

# IP4285CZ9-TBB

ESD protection for high-speed interfaces

Rev. 1 — 27 May 2011

Product data sheet

## 1. Product profile

### 1.1 General description

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

The device includes high-level ESD protection diodes for high-speed signal lines in a 4-channel 0.4 mm pitch XSON9 package. The extremely small package dimensions make this product ideally suitable for portable devices. The pinout is designed for convenient flow-through routing of high-speed signal lines.

All signal lines are protected by a special diode configuration offering ultra low line capacitance of 0.85 pF maximum. These diodes provide protection to downstream components from ESD voltages up to  $\pm 12$  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, 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  $\pm 12$  kV according to IEC 61000-4-2, level 4
- Matched 0.4 mm trace spacing
- Signal lines with  $\leq 0.05$  pF matching capacitance between signal pairs
- Line capacitance of 0.85 pF maximum for each channel
- 4-channel, XSON9 Pb-free package
- Design-friendly 'flow-through' signal routing

### 1.3 Applications

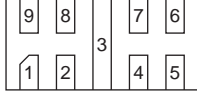
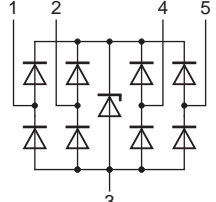
The device is designed for high-speed receiver and transmitter port protection:

- Portable devices
- Mobile handsets
- 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
1	CH1	channel 1 ESD protection	 <p>Transparent top view</p>	 <p>018aaa116</p>
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	n.c.	not connected		
9	n.c.	not connected		

## 3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
IP4285CZ9-TBB	XSON9	plastic extremely thin small outline package; no leads; 9 terminals; body 1 × 2.1 × 0.5 mm	SOT1178-1

## 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] -	±12	kV
		air discharge	[1] -	±18	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**

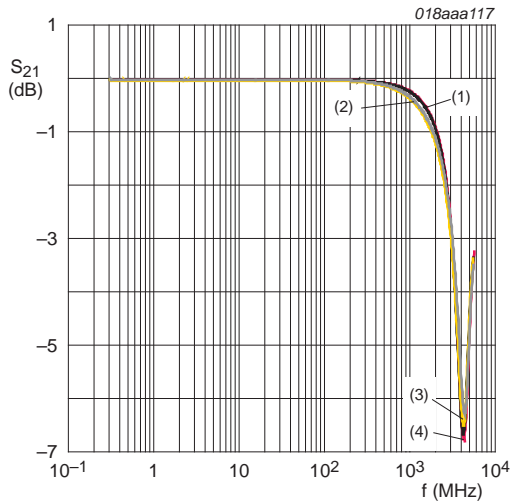
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BRzd}$	Zener diode breakdown voltage	$I_{test} = 1\text{ mA}$	6	-	9	V
$I_{LRzd}$	Zener diode reverse leakage current	per TMDS channel; $V_I = 5.0\text{ V}$	-	-	1	$\mu\text{A}$
$V_F$	forward voltage		-	0.7	-	V
$C_{ch(TMDS)}$	TMDS channel capacitance	$f = 1\text{ MHz}$	[1]			
		$V_{bias} = 0\text{ V}$	-	-	0.85	pF
		$V_{bias} = 2.5\text{ V}$	-	-	0.75	pF
$\Delta C_{ch(TMDS)}$	TMDS channel capacitance difference	$f = 1\text{ MHz};$ $V_{bias} = 2.5\text{ V}$	[1]	-	0.1	pF
$C_{ch(mutual)}$	mutual channel capacitance	$f = 1\text{ MHz};$ $V_{bias} = 2.5\text{ V}$	[1][2]	-	0.25	pF
$R_{dyn}$	dynamic resistance	$I_{PP} = 1\text{ A}$	[3]			
		positive transient	-	0.42	-	$\Omega$
		negative transient	-	0.33	-	$\Omega$
$V_{CL(ch)trt(pos)}$	positive transient channel clamping voltage	$I_{PP} = 4\text{ A}$	[3]	-	4.2	V

[1] This parameter is guaranteed by design.

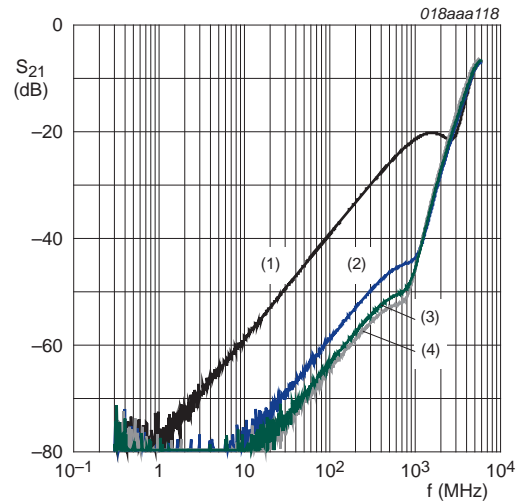
[2] Between signal pin and pin n.c.

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



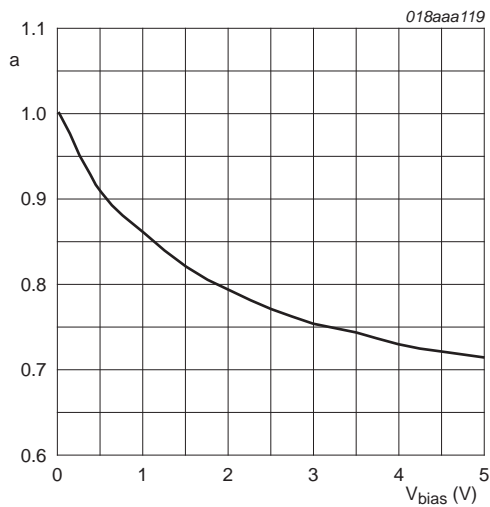
- (1) Pin 1
- (2) Pin 2
- (3) Pin 4
- (4) Pin 5

Fig 1. Insertion loss



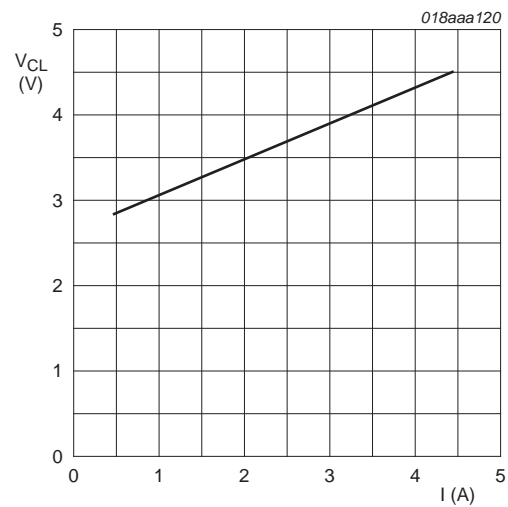
- (1) Pin 1 to 2
- (2) Pin 2 to 4
- (3) Pin 2 to 5
- (4) Pin 1 to 5

Fig 2. Crosstalk



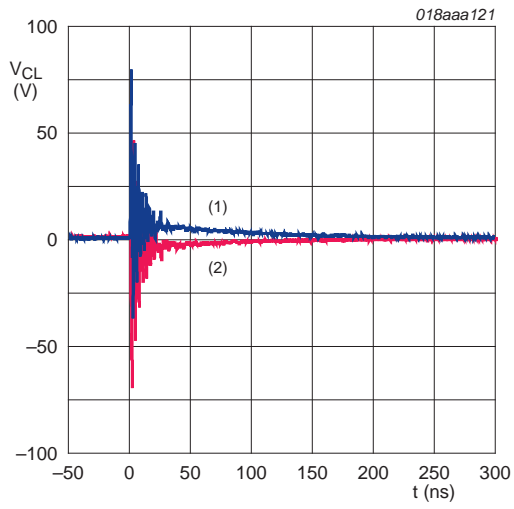
$$a = \frac{C_{ch(TMDS)}}{C_{ch(TMDS)(OV_{bias})}}$$

Fig 3. Line capacitance as a function of bias voltage; typical values



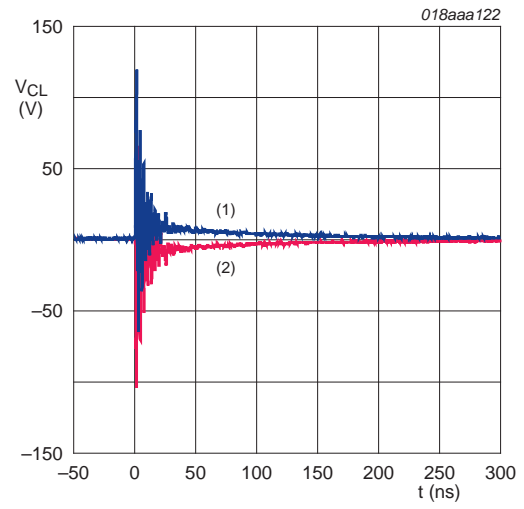
IEC 61000-4-5;  $t_p = 8/20 \mu s$

Fig 4. Dynamic resistance with negative clamping



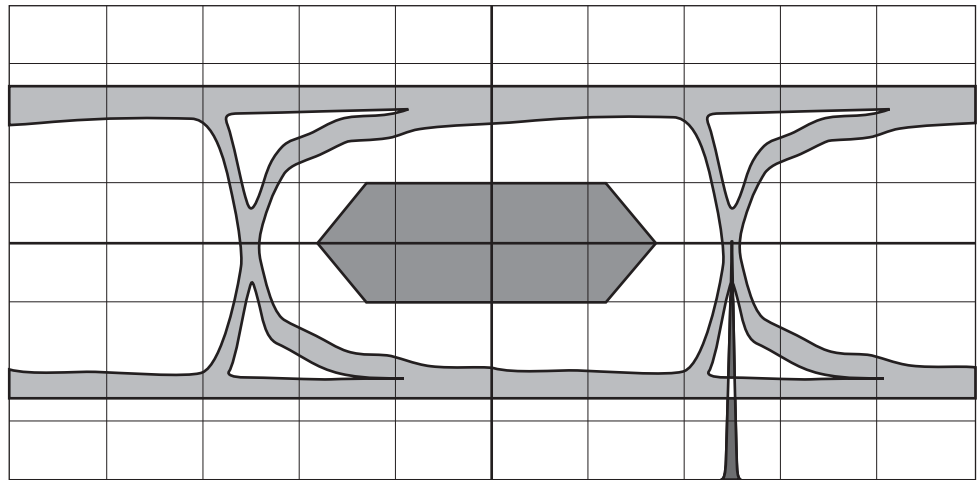
- (1) +8 kV
- (2) -8 kV

**Fig 5. Clamped ±8 kV ESD pulse waveform (IEC 61000-4-2 network)**



- (1) +12 kV
- (2) -12 kV

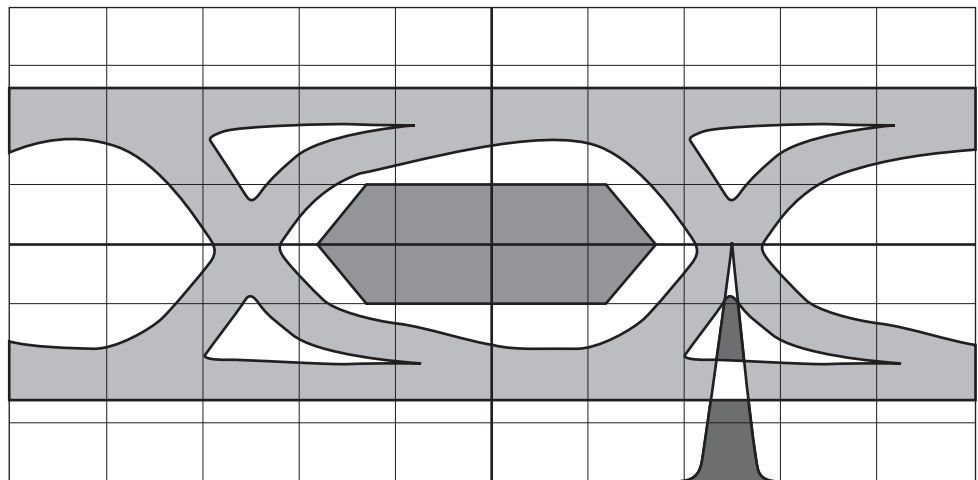
**Fig 6. Clamped ±12 kV ESD pulse waveform (IEC 61000-4-2 network)**



001aa035

HDMI input signal 1280 × 720p; pixel clock = 74.25 MHz  
 Vertical scale = 200 mV/div  
 Horizontal scale = 270 ps/div

**Fig 7. HDMI eye diagram with IP4285CZ9-TBB (720p)**



001aa034

HDMI input signal 1920 × 1080p; pixel clock = 222.75 MHz  
 Vertical scale = 200 mV/div  
 Horizontal scale = 90 ps/div

**Fig 8. HDMI eye diagram with IP4285CZ9-TBB (1080p)**

### 6. Application information

The device is 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. Signal pins 1 and 2 (4 and 5) can be laid out through not connected pins 9 and 8 (6 and 7) respectively to avoid the need for vias and stubs.

Basic application diagrams for the ESD protection of an HDMI interface are shown in [Figure 9](#).

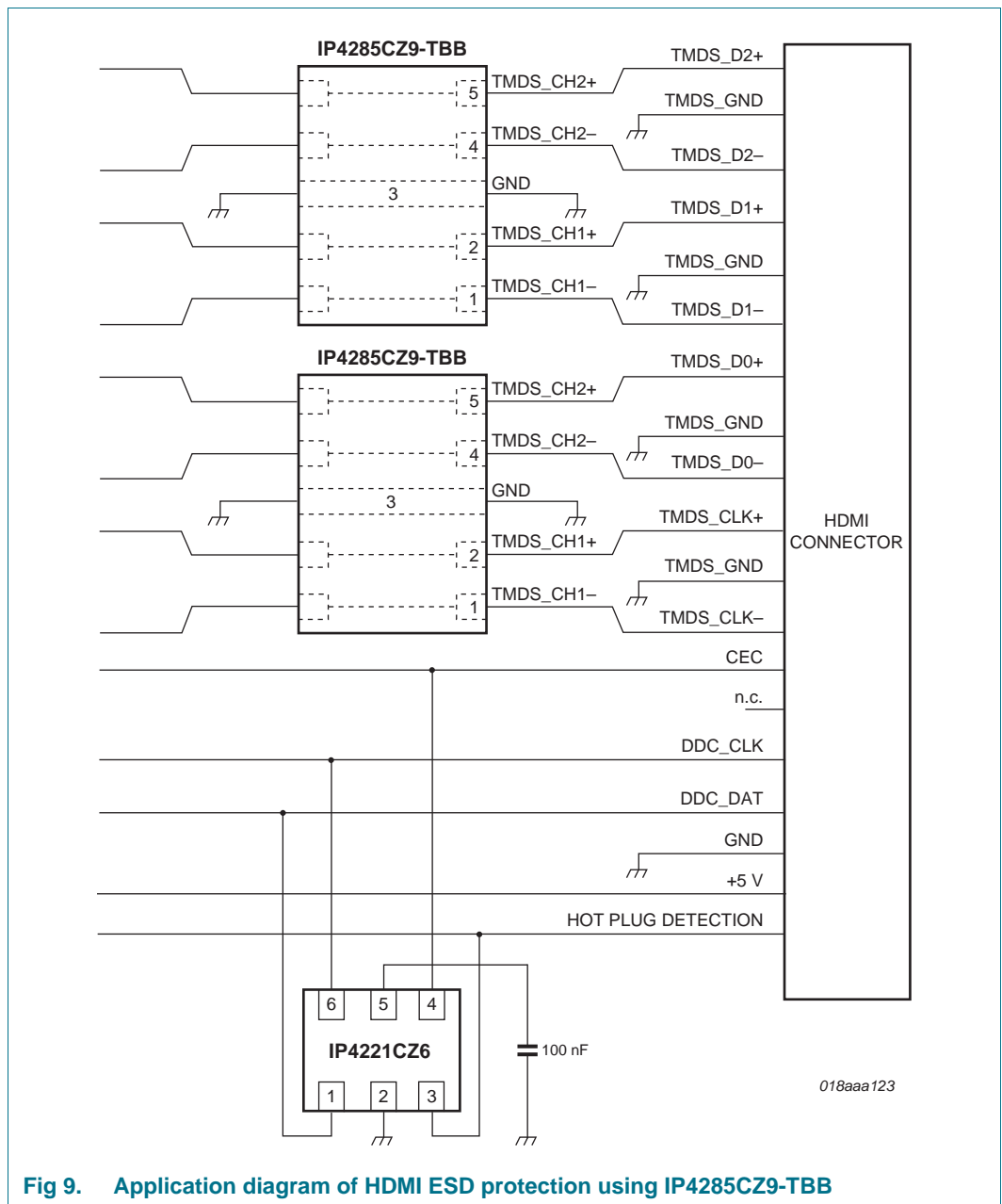


Fig 9. Application diagram of HDMI ESD protection using IP4285CZ9-TBB

7. Package outline

XSON9: plastic extremely thin small outline package; no leads  
9 terminals; body 1 x 2.1 x 0.5 mm

SOT1178-1

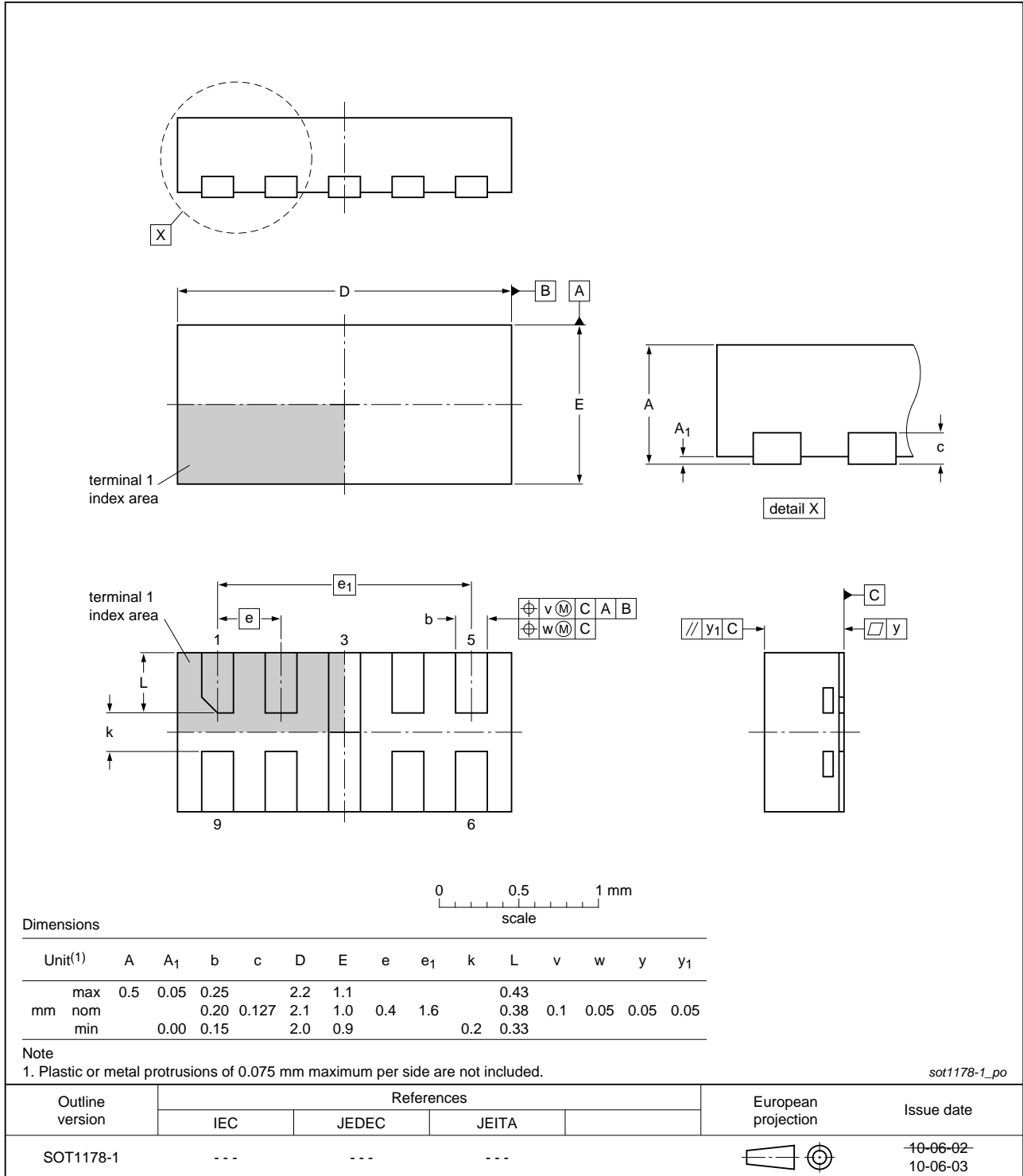


Fig 10. Package outline SOT1178-1 (XSON9)



## 8. Abbreviations

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Table 5. Abbreviations

Acronym	Description
TMDS	Transition Minimized Differential Signaling

## 9. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4285CZ9-TBB v.1	20110527	Product data sheet	-	-

## 10. Legal information

### 10.1 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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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