



# **HDMI VIP Input Bridge Board**

## **Evaluation Board User Guide**

FPGA-EB-02008 Version 1.0

July 2017

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## Acronyms in This Document

A list of acronyms used in this document.

| Acronym          | Definition                                  |
|------------------|---------------------------------------------|
| DVI              | Digital Visual Interface                    |
| GPIO             | General Purpose Input/Output                |
| HDCP             | High-Definition Content Protection          |
| HDMI             | High Definition Multimedia Interface        |
| I <sup>2</sup> C | Inter-Integrated Circuit                    |
| LDO              | Low Dropout                                 |
| TMDS             | Transition-Minimized Differential Signaling |
| VIP              | Video Interface Platform                    |

# 1. Introduction

This document describes the Lattice Semiconductor HDMI<sup>®</sup> VIP Input Bridge Board. This board is designed to work with the Lattice Video Interface Platform board interconnect system. The key component of this board is the Lattice Semiconductor Si1127A HDMI Deep Color Receiver.

The contents of this user guide include descriptions of board components, schematics, and bill of materials.

## 1.1. Features

Key features of the HDMI VIP input bridge board include:

- Si1127A HDMI Deep Color Receiver
  - Supports Deep Color video resolution up to 12-bit, 1080p at 60 Hz
  - Video Input:
    - Two HDMI/DVI-compatible ports
    - The TMDS<sup>™</sup> core runs at 25 MHz – 225 MHz
    - Dynamic cable equalization automatically detects the equalization required for the incoming signal
  - Video Output:
    - xVCC to extended RGB
    - 36-bit RGB/YCbCr 4:4:4
    - 16/20/24-bit YCbCr 4:2:2
    - 8/10/12-bit YCbCr 4:2:2 (ITU BT.656)
  - No HDCP support
- Two Single-Link 19-pin HDMI Type-A connectors
- Two 60 pin Rugged High-Speed Headers

Figure 1.1 shows the top view of the HDMI VIP input bridge board and its key components. Figure 1.2 on page 5 shows the bottom view of the board.

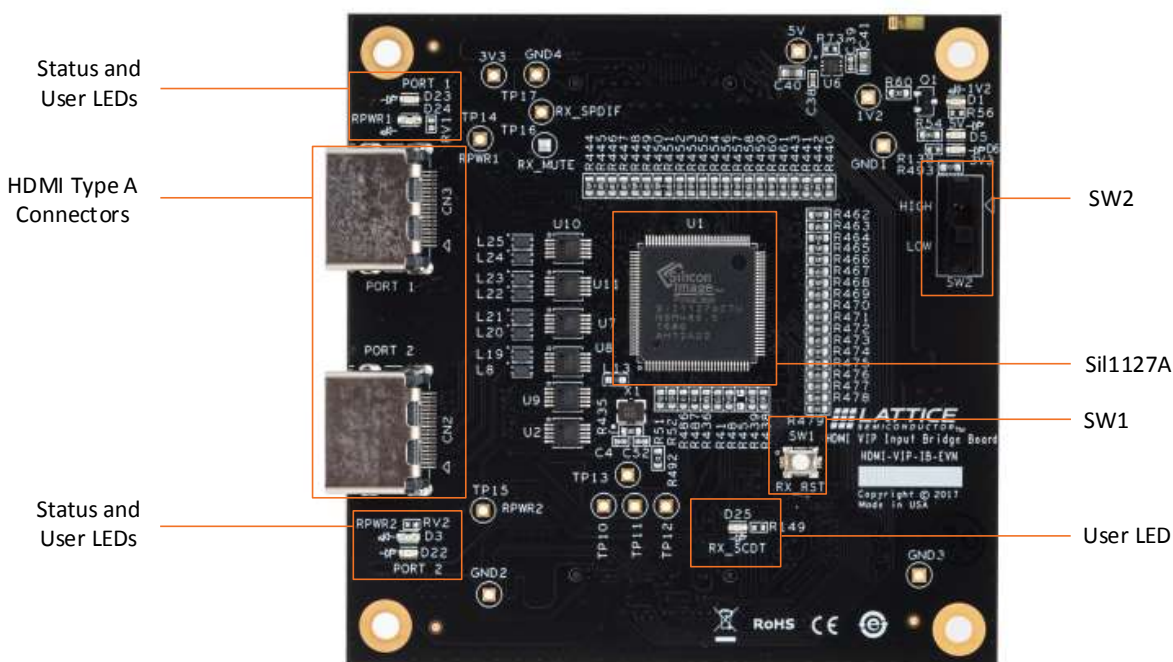


Figure 1.1. Top Side of HDMI VIP Input Bridge Board

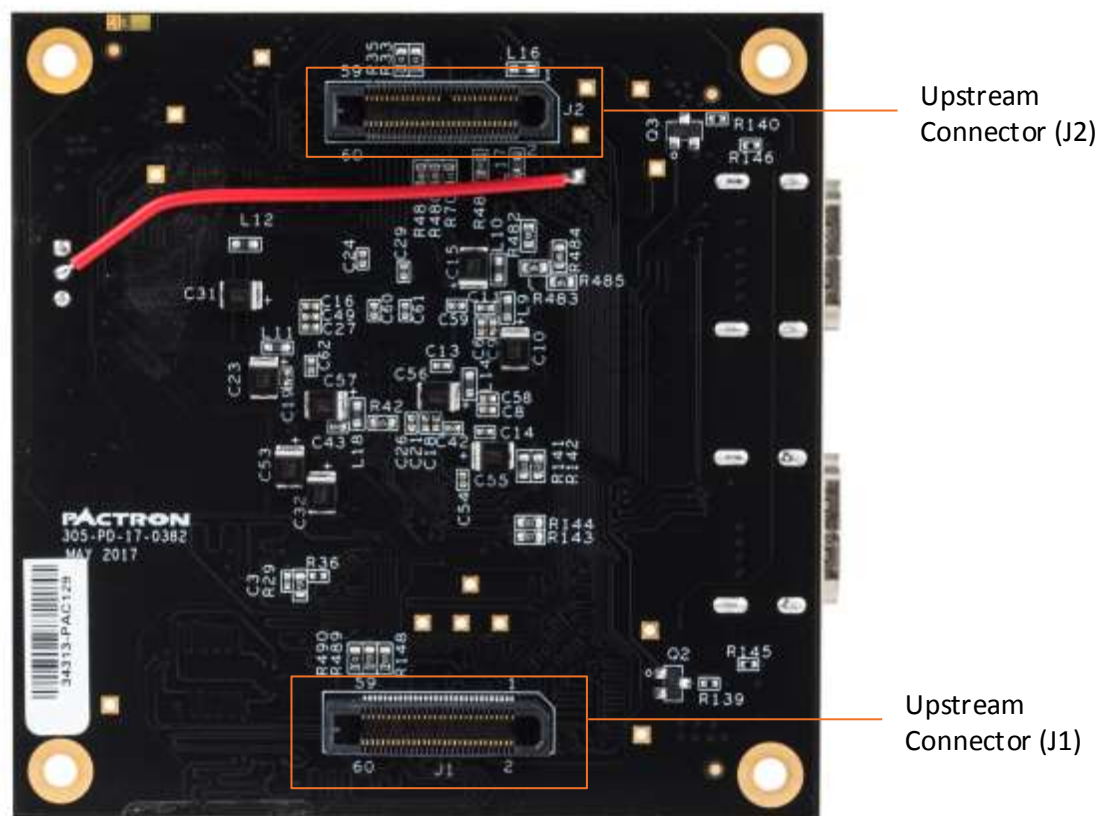


Figure 1.2. Bottom Side of HDMI VIP Input Bridge Board

## 1.2. Further Information

For more information on boards and kits available for the VIP system, visit <http://www.latticesemi.com/boards>.

For details about the SiI1127A device, refer to [SiI9127A/SiI1127A HDMI Receiver with Deep Color Output Data Sheet \(SiI-DS-1059\)](#).

Refer to [Appendix A](#) and [Appendix B](#) for the schematics and BOM of the HDMI VIP Input Bridge board.

## 2. Functional Description

The Si1127A device receives up to 1080p @ 60 Hz HDMI-compliant digital audio and video from either HDMI Type A Connector Port 1 or Port 2 and transmits RGB or YCbCr parallel video and I<sup>2</sup>S or SPDIF audio to connectors J1 and J2. The Si1127A device does not support HDCP decryption, therefore can only receive unencrypted video.

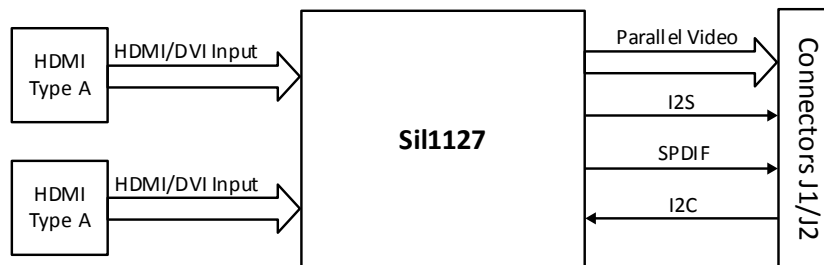


Figure 2.1 Functional Block Diagram

The Si1127A device is configured using the I<sup>2</sup>C interface from connector J2. The I<sup>2</sup>C registers monitor and control all functions of the Si1127A device, including selection of input. The Device Address Select Pin CI2CA on the Si1127A device is pulled low. Refer to [Table 2.1](#) for the corresponding I<sup>2</sup>C Address. For configuration, refer to the Si19223/9233/9127 HDMI Receivers Programmer's Reference (Si1-PR-1019) for detailed information. *The Programmer's Reference requires an NDA with Lattice Semiconductor.*

Table 2.1 Si1127A 7-bit I<sup>2</sup>C Address

| Block          | CI2CA = 0 |
|----------------|-----------|
| Device Address | 0x30      |

### 2.1. Switches

There is one push button switch, SW1, which controls the reset signal RX\_RST. When pressing the push-button, logic 0 will be sent to the Si1127A RESET# pin. RX\_RST is connected to GSRN on connector J1, allowing SW1 to control the reset signal for other connected boards.

There is one slide switch, SW2, which is connected to GPIO3/MUTEOUT of the Si1127A device and Pin 28 of connector J2. When this connection is being driven by either Si1127A device or connector J2, SW2 should be placed in the HIGH position (4.7K  $\Omega$  pull-up resistor to 3.3 V) to prevent any contention.

### 2.2. HDMI Interface

There are two HDMI Type A connectors for connecting the HDMI VIP Input Board to an HDMI Source. ESD protection is provided on the TMDS signals.

### 3. High-Speed Headers

There are two 60 pin high speed headers, connectors J1 and J2, used to connect to a host board.

**Table 3.1 Connector J1**

| J1 Connector Pin | Signal Name | Sil1127A Pin |
|------------------|-------------|--------------|
| 1                | 3.3 V       | —            |
| 2                | 3.3 V       | —            |
| 3                | 3.3 V       | —            |
| 4                | 3.3 V       | —            |
| 5                | UP_GPIO31   | Q30          |
| 6                | UP_GPIO5    | Q4           |
| 7                | UP_GPIO32   | Q31          |
| 8                | UP_GPIO6    | Q5           |
| 9                | UP_GPIO33   | Q32          |
| 10               | UP_GPIO7    | Q6           |
| 11               | UP_GPIO34   | Q33          |
| 12               | UP_GPIO8    | Q7           |
| 13               | UP_GPIO1    | Q0           |
| 14               | UP_GPIO9    | Q8           |
| 15               | UP_GPIO2    | Q1           |
| 16               | UP_GPIO10   | Q9           |
| 17               | GND         | —            |
| 18               | GND         | —            |
| 19               | GND         | —            |
| 20               | GND         | —            |
| 21               | UP_GPIO13   | Q12          |
| 22               | GND         | —            |
| 23               | UP_GPIO11   | Q10          |
| 24               | UP_GPIO14   | Q13          |
| 25               | UP_GPIO35   | Q34          |
| 26               | UP_GPIO12   | Q11          |
| 27               | UP_GPIO36   | Q35          |
| 28               | UP_GPIO17   | Q16          |
| 29               | UP_GPIO25   | Q24          |
| 30               | UP_GPIO18   | Q17          |

| J1 Connector Pin | Signal Name | Sil1127A Pin |
|------------------|-------------|--------------|
| 31               | UP_GPIO26   | Q25          |
| 32               | UP_GPIO19   | Q18          |
| 33               | GND         | —            |
| 34               | UP_GPIO20   | Q19          |
| 35               | GND         | —            |
| 36               | GND         | —            |
| 37               | UP_GPIO27   | Q26          |
| 38               | GND         | —            |
| 39               | UP_GPIO28   | Q27          |
| 40               | GND         | —            |
| 41               | RX_SDO      | SDO          |
| 42               | UP_GPIO21   | —            |
| 43               | RX_WS       | WS           |
| 44               | UP_GPIO22   | Q21          |
| 45               | RX_SCK      | SCK          |
| 46               | UP_GPIO23   | Q22          |
| 47               | RX_MCLK     | MCLK         |
| 48               | UP_GPIO24   | Q23          |
| 49               | CEC_D       | CEC_D        |
| 50               | UP_GPIO29   | Q28          |
| 51               | RX_SCDT     | GPIO1/SCDT   |
| 52               | UP_GPIO30   | Q29          |
| 53               | GND         | —            |
| 54               | GND         | —            |
| 55               | GND         | —            |
| 56               | GND         | —            |
| 57               | 2.5 V       | —            |
| 58               | 2.5 V       | —            |
| 59               | 2.5 V       | —            |
| 60               | 2.5 V       | —            |

**Table 3.2 Connector J2**

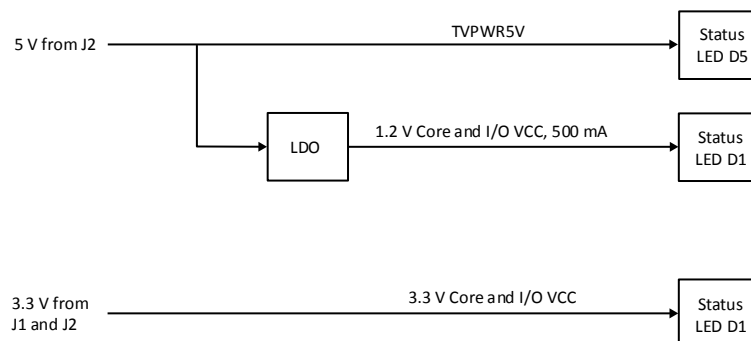
| J2 Connector Pin | Signal Name | Sil1127A pin   |
|------------------|-------------|----------------|
| 1                | 3.3 V       | —              |
| 2                | 5 V         | —              |
| 3                | 3.3 V       | —              |
| 4                | 5 V         | —              |
| 5                | GND         | —              |
| 6                | 5V          | —              |
| 7                | RODCK       | ODCK           |
| 8                | GND         | —              |
| 9                | GPIO0       | GPIO0/XCLKOUT2 |
| 10               | RVSYN       | VSYN           |
| 11               | GND         | —              |
| 12               | UP_GPIO15   | Q14            |
| 13               | RHSYN       | HSYN           |
| 14               | GND         | —              |
| 15               | UP_GPIO16   | Q15            |
| 16               | RX_INT      | INT            |
| 17               | GND         | —              |
| 18               | UP_GPIO4    | Q3             |
| 19               | RDE         | DE             |
| 20               | GND         | —              |
| 21               | UP_GPIO3    | Q2             |
| 22               | 2.5 V       | —              |

**\*Note:** Connected to SW2

| J2 Connector Pin                                                                                  | Signal Name   | Sil1127A pin   |
|---------------------------------------------------------------------------------------------------|---------------|----------------|
| 23                                                                                                | GND           | —              |
| 24                                                                                                | 2.5 V         | —              |
| 26                                                                                                | GND           | —              |
| 28                                                                                                | RX_RST        | RESET#         |
| 30                                                                                                | RX_MUTE       | GPIO3/MUTEOUT* |
| 32                                                                                                | RX_SPDIF      | SPDIF          |
| 34                                                                                                | GND           | —              |
| 40                                                                                                | GND           | —              |
| 41                                                                                                | CSCL          | CSCL           |
| 43                                                                                                | CSDA          | CSDA           |
| 46                                                                                                | GND           | —              |
| 52                                                                                                | GND           | —              |
| 55                                                                                                | GND           | —              |
| 57                                                                                                | GND           | —              |
| 58                                                                                                | GND           | —              |
| 59                                                                                                | GND           | —              |
| 25, 27, 29,31, 33,<br>35, 36, 37, 38, 39,<br>42, 44, 45, 47, 48,<br>49, 50, 51, 53, 54,<br>56, 60 | Not Connected | —              |

## 4. Power Supply

Board power is supplied through connectors J1 and J2.



**Figure 4.1. Power Supply**

## 5. Status Indicators and Test Points

Three discrete LEDs are available to the user. These are driven by the Sil1127A.

**Table 5.1 User LEDs**

| Signal | LED # | Sil1127A Pin    | Color |
|--------|-------|-----------------|-------|
| PORT_1 | D23   | 14 (GPIO4)      | Green |
| PORT_2 | D22   | 15 (GPIO5)      | Green |
| SCDT   | D25   | 12 (GPIO1/SDCT) | Green |

Two discrete LEDs are used as status indicators. These are driven by the HDMI Ports.

**Table 5.2 Status LEDs**

| Signal | LED # | Source            | Color |
|--------|-------|-------------------|-------|
| RPWR1  | D24   | Port 1 - HDMI 5 V | Blue  |
| RPWR2  | D3    | Port 2 - HDMI 5 V | Blue  |

**Table 5.3 Test Points**

| Test Point | Connection           |
|------------|----------------------|
| TP10       | Sil1127A Pin16/GPIO6 |
| TP11       | Sil1127A Pin17/GPIO7 |
| TP14       | RPWR1                |
| TP15       | RPWR2                |
| TP16       | RX_MUTE              |
| TP17       | RX_SPDIF             |

## 6. Ordering Information

Visit [www.latticesemi.com/boards](http://www.latticesemi.com/boards) for the latest ordering information.

**Table 6.1 Reference Part Number**

| Description                 | Ordering Part Number |
|-----------------------------|----------------------|
| HDMI VIP Input Bridge Board | HDMI-VIP-IB-EVN      |

## References

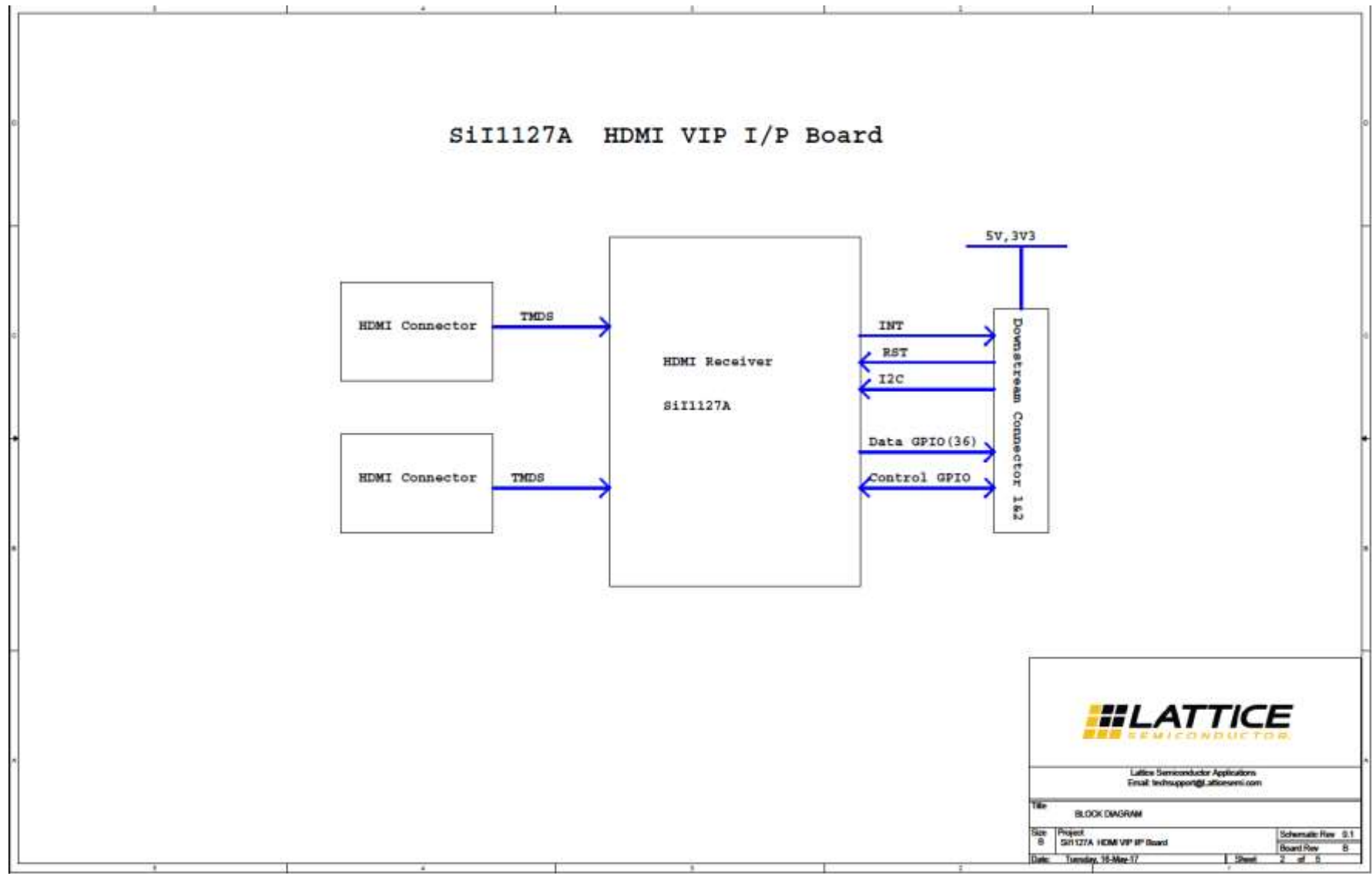
For more information, refer to:

- [Sii9127A/Sii1127A HDMI Receiver with Deep Color Output Data Sheet \(Sil-DS-1059\)](#)
- [Sii9223/9233/9127 HDMI Receivers Programmer's Reference \(Sil-PR-1019\)](#) (*The Programmer's Reference requires an NDA with Lattice Semiconductor*)
- [Lattice Embedded Vision Development Kit User Guide \(FPGA-UG-02015\)](#)
- [ECP5 VIP Processing Board \(FPGA-EB-02001\)](#)

## Technical Support Assistance

Submit a technical support case through [www.latticesemi.com/techsupport](http://www.latticesemi.com/techsupport).

## Appendix A. HDMI VIP Input Bridge Board Schematics



**Figure A.1. Block Diagram**

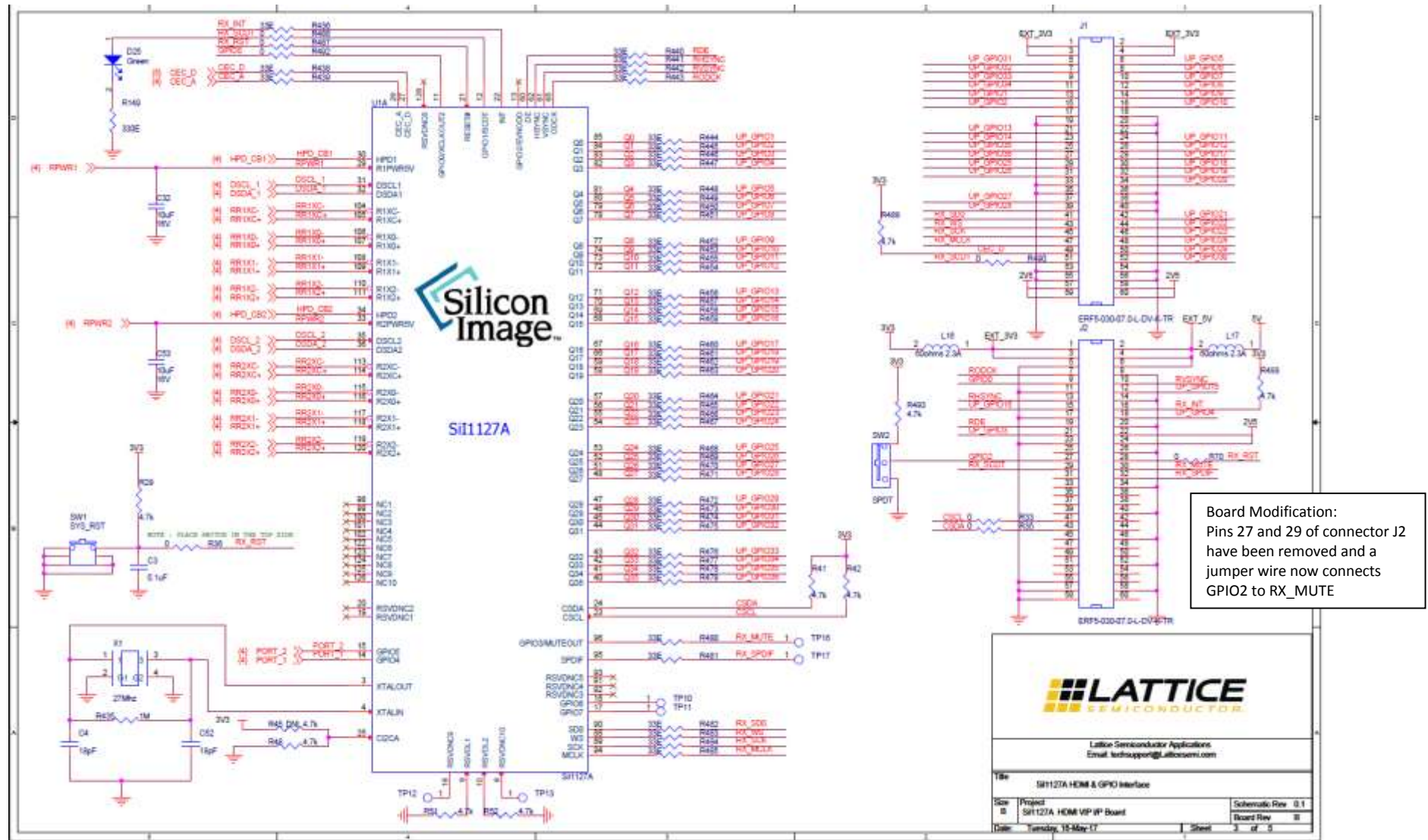


Figure A.2. Si1127A HDMI and GPIO Interface

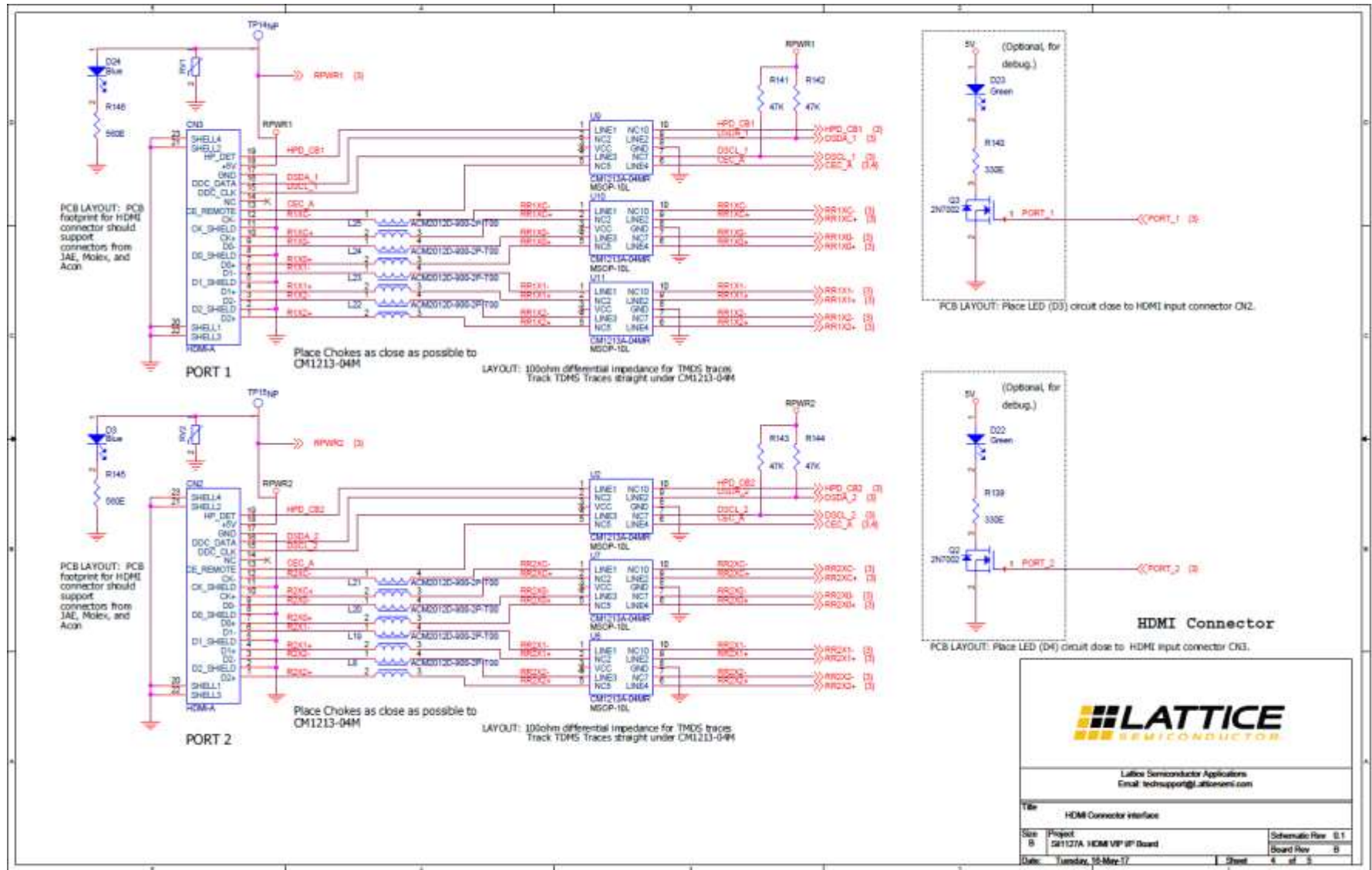


Figure A.3. Power Decoupling



## Appendix B. HDMI VIP Input Bridge Board Bill of Materials

| Item | Reference                                                                                       | Qty | Part                     | PART_NUMBER             | Manufacturer              | Description                                                                   |
|------|-------------------------------------------------------------------------------------------------|-----|--------------------------|-------------------------|---------------------------|-------------------------------------------------------------------------------|
| 1    | CN2, CN3                                                                                        | 2   | HDMI-A                   | 685119134923            | Wurth Electronics         | CONN RCPT HDMI 19POS SMD R/A                                                  |
| 2    | C3                                                                                              | 1   | 0.1 $\mu$ F              | C0402C104K4RACTU        | Kemet                     | CAP CER 0.1 $\mu$ F 16V X7R 0402                                              |
| 3    | C4, C52                                                                                         | 2   | 18 pF                    | C0402C180K3GACTU        | Kemet                     | CAP CER 18PF 25V C0G 0402                                                     |
| 4    | C6, C8, C9, C11, C13, C14, C16, C18, C19, C21, C24, C26, C27, C29, C49, C58, C59, C60, C61, C62 | 20  | 100 nF                   | C0402C104K4RACTU        | Kemet                     | CAP CER 0.1 $\mu$ F 16 V X7R 0402                                             |
| 5    | C10, C15, C23, C31, C32, C53, C55, C56, C57                                                     | 9   | 10 $\mu$ F               | THJB106K016SJN          | AVX                       | Tantalum Capacitors – Solid SMD 16 V 10 $\mu$ F 10%                           |
| 6    | C38, C39                                                                                        | 2   | 0.1 $\mu$                | CL05A104MP5NNNC         | Samsung                   | CAP CER 0.1 $\mu$ F 10 V X5R 0402                                             |
| 7    | C40, C41                                                                                        | 2   | 10 $\mu$                 | CL10X106MP8NRNC         | Samsung                   | CAP CER 10 $\mu$ F 10 V 20% X6S 0603                                          |
| 8    | C42, C43, C54                                                                                   | 3   | 10 nF                    | ECJ0EB1E103K            | Panasonic                 | CAP CER 10000 PF 25 V X7R 0402                                                |
| 9    | D1, D5, D6, D22, D23, D25                                                                       | 6   | Green                    | LTST-C190KGKT           | LITE-On INC               | LED GREEN CLEAR 0603 SMD                                                      |
| 10   | D3, D24                                                                                         | 2   | Blue                     | SMLE12BC7TT86           | Rohm Semiconductor        | LED BLUE CLEAR 0603 SMD                                                       |
| 11   | GND1, GND2, GND3, GND4, 5 V, TP10, TP11, TP12, 1V2, TP13, TP16, TP17, 3V3                       | 13  | TP_S_40_63               | —                       | —                         | —                                                                             |
| 12   | J1, J2                                                                                          | 2   | ERF5-030-07.0 -L-DV-K-TR | ERF5-030-07.0-L-DV-K-TR | Samtec Inc                | Conn High Speed Edge Rate Terminal Strip HDR 60 POS 0.5mm Solder ST SMD T/R - |
| 13   | L8, L19, L20, L21, L22, L23, L24, L25                                                           | 8   | ACM2012D-900 -2P-T00     | ACM2012D-900-2P-T00     | TDK                       | CMC 300MA 2LN 90 OHM SMD                                                      |
| 14   | L9, L10, L11, L12, L13, L14, L16, L17, L18                                                      | 9   | 60ohms 2.3A              | MPZ1608Y600B            | TDK                       | FERRITE BEAD 60 OHM 0603 1LN                                                  |
| 15   | Q1                                                                                              | 1   | MMBT2222A                | MMBT2222A, 215          | NXP Semiconductor         | TRANS NPN 40V 0.6A SOT23                                                      |
| 16   | Q2, Q3                                                                                          | 2   | 2N7002                   | 2N7002                  | Fairchild Semiconductor   | MOSFET N-CH 60V 115MA SOT-23                                                  |
| 17   | RV1, RV2                                                                                        | 2   | Varistor                 | AVRL101A1R1NTB          | TDK                       | Varistor 0402 39V 1.1pF                                                       |
| 18   | R29, R41, R42, R48, R51, R52, R148, R488, R489, R493                                            | 10  | 4.7 K                    | CRCW06034K70FKEA        | Vishay                    | RES SMD 4.7K $\Omega$ 1% 1/10W 0603                                           |
| 19   | R33, R35, R70, R486, R487, R490, R492                                                           | 7   | 0                        | RC0603JR-070RL          | Yageo                     | RES SMD 0.0 $\Omega$ JUMPER 1/10W 0603                                        |
| 20   | R36                                                                                             | 1   | 0                        | RC0402JR-070RL          | Yageo                     | RES SMD 0.0 $\Omega$ JUMPER 1/16W 0402                                        |
| 21   | R45                                                                                             | 1   | 4.7 K                    | CRCW06034K70FKEA        | Vishay                    | RES SMD 4.7K $\Omega$ 1% 1/10W 0603                                           |
| 22   | R54                                                                                             | 1   | 1 K                      | RC0603FR-071KL          | Yageo                     | RES SMD 1K $\Omega$ 1% 1/10W 0603                                             |
| 23   | R56, R73                                                                                        | 2   | 1 K                      | RMCF0402JT1K00          | Stackpole Electronics Inc | RES SMD 1K $\Omega$ 5% 1/16W 0402                                             |
| 24   | R60                                                                                             | 1   | 10 K                     | ERJ-3EKF1002V           | Panasonic                 | RES SMD 10K $\Omega$ 1% 1/10W 0603                                            |

| Item | Reference                                                                                                                                                                                                                                                                                            | Qty | Part         | PART_NUMBER              | Manufacturer          | Description                              |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------|--------------------------|-----------------------|------------------------------------------|
| 25   | R138, R139, R140, R149                                                                                                                                                                                                                                                                               | 4   | 330 E        | CRCW0402330RFKED         | Vishay Dale           | RES SMD 330 $\Omega$ 1% 1/16W 0402       |
| 26   | R141, R142, R143, R144                                                                                                                                                                                                                                                                               | 4   | 47 K         | ERA-3ARB473V             | Panasonic             | RES SMD 47K $\Omega$ 0.1% 1/10W 0603     |
| 27   | R145, R146                                                                                                                                                                                                                                                                                           | 2   | 560 E        | CRCW0402560RFKED         | Vishay Dale           | RES SMD 560 $\Omega$ 1% 1/16W 0402       |
| 28   | R435                                                                                                                                                                                                                                                                                                 | 1   | 1 M          | ERJ-S03F1004V            | Panasonic             | RES SMD 1M $\Omega$ 1% 1/10W 0603        |
| 29   | R436, R438, R439, R440, R441, R442, R443, R444, R445, R446, R447, R448, R449, R450, R451, R452, R453, R454, R455, R456, R457, R458, R459, R460, R461, R462, R463, R464, R465, R466, R467, R468, R469, R470, R471, R472, R473, R474, R475, R476, R477, R478, R479, R480, R481, R482, R483, R484, R485 | 49  | 33 E         | CRCW060333R0FKEA         | Vishay Dale           | RES SMD 33 $\Omega$ 1% 1/10W 0603        |
| 30   | SW1                                                                                                                                                                                                                                                                                                  | 1   | SYS_RST      | TL1015AF160QG            | E-Switch              | SWITCH TACTILE SPST-NO 0.05A 12V         |
| 31   | SW2                                                                                                                                                                                                                                                                                                  | 1   | SPDT         | EG1218                   | E-Switch              | SWITCH SLIDE SPDT 200MA 30V              |
| 32   | TH1, TH2, TH3, TH4                                                                                                                                                                                                                                                                                   | 4   | ThruHole     | —                        | —                     | —                                        |
| 33   | TP14, TP15                                                                                                                                                                                                                                                                                           | 2   | NP           | —                        | —                     | —                                        |
| 34   | U1                                                                                                                                                                                                                                                                                                   | 1   | SiI1127A     | SiI1127ACTU              | Lattice Semiconductor | PanelLink 4-Input HDMI Receiver          |
| 35   | U2, U7, U8, U9, U10, U11                                                                                                                                                                                                                                                                             | 6   | CM1213A-04MR | CM1213A-04MR             | ON Semiconductor      | TVS DIODE 3.3VWM 10VC 10MSOP             |
| 36   | U6                                                                                                                                                                                                                                                                                                   | 1   | LTC3025-2    | LTC3025EDC-2#PBF         | Linear Tech           | LDO Regulator Pos 1.2V 0.5A 6-Pin DFN EP |
| 37   | X1                                                                                                                                                                                                                                                                                                   | 1   | 27 MHz       | ABM8G-27.000MHZ-18-D2Y-T | ABRACON               | CRYSTAL 27.0000MHZ 18PF SMD              |
| 38   | HDMI Video Processing Input Board RevB PCB                                                                                                                                                                                                                                                           | 1   | —            | 305-PD-17-00XX           | PACTRON               | —                                        |

## Revision History

| Date      | Version | Change Summary   |
|-----------|---------|------------------|
| July 2017 | 1.0     | Initial release. |



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- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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