

Protecting from Electro-Static Discharge (ESD)

Electrostatic discharge (ESD) has reportedly caused more damage and upset to microchip electronics than all other threats. IEC 801-2 specification defines the worst case as being 15kV with a current of 15A. The current waveform of this threat is shown in Figure 1. Some manufacturers qualify equipment to ESD levels up to 25kV.

According to susceptibility data published by the government funded Reliability Analysis Center in Rome, New York, most integrated circuits are susceptible to ESD levels of 2,000 V or less. Your fingertip can't feel 3,000 V, but your computer can, so you can cause damage without knowing it.

ESD paths into a circuit can be via conduction, for example from a fingertip arc, or by radiation from a nearby spark. In addition to the human body, mobile metal furniture such as chairs and carts are also sources of static buildup and discharge. Air discharges can

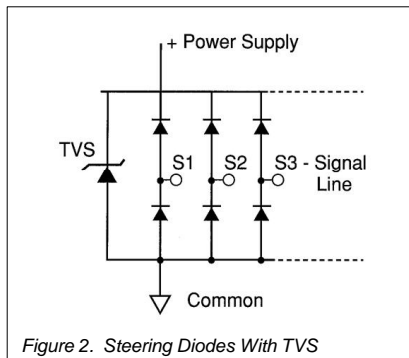


Figure 2. Steering Diodes With TVS

have very fast rise-times of less than 100 picoseconds for values below 1 kV. Equipment upset at voltages below 4 kV, but not at 10 kV, is attributed to these superfast rise-times which readily induce unwanted voltages into sensitive circuits.

To protect from this destructive phenomenon, a low clamping suppressor device with fast turn-on time, such as a silicon transient voltage suppressor (TVS) is often used. These devices have a proven history of protecting from ESD in communication systems, computer data ports, keyboards, laser printers, instrumentation, medical monitoring apparatus and other applications. For ESD, a relatively small device such as one of Microsemi's 1.4KESD axial lead series or the SM1.4KESD and MLL1.4KESD surface mount series devices are adequate. However if induced lightning is also a threat, a larger device rated at 600 W or even 1500 W may be required to withstand the more severe lightning surges.

For high data rate lines, the small devices referenced above normally have sufficiently low capacitance for acceptable attenuation up to 10 MB.

For higher data rates, Microsemi also offers very low capacitance TVS options in its new USB0805C and SM8LC Series in SO-8 packages.

The 600 W and 1.5 kW higher power devices have proportionally higher capacitance that will significantly attenuate at high baud rates. To minimize capacitance for these high threat applications, low

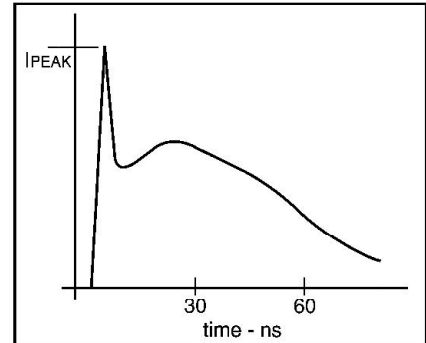


Figure 1. IEC 801-2 ESD Current Waveform

capacitance steering diodes such as 1N4001 rectifiers are sometimes employed. Two per line are used to direct transients to either the + side of the power supply line or to the ground plane as illustrated in Figure 2. A silicon TVS directs the surge to ground, keeping it out of the power system.

For greater efficiency and fewer components, Microsemi offers TVSs with low capacitance rectifiers integrated into one package for 500 Watt (SAC Series) and 1500 Watt (LC Series).

For effective ESD protection, very low parasitic inductance in the TVS conductive path is necessary. Placement of the TVS should be at the location where the transient enters the circuit board to reduce radiation beyond this point from reaching sensitive components.