CertusPro-NX System on Module (SoM) Board

Preliminary User Guide

FPGA-EB-02080-0.80

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Abbreviations in This Document

A list of abbreviations used in this document.

Abbreviation	Definition
AC	Alternating Current
ADC	Analog-to-Digital Converter
ASC	Analog Sense and Control
caBGA	Chip Array Ball Grid Array
CMOS	Complementary Metal-Oxide Semiconductor
CSI-2	Camera Serial Interface 2
DC	Direct Current
DI	Do Install
DIP	Dual In-line Package
DN	Data Minus
DNI	Do Not Install
DNL	Do Not Load
DP	Data Plus
DPI	Display Parallel Interface
DSI	Display Serial Interface
EFUP	Environment-Friendly Use Period
eMMC	Embedded MultiMediaCard
ESD	Electrostatic Discharge
FPC	Flexible Printed Circuit
FPGA	Field Programmable Gate Array
FTDI	Future Technology Devices International
Gbe	Gigabit Ethernet
GPIO	General Purpose Input/Output
HDMI	High-Definition Multimedia Interface
HEVC	High Efficiency Video Coding
I2C	Inter-Integrated Circuit
I2S	Inter-IC Sound interface
IP	Intellectual Property
I/O	Input/Output
JEDEC	Joint Electron Device Engineering Council
JTAG	Joint Test Action Group
L-ASC10	Lattice Analog Sense and Control-10 Rail
LPDDR4	Low Power Double Data Rate 4
LDO	Low Dropout
LED	Light Emitting Diode
LPDDR4	Low Power Double Data Rate Four
LVCMOS	Low-Voltage Complementary Metal Oxide Semiconductor
LVDS	Low-Voltage Differential Signaling
MIC	Microphone
MIPI	Mobile Industry Processor Interface
OPN	Ordering Part Number
OSC	Oscillator
PC	Personal Computer
PCB	Printed Circuit Board
PCIe	Peripheral Component Interconnect Express

Abbreviation	Definition
PCS	Physical Coding Sublayer
PG	Power Good
PHY	Physical Layer
PLD	Programmable Logic Device
PLL	Phase-Locked Loop
PMOD	Peripheral Module
PoC	Proof-of-Concept
POT	Potentiometer
PWM	Pulse Width Modulation
RAM	Random Access Memory
RX	Receiver
RGB	Red, Green, Blue
RGMII	Reduced Gigabit Media Independent Interface
RoT	Root-of-Trust
RTC	Real-time clock
RPi CM5	Raspberry Pi Compute Module 5
UART	Universal Asynchronous Receiver/Transmitter
SD	Secure Digital
SDIO	Secure Digital Input/Output
SDRAM	Synchronous Dynamic Random-Access Memory
SGMII	Serial Gigabit Media Independent Interface
SLVS	Scalable Low Voltage Signaling
SMA	SubMiniature version A
SPI	Serial Peripheral Interface
TX	Transmitter
USB	Universal Serial Bus
USB PD	USB Power Delivery
VNC	Virtual Network Computing
MOD	Multi-Object Detection
WRIO	Wide Range I/O
HPIO	High Performance I/O
RPi	Raspberry Pi

1. Introduction

This document describes the Lattice Semiconductor CertusPro™-NX SoM Module. The board's key component is the CertusPro-NX FPGA, which serves as the main processing element for high-performance embedded and AI-driven applications. The module is designed to integrate seamlessly with the CertusPro-NX Carrier Module and the Raspberry Pi Compute Module 5 (RPi CM5), together providing a complete solution for rapid prototyping, proof-of-concept (PoC) development, and demonstration purposes.

The key features of the CertusPro-NX SoM Module include:

- CertusPro-NX FPGA (LFCPNX-100-ASG256)
  - 2-channel Mobile Industry Processor Interface (MIPI), four lanes for each channel
  - 1-channel 4-pair SerDes
  - Ethernet RGMII interface
  - Serial Peripheral Interface (SPI) flash configuration
  - General Purpose Input/Output (GPIO)
- MachXO3D™ FPGA (LCMXO3D-9400-UWG69)
  - Hardware Root of Trust (RoT)
- Board Resources
  - 2 × 64 Mb HyperRAM
  - 2 x 100-Pin Connector to connect with CertusPro-NX Carrier Module
- Programming Circuit
  - Support programming with programming software through the USB/FTDI interface using JTAG
  - Support programming from on-board Flash using SPI

Figure 1.5 and Figure 1.6 shows the top and bottom views of the CertusPro-NX SoM Module and its key components.

1.1. System Integration

Figure 1.1 illustrates the integration of SoM modules on a Carrier Board.
The Carrier Board receives a 5 V power from a USB Type-C interface and distributes it to both the SoM Board and the RPi Module. Each of these modules connects to the Carrier Board through two 100-pin connectors.

The Carrier Board functions as a central hub, enabling:

- power distribution to all connected modules;
- signal routing between the SoM and RPi modules;
- peripheral expansion, including interfaces for USB, Ethernet, and Secure Digital (SD) card.

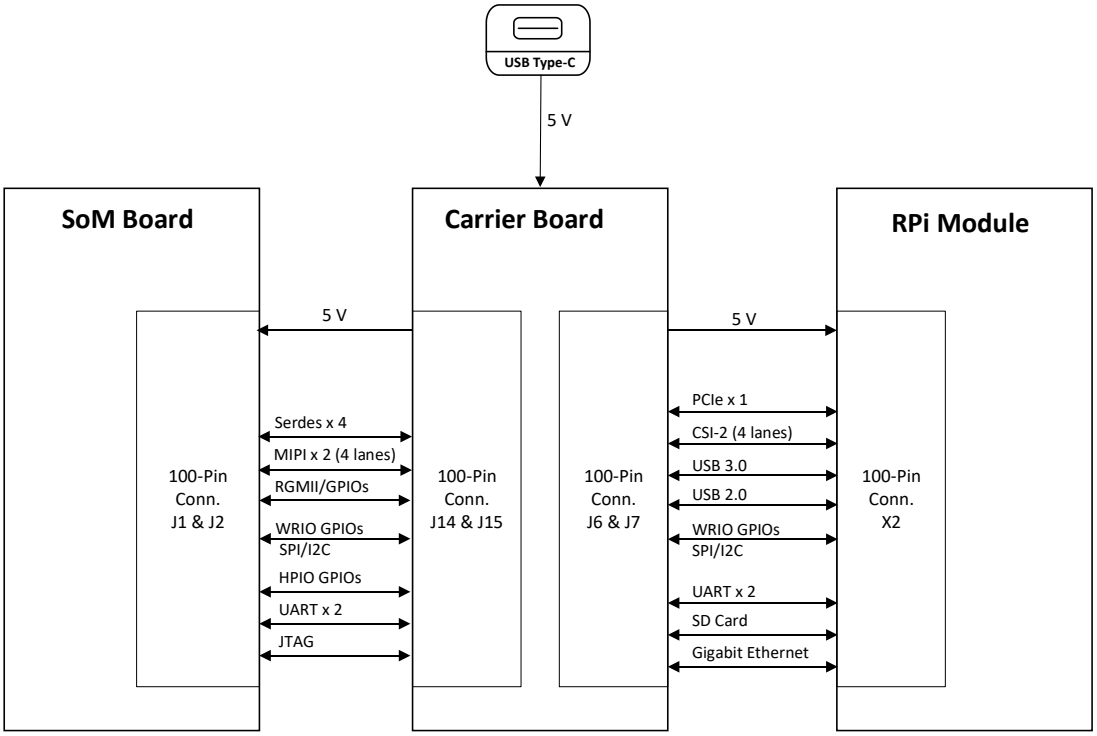

Figure 1.1. System Integration Schematic

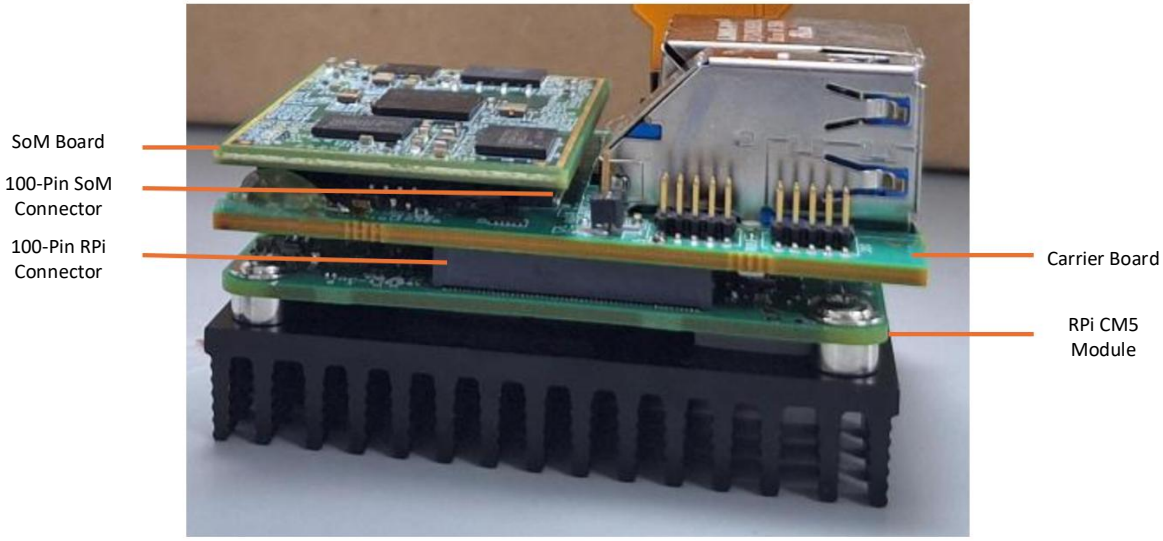

Figure 1.2. System Integration

1.2. CertusPro-NX SoM Block Diagram

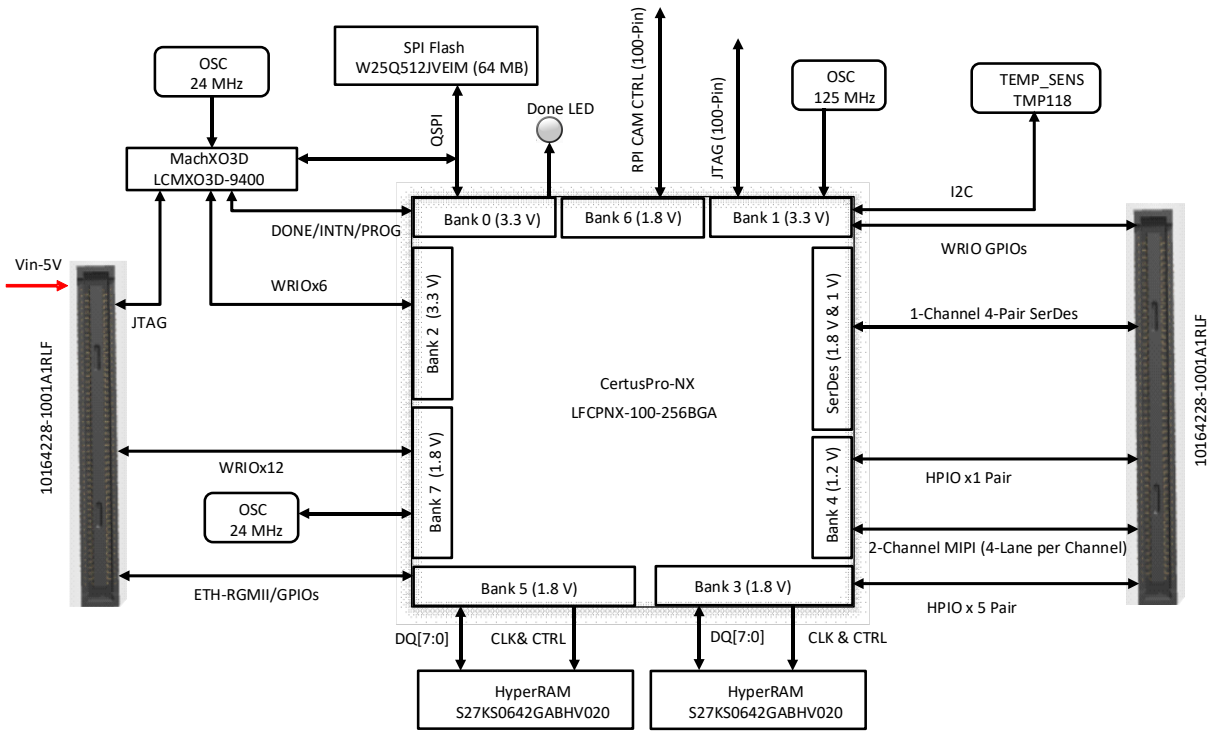

Figure 1.3. CertusPro-NX SoM Block Diagram

- CertusPro-NX FPGA (LFCNX-100-256BGA)
  This is the main programmable logic device. It has multiple I/O banks with different voltage levels:
  - Bank 0, Bank 1, and Bank 2: 3.3 V
  - Bank 3, Bank 5, Bank 6, and Bank 7: 1.8 V
  - Bank 4: 1.2 V
- MachXO3D FPGA (LCMXO3D-9400-UWG69)
  This FPGA is mainly for providing security and for monitoring purposes.
  - Keeps monitoring the SPI interface with the CertusPro-NX device.
  - Controls the CertusPro-NX FPGA by DONE, INT, and PROGRAM interfaces.
- Interfaces and peripherals
  - 64 MB SPI Flash (W25Q512JVEIM): connected through SPI for FPGA configuration and storage.
  - HyperRAM (S27KS0642GABHV020): two 64 Mb HyperRAM chips connected.
  - Temperature Sensor (TMP118): connected through I2C for thermal monitoring.
  - Wide Range I/O (WRIO): multiple WRIO for general purpose I/O (GPIO) connected to the 100-pin connector.
  - ETH-RGMII/GPIOs: an Ethernet interface available using the RGMII standard, multiplexed with GPIO functionality. When Ethernet is not in use, the pins can function as GPIOs.
  - High Performance I/O (HPIO): five pairs with high-speed differential signaling provided on Bank 3.
  - MIPI interface: 2-channel MIPI with 4-lane per channel for camera or display connectivity.
  - SerDes: 1-channel 4-pair SerDes for high-speed serial communication.
- Programming and debug
  - The JTAG/UART interface: standard interface for programming and debugging FPGA.
- Connectors
  - Two 100-pin connectors labeled 10164228-1001A1RLF on-board to interface with the Carrier Board.

1.3. Carrier Board Block Diagram

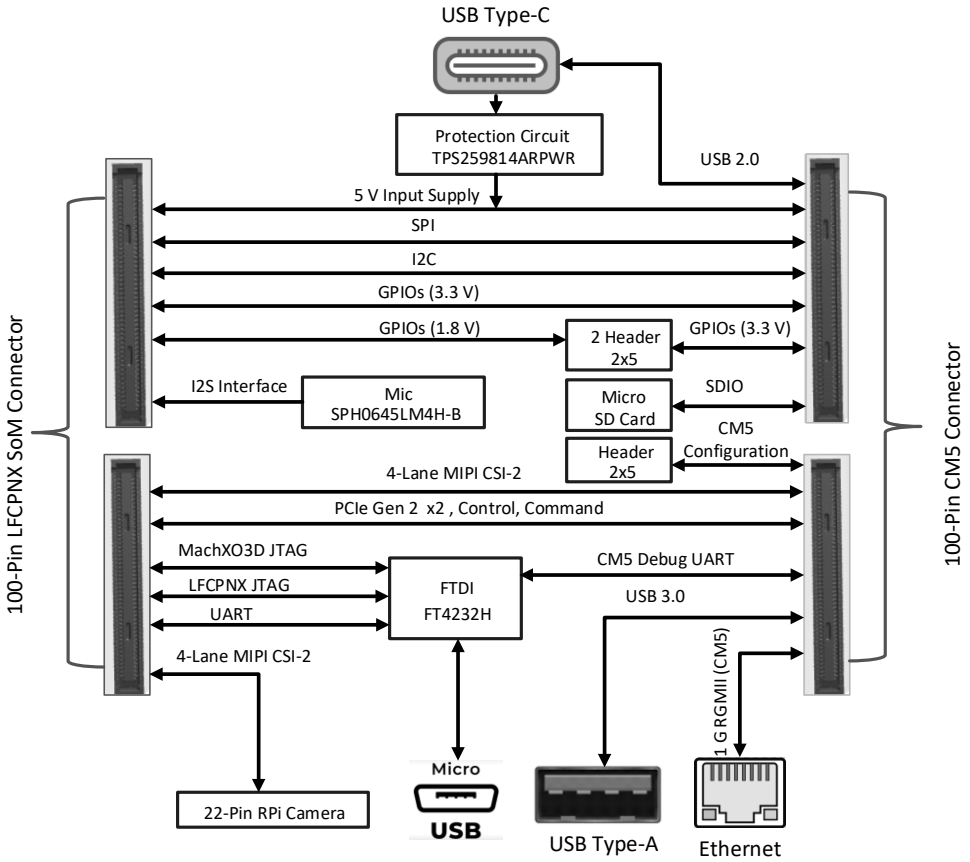

Figure 1.4. Carrier Board Block Diagram

The Carrier Board acts as the central interface hub between the SoM Board and the RPi CM5 module.

- Power and protection
  - Type-C power connector: accepts 5 V input from USB Type-C.
  - Protection circuit: ensures safe delivery to both SoM and RPi modules.
  - Power distribution: supplies regulated 5 V to SoM and RPi connectors.
- Storage and USB
  - Micro SD card slot: provides storage for the RPi module.
  - USB 2.0: differential pair DP and DN for data transfer between RPi and external devices.
  - USB 3.0 Type-A: high-speed external USB interface.
  - u-USB Connector: for debugging or Future Technology Devices International (FTDI) USB-to-serial communication.
- Expansion connector
  Extends GPIO signals from both the SoM and RPi interfaces.
- High-speed interfaces
  - Camera Serial Interface 2 (CSI-2) with four data pairs and one clock pair: camera interface routed between SoM and RPi.
  - CSI-2 with four data pairs and one clock pair: dedicated connector, MIPI CSI-2 camera for camera modules.
  - PCIe Gen2 x1: high-speed expansion bus for the RPi module, with control signals, CLK_REQ, WAKE#, PWR_EN, PRSTn for power and reset management.
- Debug and communication
  - FTDI USB-IO: converts USB to Universal Asynchronous Receiver/Transmitter (UART) for debugging or programming.

  - UART: Serial interface for RPi and SoM.
  - JTAG-1, JTAG-2: debugging and programming interfaces for SoM.
- Networking
  - RJ45 Magjack: the Gigabit Ethernet interface for RPi.

1.4. RPi CM5 Module Description

Key features of the RPi CM5 module are as follows:

- Broadcom BCM2712, featuring a 64-bit Cortex-A76 quad-core processor with ARMv8 architecture operating at up to 2.4 GHz
- Small Footprint 55mm x 40mm x 4.7mm module
- Four M2.5 mounting holes
- 4kp60 High Efficiency Video Coding (HEVC) decoder
- Supports OpenGL ES 3.1 graphics and Vulkan 1.2
- Options for 2 GB, 4 GB, or 8 GB LPDDR4-4267 Synchronous Dynamic Random-Access Memory (SDRAM) with Error Correction Code (ECC). Refer to the Compute Module 5 documentation on the Raspberry Pi web page for more details.
- Options for 0 GB CM5Lite, 16 GB, or 32 GB Embedded MultiMediaCard (eMMC) flash memory. Refer to the Compute Module 5 documentation on the Raspberry Pi web page for more details.
- Peak eMMC bandwidth is 400 Mbps, which is four times faster than previous compute modules.
- Option for a certified radio module include:
  - 2.4 GHz, 5.0 GHz IEEE 802.11 b/g/n/ac wireless
  - Bluetooth 5.0, BLE
  - On-board electronic switch to select between PCB trace or external antenna
- Gigabit Ethernet PHY supporting IEEE 1588
- One PCIe Gen 2 Host of 1-lane, up to 5 Gbps
- One high-speed USB 2.0 port
- Two USB 3.0 ports, supporting simultaneous 5 Gbps operation
- up to 30 GPIO supporting either 1.8 V or 3.3 V signaling and peripheral options:
  - Up to five UART
  - Up to five Inter-Integrated Circuit (I2C)
  - Up to five SPI
  - One Secure Digital Input/Output (SDIO) interface
  - One Display Parallel Interface (DPI) for parallel RGB display
  - One Inter-IC Sound (I2S)
  - Up to four PWM channels
  - Up to three GPCLK outputs
- Two High-Definition Multimedia Interface (HDMI) 2.0 ports that support up to 4Kp60 on each port simultaneously
- Two 4-lane MIPI ports
- Supports both the Display Serial Interface (DSI) display port and the CSI-2 camera port
- One SDIO 2.0 of CM5Lite
- Single +5V PSU input supports USB Power Delivery (PD) for up to 5 A at 5 V
- Real-time clock (RTC), powered from an external battery

Refer to the Compute Module 5 documentation on the Raspberry Pi web page for more details about the CM5 module.

1.5. SoM Board Top and Bottom Views

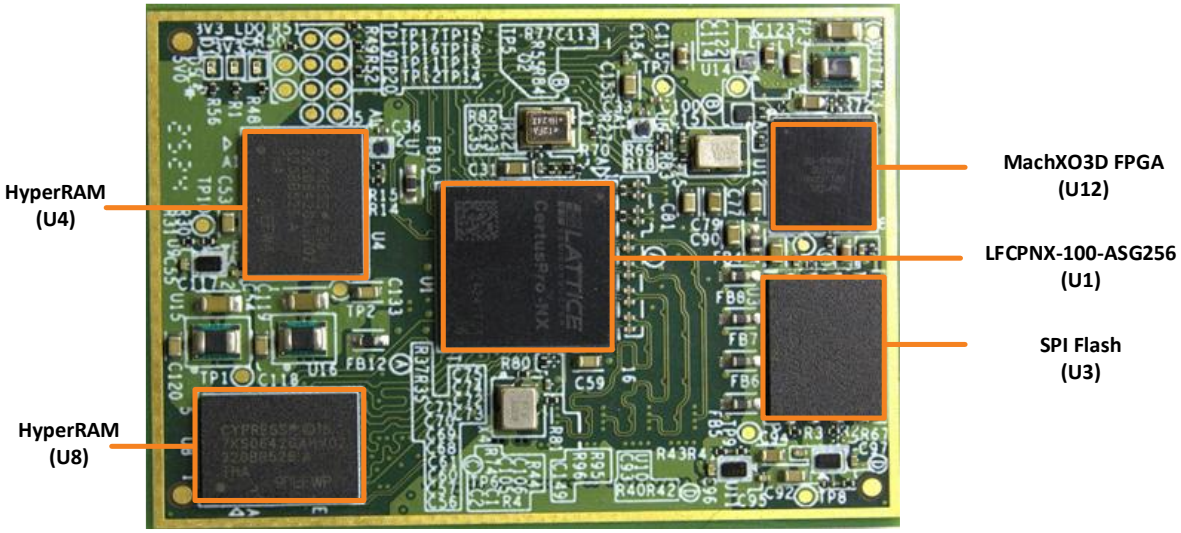

Figure 1.5. Top View of CertusPro-NX SoM Module

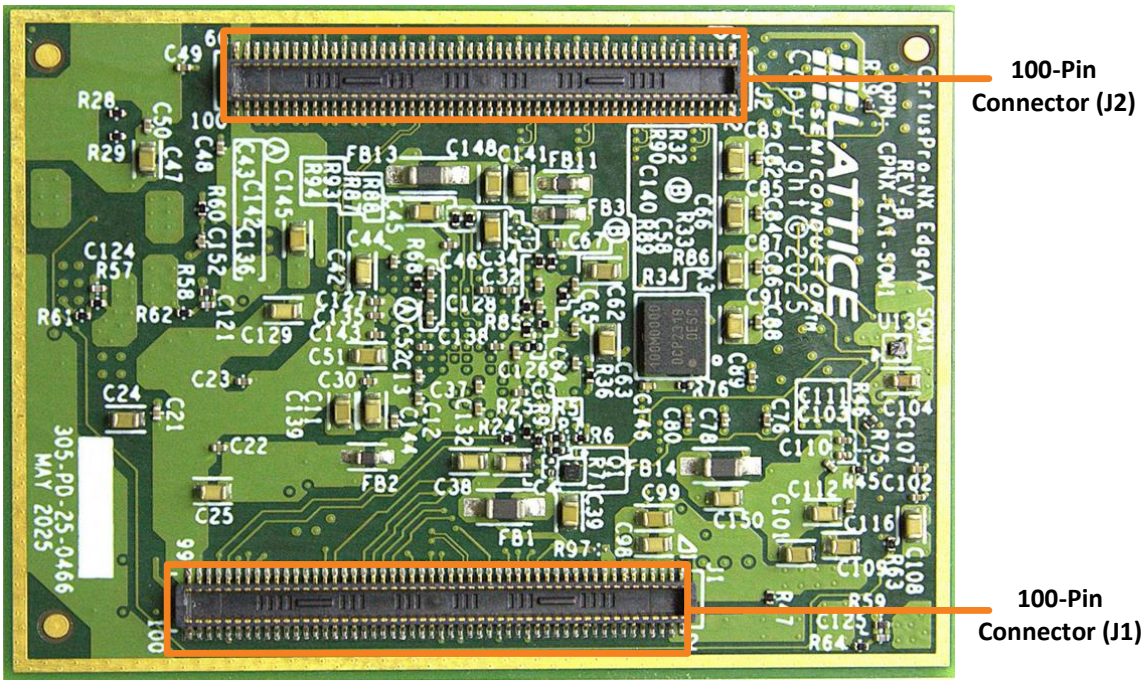

Figure 1.6. Bottom View of CertusPro-NX SoM Module

1.6. Carrier Board Top and Bottom Views

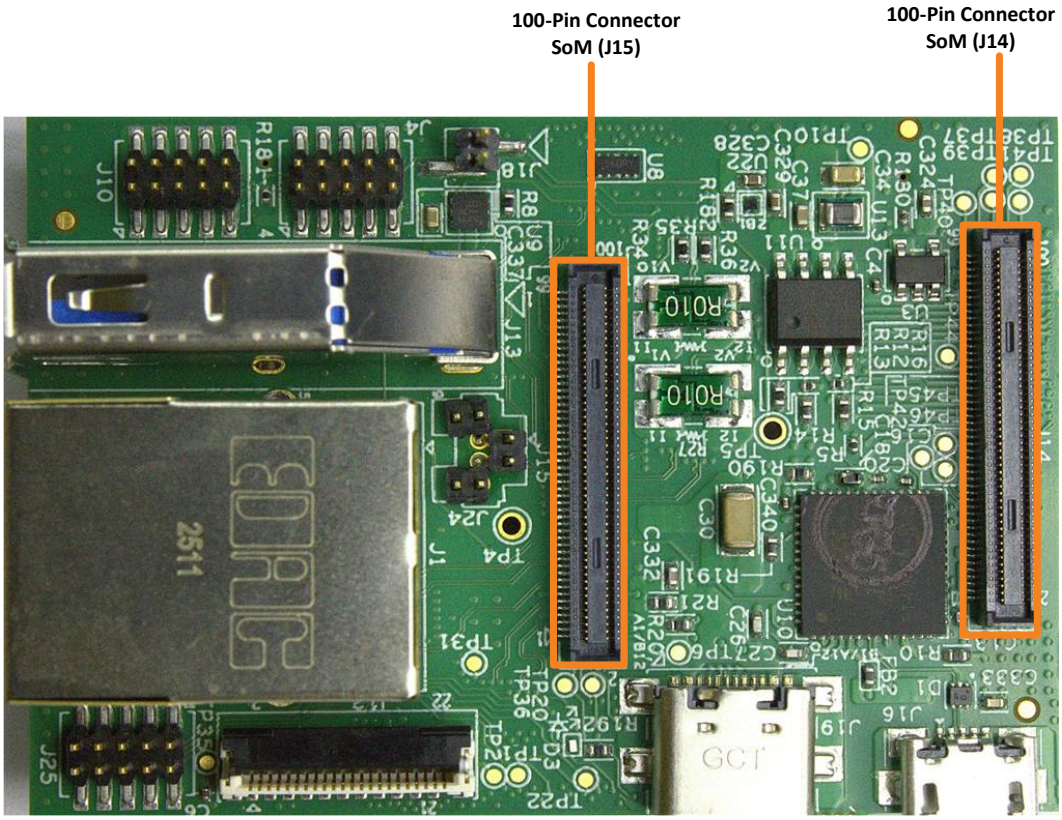

Figure 1.7. Top View of CertusPro-NX Carrier Module

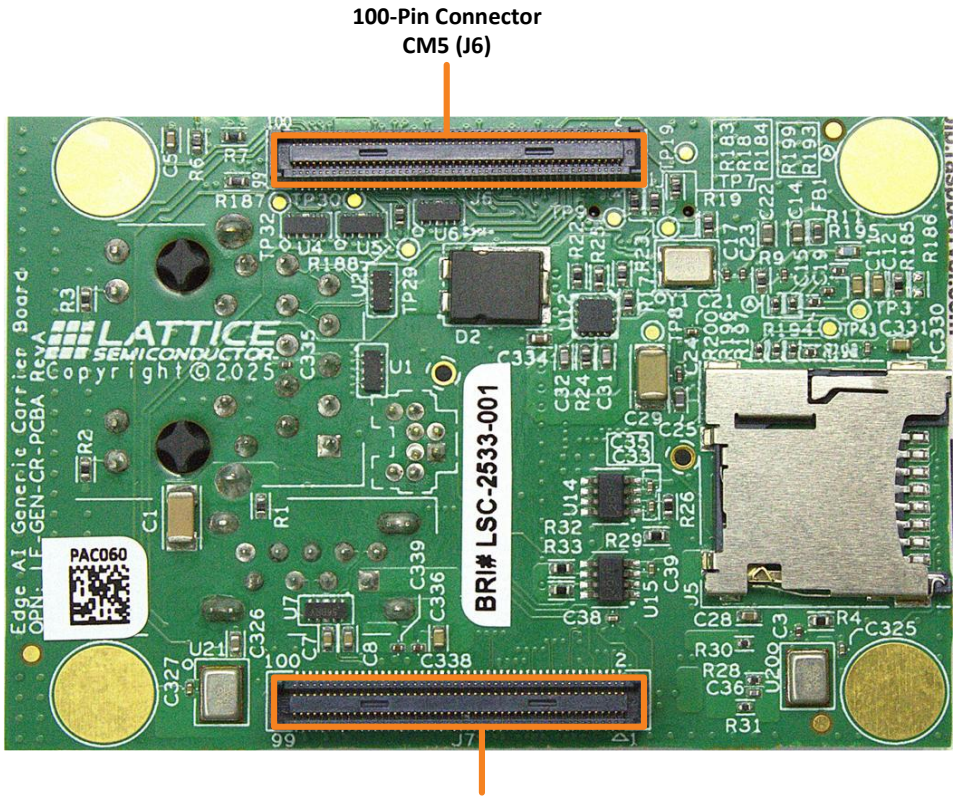

Figure 1.8. Bottom View of CertusPro-NX Carrier Module

1.7. RPi Board Top and Bottom Views

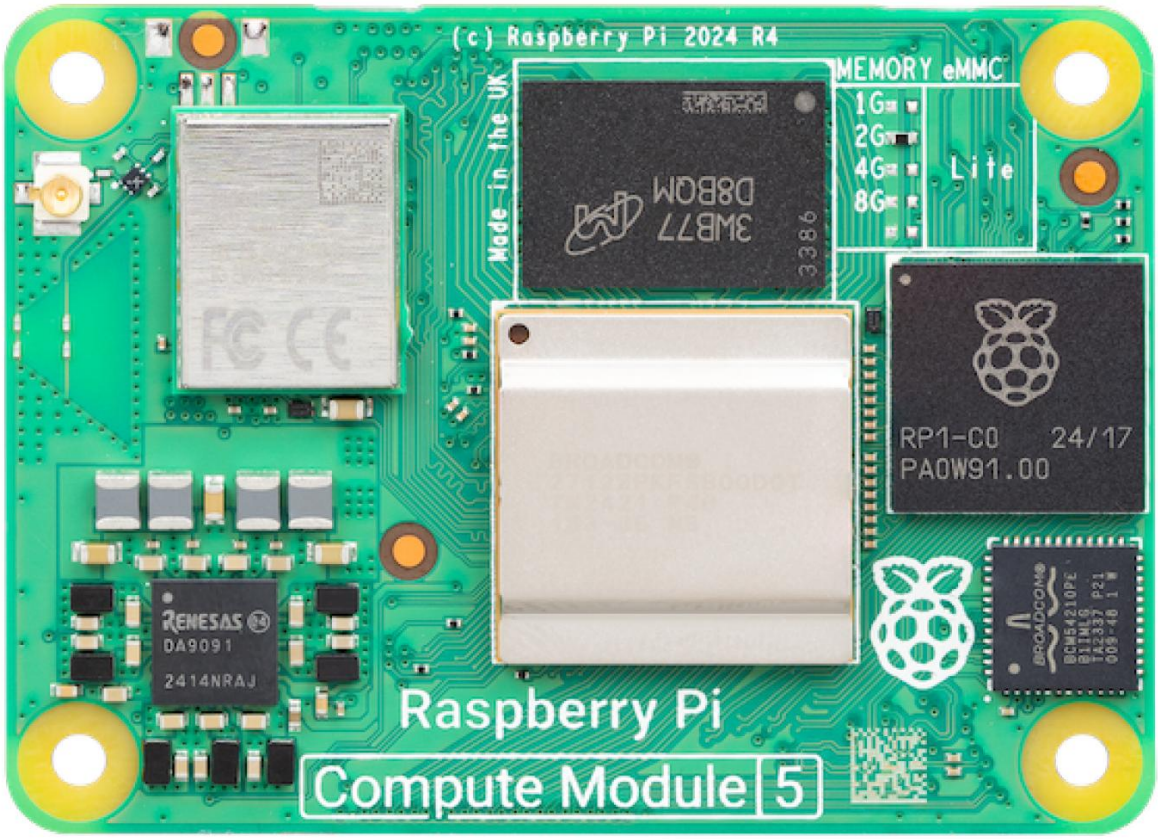

Figure 1.9. Top View of RPi Module

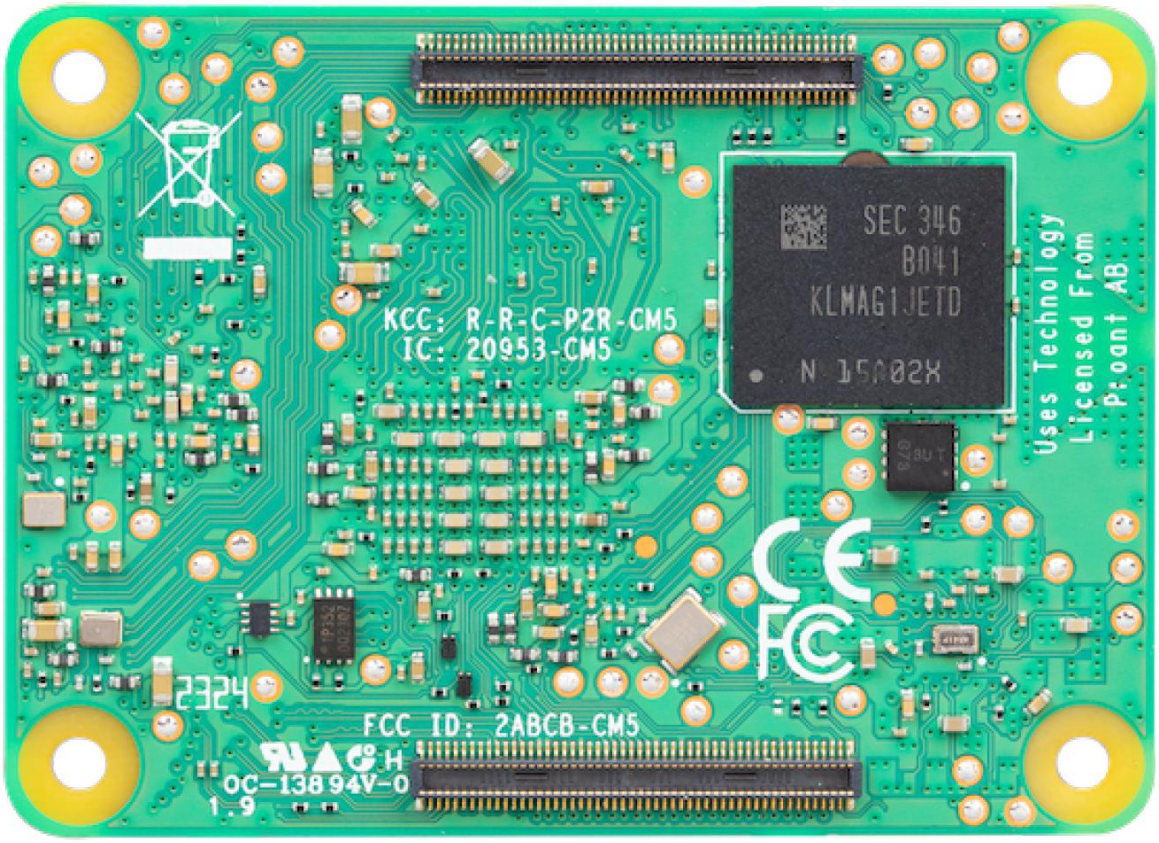

Figure 1.10. Bottom View of RPi Module

1.8. Further Information

The following references provide detailed information on the CertusPro-NX SoM Module, Carrier Module, RPi CM5 module and the CertusPro-NX FPGA device:

- Appendix A. CertusPro-NX SoM Revision C Module Schematics
- Appendix B. CertusPro-NX SoM Revision C Module Bill of Materials
- Appendix C. Carrier Board Revision A Module Schematics
- Appendix D. Carrier Board Revision A Module Bill of Materials
- Lattice Boards for CertusPro-NX Devices
- CertusPro-NX Family Data Sheet (FPGA-DS-02086)
- RPi CM5 Datasheet for details on RPi CM5 module

2. Power Supply and Sequencing

The entire system is powered from a 5 V input supply provided by the carrier board through a 100-pin connector. The first step in the sequence is generating the core voltages: VCC_1V0 for the CertusPro-NX FPGA and VCC_1V2_LDO for the MachXO3D FPGA. These rails are critical for FPGA operation and must be stable before any other power rails are enabled. Once the core voltages are stable, a Power Good (PG) signal triggers the enable sequence for additional rails: VCC_1V8, VCC_3V3, VCC_1V2_LDO_MIPI.

Simultaneously, the MachXO3D core voltage VCC_1V2_LDO enables the MachXO3D FPGA I/O voltage, VCC_3V3_LDO. Finally, power for the SerDes interface is activated through the MachXO3D FPGA I/O.

A detailed power diagram is provided in Figure 2.1.

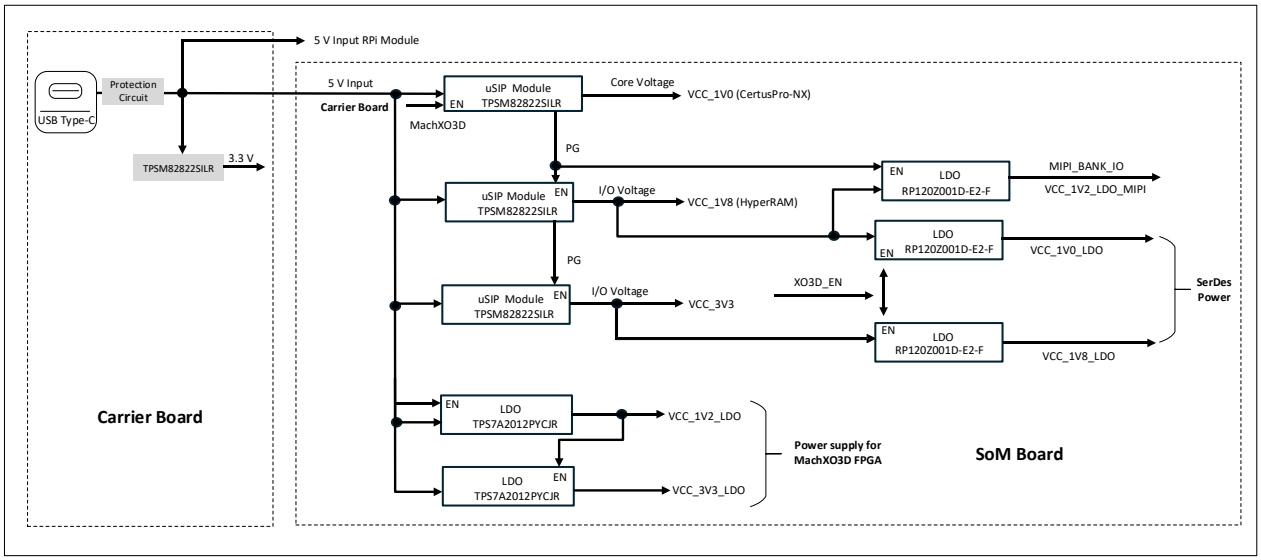

Figure 2.1. Board Power Supply Diagram

Table 2.1 and Table 2.2 summarizes on-board major power rails and their test points.

Table 2.1. SoM Board On-Board Power Rails

Power Net Name	Primary Source	Test Point
VCC_1V0	DC/DC Regulator (U16)	TP2
VCC_1V8	DC/DC Regulator (U15)	TP1
VCC_3V3	DC/DC Regulator (U17)	TP3
VCC_1V2_LDO_MIPI	LDO (U9)	TP10
VCC_1V0_LDO	LDO (U10)	TP8
VCC_1V8_LDO	LDO (U11)	TP9
VCC_1V2_LDO	LDO (U14)	TP5
VCC_3V3_LDO	LDO (U13)	TP6
VCC_5V0	—	TP7
GND	—	TP19, TP20

Table 2.2. Carrier Board On-Board Power Rails

Power Net Name	Primary Source	Test Point
VCC_1V8	LDO	—
VCC_3V3	DC/DC Regulator (U13)	TP10
VCC_5V0_PWR	—	TP8
VBUS_5V00_FTDI	—	—

3. Clock Source

The diagram in Figure 3.1 illustrates the clock distribution and the flow for the system.

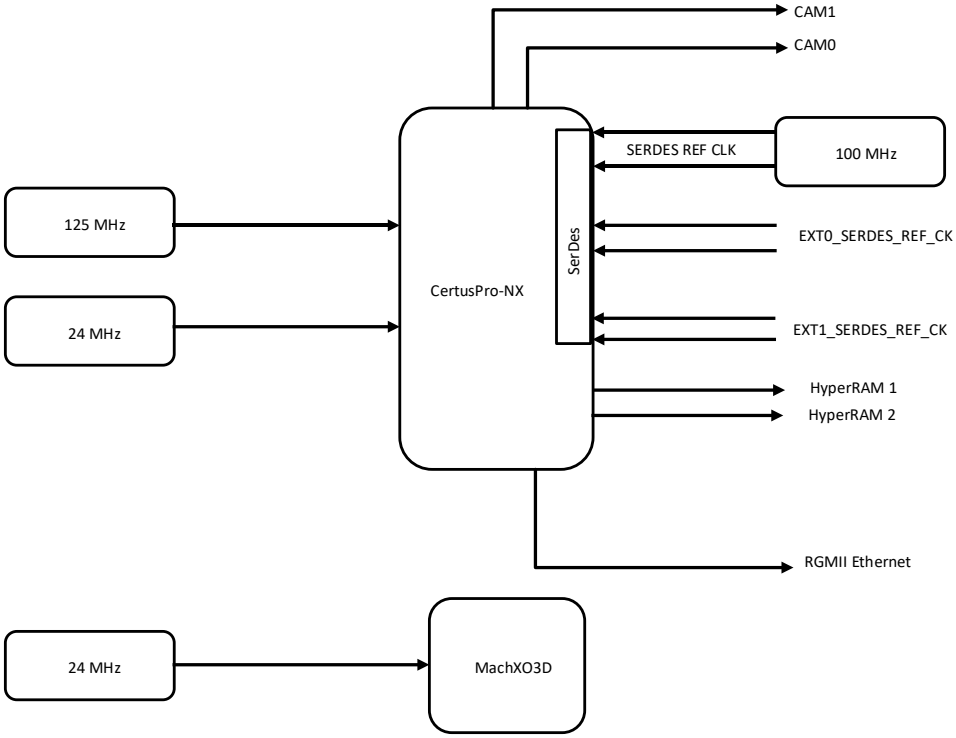

Figure 3.1. Clock Distribution Diagram

Clock sources:

- 125 MHz, 24 MHz, and 100 MHz Oscillator: Feeds directly into the CertusPro-NX FPGA.
- 24 MHz Oscillator: Connected directly to the MachXO3D FPGA
- SerDes REF CLK: External or Internal reference clock for SerDes.

FPGA internally distributes these clocks to:

- Camera interfaces (CAM0, CAM1) for image data capture.
- HyperRAM for memory transactions.

4. PCIe SerDes Interface

The SoM board features a 4-lane SerDes interface. One lane is utilized for PCIe connectivity to the RPi module. In this configuration, the RPi acts as the host and provides the reference clock. Additionally, an internal reference clock is available through the on-board oscillator.

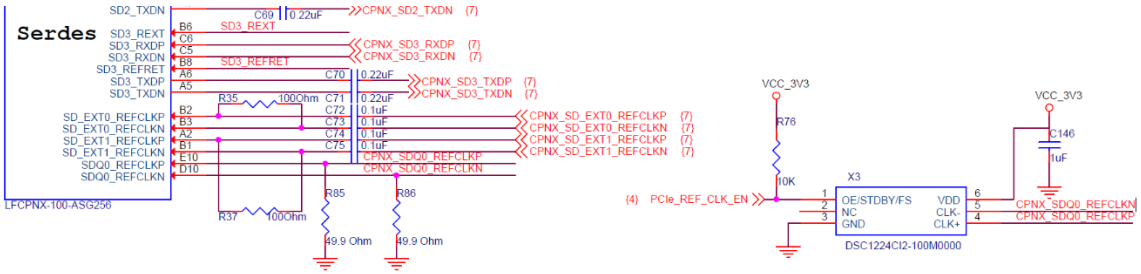

Figure 4.1. PCIe Clock Interface

The table below provides detailed pin mapping of the PCIe interface signals between the RPi and the SoM module.

Table 4.1. RPi PCIe Pin Mapping to SoM Module

CertusPro-NX SoM Module	CertusPro-NX FPGA Ball Location	RPi Module
CPNX_SD0_TXDP	A15	RPI_CPNX_PCIe_RX_P
CPNX_SD0_TXDN	A14	RPI_CPNX_PCIe_RX_N
CPNX_SD0_RXDP	C13	RPI_CPNX_PCIe_TX_P
CPNX_SD0_RXDN	C14	RPI_CPNX_PCIe_TX_N
CPNX_SD_EXT0_REFCLKP	B2	RPI_CPNX_PCIe_CLK_P
CPNX_SD_EXT0_REFCLKN	B3	RPI_CPNX_PCIe_CLK_N
CPNX_WRIO_3V3_11	G1	RPI_PCIe_CLK_nREQ
CPNX_WRIO_3V3_12	H1	RPI_PCIE_nWAKE
CPNX_WRIO_3V3_9	H3	RPI_PCIE_PWR_EN
CPNX_WRIO_3V3_10	H2	RPI_PCIe_nRST

5. HyperRAM Memory Interface

Table 5.1 lists all signals of the HyperRAM memory controller interface.

Table 5.1. HyperRAM Memory Controller Interface

IC	HyperRAM Net Name	CPNX FPGA Ball Location
U8	HR_DQ0	N16
	HR_DQ1	M16
	HR_DQ2	P15
	HR_DQ3	N15
	HR_DQ4	P16
	HR_DQ5	M15
	HR_DQ6	L15
	HR_DQ7	L16
	HR_RWDS	K14
	HR_CS	R16
	HR_RESET	P14
	HR_CLK#	K15
	HR_CLK	K16
U4	HR1_DQ0	M4
	HR1_DQ1	N5
	HR1_DQ2	L5
	HR1_DQ3	M5
	HR1_DQ4	N4
	HR1_DQ5	L6
	HR1_DQ6	T6
	HR1_DQ7	R6
	HR1_RWDS	R5
	HR1_CSN	T5
	HR1_RST	K5
	HR1_CKN	M3
	HR1_CKP	N3

6. Ethernet RGMII interface

The SoM includes an Ethernet interface based on the RGMII standard for future expansion. However, it is currently not connected to the carrier board. Table 6.1 lists all Ethernet RGMII interface signals.

Table 6.1. Ethernet RGMII interface

Signal Name on Schematic	CertusPro-NX FPGA Ball Location	Connector J1 Pin Number
ETH_GPIO_0	H14	60
ETH_GPIO_1	H15	62
ETH_RGMII_RX_0	L14	20
ETH_RGMII_RX_1	M14	22
ETH_RGMII_RX_2	K13	24
ETH_RGMII_RX_3	L13	26
ETH_RGMII_TX_0	T13	40
ETH_RGMII_TX_1	R13	42
ETH_RGMII_TX_2	T14	44
ETH_RGMII_TX_3	R14	46
ETH_MDIO	P13	32
ETH_MDC	L11	30
ETH_RGMII_TX_CLK	P12	50
ETH_RGMII_TX_CTRL	R15	52
ETH_RESET	R12	54
ETH_RGMII_RX_CLK	L12	36
ETH_RGMII_RX_CTRL	M13	34

7. MIPI Camera Interface

The CertusPro-NX SoM module provides a 2-channel MIPI CSI-2 interface for connecting compatible image sensors or camera modules. Each MIPI channel consists of four high-speed differential data lanes and one differential clock pair, enabling high-bandwidth image data transfer from the sensor to the FPGA.

The MIPI signals are routed to HPIO Bank 4, operating at 1.2 V I/O, and are designed with 100 Ω differential impedance to ensure signal integrity.

Table 7.1 lists all MIPI interface signals.

Table 7.1. MIPI Interface

Signal Name	CertusPro-NX FPGA Ball Location	Connector
CPNX_CAM0_MIPI_CKP	M7	J12 on the carrier card, RPi CAM 22-pin connector
CPNX_CAM0_MIPI_CKN	M6	
CPNX_CAM0_MIPI_D0P	K11	
CPNX_CAM0_MIPI_D0N	K10	
CPNX_CAM0_MIPI_D1P	K8	
CPNX_CAM0_MIPI_D1N	K7	
CPNX_CAM0_MIPI_D2P	L8	
CPNX_CAM0_MIPI_D2N	L7	
CPNX_CAM0_MIPI_D3P	M10	
CPNX_CAM0_MIPI_D3N	L10	
CPNX_CAM1_MIPI_CKP	K9	J7 on the carrier card. RPi CM5 100-pin connector
CPNX_CAM1_MIPI_CKN	L9	
CPNX_CAM1_MIPI_D0P	P9	
CPNX_CAM1_MIPI_D0N	P10	
CPNX_CAM1_MIPI_D1P	T10	
CPNX_CAM1_MIPI_D1N	R10	
CPNX_CAM1_MIPI_D2P	R8	
CPNX_CAM1_MIPI_D2N	T8	
CPNX_CAM1_MIPI_D3P	N7	
CPNX_CAM1_MIPI_D3N	N6	

The MIPI CSI-2 CAM0 channel is directly connected to the RPi 22-pin camera connector, while the CAM1 channel interfaces with the RPi CM5 through the 100-pin connector on the carrier board.

The camera voltage selection circuit (Figure 7.1) allows choosing between the default 3.3 V and 1.8 V for the camera power rail using 0 Ω resistors as jumpers.

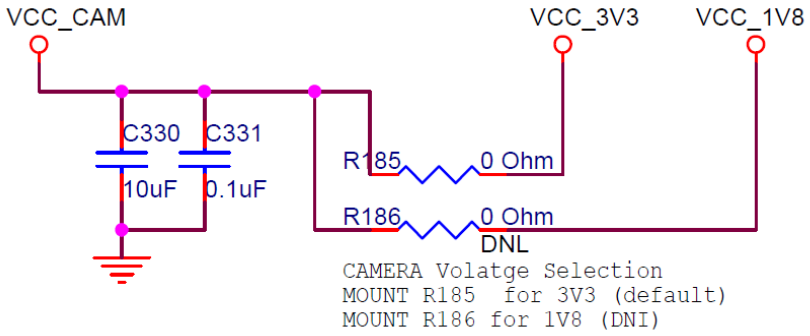

Figure 7.1. Camera Voltage Selection Circuit

8. SD Card Interface

The carrier board supports an SD card interface for RPi CM5 module (Figure 8.1), which does not have on-board eMMC. The SD card power is controlled by the RPI_SD_PWR_ON signal through a power switch (RT9742GJ5).

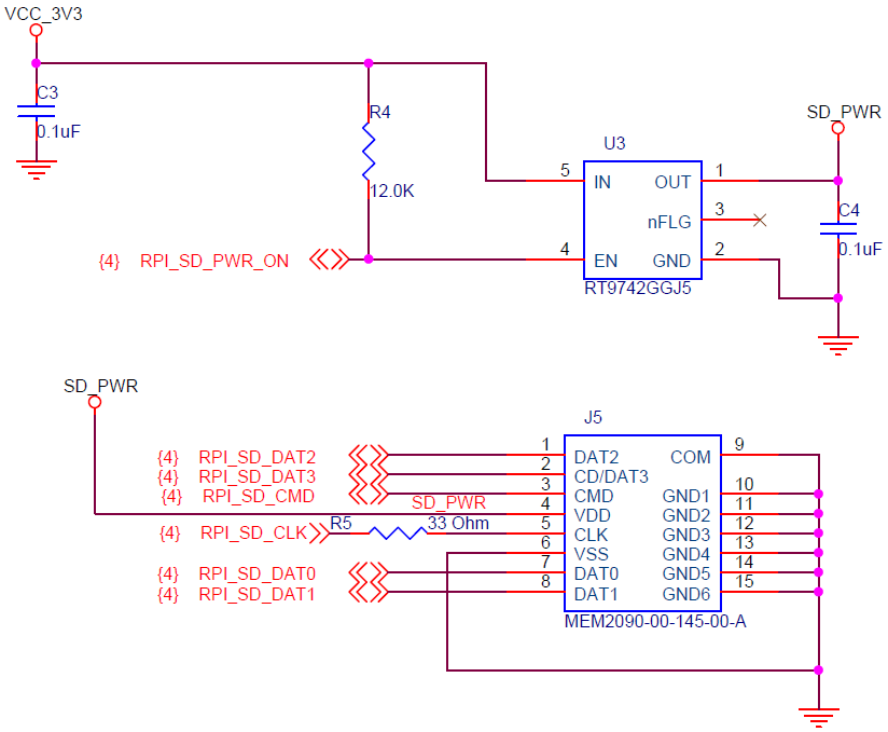

Figure 8.1. SD Card Interface

9. USB Interface

The carrier board includes three USB connectors with the following functions:

- USB Type-C connector
  - Supplies 5 V power to both the SoM and the RPI board.
  - Also provides a USB 2.0 data communication interface for RPI board.
- USB 3.0 Type-A connector
  - Connects directly to the RPI board for high-speed peripheral connectivity.
- Micro-USB connector
  - Interfaces with the FTDI for debugging and programming purposes.

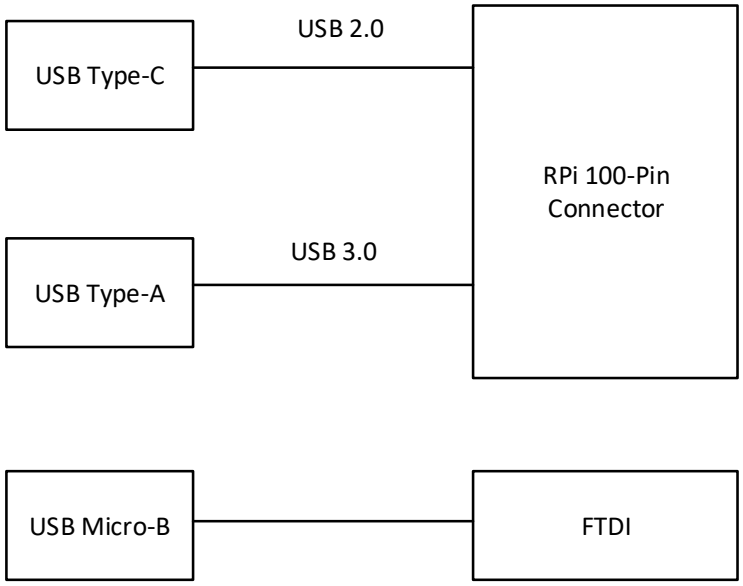

Figure 9.1. USB Interface

10. RPi and CertusPro-NX Expansion GPIO

The carrier board provides dedicated expansion headers, J4 and J25, to extend GPIO signals from both the SoM and RPi interfaces.

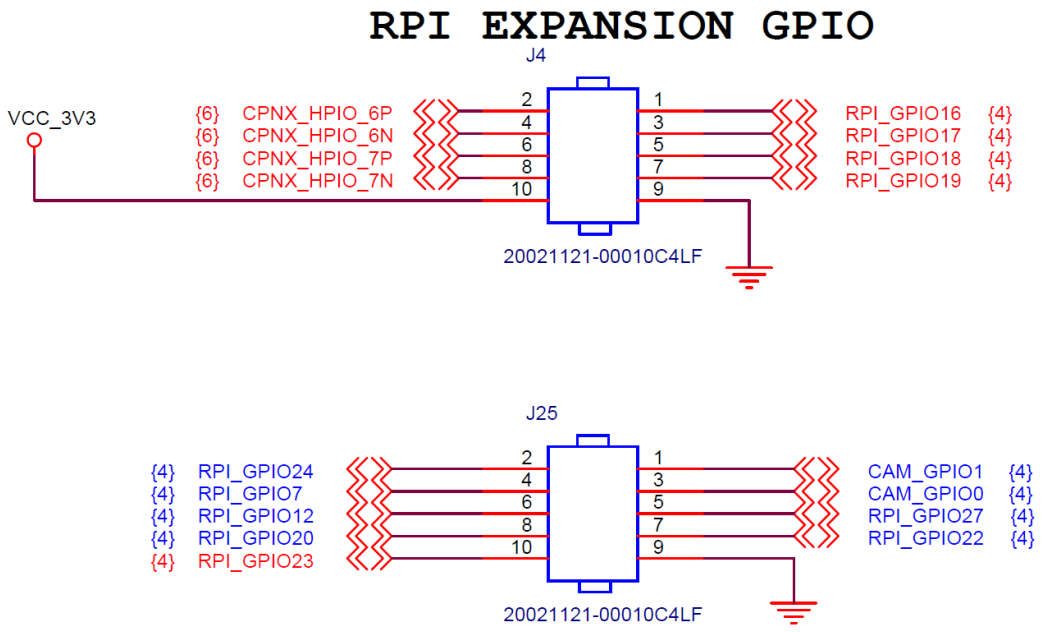

Figure 10.1. Expansion Header

Table 10.1. Expansion GPIO Details

Signal Name	CertusPro-NX FPGA Ball Location	Connector
CPNX_HPIO_6P	T4	J4 on the carrier board
CPNX_HPIO_6N	R4	
CPNX_HPIO_7P	R3	
CPNX_HPIO_7N	T3	
RPI_GPIO16	—	
RPI_GPIO17	—	
RPI_GPIO18	—	
RPI_GPIO19	—	
CAM_GPIO1	—	J25 on the carrier board
CAM_GPIO0	—	
RPI_GPIO7	—	
RPI_GPIO12	—	
RPI_GPIO20	—	
RPI_GPIO22	—	
RPI_GPIO23	—	
RPI_GPIO24	—	
RPI_GPIO27	—	

11. CertusPro-NX SoM to Carrier Board 100-Pin Connector Details

Table 11.1 and Table 11.2 show the 100-pin connector interface between the SoM board and the carrier card.

Table 11.1. SoM (J1) and Carrier Card (J14) Connector Interface, J1 Pin 1 to Pin 56

Interface	FPGA Pin	Carrier Board (J14) Signal Name	CertusPro-NX SoM 100-Pin (J1) Pin Number and Signal Name					Carrier Board (J14) Signal Name	FPGA Pin	Interface
			J1 Signal Name	J1 Pin Number		J1 Pin Number	J1 Signal Name			
				1		2	GND	GND	—	
				3		4	CPNX_HPIO_6P	CPNX_HPIO_6P	T4	
	—	VCC_5V0	VCC_5V0	5		6	CPNX_HPIO_6N	CPNX_HPIO_6N	R4	
				7		8	GND	GND	—	
				9		10	CPNX_HPIO_7P	CPNX_HPIO_7P	R3	
				11		12	CPNX_HPIO_7N	CPNX_HPIO_7N	T3	
	—	VCC_CAM	VCC_CAM	13		14	GND	GND		
				15		16	CPNX_HPIO_8P	NC		
—	—	GND	GND	17		18	CPNX_HPIO_8N	NC		
	H11	TP42	CPNX_WRIO_5	19		20	ETH_RGMII_RX_0	NC		
	H10	NC	CPNX_WRIO_6	21		22	ETH_RGMII_RX_1	NC		
	F11	TP43	CPNX_WRIO_7	23		24	ETH_RGMII_RX_2	NC		
	F12	NC	CPNX_WRIO_8	25		26	ETH_RGMII_RX_3	NC		
	—	GND	GND	27		28	GND	GND		
	H7	TP45	CPNX_WRIO_3V3_5	29		30	ETH_MDC	NC		
	H6	TP46	CPNX_WRIO_3V3_6	31		32	ETH_MDIO	NC		
UART	E6	CPNX_UART_TX	CPNX_UART_TX	33		34	ETH_RGMII_RX_CTRL	NC		
	F9	CPNX_UART_RX	CPNX_UART_RX	35		36	ETH_RGMII_RX_CLK	NC		
	—	GND	GND	37		38	GND	GND		
	K6	NC	CPNX_HPIO_10P	39		40	ETH_RGMII_TX_0	NC		
—	—	GND	GND	41		42	ETH_RGMII_TX_1	NC		
	L3	NC	CPNX_HPIO_9P	43		44	ETH_RGMII_TX_2	NC		
	K3	NC	CPNX_HPIO_9N	45		46	ETH_RGMII_TX_3	NC		
	—	GND	GND	47		48	GND	GND		
	G6	RPI_CPNX_SCLK	CPNX_WRIO_3V3_1	49		50	ETH_RGMII_TX_CLK	NC		
SPI	G5	RPI_CPNX_CSN	CPNX_WRIO_3V3_2	51		52	ETH_RGMII_TX_CTRL	NC		
	G3	RPI_CPNX_MOSI	CPNX_WRIO_3V3_3	53		54	ETH_RESET	NC		
	G2	RPI_CPNX_MISO	CPNX_WRIO_3V3_4	55		56	CPNX_WRIO_3V3_14	RPI_CPNX_GPIO	E3	

Table 11.2. SoM (J1) and Carrier Card (J14) Connector Interface, J1 Pin 57 to Pin 100

Interface	FPGA Pin	Carrier Board (J14) Signal Name	CertusPro-NX SoM 100-Pin (J1) Pin Number and Signal Name				Carrier Board (J14) Signal Name	FPGA Pin	Interface
			J1 Signal Name	J1 Pin Number	J1 Pin Number	J1 Signal Name			
—	—	GND	GND	57	58	GND	GND	—	
RPI CAM	J16	RPI_CAM_GPIO_0	RPI_CAM_GPIO_0	59	60	ETH_GPIO_0	NC	H14	
	J15	RPI_CAM_GPIO_1	RPI_CAM_GPIO_1	61	62	ETH_GPIO_1	NC	H15	
	J10	RPI_CAM_SDA	RPI_CAM_SDA	63	64	CPNX_WRIO_3V3_15	RPI_CPNX_GPIO2	D1	
	J11	RPI_CAM_SCL	RPI_CAM_SCL	65	66	CPNX_WRIO_3V3_16	RPI_CPNX_GPIO3	C2	
—	—	GND	GND	67	68	GND	GND	—	—
	E14	TP44	CPNX_WRIO_4	69	70	XO3D_WRIO_0	TP37	XO3D_H1	
	J9	NC	RPI_CAM1_GPIO_0	71	72	XO3D_WRIO_1	NC	XO3D_G1	
	J8	NC	RPI_CAM1_GPIO_1	73	74	XO3D_WRIO_2	TP38	XO3D_G2	
	F6	RPI_CPNX_GPIO4	CPNX_WRIO_3V3_13	75	76	XO3D_WRIO_3	NC	XO3D_F3	
	C1	RPI_CPNX_GPIO5	CPNX_WRIO_3V3_17	77	78	XO3D_WRIO_4	TP39	XO3D_F2	
	—	GND	GND	79	80	GND	GND	—	
UART	XO3D_E6	XO3D_UART_RX	XO3D_UART_RX	81	82	CPNX_WRIO_1	CPNX_I2S_MIC	G14	MIC
	XO3D_D6	XO3D_UART_TX	XO3D_UART_TX	83	84	CPNX_WRIO_2	CPNX_I2S_WS	G15	
—	XO3D_D5	XO3D_PROGRAMN	XO3D_PROGRAMN	85	86	CPNX_WRIO_3	CPNX_I2S_BCLK	E15	
	—	GND	GND	87	88	GND	GND	—	—
CertusPro-NX JTAG	D6	TP40	CPNX_JTAG_EN	89	90	XO3D_JTAG_EN	TP41	XO3D_C5	MachXO 3D JTAG
	F3	CPNX_JTAG_TDO	CPNX_JTAG_TDO	91	92	XO3D_JTAG_TMS	XO3D_JTAG_TMS	XO3D_C7	
	F5	CPNX_JTAG_TDI	CPNX_JTAG_TDI	93	94	XO3D_JTAG_TDI	XO3D_JTAG_TDI	XO3D_A6	
	G7	CPNX_JTAG_TMS	CPNX_JTAG_TMS	95	96	XO3D_JTAG_TDO	XO3D_JTAG_TDO	XO3D_B7	
	E14	CPNX_JTAG_CLK	CPNX_JTAG_CLK	97	98	XO3D_JTAG_TCK	XO3D_JTAG_TCK	XO3D_B6	
—	—	GND	GND	99	100	GND	GND	—	—

Table 11.3. SoM (J2) and Carrier Card (J15) Connector Interface, J2 Pin 1 to Pin 56

Interface	FPGA Pin	Carrier Board (J15) Signal Name	CertusPro-NX SoM 100-Pin (J2) Pin Number and Signal Name					Carrier Board (J15) Signal Name	FPGA Pin	Interface
			J2 Signal Name	J2 Pin Number		J2 Pin Number	J2 Signal Name			
—	—	GND	GND	1		2	GND	GND	—	
RPi CAM 22-Pin Connector	K11	CPNX_CAM0_MIPI_D0P	CPNX_CAM0_MIPI_D0P	3		4	CPNX_SD3_TXDP	NC	A6	
	K10	CPNX_CAM0_MIPI_D0N	CPNX_CAM0_MIPI_D0N	5		6	CPNX_SD3_TXDN	NC	A5	
	—	GND	GND	7		8	GND	GND	—	
	K8	CPNX_CAM0_MIPI_D1P	CPNX_CAM0_MIPI_D1P	9		10	CPNX_SD3_RXDP	NC	C6	
	K7	CPNX_CAM0_MIPI_D1N	CPNX_CAM0_MIPI_D1N	11		12	CPNX_SD3_RXDN	NC	C5	
	—	GND	GND	13		14	GND	GND	—	
	L8	CPNX_CAM0_MIPI_D2P	CPNX_CAM0_MIPI_D2P	15		16	CPNX_SD2_TXDP	NC	A9	
	L7	CPNX_CAM0_MIPI_D2N	CPNX_CAM0_MIPI_D2N	17		18	CPNX_SD2_TXDN	NC	A8	
	—	GND	GND	19		20	GND	GND	—	
	M10	CPNX_CAM0_MIPI_D3P	CPNX_CAM0_MIPI_D3P	21		22	CPNX_SD2_RXDP	NC	C8	
	L10	CPNX_CAM0_MIPI_D3N	CPNX_CAM0_MIPI_D3N	23		24	CPNX_SD2_RXDN	NC	C9	
	—	GND	GND	25		26	GND	GND	—	
	M7	CPNX_CAM0_MIPI_CKP	CPNX_CAM0_MIPI_CKP	27		28	CPNX_SD1_TXDP	NC	A12	
	M6	CPNX_CAM0_MIPI_CKN	CPNX_CAM0_MIPI_CKN	29		30	CPNX_SD1_TXDN	NC	A11	
—	—	GND	GND	31		32	GND	GND	—	
RPi CM5	P9	CPNX_CAM1_MIPI_D0P	CPNX_CAM1_MIPI_D0P	33		34	CPNX_SD1_RXDP	NC	C11	
	P10	CPNX_CAM1_MIPI_D0N	CPNX_CAM1_MIPI_D0N	35		36	CPNX_SD1_RXDN	NC	B10	
	—	GND	GND	37		38	GND	GND	—	
	T10	CPNX_CAM1_MIPI_D1P	CPNX_CAM1_MIPI_D1P	39		40	CPNX_SD0_TXDP	RPI_CPNX_PCIe_RX_P	A15	PCIe 2.0 LFCPNX-RPi CM5
	R10	CPNX_CAM1_MIPI_D1N	CPNX_CAM1_MIPI_D1N	41		42	CPNX_SD0_TXDN	RPI_CPNX_PCIe_RX_N	A14	
	—	GND	GND	43		44	GND	GND	—	
	K9	CPNX_CAM1_MIPI_CKP	CPNX_CAM1_MIPI_CKP	45		46	CPNX_SD0_RXDP	RPI_CPNX_PCIe_TX_P	C13	
	L9	CPNX_CAM1_MIPI_CKN	CPNX_CAM1_MIPI_CKN	47		48	CPNX_SD0_RXDN	RPI_CPNX_PCIe_TX_N	C14	
	—	GND	GND	49		50	GND	GND	—	
	R8	CPNX_CAM1_MIPI_D2P	CPNX_CAM1_MIPI_D2P	51		52	CPNX_SD_EXT0_REFCLKP	RPI_CPNX_PCIe_CLK_P	B2	
	T8	CPNX_CAM1_MIPI_D2N	CPNX_CAM1_MIPI_D2N	53		54	CPNX_SD_EXT0_REFCLKN	RPI_CPNX_PCIe_CLK_N	B3	
	—	GND	GND	55		56	GND	GND	—	—

Table 11.4. SoM(J2) and Carrier Card(J15) Connector Interface, J2 Pin 57 to Pin 100

Interface	FPGA Pin	Carrier Board (J15) Signal Name	CertusPro-NX SoM 100-Pin (J2) Pin Number and Signal Name					Carrier Board (J15) Signal Name	FPGA Pin	Interface
			J2 Signal Name	J2 Pin Number		J2 Pin Number	J2 Signal Name			
RPi CM5	N7	CPNX_CAM1_MIPI_D3P	CPNX_CAM1_MIPI_D3P	57		58	CPNX_SD_EXT1_REFCLKP	NC	A2	
	N6	CPNX_CAM1_MIPI_D3N	CPNX_CAM1_MIPI_D3N	59		60	CPNX_SD_EXT1_REFCLKN	NC	B10	
	—	GND	GND	61		62	GND	GND	—	
	T11	NC	CPNX_HPIO_1P	63		64	CPNX_HPIO_5P	NC	L4	
	R11	NC	CPNX_HPIO_1N	65		66	CPNX_HPIO_5N	NC	K4	
	—	GND	GND	67		68	GND	GND	—	
	K12	NC	CPNX_HPIO_2P	69		70	CPNX_HPIO_4P	NC	T9	
	J12	NC	CPNX_HPIO_2N	71		72	CPNX_HPIO_4N	NC	R9	
	—	GND	GND	73		74	GND	GND	—	
	M12	NC	CPNX_HPIO_3P	75		76	CPNX_WRIO_1P	NC	E16	
	M11	NC	CPNX_HPIO_3N	77		78	CPNX_WRIO_1N	NC	F16	
	—	GND	GND	79		80	GND	GND	—	—
—	F2	CPNX_SENS_SCL_3V3	CPNX_I2C_SCL_3V3	81		82	CPNX_WRIO_2P	NC	F14	
	E2	CPNX_SENS_SDA_3V3	CPNX_I2C_SDA_3V3	83		84	CPNX_WRIO_2N	NC	F15	
	—	GND	GND	85		86	GND	GND	—	
	G1	RPI_PCIe_CLK_nREQ	CPNX_WRIO_3V3_11	87		88	CPNX_WRIO_3P	NC	G11	
	H1	RPI_PCIE_nWAKE	CPNX_WRIO_3V3_12	89		90	CPNX_WRIO_3N	NC	G12	
	—	GND	GND	91		92	GND	GND	—	
	H3	RPI_PCIE_PWR_EN	CPNX_WRIO_3V3_9	93		94	CPNX_WRIO_4P	NC	G9	
	H2	RPI_PCIe_nRST	CPNX_WRIO_3V3_10	95		96	CPNX_WRIO_4N	NC	G10	
	H5	FTDI_PWREN#	CPNX_WRIO_3V3_7	97		98	CPNX_WRIO_3V3_8	FTDI_SUSPEND#	H4	
	—	GND	GND	99		100	GND	GND	—	

12. Carrier Board to RPi CM5 100-Pin Connector Details

Table 12.1. RPi and Carrier Card (J6) Connector Interface, 100-Pin Connector Pin 1 to Pin 56

Interface	FPGA Pin	Carrier Board (J6) Signal Name	RPi 100-Pin Connector Pin Number and Signal Name				Carrier Board (J6) Signal Name	FPGA Pin	Interface
			RPi Signal Name	RPi Pin Number	RPi Pin Number	RPi Signal Name			
Ethernet	—	GND	GND	1	2	GND	GND	—	Ethernet
		RPI_ETH_TRD2_P	CPNX_HPIO_6P	3	4	Ethernet_Pair3_P	Ethernet_Pair1_P	—	
		RPI_ETH_TRD2_N	CPNX_HPIO_6N	5	6	Ethernet_Pair3_N	Ethernet_Pair1_N	—	
		GND	GND	7	8	GND	GND	—	
		RPI_ETH_TRD1_N	Ethernet_Pair0_N	9	10	Ethernet_Pair2_N	RPI_ETH_TRD3_N	—	
		RPI_ETH_TRD1_P	Ethernet_Pair0_P	11	12	Ethernet_Pair2_P	RPI_ETH_TRD3_P	—	
	—	GND	GND	13	14	GND	GND	—	
		TP20	Fan_Tacho	15	16	Ethernet_nLED3	RPI_ETH_LEDG	—	
	—	Ethernet_SYNC_OUT	Ethernet_SYNC_OUT	17	18	Ethernet_nLED2	RPI_ETH_LEDY	—	
—	—	EEPROM_nWP	EEPROM_nWP	19	20	Fan_PWM	TP19	—	—
—	—	GND	GND	21	22	LED_nACT	GND	—	—
—	C2	RPI_CPNX_GPIO3	GPIO26	23	24	GND	GND	—	—
—	—	RPI_GPIO19	GPIO19	25	26	GPIO21	RPI_CPNX_GPIO1	E3	—
—	F6	RPI_CPNX_GPIO4	GPIO13	27	28	GPIO20	RPI_GPIO20	—	—
—	C1	RPI_CPNX_GPIO5	GPIO6	29	30	GPIO16	RPI_GPIO16	—	—
—	—	GND	GND	31	32	GPIO12	RPI_GPIO12	—	—
—	—	RPI_UART_RX	GPIO5	33	34	GND	GND	—	—
—	—	TP36	ID_SD	35	36	ID_SC	TP22	—	—
SPI	G6	RPI_CPNX_SCLK	GPIO11	37	38	GPIO7	RPI_GPIO7	—	—
	G2	RPI_CPNX_MISO	GPIO9	39	40	GPIO8	RPI_CPNX_CSN	G5	—
	—	GND	GND	41	42	GPIO25	RPI_CPNX_GPIO2	D1	—
	G3	RPI_CPNX_MOSI	GPIO10	43	44	GND	GND	—	—
—	—	RPI_GPIO22	GPIO22	45	46	GPIO24	RPI_GPIO24	—	—
—	—	RPI_GPIO27	GPIO27	47	48	GPIO23	RPI_GPIO23	—	—
—	—	RPI_GPIO17	GPIO17	49	50	GPIO18	RPI_GPIO18	—	—
—	—	GND	GND	51	52	GPIO15	RPI_FTDI_UART_RX	—	UART
—	—	RPI_UART_TX	GPIO4	53	54	GND	GND	—	
I2C	F2	CPNX_SENS_SCL_3V3	GPIO3	55	56	GPIO14	RPI_FTDI_UART_TX	—	

Table 12.2. RPi and Carrier Card (J6) Connector Interface, 100-Pin Connector Pin 57 to Pin 100

Interface	FPGA Pin	Carrier Board (J6) Signal Name	RPi 100-Pin Connector Pin Number and Signal Name				Carrier Board (J6) Signal Name	FPGA Pin	Interface
			RPi Signal Name	RPi Pin Number	RPi Pin Number	RPi Signal Name			
I2C	E2	CPNX_SENS_SDA_3V3	GPIO2	57	58	SD_CLK	RPI_SD_CLK	—	SD Card
—	—	GND	GND	59	60	GND	GND	—	
SD Card	—	RPI_SD_CMD	SD_CMD	61	62	SD_DAT3	RPI_SD_DAT3	—	
—	—	NC	SD_DAT5	63	64	SD_DAT0	RPI_SD_DAT0	—	
—	—	GND	GND	65	66	GND	GND	—	
—	—	NC	SD_DAT4	67	68	SD_DAT1	RPI_SD_DAT1	—	
—	—	NC	SD_DAT7	69	70	SD_DAT2	RPI_SD_DAT2	—	
—	—	NC	SD_DAT6	71	72	GND	GND	—	
—	—	GND	GND	73	74	SD_VDD_OVERRIDE	SD_VDD_OVERRIDE	—	
—	—	TP31	VBAT	75	76	SD_PWR_ON	RPI_SD_PWR_ON	—	

Interface	FPGA Pin	Carrier Board (J6) Signal Name	RPi 100-Pin Connector Pin Number and Signal Name				Carrier Board (J6) Signal Name	FPGA Pin	Interface
			RPi Signal Name	RPi Pin Number	RPi Pin Number	RPi Signal Name			
—	—	GPIO_VREF	GPIO_VREF	77	78	+5V (Input)	VCC_5V0_RPI	—	5 V In
—	—	TP29	SCL0	79	80	+5V (Input)		—	
—	—	TP30	SDA0	81	82	+5V (Input)		—	
3.3 V In	—	RPI_3V3 TP1	CM5_3.3V (Output)	83	84	+5V (Input)		—	
	—		CM5_3.3V (Output)	85	86	+5V (Input)		—	
1.8 V In	—	RPI_1V8 TP2	CM5_1.8V (Output)	87	88	+5V (Input)		—	
	—		CM5_1.8V (Output)	89	90	WL_nDisable	WL_nDisable	—	—
—	—	TP32	PWR_Button	91	92	BT_nDisable	BT_nDisable	—	—
—	—	PD_CC1	CC1	93	94	nRPIBOOT	nRPIBOOT	—	—
—	—	PD_CC2	CC2	95	96	LED_nPWR	TP35	—	—
—	—	GND	GND	97	98	CAM_GPIO0	CAM_GPIO0	—	—
—	—	CAM_GPIO1	CAM_GPIO1	99	100	PMIC_Enable	PMIC_Enable	—	—

Table 12.3. RPi and Carrier Card(J7) Connector Interface, 100-Pin Connector Pin 1 to Pin 56

Interface	FPGA Pin	Carrier Board (J7) Signal Name	RPi 100-Pin Connector Pin Number and Signal Name				Carrier Board (J7) Signal Name	FPGA Pin	Interface
			RPi Signal Name	RPi Pin Number	RPi Pin Number	RPi Signal Name			
PCIe	G1	RPI_PCIe_CLK_nREQ	PCIe_CLK_nREQ	1	2	USB_OTG_ID	USB_OTG_ID	—	USB 2.0
	H1	RPI_PCIE_nWAKE	PCIE_nWAKE	3	4	USB_N	USB_DN	—	
	H3	RPI_PCIE_PWR_EN	PCIE_PWR_EN	5	6	USB_P	USB_DP	—	
	—	GND	GND	7	8	GND	GND	—	
	B2	RPI_CPNX_PCIe_CLK_P	PCIe_CLK_P	9	10	PCIe_nRST	RPI_PCIe_nRST	H2	PCIe
	B3	RPI_CPNX_PCIe_CLK_N	PCIe_CLK_N	11	12	VBUS_EN	USB_VBUS_EN	—	—
	—	GND	GND	13	14	GND	GND	—	—
	A15	RPI_CPNX_PCIe_RX_P	PCIe_RX_P	15	16	MIPI0_D0_N	CPNX_CAM1_MIPI_D0N	P10	MIPI
	A14	RPI_CPNX_PCIe_RX_N	PCIe_RX_N	17	18	MIPI0_D0_P	CPNX_CAM1_MIPI_D0P	P9	
	—	GND	GND	19	20	GND	GND	—	
	C13	RPI_CPNX_PCIe_TX_P	PCIe_TX_P	21	22	MIPI0_D1_N	CPNX_CAM1_MIPI_D1N	R10	
	C14	RPI_CPNX_PCIe_TX_N	PCIe_TX_N	23	24	MIPI0_D1_P	CPNX_CAM1_MIPI_D1P	T10	
	—	GND	GND	25	26	GND	GND	—	
USB 3.0	—	RPI_USB3-0-RX_N	USB3-0-RX_N	27	28	MIPI0_C_N	CPNX_CAM1_MIPI_CKN	L9	
	—	RPI_USB3-0-RX_P	USB3-0-RX_P	29	30	MIPI0_C_P	CPNX_CAM1_MIPI_CKP	K9	
	—	GND	GND	31	32	GND	GND	—	
	—	RPI_USB3-0-DP	USB3-0-DP	33	34	MIPI0_D2_N	CPNX_CAM1_MIPI_D2N	T8	
	—	RPI_USB3-0-DM	USB3-0-DM	35	36	MIPI0_D2_P	CPNX_CAM1_MIPI_D2P	R8	
	—	GND	GND	37	38	GND	GND	—	
	—	RPI_USB3-0-TX_N_AC	USB3-0-TX_N	39	40	MIPI0_D3_N	CPNX_CAM1_MIPI_D3N	N6	
	—	RPI_USB3-0-TX_P_AC	USB3-0-TX_P	41	42	MIPI0_D3_P	CPNX_CAM1_MIPI_D3P	N7	
	—	GND	GND	43	44	HDMI1_HOTPLUG	NC	—	—
—	—	NC	HDMI1_TX2_P	45	46	HDMI1_SDA	NC	—	
	—	NC	HDMI1_TX2_N	47	48	HDMI1_SCL	NC	—	
	—	GND	GND	49	50	HDMI1_CEC	GND	—	
	—	NC	HDMI1_TX1_P	51	52	HDMI0_CEC	NC	—	
	—	NC	HDMI1_TX1_N	53	54	HDMI0_HOTPLUG	NC	—	
	—	GND	GND	55	56	GND	GND	—	

Table 12.4. RPi and Carrier Card (J7) Connector Interface, 100-Pin Connector Pin 57 to Pin 100

Interface	FPGA Pin	Carrier Board (J7) Signal Name	RPi 100-Pin Connector Pin Number and Signal Name				Carrier Board (J7) Signal Name	FPGA Pin	Interface
			RPi Signal Name	RPi Pin Number	RPi Pin Number	RPi Signal Name			
—	—	NC	HDMI1_TX0_P	57	58	USB3-1-RX_N	NC	—	—
	—	NC	HDMI1_TX0_N	59	60	USB3-1-RX_P	NC	—	
	—	GND	GND	61	62	GND	GND	—	
	—	NC	HDMI1_CLK_P	63	64	USB3-1-DP	NC	—	
	—	NC	HDMI1_CLK_N	65	66	USB3-1-DM	NC	—	
	—	GND	GND	67	68	GND	GND	—	
	—	NC	HDMI0_TX2_P	69	70	USB3-1-TX_N	NC	—	
	—	NC	HDMI0_TX2_N	71	72	USB3-1-TX_P	NC	—	
	—	GND	GND	73	74	GND	GND	—	
	—	NC	HDMI0_TX1_P	75	76	MIPI1_D0_N	NC	—	
	—	NC	HDMI0_TX1_N	77	78	MIPI1_D0_P	NC	—	
	—	GND	GND	79	80	GND	GND	—	
	—	NC	HDMI0_TX0_P	81	82	MIPI1_D1_N	NC	—	
	—	NC	HDMI0_TX0_N	83	84	MIPI1_D1_P	NC	—	
	—	GND	GND	85	86	GND	GND	—	
	—	NC	HDMI0_CLK_P	87	88	MIPI1_C_N	NC	—	
	—	NC	HDMI0_CLK_N	89	90	MIPI1_C_P	NC	—	
	—	GND	GND	91	92	GND	GND	—	
	—	NC	MIPI1_D3_N	93	94	MIPI1_D2_N	NC	—	
	—	NC	MIPI1_D3_P	95	96	MIPI1_D2_P	NC	—	
	—	GND	GND	97	98	GND	GND	—	
	—	NC	HDMI0_SCL	99	100	HDMI0_SDA	NC	—	

13. Board Version Setting

Hardware settings are given to control the version of the modules. Refer to Figure 13.1 hardware setting to define the **board version** by reading signals as digital inputs. Configurating resistors differently or leaving some positions as Do Not Load (DNL) create unique logic levels for each pin, either HIGH or LOW. These logic levels together form a binary code that represents the version.

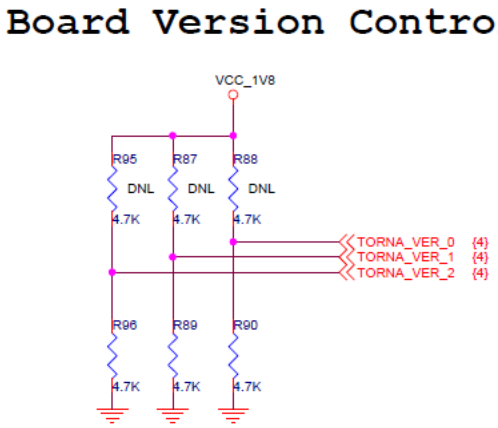

Figure 13.1. Board Version Control

Table 13.1. Board Version Setting

Signal Name	CertusPro-NX FPGA Ball Location
TORNA_VER_0	D16
TORNA_VER_1	E12
TORNA_VER_2	E13

14. Audio Interface

The carrier board uses two digital microphones with an I2S interface to deliver synchronized stereo audio with left and right channels to the host processor, the CertusPro-NX SoM module. The audio interface is shown in Figure 14.1.

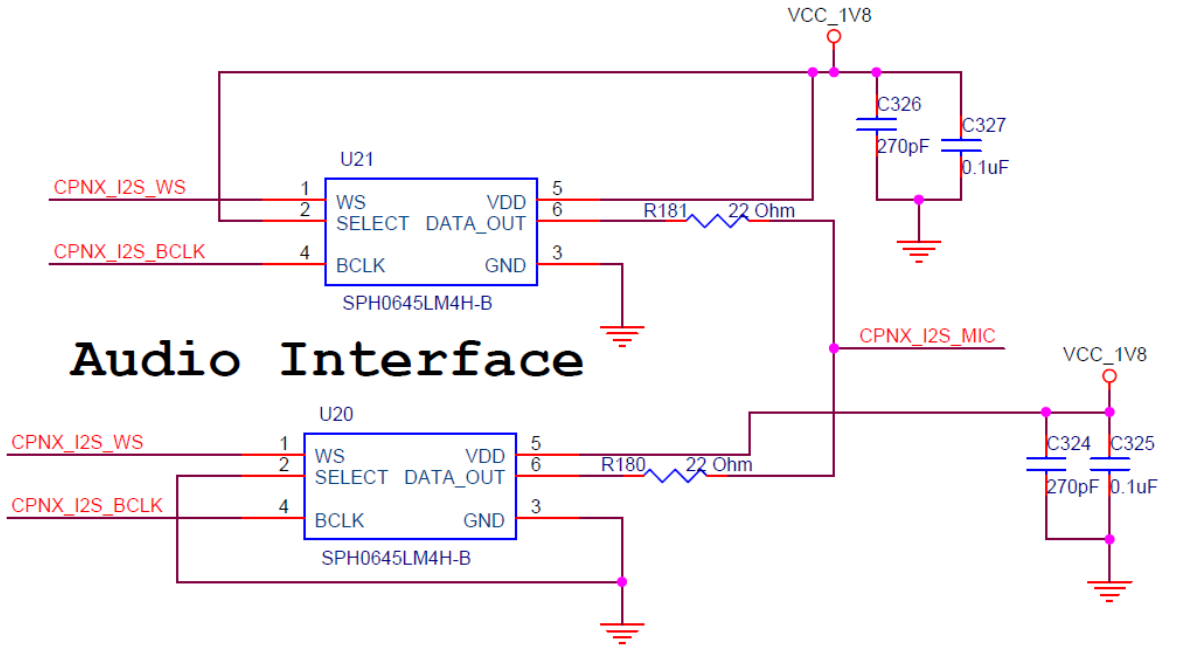

Figure 14.1. Audio Interface

Table 14.1. Audio Interface

Signal Name	CertusPro-NX FPGA Ball Location
CPNX_I2S_WS	G15
CPNX_I2S_BCLK	E15
CPNX_I2S_MIC	G14

15. LED and Function

15.1. Function

Table 15.1 summarizes on-board LEDs and their indications.

Table 15.1. On-board LEDs and Function

Reference Designator	Function	Color
D3	Indicates the MachXO3D device programming is done.	Green
D1	Indicates the CertusPro-NX device programming is done.	Green
D5	Indicates 5 V Input supply.	Green

15.2. LED Placement on Board

Figure 15.1 illustrates the LED placement on the module.

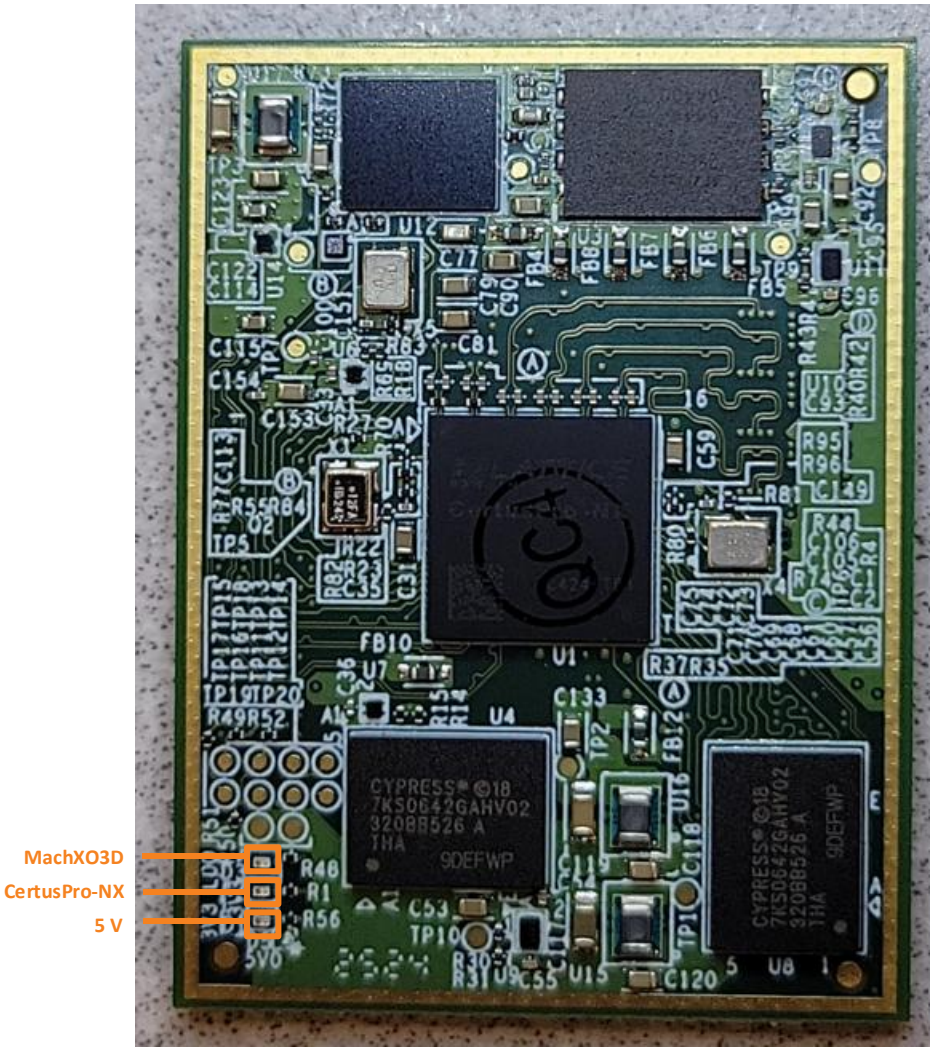

Figure 15.1. LED Placement

16. Soft JTAG/UART User Interface

The soft JTAG/UART user interface for the CertusPro-NX SoM Module is shown in Figure 16.1. It uses an FTDI FT4232H chip, which acts as a high-speed USB-to-multi-interface bridge.

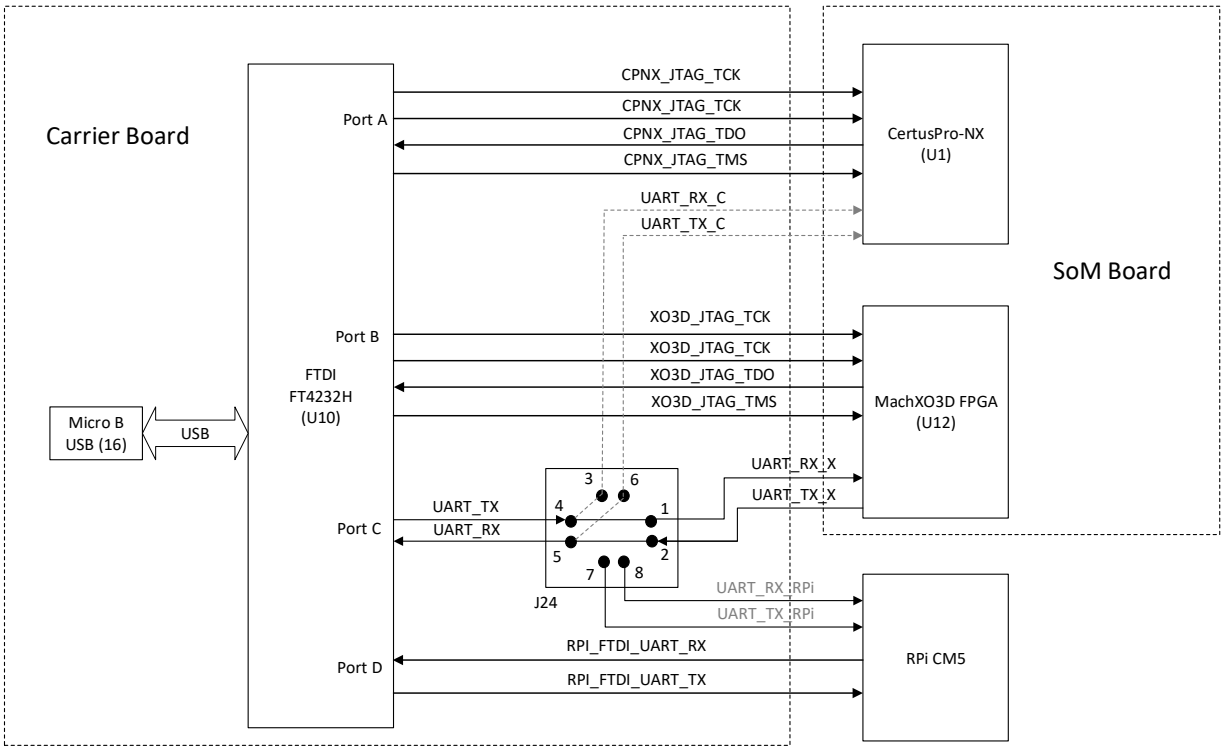

Figure 16.1. JTAG/UART User Interface

This design uses the FTDI to provide:

- USB-to-JTAG communication for the CertusPro-NX FPGA and MachXO3D FPGA through Port A and Port B, respectively.
- USB-to-UART for the CertusPro-NX FPGA and MachXO3D FPGA through Port C using J24 Jumper settings, with the jumper configuration.
  - FTDI to CertusPro-NX FPGA: connect J24 Pin 3 to Pin 4, and Pin 5 to Pin 6.
  - FTDI to MachXO3D FPGA: connect J24 Pin 1 to Pin 4, and Pin 2 to Pin 5.
- USB-to-UART communication for the RPi CM5 module through port D.
- Boards can be programmed or debugged through the RPi board instead of the carrier module by adjusting the J24 jumper setting.
  - RPi to CertusPro-NX FPGA: connect J24 Pin 3 to Pin 7, and Pin 6 to Pin 8.
- The UART Target selection setting through jumper J24, as shown in Figure 16.2.

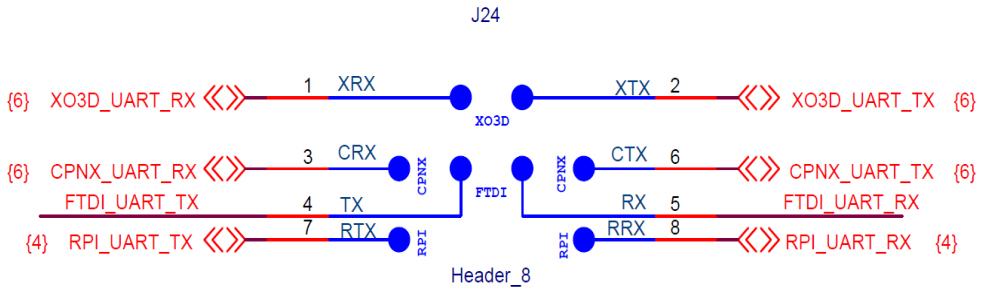

Figure 16.2. J24 Jumper Schematic

- Jumper J24 setting on board, as shown in Figure 16.3.

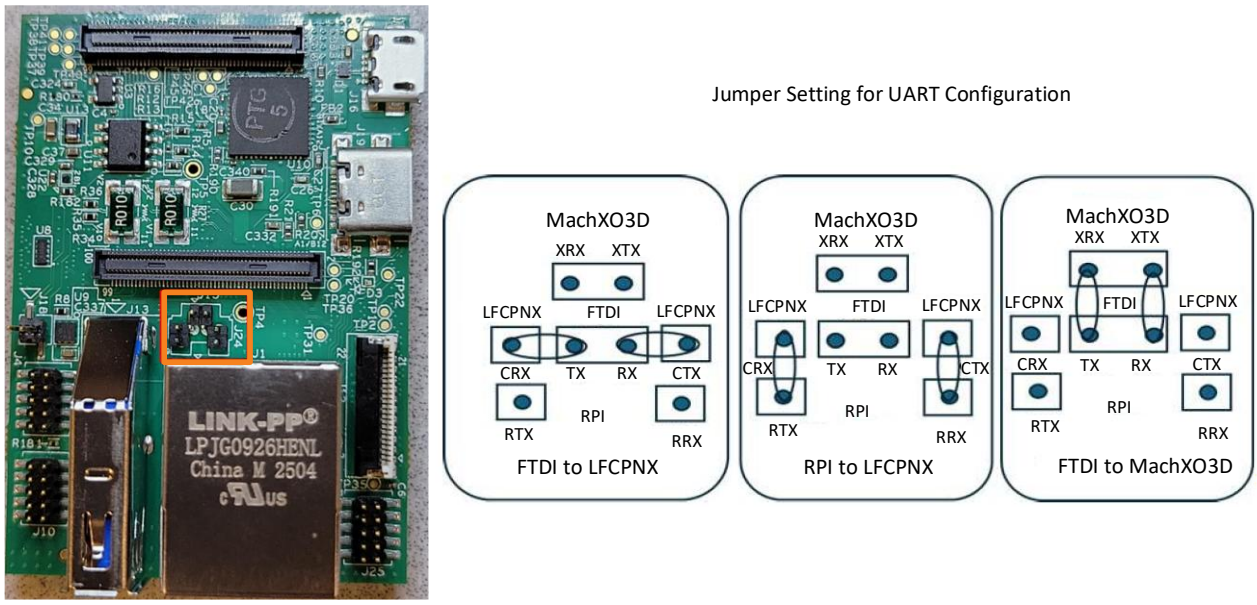

Figure 16.3. J24 PCB Placement

Board Programming

16.1. Software Requirements

The following software are required to develop and design for the CertusPro-NX SoM Module:

- Lattice Radiant™ Software 2025.1 and Lattice Propel™ Builder 2025.1 or later release for testing the CertusPro-NX FPGA
- Lattice Diamond™ Software 3.12 .jed file for programming the MachXO3D FPGA
- Tera Term, PuTTY, or UART for logs and debugging
- Camera output over RealVNC® Virtual Network Computing (VNC) Software for the CM5 RPi module

16.2. Programming the MachXO3D Device

Always start with MachXO3D FPGA programming first.

1. Power on the board and check the FTDI. Four COM ports are detected, as shown in Figure 16.4.
   - First Port (COM16): For CertusPro-NX JTAG
   - Second Port (COM17): For MachXO3D JTAG
   - Third Port (COM18): UART for different configurations used in FTDI
   - Fourth Port (COM19): CM5 Debug Port, which corresponds to GPIO14 and GPIO15 on the carrier board

   Note: This Port sequence may change depending on different PCs.

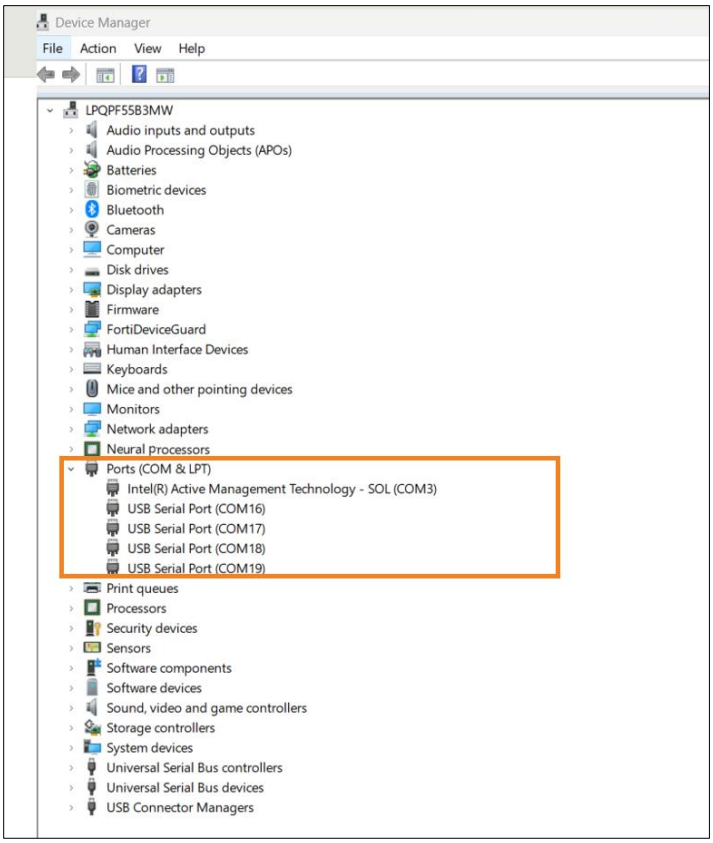

Figure 16.4. Check for COM Ports

2. Open the Lattice Dimond programmer and select the cable port for MachXO3D programming (Figure 16.5).

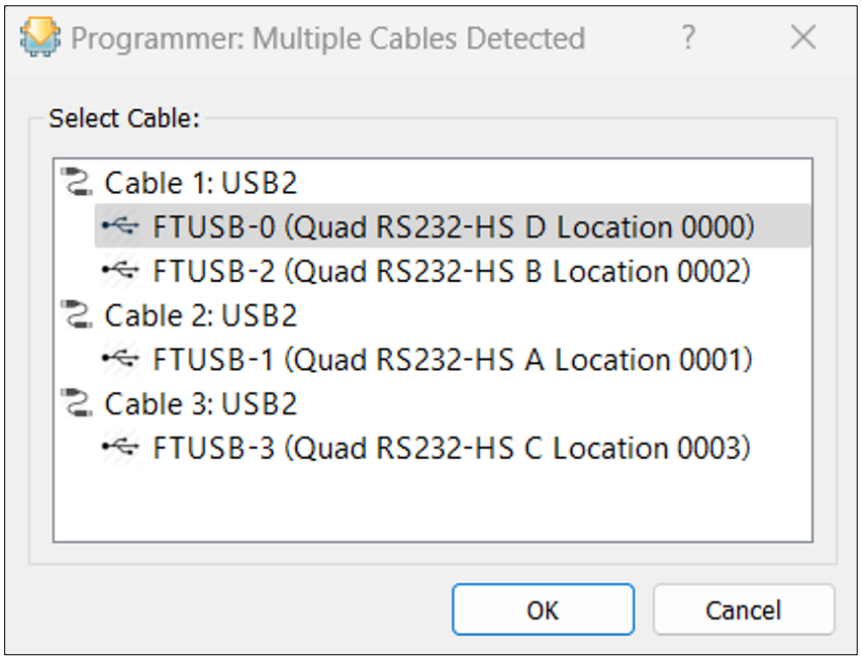

Figure 16.5. Port Selection for MachXO3D Programming

3. Click **OK**.
4. Select **Device Properties** and click **OK** (Figure 16.6).

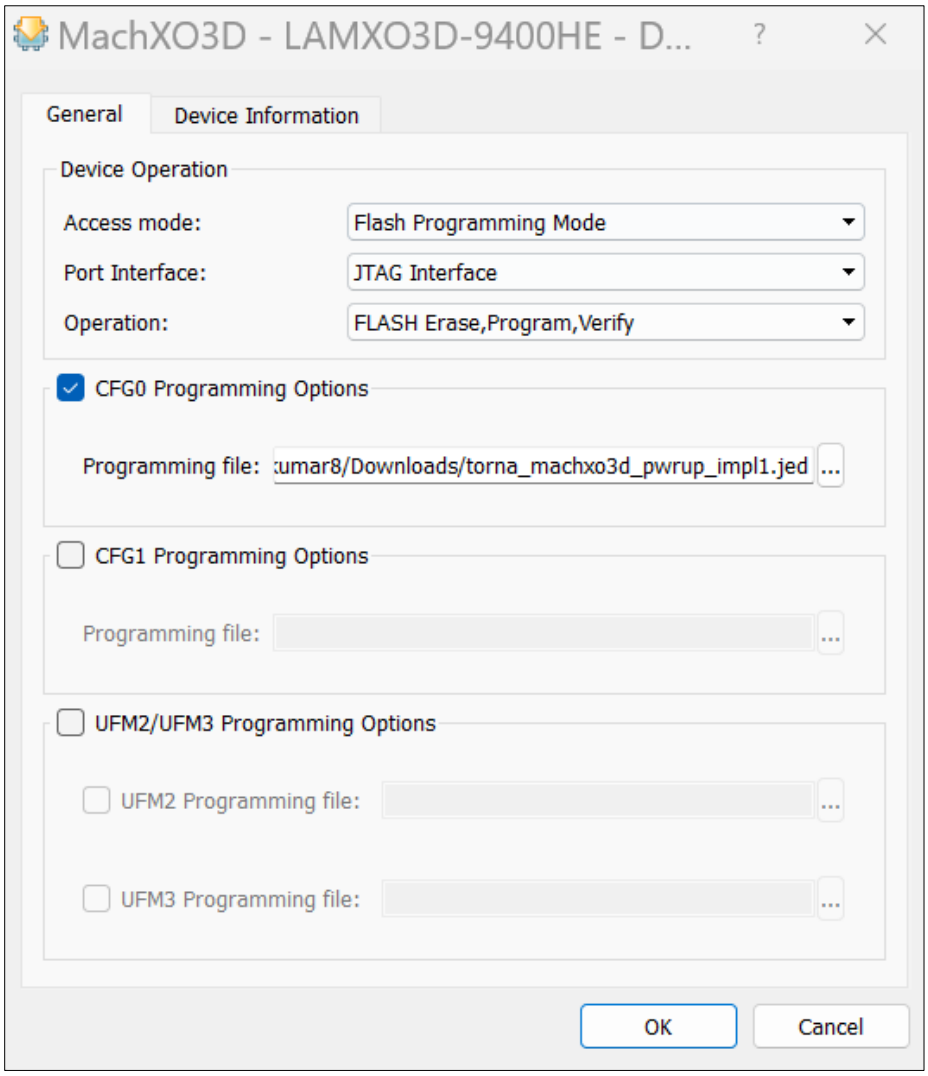

Figure 16.6. Diamond Programmer – Select Device Property

5. The programming process initiates, and upon completion, a confirmation message is displayed in the Output console, indicating successful programming (Figure 16.7).

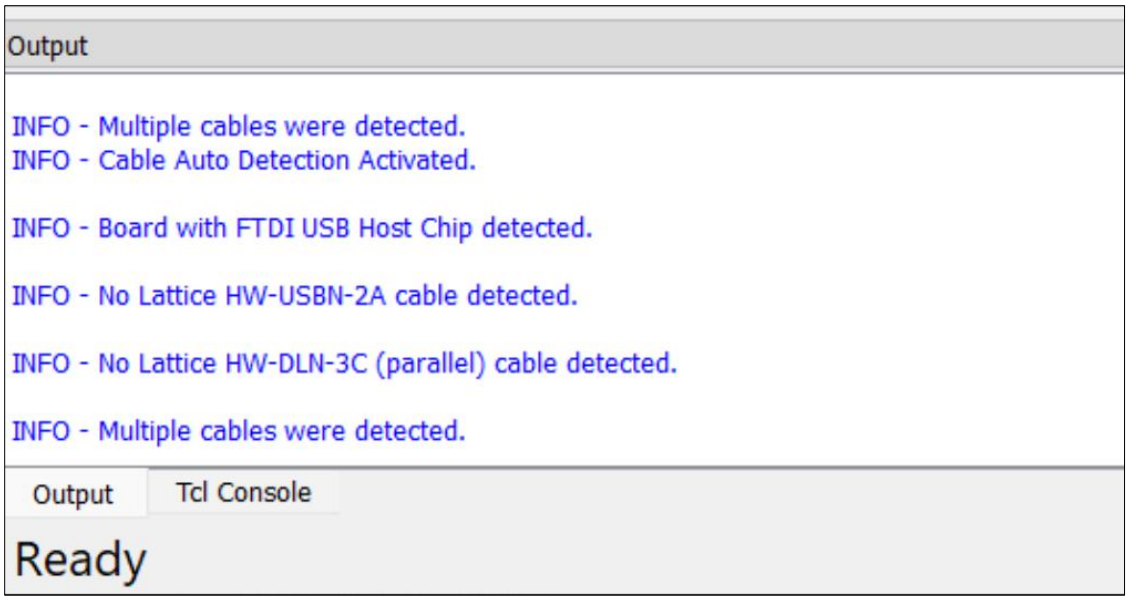

Figure 16.7. Diamond Program – Output Console

16.3. Programming the CertusPro-NX Device

16.3.1. Erasing the CertusPro-NX

If the CertusPro-NX device is already programmed directly, or loaded from an SPI Flash, follow this procedure to erase the CertusPro-NX SRAM memory before re-programming the CertusPro-NX's SPI Flash. If you do so, keep the board powered when re-programming the SPI Flash so that it does not reload on reboot.

To erase the CertusPro-NX device:

1. Launch Radiant Programmer. In the Getting Started dialog box, select **Create a new blank project** (Figure 16.8).

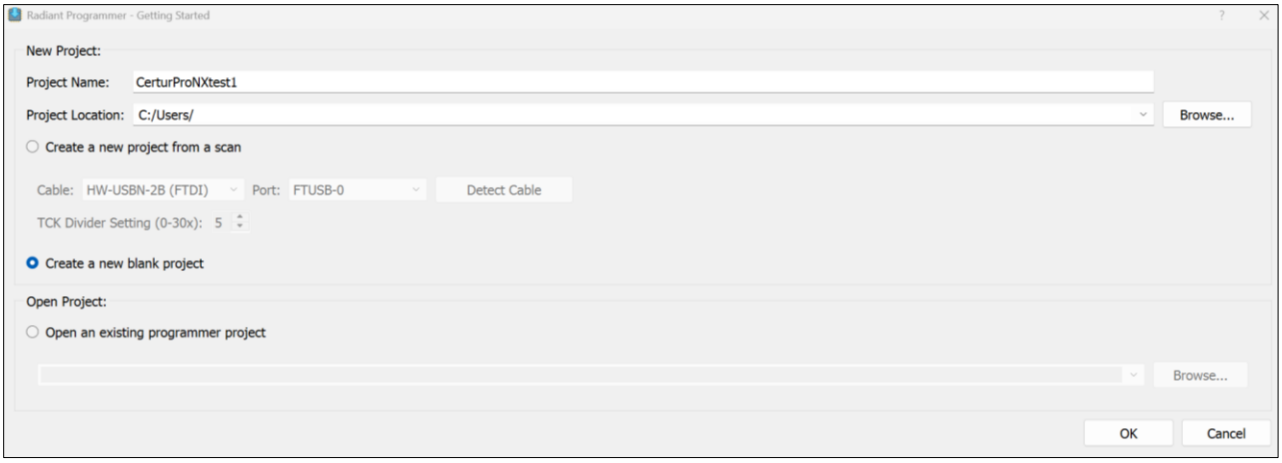

Figure 16.8. Radiant Programmer – Default Screen

2. Select the detected cable and click **OK** (Figure 16.9).

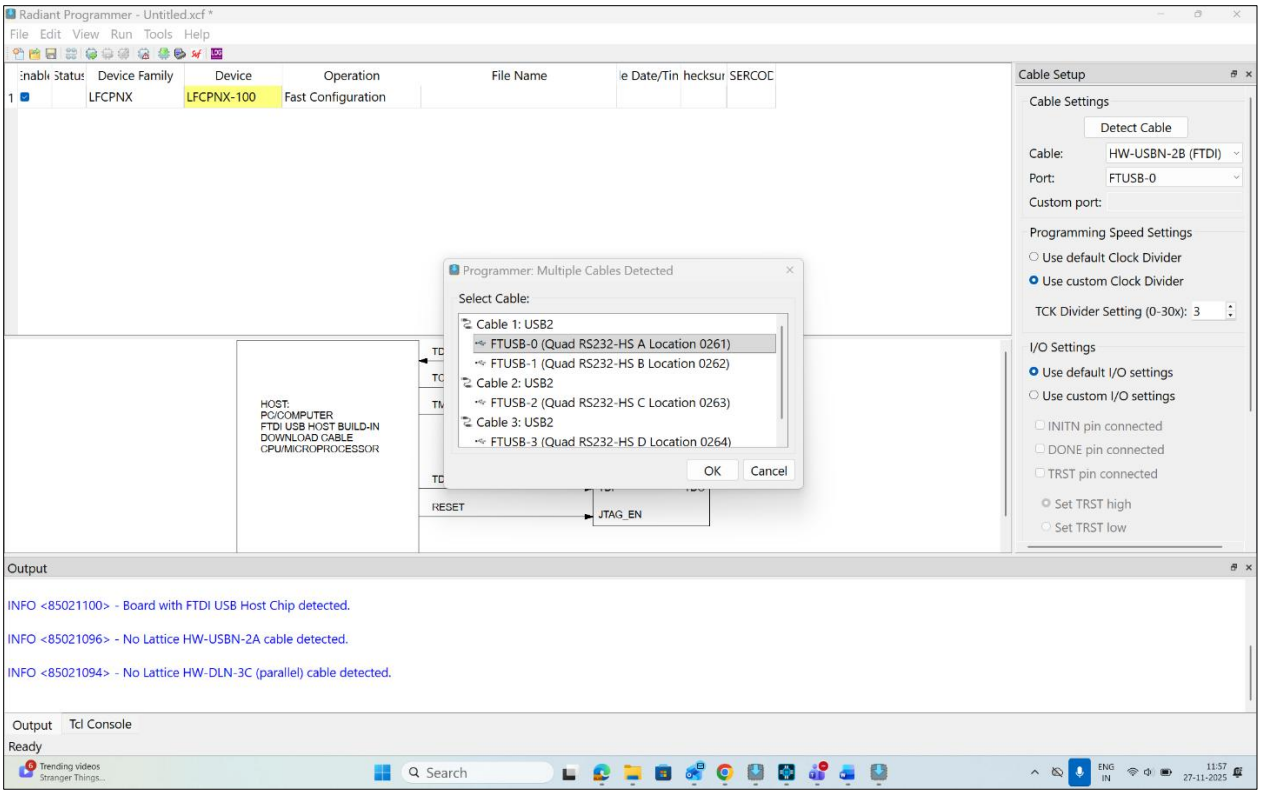

Figure 16.9. Setting Cable

3. In the Radiant Programmer main interface, select LFCPNX for **Device Family** and LFCPNX-100 for **Device** (Figure 16.10).

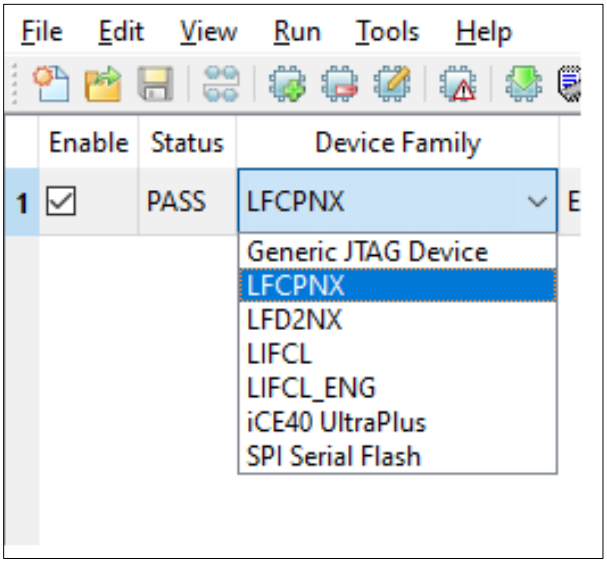

Figure 16.10. Radiant Programmer – Device Selection

4. Right-click and select **Device Properties**.
5. Select JTAG2SPI for **Port Interface**, Direct Programming for **Access Mode**, and Erase All for **Operation** (Figure 16.11).

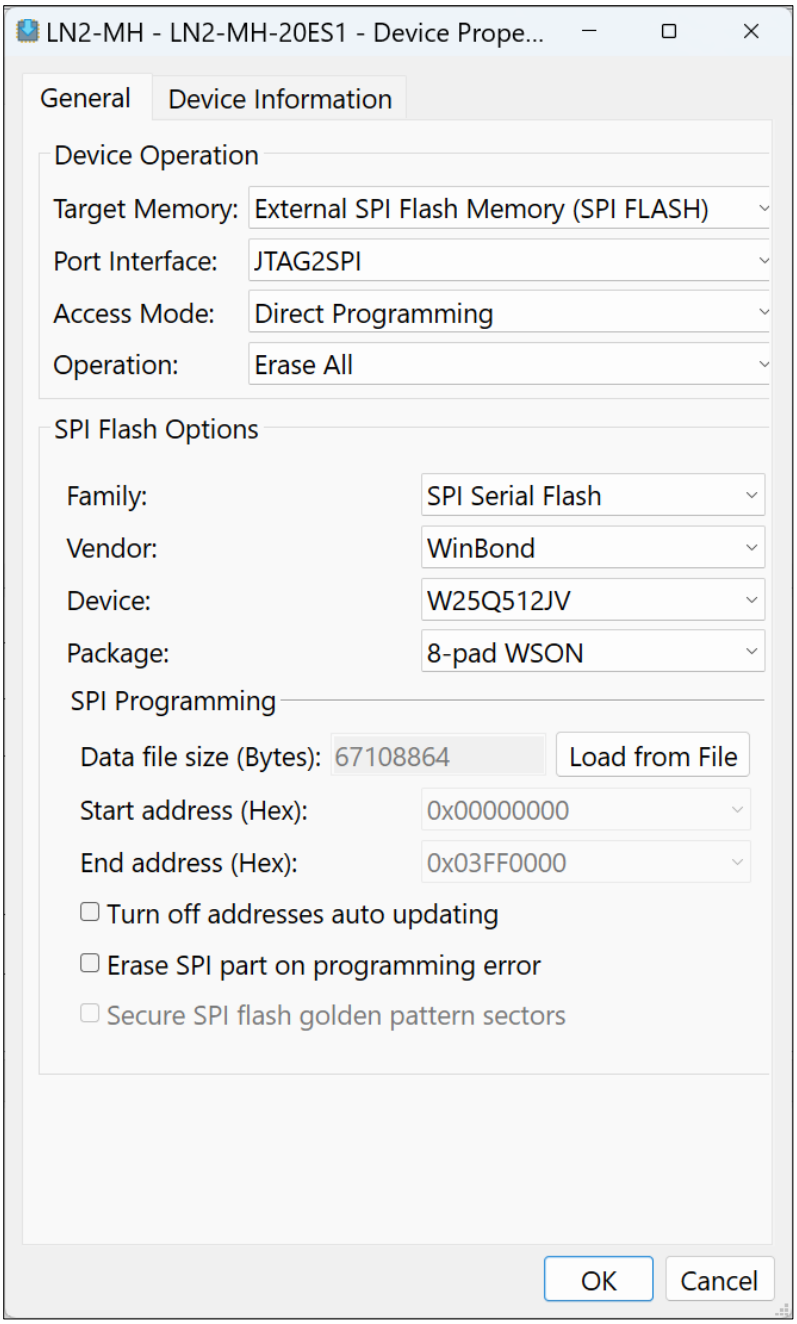

Figure 16.11. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flash

6. Click **OK** to close the Device Properties dialog box.
7. Click the **Program** button to start the erase operation.

16.4. Programming the CertusPro-NX SPI Flash

To program the CertusPro-NX SPI Flash:

1. Ensure that the CertusPro-NX SRAM is erased by performing the steps in the Erasing the CertusPro-NX Prior to Reprogramming section.
2. In the Radiant Programmer main interface, right-click the CertusPro-NX row and select **Device Properties.**
3. Apply the settings below:

a. Under Device Operation, select the options below:
   - Port Interface – JTAG2SPI
   - Access Mode – Direct Programming
   - Operation – SPI Flash Erase, Program, Verify

b. Under Programming Options, select the bitstream file.

c. For **SPI Flash Options**, select the Winbond **W25Q512JV** device (Figure 16.12).

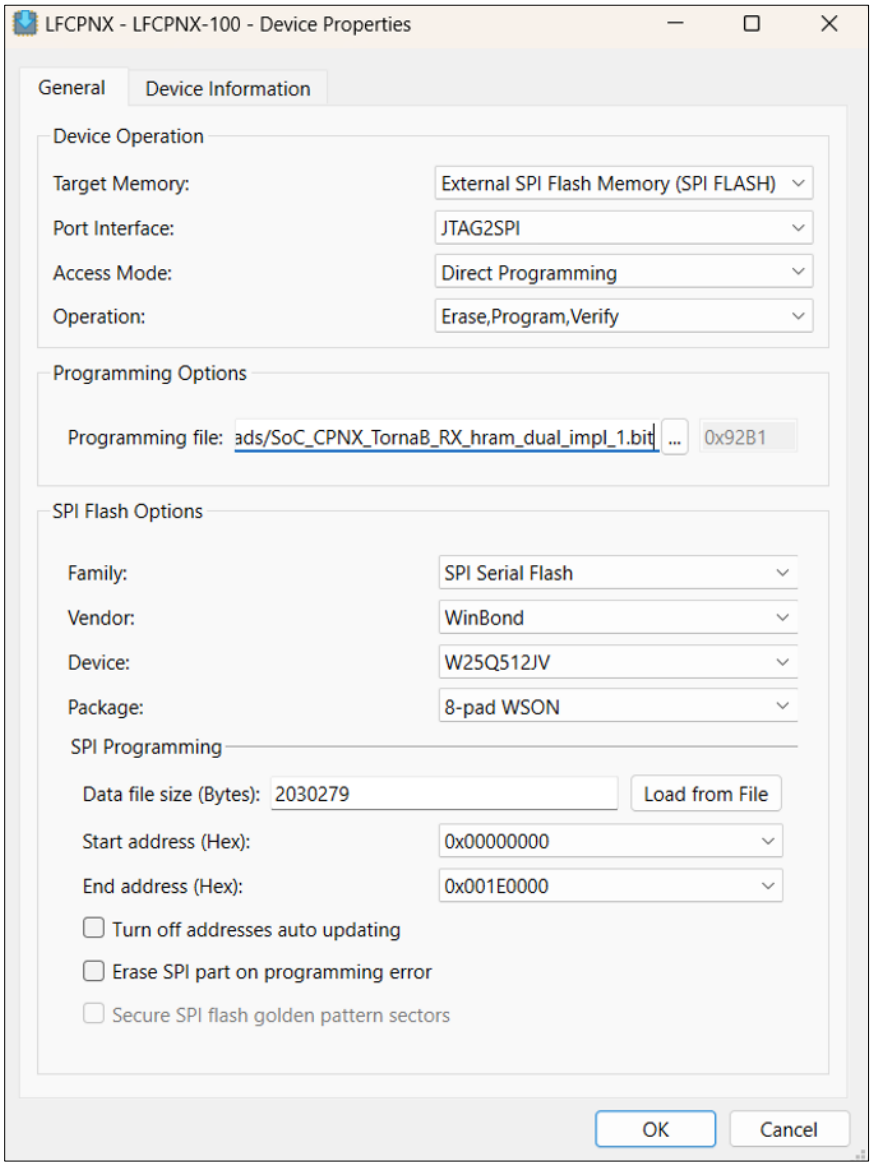

Figure 16.12. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flashing

d. Click Load from File to update the Data file size (bytes) value.

4. Click **OK**.
5. Click the **Program** button  to start the programming operation.
6. After successful programming, the **Output** console displays the result, as shown in Figure 16.13.

```
INFO <85021074> - Check configuration setup: Start.

INFO <85021077> - Check configuration setup: Successful (Ignored JTAG Connection Checking).

INFO <85021294> - Device1 LFCPNX-100: LFCPNX-100: Refresh Verify ID

INFO <85021298> - Operation Done. No errors.

INFO <85021294> - Device1 LFCPNX-100: W25Q512JV: Erase,Program,Verify

Initializing...

IDCode Checking...

Enter 4-Byte mode...

Enabling...

Erasing...

Disabling...

Enabling...

Programming...

Disabling...

Verifying...

INFO <85021399> - Execution time: 01 min : 07 sec

INFO <85021371> - Elapsed time: 01 min : 13 sec

INFO <85021373> - Operation: successful.
```

Figure 16.13. Radiant Programmer – Output Console

16.5. Programming and Configuring the RPi Module

A 10-pin header is provided to configure the RPi Module. Connect pins 1 and 2 on Jumper J10 for flashing the RPi Module, as shown in Figure 16.14.
Refer to the CertusPro-NX Multi-Object Detection on SOM Board Demo User Guide (FPGA-UG-02247) for more details about the complete installation process.

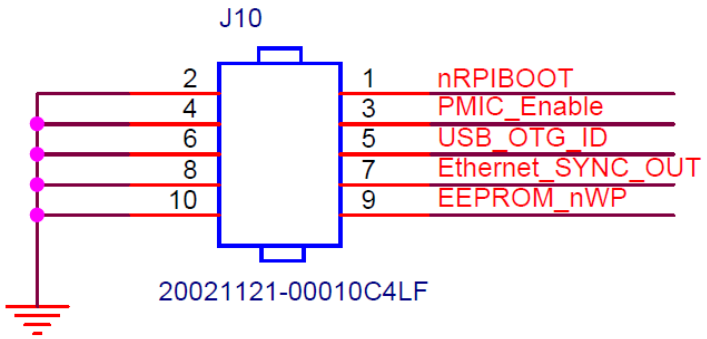

Figure 16.14. RPi Module Configuration Header

17. 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 CertusPro-NX SoM Module in the provided packaging.
Touch the metal USB housing to equalize the voltage potential between yourself and the board.

18. Ordering Information

Table 18.1 Ordering Information

Description	Ordering Part Number	China RoHS Environment-Friendly Use Period (EFUP)
CertusPro-NX System on Module (SoM) Board	LFCPNX-SOM-EVN	
Carrier Board	LF-GEN-CR-PCBA	
RPi Compute Module 5	SC1601	

19. Assembly Instruction

1. Always wear an ESD wrist strap during assembly and disassembly activities (Figure 19.1).

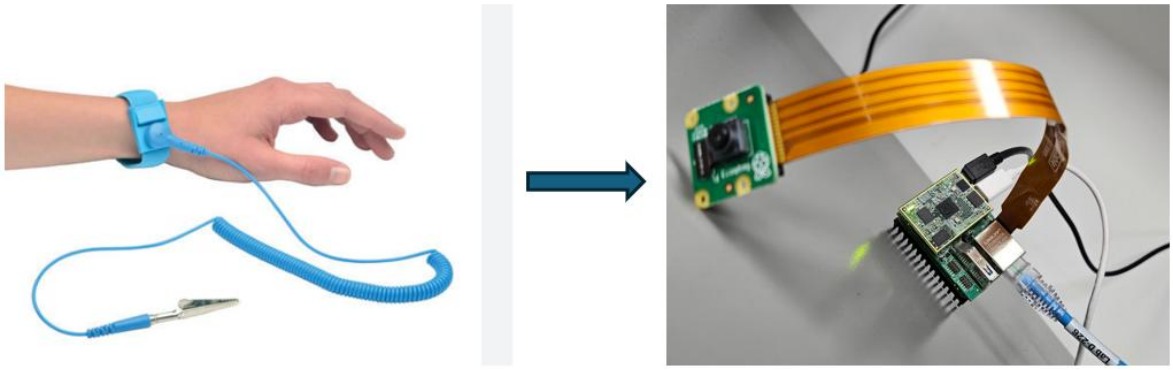

Figure 19.1. ESD Precaution

2. Align the SoM board with the carrier board, as shown in the picture below (Figure 19.2). Then, securely fit the SoM board onto the carrier board.

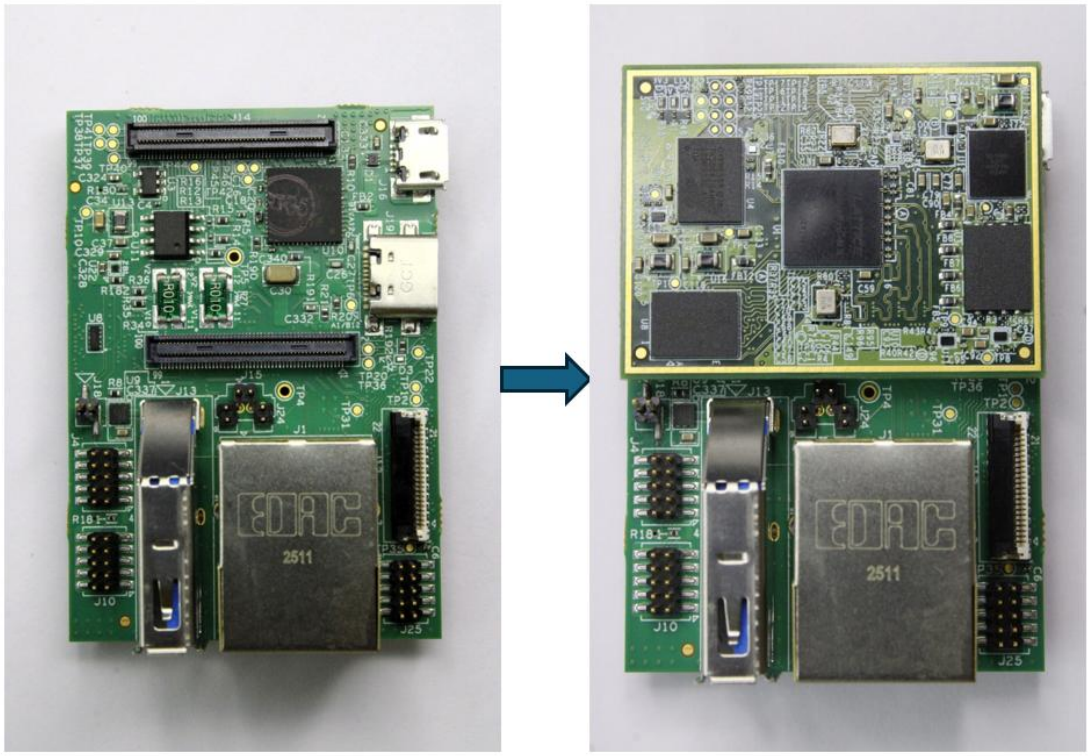

Figure 19.2. SoM and Carrier Boards Assembly

3. Assembly of heatsink on CM5:
   The heatsink assembly includes four screws and black washers. Use the smaller-height black washers for assembly. Align the heatsink with the RPi CM5 module, insert the four screws, and tighten them securely, as shown in Figure 19.3.

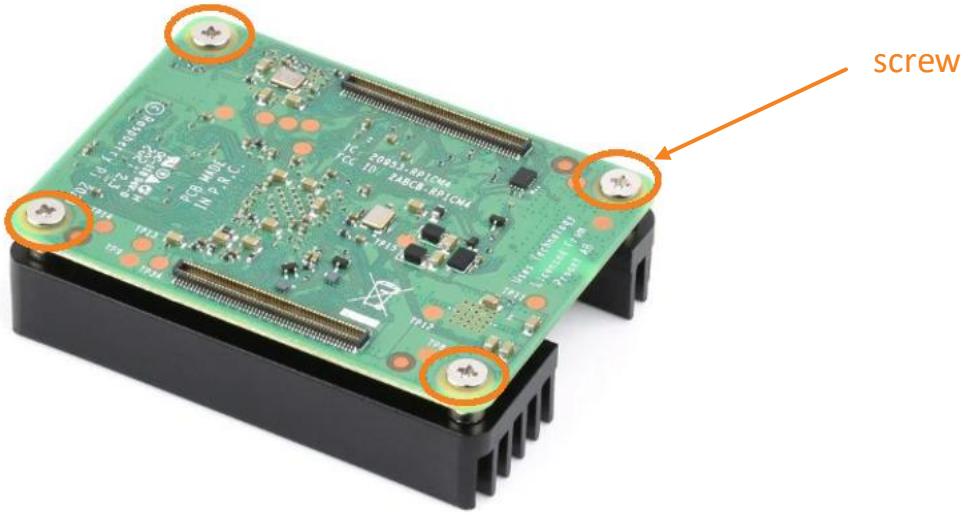

Figure 19.3. Heatsink Assembly

4. Assemble CM5 with the carrier board:
   Align the RPi CM5 and the carrier board, as shown in Figure 19.4, and securely fit the boards in place.

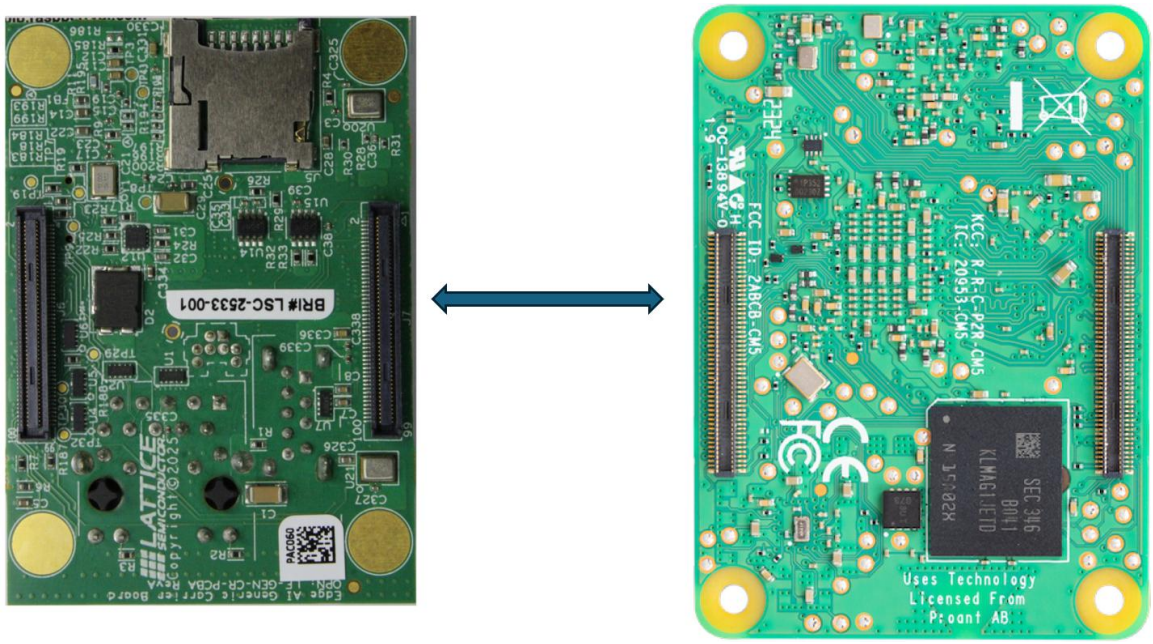

Figure 19.4. RPi CM5 Assembly on Carrier Card

The assembled board is shown in Figure 19.5.

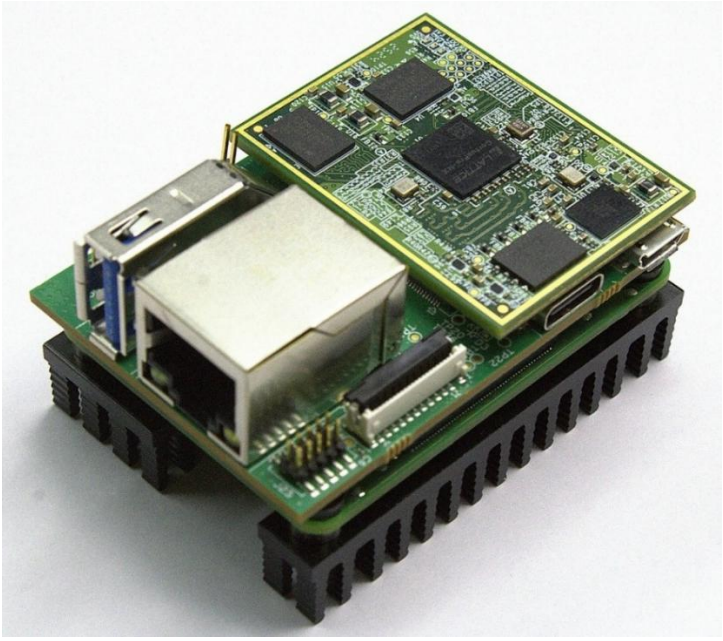

Figure 19.5. Assembled Board

Assembly Accessories include (Figure 19.7):

- Micro USB cable for UART and JTAG
- Type C type Adapter for power the setup
- RPi camera for Video
- Ethernet cable for CM5 communication

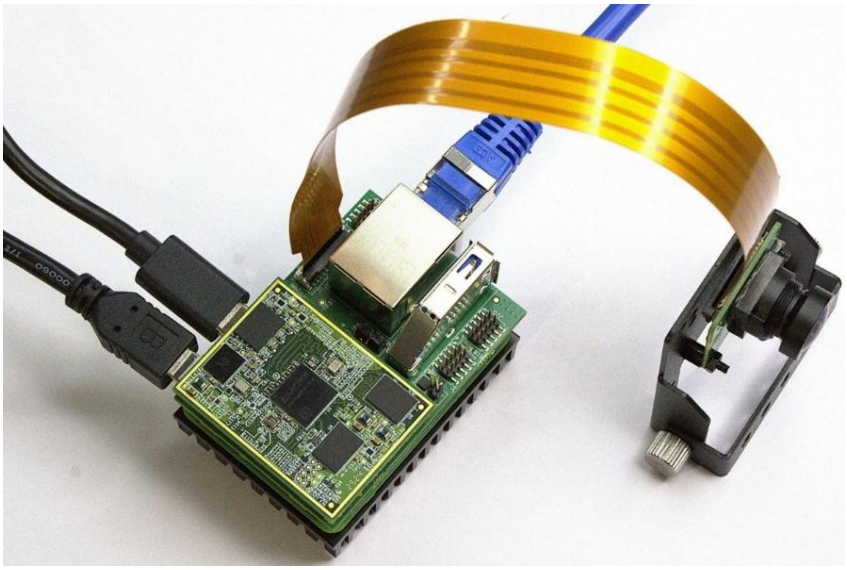

Figure 19.6. System Integration

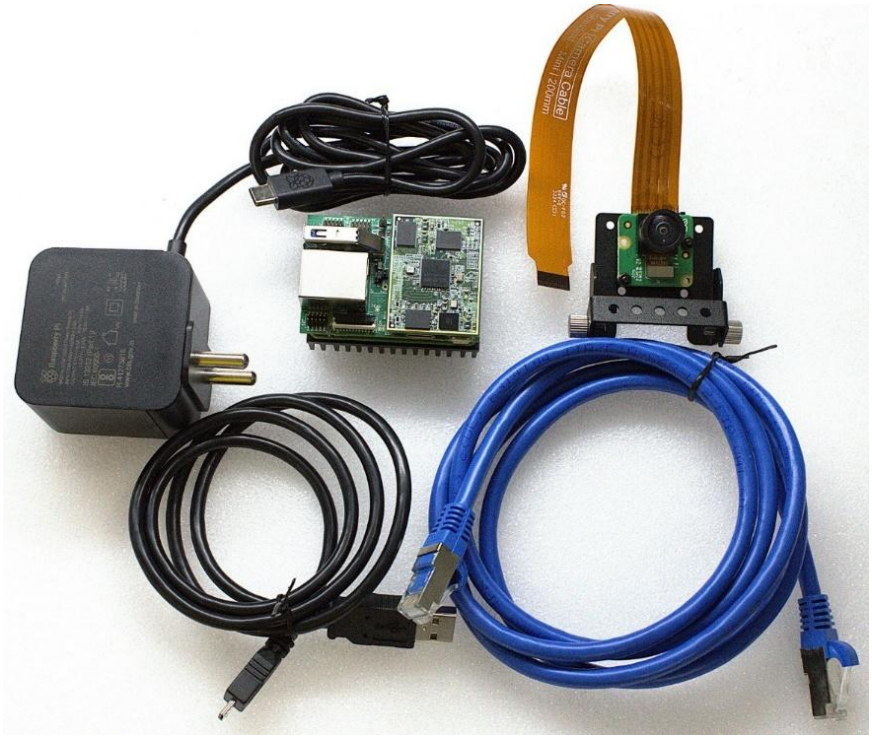

Figure 19.7. Assembly Accessories

Appendix A. CertusPro-NX SoM Revision C Module Schematics

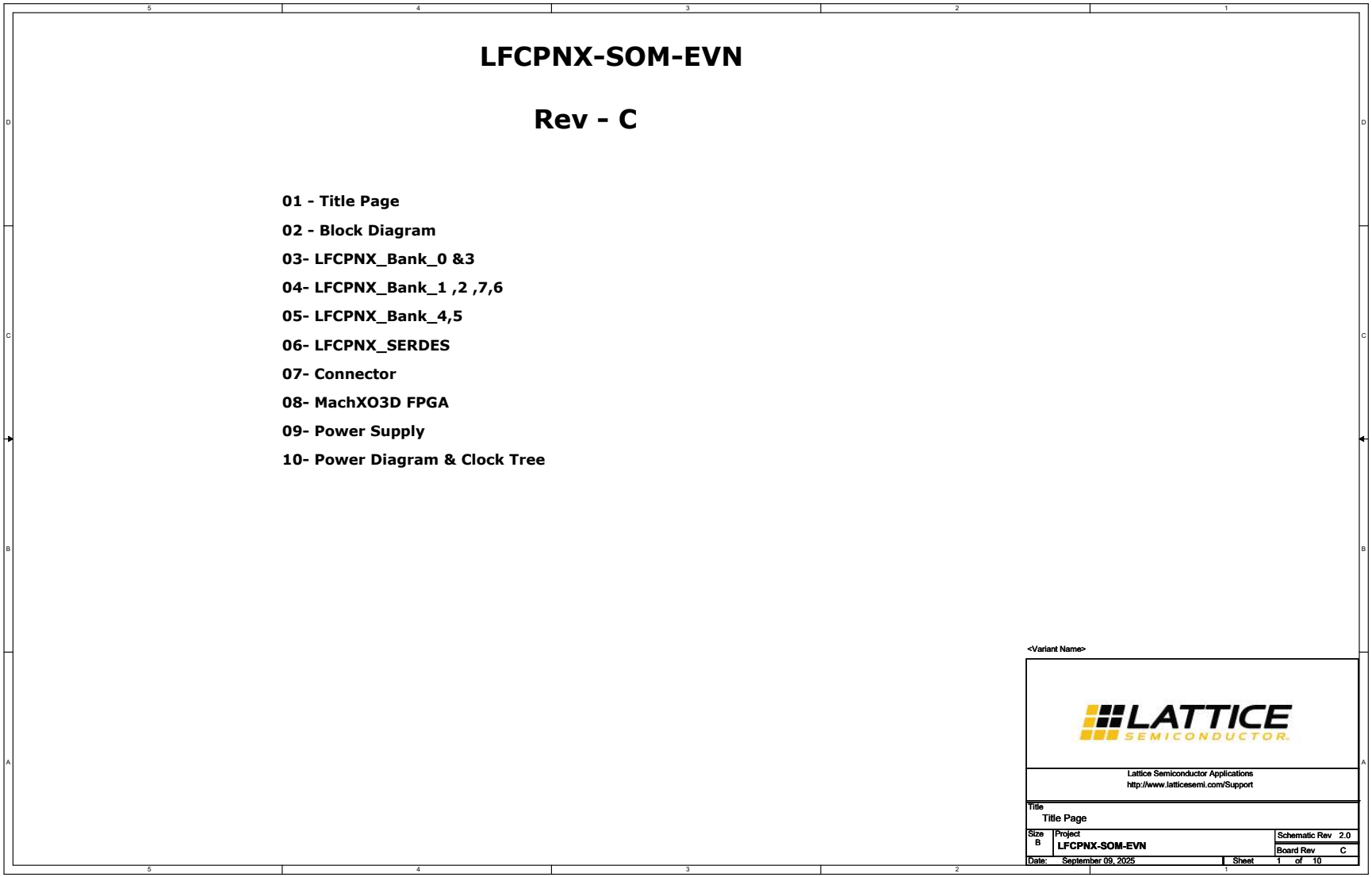

Figure A.1. Title Page

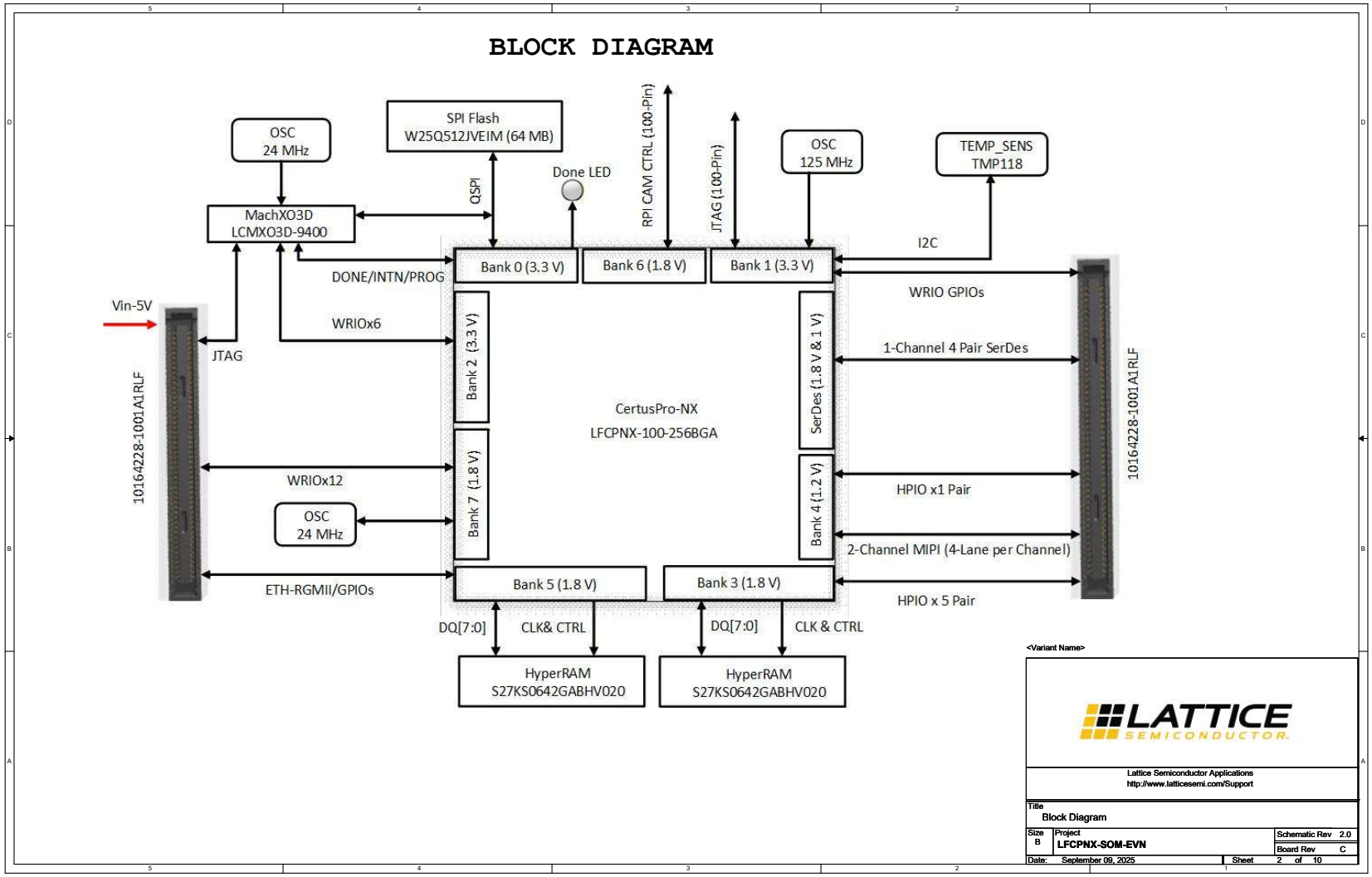

Figure A.2. Block Diagram

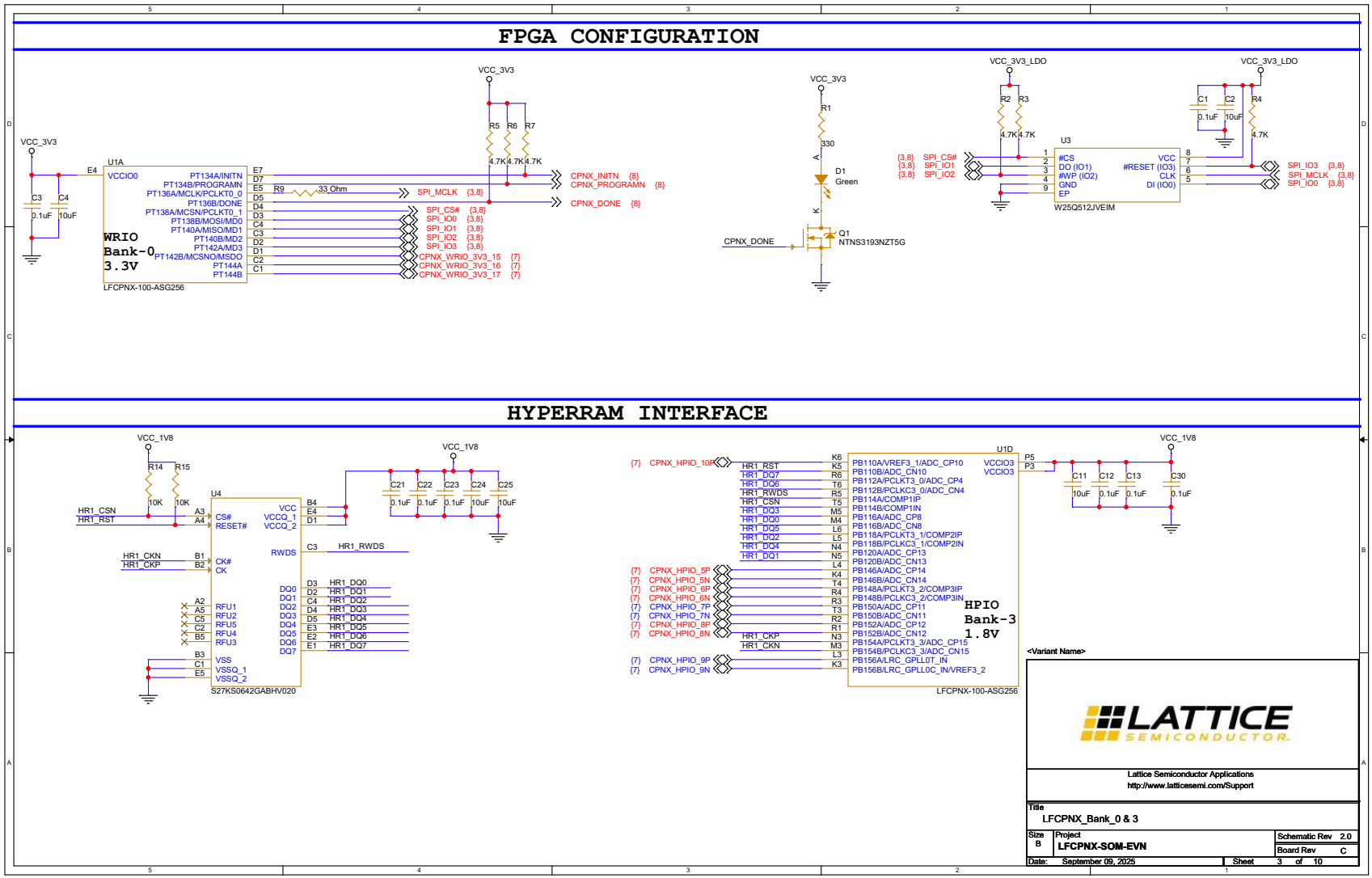

Figure A.3. LFCPNX_Bank_0 & 3

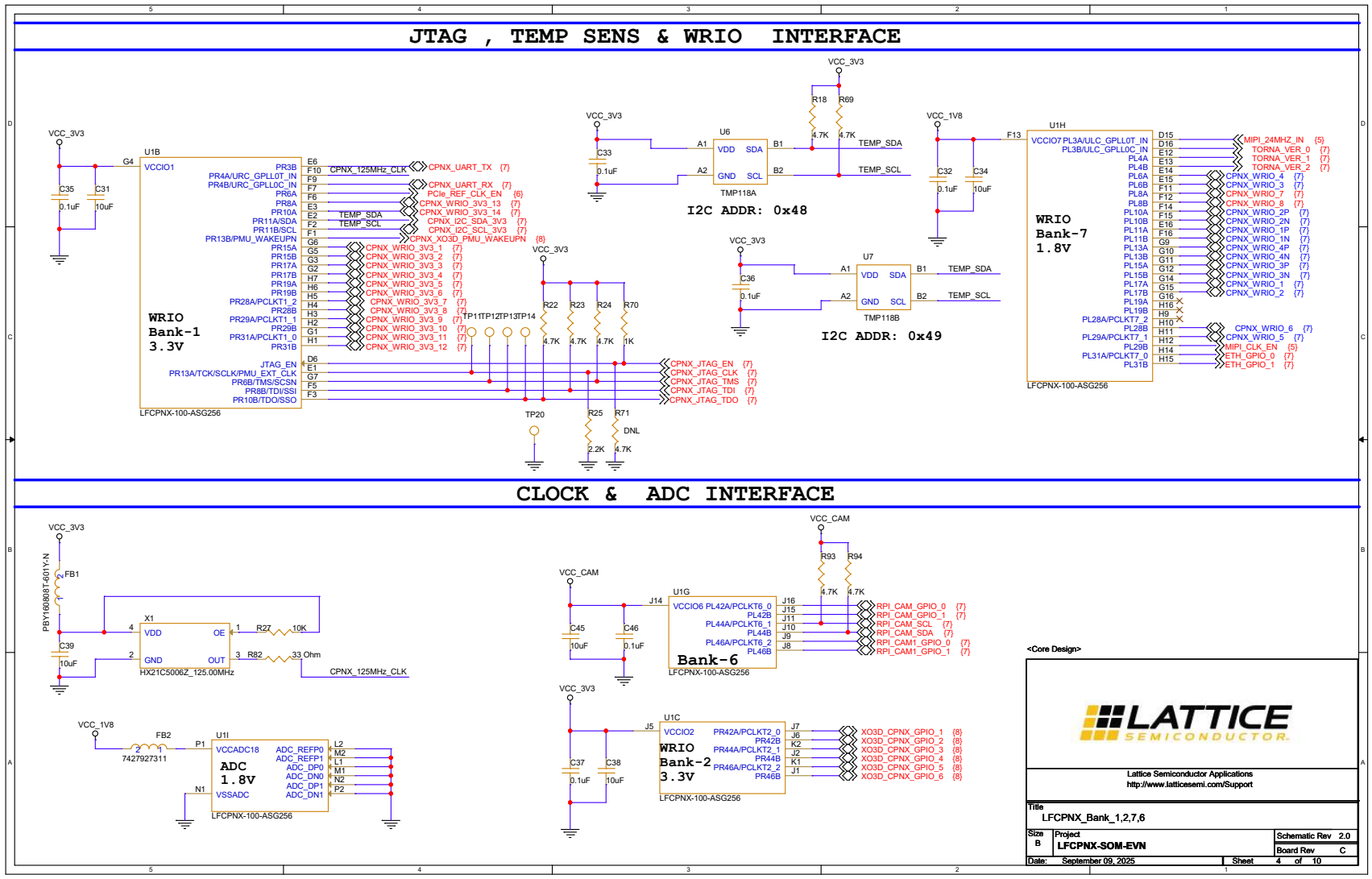

Figure A.4. LFCPNX_Bank_1,2,7,6

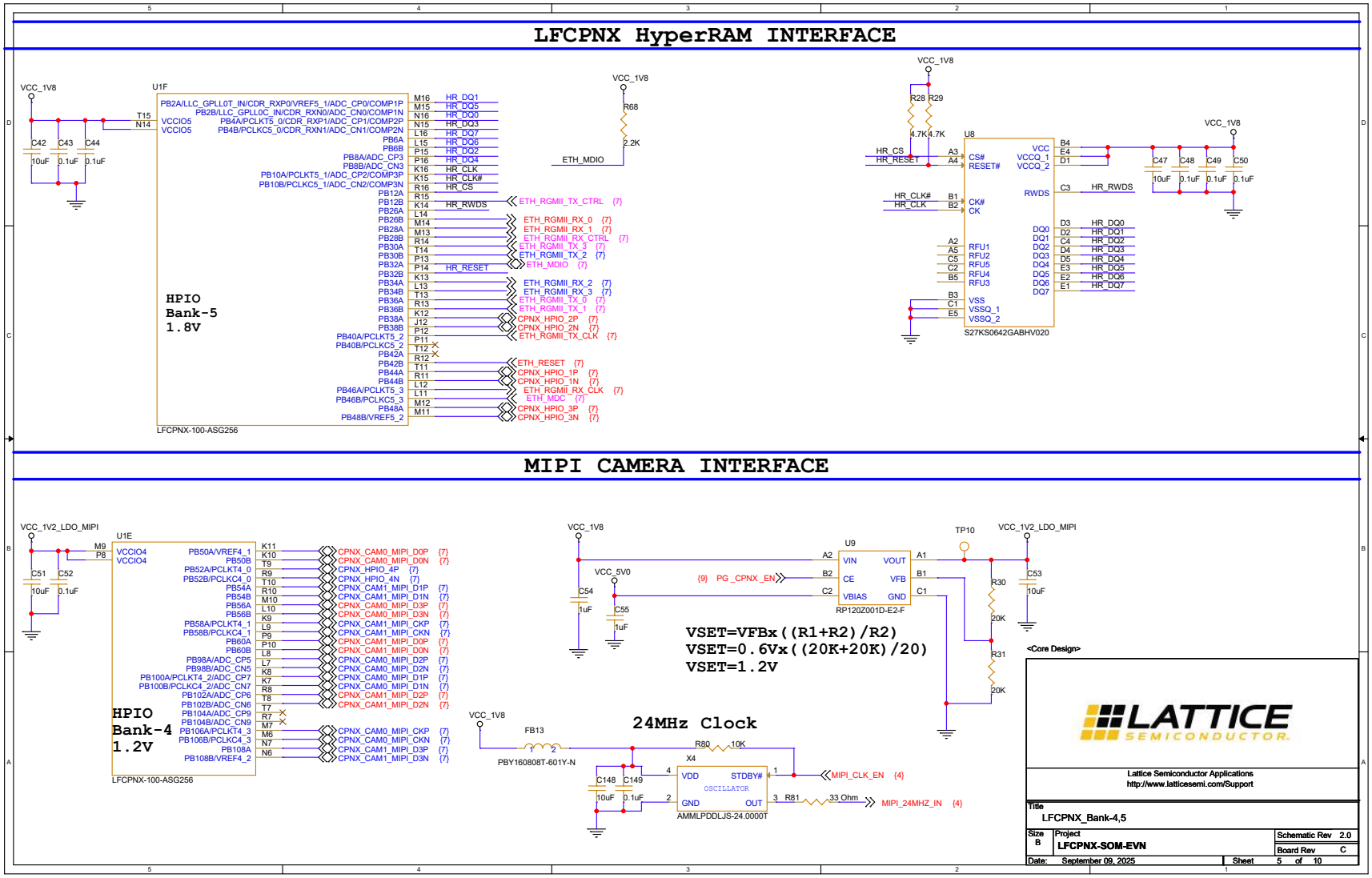

Figure A.5. LFCPNX_Bank-4, 5

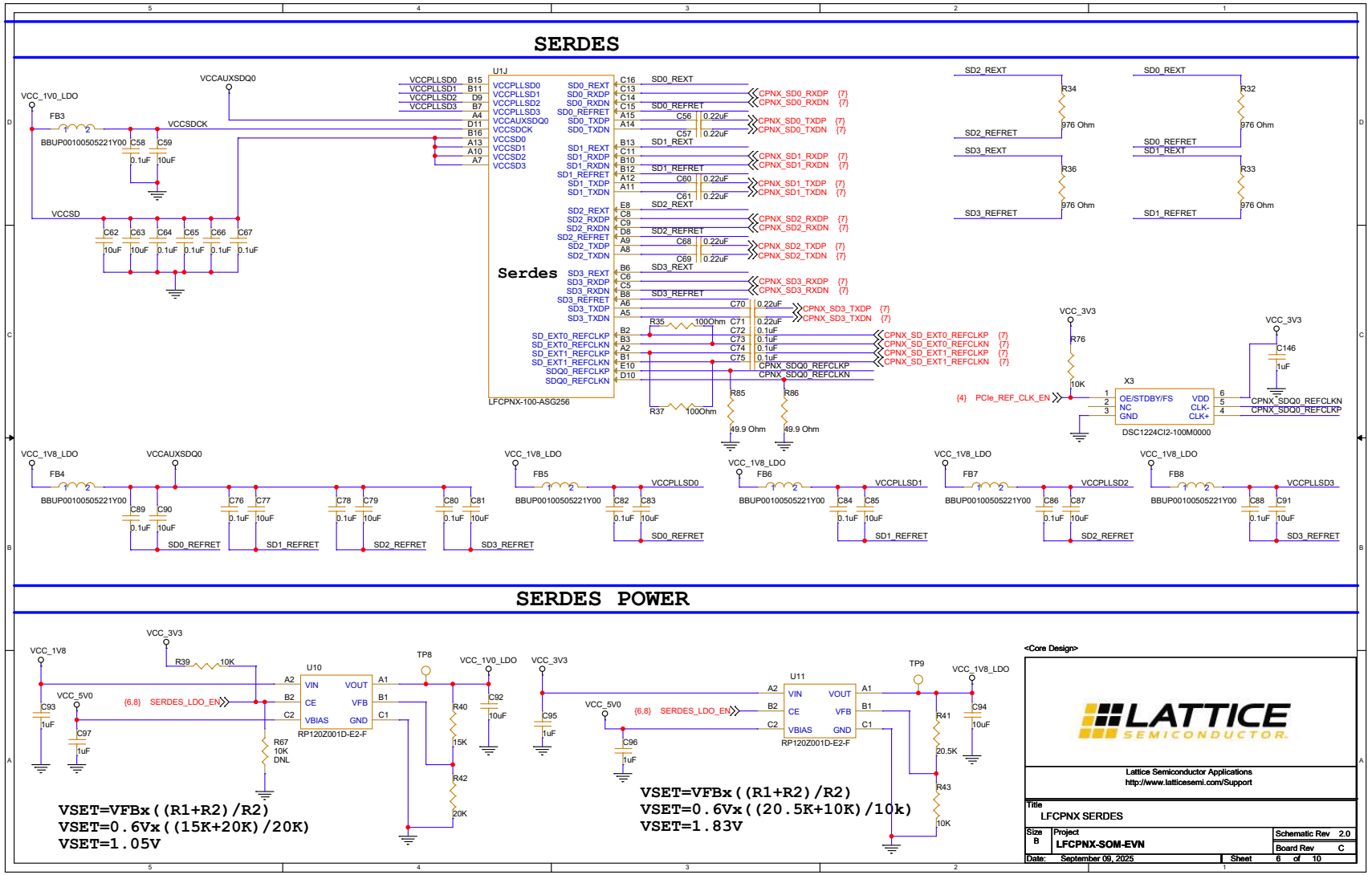

Figure A.6. LFCPNX SERDES

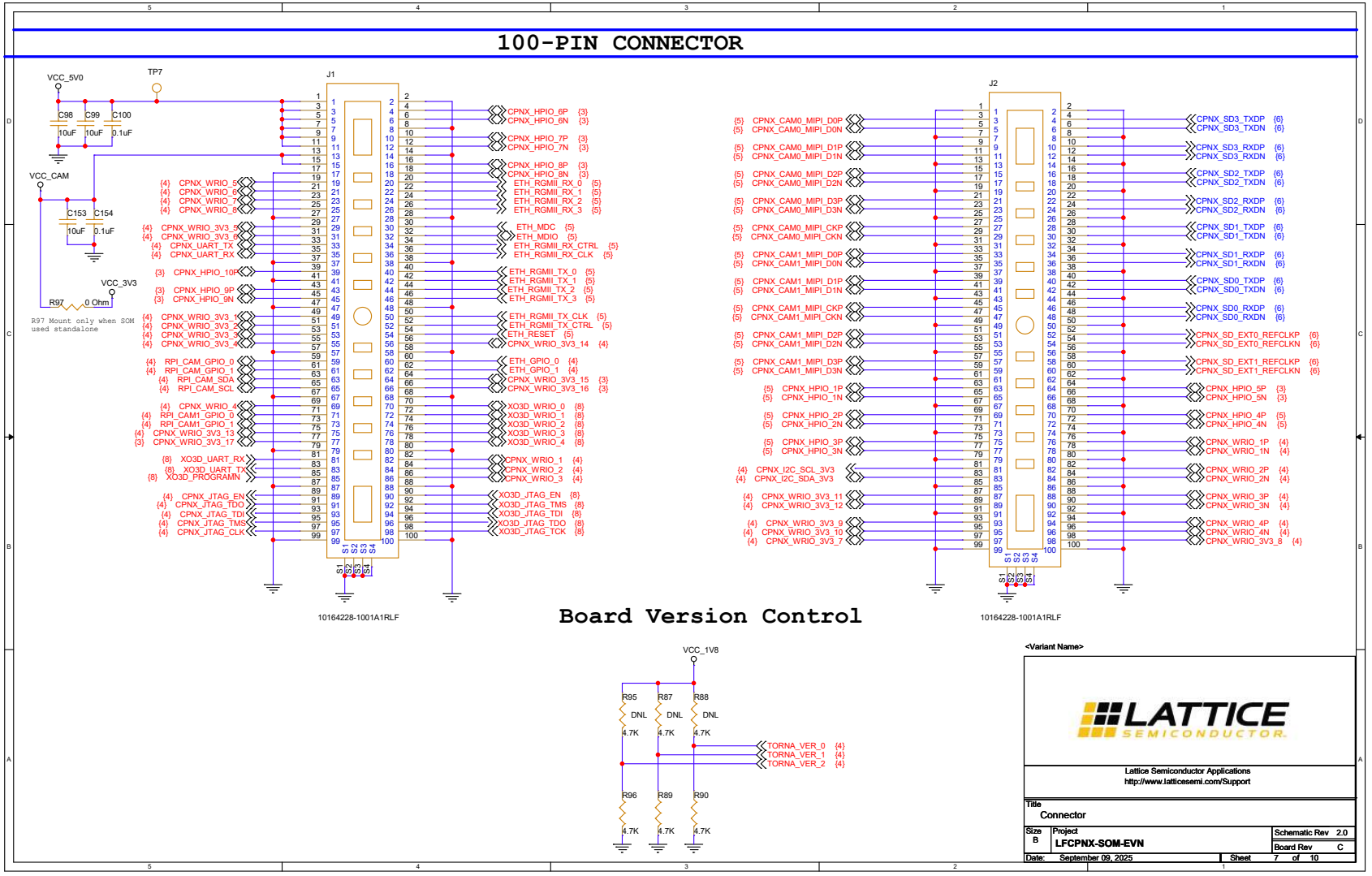

Figure A.7. Connector

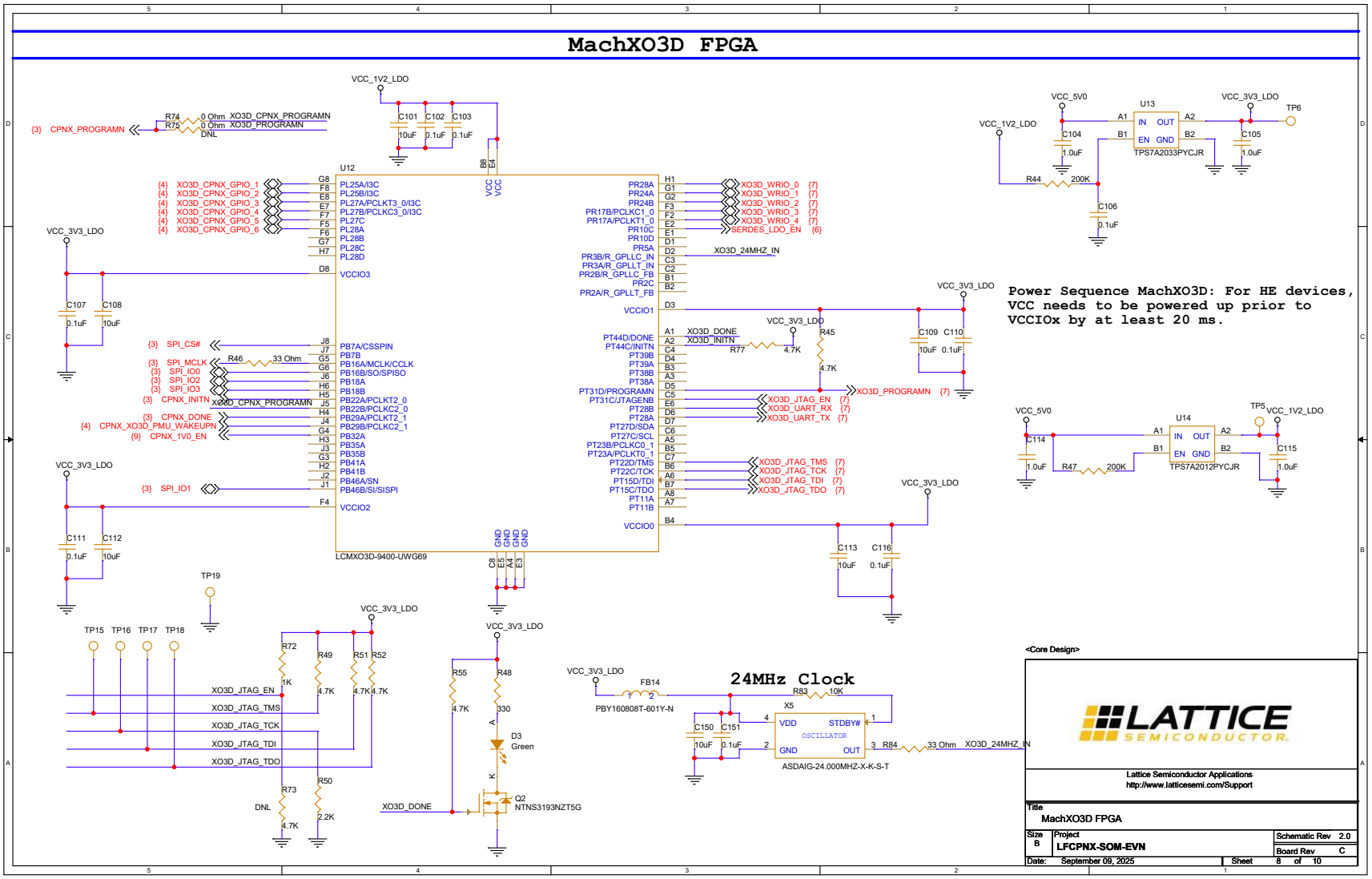

Figure A.8. MachXO3D FPGA

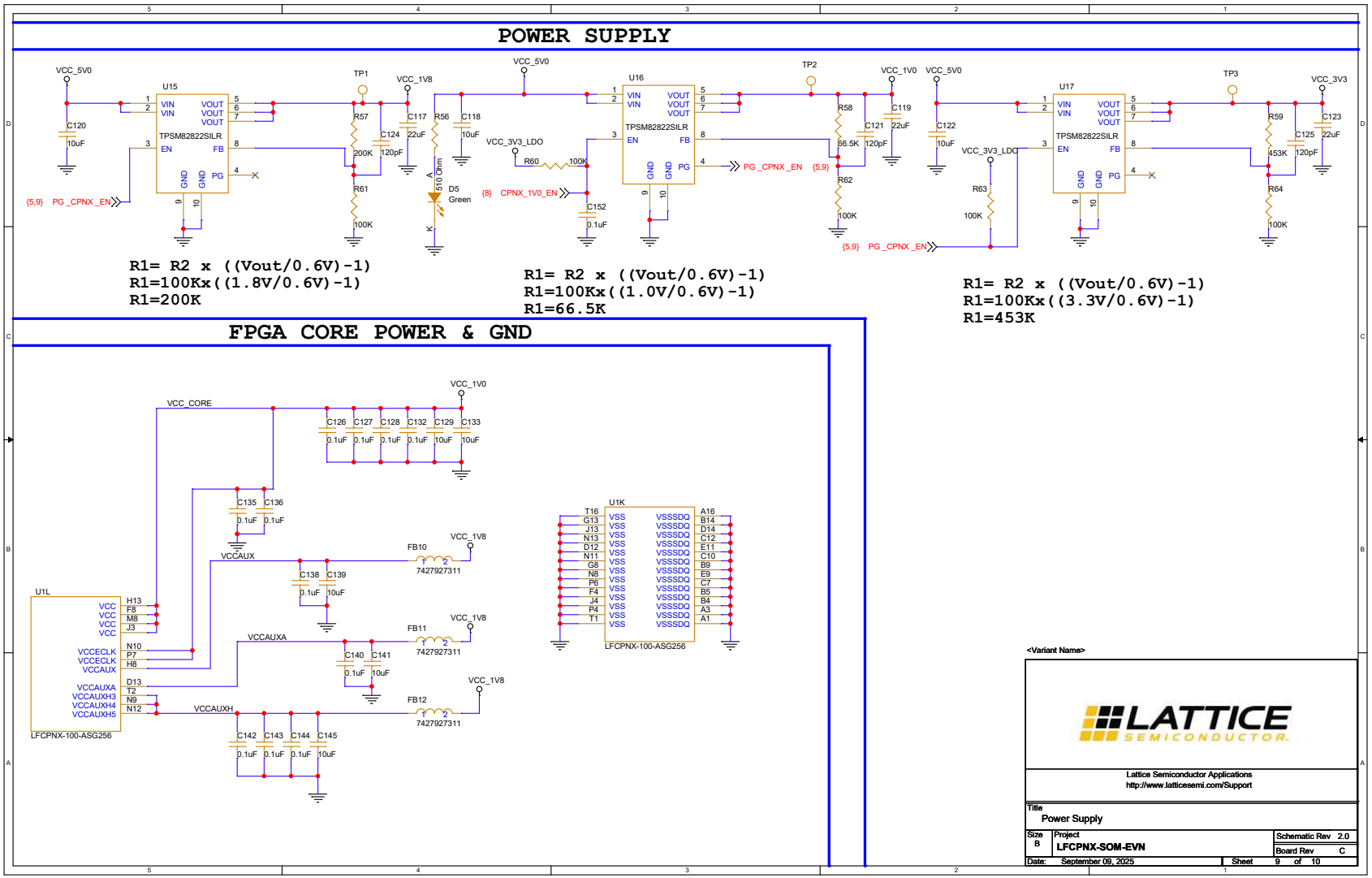

Figure A.9. Power Supply

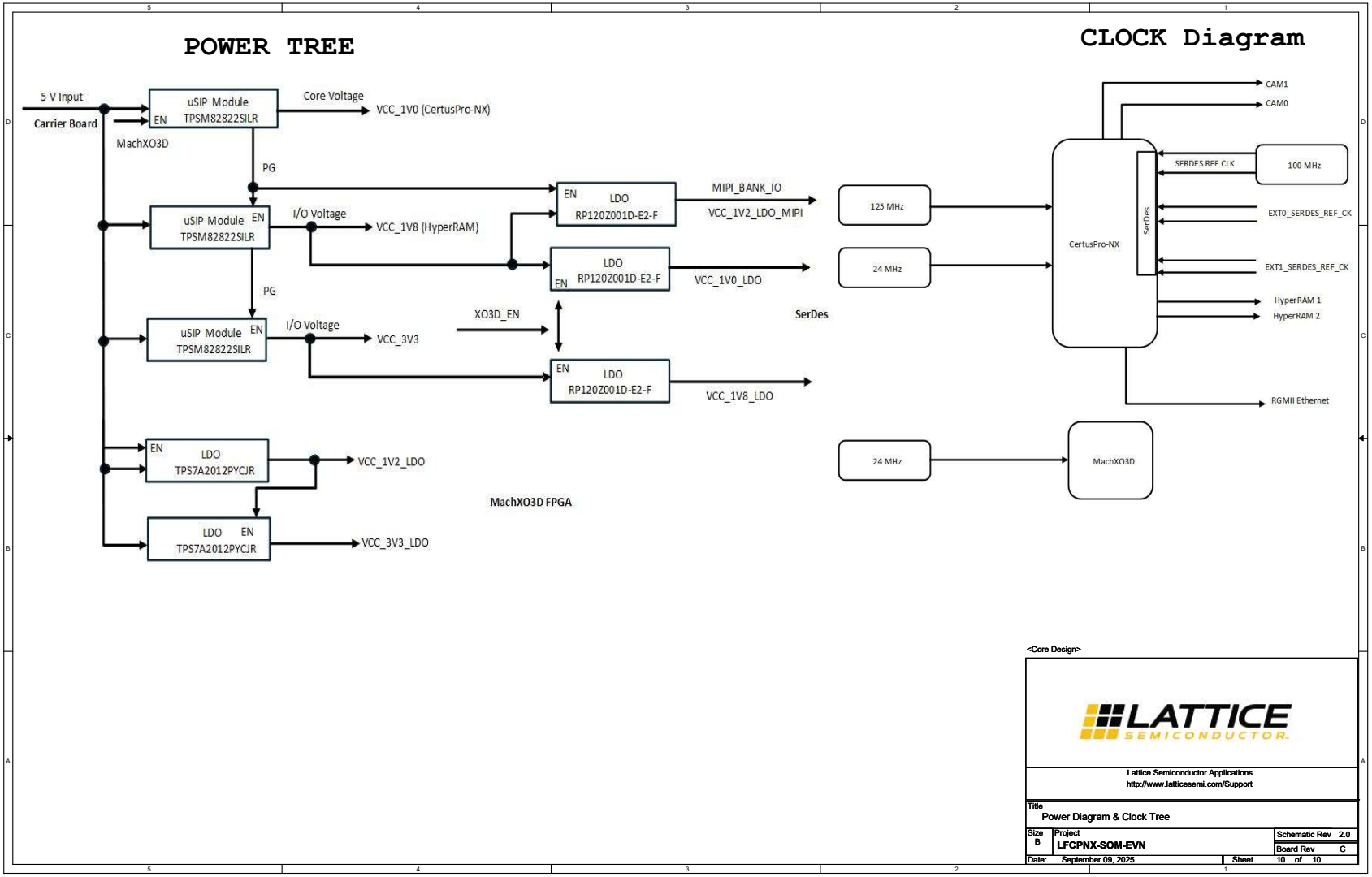

Figure A.10. Power Diagram & Clock Tree

Appendix B. CertusPro-NX SoM Revision C Module Bill of Materials

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
1	C1,C3,C12,C13,C21,C22,C23, C30,C32,C33,C35,C36,C37,C43, C44,C46,C48,C49,C50,C52,C58, C64,C65,C66,C67,C72,C73,C74, C75,C76,C78,C80,C82,C84,C86, C88,C89,C100,C102,C103,C106, C107,C110,C111,C116,C126, C127,C128,C132,C135,C136, C138,C140,C142,C143,C144, C149,C151,C152,C154	60	0.1uF	C0201-L	—	C0603X5R1A104K030BC	TDK	0.1 µF ±10% 10V Ceramic Capacitor X5R 0201 (0603 Metric)
2	C2,C4,C11,C24,C25,C31,C34, C38,C39,C42,C45,C47,C51,C53, C59,C62,C63,C77,C79,C81,C83, C85,C87,C90,C91,C92,C94,C98, C99,C101,C108,C109,C112, C113,C118,C120,C122,C129, C133,C139,C141,C145,C148, C150,C153	45	10uF	C0402-L	—	CC0402MRX5R6BB106	Yageo	CAP CER 10UF 10V X5R 0402
3	C54,C55,C93,C95,C96,C97,C146	7	1uF	C0201-L	—	GRM033R61A105ME15D	Murata Electronics	1 µF ±20% 10V Ceramic Capacitor X5R 0201 (0603 Metric)
4	C56,C57,C60,C61,C68,C69,C70, C71	8	0.22uF	C0201-L	—	GRM033R61A224KE90D	Murata Electronics	CAP CER 0.22UF 10V X5R 0201
5	C104,C105,C114,C115	4	1.0uF	C0402-L	—	GRM155R61E105KA12D	Murata	1 µF ±10% 25V Ceramic Capacitor X5R 0402 (1005 Metric)
6	C117,C119,C123	3	22uF	C0603-L	—	GRM188R61A226ME15D	Murata	22 µF ±20% 10V Ceramic Capacitor X5R 0603 (1608 Metric)
7	C121,C124,C125	3	120pF	C0201-L	—	GRM0335C1H121JA01D	Murata Electronics	CAP CER 120PF 50V C0G/NP0 0201
8	D1,D3,D5	3	Green	201	—	APG0603CGC-TT	Kingbright	Green 571nm LED Indication - Discrete 1.97V 2-SMD, 0201
9	FB1,FB13,FB14	3	PBY160808T-601Y-N	FB0603	—	PBY160808T-601Y-N	Pulse Electronics	FERRITE BEAD 600 OHM 0603 1LN

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
10	FB2,FB10,FB11,FB12	4	7427927311	402	—	7427927311	Würth Elektronik	120 Ohms @ 100 MHz 1 Signal Line Ferrite Bead 0402 (1005 Metric) 1.2A 90mOhm
11	FB3,FB4,FB5,FB6,FB7,FB8	6	BBUP00100505221Y00	402	—	BBUP00100505221Y00	Pulse Electronics	Ferrite Beads 1.4 A 25 % IMP=220 Ohms Shielded SMD/SMT DCR=100 mOhms - 55 C to + 125 C
12	J1,J2	2	10164228-1001A1RLF	10164228-1001A1RLF	—	10164228-1001A1RLF	Amphenol ICC (FCI)	100 Position Connector Header, Outer Shroud Contacts Surface Mount Gold
13	Q1,Q2	2	NTNS3193NZT5G	3-XFLGA	—	NTNS3193NZT5G	onsemi	MOSFET N-CH 20V 224MA 3XLLGA
14	R1,R48	2	330	R0201-L	—	AC0201FR-07330RL	YAGEO	RES SMD 330 OHM 1% 1/20W 0201
15	R2,R3,R4,R5,R6,R7,R18,R22, R23,R24,R28,R29,R45,R49,R51, R52,R55,R69,R77,R89,R90,R93, R94,R96	24	4.7K	R0201	—	ERJ-1GNF4701C	Panasonic Electronic Components	RES SMD 4.7K OHM 1% 1/20W 0201
16	R9,R46,R81,R82,R84	5	33 Ohm	R0201	—	RC0201FR-0733RL	Yageo	RES 33 OHM 1% 1/20W 0201
17	R14,R15,R27,R39,R43,R76,R80, R83	8	10K	R0201-L	—	RC0201FR-0710KL	YAGEO	RES 10K OHM 1% 1/20W 0201
18	R25,R50,R68	3	2.2K	R0201-L	—	RC0201FR-072K2L	YAGEO	RES 2.2K OHM 1% 1/20W 0201
19	R30,R31,R42	3	20K	R0201-L	—	RC0201FR-0720KL	YAGEO	RES 20K OHM 1% 1/20W 0201
20	R32,R33,R34,R36	4	976 Ohm	R0201-L	Alternate PN : CPF0201B976RE1	ERA-1ARB9760C	Panasonic Electronic Components	RES SMD 976 OHM 0.1% 1/20W 0201
21	R35,R37	2	100Ohm	R0201-L	—	RC0201FR-07100RL	Yageo	RES 100 OHM 1% 1/20W 0201
22	R40	1	15K	R0201-L	—	ERJ-1GNF1502C	Panasonic Electronic Components	RES SMD 15K OHM 1% 1/20W 0201

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
23	R41	1	20.5K	R0201-L	—	RC0201FR-0720K5L	Yageo	RES 20.5K OHM 1% 1/20W 0201
24	R44,R47,R57	3	200K	R0201-L	—	ERJ-1GNF2003C	Panasonic Electronic Components	RES SMD 200K OHM 1% 1/20W 0201
25	R56	1	510 Ohm	R0201-L	—	CRCW0201510RFNED	Vishay Dale	RES SMD 510 OHM 1% 1/20W 0201
26	R58	1	66.5K	R0201-L	—	ERJ-1GNF6652C	Panasonic Electronic Components	RES SMD 66.5K OHM 1% 1/20W 0201
27	R59	1	453K	R0201-L	—	ERJ-1GNF4533C	Panasonic Electronic Components	RES SMD 453K OHM 1% 1/20W 0201
28	R60,R61,R62,R63,R64	5	100K	R0201-L	—	ERJ-1GNF1003C	Panasonic Electronic Components	RES SMD 100K OHM 1% 1/20W 0201
29	R67	1	10K	R0201-L	DNL	RC0201FR-0710KL	YAGEO	RES 10K OHM 1% 1/20W 0201
30	R70,R72	2	1K	R0201-L	—	CRCW02011K00FKED	Vishay Dale	RES SMD 1K OHM 1% 1/20W 0201
31	R74	1	0 Ohm	R0201-L	—	CRCW02010000Z0ED	Vishay Dale	RES SMD 0 OHM JUMPER 1/20W 0201
32	R75,R97	2	0 Ohm	R0201-L	DNL	CRCW02010000Z0ED	Vishay Dale	RES SMD 0 OHM JUMPER 1/20W 0201
33	R85,R86	2	49.9 Ohm	R0201	—	RC0201DR-0749R9L	Yageo	RES 49.9 OHM 0.5% 1/20W 0201
34	R71,R73,R87,R88,R95	5	4.7K	R0201	DNL	ERJ-1GNF4701C	Panasonic Electronic Components	RES SMD 4.7K OHM 1% 1/20W 0201
35	TP1,TP2,TP3,TP5,TP6,TP7,TP8, TP9,TP10,TP11,TP12,TP13,TP14, TP15,TP16,TP17,TP18,TP19, TP20	19	Test Point	TP_SM_32	DNL	TP_SM	NA	Test point 0.32" surface mount
36	U1	1	LFCPNX-100-ASG256	LFCPNX-100-ASG256	Customer Supplied	LFCPNX-100-9ASG256I	Lattice	IC FPGA CERTUSPRO-NX 256WLP
37	U3	1	W25Q512JVEIM	8-WSON_8x6	—	W25Q512JVEIM	Winbond Electronics	FLASH - NOR Memory IC 512Mbit SPI - Quad I/O 133 MHz 8-WSON (8x6)

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
38	U4,U8	2	S27KS0642GABHV020	24-VBGA	—	S27KS0642GABHV020	Infineon Technologies	PSRAM (Pseudo SRAM) Memory IC 64Mbit HyperBus 200 MHz 35 ns 24-FBGA (6x8)
39	U6	1	TMP118A	4-XFBGA	—	TMP118MAIYMSR	Texas Instruments	0.1C ACCURATE DIGITAL TEMPERATUR
40	U7	1	TMP118B	4-XFBGA	—	TMP118MBIYMSR	Texas Instruments	0.1C ACCURATE DIGITAL TEMPERATUR
41	U9,U10,U11	3	RP120Z001D-E2-F	6-XFBGA	—	RP120Z001D-E2-F	Nisshinbo Micro Devices Inc.	Linear Voltage Regulator IC Positive Adjustable 1 Output 1.5A WLCSP-6-P11
42	U12	1	LCMXO3D-9400-UWG69	LCMXO3D-9400-UWG69	Customer Supplied	LCMXO3D-9400HE-5UTG69C	Lattice	IC FPGA MACHXO3D 69WLCSP
43	U13	1	TPS7A2033PYCJR	4-DSBGA	—	TPS7A2033PYCJR	Texas Instruments	IC REG LINEAR 3.3V 300MA 4-DSBGA
44	U14	1	TPS7A2012PYCJR	4-DSBGA	—	TPS7A2012PYCJR	Texas Instruments	IC REG LINEAR 1.2V 300MA 4-DSBGA
45	U15,U16,U17	3	TPSM82822SILR	10-uSIP_2p5x2	—	TPSM82822SILR	Texas Instruments	Non-Isolated PoL Module DC DC Converter 1 Output 0.6 ~ 4V 2A 2.4V - 5.5V Input
46	X1	1	HX21C5006Z_125.00MHz	4-SMD	—	HX21C5006Z	Diodes Incorporated	125 MHz XO (Standard) LVCMOS Oscillator 3.3V Enable/Disable 4-SMD, No Lead
47	X3	1	DSC1224CI2-100M0000	VDFN6_DSC1224CI2	—	DSC1224CI2-100M0000	Microchip	Standard Clock Oscillators MEMS OSC, HCSL, 100MHz, 25PPM, 2.5-3.3V, -40 to 85C, 3.2 x 2.5mm

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
48	X4	1	AMMLPDDLJS-24.0000T	4-SMD_2p5x2_27 MHz	Used 24 MHz part	AMMLPDDLJS-24.0000T	Abracon LLC	24 MHz XO (Standard) CMOS Oscillator 1.8V Standby (Power Down) 4-SMD, No Lead
49	X5	1	ASDAIG-24.000MHZ-X-K-S-T	4-SMD_2p5x2_24 MHz	—	ASDAIG-24.000MHZ-X-K-S-T	Abracon LLC	24 MHz XO (Standard) CMOS Oscillator 3.3V Enable/Disable 4-SMD, No Lead
50	LFCPNX-SOM-EVN BRD REVC PCB	1	—	—	—	305-PD-25-0961	PACTRON	—

Appendix C. Carrier Board Revision A Module Schematics

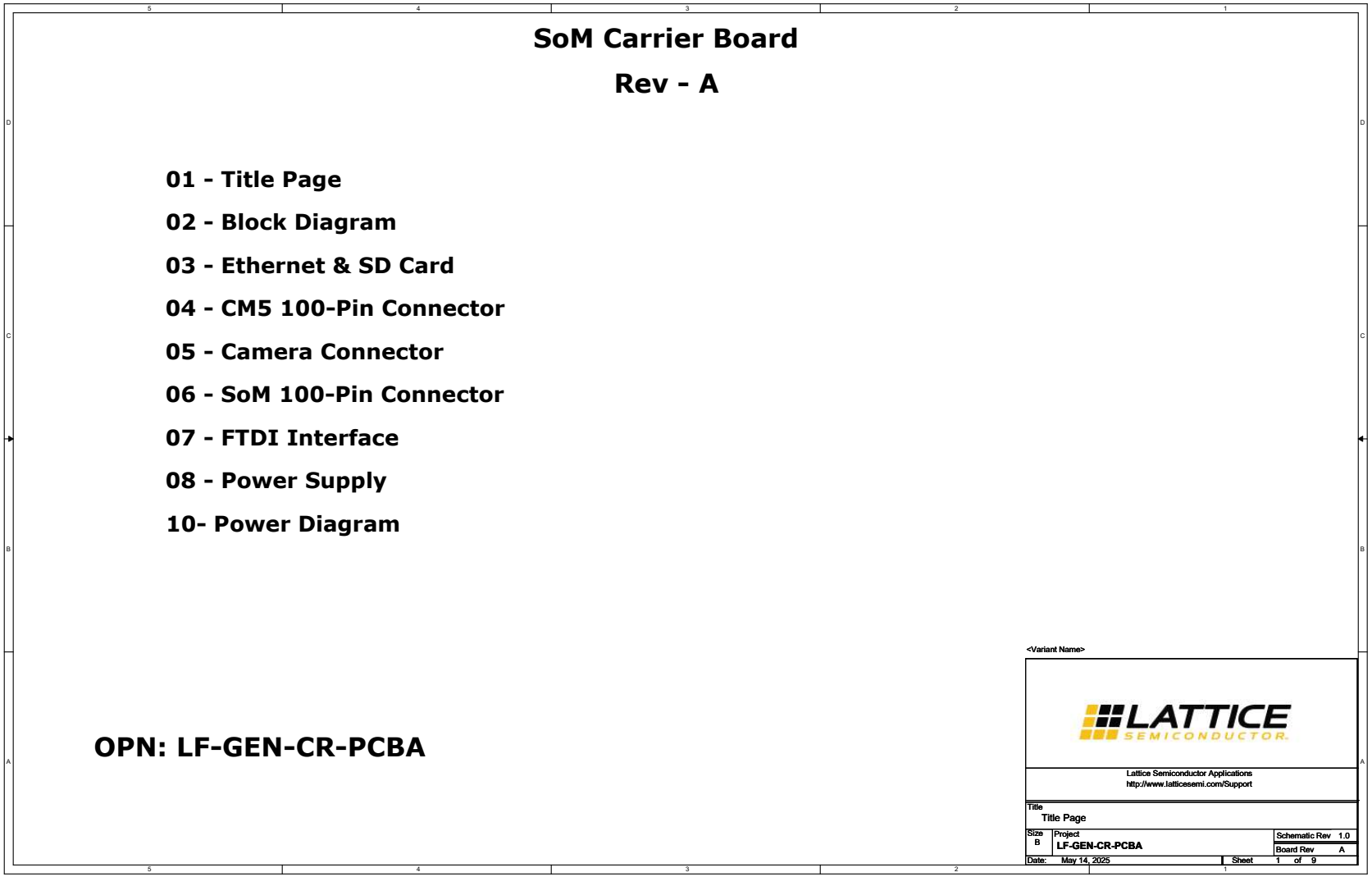

Figure C.1. Title Page

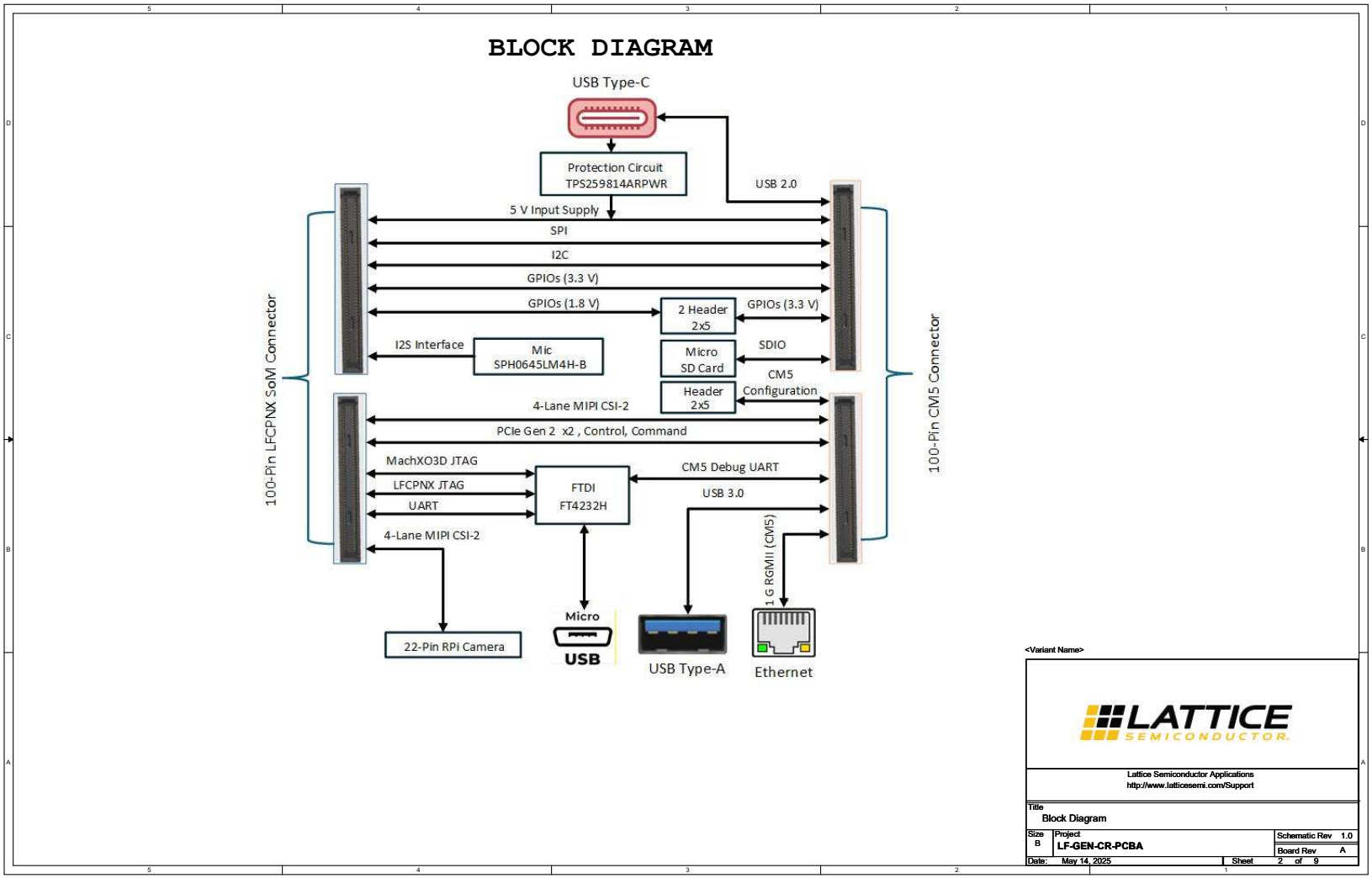

Figure C.2. Block Diagram

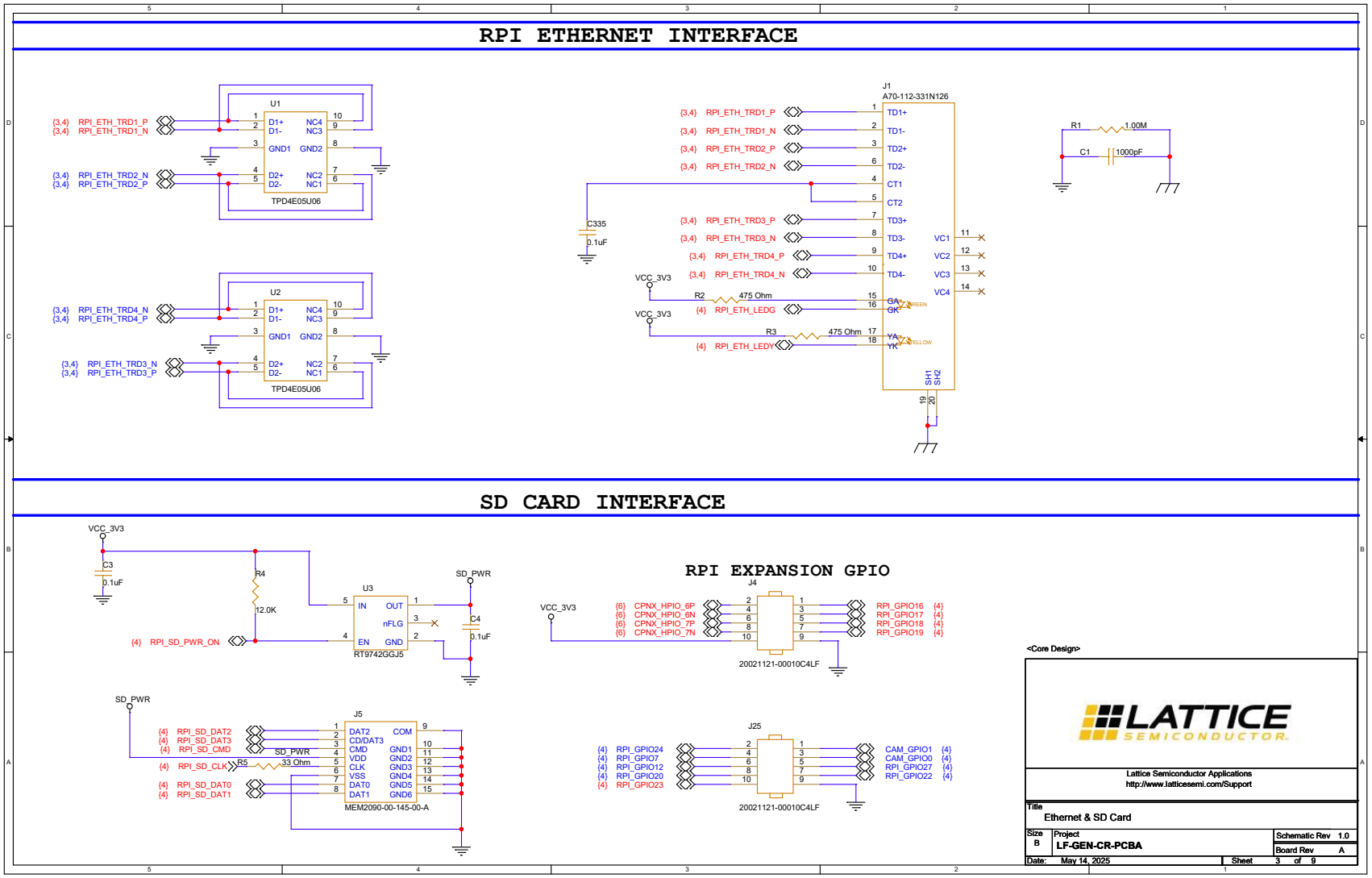

Figure C.3. Ethernet & SD Card

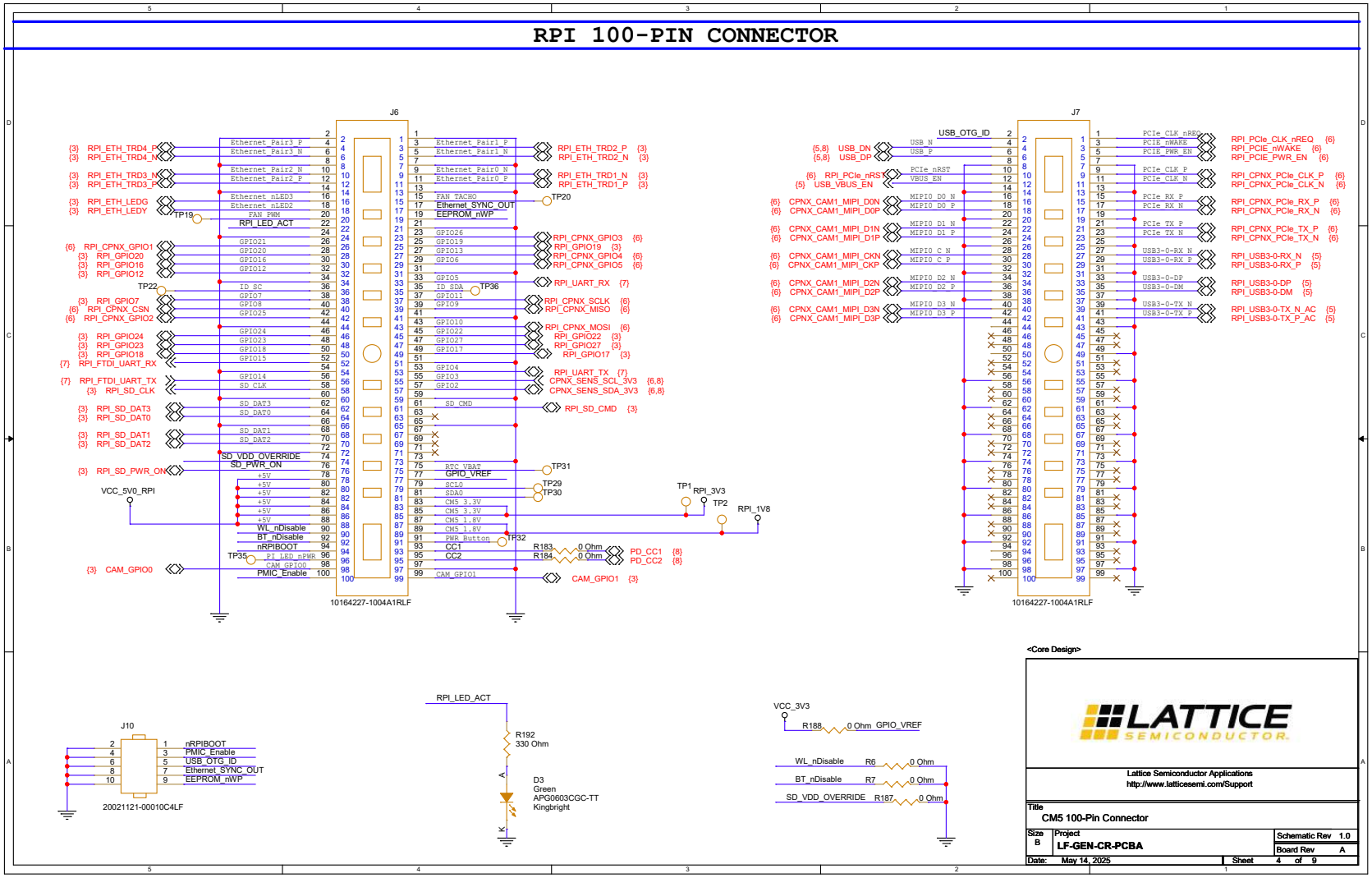

Figure C.4. CM5 100-Pin Connector

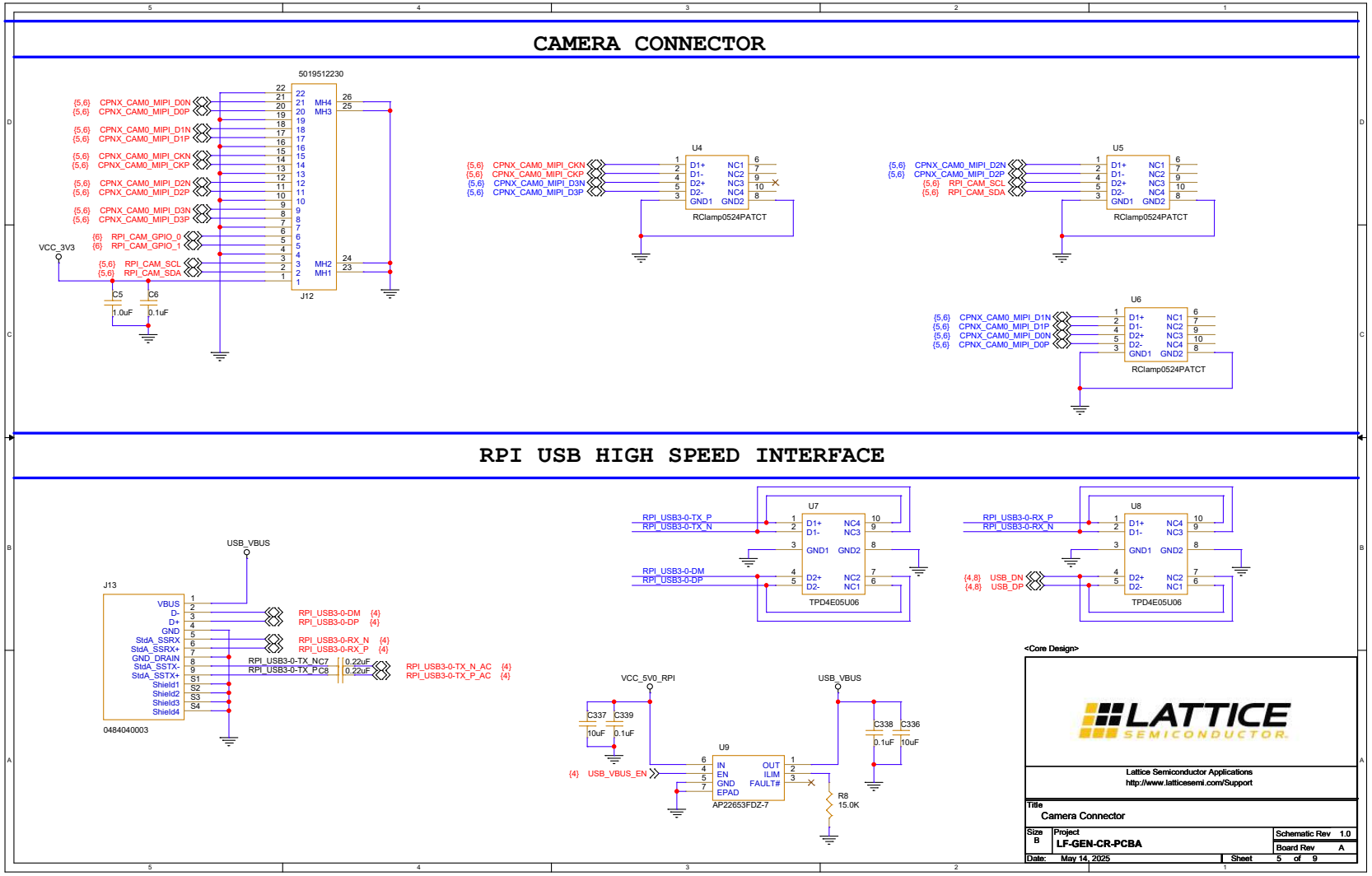

Figure C.5. Camera Connector

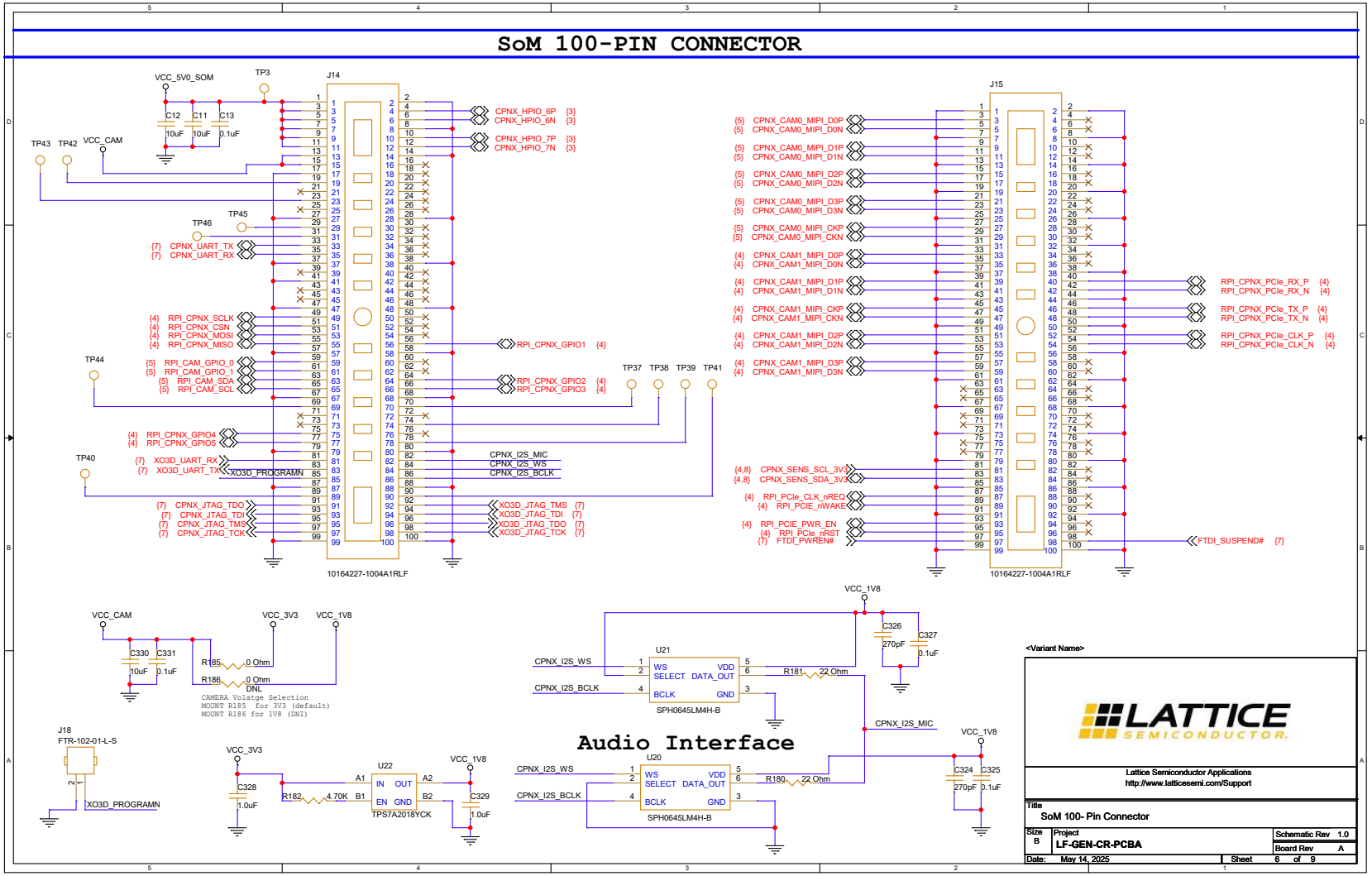

Figure C.6. SoM 100-Pin Connector

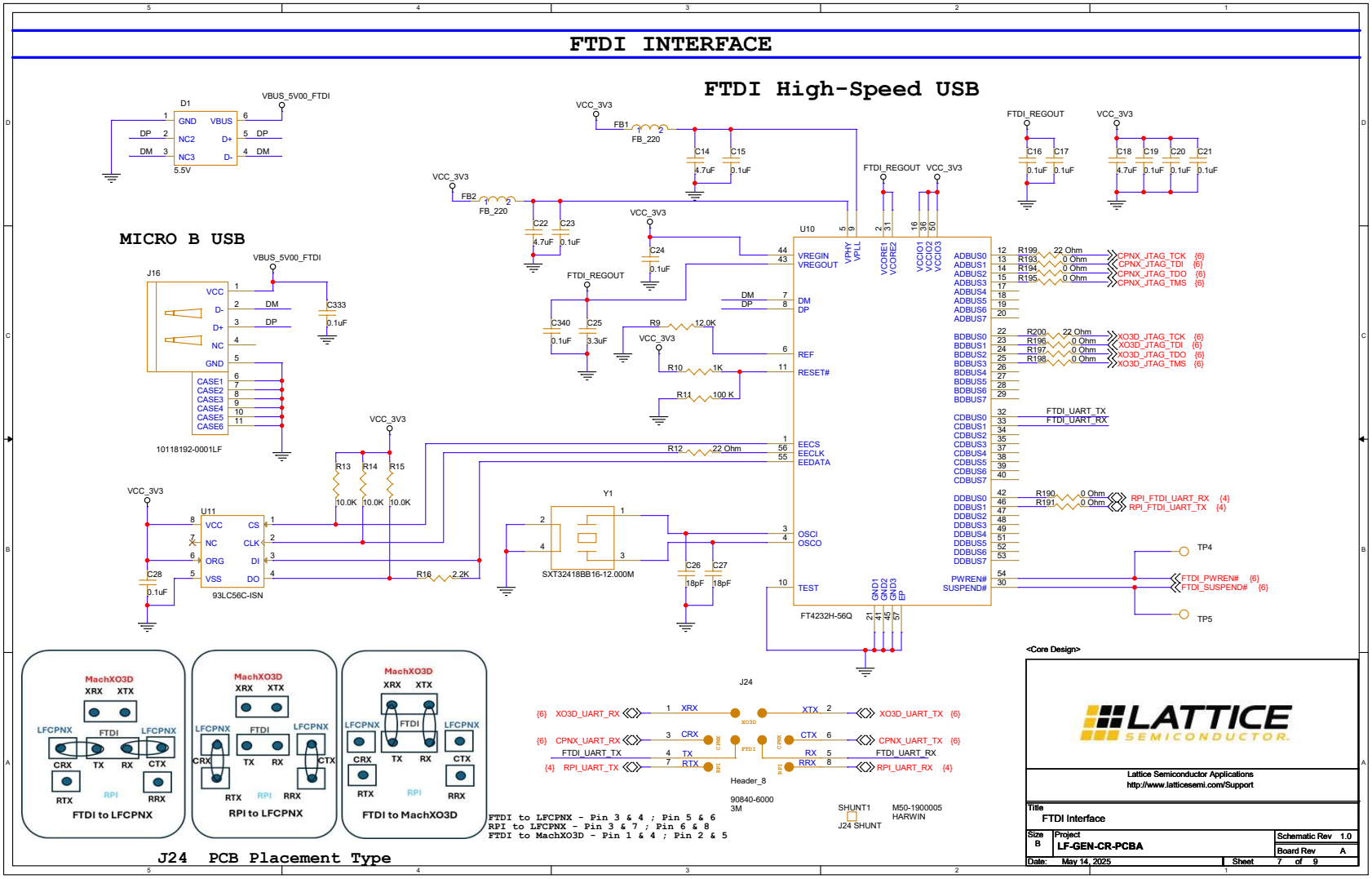

Figure C.7. FTDI Interface

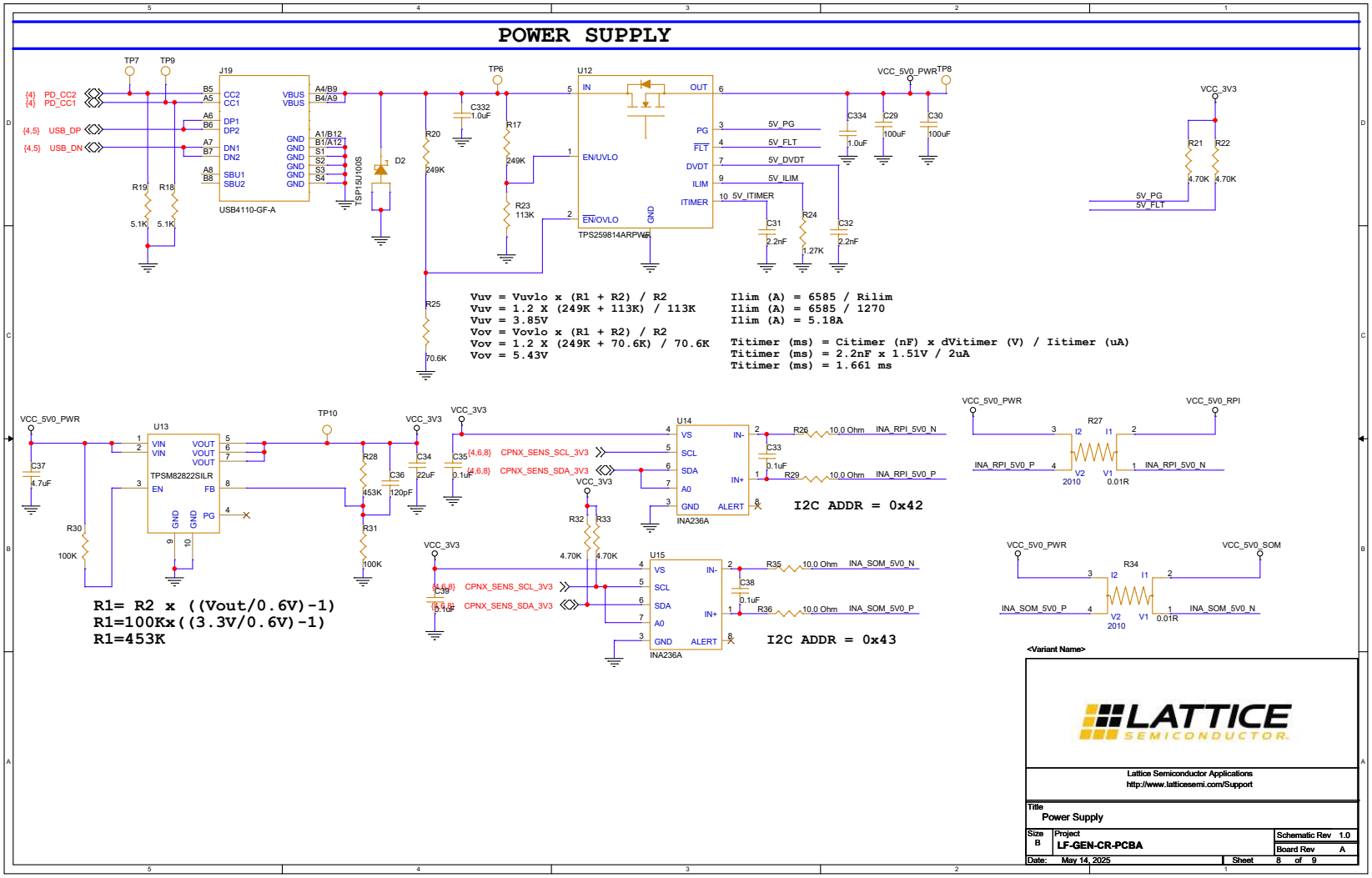

Figure C.8. Power Supply

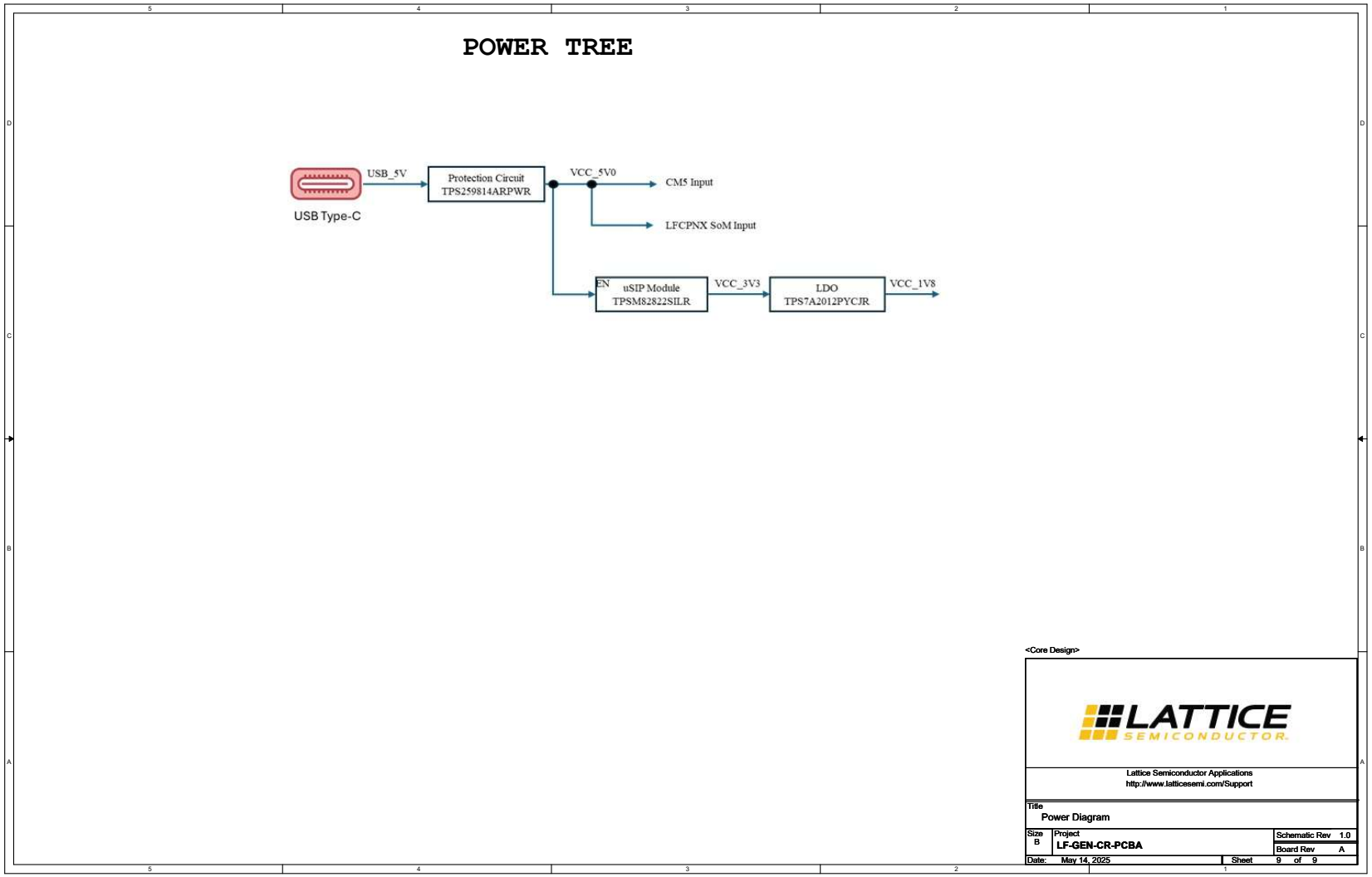

Figure C.9. Power Diagram

Appendix D. Carrier Board Revision A Module Bill of Materials

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
1	C1	1	1000pF	C1206	—	CC1206KKX7RDBB102	YAGEO	CAP CER 1000PF 2KV X7R 1206
2	C3,C4,C6,C15,C16,C17,C19,C20,C21,C23,C24,C335,C338,C339,C340	15	0.1uF	C0201	—	GRM033Z71C104KE14D	Murata	CAP CER 0.1UF 16V X7R 0201
3	C5,C328,C329,C332,C334	5	1.0uF	C0402-L	—	GRM155R61E105KA12D	Murata	CAP CER 1UF 25V X5R 0402
4	C7,C8	2	0.22uF	C0402-L	—	GRM155R61H224KE01W	Murata	CAP CER 0.22UF 50V X5R 0402
5	C11,C12,C330,C336,C337	5	10uF	C0402-L	—	CC0402MRX5R6BB106	YAGEO	CAP CER 10UF 10V X5R 0402
6	C13,C325,C327,C331	4	0.1uF	C0201-L	—	C0603X5R1A104K030BC	TDK	CAP CER 0.1UF 10V X5R 0201
7	C14,C18,C22	3	4.7uF	C0402-L	—	CC0402MRX5R6BB475	Yageo	CAP CER 4.7UF 10V X5R 0402
8	C25	1	3.3uF	C0402-L	—	C1005X5R1A335K050BC	TDK Corporation	CAP CER 3.3UF 10V X5R 0402
9	C26,C27	2	18pF	C0402-L	—	CC0402JRNPO9BN180	YAGEO	CAP CER 18PF 50V C0G/NPO 0402
10	C28,C333	2	0.1uF	C0402-L	—	GRM155R71H104KE14J	Murata	CAP CER 0.1UF 50V X7R 0402
11	C29,C30	2	100uF	C1206	—	GRM31CR61A107MEA8L	Murata Electronics	CAP CER 100UF 10V X5R 1206
12	C31,C32	2	2.2nF	C0402-L	—	GRM1555C1H222JA01D	Murata	CAP CER 2200PF 50V C0G/NP0 0402
13	C33,C35,C38,C39	4	0.1uF	C0201-L	—	GRM033R61A104KE15D	Murata Electronics	CAP CER 0.1UF 10V X5R 0201
14	C34	1	22uF	C0603-L	—	GRM188R61A226ME15D	Murata	CAP CER 22UF 10V X5R 0603
15	C36	1	120pF	C0201-L	—	GRM0335C1H121JA01D	Murata Electronics	CAP CER 120PF 50V C0G/NP0 0201
16	C37	1	4.7uF	C0402-L	—	CL05A475MO5NUNC	Samsung	CAP CER 4.7UF 16V X5R 0402
17	C324,C326	2	270pF	C0402-L	—	C0402C271J5GACTU	KEMET	CAP CER 270PF 50V C0G/NP0 0402
18	D1	1	5.5V	UDFN6_1P2X1	—	ESDR0502NMUTAG	ONSEMI	TVS DIODE 5.5VWM 6UDFN
19	D2	1	TSP15U100S	TO-227A_TS	—	TSP15U100S	Taiwan Semiconductor	DIODE SCHOTTKY 100V 15A TO277A
20	D3	1	Green	D0201	—	APG0603CGC-TT	Kingbright	Green 571nm LED Indication - Discrete 1.97V 2-SMD 0201
21	FB1,FB2	2	FB_220	IND_1005_TDK-L	—	BLM15PX221SN1D	Murata	FERRITE BEAD 220 OHM 0402 1LN

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
22	J1	1	A70-112-331N126	A70-112-331N126	Alternate PN : LPJG0926 HENL	A70-112-331N126	EDAC	100/1000 Base-T RJ45 PoE+ Gigabit Magnetics Jack Tab Down Green/Yellow Led
23	J4,J10,J25	3	20021121-00010C4LF	20021121-00010C4LF	—	20021121-00010C4LF	Amphenol ICC (FCI)	CONN HEADER SMD 10POS 1.27MM
24	J5	1	MEM2090-00-145-00-A	MEM2090-00-145-00-A	—	MEM2090-00-145-00-A	GCT	CONN MICROSD CARD R/A SMD
25	J6,J7,J14,J15	4	10164227-1004A1RLF	10164227-1004A1RLF	—	10164227-1004A1RLF	Amphenol ICC (FCI)	100 Position Connector Receptacle, Center Strip Contacts Surface Mount Gold
26	J12	1	5019512230	501951-2230	—	5019512230	Molex	CONN FFC VERT 22POS 0.5MM SMD
27	J13	1	484040003	MOLEX_0484040003	—	484040003	Molex	USB-A (USB TYPE-A) USB 3.2 Gen 1 (USB 3.1 Gen 1, Superspeed (USB 3.0)) Receptacle Connector 9 Position Through Hole, Right Angle
28	J16	1	10118192-0001LF	10118192-0001LF	—	10118192-0001LF	Amphenol ICC (FCI)	USB - micro B USB 2.0 Receptacle Connector 5 Position Surface Mount, Right Angle
29	J18	1	FTR-102-01-L-S	FTR-102-01-L-S	—	FTR-102-01-L-S	Samtec Inc.	CONN HEADER SMD 2POS 1.27MM
30	J19	1	USB4110-GF-A	GCT_USB4110GFA	—	USB4110-GF-A	GCT	CONN RCP USB2.0 TYP C 24P SMD RA
31	J24	1	Header_8	HDR_8_50MIL	Refer to the Note Below this table.	90840-6000	3M	PIN STRIP HEADER .050" (1.27MM)
32	R1	1	1.00M	R0402-L	—	ERJ-2RKF1004X	Panasonic	RES SMD 1M OHM 1% 1/10W 0402
33	R2,R3	2	475 Ohm	R0402-L	—	RC0402FR-07475RL	YAGEO	RES 475 OHM 1% 1/16W 0402

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
34	R4,R9	2	12.0K	R0402-L	—	RC0402FR-0712KL	YAGEO	RES 12K OHM 1% 1/16W 0402
35	R5	1	33 Ohm	R0201	—	RC0201FR-0733RL	YAGEO	RES 33 OHM 1% 1/20W 0201
36	R6,R7,R183,R184,R185,R187, R188,R190,R191	9	0 Ohm	R0402-L	—	RC0402FR-070RL	YAGEO	RES 0 OHM JUMPER 1/16W 0402
37	R8	1	15.0K	R0402-L	—	RC0402FR-1315KL	YAGEO	RES 15K OHM 1% 1/16W 0402
38	R10	1	1K	R0402-L	—	RM04FTN1001	TA-I Technology Co., Ltd.	RES 0402 1kohm 1% 1/16W
39	R11	1	100 K	R0402-L	—	RK73H1ETTP1003 F	KOA Speer Electronics, Inc.	RES 0402 100kohm 1% 62.5mW
40	R12,R180,R181,R199,R200	5	22 Ohm	R0201-L	—	RC0201FR-0722RL	YAGEO	RES 22 OHM 1% 1/20W 0201
41	R13,R14,R15	3	10.0K	R0402-L	—	RC0402FR-0710KP	YAGEO	RES 10K OHM 1% 1/16W 0402
42	R16	1	2.2K	R0201-L	—	RC0201FR-072K2L	YAGEO	RES 2.2K OHM 1% 1/20W 0201
43	R17,R20	2	249K	R0402-L	—	RC0402FR-07249KL	YAGEO	RES 249K OHM 1% 1/16W 0402
44	R18,R19	2	5.1K	R0402-L	—	RC0402FR-075K1L	YAGEO	RES 5.1K OHM 1% 1/16W 0402
45	R21,R22,R32,R33,R182	5	4.70K	R0402-L	—	RC0402FR-074K7P	YAGEO	RES 4.7K OHM 1% 1/16W 0402
46	R23	1	113K	R0402-L	—	RC0402FR-07113KL	YAGEO	RES 113K OHM 1% 1/16W 0402
47	R24	1	1.27K	R0402-L	—	RC0402FR-071K27L	YAGEO	RES 1.27K OHM 1% 1/16W 0402
48	R25	1	70.6K	R0402-L	—	RN73H1ETTP7062 F25	KOA Speer Electronics, Inc.	RES 70.6K OHM 1% 1/16W 0402
49	R26,R29,R35,R36	4	10.0 Ohm	R0402-L	—	RC0402FR-7W10RL	YAGEO	10 Ohms ±1% 0.125W, 1/8W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
50	R27,R34	2	0.01R	2010	—	LVK20R010CER	Ohmite	0.75W 0.010 OHM 0.25% LVK(2010)
51	R28	1	453K	R0201-L	—	ERJ-1GNF4533C	Panasonic Electronic Components	RES SMD 453K OHM 1% 1/20W 0201
52	R30,R31	2	100K	R0201-L	—	ERJ-1GNF1003C	Panasonic Electronic Components	RES SMD 100K OHM 1% 1/20W 0201
53	R186	1	0 Ohm	R0402-L	DNL	RC0402FR-070RL	YAGEO	RES 0 OHM JUMPER 1/16W 0402
54	R192	1	330 Ohm	R0402-L	—	RC0402FR-07330RL	YAGEO	330 Ohms ±1% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
55	R193,R194,R195,R196,R197, R198	6	0 Ohm	R0201-L	—	CRCW0201000Z0ED	Vishay Dale	RES SMD 0 OHM JUMPER 1/20W 0201
56	SHUNTS FOR J24	2	J24 SHUNT	—	—	M50-1900005	HARWIN	2 Pos. Female Jumper Socket, Closed Shunt, Black, QTY 2
57	TP1,TP2,TP3,TP6,TP7,TP8,TP9, TP10,TP19,TP20,TP22,TP29, TP30,TP31,TP32,TP35,TP36, TP37,TP38,TP39,TP40,TP41, TP42,TP43,TP44,TP45,TP46	27	Test Point	TP_SM_32	DNL	TP_SM	NA	Test point 0.32" surface mount
58	TP4,TP5	2	TP1	TPd39c60	DNL	TP1	NA	Test Point 0.39"
59	U1,U2,U7,U8	4	TPD4E05U06	USON10_TPD4E05U06	—	TPD4E05U06DQAR	Texas Instruments	TVS DIODE 5.5VWM 14VC 10USON
60	U3	1	RT9742GGJ5	TSOT-23-5	—	RT9742GGJ5	Richtek USA Inc.	Power Switch/Driver 1:1 N-Channel 1A TSOT-23-5
61	U4,U5,U6	3	RClamp0524PATCT	10-UFDFN	—	RClamp0524PATCT	Semtech Corporation	15V Clamp 5A (8/20µs) Ipp Tvs Diode Surface Mount SLP2510P8
62	U9	1	AP22653FDZ-7	AP22653FDZ-7	—	AP22653FDZ-7	Diodes Incorporated	Power Switch/Driver 1:1 P-Channel 2.1A W-DFN2020-6 (Type A1)
63	U10	1	FT4232H-56Q	56-VQFN_8x8	—	FT4232H-56Q-REEL	FTDI, Future Technology Devices International Ltd	USB Bridge, USB to UART,FIFO USB 2.0 FIFO Interface 56-VQFN (8x8)

Item	Reference	Qty	Part	PCB Footprint	Comment	Manufacturer Part Number	Manufacturer	Description
64	U11	1	93LC56C-ISN	SOIC8-N	—	93LC56C-ISN	Microchip Technology	EEPROM Memory IC 2Kbit Microwire 3 MHz 8-SOIC
65	U12	1	TPS259814ARPWR	VQFN10_RPW_TEX	—	TPS259814ARPWR	Texas Instruments	2.7-V TO 16-V, 10-A, 6-M EFUSE W
66	U13	1	TPSM82822SILR	10-uSIP_2p5x2	—	TPSM82822SILR	Texas Instruments	5.5-V INPUT, 2-A STEP-DOWN MODUL
67	U14,U15	2	INA236A	SOT23-8_DDF_TEX	—	INA236AIDDFR	Texas Instruments	Current Monitor Regulator High/Low-Side TSOT-23-8
68	U20,U21	2	SPH0645LM4H-B	SPH0645LM4H-B	—	SPH0645LM4H-B	Syntiant	20 Hz ~ 10 kHz Digital, I2S Microphone MEMS (Silicon) 1.62 V ~ 3.6 V Omnidirectional (-26dB ±3dB @ 94dB SPL) Solder Pads
69	U22	1	TPS7A2018YCK	4-DSBGA	—	TPS7A2018YCKR	Texas Instruments	IC REG LINEAR 1.8V 300MA 4-DSBGA
70	Y1	1	SXT32418BB16-12.000M	SXT32418BB16-12p000M	—	SXT32418BB16-12.000M	Suntsu Electronics, Inc	12 MHz ±30ppm Crystal 18pF 100 Ohms 4-SMD, No Lead
71	Stand offs	4	—	—	—	9774025151R	Wurth Elektronik	"WA-SMSI SMT Steel Spacer with
72	TORNA SOM CARRIER BOARD REVA PCB	1	—	—	—	305-PD-25-0428	PACTRON	—

Note:
For J24 procurement, one part is enough for all the 5 boards. It is a 40-pin breakaway part.

References

- CertusPro-NX Family Devices web page
- CertusPro-NX System on Module (SoM) Board web page
- CertusPro-NX Multi-Object Detection on SOM Board Demo User Guide (FPGA-UG-02247)
- CertusPro-NX Family Data Sheet (FPGA-DS-02086)
- Lattice Boards for CertusPro-NX Devices
- Lattice Radiant FPGA Design Software web page
- Lattice Diamond FPGA Design Software web page
- Lattice Propel Design Environment web page
- Raspberry Pi web page
- RealVNC software web page
- Lattice Insights for Lattice Semiconductor training courses and learning plans

Technical Support Assistance

Submit a technical support case through www.latticesemi.com/techsupport.

For frequently asked questions, refer to the Lattice Answer Database at www.latticesemi.com/Support/AnswerDatabase.

Revision History

Revision 0.80, January 2026

Section	Change Summary
All	Initial preliminary release.

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