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Chapter 1

Introduction

The ZC706 evaluation kit is based on the Zynq™-7000 XC7Z045 FFG900-2 All Programmable SoC (AP SoC). For additional information, see the product table for the Zynq-7000 family of AP SoCs:


A built-in self-test (BIST) and a PCIe® Targeted Reference Design (PCIe TRD) are provided for the ZC706 evaluation kit. The BIST provides a convenient way to test many of the board's features on power-up and upon reconfiguration. The PCIe TRD showcases various features and capabilities of the Zynq-7000 Z-7045 AP SoC for the embedded domain in a single package. The tutorials and reference designs available on the ZC706 web page can be used to further explore the capabilities of the ZC706 board and the Zynq-7000 AP SoC. For the most up-to-date information on the tutorial content provided with the ZC706 evaluation kit, go to the Xilinx Zynq-7000 AP SoC ZC706 Evaluation Kit web page at www.xilinx.com/ZC706 and click on the Docs & Designs tab.

Note: Users of the new Intel® Ivy Bridge systems should refer to the special instructions PCIe does not link up on Z77 (Ivy Bridge) platform at the ZC706 Master Answer Record site www.xilinx.com/support/answers/51899.htm. These instructions contain the current workaround to the Intel Ivy Bridge Errata.
ZC706 Evaluation Kit Contents

The ZC706 evaluation kit includes the following items:

- ZC706 evaluation board (EK-Z7-ZC706-CES-G) featuring the XC7Z045 FFG900-2 AP SoC
- Full seat ISE® Design Suite: Embedded Edition
  - Device-locked to the XC7Z045 FFG900-2 AP SoC
- Board design files
  - Schematics
  - Board layout files
  - Bill of Material (BOM)
- Documentation
  - UG954, ZC706 Evaluation Board for the Zynq-7000 XC7Z045 All Programmable SoC User Guide
  - UG961, Zynq-7000 All Programmable SoC ZC706 Evaluation Kit Getting Started Guide (ISE Design Suite 14.3) (this document)
Key Features


- 12V AC adapter power supply
- Cables
  - RJ45 Ethernet cable
  - HDMI cable
  - Digilent USB JTAG Cable
  - USB Type-A to USB Mini-B cable
- Secure Digital (SD) multimedia card
- The Fedora 16.2 LiveDVD

The evaluation kit contains all the software and reference designs, demonstrations, and documentation needed to help the user get started quickly.

For reference design files, documents, and board source files, go to the ZC706 Product Page at [www.xilinx.com/zc706](http://www.xilinx.com/zc706) and click on the **Docs & Designs** tab.

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### Key Features

- Zynq-7000 XC7Z045 FFG900-2 AP SoC
- 1 GB DDR3 memory SODIMM on the programmable logic (PL) side
- 1 GB DDR3 component memory (four 256 Mb x 8 devices) on the processing system (PS) side
- Two 128 Mb Quad SPI flash memory (Dual QSPI)
- USB 2.0 ULPI (UTMI+ low pin interface) transceiver with Micro-B USB connector
- Secure Digital (SD) card connector
- USB JTAG interface through Digilent module with Micro-B USB connector
- Clock sources:
  - Fixed 200 MHz LVDS oscillator (differential)
  - I²C programmable LVDS oscillator (differential)
  - Fixed 33.33 MHz LVCMOS oscillator (single-ended)
  - SMA connectors (differential)
  - SMA connectors for GTX transceiver clocking (differential)
• GTX transceivers
  ° FMC HPC connector (eight GTX transceivers)
  ° FMC LPC connector (one GTX transceiver)
  ° SMA connectors (one pair each for TX, RX, and REFCLK)
  ° PCI Express® integrated Endpoint block (four lanes)
  ° Small form-factor pluggable plus (SFP+) connector
  ° 10/100/1,000 MHz tri-speed Ethernet PHY
• PCI Express endpoint connectivity
  ° Gen1 4-lane (x4)
  ° Gen2 4-lane (x4)
• SFP+ Connector
• Ethernet PHY RGMII interface with RJ-45 connector
• USB-to-UART bridge with Mini-B USB connector
• HDMI codec with HDMI connector
• I²C bus
• I²C bus multiplexed to:
  ° Si570 user clock
  ° ADV7511 HDMI codec
  ° M24C08 EEPROM (1 kB)
  ° 1-to-16 TCA6416APWR port expander
  ° RTC-8564JE real time clock
  ° FMC HPC connector
  ° FMC LPC connector
  ° PMBUS data/clock
• Status LEDs:
  ° Ethernet status
  ° TI power good
  ° Linear power good
  ° PS DDR3 component $V_{TT}$ good
  ° PL DDR3 SODIMM $V_{TT}$ Good
  ° FMC Power good
Key Features

- 12V input power on
- FPGA INIT
- FPGA DONE

- **User I/O:**
  - Three PL user LEDs
  - Three PL user pushbuttons
  - One PL 4-pole user DIP switch
  - Two dual row Pmod GPIO headers

- **AP SoC PS Reset pushbuttons:**
  - SRST_B PS reset button
  - POR_B PS reset button

- **VITA 57.1 FMC HPC connector**
- **VITA 57.1 FMC LPC connector**
- Power on/off slide switch
- Power management with PMBus voltage and current monitoring through TI power controller
- Dual 12-bit 1 MSPS XADC analog-to-digital front end
- Configuration options:
  - Dual Quad SPI flash memory
  - USB JTAG configuration port (Digilent module)
  - Platform cable header JTAG configuration port
  - 20-pin PL PJTAG header
Chapter 2

ZC706 Evaluation Kit Built-In Self-Test

Introduction

The built-in self-test (BIST) tests many of the features offered by the Zynq-7000 All Programmable SoC ZC706 evaluation kit. The test is available after programming the FPGA through JTAG.

Figure 2-1 provides an overview of the board features utilized by the BIST.

Figure 2-1: ZC706 Board Features

Note: For a diagram of all the features on the ZC706 board, see UG954, ZC706 Evaluation Board for the Zynq-7000 XC7Z045 All Programmable SoC User Guide.
Built-In Self-Test Setup Requirements

The prerequisites for testing the design in hardware are:

- ZC706 evaluation board with the Zynq-7000 XC7Z045 FFG900-2 AP SoC part
- USB to Mini-B cable (for UART)
- Digilent JTAG USB to Micro-B cable
- AC power adapter (12 VDC)
- TeraTerm Pro terminal program, or equivalent terminal program [Ref 7]
- USB-UART drivers from Silicon Labs

Hardware Test Board Setup

This section details the hardware setup and use of the terminal program for running the BIST application. It contains step-by-step instructions for board bring-up.

ZC706 Evaluation Board Setup

To set the ZC706 jumpers and switches, verify the switch and jumper settings are set as listed in Figure 2-2.

Note: For this application, the board should be set up as a stand-alone system, with power coming from the cord and AC adapter that comes with the ZC706 evaluation kit.
Hardware Bring-Up

This section details the steps for hardware bring-up.

1. With the board switched off, plug a USB Mini-B cable into the UART port of the ZC706 board and your control PC.

2. With the board switched off, plug the Digilent JTAG cable into the JTAG port of the ZC706 board and your control PC.
3. Install the power cable 12V stand-alone power supply (included).

4. Switch the ZC706 board power to ON.

**Install the Silicon Labs Driver**

1. Run the downloaded executable UART-USB driver file, listed in *Built-In Self-Test Setup Requirements, page 12*. This enables UART-USB communications with a control PC (see *Figure 2-4*).
2. Set the USB-UART connection to a known PORT in the Device Manager.
3. Right-click My Computer and select Properties.
4. Select the Hardware tab. Click the Device Manager button (Windows 7).
5. Click PORTS (Windows 7).
6. Find the Silicon Labs device in the list, right-click it. Select Properties.
7. Click the Port Settings tab and the Advanced... button.
8. Select an open COM port between COM1 and COM4.

Note: Steps and diagrams refer to using a Windows XP or Windows 7 control PC.

Figure 2-5 shows the steps for setting the USB-UART Port.
Unzip the Application Folder

1. Go to http://xilinx.com/zc706 and download the latest version of the ZC706 BIST design files.
2. Unzip the folder to your C:/ drive.

Run the BIST Application

1. Start the installed terminal program.
2. Click Setup > Serial Port... and set Baud rate to 115200, parity to none, data bits to 8, and stop bits to 1.
3. Run the script file in C: /zbist/ready_for_download/zc706_bist.bat (see Figure 2-6).
Run the BIST Application

For more information on the BIST software and additional tutorials, including how to restore the default content of the onboard non-volatile storage, see resources at http://xilinx.com/zc706 listed under the Docs & Designs tab.
Chapter 3

Getting Started with the ZC706 PCIe Targeted Reference Design

Introduction

The Zynq-7000 PCIe® Targeted Reference Design (TRD) expands the Zynq-7000 All Programmable SoC ZC702 Base TRD (UG925, Zynq-7000 All Programmable SoC ZC702 Base Targeted Reference Design User Guide) by adding PCI Express® communication with a PCIe host system at PCIe x4 GEN2 speed. In the ZC702 Base TRD, the input of the video processing pipeline is generated by a test pattern generator in the FPGA logic. In this design, the input of the video processing pipeline is generated by an application on the PCIe host computer at 1080p60 resolution and transmitted to the ZC706 board through PCIe. The data is processed by video pipeline and passed back to the PCIe host system through PCIe. As the full 1080p60 video stream only takes up around 4 Gb/s, an additional data generator and a checker are implemented and connected to channel 1 of PCIe DMA, showcasing the maximum PCIe x4 GEN2 bandwidth achieved by the hardware.

The Zynq-7000 PCIe TRD demonstrates the following components working together:

- PCI Express Endpoint (x4 GEN2)
- High speed serial transceivers
- High speed multichannel DMA interfacing to PCIe Endpoint device
- Zynq-7000 Processing System (PS)
- Video DMA (VDMA) and Sobel filtering
- HDMI based display controller
Chapter 3: Getting Started with the ZC706 PCIe Targeted Reference Design

The design is a PCI Express based video processing card demonstrating the following capabilities:

- **PCIe based connectivity demonstration**
  - PCI Express block of ZC7Z045 used in x4 GEN2 configuration
  - PCI Express compatible high performance low latency multichannel DMA from third party vendor Northwest Logic [Ref 8].
  - Performance demonstration using traffic generator and checker running on FPGA hardware and PCIe host software containing PCIe root port

- **ARM Cortex-A9 core processor processing and offload demonstration**
  - Zynq-7000 AP SoC as an offload device to process video data—The TRD provides an example with the Sobel filter in the Zynq-7000 AP SoC programmable logic (PL).
  - HDMI based display controller from third party vendor
  - Cortex-A9 in Zynq-7000 as a co-processor processing video data
  - An example design showing independent memory management in the PCIe host system and Cortex-A9 PS.

---

Figure 3-1: Zynq-7000 PCIe TRD Block Diagram
Key Components

The PCIe TRD features the following components:

- PCI Express v2.1 compliant x4 Endpoint operating at 5 Gb/s/lane/direction
  - PCIe transaction interface utilization engine
  - Message signal interrupt (MSI) and legacy interrupt support
- Bus mastering scatter-gather PCIe DMA to offload the PCIe host processor
  - Multichannel DMA
  - AXI4 Streaming interface for data
  - AXI4 interface for register space access
  - DMA performance engine
  - Full duplex operation
    - Independent transmit and receive channels
- Multichannel VDMA with programmable VSIZE and HSIZE
  - AXI4 compliant
  - Optional flush on frame sync
  - Optional frame advancement on error
- Multilayer display controller
  - Alpha blending, transparency, and move around support
  - Continuous switching mode support
- Sobel filter
  - AXI4 Stream interface
  - AXI4 Control interface
  - Supports image size up to 1080p
- Java based GUI running on the PCIe host system
  - Test control panel
  - PCIe performance monitoring
- A QT based GUI running on Zynq-7000 PS
  - Monitors power and die temperature
  - Zynq-7000 processing system's HP0 and HP2 performance numbers
Data Flow

The TRD shows how the Zynq-7000 platform can be used as an offload engine to the PCIe host machine it is connected to.

Video Processing and Offload Demonstration on Channel 0 of PCIe DMA

The user application in the PCIe host system repeatedly generates video frames of size 1920 x 1080 pixels containing 8 color bars. Software on the PCIe host system manages channel 0 of PCIe DMA to transmit the video stream from the PCIe host over x4 GEN2 PCIe links to the Zynq-7000 ZC706 board. PCIe DMA translates the stream of PCIe video data packets into AXI streaming data, which is in turn connected to a video DMA (VDMA). Software running on the Cortex-A9 processor manages the AXI VDMA and transfers the raw video frames into the PS DDR3 memory. The Sobel filter in the PL reads the image using another VDMA, performs edge detection on the raw image, and sends the data back to PS DDR3. The processed data in PS DDR3 can either be transferred back to PCIe host system using channel 0 of card-to-system (C2S) interface of PCIe DMA or be displayed on the monitor using the LogiCVC display controller. Due to limitations of the PS DDR3 bandwidth, the same data cannot be displayed and sent back to PCIe host system simultaneously. As in the Base TRD, this design also demonstrates hardware based Sobel filter for video processing.

Generator and Checker Demonstration on Channel 1 of PCIe DMA

A generator and checker on channel 1 of PCIe DMA allow the RX and TX paths to run independently. The hardware generator in the PL fabric generates data packets with an incremental sequence pattern. The software checker running on the PCIe host system verifies the incremental sequence pattern generated by the hardware generator. Independently, the driver running on the PCIe host system generates a stream of incremental data which is transferred through PCIe link by NWL PCIe DMA to the checker implemented in the PL fabric.
Hardware Test Setup

This section describes how to set up the ZC706 board, control computer, host computer, and software for the Zynq™-7000 PCIe® Targeted Reference Design.

ZC706 Evaluation Kit Contents

Material supplied with the ZC706 Evaluation Kit includes:

- ZC706 board with the Zynq-7000 XC7Z045-2 FFG900C AP SoC
- ISE Design Suite: Logic Edition (full seat, device-locked to the XC7Z045-2 FFG900C AP SoC)
- USB cable, standard-A plug to mini-B plug
- USB cable, standard-A plug to micro-B plug
- HDMI cable, type-A plug to type-A plug
- Ethernet cable
- Power Supply: 100 VAC–240 VAC input, 12 VDC 5.0A output
- Power cords to support three mains plug types
- ATX adapter cable, Xilinx part number 2600304
- SD card containing the reference design files
- Fedora 16 LiveDVD

Additional Materials

User-supplied materials include:

- Monitor supporting 1080p
- Two personal computers (PCs). See Computer Requirements.
- USB mouse (for use with the ZC706 board)
Computer Requirements

Running the Zynq-7000 PCIe TRD requires two PCs.

Control PC

The TRD requires an Intel processor-based laptop or desktop PC running the Windows 7 operating system. The computer must have an SD memory card receptacle, and one USB port to communicate with the ZC706 board.

Required Software

The software listed here must be installed on the control computer:


PCIe Host System Computer

An Intel processor-based desktop PC running Fedora Core 16 Linux operating system is required for the PCIe host system. The computer must have a PCIe v2.0 slot where the ZC706 board is installed in the open chassis of this computer.

Recommended Motherboards

Recommended PCI Express GEN2 PC system motherboards are:

- ASUS P5E (Intel X38)
- ASUS Rampage II Gene (Intel X58) and Intel DX58SO (Intel X58)

TIP: The Intel X58 chipsets tend to show higher performance.

Programming the ZC706 Board

The XC7Z045 AP SoC is configured from a bitstream in a 2 x 128 Mb Quad-SPI flash memory. This bitstream must first be loaded in the Quad-SPI flash memory from the SD card plugged into J30 on the ZC706 board.

Files for configuring the Zynq-7000 PCIe TRD are compiled in zc706_pcie_trd.bin which contains the zynq_fsbl.elf bitstream and u-boot.elf bitstream along with the Linux kernel, Linux file system image files, and Linux device tree binary files.
Extracting the Project Files

The Zynq-7000 PCIe Targeted Reference Design files are located in zynq_pcie_trd_14_3.zip. This file is available for download online at [http://www.xilinx.com/zc706](http://www.xilinx.com/zc706) (listed under the Docs & Designs tab).

To extract the files:

1. Download zynq_pcie_trd_14_3.zip to a working directory on the control computer.
2. Unzip the files contained in zynq_pcie_trd_14_3.zip.

Programming the SD Card

On the control computer:

1. Plug the SD card into the SD card receptacle.
2. Navigate to the working directory zynq_pcie_trd_14_3/prog_qspi and copy BOOT.bin, zc706_pcie_trd.bin, devicetree.dtb, devicetree_qspi.dtb, uramdisk.image.gz, uImage, and init.sh to the SD card.

   The BOO.bin file enables the PS to boot in the SD boot mode. The zc706_pcie_trd.bin file contains the TRD bitstream. The remaining files are required for Linux boot-up.

3. Unmount and remove the SD card from the computer and insert it into the SD card receptacle on the ZC706 board (Figure 3-2).
Programming the Quad-SPI Flash Memory

This procedure programs the Quad-SPI flash memory with files from the SD card to run the Zynq-7000 PCIe TRD.

1. Complete the communications setup. (See UG963, Zynq-7000 All Programmable SoC ZC706 PCI Express Targeted Reference Design User Guide (ISE Design Suite 14.3), Appendix A for details.)

2. Power off the ZC706 board (SW12).

3. Verify the SD card is plugged into receptacle J30 as shown in Figure 3-2.

4. Connect the ZC706 board to the control computer and power supply as shown in Figure 3-3.
5. Set DIP switch SW11 as shown in Figure 3-4.

6. Power ON the control computer and start TeraTerm Pro using **115200** bits/s, **8** data bits, **None** parity, **1** stop bit, **None** flow control.

7. Power ON the ZC706 board (SW12). The **init.sh** script in the SD card loads the Quad-SPI flash memory with **zc706_pcie_trd.bin** and the Linux kernel images. Initialization progress is shown on the TeraTerm Pro display (Figure 3-5).

Four commands are executed by **init.sh**:

```
zyng>flashcp -v zc706_pcie_trd.bin /dev/mtd0
zyng>flashcp -v uImage /dev/mtd1
zyng>flashcp -v devicetree_qspi.dtb /dev/mtd2
zyng>flashcp -v uramdisk.image.gz /dev/mtd3
```
8. Initialization is complete when the zynq> prompt appears on the TeraTerm Pro display.

9. Navigate to the zynq_pcie_trd_14_3/sd_image folder and copy qt_lib.img, init.sh, zynq_pcie_qt, and zynq_pcie_qt.sh files to the SD card used to program the QSPI device. These files are required for loading the Zynq-7000 PCIe TRD. Insert the SD card into the SD card slot.

---

**TRD Demonstration Setup**

This section describes hardware bring-up, software bring-up, and using the application GUI.

**Installing ZC706 Board in the Host Computer Chassis**

When the ZC706 board is used inside a computer chassis power is provided from the ATX power supply peripheral connector through the ATX adapter cable shown in Figure 3-6.
To install the ZC706 board in a computer chassis:

1. Remove all six rubber feet and standoffs from the ZC706 board.
2. Power down the host computer and remove the computer power cord.
3. Open the chassis, select a vacant PCIe expansion slot, and remove the expansion cover at the back of the chassis.
4. Plug the ZC706 board into the PCIe connector at this slot.
5. Install the top mounting bracket screw into the PC expansion cover retainer bracket to secure the ZC706 board in its slot.

**IMPORTANT:** The ZC706 board is taller than standard PCIe cards. Ensure that the height of the card is free of obstructions.

6. Connect the ATX power supply to the ZC706 board using the ATX power supply adapter cable as shown in Figure 3-7:

7. Slide the ZC706 board power switch SW12 to the ON position.

8. Connect the HDMI monitor and USB mouse as shown in Figure 3-7.

**Figure 3-7: ZC706 Board TRD Setup in Host Computer**

**Figure 3-8** shows a typical setup for running the TRD.
Chapter 3: Getting Started with the ZC706 PCIe Targeted Reference Design


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Installing Device Drivers

Host Computer Bootup

The procedures listed in this section require Linux super user access on the host computer. When using the Fedora 16 LiveDVD, super user access is granted by default. If not using the Fedora 16 LiveDVD, contact your system administrator for super user access.

If Fedora 16 is installed on the host computer hard disk, boot as a root-privileged user.

If Linux is not installed, place the Fedora 16 LiveDVD in the host computer CD-ROM drive and restart the computer.

The Fedora 16 Live Media is for Intel-compatible PCs and contains a complete, bootable 32-bit Fedora 16 environment with the proper packages installed for the TRD demonstration. The PC boots from the CD-ROM drive and logs into a liveuser account. That has the kernel development root privileges required to install and remove device driver modules.

IMPORTANT: The BIOS boot order must be set so that the CD-ROM drive is the first drive in the boot order. To set the boot order, power on the computer and press the DEL or F2 key. Set the boot order and save the change.
1. Switch SW12 on the ZC706 board to the ON position. Power on the PCIe host system. The Zynq-7000 PCIe TRD provides PCIe status on the GPIO LEDs near the ZC706 board power switch. LED R, C, L should be on. They are as follows: LED R-PCIe x4 link stable, LED C-PCIe 250 MHz clock active, and LED L-PCIe link up.

![LED Position on the ZC706 Board](image1)

*Figure 3-9: LED Position on the ZC706 Board*

The images in Figure 3-10 are seen on the monitor during boot up. On the HDMI monitor connected to the ZC706 board, a Qt-based application appears that shows device power and temperature.

![Fedora 16 LiveDVD Boot Sequence](image2)

*Figure 3-10: Fedora 16 LiveDVD Boot Sequence*
2. Download `zynq_pcie_trd_14_3.zip` from www.xilinx.com/zc706 and copy it to specific `/tmp` folder of PCIe host PC. Change permissions so that files inside `zynq_pcie_trd_14_3` have execution permission. Double click on the copied `zynq_pcie_trd_14_3`. The screen capture in Figure 3-11 shows the content of the `zynq_pcie_trd_14_3` folder.

![Figure 3-11: Directory Structure of z7_pcie_trd](image.png)

**Figure 3-11:** Directory Structure of z7_pcie_trd
3. Double click on the `quickstart.sh` script. This script sets proper permission and invokes the driver installation GUI. Click **Run in Terminal**.

![Running Quickstart Script](UG961_c3_12_111312)

**Figure 3-12:** Running Quickstart Script

4. The GUI with driver installation option pops up as shown in Figure 3-13. The step installs all the software necessary for the host system to control, generate, and receive PCIe traffic to and from the ZC706 board and monitor performance. Select **Video/Raw performance mode driver** mode and click **Install**.
5. After installing the Video/Raw performance mode driver, the control and monitor user interface pops up as shown in Figure 3-14. The control pane shows control parameters such as Sobel Filter and Video Out selection modes.
6. Click the **Start** button in the Video Path panel to start the PCIe host system generating a 1080p60 video stream and sending it over to the ZC706 board through PCIe. The video stream is processed and displayed on the HDMI monitor or sent back to the host through PCIe, based on the test mode selected in the Video Out menu. The Performance Plots tab shows the system-to-card (S2C) and card-to-system (C2S) PCIe performance numbers.

You can select various test modes from the Sobel Filter drop-down menu:

- Select option **None** to display the frames on the monitor without Sobel.
- Select option **Sobel-HW** to display the frames on the monitor with HW Sobel.
- Select option **Sobel-SW** to display the frames on the monitor with SW Sobel.

You can select various test modes from the Video Out drop-down menu:

- Select option **HDMI** to display Sobel data on HDMI monitor.
- Select option **PCIe Host** to send data back to the PCIe host system.

For option Sobel Filter: None and Video Out: HDMI, video data from PCIe host system is directly sent to the display without being processed by the edge detection Sobel filter. A color bar pattern appears on the display as shown in Figure 3-15 for this option.

![HDMI Display for Color Bar Display](image)

**Figure 3-15:** HDMI Display for Color Bar Display

7. For option Sobel Filter: Sobel-HW and Video Out: HDMI, video data from PCIe host system is directly processed by the edge detection Sobel filter in the PL, then sent to the display. Edges of the color bar pattern appear on the display as shown in Figure 3-16 for
this option.

![HDMI Display for Sobel Output Display](image)

**Figure 3-16:**  **HDMI Display for Sobel Output Display**

For option Sobel Filter: Sobel-SW and Video Out: HDMI, video data from the PCIe host system is directly processed by the edge detection Sobel filter in the PS, then sent to the display. Edges of the color bar pattern appear on the display.

For option Video Out: PCIe Host, video data from PCIe host system is processed by Sobel filter in the PL or PS depending on mode selected in Sobel Filter, then sent back to the PCIe host system through PCIe. The data is not sent to the display. Sobel Filter:none is not a supported option when Video Out is set to **PCIe Host**.

The Qt GUI monitors the power of the device voltage rails and die temperature. The CPU utilization and PS HP port 0 and HP port 2 performance numbers are also periodically plotted. When the user selects **Sobel Filter: None** HP port 0 performance becomes 8 Gb/s and HP port 2 port performance becomes 0 Gb/s When the user selects **Sobel Filter: Sobel-HW** both HP port 0 and HP port 2 performance is close to 8 Gb/s. When you select Sobel Filter: Sobel-SW, the CPU2 performance becomes 100%, HP port 0 performance becomes close to 8 Gb/s, and HP port 2 performance becomes 0.

8. As noted in the discussion above, because a single HD stream of video data is insufficient to saturate available PCIe x4 GEN2 bandwidth, datapath 1 can be turned on to add additional PCIe traffic. Click on the **Start** button in the Data Path-1 panel to generate additional traffic. On this path, the user can vary packet sizes and see performance variation accordingly. Total PCIe BW is updated in the PCIe statistics panel and the performance plot. The user can select **Loopback**, **HW Generator**, and the **HW Checker** option in the GUI for Data Path-1 (Figure 3-17).
9. Click on the **Block Diagram** option to view the design block diagram as shown in **Figure 3-18**.
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10. Exit the Qt GUI by clicking on the **Exit** button in the GUI as shown in **Figure 3-19**.

11. Close the GUI. This process uninstalls the driver on the PCIe host system and opens the landing page of the Zynq-7000 PCIe TRD. Uninstalling the driver requires the GUI to be closed first.
Additional Resources

Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see the Xilinx Support website at:


For continual updates, add the Answer Record to your myAlerts:


For a glossary of technical terms used in Xilinx documentation, see:


Solution Centers

See the Xilinx Solution Centers for support on devices, software tools, and intellectual property at all stages of the design cycle. Topics include design assistance, advisories, and troubleshooting tips.

Further Resources

The most up to date information related to the ZC706 board and its documentation is available on the following websites.

The Zynq-7000 AP SoC ZC706 Evaluation Kit Product Page:

www.xilinx.com/zc706

The Zynq-7000 AP SoC ZC706 Evaluation Kit Master Answer Record:

http://www.xilinx.com/support/answers/51899.htm
Appendix A: Additional Resources

These Xilinx documents and sites provide supplemental material useful with this guide:

**DS190**, Zynq-7000 Extensible Processing Platform Overview

**DS406**, LogiCORE IP Processor System Reset Module Product Specification

**DS768**, LogiCORE IP AXI Interconnect

**PG020**, LogiCORE IP AXI Video Direct Memory Access Product Guide

**UG477**, 7 Series FPGAs Integrated Block for PCI Express User Guide


**UG673**, Quick Front-to-Back Overview Tutorial: PlanAhead Design Tool


**UG804**, Zynq-7000 AP SoC Summary User Guide

**UG821**, Zynq-7000 All Programmable SoC Software Developers Guide

**UG873**, Zynq-7000 Concepts, Tools, and Techniques

**UG882**, Kintex-7 FPGA Base Targeted Reference Design User Guide

**UG883**, Kintex-7 FPGA KC705 Evaluation Kit Getting Started Guide


**UG926**, Zynq-7000 All Programmable SoC: ZC702 Evaluation Kit and Video and Imaging Kit Getting Started Guide (ISE Design Suite 14.3)

**UG954**, ZC706 Evaluation Board for the Zynq-7000 XC7Z045 All Programmable SoC User Guide

**UG961**, Zynq-7000 All Programmable SoC ZC706 Evaluation Kit Getting Started Guide (this document)


Xilinx Zynq-7000 All Programmable SoC website:

Zynq-7000 All Programmable SoC Product Table:
Zynq-7000 AP SoC ZC706 Evaluation Kit: www.xilinx.com/ZC706

Xilinx Open Source ARM git Repository: http://git.xilinx.com/

Using Git: wiki.xilinx.com/using-git

Xilinx ARM GNU Tools: wiki.xilinx.com/zynq-tools

Zynq Linux—Downloading the Kernel Tree: xilinx.wikidot.com/zynq-linux#toc7

Zynq Linux—Configuring and Building the Linux Kernel: xilinx.wikidot.com/zynq-linux#toc8

Xilinx Open Source Linux: wiki.xilinx.com/open-source-linux

Xilinx Device Tree Generator: xilinx.wikidot.com/device-tree-generator

Xilinx PlanAhead Design and Analysis Tool website: www.xilinx.com/tools/planahead.htm

More information on the Zynq-7000 AP SoC processor family boards, FMC extension cards, and other kits based on Zynq-7000 architecture is available at this website:


Xilinx Zynq-7000 PCIe Targeted Reference Design wiki page wiki.xilinx.com/zynq-pcie-trd

References

The following websites provide supplemental material useful with this guide:

1. git: the fast version control system home page: http://git-scm.com/
2. Device Tree general information: devicetree.org/Main_Page
4. PCI-SIG Documentation: www.pcisig.com/specifications
5. Xylon IP Cores
   logiCVC-ML Compact Multilayer Video Controller description: www.logicbricks.com/Products/logiCVC-ML.aspx
logiCVC-ML Compact Multilayer Video Controller data sheet: 

6. Qt Online Reference Documentation. Qt is a toolkit for creating GUIs: doc.qt.nokia.com/

7. Silicon Labs

P210x USB to UART Bridge VCP Drivers: 
www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx

USB to UART Bridge: 
www.silabs.com/products/interface/usbtouart/Pages/usb-to-uart-bridge.aspx

8. Northwest Logic DMA back-end core: www.nwlogic.com

9. Fedora is a Linux-based operating system used in the development of this TRD. 
Fedora project: fedoraproject.org
Appendix B

Warranty

THIS LIMITED WARRANTY applies solely to standard hardware development boards and standard hardware programming cables manufactured by or on behalf of Xilinx (“Development Systems”). Subject to the limitations herein, Xilinx warrants that Development Systems, when delivered by Xilinx or its authorized distributor, for ninety (90) days following the delivery date, will be free from defects in material and workmanship and will substantially conform to Xilinx publicly available specifications for such products in effect at the time of delivery. This limited warranty excludes: (i) engineering samples or beta versions of Development Systems (which are provided “AS IS” without warranty); (ii) design defects or errors known as “errata”; (iii) Development Systems procured through unauthorized third parties; and (iv) Development Systems that have been subject to misuse, mishandling, accident, alteration, neglect, unauthorized repair or installation. Furthermore, this limited warranty shall not apply to the use of covered products in an application or environment that is not within Xilinx specifications or in the event of any act, error, neglect or default of Customer. For any breach by Xilinx of this limited warranty, the exclusive remedy of Customer and the sole liability of Xilinx shall be, at the option of Xilinx, to replace or repair the affected products, or to refund to Customer the price of the affected products. The availability of replacement products is subject to product discontinuation policies at Xilinx. Customer may not return product without first obtaining a customer return material authorization (RMA) number from Xilinx.

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http:\www.xilinx.com\ehs\weee.htm.