



Lattice Sentry 4.0 Demo Board for MachXO5D-NX

Evaluation Board User Guide

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Abbreviations in This Document

A list of abbreviations used in this document.

Abbreviation	Definition
BMC	Baseboard Management Controller
CPLD	Complex Programmable Logic Device
DC	Direct Current
ESD	Electrostatic Discharge
eSPI	Enhanced Serial Peripheral Interface
FPGA	Field Programmable Gate Array
FTDI	Future Technology Devices International
HPM	Host Processor Module
I2C	Inter-Integrated Circuit
I3C	Improved Inter-Integrated Circuit
JTAG	Joint Test Action Group
LDO	Low-Drop Out
LTPI	LVDS Tunneling Protocol Interface
OOB	Out-Of-Band
PCH	Platform Controller Hub
PFR	Platform Firmware Resiliency
QSPI	Quad Serial Peripheral Interface
SCM	Secure Control Module
SFB	SoC Function Block
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus

1. Introduction

The purpose of this document is to introduce the hardware resources and basic functions of the Lattice Sentry™ 4.0 Demo Board for MachXO5D™-NX.

This user guide includes functional descriptions of the various hardware modules of Lattice Sentry 4.0 Demo Board for MachXO5D-NX. It also provides descriptions of the onboard connectors, status LEDs, switches, push buttons, Interfaces and JTAG function enablement.

1.1. Overview

The Lattice Sentry4.0 Demo Board for MachXO5D-NX is a single-board, system-level demo environment for the Lattice Platform Firmware Resiliency (PFR) system security solution. The demo board includes three main devices:

- **MachXO5-NX – LFMXO5-55TD-9BBG400C**
This device is a next generation FPGA with enhanced security features including hardware root-of-trust and dual boot flash comprised of SoC Function Block (SFB) and FPGA partitions. For a complete description of the MachXO5-NX Root-of-Trust (RoT) devices, refer to [MachXO5-NX Family Root-of-Trust Devices Data Sheet \(FPGA-DS-02102\)](#).
- **CertusPro-NX – LFCPNX-100-LFG672**
This device is part of the CertusPro-NX family of FPGA devices that are optimized to deliver high performance through advanced in-device architecture and the use of 28 nm technology. These make the device suitable for high-volume, high-speed, affordable applications. For a complete description of the CertusPro-NX device, refer to [CertusPro-NX Family Data Sheet \(FPGA-DS-02086\)](#). This Part used to simulate the Baseboard management controller (BMC) behavior and the Platform controller hub (PCH) Behavior.
- **MachXO3D – LCMXO3D-9400HC-5BG484C**
This device is part of the MachXO3D family of FPGA Devices that are optimized for immutable embedded security block, enhanced control functions. For a complete description of the MachXO3D device, refer to [MachXO3D Family Data Sheet \(FPGA-DS-02026\)](#).

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX demonstrates the Lattice PFR system security capability on a hardware platform that can be controlled through a dedicated user interface on a PC workstation. This board allows you to take advantage of the enhanced security features and greater configurability of the MachXO5D-NX part.

The MachXO5D-NX part authenticates the boot code of the CertusPro-NX (BMC&PCH) devices. It detects illegal flash operations, blocks them, and automatically recovers damaged boot images. Before the system boots up and throughout its operation, these functions provide security at the hardware level.

[Figure 1.1](#) and [Figure 1.2](#) show the top view and the bottom view of the Lattice Sentry 4.0 Demo Board for MachXO5D-NX respectively.

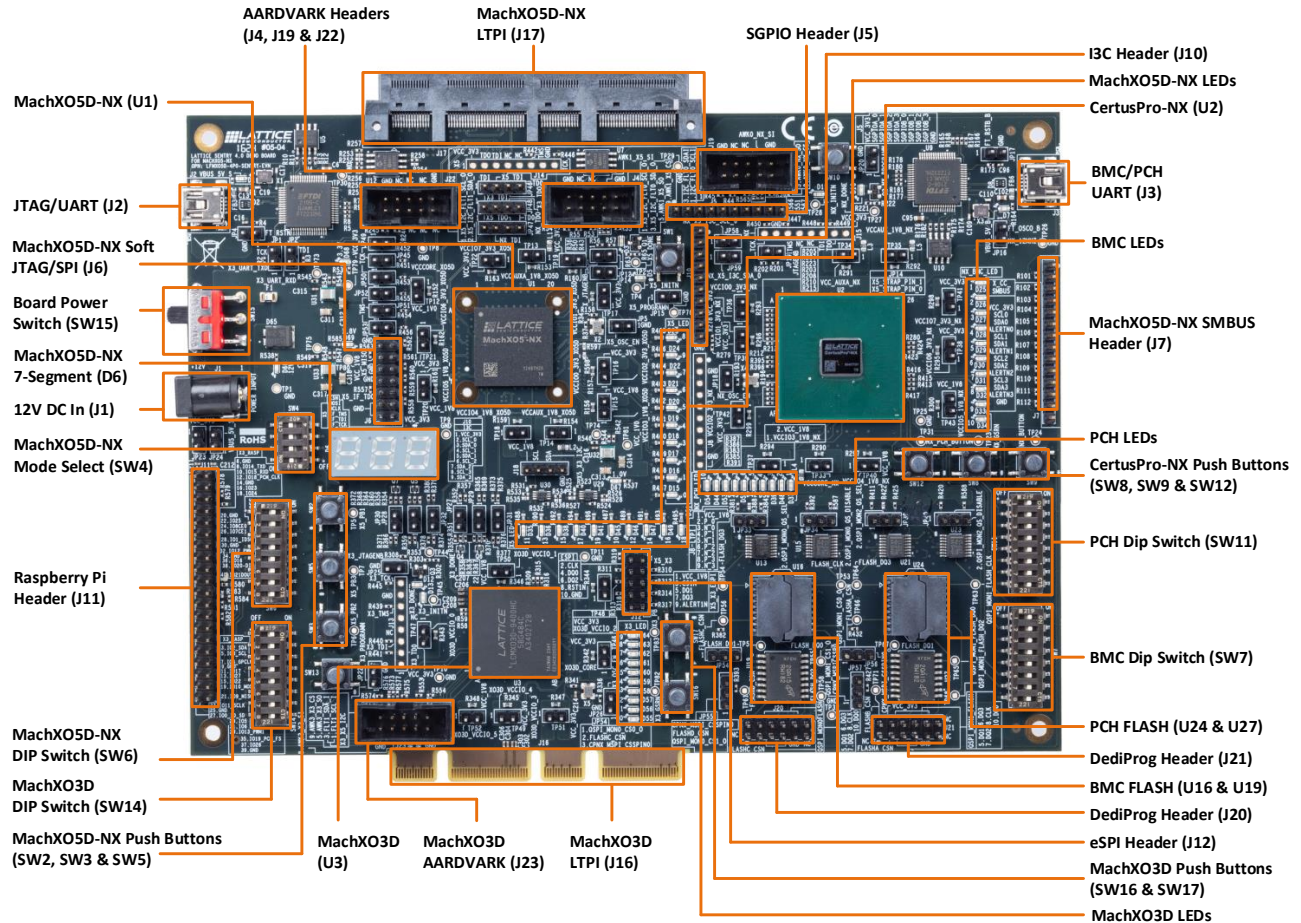


Figure 1.1. Lattice Sentry 4.0 Demo Board for MachXO5D-NX, Top View

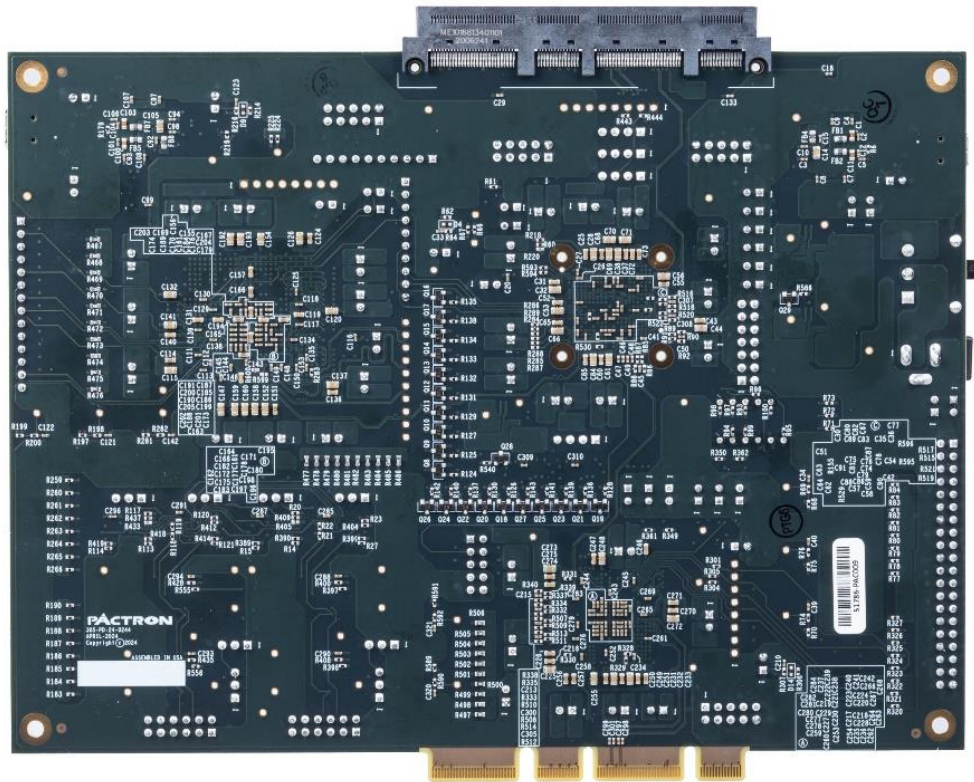


Figure 1.2. Lattice Sentry 4.0 Demo Board for MachXO5D-NX, Bottom View

2. Features

The key features of the Lattice Sentry 4.0 Demo Board for MachXO5D-NX are:

- Lattice security solution PFR demo support
- PFR system-level behavior validation
- USB connection for device programming
- USB connection for UART communication to PFR firmware
- Four 1 Gb SPI/QSPI flash devices with SMT mount IC and Socket Mount IC for device configuration and firmware image storage.
- Flexible expansion Raspberry Pi header
- I3C, I2C, SMBUS, LTPI, GPIO/SGPIO/MPESTI, and eSPI Interfaces
- LEDs, switches, and push buttons for all three FPGAs
- Lattice Diamond® and Lattice Radiant® programming support
- Lattice Propel SDK, Builder, and PFR interface support

Caution The Lattice Sentry 4.0 Demo Board for MachXO5D-NX contains ESD-sensitive components. ESD safe practices should be followed while handling and using the demo board.

To prevent power surge impact on the USB port, remove the USB cable before you plug in or remove the 12 V DC power cable.

3. Power Supply

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX comes ready to power up. This board can power up using a 12 V DC power source input. The power supply connects with the right-angle DC power input jack J1, which is fused with a surface mounted fuse F1.

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX contains three logic devices. It works within appropriate power supply conditions. Using an incorrect power supply may cause permanent device and board damage. The recommended operating conditions can be found in [CertusPro-NX Device Family Data Sheet \(FPGA-DS-02086\)](#), [MachXO5-NX Family Root-of-Trust \(RoT\) Devices Data Sheet \(FPGA-DS-02102\)](#) and [MachXO3D Family Data Sheet \(FPGA-DS-02026\)](#). The 5 A fuse prevents the crashed current from flowing into the internal circuits and cause serious damage. The power supply architecture is shown below in [Figure 3.1](#).

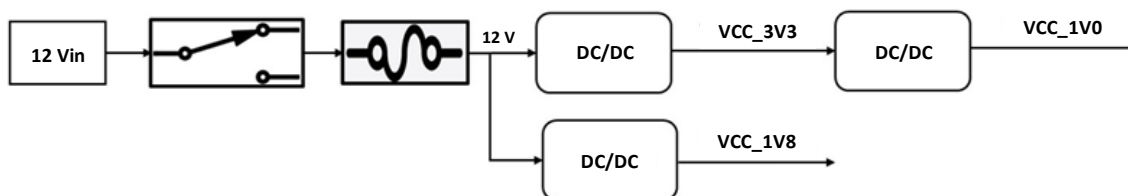


Figure 3.1. Power Supply Architecture

The board LEDs provide a visual indication of power status as listed in [Table 3.1. Power Status LEDs](#).

Table 3.1. Power Status LEDs

LED Designator	Color	Description
D66	Green	12 V Power Input (J1)
D68	Green	3.3 V power on
D69	Green	1.8 V power on
D67	Green	1.0 V power on. 1.0 V is the core power.

4. Programming and Configuration

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has a built-in download controller for programming the MachXO5D-NX, CertusPro-NX (BMC & PCH), and MachXO3D devices. The built-in module consists of a Mini-USB connector and an FTDI device. This module translates USB format data into JTAG type stream and allows you to configure the FPGA directly through a USB cable. To use the built-in download controller, connect a standard Mini-B USB to a type-A USB cable from J2 to your PC. J2 connector is used to program all the three devices. The USB hub on the PC detects the addition of the USB function and allows you to use the built-in download controller with the programming software.

4.1. Setting Configuration Mode

The MachXO5D-NX, CertusPro-NX (BMC & PCH), and MachXO3D devices support a variety of configuration modes, including 1149.1 JTAG and Master SPI. For detailed information, refer to the [MachXO5-NX Programming and Configuration User Guide \(FPGA-TN-02271\)](#), [Common Programming and Configuration CertusPro-NX \(FPGA-AN-02048\)](#) and [MachXO3D Programming and Configuration User Guide \(FPGA-TN-02069\)](#).

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX supports various JTAG chain options to scan individual or certain combinations of devices. The jumper setting to scan all devices in the JTAG chain is shown in [Figure 4.1](#) and [Table 4.1](#). The configuration to scan the MachXO5D-NX only is shown in [Figure 4.2](#) and [Table 4.2](#). Other configuration JTAG jumper settings are provided in [Figure 4.3](#), [Table 4.3](#), [Figure 4.4](#), and [Table 4.4](#).

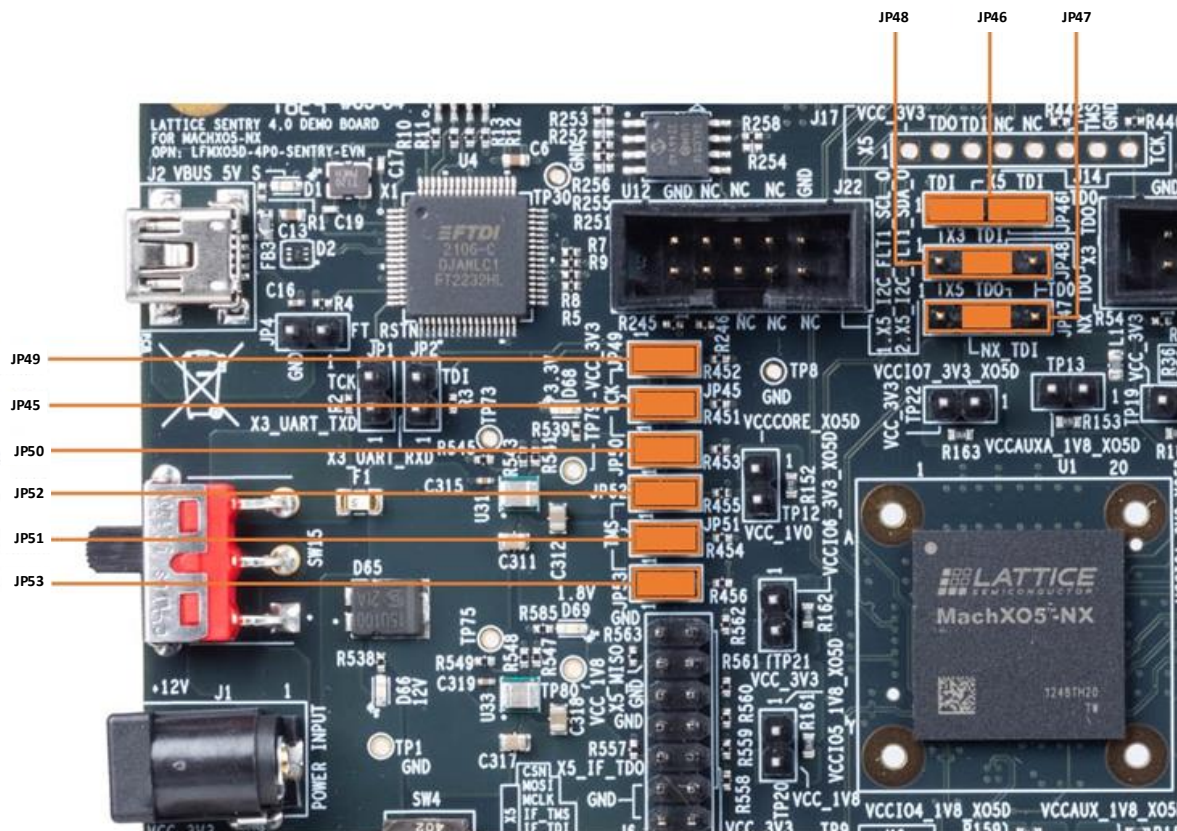


Figure 4.1. JTAG All Devices Chain Jumper Setting

Table 4.1. Jumper Settings for All Devices Configuration

Jumper Name	Connection
JP45	Short
JP46	1-2 and 3-4
JP47	2-3
JP48	2-3
JP49	Short
JP50	Short
JP51	Short
JP52	Short
JP53	Short

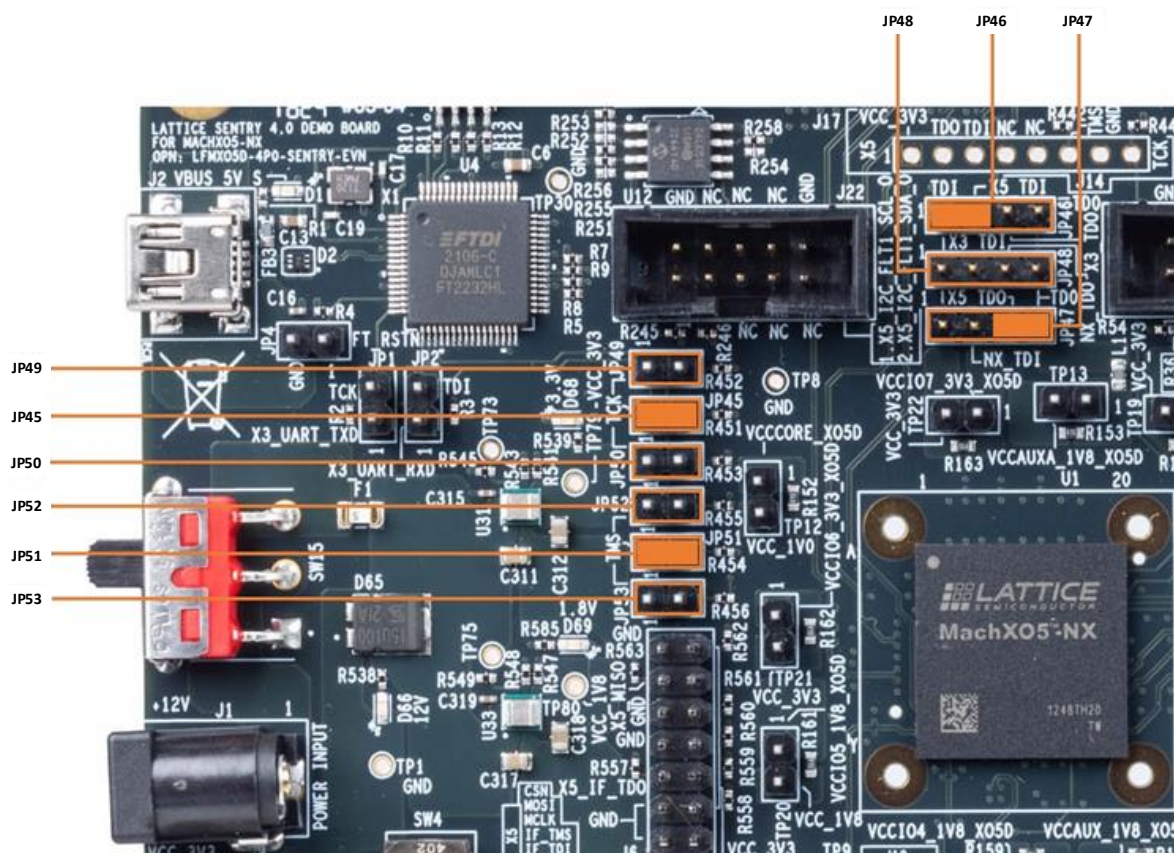


Figure 4.2. MachXO5D-NX JTAG Chain Jumper Setting

Table 4.2. Jumper Settings for MachXO5D-NX Configuration

Jumper Name	Connection
JP45	Short
JP46	1-2
JP47	3-4
JP48	Open
JP49	Open
JP50	Open
JP51	Short
JP52	Open
JP53	Open

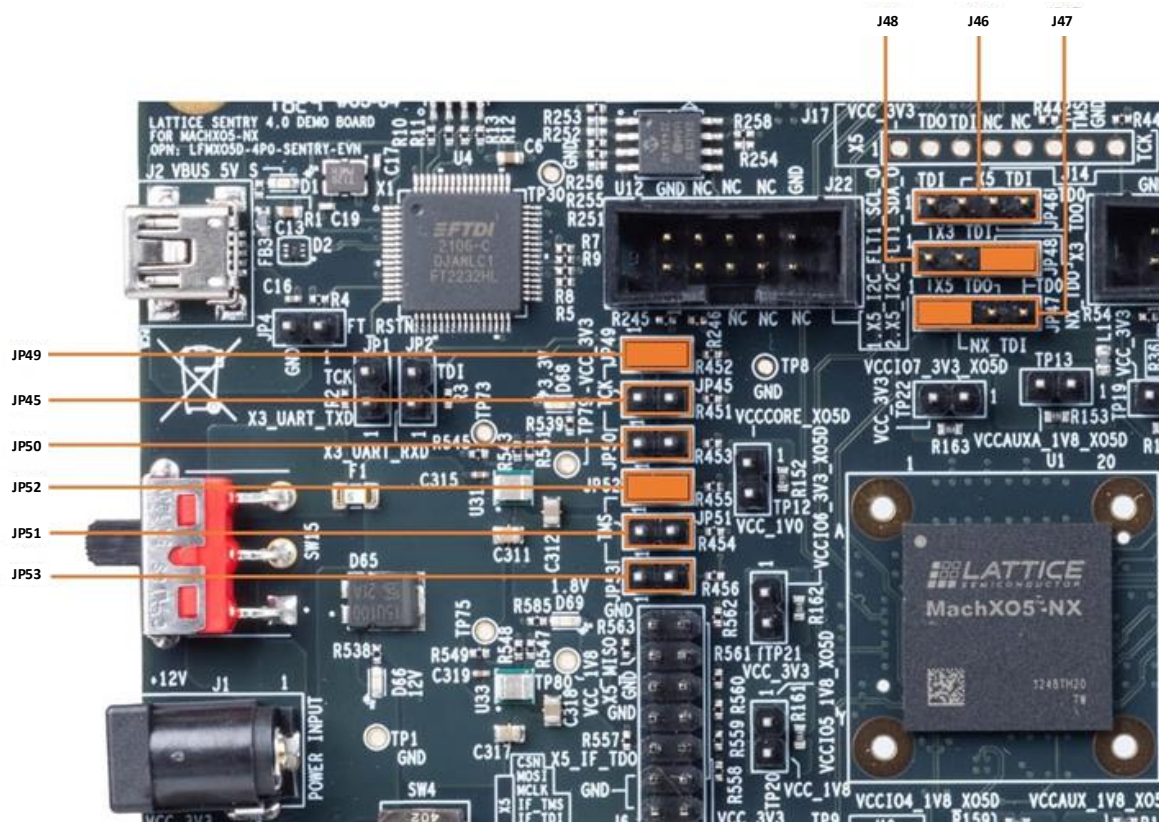


Figure 4.3. CertusPro-NX Chain Jumper Setting

Table 4.3. Jumper Settings for CertusPro-NX Configuration

Jumper Name	Connection
JP45	Open
JP46	Open
JP47	1-2
JP48	3-4
JP49	Short
JP50	Open
JP51	Open
JP52	Short
JP53	Open

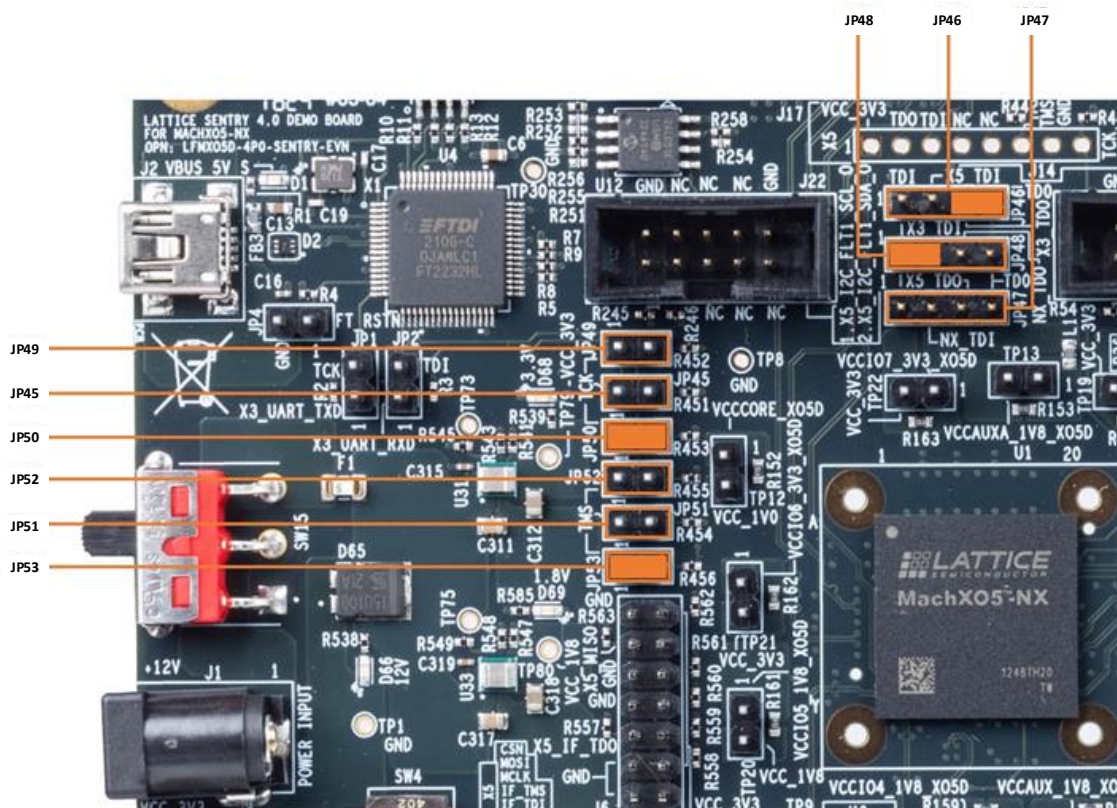


Figure 4.4. MachXO3D JTAG Chain Jumper Settings

Table 4.4. Jumper Settings for MachXO3D Configuration

Jumper Name	Connection
JP45	Open
JP46	3-4
JP47	Open
JP48	1-2
JP49	Open
JP50	Short
JP51	Open
JP52	Open
JP53	Short

Connectors J13, J14 and J15 are DNP in actual EVK. This connector is used to program FPGAs device using JTAG programmer. Connector J13 is used for MachXO3D, J14 is used for MachXO5D-NX and J15 is used for CertusPro-NX.

4.2. Programming LEDs and Buttons

There is individual programming buttons used to reload SRAM content from flash for each device as well as LEDs that indicate programming status. Locations are shown in [Figure 4.5](#) and [Table 4.5](#).

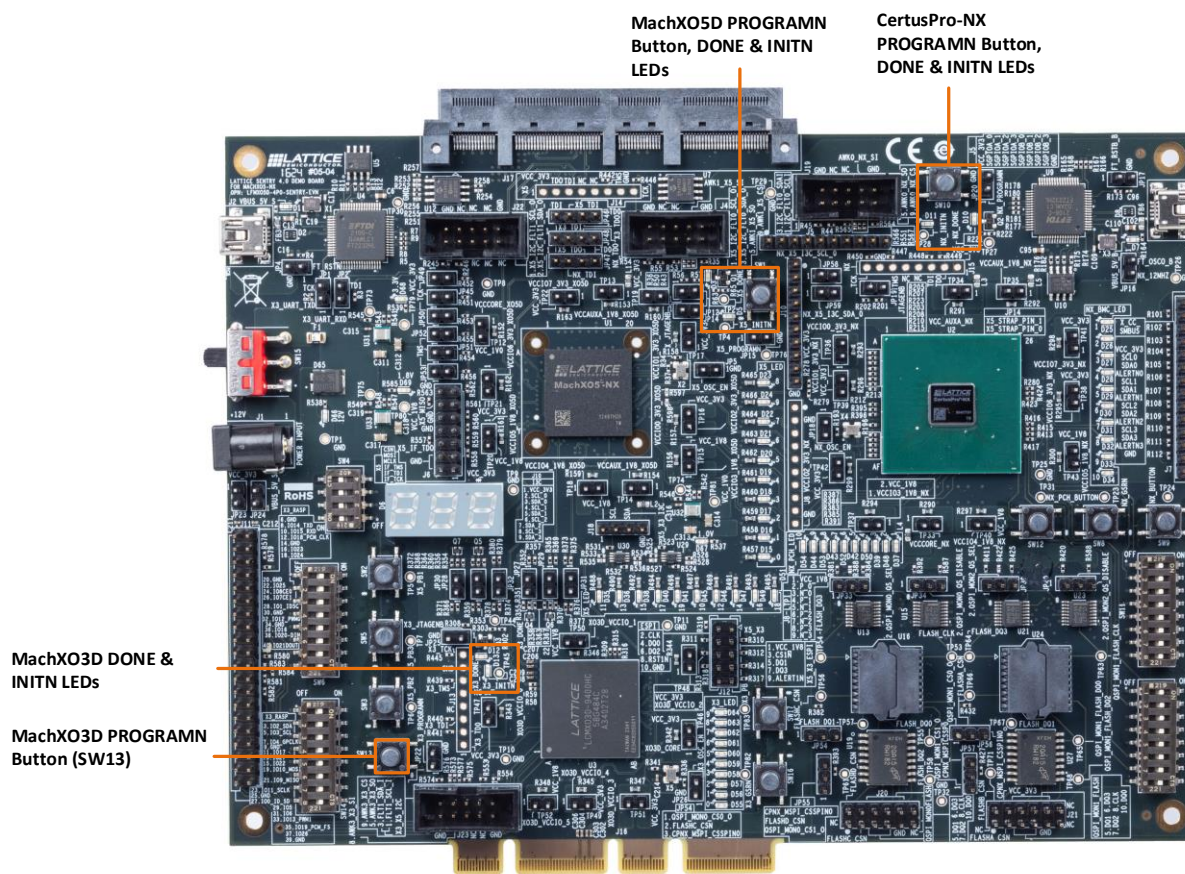


Figure 4.5 Location of Configuration Buttons and LEDs

Table 4.5. Programming Status LED Definitions

LED Designator	Color	Description
D5	Green	Indicates that the programming of the MachXO5D-NX device is aborted or reinitialized, driving the INITN output low.
D3	Green	Indicates that the configuration of the MachXO5D-NX device is completed successfully by releasing the open collector DONE output pin.
D11	Green	Indicates that the programming of the CertusPro-NX device is aborted or reinitialized, driving the INITN output low.
D10	Green	Indicates that the configuration of the CertusPro-NX device is completed successfully by releasing the open collector DONE output pin.
D13	Green	Indicates that the programming of the XO3D device is aborted or reinitialized, driving the INITN output low.
D12	Green	Indicates that the configuration of the XO3D device is completed successfully by releasing the open collector DONE output pin.

4.3. Programming Flash Memory

In the Lattice Sentry 4.0 Demo Board for MachXO5D-NX, the device loads its program from its internal flash memory and the CertusPro-NX loads its program from one of the four external SPI flash. Of the four SPI flash devices, Flash A (U24) and Flash B (U27) belong to the CertusPro-NX (PCH) device and Flash C (U16) and Flash D (U19) belong to the CertusPro-NX (BMC) device. Before starting to program external SPI flash, configure the jumpers as indicated in [Table 4.6](#). The jumpers are located next to the four flash devices.

Table 4.6. Programming Jumper Description

Jumper Designator	Description
JP56/JP57	This Jumper is used to select the PCH flash A and chip select source.
JP39	This Jumper is used to control the select pin of MUX IC U21 and U23.
JP40	This Jumper is used to control the Output Enable Pin of MUX IC U21 and U23.
J21	J21 Used to program the PCH flash directly from Flash programmer.
JP54/JP55	This Jumper is used to select the BMC flash C and BMC Flash D chip select source.
JP33	This Jumper is used to control the select Pin of MUX IC U13 and U15.
JP34	This Jumper is used to control the Output Enable Pin of MUX IC U13 and U15.
J20	This header Used to program the PCH flash C and D directly from Flash programmer.

The four FLASH chips can be programmed either through the Certus-Pro-NX JTAG-to-SPI bridge or via the programming headers J20 and J21. [Table 4.7](#) lists the jumper settings for the various FLASH programming options.

Table 4.7. Programming Jumper Selection

Target Flash Programming	JP56	JP57	JP39	JP40	JP54	JP55	JP33	JP34
Flash A or B via header J21	Open	Open	Short 1-2	Short 1-2	NA	NA	NA	NA
Flash C or D via header J20	NA	NA	NA	NA	Open	Open	Short 1-2	Short 1-2
Flash A via JTAG-to-SPI	Short 2-3	Open	Short 2-3	Short 2-3	NA	NA	NA	NA
Flash B via JTAG-to-SPI	Open	Short 2-3	Short 2-3	Short 2-3	NA	NA	NA	NA
Flash C via JTAG-to-SPI	NA	NA	NA	NA	Short 2-3	Open	Short 2-3	Short 2-3

Target Flash Programming	JP56	JP57	JP39	JP40	JP54	JP55	JP33	JP34
Flash D via JTAG-to-SPI	NA	NA	NA	NA	Open	Short 2-3	Short 2-3	Short 2-3
PFR Demo	Short 1-2	Short 1-2	Open	Open	Short 1-2	Short 1-2	Open	Open

Two SPI (16-pin SO16W, and 1 Gb) flash memory devices are onboard for non-volatile configuration memory storage. Two SPI Flash sockets are mounted on the board where you can install SOIC 16-pin package. The Micron MT25QL01GBBB8ESF-0SIT device is populated on the current PCB version. When programming external flash, the Lattice Radiant® Programmer locates and indicates the device in the Device Properties dialog box. The SPI flash memory device can be configured through the USB cable. The Master SPI configuration mode enables the three main devices to be programmed at power-up or assertion of PROGRAMN by the bitstream stored in the internal and external memories.

5. FPGA/CPLD Resources

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX supports various development resources including 50 LEDs, 20 of which belong to CertusPro-NX device (10 LEDs belong to BMC and 10 LEDs belong to PCH), 20 LEDs for MachXO5D-NX devices and 10 LEDs for MachXO3L devices. There is a 3-digit 7-segment LED, which belongs to the MachXO5D-NX part. There are 16 switches for the CertusPro-NX device in which eight each for the BMC and PCH. Also, there are eight switches for MachXO5D-NX and eight switches for MachXO3D device. There are eight push buttons for MachXO5D-NX, CertusPro-NX and MachXO3D devices. You can utilize these resources through the FPGA/CPLD logic coding.

5.1. General Purpose LEDs

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has 50 LEDs that are connected to general purpose I/O. These green LEDs are visual status indicators for user designs. The LEDs are illuminated when the FPGA/CPLD output is driven LOW.

Table 5.1 shows the CertusPro-NX (BMC) LEDs and associated pins name. Table 5.2 shows the CertusPro-NX (PCH) LEDs and associated pins name. Table 5.3 shows the MachXO5D-NX LEDs and associated pins name. Table 5.4 shows the MachXO3L LEDs and associated pins name. These pins are within an I/O bank connected to 3.3 V and you should program these pins to be LVCMOS33 type output in your design.

Table 5.1. CertusPro-NX (BMC) LEDs Definitions

LED Designator	CertusPro-NX U2 Pin Number	Signal Name
D25	L24	NX_BMC_LED_1
D26	L23	NX_BMC_LED_2
D27	L22	NX_BMC_LED_3
D28	L20	NX_BMC_LED_4
D29	L19	NX_BMC_LED_5
D30	M26	NX_BMC_LED_6
D31	N26	NX_BMC_LED_7
D32	N25	NX_BMC_LED_8
D33	N24	NX_BMC_LED_9
D34	N22	NX_BMC_LED_10

Table 5.2. CertusPro-NX (PCH) LEDs Definitions

LED Designator	CertusPro-NX U2 Pin Number	Signal Name
V4	D37	NX_PCH_LED_1
V5	D48	NX_PCH_LED_2
V6	D39	NX_PCH_LED_3
W7	D50	NX_PCH_LED_4
W6	D42	NX_PCH_LED_5
W5	D52	NX_PCH_LED_6
W2	D43	NX_PCH_LED_7
W2	D53	NX_PCH_LED_8
Y1	D44	NX_PCH_LED_9
Y4	D54	NX_PCH_LED_10

Table 5.3. MachXO5D-NX LEDs Definitions

LED Designator	MachXO5D-NX U1 Pin Number	Signal Name
D15	R14	X5_LED_0
D16	R15	X5_LED_1
D17	N16	X5_LED_2
D18	P16	X5_LED_3
D19	M17	X5_LED_4
D20	M16	X5_LED_5
D21	P19	X5_LED_6
D22	P20	X5_LED_7
D23	P17	X5_LED_8
D24	P18	X5_LED_9
D45	W10	X5_LED_10
D35	P12	X5_LED_11
D46	R12	X5_LED_12
D36	P11	X5_LED_13
D47	V12	X5_LED_14
D38	W11	X5_LED_15
D49	V11	X5_LED_16
D40	U12	X5_LED_17
D51	W13	X5_LED_18
D41	W12	X5_LED_19

Table 5.4. MachXO3D LEDs Definitions

LED Designator	MachXO3D U3 Pin Number	Signal Name
D55	T1	X3_LED_0
D56	U1	X3_LED_1
D57	R2	X3_LED_2
D58	T2	X3_LED_3
D59	R3	X3_LED_4
D60	T3	X3_LED_5
D61	R4	X3_LED_6
D62	T4	X3_LED_7
D63	R5	X3_LED_8
D64	T5	X3_LED_9

5.2. 7-Segment LEDs

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has 3-digit 7-segment LEDs that are connected to the MachXO5D-NX device general purpose I/O. These LEDs are visual status indicators for user designs. The LEDs are illuminated for the digit when the FPGA/CPLD output is driven LOW, and for each segment when the FPGA/CPLD output is driven HIGH.

Table 5.5 shows the MachXO5D-NX 7-segment LEDs and associated pins name. These pins are within an I/O bank connected to 3.3 V and you should program these pins to be LVCMOS33 type output in your design.

Table 5.5. MachXO5D-NX 7-Segment LED Definitions

LED Designator	MachXO5D-NX U1 Pin Number	Signal Name
D6.3	J10	X5_SEG_DP_B
D6.11	K19	X5_SEG_A_B
D6.7	K15	X5_SEG_B_B
D6.4	K16	X5_SEG_C_B
D6.2	K11	X5_SEG_D_B
D6.1	K12	X5_SEG_E_B
D6.10	K13	X5_SEG_F_B
D6.5	K14	X5_SEG_G_B
D6.12	J11	X5_K_DIG1
D6.8	K10	X5_K_DIG3
D6.9	J12	X5_K_DIG2

5.3. General Purpose DIP Switches

General purpose FPGA/CPLD pins are available for user applications. FPGA/CPLD pins are connected to DIP switches SW7, SW11, SW14 and SW6. SW7 belongs to CertusPro-NX (BMC) and SW11 belongs to the CertusPro-NX (PCH) device, SW14 belongs to the MachXO3D device and SW6 belong to the MachXO5D-NX part. Switch position OFF is indicated with the logic 1 input. The switches are connected to logic level 0 input when moved to the ON position. You should program these pins to be LVCMOS33 type output in your design. [Table 5.6](#), [Table 5.7](#), [Table 5.8](#), and [Table 5.9](#) show the switches and associated FPGA/CPLD pins.

Table 5.6. CertusPro-NX (BMC) Pins to DIP Switch Position

SW7 DIP Switch Position	CertusPro-NX (BMC) U2 Pin Number	Signal Name
SW7.1	V24	NX_BMC_DIP_SW1
SW7.2	V25	NX_BMC_DIP_SW2
SW7.3	V23	NX_BMC_DIP_SW3
SW7.4	V22	NX_BMC_DIP_SW4
SW7.5	U26	NX_BMC_DIP_SW5
SW7.6	W26	NX_BMC_DIP_SW6
SW7.7	W24	NX_BMC_DIP_SW7
SW7.8	W23	NX_BMC_DIP_SW8

Table 5.7. CertusPro-NX (PCH) Pins to DIP Switch Position

SW11 DIP Switch Position	CertusPro-NX (PCH) U2 Pin Number	Signal Name
SW11.1	P26	NX_PCH_DIP_SW1
SW11.2	P25	NX_PCH_DIP_SW2
SW11.3	P24	NX_PCH_DIP_SW3
SW11.4	P23	NX_PCH_DIP_SW4
SW11.5	P22	NX_PCH_DIP_SW5
SW11.6	P21	NX_PCH_DIP_SW6
SW11.7	R21	NX_PCH_DIP_SW7
SW11.8	R19	NX_PCH_DIP_SW8

Table 5.8. MachXO3D Pins to DIP Switch Position

SW14 DIP Switch Position	MachXO3D U3 Pin Number	Signal Name
SW14.1	E22	X3_DIP_SW1
SW14.2	F22	X3_DIP_SW2
SW14.3	G22	X3_DIP_SW3
SW14.4	E21	X3_DIP_SW4
SW14.5	G21	X3_DIP_SW5
SW14.6	E20	X3_DIP_SW6
SW14.7	G20	X3_DIP_SW7
SW14.8	E19	X3_DIP_SW8

Table 5.9. MachXO5D-NX Pins to DIP Switch Position

SW6 DIP Switch Position	MachXO5D-NX U1 Pin Number	Signal Name
SW6.1	P2	X5_DIP_SW1
SW6.2	R2	X5_DIP_SW2
SW6.3	U2	X5_DIP_SW3
SW6.4	P5	X5_DIP_SW4
SW6.5	P1	X5_DIP_SW5
SW6.6	R1	X5_DIP_SW6
SW6.7	R4	X5_DIP_SW7
SW6.8	P4	X5_DIP_SW8

5.4. General Purpose Clock Sources

There are five clock sources available on the board, as shown in [Table 5.10](#).

Table 5.10. FPGA/CPLD Clock Source

Clock Source	Clock Frequency (MHz)	CertusPro-NX (BMC/PCH) U2 Pin Number	MachXO5D-NX U1 Pin Number	MachXO3D U3 Pin Number	Comment
X2	25	—	F20	—	Closing JP5, or output 0 to pin U1. E20 of the U1 device to disable clock output.
X3	12	N23	—	—	Closing JP16 to enable clock input.
X4	25	R8	—	—	Closing JP18, or output 0 to pin U2. R5 of the U2 device to disable clock output.
X5	25	—	—	U2	Closing JP26, or output 0 to pin U3. U2 of the device to disable clock output.

5.5. Push Buttons

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has eight push buttons for general or dedicated purpose FPGA/CPLD pins. [Table 5.11](#), [Table 5.12](#), [Table 5.13](#), and [Table 5.14](#) below describe the function and connections of the push buttons. When a push button is pressed, the logic 0 is sent to FPGA/CPLD. You must program inputs to be the LVCMOS33 type in the design for the push buttons.

Table 5.11. Push Buttons to CertusPro-NX(BMC) Pins Position

Push Button Designator	CertusPro-NX U2 Pin Number	Signal Name
SW8	R6	NX_GSRN
SW9	N9	NX_BUTTON

Table 5.12. Push Buttons to CertusPro-NX (PCH) Pins Position

Push Button Designator	CertusPro-NX (BMC/PCH) U2 Pin Number	Signal Name
SW12	AB2	NX_PCH_BUTTON

Table 5.13. Push Buttons to MachXO5D-NX Pins Position

Push Button Designator	MachXO5D-NX U1 Pin Number	Signal Name
SW2	T2	X5_PB1
SW3	T5	X5_PB2
SW5	U5	X5_PB3

Table 5.14. Push Buttons to MachXO3D Pins Position

Push Button Designator	MachXO3D U3 Pin Number	Signal Name
SW16	L1	X3_GSRN
SW17	R1	X3_PB

6. Board Interface Connections

This section describes the major board interfaces, which include chip-to-chip communication, quick switch control, I2C, I3C, LTPI, GPIO/SGPIO/MPESTI SPI, OOB, eSPI, UART, and Raspberry Pi.

6.1. SPI/QSPI Monitor Connections

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX provides two SPI/QSPI monitor paths. The MachXO5D-NX part can detect and block illegal data transaction by these paths. The signal definitions of the MachXO5D-NX part are provided in [Table 6.1](#), [Table 6.2](#), and [Table 6.3](#).

Table 6.1. MachXO5D-NX SPI/QSPI Monitor Interface Definitions

MachXO5D-NX U1 Pin Number	Signal Name	Signal Comment
C17	QSPI_MON0_QS_SEL	Quick switches enable signal
D16	QSPI_MON0_QS_DISABLE	Quick disable switch output signal
M20	X5_FLASHC_RSTN	Reset Flash C device
M19	X5_FLASHD_RSTN	Reset Flash D device
C22	QSPI_MON0_CS0_O	Flash C selection signal
D22	QSPI_MON0_CS1_O	Flash D selection signal
F18	QMON0_CSN0	Flash chip select monitor
E18	QMON0_CSN1	Flash chip select monitor
G17	QMON0_SCLK	Flash clock signal
E19	QMON0_MOSI_DQ0	Flash data0 signal
G18	QMON0_MISO_DQ1	Flash data1 signal
F19	QMON0_DQ2	Flash data2 signal
G16	QMON0_DQ3	Flash data3 signal

Table 6.2. MachXO5D-NX SPI/QSPI Monitor Interface Definitions

MachXO5D-NX U1 Pin Number	Signal Name	Signal Comment
J8	QSPI_MON2_QS_SEL	Quick switches enable signal
N3	QSPI_MON2_QS_DISABLE	Quick disable switch output signal
L15	X5_FLASHA_RSTN	Reset Flash A device
L14	X5_FLASHB_RSTN	Reset Flash B device
L1	QSPI_MON1_CS0_O	Flash A chip select signal
L2	QSPI_MON1_CS1_O	Flash B chip select signal
K4	QSPI_MON1_CS0	Flash chip select monitor
K5	QSPI_MON1_CS1	Flash chip select monitor
K2	QSPI_MON1_CLK	Flash clock signal
K3	QSPI_MON1_DQ0	Flash data0 signal
K6	QSPI_MON1_DQ1	Flash data1 signal
K7	QSPI_MON1_DQ2	Flash data2 signal
J9	QSPI_MON1_DQ3	Flash data3 signal

Table 6.3 MachXO5D-NX J6 Header SPI/JTAG Interface Definitions

MachXO5D-NX U1 Pin Number	Signal Name	J6 Header	Signal Comment
H8	X5_CSN	J6.13	Header chip select signal
H6	X5_MCLK	J6.9	Header chip select signal
H5	X5_MOSI	J6.11	Header chip select signal
H7	X5_MISO	J6.12	Header chip select signal
H4	X5_IF_TDI	J6.5	Header JTAG TDI signal
H3	X5_IF_TCK	J6.3	Header JTAG TCK signal
H2	X5_IF_TDO	J6.6	Header JTAG TDO signal
H1	X5_IF_TMS	J6.7	Header JTAG TMS signal

6.2. CertusPro-NX SPI/QSPI and Control Interface

The CertusPro-NX (BMC) device has two SPI/QSPI data paths to access to external flash. The signal definitions of the CertusPro-NX (BMC) device are provided in [Table 6.4](#).

Table 6.4. CertusPro-NX (BMC) SPI/QSPI and Control Interface Definitions

CertusPro-NX U2 Pin Number	Signal Name	Signal Comment
L2	CPNX_QSPI1_CSN0	QSPI CS0 signal
L3	CPNX_QSPI1_CSN1	QSPI CS1 signal
R4	CPNX_QSPI1_SCLK	QSPI clock signal
M2	CPNX_QSPI1_DQ0	QSPI data0 signal
M1	CPNX_QSPI1_DQ1	QSPI data1 signal
N1	CPNX_QSPI1_DQ2	QSPI data2 signal
N2	CPNX_QSPI1_DQ3	QSPI data3 signal
G7	CPNX_MSPI_CSSPIN0	MSPI chip select signal
H7	CPNX_MSPI_DQ0_MOSI	MSPI data0 signal
H6	CPNX_MSPI_DQ1_MISO	MSPI data1 signal
K5	CPNX_MSPI_DQ2	MSPI data2 signal
H4	CPNX_MSPI_DQ3	MSPI data3 signal
H3	CPNX_QSPI_CSSPIN1	QSPI chip select signal
H2	QSPI_BMC_QS_SEL	Quick switch selection signal (BMC flash)

6.3. CertusPro-NX (PCH) SPI/QSPI and Control and Monitor Interface

The CertusPro-NX (PCH) device has one SPI/QSPI data path to access to external flash. The signal definitions of the CertusPro-NX (PCH) device are provided in [Table 6.5](#).

Table 6.5. CertusPro-NX SPI/QSPI and Control Interface Definitions

CertusPro-NX U2 Pin Number	Signal Name	Signal Comment
R26	CPNX_QSPI2_CSN0	QSPI CS0 signal
T24	CPNX_QSPI2_CSN1	QSPI CS1 signal
R20	CPNX_QSPI2_SCLK	QSPI clock signal
R25	CPNX_QSPI2_DQ0_MOSI	QSPI data0 signal
T22	CPNX_QSPI2_DQ1_MISO	QSPI data1 signal
T25	CPNX_QSPI2_DQ2	QSPI data2 signal
T26	CPNX_QSPI2_DQ3	QSPI data3 signal

Table 6.6. MachXO5D-NX and J21 Header SPI/QSPI Programming Header Interface Definitions

MachXO5D-NX U1 Pin Number	Signal Name	J21 Header	Signal Comment
—	FLASHA_CSN	J21.3	JP56 to be open for flash programming from Header
—	FLASHB_CSN	J21.2	JP57 to be open for flash programming from Header
K2	QSPI_MON1_FLASH_CLK	J21.8	QSPI_MON1_CLK Net name after resistor R17
K3	QSPI_MON1_FLASH_DQ0	J21.10	QSPI_MON1_DQ0 Net name after resistor R118
K6	QSPI_MON1_FLASH_DQ1	J21.5	QSPI_MON1_DQ1 Net name after resistor R119
K7	QSPI_MON1_FLASH_DQ2	J21.7	QSPI_MON1_DQ2 Net name after resistor R120
J9	QSPI_MON1_FLASH_DQ3	J21.6	QSPI_MON1_DQ3 Net name after resistor R121

6.4. CertusPro-NX (BMC) SPI/QSPI and Control and Monitor Interface

The Certus-Pro-NX (BMC) device has one SPI/QSPI data path to access to external flash. The signal definitions of the CertusPro-NX (PCH) device are provided in [Table 6.7](#) and [Table 6.8](#).

Table 6.7. CertusPro-NX SPI/QSPI and Control Interface Definitions

CertusPro-NX U2 Pin Number	Signal Name	Signal Comment
L2	CPNX_QSPI1_CSN0	QSPI CS0 signal
L3	CPNX_QSPI1_CSN1	QSPI CS1 signal
R4	CPNX_QSPI1_SCLK	QSPI clock signal
M2	CPNX_QSPI1_DQ0	QSPI data0 signal
M1	CPNX_QSPI1_DQ1	QSPI data1 signal
N1	CPNX_QSPI1_DQ2	QSPI data2 signal
N2	CPNX_QSPI1_DQ3	QSPI data3 signal

Table 6.8 CertusPro-NX J20 Header SPI/QSPI Programming Header Interface Definitions

CertusPro-NX U1 Pin Number	Signal Name	J21 Header	Signal Comment
—	FLASHC_CSN	J20.3	JP54 to be open for flash programming from Header
—	FLASHD_CSN	J20.2	JP55 to be open for flash programming from Header
G17	QMON0_SCLK	J20.8	QSPI_MON1_CLK net name after resistor R20
E19	QMON0_MOSI_DQ0	J20.10	QSPI_MON1_DQ0 net name after resistor R21
G18	QMON0_MISO_DQ1	J20.5	QSPI_MON1_DQ1 net name after resistor R22
F19	QMON0_DQ2	J20.7	QSPI_MON1_DQ2 net name after resistor R23
G16	QMON0_DQ3	J20.6	QSPI_MON1_DQ3 net name after resistor R27

6.5. OOB Interface

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has one OOB data path between the MachXO5D-NX and CertusPro-NX (BMC) devices, and the data can be encrypted and transmitted. The signal definitions of OOB path are provided in [Table 6.9](#).

Table 6.9. OOB Interface Definitions

MachXO5D-NX U1 Pin Number	CertusPro-NX (BMC) U2 Pin Number	Signal Name
E15	K7	NX_X5_INT_SIDEHAND
D15	K8	NX_X5_RND_SIDEHAND
B15	J1	NX_X5_SIDEHAND_D0
E13	J2	NX_X5_SIDEHAND_D1
E12	J3	NX_X5_SIDEHAND_D2
D14	J6	NX_X5_SIDEHAND_D3
C15	J7	NX_X5_SIDEHAND_D4

6.6. LTPI Interface

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX supports the LVDS Tunneling Protocol Interface (LTPI) in HPM and SCM Mode. There are four LTPI communication interfaces supported. The first is a direct onboard interface between the MachXO5D-NX and the MachXO3D devices, either device of which can support HPM or SCM mode. The second interface is a direct onboard interface between the MachXO5D-NX and the CertusPro-NX devices, either device of which can support HPM or SCM mode. The third interface is between the MachXO5D-NX that is acting as the HPM and connector J17. The final LTPI interface is between the MachXO3D that is acting as SCM and connector J16. The signal definition of the LTPI paths is provided in [Table 6.10](#), [Table 6.11](#), [Table 6.12](#), and [Table 6.13](#).

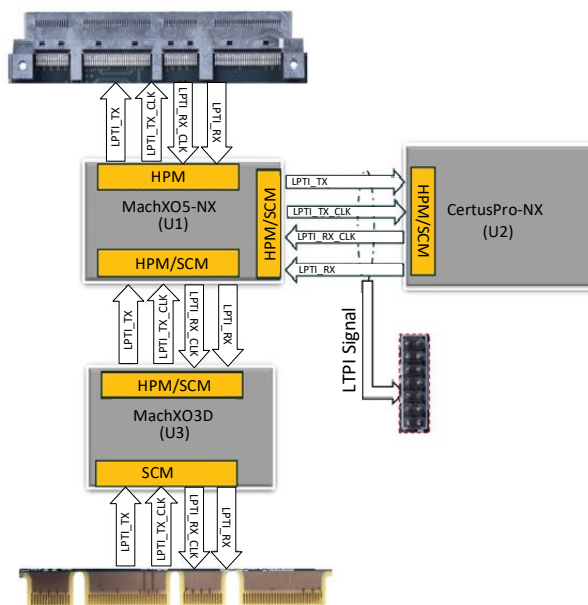


Figure 6.1. LTPI Interface Diagram

Table 6.10. LTPI Interface Definitions for MachXO5D-NX (HPM) to DC-SCM Connector J17

MachXO5D-NX U1 Pin Number	HPM Connector J17 Pin Number	Signal Name
P7	J17.A20	X05_HPM_RXD_N
P6	J17.A21	X05_HPM_RXD_P
P3	J17.A23	X05_HPM_RXCLK_N
R3	J17.A24	X05_HPM_RXCLK_P
T4	J17.B20	X05_HPM_TXD_N
U4	J17.B21	X05_HPM_TXD_P
U1	J17.B23	X05_HPM_TXCLK_N
T1	J17.B24	X05_HPM_TXCLK_P

MachXO5D-NX U1 Pin Number	HPM Connector J17 Pin Number	Signal Name
—	J17.A1	12V
—	J17.A2	12V
—	J17.A3	12V

Table 6.11. LTPI Interface Definitions for MachXO3D (SCM) to DC-SCM Connector J16

MachXO3D U3 Pin Number	SCM Gold Finger J16 Pin Number	Signal Name
E12	J16.A20	X03_SCM_TXD_N
D12	J16.A21	X03_SCM_TXD_P
B11	J16.A24	X03_SCM_TXCLK_P
A11	J16.A23	X03_SCM_TXCLK_N
AB11	J16.B20	X03_SCM_RXD_N
AA11	J16.B21	X03_SCM_RXD_P
AA10	J16.B23	X03_SCM_RXCLK_P
AB10	J16.B24	X03_SCM_RXCLK_N

Table 6.12. LTPI Interface Definitions for MachXO5D-NX to MachXO3D

MachXO5D-NX U1 Pin Number	MachXO3D U3 Pin Number	Signal Name
V4	AB12	X5_X3_LTPI_TXCLK_P
V5	AA12	X5_X3_LTPI_TXCLK_N
W2	AB13	X5_X3_LTPI_TXD_P
W3	AA13	X5_X3_LTPI_TXD_N
Y2	A18	X5_X3_LTPI_RXCLK_P
Y3	B19	X5_X3_LTPI_RXCLK_N
V1	C18	X5_X3_LTPI_RXD_P
W1	D18	X5_X3_LTPI_RXD_N

Table 6.13. LTPI Interface Definitions Shared among MachXO5D-NX, CertusPro-NX, and LTPI Header J8

MachXO5D-NX U1 Pin Number	CertusPro-NX U2 Pin Number	LTPI header J8	Signal Name
R19	AD10	J8.2	X5_NX_LTPI_P_0
R20	AE10	J8.3	X5_NX_LTPI_N_0
V20	AF10	J8.4	X5_NX_LTPI_P_1
W20	AF9	J8.5	X5_NX_LTPI_N_1
N20	AB11	J8.6	X5_NX_LTPI_P_2
N19	AC11	J8.7	X5_NX_LTPI_N_2
W18	Y11	J8.8	X5_NX_LTPI_P_3
V18	AA11	J8.9	X5_NX_LTPI_N_3

6.7. I2C Interface

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has multiple I2C paths. They can implement various types of I2C functions. In addition, several of the I2C paths can be accessed through an Aardvark connector, as discussed in the [Expansion Signals](#) section. The signal definitions of the I2C paths are provided in [Table 6.14](#), [Table 6.15](#), [Table 6.16](#), [Table 6.17](#), and [Table 6.18](#).

Table 6.14. I2C among CertusPro-NX, MachXO5D-NX, EEPROM, J4, and J19 Signal Definitions

CertusPro-NX (U2) Pin Number	MachXO5D-NX (U1) Pin Number	EEPROM (U7) Pin Number	J4 Pin Number	J19 Pin Number	Signal Name
M6	A18	—	—	J19.3	NX_X5_I2C_FLT0_SDA_I
M7	A19	—	—	J19.1	NX_X5_I2C_FLT0_SCL_I
—	H15	U7.5	J4.3	—	X5_I2C_FLT0_SDA_O
—	H16	U7.6	J4.1	—	X5_I2C_FLT0_SCL_O

Table 6.15. I2C among MachXO3D, MachXO5D-NX, EEPROM, J22, and J23 Signal Definitions

MachXO3D (U3) Pin Number	MachXO5D-NX (U1) Pin Number	EEPROM (U12) Pin Number	J22 Pin Number	J23 Pin Number	Signal Name
B9	M1	—	—	J23.3	X3_X5_I2C_FLT1_SDA_I
A9	M2	—	—	J23.1	X3_X5_I2C_FLT1_SCL_I
—	N2	U12.5	J22.3	—	X5_I2C_FLT1_SDA_O
—	N1	U12.6	J22.1	—	X5_I2C_FLT1_SCL_O

Table 6.16. I2C between MachXO5D-NX and CertusPro-NX Signal Definitions

MachXO5D-NX (U1) Pin Number	CertusPro-NX (U2) Pin Number	Signal Name
L18	K3	X5_NX_I2C1_SDA
M18	K2	X5_NX_I2C1_SCL

Table 6.17. Interconnections among MachXO3D, MachXO5D-NX, and J18 Signal Definitions

MachXO3D U3 Pin Number	MachXO5D-NX U1 Pin Number	J18 Pin Number	Signal Name
G1, G2	Y17	J18.2	X5_X3_I3C_SCL
H2, H1	W17	J18.3	X5_X3_I3C_SDA

Table 6.18. Interconnections between MachXO5D-NX, and EEPROM (U7) Signal Definitions

MachXO5D-NX U1 Pin Number	EEPROM U7 Pin Number	Signal Name
F15	U7.1	X5_EEPROM_1_ADR_A0
F16	U7.2	X5_EEPROM_1_ADR_A1
F17	U7.3	X5_EEPROM_1_ADR_A2
E17	U7.7	X5_EEPROM_1_WP
H16	U7.6	X5_I2C_FLT0_SCL_O
H15	U7.5	X5_I2C_FLT0_SDA_O

6.8. I3C Interface

The Lattice Sentry Demo Board for MachXO5D-NX has multiple I3C paths. They can implement various types of I3C functions. In addition, several of the I3C paths can be monitored through Header connector, as discussed in the [Expansion Signals](#) section. The signal definitions of the I3C paths are provided in [Table 6.19](#), and [Table 6.20](#).

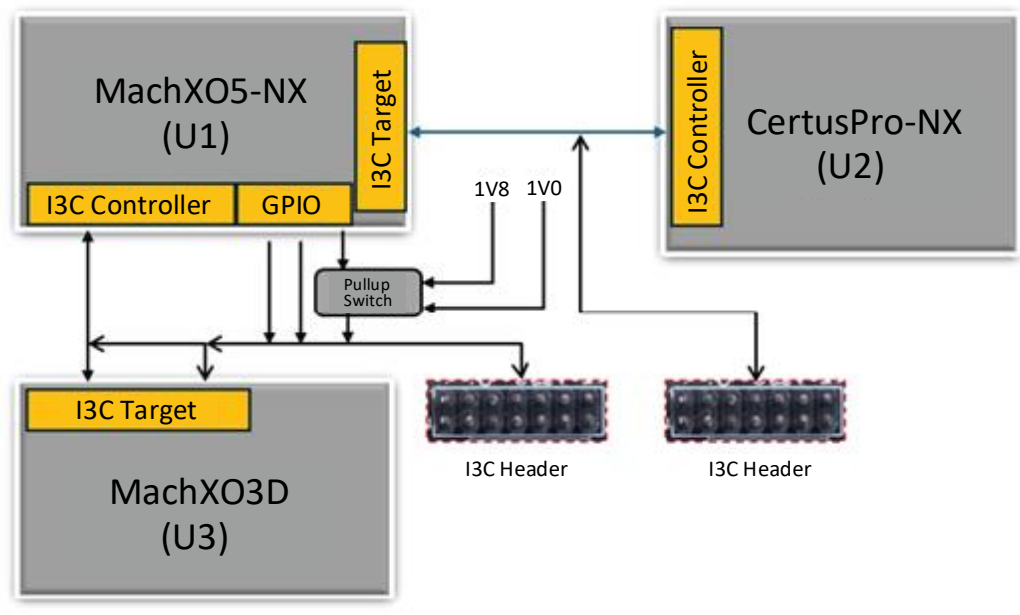


Figure 6.2. I3C Interface Diagram

Table 6.19. Interconnections among CertusPro-NX, MachXO5D-NX, and J18 Signal Definition

CertusPro-NX U2 Pin Number	MachXO5D-NX U1 Pin Number	J10 Pin Number	Signal Name	Comment
K19	N4	J10.2	NX_X5_I3C_SCL_0	JP58 jumper should be short.
K21	N5	J10.3	NX_X5_I3C_SDA_0	JP59 jumper should be short.
L21	L3	J10.4	NX_X5_I3C_SCL_1	CertusPro-NX to MachXO5D-NX Clock 1
K24	L6	J10.5	NX_X5_I3C_SDA_1	CertusPro-NX to MachXO5D-NX Data 1
K25	L17	J10.6	NX_X5_I3C_SCL_2	CertusPro-NX to MachXO5D-NX Clock 2
K26	L16	J10.7	NX_X5_I3C_SDA_2	CertusPro-NX to MachXO5D-NX Data 2
L26	J4	J10.8	NX_X5_I3C_SCL_3	CertusPro-NX to MachXO5D-NX Clock 3
L25	J5	J10.9	NX_X5_I3C_SDA_3	CertusPro-NX to MachXO5D-NX Data 3

Table 6.20. Interconnections among MachXO5D-NX, MachXO3D, and J18 Signal Definition

MachXO3D U3 Pin Number	MachXO5D-NX U1 Pin Number	J18 Pin Number	Signal Name	Comment
G2, H3	Y17	J18.2	X5_X3_I3C_SCL	H3 (X3_I2C_SCL) R328 is used for Loopback.
H2, H1	W17	J18.3	X5_X3_I3C_SDA	H1 (X3_I2C_SDA) R329 is used for loopback.
—	V17	—	X5_I3C_SCL_PU_EN	This is used for the selection of pull up resistor.
—	Y16	—	X5_I3C_SCL_KEEP_EN	This is used for the selection of pull up resistor.
—	Y19	—	X5_I3C_SDA_KEEP_EN	This is used for the selection of pull up resistor.

MachXO3D U3 Pin Number	MachXO5D-NX U1 Pin Number	J18 Pin Number	Signal Name	Comment
—	Y18	—	X5_I3C_SDA_PU_EN	This is used for the selection of pull up resistor.
—	U17	—	X5_X3_SDA_HV_I_LV_PD	This is used for the selection of pull up resistor.
—	T17	—	X5_X3_SDA_LV_O	This is used for the selection of pull up resistor.
—	R17	—	X5_X3_SCL_HV_I_LV_PD	This is used for the selection of pull up resistor.
—	T16	—	X5_X3_SCL_LV_O	This is used for the selection of pull up resistor.
—	W16	—	X5_I3C_VREF	This is used to provide the setup of the low threshold voltage.

6.9. eSPI Interface

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has three eSPI paths on this demo board. They can implement eSPI data transition functions. The signal definitions of eSPI paths describe as [Table 6.21](#), and [Table 6.22](#).

Note: eSPI interface is not available for Sentry 2.2.

Table 6.21. eSPI between CertusPro-NX and MachXO5D-NX Definitions

CertusPro-NX U2 Pin Number	MachXO5D-NX U1 Pin Number	Signal Name	Comment
AD12	W19	X5_NX_ESPI_CS	CertusPro-NX to MachXO5D-NX eSPI CS signal
AC12	V19	X5_NX_ESPI_CLK	CertusPro-NX to MachXO5D-NX eSPI Clock signal
AD11	T19	X5_NX_ESPI_RSTN	CertusPro-NX to MachXO5D-NX eSPI reset signal
AE11	T20	X5_NX_ESPI_ALERT	CertusPro-NX to MachXO5D-NX eSPI alert signal
AA12	U19	X5_NX_ESPI_DATA0	CertusPro-NX to MachXO5D-NX eSPI data0 signal
AB12	U20	X5_NX_ESPI_DATA1	CertusPro-NX to MachXO5D-NX eSPI data1 signal

Table 6.22. eSPI among MachXO5D-NX, CertusPro-NX, MachXO3D, and J12 Definitions

MachXO5D-NX U1 Pin Number	CertusPro-NX U2 Pin Number	MachXO3D U3 Pin Number	J12 Pin Number	Signal Name	Comment
V7	AA5	—	J12.3	X5_X3_ESPI_CS1n	JP60 Select between CS0 and CS1 to J12
R7	AC4	M21	J12.3	X5_X3_ESPI_CS0n	JP60 Select between CS0 and CS1 to J12
T7	AB4	M22	J12.2	X5_X3_ESPI_CLK	MachXO5D-NX to MachXO3D eSPI Clock
R8	AE5	—	J12.8	X5_X3_ESPI_RST1n	MachXO5D-NX to MachXO3D eSPI Reset 1

MachXO5D-NX U1 Pin Number	CertusPro-NX U2 Pin Number	MachXO3D U3 Pin Number	J12 Pin Number	Signal Name	Comment
N9	AD5	N19	—	X5_X3_ESPI_RST0n	MachXO5D-NX to MachXO3D eSPI Reset 0
P8	AD6	—	J12.9	X5_X3_ESPI_ALERT1n	MachXO5D-NX to MachXO3D eSPI Alert 1
P9	AF5	N20	—	X5_X3_ESPI_ALERT0n	MachXO5D-NX to MachXO3D eSPI Alert 0
Y6	AD3	M20	J12.4	X5_X3_ESPI_DQ0	MachXO5D-NX to MachXO3D eSPI DQ0
Y7	AD4	M19	J12.5	X5_X3_ESPI_DQ1	MachXO5D-NX to MachXO3D eSPI DQ1
N7	AE3	N22	J12.6	X5_X3_ESPI_DQ2	MachXO5D-NX to MachXO3D eSPI DQ2
N8	AE4	P21	J12.7	X5_X3_ESPI_DQ3	MachXO5D-NX to MachXO3D eSPI DQ3

6.10.UART Interface

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has three UART interfaces. The PC can communicate with the CertusPro-NX device BMC and PCH with serial terminal software, through connector J3 and a USB cable. It can connect to the MachXO5D-NX and the MachXO3D devices through connector J2 and a USB cable in the same way. The MachXO3D Device UART can be enabled after mounting the JP1 and JP2. The devices can input order and output information with UART interface. The signal definitions are described in [Table 6.23](#), [Table 6.24](#), [Table 6.25](#), and [Table 6.26](#).

Table 6.23. CertusPro-NX (BMC) UART Definitions

CertusPro-NX U2 Pin Number	FTDI U9 Pin Number	Signal Name
T5	U9.16	NX_BMC_UART_TXD
T4	U9.17	NX_BMC_UART_RXD

Table 6.24. CertusPro-NX (PCH) UART Definitions

CertusPro-NX U2 Pin Number	FTDI U9 Pin Number	Signal Name
W4	U9.38	NX_PCH_UART_TXD
W3	U9.39	NX_PCH_UART_RXD

Table 6.25. MachXO5D-NX UART Definitions

MachXO5D-NX U1 Pin Number	FTDI U4 Pin Number	Signal Name
J6	U4.38	X5_UART_TXD
J7	U4.39	X5_UART_RXD

Table 6.26. MachXO3D UART Definitions

MachXO3D U3 Pin Number	FTDI U4 Pin Number	Signal Name	Comment
M1	U4.16	X3_UART_TXD	Install JP1 to enable UART.
N1	U4.17	X3_UART_RXD	Install JP2 to enable UART.

Note: To enable the UART of MachXO3D device JP1 and JP2 to be mounted.

6.11.Expansion Signals

The Lattice Sentry 4.0 Demo Board for MachXO5D-NX has two expansion connectors. The connector J11 is the Raspberry PI connector. It is installed on the bottom side of the board. The connector J23 is Aardvark connector. The expansion signals of these connectors are LVCMOS33 power level. These expansion signals are available for user functions and observing I2C traffic. The signal definitions are described in [Table 6.25](#), [Table 6.26](#), [Table 6.27](#), and [Table 6.28](#).

Table 6.27. Raspberry PI Connector Signal Definitions

MachXO3D U3 Pin Number	Raspberry PI Connector J11 Pin Number	Signal Name
—	J11.1	VCC_3V3 (JP23) Jumper is required for Board power supply.
—	J11.2	VBUS_5V_S (JP23) Jumper is required for Board power supply.
E6	J11.3	X3_RASP_IO2_SDA
—	J11.4	VBUS_5V_S (JP23) Jumper is required for Board power supply.
F7	J11.5	X3_RASP_IO3_SCL
—	J11.6	GND
B2	J11.7	X3_RASP_IO4_GPCLK0
A5	J11.8	X3_RASP_IO14_TXD
—	J11.9	GND
D5	J11.10	X3_RASP_IO15_RXD
B5	J11.11	X3_RASP_IO17
A6	J11.12	X3_RASP_IO18_PCM_CLK
B8	J11.13	X3_RASP_IO27
—	J11.14	GND
A7	J11.15	X3_RASP_IO22
C6	J11.16	X3_RASP_IO23
—	J11.17	VCC_3V3 (JP23) Jumper is required for Board power supply.
D7	J11.18	X3_RASP_IO24
F8	J11.19	X3_RASP_IO10_MOSI
—	J11.20	GND
A4	J11.21	X3_RASP_IO9_MISO
C8	J11.22	X3_RASP_IO25
B10	J11.23	X3_RASP_IO11_SCLK
B3	J11.24	X3_RASP_IO8_CEO
—	J11.25	GND
C4	J11.26	X3_RASP_IO7_CE1
B1	J11.27	X3_RASP_IO0_ID_SD
A2	J11.28	X3_RASP_IO1_ID_SC
A3	J11.29	X3_RASP_IO5
—	J11.30	GND
C3	J11.31	X3_RASP_IO6
G8	J11.32	X3_RASP_IO12_PWM0
B4	J11.33	X3_RASP_IO13_PWM1
—	J11.34	GND
D6	J11.35	X3_RASP_IO19_PCM_FS
C5	J11.36	X3_RASP_IO16
D8	J11.37	X3_RASP_IO26
E7	J11.38	X3_RASP_IO20_PCM_DIN
—	J11.39	GND
B6	J11.40	X3_RASP_IO21_PCM_DOUT

Table 6.28. Aardvark J23 Connector Signal Definitions

MachXO3D U3	MachXO5D-NX U1 Pin	Aardvark Connector J23 Pin	Signal Name
A9	M2	J23.1	X3_X5_I2C_FLT1_SCL_I
B9	M1	J23.3	X3_X5_I2C_FLT1_SDA_I
E10	—	J23.5	AWK3_X3_SO
A10	—	J23.7	AWK3_X3_MCLK
G9	—	J23.8	AWK3_X3_SI
F10	—	J23.9	AWK3_X3_CS

Table 6.29. Aardvark J22 Connector Signal Definitions

MachXO5D-NX U1 Pin	Aardvark Connector J22 Pin	Signal Name
N1	J22.1	X5_I2C_FLT1_SCL_O
N2	J22.3	X5_I2C_FLT1_SDA_O

Table 6.30. Aardvark J19 Connector Signal Definitions

CertusPro-NX U2 Pin	MachXO5D-NX U1 Pin	Aardvark Connector J19 Pin	Signal Name
M7	A19	J19.1	NX_X5_I2C_FLT0_SCL_I
M6	A18	J19.3	NX_X5_I2C_FLT0_SDA_I
N8	—	J19.5	AWK0_NX_SO
R9	—	J19.7	AWK0_NX_MCLK
P8	—	J19.8	AWK0_NX_SI
R7	—	J19.9	AWK0_NX_CS

7. Ordering Information

Table 7.1 Ordering Information

Description	Ordering Part Number	China RoHS Environment-Friendly Use Period (EFUP)
Lattice Sentry 4.0 Demo Board for MachXO5D-NX	LFMXO5D-4P0-SENTRY-EVN	

Appendix A. Lattice Sentry™ 4.0 Demo Board for MachXO5D-NX Schematics

Sentry 4.0 Board for MachXO5D-NX Rev - A.1	
01 - Title page	17 - LCMXO3D BANK0
02 - Block diagram	18 - LCMXO3D BANK1
03 - JTAG FTDI	19 - LCMXO3D BANK2,3,4,5
04 - LFMXO5-55TD Bank1	20 - LCMXO3D Power
05 - LFMXO5-55TD Bank0	21 - MPESTI
06 - LFMXO5-55TD Bank5,7	22 - BMC Flash
07 - LFMXO5-55TD Bank2,6	23 - PCH Flash
08 - LFMXO5-55TD Bank3,4,ADC	24 - JTAG Chain
09 - LFMXO5-55TD Power	25 - LEDs
10 - Demo FTDI	26 - DC-SCM Connectors
11 - CertusPro-NX Bank1,5 (BMC)	27 - I3C PU
12 - CertusPro-NX Bank0 (BMC)	28 - Power Regulators
13 - CertusPro-NX Bank7 (BMC)	29 - Power Tree
14 - CertusPro-NX Bank2,6 (PCH)	
15 - CertusPro-NX Bank3,4,ADC (PCH)	
16 - CertusPro-NX Power	

LATTICE SEMICONDUCTOR	
Lattice Semiconductor Applications Email: techsupport@latticesemi.com Phone (503) 268-8001 or (800) LATTICE	
Title Title page	
Size B	Project Sentry 4.0 Board for MachXO5D-NX
Date Monday, January 06, 2025	Schematic Rev 1.1
Sheet 1	Board Rev A.1
of 29	

Figure A.1. Title Page

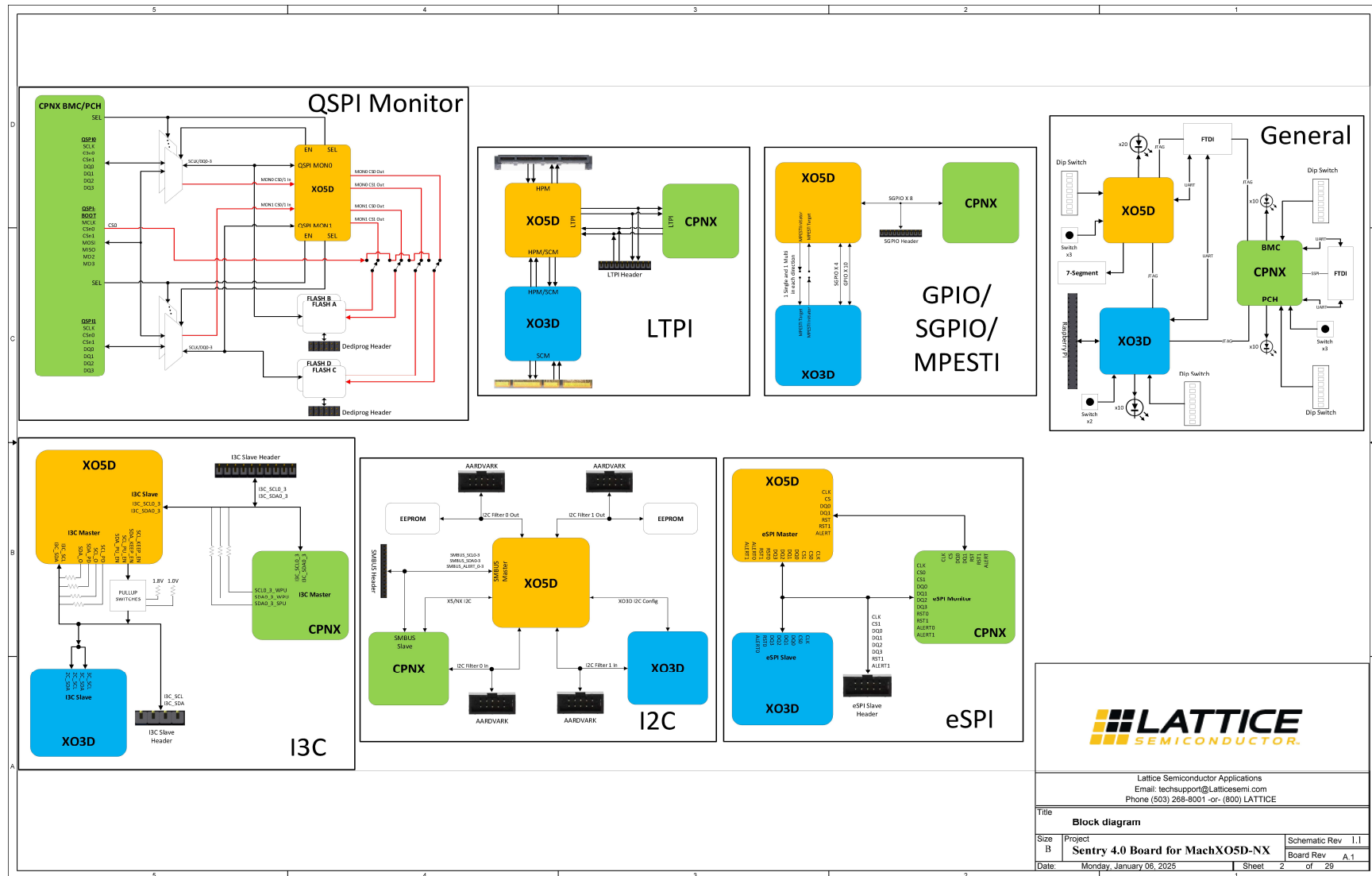


Figure A.2. Block Diagram

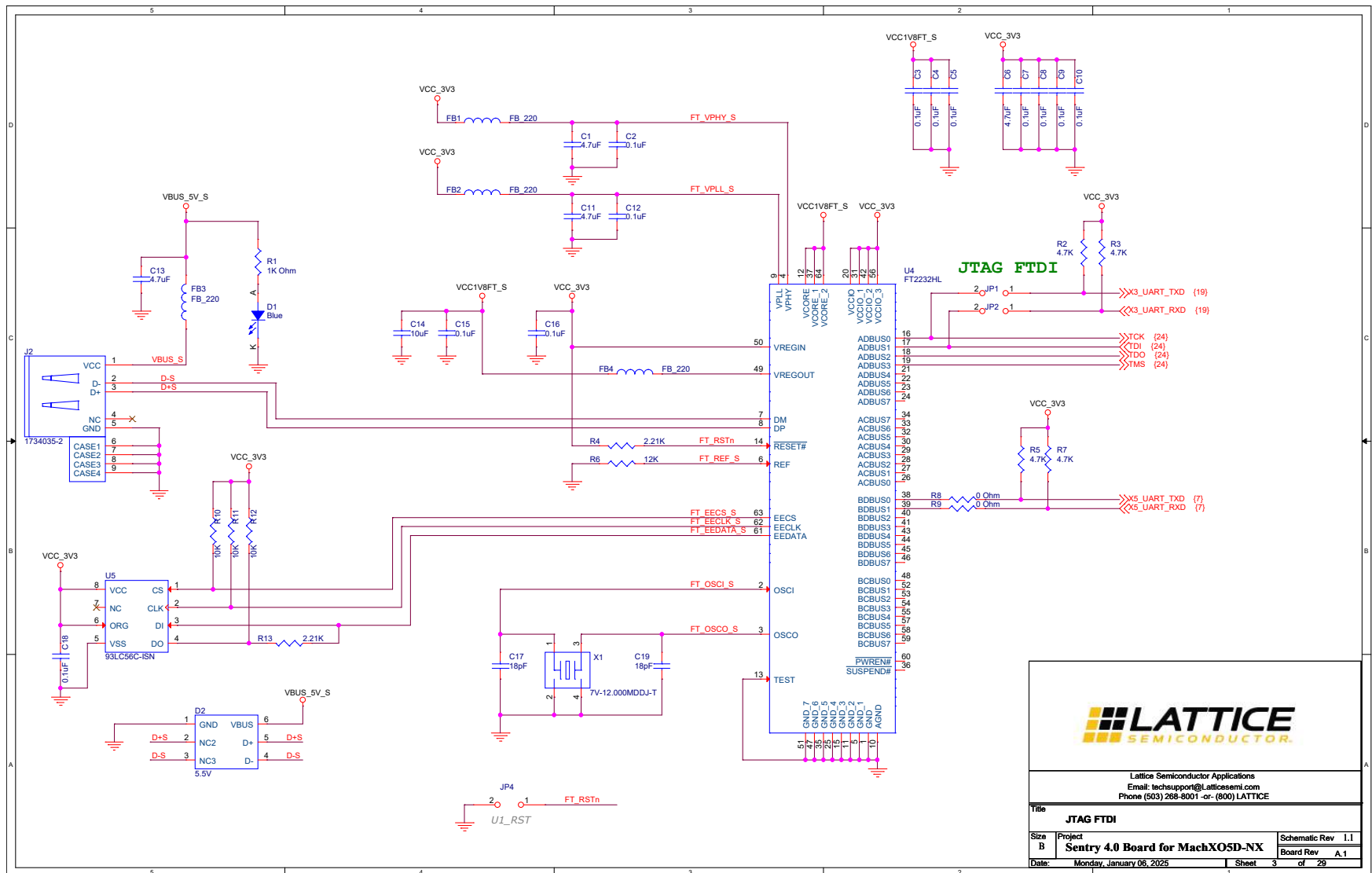
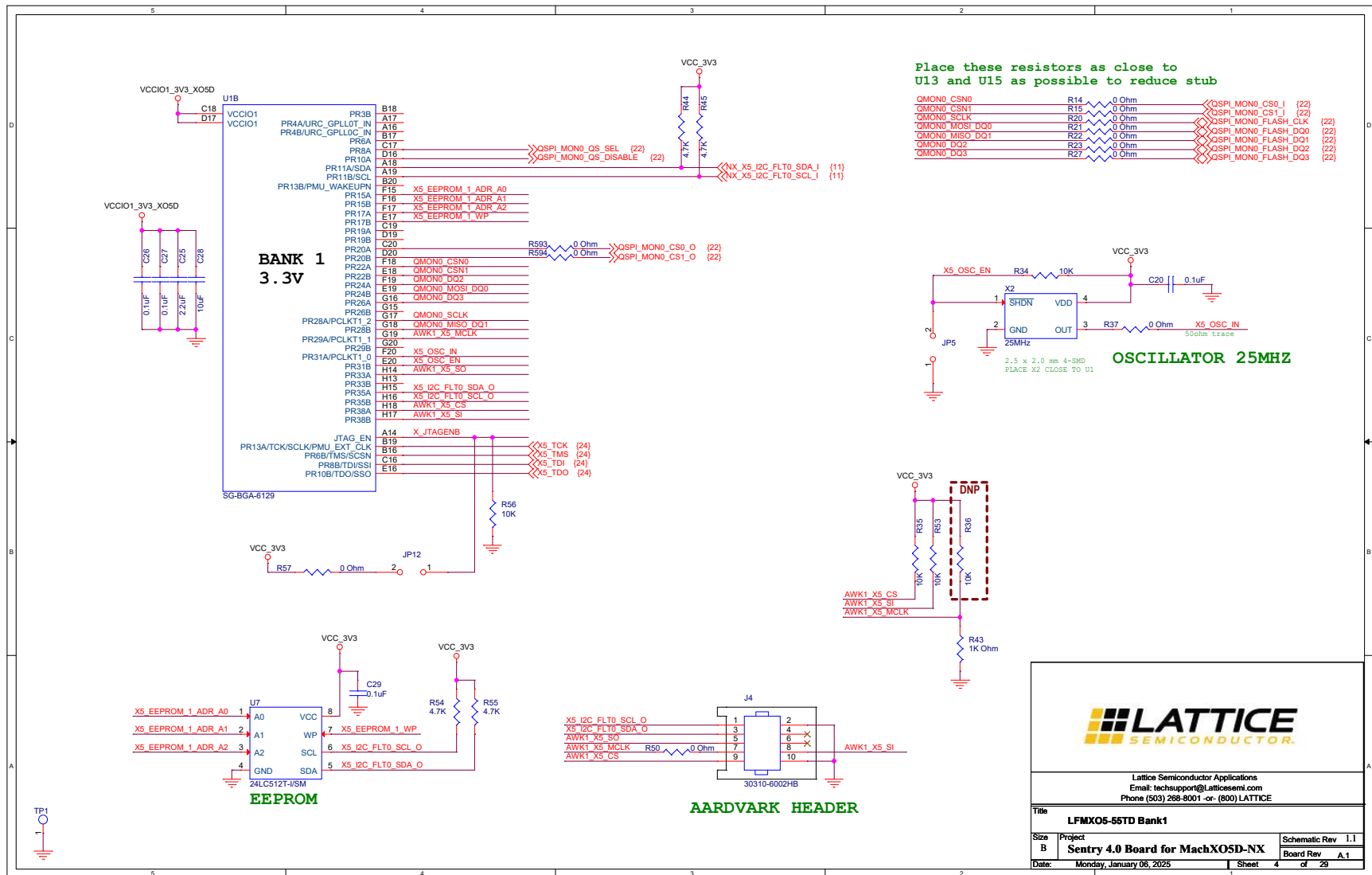


Figure A.3. JTAG FTDI



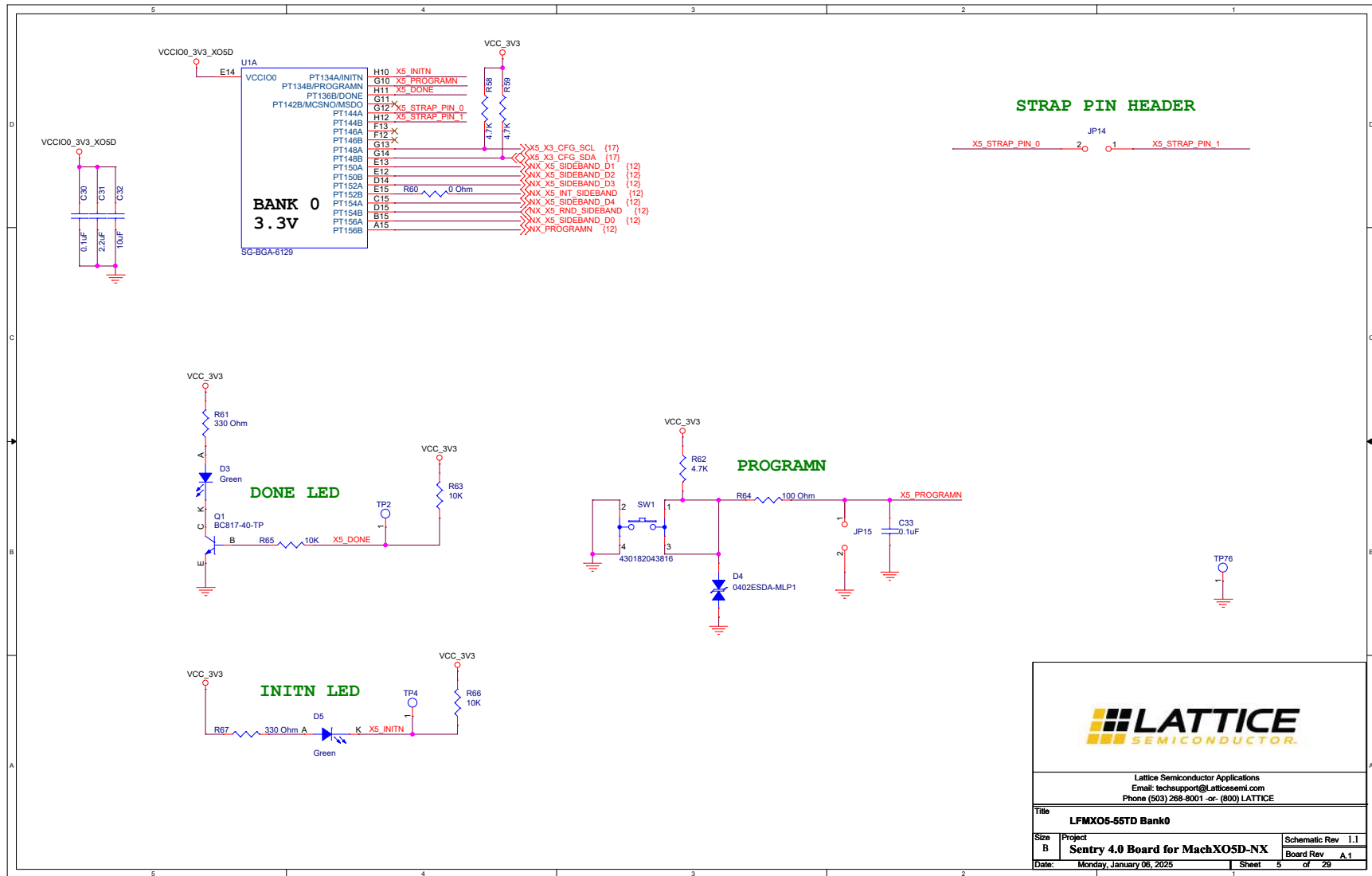


Figure A.5. LFMX05-55TD Bank 0

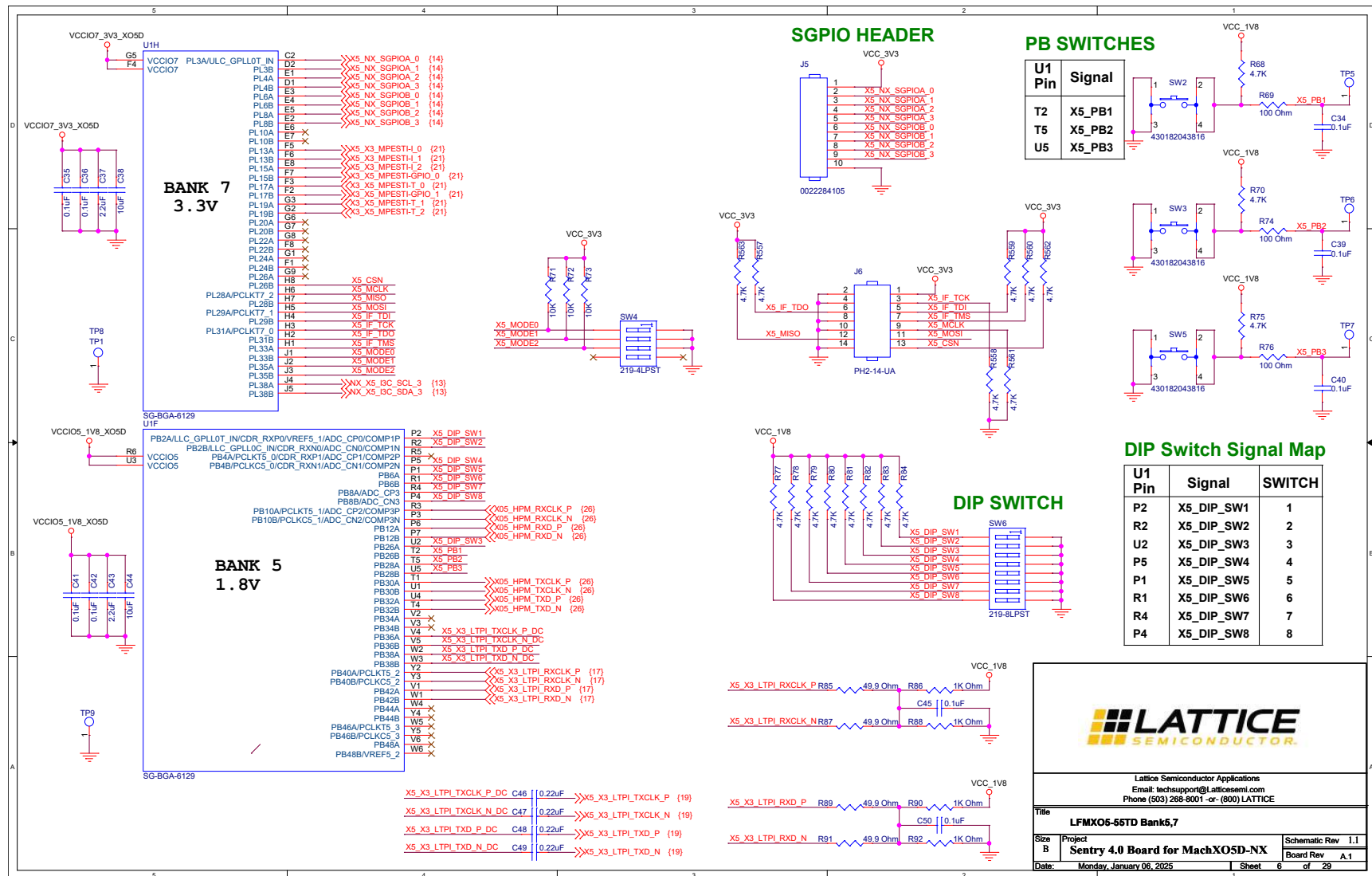


Figure A.6. LFMXO5-55TD Bank 5, 7

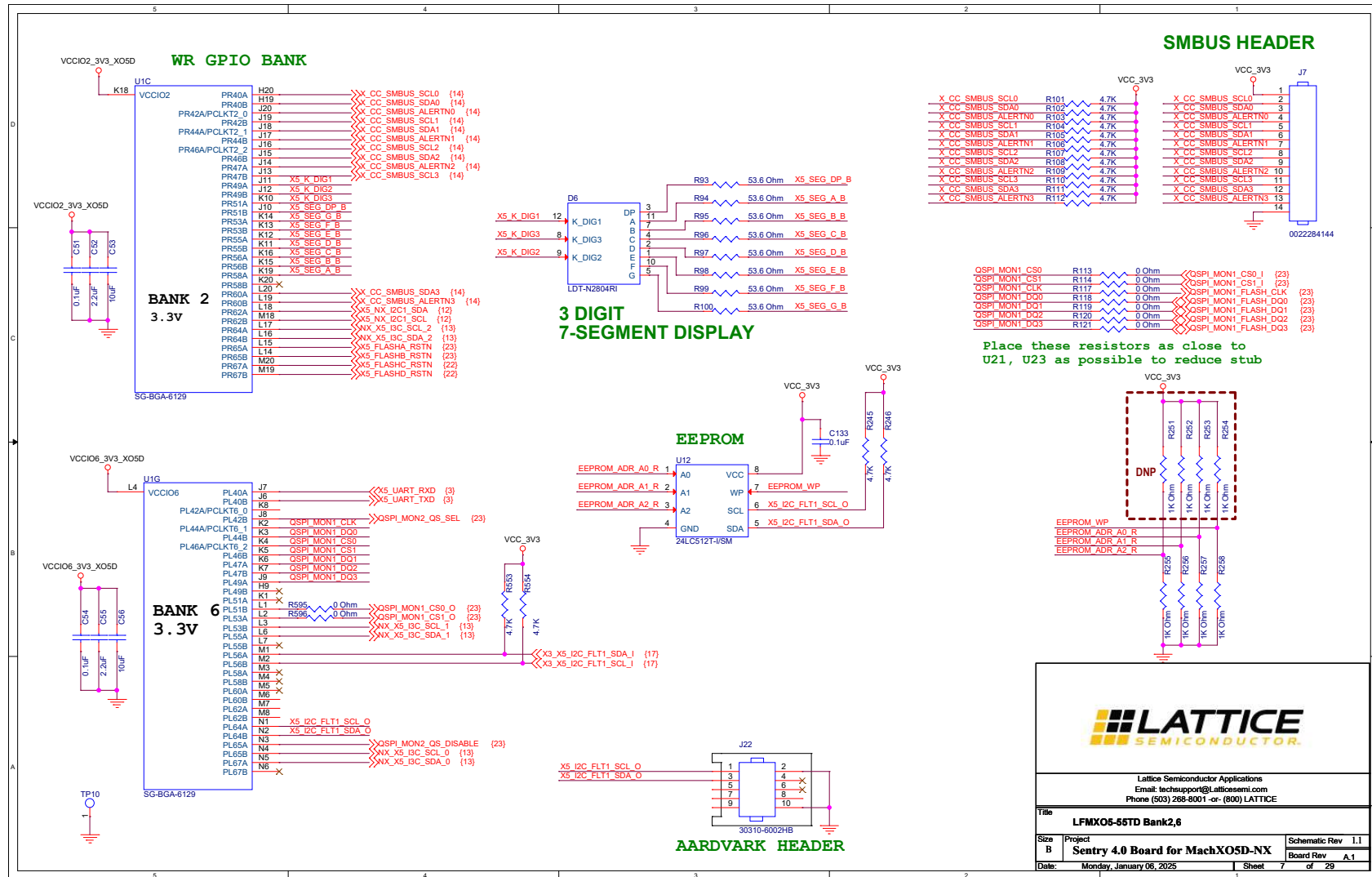


Figure A.7. LFMXO5-55TD Bank 2, 6

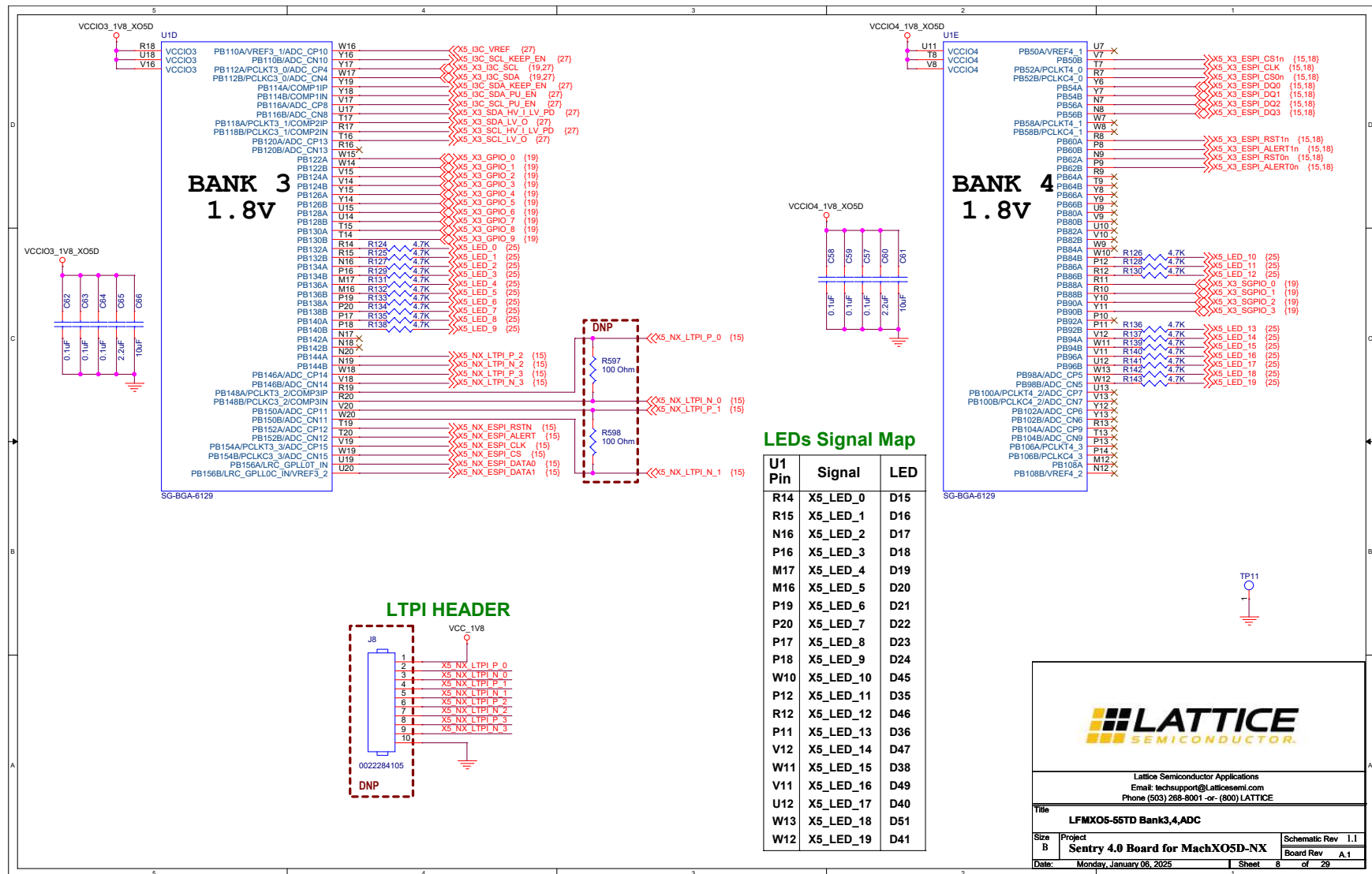


Figure A.8. LFMXO5-55TD Bank 3, 4, ADC



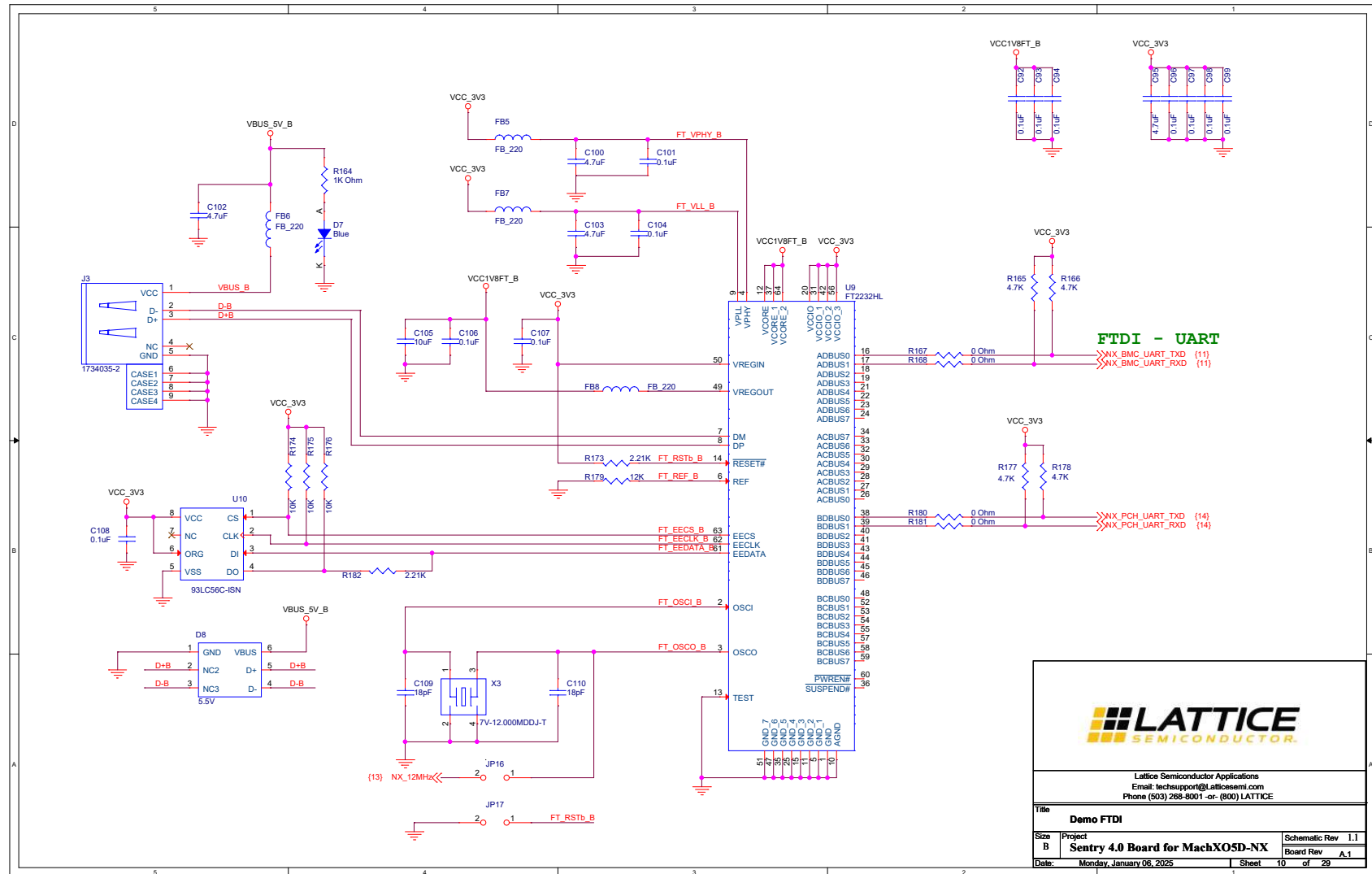


Figure A.10. Demo FTDI

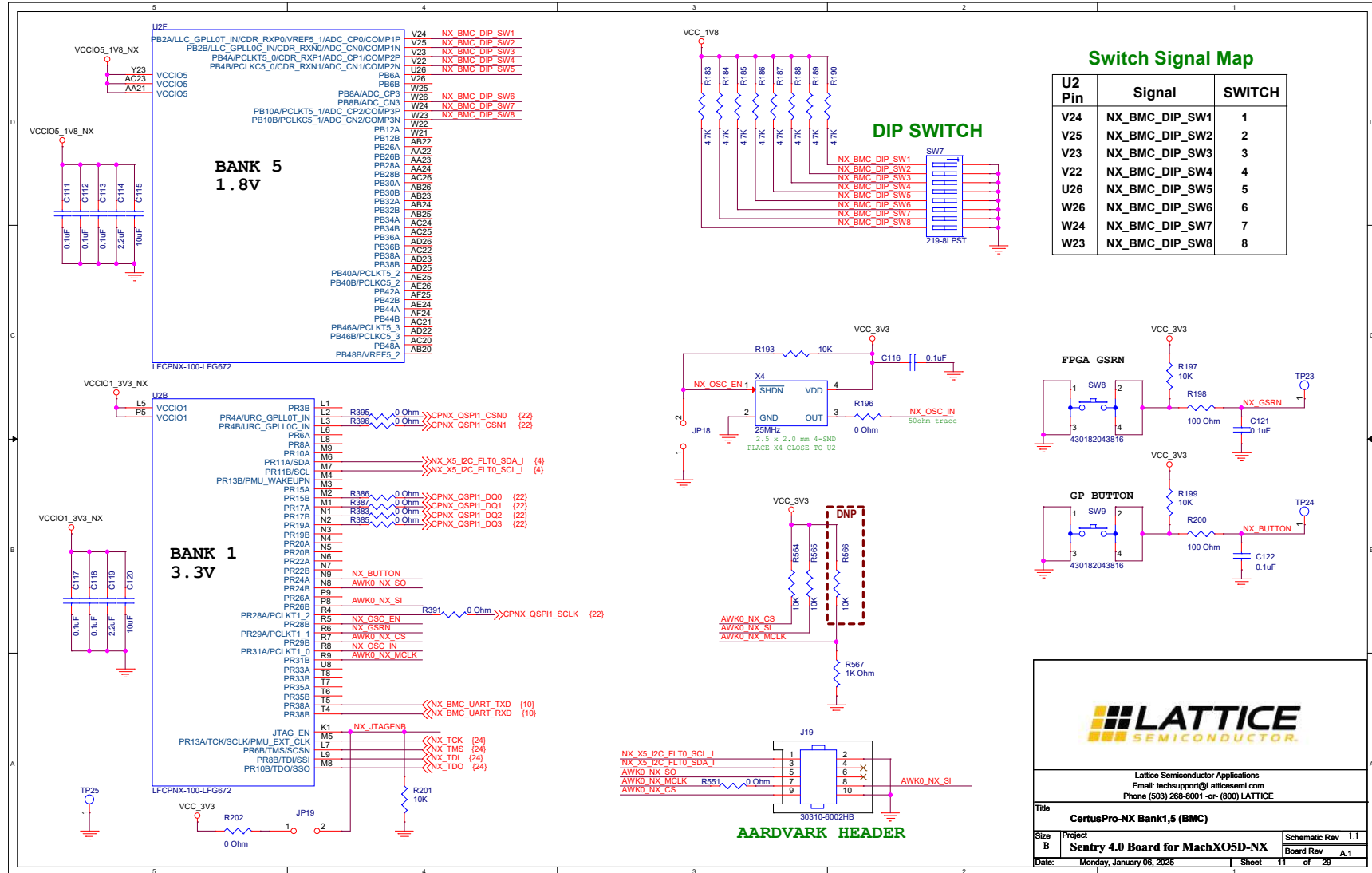


Figure A.11. CertusPro-NX Bank 1, 5 (BMC)





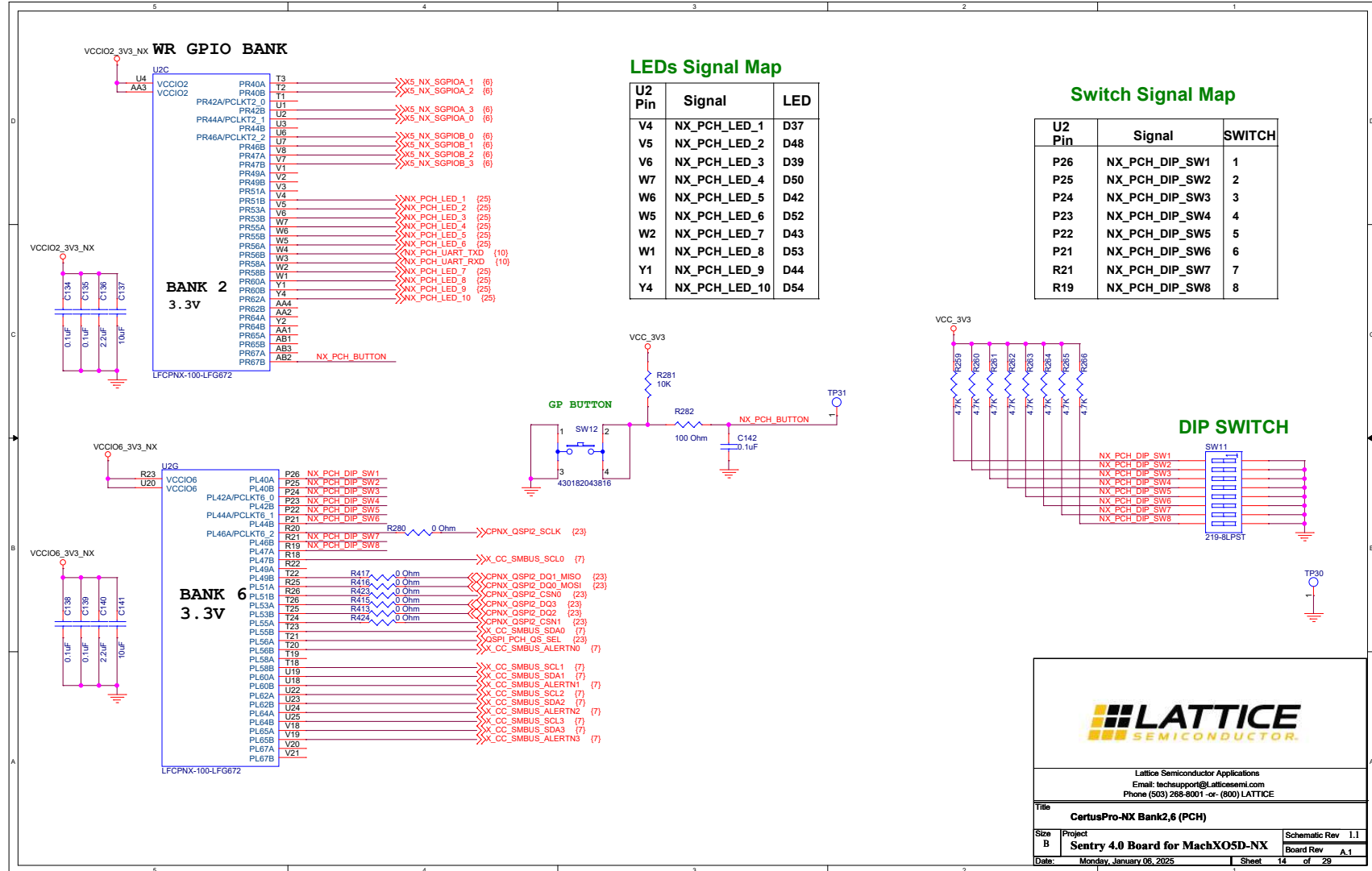


Figure A.14. CertusPro-NX Bank 2, 6 (PCH)

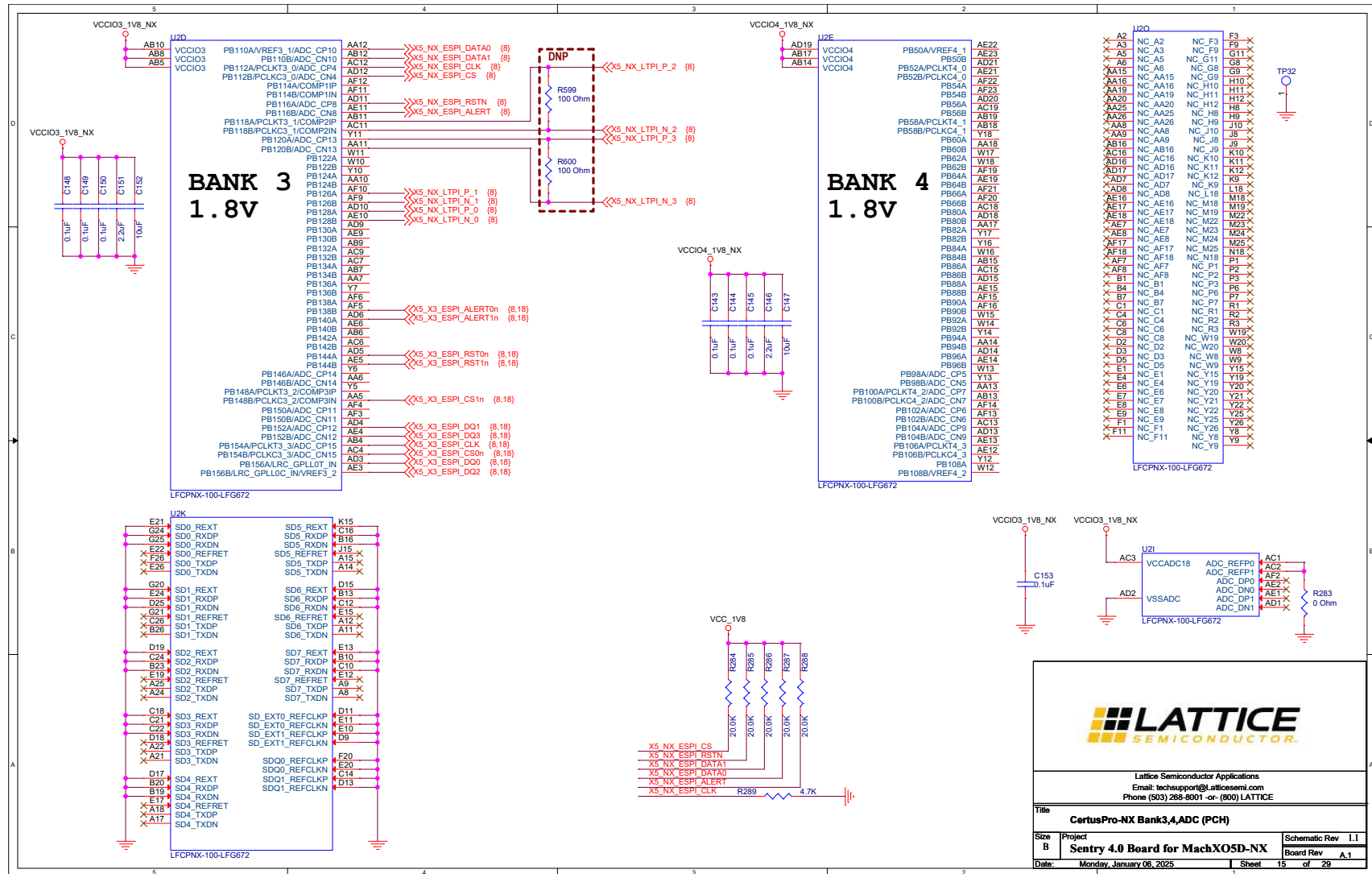


Figure A.15. CertusPro-NX Bank 3, 4, ADC (PCH)

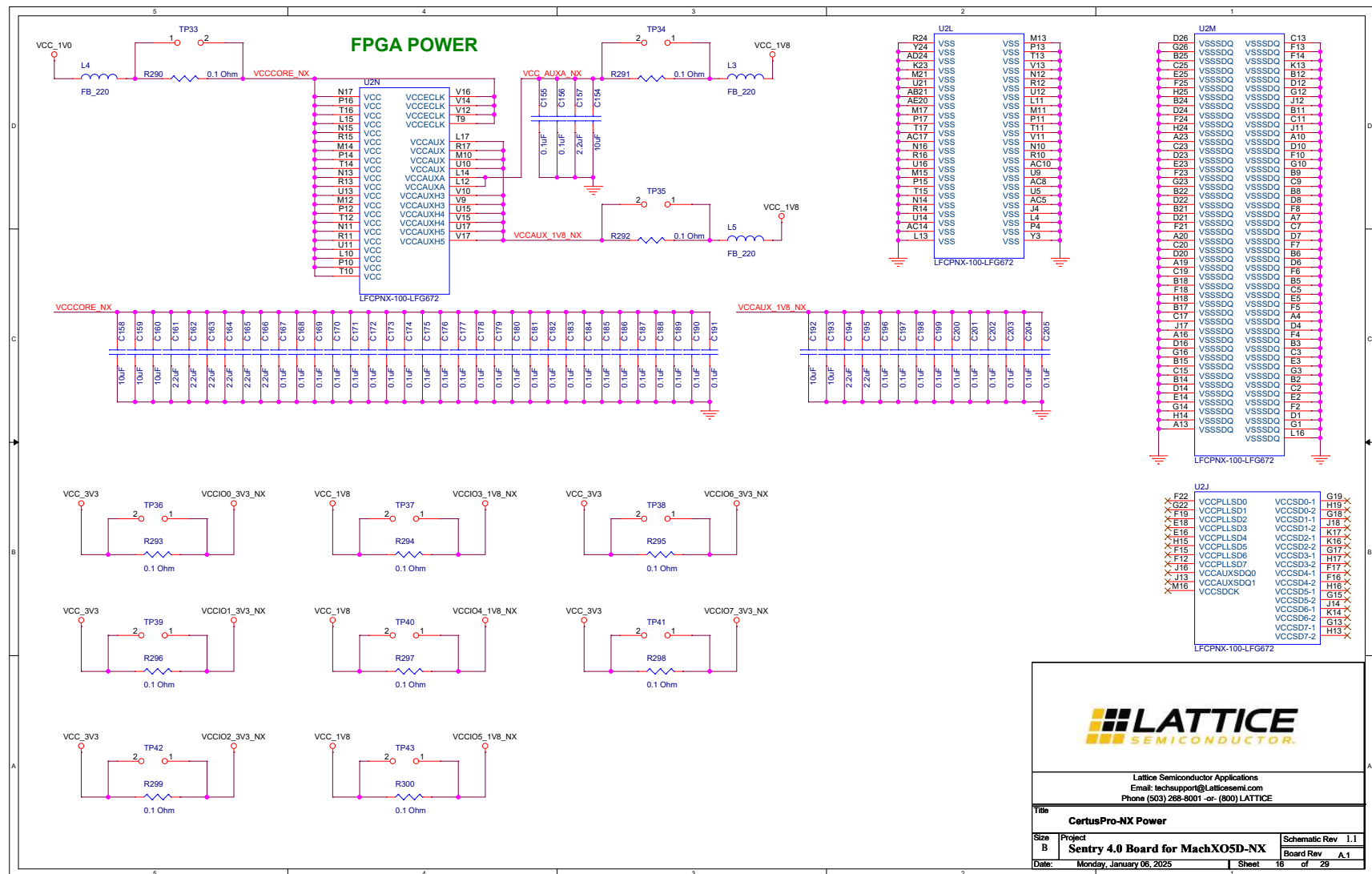


Figure A.16. CertusPro-NX Power





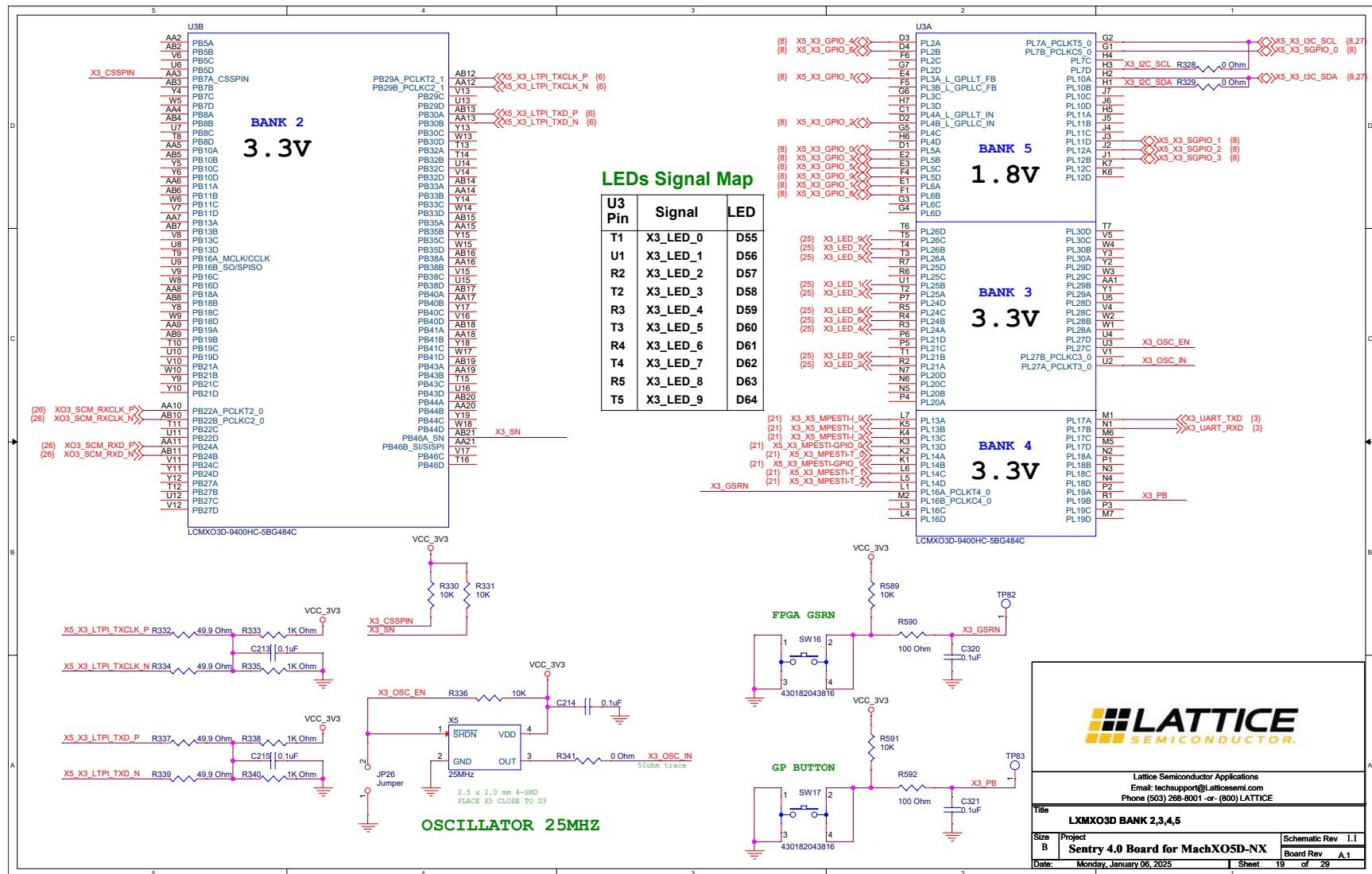


Figure A.19. LCMXO3D BANK 2, 3, 4, 5

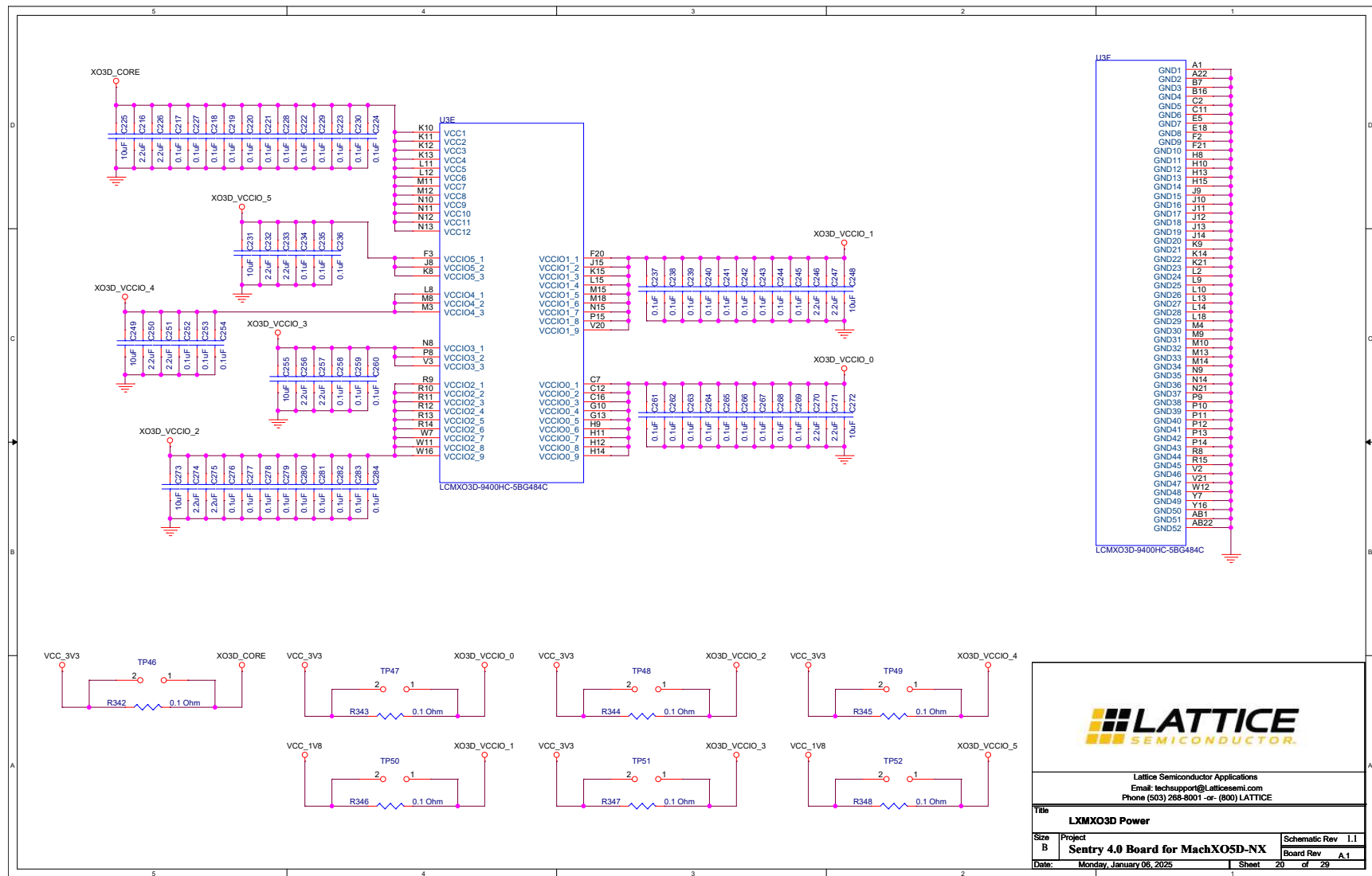


Figure A.20. LCMXO3D Power

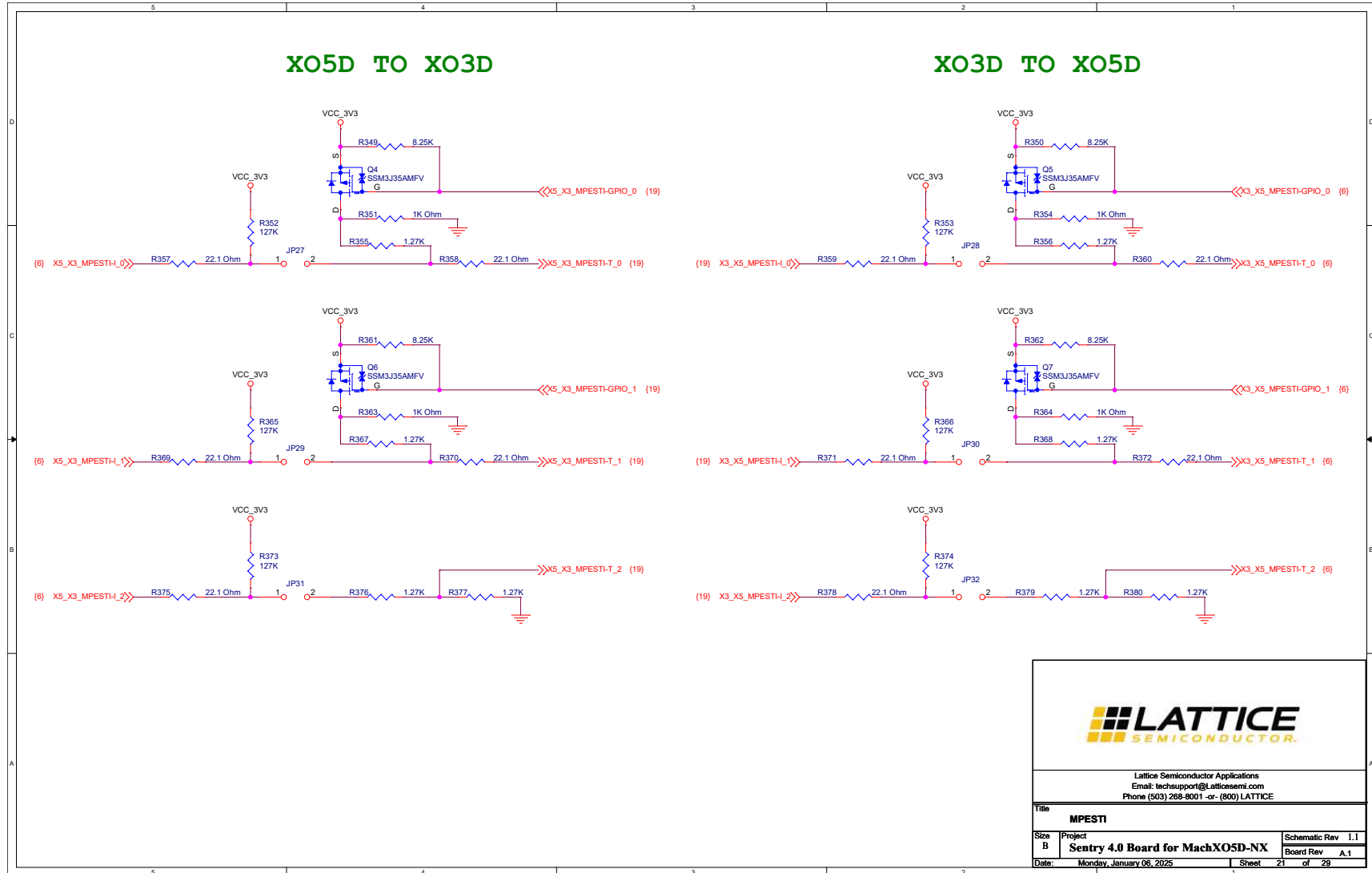


Figure A.21. MPESTI

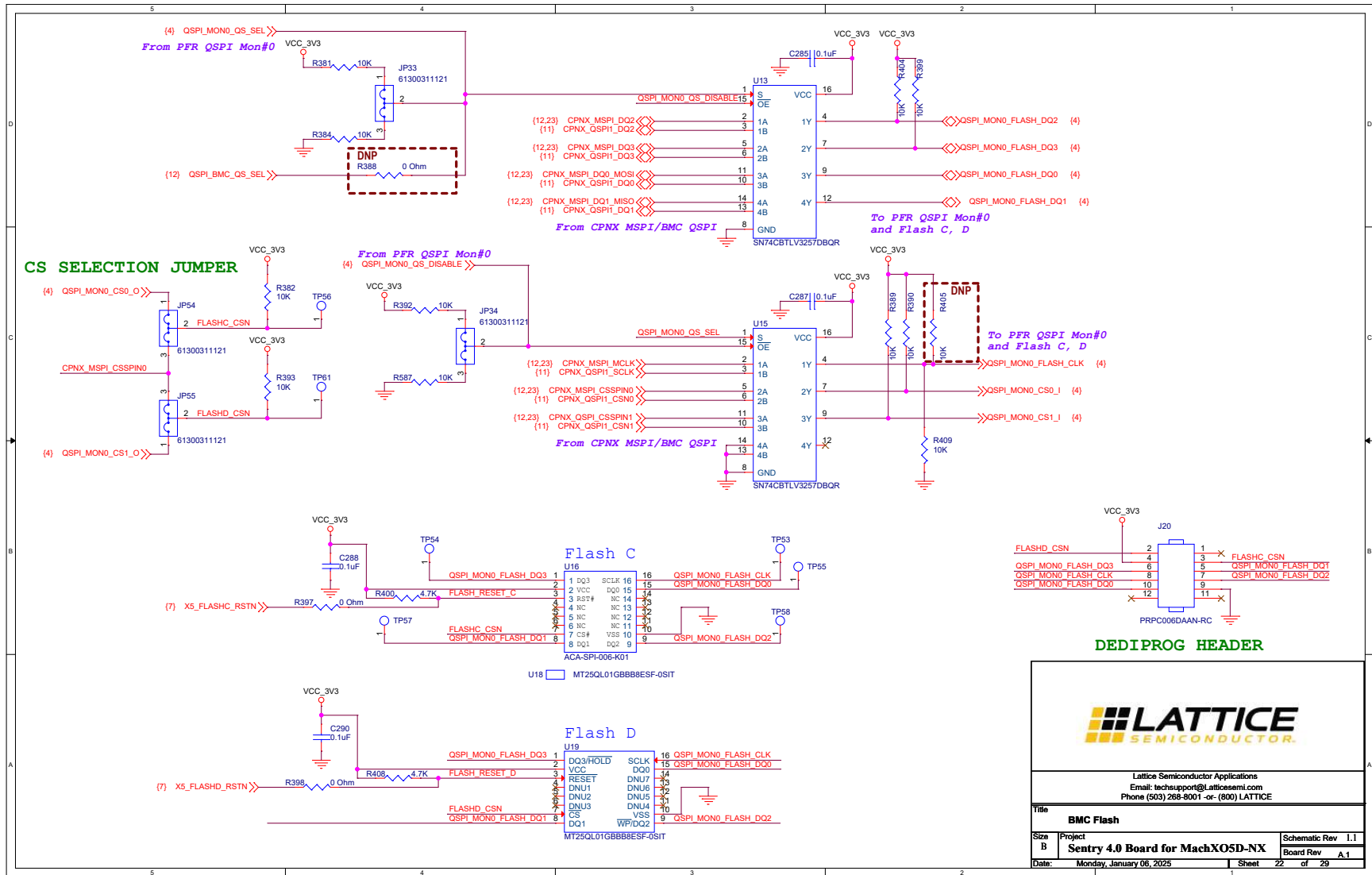


Figure A.22. BMC Flash

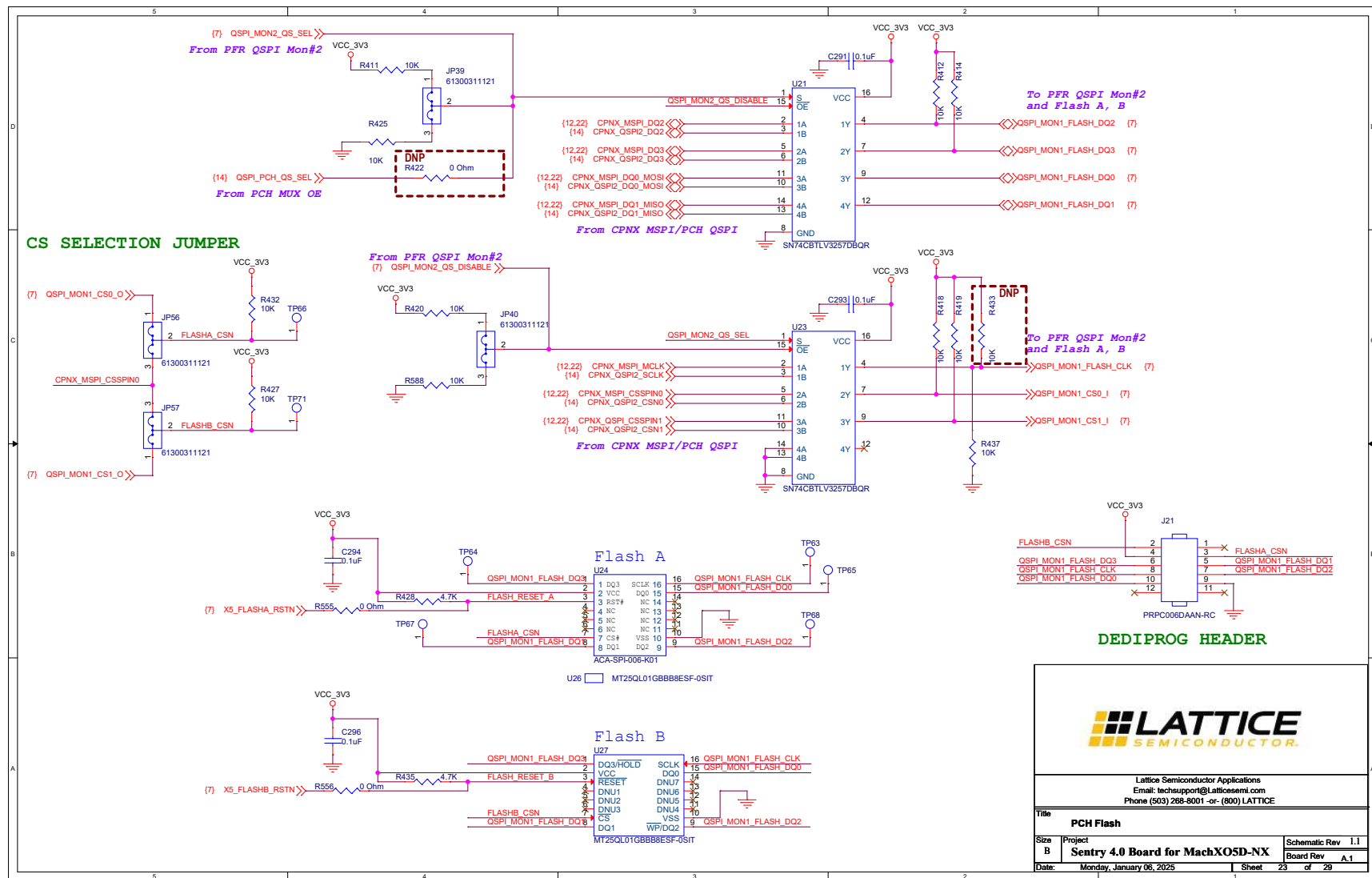


Figure A.23. PCH Flash

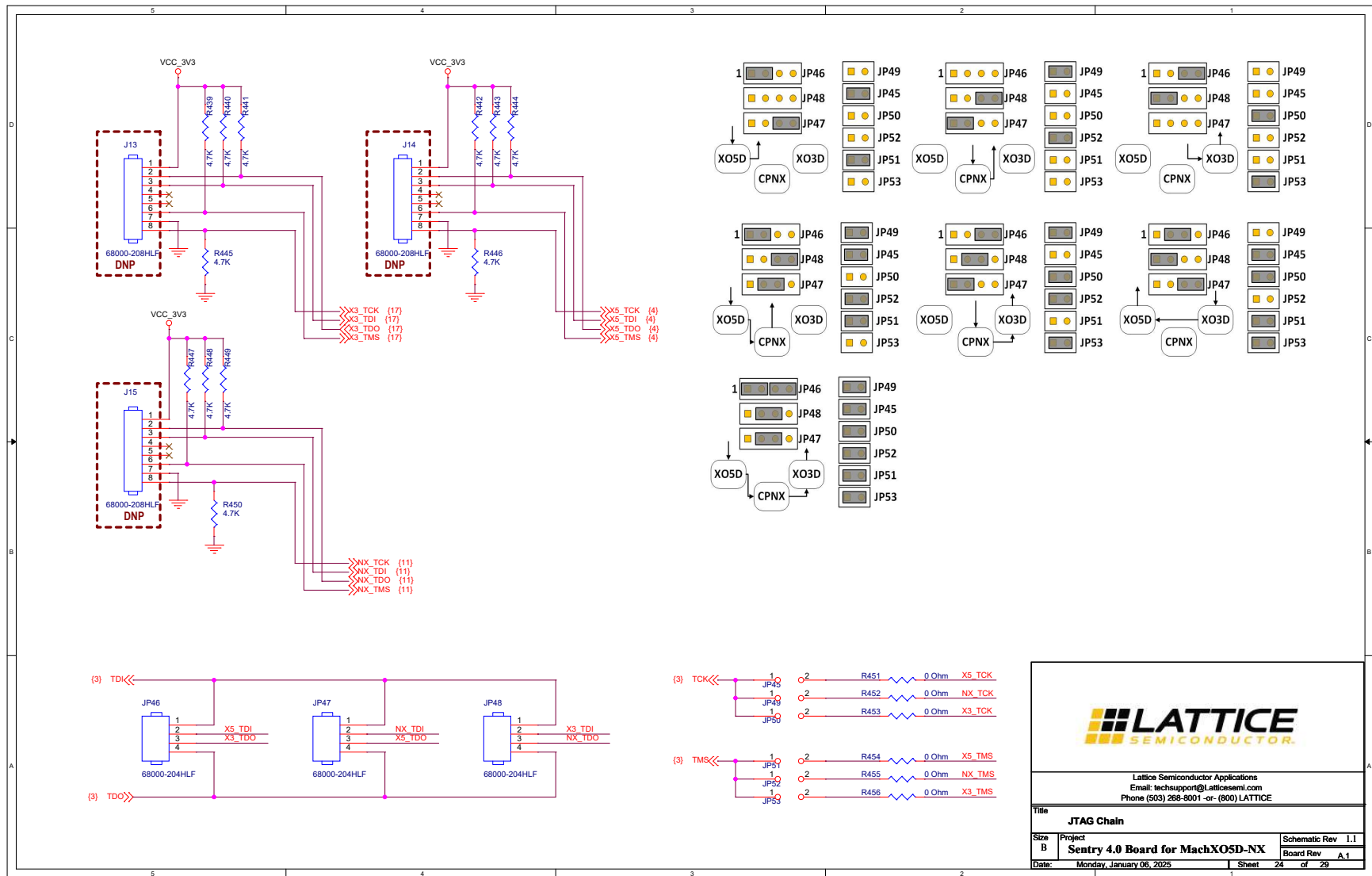


Figure A.24. JTAG Chain

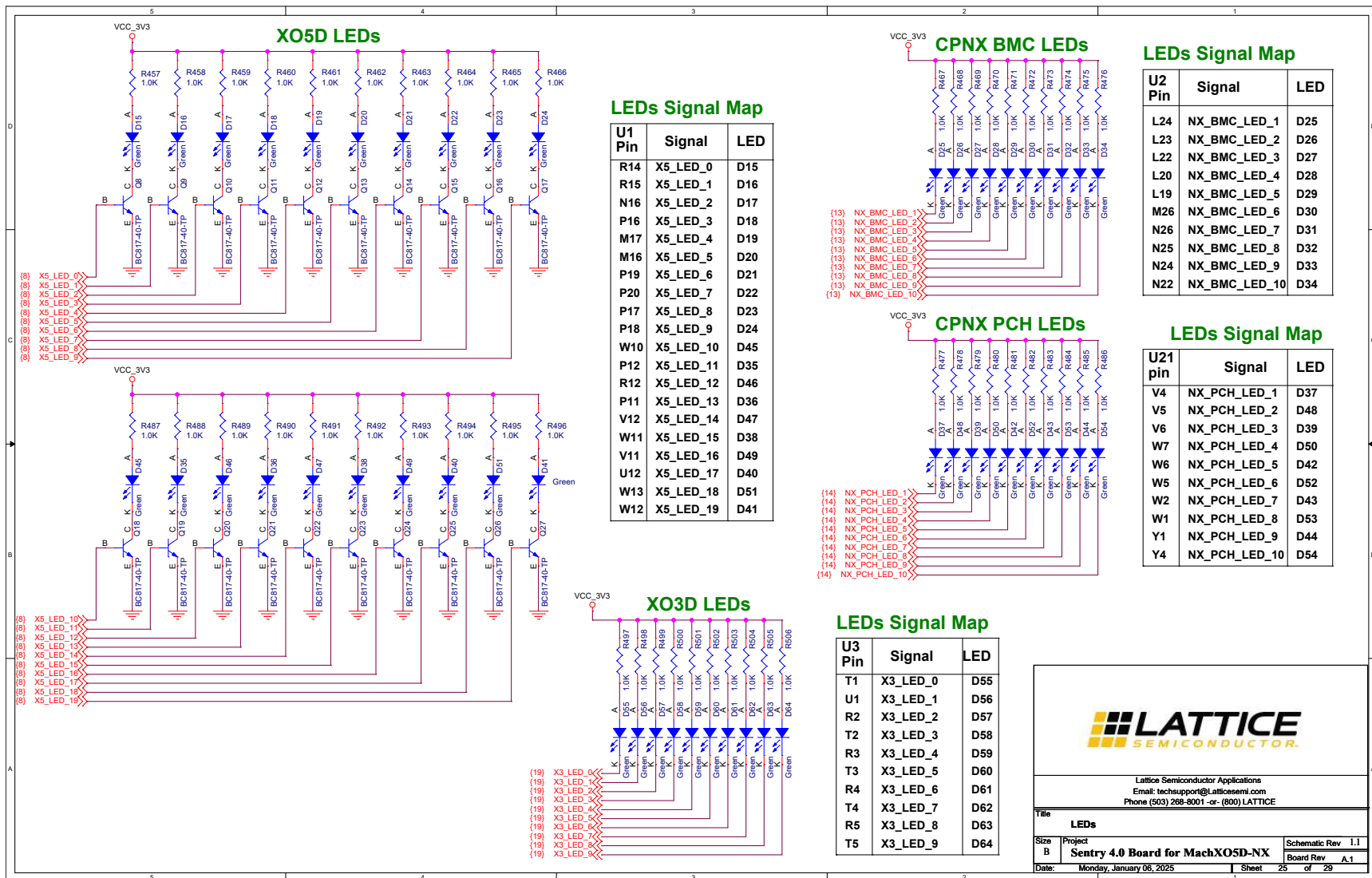


Figure A.25. LEDs

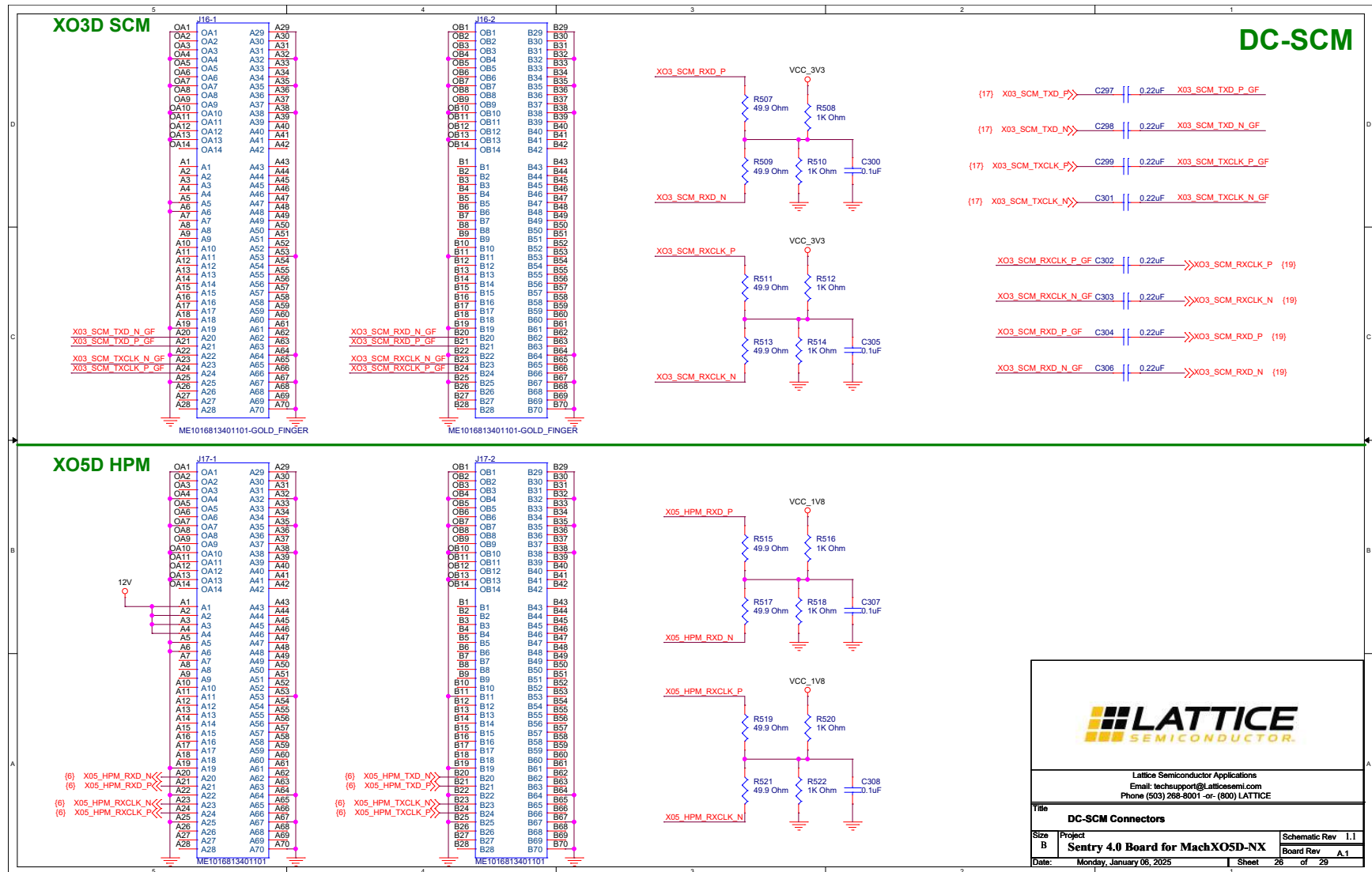
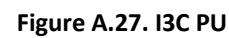


Figure A.26. DC-SCM Connectors





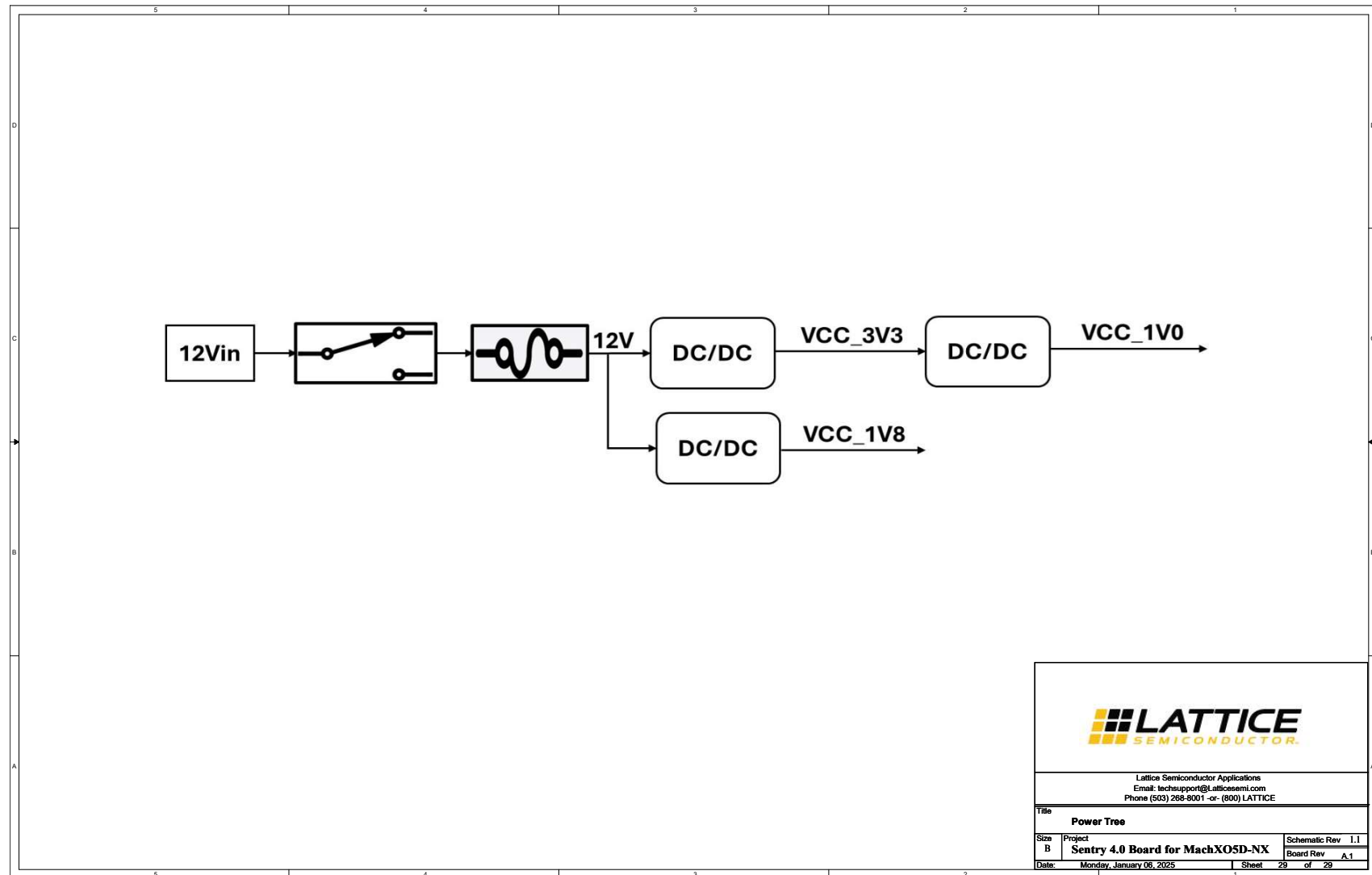


Figure A.29. Power Tree

Appendix B. Bill of Materials

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
1	C1,C6,C11,C13,C95,C100,C102,C103	8	4.7uF	C0603-L	-	C1608X5R 1E475K08 0AC	TDK	4.7 μ F $\pm$ 10% 25V Ceramic Capacitor X5R 0603 (1608 Metric)
2	C2,C3,C4,C5,C7,C8,C9,C10,C12,C15,C16,C18,C20,C26,C27,C29,C30,C33,C34,C35,C36,C39,C40,C41,C42,C45,C50,C51,C54,C57,C58,C59,C62,C63,C64,C67,C74,C75,C76,C77,C78,C79,C80,C81,C82,C83,C86,C87,C88,C89,C90,C91,C92,C93,C94,C96,C97,C98,C99,C101,C104,C106,C107,C108,C111,C112,C113,C116,C117,C118,C121,C122,C123,C125,C129,C130,C133,C134,C135,C138,C139,C142,C143,C144,C145,C148,C149,C150,C153,C155,C156,C167,C168,C169,C170,C171,C172,C173,C174,C175,C176,C177,C178,C179,C180,C181,C182,C183,C184,C185,C186,C187,C188,C189,C190,C191,C196,C197,C198,C199,C200,C201,C202,C203,C204,C205,C210,C211,C212,C213,C214,C215,C217,C218,C219,C220,C221,C222,C223,C224,C227,C228,C229,C230,C234,C235,C236,C237,C238,C239,C240,C241,C242,C243,C244,C245,C252,C253,C254,C258,C259,C260,C261,C262,C263,C264,C265,C266,C267,C268,C269,C276,C277,C278,C279,C280,C281,C282,C283,C284,C285,C287,C288,C290,C291,C293,C294,C296,C300,C305,C307,C308,C309,C310,C320,C321,C322	197	0.1uF	C0402-L	-	GRM155R 71H104KE 14J	Murata	0.1 μ F $\pm$ 10% 50V Ceramic Capacitor X7R 0402 (1005 Metric)
3	C14,C28,C32,C38,C44,C53,C56,C61,C66,C69,C70,C71,C84,C105,C115,C120,C126,C132,C137,C141,C147,C152,C154,C158,C159,C160,C192,C193,C225,C231,C248,C249,C255,C272,C273,C311,C313,C317	38	10uF	C0805-L	-	GRM21BR 61E106KA 73K	Murata	10 μ F $\pm$ 10% 25V Ceramic Capacitor X5R 0805 (2012 Metric)
4	C17,C19,C109,C110	4	18pF	C0402-L	-	CC0402JR NPO9BN1 80	Yageo	18 pF $\pm$ 5% 50V Ceramic Capacitor C0G, NPO 0402 (1005 Metric)
5	C25,C31,C37,C43,C52,C55,C60,C65,C68,C72,C73,C85,C114,C119,C124,C131,C136,C140,C146,C151,C157,C161,C162,C163,C164,C165,C166,C194,C195,C216,C226,C232,C233,C246,C247,C250,C251,C256,C257,C270,C271,C274,C275	43	2.2uF	C0603-L	-	GRM188R 61E225KA 12J	Murata	2.2 μ F $\pm$ 10% 25V Ceramic Capacitor X5R 0603 (1608 Metric)

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
6	C46,C47,C48,C49,C206,C207,C208,C209,C297,C298,C299,C301,C302,C303,C304,C306	16	0.22uF	C0402-L	-	GRM155R 61H224KE 01W	Murata	0.22 μ F $\pm$ 10% 50V Ceramic Capacitor X5R 0402 (1005 Metric)
7	C312,C314,C318	3	22uF	C0805-L	-	GRM21BR 61E226M E44K	Murata	22 μ F $\pm$ 20% 25V Ceramic Capacitor X5R 0805 (2012 Metric)
8	C315,C316,C319	3	10nF	C0402-L	-	GRM155R 71H103K A88D	Murata	10000 pF $\pm$ 10% 50V Ceramic Capacitor X7R 0402 (1005 Metric)
9	D1,D7	2	Blue	LED0603	-	SMLD12B N1WT86	Rohm Semiconductor	Blue 470nm LED Indication - Discrete 2.9V 0603 (1608 Metric)
10	D2,D8	2	5.5V	UDFN6_1 P2X1	-	ESDR0502 NMUTAG	ONSEMI	Clamp Ipp Tvs Diode Surface Mount 6-UDFN (1.2x1)
11	D3,D5,D10,D11,D12,D13,D15,D16,D17,D18,D19,D20,D21,D22,D23,D24,D25,D26,D27,D28,D29,D30,D31,D32,D33,D34,D35,D36,D37,D38,D39,D40,D41,D42,D43,D44,D45,D46,D47,D48,D49,D50,D51,D52,D53,D54,D55,D56,D57,D58,D59,D60,D61,D62,D63,D64,D66,D67,D68,D69	60	Green	LED0603	-	SML- D12M8W T86	Rohm Semiconductor	Green 572nm LED indication - Discrete 2.2V 0603
12	D4,D9,D14	3	0402ES DA- MLP1	TVS0402	-	0402ESDA -MLP1	Eaton	TVS DEVICE POLYMER 35V 0402
13	D6	1	LDT- N2804RI	LDT- N2804RI_ LUM	-	LDT- N2804RI	Lumex	Display Modules - LED Character and Numeric Red 7-Segment 3 Character Common Cathode 2V 10mA 0.394" H x 0.887" W x

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
								0.240" D (10.00mm x 22.53mm x 6.10mm) 12-DIP (0.300", 7.62mm), 1
14	D65	1	TSP15U 100S	TO- 227A_TS	-	TSP15U10 0S	Taiwan Semiconductor	Diode Schottky 100 V 15A Surface Mount TO-277A (SMPC)
15	L1,FB1,L2,FB2,L3,FB3,L4,FB4,L5,FB5,FB6,FB7,FB8	13	FB_220	IND_1608 _TDK	-	BLM18KG 221SN1D	Murata Electronics	220 Ohms @ 100 MHz 1 Power Line Ferrite Bead 0603 (1608 Metric) 2.2A 50mOhm
16	F1	1	045800 5.DR	0458Serie s_LTF-L	-	0458005. DR	Little Fuse	5 A 32 V AC 75 V DC Fuse Board Mount (Cartridge Style Excluded) Surface Mount 1206 (3216 Metric)
17	JP1,JP2,JP4,JP5,TP12,JP12,TP13,TP14,JP14,TP15,JP15,TP16,JP16,TP17,JP17,TP18,JP18,TP19,JP19,TP20,JP20,TP21,TP22,JP22,JP23,JP24,JP25,JP26,JP27,JP28,JP29,JP30,JP31,JP32,TP33,TP34,TP35,TP36,TP37,TP38,TP39,TP40,TP41,TP42,TP43,JP45,TP46,TP47,TP48,TP49,JP49,TP50,JP50,TP51,JP51,TP52,JP52,JP53,JP58,JP59	60	Jumper	CONN2_M 20- 999_1x2_ HRW	-	PREC002S AAN-RC	Sullins	Connector Header Through Hole 2 position 0.100" (2.54mm)
18	JP33,JP34,JP39,JP40,JP54,JP55,JP56,JP57,JP60	9	613003 11121	CONN03_ 6130_7P6 2X2P54_ WRE	-	61300311 121	Würth	Connector Header Through Hole 3 position 0.100" (2.54mm)

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
19	J18,JP46,JP47,JP48	4	68000-204HLF	CONN_61 30041112 1_WRE	-	68000-204HLF	Amphenol	Connector Header Through Hole 4 position 0.100" (2.54mm)
20	J1	1	694106301002	CONN3_0 1002_WRE	-	694106301002	Würth	Power Barrel Connector Jack 2.10mm ID (0.083"), 5.50mm OD (0.217") Through Hole, Right Angle
21	J2,J3	2	1734035-2	CONN5_USB1734035_TEC	-	1734035-2	TE Connectivity	USB - mini B USB 2.0 Receptacle Connector 5 Position Surface Mount, Right Angle
22	J4,J19,J22,J23	4	30310-6002HB	CONN_30310-6002HB_3MM	-	30310-6002HB	3M	Connector Header Through Hole 10 position 0.100" (2.54mm)
23	J5,J10	2	22284105	22-28-4105_MOL	-	22284105	Molex	Connector Header Through Hole 10 position 0.100" (2.54mm)
24	J6	1	PH2-14-UA	CONN_PH2-14-UA_AT	-	PH2-14-UA	Adam Tech	Connector Header Through Hole 14 position 0.100" (2.54mm)
25	J7	1	22284144	22-28-4144_MOL	-	22284144	Molex	Connector Header Through Hole 14 position 0.100" (2.54mm)

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
26	J8	1	22284105	22-28-4105_MOL	DNL	22284105	Molex	Connector Header Through Hole 10 position 0.100" (2.54mm)
27	J11	1	PRPC020DFAN-RC	AMPHENO L_10129381-940002BLF	-	PRPC020DFAN-RC	Sullins	Connector Header Through Hole 40 position 0.100" (2.54mm)
28	J12	1	PRPC005DAAN-RC	CON10_2X5_TU_TS W_SAI	-	PRPC005DAAN-RC	Sullins	Connector Header Through Hole 10 position 0.100" (2.54mm)
29	J13,J14,J15	3	68000-208HLF	CONN_68000-408HLF_A MP	DNL	68000-208HLF	Amphenol	Connector Header Through Hole 8 position 0.100" (2.54mm)
30	J16	1	ME1016813401101-GOLD_FINGER	AMPHENO L_ME1016813401101_GF	DNL	ME1016813401101-GOLD_FINGER	Amphenol	168 Position Gold Finger - Dual Edge Gold 0.024" (0.60mm)
31	J17	1	ME1016813401101	AMPHENO L_ME1016813401101	-	ME1016813401101	Amphenol	168 Position Female Connector Non Specified - Dual Edge Gold 0.024" (0.60mm) Black
32	J20,J21	2	PRPC006DAAN-RC	CONN_PRPC006DAAN-RC_SUL	-	PRPC006DAAN-RC	Sullins	Connector Header Through Hole 12 position 0.100" (2.54mm)
33	MH1,MH2,MH3,MH4	4	MH	MTG125	DNL	NA	NA	Mounting Hole

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
34	Q1,Q2,Q3,Q8,Q9,Q10,Q11,Q12,Q13,Q14,Q15,Q16,Q17,Q18,Q19,Q20,Q21,Q22,Q23,Q24,Q25,Q26,Q27,Q28,Q29	25	BC817-40-TP	SOT-23-3	-	BC817-40-TP	Micro Commercial	Bipolar (BJT) Transistor NPN 45 V 800 mA 100MHz 310 mW Surface Mount SOT-23
35	Q4,Q5,Q6,Q7	4	SSM3J3 5AMFV	VESM_TO S	-	SSM3J35A MFV	Toshiba Semiconductor	P-Channel 20 V 250mA (Ta) 150mW (Ta) Surface Mount VESM
36	R1,R43,R86,R88,R90,R92,R164,R223,R255,R256,R257,R258,R333,R335,R338,R340,R351,R354,R363,R364,R508,R510,R512,R514,R516,R518,R520,R522,R567,R577,R584	31	1K Ohm	R0402-L	-	RC0402FR-071KP	Yageo	1 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
37	R2,R3,R5,R7,R44,R45,R54,R55,R58,R59,R62,R68,R70,R75,R77,R78,R79,R80,R81,R82,R83,R84,R101,R102,R103,R104,R105,R106,R107,R108,R109,R110,R111,R112,R124,R125,R126,R127,R128,R129,R130,R131,R132,R133,R134,R135,R136,R137,R138,R139,R140,R141,R142,R143,R165,R166,R177,R178,R183,R184,R185,R186,R187,R188,R189,R190,R205,R214,R245,R246,R259,R260,R261,R262,R263,R264,R265,R266,R278,R279,R289,R306,R315,R317,R319,R320,R321,R322,R323,R324,R325,R326,R327,R400,R408,R428,R435,R439,R440,R441,R442,R443,R444,R445,R446,R447,R448,R449,R450,R529,R530,R540,R553,R554,R557,R558,R559,R560,R561,R562,R563,R578,R579,R586	124	4.7K	R0402-L	-	RC0402FR-074K7P	Yageo	4.7 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
38	R4,R13,R173,R182	4	2.21K	R0402-L	-	RC0402FR-072K21L	Yageo	2.21 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
39	R6,R179	2	12K	R0402-L	-	RC0402FR-0712KL	Yageo	12 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
40	R8,R9,R14,R15,R20,R21,R22,R23,R27,R37,R50,R57,R60,R113,R114,R117,R118,R119,R120,R121,R155,R167,R168,R180,R181,R196,R202,R203,R207,R208,R210,R212,R213,R215,R280,R283,R328,R329,R341,R383,R385,R386,R387,R391,R395,R396,R397,R398,R413,R415,R416,R417,R423,R424,R451,R452,R453,R454,R455,R456,R551,R555,R556,R573,R593,R594,R595,R596	68	0 Ohm	R0402-L	-	RC0402FR-070RL	Yageo	0 Ohms Jumper Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
41	R10,R11,R12,R34,R35,R53,R56,R63,R65,R66,R71,R72,R73,R174,R175,R176,R193,R197,R199,R201,R218,R221,R222,R224,R281,R302,R303,R304,R308,R309,R310,R311,R312,R313,R314,R316,R318,R330,R331,R336,R381,R382,R384,R389,R390,R392,R393,R399,R404,R409,R411,R412,R414,R418,R419,R420,R425,R427,R432,R437,R538,R542,R545,R546,R549,R564,R565,R574,R575,R580,R581,R582,R587,R588,R589,R591	76	10K	R0402-L	-	RC0402FR-0710KP	Yageo	10 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
42	R36,R405,R433,R527,R535,R566,R576,R583	8	10K	R0402-L	DNL	RC0402FR-0710KP	Yageo	10 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
43	R61,R67,R219,R225,R301,R305,R537,R539,R585	9	330 Ohm	R0402-L	-	RC0402FR-07330RL	Yageo	330 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
44	R64,R69,R74,R76,R198,R200,R216,R282,R307,R590,R592	11	100 Ohm	R0402-L	-	RC0402FR-07100RL	Yageo	100 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
45	R85,R87,R89,R91,R332,R334,R337,R339,R507,R509,R511,R513,R515,R517,R519,R521	16	49.9 Ohm	R0402-L	-	RC0402FR-0749R9L	Yageo	49.9 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
46	R93,R94,R95,R96,R97,R98,R99,R100	8	53.6 Ohm	R0402-L	-	RC0402FR-0753R6L	Yageo	53.6 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
47	R152,R153,R154,R156,R157,R158,R159,R160,R161,R162,R163,R290,R291,R292,R293,R294,R295,R296,R297,R298,R299,R300,R342,R343,R344,R345,R346,R347,R348	29	0.1 Ohm	R0603-L	-	KDV06FR100ET	Ohmite	100 mOhms $\pm 1\%$ 0.2W, 1/5W Chip Resistor 0603 (1608 Metric) Current Sense Metal Film
48	R220	1	2.21K	R0402-L	DNL	RC0402FR-072K21L	Yageo	2.21 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
49	R251,R252,R253,R254	4	1K Ohm	R0402-L	DNL	RC0402FR-071KP	Yageo	1 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film
50	R284,R285,R286,R287,R288	5	20.0K	R0402-L	-	RC0402FR-0720KL	Yageo	20 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
51	R349,R350,R361,R362	4	8.25K	R0402-L	-	RC0402FR-078K25L	Yageo	8.25 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
52	R352,R353,R365,R366,R373,R374,R541	7	127K	R0402-L	-	RC0402FR-07127KL	Yageo	127 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
53	R355,R356,R367,R368,R376,R377,R379,R380	8	1.27K	R0402-L	-	RC0402FR-071K27L	Yageo	1.27 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
54	R357,R358,R359,R360,R369,R370,R371,R372,R375,R378	10	22.1 Ohm	R0402-L	-	RC0402FR-0722R1L	Yageo	22.1 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
55	R388,R422	2	0 Ohm	R0402-L	DNL	RC0402FR-070RL	Yageo	0 Ohms Jumper Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
56	R457,R458,R459,R460,R461,R462,R463,R464,R465,R466,R467,R468,R469,R470,R471,R472,R473,R474,R475,R476,R477,R478,R479,R480,R481,R482,R483,R484,R485,R486,R487,R488,R489,R490,R491,R492,R493,R494,R495,R496,R497,R498,R499,R500,R501,R502,R503,R504,R505,R506	50	1.0K	R0603-L	-	RC0603FR-071KL	Yageo	1 kOhms $\pm 1\%$ 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film
57	R523,R531	2	2.0K	R0402-L	-	RC0402FR-072KL	Yageo	2 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
58	R524,R526,R532,R534	4	100K	R0402-L	-	RC0402FR-07100KL	Yageo	100 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
59	R525,R533	2	2.8K	R0402-L	-	RC0402FR-072K8L	Yageo	2.8 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
60	R528,R536	2	100K	R0402-L	DNL	RC0402FR-07100KL	Yageo	100 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
61	R543,R544,R548	3	40.2K	R0402-L	-	RC0402FR-0740K2L	Yageo	40.2 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
62	R547	1	51.0K	R0402-L	-	RC0402FR-0751KL	Yageo	51 kOhms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film
63	R597,R598,R599,R600	4	100 Ohm	R0402-L	DNL	RC0402FR-07100RL	Yageo	100 Ohms $\pm 1\%$ 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
64	SW1,SW2,SW3,SW5,SW8,SW9,SW10,SW12,SW13,SW16,SW17	11	'430182 043816	SOIC_820 43816_W RE	-	43018204 3816	Würth	Tactile Switch SPST-NO Top Actuated Surface Mount
65	SW4	1	219- 4LPST	219- 4LP_CTS	-	219-4LPST	CTS Electrocompo nents	Dip Switch SPST 4 Position Surface Mount Slide (Standard) Actuator 100mA 20VDC
66	SW6,SW7,SW11,SW14	4	219- 8LPST	219- 8LPST_CTS	-	219-8LPST	CTS Electrocompo nents	Dip Switch SPST 8 Position Surface Mount Slide (Standard) Actuator 100mA 20VDC
67	SW15	1	500SSP1 S1M6QE A	SW_500SS P1S1M6Q EA	-	500SSP1S 1M6QEA	E-Switch	Slide Switch SPDT Through Hole, Right Angle
68	TP1,TP2,TP4,TP5,TP6,TP7,TP8,TP9,TP10,TP11,TP23,TP24,TP25,TP26,TP27,TP28,TP29,TP30,TP31,TP32,TP44,TP45,TP53,TP54,TP55,TP56,TP57,TP58,TP61,TP63,TP64,TP65,TP66,TP67,TP68,TP71,TP73,TP74,TP75,TP76,TP79,TP80,TP81,TP82,TP83	45	TP1	TPd39c60	DNL	TP1	NA	Test Point 0.39"
69	U1	1	SG-BGA- 6129	bga400_s ocket	(Refer Assembly Notes below)	SG-BGA- 6129	Ironwood Electronics	GHz BGA Socket - Direct mount, solderless
70	U2	1	LFCPNX- 100- LFG672	fcBGA- 100p27x2 7-672	Customer Supplied	LFCPNX- 100- 9LFG672C	Lattice Semiconductor	Lattice Lattice CertusPro-NX General Purpose FPGA on Nexus platform (28nm FD-SOI)

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
71	U3	1	LCMX03D-9400HC-5BG484C	caBGA-080p19x19-484	Customer Supplied	LCMX03D-9400HC-5BG484C	Lattice Semiconductor	FPGA - Field Programmable Gate Array Lattice MachXO3D; 9400LUTs 2.5V/3.3V
72	U4,U9	2	FT2232HL	64L-LQFP	Customer Supplied	FT2232HL-REEL	FTDI	IC USB HS DUAL UART/FIFO 64-LQFP
73	U5,U10	2	93LC56C-ISN	SOIC8-N	-	93LC56C-ISN	Microchip	EEPROM Memory IC 2Kbit Microwire 3 MHz 8-SOIC
74	U7,U12	2	24LC512T-I/SM	SOIC8-W_MC_MCH	-	24LC512T-I/SM	Microchip	EEPROM Memory IC 512Kbit I2C 400 kHz 900 ns 8-SOIJ
75	U8	1	LFMX05D-100-BBG400		Customer Supplied (Refer Assembly Notes below)	LFMX05D-100-BBG400	Lattice	LFMX05D-100-BBG400
76	U13,U15,U21,U23	4	SN74CBTLV3257DBQR	DBQ16	-	SN74CBTLV3257DBQR	Texas Instruments	Multiplexer/De multiplexer 4 x 1:2 16-SSOP
77	U16,U24	2	ACA-SPI-006-K01	ACA-SPI-006-K01_LOTE S	-	ACA-SPI-006-K01	Lotes	16 (2 x 8) Pos SOIC Socket Gold Surface Mount

Item	Reference	Qty	Part	PCB Footprint	Comment	Part No.	Manufacturer	Description
78	U18,U26	2	Flash		ALTERNATE PART NUMBER (MX66L1G45GMI-08G) Refer Assembly Notes below	MT25QL01GBBB8E SF-0SIT	Micron	FLASH - NOR Memory IC 1Gbit SPI - Quad I/O 133 MHz 16-SO
79	U19,U27	2	MT25QL01GBBB8ESF-0SIT	SOP2-16_300MIL_SF_MRN	-	MT25QL01GBBB8E SF-0SIT	Micron	FLASH - NOR Memory IC 1Gbit SPI - Quad I/O 133 MHz 16-SO
80	U29,U30	2	SN74LVC2G66DCUR	DCU8	-	SN74LVC2G66DCUR	Texas Instruments	IC SWITCH SPST-NOX2 100HM 8VSSOP
81	U31,U32,U33	3	TPS82130SILR	CONV_TPS82140SILR	-	TPS82130SILR	Texas Instruments	Non-Isolated PoL Module DC DC Converter 1 Output 0.9 ~ 5V 3A 3V - 17V Input
82	X1,X3	2	7V-12.000MDDJ-T	SMD_0MAHE-T_TXC-L	-	7V-12.000MDDJ-T	TXC	12 MHz $\pm$ 20ppm Crystal 18pF 150 Ohms 4-SMD, No Lead
83	X2,X4,X5	3	25MHz	ECS-2520MV-ECS	-	ECS-2520MV-250-CM-TR	ECS	25 MHz XO (Standard) HCMOS Oscillator 1.6V ~ 3.6V Enable/Disable 4-SMD, No Lead
84	Sentry 4.0 Demo Board for MachXO5-NX REVA.1 PCB	1	-	-	-	305-PD-24-0XXX	PACTRON	

References

- [MachXO5-NX Family Data Sheet \(FPGA-DS-02102\)](#)
- [MachXO5-NX Family Root-of-Trust Devices Data Sheet \(FPGA-DS-02120\)](#)
- [MachXO5-NX Programming and Configuration User Guide \(FPGA-TN-02271\)](#)
- [CertusPro-NX Family Data Sheet \(FPGA-DS-02086\)](#)
- [Common Programming and Configuration CertusPro-NX \(FPGA-AN-02048\)](#)
- [MachXO3D Family Data Sheet \(FPGA-DS-02026\)](#)
- [MachXO3D Programming and Configuration User Guide \(FPGA-TN-02069\)](#)
- [IP & Reference Designs for MachXO5-NX](#)
- [Development Kits & Boards for MachXO5-NX](#)
- [Lattice Propel 1.1 Root of Trust Reference Design \(FPGA-RD-02243\)](#)
- [MachXO5-NX web page](#)
- [MachXO3D web page](#)
- [CertusPro-NX web page](#)
- [Lattice Insights](#) for training series 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 1.0, January 2025

Section	Change Summary
All	Initial release



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