

ESD Protection InfiniBandSM Data Lines

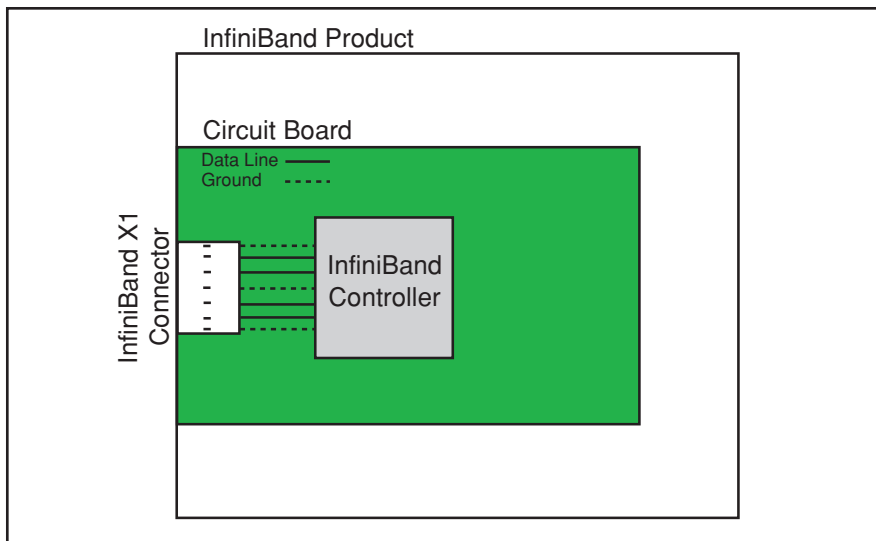


Figure 1. Simple InfiniBand circuit diagram (ESD suppressors protect the data lines which have exposure to the outside world. The InfiniBand 1x protocol uses 4 data lines).

Background

InfiniBand products (servers, adapters, switches, storage units, etc.) can be susceptible to ESD events when the cable is either connected or disconnected from the data port. An ESD pulse (up to 15 kV per IEC 61000-4-2) can be introduced directly into the open port, or into the disconnected end of the cable. Either way, the integrated circuitry that controls the InfiniBand functionality can be damaged.

The Problem

After the ESD pulse is introduced into the data port, it will travel through the connector to the PC board. Once on the PC board, it will propagate down the data lines toward the integrated circuitry. Specifically, the IC of concern is the **InfiniBand Controller**. Without sufficient protection, the Controller chip can be rendered inoperable.

The Solution

In order to provide the IC with protection against ESD transients, the use of suppression products is recommended. ESD suppressors

are installed between the data line and the chassis ground (parallel connection) and shunt the ESD transient from the data line to the ground.

For high-speed protocols like that of InfiniBand (2.5Gbps), suppressors with extremely low capacitance levels should be used. Suppressors with high capacitance can affect the data stream by distorting the data waveforms.

Littelfuse offers PulseGuard[®] ESD suppressors as a solution for InfiniBand data line ESD protection. These products are surface mount devices with 0.050 pF of capacitance. As a result, they will provide ESD protection and maintain the integrity of the data signals.

Examples of InfiniBand products which can benefit from ESD protection include:

- Servers
- Switches
- Routers
- Links and repeaters
- Host channel adapters
- Target channel adapters



Capacitance and Signal Integrity

In previous generations of I/O protocols (RS232, USB 1.1, 10BaseT, etc.), the signal speed (rise/fall time of logic states) was sufficiently slow that the parasitic components of circuit protection devices was of minimal concern.

However, as data rates have increased, the capacitive loading that is presented to the data circuitry by the protection device becomes more of a concern. For example, the diagrams to the right show the effect capacitive loading has on an InfiniBand waveform.

The first diagram shows the eye diagram for a control board which only contains the data lines. The second diagram shows the response of the data line which has a PulseGuard[®] ESD suppressor installed. The third diagram is included for reference, and shows the response when a 3 pF capacitor is installed on the data line. The PulseGuard device and capacitor were reference to ground.

The signals replicate the InfiniBand protocol (1.0 - 1.6V, 2.5 Gbps); created on Agilent BERT equipment and measured with an Agilent Infiniium DCA.

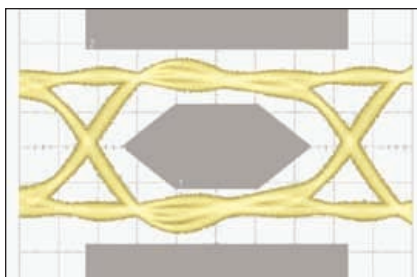


Figure 2. Control signal (no devices added) for InfiniBand data line at 2.5Gbps

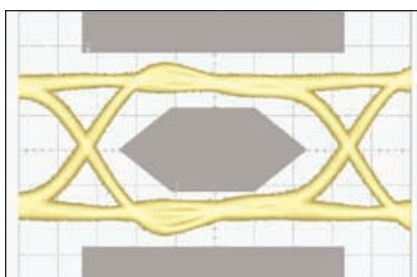


Figure 3. PulseGuard[®] suppressor traces (0.050pF) for InfiniBand data line at 2.5Gbps

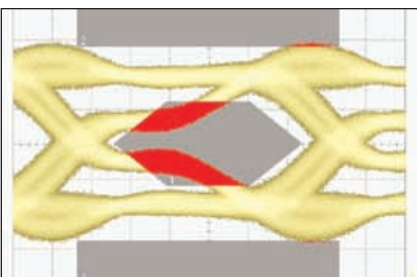


Figure 4. Surface mount capacitor traces (3.0pF) for InfiniBand data line at 2.5Gbps

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