Features

- ESD protection for one line with uni-direction
- Provide transient protection for the protected line to

  IEC 61000-4-2 (ESD) ±20kV (air/contact)

  IEC 61000-4-4 (EFT) 80A (5/50ns)

  IEC 61000-4-5 (Lightning) 13A (8/20μs)
- Ultra-low capacitance: 0.85pF typical
- 0402 small DFN package saves board space
- **High breakdown voltage** to provide over-voltage protection on USB 2.0 D+/D- pins
- Fast turn-on and low clamping voltage
- For low operating voltage applications: 3.3V
- Solid-state silicon-avalanche and active circuit triggering technology
- ***Green part***

Applications

- USB 2.0
- USB Type-C D+/D- pins
- Handheld portable applications
- Data and I/O lines protection
- Analog input lines protection
- Video lines protection

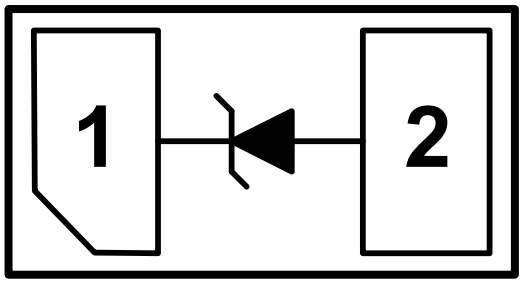
Description

AZ5H33-01F is a design which includes a uni-directional surge rated clamping cell to protect high-speed data interfaces in an electronic system. The AZ5H33-01F has been specifically designed to protect sensitive components which are connected to data and transmission lines from over-voltage caused by Electrostatic Discharging (ESD), Electrical Fast Transients (EFT), Lightning, and Cable Discharge Event (CDE).

AZ5H33-01F is a unique design which includes proprietary clamping cell in a single package. During transient conditions, the proprietary clamping cell prevents over-voltage on the data lines, which is protecting any downstream components.

AZ5H33-01F may be used to meet the ESD immunity requirements of IEC 61000-4-2, Level 4 (±15kV air, ±8kV contact discharge).

Circuit Diagram / Pin Configuration



DFN1006P2E (Bottom View)

SPECIFICATIONS

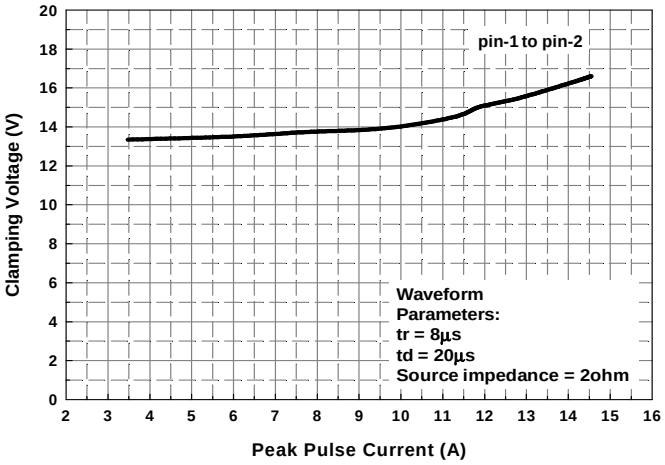
ABSOLUTE MAXIMUM RATINGS (T_A= 25°C, unless otherwise specified)			
PARAMETER	**SYMBOL**	**RATING**	**UNIT**
Peak Pulse Current (tp=8/20μs)	I_{PP} (Note 1)	13	A
Operating Voltage (pin-1 to pin-2)	V_{DC}	3.6	V
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD-1} V_{ESD-2}	±20 ±20	kV
Lead Soldering Temperature	T_{SOL}	260 (10 sec.)	°C
Operating Temperature	T_{OP}	-55 to +125	°C
Storage Temperature	T_{STO}	-55 to +150	°C

ELECTRICAL CHARACTERISTICS						
PARAMETER	**SYMBOL**	**CONDITION**	**MIN**	**TYP**	**MAX**	**UNIT**
Reverse Stand-Off Voltage	V_{RWM}	Pin-1 to pin-2, T = 25°C.			3.3	V
Reverse Leakage Current	I_{Leak}	V_R = 15V, T = 25°C, pin-1 to pin-2.			1	μA
Reverse Breakdown Voltage	V_{BV}	I_{BV} = 1mA, T = 25°C, pin-1 to pin-2.	16		19	V
Forward Voltage	V_F	I_F = 15mA, T = 25°C, pin-2 to pin-1.	0.6		1.2	V
Surge Clamping Voltage (Note 1)	$V_{CL-surge}$	I_{PP} = 5A, T = 25°C, pin-1 to pin-2.		13.5		V
		I_{PP} = 13A, T = 25°C, pin-1 to pin-2.		15.5		
ESD Clamping Voltage (Note 2)	V_{CL-ESD}	IEC 61000-4-2 +8kV (I_{TLP} = 16A), T = 25°C, contact mode, pin-1 to pin-2.		15		V
ESD Dynamic Turn-on Resistance	$R_{dynamic}$	IEC 61000-4-2, 0~+8kV, contact mode, T = 25 °C, pin-1 to pin-2.		0.2		Ω
Channel Input Capacitance	C_{IN}	V_R = 1.65V, f = 1MHz, pin-1 to pin-2, T = 25 °C.		0.85	1	pF

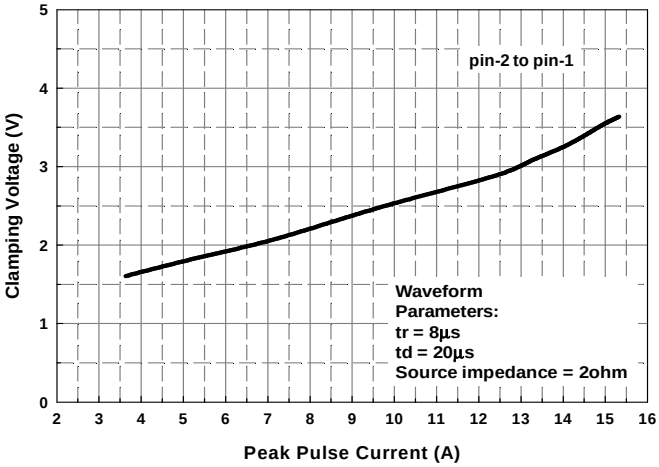
Note 1: The Peak Pulse Current measured conditions: tp = 8/20μs, 2ohm source impedance.
Note 2: ESD Clamping Voltage was measured by Transmission Line Pulsing (TLP) System.
TLP conditions: Z_0= 50Ω, t_p= 100ns, t_r= 1ns.

Typical Characteristics

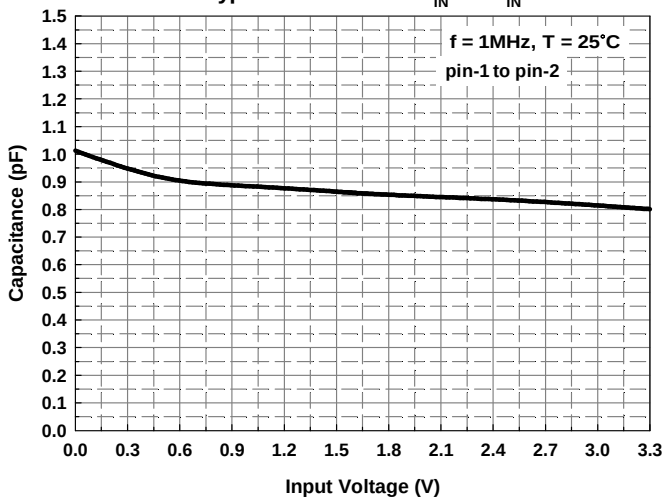
Reverse Clamping Voltage vs. Peak Pulse Current



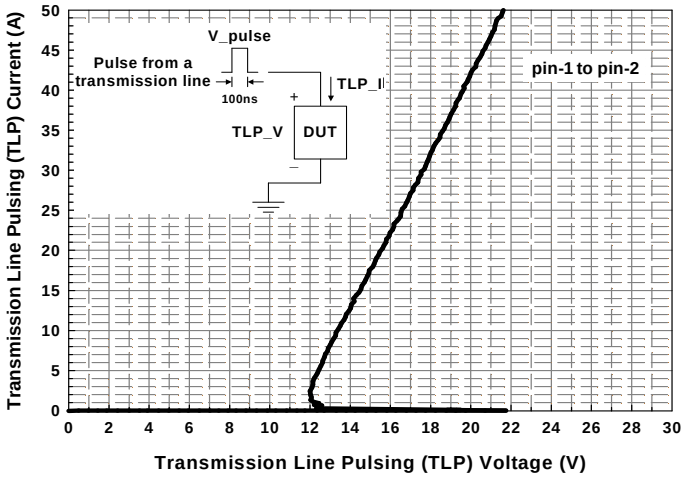
Forward Clamping Voltage vs. Peak Pulse Current



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



Transmission Line Pulsing (TLP) Measurement



Application Information

The AZ5H33-01F is designed to protect one line against system ESD / EFT / Lightning pulses by clamping it to an acceptable reference. It provides uni-directional protection.

The usage of the AZ5H33-01F is shown in Fig. 1. Protected lines, such as data line, control line, or power line, is connected to pin 1. The pin 2 should be connected to a ground plane on the board. In order to minimize parasitic inductance in the board traces, all path lengths connected to the pins of AZ5H33-01F should be kept as short as possible.

In order to obtain enough suppression of ESD induced transient, a good circuit board is critical. Thus, the following guidelines are recommended:

- Minimize the path length between the protected lines and the AZ5H33-01F.
- Place the AZ5H33-01F near the input terminals or connectors to restrict transient coupling.
- The ESD current return path to ground should be kept as short as possible.
- Use ground planes whenever possible.
- NEVER route critical signals near board edges and near the lines which the ESD transient easily injects to.

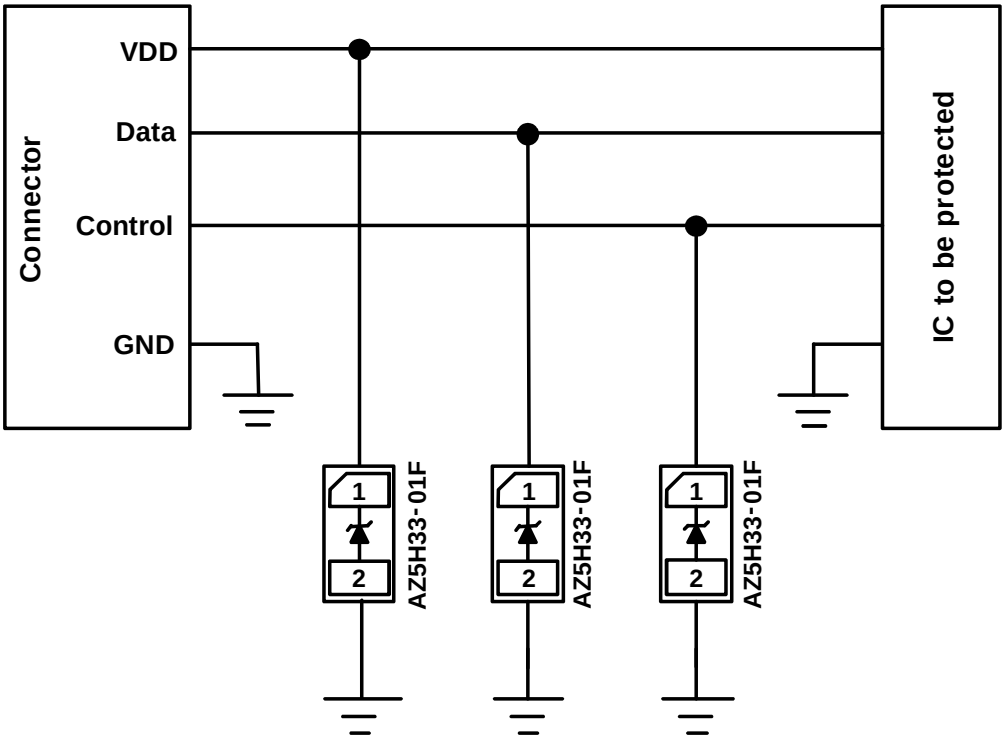
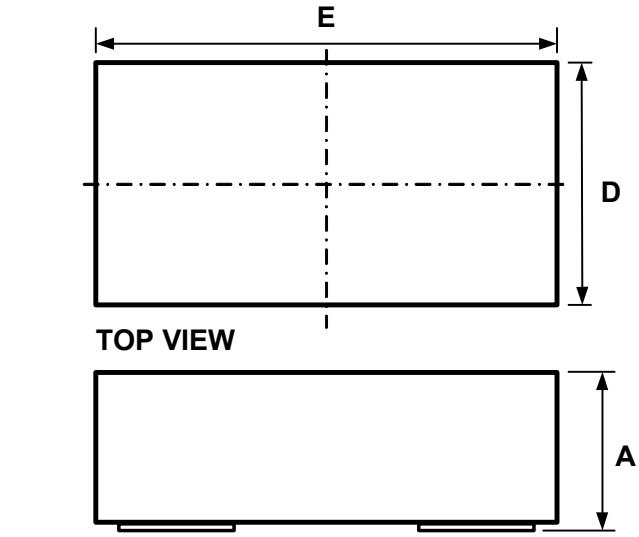
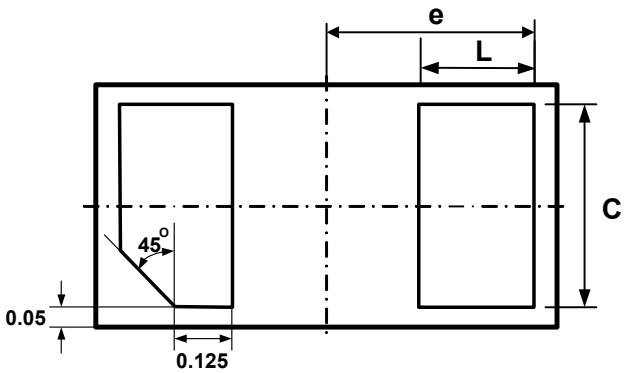


Fig. 1

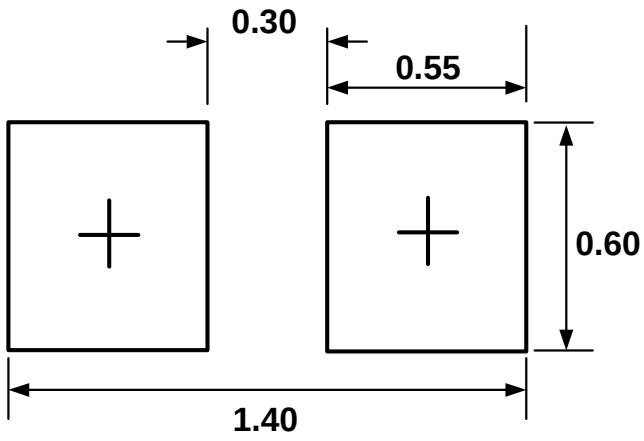
Mechanical Details

DFN1006P2E
PACKAGE DIAGRAMS





LAND LAYOUT

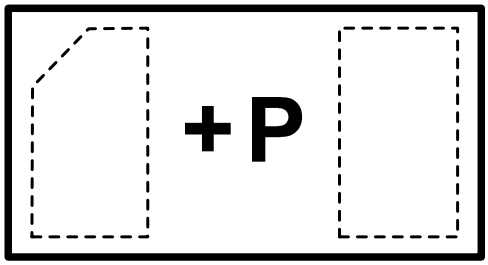


(Unit: mm)

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

SYMBOL	MILLIMETERS	
	MIN.	MAX.
E	0.95	1.05
D	0.55	0.65
A	0.45	0.55
e	0.45 BSC	
L	0.20	0.30
C	0.45	0.55

MARKING CODE



Top View

P = Device Code

Part Number	Marking Code
AZ5H33-01F.R7GR (Green Part)	P

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

Ordering Information

PN#	Material	Type	Reel size	MOQ	MOQ/internal box	MOQ/carton
AZ5H33-01F.R7GR	Green	T/R	7 inch	12,000/reel	4 reels = 48,000/box	6 boxes = 288,000/carton

Revision History

Revision	Modification Description
Revision 2019/07/22	Formal Release.