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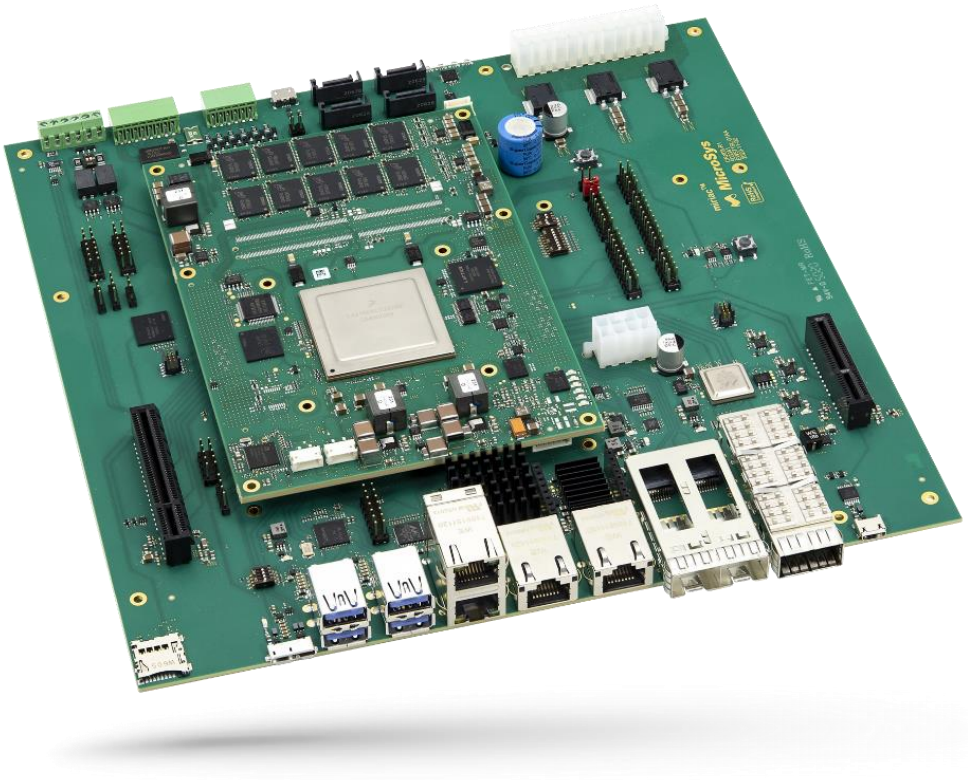

miriac SBC-LX2160A

User Manual (SBC-LX2160A based on CRX08 Revision 2)

V 1.7

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1 General Notes

1.1 Warranty

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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-LX2160A 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.***
	**DO NOT REMOVE THE MODULE FROM THE CRX-08 CARRRIER UNLESS INSTRUCTED BY MICROSYS.** **IF THE MODULE NEEDS TO BE REMOVED, USE EXTREME CARE AND ONLY EXERCISE EQUAL FORCE / PRESSURE ON THE BOARD-TO-BOARD CONNECTORS. DO NOT TILT / SHIFT THE MODULE DURING MATING OR REMOVAL.**

Table 2-1 Safety and Handling Precautions

2.2 Short Description

The SBC-LX2160A is a small computer system consisting of

- MPX-LX2160A module, based on NXP's LX2160A Multicore Communications Processors
- CRX08 carrier board.

It targets both

- evaluation of the respective MPX-LX2160A SOM
- direct usage as an industrial edge computing solution

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

2.3 Shipping List

The SBC-LX2160A Development Kit contains the following items:

- The SBC-LX2160A system, mounted with adapter plate and lab cooling solution
- Off-The-Shelf SFX or ATX Power Supply
  (Type and brand may vary based on availability)
- Power supply cable set
- USB cable type A – mini B
- Micro-SD-Card with U-Boot and root file system

2.4 Functional Coverage

The following table shows the coverage achieved by the SBC-LX2160A compared to the features which are available on the carrierboard:

Interfaces provided by CRX08 carrierboard		Interfaces available with the SBC-LX2160A
SerDes 1 Lane 0	USXGMII to PHY	✓
SerDes 1 Lane 1	USXGMII to PHY	✓
SerDes 1 Lane 2	25G-AUI to SFP+	✓
SerDes 1 Lane 3	25G-AUI to SFP+	✓
SerDes 1 Lane 4…7	XLAUI4 to PHY	✓
SerDes 2 Lane 0…3	PCIe x4	✓ (4.0)
SerDes 2 Lane 4…7	4x SATA	✓ (3.0)
SerDes 3 Lane 0…7	PCIe x8	✓ (4.0)
RGMII 1	RGMII to Phy	✓
RGMII 2	RGMII to Phy	✓
USB 1…4	3.0 Host via Hub	✓ (3.0)
USB 5	3.0 OTG	✓ (3.0)
SD-Card	1bit / 4 bit & boot device	✓
UART 1	UART to USB (debug console)	✓
UART 2	TTL only	✓
I²C 1	Multiple devices	✓
I²C 6	Multiple devices	✓
JTAG	Signals on non-standard connector	✓
Watchdog	Hardware watchdog with trigger signal from module	✓
RTC backup	Battery	✓
Manual Reset	Button	✓
Reset / Power LEDs	1x red, 9x green	✓
User LEDs	4x RGB	✓

Table 2-2 Functional coverage

3 Quick Start Guide

3.1 Prerequisites

Always make sure to handle the SBC-LX2160A 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.

After unpacking the unit, make sure that is clean and free of visible damage or foreign objects.

3.1.1 Minimum Required Items

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

- an adequate ATX power supply, delivering 200W minimum.
- an USB cable (type A – mini B) adapted to connector ST29
- 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 optional, but strongly recommended for practical operation and development purposes:

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

3.2 Basic Operation

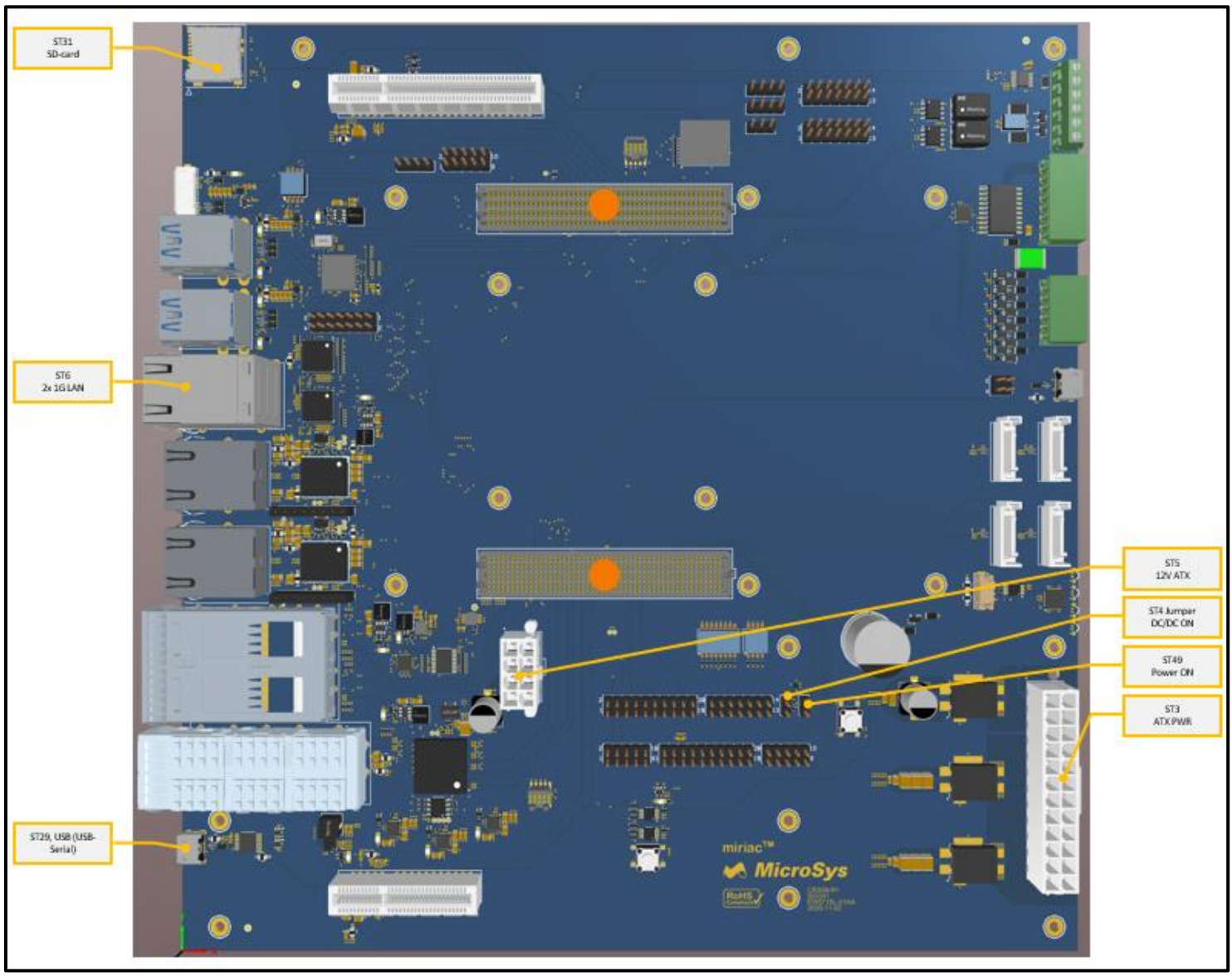
3.2.1 Board Preparation and Power-Up

- Make sure the switches SW4 and SW5 are set properly in order to select the correct boot source and board configuration. The board comes preconfigured to boot correctly on arrival.
- Connect a mini USB cable to ST29.
- Connect other peripherals (USB, LAN ...) as intended.
- Connect the ATX power supply to the PWR connectors ST3 and ST5, while the ATX power supply is still switched off.
- Make sure a jumper is placed on ST4 (DCDC_ON) to enable all dc/dc on carrier
- Make sure a jumper is placed on ST49 (ON/OFF-switch) to switch the carrier board ON
- Enable the ATX power supply via its On/Off switch, located near the AC input.

After Power-up, the green LEDs on the carrier and the module should light up and the red LEDs should be off.

IF NOT, DISCONNECT THE UNIT FROM POWER AND CHECK FOR FAULTS!

Figure 3-1 System setup example



3.2.2 ATF/U-Boot Startup

The ARM Trusted Firmware bootloader / U-Boot will automatically start after the LX2160A exits hardware reset with a valid boot configuration and valid boot media. ATF and U-Boot will present a boot prompt similar to the following example:

```
NOTICE:  32 GB DDR4, 64-bit, CL=17, ECC on, 256B, CS0+CS1
NOTICE:  BL2: Booting BL31
NOTICE:  BL31: v1.5(release):LSDK-20.12-17-gc4d945214
NOTICE:  BL31: Built : 13:12:12, Mar  5 2021
NOTICE:  Welcome to LX2160 BL31 Phase


U-Boot 2020.04-2.3-00069-g2a4cd53631-dirty (Mar 05 2021 - 14:10:59 +0100)

SoC:  LX2160ACE Rev2.0 (0x87360020)
Clock Configuration:
       CPU0(A72):2000 MHz  CPU1(A72):2000 MHz  CPU2(A72):2000 MHz
       CPU3(A72):2000 MHz  CPU4(A72):2000 MHz  CPU5(A72):2000 MHz
       CPU6(A72):2000 MHz  CPU7(A72):2000 MHz  CPU8(A72):2000 MHz
       CPU9(A72):2000 MHz  CPU10(A72):2000 MHz  CPU11(A72):2000 MHz
       CPU12(A72):2000 MHz  CPU13(A72):2000 MHz  CPU14(A72):2000 MHz
       CPU15(A72):2000 MHz
       Bus:      700  MHz  DDR:      2400 MT/s
Reset Configuration Word (RCW):
       00000000: 50636338 20500050 00000000 00000000
       00000010: 00000000 0c010000 00000000 00000000
       00000020: 06000140 00002580 00000000 00000606
       00000030: 00010400 00000000 00000000 00000000
       00000040: 00000000 00000000 00000000 00000000
       00000050: 00000000 00000000 00000000 00000000
       00000060: 00000000 00000000 000270c0 00000000
       00000070: 08b30000 00150000
Model: MPXLX2160A/CRX08
Board: LX2160ACE Rev2.0, SD

SERDES1 Reference: Clock1 = 156.25MHz Clock2 = 161.1328125MHz
SERDES2 Reference: Clock1 = 100MHz    Clock2 = 100MHz
SERDES3 Reference: Clock1 = 100MHz    Clock2 = 100MHz
DRAM:  31.9 GiB
DDR    31.9 GiB (DDR4, 64-bit, CL=17, ECC on)
       DDR Controller Interleaving Mode: 256B
       DDR Chip-Select Interleaving Mode: CS0+CS1
Using SERDES1 Protocol: 19 (0x13)
Using SERDES2 Protocol: 5 (0x5)
Using SERDES3 Protocol: 2 (0x2)
MMC:   FSL_SDHC: 0, FSL_SDHC: 1
Loading Environment from MMC... OK
EEPROM: Read failed.
In:    serial_pl01x
Out:   serial_pl01x
Err:   serial_pl01x
Net:    DPMAC2@xlaui4 DPMAC3@usxgmii
FSL_MDIO1 PHY@10: Revision 0x1a 11 1/1:
################################################################
################################################################
################################################################
FSL_MDIO1 PHY@10: Firmware version: 0.3.10.0
88X3310 MAC Type USXGMII
 DPMAC4@usxgmii
FSL_MDIO1 PHY@11: Revision 0x1a 11 1/1:
################################################################
################################################################
################################################################
FSL_MDIO1 PHY@11: Firmware version: 0.3.10.0
88X3310 MAC Type USXGMII
```

```
 DPMAC5@25g-aui DPMAC6@25g-aui DPMAC17@rgmii-id DPMAC18@rgmii-id
PCIe1: pcie@3400000 disabled
PCIe2: pcie@3500000 disabled
PCIe3: pcie@3600000 Root Complex: no link
PCIe4: pcie@3700000 disabled
PCIe5: pcie@3800000 Root Complex: no link
PCIe6: pcie@3900000 disabled
DPMAC2@xlaui4, DPMAC3@usxgmii, DPMAC4@usxgmii, DPMAC5@25g-aui, DPMAC6@25g-
aui, DPMAC17@rgmii-id, DPMAC18@rgmii-id

MMC read: dev # 0, block # 20480, count 4608 ... 4608 blocks read: OK
MMC read: dev # 0, block # 28672, count 2048 ... 2048 blocks read: OK
crc32+
fsl-mc: Booting Management Complex ... SUCCESS
fsl-mc: Management Complex booted (version: 10.24.0, boot status: 0x1)
Hit any key to stop autoboot:  0
=>
```

The exact output may vary, depending on U-Boot and MPX-LX2160A module versions in use.

3.2.3 Linux

For detailed setup instructions and general information on the board support package, refer to “Linux_QorIQ_Yocto_SDK_User_Manual”.

3.2.4 Power-Down

To power doen the complete system switch off the ATX-power supply.

Removing ST49 will power down just the carrier. The modul is not powered down by ST49. The module is just forced to RESET.

3.2.5 Reset

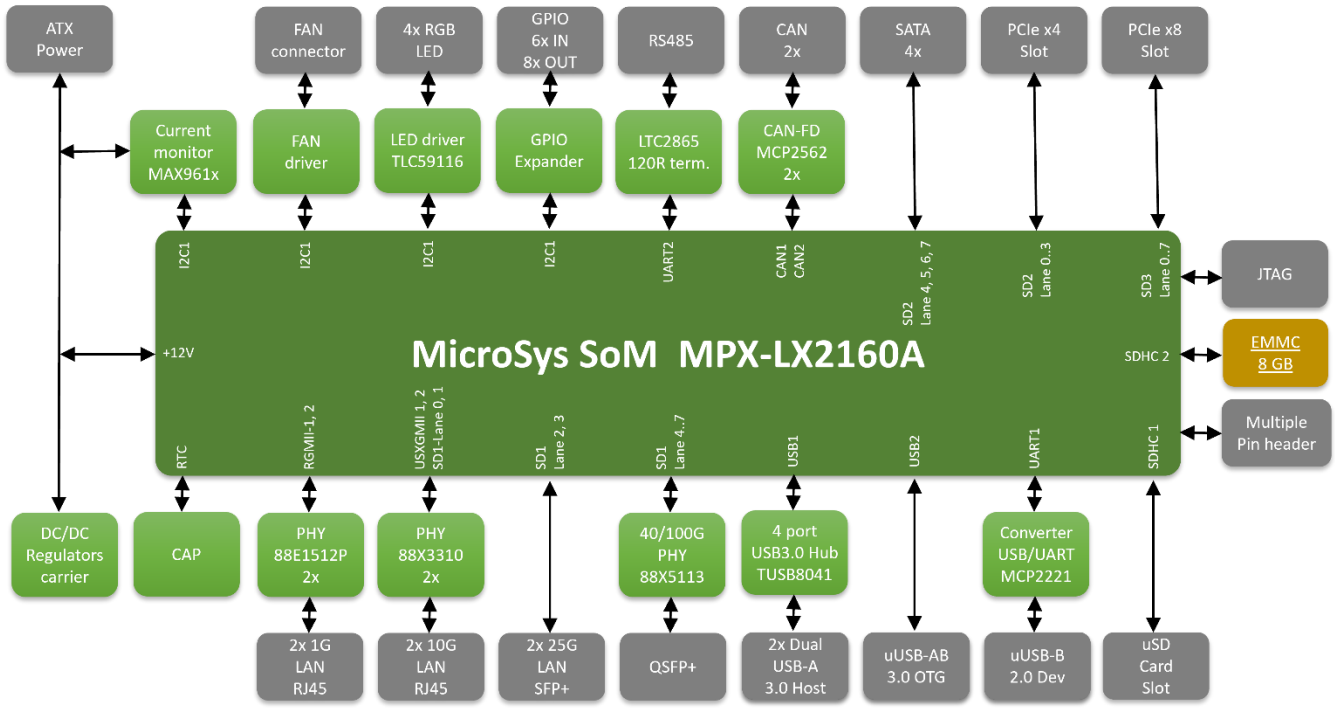
Pressing the SW2 switch will force a RESET to carrier and module.

RESET will also occure if one oft he carrier voltages is no in defined range. (12V, 2V5, 1V8, 1V5, 5V0, 1V3, 1V1, 0V88)

4 System Description

This section gives a general overview of the SBC-LX2160A system and its key features.

4.1 Block Diagram



4.2 Feature Overview

The SBC-LX2160A carrier offers the following features:
(see the MPX-LX2160A User Manual for a more detailed description of its features)

SBC-LX2160A		
Synchronous Memory	8GB eMMC Flash	Default: 8GByte
PCI Express port	4.0 / 16Gbps Lane x4 Root complex operations Serdes 2 Lane 0…3	PCIe connector
	4.0 / 16Gbps Lane x8 Root complex operations Serdes 3 Lane 0…7	PCIe connector
USB	USB 3.0 Phy	4x USB Host connector type A per USB Hub
	USB 3.0 OTG Phy	USB OTG connector type Micro-AB
SATA	3.0 SATA up to 6Gbps	SATA connector 1
	3.0 SATA up to 6Gbps	SATA connector 2

SBC-LX2160A		
	3.0 SATA up to 6Gbps	SATA connector 3
	3.0 SATA up to 6Gbps	SATA connector 4
FlexCAN (FD support depends on processor variant)	2.0 B CAN-FD 1	Terminal Block 1
	2.0 B CAN-FD 2	Terminal Block 2
Serial Interfaces	UART1	Converted to USB (MCP2221), Available on USB connector Micro USB type B
	UART3	4-wire Extension Port LVTTL
I2C	I2C-1	400 kbps
		Connected Devices:
		MAX9611AUB Current monitor J11
		MAX7325ATG+ GPIO-Expander J26
		MAX7325ATG+ GPIO-Expander J50
		TLC59116IRHBR RGB LED Driver J49
		EMC2301-1-ACZL FAN controller J52
	I2C-6	400 kbps
		Connected Devices:
		TCA9544APWR I²C Expander J27
		TCA9544APWR I²C Expander J35
10G Ethernet Transceiver	Serdes 1 Lane 0: USXGMII	2.5/5/10 Gbps 10/100/1000 Mbps
	Serdes 1 Lane 1: USXGMII	2.5/5/10 Gbps 10/100/1000 Mbps
25G Ethernet (currently not supported on R2 carrier)	Serdes 1 Lane 2: 25G-AUI	25 Gbps zSFP+
25G Ethernet	Serdes 1 Lane 3: 25G-AUI	25 Gbps zSFP+
40G / 100G Ethernet Transceiver	Serdes 1 Lane 4..7: XLAUI4	40 Gbps QSFP+
Gigabit Ethernet Transceiver	RGMII 1	10/100/1000 Mbps
Gigabit Ethernet Transceiver	RGMII 2	10/100/1000 Mbps
System JTAG Controller	JTAG	10 pin header

SBC-LX2160A		
Power Management	Primary Supply	ATX power supply Separate 12V lane
	Backup Supply (RTC backup)	0,47F / 5,5V Power Cap

Table 4-1 Feature Overview

4.3 Mechanical Dimensions

4.3.1 MPX-LX2160A

For mechanical information of the SoM, please refer to the MPX-LX2160A User Manual.

4.3.2 SBC-LX2160A

Board is Micro ATX format with size **243,84 x 243,84 mm** (9,6” x 9,6”). The following drawing shows the mechanical outline of the SBC-LX2160A assembly.

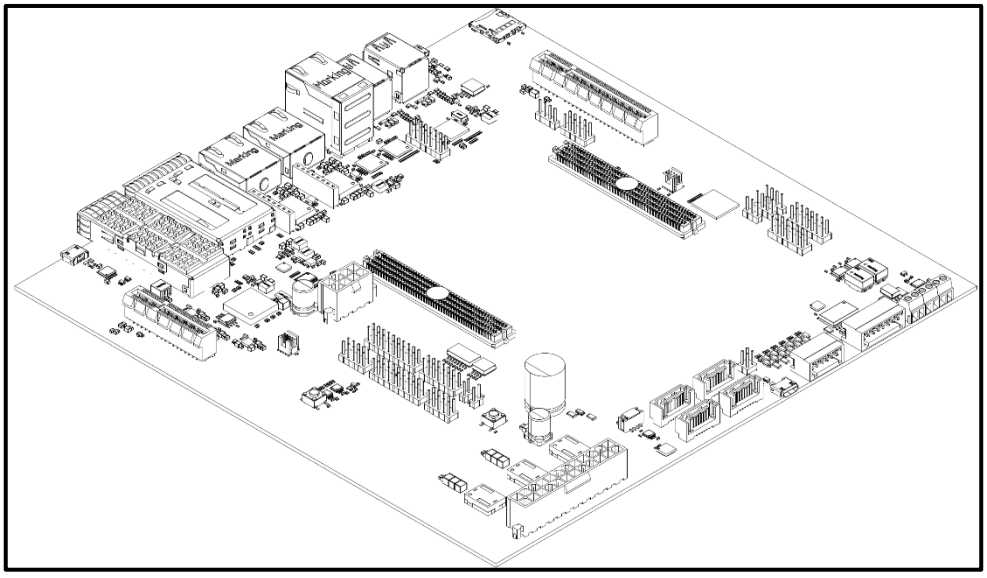


Figure 4-1 mechanical drawing CRX08 carrier

NOTE

This drawing is not to scale.

NOTE

For 3D data files please contact MicroSys.

4.4 Connector Layout

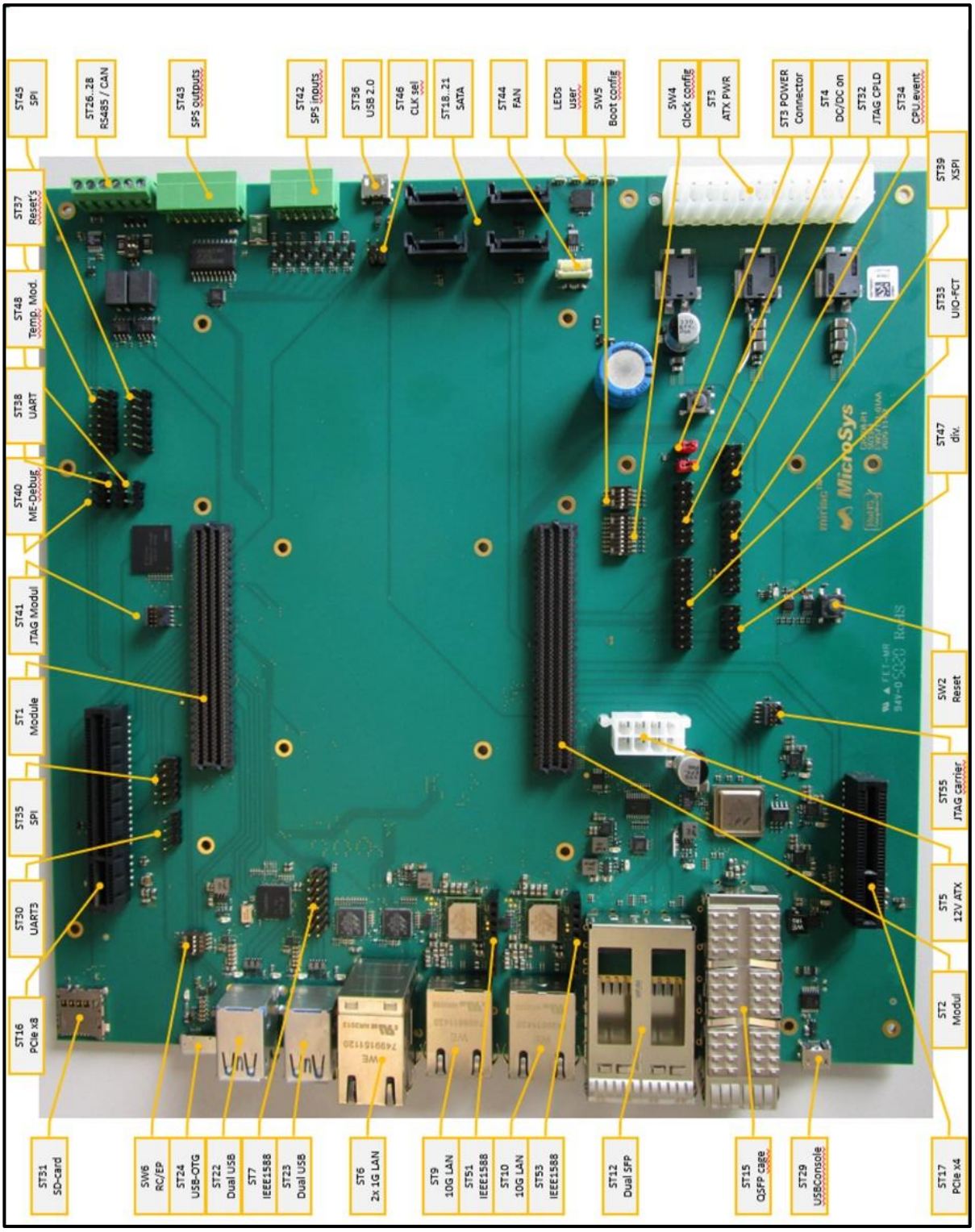


Figure 4-2 connector layout CRX08 carrier

4.5 Connector References

Reference	Function	Populated?
ST1	LX2160A Module Connector 1	✓
ST2	LX2160A Module Connector 2	✓
ST3	ATX Main Power Supply	✓
ST4	DCDC On (without module)	✓
ST5	ATX 12V Power Supply	✓
ST6	Dual RJ45 Connector 1GE LAN1 and LAN2	✓
ST7	IEEE1588 Extension Connector for 1GE LAN1	✓
ST9	RJ45 Connector 10GE LAN3	✓
ST10	RJ45 Connector 10GE LAN4	✓
ST11	SFP+ Slot 25GE LAN5	✓
ST13	SFP+ Slot 25GE LAN6	✓
ST14	QSFP+ Slot 40/100GE LAN7	✓
ST16	PCIe x8 Slot	✓
ST17	PCIe x4 Slot	✓
ST18	SATA Connector 1	✓
ST19	SATA Connector 2	✓
ST20	SATA Connector 3	✓
ST21	SATA Connector 4	✓
ST22	Dual USB 3.0 Host1 and Host2	✓
ST23	Dual USB 3.0 Host3 and Host4	✓
ST24	MicroUSB 3.0 OTG	✓
ST26	Terminal Socket CAN 1	✓
ST27	Terminal Socket CAN 2	✓
ST28	Terminal Socket RS485	✓
ST29	MicroUSB 2.0 Type B Device	✓
ST30	UART 3 Pin Connector	✓
ST31	Micro SD Card Slot	✓
ST32	JTAG Pin Connector CPLD on LX2160A Module	✓
ST33	User Funktion Pin Connector	✓
ST34	CPU Event Pin Connector	✓
ST35	SPI 3 Pin Connector	✓
ST36	MicroUSB 2.0 Type B Device uController on LX2160A Module	✓
ST37	CPU Control Signals Pin Header	✓
ST38	UART Pin Connector uController on LX2160A Module	✓
ST39	SWDIO Debug Pin Connector uController on LX2160A Module	✓
ST40	QSPI Emulator Pin Header	✓

Reference	Function	Populated?
ST41	JTAG Pin Connector CPU on LX2160A Module	✓
ST42	Terminal Socket PLC Inputs	✓
ST43	Terminal Socket PLC Outputs	✓
ST44	FAN Connector	✓
ST45	uController and CPLD Signals Pin Header on LX2160A Module	✓
ST46	CPU Clock Input Pin Header	✓
ST47	CPU Control Signals Pin Header	✓
ST48	CPU Temperature Signals Pin Header	✓
ST49	Parallel to Power On/Off Switch SW1	✓
ST51	USX1 IEEE 1588 Connector	✓
ST53	USX2 IEEE 1588 Connector	✓
ST55	JTAG Pin Connector Parts on carrier	✓

Table 4-1 Connector reference overview

4.6 Power Supply

4.6.1 Input Supply Rating

The SBC-LX2160A system is powered by an ATX/SFX PSU with at least the following typical ratings:

Typical Input Voltage Operating Range: **(for ATX Standard supply)**	**100V - 240V AC**
Nominal Output Supply Voltages and minimum currents needed for SPC-LX2160A:	**12V ±5%/ 20A DC** **5V ±5%/ 10A DC** **3.3V ±5% / 10A DC**

All output voltages should startup monotonically within 20ms.

The PSU should not exceed a maximum ripple and noise on its voltage rails over the 10 Hz to 20 MHz frequency band of:

Maximum ripple and noise	**12V max. 120mVpp** **5V max. 50mVpp** **3.3V max. 50mVpp**

Additional filters on the SBC-LX2160A with a high bandwith integrated filter network (BNX028-01) and capacitve buffer (up to 3.300uF for each voltage rail is allowed by specification) are included to further dampen PSU induced noise and rippe to the unit. For more detaillied information on current ATX and other formfactors power supplies see:

Intel Design Guide, Desktop Platform Form Factors power Supply (June 2018 Revision 002).

4.6.2 Input Power Connectors

The SBC-LX2160A uses the following ATX power supply connectors:

The main 24 pin connector is used for 3.3V, 5V and provides power to the 12V supply of the CRX08.

Part Reference	ST3
Manufacturer:	Molex
Type:	442060007 or 442060001
Mates with:	24 Pin Molex Mini-Fit

Pin-out:

Pin	Name	Function / Color	Function / Color	Name	Pin
1	3V3_ATX	3.3V / Orange	3.3V / Orange	3V3_ATX	13
2	3V3_ATX	3.3V / Orange	NC / Blue	12V_ATX	14
3	GND_ATX	GND / Black	GND / Black	GND_ATX	15
4	5V0_ATX	5V / Red	Power On / Green	PS_ON#	16
5	GND_ATX	GND / Black	GND / Black	GND_ATX	17
6	5V0_ATX	5V / Red	GND / Black	GND_ATX	18
7	GND_ATX	GND / Black	GND / Black	GND_ATX	19
8	nc	Power OK / Gray	RESV	nc	20
9	5V0_STBY	Always on 5V / Purple	5V / Red	5V0_ATX	21
10	12V_ATX	12V / Yellow	5V / Red	5V0_ATX	22
11	12V_ATX	12V / Yellow	5V / Red	5V0_ATX	23
12	3V3_ATX	3.3V / Orange	GND / Black	GND_ATX	24

Table 4-2 Pinout ATX Main-PWR (ST3)

The additional 8 pin connector is providing power to the MPX-LX2160 SoM .

Part Reference	ST5
Manufacturer:	Molex
Type:	39299082
Mates with:	8 Pin Molex Mini-Fit

Pin-out:

Pin	Name	Function / Color	Function / Color	Name	Pin
1	GND	GND / Black	12V / Yellow	12V_MOD	5
2	GND	GND / Black	12V / Yellow	12V_MOD	6
3	GND	GND / Black	12V / Yellow	12V_MOD	7
4	GND	GND / Black	12V / Yellow	12V_MOD	8

Table 4-3 Pinout ATX +12V-PWR (ST5)

Externally connected peripherals, such as SATA drives may require dedicated power connections from the PSU and are not supplied via the SBC-LX2160A.

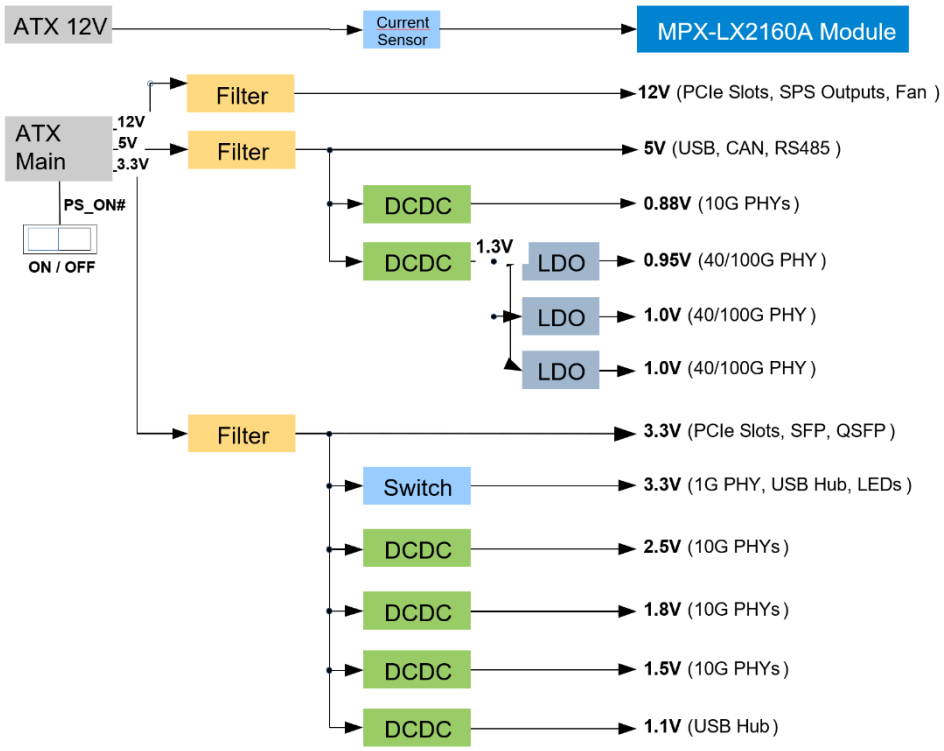
PCIe peripherals can be supplied with up to 35 W per slot, 70 W total over both interfaces. Some PCIe devise may require an additional, external power connection via the PSU (such as GPUs).

As the board itself consumes not enough power on the ATX +5V rail, it is recommended to connect an additonal load, e.g. 3 ½" Harddisk, to the power supply! Otherwise, the +3V3 rail may be unstable due to the ATX speficiation.

4.6.3 Power Supply Structure

- The filtered Input Power from the ATX power supply feeds some 12V DC, 5V DC and 3.3V DC components directly.
- The LX2160A module is fed from 12V DC (8 pin connector) via an I2C current sensor.
- The 5V DC are fed to 2 secondary step-down converter in parallel, which produces 1.3V and 0.88V DC. The 1.3V are fed into 3 low noise LDOs for the 40G / 100G Ethernet interfaces.
- The 3.3V DC supply four secondary step-down converters in parallel, which produce 2.5V, 1.8V, 1.5V and 1.1V DC.
- The usage of the 5V and 3.3VDC ATX rails distributes the required power more evently.
- For components directly connected to the MPX-LX2160 SoM, the carrier's 3.3V DC are enabled via a power switch, driven by the POWER_GOOD signal of the SoM.
- All step-down converters are enabled by the MPX-LX2160A SoM POWER_GOOD signal.

The following diagram summarizes the Power Supply structure:



The expected maximum power consumption of individual components, sub-circuits and peripherals are listed in the following table.

Component	Voltage rail	Current consumption maximum	Power consumption maximum
CPU module	12V	5.0A	60W
QSFP+ slot	3.3V	350mA (SR) / 1.25A (LR)	4.2W
SFP+ slot (2x)	3.3V	300mA (SR) / 1.0A (LR)	2x 3.3W
SATA power (4x)	12V	Direct connection from ATX power supply	4x 1…10W
	5V		
	3.3V		
USB power (5x)	5V	0.9A	5x 4.5W
PCIe slot (2x)	12V	2.1A	2x 35W
	3.3V	3.0A	
Fan	12V	0.85A	10W
40G /100G PHY (88X5113)	3.3V	50mA	0.16W
	1.0V	1.5A	2x 1.5W
	0.95V	2.1A	2W
10G PHY (2x 88X3310P)	3.3V	156mA	2x 3.5W
	2.5V	246mA	
	1.8V	380mA	
	1.5V	503mA	
	0.88V	1581mA	
1GE PHY (2x 88E1512)	3.3V	166mA	2x 0.55W
RS485 (LTC2865)	5V	50mA	250mW
MicroSD	3.3V	300mA	1W
CAN-FD (2x MCP2562FD)	5V	70mA	2x 350mW
	1.8V	0,5mA	Module VCC1V8OUT
USB Hub (TUSB8041)	3.3V	99mA	0.33W
	1.1V	778mA	0,86W
Other peripherals	3.3V	200mA	0.66W

Table 4-4 Current consumption components and peripherals

4.6.4 RTC Backup

The RTC backup voltage supplied to the MPX-LX2160 SoM is provided by a 0.47F PowerCap.

4.6.5 SoM Current and Power Measurement

For measuring the MPX-LX2160A supply current, the carrierboard provides two parallel 10 mΩ shunt resistors (5 mΩ total) in the 12VDC rail.

For automated power measurements, an I²C current sense amplifier with voltage sense (MAX9611AUB) is connected over the shunt.

4.6.6 Voltage Rail Monitoring

The carrier monitors all voltage rails and resets the module in case any voltage drops below it's undervoltage limit:

Voltage	Monitoring	Threshold (nom.)
12V	Undervoltage	10.8V
5V	Undervoltage	4.5V
3.3V	Undervoltage	3.08V
2.5V	Undervoltage	2.25V
1.8V	Undervoltage	1.62V
1.5V	Undervoltage	1.35V
1.3V	Undervoltage	1.17V
1.1V	Undervoltage	0.99V
0.88V	Undervoltage	0.79V

Table 4-5 Voltage monitoring limits (carrier)

4.6.7 Fuses

The fuse F1 (ASMDC185F/33, 33V max, 1,85 A trip) protects the general purpose PLC output driver stage for connector ST43.

5 System Core, Boot Configuration and On-Board Memory

5.1 Processor NXP LX2160A

The LX2160A Processor by NXP is a QorIQ Layerscape CPU with 16 Cortex-A72 cores. It exposes a wide variety of external interfaces, which are explained in detail in the following chapters. Variations with 12 and 8 cores are available.

The cores run at a maximum clock speed of 2200MHz, 2000MHz or 1800MHz respectively, depending on the ordered type. The CPU frequency can be clocked down if necessary.

5.2 JTAG Chain

The JTAG 1 chain of the SBC-LX2160A includes the LX2160A processor ONLY. JTAG 1 is available on connector “ST41”.

The JTAG 2 chain of the SBC-LX2160A includes the 40/100G and both 10G Ethernet PHYs. The JTAG 2 port is available via connector “ST55”.

For interfacing standard debugger pinouts an additional intermediate adapter may be necessary, Please see chapter 6.12 for the pinout of the JTAG connectors.

5.3 Reset Structure

Pin Number on ST1	Signal Name	Signal Direction	Function
A10	RESIN#	Input to the module	Active low module reset: while active the module is held in reset state 1,8V level
A9	RESET_OUT#	Output from the module	Active low peripheral reset: while active peripheral devices shall be held in reset state 1,8V level

Table 5-1 Reset signal overview

RESIN# (to module) is generated from the power rail monitoring by two quintuple voltage supervisors with push-button reset. RESIN# may also be forced by SW2.

All devices on the carrier are reset if RESIN# or RESET_OUT# (from module) ist active.

5.4 Boot Configuration

The SBC-LX2160A board offers three possible boot devices. The boot source settings can be adjusted via SW5 (see chapter 7 for details).
SW5 configures the signals “BOOT-SRC_0” to “BOOT-SRC_3” which have a default high state (10k pullups are on the module) when open or SW5 is switched off. SW5 pulls these signals to ground.

For details on bootsource selecetion refer to “miriac_MPX-LX2160A_User_Manual.pdf” chapter 4.9.

5.5 I²C Bus Topology and Addresses

The SBC-LX2160A offers two independent I²C busses.

The following tables show the I²C addresses (7 Bit). The trailing R/W bit is always denoted as “x”.

5.5.1 I2C-1

I²C Bus 1 carrier level devices (7-Bit address):

Address	Device	Function
1111 111x	MAX9611AUB	Current monitor J11
1101 001x	MAX7325ATG+	GPIO-Expander J26
1101 100x	MAX7325ATG+	GPIO-Expander J50
1100 000x	TLC59116IRHBR	RGB LED Driver J49 Slave Address
1101 000x		LED All Call Address
1101 011x		Software Reset Address
0101 111x	EMC2301-1-ACZL	FAN controller J52

Table 5-2 I²C1 bus map

The I²C Bus 1 has the following layout, including devices on the MPX-LX2160 SoM (LVTTL 3.3V):

Device	SCL (Signal Name)	Pin	SDA (Signal Name)	Pin
LX2160A	IIC1_SCL	F5	IIC1_SDA	G5
	↓		↕	
MACHXO3 J2	SCL	A9	SDA	C9
NTSX2102 J22	SCL	6	SDA	7
LTC4311 J58	SCL	4	SDA	6
SA56004ADP J59	SCL	8	SDA	7
SA56004CDP J61	SCL	8	SDA	7
SA56004EDP J62	SCL	8	SDA	7
NTSX2102 J63	SCL	7	SDA	6
PCF85063 J64	SCL	6	SDA	5
CAT24C128 J66	SCL	6	SDA	5
CAT24C128 J67	SCL	6	SDA	5

Device	SCL (Signal Name)	Pin	SDA (Signal Name)	Pin
	↓		↕	
Module Connector	I2C1_SCL	ST1-H46	I2C1_SDA	ST1-H45
	↓		↕	
MAX7325 J26	SCL	19	SDA	20
MAX7325 J50	SCL	19	SDA	20
TLC59116IRHBR J49	SCL	25	SDA	26
MAX9611AUB J11	SCL	6	SDA	7
EMC2301-1-ACZL J52	SCL	2	SDA	1

Table 5-3 I²C-1 pin assignment

5.5.2 I2C-6

I²C Bus 6 carrier level devices (7-Bit address):

Address	Device	Function
1110 000x	TCA9544APWR	I²C Expander J27
1110 001x	TCA9544APWR	I²C Expander J35

Table 5-4 I²C6 bus map

The I²C bus 6 has the following layout (LVTTL 1.8V):

Device	SCL (Signal Name)	Pin	SDA (Signal Name)	Pin
LX2160A	IIC6_SCL	D27	IIC6_SDA	C27
	↓		↕	
Module Connector	I2C6_SCL	ST1-H42	I2C6_SDA	ST1-H43
	↓		↕	
TCA9544APWR J27	SCL	18	SDA	19
TCA9544APWR J35	SCL	18	SDA	19

Table 5-5 I²C-6 pin assignment

6 Peripherals

6.1 Module Connector

The carrierboard CRX08 provides two high speed board-to-board connectors “ST1” and “ST2”. Note that these connectors are not directly compatible with other small form factor MPX-modules based on the MXM-3 connector.

Manufacturer:	Samtec
Type:	SEAM-50-02.0-L-08-1-A-K-TR
Used with:	ST-SEAF-50-05.0-L-08-2-A-K-TR On MPX-LX2160A moule

6.2 Serdes Mapping

The three Serdes ports of the processor are assigned as follows.

LX2160A	usage
Serdes 1 Lane 0	USXGMII to 10 Gb Phy 1
Serdes 1 Lane 1	USXGMII to 10 Gb Phy 2
Serdes 1 Lane 2	25G-AUI to zSFP+ 1
Serdes 1 Lane 3	25G-AUI to zSFP+ 2
Serdes 1 Lanes 4…7	XLAUI4 to QSFP+ 1
Serdes 2 Lanes 0…3	PCIe x4 to PCIe slot 1
Serdes 2 Lane 4	SATA port 1
Serdes 2 Lane 5	SATA port 2
Serdes 2 Lane 6	SATA port 3
Serdes 2 Lane 7	SATA port 4
Serdes 3 Lanes 0…7	PCIe x8 to PCIe slot 2

Table 6-1 SerDes usage

6.3 LAN Connections

The SBC-LX2160A system offers:

- 2x independent 1 Gigabit LAN connections, LAN1, LAN2 (ST6A, ST6B)
- 2x independent 10 Gigabit LAN connections LAN3, LAN4 (ST9, ST10)
- 2x independent 25 Gigabit LAN connections LAN5, LAN6 (ST11, ST13)
- 1x 40 Gigabit LAN connection LAN7 (ST14)

6.3.1 LAN1, LAN2: 10/100/1000 Mbps (RJ45)

The LX2160A offers two RGMII interfaces which are routed (via the module connectors) to individual Marvell Ethernet PHYs 88E1512P. The MDI interfaces of each 88E1512P is connected to a dedicated RJ45 connector with integrated magnetics.

Part Reference:	ST6
Manufacturer:	Würth Elektronik
Type:	7499151120
Mates with:	RJ45 patch cable, catgory depending on speed

LAN Sockets have a standard layout for 1000-BaseT 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 6-2 LAN Gigabit Ethernet connector pairs (LAN1, LAN2)

6.4.1 LAN3, LAN4: 2.5/5/10 Gbps 10/100/1000 Mbps (RJ45)

The LX2160A offers two USXGMII interfaces which are routed (via the module connectors) to individual Marvell Ethernet PHYs 88X3310P. The MDI interfaces of each 88X3310P is connected to a RJ45 connector with integrated magnetics.

Part Reference:	ST9, ST10
Manufacturer:	Würth Elektronik
Type:	7499611420
Mates with:	RJ45 patch cable, catgory depending on speed

88X3310P			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
C10	*SD1_TX0_P*	←	ST2-E40	*SD1_TX0_P*	←	AP9	*SD1_TX0_P*
D10	*SD1_TX0_N*	←	ST2-E41	*SD1_TX0_N*	←	AN9	*SD1_TX0_N*
A9	*SD1_RX0_P*	→	ST2-C40	*SD1_RX0_P*	→	AW9	*SD1_RX0_P*
B9	*SD1_RX0_N*	→	ST2-C41	*SD1_RX0_N*	→	AV9	*SD1_RX0_N*

Table 6-3 LAN3 pin assignment

88X3310P			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
C10	*SD1_TX1_P*	←	ST2-G40	*SD1_TX1_P*	←	AM10	*SD1_TX1_P*
D10	*SD1_TX1_N*	←	ST2-G41	*SD1_TX1_N*	←	AL10	*SD1_TX1_N*
A9	*SD1_RX1_P*	→	ST2-B38	*SD1_RX1_P*	→	AU10	*SD1_RX1_P*
B9	*SD1_RX1_N*	→	ST2-B39	*SD1_RX1_N*	→	AT10	*SD1_RX1_N*

Table 6-4 LAN4 pin assignment

6.4.2 LAN5 and LAN6: 25 Gbps (zSFP+ / SFP28)

The LX2160A offers two 25G-AUI interfaces which are routed via the module connectors directly to zSFP+ (SFP28) interface slots. No PHYs or Retimers are used. 25G SFP28 Transceivers with internal Clock and Data Recovery (CDR) on transmit and receive channel are recommended.

Part Reference:	ST11, ST13
Manufacturer:	TE Connectivity
Type:	Socket 20 Pin: 2170088-2 Dual Cage: 2180739-1
Mates with:	Several 25G SFP28 Transceivers for short and long reach distances

zSFP+			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
18	*TD+*	←	ST2-F38	*SD1_TX2_P*	←	AP11	*SD1_TX2_P*
19	*TD-*	←	ST2-F39	*SD1_TX2_N*	←	AN11	*SD1_TX2_N*
13	*RD+*	→	ST2-D38	*SD1_RX2_P*	→	AW11	*SD1_RX2_P*
12	*RD-*	→	ST2-D39	*SD1_RX2_N*	→	AV11	*SD1_RX2_N*

Table 6-5 LAN5 pin assignment

zSFP+			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
18	*TD+*	←	ST2-H38	*SD1_TX3_P*	←	AM12	*SD1_TX3_P*
19	*TD-*	←	ST2-H39	*SD1_TX3_N*	←	AL12	*SD1_TX3_N*
13	*RD+*	→	ST2-C36	*SD1_RX3_P*	→	AU12	*SD1_RX3_P*
12	*RD-*	→	ST2-C37	*SD1_RX3_N*	→	AT12	*SD1_RX3_N*

Table 6-6 LAN6 pin assignment

6.4.3 LAN7: 40 Gbps (QSFP+)

The LX2160A offers one XLAUI4 interface which is routed (via the module connectors) to a Marvell Ethernet PHY 88X5113. The line side SERDES interface of the 88X5113 is connected to a QSFP+ interface slot.

Part Reference:	ST14
Manufacturer:	TE Connectivity
Type:	Socket 38 Pin: 2110819-1 Single Cage: 1888631-1
Mates with:	Several 40G Transceivers for short and long reach distances

88X5113			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
M1	*HI0_P*	←	ST2-E36	*SD1_TX4_P*	←	AM14	*SD1_TX4_P*
L1	*HI0_N*	←	ST2-E37	*SD1_TX4_N*	←	AL14	*SD1_TX4_N*
L3	*HO0_P*	→	ST2-B34	*SD1_RX4_P*	→	AU14	*SD1_RX4_P*
M3	*HO0_N*	→	ST2-B35	*SD1_RX4_N*	→	AT14	*SD1_RX4_N*
J1	*HI1_P*	←	ST2-G36	*SD1_TX5_P*	←	AP15	*SD1_TX5_P*
H1	*HI1_N*	←	ST2-G37	*SD1_TX5_N*	←	AN15	*SD1_TX5_N*
H3	*HO1_P*	→	ST2-D34	*SD1_RX5_P*	→	AW15	*SD1_RX5_P*
J3	*HO1_N*	→	ST2-D35	*SD1_RX5_N*	→	AV15	*SD1_RX5_N*
F1	*HI2_P*	←	ST2-F34	*SD1_TX6_P*	←	AM16	*SD1_TX6_P*
E1	*HI2_N*	←	ST2-F35	*SD1_TX6_N*	←	AL16	*SD1_TX6_N*
E3	*HO2_P*	→	ST2-C32	*SD1_RX6_P*	→	AU16	*SD1_RX6_P*
F3	*HO2_N*	→	ST2-C33	*SD1_RX6_N*	→	AT16	*SD1_RX6_N*
C1	*HI3_P*	←	ST2-H34	*SD1_TX7_P*	←	AP17	*SD1_TX7_P*
B1	*HI3_N*	←	ST2-H35	*SD1_TX7_N*	←	AN17	*SD1_TX7_N*
B3	*HO3_P*	→	ST2-E32	*SD1_RX7_P*	→	AW17	*SD1_RX7_P*
C3	*HO3_N*	→	ST2-E33	*SD1_RX7_N*	→	AV17	*SD1_RX7_N*

Table 6-7 LAN7 pin assignment

6.4.4 MDIO1 (EMI1) addressing

MDIO1 is connected to the 1000Base-T 88E1512P PHYs.

Part	component	Address
J12	88E1512P	Addr = 00000
J19	88E1512P	Addr = 00001

Table 6-8 LAN / MDIO1 / Addressing

6.4.5 MDIO2 (EMI2) addressing

MDIO2 is connected to the 2x 88X3310P (10GBase-T) and 88X5113 (QSFP+).

Part	component	Address
J20	88X3310P	Addr = 10000
J23	88X3310P	Addr = 10001
J28	88X5113	Addr = 00011

Table 6-9 LAN / MDIO2 / Addressin

6.5 PCIe Connections

6.5.1 PCIe x4

The SBC-LX2160A offers one PCIe 4.0 x4 lane slot for PCIe x1/x2/x4 cards.

Part Reference:	ST17
Manufacturer:	Molex
Type:	MOL-0877159106
Used with:	PCIe cards

Pin:			Pin:
1a	PRSNT1#	+12V	1b
2a	+12V	+12V	2b
3a	+12V	+12V	3b
4a	GND	GND	4b
5a	JTCK	SMCLK	5b
6a	JTDI	SMDAT	6b
7a	JTDO	GND	7b
8a	JTMS	+3.3V	8b
9a	+3.3V	JTRST#	9b
10a	+3.3V	+3.3V	10b
11a	PERST#	GND	11b
MECHANICAL KEY			
12a	GND	RSVD1	12b
13a	RFCLK+	GND	13b
14a	RFCLK-	PET0+	14b
15a	GND	PET0-	15b
16a	PER0+	GND	16b
17a	PER0-	PRSNT2#	17b
18a	GND	GND	18b
19a	RSVD2	PET1+	19b
20a	GND	PET1-	20b
21a	PER1+	GND	21b
22a	PER1-	GND	22b
23a	GND	PET2+	23b
24a	GND	PET2-	24b
25a	PER2+	GND	25b
26a	PER2-	GND	26b
27a	GND	PET3+	27b
28a	GND	PET3-	28b
29a	PER3+	GND	29b
30a	PER3-	RSVD3	30b
31a	GND	PRSNT2#	31b
32a	RSVD4	GND	32b

Table 6-10 PCIe x4 Slot pinout

The following table shows the internal connections:

ST17			ST2			LS2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
14b	*PET0+*	←	ST2-F30	*SD2_TX0_P*	←	AP19	*SD2_TX0_P*
15b	*PET0-*	←	ST2-F31	*SD2_TX0_N*	←	AN19	*SD2_TX0_N*
16a	*PER0+*	→	ST2-B30	*SD2_RX0_P*	→	AW19	*SD2_RX0_P*
17a	*PER0-*	→	ST2-B31	*SD2_RX0_N*	→	AV19	*SD2_RX0_N*
19b	*PET1+*	←	ST2-H30	*SD2_TX1_P*	←	AM20	*SD2_TX1_P*
20b	*PET1-*	←	ST2-H31	*SD2_TX1_N*	←	AL20	*SD2_TX1_N*
21a	*PER1+*	→	ST2-D30	*SD2_RX1_P*	→	AU20	*SD2_RX1_P*
22a	*PER1-*	→	ST2-D31	*SD2_RX1_N*	→	AT20	*SD2_RX1_N*
23b	*PET2+*	←	ST2-E28	*SD2_TX2_P*	←	AP21	*SD2_TX2_P*
24b	*PET2-*	←	ST2-E29	*SD2_TX2_N*	←	AN21	*SD2_TX2_N*
25a	*PER2+*	→	ST2-C28	*SD2_RX2_P*	→	AW21	*SD2_RX2_P*
26a	*PER2-*	→	ST2-C29	*SD2_RX2_N*	→	AV21	*SD2_RX2_N*
27b	*PET3+*	←	ST2-G28	*SD2_TX3_P*	←	AM22	*SD2_TX3_P*
28b	*PET3-*	←	ST2-G29	*SD2_TX3_N*	←	AL22	*SD2_TX3_N*
29a	*PER3+*	→	ST2-B26	*SD2_RX3_P*	→	AU22	*SD2_RX3_P*
30a	*PER3-*	→	ST2-B27	*SD2_RX3_N*	→	AT22	*SD2_RX3_N*

Table 6-11 PCIe x4 Slot SerDes 2 assignment

6.5.2 PCIe x8

The SBC-LX2160A offers one PCIe 4.0 x8 lane slot for PCIe x1/x2/x4/x8 cards.

Part Reference:	ST16
Manufacturer:	Molex
Type:	MOL-0877159206
Used with:	PCIe cards

Pin:			Pin:
1a	PRSNT1#	+12V	1b
2a	+12V	+12V	2b
3a	+12V	+12V	3b
4a	GND	GND	4b
5a	JTCK	SMCLK	5b
6a	JTDI	SMDAT	6b
7a	JTDO	GND	7b
8a	JTMS	+3.3V	8b

Pin:			Pin:
9a	+3.3V	JTRST#	9b
10a	+3.3V	+3.3V	10b
11a	PERST#	GND	11b
MECHANICAL KEY			
12a	GND	RSVD1	12b
13a	RFCLK+	GND	13b
14a	RFCLK-	PET0+	14b
15a	GND	PET0-	15b
16a	PER0+	GND	16b
17a	PER0-	PRSNT2#	17b
18a	GND	GND	18b
19a	RSVD2	PET1+	19b
20a	GND	PET1-	20b
21a	PER1+	GND	21b
22a	PER1-	GND	22b
23a	GND	PET2+	23b
24a	GND	PET2-	24b
25a	PER2+	GND	25b
26a	PER2-	GND	26b
27a	GND	PET3+	27b
28a	GND	PET3-	28b
29a	PER3+	GND	29b
30a	PER3-	RSVD3	30b
31a	GND	PRSNT2#	31b
32a	RSVD4	GND	32b
33a	RSVD5	PET4+	33b
34a	GND	PET4-	34b
35a	PER4+	GND	35b
36a	PER4-	GND	36b
37a	GND	PET5+	37b
38a	GND	PET5-	38b
39a	PER5+	GND	39b
40a	PER5-	GND	40b
41a	GND	PET6+	41b
42a	GND	PET6-	42b
43a	PER6+	GND	43b
44a	PER6-	GND	44b
45a	GND	PET7+	45b
46a	GND	PET7-	46b
47a	PER7+	GND	47b
48a	PER7-	PRSNT2#	48b
49a	GND	GND	49b

Table 6-12 PCIe x8 Slot pinout

The following table shows the internal connections:

ST16			ST1			LS2160A	
Pin	Name		Pin	Signal		Pin	Name
14b	*PET0+*	←	ST1-D30	*SD3_TX0_P*	←	F13	*SD3_TX0_P*
15b	*PET0-*	←	ST1-D31	*SD3_TX0_N*	←	G13	*SD3_TX0_N*

ST16			ST1			LS2160A	
16a	*PER0+*	→	ST1-G32	*SD3_RX0_P*	→	A13	*SD3_RX0_P*
17a	*PER0-*	→	ST1-G33	*SD3_RX0_N*	→	B13	*SD3_RX0_N*
19b	*PET1+*	←	ST1-C28	*SD3_TX1_P*	←	H14	*SD3_TX1_P*
20b	*PET1-*	←	ST1-C29	*SD3_TX1_N*	←	J14	*SD3_TX1_N*
21a	*PER1+*	→	ST1-F30	*SD3_RX1_P*	→	C14	*SD3_RX1_P*
22a	*PER1-*	→	ST1-F31	*SD3_RX1_N*	→	D14	*SD3_RX1_N*
23b	*PET2+*	←	ST1-E28	*SD3_TX2_P*	←	F15	*SD3_TX2_P*
24b	*PET2-*	←	ST1-E29	*SD3_TX2_N*	←	G15	*SD3_TX2_N*
25a	*PER2+*	→	ST1-H30	*SD3_RX2_P*	→	A15	*SD3_RX2_P*
26a	*PER2-*	→	ST1-H31	*SD3_RX2_N*	→	B15	*SD3_RX2_N*
27b	*PET3+*	←	ST1-D26	*SD3_TX3_P*	←	H16	*SD3_TX3_P*
28b	*PET3-*	←	ST1-D27	*SD3_TX3_N*	←	J16	*SD3_TX3_N*
29a	*PER3+*	→	ST1-G28	*SD3_RX3_P*	→	C16	*SD3_RX3_P*
30a	*PER3-*	→	ST1-G29	*SD3_RX3_N*	→	D16	*SD3_RX3_N*
33b	*PET4+*	←	ST1-C24	*SD3_TX4_P*	←	H18	*SD3_TX4_P*
34b	*PET4-*	←	ST1-C25	*SD3_TX4_N*	←	J18	*SD3_TX4_N*
35a	*PER4+*	→	ST1-F26	*SD3_RX4_P*	→	C18	*SD3_RX4_P*
36a	*PER4-*	→	ST1-F27	*SD3_RX4_N*	→	D18	*SD3_RX4_N*
37b	*PET5+*	←	ST1-E24	*SD3_TX5_P*	←	F19	*SD3_TX5_P*
38b	*PET5-*	←	ST1-E25	*SD3_TX5_N*	←	G19	*SD3_TX5_N*
39a	*PER5+*	→	ST1-H26	*SD3_RX5_P*	→	A19	*SD3_RX5_P*
40a	*PER5-*	→	ST1-H27	*SD3_RX5_N*	→	B19	*SD3_RX5_N*
41b	*PET6+*	←	ST1-D22	*SD3_TX6_P*	←	H20	*SD3_TX6_P*
42b	*PET6-*	←	ST1-D23	*SD3_TX6_N*	←	J20	*SD3_TX6_N*
43a	*PER6+*	→	ST1-G24	*SD3_RX6_P*	→	C20	*SD3_RX6_P*
44a	*PER6-*	→	ST1-G25	*SD3_RX6_N*	→	D20	*SD3_RX6_N*
45b	*PET7+*	←	ST1-C20	*SD3_TX7_P*	←	F21	*SD3_TX7_P*
46b	*PET7-*	←	ST1-C21	*SD3_TX7_N*	←	G21	*SD3_TX7_N*
47a	*PER7+*	→	ST1-F22	*SD3_RX7_P*	→	A21	*SD3_RX7_P*
48a	*PER7-*	→	ST1-F23	*SD3_RX7_N*	→	B21	*SD3_RX7_N*

Table 6-13 PCIe x8 Slot SerDes 3 assignment

6.6 SATA

The SBC-LX2160A system offers four standard SATA3 interfaces. Note that no power is supplied to the connected peripheral. An external power source is always required.

Part Reference:	ST18, ST19, ST20, ST21
Manufacturer:	3M
Type:	5607-5102-SH
Used with:	SATA drives

The following table shows the internal connections:

St18			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
S2	*Tx+*	←	ST2-F26	*SD2_TX4_P*	←	AM24	*SD2_TX4_P*
S3	*Tx-*	←	ST2-F27	*SD2_TX4_N*	←	AL24	*SD2_TX4_N*
S6	*Rx+*	→	ST2-D26	*SD2_RX4_P*	→	AU24	*SD2_RX4_P*
S5	*Rx-*	→	ST2-D27	*SD2_RX4_N*	→	AT24	*SD2_RX4_N*

Table 6-14 SATA 1 pin assignment

ST19			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
S2	*Tx+*	←	ST2-H26	*SD2_TX5_P*	←	AP25	*SD2_TX5_P*
S3	*Tx-*	←	ST2-H27	*SD2_TX5_N*	←	AN25	*SD2_TX5_N*
S6	*Rx+*	→	ST2-A24	*SD2_RX5_P*	→	AW25	*SD2_RX5_P*
S5	*Rx-*	→	ST2-A25	*SD2_RX5_N*	→	AV25	*SD2_RX5_N*

Table 6-15 SATA 2 pin assignment

ST20			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
S2	*Tx+*	←	ST2-E24	*SD2_TX6_P*	←	AM26	*SD2_TX6_P*
S3	*Tx-*	←	ST2-E25	*SD2_TX6_N*	←	AL26	*SD2_TX6_N*
S6	*Rx+*	→	ST2-C24	*SD2_RX6_P*	→	AU26	*SD2_RX6_P*
S5	*Rx-*	→	ST2-C25	*SD2_RX6_N*	→	AT26	*SD2_RX6_N*

Table 6-16 SATA 3 pin assignment

St21			ST2			LX2160A	
Pin	**Name**		**Pin**	**Signal**		**Pin**	**Name**
S2	*Tx+*	←	ST2-G24	*SD2_TX7_P*	←	AP27	*SD2_TX7_P*
S3	*Tx-*	←	ST2-G25	*SD2_TX7_N*	←	AN27	*SD2_TX7_N*
S6	*Rx+*	→	ST2-D22	*SD2_RX7_P*	→	AW27	*SD2_RX7_P*
S5	*Rx-*	→	ST2-D23	*SD2_RX7_N*	→	AV27	*SD2_RX7_N*

Table 6-17 SATA 4 pin assignment

6.7 MicroSD Card Slot

The SBC-LX2160A system offers a microSD Card slot wich can be configured as a boot device.

Part Reference:	ST31
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	ST31			ST1			LX2160A	
	Pin	Name		Pin	Signal		Pin	Name
LVTTL	1	DAT2	↔	F48	SDHC1_DAT2	↔	C1	SDHC1_DAT2
LVTTL	2	CD/DAT3	↔	G48	SDHC1_DAT3	↔	C2	SDHC1_DAT3
LVTTL	3	CMD	↔	B48	SDHC1_CMD	↔	E1	SDHC1_CMD
	4	Vdd						
LVTTL	5	CLK	←	C47	SDHC1_CLK	←	D1	SDHC1_CLK
	6	Vss						
LVTTL	7	DAT0	↔	D48	SDHC1_DAT0	↔	F1	SDHC1_DAT0
LVTTL	8	DAT1	↔	E48	SDHC1_DAT1	↔	E2	SDHC1_DAT1
LVTTL	9	SW1	→	D49	SDHC1_ CD#		E3	SDHC1_ CD#
LVTTL	10	SW2	VSS					

Table 6-18 microSD card slot pin assignment

6.8 eMMC

An additional eMMC chip is available on the carrierboard CRX08, connected to SDHC2 of the LX2160A CPU.

An 8GB eMMC (THGBMJG6C1LBAU7) from Kioxia is assembled.

6.9 USB

6.9.1 USB Host Ports

The SBC-LX2160A system features two stacked USB 3.0 connectors for four USB-Host ports from the LX2160 USB1 interface via a SuperSpeed USB 3.0 Hub TUSB8041IRGCR/T. All USB host ports also support high-speed, full-speed, or low-speed USB 2.0 operation.

The USB VBUS current is limited to 0.9A by default on each port by a Power Distribution Switch MIC2099-1YMT with Resistor Programmable Current Limit. All four USB Host ports can be individually enabled and have a separate overcurrent signal.

Part Reference:	ST22 and ST23
Manufacturer:	Würth Elektronik
Type:	692141030100
Mates with:	USB Type A cables

The following table shows the internal connections:

TUSB8041 upstream			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
48	USB_VBUS	→	A30	USB1_VBUS	→	G8	USB1_VBUS
54	USB_DM_UP	↔	B32	USB1_D_N	↔	F9	USB1_D_N
53	USB_DP_UP	↔	B31	USB1_ D _P	↔	F8	USB1_D_P
55	USB_SSTXP_UP	→	B34	USB1_RX_P	→	C8	USB1_RX_P
56	USB_SSTXM_UP	→	B35	USB1_RX_N	→	D8	USB1_RX_N
58	USB_SSRXP_UP	←	D34	USB1_TX_P	←	A9	USB1_TX_P
59	USB_SSRXM_UP	←	D35	USB1_TX_N	←	B9	USB1_TX_N
-	Not used	←	A35	USB1_DRVBUS	←	A7	USB1_DRVBUS
-	Not used	→	A34	USB1_PWRFLT	→	B7	USB1_PWRFAULT
-	GND (Host Mode)	→	G3	USB1_UID	→	E9	USB1_ID

Table 6-19 USB 1 Hub pin assignment

The signal USB1_UID is per default (Jumper closed) connected to GND forcing Host-Mode. Leave the Jumper open to enable Device-Mode.

ST22/ST23 (Bottom)			TUSB8041 downstream P1/P3	
Pin	**Signal**		**Pin**	**Signal**
1	Vbus+	→	1 (J36/J39)	VOUT
2	D-	↔	2 / 18	USB_DM_DN1/3

ST22/ST23 (Bottom)			TUSB8041 downstream P1/P3	
3	D+	↔	1 / 17	USB_DP_DN1/3
4	GND		-	-
5	SSRX-	→	7 / 23	USB_SSRXM_DN1/3
6	SSRX+	→	6 / 22	USB_SSRXP_DN1/3
7	GND		-	-
8	SSTX-	←	4 / 20	USB_SSTXM_DN1/3
9	SSTX+	←	3 / 19	USB_SSTXP_DN1/3
J36/J39 (MIC2099)				
Pin	**Signal**			
4	ENABLE	←	36 / 33	PWRCTL1/3
3	FAULT#	→	46 / 44	OVERCUR1/3

Table 6-20 USB Host Ports 1/3 pin assignment

ST22/ST23 (Top)			TUSB8041 downstream P2/P4	
Pin	**Signal**		**Pin**	**Signal**
10	Vbus+	→	1 (J38/J40)	VOUT
11	D-	↔	10 / 25	USB_DM_DN2/4
12	D+	↔	9 / 24	USB_DP_DN2/4
13	GND		-	-
14	SSRX-	→	15 / 30	USB_SSRXM_DN2/4
15	SSRX+	→	14 / 29	USB_SSRXP_DN2/4
16	GND		-	-
17	SSTX-	←	12 / 27	USB_SSTXM_DN2/4
18	SSTX+	←	11 / 26	USB_SSTXP_DN2/4
J38/J40 (MIC2099)				
Pin	**Signal**			
4	ENABLE	←	35 / 32	PWRCTL2/4
3	FAULT#	→	47 / 43	OVERCUR2/4

Table 6-21 USB Host Ports 2/4 pin assignment

USB1...4_FAULT# are low-active signals. A logic low level signals the port is in over-current situation

6.9.2 USB OTG Port

The SBC-LX2160A system features one USB 3.0 OTG interface, connected to the LX2160A USB2 interface.

This USB OTG port support high-speed, full-speed, or low-speed USB 2.0 connections. SuperSpeed USB 3.0 is only available in Host-Mode (Type A connector).

The VBUS current is limited to 0.9A by a Power Distribution Switch MIC2099-1YMT with Resistor Programmable Current Limit.

Signal FAULT# from MIC2099 is routed via a logic inverter to USB2_PWRFLT.

Part Reference:	ST24
Manufacturer:	CUI Inc.
Type:	UJ3-MIABH-1-SMT
Mates with:	Micro USB Type A or B cables

The following table shows the internal connections:

ST24			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
1	Vbus+	→	F39	USB2_VBUS	→	G10	USB2_VBUS
2	D-	↔	E35	USB2_D_N	↔	F11	USB2_D_N
3	D+	↔	E34	USB2_ D _P	↔	F10	USB2_D_P
4	ID	→	E40	USB2_UID	→	E11	USB2_UID
5	GND						
6	SSTX-	←	E43	USB2_TX_N	←	B11	USB2_TX_N
7	SSTX+	←	E42	USB2_TX_P	←	A11	USB2_TX_P
8	GND						
9	SSRX-	→	E38	USB2_RX_N	→	D10	USB2_RX_N
10	SSRX+	→	E37	USB2_RX_P	→	C10	USB2_RX_P
J41 (MIC2099)							
Pin	**Signal**						
4	ENABLE	←	A32	USB2_DRVBUS	←	E7	USB2_DRVBUS
3	FAULT#	→	A31	USB2_PWRFLT	→	G7	USB2_PWRFAULT

Table 6-22 USB 3.0 OTG Port pin assignment

USB2_PWRFLT is a high-active signal. A logic high level signals the port is in an overcurrent situation

SSRX / SSTX is for type B connection. Type A using cross over.

Mode is set by SW6-4. Open = OTG Mode, Closed = Host Mode.

6.9.3 USB UART Bridge Port

UART1 of the MPX-LX2160 Module is converted via a MCP2221 for console access (bootloader and standard linux BSP). The usb-to-serial converter always operates in device mode.

The USB UART Bridge is available on a Micro USB 2.0 type B connector.

The MCP2221 is externally powered via VBUS supplies by the host. In oder to gain access to early boot messages, make sure that the MCP2221 device is detected by the host before the SBC-LX2160 is powered up.

Part Reference:	ST29
Manufacturer:	Würth Elektronik
Type:	629105150521
Used with:	Micro USB Type B cables

The following table shows the internal connections:

ST29			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
1	Vbus+						
2	D-	J47	A50	UART1_SIN	→	B5	UART1_SIN
3	D+		B50	UART1_SOUT	←	B6	UART1_SOUT
4	ID						
5	GND						

Table 6-23 Console pin assignment

6.9.4 USB Supervisor Service Port

The supervision and system controller on the MPX-LX2160A SoM offers a USB device service interface that is routed to a microUSB connector on the carrierboard CRX08.

Part Reference:	ST36
Manufacturer:	Würth Elektronik
Type:	629105150521
Mates with:	Micro USB Type B cables

This interface always operates in device mode. The externally supplied VBUS voltage is provided to the microcontroller on the MPX-2160A module.

The following table shows the internal connections:

ST36			ST1			uController J24	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
1	Vbus+						
2	D-	J47	G6	USBME_D_N	→	18	USBME_D_N
3	D+		G5	USBME_D_P	←	19	USBME_D_P
4	ID						
5	GND						

Table 6-24 uC USB interface pin assignment

6.10 RS485

The SBC-LX2160A offers a half-duplex RS485 interface via a Anlog Devices LTC2865IDE transceiver. The RS485 interface is routed to UART2 of the MPX-LX2160 SoM.

Part Reference:	ST28
Manufacturer:	Würth Elektronik
Type:	691214110002
Used with:	Terminal block cable

The following table shows the internal connections:

ST28			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
			D50	UART2_SIN	→	D5	UART2_SIN
1	A	J45	E50	UART2_SOUT	←	D6	UART2_SOUT
2	B		C50	UART2_RTS#	←	C5	UART2_RTS_B
			F50	UART2_CTS#	→	C6	UART2_CTS_B

Table 6-25 RS485 pin assignment

6.11 CAN-FD

The SBC-LX2160A system offers two flexible data rate CAN interfaces with switchable termination resistors (120 Ohms).

Each interface is driven by a MCP2562FD-E/SN CAN-FD transceiver.

The support for CAN-FD depends on the specific processor variant used on the MPX-LX2160. The current standard version does not support CAN-FD, however the CRX08 carrier is prepared in case a different processor variant is used.

Part Reference:	ST26 and ST27
Manufacturer:	Würth Elektronik
Type:	691214110002
Used with:	Terminal block cable

The CAN interface signals of the LX2160A are multiplexed with the I2C3/I2C4 signal lines (SCL = Tx and SDA = Rx).

ST26			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
1	CANH	J43	F2	IIC3_SCL	←	H5	IIC3_SCL
2	CANL		F1	IIC3_SDA	←	J5	IIC3_SDA

Table 6-26 CAN-FD 1 pin assignment

ST27			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
1	CANH	J44	F4	IIC4_SCL	←	K4	IIC4_SCL
2	CANL		F5	IIC4_SDA	←	L5	IIC4_SDA

Table 6-27 CAN-FD 2 pin assignment

6.12 JTAG 1 Connector (Processor)

The JTAG1 signals are available on a 2x5 pin header. This TAP connets to the LX2160A processor only. The pinout is compatible with standard Lauterbach debug probes.

Part Reference:	ST41
Manufacturer:	Samtec
Type:	FTSH-105-01-L-DV-K

ST41			ST1			LX2160A	
Pin	**Signal**		**Pin**	**Signal**		**Pin**	**Signal**
1	VREF 1.8V						
2	TMS	→		TMS	→		TMS
3	GND						
4	TCK	→		TCK	→		TCK
5	GND						
6	TDO	→		TDO	→		TDO
7	-						
8	TDI	←		TDI	←		TDI
9	GND						
10	TRST_B	→		TRST_B	→		TRST_B

Table 6-28 Module JTAG Connector Pinout

6.13 JTAG 2 Connector (Carrier Components)

The JTAG2 signals are available on a 2x5 pin header.This TAP connects to devices on the carrier board only. Interface follows the Göpel boundary scan controller pinout specification for production bingup and testing. Note that multiple devices reside in the scan chain.

Part Reference:	ST55
Manufacturer:	Samtec
Type:	FTSH-105-01-L-DV-K

ST55			Carrier components
Pin	**Signal**		
1	TCK	→	J28, J20, J23
2	GND	↔	
3	TMS		J28, J20, J23
4	GND	→	
5	TDO	←	TDO ➔ J23
6	GND	→	
7	TDI		TDI ➔ J28 ➔ J20 ➔ J23 (chain)
8	GND	→	
9	TRST#	→	J28, J20, J23
10	-		

Table 6-29 Carrier JTAG Connector Pinout

6.14 GPIO Extension (PLC IO)

The carrierboard features industrial-grade GPIOs, with 24VDC max. support input/output voltage. The maximum output level depends on the output driver voltage, which is either sourced internall (12VDC rail) or supplied externally (24VDC max.). For the latter case, a hardware modification is necessary (Remove R273) in order to covert the output stage to external voltage supply.

The I/Os are controlled by a MAX7325ATG I²C GPIO Expander, which also provides the necessairy level shifting. The output driver of the expander can be separately enabled and disabled. Additionally a fault pin exists, signaling a chip thermal shutdown or an overcurrent condition on one or more channel(s).

Part Reference:	ST42
Manufacturer:	Würth Elektronik
Type:	691 382 010 006
Mates with:	691 381 000 006

Part Reference:	ST43
Manufacturer:	Würth Elektronik
Type:	691 382 010 008
Mates with:	691 381 000 008

Pin:	Description	MAX7325ATG
1	IN0	Pin 1
2	IN1	Pin 2
3	IN2	Pin 3
4	IN3	Pin 4
5	IN4	Pin 5
6	IN5	Pin 6

Table 6-30 GPIN connector pinout (ST42)

Pin:	Description	MAX7325ATG	UDN2987LW
1	EXT_GND	-	Pin 12 (GND)
2	OUT0	Pin 10	Pin 20
3	OUT 1	Pin 11	Pin 19
4	OUT 2	Pin 12	Pin 18
5	OUT 3	Pin 13	Pin 17
6	OUT 4	Pin 14	Pin 16
7	OUT 5	Pin 15	Pin 15
8	EXT_12V_24V	-	Pin 11 (VS)

Table 6-31 GPOUT connector pinout (ST43)

Description	MAX7325ATG
FAULT input: logic low signals fault event from UDN2978LW	Pin 7 (P6)
A logic high enables the GPOUT driver	Pin 16 (O14)

Table 6-32 GPOUT control and status signals

6.15 Fan Connector

The SBC-LX2160A provides a fan connector on the carrier board (marked with „FAN).

In case evaluation with an active cooling solution is necessary, MicroSys recommends a 12VDC rated, PWM controlled fan with tacho output. If both signals are provided, the fan curve can be adjusted in software by the included MicroChip EMC2301 I²C fan controller which is controlled by the LX2160A on I²C1.

Part Reference:	ST44
Manufacturer:	Würth Elektronik
Type:	679 304 124 022
Mates with:	648 004 113 322

Pin:	Description
1	GND
2	+12V
3	TACHO
4	PWM

Table 6-33 FAN connector pinout

6.16 Special Expansion Headers

There are several headers with additional signals for testing and debugging purposes. Please refer to the next chapter for a extended list. ST7 and ST30 are fixed function expansions and provide the IEEE1588 sigals of the ethernet subsystem for external usage, as well as an additional UART on ST30.

For detailed signal description refer to connector pin list and LX2160A user manual.

6.16.1 ST7 IEEE 1588 Signals

If SW6-1 is closed, RGMII2 signals from the MPX-LX2160 SoM act as IEEE1588 signals.

All ST7 signals are 3V3 level.

ST7		ST2 (Module connector)			
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	1V8				
2	1V8				
3	RCLK0	A12	RCLK0	N8	RCLK0
4	RCLK1	C7	RCLK1	N8	RCLK1
5	1588_ALARM_OUT2	C38	EC2_TXD3	L3	EC2_TXD3
6	1588_ALARM_OUT1	D39	EC2_TXD2	L4	EC2_TXD2
7	1588_PULSE_OUT2	C36	EC2_TXD0	N3	EC2_TXD0
8	1588_CLOCK_OUT	C37	EC2_TXD1	M3	EC2_TXD1
9	1588_PULSE_OUT1	A38	EC2_RXD1	N1	EC2_RXD1
10	1588_CLOCK_IN	A40	EC2_RX_CLK	L1	EC2_RX_CLK
11	1588_TRIGGER_IN1	A37	EC2_RX_DV1	P1	EC2_RX_DV1
12	1588_TRIGGER_IN2	B37	EC2_RXD0	N2	EC2_RXD0
13	GND				
14	GND				

Table 6-34 ST7 connector pinout

6.16.2 ST30 CPU UART3

All ST30 signals are 1V8 level.

ST30		ST1 (Module connector)		LX2160A	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	1V8				
2	CPU_UART3.SOUT	G50	UART3_SOUT	A5	UART3_SOUT
3	CPU_UART3.SIN	H50	UART3_SIN	A6	UART3_SIN
4	GND				

Table 6-35 ST30 connector pinout

7 Switches, Buttons and Misc. Headers

7.1 Switches and Buttons

7.1.1 SW1 (Power Enable)

SW1 is not assembled. Functionallity is done by jumper ST49. If ST49 is closed, power is ON, IF ST49 is open, power is off.

7.1.2 SW2 (Reset Button)

SW2 triggers a Hardware Reset of the MPX-LX2160A SoM when pressed. It is connected to the reset input of two STM6905 reset supervisor ICs. The resulting open drain reset signal is fed to the carrier and the SoM.

The following table shows the internal connections:

SW2			J6/J9		ST1			Microcontroller	
Pin	Signal		Pin		Pin	Signal		Pin	Name
1 & 3	GND								
2 & 4	RST-BTN	→	1						
			8	→		RESIN#	→	52	PTC7

Table 7-1 Reset button pinout

7.1.3 SW3 (CAN Termination)

SW3 switches the on-board 120R termiation resistor for the CAN interface.

SW3-1 sets the termination for CAN1. SW3-2 sets the termination for CAN2.

If SW3-1/-2 is open, the CAN channel is unterminated.

7.1.4 SW4 (Clock Configuration)

This functionality is currently not supported and subject to future expansion of the evaluation kit.

7.1.5 SW5 (Boot Configuration)

The following table shows the internal connections of the BOOT_SRC pins:

SW5			ST2			CPLD	
Switch	**Signal**		**Pin**	**Signal**		**Pin**	**Name**
5-1	BOOT_SRC_0	→	A4	BOOT_SRC_0	→	B9	BOOT_SRC_SEL0
5-2	BOOT_SRC_1	→	A3	BOOT_SRC_1	→	A10	BOOT_SRC_SEL1
5-3	BOOT_SRC_2	→	A2	BOOT_SRC_2	→	F9	BOOT_SRC_SEL2
5-4	BOOT_SRC_3	→	A1	BOOT_SRC_3	→	E11	BOOT_SRC_SEL3

Table 7-2 BOOT-SELx pin assignment

For details on bootsource selecetion refer to “miriac_MPX-LX2160A_User_Manual.pdf” chapter 4.9.

7.1.6 SW6 (Board Configuration)

SW6 configures some functionallity on the carrier.

SW-pin	Description	Function
1	closed	RGMII_2 is used for IEEE 1588
1	open	RMII_2 is connected to J19, Phy 88E1512P
2	closed	EP_SELECT = EP = endpoint
2	open	EP_SELECT = RC = root complex
3	closed	Not used
3	open	Not used
4	closed	USB Host mode
4	open	USB OTG mode

Table 7-3 SW6 function

7.2 Expansion / Development Headers

7.2.1 ST49 (ATX Power On Jumper)

ST49 has to be closed by a jumper to enable power to the carrier. The module power is independent from this jumper.

7.2.2 ST4 (Regulator Enable)

If the included jumper on ST4 is inserted, all carrier board supplies are enabled. Otherwise, all regulators on the carrier board are disabled. The MPX-LX2160A SoM will also loose power if ST4 is removed.

For evaluation purpose, a switch (permanent, not momentary) can also be connected, to enable / disable the carrier power supply.

7.2.3 ST32 (Module CPLD JTAG)

This connector is for MicroSys internal use only. Please contact MicroSys for further information on custom CPLD implementations on the SoM.

Interface is used for CPLD programming and debugging. Signal level is 3,3V.

ST32		ST2 (Module connector)		CPLD	
Pin	Signal	Pin	Signal	Pin	Signal
1	JTAG_CPLD.ENB	E12	JTAG_CPLD_ENB	C10	JTAG_CPLD_ENB
2	3V3				
3	JTAG_CPLD.TDO	E16	JTAG_CPLD_TDO	C6	JTAG_CPLD_TDO
4	3V3				
5	JTAG_CPLD.TDI	E15	JTAG_CPLD_TDI	A6	JTAG_CPLD_TDI
6	CPLD_USART.RX	B22	CPLD-USART-RX	E9	CPLD-USART-RX
7	JTAG_CPLD.TCK	E14	JTAG_CPLD_TCK	A7	JTAG_CPLD_TCK
8	CPLD_USART.TX	B23	CPLD-USART-TX	D8	CPLD-USART-TX
9	JTAG_CPLD.TMS	E13	JTAG_CPLD_TMS	B8	JTAG_CPLD_TMS

ST32		ST2 (Module connector)		CPLD	
10	JTAG_CPLD.PROGMN		JTAG_CPLD_PROGMN	B10	CPLD_PROGMN
11	JTAG_CPLD.INTIN	E10	CPLD_INTIN	A13	CPLD_INTIN
12	GND				
13	JTAG_CPLD.DONE	E9	CPLD_DONE	C13	CPLD_DONE
14	GND				

Table 7-4 ST32 connector pinout

7.2.4 ST33 (CPLD user IO)

Future expansion header for customer specific CPLD expansions. For special requirement please contact MicroSys.

Signal level is customer defined 1,8V or 3,3V by external voltage “USR_PRW_IN” on Pin 1 and 2.

ST33		ST2 (Module connector)		CPLD	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	USR_PWR_IN	G9	USR_PWR_IN		
2	USR_PWR_IN	Pins G9 to G16			
3	CPU_UIO.FCT-01	C18	USR-FCT-01	M3	USR-FCT-01 (PL13A)
4	CPU_UIO.FCT-02	C20	USR-FCT-02	N1	USR-FCT-02 (PL13B)
5	CPU_UIO.FCT-03	G20	USR-FCT-03	N2	USR-FCT-03 PL13C)
6	CPU_UIO.FCT-04	D20	USR-FCT-04	P1	USR-FCT-04 (PL13D)
7	CPU_UIO.FCT-05	F20	USR-FCT-05	M2	USR-FCT-05 (PL14A)
8	CPU_UIO.FCT-06	D18	USR-FCT-06	N3	USR-FCT-06 (PL14B)
9	CPU_UIO.FCT-07	E20	USR-FCT-07	R1	USR-FCT-07 (PL14C)
10	CPU_UIO.FCT-08	A20	USR-FCT-08	P2	USR-FCT-08 (PL14D)
11	CPU_UIO.FCT-09	B18	USR-FCT-09	L1	USR-FCT-09 (PL11A)
12	CPU_UIO.FCT-10	E18	USR-FCT-10	L3	USR-FCT-10 (PL11B)
13	CPU_UIO.FCT-11	A18	USR-FCT-11	K4	USR-FCT-11 (PL11C)
14	CPU_UIO.FCT-12	E18	USR-FCT-12	L5	USR-FCT-12 (PL11D)
15	CPU_UIO.FCT-13	A18	USR-FCT-13	L2	USR-FCT-13 (PL12A)
16	CPU_UIO.FCT-14	B20	USR-FCT-14	M1	USR-FCT-14 (PL12B)
17	CPU_UIO.FCT-15	G18	USR-FCT-15	K5	USR-FCT-15 (PL12C)
18	CPU_UIO.FCT-16	F18	USR-FCT-16	L4	USR-FCT-16 (PL12D)
19	GND				
20	GND				

Table 7-5 ST33 connector pinout

7.2.5 ST34 (GPIOs / Timers / Events)

Signal level is 1,8V conditioned with 4K7 PU on MPX-LX2160A module.

ST34		ST2 (Module connector)		LX2160A	
Pin	Signal	Pin	Signal	Pin	Signal
1	CPU_EVENT.ASLEEP	A7	CPU_ASLEEP	M7	CPU_ASLEEP
2					
3	CPU_EVENT.EVT0	A13	FTM1_CH1	L6	FTM1_CH1
4	CPU_EVENT.EVT1	A6	FTM2_CH1	K9	FTM2_CH1
5	CPU_EVENT.EVT2	A12	FTM1_CH2	L11	FTM1_CH2
6	CPU_EVENT.EVT3	A11	FTM2_CH2	G6	FTM2_CH2
7	CPU_EVENT.EVT4	A9	FTM1_CH3	L10	FTM1_CH3
8	CPU_EVENT.EVT5	A8	FTM2_CH3	M10	FTM2_CH3
9	GND				
10	GND				

7.2.6 ST35 (SPI3)

Connector hosts the SPI3 interface with 4 chip selects. Signal level is 1,8V.

ST35		ST1 (Module connector)		LX2160A	
Pin	Signal	Pin	Signal	Pin	Signal
1	SPI3.MOSI	F47	SPI3_SOUT	C4	SPI3_SOUT
2	SPI3.CS0	G49	SPI3_PCS0	A3	SPI3_PCS0
3	SPI3.MISO		SPI3_SIN		SPI3_SIN
4	SPI3.CS1	A48	SPI3_PCS1	A4	SPI3_PCS1
5	GND				
6	SPI3.CS2	C49	SPI3_PCS2	B3	SPI3_PCS2
7	SPI3.SCK	E49	SPI3_SCK	B2	SPI3_SCK
8	SPI3.CS3	A47	SPI3_PCS3	C3	SPI3_PCS3
9	GND				
10	GND				

Table 7-6 ST35 connector pinout

7.2.7 ST37 (Extended Reset and Power)

Connector ST37 hosts Reset an power control signals.

ST37		STx (Module connector)		Device	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	RTC_CLK_OUT	ST1-D15	RTC_CLK_OUT	7	RTC PCF85063 RTC_CLK_OUT (3,3V)
2	PORESET#	ST1-C4	PORESET#	E5	LX2160 PORESET# (1,8V)
3	RST-OUT2-DELAY-B	ST2-G21	RST-OUT2-DELAY-B	N14	CPLD RST-OUT2-DELAY-B (1,8V)
4	HRESET#	ST1-C5	HRESET#	F6	LX2160A HRESET# (1,8V)
5	RST-OUT1-B	ST2-H21	RST-OUT1-B	N16	CPLD RST-OUT1-B (1,8V)
6	POR_RESET#	ST1-C16	POR_RESET#	40	AMD1266 GPIO7 POR_RESET# (3,3V)
7	RST-OUT3-B	ST2-F9	RST-OUT3-B	P15	CPLD RST-OUT3-B (1,8V)
8	RESET_REQ#	ST1-C10	RESET_REQ#	M9	LX2160A RESET_REQ# (1,8V)
9	SLEEPn	ST1-E8	SLEEPn	34	uC SLEEPn (3,3V)
10	POWER_FAIL#	ST1-B11	POWER_FAIL#	44	uC POWER_FAIL# (3,3V)
11	WAKEn	ST1-D7	WAKEn	43	uC WAKEn (3,3V)
12	RST_XSPI#	ST2-D11	RST_XSPI#	M16	CPLD RST_XSPI# (1,8v)
13	GND				
14	GND				

Table 7-7 ST37 connector pinout

7.2.8 ST38 (SoM Supervisior MCU Console)

Serial interface to microcontroller on MPX-LX2160A module.

Customer console to microcontroller. For more details see “miriac_MPX-LX2160A_User_Manual.pdf” chapter “4.21.1 ME Console”.

Interface is V24-level (RS232).

ST38		ST1 (Module connector)		uController	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	3V3				
2	UART_SRVC.TX	H7	UART_SOUT_ME	37	UART-TX-SRCV Port P112
3	UART_SRVC.RX	H8	UART_SIN_ME	44	UART-RX-SRCV Port P104
4	GND				

Table 7-8 ST38 connector pinout

7.2.9 ST39 QSPI EMU

This interface to is actually not useable. It requires special assembly version of MPX-LX2160A module. Signal level is 1,8V.

ST39		ST2 (Module connector)		LX2160A	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1					
2	XSPI.CS0#	C16	XSPI_A_DQS	E23	XSPI_A_DQS
3					
4					
5	GND				
6	1V8_MODULE				
7	XSPI.CLK	C15	XSPI_A_SCK	D22	XSPI_A_SCK
8	XSPI.DATA2	C11	XSPI_A_DATA2	E26	XSPI_A_DATA2
9	XSPI.DATA3	C10	XSPI_A_DATA3	E27	XSPI_A_DATA3
10	XSPI.DATA1	C12	XSPI_A_DATA1	E24	XSPI_A_DATA1
11					
12	XSPI.DATA0	C13	XSPI_A_DATA0	F25	XSPI_A_DATA0
13					
14					
15					
16					
17					
18					
19					
20					

Table 7-9 *ST39 connector pinout*

7.2.10 ST40 (SoM ME Debug)

This interface is for firmware update to microcontroller. For mor details see: “miriac_MPX-LX2160A_User_Manual.pdf” chapter “4.21.2 ME Programming”.

Signal level is 3,3V.

ST40		ST1 (Module connector)		uController	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	3V3				
2	ME_DBG.SWDIO	B6	SWDIO	33	SWDIO
3	ME_DBG.SWCLK	B7	SWCLK	32	SWCLK
4	GND				

Table 7-10 ST40 connector pinout

7.2.11 ST45 (SPI_SRVC)

This interface is for MicroSys internal use only. Singnal level is 3,3V.

ST45		STx (Module connector)		Device	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	SPI_ME.MOSI	ST1-F9	SPI_MOSI_ME	5	J19 W25Q16JVSNIQ ME_MOSI (3,3V)
2	I2C_ME.SCL	ST1-F8	IIC_SCL_ME	13	J15 Si5332B SCL (3,3V)
3	SPI_ME.MISO	ST1-G10	SPI_MISO_ME	2	J19 W25Q16JVSNIQ ME_MISO (3,3V)
4	I2C_ME.SDA	ST1-F7	IIC_SDA_ME	14	J15 Si5332B SDA (3,3V)
5	SPI_ME.SCLK	ST1-G9	SPI_CLK_ME	6	J19 W25Q16JVSNIQ ME_SCLK (3,3V)
6	ME_MD#	ST2-A16	ME_MD#	26	uC ME_MD# (3,3V)
7	SPI_ME.CS	ST1-F10	SPI_CS_ME	1	J19 W25Q16JVSNIQ ME_SCS#I (3,3V)
8	RESET_ME#	ST2-A15	RESET_ME#	25	uC RESET_ME# (3,3V)
9	PMBUS.ALERT	ST1-H19	PMBUS_SALRT	31	uC PMBUS_SALRT (3,3V)
10	GND		GND		
11	PMBUS.SCL	ST1-H21	PMBUS_SCL	48	uC PMBUS_SCL (3,3V)
12	I2C_PROG.SCL	ST2-D10	I2C_PROG.SCL		Not conneced on module
13	PMBUS.SDA	ST1-H20	PMBUS_SDA	47	uC PMBUS_SDA (3,3V)
14	I2C_PROG.SDA	ST2-D9	I2C_PROG.SDA		Not conneced on module

Table 7-11 ST45 connector pinout

7.2.12 ST46 (Clocks)

ST46 provides differential inputs to J15 system clock generator and to J13 clock multiplexer. Inputs are ac coupled.

ST46		STx (Module connector)		Device	
Pin	**Signal**	***Pin***	**Signal**	**Pin**	**Signal**
1	CLK_GEN_IN.CLK_IN_P	ST1-B26	CLK_IN_P	2	Input to J15 CLK_GI_P
2	CLK_GEN_IN1.CLK_IN_P	ST2-A40	CLKIN1_P	15	Input to J13 CLK_GENIN1_P
3	CLK_GEN_IN.CLK_IN_N	ST1-B27	CLK_IN_N	3	Input to J15 CLK_GI_N
4	CLK_GEN_IN1.CLK_IN_N	ST2-A41	CLKIN1_N	16	Input to J13 CLK_GENIN1_N

Table 7-12 ST46 connector pinout

7.2.13 ST47 (Tamper Detect, RTC)

System control signals. Signal level is 1,8V.

ST47		STx (Module connector)		LX2160A	
Pin	**Signal**	***Pin***	**Signal**	**Pin**	**Signal**
1	TEST_SEL#	ST2-A22	TEST_SEL#	E6	TEST_SEL#
2					
3	TMP_DETECT#	ST2-A21	TMP_DETECT#	N9	TMP_DETECT#
4	TA_BAT_VDD	ST2-B9	TA_BAT_VDD		
5	BB_TMP_DETECT#	ST2-B21	BB_TMP_DETECT#	J27	BB_TMP_DETECT#
6	PROG_SFP	ST2-B13	PROG_SFP	M26	PROG_SFP
7	CPU_TBSCAN_EN#	ST2-C21	CPU_TBSCAN_EN#	F23	CPU_TBSCAN_EN#
8	RTC_INT#	ST1-H12	RTC_INT#	K8	RTC_INT#
9	GND				
10	GND				

Table 7-13 ST47 connector pinout

7.2.14 ST48 (SoM Temperature Status)

Signal level is 3,3V with PU 4k7 on module.

Signaling temperature status of all on module temperature sensors. Additional external sensors may be added to these OC lines.

ST48		ST1		Sensor	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	TEMP_MOD.CRIT	E10	TEMP_CRIT_MOD		T_CRITn
2	TEMP_MOD.WARN	F11	TEMP_WARN_MOD		ALERTn
3	GND				

Table 7-14 ST48 connector pinout

7.2.15 ST51 J20 (USX1) IEEE1588 Connector

ST51 hosts the IEEE1588 signals from Marvell 88X3310 Phy J20. For details on functionality and setup refer to 88X3310 mamual.

Signal level is 3,3V.

ST51				J20 (88X3310)	
Pin	**Signal**			**Pin**	**Signal**
1	3V3_SW				
2	GPIO-0			F10	GPIO-0
3	GPIO-1			G10	GPIO-1
4	GPIO-2			H10	GPIO-2
5	GPIO-3			K10	GPIO-3
6	GPIO-4			H11	GPIO-4
7	GPIO-5			G12	GPIO-5
8	GND				

Table 7-15 ST51 connector pinout

7.2.16 ST53 J23 (USX2) IEEE1588 Connector

ST51 hosts the IEEE1588 signals from Marvell 88X3310 Phy J23. For details on functionality and setup refer to 88X3310 mamual.

Signal level is 3,3V.

ST53				J23 (88X3310)	
Pin	**Signal**			**Pin**	**Signal**
1	3V3_SW				
2	GPIO-0			F10	GPIO-0
3	GPIO-1			G10	GPIO-1
4	GPIO-2			H10	GPIO-2
5	GPIO-3			K10	GPIO-3
6	GPIO-4			H11	GPIO-4
7	GPIO-5			G12	GPIO-5
8	GND				

Table 7-16 ST53 connector pinout

8 LEDs

8.1 RJ45 LEDs 1Gb

The following table summarizes the RJ45 LEDs for 1Gb of the SBC-LX2160A:

Part Reference	Source	Signal Name	Function
LAN1	*J12*	*RGMII_P1_LED1*	Left Yellow LED: off
LAN1	*J12*	*RGMII_P1_LED0*	Right Green LED: configurable Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link
LAN2	*J19*	*RGMII_P2_LED1*	Left Yellow LED: off
LAN2	*J19*	*RGMII_P2_LED0*	Right Green LED: configurable Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link

Table 8-1 Indicator LEDs 1G Ethernet ports

8.2 RJ45 LEDs 10Gb

The following table summarizes the RJ45 LEDs for 10Gb of the SBC-LX2160A:

Part Reference	Source	Signal Name	Function
LAN3	*J20*	*USXGMII_P1_LED0*	Left green LED: off
LAN3	*J20*	*USXGMII_P1_LED2* *USXGMII_P1_LED1*	Right Green LED: configurable Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link Right Yellow LED: off
LAN4	*J23*	*USXGMII_P2_LED0*	Left green LED: off
LAN4	*J23*	*USXGMII_P2_LED2* *USXGMII_P2_LED1*	Right Green LED: configurable Default: 3 blinks – 1000Mbps / 2 blinks – 100 Mbps / 1 blink – 10 Mbps / 0 blinks – no link Right Yellow LED: off

Table 8-2 Indicator LEDs 10G Ethernet ports

8.3 Power and Reset LEDs

Part Reference	Source	Signal Name	Function
LD1	*J1*	*2V5_PGOOD*	LED ON : 2.5V within tolerance LED OFF: 2.5V DCDC power fail
LD2	*J2*	*1V8_PGOOD*	LED ON : 1.8V within tolerance LED OFF: 1.8V DCDC power fail
LD3	*J4*	*1V5_PGOOD*	LED ON : 1.5V within tolerance LED OFF: 1.5V DCDC power fail
LD4	*J5*	*1V1_PGOOD*	LED ON : 1.1V within tolerance LED OFF: 1.1V DCDC power fail
LD5	*J8*	*0V88_PGOOD*	LED ON : 0.88V within tolerance LED OFF: 0.88V DCDC power fail
LD6	*J10*	*1V3_PGOOD*	LED ON : 1.3V within tolerance LED OFF: 1.3V DCDC power fail
LD7	*J31*	*1V0H_PGOOD*	LED ON : 1.0V within tolerance LED OFF: 1.0V LDO power fail
LD8	*J32*	*0V95_PGOOD*	LED ON : 0.95V within tolerance LED OFF: 0.95V LDO power fail
LD9	*J33*	*1V0L_PGOOD*	LED ON : 1.0V within tolerance LED OFF: 1.0V LDO power fail
LD10	*J36*	*USB1_VBUS*	LED ON : 5.0V USB 1 power is ON LED OFF: 5.0V USB 1 power is OFF
LD11	*J38*	*USB2_VBUS*	LED ON : 5.0V USB 2 power is ON LED OFF: 5.0V USB 2 power is OFF
LD12	*J39*	*USB3_VBUS*	LED ON : 5.0V USB 3 power is ON LED OFF: 5.0V USB 3 power is OFF
LD13	*J40*	*USB4_VBUS*	LED ON : 5.0V USB 4 power is ON LED OFF: 5.0V USB 4 power is OFF
LD14	*J41*	*USBOTG_VBUS*	LED ON : 5.0V USB *OTG* power is ON LED OFF: 5.0V USB *OTG* power is OFF
LD15..18	*J49*	*RGB-LEDs*	Defined separate
LD19	*J55*	*Reset*	LED ON : CB_RESET# is activ LED OFF: reset inactiv

Table 8-3 *Indicator LEDs - Carrier board*

8.4 Module LEDs

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

Table 8-4 Indicator LEDs – Module

8.5 RGB LEDs

The SBC-LX2160A provides a RGB LED driver TLC59116IRHBR controlling four RGB LEDs.

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

Part Reference	LED Driver Output	LED Output Register
LD18	*OUT0*	*0x14*
	OUT1	
	OUT2	
	Pin OUT3 is not connected	
LD17	*OUT4*	*0x15*
	OUT5	
	OUT6	
	Pin OUT7 is not connected	
LD16	*OUT8*	*0x16*
	OUT9	
	OUT10	
	Pin OUT11 is not connected	
LD15	*OUT12*	*0x17*
	OUT13	
	OUT14	
	Pin OUT15 is not connected	

Table 8-5 RGB LEDs – Carrier

9 Appendix

9.1 Acronyms

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

AUI ..... *Attachment Unit Interface*
CPU ..... *Central Processing Unit*
DC ..... *Direct Current*
ESD ..... *Electrostatic Discharge*
Gbps ..... *Gigabit per second, Gigabit per second*
GND ..... *Ground*
GPL ..... *General Public License*
I2C ..... *Inter-Integrated Circuit*
JTAG ..... *Joint Test Action Group*
LAN ..... *Local Area Network*
LVTTL ..... *Low Voltage Transistor–Transistor Logic*
MCU ..... *Microcontroller Unit*
PCIe ..... *Peripheral Component Interconnect Express*
RGMII ..... *Reduced Gigabit Media-independent Interface*
RTC ..... *Real Time Clock*
SOM ..... *System On Module*
UART ..... *Universal Asynchronous Receiver Transmitter*
USB ..... *Universal Serial Bus*
USXGMII ..... *Universal Serial 10GE Media Independent Interface*
XLAUI4 ..... *Attachment Unit Interface 40/100GE Specific*

9.2 Table of Figures

10 History

Date	Version	Change Description
2020-04-22	**1.0**	Initial Version
2021-05-28	**1.2**	4.3.2 added Board size
2021-07-01	**1.3**	Cover Sheet Rebrand
2021-10-07	**1.5**	Add warning for module removal
2021-10-12	**1.6**	Update block diagram to new corporate ID
2022-08-17	**1.7**	25Gbit on Serdes Lane 2 not working on R2 carrier

Table 10-1 Document history