PolarFire Quad Channel CXP-12 Kit User Guide

Introduction (Ask a Question)

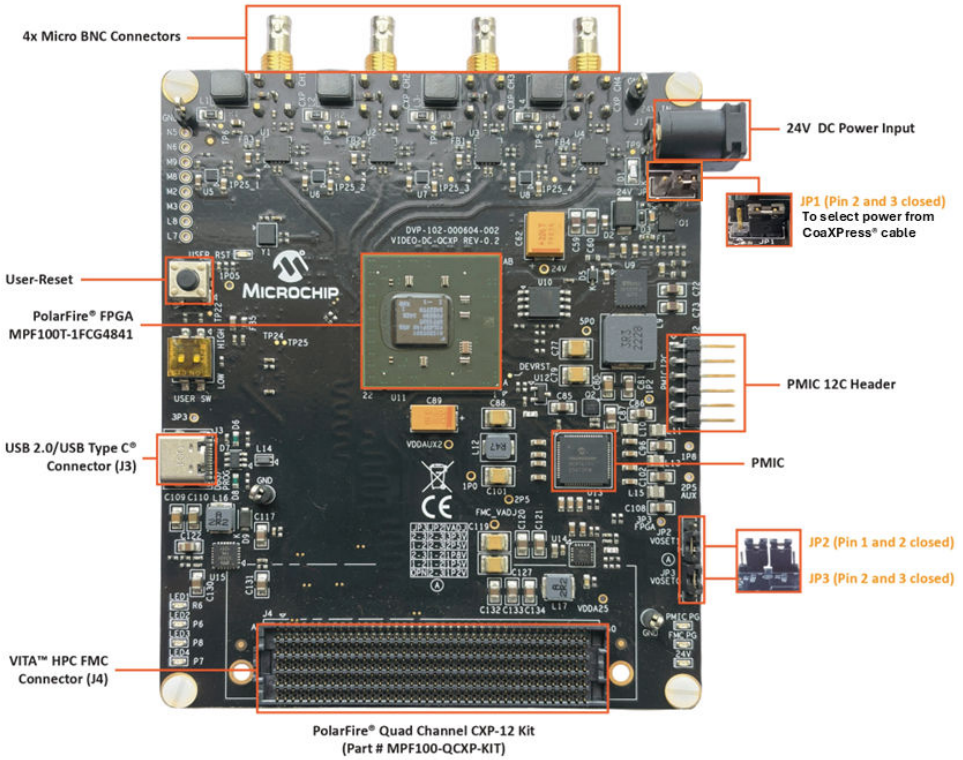
The PolarFire® Quad Channel CXP-12 Kit (MPF100-QCXP-KIT) is an RoHS-compliant, cost-optimized kit that enables you to connect the high-performance, high-resolution cameras (SLVS-EC FMC Card) to high-speed capture cards (CoaXPress Frame Grabbers) through 75Ω coaxial cables. The Quad Channel CXP-12 Kit supports four 12.5G CoaXPress PHYs and eight lanes of SLVS-EC interface for fast, high-resolution image sensors. With a 109K Logic Element (LE) PolarFire FPGA and an SPI-Flash, the kit is ideal for mid-bandwidth imaging and video applications.

The PolarFire Quad Channel CXP-12 Kit supports the following interfaces:

- 8x SLVS-EC I/Os for input and 4x CoaXPress v2.0 I/Os for output
- 1x USB2.0 to UART
- 1x JTAG interface
- 1x 400-pin VITA 57.1 compliant FMC connector (LPC interface)
- 4x Micro BNC Connectors

The following image highlights various components of the PolarFire Quad Channel CXP-12 Kit.

Figure 1. Board Callout



For more information about the kit, see the MPF100-QCXP-KIT web page.

The PolarFire Quad Channel CXP-12 Kit receives camera signals from Microchip's SLVS-EC FMC Card through the FMC Connector and outputs CoaXPress 2.0 signals through BNC connector (coaxial cable) to off-the-shelf CoaXPress Frame Grabbers.

Figure 2. System Level Block Diagram

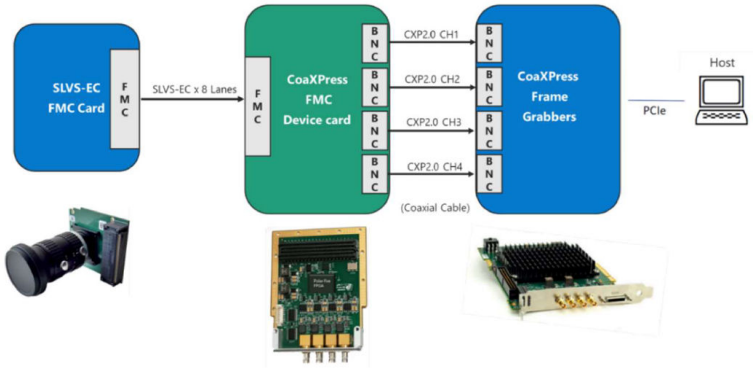


Table of Contents

1. Getting Started (Ask a Question)

This section provides information about kit contents, board components, and other high-level information about the kit.

1.1. Kit Contents (Ask a Question)

The following table lists the PolarFire Quad Channel CXP-12 Kit contents.

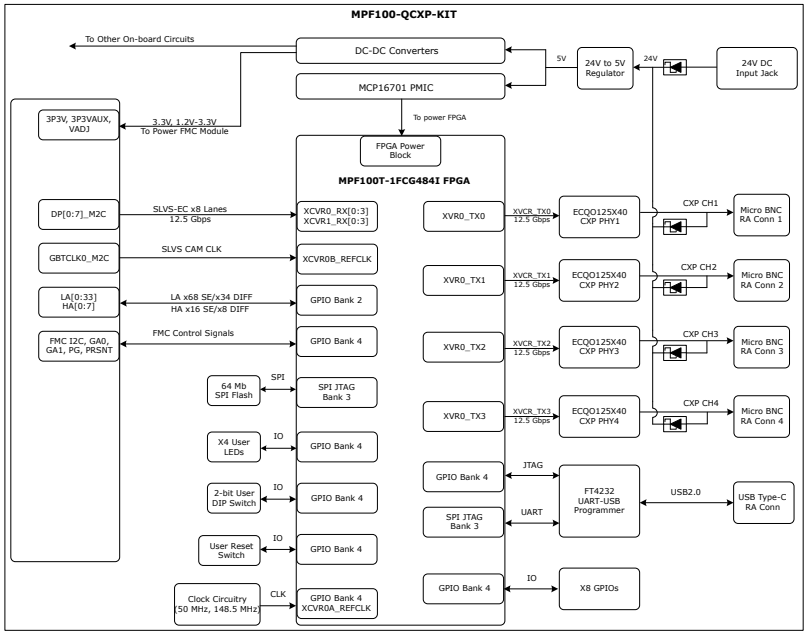
Table 1-1. Kit Contents

Item	Quantity
PolarFire Quad Channel CXP-12 Kit with Acrylic base	1
USB 2.0 Cable C Male to C Male	1
Power Cord and Adaptor (24V, 90W)	1
Quickstart Card	1

1.2. Block Diagram (Ask a Question)

The following block diagram shows the key components of the PolarFire Quad Channel CXP-12 Kit.

Figure 1-1. Block Diagram



1.3. Board Overview (Ask a Question)

The following table lists the key components of the PolarFire Quad Channel CXP-12 Kit.

Table 1-2. Board Components

Component	Label on Board	Description
Featured Device		
MPF100T-1FCG484I	U11	See PolarFire FPGA Datasheet.
Power Supply		

Table 1-2. Board Components (continued)

Component	Label on Board	Description
24V DC Jack	J1	The PolarFire Quad Channel CXP-12 Kit receives power from the 24V DC Jack (J1) or BNC Connectors through the Coaxial Cables. The JP1 jumper setting determines which power source is used. By default, the kit receives power from the 24V DC Jack. For more information about the JP1 jumper setting, see Powering Up the Board.
Clocks		
50 MHz Oscillator	Y2	50 MHz clock oscillator with single-ended output.
Programming and Debugging		
USB-UART	U22	FT4232HL is a USB to quad UART bridge controller.
Communication Interfaces		
CXP-12 PHYs	U1, U2, U3, and U4	Four 12.5 Gbps CoaXPress PHYs facilitate interfacing the PolarFire Transceiver with the off-the-shelf CoaXPress frame grabbers through BNC connectors (coaxial cable).
BNC Connectors	J5, J6, J7 and J8	Four Micro BNC connectors
Memory Chips		
SPI Flash	U10	External SPI Flash for In-Application Programming (IAP).
General Purpose I/O		
Light Emitting Diodes (LEDs)	LED1, LED2, LED3 and LED4	Four user LEDs are available for debugging.
Dip Switches	SW2	2-bit user dip switches are available for debugging.
Expansion Interfaces		
FMC Connector	J4	Facilitates interfacing with image sensor cards through SLVS-EC interface.

1.4. Form Factor (Ask a Question)

The form factor of the PIC64GX1000 Curiosity kit is 110 mm × 90 mm, approximately.

1.5. Handling the Board (Ask a Question)

To avoid damage, handle the PolarFire Quad Channel CXP-12 Kit with Electrostatic Discharge (ESD) precautions.

1.6. Powering Up the Board (Ask a Question)

The PolarFire Quad Channel CXP-12 Kit receives power from the BNC connectors or 24V DC Jack (J1). The JP1 jumper setting determines which power source is used. By default, the board receives the power from BNC connectors. The following table lists the JP1 jumper setting.

Table 1-3. JP1 Jumper Setting

Pins	Function
1 and 2	When pins 1 and 2 are closed, the kit receives power from the 24V DC Jack (J1).
2 and 3	When pins 2 and 3 are closed, the kit receives power from the BNC connectors. **Note:** This is the default setting.

As per the CoaXPress standard, 13W of power is available through the BNC connectors (through the coaxial cables connected to the external host links of the frame grabbers). If the image sensor FMC card inserted requires more than 13W of power, the kit must be powered from the 24V DC Jack.

2. Installation and Settings (Ask a Question)

This section provides information about the software and hardware settings required to run the pre-programmed demo design on the PolarFire Quad Channel CXP-12 Kit.

2.1. Software Settings (Ask a Question)

Download and install the latest release of Microchip's Libero® SoC and generate your free Silver license at Microchip Portal. The Libero SoC installer includes the required device programmer drivers. See the following references:

1. For more information about the instructions about licensing and installing Libero SoC, see the Libero SoC Documentation.
2. For more information about installing SoftConsole, see the SoftConsole page.
3. For more information about downloading and installing Microchip's DirectCores on the Host PC where Libero SoC is installed, see the IP Core Tools.
4. For more information about downloading and installing Microchip's firmware drivers on the Host PC where Libero SoC is installed, see the Firmware Catalog Documentation.

2.2. Hardware Settings (Ask a Question)

This section provides information about power LEDs and power topology available on the PolarFire Quad Channel CXP-12 Kit.

2.2.1. Power Supply LEDs (Ask a Question)

The following table lists the power supply LEDs available on the PolarFire Quad Channel CXP-12 Kit.

Table 2-1. Power Supply LEDs

LED	Description
V_24P0	24V power supply
PMIC_PG	PMIC power good supply
FMC_PG_C2M	FMC power good supply

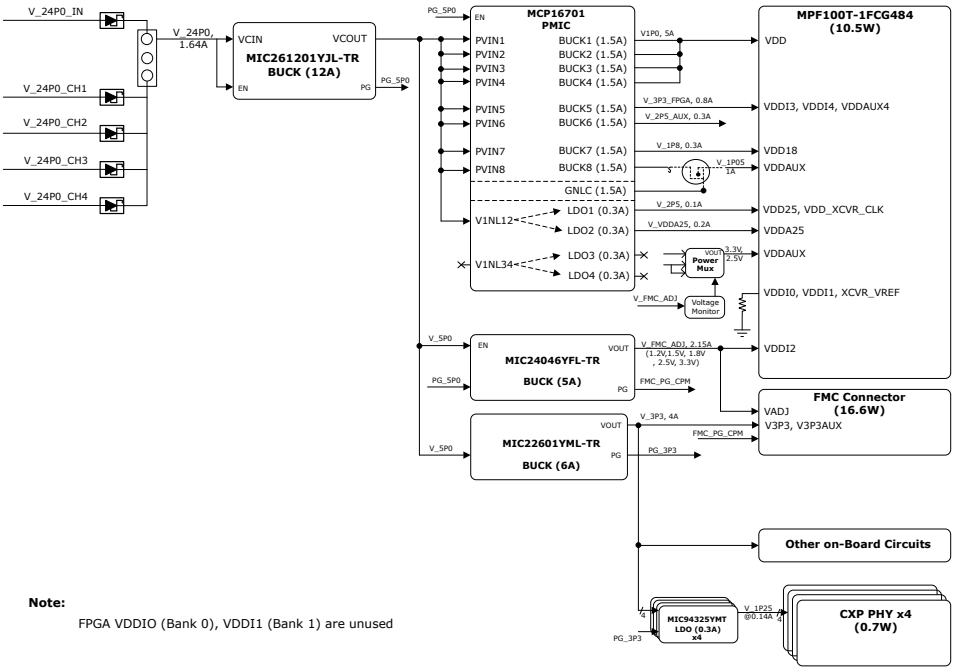
2.2.2. Power Topology (Ask a Question)

The kit is powered from a 24V DC input, either through a DC jack or from BNC Connectors (through coaxial cables). The power input to the board is selected through the jumper. The default option to power up the kit is the power from the BNC connectors. As per the CoaXPress standard, 13W of power is sourced through the BNC connectors through the coaxial cables connected to the external host links of the frame grabbers. If the inserted FMC card requires more than 13W of power, the kit must be powered from a DC jack. Power over Coax (PoC) filters and circuitry are provided to extract power from the coaxial cable.

Except for the adjustable voltage V_FMC_ADJ for FMC LA and HA signals connected to GPIO Bank 2, all other FPGA power rails are powered by the MCP16701 PMIC IC. V_FMC_ADJ (1.2V/1.5V/1.8V/2.5V/3.3V) voltage must be selected based on the FMC module by configuring the jumpers JP2 and JP3. GPIO Bank 2 Auxiliary voltage V_VDDAUX2 (2.5V/3.3) is selected automatically based on V_FMC_ADJ voltage by using a power switch. Microchip's SLVS-EC FMC Card is powered by PolarFire Quad Channel CXP-12 Kit.

The following figure shows the power topology of the PolarFire Quad Channel CXP-12 Kit.

Figure 2-1. Power Topology



Note:

FPGA VDDIO (Bank 0), VDDI1 (Bank 1) are unused

3. Board Components and Operation (Ask a Question)

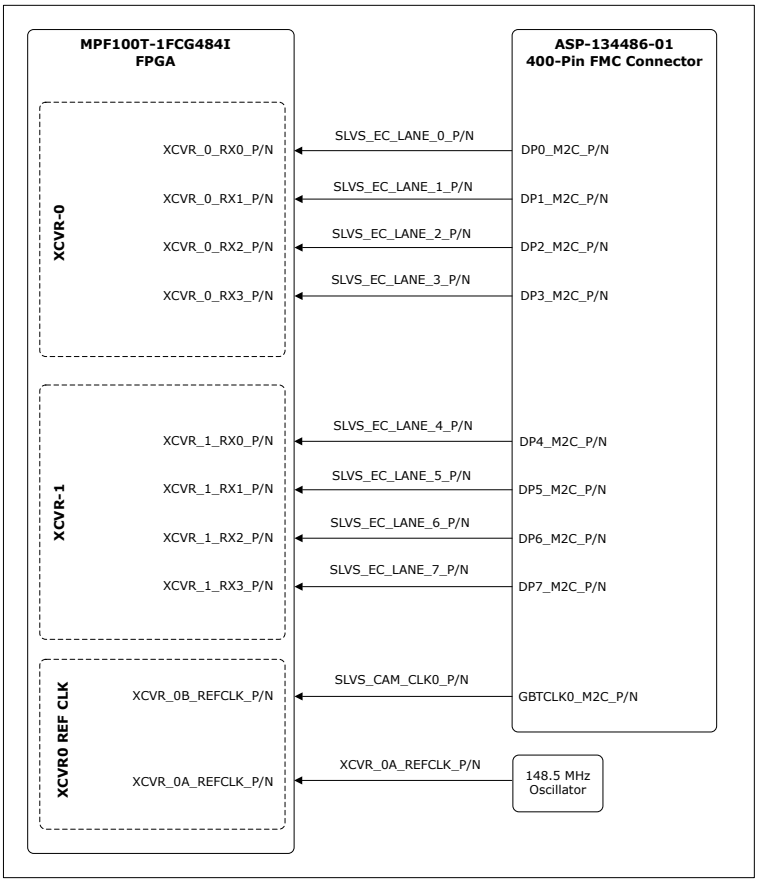
This section describes the key components of the PolarFire Quad Channel CXP-12 Kit and provides information about important board operations.

3.1. FMC Interface (Ask a Question)

3.1.1. SLVS-EC Interface (Ask a Question)

Eight lanes of SLVS-EC camera signals from Microchip's SLVS-EC FMC daughter card are interfaced to the PolarFire Quad Channel CXP-12 Kit through the 400-pin FMC connector. Eight lanes of SLVS-EC camera signals are connected from FMC connector to FPGA's two Transceiver's RX blocks having Quad channels XCVR0_RX[0:3] and XCVR1_RX[0:3].

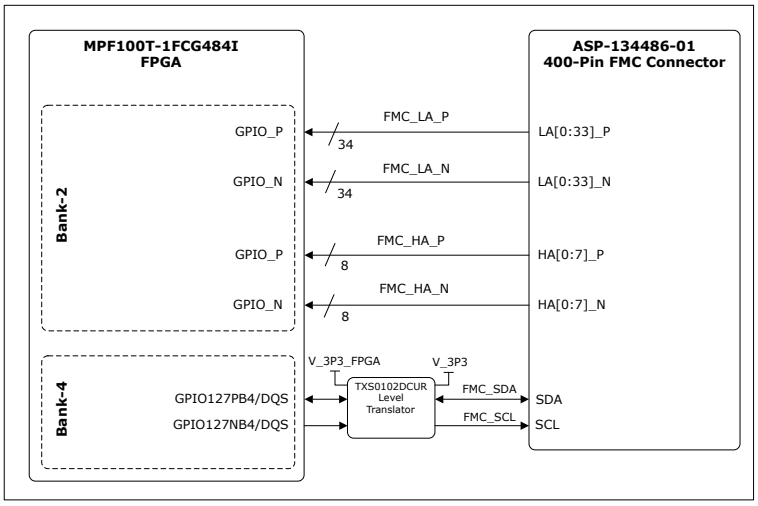
Figure 3-1. SLVS-EC Interface



3.1.2. HA and LA Signals (Ask a Question)

The PolarFire Quad Channel CXP-12 Kit's FMC connector connects all LA signals (x68 SE/ x34 DIFF) to GPIO Bank 2 with adjustable voltage (VADJ) 1.2V, 1.5V, 1.8V, 2.5V or 3.3V. The remaining unused GPIO Bank 2 pins are routed to FMC HA signals (x16 SE/ x8 DIFF) of the FMC connector. SLVS-EC camera control signals from Microchip's SLVS-EC FMC daughter card are connected to FPGA Fabric GPIO Bank through the 400-pin FMC connector.

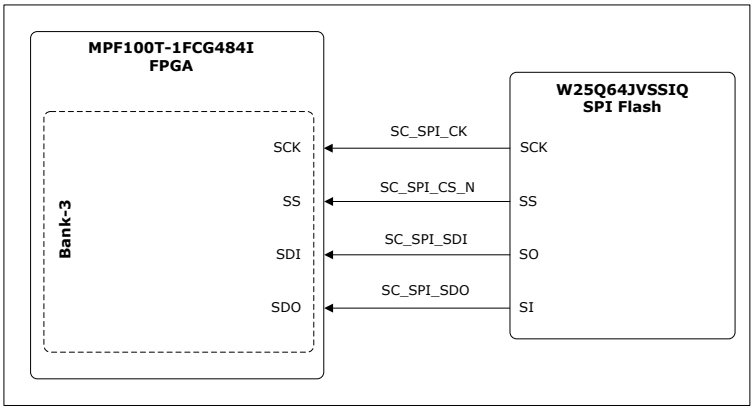
Figure 3-2. HA and LA Signals



3.2. SPI Flash (Ask a Question)

An external 64 Mb SPI Flash is connected to the FPGA Bank 3 for In-Application Programming (IAP).

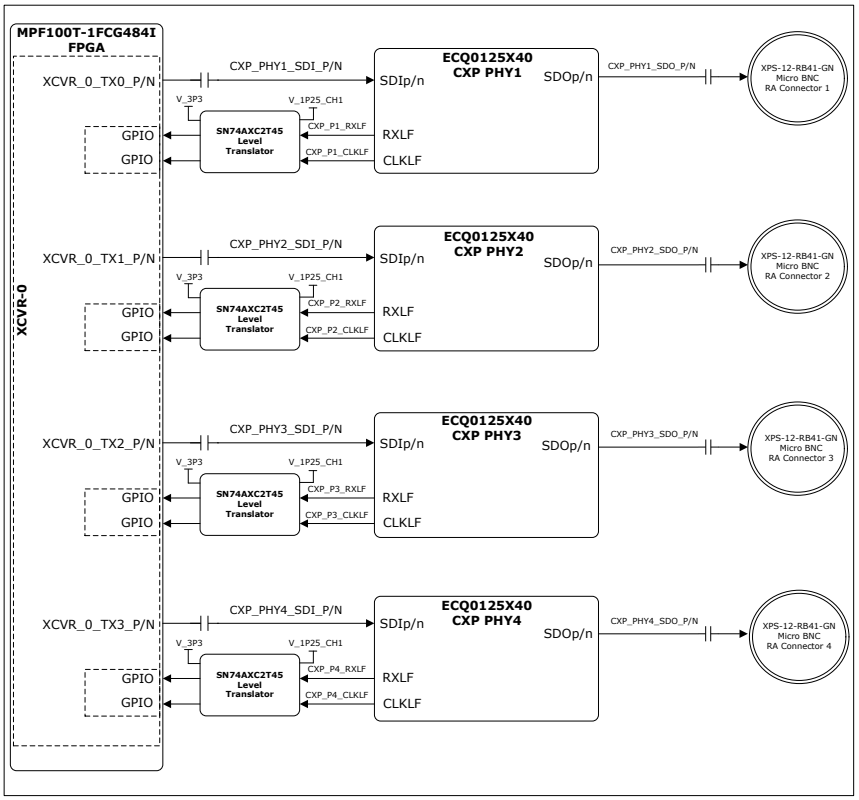
Figure 3-3. SPI Interface



3.3. CoaXPress 2.0 Interface (Ask a Question)

The four TX lanes of the PolarFire Transceiver' (XCVR0) are connected to the four CXP-12 (12.5G CoaXPress) PHYs. Each PHY output is connected to a Micro BNC connector to transmit the signals over a coaxial cable or link.

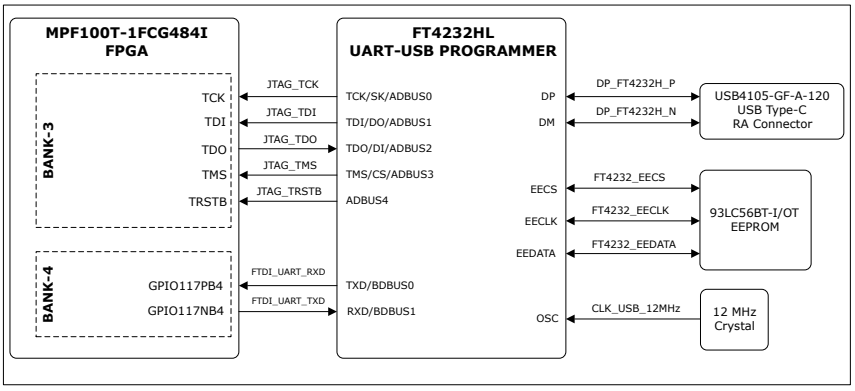
Figure 3-4. CoaXPress 2.0 Interface



3.4. USB-UART Interface and Programming Scheme (Ask a Question)

The PolarFire Quad Channel CXP-12 Kit has a USB to UART/JTAG bridge controller IC (FT4232HL) to support the UART and JTAG interface. The UART signals from FT4232HL are connected to the FPGA GPIO Bank 4. JTAG I/Os from FT4232HL are connected to FPGA Bank 3 to provide the eFP5 (Embedded Flash Pro5) on-board programming option. The USB2.0 signals from the bridge controller are connected to a USB Type C Connector. An external EEPROM IC is connected to FT4232HL IC for configuration.

Figure 3-5. USB to UART and JTAG Interface



3.5. Clocking (Ask a Question)

The following table lists the oscillators available on the PolarFire Quad Channel CXP-12 Kit.

Table 3-1. List of Oscillators

Item	Component	Part Number	Manufacturer	Clock Frequency	Label on Board
1	FPGA GPIO Bank	DSC1003CI2-050.0000	Microchip	50 MHz	Y2
2	USB to UART	VXM7-9022-12M0000000	Microchip	12 MHz	X1
3	FPGA XCVR_0A REF Clock	DSC1123CI2-148.5000	Microchip	148.5 MHz	Y1

3.5.1. 50 MHz Oscillator (Ask a Question)

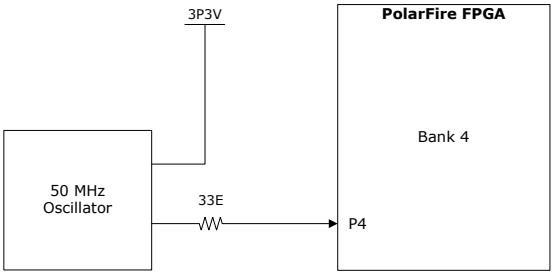
A 50 MHz clock oscillator with an accuracy of +/-25 ppm is available on the board. This clock oscillator is connected to the FPGA fabric to provide a system reference clock. An on-chip PLL can be configured to generate a wide range of high-precision clock frequencies.

The connection of the 50 MHz oscillator with the FPGA fabric is listed the following table.

Table 3-2. 50 MHz Oscillator Connection

Package Pin Number	FPGA Pin Name
P4	GPIO114PB4/CLKIN_W_6/CCC_NW_CLKIN_W_6/ CCC_NW_PLL0_OUT1

Figure 3-6. 50 MHz Oscillator Interface



3.6. User Interface (Ask a Question)

This section describes the LEDs, DIP switches and test points available on the board for the user interface.

3.6.1. User LEDs (Ask a Question)

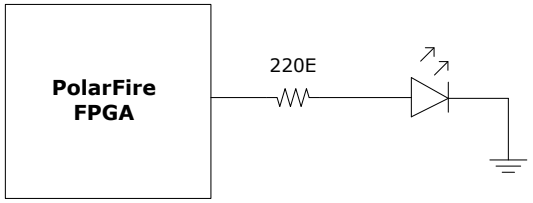
Four active-high LEDs are connected to the PolarFire device. The following table lists the on-board label of these LEDs, the associated PolarFire pin number, name, and Bank.

Table 3-3. User LEDs

Label on Board	FPGA Pin Number	FPGA Pin Name	FPGA Bank
LED 1	R6	GPIO119NB4	Bank 4
LED 2	P6	GPIO119PB4	Bank 4
LED 3	P8	GPIO120NB4	Bank 4
LED 4	P7	GPIO120PB4	Bank 4

The following figure shows how each user LED interfaces with the PolarFire device.

Figure 3-7. LED Interface



3.6.2. User DIP Switches (Ask a Question)

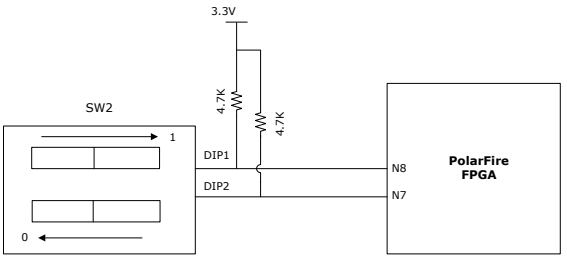
The SW2 DIP switch includes 2 connections to the PolarFire device as listed in the following table.

Table 3-4. DIP Switches

DIP Switch	SW Pin Number	FPGA Pin Number	FPGA Pin Name	FPGA Bank
DIP 1	SW2.1	N8	GPIO121NB4/DQS	Bank 4
DIP 2	SW2.3	N7	GPIO121PB4/DQS	Bank 4

The following figure shows how each user LED interfaces with the PolarFire device.

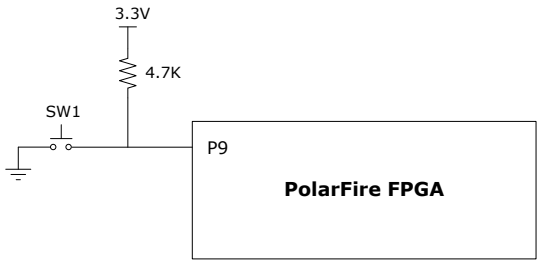
Figure 3-8. DIP Switches Interface



3.6.3. User Reset (Ask a Question)

As shown in the following figure, the user reset (SW1 push-button) is an input-only reset switch that allows assertion of a reset of the fabric logic.

Figure 3-9. User Reset



3.6.4. User Configurable I/Os (Ask a Question)

Eight test points are connected to the GPIO Bank 4 of the PolarFire device. The following table lists the these test points, the associated PolarFire pin number, name, and Bank.

Table 3-5. User Configurable I/Os

Test Point Reference Designator	PolarFire Pin Number	PolarFire Pin Name	PolarFire Bank
TP7	N5	GPIO_TEST_N5	Bank 4
TP8	N6	GPIO_TEST_N6	Bank 4
TP10	M9	GPIO_TEST_M9	Bank 4
TP15	M8	GPIO_TEST_M8	Bank 4
TP16	M2	GPIO_TEST_M2	Bank 4
TP17	M3	GPIO_TEST_M3	Bank 4
TP18	L8	GPIO_TEST_L8	Bank 4
TP19	L7	GPIO_TEST_L7	Bank 4

3.7. I/O Connectors (Ask a Question)

The following table lists the I/O connectors available on the board.

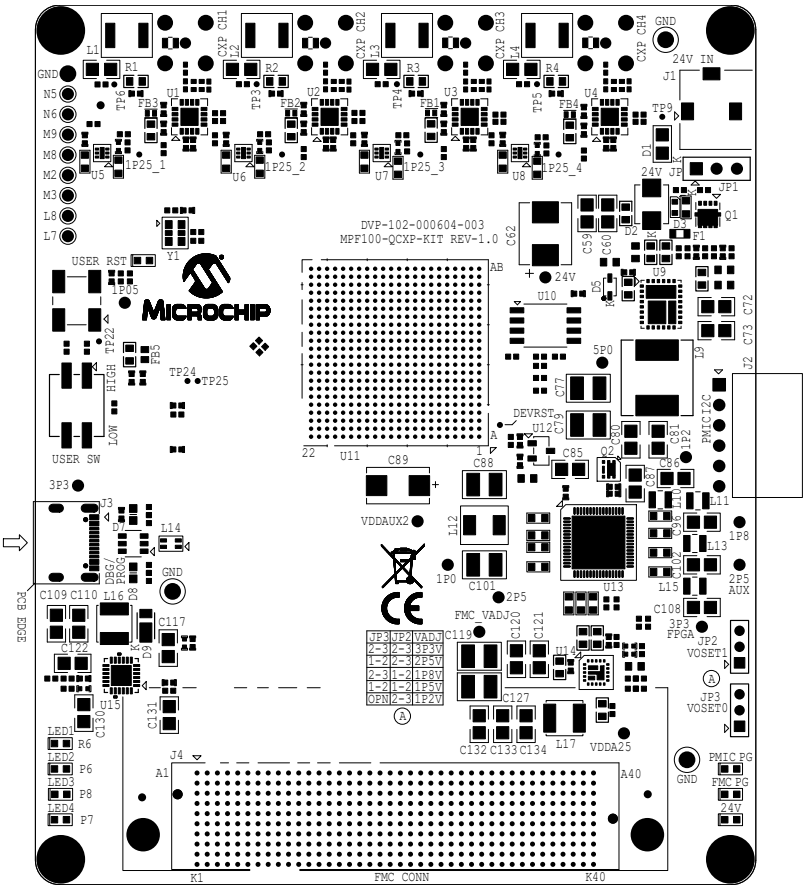
Table 3-6. I/O Connectors

Item	Connector	Part Number	Manufacturer	Description
1	FMC Connector	ASP-134486-01	Samtec	CONN SNGL-END ARRAY FMALE 400POS
2	USB type-C connector	USB4105-GF-A-120	GCT	CONN RCP USB2.0 TYP C 24P SMD RA
3	Micro BNC connector x4	XPS-12-RB41-GN	Cambridge	Right Angle Bulkhead Micro BNC Connector
4	PWR Jack	PJ-102BH	Same Sky	CONN PWR JACK 2.5 x 5.5 mm SOLDER
5	PMIC I2C Header	0022288062	Molex	Header Through Hole, Right Angle 6 position 0.100" (2.54 mm)

4. Board Components Placement (Ask a Question)

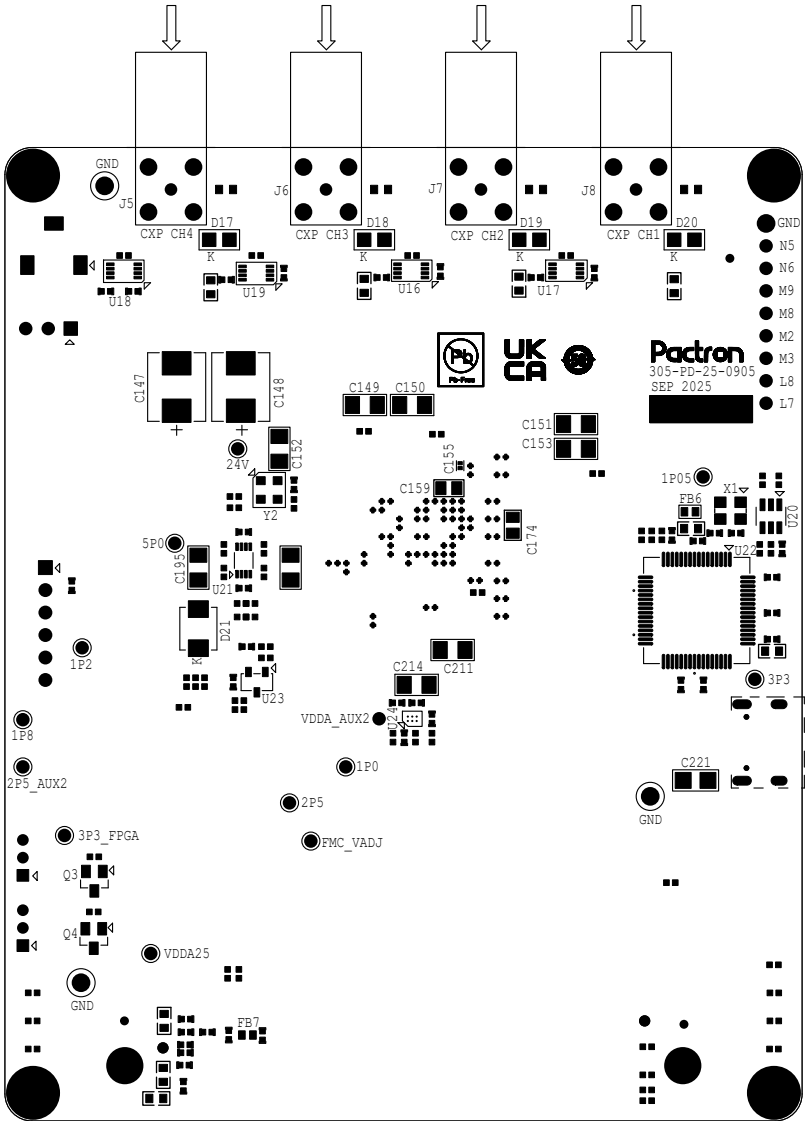
The following silkscreen shows the top view of the board.

Figure 4-1. Top View



The following silkscreen shows the bottom view of the board.

Figure 4-2. Bottom View



5. Revision History (Ask a Question)

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	01/2026	Initial Revision

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