TE0807 Test Board
# Table of Contents

Overview ........................................................................................................ 4
Key Features .................................................................................................... 4
Revision History ............................................................................................ 4
Release Notes and Know Issues .................................................................... 4
Requirements ................................................................................................ 4
  Software ........................................................................................................ 4
  Hardware ....................................................................................................... 4
Content ............................................................................................................ 5
  Design Sources ............................................................................................ 5
  Additional Sources ...................................................................................... 5
  Prebuilt ......................................................................................................... 5
  Download ..................................................................................................... 6
Design Flow .................................................................................................... 7
Launch ............................................................................................................. 9
  Programming ............................................................................................... 9
    QSPI ........................................................................................................... 9
    SD .............................................................................................................. 9
    JTAG ......................................................................................................... 9
Usage ................................................................................................................ 9
System Design - Vivado .................................................................................. 11
  Block Design ............................................................................................. 11
    PS Interfaces ............................................................................................ 11
  Constrains .................................................................................................... 11
    Basic module constrains ......................................................................... 11
    Design specific constrain ....................................................................... 11
Software Design - SDK/HSI .......................................................................... 12
  Application ................................................................................................. 12
    FSBL ......................................................................................................... 12
    Hello TE0803 .......................................................................................... 12
Additional Software ....................................................................................... 13
Appx. A: Change History and Legal Notices .................................................. 14
  Document Change History ......................................................................... 14
  Legal Notices .............................................................................................. 14
  Data privacy ................................................................................................ 14
  Document Warranty ..................................................................................... 14
  Limitation of Liability ................................................................................ 14
  Copyright Notice ......................................................................................... 15
  Technology Licenses ................................................................................... 15
  Environmental Protection ........................................................................... 15
  REACH, RoHS and WEEE ......................................................................... 16
Online version of this manual and other related documents can be found at https://wiki.trenz-electronic.de/display/PD/Trenz+Electronic+Documentation
Overview
Design Example with minimum PS Setup (DDR, QSPI, UART0) only for custom boards or easier debug via SDK.

Key Features
- QSPI
- SDK
- Custom Carrier (with other MIO settings as TEBF0808)

Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Vivado</th>
<th>Project Built</th>
<th>Authors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-11-14</td>
<td>2017.2</td>
<td>TE0807-test_board_noprebuilt-vivado_2017.2-build_05_2017111415524.zip</td>
<td>John Hartfiel</td>
<td>initial release</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TE0807-test_board-vivado_2017.2-build_05_2017111415511.zip</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Release Notes and Know Issues

<table>
<thead>
<tr>
<th>Issues</th>
<th>Description</th>
<th>Workaround</th>
<th>To be fixed version</th>
</tr>
</thead>
<tbody>
<tr>
<td>No known issues</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Requirements

Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivado</td>
<td>2017.2</td>
<td>needed</td>
</tr>
<tr>
<td>SDK</td>
<td>2017.2</td>
<td>needed</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Module Model</th>
<th>Board Part Short Name</th>
<th>PCB Revision Support</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE0807-01-ES2</td>
<td>es2</td>
<td>REV01</td>
<td></td>
</tr>
</tbody>
</table>
Note: Design contains also Board Part Files for TE0803+TEBF0808 configuration, this board part files are not used for this reference design.

Design supports following carriers:

<table>
<thead>
<tr>
<th>Carrier Model</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom PCB</td>
<td>use simple Board Part files, if MIO connected is different to TEBF0808</td>
</tr>
<tr>
<td>TEBF0808</td>
<td>Used as reference carrier.</td>
</tr>
<tr>
<td>TEBT0808</td>
<td>Change UART0 to UART1 (MIO68...69) and regenerate design</td>
</tr>
</tbody>
</table>

Additional HW Requirements:

**Additional Hardware** | **Notes**
--- | ---

Content

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

Design Sources

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivado</td>
<td><code>&lt;design name&gt;/block_design</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>&lt;design name&gt;/constraints</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>&lt;design name&gt;/ip_lib</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vivado Project will be generated by TE Scripts</td>
<td></td>
</tr>
<tr>
<td>SDK/HSI</td>
<td><code>&lt;design name&gt;/sw_lib</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional Software Template for SDK/HSI and apps_list.csv with settings for HSI</td>
<td></td>
</tr>
</tbody>
</table>

Additional Sources

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
</table>

Prebuilt

<table>
<thead>
<tr>
<th>File</th>
<th>File-Extension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIF-File</td>
<td>*.bif</td>
<td>File with description to generate Bin-File</td>
</tr>
<tr>
<td>BIN-File</td>
<td>*.bin</td>
<td>Flash Configuration File with Boot-Image (Zynq-FPGAs)</td>
</tr>
<tr>
<td>BIT-File</td>
<td>*.bit</td>
<td>FPGA (PL Part) Configuration File</td>
</tr>
<tr>
<td>Diverse Reports</td>
<td>---</td>
<td>Report files in different formats</td>
</tr>
<tr>
<td>Hardware-Platform-Specification-Files</td>
<td>*.hdf</td>
<td>Exported Vivado Hardware Specification for SDK/HSI and PetaLinux</td>
</tr>
<tr>
<td>LabTools Project-File</td>
<td>*.lpr</td>
<td>Vivado Labtools Project File</td>
</tr>
<tr>
<td>Software-Application-File</td>
<td>*.elf</td>
<td>Software Application for Zynq or MicroBlaze Processor Systems</td>
</tr>
</tbody>
</table>
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:

- TE0807 Test Board
# 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:
- Vivado/SDK/SDSoC/XilinxSoftware-BasicUserGuides
- Vivado Projects
- 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 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 for minimum setup
3. (optional Win OS) Generate Virtual Drive or use short directory for the reference design (for example x:\<design name>)
4. Create Project
   a. 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**
   
   Use Board Part Files, which **did not** contains with *_tebf0808
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. Generate Programming Files with HSI/SDK
   a. Run on Vivado TCL: `TE::sw_run_hsi`
      Note: Scripts generate applications and bootable files, which are defined in "sw_lib\apps_list.csv"
   b. (alternative) Start SDK with Vivado GUI or start with TE Scripts on Vivado TCL: `TE::sw_run_sdk`
      Note: See SDK Projects
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](http://www.trenz-electronic.de)

**QSPI**

1. Select JTAG as Boot Mode (see Carrier Description and ZynqMP TRM)
2. Connect JTAG to Host PC
3. Power On
4. Open Vivado Hardware Manager with Auto Connect
5. Right Click to FPGA Device XCU... and select Add Configuration Memory Device
   a. Select correct Flash Typ (see schematics or FPGAFLASH_TYP on test_board/board_files/TE0808_board_files.csv)
6. Open Program Configuration Memory Device
   a. Configuration file: test_board/prebuilt/boot_image/<short dir>/hello_te0803/Boot.bin
   b. Zynq FSBL: test_board/prebuilt/software/<short dir>/zynqmp_fsbl.elf
   c. Program Device Flash

Use SDK instead of Vivado is also possible, see: [SDK Projects#Xilinx%22HelloWorld%22onZynqMP](http://www.trenz-electronic.de)

**SD**

This does not work, because SD controller is not selected on PS.

**JTAG**

Load configuration and Application with SDK Debugger into device, see:

- [SDK Projects](http://www.trenz-electronic.de)
- [SDK Projects#DebugSoftwareApplication](http://www.trenz-electronic.de)

**Usage**

QSPI Boot:

1. Prepare HW like described on section Programming
2. Connect UART USB (most cases same as JTAG)
3. Select QSPI Card as Boot Mode  
   Note: See TRM of the Carrier, which is used.

4. Power On PCB  
   Note: 1. ZynqMP Boot ROM loads PMU Firmware and FSBL from QSPI into OCM, 2. FSBL loads Application into DDR

Debugging:

- SDK Projects
- SDK Projects#DebugSoftwareApplication
System Design - Vivado

Block Design

PS Interfaces

Activated interfaces:

<table>
<thead>
<tr>
<th>Type</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR</td>
<td></td>
</tr>
<tr>
<td>QSPI</td>
<td>MIO</td>
</tr>
<tr>
<td>UART0</td>
<td>MIO, please select other one, if you have connected uart to second controller or other MIO</td>
</tr>
</tbody>
</table>

Constrains

Basic module constrains

```
_i_bitgen.xdc

set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
set_property BITSTREAM.CONFIGUNUSEDPULLNONE [current_design]
```

Design specific constrain

Not needed.
Software Design - SDK/HSI

For SDK project creation, follow instructions from:

SDK Projects

Application

FSBL
Xilinx default FSBL

Hello TE0803
Hello TE0803 is a Xilinx Hello World example as endless loop instead of one console output.
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.

<table>
<thead>
<tr>
<th>Date</th>
<th>Document Revision</th>
<th>Authors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-02-07</td>
<td>v.9</td>
<td>John Hartfiel</td>
<td>• Release 2017.2</td>
</tr>
<tr>
<td>All</td>
<td></td>
<td>John Hartfiel</td>
<td></td>
</tr>
</tbody>
</table>

Legal Notices

Data privacy

Please also note our data protection declaration at https://www.trenz-electronic.de/en/Data-protection-Privacy

Document Warranty

The material contained in this document is provided “as is” and is subject to being changed at any time without notice. Trenz Electronic does not warrant the accuracy and completeness of the materials in this document. Further, to the maximum extent permitted by applicable law, Trenz Electronic disclaims all warranties, either express or implied, with regard to this document and any information contained herein, including but not limited to the implied warranties of merchantability, fitness for a particular purpose or non infringement of intellectual property. Trenz Electronic shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein.

Limitation of Liability

In no event will Trenz Electronic, its suppliers, or other third parties mentioned in this document be liable for any damages whatsoever (including, without limitation, those resulting from lost profits, lost data or business interruption) arising out of the use, inability to use, or the results of use of this document, any documents linked to this document, or the materials or information contained at any or all such documents. If your use of the materials or information from this document results in the need for servicing, repair or correction of equipment or data, you assume all costs thereof.
Copyright Notice

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Trenz Electronic.

Technology Licenses

The hardware / firmware / software described in this document are furnished under a license and may be used / modified / copied only in accordance with the terms of such license.

Environmental Protection

To confront directly with the responsibility toward the environment, the global community and eventually also oneself. Such a resolution should be integral part not only of everybody's life. Also enterprises shall be conscious of their social responsibility and contribute to the preservation of our common living space. That is why Trenz Electronic invests in the protection of our Environment.
REACH, RoHS and WEEE

REACH

Trenz Electronic is a manufacturer and a distributor of electronic products. It is therefore a so called downstream user in the sense of REACH. The products we supply to you are solely non-chemical products (goods). Moreover and under normal and reasonably foreseeable circumstances of application, the goods supplied to you shall not release any substance. For that, Trenz Electronic is obliged to neither register nor to provide safety data sheet. According to present knowledge and to best of our knowledge, no SVHC (Substances of Very High Concern) on the Candidate List are contained in our products. Furthermore, we will immediately and unsolicited inform our customers in compliance with REACH - Article 33 if any substance present in our goods (above a concentration of 0,1 % weight by weight) will be classified as SVHC by the European Chemicals Agency (ECHA).

RoHS

Trenz Electronic GmbH herewith declares that all its products are developed, manufactured and distributed RoHS compliant.

WEEE


Users of electrical and electronic equipment in private households are required not to dispose of waste electrical and electronic equipment as unsorted municipal waste and to collect such waste electrical and electronic equipment separately. By the 13 August 2005, Member States shall have ensured that systems are set up allowing final holders and distributors to return waste electrical and electronic equipment at least free of charge. Member States shall ensure the availability and accessibility of the necessary collection facilities. Separate collection is the precondition to ensure specific treatment and recycling of waste electrical and electronic equipment and is necessary to achieve the chosen level of protection of human health and the environment in the European Union. Consumers have to actively contribute to the success of such collection and the return of waste electrical and electronic equipment. Presence of hazardous substances in electrical and electronic equipment results in potential effects on the environment and human health. The symbol consisting of the crossed-out wheeled bin indicates separate collection for waste electrical and electronic equipment.

Trenz Electronic is registered under WEEE-Reg.-Nr. DE97922676.

2018-09-18