IP4284CZ10-TB; IP4284CZ10-TT

ESD protection for ultra high-speed interfaces

Rev. 02 — 1 April 2010 Product data sheet

1. Product profile

1.1 General description

The devices are designed to protect high-speed interfaces such as High-Definition Multimedia Interface (HDMI), DisplayPort, SuperSpeed USB, external Serial Advanced Technology Attachment (eSATA) and Low Voltage Differential Signaling (LVDS) interfaces against ElectroStatic Discharge (ESD).

The devices include high-level ESD protection diodes for ultra high-speed signal lines and are available in two package variants: XSON10U and TSSOP10.

All signal lines are protected by a special diode configuration offering ultra low line capacitance of only 0.5 pF. These diodes provide protection to downstream components from ESD voltages up to ±8 kV contact according to IEC 61000-4-2, level 4.

1.2 Features and benefits

- Pb-free, Restriction of Hazardous Substances (RoHS) compliant and free of halogen and antimony (Dark Green compliant)
- System ESD protection for USB 2.0 and USB SuperSpeed 3.0, HDMI 1.3 and HDMI 1.4, DisplayPort, eSATA and LVDS
- 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
- Matched 0.5 mm trace spacing
- Signal lines with ≤ 0.05 pF matching capacitance between signal pairs
- Line capacitance of only 0.5 pF for each channel
- 4-channel, XSON10U or TSSOP10 Pb-free package
- Design-friendly ’pass-thru’ signal routing

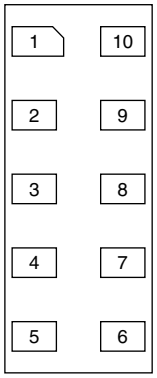
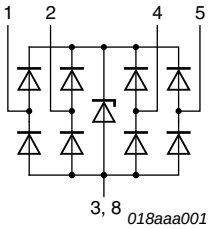
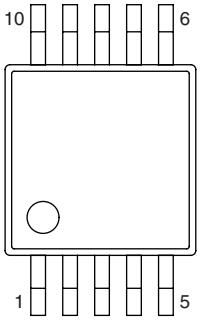
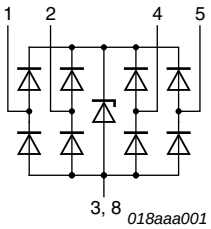
1.3 Applications

The devices are designed for high-speed receiver and transmitter port protection:

- TVs, 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
IP4284CZ10-TB (SOT1059-1)				
1	CH1	channel 1 ESD protection	 Transparent top view **XSON10U**	
2	CH2	channel 2 ESD protection		
3	GND	ground		
4	CH3	channel 3 ESD protection		
5	CH4	channel 4 ESD protection		
6	n.c.	not connected		
7	n.c.	not connected		
8	GND	ground		
9	n.c.	not connected		
10	n.c.	not connected		
IP4284CZ10-TT (SOT552-1)				
1	CH1	channel 1 ESD protection	 **TSSOP10**	
2	CH2	channel 2 ESD protection		
3	GND	ground		
4	CH3	channel 3 ESD protection		
5	CH4	channel 4 ESD protection		
6	n.c.	not connected		
7	n.c.	not connected		
8	GND	ground		
9	n.c.	not connected		
10	n.c.	not connected		

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
IP4284CZ10-TB	XSON10U	plastic extremely thin small outline package; no leads; 10 terminals; UTLP based; body 1 × 2.5 × 0.5 mm	SOT1059-1
IP4284CZ10-TT	TSSOP10	plastic thin shrink small outline package; 10 leads; body width 3 mm	SOT552-1

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

[1] All pins to ground.

5. Characteristics

Table 4. Characteristics

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

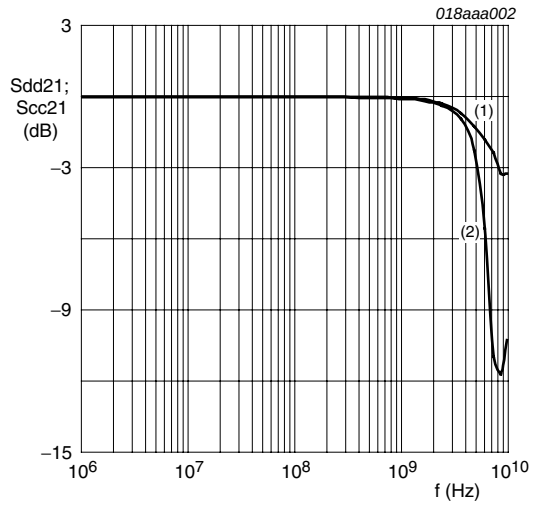
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{BRzd}	Zener diode breakdown voltage	I_{test} = 1 mA		6	-	9	V
I_{LRzd}	Zener diode reverse leakage current	per TMDS channel; V_I = 3.0 V		-	-	1	μA
V_F	forward voltage			-	0.7	-	V
$C_{ch(TMDS)}$	TMDS channel capacitance	f = 1 MHz; V_{bias} = 2.5 V	[1]	0.4	0.5	0.7	pF
$\Delta C_{ch(TMDS)}$	TMDS channel capacitance difference	f = 1 MHz; V_{bias} = 2.5 V	[1]	-	0.05	-	pF
$C_{ch(mutual)}$	mutual channel capacitance	f = 1 MHz; V_{bias} = 2.5 V	[1][2]	-	0.07	-	pF
R_{dyn}	dynamic resistance	I = 1 A	[4]				
		positive transient		-	1	-	Ω
		negative transient		-	1	-	Ω
$V_{CL(ch)trt(pos)}$	positive transient channel clamping voltage	V_{ESD} = 8 kV	[3]	-	8	-	V

[1] This parameter is guaranteed by design.

[2] Between signal pin and pin n.c.

[3] Human Body Model (HBM) according to JESD22-A-J114D.

[4] According to IEC 61000-4-5 and IEC 61000-4-9.

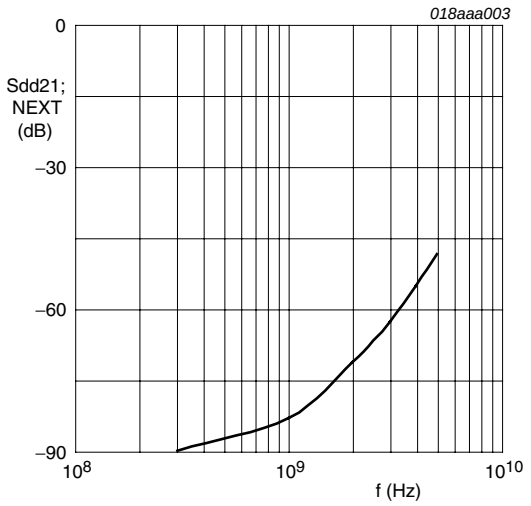


(1) Sdd21

(2) Scc21

normalized to 100 Ω;
differential pairs at CH1/CH2 or at CH3/CH4

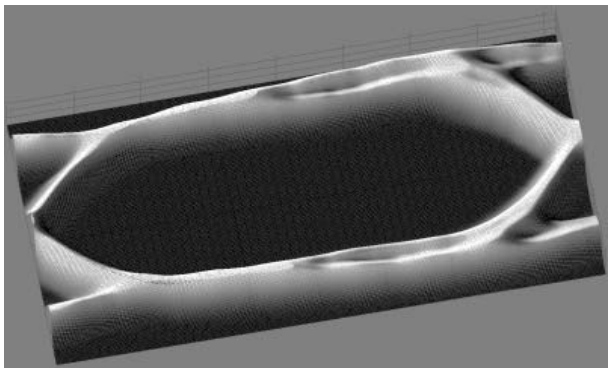
Fig 1. Mixed-mode differential and common-mode insertion loss; typical values



Sdd21

normalized to 100 Ω;
differential pairs CH1/CH2 versus CH3/CH4

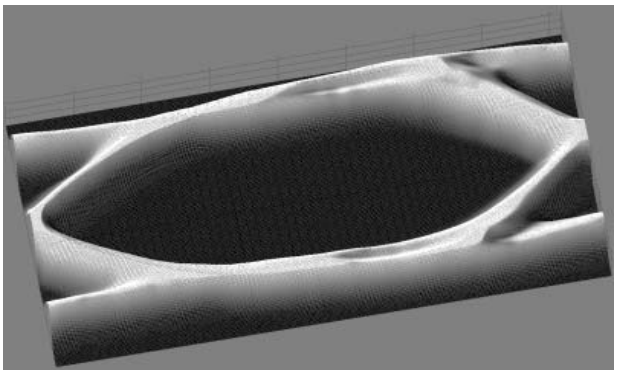
Fig 2. Mixed-mode differential NEXT crosstalk; typical values



018aaa004

5 Gbit/s; USB 3.0 CP0 pattern

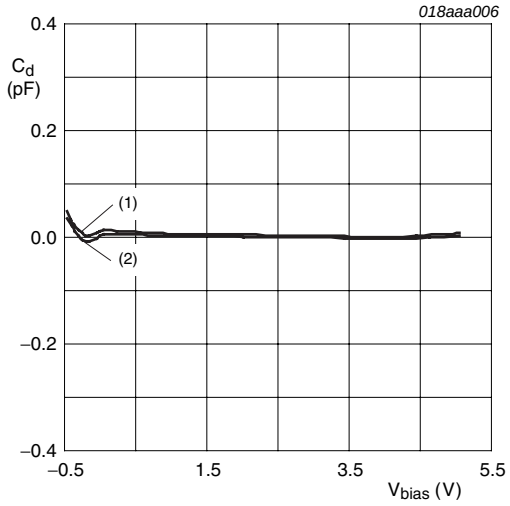
Fig 3. Eye diagram using reference PCB



018aaa003

5 Gbit/s; USB 3.0 CP0 pattern

Fig 4. Eye diagram using IP4284CZ10-TB

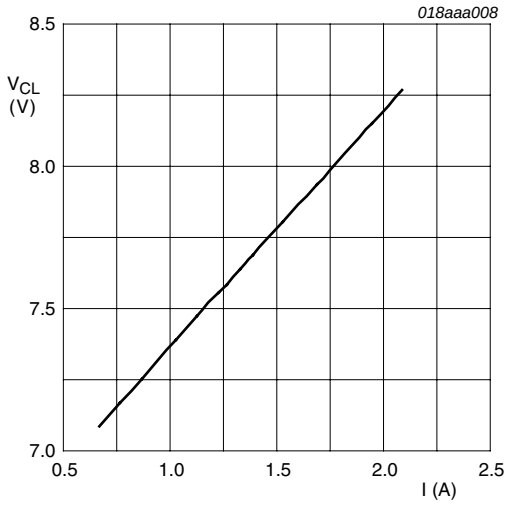


(1) Pin 2

(2) Pin 1

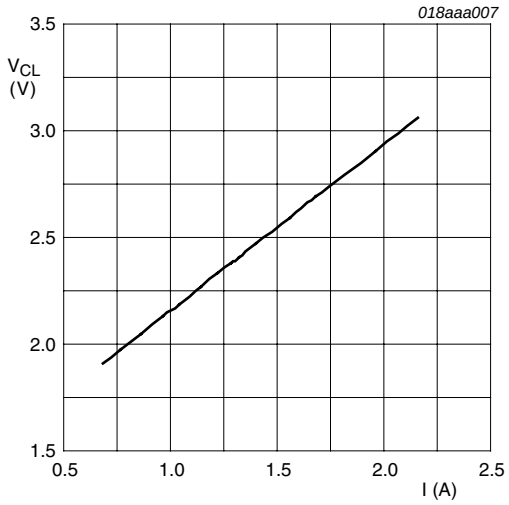
Deviation from typical capacitance normalized at V_{bias} = 2.5 V

Fig 5. Line capacitance as a function of bias voltage; typical values



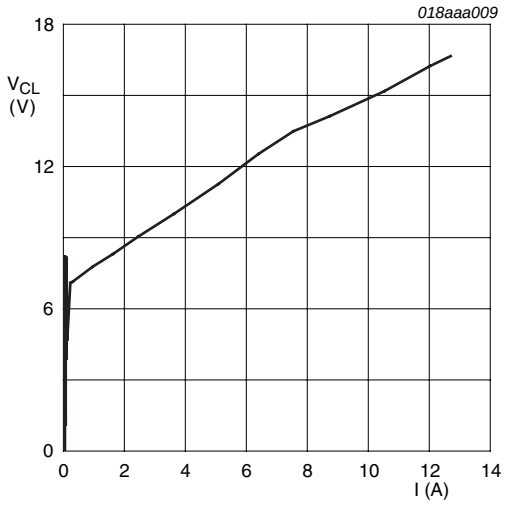
IEC 61000-4-5; t_p = 8/20 μs; positive pulse

Fig 6. Dynamic resistance with positive clamping



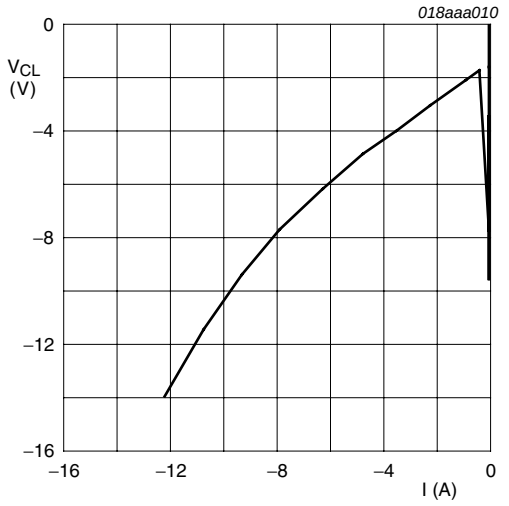
IEC 61000-4-5; t_p = 8/20 μs; negative pulse

Fig 7. Dynamic resistance with negative clamping



t_p = 100 ns; Transmission Line Pulse (TLP)

Fig 8. Dynamic resistance with positive clamping



t_p = 100 ns; Transmission Line Pulse (TLP)

Fig 9. Dynamic resistance with negative clamping

6. Application information

The devices are designed to provide high-level ESD protection for high-speed serial data buses such as HDMI, DisplayPort, eSATA and LVDS data lines.

When designing the Printed-Circuit Board (PCB), careful consideration should be given to basic high-speed routing guidelines, impedance matching, and signal coupling.

Basic application diagrams for the ESD protection of an HDMI interface are shown in Figure 10 and Figure 11.

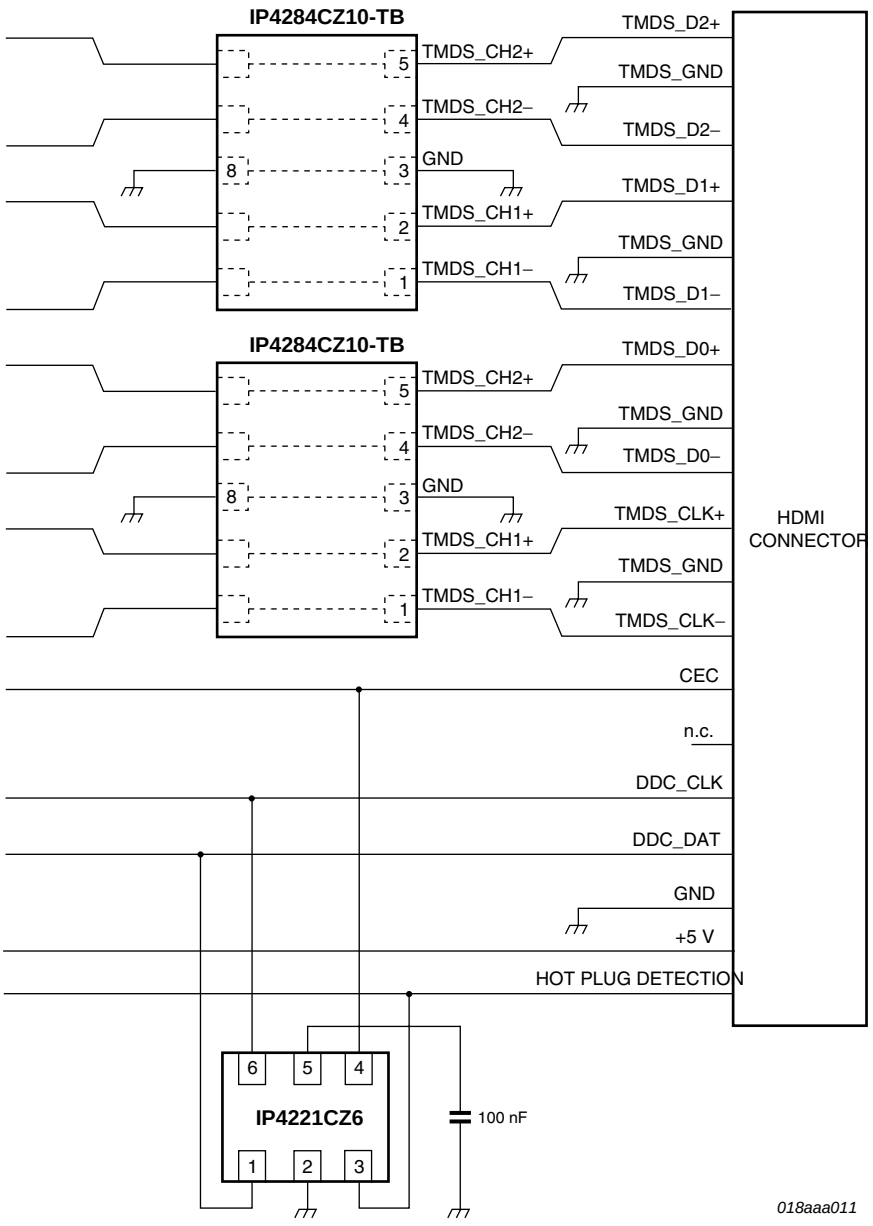


Fig 10. Application diagram of HDMI ESD protection using IP4284CZ10-TB

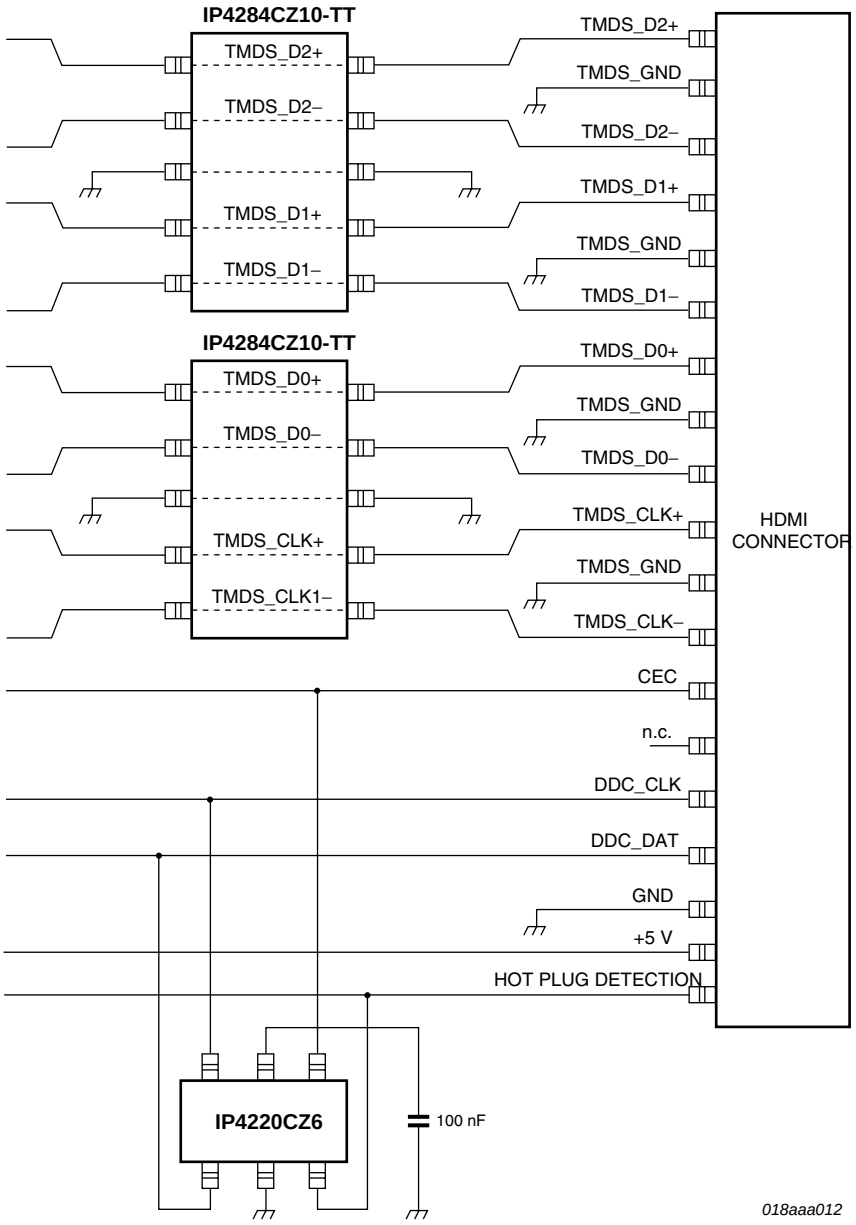
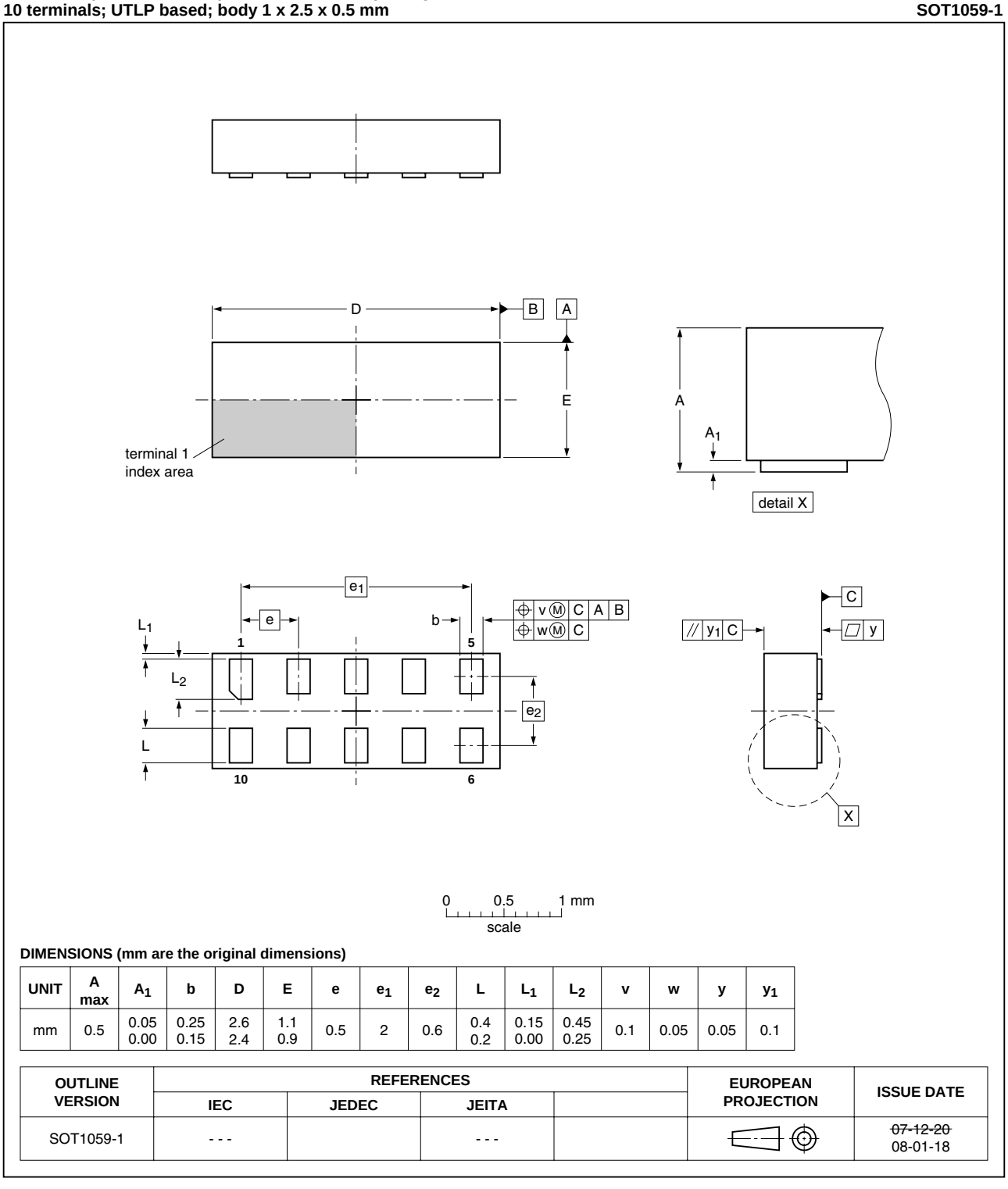


Fig 11. Application diagram of HDMI ESD protection using IP4284CZ10-TT

7. 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**



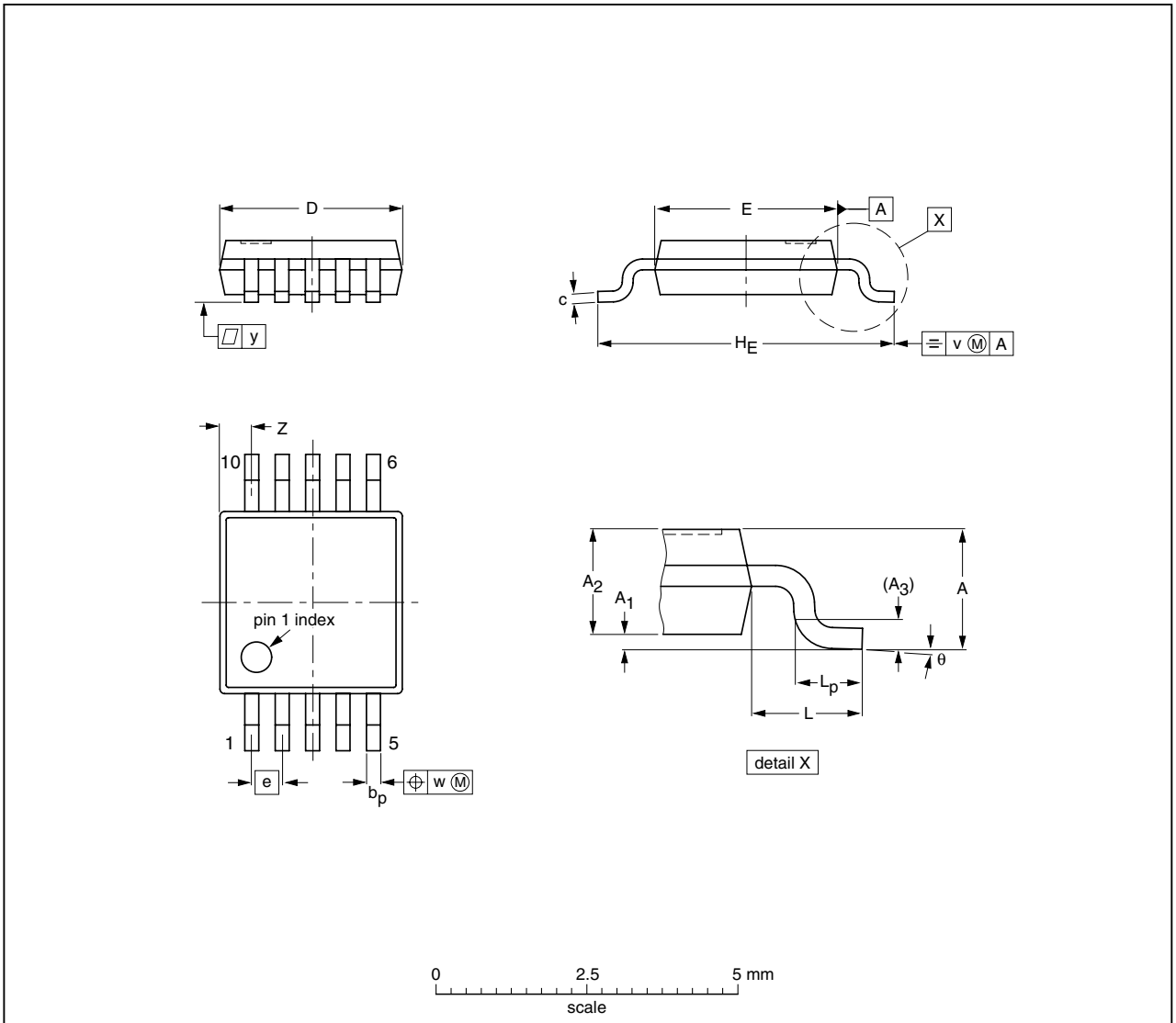
DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1	b	D	E	e	e_1	e_2	L	L_1	L_2	v	w	y	y_1
mm	0.5	0.05 0.00	0.25 0.15	2.6 2.4	1.1 0.9	0.5	2	0.6	0.4 0.2	0.15 0.00	0.45 0.25	0.1	0.05	0.05	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT1059-1	- - -		- - -			~~07-12-20~~ 08-01-18

Fig 12. Package outline SOT1059-1 (XSON10U)

TSSOP10: plastic thin shrink small outline package; 10 leads; body width 3 mm **SOT552-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(2)	e	H_E	L	L_p	v	w	y	Z(1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.15	0.23 0.15	3.1 2.9	3.1 2.9	0.5	5.0 4.8	0.95	0.7 0.4	0.1	0.1	0.1	0.67 0.34	6° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT552-1						~~99-07-29~~ 03-02-18

Fig 13. Package outline SOT552-1 (TSSOP10)

8. Abbreviations

Table 5. Abbreviations

Acronym	Description
DVD	Digital Versatile Disc
eSATA	external Serial Advanced Technology Attachment
ESD	ElectroStatic Discharge
HBM	Human Body Model
HDMI	High-Definition Multimedia Interface
LVDS	Low Voltage Differential Signaling
NEXT	Near End Crosstalk
RoHS	Restriction of Hazardous Substances
TLP	Transmission Line Pulse
TMDS	Transition Minimized Differential Signaling
UTLP	Ultra Thin Leadless Package

9. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4284CZ10-TB_TT_2	20100401	Product data sheet	-	IP4284CZ10-TB_TT_1
Modifications:	• Data sheet status changed to 'Product data sheet'			
IP4284CZ10-TB_TT_1	20100304	Preliminary data sheet	-	-

10. Legal information

10.1 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".

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12. Contents

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