

# IP4281CZ10

ESD protection for high-speed interfaces

Rev. 01 — 25 September 2008

Product data sheet

# HDMI

## 1. Product profile

### 1.1 General description

The IP4281CZ10 is designed for HDMI interface protection. The device includes high-level ElectroStatic Discharge (ESD) protection diodes for the TMDS signal lines.

All TMDS intra-pairs are protected by a special diode configuration offering a low line capacitance of only 0.7 pF. These diodes provide protection to downstream components from ESD voltages up to  $\pm 8$  kV contact according to IEC 61000-4-2, level 4.

### 1.2 Features

- Pb-free, RoHS compliant and free of Halogen and Antimony (dark green compliant)
- ESD protection for HDMI and other LVDS data lines
- All TMDS lines with integrated rail-to-rail clamping diodes for downstream ESD protection of  $\pm 8$  kV according to IEC61000-4-2, level 4
- Matched 0.5 mm trace spacing
- TMDS lines with  $\leq 0.05$  pF matching capacitance between TMDS pairs
- Line capacitance of only 0.7 pF for each channel
- 4-channel, 10-terminal Ultra-Thin Leadless Package (UTLP)
- HDMI 1.3a compliant

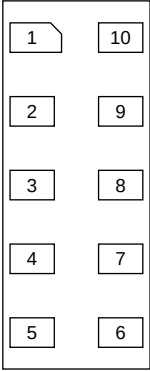
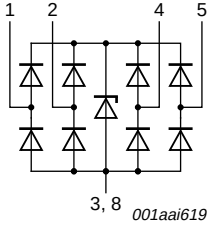
### 1.3 Applications

The IP4281CZ10 is designed for HDMI receiver and transmitter port protection:

- TV, monitor
- Notebook, main board graphics card and ports
- Set-top box and game consoles
- DVD recorder and player

## 2. Pinning information

Table 1. Pinning

| Pin | Symbol    | Description                       | Simplified outline                                                                 | Graphic symbol                                                                      |
|-----|-----------|-----------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | TMDS_CH1– | negative channel 1 ESD protection |  |  |
| 2   | TMDS_CH1+ | positive channel 1 ESD protection |                                                                                    |                                                                                     |
| 3   | GND       | GND                               |                                                                                    |                                                                                     |
| 4   | TMDS_CH2– | negative channel 2 ESD protection |                                                                                    |                                                                                     |
| 5   | TMDS_CH2+ | positive channel 2 ESD protection |                                                                                    |                                                                                     |
| 6   | n.c.      | not connected                     |                                                                                    |                                                                                     |
| 7   | n.c.      | not connected                     |                                                                                    |                                                                                     |
| 8   | GND       | GND                               |                                                                                    |                                                                                     |
| 9   | n.c.      | not connected                     |                                                                                    |                                                                                     |
| 10  | n.c.      | not connected                     |                                                                                    |                                                                                     |

Transparent top view

## 3. Ordering information

Table 2. Ordering information

| Type number | Package |                                                                                                         |           |
|-------------|---------|---------------------------------------------------------------------------------------------------------|-----------|
|             | Name    | Description                                                                                             | Version   |
| IP4281CZ10  | XSON10U | plastic extremely thin small outline package; no leads; 10 terminals; UTLP based; body 1 × 2.5 × 0.5 mm | SOT1059-1 |

## 4. Limiting values

Table 3. Limiting values

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

| Symbol           | Parameter                       | Conditions                                    | Min       | Max   | Unit |
|------------------|---------------------------------|-----------------------------------------------|-----------|-------|------|
| $V_I$            | input voltage                   |                                               | GND – 0.5 | +3.63 | V    |
| $V_{\text{esd}}$ | electrostatic discharge voltage | all pins to ground;<br>IEC 61000-4-2, level 4 |           |       |      |
|                  |                                 | contact                                       | –8        | +8    | kV   |
|                  |                                 | air discharge                                 | –15       | +15   | kV   |
| $T_{\text{stg}}$ | storage temperature             |                                               | –55       | +125  | °C   |

## 5. Recommended operating conditions

Table 4. Operating conditions

| Symbol           | Parameter           | Conditions | Min | Max | Unit |
|------------------|---------------------|------------|-----|-----|------|
| $T_{\text{amb}}$ | ambient temperature |            | –40 | +85 | °C   |

## 6. Characteristics

**Table 5. Characteristics**

| Symbol                | Parameter                                   | Conditions                                                                           | Min | Typ | Max  | Unit          |
|-----------------------|---------------------------------------------|--------------------------------------------------------------------------------------|-----|-----|------|---------------|
| $V_{BRzd}$            | Zener diode breakdown voltage               | $I = 1 \text{ mA}$                                                                   | 6   | -   | 9    | V             |
| $I_{LRzd}$            | Zener diode reverse leakage current         | per TMDS channel; $V = 3.0 \text{ V}$                                                | -   | -   | 1    | $\mu\text{A}$ |
| $V_F$                 | forward voltage                             |                                                                                      | -   | 0.7 | -    | V             |
| $C_{ch(TMDS)}$        | TMDS channel capacitance                    | $f = 1 \text{ MHz}$ ; $V_{bias} = 2.5 \text{ V}$                                     | [1] | -   | 0.7  | pF            |
| $\Delta C_{ch(TMDS)}$ | TMDS channel capacitance difference         | $f = 1 \text{ MHz}$ ; $V_{bias} = 2.5 \text{ V}$                                     | [1] | -   | 0.05 | pF            |
| $C_{ch(mutual)}$      | mutual channel capacitance                  | between signal pin and pin n.c.;<br>$f = 1 \text{ MHz}$ ; $V_{bias} = 2.5 \text{ V}$ | [1] | -   | 0.07 | pF            |
| $R_{dyn}$             | dynamic resistance                          | $I = 1 \text{ A}$ , $T_{amb} = 25 \text{ }^\circ\text{C}$ ; IEC 61000-4-5/9          |     |     |      |               |
|                       |                                             | positive transient                                                                   | -   | 2.4 | -    | $\Omega$      |
|                       |                                             | negative transient                                                                   | -   | 1.3 | -    | $\Omega$      |
| $V_{CL(ch)trt(pos)}$  | positive transient channel clamping voltage | $V_{esd} = 8 \text{ kV HBM}$ ; $T_{amb} = 25 \text{ }^\circ\text{C}$                 | -   | 8   | -    | V             |

[1] This parameter is guaranteed by design.

7. Application information

The IP4281CZ10 is mainly designed to provide high-level ESD protection for high-speed serial data buses such as HDMI and other LVDS data lines.

Therefore, careful printed-circuit board design with respect to impedance matching, coupling to other signals etc. is recommended. An example showing a basic abstract view of a layout for an HDMI interface is shown in [Figure 1](#).

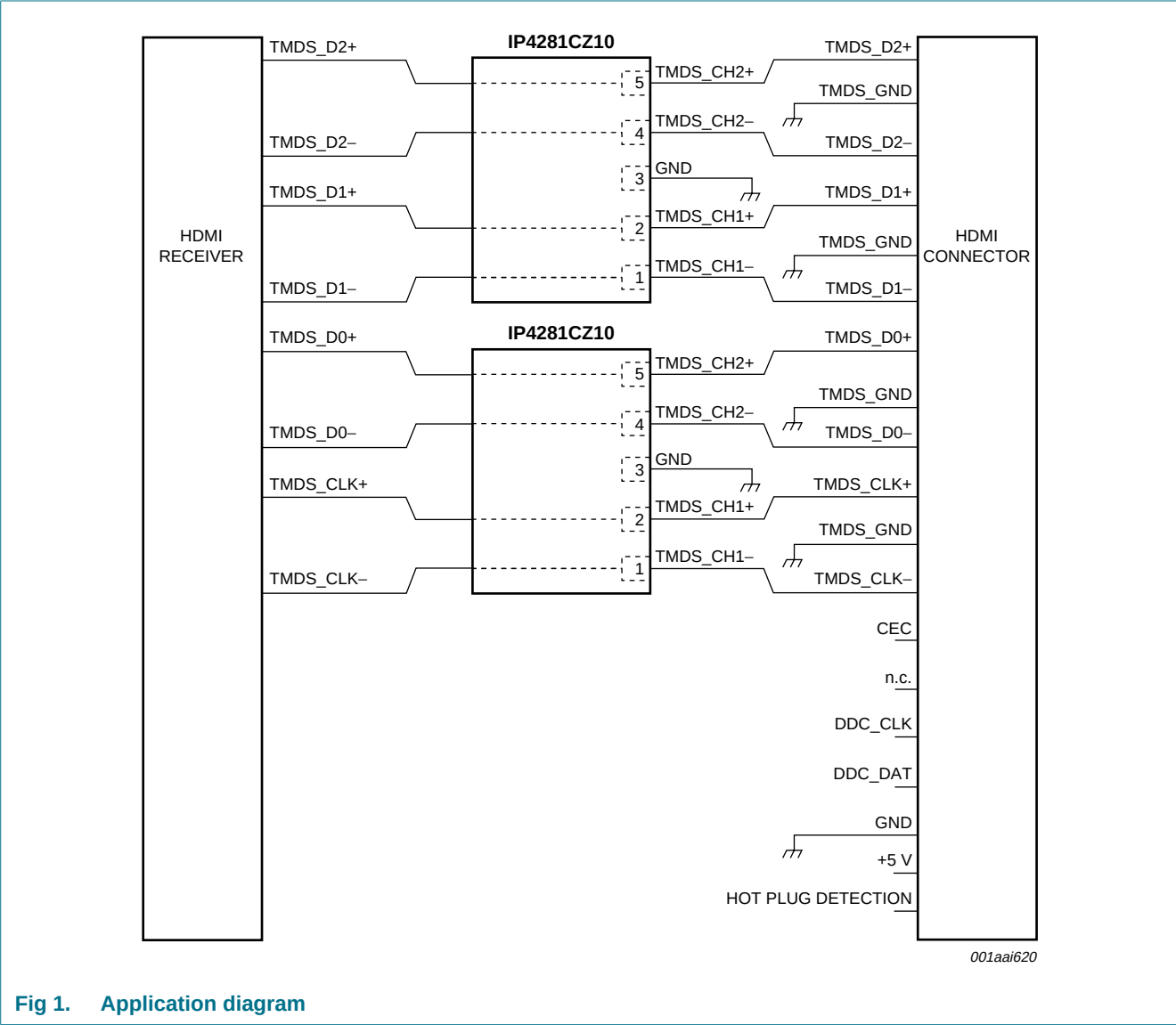


Fig 1. Application diagram

8. Package outline

XSON10U: plastic extremely thin small outline package; no leads;  
10 terminals; UTLP based; body 1 x 2.5 x 0.5 mm

SOT1059-1

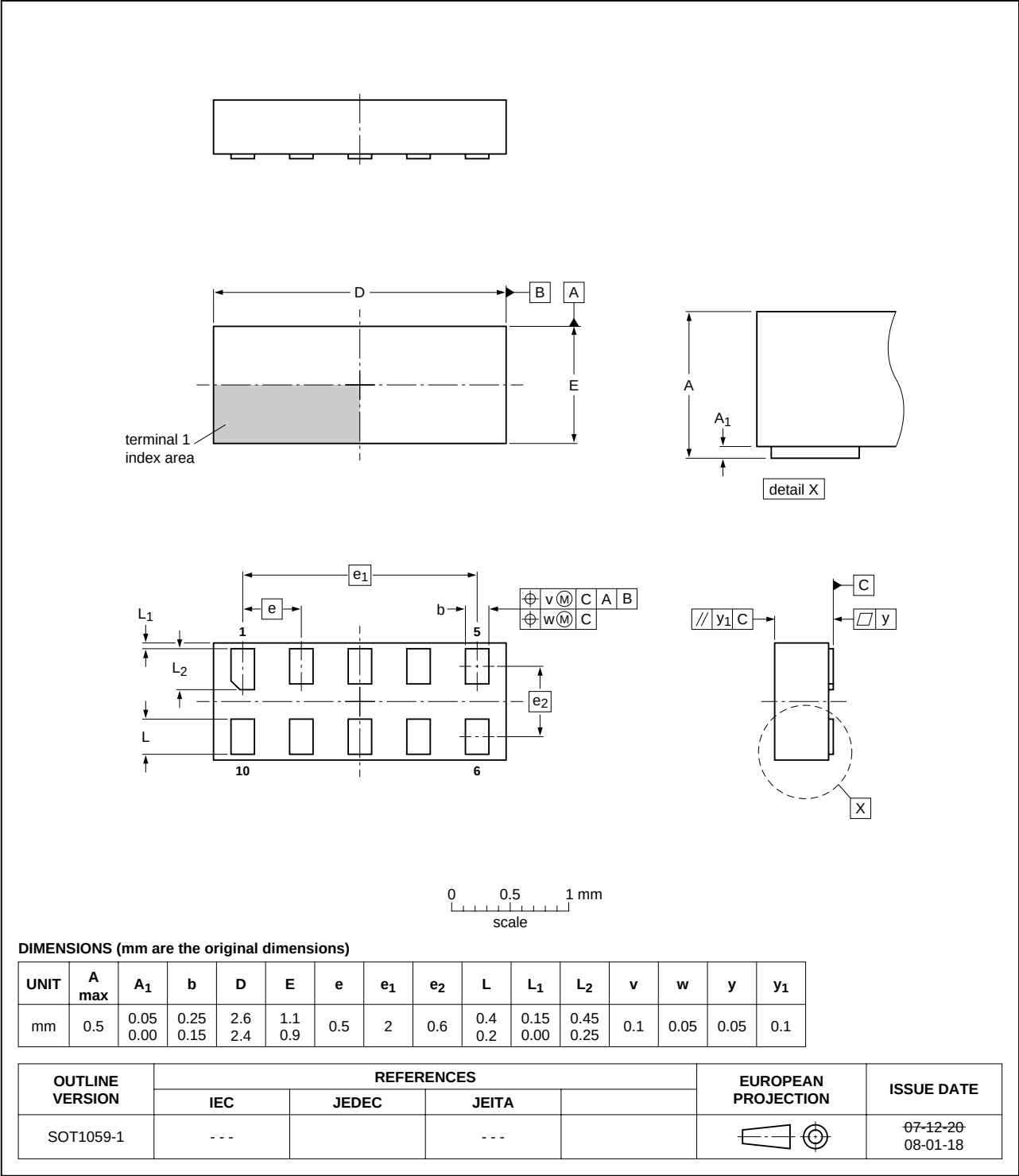


Fig 2. Package outline SOT1059-1 (XSON10U)

## 9. Abbreviations

Table 6. Abbreviations

| Acronym | Description                                 |
|---------|---------------------------------------------|
| DVD     | Digital Video Disk                          |
| ESD     | ElectroStatic Discharge                     |
| HBM     | Human Body Model                            |
| HDMI    | High-Definition Multimedia Interface        |
| LVDS    | Low-Voltage Differential Signaling          |
| RoHS    | Restriction of Hazardous Substances         |
| TMDs    | Transition Minimized Differential Signaling |

## 10. Revision history

Table 7. Revision history

| Document ID  | Release date | Data sheet status  | Change notice | Supersedes |
|--------------|--------------|--------------------|---------------|------------|
| IP4281CZ10_1 | 20080925     | Product data sheet | -             | -          |

## 11. Legal information

### 11.1 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>.

### 11.2 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.

### 11.3 Disclaimers

**General** — 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.

**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 medical, military, aircraft, space or life support 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 accepts 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.

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

**Terms and conditions of 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>, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

**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.

### 11.4 Trademarks

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

## 12. Contact information

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

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

13. Contents

1 Product profile ..... 1

1.1 General description..... 1

1.2 Features ..... 1

1.3 Applications ..... 1

2 Pinning information..... 2

3 Ordering information..... 2

4 Limiting values..... 2

5 Recommended operating conditions..... 2

6 Characteristics..... 3

7 Application information..... 4

8 Package outline ..... 5

9 Abbreviations..... 6

10 Revision history..... 6

11 Legal information..... 7

11.1 Data sheet status ..... 7

11.2 Definitions..... 7

11.3 Disclaimers..... 7

11.4 Trademarks..... 7

12 Contact information..... 7

13 Contents ..... 8



Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.