AOZ8936DI

7-Channel Combo TVS

General Description

The AOZ8936DI is a multi-channel combo transient voltage suppressor array designed to protect high speed data lines such as USB3.1, USB2.0,and VBUS from damaging ESD events.

This device incorporates 2 channels for USB2.0, 4 channels for USB3.1 and 1 channel for VBUS.

The AOZ8936DI comes in a RoHS compliant and Halogen Free DFN4.1x2.0 package and is rated for -40°C to +125°C junction temperature range.

Features

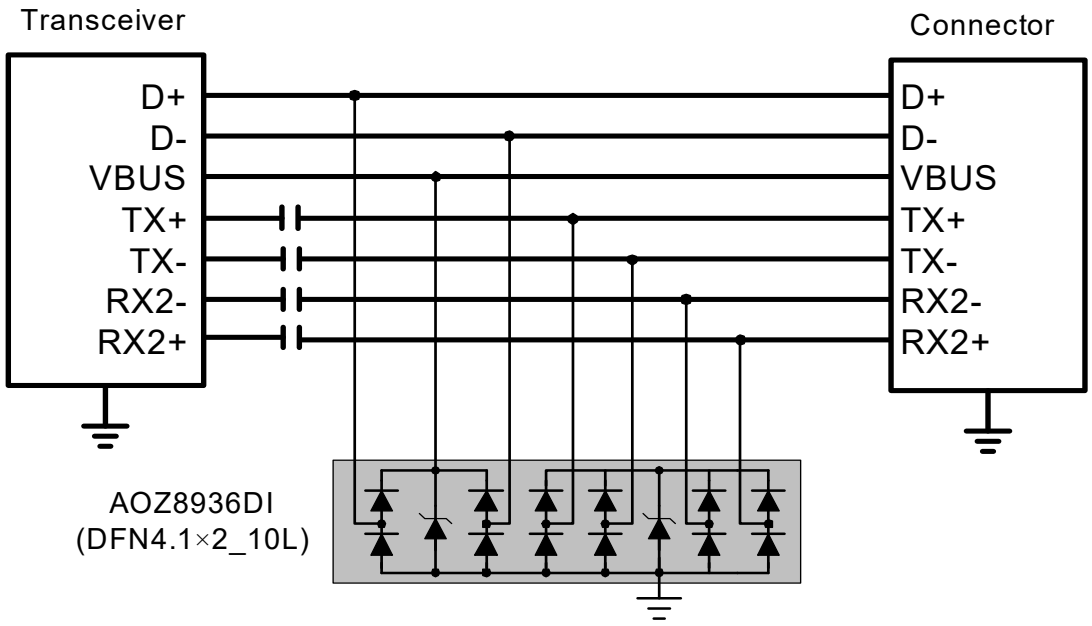
- IEC61000-4-2, ESD immunity (Contact/Air):
  - ± 30/30 kV (USB 3.1)
  - ± 24/30 kV (USB 2.0)
  - ± 30/30 kV (VBUS)
- IEC61000-4-5, Surge Immunity (8/20μs):
  - ± 6 A (USB 3.1)
  - ± 4 A (USB 2.0)
  - ± 15 A (VBUS)
- Capacitance between I/O to GND:
  - 0.4pF (USB 3.1)
  - 1.75pF (USB 2.0)
  - 120pF (VBUS)

Applications

- USB 3.1/3.2 & USB 2.0
- Monitors and flat panel displays
- Set-top-box
- Notebook computers

Green Product

Typical Application

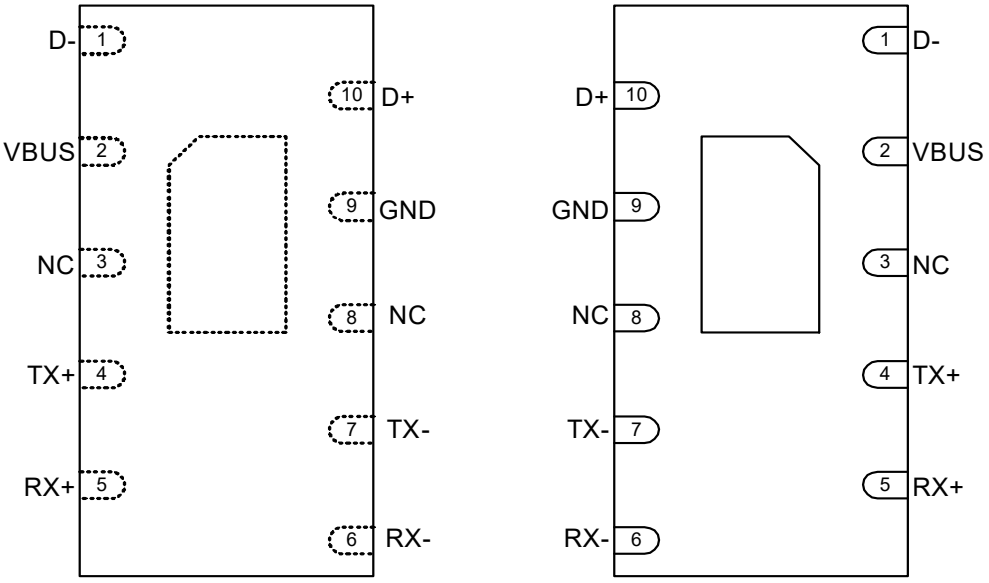


Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ8936DI	-40°C to +125°C	DFN4.1X2_10L	Green Product

AOS Green Products use reduced levels of Halogens, and are also RoHS compliant.
Please visit www.aosmd.com/media/AOSGreenPolicy.pdf for additional information.

Pin Configuration



Top View Bottom View

Absolute Maximum Ratings

Exceeding the Absolute Maximum ratings may damage the device.

Parameter	Rating		
	Pin 1 & Pin 10 (USB 2.0)	**Pin 4 to Pin 7 (USB 3.1/3.2)**	**Pin 2 (VBUS)**
Storage Temperature (T_S)	-65°C to +150°C	-65°C to +150°C	-65 °C to +150°C
ESD Rating per IEC61000-4-2, contact[1]	±24 kV	±30 kV	±30 kV
ESD Rating per IEC61000-4-2, air[1]	±30 kV	±30 kV	±30 kV
8/20µs Surge IEC61000-4-5	±4 A	±6 A	±15 kV

Notes:

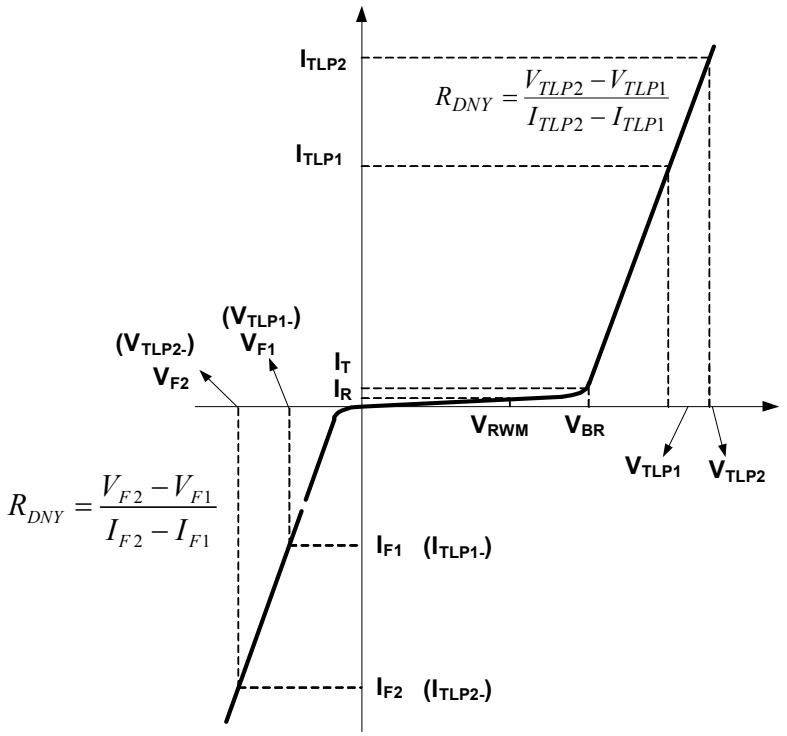
1. IEC 61000-4-2 discharge with $C_{Discharge}$ = 150pF, $R_{Discharge}$ = 330Ω.
2. Human Body Discharge per MIL-STD-883, Method 3015 $C_{Discharge}$ = 100pF, $R_{Discharge}$ = 1.5kΩ.

Maximum Operating Ratings

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

Electrical Characteristics

T_A = 25°C unless otherwise specified. Any I/O Pin to GND.



Pin1 & Pin 10 (D+, D- of USB 2.0)						
Symbol	**Parameter**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{RWM}	Reverse Working Voltage				5.5	V
V_{BR}	Reverse Breakdown Voltage	I_T = 100µA	6.6			V
I_R	Reverse Leakage Current	V_T = Max, V_{RWM}			1	µA
V_F	Forward Voltage		0.7	0.85	0.95	V
V_{CL}	Clamping Voltage(3)(4) (100ns Transmission Line Pulse)	I_{TLP} = 1A I_{TLP} = -1A		11 -1.5		V
		I_{TLP} = 16A I_{TLP} = -16A		18 -7.5		
R_{DNY}	Dynamic Resistance(3)(4)	I_{TLP} = 1A to 16A I_{TLP} = -1A to -16A			0.45 0.40	Ω
I_{PP}	Peak Pulse Current(3) IEC61000-4-5 Surge 8/20µs	Any I/O Pin to GND GND to any I/O Pin			±4	A
V_{CL}	Clamping Voltage(3) IEC61000-4-5 Surge 8/20µs	I_{PP} = 1A I_{PP} = -1A		10 -2		V
		I_{PP} = 4A I_{PP} = -4A		12.5 -4.5		
C_j	Junction Capacitance(3)	V_{BUS}=3.3V, f = 1MHz, Any I/O Pin to GND		1.75	2	pF

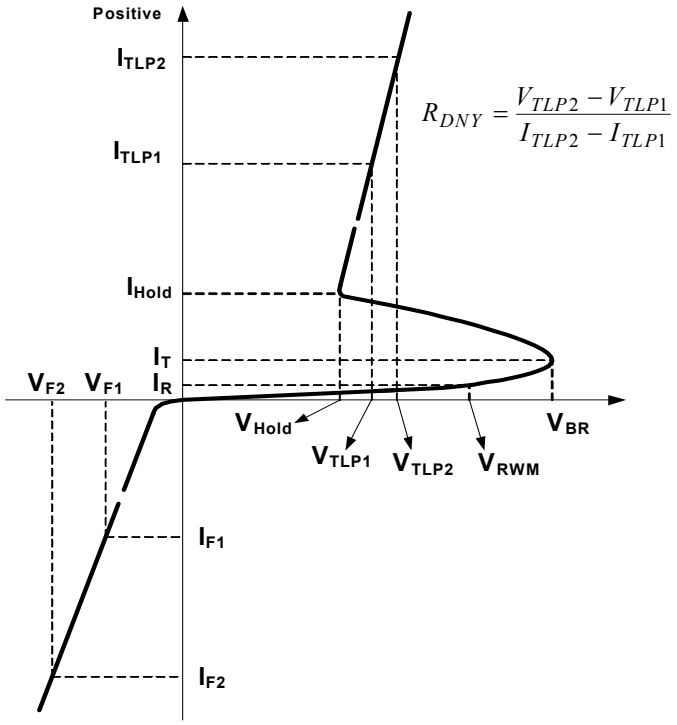
Notes:

3. These specifications are guaranteed by design and characterization.

4. Measurements performed using a 100ns Transmission Line Pulse (TLP) system.

Electrical Characteristics

T_A = 25°C unless otherwise specified. Any I/O Pin to GND.



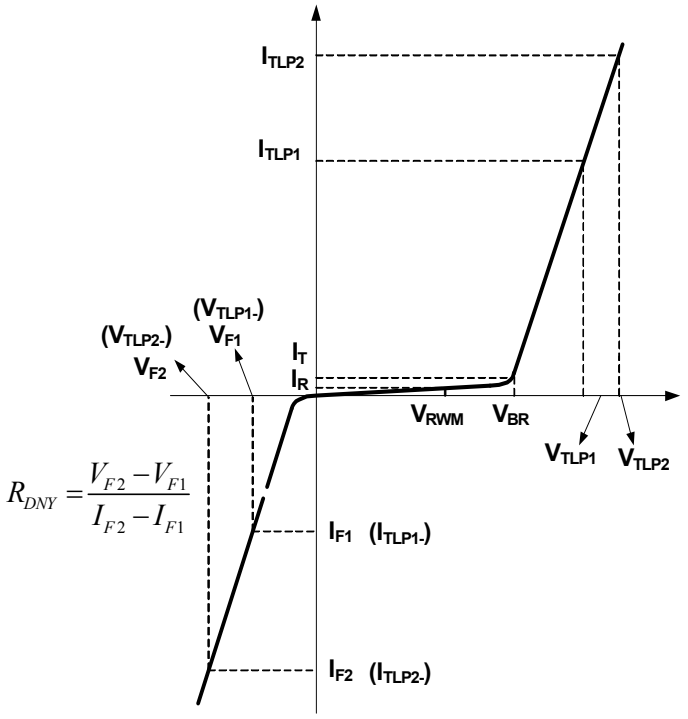
Pin 4 to Pin 7 (TX+, TX-, RX+, RX- of USB 3.1/3.2)						
Symbol	**Parameter**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{RWM}	Reverse Working Voltage				5.5	V
V_{BR}	Reverse Breakdown Voltage	I_T = 100µA	6.6			
I_R	Reverse Leakage Current	V_T = Max, V_{RWM}			100	nA
V_F	Forward Voltage		0.7	0.85	0.95	V
V_{CL}	Clamping Voltage(3)(4) (100ns Transmission Line Pulse)	I_{TLP} = 1A I_{TLP} = -1A		1.5 -1.5		V
		I_{TLP} = 16A I_{TLP} = -16A		6 -4		
R_{DNY}	Dynamic Resistance(3)(4)	I_{TLP}=1 to 16A I_{TLP}=-1 to -16A			0.30 0.20	Ω
I_{PP}	Peak Pulse Current(3) IEC61000-4-5 Surge 8/20µs	Any I/O Pin to GND GND to any I/O Pin			±6	A
V_{CL}	Clamping Voltage(3) IEC61000-4-5 Surge 8/20µs	I_{PP}=1A I_{PP}=-1A		2 -2		V
		I_{PP}=6A I_{PP}=-6A		6 -5		
C_J	Junction Capacitance	$V_{I/O}$ = 1.65V, f = 1MHz, Any I/O Pin to GND		0.4	0.6	pF

Notes:

3. These specifications are guaranteed by design and characterization.
4. Measurements performed using a 100ns Transmission Line Pulse (TLP) system.

Electrical Characteristics

T_A = 25°C unless otherwise specified. Pin 2 to GND.



Pin 2 (VBUS)						
Symbol	**Parameter**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{RWM}	Reverse Working Voltage				5.5	V
V_{BR}	Reverse Breakdown Voltage	I_T = 1mA	6.6			
I_R	Reverse Leakage Current	V_T = Max, V_{RWM}			1	µA
V_F	Forward Voltage		0.7	0.85	0.95	V
V_{CL}	Clamping Voltage(3)(4) (100ns Transmission Line Pulse)	I_{TLP} = 1A I_{TLP} = -1A		9 -1		V
		I_{TLP} = 16A I_{TLP} = -16A		12 -3		
R_{DNY}	Dynamic Resistance(3)(4)	I_{TLP}=1 to 16A I_{TLP}=-1 to -16A			0.20 0.13	Ω
I_{PP}	Peak Pulse Current(3) IEC61000-4-5 Surge 8/20µs	Any I/O Pin to GND GND to any I/O Pin			±15	A
V_{CL}	Clamping Voltage(3) IEC61000-4-5 Surge 8/20µs	I_{PP}=1A I_{PP}=-1A		9 -1.3		V
		I_{PP}=15A I_{PP}=-15A		15 -3		
C_J	Junction Capacitance	$V_{I/O}$ = 0V, f = 1MHz, Any I/O Pin to GND		120		pF

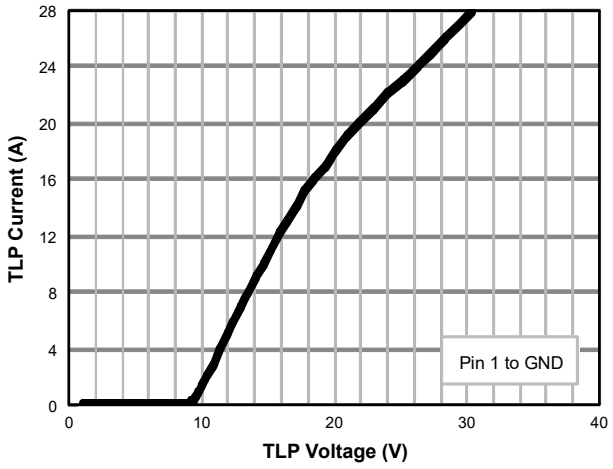
Notes:

3. These specifications are guaranteed by design and characterization.

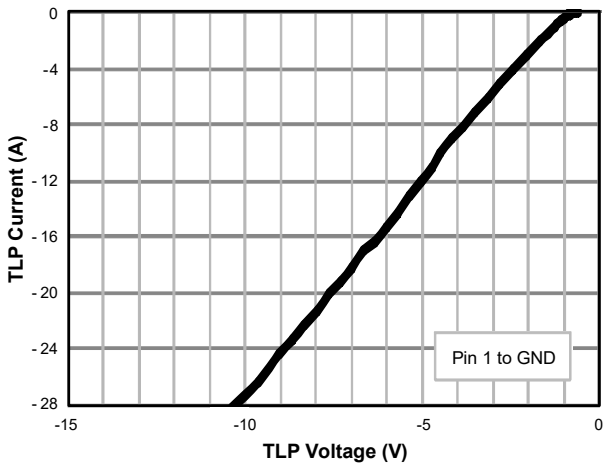
4. Measurements performed using a 100ns Transmission Line Pulse (TLP) system.

Typical Performance Characteristics

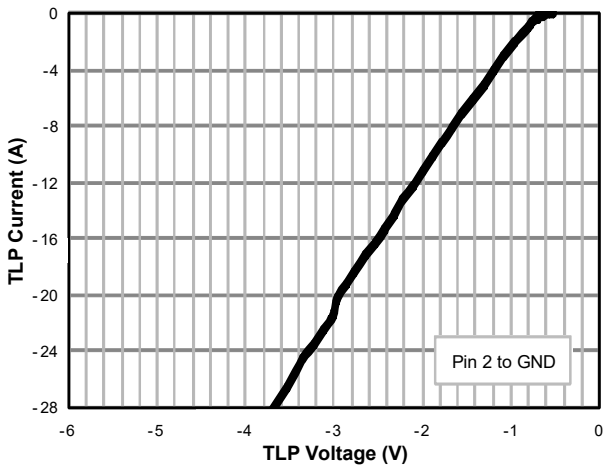
Positive Transmission Line Pulse
(tp=100ns, tr=0.2ns)



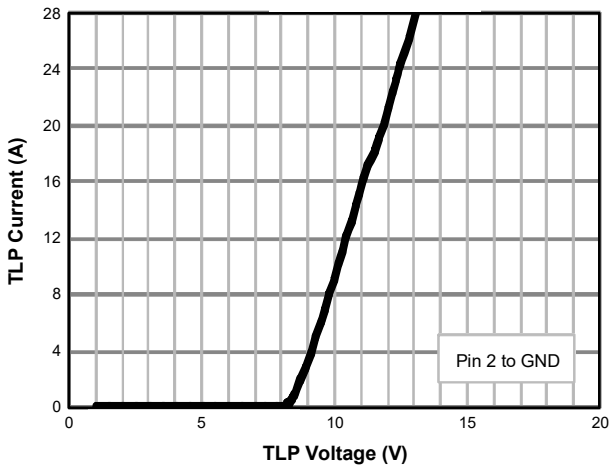
Negative Transmission Line Pulse
(tp=100ns, tr=0.2ns)



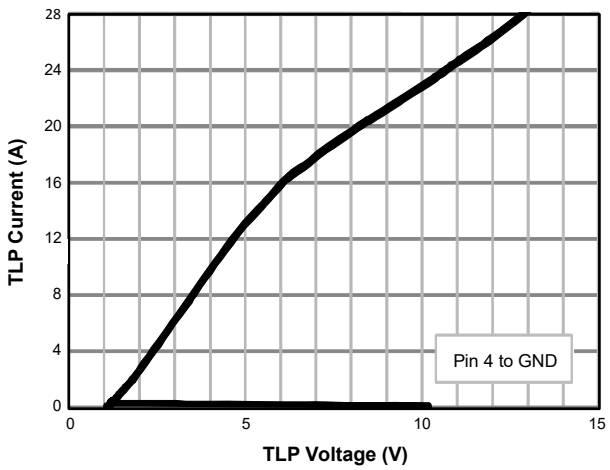
Negative Transmission Line Pulse
(tp=100ns, tr=0.2ns)



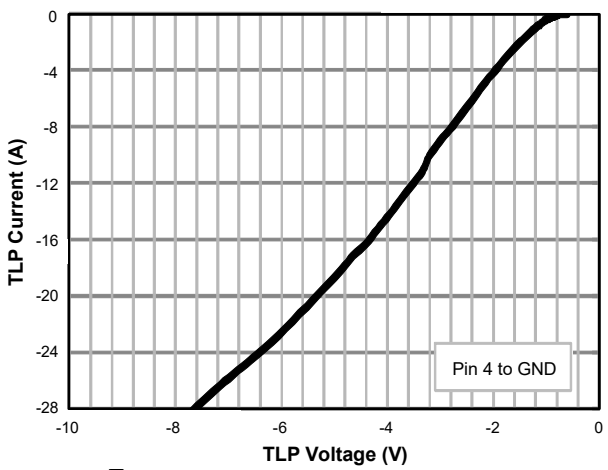
Positive Transmission Line Pulse
(tp=100ns, tr=0.2ns)



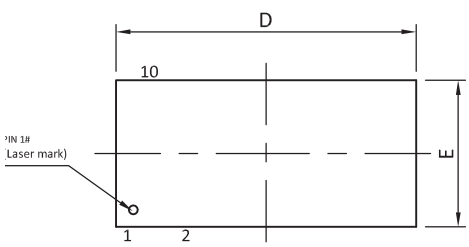
Positive Transmission Line Pulse
(tp=100ns, tr=0.2ns)



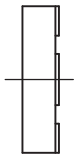
Negative Transmission Line Pulse
(tp=100ns, tr=0.2ns)



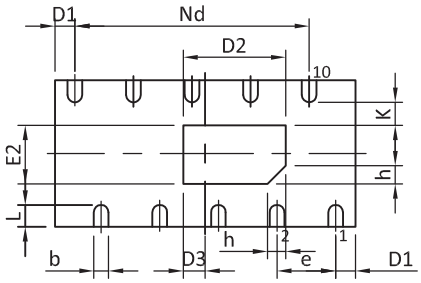
Package Dimensions, DFN4.1x2.0-10L, EP1_S



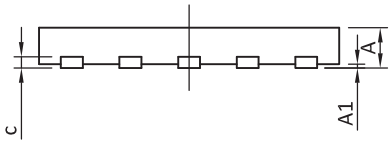
TOP VIEW



SIDE VIEW



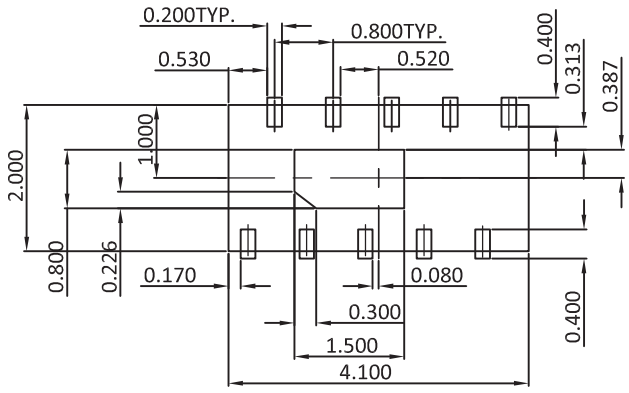
BOTTOM VIEW



SIDE VIEW

SYMBOLS	DIMENSION IN MILLIMETRES			DIMENSION IN INCHS		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	---	0.02	0.05	----	0.001	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
c	0.10	0.15	0.20	0.004	0.006	0.008
D	4.00	4.10	4.20	0.157	0.161	0.165
D1	0.20	0.25	0.30	0.008	0.010	0.012
D2	1.30	1.40	1.50	0.051	0.055	0.059
D3	0.25	0.30	0.35	0.010	0.012	0.014
e	0.80 BSC			0.031 BSC		
Nd	3.20 BSC			0.126 BSC		
E	1.90	2.00	2.10	0.075	0.079	0.083
E2	0.70	0.80	0.90	0.028	0.031	0.035
K	0.20	---	---	0.008	----	----
L	0.25	0.30	0.35	0.010	0.012	0.014
h	0.15	0.20	0.25	0.006	0.008	0.010

LAND PATTERN RECOMMENDATIONS



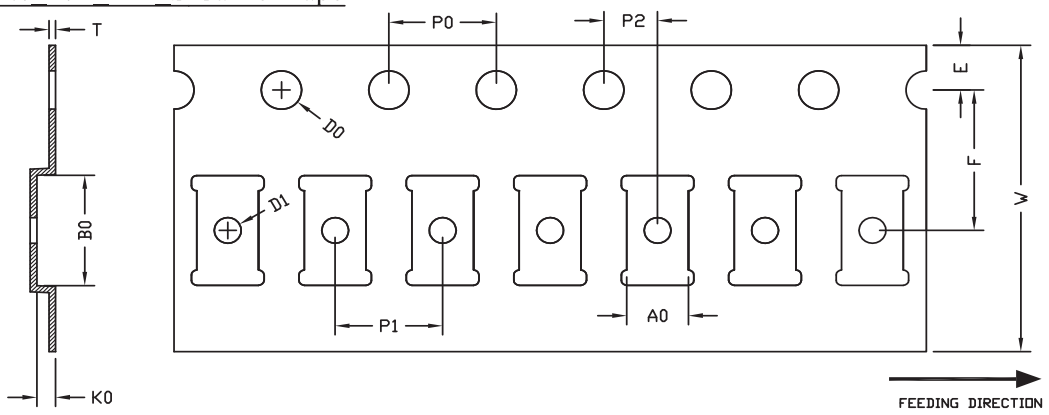
UNIT: mm

NOTES

1. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

Tape and Reel Dimensions, DFN4.1x2.0-10L, EP1_S

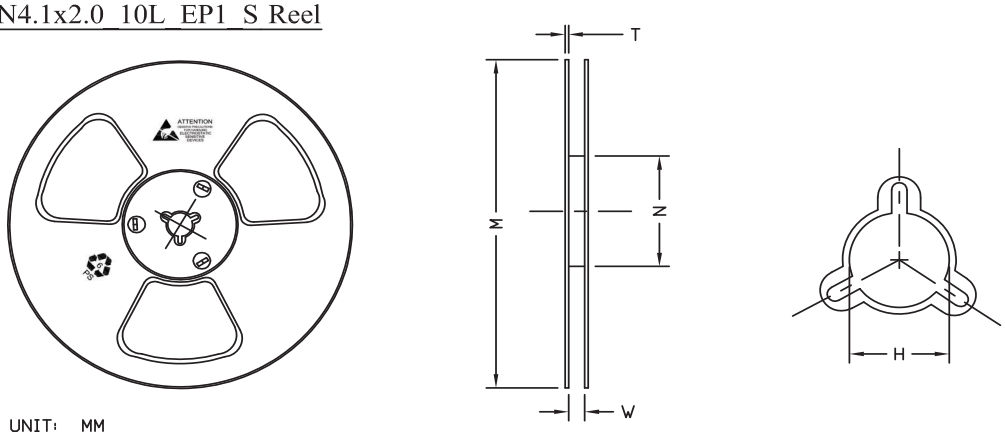
DFN4.1x2.0_10L_EP1_S Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	W	E	F	P0	P1	P2	T
DFN4.1x2.0	2.30 ±0.05	4.30 ±0.05	0.70 ±0.05	1.50 +0.1 −0.0	1.00 Min.	12.00 +0.30 −0.10	1.75 ±0.10	5.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.25 ±0.03

DFN4.1x2.0_10L_EP1_S Reel



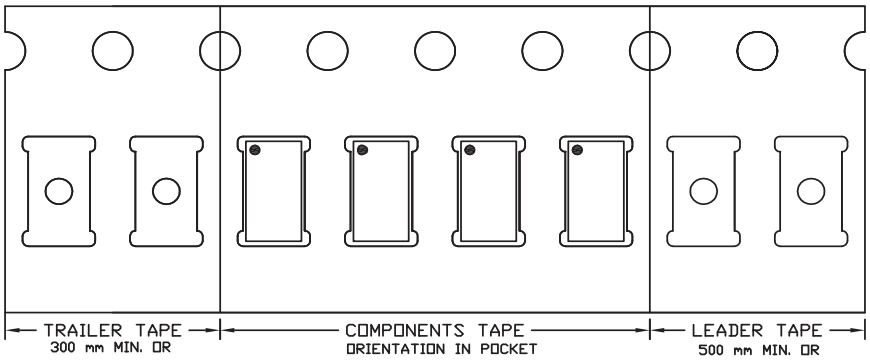
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	T	H	K	S	G	R	V
12 mm	ø329	ø329.00 ±1.00	ø100.00 ±1.00	12.80 ±1.00	2.00 ±0.30	ø13.30 ±0.30	---	---	---	---	---

DFN4.1x2.0_10L_EP1_S Package Tape

Leader / Trailer & Orientation

Unit Per Reel: 6000pcs



Part Marking

AOZ8936DI
(DFN4.1x2.0_10L)