Contents

1 Revision History ......................................................... 1
  1.1 Revision 1.0 .......................................................... 1

2 PolarFire Dual Camera Video Kit .................................... 2
  2.1 Design Requirements .............................................. 3
  2.2 Prerequisites .......................................................... 3
  2.3 Demo Resources ..................................................... 3
  2.4 Installing the Demo GUI ........................................... 4
  2.5 Setting Up the Demo ................................................. 4
    2.5.1 Setting Up the Hardware .................................... 4
    2.5.2 Programming the PolarFire Device ....................... 5
  2.6 Running the Demo .................................................. 9
Figures

Figure 1  PolarFire Video Kit (DVP-102-000512-001) ......................................................... 2
Figure 2  Creating New Project ............................................................................. 5
Figure 3  View Programmer .................................................................................. 6
Figure 4  Running Script ......................................................................................... 7
Figure 5  Run Passed-Notification ......................................................................... 8
Figure 6  Video_Contrl GUI ..................................................................................... 9
Figure 7  FlashPro5 COM Port ............................................................................... 9
Figure 8  Connecting the GUI and Video kit .......................................................... 10
Figure 9  Connection Successful ......................................................................... 10
Figure 10 Adjusting Contrast and Brightness .......................................................... 11
Figure 11 Adjusting Colors ....................................................................................... 11
Figure 12 Edge Detection Option .......................................................................... 12
Figure 13 PIP Menu ............................................................................................... 12
## Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Design Requirements</td>
<td>3</td>
</tr>
<tr>
<td>Table 2</td>
<td>Jumper Settings</td>
<td>4</td>
</tr>
</tbody>
</table>
1 Revision History

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

1.1 Revision 1.0

The first publication of this document.
This document describes how to run the imaging and video demo using the PolarFire Video Kit, Dual Camera sensor module, and a HDMI monitor. The demo design features a fully integrated solution created using Microsemi Libero SoC PolarFire® to help customers build prototypes quickly.

The demo demonstrates the following functions:

- MIPI CSI-2 RX to read the camera input
- CFA (Color filter array) to RGB (red, green, blue) conversion
- Display controller
- Picture in picture (PIP)
- Edge detection
- Image enhancements such as contrast, brightness, color balance

**Note:** The solution includes a user-friendly GUI used to control these image/video settings.

The PolarFire Video Kit (DVP-102-000512-001) features:

- A 300K LE FPGA (MPF300T, FCG1152)
- HDMI 1.4 transmitter (ADV7511) chipset and corresponding connector
- HDMI 2.0 with rail clamps and redrivers and corresponding connectors
- Dual camera sensor featuring IMX334 Sony image sensor
- Image sensor interface to support upto two MIPI CSI-2 cameras
- DSI Interface
- NVIDIA Jetson Interface
- A high pin count (HPC) FMC connector to connect to high-speed interfaces (like HDSDI)

For more information about this video kit, see [https://www.microsemi.com/existing-parts/parts/150747](https://www.microsemi.com/existing-parts/parts/150747).

The following figure highlights the various features of the PolarFire Video Kit.

*Figure 1 • PolarFire Video Kit (DVP-102-000512-001)*
2.1 Design Requirements

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

Table 1 • Design Requirements

<table>
<thead>
<tr>
<th>Design Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td></td>
</tr>
<tr>
<td>- PolarFire VIDEO KIT</td>
<td>DVP-102-000512-001 REV 1.0</td>
</tr>
<tr>
<td>- Image Sensor module</td>
<td>LI-IMX334-MIPI-MICRO v1.0</td>
</tr>
<tr>
<td>- USB A to mini-B cable</td>
<td></td>
</tr>
<tr>
<td>- HDMI cable</td>
<td>HDMI A Male to Male cable</td>
</tr>
<tr>
<td>- HDMI monitor</td>
<td>Any display with HDMI input</td>
</tr>
<tr>
<td>- Power Adapter</td>
<td>12V, 5A</td>
</tr>
<tr>
<td>- Host PC</td>
<td>OS: Windows 7 or later, with HDMI TX port</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td></td>
</tr>
<tr>
<td>- Program_Debug_PolarFire_v2.3_win.exe</td>
<td>This executable installs FlashPro PolarFire v2.3 used to program the FPGA</td>
</tr>
</tbody>
</table>

Note: For HDMI 2.0, do not use a HDMI converter with the monitor or the Host PC.

2.2 Prerequisites

Before you start:

1. Download the programming files and the TCL script from:
   [http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosocpolarfirev2p3_pf](http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosocpolarfirev2p3_pf)
2. Download the GUI from:
   [http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosocpolarfirev2p3_gui](http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosocpolarfirev2p3_gui)
3. Download and install the program and Debug software from:

Note: On this web page, you are prompted to download the Program_Debug_PolarFire_v2.3_win.exe binary file. Installation of this executable installs FlashPro and SmartDebug used for FPGA programming and debugging. FlashPro is used in this demo.

2.3 Demo Resources

The programming files folder contains the following resources:

- A programming file (STP file): This file is the FPGA bitstream to be programmed.
- A binary file (BIN file) for the on-board SPI flash: This file is the user application that is executed by the Mi-V soft processor in the FPGA. The file is stored in SPI flash and is used to initialize the fabric RAMs at device power-up.
- A TCL script file: This script stores the TCL instructions to program the PolarFire device and the SPI Flash.

Follow these steps to make the TCL file compatible with your setup.

1. Unzip the <programming files>.zip file.
2. Open the TCL file using a text editor like notepad++
3. Update the location of the STP and BIN files as per your file system paths.
4. Replace the path separator ‘\’ with ‘/’ when copying the Windows file paths.
5. Save and close the TCL file.
2.4 Installing the Demo GUI

To install the GUI:

1. Extract the Installer.rar file from the <$DownloadedFolder>\Installer folder and run the setup.exe file.
2. Click Yes for any message from User Account Control. The Video Control GUI installation wizard is displayed.
3. Confirm the installation directory locations for the GUI and the National Instruments products and click Next.
4. Accept the license agreement, and click Next.
5. Review the summary and click Next.
6. Click Next to exit the installation wizard.
7. Restart the host PC when prompted.

The Video_Control GUI is installed.

2.5 Setting Up the Demo

Setting up the demo involves the following steps:

1. Setting Up the Hardware, page 4
2. Programming the PolarFire Device, page 5

2.5.1 Setting Up the Hardware

Setting up the hardware involves interfacing the dual camera sensor module with the PolarFire Video Kit and verifying the jumper settings. The following steps describe how to connect the camera module to the video kit.

1. Connect the J1 connector of the dual camera sensor module to J38 interface of the video kit.
2. Connect the video kit and the HDMI monitor through J2 (HDMI 1.4) of the video kit using the HDMI cable.
3. Connect the Host PC and the video kit through J12 of the video kit using the USB mini cable.
4. Connect the power supply cable to J20 of the video kit.
5. Ensure that the following jumper settings are set on the video kit.
6. Power-up the HDMI monitor.
7. Power-up the board using the SW4 slide switch.

Table 2 • Jumper Settings

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Default Position</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>J15</td>
<td>Open</td>
<td>SPI Slave and Master mode selection. By Default SPI master</td>
</tr>
<tr>
<td>J17</td>
<td>Open</td>
<td>100K PD for TRSTn, by default 1K PD is connected.</td>
</tr>
<tr>
<td>J19</td>
<td>Pin 1&amp;2</td>
<td>Default: XCVR_VREF is connected to GND</td>
</tr>
<tr>
<td>J28</td>
<td>Pin 1&amp;2</td>
<td>Default: Programming through the FTDI</td>
</tr>
<tr>
<td>J24</td>
<td>Pin 2&amp;4</td>
<td>Default: VDDAUX4 voltage is set to 3V3</td>
</tr>
<tr>
<td>J25</td>
<td>Pin 5&amp;6</td>
<td>Default: Bank4 voltage is set to 1V8</td>
</tr>
<tr>
<td>J36</td>
<td>Pin 1&amp;2</td>
<td>Default: Board power up through the SW4</td>
</tr>
<tr>
<td>SW4</td>
<td>OFF (Pin 2-3,5-6 Positions)</td>
<td>Power ON/OFF switch</td>
</tr>
<tr>
<td>SW6</td>
<td>OFF position</td>
<td>user slide switch, Default OFF position</td>
</tr>
<tr>
<td>J20</td>
<td>12Volts Input</td>
<td>12V input to the board</td>
</tr>
</tbody>
</table>
The PolarFire dual camera video and imaging hardware is set up. See the next section to program the PolarFire device.

### 2.5.2 Programming the PolarFire Device

The TCL script is used to program the PolarFire device. The FlashPro software can execute the TCL script file.

Follow these steps:

1. Open FlashPro and create a new project as shown in the following figure.

**Figure 2 • Creating New Project**
2. Verify that the FlashPro5 programmer is detected and displayed as shown in the following figure.

**Figure 3**  View Programmer

3. Select **File -> Run script**. The Execute Script dialog box opens as shown in the following figure.
4. Use the Browse option to select the Script.tcl file from the following design files folder:
   <script file location>

**Note:** In the TCL file, ensure that the path separator `\` is replaced with `/` when using a Windows PC.

5. Select **Run** to run the script. Once complete, a message appears in the log as shown in the following figure.
Figure 5 • Run Passed-Notification

The PolarFire device and SPI Flash are programmed.

Power cycle the board using switch SW4. The camera feed from the 2 cameras is displayed on the HDMI monitor as Picture in Picture.
2.6 Running the Demo

Running the demo involves verifying the imaging and video settings using the Video_Control GUI and then observing the result on the HDMI monitor.

To use the demo GUI:

1. Start the Video_Control GUI from the installation directory. The GUI is displayed as shown in the following figure.

*Figure 6 • Video_Control GUI*

2. Note the FlashPro5 COM port from Device Manager.

*Figure 7 • FlashPro5 COM Port*

3. Select the same FlashPro5 COM port on the GUI and select the Connect option.
4. The connect button turns green to indicate that the connection is successful.

**Figure 9 • Connection Successful**
5. Use the Contrast and Brightness sliders to adjust the contrast and brightness and observe the change on the HDMI monitor. These sliders are highlighted in the following figure.

*Figure 10 • Adjusting Contrast and Brightness*

6. Similarly, adjust the color balance of the image using the color balance sliders.

*Figure 11 • Adjusting Colors*

7. Similarly, adjust the Alpha slider. The alpha blending feature enables adjusting the transparency of the PIP image. When the alpha value is adjusted to minimum (0), the image disappears.

8. Switch to edge detection mode using the Edge option.
9. Select PIP Menu to change the PIP settings.
10. In the PIP Menu, the source of the PIP window can be selected between Camera 1 and Camera 2 using PIP: Source Select. The position of the PIP window can be moved anywhere within the screen by dragging it. The Auto Mode Start option moves the PIP window automatically. The speed of this movement can be controlled using the Auto Mode Step slider.

This concludes the demo.