



CrossLink-NX Voice and Vision Machine Learning Board

Evaluation Board User Guide

FPGA-EB-02039-1.0

February 2021

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Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
CMOS	Complementary Metal-Oxide Semiconductor
CSI-2	Camera Serial Interface
DDR	Double Data Rate
DSI	Display Serial Interface
FTDI	Future Technology Devices International
GPIO	General Purpose Input/Output
I ² C	Inter-Integrated Circuit
I ² S	Inter-IC Sound
LDO	Low Dropout
LVDS	Low-Voltage Differential Signaling
MIPI	Mobile Industry Processor Interface
ML	Machine Learning
MSPI	Master SPI
PMOD	Peripheral Module
SMA	SubMiniature version A
SPI	Serial Peripheral Interface
SSPI	Slave SPI
VIP	Video Interface Platform
VTT	Tracking Termination Voltage

1. Introduction

This document describes the Lattice Semiconductor CrossLink-NX Voice and Vision Machine Learning Board. The board's key component is the CrossLink™-NX FPGA, which receives input from high- and low-resolution cameras and microphones, and sends video output over USB3. This board is ideal for machine learning applications and features onboard HyperRAM as well as PMOD (Peripheral Module) connectors for off board support.

The content of this user guide includes descriptions of onboard settings, connectors, programming circuit, a complete set of schematics, and bill of materials for the CrossLink-NX Voice and Vision Machine Learning Board.

The key features of the CrossLink-NX Voice and Vision Machine Learning Board include:

- CrossLink-NX FPGA (LIFCL-40-MG289)
 - 4-lane MIPI CSI-2 receiver interface for high resolution camera data
 - Serial interface for low resolution camera data
 - I²S interface for audio data from two microphones
 - SPI flash configuration
 - General Purpose Input/Output
- Board Resources
 - 2*64 Mb HyperRAM available for ML (Machine Learning) applications
 - Cypress CYUSB3014 for Video Output to PC over USB3
 - Four PMOD connectors expansion headers available
 - Expansion header for Hard MIPI DPHY connectivity
- Programming Circuit
 - From programming software through USB/FTDI interface (JTAG or SPI)
 - From onboard Flash
 - SPI external programmer using header

[Figure](#) and [Figure 1.2](#) show the top and bottom views of the CrossLink-NX Voice and Vision Machine Learning Board and its key components.

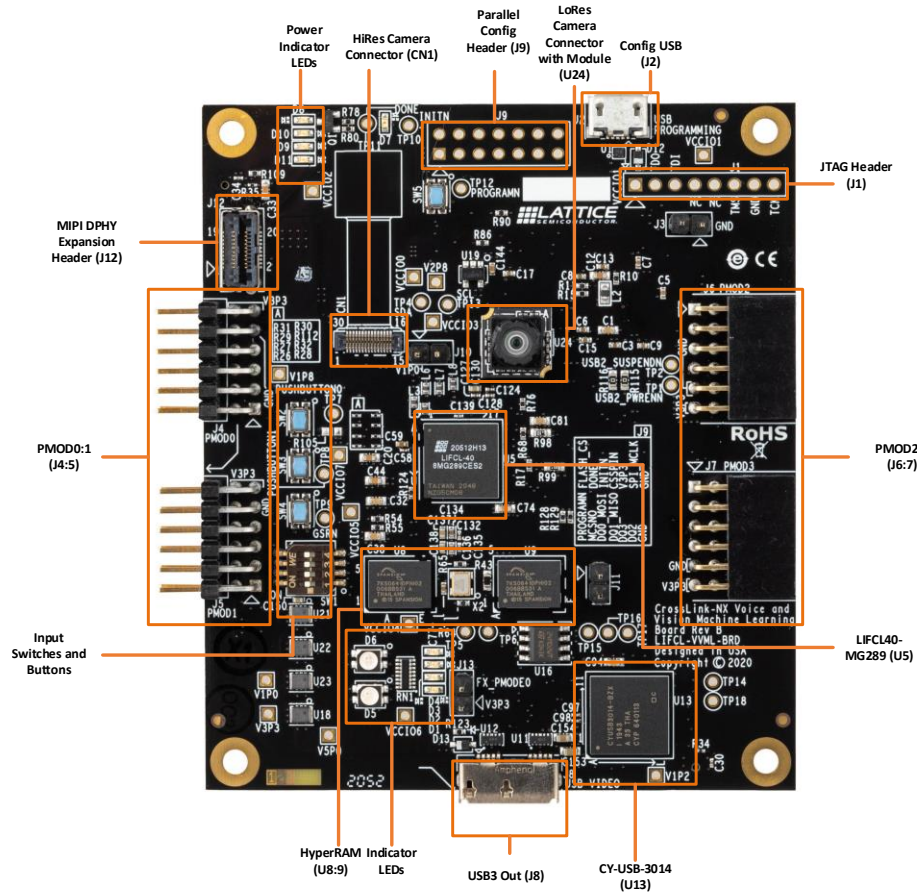


Figure 1.1. Top View of CrossLink-NX Voice and Vision Machine Learning Board

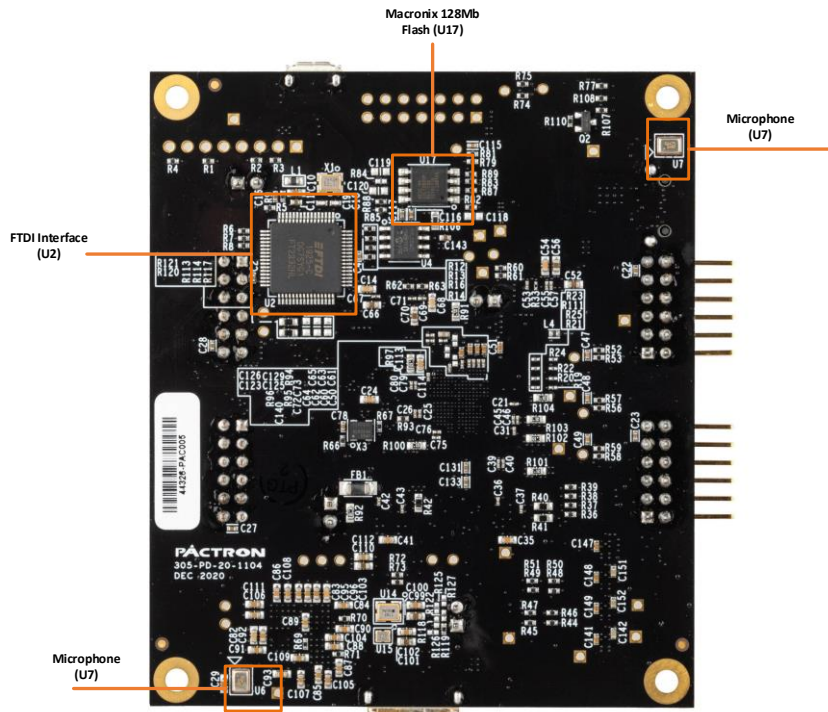


Figure 1.2. Bottom View of CrossLink-NX Voice and Vision Machine Learning Board

1.1. Further Information

The following references provide detailed information on the CrossLink-NX Voice and Vision Machine Learning Board and the CrossLink-NX FPGA device:

- [Appendix A. CrossLink-NX Voice and Vision Machine Learning Board Schematics](#)
- [Appendix B. CrossLink-NX Voice and Vision Machine Learning Board Bill of Materials](#)
- www.latticesemi.com/boards for more information on boards and kits
- [CrossLink-NX Family Data Sheet \(FPGA-DS-02049\)](#) for details on the CrossLink-NX FPGA

2. Headers and Jumpers

Table 2.1 lists the headers and jumpers as shown in Figure .

Table 2.1. Headers and Test Connectors

Part	Description	Settings (Default first)
J3	FTDI Reset Jumper	Open (active FTDI)/Short (reset FTDI)
J1	JTAG Header	—
J9	Parallel Configuration Header	—
J10, J11	Current Measurement Headers	Open (functional, attach measurement probes)
J13	USB3 Chip Mode	Open (FX_PMODE0=HiZ)/Short (FX_PMODE0=V3P3)
J4, J5, J6, J7	PMOD Headers	—
J12	MIPI DPHY Expansion Header	—

3. Board Programming

3.1. Programming Circuit

CrossLink-NX can be programmed with USB through the FTDI/JTAG interface using Lattice Radiant™ programmer software, or by an external programmer connected to Header J9.

Figure 3.1 shows the programming block of CrossLink-NX Voice and Vision Machine Learning board.

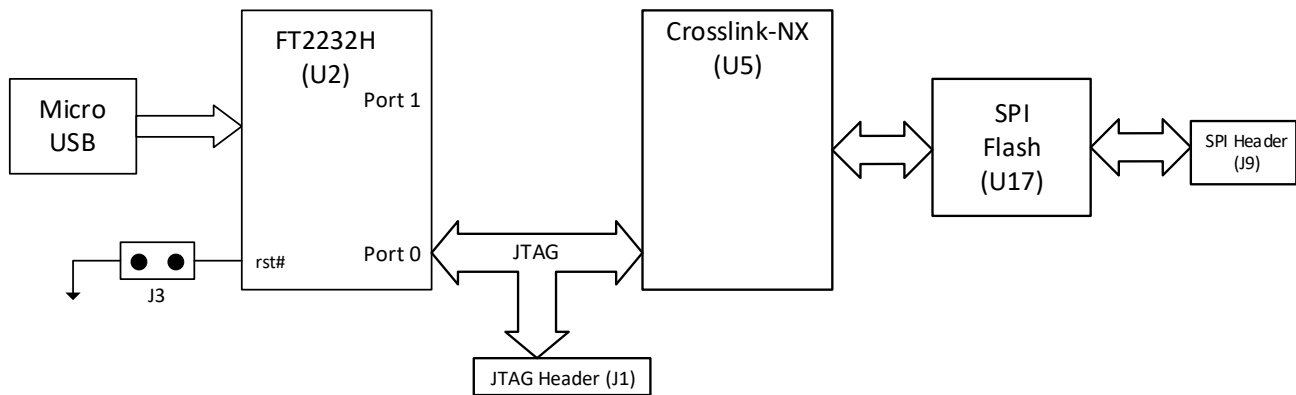


Figure 3.1. Programming Block

The FTDI/JTAG interface is used to program both CrossLink-NX and SPI Flash Memory (Macronix 25L12833 128Mb).

3.2. Programming the Board

This section describes the procedure for programming a pattern to the SRAM (volatile) configuration memory of Crosslink-NX. The Crosslink-NX can be programmed via JTAG, I2C, or SPI interfaces. This section focuses on JTAG programming via the USB/FTDI interface. For details on the other configuration modes, refer to the [CrossLink-NX sysConfig Usage Guide \(FPGA-UG-02099\)](#).

The board is programmed using Lattice Radiant Programmer software, which can be started as a stand-alone tool or from a Lattice Radiant project.

To program the board:

1. Power ON the board on the EVDK board stack.
2. Start a programming project by launching the tool and initiating a board scan, as shown in Figure 3.2.

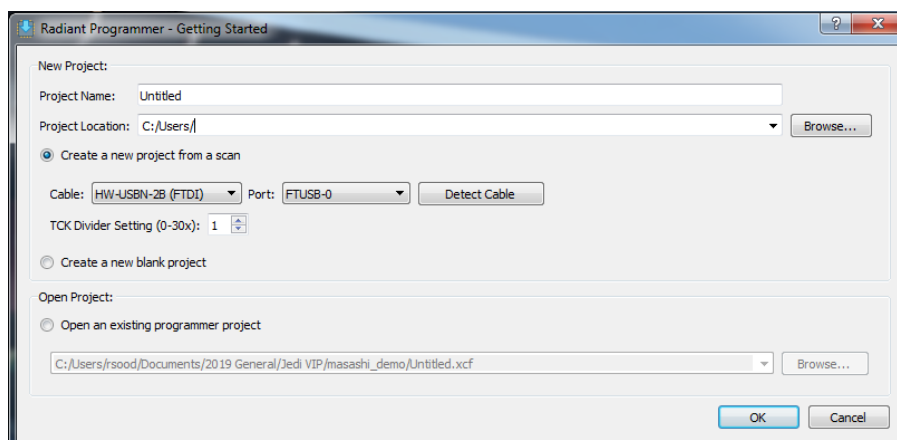


Figure 3.2. Starting Programmer

- When the board is successfully scanned, the window shown in [Figure 3.3](#) appears. This interface allows you to enter the file name.

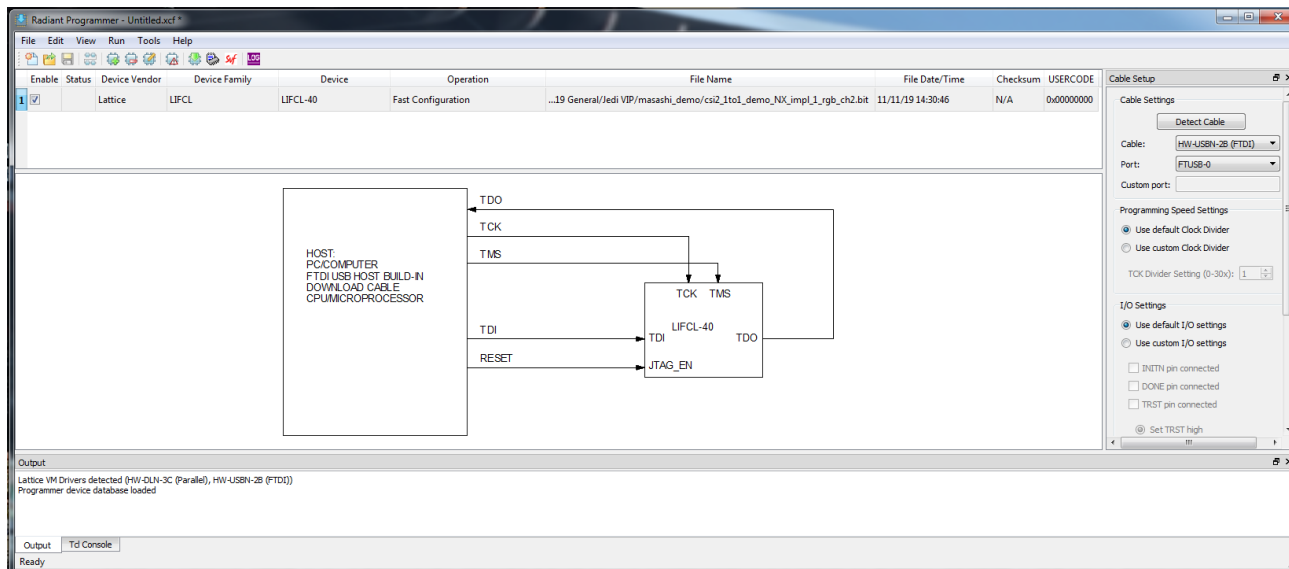


Figure 3.3. Entering File Name

- Double click on the **Operation** field and select the appropriate programming mode. In this example, **Fast Configuration** of the SRAM array through JTAG is selected.

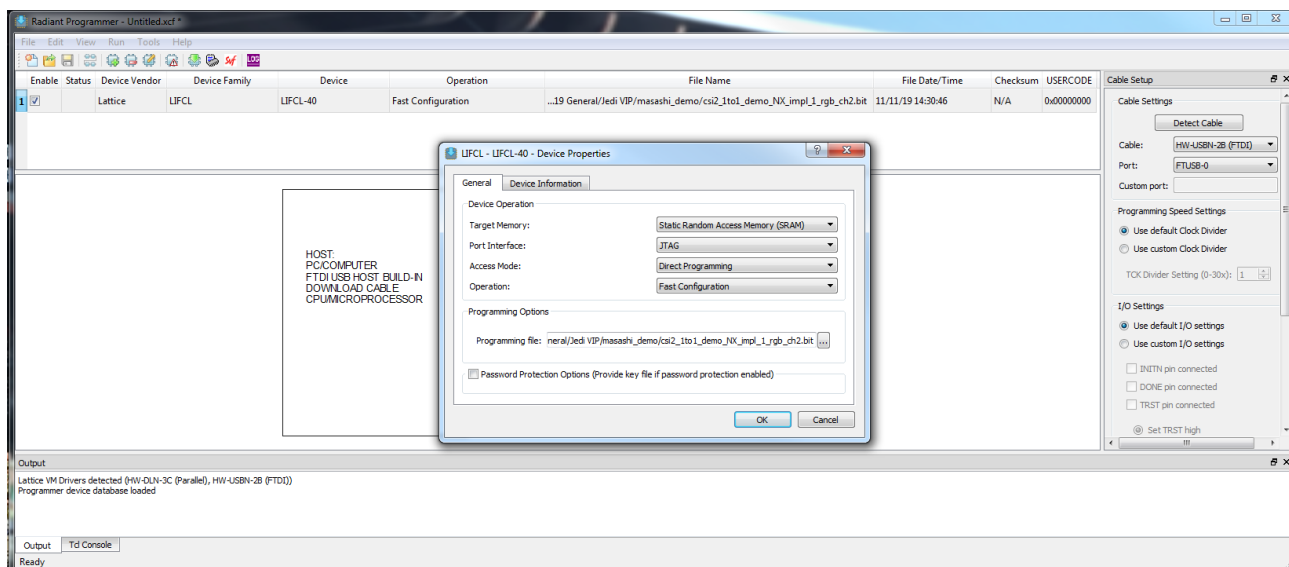


Figure 3.4. Entering Programming Mode

After this, clicking on the program button will configure the Crosslink-NX on the board.

4. CrossLink-NX Interface Support

The CrossLink-NX Voice and Vision Machine Learning board supports various onboard interfaces and external interfaces. The sections below describe key onboard interfaces supported on CrossLink-NX Voice and Vision Machine Learning board.

4.1. HiRes Camera Sensor Interfaces

Figure 4.1 shows the block diagram of the camera sensor interface. The Sony IMX258 image sensor is used as the input source on the camera sensor connector. The data path interface between the camera sensor module and CrossLink-NX is CSI-2. The cameras are configured using I²C interface from the Crosslink-NX.

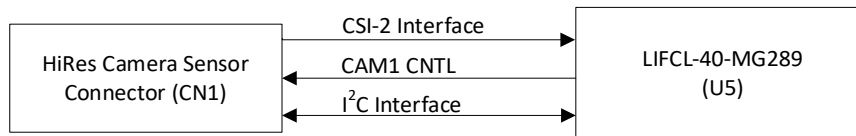


Figure 4.1. HiRes Camera Sensor Interface

4.2. LoRes Camera Sensor Interface

Figure 4.2 shows the block diagram of the camera sensor interface. The HiMax HM360 image sensor is used as the input source on the camera sensor connector. The data path interface between the camera sensor module and CrossLink-NX is serial differential. The cameras are configured using I²C interface from the Crosslink-NX.

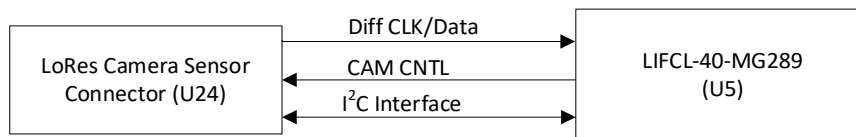


Figure 4.2. Upstream Connector Interface

4.3. Microphone Sensor Interface

Figure 4.23 shows the block diagram of the microphone sensor interface. The microphone sensors are Knowles SPH0645LM4H. There are two sensors on opposite sides of the board. The sensors share the I2S bus to the Crosslink-NX, which will be the I2S master.

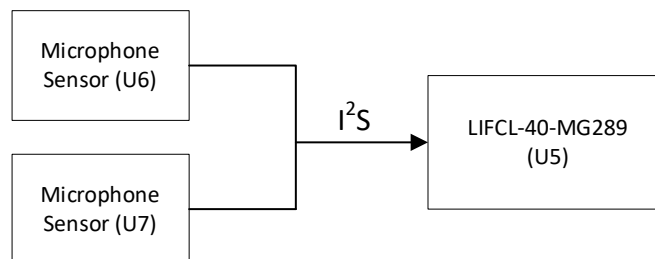


Figure 4.3. Microphone Sensor Interface

4.4. Video Out Interface

Figure 4.24 shows the block diagram of the video out interface. Video data from the Crosslink-NX is sent to the CYUSB3014, which processes the data and sends it out via USB3.

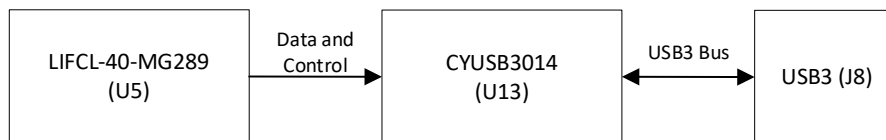


Figure 4.4. Video Out Interface

5. Power Supply

The power supply to the CrossLink-NX Voice and Vision Machine Learning Board is provided from the J2 or J8 USB connectors. If either or both USB ports are connected to a powered cable, the board powers up.

Figure 5.1 shows the power supply block of CrossLink-NX Voice and Vision Machine Learning Board. The 5v is supplied via USB, and then board converters create the remaining 3.3v, 2.8v, 1.8v, 1.2v, and 1.0v supplies required by the board components. Each I/O and core voltage rail on the board is accessible by a test point on the board.

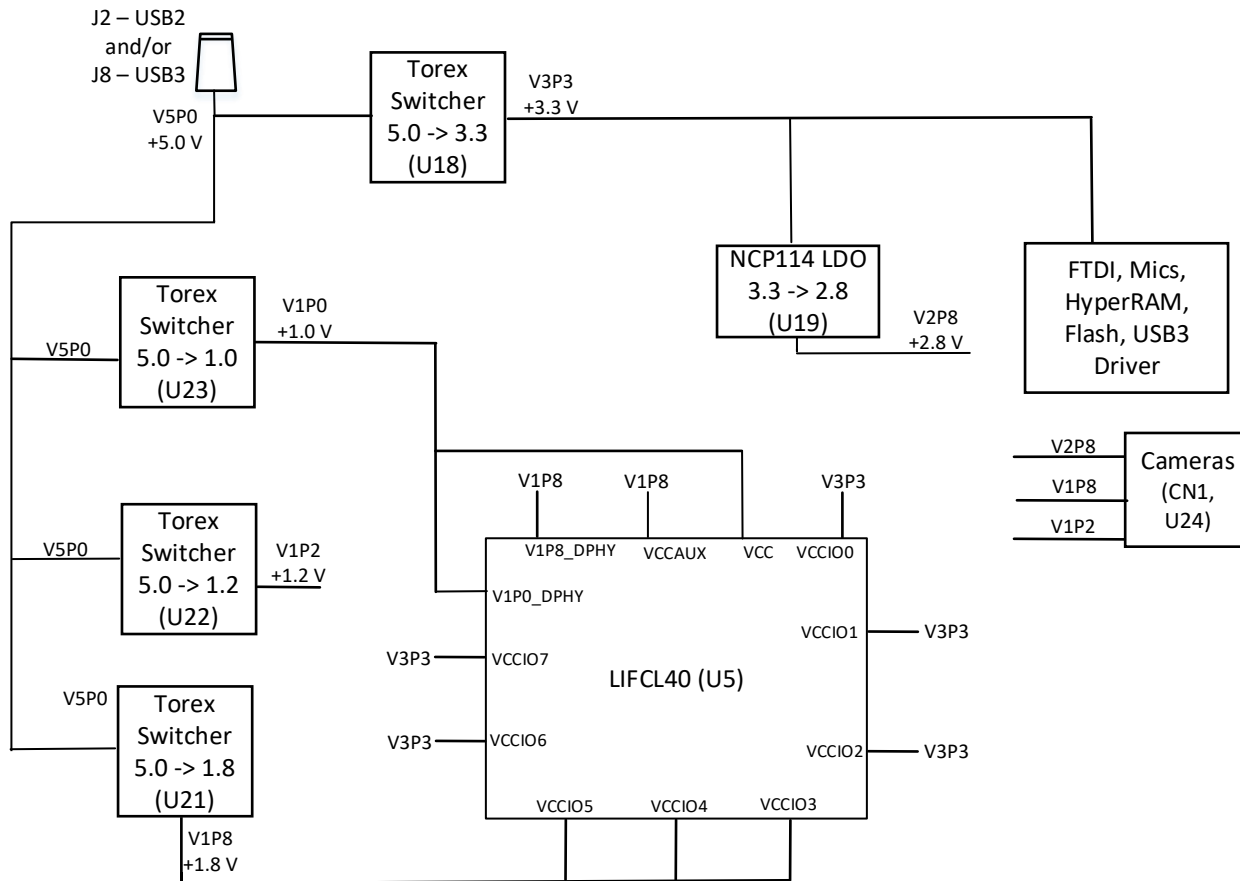


Figure 5.1. Power Supply Block

Table 5.1 lists the board voltage rails, including the rail source voltage, test point number, and voltage on net.

Table 5.1. Device Power Rail Summary

Voltage Rail	Source Rail	Voltage on Net (V)	Status LED	LED Color
V5P0	USB	5.0	D9	Blue
V3P3	V5P0	3.3	D10	Blue
V2P8	V3P3	2.8	-	-
V1P8	V5P0	1.8	D11	Green
V1P2	V5P0	1.2	-	-
V1P0	V5P0	1.0	-	-

6. CrossLink-NX I/O Ball Mapping to Connectors

Table 6.1. Camera Sensor Connector Pin Mapping

CN1			U24		
Pin Num	Net Name	Ball Num	Pin Num	Net Name	Ball Num
1	—	—	1	V2P8	—
2	CAM0_CLKN	E2	2	GND	—
3	CAM0_CLKP	D1	3	HM_CP	T1
4	GND	—	4	HM_CN	R1
5	CAM0_3N	C2	5	GND	—
6	CAM0_3P	B1	6	HM_DP	R2
7	GND	—	7	HM_DN	P2
8	CAM0_1N	D2	8	GND	—
9	CAM0_1P	C1	9	—	—
10	GND	—	10	—	—
11	CAM0_ON	F2	11	GND	—
12	CAM0_OP	E1	12	V1P8	—
13	GND	—	13	V1P2	—
14	CAM0_2N	G2	14	GND	—
15	CAM0_2P	F1	15	HM_MCLK	M13
16	GND	—	16	HM_PCLK	M12
17	GND	—	17	HM_CTX_SELO	U14
18	V2P8	—	18	HM_INT	T15
19	—	—	19	HM_SDA	T14
20	CAM0_MCLK	M14	20	HM_SCL	U12
21	CAM_FRAME_SYNC	P15	21	HM_HSYNC	U13
22	I2CO_SDA	U15	22	HM_VSYNC	N13
23	I2CO_SCL	R15	23	HM_TRIG	N12
24	CAM_RESET	N15	24	GND	—
25	V1P2	—	25	HM_CLK_SEL	T13
26	V1P8	—	26	HM_CLK_RTC	P12
27	GND	—	27	HM_FAE	T12
28	GND	—	28	HM_XSDN	P11
29	V2P8	—	29	HM_XSLEEPN	N11
30	GND	—	30	HM_STROBE	P10

Table 6.2. PMOD Connector Pin Mapping

PMOD0 (J4)			PMOD1 (J5)			PMOD2 (J6)			PMOD3 (J7)		
Pin Num	Net Name	Ball Num	Pin Num	Net Name	Ball Num	Pin Num	Net Name	Ball Num	Pin Num	Net Name	Ball Num
1	PMOD0_1	D7	1	PMOD1_1	F7	1	PMOD2_1	L13	1	PMOD3_1	J17
2	PMOD0_2	D6	2	PMOD1_2	F6	2	PMOD2_2	L12	2	PMOD3_2	J16
3	PMOD0_3	E7	3	PMOD1_3	H3	3	PMOD2_3	L11	3	PMOD3_3	J15
4	PMOD0_4	E6	4	PMOD1_4	H4	4	PMOD2_4	L10	4	PMOD3_4	J14
5	GND	—	5	GND	—	5	GND	—	5	GND	—
6	V3P3	—	6	V3P3	—	6	V3P3	—	6	V3P3	—
7	PMOD0_7	D4	7	PMOD1_7	G7	7	PMOD2_7	K11	7	PMOD3_7	J13
8	PMOD0_8	D5	8	PMOD1_8	G6	8	PMOD2_8	K10	8	PMOD3_8	J12
9	PMOD0_9	E5	9	PMOD1_9	H7	9	PMOD2_9	K17	9	PMOD3_9	J11
10	PMOD0_10	E4	10	PMOD1_10	H8	10	PMOD2_10	K16	10	PMOD3_10	J10
11	GND	—	11	GND	—	11	GND	—	11	GND	—
12	V3P3	—	12	V3P3	—	12	V3P3	—	12	V3P3	—

Table 6.3. HyperRAM Pin Mapping

HyperRAM0 (U8)			HyperRAM1 (U9)		
Pin Name/Num	Net Name	Ball Num	Pin Name/Num	Net Name	Ball Num
RFU1/A2	—	—	RFU1/A2	—	—
RFU2/A5	—	—	RFU2/A5	—	—
CS#/A3	HR0_CS	N5	CS#/A3	HR1_CS	T9
RESET#/A4	HR0_RST	P5	RESET#/A4	HR1_RST	P7
CK#/B1	HR0_CKN	P4	CK#/B1	HR1_CKN	U11
CK/B2	HR0_CK	R4	CK/B2	HR1_CK	T11
VSS/B3	GND	—	VSS/B3	GND	—
VSSQ/C1	GND	—	VSSQ/C1	GND	—
VSSQ/E5	GND	—	VSSQ/E5	GND	—
VCC/B4	VCCIO4	—	VCC/B4	VCCIO4	—
VCCQ/E4	VCCIO4	—	VCCQ/E4	VCCIO4	—
VCCQ/D1	VCCIO4	—	VCCQ/D1	VCCIO4	—
RFU3/B5	—	—	RFU3/B5	—	—
RFU4/C2	—	—	RFU4/C2	—	—
RFU5/C5	—	—	RFU5/C5	—	—
RWDS/C3	HR0_RW	U4	RWDS/C3	HR1_RW	N7
DQ0/D3	HR0_DQ0	U5	DQ0/D3	HR1_DQ0	P8
DQ1/D2	HR0_DQ1	U6	DQ1/D2	HR1_DQ1	N8
DQ2/C4	HR0_DQ2	T6	DQ2/C4	HR1_DQ2	U9
DQ3/D4	HR0_DQ3	N6	DQ3/D4	HR1_DQ3	U10
DQ4/D5	HR0_DQ4	P6	DQ4/D5	HR1_DQ4	T10
DQ5/E3	HR0_DQ5	U7	DQ5/E3	HR1_DQ5	R10
DQ6/E2	HR0_DQ6	U8	DQ6/E2	HR1_DQ6	P9
DQ7/E1	HR0_DQ7	T7	DQ7/E1	HR1_DQ7	N9

Table 6.4. CYUSB3014 Pin Mapping

CYUSB3014 (U13)			CYUSB3014 (U13)		
Pin Name/Num	Net Name	Ball Num	Pin Name/Num	Net Name	Ball Num
PCLK_CLK	FX_PCLK	K1	SSTX-	USB3_SSTXN	USB3:SSTX-
RESETN	FX_RSTN	N1	SSTX+	USB3_SSTXP	USB3:SSTX+
CTL0_SLCSN	FX_CTL0_SLCSN	F7	D+	USB3_DP	USB3:D+
CTL1_SLWRN	FX_CTL1_SLWRN	F6	D-	USB3_DN	USB3:D-
CTL2_SLOEN	FX_CTL2_SLOEN	H3	FSLC0	GND	—
CTL3_SLRDN	FX_CTL3_SLRDN	H4	FSLC1	GND	—
CTL4_FLAGA	—	—	FSLC2	V3P3	—
CTL5_FLAGB	FX_CTL5_FLAGB	G7	CLKIN	MSTCLK_FX3	OSC_19M2:OUT
CTL6_GPIO	—	—	CLKIN_32	CLK_32MHZ	OSC_32768:OUT
CTL7_PKTENDN	FX_CTL7_PKTENDN	G6	TDI	—	TP14
CTL8_GPIO	FX_CTL8_GPIO	H7	TDO	—	TP15
CTL9_GPIO	—	—	TRSTN	—	TP16
CTL10_GPIO	—	—	TMS	—	TP17
CTL11_A1	FX_LV	M3	TCK	—	TP18
CTL12_A0	FX_FV	M4	O60_CHGDET	—	—
INTN_CTL15	FX_INTN_CTL15	H8	PMODE0	FX_PMODE0	—
GPIO_I2SCLK	FX_GPIO_I2SCLK	L5	PMODE1	FX_PMODE1	—
GPIO_I2SSD	FX_GPIO_I2SSD	L7	PMODE2	FX_PMODE2	—
GPIO_I2SWS	FX_GPIO_I2SWS	L6	R_USB2	GND	—
SPISCK_UARTRTS_GPIO	—	—	R_USB3	GND	—
SPISSN_UARTCTS_GPIO	—	—	NC	—	—
SPIMISO_UARTTX_GPIO	FX_SPIMISO_UARTTX	K6	VBATT	V5P0	—
SPIMOSI_UARTRX_GPIO	FX_SPIMOSI_UARTRX	K7	VBUS	V5P0	—
GPIO_I2SMCLK	FX_GPIO_I2SMCLK	H13	AVDD	V1P2	—
GPIO	—	—	CVDDQ	V3P3	—
I2C_SCL	FX_I2C_SCL	M1	U3TXVDDQ	V1P2	—
I2C_SDA	FX_I2C_SDA	M2	U3RXVDDQ	V1P2	—
DQ0	FX_D0	G11	VDD-1:VDD-8	V1P2	—
DQ1	FX_D1	G10	VIO1-1:VIO5	V3P3	—
DQ2	FX_D2	G13	VSS1:VSS14	GND	—
DQ3	FX_D3	G12	AVSS	GND	—
DQ4	FX_D4	G16	U3VSSQ	GND	—
DQ5	FX_D5	G15			
DQ6	FX_D6	F16			
DQ7	FX_D7	F17			
DQ8	FX_D8	F11			
DQ9	FX_D9	E14			
DQ10	FX_D10	E16			
DQ11	FX_D11	E15			
DQ12	FX_D12	D17			
DQ13	FX_D13	N3			
DQ14	FX_D14	N2			
DQ15	FX_D15	P1			
DQ16:DQ31	—	—			

CYUSB3014 (U13)			CYUSB3014 (U13)		
Pin Name/Num	Net Name	Ball Num	Pin Name/Num	Net Name	Ball Num
XTALIN	—	—			
XTALOUT	—	—			
OTG_ID	USB_OTG	USB3:O TG			
SSRX-	USB3_SSRXN	USB3:S SRX-			
SSTX+	USB3_SSRXP	USB3_S SRX+			

Table 6.5. MIPI DPHY Expansion Header

J12		
Pin Num	Net Name	Ball Num
1	GND	—
2	GND	—
3	DPHY1_CKP	A4
4	DPHY1_DP1	A5
5	DPHY1_CKN	B4
6	DPHY1_DN1	B5
7	GND	—
8	GND	—
9	DPHY1_DP0	A3
10	DPHY1_DP2	A2
11	DPHY1_DN0	B3
12	DPHY1_DN2	B2
13	GND	—
14	GND	—
15	I2C_DPHY1_SCL	T17
16	DPHY1_DP3	A6
17	I2C_DPHY1_SDA	T16
18	DPHY1_DN3	B6
19	V3P3	—
20	GND	—
SH1	GND	—
SH2	GND	—

7. Status Indicators

The LED status indicators on the board show the application status. [Table](#) lists the status LED I/O map.

Table 7.1. Status LED I/O Map

Net Name	LED	Connector/Pin	Color
LED0	D1	H1	Green
LED1	D2	J1	Green
LED2	D3	H5	Green
LED3	D4	H6	Green
LED4 – Red	D5	J7	RGB
LED4 – Green		J6	
LED4 – Blue		J2	
LED5 – Red	D6	J3	RGB
LED5 – Green		J4	
LED5 – Blue		J5	

8. Input Switches and Pushbuttons

[Table](#) below lists all input switches and pushbuttons. This board has one 4 input slider switch and 5 pushbuttons.

Table 8.1. Switch and Pushbutton I/O Map

Net Name	Component	Connector/Pin
SWITCH0	SW1	R5
SWITCH1	SW1	T4
SWITCH2	SW1	R7
SWITCH3	SW1	T8
PUSHBUTTON0	SW2	K2
PUSHBUTTON1	SW3	L1
GSRN	SW4	L2
PROGRAMN	SW5	D13

9. Ordering Information

This board is included as part of a kit, and not available as a separate item. The below part number is for reference only, so it is clear which board is described in this document. Please visit www.latticesemi.com/boards for the latest ordering information.

Table 9.1. Reference Part Number

Description	Ordering Part Number
CrossLink-NX Voice and Vision Machine Learning Board	LIFCL-VVML-EVN

References

For more information, refer to [CrossLink-NX Family Data Sheet \(FPGA-DS-02049\)](#).

Technical Support Assistance

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

Appendix A. CrossLink-NX Voice and Vision Machine Learning Board Schematics

5	4	3	2	1
<h1>Crosslink-NX Voice and Vision Machine Learning Board</h1> <h2>Rev - B</h2>				
D	<ul style="list-style-type: none"> 01 - Title Page 02 - Block Diagram 03 - FTDI/USB Interface 04 - PMOD Connectors and Mic 05 - HyperRAM and GPIO 06 - EVDK and Himax Cameras 07 - USB3 Out 08 - Flash Interface 09 - Unused and Power Banks 10 - Power Distribution and VCCIO 11 - Power Diagram 			D
C				C
B				B
A				A
5	4	3	2	1

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Title Title Page	
Size A	Project Crosslink-NX Voice and Vision ML Board
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Figure A.1. Title Page

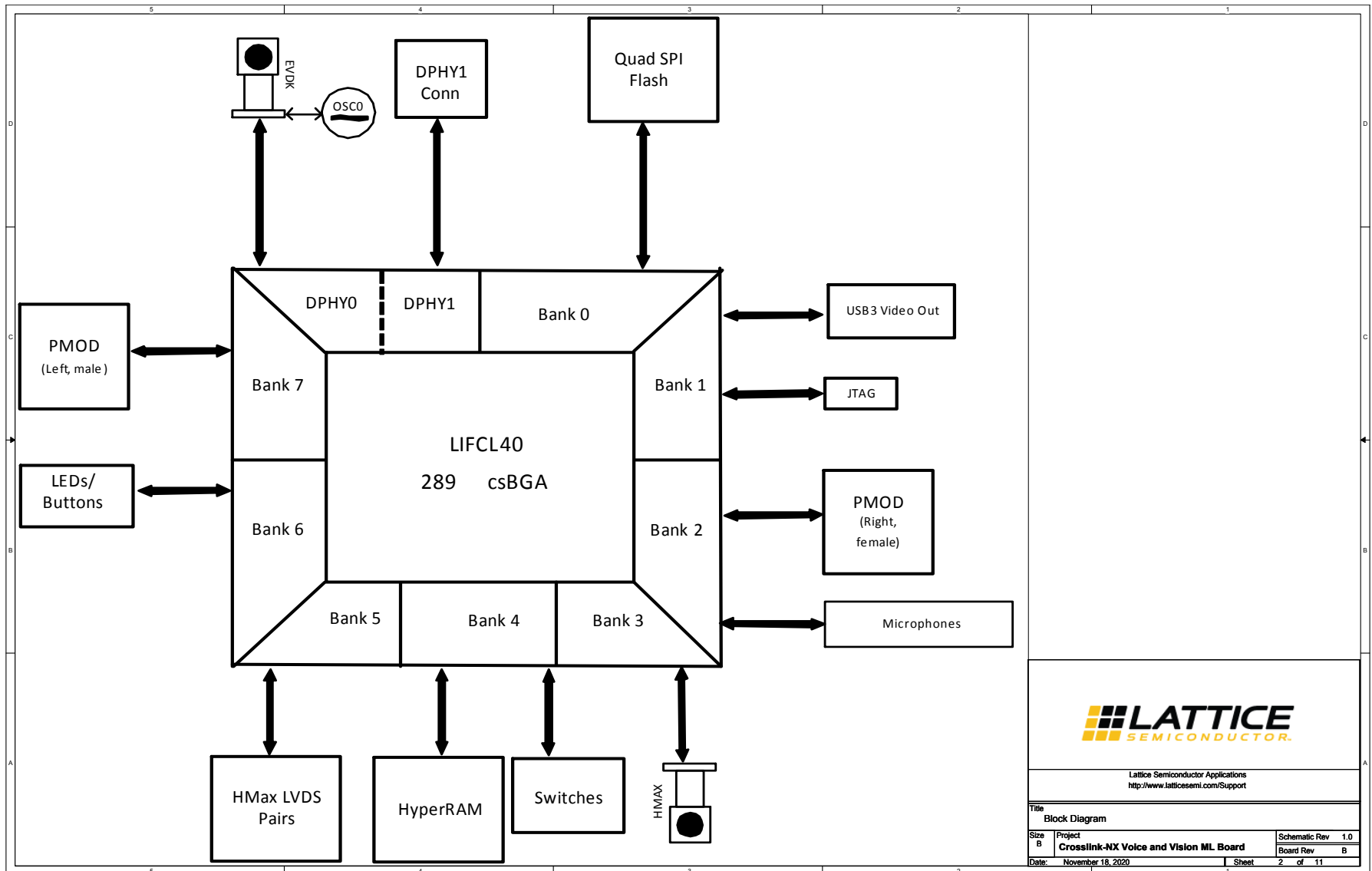


Figure A.2. Block Diagram

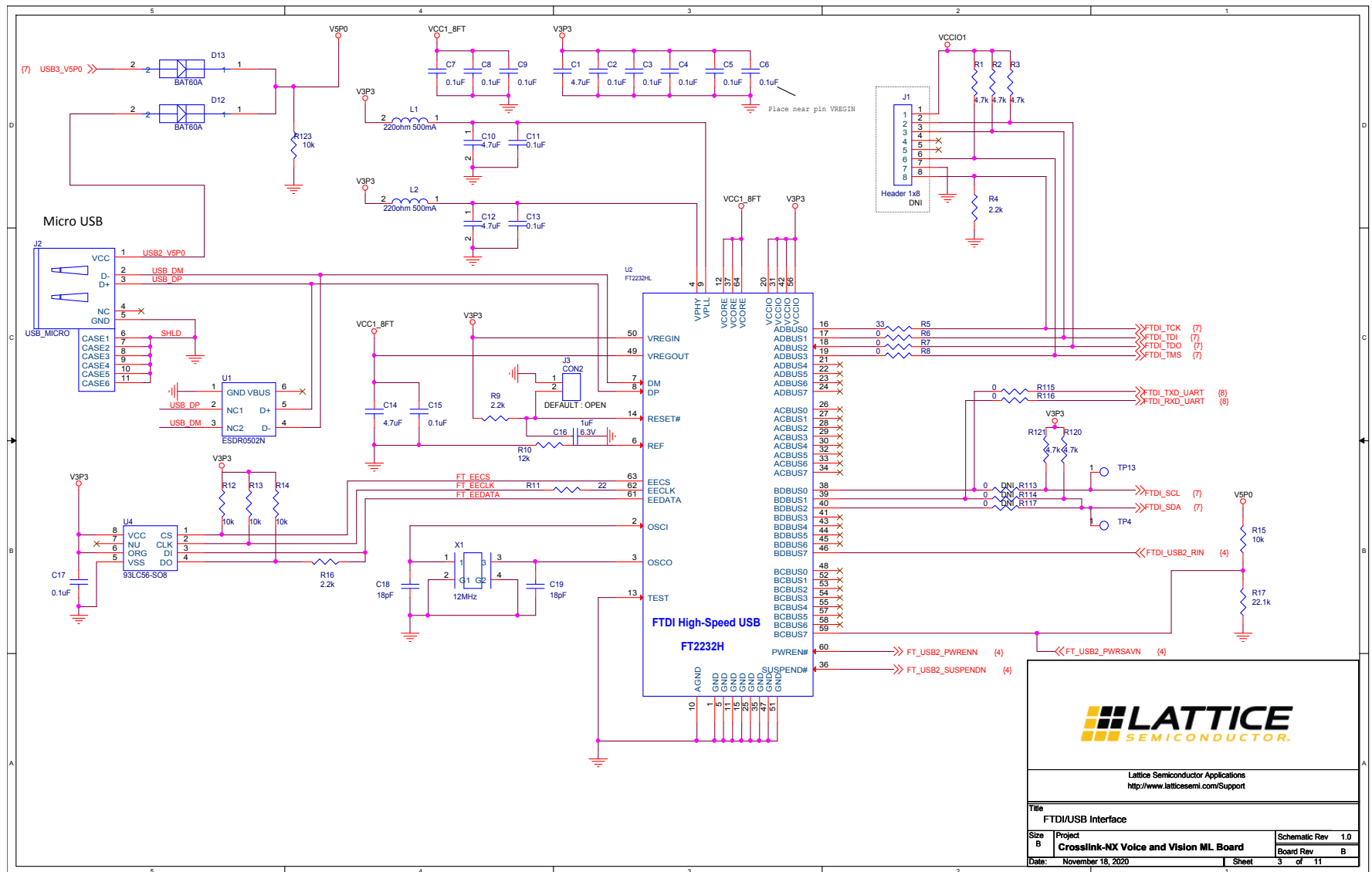


Figure A.3. FTDI/USB Interface

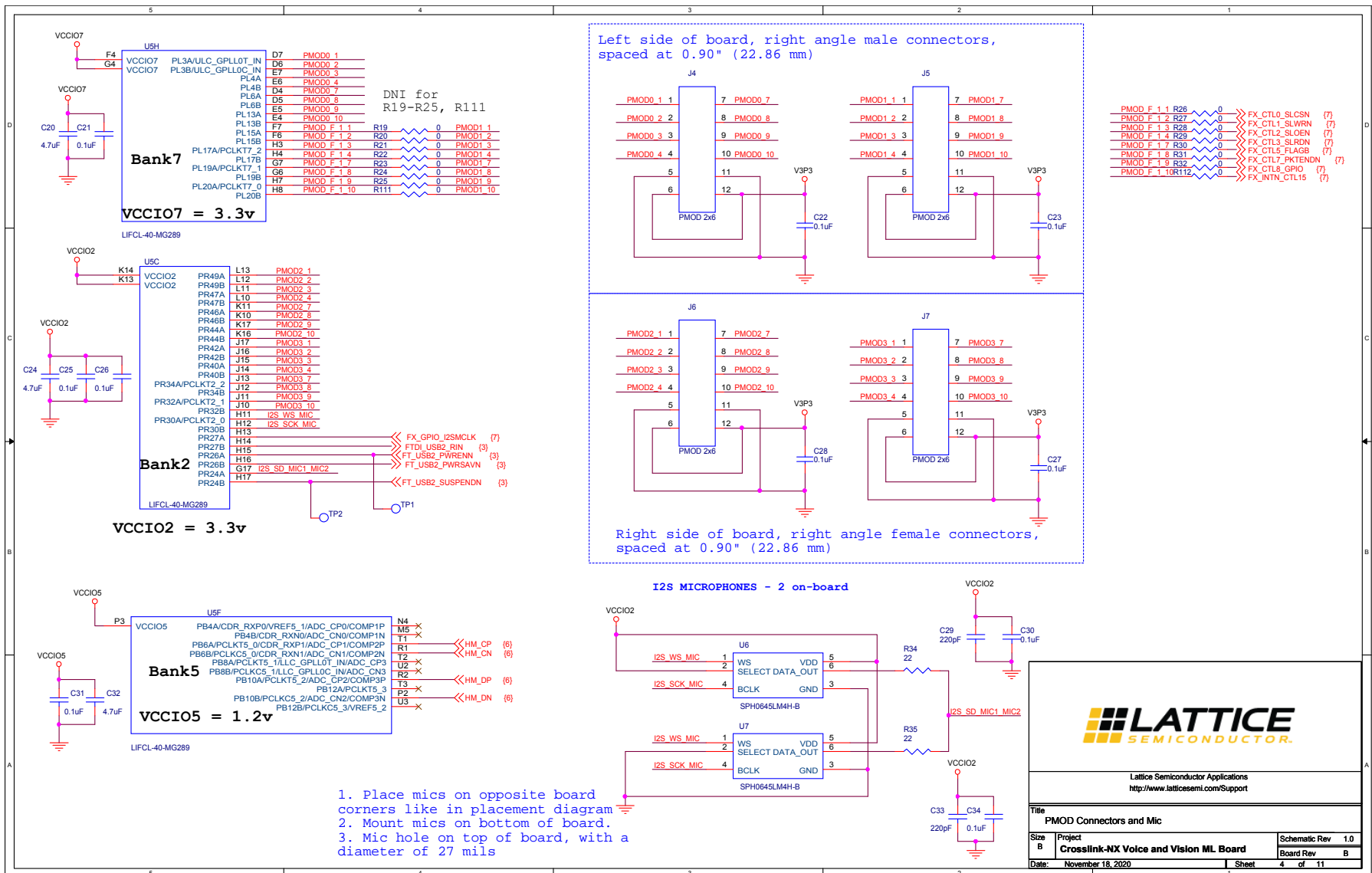


Figure A.4. PMOD Connectors and Mic

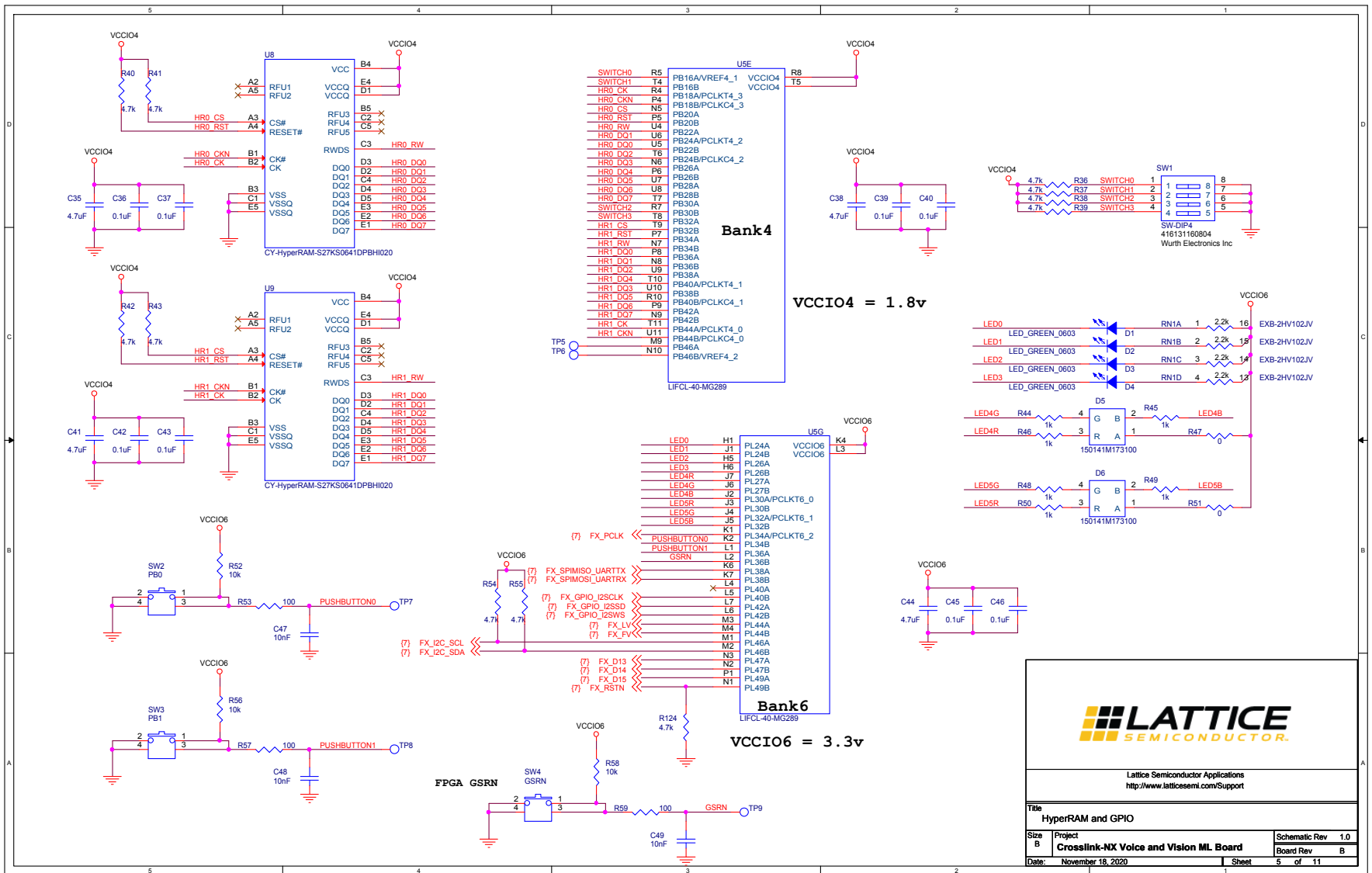


Figure A.5. HyperRAM and GPIO

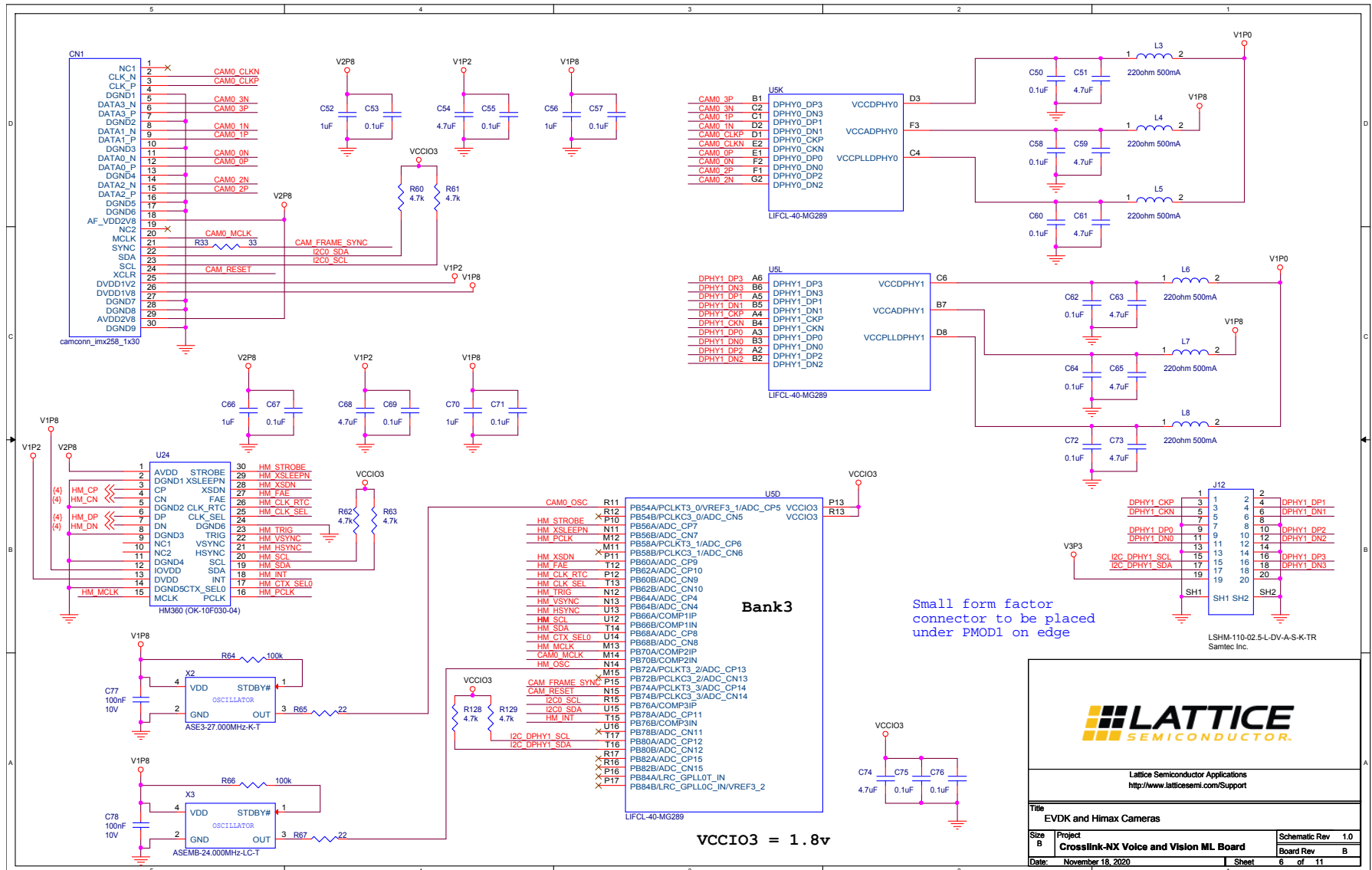


Figure A.6. EVDK and HiMax Cameras

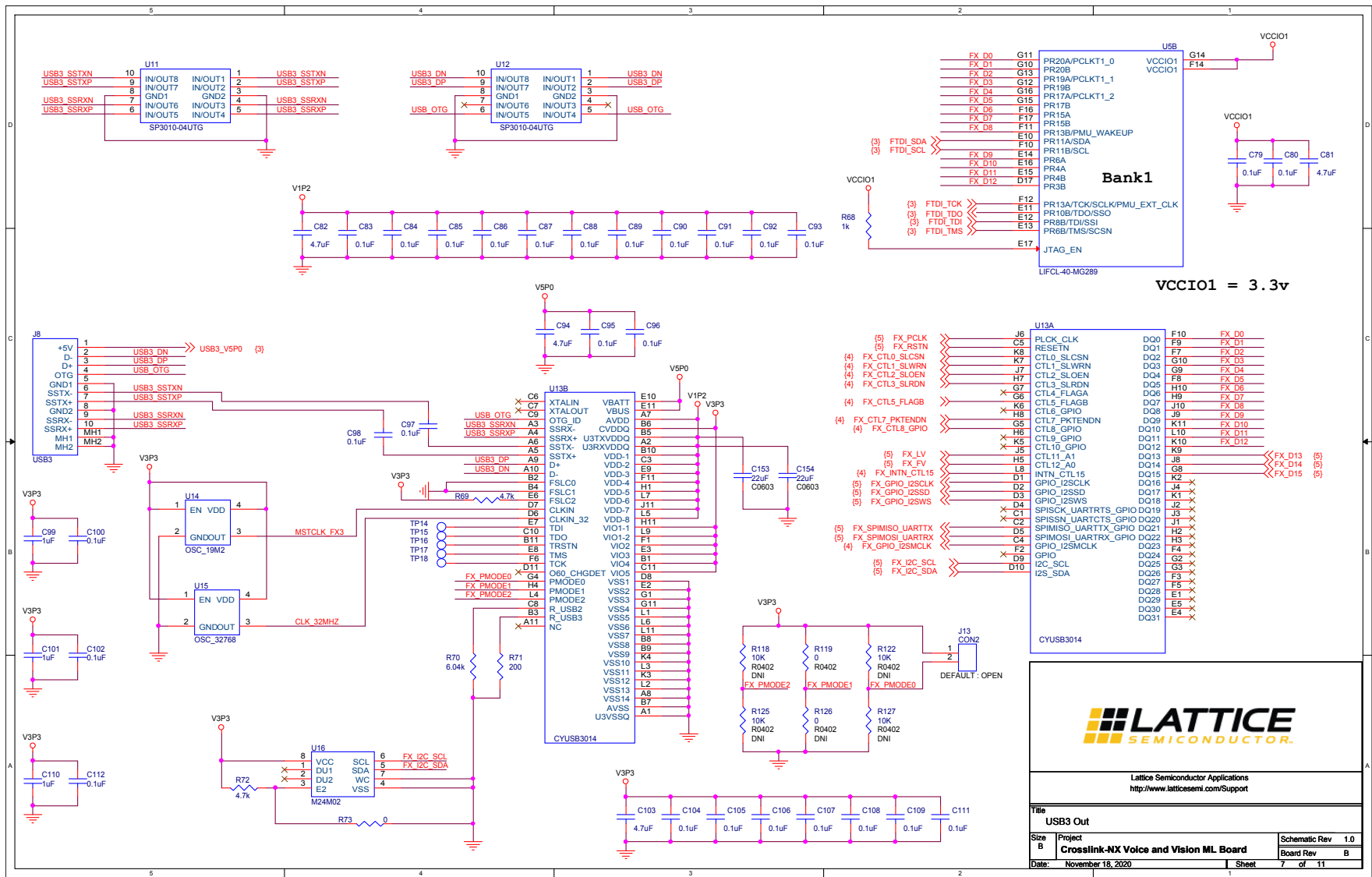


Figure A.7. USB3 Out

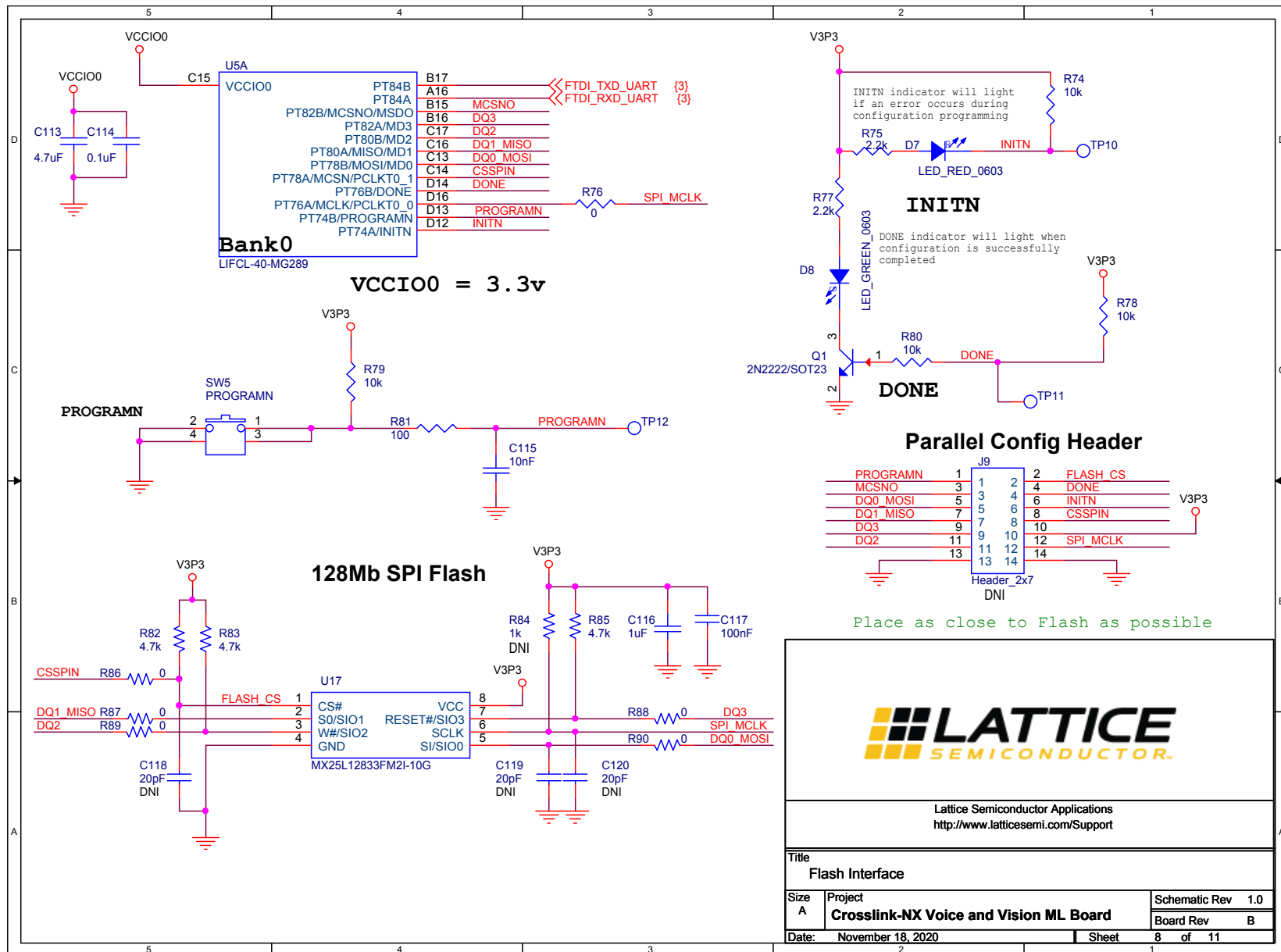


Figure A.8. Flash Interface

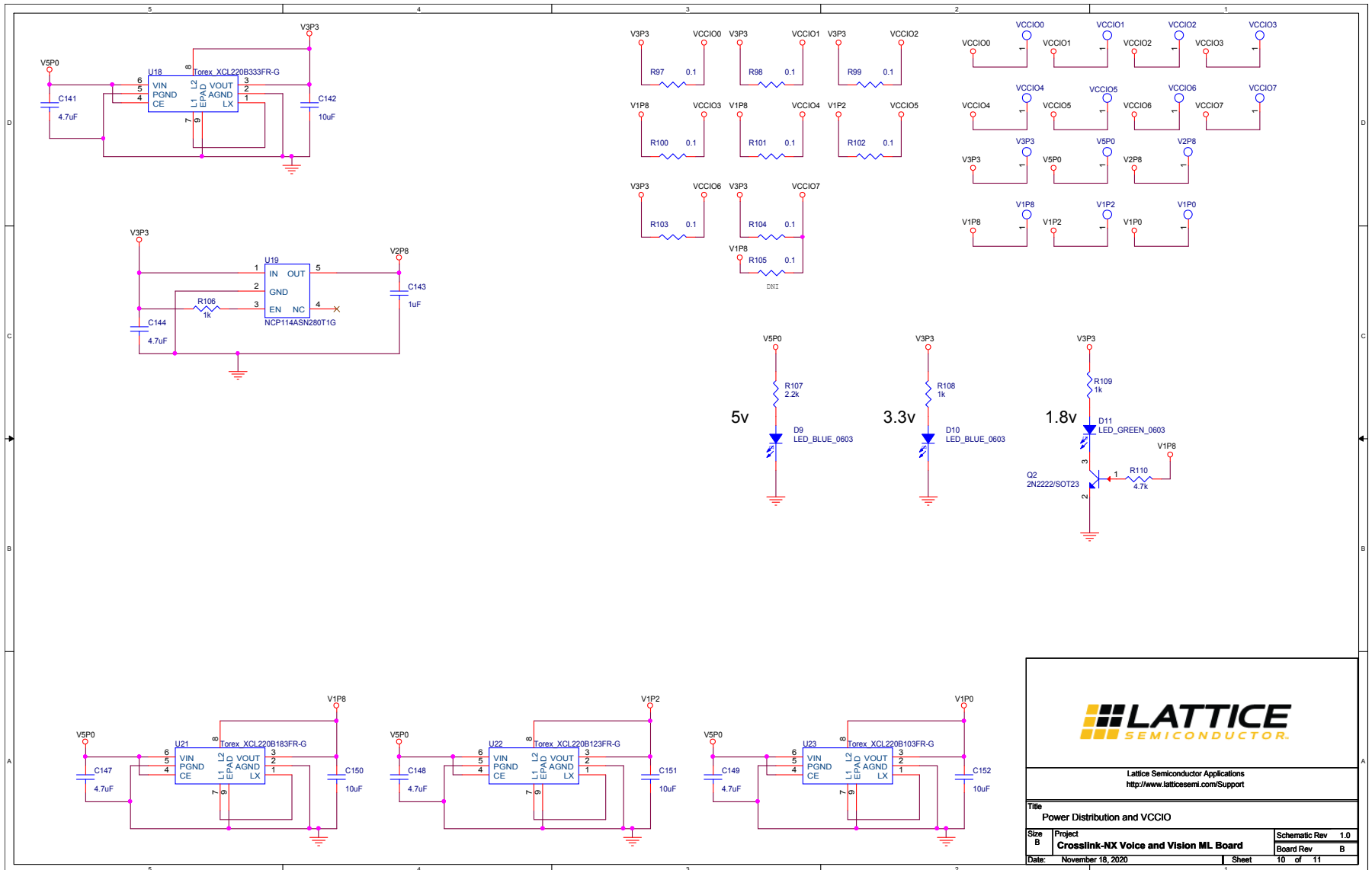


Figure A.10. Power Distribution and VCCIO

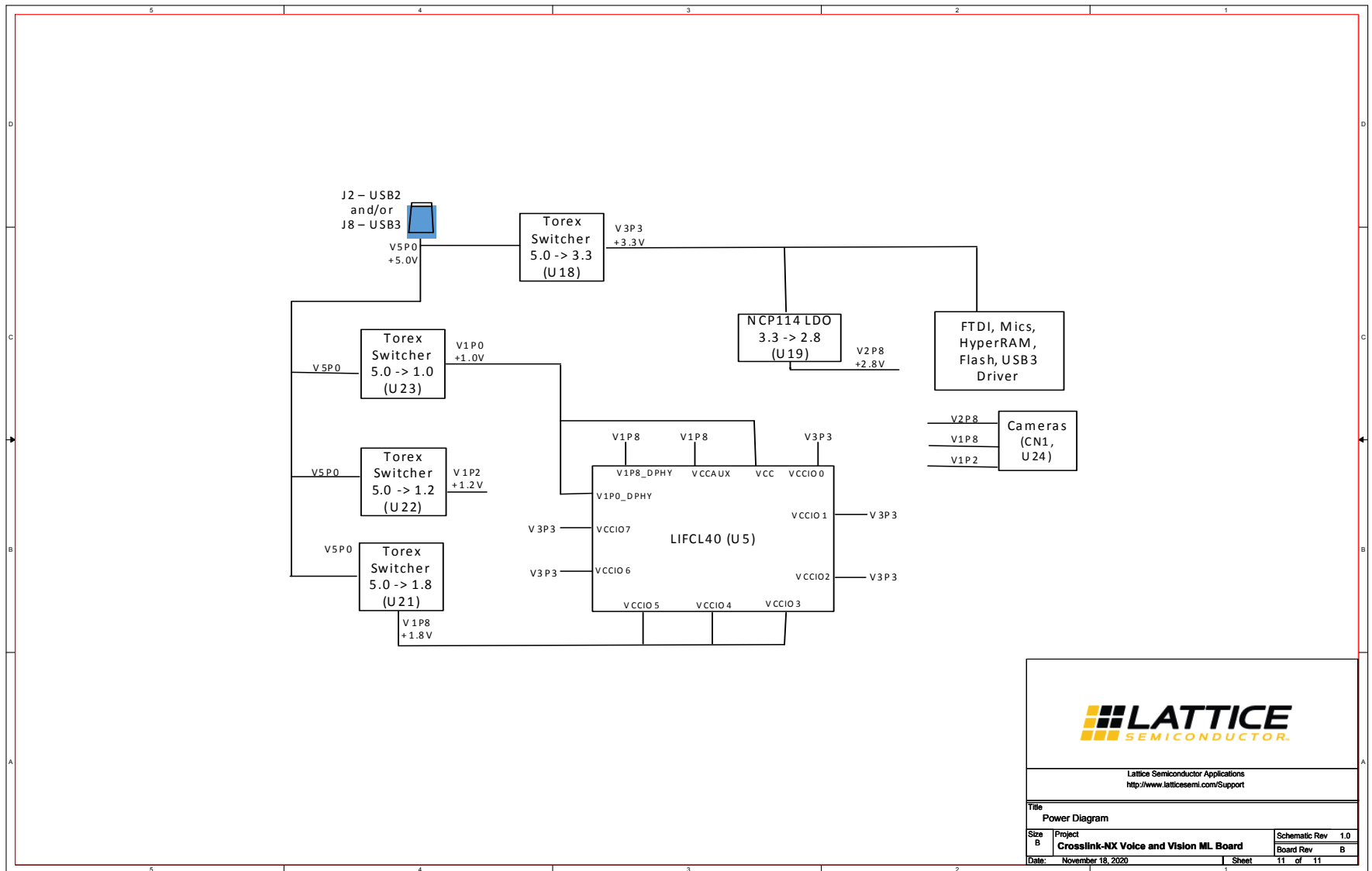


Figure A.11. Power Diagram

Appendix B. CrossLink-NX Voice and Vision Machine Learning Board Bill of Materials

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
1	CN1	1	camconn_imx258_1x30	camconn	-	245804030000829+	Kyocera International Inc. Electronic Components	CONN RCPT 30POS SMD
2	C1,C14	2	4.7uF	C0603	-	LMK107BJ475K A-T	Taiyo Yuden	CAP CER 4.7UF 10V X5R 0603
3	C2,C3,C4,C5,C6,C7,C8,C9,C11,C13,C15,C17	12	0.1uF	C0402	-	GRM155R61H104KE14D	Murata Electronics	CAP CER 0.1UF 50V X5R 0402
4	C10,C12	2	4.7uF	C0603	-	ECJ-1VB0J475K	Panasonic Electronic Components	CAP CER 4.7UF 6.3V X5R 0603
5	C16	1	1uF	C0402	-	885012105012	Wurth Elektronik	CAP CER 1UF 10V X5R 0402
6	C18,C19	2	18pF	C0402	-	C0402C180K3G AC7867	Kemet	CAP CER 18PF 25V NP0 0402
7	C20,C24,C32,C35,C38,C41,C44,C54,C68,C74,C81,C82,C94,C103,C113	15	4.7uF	C0603	-	LMK107BJ475K A-T	Taiyo Yuden	CAP CER 4.7UF 10V X5R 0603
8	C21,C25,C26,C30,C31,C34,C36,C37,C39,C40,C42,C43,C45,C46,C50,C53,C55,C57,C58,C60,C62,C64,C67,C69,C71,C72,C75,C76,C79,C80,C97,C98,C114,C123,C124,C125,C126,C127,C128,C132,C135	41	0.1uF	C0201	-	C0603X5R1C104K030BC	TDK Corporation	CAP CER 0.1UF 16V X5R 0201
9	C22,C23,C27,C28	4	0.1uF	cc0402	-	CL05B104KA5N NNC	Samsung Electro-Mechanics	CAP CER 0.1UF 25V X7R 0402
10	C29,C33	2	220pF	C0603	-	CC0603KRX7R9BB221	Yageo	CAP CER 220PF 50V X7R 0603
11	C47,C48,C49,C115	4	10nF	RLP-130-A	-	CC0402KRX7R7BB103	Yageo	CAP CER 10000PF 16V X7R 0402
12	C51,C59,C61,C63,C65,C73	6	4.7uF	C0402	-	GRM155R61A475MEAAD	Murata Electronics	CAP CER 4.7UF 10V X5R 0402
13	C52,C56,C66,C70,C99,C101,C110	7	1uF	C0603	-	TMK107B7105K A-T	Taiyo Yuden	CAP CER 1UF 25V X7R 0603
14	C77,C78	2	100nF	C0402	-	CL05B104KA5N NNC	Samsung Electro-Mechanics	CAP CER 0.1UF 25V X7R 0402
15	C83,C84,C85,C86,C87,C88,C89,C90,C91,C92,C93,C95,C96,C100,C102,C104,C105,C106,C107,C108,C109,C111,C112	23	0.1uF	C0603	-	CC0603KRX7R8BB104	Yageo	CAP CER 0.1UF 25V X7R 0603
16	C116	1	1uF	RLP-130-A	-	885012105012	Wurth Elektronik	CAP CER 1UF 10V X5R 0402
17	C117	1	100nF	RLP-130-A	-	CL05B104KA5N NNC	Samsung Electro-Mechanics	CAP CER 0.1UF 25V X7R 0402

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
18	C118,C119,C120	3	20pF	RLP-132	DNL	-	-	-
19	C129,C130,C142,C150,C151,C152	6	10uF	C0402	-	CL05A106MP8N-UB8	Samsung Electro-Mechanics	CAP CER 10UF 10V X5R 0402
20	C131,C133,C134,C136	4	0.1uF	RLP-130-A	-	CL05B104KA5N-NNC	Samsung Electro-Mechanics	CAP CER 0.1UF 25V X7R 0402
21	C137,C138	2	10uF	C0402	-	CL05A106MP8N-UB8	Samsung Electro-Mechanics	CAP CER 10UF 10V X5R 0402
22	C139,C140	2	100nF	C0201	-	C0603X5R1C104K030BC	TDK Corporation	CAP CER 0.1UF 16V X5R 0201
23	C141,C147,C148,C149	4	4.7uF	C0402	-	GRM155R61A475MEAAD	Murata Electronics	CAP CER 4.7UF 10V X5R 0402
24	C143	1	1uF	C0402	-	885012105012	Wurth Elektronik	CAP CER 1UF 10V X5R 0402
25	C144	1	4.7uF	C0402	-	GRM155R61A475MEAAD	Murata Electronics	CAP CER 4.7UF 10V X5R 0402
26	C153,C154	2	22uF	C0603	-	CL10A226MQ8N-RNC	Samsung Electro-Mechanics	CAP CER 22UF 6.3V X5R 0603
27	D1,D2,D3,D4,D8,D11	6	LED_GREEN_0603	APT1608	-	150060GS75000	Wurth Elektronik	LED GREEN CLEAR 0603 SMD
28	D5,D6	2	150141M173100	RGBOPT2	-	150141M173100	Wurth Elektronik	LED RGB CLEAR 3528 SMD
29	D7	1	LED_RED_0603	APT1608	-	150060RS75000	Wurth Elektronik	LED RED CLEAR 0603 SMD
30	D9,D10	2	LED_BLUE_0603	APT1608	-	150060BS75000	Wurth Elektronik	LED BLUE CLEAR 0603 SMD
31	D12,D13	2	BAT60A	SOD323_BAT60A	-	BAT60AE6327HTSA1	Infineon Technologies	DIODE SCHOTTKY 10V 3A SOD323-2
32	FB1	1	BLM31KN121SN1L	BLM41P	-	BLM31KN121SN1L	Murata Electronics	FERRITE BEAD 120 OHM 1206 1LN
33	J1	1	Header 1x8	hdr_amp_87220_8_1x8_100	DNL	0022284081	Molex	CONN HEADER VERT 8POS 2.54MM
34	J2	1	USB_MICRO	MICRO_TYPE_B	Used USB 2.0 Micro Type B	10118193-0001LF	Amphenol ICC (FCI)	CONN RCPT USB2.0 MICRO B SMD R/A
35	J3,J13	2	CON2	CON2	DEFAULT : OPEN	61300211121	Wurth Elektronik	CONN HEADER VERT 2POS 2.54MM
36	J4,J5	2	PMOD 2x6	skt_sullins_PBC06DBAN	-	PBC06DBAN	Sullins Connector Solutions	CONN HEADER R/A 12POS 2.54MM
37	J6,J7	2	PMOD 2x6	skt_sullins_PPPC062LJBN-RC	-	PPPC062LJBN-RC	Sullins Connector Solutions	CONN HDR 12POS 0.1 GOLD PCB R/A
38	J8	1	USB3	USB3_Micro B_Type3	Used USB 3.0 Micro Type B	GSB343K33HR	Amphenol ICC	CONN RCPT USB3.0 MICRO B SMD R/A
39	J9	1	Header_2x7	Header_2x7	DNL	-	-	-

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
40	J10,J11	2	CON2	CON2	DEFAULT : OPEN	61300211121	Wurth Elektronik	CONN HEADER VERT 2POS 2.54MM
41	J12	1	LSHM-110-02-5-L-DV-A-S-K-TR	LSHM-110_DV	-	LSHM-110-02.5-L-DV-A-S-K-TR	Samtec Inc.	CONN SELF-MATE 20POS SMD GOLD
42	L1,L2	2	220ohm 500mA	FB0603	-	BLM18AG221SN1D	Murata Electronics	FERRITE BEAD 220 OHM 0603 1LN
43	L3,L4,L5	3	220ohm 500mA	FB0402	-	BLM15AX221SN1D	Murata Electronics	FERRITE BEAD 220 OHM 0402 1LN
44	L6,L7,L8	3	220ohm 500mA	FB0402	-	BLM15AX221SN1D	Murata Electronics	FERRITE BEAD 220 OHM 0402 1LN
45	Q1,Q2	2	2N2222/SOT23	MMBT2222A LT-1	-	MMBT2222ALT1G	ON Semiconductor	TRANS NPN 40V 600MA SOT23
46	RN1	1	EXB-2HV102JV	EXB-2HV	-	EXB-2HV102JV	Panasonic Electronic Components	RES ARRAY 8 RES 1K OHM 1506
47	R1,R2,R3,R82,R83,R85,R110	7	4.7k	R0402	-	ERJ-2GEJ472X	Panasonic Electronic Components	RES SMD 4.7K OHM 5% 1/10W 0402
48	R4,R9,R16,R107	4	2.2k	R0402	-	ERJ-2RKF2201X	Panasonic Electronic Components	RES SMD 2.2K OHM 1% 1/10W 0402
49	R5	1	33	R0402	-	ERJ-2RKF33R0X	Panasonic Electronic Components	RES SMD 33 OHM 1% 1/10W 0402
50	R6,R7,R8,R86,R87,R88,R89,R90	8	0	R0402	-	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
51	R10	1	12k	R0402	-	ERJ-2RKF1202X	Panasonic Electronic Components	RES SMD 12K OHM 1% 1/10W 0402
52	R11,R65,R67	3	22	R0402	-	ERJ-2RKF22R0X	Panasonic Electronic Components	RES SMD 22 OHM 1% 1/10W 0402
53	R12,R13,R14,R52,R56,R58,R74,R78,R79,R80	10	10k	R0402	-	RC0402FR-0710KL	Yageo	RES SMD 10K OHM 1% 1/16W 0402
54	R15	1	10k	R0402	-	RC0402FR-0710KL	Yageo	RES SMD 10K OHM 1% 1/16W 0402
55	R17	1	22.1k	R0402	-	RC0402FR-0722K1L	Yageo	RES SMD 22.1K OHM 1% 1/16W 0402
56	R19,R20,R21,R22,R23,R24,R25,R111	8	0	R0201	DNL	ERJ-1GN0R00C	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/20W 0201
57	R26,R27,R28,R29,R30,R31,R32,R112	8	0	R0201	-	ERJ-1GN0R00C	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/20W 0201

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
58	R33	1	33	R0201	-	RC0201FR-0733RL	Yageo	RES SMD 33 OHM 1% 1/20W 0201
59	R34,R35	2	22	R0201	-	RC0201FR-0722RL	Yageo	RES SMD 22 OHM 1% 1/20W 0201
60	R36,R37,R38,R39	4	4.7k	R0402	-	ERJ-2GEJ472X	Panasonic Electronic Components	RES SMD 4.7K OHM 5% 1/10W 0402
61	R40,R41,R42,R43	4	4.7k	R0603	-	CRCW06034K70FKEA	Vishay Dale	RES SMD 4.7K OHM 1% 1/10W 0603
62	R44,R45,R46,R48,R49,R50,R68	7	1k	R0402	-	ERJ-2RKF1001X	Panasonic Electronic Components	RES SMD 1K OHM 1% 1/10W 0402
63	R47,R51,R93	3	0	R0402	-	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
64	R53,R57,R59,R81	4	100	R0402	-	RC0402FR-07100RL	Yageo	RES SMD 100 OHM 1% 1/16W 0402
65	R54,R55,R60,R61,R62,R63,R124,R128,R129	9	4.7k	R0402	-	ERJ-2GEJ472X	Panasonic Electronic Components	RES SMD 4.7K OHM 5% 1/10W 0402
66	R64,R66	2	100k	R0402	-	ERJ-2RKF1003X	Panasonic Electronic Components	RES SMD 100K OHM 1% 1/10W 0402
67	R69,R72	2	4.7k	R0402	-	ERJ-2GEJ472X	Panasonic Electronic Components	RES SMD 4.7K OHM 5% 1/10W 0402
68	R70	1	6.04k	R0402	-	RC0402FR-076K04L	Yageo	RES SMD 6.04K OHM 1% 1/16W 0402
69	R71	1	200	R0402	-	RC0402FR-07200RL	Yageo	RES SMD 200 OHM 1% 1/16W 0402
70	R73	1	0	R0402	-	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
71	R75,R77	2	2.2k	R0402	-	ERJ-2RKF2201X	Panasonic Electronic Components	RES SMD 2.2K OHM 1% 1/10W 0402
72	R76	1	0	R0402	-	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
73	R84	1	1k	R0402	DNL	ERJ-2RKF1001X	Panasonic Electronic Components	RES SMD 1K OHM 1% 1/10W 0402
74	R91,R92,R97,R98,R99,R100,R101,R102,R103,R104	10	0.1	R0603	-	RL0603FR-070R1L	Yageo	RES 0.1 OHM 1% 1/10W 0603

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
75	R94,R95,R96	3	0	R0402	DNL	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
76	R105	1	0.1	R0603	DNL	RL0603FR-070R1L	Yageo	RES 0.1 OHM 1% 1/10W 0603
77	R106	1	1k	R0603	-	ERJ-3EKF1001V	Panasonic Electronic Components	RES SMD 1K OHM 1% 1/10W 0603
78	R108,R109	2	1k	R0402	-	ERJ-2RKF1001X	Panasonic Electronic Components	RES SMD 1K OHM 1% 1/10W 0402
79	R113,R114,R117	3	0	R0603	DNL	RC0603JR-070RL	Yageo	RES SMD 0 OHM JUMPER 1/10W 0603
80	R115,R116	2	0	R0603	-	RC0603JR-070RL	Yageo	RES SMD 0 OHM JUMPER 1/10W 0603
81	R118,R122,R125,R127	4	10K	R0402	-	RC0402FR-0710KL	Yageo	RES SMD 10K OHM 1% 1/16W 0402
82	R119	1	0	R0402	-	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
83	R120,R121	2	4.7k	R0603	-	CRCW06034K70FKEA	Vishay Dale	RES SMD 4.7K OHM 1% 1/10W 0603
84	R123	1	10k	R0402	-	RC0402FR-0710KL	Yageo	RES SMD 10K OHM 1% 1/16W 0402
85	R126	1	0	R0402	DNL	ERJ-2GE0R00X	Panasonic Electronic Components	RES SMD 0 OHM JUMPER 1/10W 0402
86	SW1	1	SW-DIP4	416131160804	-	416131160804	Wurth Elektronik	SWITCH SLIDE DIP SPST 25MA 24V
87	SW2	1	PB0	4psmd_switc h	-	434153017835	Wurth Elektronik	SWITCH TACTILE SPST-NO 0.05A 12V
88	SW3	1	PB1	4psmd_switc h	-	434153017835	Wurth Elektronik	SWITCH TACTILE SPST-NO 0.05A 12V
89	SW4	1	GSRN	4psmd_switc h	-	434153017835	Wurth Elektronik	SWITCH TACTILE SPST-NO 0.05A 12V
90	SW5	1	PROGRAMN	4psmd_switc h	-	434153017835	Wurth Elektronik	SWITCH TACTILE SPST-NO 0.05A 12V
91	TP1,TP2,TP5,TP6,TP7,TP8,TP9,TP10,TP11,TP12,TP14,TP15,TP16,TP17,TP18	15	TestPoint	TP50	DNL	-	-	-
92	TP4,TP13	2	TP_S_40_63	TP	DNL	-	-	-
93	U1	1	ESDR0502N	ESDR0502N	-	ESDR0502NMU TBG	ON Semiconductor	TVS DIODE 5.5V 6UDFN
94	U2	1	FT2232HL	tqfp64_0p5_12p2x12p2_h1p6	-	FT2232HL-REEL	FTDI	IC USB HS DUAL UART/FIFO 64-LQFP

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
95	U4	1	93LC56-SO8	so8_50_244	-	93LC56C-I/SN	Microchip Technology	IC EEPROM 2K SPI 3MHZ 8SOIC
96	U5	1	LIFCL-40-MG289	LIFCL-40-MG289	Customer Supplied	-	-	-
97	U6,U7	2	SPH0645LM4H-B	SPH0645LM4H-B	-	SPH0645LM4H-B	Knowles	CRAWFORD MIC DGT I2S BOTTOM PORT
98	U8,U9	2	CY-HyperRAM-S27KS0641DPB HI020	24FBGA_S27KS	-	S27KS0641DPB HI020	Cypress Semiconductor Corp	IC DRAM 64M PARALLEL 24BGA
99	U11,U12	2	SP3010-04UTG	UDFN10_SP3010-04UTG	-	SP3010-04UTG	Littelfuse Inc.	TVS DIODE 6V 12.3V 10UDFN
100	U13	1	CYUSB3014	121BGA	-	CYUSB3014-BZXI	Cypress Semiconductor Corp	IC ARM9 USB CONTROLLER 121FBGA
101	U14	1	OSC_19M2	7X-19p200MBA-T	-	7X-19.200MBA-T	TXC CORPORATION	XTAL OSC XO 19.2000MHZ CMOS SMD
102	U15	1	OSC_32768	ASAK-32p768KHZ-LRS-T	-	ASAK-32.768KHZ-LRS-T	Abrakon LLC	XTAL OSC XO 32.7680KHZ LVCMOS
103	U16	1	M24M02	SOIC8_M24M02-DWMN3TP_K	-	M24M02-DWMN3TP/K	STMicroelectronics	IC EEPROM 2M I2C 1MHZ 8SO
104	U17	1	MX25L12833FM2I-10G	SO8_MX25L12833FM2I10G	-	MX25L12833FM2I-10G	Macronix	FLASH - NOR Memory IC 128Mb (16M x 8) SPI - Quad I/O, QPI 133MHz 8-SOP
105	U18	1	Torex_XCL220B333FR-G	XCL220B123FR-G	-	XCL220B333FR-G	Torex Semiconductor Ltd	DC DC CONVERTER 3.3V
106	U19	1	NCP114ASN280T1G	TSOP5_NCP114ASN280T1G	-	NCP114ASN280T1G	ON Semiconductor	IC REG LINEAR 2.8V 300MA 5TSOP
107	U21	1	Torex_XCL220B183FR-G	XCL220B123FR-G	-	XCL220B183FR-G	Torex Semiconductor Ltd	DC DC CONVERTER 1.8V
108	U22	1	Torex_XCL220B123FR-G	XCL220B123FR-G	-	XCL220B123FR-G	Torex Semiconductor Ltd	DC DC CONVERTER 1.2V
109	U23	1	Torex_XCL220B103FR-G	XCL220B123FR-G	-	XCL220B103FR-G	Torex Semiconductor Ltd	DC DC CONVERTER 1V 1A
110	U24	1	HM360 (OK-10F030-04)	OK_10F030_04	Customer Supplied	OK-10F030-04	Himax	Female Connector to mate with Male connector on Compact Camera Module

Item	Reference	Qty	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
111	VCCIO1,VCCIO2,VCCIO3,VCCIO4,VCCIO5,VCCIO6,VCCIO7,V1P0,V1P2,V1P8,V2P8,V3P3,V5P0,VCCIO0	14	TP_S_40_63	tp_s_40_63	DNL	-	-	-
112	X1	1	12MHz	crystal_4p_3p2x2p5	-	7M-12.000MAAJ-T	TXC CORPORATION	CRYSTAL 12.0000MHZ 18PF SMD
113	X2	1	ASE3-27.000MHZ-K-T	27MHZ	-	ASE3-27.000MHZ-KT	Abracon LLC	XTAL OSC XO 27.0000MHZ CMOS SMD
114	X3	1	ASEMB-24.000MHZ-LC-T	ASEMB_24p000MHz_LC_T	-	ASEMB-24.000MHZ-LC-T	Abracon LLC	MEMS OSC XO 24.0000MHZ CMOS SMD
115	CN1 Camera Module	1	Camera Module with IMX258	-	DNL	IMX258 (HL190244)	Happiness Live	-
116	Camera Module For U24	1	HiMax Camera Module with OK-10GM030-04	-	-	HM0360-MWA-03PP962	Himax	-
117	CROSSLINK-NX VOICE VISION ML BOARD RevB PCB	1	-	-	-	305-PD-20-1104	PACTRON	-

Revision History

Revision 1.0, February 2021

Section	Change Summary
All	Initial release.



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