TE0722 TRM

Table of Contents

- Overview
 - Key Features
 - Block Diagram
 - Main Components
 - Initial Delivery State
- Boot Process ٠
 - Signals, Interfaces and Pins
 - I/O Signals on Connectors Zynq SoC I/O Banks

 - JTAG Interface
 Quad SPI Interface
 - SD Card Interface

 - I²C Interface
 Default PS MIO Mapping
- On-board Peripherals Quad SPI Flash Memory
 - Proximity and Ambient Light Sensor
 - Oscillator
 - On-board LEDs
 - Connectors
- Power and Power-On Sequence
 - Power Supply

 - Power Consumption
 Power-On Sequence
 - Voltage Monitor Circuit
 - Power Rails
 - Bank Voltages
- Variants Currently in Production
- **Technical Specifications** ٠
- Absolute Maximum Ratings
 Recommended Operating Conditions
 - Physical Dimensions
- Revision History
 - Hardware Revision History
 - Document Change History
- Disclaimer
 - Data Privacy
 - Document Warranty
 - Limitation of Liability
 - Copyright Notice
 - Technology Licenses
 - Environmental Protection
 - REACH, RoHS and WEEE

Overview

The Trenz Electronic TE0722-02 is a DIPFORTy1 "Soft Propeller" based on the Xilinx Zynq-7000 SoC.

Key Features

- Xilinx Zynq XC7Z010 SoC
- Dual-core ARM A9+ (TE0722-02-07S-1C variant has single-core ARM A9+)
- 16 MByte Quad SPI Flash
- · Micro SD Card socket with card detect signal
- 34 I/Os on DIP40 header pins
- System status LED (DONE)
- RGB LED connected to PL I/O
- Green user LED connected to ARM CPU GPIO

- Proximity and ambient light sensor
- DIP40 form factor (size 18 x 51 mm)

Additional assembly options are available for cost or performance optimization upon request.

Block Diagram



Figure 1: TE022-02 block diagram.

Main Components



Figure 2: TE0722-02 PCB top side.



Figure 3: TE0722-02 PCB bottom side.

- 1. Xilinx Zynq XC7Z010 or Zynq XC7Z007S SoC, U1
- 2. Micro SD card socket with card detect, J8
- 3. Red LED, D3
- 4. Green LED, D2
- 5. Red LED, D6
- 6. 20-pin connector placeholder, P1
- 7. Red LED, D5
- 8. Proximity/ambient light sensor, U4
- 9. RGB LED, D4
- 10. Red LED, D1
- 11. 20-pin connector placeholder, P2
- 12. Ultra-low supply-current voltage monitor, U4
- 13. 2 x 5-pin connector placeholder, J1
- 14. 2 x 5-pin connector placeholder, J2
- 15. 2 x 5-pin connector placeholder, J3
- 16. 16 MByte QSPI Flash memory, U5
- 17. Low-power programmable oscillator @ 33.333333 MHz, U8
- 18. 1A PowerSoC DC-DC converter (1.0V), U2
- 19. 1A PowerSoC DC-DC converter (1.8V), U3

Initial Delivery State

Storage device name	Content	Notes
Quad SPI Flash	Empty	

Table 1: Initial delivery state of programmable devices on the module

Boot Process

The 7 boot mode strapping pins (MIO2 ... MIO8) of the Xiliny Zynq Z-7010 device are hardware programmed on the board. They are evaluated by the Zynq device soon after the 'POR_B'.signal is deasserted to begin the boot process (see section "Boot Mode Pin Settings" of Xilinx manual UG585).

The TE0722 FPGA board is hardware programmed to boot initially from the on-board QSPI Flash memory U5. The JTAG interface of the module is provided for storing the data to the QSPI Flash memory through the Zynq device.

Signals, Interfaces and Pins

I/O Signals on Connectors

Verview of the PL 1/O banks signals routed to the external connectors.					
Bank	Туре	Connector	I/O Signal Count	Voltage	Notes
34	HR	P1	8	3.3V	Signal Schematic names: 'P0' - 'P7'
34	HR	P2	8	3.3V	Signal Schematic names: 'P24' - 'P31'
34	HR	P2	10 single ended I/O's or 5 differential pairs	3.3V	-
34	HR	J1	6	3.3V	Signal Schematic names: 'X2A' - 'X2F'
34	HR	J2	2	3.3V	-
34	HR	J3	4	3.3V	Signal Schematic names: 'X1A' - 'X1D'
35	HR	P1	8 single ended I/O's or 4 differential pairs	3.3V	-

Overview of the PL I/O banks signals routed to the external connectors:

Table 2: Zynq SoC PL I/O signals overview

Zynq SoC I/O Banks

Bank	Туре	VCCIO	I/O Signal Count	Available on Connectors	Notes
34	HR	3.3V	41	38	38 user I/O's, 3 I/O's used for controlling the RGB LED D4.
35	HR	3.3V	8	8	8 single ended or 4 differential.
500	PS MIO	3.3V	7	-	$6~\mbox{MIO}$ pins used for QSPI flash memory interface, 1 MIO pin connected to green LED D2.
501	PS MIO	3.3V	10	-	7 MIO pins used for SD Card interface, 3 MIO pins connected to light sensor U4.
0	Config	3.3V	5	-	4 I/O's are dedicated to JTAG interface, 'DONE'-signal is indicated by red LED D6.

Table 3: General overview of Zynq SoC PL/PS I/O banks

JTAG Interface

JTAG access to the Xilinx ZYNQ XC7Z010 SoC is provided through J2 connector:

JTAG Signal	J2 Connector Pin
ТСК	4
TDI	9
TDO	10
TMS	8

Table 4: JTAG interface signals

Quad SPI Interface

Quad SPI Flash memory (U5) is connected to the Zynq SoC PS QSPI0 interface via PS MIO bank 500, pins MIO1 ... MIO6:

Zynq SoC's MIO-pin U5 Pin Signal Schematic Name

MIO1	1	SPI0-CS
MIO2	5	SPI0-DQ0/M0
MIO3	2	SPI0-DQ1/M1
MIO4	3	SPI0-DQ2/M2
MIO5	7	SPI0-DQ3/M3
MIO6	6	SPI0-SCK

Table 5: Quad SPI interface signals and connections

SD Card Interface

TE0722 board has on-board 3.3V SD Card socket (J8) with card detect switch wired to the Zynq SoC PS MIO bank 501, pins MIO28 .. MIO33 and MIO49.

Zynq SoC's MIO-pin	J8 pin	Signal Schematic Name
MIO28	J8-7	DAT0
MIO29	J8-3	CMD
MIO30	J8-5	CLK
MIO31	J8-8	DAT1
MIO32	J8-1	DAT2
MIO33	J8-2	CD/DAT3
MIO49	J8-G4	Card detect switch

Table 6: SD card interface signals

I²C Interface

I²C interface pins SCL and SDA from the Zynq SoC PS MIO-bank 501 (MIO36, MIO37) are connected to ambient / proximity light sensor (U4).

Zynq SoC's MIO-pin	U4 pin	Signal Schematic Name
MIO36	2	SCL
MIO37	1	SDA

 Table 7: Zynq SoC I²C interface signals

Default PS MIO Mapping

MIO-pin	Function	Connector to
MIO1	QSPI	QSPI flash memory, pin 1
MIO2	QSPI	QSPI flash memory, pin 5
MIO3	QSPI	QSPI flash memory, pin 2
MIO4	QSPI	QSPI flash memory, pin 7

MIO5	QSPI	QSPI flash memory, pin 3
MIO6	QSPI	QSPI flash memory, pin 6
MIO7	GPIO	Green LED D2
MIO28	SDIO	SD Card socket. pin J8-5
MIO29	SDIO	SD Card socket. pin J8-3
MIO30	SDIO	SD Card socket. pin J8-7
MIO31	SDIO	SD Card socket. pin J8-8
MIO32	SDIO	SD Card socket. pin J8-1
MIO33	SDIO	SD Card socket. pin J8-2
MIO36	I²C	Ambient / Proximity Light Sensor U4, pin 2
MIO37	I ² C	Ambient / Proximity Light Sensor U4, pin 1
MIO39	GPIO	Ambient / Proximity Light Sensor U4, Interrupt pin 4
MIO49	GPIO	SD Card socket card detect pin J8-G4

Table 8: Default mapping of Zynq PS MIO-bank pins

On-board Peripherals

Quad SPI Flash Memory

On-board QSPI flash memory (U5) is provided by Cypress Semiconductor Serial Flash Memory S25FL127SABMFV101 with 128 MBit (16 MByte) storage capacity. This non volatile memory is used to store initial configuration data. Besides initial configuration data, remaining free flash memory can be used for user application and data storage.

Proximity and Ambient Light Sensor

The TE0722-02 Zynq SoC board is equipped with the Si1143 infrared proximity and ambient light sensor. On-board three red LEDs D1, D3 and D5 are connected to the light sensor to use the proximity sensing functionality. For more details and how to configure and use this chip, refer to the Si1141/42/43 data sheet.

Oscillator

The Zynq SoC board one reference clocking signal as system clock provided by on-board oscillator U8:

Clock Source	Frequency	Clock Input Destination
SiTime SiT8008AI Oscillator, U8	33.333333 MHz	Zynq PS Bank 500, pin C7

Table 9: Clock sources overview

On-board LEDs

There are 6 LEDs fitted on the Zynq SoC board. The LEDs are user configurable to indicate for example any system status.

LED	Color	Connected to	Signal Schematic Name	Description and Notes
-----	-------	--------------	-----------------------	-----------------------

D1	Red	Light sensor U4, pin 6	-	Proximity sensing functionality of light sensor U4
D2	Green	Zynq PS bank 500	MIO7	user configurable
D3	Red	Light sensor U4, pin 9	-	Proximity sensing functionality of light sensor U4
D4	RGB	Zynq PL bank 34, pins J15, L14, K12	RGB_R, U1, RGB_G, U1, RGB_B, U1	user configurable
D5	Red	Light sensor U4, pin 7	-	Proximity sensing functionality of light sensor U4
D6	Green	Zynq config bank 0	DONE	Reflects inverted DONE signal. ON when FPGA is not configured, OFF as soon as PL configuration is finished.

Table 10: LEDs of the board

Connectors

All connectors are for 100mil (2.54mm pitch) headers, all connector locations are in 100mil grid. The module's PCB provides footprints to mount and solder optional pin headers, if those are not factory-fitted on module.

Power and Power-On Sequence

To power-up a module, power supply with minimum current capability of 1A is recommended.

Power Supply

TE0722-02 needs one single power supply with nominal of 3.3V at all variants. Following diagram shows the dependencies of the power supply:



Figure 4: Module power supply dependencies

Power Consumption

Board Variant	FPGA	Design	Typical Power, 25°C ambient
TE0722-02I	XC7Z010-1CLG225I	Not configured	TBD*
TE0722-02	XC7Z010-1CLG225C	Not configured	TBD*
TE0722-02-07S-1C	XC7Z007S-1CLG225C	Not configured	TBD*

Table 11: Module power consumption

*TBD - To Be Determined.

The maximum power consumption of the module mainly depends on the design running on the Zynq SoC's FPGA and ambient temperature.

Xilinx provide a power estimator excel sheets to calculate power consumption. It is also possible to evaluate the power consumption of the developed design with Vivado. See also Trenz Electronic Wiki FAQ.

Power-On Sequence

There is no specific or special power-on sequence, single power source is needed as 3.3V as power supply voltage.

Voltage Monitor Circuit

The voltages 1.0V (core voltage) and 3.3V are monitored by the voltage monitor circuit U6, which generates the POR_B reset signal at power-on. A manual reset is also possible by driving the connector pin P1-10 ('NRST') to GND. Leave this pin unconnected or connect to VDD (3.3V) when unused.



Figure 5: Voltage monitor circuit

Power Rails

Power Rail Name	J1 Pins	J2 Pins	J3 Pins	P1 Pin	P2 Pin	Direction	Notes
3.3V	5, 6	5, 6	5, 6	12	12	Input	3.3V power supply voltage

Table 12: Board power rails

Bank Voltages

Bank	Bank I/O Voltage VCCO	Voltage Range
0 (config)	3.3V	fixed
500 (MIO)	3.3V	fixed
501 (MIO)	3.3V	fixed
34 (HR)	3.3V	fixed
35 (HR)	3.3V	fixed

Table 13: Board bank voltages

Variants Currently in Production

Board Variant	Xilinx Zynq SoC	ARM Cores	PL Cells	LUTs	Flip- Flops	Block RAM	DSP Slices	Zynq SoC Operating Temp.	Temp. Range
TE0722-02I	XC7Z010-1CLG225I	A9+ Dual-core	28K	17,6K	35,2K	2.1 MBytes	80	-40°C to +100°C	Industrial

TE0722-02	XC7Z010-1CLG225C	A9+ Dual-core	28K	17,6K	35,2K	2.1 MBytes	80	0°C to +85°C	Commercial
TE0722-02-07S- 1C	XC7Z007S- 1CLG225C	A9+ Single- core	23K	14,4K	28,8K	1.8 MBytes	66	0°C to +85°C	Commercial

Table 14: Board variants

Technical Specifications

Absolute Maximum Ratings

Parameter	Min	Мах	Units	Reference Document
3.3 supply voltage	-0.3	3.6	V	EN5311QI datasheet / Xilinx datasheet DS187
HR PL I/O banks input voltage (VCCIO single ended)	-0.4	VCCO + 0.55	V	Xilinx datasheet DS187 (VCCO 3.3V nominal)
Storage temperature	-40	+85	°C	Silicon Labs Si1141/42/43 datasheet.

Table 15: Board absolute maximum ratings

Recommended Operating Conditions

Parameter	Min	Max	Units	Reference Document
3.3 supply voltage	3.3	3.465	V	Xilinx datasheet DS187
HR PL I/O banks input voltage (VCCIO single ended)	-0.20	VCCO + 0.20	V	Xilinx datasheet DS187 (VCCO 3.3V nominal)
Operating Temperature Commercial (Variant TE0722-02 and TE0722-02-07S-1C)	0	+85	°C	Xilinx datasheet DS190
Operating Temperature Industrial (Variant TE0722-02I)	-40	+85		Xilinx datasheet DS190

Table 16: Board recommended operating condition

Please check Xilinx datasheet DS187 for complete list of absolute maximum and recommended operating ratings for the Zynq-7 device.

Physical Dimensions

- Module size: 17.9 mm x 51 mm. Please download the assembly diagram for exact numbers.
- PCB thickness: 1.65 mm.
- Highest part on PCB approx. 4 mm. Please download the step model for exact numbers.

All dimensions are given in millimeters.



Figure 6: Board physical dimensions

Revision History

Hardware Revision History

Date	Revision	Notes	PCN	Documentation Link
-	02	-	-	TE0722-02
-	01	First production release	-	-

Table 17: Board hardware revision history

Hardware revision number is printed on the PCB board together with the module model number separated by the dash.



Figure 7: TE0722 module hardware revision number

Document Change History

Date	Revision	Contributors	Description



Table 18: Document change history

Disclaimer

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

Information for users within the European Union in accordance with Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (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.

Error rendering macro 'page-info'

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]