

General Description

The AOZ8802 is a transient voltage suppressor array designed to protect high speed data lines such as HDMI, MDDI, USB, SATA, and Gigabit Ethernet from damaging ESD events.

This device incorporates four surge rated, low capacitance steering diodes and a TVS in a single package. During transient conditions, the steering diodes direct the transient to either the positive side of the power supply line or to ground.

The AOZ8802 provides a typical line to line capacitance of 0.25pF and low insertion loss up to 6GHz providing greater signal integrity making it ideally suited for HDMI 1.3 applications, such as Digital TVs, DVD players, set-top boxes and USB applications in mobile computing devices.

The AOZ8802 comes in RoHS compliant, 1.6mm x 1.0mm x 0.5mm DFN-6 package and is rated -40°C to +85°C junction temperature range.

Features

- ESD protection for high-speed data lines:
 - IEC 61000-4-2, level 4 (ESD) immunity test
 - $\pm 15\text{kV}$ (air discharge) and $\pm 8\text{kV}$ (contact discharge)
 - IEC61000-4-4 (EFT) 40A (5/50nS)
 - IEC61000-4-5 (Lightning) 2.5A (8/20 μs)
 - Human Body Model (HBM) $\pm 15\text{kV}$
- Array of surge rated diodes with internal TVS diode
- Small package saves board space
- Protects two I/O lines
- Low capacitance between I/O lines: 0.25pF
- Low clamping voltage
- Low operating voltage: 5.0V

Applications

- USB, MDDI, SATA ports
- Monitors and flat panel displays
- Set-top box
- Video graphics cards
- Digital Video Interface (DVI)
- Notebook computers



Typical Application

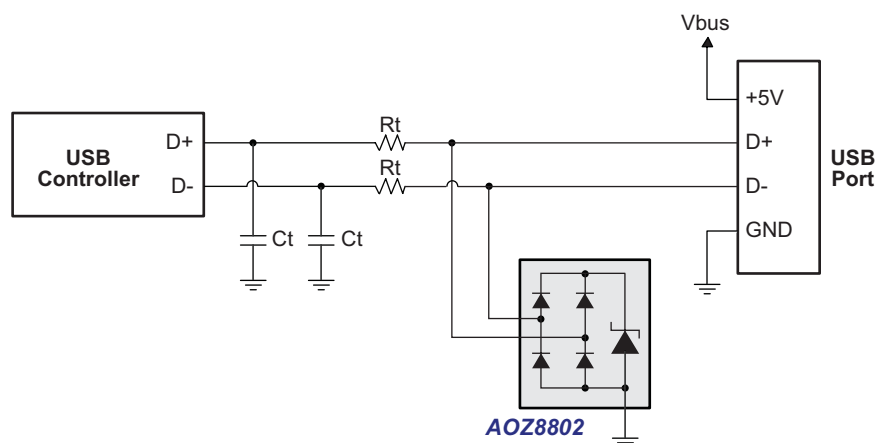


Figure 1. USB Port

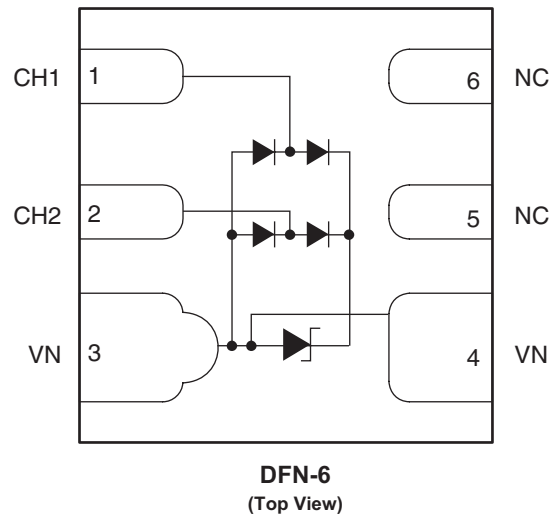
Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ8802DI	-40°C to +85°C	DFN-6	Green Product RoHS Compliant



AOS Green Products use reduced levels of Halogens, and are also RoHS compliant.
Please visit www.aosmd.com/web/quality/rohs_compliant.jsp for additional information.

Pin Configuration



Absolute Maximum Ratings

Exceeding the Absolute Maximum ratings may damage the device.

Parameter	Rating
Storage Temperature (T_S)	-65°C to +150°C
ESD Rating per IEC61000-4-2, contact ⁽¹⁾	±8kV
ESD Rating per IEC61000-4-2, air ⁽¹⁾	±15kV
ESD Rating per Human Body Model ⁽²⁾	±15kV

Notes:

- IEC 61000-4-2 discharge with $C_{Discharge} = 150\text{pF}$, $R_{Discharge} = 330\Omega$.
- Human Body Discharge per MIL-STD-883, Method 3015 $C_{Discharge} = 100\text{pF}$, $R_{Discharge} = 1.5\text{k}\Omega$.

Maximum Operating Ratings

Parameter	Rating
Junction Temperature (T_J)	-40°C to +125°C

Electrical Characteristics

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

Symbol	Parameter	Diagram
I_{PP}	Maximum Reverse Peak Pulse Current	
V_{CL}	Clamping Voltage @ I_{PP}	
V_{RWM}	Working Peak Reverse Voltage	
I_R	Maximum Reverse Leakage Current	
V_{BR}	Breakdown Voltage	
I_F	Forward Current	
V_F	Forward Voltage	
P_{PK}	Peak Power Dissipation	
C_j	Max. Capacitance @ $V_R = 0$ and $f = 1\text{MHz}$	

Specifications in **BOLD** indicate a temperature range of -40°C to $+85^\circ\text{C}$.

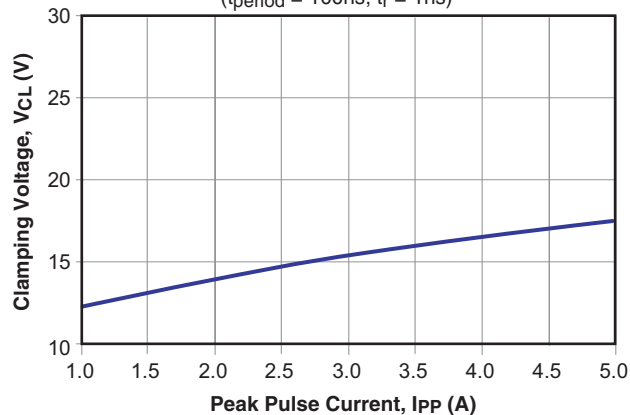
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{RWM}	Reverse Working Voltage	Between I/O and VN ⁽³⁾			5.0	V
V_{BR}	Reverse Breakdown Voltage	$I_T = 1\text{mA}$, between I/O and VN ⁽⁴⁾	6.0			V
I_R	Reverse Leakage Current	$V_{RWM} = 5\text{V}$, between I/O and VN			1	μA
V_F	Diode Forward Voltage	$I_F = 15\text{mA}$	0.70	0.85	1	V
V_{CL}	Channel Clamp Voltage	$I_{PP} = 1\text{A}$, $t_p = 100\text{ns}$, any I/O pin to Ground ⁽⁵⁾			13.5	V
	Positive Transients				-1.85	V
	Channel Clamp Voltage	$I_{PP} = 5\text{A}$, $t_p = 100\text{ns}$, any I/O pin to Ground ⁽⁵⁾			19	V
	Negative Transient				-3.5	V
C_j	Channel Input Capacitance	$V_R = 0\text{V}$, $f = 1\text{MHz}$, between I/O pins		0.25	0.35	pF
		$V_R = 0\text{V}$, $f = 1\text{MHz}$, any I/O pin to Ground		0.5	0.75	pF

Notes:

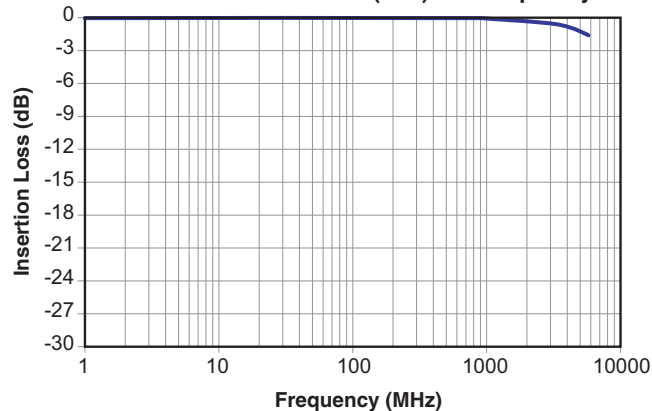
- The working peak reverse voltage, V_{RWM} , should be equal to or greater than the DC or continuous peak operating voltage level.
- V_{BR} is measured at the pulse test current I_T .
- Measurements performed using a 100ns Transmission Line Pulse (TLP) system.

Typical Performance Characteristics

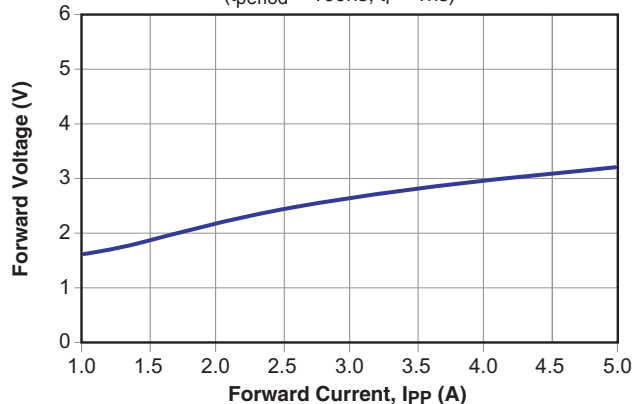
Clamping Voltage vs. Peak Pulse Current
($t_{\text{period}} = 100\text{ns}$, $t_r = 1\text{ns}$)



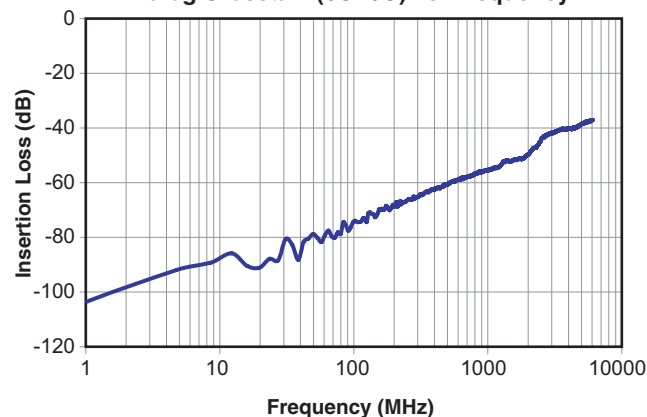
I/O – Gnd Insertion Loss (S21) vs. Frequency



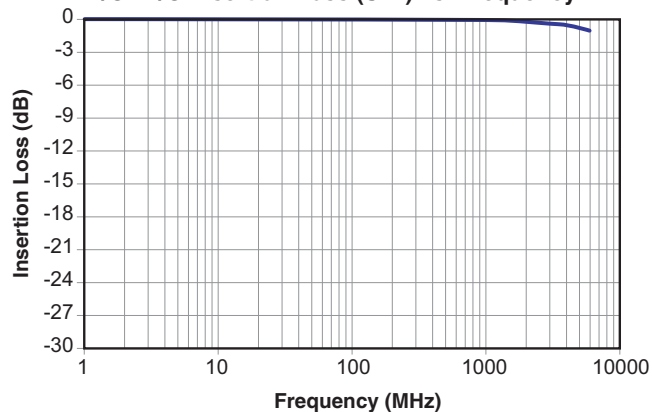
Forward Voltage vs. Forward Current
($t_{\text{period}} = 100\text{ns}$, $t_r = 1\text{ns}$)



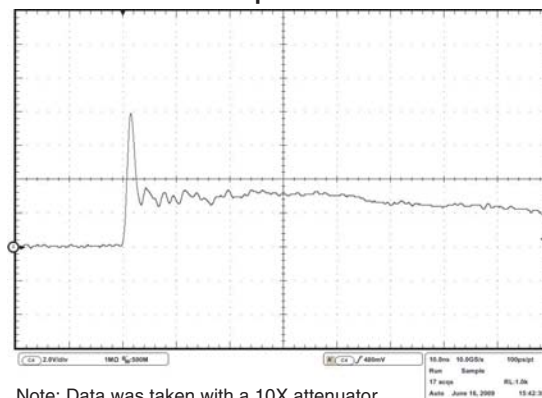
Analog Crosstalk (I/O–I/O) vs. Frequency



I/O – I/O Insertion Loss (S21) vs. Frequency



ESD Clamping
8kV Contact per IEC61000-4-2



Note: Data was taken with a 10X attenuator

Protecting USB Ports from ESD

Because electrostatic discharge (ESD) is common in electronic systems, a device that provides protection from the undesirable effects of ESD must be included in the system design. Designing ESD protection structures is becoming more and more challenging with the system bus and I/O operating more often at high-speed data rates. An Integrated Circuit (IC) connected to external ports can be damaged by ESD from the operating environment. The result of ever-shrinking IC process technology is the decrease of ESD robustness because of the smaller geometry of the silicon die.

Since USB is a hot insertion and removal system, the USB components are subjected to ESD and cable discharge event more frequently. Traditional methods of ESD protection include metal oxide varistors (MOVs), and regular CMOS or bipolar clamping diodes. At higher data rates the parasitic characteristics of those devices

can cause distortion, deterioration and data loss of the signal integrity. AOZ8802 offers ESD protection for high-speed data rates and for diode array chips for ease of design.

The very low 0.5pF (typical) line capacitance of the AOZ8802 ensures less distortion of the 480 Mbit/s USB 2.0 signal; the chips also protect against electrostatic discharge up to the stringent IEC61000-4-2 level 4, 8kV (Contact Discharge) and 15kV standard (Air Discharge). They also provide ultra low matching capacitance to help improve the signal quality of differential data lines. Monolithic integration provides high device reliability, and an optimized pin-out allows EMI-free board layouts. Figure 2 illustrates the flow through design of the PCB layout with the AOZ8802 package design.

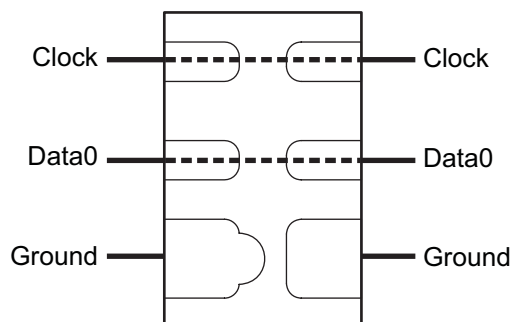
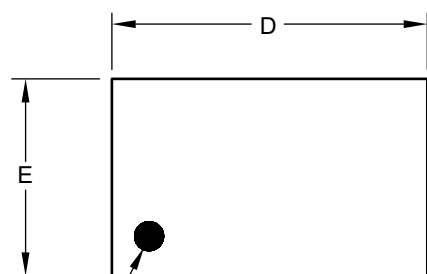
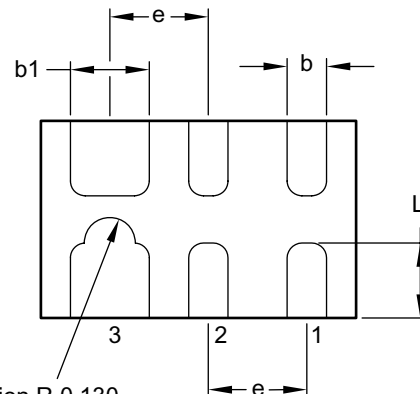


Figure 2. Flow-through

Package Dimensions, DFN-6 1.6mm x 1.0mm x 0.5mm

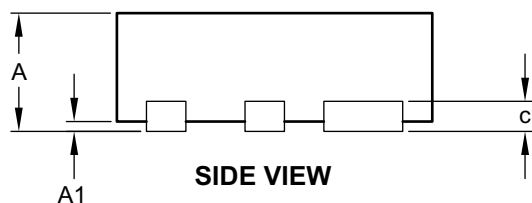


Pin #1 Dot by Marking
TOP VIEW



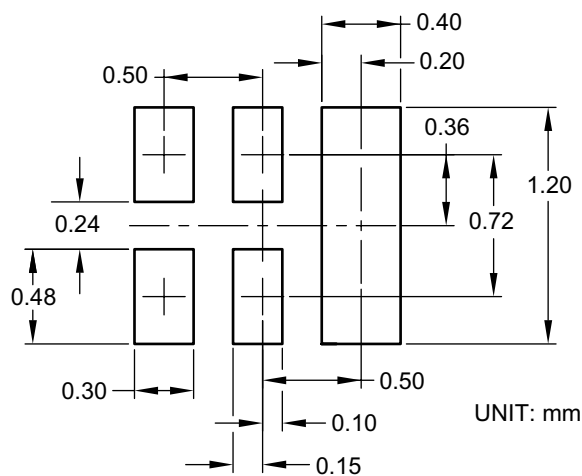
Pin #3 Identification R 0.130

BOTTOM VIEW



SIDE VIEW

RECOMMENDED LAND PATTERN



UNIT: mm

Dimensions in millimeters

Symbols	Min.	Nom.	Max.
A	0.50	0.55	0.60
A1	0.00	—	0.05
b	0.15	0.20	0.25
b1	0.40		
c	0.152 Ref.		
D	1.55	1.60	1.65
E	0.95	1.00	1.05
e	0.50 BSC		
L	0.33	0.38	0.43

Dimensions in inches

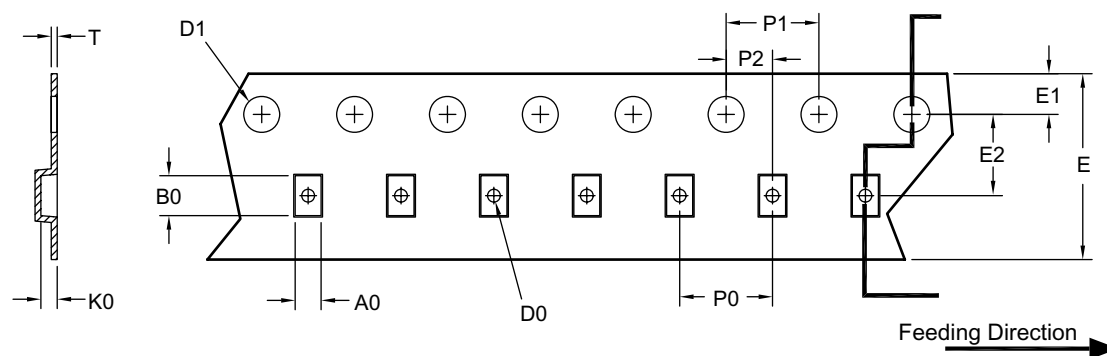
Symbols	Min.	Nom.	Max.
A	0.020	0.022	0.024
A1	0.000	—	0.002
b	0.006	0.008	0.010
b1	0.016		
c	0.006 Ref.		
D	0.061	0.063	0.065
E	0.037	0.039	0.041
e	0.020 BSC		
L	0.013	0.015	0.017

Note:

1. Controlling dimension is millimeter. Converted inch dimensions are not necessarily exact.

Tape and Reel Dimensions, DFN-6 1.6mm x 1.0mm x 0.5mm

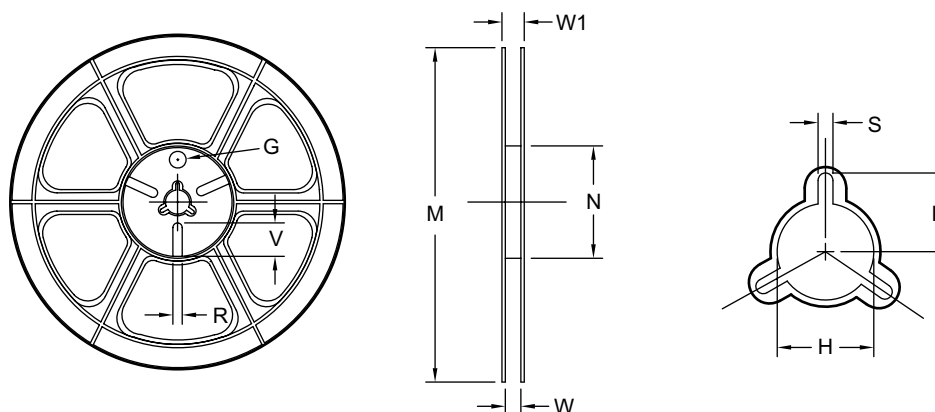
Carrier Tape



UNIT: mm

Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DFN 1.6 x 1.0 (8 mm)	1.12 ±0.05	1.72 ±0.05	0.70 ±0.05	0.55 ±0.05	1.55 ±0.10	8.00 +0.30/-0.10	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.25 ±0.05

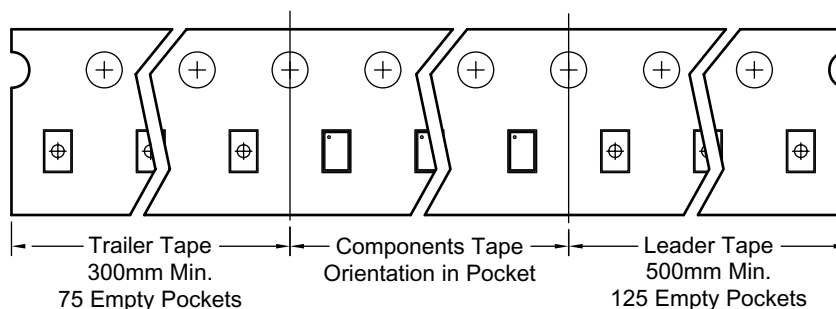
Reel



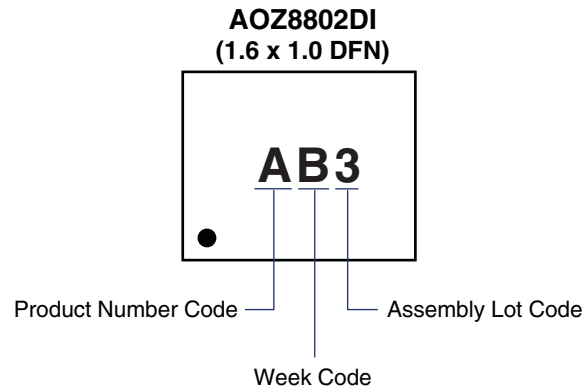
UNIT: mm

Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
8mm	ø178	ø178.0 ±0.50	ø60.0 ±1	9.0 ±0.5	N/A	ø13.0 +0.5/-0.2	10.25 ±0.2	2.40 ±0.10	ø9.8	N/A	N/A

Leader / Trailer & Orientation



Part Marking



Not recommended for new designs.

This datasheet contains preliminary data; supplementary data may be published at a later date. Alpha & Omega Semiconductor reserves the right to make changes at any time without notice.

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