

Understanding Steering Diode Arrays

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Steering diode arrays are low capacitance devices that provide high-speed data line and I/O port protection from transients caused by Electrostatic Discharge (ESD), Electrical Fast Transients (EFT) and other induced voltages. These devices divert the transient to the power-bus or ground and away from sensitive IC components. Typical Leakage Current for a steering diode array is 0.1 μ A, Capacitance 1-5pF and Forward Peak Pulse Current 12-40A. Figure 1 shows a typical steering diode array manufactured by ProTek Devices.

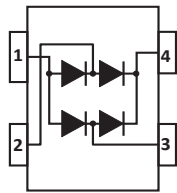


Figure 1. USB004 - Steering Diode Array

A common means of protecting high-speed data lines is to employ steering diodes in a rail-to-rail configuration. Two devices per line are connected between two fixed voltage references such as VCC and ground. When the transient voltage on the line exceeds the forward voltage (V_f) drop of the diode plus the reference voltage, the steering diodes direct the surge to the supply rail or ground as shown in Figure 2.

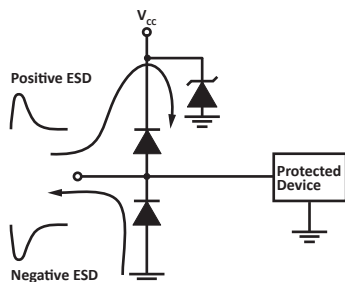


Figure 2. Integrated Steering Diode/TVS Transient Protection

The advantages of this configuration include low loading capacitance, fast response times and inherent bidirectionality (within the reference voltages). The disadvantages of this configuration include possible damage to the downstream components, which results when redirecting the surge onto the power supply rail. To overcome this disadvantage a TVS diode is added to the power supply rail.

When using steering diode arrays for protection, board layout must be considered. Parasitic inductance between the TVS and the protection diode can cause a dramatic rise in the clamping voltage. Integrated TVS-Steering Diodes are designed to eliminate any disadvantages inherent in this configuration, while enhancing the positive aspects. These types of devices combine surge-rated low capacitance steering diodes with a TVS diode in the same package. Figure 3 shows a steering diode/TVS array device.

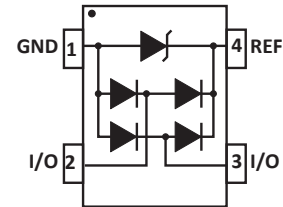


Figure 3. PLR0502 - Steering Diode/TVS Array

Steering diodes have been tested to conditions of up to 25kV of contact ESD. In addition, integrated steering diode/TVS arrays meet the IEC 61000-4-2 (ESD, Air -15kV & 8kV Air), 61000-4-4 (40A, 5/50ns) and 61000-4-5 (Surge - levels vary depending upon device) standards

Applications that benefit from both shunt and rail-to-rail protection are T1/E1 interfaces, as shown in Figure 4. On the line side of the transformer, a low capacitance TVS diode array is utilized as the primary lightning and ESD protector. This device should be rated to handle the lightning surge as specified by the design standard and should begin to clamp the transient at approximately 6V for maximum protection.

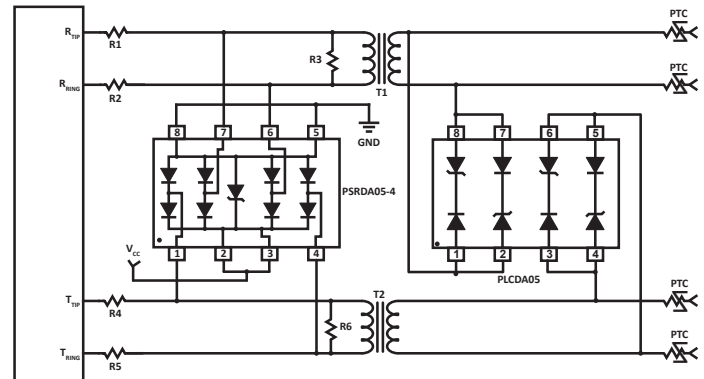


Figure 4. Typical T1/E1 interface circuit benefiting from both shunt and rail-to-rail configurations.

On the IC side of the transformer, a rail-to-rail device is used to prevent CMOS latch-up by clamping the line voltage to the level of the supply rail. The integrated TVS/Steering Diode array keeps the potential between the supply voltage and the ground to within the breakdown voltage of the device (plus one drop).

COMPANY INFORMATION

COMPANY PROFILE

ProTek Devices, based in Tempe, Arizona USA, is a manufacturer of Transient Voltage Suppression (TVS) products designed specifically for the protection of electronic systems from the effects of lightning, Electrostatic Discharge (ESD), Nuclear Electromagnetic Pulse (NEMP), inductive switching and EMI/RFI. With over 25 years of engineering and manufacturing experience, ProTek designs TVS devices that provide application specific protection solutions for all electronic equipment/systems.

ProTek Devices Analog Products Division, also manufactures analog interface, control, RF and power management products.

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