

# **miriac SBC-LS1088A**

**User Manual (CRX05 Revision 2+3)**

**V 2.5**

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# 1 General Notes

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## 1.5 Symbols, Conventions and Abbreviations

### 1.5.1 Symbols

Throughout this document, the following symbols will be used:



**Information marked with this symbol *MUST* be obeyed to avoid the risk of severe injury, health danger, or major destruction of the unit and its environment**



**Information marked with this symbol *MUST* be obeyed to avoid the risk of possible injury, permanent damage or malfunction of the unit.**



**Information marked with this symbol gives important hints upon details of this manual, or in order to get the best use out of the product and its features.**

Table 1-1 Symbols

### 1.5.2 Conventions

| Symbol  | explanation  |
|---------|--|
| #       | denotes a low active signal  |
| ←       | denotes the signal flow in the shown direction   |
| →       | denotes the signal flow in the shown direction   |
| ↔       | denotes the signal flow in both directions   |
| →       | denotes the signal flow in the shown direction with additional logic / additional ICs in the signal path |
| I/O     | denotes a bidirectional pin  |
| Input   | denotes an input pin   |
| matched | denotes the according signal to be routed impedance controlled and length matched                        |
| Output  | denotes an output pin  |
| Pin 1   | refers to the numeric pin of a component package   |
| Pin a1  | refers to the array position of a pin within a component package   |
| XXX-    | denotes the negative signal of a differential pair   |
| XXX+    | denotes the positive signal of a differential pair   |
| XXX     | denotes an optional not mounted or fitted part   |

Table 1-2 Conventions

## 2 Introduction

Thank you for choosing the MicroSys SBC-LS1088A Single Board Computer system. This manual should help you to get the best performance and details out all of its features.

### 2.1 Safety and Handling Precautions



**ALWAYS use the correct type and polarity of the power supply!**

**DO NOT exceed the rated maximum values for the power supply! This may result in severe permanent damage to the unit, as well as possible serious injury.**

**ALWAYS keep the unit dry, clean and free of foreign objects. Otherwise, irreparable damage may occur.**



**Parts of the unit may become hot during operation. Take care not to touch any parts of the circuitry during operation to avoid burns, and operate the unit in a well-ventilated location. Provide an appropriate cooling solution as required.**



**ALWAYS take care of ESD-safe handling!**

**Many pins on external connectors are directly connected to the CPU or other ESD sensitive devices.**

**Make or break ANY connections ONLY while the unit is switched OFF.**

**Otherwise, permanent damage to the unit may occur, which is not covered by warranty.**



**There is no separate SHIELD connection.**

**All the metal sheaths of shielded connectors are connected to GND.**

**Also, all mounting holes of the carrier board are connected to GND.**

**The module's mounting holes are not connected to GND**

**Take this into account when handling and mounting the unit.**

Table 2-1 Safety and Handling Precautions

## 2.2 Short Description

The SBC-LS1088A is a small computer system consisting of

- the MPX-LS1088A module, based on NXP's LS1088A Multicore Communications Processors
- and the CRX05 carrier board.

It targets both

- evaluation of the respective MPX-LS1088A SOM
- direct usage as an industrial computing solution

This document gives you an overview on the board's connectors and how to take the first steps on the initial setup.

## 2.3 Shipping List

The SBC-LS1088A EvalKit package contains the following items:

- The SBC-LS1088A system, mounted with cooling solution
- Power Supply 12V DC stabilized / 2 A
- Cable adapter for the power supply
- USB cable type A – mini B
- Micro-SD-Card with U-Boot and root file system

## 2.4 Feature Changelist for HW Revisions

### 2.4.1 Changes from revision 2 to revision 3

The revision 3 of the carrier board provides the following changes:

- Added SW4 to switch between root complex and endpoint
- Added 2 header for GND interconnection (JP1, JP2)
- Added buffer to SPI-CLK
- Added possibility to modify board to run with external PCIe-clock, requires hardware modification (default assembled to use internal clock)
- Type of "JTG-connector" changed to JST-BM14B-SRSS-TB



## 2.4.2 Changes from revision 1 to revision 2

The revision 2 of the carrier board provides new features:

- Added LED driver with 4x RGB LEDs
- Added 12 GPIOs (6x in / 6x out) addressable via I<sup>2</sup>C
  - Output voltage level maximum 24V (according to the input voltage of the carrier board)
  - Input voltage range 24V maximum
- Added SuperCap for RTC backup battery (CR2032 coin cell as assembly option still available)
- Added prerequisites for support of emBRICK devices
- Added current shunt for current measurements
- Added optional (by assembly option) support for onboard current measurements of the CPU module consumption via I<sup>2</sup>C current sense amplifier
- Added LAN interrupt support
- Added SMART CARD connector
- Added optional (by assembly option) extension connector (for example for additional GPIOs or graphic support if provided by the CPU)
- Added mounting holes for the carrierboard
- Added a fan connector
- Added connector labeling (silkscreen) on the PCB

Some features were changed:

- SerDes 6 and SerDes 7 lanes were swapped in order to achieve a wider functional coverage within the MPX2 module family
  - SerDes 6 is now connected to the SATA connector (ST10)
  - SerDes 7 is now connected to the mPCIe / mSATA slot (ST7)
- Improved power input section with filters
- Improved mechanical mounting of the CPU module and mPCIe/ mSATA cards
- Replaced PCIe x1 edge card connector with second PCIe extension connector

## 2.5 Functional Coverage

The following table shows the coverage achieved by the SBC-LS1088A compared to the features which are available on the carrierboard:

| Interfaces provided by CRX05 carrierboard |   | Interfaces available with the SBC-LS1088A |
|---|---|---|
| SerDes 0                                  | PCIe  | ✓   |
| SerDes 1                                  | SGMII   | ✓   |
| SerDes 2                                  | SGMII   | ✓   |
| SerDes 3                                  | SGMII   | ✓   |
| SerDes 4                                  | mPCIe / Aurora                                    | ✓ (mPCIe)                                 |
| SerDes 5                                  | PCIe  | ✓   |
| SerDes 6                                  | SATA  | -   |
| SerDes 7                                  | mPCIe / mSATA                                     | ✓   |
| RGMII 1                                   | PHY   | ✓   |
| USB 1                                     | 2.0 / 3.0   | ✓ (3.0)                                   |
| USB 2                                     | 2.0 / 3.0   | ✓ (3.0)                                   |
| SD-Card                                   | 1bit / 4 bit & boot device                        | ✓   |
| UART 1                                    | UART to USB<br>(debug console)                    | ✓   |
| UART 2                                    | TTL only  | ✓   |
| I <sup>2</sup> C 1                        | Multiple devices                                  | ✓   |
| I <sup>2</sup> C 2                        | Multiple devices                                  | -   |
| JTAG                                      | Signals on non-standard connector                 | ✓   |
| Watchdog                                  | Hardware watchdog with trigger signal from module | ✓   |
| RTC backup                                | Supercap  | ✓   |
| Manual Reset                              | Button  | ✓   |
| Reset LEDs                                | 2x red  | ✓   |
| Power LED                                 | 1x green  | ✓   |

Table 2-2 Functional coverage

## 3 Quick Start Guide

### 3.1 Prerequisites



---

*Always make sure to handle the SBC-LS1088A unit ESD-safe!  
Otherwise, the unit may suffer permanent damage.*

*However, do not place the unit directly flat on a metal surface,  
as this may result in short circuits and damage to the board.*

---

At first time operation unpack the unit and make sure that is clean and free of visible damage or foreign objects.

#### 3.1.1 Minimum Requirements

To operate the board, you will at least need the following items:

- an adequate power supply, delivering 12V DC (stabilized) / 2A minimum.
- an USB cable (type A – mini B) adapted to connector ST5
- a serial terminal, such as a PC with an USB port running a terminal Software (e.g. TeraTerm, HyperTerminal, putty, ckermit...), or else a hardware serial console. **Choose the following parameters:**
  - (a) **115200 Bd**
  - (b) **8 Data bits**
  - (c) **No parity**
  - (d) **1 Stop Bit**

#### 3.1.2 Recommended Items

The following items are not absolutely necessary, but strongly recommended for practical operation and development purposes:

- Network connection via Port1 to your local network installation
- TFTP server available for downloading within the network (Hint: may run on the same PC as the serial Terminal)
- SATA HDD/SSD and/or SD card as mass storage and/or boot media

## 3.2 Board Preparation and Power-Up

- Make sure the switches SW1 and SW2 are set properly in order to select the correct boot source and board configuration
- The board comes preconfigured to boot correctly on arrival.
- Connect the mini USB cable to ST5.
- Connect other peripherals (USB, LAN, SATA, ...) as far as intended.
- Connect the power line to the ST3 connector, while the power supply is still switched off.
- Switch on the power.



Figure 3-1 System setup example (LAN port 1)

## 3.3 Operation




---

**After Power-up, the green LED on the module should light up and any red LED should be off.  
IF NOT, DISCONNECT THE UNIT FROM POWER AND CHECK FOR FAULTS!**

---

### 3.3.1 U-Boot Startup

When power is supplied the system will start.

On startup, U-Boot will come up similar to the following:




---

**The exact output may vary, depending on U-Boot and MPX-LS1088A module versions in use.**

---

```
U-Boot SPL 2016.012.0+g624c887 (Feb 08 2017 - 14:42:03)
Initializing DDR....using SPD
Address hashing enabled.
Trying to boot from MMC
```

```
U-Boot 2016.012.0+g624c887 (Feb 08 2017 - 14:42:03 +0100)
```

```
SoC: LS1088E Version:1.0 (0x87030010)
```

```
Clock Configuration:
```

```
    CPU0 (A53):1400 MHz   CPU1 (A53):1400 MHz   CPU2 (A53):1400
MHz
```

```
    CPU3 (A53):1400 MHz   CPU4 (A53):1400 MHz   CPU5 (A53):1400
MHz
```

```
    CPU6 (A53):1400 MHz   CPU7 (A53):1400 MHz
```

```
Bus:      600 MHz   DDR:      1600 MT/s
```

```
Reset Configuration Word (RCW):
```

```
00000000: 38004018 00000040 00000000 00000000
```

```
00000010: 00000000 000a0000 00300000 00000000
```

```
00000020: 00e01140 00002580 00000000 00000040
```

```
00000030: 01800052 00000000 00000a83 00000000
```

```
00000040: 00000000 00000000 00000000 00000000
```

```
00000050: 00000000 00000000 00000000 00000000
```

```
00000060: 00000000 00000000 00000000 000009e7
```

```
00000070: 33330000 00009555 00000000 00000000
```

```
I2C:   ready
```

```
Model: MicroSys Layerscape MPXLS1088 Board
```

```
Board: MPXLS1088, booting from SD card
```

```
DRAM:  Detected UDIMM Fixed DDR on board
```

```
3 GiB
```

```
DDR      3 GiB (DDR4, 64-bit, CL=11, ECC on)
Waking secondary cores to start from fff1c000
All (8) cores are up.
Using SERDES1 Protocol: 18 (0x12)
Using SERDES2 Protocol: 13 (0xd)
NAND:    512 MiB
MMC:     FSL_SDHC: 0
PCIe1:   Root Complex no link, regs @ 0x3400000
PCIe2:   Root Complex no link, regs @ 0x3500000
PCIe3:   Root Complex no link, regs @ 0x3600000
In:      serial
Out:     serial
Err:     serial
SEC0:    RNG instantiated
SATA link 0 timeout.
AHCI 0001.0301 32 slots 1 ports 6 Gbps 0x1 impl SATA mode
flags: 64bit ncq pm clo only pmp fbss pio slum part ccc apst
Found 0 device(s).
SCSI:    Net:      Device: FSL_SDHC
Manufacturer ID: 74
OEM:     4a60
Name:    USD
Tran Speed: 50000000
Rd Block Len: 512
SD version 3.0
High Capacity: No
Capacity: 1.9 GiB
Bus Width: 4-bit
Erase Group Size: 512 Bytes

MMC read: dev # 0, block # 6144, count 2048 ... 2048 blocks
read: OK

MMC read: dev # 0, block # 16384, count 2048 ... 2048 blocks
read: OK
crc32+
fsl-mc: Booting Management Complex ... SUCCESS
fsl-mc: Management Complex booted (version: 10.0.2, boot sta-
tus: 0x1)
DPMAC2@sgmii [PRIME], DPMAC3@sgmii, DPMAC4@rgmii,
DPMAC7@sgmii
=>
```

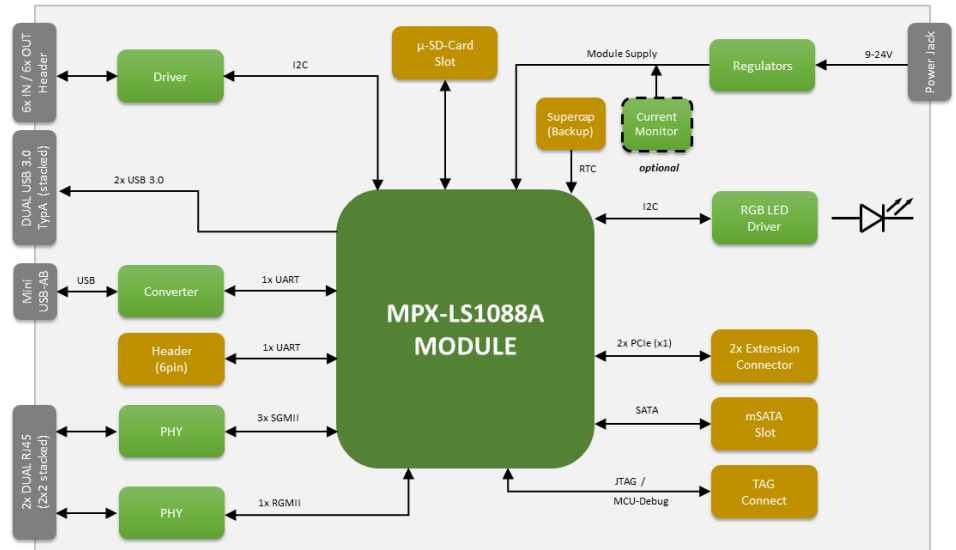
### 3.3.2 Linux

For detailed setup instructions, refer to the readme document delivered along with the unit!

# 4 System Description

This section describes all parts of the SBC-LS1088A system.

## 4.1 Block Diagram



SBC-LS1088A: Version 2.0.0 – 2017-09-29

Figure 4-1 Block Diagram (MPX-LS1088A Revision 2 on carrier CRX05 Revision 2)

## 4.2 Feature Overview

The SBC-LS1088A offers the following features:

| QorIQ ARM Cortex A53 cores 8xCPU Processor |   |  |
|--|---|--|
| <b>SDRAM</b>                               | 64-bit DDR4 interface                             | Default: 2GByte<br>up to 4GByte<br>up to 2100MT/s<br>4 x DDR4 (x16)<br>single bank |
| <b>Synchronous Memory</b>                  | 8-bit NAND Flash                                  | Default: 512 MB<br>up to 2 GByte   |
| <b>Hard Disk Drives Interface</b>          | SATA 3.0  | mSATA slot   |
| <b>PCI Express port</b>                    | 3.0 / 8Gbps<br>Lane x1<br>Root complex operations | 2x PCIe extension connector  |
|  | 3.0 / 8Gbps<br>Lane x1<br>Root complex operations | 1x Mini PCIe/mSata Slot  |
|  | 3.0 / 8Gbps<br>Lane x1<br>Root complex operations | 1x Mini PCIe Slot  |
| <b>USB</b>                                 | USB 3.0 Phy                                       | USB connector type A   |

| QorIQ ARM Cortex A53 cores 8xCPU Processor |                            |   |
|--|----------------------------|---|
|  | USB 3.0 Phy                | USB connector type A  |
| <b>Expansion Cards</b>                     | MMC/SD/SDIO                | micro SD card holder  |
| <b>Serial Interfaces</b>                   | UART1                      | Converted to USB (FT232), Available on USB connector type mini B  |
|  | UART2                      | 4-wire Extension Port LVTTTL  |
| <b>I2C</b>                                 | I2C-1                      | 400 kbps<br><b>Connected Devices:</b><br>TMP451AIDQF Temperature Sensor<br>2x BR24G128NUX-3 EEPROM<br>RX-8803 RTC<br>IDT6V49205B Clock Generator<br>TLC59116 RGB LED Driver<br>MAX7325 GPIO Port Expander |
|  | I2C-4                      | 400 kbps  |
| <b>Gigabit Ethernet Controller</b>         | RGMII                      | 10/100/1000 Mbps  |
|  | SGMII                      | 10/100/1000 Mbps  |
|  | SGMII                      | 10/100/1000 Mbps  |
|  | SGMII                      | 10/100/1000 Mbps  |
| <b>System JTAG Controller</b>              | JTAG                       | Different connector on CRX05-R2 and R3  |
| <b>Power Management</b>                    | Primary Supply             | LM25116MH<br><b>Input:</b><br>9-24V DC<br><b>Output:</b><br>5V DC / peak 8A   |
|  | Backup Supply (RTC backup) | Supercap  |

Table 4-1 Feature Overview

## 4.3 Mechanical Dimensions

### 4.3.1 MPX-LS1088A

The following drawing shows the mechanical outline of the MPX-LS1088A module that is plugged in the CRX05 carrier board.





This drawing is not to scale.



For 3D data files please contact MicroSys.

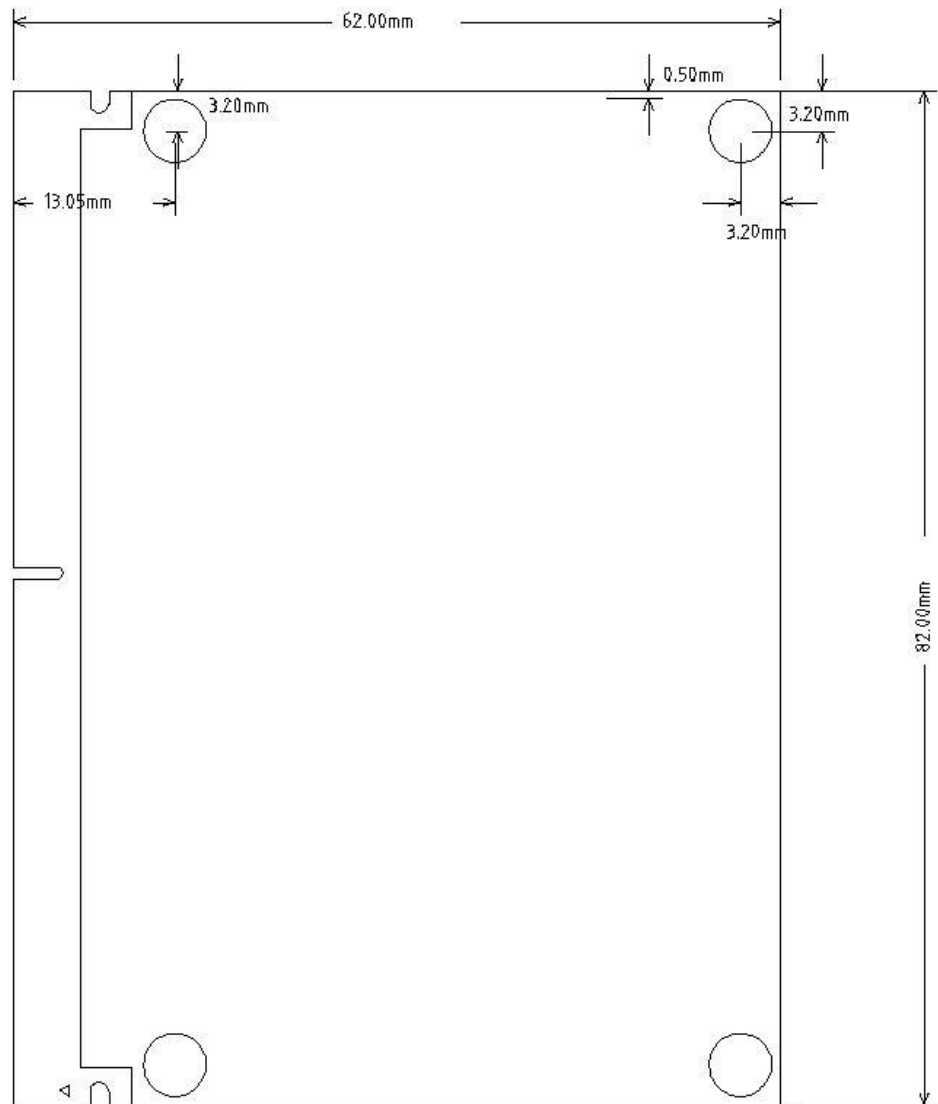


Figure 4-2 Mechanical Dimensions Modul

### 4.3.2 SBC-LS1088A

The following drawing shows the mechanical outline of the SBC-LS1088A assembly.



This drawing is not to scale.



For 3D data files please contact MicroSys.

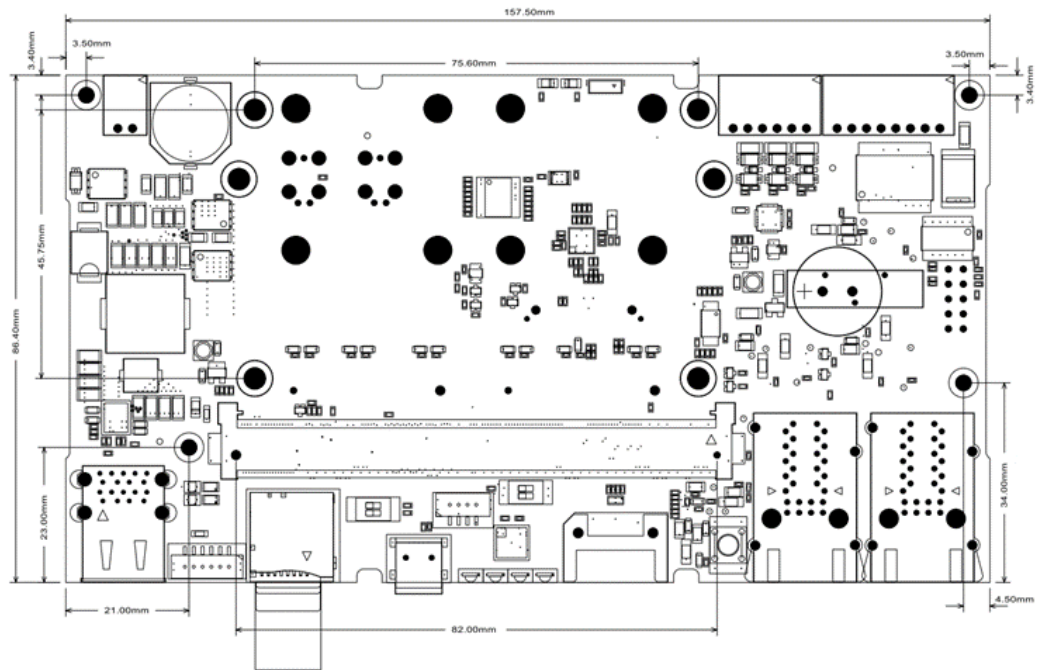


Figure 4-3 SBC-LS1088A Mechanical Dimensions

### 4.4 Connector Layout – Top

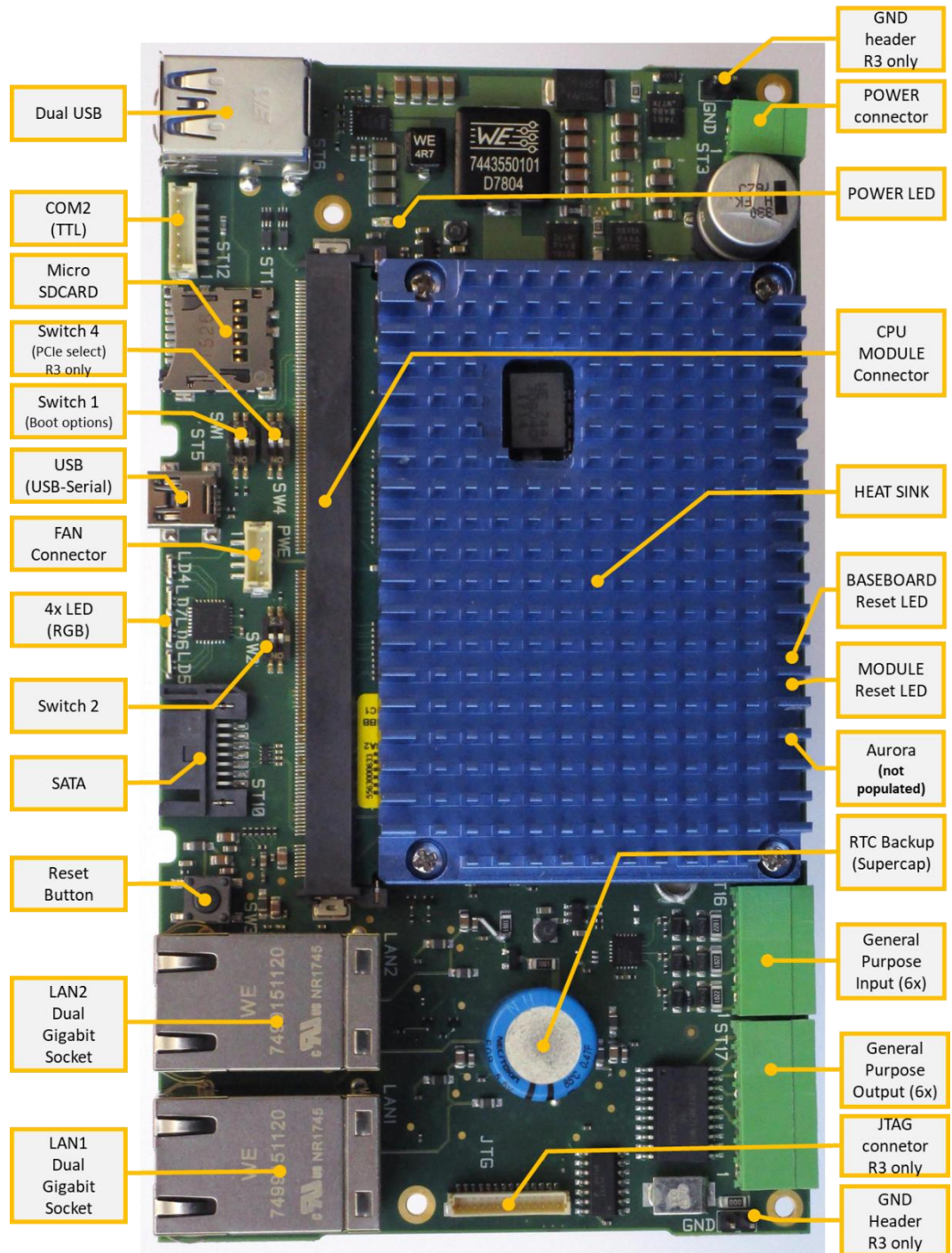


Figure 4-4 Top connectors

## 4.5 Connector Layout – Bottom

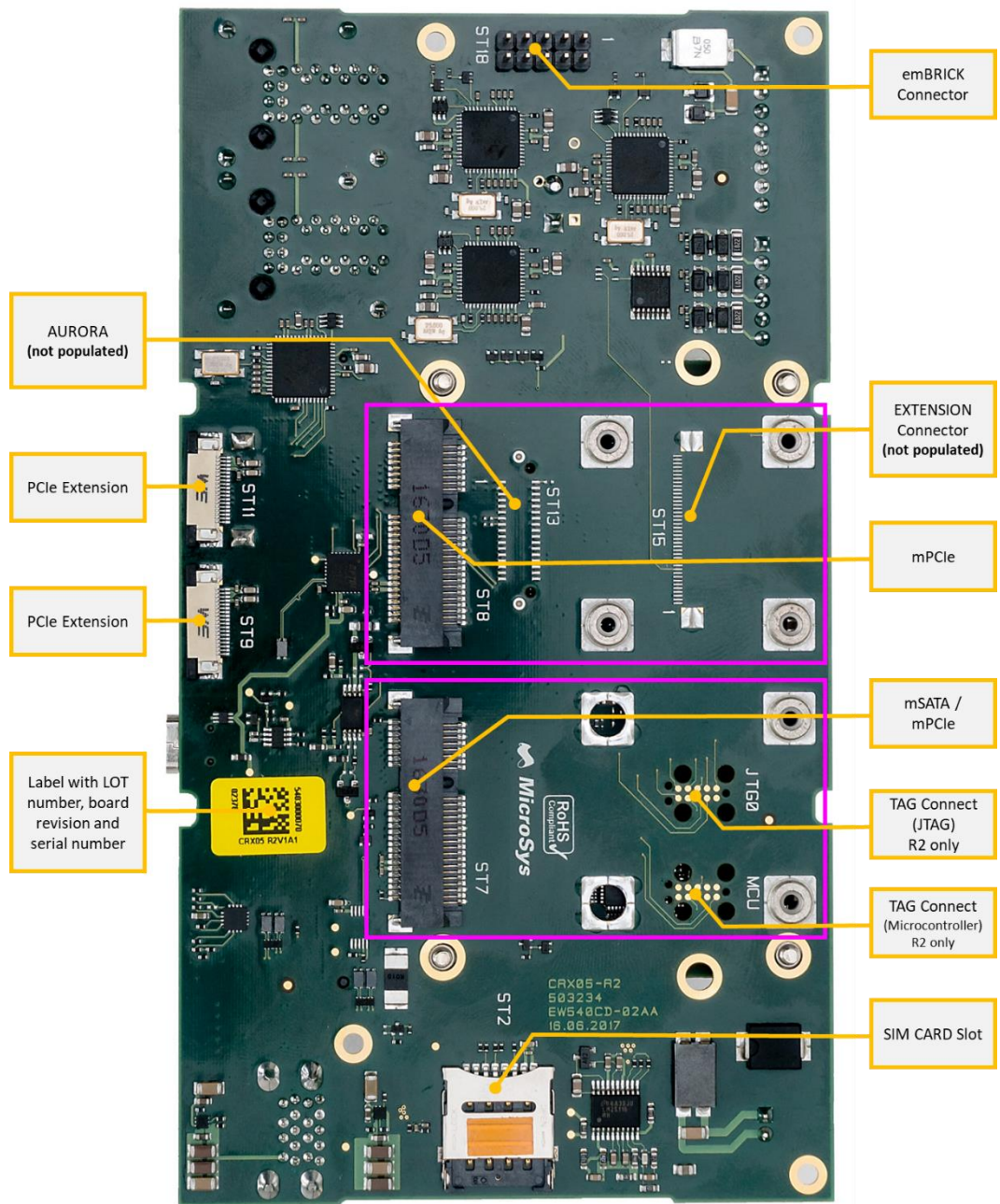


Figure 4-5 Bottom connectors

## 4.6 Power Supply

### 4.6.1 Input Supply Rating

The SBC-LS1088A system is run from a single DC power supply with the following ratings:

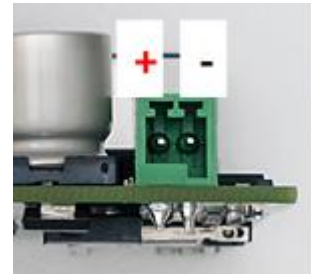
|   |                    |
|---|--------------------|
| <b>Maximum Input Voltage Operating Range:</b>                                     | <b>9V - 30V DC</b> |
| <b>Nominal Input Supply Voltage:</b>  | <b>12V DC</b>      |
| <b>Typical Current Consumption<br/>(@12V / room temperature / U-boot prompt):</b> | <b>~0,77A</b>      |



**ALWAYS use the correct type and polarity of the power supply!  
DO NOT exceed the rated maximum values for the power supply! This may result in severe permanent damage to the unit, as well as possible serious injury.**

### 4.6.2 Input Power Connector

|                |   |
|----------------|---|
| Part Reference | ST3                                       |
| Manufacturer:  | Würth Elektronik                          |
| Type:          | 691 382 010 002                           |
| Mates with:    | 691 381 000 002<br>(included in delivery) |



Pin-out:

| Pin | Name | Function          |
|-----|------|-------------------|
| 1   | „+“  | +VIN (= typ. 12V) |
| 2   | „-“  | GND               |

Table 4-1 Pinout ST3

### 4.6.3 Power Supply Structure

- Input Power from ST3 connector is fed to the primary step-down converter.
- The primary step-down converter produces 5V DC / max. 8A peak from the input supply which supplies both the LS1088A module and peripheral devices on the carrierboard CRX05.

- The 5V DC are fed to a secondary step-down converter, which produces 3.3V DC / max. 4A peak.
- Two NCP1529 produce 1.8V and 1.5V from 3.3V, which are used for both PCIe and onboard devices.

The following diagram shows the Power Supply structure:

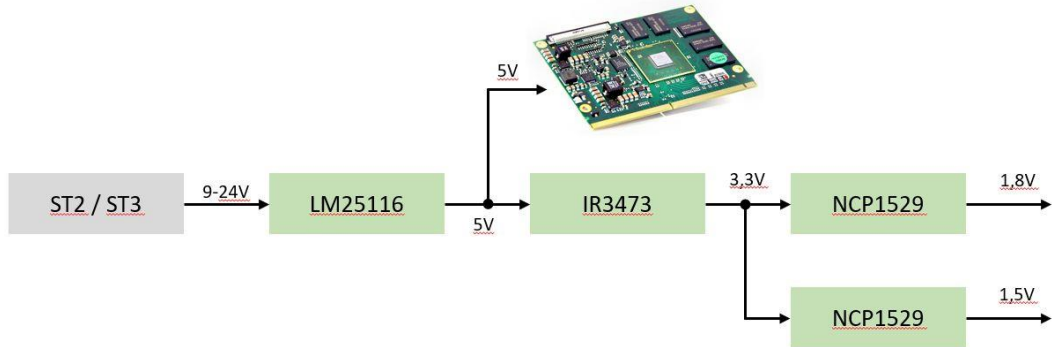


Figure 4-6 Power supply structure

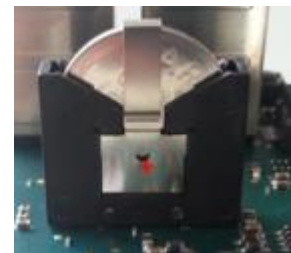
#### 4.6.4 RTC Backup Battery

The RTC on the module is supplied from a 470mF supercap that is loaded by the 5V power source on the carrier board.



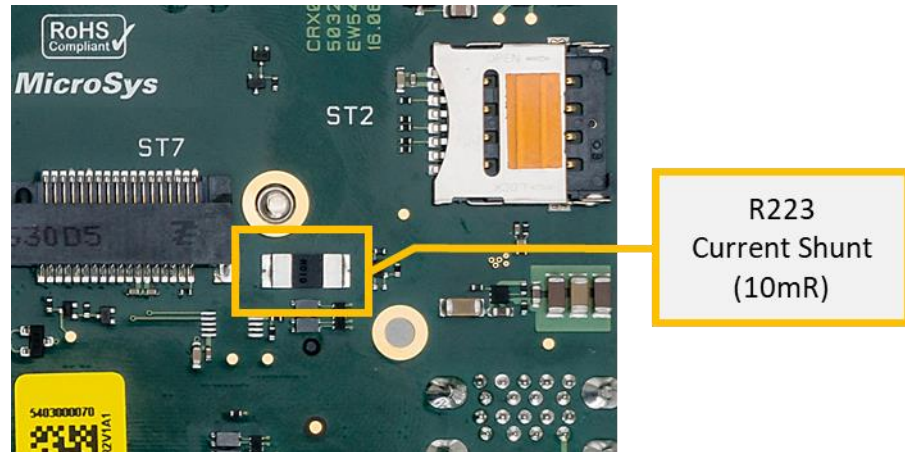
Alternatively, there's another version of the carrier board available that has a backup battery holder for CR2032 batteries. Please contact MicroSys for more information.

|                 |                  |
|-----------------|------------------|
| Part Reference: | BAT1             |
| Manufacturer:   | Renata Batteries |
| Type:           | VBH2032-1        |
| Used with:      | CR2032 batteries |



### 4.6.5 Current Measurement

For current measurements the carrierboard provides a 10mΩ shunt resistor in the 5V path supplying the CPU module.



For automated measurements there's a carrierboard version available that already provides an I<sup>2</sup>C current sense amplifier.



**NOTE**

*The current sense amplifier is not populated by default.*

*For more information please contact MicroSys.*

### 4.6.6 Fuses

There are no fuses on the SBC-LS1088A.

# 5 System Core, Boot Configuration and On-Board Memory

## 5.1 Processor NXP LS1088A

The LS1088A Processor by NXP is a QorIQ Layerscape CPU with four CPU cores. It exposes a wide variety of external interfaces, which are explained in detail in the following chapters. The cores share a single 2MB L2 Cache.

The four CPU cores run at a maximum clock speed of 1600 MHz, 1400 MHz or 1000 MHz respectively, depending on the ordered type. The CPU frequency can be clocked down if necessary.

## 5.2 JTAG Chain

The JTAG chain of the SBC-LS1088A includes the LS1088A processor only. The JTAG port is directly connected to the connector “JTGO”.

The JTAG connector footprint provides JTAG signals. For interfacing standard debugger pinouts an additional intermediate adapter is necessary.

Please see chapter 6.10 for a description of the JTAG connector.

## 5.3 Reset Structure

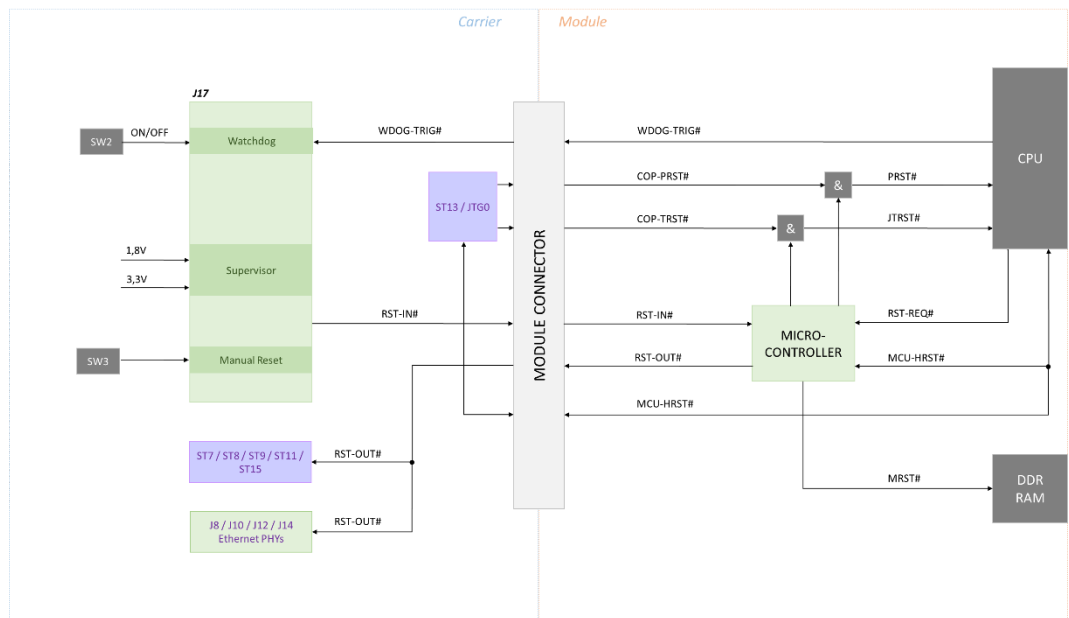


Figure 5-1 Reset Structure (carrier CRX05 Revision 2)



| Pin Number on ST4 | Signal Name | Signal Direction       | Function  |
|-------------------|-------------|------------------------|---|
| T136              | RST-IN#     | Input to the module    | Active low module reset: while active the module is held in reset state   |
| T135              | RST-OUT#    | Output from the module | Active low peripheral reset: while active peripheral devices shall be held in reset state   |
| B118              | WDOG-TRIG#  | Output from the module | Watchdog service signal from the module which has to be triggered periodically. When the watchdog is active and the service stops the module will be reset. |
| B111              | MCU-HRST#   | Bi-directional         | Please contact MicroSys   |
| B110              | COP-PRST#   | Input to the module    | Please contact MicroSys   |
| B106              | COP-TRST#   | Input to the module    | Please contact MicroSys   |

Table 5-1 Reset signal overview



**NOTE**

**The default state for RST-IN# is active. Consequently, the module is always in a reset state when the RST-IN# signal is not actively driven high by the carrierboard.**

The RST-IN# is an input to the module. It signals that the voltage supplies on the carrierboard are within their limits and no manual reset is triggered. When active (signal is low) the microcontroller unit on the module initiates the reset sequence in order to keep the CPU in a defined reset state. No further interaction from the carrierboard is necessary. In case the module reset is active, the module triggers the RST-OUT# signal which is intended to control the reset of peripheral devices on the carrierboard i.e. Ethernet PHYs, PCIe slots and devices.

The RST-IN# signal can be triggered by either a power fault situation, a manual reset button press (SW3) or a missing watchdog trigger signal WDOG-TRIG# from the CPU in case the watchdog has been manually enabled beforehand via SW2.

MCU-HRST#, COP-PRST# and COP-TRST# are for JTAG and debugging purposes only.



**NOTE**

**The watchdog is off by default.**

**The watchdog is implemented on the carrier board.**

The following voltages on the carrier board are monitored by a Maxim MAX6751KA29 chip:

| Voltage | Monitoring   | Voltage Limit               |
|---------|--------------|-----------------------------|
| 3,3V    | Undervoltage | Typ. 2,925V [2,867V-2,984V] |
| 1,8V    | Undervoltage | Typ. 1,72V [1,69V-1,75V]    |

Table 5-2 Voltage monitoring limits (carrier)

## 5.4 Clock Distribution

The following diagram shows the clock distribution of the SBC-LS1088A system



| IDT6V49205B |           | LS1088A      |      |
|-------------|-----------|--------------|------|
| Pin         | Name      | Name         | Pin  |
| 23          | PCIeT_LR0 | SD1-REFCLK1  | AA8  |
| 24          | PCIeC_LR0 | SD1-REFCLK1# | AB8  |
| 26          | PCIeT_LR1 | SD1-REFCLK2  | AB18 |
| 25          | PCIeC_LR1 | SD1-REFCLK2# | AB19 |

|    |           | ST4       |     | J6     |     |
|----|-----------|-----------|-----|--------|-----|
|    |           | Signal    | Pin | Signal | Pin |
| 36 | PCIeT_LR4 | SRD-CLK1+ | T50 | SRC    | 19  |
| 35 | PCIeC_LR4 | SRD-CLK1- | T51 | SRC#   | 20  |

|       |   | ST7        |    |
|-------|---|------------|----|
| OUT0  | 2 | PCIE-CLKD+ | 13 |
| OUT0# | 3 | PCIE-CLKD- | 11 |

|       |   | ST8        |    |
|-------|---|------------|----|
| OUT1  | 5 | PCIE-CLKB+ | 13 |
| OUT1# | 6 | PCIE-CLKB- | 11 |

|       |    | ST11       |     |
|-------|----|------------|-----|
| OUT2  | 12 | PCIE-CLKC+ | A13 |
| OUT2# | 11 | PCIE-CLKC- | A14 |

|       |    | ST9        |   |
|-------|----|------------|---|
| OUT3  | 15 | PCIE-CLKA+ | 7 |
| OUT3# | 14 | PCIE-CLKA- | 6 |

Table 5-3 Clock distribution

## 5.5 Boot Configuration

The SBC-LS1088A board offers three possible boot devices to choose from. The settings can be done via SW1 (see chapter 7 for details). SW1 configures two signals “BOOT-SEL1” and “BOOT-SEL2” which have a default high state (10k pullups are on the module) when no connection is made or SW1 is off. When the switch is on, the respective pin is grounded.

The BOOT-SELx pins are decoded to the following configuration (1= high, 0=low):

| LS1088A  |     | BOOT-SEL2   BOOT-SEL1 = |              |               |
|----------|-----|-------------------------|--------------|---------------|
| Signal   | Pin | SDHC<br>=[10]           | SPI<br>=[11] | NAND<br>=[01] |
| IFC_AD08 | A12 | 0                       | 1            | t.b.d         |
| IFC_AD09 | A13 | 0                       | 0            | t.b.d         |
| IFC_AD10 | B14 | 0                       | 0            | t.b.d         |
| IFC_AD11 | A14 | 0                       | 0            | t.b.d         |
| IFC_AD12 | B15 | 0                       | 1            | t.b.d         |
| IFC_AD13 | A15 | 1                       | 1            | t.b.d         |
| IFC_AD14 | A16 | 0                       | 0            | t.b.d         |
| IFC_AD15 | A17 | 0                       | 0            | t.b.d         |
| IFC_CLE  | C19 | 0                       | 0            | t.b.d         |

Table 5-4 Hard wired boot signals

## 5.6 NAND Flash

The SBC-LS1088A system is equipped with 2GB of NAND Flash by default. Different sizes may be available on request/order. The following table shows the connections and signal levels for the NAND Flash.

| I/O Range | NAND Flash      |       |   | SBC-LS1088A |   | LS1088A |          | Description             |
|-----------|-----------------|-------|---|-------------|---|---------|----------|-------------------------|
|           | Pin             | Name  |   | Signal      |   | Pin     | Name     |                         |
| 1,8V      | G5              | LOCK  |   |             |   |         |          | Lock                    |
| 1,8V      | C8              | RY/BY | → | IFC-RB0#    | → | C16     | IFC_RB0# | ready/busy, 4,7K pullup |
| 1,8V      | D4              | RE#   | ← | IFC-OE#     | ← | C18     | IFC_OE#  | read enable             |
| 1,8V      | C6              | CE#   | ← | IFC-CS0#    | ← | C17     | IFC_CS0# | chip select             |
| 1,8V      | D3,G4,H8,<br>J6 | VCC   |   | +1.8V       |   |         |          |                         |
|           | C5,F7,K3,<br>K8 | GND   |   | GND         |   |         |          |                         |
| 1,8V      | D5              | CLE   | ← | IFC-CLE     | ← | C19     | IFC_CLE  | command latch enable    |
| 1,8V      | C4              | ALE   | ← | IFC-AVD     | ← | A18     | IFC_AVD  | address latch enable    |
| 1,8V      | C7              | WE#   | ← | IFC-WE#     | ← | C15     | IFC_WE0# | write enable            |
| 1,8V      | C3              | WP#   | ← | IFC-WP#     | ← | D19     | IFC_WP0# | write protect           |
| 1,8V      | H4              | D0    | ↔ | IFC-AD7     | ↔ | B12     | IFC_AD0  | data line               |
| 1,8V      | J4              | D1    | ↔ | IFC-AD6     | ↔ | A11     | IFC_AD1  | data line               |
| 1,8V      | K4              | D2    | ↔ | IFC-AD5     | ↔ | B11     | IFC_AD2  | data line               |
| 1,8V      | K5              | D3    | ↔ | IFC-AD4     | ↔ | A10     | IFC_AD3  | data line               |
| 1,8V      | K6              | D4    | ↔ | IFC-AD3     | ↔ | A9      | IFC_AD4  | data line               |
| 1,8V      | J7              | D5    | ↔ | IFC-AD2     | ↔ | B9      | IFC_AD5  | data line               |
| 1,8V      | K7              | D6    | ↔ | IFC-AD1     | ↔ | A8      | IFC_AD6  | data line               |
| 1,8V      | J8              | D7    | ↔ | IFC-AD0     | ↔ | B8      | IFC_AD7  | data line               |
|           | G3              | n.c.  |   |             |   |         |          | Not connect             |
|           | G8              | n.c.  |   |             |   |         |          | Not connect             |

Table 5-5 NAND Flash pin assignments

## 5.7 QSPI Flash

The SBC-LS1088A system is equipped with 16MB of QSPI Flash on the LS1088A's QSPI port. Up to 64 MB are available on request/order.

The following table shows the internal connections:

| I/O Range | QSPI Flash<br>MT25QU128ABA8E12 |       |   | LS1088A |              |
|-----------|--------------------------------|-------|---|---------|--------------|
|           | Pin                            | Name  |   | Pin     | Name         |
| LVTTL     | C2                             | CS    | ← | D8      | QSPI_A_CS0   |
| LVTTL     | B2                             | CLK   | ← | C9      | QSPI_A_SCK   |
|           | B3                             | GND   | ← |         |              |
| LVTTL     | D3                             | D0    | ↔ | D11     | QSPI_A_DATA0 |
| LVTTL     | D2                             | D1    | ↔ | C12     | QSPI_A_DATA1 |
| LVTTL     | C4                             | D2    | ↔ | D13     | QSPI_A_DATA2 |
| LVTTL     | D4                             | D3    | ↔ | C13     | QSPI_A_DATA3 |
|           | B4                             | +1.8V |   |         |              |

Table 5-6 QSPI Flash pin assignment

## 5.8 I<sup>2</sup>C Bus

The SBC-LS1088A offers two independent I<sup>2</sup>C busses.

The following tables show the I<sup>2</sup>C addresses as 7 Bit addresses. The R/W bit is not displayed.

### 5.8.1 I2C-1

I<sup>2</sup>C Bus 1 (7-Bit address):

| Address                                       | Device          | Function                                       |
|---|-----------------|--|
| 0x32  | RX-8803LC       | RTC  |
| 0x00  | TMP451AIDQF     | General Call reset address                     |
| 0x4C  |                 | Temperature sensor                             |
| 0x50  | BR24G128NUX-3   | EEPROM (on module)                             |
| 0x57 / (0x55)<br>Selectable via SW2 (see 7.2) | BR24G128NUX-3   | EEPROM (on carrier)                            |
| 0x58  | MAX7325ATG      | Port Expander GP output address                |
| 0x68  |                 | Port Expander GP input address                 |
| 0x60  | TLC59116IRHBR   | RGB LED Driver Slave Address                   |
| 0x68  |                 | All Call Address<br><b>(must be disabled!)</b> |
| 0x6B  |                 | Software Reset Address                         |
| 0x69  | IDT6V49205BNLGI | Clock Generator                                |

Table 5-7 I<sup>2</sup>C1 bus map



**I<sup>2</sup>C address 0x68 is existing twice on I2C-1 bus.**

**Therefore, the so-called “All Call I2C address” of the TLC59116IRHBR RGB LED driver has to be disabled before GP input pins of the MAX7325 port expander can be read correctly. This can be achieved by setting the default value 1 of Bit 0 in MODE1 register to 0.**

The I<sup>2</sup>C Bus 1 has the following layout:

I/O Range: LVTTTL

| Device           | SCL<br>(Signal Name) | Pin | SDA<br>(Signal Name) | Pin |
|------------------|----------------------|-----|----------------------|-----|
| LS1088A          | IIC1_SCL             | N1  | IIC1_SDA             | M1  |
|                  | ↓                    |     | ↑                    |     |
| RX-8803LC        | SCL                  | 5   | SDA                  | 8   |
|                  | ↓                    |     | ↑                    |     |
| BR24G128NUX-3    | SCL                  | 6   | SDA                  | 5   |
|                  | ↓                    |     | ↑                    |     |
| TMP451AIDQF      | SCK                  | 8   | SDA                  | 7   |
|                  | ↓                    |     | ↑                    |     |
| IDT6V49205B      | SCLK                 | 46  | SDATA                | 47  |
|                  | ↓                    |     | ↑                    |     |
| Module Connector | I2C1_SCL             | B78 | I2C1_SDA             | B77 |
|                  | ↓                    |     | ↑                    |     |
| MAX7325          | SCL                  | 19  | SDA                  | 20  |
|                  | ↓                    |     | ↑                    |     |
| BR24G128NUX-3    | SCL                  | 6   | SDA                  | 5   |
|                  | ↓                    |     | ↑                    |     |
| TLC59116IRHBR    | SCL                  | 25  | SDA                  | 26  |

Table 5-8 I<sup>2</sup>C-1 pin assignment

### 5.8.2 I2C-2 (not available)



ATTENTION

*I<sup>2</sup>C-2 is not available with the LS1088A*

### 5.8.3 I2C-4



ATTENTION

*I<sup>2</sup>C-4 is available without hardware modifications.  
Unlike SBC-LS1046A and SBC-LS1043A I<sup>2</sup>C-4 can be accessed on pins B7 (SDA) and B13 (SCL)*

No devices or connectors are connected to I<sup>2</sup>C-4 port on the CRX05.



# 6 Peripherals

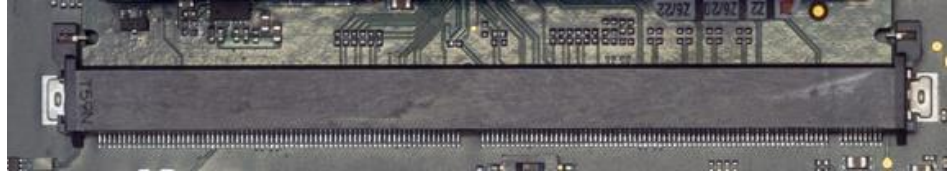
## 6.1 Connector References

| Reference | Function                 | Populated?                   | Top / Bottom            |
|-----------|--------------------------|------------------------------|-------------------------|
| ST1       | Micro SD slot            | ✓                            | Top                     |
| ST2       | Smart Card connector     | ✓                            | Bottom                  |
| ST3       | Power connector          | ✓                            | Top                     |
| ST4       | CPU Module Connector     | ✓                            | Top                     |
| ST5       | USB to serial connector  | ✓                            | Top                     |
| ST6       | Dual USB connector       | ✓                            | Top                     |
| ST7       | mPCIe / mSATA slot       | ✓                            | Bottom                  |
| ST8       | mPCIe slot               | ✓                            | Bottom                  |
| ST9       | PCIe extension connector | ✓                            | Bottom                  |
| ST10      | SATA connector           | ✓                            | Top                     |
| ST11      | PCIe extension connector | ✓                            | Bottom                  |
| ST12      | UART2 connector          | ✓                            | Top                     |
| ST13      | Aurora connector 1       | -                            | Bottom                  |
| ST14      | Aurora connector 2       | -                            | Bottom                  |
| ST15      | Extension connector      | -                            | Bottom                  |
| ST16      | GPIN connector           | ✓                            | Top                     |
| ST17      | GPOUT connector          | ✓                            | Top                     |
| ST18      | emBRICK connector        | ✓                            | Bottom                  |
| PWE       | Fan connector            | ✓                            | Top                     |
| LAN1      | RJ45 connector           | ✓                            | Top                     |
| LAN2      | RJ45 connector           | ✓                            | Top                     |
| MCU       | Microcontroller          | TAG connect                  | Bottom R2 only          |
| JTG0      | JTAG connector           | TAG connect<br>JST-BM14-SRSS | Bottom (R2)<br>Top (R3) |

Table 6-1 Connector reference overview

## 6.2 Module Connector

The carrierboard CRX05 provides a connector “ST4” which accepts compatible CPU modules from the MicroSys MPX2-family.



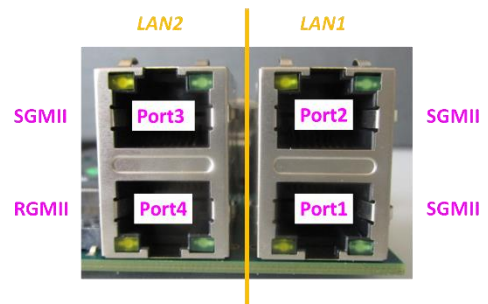
|               |                             |
|---------------|-----------------------------|
| Manufacturer: | JAE                         |
| Type:         | MM70-314-310-B1-1-R300      |
| Used with:    | MicroSys MPX2 module family |

## 6.3 LAN Connections

The SBC-LS1088A system offers four independent Gigabit LAN connections. These three ports are distributed over two connectors named “LAN1” and “LAN2”. The connectors have integrated magnetics.

The following picture shows the front view of the two connectors as placed on the CRX05 baseboard. For further information on the LEDs please see chapter 8

|                 |   |
|-----------------|---|
| Part Reference: | LAN1, LAN2                                    |
| Manufacturer:   | Würth Elektronik                              |
| Type:           | 749 915 1120                                  |
| Mates with:     | RJ45 patch cable, category depending on speed |



| Port | LS1088A connection | Serdes Lane on ST4 | RGMII on ST4 | PHY address |
|------|--------------------|--------------------|--------------|-------------|
| 1    | „DPMAC2“           | Lane1              | ---          | 0000        |
| 2    | „DPMAC3“           | Lane2              | ---          | 0001        |
| 3    | „DPMAC7“           | Lane3              | ---          | 0010        |
| 4    | „DPMAC4“           | ---                | RGMII1       | 0011        |

Table 6-2 LAN / DTSEC / SerDes / RGMII assignment

The LAN Sockets have a standard layout for GBit Ethernet, i.e. the pairs are 1-2, 3-6, 4-5 and 7-8.

| Pin | Pair |
|-----|------|
| 1   | D-A+ |
| 2   | D-A- |
| 3   | D-B+ |
| 4   | D-C+ |
| 5   | D-C- |
| 6   | D-B- |
| 7   | D-D+ |
| 8   | D-D- |

Table 6-3 LAN Gigabit Ethernet connector pairs

### 6.3.1 Port 1

Port 1 is connected to a standard RJ-45 socket "LAN1". It uses the SerDes Lanes 1 provided by the LS1088A CPU configured as SGMII port. The SGMII lanes connect to a Marvell PHY 88E1512P which uses a copy of the reference voltage on pin T80 of the module connector ST4 as I/O voltage (1.8V).

| 88E1512P |        |   | ST4 |          |   | LS1088A |          |
|----------|--------|---|-----|----------|---|---------|----------|
| Pin      | Name   |   | Pin | Signal   |   | Pin     | Name     |
| 1        | S_INP  | ← | T41 | SRD-TX1+ | ← | AD6     | SD1-TX0  |
| 2        | S_INN  | ← | T42 | SRD-TX1- | ← | AE6     | SD1-TX0# |
| 4        | S_OUTP | → | T38 | SRD-RX1+ | → | AG6     | SD1-RX0  |
| 5        | S_OUTN | → | T39 | SRD-RX1- | → | AH6     | SD1-RX0# |

Table 6-4 SerDes 1 pin assignment

### 6.3.2 Port 2

Port 2 is connected to a standard RJ-45 socket "LAN1". It uses the SerDes Lanes 2 provided by the LS1088A CPU configured as SGMII port. The SGMII lanes connect to a Marvell PHY 88E1512P which uses a copy of the reference voltage on pin T80 of the module connector ST4 as I/O voltage (1.8V).

| 88E1512P |        |   | ST4 |          |   | LS1088A |         |
|----------|--------|---|-----|----------|---|---------|---------|
| Pin      | Name   |   | Pin | Signal   |   | Pin     | Name    |
| 1        | S_INP  | ← | T35 | SRD-TX2+ | ← | AD11    | SD-TX3  |
| 2        | S_INN  | ← | T36 | SRD-TX2- | ← | AE11    | SD-TX3# |
| 4        | S_OUTP | → | T32 | SRD-RX2+ | → | AG11    | SD-RX3  |
| 5        | S_OUTN | → | T33 | SRD-RX2- | → | AH11    | SD-RX3# |

Table 6-5 SerDes 2 pin assignment

### 6.3.3 Port 3

Port 3 is connected to a standard RJ-45 socket "LAN2". It uses the SerDes Lanes 3 provided by the LS1088A CPU configured as SGMII port. The SGMII lanes connect to a Marvell PHY 88E1512P which uses a copy of the reference voltage on pin T80 of the module connector ST4 as I/O voltage (1.8V).

| 88E1512P |        |   | ST4 |          |   | LS1088A |          |
|----------|--------|---|-----|----------|---|---------|----------|
| Pin      | Name   |   | Pin | Signal   |   | Pin     | Name     |
| 1        | S_INP  | ← | T41 | SRD-TX3+ | ← | AD10    | SD1-TX1  |
| 2        | S_INN  | ← | T42 | SRD-TX3- | ← | AE10    | SD1-TX1# |
| 4        | S_OUTP | → | T38 | SRD-RX3+ | → | AG10    | SD1-RX1  |
| 5        | S_OUTN | → | T39 | SRD-RX3- | → | AH10    | SD1-RX1# |

Table 6-6 SerDes 3 pin assignment

### 6.3.4 Port 4

Port 4 is connected to a standard RJ-45 socket "LAN2". It uses the Ethernet controller EC1 as RGMII port provided by the LS1088A CPU. The RGMII lanes connect to a Marvell PHY 88E1512P which uses a copy of the reference voltage on pin T80 of the module connector ST4 as I/O voltage (1.8V).

The following table shows the internal connections for Port 4.

| I/O Range |         |           | 88E1512P |         |   | ST4  |           |   | LS1088A |                |
|-----------|---------|-----------|----------|---------|---|------|-----------|---|---------|----------------|
|           | Pull-up | Pull-down | Pin      | Name    |   | Pin  | Signal    |   | Pin     | Name           |
| 1.8V      |         |           | 46       | RX_CLK  | → | T86  | MII1-RXCK | → | W1      | MII_RX_CLK     |
| 1.8V      |         |           | 43       | RX_CTRL | → | T95  | MII1-RXDV | → | AB1     | MII_RX_DV      |
| 1.8V      |         |           | 44       | RXD0    | → | T88  | MII1-RXD0 | → | AA2     | MII_RXD0       |
| 1.8V      |         | 4k7       | 45       | RXD1    | → | T89  | MII1-RXD1 | → | AA1     | MII_RXD1       |
| 1.8V      |         |           | 47       | RXD2    | → | T91  | MII1-RXD2 | → | Y1      | MII_RXD2       |
| 1.8V      |         |           | 48       | RXD3    | → | T92  | MII1-RXD3 | → | W2      | MII_RXD3       |
| 1.8V      |         |           | 53       | TX_CLK  | ← | T94  | MII1-TXCK | ← | W4      | MII_TX_CLK     |
| 1.8V      |         |           | 50       | TXD0    | ← | T97  | MII1-TXD0 | ← | AB3     | MII_TXD0       |
| 1.8V      |         |           | 51       | TXD1    | ← | T98  | MII1-TXD1 | ← | AA3     | MII_TXD1       |
| 1.8V      |         |           | 54       | TXD2    | ← | T100 | MII1-TXD2 | ← | Y4      | MII_TXD2       |
| 1.8V      |         |           | 55       | TXD3    | ← | T101 | MII1-TXD3 | ← | Y3      | MII_TXD3       |
| 1.8V      |         | 4k7       | 56       | TX_CTRL | ← | T103 | MII1-TXEN | ← | AB4     | MII_TXEN       |
| 1.8V      | 5k0     |           | 8        | MDIO    | ↔ | B87  | MII1-MDIO | ↔ | AF2     | EMI1_MDIO      |
| 1.8V      | 10k0    |           | 7        | MDC     | ← | B86  | MII1-MDC  | ← | AG2     | EMI1_MDC       |
| 1.8V      |         |           | 9        | CLK125  | → | T83  | MII1-CRS  | → | AC3     | EC1_GTX_CLK125 |

Table 6-7 Port4 pin assignment

## 6.4 PCIe Connections

The SBC-LS1088A offers three x1 lanes on the following connectors.

| Serdes | ST7<br>(Mini-PCle /<br>mSATA Slot) | ST8<br>(Mini PCIe Slot) | ST9<br>(PCIe Extension<br>Connector) | ST11<br>(PCIe Extension<br>Connector) |
|--------|------------------------------------|-------------------------|--------------------------------------|---------------------------------------|
| Lane 0 |                                    |                         | ✓                                    |                                       |
| Lane 4 |                                    | ✓                       |                                      |                                       |
| Lane 5 |                                    |                         |                                      | ✓                                     |
| Lane 7 | ✓<br>(mSATA)                       |                         |                                      |                                       |

Table 6-8 PCIe SerDes assignment

Basically, the carrierboard offers four x1 lanes on different connectors which may be available in combination with other MPX2 modules.

### 6.4.1 Mini-PCle Slot

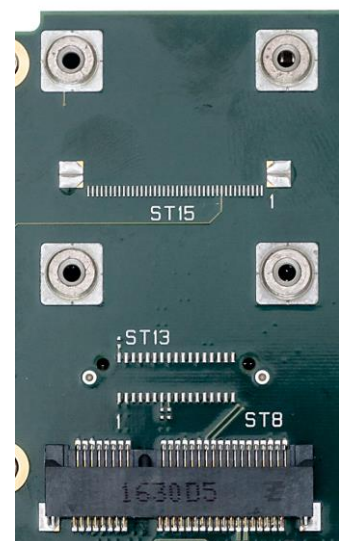
There are two mini PCIe slot on the carrierboard. The first one can hold mPCle cards only, mSATA is not supported.

|                 |   |
|-----------------|---|
| Part Reference: | ST8                                     |
| Manufacturer:   | Tyco                                    |
| Type:           | 2041119-1                               |
| Used with:      | Half size mini PCIe cards are preferred |



Broaching nuts for both half and full size cards are placed on the carrier board. When full size cards are used care has to be taken to choose cards that do not have parts on the bottom side accidentally shorting signals.

MicroSys recommends to use half size cards with this slot only!



| Pin:           |          |           | Pin: |
|----------------|----------|-----------|------|
| 1              | WAKE#    | +3.3Vaux  | 2    |
| 3              | COEX1    | GND       | 4    |
| 5              | COEX2    | +1.5V     | 6    |
| 7              | CLKREQ#  | UIM-PWR   | 8    |
| 9              | GND      | UIM-DAT   | 10   |
| 11             | REFCLK-  | UIM-CLK   | 12   |
| 13             | REFCLK+  | UIM-RST   | 14   |
| 15             | GND      | UIM-VPP   | 16   |
| MECHANICAL KEY |          |           |      |
| 17             | Reserved | GND       | 18   |
| 19             | Reserved | WDIS#     | 20   |
| 21             | GND      | PERST#    | 22   |
| 23             | PER0-    | +3.3Vaux  | 24   |
| 25             | PER0+    | GND       | 26   |
| 27             | GND      | +1.5V     | 28   |
| 29             | GND      | SMB-CLK   | 30   |
| 31             | PET0-    | SMB-DAT   | 32   |
| 33             | PET0+    | GND       | 34   |
| 35             | GND      | USB-D-    | 36   |
| 37             | GND      | USB-D+    | 38   |
| 39             | +3.3Vaux | GND       | 40   |
| 41             | +3.3Vaux | LED-WWAN# | 42   |
| 43             | GND      | LED_WLAN# | 44   |
| 45             | Reserved | LED_WPAN# | 46   |
| 47             | Reserved | +1.5V     | 48   |
| 49             | Reserved | GND       | 50   |
| 51             | Reserved | +3.3Vaux  | 52   |

Table 6-9 mPCIe Slot pinout

The following table shows the internal connections:

| ST8 |       |   | ST4 |          |   | LS1088A |          |
|-----|-------|---|-----|----------|---|---------|----------|
| Pin | Name  |   | Pin | Signal   |   | Pin     | Name     |
| 33  | PET4+ | ← | T23 | SRD-TX4+ | ← | AD15    | SD2-TX0  |
| 31  | PET4- | ← | T24 | SRD-TX4- | ← | AE15    | SD2-TX0# |
| 25  | PER4+ | → | T20 | SRD-RX4+ | → | AG15    | SD2-RX0  |
| 23  | PER4- | → | T21 | SRD-RX4- | → | AH15    | SD2-RX0# |

Table 6-10 mPCIe Slot SerDes 4 assignment

### 6.4.2 Mini-PCIe Slot / mSATA Slot

Basically, the second slot can hold both mSATA cards and mPCIe cards.

Depending on the software configuration (SerDes configuration) either mSATA or mPCIe cards can be used.

|                 |   |
|-----------------|---|
| Part Reference: | ST7   |
| Manufacturer:   | Tyco  |
| Type:           | 2041119-1                                       |
| Used with:      | Full size or half size mini PCIe or mSATA cards |



Four holes for broaching nuts are designed to allow for half and full size cards to be used with this slot.

The broaching nuts for half size cards are not populated as standard to allow cards without height restrictions.

Revision 3 has NO connector JTG0 and MCU in this area!



| Pin:           |              |           | Pin: |
|----------------|--------------|-----------|------|
| 1              | WAKE#        | +3.3Vaux  | 2    |
| 3              | COEX1        | GND       | 4    |
| 5              | COEX2        | +1.5V     | 6    |
| 7              | CLKREQ#      | UIM-PWR   | 8    |
| 9              | GND          | UIM-DAT   | 10   |
| 11             | REFCLK-      | UIM-CLK   | 12   |
| 13             | REFCLK+      | UIM-RST   | 14   |
| 15             | GND          | UIM-VPP   | 16   |
| MECHANICAL KEY |              |           |      |
| 17             | Reserved     | GND       | 18   |
| 19             | Reserved     | WDIS#     | 20   |
| 21             | GND          | PERST#    | 22   |
| 23             | <b>PER0+</b> | +3.3Vaux  | 24   |
| 25             | <b>PER0-</b> | GND       | 26   |
| 27             | GND          | +1.5V     | 28   |
| 29             | GND          | SMB-CLK   | 30   |
| 31             | PET0-        | SMB-DAT   | 32   |
| 33             | PET0+        | GND       | 34   |
| 35             | GND          | USB-D-    | 36   |
| 37             | GND          | USB-D+    | 38   |
| 39             | +3.3Vaux     | GND       | 40   |
| 41             | +3.3Vaux     | LED-WWAN# | 42   |
| 43             | GND          | LED_WLAN# | 44   |
| 45             | Reserved     | LED_WPAN# | 46   |
| 47             | Reserved     | +1.5V     | 48   |
| 49             | Reserved     | GND       | 50   |
| 51             | Reserved     | +3.3Vaux  | 52   |

Table 6-11 mPCIe / mSATA Slot pinout

The following table shows the internal connections:

| ST7 |              |   | ST4 |          |   | LS1088A |           |
|-----|--------------|---|-----|----------|---|---------|-----------|
| Pin | Name         |   | Pin | Signal   |   | Pin     | Name      |
| 33  | PET0+        | ← | T5  | SRD-TX7+ | ← | AD19    | SD2_TX3_P |
| 31  | PET0-        | ← | T6  | SRD-TX7- | ← | AE19    | SD2_TX3_N |
| 23  | <b>PER0-</b> | → | T2  | SRD-RX7+ | → | AG19    | SD2_RX3_P |
| 25  | <b>PER0+</b> | → | T3  | SRD-RX7- | → | AH19    | SD2_RX3_N |

Table 6-12 mPCIe Slot SerDes 7 assignment



### 6.4.3 PCIe Extension Connector 1

The PCIe Extension Connectors “ST9” and “ST11” provide basic PCIe signals. They have identical pinouts providing power, data, clock, reset and I<sup>2</sup>C signals.

Depending on the module and software configuration the data signals can also be used for other interfaces according to the SerDes configuration of the respective module.

The extension connectors interface the CRX05 carrier board with any specially developed adapter. No standard pinout is used.

|                 |                                |
|-----------------|--------------------------------|
| Part Reference: | ST9                            |
| Manufacturer:   | Würth Elektronik               |
| Type:           | 687 118 140 22                 |
| Mates with:     | FFC cable, 18pins, pitch 0.5mm |



*The I<sup>2</sup>C port is accessible via I<sup>2</sup>C Bus 2 and the I<sup>2</sup>C multiplexer TCA9544A (address 0x70). See chapter 5.8.2 for more information.*

**NOTE** *Devices connected to ST9 and ST11 share channel 3.*

| Pin: |           |
|------|-----------|
| 1    | +3.3V     |
| 2    | +3.3V     |
| 3    | +3.3V     |
| 4    | +1.5V     |
| 5    | GND       |
| 6    | REFCLK-   |
| 7    | REFCLK+   |
| 8    | GND       |
| 9    | PER0-     |
| 10   | PER0+     |
| 11   | GND       |
| 12   | PET0-     |
| 13   | PET0+     |
| 14   | GND       |
| 15   | I2C2D-SCL |
| 16   | I2C2D-SDA |
| 17   | GND       |
| 18   | PERST#    |

Table 6-13 PCIe Extension connector pinout (ST9)

The following table shows the internal connections:

| ST9 |       |   | ST4 |          |   | LS1088A |          |
|-----|-------|---|-----|----------|---|---------|----------|
| Pin | Name  |   | Pin | Signal   |   | Pin     | Name     |
| 13  | PET0+ | ← | T47 | SRD-TX0+ | ← | AD18    | SD2-TX2  |
| 12  | PET0- | ← | T48 | SRD-TX0- | ← | AE18    | SD2-TX2# |
| 10  | PER0+ | → | T44 | SRD-RX0+ | → | AG18    | SD2-RX2  |
| 9   | PER0- | → | T45 | SRD-RX0- | → | AH18    | SD2-RX2# |

Table 6-14 PCIe Edge Card connector SerDes 0 assignment

### 6.4.4 PCIe Extension Connector 2

|                 |                                |
|-----------------|--------------------------------|
| Part Reference: | ST11                           |
| Manufacturer:   | Würth Elektronik               |
| Type:           | 687 118 140 22                 |
| Mates with:     | FFC cable, 18pins, pitch 0.5mm |



The I2C port is accessible via I2C Bus 2 and the I2C multiplexer TCA9544A (address 0x70). See chapter 5.8.2 for more information.

**NOTE**

Devices connected to ST9 and ST11 share channel 3.

| Pin: |           |
|------|-----------|
| 1    | +3.3V     |
| 2    | +3.3V     |
| 3    | +3.3V     |
| 4    | +1.5V     |
| 5    | GND       |
| 6    | REFCLK-   |
| 7    | REFCLK+   |
| 8    | GND       |
| 9    | PER0-     |
| 10   | PER0+     |
| 11   | GND       |
| 12   | PET0-     |
| 13   | PET0+     |
| 14   | GND       |
| 15   | I2C2D-SCL |
| 16   | I2C2D-SDA |
| 17   | GND       |
| 18   | PERST#    |

Table 6-15 PCIe Extension connector pinout (ST11)

The following table shows the internal connections:

| ST11 |       |   | ST4 |          |   | LS1088A |           |
|------|-------|---|-----|----------|---|---------|-----------|
| Pin  | Name  |   | Pin | Signal   |   | Pin     | Name      |
| 13   | PET0+ | ← | T17 | SRD-TX5+ | ← | AD16    | SD2-TX1_P |
| 12   | PET0- | ← | T18 | SRD-TX5- | ← | AE16    | SD2-TX1_N |
| 10   | PER0+ | → | T14 | SRD-RX5+ | → | AG16    | SD2-RX1_P |
| 9    | PER0- | → | T15 | SRD-RX5- | → | AH16    | SD2-RX1_N |

Table 6-16 PCIe Edge Card connector SerDes 5 assignment

### 6.4.5 PCIe with external clock

To run board with external PCIe clock board has to be modified on assembly level. Please contact MicroSys if required.

## 6.5 SATA



The SATA port is not available with the SBC-LS1088A system.

|                 |                   |
|-----------------|-------------------|
| Part Reference: | ST10              |
| Manufacturer:   | 3M                |
| Type:           | 5607-4200-SH      |
| Used with:      | SATA cable (7pin) |



The following table shows the internal connections:

| ST10 |      |   | ST4 |          |   | LS1088A |          |
|------|------|---|-----|----------|---|---------|----------|
| Pin  | Name |   | Pin | Signal   |   | Pin     | Name     |
| 1    | GND  |   |     |          |   |         |          |
| 2    | A+   | ← | T11 | SRD-TX6+ | ← | AD19    | SD2-TX3  |
| 3    | A-   | ← | T12 | SRD-TX6- | ← | AE19    | SD2-TX3# |
| 4    | GND  |   |     |          |   |         |          |
| 5    | B-   | → | T9  | SRD-RX6- | → | AH19    | SD2-RX3# |
| 6    | B+   | → | T8  | SRD-RX6+ | → | AG19    | SD2-RX3  |
| 7    | GND  |   |     |          |   |         |          |

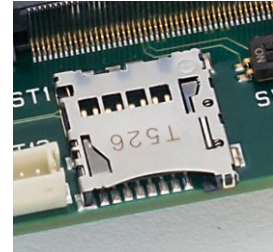
Table 6-17 SATA connector pin assignment

## 6.6 microSD Card Slot

The SBC-LS1088A system offers a microSD Card slot.

The microSD card can also be configured as a boot device.

|                 |                |
|-----------------|----------------|
| Part Reference: | ST1            |
| Manufacturer:   | Yamaichi       |
| Type:           | PJS-008-2130-0 |
| Used with:      | microSD cards  |



The following table shows the connections of the microSD card slot:

| I/O Range | ST1 |         |   | ST4  |         |   | LS1088A |           |
|-----------|-----|---------|---|------|---------|---|---------|-----------|
|           | Pin | Name    |   | Pin  | Signal  |   | Pin     | Name      |
| LVTTL     | 1   | DAT2    | ↔ | B96  | SDC-D2  | ↔ | R1      | SDHC_DAT2 |
| LVTTL     | 2   | CD/DAT3 | ↔ | B95  | SDC-D3  | ↔ | T1      | SDHC_DAT3 |
| LVTTL     | 3   | CMD     | ↔ | B99  | SDC-CMD | ↔ | P2      | SDHC_CMD  |
|           | 4   | Vdd     |   |      |         |   |         |           |
| LVTTL     | 5   | CLK     | ← | B100 | SDC-CLK | ← | P3      | SDHC_CLK  |
|           | 6   | Vss     |   |      |         |   |         |           |
| LVTTL     | 7   | DAT0    | ↔ | B98  | SDC-D0  | ↔ | P1      | SDHC_DAT0 |
| LVTTL     | 8   | DAT1    | ↔ | B97  | SDC-D1  | ↔ | R2      | SDHC_DAT1 |
| LVTTL     | 9   | SW1     | → | B90  | SDC-CD# |   |         |           |
| LVTTL     | 10  | SW2     | → | B89  | SDC-WP  |   |         |           |

Table 6-18 microSD card slot pin assignment



**NOTE**

The microSD card slot uses a copy of the reference voltage on pin B81 of the module connector ST4 as I/O voltage (3.3V).

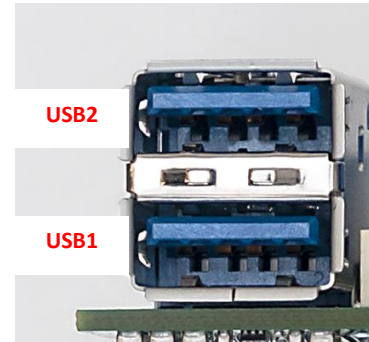
This voltage is generated on the carrierboard.

## 6.7 USB

The SBC-LS1088A system features a stacked USB connector for two ports.

Both USB host ports support USB super speed mode

|                 |                   |
|-----------------|-------------------|
| Part Reference: | ST6               |
| Manufacturer:   | Würth Elektronik  |
| Type:           | 692 141 030 100   |
| Mates with:     | USB Type A cables |



### 6.7.1 USB1

The following table shows the internal connections:

| ST6 (Bottom) |        |   | ST4  |            |   | LS1088A |               |
|--------------|--------|---|------|------------|---|---------|---------------|
| Pin          | Signal |   | Pin  | Signal     |   | Pin     | Name          |
| 1            | Vbus+  | → | B133 | USB1-VBUS  | → | E7      | USB1_VBUS     |
| 2            | D-     | ↔ | T131 | USB1-D-    | ↔ | E6      | USB1_D_M      |
| 3            | D+     | ↔ | T130 | USB1-D+    | ↔ | F6      | USB1_D_P      |
| 4            | GND    |   |      |            |   |         |               |
| 5            | SSRX-  | → | T118 | USB1-SSRX+ | → | E3      | USB1_RX_P     |
| 6            | SSRX+  | → | T119 | USB1-SSRX- | → | E4      | USB1_RX_M     |
| 7            | GND    |   |      |            |   |         |               |
| 8            | SSTX-  | ← | T122 | USB1-SSTX- | ← | F2      | USB1_TX_M     |
| 9            | SSTX+  | ← | T121 | USB1-SSTX+ | ← | F1      | USB1_TX_P     |
| J4           |        |   |      |            |   |         |               |
| Pin          | Signal |   |      |            |   |         |               |
| 4            | ENABLE | ← | B132 | USB1-EN    | ← | H6      | USB1_DRVVBUS  |
| 3            | FAULT# | → | B131 | USB1-OC    | → | G6      | USB1_PWRFAULT |
|              |        | → | B130 | USB1-UID   | → | F5      | USB1_ID       |

Table 6-19 USB Host-Only Port 1 pin assignment

USB port 1 can be individually enabled and has a separate overcurrent signal.



**USB1\_PWRFAULT is a high-active signal. A logic high level signals the port is in an overcurrent situation**

### 6.7.2 USB2

The following table shows the internal connections:

| ST6 (Top) |        |   | ST4  |            |   | LS1088A |               |
|-----------|--------|---|------|------------|---|---------|---------------|
| Pin       | Signal |   | Pin  | Signal     |   | Pin     | Name          |
| 1         | Vbus+  | → | B128 | USB2-VBUS  | → | C7      | USB2_VBUS     |
| 2         | D-     | ↔ | T128 | USB2-D-    | ↔ | C6      | USB2_D_M      |
| 3         | D+     | ↔ | T127 | USB2-D+    | ↔ | D6      | USB2_D_P      |
| 4         | GND    |   |      |            |   |         |               |
| 5         | SSRX-  | → | T112 | USB2-SSRX+ | → | C3      | USB2_RX_P     |
| 6         | SSRX+  | → | T113 | USB2-SSRX- | → | C4      | USB2_RX_M     |
| 7         | GND    |   |      |            |   |         |               |
| 8         | SSTX-  | ← | T116 | USB2-SSTX- | ← | D2      | USB2_TX_M     |
| 9         | SSTX+  | ← | T115 | USB2-SSTX+ | ← | D1      | USB2_TX_P     |
| J5        |        |   |      |            |   |         |               |
| Pin       | Signal |   | Pin  | Signal     |   | Pin     | Name          |
| 4         | ENABLE | ← | B127 | USB2-EN    | ← | L4      | USB2_DRVVBUS  |
| 3         | FAULT# | → | B126 | USB2-OC    | → | M4      | USB2_PWRFAULT |
|           |        | → | B125 | USB2-UID   | → | D5      | USB2_ID       |

Table 6-20 USB Host-Only Port 2 pin assignment

USB port 2 can be individually enabled and has a separate overcurrent signal.



**USB2\_PWRFAULT is a high-active signal. A logic high level signals the port is in an overcurrent situation**

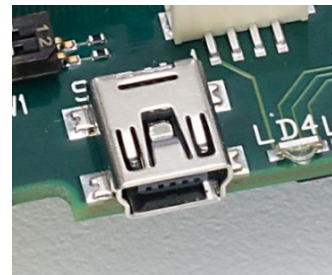
### 6.7.3 USB3

USB port 3 is not a native USB port of the CPU but converted from UART1 by means of a FT232RQ chip.

USB3 is available on an USB mini connector type B.

The port is used as the debug port of the LS1088A.

|                 |                        |
|-----------------|------------------------|
| Part Reference: | ST5                    |
| Manufacturer:   | Würth Elektronik       |
| Type:           | 651 005 161 21         |
| Used with:      | Mini USB type B cables |



The following table shows the internal connections:

| ST5 |        | ST4 |            | LS1088A |      |            |
|-----|--------|-----|------------|---------|------|------------|
| Pin | Signal | Pin | Signal     | Pin     | Name |            |
| 1   | Vbus+  | B37 | UART1-RXD  | →       | H2   | UART1_SIN  |
| 2   | D-     | B38 | UART1-TXD  | ←       | H1   | UART1_SOUT |
| 3   | D+     | B39 | UART1-CTS# | →       | J1   | UART1_CTS# |
| 4   | ID     | B40 | UART1-RTS# | ←       | J2   | UART1_RTS# |
| 5   | GND    |     |            |         |      |            |

Table 6-21 USB Host-Only Port 3 pin assignment



## 6.8 UART

The SBC-LS1088A system is provided with one serial port (UART).

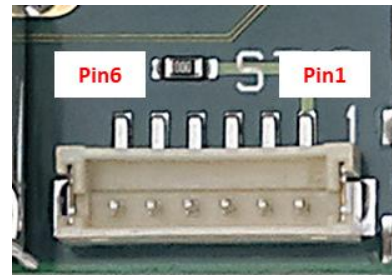
UART1 is converted to USB. See chapter 6.7.3 for details.

UART2 is available on the following extension connector including hardware handshaking with RTS/CTS. The I/O range is LVTTTL.



**For RS232 or RS485 additional transceivers are necessary. They are not implemented on the SBC-LS1088A system.**

|                 |                  |
|-----------------|------------------|
| Part Reference: | ST12             |
| Manufacturer:   | Würth Elektronik |
| Type:           | 648 106 131 822  |
| Mates with:     | 648 006 113 322  |



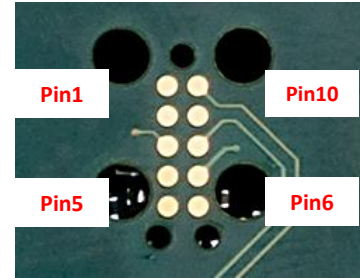
| ST12 |            |   | ST4 |            |   | LS1088A |            |
|------|------------|---|-----|------------|---|---------|------------|
| Pin  | Signal     |   | Pin | Signal     |   | Pin     | Name       |
| 1    | +3.3V      |   |     |            |   |         |            |
| 2    | UART2-RXD  | → | B32 | UART2-RXD  | → | K1      | UART2_SIN  |
| 3    | UART2-TXD  | ← | B33 | UART2-TXD  | ← | L2      | UART2_SOUT |
| 4    | UART2-RTS# | ← | B35 | UART2-RTS# | ← | L1      | UART2_RTS# |
| 5    | UART2-CTS# | → | B34 | UART2-CTS# | → | M2      | UART2_CTS# |
| 6    | GND        |   |     |            |   |         |            |

Table 6-22 UART2 pin assignment

## 6.9 MCU Connector

The connector "MCU" is for production test R2 only. Not available on CRX05R3.

|                 |               |
|-----------------|---------------|
| Part Reference: | MCU           |
| Manufacturer:   | Tag-Connect   |
| Type:           | TC2050-IDC-FP |



| MCU |                         |
|-----|-------------------------|
| Pin | Signal                  |
| 1   | Please contact MicroSys |
| 2   |                         |
| 3   |                         |
| 4   |                         |
| 5   |                         |
| 6   |                         |
| 7   |                         |
| 8   |                         |
| 9   |                         |
| 10  |                         |

Table 6-23 MCU Connector Pinout

## 6.10 JTAG Connector

### 6.10.1 JTAG on Revision R3

The JTAG signals are available on JST-BM14B-SRSS-TB connector.

|                 |               |
|-----------------|---------------|
| Part Reference: | JTG0          |
| Manufacturer:   | JST           |
| Type:           | BM14B-SrSS-TB |



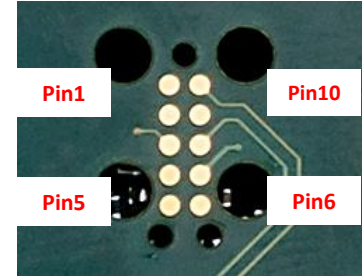
| JTG0 |              |   | ST4  |              |   | LS1046A |                      |
|------|--------------|---|------|--------------|---|---------|----------------------|
| Pin  | Signal       |   | Pin  | Signal       |   | Pin     | Signal               |
| 1    | JTDO         | ← | B104 | JTDO         | ← | E20     | TDO                  |
| 2    | GND          |   |      |              |   |         |                      |
| 3    | JTDI         | → | B103 | JTDI         | → | G17     | TDI                  |
| 4    | TRST#        | → | B106 | TRST#        | → | E19     | TRST#                |
| 5    | +1,8V        |   |      |              |   |         |                      |
| 6    | -            |   |      |              |   |         |                      |
| 7    | JTCK         | → | B105 | JTCK         | → | E18     | TCK                  |
| 8    | HRST#        | ↔ | B111 | HRST#        | ↔ | F8      | HRESET#              |
| 9    | JTMS         | → | B102 | JTMS         | → | G18     | TMS                  |
| 10   | GND          |   |      |              |   |         |                      |
| 11   | PRST#        | → | B110 | PRST#        | → | F9      | PORESET#             |
| 12   | GND          |   |      |              |   |         |                      |
| 13   | MCU-UART-RDD | → | B114 | MCU-UART-RDD | → | 46      | J11<br>MK02FN64VLH10 |
| 14   | MCU-UART-TXD | ← | B113 | MCU-UART-TXD | ← | 49      | J11<br>MK02FN64VLH10 |

Table 6-24 JTAG Connector Pinout R3

### 6.10.2 JTAG on Revision R2

The JTAG signals are available on a TAG connect footprint.

|                 |               |
|-----------------|---------------|
| Part Reference: | JTG0          |
| Manufacturer:   | Tag-Connect   |
| Type:           | TC2050-IDC-FP |



| JTG0 |        |   | ST4  |        |   | LS1046A |          |
|------|--------|---|------|--------|---|---------|----------|
| Pin  | Signal |   | Pin  | Signal |   | Pin     | Signal   |
| 1    | JTMS   | → | B102 | JTMS   | → | G18     | TMS      |
| 2    | HRST#  | ↔ | B111 | HRST#  | ↔ | F8      | HRESET#  |
| 3    | +1,8V  |   |      |        |   |         |          |
| 4    | TRST#  | → | B106 | TRST#  | → | E19     | TRST#    |
| 5    | JTDO   | ← | B104 | JTDO   | ← | E20     | TDO      |
| 6    | JTCK   | → | B105 | JTCK   | → | E18     | TCK      |
| 7    | GND    |   |      |        |   |         |          |
| 8    | PRST#  | → | B110 | PRST#  | → | F9      | PORESET# |
| 9    | JTDI   | → | B103 | JTDI   | → | G17     | TDI      |
| 10   | -      |   |      |        |   |         |          |

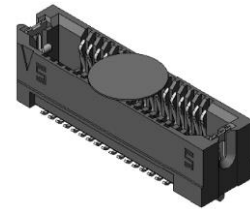
Table 6-25 JTAG Connector Pinout R2

## 6.11 Aurora Connectors (optional)



The Aurora interface is not available with the LS1088A processor.

|                 |               |
|-----------------|---------------|
| Part Reference: | ST13          |
| Manufacturer:   | Samtec        |
| Type:           | ASP-137973-01 |



| Pin: |      |             | Pin: |
|------|------|-------------|------|
| 1    | TX0+ | VREF (1,8V) | 2    |
| 3    | TX0- | TCK         | 4    |
| 5    | GND  | TMS         | 6    |
| 7    | TX1+ | TDI         | 8    |
| 9    | TX1- | TDO         | 10   |
| 11   | GND  | TRST#       | 12   |
| 13   | TX2+ | HALT#       | 14   |
| 15   | TX2- | EVTI#       | 16   |
| 17   | GND  | EVTO#       | 18   |
| 19   | TX3+ | GEN_IO3     | 20   |
| 21   | TX3- | RST#        | 22   |
| 23   | GND  | GND         | 24   |
| 25   | TX4+ | CLK+        | 26   |
| 27   | TX4- | CLK-        | 28   |
| 29   | GND  | GND         | 30   |
| 31   | TX5+ | RDY#        | 32   |
| 33   | TX5- | HRST#       | 34   |

Table 6-26 Aurora Connector Pinout

The module standard connector pinout (ST4) does not provide all signals which are necessary for the Aurora interface. Additional signals are available on the following connector "ST14". For more information please contact MicroSys.

|                 |                |
|-----------------|----------------|
| Part Reference: | ST14           |
| Manufacturer:   | JST            |
| Type:           | SM06B-XSRS-ETB |
| Mates with:     | 06XSR-36S      |



| Pin | Signal |
|-----|--------|
| 1   | HALT#  |
| 2   | EVTI#  |
| 3   | EVTO#  |
| 4   | -      |
| 5   | -      |
| 6   | -      |

Table 6-27 Aurora Connector (ST14) Pinout

## 6.12 General Purpose Inputs / Outputs

The functional scope of the carrierboard has been extended by GPIOs which support a maximum of 24V at the input. The maximum output level depends on the input voltage which is limited to 24V. For lower input voltages an external voltage up to 24V can alternatively be supplied. In that case a hardware modification is necessary.

Inputs and outputs are controlled by a MAX7325ATG I<sup>2</sup>C GPIO Expander. The output pins are level shifted to either the input voltage or to the level of an externally supplied voltage. The output driver can be separately enabled and disabled. Additionally, a fault pin exists that signals a chip thermal shutdown or an overcurrent condition on any channel.

| MAX7325ATG  | Description                                |
|-------------|--|
| P6 (Pin7)   | FAULT input: Logic low signals fault event |
| O14 (Pin16) | A logic high enables the GPOUT driver      |

GPINs:

|                 |                  |
|-----------------|------------------|
| Part Reference: | ST16             |
| Manufacturer:   | Würth Elektronik |
| Type:           | 691 382 010 006  |
| Mates with:     | 691 381 000 006  |

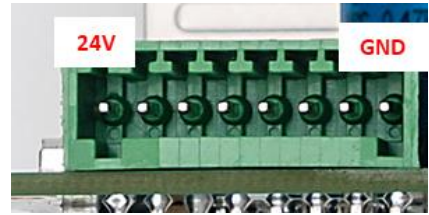


| Pin: | Description | MAX7325ATG |
|------|-------------|------------|
| 1    | IN0         | P0 (Pin1)  |
| 2    | IN1         | P1 (Pin2)  |
| 3    | IN2         | P2 (Pin3)  |
| 4    | IN3         | P3 (Pin4)  |
| 5    | IN4         | P4 (Pin5)  |
| 6    | IN5         | P5 (Pin6)  |

Table 6-28 GPIN connector pinout (ST16)

GPOUTs:

|                 |                  |
|-----------------|------------------|
| Part Reference: | ST17             |
| Manufacturer:   | Würth Elektronik |
| Type:           | 691 382 010 008  |
| Mates with:     | 691 381 000 008  |



| Pin: | Description  |   | MAX7325ATG  |
|------|--------------|---|-------------|
| 1    | +VIN / +VEXT |   | -           |
| 2    | OUT6         | Maximum output current on all ports together: 350mA | O13 (Pin15) |
| 3    | OUT5         |   | O12 (Pin14) |
| 4    | OUT4         |   | O11 (Pin13) |
| 5    | OUT3         |   | O10 (Pin12) |
| 6    | OUT2         |   | O9 (Pin11)  |
| 7    | OUT1         |   | O8 (Pin10)  |
| 8    | GND          |   | -           |

Table 6-29 GPOUT connector pinout (ST17)



Remove R154 and supply GPOUTs with external voltage on PIN1

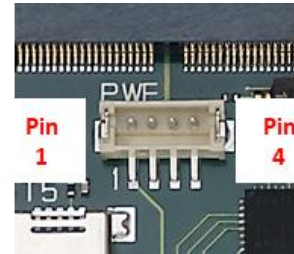
**Pin 1 of connector ST17 is connected to the carrierboard input voltage via R154. In order to supply the GPOUT section with input voltages different from the input voltage R154 has to be removed. V\_EXT on pin1 supports input voltages from 5V to 24V.**

## 6.13 Fan Connector

The SBC-LS1088A provides a fan connector marked with „PWE“.

In case a fan is necessary MicroSys recommends using a 5V rated fan.

|                 |                  |
|-----------------|------------------|
| Part Reference: | PWE              |
| Manufacturer:   | Würth Elektronik |
| Type:           | 679 304 124 022  |
| Mates with:     | 648 004 113 322  |



| Pin: | Description |
|------|-------------|
| 1    | +5V         |
| 2    | GND         |
| 3    | GND         |
| 4    | +VIN        |

Table 6-30 FAN connector pinout (PWE)

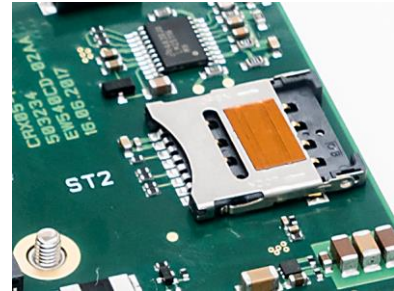


## 6.14 Smart Card Connector



**THE SMART CARD INTERFACE IS NOT CONNECTED TO THE LS1088A CPU.**

|                 |                  |
|-----------------|------------------|
| Part Reference: | ST2              |
| Manufacturer:   | Würth Elektronik |
| Type:           | 693 022 010 811  |
| Mates with:     | t.b.d.           |



Connection von CRX05-R3:

| ST2 |             |   | ST4  |             |   | LS1046A |             |
|-----|-------------|---|------|-------------|---|---------|-------------|
| Pin | Signal Name |   | Pin  | Description |   | Pin     | Signal Name |
| 1   | +3,3V       |   | -    |             |   |         |             |
| 2   | RST         | ← | B121 | 10k PU      | ← | C20     | GPIO2_12    |
| 3   | CLK         | ← | B122 | 10k PU      | ← | D20     | GPIO2_11    |
| 4   | -           |   | -    |             |   |         |             |
| 5   | GND         |   | -    |             |   |         |             |
| 6   | -           |   | -    |             |   |         |             |
| 7   | I/O         | ↔ | B123 | 10k PU      | ↔ | A19     | GPIO2_10    |
| 8   | -           |   | -    |             |   |         |             |

Table 6-31 Smart Card connector pinout (ST2)

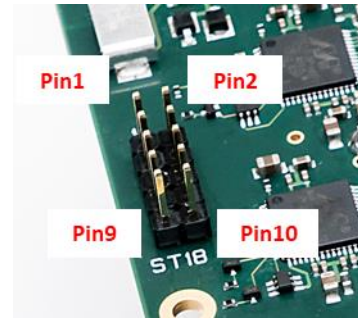
## 6.15 emBRICK Connector



**THE emBRICK INTERFACE IS CURRENTLY NOT SUPPORTED**

**NOTE**

|                 |                                 |
|-----------------|---------------------------------|
| Part Reference: | ST18                            |
| Manufacturer:   | Würth Elektronik                |
| Type:           | 613 005 211 21                  |
| Mates with:     | Standard 2.54mm dual row socket |



| Pin | Signal Name | Connection                   |
|-----|-------------|------------------------------|
| 1   | SEL_OUT     | MAX7325ATG O15 (Pin17)       |
| 2   | MOSI#       | SC18IS602BIPW MOSI (Pin6)    |
| 3   | MISO#       | SC18IS602BIPW MISO (Pin5)    |
| 4   | CLK#        | SC18IS602BIPW SPICLK (Pin11) |
| 5   | +3,3V       |                              |
| 6   | GND         |                              |
| 7   | GND         |                              |
| 8   | GND         |                              |
| 9   | +VIN        |                              |
| 10  | +VIN        |                              |

Table 6-32 emBRICK connector pinout (ST18)

# 7 Switches, Buttons and Jumpers

## 7.1 Boot Device Switch

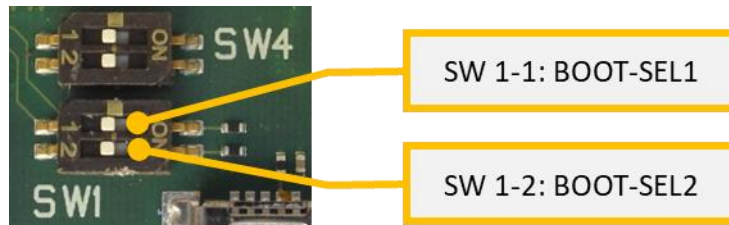


Figure 7-1 Boot Device Switch

The boot device can be selected by the switch “SW1”.

The boot device switches implement a maximum of four possible boot devices. The following boot devices are supported by the LS1088A:





| Setting   | SW 1-1 | SW 1-2 | Boot device | Features   | Boot location |
|---|--------|--------|-------------|--|---------------|
|  | OFF    | OFF    | SPI Flash   |  | module        |
|  | OFF    | ON     | NAND Flash  |  | module        |
|  | ON     | OFF    | SD/MMC      | SD/MMC Bus width: 8 bit<br>SPI-CS0# [PIN-B70] is <u>NOT</u> accessible | carrier board |
|  | ON     | ON     | SD/MMC      | SD/MMC Bus width: 4 bit<br>SPI-CS0# [PIN-B70] is <u>NOT</u> accessible | carrier board |

Table 7-1 Boot device settings



**NOTE**

**SW1 inverts the logic levels of the BOOT-SELx pins. By setting the switch to ON the corresponding pin is actually pulled low (grounded).**

The following table shows the internal connections of the BOOT-SEL pins:

| SW1    |           |   | ST4  |           |   | Microcontroller |      |
|--------|-----------|---|------|-----------|---|-----------------|------|
| Switch | Signal    |   | Pin  | Signal    |   | Pin             | Name |
| 1-1    | BOOT-SEL1 | → | T134 | BOOT-SEL1 | → | 61              | PTD4 |
| 1-2    | BOOT-SEL2 | → | T133 | BOOT-SEL2 | → | 62              | PTD5 |

Table 7-2 BOOT-SELx pin assignment

## 7.2 Board Configuration Switch

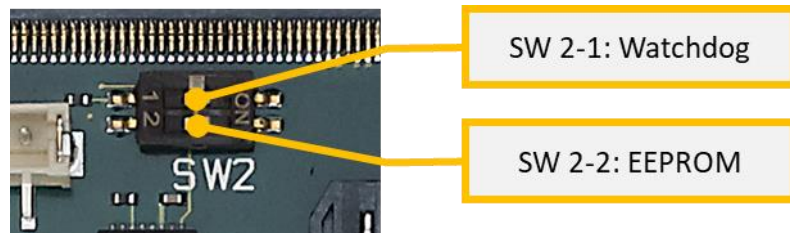


Figure 7-2 Board Configuration Switch

The board configuration switch influences the behavior of the watchdog and the I<sup>2</sup>C address of the EEPROM on I<sup>2</sup>C Bus1:

| Setting   | SW 2-1 | SW 2-2 | Description              |
|---|--------|--------|--------------------------|
|    | OFF    | -      | Watchdog disabled        |
|   | ON     | -      | Watchdog active          |
|  | -      | OFF    | EEPROM J25: address 0x57 |
|  | -      | ON     | EEPROM J25: address 0x55 |

Table 7-3 Configuration switch settings

## 7.3 PCIe selection: root complex / endpoint

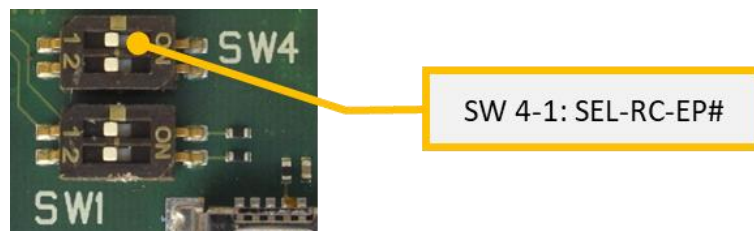


Figure 7-3 PCIe selection Switch

The PCIe configuration switch influences the behavior of root complex or endpoint.

| Setting   | SW 4-1 | SW 4-2 | Description         |
|---|--------|--------|---------------------|
|  | OFF    | -      | PCIe = root complex |
|  | ON     | -      | PCIe = endpoint     |
|  | -      | OFF    | Not used            |
|  | -      | ON     | Not used            |

Table 7-4 PCIe Configuration switch settings

## 7.4 Reset Button

Pressing the reset switch “SW3” triggers a Hard Reset.

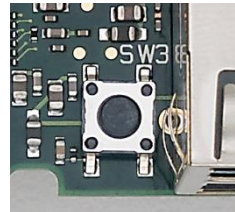


Figure 7-3 Reset Button

SW3 is connected to the reset input of a MAX6751KA29 chip via additional logic. The resulting open drain reset signal is then inverted and fed to the microcontroller.

The following table shows the internal connections:

| SW3   |                   | J17 | ST4    |         | Microcontroller |      |
|-------|-------------------|-----|--------|---------|-----------------|------|
| Pin   | Signal            | Pin | Pin    | Signal  | Pin             | Name |
| 1 & 3 | +3,3V             |     |        |         |                 |      |
| 2 & 4 | RST-BTN (\$39166) | → 1 |        |         |                 |      |
|       |                   | 7   | → T136 | RST-IN# | → 52            | PTC7 |

Table 7-4 Reset button pinout

# 8 LEDs

## 8.1 RJ45 LEDs

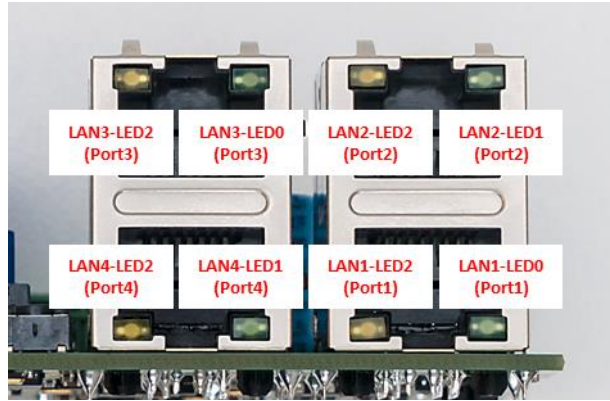


Figure 8-1 RJ 45 LEDs

The following table summarizes the RJ45 LEDs of the SBC-LS1088A:

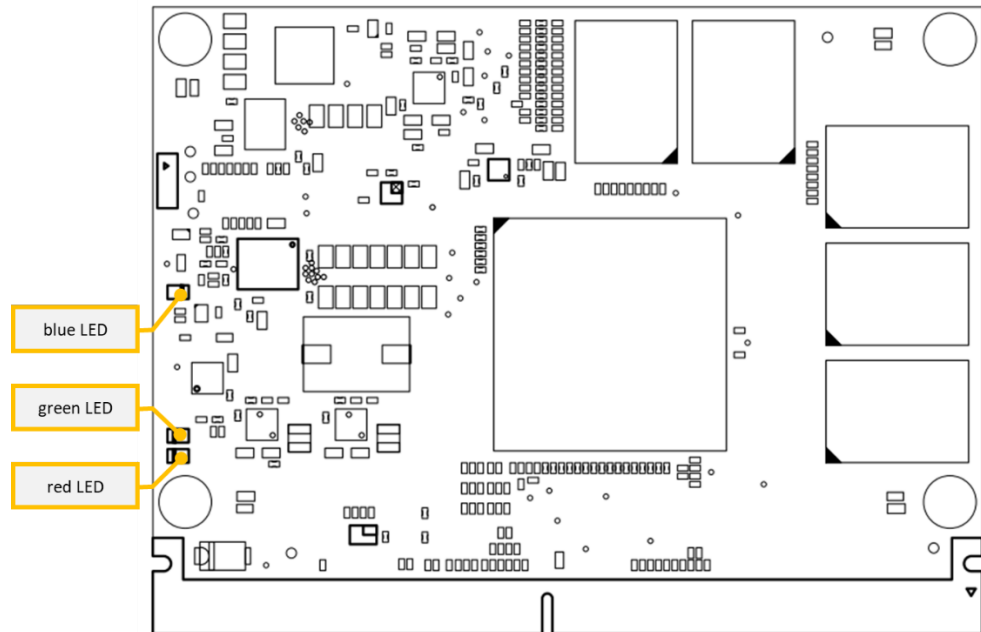
| Part Reference | Source | Signal Name | Function   |
|----------------|--------|-------------|--|
| LAN1-A         | J8     | LAN1-LED0   | Green LED: configurable<br>Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link |
| LAN1-A         | J8     | LAN1-LED2   | Yellow LED: off  |
| LAN1-B         | J10    | LAN2-LED1   | Green LED: configurable<br>Default: On = Link / Off = no Link / Blink = Activity                                       |
| LAN1-B         | J10    | LAN2-LED2   | Yellow LED: off  |
| LAN2-B         | J12    | LAN3-LED0   | Green LED: configurable<br>Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link |
| LAN2-B         | J12    | LAN3-LED2   | Yellow LED: off  |
| LAN2-A         | J14    | LAN4-LED1   | Green LED: configurable<br>Default: On = Link / Off = no Link / Blink = Activity                                       |
| LAN2-A         | J14    | LAN4-LED2   | Yellow LED: off  |

Table 8-1 Indicator LEDs

## 8.2 Power And Reset LEDs

| Part Reference | Source    | Signal Name | Function  |
|----------------|-----------|-------------|---|
| LD1            | ST3       | VEXT        | Power (VEXT) On   |
| LD2            | ST4       | CB-RST#     | Carrier board reset active  |
| LD3            | J17 / SW3 | RST-IN#     | <ul style="list-style-type: none"> <li>• Power on the carrier is not ok</li> <li>• watchdog reset is active</li> <li>• manual reset is triggered</li> </ul> |

Table 8-2 Indicator LEDs - Carrier board



| Colour | Function  |
|--------|---|
| Green  | LED ON: Power-up sequence of the module is finished, power is good<br>LED OFF: Power fail |
| Red    | LED ON: Module reset is active<br>LED OFF: Reset is inactive                              |
| Blue   | General Purpose LED   |

Table 8-3 Indicator LEDs – Module

### 8.3 RGB LEDs

The SBC-LS1088A provides a RGB LED driver controlling four RGB LEDs.



*I<sup>2</sup>C address 0x68 is existing twice on I2C-1 bus.*

*Therefore, the so-called “All Call I2C address” of the TLC59116IRHBR RGB LED driver has to be disabled before GP input pins of the MAX7325 port expander can be read correctly. This can be achieved by setting the default value 1 of Bit 0 in MODE1 register to 0.*

The following table shows how the LEDs are mapped to the driver outputs:

| Part Reference | LED Driver Output      | LED Output Register |
|----------------|------------------------|---------------------|
| LD4            | LED0                   | 0x14                |
|                | LED1                   |                     |
|                | LED2                   |                     |
|                | LED3 is not connected  |                     |
| LD7            | LED4                   | 0x15                |
|                | LED5                   |                     |
|                | LED6                   |                     |
|                | LED7 is not connected  |                     |
| LD6            | LED8                   | 0x16                |
|                | LED9                   |                     |
|                | LED10                  |                     |
|                | LED11 is not connected |                     |
| LD5            | LED12                  | 0x17                |
|                | LED13                  |                     |
|                | LED14                  |                     |
|                | LED15 is not connected |                     |

Table 8-4 Indicator LEDs – Mapping



## 9 Software

### 9.1 U-Boot

The SBC-LS1088A uses a U-Boot as standard boot loader, which is integrated in the board's QSPI Flash memory on delivery. NAND boot is not any longer recommended due to reliability and thus not included in standard delivery.

Additionally, there's a U-Boot version available to be placed on microSD card, if both other boot options should fail for some reason.

Either boot option can be selected by the Boot Device Switch (see chapter 7).

### 9.2 Operating System Support

MicroSys Electronics GmbH offers Linux and Microware OS-9 RTOS support for the board.

Other Operating Systems are available on request only.

If you should have ordered a Starter Kit, the most recent Linux will already be installed in the board's flash, so you can start to develop and test your application right away.

# 10 Appendix

## 10.1 Acronyms

These acronyms are being used within the document; note that this list does not claim to be complete or exhaustive:

|               |   |
|---------------|---|
| <i>CPU</i>    | <i>Central Processing Unit</i>                        |
| <i>DC</i>     | <i>Direct Current</i>                                 |
| <i>DDR4</i>   | <i>Double Data Rate Memory fourth-generation</i>      |
| <i>EC</i>     | <i>Ethernet Controller</i>                            |
| <i>ESD</i>    | <i>Electrostatic Discharge</i>                        |
| <i>Gbps</i>   | <i>Gigabit per second, Gigabit per second</i>         |
| <i>GND</i>    | <i>Ground</i>   |
| <i>GPL</i>    | <i>General Public License</i>                         |
| <i>I2C</i>    | <i>Inter-Integrated Circuit</i>                       |
| <i>JTAG</i>   | <i>Joint Test Action Group</i>                        |
| <i>LAN</i>    | <i>Local Area Network</i>                             |
| <i>LED</i>    | <i>Light Emitting Diode</i>                           |
| <i>LVTTL</i>  | <i>Low Voltage Transistor–Transistor Logic</i>        |
| <i>MCU</i>    | <i>Microcontroller Unit</i>                           |
| <i>MMC</i>    | <i>Multimedia Card</i>                                |
| <i>mPCIe</i>  | <i>Mini Peripheral Component Interconnect Express</i> |
| <i>mSATA</i>  | <i>Mini Serial Advanced Technology Attachment</i>     |
| <i>RGMI</i>   | <i>Reduced Gigabit Media-independent Interface</i>    |
| <i>RTC</i>    | <i>Real Time Clock</i>                                |
| <i>SBC</i>    | <i>Single Board Computer</i>                          |
| <i>SD</i>     | <i>Secure Digital</i>                                 |
| <i>SDIO</i>   | <i>Secure Digital Input Output</i>                    |
| <i>SDRAM</i>  | <i>Synchronous Dynamic Random Access Memory</i>       |
| <i>SerDes</i> | <i>Serializer/Deserializer</i>                        |
| <i>SOM</i>    | <i>System On Module</i>                               |
| <i>UART</i>   | <i>Universal Asynchronous Receiver Transmitter</i>    |
| <i>USB</i>    | <i>Universal Serial Bus</i>                           |

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# 11 History

| Date       | Version | Change Description   |
|------------|---------|--|
| 2017-10-09 | 2.0     | Release Version for carrier CRX05 Revision 2   |
| 2017-11-09 | 2.1     | Added I2C1 address 0x00 in Table 5-7   |
| 2018-07-16 | 2.2     | Table 2-2: add LED colors<br>Operating voltage change to 9V – 30V<br>PCIe portcount correction                                 |
| 2019-01-28 | 2.3     | Added differences CRX05 carrier revision 2 to revision 3 (2.4.1)   |
| 2019-04-26 | 2.4     | Removed typos<br>Removed I2C-2 and added I2C-4 in chapter 5.8  |
| 2024-03-07 | 2.5     | NAND Boot not any longer recommended 9.1<br>Removed memory layout due to frequent changes in BSP<br>Minor spelling corrections |
|            |         |  |
|            |         |  |

Table 11-1 Document history