APPNOTE NUMBER – AN1139
PI3WVR13412 DP1.4/HDMI2.0 Mux/Demux Application Guidelines

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1. Introduction

PI3WVR13412 is video switch that supports wide input voltage range. It can be employed in DP1.3/4 or HDMI2.0 switch application. This application note explains how it can be used for HDMI2.0 mux applications.

2. Application Guidelines

The PI3WVR13412 is a passive switch, and therefore it can fit in both source and sink applications. The switch can be used as MUX and DEMUX.

2.1 HDMI 2 to 1 Application

Below is a source application diagram of PI3WVR13412 as a HDMI2.0 2-to-1 Mux

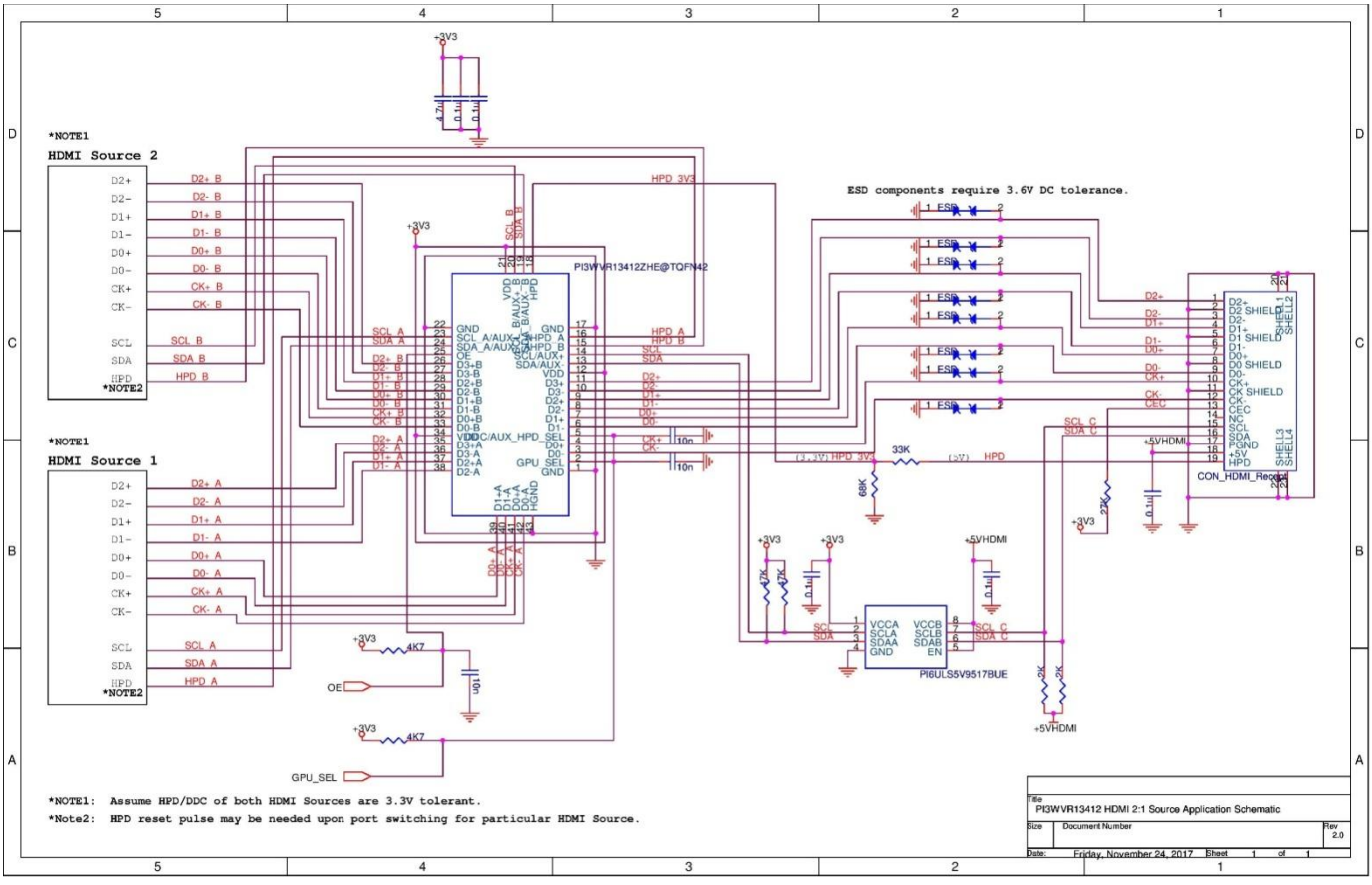

Figure 1: HDMI 2 to 1 Source Application Diagram

2.1.1 GPU_SEL and DDC/AUX_HPD_SEL Pin

In order to achieve better high-speed signal isolation, decoupling capacitors of 10n-100nF at GPU_SEL pin and DDC/AUX_HPD_SEL are recommended.

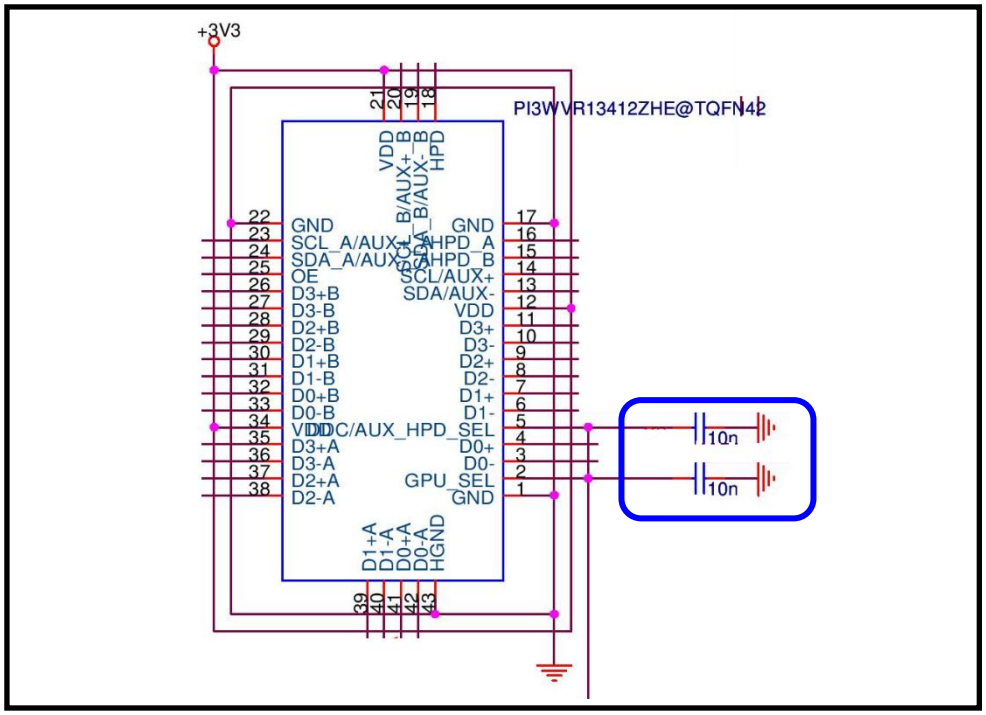

Figure 2: GPU_SEL and DDC/AUX_HPD_SEL Decoupling Design

2.1.2 OE Pin Design

A 10n-100nF capacitor is also recommended for OE pin. Since HPD from HDMI connector is 5V, if OE pin is controlled by HPD signal, voltage divider must be considered. 33kΩ and 68kΩ resistors are to form a voltage divider in the above application diagram.

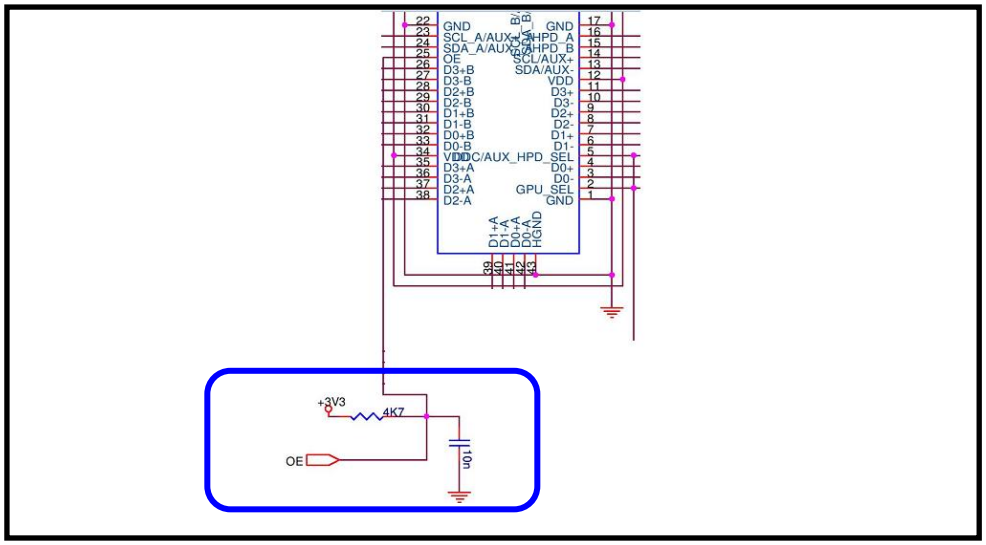

Figure 3: OE Controlled by GPIO

Similar to GPU_SEL pin, a decoupling capacitor of 10n-100nF at OE pin is recommended for better isolation.

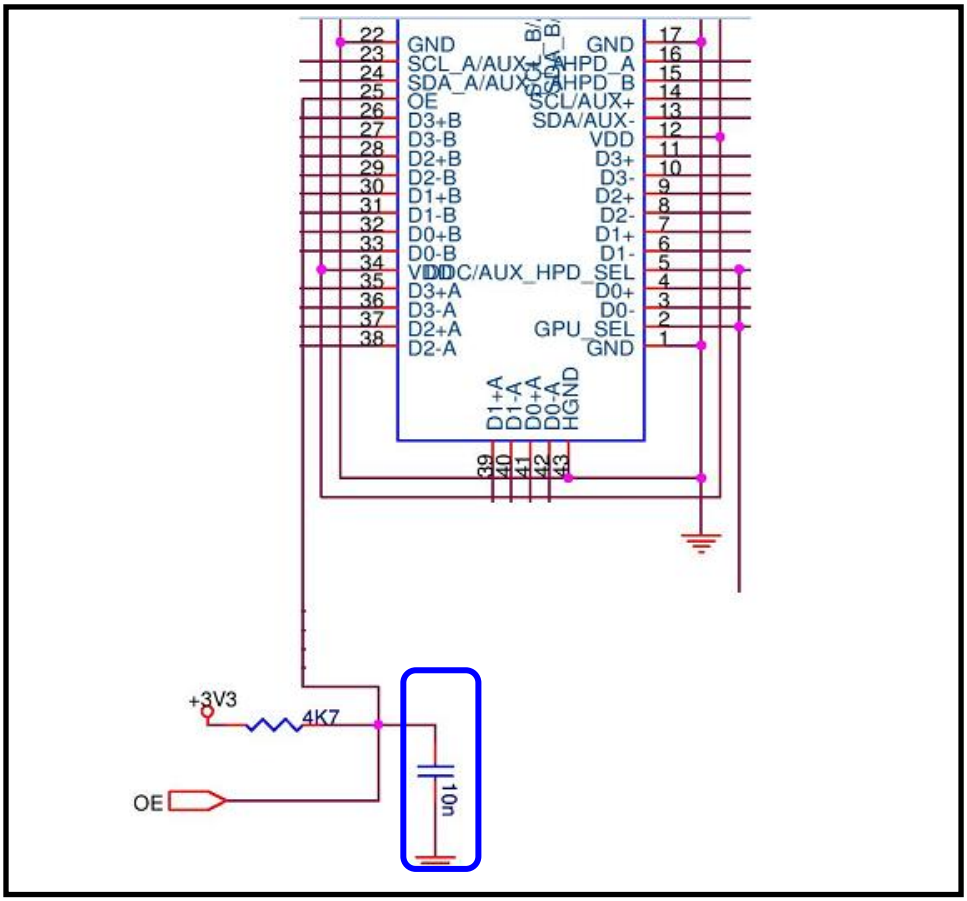

Figure 4: OE Decoupling Design

2.1.3 DDC Design

As DDC path of PI3WVR13412 is 4V tolerant, SCL and SDA signals from PI3WVR13412 cannot be connected to HDMI connector directly. DDC level shifters must be added in between.

2.1.4 TMDS Design

Per HDMI specification, TMDS path is DC coupled. HDMI input and HDMI output are connected to PI3WVR13412 directly. To provide high-speed path from ESD damage, ESD protectors are recommended. 2-pin ESD protector, i.e. DESD3V3Z1BCSF, is more preferable for better control of PCB impedance.

2.1.5 HPD Signal

In HDMI source application, as shown in figure 5, 100KΩ pull-down resistor is implemented at HPD in order to have a known state for HDMI source device when no sink device is attached to it. Since PI3WVR13412 HPD pin is 4V tolerant, voltage divider must be considered - 33kΩ and 68kΩ resistors are to form a voltage divider.

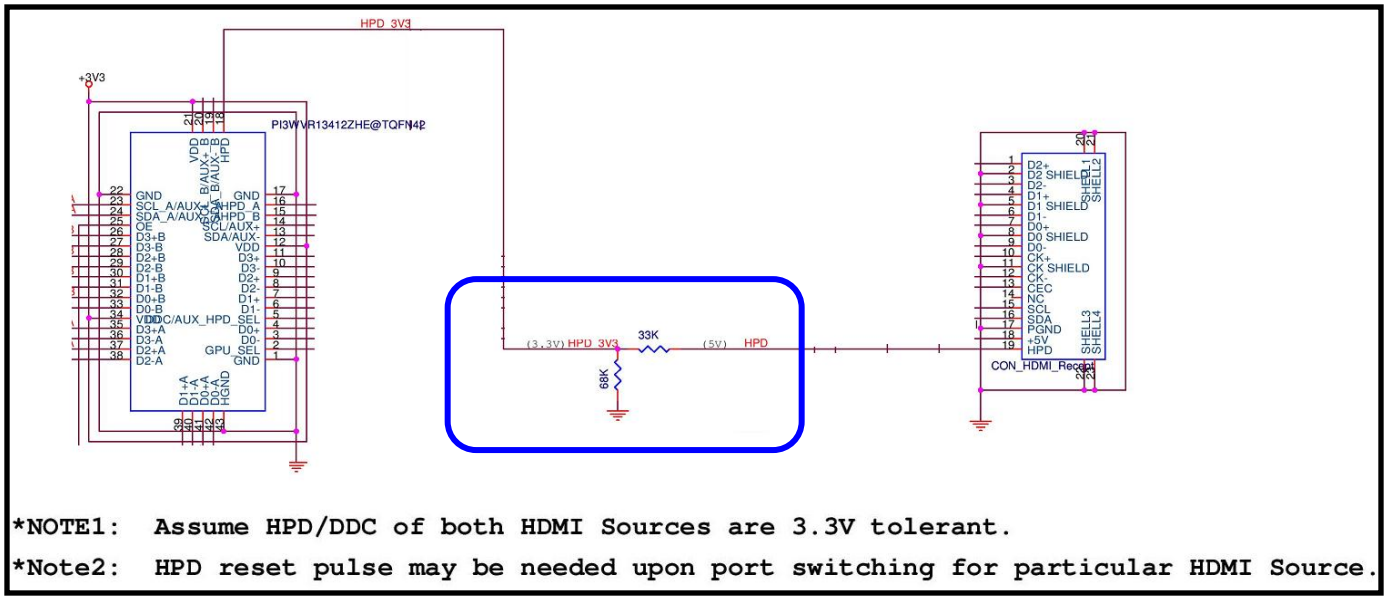

Figure 5: HPD Signal pull-down requirement in HDMI 2 to 1 Source Application

2.2 HDMI 1 to 2 Application

Below is a source application diagram of PI3WVR13412 HDMI 1 to 2 switch.

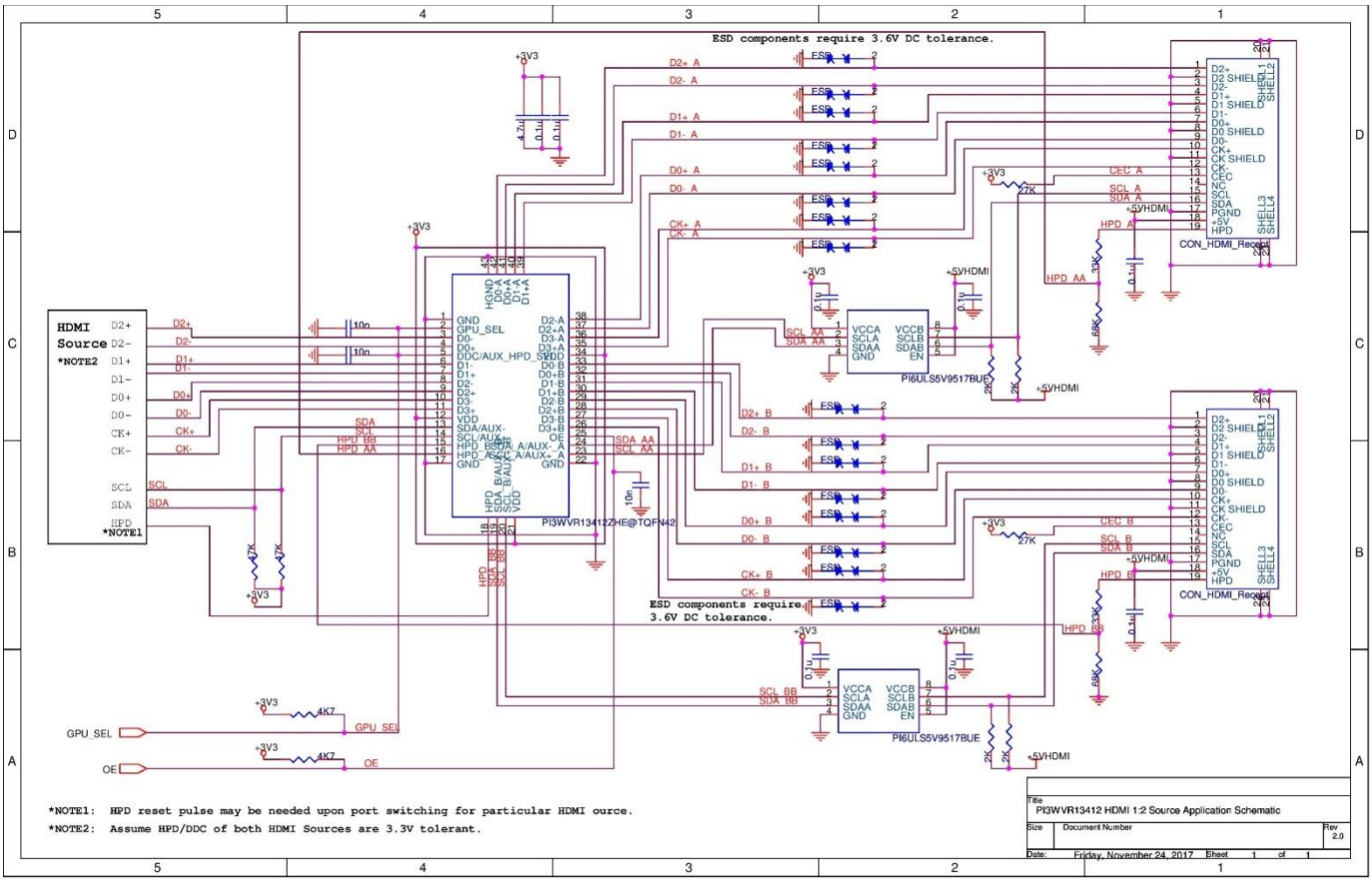

Figure 6: HDMI 1 to 2 Source Application Diagram

2.2.1 GPU_SEL Pin and DDC/AUX_HPD_SEL Design

As shown in figure 2, decoupling capacitors of 10n-100nF at GPU_SEL pin and DDC/AUX_HPD_SEL pin are recommended for better high-speed signal isolation.

2.2.2 OE Pin Design

OE pin of PI3WVR13412 is active HIGH. It should be pulled to VDD for output enabled. To save power, it can be controlled by GPIO.

Similar to GPU_SEL pin, a decoupling capacitor of 10n-100nF at OE pin is recommended for better isolation.

2.2.3 DDC Design

Please refer to Section 2.1.3

2.2.4 TMDS Design

Please refer to Section 2.1.4.

2.2.5 HPD Signal

In HDMI source application, as shown in figure 7, 100kΩ pull-down resistor is implemented at HPD in order to have a known state for HDMI source device when no sink device is attached to it. Since PI3WVR13412 HPD_A and HPD_B pins are 4V tolerant, voltage divider must be considered. 33kΩ and 68kΩ resistors are to form a voltage divider.

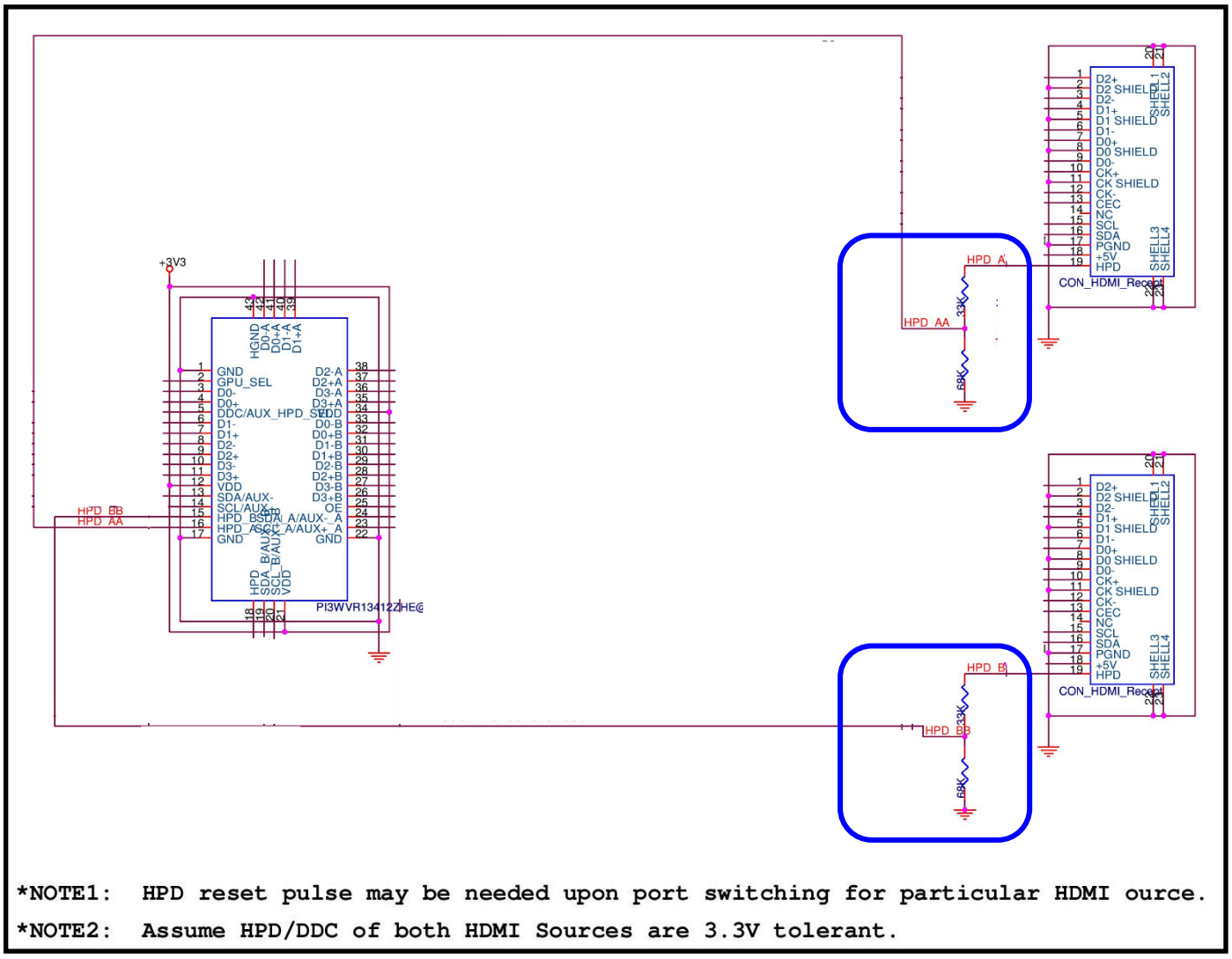

Figure 7: HPD Signal pull-down requirement in HDMI 1 to 2 Source Application

3. References

(1) VESA DisplayPort (DP) Standard Version 1.4, Video Electronics Standards Association, February 23, 2016
(2) High-Definition Multimedia Interface Specification Version 2.0b, HDMI Forum, March 3, 2016
(3) High-Definition Multimedia Interface Specification Version 2.0n Compliance Test Specification, HDMI Forum, January 4, 2016
(4) DESD3V3Z1BCSF datasheet, Diodes Incorporated, Document Number: DS39330 Rev.1-0, November 2016

Revision History

Revision	Date	Description
1.0	24 Nov., 2017	This Doc. 1. Initial release.