

ESD Protection of High-Speed Data Lines

DVI/HDMI High Speed Data Rates

Communication data lines continue to be increasingly vulnerable to ESD transients. The ever-increasing bandwidth of the faster data lines such as the 10/100 or Gigabit Ethernet, USB 2.0, IEEE-1394b, make the traditional ESD protection schemes such as silicon based devices, or multi layer varistors less desirable, due to signal distortion from the relatively high capacitance of these components.

PolySurg™ ESD Suppressors

The typical capacitance of the device (0402ESDA-MLP, 0603ESDA-MLP, or 0603ESDA-TR) is measured to be below 0.15pF, in a range of 0.1 kHz to nearly 2 GHz. The low capacitance throughout this wide frequency range makes these devices suitable for ESD protection of low analog signals to fast digital data lines.

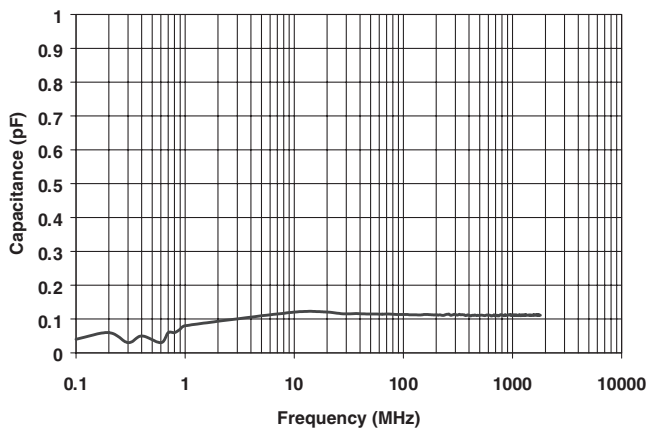


Chart 1. The Capacitance of a PolySurg™ ESD Suppressor from 0.1MHz to 1.8GHz

Another special characteristic of the PolySurg™ ESD Suppressor is that it is virtually invisible to the circuit at normal operation. The off-state resistance of the device is over 10^{13} Ohms, and the typical current leakage of the device is a negligible, 0.01nA at 12VDC. As Chart 2 shows, the additional attenuation in a 50ohm circuit measured at frequencies up to 6GHz is less than -0.2dB.

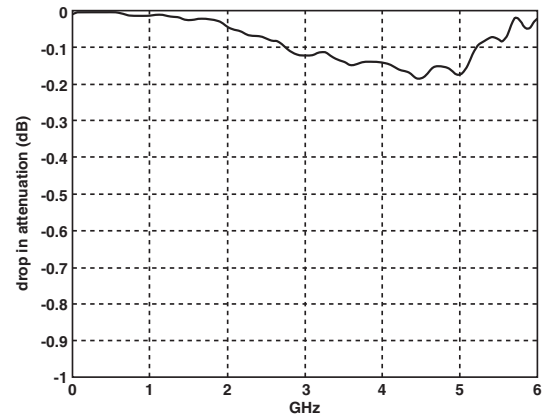


Chart 2. Additional Attenuation in a 50ohm System due to the PolySurg™ ESD Suppressor

Example of devices that ESDA family devices can protect from ESD:

- Network interface cards for desktops
- PC cards for laptops
- DSL / Cable modems.
- Routers and switches /hubs

Selected Protection Applications

Ethernet ports: The RJ-45 is the most common Ethernet connection. The typical 10Base-T/100Base-TX uses 4 out of 8 lines. Each line in use can be protected with one PolySurg™ ESD Suppressor installed between the data line and the ground. For the best performance, place the devices at the closest location to the RJ-45 port (See Figure 1)

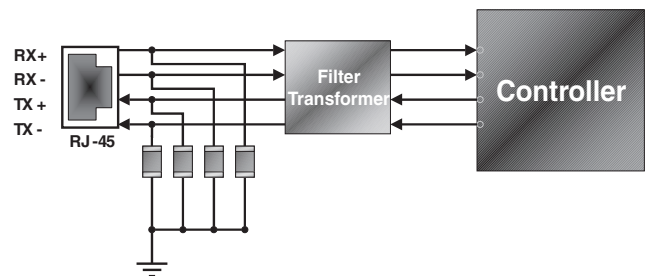


Figure 1. The ESD Protection of 10 / 100 Ethernet (RJ-45) device with a PolySurg™ ESD Suppressor

Firewire: The IEEE-1394 (Firewire) series are the newest serial ports for computer and other instruments with data transfer rates up to 1,600Mbps (1394a is 400Mbps, and 1394b will be 800~1,600Mbps.) This higher transfer speed data is more easily subject to distortion (Chart 3). The PolySurg™ ESD Suppressor can protect data lines from ESD without distorting the high speed signal possible from IEEE-1394 connection. All data lines should be protected individually. (See Figure 2)

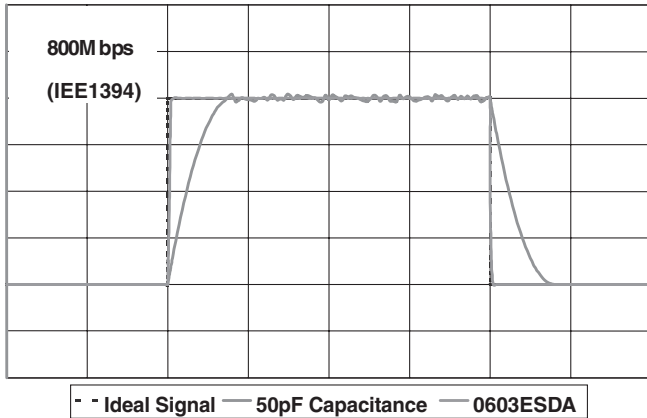


Chart 3. Signal distortion comparisons at 800Mbps

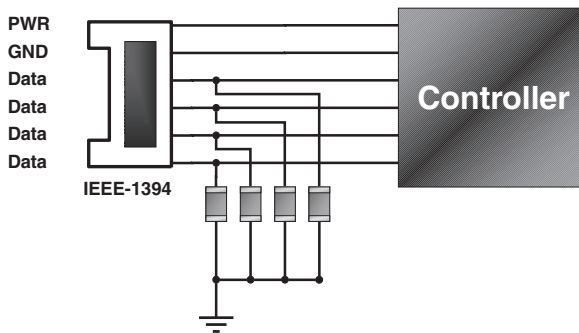


Figure 2. The ESD Protection of Typical IEEE-1394a device with a PolySurg™ ESD Suppressor

Example of devices that PolySurg™ ESD Suppressor can protect from ESD:

- Firewire interface cards
- Digital camcorders
- Printers / scanners
- Other peripherals with Firewire capability

USB 2.0: The USB 2.0 has a fast data transfer rate of 400Mbps. A device equipped with USB 2.0 will give the best performance when protected with the ultra low capacitance PolySurg ESD Suppressor. This will result in much less data distortion than if zener diodes or multi layer varistors are used for ESD protection (See Figure 3)

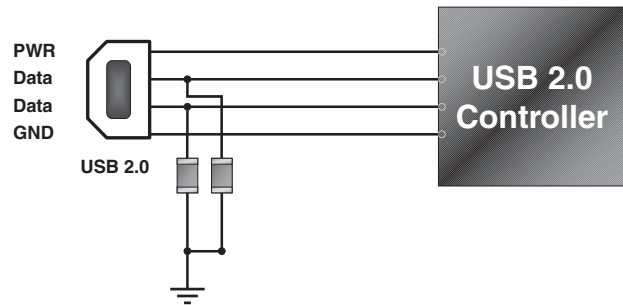


Figure 3. ESD protection of USB 2.0 devices with a PolySurg™ ESD Suppressor

Special Applications

When the unused data port is connected to a higher operating voltage such as 24V or higher for special applications, the PolySurg™ ESD Suppressor can be installed in series for ESD protection on the higher voltage line. The operating voltage capability will be increased without changing total capacitance or the current leakage of the devices.

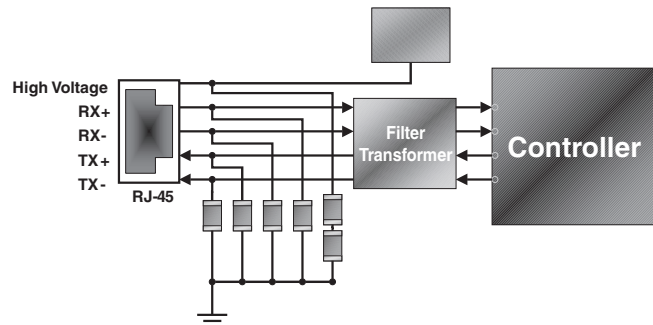


Figure 4. The Parallel connection for high voltage line protection using an ESDA family device on RJ-45