

# TE0726 Zynqberry Demo2

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## Overview

Zynq PS Design with Debian Desktop.

Refer to <http://trenz.org/te0726-info> for the current online version of this manual and other available documentation.

## Key Features

- Vitis/Vivado 2019.2
- Win32DiskImager
- SD Card Formatter
- Linux Debian 9 (Stretch) or Linux Ubuntu 18.04 (Bionic Beaver)
- HDMI
- PetaLinux
- SD
- ETH
- USB
- I2C
- Special FSBL for QSPI programming

## Revision History

| Date       | Vivado | Project Built                                                                                                                                     | Authors                        | Description                                                                           |
|------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------|
| 2020-03-25 | 2019.2 | TE0726-zynqberrydemo2_noprebuilt-vivado_2019.2-build_8_20200325081643.zip<br>TE0726-zynqberrydemo2-vivado_2019.2-build_8_20200325081634.zip       | Mohsen Chamanbaz/John Hartfiel | <ul style="list-style-type: none"><li>• script update</li></ul>                       |
| 2020-02-25 | 2019.2 | TE0726-zynqberrydemo2_noprebuilt-vivado_2019.2-build_6_20200225121842.zip<br>TE0726-zynqberrydemo2-vivado_2019.2-build_6_20200225121832.zip       | Mohsen Chamanbaz               | <ul style="list-style-type: none"><li>• optional Ubuntu as root file system</li></ul> |
| 2020-02-21 | 2019.2 | TE0726-zynqberrydemo2_noprebuilt-vivado_2019.2-build_5_20200214101600.zip<br>TE0726-zynqberrydemo2-vivado_2019.2-build_5_20200214101548.zip       | Mohsen Chamanbaz               | <ul style="list-style-type: none"><li>• update with Vivado 2019.2</li></ul>           |
| 2019-12-19 | 2018.3 | te0726-zynqberrydemo2_noprebuilt-vivado_2018.3-build_10_20200113155225.zip<br>te0726-zynqberrydemo2-vivado_2018.3-build_10_20200113155211.zip     | Mohsen Chamanbaz               | <ul style="list-style-type: none"><li>• update with Vivado 2018.3</li></ul>           |
| 2018-11-19 | 2018.2 | te0726-zynqberrydemo1_noprebuilt-vivado_2018.2-build_03_20181119110154.zip<br><br>te0726-zynqberrydemo1-vivado_2018.2-build_03_20181119110059.zip | Oleksandr Kiyenko              | <ul style="list-style-type: none"><li>• initial release (not published)</li></ul>     |

### Design Revision History

## Release Notes and Know Issues

| Issues                             | Description                                                                                                                     | Workaround                                                                                                                                                                                                                                                                                                                                  | To be fixed version |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Flash Programming failed with 19.2 | Depending on Flash content Flash programming failed with provided fsbl_flash (Xilinx <a href="#">AR# 70548</a> ) 2019.2 version | <ul style="list-style-type: none"><li>• Option1:<ul style="list-style-type: none"><li>◦ In case Flash is empty, use fsbl_flash on programming GUI</li><li>◦ In case Flash is programmed use normal fsbl on programming GUI</li></ul></li><li>• Option2: use in both case fsbl_flash on programming GUI and Vivado LabTools 2018.3</li></ul> | ---                 |

### Known Issues

# Requirements

## Software

| Software  | Version | Note                                               |
|-----------|---------|----------------------------------------------------|
| Vitis     | 2019.2  | needed, Vivado is included into Vitis installation |
| PetaLinux | 2019.2  | needed                                             |

### Software

## Hardware

Basic description of TE Board Part Files is available on [TE Board Part Files](#).

Complete List is available on <design name>/board\_files/\*\_board\_files.csv

Design supports following modules:

| Module Model          | Board Part Short Name | PCB Revision Support | DDR         | QSPI Flash | Others | Notes                                       |
|-----------------------|-----------------------|----------------------|-------------|------------|--------|---------------------------------------------|
| <del>te0726-01</del>  | 01                    | REV01                | 64MB LPDDR2 | 16MB       |        | not included, user modifications are needed |
| <del>te0726-03r</del> | r                     | REV02, REV03         | 128MB DDR3L | 16MB       |        | not included, user modifications are needed |
| te0726-03m            | m                     | REV02, REV03         | 512MB DDR3L | 16MB       |        |                                             |
| te0726-03-07s-1c      | 7s                    | REV03                | 512MB DDR3L | 16MB       |        |                                             |

### Hardware Modules

Design supports following carriers:

| Carrier Model | Notes |
|---------------|-------|
| ---           |       |

### Hardware Carrier

Additional HW Requirements:

| Additional Hardware | Notes                                                               |
|---------------------|---------------------------------------------------------------------|
| USB Power           | Use USB2.0 or higher for power supply via USB                       |
| USB Cable           | Connect to USB2 or better USB3 Hub for proper power supply over USB |
| Monitor             | DELL Model Number: U2412Mc                                          |
| HDMI Cable          | --                                                                  |

### Additional Hardware

## Content

For general structure and of the reference design, see [Project Delivery - AMD devices](#)

## Design Sources

| Type      | Location                                                                        | Notes                                                                                                         |
|-----------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Vivado    | <design name>/block_design<br><design name>/constraints<br><design name>/ip_lib | Vivado Project will be generated by TE Scripts                                                                |
| Vitis     | <design name>/sw_lib                                                            | Additional Software Template for Vitis and apps_list.csv with settings automatically for Vitis app generation |
| PetaLinux | <design name>/os/petalinux                                                      | PetaLinux template with current configuration                                                                 |

Design sources

## Additional Sources

| Type | Location | Notes |
|------|----------|-------|
| --   | --       | --    |

Additional design sources

## Prebuilt

| File                                  | File-Extension | Description                                                                  |
|---------------------------------------|----------------|------------------------------------------------------------------------------|
| BIF-File                              | *.bif          | File with description to generate Bin-File                                   |
| BIN-File                              | *.bin          | Flash Configuration File with Boot-Image (Zynq-FPGAs)                        |
| BIT-File                              | *.bit          | FPGA (PL Part) Configuration File                                            |
| DebugProbes-File                      | *.ltx          | Definition File for Vivado/Vivado Labtools Debugging Interface               |
| Debian SD-Image                       | *.img          | Debian Image for SD-Card                                                     |
| Diverse Reports                       | ---            | Report files in different formats                                            |
| Hardware-Platform-Specification-Files | *.xsa          | Exported Vivado Hardware Specification for Vitis and PetaLinux               |
| LabTools Project-File                 | *.lpr          | Vivado Labtools Project File                                                 |
| OS-Image                              | *.ub           | Image with Linux Kernel (On Petalinux optional with Devicetree and RAM-Disk) |
| Software-Application-File             | *.elf          | Software Application for Zynq or MicroBlaze Processor Systems                |

Prebuilt files (only on ZIP with prebuilt content)

## Download

Reference Design is only usable with the specified Vivado/SDK/PetaLinux/SDx version. Do never use different Versions of Xilinx Software for the same Project.

Reference Design is available on:

- [TE0726 "Zynqberry Demo2" Reference Design](#)

## Design Flow



Reference Design is available with and without prebuilt files. It's recommended to use TE prebuilt files for first lunch.

Trenz Electronic provides a tcl based built environment based on Xilinx Design Flow.

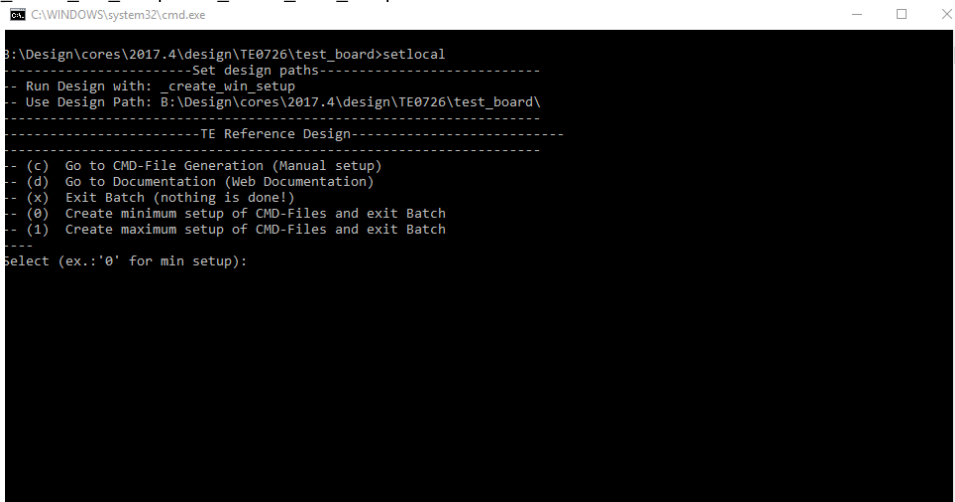
See also:

- [AMD Development Tools#XilinxSoftware-BasicUserGuides](#)
- [Vivado Projects - TE Reference Design](#)
- [Project Delivery](#).

The Trenz Electronic FPGA Reference Designs are TCL-script based project. Command files for execution will be generated with "\_create\_win\_setup.cmd" on Windows OS and "\_create\_linux\_setup.sh" on Linux OS.

TE Scripts are only needed to generate the vivado project, all other additional steps are optional and can also be executed by Xilinx Vivado/SDK GUI. For currently Scripts limitations on Win and Linux OS see: [Project Delivery Currently limitations of functionality](#)

1. \_create\_win\_setup.cmd/\_create\_linux\_setup.sh and follow instructions on shell:



2. Press 0 and enter to start "Module Selection Guide"
3. (optional Win OS) Generate Virtual Drive or use short directory for the reference design (for example x:\<design name>)
4. Create Project (follow instruction of the product selection guide), settings file will be configured automatically during this process
  - a. (optional for manual changes) Select correct device and Xilinx install path on "design\_basic\_settings.cmd" and create Vivado project with "vivado\_create\_project\_gui mode.cmd"  
Note: Select correct one, see [TE Board Part Files](#)
5. Create HDF and export to prebuilt folder
  - a. Run on Vivado TCL: TE::hw\_build\_design -export\_prebuilt  
Note: Script generate design and export files into \prebuilt\hardware\<short dir>. Use GUI is the same, except file export to prebuilt folder
6. Create Linux (uboot.elf and image.ub) with exported XSA
  - a. XSA is exported to "prebuilt\hardware\<short name>"  
Note: HW Export from Vivado GUI create another path as default workspace.  
Create Linux images on VM, see [PetaLinux KICKstart](#)
    - i. Use TE Template from /os/petalinux
    - ii. For 128MB and 64MB only: Netboot Offset must be reduced manually, see [TE0726 Zynqberry Demo2#Config](#)
  - c. Build the Debian image/Ubuntu image file with executing the "mkdebian\_Demo2\_stretch.sh"/"mkubuntu\_Demo2.sh" file in Linux Terminal
7. Add Linux files (uboot.elf and image.ub) to prebuilt folder
  - a. "prebuilt\os\petalinux\<DDR size>" or "prebuilt\os\petalinux\<short name>"  
Notes: Scripts select "prebuilt\os\petalinux\<DDR size>", if exist, otherwise "prebuilt\os\petalinux\<short name>"
8. Generate Programming Files with Vitis
  - a. Run on Vivado TCL: TE::sw\_run\_vitis -all  
Note: Scripts generate applications and bootable files, which are defined in "sw\_lib\apps\_list.csv"

- b. (alternative) Start Vitis with Vivado GUI or start with TE Scripts on Vivado TCL: `TE::sw_run_vitis`  
Note: TCL scripts generate also platform project, this must be done manually in case GUI is used. See [Vitis](#)

## Launch

## Programming



Check Module and Carrier TRMs for proper HW configuration before you try any design.

Xilinx documentation for programming and debugging: [Vivado/SDK/SDSoC-Xilinx Software Programming and Debugging](#)

## Get prebuilt boot binaries

1. `_create_win_setup.cmd/_create_linux_setup.sh` and follow instructions on shell
2. Press 0 and enter to start "Module Selection Guide"
  - a. Select assembly version
  - b. Validate selection
  - c. Select Create and open delivery binary folderNote: Folder (`<project folder>/_binaries_<Article Name>`) with subfolder (`boot_<app name>`) for different applications will be generated

## QSPI

1. Connect JTAG and power module (TE0726 can be powered via JTAG USB or external)
2. Open Vivado Project with "vivado\_open\_existing\_project\_gui mode.cmd" or if not created, create with "vivado\_create\_project\_gui mode.cmd"
3. Type on Vivado TCL Console: `TE::pr_program_flash -swapp u-boot`  
Note: To program with SDK/Vivado GUI, use special FSBL (`zynqmp_fsbl_flash`) on setup  
optional "TE::pr\_program\_flash -swapp hello\_te0726" possible
4. Format the SD Card with SD Card Formatter or other tool
5. Write the Debian image or Ubuntu image file on SD Card with Win32DiskImager
6. Copy the Petalinux image.ub on SD-Card if you use Debian
  - For correct prebuilt file location, see `<design_name>/prebuilt/readme_file_location.txt`
7. Insert SD-Card

## SD

Xilinx Zynq devices in CLG225 package do not support SD Card boot directly from ROM bootloader. Use QSPI for primary boot and SD for secondary boot (u-boot)

## JTAG

Not used on this Example.

## Usage

1. Prepare HW like described in section [TE0726 Zynqberry Demo2#Programming](#)
  2. Connect UART USB (most cases same as JTAG)
  3. Insert SD Card with image.ub
  4. Power On PCB
- Note: 1. Zynq Boot ROM loads FSBL from QSPI into OCM, 2. FSBL loads U-boot from QSPI into DDR, 3. U-boot load Linux from SD into DDR

## Linux

1. Open Serial Console (e.g. putty)
  - a. Speed: 115200

- b. COM Port: Win OS, see device manager, Linux OS see `dmesg |grep tty` (UART is \*USB1)
2. Linux Console:
 

Note: Wait until Linux boot finished For Linux Login use:

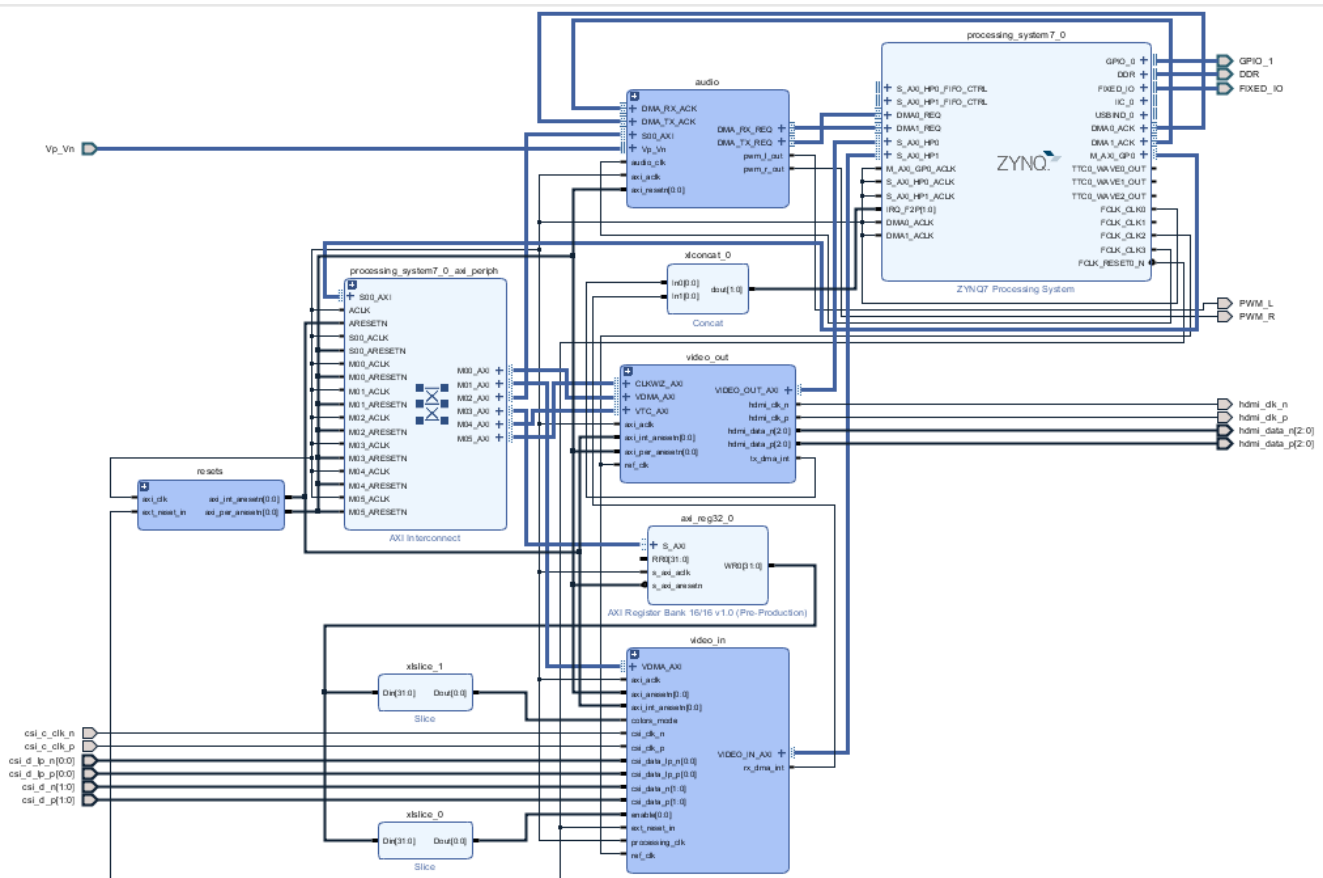
  - a. User Name: root
  - b. Password: root

Note: Wait until Linux boot finished For Linux Login use:

  - i. User Name: root
  - ii. Password: root
3. GUI starts for both variants Debian or Ubuntu automatically.
4. Debian Desktop
  - a. Web Browser Dillo open console and type `dillo` or use browser
  - b. open console and start video or audio with "`mplayer <video or audio file>`"
5. Ubuntu Desktop
  - a. Web Browser Mozilla firefox can be used.
  - b. Audio or Video file can also be performed directly in GUI.

## System Design - Vivado

### Block Design



Block Design

### PS Interfaces

Activated interfaces:

| Type       | Note              |
|------------|-------------------|
| DDR        | ---               |
| QSPI       | MIO               |
| USB0       | MIO, ETH over USB |
| SD1        | MIO               |
| UART1      | MIO               |
| I2C0       | EMIO              |
| I2C1       | MIO               |
| GPIO       | MIO / EMIO        |
| USB RST    | MIO               |
| TTC0..1    | MIO               |
| WDT        | MIO               |
| AXI HP0..1 |                   |
| DMA0..1    |                   |

#### PS Interfaces

## Constraints

### Basic module constraints

#### **\_i\_bitgen\_common.xdc**

```
#
# Common BITGEN related settings for TE0726
#
set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
set_property CONFIG_VOLTAGE 3.3 [current_design]
set_property CFGBVS VCC0 [current_design]

set_property BITSTREAM.CONFIG.UNUSEDPIN PULLUP [current_design]
```

### Design specific constraint

#### **\_i\_common.xdc**

```
#
#
#
set_property BITSTREAM.CONFIG.UNUSEDPIN PULLUP [current_design]
```

#### **\_i\_te0726.xdc**



```
#set_property IOSTANDARD LVCMOS33 [get_ports spdif_tx_o]
#set_property PACKAGE_PIN K15 [get_ports spdif_tx_o]

set_property IOSTANDARD LVCMOS33 [get_ports {GPIO_1_tri_io[*]}]
# GPIO Pins
# GPIO2
set_property PACKAGE_PIN K15 [get_ports {GPIO_1_tri_io[0]}]
# GPIO3
set_property PACKAGE_PIN J14 [get_ports {GPIO_1_tri_io[1]}]
# GPIO4
set_property PACKAGE_PIN H12 [get_ports {GPIO_1_tri_io[2]}]
# GPIO5
set_property PACKAGE_PIN N14 [get_ports {GPIO_1_tri_io[3]}]
# GPIO6
set_property PACKAGE_PIN R15 [get_ports {GPIO_1_tri_io[4]}]
# GPIO7
set_property PACKAGE_PIN L14 [get_ports {GPIO_1_tri_io[5]}]
# GPIO8
set_property PACKAGE_PIN L15 [get_ports {GPIO_1_tri_io[6]}]
# GPIO9
set_property PACKAGE_PIN J13 [get_ports {GPIO_1_tri_io[7]}]
# GPIO10
set_property PACKAGE_PIN H14 [get_ports {GPIO_1_tri_io[8]}]
# GPIO11
set_property PACKAGE_PIN J15 [get_ports {GPIO_1_tri_io[9]}]
# GPIO12
set_property PACKAGE_PIN M15 [get_ports {GPIO_1_tri_io[10]}]
# GPIO13
set_property PACKAGE_PIN R13 [get_ports {GPIO_1_tri_io[11]}]
# GPIO16
set_property PACKAGE_PIN L13 [get_ports {GPIO_1_tri_io[12]}]
# GPIO17
set_property PACKAGE_PIN G11 [get_ports {GPIO_1_tri_io[13]}]
# GPIO18
set_property PACKAGE_PIN H11 [get_ports {GPIO_1_tri_io[14]}]
# GPIO19
set_property PACKAGE_PIN R12 [get_ports {GPIO_1_tri_io[15]}]
# GPIO20
set_property PACKAGE_PIN M14 [get_ports {GPIO_1_tri_io[16]}]
# GPIO21
set_property PACKAGE_PIN P15 [get_ports {GPIO_1_tri_io[17]}]
# GPIO22
set_property PACKAGE_PIN H13 [get_ports {GPIO_1_tri_io[18]}]
# GPIO23
set_property PACKAGE_PIN J11 [get_ports {GPIO_1_tri_io[19]}]
# GPIO24
set_property PACKAGE_PIN K11 [get_ports {GPIO_1_tri_io[20]}]
# GPIO25
set_property PACKAGE_PIN K13 [get_ports {GPIO_1_tri_io[21]}]
# GPIO26
set_property PACKAGE_PIN L12 [get_ports {GPIO_1_tri_io[22]}]
# GPIO27
set_property PACKAGE_PIN G12 [get_ports {GPIO_1_tri_io[23]}]

## DSI_D0_N
#set_property PACKAGE_PIN F13 [get_ports {GPIO_1_tri_io[24]}]
## DSI_D0_P
#set_property PACKAGE_PIN F14 [get_ports {GPIO_1_tri_io[25]}]
## DSI_D1_N
#set_property PACKAGE_PIN F12 [get_ports {GPIO_1_tri_io[26]}]
## DSI_D1_P
```

```

#set_property PACKAGE_PIN E13 [get_ports {GPIO_1_tri_io[27]]}
## DSI_C_N
#set_property PACKAGE_PIN E11 [get_ports {GPIO_1_tri_io[28]]}
## DSI_C_P
#set_property PACKAGE_PIN E12 [get_ports {GPIO_1_tri_io[29]]}

## CSI_D0_N
#set_property PACKAGE_PIN M11 [get_ports {GPIO_1_tri_io[30]]}
## CSI_D0_P
#set_property PACKAGE_PIN M10 [get_ports {GPIO_1_tri_io[31]]}
## CSI_D1_N
#set_property PACKAGE_PIN P14 [get_ports {GPIO_1_tri_io[32]]}
## CSI_D2_P
#set_property PACKAGE_PIN P13 [get_ports {GPIO_1_tri_io[33]]}
## CSI_C_N
#set_property PACKAGE_PIN N12 [get_ports {GPIO_1_tri_io[34]]}
## CSI_C_P
#set_property PACKAGE_PIN N11 [get_ports {GPIO_1_tri_io[35]]}
## PWM_R
##set_property PACKAGE_PIN N8 [get_ports {GPIO_1_tri_io[36]]}
## PWM_L
##set_property PACKAGE_PIN N7 [get_ports {GPIO_1_tri_io[37]]}

# PWM_R
set_property PACKAGE_PIN N8 [get_ports PWM_R]
# PWM_L
set_property PACKAGE_PIN N7 [get_ports PWM_L]
set_property IOSTANDARD LVCMOS33 [get_ports PWM_*]

```

#### \_i\_hdmi.xdc

```

set_property IOSTANDARD TMDS_33 [get_ports hdmi_clk_p]
set_property PACKAGE_PIN R7 [get_ports hdmi_clk_p]

set_property IOSTANDARD TMDS_33 [get_ports {hdmi_data_p[*]}]
set_property PACKAGE_PIN P8 [get_ports {hdmi_data_p[0]}]
set_property PACKAGE_PIN P10 [get_ports {hdmi_data_p[1]}]
set_property PACKAGE_PIN P11 [get_ports {hdmi_data_p[2]}]

```

### i\_csi.xdc

```
set_property PACKAGE_PIN N11 [get_ports csi_c_clk_p]
set_property IOSTANDARD LVDS_25 [get_ports csi_c_clk_p]
set_property PACKAGE_PIN M9 [get_ports {csi_d_lp_n[0]}]
set_property IOSTANDARD HSUL_12 [get_ports {csi_d_lp_n[0]}]
set_property PACKAGE_PIN N9 [get_ports {csi_d_lp_p[0]}]
set_property IOSTANDARD HSUL_12 [get_ports {csi_d_lp_p[0]}]
set_property PACKAGE_PIN M10 [get_ports {csi_d_p[0]}]
set_property IOSTANDARD LVDS_25 [get_ports {csi_d_p[0]}]
set_property PACKAGE_PIN P13 [get_ports {csi_d_p[1]}]
set_property IOSTANDARD LVDS_25 [get_ports {csi_d_p[1]}]
set_property INTERNAL_VREF 0.6 [get_iobanks 34]
set_property PULLDOWN true [get_ports {csi_d_lp_p[0]}]
set_property PULLDOWN true [get_ports {csi_d_lp_n[0]}]
# RPI Camera 1
create_clock -period 6.250 -name csi_clk -add [get_ports csi_c_clk_p]
# RPI Camera 2.1
#create_clock -period 1.875 -name csi_clk -add [get_ports csi_c_clk_p]
```

### i\_timing.xdc

```
set_property ASYNC_REG true [get_cells {zsys_i/audio/axi_i2s_adi_0/U0/ctrl/tx_sync/out_data_reg[4]}]
set_property ASYNC_REG true [get_cells {zsys_i/audio/axi_i2s_adi_0/U0/ctrl/SDATA_0_reg[0]}]
set_false_path -from [get_clocks clk_fpga_0] -to [get_clocks clk_fpga_3]
set_false_path -from [get_clocks clk_fpga_3] -to [get_clocks clk_fpga_0]

set_false_path -from [get_pins {zsys_i/axi_reg32_0/U0/axi_reg32_v1_0_S_AXI_inst/slv_reg16_reg[1]/C}] -to
[get_pins zsys_i/video_in/axis_raw_demosaic_0/U0/colors_mode_i_reg/D]
set_false_path -from [get_pins zsys_i/video_in/csi_to_axis_0/U0/lane_align_inst/err_req_reg/C] -to [get_pins
zsys_i/video_in/csi2_d_phy_rx_0/U0/clock_upd_req_reg/D]

set_false_path -from [get_pins {zsys_i/video_in/axi_vdma_0/U0/I_PRMRY_DATAMOVER/GEN_S2MM_FULL.
I_S2MM_FULL_WRAPPER/GEN_INCLUDE_REALIGNER.I_S2MM_REALIGNER/GEN_INCLUDE_SCATTER.I_S2MM_SCATTER
/sig_max_first_increment_reg[2]/C}] -to [get_pins zsys_i/video_in/axi_vdma_0/U0/I_PRMRY_DATAMOVER/GEN_S2MM_FULL.
I_S2MM_FULL_WRAPPER/GEN_INCLUDE_REALIGNER.I_S2MM_REALIGNER/GEN_INCLUDE_SCATTER.I_S2MM_SCATTER/sig_btt_eq_0_reg
/D]
set_false_path -from [get_pins {zsys_i/video_in/axi_vdma_0/U0/I_PRMRY_DATAMOVER/GEN_S2MM_FULL.
I_S2MM_FULL_WRAPPER/GEN_INCLUDE_REALIGNER.I_S2MM_REALIGNER/GEN_INCLUDE_SCATTER.I_S2MM_SCATTER
/sig_btt_cntr_dup_reg[1]/C}] -to [get_pins zsys_i/video_in/axi_vdma_0/U0/I_PRMRY_DATAMOVER/GEN_S2MM_FULL.
I_S2MM_FULL_WRAPPER/GEN_INCLUDE_REALIGNER.I_S2MM_REALIGNER/GEN_INCLUDE_SCATTER.I_S2MM_SCATTER/sig_btt_eq_0_reg
/D]
```

## Software Design - Vitis

For SDK project creation, follow instructions from:

[Vitis](#)

## Application

SDK template in `./sw_lib/sw_apps/` available.

## zynq\_fsbl

TE modified 2019.2 FSBL

General:

- Modified Files: main.c, fsbl\_hooks.h/.c (search for 'TE Mod' on source code)
- Add Files: te\_fsbl\_hooks.h/.c (for hooks and board)\n\
- General Changes:
  - Display FSBL Banner and Device ID

Module Specific:

- Add Files: all TE Files start with te\_\*
  - enable VTC and VDMA cores for debian desktop

## zynq\_fsbl\_flash

TE modified 2019.2 FSBL

General:

- Modified Files: main.c
- General Changes:
  - Display FSBL Banner
  - Set FSBL Boot Mode to JTAG
  - Disable Memory initialisation

## hello\_te0726

Hello TE0726 is a Xilinx Hello World example as endless loop instead of one console output.

## u-boot

U-Boot.elf is generated with PetaLinux. Vitis is used to generate Boot.bin.

# Software Design - PetaLinux

For PetaLinux installation and project creation, follow instructions from:

- [PetaLinux KICKstart](#)

## Config

Start with **petalinux-config** or **petalinux-config --get-hw-description**

Select Image Packaging Configuration ==> Root filesystem type ==> Select SD Card

Changes:

- # CONFIG\_SUBSYSTEM\_ROOTFS\_INITRAMFS is not set
- # CONFIG\_SUBSYSTEM\_ROOTFS\_INITRD is not set
- # CONFIG\_SUBSYSTEM\_ROOTFS\_JFFS2 is not set
- # CONFIG\_SUBSYSTEM\_ROOTFS\_NFS is not set
- CONFIG\_SUBSYSTEM\_ROOTFS\_SD=y
- # CONFIG\_SUBSYSTEM\_ROOTFS\_OTHER is not set

For 64MB variant only:

- CONFIG\_SUBSYSTEM\_NETBOOT\_OFFSET = 0x2000000

For 128MB variant only:

- CONFIG\_SUBSYSTEM\_NETBOOT\_OFFSET = 0x4000000

## U-Boot

Start with **petalinux-config -c u-boot**

Changes:

- CONFIG\_ENV\_IS\_NOWHERE=y
- # CONFIG\_ENV\_IS\_IN\_SPI\_FLASH is not set

## Device Tree

```
/include/ "system-conf.dtsi"
/ {
};

/ {
    #address-cells = <1>;
    #size-cells = <1>;

    reserved-memory {
        #address-cells = <1>;
        #size-cells = <1>;
        ranges;
        hdmi_fb_reserved_region@1FC00000 {
            compatible = "removed-dma-pool";
            no-map;
            // 512M (M modules)
            reg = <0x1FC00000 0x400000>;
            // 128M (R modules)
            //reg = <0x7C000000 0x400000>;
        };
        camera_fb_reserved_region@1F800000 {
            compatible = "removed-dma-pool";
            no-map;
            // 512M (M modules)
            reg = <0x1F800000 0x400000>;
            // 128M (R modules)
            //reg = <0x78000000 0x400000>;
        };
    };

    hdmi_fb: framebuffer@0x1FC00000 {                // HDMI out
        compatible = "simple-framebuffer";
        // 512M (M modules)
        reg = <0x1FC00000 (1280 * 720 * 4)>;        // 720p
        // 128M (R modules)
        //reg = <0x7C000000 (1280 * 720 * 4)>;        // 720p
        width = <1280>;                            // 720p
        height = <720>;                             // 720p
        stride = <(1280 * 4)>;                       // 720p
        format = "a8b8g8r8";
        status = "okay";
    };
};
```

```

camera_fb: framebuffer@0x1F800000 {          // CAMERA in
    compatible = "simple-framebuffer";
    // 512M (M modules)
    reg = <0x1F800000 (1280 * 720 * 4)>;    // 720p
    // 128M (R modules)
    //reg = <0x78000000 (1280 * 720 * 4)>;    // 720p
    width = <1280>;                        // 720p
    height = <720>;                        // 720p
    stride = <(1280 * 4)>;                  // 720p
    format = "a8b8g8r8";
};

vcc_3V3: fixedregulator@0 {
    compatible = "regulator-fixed";
    regulator-name = "vccaux-supply";
    regulator-min-microvolt = <3300000>;
    regulator-max-microvolt = <3300000>;
    regulator-always-on;
};

};

&qspi {
    #address-cells = <1>;
    #size-cells = <0>;
    status = "okay";
    flash0: flash@0 {
        compatible = "jedec,spi-nor";
        reg = <0x0>;
        #address-cells = <1>;
        #size-cells = <1>;
        spi-max-frequency = <50000000>;
        partition@0x00000000 {
            label = "boot";
            reg = <0x00000000 0x00500000>;
        };
        partition@0x00500000 {
            label = "bootenv";
            reg = <0x00500000 0x00020000>;
        };
        partition@0x00520000 {
            label = "kernel";
            reg = <0x00520000 0x00a80000>;
        };
        partition@0x00fa0000 {
            label = "spare";
            reg = <0x00fa0000 0x00000000>;
        };
    };
};

/*
 * We need to disable Linux VDMA driver as VDMA
 * already configured in FSBL
 */
&video_in_axi_vdma_0 {
    status = "disabled";
};

&video_out_axi_vdma_0 {
    status = "disabled";
};

```

```

};

&video_out_v_tc_0 {
    //xilinx-vtc: probe of 43c20000.v_tc failed with error -2
    status = "disabled";
};

&gpio0 {
    interrupt-controller;
    #interrupt-cells = <2>;
};

&i2c1 {
    #address-cells = <1>;
    #size-cells = <0>;

    i2cmux0: i2cmux@70 {
        compatible = "nxp,pca9544";
        #address-cells = <1>;
        #size-cells = <0>;
        reg = <0x70>;

        i2c1@0 {
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <0>;

            id_eeprom@50 {
                compatible = "atmel,24c32";
                reg = <0x50>;
            };
        };

        i2c1@1 { // Display Interface Connector
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <1>;
        };

        i2c1@2 { // HDMI Interface Connector
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <2>;
        };

        i2c1@3 { // Camera Interface Connector
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <3>;
        };
    };
};

/{
    usb_phy0: usb_phy@0 {
        compatible = "ulpi-phy";
        #phy-cells = <0>;
        reg = <0xe0002000 0x1000>;
        view-port = <0x0170>;
        drv-vbus;
    };
};

```

```

};

&usb0 {
    usb-phy = <&usb_phy0>;
} ;

/*
 * Sound configuration
 */

/{
    // Custom driver based on spdif-transmitter
    te_audio: dummy_codec_te {
        compatible = "te,te-audio";
        #sound-dai-cells = <0>;
    };

    // Simple Audio Card from AXI_I2S and custom XADC audio input and
    // PWM audio output cores
    sound {
        compatible = "simple-audio-card";
        simple-audio-card,name = "TE0726-PWM-Audio";
        simple-audio-card,format = "i2s";
        simple-audio-card,widgets =
            "Microphone", "In Jack",
            "Line", "Line In Jack",
            "Line", "Line Out Jack",
            "Headphone", "Out Jack";

        simple-audio-card,routing =
            "Out Jack", "te-out",
            "te-in", "In Jack";

        simple-audio-card,cpu {
            sound-dai = <&audio_axi_i2s_adi_0>;
        };
        simple-audio-card,codec {
            sound-dai = <&te_audio>;
        };
    };
};

&audio_axi_i2s_adi_0 {
    compatible = "adi,axi-i2s-1.00.a";
    reg = <0x43c00000 0x1000>;
    clocks = <&clkc 15>, <&clkc 18>; // FCLK_CLK0, FCLK_CLK3
    clock-names = "axi", "ref";
    dmas = <&dmac_s 0 &dmac_s 1>;
    dma-names = "tx", "rx";
    #sound-dai-cells = <0>;
};

/*
 * We need to disable Linux XADC driver to use XADC for audio recording
 */
&adc {
    status = "disabled";
};

```



## Kernel

Start with **petalinux-config -c kernel**

Changes:

- CONFIG\_XILINX\_GMII2RGMII=y
- CONFIG\_USB\_USBNET=y
- CONFIG\_USB\_NET\_AX8817X=y
- CONFIG\_USB\_NET\_AX88179\_178A=y
- CONFIG\_USB\_NET\_CDCETHER=y
- # CONFIG\_USB\_NET\_CDC\_EEM is not set
- CONFIG\_USB\_NET\_CDC\_NCM=y
- # CONFIG\_USB\_NET\_HUAWEI\_CDC\_NCM is not set
- # CONFIG\_USB\_NET\_CDC\_MBIM is not set
- # CONFIG\_USB\_NET\_DM9601 is not set
- # CONFIG\_USB\_NET\_SR9700 is not set
- # CONFIG\_USB\_NET\_SR9800 is not set
- # CONFIG\_USB\_NET\_SMSC75XX is not set
- CONFIG\_USB\_NET\_SMSC95XX=y
- # CONFIG\_USB\_NET\_GL620A is not set
- CONFIG\_USB\_NET\_NET1080=y
- # CONFIG\_USB\_NET\_PLUSB is not set
- # CONFIG\_USB\_NET\_MCS7830 is not set
- # CONFIG\_USB\_NET\_RNDIS\_HOST is not set
- CONFIG\_USB\_NET\_CDC\_SUBSET\_ENABLE=y
- CONFIG\_USB\_NET\_CDC\_SUBSET=y
- # CONFIG\_USB\_ALI\_M5632 is not set
- # CONFIG\_USB\_AN2720 is not set
- CONFIG\_USB\_BELKIN=y
- CONFIG\_USB\_ARMLINUX=y
- # CONFIG\_USB\_EPSON2888 is not set
- # CONFIG\_USB\_KC2190 is not set
- CONFIG\_USB\_NET\_ZAURUS=y
- # CONFIG\_USB\_NET\_CX82310\_ETH is not set
- # CONFIG\_USB\_NET\_KALMIA is not set
- # CONFIG\_USB\_NET\_QMI\_WWAN is not set
- # CONFIG\_USB\_NET\_INT51X1 is not set
- # CONFIG\_USB\_SIERRA\_NET is not set
- # CONFIG\_USB\_VL600 is not set
- # CONFIG\_USB\_NET\_CH9200 is not set
- CONFIG\_USBIP\_CORE=y
- # CONFIG\_USBIP\_VHCI\_HCD is not set
- # CONFIG\_USBIP\_HOST is not set
- # CONFIG\_USBIP\_VUDC is not set
- # CONFIG\_USBIP\_DEBUG is not set
- # CONFIG\_FRAMEBUFFER\_CONSOLE is not set
- CONFIG\_FB\_SIMPLE=y
- CONFIG\_SND\_SIMPLE\_CARD\_UTILS=y
- CONFIG\_SND\_SIMPLE\_CARD=y

## Rootfs

File system will be generated with Debian script or Ubuntu script (mkdebian\_Demo2\_stretch.sh/mkubuntu\_Demo2.sh)

## Applications

Applications will be generated with Debian script or Ubuntu script (mkdebian\_Demo2\_stretch.sh/mkubuntu\_Demo2.sh)

## Kernel Modules

## te-audio-codec

Simple module stub to use audio interface. Will be installed with debian script

See: `\os\petalinux\project-spec\meta-user\recipes-modules\te-audio-codec\files`

## Additional Software

No additional software is needed.

## Appx. A: Change History and Legal Notices

### Document Change History

To get content of older revision got to "Change History" of this page and select older document revision number.

| Date | Document Revision | Authors | Description |
|------|-------------------|---------|-------------|
|------|-------------------|---------|-------------|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <p><b>Error rendering macro 'page-info'</b></p> <p>Ambiguous method overloading for method jdk.proxy279.\$Proxy4022#hasContentLevelPermission. Cannot resolve which method to invoke for [null, class java.lang.String, class com.atlassian.confluence.pages.Page] due to overlapping prototypes between: [interface com.atlassian.confluence.user.ConfluenceUser, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject] [interface com.atlassian.user.User, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject]</p> | <p><b>Error rendering macro 'page-info'</b></p> <p>Ambiguous method overloading for method jdk.proxy279.\$Proxy4022#hasContentLevelPermission. Cannot resolve which method to invoke for [null, class java.lang.String, class com.atlassian.confluence.pages.Page] due to overlapping prototypes between: [interface com.atlassian.confluence.user.ConfluenceUser, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject] [interface com.atlassian.user.User, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject]</p> | <p><b>Error rendering macro 'page-info'</b></p> <p>Ambiguous method overloading for method jdk.proxy279.\$Proxy4022#hasContentLevelPermission. Cannot resolve which method to invoke for [null, class java.lang.String, class com.atlassian.confluence.pages.Page] due to overlapping prototypes between: [interface com.atlassian.confluence.user.ConfluenceUser, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject] [interface com.atlassian.user.User, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject]</p> | <ul style="list-style-type: none"> <li>• typo</li> <li>• Programming issue note</li> </ul>                         |
| 2020-03-25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | v.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | John Hartfiel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• script update</li> </ul>                                                  |
| 2020-02-25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | v.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mohsen Chamanbaz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• add Ubuntu as root file system</li> <li>• documentation update</li> </ul> |
| 2020-02-21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | v.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mohsen Chamanbaz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Vivado 2019.2 release</li> </ul>                                          |

|            |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |
|------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 2020-01-13 | v.2 | Mohsen Chamanbaz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>Vivado 2018.3 release</li> </ul> |
| 2018-12-19 | v.1 | John Hartfiel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Vivado 2018.2 release</li> </ul> |
| --         | all | <div> <p><b>Error rendering macro 'page-info'</b></p> <p>Ambiguous method overloading for method jdk.proxy279.\$Proxy4022#hasContentLevelPermission. Cannot resolve which method to invoke for [null, class java.lang.String, class com.atlassian.confluence.pages.Page] due to overlapping prototypes between: [interface com.atlassian.confluence.user.ConfluenceUser, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject] [interface com.atlassian.user.User, class java.lang.String, class com.atlassian.confluence.core.ContentEntityObject]</p> </div> | <ul style="list-style-type: none"> <li>update documentation</li> </ul>  |

Document change history.

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