DisplayPort FMC QuickStart Guide

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1. Introduction

Microchip's DisplayPort FPGA Mezzanine Card (FMC) Daughter Card (VIDEO-DC-DP) is a dedicated platform for evaluating and testing the comprehensive IP for transmit and receive, and a ready-to-run demonstration design.

The daughter card works with the PolarFire® Video and Imaging Kit (MPF300-VIDEO-KIT-NS) featuring the PolarFire® 300KLE FPGA device.

The PolarFire and PolarFire SoC FPGAs support DisplayPort v1.4 with a transceiver-based IP that can attain speed up to 8.1 Gbps per lane in 1, 2 or 4-lane configurations. This solution is part of Microchip's extensive Smart Embedded Vision Portfolio of IPs and solutions. The IP is license-locked in clear text RTL. It supports the generation of encrypted RTL for a Verilog version with no license. The IP and the hardware must be purchased separately as and where applicable.

The following table shows the contents of DisplayPort FMC daughter card.

Table 1-1. VIDEO-DC-DP Contents

Quantity	Description
1	DisplayPort FMC daughter board
1	Quickstart card

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2. Demo Requirements

The following table lists the hardware and software required to run the demo.

Table 2-1. Demo Requirements

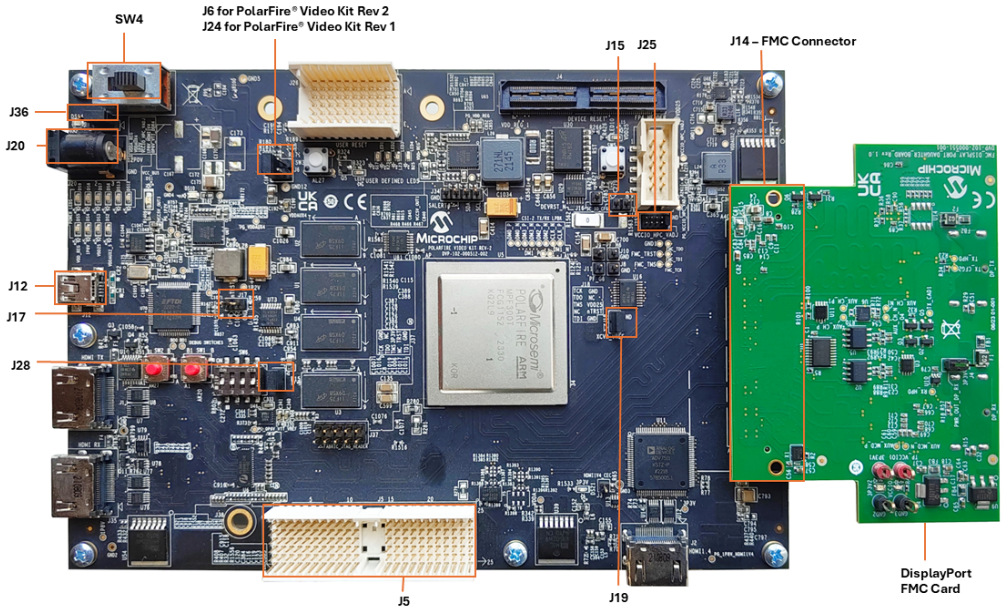
Requirement	Description
Hardware	
PolarFire® Video Kit	MPF300-VIDEO-KIT-NS Kit Contents: • PolarFire Video and Imaging board with MPF300T-1FCG1152E Device • HDMI cable • 12V power pack/AC adapter • USB 2.0 A male to mini-B
DisplayPort FMC card	VIDEO-DC-DP
DisplayPort cable	DisplayPort A Male-to-Male cable
HDMI monitor	1920 × 1080 (60 Hz) resolution
Host PC with USB port	—
Software	
Libero® SoC	FlashPro Express is installed with Libero SoC.
Prerequisites	
Before you begin, ensure that you download the following file from AN4684: PolarFire DisplayPort Rx Solution with Video Output., `mpf_an4684_v2024p2_jb`: Job file to test on PolarFire Video kit.	

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3. Setting up the Hardware

The following figure shows the hardware setup of the DisplayPort FMC with the PolarFire Video kit.

Figure 3-1. Setting up the Hardware



The following table lists the jumper and switch settings of the PolarFire Video kit.

Table 3-1. Jumper and Switch Settings of PolarFire Video Kit

Jumper and Switch	Position	Description
J15	Open (default)	SPI Target and Initiator mode selection. By default, select SPI Initiator.
J14	DisplayPort FMC	DisplayPort FMC to be connected
J17	Open	100K PD for TRSTn
J19	Pin 1 and 2 (default)	Default: XCVR_VREF is connected to ground
J28	Pin 1 and 2 (default)	Default: Programming through the FTDI
J24 (For Video Kit Rev1) J6 (For Video Kit Rev2)	Pin 1 and 3	Default: VDDAUX4 voltage is set to 2.5V.
J25	Pin 5 and 6	Bank4 voltage which is set to 1.8V.
J36	Pin 1 and 2 (default)	Default: Board power-up through the SW4
SW4	OFF or ON	Power On or Off slide switch
SW6	OFF	User slide switch. Default position: Off
J20	12 Volts Input	12V input to the board
J12	USB-UART	USB-UART mini cable

3.1 PolarFire Display Port Rx Solution with Video Demo

This section demonstrates the usage and running of the imaging and video demo using the PolarFire Video kit, with a Host PC and a DisplayPort Rx.

3.1.1 Setting up the Hardware for the PolarFire DisplayPort Rx

To set up the hardware for the PolarFire DisplayPort Rx, perform the following steps:

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1. To connect the DisplayPort FMC card, attach the DisplayPort FMC card to the J14 FMC connector on the PolarFire Video kit.
2. To connect the host laptop, use a DisplayPort cable to connect the laptop's DisplayPort output to the DisplayPort Rx interface on the DisplayPort FMC card.
3. To connect the HDMI output, connect an HDMI cable from the monitor to the J1 (HDMI TX) port on the PolarFire Video kit.
4. To establish host PC communication, use a USB mini cable to connect the host PC to the PolarFire Video kit through the J12 connector.
5. To power the board, plug the 12V power supply cable into the J20 onboard DC jack of the video kit.
6. Ensure the jumper settings on the video kit are configured as required for the demo.
7. To power on the Board, slide the SW4 switch to the ON position.

3.1.2 Programming the PolarFire Device Using FlashPro Express

To program the PolarFire device, perform the following steps:

1. On the host PC, start the **FlashPro Express** software from its installation directory.
2. To create a new job project, navigate to the **Project** menu and click **New** or **New Job Project from FlashPro Express Job**.
3. In the **New Job Project from FlashPro Express Job** dialog box, perform the following steps:
   a. **Programming job file**: Click **Browse** and navigate to the location of the job file, and then select the file. The default location is `mpf_an4576_v2024p2_df\designer\top\export`.
   b. **FlashPro Express job project location**: Click **Browse**, and navigate to the location where you want to save the project.
4. Click **OK**. The required programming file is selected and ready to be programmed in the device. The FlashPro Express window appears.
5. Verify that a programmer number appears in the **Programmer** box. If it does not, verify the board connections, and then click **Refresh/Rescan Programmers**.
6. To program the device, click **RUN**. When the device is programmed successfully, a **RUN PASSED** status appears.
7. To close **FlashPro Express**, click **Project**>**Exit**.
   The PolarFire device and SPI Flash are programmed.

Power cycle the board using the **SW4** switch. After power cycling, the full HD DisplayPort monitor displays the camera feed.

3.1.3 Running the Demo

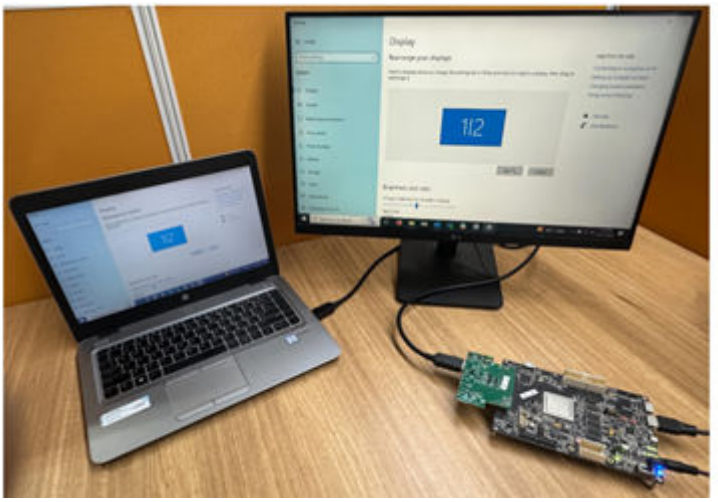
This demonstration showcases a video processing system that:

- Receives video data through DisplayPort input
- Processes it through the FPGA board
- Outputs the video signal through HDMI
- Functions once the FPGA is programmed and all connections are set up correctly

The demonstration showcases the successful integration and operation of the display interface conversion from DisplayPort to HDMI. The following figure illustrates the demo setup and its components, including the host PC, FPGA board, and HDMI monitor.

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Figure 3-2. HDMI TX Displaying the Laptop Data from DisplayPort Rx



3.2 PolarFire DisplayPort Tx Solution with Video Demo

This section demonstrates the usage and running of the imaging and video demo using the PolarFire Video kit, with a Host PC and a DisplayPort Tx.

3.2.1 Setting up the Hardware for PolarFire DisplayPort Tx

To set up the hardware for the PolarFire DisplayPort Tx, perform the following steps:

1. Connect the DisplayPort daughter card to **J14** of the FMC connector of the PolarFire Video kit.
2. Connect the DisplayPort cable to the DisplayPort Tx on the DisplayPort FMC daughter card.
3. Connect the Host PC and the video kit using the USB mini cable through **J12** on the video kit.
4. Connect the 12V power supply cable to the **J20** onboard DC jack on the video kit.
5. Ensure that the jumper settings on the video kit are correctly configured according to the preceding table.
6. Power-up the board using the **SW4** slide switch.
7. After the powering up, program the PolarFire Video kit device. For more information, see Programming the PolarFire Device using FlashPro Express.
8. Once the PolarFire device is programmed, the live feed starts streaming the camera video data.

3.2.2 Programming the PolarFire Device using FlashPro Express

This section describes how to program the PolarFire Video kit with the .job file using FlashPro Express. The .job file `mpf_an4576_v2024p2_jb` to test on PolarFire Video kit is provided here: AN4576

To program the PolarFire device, perform the following steps:

1. On the host PC, start the FlashPro Express software from its installation directory.
2. To create a new job project on the Project menu, click **New** or **New Job Project from FlashPro Express Job**.
3. In the New Job Project from FlashPro Express Job dialog box, perform the following steps:
   a. Programming job file : Click **Browse**, navigate to the location of the job file, and then select the file. The default location is `<$designfiles download directory>\mpf_an4576_v2024p2_df\VKPFC1DPTX\designer\VIDEO_KIT_TOP\export\dp_tx_demo.job`.

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b. FlashPro Express job project location: Click **Browse**, and navigate to the location where you want to save the project.

4. Click **OK**. The required programming file is selected and ready to be programmed in the device. The FlashPro Express window appears.
5. Verify that a programmer number appears in the Programmer box. If it does not, confirm the board connections, and then click **Refresh/Rescan Programmers**.
6. To program the device, click **RUN**. When the device is programmed successfully, RUN PASSED status appears.
7. To close FlashPro Express, click **Project Exit**.

The PolarFire device and SPI Flash are programmed.

Power cycle the board using the **SW4** switch. After power cycling, the full HD DisplayPort monitor displays the camera feed from the camera.

3.2.3 Running the Demo

This demonstration showcases a video processing system that:

- Captures 4K video data from a MIPI camera
- Processes the raw images through multiple enhancement stages (Bayer interpolation, gamma correction, and image enhancement)
- Stores the frames in DDR memory
- Outputs the processed video to a DisplayPort monitor
- Features automatic exposure adjustment based on lighting conditions
- The system functions as an end-to-end pipeline, taking raw camera input and producing enhanced live video output on a display. The following figure shows the DisplayPort monitor displaying the live camera feed.

Figure 3-3. DisplayPort Monitor Displaying the Live Camera Feed



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4. Software and Licensing

Libero® SoC PolarFire Design Suite offers high productivity with its comprehensive, easy-to-learn, and easy-to-adopt development tools for designing with Microchip's PolarFire FPGAs. The suite integrates industry standard Synopsys® Synplify Pro® synthesis and Siemens EDA ModelSim® simulation with best-inclass constraints management and debug capabilities

Download the latest Libero SoC release from Libero SoC v12.0 or later website

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5. Documentation Resources

For more information on DisplayPort FMC Daughter Card including Schematics and Application notes, see VIDEO-DC-DP.

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ISBN: 979-8-3371-0763-9

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