PCB Layout and Power Supply Design Recommendations for HDMI RX Products

Digital Video Group
Analog Devices
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Rev. A

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Revision History

Revision	Date	Details
Rev. 0	April 2011	Initial
Rev. A	April 2011	Power Supply Filtering and Decoupling section updated Power Supply Choice section updated Figure 2 updated Figure 3 updated

Introduction

Analog Device's HDMI receivers typically have a number of analog and digital supplies. Customers are recommended to follow the reference schematic and layout for each part in their hardware design. This document is provided in addition to outline the best power supply design and layout techniques to ensure the optimum performance of an Analog Devices HDMI receiver.

Power Supply Filtering and Decoupling

Analog Device's HDMI receiver parts typically have the following power supplies – AVDD, CVDD, DVDD, DVDDIO, PVDD and TVDD. The following recommendations are provided on how to handle each of the supplies to ensure optimum performance:

Power Supply	Analog/ Digital	Internal Circuit	Noise Sensitivity	Recommended Action
Analog power supply (AVDD)	Analog	HDMI receiver analog circuitry	Sensitive	- Isolate from other 1.8V supplies using a ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible - Place an large decoupling capacitor further away from the pins (e.g. 10uF), closer to the source of the current
Comparator & HDMI front end power supply (CVDD)	Analog	HDMI receiver analog circuitry	Sensitive	- Isolate from other 1.8V supplies with ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible

				- Place an large decoupling capacitor further away from the pins (e.g. 10uF), closer to the source of the current
Core power supply (DVDD)	Digital	HDMI receiver digital core	Normal	- Isolate from other 1.8V supplies with ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible
Input/Output power supply (DVDDIO)	Digital	Digital input/output	Normal	- Isolate from other 3.3V supplies with ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible
PLL Power Supply (PVDD)	Analog	HDMI receiver analog circuitry	Sensitive	- Isolate from other 1.8V supplies with ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible - Place an large decoupling capacitor further away from the pins (e.g. 10uF), closer to the source of the current
Termination power supply (TVDD)	Analog	HDMI terminations	Normal	- Isolate from other 3.3V supplies with ferrite - Decouple each pin with 10nF and 100nF capacitors as close to the pin as possible

Ferrite Choice

The ferrite utilised by Analog Devices has the insertion loss characteristic shown in Figure 1. This is a Murata part, NFE61PT472C1H9.

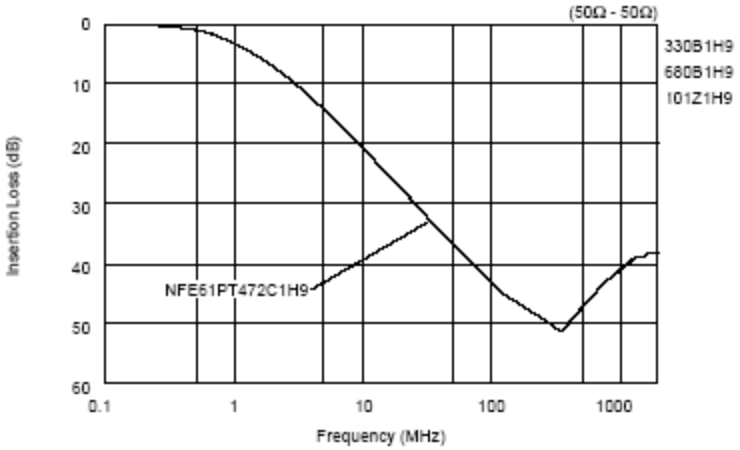


Figure 1. Recommended Ferrite Characteristic

Power Supply Choice

For best results, ADI recommends the use of linear low drop out (LDO) regulators for its video parts, especially the 1.8V supplies e.g. Analog Devices ADP170x linear regulator devices. This recommendation is based on the lower switching noise that LDO regulators generate compared to equivalent switch mode power supplies (SMPS). A reference power supply design for LDO regulators is provided in Figure 2.

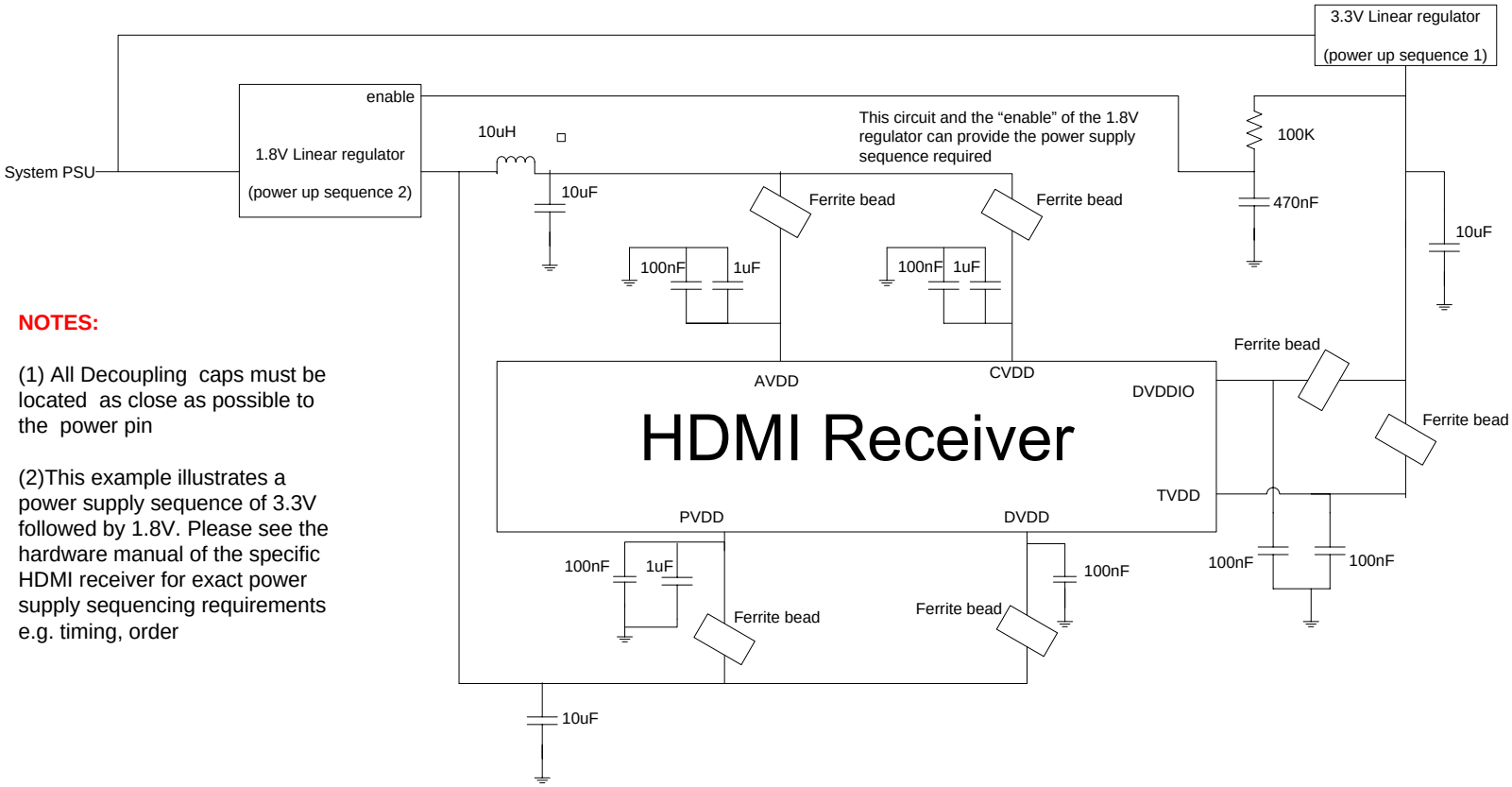
If a SMPS must be employed, the design of the power supply and power supply interface to the HDMI receiver (filtering, decoupling and layout) must be considered very carefully to minimise the possibility of transfer of noise to the video part.

Please reference the max current requirements of the selected HDMI receiver from its shortform datasheet to inform the current supply required.

Power Supply Layout

The following important considerations should be taken into account when designing the power supply layout for an Analog Devices HDMI receiver (e.g. Figure 3):

- Single ground plane is recommended
- Place power and ground planes as close to the top and bottom surfaces of the printed circuit board as the stack-up and target trace impedances will allow
- Separate power and ground planes with the thinnest dielectric that the stack-up and target trace impedances will allow
- Power supply planes
    - Crossing power supply planes with signal traces on one the layer above/beneath is to be avoided. Bypass capacitors should be employed when crossing planes can not be avoided
    - Consider possible voltage drops, especially on high current supplies, when routing internal planes
    - When it is not possible to use a plane on an internal layer to route a power supply, use the thickest trace possible
    - Fill any blank sections of a power plane layer with ground copper
    - The possibility of interference between two supply planes on adjacent layers (e.g. noisy supply over analog supply) should be considered
    - Ensure that current return paths are low impedance
- Decoupling capacitors
    - Should be placed as close to the pin to be decoupled as possible
    - The connection to the pin must be as short and wide as possible
    - The connection to ground must be as short and wide as possible
    - Use more than one via per pad if the available space allows but ensure that vias are spaced by at least the depth of the via



NOTES:

(1) All Decoupling caps must be located as close as possible to the power pin

(2)This example illustrates a power supply sequence of 3.3V followed by 1.8V. Please see the hardware manual of the specific HDMI receiver for exact power supply sequencing requirements e.g. timing, order

Figure 2. Example Power Supply Architecture with LDO Regulators

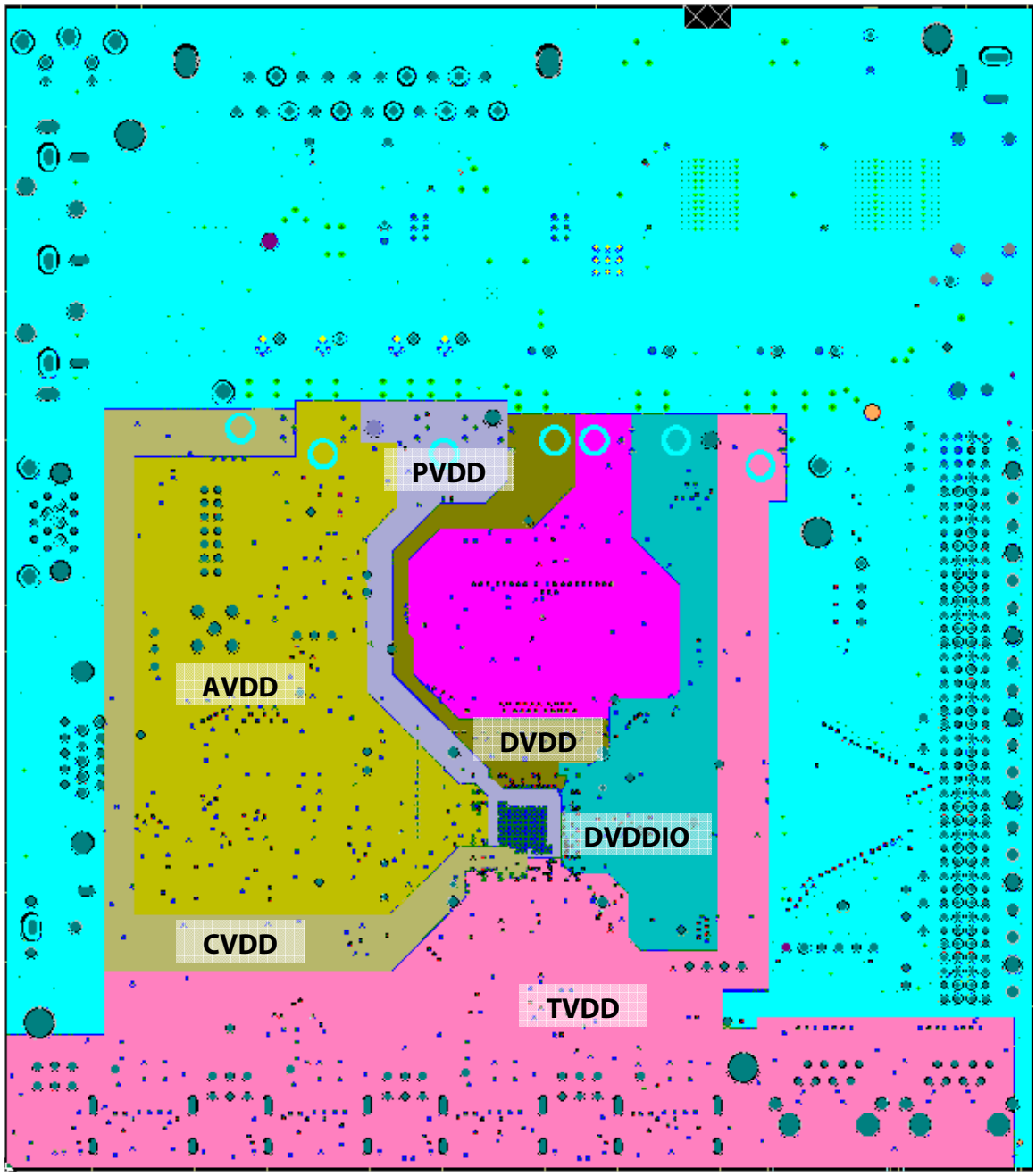


Figure 3. Reference Power Supply Layout (e.g. ADV7844)