Avant-G/X Versa Board

User Guide

FPGA-EB-02063-1.6

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This document was created consistent with Lattice Semiconductor’s inclusive language policy. In some cases, the language in underlying tools and other items may not yet have been updated. Please refer to Lattice’s inclusive language FAQ 6878 for a cross reference of terms. Note in some cases such as register names and state names it has been necessary to continue to utilize older terminology for compatibility.

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Abbreviations in This Document

A list of abbreviations used in this document.

Abbreviation	Definition
AC/DC	Alternating Current and Direct Current
ADC	Analog-to-digital Converter
DCO	Digitally Controlled Oscillator
DIP	Dual Inline Package
DPLL	Digital Phase Lock Loop
DRP	Dual Role Port
ECC	Error Correction Coding
ESD	Electro Static Discharge
EPPS	Even Pulse Per Second
FMC+	FPGA Mezzanine Card Plus
FPGA	Field Programmable Gate Array
FTDI	Future Technology Devices International
GUI	Graphic User Interface
GPIO	General Purpose Input/Output
GPIF-II	General Programmable Interface II
HPC	High Pin Connector
I2C	Inter-Integrated Circuit
I3C	Improved Inter-Integrated Circuit
I/O	Input/Output
JTAG	Joint Test Action Group
LED	Light Emitting Diode
LVDS	Low-Voltage Differential Signaling
OSC	Oscillator
PC	Personal Computer
PCIe	Peripheral Component Interconnect Express
PMIC	Power Management Integrated Circuit
PMOD	Peripheral Module
POT	Potentiometer
PPS	Pulse Per Second
PTP	Precision Time Protocol
QSFP	Quad Small Form-Factor Pluggable module
SerDes	Serializer/Deserializer
SFP	Small Form-Factor Pluggable module
SMA	Sub-Miniature Type A
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
TAP	Test Access Port
TCP	Timing Commander Personality file
TI	Texas Instruments
TX	Transmitter
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

1. Introduction

Lattice Semiconductor Avant™-G/X Versa Board allows you to investigate and experiment with the features of our Avant-AT-G/X FPGAs. The features of the Avant-G/X Versa Board can assist you with rapid prototyping and testing of your specific design. The Avant-G/X Versa Board is part of the Avant-G/X Versa Board Kit. This guide is intended to be used as a reference, which demonstrates the Avant-G/X FPGA features and introduces the board resources.

The Avant-G/X Versa Board Kit includes the following:

- The Avant-G/X Versa Board is pre-loaded with a default demonstration design.
- USB-A to USB-B (Mini) cable for programming FPGA SRAM through a PC.
  The Avant-G/X Versa Board can allow programming of the Flash device through the on-board J33 mini-USB connector,
  eliminating the need for the Lattice Programming Cable.
- 12 V AC/DC power adapter and international plug adapters.
- Lattice Radiant™ software download information.

The contents of this user guide include top-level functional descriptions of the various portions of the Versa Board, descriptions of the on-board headers, status indicators, push buttons, and switches, and a complete set of schematics.

This development board comes in two different versions, as shown in the following tables.

Table 1.1 lists the development kit version, ordering part number, and device part number. Table 1.2 highlights major features supported by the two Versa Boards.

Table 1.1. Lattice Avant-G/X Versa Board Development Kit Versions

Development Kit Version	Ordering Part Number	Device Part Number
Lattice Avant-G Versa Board Development Kit	LAV-G70-VERSA-EVN	LAV-AT-G70-3LFG1156I
Lattice Avant-X Versa Board Development Kit	LAV-X70-VERSA-EVN	LAV-AT-X70-3LFG1156I

Note: The FPGA capabilities vary depending on the board kit version selected, but the board remains the same between the two versions of the board kits. For more information on Lattice Avant-AT-G and Avant-AT-X FPGAs, refer to the Lattice Avant-G and Avant-X product pages on the Lattice website.

Table 1.2. Differences between Avant-G Versa Board and Avant-X Versa Board

Board Name	DDR5	10GE	40GE	25GE	100GE
Avant-G Versa Board	—	✓	✓	—	—
Avant-X Versa Board	✓	✓	✓	✓	✓

1.1. Avant-G/X Versa Board

The Avant-G/X Versa Board features the Avant-AT-G/X FPGA in the LFG1156 package. The board can expand the usability of the Avant-AT-G/X FPGA with FMC+, SFP28, QSFP28, PMOD, and Raspberry Pi connectors. Easy-to-use board resources of the jumpers, LED indicators, push buttons, and switches are available for various user-defined applications.

Figure 1.1 shows the top view of the Avant-G/X Versa Board. Figure 1.2 shows the bottom view of the Avant-G/X Versa Board.

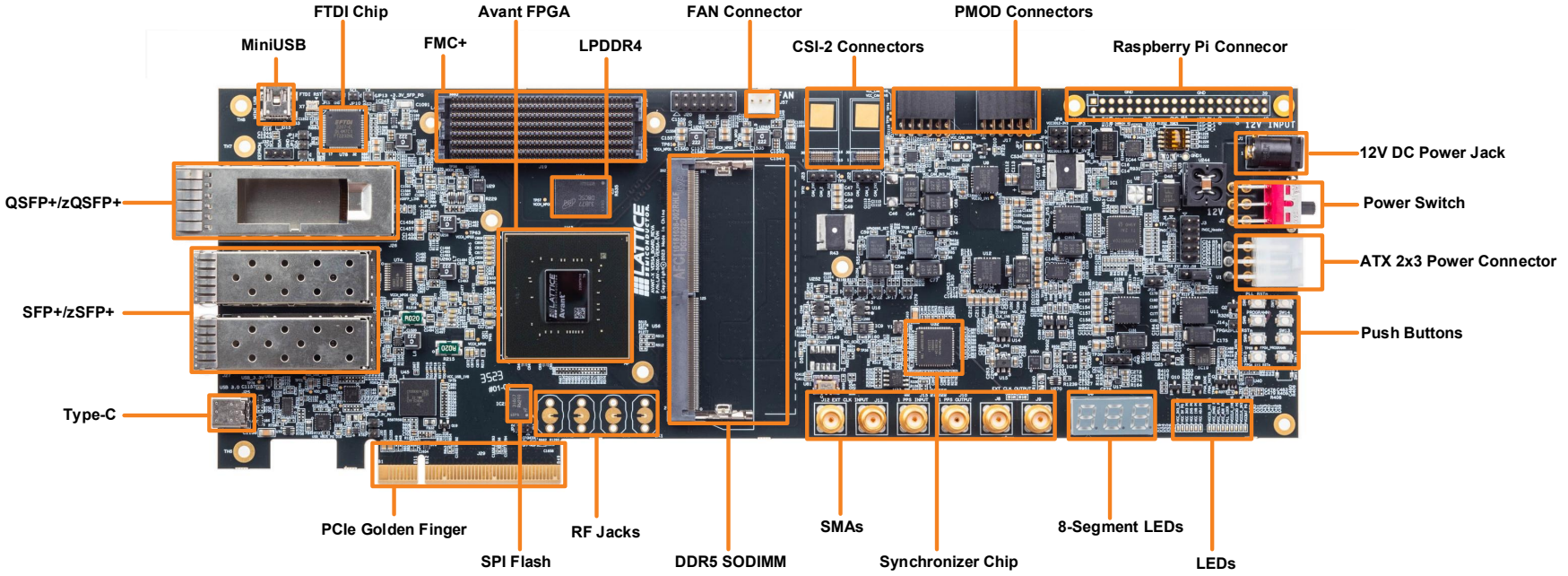

Figure 1.1. Top View of Avant-G/X Versa Board

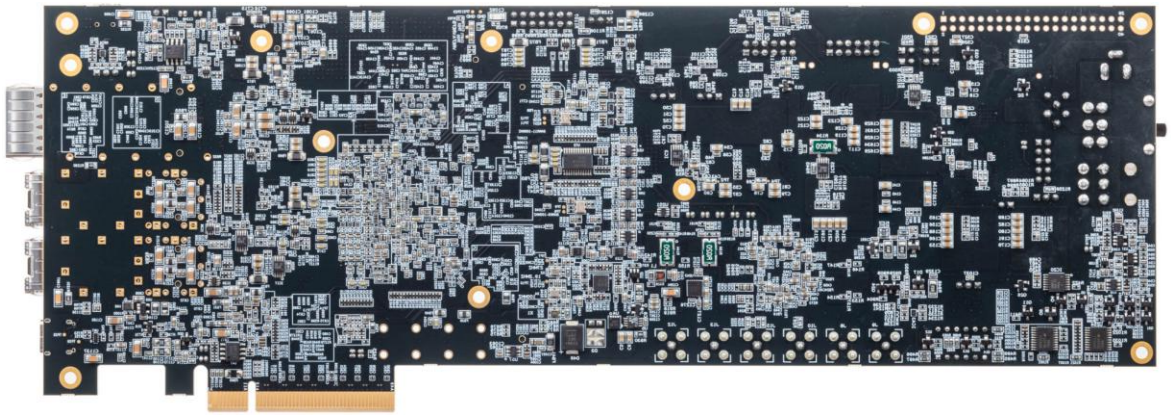

Figure 1.2. Bottom View of Avant-G/X Versa Board

1.2. Features

The Avant-G/X Versa Board includes the following features:

- Avant-AT-G/X FPGA
- General purpose Input/Output (GPIO) breakout with FMC+, PMOD, and Raspberry Pi connectors
- USB-B (Mini) connection for device programming
- On-board boot flash – 512 Mb Serial Peripheral Interface (SPI) flash, with single/octal support
- PCIe x8 Golden Finger
- Up to 2x 25GE zSFP+, 1x 100GE zQSFP+ connectors
- LPDDR4 x32
- DDR5 x72 SODIMM
- USB 3.1 Gen1 Type-C interface
- Two MIPI CSI-2 connectors for camera sensor input
- Four input DIP switches, four push buttons, three green LEDs, and three seven-segment LEDs for designer configuration
- Lattice Radiant software programming support
- Programmable Clock Generator

Caution: The Avant-G/X Versa Board contains electro static discharge (ESD)-sensitive components. Follow ESD-safe practices while handling and using this Avant-G/X Versa Board.

1.3. Avant-AT-G/X Device

The Avant-G/X Versa Board features the Avant-AT-G/X device in an LFG1156 package, which is also referred to as LAV-AT-G70-3LFG1156I or LAV-AT-X70-3LFG1156I. The low-power general purpose FPGA can be used in a wide range of applications across multiple markets and is optimized for bridging and processing needs in edge applications. For more information on the capabilities of Avant-AT-G/X devices, see Lattice Avant Platform Data Sheet – Overview (FPGA-DS-02107) and Lattice Avant Platform Data Sheet – Specifications (FPGA-DS-02112).

2. Jumper Definition

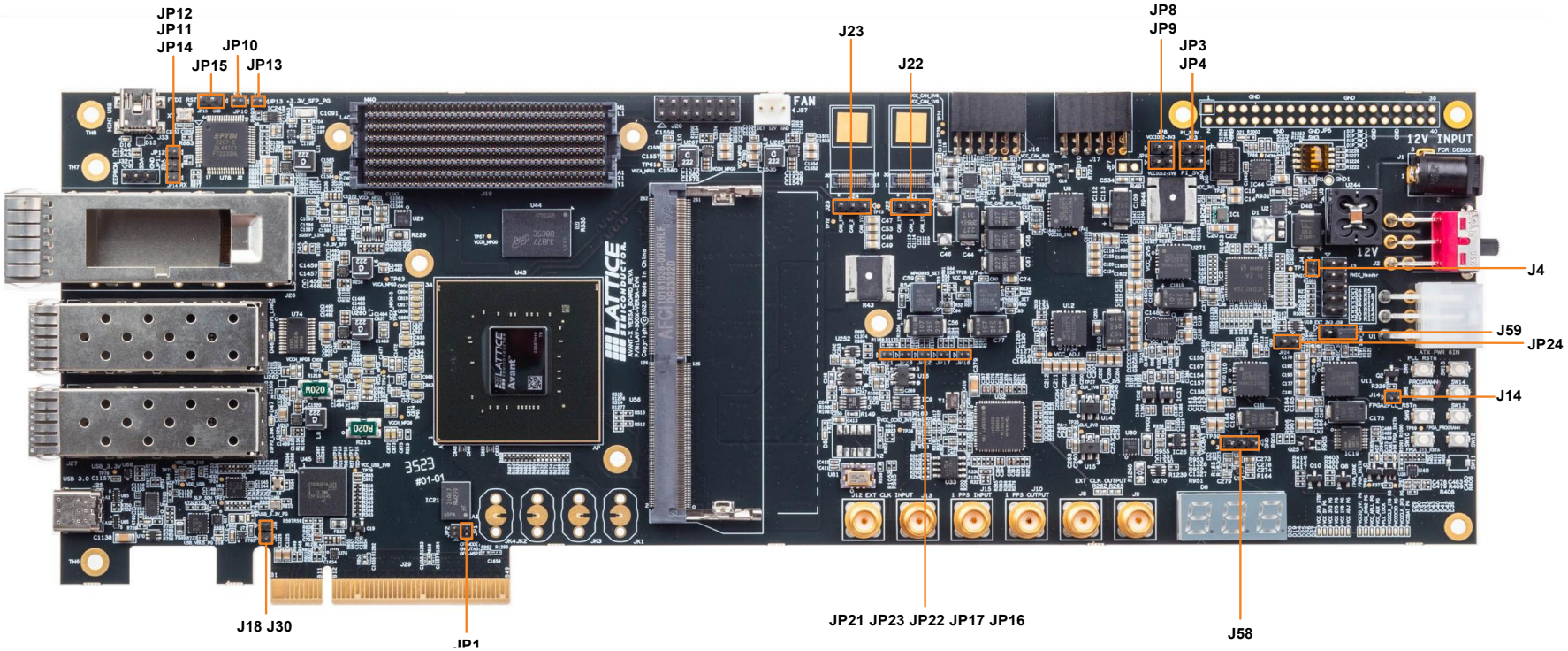

Figure 2.1. Top View of Avant-G/X Versa Board – Jumper Locations

Table 2.1. Jumper Setting

Part Designator	Description	Setting	Default
JP15	FTDI Reset	Open – FTDI active Close – Holds FTDI in reset	Open
JP10, JP11, JP12	FTDI I2C, Used for RC38612A configure	Open – I2C bus unconnected Close – I2C bus connected	Open
JP13, JP14	FTDI UART Debug	Open – UART bus unconnected Close – UART bus connected	Open
J59	PMIC Power Jumper	2-3 – VCC_3V3_PMIC powered by on-board VCC_3V3_STBY 1-2 – VCC_3V3_PMIC powered by external power VCC_3V3_EXT	2-3
JP24	PMIC VCC_3V3_EXT Jumper	PMIC External power connector	Open
J4	PMIC PMBUS_CTRL signal	Open – PMIC Turn-On Sequencing (Reserved) Close – PMIC Turn-Off Sequencing (Reserved)	Open
JP16	JP16 is used to set VCCH_MPQ3 & VCCA_MPQ3 Voltage	Open – VCCH_MPQ3: 1.5 V VCCA_MPQ3: 0.8 V Close[1] – VCCH_MPQ3: 1.8 V VCCA_MPQ3: 0.9 V	Open
JP17	JP17 is used to set VCCH_MPQ6 & VCCA_MPQ6 Voltage	Open – VCCH_MPQ6: 1.5 V VCCA_MPQ6: 0.8 V Close[1] – VCCH_MPQ6: 1.8 V VCCA_MPQ6: 0.9 V	Open
JP21	JP21 is used to set VCCH_MPQ0 & VCCA_MPQ0 Voltage	Open – VCCH_MPQ0: 1.5 V VCCA_MPQ0: 0.8 V Close[1] – VCCH_MPQ0: 1.8 V VCCA_MPQ0: 0.9 V	Open
JP22	JP22 is used to set VCCH_MPQ1 & VCCA_MPQ1 Voltage	Open – VCCH_MPQ1: 1.5 V VCCA_MPQ1: 0.8 V Close[1] – VCCH_MPQ1: 1.8 V VCCA_MPQ1: 0.9 V	Open
JP23	JP23 is used to set VCCH_MPQ2 & VCCA_MPQ2 Voltage	Open – VCCH_MPQ2: 1.5 V VCCA_MPQ2: 0.8 V Close[1] – VCCH_MPQ2: 1.8 V VCCA_MPQ2: 0.9 V	Open
J14	Reserved for RC38612A (Clock Synchronizer) reset signal	Open – FPGA2PLL_RSTn is not controlled by FPGA Close – FPGA2PLL_RSTn is controlled by FPGA	Open
JP1	FPGA Configuration Mode Select	Open – MSPI Mode, FPGA boots from an external SPI flash Close – Configure from JTAG Port	Open
JP3	Raspberry Pi Connector (JP5) Power	Open – Raspberry Pi self-power Close – 3.3 V supplied to Raspberry Pi connector	Open
JP4	Raspberry Pi Connector (JP5) Power	Open – Raspberry Pi self-power Close – 5.0 V supplied to Raspberry Pi connector	Open
JP8, JP9	Avant Bank 12 Power Select (VCCIO12)	JP8 and JP9 select voltage to VCCIO12. Only one of these jumpers can be inserted. JP8-Close, JP9-Open: VCCIO12 = 3.3 V JP8-Open, JP9-Close: VCCIO12 = 1.8 V	JP8 Close, JP9 Open
J58	Avant VCC_BAT Power	2-3 – VCC BAT is powered from on-board VCCBAT_1V5 1-2 – VCC BAT is powered from external 1.5 V Power	2-3

Part Designator	Description	Setting	Default
J18	Reserved for CYUSB3014 PMODE setting	Open – PMODE[2:0] : Z1Z -->I2C, on failure, USB boot is enabled Close – PMODE[2:0] : Z11 --> USB boot	Open
J22	Camera Connector(J21) Power	2-3 – VDD_CAM_1 = 1.0 V 1-2 – VDD_CAM_1 = 1.2 V	2-3
J23	Camera Connector(J24) Power	2-3 – VDD_CAM_2 = 1.0 V 1-2 – VDD_CAM_2 = 1.2 V	2-3
J30	Reserved for PCIe EP/RC REFCLK select	Open – PCIE_REFCLK Input Close – PCIE_REFCLK Output	Open

Note:

1. Not applicable for Avant-G Versa Board.

3. Power Scheme

This section describes the power supply of the Avant-G/X Versa Board. The Avant-G/X Versa Board has the majority of on-board regulators powered by a 12 V DC supply. Refer to Appendix A. Avant Versa Board Schematics to see the details of these power supply options.

An on-board TI Power Management Integrated Circuit (PMIC) measures both the voltage and current for several specific board rails. The power supply voltage and current consumption can be displayed on the TI Graphical User Interface (GUI).

3.1. Apply Power to the Board

The Avant-G/X Versa Board can be powered up from the PCIe host through the PCIe Golden Finger, and it can also be powered up using the 12 V DC power adapter (Figure 3.1). J1 and U1 are the two 12 V DC power input connectors on the Avant-G/X Versa Board. The maximum power supply capacity of J1 is 12 V/5 A. U1 is the PCIe 2 x 3 auxiliary connector (Figure 3.2), which can support a 150 W power supply. For details about the PCIe 2 x 3 auxiliary connector, refer to the PCI Express Card Electromechanical Specification. Switch J2 is used to switch the power supply from J1 or U1. When J2 is switched to up, the board power supply is supplied by a power adapter connected to J1. When J2 is switched to down, the board is powered by a power adapter connected to U1.

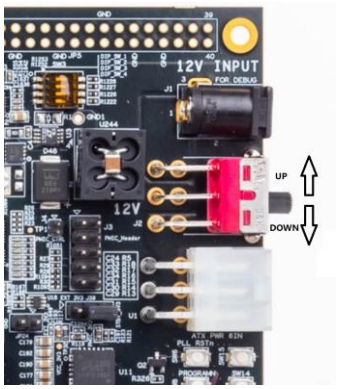

Figure 3.1. 12 V DC Power Supply

Table 3.1. Board Power Supply

Part Designator	Description
J1	+12 V DC input supply Jack
U1	PCIe 2 x 3 auxiliary connector
J2	ON/OFF switch

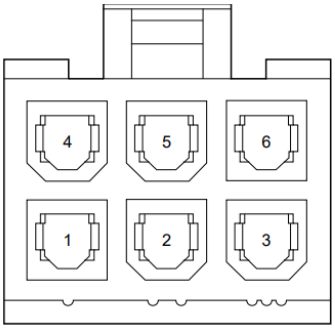

Figure 3.2. PCIe 2 x 3 Auxiliary Connector

Table 3.2. Pin Definition of PCIe 2x3 Auxiliary Connector

Pin	Signal
1	+12V
2	+12V
3	+12V
4	GND
5	GND
6	GND

3.2. Fan Connector

The Avant-G/X Versa Board provides a three-pin fan connector (Figure 3.3) that connects a fan to cool down the board.

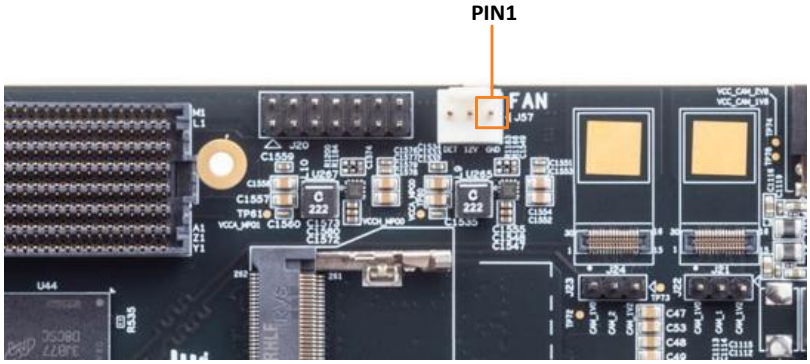

Figure 3.3. Fan Connector

Table 3.3. Fan Connector

Part Designator	Description
J57	Fan Connector – Used to connect a DC 12 V fan PIN1 – GND PIN2 – DC 12 V PIN3 – FANDET (Reserved)

3.3. Power Distribution System

Figure 3.4 shows the high-level power distribution system on the Avant-G/X Versa Board. Table 3.4 shows the voltage options available for various VCCIO supplies. Table 3.5 shows the voltage options available for SerDes power supplies.

The Avant-G/X Versa Board has one FMC+ connector. The VCC_VADJ power supplies are required for the FMC+ connector according to the FMC+ standard. You can set the power output level by changing R130. Table 3.6 shows the VCC_VADJ setting.

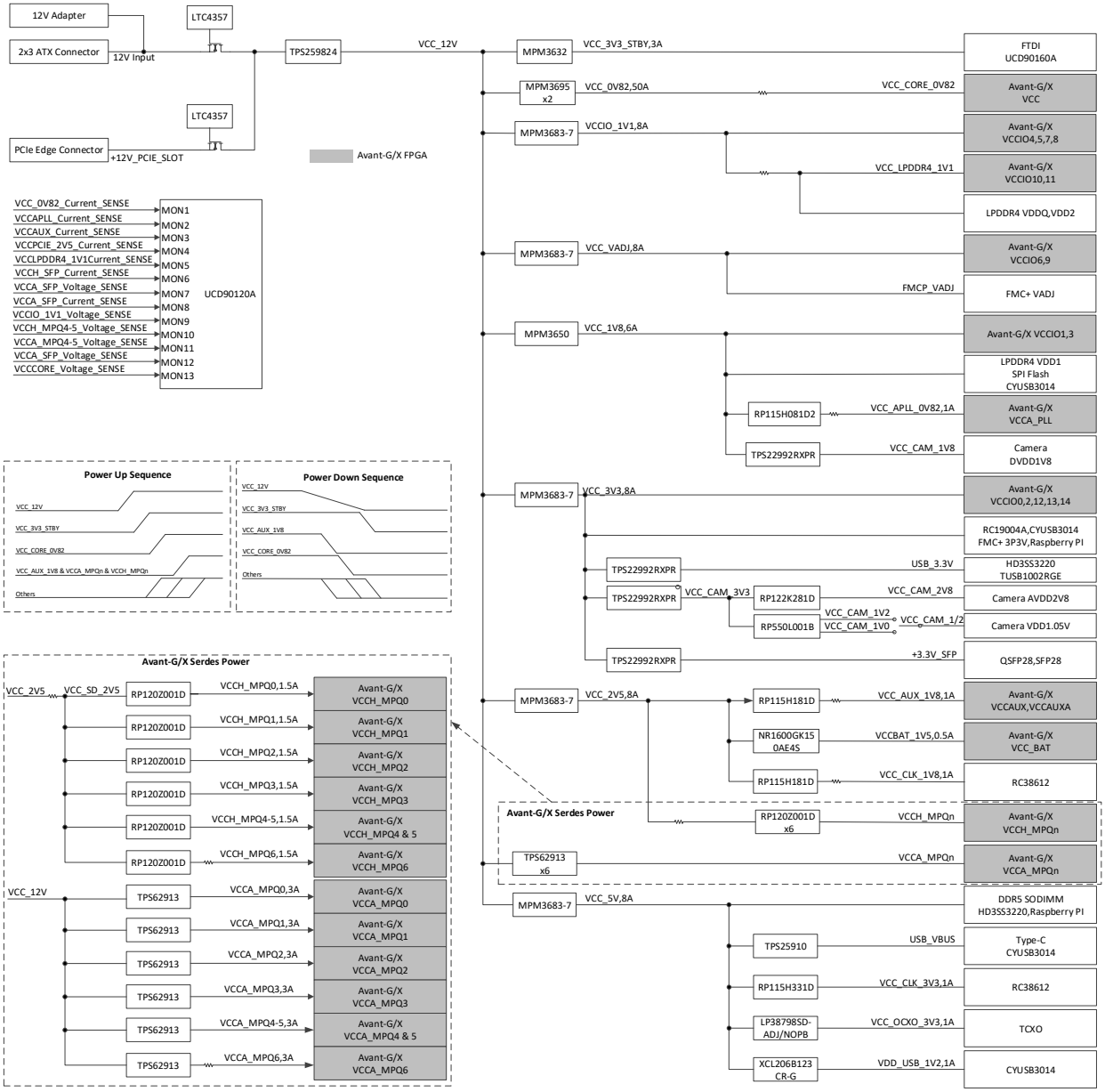

Figure 3.4. Power Distribution System Block Diagram

Table 3.4. VCCIO Supply Options

V_{CCIO} Bank	3.30 V	2.50 V	1.80 V	1.50 V	1.35 V	1.20 V	1.10 V
V_{CCIO0}	Fixed	—	—	—	—	—	—
V_{CCIO1}	—	—	Fixed	—	—	—	—
V_{CCIO2}	Fixed	—	—	—	—	—	—
V_{CCIO3}	—	—	Fixed	—	—	—	—
V_{CCIO4}	—	—	—	—	—	—	Fixed
V_{CCIO5}	—	—	—	—	—	—	Fixed
V_{CCIO7}	—	—	—	—	—	—	Fixed
V_{CCIO8}	—	—	—	—	—	—	Fixed
V_{CCIO6} / V_{CCIO9}	—	—	Default	Selectable[1]	Selectable[1]	Selectable[1]	—
V_{CCIO10}	—	—	—	—	—	—	Fixed
V_{CCIO11}	—	—	—	—	—	—	Fixed
V_{CCIO12}	Default	—	Selectable[2]	—	—	—	—
V_{CCIO13}	Fixed	—	—	—	—	—	—
V_{CCIO14}	Fixed	—	—	—	—	—	—

Notes:

1. R130 is used to set VCCIO6 & VCCIO9 voltage. Refer to Table 3.6 for detailed information.
2. JP8 and JP9 are used to select VCCIO12 voltage. Refer to Table 2.1 for detailed information.

Table 3.5. SerDes Power Supplies

V_{CCIO} Bank	1.8 V	1.5 V	0.9 V	0.8 V
VCCH_MPQ0 / VCCH_MPQ1 / VCCH_MPQ2	Selectable[1]	Default	—	—
VCCA_MPQ0 / VCCA_MPQ1 / VCCA_MPQ2	—	—	Selectable[1]	Default
VCCH_MPQ3	Selectable[1]	Default	—	—
VCCA_MPQ3	—	—	Selectable[1]	Default
VCCH_MPQ4-5	—	Fixed	—	
VCCA_MPQ4-5	—		—	Fixed
VCCH_MPQ6	Selectable[1]	Default	—	—
VCCA_MPQ6	—	—	Selectable[1]	Default

Note:

1. JP16, JP17, JP21, JP22, and JP23 are used to select SerDes power voltage. Refer to Table 2.1 for detailed information.

Table 3.6. VCC_VADJ Setting

R130	Voltage Settings for the FPGA Mezzanine (FMC+) Ports	1 kΩ: VCC_VADJ = 1.8 V (default) 1.33 kΩ: VCC_VADJ = 1.5 V 1.6 kΩ: VCC_VADJ = 1.35 V 2 kΩ: VCC_VADJ = 1.2 V

3.4. Power Management

The Avant-G/X Versa Board has an on-board PMIC (TI UCD90120ARGCT) with 13 rail inputs for power voltage and current measurement. The precision sense resistor is placed in series in the power rail to accurately measure the consumed current. Refer to the Power Distribution System Block Diagram (Figure 3.4) for detailed connections.

For power measurement, prepare the following:

- Short J59 Pin 2-3.
- Use a TI USB-TO-GPIO2 cable to connect J3 to the PC.
- Install the TI GUI software FUSION DIGITAL POWER DESIGNER to a PC.

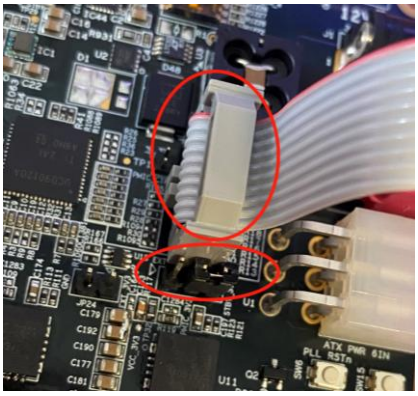

Figure 3.5. TI USB-TO-GPIO2 Cable Connection

3.5. Power Status LEDs

The Avant-G/X Versa Board provides status LEDs for visual indication of the power status (Table 3.7).

Table 3.7. Status LED Definition

LED Designator	Color	Description
D21	Green	DC12V Power Good
D20	Green	VCC_3V3_STBY Power Good
D19	Green	VCC_5V Power Good
D24	Green	VCC_3V3 Power Good
D25	Green	VCC_2V5 Power Good
D26	Green	VCC_1V8 Power Good
D27	Green	VCC_VADJ Power Good
D29	Green	VCCIO_1V1 Power Good
D30	Green	VCC_0V82 Power Good
D31	Green	VCC_APLL Power Good
D32	Green	VCC_AUX Power Good
D41	Green	VCCOCXO Power Good
D42	Green	VCCCLK_3V3 Power Good
D39	Green	VCCBAT_1V5 Power Good
D40	Green	VCCCLK_1V8 Power Good
D9	Green	VCC_CAM_3V3 Power Good
D10	Green	VCC_CAM_1V8 Power Good
D18	Green	USB_VBUS Power on
D13	Green	USB_3.3V Power Good
D14	Green	+3.3V_SFP Power Good
D16	Green	VBUS_5V Power Good

4. Programming

The JTAG programming architecture of the Avant-G/X Versa Board is shown in Figure 4.1. An on-board USB to JTAG/I2C bridge is implemented with the FT2232H. It is in the form of a mini-USB connector (J33).

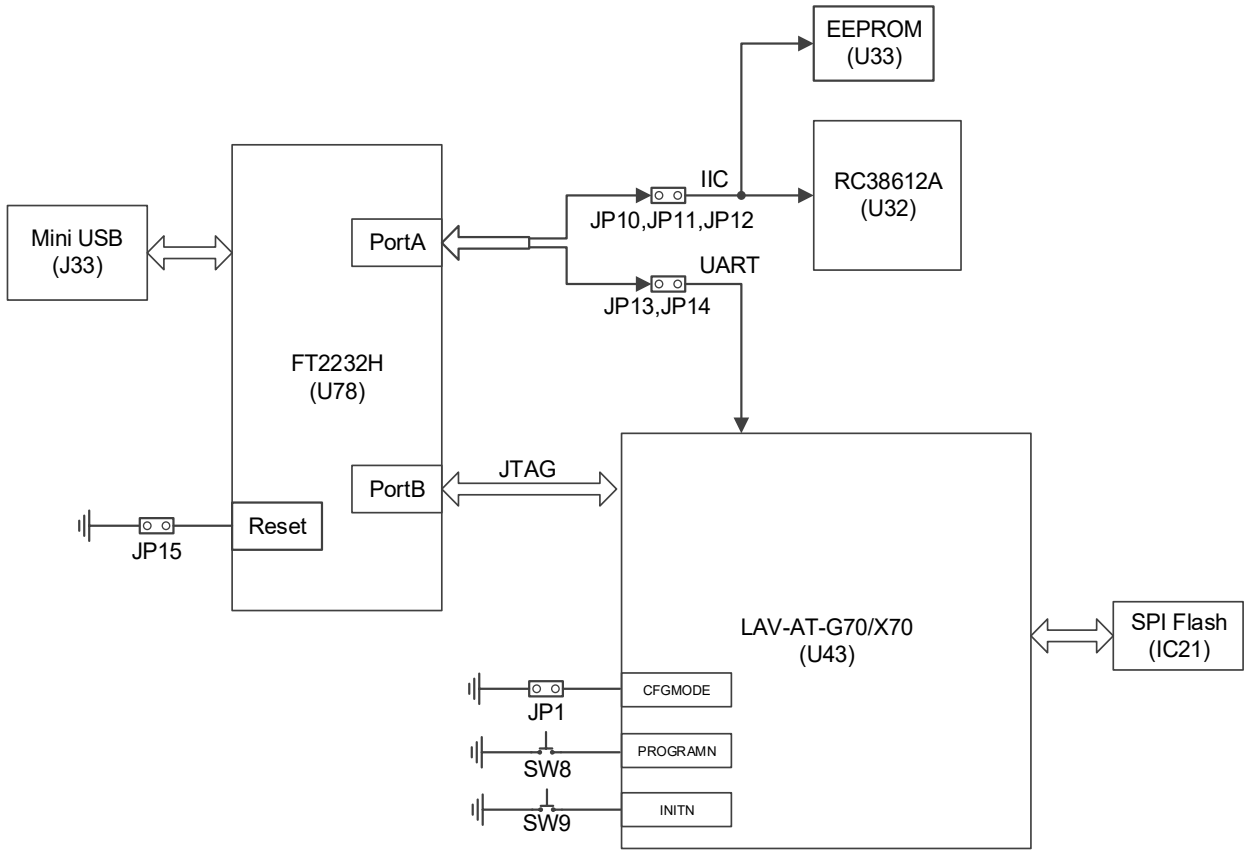

Figure 4.1. JTAG Topology Block Diagram

4.1. Configuration

The Avant-AT-G/X devices contain two ports that can be used for device configuration. One is the Test Access Port (TAP) that supports bit-wide configuration, and the other is the sysCONFIG port that supports serial, quad, and byte configuration. The TAP that has dedicated I/O supports the IEEE Standard 1149.1 Boundary Scan specification. CFGMODE, PROGRAMN, INITN, and DONE are dedicated configuration pins. The remaining sysCONFIG pins are used as dual-function pins. Refer to the Lattice Avant sysCONFIG User Guide (FPGA-TN-02299) for more information about using the dual-use pins as general purpose I/O.

The following configuration interfaces are supported on Avant-G/X Versa Board:

- JTAG (proprietary protocol)
- Controller SPI – ×1, ×8 (dual transfer rate)

On power-up, based on the voltage level, high or low, of the CFGMODE pin, the FPGA SRAM is configured by the appropriate sysCONFIG port. If the CFGMODE pin is low, the FPGA is in configuration mode (JTAG). If the CFGMODE pin is driven high, the FPGA is in Controller SPI booting mode. In Controller SPI booting mode, the FPGA boots from an external SPI flash. The Jumper JP1 sets the voltage level of the CFGMODE pin. Open = MSPI mode; Closed = JTAG mode.

Refer to Table 2.1.

4.2. System Configuration Pins

The Avant-G/X Versa Board provides test points and LEDs for system configuration pins, as shown in Table 4.1.

Table 4.1. System Configuration Pins

Signal Name	Avant Bank	Avant Ball	Test Points	Direction
CFGMODE	2	P1	—	Input
PROGRAMN	2	P2	TP69	Input
INITN	2	T5	TP67	Bidirectional open drain
DONE	2	U4	TP68	Bidirectional open drain

INITN: Open-drain pin. This signal is driven low when the configuration sequence is started, indicating the device is in the initialization state. At this moment, the LED (D6) lights red. This signal is released after initialization is completed, and the configuration download starts.

DONE: Open-drain pin. This signal is driven low during the configuration. Releasing this signal indicates the device has completed configuration. At this moment, the LED (D7) lights green.

For more information on the Avant JTAG and SPI programming, refer to the Lattice Avant sysCONFIG User Guide (FPGA-TN-02299).

4.3. JTAG Download Interface

The Avant-G/X Versa Board has a built-in download controller for programming the Avant device. It uses the FT2232H part from Future Technology Devices International Ltd. (FTDI) to convert USB to JTAG. To use the built-in download cable, connect the USB cable from a PC with the Radiant Programmer installed to the mini-USB connector (J33) on the board. A USB-A to USB-B (Mini) cable is included in the Avant-G/X Versa Board Kit. The USB hub on the PC detects the cable of the USB function on Port B, making the built-in cable available for use with the Radiant programming software.

4.4. Programming of Avant-G/X SRAM

The Radiant Programmer can be used to program the .bit file to the Avant-G/X SRAM. The Radiant Programmer is integrated into the Radiant software and is also available as a stand-alone version.

To program the Avant-G/X SRAM:

1. For the JTAG mode, make sure JP1 is connected with a jumper.
2. Connect the PC and Avant Versa Board (J33) using the USB cable.
3. In the Radiant software, click **Tools > Programmer**. Or, in Windows, go to **Start > Lattice Radiant Software 2023.2 > Radiant Programmer**.
4. The Radiant Programmer interface opens as shown in Figure 4.2. Select FTUSB-1 Port in the cable Setup field.
5. Double-click the **Operation** field.

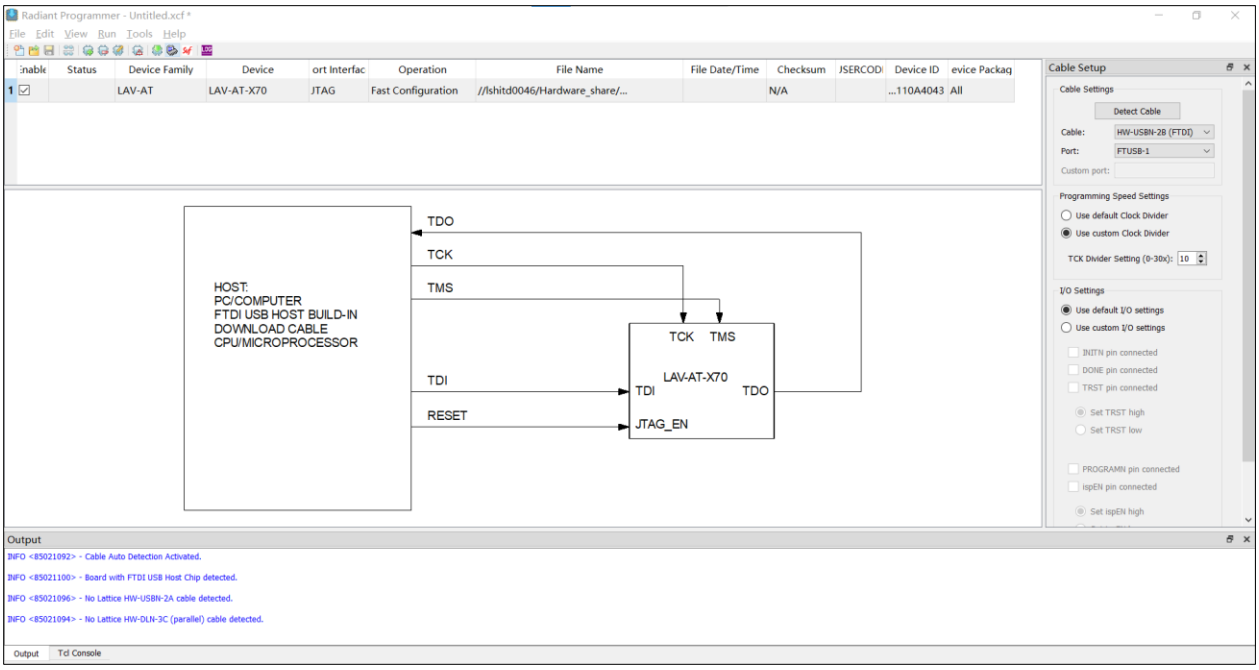

Figure 4.2. Radiant Programmer

6. The Device Properties dialog box opens, as shown in Figure 4.3. Select the following options:
   - Target Memory – Compressed Random Access Memory (CRAM)
   - Port Interface – JTAG
   - Access Mode – Direct Programming
   - Operation – Fast Configuration
   - Programming file – Select the .bit file to be programmed.

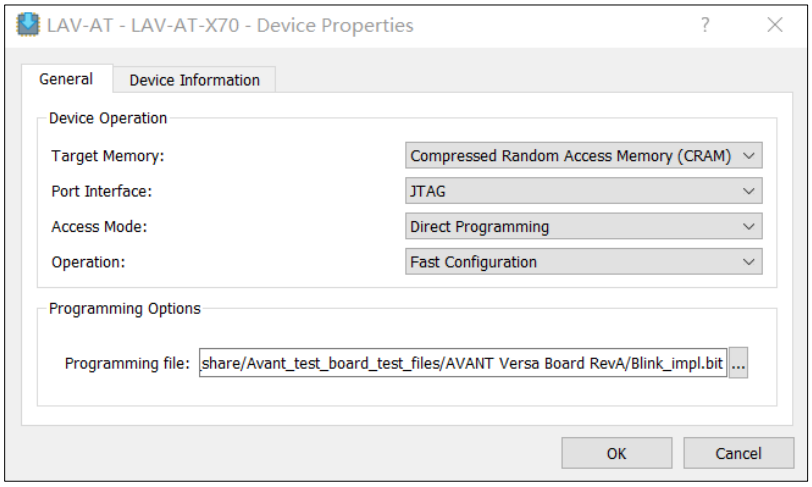

Figure 4.3. Radiant Programmer – Device Properties

7. Click **OK**.

To program the .bit file, click the **Program** button in the Radiant Programmer or select **Run > Program Device**. If successful, the Status column shows PASS. The Output pane also shows INFO – Operation: successful.

4.5. SPI Flash Device Selection in Programmer

The on-board flash device is the Micron MT35XU512, which powers up through the 1.8 V supply (Figure 4.4). The flash device can be programmed with Radiant Programmer through the J33 header with the USB-A to USB-B (Mini) cable.
Note: Before programming, ensure a jumper is installed on the JP1 header.

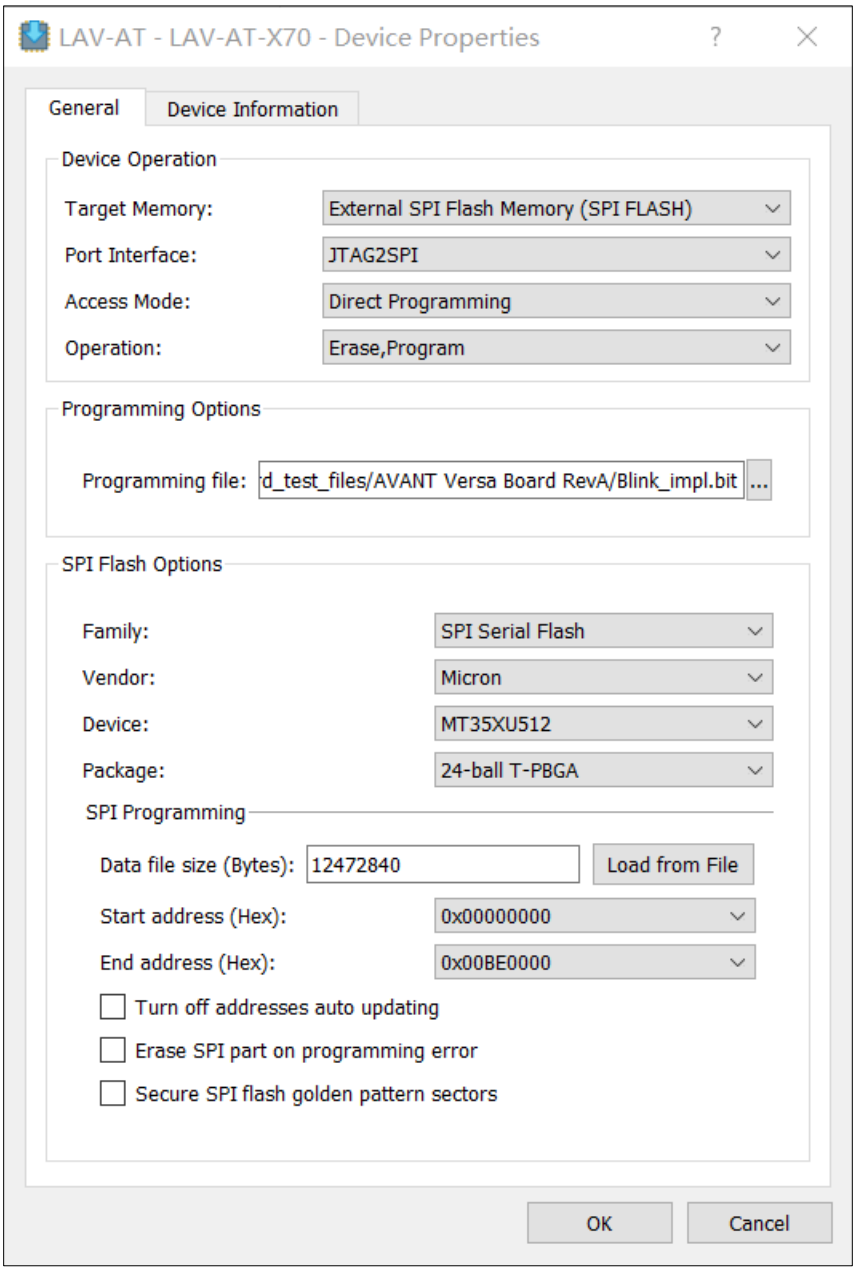

Figure 4.4. SPI Flash Operation Dialog

The design and bitstream files that are loaded into the Avant-G/X Versa Board flash (IC21) can be found under the Design File tab on the Avant-X Versa Board web page.

Caution:

- If the MSPI-Flash boot is required after programming, power off the board, remove JP1 to select the MSPI mode, and then power on.
- SPI flash programming may fail when CFGMODE = 1. See the details and workarounds below.

SPI flash programming may fail when CFGMODE = 1 (JP1 open, MSPI mode) if the on-board flash is blank or holds a corrupted configuration image. In this state, MSPI configuration fails and the FPGA drives INITN low, which holds the SPI flash in reset on this board and blocks Programmer access to the device.

To program the SPI flash successfully, use one of the following workarounds:

- Press and hold PROGRAMN low (SW8) for the entire SPI flash programming operation, then release it once programming completes.
- Alternatively, set CFGMODE = 0 (JP1 closed, JTAG mode) before programming the SPI flash. After programming, restore CFGMODE = 1 only if the MSPI-Flash boot is required.

  Note: CFGMODE is set by jumper JP1: open = MSPI mode (CFGMODE = 1), closed = JTAG mode (CFGMODE = 0). See Table 2.1 and the Configuration section. For related hardware design guidance on the SPI flash reset pin, see the SPI Flash section.

5. Clocks

The Avant-G/X Versa Board has a variety of clock sources, as shown in Table 5.1, Table 5.2, and Table 5.3.

5.1. Clock Distribution

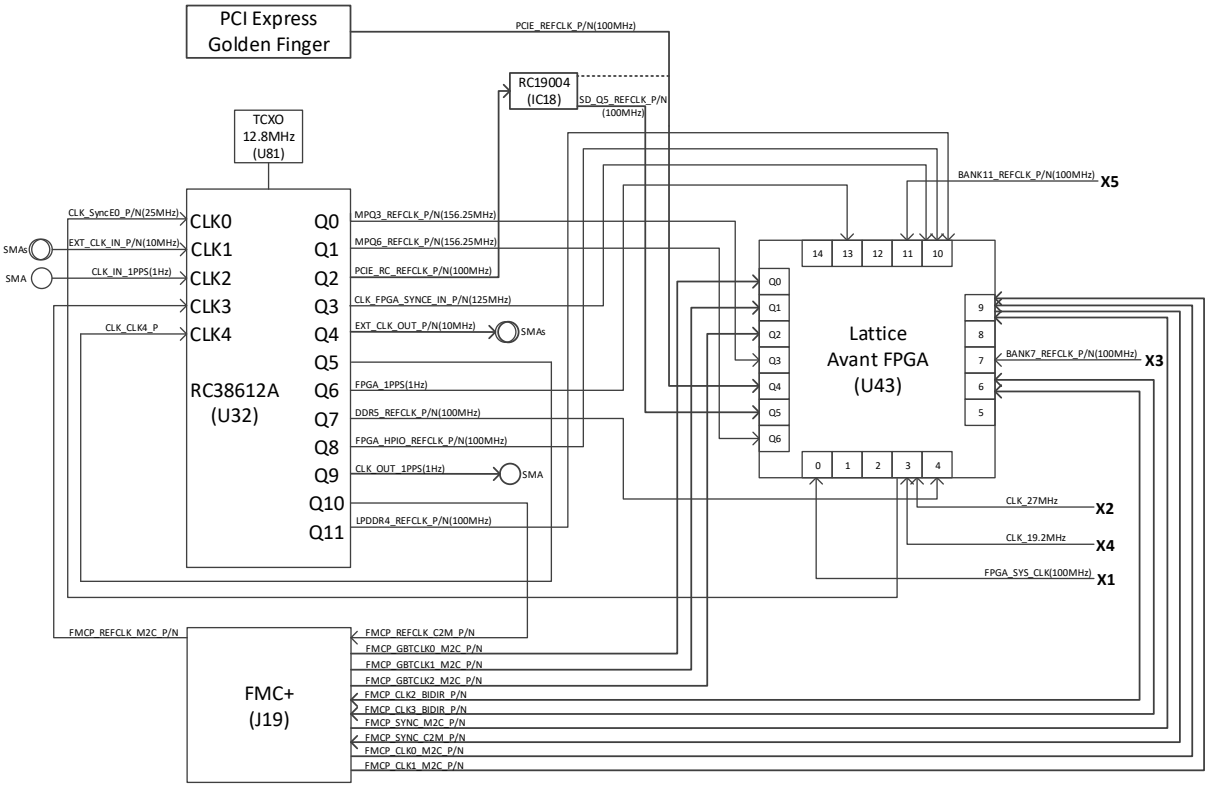

Figure 5.1. Clock Distribution

The Avant-G/X Versa Board clocks are generated from local oscillators and RC38612A.

The RC38612A device is a programmable multi-channel clock synchronizer. It is configurable with an I2C interface at address 7'b1011000. The Renesas GUI and Timing Commander Personality (TCP) file can be used to configure the RC38612A, and they are downloadable from the Renesas website. Jumpers JP10, JP11, and JP12 are used to establish I2C communication between FTDI and RC38612A. The highly stable 12.8 MHz TCXO is used as the clock source for the RC38612A.

The following lists the features of RC38612A:

- Six independent timing channels
- Twelve differential/24 LVCMOS outputs
  - Any frequency from 0.5 Hz to 1 GHz (250 MHz for LVCMOS)
  - Jitter below 150 fs RMS (10 kHz to 20 MHz)
- Five differential/ten single-ended clock inputs
  - Supports any frequency from 0.5 Hz to 1 GHz
  - Any input can be designated as external frame/sync pulse of EPPS (Even Pulse per Second), 1 PPS (Pulse per Second), 5 PPS, 10 PPS, 50 Hz, 100 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz associated with a selectable reference clock input.
- Automatic reference selection state machines select the active reference for each DPLL based on the reference monitors, priority tables, revertive/non-revertive, and other programmable settings.
- DPLLs can be configured as DCOs to synthesize Precision Time Protocol (PTP)/IEEE 1588 clocks.

Table 5.1. Clock Connection to Avant-AT-G/X FPGA

Frequency	Net Name	Avant FPGA Ball Location	Clock Source	I/O Standard
Fixed Clocks				
100 MHz	FPGA_SYS_CLK	T7	X1	LVCMOS33
27 MHz	CLK_27MHz	AB7	X2	LVCMOS18
19.2 MHz	CLK_19.2MHz	AB1	X4	LVCMOS18
100 MHz	BANK7_REFCLK_P/N	AP21/AN21	X3	HCSL
100 MHz	BANK11_REFCLK_P/N	U33/U32	X5	HCSL
Programmable Frequency Clocks				
156.25 MHz (Default)	MPQ3_REFCLK_P/N	J21/J20	U32 Q0	Diff AC couple
156.25 MHz (Default)	MPQ6_REFCLK_P/N	L5/K5	U32 Q1	Diff AC couple
100 MHz (Default)	SD_Q5_REFCLK_P/N	J8/J9	IC18	HCSL
125 MHz (Default)	CLK_FPGA_SYNCE_IN_P/N	AD26/AE26	U32 Q3	Diff AC couple
1Hz (Default)	FPGA_1PPS	U15	U32 Q6	LVCMOS33
100 MHz (Default)	DDR5_REFCLK_P/N	AL2/AM2	U32 Q7	Diff AC couple
100 MHz (Default)	FPGA_HPIO_REFCLK_P/N	AA34/AA33	U32 Q8	Diff AC couple
100 MHz (Default)	LPDDR4_REFCLK_P/N	AD32/AD31	U32 Q11	Diff AC couple

5.2. Off-Board Clock I/O

The Avant-G/X Versa Board has input and output clocks that can be driven onto the board. The output clocks can be programmed to different I/O standards according to the RC38612A device specification.

These input and output clocks are connected to SMA connectors.

Table 5.2. Off-Board Clock Input

Frequency	Net Name	Clock Source	I/O Standard
10 MHz (Default)	EXT_CLK_IN_P/N	J12/J13	Diff AC couple
1 Hz (Default)	CLK_IN_1PPS	J15	LVCMOS33

Table 5.3. Off-Board Clock Output

Frequency	Net Name	Clock Source	I/O Standard
10 MHz (Default)	EXT_CLK_OUT_P/N	U32 Q4	Diff AC couple
1 Hz (Default)	CLK_OUT_1PPS	U32 Q9	LVCMOS33

6. Memory

This section describes the Avant-G/X Versa Board external memory interface support and their signal names, types, and connectivity related to the Lattice Avant-AT-G/X devices.

The Avant-G/X Versa Board supports the following memory interfaces:

- LPDDR4 ×32
- DDR5 ×72 SODIMM
- SPI Flash ×1/×8

6.1. LPDDR4

Table 6.1. LPDDR4 Connections

Signal Name	Avant Bank	Avant Ball	Comments
BANK10_EXT_RES	10	AE27	240 Ω pull up to 1.1 V
BANK11_EXT_RES	11	U26	
LPDDR4_REFCLK_P	10	AD32	100 MHz reference clock
LPDDR4_REFCLK_N	10	AD31	
LPDDR4_CK_A_P	10	AB25	LPDDR4 clock
LPDDR4_CK_A_N	10	AC25	LPDDR4 clock
LPDDR4_RESET_N	10	AF34	LPDDR4 reset
LPDDR4_CA0	10	AC26	LPDDR4 command/address inputs
LPDDR4_CA1	10	AB27	
LPDDR4_CA2	10	AB28	
LPDDR4_CA3	10	AC29	
LPDDR4_CA4	10	AB29	
LPDDR4_CA5	10	AD27	
LPDDR4_CKE0	10	AB26	LPDDR4 clock enable
LPDDR4_CS0	10	AA31	LPDDR4 Chip select
LPDDR4_LDQS_A_P	10	AC23	LPDDR4 Channel A data strobe
LPDDR4_LDQS_A_N	10	AD23	
LPDDR4_UDQS_A_P	10	AC34	
LPDDR4_UDQS_A_N	10	AC33	
LPDDR4_LDM_A	10	AC21	LPDDR4 Channel A data mask/data bus inversion
LPDDR4_UDM_A	10	AF33	
LPDDR4_DQ0_A	10	AD22	LPDDR4 Channel A data input/output
LPDDR4_DQ1_A	10	AD21	
LPDDR4_DQ2_A	10	AE25	
LPDDR4_DQ3_A	10	AE24	
LPDDR4_DQ4_A	10	AA21	
LPDDR4_DQ5_A	10	Y21	
LPDDR4_DQ6_A	10	AB24	
LPDDR4_DQ7_A	10	AC24	
LPDDR4_DQ8_A	10	AD34	
LPDDR4_DQ9_A	10	AD33	
LPDDR4_DQ10_A	10	AE32	
LPDDR4_DQ11_A	10	AE31	
LPDDR4_DQ12_A	10	AE33	
LPDDR4_DQ13_A	10	AE34	
LPDDR4_DQ14_A	10	AB34	
LPDDR4_DQ15_A	10	AB33	

Signal Name	Avant Bank	Avant Ball	Comments
LPDDR4_LDQS_B_P	11	Y29	LPDDR4 Channel B data strobe
LPDDR4_LDQS_B_N	11	W29	
LPDDR4_UDQS_B_P	11	W23	
LPDDR4_UDQS_B_N	11	W24	
LPDDR4_LDM_B	11	V32	LPDDR4 Channel B data mask/data bus inversion
LPDDR4_UDM_B	11	V22	
LPDDR4_DQ0_B	11	U29	LPDDR4 Channel B data input/output
LPDDR4_DQ1_B	11	V29	
LPDDR4_DQ2_B	11	U30	
LPDDR4_DQ3_B	11	U31	
LPDDR4_DQ4_B	11	Y28	
LPDDR4_DQ5_B	11	AA28	
LPDDR4_DQ6_B	11	V30	
LPDDR4_DQ7_B	11	W30	
LPDDR4_DQ8_B	11	AA24	
LPDDR4_DQ9_B	11	Y24	
LPDDR4_DQ10_B	11	U23	
LPDDR4_DQ11_B	11	U22	
LPDDR4_DQ12_B	11	U25	
LPDDR4_DQ13_B	11	T25	
LPDDR4_DQ14_B	11	U24	
LPDDR4_DQ15_B	11	T24	

6.2. DDR5 SODIMM

The Avant-G/X Versa Board provides a DDR5 SODIMM connector. The DDR5 SODIMM meets the JESD309 standard.

Table 6.2. DDR5 Connections

Signal Name	Avant Bank	Avant Ball	Comments
BANK4_EXT_RES	4	AG5	240 Ω pull up to 1.1 V
BANK5_EXT_RES	5	AE13	
BANK7_EXT_RES	7	AF17	
BANK8_EXT_RES	8	AF23	
DDR5_REFCLK_P	4	AL2	100 MHz reference clock
DDR5_REFCLK_N	4	AM2	
DIMM_PWR_EN	4	AF10	DDR5 SODIMM PMIC enable
DIMM_PWR_GOOD	4	AM4	DDR5 SODIMM Power good indicator
DDR5_HSCL	5	AP5	DDR5 SODIMM SidebandBus clock
DDR5_HSDA	5	AP6	DDR5 SODIMM SidebandBus data
DDR5_RST_N	4	AJ1	DDR5 SODIMM reset signal
DDR5_ALERT_N	4	AE1	DDR5 SODIMM ALERT_n
DDR5_CK0A_P	4	AE11	DDR5 Channel A clocks
DDR5_CK0A_N	4	AF11	
DDR5_CK1A_P	4	AH6	
DDR5_CK1A_N	4	AH5	
DDR5_CS0A	4	AN4	DDR5 Channel A chip select
DDR5_CS1A	4	AL4	
DDR5_CA0A	4	AE10	DDR5 Channel A command/address bus

Signal Name	Avant Bank	Avant Ball	Comments
DDR5_CA1A	4	AF9	
DDR5_CA2A	4	AE9	
DDR5_CA3A	4	AG7	
DDR5_CA4A	4	AG8	
DDR5_CA5A	4	AE7	
DDR5_CA6A	4	AF7	
DDR5_CA7A	4	AF6	
DDR5_CA8A	4	AE6	
DDR5_CA9A	4	AP4	
DDR5_CA10A	4	AM3	
DDR5_CA11A	4	AN3	
DDR5_CA12A	4	AP2	
DDR5_DQS0A_P	4	AF3	DDR5 Channel A data strobes
DDR5_DQS0A_N	4	AE3	
DDR5_DQS1A_P	4	AJ2	
DDR5_DQS1A_N	4	AK2	
DDR5_DQS2A_P	5	AM8	
DDR5_DQS2A_N	5	AM9	
DDR5_DQS3A_P	5	AH9	
DDR5_DQS3A_N	5	AG9	
DDR5_DQS4A_P	5	AC15	
DDR5_DQS4A_N	5	AC14	
DDR5_DM0A	4	AF1	DDR5 Channel A data masks
DDR5_DM1A	4	AH1	
DDR5_DM2A	5	AN7	
DDR5_DM3A	5	AF12	
DDR5_DQ0A	4	AF2	DDR5 Channel A memory data bus
DDR5_DQ1A	4	AE2	
DDR5_DQ2A	4	AF5	
DDR5_DQ3A	4	AE5	
DDR5_DQ4A	4	AG2	
DDR5_DQ5A	4	AG1	
DDR5_DQ6A	4	AF4	
DDR5_DQ7A	4	AE4	
DDR5_DQ8A	4	AH3	
DDR5_DQ9A	4	AH4	
DDR5_DQ10A	4	AM1	
DDR5_DQ11A	4	AN1	
DDR5_DQ12A	4	AJ3	
DDR5_DQ13A	4	AH2	
DDR5_DQ14A	4	AK1	
DDR5_DQ15A	4	AL1	
DDR5_DQ16A	5	AL8	
DDR5_DQ17A	5	AL9	
DDR5_DQ18A	5	AP9	
DDR5_DQ19A	5	AP8	
DDR5_DQ20A	5	AK9	
DDR5_DQ21A	5	AK8	

Signal Name	Avant Bank	Avant Ball	Comments
DDR5_DQ22A	5	AN9	
DDR5_DQ23A	5	AN8	
DDR5_DQ24A	5	AH10	
DDR5_DQ25A	5	AJ10	
DDR5_DQ26A	5	AH7	
DDR5_DQ27A	5	AH8	
DDR5_DQ28A	5	AK10	
DDR5_DQ29A	5	AK11	
DDR5_DQ30A	5	AG10	
DDR5_DQ31A	5	AG11	
DDR5_CB0A	5	AB14	DDR5 Channel A ECC check bits
DDR5_CB1A	5	AB15	
DDR5_CB2A	5	AG12	
DDR5_CB3A	5	AG13	
DDR5_CK0B_P	7	AB18	DDR5 Channel B clocks
DDR5_CK0B_N	7	AA18	
DDR5_CK1B_P	7	AK21	
DDR5_CK1B_N	7	AK22	
DDR5_CS0B	7	AL20	DDR5 Channel B Chip Select
DDR5_CS1B	7	AL21	
DDR5_CA0B	7	Y18	DDR5 Channel B Command/Address bus
DDR5_CA1B	7	AD17	
DDR5_CA2B	7	AE17	
DDR5_CA3B	7	AE18	
DDR5_CA4B	7	AE19	
DDR5_CA5B	7	AF19	
DDR5_CA6B	7	AF20	
DDR5_CA7B	7	AG20	
DDR5_CA8B	7	AH20	
DDR5_CA9B	7	AM20	
DDR5_CA10B	7	AN23	
DDR5_CA11B	7	AP23	
DDR5_CA12B	7	AP22	
DDR5_DQS0B_P	7	AJ22	DDR5 Channel B data strobes
DDR5_DQS0B_N	7	AJ21	
DDR5_DQS1B_P	7	AM18	
DDR5_DQS1B_N	7	AL18	
DDR5_DQS2B_P	8	AK28	
DDR5_DQS2B_N	8	AK27	
DDR5_DQS3B_P	8	AF21	
DDR5_DQS3B_N	8	AG21	
DDR5_DQS4B_P	8	AB19	
DDR5_DQS4B_N	8	AA19	
DDR5_DM0B	7	AJ18	DDR5 Channel B data masks
DDR5_DM1B	7	AP17	
DDR5_DM2B	8	AN28	
DDR5_DM3B	8	AK24	
DDR5_DQ0B	7	AJ20	DDR5 Channel B memory data bus

Signal Name	Avant Bank	Avant Ball	Comments
DDR5_DQ1B	7	AK20	
DDR5_DQ2B	7	AH22	
DDR5_DQ3B	7	AH21	
DDR5_DQ4B	7	AJ19	
DDR5_DQ5B	7	AK19	
DDR5_DQ6B	7	AG18	
DDR5_DQ7B	7	AH18	
DDR5_DQ8B	7	AP18	
DDR5_DQ9B	7	AN18	
DDR5_DQ10B	7	AP20	
DDR5_DQ11B	7	AN20	
DDR5_DQ12B	7	AL17	
DDR5_DQ13B	7	AM17	
DDR5_DQ14B	7	AP19	
DDR5_DQ15B	7	AN19	
DDR5_DQ16B	8	AL26	
DDR5_DQ17B	8	AK26	
DDR5_DQ18B	8	AL29	
DDR5_DQ19B	8	AM29	
DDR5_DQ20B	8	AK25	
DDR5_DQ21B	8	AL25	
DDR5_DQ22B	8	AL27	
DDR5_DQ23B	8	AL28	
DDR5_DQ24B	8	AG23	
DDR5_DQ25B	8	AG24	
DDR5_DQ26B	8	AJ23	
DDR5_DQ27B	8	AH23	
DDR5_DQ28B	8	AG25	
DDR5_DQ29B	8	AF25	
DDR5_DQ30B	8	AH24	
DDR5_DQ31B	8	AH25	
DDR5_CB0B	8	Y20	DDR5 Channel B ECC check bits
DDR5_CB1B	8	AA20	
DDR5_CB2B	8	AE20	
DDR5_CB3B	8	AE21	

6.3. SPI Flash

The Avant-G/X Versa Board supports a 512 Mb SPI flash device for non-volatile storage of FPGA configuration data, board information, test application data, and user code space. The part number of the flash is MT35XU512ABA1G12-0AUT from Micron.

Table 6.3. MSPI Bus Connections

Signal Name	Avant Bank	Avant Ball	Comments
OSPI_Flash_RSTn	N/A	N/A	RESET: Resets device to its default settings.
MSPI_CSN	1	P7	Chip select: When S# is LOW, device is selected and in active power mode.
MSPI_CLK	1	P9	Clock: Provides timing for the serial interface.
MSPI_MDS	1	N7	Data strobe: Indicates output data valid for DDR modes and is required to support high-speed data output.
MSPI_DQ0	1	L12	Bidirectional signals that transfer address, data, and command information. In extended-SPI protocol, DQ0 functions as input and DQ1 as output. DQ[7:2] are not used.
MSPI_DQ1	1	L11	
MSPI_DQ2	1	L10	
MSPI_DQ3	1	L9	
MSPI_DQ4	1	L7	
MSPI_DQ5	1	L8	
MSPI_DQ6	1	M8	
MSPI_DQ7	1	M9	

Note: Avant-G70/X70 devices of production release provide a dedicated MSPI Flash Reset output on the P10 pin (MRSTN). For new designs, connect Avant-G70/X70 MRSTN (P10) to the SPI flash RESETn input rather than connecting INITN to the flash RESETn.

7. Control Buses – I2C, UART

This section describes the topology of the various configuration and communication buses.

7.1. I2C Topology

The Avant-G/X Versa Board has six sets of I2C buses (Figure 7.1). One I2C bus is through the output port A of the FTDI chip (Table 7.1).

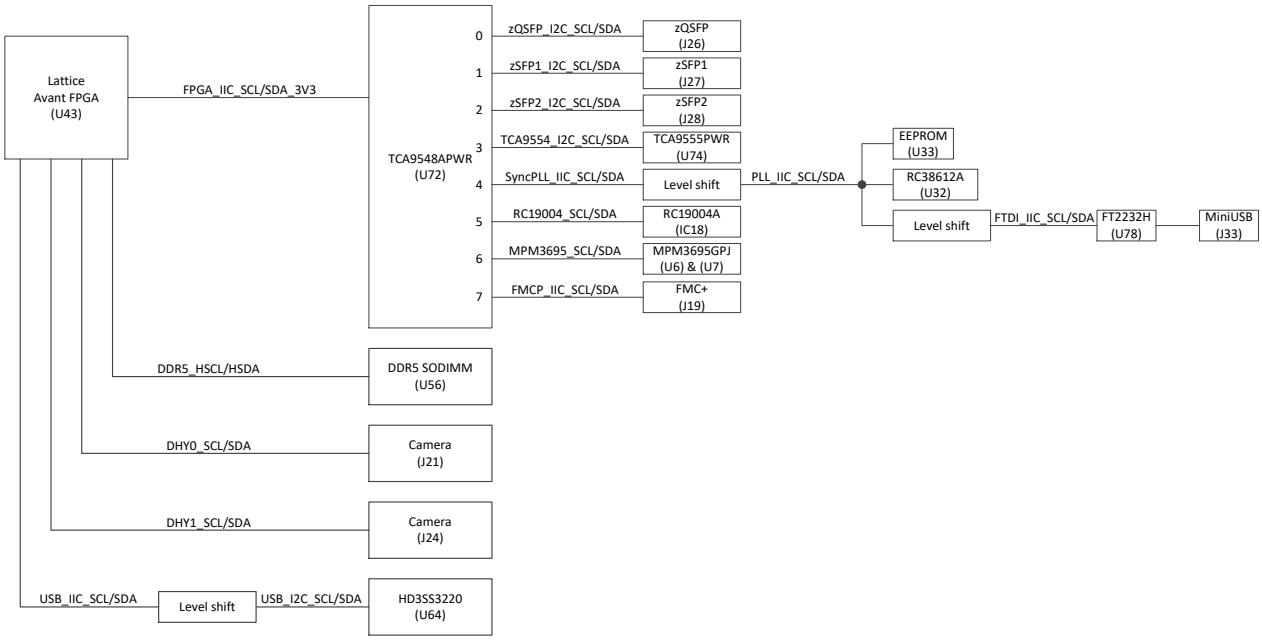

Figure 7.1. I2C Block Diagram

Table 7.1. I2C Bus Connections

Signal Name	Avant Bank	Avant Ball Location	I2C Address	Comments
FPGA_IIC_SCL_3V3	0	W4	0x70	Connect to TCA9548APWR to extend multi-channel I2C.
FPGA_IIC_SDA_3V3	0	U7		
DDR5_HSCL	5	AP5	0x50	Used as DDR5 SODIMM I2C or I3C interface.
DDR5_HSDA	5	AP6		
DPHY0_SCL	3	Y1	Camera Address	Connect to camera 0.
DPHY0_SDA	3	AA1		
DPHY1_SCL	3	Y5	Camera Address	Connect to camera 1.
DPHY1_SDA	3	AA5		
USB_IIC_SCL	3	AC6	0x67	Connect to USB Type-C DRP Port Controller HD3SS3220.
USB_IIC_SDA	3	AB4		

Table 7.2. TCA9548APWR Channel Definition

Signal Name	TCA9548APWR Channel	Device	I2C Address
zQSFP_I2C_SCL/SDA	Channel0	QSFP+/QSFP28 Optical Transceiver	0x50
zSFP1_I2C_SCL/SDA	Channel1	SFP+/SFP28 Optical Transceiver	0x50 and 0x51
zSFP2_I2C_SCL/SDA	Channel2	SFP+/SFP28 Optical Transceiver	0x50 and 0x51
TCA9554_I2C_SCL/SDA	Channel3	TCA9555PWR	0x20
SyncPLL_IIC_SCL/SDA	Channel4	RC38612A	0x58
RC19004_SCL/SDA	Channel5	RC19004A	0x62
MPM3695_SCL/SDA	Channel6	MPM3695GPJ-20	0x30
FMCP_IIC_SCL/SDA	Channel7	FMC+ Module	0x50 (EEPROM)

Table 7.3. TCA9555PWR I/O Definition

Signal Name	TCA9555APWR Channel	Direction	Comments
zQSFP_MODSEL_B	P00	Output	Module Select 0: QSFP+/QSFP28 module responds to two-wire serial communication commands. 1: QSFP+/QSFP28 module does not respond to two-wire serial communication commands.
zQSFP_MODPRS_B	P01	Input	Module Present 0: QSFP+/QSFP28 module is inserted. 1: QSFP+/QSFP28 module is physically absent.
zQSFP_RESET_B	P02	Output	QSFP+/QSFP28 module reset 0: Reset QSFP+/QSFP28 module. 1: Release QSFP+/QSFP28 module reset.
zQSFP_LPMODE	P03	Output	QSFP+/QSFP28 Low power mode 0: Normal mode. 1: Low power mode (< 1.5 W).
SFP1_LOSn	P04	Input	SFP1 Receiver Loss of Signal 0: Normal operation. 1: Loss of signal.
SFP1_PRSTn	P05	Input	SFP1 Module Present 0: Module is inserted. 1: Module is physically absent.
SFP1_TX_FAULT	P06	Input	SFP1 Transmitter Fault 0: Normal operation. 1: Module transmitter fault.
SFP1_TX_DIS	P07	Output	SFP1 Transmitter Disable 0: Normal operation. 1: Transmitter disable.
SFP2_LOSn	P10	Input	SFP2 Receiver Loss of Signal 0: Normal operation. 1: Loss of signal.
SFP2_PRSTn	P11	Input	SFP2 Module Present 0: Module is inserted. 1: Module is physically absent.
SFP2_TX_FAULT	P12	Output	SFP2 Transmitter Fault 0: Normal operation. 1: Module transmitter fault.
SFP2_TX_DIS	P13	Output	SFP2 Transmitter Disable 0: Normal operation. 1: Transmitter disable.

Signal Name	TCA9555APWR Channel	Direction	Comments
SFP1_RS0	P14	Output	Receiver Bandwidths Select 0: Reduced bandwidth. 1: Full bandwidth.
SFP1_RS1	P15	Output	
SFP2_RS0	P16	Output	Receiver Bandwidths Select 0: Reduced bandwidth. 1: Full bandwidth.
SFP2_RS1	P17	Output	

7.2. UART Topology

The Avant-G/X Versa Board provides one UART communication interface by establishing a flexible connection between the Avant-AT-G/X device and FTDI chip. A voltage-level translator TXB0102DCUT is used to convert 3.3 V I/O to 1.8 V I/O.

Close the two jumpers, JP13 and JP14, to connect to two general-purpose I/O in Bank 9, as shown in Table 7.4. This UART connection is shared with the I2C bus connection on the FTDI device.

Table 7.4. UART Bus Connections

Signal Name	Direction	Avant Bank	Avant Ball Location	FTDI Chip Ball Location	Jumper
FPGA_UART_TXD	Input	9	AJ28	16	JP13
FPGA_UART_RXD	Output	9	AJ29	17	JP14

8. LEDs, Switches, and Segment Displays

This section describes the Avant-G/X Versa Board LEDs, switches, and segment displays that can be used in the demonstration design and customer designs.

8.1. DIP Switch

Four Avant-AT-G/X FPGA pins are connected to the DIP switch (SW3) to allow manual actuating input to the FPGA. One side of each switch is connected to GPIOs within Bank 10 and is pulled down through 10 kΩ resistors. The other side is pulled up through 1 kΩ resistors. The designated pins are connected as shown in Table 8.1, pulled down by default.

Table 8.1. DIP Switch Signals

Signal Name	Avant Ball Location	Avant Bank
DIP_SW_1	AE29	10
DIP_SW_2	AE30	10
DIP_SW_3	AC27	10
DIP_SW_4	AA32	10

8.2. General Purpose Push Buttons

The Avant-G/X Versa Board provides eight push button switches for demo and user applications. Four of the buttons are pre-defined functional pins, and the other four are generic pins. Pressing these buttons drives a logic level 0 to the corresponding I/O pins. The designated pins are connected as shown in Table 8.2.

Table 8.2. Push Button Switch Signals

Signal Name	Avant Bank	Avant Ball Location	Push Button Reference	Logic Level at Button Pressed	Comments
PROGRAMN	2	P2	SW8	0	Re-initiate configuration sequence when SW8 pressed.
FPGA_INITN	2	T5	SW9	0	You can keep SW9 pressed to delay configuration download to start.
DIP_SWITCH1	13	V16	SW12	0	General purpose
DIP_SWITCH2	13	V15	SW13	0	General purpose
DIP_SWITCH3	13	T13	SW14	0	General purpose
DIP_SWITCH4	13	R13	SW15	0	General purpose
FPGA_SYS_RSTn	2	U3	SW10	0	Reserved for FPGA global hardware reset control.
PLL_nRESET	—	—	SW6	0	Reserved for RC38612A hardware manual reset.

For more information on PROGRAMN and FPGA_INITN, refer to the Lattice Avant sysCONFIG User Guide (FPGA-TN-02299). SW12, SW13, SW14, and SW15 can be used as generic input.

8.3. Status LED and General Purpose LEDs

The Avant-G/X Versa Board provides seven LEDs, five of which are connected to I/O within Bank 2 and Bank 6. The LEDs are either green or red, as shown in Table 8.3 and Table 8.4.

Table 8.3. Status LED Signals

Signal Name	Avant Ball Location	Avant Bank	LED	Color	Comments
PLL_LOCK	—	—	D43	Green	RC38612A PLL lock status indication
CLKIN_LOSn	—	—	D5	Red	RC19004A CLKIN_LOSn status indication
FPGA_INITN	T5	2	D6	Red	FPGA INITN status indication
FPGA_DONE	U4	2	D7	Green	FPGA DONE status indication

Table 8.4. General Purpose LED Signals

Signal Name	Avant Ball Location	Avant Bank	LED	Color	Comments
QSFP_LINK_LED	AN10	6	D45	Green	QSFP+/QSFP28 link status indication. Can also be used as general purpose LED.
zSFP1_LINK_LED	AJ13	6	D47	Green	SFP+/SFP28 link status indication. Can also be used as general purpose LED.
zSFP2_LINK_LED	AH13	6	D46	Green	SFP+/SFP28 link status indication. Can also be used as general purpose LED.

8.4. Segment Displays

The Avant-G/X Versa Board provides a three-character, seven-segment LED display (D8) that is connected to I/O within Bank 13. The designated pins are connected as shown in Table 8.5.

Table 8.5. Segment Display

Signal Name	Avant Ball Location	Avant Bank	Segment Display
SEG_A	T18	13	A
SEG_B	T19	13	B
SEG_C	T15	13	C
SEG_D	U16	13	D
SEG_E	U17	13	E
SEG_F	W14	13	F
SEG_G	V14	13	G
SEG_DP	R15	13	DP
F_K_DIG1	R19	13	K_DIG1
F_K_DIG2	R18	13	K_DIG2
F_K_DIG3	R14	13	K_DIG3

9. Headers/Connectors and Avant Device Ball Mapping

This section describes the Avant-G/X Versa Board headers/connectors and ball mapping.

9.1. FMC+ Connector

The Avant-G/X Versa Board includes an FPGA Mezzanine Card Plus (FMC+) connector that provides ×12 SerDes and ×34 LVDS (or ×68 single-ended signals). The VCCIO supply for the FMC+ banks in the low pin count (LPC) provides a variable voltage of 1.2 V, 1.35 V, 1.5 V, and 1.8 V (default).

Table 9.1. FPGA Mezzanine Card Plus Pin Connections

J19 Pin Name	Signal Name	Avant Bank	Avant Ball Location
Y10	FMCP_DP10_M2C_P	SerDes Q2	A23
Y11	FMCP_DP10_M2C_N	SerDes Q2	A24
Y26	FMCP_DP11_C2M_P	SerDes Q2	G23
Y27	FMCP_DP11_C2M_N	SerDes Q2	G24
Z1	FMCP_PRSNT_L	0	V4
Z12	FMCP_DP11_M2C_P	SerDes Q2	C23
Z13	FMCP_DP11_M2C_N	SerDes Q2	C24
Z24	FMCP_DP10_C2M_P	SerDes Q2	E23
Z25	FMCP_DP10_C2M_N	SerDes Q2	E24
A2	FMCP_DP1_M2C_P	SerDes Q0	P32
A3	FMCP_DP1_M2C_N	SerDes Q0	R32
A6	FMCP_DP2_M2C_P	SerDes Q0	L34
A7	FMCP_DP2_M2C_N	SerDes Q0	M34
A10	FMCP_DP3_M2C_P	SerDes Q0	L32
A11	FMCP_DP3_M2C_N	SerDes Q0	M32
A14	FMCP_DP4_M2C_P	SerDes Q1	A32
A15	FMCP_DP4_M2C_N	SerDes Q1	A33
A18	FMCP_DP5_M2C_P	SerDes Q1	C32
A19	FMCP_DP5_M2C_N	SerDes Q1	C33
A22	FMCP_DP1_C2M_P	SerDes Q0	P28
A23	FMCP_DP1_C2M_N	SerDes Q0	R28
A26	FMCP_DP2_C2M_P	SerDes Q0	L30
A27	FMCP_DP2_C2M_N	SerDes Q0	M30
A30	FMCP_DP3_C2M_P	SerDes Q0	L28
A31	FMCP_DP3_C2M_N	SerDes Q0	M28
A34	FMCP_DP4_C2M_P	SerDes Q1	E32
A35	FMCP_DP4_C2M_N	SerDes Q1	E33
A38	FMCP_DP5_C2M_P	SerDes Q1	G32
A39	FMCP_DP5_C2M_N	SerDes Q1	G33
B1	FMCP_CLK_DIR	6	AN11
B4	FMCP_DP9_M2C_P	SerDes Q2	C26
B5	FMCP_DP9_M2C_N	SerDes Q2	C27
B8	FMCP_DP8_M2C_P	SerDes Q2	A26
B9	FMCP_DP8_M2C_N	SerDes Q2	A27
B12	FMCP_DP7_M2C_P	SerDes Q1	C29
B13	FMCP_DP7_M2C_N	SerDes Q1	C30
B16	FMCP_DP6_M2C_P	SerDes Q1	A29
B17	FMCP_DP6_M2C_N	SerDes Q1	A30

J19 Pin Name	Signal Name	Avant Bank	Avant Ball Location
B20	FMCP_GBTCLK1_M2C_P	SerDes Q1	J32
B21	FMCP_GBTCLK1_M2C_N	SerDes Q1	J33
B24	FMCP_DP9_C2M_P	SerDes Q2	G26
B25	FMCP_DP9_C2M_N	SerDes Q2	G27
B28	FMCP_DP8_C2M_P	SerDes Q2	E26
B29	FMCP_DP8_C2M_N	SerDes Q2	E27
B32	FMCP_DP7_C2M_P	SerDes Q1	G29
B33	FMCP_DP7_C2M_N	SerDes Q1	G30
B36	FMCP_DP6_C2M_P	SerDes Q1	E29
B37	FMCP_DP6_C2M_N	SerDes Q1	E30
C2	FMCP_DP0_C2M_P	SerDes Q0	P30
C3	FMCP_DP0_C2M_N	SerDes Q0	R30
C6	FMCP_DP0_M2C_P	SerDes Q0	P34
C7	FMCP_DP0_M2C_N	SerDes Q0	R34
C10	FMCP_LA06_P	6	AM14
C11	FMCP_LA06_N	6	AL14
C14	FMCP_LA10_P	6	AF15
C15	FMCP_LA10_N	6	AF16
C18	FMCP_LA14_P	6	AH17
C19	FMCP_LA14_N	6	AG17
C22	FMCP_LA18_CC_P	9	AG33
C23	FMCP_LA18_CC_N	9	AH33
C26	FMCP_LA27_P	9	AJ31
C27	FMCP_LA27_N	9	AJ32
C30	FMCP_IIC_SCL	—	—
C31	FMCP_IIC_SDA	—	—
C34	FMCP_GA0	—	—
D1	FMCP_C2M_PG	0	V1
D4	FMCP_GBTCLK0_M2C_P	SerDes Q0	P26
D5	FMCP_GBTCLK0_M2C_N	SerDes Q0	N26
D8	FMCP_LA01_CC_P	6	AE15
D9	FMCP_LA01_CC_N	6	AD15
D11	FMCP_LA05_P	6	AN14
D12	FMCP_LA05_N	6	AP14
D14	FMCP_LA09_P	6	AK14
D15	FMCP_LA09_N	6	AK15
D17	FMCP_LA13_P	6	AC17
D18	FMCP_LA13_N	6	AC16
D20	FMCP_LA17_CC_P	9	AM30
D21	FMCP_LA17_CC_N	9	AL30
D23	FMCP_LA23_P	9	AH30
D24	FMCP_LA23_N	9	AJ30
D26	FMCP_LA26_P	9	AK31
D27	FMCP_LA26_N	9	AK32
D29	FMCP_TCK	0	V2
D30	FMCP_TDI	0	T6
D31	FMCP_TDO	0	W2
D33	FMCP_TMS	0	U6

J19 Pin Name	Signal Name	Avant Bank	Avant Ball Location
D34	FMCP_TRST_L	—	—
D35	FMCP_GA1	—	—
F1	FMCP_M2C_PG	0	W1
G2	FMCP_CLK1_M2C_P	9	AJ27
G3	FMCP_CLK1_M2C_N	9	AJ26
G6	FMCP_LA00_CC_P	6	AH16
G7	FMCP_LA00_CC_N	6	AG16
G9	FMCP_LA03_P	6	AP12
G10	FMCP_LA03_N	6	AN12
G12	FMCP_LA08_P	6	AK13
G13	FMCP_LA08_N	6	AK12
G15	FMCP_LA12_P	6	AL16
G16	FMCP_LA12_N	6	AM16
G18	FMCP_LA16_P	6	AG15
G19	FMCP_LA16_N	6	AH15
G21	FMCP_LA20_P	9	AK29
G22	FMCP_LA20_N	9	AK30
G24	FMCP_LA22_P	9	AL33
G25	FMCP_LA22_N	9	AL34
G27	FMCP_LA25_P	9	AJ34
G28	FMCP_LA25_N	9	AJ33
G30	FMCP_LA29_P	9	AG32
G31	FMCP_LA29_N	9	AF32
G33	FMCP_LA31_P	9	AF30
G34	FMCP_LA31_N	9	AG30
G36	FMCP_LA33_P	9	AG27
G37	FMCP_LA33_N	9	AG28
H1	FMCP_VREFA	9/6	AF27/AJ16
H2	FMCP_PRSNT_L	0	V4
H4	FMCP_CLK0_M2C_P	9	AP30
H5	FMCP_CLK0_M2C_N	9	AN30
H7	FMCP_LA02_P	6	AP10
H8	FMCP_LA02_N	6	AP11
H10	FMCP_LA04_P	6	AP15
H11	FMCP_LA04_N	6	AN15
H13	FMCP_LA07_P	6	AP16
H14	FMCP_LA07_N	6	AN16
H16	FMCP_LA11_P	6	AK17
H17	FMCP_LA11_N	6	AJ17
H19	FMCP_LA15_P	6	AH14
H20	FMCP_LA15_N	6	AG14
H22	FMCP_LA19_P	9	AM33
H23	FMCP_LA19_N	9	AM34
H25	FMCP_LA21_P	9	AK33
H26	FMCP_LA21_N	9	AK34
H28	FMCP_LA24_P	9	AH34
H29	FMCP_LA24_N	9	AG34
H31	FMCP_LA28_P	9	AF31

J19 Pin Name	Signal Name	Avant Bank	Avant Ball Location
H32	FMCP_LA28_N	9	AG31
H34	FMCP_LA30_P	9	AH29
H35	FMCP_LA30_N	9	AG29
H37	FMCP_LA32_P	9	AF28
H38	FMCP_LA32_N	9	AF29
J2	FMCP_CLK3_BIDIR_P	6	AL10
J3	FMCP_CLK3_BIDIR_N	6	AL11
K1	FMCP_VREFB	—	—
K4	FMCP_CLK2_BIDIR_P	6	AN13
K5	FMCP_CLK2_BIDIR_N	6	AP13
L12	FMCP_GBTCLK2_M2C_P	SerDes Q2	J26
L13	FMCP_GBTCLK2_M2C_N	SerDes Q2	J27
L16	FMCP_SYNC_C2M_P	9	AM32
L17	FMCP_SYNC_C2M_N	9	AM31
L20	FMCP_REFCLK_C2M_P	—	—
L21	FMCP_REFCLK_C2M_N	—	—
L24	FMCP_REFCLK_M2C_P	—	—
L25	FMCP_REFCLK_M2C_N	—	—
L28	FMCP_SYNC_M2C_P	9	AN34
L29	FMCP_SYNC_M2C_N	9	AN33

9.2. Parallel FMC+ Configuration Header

Table 9.2. Parallel FMC+ Configuration Header Pin Connections

J20 Pin Name	Signal Name	Avant Bank	Avant Ball Location
1	FMCP_DC3V3	—	—
2	FMCP_DC3V3	—	—
3	FMCP_TCK	0	V2
4	FMCP_C2M_PG	0	V1
5	FMCP_M2C_PG	0	W1
6	FMCP_TRST_L	—	—
7	FMCP_TDI	0	T6
8	FMCP_PRSNT_L	0	V4
9	FMCP_TDO	0	W2
10	FMCP_IIC_SCL	—	—
11	GND	—	—
12	GND	—	—
13	FMCP_TMS	0	U6
14	FMCP_IIC_SDA	—	—

9.3. Raspberry Pi Board GPIO Header

The Avant-G/X Versa Board provides a 40-pin receptacle, which is compatible with the GPIO header of Raspberry Pi 2/3 series models, or can be used for general purpose I/O.

Table 9.3. Raspberry Pi Headers (JP5) Pin Connections

JP5 Pin Name	Signal Name	Avant Bank	Avant Ball Location
1	VCC_3V3[1]	—	—
2	VCC_5V0[1]	—	—
3	RASP_IO02	14	R12
4	VCC_5V0[1]	—	—
5	RASP_IO03	14	T12
6	GND	—	—
7	RASP_IO04	14	V13
8	RASP_IO14	14	R11
9	GND	—	—
10	RASP_IO15	14	W12
11	RASP_IO17	14	V12
12	RASP_IO18	14	W11
13	RASP_IO27	14	V11
14	GND	—	—
15	RASP_IO22	14	W10
16	RASP_IO23	14	V10
17	VCC_3V3[1]	—	—
18	RASP_IO24	14	W9
19	RASP_IO10	14	V9
20	GND	—	—
21	RASP_IO09	14	W8
22	RASP_IO25	14	V8
23	RASP_IO11	14	T11
24	RASP_IO08	14	T10
25	GND	—	—
26	RASP_IO07	2	U5
27	RASP_ID_SD	14	R10
28	RASP_ID_SC	14	T9
29	RASP_IO05	14	R9
30	GND	—	—
31	RASP_IO06	2	R6
32	RASP_IO12	2	R5
33	RASP_IO13	2	P6
34	GND	—	—
35	RASP_IO19	2	P5
36	RASP_IO16	2	P3
37	RASP_IO26	2	P4
38	RASP_IO20	2	N5
39	GND	—	—
40	RASP_IO21	2	N6

Note:

1. 3.3 V and 5 V provide the power to the Raspberry Pi board when JP3 and JP4 are installed. When JP3 and JP4 are not installed, Raspberry Pi needs its own 3.3 V and 5 V power.

When connecting directly to a Raspberry Pi board, depending on the individual setup, an adapter may be needed to avoid mechanical interference between the two boards. A generic 40-pin (2×20), 100-mil spacing header extender serves this function. Alternatively, the two boards can be connected by a length of ribbon cable with 2×20 connectors on either end.

9.4. PMOD Header

J16 and J17 headers can be used as GPIOs or as a connector for the PMOD interface. See Table 9.4 for more details.

Table 9.4. PMOD Header Pin Connections

Pin Name		Signal Name	Avant Bank	Avant Ball Location
J16	1	PMOD2_1	12	R17
	2	PMOD2_2	12	R16
	3	PMOD2_3	12	P13
	4	PMOD2_4	12	P14
	7	PMOD2_5	12	P20
	8	PMOD2_6	12	P19
	9	PMOD2_7	12	N20
	10	PMOD2_8	12	M20
J17	1	PMOD3_1	12	N19
	2	PMOD3_2	12	P18
	3	PMOD3_3	12	N16
	4	PMOD3_4	12	N15
	7	PMOD3_5	12	M19
	8	PMOD3_6	12	N17
	9	PMOD3_7	12	P15
	10	PMOD3_8	12	N14

9.5. CSI-2 Interface

The Avant-G/X Versa Board provides two 30-pin connectors J21 and J24 for connecting cameras. The part number of these connectors is 245804030000829+ from Kyocera. See Table 9.5 and Table 9.6 for more details.

Table 9.5. CSI-2 Connector J21 Pin Connections

Pin Name		Signal Name	Avant Bank	Avant Ball Location
J21	1	—	—	—
	2	DPHY0_CKN	11	W25
	3	DPHY0_CKP	11	V25
	4	GND	—	—
	5	DPHY0_DN3	11	Y26
	6	DPHY0_DP3	11	AA26
	7	GND	—	—
	8	DPHY0_DN1	11	U28
	9	DPHY0_DP1	11	V28
	10	GND	—	—
	11	DPHY0_DN0	11	Y27
	12	DPHY0_DP0	11	AA27
	13	GND	—	—
	14	DPHY0_DN2	11	V27
	15	DPHY0_DP2	11	U27
	16	GND	—	—

Pin Name		Signal Name	Avant Bank	Avant Ball Location
	17	GND	—	—
	18	VCC_CAM_2V8	—	—
	19	NC	—	—
	20	DPHY0_CLK	3	AA4
	21	DPHY0_FSYNC	3	Y4
	22	DPHY0_SDA	3	AA1
	23	DPHY0_SCL	3	Y1
	24	DPHY0_RST	3	AC10
	25	VDD_CAM_1	—	—
	26	VCC_CAM_1V8	—	—
	27	GND	—	—
	28	GND	—	—
	29	VCC_CAM_2V8	—	—
	30	GND	—	—

Table 9.6. CSI-2 Connector J24 Pin Connections

Pin Name		Signal Name	Avant Bank	Avant Ball Location
J24	1	NC	—	—
	2	DPHY1_CKN	11	AA29
	3	DPHY1_CKP	11	AA30
	4	GND	—	—
	5	DPHY1_DN3	11	Y30
	6	DPHY1_DP3	11	Y31
	7	GND	—	—
	8	DPHY1_DN1	11	W34
	9	DPHY1_DP1	11	Y34
	10	GND	—	—
	11	DPHY1_DN0	11	V34
	12	DPHY1_DP0	11	U34
	13	GND	—	—
	14	DPHY1_DN2	11	Y33
	15	DPHY1_DP2	11	Y32
	16	GND	—	—
	17	GND	—	—
	18	VCC_CAM_2V8	—	—
	19	NC	—	—
	20	DPHY1_CLK	3	AA8
	21	DPHY1_FSYNC	3	AA9
	22	DPHY1_SDA	3	AA5
	23	DPHY1_SCL	3	Y5
	24	DPHY1_RST	3	AA7
	25	VDD_CAM_2	—	—
	26	VCC_CAM_1V8	—	—
	27	GND	—	—
	28	GND	—	—
	29	VCC_CAM_2V8	—	—
	30	GND	—	—

9.6. USB 3.1 Gen1 Type-C Interface

A USB 3.1 Type-C interface (J25) is provided on the Avant-G/X Versa Board. The interface supports SuperSpeed up to 5 Gbps as well as the backward-compatible support for USB 2.0.

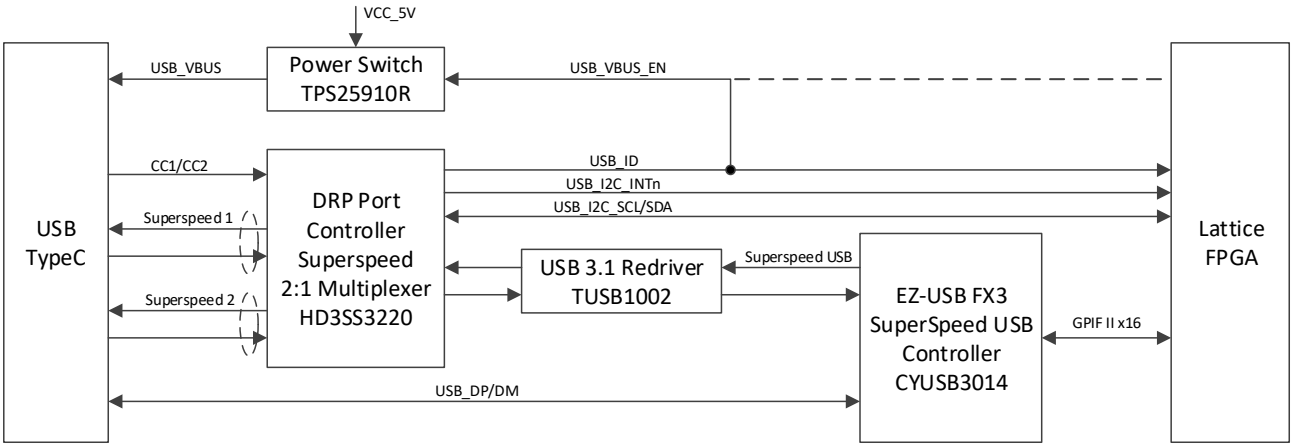

Figure 9.1. USB 3.1 Type-C Block Diagram

The Type-C connector provides any orientation insertion of the cable. To support this feature, a Texas Instruments (TI) DRP port controller and SuperSpeed 2:1 MUX HD3SS3220 are used.

Parameters of USB 3.1

- I2C address is 7'b110_0111 by default. It can be changed to 7'b100_0111 by installing R762 and removing R761
- Current Advertisement is 1.5 A.

To support the 5 Gbps SuperSpeed, a USB 3.1 Redriver TUSB1002 is used to condition the high-speed signal because of the degradation caused by the 2:1 mux. The equalization gain and VOD gain of TUSB1002 are set by resistors. The default settings are:

- EQ for channel 1: 1.9 dB
- EQ for channel 2: 1.9 dB
- VOD Gain: 0 for both channels with linear range of 1,200 mV.

The resistors are set in pull-down mode on the board. Other configurations are available by changing the pulling resistors. EQ configurations with pin level 1 are not available. The power of USB VBUS is controlled with a Texas Instruments power switch TPS25910. The voltage is 5 V and the maximum current is 1.5 A. The power control pin to the TPS25910 is connected to the USB_ID output of HD3SS3220.

USB 3.1 Gen1 is implemented with Cypress CYUSB3014 USB controller. It interfaces with the Avant-AT-G/X FPGA through the GPIF-II interface.

Table 9.7. CYUSB3014 Connections

Signal Name	Avant Ball Location	Avant Bank	I/O Standard
FX_USB3_CLK	AC8	3	1.8 V
FX_USB3_RSTn	AB13	3	1.8 V
FX_USB3_SLCSN	AD10	3	1.8 V
FX_USB3_SLWRN	Y3	3	1.8 V
FX_USB3_SLOEN	AD11	3	1.8 V
FX_USB3_SLRDN	AC12	3	1.8 V
FX_USB3_D0	AD8	3	1.8 V
FX_USB3_D1	AA2	3	1.8 V
FX_USB3_D2	AC5	3	1.8 V
FX_USB3_D3	AC4	3	1.8 V
FX_USB3_D4	AC1	3	1.8 V
FX_USB3_D5	AD9	3	1.8 V
FX_USB3_D6	AC2	3	1.8 V
FX_USB3_D7	AD2	3	1.8 V
FX_USB3_D8	AD1	3	1.8 V
FX_USB3_D9	AD4	3	1.8 V
FX_USB3_D10	AD3	3	1.8 V
FX_USB3_D11	AD7	3	1.8 V
FX_USB3_D12	AD5	3	1.8 V
FX_USB3_D13	AA3	3	1.8 V
FX_USB3_D14	AD6	3	1.8 V
FX_USB3_D15	AC3	3	1.8 V
FX_USB3_FLAGA	AC13	3	1.8 V
FX_USB3_FLAGB	Y10	3	1.8 V
FX_USB3_FLAGC	Y8	3	1.8 V
FX_USB3_FLAGD	AB12	3	1.8 V
FX_USB3_PKTENDN	AD12	3	1.8 V
FX_USB3_A1	Y9	3	1.8 V
FX_USB3_A0	Y11	3	1.8 V
FX_USB3_INTN	Y2	3	1.8 V
FX_USB3_UART_TX	AA11	3	1.8 V
FX_USB3_UART_RX	AC9	3	1.8 V

10. SerDes Interface

10.1. PCIe

The Avant-G/X Versa Board is designed to fit entirely into a PC motherboard with a ×8 PCI Express slot that can accommodate a full-height, full-length form factor add-in card. This board is a PCIe add-in card. The PCIe interface is configured as an endpoint.

The PCIe interface has the following signals:

- SerDes, ×8, up to 16 Gbps
- PCIE_REFCLK_p/n, 100 MHz clock from PCIe motherboard
- PCIE_SMBUS, 3.3 V level, reserved, not required for normal operation.
- PERSTn, reset signal from PCIe motherboard
- PCIE_WAKEn, reserved

The PCIe width can be selected with Jumper resistors:

- R853 installed, ×1 mode
- R856 installed, ×4 mode
- R862 installed, ×8 mode, the default mode

Table 10.1. PCI Express Pin Assignments

Golden Finger Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
B5	PCIE_SMCLK[1]	0	W5	SMB clock
B6	PCIE_SMDAT[1]	0	V5	SMB data
B11	PCIE_WAKEn[2]	0	U8	Wake Signal
A11	PERSTn	0	T8	PCIe Reset
A13	PCIE_REFCLK_p	SerDes Q4	J15	Motherboard reference clock
A14	PCIE_REFCLK_n	SerDes Q4	J14	Motherboard reference clock
B14	PERp0	SerDes Q4	A14	Receive bus
B15	PERn0	SerDes Q4	A15	Receive bus
B19	PERp1	SerDes Q4	C14	Receive bus
B20	PERn1	SerDes Q4	C15	Receive bus
B23	PERp2	SerDes Q4	A11	Receive bus
B24	PERn2	SerDes Q4	A12	Receive bus
B27	PERp3	SerDes Q4	C11	Receive bus
B28	PERn3	SerDes Q4	C12	Receive bus
B33	PERp4	SerDes Q5	A8	Receive bus
B34	PERn4	SerDes Q5	A9	Receive bus
B37	PERp5	SerDes Q5	C8	Receive bus
B38	PERn5	SerDes Q5	C9	Receive bus
B41	PERp6	SerDes Q5	A5	Receive bus
B42	PERn6	SerDes Q5	A6	Receive bus
B45	PERp7	SerDes Q5	C5	Receive bus
B46	PERn7	SerDes Q5	C6	Receive bus
A16	PETp0	SerDes Q4	E14	Transmit bus
A17	PETn0	SerDes Q4	E15	Transmit bus
A21	PETp1	SerDes Q4	G14	Transmit bus
A22	PETn1	SerDes Q4	G15	Transmit bus
A25	PETp2	SerDes Q4	E11	Transmit bus
A26	PETn2	SerDes Q4	E12	Transmit bus
A29	PETp3	SerDes Q4	G11	Transmit bus
A30	PETn3	SerDes Q4	G12	Transmit bus

Golden Finger Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
A35	PETp4	SerDes Q4	E8	Transmit bus
A36	PETn4	SerDes Q4	E9	Transmit bus
A39	PETp5	SerDes Q5	G8	Transmit bus
A40	PETn5	SerDes Q5	G9	Transmit bus
A43	PETp6	SerDes Q5	E5	Transmit bus
A44	PETn6	SerDes Q5	E6	Transmit bus
A47	PETp7	SerDes Q5	G5	Transmit bus
A48	PETn7	SerDes Q5	G6	Transmit bus

Notes:
1. PCIE_SMBUS is not connected by default. R474 and R475 need to be mounted before using PCIE_SMBUS.
2. PCIE_WAKEn is not connected by default. R476 needs to be mounted before using PCIE_WAKEn.

10.2. SFP+/zSFP+ Interface

Two SFP+/zSFP+ connectors are provided on the Avant-G/X Versa Board. Each connector supports a 10GE SFP+/25GE SFP28 hot-pluggable module. Each SFP+/SFP28 module has six status/control signals. The FPGA does not have enough I/O pins for these signals; hence an I/O expander is used to implement these I/O for each SFP+/zSFP+ connector. For detailed information of status/control signals and I2C bus, refer to the Control Buses – I2C, UART section.

For 25 Gb Ethernet, an example design that demonstrates the application of this SFP28 interface is available. The example design instantiates the 25Gb Ethernet MAC+PHY IP. For complete guidance of the example design, from IP generation to running the 25Gb Ethernet on the Avant-X Versa Board, refer to the *Example Design* section of the 25Gb Ethernet MAC+PHY IP Core User Guide.

Table 10.2. SFP+/zSFP J27 Connections

J27 Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
13	zSFP1_RXp	Serdes Q6	C1	zSFP+ receiver data
12	zSFP1_RXn	Serdes Q6	B1	zSFP+ receiver data
18	zSFP1_TXp	Serdes Q6	J1	zSFP+ transmitter data
19	zSFP1_TXn	Serdes Q6	H1	zSFP+ transmitter data
2	SFP1_TX_FAULT[1]	—	—	Tx fault, pulled up, indicates fault when high.
3	SFP1_TX_DIS[1]	—	—	Tx disable, pulled down, transmitter is turned off if high.
6	SFP1_PRSTn[1]	—	—	Mod_ABS, pulled up, module in place when low.
8	SFP1_LOSn[1]	—	—	Rx_LOS, pulled up, indicates LOS when high.
7	SFP1_RS0[1]	—	—	Rate Select, pulled up with 1 kΩ resistor.
9	SFP1_RS1[1]	—	—	Rate Select, pulled up with 1 kΩ resistor.
5	zSFP1_I2C_SCL[2]	—	—	zSFP+ serial two-wire clock
4	zSFP1_I2C_SDA[2]	—	—	zSFP+ serial two-wire data

Notes:
1. These signals are controlled by a I2C I/O expander. Refer to the Control Buses – I2C, UART section for detailed information.
2. These I2C interfaces are extended by the PCA9548APWR. Refer to the Control Buses – I2C, UART section for detailed information.

Table 10.3. SFP+/zSFP+ J28 Connections

J28 Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
13	zSFP2_RXp	Serdes Q6	C3	zSFP+ receiver data
12	zSFP2_RXn	Serdes Q6	B3	zSFP+ receiver data
18	zSFP2_TXp	Serdes Q6	J3	zSFP+ transmitter data
19	zSFP2_TXn	Serdes Q6	H3	zSFP+ transmitter data
2	SFP2_TX_FAULT[1]	—	—	Tx fault, pulled up, indicates fault when high.
3	SFP2_TX_DIS[1]	—	—	Tx disable, pulled down, transmitter is turned off if high.

J28 Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
6	SFP2_PRSTn[1]	—	—	Mod_ABS, pulled up, module in place when low.
8	SFP2_LOSn[1]	—	—	Rx_LOS, pulled up, indicates LOS when high.
7	SFP2_RS0[1]	—	—	Rate Select, pulled up with 1 kΩ resistor.
9	SFP2_RS1[1]	—	—	Rate Select, pulled up with 1 kΩ resistor.
5	zSFP2_I2C_SCL[2]	—	—	zSFP+ serial two-wire clock
4	zSFP2_I2C_SDA[2]	—	—	zSFP+ serial two-wire data

Notes:
1. These signals are controlled by a I2C I/O expander. Refer to the Control Buses – I2C, UART section for detailed information.
2. These I2C interfaces are extended by the PCA9548APWR. Refer to the Control Buses – I2C, UART section for detailed information.
3. These signals are controlled by a I2C I/O expander. Refer to the Control Buses – I2C, UART section for detailed information.
4. These I2C interfaces are extended by the PCA9548APWR. Refer to the Control Buses – I2C, UART section for detailed information.

10.3. QSFP+/zQSFP+ Interface

The Avant-G/X Versa Board includes a zQSFP+ (QSFP28/56) connector. It can support a 40GE QSFP+/100GE QSFP28 hot-pluggable module. The FPGA does not have enough I/O pins for status/control signals; hence an I/O expander is used to implement these I/O for the zQSFP+ connector. For detailed information of status/control signals and I2C bus, refer to the Control Buses – I2C, UART section.

Table 10.4. QSFP+/zQSFP+ J26 Connections

J26 Pin Number	Signal Name	Avant Bank	Avant Ball Location	Comments
17	zQSFP_RXp0	Serdes Q3	A20	zQSFP+ receiver data
18	zQSFP_RXn0	Serdes Q3	A21	zQSFP+ receiver data
22	zQSFP_RXp1	Serdes Q3	C20	zQSFP+ receiver data
21	zQSFP_RXn1	Serdes Q3	C21	zQSFP+ receiver data
14	zQSFP_RXp2	Serdes Q3	A17	zQSFP+ receiver data
15	zQSFP_RXn2	Serdes Q3	A18	zQSFP+ receiver data
25	zQSFP_RXp3	Serdes Q3	C17	zQSFP+ receiver data
24	zQSFP_RXn3	Serdes Q3	C18	zQSFP+ receiver data
36	zQSFP_TXp0	Serdes Q3	E20	zQSFP+ transmitter data
37	zQSFP_TXn0	Serdes Q3	E21	zQSFP+ transmitter data
3	zQSFP_TXp1	Serdes Q3	G20	zQSFP+ transmitter data
2	zQSFP_TXn1	Serdes Q3	G21	zQSFP+ transmitter data
33	zQSFP_TXp2	Serdes Q3	E17	zQSFP+ transmitter data
34	zQSFP_TXn2	Serdes Q3	E18	zQSFP+ transmitter data
6	zQSFP_TXp3	Serdes Q3	G17	zQSFP+ transmitter data
5	zQSFP_TXn3	Serdes Q3	G18	zQSFP+ transmitter data
28	zQSFP_INTn	9	AN32	zQSFP+ interrupt
8	zQSFP_MODSEL_B[1]	—	—	Module select
27	zQSFP_MODPRS_B[1]	—	—	Pulled up, module in place when low
9	zQSFP_RESET_B[1]	—	—	Module reset
31	zQSFP_LPMODE[1]	—	—	zQSFP+ low power mode
11	zQSFP_I2C_SCL[2]	—	—	zQSFP+ serial two-wire clock
12	zQSFP_I2C_SDA[2]	—	—	zQSFP+ serial two-wire data

Notes:
1. These signals are controlled by a I2C I/O expander. Refer to the Control Buses – I2C, UART section for detailed information.
2. These I2C interfaces are extended by the PCA9548APWR. Refer to the Control Buses – I2C, UART section for detailed information.
3. Refer to Appendix C. Avant Versa Board zQSFP+ Enablement through I2C for more information.

10.4. RF Jacks

The Avant-G/X Versa Board includes four RF jacks that can be used to connect to a test instrument or another board. The recommended part number of the RF jack is SF3321-60024-1S from SV Microwave. These RF jacks are not mounted by default.

Table 10.5. RF Jacks Connections

Board Reference	Signal Name	Avant Bank	Avant Ball Location
JK2	RF_MPQ6_RX2P	SerDes Q6	F1
JK4	RF_MPQ6_RX2N	SerDes Q6	E1
JK1	RF_MPQ6_TX2P	SerDes Q6	M1
JK3	RF_MPQ6_TX2N	SerDes Q6	L1

11. Software Requirements

The following software versions are required to develop designs for the Avant-G/X Versa Board:

- Lattice Radiant Software 2023.2 or later
- Lattice Radiant Programmer 2023.2 or later

12. Storage and Handling

Static electricity can shorten the life span of electronic components. Observe these tips to prevent damage that can occur from electrostatic discharge:

- Use antistatic precautions such as operating on an antistatic mat and wearing an antistatic wristband.
- Store the development board in the provided packaging.
- Touch a metal USB housing to equalize voltage potential between you and the board.

13. Ordering Information

Table 13.1. Ordering Information

Description	Ordering Part Number	China RoHS Environment-Friendly Use Period (EFUP)
Avant-G Versa Board	LAV-G70-VERSA-EVN	
Avant-X Versa Board	LAV-X70-VERSA-EVN	

Appendix A. Avant Versa Board Schematics

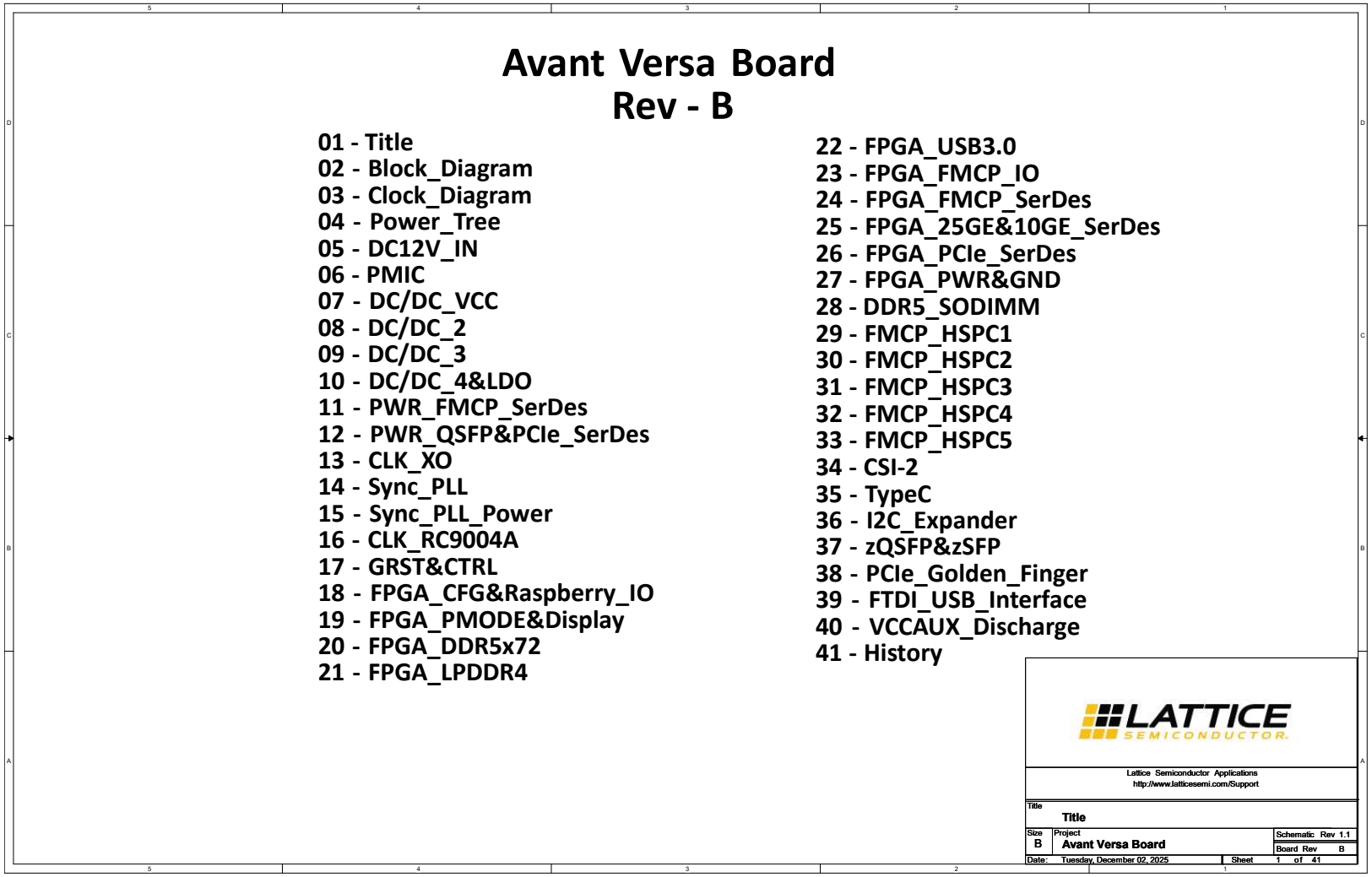

Figure A.1. Title Page

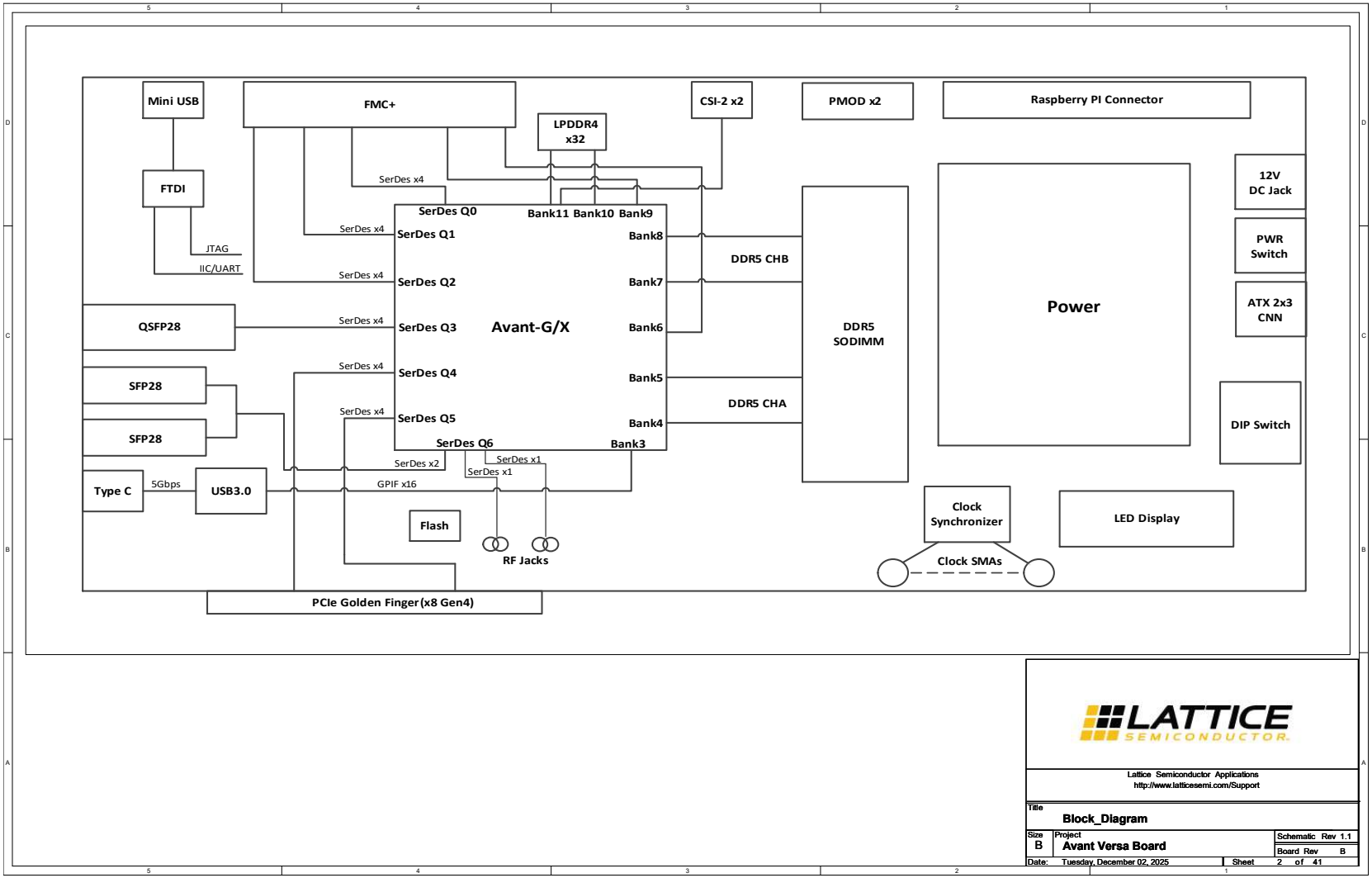

Figure A.2. Block Diagram

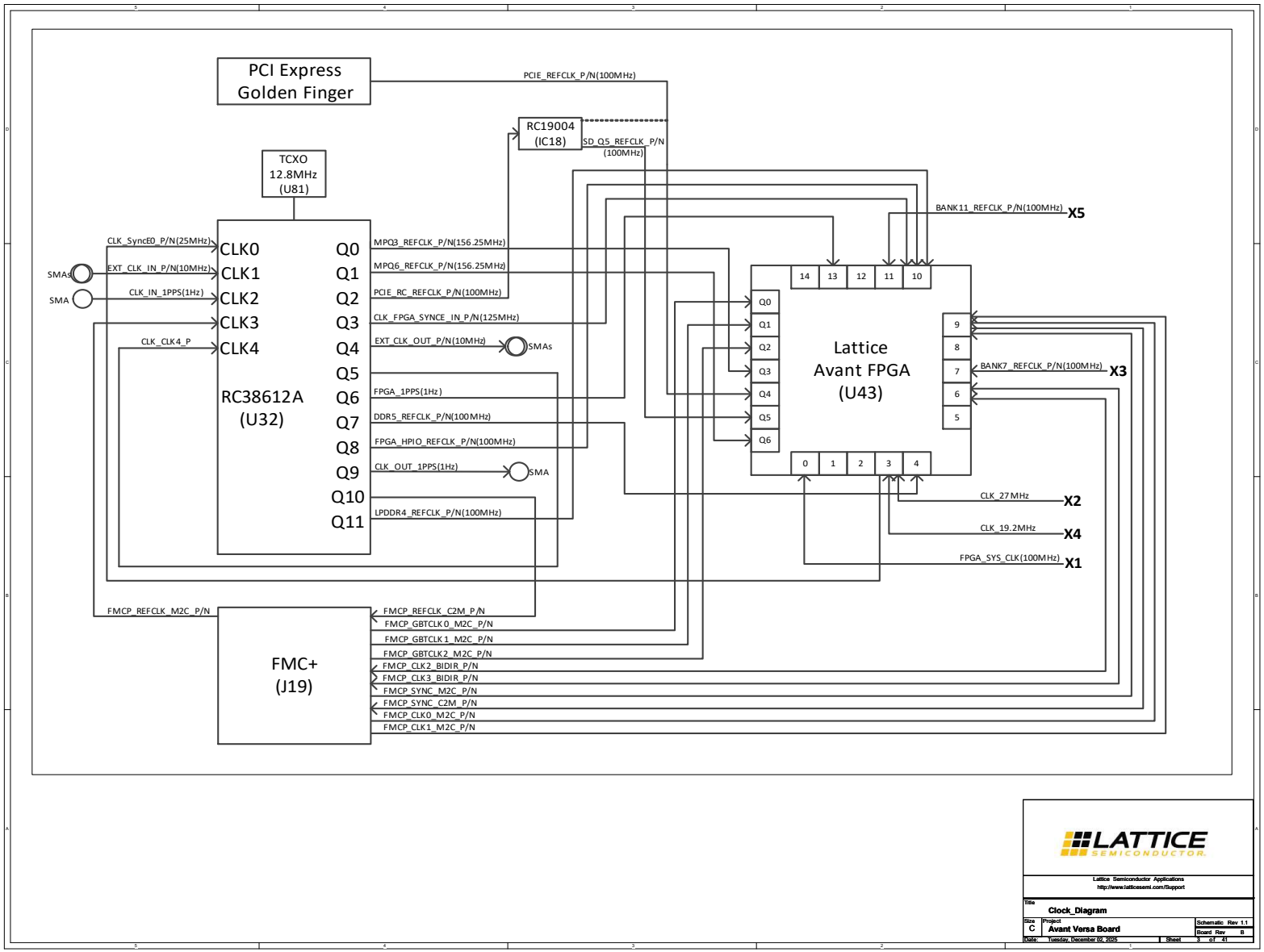

Figure A.3. Clock Diagram

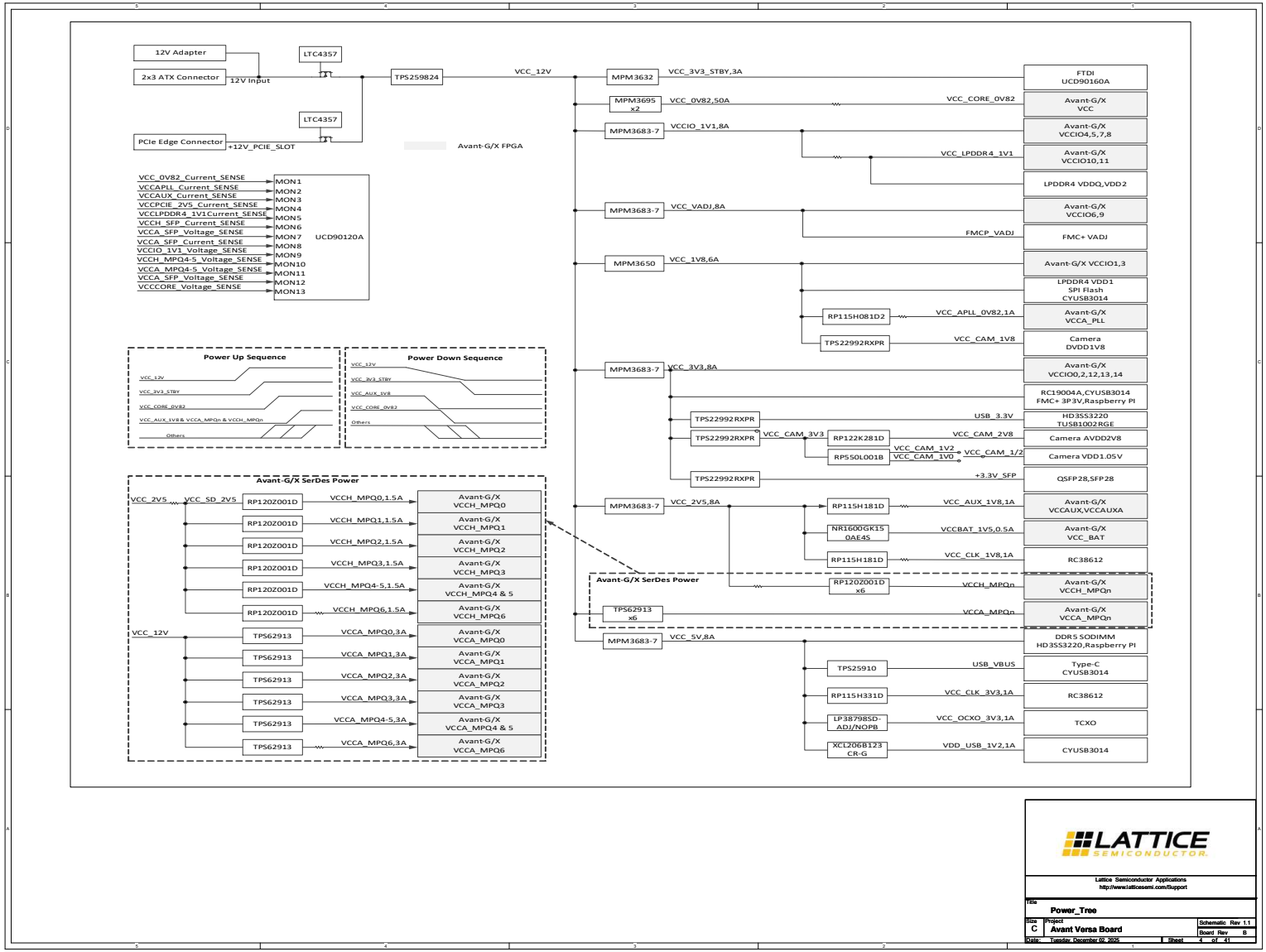

Figure A.4. Power_Tree

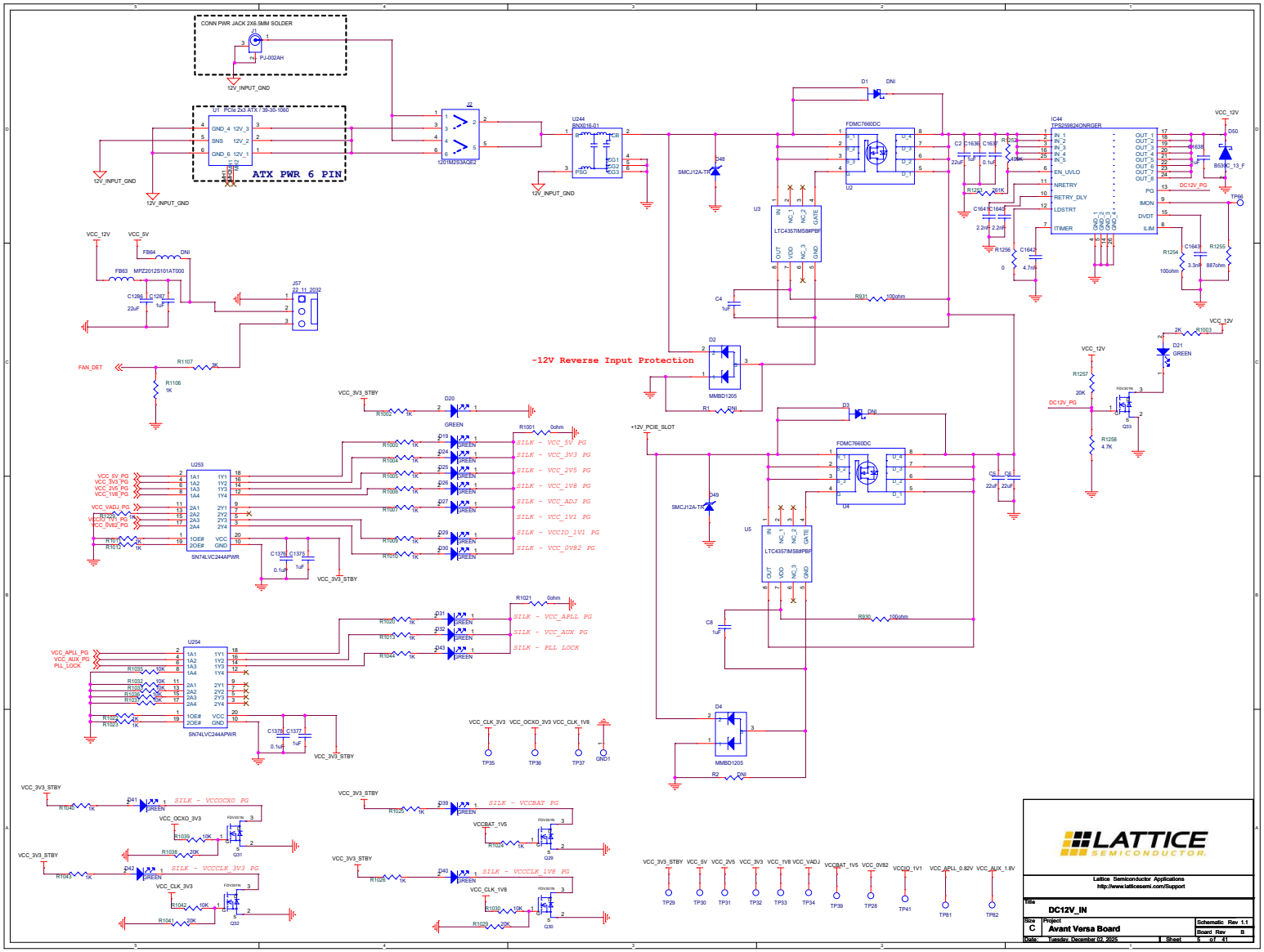

Figure A.5. DC12V_IN

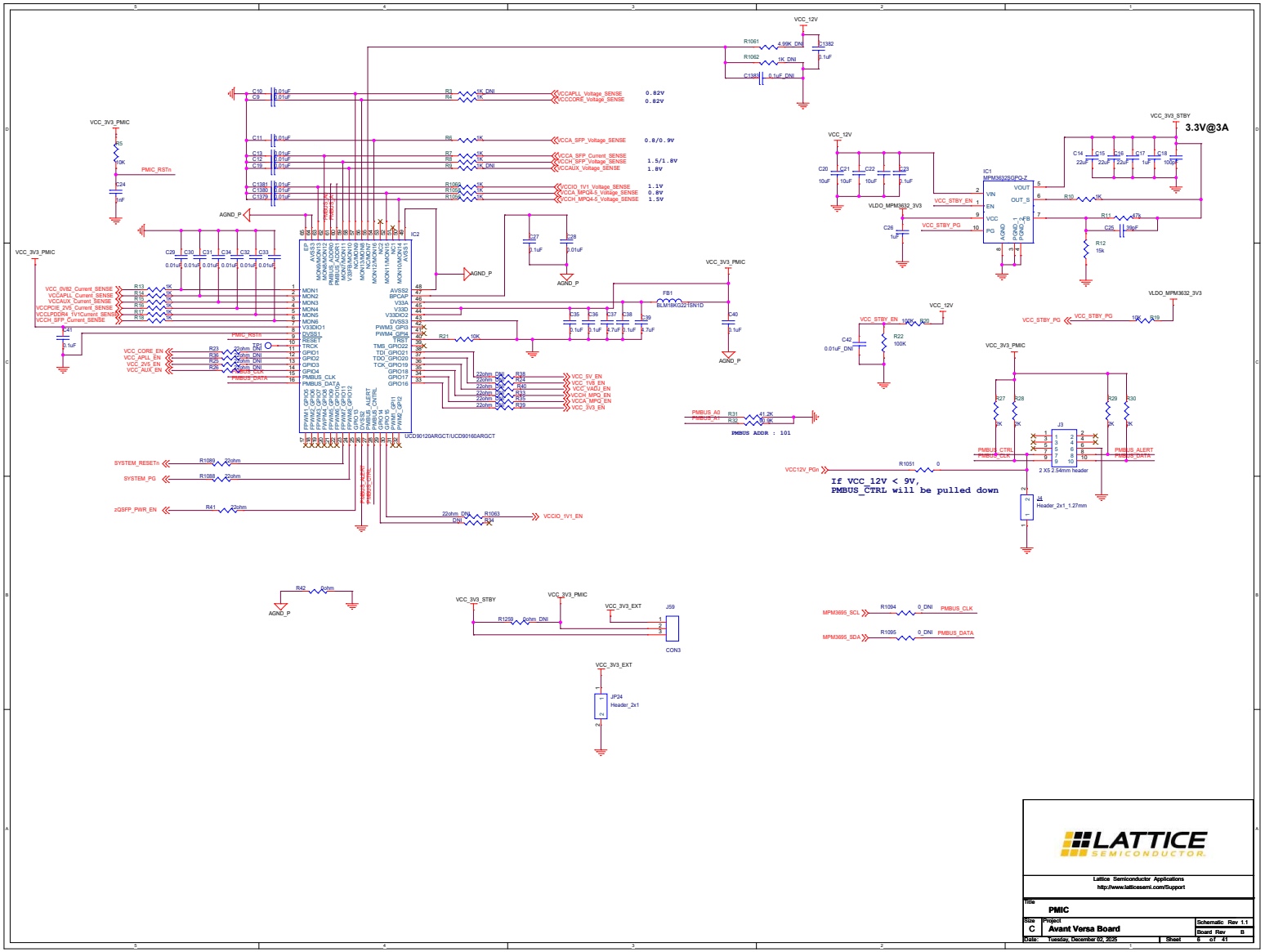

Figure A.6. PMIC

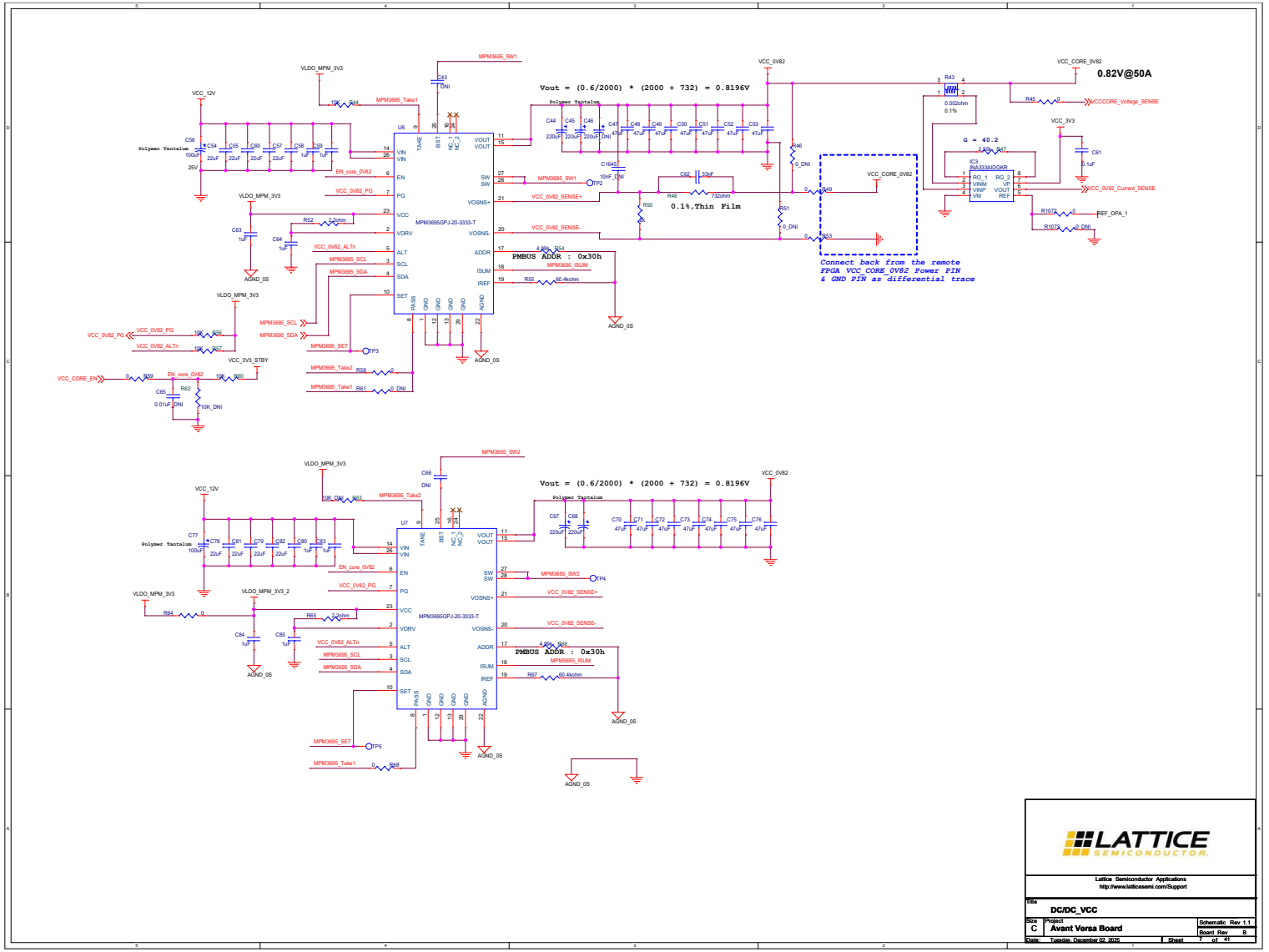

Figure A.7. DC/DC_VCC

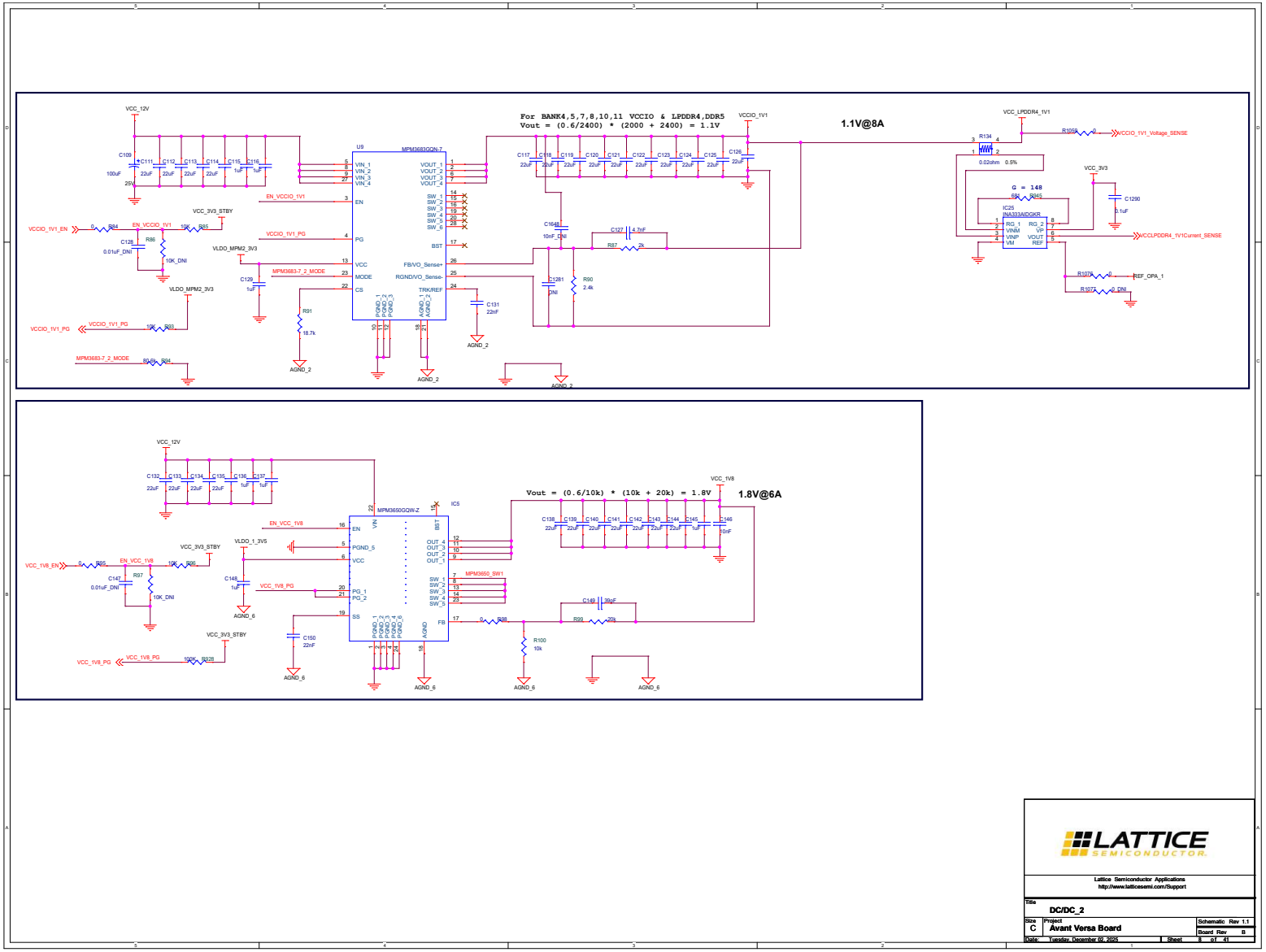

Figure A.8. DC/DC_2

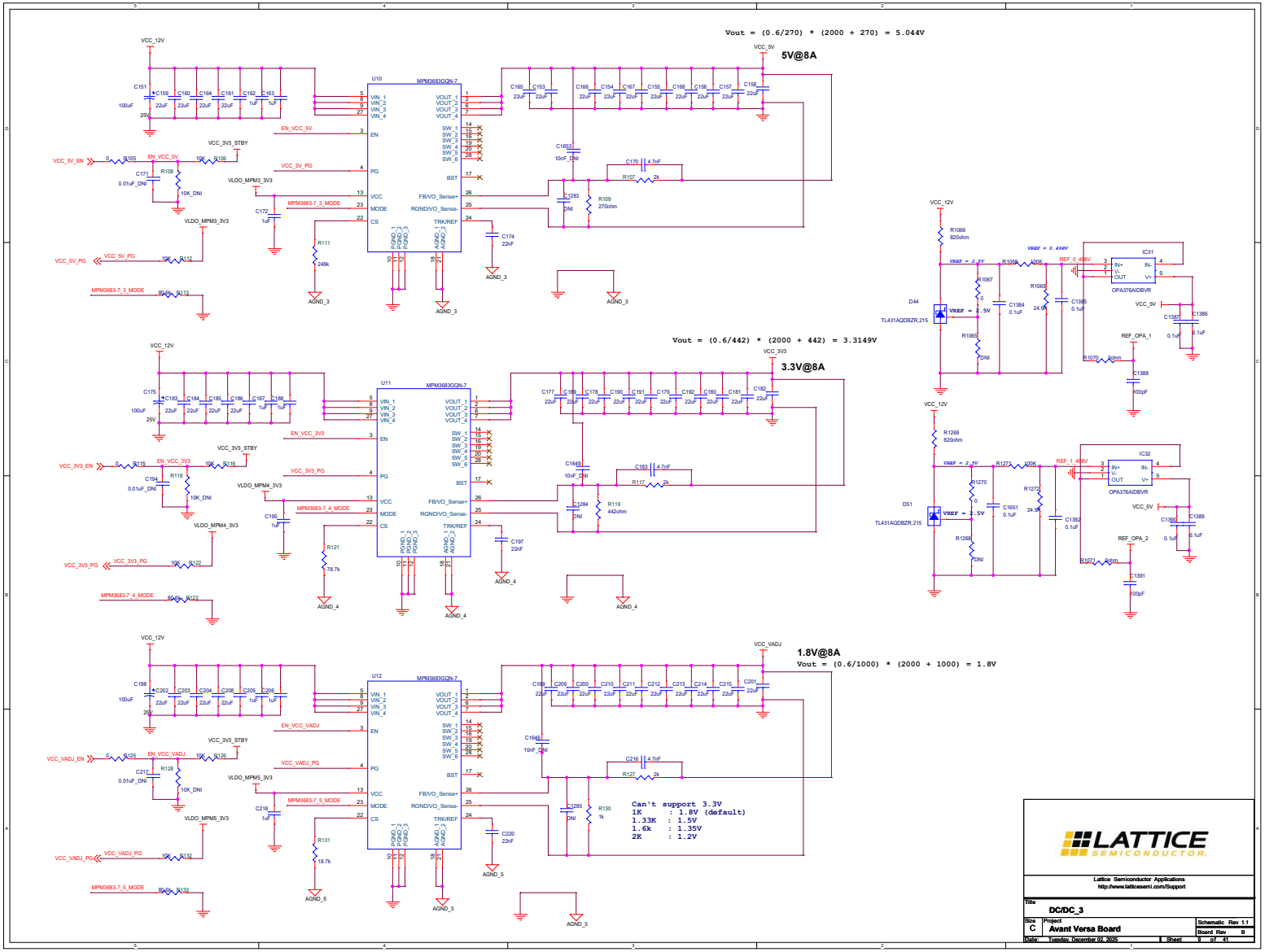

Figure A.9. DC/DC_3

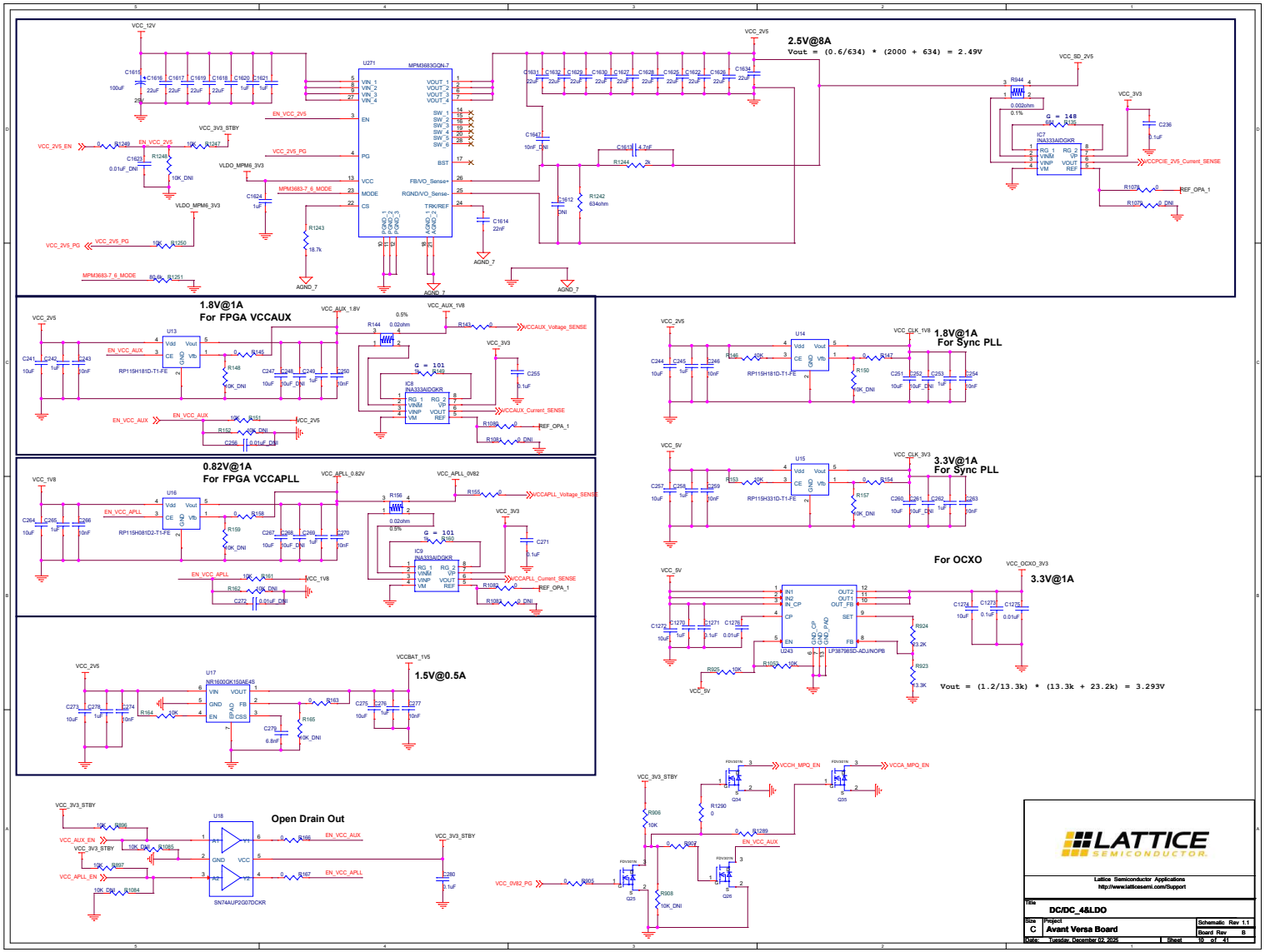

Figure A.10. DC/DC_4&LDO

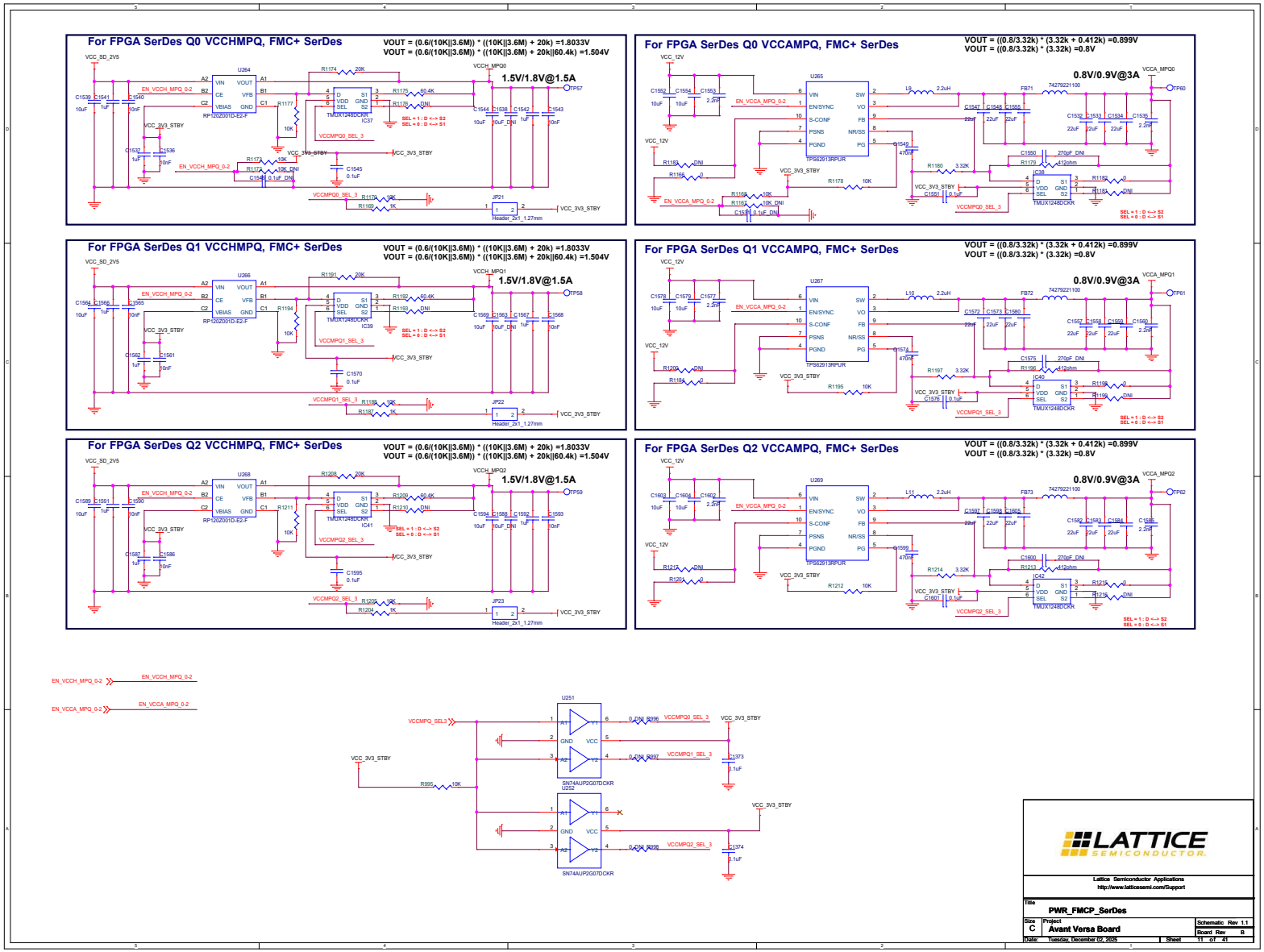

Figure A.11. PWR_FMCP_SerDes

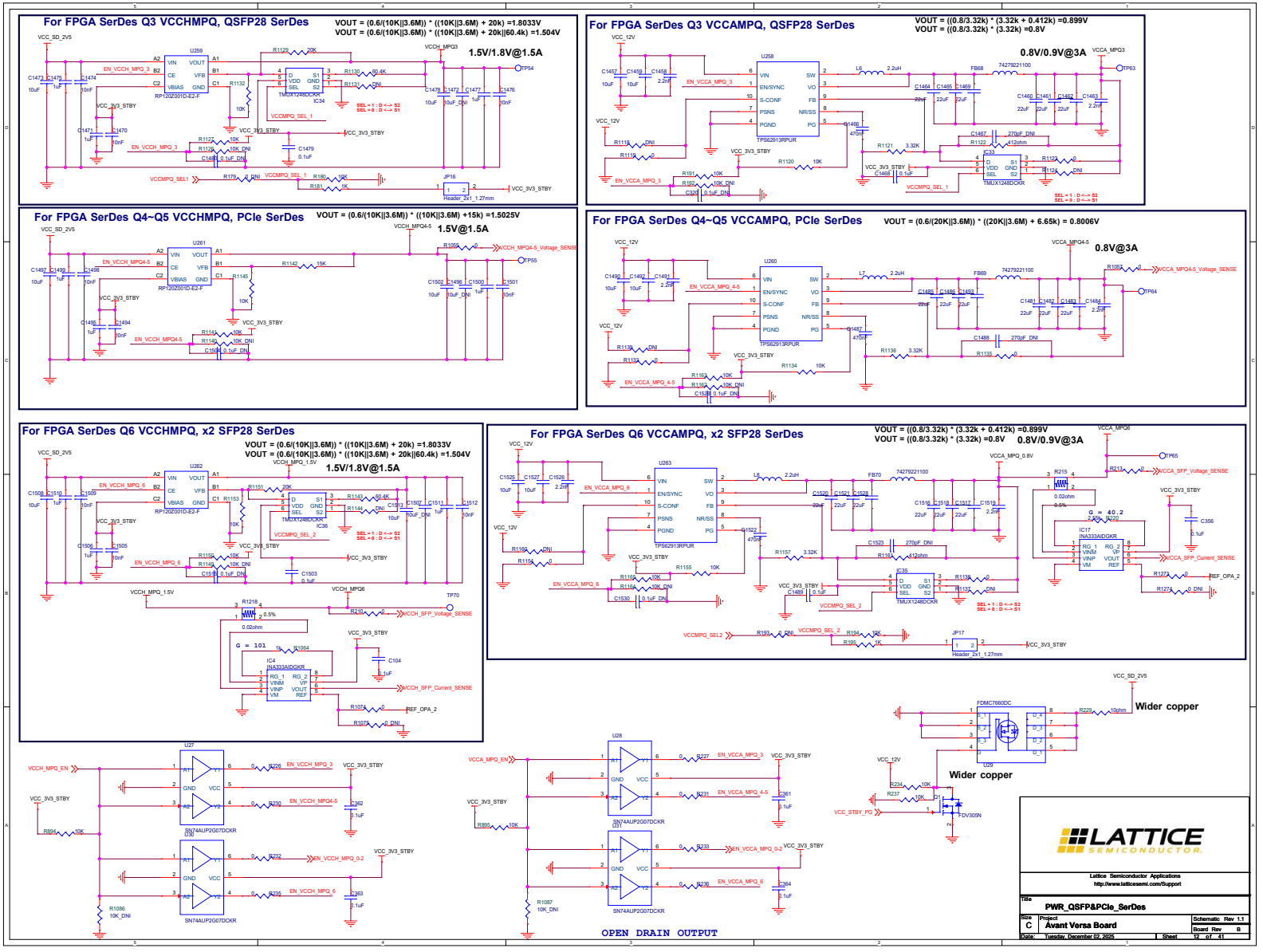

Figure A.12. PWR_QSFP&PCIe_SerDes

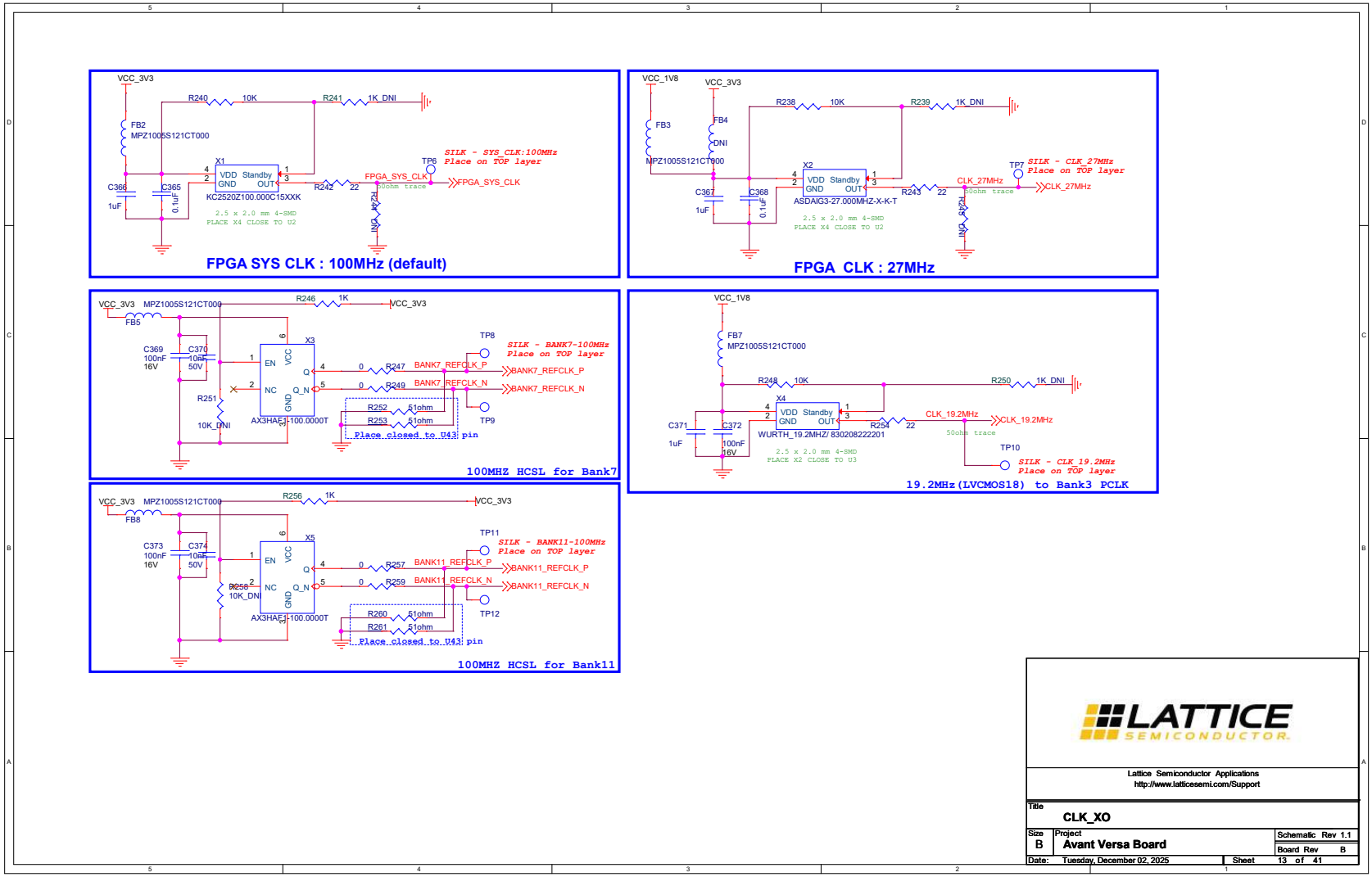

Figure A.13. CLK_XO

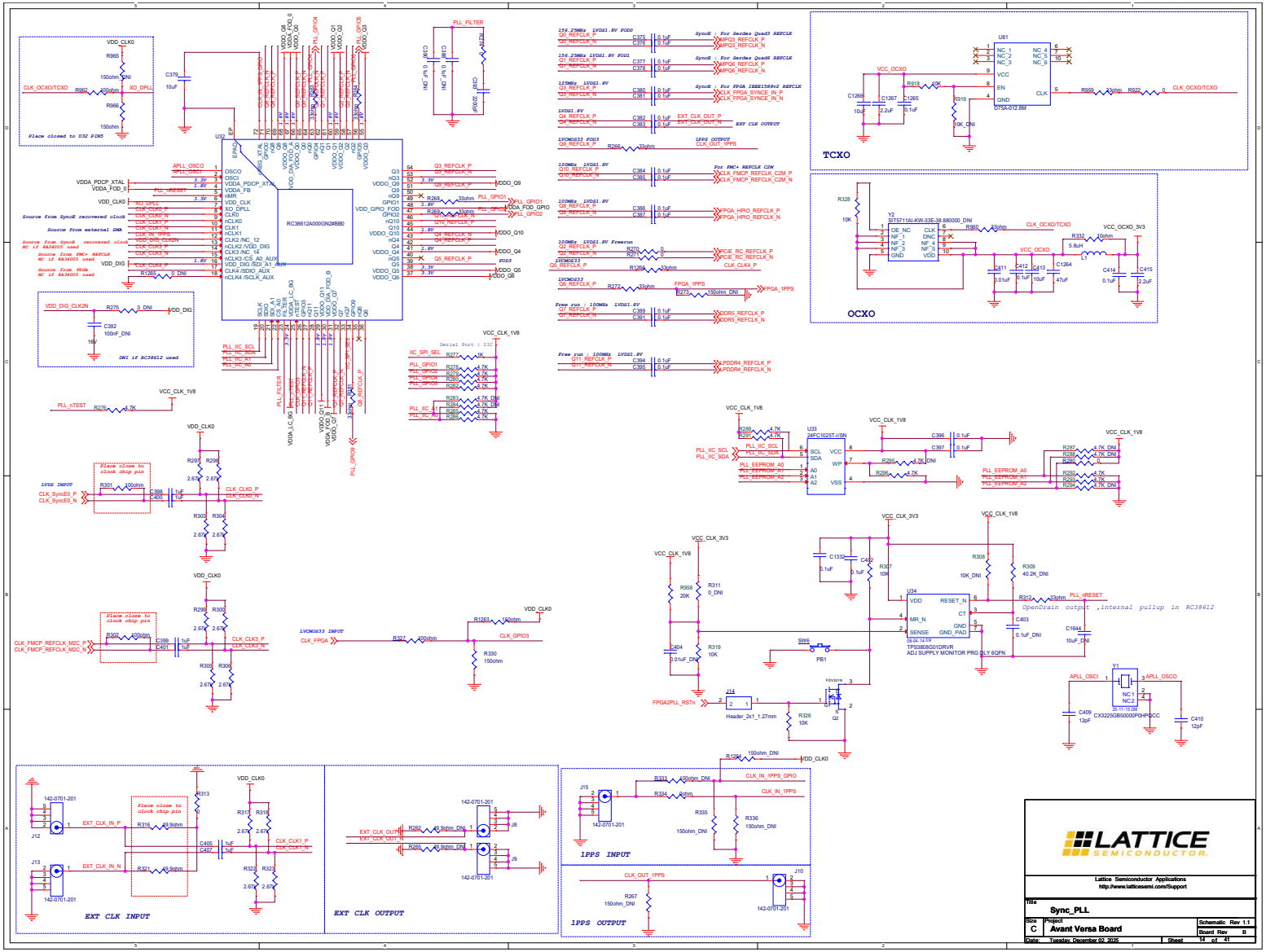

Figure A.14. Sync_PLL

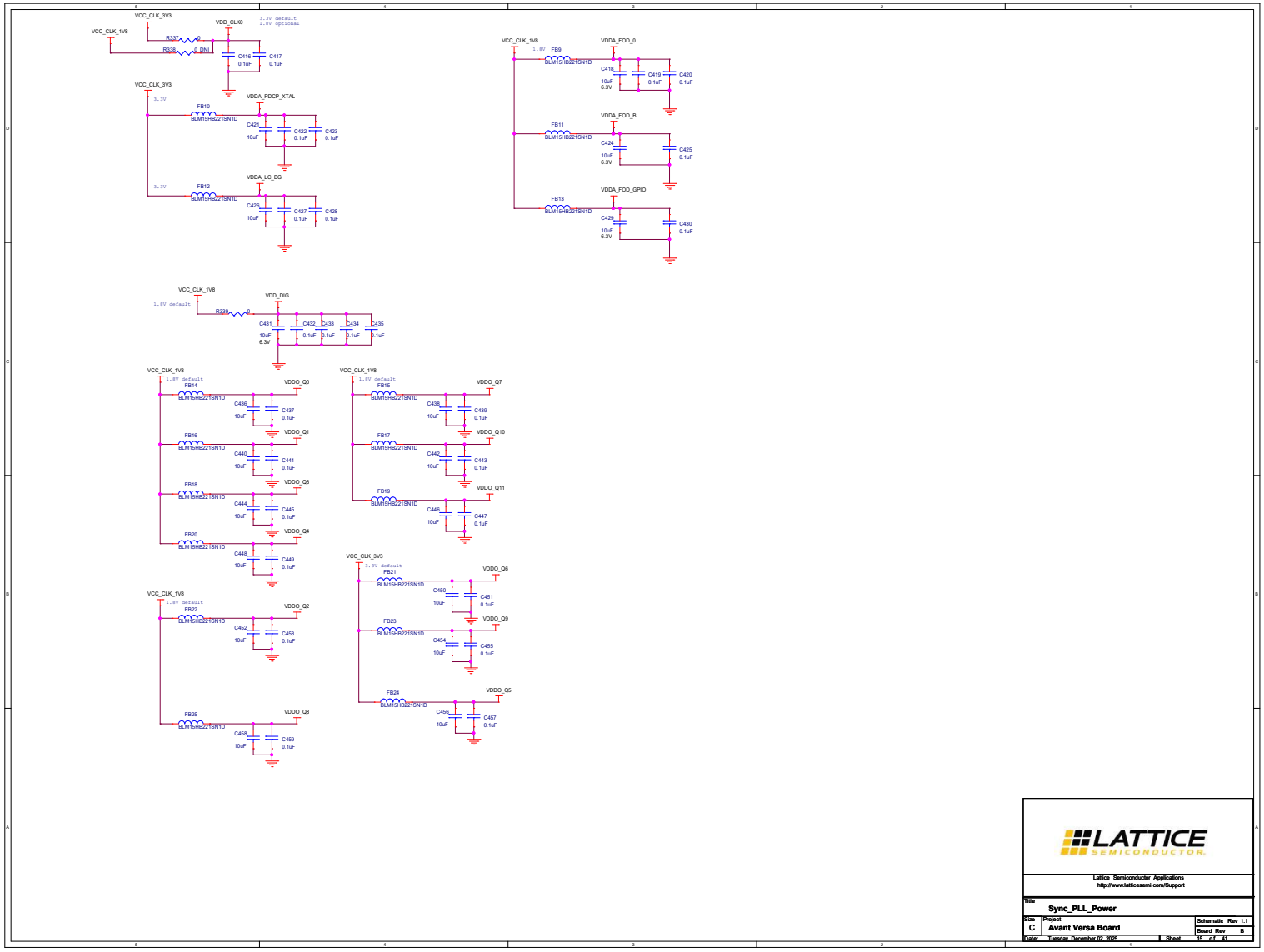

Figure A.15. Sync_PLL_Power

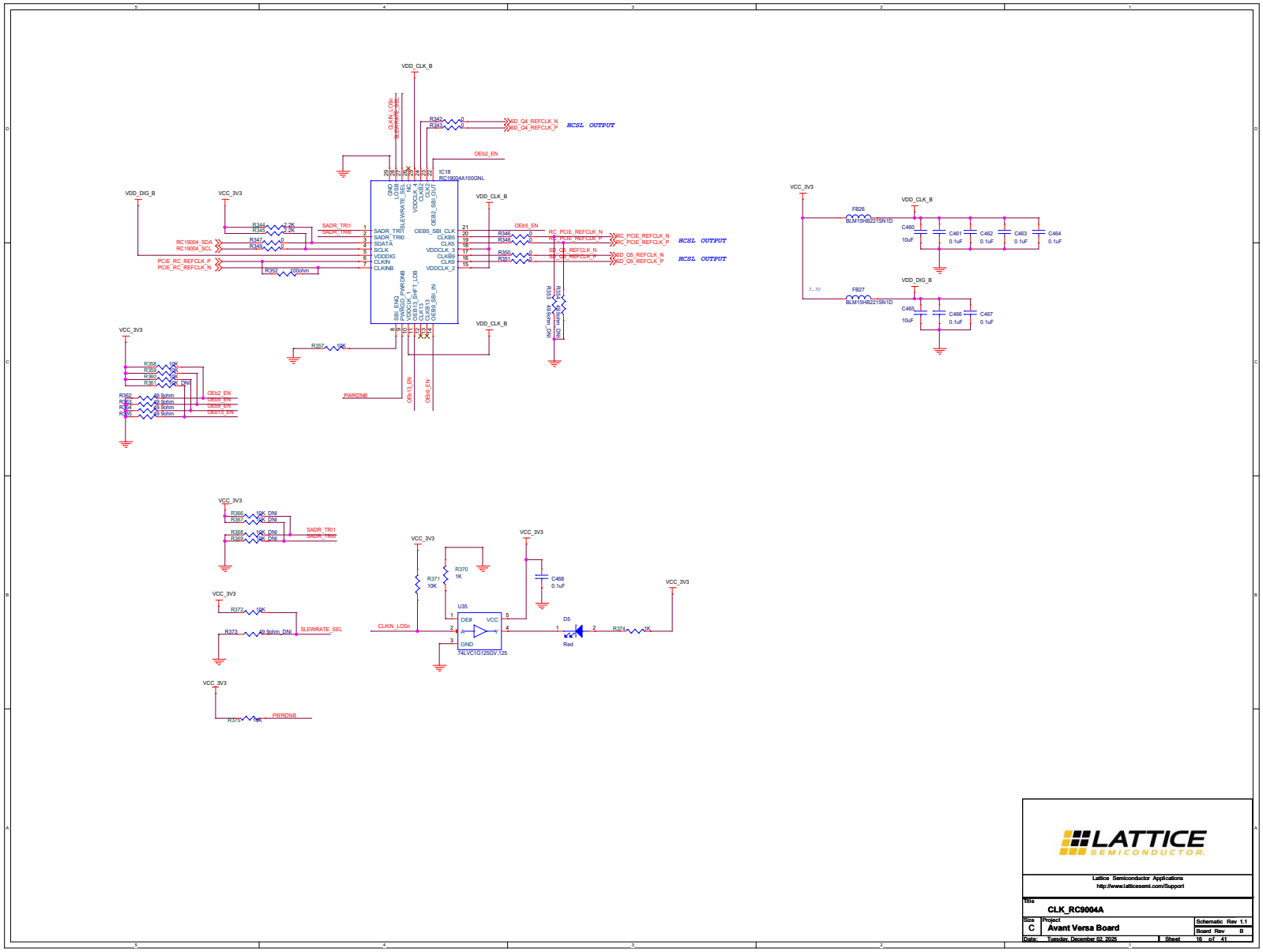

Figure A.16. CLK_RC9004A

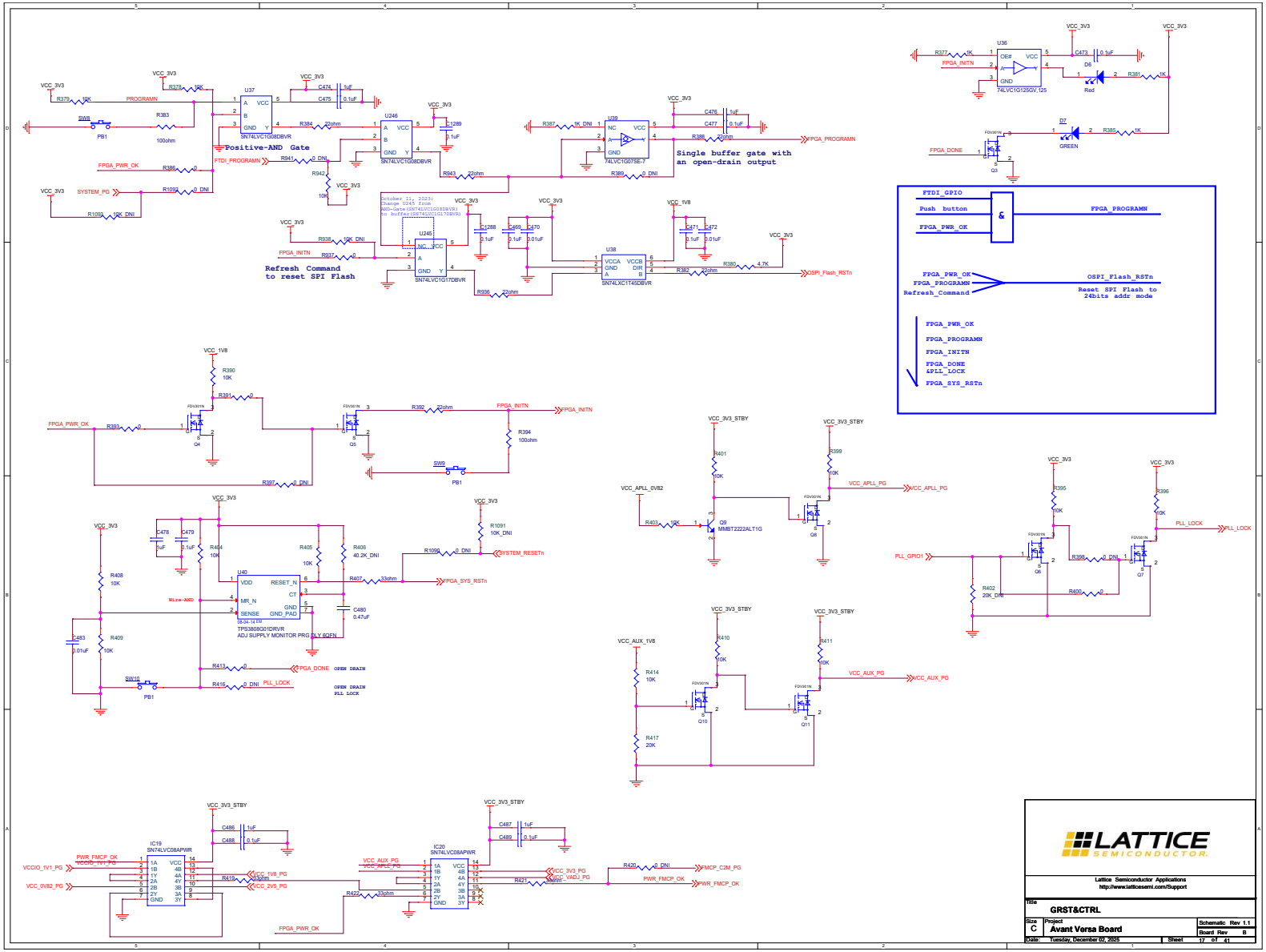

Figure A.17. GRST & CTRL

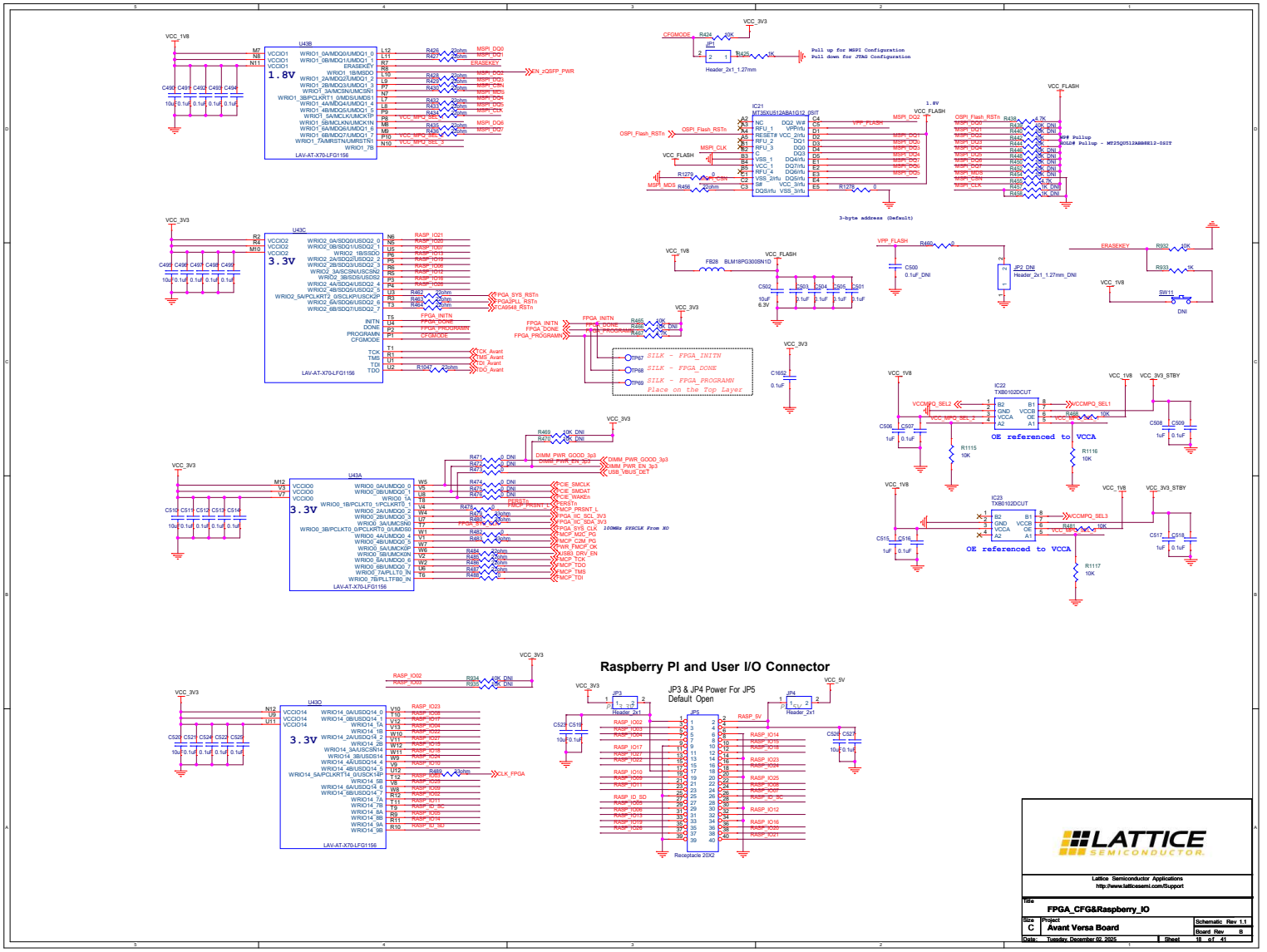

Figure A.18. FPGA_CFG&Raspberry_IO

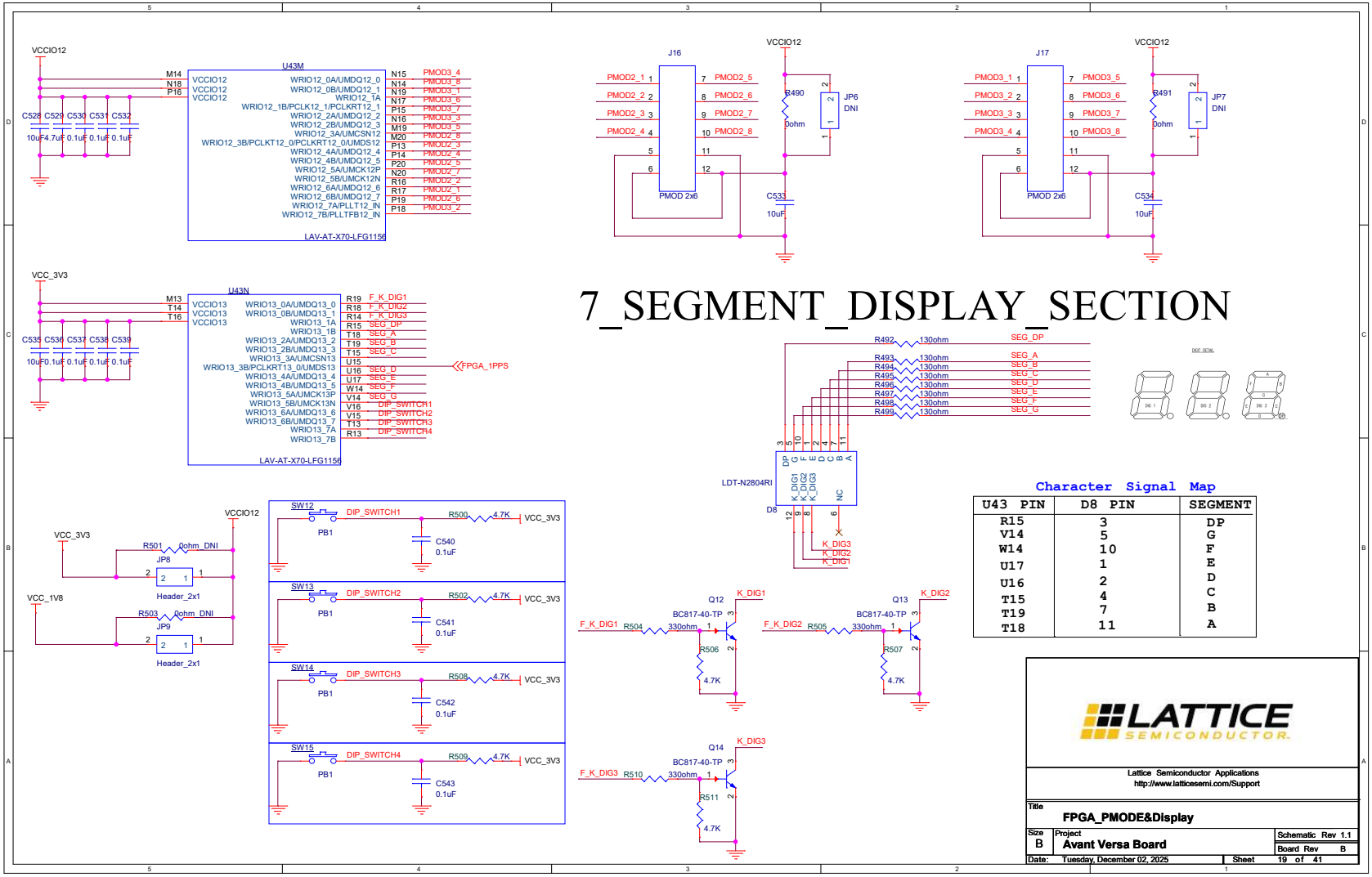

Figure A.19. FPGA_PMODE & Display

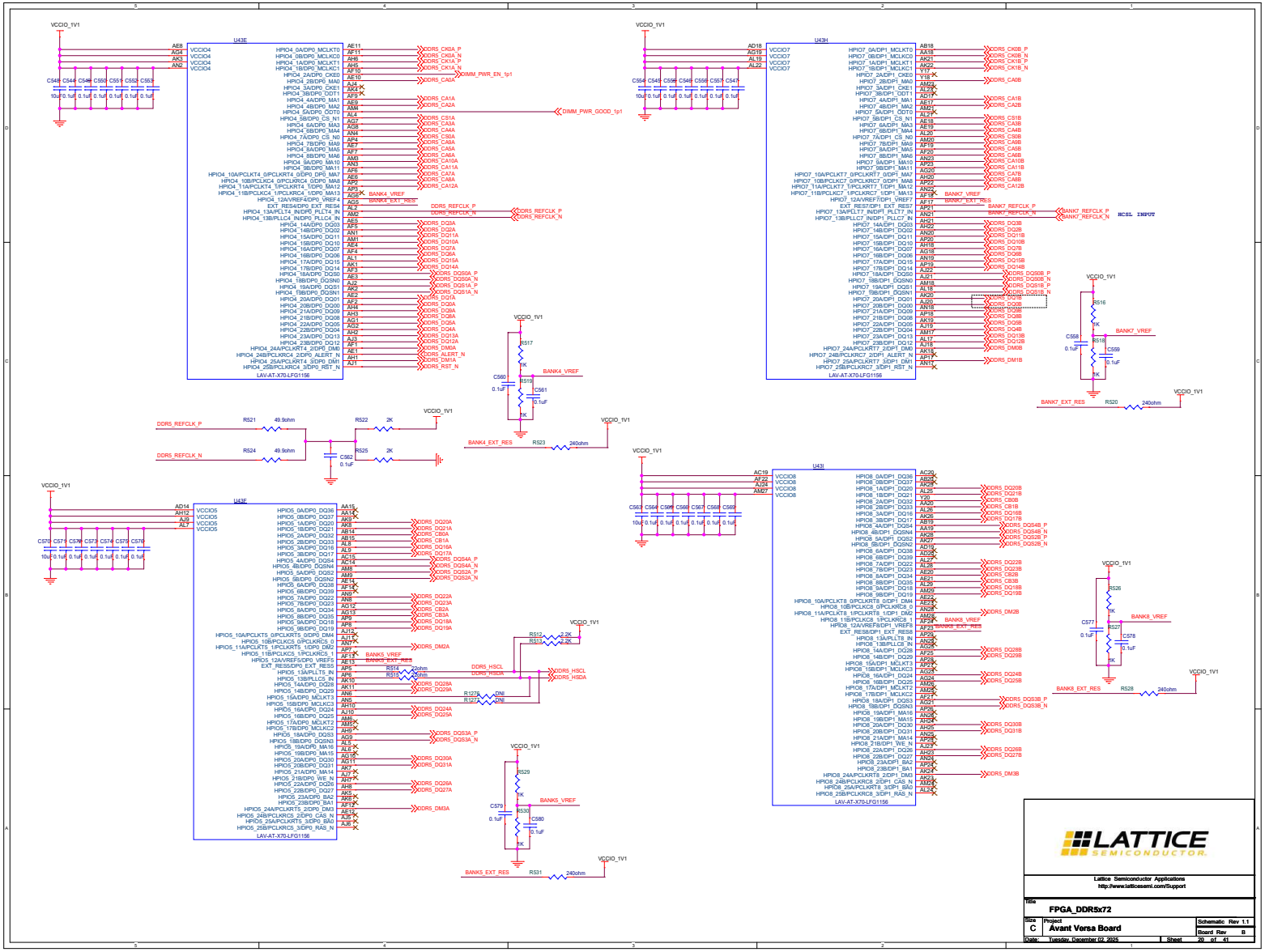

Figure A.20. FPGA_DDR5x72

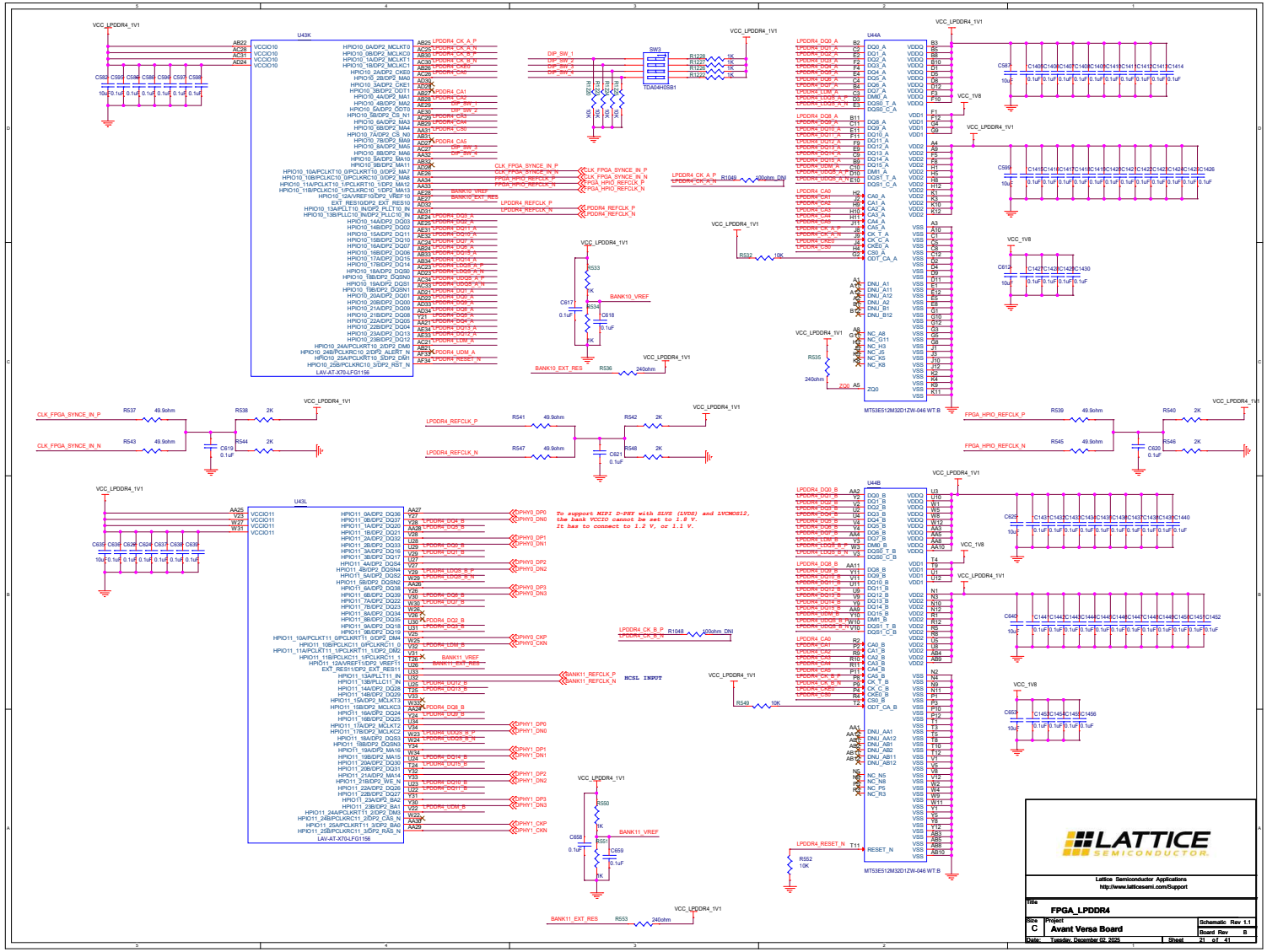

Figure A.21. FPGA_LPDDR4

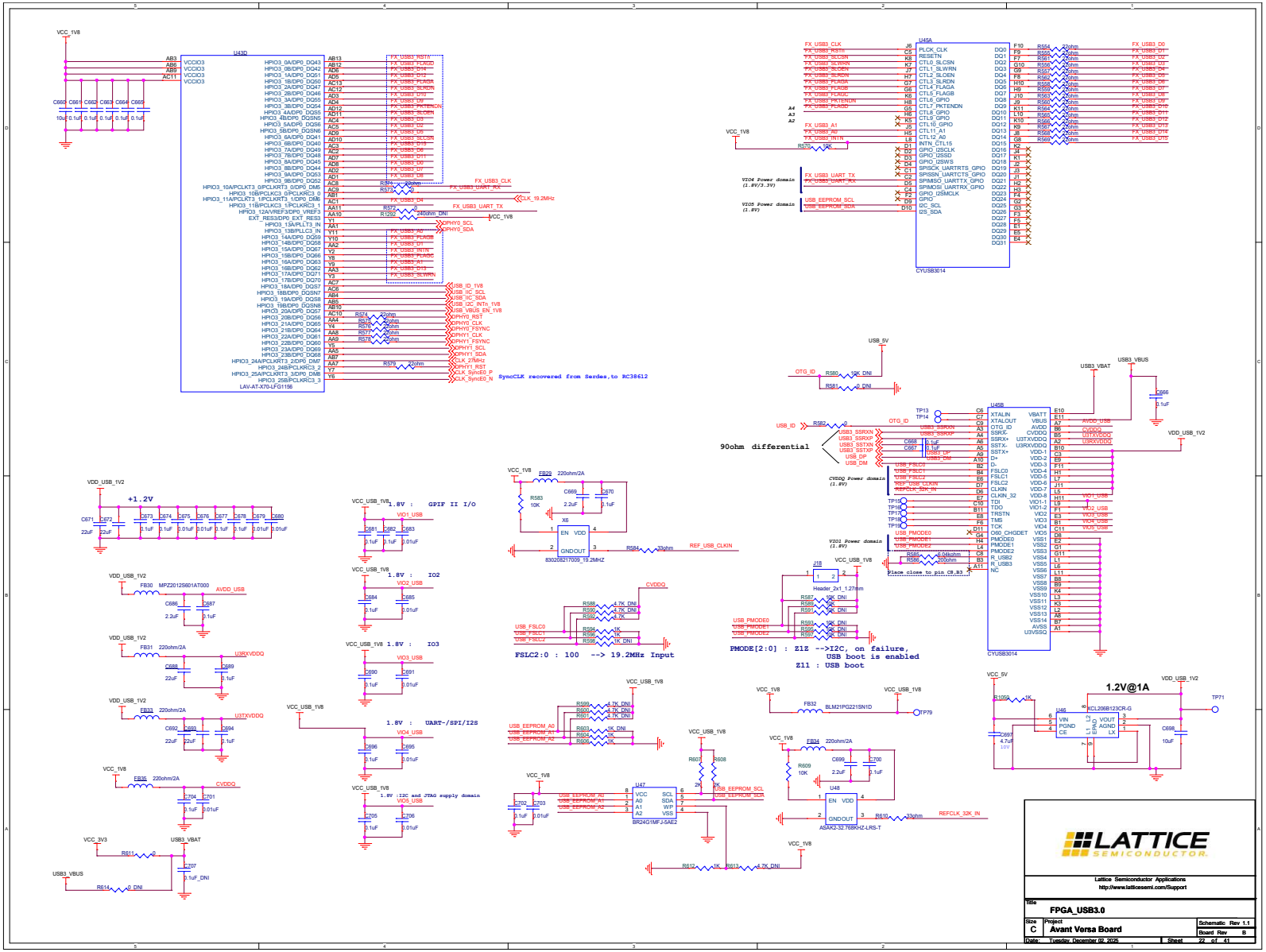

Figure A.22. FPGA_USB3.0

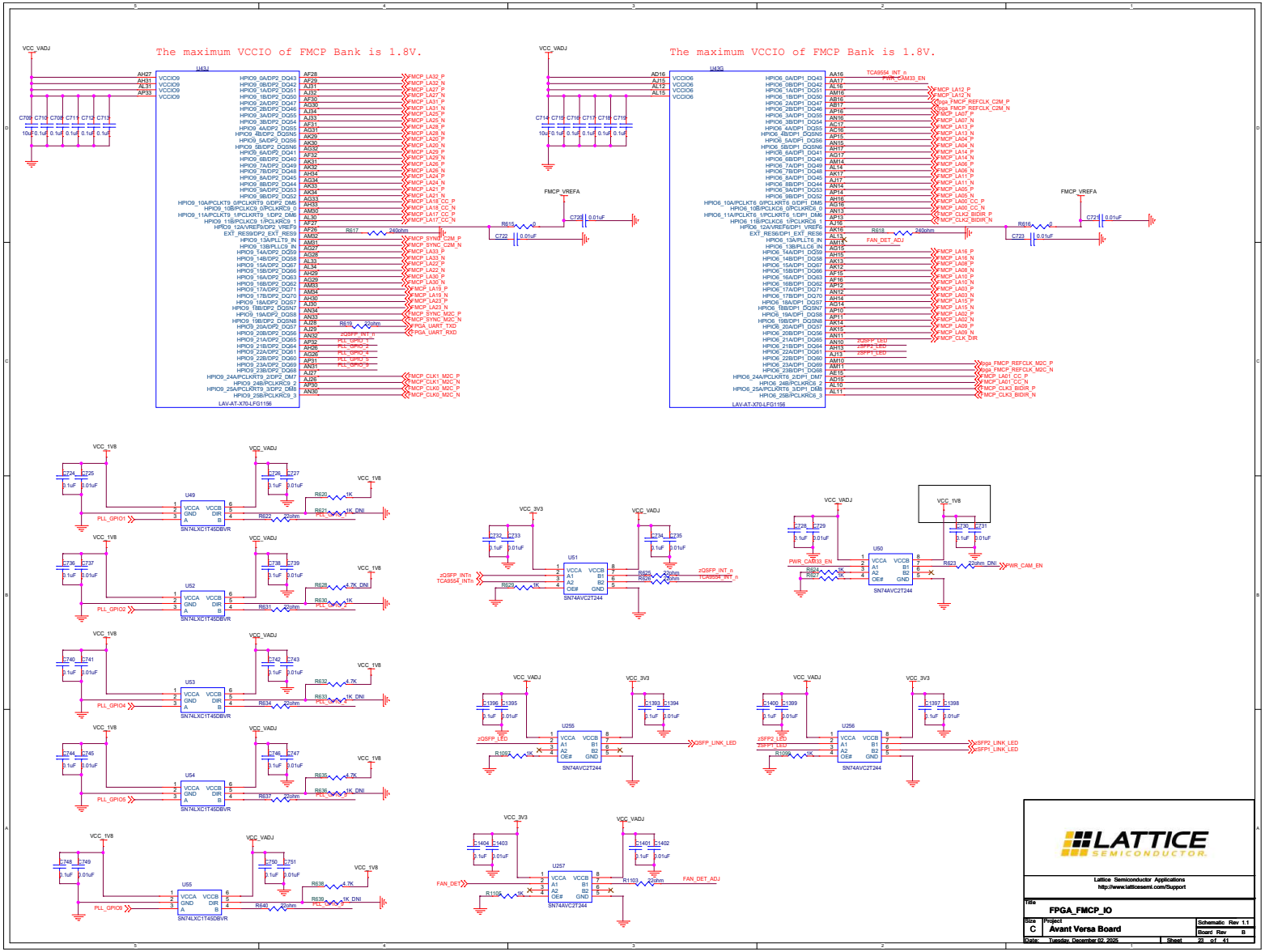

Figure A.23. FPGA_FMCP_IO

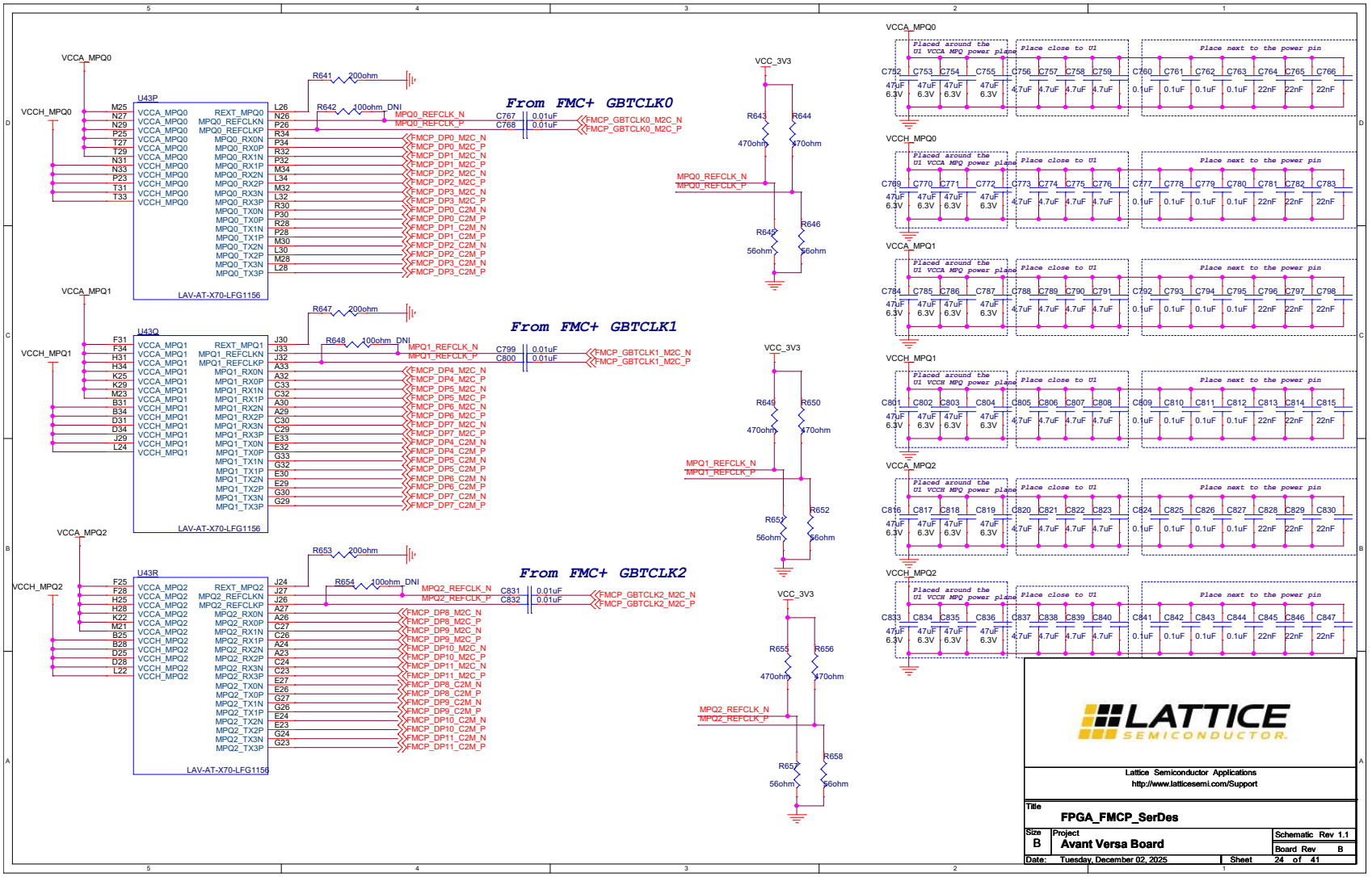

Figure A.24. FPGA_FMCP_SerDes

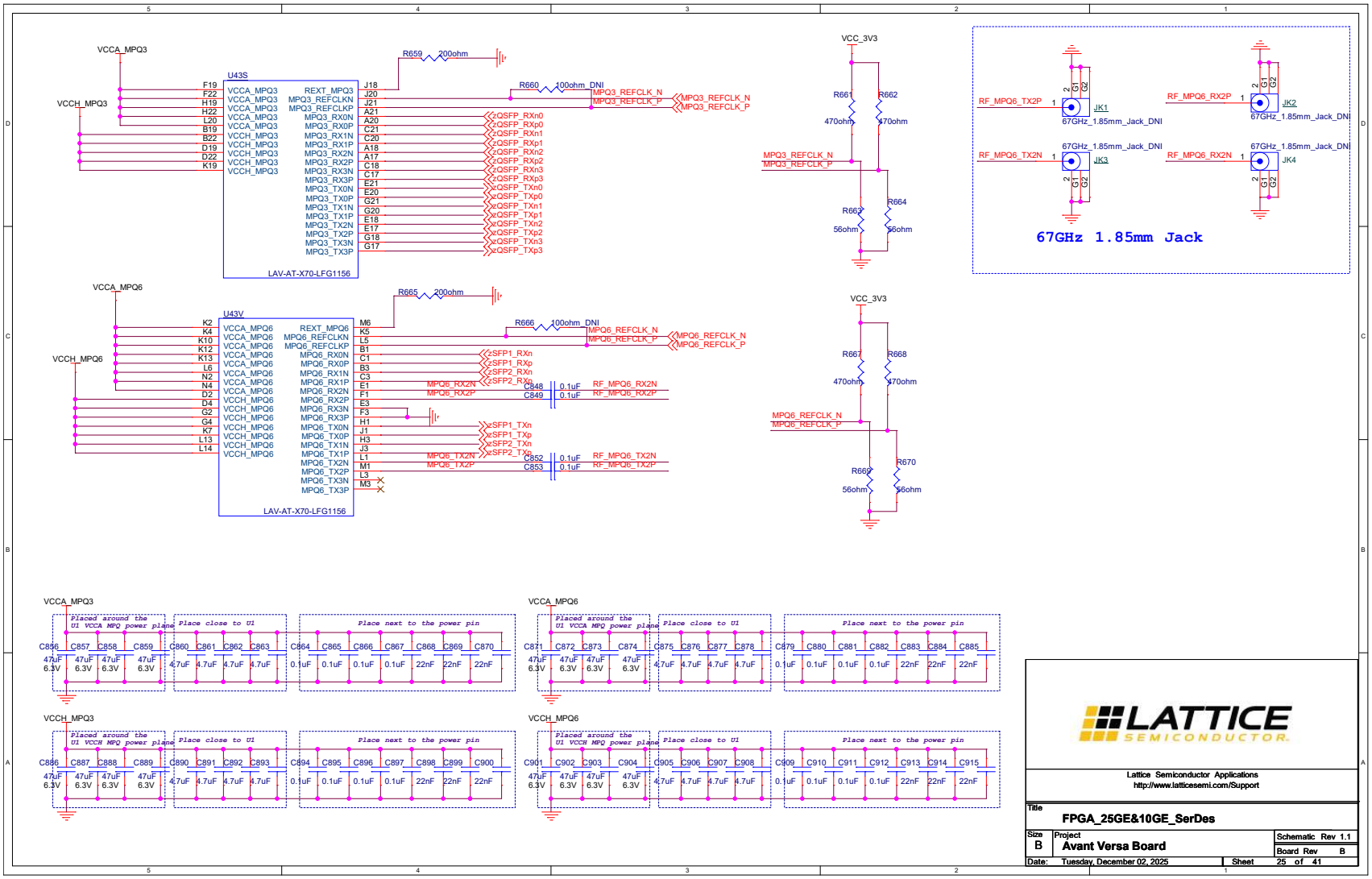

Figure A.25. FPGA_25GE&10GE_SerDes

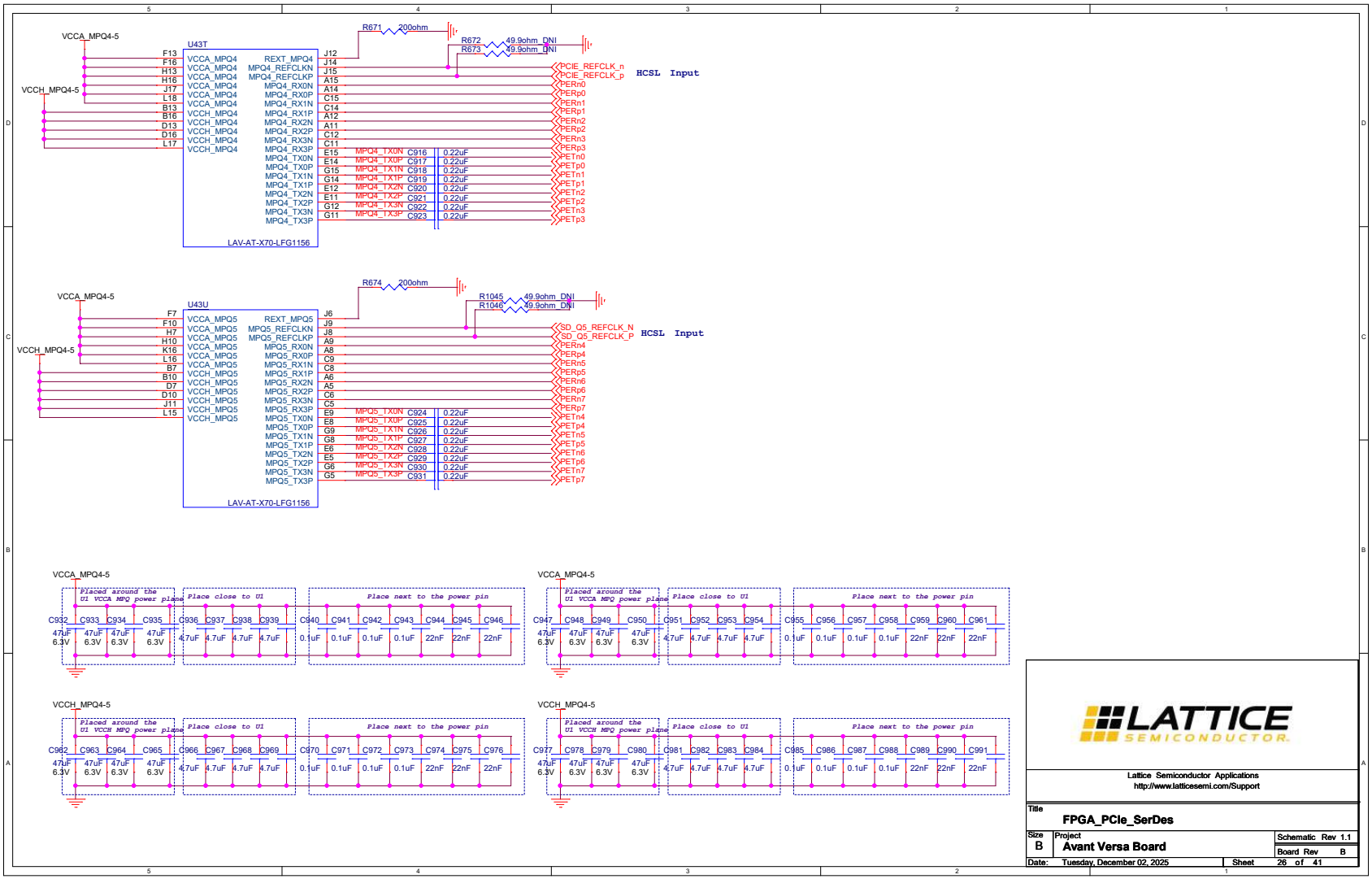

Figure A.26. FPGA_PCIe_SerDes

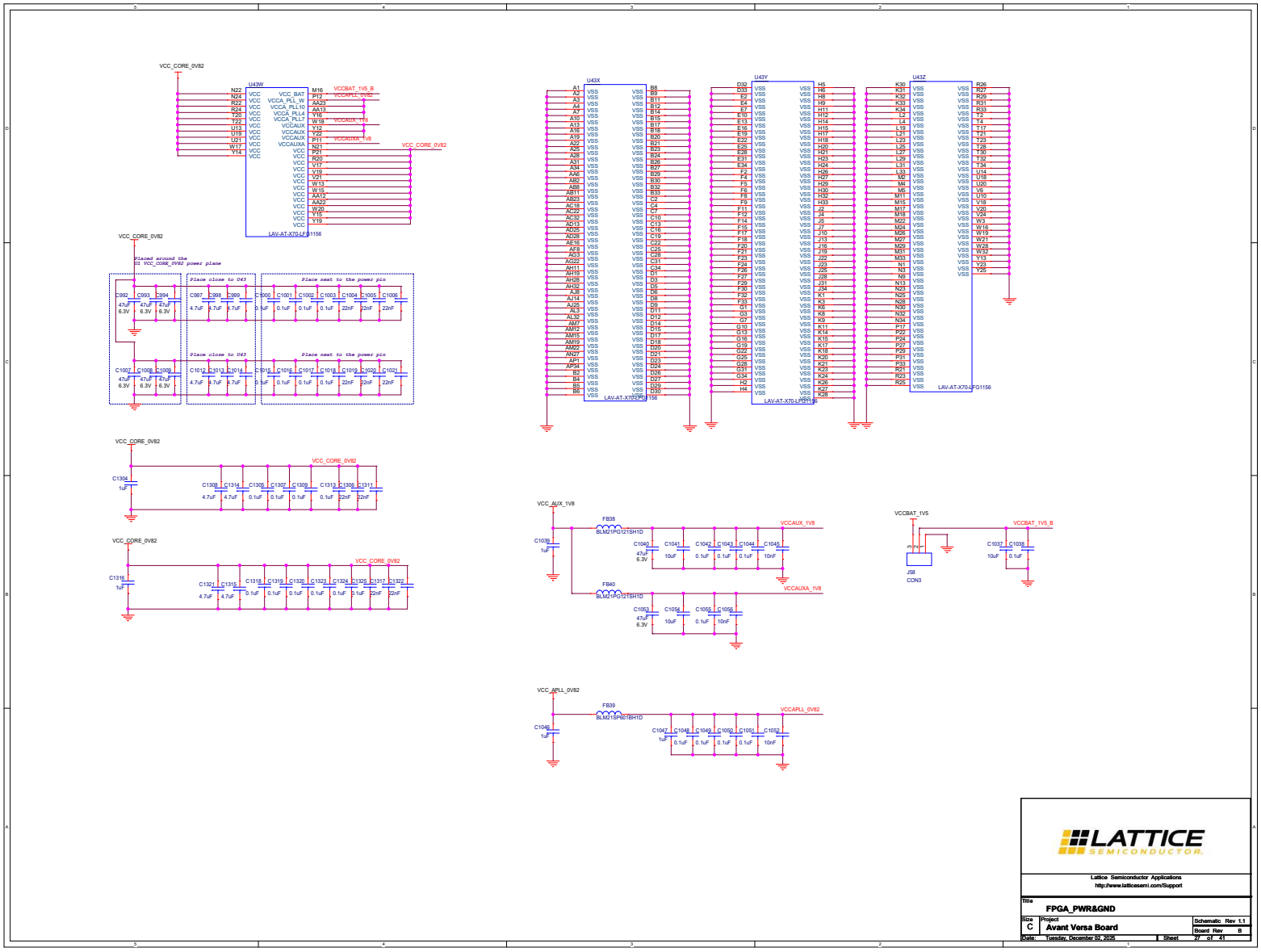

Figure A.27. FPGA_PWR&GND

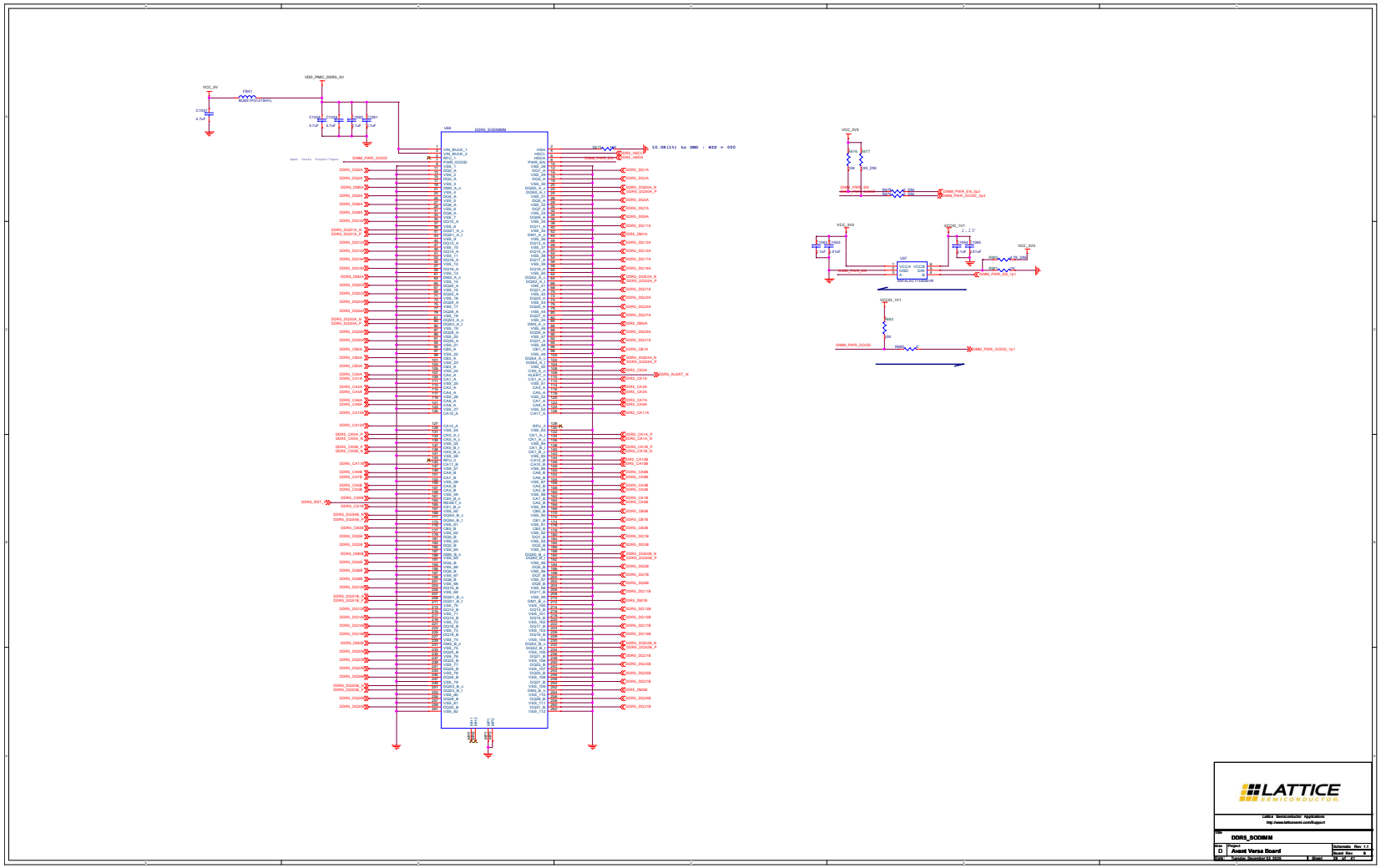

Figure A.28. DDR5_SODIMM

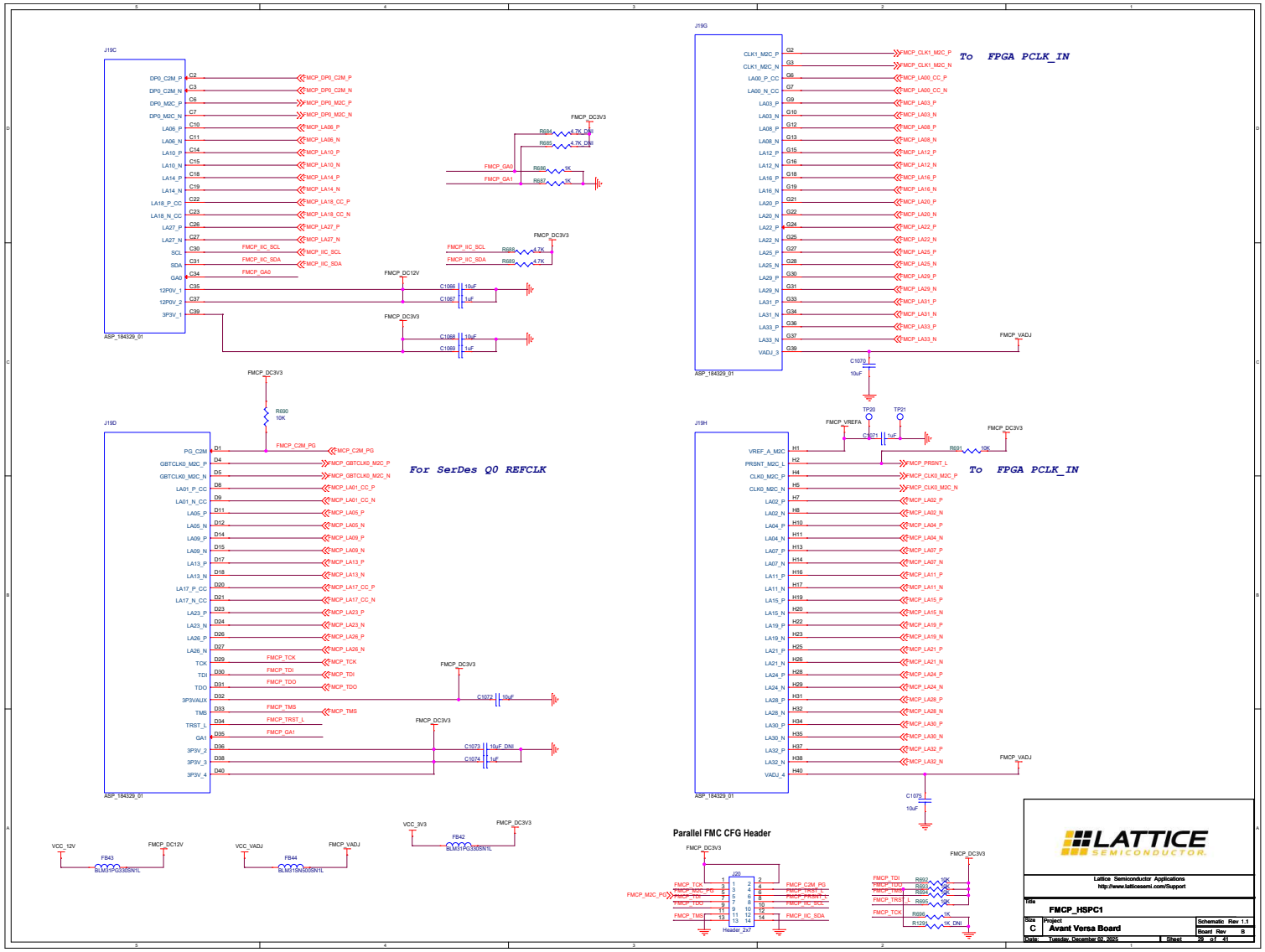

Figure A.29. FMCP_HSPC1

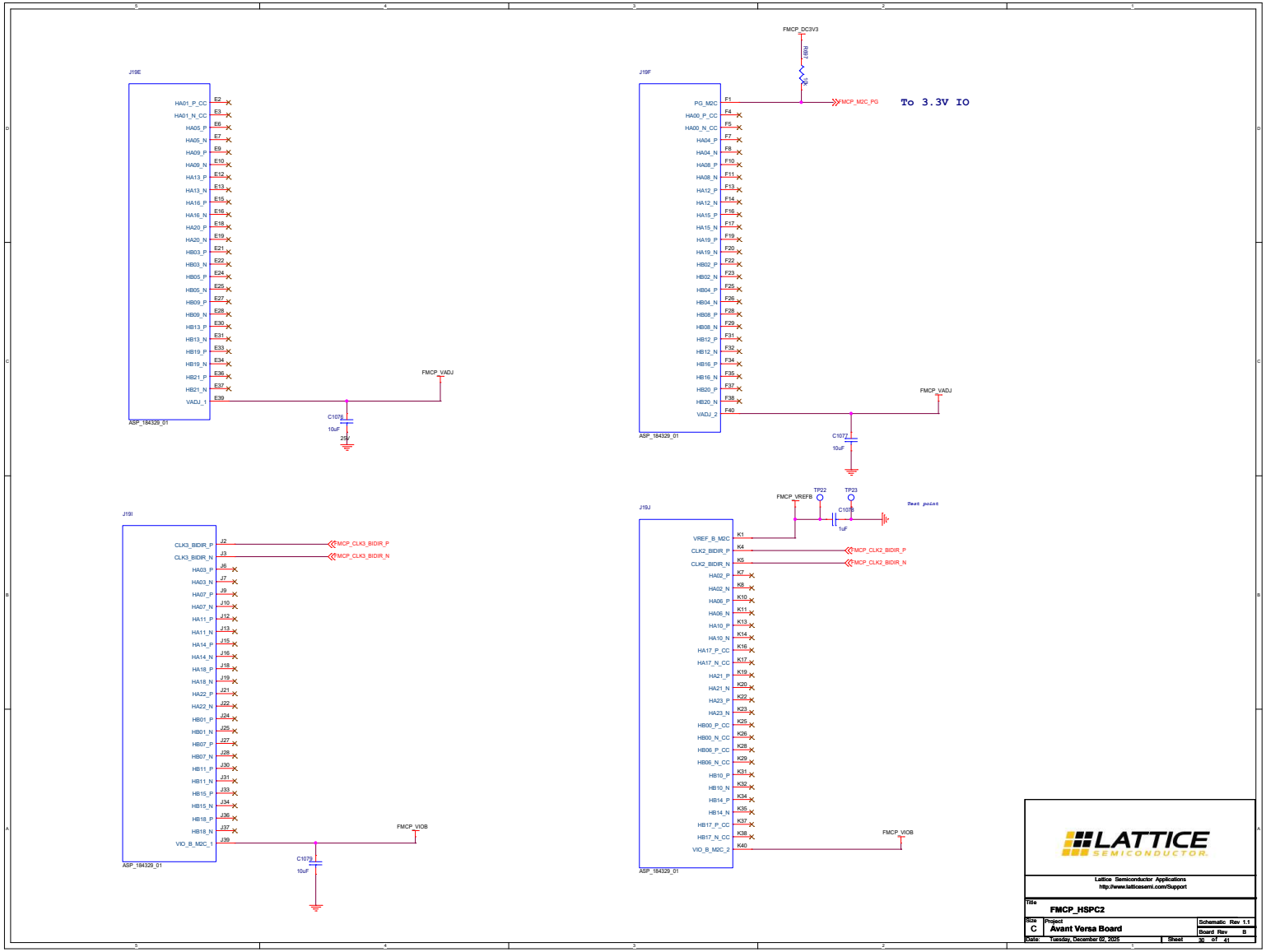

Figure A.30. FMCP_HSPC2

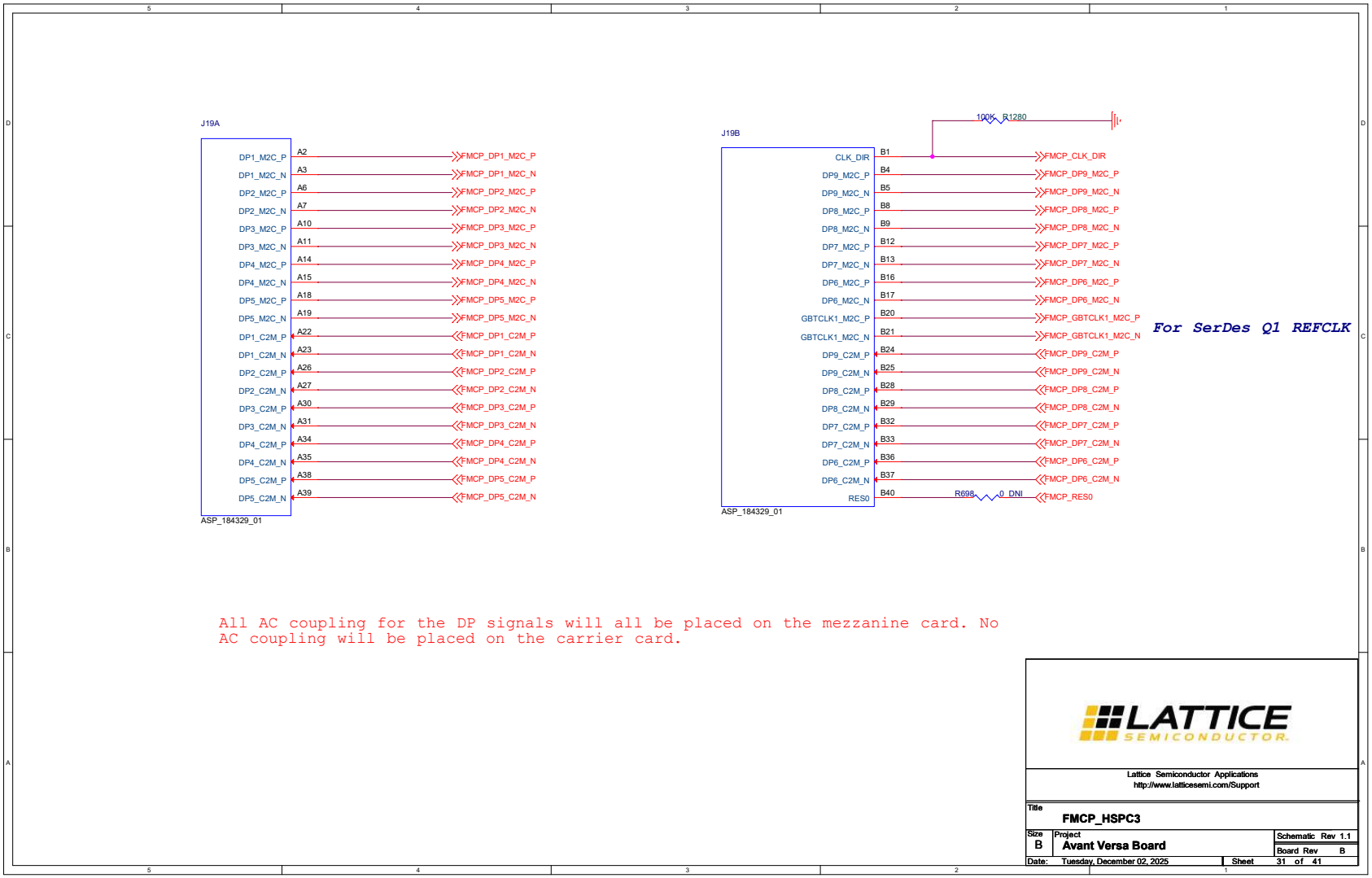

Figure A.31. FMCP_HSPC3

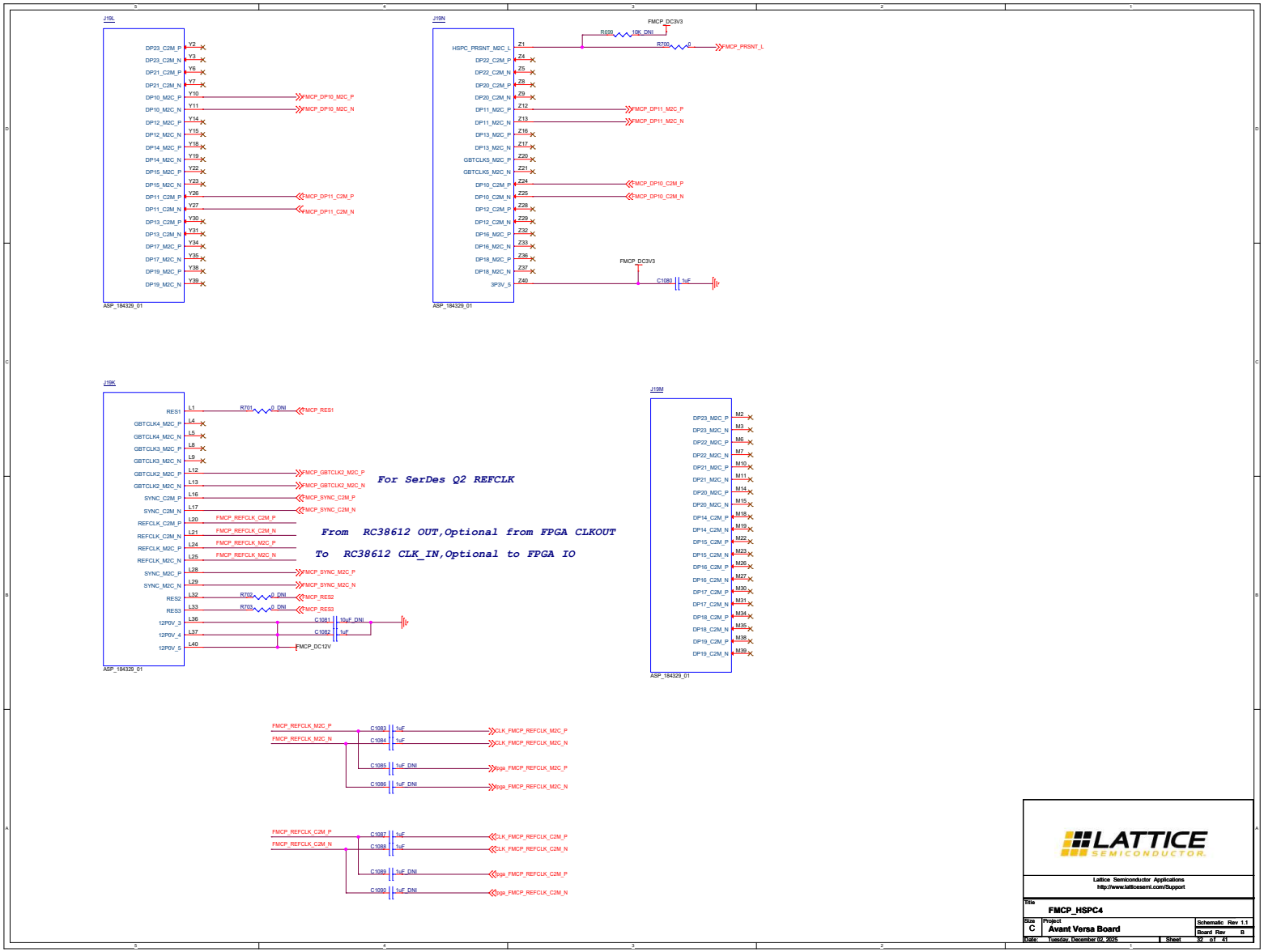

Figure A.32. FMCP_HSPC4

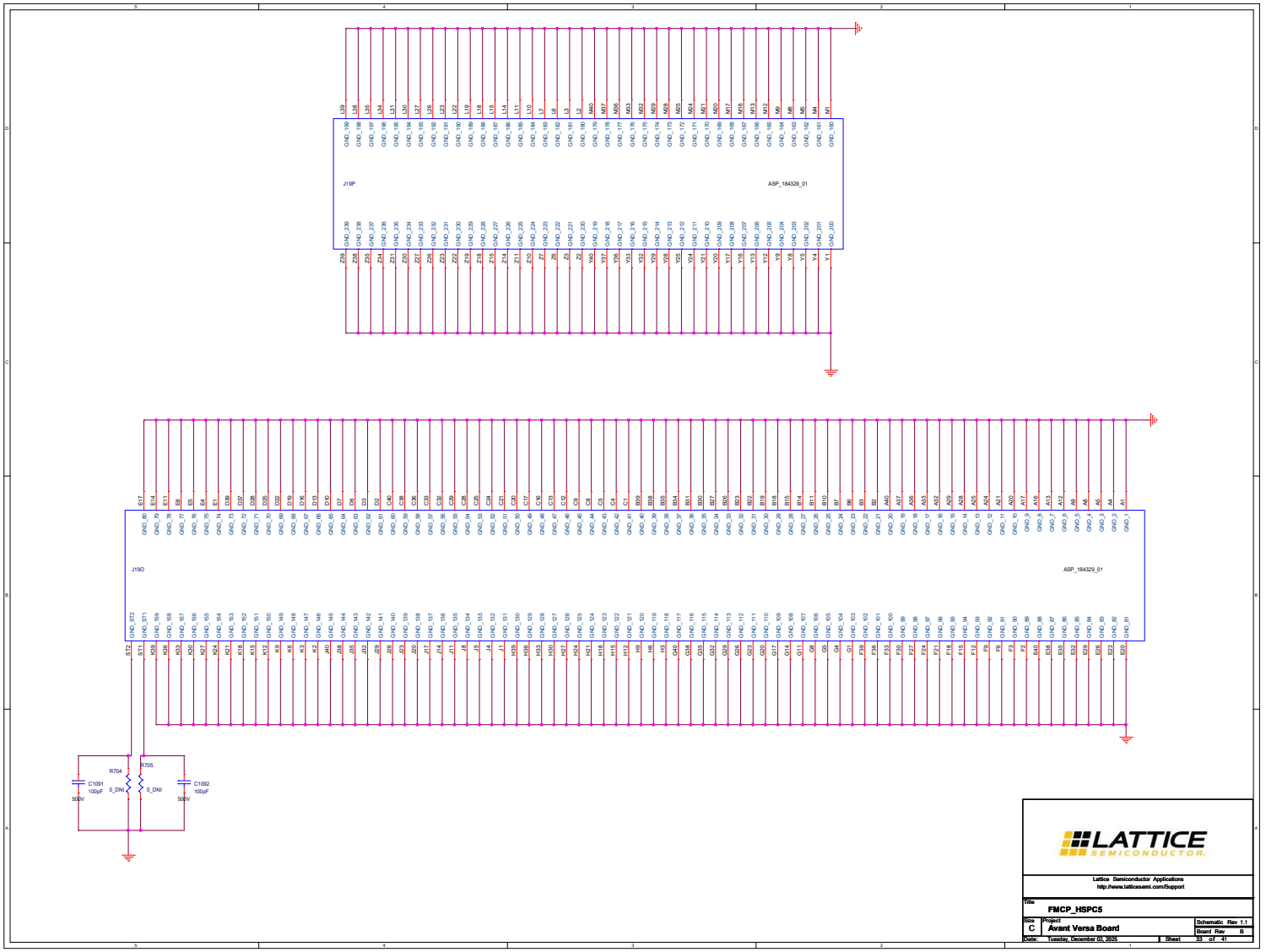

Figure A.33. FMCP_HSPC5

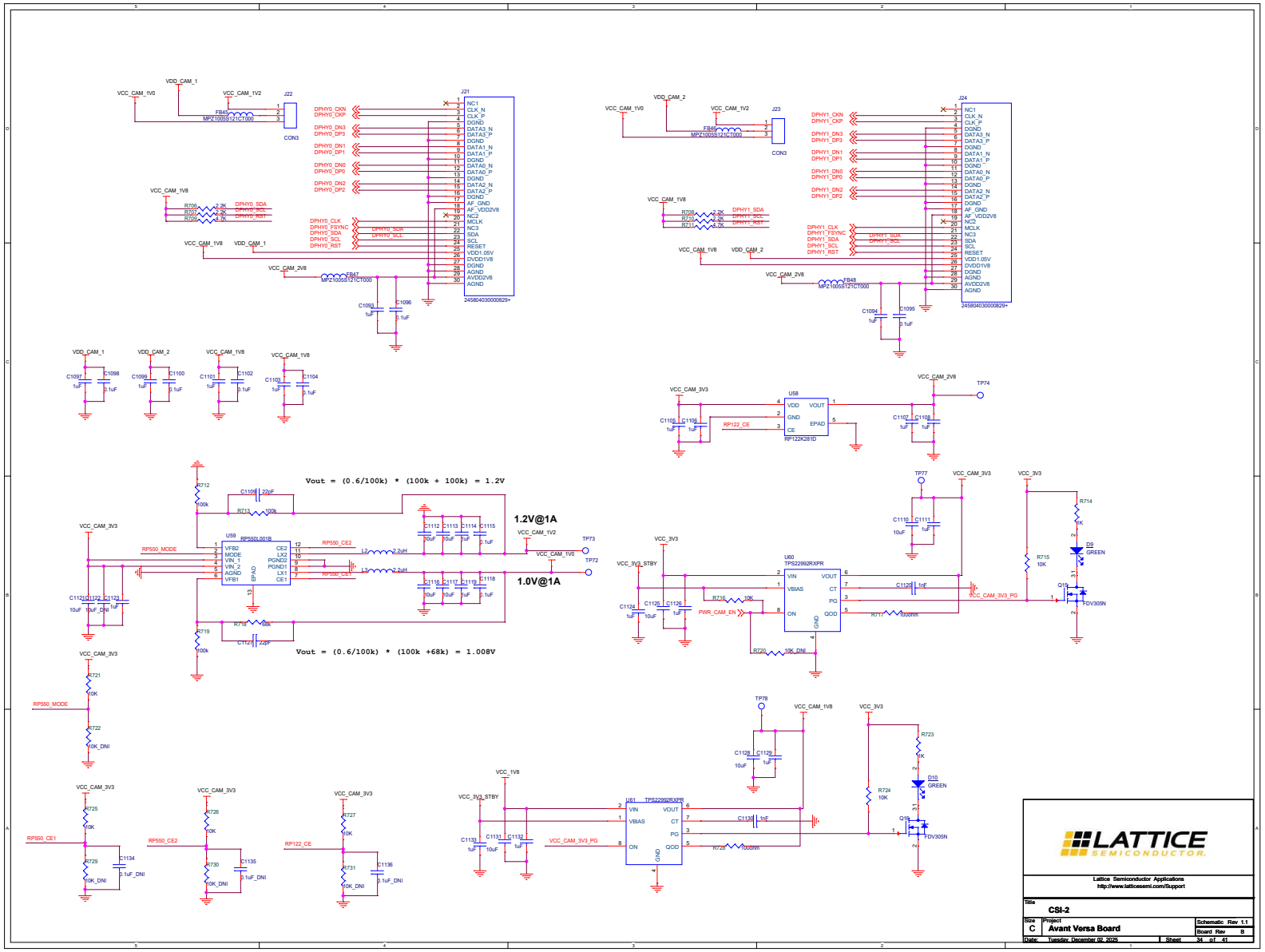

Figure A.34. CSI-2

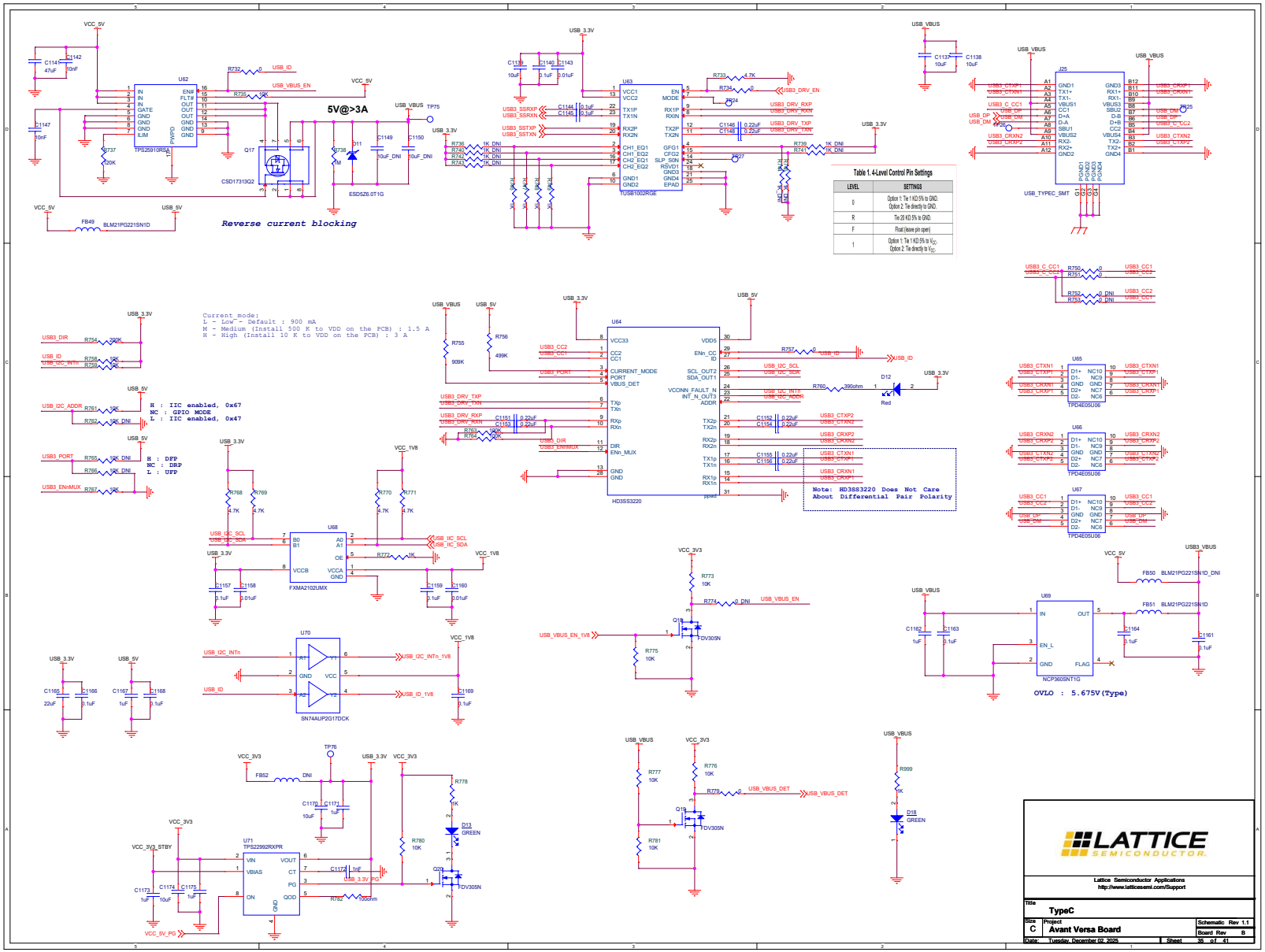

Figure A.35. TypeC

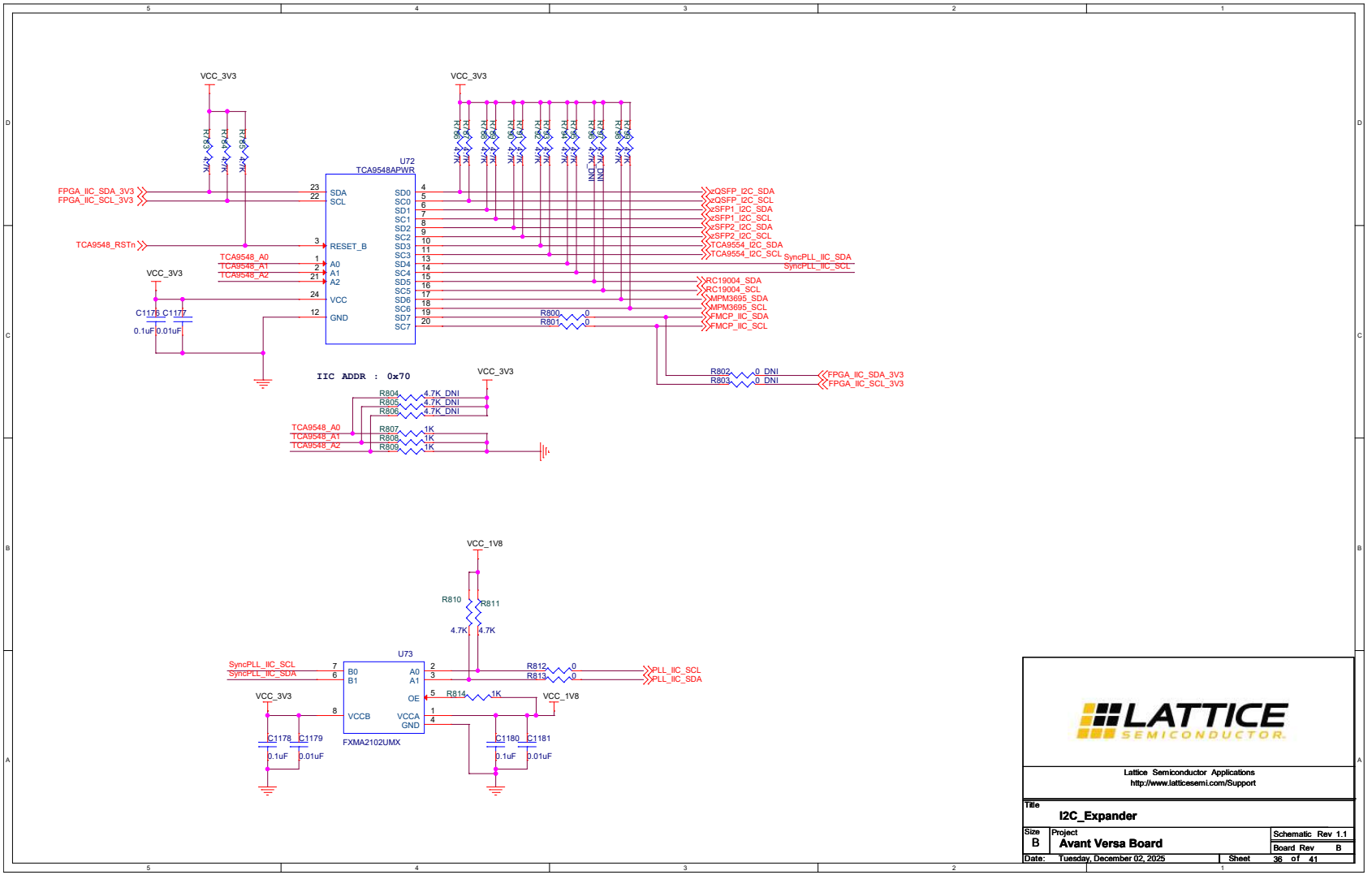

Figure A.36. I2C_Expander

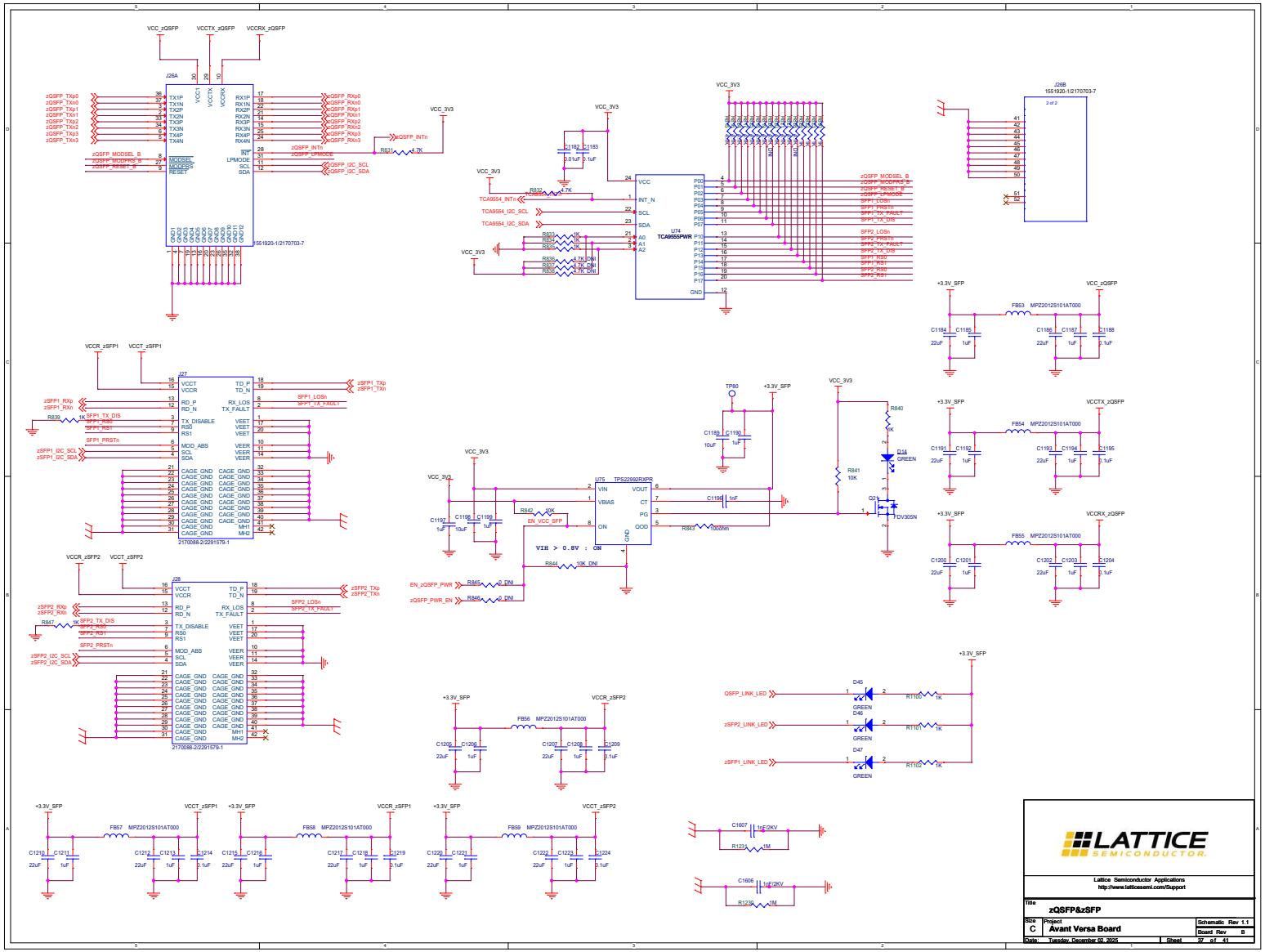

Figure A.37. zQSFP&zSFP

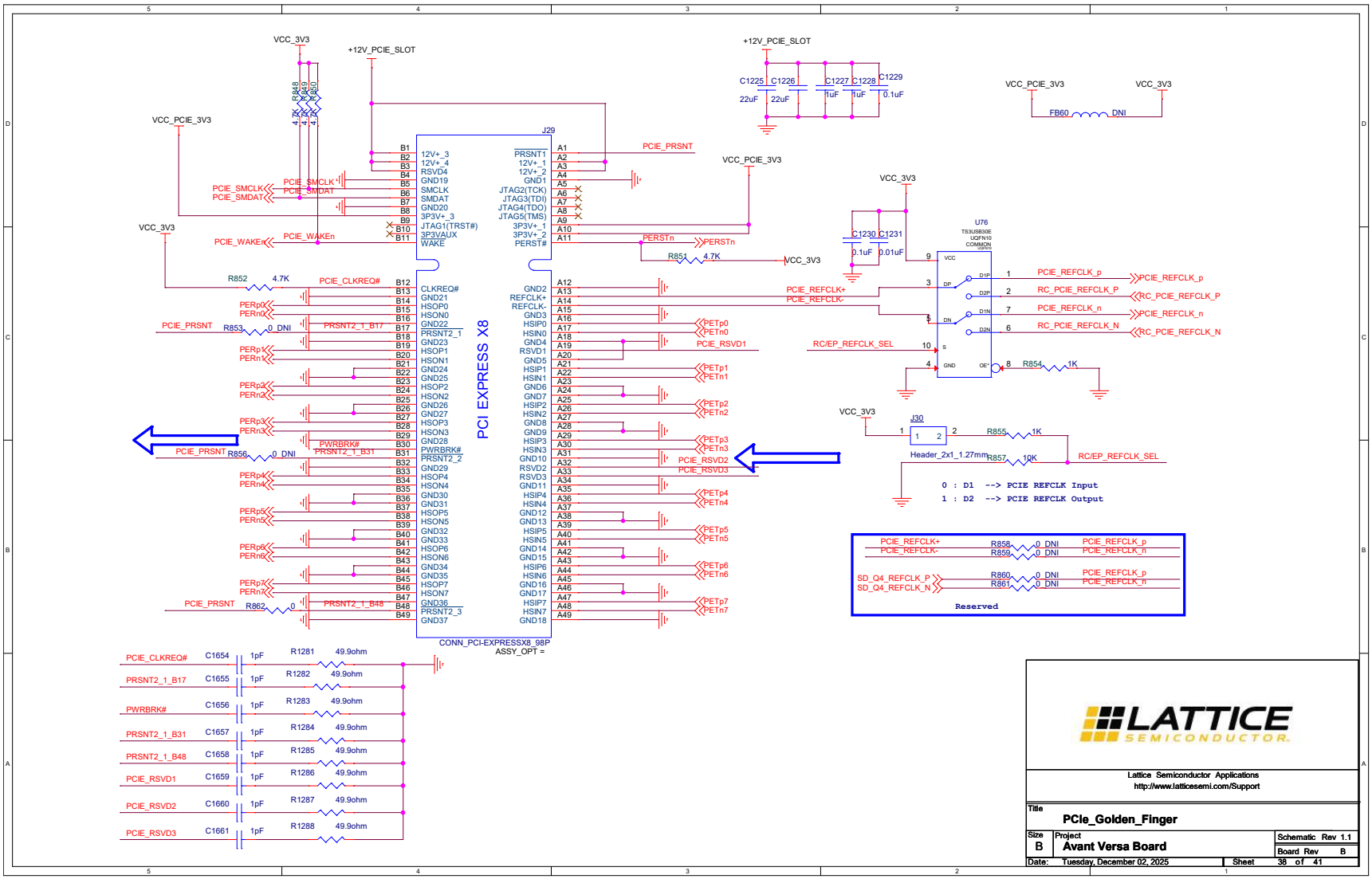

Figure A.38. PCIe_Golden_Finger

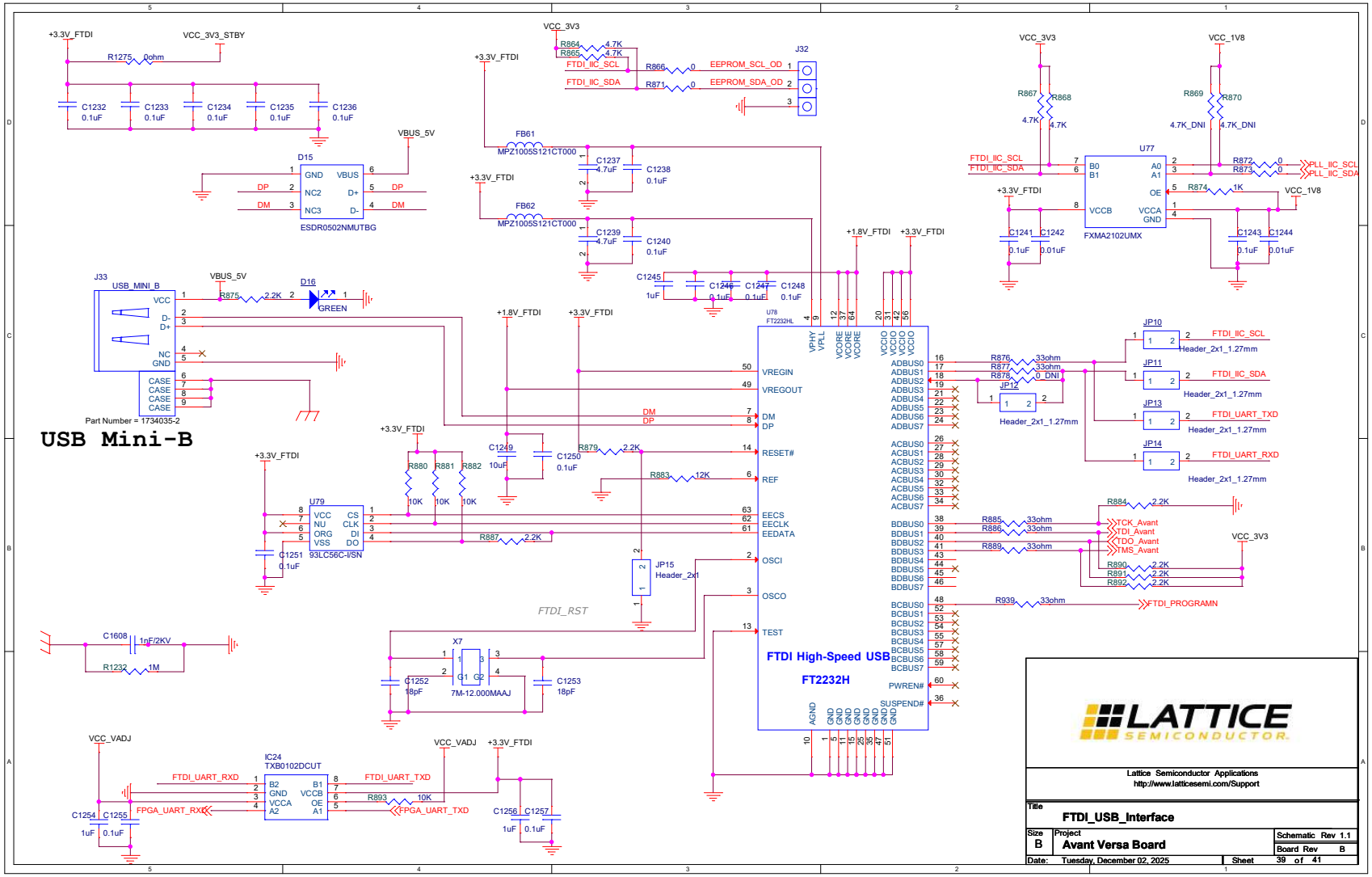

Figure A.39. FTDI_USB_Interface

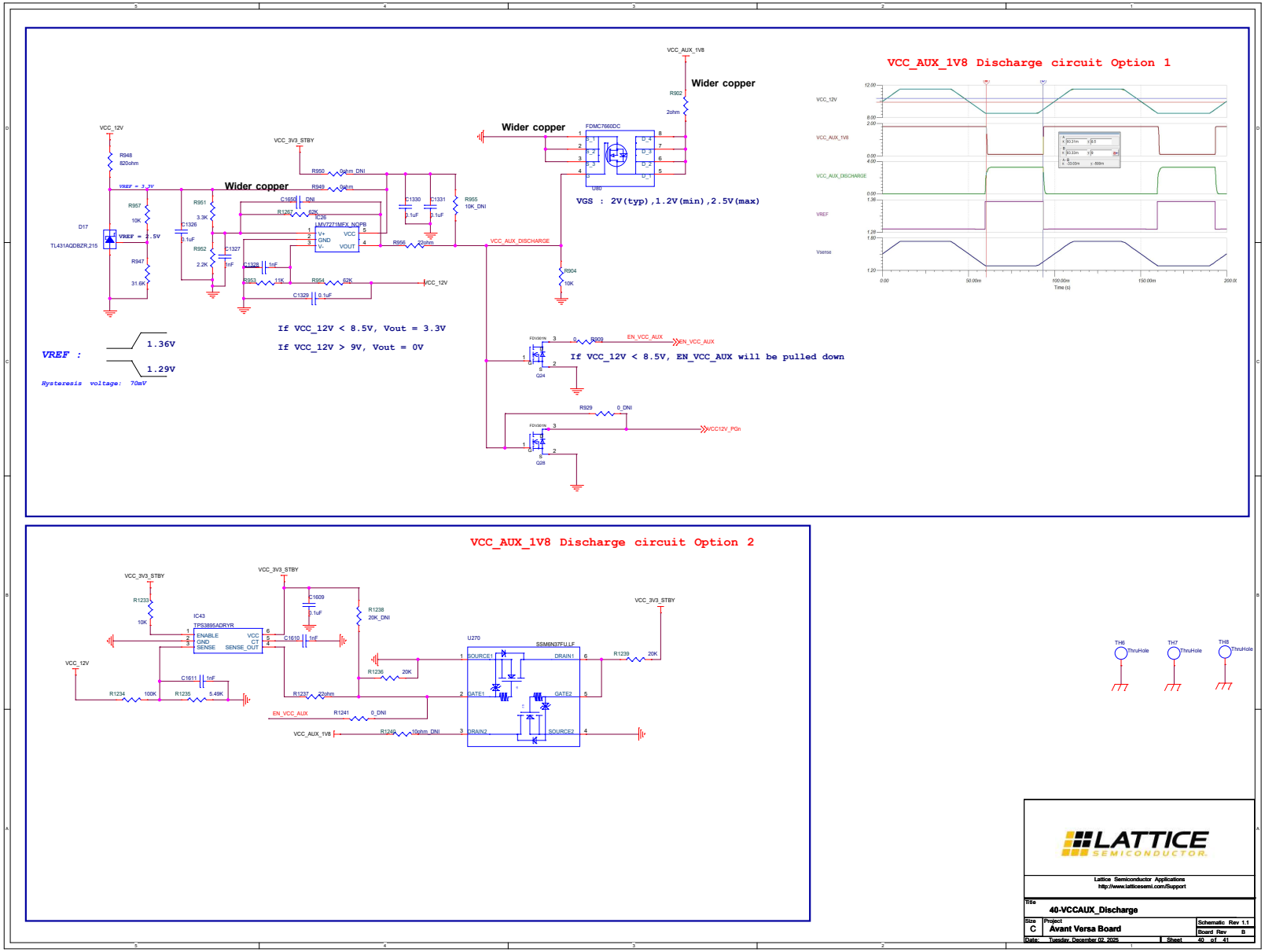

Figure A.40. VCCAUX_Discharge

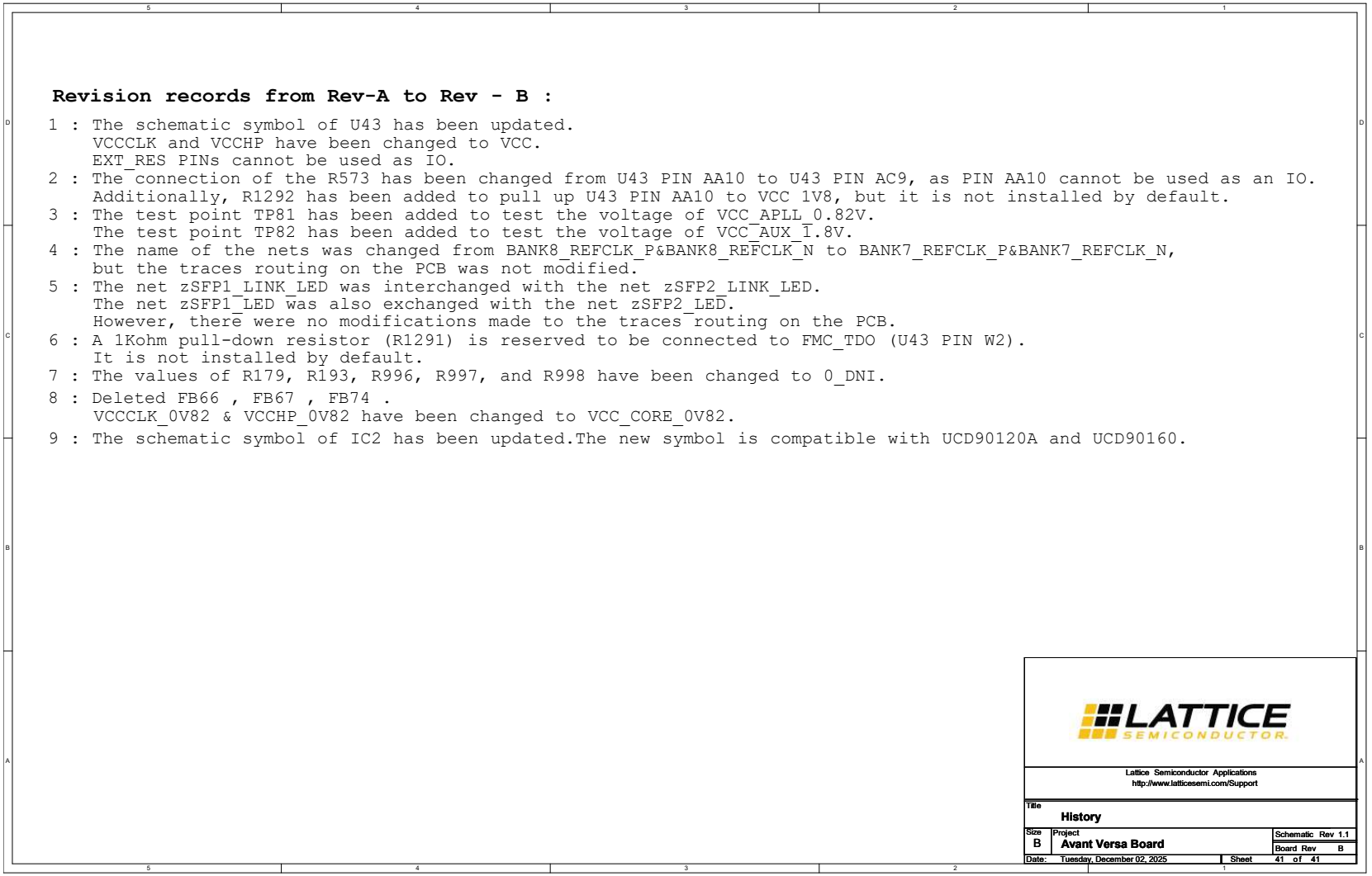

Figure A.41. History

Appendix B. Avant Versa Board Bill of Materials

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
1	38	C2,C5,C6,C54,C55,C57,C60,C78,C79,C81,C82, C111,C112,C113,C114,C132,C133,C134,C135, C159,C160,C161,C164,C183,C184,C185,C186, C202,C203,C204,C208,C1225,C1226,C1286, C1616,C1617,C1618,C1619	22uF	C0805	—	GRM21BR61E226ME44L	Murata	MLCC - SMD/SMT 22 uF 25 VDC 20% 0805 X5R
2	127	C4,C8,C17,C26,C58,C59,C63,C64,C80,C83,C84, C85,C115,C116,C129,C136,C137,C145,C148, C162,C163,C172,C187,C188,C195,C205,C206, C218,C242,C245,C249,C253,C258,C262,C265, C269,C276,C278,C398,C399,C400,C401,C405, C407,C474,C476,C478,C486,C487,C1039,C104 6,C1083,C1084,C1087,C1088,C1093,C1094, C1097,C1099,C1101,C1103,C1105,C1106, C1107,C1108,C1111,C1114,C1119,C1123, C1124,C1126,C1129,C1132,C1133,C1171, C1173,C1175,C1185,C1187,C1190,C1192, C1194,C1197,C1199,C1201,C1203,C1206, C1208,C1211,C1213,C1216,C1218,C1221, C1223,C1227,C1228,C1287,C1304,C1316, C1375,C1377,C1471,C1475,C1477,C1495, C1499,C1500,C1506,C1510,C1511,C1537, C1541,C1542,C1562,C1566,C1567, C1587,C1591,C1592,C1620,C1621,C1624, C1636,C1638,C366,C367,C371	1uF	C0402	—	GRM155R61E105KA12D	Murata	MLCC - SMD/SMT 1 uF 25 VDC 10% 0402 X5R
3	65	C9,C10,C11,C12,C13,C19,C28,C29,C30,C31, C32,C33,C34,C411,C470,C472,C483,C675, C676,C683,C685,C691,C695,C701,C703,C706, C720,C721,C725,C727,C729,C731,C733,C735, C737,C739,C741,C743,C745,C747,C749,C751, C1063,C1065,C1143,C1158,C1160,C1177, C1179,C1181,C1182,C1231,C1242,C1244, C1275,C1276,C1379,C1380,C1381,C1394, C1395,C1398,C1399,C1402,C1403	0.01uF	C0402	—	GCM155R71E103KA37D	Murata	MLCC - SMD/SMT 0.01 uF 25 VDC 10% 0402 X7R AEC-Q200
4	60	C14,C15,C16,C117,C118,C119,C120,C121, C122,C123,C124,C125,C126,C138,C139,C140, C141,C142,C143,C144,C153,C154,C155,C156, C157,C158,C165,C166,C167,C168,C177,C178, C179,C180,C181,C182,C189,C190,C191,C192, C199,C200,C201,C209,C210,C211,C212,C213, C214,C215,C1622,C1625,C1626,C1627,C1628, C1629,C1630,C1631,C1632,C1634	22uF	C0805	—	GRM219R61C226ME15L	Murata	MLCC - SMD/SMT 22 uF 16 VDC 20% 0805 X5R

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
5	8	C1654,C1655,C1656,C1657,C1658,C1659, C1660,C1661	1pF	C0201	—	GRT0335C1E1R0CA02D	Murata	MLCC - SMD/SMT 1 pF 25 VDC 0.25 pF 0201 C0G (NP0) AEC-Q200
6	1	C18	100pF	C0402	—	C0402C101K4RACTU	Kemet	MLCC - SMD/SMT 16V 100pF X7R 0402 10%
7	11	C20,C21,C22,C1066,C1068,C1070,C1072, C1075,C1076,C1077,C1079	10uF	C0805	—	GRM21BR61E106KA73L	Murata	MLCC - SMD/SMT 10 uF 25 VDC 10% 0805 X5R
8	284	C23,C27,C35,C36,C38,C40,C41,C61,C104,C236 ,C255,C271,C280,C356,C361,C362,C363,C364, C375,C376,C377,C378,C380,C381,C382,C383, C384,C385,C386,C387,C389,C391,C394,C395, C396,C397,C402,C412,C414,C416,C417,C419, C420,C422,C423,C425,C427,C428,C430,C432, C433,C434,C435,C437,C439,C441,C443,C445, C447,C449,C451,C453,C455,C457,C459,C461, C462,C463,C464,C466,C467,C468,C469,C471, C473,C475,C477,C479,C488,C489,C491,C492, C493,C494,C496,C497,C498,C499,C501,C503, C504,C505,C507,C509,C511,C512,C513,C514, C516,C518,C519,C521,C522,C524,C525,C527, C530,C531,C532,C536,C537,C538,C539,C540, C541,C542,C543,C544,C545,C546,C547,C549, C550,C551,C552,C553,C555,C556,C557,C564, C565,C566,C567,C568,C569,C571,C572,C573, C574,C575,C576,C585,C586,C595,C596,C597, C598,C622,C624,C636,C637,C638,C639,C661, C662,C663,C664,C665,C666,C670,C673,C674, C677,C678,C681,C682,C684,C687,C689,C690, C694,C696,C700,C702,C704,C705,C708,C710, C711,C712,C713,C715,C716,C717,C718,C719, C724,C726,C728,C730,C732,C734,C736,C738, C740,C742,C744,C746,C748,C750,C1060, C1061,C1062,C1064,C1140,C1157,C1159, C1161,C1163,C1164,C1166,C1168,C1169, C1176,C1178,C1180,C1183,C1188,C1195, C1204,C1209,C1214,C1219,C1224,C1229, C1230,C1232,C1233,C1234,C1235,C1236, C1238,C1240,C1241,C1243,C1246,C1247, C1248,C1250,C1251,C1255,C1257,C1265, C1271,C1273,C1288,C1289,C1290,C1326, C1329,C1330,C1331,C1332,C1373,C1374, C1376,C1378,C1382,C1384,C1385,C1386, C1387,C1389,C1390,C1392,C1393,C1396, C1397,C1400,C1401,C1404,C1468,C1479, C1489,C1503,C1545,C1551,C1570,C1576, C1595,C1601,C1609,C1637,C1651	0.1uF	C0402	—	GRM155R71E104KE14D	Murata	MLCC - SMD/SMT 0.1 uF 25 VDC 10% 0402 X7R

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
9	5	C24,C1327,C1328,C1610,C1611	1nF	C0402	—	GCM155R71H102KA37D	Murata	MLCC - SMD/SMT 1000 pF 50 VDC 10% 0402 X7R AEC-Q200
10	2	C25,C149	39pF	C0402	—	GRM1555C1H390JA01D	Murata	MLCC - SMD/SMT 39 pF 50 VDC 5% 0402 C0G (NP0)
11	4	C37,C39,C1237,C1239	4.7uF	C0603	—	GRM188R61C475ME11D	Murata	MLCC - SMD/SMT 4.7 uF 16 VDC 20% 0603 X5R
12	4	C44,C45,C67,C68	220uF	TC7343	—	T598D227M2R5ATE009	Kemet	Polymer Tantalum, 2.5V 220uF 7343 20% ESR=0.009Ohms
13	14	C47,C48,C49,C50,C51,C52,C53,C70,C71,C72, C73,C74,C75,C76	47uF	C0805	—	GRM219R60J476ME44D	Murata	MLCC - SMD/SMT 47 uF 6.3 VDC 20% 0805 X5R
14	7	C56,C77,C109,C151,C175,C198,C1615	100uF	TC7343	—	T521X107M025ATE060	Kemet	T521, Polymer Tantalum, 100 uF, 20%, 25 VDC, SMD, Polymer,ESR=60mohm
15	1	C62	33nF	C0603	—	C0603C333K5RACTU	Kemet	MLCC - SMD/SMT 50V 0.033uF X7R 0603 10%
16	5	C127,C170,C193,C216,C1613	4.7nF	C0603	—	885012206087	Wurth Elektronik	MLCC - SMD/SMT WCAP-CSGP 4700pF 0603 10% 50V MLCC
17	6	C131,C150,C174,C197,C220,C1614	22nF	C0603	—	885012206042	Wurth Elektronik	MLCC - SMD/SMT WCAP-CSGP 0.022uF 0603 10% 16V MLCC
18	31	C146,C243,C246,C250,C254,C259,C263,C266, C270,C274,C277,C1142,C1147,C1470,C1474, C1476,C1494,C1498,C1501,C1505,C1509, C1512,C1536,C1540,C1543,C1561,C1565, C1568,C1586,C1590,C1593	10nF	C0402	—	GRM155R71H103KA88D	Murata	MLCC - SMD/SMT 0.01 uF 50 VDC 10% 0402 X7R
19	77	C241,C244,C247,C251,C257,C260,C264,C267, C273,C275,C413,C421,C426,C436,C438,C440, C442,C444,C446,C448,C450,C452,C454,C456, C458,C460,C465,C490,C495,C510,C520,C523, C526,C528,C533,C534,C535,C548,C554,C563, C570,C582,C635,C660,C698,C709,C714, C1110,C1112,C1113,C1116,C1117,C1121, C1125,C1128,C1131,C1139,C1170,C1174, C1189,C1198,C1249,C1266,C1272,C1274, C1473,C1478,C1497,C1502,C1508,C1513, C1539,C1544,C1564,C1569,C1589,C1594	10uF	C0603	—	GRM188R61A106ME69D	Murata	MLCC - SMD/SMT 10 uF 10 VDC 20% 0603 X5R
20	1	C279	6.8nF	C0402	—	GRT155R71H682KE01D	Murata	MLCC - SMD/SMT 6800 pF 50 VDC 10% 0402 X7R AEC-Q200

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
21	2	C365,C368	0.1uF	C0201	—	GRM033R61E104KE14J	Murata	CAP CER 0.1UF 25V 10% X5R 0201
22	3	C369,C372,C373	100nF	C0402	—	C0402C104K4RACTU	Kemet	CAP CER 0.1UF 16V X7R 0402
23	2	C370,C374	10nF	C0402	—	GRM155R71H103KA88D	Murata	CAP CER 10000PF 50V X7R 0402
24	1	C379	10uF	C1206	—	GRM31CR71E106KA12L	Murata	MLCC - SMD/SMT 10 uF 25 VDC 10% 1206 X7R
25	1	C393	2200pF	C0402	—	04023C222KAT2A	KYOCERA /AVX	MLCC - SMD/SMT 25V 2200pF X7R 0402 10%
26	2	C409,C410	12pF	C0402	—	04025A120JAT2A	KYOCERA AVX	MLCC - SMD/SMT 50V 12pF C0G 0402 5%
27	5	C415,C669,C686,C699,C1267	2.2uF	C0603	—	GRM188R71A225KE15D	Murata	MLCC - SMD/SMT 2.2 uF 10 VDC 10% 0603 X7R
28	11	C418,C424,C429,C431,C502,C587,C599,C612, C625,C640,C653	10uF	C0402	—	GRM155R60J106ME05D	Murata	MLCC - SMD/SMT 10 uF 6.3 VDC 20% 0402 X5R
29	1	C480	0.47uF	C0402	—	CC0402KRX5R8BB474	Yageo	MLCC - SMD/SMT 25V 0.47uF X5R 0402 10%
30	17	C506,C508,C515,C517,C1067,C1069,C1071, C1074,C1078,C1080,C1082,C1162,C1167, C1245,C1254,C1256,C1270	1uF	C0603	—	GCM188R71E105KA64D	Murata	MLCC - SMD/SMT 1 uF 25 VDC 10% 0603 X7R AEC-Q200
31	4	C529,C1057,C1058,C1059	4.7uF	C0402	—	GRM155R61A475MEAAD	Murata	MLCC - SMD/SMT 4.7 uF 10 VDC 20% 0402 X5R
32	68	C558,C559,C560,C561,C562,C577,C578,C579, C580,C617,C618,C619,C620,C621,C658,C659, C1405,C1406,C1407,C1408,C1409,C1410, C1411,C1412,C1413,C1414,C1415,C1416, C1417,C1418,C1419,C1420,C1421,C1422, C1423,C1424,C1425,C1426,C1427,C1428, C1429,C1430,C1431,C1432,C1433,C1434, C1435,C1436,C1437,C1438,C1439,C1440, C1441,C1442,C1443,C1444,C1445,C1446, C1447,C1448,C1449,C1450,C1451,C1452, C1453,C1454,C1455,C1456	0.1uF	C0201	—	GRM033R60J104KE19D	Murata	MLCC - SMD/SMT 0.1 uF 6.3 VDC 10% 0201 X5R
33	8	C667,C668,C848,C849,C852,C853,C1144, C1145	0.1uF	C0201	—	GRM033R61C104KE14D	Murata	MLCC - SMD/SMT 0.1 uF 16 VDC 10% 0201 X5R
34	17	C671,C672,C1165,C1184,C1186,C1191,C1193, C1200,C1202,C1205,C1207,C1210,C1212, C1215,C1217,C1220,C1222	22uF	C1206	—	GCJ31CR71A226KE01L	Murata	MLCC - SMD/SMT 22 uF 10 VDC 10% 1206 X7R AEC-Q200
35	4	C679,C680,C722,C723	0.01uF	C0201	—	GRM033R71A103KA01D	Murata	MLCC - SMD/SMT 0.01 uF 10 VDC 10% 0201 X7R
36	3	C688,C692,C693	22uF	C0603	—	GRM188R61A226ME15D	Murata	MLCC - SMD/SMT 22 uF 10 VDC 20% 0603 X5R

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
37	1	C697	4.7uF	C0603	—	GRM188R61A475KE15D	Murata	CAP CER 4.7uF 10V 20% X5R 0603
38	64	C752,C753,C754,C755,C769,C770,C771,C772, C784,C785,C786,C787,C801,C802,C803,C804, C816,C817,C818,C819,C833,C834,C835,C836, C856,C857,C858,C859,C871,C872,C873,C874, C886,C887,C888,C889,C901,C902,C903,C904, C932,C933,C934,C935,C947,C948,C949,C950, C962,C963,C964,C965,C977,C978,C979,C980, C992,C993,C994,C1007,C1008,C1009,C1040, C1053	47uF	C0603	—	GRM188R60J476ME15D	Murata	MLCC - SMD/SMT 47 uF 6.3 VDC 20% 0603 X5R
39	66	C756,C757,C758,C759,C773,C774,C775,C776, C788,C789,C790,C791,C805,C806,C807,C808, C820,C821,C822,C823,C837,C838,C839,C840, C860,C861,C862,C863,C875,C876,C877,C878, C890,C891,C892,C893,C905,C906,C907,C908, C936,C937,C938,C939,C951,C952,C953,C954, C966,C967,C968,C969,C981,C982,C983,C984, C997,C998,C999,C1012,C1013,C1014,C1308, C1314,C1315,C1321	4.7uF	C0402	—	GRM155R60J475ME87D	Murata	MLCC - SMD/SMT 4.7 uF 6.3 VDC 20% 0402 X5R
40	92	C760,C761,C762,C763,C777,C778,C779,C780, C792,C793,C794,C795,C809,C810,C811,C812, C824,C825,C826,C827,C841,C842,C843,C844, C864,C865,C866,C867,C879,C880,C881,C882, C894,C895,C896,C897,C909,C910,C911,C912, C940,C941,C942,C943,C955,C956,C957,C958, C970,C971,C972,C973,C985,C986,C987,C988, C1000,C1001,C1002,C1003,C1015,C1016, C1017,C1018,C1038,C1042,C1043,C1044, C1048,C1049,C1050,C1051,C1055,C1095, C1096,C1098,C1100,C1102,C1104,C1115, C1118,C1305,C1307,C1309,C1313,C1318, C1319,C1320,C1323,C1324,C1325,C1652	0.1uF	C0201	—	GRM033R61E104ME14D	Murata	MLCC - SMD/SMT 0.1 uF 25 VDC 20% 0201 X5R
41	52	C764,C765,C766,C781,C782,C783,C796,C797, C798,C813,C814,C815,C828,C829,C830,C845, C846,C847,C868,C869,C870,C883,C884,C885, C898,C899,C900,C913,C914,C915,C944,C945, C946,C959,C960,C961,C974,C975,C976,C989, C990,C991,C1004,C1005,C1006,C1019,C1020, C1021,C1306,C1311,C1317,C1322	22nF	C0201	—	GRM033R61C223KE84D	Murata	MLCC - SMD/SMT 0.022 uF 16 VDC 10% 0201 X5R
42	6	C767,C768,C799,C800,C831,C832	0.01uF	C0201	—	GRM033R71C103KE14D	Murata	MLCC - SMD/SMT .01UF 16V 10% 0201

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
43	24	C916,C917,C918,C919,C920,C921,C922,C923, C924,C925,C926,C927,C928,C929,C930,C931, C1146,C1148,C1151,C1152,C1153,C1154, C1155,C1156	0.22uF	C0201	—	GRM033R61C224KE14D	Murata	MLCC - SMD/SMT .22UF 16V 10% 0201
44	3	C1037,C1041,C1054	10uF	C0402	—	CC0402MRX5R5BB106	Yageo	MLCC - SMD/SMT 6.3 V 10 uF X5R 0402 20%
45	3	C1045,C1052,C1056	10nF	C0201	—	GRM033R71A103KA01D	Murata	MLCC - SMD/SMT 0.01 uF 10 VDC 10% 0201 X7R
46	1	C1047	1uF	C0201	—	GRM033R61C105ME15D	Murata	MLCC - SMD/SMT 1 uF 16 VDC 20% 0201 X5R
47	2	C1091,C1092	100pF	C1206	—	CC1206JRNPOBBN101	Yageo	MLCC - SMD/SMT 500V 100pF C0G 1206 5%
48	2	C1109,C1127	22pF	C0402	—	CC0402JRNPO9BN220	Yageo	MLCC - SMD/SMT 50 V 22 pF C0G 0402 5%
49	4	C1120,C1130,C1172,C1196	1nF	C0603	—	CC0603KRX7R9BB102	Yageo	MLCC - SMD/SMT 50V 1000pF X7R 0603 10%
50	2	C1137,C1138	10uF	C1206	—	GRM31CD71H106KE11L	Murata	MLCC - SMD/SMT 10 uF 50 VDC 10% 1206 X7T
51	1	C1141	47uF	C1206	—	GRM31CR61C476ME44L	Murata	MLCC - SMD/SMT 47 uF 16 VDC 20% 1206 X5R
52	2	C1252,C1253	18pF	C0402	—	C0402C180K3GACTU	Kemet	CAP CER 18PF 25V 10% NP0 0402
53	1	C1264	47uF	C1206	—	GRT31CR61A476KE13L	Murata	MLCC - SMD/SMT 47 uF 10 VDC 10% 1206 X5R AEC-Q200
54	2	C1388,C1391	100pF	C0402	—	CC0402JRNPO9BN101	Yageo	MLCC - SMD/SMT 50 V 100pF C0G 0402 5%
55	12	C1457,C1459,C1490,C1492,C1525,C1527, C1552,C1554,C1578,C1579,C1603,C1604	10uF	C0805	—	C2012X7S1E106K125AC	TDK	MLCC - SMD/SMT MLCC,0805,X7S,25V,10uF, 1.25mm
56	12	C1458,C1463,C1484,C1491,C1519,C1526, C1535,C1553,C1560,C1577,C1585,C1602	2.2nF	C0402	—	GRM155R71H222KA01D	Murata	MLCC - SMD/SMT 2200 pF 50 VDC 10% 0402 X7R
57	12	C1460,C1461,C1481,C1482,C1516,C1518, C1532,C1533,C1557,C1558,C1582,C1583	22uF	C0805	—	C2012X7S1A226M125AC	TDK	MLCC - SMD/SMT 0805 10V 22uF X7S 20% T: 1.25mm
58	24	C1462,C1464,C1465,C1469,C1483,C1485, C1486,C1493,C1517,C1520,C1521,C1528, C1534,C1547,C1548,C1555,C1559,C1572, C1573,C1580,C1584,C1597,C1598,C1605	22uF	C0402	—	GRM158R61A226ME15D	Murata	MLCC - SMD/SMT 22 uF 10 VDC 20% 0402 X5R
59	6	C1466,C1487,C1522,C1549,C1574,C1599	470nF	C0402	—	GRT155R61E474KE01D	Murata	MLCC - SMD/SMT 0.47 uF 25 VDC 10% 0402 X5R AEC-Q200

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
60	3	C1606,C1607,C1608	1nF/2KV	C1206	—	CC1206KKX7RDBB102	Yageo	MLCC - SMD/SMT 2kV 1000pF X7R 1206 10%
61	2	C1640,C1641	2.2nF	C0402	—	GCM155R71H222KA37D	Murata	MLCC - SMD/SMT 2200 pF 50 VDC 10% 0402 X7R AEC-Q200
62	1	C1642	4.7nF	C0402	—	GCM155R71H472KA37D	Murata	MLCC - SMD/SMT 4700 pF 50 VDC 10% 0402 X7R AEC-Q200
63	1	C1643	3.3nF	C0402	—	GRT155R71H332KE01D	Murata	MLCC - SMD/SMT 3300 pF 50 VDC 10% 0402 X7R AEC-Q200
64	2	D2,D4	MMBD1205	SOT-23-3	—	MMBD1205	onsemi	DIODE ARRAY GP 100V 200MA SOT23
65	3	D5,D6,D12	Red	led_0402	—	150040RS73220	Wurth	LED RED 0402 SMD
66	26	D7,D9,D10,D13,D14,D16,D18,D19,D20,D21, D24,D25,D26,D27,D29,D30,D31,D32,D39,D40, D41,D42,D43,D45,D46,D47	GREEN	led_0402	—	150040GS73240	Wurth	SMD WL-SMCC SMD Mono SMD 0402 Green 515nm
67	1	D8	LDT-N2804RI	display_12 P-PTH	—	LDT-N2804RI	Lumex Opto/Components Inc.	DISPLAY 7SEG 0.28" TRP RED 12DIP
68	1	D11	ESD5Z6.0T1 G	SOD-523	—	ESD5Z6.0T1G	On Semiconductor	DIODE - TVS DIODE 6VWM 20.5VC SOD523
69	1	D15	ESDR0502N MUTBG	UDFN6_04 0	—	ESDR0502NMUTBG	Onsemi	TVS DIODE 5.5VWM 6UDFN
70	3	D17,D44,D51	TL431AQDBZ R,215	SOT23-3	—	TL431AQDBZR,215	Nexperia	adjustable, precision shunt regulator with optimized reference current 3-SOT-23
71	2	D48,D49	SMCJ12A-TR	DO-214AB-2	—	SMCJ12A-TR	SMCJ12A-TR	ESD 1500W, 14V, 5%, Unidirectional, TVS
72	1	D50	B530C_13_F	DIOM7959 X250N	—	B530C-13-F	Diodes	Diodes Inc B530C-13-F, SMT Schottky Diode, 30V 5A, 2-Pin DO-214AB
73	1	FB1	BLM18KG22 1SN1D	FB0603	—	BLM18KG221SN1D	MURATA	0603 220 ohm, 2.2 A, EMIFIL BLM18K, 0.05 ohm, 25%
74	7	FB2,FB3,FB5,FB7,FB8,FB45,FB46	MPZ1005S12 1CT000	FB0402	—	MPZ1005S121CT000	TDK Corporation	FERRITE BEAD 120 OHM 0402 1LN
75	19	FB9,FB10,FB11,FB12,FB13,FB14,FB15,FB16, FB17,FB18,FB19,FB20,FB21,FB22,FB23,FB24, FB25,FB26,FB27	BLM15HB22 1SN1D	FB0402	—	BLM15HB221SN1D	MURATA	220 OHM 25% Alternate Sizing Guide Below

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
76	1	FB28	BLM18PG300SN1D	FB0603	—	BLM18PG300SN1D	MURATA	30 ohm, 1 A, BLM18P,0603 0.05 ohm
77	5	FB29,FB31,FB33,FB34,FB35	220ohm/2A	FB0603	—	BBPY00160808221Y00	Pulse Electronics	220Ohms RDC=0.1Ohms 2000mA
78	1	FB30	MPZ2012S601AT000	FB0805	—	MPZ2012S601AT000	TDK	600ohms 2A 100mOhms 0805 Ferrite Chip
79	3	FB32,FB49,FB51	BLM21PG221SN1D	FB0805	—	BLM21PG221SN1D	MURATA	220ohms 2A 50mOhms 0805 Ferrite Chip
80	2	FB38,FB40	BLM21PG121SH1D	FB0805	—	BLM21PG121SH1D	MURATA	120 ohm, 3 A, BLM21PG, 0.03 ohm, 25%
81	1	FB39	BLM21SP601BH1D	FB0805	—	BLM21SP601BH1D	MURATA	600 ohm, 2.3 A, BLM21_BH, 0.06 ohm, 25%
82	1	FB41	BLM31PG121SH1L	FB1206	—	BLM31PG121SH1L	MURATA	120 ohm, 3.5 A, BLM31PG, 0.02 ohm, 25
83	2	FB42,FB43	BLM31PG330SN1L	FB1206	—	BLM31PG330SN1L	MURATA	33 ohm, 6 A, BLM31PG, 0.009 ohm, 25%
84	1	FB44	BLM31SN500SN1L	FB1206	—	BLM31SN500SN1L	MURATA	BLM31SN,1206 [3216], 50 ohm, 12 A, 0.0016 ohm, 12.5ohm
85	2	FB47,FB48	MPZ1005S121CT000	FB0402	—	MPZ1005S121CT000	TDK Corporation	FERRITE BEAD 120 OHM 0402 1.2A
86	8	FB53,FB54,FB55,FB56,FB57,FB58,FB59,FB63	MPZ2012S101AT000	FB0805	—	MPZ2012S101AT000	TDK	100ohms 4A 20mOhms 0805 Ferrite Chip
87	2	FB61,FB62	MPZ1005S121CT000	FB0402	—	MPZ1005S121CT000	TDK Corporation	FERRITE BEAD 120 OHM 0402 1LN
88	6	FB68,FB69,FB70,FB71,FB72,FB73	742792211 00	FB1206	—	74279221100	WURTH	1206, 10 ohm, 10.5 A, WE-MPSB, 0.003 ohm
89	1	IC1	MPM3632SGPQ-Z	MPM3632SGPQP	—	MPM3632SGPQ-Z	MPS	High-Frequency 18V/3A DC/DC Regulator
90	1	IC2	UCD90120ARGCT	QFN50P900X900X100-65N-D	—	UCD90120ARGCT	TI	12-Rail Pwr Supply Sequencer & and System Manager with ACPI Support 64-VQFN -40 to 125
91	7	IC3,IC4,IC7,IC8,IC9,IC17,IC25	INA333AIDGKR	VSSOP8_3R0X3R0-0R65	—	INA333AIDGKR	TI	Low-Power, Zero-Drift, Precision Instrumentation Amplifier
92	1	IC5	MPM3650GQW-Z	QFN-24P-4X6-1R6MM	—	MPM3650GQW-Z	MPS	1.2MHz, Synchronous, 2.75V to 17V, 5A, U

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
93	1	IC18	RC19004A100GNL	VFQFPN28_4X4-0r4	—	RC19004A100GNL#BB0	Renesas Electronics	RC19004A100 QBUFFER, 100 OHMS, 4 O/P T&R
94	2	IC19,IC20	SN74LVC08APWR	TSSOP14-5r0x4r4-0r65	—	SN74LVC08APWR	TI	QUAD AND GATE, 2I/P, TSSOP-14, FULL REEL
95	1	IC21	MT35XU512ABA1G12_0AUT	BGA24-6x8-1r0	—	MT35XU512ABA1G12-0AUT	Micron	NOR Flash SPI FLASH NOR SLC 64MX8 TBGA
96	3	IC22,IC23,IC24	TXB0102DCUT	VSSOP8-2R0X3R0-0R5	—	TXB0102DCUT	TI	2B Bidir Vltg-Level Translator
97	1	IC26	LMV7271MFX_NOPB	SOT23-5	—	LMV7271MFX/NOPB	TI	Single low voltage, push-pull comparator 5-SOT-23 -40 to 85
98	2	IC31,IC32	OPA376AIDBVR	SOT23-5	—	OPA376AIDBVR	TI	Prec Low Noise Low Iq Op Amp
99	10	IC33,IC34,IC35,IC36,IC37,IC38,IC39,IC40,IC41,IC42	TMUX1248DCKR	sc70-2r0x1r25-6p	—	TMUX1248DCKR	TI	Analogue Switch ICs 3-? low RON, 5-V, 2:1 (SPDT) general purpose switch with 3157 pinout
100	1	IC43	TPS3895ADRYR	TPS3895ADRYR	—	TPS3895ADRYR	TI	Single Channel, Ultra Small, Adjustable Supervisory Circuit with Active-High, Push-Pull Output
101	1	IC44	TPS259824ONRGER	TPS259824ONRGER	—	TPS259824ONRGER	TI	2.7-V to 24-V, 2.7-m , 15-A eFuse with hot-swap protection, +/-1.5% current monitor & adj. fault mgmt. 24-VQFN -40 to 125
102	15	JP1,J4,JP10,JP11,JP12,JP13,JP14,J14,JP16,JP17,J18,JP21,JP22,JP23,J30	Header_2x1_1.27mm	sip2-1p27	—	M50-3530242	M50-3530642	1.27mm Header,2pin,Through Hole
103	6	JP3,JP4,JP8,JP9,JP15,JP24	Header_2x1	Header_2x1	—	77311-101-02LF	Amphenol FCI	UNSHROUDED 1ROW STRT THRU HOLE 2 POS
104	1	J1	PJ-002AH	pj_002a_3p	—	PJ-002AH	CUI Devices	CONN PWR JACK 2X6.5MM SOLDER
105	1	J2	1201M2S3AQE2	1201M2S3AQE2	—	1201M2S3AQE2	C&K Components	DPDT Side Slide 6@120VAC28VDC4.72 PC
106	1	J3	2 X5 2.54mm header	2X5_254mm_header	—	AWHW 10G-0202-T	Assmann WSW Components	CONN HEADER VERT 10POS 2.54MM

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
107	6	J8,J9,J10,J12,J13,J15	142-0701-201	142-0701-201	—	142-0701-201	Johnson / Cinch Connectivity Solutions	PCB STRAIGHT JACK 50ohm .155" LEGS GLD
108	2	J16,J17	PMOD 2x6	PPPC062LJBN-RC	—	PPPC062LJBN-RC	Sullins	CONN HDR 12POS 0.1 GOLD PCB R/A
109	1	J19	ASP_184329_01	ASP-184329-01	—	ASP-184329-01	Samtec	Conn Rcpt Female Vert 560 Pos 14x40 1.27mm P Black SMT
110	1	J20	Header_2x7	Header_2x7	—	10129381-914004BLF	Amphenol FCI	ECONOSTIK HEADER DR VT TH 2X7,2.54mm
111	2	J21,J24	245804030000829+	245804030000829	—	245804030000829+	KYOCERA	30P STR SMD 0.4mm BTB Rcpt H: 0.9mm
112	5	J22,J23,J58,J59,J32	CON3	HDR1X3	—	5-146274-3	TE	CONN HEADER VERT 3POS 2.54MM
113	1	J25	USB_TYPEC_SMT	USB_TYPEC_RA_SMT	—	12401610E4#2A	Amphenol	USB TYPE C RCPT R/A SMT TOP MOUNT
114	1	J26	1551920-1	2170703-7	—	1551920-1	TE Connectivity	CONN ZQSFP+ RCPT 38P SLD RA SMD
115	1	J26	2170703-7	2170703-7	—	2170703-7	TE Connectivity	CAGE ASSEMBLY QSFP28 1X1 SPRING
116	2	J27,J28	2170088-2	Molex_SFP20_cage	—	2170088-2	TE Connectivity	zSFP+ 15u SMT RCPT CONNECTOR
117	2	J27,J28	2291579-1	Molex_SFP20_cage	—	2291579-1	TE Connectivity	ZSFP+ 1X1 CAGE ASSY PCI PRESS-FIT
118	1	J33	USB_MINI_B	USB_MINI_B-1734035-2	—	1734035-2	TE Connectivity AMP Connectors	CONN RCPT USB2.0 MINI B SMD R/A
119	1	J57	22_11_2032	HDR_1X3_LOCK_MOLEX	—	22-11-2032	22-11-2032	Conn Hdr Male Vert 3 Pos 1x3 2.54mm P Natural TH Friction Lock
120	1	L1	5.8uH	1008AF	—	1008AF-582XJLB	Coilcraft	1008 5.8uH Unshld 5% 750mA 280mOhms
121	2	L2,L3	2.2uH	L1008	—	LQM2HPN2R2MJ0L	MURATA	2.2 µH, 0.12 ohm, 40 MHz, 1 A, 1008 [2520??], LQM2HPN
122	6	L6,L7,L8,L9,L10,L11	2.2uH	XGL4030	—	XGL4030-222MEC	Coilcraft	SMD,2.2uH,13.5mohm,5A @20% drop
123	7	Q1,Q15,Q16,Q18,Q19,Q20,Q21	FDV305N	SOT23	—	FDV305N	Fairchild Semiconductor	IC, MOSFET, N-CHANNEL, 20V
124	20	Q2,Q3,Q4,Q5,Q6,Q7,Q8,Q10,Q11,Q24,Q25, Q26,Q28,Q29,Q30,Q31,Q32,Q33,Q34,Q35	FDV301N	SOT23	—	FDV301N	onsemi / Fairchild	MOSFET, N-CHANNEL,25 V, 220 mA, 3.1 ohm, SOT-23,

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
125	1	Q9	MMBT2222ALT1G	MMBT2222ALT-1	—	MMBT2222ALT1G	onsemi	(BJT) SS SOT23 GP XSTR NPN 40V
126	3	Q12,Q13,Q14	BC817-40-TP	SOT23-3	—	BC817-40-TP	Micro Commercial Co	TRANS NPN 45V 0.8A SOT-23
127	1	Q17	CSD17313Q2	SON2x2-0r65-8P	—	CSD17313Q2T	TI	MOSFET 30V, N-Channel NexFET Power Mosfet
128	101	R4,R6,R7,R8,R10,R13,R14,R15,R16,R17,R18, R181,R195,R246,R256,R277,R370,R374,R377, R381,R385,R425,R594,R596,R604,R606,R612, R620,R624,R627,R629,R630,R681,R686,R687, R696,R714,R723,R746,R747,R748,R749,R772, R778,R807,R808,R809,R814,R822,R823,R829, R830,R833,R834,R835,R839,R840,R847,R854, R855,R874,R933,R999,R1000,R1002,R1004, R1005,R1006,R1007,R1009,R1010,R1011, R1012,R1013,R1020,R1022,R1023,R1024, R1025,R1026,R1040,R1043,R1044,R1050, R1056,R1058,R1060,R1097,R1099,R1100, R1101,R1102,R1105,R1169,R1187,R1204, R1222,R1226,R1227,R1228,R1229	1K	R0402	—	RC0402FR-071KL	Yageo	SMD 1 kOhms 62.5mW 0402 1%
129	145	R5,R19,R21,R44,R56,R57,R60,R85,R93,R96, R106,R112,R116,R122,R126,R132,R146,R151, R153,R161,R164,R180,R191,R194,R234,R237, R307,R319,R326,R328,R357,R358,R359,R360, R371,R372,R375,R378,R379,R390,R395,R396, R399,R401,R403,R404,R405,R408,R409,R410, R411,R414,R424,R442,R444,R465,R468,R481, R570,R583,R589,R609,R675,R676,R682,R690, R691,R692,R693,R694,R695,R697,R715,R716, R721,R724,R725,R726,R727,R735,R758,R759, R761,R767,R773,R775,R776,R777,R780,R781, R841,R842,R857,R880,R881,R882,R893,R894, R895,R896,R897,R904,R906,R918,R925,R932, R942,R957,R995,R1030,R1032,R1033,R1035, R1036,R1037,R1039,R1042,R1052,R1115, R1116,R1117,R1120,R1127,R1134,R1141, R1150,R1155,R1163,R1165,R1168,R1170, R1173,R1178,R1188,R1195,R1205,R1212, R1220,R1223,R1224,R1225,R1233,R1247, R1250,R552	10K	R0402	—	RC0402FR-0710KL	Yageo	SMD 10 kOhms 62.5mW 0402 1%
130	1	R11	47k	R0402	—	RC0402FR-0747KL	Yageo	SMD 47 kOhms 62.5mW 0402 1%
131	1	R12	15k	R0402	—	RC0402FR-0715KL	Yageo	SMD 15 kOhms 62.5mW 0402 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
132	3	R20,R22,R1280	100K	R0603	—	RC0603FR-07100KL	Yageo	SMD 100 kOhms 100mW 0603 1%
133	67	R41,R382,R384,R388,R392,R426,R427,R428, R429,R430,R432,R433,R434,R435,R436,R456, R462,R463,R464,R484,R485,R486,R487,R514, R515,R554,R555,R556,R557,R558,R559,R560, R561,R562,R563,R564,R565,R566,R567,R568, R569,R571,R574,R575,R576,R577,R578,R579, R619,R622,R625,R626,R631,R634,R637,R640, R936,R943,R956,R1047,R1088,R1089,R1103, R1237,R242,R243,R254	22ohm	R0402	—	RC0402FR-0722RL	Yageo	SMD 22 Ohms 62.5mW 0402 1%
134	7	R27,R28,R29,R30,R607,R608,R1003	2K	R0402	—	RC0402FR-072KL	Yageo	SMD 2 kOhms 62.5mW 0402 1%
135	1	R31	41.2K	R0402	—	RC0402FR-0741K2L	Yageo	MD 41.2 kOhms 62.5mW 0402 1%
136	1	R32	90.9K	R0402	—	RC0402FR-0790K9L	Yageo	SMD 90.9 kOhms 62.5mW 0402 1%
137	10	R42,R334,R490,R491,R949,R1001,R1021, R1070,R1071,R1275	0ohm	R0603	—	RC0603JR-070RL	Yageo	SMD 0 Ohms 100 mW 0603 5%
138	2	R43,R944	0.002ohm	R3637	—	Y14880R00200B9R	Vishay Precision Group	SMD 0.002ohms 0.1% 3w
139	120	R45,R49,R53,R58,R59,R64,R68,R84,R95,R98, R105,R115,R125,R143,R145,R147,R154,R155, R158,R163,R166,R167,R210,R213,R226,R227, R230,R231,R232,R233,R235,R236,R270,R271, R274,R290,R313,R337,R339,R342,R343,R346, R347,R348,R349,R350,R351,R386,R391,R393, R400,R413,R460,R473,R478,R482,R488,R572, R573,R582,R611,R615,R616,R683,R700,R732, R734,R750,R751,R757,R779,R800,R801,R812, R813,R862,R866,R871,R872,R873,R905,R907, R909,R922,R937,R1051,R1055,R1057,R1059, R1067,R1072,R1074,R1076,R1078,R1080, R1082,R1119,R1123,R1133,R1138,R1154, R1135,R1166,R1182,R1184,R1198,R1201, R1215,R1249,R1256,R1270,R1273,R1278, R1279,R247,R249,R257,R259,R1289,R1290	0	R0402	—	CRCW04020000ZSTD	Vishay / Dale	Thick Film Resistors - SMD 0402 Zero Ohms
140	2	R47,R220	2.55k	R0603	—	RC0603FR-072K55L	Yageo	SMD 2.55 kOhms 100 mW 0603 1%
141	1	R48	732ohm	R0603	—	CPF0603B732RE1	TE Connectivity	Thin film chip resistor SMD CPF 0603 732R 0.1% 25PPM
142	6	R50,R87,R107,R117,R127,R1244	2k	R0603	—	RT0603BRD072KL	Yageo	Thin film chip resistor SMD 2K OHM .1% 25PPM

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
143	2	R52,R65	2.2ohm	R0603	—	RC0603FR-072R2L	Yageo	SMD 2.2 Ohms 100mW 0603 1%
144	2	R54,R66	4.99k	R0402	—	RC0402FR-074K99L	Yageo	SMD 4.99 kOhms 62.5mW 0402 1%
145	2	R55,R67	60.4kohm	R0603	—	RC0603FR-0760K4L	Yageo	SMD 60.4 kOhms 100mW 0603 1%
146	1	R90	2.4k	R0603	—	CPF0603B2K4E1	TE Connectivity	Thin film chip resistor SMD CPF 0603 2K4 0.1% 25PPM 1K RL
147	3	R91,R131,R1243	18.7k	R0402	—	RC0402FR-0718K7L	Yageo	SMD 18.7 kOhms 62.5mW 04 02 1%
148	5	R94,R113,R123,R133,R1251	80.6k	R0402	—	RC0402FR-0780K6L	Yageo	SMD 80.6 kOhms 62.5mW 04 02 1%
149	1	R99	20k	R0603	—	RT0603FRE1320KL	Yageo	Thin film chip resistor SMD 1/10W 20K ohm 1% 50p pm
150	4	R100,R238,R240,R248	10k	R0603	—	RT0603FRE0710KL	Yageo	Thin film chip resistor SMD 10K ohm 1% 1/10W
151	1	R109	270ohm	R0603	—	RT0603BRD07270RL	Yageo	Thin film chip resistor SMD 1/10W 270 ohm .1% 25 ppm
152	1	R111	249k	R0402	—	RC0402FR-07249KL	Yageo	SMD 249 kOhms 62.5mW 040 2 1%
153	1	R119	442ohm	R0603	—	RP73PF1J442RBTDF	TE Connectivity	Thin film chip resistor SMD RP 1J 0.166W 442R 0.1% 25PPM
154	1	R121	78.7k	R0402	—	RC0402FR-0778K7L	Yageo	SMD 78.7 kOhms 62.5mW 04 02 1%
155	1	R130	1k	R0603	—	CPF-A-0603B1K0E1	TE Connectivity	SMD CPF A 0603 1K0 0.1% 25PPM
156	5	R134,R144,R156,R215,R1218	0.02ohm	R2412	—	LVK24R020DER	Ohmite	SMD 0.02ohm .5% 4 Terminal
157	4	R149,R160,R1106,R1064	1K	R0603	—	RC0603FR-071KL	Yageo	SMD 1 kOhms 100mW 0603 1%
158	2	R945,R135	681	R0603	—	RC0603FR-07681RL	Yageo	SMD 681 Ohms 100mW 0603 1%
159	1	R229	10ohm	R1206	—	RC1206JR-0710RL	Yageo	SMD 10 Ohms 250 mW 1206 5%
160	4	R252,R253,R260,R261	51ohm	R0201	—	RC0201FR-0751RL	Yageo	SMD 51 Ohms 50 mW 0201 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
161	27	R263,R264,R266,R268,R269,R272,R281,R312, R407,R419,R421,R422,R479,R480,R483,R489, R584,R610,R876,R877,R885,R886,R889,R939, R959,R960,R1266	33ohm	R0402	—	RC0402FR-0733RL	Yageo	SMD 33 Ohms 62.5mW 0402 1%
162	75	R276,R278,R279,R280,R282,R285,R286,R289, R291,R292,R293,R296,R380,R438,R455,R467, R500,R502,R506,R507,R508,R509,R511,R592, R632,R635,R638,R688,R689,R709,R711,R733, R768,R769,R770,R771,R783,R784,R785,R786, R787,R788,R789,R790,R791,R792,R793,R794, R795,R798,R799,R810,R811,R815,R816,R817, R818,R819,R820,R821,R824,R825,R827,R831, R832,R848,R849,R850,R851,R852,R864,R865, R867,R868,R1258	4.7K	R0402	—	RC0402FR-074K7L	Yageo	SMD 4.7 kOhms 62.5mW 0402 1%
163	12	R297,R298,R299,R300,R303,R304,R305,R306, R317,R318,R322,R323	2.67k	R0402	—	RC0402FR-072K67L	Yageo	SMD 2.67 kOhms 62.5 mW 0402 1%
164	5	R301,R302,R327,R352,R962	100ohm	R0402	—	RC0402FR-07100RL	Yageo	SMD 100 Ohms 62.5mW 0402 1%
165	2	R316,R321	49.9ohm	R0603	—	RC0603FR-0749R9L	Yageo	SMD 49.9 Ohms 100mW 0603 1%
166	1	R330	150ohm	R0603	—	RC0603FR-07150RL	Yageo	SMD 150 Ohms 100mW 0603 1%
167	1	R332	10ohm	R0603	—	RC0603FR-0710RL	Yageo	SMD 10 Ohms 100mW 0603 1%
168	16	R344,R345,R512,R513,R706,R707,R708,R710, R875,R879,R884,R887,R890,R891,R892,R952	2.2K	R0402	—	RC0402FR-072K2L	Yageo	SMD 2.2 kOhms 62.5mW 040 2 1%
169	4	R362,R363,R364,R365	49.9ohm	R0402	—	RC0402FR-0749R9L	Yageo	SMD 49.9 Ohms 62.5mW 040 2 1%
170	8	R417,R958,R1029,R1038,R1041,R1236,R1239, R1257	20K	R0402	—	RC0402FR-0720KL	Yageo	SMD 20 kOhms 62.5mW 0402 1%
171	8	R492,R493,R494,R495,R496,R497,R498,R499	130ohm	R0603	—	RC0603FR-07130RL	Yageo	SMD 130 Ohms 100mW 0603 1%
172	3	R504,R505,R510	330ohm	R0402	—	RC0402FR-07330RL	Yageo	SMD 330 Ohms 62.5mW 0402 1%
173	12	R516,R517,R518,R519,R526,R527,R529,R530, R533,R534,R550,R551	1K	R0201	—	RC0201FR-071KL	Yageo	SMD 1 kOhms 50mW 0201 1%
174	9	R520,R523,R528,R531,R535,R536,R553,R617, R618	240ohm	R0201	—	RC0201FR-07240RL	Yageo	SMD 240 Ohms 50mW 0201 1%
175	16	R521,R524,R537,R539,R541,R543,R545,R547, R1281,R1282,R1283,R1284,R1285,R1286, R1287,R1288	49.9ohm	R0201	—	RC0201FR-0749R9L	Yageo	SMD 49.9 Ohms 50mW 0201 1%
176	8	R522,R525,R538,R540,R542,R544,R546,R548	2K	R0201	—	RC0201FR-072KL	Yageo	SMD 2 kOhms 50mW 0201 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
177	2	R532,R549	10K	R0201	—	RC0201FR-0710KL	Yageo	SMD 10 kOhms 50mW 0201 1%
178	1	R585	6.04kohm	R0402	—	RC0402FR-076K04L	Yageo	SMD 6.04 kOhms 62.5mW 0402 1%
179	8	R641,R647,R653,R659,R665,R671,R674,R586	200ohm	R0402	—	ERJ-2RHD2000X	Panasonic	SMD 0402 200ohms 0.5%AEC-Q200
180	10	R643,R644,R649,R650,R655,R656,R661,R662, R667,R668	470ohm	R0402	—	RC0402FR-07470RL	Yageo	SMD 470 Ohms 62.5mW 0402 1%
181	10	R645,R646,R651,R652,R657,R658,R663,R664, R669,R670	56ohm	R0402	—	RC0402FR-0756RL	Yageo	SMD 56 Ohms 62.5mW 0402 1%
182	7	R712,R713,R719,R763,R764,R928,R1234	100K	R0402	—	RC0402FR-07100KL	Yageo	SMD 100 kOhms 62.5mW 0402 1%
183	7	R717,R728,R782,R843,R383,R394,R1254	100ohm	R0603	—	RC0603FR-07100RL	Yageo	SMD 100 Ohms 100 mW 0603 1%
184	1	R718	68k	R0402	—	RC0402FR-0768KL	Yageo	SMD 68 kOhms 62.5mW 0402 1%
185	1	R737	120K	R0402	—	RC0402FR-07120KL	Yageo	SMD 120 kOhms 62.5mW 0402 1%
186	1	R738	1M	R0402	—	RC0402FR-071ML	Yageo	SMD 1 MOhms 62.5mW 0402 1%
187	1	R754	200K	R0402	—	RC0402FR-07200KL	Yageo	SMD 200 kOhms 62.5mW 040 2 1%
188	1	R755	909K	R0402	—	RC0402FR-07909KL	Yageo	SMD 909 kOhms 62.5 mW 04 02 1%
189	2	R756,R1252	499K	R0402	—	RC0402FR-07499KL	Yageo	SMD 499 kOhms 62.5mW 040 2 1%
190	1	R760	390ohm	R0402	—	RC0402FR-07390RL	Yageo	SMD 390 Ohms 62.5mW 0402 1%
191	1	R883	12K	R0402	—	RC0402FR-0712KL	Yageo	SMD 12 kOhms 62.5mW 0402 1%
192	1	R902	2ohm	R1206	—	RC1206FR-072RL	Yageo	SMD 2 Ohms 250 mW 1206 1%
193	1	R923	13.3K	R0402	—	RC0402FR-0713K3L	Yageo	SMD 13.3 kOhms 62.5mW 0402 1%
194	1	R924	23.2K	R0402	—	RC0402FR-0723K2L	Yageo	SMD 23.2 kOhms 62.5mW 04 02 1%
195	2	R930,R931	100ohm	R0805	—	RC0805FR-07100RL	Yageo	SMD 100 Ohms 125 mW 0805 1%
196	1	R947	31.6K	R0402	—	RC0402FR-0731K6L	Yageo	SMD 31.6 kOhms 62.5mW 0402 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
197	3	R948,R1066,R1269	820ohm	R1206	—	RC1206FR-07820RL	Yageo	SMD 820 Ohms 250 mW 1206 1%
198	1	R951	3.3K	R0402	—	RC0402FR-073K3L	Yageo	SMD 3.3 kOhms 62.5mW 0402 1%
199	1	R953	11K	R0402	—	RC0402FR-0711KL	Yageo	SMD 11 kOhms 62.5mW 0402 1%
200	1	R954	62K	R0402	—	RC0402FR-0762KL	Yageo	SMD 62 kOhms 62.5mW 0402 1%
201	2	R966,R1263	150ohm	R0402	—	RC0402FR-07150RL	Yageo	SMD 150 Ohms 62.5mW 0402 1%
202	2	R1068,R1271	100K	R0603	—	RE0603DRE07100KL	Yageo	SMD 100 kOhms 100 mW 0603 0.5%
203	2	R1069,R1272	24.9K	R0603	—	RT0603DRD0724K9L	Yageo	SMD 24.9K OHM .5% 25PPM 1/10W
204	1	R1107	3K	R0603	—	RC0603FR-073KL	Yageo	SMD 3 kOhms 100mW 0603 1%
205	6	R1121,R1136,R1157,R1180,R1197,R1214	3.32K	R0402	—	RP0402BRD073K32L	Yageo	SMD 1/16W 3.32K Ohm 0.1% 0402 AEC-Q200
206	5	R1122,R1161,R1179,R1196,R1213	412ohm	R0402	—	CPF0402B412RE1	TE	SMD CPF 0402 412ohm 0.1% 25PPM
207	5	R1129,R1174,R1191,R1208,R1151	20K	R0402	—	RT0402BRE0720KL	Yageo	SMD 20K OHM .1% 50PPM 1/16W
208	5	R1130,R1143,R1175,R1192,R1209	60.4K	R0402	—	RT0402BRD0760K4L	Yageo	SMD 1/16W 60.4K ohm .1% 25ppm
209	6	R1132,R1145,R1153,R1177,R1194,R1211	10K	R0603	—	RT0603BRD0710KL	Yageo	Thin Film resistor SMD 10K ohm 0.1% 1/10W
210	1	R1142	15K	R0402	—	RT0402BRD0715KL	Yageo	SMD 1/16W 15K ohm .1% 25ppm
211	3	R1230,R1231,R1232	1M	R0805	—	RC0805JR-071ML	Yageo	SMD 1 MOhms 125 mW 0805 5%
212	1	R1235	5.49K	R0402	—	RC0402FR-075K49L	Yageo	SMD 5.49 kOhms 62.5 mW 0402 1%
213	1	R1242	634ohm	R0603	—	RC0603FR-07634RL	Yageo	SMD 634 Ohms 100 mW 0603 1%
214	1	R1253	261K	R0402	—	RC0402FR-07261KL	Yageo	SMD 261 kOhms 62.5mW 0402 1%
215	1	R1255	887ohm	R0603	—	RC0603FR-07887RL	Yageo	SMD 887 Ohms 100 mW 0603 1%
216	1	R1267	62K	R0402	—	RT0402FRE0762KL	Yageo	SMD 62K OHM 1% 50PPM
217	1	SW3	TDA04H0SB1	TDA04H0SB1	—	TDA04H0SB1	C&K COMPONENTS	SIP Switch, HALF PITCH 4 POS

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
218	8	SW6,SW8,SW9,SW10,SW12,SW13,SW14, SW15	PB1	sw_sp_st_eswitch_tl1015	—	TL1015AF160QG	E-Switch	4mm x 3mm SMT Gull Wing Top Act
219	1	U1	PCIe 2x3 ATX / 39-30-1060	pcie_atx_2x3	—	39-30-1060	Molex	6 CKT R/A HEADER
220	4	U2,U4,U29,U80	FDMC7660DC	DualCool-33-8	—	FDMC7660DC	onsemi / Fairchild	MOSFET 30V N-Chan Dual Cool PowerTrench MOSFET
221	2	U3,U5	LTC4357IMS8#PBF	MSOP-8	—	LTC4357IMS8#PBF	Analog Devices	Positive High Voltage Ideal Diode Controller,MSOP8
222	2	U6,U7	MPM3695GPJ-20-3333-T	ECLGA-29-5x6x4r4	—	MPM3695GPJ-20-3333-T	MPS	2.95V to 16V Input Power Module Continouns 20A,Peak 25A
223	5	U9,U10,U11,U12,U271	MPM3683GQN-7	QFN28-7X7X4	—	MPM3683GQN-7	MPS	2.7V-16V, 8A, Step-Down Power Module
224	2	U13,U14	RP115H181D-T1-FE	SOT89-5	—	RP115H181D-T1-FE	Nisshinbo	Low noise LDO Regulator 1.8V,1A
225	1	U15	RP115H331D-T1-FE	SOT89-5	—	RP115H331D-T1-FE	Nisshinbo	Low noise LDO Regulator 3.3V,1A
226	1	U16	RP115H081D2-T1-FE	SOT89-5	—	RP115H081D2-T1-FE	Nisshinbo	Low noise LDO Regulator 0.82V,1A
227	1	U17	NR1600GK150AE4S	DFN1212-6-GK	—	NR1600GK150AE4S	Nisshinbo	500mA Low Dropout Voltage Regulator
228	7	U18,U27,U28,U30,U31,U251,U252	SN74AUP2G07DCKR	sc70-2r0x1r25-6p	—	SN74AUP2G07DCKR	TI	Lo-Pwr Dual r Buffer,Open Drain
229	1	U32	RC38612	QFN72-10x10x0r9-0r5	—	RC38612A000GN2#BB0	Renesas	Radio Access Network Equipment Synchronizer,72-QFN
230	1	U33	24FC1025T-I/SN	SOIC8-4r9x3r9-1r27	—	24FC1025T-I/SN	Microchip	IC EEPROM 1Mb 128Kbx8 1MHz 1.8-5.5V SOIC-8
231	2	U34,U40	TPS3808G01DRVR	WSON6-2x2-0r65	—	TPS3808G01DRVR	TI	ADJ SUPPLY MONITOR PRG DLY 6QFN
232	2	U35,U36	74LVC1G125GV,125	SOT753	—	74LVC1G125GV,125	Nexperia	Buffer / Line Driver, 3-State, Non-Inverting, 1.65 V to 5.5 V
233	2	U37,U246	SN74LVC1G08DBVR	SOT23-5	—	SN74LVC1G08DBVR	TI	Single 2-Input Pos AND Gate
234	1	U245	SN74LVC1G17DBVR	SOT23-5	—	SN74LVC1G17DBVR	TI	Single Schmitt-Trgr

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
235	7	U38,U49,U52,U53,U54,U55,U57	SN74LXC1T45DBVR	SOT-23-6	—	SN74LXC1T45DBVR	TI	Single-Bit Dual-Supply Bus Transceiver With Configurable Level Shifting
236	1	U39	74LVC1G07SE-7	SOT-353	—	74LVC1G07SE-7	Diodes Incorporated	Single Gate Open Out 1.65 to 5.5V 32mA,SOT-353
237	1	U43	avant_x_400_1156	LAV-AT-500-L_1156	—	Avant-G/X FPGA	Lattice	low-power mid-range general purpose FPGA platform,477K,LFG1156
238	1	U44	MT53E512M32D1ZW-046 AUT:B	TFBGA200	—	MT53E512M32D1ZW-046 AUT:B	Micron	DRAM LPDDR4 16G 512MX32 FBGA
239	1	U45	CYUSB3014-BZXI	CYUSB3014-BGA121-0r8	—	CYUSB3014-BZXI	Cypress	IC ARM9 USB CONTROLLER 121FBGA
240	1	U46	XCL206B123CR-G	CL-205-02	—	XCL206B123CR-G	Torex Semiconductor Ltd	600mA Inductor DCDC Converter
241	1	U47	BR24G1MFJ-5AE2	SOP-J8	—	BR24G1MFJ-5AE2	Rohm Semiconductor	1MB, IC BUS, HIGH SPEED WRITE
242	1	U48	ASAK2-32.768KHZ-LRS-T	SMD_ASAK2	—	ASAK2-32.768KHZ-LRS-T	Abracon	Oscillator XTAL OSC XO 32.7680KHZ LVCMOS
243	5	U50,U51,U255,U256,U257	SN74AVC2T244	X2SON-1r4x1r0-0r4-DQE	—	SN74AVC2T244DQER	TI	DUAL BIT DUAL-SUPPLY BUS TRANSCEIVER
244	1	U56	DDR5_SODIMMM	SODIMM262-DDR5	—	10161036-002RHLF	Amphenol FCI	DDR5 SODIMM, Storage and Server Connector, Right Angle, Surface Mount,262 Position, 0.5mm Pitch,5.2mm Height, Reverse, 10in Gold Plating
245	1	U58	RP122K281D	DFN-PL-1010-4B	—	RP122K281D	Nisshinbo	400 mA Low Noise and Low Supply Current LDO Regulator
246	1	U59	RP550L001B-A	DFN12-3R0X3R0-0R5	—	RP550L001B-A	Nisshinbo	1 A PWM/VFM Dual Step-down DC/DC Converter
247	4	U60,U61,U71,U75	TPS22992RXPR	WQFN8-1r5x1r25-RXP	—	TPS22992RXPR	TI	5.5-V, 6-A, 10-mO load switch with adjustable rise time and adjustable quick output discharge

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
248	1	U62	TPS25910RSA	QFN16_4x4_TI	—	TPS25910RSAR	TI	3V-20V High-Current Load Switch
249	1	U63	TUSB1002RGE	qfn24-050-4x4-h2r7	—	TUSB1002RGER	TI	USB 3.1 10Gbps Dual Channel Linear Redriver 24-VQFN 0 to 70
250	1	U64	HD3SS3220	WQFN30-2r5x4r5-0r4mm	—	HD3SS3220IRNHR	TI	10-Gbps USB 3.1 Type-C 2:1 mux with DRP Controller 30-WQFN -40 to 85
251	3	U65,U66,U67	TPD4E05U06	USON10-2r5x1r0-0r5	—	TPD4E05U06DQAR	TI	4Chnl U-Lo Capacitnc IEC ESD Prot Diodes
252	3	U68,U73,U77	FXMA2102UMX	UMLP8-1r2x1r4-0r4	—	FXMA2102UMX	onsemi / Fairchild	2xSupply 2-Bit Volt Trnsltr/Bffr/Rptr
253	1	U69	NCP360SNT1G	TSOP5-3r0x1r5	—	NCP360SNT1G	ON Semiconductor	IC USB POS OVP/OC_TSOP5
254	1	U70	SN74AUP2G17DCK	sc70-2r0x1r25-6p	—	SN74AUP2G17DCKR	TI	Lo-Pwr Dual Schmitt-Trigger Buffer
255	1	U72	TCA9548APWR	TSSOP_24	—	TCA9548APWR	TI	IC MUX I2C 1 to 8 400KHz TSSOP-24 with Reset
256	1	U74	TCA9555PWR	tssop24-0r65-7r8x4r4-sm	—	TCA9555PWR	TI	Remote 16B I2C & SMBus I/O Expander
257	1	U76	U_SW_ANA_USB	UQFN10-1r4x1r8-0r4	—	TS3USB30ERSWR	TI	IC High-Spd USB 2.0 1:2 Mux/Demux Sw
258	1	U78	FT2232HL	tqfp64_0p5_12p2x12p2_h1p6	—	FT2232HL-REEL	FTDI	IC USB HS DUAL UART/FIFO 64-LQFP
259	1	U79	93LC56C-I/SN	so8_50_244	—	93LC56C-I/SN	Microchip	IC EEPROM 2KBIT 3MHZ 8SOIC
260	1	U81	D75A-012.8M	D75A	—	D75A-012.8M	Connor Winfield	XTAL OSC TCXO 12.8000MHZ LVCMOS
261	1	U243	LP38798SD-ADJ/NOPB	WSON12-4r0x4r0-0r5	—	LP38798SD-ADJ/NOPB	TI	800mA Ultra-Lo Noise Hi PSRR LDO
262	1	U244	BNX016-01	BNX016-01-12X11mm	—	BNX016-01	Murata	EMIFIL 50R 15A 0.8mR 40 dB Attn 100KHz - 1GHz 12x11mm TH
263	2	U253,U254	SN74LVC244APWR	tssop20-0r65-4r40	—	SN74LVC244APWR	TI	IC BUF NON-INVERT 3.6V 20TSSOP

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
264	6	U258,U260,U263,U265,U267,U269	TPS62913RPUR	QFN10-2mmx2mm	—	TPS62913RPUR	TI	17-VIN, 3-A low noise and low ripple buck converter with integrated ferrite bead filter compensation 10-VQFN-HR -40 to 150
265	6	U259,U261,U262,U264,U266,U268	RP120Z001D-E2-F	WLCSP-6-P11	—	RP120Z001D-E2-F	Nisshinbo	Low Input / Output 1.5 A Low Dropout Regulator
266	1	U270	SSM6N37FU,LF	SOT-363_US6__TOS	—	SSM6N37FU,LF	Toshiba	MOSFET Small-signal MOSFET ID=0.25A VDSS=20V
267	1	X1	KC2520Z100.000C15XXK	x4-2520	—	KC2520Z100.000C15XXK	KYOCERA AVX	Clock Oscillator,2.5x2.0x0.8mm size, CMOS, 100.000MHz, 1.8, 2.5, 3.3V Compatible, +/-30ppm (-40 - +105C)
268	1	X2	ASDAIG3-27.000MHZ-X-K-T	x4-2520	—	ASDAIG3-27.000MHZ-X-K-T	ABRACON	AEC-Q200 OSC XO 27.000MHZ 1.8V CMOS SMD
269	2	X3,X5	AX3HAF1-100.0000T	NX33C5013Z	—	AX3HAF1-100.0000T	ABRACON	100.00 MHZ HCSL XO 153FS
270	1	X4	WURTH_19.2MHZ/830208222201	x4-2520	—	830208222201	Wurth Elektronik	WE-SPXO 19.2MHz 25ppm 2.5 x 2.0mm
271	1	X6	830208217009_19.2MHZ	4-SMD	—	830208217009	Wurth Elektronik	XTAL OSC XO 19.2000 MHZ CMOS
272	1	X7	7M-12.000MAAJ	xtal_4p_7m	—	7M-12.000MAAJ-T	TXC	CRYSTAL 12MHZ 18PF SMD
273	1	Y1	CX3225GB49152P0HPQCC	OSCCC320X250X90N	—	CX3225GB49152P0HPQCC	KYOCERA	CRYSTAL 49.152MHZ 20PPM 18PF SMD
274	11	C42,C65,C128,C147,C171,C194,C217,C256,C272,C404,C1623	0.01uF_DNI	C0402	DNI	GCM155R71E103KA37D	Murata	MLCC - SMD/SMT 0.01 uF 25 VDC 10% 0402 X7R AEC-Q200
275	2	C43,C66	DNI	C0603	DNI	GRM188R71A225KE15D	Murata	MLCC - SMD/SMT 2.2 uF 10 VDC 10% 0603 X7R
276	1	C46	220uF_DNI	TC7343	DNI	T598D227M2R5ATE009	Kemet	Polymer Tantalum, 2.5V 220uF 7343 20% ESR=0.009Ohms
277	12	C248,C252,C261,C268,C1122,C1472,C1496,C1507,C1538,C1563,C1588,C1644	10uF_DNI	C0603	DNI	GRM188R61A106ME69D	Murata	MLCC - SMD/SMT 10 uF 10 VDC 20% 0603 X5R

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
278	14	C320,C388,C390,C403,C500,C707,C1383, C1480,C1504,C1515,C1529,C1530,C1531, C1546	0.1uF_DNI	C0402	DNI	GRM155R71E104KE14D	Murata	MLCC - SMD/SMT 0.1 uF 25 VDC 10% 0402 X7R
279	2	C1073,C1081	10uF_DNI	C0805	DNI	GRM21BR61E106KA73L	Murata	MLCC - SMD/SMT 10 uF 25 VDC 10% 0805 X5R
280	4	C1085,C1086,C1089,C1090	1uF_DNI	C0402	DNI	GRM155R61E105KA12D	Murata	MLCC - SMD/SMT 1 uF 25 VDC 10% 0402 X5R
281	4	C1134,C1135,C1136,C392	0.1uF_DNI	C0201	DNI	GRM033R61E104ME14D	Murata	MLCC - SMD/SMT 0.1 uF 25 VDC 20% 0201 X5R
282	2	C1149,C1150	10uF_DNI	C1206	DNI	GRM31CD71H106KE11L	Murata	MLCC - SMD/SMT 10 uF 50 VDC 10% 1206 X7T
283	5	C1281,C1283,C1284,C1285,C1612	DNI	C0402	DNI	GRM155R71H103KA88D	Murata	MLCC - SMD/SMT 0.01 uF 50 VDC 10% 0402 X7R
284	6	C1467,C1488,C1523,C1550,C1575,C1600	270pF_DNI	C0402	DNI	GCM1555C1H271FA16D	Murata	MLCC - SMD/SMT 270 pF 50 VDC 1% 0402 C0G (NP0) AEC-Q200
285	6	C1645,C1646,C1647,C1648,C1649,C1653	10nF_DNI	C0402	DNI	GCM155R71E103KA37D	Murata	MLCC - SMD/SMT 0.01 uF 25 VDC 10% 0402 X7R AEC-Q200
286	1	C1650	DNI	C0402	DNI	GJM1555C1H1R0WB01D	Murata	MLCC - SMD/SMT 1 pF 50 VDC 0.05 pF 0402 C0G (NP0)
287	2	D1,D3	DNI	V12P10	DNI	V12P10-M3/86A	Vishay	DIODE SCHOTTKY 100V 12A TO277A
288	1	FB4	DNI	FB0402	DNI	MPZ1005S121CT000	TDK Corporation	FERRITE BEAD 120 OHM 0402 1LN
289	2	FB50,FB52	BLM21PG221SN1D_DNI	FB0805	DNI	BLM21PG221SN1D	Murata	220ohms 2A 50mOhms 0805 Ferrite Chip
290	1	FB60	DNI	FB1206	DNI	BLM31PG330SN1L	Murata	33 OHM 25% Alternate Sizing Guide Below
291	1	FB64	DNI	FB0805	DNI	MPZ2012S101AT000	TDK	100ohms 4A 20mOhms 0805 Ferrite Chip
292	4	JK1,JK2,JK3,JK4	67GHz_1.85 mm_Jack_DNI	SF3321-60024-1S_PDD	DNI	SF3321-60024-1S	SV Microwave	1.85mm F PCBComp/Mnt Conn 2Hole w Scrw
293	2	JP6,JP7	DNI	Header_2x1	DNI	77311-101-02LF	Amphenol FCI	UNSHROUDED 1ROW STRT THRU HOLE 2 POS
294	2	R1,R2	DNI	R1206	DNI	RC1206JR-070RL	Yageo	SMD 0 Ohms 250 mW 1206 5%
295	20	R3,R9,R387,R457,R458,R598,R603,R621,R633, R636,R639,R736,R739,R740,R741,R742,R743, R744,R745,R1291	1K_DNI	R0402	DNI	RC0402FR-071KL	Yageo	SMD 1 kOhms 62.5mW 0402 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
296	13	R23,R24,R25,R26,R33,R35,R36,R38,R39,R40, R623,R1063,R34	22ohm_DNI	R0402	DNI	RC0402FR-0722RL	Yageo	SMD 22 Ohms 62.5mW 0402 1%
297	69	R46,R51,R61,R179,R193,R311,R338,R389, R397,R398,R416,R420,R471,R472,R474,R475, R476,R581,R614,R678,R679,R698,R701,R702, R703,R704,R705,R752,R753,R774,R802,R803, R845,R846,R853,R856,R858,R859,R860,R861, R878,R929,R941,R996,R997,R998,R1073, R1075,R1077,R1079,R1081,R1083,R1090, R1092,R1094,R1095,R1241,R1274,R1118, R1124,R1137,R1139,R1160,R1181,R1183, R1199,R1200,R1216,R1217	0_DNI	R0402	DNI	CRCW04020000ZSTD	Vishay / Dale	Thick Film Resistors - SMD 0402 Zero Ohms
298	70	R62,R63,R86,R97,R108,R118,R128,R148,R150, R152,R157,R159,R162,R165,R192,R308,R361, R366,R367,R368,R369,R439,R440,R446,R448, R450,R452,R454,R466,R469,R470,R580,R587, R591,R593,R595,R597,R677,R699,R720,R722, R729,R730,R731,R762,R765,R766,R844,R908, R919,R934,R935,R938,R955,R1084,R1085, R1086,R1087,R1091,R1093,R1126,R1140, R1149,R1162,R1164,R1167,R1172,R1248, R251,R258	10K_DNI	R0402	DNI	RC0402FR-0710KL	Yageo	SMD 10 kOhms 62.5mW 0402 1%
299	3	R239,R241,R250	1K_DNI	R0402	DNI	RMCF0402JT1K00	Stackpole Electronics Inc	RES 1K OHM 1/16W 5% 0402
300	2	R244,R245	DNI	R0402	DNI	CRCW040249R9FKED	Vishay / Dale	Thick Film Resistors - SMD 1/16watt 49.9ohms 1%
301	2	R262,R265	49.9ohm_DNI	R0603	DNI	RC0603FR-0749R9L	Yageo	SMD 49.9 Ohms 100mW 0603 1%
302	4	R267,R335,R336,R1264	150ohm_DNI	R0603	DNI	RC0603FR-07150RL	Yageo	SMD 150 Ohms 100mW 0603 1%
303	2	R273,R965	150ohm_DNI	R0402	DNI	RC0402FR-07150RL	Yageo	SMD 150 Ohms 62.5mW 0402 1%
304	2	R275,R1265	0_DNI	R0201	DNI	RC0201JR-070RL	Yageo	Thick Film Resistors - SMD 0201 Zero Ohms
305	28	R283,R284,R287,R288,R294,R295,R588,R590, R599,R600,R601,R613,R628,R680,R684,R685, R796,R797,R804,R805,R806,R826,R828,R836, R837,R838,R869,R870	4.7K_DNI	R0402	DNI	RC0402FR-074K7L	Yageo	SMD 4.7 kOhms 62.5mW 0402 1%
306	2	R309,R406	40.2K_DNI	R0402	DNI	CRCW060340K2FKEA	Vishay / Dale	SMD 1/10watt 40.2Kohms 1%
307	3	R333,R660,R666	100ohm_DNI	R0402	DNI	RC0402FR-07100RL	Yageo	SMD 100 Ohms 62.5mW 0402 1%

Item	Quantity	Reference	Value	PCB Footprint	Comments	Part Number	Manufacturer	Description
308	7	R353,R354,R373,R672,R673,R1045,R1046	49.9ohm_DNI	R0402	DNI	RC0402FR-0749R9L	Yageo	SMD 49.9 Ohms 62.5mW 040 2 1%
309	2	R402,R1238	20K_DNI	R0402	DNI	RC0402FR-0720KL	Yageo	SMD 20 kOhms 62.5mW 0402 1%
310	4	R501,R503,R950,R1259	0ohm_DNI	R0603	DNI	RC0603JR-070RL	Yageo	SMD 0 Ohms 100 mW 0603 5%
311	5	R642,R648,R654,R1048,R1049	100ohm_DNI	R0201	DNI	RC0201FR-07100RL	Yageo	SMD 100 Ohms 50mW 0201 1 %
312	1	R1061	4.99K_DNI	R0603	DNI	RC0603FR-104K99L	Yageo	SMD 4.99 kOhms 100 mW 0603 1%
313	1	R1062	1K_DNI	R0603	DNI	RC0603FR-071KL	Yageo	SMD 1 kOhms 100mW 0603 1%
314	2	R1065,R1268	DNI	R0402	DNI	RC0402FR-0731K6L	Yageo	SMD 31.6 kOhms 62.5mW 0402 1%
315	5	R1131,R1144,R1176,R1193,R1210	DNI	R0402	DNI	RT0402BRE0720KL	Yageo	Thin Film resistor SMD 20K OHM .1% 50PPM 1/16W
316	1	R1240	10ohm_DNI	R1206	DNI	RC1206JR-0710RL	Yageo	SMD 10 Ohms 250 mW 1206 5%
317	2	R1276,R1277	DNI	R0402	DNI	RC0402FR-072K2L	Yageo	SMD 2.2 kOhms 62.5mW 040 2 1%
318	1	R1292	240ohm_DNI	R0201	DNI	RC0201FR-07240RL	Yageo	SMD 240 Ohms 50mW 0201 1%
319	1	SW11	DNI	sw_sp_st_eswitch_tl1015	DNI	TL1015AF160QG	E-Switch	4mm x 3mm SMT Gull Wing Top Act
320	1	Y2	SIT5711AI-KW-33E-38.880000_DNI	SIT5711AI-KW-33E-38D88	DNI	SIT5711AI-KW-33E-38.880000	SiTime	38.88 MHz, 3.3V, 0.005 ppm, 9070, OCXO
321	1	JP2	Header_2x1_1.27mm_DNI	sip2-1p27	DNI	M50-3530242	M50-3530642	1.27mm Header,2pin,Through Hole
322	1	PCB	AVANT VERSA BOARD REV B	—	—	PCB__LAV-X70-VERSA-EVN	—	PCB TOP SILK : AVANT VERSA BOARD REV B

Appendix C. Avant Versa Board zQSFP+ Enablement through I2C

The Avant-G/X zQSFP+ connector is primarily used in low power mode by default. To configure the zQSFP+ connector to normal mode, it needs to be configured through the I2C interface. The I2C interface is extended by the device TCA9548APWR to select Channel 3 and access device TCA9555APWR to configure the respective pin to normal mode, as shown in Figure C.2. In the Avant Versa Board Blinking LED Default Demo project, refer to i2c_qsfp_lpmode_avant_g/x.zip as an example design of using I2C controller to configure zQSFP+.

The design contains three parts:

- Lattice Propel SoC project (Figure C.1). The hardware portion of the project builds and generates the RISC-V SoC system that contains a CPU and peripherals that are instanced in the FPGA portion of the Avant Versa board using Lattice Propel Builder.
- Lattice Propel RISC-V project. Figure C.3 shows the software portion of the project that is used to develop and test software codes running on the RISC-V processor using Lattice Propel Builder.
- Lattice Radiant project. This portion of the project instantiates the I2C controller IP and interfaces the I2C Module IP to the SoC system generated from Lattice Propel Builder. It is also used to synthesize, place and route, and generate the programming file to be loaded into the FPGA portion of Avant Versa devices.

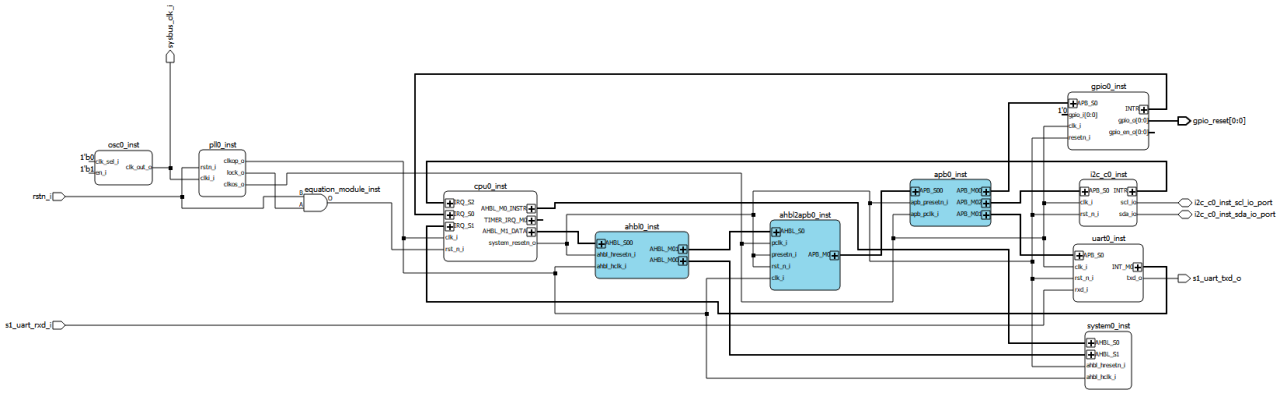

Figure C.1. Overview of the RISC-V SoC System in Lattice Propel Builder

Table C.1. Exported Signals in Lattice Propel Builder

IP Instantiate Name	Exported Signal Name in Propel	Exported Signal Name in Radiant	Direction	Description
osc0_inst	clk_out_o	sysbus_clk_i	Input	Export signal using the Create Port feature, to be connected to top module in Lattice Radiant software.
gpio0_inst	gpio_o	gpio_reset	Output	Export signal using the Create Port feature, to be connected to top module in Lattice Radiant software.
i2c_c0_inst	scl_io	i2c_c0_inst_scl_io_port	Inout	Export signal using the Create Port feature, to be connected to top module in Lattice Radiant software.
i2c_c0_inst	sda_io	i2c_c0_inst_sda_io_port	Inout	Export signal using the Create Port feature, to be connected to top module in Lattice Radiant software.
uart0_inst	txd_o	s1_uart_txd_o	Output	Export signal using the Create Port feature, to be connected to top module in Lattice Radiant software.

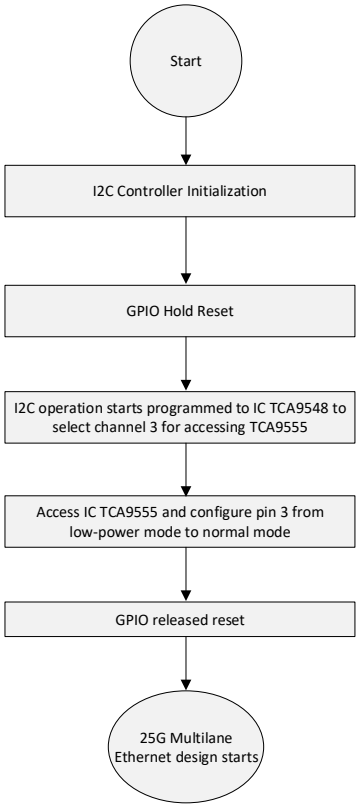

Figure C.2. I2C Handling Flow

```
int main(void) {
    bsp_init();

    printf("Started!\nHello RISC-V world!\n");

    //Buffers
    uint8_t rx_buffer; //rx buffer
    uint8_t tx_buffer; //tx buffer
    uint16_t tx_buffer_16;

    //###################################
    //#####   TCA9548
    //###################################

    tx_buffer = 0x08; // TCA9548 -> CH03
    i2c_master_write(&i2c_controller_inst, 0x70, 1, &tx_buffer);
    printf("SELECTING CH3 (0x08) of TCA9548 MUX IC (0x70)\n\n", rx_buffer);

    //###################################
    //#####   TCA9555
    //###################################
    tx_buffer = 0x02; // Control Register -> Output Port 0
    for(int i = 0; i < 3; i++) {
        i2c_master_repeated_start(&i2c_controller_inst, 0x20, 1, &tx_buffer, 1, &rx_buffer);
        printf("READ Output Port 0 TCA9555 MUX IC (0x20): %2p - READ %d\n", rx_buffer, i);
    }

    printf("\n");

    tx_buffer_16 = 0xF706; // Control Register -> Configuration Port 0 -> Set QSFP_LPMODE pin to output mode.
    i2c_master_write(&i2c_controller_inst, 0x20, 2, &tx_buffer_16);

    tx_buffer_16 = 0xF702; // Output Port 0 -> Set QSFP_LPMODE pin to drive '0'
    i2c_master_write(&i2c_controller_inst, 0x20, 2, &tx_buffer_16);

    tx_buffer = 0x02; // Control Register -> Output Port 0
    for(int i = 0; i < 3; i++) {
        i2c_master_repeated_start(&i2c_controller_inst, 0x20, 1, &tx_buffer, 1, &rx_buffer);
        printf("READ Output Port 0 TCA9555 MUX IC (0x20): %2p - READ %d\n", rx_buffer, i);
    }

    printf("Program ended\n\n");

    return 0;
}
```

Figure C.3. I2C Controller Configuration in Lattice Propel Builder

References

Related documents available from your Lattice Semiconductor sales representative are listed below.

- Programming Cables User Guide (FPGA-UG-02042)
- Lattice Avant sysCONFIG User Guide (FPGA-TN-02299)
- Avant-G Family Devices web page
- Avant-X Family Devices web page
- Lattice Avant Platform Data Sheet – Overview (FPGA-DS-02107)
- Lattice Avant Platform Data Sheet – Specifications (FPGA-DS-02112)
- Development Kits & Boards for Avant-G Devices
- Development Kits & Boards for Avant-X Devices
- IP Cores and Reference Designs for Avant-G Devices
- IP Cores and Reference Designs for Avant-X Devices
- Lattice Radiant FPGA design software web page
- Lattice Propel FPGA design environment web page
- Renesas web page
- Lattice Insights for Lattice Semiconductor training courses and learning plans

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Revision History

Revision 1.6, July 2026

Section	Change Summary
All	Made editorial fixes.
Abbreviations in This Document	Updated this section.
Programming	In the SPI Flash Device Selection in Programmer section: • added the following note, *Before programming, ensure a jumper is installed on the JP1 header*; • added a caution note stating that the SPI flash programming may fail when CFGMODE = 1 and provided related details and workarounds.
Memory	Added the following note for Table 6.3. MSPI Bus Connections: *Note: Avant-G70/X70 devices of production release provide a dedicated MSPI Flash Reset output on the P10 pin (MRSTN). For new designs, connect Avant-G70/X70 MRSTN (P10) to the SPI flash RESETn input rather than connecting INITN to the flash RESETn*.

Revision 1.5, January 2026

Section	Change Summary
Acronyms in This Document	Updated this section.
Programming	• In the Configuration section, added: *Open = MSPI mode, Close = JTAG, refer to Table 2.1*. • In the Programming of Avant-G/X SRAM section, added the new step 1: *For the JTAG mode, make sure JP1 is connected with a jumper*. • In the SPI Flash Device Selection in Programmer section, added the following: *Caution: If the MSPI-Flash boot is required after programming, power off the board, remove JP1 to select the MSPI mode, and then power on*.
Clocks	In the Clock Distribution section, added *The Renesas GUI and Timing Commander Personality (TCP) file can be used to configure the RC38612A and they are downloadable from the Renesas website.*
LEDs, Switches, and Segment Displays	In the DIP Switch section, changed *The designated pins are connected as shown in Table 8.1* to *The designated pins are connected as shown in Table 8.1, pulled down in default*.
Appendix A. Avant Versa Board Schematics	• Updated Schematics Rev from *1.0* to *1.1* for all pages. • Updated Date to *Tuesday, December 02, 2025* for all pages. • Updated the schematic Sheet 20, FPGA_DDR5x72.
References	Added the reference to the Renesas website.

Revision 1.4, March 2025

Section	Change Summary
SerDes Interface	Added the following note for Table 10.4. QSFP+/zQSFP+ J26 Connections: *Refer to Appendix C. Avant Versa Board zQSFP+ Enablement through I2C for more information.*
Appendix C. Avant Versa Board QSFP+ Enablement through I2C	Added this section.

Revision 1.3, August 2024

Section	Change Summary
Appendix A. Avant Versa Board Schematics	Updated all schematics in this section to make them text searchable.

Revision 1.2, March 2024

Section	Change Summary
All	Replaced *Avant-G/X* device name with *Avant-AT-G/X* device.
SerDes Interface	Added the following reference in the SFP+/zSFP+ Interface section: *For 25Gb Ethernet, an example design that demonstrates the application of this SFP28 interface is available. The example design instantiates the 25Gb Ethernet MAC+PHY IP. For complete guidance of the example design, from IP generation to running the 25Gb Ethernet on the Avant-X Versa Board, refer to the Example Design section of the* 25Gb Ethernet MAC+PHY IP Core User Guide.

Revision 1.1, February 2024

Section	Change Summary
Programming	In the Configuration section, changed *Master SPI* to *Controller SPI* and changed *Slave configuration mode (JTAG)* to *configuration mode (JTAG)*.
Headers/Connectors and Avant Device Ball Mapping	Changed the caption of Table 9.5. CSI-2 Connector J21 Pin Connections from *Raspberry PI header (JP5) Pin Connections* to the current.
SerDes Interface	Changed the caption of Table 10.3. SFP+/zSFP+ J28 Connections from *SFP+/zSFP+ K28 Connections* to the current.

Revision 1.0, January 2024

Section	Change Summary
All	Production release.

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