Image Sensor Bridge Demo

User Guide

FPGA-UG-02075-1.0

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Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
CMOS	Complementary Metal-Oxide-Semiconductor
DVP	Digital Video Port
MDP	Mobile Development Platform
RGB	Red Green Blue
VGA	Video Graphics Array

1. Introduction

The image sensor bridge shows one of the many features of our UltraPlus device. In this image sensor bridge demonstration, the UltraPlus devices' capability is shown to interface to an on-board CMOS camera over Digital Video Port (DVP) and convert this image data to RGB format for further basic image processing.

This user guide describes how to perform the image sensor bridge demo on the iCE40 UltraPlus™ Mobile Development Platform (MDP) board. This demo uses the on-board OVM7692-RYAA camera, which is a low voltage CMOS image sensor that provides the full functionality of a single-chip VGA camera and image processor in a small footprint package, to capture the image using iCE40 UltraPlus device. The camera is configured to enable Digital Video Port (DVP) interface. The UltraPlus device takes this DVP interface such as clock, vsync, hsync, and 8-bit data, and converts it into 16-bit RGB format for basic image processing.

This image senor bridge can detect an object when the object having human skin color is in front of the camera, ideally located roughly one to two feet away from the board. Lighting conditions must be normal, which is without extreme shadows, brightness, or backlight.

2. Block Diagram

Total there are four iCE40 UltraPlus devices on board. The iCE40UP5K_D (U4 on iCE40 UltraPlus MDP board) device is used to run this demo.

In this demo, the result is indicated by the current status of LED D14 (the green LED shown in Figure 2.1).

Figure 2.1 shows the diagram of the image sensor bridge demo. The camera sensor captures the detected image, then sends the captured image to the iCE40 device through DVP interface. iCE40 device analyzes the income image data, and uses the LED D14 to show the result.

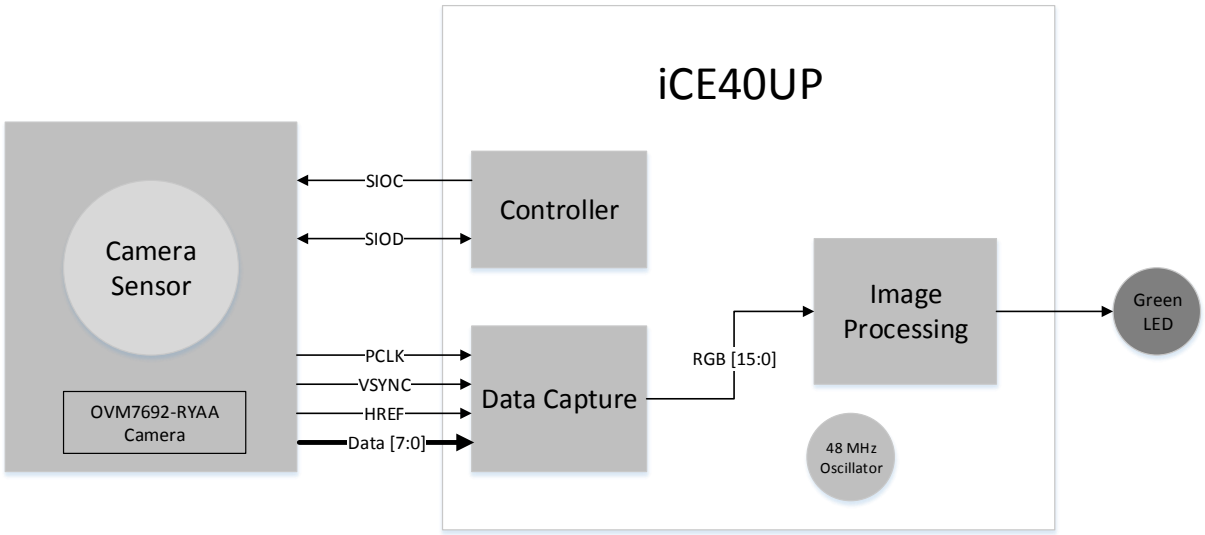

Figure 2.1. Block Diagram of Image Sensor Bridge Demo

3. Demo Platform

This section describes the demo setup.

3.1. Setting Jumpers and Switches

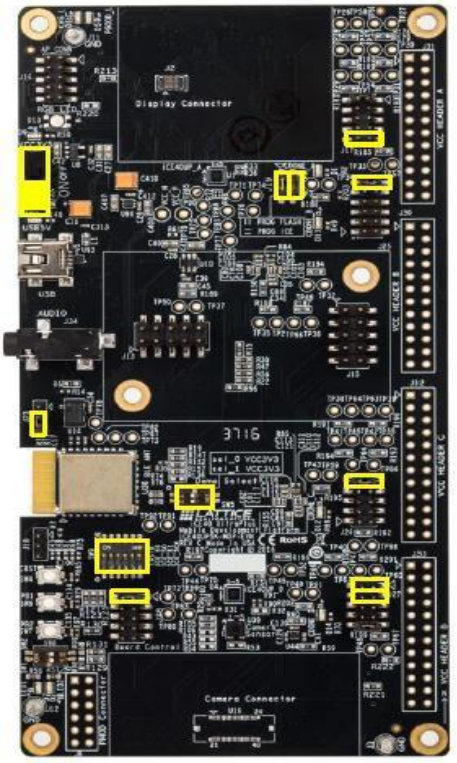

Figure 3.1. iCE40 UltraPlus MDP Board Configuration

Table 3.1. iCE40 UltraPlus MDP Board Configuration Details

Items	Configuration	Description
J17, J26	Shunt pin 9-10	Disable iCE40UP5K_A/B/C devices
J25	Shunt pin 11-12	Disable iCE40UP5K_C device
J27	Shunt pin 1-2	Enable iCE40UP5K_D device
J27	Shunt pin 3-4	Provide power supply to camera sensor from USB cable
J28	Shunt pin 1-2	Board control, for programming SPI Flash
J19	Shunt pin 1-3, 2-4 (vertical)	Enable programming SPI Flash
J23	Shunt pin 2-3	Use Xtal U14 as clock source
SW2	Set to ON	Power switch, slide down for power-on
SW5	All set to ON	Select iCE40UP5K_D as target device

3.2. Programming SPI Flash on iCE40 UltraPlus MDP Board

To program SPI flash in Radiant Programmer (version 1.0 or higher):

1. Connect iCE40 UltraPlus MDP board to PC using a USB cable. Power ON iCE40 UltraPlus MDP board.
2. Launch Lattice Radiant Programmer (Figure 3.2).

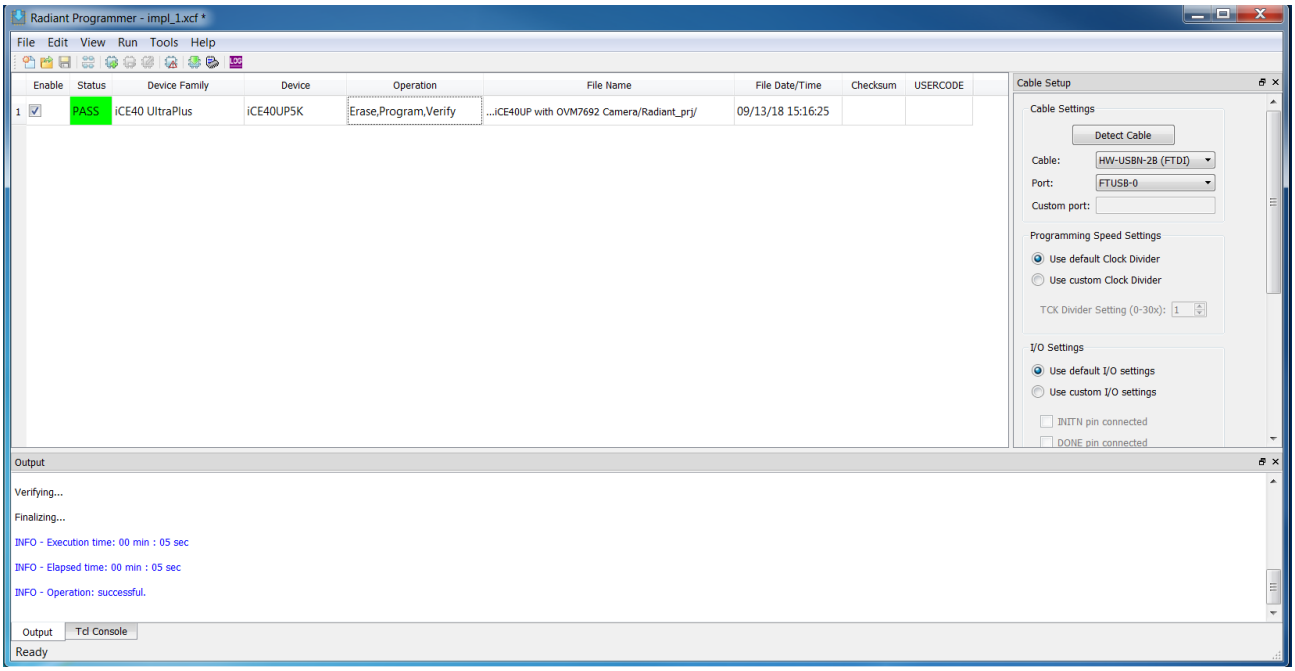

Figure 3.2. Lattice Radiant Programmer

3. After scanning, select:
   Device Family: iCE40 UltraPlus
   Device: iCE40UP5K
4. Choose **Edit > Device Properties** menu item (Figure 3.3) to open the Device Properties dialog.

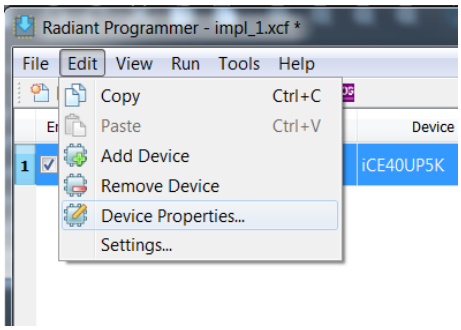

Figure 3.3. Edit > Device Properties Menu Item

5. Apply the settings in the Device Properties dialog as shown in Figure 3.4. Target
   Memory: External SPI Flash Memory (SPI FLASH)
   Port Interface: SPI
   Access Mode: Direct Programming
   Operation: Erase, Program, Verify
   Programming file: Load the bit stream file (Img_brg_UP_impl1_1.bin) for demo.

   SPI Flash Options:
   Family: SPI Serial Flash
   Vendor: Micron
   Device: SPI-M25P80
   Package: 8-pin SOIC
   SPI Programming:
   Load from file: Use this button to refresh fields such as **Data file size (Bytes)** and **End address (Hex)**.

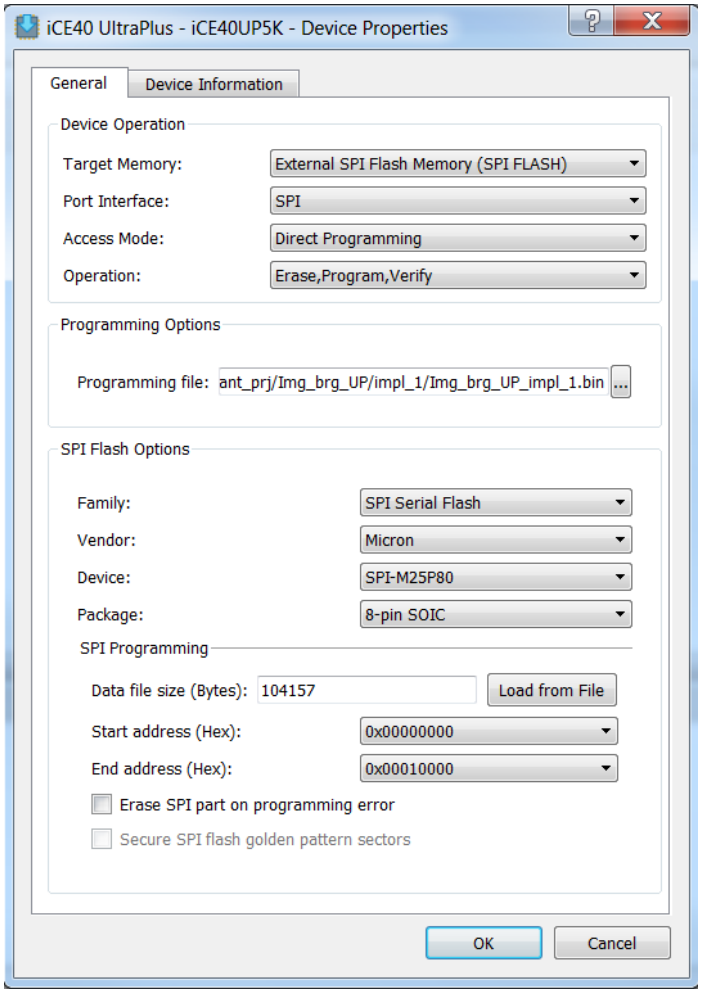

Figure 3.4. Device Properties Dialog

6. Click **OK** to exit the Device Properties dialog.
7. Click the **Program Device** icon from the Radiant Programmer toolbar (Figure 3.5) to download the bitstream file.

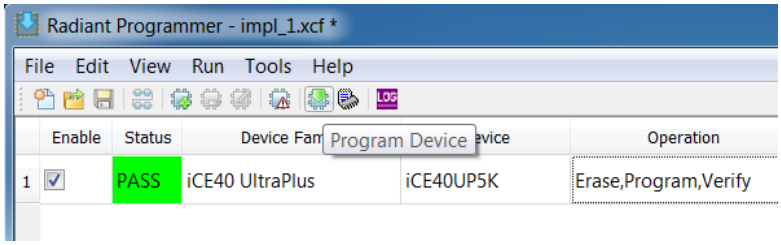

Figure 3.5. Program Device Button in Radiant Software

4. Running the Image Sensor Bridge Demo

Follow the steps below to run the image sensor bridge demo:

1. Power ON iCE40 UltraPlus MDP board.
2. LED D14 is stably ON for 6-7 seconds. Then it turns OFF
3. Position any object that has human skin color one to three feet away from the camera. Make sure that the camera is placed in a well-lit area.
4. The camera sensor starts to capture image frames.
5. LED D14 (Green color) is used to display the result of a previously captured image.

LED Status	Indication
ON	There are enough pixels that have human skin color on the captured image.
OFF	There is no pixel that have human skin color on the captured image.
Blinking	There is not enough pixels that have human skin color on the captured image

References

You may want to refer to the following sections on Lattice Semiconductor website for references.

- iCE40 UltraPlus FPGA
- iCE40 UltraPlus MDP Board
- iCE40 UltraPlus MDP User Guide

Technical Support

For assistance, submit a technical support case at www.latticesemi.com/techsupport.

Revision History

Revision 1.0, September 2018

Section	Change Summary
All	Initial release.

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