IP4221CZ6-XS

ESD protection for high-speed interfaces

Rev. 2 — 13 December 2012 Product data sheet

1. Product profile

1.1 General description

The device is designed to protect high-speed interfaces such as USB 2.0, Ethernet and Digital Visual Interface (DVI) against ElectroStatic Discharge (ESD).

The device includes four high-level ESD protection diode structures for high-speed signal lines and is encapsulated in a leadless ultra small DFN1010-6 (SOT891) plastic package.

Special diode configuration protects all signal lines and offers ultra low line capacitance of only 1 pF. The rail-to-rail diodes are connected to the Zener diode which allows ESD protection to be independent of supply voltage.

1.2 Features and benefits

- System ESD protection for high-speed data lines such as USB 2.0, Ethernet and DVI
- All signal lines with integrated rail-to-rail clamping diodes for downstream ESD protection of ±8 kV according to IEC 61000-4-2, level 4
- Line capacitance of only 1 pF for each channel
- Leadless ultra small DFN1010-6 package: 1 × 1 × 0.5 mm; pitch 0.5 mm

1.3 Applications

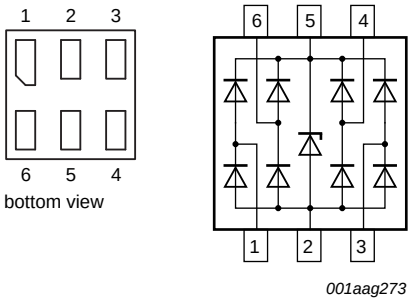
The device is designed for high-speed receiver and transmitter port protection:

- Mobile phones, smartphones and handsets
- TVs and monitors
- DVD recorders and players
- Notebooks, mother boards, graphic cards and ports
- Set-top boxes and game consoles

2. Pinning information

Table 1. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I/O 1	ESD protection		
2	GND	ground		
3	I/O 2	ESD protection		
4	I/O 3	ESD protection		
5	V_{CC}	supply voltage		
6	I/O 4	ESD protection		



3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
IP4221CZ6-XS	DFN1010-6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891

4. Marking

Table 3. Marking codes

Type number	Marking code
IP4221CZ6-XS	1X

5. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_I	input voltage			−0.5	+5.5	V
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2, level 4; contact discharge	[1]	−8	+8	kV
T_{stg}	storage temperature			−55	+125	°C
T_{amb}	ambient temperature			−40	+85	°C

[1] All pins to ground.

6. Characteristics

Table 5. Characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$C_{(I/O-GND)}$	input/output to ground capacitance	V_I = 0 V; f = 1 MHz; V_{CC} = 3 V	[1][2]	-	1	1.2	pF
I_{RM}	reverse leakage current	V_I = 3 V	[3][2]	-	-	100	nA
V_{BRzd}	Zener diode breakdown voltage	I_I = 1 mA	[4]	6	-	9	V
V_F	forward voltage	I_{test} = 10 mA		-	0.7	-	V

[1] This parameter is guaranteed by design.

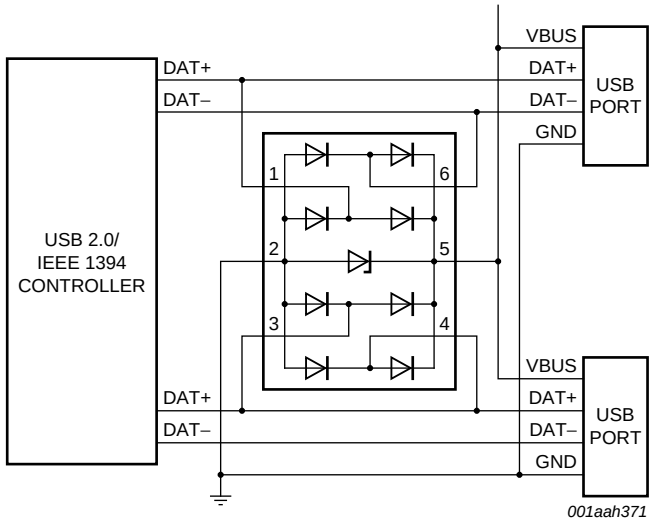
[2] Pins 1, 3, 4 and 6 are measured to ground.

[3] All pins measured to ground (pin 2).

[4] Measured from pin 5 to pin 2.

7. Application information

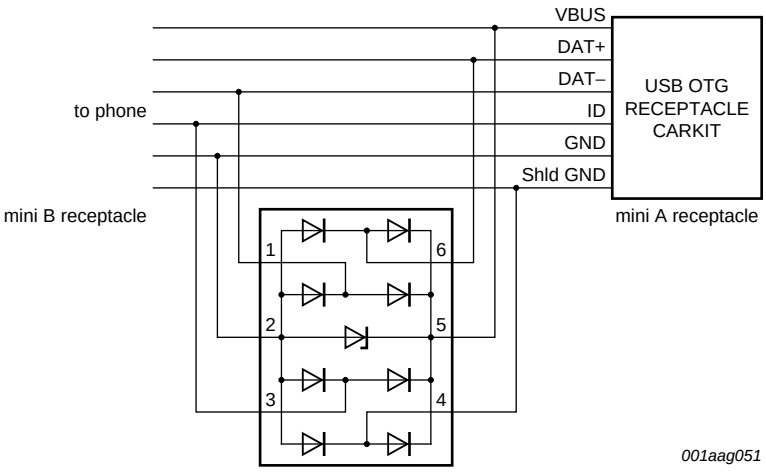
7.1 USB 1.1 and 2.0 protection



Each device is capable to protect USB data lines and V_{BUS} supply.

Fig 1. Typical application for USB ESD protection

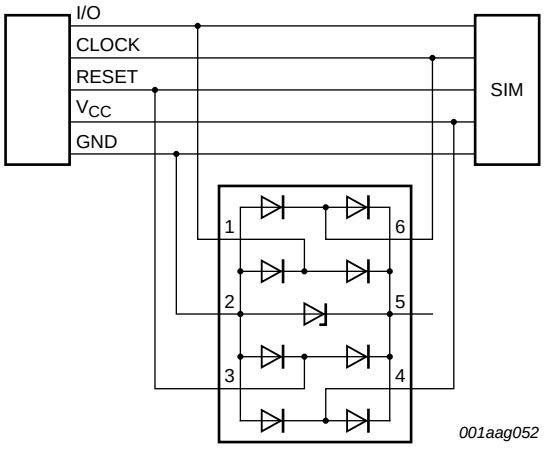
7.2 USB On-The-GO (OTG) protection



The device is capable to protect USB data lines, V_{BUS} supply and ID pin.

Fig 2. Typical application for USB OTG ESD protection

7.3 Universal SIM card protection



The device also protects V_{CC}.

Fig 3. Typical application for universal SIM card ESD protection

7.4 IEEE 1394a/b protection

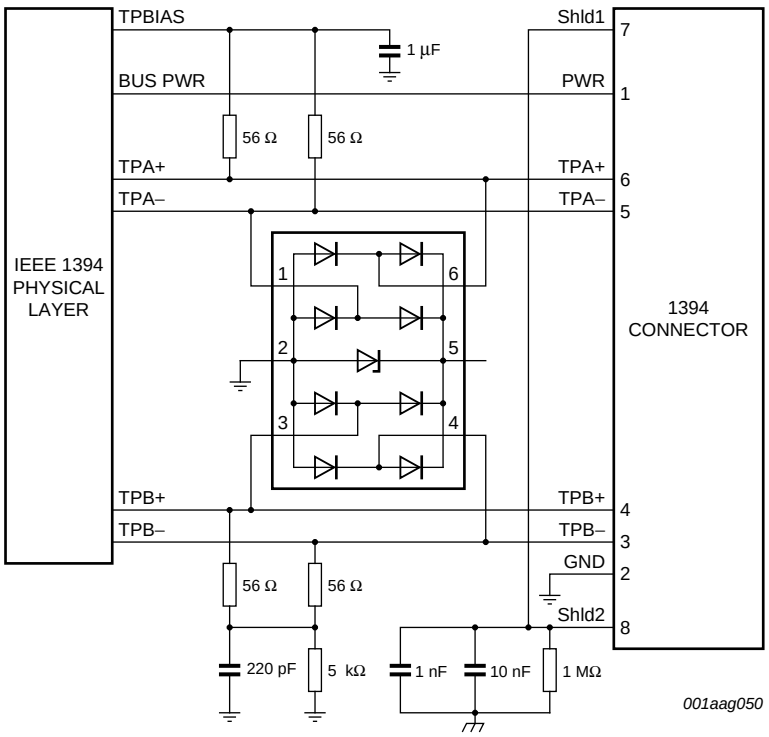


Fig 4. Typical application for IEEE 1394a/b ESD protection

7.5 Gigabit Ethernet transceiver protection

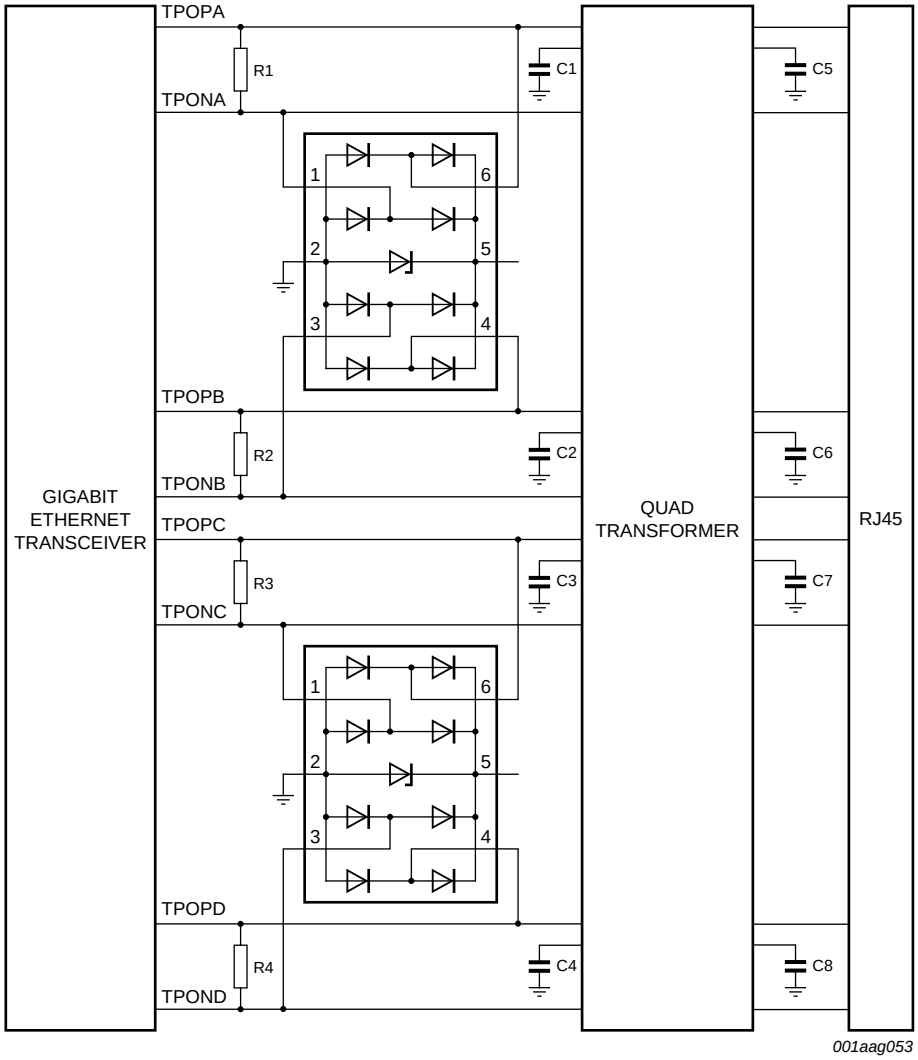


Fig 5. Typical application for gigabit Ethernet transceiver ESD protection

7.6 Universal microSD/TransFlash and SD memory card protection

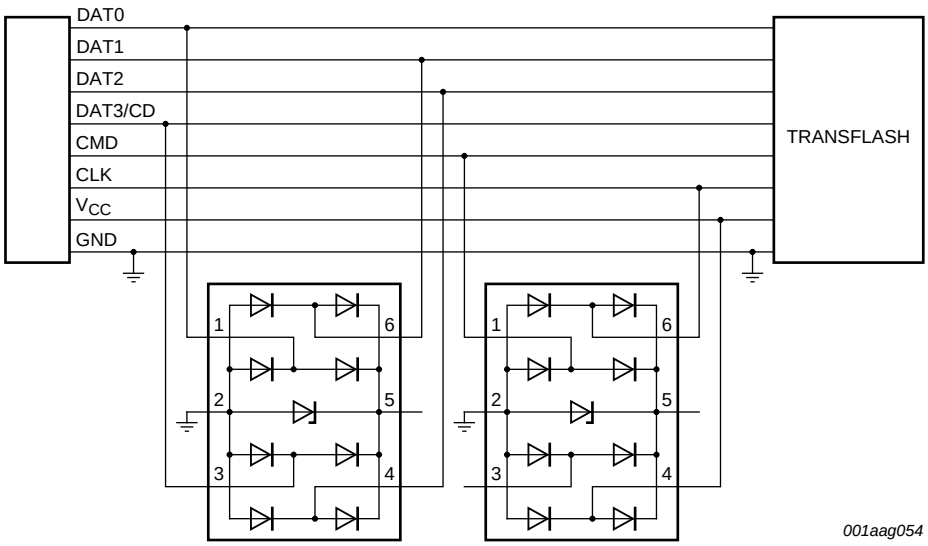


Fig 6. Typical application for universal microSD/TransFlash and SD memory card ESD protection

8. Package outline

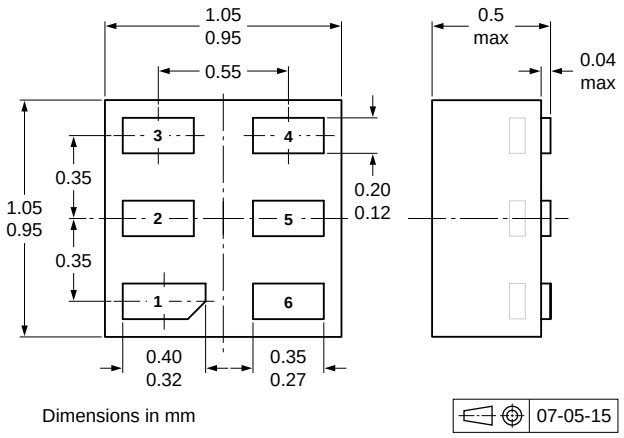


Fig 7. Package outline DFN1010-6 (SOT891)

9. Packing information

Table 6. Packing methods

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

Type number	Package	Description	Packing quantity
			5000
IP4221CZ6-XS	DFN1010-6 (SOT891)	4 mm pitch, 8 mm tape and reel; T4 [2]	-132

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

[2] T4: reverse taping

10. Soldering

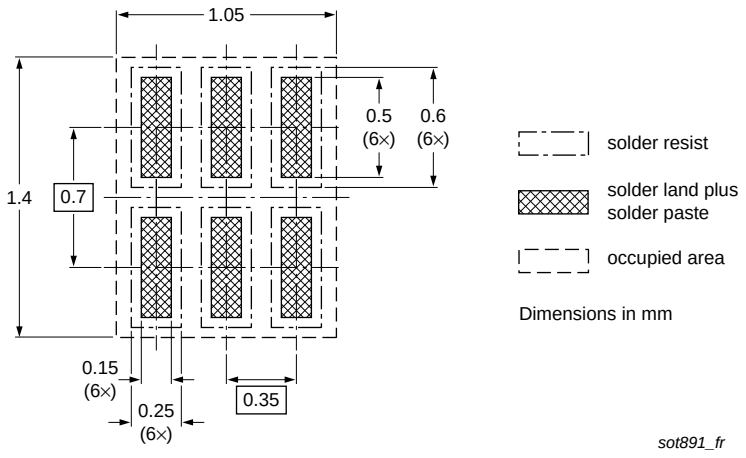


Fig 8. Reflow soldering footprint DFN1010-6 (SOT891)

11. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4221CZ6-XS v.2	20121213	Product data sheet	-	IP4221CZ6-XS v.1
Modifications:	• Section 1 “Product profile”: updated • Section 4 “Marking”: added • Section 5 “Limiting values”: T_{amb} added • Recommended operating conditions: removed • Table 5 “Characteristics”: updated • Section 7 “Application information”: updated • Section 8 “Package outline”: drawing replaced with minimized package outline drawing • Section 10 “Soldering”: added • Section 12 “Legal information”: updated			
IP4221CZ6-XS v.1	20070611	Objective data sheet	-	-

12. Legal information

12.1 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.nxp.com.

12.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

12.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

12.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

13. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 13 December 2012
Document identifier: IP4221CZ6-XS

14. Contents

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 13 December 2012
Document identifier: IP4221CZ6-XS