

TECH BRIEF

General Purpose ESD Protection

Background

Electronic systems are sensitive to both external and internal sources of overvoltage transients. This can be in the form of external Electro-Static Discharge (ESD) or internally generated Electrical Fast Transients (EFT). The purpose of this application brief is to detail "General Purpose" transient protection with signal bandwidth less than 125 Mbps.

The Problem

Externally generated ESD pulses are introduced into the I/O port and travel through the connector onto system board. Once on the board, they will propagate down the signal lines toward the integrated circuits (IC). Most ICs are designed with 2,000V of internal ESD protection. However it is not uncommon to measure ESD transients in consumer environments over 8,000V. Without sufficient protection, the sensitive ICs can experience "soft failures" or corrupted data. In addition, the IC could be permanently damaged, rendering the whole system inoperable.

Internally generated EFT pulses are created by the electronic system. Sources include switching high current loads (such as pump lasers),

automotive load dump or other harsh events. The EFT can be introduced via the power supply or inductively coupled onto a signal line. Regardless of the method of introduction, the results may be soft or hard failures similar to ESD failures.

The Solution

In order to provide the IC with protection against ESD and EFT transients, the use of suppression products is recommended. The suppressors are installed between the signal line and the power supply or chassis ground (parallel connection) to shunt the transient from the signal line to AC ground. Since this technical brief is tailored to general purpose transient protection we will discuss several examples relating to signals less than 125 Mbps.

Examples of products which can benefit from general purpose transient protection:

- Field programmable systems
- Remote peripherals (data logger, security scanners, printers)
- Industrial controls (process monitor, motor control)
- Medical electronics
- Industrial computers



Examples

Figure 1 shows the SP720 providing EFT protection in a system comprised of an Analog-to-Digital converter and microprocessor. The microprocessor block could easily be replaced by a dedicated Digital Signal Processor (DSP). In a harsh industrial or electrically noisy environment, transients may be coupled onto the data bus to either corrupt or damage the system. The SP720 is an array of 14 low capacitance (3pF) diode pairs that “steers” the transient voltage into the positive or negative power supply. The SP720 shown in figure 1 has an expanded view of a single diode pair.

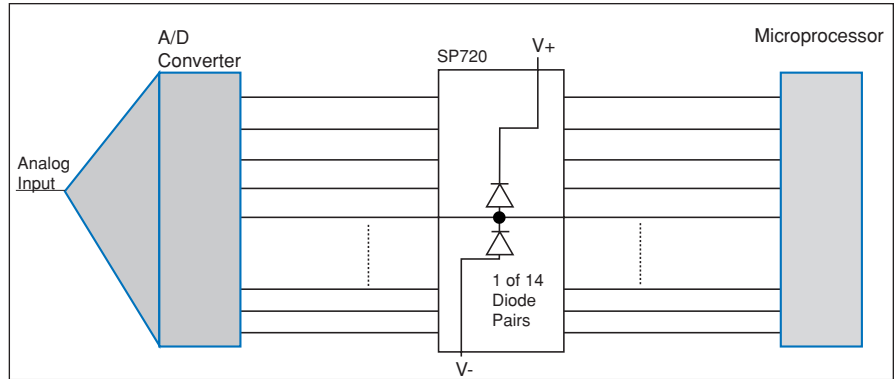


Figure 1. Protecting a data bus from EFT with the SP720

Figure 2 is an example of very low leakage protection of an I/O port. Handheld products and other battery operated equipment are sensitive to any leakage current to lengthen usage time between recharges or battery replacement. The figure shows a possible 3 channel application with 3 PulseGuard® suppressor devices providing shunt protection for ESD transients. With less than 1 nA of leakage current, during data transmission, the PulseGuard device offers the very least amount of leakage.

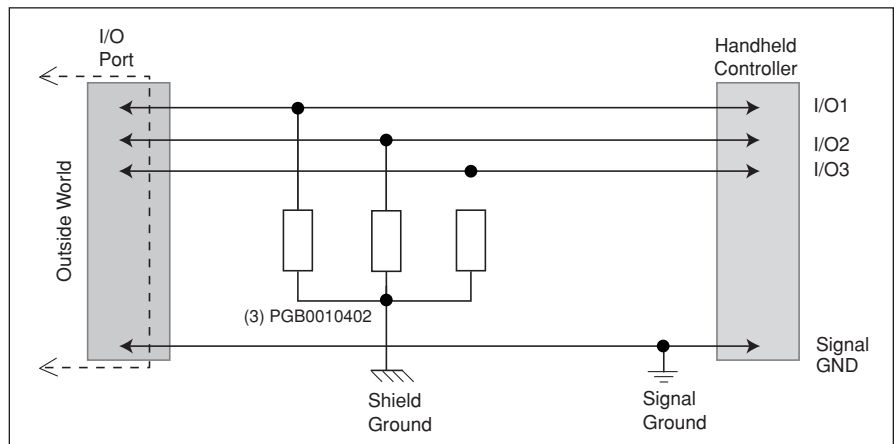


Figure 2. Low leakage port protection with PulseGuard® suppressors

Figure 3 consists of a SP0506CAx providing ESD/EFT protection of a standard JTAG interface. In addition to low capacitance steering diodes for the signal lines, the device also has an integrated TVS avalanche diode for power supply protection.

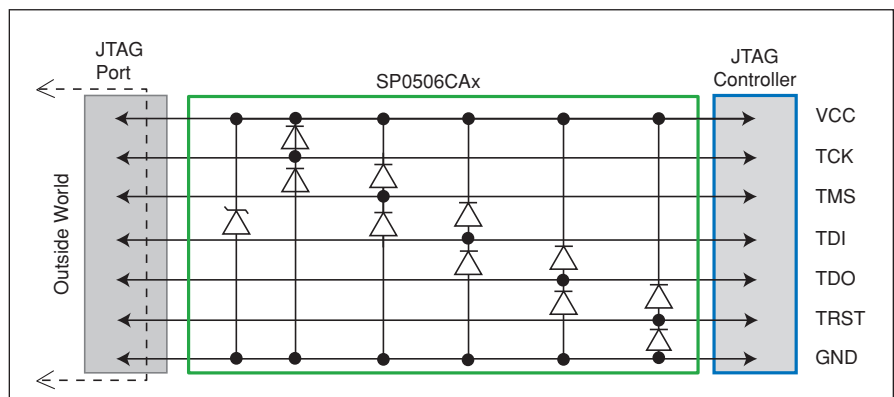


Figure 3. JTAG interface protection with integrated Vcc clamp

Littelfuse, Inc.
800 E. Northwest Highway
Des Plaines, IL 60016
(847) 824-1188
www.littelfuse.com/esd