



NXP ESD protection device IP4294CZ10

ESD protection for USB 3.0 (SuperSpeed USB) and eSATA data lines

Designed to protect even the most sensitive high-speed differential interfaces, this device delivers a unique combination of strong system-level ESD protection with an extremely low «line-to-ground» capacitance, minimal crosstalk, and excellent capacitance matching.

Key features

- ▶ Industry's best overall protection for USB 3.0 system chips
- ▶ Extremely low channel capacitance: 0.5 pF (typ)
- ▶ Extremely low differential crosstalk: less than -60 dB @ 2.5 GHz
- ▶ Very low dynamic resistance (less than 0.4 Ω) for both polarities
- ▶ RF-optimized DFN2510A-10 (SOT1176) package

Key applications

- ▶ USB 3.0 (SuperSpeed), eSATA, SATA, HDMI, DisplayPort, or other high-speed datalines in:
 - ▶ Notebook PCs, motherboards, graphic cards
 - ▶ TVs, monitors
 - ▶ Hard-disk drives, digital still- and video cameras (DSC, DVC)

The ICs for high-speed interfaces like USB 3.0 are particularly susceptible to ESD strikes since they're popular in portable applications that are exposed to a wide variety of ambient conditions. Also, since the interfaces operate at high speeds, they react quickly to ESD pulses. As a result, they need ESD protection with extremely low clamping, which can at the same time support their demanding requirements for signal integrity.

USB 3.0 and eSATA require close line-to-line capacitance matching to minimize intra-pair skew. Since they transmit and receive simultaneously, these interfaces also require very low differential crosstalk. The NXP IP4294CZ10 delivers a line-to-line capacitance matching of better than 0.05 pF while offering an extremely low differential crosstalk of less than 60 dB @ 2.5 GHz.

To guard against exposure to ESD pulses during assembly, the system chips for very fast data lines typically include integrated ESD protection, commonly with fast snapback. TLP measurements and several system-level board tests show that the IP4294 is the only device in the ultra-low-capacitance segment that can provide these ultra-fast system chips with the ESD protection against positive and negative pulses they need.



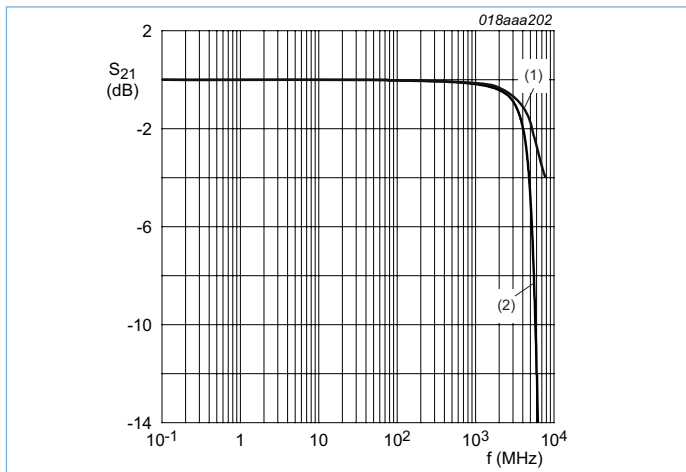
The IP4294 delivers ESD protection optimized for one USB 3.0 port or an eSATA port with up to four lines. It exceeds IEC61000-4-2 standard level 4 by providing 10 kV of contact ESD protection.

The IP4294 minimizes the addition of signal skew on sensitive receivers when an adjacent transmitter channel is active.

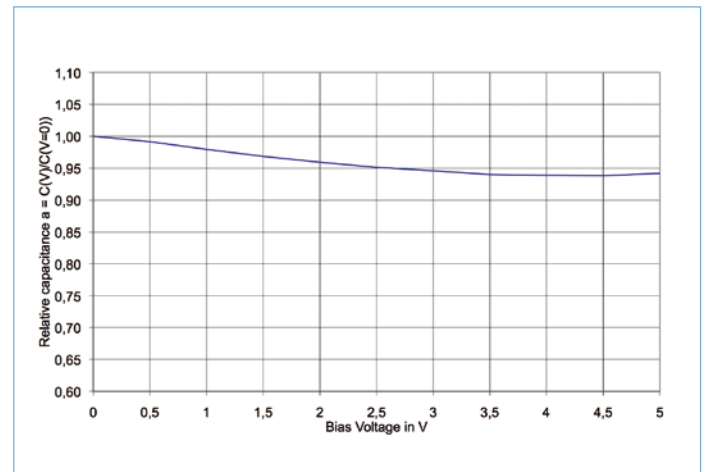
The IP4294 is housed in a leadless DFN2510A-10 (SOT1176) package, optimized for RF signals, that measures 1.0 x 2.5 x 0.5 mm. To optimize signal integrity and simplify board layout, the package is designed for pass-through routing. It is also Pb-free and RoHS-compliant.



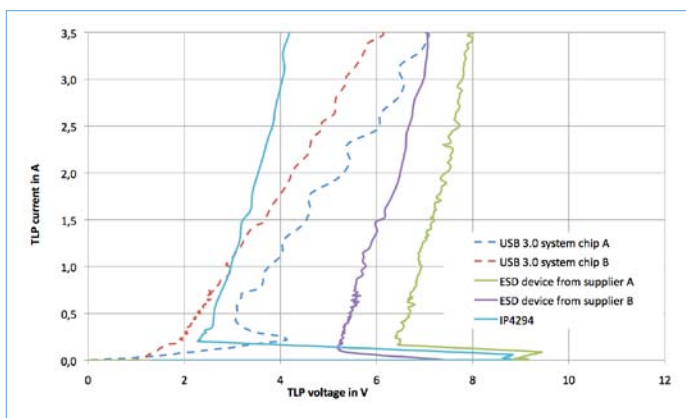
A very wide differential mode pass band ensures, that even higher harmonics see no attenuation



To avoid signal distortion, the IP4294 capacitance is nearly independent from the bias voltage



Comparative transmission line pulse (TLP) measurements



If the ESD device has a higher TLP voltage for a given TLP current, the USB 3.0 system chip will see the majority of the ESD pulse's energy. The results shown in this diagram have been confirmed with tests that brought complete boards to destruction. When protected by the IP4294, the USB 3.0 system chip survived 10 kV IEC61000-4-2 pulses, but when protected by the ESD device from supplier B, the USB 3.0 system chip failed already at 4 kV.