



CertusPro-NX MobileNet Object Classification on VVML Board Demonstration

User Guide

FPGA-UG-02139-1.0

January 2022

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Contents

Acronyms in This Document	4
1. Introduction	5
2. Functional Description	5
3. Demo Setup	7
3.1. Hardware Requirements	7
3.2. Software Requirements	7
4. Programming the Demo	8
4.1. Package Folder Structure	8
4.2. Load Firmware in FX3 I ² C EEPROM	8
4.3. Programming the CertusPro-NX Voice and Vision SPI Flash	10
4.3.1. Erasing the CertusPro-NX Voice and Vision SRAM Prior to Reprogramming	10
4.3.2. Programming the CertusPro-NX Board	11
4.3.3. Programming sensAI Firmware Binary to the CertusPro-NX SPI Flash	13
4.3.3.1. Convert Flash sensAI Firmware Hex to CertusPro-NX SPI Flash	13
5. Running the Demo	16
Technical Support Assistance	17
Revision History	18

Figures

Figure 2.1. Top View of CertusPro-NX Voice and Vision Machine Learning Board	5
Figure 2.2. Bottom View of CertusPro-NX Voice and Vision Machine Learning Board	6
Figure 3.1. Lattice CertusPro-NX Voice and Vision Board	7
Figure 4.1. Demo Package Folder Structure after Unzipping the Package	8
Figure 4.2. Selecting FX3 I ² C EEPROM in USB Control Centre	9
Figure 4.3. Radiant Programmer – Default Screen	10
Figure 4.4. Radiant Programmer – Device Selection	10
Figure 4.5. Radiant Programmer – Device Operation	11
Figure 4.6. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flashing	12
Figure 4.7. CertusPro-NX Flashing Switch – SW4 Push Button	13
Figure 4.8. Radiant Programmer – Output Console	13
Figure 4.9. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flashing	14
Figure 4.10. Radiant Programmer – Output Console	15
Figure 5.1. Running the Demo	16

Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
FPGA	Field-Programmable Gate Array
ML	Machine Learning
SD	Secure Digital
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
USB	Universal Serial Bus
VVML	Voice and Vision Machine Learning

1. Introduction

This document describes the Object Classification Demo using the CertusPro™-NX Voice and Vision Machine Learning platform. Object Classification uses the generic Object Counting base design.

2. Functional Description

The Object Classification demo is designed to utilize the CertusPro-NX Voice and Vision Machine Learning board.

Figure 2.1 and Figure 2.2 show the top view and bottom view of the Voice and Vision board used in this demonstration.

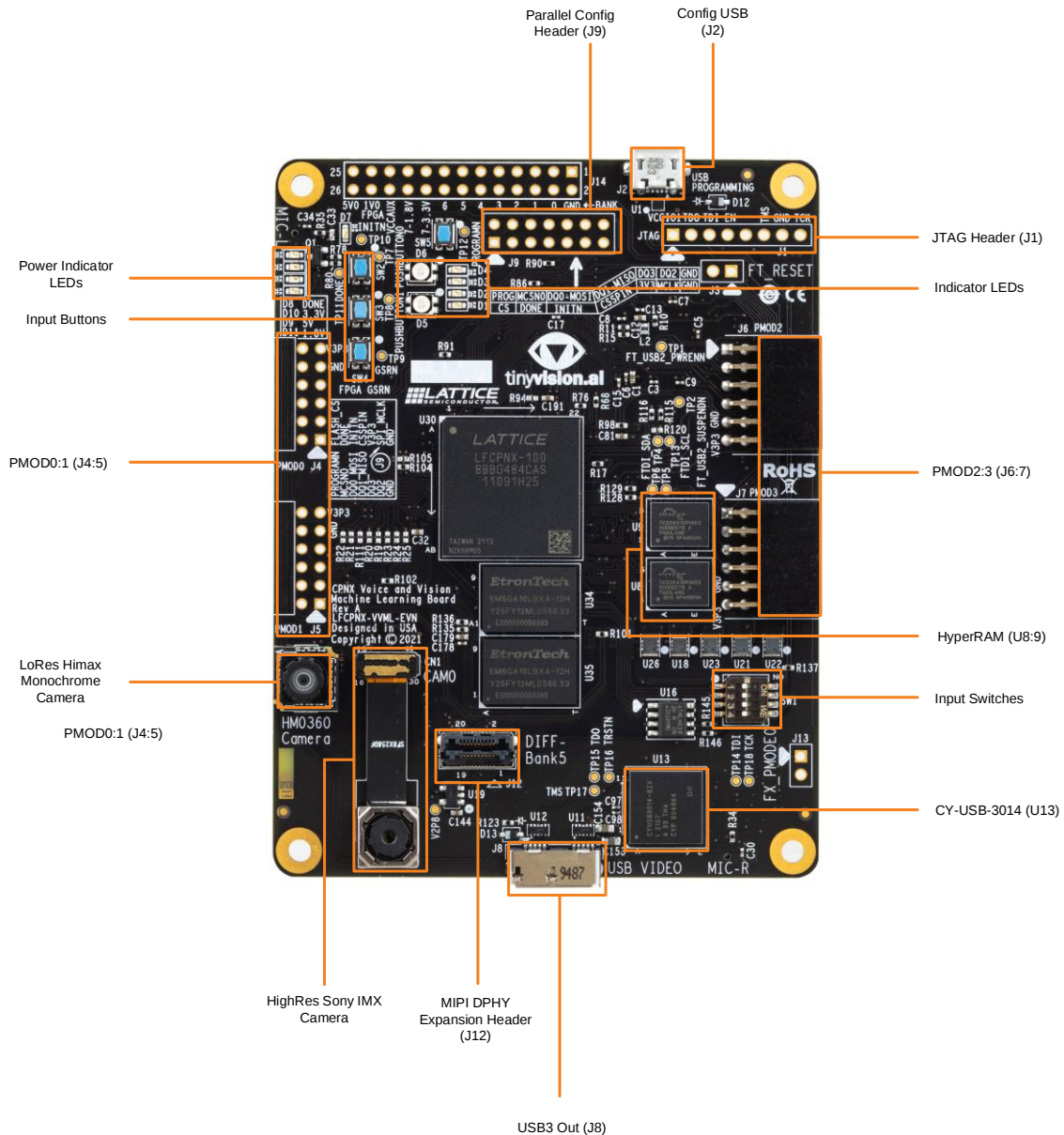


Figure 2.1. Top View of CertusPro-NX Voice and Vision Machine Learning Board

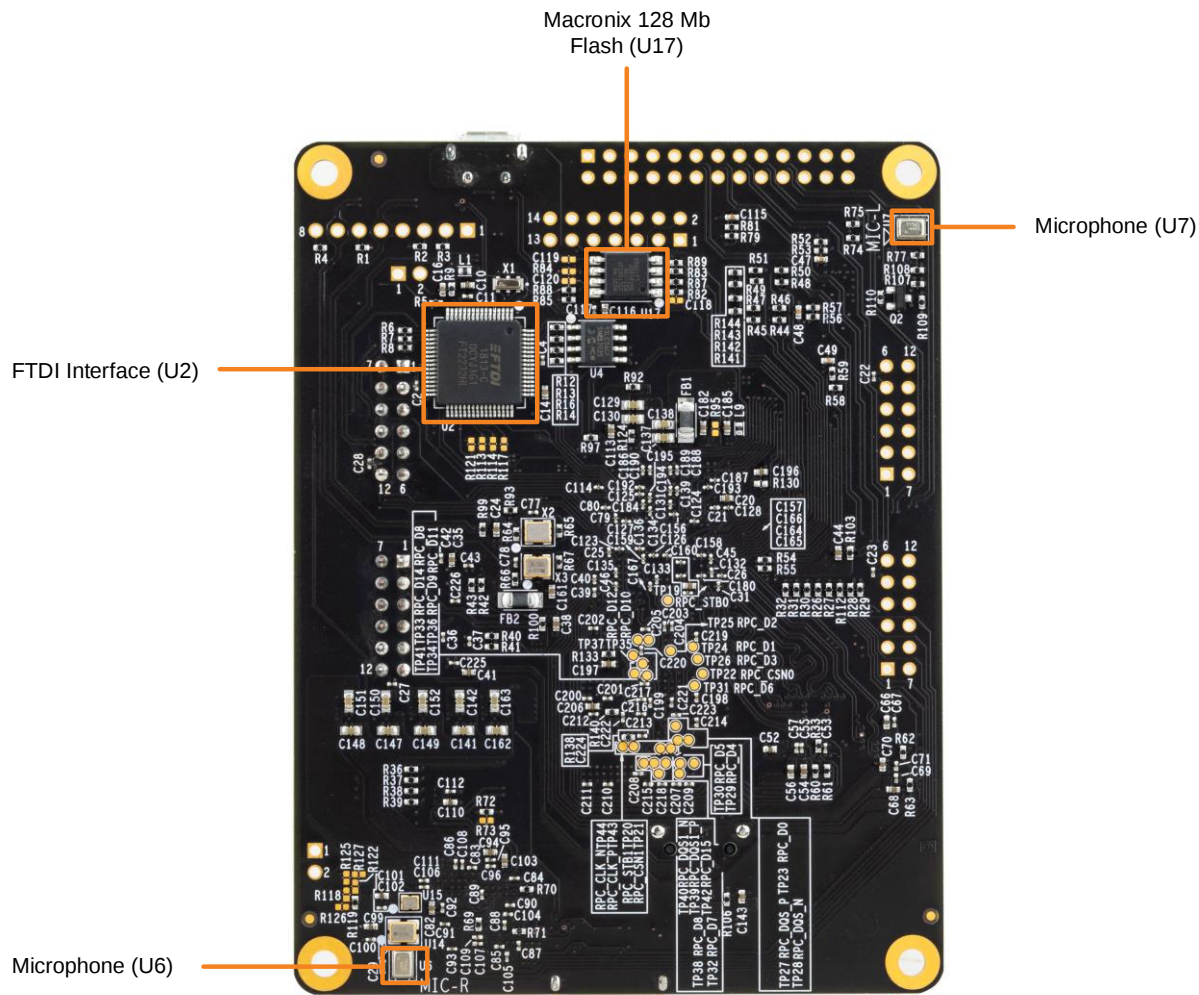


Figure 2.2. Bottom View of CertusPro-NX Voice and Vision Machine Learning Board

3. Demo Setup

This section describes the demo setup.

3.1. Hardware Requirements

- CertusPro-NX Voice and Vision Board

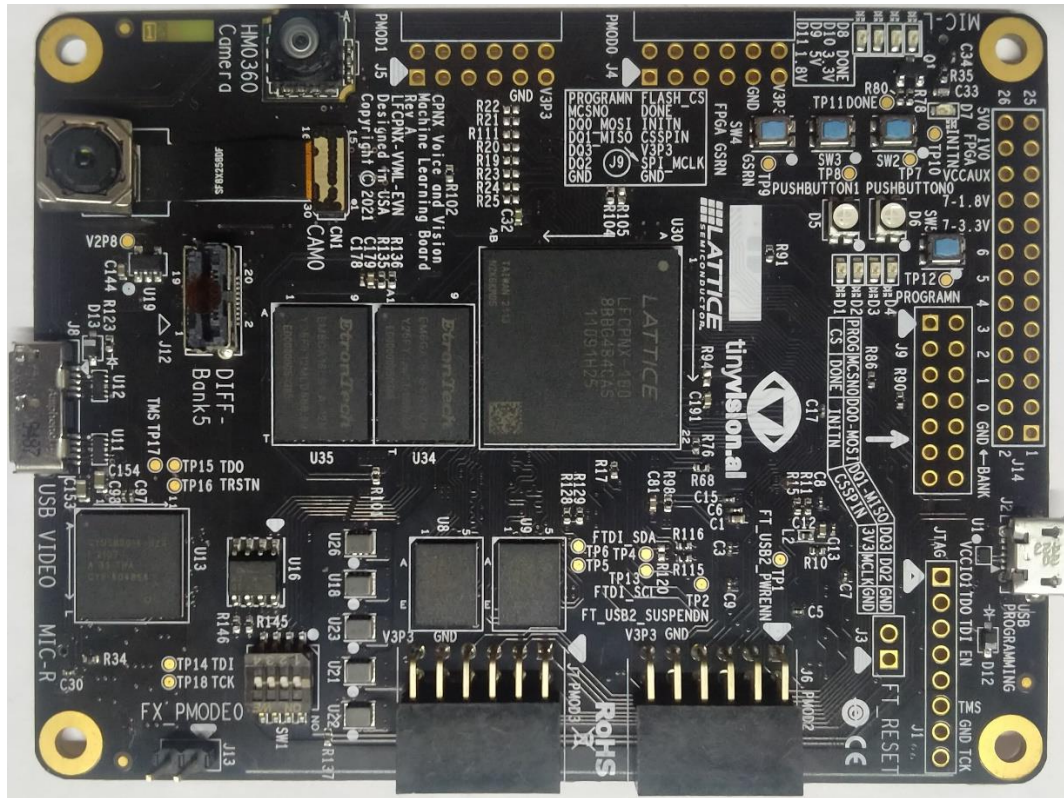


Figure 3.1. Lattice CertusPro-NX Voice and Vision Board

3.2. Software Requirements

- Lattice Radiant™ Programmer version 3.0 (Refer to <http://www.latticesemi.com/programmer>)

4. Programming the Demo

4.1. Package Folder Structure

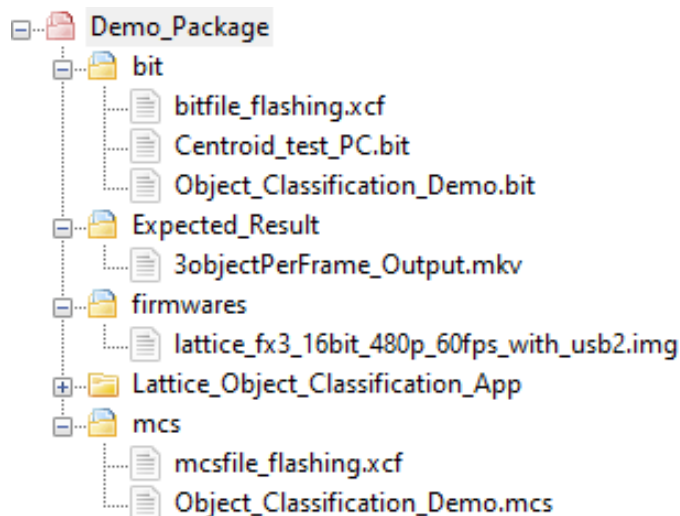


Figure 4.1. Demo Package Folder Structure after Unzipping the Package

4.2. Load Firmware in FX3 I²C EEPROM

To load the firmware:

1. Connect the USB3 port of the CertusPro-NX Voice and Vision Machine Learning board to the PC using the USB3 cable.
2. Open the USB Control Centre application. Cypress FX3 SDK should also be installed.
3. Use the CertusPro-NX Voice and Vision Machine Learning board and put the jumper on **J13** to make the FX3 firmware programmable.
4. Connect the **FX3** cable to the display monitor.
5. Press the **Push** button **SW5** to reset the FX3 chip. [Figure 4.2](#) shows the boot loader device screen.

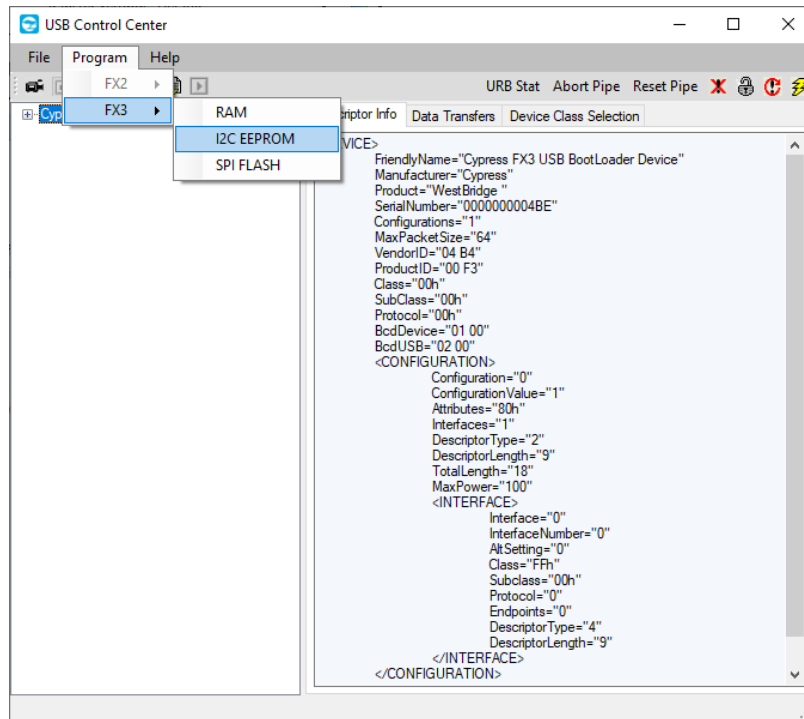


Figure 4.2. Selecting FX3 I²C EEPROM in USB Control Centre

6. Select **Cypress USB Bootloader**.
7. Go to **Program > FX3 > I2C E2PROM**.
8. Open and select the FX3 image file *lattice_fx3_16bit_480p_60fps_with_usb2.img* for the monochrome camera inside the *Firmware* folder. Wait for the *Programming Successful* message to appear in the bottom taskbar.
9. Power off and power on the board to boot the FX3 from I²C E2PROM.

4.3. Programming the CertusPro-NX Voice and Vision SPI Flash

4.3.1. Erasing the CertusPro-NX Voice and Vision SRAM Prior to Reprogramming

If the CertusPro-NX device is already programmed (either directly, or loaded from SPI Flash), follow this procedure to first erase the CertusPro-NX SRAM memory before re-programming the CertusPro-NX's SPI Flash. If you are doing this, keep the board powered when re-programming the SPI Flash (so it does not reload on reboot).

To erase the CertusPro-NX device:

1. Launch Radiant Programmer. In the Getting Started dialog box, select **Create a new blank project**.

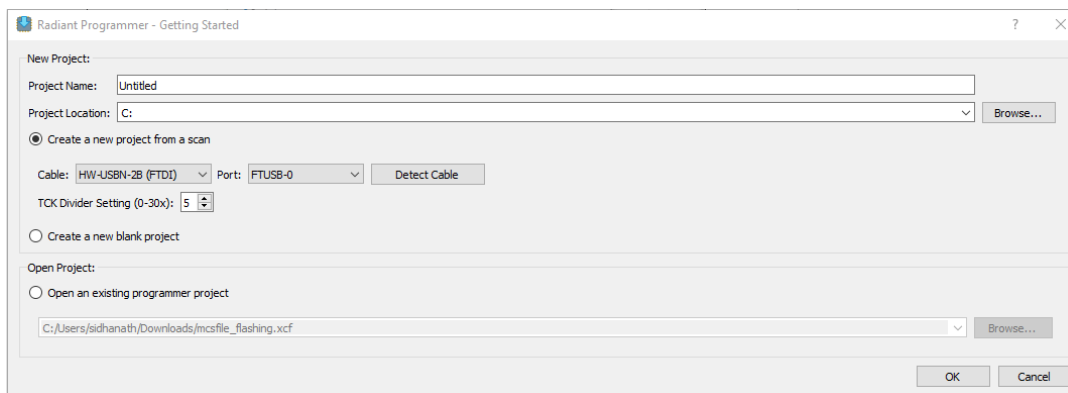


Figure 4.3. Radiant Programmer – Default Screen

2. Click **OK**.
3. In the Radiant Programmer main interface, select **LFCPNX** for Device Family and **LFCPNX-100** for Device, as shown in Figure 4.4.

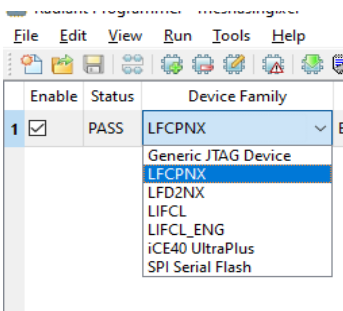


Figure 4.4. Radiant Programmer – Device Selection

4. Right-click and select **Device Properties**.
5. Select **JTAG** for Port Interface, **Direct Programming** for Access Mode, and **Erase Only** for Operation, as shown in Figure 4.5.

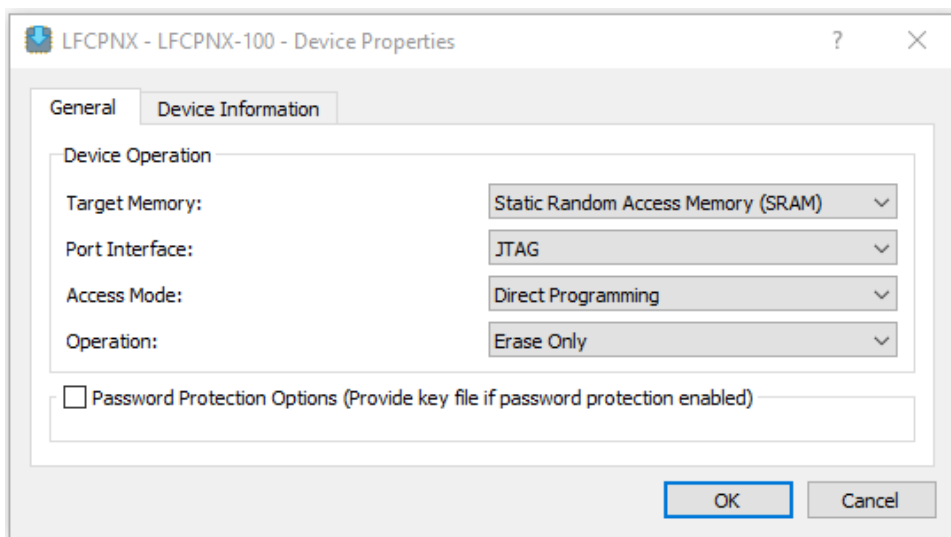


Figure 4.5. Radiant Programmer – Device Operation

6. Click **OK** to close the Device Properties dialog box.
7. Click the **Program** button  to start the erase operation.

4.3.2. Programming the CertusPro-NX Board

To program the CertusPro-NX Voice and Vision SPI Flash:

1. Ensure that the CertusPro-NX Voice and Vision device SRAM is erased by performing the steps in the [Erasing the CertusPro-NX Voice and Vision SRAM Prior to Reprogramming](#) section.
2. In the Radiant Programmer main interface, right-click the CertusPro-NX Voice and Vision row and select **Device Properties**.
3. Apply the settings below:
 - a. Under Device Operation, select the options below:
 - **Port Interface – JTAG2SPI**
 - **Access Mode – Direct Programming**
 - **Operation – SPI Flash Erase, Program, Verify**
 - b. Under Programming Options, select the bitstream file.
 - c. For **SPI Flash Options**, select the **Macronix 25L12833F** device, as shown in [Figure 4.6](#).

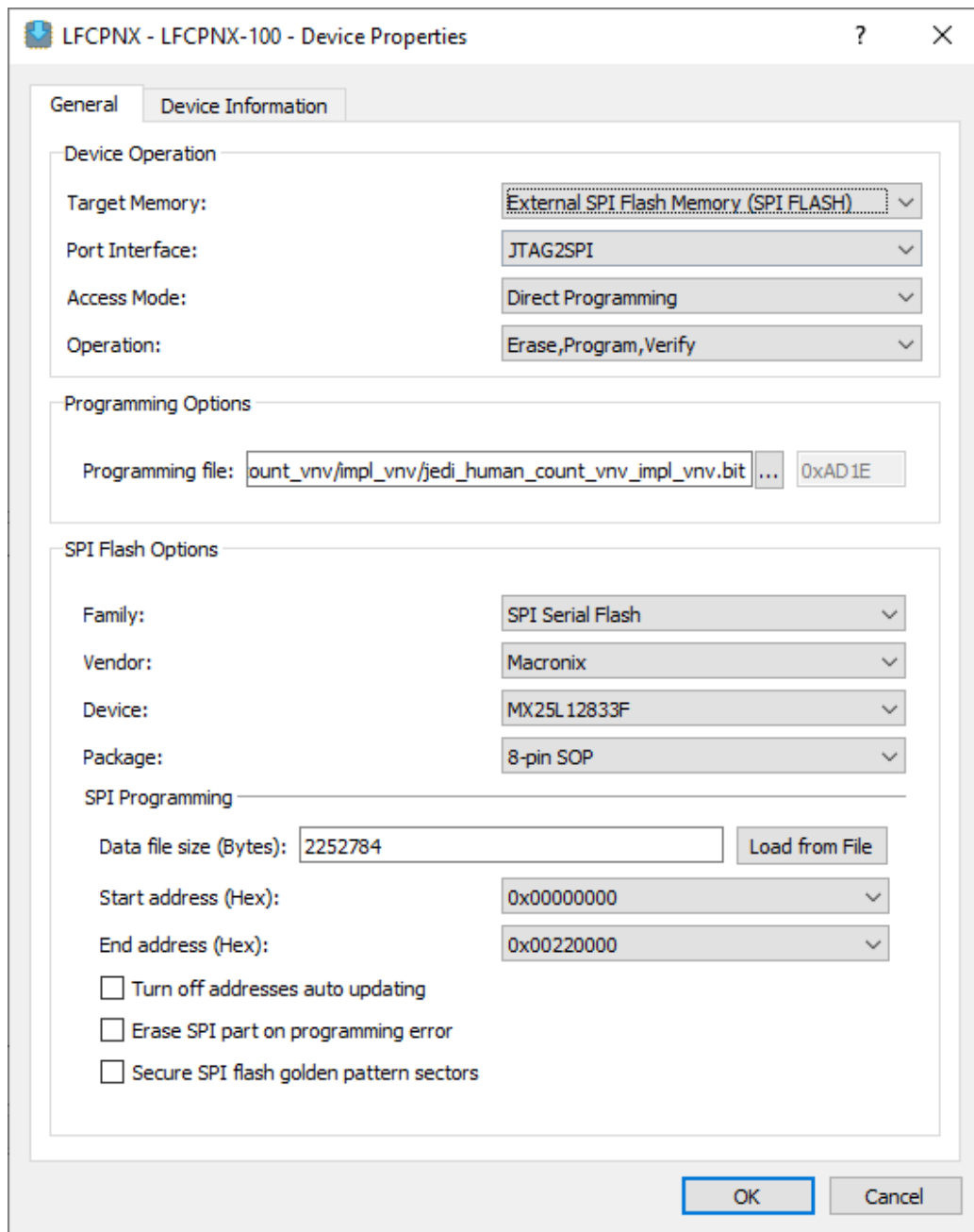


Figure 4.6. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flashing

- d. Click **Load from File** to update the Data file size (bytes) value.
- e. Ensure that the following addresses are correct:
 - Start Address (Hex) – 0x00000000
 - End Address (Hex) – 0x00220000
4. Click **OK**.
5. Press the **SW5** push button switch before clicking the **Program** button, as shown in [Figure 4.7](#). Hold it until you see the *Successful* message in the Radiant log window.

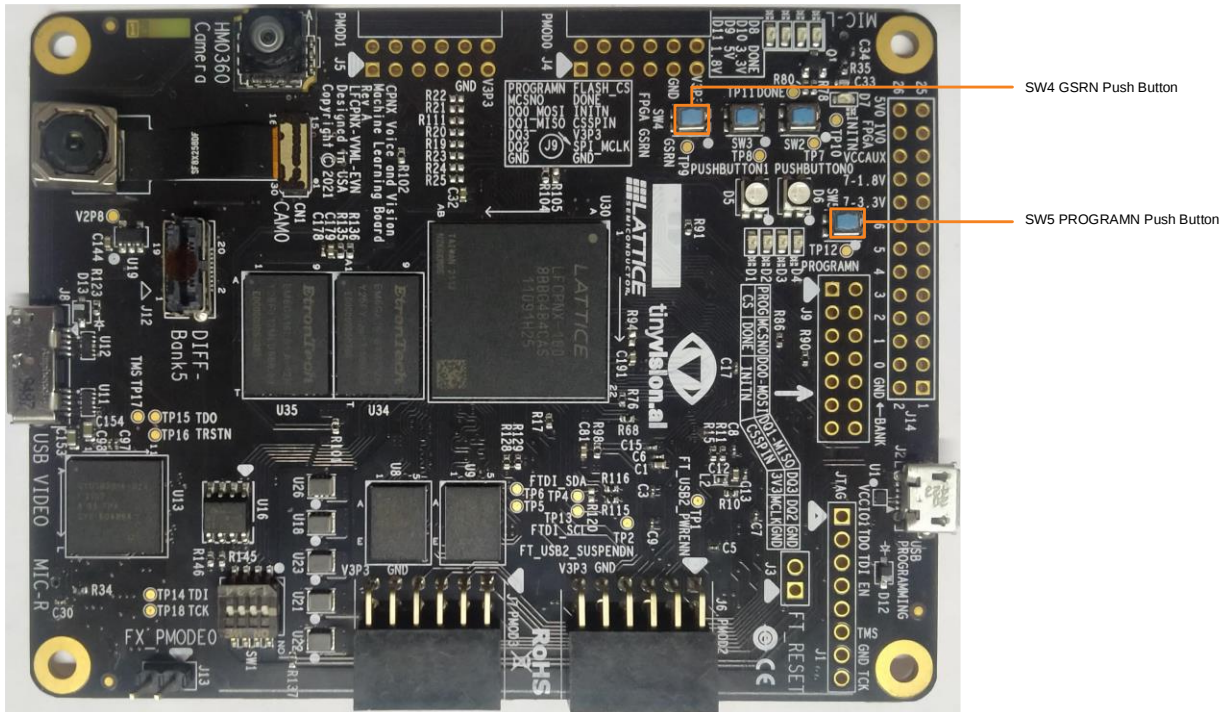


Figure 4.7. CertusPro-NX Flashing Switch – SW4 Push Button

6. Click the **Program** button  to start the programming operation.
7. After successful programming, the **Output** console displays the result, as shown in Figure 4.8.



Figure 4.8. Radiant Programmer – Output Console

4.3.3. Programming sensAI Firmware Binary to the CertusPro-NX SPI Flash

4.3.3.1. Convert Flash sensAI Firmware Hex to CertusPro-NX SPI Flash

To program the CertusPro-NX SPI flash:

1. Ensure that the CertusPro-NX device SRAM is erased by performing the steps in the [Erasing the CertusPro-NX Voice and Vision SRAM Prior to Reprogramming](#) section before flashing bitstream and sensAI firmware binary.
2. In the Radiant Programmer main interface, right-click the CertusPro-NX row. Select **Device Properties** to open the dialog box, as shown in Figure 4.9.
3. Select SPI FLASH for Target Memory, JTAG2SPI for Port Interface, and Direct Programming for Access Mode.
4. For Programming File, select the **CertusPro-NX sensAI firmware** binary file after converting it to hex (*.mcs).
5. For SPI Flash Options, follow the configurations in Figure 4.9.

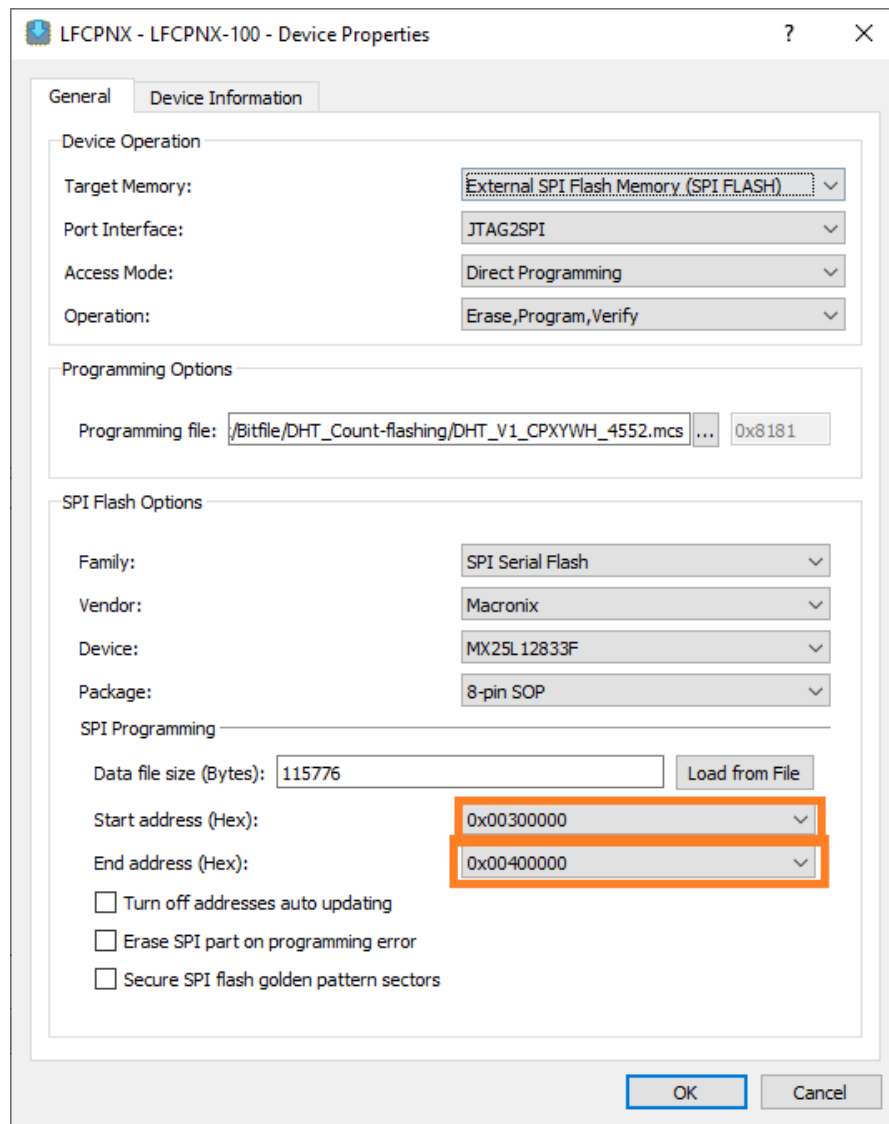


Figure 4.9. Radiant Programmer – Selecting Device Properties Options for CertusPro-NX Flashing

6. Click **Load from File** to update the data file size (bytes) value.
7. Ensure that the following addresses are correct:
 - **Start Address (Hex)** – 0x00300000
 - **End Address (Hex)** – 0x00400000
8. Click **OK**.
9. Press the **SW5** push button switch. Click the **PROGRAMN** push button and hold it until you see the *Successful* message in the Radiant log window.
10. Click the **Program** button  to start the programming operation.
11. After successful programming, the **Output** console displays the result, as shown in [Figure 4.10](#).



Figure 4.10. Radiant Programmer – Output Console

5. Running the Demo

To run the demo:

1. Double-click **Executable** in the *Lattice_Object_Detector_App* folder to open the PC Application.
2. Connect the board using the USB3 cable. Once the USB device is connected, open the **Camera** button. The camera output from the board is displayed on the right side of the application window.
3. Press the **Play** button to start the video playback.
4. Hold the board in such a way that the camera sees the video playback. Objects detected will have bounding box drawn over them and cumulative count is displayed on the bottom left corner of the Camera output window.

The screen displays the video image with a bounding box when an object is detected. The LED D6 lights up when an object is detected. Cumulative count is displayed to the left of the Camera output window.

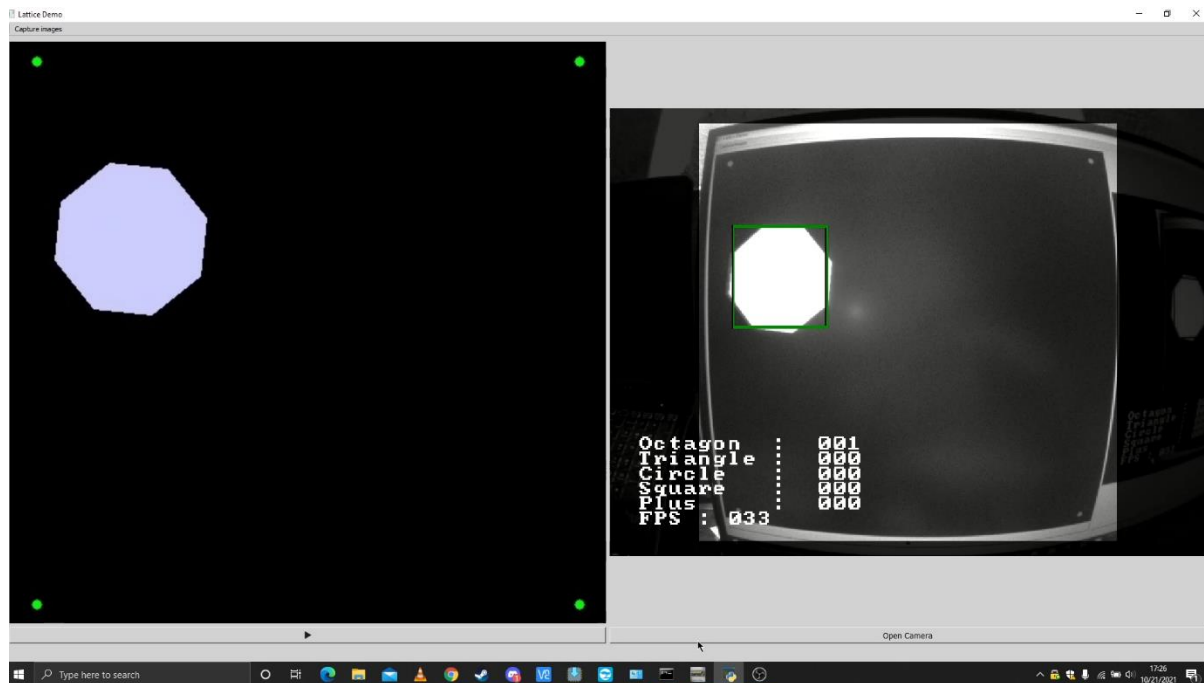


Figure 5.1. Running the Demo

Notes:

- Keep the board stationary for best performance or the count may go wrong.
- If different camera output is coming in the app, reconnect the board.
- Demo was tested for five minutes.

Technical Support Assistance

Submit a technical support case through www.latticesemi.com/techsupport.

Revision History

Revision 1.0, January 2022

Section	Change Summary
All	Initial release



www.latticesemi.com