

## Features

- ESD Protect for Super Speed Differential Signaling (above 5Gb/s) channels
- Protects four I/O lines
- Provide ESD protection for each line to IEC 61000-4-2 (ESD)  $\pm 15\text{kV}$  (air),  $\pm 10\text{kV}$  (contact)
- For operating voltage of 5V and below
- Ultra low capacitance : 0.35pF 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
- **Green part**

## Applications

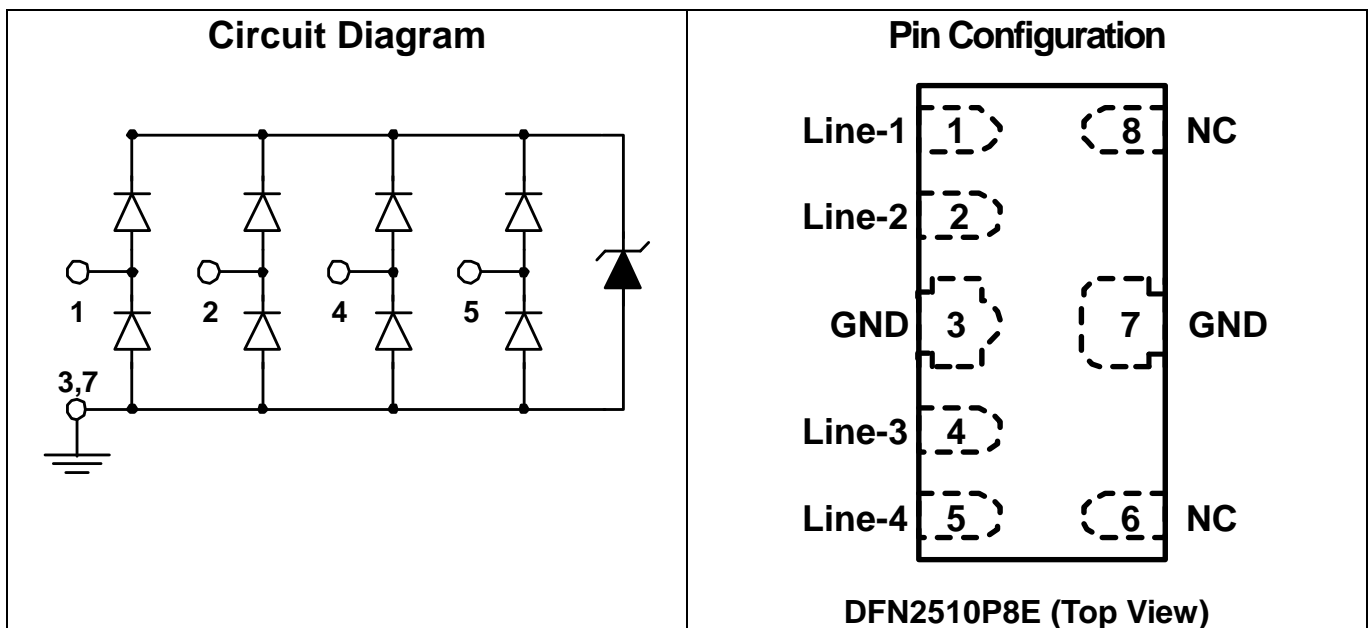
- USB3.0 / USB3.1
- HDMI 1.4 / HDMI 2.0
- DisplayPort interface
- SATA and eSATA interface
- High Speed I/O Ports in Any Electronic Product

## Description

AZ1345-04F is a design which includes ESD rated diode arrays to protect high speed data interfaces. The AZ1345-04F has been specifically designed to protect sensitive components which are connected to data and transmission lines from over-voltage caused by Electrostatic Discharging (ESD).

AZ1345-04F 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.

AZ1345-04F may be used to meet the ESD immunity requirements of IEC 61000-4-2, Level 4 ( $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  contact discharge).





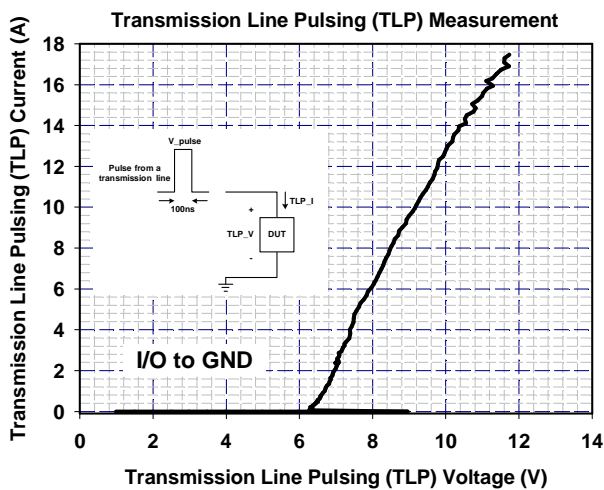
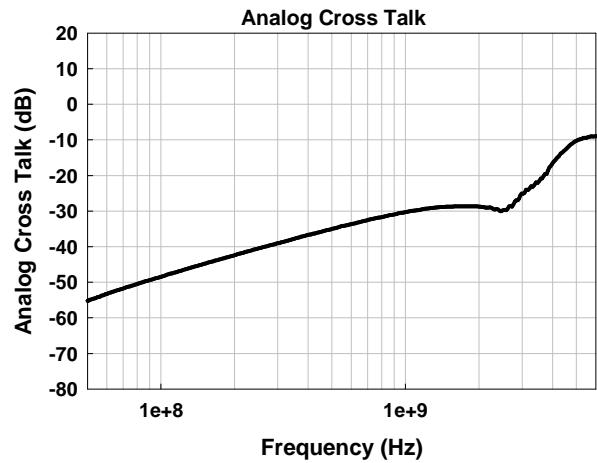
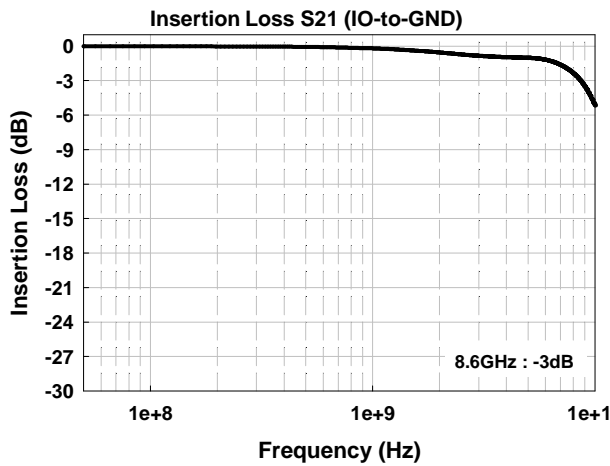
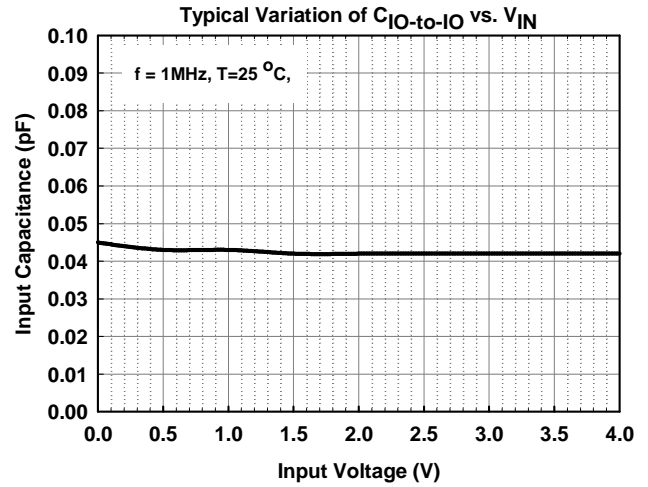
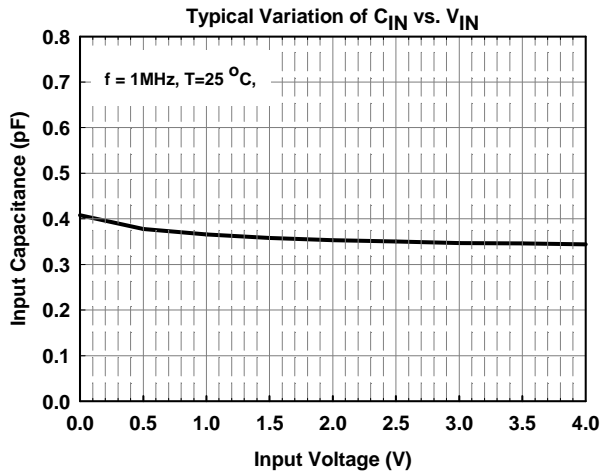
## SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS			
PARAMETER	SYMBOL	RATING	UNITS
Operating Voltage (I/O pin-GND)	$V_{DC}$	(GND – 0.5) to 5.5	V
ESD per IEC 61000-4-2 (Air)	$V_{ESD}$	15	kV
ESD per IEC 61000-4-2 (Contact)		10	
Lead Soldering Temperature	$T_{SOL}$	260 (10 sec.)	°C
Operating Temperature	$T_{OP}$	-55 to +85	°C
Storage Temperature	$T_{STO}$	-55 to +150	°C

ELECTRICAL CHARACTERISTICS						
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Reverse Stand-Off Voltage	$V_{RWM}$	Pin-1,-2,-4,-5 to pin-3,-7, T=25 °C			5	V
Channel Leakage Current	$I_{CH-Leak}$	$V_{Pin-1,-2,-4,-5} = 5V, V_{Pin-3,-7} = 0V, T=25 °C$			1	μA
Reverse Breakdown Voltage	$V_{BV}$	$I_{BV} = 1mA, T=25 °C, pin-1,-2,-4,-5 to pin-3,-7$	6		9	V
Forward Voltage	$V_F$	$I_F = 15mA, T=25 °C, pin-3,-7 to pin-1,-2,-4,-5$		0.9	1.1	V
ESD Clamping Voltage	$V_{clamp}$	IEC 61000-4-2 +6kV, T=25 °C, Contact mode, any I/O pin to Ground		12		V
ESD Dynamic Turn-on Resistance	$R_{dynamic}$	IEC 61000-4-2, 0~+6kV, T=25 °C, Contact mode, any I/O pin to Ground		0.3		Ω
Channel Input Capacitance	$C_{IN}$	$V_{pin-3,-7} = 0V, V_{IN} = 2.5V, f = 1MHz, T=25 °C, any I/O pin to Ground$		0.35	0.5	pF
Channel to Channel Input Capacitance	$C_{CROSS}$	$V_{pin-3,-7} = 0V, V_{IN} = 2.5V, f = 1MHz, T=25 °C, between I/O pins$		0.04	0.08	pF



## Typical Characteristics



## Applications Information

### A. Device Connection

The AZ1345-04F is designed to protect four data lines from transient over-voltage (such as ESD stress pulse). The device connection of AZ1345-04F is shown in the Fig. 1. In Fig. 1, the four protected data lines are connected to the ESD protection pins (pin1, pin2, pin4, and pin5) of AZ1345-04F. The ground pins (pin3 and pin7) of AZ1345-04F are the negative reference pins.

These pins 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.

AZ1345-04F can provide ESD protection for 4 I/O signal lines simultaneously. If the number of I/O signal lines is less than 4, the unused I/O pins can be simply left as NC pins.

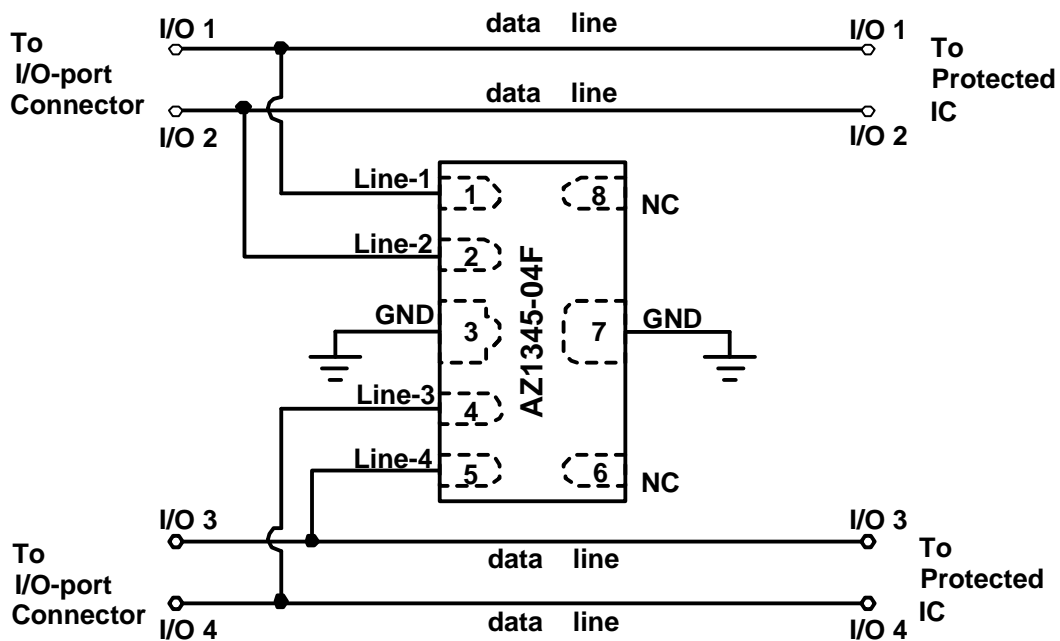


Fig. 1 Data lines connection of AZ1345-04F.

### B. Application

AZ1345-04F is designed for protecting high speed I/O ports from over-voltage caused by Electrostatic Discharging (ESD). Thus, a lot of kinds of high speed I/O ports can be the applications of AZ1345-04F, especially, the USB3.0 port.

#### USB3.0 Protection for Super Speed Differential signals

USB3.0 is expected to transmit and receive above 5Gb/s data, which needs differential

signaling. For differential signaling, keep the differential impedance at constant is the most importance.

ESD protection devices have an inherent junction capacitance. Usually, this added capacitance on an USB3.0 port will cause the impedance of the differential pair to drop to interfere with the signaling. The AZ1345-04F presents only **0.35pF** capacitance to each differential signal while being rated to handle >8kV ESD contact discharge (>15kV air discharge) as outlined in IEC 61000-4-2 and providing a low clamping voltage to protect the

downstream devices.

Therefore, AZ1345-04F is the most suitable ESD protector for USB3.0 I/O port and other high speed, above 5Gb/s, I/O ports in any electronic product. Fig. 2 shows the PCB layout example for USB3.0 I/O port. The AZ1345-04F is designed for allowing the traces to run straight

through the device to simplify the PCB layout. As shown in Fig. 2, the best way to design the PCB trace is using the flow through layout. **In Fig. 2, the USB2.0 differential pair (D+/D-) and power line (VBUS) of an USB3.0 port can be protected with another low cost part, e.g., AZC199-04S.**

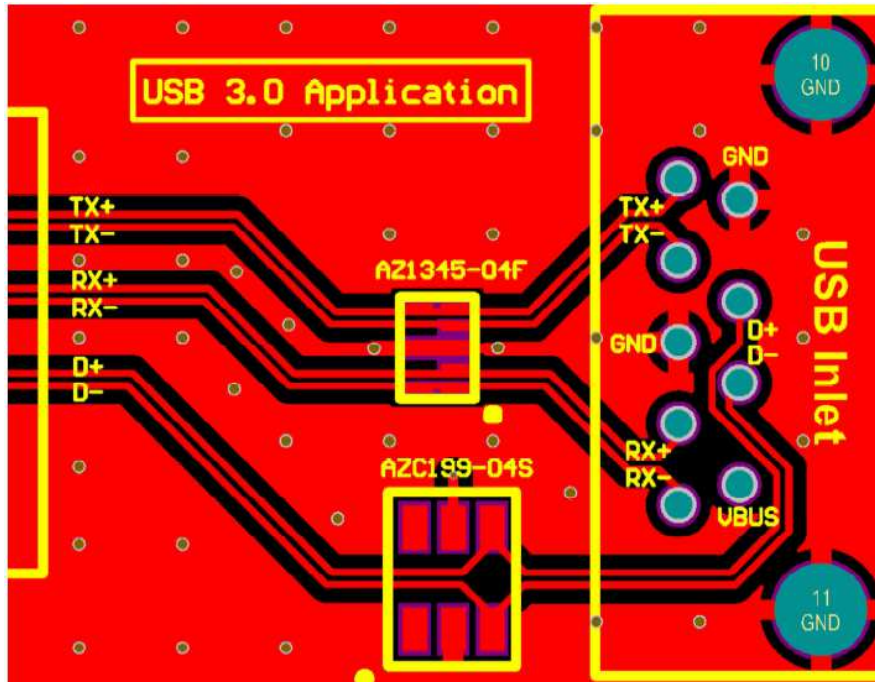
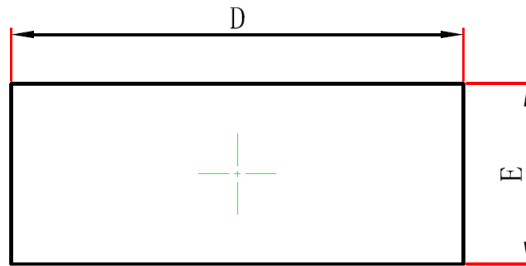


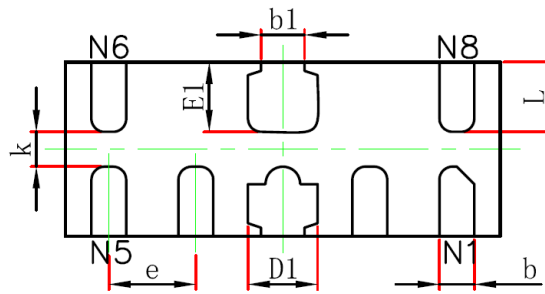
Fig. 2 USB3.0 ESD Protection by using AZ1345-04F and AZC199-04S.



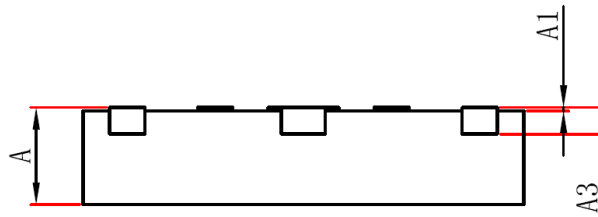
**PACKAGE OUTLINE  
(DFN2510P8E)**



**TOP VIEW (unit in mm)**



**BOTTOM VIEW (unit in mm)**

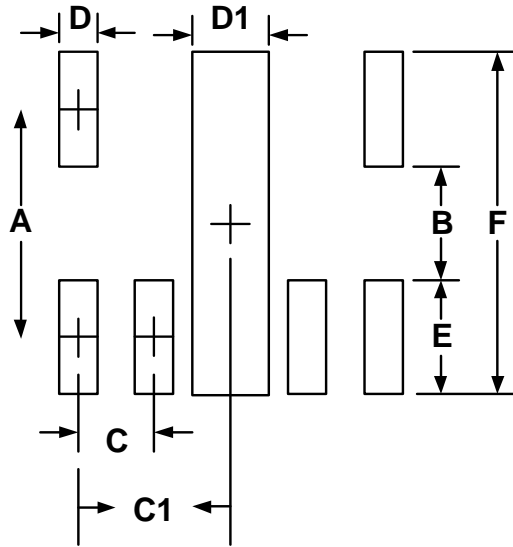


**SIDE VIEW (unit in mm)**

Symbol	Millimeters		Inches	
	Min	max	min	max
<b>A</b>	0.40	0.55	0.016	0.022
<b>A1</b>	0.00	0.05	0.000	0.002
<b>A3</b>	0.152 REF.		0.006 REF.	
<b>D</b>	2.45	2.55	0.096	0.100
<b>E</b>	0.95	1.05	0.037	0.041
<b>D1</b>	0.35	0.45	0.014	0.018
<b>E1</b>	0.35	0.45	0.014	0.018
<b>k</b>	0.15 Min.		0.006 Min.	
<b>b</b>	0.15	0.25	0.006	0.010
<b>b1</b>	0.20	0.30	0.008	0.012
<b>e</b>	0.50 TYP.		0.020 TYP.	
<b>L</b>	0.35	0.45	0.014	0.018



## LAND LAYOUT

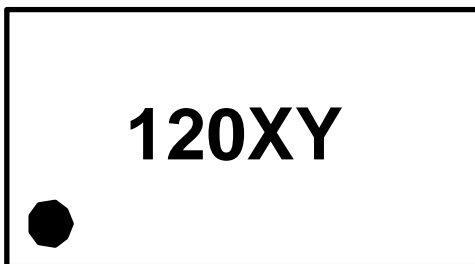


Dimensions		
Index	Millimeter	Inches
A	0.875	0.034
B	0.20	0.008
C	0.50	0.02
C1	1.00	0.039
D	0.25	0.01
D1	0.4	0.016
E	0.675	0.027
F	1.55	0.061

### 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



120 = Device Code  
X = Date Code  
Y = Control Code

Part Number	Marking Code
AZ1345-04F (Green part)	120XY

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

## Ordering Information

PN#	Material	Type	Reel size	MOQ/internal box	MOQ/carton
AZ1345-04F.R7G	Green	T/R	7 inch	4 reel= 12,000/box	6 box =72,000/carton



## Revision History

Revision	Modification Description
Revision 2012/05/15	Preliminary Release.
Revision 2013/03/25	Formal Release.
Revision 2014/03/04	Add the MAX spec. of Reverse Breakdown Voltage.
Revision 2015/04/28	1. Update the characteristics of Insertion Loss S21. 2. Add the Ordering Information.