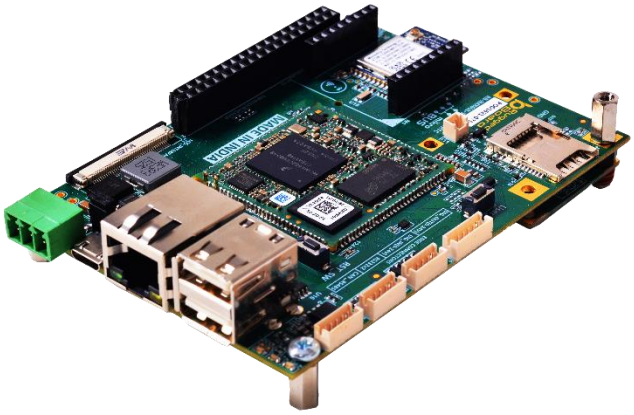
RuggerdBOARD – I.MX 6UL



Hardware and System Reference Manual

Document No.	**:**	**RB-HWR-001-A3**
CB PCB Number	**:**	**1P3**
SOM PCB Number	**:**	**1468.2**

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A Product Of Rugged Board – An open source Hardware Platform

Revision History

Date	Change Note	Revision
July 2020	Modification of the peripherals	**2**
Sept 2021	1.Removal of SAML11 2.Adding the Boot Mode Lines 3.Adding the SD-Card Boot 4.Removal of Common GPIO's	**3**

Conventions, Abbreviations and Acronyms

This hardware manual describes the phycore-iMx6ul, the following is referred to as Rugged Board-iMx6ul. The manual specifies the Rugged Board-iMx6ul design and function. Precise specifications for the NXP based iMx6ul microcontrollers can found in the iMx6ul Data Sheet and Technical Reference Manual.

SIP	System-In-Package
SOM	System On Module
DDR2-SDRAM	Double Data Rate 2 Synchronous Dynamic Random-Access Memory
DSC	Direct Solder Connection
ESD	Electrostatic discharge
Mbit	Megabit
EMI/EMC	Electromagnetic Interference/Electromagnetic Compatibility
DDR	Double Data Rate
BGA	Ball Grid Array
RTC	Real-Time Clock
USB	Universal Serial Bus
TFT-LCD	Thin Film Transistor - Liquid Crystal Display.
ADC	Analog-to-Digital Converter
PWM	Pulse width Modulation
QSPI	Queued Serial Peripheral Interface
UART	universal asynchronous receiver-transmitter
IIC	Inter-Integrated Circuit
eMMC	Embedded Multi-Media Controller"
PCB	Printed Circuit Board
PMIC	Power Management IC
POR	Power On reset
GPIO	General Purpose Input/output

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Note: The BSP delivered with the phyCORE-iMx6ul usually includes drivers and/or software for controlling all components such as interfaces, memory, etc. Therefore, programming of the hardware at register level is not necessary in most cases. For this reason, this manual contains no detailed description of the controller's registers, or information relevant for software development. Please refer to the iMx6ul Reference Manual, if such information needs to connect customer designed applications.

Product Specific Information and Technical Support

In order to receive product specific information on changes and updates in the best way also in the future, we recommend to register at:

Contact Information	
Address	**PHYTEC Embedded Pvt. Ltd.**
	27th Main, HSR Layout, Bengaluru 560102
Phone Number	**+91-9741652770**
E-Mail	
Technical Support	
Website	**www.ruggedboard.com**

Declaration of Electro Magnetic Conformity of the Rugged Board [To Be Decided]

PhyCORE-iMx6ul: System on Module (henceforth products) are designed for installation in electrical appliances or as dedicated Evaluation Boards (i.e.: for use as a test and prototype platform for hardware/software development) in laboratory environments.

Caution!

Rugged Board-iMx6ul products lacking protective enclosures are subject to damage by ESD and hence, may only be unpacked, handled or operated in environments in which sufficient precautionary measures have been taken in respect to ESD-dangers. It is also necessary that only appropriately trained personnel (such as electricians, technicians and engineers) handle and/or operate these products.

Rugged Board-iMx6ul products fulfill the norms of the European Union's Directive for Electro Magnetic Conformity only in accordance to the descriptions and rules of usage indicated in this hardware manual (particularly in respect to the pin header row connectors, power connector and serial interface to a host-PC).

Note:

Implementation of Rugged Board-iMx6ul into target devices, as well as user modifications and extensions of products, is subject to renewed establishment of conformity to, and certification of, Electro Magnetic Directives. Users should ensure conformance following any modifications to the products as well as implementation of the products into target systems.

Products EMI/EMC standards test Specifications and qualified for CE

- IEC/EN 61000-4-6 (RE conducted susceptibility test) : 1G to 3G
- IEC/EN 61000-4-2 (Electro Static Discharge immunity test)
- IEC/EN 61000-4--5 (Surge immunity test)
- IEC /EN** Vibration Test (Shockproof with Multiple drops from 5' (1.5 m)(TBD)

ESD Warning:

Electronic components and circuits are sensitive to Electrostatic Discharge (ESD). When handling any circuit board assemblies including Rugged Board-iMx6UL carrier assemblies, it is recommended that ESD safety precautions be observed. ESD safe best practices include, but are not limited to:

- Leaving circuit boards in their antistatic packaging until they are ready to be installed.
- Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static charge that may be present on you.
- Only handling circuit boards in ESD safe areas, which may include ESD floor and table mats, wrist strap stations and ESD safe lab coats.
- Avoiding handling circuit boards in carpeted areas.
- Try to handle the board by the edges, avoiding contact with components

Power Supply Warning:

Hardware Power Supply Limitation: Powering the board with voltages higher than **3.3V ± 5%** may damage the module. We recommend Supply voltage to SOM module from Carrier Board is **3.3V ± 5%.**

In addition, for proper operation of the module into the target application also requires connecting all GND pins common.

1. INTRODUCTION

1.1.Hardware overview

The Rugged board for phyCORE-iMx6ul modules is a low-cost, feature-rich software development platform supporting the microchip Semiconductor phyCORE-iMx6ul microprocessors. Moreover, due to the numerous standard interfaces the Rugged Board (iMx6ul) can serve as bedrock for your application. At the core of the Rugged Board is the phyCORE-iMx6ul System on Module (SOM), containing the processor, DRAM, NAND Flash, power regulation, supervision, transceivers, and other core functions required to support the phyCORE-iMx6ul processor. Surrounding the SOM is the Rugged Board (phyCORE-iMx6ul) carrier board, adding power input, buttons, connectors, signal breakout, and Ethernet connectivity amongst other peripherals.

The phyCORE-iMx6ul is a connector-less, BGA style System on Module (SOM) in a direct solder form factor. Unlike traditional PHYTEC SOM products that support high-density connectors, the phyCORE-iMx6ul SOM is directly soldered down to the RUGGED BOARD using Half-Hole Technology. This solution offers an ultra-low-cost Single Board Computer for the phyCORE-Imx6ulprocessor, while maintaining most of the advantages of the SOM concept.

Adding the phyCORE-iMx6ul into your own design is as simple as ordering the connector version and making use of our rugged Board's Carrier Board reference schematics.

Features:

The Industrial Rugged Board has the following features.

Name	Interface	Numbers	Details
Input DC Power Supply	Power Section		Either USB or 5V DC Power adaptor (~3 to 5A)
Power Management	Power Section		Step -down regulators
RTC Power Header (3V) Use SOM Internal RTC function or CMOS battery	Power Section		RTC power Header: 2 Pin
Reset Switch (Board at board Edge) 2pin SMD	Reset Dedicated	1	
User Switch; GPIO Control	User Switch	1	
Debug Port: TTL 3.3V as well USB Micro Port	UART /USB	1	3 pin Header / USB Port Via FTDI Bridge chipset

Combo Connector: uSIM and uSD Socket	SDIO and SIM	1	
Ethernet RJ45 Connector(10BASE-T/100BASE-TX)	10/100 ETHERNET MDI	1	
USB 2.0 Host Port/ GSM/Wi-Fi	USB 2.0	2	Dual Port Stack USB Header
CAN Interface (Transceiver Non-Isolated)	CAN interface	1	5 Pin Header; Shared between RS485 and CAN
Serial Port RS485 (Non-Isolated)	UART	1	5 Pin Header; Shared between RS485 and CAN
Serial Port RS232 (Non-Isolated) and with Full Modem (RTS, CTS)	UART	1	5 Pin Header: Configured as Full Modem / Half Modem
Digital Inputs x 4 (Isolated) up to 24V Support	GPIO	1	5 Pin Header
Digital outputs x 4 (Isolated) up to 24V Support	GPIO	1	5 Pin Header
microbus Header	SPI, UART, I2C, PWM, INT	1	Female header
LED's (Power, User Configurable LED's)	GPIO	2	Panel Mount Header
LCD Interface FPC lock type Connector	RGB with Control Signals	1	
Expansion Header: GPIO's	GPIO	1	36 Position
PCB Form factor: Board Size: 100x72.5mm			4-layer impedance-controlled PCB

Table 1

2. Accessing the Rugged Board

Industrial Rugged Board is fully equipped with all mechanical and electrical components necessary for the speedy and secure start-up.

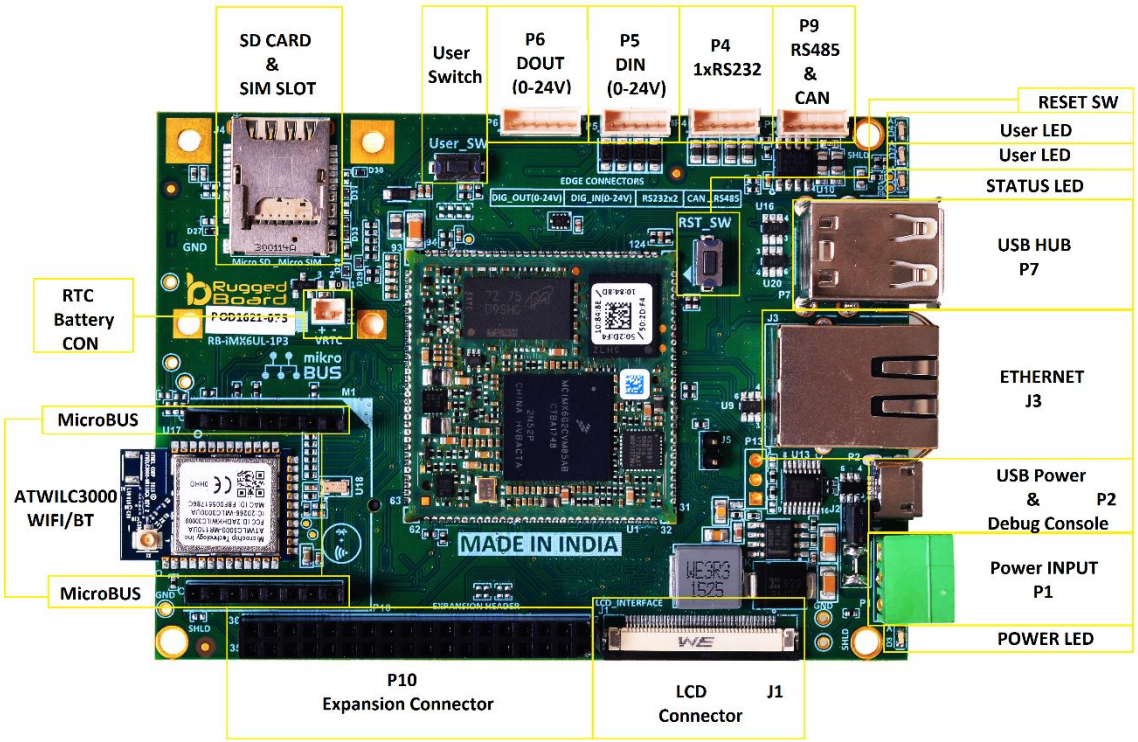
2.1. Overview

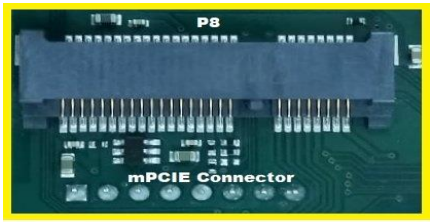
The Industrial Rugged Board is depicted in Figure 2. It features many different interfaces and is equipped with the components as listed in Table 2, and Table 3. For a more detailed description of each peripheral, refer to the appropriate chapter listed in the applicable table. Figure 2 highlights the location of each peripheral for easy identification.

Reference Designator	Description	Temperature Parameters
P1	Power Supply 5V (1. Phoenix comb icon 3-pole connector) TBD (Power IN 5V as well 24V DC IN (While Using 24V DC IN, USB Ports (HOST) Not accessible to User)	-40°C to 105°C
P2	USB power/ Debug Console (2. USB Micro-AB connector 5V Power supply)	-40°C to 105°C
P4	RS232	-25°C to 85°C
P5	Digital Input(0-24v)	-25°C to 85°C
P6	Digital Output(0-24v)	-25°C to 85°C
P7	USB 2.0	-40°C to 105°C
P8	mPCIe (Supports multiple Cellular Modules 2G/3G/4G/Cat-M/NB-IoT, Supports AI & ML VPU/TPU co-processor).	-
P9	CAN & RS-485	-25°C to 85°C
P10	Expansion Header	-40°C to 105°C
P11	RTC Battery	-25°C to 85°C
P13	Debug port	-40°C to 120°C
J1	LCD Connector	-
SW2	Reset	-30°C to 85°C
M1	microbus Expansion (Supports multiple IoT wireless modules (ZigBee/BLE/LoRa/6LoWPAN), Supports multiple IoT Sensor modules based on UART/I2C/SPI Interface)	-40°C to 105°C
U17	ATWILC3000	Based on requirement
J3	Ethernet (RJ45 10/100Mbps)	-40°C to 85°C
J4	SD card + SIM (Dual connector)	-
D5	Power LED	-55°C to 85°C
D4/D7	User Level LEDs	-55°C to 85°C

Table 2

2.1.1. Connectors and PIN Header





(Bottom View)

Fig. 1

2.1.2. Block Diagram

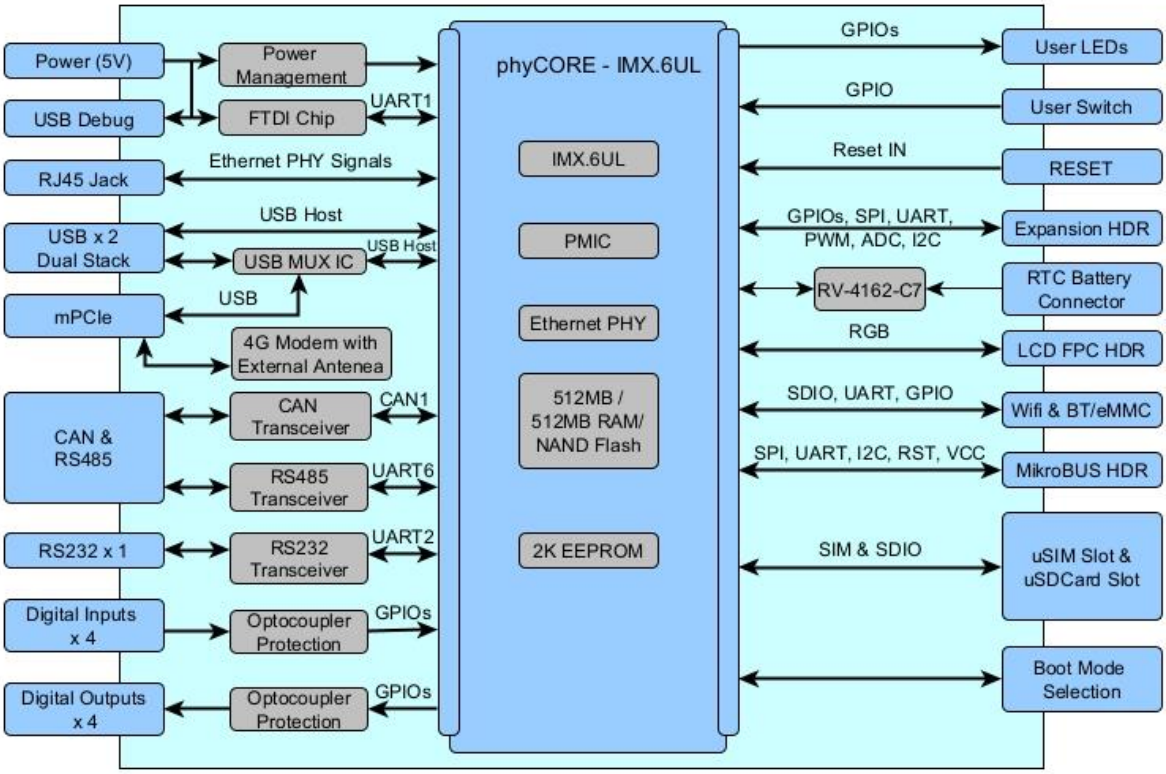


Fig. 2

2.2.Functional Components

This section describes the functional components of the Industrial Rugged Board. Each subsection details a particular connector/interface and associated jumpers for configuring that interface.

2.2.1. Power Supply (P2)

The Industrial Rugged Board is available with two different power supply connectors.

2.2.1.1 Power IN

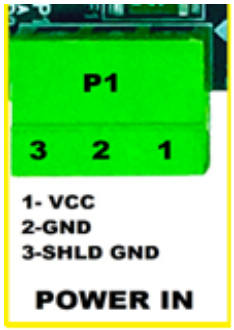


Fig. 3

A 3-pole Phoenix Contact MINI COMBICON base strip 3.5 mm connector (P1) suitable for a single 5 V supply voltage (Fig. 3)

PIN	Signal Name	Description
1	DC_IN	Power supply (5V)
2	GND	Ground
3	SHLD	Shield

Table 3

2.2.1.2 USB PWR / DBG CONSOLE

Fig. 4

A USB Micro-AB connector (P2) to connect a standard 5V USB power supply. (Fig. 4)

PIN NO	SIGNAL NAME	DESCRIPTION
1	DC_IN/USB	VBUS
2	Debug_D_N	DM
3	Debug_D_P	DP
4	ID	ID
5	GND	GND
6,7,8,9,10,11	SH1, SH2, SH3, SH4, SH5, SH6	SHIELD_GND

Table 4

2.2.2 Ethernet (J3)

Fig. 5

Ethernet Connectivity (J3) the Ethernet interfaces of the Industrial Rugged Board are accessible at J3. Figure 6: Ethernet Interface at Connector (J3) Ethernet interface is configured as 10/100Base-T networks. The LEDs for LINK (green) and SPEED (yellow) indication are integrated in the connector. Ethernet transceiver support HP Auto-MDIX, they detect the TX and RX pins of the connected device and automatically configure the PHY TX and RX pins accordingly.

PIN NO	SIGNAL NAME	DESCRIPTION
1	X_ENET1_TX+	TD+
2	X_ENET1_TX	TD-
3	X_ENET1_RX+	RD+
4	Poe_V+/TDCT	PoE_V+
5	Poe_V+/RDCT	PoE_V+
6	X_ENET1_RX	RD-
7	Poe_V-/NC	SHLD
8	Poe_V-/CH_GND	PoE_V-
9	VCC_3V3	LED1-A
10	X_ENET1_LED0	LED1-K
11	X_ENET1_LED1	LED2-K
12	VCC_3V3	LED2-A
13	SHIELD1	SHIELD
14	SHIELD2	SHIELD

Table 5

2.2.3 Secure digital Memory card + SIM (Dual Connector) (J4)

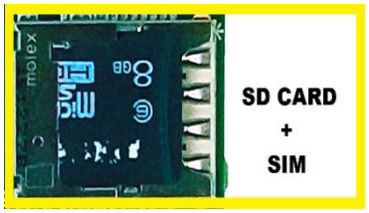


Fig. 6

The Industrial Rugged Board provides a standard micro SDHC card slot at J4 for connection to MMC/SD interface cards. It allows easy and convenient connection to peripheral devices like SD and MMC cards. Power to the SD interface is supplied by inserting the appropriate card into the MMC/SD connector, which features card

detection, a lock mechanism and a smooth extraction function by Push-in/ Push-out of card. DIP switch S4 allows to toggle between NAND boot and boot from SD card.

PIN	SIGNAL NAME	DESCRIPTION
T1	X_SD1_D2	DAT2
T2	X_SD1_D3	DAT3
T3	X_SD1_CMD	CMD
T4	VCC_3V3	VCC
T5	X_SD1_CLK	CLK
T6	GND	GND
T7	X_SD1_D0	DAT0
T8	X_SD1_D1	DAT1
SW	X_UART1_RTS_B_SD_CD	SW1
C1	SIM_VCC	SIM_VCC
C2	SIM_RST	SIM_RST
C3	SIM_CLK	SIM_CLK
C4	SIM_GND	GND
C5	SIM_VPP	SIM_VPP
C6	SIM_IO	SIM_IO
G1 G2 G3 G4 G5 G6 G7 G8	GND	GND

Table.6

2.2.4 RS-232 (P4)

Fig. 7

RS-232 transceivers on the Rugged Board convert the TTL level signals of UART2 from the phyCORE-iMx6ul to RS-232 level signals. Serial Port RS232 (Non-Isolated) and with Full Modem (RTS, CTS). 5 Pin Header: Configured as Full Modem / Half Modem.

PIN NO	Signal Name	DESCRIPTION
1	X_UART2_TX	RS232_TX_1
2	X_UART2_RX	RS232_RX_1
3	GND	GND

4	X_UART2_CTS_B	RS232_TX_2
5	X_UART2_RTS_B	RS232_RX_2

Table 7

2.2.5 DIN and DOUT (0-24V) (P5 and P6)

Fig. 8

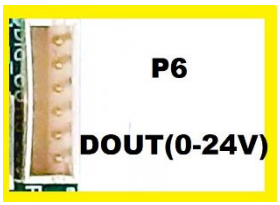


Fig. 9

The Industrial Rugged Board comes with an isolated Digital IOs (0-24V). The Rugged Board provides four digital IOs that are designed for processing DC-signals with up to 24 V DC. The digital output voltage depends on the input voltage of the board. Input and output signals are routed to the CPU (phyCORE-iMx6ul) through two discrete optocouplers for galvanic isolation. Thus, it is possible to write and read the status of every single GPIO of the Rugged Board simultaneously.

 WARNING!	Please consider that the GPIOs do not have a separate current driver on board. In case the GPIOs are used as outputs, the current is self-limited by the output-optocoupler and should not exceed 750mA for each GPIO channel. These outputs are low WARNING! Side outputs.

P5 Connector:

PIN NO	Signal Name	DESCRIPTION
1	X_GPIO5_5	DIN(0-24V) _01
2	X_ENET2_TX_EN_GPIO2_IO13	DIN(0-24V) _02
3	X_GPIO1_1_ADC1_IN1	DIN(0-24V) _03
4	X_JTAG_TMS/SAI2_MCLK	DIN(0-24V) _04
5	DGND_ISO_IN	DGND_ISO_IN

Table 8

P6 Connector:

PIN NO	Signal Name	DESCRIPTION
1	ISO_VCC_IN	ISO_VCC_IN
2	X_JTAG_TDI/SAI2_BCLK	DOUT(0-24V) _04
3	X_JTAG_TDO/SAI2_SYNC	DOUT(0-24V) _03
4	X_nJTAG_TRST/SAI2_TXD	DOUT(0-24V) _02
5	X_JTAG_TCK/SAI2_RXD	DOUT(0-24V) _01
6	DGND_ISO_IN	DGND_ISO_IN

Table 9

2.2.6 USB 2.0 (P7)

Fig. 10

SIGNAL NAME	DESCRIPTION
X_USB_OTG1_VBUS	VBUS
X_USB_OTG_N	DM
X_USB_OTG_P	DP
GND	GND
X_USB_VBUS_OTG2	VBUS 9
USBD_HOST_N	DM 10
USBD_HOST_P	DP 11
GND	GND 12

Table.10

2.2.7 RS-485 (P9)

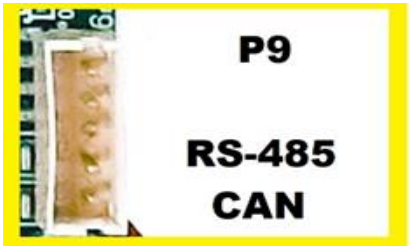


Fig. 11

A), EIA-**485**, is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems.... Digital communications networks implementing the standard can be used effectively over long distances and in electrically noisy environments.

An RS-485 transceiver on the Industrial Rugged Board converts the TTL level signals of UART6 from the phyCORE-iMx6ul to RS-485 level signals. The RS-485 level signals are available at the connector P9. Figure shows a detailed view of the P9 connector.

Refer Table from section 2.2.8 for pinout details.

2.2.8 CAN (P9)

Fig. 12

The Controller Area Network (CAN) bus offers a low-bandwidth, prioritized message fieldbus for serial communication between microcontrollers. It efficiently supports distributed real time control with a high level of security. The DCAN module of the SAMImx6ul implements the CAN protocol according to the CAN 2.0B protocol specification and supports bit rates up to 1 Mbit/s. The CAN interface of the Industrial Rugged Board phyCORE-iMx6ul is connected to the CAN-controller DCAN1 of the phyCORE-iMx6ul SOM. The CAN interface of the Industrial Rugged Board phyCORE-iMx6ul is accessible at the connector P9.

PIN	Signal Name	Description
1	X_UART3_CTS_B_CAN_TX	CANH (CAN)
2	X_UART3_RTS_B_CAN_RX	CANL (CAN)
3	GND	GND
4	X_CSI_PIXCLK_UART6_RX	B (RS485)
5	X_CSI_MCLK_UART6_TX	A (RS485)

Table 11

2.2.9 Expansion Header (P10)

Fig. 13

Expansion connector P10 provides an easy way to add other functions and features to the Industrial Rugged Board Standard interfaces such as UART, SPI and I2 C as well as different supply voltages and some GPIOs are available at the expansion female connector. The expansion connector is intended to add specific functions with custom expansion boards.

The pinout of the expansion connector shown in Table given below:

PIN	Signal Name	DESCRIPTION
1	VCC_3V3	3V3
2	VCC5V_IN	5V_IN
3	VCC_3V3	3V3
4	VCC5V_IN	5V_IN

5	X_GPIO5_1	GPIO5_1
6	VCC5V_IN	5V_IN
7	X_GPIO5_2	GPIO5_2
8	VCC5V_IN	5V_IN
9	X_GPIO5_3	GPIO5_3
10	X_nRESET_IN	Reset IN
11	X_JTAG_TCK/SAI2_RXD	GPIO1_14
12	X_RESET#	External reset
13	GND	Ground
14	X_SPI2_MISO	SPI 2 MISO
15	X_USB_OTG1_VBUS	USB VBUS
16	X_SPI2_MOSI	SPI 2 MOSI
17	X_USB_OTG_N	USB Negative
18	X_SPI2_SCLK	SPI 2 Clock
19	X_USB_OTG_P	USB Positive
20	X_GPIO1_4/PWM3	Pulse width Modulation
21	X_USB_OTG1_ID	USB ID
22	X_CSI_D6_SPI1_SCLK	SPI 1 Clock
23	X_UART3_TX	UART 3 Transmit
24	X_CSI_D9_SPI1_MISO	SPI 1 MISO
25	X_UART3_RX	UART 3 Receive
26	X_CSI_D8_SPI1_MOSI	SPI 1 MOSI
27	X_GPIO1_1_ADC1_IN1	ADC_IN
28	X_I2C1_SCL	I2C 1 Serial Clock
29	X_ENET2_TX_CLK_GPIO	GPIO2_14
30	X_I2C1_SDA	I2C 1 Serial Data
31	X_JTAG_TMS/SAI2_MCL	GPIO1_11
32	X_I2C2_SCL	I2C 2 Serial Clock
33	GND	Ground
34	X_I2C2_SDA	I2C 2 Serial Data
35	X_JTAG_MOD_gpio1_IO10	GPIO1_10
36	GND	Ground

Table 12

2.2.10RTC Battery (P11)

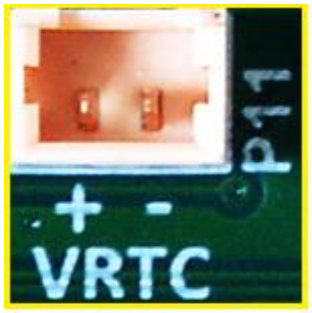


Fig. 14

A **real-time clock** (**RTC**) is a (most often in the form of an) that keeps track of the current.

The Industrial Rugged Board uses RTC for real-time or time driven applications. Please note that if the RTC's interrupt is needed, at expansion connector P11 need to be shortcut (section 3.1). The Industrial Rugged Board is equipped with a Gold Capacitor (placed next to connector P11) which is also intended to back up the external RTC.

PIN No.	Description
1	VCC 3V
2	GND

Table 13

2.2.11 User LED GPIO (D17, D7, D4) & USER Switch(SW1)

Fig. 15

LED GPIO's as shown in the above figure, consists of D7, D4

USER SWITCH (SW) as shown in the above figure.

The Industrial Rugged Board is populated with one LED to indicate the status of the USB VBUS voltages, the power supply voltages, and the RUN/STOP and ERROR.

In Figure 15shows the location of the LEDs. Their functions are listed in Table given below.

PIN	Signal Name	Description
1	X_ENET2_TX_D0_GPIO2_IO11_ULED1	GPIO2_11
2	X_ENET2_TX_D1_GPIO2_IO12_ULED2	GPIO2_12

Table 14

The Industrial Rugged Boards is populated with Single user switch to check the INPUT operation of the board.

PIN	Signal Name	Description
1	X_ENET2_RX_DATA0__GPIO2_IO08	GPIO2_8

Table 15

2.2.12DBG PORT (P13)

Fig. 16

Debug port is a **port** included in a device to simplify development and **debugging** which is not necessary for normal functioning of it. **Debug ports** are usually not removed or disabled.

Debugging facility is also available in Micro USB connector P2.

The table below shows the pin description:

PIN No	Signal Name	Description
1	X_UART1_TX_DBG	UART 1 TX
2	X_UART1_RX_DBG	UART 1 RX
3	GND	Ground

Table 16

2.2.13LCD Connector (P16)

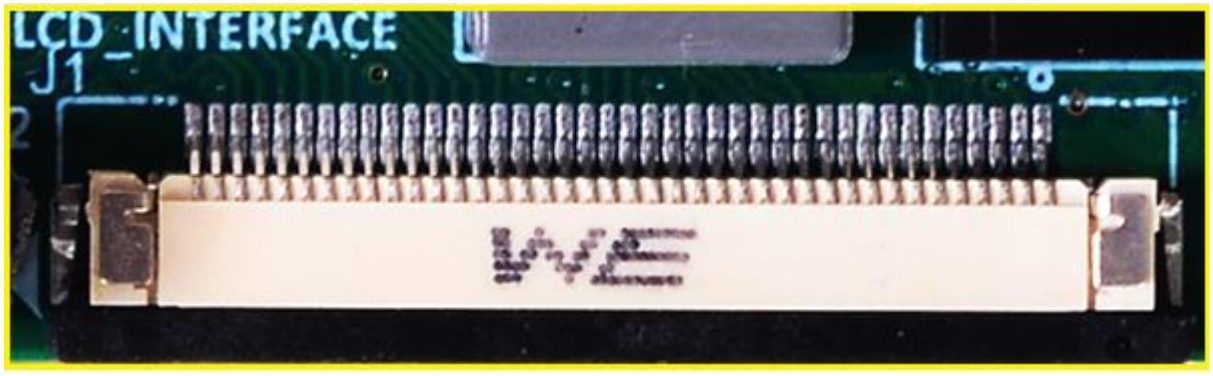


Fig. 17

Meanwhile there are a few RGB displays on the market with kind of standardized interfaces. In the following table is a complete overview of the RGB display connector pin assignment.

PIN No.	Signal Name	DESCRIPTION
1	NC	No Connection
2	X_I2C1_SDA	I2C 1 Serial Data
3	NC	No Connection
4	X_I2C1_SCL	I2c 1 Serial Clock
5	NC	No Connection
6	X_GPIO5_9_CT	GPIO5_9
7	VCC_3V3	3V3
8	VCC_3V3	3V3
9	GND	Ground
10	GND	Ground
11	VCC_3V3	3V3
12	X_SPI2_MOSI	SPI 2 MOSI
13	X_LCD_ENABL	LCD Enable
14	X_LCD_VSYNC	LCD VSYNC
15	X_LCD_HSYNC	LCD HSYNC
16	NC	No Connection
17	X_LCD_CLK	LCD Clock
18	GND	Ground
19	X_SPI2_SSO	SPIO 2 Chip Select
20	X_LCD_D13	LCD Data line 13
21	X_LCD_D14	LCD Data line 14
22	X_LCD_D15	LCD Data line 15
23	X_LCD_D16	LCD Data line 16
24	X_LCD_D17	LCD Data line 17
25	GND	Ground
26	X_LCD_D6	LCD Data line 6
27	X_LCD_D7	LCD Data line 7
28	X_LCD_D8	LCD Data line 8
29	X_LCD_D9	LCD Data line 9
30	X_LCD_D10	LCD Data line 10
31	X_LCD_D11	LCD Data line 11
32	GND	Ground
33	X_SPI2_SCLK	SPI 2 Serial clock
34	X_LCD_D1	LCD Data line 1
35	X_LCD_D2	LCD Data line 2
36	X_LCD_D3	LCD Data line 3
37	X_LCD_D4	LCD Data line 4
38	X_LCD_D5	LCD Data line 5
39	X_RESET#	External Reset
40	X_LCD_RESET	LCD Reset
41	GND	Ground
42	GND	Ground

Table 17

2.2.14mPCIe Connector (P8)

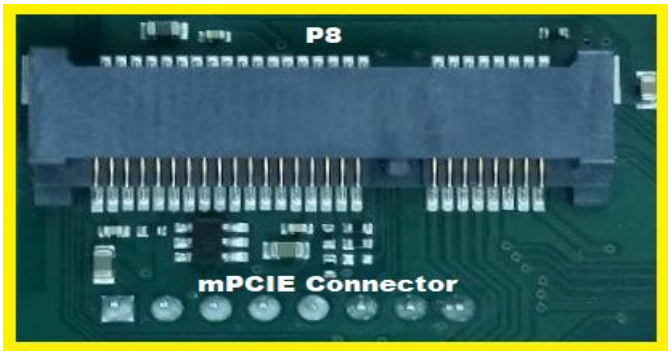


Fig. 18

The mPCIe interface is brought out at the Mini PCIe connector. The SIM/UIM card signals of a connected mPCIe module can be made available at expansion connector. Please refer to Table for more information about the jumper settings. Soldering jumpers allow connecting the USB host interface to the Mini PCIe connector P8 (Table 17). In the following table is a complete overview of the Mini PCI Express connector pin Assignment:

PIN NO	SIGNAL NAME	DESCRIPTION
1	WAKE	VCC_3V3
2	+3.3V_1	VCC_3V3
3	RSVD1	NC
	GND7	GND
5	RSVD2	NC
6	+1.5V_1	NC
7	CLKREQ	NC
8	RSVD13	SIM_VCC
9	GND1	GND
10	RSVD14	SIM_IO
11	REFCLK-	NC
12	RSVD15	SIM_CLK
13	REFCLK+	NC
14	RSVD16	SIM_RST
15	GND2	GND

16	RSVD17	SIM_VPP
17	RSVD3	NC
18	GND8	GND
19	RSVD4	NC
20	RSVD18	VCC_3V3
21	GND3	GND
22	PERST	X_RESET#
23	PER_N0	NC
24	+3.3V_AUX	VCC_3V3
25	PER_P0	NC
26	GND9	GND
27	GND4	GND
28	+1.5V_2	NC
29	GND5	GND
30	SMB_CLK	NC
31	PET_N0	NC
32	SMB_DATA	NC
33	PET_P0	NC
34	GND10	GND
35	GND6	GND
36	USB_D-	USB_mPCIe_N
37	RSVD5	GND
38	USB_D+	USB_mPCIe_P
39	RSVD6	VCC_3V3/GND
40	GND11	GND
41	RSVD7	VCC_3V3/GND
42	LED_WWAN	VCC_3V3
43	RSVD8	GND
44	LED_WLAN	NC
45	RSVD9	NC
46	LED_WPAN	NC
47	RSVD10	NC
48	+1.5V_3	NC
49	RSVD11	NC

50	GND12	GND
51	RSVD12	NC
52	+3.3V_2	VCC_3V3/GND
S1	GNDM1	GND
S2	GNDM1	GND
M1	GNDM3	GND
M2	GNDM4	GND

Table 18

2.2.15 ATWILC3000 (U17) – [Optional Mount]

Fig. 19

ATWILC3000 is a single chip IEEE 802.11 b/g/n RF/Baseband/MAC link controller and Bluetooth 5. The ATWILC1000 connects to Microchip AVR/SMART MCUs, SMART MPUs, and other processors with minimal resource requirements with simple SPI/SDIO-to-Wi-Fi and UART-to Bluetooth interfaces.

The ATWILC3000 supports single stream 1x1 802.11n mode providing tested throughput of up to 46 Mbps UDP & 28 Mbps TCP/IP. The ATWILC3000 features fully integrated Power Amplifier, LNA, Switch and Power Management. Implemented in low-power CMOS technology, the ATWILC3000 offers very low power consumption while simultaneously providing high performance and minimal bill of materials.

The ATWILC3000 utilizes highly optimized 802.11-Bluetooth coexistence protocols. The only external clock sources needed for the ATWILC3000 is a high-speed crystal or oscillator and a 32.768 kHz clock for sleep operation. IEEE 802.11 b/g/n 20MHz (1x1) Wi-Fi plus Bluetooth 5 Low Energy Module Supports Personal & Enterprise IEEE 802.11 WEP, WPA, WPA2 Security, SPI, SDIO, I2C, and UART host interfaces Operating temperature range of -40C to +85C Bluetooth 5 Certified Module is Agency Certified in over 75 Countries.

PIN NO	SIGNAL NAME	DESCRIPTION	PIN OF
1	GND	GND	1
2	GND/SDIO MODE	SDIO/SPI_CFG	2
3	NC	No Connection	3
4	NC	No Connection	4
5	NC	No Connection	5
6	NC	No Connection	6
7	X_RESET#	RESETN	7
8	X_UART5_RX	BT_TXD	8
9	X_UART5_TX	BT_RXD	9
10	uart5_RTS_B	BT_RTS	10
11	uart5_CTS_B	BT_CTS	11
12	VCC_3V3	DVDDIO	12
13	GND	GND	13
14	GPIO3	No Connection	14
15	GPIO4	No Connection	15
16	TP14	UART_TXD	16
17	TP15	UART_RXD	17
18	VCC_3V3	VBAT	18
19	X_GPIO1_18_Wifi_EN	CHIP_EN	19
20	ASH7KW(OUT)	RTC	20
21	GND	GND	21
22	X_LCD_D19_usdhc2_CLK	SD_CLK/GPIO8	22
23	X_LCD_D18_usdhc2_CMD	SD_CMD/SPI_CLK	23
24	X_LCD_D20_usdhc2_DATA0	SD_DATA0SPI_MISO	24
25	X_LCD_D21_usdhc2_DATA1	SD_DAT1/SPI_SSN	25
26	X_LCD_D22_usdhc2_DATA2	SD_DAT2/SPI_MOSI	26
27	X_LCD_D23_usdhc2_DATA3	SD_DAT3/GPIO7	27
28	GND	GND	28
29	GPIO17	No connection	29
30	GPIO18	No Connection	30
31	GPIO19	No Connection	31
32	GPIO20	No Connection	32
33	X_CSI_FIELD_GPIO_3V3	IRQN	33

34	TP11	I2C_SDA_M	34
35	TP9	I2C_SCL_M	35
36	GND	GND	36
37	GND	PADDLE	37

Table 19

2.2.16 Microbus Connector (M1)

Fig. 20

All Industrial Rugged Board has many dual row, 20-pin, 100-mil extension headers. The Industrial Rugged Board has male headers, while the explained Pro-extensions have their female counterparts. The following table provides the pin description of all the connected pins. Info: Not all pins are always connected on all extension headers. The extension headers can have used to connect a variety of Add-On modules to Industrial Rugged Board or to access the pins of the target microcontroller on the Industrial Rugged Board.

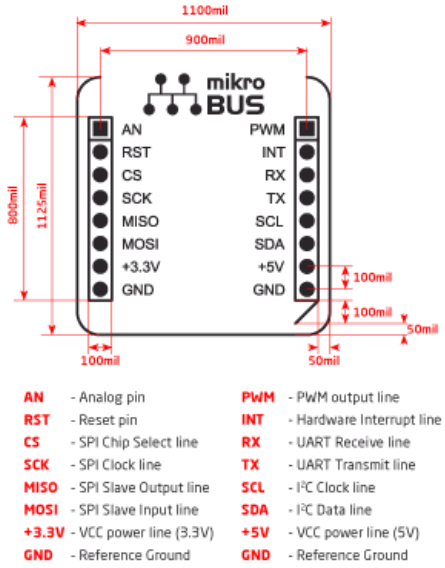


Fig.21

PIN NO	SIGNAL NAME	DESCRIPTION
1	X_GPIO1_3_ADC1_IN3	Analog PIN
2	X_RESET#	RST
3	X_CSI_D7_GPIO_3V3	SPI 1 CS
4	X_CSI_D6_SPI1_SCLK	SPI 1 SCK
5	X_CSI_D9_SPI1_MISO	SPI 1 MISO
6	X_CSI_D8_SPI1_MOSI	SPI 1 MOSI
7	VCC_3V3	3V
8	GND	GND
9	GND	GND
10	VCC5V_IN	5V
11	X_I2C1_SDA	SDA
12	X_I2C1_SCL	SCL
13	X_UART3_TX	UART 3 TX
14	X_UART3_RX	UART 3 RX
15	X_GPIO5_0_INPT	INT(GPIO5_0)
16	X_GPIO1_4/PWM3	PWM 3

Table 20

2.2.17POWER CONSUMPTION TABLE

Peripherals	TEST Scenario	Current Consumption
Board		
USB Slot		
Ethernet		
RTC battery		
CAN		
RS485		
DIN (5V)		
DOUT (5V)		
microbus		
GPIOs		

Table 21

3. Ordering Information:

The part numbering of the phyCORE-iMX6 UL has the following structure:

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