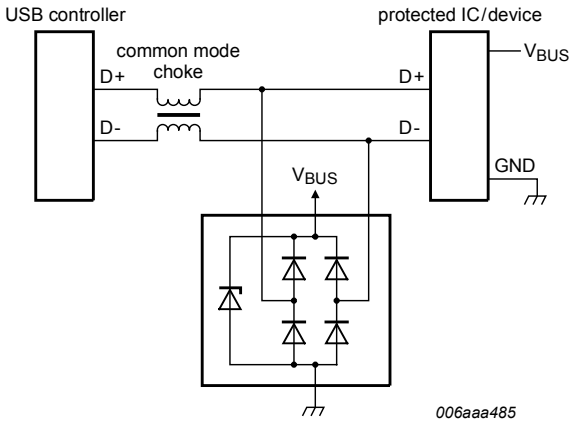


Figure 4. Application diagram: USB 2.0

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 device as close to the input terminal or connector as possible.
2. Minimize the path length between the device and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) 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. Use ground planes whenever possible. For multilayer PCBs, use ground vias.

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

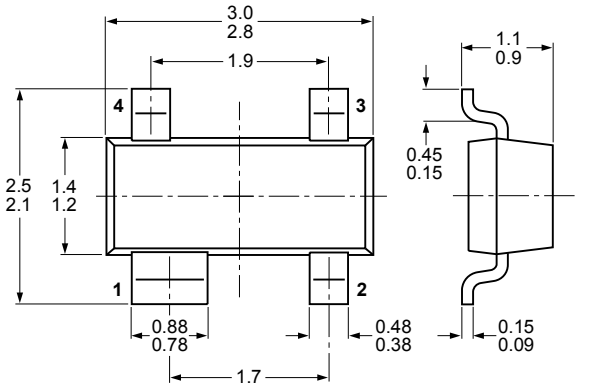


Figure 5. Package outline SOT143B

10 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
PRTR5V0U2AX	SOT143B	4 mm pitch, 8 mm tape and reel	-215	-235

[1] For further information and the availability of packing methods, see Section 14.

11 Soldering

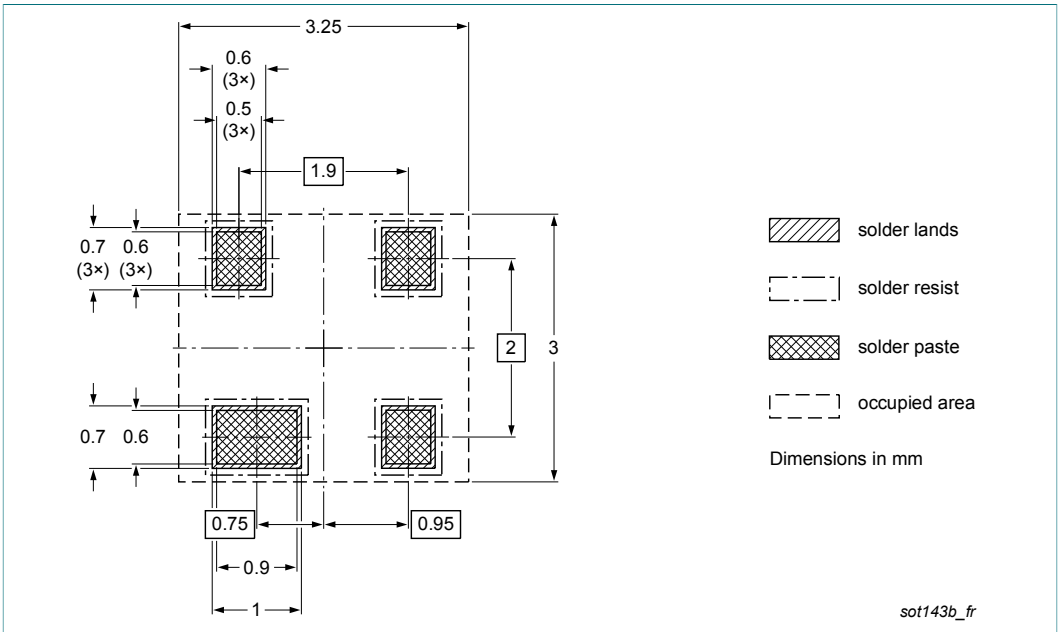


Figure 6. Reflow soldering footprint SOT143B

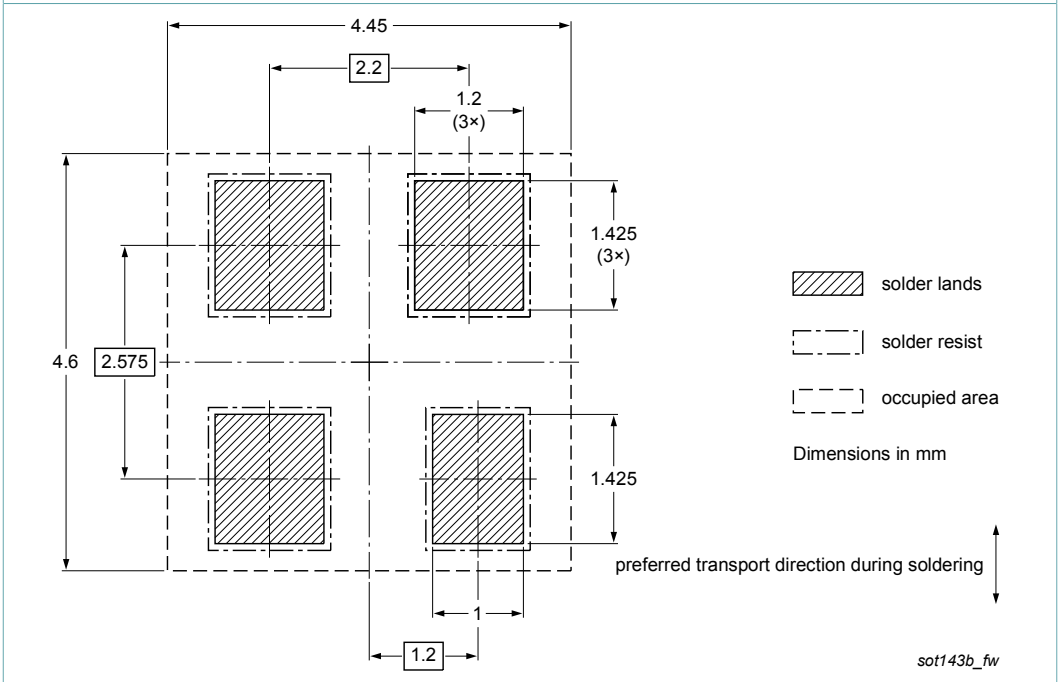


Figure 7. Wave soldering footprint SOT143B

12 Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PRTR5V0U2AX v.4	20170418	Product data sheet	-	PRTR5V0U2AX v.3
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Table 5: maximum ambient temperature changed from +85 °C to +125 °C.			
PRTR5V0U2AX v.3	20120515	Product data sheet	-	PRTR5V0U2AX v.2
Modifications:	• Section 1: editorial update • Section 4: updated • Section 6: editorial update; added condition to V_F • Section 8.1: added • Section 11: added • Section 13: updated			
PRTR5V0U2AX v.2	20061221	Product data sheet	-	PRTR5V0U2AX v.1
PRTR5V0U2AX v.1	20060522	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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