Contents

1 Getting Started with the Smart Vision Development Kit ........................................4
2 What’s Inside the Box? ..........................................................................................5
  2.1 Smart Vision Development Kit .....................................................................5
3 What’s on the Web? .............................................................................................6
  3.1 Official Documentation: ...............................................................................6
  3.2 Tutorials and Reference Designs: .................................................................6
  3.3 Training and Videos: .....................................................................................6
4 Smart Vision Development Kit – Key Features .....................................................7
5 Smart Vision Development Kit – Basic Setup and Operation ...............................8
  5.1 Example Design ...........................................................................................9
  5.2 Hardware Setup ..........................................................................................10
  5.3 Programming the Firmware .........................................................................12
  5.4 Installing the USB3 Vision driver on the PC ...............................................14
  5.5 Running the Example ..................................................................................14
6 Getting Help and Support ..................................................................................21
  6.1 Avnet Support..............................................................................................21
  6.2 Xilinx Support ............................................................................................22
7 Appendix A: Installing and Licensing Xilinx Software .........................................23
  7.1 Install Vivado Design Edition .......................................................................23
1 Getting Started with the Smart Vision Development Kit

The Smart Vision Development Kit builds on the PicoZed SOM by providing a carrier card for machine vision applications. This kit provides all the necessary components to start development of embedded vision applications.

It features a low cost all-in one-package with 5 minutes out of box experience and is equipped with all the industry vision connectivity such as GigE Vision (GEV), USB3 Vision (U3V), and CoaXPress (CXP). The kit includes an Aptina 1.2MP camera module.

In addition, industry leading software tools are offered and supported on this kit to provide an accelerated development cycle.

This Getting Started Guide will outline the steps to setup the Smart Vision Development Kit (SVDK), and run the plug-and-play USB3 Vision demonstration with the Aptina camera module.

The SVDK carrier card is hardware compatible with the PicoZed 7015 SOM, as well as the PicoZed 7010/7020 SOMs.

NOTE: When the SVDK carrier card is used with the PicoZed 7010 SOM, the PMOD, HDMI and CoaXPress (CXP) interfaces are not available.

NOTE: When the SVDK carrier card is used with the PicoZed 7020 SOM, the HDMI and CoaXPress (CXP) interfaces are not av

NOTE: The SVDK carrier card IS NOT COMPATIBLE with the PicoZed 7030 SOM! Attempting to mate the PicoZed 7030 SOM to the SVDK will permanently damage the SOM !!!
2 What’s Inside the Box?

2.1 Smart Vision Development Kit
- PicoZed (Zynq-7015) SOM module
- Machine Vision Carrier Board
- Aptina 1.2MP camera module
- Universal Power Adapters
- mini-USB-B to USB-A cable
- Ethernet cable
- Vivado Design Edition entitlement voucher – Device Locked
- Quick Start Card
- Downloadable documentation and reference designs

Figure 1 – Smart Vision Development Kit Contents
3 What’s on the Web?

PicoZed is a community-oriented kit, with all materials being made available through the www.picozed.org community website.

3.1 Official Documentation:
- Available on www.picozed.org
- Getting started guides
- Hardware user guide
- Available from Sensor to Image after kit registration
- Schematics
- Layout (Gerber files)

3.2 Tutorials and Reference Designs:
- Design examples, including:
  - GigE Vision (GEV)
  - USB3 Vision (U3V)
  - CoaXPress (CXP)
- Community projects

For the latest collateral for the kit, including documentation and getting started designs:

1. Go to www.picozed.org
2. Select Products ➔ Smart Vision Development Kit
3. Click on image

3.3 Training and Videos:
- Overview of PicoZed
- Introduction to Zynq
- Implementing Linux on the Zynq-7000 SoC

For the latest training and videos:

1. Go to www.picozed.org
2. Click Support ➔ Trainings and Videos
4 Smart Vision Development Kit – Key Features

- PicoZed (Zynq-7015) SOM module
- Machine Vision Carrier Board, including:
  - GigE Vision (GEV)
    - 10/100/1000 Ethernet interface
    - Evaluation version of GigE Vision IP from Sensor to Image
  - CoaXPress (CXP)
    - Featuring MicroChip CoaXPress transmitter and receiver devices
    - Evaluation version of CoaXPress IP from Sensor to Image
  - USB3 Vision (U3V)
    - Featuring Cypress EZ-USB FX3 SuperSpeed USB 3.0 peripheral interface
    - Evaluation version of USB3 Vision IP from Sensor to Image
  - HDMI Output Interface
    - Featuring Analog Devices ADV7511 HDMI output transmitter
  - Camera Interface, supporting optional camera modules
- Camera Module
  - Aptina 1.2MP camera module, featuring Aptina AR0134 image sensor

Figure 2 – Smart Vision Development Kit (SVDK) – Block Diagram
5 Smart Vision Development Kit – Basic Setup and Operation

In addition to the items included in the kit, you will also need the following to run the out of box example on your SVDK.

- **PC, running SphinxU3VViewer application**
  (provided in the SVDK_U3V_Vision_Getting_Started_{version}.zip archive)
- **JTAG Programming Cable (Platform Cable, Digilent HS1 or HS2 cable)**
  (required, to re-program firmware)
- **USB3 Cable (Superspeed A to micro-B cable)**
  (required, to transfer video content to PC via USB3 VIsion)

An image of the SVDK in its expected out-of-box configuration is shown below along with the locations of several key components.

![Smart Vision Development Kit (SVDK) – Topology](image)

*Figure 3 – Smart Vision Development Kit (SV2) – Topology*
5.1 Example Design

In order to run this design, the SVDK USB3 Vision Reference Design (for Aptina camera) firmware will need to be programmed in the PicoZed SOM’s QSPI flash device. The pre-built getting started design is available at [http://www.picozed.org](http://www.picozed.org), in the Reference Design/Tutorials section for the Smart Vision Development Kit. For more information on how to build this design please review the tutorial document and full reference design that is available from Sensor to Image after product registration. Details on how to register with Sensor to Image are included at the end of the Hardware Setup section.

The example design uses the Aptina 1.2MP Camera Module, as well as the Sensor to Image USB3 Vision (U3V) IP, to implement a USB3 Vision camera. The USB3 connector of interest is highlighted in the photo below.

Figure 4 – USB3 connector of interest for Example Design
5.2 Hardware Setup

1. A terminal program is required. Windows 7 does not come pre-installed with a terminal program. Tera Term was used in this example which can be downloaded from the Tera Term project on the SourceForge Japan page: [ttssh2.sourceforge.jp](ttssh2.sourceforge.jp) Install Tera Term or another terminal program of your choice.

2. If not previously installed, go to [www.microzed.org](http://www.microzed.org) to download and install the Silicon Labs CP2104 USB-to-UART driver. [http://www.microzed.org/support/documentation/1519](http://www.microzed.org/support/documentation/1519) Silicon Labs CP210x USB-to-UART Setup Guide

3. Set the PicoZed boot mode DIP switches (SW1) to QSPI mode as described in the PicoZed SOM’s Hardware Users Guide. [http://www.picozed.org/support/documentation/4736](http://www.picozed.org/support/documentation/4736)

![Figure 5 – QSPI Boot Settings](image-url)
4. Verify the following default SVDK jumper settings:
   - FX3 Boot Jumper => boot from SPI
     - JP6 (1-2, 5-6 closed)
   - USB OTG Configuration => HOST
     - JP7 (2-3 closed)
     - JP8 (2-3 closed)
     - JP9 (2-3 closed)
     - JP10 (1-2 closed)
   - UART Selector => PS UART
     - JP12 (5-6, 7-8 closed)

Figure 6 – SVDK – Default Jumper Configuration
5. Make sure the SVDK power switch is in the OFF position.
6. Insert the PicoZed module onto the SVDK (if not already mounted).
7. Insert the Aptina 1.2MP camera module onto the SVDK.
8. Insert the appropriate country plug into the 5V DC Power Supply AC/DC adapter. Plug it into the 5V DC Power Supply Connector.
9. We will be using a USB3 cable to transfer images via USB3 Vision, but this will be plugged in later.
10. We will be using a mini-USB cable to communicate through a terminal, but this will be plugged in a bit later.

5.3 Programming the Firmware
The SVDK kit is shipped with the GigE Vision design pre-programmed on the PicoZed 7015T SOM’s QSPI Flash device. For this reason, you will need to re-program the PicoZed SOM’s QSPI Flash device with the USB3 Vision design.

1. Connect a JTAG Programming Cable (Platform Cable, Digilent HS1 or HS2 cable), not included with the kit, to the PC using a USB cable and then plug the 14-Pin PC4 header or cable into the PC4 connector on the SVDK carrier card.
2. Launch Vivado 2014.4 (or greater)
3. Click the Open Hardware Manager icon
4. In the Vivado menu, select Tools, then Auto Connect
   You should see the xc7z015_1 device in the JTAG chain, as shown in the following screen capture.

![Figure 7 – Hardware JTAG Chain](image-url)
5. In the Vivado menu, select **Tools**, then **Add Configuration Memory Device**, then **xc7z015_1**
   a. Specify the following Filters:
      i. Manufacturer = **Spansion**
      ii. Density (Mb) = **128**
      iii. Type = qspi
      iv. Width = **x4-single**
   b. Specify the following **Configuration Memory Part**:
      i. **S25FL128S-3.3V-QSPI-X4-Single**
   c. Click **OK**
6. Click **OK** if asked if you want to program the configuration memory device now.
7. In the Program Configuration Memory Device dialog, specify the following:
   a. Configuration file: **SVDK_1.2_U3V_Firmware/BOOT.bin**
   b. Make sure the **Erase**, **Program**, and **Verify** options are enabled
   c. Click **OK** to program the QSPI device.
8. When done, close Vivado
5.4 Installing the USB3 Vision driver on the PC
The USB3 Vision driver for the Sensor to Image USB3 Vision Reference Design has to be installed on the PC.

1. Connect the USB cable (mini-USB-B to USB-A cable) between the PC and the USB (J17) connector on SVDK.
2. Connect the USB3 cable (Superspeed A to micro-B) between the PC and the USB3 (J14) connector on SVDK.
3. Power on the SVDK.
4. The PC will try to install the driver, but without success. This is expected, the driver will be specified manually.
5. Install the USB3 Vision driver on the PC
   a. Open device manager
   b. Select the “USB3 Vision Device” device,
   c. Right-Click, then select Update driver
   d. When the following location for the driver located in provided software-SVDK_USB3_Vision_Getting_Started\SphinxU3VViewer_V1.0.2\Driver
   e. A security warning will appear, accept the warning to continue
   f. “USB3 Vision Device” will now appear as “S2I U3V Reference Design”
   g. Close the device manager

5.5 Running the Example
1. Turn the power switch on the SVDK to the ON position. After 1-2 seconds, you will notice several LEDs that are lit, including the FPGA DONE LED (DS1).
2. Now plug in the mini-USB-B to USB-A cable between the PC and the USB Serial (J17) connector on SVDK.
3. On the PC, open a serial terminal program. Tera Term is used to show the example output for this lab document. Follow the instructions in the CP210x
Setup Guide to set the terminal as shown in Figure 8, using the appropriate COM port that you discover on your own machine.

![Image of Tera Term setup window]

Figure 8 – Connect Tera Term to the proper COMx port

1. Cycle power on the SVDK. The terminal output displays feedback from the bare-metal example application.

```
Starting ARM application ...!
```

Figure 9 – SVDK – Serial Console Output
5. Start the **SphinxU3VViewer.exe** USB3 Vision Viewer application

![Sphinx USB3 Vision Viewer](image)

**Figure 10 – Sphinx USB3 Vision (U3V) Viewer – Main Window**
6. Press the Discovery button

![Discovery Window]

Figure 11 – Sphinx USB3 Vision (U3V) Viewer – Discovery
7. Select the “U3V Reference Design” in the Discovered Devices list
8. Click on the Open button to open it

**NOTE:** If you get a message box indicating “SphinxLib: Evaluation period expired”, the hardware evaluation has expired. Cycle power on the SVDK, and re-start the Discovery process.

9. Click the Grab checkbox to start streaming video to the PC

![Figure 12 – Sphinx USB3 Vision (U3V) Viewer – Click Grab checkbox](image)

10. Click the Grab checkbox to start streaming video to the PC

You should see capture images in the Image section of the SphinxU3VViewer. If the image is out of focus, adjust the focus by turning the lens on the Aptina camera module.
NOTE: The U3V reference design uses no external memory to buffer data, only a small fifo. If the PC is blocked for some reason and cannot serve the USB interface for a while, this internal fifo overruns and the image is corrupted. To signal this to the application the overrun status flag is set. This may happen on PCs with poor USB performance.

Actual performance of USB3 is dependent on USB3 chipset, its connection to the PCIe bus and drivers. Especially USB3 add-on boards often have poor performance compared to (native) onboard interfaces. S2I cannot guarantee that the demo design runs on every PC.

The official test PC for USB3 Vision certification follows as much as possible to USB-IF’s official test setup and uses a laptop with the Intel HM87 chipset, specifically a Dell Latitude 3440 together with the latest Microsoft XHCI driver.
To further examine this reference design, please contact Sensor to Image whom, upon registering, can provide access to the tutorial document included in the **SVDK USB3 Vision Reference Design for Aptina camera**. A link to contact is provided below:

http://www.sensor-to-image.de/index.php/products-mainmenu-33/registration

To complete this tutorial, you will need to install the correct version of the Xilinx development tools as indicated in the tutorial documentation. For instructions on installing the Xilinx software, please refer to **Appendix A: Installing and Licensing Xilinx Software**.
6 Getting Help and Support

6.1 Avnet Support

PicoZed is a versatile development kit and a SOM ready to be adopted into your next design. All technical support is offered through the PicoZed.org website support forums. PicoZed users are encouraged to participate in the forums and offer help to others when possible.

For questions regarding the PicoZed community website, please direct any questions to:

PicoZed.org Web Master – webmaster@picozed.org

To access the most current collateral for PicoZed please visit the community support page at:

http://www.picozed.org/content/support

Once on the PicoZed.org support page:

To access the latest PicoZed documentation, click on the Documentation link:

Documentation

To access the latest reference designs for PicoZed, click on the following link:

Reference Designs

Tutorials

To access the PicoZed technical forums, click on the following link:

Support Forums
6.2 Xilinx Support
For questions regarding products within the Product Entitlement Account, send an e-mail message to the Customer Service Representative in your region:

Canada, USA and South America – isscs_cases@xilinx.com
Europe, Middle East, and Africa – eucases@xilinx.com
Asia Pacific including Japan – apaccase@xilinx.com

For technical support including the installation and use of the product license file, contact Xilinx Online Technical Support at www.xilinx.com/support. The following assistance resources are also available on the website:

– Software, IP and documentation updates
– Access to technical support web tools
– Searchable answer database with over 4,000 solutions
– User forums
Appendix A: Installing and Licensing Xilinx Software

7.1 Install Vivado Design Edition

The PicoZed Zynq-7000 AP SoC device development is supported by Vivado WebPACK licensing. The SVDK also comes with an entitlement voucher to a seat of Vivado Design Edition which is device locked to a XC7Z015-1SBG485 Zynq-7000 AP SoC device. The Design Edition software is an advantage over WebPACK as it adds the Logic Analyzer capability. See http://www.xilinx.com/products/design_tools/vivado/vivado-webpack.htm

This software can be downloaded online at:
www.xilinx.com/support/download/index.htm

You can also request a free DVD from
www.xilinx.com/onlinestore/dvd_fulfillment_request.htm

If a full seat of Vivado System Edition has already been installed, then no further software will be needed. Please check online for any updates at:
www.xilinx.com/support/download/index.htm

For detailed instructions on installing and licensing the Xilinx tools, please refer to the Vivado Design Suite User Guide Release Notes, Installation, and Licensing (UG973) available on the Xilinx website: