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# TWR-LS1021A Reference Manual

## Supports

LS1021A

LS1020A

LS1022A

TWR-LS1021ARM

Rev. 0

09/2014





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# Contents

Paragraph Number	Title	Page Number
<b>Chapter 1</b>		
<b>LS1021A/LS1020A Overview</b>		
1.1	Related documentation .....	1-1
1.2	Silicon features .....	1-2
1.3	Board features .....	1-3
1.4	Block diagram.....	1-4
1.5	Lead-Free/RoHS .....	1-6
<b>Chapter 2</b>		
<b>Architecture</b>		
2.1	Processor .....	2-2
2.2	Power .....	2-2
2.2.1	VDD/VDDC - Core and platform supply power .....	2-3
2.2.2	GVDD, OVDD, BVDD, DVDD, EVDD, LVDD, and general I/O power.....	2-4
2.2.3	Fuse programming power .....	2-5
2.3	Deep sleep control .....	2-6
2.4	Reset.....	2-6
2.5	Device configuration.....	2-7
2.6	Clocks .....	2-7
2.6.1	SYSCLK / DDRCLK.....	2-8
2.6.1.1	Single-Source SYSCLK .....	2-9
2.6.2	SerDes clocks.....	2-9
2.6.3	Ethernet and USB clocks .....	2-9
2.7	Memory controllers.....	2-9
2.8	SerDes port .....	2-10
2.8.1	PCI Express support.....	2-11
2.8.2	SGMII support .....	2-12
2.8.3	SATA support.....	2-12
2.8.4	SerDes configuration and setup .....	2-12
2.9	Ethernet controllers.....	2-13
2.10	Ethernet management interface .....	2-13
2.10.1	IEEE-1588™ support .....	2-14
2.11	USB interface.....	2-15
2.11.1	USB configuration and setup.....	2-16
2.12	Local bus.....	2-16
2.12.1	IFC chip select .....	2-17
2.12.2	Memory map.....	2-17
2.12.3	Virtual banks .....	2-17

# Contents

Paragraph Number	Title	Page Number
2.13	2D ACE - Display Controller Port.....	2-18
2.13.1	Display Control Unit (2D-ACE) programming/setup information.....	2-18
2.14	I <sup>2</sup> C.....	2-19
2.15	SPI interface.....	2-21
2.15.1	SPI configuration and setup.....	2-21
2.16	SDHC interface.....	2-22
2.17	Interrupt controller.....	2-23
2.18	Serial ports.....	2-24
2.18.1	UART configuration and setup.....	2-24
2.19	Audio port.....	2-25
2.20	JTAG port.....	2-26
2.21	GPIO pins.....	2-26
2.22	Monitoring LEDs.....	2-27
2.23	MBED.....	2-27

## Chapter 3 Tower Elevator Connections

3.1	Overview.....	3-1
3.2	Supported TWR modules.....	3-7
3.2.1	TWR-IND-IO.....	3-8
3.2.2	TWR-SER2.....	3-9
3.2.3	TWR-EtherCAT-SLV.....	3-9
3.2.4	TWR-MC-LV3PH.....	3-10
3.2.5	TWR-LCD.....	3-11
3.2.6	TWR-LCD-RGB.....	3-12

## Chapter 4 CPLD System Controller Architecture

4.1	CPLD key features.....	4-1
4.2	Reset.....	4-2
4.3	CPLD register map.....	4-3
4.3.1	Memory map.....	4-3
4.3.2	BCSR registers map.....	4-3
4.4	LCD FDI translator.....	4-7

## Chapter 5 Board Configuration and Debug Support

5.1	TWR-LS1021A board drawings.....	5-1
-----	---------------------------------	-----

# Contents

<b>Paragraph Number</b>	<b>Title</b>	<b>Page Number</b>
5.1.1	Top side.....	5-2
5.1.2	Bottom side .....	5-3
5.2	Switch configuration.....	5-3
5.3	CMSIS-DAP debug support .....	5-5

# Figures

Figure Number	Title	Page Number
1-1	LS1021A block diagram .....	1-5
1-2	LS1020A block diagram .....	1-5
1-3	System block diagram .....	1-6
2-1	Power supply barrel connector polarity .....	2-2
2-2	VDD/VDDC power.....	2-4
2-3	GVDD/OVDD/BVDD/DVDD/EVDD/LVDD and general IO power.....	2-5
2-4	Fuse programming power .....	2-6
2-5	Reset architecture .....	2-6
2-6	Clock architecture .....	2-8
2-7	DDR3L memory architecture.....	2-10
2-8	Ethernet MII routing .....	2-14
2-9	IEEE-1588 interface overview.....	2-15
2-10	USB architecture .....	2-15
2-11	IFC architecture.....	2-16
2-12	NORFlash virtual bank address XOR .....	2-17
2-13	DIU architecture.....	2-18
2-14	I <sup>2</sup> C architecture .....	2-20
2-15	SPI architecture .....	2-21
2-16	SDHC architecture .....	2-22
2-17	Interrupt architecture.....	2-23
2-18	Serial architecture .....	2-24
2-19	Audio port architecture .....	2-25
2-20	JTAG/COP connections .....	2-26
2-21	MBED architecture .....	2-28
4-1	CPLD overview.....	4-1
4-2	Reset power sequencing.....	4-3
4-3	Timing of FDI translation .....	4-8
5-1	Board outline and cabling .....	5-1
5-2	TWR-LS1021A reference drawing - Top side.....	5-2
5-3	TWR-LS1021A reference drawing - Bottom side .....	5-3



# Tables

Table Number	Title	Page Number
1-1	Related documentation.....	1-1
2-1	Processor functional blocks .....	2-1
2-2	Power supply overview .....	2-3
2-3	Configuration options .....	2-7
2-4	SYSCLK frequency options.....	2-8
2-5	DDRCLK frequency options .....	2-8
2-6	LS1021A SerDes protocols.....	2-10
2-7	Specific mini PCIe pinout .....	2-11
2-8	SerDes configuration.....	2-12
2-9	Ethernet port locations .....	2-13
2-10	IFC devices .....	2-16
2-11	IFC chip select mapping .....	2-17
2-12	IFC 32b address mapping .....	2-17
2-13	DIU configuration .....	2-19
2-14	I2C bus device map.....	2-20
2-15	SPI configuration .....	2-22
2-16	Interrupt connections.....	2-23
2-17	LPUART1 configuration.....	2-25
2-18	GPIO mapping .....	2-26
2-19	LED status monitors.....	2-27
3-1	TWR-LS1021A primary connector pinout .....	3-1
3-2	TWR-LS1021A secondary connector pinout.....	3-4
3-3	Supported peripheral TWR modules.....	3-7
3-4	Signal connections between TWR-IND-IO and TWR-LS1021A.....	3-8
3-5	Signal connections between TWR-SER2 and TWR-LS1021A.....	3-9
3-6	Signal connections between TWR-EtherCAT-SLV and TWR-LS1021A.....	3-9
3-7	Signal connections between TWR-MC-LV3PH and TWR-LS1021A.....	3-10
3-8	Signal connections between TWR-LCD and TWR-LS1021A .....	3-11
3-9	Signal connections between TWR-LCD-RGB and TWR-LS1021A.....	3-13
4-1	CPLD memory map .....	4-3
4-2	CPLD BCSR register block map .....	4-3
4-3	CPLD BCSR register detail map .....	4-4
5-1	Switch configuration .....	5-3

# Chapter 1

## LS1021A/LS1020A Overview

The QorIQ LS1021A Tower System Module (TWR-LS1021A) is a low cost, high-performance evaluation, development, and test platform supporting the LS1021A processor, which is based on the dual ARM® Cortex™-A7 cores up to 1.0 GHz. TWR-LS1021A feature an integrated on-board probe for future cost savings, along with third-party platforms developed by Freescale's embedded board solution partners. The TWR-LS1021A is optimized to support the high-bandwidth DDR3L memory and a full complement of high-speed SerDes ports. The system is lead-free and RoHS-compliant.

The TWR-LS1021A additionally provides support for pin-compatible subset device, the LS1020A processor. Throughout this document, references to LS1021A should be presumed to apply equally as well to the LS1020A, unless otherwise noted. Similarly, references to TWR-LS1021A apply equally to the TWR-LS1020A.

### 1.1 Related documentation

Table 1-1 lists and explains the additional documents and resources that you can refer, for more information on TWR-LS1021A board.

Some of the documents listed below may be available only under a non-disclosure agreement (NDA). To request access to these documents, contact your local field applications engineer or sales representative.

**Table 1-1. Related documentation**

Document	Description
LS1021A QorIQ Advanced Multicore Processor Data Sheet	Provides information about electrical characteristics, hardware design considerations, pin assignments, package information, and ordering information.
LS1021A QorIQ Integrated Multicore Processor Reference Manual (LS1021ARM)	Provides a detailed description about LS1021A QorIQ multicore processor and its features, such as memory map, serial interfaces, power supply, chip features, and clock information.
The SystemID Format for Power Architecture™ Development Systems (AN3638)	Freescale Semiconductor Power Architecture™ technology-based evaluation and development platforms may optionally implement a "System ID" non-volatile memory device. This device stores important configuration data about the board.
TWR-LS1021A Getting Started (TWR-LS1021AGS)	This TWR-LS1021A Getting Started Guide explains how to connect the TWR-LS1021A card (700-28040 revX3) and verify its basic operation. This document shows the settings for switches, connectors, jumpers, push buttons, and LEDs, and the instructions for connecting the peripheral devices.
MBED Documents	<a href="http://mbed.org/">http://mbed.org/</a>

#### NOTE

Freescale Semiconductor, Inc. does not own MBED Documents and are mentioned solely for the reference purpose.

## 1.2 Silicon features

A LS1021A or LS1020A processor includes the following functions and features:

- Two (LS1021A) ARM Cortex-A7 cores based on Harvard architecture including AMBA4 MPCORE™ Virtualization, each with separate ECC protected L1 32KB I Cache and 32KB D Cache and a shared 512 KB L2 cache with ECC protection.
  - Up to 1.0 GHz at 1.0 V with 32-bit ISA support
  - Three levels of instructions: User, supervisor, and hypervisor
  - Independent boot and reset
  - Secure boot capability with QorIQ Trust Architecture and ARM TrustZone support
- Hierarchical interconnect fabric
  - Cache Coherency Interconnect (CCI-400)
- 16-/32-bit DDR3LP/DDR4 SDRAM memory controller with ECC
- Encryption/Decryption (SEC 5.x)
- RegEx pattern matching (PME 2)
- VeTSEC Ethernet interfaces
  - Three 1 Gbps Ethernet controllers with IEEE 1588
- High speed peripheral interfaces
  - Two PCI Express 2.0 controllers/ports running at up to 5 GHz
- Additional peripheral interfaces
  - One SATA3 controller supporting up to 6 Gb/s operation
  - One USB 2.0/3.0 controller with integrated PHY, and one USB 2.0 controller with ULPI interface
  - SD/SDXC/eMMC
  - Two SPI controllers and one QuadSPI controller
  - Three I2C controllers
  - Four 16550 compliant UARTs and 6 LPUARTs
  - Integrated flash controller (IFC)
  - Integrated LCD controller 2D-ACE (only on LS1021A)
  - Four FlexCAN controllers (only on LS1021A)
- Multicore programmable interrupt controller (PIC)
- One 8-channel DMA engine
- QUICC Engine block (LS1021A only)
  - 32-bit RISC controller for flexible support of the communications peripherals
  - Serial DMA channel for receive and transmit on all serial channels
  - Two universal communication controllers, supporting TDM, HDLC, UART, and ISDN

## 1.3 Board features

The features of the TWR-LS1021A reference board are as follows:

- SERDES Connections
  - Four lanes supporting:
    - PCI Express: supporting Gen 1 and Gen 2
    - SGMII
    - SATA 2.0/3.0
    - Integrated USB3 PHY features dedicated SERDES lane
- DDR Controller
  - Supports rates of up to 1600 MHz data-rate
  - Supports 1 GB unbuffered DDR3L SDRAM discrete devices (32-bit bus)
  - DDR power supplies 1.35 V to all devices with automatic tracking of VTT
- IFC/Local Bus
  - NOR: 16-bit, non-multiplexed, up to 128 MB
    - NOR devices support two virtual banks
  - CPLD: 8-bit registers in CPLD to configure some mux/demux selection
- Ethernet
  - One on-board RGMII 10/100/1G ethernet port
  - IEEE1588 test header on board
  - Two on-board SGMII 10/100/1G ethernet ports
- System Logic CPLD
  - Manages system power and reset sequencing
  - LCD 2-bit FDI convert to 1-bit
  - Latch IFC address/data multiplexed signals.
  - Signal mux/demux function (for example, CAN3/4\_TX/RX, LCD and UCC)
  - Level shifter (for example, USB2 signals)
  - NOR bank selection logic
- Clocks
  - System and DDR clock (SYSCLK, “DDRCLK”)
    - Switch selectable to one of four settings: 66 MHz, 80 MHz, 83 MHz and 100 MHz for system clock
  - 100 MHz new single-source DIFF\_SYCLK\_/DIFF\_SYCLK\_N input to processor which supports to core/platform SYSCLK, DDR controller (DDRCLK), and USB controller (USBCLK)
  - SERDES clocks
    - Provides clocks to all SerDes blocks and slots
    - 100 MHz or 125 MHz

- Power Supplies
  - Dedicated regulator for VDD and VDDC and DDR GVDD
  - DDR3 power supply for GVDD: 1.35V
    - VTT/MVREF automatically track operating voltage
  - Dedicated regulators/filters for AVDD supplies
  - Dedicated regulators for other supplies: OVDD, BVDD, DVDD, LVDD, POVDD, and so on
- Video
  - Support TWR-LCD module which support a 3.2” QVGA TFT LCD display
  - Support TWR-LCD-RGB module which support a 4.3” WQVGA TFT LCD display
  - LCD controller (2D-ACE) supports video at up to 1280x1024x32bpp
    - Siliconimage SiI9022A for HDMI connection on board
- USB
  - Support two USB 3.0 type A ports
  - Support two USB2.0 connection on two mini PCIE connectors
  - Support one USB2.0 ULPI port by TWR-SER2 module
- SDHC
  - SDHC port connects directly to a full SD/MMC slot.
- EEPROM
  - DDR SPD Configuration
  - Board MAC address configuration
- MBED
  - Serial-to-USB converter
  - Flash programmer
  - Run-control debug interface and others applications

## 1.4 Block diagram

This section provides a high-level overview of the LS1021A and LS1020A processors, as well as the TWR-LS1021A/LS1020A platform. [Figure 1-1](#) shows the major functional units within the LS1021A device.

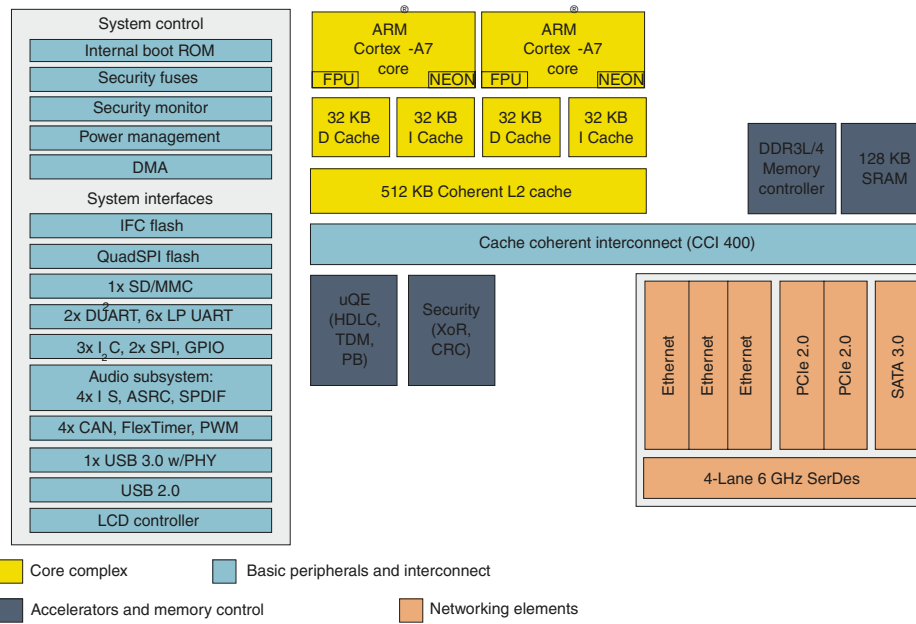


Figure 1-1. LS1021A block diagram

Figure 1-2 shows the major functional units within the LS1020A device.

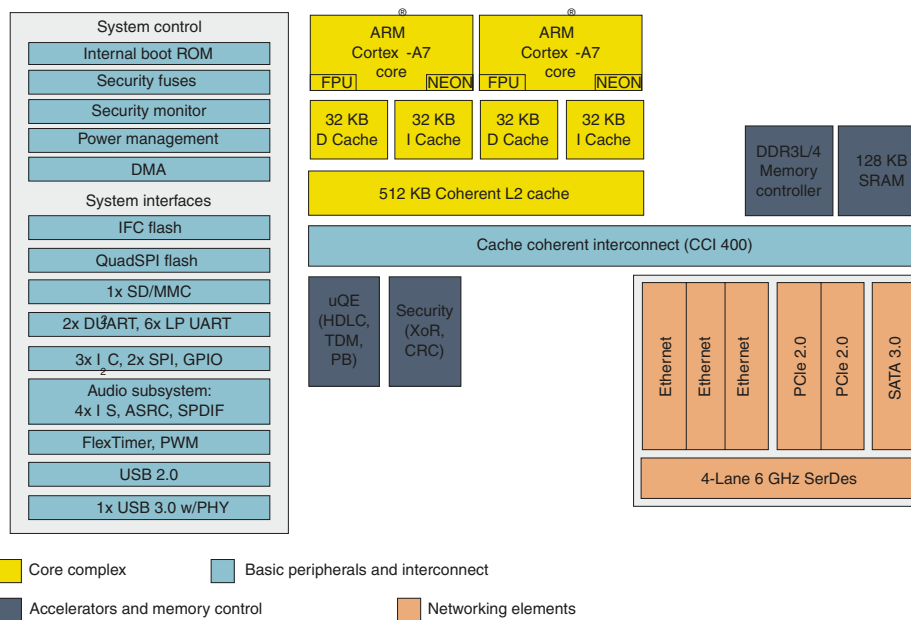


Figure 1-2. LS1020A block diagram

Figure 1-3 shows the overall architecture of the TWR-LS1021A/LS1020A platform.

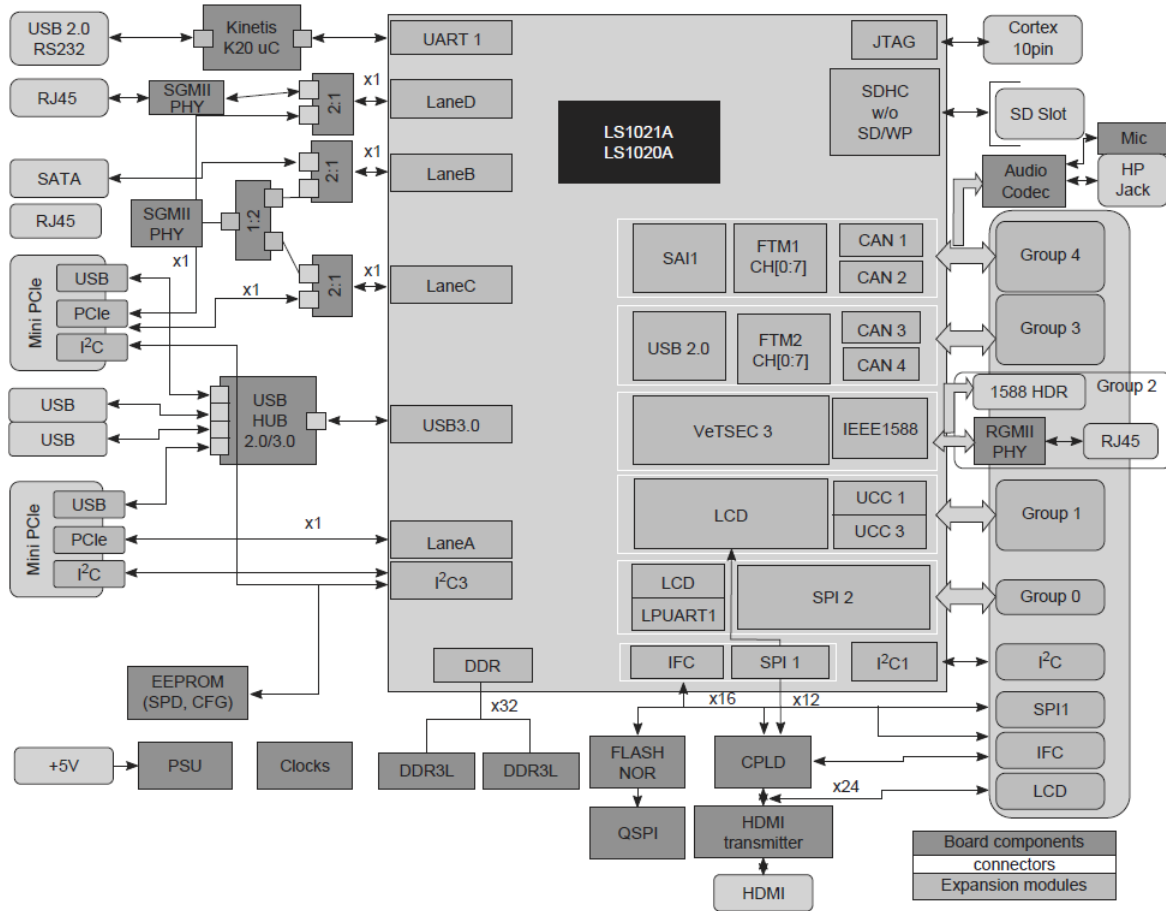


Figure 1-3. System block diagram

## 1.5 Lead-Free/RoHS

All components are lead-free/RoHS compliant.

## Chapter 2 Architecture

The TWR-LS1021A architectures are primarily determined by the processor, and by the need to evaluate as many of its features as possible, maximizing testability without impacting the ability to deliver an easily usable off-the-shelf software development platform.

[Table 2-1](#) lists the major functional blocks of each processor and the associated circuitry for evaluating them. Included is a reference to specific board-related setup and programming instructions.

**Table 2-1. Processor functional blocks**

Signal Group	Details	Configuration
Processor	<a href="#">Section 2.1, "Processor"</a>	n/a
Power	<a href="#">Section 2.2, "Power"</a>	n/a
Deep Sleep Control	<a href="#">Section 2.3, "Deep sleep control"</a>	n/a
Reset	<a href="#">Section 2.4, "Reset"</a>	n/a
Configuration	<a href="#">Section 2.5, "Device configuration"</a>	n/a
Clock	<a href="#">Section 2.6, "Clocks"</a>	n/a
Memory Controllers	<a href="#">Section 2.7, "Memory controllers"</a>	n/a
SerDes Ports	<a href="#">Section 2.8, "SerDes port"</a>	<a href="#">Section 2.8.4, "SerDes configuration and setup"</a>
Ethernet	<a href="#">Section 2.9, "Ethernet controllers"</a>	n/a
EMI Ports	<a href="#">Section 2.10, "Ethernet management interface"</a>	n/a
IEEE 1588	<a href="#">Section 2.10.1, "IEEE-1588™ support"</a>	n/a
USB	<a href="#">Section 2.11, "USB interface"</a>	<a href="#">Section 2.11.1, "USB configuration and setup"</a>
Local Bus	<a href="#">Section 2.12, "Local bus"</a>	n/a
DIU	<a href="#">Section 2.13, "2D ACE - Display Controller Port"</a>	n/a
I2C	<a href="#">Section 2.14, "I<sup>2</sup>C"</a>	n/a
SPI	<a href="#">Section 2.15, "SPI interface"</a>	<a href="#">Section 2.15.1, "SPI configuration and setup"</a>
SDHC	<a href="#">Section 2.16, "SDHC interface"</a>	n/a
Interrupts	<a href="#">Section 2.17, "Interrupt controller"</a>	n/a
UART	<a href="#">Section 2.18, "Serial ports"</a>	<a href="#">Section 2.18.1, "UART configuration and setup"</a>
Audio	<a href="#">Section 2.19, "Audio port"</a>	n/a
JTAG Port	<a href="#">Section 2.20, "JTAG port"</a>	n/a
GPIO	<a href="#">Section 2.21, "GPIO pins"</a>	n/a
LEDs	<a href="#">Section 2.22, "Monitoring LEDs"</a>	n/a
MBED	<a href="#">Section 2.23, "MBED"</a>	n/a



## 2.1 Processor

The TWR-LS1021A supports as many features of the LS1021A as possible, as detailed in the following sections. In addition, TWR-LS1021A provides the ability to accept the pin-compatible LS1020A as well, with changes as noted as necessary. A system with a TWR-LS1020A installed is referred to as a TWR-LS1020A; the boards and supporting hardware are all identical, but the ability to use various features depends on the device used.

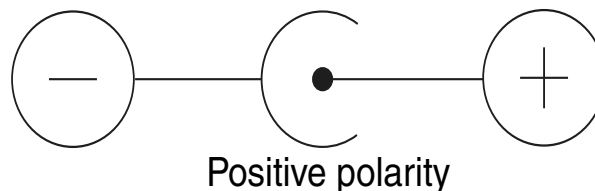
Lastly, the TWR-LS1021A accept an interposer which allows early evaluation of boards but has limited features and restrictions. A notable restriction of the interposer is that the P1010 used requires 3.3V on OVDD, forcing IFC and other rails to operate and 3.3V. TWR-LS1021A support this by isolating OVDD-powered signals through external translation devices or the FPGA where required.

## 2.2 Power

The power supply system of the TWR-LS1021A systems use power from a desktop power supply to provide the numerous processor and peripheral device supplies required. In addition to meeting required power specifications, the following goals guide the power supply architecture:

- Monolithic power supply for VCC (powering internal cores and platform logic)
- DUT-specific power rails are instrumented such that current measurement is possible
- All power supplies can be sequenced per hardware specifications

The board is powered through barrel connector from a 5V @ 5A DC supply. The mating plug should have an inner diameter of 2.1 mm and outer diameter of 5.5 mm. [Figure 2-1](#) shows the polarity of the barrel connector.



**Figure 2-1. Power supply barrel connector polarity**

The 5 V input is used to generate all voltages on the board. Additionally when used with TWR elevators and other TWR peripherals, the TWR-LS1021A provides 5 V and 3.3 V supplies.

The power supplies provided are organized into general categories and described in individual sections below. [Table 2-2](#) shows a general summary of power supplies and features.

Table 2-2. Power supply overview

LS1021A power	Nominal voltage	Voltage range	Adjustment method	Measurement method
VDD / VDDC/ USB1_SDVDD/ USB1_SXVDD/ USB1_SPVDD/ TA_BB_VDD	1.00 V	0.97 - 1.03 V	None, fixed.	Meter across low-ohm R
S1VDD	1.00 V	0.97 - 1.03 V	None, fixed.	Meter across low-ohm R
G1VDD	1.35 V	1.283 - 1.417 V	None, fixed.	Meter across low-ohm R
VTT/VREF	0.675	0.629 - 0.723	None, fixed	Meter across low-ohm R
X1VDD	1.35 V	1.283 - 1.417 V	None, fixed.	Meter across low-ohm R
USB_HVDD	3.30 V	3.135 - 3.465 V	None, fixed.	Meter across low-ohm R
OVDD O1VDD TH_VDD	1.80 V	1.71 - 1.89 V	None, fixed.	Meter across low-ohm R
LVDD/L1VDD (SW2[6]=ON)	2.5 V	2.375 - 2.625 V	None, fixed.	Meter across low-ohm R
L1VDD (SW2[6]=OFF)	3.30 V	3.135 - 3.465 V	None, fixed.	Meter across low-ohm R
DVDD D1VDD	3.30 V	3.135 - 3.465 V	None, fixed.	Meter across low-ohm R
BVDD	3.30 V	3.135 - 3.465 V	None, fixed.	Meter across low-ohm R
EVDD	3.30 V	3.135 - 3.465 V	None, fixed.	Meter across low-ohm R
PROG_SFP PROG_MTR	1.80 V	1.71 - 1.89 V	None, fixed.	Meter across low-ohm R

## 2.2.1 VDD/VDDC - Core and platform supply power

The TWR-LS1021A uses an LTC3616 to provide VDD and VDDC power.

Figure 2-2 shows an overview of this power supply.

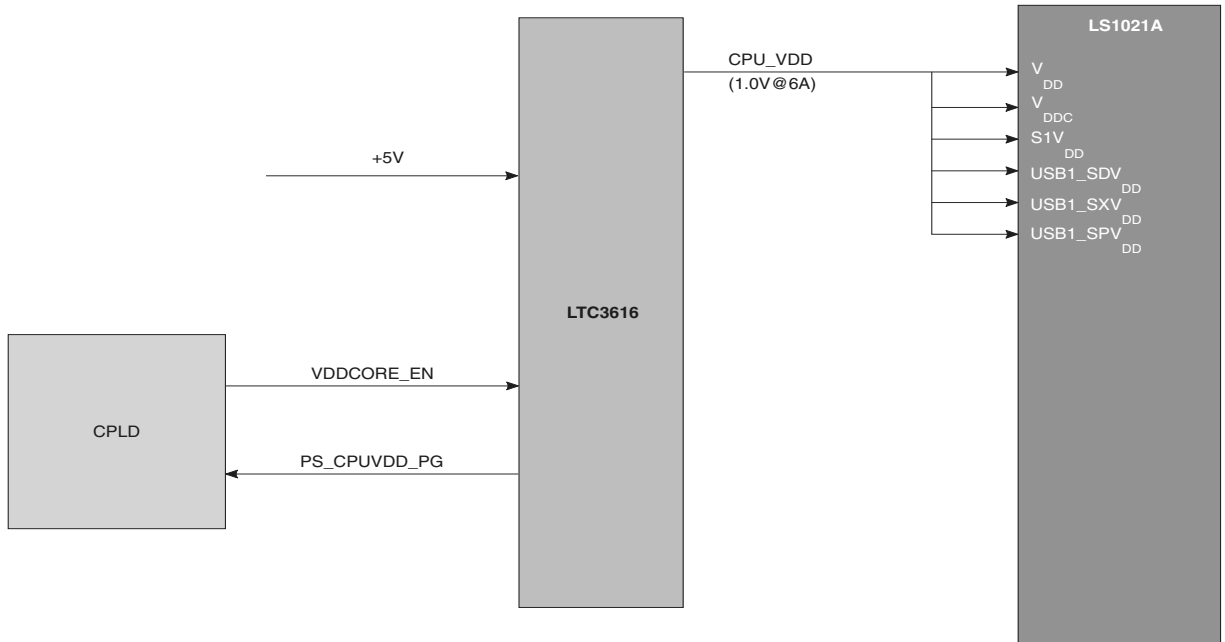


Figure 2-2. VDD/VDDC power

## 2.2.2 GVDD, OVDD, BVDD, DVDD, EVDD, LVDD, and general I/O power

LTC3374 is used on TWR-LS1021A board to support 4 group output voltages for others power rails except core voltage. [Figure 2-3](#) shows these power supplies.

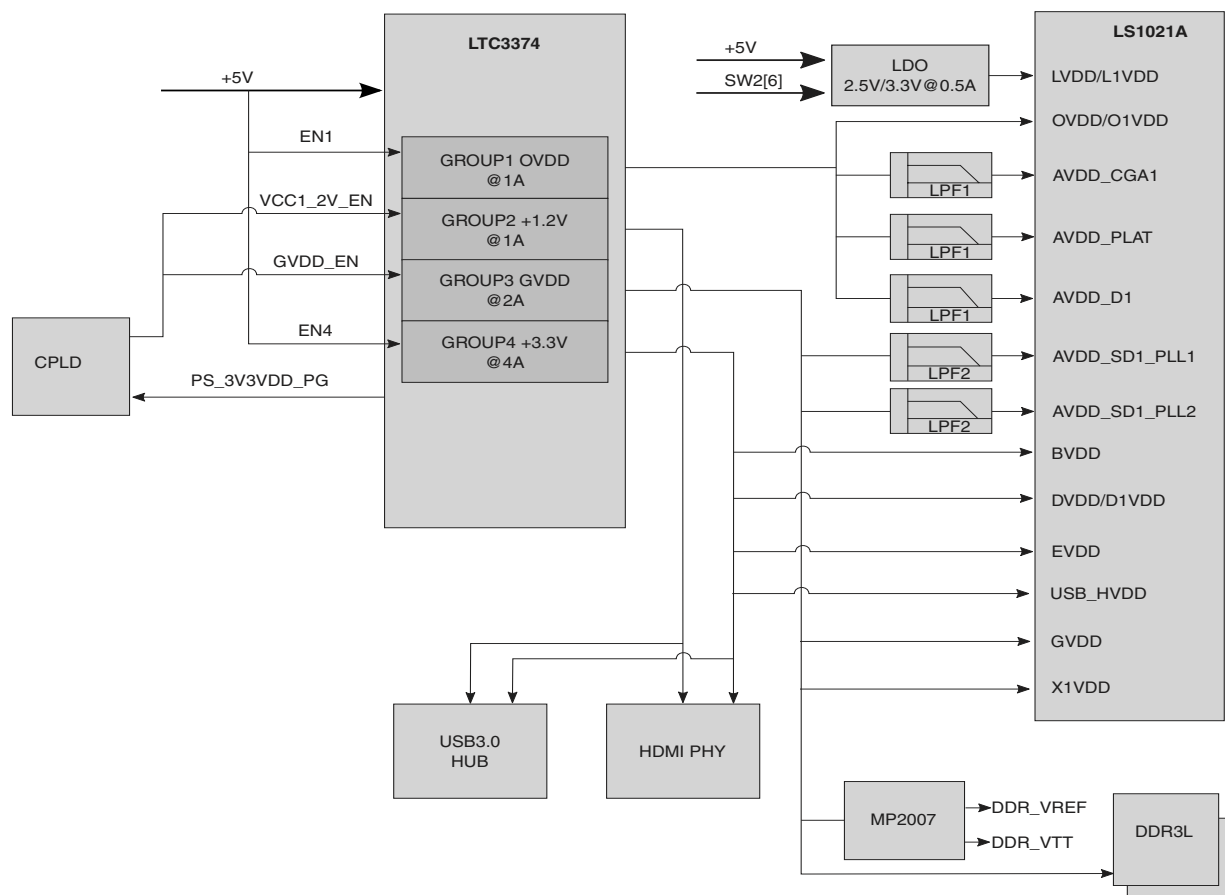


Figure 2-3. GVDD/OVDD/BVDD/DVDD/EVDD/LVDD and general IO power

### 2.2.3 Fuse programming power

Additionally, fuse programming power is supplied to allow customer programming of ECID fuses; this power is normally off to prevent inadvertent fuse programming.

Figure 2-4 shows the remaining power supplies.

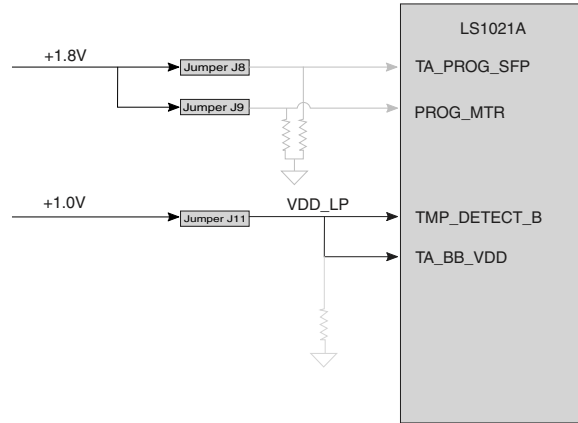


Figure 2-4. Fuse programming power

### 2.3 Deep sleep control

Not supported on TWR-LS1021A board.

### 2.4 Reset

Reset signals to and from the LS1021A and other devices on TWR-LS1021A are managed by **CPLD**. [Figure 2-5](#) shows an overview of the reset architecture.

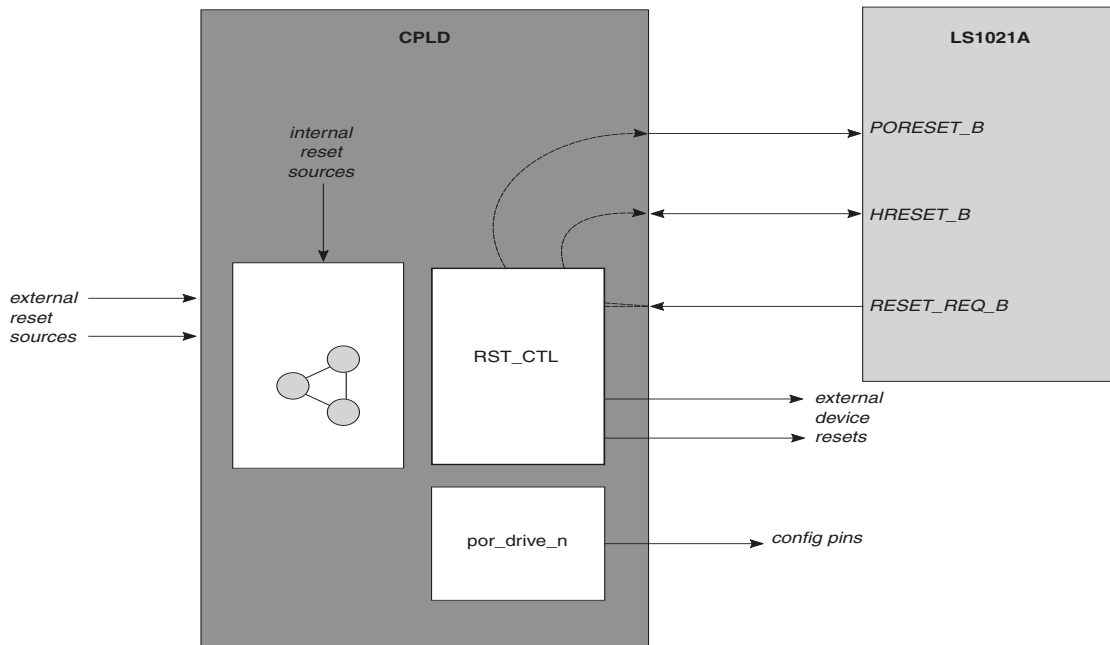


Figure 2-5. Reset architecture

A reset controller (the reset sequencer) manages the collection of various reset triggers, and then asserts reset to internal and external devices as needed. Depending on the type of reset, not all registers and/or devices will be reset. In addition to functional reset choices, the reset controller manages the timing of the

pin-sampled configuration driver logic to insure hardware-spec compliance; Refer Section “(Re)Configuration” for further details.

## 2.5 Device configuration

The processor uses hardware-sampled pins to configure various portions of the device. The remainder are configured from data in the **Reset Configuration Word (RCW)**.

TWR-LS1021A configuration pins are described in [Table 2-3](#).

**Table 2-3. Configuration options**

Configuration Signal	Nets Sampled	Switch Preset	CPLD Register	Description
cfg_rcw_src[0:8]	IFC_AD[8:15], IFC_CLE	SW2[1:4]	0x05: cfg_rcw_src1[0:7] 0x06: cfg_rcw_src2[0]	Specifies RCW fetch location by SW2[1:4] decode.
cfg_dram_type	IFC_A[21]	n/a	n/a	Specifies DDR3L or DDR4. Affects GVDD power supply.
cfg_ifc_te	IFC_TE	n/a	n/a	IFC TE signal enable; not normally used.
cfg_gpinput[0:7]	IFC_AD[0:7]	n/a	n/a	Application defined.
cfg_eng_use0	IFC_WE0_B	n/a	n/a	Differential or single ended clock selection.
cfg_eng_use1	IFC_OE_B	n/a	n/a	Reserved

## 2.6 Clocks

The clocks section specify various clocks:

- SYSCLK(single-ended and differential)
- DDRCLK (single-ended)
- SERDES clocks (2 independent options)
- Ethernet clocks
- USB clock

The architecture of the clock section is shown in in [Figure 2-6](#).

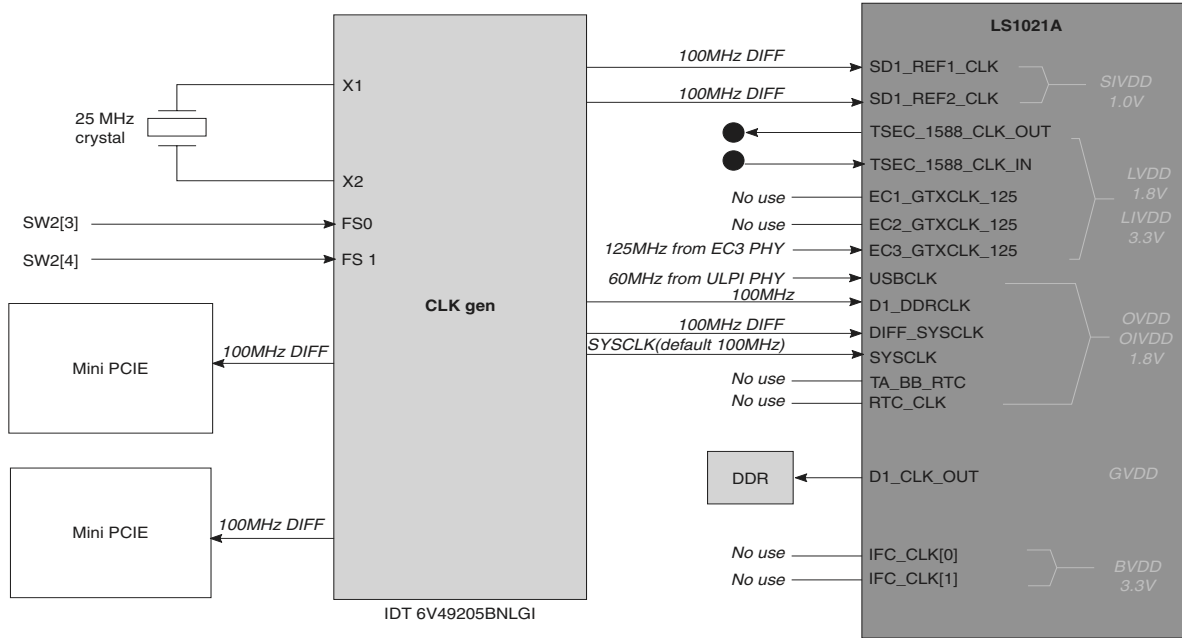


Figure 2-6. Clock architecture

### 2.6.1 SYSCLK / DDRCLK

SYSCLK and DDRCLK are provided by an IDT 6V49205BNLGI, a programmable frequency synthesizer with hardware presets. The device is strapped to provide 100 MHz to SYSCLK and 67 MHz to DDRCLK during power up. LS1021A requires 64 MHz to 100 MHz for both SYSCLK and DDRCLK.

Table 2-4. SYSCLK frequency options

FS[0:1]	SYSCLK	Notes
0 0	66.67 MHz	n/a
0 1	80 MHz	n/a
1 0	100.00 MHz	default
1 1	83.33 MHz	n/a

Table 2-5. DDRCLK frequency options

DDRCLK pin	DDRCLK	Notes
pull-up	66.67 MHz	n/a
pull-down	100.00 MHz	Default on TWR-LS1021A

**Spread Spectrum Clocking (SSC)** options are supported for SYSCLK and DDRCLK by SMBUS. Because SSC reduces the clock rate, reducing the performance somewhat, it is not a preferred operating mode.

### 2.6.1.1 Single-Source SYSCLK

A new feature supported on TWR-LS1021A is “single-source” clocking. In this mode, a differential clock is supplied to the DIFF\_SYSCLK\_P/DIFF\_SYSCLK\_N inputs to the processor, which is in turn used to supply clocks to the core and platform (SYSCLK), DDR controller (DDRCLK) and USB controller (USBCLK).

### 2.6.2 SerDes clocks

The LS1021A SerDes port accepts two different differential clock inputs (SD1\_REFCLK1 and SD1\_REFCLK2), allowing the flexibility to use different protocols with different clock rates on the SerDes pins. The clock inputs are provided by the IDT clock generator device, which can generate the required 100.00 or 125.00 frequencies.

### 2.6.3 Ethernet and USB clocks

Ethernet clock is also provided by an IDT6V49205BNLGI, which supplies 125.0 MHz to the Ethernet port clock inputs (EC3\_GTXCLK\_125), as well as to the separate RGMII PHYs. Additionally, a 60 MHz reference clock is provided for the USBCLK input from external USB PHY.

Additionally, for the Ethernet PHY input clocks are individually supplied by IDT6V49205BNLGI as well.

## 2.7 Memory controllers

The TWR-LS1021A supports high-speed DRAM with 1 GB DDR3L SDRAM discrete devices (32-bit bus). The memory interface includes all the necessary termination and I/O power, and is routed so as to achieve maximum performance of the memory bus, as shown in [Figure 2-7](#).



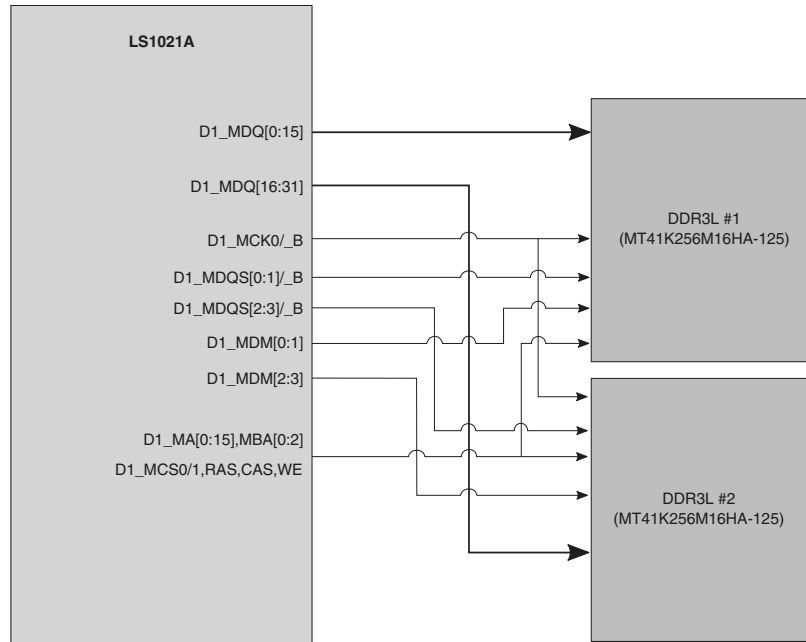


Figure 2-7. DDR3L memory architecture

## 2.8 SerDes port

The LS1021A / LS1020A SerDes block provides four high-speed serial communication lanes supporting a variety of protocols, including:

- SGMII1.25 / 3.125 Gbps
- PCI Express (PEX) Gen 11X / 2X / 4X2.5 Gbps
- PCI Express (PEX) Gen 21X / 2X / 4X5 Gbps
- SATA1X1.5 / 3 Gbps

An overview of the SerDes protocols supported on LS1021A is shown in [Table 2-6](#).

Table 2-6. LS1021A SerDes protocols

2 bits		Protocol	SerDes			
			A	B	C	D
0	0	0x10	PCle1	SATA	PCle2	
0	1	0x20	PCle1	VeTSec1	PCle2	VeTsec2
1	0	0x30	PCle1	SATA	VeTSec1	VeTsec2
1	1	0x70	PCle1	SATA	PCle2	VeTsec2

SerDes lanes are routed through high-speed multiplexers, the CBTL02043A. The multiplexers route SerDes lanes and connect them to SATA connectors or PCI Express slots for evaluation of PCI Express.

Software must map the *cfg\_srds1\_prctl* field in the RCW to the bits shown in [Table 2-6](#) to the selected Serdes configuration. To assist software in this, the **CPLD** will map either the RCW[*cfg\_srds1\_prctl*] field to these bits (if accessible), or map a DIP switch using the same process, see [Section 2.8.4](#) for details.

## 2.8.1 PCI Express support

TWR-LS1021A supports evaluation of two PCI Express slots using mini PCI Express Gen-1 or Gen-2 card. In a few specialized cases (0x10 protocol), two PCI Express controllers are routed to one PCI Express slot. This mode is designed for use with a specialized breakout card, and should never be enabled with normal PCI Express cards installed.

For support this specific x2 mini PCI Express, one of connectors has some additional signals. The expansion connector is used to support costumed x2 mini PCIE card.

The pinout of the side-band connector is shown in [Table 2-7](#).

**Table 2-7. Specific mini PCIe pinout**

Signal	Pin	Pin	Signal
GND	51	52	+3.3Vaux
RERp1	49	50	GND
RERn1	47	48	+1.5V
GND	45	46	GND
GND	43	44	RETp1
+3.3Vaux	41	42	RETn1
+3.3Vaux	39	40	GND
GND	37	38	USB_D+
GND	35	36	USB_D-
PETp0	33	34	GND
PETn0	31	32	SMB_DATA
GND	29	30	SMB_CLK
GND	27	28	+1.5V
PERp0	25	26	GND
PERn0	23	24	+3.3Vaux
GND	21	22	PERST#
Reserved (UIM_C4)	19	20	W_DISABLE
Reserved (UIM_C48)	17	18	GND
Mechanical Key			
GND	15	16	UIM_VPP
REFCLK+	13	14	UIM_RESET
REFCLK-	11	12	UIM_CLK

Table 2-7. Specific mini PCIe pinout

Signal	Pin	Pin	Signal
GND	9	10	UIM_DATA
CLKREQ#	7	8	UIM_PWR
COEX2	5	6	1.5V
COEX1	3	4	GND
WAKE#	1	2	3.3Vaux

## 2.8.2 SGMII support

TWR-LS1021A supports evaluation of the SGMII protocol for serialized Ethernet PHYs. Ethernet data is carried over the SerDes lanes. On TWR-LS1021A, two Atheros AR8033 PHY are used to support SGMII mode.

## 2.8.3 SATA support

SATA could be evaluated on on-board SATA headers. LS1021A could support SATA3.0 protocol with maximum 6 Gbps data rate.

## 2.8.4 SerDes configuration and setup

The SerDes multiplexers require initialization of several **CPLD** register bits. **CPLD** attempts to preset the values based on a DIP switch, which should be set to match the selected RCW[*cfg\_srds1\_prctl*] field. Software can override the presets at any time.

Table 2-8. SerDes configuration

Configuration Signal	Controls	Value	Description
none	SW: SW3[6]	0	Lane A PCIe#1 (x1) Lane B SGMII 1 Lane C PCIe#2 (x1) Lane D SGMII 2
		1	Lane A PCIe#1 (x1) Lane B SATA x1 Lane C PCIe#2 (x1) Lane D SGMII 2
	REG: 0x0D	0	Lane A PCIe#1 (x1) Lane B SGMII 1 Lane C PCIe#2 (x1) Lane D SGMII 2
		1	Lane A PCIe#1 (x1) Lane B SATA x1 Lane C PCIe#2 (x1) Lane D SGMII 2

## 2.9 Ethernet controllers

The TWR-LS1021A supports three Ethernet Controllers (EC) which can connect to Ethernet PHYs using MII or RGMII protocols. The EC3 port can operate in RGMII mode and is always on, while the EC2 and EC3 ports only operates in SGMII mode. All three ports connects to Atheros AR8033 PHYs.

Connections and routing for the TSEC are summarized in [Table 2-9](#).

**Table 2-9. Ethernet port locations**

EC #	Mode	Interface voltage	PHY address	Connector location	Status indicator
1	SGMII	S1VDD/X1VDD (1.0V/1.35V)	2	P1 Bottom	R: Transmit or Receive activity L: Link (1000M)
2	SGMII	S1VDD/X1VDD (1.0V/1.35V)	0	P1 Top	R: Transmit or Receive activity L: Link (1000M)
3	RGMII	LVDD (2.5V)	1	U20	L: Transmit or Receive activity R: Link (Any speed)

The drives the and associated PHY devices with a 125.00 MHz clock, from one of various sources. See Section 2.6 for details on Ethernet clocking.

## 2.10 Ethernet management interface

The EMI routing architecture is shown in [Figure 2-8](#).

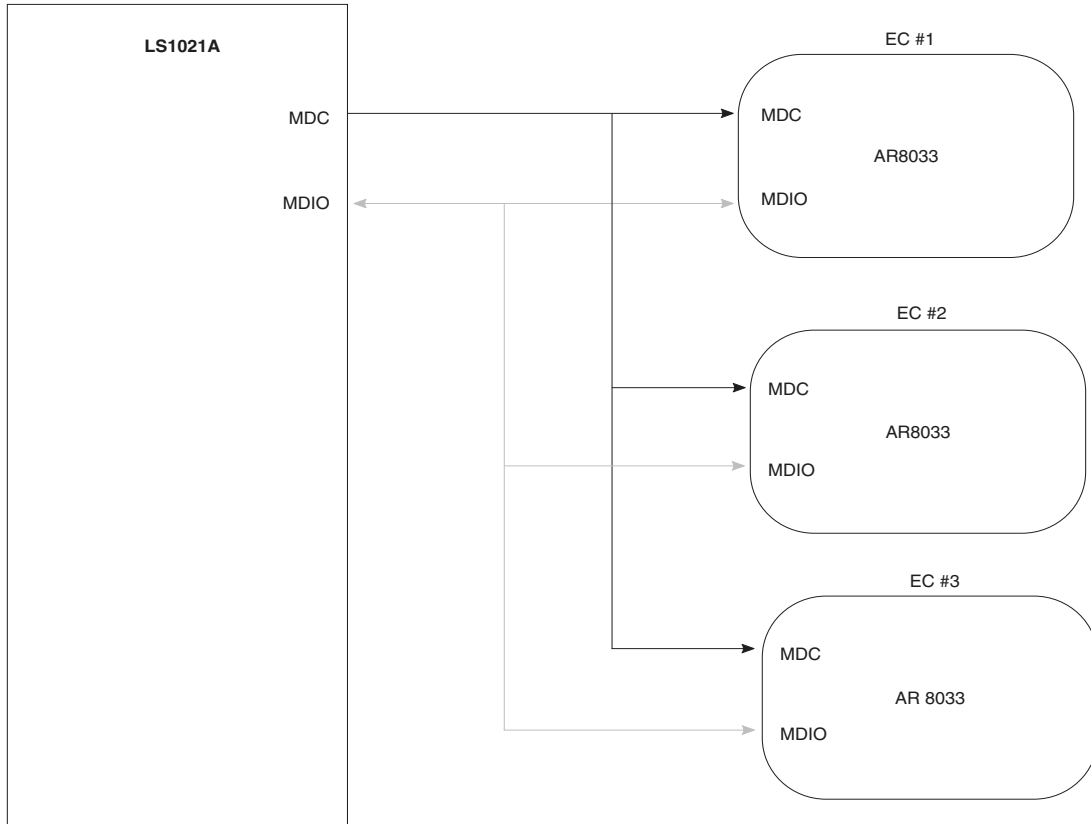


Figure 2-8. Ethernet MII routing

### 2.10.1 IEEE-1588™ support

The LS1021A/LS1020A includes support for the IEEE 1588 precision time protocol (PTP). This facility works in tandem with the internal Ethernet controllers to time-stamp incoming packets. This is supported at a basic level with internal logic and the use of a precision 125.00 MHz reference clock, accurate to  $\pm 25$  ppm. [Figure 2-9](#) shows an overview of the IEEE 1588 block.

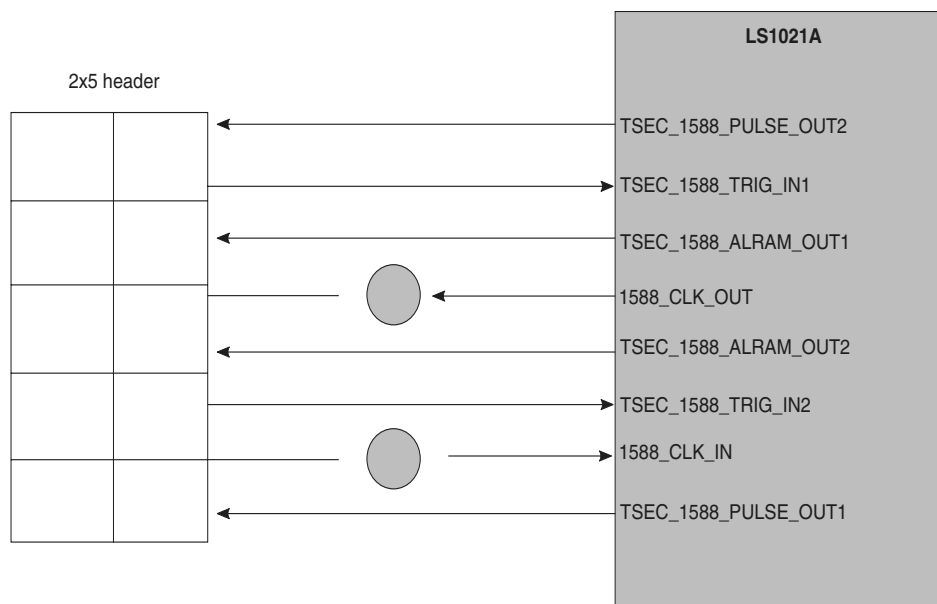


Figure 2-9. IEEE-1588 interface overview

## 2.11 USB interface

The TWR-LS1021A/LS1020A systems have one integrated USB 3.0 (USB1) and one USB 2.0 (USB2) controllers that allow direct connection to USB ports with appropriate protection circuitry and power supplies. Figure 2-10 shows the USB section.

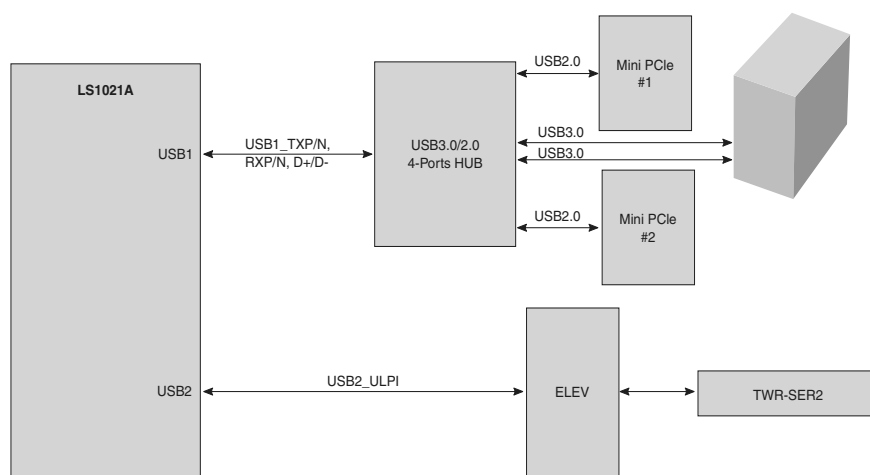


Figure 2-10. USB architecture

Power for the ports is provided by a Maxim MAX1588, which supplies 5V at up to 1.2A per port. The power enable and power-fault-detect pins are connected directly to the LS1021A/LS1020A for individual port management.

### 2.11.1 USB configuration and setup

The USB block requires no board-specific setup or programming.

## 2.12 Local bus

The LS1021A / LS1020A Integrated Flash Controller (IFC), also called the “local bus”, supports 32-bit addressing and 8- or 16-bit data widths, for a variety of devices. Figure 2-12 shows an overview of the IFC bus.

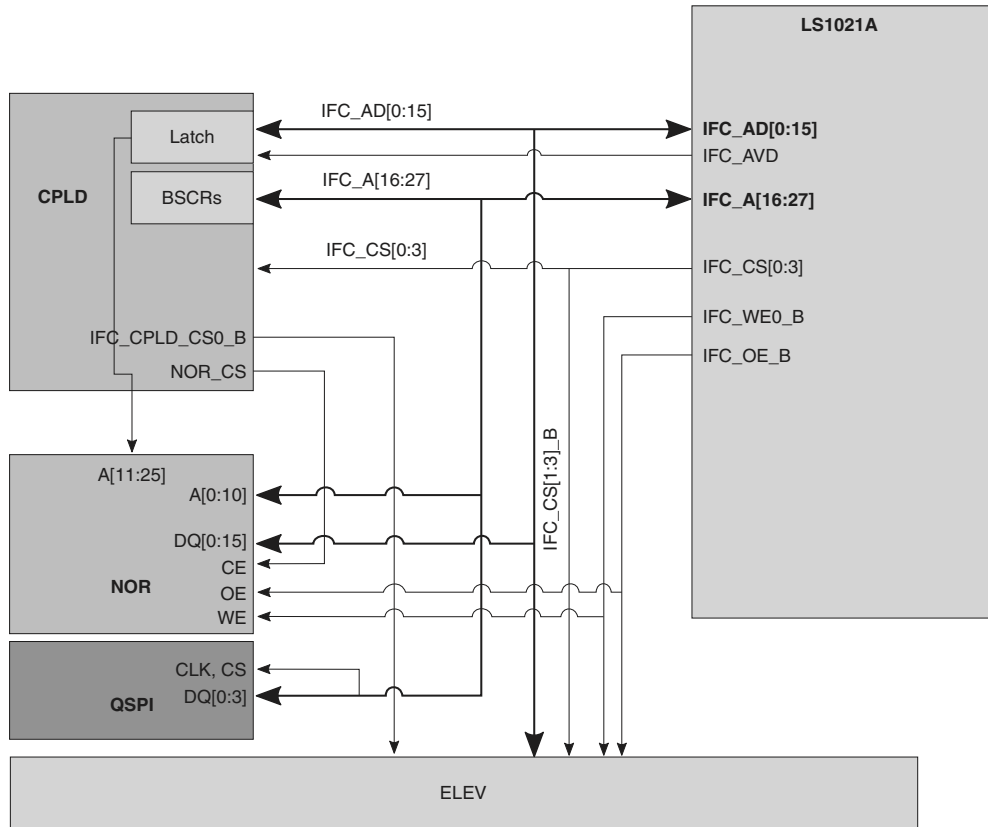


Figure 2-11. IFC architecture

On TWR-LS1021A board, the devices available on the IFC bus include:

Table 2-10. IFC devices

IFC device	Mfg.	Part number	Description
NOR	Micron	JS28F00AM29EWHA	1Gb (128MB) 110ns parallel NOR flash.
ELEV	Freescale	TWR-ELEV, TWR-LCD	Support TWR-LCD module using IFC bus
CPLD BCSR	Freescale	n/a	Board Control and Status Registers

## 2.12.1 IFC chip select

IFC chip select signals are assigned in [Table 2-11](#):

**Table 2-11. IFC chip select mapping**

Device	NOR Flash	CPLD	ELEV -C78 pin	ELEV -C77 pin	ELEV -C76 pin
CS mapping	CS0	CS1	CS1	CS2	CS3

### NOTE

IFC CS2 and CS3 are multiplexed with I2C3 SCL and SDA, the selection is done in CPLD.

## 2.12.2 Memory map

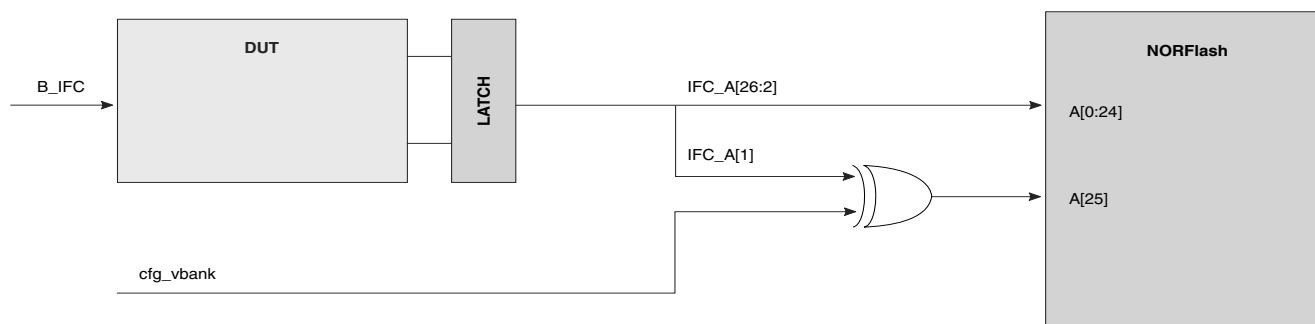
Memory addresses are defined by software and rearranged externally by the “cfg\_lomap” functions, there are many possible memory maps. The default memory map shown in [Table 2-12](#) reflects selecting the first line in [Table 2-11](#) (with NOR flash as the boot device).

**Table 2-12. IFC 32b address mapping**

32b Address Range	Size	Device	IFC_CS	Description
0x8000_0000 - 0xBFFF_FFFF	1GB	DDR DRAM	-	
0x0100_0000 - 0x0FFF_FFFF	240MB	CCSR Space	-	
0x7FB0_0000 - 0x7FB0_FFFF	64KB	CPLD Registers	1	
0x6000_0000 - 0x67FF_FFFF	128MB	3.3V NOR Flash	0	
<b>Note:</b> This address is only valid if boot software opts to implement it - check software documentation for actual memory map.				

## 2.12.3 Virtual banks

As noted earlier, the “virtual bank” feature is available when the NOR flash is selected as the device connected to IFC\_CS0\_B. In that case, the value will be divided into two banks of XOR gates, which toggle the MSB’s of the NOR address, as shown in [Figure 2-12](#).



**Figure 2-12. NORFlash virtual bank address XOR**



## 2.13 2D ACE - Display Controller Port

The LS1021A has an internal **Display Control Unit (2D ACE)**, suitable for driving video at resolutions up to XGA (1024 x 768 x 24 bpp x 60 Hz); higher resolutions such as UXGA may be possible depending on overall system memory bandwidth. The display buffer resides in main memory, with the R-G-B pixel data streaming out at a rate sufficient to maintain the LCD raster. Since the DCU handles all the raster generation, all that remains is to convert the data stream into a format suitable for the LCD displays.

The DCU hardware signals are extracted from the QE\_TDM port and then drives either DVI or HDMI ports onboard as in the below [Figure 2-13](#).

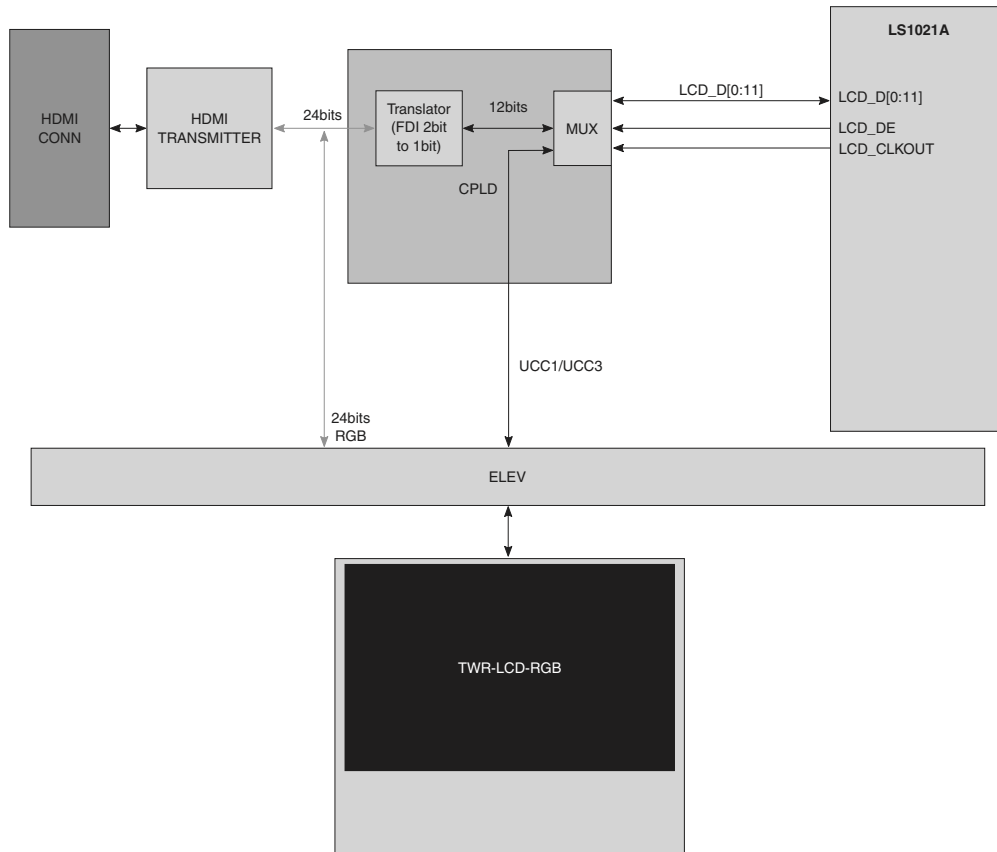


Figure 2-13. DIU architecture

### NOTE

The DIU is an output-only port, so multiple levels of multiplexing and translation do not effect the output, as long as good signal integrity is maintained.

### 2.13.1 Display Control Unit (2D-ACE) programming/setup information

The DCU needs to be programmed to generate the pixel data/clock/enables in order to properly drive the selected encoder. Specific encoder information follows, but for all three the following steps apply:

- Program the DCU with the following information:

- Raster (framebuffer) width, height and depth
- An “Area Of Interest”, often just equal to the display width and height.
- Pixel clock within limits of monitor
- Horizontal and vertical sync parameters, which include:
  - Polarity (generally positive, but not always)
  - Front/back “porch” - the interval between sync transitions and active pixel data; usually one or two pixel clocks (HSYNC) or one or two lines (VSYNC) is sufficient.
  - Sync assertion time - display width (in pixels) + front and back porch (in pixels), plus the sync assertion time, should be approximately equal to the monitor stated horizontal timing parameter (which might be in units of microseconds, pixels or Hz). A similar process is used for vertical timing.

The DCU block are configured as described in [Table 2-13](#).

**Table 2-13. DIU configuration**

Configuration signal	Controls	Value	Description
cfg_mux_getdm_diu0	SW: SW3[6] REG:0x0C	0	QE TDM signals are routed to the DCU block.
		1	QE TDM signals are routed to the UCC block.

## 2.14 I<sup>2</sup>C

The LS1021A / LS1020A devices support up to four I2C buses.

[Figure 2-14](#) shows the I2C subsystem connection. The devices available on each I2C bus segment are listed in [Table 2-14](#).

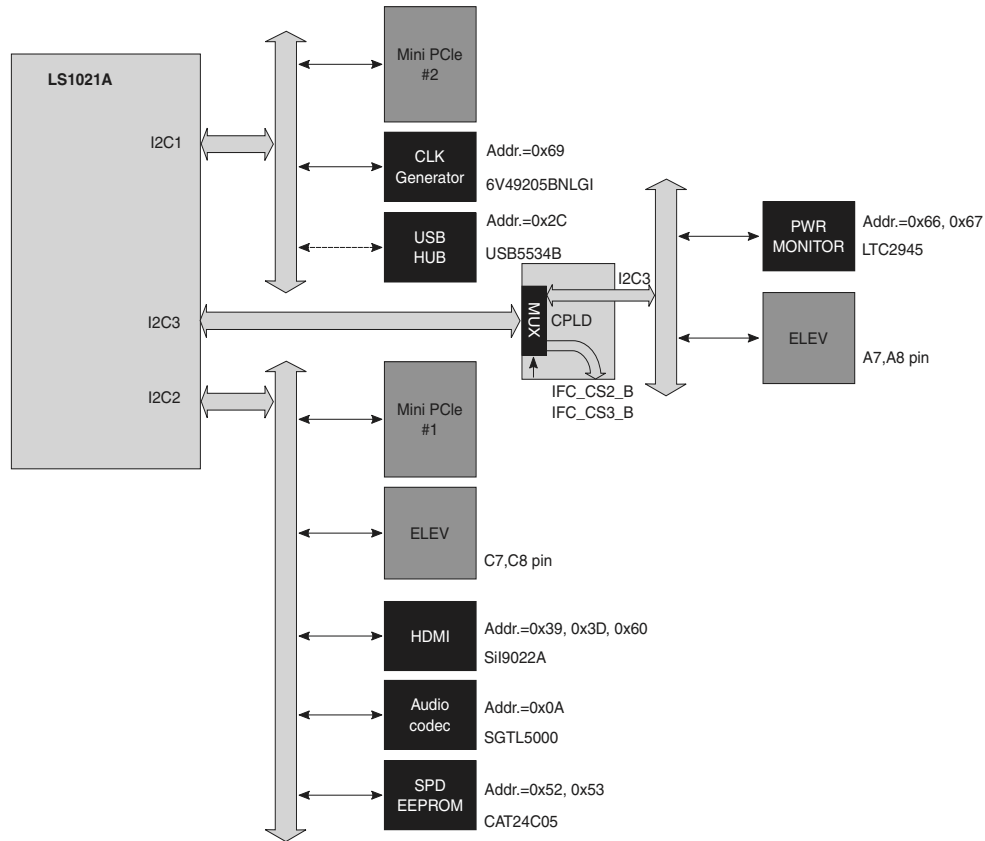


Figure 2-14. I<sup>2</sup>C architecture

I<sup>2</sup>C bus device addresses are summarized in [Table 2-14](#).

Table 2-14. I2C bus device map

I2C Bus	7b Addr.	Description	Device	Notes
(all)	-	/	I2C Master	n/a
I2C2	0x0A	Audio Codec	SGTL5000	n/a
I2C2	0x39, 0x3D	HDMI Transmitter	SiI9022A	n/a
I2C2	0x52 0x53	0x52(256B): SPD; 0x53(256B): SystemID	512B EEPROM: CAT24C05	DIMM SPD. Stores board specific data, including MAC addresses, serial number/errata, etc. Write protectable.
I2C2	-		miniPCIe1 Slot	Slave address depends on miniPCIe cards on the slot.
I2C2	-		TWR-ELEV Pin NO. C7, C8	Slave address depends on TWR modules on the ELEV.
I2C1	0x69	Clock generator	6V49205BNLGI	n/a



**Table 2-15. SPI configuration**

Configuration Signal	Controls	Value	Description
cfg_spi2_lcd	SW: SW3[6]	0	LCD/LPUART
		1	SPI2
	REG: 0x0A	0	SPI2
		1	LPUART1
cfg_ifc_spi1	SW: SW2[7]	0	SPI1
		1	IFC (or I2C3)

## 2.16 SDHC interface

The LS1021A / LS1020A SDHC interface supports a large variety of devices, both in terms of width as well as the ability to use special signals to accelerate data transfer:

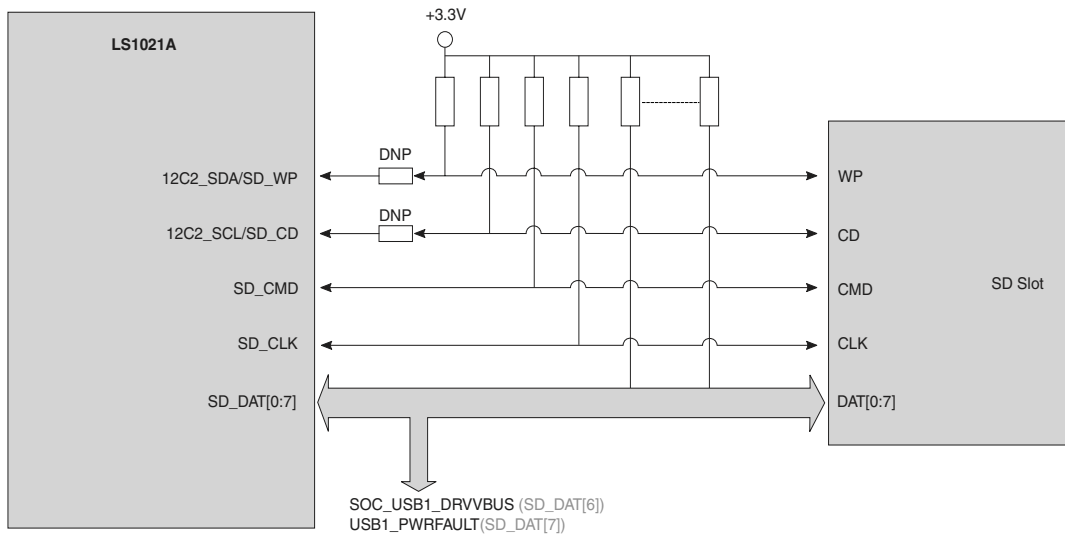
- MMC cards, 1x, 4x or 8x wide, 3.3 V only
- Legacy MMC cards: 1x, 4x or 8x wide, 3.3 V only
- SDHC card, 1x or 4x wide, 3.3 V only

To handle all these options, TWR-LS1021A systems feature a full-size connector which a variety of adapter cards install.

### NOTE

SDHC\_WP and SDHC\_CD\_N are multiplexed with I2C2 signals, so default they are not supported.

Figure 2-16 shows the overall connections of the SDHC portion

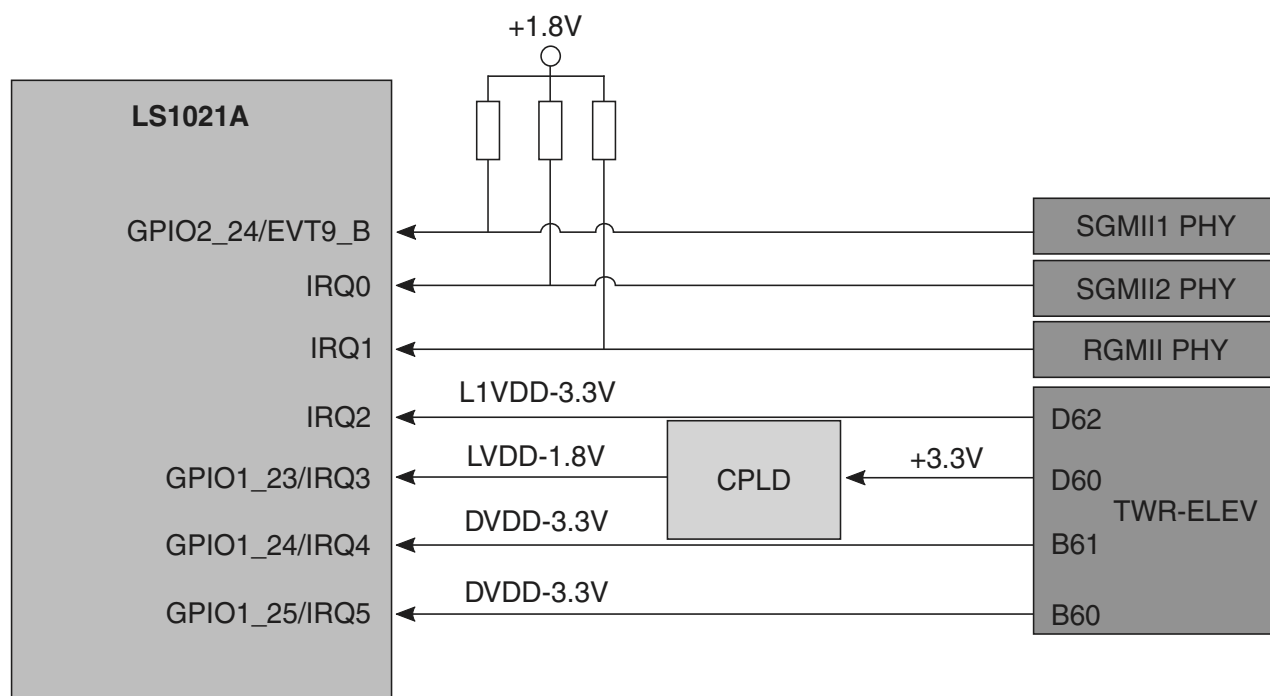


**Figure 2-16. SDHC architecture**

## 2.17 Interrupt controller

The LS1021A / LS1020A MPIC pins are typically connected to a variety of devices, many operating at differing voltages.

Figure 2-18 shows the interrupt architecture.



**Figure 2-17. Interrupt architecture**

The connection from external interrupts to the correct MPIC pins is shown in [Table 2-16](#).

**Table 2-16. Interrupt connections**

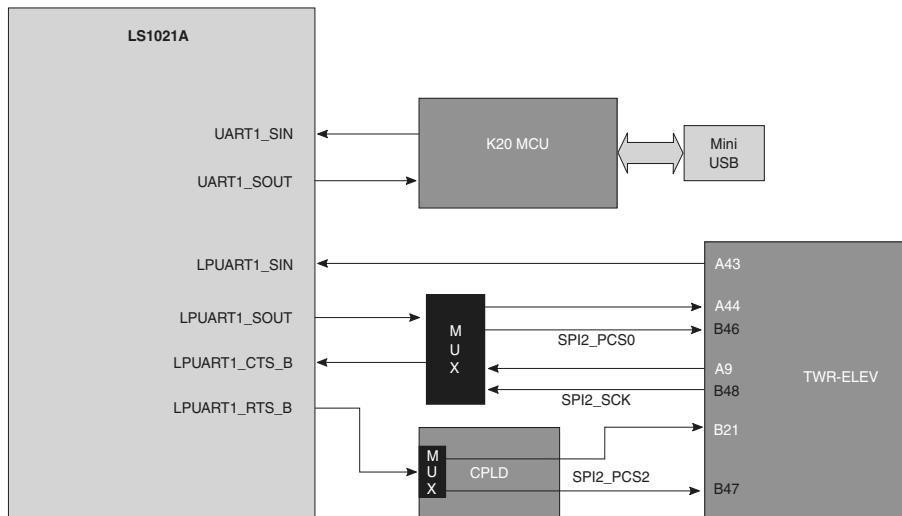
Signal names	Connected devices	Note
IRQ0_B	SGMII2 Interrupt	+1.8V O1VDD, pull-up on board
IRQ1_B	RGMII Interrupt	+1.8V OVDD, Pull-up on board
IRQ2_B	TWR ELEV D62 pin LCD_IRQ_I interrupt	L1VDD, without pull-up on board for TWR-LCD interrupt
IRQ3_B	TWR ELEV D60 pin LCD_IRQ_K interrupt	LVDD, pull-up on board for TWR-LCD interrupt
IRQ4_B	TWR ELEV B61 pin IRQ_SPI interrupt	+3.3V DVDD, without pull-up on board.
IRQ5_B	TWR ELEV B62 pin IRQ_KBI interrupt	+3.3V DVDD, without pull-up on board.

**Table 2-16. Interrupt connections (continued)**

Signal names	Connected devices	Note
EVT0_B	N.A	Unused, pull up only.
EVT1_B	N.A	Unused
EVT2_B	N.A	Unused
EVT3_B	N.A	Unused
EVT4_B	N.A	Unused.
EVT9_B	SGMII1 Interrupt	+1.8V O1VDD, pull-up on board

## 2.18 Serial ports

The TWR-LS1021A connect LS1021A UART1 2-wire serial ports to MBED circuit and convert UART signals to a mini USB connector as console UART. TWR-LS1021A could support a 4-wire LPUART by TWR modules, in this case, RTS/CTS flow control is supported. Figure 2-19 shows an overview of the serial ports.

**Figure 2-18. Serial architecture**

To support the 4-wire LPUART, CPLD can select LPUART1 signals from multiplexed SPI2 signals.

### 2.18.1 UART configuration and setup

The UART configuration controls are described in [Table 2-17](#).

Table 2-17. LPUART1 configuration

Configuration Signal	Controls	Value	Description
cfg_lpuart1_spi2	SW: SW3[6]	0	LPUART1 pins are selected.
		1	SPI2 pins are selected.
	REG: 0x0A	0	SPI2 pins are selected.
		1	LPUART1 pins are selected.

## 2.19 Audio port

The SAI (Synchronous Audio Interface) architecture is shown in [Figure 2-19](#).

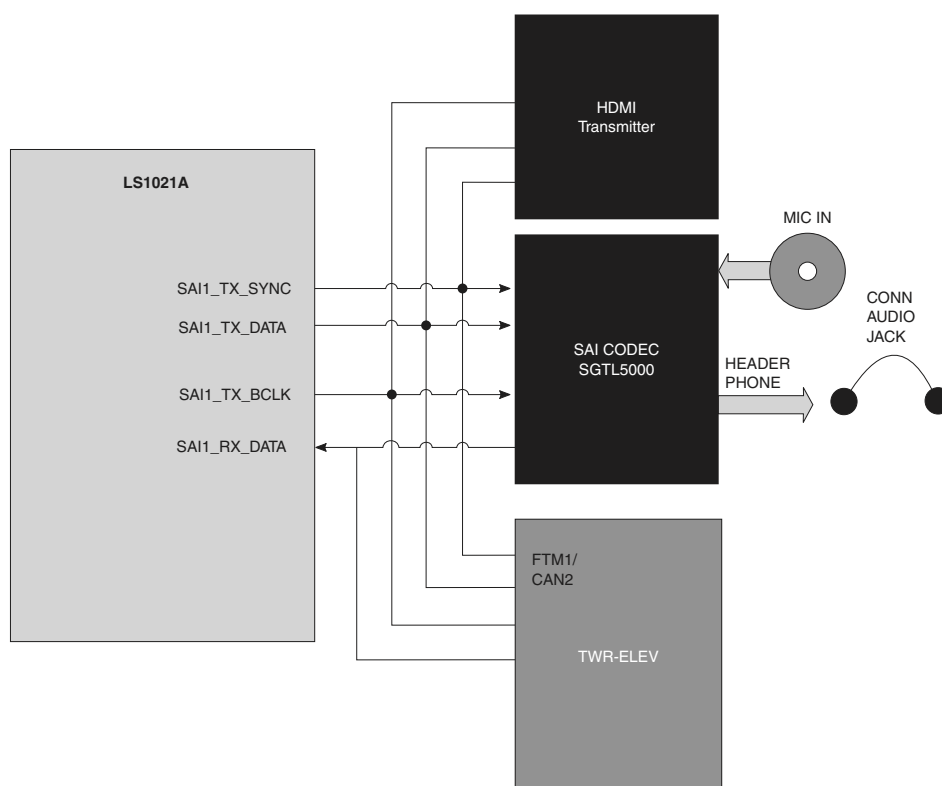


Figure 2-19. Audio port architecture

Though the LS1021A/LS1020A supports four full duplex Synchronous Audio Interface (SAI) ports up to 30 Mbps each, but only SAI1 is connected to Freescale SGTL5000-32QFN CODECs which drives headphone for I2S, AC97, and Codec/DSP interfaces. Also, SAI1 is routed to HDMI transmitter to supply audio output.



## 2.20 JTAG port

The COP/JTAG architecture is shown in Figure 2-20.

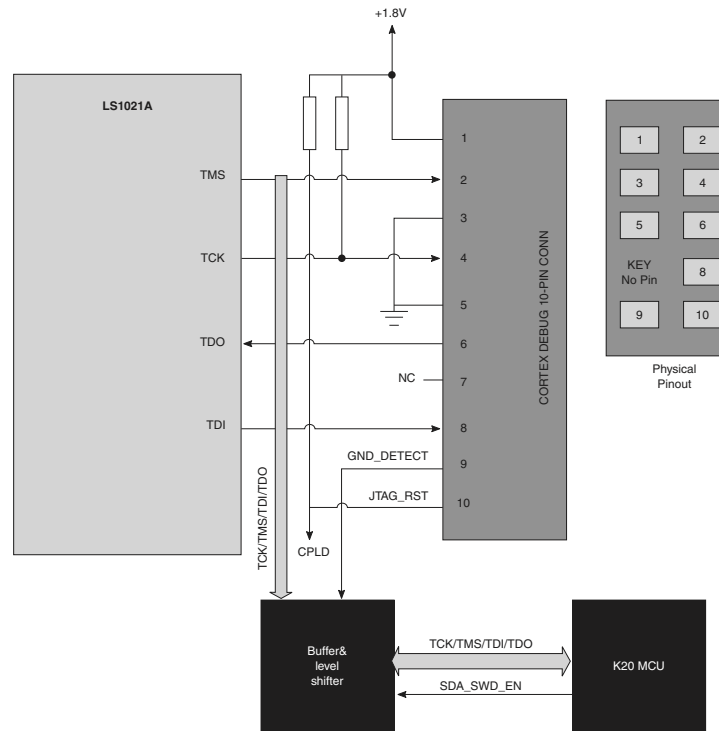


Figure 2-20. JTAG/COP connections

JTAG commands are accepted from the standard COP/JTAG/CCS header and are sent to LS1021A. JTAG could be accessed by external emulator or MBED.

JTAG RST connect to CPLD to generate PORESET signals only at power up.

## 2.21 GPIO pins

The LS1021A has no dedicated GPIO pins; instead, GPIO functions are multiplexed internally on other signals, which must be disabled before using the GPIO functions. Because GPIO is not needed for board operation, GPIO evaluation is strictly limited to validation purposes.

In an addition, to remain those GPIO pins primary function, CPLD registers will offer GPIO pin functions for TWR modules control.

Table 2-18. GPIO mapping

DUT Primary Function	DUT GPIO Function	Notes
GPIO	GPIO_3[13]	Connect to TWR-ELEV pin A10.
GPIO	GPIO_3[14]	Connect to TWR-ELEV pin B23.
ASLEEP, RTC, etc	GPIO_1[13:26]	Required for non-GPIO function

Table 2-18. GPIO mapping (continued)

DUT Primary Function	DUT GPIO Function	Notes
SDHC_CMD, etc	GPIO_2[04:27]	Required for non-GPIO function
EMI_MDC, etc	GPIO_3[00:31]	Required for non-GPIO function
EC3_TX_EN, etc	GPIO_4[00:28]	Required for non-GPIO function

**NOTE**

GPIO I/O signals are actively driven to high or low levels; software can emulate open-drain drivers by driving 0 normally, but driving 1 by switching to input mode and letting the external pullup operate.

## 2.22 Monitoring LEDs

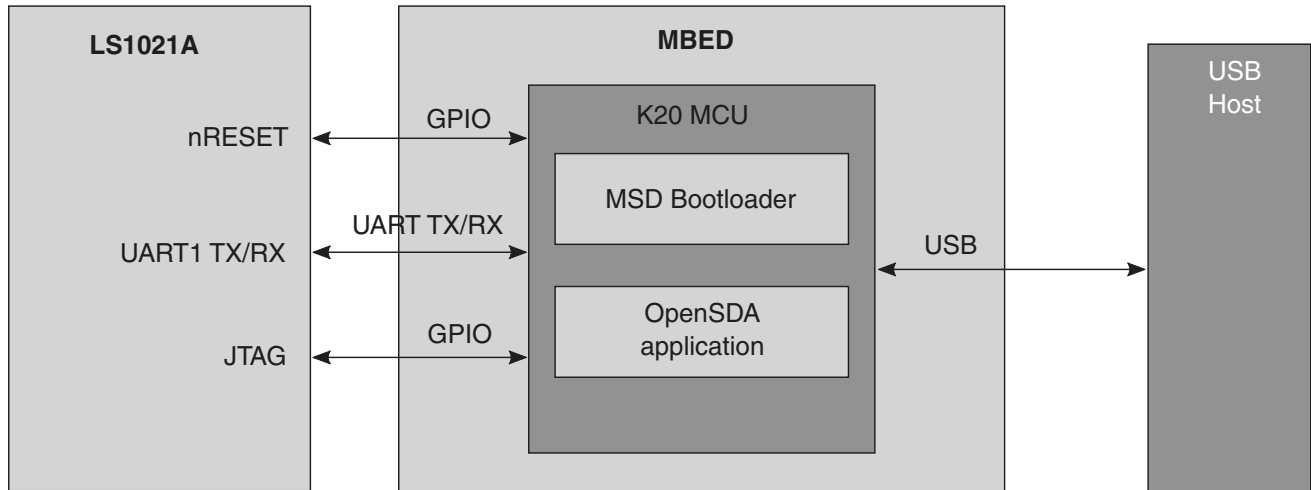
The TWR-LS1021A has some LEDs which can be used to monitor various functions of the system:

Table 2-19. LED status monitors

LED	LED Legend	Description	COLOR
D1	POWER	3.3V is powered up	GREEN
D2	SDA	MBED firmware is loaded.	GREEN
D5	ASLEEP	ASLEEP is being asserted.	GREEN
RJ45(U20) right	Link	RGMI Link	GREEN
RJ45(U20) left	Activity	RGMI Activity	YELLOW
RJ45(P1) left down	Link	SGMI1 Link	GREEN
RJ45(P1) right down	Activity	SGMI1 Activity	YELLOW
RJ45(P1) left up	Link	SGMI2 Link	GREEN
RJ45(P1) right up	Activity	SGMI2 Activity	YELLOW

## 2.23 MBED

This section will describe MBED circuit on TWR-LS1021A board. MBED is an open-standard serial and debug adapter. It bridges serial and debug communications between a USB host and an embedded target processor as shown in [Figure 2-21](#).



**Figure 2-21. MBED architecture**

MBED is managed by a Kinetis K20 MCU built on the ARM® Cortex™-M4 core. The Kinetis K20 includes an integrated USB controller that can operate at clock rates up to 50MHz. The MBED circuit includes a status LED and a pushbutton. The pushbutton asserts the Reset signal to the target processor. GPIO signals provide an interface to either a JTAG debug port on a target processor. Additionally, signal connections are available to implement a UART serial channel.

MBED features a mass storage device (MSD) bootloader, which provides a quick and easy mechanism for loading different MBED Applications such as flash programmers, run-control debug interfaces, serial-to-USB converters, and more.

## Chapter 3

# Tower Elevator Connections

This section describes the TWR elevator pinouts.

### 3.1 Overview

The TWR-LS1021A features two expansion card-edge connectors that interface to the primary and secondary elevator boards in a Tower system. The Primary Connector (comprised of sides A and B) is utilized by the TWR-LS1021A while the Secondary Connector (comprised of sides C and D) makes connections to the LCD and ULPI etc signals. [Table 3-1](#) provides the pinout for the Primary Connector. [Table](#) provides the pinout for the Secondary Connector.

**Table 3-1. TWR-LS1021A primary connector pinout**

Pin#	Side B		Pin#	Side A	
	Name	Usage		Name	Usage
B1	5V	5.0V Power	A1	5V	5.0V Power
B2	GND	Ground	A2	GND	Ground
B3	3.3V	3.3V Power	A3	3.3V	3.3V Power
B4	ELE_PS_SE NSE	Elevator Power Sense	A4	3.3V	3.3V Power
B5	GND	Ground	A5	GND	Ground
B6	GND	Ground	A6	GND	Ground
B7	SDHC_CLK / SPI1_CLK	SPI1_SCK	A7	SCL0	I2C3_SCL
B8	SDHC_D3 / SPI1_CS1_b	SPI1_CS1_B	A8	SDA0	I2C3_SDA
B9	SDHC_D3 / SPI1_CS0_b	SPI1_CS0_B	A9	GPIO9 / CTS1	LPUART1_CTS1
B10	SDHC_CMD / SPI1_MOSI	SPI1_SOUT	A10	GPIO8 / SDHC_led	FTM1_QD_PHA_ GPIO3_13
B11	SDHC_D0 / SPI1_MISO	SPI1_SIN	A11	GPIO7 / SD_WP_DET	ELEV_GPIO07_A 11
B12	ETH_COL		A12	ETH_CRS	
B13	ETH_RXER		A13	ETH_MDC	
B14	ETH_TXCLK		A14	ETH_MDIO	
B15	ETH_TXEN		A15	ETH_RXCLK	
B16	ETH_TXER		A16	ETH_RXDV	
B17	ETH_TXD3		A17	ETH_RXD3	
B18	ETH_TXD2		A18	ETH_RXD2	

Table 3-1. TWR-LS1021A primary connector pinout (continued)

Pin#	Side B		Pin#	Side A	
B19	ETH_TXD1		A19	ETH_RXD1	
B20	ETH_TXD0		A20	ETH_RXD0	
B21	GPIO1 / RTS1	LPUART1_RT S1	A21	SSI_MCLK	
B22	GPIO2 / SDHC_D1	GPIO_BRAK E_CTR	A22	SSI_BCLK	
B23	GPIO3	GPIO_ASIC_ RST	A23	SSI_FS	
B24	CLKIN0		A24	SSI_RXD	
B25	CLKOUT1		A25	SSI_TXD	
B26	GND	Ground	A26	GND	Ground
B27	AN7		A27	AN3	
B28	AN6		A28	AN2	
B29	AN5		A29	AN1	
B30	AN4		A30	AN0	
B31	GND	Ground	A31	GND	Ground
B32	DAC1		A32	DAC0	
B33	TMR3		A33	TMR1	FTM_ENC_PHAS E_B
B34	TMR2	FTM_ENC_IN DEX	A34	TMR0	FTM_ENC_PHAS E_A
B35	GPIO4	GPIO_ASIC_ EEPROM_LO ADED	A35	GPIO6	ELEV_GPIO06_A 35
B36	3.3V	3.3V Power	A36	3.3V	3.3V Power
B37	PWM7	FTM1_CH7	A37	PWM3	FTM1_CH3
B38	PWM6	FTM1_CH6	A38	PWM2	FTM1_CH2
B39	PWM5	FTM1_CH5	A39	PWM1	FTM1_CH1
B40	PWM4	FTM1_CH4	A40	PWM0	FTM1_CH0
B41	CANRX0	CAN1_RX	A41	RXD0	CAN2_RX
B42	CANTX0	CAN1_TX	A42	TXD0	CAN2_TX
B43	1WIRE		A43	RXD1	LPUART1_RXD1
B44	SPI0_MISO	SPI2_MISO	A44	TXD1	LPUART1_TXD1
B45	SPI0_MOSI	SPI2_MOSI	A45	VSS	
B46	SPI0_CS0_b	SPI2_CS0_B	A46	VDDA	

Table 3-1. TWR-LS1021A primary connector pinout (continued)

Pin#	Side B		Pin#	Side A	
B47	SPI0_CS1_b	SPI2_CS1_B	A47	VREFA1	CAN3_RX
B48	SPI0_CLK	SPI2_CLK	A48	VREFA2	CAN3_TX
B49	GND	Ground	A49	GND	Ground
B50	SCL1		A50	GPIO14	
B51	SDA1	ELEV_GPIO_B51	A51	GPIO15	
B52	GPIO5 / SD_CARD_DET	ELEV_GPIO05_B52	A52	GPIO16	
B53	USB0_DP_DOWN		A53	GPIO17	
B54	USB0_DM_DOWN		A54	USB0_DM	
B55	IRQ_H		A55	USB0_DP	
B56	IRQ_G		A56	USB0_ID	
B57	IRQ_F		A57	USB0_VBUS	
B58	IRQ_E		A58	TMR7	
B59	IRQ_D		A59	TMR6	
B60	IRQ_C		A60	TMR5	
B61	IRQ_B	IRQ_SPI	A61	TMR4	IFC_TE
B62	IRQ_A	FTM1_FAULT	A62	RSTIN_b	
B63	EBI_ALE / EBI_CS1_b	IFC_AVD	A63	RSTOUT_b	ELEV_RSTOUT
B64	EBI_CS0_b	IFC_CPLD_CS0_B	A64	CLKOUT0	IFC_CLK0
B65	GND	Ground	A65	GND	Ground
B66	EBI_AD15	IFC_AD15	A66	EBI_AD14	IFC_AD14
B67	EBI_AD16	CPLD_A16	A67	EBI_AD13	IFC_AD13
B68	EBI_AD17	IFC_A17	A68	EBI_AD12	IFC_AD12
B69	EBI_AD18	IFC_A18	A69	EBI_AD11	IFC_AD11
B70	EBI_AD19	IFC_A19	A70	EBI_AD10	IFC_AD10
B71	EBI_R/W_b	IFC_WE_B	A71	EBI_AD9	IFC_AD09
B72	EBI_OE_b	IFC_OE	A72	EBI_AD8	IFC_AD08
B73	EBI_D7		A73	EBI_AD7	IFC_AD07
B74	EBI_D6		A74	EBI_AD6	IFC_AD06

Table 3-1. TWR-LS1021A primary connector pinout (continued)

Pin#	Side B		Pin#	Side A	
B75	EBI_D5		A75	EBI_AD5	IFC_AD05
B76	EBI_D4		A76	EBI_AD4	IFC_AD04
B77	EBI_D3		A77	EBI_AD3	IFC_AD03
B78	EBI_D2		A78	EBI_AD2	IFC_AD02
B79	EBI_D1		A79	EBI_AD1	IFC_AD01
B80	EBI_D0		A80	EBI_AD0	IFC_AD00
B81	GND	Ground	A81	GND	Ground
B82	3.3V	3.3V Power	A82	3.3V	3.3V Power

Table 3-2. TWR-LS1021A secondary connector pinout

Pin#	Side B		Pin#	Side A	
	Name	Usage		Name	Usage
D1	5V	5.0V Power	C1	5V	5.0V Power
D2	GND	Ground	C2	GND	Ground
D3	3.3V	3.3V Power	C3	3.3V	3.3V Power
D4	ELE_PS_SE NSE	Elevator Power Sense	C4	3.3V	3.3V Power
D5	GND	Ground	C5	GND	Ground
D6	GND	Ground	C6	GND	Ground
D7	SPI2_CLK		C7	SCL2	I2C2_SCL
D8	SPI2_CS1		C8	SDA2	I2C2_SDA
D9	SPI2_CS0		C9	GPIO25	ELEV_GPIO25_C 9
D10	SPI2_MOSI		C10	USB_STOP	USB2_STP
D11	SPI2_MISO		C11	USB_CLK	USB2_CLK
D12	ETH_COL		C12	GPIO26	
D13	ETH_RXER		C13	ETH_MDC	
D14	ETH_TXCLK		C14	ETH_MDIO	
D15	ETH_TXEN		C15	ETH_RXCLK	
D16	GPIO18		C16	ETH_RXDV	
D17	GPIO19		C17	GPIO27	
D18	GPIO20		C18	GPIO28	
D19	ETH_TXD1		C19	ETH_RXD1	

Table 3-2. TWR-LS1021A secondary connector pinout

Pin#	Side B		Pin#	Side A	
D20	ETH_TXD0		C20	ETH_RXD0	
D21	ULPI_NEXT/ USB1_DM	USB2_NXT	C21	ULPI_DATA0/USB3 _DM	USB2_D0
D22	ULPI_DIR/US B1_DP	USB2_DIR	C22	ULPI_DATA1/USB3 _DP	USB2_D1
D23	UPLI_DATA5/ USB2_DM	USB2_D5	C23	ULPI_DATA2/USB4 _DM	USB2_D2
D24	ULPI_DATA6/ USB2_DP	USB2_D6	C24	ULPI_DATA3/USB4 _DP	USB2_D3
D25	ULPI_DATA7	USB2_D7	C25	ULPI_DATA4	USB2_D4
D26	GND	Ground	C26	GND	Ground
D27	LCD_HSYNC / LCD24	LCD_RGB_H SYNC	C27	AN11	
D28	LCD_VSYNC / LCD25	LCD_RGB_V SYNC	C28	AN10	
D29	AN13		C29	AN9	
D30	AN12		C30	AN8	
D31	GND	Ground	C31	GND	Ground
D32	LCD_CLK / LCD26	LCD_CLK_O UT	C32	GPIO29	UCC1_DCD
D33	TMR11		C33	TMR9	
D34	TMR10		C34	TMR8	
D35	GPIO21		C35	GPIO30	UCC3_DCD
D36	3.3V	3.3V Power	C36	3.3V	3.3V Power
D37	PWM15	LCD_PWM	C37	PWM11	
D38	PWM14		C38	PWM10	CLK_IN_QE
D39	PWM13		C39	PWM9	
D40	PWM12		C40	PWM8	
D41	CANRX1	CAN4_RX	C41	RXD2 / TSI0	UCC1_RXD
D42	CANTX1	CAN4_TX	C42	TXD2 / TSI1	UCC1_TXD
D43	GPIO22	ELEV_GPIO2 2_D43	C43	RTS2 / TSI2	UCC1_RTS_B
D44	LCD_OE / LCD27	LCD_DP_DE	C44	CTS2 / TSI3	UCC1_CTS_B
D45	LCD_D0 / LCD0	LCD_DP0	C45	RXD3 / TSI4	UCC3_RXD



Table 3-2. TWR-LS1021A secondary connector pinout

Pin#	Side B		Pin#	Side A	
D46	LCD_D1 / LCD1	LCD_DP1	C46	TXD3 / TSI5	UCC3_TXD
D47	LCD_D2 / LCD2	LCD_DP2	C47	RTS3 / TSI6	UCC3_RTS_B
D48	LCD_D3 / LCD3	LCD_DP3	C48	CTS3 / TSI7	UCC3_CTS_B
D49	GND	Ground	C49	GND	Ground
D50	GPIO23		C50	LCD_D4 / LCD4	LCD_DP4
D51	GPIO24		C51	LCD_D5 / LCD5	LCD_DP5
D52	LCD_D12 / LCD12	LCD_DP12	C52	LCD_D6 / LCD6	LCD_DP6
D53	LCD_D13 / LCD13	LCD_DP13	C53	LCD_D7 / LCD7	LCD_DP7
D54	LCD_D14 / LCD14	LCD_DP14	C54	LCD_D8 / LCD8	LCD_DP8
D55	IRQ_P/SPI2_ CS2		C55	LCD_D9 / LCD9	LCD_DP9
D56	IRQ_O/SPI2_ CS3		C56	LCD_D10 / LCD10	LCD_DP10
D57	IRQ_N		C57	LCD_D11 / LCD11	LCD_DP11
D58	IRQ_M		C58	TMR16	
D59	IRQ_L		C59	TMR15	
D60	IRQ_K	LCD_IRQ_K	C60	TMR14	
D61	IRQ_J		C61	TMR13	
D62	IRQ_I	LCD_IRQ_I	C62	LCD_D15 / LCD15	LCD_DP15
D63	LCD_D18 / LCD18	LCD_DP18	C63	LCD_D16 / LCD16	LCD_DP16
D64	LCD_D19 / LCD19	LCD_DP19	C64	LCD_D17 / LCD17	LCD_DP17
D65	GND	Ground	C65	GND	Ground
D66	EBI_AD20 / LCD42	IFC_ADDR20	C66	EBI_BE3 / LCD28	IFC_WE_B
D67	EBI_AD21 / LCD43	IFC_ADDR21	C67	EBI_BE2 / LCD29	IFC_WE_B
D68	EBI_AD22 / LCD44	PLD2ELEV_A DDR22	C68	EBI_BE1 / LCD30	IFC_WE_B
D69	EBI_AD23 / LCD45	PLD2ELEV_A DDR23	C69	EBI_BE0 / LCD31	IFC_WE_B

Table 3-2. TWR-LS1021A secondary connector pinout

Pin#	Side B		Pin#	Side A	
D70	EBI_AD24 / LCD46	PLD2ELEV_A DDR24	C70	EBI_TSIZE0 / LCD32	IFC_BCTL_B
D71	EBI_AD25 / LCD47	PLD2ELEV_A DDR25	C71	EBI_TSIZE1 / LCD33	
D72	EBI_AD26 / LCD48	PLD2ELEV_A DDR26	C72	EBI_TS / LCD34	IFC_WE_B
D73	EBI_AD27 / LCD49	PLD2ELEV_A DDR27	C73	EBI_TBST / LCD35	IFC_RB0_B
D74	EBI_AD28 / LCD50	IFC_PAR0	C74	TB_TA / LCD36	IFC_RB1_B
D75	EBI_AD29 / LCD51	IFC_PAR1	C75	EBI_CS4 / LCD37	
D76	EBI_AD30 / LCD52		C76	EBI_CS3 / LCD38	IFC_CS3_B
D77	EBI_AD31 / LCD53		C77	EBI_CS2 / LCD39	IFC_CS2_B
D78	LCD_D20 / LCD20	LCD_DP20	C78	EBI_CS1 / LCD40	IFC_CS1_B
D79	LCD_D21 / LCD21	LCD_DP21	C79	GPIO31 / LCD41	
D80	LCD_D22 / LCD22	LCD_DP22	C80	LCD_D23 / LCD23	LCD_DP23
D81	GND	Ground	C81	GND	Ground
D82	3.3V	3.3V Power	C82	3.3V	3.3V Power

## 3.2 Supported TWR modules

TWR-LS1021A is compatible the TWR-ELEV pinout. Below table listed supported peripheral modules. Some modules may be supported but not in the list. The listed modules show LS1021A/LS1020A some important features.

Table 3-3. Supported peripheral TWR modules

TWR Module	Num	CAN				UCC		LPUART 1	SPI 2	I2C3	GPIO	IRQ	FTM 1	USB 2.0	LCD	VET SEC 3	IFC
		1	2	3	4	1	3										
TWR-IND-IO	1 <sup>st</sup>			✓	✓	✓		✓			1						
	2 <sup>nd</sup>	✓	✓														

Table 3-3. Supported peripheral TWR modules

TWR Module	Num	CAN				UCC		LPUART 1	SPI 2	I2C3	GPIO	IRQ	FTM 1	USB 2.0	LCD	VET SEC 3	IFC
		1	2	3	4	1	3										
TWR-SER2	1												✓				
TWR-EtherCAT-SLV	1							✓	✓		5	1					
TWR-MC-LV3PH	1							✓	✓		3	2	✓				
TWR-LCD	1							✓									✓
TWR-LCD-RGB	1									✓	2			✓			

Below sections describe how those supported modules signals connected with TWR-LS1021A board.

### 3.2.1 TWR-IND-IO

Table 3-4. Signal connections between TWR-IND-IO and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-IND-IO	
Signal	Signal	Pin	Board1	Board2
LPUART1	RXD1	A43	4wire [RS232]	Jumper open
	TXD1	A44	J8->J16	J8
	RTS1	B21		
	CTS1	A9		
UCC1	RXD2	C41	4wire [Rs485]	Jumper open
	TXD2	C42	J20->J20	J20
	RTS2	C43		
	CTS2	C44		
	DCD2	C32		
UCC3	RXD3	C45	Jumper open	4wire [RS485]
	TXD3	C46	J16	J16->J20
	RTS3	C47		
	CTS3	C48		
	DCD3	C35		

Table 3-4. Signal connections between TWR-IND-IO and TWR-LS1021A (continued)

LS1021A	TWR-ELEV		TWR-IND-IO	
CAN1	CAN0_RX	B41	NP-R10, R11	CAN PHY0
	CAN0_TX	B42		Pop R10, R11
CAN2	RXD0	A41	Jumper open	CAN PHY1
	TXD0	A42	J9	J9->J15
CAN3	CAN1_RX	A47	CAN PHY0	US-SH1, SH2
	CAN1_RX	A48	MS-SH1, SH2	
CAN4	CAN2_RX	D41	CAN PHY1	Jumper open
	CAN2_TX	D42	J15	J9
GPIO	RSTOUT	A63	Reset board	

### 3.2.2 TWR-SER2

Table 3-5. Signal connections between TWR-SER2 and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-SER2	
Signal	Signal	Pin	Signal	Function
USB 2.0	ULPI_NEXT	D21	ULPI_NEXT	USB330 PHY
	ULPI_DIR	D22	ULPI_DIR	
	ULPI_STOP	C10	ULPI_STOP	
	ULPI_CLK	C11	UPLI_CLK	
	UPLI_DATA0	C21	ULPI_DATA0	
	ULPI_DATA1	C22	ULPI_DATA1	
	ULPI_DATA2	C23	ULPI_DATA2	
	ULPI_DATA3	C24	ULPI_DATA3	
	ULPI_DATA4	C25	ULPI_DATA4	
	ULPI_DATA5	C23	ULPI_DATA5	
	ULPI_DATA6	D21	ULPI_DATA6	
	ULPI_DATA7	D25	ULPI_DATA7	

### 3.2.3 TWR-EtherCAT-SLV

Table 3-6. Signal connections between TWR-EtherCAT-SLV and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-EtherCAT-SLV	
Signal	Signal	Pin	Signal	Function

Table 3-6. Signal connections between TWR-EtherCAT-SLV and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-EtherCAT-SLV	
I2C3	SCL0	A7	I2C	EEPROM (Config)
	SDA0	A8		
SPI2	SPIO_MISO	B44	SPI	Data interface to FPGA
	SPIO_MOSI	B45		
	SPIO_CS0_B	B46		
	SPIO_CS1B	B47		
	SPIO_CLK	B48		
IRQ	IRQ_B	B61	SPI.IRQ	
LPUART/SPI	CTS1	A9	ASIC_LATCH1	
RTS1	B21	B21	ASIC_LATCH0	
GPIO	GPIO3	B23	ASIC_RESET	
	GPIO4	B35	ASIC_EEPROM_LOADED	
	GPIO6	A35	ERR LED	
	GPIO2	B22	GPIO0	NC
	SCL1	B51	GPIO1	
	GPIO8	A10	GPIO2	LATCH0
	GPIO7	A11	GPIO3	LATCH1

### 3.2.4 TWR-MC-LV3PH

Table 3-7. Signal connections between TWR-MC-LV3PH and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-MC-LV3PH		TWR-ADCDAC-LTC	
Signal	Signals	Pin	Signals	Function	Signals	Function
FTM1	PWM0	A40	PWM_AT			
	PWM1	A39	PWM_AB			
	PWM2	A38	PWM_BT			
	PWM3	A37	PWM_BB			
	PWM4	B40	PWM_CT			
	PWM5	B39	PWM_CB			

Table 3-7. Signal connections between TWR-MC-LV3PH and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-MC-LV3PH		TWR-ADCDAC-LTC	
SPI2	SPI0_MISO	B44	MISO		SPI0_MISO	J13.1-2
	SPI0_MOSI	B45	MOSI		SPI0_MOSI	J12.1-2
	SPI0_CS0	B46	/SS	R95, DNP, use CS1	SPI0_CS0	J10.1-2, use CS0
	SPI0_CS1	B47	/SS		SPI0_CS1	J25, J14, J15, J16.1-2
	SPI0_CLK	B48	SCLK		SPI0_CLK	J9.1-2
FTM1	TMR0	A34	ENC_PHASE_A			
	TMR1	A33	ENC_PHASE_B			
	TMR2	B34	ENC_INDEX			
	AN0	A30	I_SENSE_A/ BEMF_SENSE_A		U7_CH0	Connect to J27
	AN1	A29	I_SENSE_B/ BEMF_SENSE_B		U7_CH1	
	AN2	A28	I_SENSE_C/ BEMF_SENSE_C		U7_CH2	
	AN6	B28	I_SENSE_C/ I_SENSE_DCB		U7_CH3	
GPIO	GPIO1/ RTS1	B21	USER_LED			
	GPIO2/SD HC_D1	B22	BRAKE_CONTROL			
	GPIO5/ SD_CARD_ DET	B52	DRV_EN			
	RSTOUT_b	A63	RESET			
IRQ	IRQ_B	B61	DRV_INT			
	IRQ_A	B62	DRV_OC			

### 3.2.5 TWR-LCD

Table 3-8. Signal connections between TWR-LCD and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-LCD	
Signal	Signals	Pin	Signals	Function

Table 3-8. Signal connections between TWR-LCD and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-LCD	
IFC	EBI_AD15	B66	FB_AD15	EBI Bus
	EBI_AD14	A66	FB_AD14	
	EBI_AD13	A67	FB_AD13	
	EBI_AD12	A68	FB_AD12	
	EBI_AD11	A69	FB_AD11	
	EBI_AD10	A70	FB_AD10	
	EBI_AD9	A71	FB_AD9	
	EBI_AD8	A72	FB_AD8	
	EBI_AD7	A73	FB_AD7	
	EBI_AD6	A74	FB_AD6	
	EBI_AD5	A75	FB_AD5	
	EBI_AD4	A76	FB_AD4	
	EBI_AD3	A77	FB_AD3	
	EBI_AD2	A78	FB_AD2	
	EBI_AD1	A79	FB_AD1	
	EBI_AD0	A80	FB_AD0	
	EBI_R/W_B	B71	FB_R/W_B	
	EBI_AD16	B67	JM_DC	
	SPI2	SPI0_MISO	B44	
SPI0_MOSI		B45	JM_MOSI	
SPI0_CLK		B48	KM_SCK	
SPI0_CS0_B		B46		
SPI0_CS1_B		B47	JM_CSn	
	AN4	B30	XPLS	Touch panel
	AN5	B29	YMNS	
	AN6	B28	XMNS	
	AN7	B27	YPLS	

### 3.2.6 TWR-LCD-RGB

The TWR-LCD-RGB features a 4.3" WQVGA TFT LCD Display (480H x 272 V pixels, 24-bit RGB (8-bit per signal)) with touch sensitive overlay. The LCD interfaces to the Tower System through a 24-bit RGB interface. The 4-wire resistive touch overlay can interface directly with a compatible Tower Processor Module using GPIO enabled ADC lines, or can offload the resistive touch sensing to the on-board Xtrinsic Touch Sensing Platform (CRTouch). CPLD translate from FDI 2-bits to 1-bit.

Table 3-9. Signal connections between TWR-LCD-RGB and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-LCD-RGB	
	Signal	Pin	Signal	Function
I2C	SCL2	C7	I2C_SCL	I2C
	SDA2	C8	I2C_SDA	
GPIO	GPIO25	C9	RESET_IN_B	
	GPIO22	D43	LCD_ENABLE	
FTM	LED_PWM	D37	LED_PWM	
	AN11	C27	RTXR	Touch panel
	AN10	C28	RTYD	
	AN9	C29	RTXL	
	AN8	C30	RTYU	



Table 3-9. Signal connections between TWR-LCD-RGB and TWR-LS1021A

LS1021A	TWR-ELEV		TWR-LCD-RGB	
LCD	LCD_D4	C50	RBG_B4	24-bit RGB
	LCD_D5	C51	RBG_B5	
	LCD_D6	C52	RBG_B6	
	LCD_D7	C53	RBG_B7	
	LCD_D8	C54	RBG_G0	
	LCD_D9	C55	RBG_G1	
	LCD_D10	C56	RBG_G2	
	LCD_D11	C57	RBG_G3	
	LCD_D15	C62	RBG_G7	
	LCD_D16	C63	RGB_R0	
	LCD_D17	C64	RGB_R1	
	LCD_D23	C80	RGB_R7	
	LCD_HSYNC	D27	RDB_HSYNC	
	LCD_VSYNC	D28	RDB_VSYNC	
	LCD_CLK	D32	RDB_CLK	
	LCD_OE	D44	RDB_DE	
	LCD_D0	D45	RDB_B0	
	LCD_D1	D46	RDB_B1	
	LCD_D2	D47	RDB_B2	
	LCD_D3	D48	RDB_B3	
	LCD_D12	D52	RDB_G4	
	LCD_D13	D53	RDB_G5	
	LCD_D14	D54	RDB_G6	
	LCD_D18	D63	RDB_R2	
	LCD_D19	D64	RDB_R3	
	LCD_D20	D78	RDB_R4	
LCD_D21	D79	RDB_R5		
LCD_D22	D80	RDB_R6		
IRQ_K	IRQ_K	D60	IRQ_B	
	IRQ_I	D62	IRQ_A	

# Chapter 4

## CPLD System Controller Architecture

Figure 4-1 shows a detailed block diagram of the CPLD.

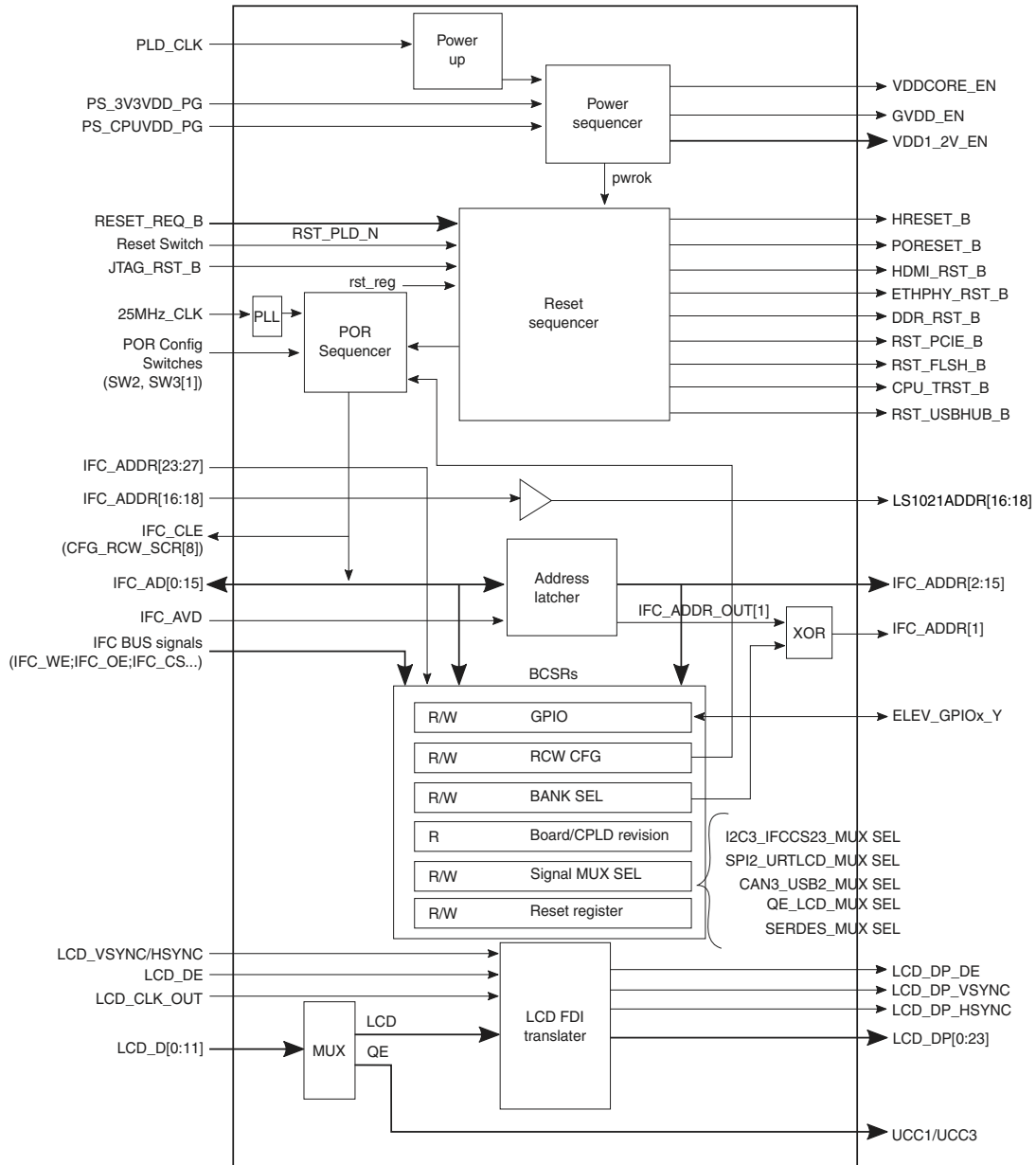


Figure 4-1. CPLD overview

### 4.1 CPLD key features

This CPLD includes the following features:

- Control power on sequence

- Power on CPU VDD, GVDD, and others powers.
- Reset signal generation and distribution. System reset features are:
  - Power on reset for LS1021A, flash, PCIe, DDR, and PHY devices with initialization of all CPLD registers to default value.
  - Manual reset: System will reset and initialize all CPLD registers to default value after pressing reset button.
  - Global register reset: Set register to reset the whole system with initializing all CPLD registers to default value.
  - Local register reset: Set register to reset the whole system and reserve all CPLD registers current value.
- Control POR Sequence
  - Configure POR signals according to external DIP switches or board request.
- Select Multiplexed pins
  - Mux I2C and IFC CS2, CS3
  - Mux SPI2 and LPUART or LCD
  - Mux CAN3 and USB2
  - Mux QE and LCD
  - Mux SerDes configurations
- IFC Bus
  - Latch out address lines from multiplexed signals and address lines.
  - Read/Write CPLD BCSR registers.
  - Configure address lines to ELEV local bus pins.
- NOR Bank Selection
  - Split NOR flash to two banks.
- LCD FDI translator
  - Translate 2-bit FDI signals to 1-bit FDI signals.

## 4.2 Reset

The reset controller manages not only asserting reset to LS1021A, but to the rest of the system as well. It also maintains the assertion timing of the configuration drive signal (cfg\_drv), which causes the CPLD to drive configuration values onto pin-sampled nets.

The following [Figure 4-2](#) shows the reset sequences.

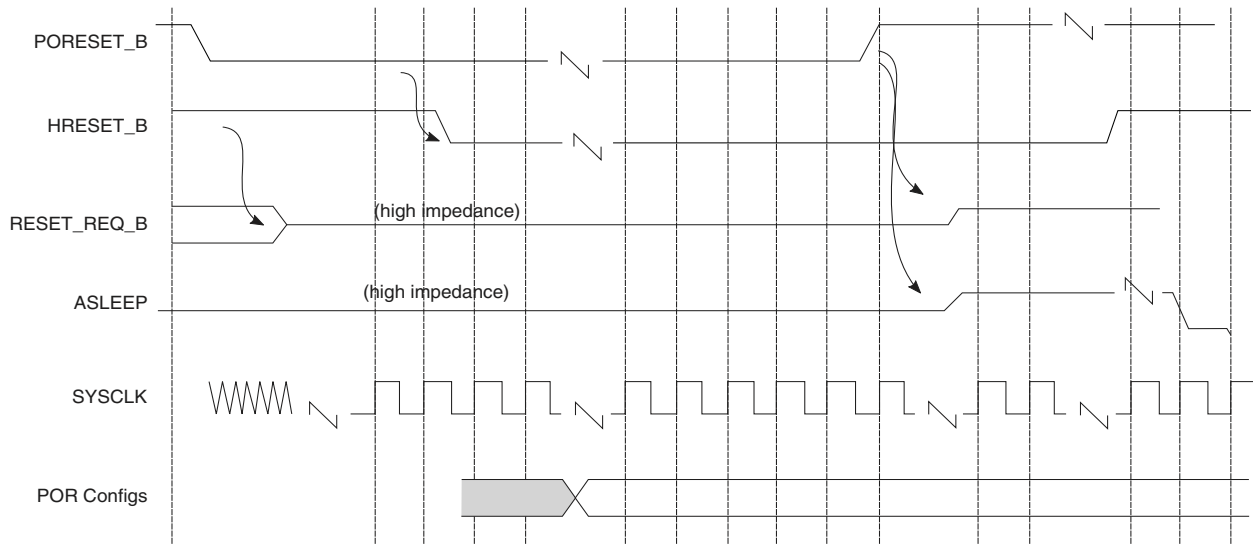


Figure 4-2. Reset power sequencing

## 4.3 CPLD register map

### 4.3.1 Memory map

CPLD registers are memory mapped to LS1021A using IFC. [Table 4-1](#) lists the peripheral data bus width and memory map.

Table 4-1. CPLD memory map

Address	CS	Bank size	Device	Data width	Access
0x7fb00000-0x7fb0ffff	CS1	64 KB	CPLD	8-bit	Read/Write

### 4.3.2 BCSR registers map

The BCSR (Board and Control Register) contains many registers that are accessible from device over IFC.

[Table 4-2](#) summarizes the all CPLD registers and [Table 4-3](#) shows a detailed address map description.

Table 4-2. CPLD BCSR register block map

Base Address Offset	Access Type	Register Name
0x00	R	cpld_ver
0x01	R	cpld_ver_sub
0x02	R	pcba_ver
0x03	R/W	system_rst
0x04	R/W	soft_mux_on1

Table 4-2. CPLD BCSR register block map

Base Address Offset	Access Type	Register Name
0x05	R/W	cfg_rcw_src1
0x06	R/W	cfg_rcw_src2
0x07	R/W	vbank
0x08	R/W	gpio
0x09	R/W	i2c3_ifc_mux
0x0A	R/W	mux_spi2
0x0B	R/W	can3_usb2_mux
0x0C	R/W	qe_lcd_mux
0x0D	R/W	serdes_mux
0x0E	R/W	global_rst
0x0F	R/W	elec_cs
0x10	R	lvdd_vsel
0x11	R/W	soft_mux_on2
0x12	R/W	nor_qspi_mux

Table 4-3. CPLD BCSR register detail map

Base Address Offset	Access Type	Description	Register Name	Default Value
0x00	R	Bit [3:0]: CPLD Major Revision Register Bit [7:4]: Reserved	cpld_ver	0x02
0x01	R	Bit [3:0]: CPLD Minor Revision Register Bit [7:4]: Reserved	cpld_ver_sub	0x00
0x02	R	Bit [3:0]: PCBA Revision Register Bit [7:4]: Reserved	pcba_ver	0x03
0x03	R/W	Writing this register to reset system with reserving CPLD registers value and overriding physical switches on the board Bit [0]: 0 system running(Default) 1 system reset Bit [7:1]: Reserved	system_rst	0x00

Table 4-3. CPLD BCSR register detail map

Base Address Offset	Access Type	Description	Register Name	Default Value
0x04	R/W	CPLD override physical switches Enable Register Bit [0]: RCW Source Location control (Register 0x05 and 0x06 cfg_rcw_src) output enable 0 Disable (Default) 1 Enable Bit [1]: I2C3/IFC_CS2/CS3_B (Register 0x09 bit[0]) output enable 0 Disable (Default) 1 Enable Bit [2]: SPI2/LPUART and LCD (Register 0x0A bit[0]) output enable 0 Disable (Default) 1 Enable Bit [3]: CAN3/USB2 Interface Selection (Register 0x0B bit[0]) output enable 0 Disable (Default) 1 Enable Bit [4]: LCD/QE Selection (Register 0x0C bit[0]) output enable 0 Disable (Default) 1 Enable Bit [5]: SerDes Lane mux Selection (Register 0x0d bit[0:3]) output enable 0 Disable (Default) 1 Enable Bit [6]: Flash bank selection (Register 0x07 vbank) output enable 0 Disable (Default) 1 Enable Bit[7]: ELEV connector EBI_CS0 selection (Register 0x0F bit[0:2]) output enable 0 Disable (Default) 1 Enable	soft_mux_on1	0x00
0x05	R/W	POR RCW source location Control/Status Register Bit [0:7]: cfg_rcw_src[0:7]	cfg_rcw_src1	Actual pins status of cfg_rcw_src[0:7] on POR
0x06	R/W	POR RCW source location Control/Status Register Bit [0]: cfg_rcw_src[8]	cfg_rcw_src2	Actual pin status of cfg_rcw_src[8] on POR
0x07	R/W	Flash bank selection Control Register Bit [0]: 0 upper bank (bank0) for booting 1 lower bank (bank1) for booting Bit [7:1]: Reserved	vbank	SW3[5]-BANK_SEL

Table 4-3. CPLD BCSR register detail map

Base Address Offset	Access Type	Description	Register Name	Default Value
0x08	R/W	GPIO for TWR-ELEV Bit [0]: ELEV_GPIO_B51 Bit [1]: ELEV_GPIO05_B52 Bit [2]: ELEV_GPIO22_D43 Bit [3]: ELEV_GPIO25_C9 Bit [4]: ELEV_GPIO06_A35 Bit [5]: ELEV_GPIO07_A11 Bit [6]: ELEV_GPIO04_B35 Bit [7]: ELEV_GPIO02_B22	gpio	0x00
0x09	R/W	I2C3 and IFC CS Selection Register Bit [0]: 0 I2C3 (default) 1 IFC_CS2_B and IFC_CS3_B Bit [7:1]: Reserved	i2c3_ifc_mux	0x00
0x0A	R/W	SPI2 and LPUART/LCD Selection Register Bit [0]: 0 SPI2 1 LPUART1/LCD Bit [7:1]: Reserved	mux_spi2	RCW (selected by SW3[6]-MUX_SEL)
0x0B	R/W	CAN3 and USB2 Selection Register Bit [0]: 0 USB2 1 CAN3 (default) Bit [7:1]: Reserved	can3_usb2_mux	0x01
0x0C	R/W	QE and LCD Selection Register Bit [0]: 0 LCD 1 QE Bit [7:1]: Reserved	qe_lcd_mux	RCW (selected by SW3[6]-MUX_SEL)
0x0D	R/W	Multiplexed pins for SerDes Lanes Register Bit [0]: MUX_SATA_SGMII1 0 lane B to SATA 1 lane B to SGMII1a Bit [1]: MUX_PCIE2_SGMII1 0 lane C to SGMII1b 1 MPCIE2 Bit [2]: MUX_PCIELN2_SGMII2 0 lane D to PCIE 2nd Lane 1 lane D to SGMII2 Bit [3]: MUX_SGMII1a_SGMII1b 0 SGMII1 from lane C 1 SGMII1 from lane B Bit [7:4]: Reserved	serdes_mux	RCW (selected by SW3[6]-MUX_SEL)
0x0E	R/W	Writing this register to reset system with initializing the CPLD registers to default values Bit [0]: 0 system running(Default) 1 system reset Bit [7:1]: Reserved	global_rst	0x00

Table 4-3. CPLD BCSR register detail map

Base Address Offset	Access Type	Description	Register Name	Default Value
0x0F	R/W	ELEV Connector EBI_CS0 select Register Bit[2:0] 001 from IFC_CS0 010 from IFC_CS2 100 from IFC_CS3 Bit[7:3] Reserved	elev_cs	0x00
0x10	R	LVDD level on the board Bit[0] 0 3.3V 1 2.5V Bit[7:1] Reserved	lvdd_vsel	SW2[6] - LVDD_VSEL
0x11	R/W	CPLD override physical switches Enable Register Bit[0] NOR Flash/QSPI selection (Register 0x12 Bit[0]) output enable 0 Disable (Default) 1 Enable Bit[7:1] Reserved	soft_mux_on2	0x00
0x12	R/W	NOR Flash or QSPI selection Register 1 NOR Flash Bit[7:1] Reserved	nor_qspi_mux SW2[5] - NOR_QSPI_SEL	Bit[0] 0 QSPI

## 4.4 LCD FDI translator

The LCD interfaces to the Tower System or HDMI Transmitter (SiI9022A) through a 24-bit RGB interface, 8-bit R, 8-bit G, and 8-bit B. Need to translate LCD signals from FDI 2-bits to 1-bit.

Figure 4-3 shows the timing for LCD FDI translation.



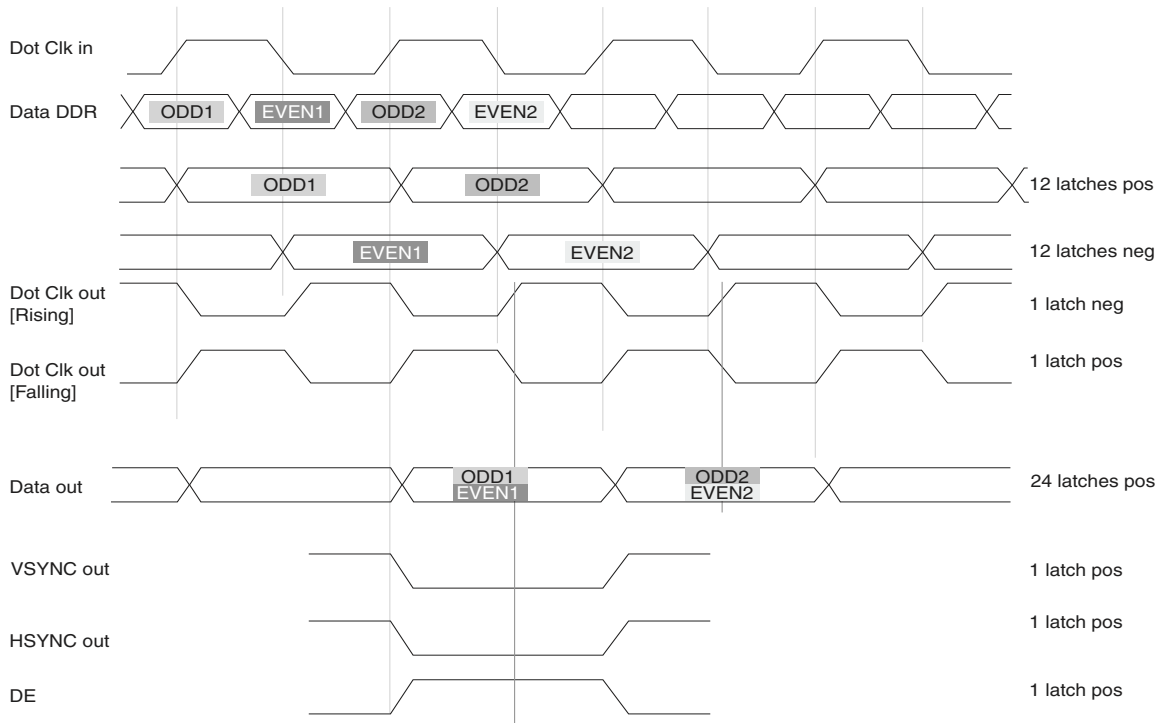
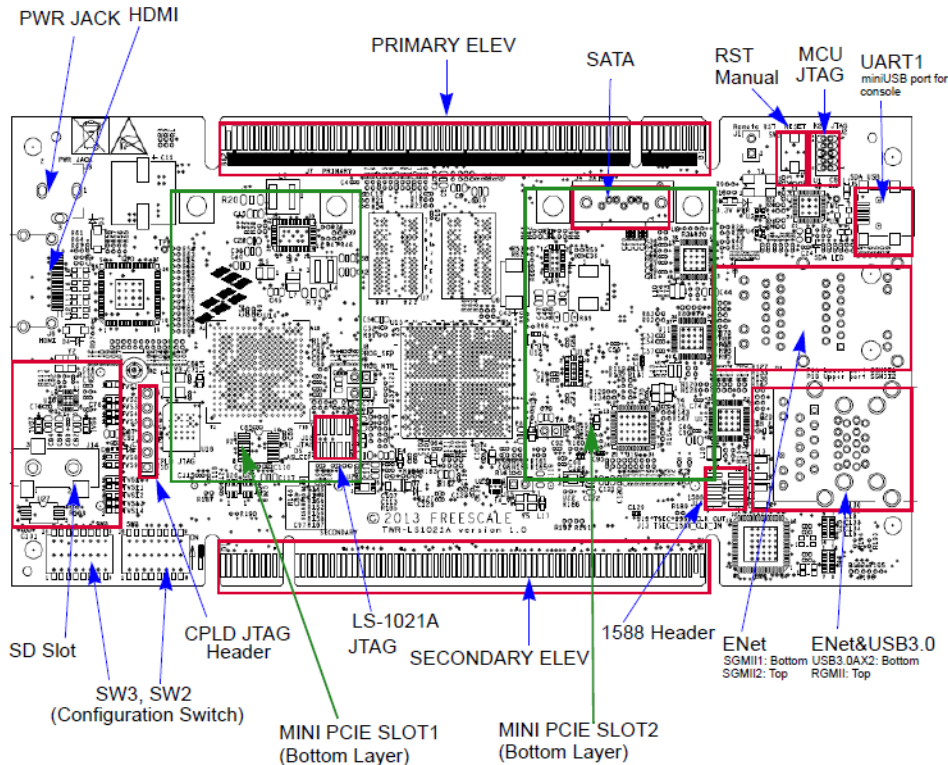


Figure 4-3. Timing of FDI translation

## Chapter 5

# Board Configuration and Debug Support

This section describes the necessary steps to configure the board for normal operation. [Figure 5-1](#) shows the connections to the board that are needed for bare boards.



**Figure 5-1. Board outline and cabling**

### 5.1 TWR-LS1021A board drawings

This section shows the TWR-LS1021A reference board drawings. [Figure 5-2](#) shows the top side of the board and [Figure 5-3](#) shows the bottom side of the board.

### 5.1.1 Top side

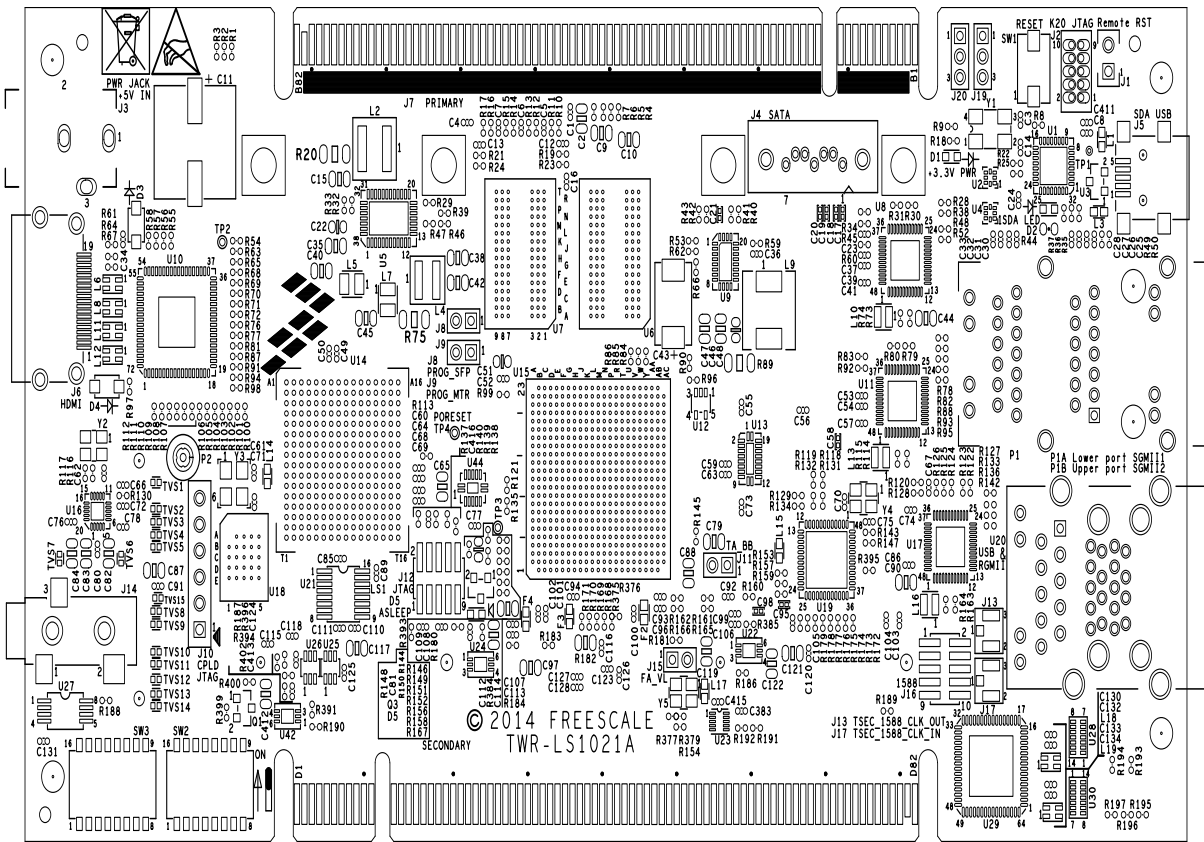


Figure 5-2. TWR-LS1021A reference drawing - Top side

#### NOTE

Zoom-in to see the clear image of the drawing.

## 5.1.2 Bottom side

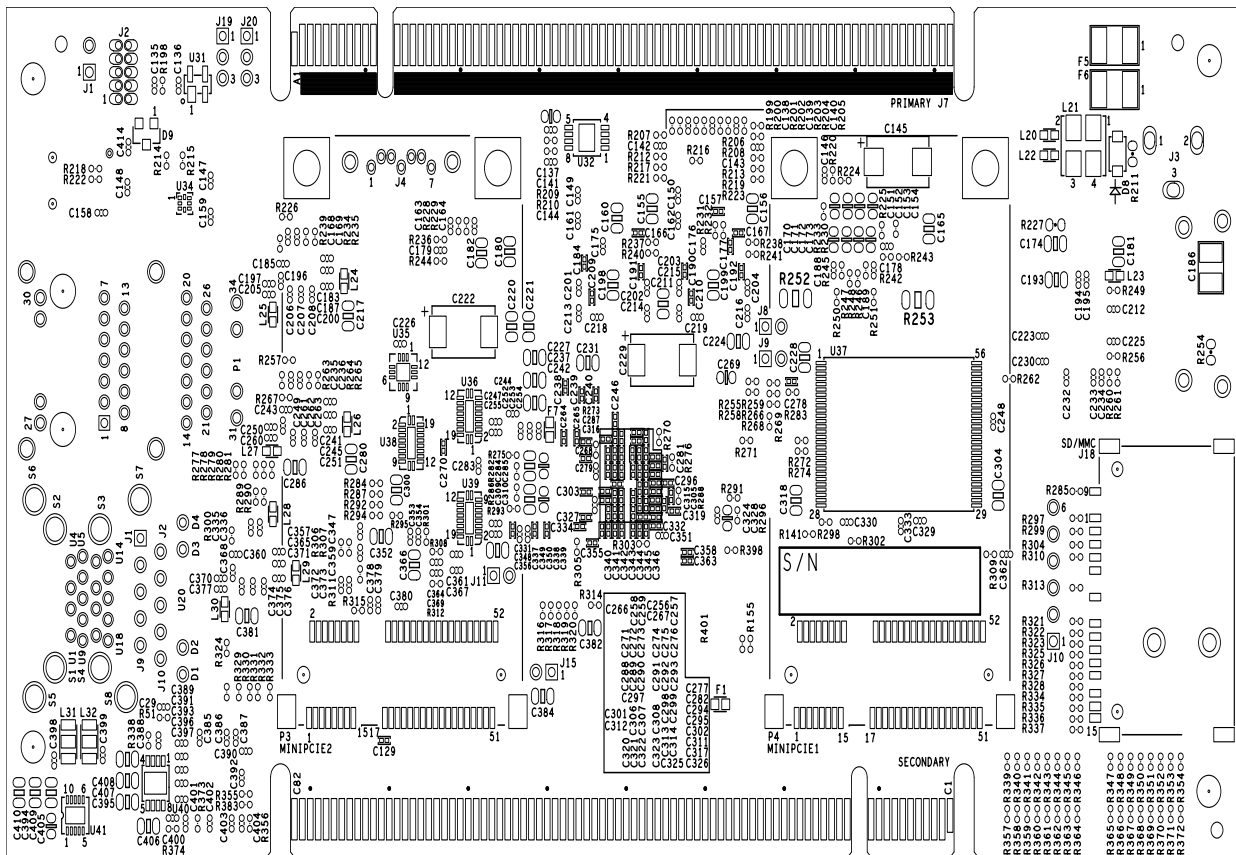


Figure 5-3. TWR-LS1021A reference drawing - Bottom side

### NOTE

Zoom-in to see the clear image of the drawing.

## 5.2 Switch configuration

While the TWR-LS1021A board offer some configuration capability through the CPLD configuration registers, for stand-alone operation switches are provided to allow easy configuration of many popular options; in particular, those of interest to software developers as opposed to test facilities.

To configure the system, use [Table 5-1](#).

Table 5-1. Switch configuration

Switch	Settings [OFF=0 ON=1]	Option	Description
SW2[1]	ON	RCW Source is NOR	NOR RCW_SEL 0 : NOR disabled 1 : NOR enabled(default)
SW2[2]	OFF	Reserved	Must be 0 [OFF]

Switch	Settings [OFF=0 ON=1]	Option	Description
SW2[3]	OFF	RCW Source is SDHC	SDHC RCW_SEL 0 : SDHC disabled (default) 1 : SDHC enabled
SW2[4]	OFF	RCW Source is QSPI	QSPI RCW_SEL 0 : QSPI disabled (default) 1 : QSPI enabled
SW2[5]	ON	Bus select is NOR or QSPI	IFC/QSPI Bus selection 0 : IFC disabled, QSPI enabled 1 : IFC enabled, QSPI disabled (default)
SW2[6]	ON	LVDD&L1VDD selection is 2.5V or 3.3V	LVDD&L1VDD Voltage Selection 0 : 3.3V 1 : 2.5V (default)
SW2[7]	ON	IFC_CS1 or SPI1_PCS0 selection	IFC_CS1/SPI1_PCS0 Selection 0 : IFC_CS1 disabled, SPI1_PCS0 enabled 1 : IFC_CS1 enabled, SPI1_PCS0 disabled (default)
SW2[8]	ON	DIPSW_IN1	SDA_SWD_EN Control 0 : use K20 IO pin to control SDA_SWD_EN 1 : tied to high to disable MBED connection (default)
SW3[1]	OFF	96MHz SYSCLK select or not	96MHz SYSCLK Selection 0 : Do not select 96MHz as SYSCLK (default) 1 : Select 96MHz as SYSCLK
SW3[2]	ON	TEST_SEL_DRV	Drive TEST_SEL signal 0 : Non-compliant mode to support boundary scan. 1 : JTAG compliant mode (default)
SW3[3]	ON	CLKGEN_FS0 System clock frequency setting	CLKGEN_FS[0:1] 00 = 66.66MHz 01 = 80.00MHz 10 = 100.00MHz (default) 11 = 83.33MHz
SW3[4]	OFF	CLKGEN_FS1 System clock frequency setting	
SW3[5]	OFF	NOR Bank Select BANK_SEL	BANK_SEL 0 : Vbank0 (default) 1 : Vbank1
SW3[6]	OFF	Signal multiplexed selection MUX_SEL	MUX_SEL 0 : PCIE1,SGMII1,PCIE2,SGMII2, RGMII, CAN3&4, SAI1&2, LCD, LPUART1 (default) 1 : PCIE1,SATA,PCIE2,SGMII2, RGMII, CAN3&4, CAN1&2, UCC1&3, SPI2
SW3[7]	OFF	Reserved	Must be 0 [OFF]
SW3[8]	ON	Reserved	Must be 1 [ON]

## 5.3 CMSIS-DAP debug support

This section describes how to enable CMSIS dap debug support for your TWR-LS1021A board.

### NOTE

The TWR-LS1021A 700-28040 board comes pre-programmed with CMSIS-DAP firmware.

To enable the CMSIS-DAP debug support for TWR-LS1021A 700 revX3/X4 board, follow these steps:

1. Download the CMSIS-DAP firmware and documentation from <http://compass.freescale.net/livelink/livelink?func=ll&objId=232410365&objAction=browse&viewType=1>
2. Plug in power to the TWR-LS1021A 700 revX3/X4 board.
3. Hold down **Reset** button (*SW1*) while plugging the PC USB cable into the *J5* USB connector on the board.
4. On Windows, the board will be mapped as a Mass Storage Device under a volume labelled *BOOTLOADER*.
5. LED *D2* will blink in green on the board to acknowledge it is in bootloader mode.
6. Copy the binary files downloaded in *Step 1*, into this new volume, *BOOTLOADER*.
7. When the binary files are finished copying, the LED *D2* will start blinking with a higher rate.
8. Unplug the USB cable from the board, then plug it back to the power cycle module.
9. Set *SW2[8]* to OFF.

You are now ready to connect to your board through CodeWarrior for ARMv7.

### NOTE

For Windows platform, you need to install *mbed USB driver*. For configuration and installation of Windows serial port, follow the link below:

<http://mbed.org/handbook/Windows-serial-configuration>

