

## Features

- ESD Protect for 4 high-speed I/O channels
- Protects 4 I/O lines operating up to **3.3V** and below
- Protects one VDD line operating up to **5V** and below
- Provide ESD protection for each channel to  
**IEC 61000-4-2 (ESD) ±30kV (air / contact)**  
**IEC 61000-4-4 (EFT) 80A (5/50ns)**  
**IEC 61000-4-5 (Lightning) 17A (8/20µs) for any I/O-to-GND**  
**IEC 61000-4-5 (Lightning) 22A (8/20µs) for VDD-to-GND**
- Low capacitance: 1.7pF 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

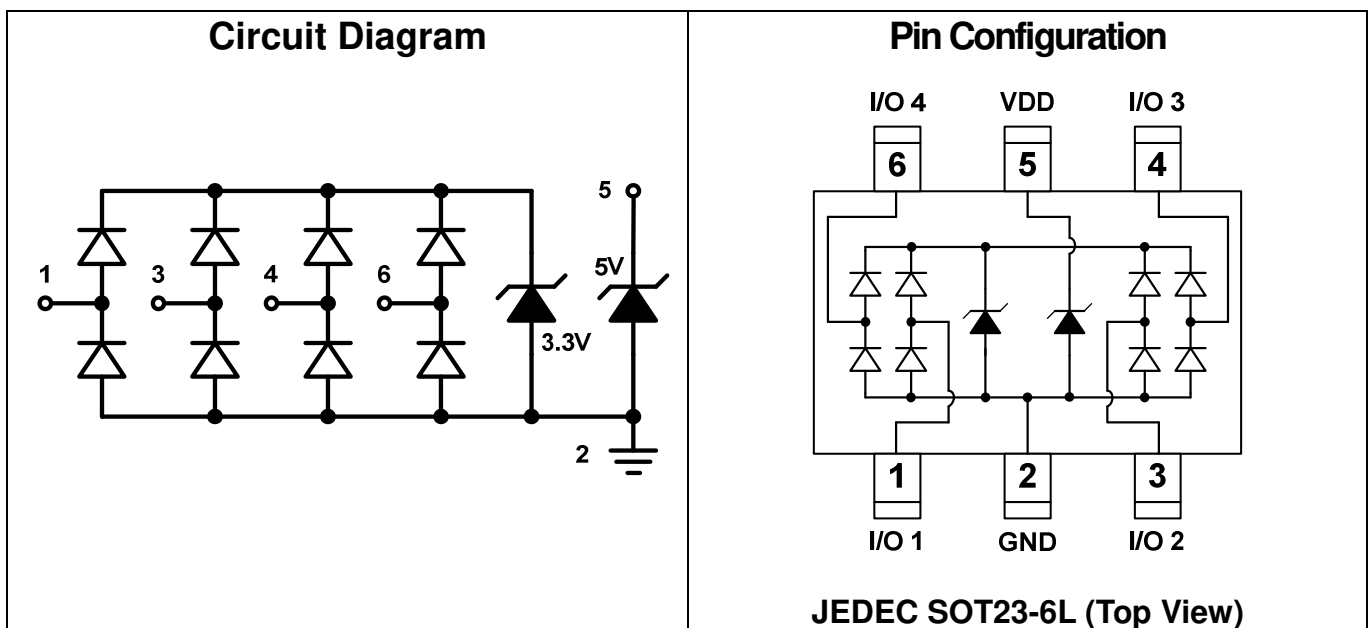
- USB2.0 interface protection
- LVDS interface protection
- LAN applications
- General purpose I/O protection
- Notebook and PC Computers

## Description

AZ1135-04S is a high performance design which includes surge rated diode arrays to protect high speed data interfaces. The AZ1135-04S 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), Electrical Fast Transients (EFT), and Lightning.

AZ1135-04S is a unique design which includes surge rated, 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 power supply line or to the ground line. The internal unique design of clamping cell prevents over-voltage on the power line, protecting any downstream components.

AZ1135-04S 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
Peak Pulse Current (tp = 8/20μs, I/O-to-GND)	I <sub>PP</sub>	17	A
Peak Pulse Current (tp = 8/20μs, VDD-to-GND)		22	
Operating Voltage (I/O-to-GND)	V <sub>DC</sub>	3.6	V
Operating Supply Voltage (VDD-to-GND)		5.5	
ESD per IEC 61000-4-2 (Air)	V <sub>ESD-1</sub>	30	kV
ESD per IEC 61000-4-2 (Contact)	V <sub>ESD-2</sub>	30	
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_VDD</sub>	Pin-5 to pin-2, T = 25°C.			5	V
	V <sub>RWM_IO</sub>	Pin-1, -3, -4, -6 to pin-2, T = 25°C.			3.3	V
Reverse Leakage Current	I <sub>Leak_VDD</sub>	V <sub>Pin-5</sub> = 5V, V <sub>Pin-2</sub> = 0V, T = 25°C.			1	μA
Channel Leakage Current	I <sub>Leak_IO</sub>	V <sub>Pin-1,-3,-4,-6</sub> = 3.3V, V <sub>Pin-2</sub> = 0V, T = 25°C.			0.5	μA
Reverse Breakdown Voltage	V <sub>BV</sub>	I <sub>BV</sub> = 1mA, T = 25°C, pin-5 to pin-2.	6		9	V
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 15mA, T = 25°C, pin-2 to pin-5.	0.6		1.2	V
ESD Clamping Voltage – I/O (Note 1)	V <sub>clamp_IO</sub>	IEC 61000-4-2 +8kV (I <sub>TLP</sub> = 16A), Contact mode, T = 25 °C, any I/O pin to GND.		7.2		V
ESD Clamping Voltage – VDD (Note 1)	V <sub>clamp_VDD</sub>	IEC 61000-4-2 +8kV (I <sub>TLP</sub> = 16A), Contact mode, T = 25 °C, VDD pin to GND.		6		V
ESD Dynamic Turn-on Resistance – I/O	R <sub>dynamic_IO</sub>	IEC 61000-4-2, 0~+8kV, T = 25°C, Contact mode, any I/O pin to GND.		0.12		Ω
ESD Dynamic Turn-on Resistance – VDD	R <sub>dynamic_VDD</sub>	IEC 61000-4-2, 0~+8kV, T = 25°C, Contact mode, VDD pin to GND.		0.05		Ω

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

TLP conditions: Z<sub>0</sub> = 50Ω, tp = 100ns, tr = 1ns.

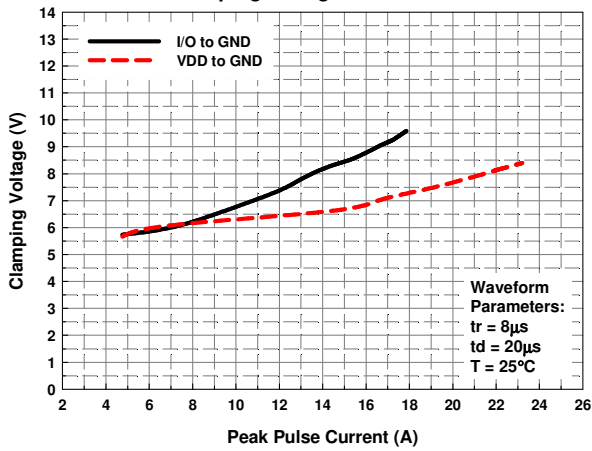


ELECTRICAL CHARACTERISTICS						
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Lightning Clamping Voltage – I/O	$V_{\text{lightning\_IO}}$	$I_{\text{PP}} = 5\text{A}$ , $t_{\text{p}} = 8/20\mu\text{s}$ , $T = 25^\circ\text{C}$ , any I/O pin to GND.		5.8		V
Lightning Clamping Voltage – VDD	$V_{\text{lightning\_VDD}}$	$I_{\text{PP}} = 5\text{A}$ , $t_{\text{p}} = 8/20\mu\text{s}$ , $T = 25^\circ\text{C}$ , VDD pin to GND.		6		V
Channel Input Capacitance	$C_{\text{IN}}$	$V_{\text{IN}} = 1.65\text{V}$ , $V_{\text{pin2}} = 0\text{V}$ , $T = 25^\circ\text{C}$ , $f = 1\text{MHz}$ , any I/O pin to GND.		1.7	2	pF
Channel to Channel Input Capacitance	$C_{\text{CROSS}}$	$V_{\text{IN}} = 1.65\text{V}$ , $V_{\text{pin2}} = 0\text{V}$ , $T = 25^\circ\text{C}$ , $f = 1\text{MHz}$ , between I/O pins.		0.15	0.25	pF

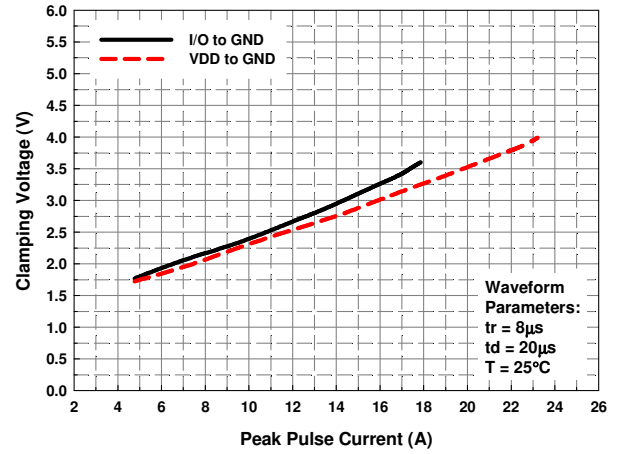


## Typical Characteristics

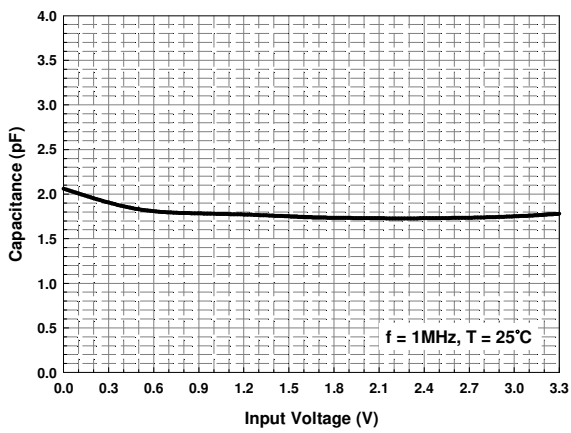
Reverse Clamping Voltage vs. Peak Pulse Current



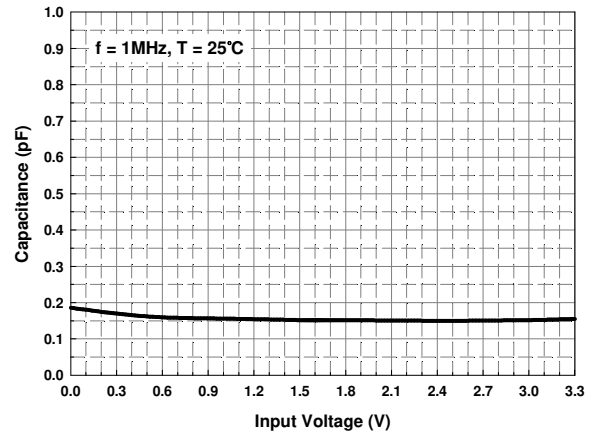
Forward Clamping Voltage vs. Peak Pulse Current



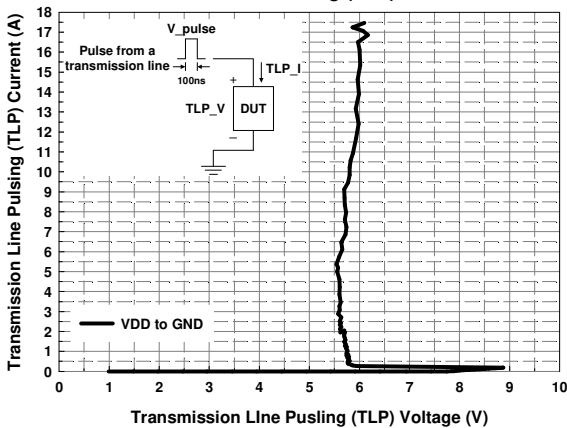
Typical Variation of  $C_{IN}$  vs.  $V_{IN}$



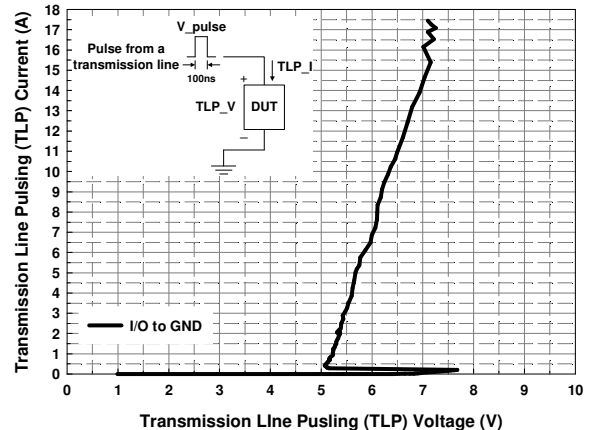
Typical Variation of  $C_{IO-to-IO}$  vs.  $V_{IN}$



Transmission Line Pulsing (TLP) Measurement



Transmission Line Pulsing (TLP) Measurement



## Applications Information

### Device Connection

The AZ1135-04S is designed to protect four data lines and power rails from transient over-voltage (such as ESD stress pulse). The device connection of AZ1135-04S is shown in the Fig. 1. In Fig. 1, the four protected data lines are connected to the ESD protection pins (pin1, pin3, pin4, and pin6) of AZ1135-04S. The ground pin (pin2) of AZ1135-04S 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. In addition, the power pin (pin 5) of AZ1135-04S is a positive reference pin. This pin should directly connect to the VDD rail of PCB, then the VDD rail also can be protected by the power-rail ESD clamped

circuit (not shown) of AZ1135-04S.

AZ1135-04S can provide 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.

In some cases, systems are not allowed to be reset or restart after the ESD stress directly applying at the I/O-port connector. Under this situation, in order to enhance the sustainable ESD Level, a 0.1 $\mu$ F chip capacitor can be added between the VDD and GND rails. The place of this chip capacitor should be as close as possible to the AZ1135-04S.

In some cases, there isn't power rail presented on the PCB. Under this situation, the power pin (pin 5) of AZ1135-04S can be left as floating. The protection will not be affected. Fig. 2 shows the detail connection.

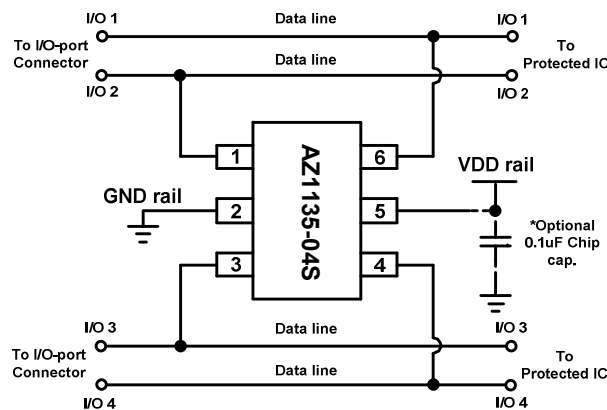


Fig. 1 Data lines and power rails connection of AZ1135-04S.

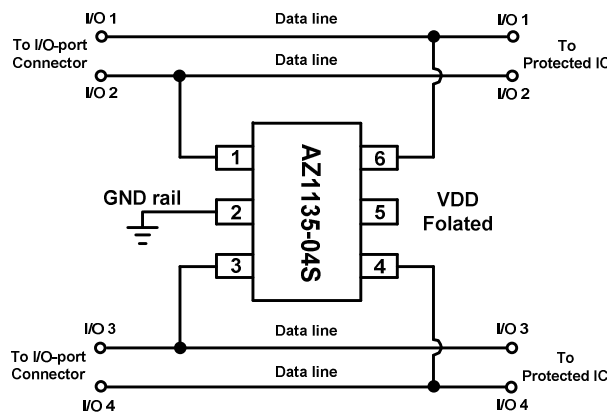
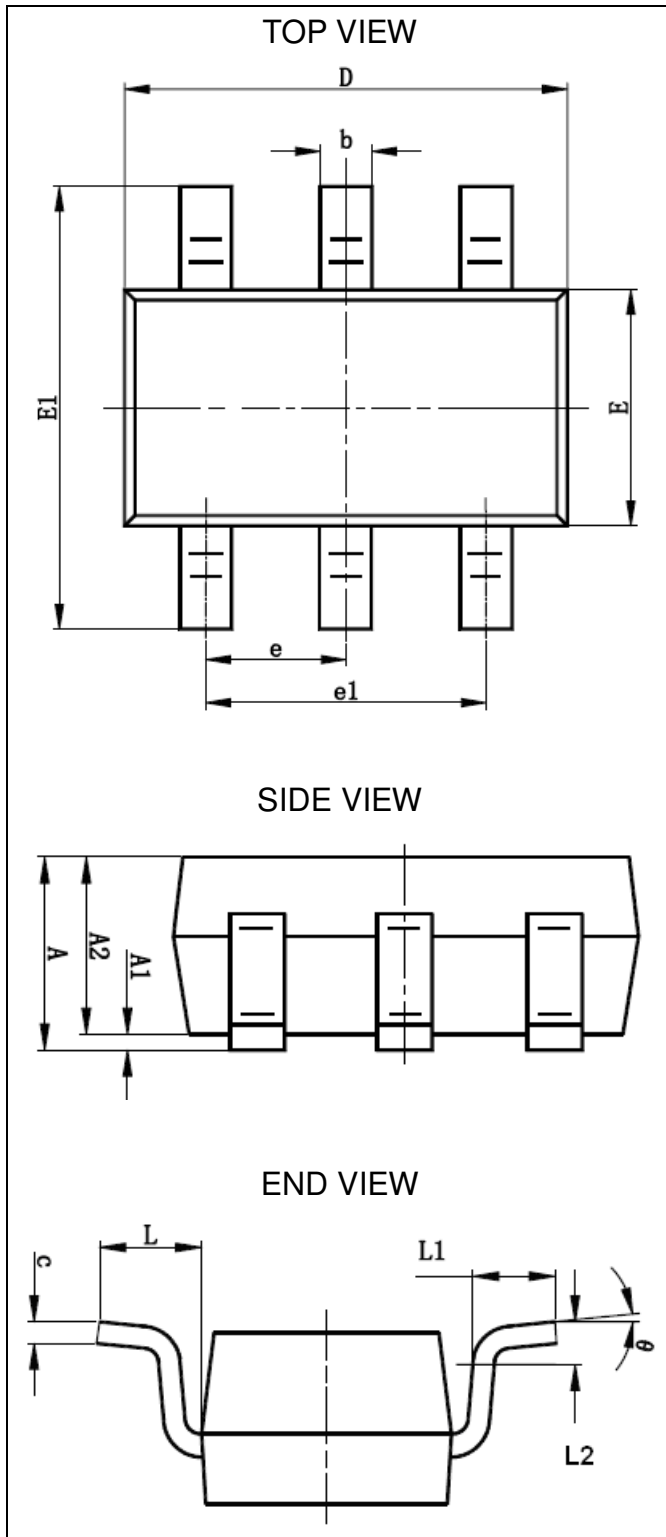


Fig. 2 Data lines and power rails connection of AZ1135-04S. VDD pin is left as floating when no power rail presented on the PCB.

## Mechanical Details

### SOT23-6L

#### PACKAGE DIAGRAMS



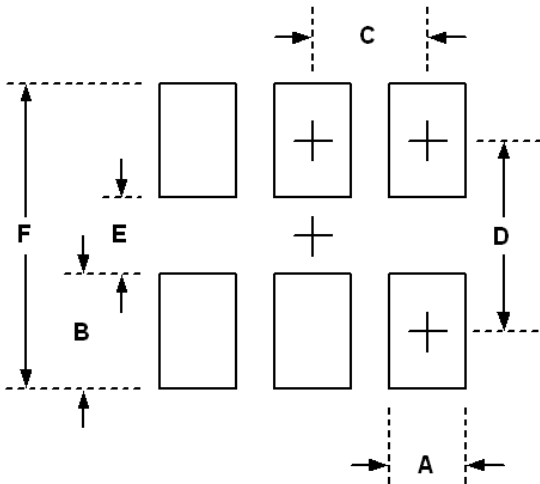
#### PACKAGE DIMENSIONS

Symbol	Millimeters		Inches	
	MIN.	MAX.	MIN.	MAX.
<b>A</b>		1.25		0.049
<b>A1</b>	0.00	0.15	0.000	0.006
<b>A2</b>	0.90	1.30	0.035	0.051
<b>b</b>	0.30	0.50	0.012	0.020
<b>c</b>	0.08	0.21	0.003	0.008
<b>D</b>	2.72	3.12	0.107	0.123
<b>E</b>	1.40	1.80	0.055	0.071
<b>E1</b>	2.60	3.00	0.102	0.118
<b>e</b>	0.95BSC		0.037BSC	
<b>e1</b>	1.90BSC		0.075BSC	
<b>L1</b>	0.30	0.60	0.012	0.024
<b>L</b>	0.70REF		0.028REF	
<b>L2</b>	0.25BSC		0.010BSC	
<b>θ</b>	0	8	0	8

#### Notes:

- This dimension complies with JEDEC outline standard MO-178 Variation AB.
- Dimensioning and tolerancing per ASME Y14.5M-1994.
- All dimensions are in millimeters, and the dimensions in inches are for reference only.
- 1mm = 40 mils = 0.04 inches.

## LAND LAYOUT

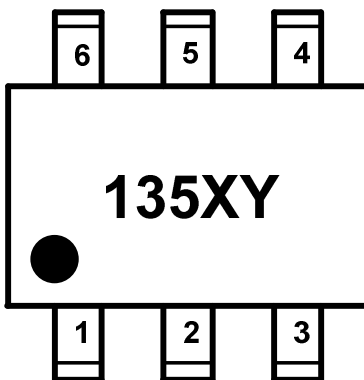


Dimensions		
Index	Millimeter	Inches
<b>A</b>	0.60	0.024
<b>B</b>	1.10	0.043
<b>C</b>	0.95	0.037
<b>D</b>	2.50	0.098
<b>E</b>	1.40	0.055
<b>F</b>	3.60	0.141

### 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



135 = Device Code  
X = Date Code  
Y = Control Code

Part Number	Marking Code
AZ1135-04S.R7G (Green part)	135XY

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

## Ordering Information

PN#	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
AZ1135-04S.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 2016/07/14	Preliminary Release.
Revision 2017/05/15	Formal Release.