



Power over Ethernet (PoE) Surge Protection per IEC 61000-4-5

APPLICATION NOTE



CDNBS08-T58CC

INTRODUCTION

Ethernet is a balanced high-speed communication standard that is widely used around the world. The addition of Power over Ethernet (PoE) provides many advantages in the marketplace. Since the same cable used for communication is also used to power the device, it eliminates the need to provide an AC power source for devices such as Internet Protocol (IP) phones, IP cameras and wireless access points. PoE allows devices to be placed wherever an Ethernet cable can be run. This simplifies and reduces the cost of installations. An added benefit is that devices can also be reset remotely by cycling power.

Many applications are located in hostile environments and require protection against damage that can be caused by power surges, indirect lightning strikes and other transient events. This application note presents a surge protection design for a four port PoE design that meets IEC 61000-4-5.

PoE PORT TYPES

The IEEE 802.3-2012 standard covers Ethernet communication. Clause 33 of this standard covers PoE and describes two different categories of devices, Type 1 and Type 2. The device or equipment supplying power is referred to as the Power Sourcing Equipment (PSE). The device receiving the power is referred to as the Powered Device (PD). Power is supplied using two line pairs of the Ethernet cable. A Type 1 PSE supplies a DC voltage between 44 and 57 V at a maximum current of 350 mA. A Type 2 PSE provides a DC voltage of 50 to 57 V at a maximum current of 600 mA. The PD which receives the power from the PSE can dissipate a maximum power of 13 W and 25.5 W for a Type 1 and Type 2 device, respectively.

The IEEE P802.3bt Task Force is currently developing a standard for delivering higher power levels using all four pairs of the Ethernet cable. The maximum power supplied by a PSE in the new standard is expected to be less than 100 watts.

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SURGE PROTECTION

The Bourns® Model CDNBS08-T58CC is a quad unidirectional diode array designed to provide differential surge protection to an isolated PoE power interface for up to four ports. The integrated device is packaged in an SO-8 surface mount package that significantly reduces the board space required in comparison to using four discrete devices in SMA or larger packages. The cathodes of the four TVS diodes in the array are connected together (common). Figure 1 shows a schematic diagram of the device being used to protect four Type 1 or Type 2 PoE ports of a PSE. The Model CDNBS08-T58CC is connected so that it protects the supply and controller from damage that could be caused by a differential surge between the PoE power pairs.

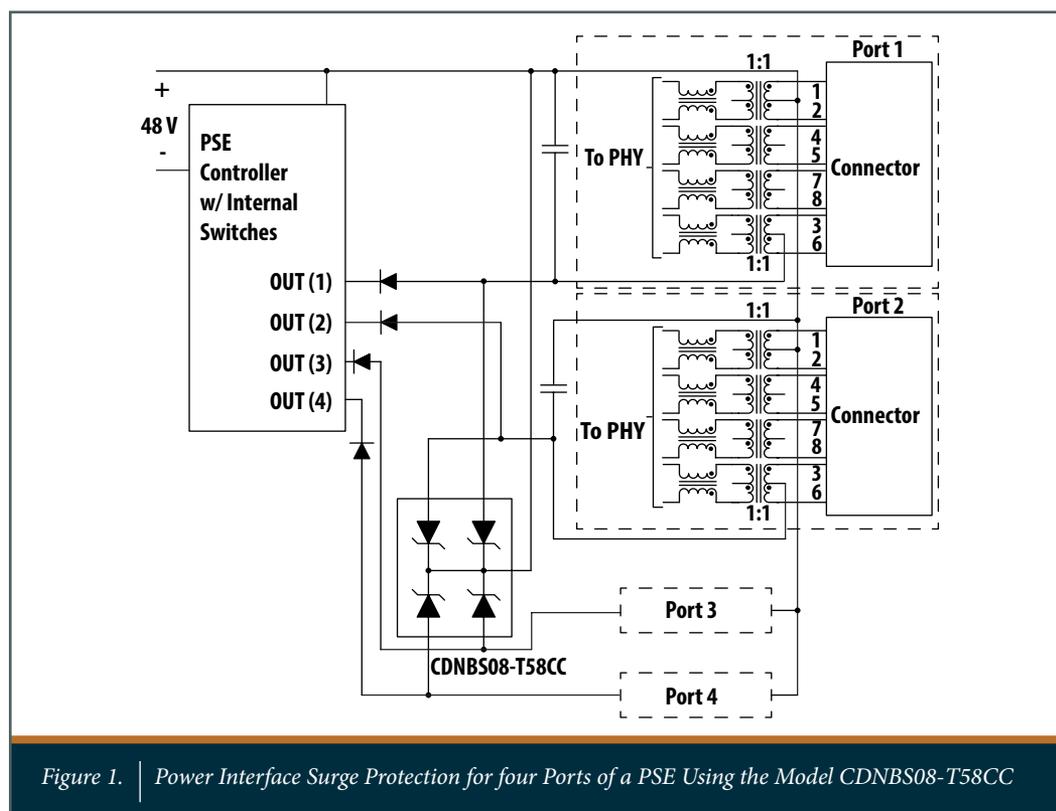


Figure 1. | Power Interface Surge Protection for four Ports of a PSE Using the Model CDNBS08-T58CC

One of the four TVS diodes in the CDNBS08-T58CC is placed across the power pair that is routed to each of the four ports. Note that the common cathodes of the four TVS diodes are connected to the positive rail of the supply. Each of the four anodes is connected to the negative rail of the supply that is routed to one of the four ports. In this example, power to each of the ports is individually controlled by an independent switch that is internal to the PSE controller.

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SURGE PROTECTION (Continued)

A common protection goal is to limit the voltage across the power lines to 100 volts or less. The Bourns® Model CDNBS08-T58CC meets this requirement with a typical clamp voltage of 90 V at a peak current of 24 A (8/20 μ s current waveform per IEC 61000-4-5). Figure 2 shows the test setup for a differential surge test between the PoE power pairs of a PSE that is supplying power over pins 1, 2, 3 and 6 (referred to as Alternative A in the IEEE 802.3-2012 standard).

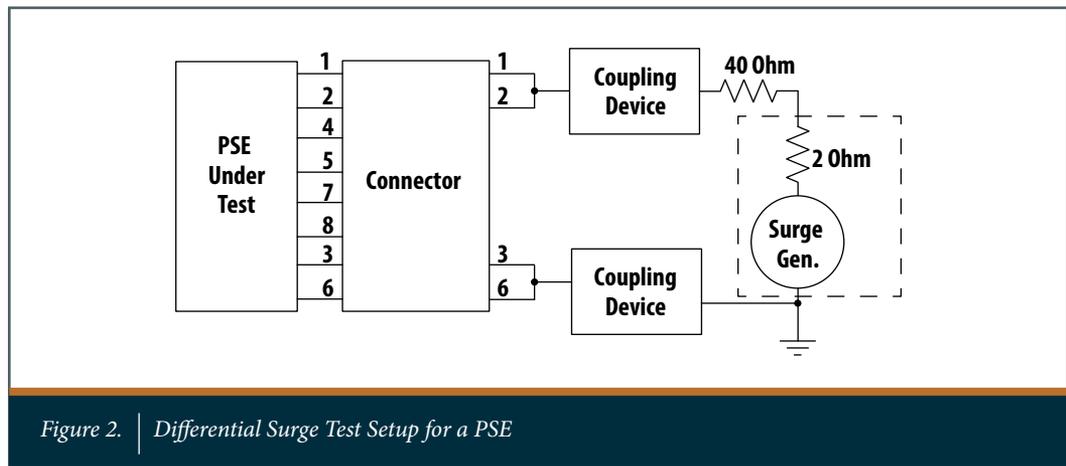


Figure 2. | Differential Surge Test Setup for a PSE

Figures 3 and 4 show the response of one diode in the Model CDNBS08-T58CC array when subjected to a 1.2/50 μ s voltage, 8/20 μ s current combination waveform with a peak current of 24 amps in the positive and negative polarities, respectively. In response to the positive surge, the voltage across the diode was limited to 88 V, which is slightly below the specified typical clamp voltage of 90 V. For the negative surge test, the voltage across the diode was limited to less than 3 V.

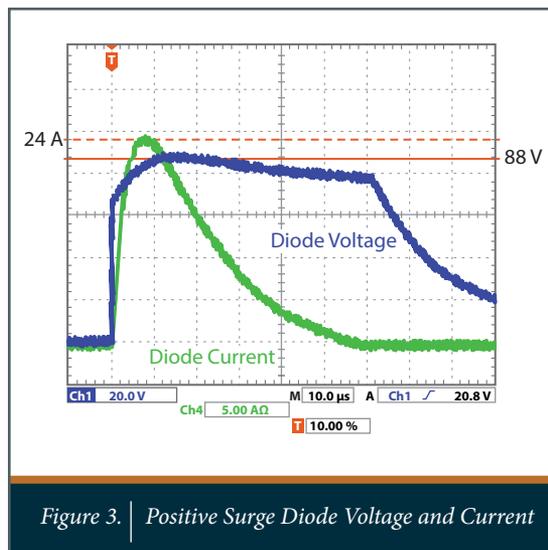


Figure 3. | Positive Surge Diode Voltage and Current

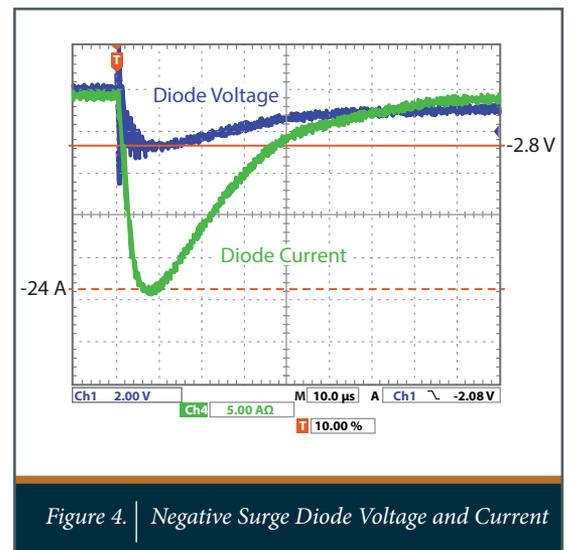


Figure 4. | Negative Surge Diode Voltage and Current

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CONCLUSION

The Bourns® Model CDNBS08-T58CC is a quad unidirectional TVS diode array that is designed to protect PoE circuits against damage from a differential surge. The integrated design minimizes the board space required to protect PoE supplies and controllers for up to four ports. Each diode in the array has a peak current rating of 24 A for an 8/20 μ s current waveform. At this current level, it will limit the differential voltage across the PoE power pairs to less than the typical requirement of 100 V.

ADDITIONAL RESOURCES

Please contact your local Bourns Application Engineer or Bourns Sales Representative for additional information.

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