

CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit guide

About this document

Scope and purpose

This document is a user guide for the CY-SD4210 EZ-USB™ SX3 HDMI 4K capture solution demo kit. This kit enables you to stream video and audio from an external HDMI source directly into a PC. See the relevant sections based on your requirements:

- **Introduction** – Provides basic information on the kit
- **Installing the kit software** – Explains the installation of software needed to program the kit
- **Kit hardware** – Explains the kit architecture and system design details
- **Kit programming** – Describes the procedure to program the kit
- **Kit operation** – Explains the procedure to operate the kit

Intended audience

This document is intended for users of the EZ-USB™ SX3 HDMI 4K capture solution demo kit.

Table of contents

Table of contents

About this document.....	1
Table of contents.....	2
1 Introduction	3
1.1 Kit contents	3
1.2 Downloading kit documents and hardware design files	3
1.3 Board details	3
1.4 Kit features	4
2 Installing the kit software	5
2.1 Before you start	5
2.2 Install SX3 Configuration Utility software	5
3 EZ-USB™ SX3 HDMI 4K capture kit system design	6
3.1 Top-level hardware design	6
3.2 CY-SD4210 design details.....	6
3.2.1 USB connector (J1)	6
3.2.2 Switch (SW1).....	6
3.2.3 Power supply.....	7
3.2.4 SX3 (U6)	7
3.2.5 SPI flash (U11)	7
3.2.6 HDMI connector (J6)	7
3.2.7 Crystal (Y1, Y3)	7
3.2.8 LED (LED1)	7
3.2.9 HDMI receiver (U17)	7
3.2.10 Lattice ECP5 FPGA (U10)	7
3.2.11 DDR3 RAM (U12)	8
4 Programming the EZ-USB™ CY-SD4210 SX3 controller	9
5 Kit operation	14
5.1 Booting from the SPI flash	14
5.2 Audio setting.....	15
5.3 Video streaming at 4K resolution	16
5.4 Video streaming at 1080p resolution.....	17
6 Troubleshooting	20
6.1 Programming test	20
6.1.1 No bootloader device detected	20
6.1.2 FX3 USB bootloader device not detected in Windows Device Manager	20
6.2 Video streaming test	21
6.2.1 SX3 camera not displayed in Device Manager.....	21
6.2.2 Black screen detected in the Camera app.....	21
References.....	22
Technical support.....	23
Revision history.....	24

Introduction

1 Introduction

The CY-SD4210 EZ-USB™ SX3 HDMI 4K capture solution demo kit is based on the SX3 product family of Infineon's configurable SuperSpeed USB controllers.

SX3 has a fully configurable general interface that can interface with any processor, ASIC, image sensor, or FPGA. It provides easy and effortless connectivity to popular industry interfaces such as synchronous slave FIFO and image sensor interfaces. The EZ-USB™ SX3 HDMI 4K capture kit combines hardware, software and documentation that enable customers to stream video from an HDMI source directly into a PC. This user guide describes the steps to install the software required by the SX3 HDMI 4K capture kit and to operate the development board provided with the kit.

This kit is intended to be a solution demo kit for USB Type C audio and video streaming applications from an HDMI source.

See the device datasheets [4] to understand and compare the various features supported by EZ-USB™ SX3 controllers.

The CY-SD4210 EZ-USB™ SX3 HDMI 4K capture solution demo kit supports the following key features:

- Audio and video streaming up to 4K (UHD) at 30 fps from an HDMI source
- USB bus-powered operation
- Onboard regulators

To view the SX3 controller details, see the [webpage](#).

1.1 Kit contents

The CY-SD4210 EZ-USB™ SX3 HDMI 4K capture solution demo kit consists of the following:

Table 1 Kit contents

Item	Type	Comments
SX3 HDMI 4K capture kit	Hardware	-
SuperSpeed USB-C cable	Cable	-
HDMI-A male cable	Cable	-
Hard copy of the quick-start guide (QSG)	Documentation	-
Mechanical enclosure	Enclosure	-
Kit casing	Package	-
Foam	Package	To protect and maintain proper placement in the kit container

1.2 Downloading kit documents and hardware design files

The documents and the hardware design files for CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit can be downloaded from the kit webpage [3]. The documents include a QSG, kit user guide (this document), and release notes. The hardware design files include schematic, bill of materials (BOM), and layout files.

1.3 Board details

This section lists the key interfaces of the CY-SD4210 board.

Introduction

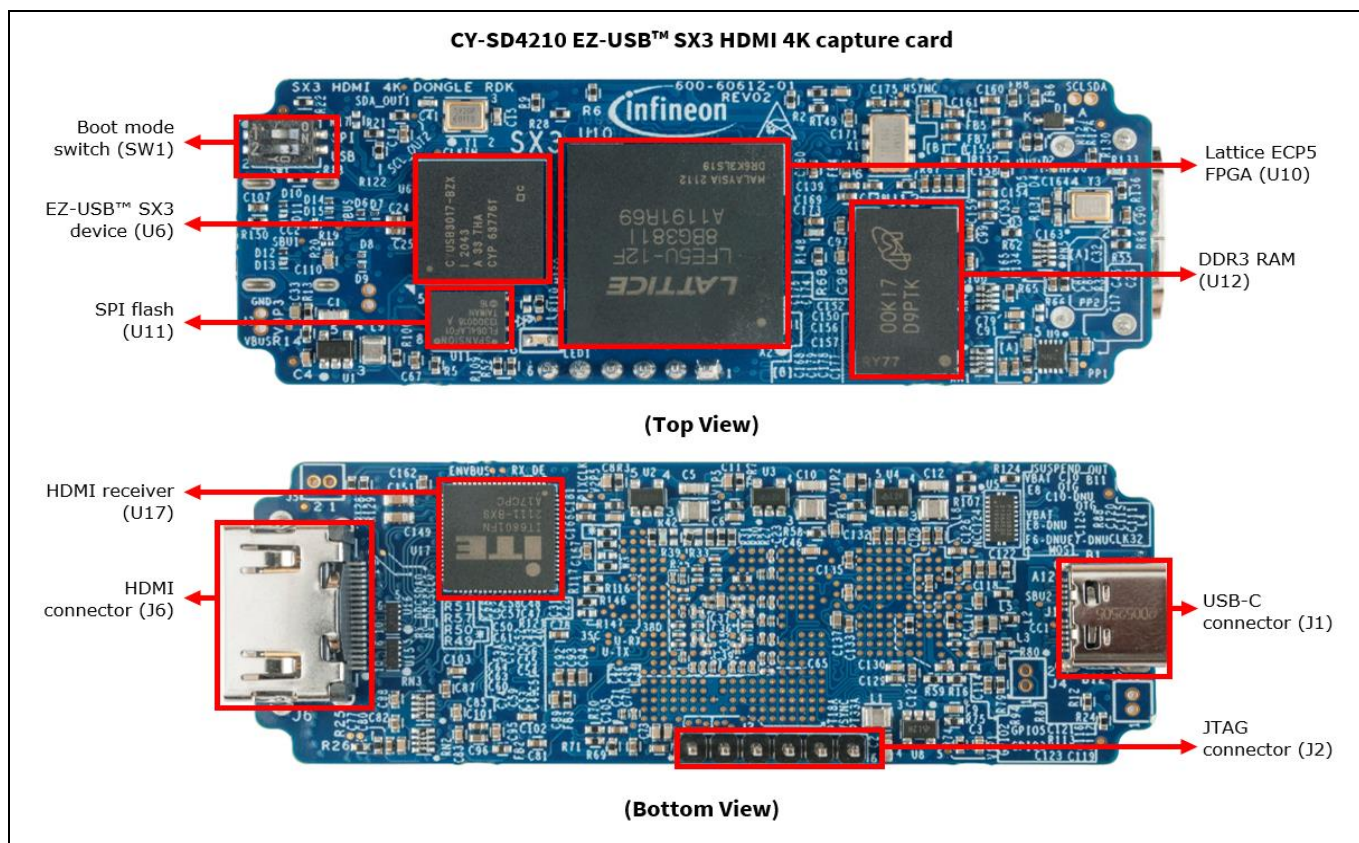


Figure 1 CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit

1.4 Kit features

The kit features an SX3 controller and ECP5 FPGA from Lattice Semiconductor that can be configured using the configuration provided to stream video and audio from an external HDMI source directly into a PC. The onboard ITE HDMI receiver enables users to stream HDMI video up to 4K at 30 fps. See [Section 5](#) for more details.

Installing the kit software

2 Installing the kit software

This chapter describes the procedure to install software for the CY-SD4210 kit.

2.1 Before you start

The installation of the SX3 Configuration Utility software and other Infineon software may require administrator privileges. However, privileges are not required to run the software once it is installed.

2.2 Install SX3 Configuration Utility software

Download and install the EZ-USB™ SX3 Configuration Utility from <https://www.infineon.com/cms/en/design-support/tools/configuration/usb-ez-usb-sx3-configuration-utility> to configure and evaluate the example templates on the CY-SD4210 kit.

Installable packages are available for Windows, Linux and macOS.

After the installation is complete, the contents are available at <Install Directory>\EZ-USB SX3 Configuration Utility.

Note:

1. For working with CY-SD4210 kit, SX3 Configuration Utility tool version should be v1.1.0.5 or higher.
2. The default <Install Directory> is C:\Program Files(x86)\Cypress.
3. See [EZ-USB™ SX3 Configuration Utility user guide](#) for more details.

EZ-USB™ SX3 HDMI 4K capture kit system design

3 EZ-USB™ SX3 HDMI 4K capture kit system design

This section provides details of the CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit design. The kit is bus-powered and supports a SuperSpeed USB-C cable to connect to the PC. To demonstrate the full functionality of the kit, an HDMI source must be connected to the onboard HDMI connector.

3.1 Top-level hardware design

The CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit consists of the SX3 device, the ECP5 FPGA from Lattice Semiconductor, an HDMI receiver, an external SPI flash module, the DDR3 SDRAM, onboard regulators, and USB-C and HDMI connectors.

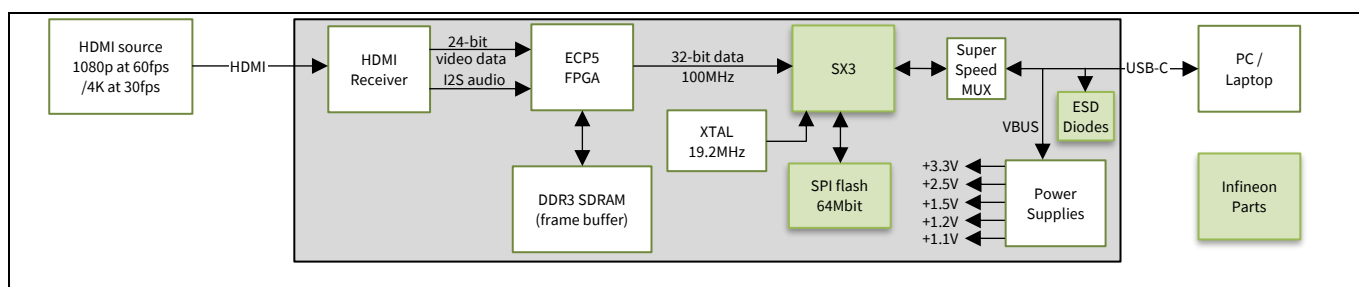


Figure 2 CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit architecture

3.2 CY-SD4210 design details

The CY-SD4210 board consists of the SX3 silicon (CYUSB3017-BZXI), SuperSpeed MUX, 64-Mbit SPI flash, HDMI receiver, ECP5 FPGA and DDR3 SDRAM. The board is bus-powered and uses a 19.2 MHz crystal for operation. The kit provides HDMI and USB-C interface connectors to connect an external HDMI source and PC, respectively.

3.2.1 USB connector (J1)

A certified USB-C receptacle (J1) onboard allows SX3 to communicate with the PC via a SuperSpeed USB-C cable that is provided with the kit. Use this port to test SX3 applications. Using the Type-C interface allows access to the SX3 debug interface using serial terminal messages.

3.2.2 Switch (SW1)

Mode selection switch, SW1: Selects the mode in which SX3 must boot upon power ON. The kit can boot in two modes based on the position of this switch.

Table 2 Boot modes

Boot mode	PMODE1	PMODE2
USB	SW1.2 ON	SW1.1 OFF
SPI	SW2.2 OFF	SW1.1 ON

To program the device, set SW1 in USB mode. After programming, setting the mode switch in SPI mode and rebooting the device by power cycle allows SX3 to boot from the onboard SPI flash.

EZ-USB™ SX3 HDMI 4K capture kit system design**3.2.3 Power supply**

The kit consists of five DC-DC step-down regulators with ratings as listed below. AP3428KTTR-G1 from Diodes Inc. is used due to its small form factor. All voltages listed below are generated from VBUS (i.e., $5\text{ V} \pm 0.25\text{ V}$).

- U1: $3.3\text{ V} \pm 5\%$ at 1A
- U2: $2.5\text{ V} \pm 5\%$ at 1A
- U3: $1.5\text{ V} \pm 5\%$ at 1A
- U4: $1.2\text{ V} \pm 5\%$ at 1A
- U8: $1.1\text{ V} \pm 5\%$ at 1A

The kit also uses a 2A DDR termination controller (U9) to power the VTT bus terminations. It also provides the reference output to the DDR IC.

3.2.4 SX3 (U6)

This is a USB 3.0 configurable SuperSpeed controller with a 32-bit ARM926EJ core CPU and 512 kB embedded SRAM. It supports UVC, UAC, and USB vendor class protocols. With a general configurable interface of 8-, 16-, 24- and 32-bit data bus at 100 MHz, SX3 supports slave FIFO and parallel camera interface features. It has dedicated interfaces for SPI flash and I²C. SX3 supports selectable clock input frequencies at 19.2, 26, 38.4 and 52 MHz. Additionally, a dedicated 19.2 MHz crystal input support is also available.

3.2.5 SPI flash (U11)

The kit configuration is stored on an Infineon Technologies 64-Mb SPI flash. After power-on, SX3 fetches the required details from the configuration image, stores it in its RAM and starts executing from it.

3.2.6 HDMI connector (J6)

The kit has an onboard HDMI connector that allows it to connect to an external HDMI source using an HDMI cable.

3.2.7 Crystal (Y1, Y3)

Y1 is a 19.2 MHz crystal used by SX3 to generate the clock for its operation. Y3 is a 27 MHz crystal used by HDMI RX.

3.2.8 LED (LED1)

LED1 (user LED) is a green LED connected to GPIO_4 of SX3. By default, with power-on, this LED glows green, indicating the power to the kit. It can also be controlled by the application.

3.2.9 HDMI receiver (U17)

The kit uses a single-port HDMI receiver that supports HDMI 1.4b. It supports streaming of 4K videos with 24-bit RGB digital video standard and up to four channels of I²S output.

3.2.10 Lattice ECP5 FPGA (U10)

The kit uses an ECP5 family FPGA from Lattice Semiconductor. It is a high-performance device with dedicated DDR3 RAM interfaces and supports high-speed signaling. This FPGA acts as a bridge between the HDMI receiver and the SX3 device. It receives 24-bit RGB video signals and I²S audio signals from the HDMI receiver, processes and sends them to SX3 via the 32-bit slave FIFO interface at 100 MHz. This allows SX3 to directly communicate with an HDMI source.

3.2.11 DDR3 RAM (U12)

This kit has an onboard 2 Gb DDR3 SDRAM that is used by the FPGA to process the digital audio and video data received from the HDMI receiver and communicate it to SX3 via the 32-bit slave FIFO.

Programming the EZ-USB™ CY-SD4210 SX3 controller

4 Programming the EZ-USB™ CY-SD4210 SX3 controller

The EZ-USB™ SX3 controller on the CY-SD4210 EZ-USB™ SX3 HDMI 4K capture kit is preprogrammed with the latest configuration at the time of manufacturing. However, check the [EZ-USB™ SX3 webpage](#) for the latest configuration.

The CY-SD4210 kit is preprogrammed with the firmware to stream 4K videos at 30 fps from an HDMI source. Use the Configuration Utility only to change the program. Ensure that the tool version is 1.1.0.5 or higher.

1. Open the EZ-USB™ SX3 Configuration Utility. If the application is not present on the desktop, browse to the SX3 SDK installation directory (C:\Program Files (x86)\Cypress\EZ-USB SX3 Configuration Utility).

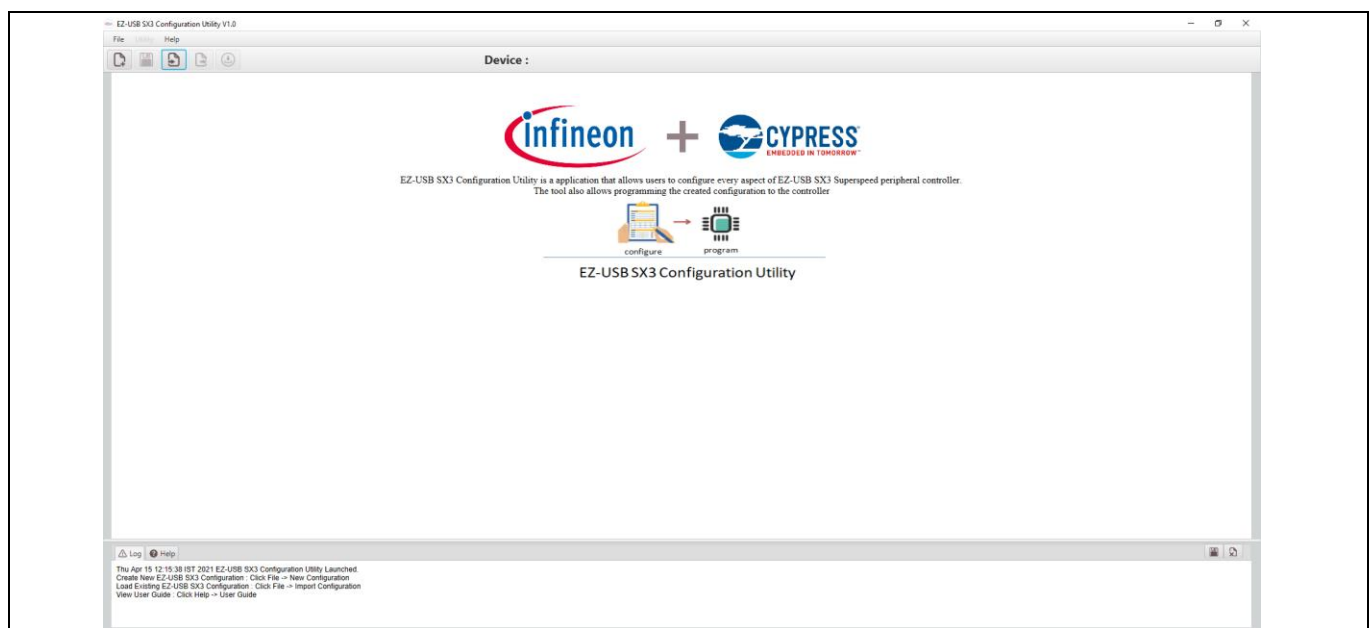


Figure 3 SX3 Configuration Utility home screen

2. Click **Import**. Select **SX3 Template Project** and click (...).

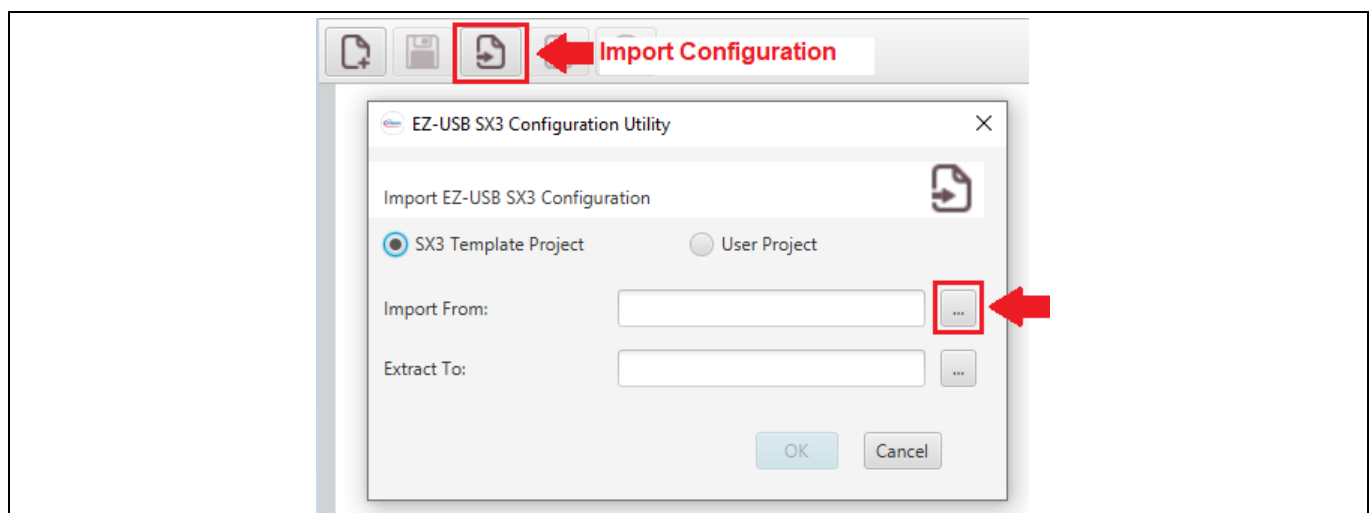


Figure 4 Import configuration screen

Programming the EZ-USB™ CY-SD4210 SX3 controller

3. Browse to import the following configuration from the local folder based on the module planned for streaming and click **Open**.

Table 3 Project files

Streaming media	Import file
1080p at 60 fps	<i>sx3_uvc_uac_hdmi_ite_1080p_dongle.zip</i>
4K at 30 fps	<i>sx3_uvc_uac_hdmi_ite_4k_dongle.zip</i>

An example window is shown below:

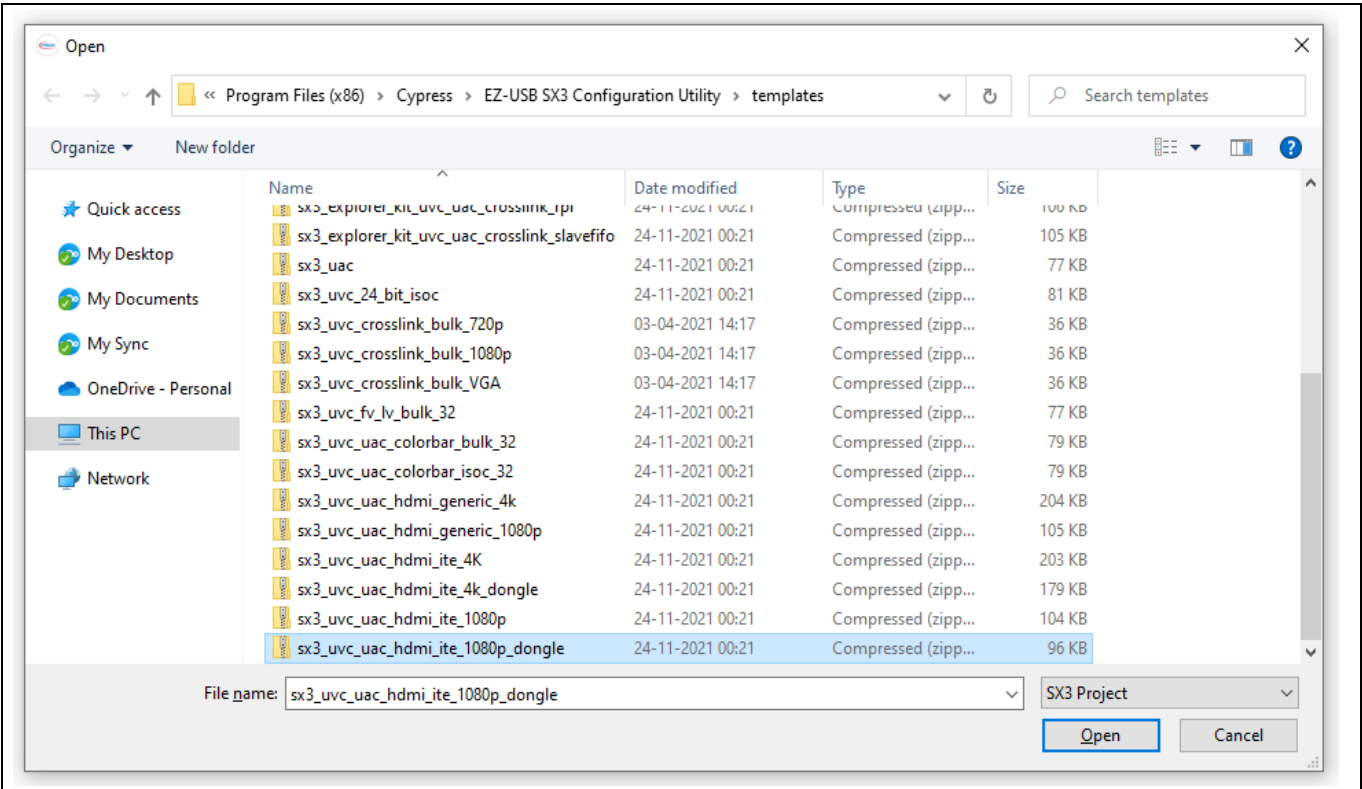


Figure 5 Project import screen

4. On the **Extract To** field, select the local folder, and click **OK**.

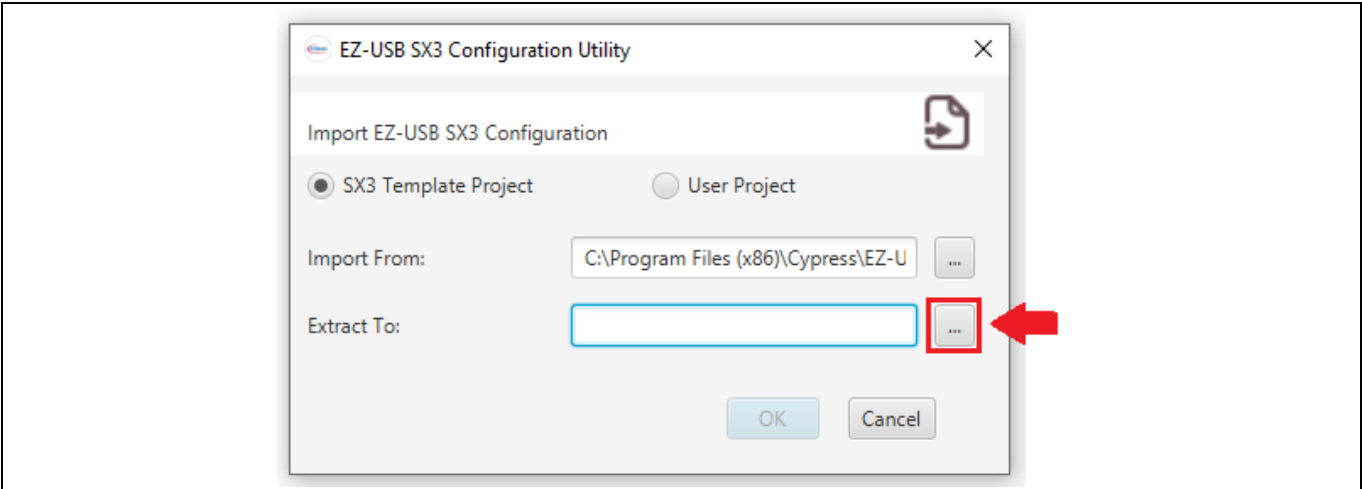


Figure 6 Project extract screen

Programming the EZ-USB™ CY-SD4210 SX3 controller

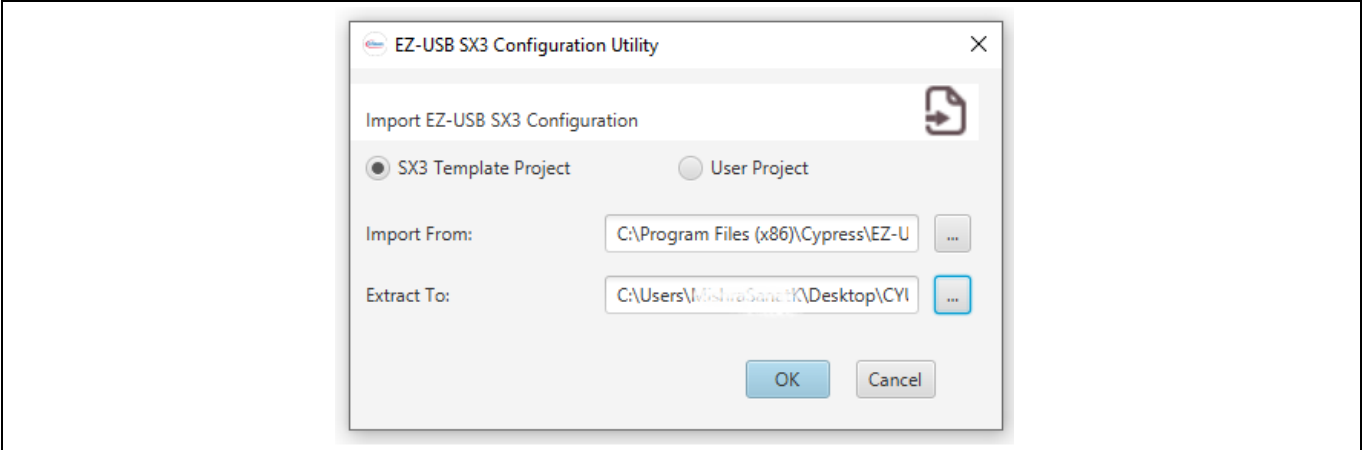


Figure 7 Selected folder

5. Set the mode switch SW1 setting to USB by moving the SW1 pin 1 to OFF and pin 2 to the ON position.

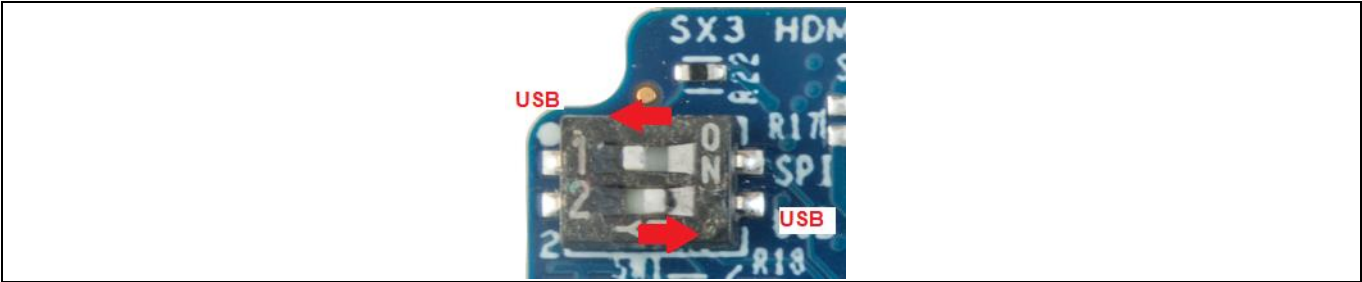


Figure 8 Mode switch setting for USB mode

6. Use the SuperSpeed USB-C cable to connect the kit to the PC as shown below:

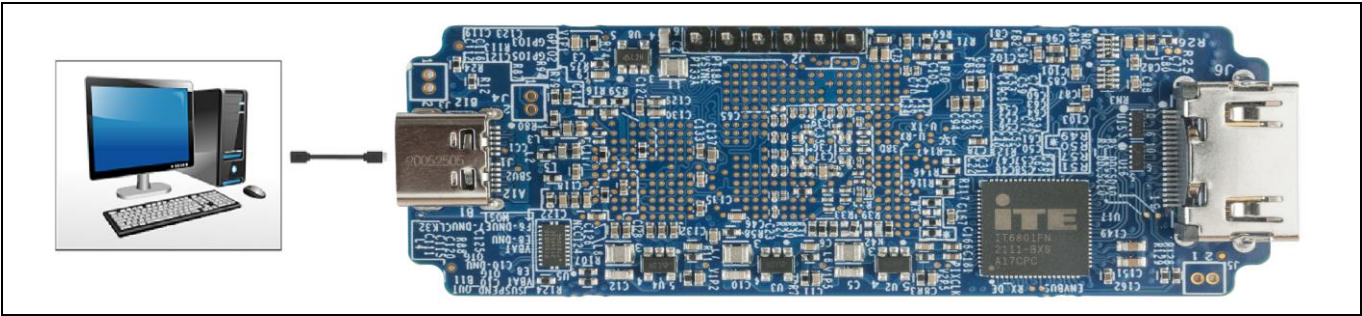


Figure 9 Connecting the kit with the PC

Programming the EZ-USB™ CY-SD4210 SX3 controller

Cypress FX3 BootLoader Device appears in **Device Manager > Universal Serial Bus controllers**.

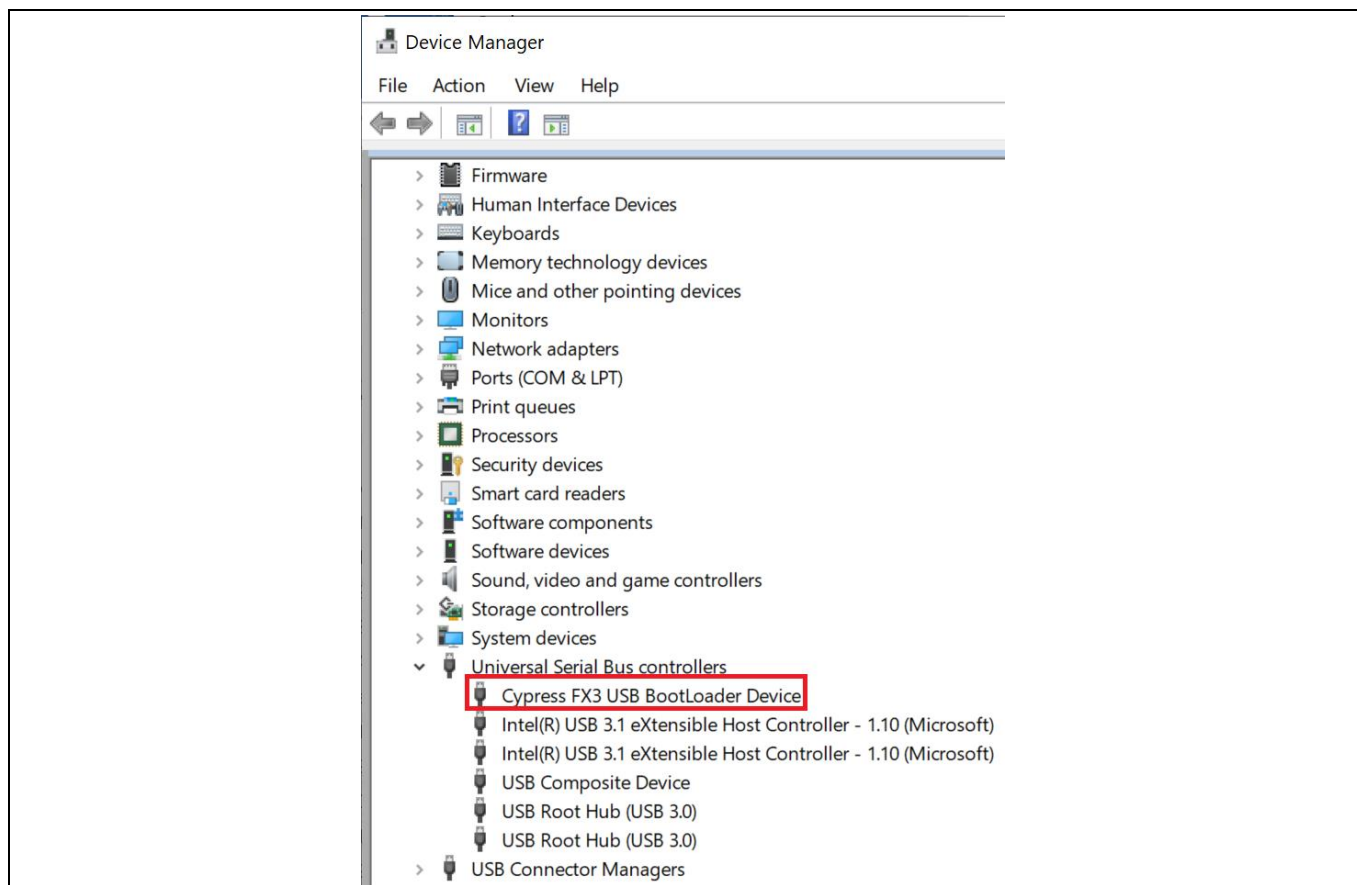


Figure 10 FX3 bootloader device appearing in Device Manager

Note: If the device is detected as "WestBridge", it means the cyusb3 driver is not installed. For more details on how to install the cyusb3 driver, see the Troubleshooting section [6.1.2](#).

7. Click the **Program config** button, and click **Program device**.

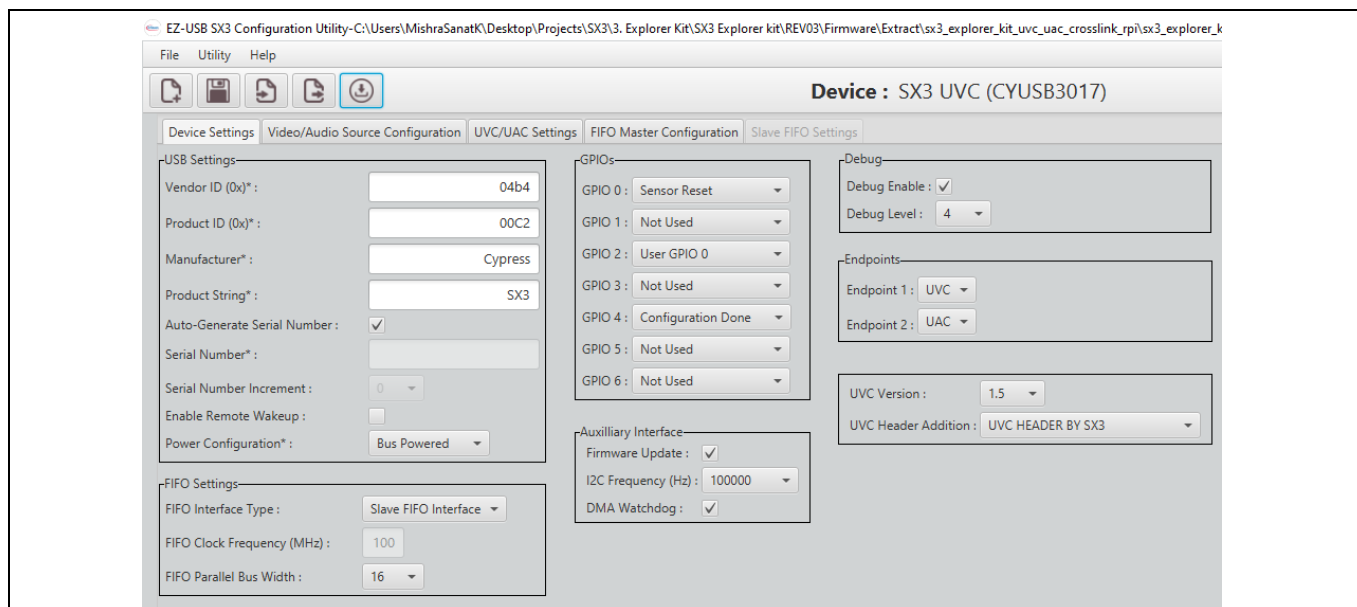
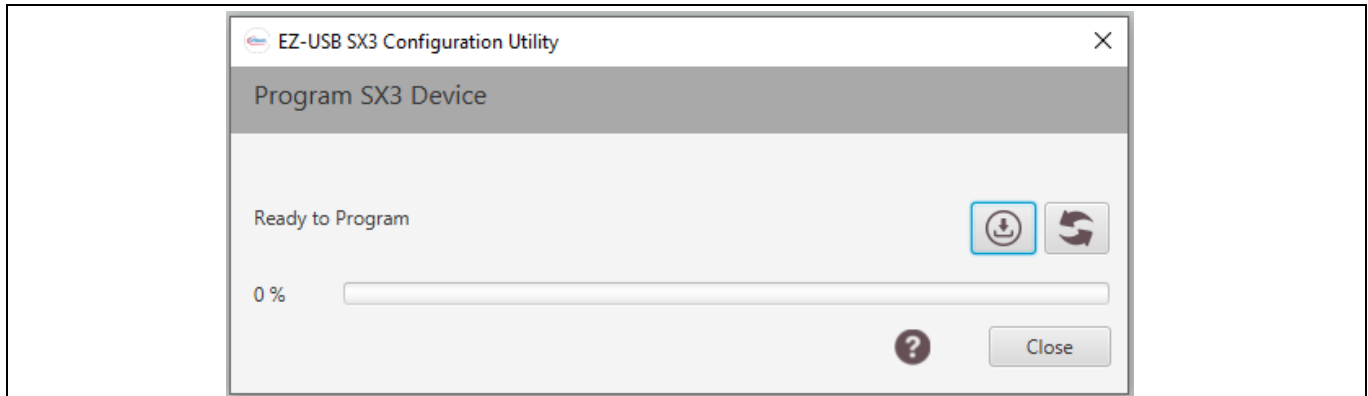
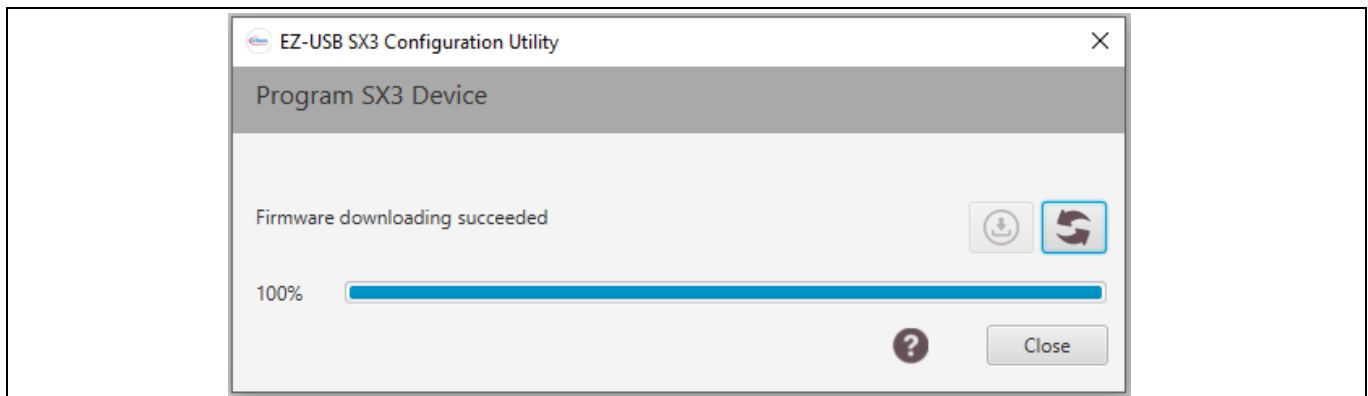


Figure 11 Program Config button highlighted

Programming the EZ-USB™ CY-SD4210 SX3 controller**Figure 12 Program download**

8. Wait for the programming to complete, and when done, click **Close**.

**Figure 13 Programming successful**

Kit operation

5 Kit operation

This chapter describes how to boot the SX3 device after successful programming to demonstrate the kit functionality by streaming video and audio. Two separate demonstrations are covered:

- Streaming 1080p video
- Streaming 4K video

Important note: Before starting the demo, ensure the kit is loaded with the appropriate configuration as shown in [Table 3](#).

5.1 Booting from the SPI flash

1. Set the switch SW1 setting to the SPI position as follows:

Move SW1 pin 1 to the ON position and pin 2 to the OFF position.

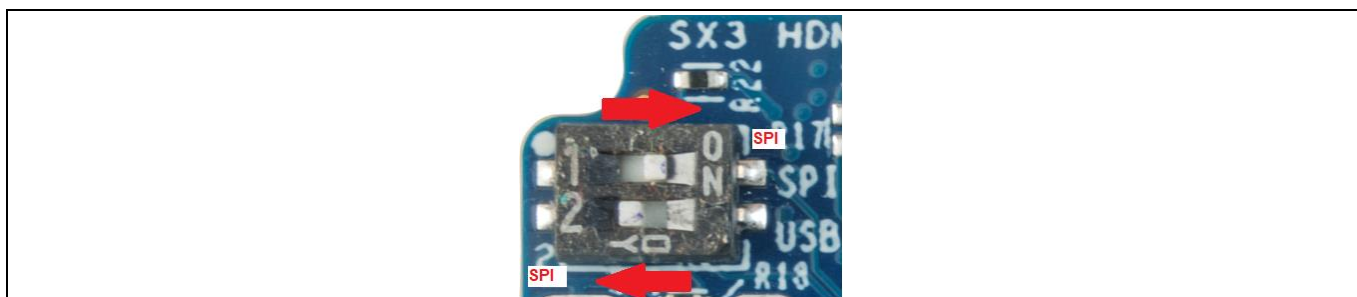


Figure 14 Mode switch setting for SPI mode

2. Power cycle the kit by unplugging and plugging the USB-C cable back in. Check for SX3 in the audio and camera section of Device Manager, as shown in the following figure:

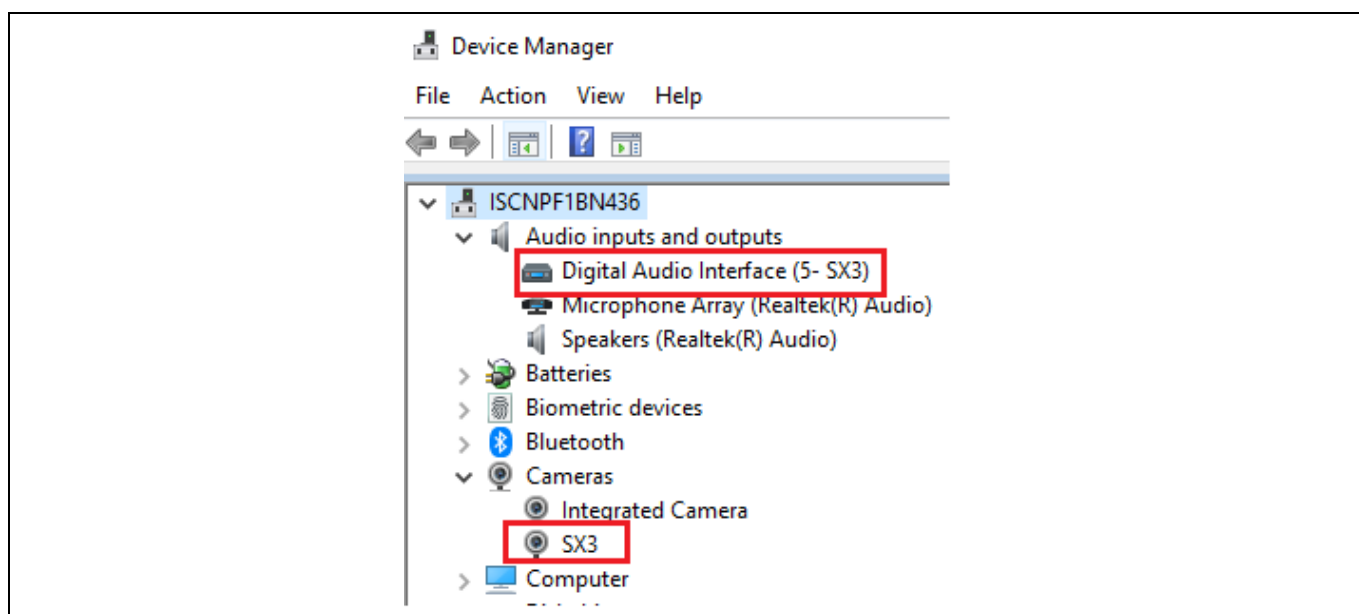


Figure 15 SX3 in Device Manager (note: in 5-SX3, the number “5” will change depending on the PC configuration)

Kit operation

- Plug in the HDMI cable connected to the kit to an HDMI source such as a laptop, set-top box or gaming console. ITE6802 appears in the Device Manager only if the same laptop is used as an HDMI source.

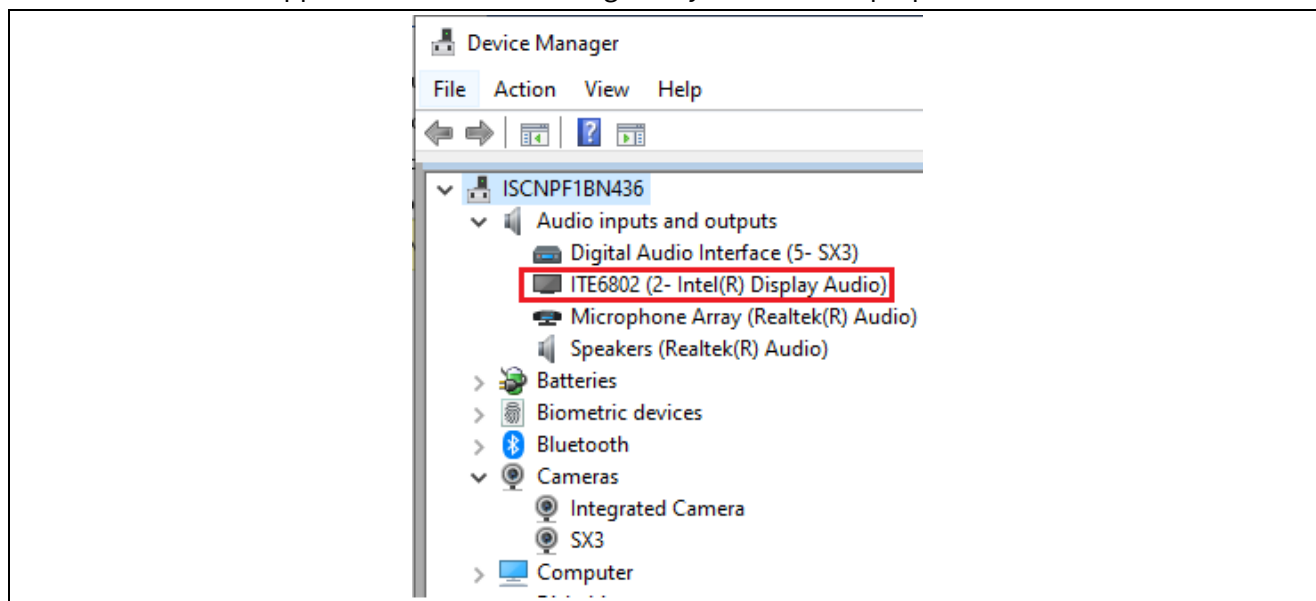


Figure 16 ITE6802 detected in Device Manager (only if the same laptop is used as an HDMI source)

5.2 Audio setting

Do the following to hear the audio from the HDMI source on the laptop speakers:

- Open Windows Control Panel.
- Click **Hardware and Sound**.
- Click **Sound**.
- Select the **Recording** tab.
- Double-click on **Microphone – SX3**.
- Select the **Listen** tab under the Microphone Properties window.
- Check the **Listen to this device** checkbox and click **Apply**.

This enables you to hear the HDMI audio through laptop speakers once video streaming is allowed.

- Adjust your speaker volume.

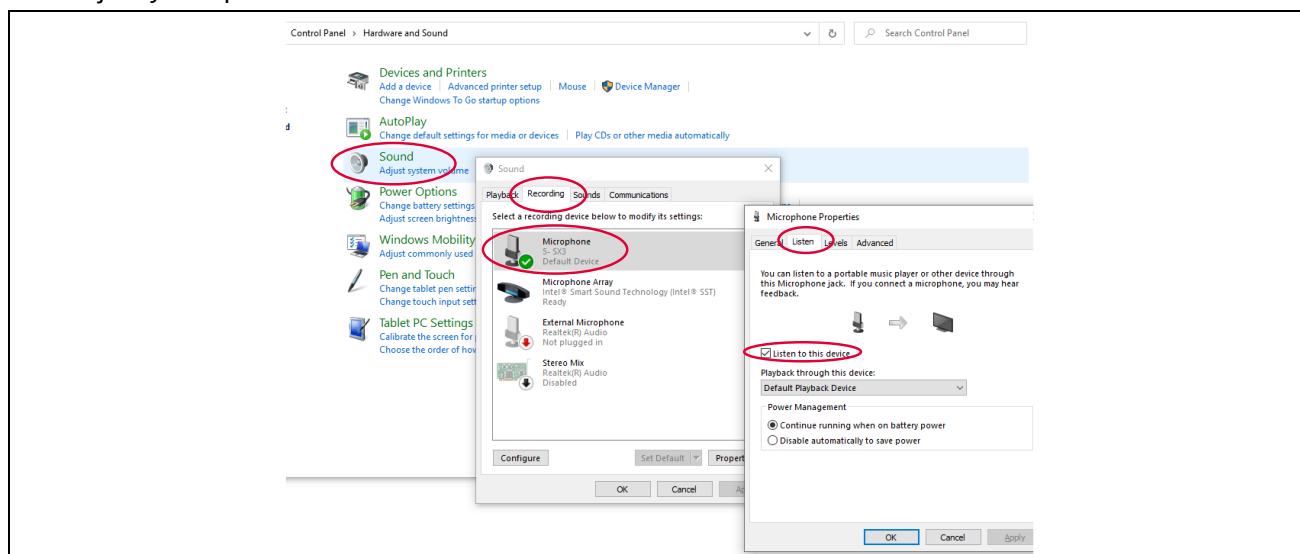


Figure 17 Audio setting to listen through PC speakers

Kit operation

Note: If the same laptop is used as an HDMI source; check and select the ITE6802 as the default playback device in the Playback tab as **Figure 18** shows.

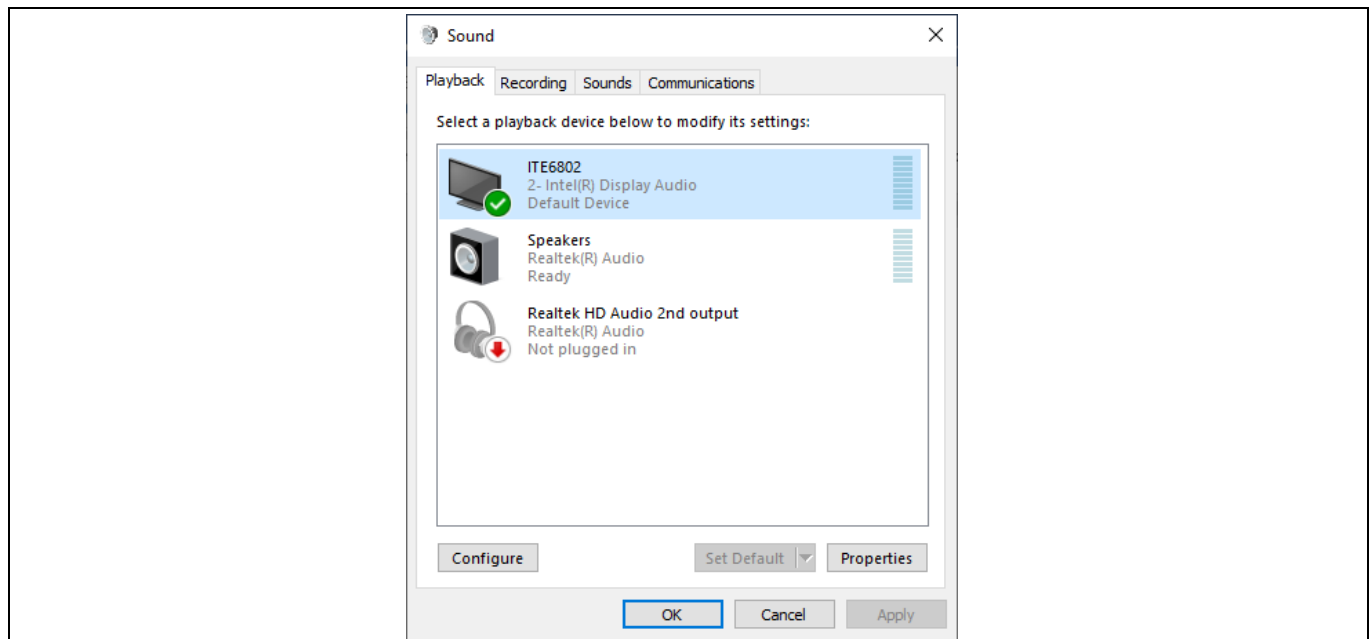



Figure 18 ITE6802 selection if the same laptop is used as an HDMI source

5.3 Video streaming at 4K resolution

1. Ensure the `sx3_uvc_uac_hdmi_ite_4k_dongle.zip` firmware is loaded before booting SX3 from the SPI flash.
2. Open the Microsoft Windows Camera app () and press the flip/reverse camera button in the application to select the SX3 camera.

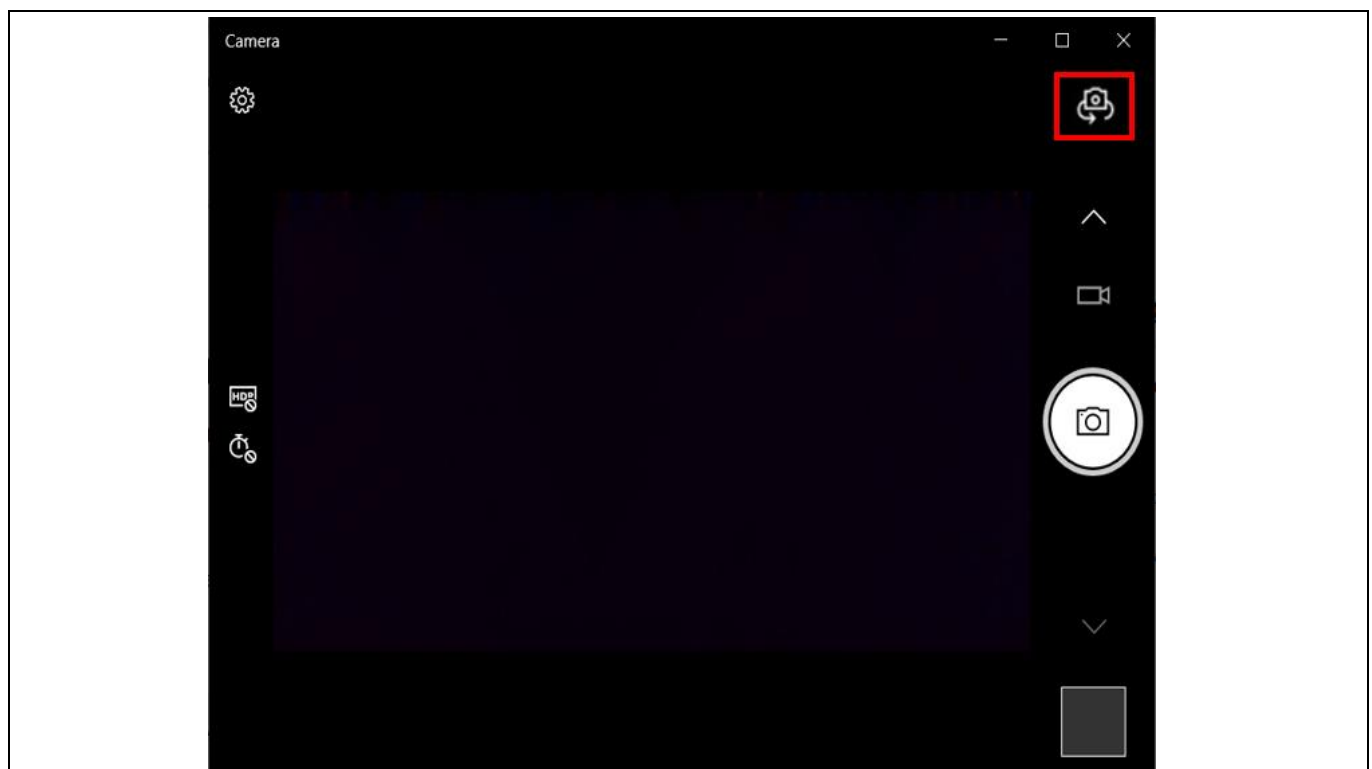


Figure 19 Microsoft Camera app

Kit operation

3. Check if the video is streaming. An example image is shown below:



Figure 20 Video streaming from PC HDMI source

4. Check the camera setting for picture quality. It should display the quality as 3840 x 2160, indicating streaming at 4K.

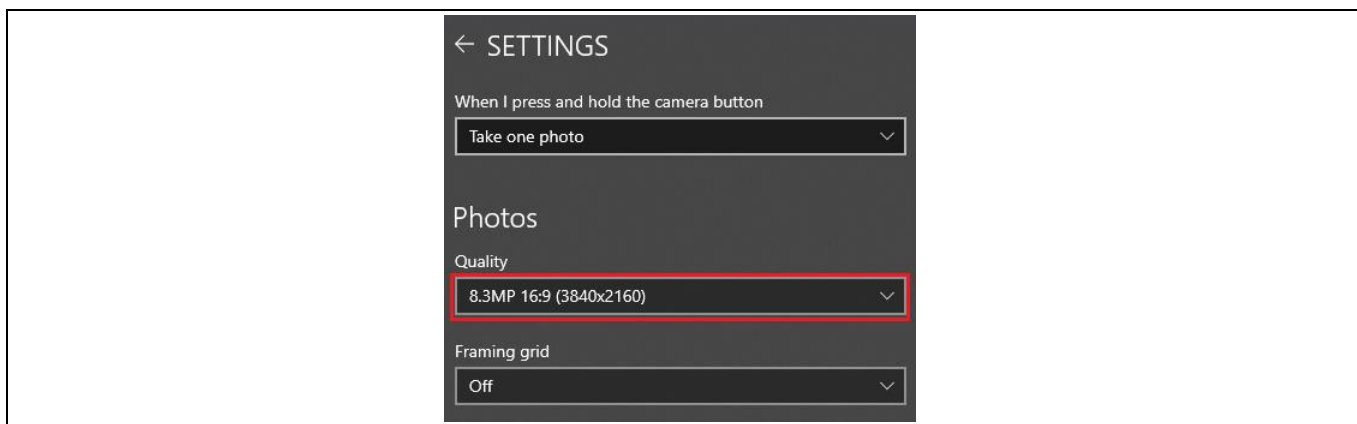

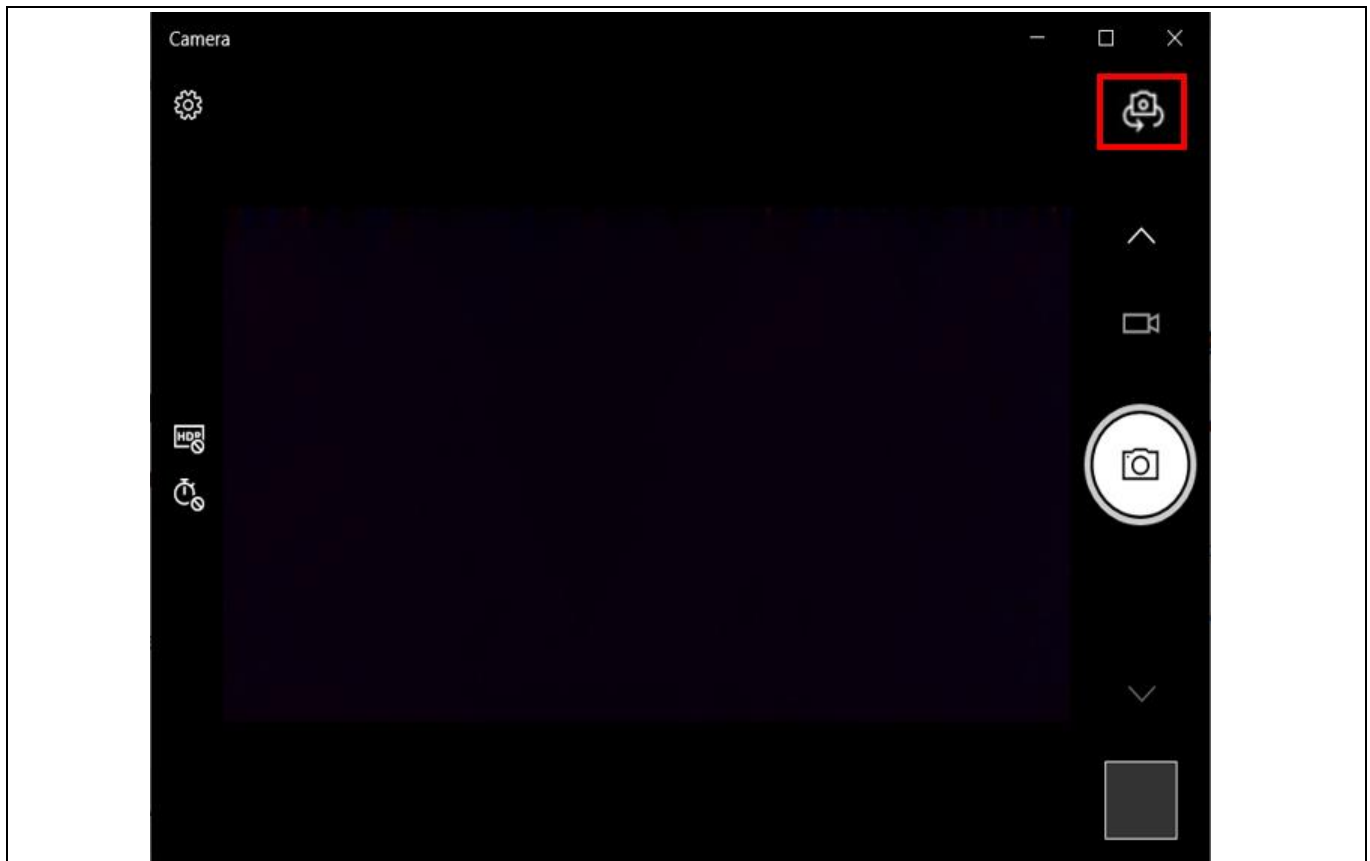


Figure 21 4K streaming in camera settings

5. Flip the camera again to turn off the streaming and disconnect the USB and HDMI cable from the PC and the board.

5.4 Video streaming at 1080p resolution

1. Ensure that `sx3_uvc_uac_hdmi_ite_1080p_dongle.zip` firmware is loaded before booting SX3 from the SPI flash.
2. Open the Microsoft Windows Camera app () and press the flip/reverse camera button in the application to select the SX3 camera.

Kit operation**Figure 22 Microsoft Camera app**

3. Check if the video is streaming. An example image is shown below:

**Figure 23 Video streaming from PC HDMI source**

4. Check the camera setting for picture quality. It should display the quality as 1920 x 1080, indicating streaming at 1080p.

Kit operation

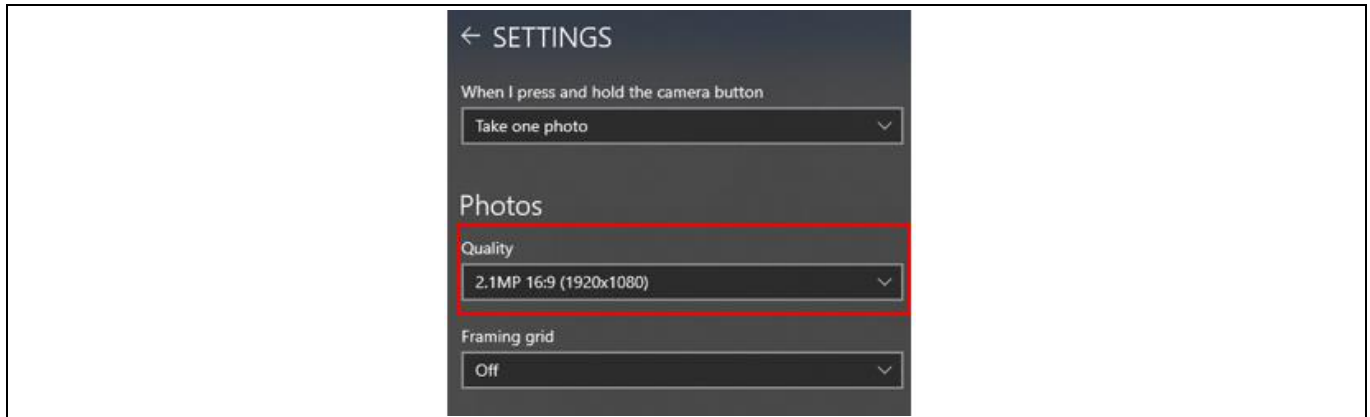


Figure 24 1080p streaming in camera settings

5. Flip the camera again to turn OFF the streaming and disconnect the USB and HDMI cable from the PC and the board.

Troubleshooting

6 Troubleshooting

6.1 Programming test

6.1.1 No bootloader device detected

If a “No Bootloader Device Detected” message appears during programming from the SX3 Configuration Utility, verify that the PMODE switch (SW1) is in the “USB” state.

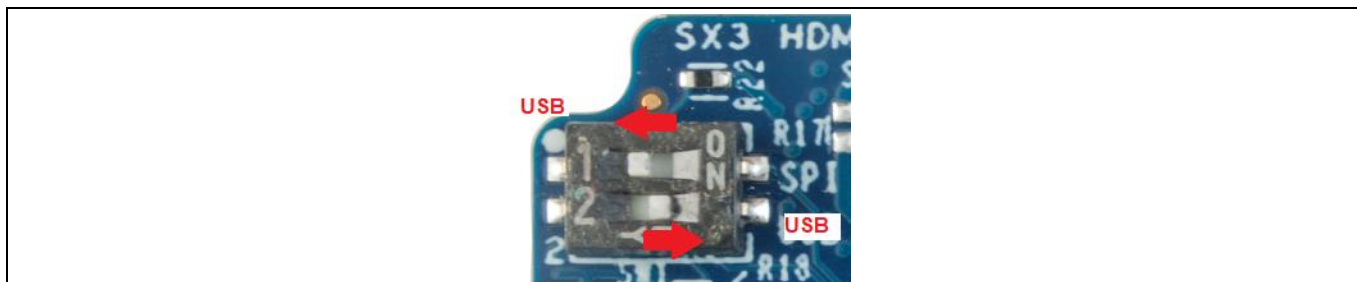


Figure 25 Mode switch setting for USB mode

6.1.2 FX3 USB bootloader device not detected in Windows Device Manager

If the connected device is detected as “WestBridge” in Windows Device Manager, install the *cyusb3* driver. Navigate to **<SX3 Configuration Utility Installation Path>\drivers\Win10\X64** and install *cyusb3* as shown in the following figure:

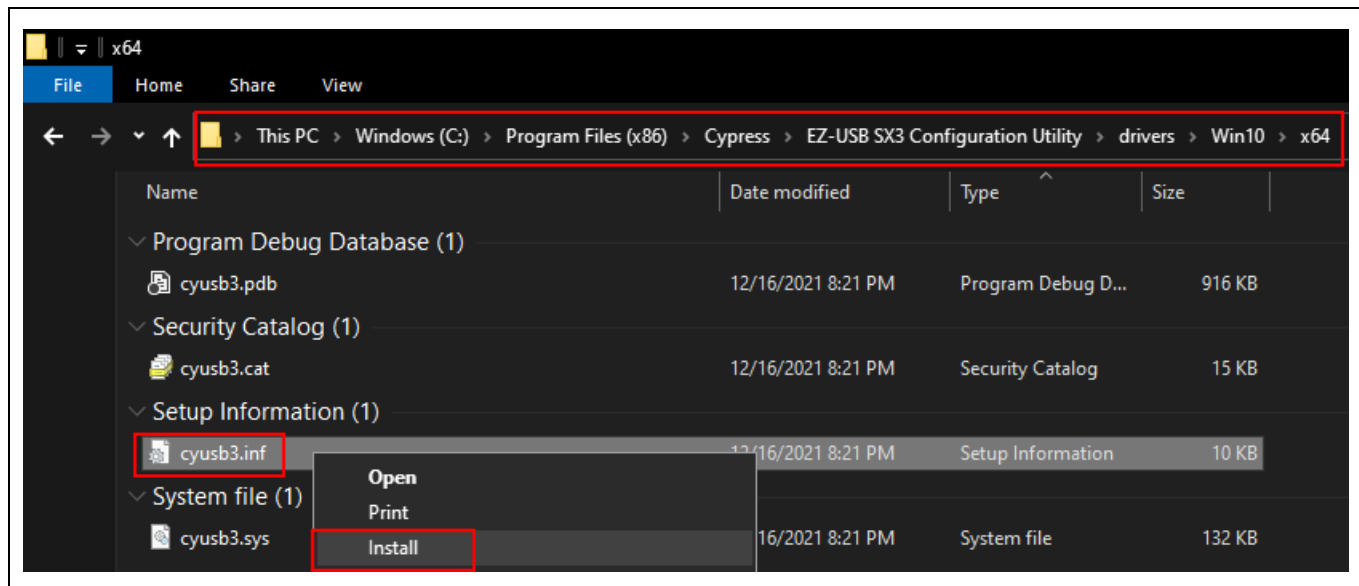


Figure 26 Install *cyusb3* driver

The device will enumerate as FX3 USB BootLoader Device after successful installation.

Troubleshooting

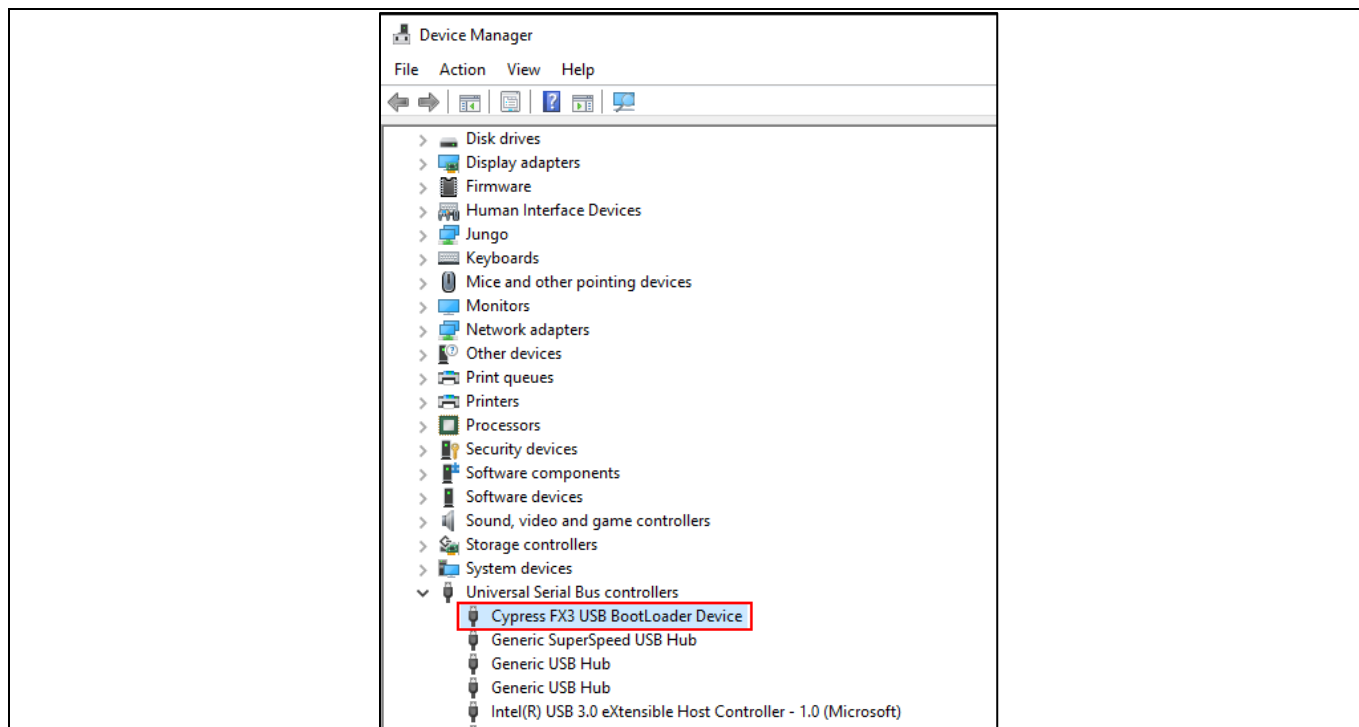


Figure 27 Device enumerated as BootLoader Device

6.2 Video streaming test

6.2.1 SX3 camera not displayed in Device Manager

Verify that the PMODE switch (SW1) is in the SPI position.

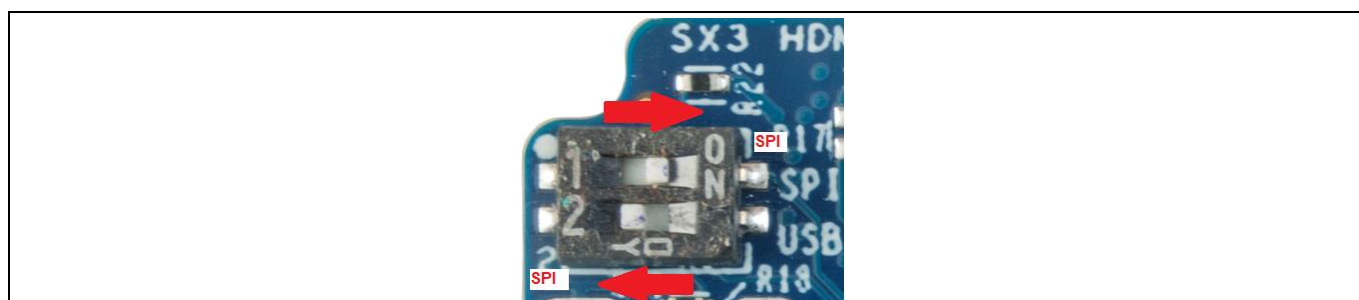


Figure 28 Mode switch setting for SPI mode

6.2.2 Black screen detected in the Camera app

Check the debug logs:

- Open Tera Term.
- Connect to the COM port associated with the SX3 device.
- Check if any error messages are displayed.

Note: If the above troubleshooting steps do not resolve the problem, visit the Infineon [Technical Support](#) page.

References

References

- [1] Overview: [Infineon USB controller roadmap](#)
- [2] Product webpage: [EZ-USB™ SX3 webpage](#)
- [3] Kit webpages: [CY-SD4210 webpage](#)
- [4] Datasheets: [EZ-USB™ SX3 datasheet](#)
- [5] Application note: [AN231295 – Getting started with EZ-USB™ SX3](#)

Technical support

Technical support

If you have any questions, create a support request on the Infineon [Technical Support](#) page.

Revision history

Revision history

Date	Version	Description of changes
2022-01-04	**	Initial release with document number 002-34554 and registration number UM_2207_PL91_2207_143022
2022-08-01	*A	Added a note and Figure 18 in Section 5.2 on how to select an ITE device if audio does not stream automatically

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2022-08-01

Published by

**Infineon Technologies AG
81726 München, Germany**

**©2022 Infineon Technologies AG.
All Rights Reserved.**

Do you have a question about this document?

Go to: www.infineon.com/support

Document reference

002-34554 Rev. *A

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.