



## Features

- ESD Protect for 2 high-speed I/O channels
- Provide ESD protection for each channel to  
**IEC 61000-4-2 (ESD) ±15kV (air), ±8kV (contact)**  
**IEC 61000-4-4 (EFT) 20A (5/50ns)**  
**IEC 61000-4-5 (Lightning) 3A (8/20µs)**
- For operating voltage of 3.3V and below
- **Ultra low capacitance: 0.18pF typical**
- Fast turn-on and low clamping voltage
- Array of ESD rated diodes with internal equivalent TVS diode
- Solid-state silicon-avalanche and active circuit triggering technology
- Simplified layout for high-speed differential signaling channels
- **Green part**

## Applications

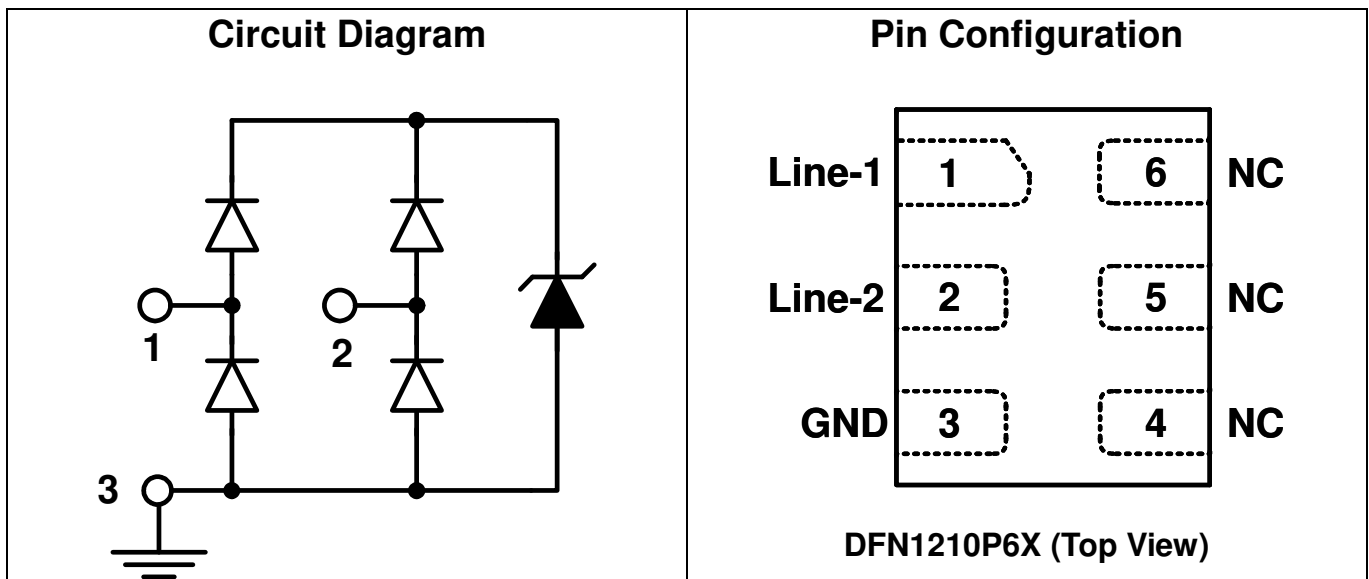
- **HDMI 1.3 & 1.4 and 2.0 version**
- **DisplayPort 1.1 & 1.2 and 1.3 version**
- USB 3.1 and 3.0 interfaces
- USB Type-C interface
- SATA and eSATA interface
- Hand Held Portable Applications

## Description

AZ1023-02F is a design which includes ESD rated diode arrays to protect high speed data interfaces. The AZ1023-02F has been specifically designed to protect sensitive components which are connected to data and transmission lines from over-voltage damage caused by Electrostatic Discharging (ESD).

AZ1023-02F is a unique design which includes ESD rated, ultra low capacitance steering diodes and a unique design of clamping cell which is an equivalent TVS diode in a single package. During transient conditions, the steering diodes direct the transient to either the internal ESD line or to ground line. The internal unique design of clamping cell prevents over-voltage on the internal ESD line and on the I/O line, which is protecting any downstream components.

AZ1023-02F may be used to meet the ESD immunity requirements of IEC 61000-4-2, Level 4 (±15kV air, ±8kV contact discharge).





## SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS			
PARAMETER	SYMBOL	RATING	UNITS
Peak Pulse Current (tp =8/20μs)	I <sub>PP</sub>	3	A
Operating Voltage (I/O pin-GND)	V <sub>DC</sub>	3.6	V
ESD per IEC 61000-4-2 (Air)	V <sub>ESD-1</sub>	±15	kV
ESD per IEC 61000-4-2 (Contact)	V <sub>ESD-2</sub>	±8	
Lead Soldering Temperature	T <sub>SOL</sub>	260 (10 sec.)	°C
Operating Temperature	T <sub>OP</sub>	-55 to +85	°C
Storage Temperature	T <sub>STO</sub>	-55 to +150	°C

ELECTRICAL CHARACTERISTICS						
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Reverse Stand-Off Voltage	V <sub>RWM</sub>	Pin-1,-2 to pin-3, T=25 °C.			3.3	V
Channel Leakage Current	I <sub>CH-Leak</sub>	V <sub>Pin-1,-2</sub> = 3.3V, V <sub>Pin-3</sub> = 0V, T=25 °C.			0.5	μA
Reverse Breakdown Voltage	V <sub>BV</sub>	I <sub>BV</sub> = 1mA, T=25 °C, Pin-1, -2 to pin-3.	4.5			V
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 15mA, T=25 °C, Pin-3 to pin-1, -2.		0.9	1.1	V
ESD Clamping Voltage (Note 1)	V <sub>clamp</sub>	IEC 61000-4-2 +8kV (I <sub>TLP</sub> = 16A), Contact mode, T=25 °C, any I/O pin to Ground.		13		V
ESD Dynamic Turn-on Resistance	R <sub>dynamic</sub>	IEC 61000-4-2, 0 ~ +8kV, Contact mode, T=25 °C, any I/O pin to Ground.		0.5		Ω
Channel Input Capacitance	C <sub>IN</sub>	V <sub>Pin-3</sub> = 0V, V <sub>IN</sub> = 1.65V, f = 1MHz, T=25 °C, any I/O pin to Ground.		0.18	0.27	pF
Channel to Channel Input Capacitance	C <sub>CROSS</sub>	V <sub>Pin-3</sub> = 0V, V <sub>IN</sub> = 1.65V, f = 1MHz, T=25 °C, between I/O pins.		0.04	0.08	pF

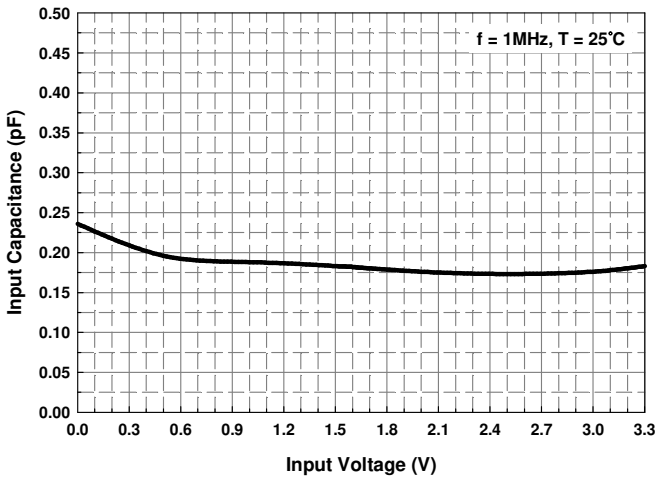
Note 1: ESD Clamping Voltage was measured by Transmission Line Pulsing (TLP) System.

TLP conditions: Z<sub>0</sub>= 50Ω, t<sub>p</sub>= 100ns, t<sub>r</sub>= 1ns.

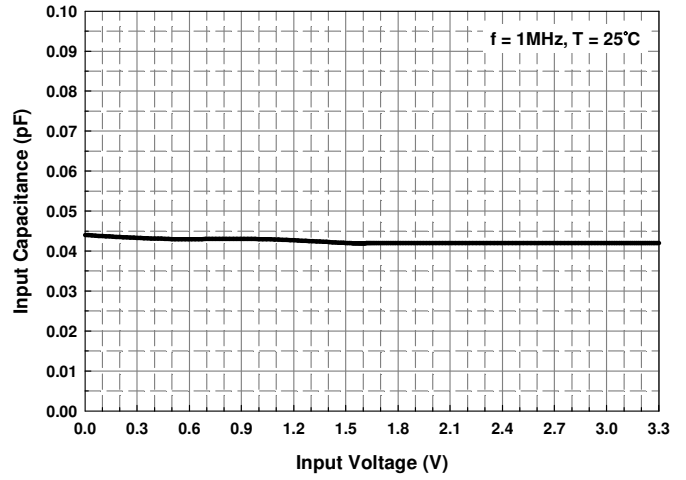


## Typical Characteristics

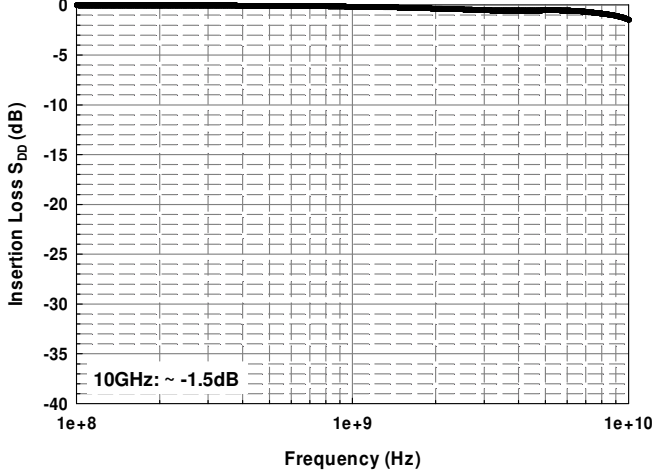
Typical Variation of  $C_{IN}$  vs.  $V_{IN}$



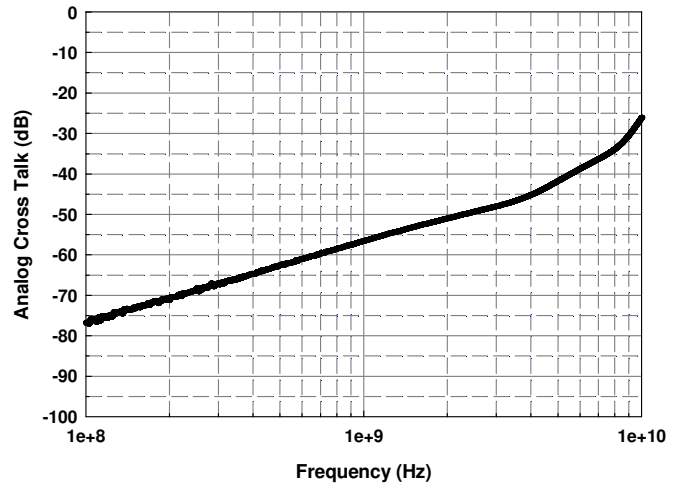
Typical Variation of  $C_{IO-to-IO}$  vs.  $V_{IN}$



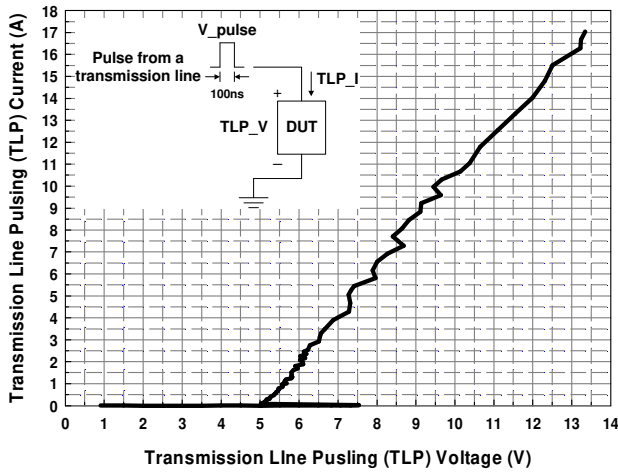
Insertion Loss  $S_{DD}$



Analog Cross Talk



Transmission Line Pulsing (TLP) Measurement





## Applications Information

### A. Device Connection

The AZ1023-02F is designed to protect two data lines from transient over-voltage (such as ESD stress pulse). The device connection of AZ1023-02F is shown in the Fig. 1. In Fig. 1, the two protected data lines are connected to the ESD protection pins (pin1, pin2) of AZ1023-02F. The ground pin (pin3) of AZ1023-02F is a

negative reference pin. This pin should be directly connected to the GND rail of PCB (Printed Circuit Board). To get minimum parasitic inductance, the path length should keep as short as possible.

AZ1023-02F can provide protection for 2 I/O signal lines simultaneously. If the number of I/O signal lines is less than 2, the unused I/O pins can be simply left as NC pins.

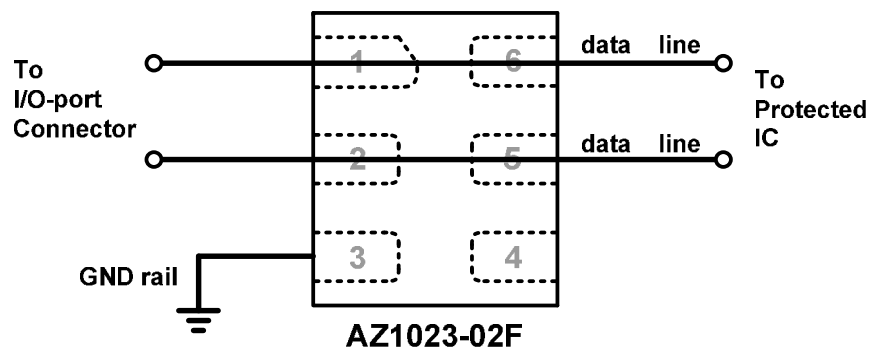
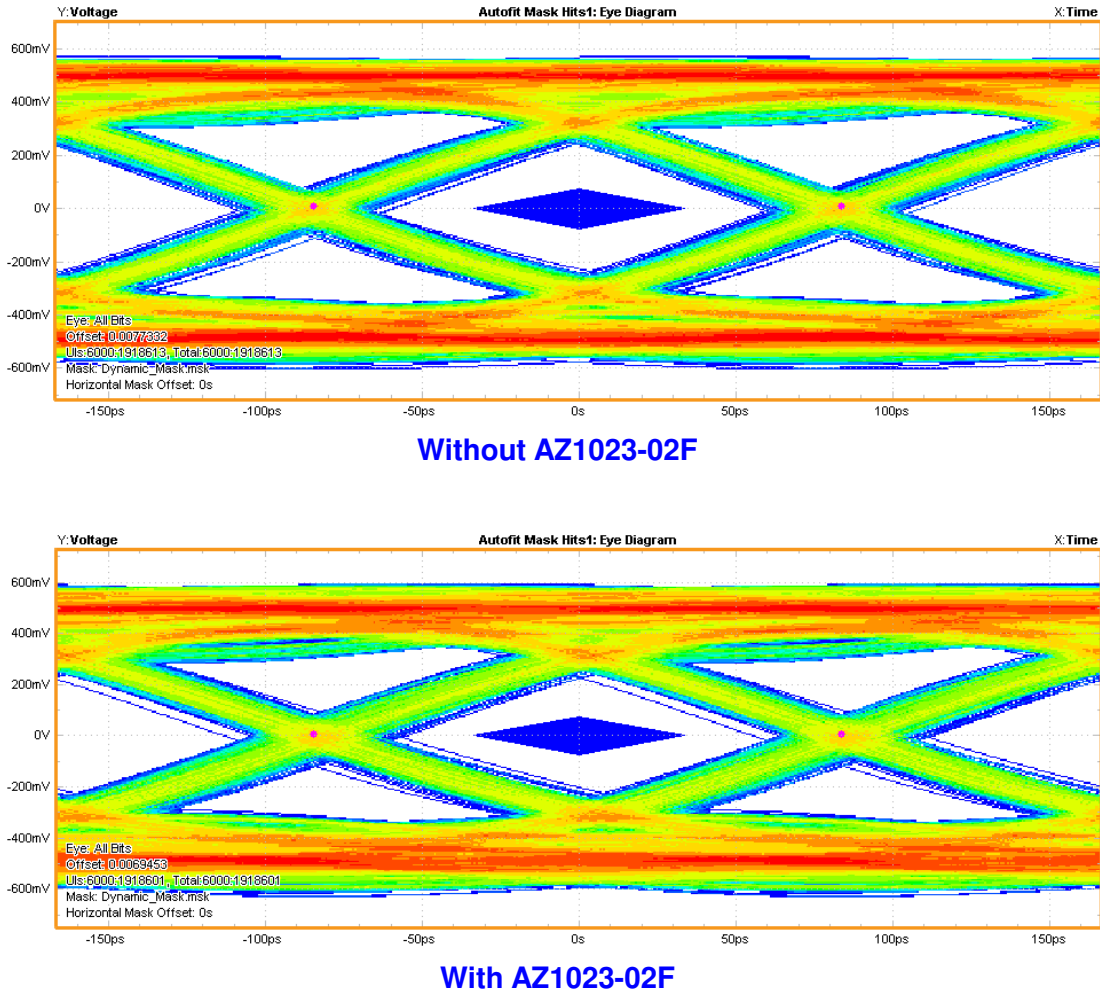


Fig. 1 Data lines connection of AZ1023-02F

Fig. 2 shows the HDMI 2.0 (6 Gb/s) eye diagrams with and without AZ1023-02F. Due to ultra low capacitance of AZ1023-02F, no degradation is observed.

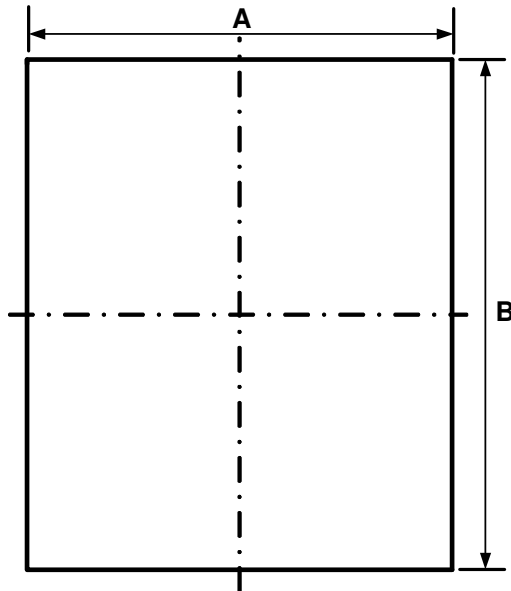


**Fig. 2 HDMI 2.0 (6 Gb/s) Eye Diagrams with and without AZ1023-02F.**

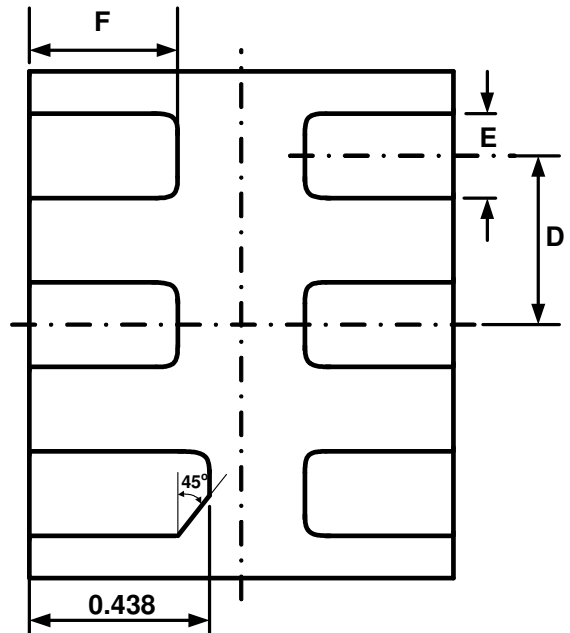


## Mechanical Details

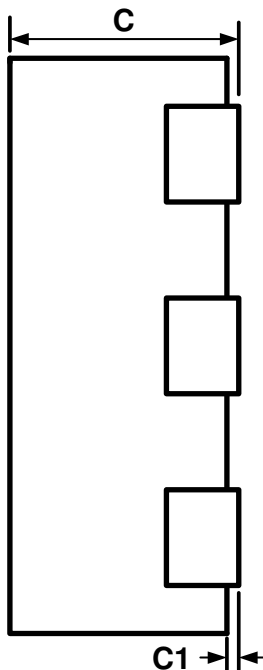
### DFN1210P6X PACKAGE DIAGRAMS AND DIMENSIONS



TOP VIEW



BOTTOM VIEW (unit in mm)

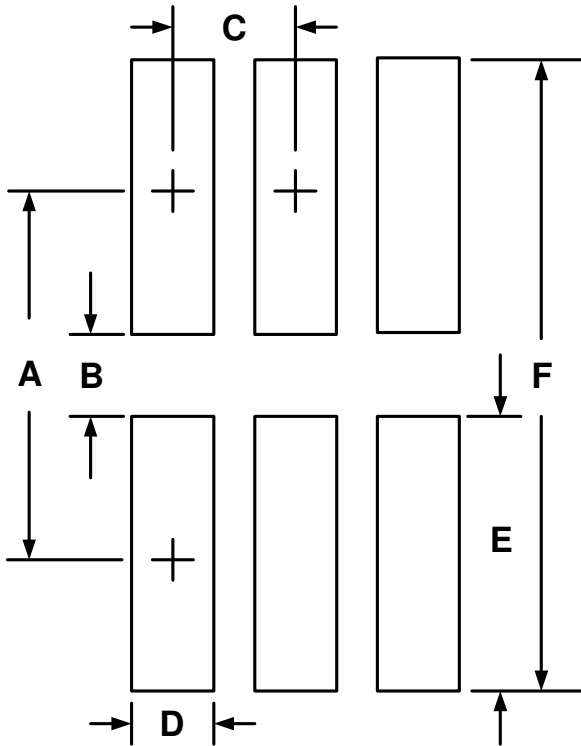


SIDE VIEW

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	0.95	1.00	1.05
B	1.15	1.20	1.25
C	0.41	0.45	0.50
C1	0.00	0.02	0.05
D	0.40		
E	0.15	0.20	0.25
F	0.25	0.35	0.45



## LAND LAYOUT

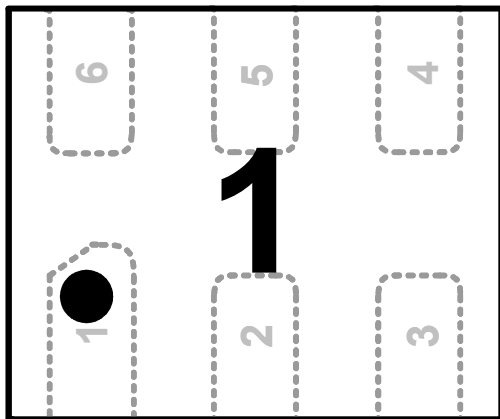


Dimensions		
Index	Millimeter	Inches
A	0.875	0.034
B	0.20	0.008
C	0.40	0.016
D	0.20	0.008
E	0.675	0.027
F	1.55	0.061

### Notes:

This LAND LAYOUT is for reference purposes only. Please consult your manufacturing partners to ensure your company's PCB design guidelines are met.

## MARKING CODE



1 = Device Code

Part Number	Marking Code
AZ1023-02F.R7G (Green Part)	1

Note. Green means Pb-free, RoHS, and Halogen free compliant.



## Ordering Information

PN#	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
AZ1023-02F.R7G	Green	T/R	7 inch	3,000/reel	4 reels = 12,000/box	6 boxes = 72,000/carton

## Revision History

Revision	Modification Description
Revision 2015/11/05	Preliminary Release.
Revision 2016/02/04	Add the Electrical Characteristics and Typical Characteristics.
Revision 2016/05/15	Formal Release.