



# **iCE40 UltraPlus Face Detection Demo**

## **User Guide**

FPGA-UG-02027 1.0

June 2017

## Contents

1. Introduction .....	3
2. Functional Description .....	3
3. Demo Platform Setup .....	4
3.1. Configuring the MDP Board .....	4
3.1.1. Setting Jumpers and Switches .....	4
3.1.2. Programming SPI Flash on the MDP Board .....	5
4. Running the Face Detection Demo .....	6
Technical Support .....	6
Revision History .....	7

## Figures

Figure 2.1. Face Detection Demo Diagram .....	3
Figure 3.1. MDP Board Configuration .....	4
Figure 3.2. Programming Settings in Diamond Standalone Programmer .....	5
Figure 4.1. UART Printout Information .....	6

## Tables

Table 3.1. MDP Board Configuration Details .....	4
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# 1. Introduction

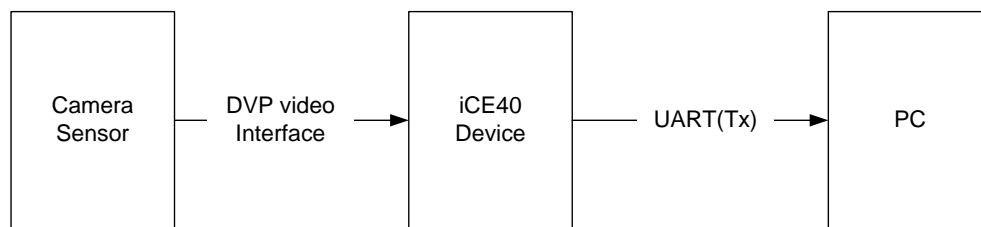
This document describes how to perform the Face Detection demo on the iCE40 UltraPlus™ Mobile Development Platform (MDP) board. It detects when a person is in the field of view of the camera, ideally located roughly one to two feet away from the board. Lighting conditions must be normal, without extreme shadows, brightness, or backlight.

# 2. Functional Description

There are totally four iCE40 UltraPlus devices onboard. The iCE40UP5K\_D (U4 on MDP board) device is used to run this demo.

In this demo, information is printed through the universal asynchronous receiver/transmitter (UART) serial port for the iCE40 UltraPlus device. The printed-out information is a list of scores in different categories, which show the quality of the image capture by the camera sensor.

Figure 2.1 shows the diagram of the Face Detection demo. The camera sensor captures the detected image, then send the captured image to the iCE40 device through DVP interface. Then iCE40 device analyzes the income image data, and use the UART Tx channel to send out information representing captured image quality.



**Figure 2.1. Face Detection Demo Diagram**

## 3. Demo Platform Setup

### 3.1. Configuring the MDP Board

#### 3.1.1. Setting Jumpers and Switches

Before running the demo, the MDP board must be configured by setting the switches and jumpers as shown in [Figure 3.1](#).

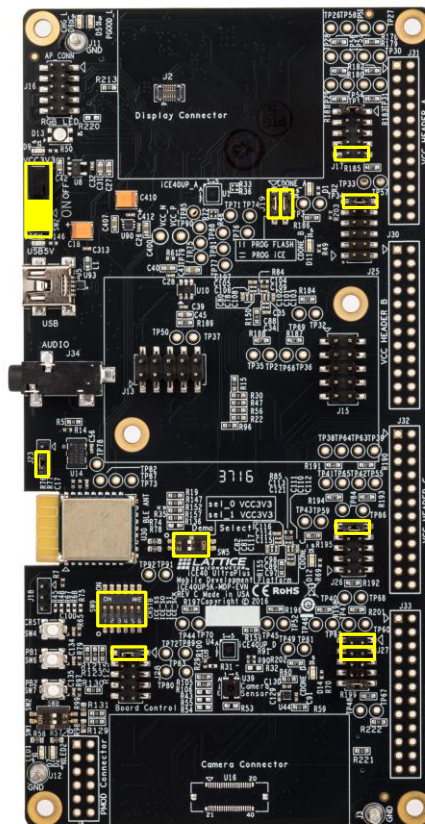


Figure 3.1. MDP Board Configuration

[Table 3.1](#) provides detailed information on the MDP switch and jumper configuration.

**Table 3.1. MDP Board Configuration Details**

ITEMS	CONFIGURATION	DESCRIPTION
J17,J25,J26	Shunt pin 9-10	Disable ICE40UP5K_A/B/C devices.
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.

**\*Note:** A universal external UART tool working in TTL mode can be used to monitor the serial information printed out from the ICE40UP5K\_D device. J33 pin 3 is used as the Tx pin in the serial port. The UART port should be set as 115200 baud rate (8-N-1).

### 3.1.2. Programming SPI Flash on the MDP Board

To program SPI flash in Diamond Programmer (version 3.8 or higher):

1. Connect the MDP board to the PC using a USB cable and power ON the MDP board.
2. Start Diamond Programmer.
3. In the Diamond Programmer Getting Started dialog box, select **Create a new project from a JTAG scan** and click **OK**.
4. After scanning, set **Programming Speed Settings** to **Use customer Clock Divider** and select the value **5**.
5. Set Device Family to “iCE40 UltraPlus” and Device to “iCE40UP5K”.
6. Open the Device Properties dialog. Apply the settings as shown in Figure 3.5.  
**Access mode:** set to “SPI Flash Programming”.  
**Operation:** set to “SPI Flash Erase, Program, Verify” mode.  
**Programming File:** load bit stream file for demo.  
**SPI Flash Options:** select correct Flash chip.  
**Load from File** button should be used to refresh fields such as “Data file size” and “End address(Hex)”.
7. Click **OK** to exit Device Properties dialog.
8. Click the **Program** button in Diamond Programmer to download the bitstream file.

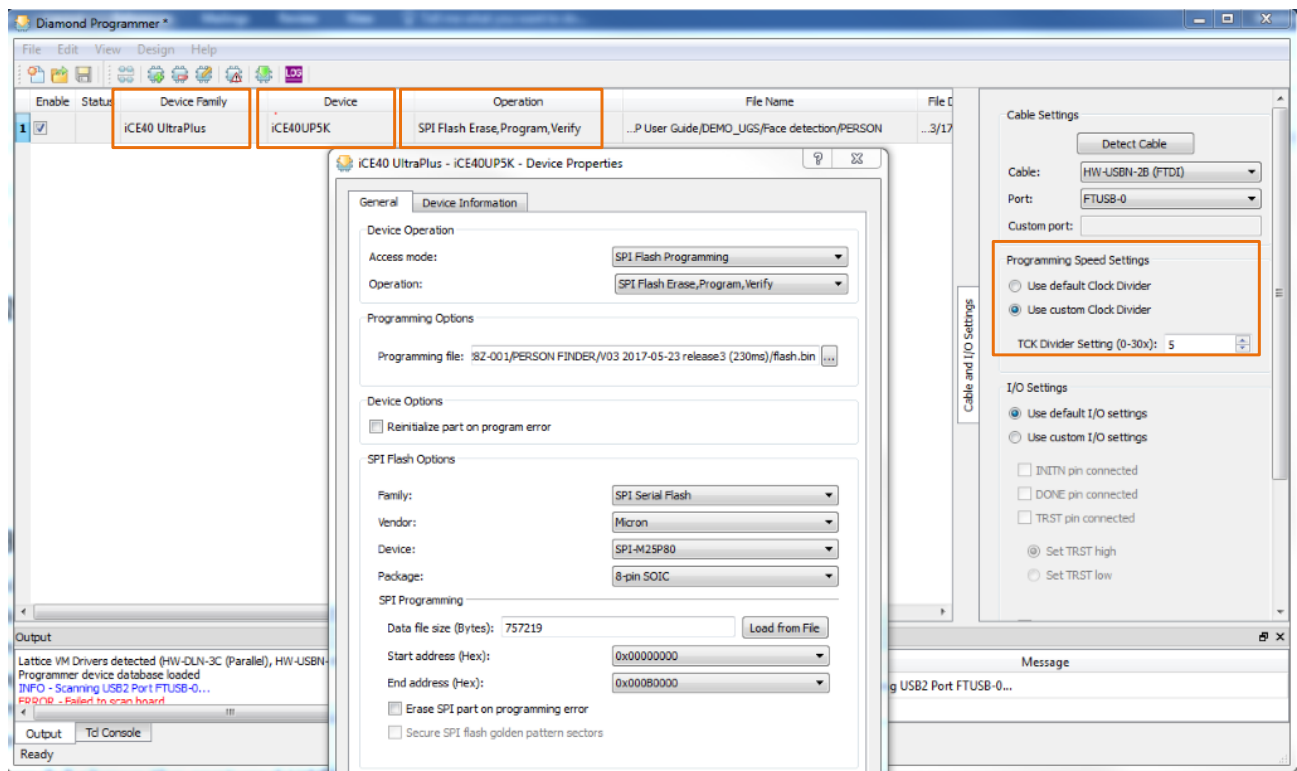


Figure 3.2. Programming Settings in Diamond Standalone Programmer

## 4. Running the Face Detection Demo

To run the demo:

- 1) Connect the UART Tx channel from the ICE40UP5K\_D device on the MDP board to the PC.
- 2) Set the UART to 115200, baud rate (8-N-1).
- 3) Power ON the MDP board.
- 4) LED D14 pulses quickly like a heartbeat. This indicates that the demo is running.
- 5) Position a human face roughly one to three feet away from the camera.

After the heartbeat, the camera sensor starts to acquire image frames. At the same time, the UART starts to print out information representing captured image quality.

D14 is used to display the result of a previously captured image. ON indicates that a face is detected. OFF indicates that no face is detected.

Figure 4.1 shows the captured UART information sent out from the ICE40UP5K\_D device.

```
1 CES demo
2 Lattice
3 categories:
4 noface
5 face
6 Frame 0: 446 ms Face Score = -47
7 Frame 1: 439 ms Face Score = -38
8 Frame 2: 439 ms Face Score = -26
9 Frame 3: 439 ms Face Score = -45
10 Frame 4: 439 ms Face Score = -33
11 Frame 5: 439 ms Face Score = -41
12 Frame 6: 439 ms Face Score = -37
13 Frame 7: 439 ms Face Score = 20
14 Frame 8: 439 ms Face Score = 20
15 Frame 9: 439 ms Face Score = 21
16 Frame 10: 439 ms Face Score = 27
17 Frame 11: 439 ms Face Score = 25
18 Frame 12: 439 ms Face Score = 26
19 Frame 13: 439 ms Face Score = 26
```

Figure 4.1. UART Printout Information

There are two categories included, “noface” and “face”. The Face Score value indicates the quality of the captured image. A higher score indicates a better match.

## Technical Support

For assistance, submit a technical support case at [www.latticesemi.com/techsupport](http://www.latticesemi.com/techsupport).

## Revision History

Date	Version	Change Summary
June 2017	1.0	Initial release.



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