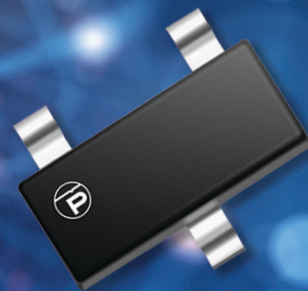
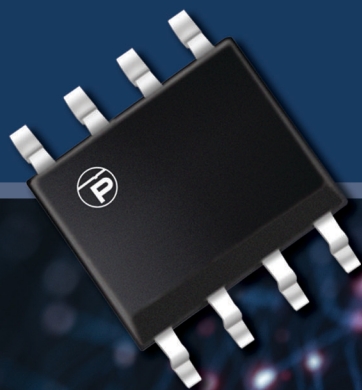


HDMI Interface Layout Suggestions Using TVS Devices

By Ivan G. Lawson



This brief is to assist the design engineer in the placement of Protek Devices various parts for the protection of HDMI applications against the effects of Electrostatic Discharge (ESD) and secondary lightning. The placements are for illustration purposes only, as the PCB engineer may have tighter geometries that are not shown in the below drawings.

The High-Definition Multimedia Interface (HDMI) combines a high-speed unidirectional TMDS data link with low speed, bidirectional control and status links (DDC and CEC) and configuration protocols in a single user-friendly high performance connector.

The high-performance digital imaging silicon ASICs required for these applications usually include some protection sufficient for a controlled manufacturing environment. But the fabrication geometry has been optimized for performance, not ruggedness, and is no match for the uncontrolled ESD environment of the end-user. Therefore, even the most basic HDMI port implementation for these applications necessarily entails multiple external interface and protection circuits. Any I/O signal exposed to the outside world ESD strikes are in constant danger during interconnection. A single spark can render an entire entertainment system useless.

Each TMDS line is protected from ESD with a low-capacitance steering diode pair that routes negative ESD pulses directly into ground and positive pulses back to ground through a TVS diode. Each of the signal lines exposed to the HDMI connector are protected in this manner as shown in Figure 1.

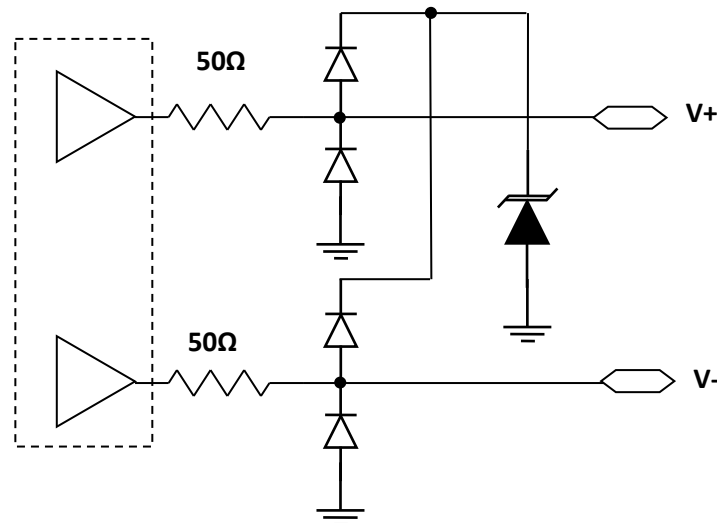


Figure 1 - TMDS Pair Protected by Using the PLR0524P

In order to meet both the signal integrity and the ESD immunity requirements, the chosen protection device should have as small of a capacitance value as possible, preferably less than 0.6pF. This is because the lower the protection device's capacitance, the less the device will affect the differential line impedance when it is added to the HDMI layout. To further facilitate the high-speed design, the protection device should also offer flow-

through, symmetrical layout capability. Symmetrical and uninterrupted signal layout will help maintain the signal integrity by streamlining high-speed signal line design and maintain impedance requirements.

In addition to the electrical characteristics requirement, to ensure maximum reliability for the HDMI ASIC, the same protection device should provide repeatable ESD immunity to and beyond level 4, IEC 61000-4-2 to each of the exposed signal pins. In other words, when testing the I/O or power pin of the HDMI connector, each pin should have a minimum of $\pm 8\text{kV}$ contact ESD and $\pm 15\text{kV}$ air ESD handling capability when surged directly with ESD. The PLR0524P is just such a device.

HDMI Applications Layout

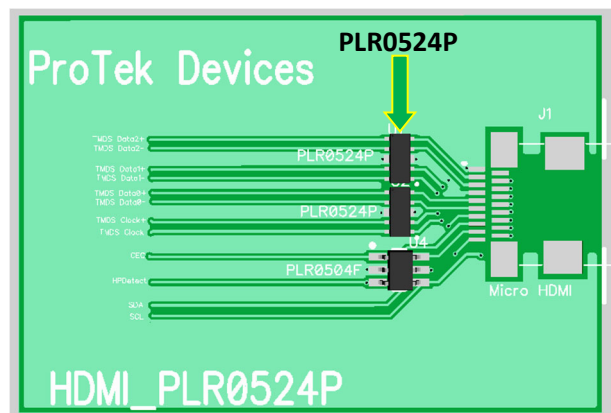


Figure 2 – TDMS Data Line and Clock Protection Using the PLR0524P

As shown in Figure 2, PLR0524P is used to protect the TMDS Data lines and the Clocks. The HP Detect, SDA, SCL and CEC are protected by the PLR0504P. The PLR0504F is used as the reference pin is connected to the V_{CCBUS} to protect from any surges and ESD threats that may be present when plugging in the HDMI connector.

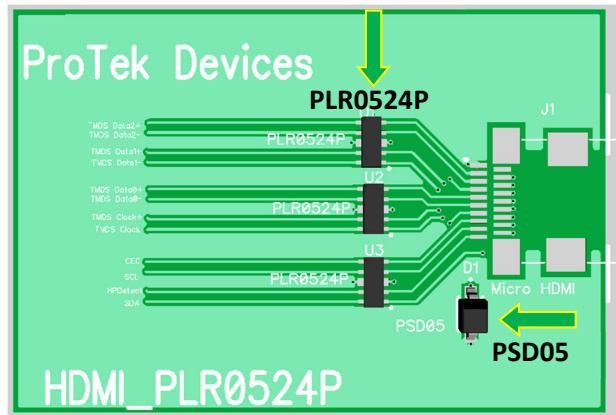


Figure 3 – Data Line & V_{CCBUS} Protection Using the PLR0524P and the PSD05

As shown in Figure 3, three of the PLR0524P are used to protect all the data lines and a PSD05 is added to protect the V_{CCBUS} . The PSD05 is a good choice as there are large inductive surges when plugging in the connector. This device has a good clamping ability with a 500 Watt surge suppression using the IEC 61000-4-5 secondary lightning specification of the 8/20 μ s surge waveform.

COMPANY PROFILE

In business more than 30 years, ProTek Devices™ is a privately held semiconductor company. The company offers a product line of overvoltage protection components. These include Transient Voltage Suppressor arrays (TVS arrays), Steering Diode/Hybrid arrays, Thyristor Surge Suppressors, EMI Filters, High-Powered Components and Modules as well as Chipscale TVS arrays. These devices deliver circuit protection in electronic systems from numerous overvoltage events. They include lightning; electrostatic discharge (ESD); nuclear electromagnetic pulses (NEMP); inductive switching; and electromagnetic interference (EMI) / radio frequency interference (RFI). ProTek Devices is an ISO 9001 certified company.

CONTACT US

Corporate Headquarters

2929 South Fair Lane
Tempe, Arizona 85282
USA

By Telephone

General: 602-431-8101
Sales: & Marketing: 602-414-5109
Customer Service: 602-414-5114
Product Technical Support: 602-414-5107

By Fax

General: 602-431-2288

By E-mail:

Asia Sales: asiasales@protekdevices.com
Europe Sales: europesales@protekdevices.com
U.S. Sales: ussales@protekdevices.com
Distributor Sales: distysales@protekdevices.com
Customer Service: service@protekdevices.com
Technical Support: support@protekdevices.com

ProTek Devices (Asia Pacific) Pte. Ltd.

8 Ubi Road 2, #06-19
Zervex
Singapore - 408538
Tel: +65-67488312
Fax: +65-67488313

Web

www.protekdevices.com

COPYRIGHT © ProTek Devices 2022 - This literature is subject to all applicable copyright laws and is not for resale in any manner.

SPECIFICATIONS: ProTek reserves the right to change the electrical and or mechanical characteristics described herein without notice.

DESIGN CHANGES: ProTek reserves the right to discontinue product lines without notice and that the final judgement concerning selection and specifications is the buyer's and that in furnishing engineering and technical assistance. ProTek assumes no responsibility with respect to the selection or specifications of such products. ProTek makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ProTek assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability without limitation special, consequential or incidental damages.

LIFE SUPPORT POLICY: ProTek Devices products are not authorized for use in life support systems without written consent from the factory.