

## Features

- ❑ Transient protection for high-speed data lines
  - IEC 61000-4-2 (ESD)  $\pm 15\text{kV}$  (Air)
  - $\pm 8\text{kV}$  (Contact)
  - IEC 61000-4-4 (EFT) 40A (5/50 ns)
  - IEC 61000-4-5 (Surge) 25A (8/20 $\mu\text{s}$ )
- ❑ Package optimized for high-speed lines
- ❑ Provides protection for two line pairs
- ❑ Low capacitance: 3.8pF @ 0V (Typical)
- ❑ Low leakage current: 0.1 $\mu\text{A}$  @  $V_{\text{RWM}}$  (Typical)
- ❑ Low operating and clamping voltage
- ❑ Each I/O pin can withstand over 1000 ESD strikes for  $\pm 8\text{kV}$  contact discharge

## Description

CS2201-33 is a low-capacitance Transient Voltage Suppressor (TVS) array designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 3.8pF only, CS2201-33 is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD), Level 4 ( $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  contact discharge), IEC 61000-4-4 (electrical fast transient - EFT) (40A, 5/50 ns), IEC 61000-4-5 (Surge) (25A, 8/20 $\mu\text{s}$ ), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc.

CS2201-33 is in a DFN2.6 $\times$ 2.6-10L package. Each CS2201-33 device can protect two high-speed line pairs. The combined features of low capacitance and high ESD robustness make CS2201-33 ideal for high-speed data port and high-frequency line (e.g., Gigabit Ethernet Ports) applications. The low clamping voltage of the CS2201-33 guarantees a minimum stress on the protected IC.

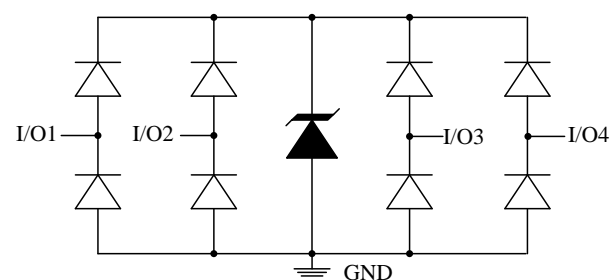
## Applications

- ❑ 10/100/1000M Ethernet Ports
- ❑ WAN/LAN Equipment
- ❑ Desktops, Servers and Notebooks
- ❑ Cellular Phones
- ❑ Switching Systems
- ❑ Audio/Video Inputs

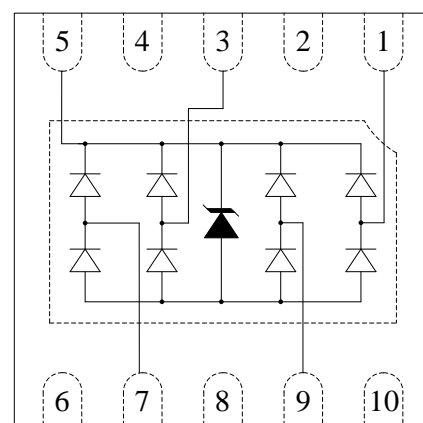
## Mechanical Characteristics

- ❑ DFN2.6 $\times$ 2.6-10L package
- ❑ Flammability Rating: UL 94V-0
- ❑ Marking: Part number, Date
- ❑ Packaging: Tape and Reel

## Circuit Diagram



## Pin Configuration



DFN2.6 $\times$ 2.6-10L  
(Top View)

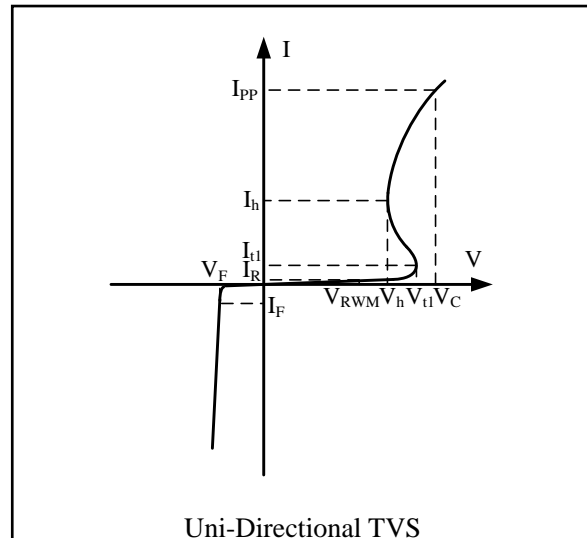


**Absolute Maximum Rating**

Symbol	Parameter	Value	Units
$I_{PP}$	Peak Pulse Current (8/20 $\mu$ s)	25	A
$P_{PK}$	Peak Pulse Power (8/20 $\mu$ s)	450	Watts
$V_{ESD}$	ESD per IEC 61000-4-2 (Air)	$\pm 25$	kV
	ESD per IEC 61000-4-2 (Contact)	$\pm 15$	
$T_{OPT}$	Operating Temperature	-55 to +125	$^{\circ}$ C
$T_{STG}$	Storage Temperature	-55 to +150	$^{\circ}$ C

**Electrical Characteristics (T = 25 $^{\circ}$ C)**

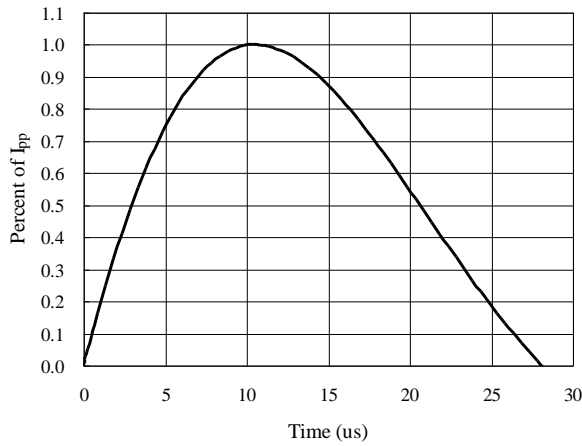
Symbol	Parameter
$V_{RWM}$	Nominal Reverse Working Voltage
$I_R$	Reverse Leakage Current @ $V_{RWM}$
$V_{t1}$	Trigger Voltage
$I_{t1}$	Trigger Current @ $V_{t1}$
$V_h$	Holding Voltage
$I_h$	Holding Current @ $V_h$
$V_C$	Clamping Voltage @ $I_{PP}$
$I_{PP}$	Maximum Peak Pulse Current
$V_F$	Forward Voltage @ $I_F$
$C_{ESD}$	Parasitic Capacitance



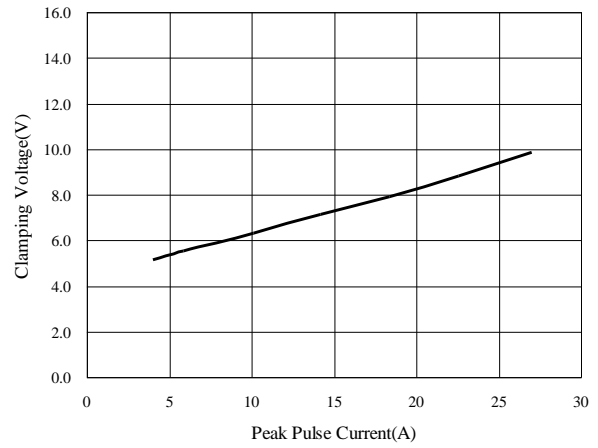
Symbol	Test Condition	Minimum	Typical	Maximum	Units
$V_{RWM}$				3.3	V
$I_R$	$V_{RWM} = 3.3V, T = 25^{\circ}C$		0.1	1.0	$\mu$ A
$V_{t1}$	$I_{t1} = 1\mu A$	3.5	4.2	5.0	V
$V_h$	$I_h = 1mA$	3.3		4.5	V
$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s$ (Each Line)			5.5	V
$V_C$	$I_{PP} = 10A, t_p = 8/20\mu s$ (Each Line)			8.5	V
$V_C$	$I_{PP} = 25A, t_p = 8/20\mu s$ (Each Line)			16.0	V
$C_{ESD}$	Between I/O Pins and Ground $V_R = 0V, f = 1MHz$		3.8	5.0	pF
$C_{ESD}$	Between I/O Pins $V_R = 0V, f = 1MHz$		2.0	2.5	pF



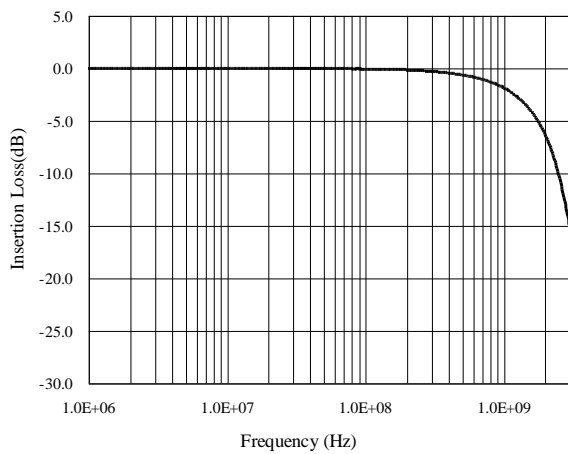
8/20 $\mu$ s Pulse Waveform



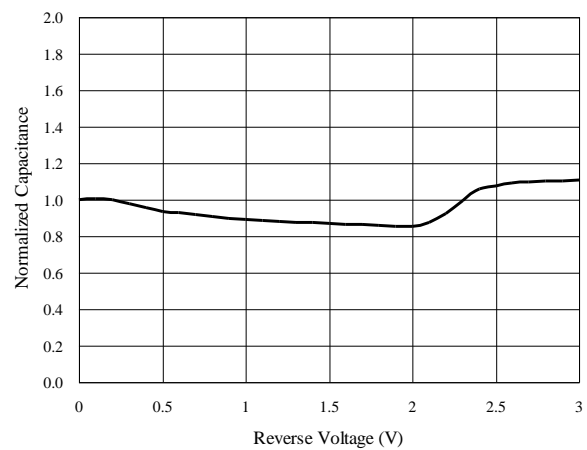
Clamping Voltage  $V_C$  vs. Current  $I_{PP}$



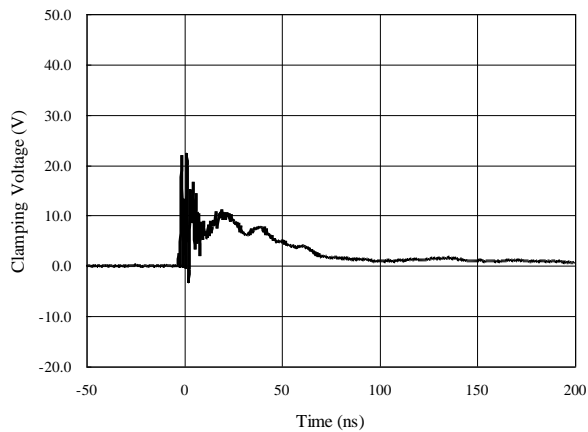
Insertion Loss S21



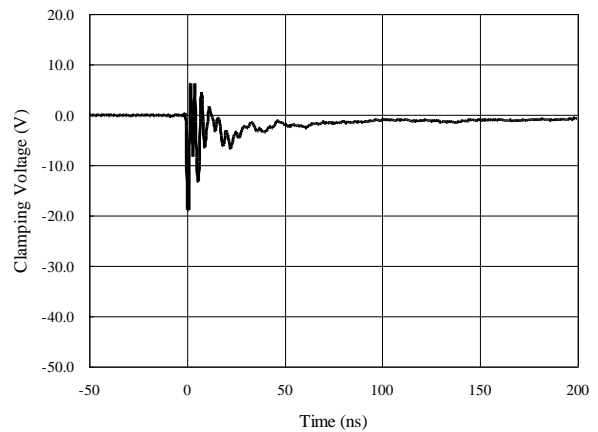
Normalized Capacitance vs. Voltage



ESD Clamping of I/O to GND  
(+8kV Contact per IEC 61000-4-2)



ESD Clamping of I/O to GND  
(-8kV Contact per IEC 61000-4-2)

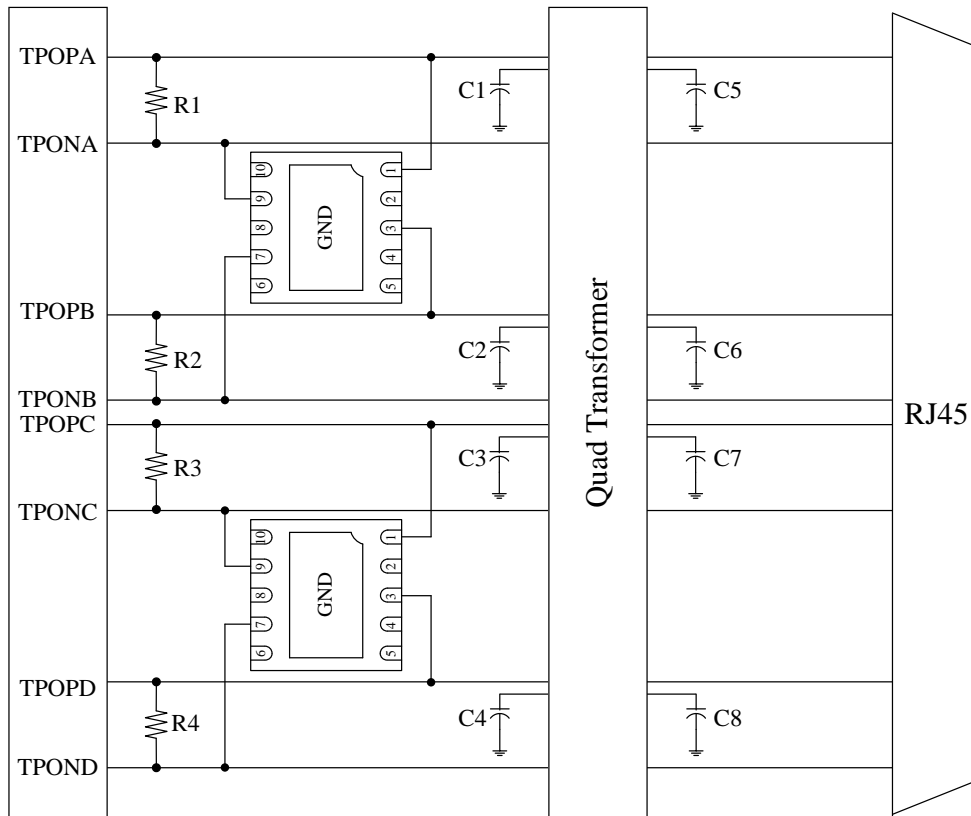




### Application Information

Electronic equipment is susceptible to damage caused by a variety of sources, including Electrostatic Discharge (ESD), Electrical Fast Transients (EFT) and Lightning strikes. The CS2201-33 was designed to protect the sensitive equipment from damage which may be induced by such transient events. This product can be configured in different connections to meet the requirement of common-mode and differential-mode as follows:

### Gigabit Ethernet Protection



Schematic Diagram for Gigabit Ethernet ESD/Surge Protection using CS2201-33

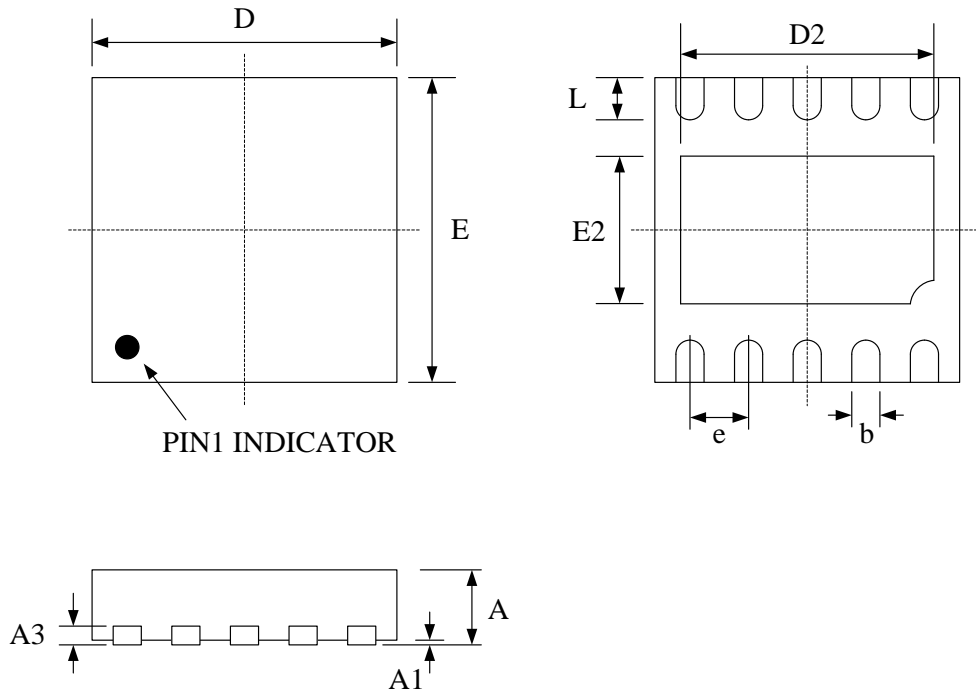
NOTE:

DO NOT connect pin5 of CS2201-33 to a DC supply.



**Package Outline**

- DFN2.6×2.6-10L package

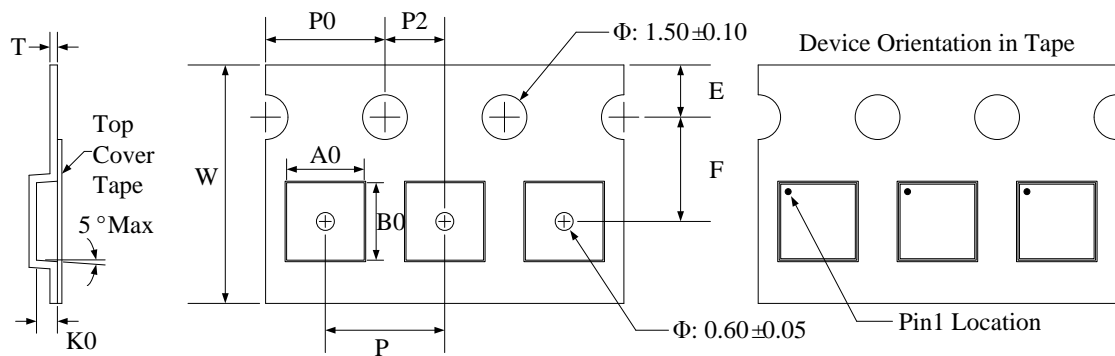


Package Dimensions (Controlling dimensions are in millimeters)

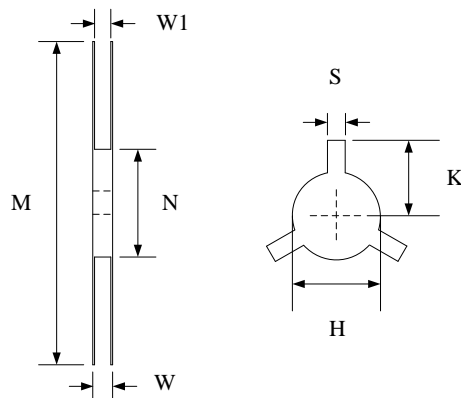
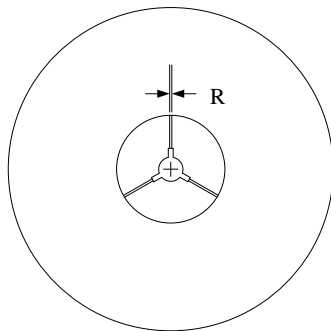
Symbol	Dimensions (mm)			Dimensions (Inches)		
	Minimum	Typical	Maximum	Minimum	Typical	Maximum
A	0.500	0.550	0.600	0.020	0.022	0.024
A1	0.000	—	0.050	0.000	—	0.002
A3	0.15 REF			0.006 REF		
b	0.200	0.250	0.300	0.008	0.010	0.012
D	2.550	2.600	2.650	0.100	0.102	0.104
D2	2.000	2.150	2.250	0.079	0.085	0.089
e	0.500 BSC			0.020 BSC		
E	2.550	2.600	2.650	0.100	0.102	0.104
E2	1.110	1.260	1.360	0.044	0.050	0.054
L	0.250	0.350	0.450	0.010	0.014	0.018



**Tape and Reel Specification**

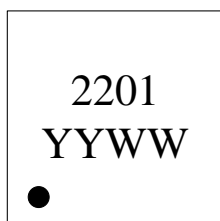


Symbol	W	A0	B0	K0	E	F	P	P0	P2	T
Dimensions (mm)	8.00+0.3 -0.1	2.74±0.05	2.74±0.05	0.72±0.05	1.75±0.1	3.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	0.25±0.02



Symbol	Reel Size	M	N	W	W1	H	S	K	R
Dimensions (mm)	Φ178	178.0±1.0	60.0±1.0	11.5±0.5	9.0±0.5	13.0±0.5	2.0±0.1	11.0±0.2	1.0±0.05

**Marking Codes**



**Ordering Information**

Part Number	Working Voltage	Quantity Per Reel	Reel Size
CS2201-33	3.3V	3,000	7 Inch

**Note:**

- (1) "2201" is the part number, fixed.
- (2) "YYWW" is date code. "YY" is year (2011 is "11"); while "WW" is assembly week in a year.

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