



TE0701 TRM

Revision v.80

Exported on 2021-02-25

Online version of this document:

<https://wiki.trenz-electronic.de/display/PD/TE0701+TRM>

1 Table of Contents

1	Table of Contents	2
2	Table of Figures	4
3	Table of Tables	5
4	Overview	6
4.1	Key Features	6
4.2	Block Diagram	6
4.3	Main Components	8
4.4	Initial Delivery State	9
4.5	Control Signals	9
5	Signals, Interfaces and Pins	11
5.1	FMC LPC Connector	11
5.2	ARM JTAG Connector	12
5.3	Mini-USB2 B Connector	13
5.4	Micro-USB2 Connector	13
5.5	MMC/SD-Card Socket	14
5.6	RJ45 - Ethernet	15
5.7	Mini CameraLink Connector	16
5.8	HDMI Connector	16
5.9	Pmod Connectors	17
6	On-board Peripherals	21
6.1	System Controller CPLD	21
6.2	FTDI FT2232H	25
6.3	SDIO Port Expander	26
6.4	HDMI Transmitter and Protection Circuit	28
6.5	Configuration DIP-switches	29
6.6	Push Buttons	31
6.7	On-board LEDs	31
6.8	Oscillators	32
7	Power and Power-On Sequence	33
7.1	Power Consumption	33
7.2	Power Distribution Dependencies	33
7.3	Power-On Sequence	34
7.4	Configuring mounted SoM's PL bank VCCO FMC_VADJ	34
7.5	Configuring 12V Power Supply Pin on the CameraLink Connector	35
7.6	Summary of VCCIO configuration via jumpers	35

7.7	Power Rails	38
8	Board to Board Connectors	42
8.1	Connector Mating height	42
8.2	Connector Speed Ratings	43
8.3	Current Rating	43
8.4	Connector Mechanical Ratings	43
9	Technical Specifications	44
9.1	Absolute Maximum Ratings	44
9.2	Recommended Operating Conditions	44
9.3	Physical Dimensions	45
10	Variants Currently In Production	46
11	Revision History	47
11.1	Hardware Revision History	47
11.2	Document Change History	48
12	Disclaimer	50
12.1	Data Privacy	50
12.2	Document Warranty	50
12.3	Limitation of Liability	50
12.4	Copyright Notice	50
12.5	Technology Licenses	50
12.6	Environmental Protection	50
12.7	REACH, RoHS and WEEE	50

2 Table of Figures

Figure 1: TE0701-06 block diagram	7
Figure 2: TE0701-06 main components.....	8
Figure 3: JTAG/UART interface	13
Figure 4: TE0701 MicroUSB2 interface configuration.....	14
Figure 5: Power Distribution	34
Figure 6: Power Sequency.....	35
Figure 7: VCCIO jumper pin location (PCB-REV06), top view	38
Figure 8: Physical dimensions drawing.....	46
Figure 9: Hardware Revision Number	48

3 Table of Tables

Table 1: Initial delivery state of programmable devices on the board.....	9
Table 2: TE0701 Control Signals.....	9
Table 3: FMC connector J10 interface	11
Table 4: ARM JTAG connector signals and pins	12
Table 5: SD/MMC Card socket signals and pins	14
Table 6: RJ45 Ethernet MagJack signals and pins.....	16
Table 7: Mini CameraLink singals and pins.....	17
Table 8: HDMI connector signals and pins	18
Table 9: Pmod connectors pin description.....	19
Table 10: System Controller CPLD I/O pins.....	21
Table 11: FT2232H interface connections.....	27
Table 12: TI TXS02612 interface description.....	28
Table 13: HDMI transmitter signals and interface	29
Table 14: DIP-switches functionality description	30
Table 15: On-board Push Buttons	32
Table 16: On-board LEDs description	31
Table 17: On-board oscillators	33
Table 18: Configuring FMC_VADJ	35
Table 19: Baseboard supply-voltages VIOTA and VIOTB.....	36
Table 20: Configuration of baseboard supply-voltages via jumpers.....	36
Table 21: Power pin description of B2B Module Connector	38
Table 22: Power pin description of FMC connector.....	39
Table 23: Power pin description of Pmod connectors	39
Table 24: Power pin description of main power supply connectors	39
Table 25: Power pin description of peripherals' connectors.....	39
Table 26: Power Pin description of VCCIO selection jumpers.....	40
Table 27: Connectors.	43
Table 28: Speed rating.	44
Table 29: Module absolute maximum ratings	45
Table 30: Recommended Operating Conditions	45
Table 31: Trenz Electronic Shop Overview	46
Table 32: Hardware Revision History	47
Table 33: Document change history	48

4 Overview

The Trenz Electronic TE0701 Carrier Board is a baseboard for 4 x 5 SoMs, which exposes the module's B2B connector pins to accessible connectors and provides a whole range of on-board components to test and evaluate TE 4 x 5 SoMs.

See page "[4 x 5 cm carriers](#)¹" to get information about the SoMs supported by the TE0701 carrier board.

Refer to <http://trenz.org/te0701-info> for the current online version of this manual and other available documentation.

4.1 Key Features

- Barrel jack for 12V power supply
- Overvoltage-, undervoltage- and reversed- supply-voltage-protection
- System Controller CPLD Lattice MachXO2 1200HC
- ARM JTAG interface connector
- Mini Camera Link
- RJ45 Gigabit Ethernet MagJack
- Low pin count FPGA Mezzanine Card (FMC LPC) connector
- USB JTAG and UART interface (FTDI FT2232HQ) with Mini-USB connector
- ADV7511 HDMI transmitter with HDMI connector
- 8 x red user LEDs
- 2 x user push-button
- 2 x 4-bit DIP switch for baseboard configuration
- Pmod connectors
- Micro SD card socket
- Micro-USB interface (device, host or OTG modes)
- Trenz Electronic 4 x 5 modules high-speed connector strips (3x Samtec LSHM series connectors)

4.2 Block Diagram

¹ <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

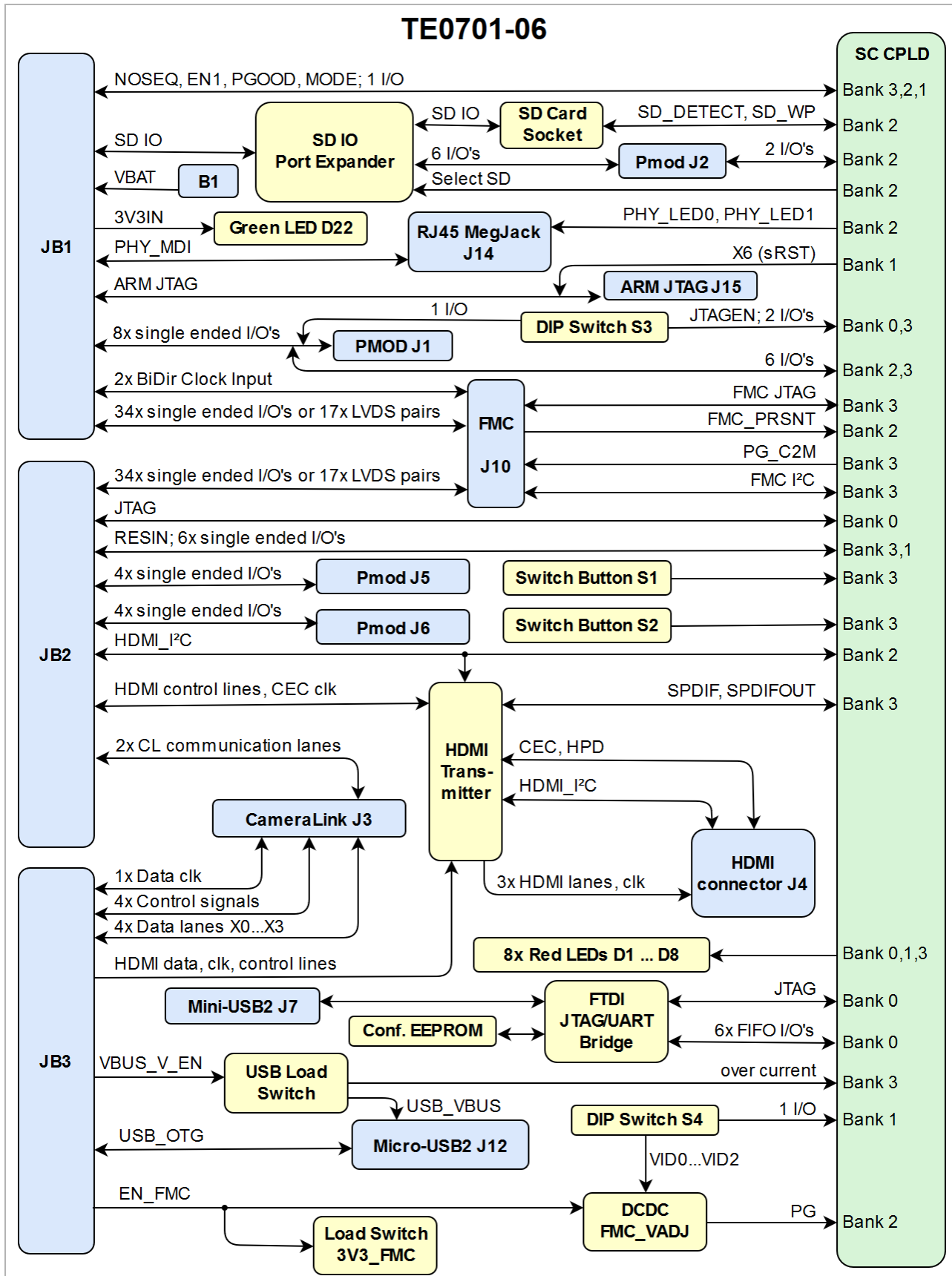


Figure 1: TE0701-06 block diagram

4.3 Main Components

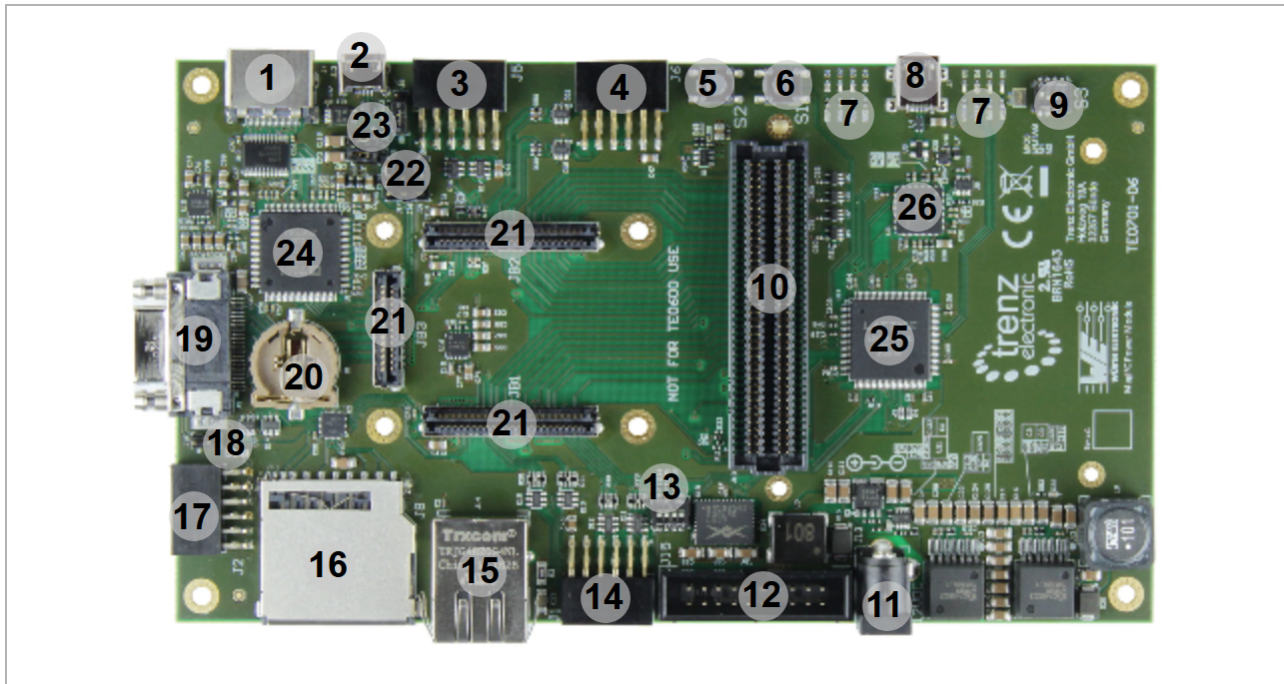


Figure 2: TE0701-06 main components

1. HDMI connector (1.4 HEAC support), J4
2. Micro-USB2 connector, J12
3. Pmod connector, J5
4. Pmod connector, J6
5. User push-button ("RESTART" button by default), S2
6. User push-button ("RESET" button by default), S1
7. 8x red user LEDs, D1 ... D8
8. Mini-USB2 connector, J7
9. User 4-bit DIP switch, S3
10. VITA 57.1 compliant LPC FMC connector, J10
11. Barrel jack for 12V power supply, J13
12. ARM JTAG connector (DS-5 D-Stream), J15, functionality depends on module
13. User 4-bit DIP switch, S4
14. Pmod connector, J1
15. RJ45 Gigabit Ethernet connector, J14
16. SD Card connector, J8
17. Pmod connector, J2
18. Jumper, J18
19. Mini CameraLink connector, J3
20. CR1220 Backup-Battery holder, B1
21. Trenz Electronic 4 x 5 modules B2B connectors, JB1 ... JB3
22. Jumper J16, J17, J21
23. Jumper J9, J19, J20
24. Analog Devices ADV7511 HDMI Transmitter, U1
25. Lattice Semiconductor MachXO2 1200 HC System Controller CPLD, U14
26. FTDI FT232RL USB2 to JTAG/UART Bridge, U3

4.4 Initial Delivery State

Storage device name	Content	Notes
FTDI chip configuration EEPROM U9 (ST M93C66)	Xilinx License	Do not overwrite, see warning in related section
System Controller CPLD U14	SC CPLD Firmware	-

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

4.5 Control Signals

To get started with TE0701 board, some basic control signals are essential and are described in the following table:

Control signal	Switch / Button / LED / Pin	Signal Schematic Names	Connected to	Functionality	Notes
SC CPLD JTAG Enable	DIP switch S3-3	JTAGEN	SC CPLD U14, pin 82	ON: SC CPLD JTAG enabled, OFF: FPGA JTAG enabled	-
BOOT MODE	SC CPLD U14, pin 27	MODE	B2B JB1, pin 31	Boot Mode for attached module (Flash or SD)	-
Module Reset	SC CPLD U14, pin 13	RESIN	B2B JB2, pin 17	Module Reset	-
Global Reset input	Push Button S2	S2	SC CPLD U14, pin 2	Manual reset from user	-
SD Card detection	SD Slot J8, pin 10	SD_DETECT	SC CPLD U14, pin 40	Detection Signal for inserted SD Card	Boot mode is set to SD Boot, when SD Card is detected.

Control signal	Switch / Button / LED / Pin	Signal Schematic Names	Connected to	Functionality	Notes
Board status indicators	Red LEDs D1 ... D8	ULED1 ... ULED8	SC CPLD U14, pins 78, 77, 76, 16, 69, 68, 65, 64	indicating various board and module status / configuration	Refer to the firmware documentation of the SC CPLD² U14 and to the subsection 'LEDs' in section 'On-board Peripherals' for more details and current functionality.
Board 3.3V power indicator	Green LED D22	3V3IN	B2B JB1, pin 14, 16	ON: 3.3V on-board voltage available	-
FMC_VADJ voltage selection	DIP switches S4-1, S4-2, S4-3	VID0 ... VID2	SC CPLD U14, pins 34, 35, 38	sets adjustable voltage for FMC connector	-
I ² C control / FMC_VADJ voltage selection	DIP switches S3-2, S3-1	CM0, CM1	SC CPLD U14, pins 99, 1	enabling / disabling I ² C control of board functionalities, sets FMC_VADJ voltage (only 3 steps), available to user if FMC_VADJ set by DIP-switch S4	Refer to the firmware documentation of the SC CPLD³ U14 and to the subsection 'DIP switches' in section 'On-board Peripherals' for current functionality and more details.

Table 2: TE0701 Control Signals
² <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>
³ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

5 Signals, Interfaces and Pins

5.1 FMC LPC Connector

I/O signals and interfaces connected to the FPGA SoCs I/O bank and FMC connector J10:

FMC Connector J2 Pins and Interfaces	I/O Signal Count	LVDS-pairs count	Connected to	VCCIO voltage	Notes
I/O	34	17	B2B JB1 connector	FMC_VAD J / 3V3_FMC	pins usable as single ended I/O's and LVDS pairs
	34	17	B2B JB2 connector	FMC_VAD J / 3V3_FMC	
I ² C	2	-	SC CPLD U14, pin 8, 10	-	FMC I ² C Geographical Address pins GA0 and GA1 set to GND.
JTAG	4	-	SC CPLD U14, pin 4, 7, 9, 12	3.3V	-
Clock Input	-	2	B2B JB1 connector	-	2x bidirectional reference clock inputs
Control Signals	2	-	SC CPLD U14, pin 20, 28	-	'PG_C2M', 'FMC_PRSENT'
Reference voltage (FMC_VREF)	1	-	B2B JB1 connector, pin 85, 97 B2B JB2 connector, pin 37, 93	-	FMC sets thresholds of attached module's reference voltage (VREF pins).

Table 3: FMC connector J10 interface

5.2 ARM JTAG Connector

The TE0701 baseboard offers the ARM JTAG 20-pin connector (2.54mm pitch). It can be used in standard JTAG or Serial Wire Debug (SWD) mode.

The following table contains the ARM JTAG connector pinout:

Connector J15 pin	Schematic Name	Connected to	Notes
1, VTREF	FMC_VADJ	DCDC U18	Voltage Target Reference
2, not connected	-	-	-
3, NTRST	X0	B2B JB1, pin 32	active low Test Reset
4, GND	-	-	-
5, TDI	X1	B2B JB1, pin 34	Test Data In
6, GND	-	-	-
7, TMS / SWDIO	X2	B2B JB1, pin 36	Test Mode Select
8, GND	-	-	-
9, TCK / SWCLK	X3	B2B JB1, pin 38	Test Clock
10, GND	-	-	-
11, RTCK	X4	B2B JB1, pin 42	Return Test Clock
12, GND	-	-	-
13, TDO / SWO	X5	B2B JB1, pin 44	Test Data Out
14, not connected	-	-	-
15, sRST	X6	B2B JB1, pin 99	active low System Test Reset
16, not connected	-	-	-
17, not connected	-	-	-
18, GND	-	-	-

Connector J15 pin	Schematic Name	Connected to	Notes
19, not connected	-	-	-
20, GND	-	-	-

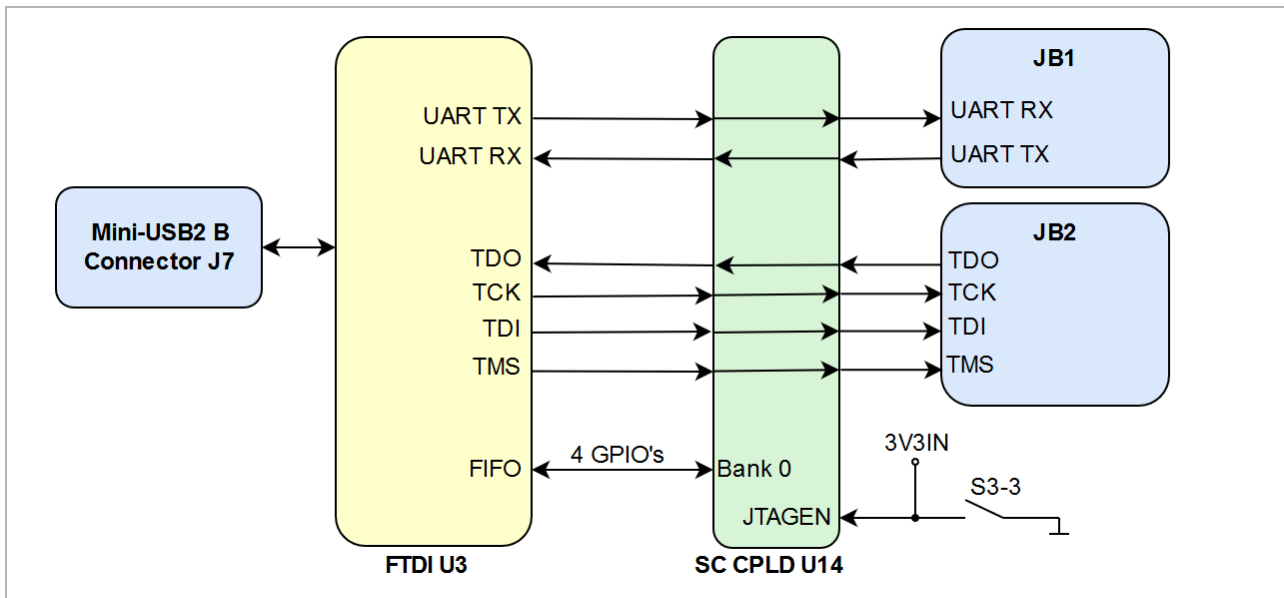
Table 4: ARM JTAG connector signals and pins

5.3 Mini-USB2 B Connector

Mini-USB2 interface provides access to UART and JTAG functions via FTDI FT2232 chip. The signals are forwarded to the B2B connectors via SC CPLD U14. 4 additional I/O's connected to the SC CPLD are available to the user.

JTAG access to the System Controller CPLD and attached module is provided via mini-USB JTAG interface J7 (FTDI FT2232H) and controlled by DIP switch S3-3.

The JTAG port of the System Controller CPLD is enabled by setting switch S3-3 JTAGEN to the OFF position.


Figure 3: JTAG/UART interface

5.4 Micro-USB2 Connector

The TE0701 carrier board can be configured as a USB host. Hence, it must provide from 5.25V to 4.75V to the board side of the downstream connection (micro-USB port on J12). To provide sufficient power, a TPS2051 power distribution switch is located on the carrier board in between the 5V power supply and the VBUS signal of the USB downstream port interface. If the output load exceeds the current-limit threshold, the TPS2051 limits the output current and pulls the over-current logic output (OC_n) low, which is routed to the on-board CPLD. The TPS2051 is put into operation by setting J19 CLOSED. J20 provides an extra 200µF decoupling capacitor (in addition to 10µF) to further stabilize the output signal. Moreover, a series terminating resistor of either 10K (J9: **1-2**, 3) or 1K (J9: 1, **2-3**) is selectable on the "USB-VBUS" signal. Both signals, USB-VBUS and VBUS_V_EN (that enables the TPS2051 on "high") are routed (as well as the corresponding D+/- data lines) via the on-board connector directly to the USB 2.0 high-speed transceiver PHY of the mounted SoM. In summary, the default jumper settings are the following: J9: **1-2**, 3 (10K series terminating resistor); J19: CLOSED (TPS2051 in operation); J20: CLOSED (200 µF added).

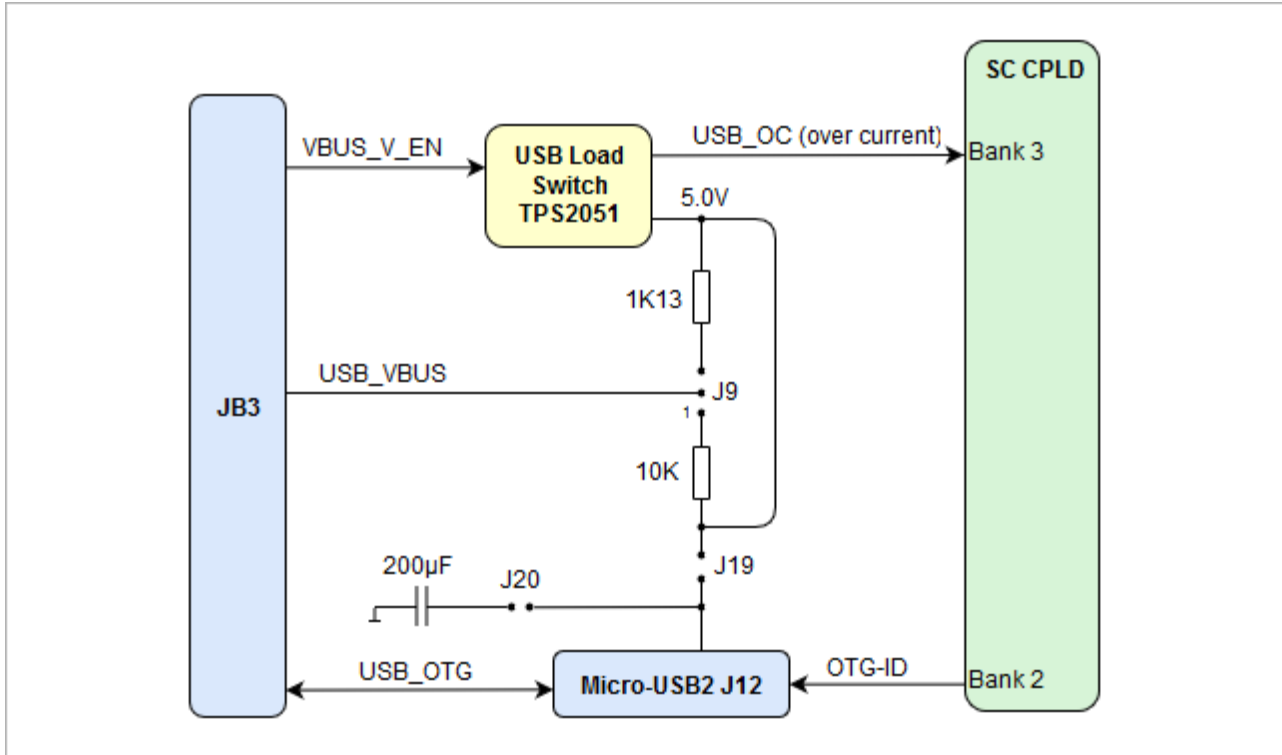


Figure 4: TE0701 MicroUSB2 interface configuration

5.5 MMC/SD-Card Socket

MMC/SD-Card socket is not directly wired to the B2B connector pins, but through a Texas Instruments TXS02612 SDIO Port Expander, which is needed for voltage translation due to different voltage levels of the Micro SD Card and MIO-bank of the Xilinx Zynq module. The Micro SD Card has 3.3V signal voltage level, but the MIO-bank on the Xilinx Zynq module has VCCIO of 1.8V.

With SD_SEL signal connected to the Texas Instruments TXS02612 SDIO Port Expander user can choose which port is accessible. Port B0 of SDIO Port Expander is connected to the Micro SD Card connector and B1 is connected to the Pmod J2 connector. SEL_SD signal can be controlled by the System Controller CPLD firmware.

Connector J8 pin	Signal Schematic Name	Muxed to signal on Port Expander	Connected to	Notes
1, DAT3	DAT3/CS	SD_DAT3	B2B JB1, pin 18	-
2, CMD	CMD/MOSI	SD_CMD	B2B JB1, pin 26	-
5, CLK	S_CLK	SD_CLK	B2B JB1, pin 28	-
7, DAT0	DAT0/MISO	SD_DAT0	B2B JB1, pin 24	-

Connector J8 pin	Signal Schematic Name	Muxed to signal on Port Expander	Connected to	Notes
8, DAT1	DAT1	SD_DAT1	B2B JB1, pin 22	-
9, DAT2	DAT2	SD_DAT2	B2B JB1, pin 20	-
10, CD	SD_DETECT	-	SC CPLD U14, pin 40	Card Detect
11, WP	SD_WP	-	SC CPLD U14, pin 41	Write Protect

Table 5: SD/MMC Card socket signals and pins

5.6 RJ45 - Ethernet

The TE0701 Carrier Board has a RJ45 Gigabit Ethernet MagJack (J14) with two LEDs. On-board Ethernet MagJack J14 pins are routed to B2B connector JB1 via MDI. The center tap of the magnetics is not connected to module's B2B connector. PHY LEDs are not connected directly to the module's B2B connectors as the 4 x 5 module have no dedicated PHY LED pins assigned. PHY LEDs are connected to the TE0701 System Controller CPLD and can be routed to some of the module's I/O pins with firmware.

See documentation of the [TE0701 System Controller CPLD⁴](#) to get information of the function of the PHY LEDs.

RJ45 MagJack J14 pin	Signal Schematic Name	Connected to	Notes
LED1	PHY_LED1	SC CPLD U14, pin 42	Yellow
LED2	PHY_LED2	SC CPLD U14, pin 43	Green
PHY_MDI	PHY_MDI0_P	B2B JB1, pin 3	-
	PHY_MDI0_N	B2B JB1, pin 5	-
	PHY_MDI1_P	B2B JB1, pin 9	-
	PHY_MDI1_N	B2B JB1, pin 11	-
	PHY_MDI2_P	B2B JB1, pin 15	-
	PHY_MDI2_N	B2B JB1, pin 17	-
	PHY_MDI3_P	B2B JB1, pin 21	-

⁴ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

RJ45 MagJack J14 pin	Signal Schematic Name	Connected to	Notes
	PHY_MDI3_N	B2B JB1, pin 23	-

Table 6: RJ45 Ethernet MagJack signals and pins

5.7 Mini CameraLink Connector

The TE0701 board provides the high speed CameraLink interface for visual input. The CameraLink is connected with 11 LVDS-pairs to the B2B connectors JB2 and JB3 which create data receive and control lanes.

CameraLink J3 pin	Signal Schematic Name	Connected to	Notes
Pin 20, 7	CL_TC_P / CL_TC_N	B2B JB2, Pin 12, 14	Communication lanes
Pin 6, 19	CL_TFG_P / CL_TFG_N	B2B JB2, Pin 16, 18	
Pin 9, 22	CL_CLK_P / CL_CLK_N	B2B JB3, Pin 31, 33	Data clock
Pin 18, 5	CL_CC1_P / CL_CC1_N	B2B JB3, Pin 26, 28	Control lanes
Pin 17, 4	CL_CC2_P / CL_CC2_N	B2B JB3, Pin 20, 22	
Pin 16, 3	CL_CC3_P / CL_CC3_N	B2B JB3, Pin 14, 16	
Pin 15, 2	CL_CC4_P / CL_CC4_N	B2B JB3, Pin 8, 10	
Pin 12, 25	CL_X0_P / CL_X0_N	B2B JB3, Pin 25, 27	Data lanes
Pin 11, 24	CL_X1_P / CL_X1_N	B2B JB3, Pin 19, 21	
Pin 10, 23	CL_X2_P / CL_X2_N	B2B JB3, Pin 13, 15	
Pin 8, 21	CL_X3_P / CL_X3_N	B2B JB3, Pin 7, 9	
Pin 1, 23	12V0_CL	12V Main Power supply (12V_LC)	filtered and protected supply voltage

Table 7: Mini CameraLink singals and pins

5.8 HDMI Connector

The TE0701 board provides a HDMI interface routed to the B2B connectors of the the Zynq module. The HDMI interface is created by the HDMI transmitter ADV7511 provided by Analog Devices. The HDMI transmitter is incorporated in conjunction with the HDMI protection circuit TI TPD12S016 for more signal robustness.

HDMI connector J4 pin	Signal Schematic Name	Connected to	Notes
Pin 1, 3	HDMI_TX2_P / HDMI_TX2_N	HDMI transmitter, Pin 43, 42	also connected to HDMI protection circuit
Pin 4, 6	HDMI_TX1_P / HDMI_TX1_N	HDMI transmitter, Pin 40, 29	also connected to HDMI protection circuit
Pin 7, 9	HDMI_TX0_P / HDMI_TX0_N	HDMI transmitter, Pin 36, 35	also connected to HDMI protection circuit
Pin 10, 12	HDMI_TXC_P / HDMI_TXC_N	HDMI transmitter, Pin 33, 32	also connected to HDMI protection circuit
Pin 13	CEC_B	HDMI transmitter, Pin 48	HDMI CEC, wired through HDMI protection circuit
Pin 15	SCL_B	HDMI transmitter, Pin 53	HDMI I ² C clock line, wired through HDMI protection circuit
Pin 16	SDA_B	HDMI transmitter, Pin 54	HDMI I ² C data line, wired through HDMI protection circuit
Pin 19	HPD_B	HDMI transmitter, Pin 30	Hot Plug Detect, wired through HDMI protection circuit
Pin 18	5V_HDMI	HDMI protection circuit, Pin 13	5V supply voltage, wired through HDMI protection circuit

Table 8: HDMI connector signals and pins

5.9 Pmod Connectors

The TE0701 board offers 4 Pmod (2x6 pins, SMT, right angle) connectors which provides as a standard modular interface I/O pins and MGT lanes for use with extension modules.

The connectors support single ended and differential signaling as the I/O's are routed from the B2B connectors of the attached module as LVDS-pairs to the Pmod connectors.

Following table gives an overview of the Pmod connectors and the signals routed to the attached module and to the System Controller CPLD U14:

Pmod connector J1 pin	Signal Schematic Name	Connected to	Notes
1	MIO0	B2B connector JB1, pin 88; DIP switch S3-4	-
2	MIO9	B2B connector JB1, pin 92	-
3	MIO14	B2B connector JB1, pin 91; SC CPLD U14, pin 37	-
4	MIO15	B2B connector JB1, pin 86; SC CPLD U14, pin 18	-
7	MIO13	B2B connector JB1, pin 98; SC CPLD U14, pin 30	-
8	MIO10	B2B connector JB1, pin 96; SC CPLD U14, pin 29	-
9	MIO11	B2B connector JB1, pin 94; SC CPLD U14, pin 19	-
10	MIO12	B2B connector JB1, pin 100; SC CPLD U14, pin 36	-
Pmod connector J2 pin	Signal Schematic Name	Connected to	Notes
1	PX3	SDIO Port Expander U2, pin 10	muxed to signal 'SD_DAT3' (B2B JB1, pin 18)
2	PX4	SDIO Port Expander U2, pin 12	muxed to signal 'SD_CMD' (B2B JB1, pin 26)
3	PX0	SDIO Port Expander U2, pin 14	muxed to signal 'SD_DAT0' (B2B JB1, pin 24)
4	PX5	SDIO Port Expander U2, pin 13	muxed to signal 'SD_CLK' (B2B JB1, pin 28)

7	PX1	SDIO Port Expander U2, pin 15	muxed to signal 'SD_DAT1' (B2B JB1, pin 22)
8	PX2	SDIO Port Expander U2, pin 8	muxed to signal 'SD_DAT2' (B2B JB1, pin 20)
9	PX6	SC CPLD U14, pin 49	-
10	PX7	SC CPLD U14, pin 48	-
Pmod connector J5 pin	Signal Schematic Name	Connected to	Notes
1	PA1_P	B2B connector JB2, pin 27	usable as LVDS pair
2	PA1_N	B2B connector JB2, pin 25	
3	PA2_P	B2B connector JB2, pin 26	usable as LVDS pair
4	PA2_N	B2B connector JB2, pin 28	
7	PA0_P	B2B connector JB2, pin 23	usable as LVDS pair
8	PA0_N	B2B connector JB2, pin 21	
9	PA3_P	B2B connector JB2, pin 22	usable as LVDS pair
10	PA3_N	B2B connector JB2, pin 24	
Pmod connector J6 pin	Signal Schematic Name	Connected to	Notes
1	PB2_N	B2B connector JB2, pin 51	usable as LVDS pair
2	PB2_P	B2B connector JB2, pin 53	
3	PB0_N	B2B connector JB2, pin 33	usable as LVDS pair
4	PB0_P	B2B connector JB2, pin 31	
7	PB3_N	B2B connector JB2, pin 47	usable as LVDS pair
8	PB3_P	B2B connector JB2, pin 45	

9	PB1_N	B2B connector JB2, pin 43	usable as LVDS pair
10	PB1_P	B2B connector JB2, pin 41	

Table 9: Pmod connectors pin description

i J5 and J6 are incompatible with dual PMODs, because they have different PMOD connector offset and variable (different) VCCIO voltage.

6 On-board Peripherals

6.1 System Controller CPLD

The System Controller CPLD (U14) is provided by Lattice Semiconductor LCMXO2-1200HC (MachXO2 Product Family). The SC-CPLD is the central system management unit where essential control signals are logically linked by the implemented logic in CPLD firmware, which generates output signals to control the system, the on-board peripherals and the interfaces. Interfaces like JTAG / UART and I²C between the on-board peripherals and the attached module are by-passed, forwarded and controlled by the System Controller CPLD.

Other tasks of the System Controller CPLD are the monitoring of the power-on sequence and the programming state of the attached module.

For detailed information, refer to [the firmware documentation of the SC CPLD](#)⁵. Table below lists the SC CPLD I/O signals and pins:

SC CPLD U14 Pins and Interfaces	Connected to	Function	Notes
FMC_TMS	FMC J10, pin D31	FMC JTAG	-
FMC_TDI	FMC J10, pin D29		
FMC_TDO	FMC J10, pin D30		
FMC_TCK	FMC J10, pin D33		
FMC_SDA	FMC J10, pin C31	FMC I ² C	-
FMC_SCL	FMC J10, pin C30		
PG_C2M	FMC J10, pin D1	FMC control signals	-
FMC_PRSNT	FMC J10, pin H2		
EN_FMC	DC-DC U18, Load switch Q1	FMC power control signals	-
POK_FMC	DC-DC U18		
S1	Pushbutton S1	available to user	-
S2	Pushbutton S2	Global Reset in standard configuration	-

⁵ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

SC CPLD U14 Pins and Interfaces	Connected to	Function	Notes
M_TDO	FTDI chip, pin 14 (ADBUS2)	SC CPLD JTAG interface activated if DIP switch S3-3 in OFF-position. Attached module JTAG interface activated if DIP switch S3-3 in ON-position.	-
M_TDI	FTDI chip, pin 13 (ADBUS1)		
M_TCK	FTDI chip, pin 12 (ADBUS0)		
M_TMS	FTDI chip, pin 15 (ADBUS3)		
JTAGEN	DIP switch S3-3		
C_TMS	B2B JB2, pin 94	Forwarded JTAG signals from FTDI chip, if DIP switch S3-3 in ON-position.	JTAG signals buffered with ICs U4, U6,U7, U8
C_TCK	B2B JB2, pin 100		
C_TDO	B2B JB2, pin 98		
C_TDI	B2B JB2, pin 96		
ADBUS4	FTDI chip, pin 17	FIFO / GPIO's available to user	-
ADBUS7	FTDI chip, pin 20		
ACBUS4	FTDI chip, pin 26		
ACBUS5	FTDI chip, pin 27		
BDBUS0	FTDI chip, pin 32	UART TX from FTDI (forwarded to MIO14)	UART signals connected to attached module
BDBUS1	FTDI chip, pin 33	UART RX to FTDI (forwarded from MIO15)	
EN1	B2B JB1, pin 27	SoM control signals, functionalities depend also on attached SoM's SC CPLD firmware.	-
NOSEQ	B2B JB1, pin 8		
PGOOD	B2B JB1, pin 29		
RESIN	B2B JB2, pin 17		
MODE	B2B JB1, pin 31		

SC CPLD U14 Pins and Interfaces	Connected to	Function	Notes
ULED1	Red LED D1	USER LEDs, refer to the current firmware documentation of the SC CPLD ⁶ .	-
ULED2	Red LED D2		
ULED3	Red LED D3		
ULED4	Red LED D4		
ULED5	Red LED D5		
ULED6	Red LED D6		
ULED7	Red LED D7		
ULED8	Red LED D8		
Y0	B2B JB2, pin 42	User I/O's between SC CPLD U14 and attached module	-
Y1	B2B JB2, pin 44		
Y2	B2B JB2, pin 90		
Y3	B2B JB2, pin 91		
Y4	B2B JB2, pin 99		
Y5	B2B JB2, pin 35		
Y6	B2B JB1, pin 87		
X6	B2B JB1, pin 99; ARM JTAG J15, pin 15	ARM JTAG sRST (active low System Test Reset)	-
PHY_LED1	RJ45 connector J14	Current indicating function depends on SC CPLD firmware.	-
PHY_LED2			
SEL_SD	SDIO port expander U2	Control signal to select Port B0 or B1.	-
SD_DETECT	SD/MMC Card socket J8, pin 10	Card Detect signal	-

⁶ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

SC CPLD U14 Pins and Interfaces	Connected to	Function	Notes
SD_WP	SD/MMC Card socket J8, pin 11	Write Protect signal	
HDMI_SCL	HDMI Transmitter U1, pin 55	HDMI transmitter 2-wire serial bus	-
HDMI_SDA	HDMI Transmitter U1, pin 56		
HDMI_SPDIFOUT	HDMI Transmitter U1, pin 46	Unidirectional HDMI S/PDIF lines	-
HDMI_SPDIF	HDMI Transmitter U1, pin 10		
CM0	DIP switch S3-2	Set FMC_VADJ "S3-1 S3-2: FMC_VADJ": OFF OFF : 1.8V OFF ON : 2.5V ON OFF : 2.2V ON ON : I2C control enabled	DIP switch S4-1, S4-2 and S4-3 have to be set to OFF if use DIP switches S3-1 and S3-2.
CM1	DIP switch S3-1		
CM2	DIP switch S4-4	depends on current SC CPLD firmware	-
VID0	DC-DC U18, pin 34; DIP switch S4-1	set bit pattern as "VID2 VID1 VID0: FMC_VADJ": 0 0 0 : 3.3V 0 0 1 : 2.5V 0 1 0 : 1.8V 0 1 1 : 1.5V 1 0 0 : 1.25V 1 0 1 : 1.2V 1 1 0 : 0.8V (not supported as VCCIO standard) 1 1 1 : Reserved	SC CPLD settings will be overridden by DIP switch S4, if one of them is set to one (OFF-position).
VID1	DC-DC U18, pin 33; DIP switch S4-2		
VID2	DC-DC U18, pin 32; DIP switch S4-3		
USB_OC	USB-VBUS Load Switch U11, pin 5	Indicates current threshold of USB devices exceeded.	low active logic

SC CPLD U14 Pins and Interfaces	Connected to	Function	Notes
MIO10	B2B JB1, pin 96; Pmod J1, pin 8	User I/O's between SC CPLD U14, attached module and Pmod connector J1.	-
MIO11	B2B JB1, pin 94; Pmod J1, pin 9		
MIO12	B2B JB1, pin 100; Pmod J1, pin 10		
MIO13	B2B JB1, pin 98; Pmod J1, pin 7		
MIO14	B2B JB1, pin 91; Pmod J1, pin 3	UART interface in standard SC CPLD firmware, else user I/O's.	
MIO15	B2B JB1, pin 86; Pmod J1, pin 4		
PX6	Pmod J2, pin 9	User I/O's of SC CPLD U14	-
PX7	Pmod J2, pin 10		
VCCIO0	3V3IN	VCCIO SC CPLD bank 0	-
VCCIO1	VIOTB	VCCIO SC CPLD bank 1	adjustable voltage, see section 'Power'
VCCIO2	3V3IN	VCCIO SC CPLD bank 2	-
VCCIO3	3V3IN	VCCIO SC CPLD bank 3	-

Table 10: System Controller CPLD I/O pins

6.2 FTDI FT2232H

The TE0701 board is equipped with the FTDI FT2232H USB2 to JTAG/UART adapter controller connected to the Mini-USB2 B connector J7 to provide JTAG and UART access to the attached module or to the SC CPLD U14 (switchable over DIP switch S3-3).

There is also a 256-byte configuration EEPROM U9 (93AA56BT) wired to the FT2232H chip via Microwire bus which holds pre-programmed license code to support Xilinx programming tools. Refer to the FTDI datasheet to get information about the capacity of the FT2232H chip.

⚠ Do not access the FT2232H EEPROM using FTDI programming tools, doing so will erase normally invisible user EEPROM content and invalidate stored Xilinx JTAG license. Without this license the on-board JTAG will not be accessible any more with any Xilinx tools. Software tools from FTDI website do not warn or ask for confirmation before erasing user EEPROM content.

Channel A of the FTDI chip is configured as JTAG interface (MPSSE) connected to the SC CPLD U14, the JTAG signals are forwarded to the JTAG interface of the attached module if DIP switch S3-3 is in OFF-position.

Channel B can be used as UART interface routed to the SC CPLD U14 and is available for other user-specific purposes.

FT2232H U3 Pin	Signal Schematic Name	Connected to	Notes
Pin 12, ADBUS0	M_TCK	SC CPLD U14, pin 91	JTAG interface
Pin 13, ADBUS1	M_TDI	SC CPLD U14, pin 94	
Pin 14, ADBUS2	M_TDO	SC CPLD U14, pin 95	
Pin 15, ADBUS3	M_TMS	SC CPLD U14, pin 90	
Pin 20, ADBUS7	ADBUS7	SC CPLD U14, pin 97	UART and user configurable GPIO's
Pin 26, ACBUS4	ACBUS4	SC CPLD U14, pin 96	
Pin 27, ACBUS5	ACBUS5	SC CPLD U14, pin 88	
Pin 32, BDBUS0	BDBUS0	SC CPLD U14, pin 87	
Pin 33, BDBUS1	BDBUS1	SC CPLD U14, pin 86	
Pin 40, BDBUS7	JTAGEN	DIP switch S3-3; SC CPLD U14, pin 82	Control line

Table 11: FT2232H interface connections

6.3 SDIO Port Expander

The TE0701 carrier board is equipped with the Texas Instruments TXS02612 SDIO Port Expander, which connected the SDIO port of the attached module either to the SD/MMC Card socket J8 or Pmod J1.

The SD IO port expander fullfills also a voltage translation between the ports A with bank voltage VCCO 'VIOB' and the ports B0 and B1 with VCCIO '3.3VOUT'.

TI TXS02612 U2 Port A Pins and Signals	Connected to	TI TXS02612 U2 Port B0 and B1 Pins and Signals	Connected to	Notes
Pin 6, 'SD_DAT0'	B2B JB1, pin 24	Pin 18, 'DAT0/MISO', Port B0	SD/MMC Socket J8, pin 7	The SD IO port expander connects the signals of Port A to Port B0 or B1 depending on the state of the control line 'SEL_SD' (pin 24), connected to SC CPLD U14, pin 39. When 'SEL_SD' is low, port B0 is selected, when 'SEL_SD' is high, port B1 is selected.
		Pin 14, 'PX0', Port B1	Pmod J2, pin 3	
Pin 7, 'SD_DAT1'	B2B JB1, pin 22	Pin 16, 'DAT1', Port B0	SD/MMC Socket J8, pin 8	
		Pin 15, 'PX1', Port B1	Pmod J2, pin 7	
Pin 1, 'SD_DAT2'	B2B JB1, pin 20	Pin 23, 'DAT2', Port B0	SD/MMC Socket J8, pin 9	
		Pin 8, 'PX2', Port B1	Pmod J2, pin 8	
Pin 3, 'SD_DAT3'	B2B JB1, pin 18	Pin 22, 'DAT3/CS', Port B0	SD/MMC Socket J8, pin 1	
		Pin 10, 'PX3', Port B1	Pmod J2, pin 1	
Pin 4, 'SD_CMD'	B2B JB1, pin 26	Pin 20, 'CMD/MOSI', Port B0	SD/MMC Socket J8, pin 2	
		Pin 12, 'PX4', Port B1	Pmod J2, pin 2	
Pin 9, 'SD_CLK'	B2B JB1, pin 28	Pin 19, 'SCLK', Port B0	SD/MMC Socket J8, pin 5	
		Pin 13, 'PX5', Port B1	Pmod J2, pin 4	

Table 12: TI TXS02612 interface description

6.4 HDMI Transmitter and Protection Circuit

The TE0701 board is equipped with the HDMI transmitter chip ADV7511KSTZ U1 provided by Analog Devices. The HDMI transmitter chip is incorporated in conjunction with the HDMI protection circuit TPD12S016 by Texas Instruments.

Attached Zynq modules can output a HDMI video signal to the on-board HDMI connector J4 with CEC, S/DPDIF, HPD and 2-wire serial bus functionalities.

Following pins and signals are assigned between the HDMI transmitter chip U1, the B2B connectors and the SC CPLD U14:

AD ADV7511KSTZ U1 Pins and Signals	Connected to	Protection Circuit U10	Notes
'HDMI_D0' ... 'HDMI_D11', Pin 85 ... 96	B2B JB3	-	-
'HDMI_TXC_N, HDMI_TXC_P, Pin 32, 33	HDMI J4, pin 12, 10	ESD protection	-
'HDMI_TX0_N, HDMI_TX0_P, Pin 35, 36	HDMI J4, pin 9, 7	ESD protection	-
'HDMI_TX1_N, HDMI_TX1_P, Pin 39, 40	HDMI J4, pin 6, 4	ESD protection	-
'HDMI_TX2_N, HDMI_TX2_P, Pin 42, 43	HDMI J4, pin 3, 1	ESD protection	-
'HDMI_VS', Pin 2	B2B JB3, pin 60	-	-
'HDMI_HS', Pin 98	B2B JB3, pin 58	-	-
'HDMI_CLK', Pin 79	B2B JB3, pin 59	-	-
'HDMI_DE', Pin 97	B2B JB3, pin 57	-	-
'HPD_A', Pin 30	HDMI J4, pin 19	signal pass-thru	level shifted signal ('HPD_B') to 5V
'CEC_A', Pin 48	HDMI J4, pin 13	signal pass-thru	level shifted signal ('CEC_B') to 5V
'CEC_CLK', Pin 50	B2B JB2, pin 38	-	-

'SCL_A', Pin 53	HDMI J4, pin 15	signal pass-thru	level shifted signal ('SCL_B') to 5V
'SDA_A', Pin 54	HDMI J4, pin 16	signal pass-thru	level shifted signal ('SDA_B') to 5V
'HDMI_SCL', Pin 55	B2B JB2, pin 13, SC CPLD U14, pin 47	-	I ² C bus lines also used for I2C control (if activated) of SC CPLD U14 functions
'HDMI_SDA', Pin 56	B2B JB2, pin 15; SC CPLD U14, pin 45	-	
'HDMI_INT', Pin 45	B2B JB2, pin 32	-	-
'HDMI_SPDIF', Pin 10	SC CPLD U14, pin 15	-	-
'HDMI_SPDIFOUT', Pin 46	SC CPLD U14, pin 14	-	-
TPD12S016 U10 Control Signals	Connected to	Functionality	Notes
LS_OE	B2B JB2, pin 36	enable Level Shifter (1.8V ↔ 5.0V)	Both signals must be HIGH level for full functionality of HDMI Protection Circuit U10.
CT_HPD	B2B JB2, pin 34	enable Load Switch for HPD	

Table 13: HDMI transmitter signals and interface

6.5 Configuration DIP-switches

There are two 4-bit DIP-switches S3 and S4 present on the TE0701 board to configure options and set parameters. The following table describes the functionalities of the particular switches.

DIP-switch S3	Signal Schematic Name	Connected to	Functionality	Notes
---------------	-----------------------	--------------	---------------	-------

S3-1	CM1	SC CPLD U14, pin 1	Set FMC_VADJ "S3-1 S3-2: FMC_VADJ":	DIP switch S4-1, S4-2 and S4-3 have to be set to OFF if use DIP switches S3-1 and S3-2.
S3-2	CM0	SC CPLD U14, pin 99	OFF OFF : 1.8V OFF ON : 2.5V ON OFF : 2.2V ON ON : I2C control enable	
S3-3	JTAGEN	SC CPLD U14, pin 82	Positions: ON: enables JTAG interface of module OFF: enables JTAG interface of SC CPLD U14	JTAG interface accessible through FTDI chip with Mini-USB2 B connector J7
S3-4	MIO0	Pmod J1, pin 1; B2B JB1, pin 88	depends on attached module	-
DIP- switch S4	Signal Schematic Name	Connected to	Functionality	Notes
S4-1	VID0	SC CPLD U14, pin 34	set 3bit code to adjust FMC_VADJ voltage	The FMC_VADJ voltage is provided by DCDC U8 EN5335QI, Set DIP-switches as bit pattern "S4-3 S4-2 S4-1: FMC_VADJ": ON ON ON : 3.3V ON ON OFF : 2.5V ON OFF ON : 1.8V ON OFF OFF : 1.5V OFF ON ON : 1.25V OFF ON OFF : 1.2V OFF OFF ON : 0.8V (not supported as VCCIO standard) OFF OFF OFF : activate I2C control of some SC CPLD functions
S4-2	VID1	SC CPLD U14, pin 35		
S4-3	VID2	SC CPLD U14, pin 38		

S4-4	CM2	SC CPLD U14, pin 51	depends on current SC CPLD firmware	-
------	-----	---------------------	-------------------------------------	---

Table 14: DIP-switches functionality description

6.6 Push Buttons

There are two push buttons available to the user connected to the SC CPLD U14:

Button	Connected to	Function	Notes
S1	SC CPLD U14, pin 3	User button, function depends on SC CPLD firmware.	-
S2	SC CPLD U14, pin 2	Global Reset of attached module	-

Table 15: On-board Push Buttons

Note: Functionality depends also on CPLD Firmware: [TE0701 CPLD](#)⁷

6.7 On-board LEDs

The TE0701 board is equipped with several LEDs to indicate states and activities.

LED	Color	Connected to	Description and Notes
D22	green	3.3VIN	indicates available 3.3V voltage level of attached module
D1	red	SC CPLD U14, pin 78	functionality depends on the current firmware of the SC CPLD , refer to the documentation . ⁸
D2	red	SC CPLD U14, pin 77	
D3	red	SC CPLD U14, pin 76	
D4	red	SC CPLD U14, pin 16	
D5	red	SC CPLD U14, pin 69	
D6	red	SC CPLD U14, pin 68	
D7	red	SC CPLD U14, pin 65	
D8	red	SC CPLD U14, pin 64	

Table 16: On-board LEDs description

⁷ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

⁸ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

6.8 Oscillators

The TE0701 board is equipped with one oscillator which provide reference clock signal to the FTDI chip:

Clock Source	Signal Schematic Name	Frequency	Clock Input Destination
SiTime SiT8008AI oscillator, U20	OSCI	12.000000 MHz	USB2 to JTAG/UART adapter U3, pin 3

Table 17: On-board oscillators

7 Power and Power-On Sequence

7.1 Power Consumption

Power supply with minimum current capability of 3A at 12V for system startup is recommended.

7.2 Power Distribution Dependencies

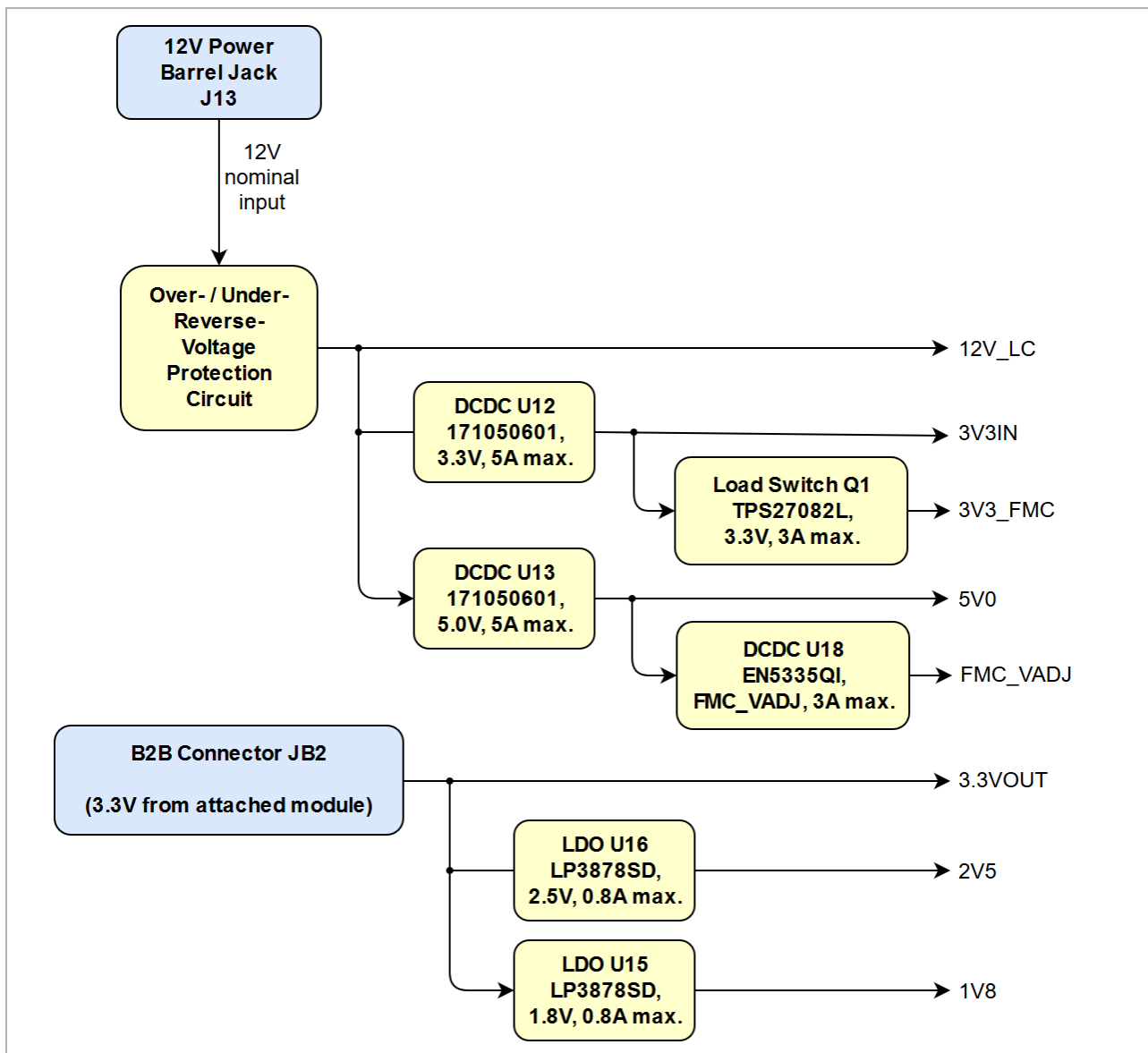


Figure 5: Power Distribution

7.3 Power-On Sequence

The on-board voltages 3.3V and 5.0V of the carrier board will be powered up simultaneously when 12V power supply is connected to the barrel jack J10.

The on-board voltages 1.8V and 2.5V will be enabled when module's 3.3V voltage level has become stable and 3.3VOUT is available on the B2B connector JB2 pins 9 and 11.

The PL IO-bank supply voltage FMC_VADJ will be available after the output of the 5.0V DC-DC converter is active and the pin EN_FMC of the System Controller CPLD U14 is asserted.

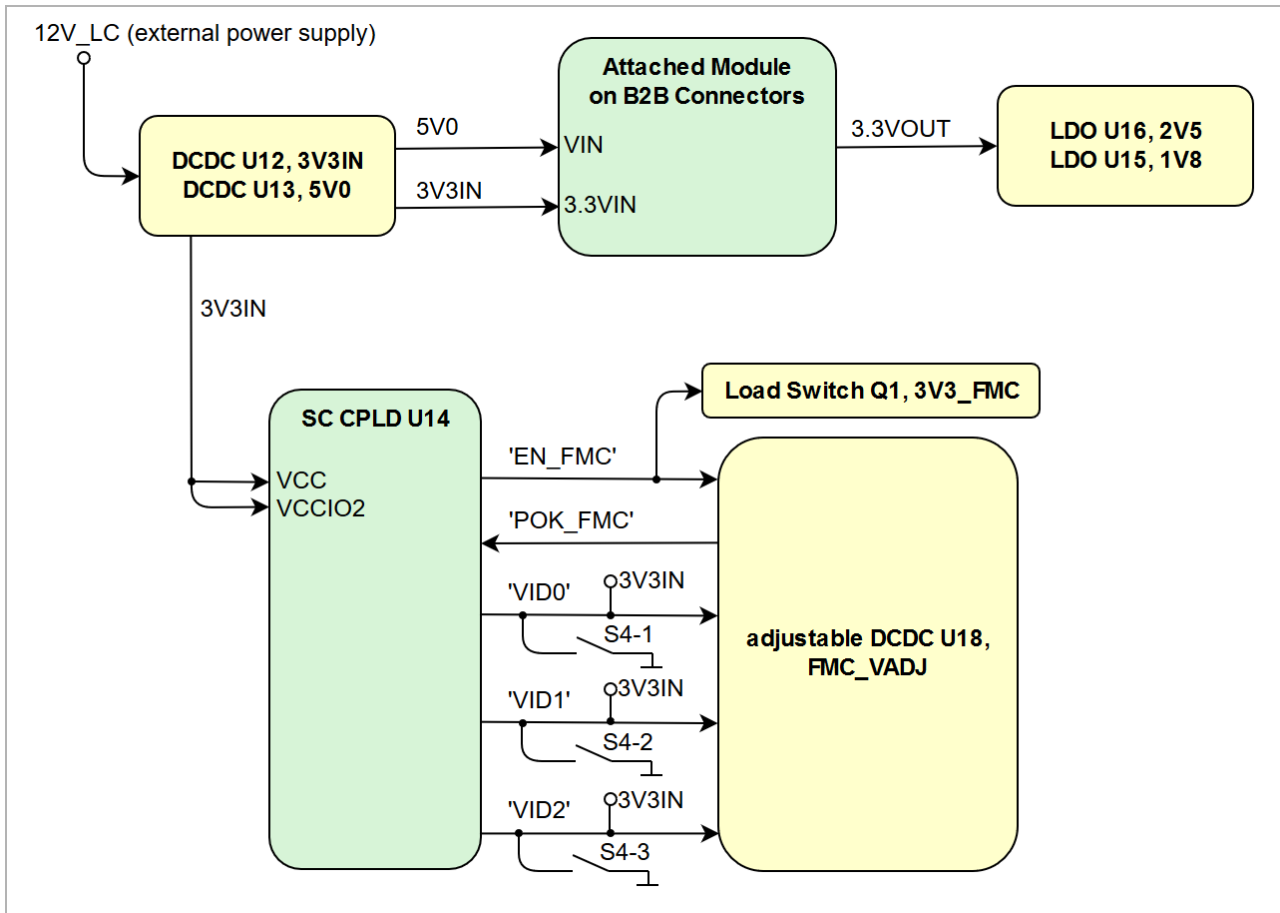


Figure 6: Power Sequence

7.4 Configuring mounted SoM's PL bank VCCO FMC_VADJ

On the TE0701 carrier board different VCCIO configurations can be chosen by 7 jumpers and one dedicated 4-bit DIP-switch S4. Settings of the jumpers and the DIP-switch S4 are explained below.

The baseboard supply voltages for the PL IO-banks VCCO of the SoM are selectable by the jumpers J16, J17 and J21. The DIP-switch S4 sets the adjustable baseboard supply-voltage FMC_VADJ.

Following table below describes switch S4 settings for different FMC_VADJ voltages.

S4-1	S4-2	S4-3	FMC_VADJ Value
ON	ON	ON	3.3V
OFF	ON	ON	2.5V
ON	OFF	ON	1.8V
OFF	OFF	ON	1.5V
ON	ON	OFF	1.25V
OFF	OFF	OFF	Attention: Set VADJ to S3-M1 and S3-M2 control, read TE0701 System Controller CPLD ⁹ description, before this mode is used!

Table 18: Configuring FMC_VADJ

i There is also option to select fixed voltage of FMC_VADJ with the configuration of the 8-bit control register of the I²C-to-GPIO-module of the System Controller CPLD U14.

Switch S4 is also routed to the System Controller CPLD, hence the VCCIO configuration can be registered by the SC CPLD. Switch S4-4 is not dedicated for FMC_VADJ setting, the function of this switch depends on the System Controller CPLD firmware.

The supply-voltage FMC_VADJ is user programmable via I²C. Configuration of the adjustable voltage FMC_VADJ is done over dedicated I²C bus (lines HDMI_SCL and HDMI_SDA). A control byte has to be sent to the 8-bit control register of the I²C-to-GPIO module of the System Controller CPLD. This module's I²C address is 0x22. To enable FMC_VADJ on TE0701, bit 7 of the control register should be set to 1. Note that the I²C bus is shared with the I²C interface of the HDMI Controller.

For detailed information how to set the voltage FMC_VADJ via I²C, please refer to the documentation of the [TE0701 System Controller CPLD](#)¹⁰.

7.5 Configuring 12V Power Supply Pin on the CameraLink Connector

12V power supply can be connected to pin 26 of the CameraLink by closing J18. However, this option is disabled by default (J18: OPEN).

7.6 Summary of VCCIO configuration via jumpers

There are two baseboard supply voltages VIOTA and VIOTB connected to the 4 x 5 SoM's PL IO-bank. The supply-voltages have following pin assignments on B2B-connectors:

⁹ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

¹⁰ <https://wiki.trenz-electronic.de/display/PD/TE0701+CPLD>

Baseboard supply voltages	TE0701 B2B connector-pins	Standard 4 x 5 SoM's VCCO pins on B2B connectors	Connected with (Pull-up, VCCIO)
VIOTA	JB2-2, JB2-4, JB2-6	VCCIOB (JM2-1, JM2-3) / VCCIOC (JM2-5)	HDMI_SCL, HDMI_SDA, HDMI_INT, J5 VCCIO
VIOTB	JB1-10, JB1-12, JB2-8, JB2-10	VCCIOA (JM1-9, JM1-11) / VCCIOD (JM2-7, JM2-9)	VCCIO1 (System Controller CPLD pin 55, 73)

Table 19: Baseboard supply-voltages VIOTA and VIOTB

Note: The corresponding PL IO-voltage supply voltages of the 4 x 5 SoM to the selectable baseboard voltages VIOTA and VIOTB are depending on the mounted 4 x 5 SoM and varying in order of the used model.

Refer to SoM's schematics for more information about the specific pin assignment on module's B2B-connectors regarding PL IO-bank supply voltages and to the [4 x 5 Module integration Guide](#)¹¹ for VCCIO voltage options.

Following table shows baseboard supply voltages versus the available voltage levels, which can be configured via jumpers.

Notation: 'Jx: **1-2**, 3' means pins 1 and 2 are closed, pin 3 is open. 'Jx: 1, **2-3**' means pins 2 and 3 are closed, pin 1 is open.

Voltage Levels	VIOTA	VIOTB	USB-VBUS	12V0_CL
3V3	J17: 1-2 , 3 & J16: open	J17: 1-2 , 3 & J16: open & J21: 1-2 , 3	-	-
2V5	J17: 1, 2-3 & J16: open	J17: 1, 2-3 & J16: open & J21: 1-2 , 3	-	-
FMC_VADJ	J17: open & J16: 1-2	J21: 1, 2-3	-	-

¹¹ <https://wiki.trenz-electronic.de/display/PD/4x5+Module+Integration+Guide>

Voltage Levels	VIOTA	VIOTB	USB-VBUS	12V0_CL
5V0 intern	-	-	J9: 1-2 , 3 & J19: 1-2 (J20: 1-2 : additional decoupling-capacitor 200 µF)	-
VBUS extern	-	-	J9: 1, 2-3 & J19: open	-
12V_LC	-	-	-	J18: 1-2

Table 20: Configuration of baseboard supply-voltages via jumpers

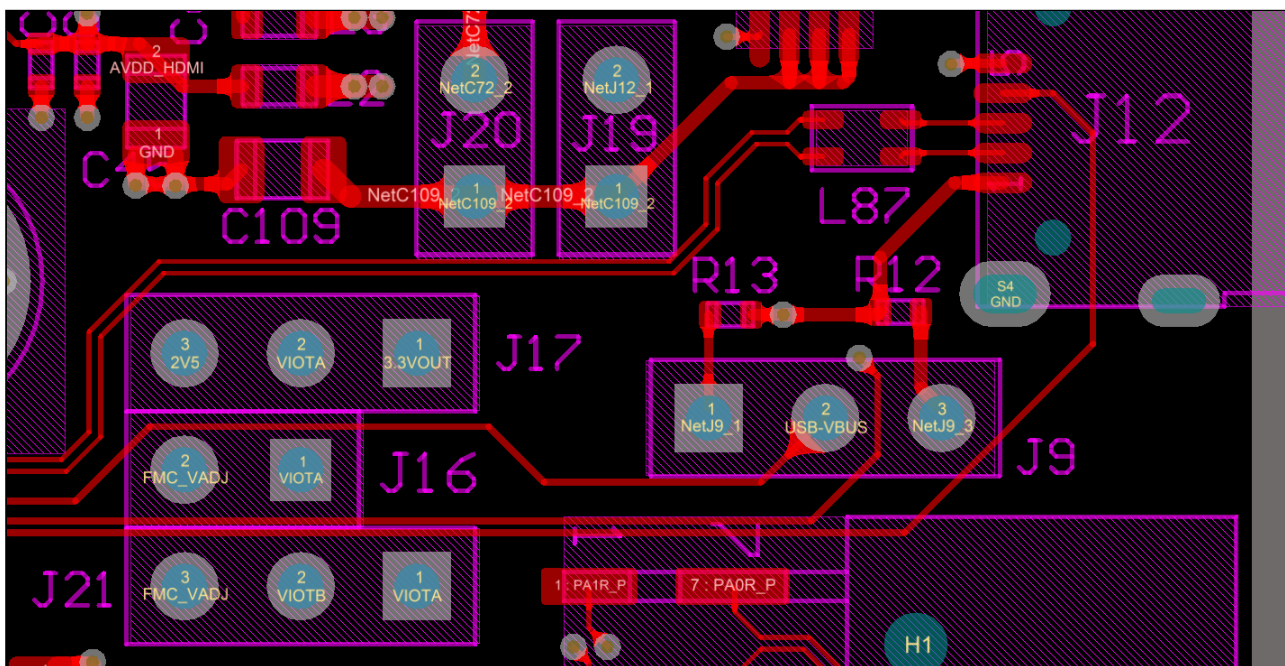


Figure 7: VCCIO jumper pin location (PCB-REV06), top view

⚠ Take care of the VCCO voltage ranges of the particular PL IO-banks (HR, HP) of the mounted SoM, otherwise damages may occur to the FPGA. Therefore, refer to the TRM of the mounted SoM to get the specific information of the voltage ranges.

It is recommended to set and measure the PL IO-bank supply-voltages before mounting of TE 4 x 5 module to avoid failures and damages to the functionality of the mounted SoM.

7.7 Power Rails

Module Connector (B2B) Designator	VCC / VCCIO	Direction	Pins	Notes
JB1	5V0	Out	2, 4, 6	5.0V module supply voltage
	3.3VIN	Out	14, 16	3.3V module supply voltage
	VIOTB	Out	10, 12	PL IO-bank VCCO
	VIOB	In	40	1.8V module output voltage
JB2	3.3VOUT	In	9, 11	3.3V module output voltage
	5V0	Out	1, 3, 5, 7	5.0V module supply voltage
	VIOTA	Out	2, 4, 6	PL IO-bank VCCO
	VIOTB	Out	8, 10	PL IO-bank VCCO
	VCCJTAG	In	92	3.3V JTAG reference voltage
JB3	USB-VBUS	Out	56	USB Host supply voltage

Table 21: Power pin description of B2B Module Connector

FMC Designator	VCC / VCCIO	Direction	Pins	Notes
J10	12V_LC	In	Pin C35, C37	-
	3V3_FMC	In	Pin D36, D38, D40, C39	-
	3.3VOUT	In	Pin D32	-
	FMC_VADJ	Out	Pin G39, H40	adjustable FMC VCCIO

Table 22: Power pin description of FMC connector

PMOD Designator	VCC / VCCIO	Direction	Pins	Notes
J1	3.3VOUT	Out	Pin 6, 12	-
J2	3.3VOUT	Out	Pin 6, 12	-
J5	VIOTA	Out	Pin 6, 12	-
J6	FMC_VADJ	Out	Pin 6, 12	-

Table 23: Power pin description of Pmod connectors

Main Power Jack Designator	VCC / VCCIO	Direction	Pins	Notes
J13	12VIN	In	1	-
B1	VBAT	In	+	CR1220 Battery Holder (3.0V)

Table 24: Power pin description of main power supply connectors

Peripheral Socket Designator	VCC / VCCIO	Direction	Pins	Notes
J15	FMC_VADJ	In	1	ARM JTAG reference voltage VTREF

Peripheral Socket Designator	VCC / VCCIO	Direction	Pins	Notes
J3	12V0_CL	In	1, 26	12V CameraLink power supply voltage
J7	VBUS	In	1	USB2.0 device mode USB VBUS
J4	5V_HDMI	Out	18	5V HDMI supply voltage from HDMI Protection Circuit U10
J8	3.3VOUT	Out	4	MicroSD Card Socket
J12	USB-VBUS	In / Out	1	Direction depends on USB2 mode (OTG, Host, Device mode)

Table 25: Power pin description of peripherals' connectors

Jumper / Header Designator	VCC / VCCIO	Direction	Pins	Notes
J17	VIOTA	In	2	-
	3.3VOUT	Out	1	-
	2V5	Out	3	-
J21	VIOTA	In	1	-
	VIOTB	In	2	-
	FMC_VADJ	Out	3	-
J16	FMC_VADJ	Out	2	-
	VIOTA	In	1	-
J18	12V_LC	Out	1	-
	12V0_CL	In	2	-
J6	VCCIOC	In	2, 4, 6	-
	M1.8VOUT	Out	1	-
J9	USB-VBUS	In	2	-

Jumper / Header Designator	VCC / VCCIO	Direction	Pins	Notes
	VBUS	Out	3	1K13 serial resistor
	VBUS	Out	1	10K serial resistor
J19	5.0V	Out	1	5.0V from USB-VBUS load switch U11
	VBUS	In	2	-
J20	5.0V	In	1	USB-VBUS voltage stabilization with additional 200µF capacitance.
	5.0V	Out	2	

Table 26: Power Pin description of VCCIO selection jumpers

8 Board to Board Connectors

⚠ These connectors are hermaphroditic. Odd pin numbers on the module are connected to even pin numbers on the baseboard and vice versa.

4 x 5 modules use two or three [Samtec Razor Beam LSHM connectors](#)¹² on the bottom side.

- 2 x REF-189016-02 (compatible to LSHM-150-04.0-L-DV-A-S-K-TR), (100 pins, "50" per row)
- 1 x REF-189017-02 (compatible to LSHM-130-04.0-L-DV-A-S-K-TR), (60 pins, "30" per row) (depending on module)

8.1 Connector Mating height

When using the same type on baseboard, the mating height is 8mm. Other mating heights are possible by using connectors with a different height

Order number	Connector on baseboard	compatible to	Mating height
23836	REF-189016-01	LSHM-150-02.5-L-DV-A-S-K-TR	6.5 mm
	LSHM-150-03.0-L-DV-A-S-K-TR	LSHM-150-03.0-L-DV-A-S-K-TR	7.0 mm
23838	REF-189016-02	LSHM-150-04.0-L-DV-A-S-K-TR	8.0 mm
	LSHM-150-06.0-L-DV-A-S-K-TR	LSHM-150-06.0-L-DV-A-S-K-TR	10.0mm
26125	REF-189017-01	LSHM-130-02.5-L-DV-A-S-K-TR	6.5 mm
	LSHM-130-03.0-L-DV-A-S-K-TR	LSHM-130-03.0-L-DV-A-S-K-TR	7.0 mm
24903	REF-189017-02	LSHM-130-04.0-L-DV-A-S-K-TR	8.0 mm
	LSHM-130-06.0-L-DV-A-S-K-TR	LSHM-130-06.0-L-DV-A-S-K-TR	10.0mm

Table 27: Connectors.

The module can be manufactured using other connectors upon request.

¹² <https://www.samtec.com/technical-specifications/Default.aspx?SeriesMaster=LSHM>

8.2 Connector Speed Ratings

The LSHM connector speed rating depends on the stacking height; please see the following table:

Stacking height	Speed rating
12 mm, Single-Ended	7.5 GHz / 15 Gbps
12 mm, Differential	6.5 GHz / 13 Gbps
5 mm, Single-Ended	11.5 GHz / 23 Gbps
5 mm, Differential	7.0 GHz / 14 Gbps

Table 28: Speed rating.

8.3 Current Rating

Current rating of Samtec Razor Beam™ LSHM B2B connectors is 2.0A per pin (2 adjacent pins powered).

8.4 Connector Mechanical Ratings

- Shock: 100G, 6 ms Sine
- Vibration: 7.5G random, 2 hours per axis, 3 axes total

9 Technical Specifications

9.1 Absolute Maximum Ratings

Parameter	Min	Max	Units	Notes
VIN supply voltage	11.4	12.6	V	ANSI/VITA 57.1 FPGA Mezzanine Card (FMC) standard
I/O input voltage for SC CPLD U114	-0.5	3.75	V	Lattice MachXO2 Family datasheet
Voltage on TXS02612RTWR pins	-0.5	3.8	V	TI TXS02612RTWR data sheet
Storage temperature	-40	100	°C	LED's SML-P11MTT86 data sheet

Table 29: Module absolute maximum ratings

9.2 Recommended Operating Conditions

Parameter	Min	Max	Units	Notes
VIN supply voltage	11.4	12.6	V	-
I/O input voltage for SC CPLD U14	-0.3	3.6	V	Lattice MachXO2 Family datasheet
Voltage on TXS02612RTWR pins	0	3.3	V	TI TXS02612RTWR data sheet
Operating Temperature Range ^{1), 2), 3)}	0	70	°C	-

Table 30: Recommended Operating Conditions

1) Temperature range may vary depending on assembly options

2) The operating temperature range of the onboard peripherals are a junction and also ambient operating temperature ranges

3) The relevant operating temperature range of the overall system is also determined by the operating temperature range of the attached module.

9.3 Physical Dimensions

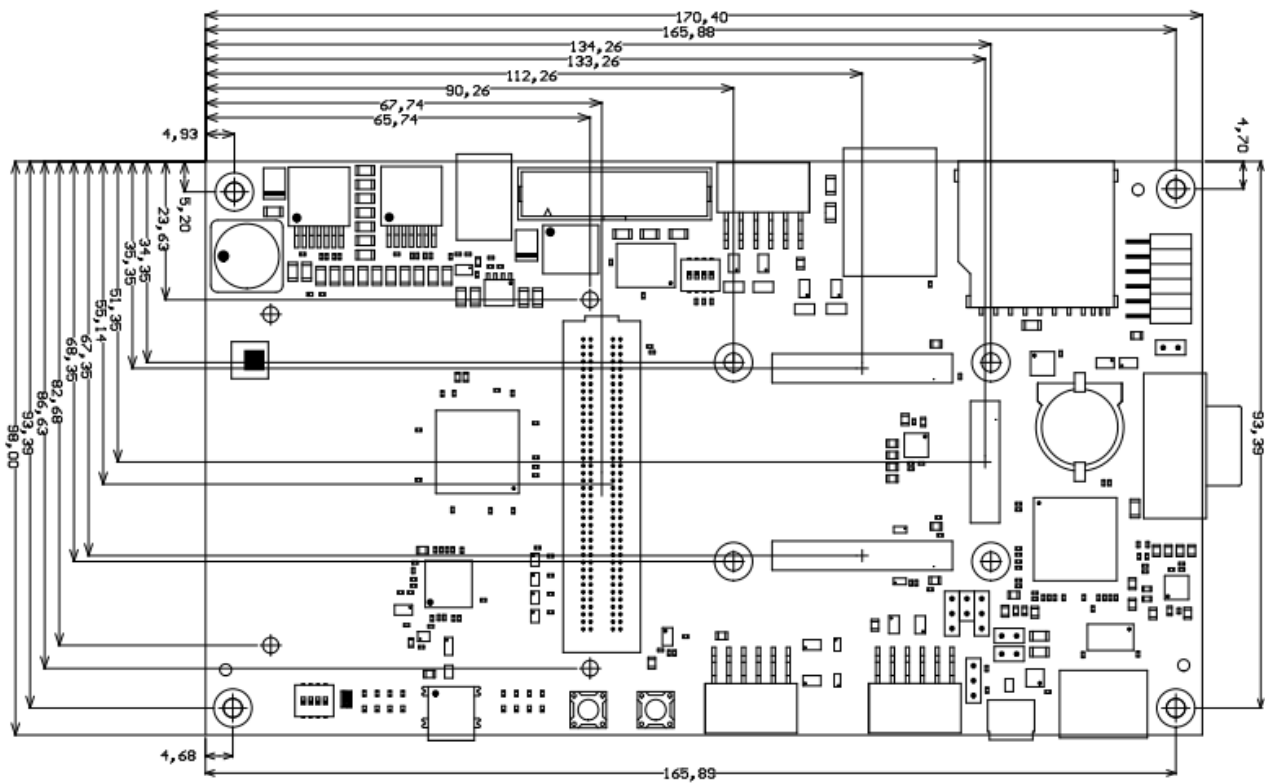


Figure 8: Physical dimensions drawing

10 Variants Currently In Production

Trenz shop TE0701 overview page	
English page¹³	German page¹⁴

Table 31: Trenz Electronic Shop Overview

¹³ <https://shop.trenz-electronic.de/en/TE0701-06-Carrier-Board-for-Trenz-Electronic-7-Series>

¹⁴ <https://shop.trenz-electronic.de/de/TE0701-06-Carrier-Board-for-Trenz-Electronic-7-Series>

11 Revision History

11.1 Hardware Revision History

Date	Revision	Notes	PCN	Documentation link
-	06	Additional Jumper J16 and switch S4 for setting voltage FMC_VADJ.	PCN-20161128 ¹⁵	TE0701-06 ¹⁶
-	05	Improved manufacturing	-	TE0701-05 ¹⁷
-	04	-	-	TE0701-04 ¹⁸
-	03	Changed DC/DC converters	-	TE0701-03 ¹⁹
-	02	Prototype	-	TE0701-02 ²⁰
-	01	Prototype	-	TE0701-01 ²¹

Table 32: Hardware Revision History



Figure 9: Hardware Revision Number

Hardware revision number is printed on the PCB board next to the module model number separated by the dash.

¹⁵ <https://wiki.trenz-electronic.de/display/PD/PCN-20161128+TE0701-05+to+TE0701-06+Hardware+Revision+Change>

¹⁶ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV06

¹⁷ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV05

¹⁸ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV04

¹⁹ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV03

²⁰ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV02

²¹ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/4x5_Carriers/TE0701/REV01

11.2 Document Change History

Date	Revision	Authors	Description
 2020-08-19	v.80(see page 6)	John Hartfiel ²²	- Corrected USB J9 description - Typos - update Button description - Note for J15
2019-01-11	v. 73	John Hartfiel	correction temperature range
2018-10-22	v.72	Ali Naseri	General TRM revision and updated to new style
2018-06-13	v.66	Ali Naseri	updated Power-on sequence diagram
2018-01-12	v.62	John Hartfiel	Dual PMOD note
2017-11-09	v.60	John Hartfiel	add B2B connector section
2017-08-15	v.59	John Hartfiel	- Add VCCIO Jumper Pin location. - Updated VADJ description.
2017-08-14	v.58	John Hartfiel	Description correction.
2017-05-25	v.56	Jan Kumann	New physical dimensions drawing of the board.
2017-05-16	v.51	Jan Kumann	A few overall improvements and corrections, new block diagram.
2017-04-11		Ali Naseri	added block diagram
2017-02-15	v.45	Ali Naseri	added warning concerning the use of FTDI tools
2017-02-15	v.40	Ali Naseri	added power-on sequence diagram

²² <https://wiki.trenz-electronic.de/display/~j.hartfiel>

Date	Revision	Authors	Description
2017-01-19	v.35	Ali Naseri	• correction of table 3 (switch-positions to adjust FMC_VADJ) • inserted hint to set and measure the PL IO-bank supply-voltages
2017-01-13	v.20	Ali Naseri	• added section for baseboard supply voltage configuration
2016-11-29	v.10	Ali Naseri	• TRM update due to new revision 06 of the carrier board.
2016-11-28	v.4	Ali Naseri	• TRM adjustment to the newest revision (05) of TE0701 Carrier Board.
2014-02-18	0.2	Sven-Ole Voigt	• TE0701-03 (REV3) updated
2014-01-05	0.1	Sven-Ole Voigt	• Initial release

Table 33: Document change history

12 Disclaimer

12.1 Data Privacy

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

12.2 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.

12.3 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.

12.4 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.

12.5 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.

12.6 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.

12.7 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 REACH²³. 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 List²⁴ 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)²⁵.

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.

 2019-06-07

²³ <http://guidance.echa.europa.eu/>

²⁴ <https://echa.europa.eu/candidate-list-table>

²⁵ <http://www.echa.europa.eu/>

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Trenz Electronic:](#)

[TE0701-06](#)