pITX-IOB-2201

User Guide Rev. 1.0

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▶ pITX-IOB-2201 USER GUIDE

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⚠ CAUTION

Handling and operation of the product is permitted only for trained personnel within a work place that is access controlled. Please follow the "General Safety Instructions" supplied with the system.

NOTICE

You find the most recent version of the "General Safety Instructions" online in the download area of this product.

Revision History

Revision	Brief Description of Changes	Date of Issue	Author
1.0	Initial Issue	2022-Oct-01	ykl

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If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact Embedian support. Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user guide on our website.

Symbols

The following symbols may be used in this manual

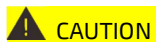|	
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	NOTICE indicates a property damage message.
⚠ CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

ESD Sensitive Device!

This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.

HOT Surface!

Do NOT touch! Allow to cool before servicing.

This symbol indicates general information about the product and the user guide. This symbol also indicates detail information about the specific product configuration.

For Your Safety

Your new Embedian product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Embedian product, you are requested to conform with the following guidelines.
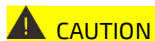
High Voltage Safety Instructions

As a precaution and in case of danger, the power connector must be easily accessible. The power connector is the product's main disconnect device.

⚠ CAUTION

Warning

All operations on this product must be carried out by sufficiently skilled personnel only.

⚠ CAUTION

Electric Shock!

Before installing a non hot-swappable Embedian product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.

Special Handling and Unpacking Instruction

NOTICE

ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

Lithium Battery Precautions

If your product is equipped with a lithium battery, take the following precautions when replacing the battery.

⚠ CAUTION   Danger of explosion if the battery is replaced incorrectly.

> ➢ Replace only with same or equivalent battery type recommended by the manufacturer.

> ➢ Dispose of used batteries according to the manufacturer's instructions.

General Instructions on Usage

In order to maintain Embedian's product warranty, this product must not be altered or modified in any way. Changes or modifications to the product, that are not explicitly approved by Embedian and described in this user guide or received from Embedian Support as a special handling instruction, will void your warranty.

This product should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This also applies to the operational temperature range of the specific board version that must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, only follow the instructions supplied by the present user guide.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the product then re-pack it in the same manner as it was delivered.

Special care is necessary when handling or unpacking the product. See Special Handling and Unpacking Instruction.

Quality and Environmental Management

Embedian aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements.

Disposal and Recycling

Embedian's products are manufactured to satisfy environmental protection requirements where possible. Many of the components used are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.

WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

➢ Reduce waste arising from electrical and electronic equipment (EEE)

➢ Make producers of EEE responsible for the environmental impact of their products, especially when the product become waste

➢ Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE

➢ Improve the environmental performance of all those involved during the lifecycle of EEE

Environmental protection is a high priority with Embedian.

Embedian follows the WEEE directive

You are encouraged to return our products for proper disposal.

Packing List

Your product package should include the items listed below.

If any of the items below is missing, contact the seller from whom you have purchased the product.

Packing List
1 x pITX-IOB-2201

NOTICE	All most update user's manual and software source codes can be downloaded from Embedian's website. No printed or digital CD will be included.

Ordering Information

Part Number	Description
pITX-IOB-2201	Embedian Pico-ITX SBC Expansion Board

Table of Contents

Chapter 1

General Information

The information provided in this chapter includes:

➢ Introduction

➢ pITX-IOB-2201 Expansion Board Goals

➢ Features and Functionality

➢ Product View

➢ Mechanical Drawing

➢ Overall System illustration

Chapter 1 General Information

1.1 Introduction

This document serves as a user manual and technical reference for the EMBEDIAN Pico-ITX SBC expansion board. The manual is intended for use by engineering personnel working with Embedian Pico-ITX SBC. It will be very helpful if developers can refer together with the expansion board schematics.

1.2 pITX-IOB-2201 Expansion Board Goals

pITX-IOB-2201 expansion board is equipped with all mechanical and electrical components necessary for the rapid start-up of Embedian Pico-ITX SBC. The pITX-IOB-2201 is designed for evaluation, testing and prototyping of Embedian Pico-ITX SBC in development environments prior to use in customer designed applications. It can also be used together with Embedian Pico-ITX SBC as an "application ready" *Pico-ITX* single board computer.

The pITX-IOB-2201 Evaluation Carrier is intended to serve multiple needs and summarized as followed:

- Customer evaluation platform.
- Customer design reference.
- Manufacturing test platform.
- Flexible prototyping vehicle
- An "application ready" single board computer. (together with Embedian Pico-ITX SBC)

1.3 Features and Functionality

The pITX-IOB-2201 has the following features for supporting Embedian Pico-ITXSBC. Board key features are:

- Dimension: 146mm x 31mm
- 1 x SPI Header
- 2 x I2C Header
- 1 x pCAP Touch Screen Header
- 1 x USB 2.0 Type A Connector
- 1 x USB 3.0 + 2.0 dual-stacked Type A Connector
- 6 Pos GPIO Terminal Block (-24V-24V)
- 2 x CAN Bus Terminal Block
- 3 x RS232 Terminal Block (up to 1Mbps)
- 1 x RS485 Terminal Block
- EEPROM to store serial number and model number

1.4 Product View

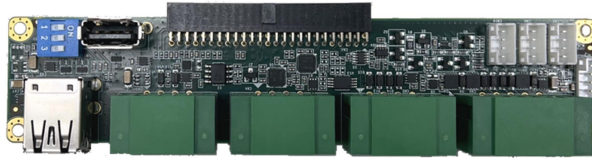Figure 1: pITX-IOB-2201 Product View (Top View)

Figure 2: pITX-IOB-2201 Product View (Front View)

Figure 3: pITX-IOB-2201 Product View (Rear View)

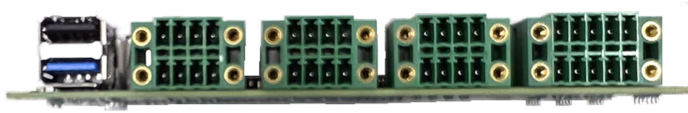Figure 4: pITX-IOB-2201 Product View (back View)

Figure 5: pITX-IOB-2201 Product View (bottom View)

1.5 Mechanical Drawing

Overall system mechanical drawings are shown in the following figures.
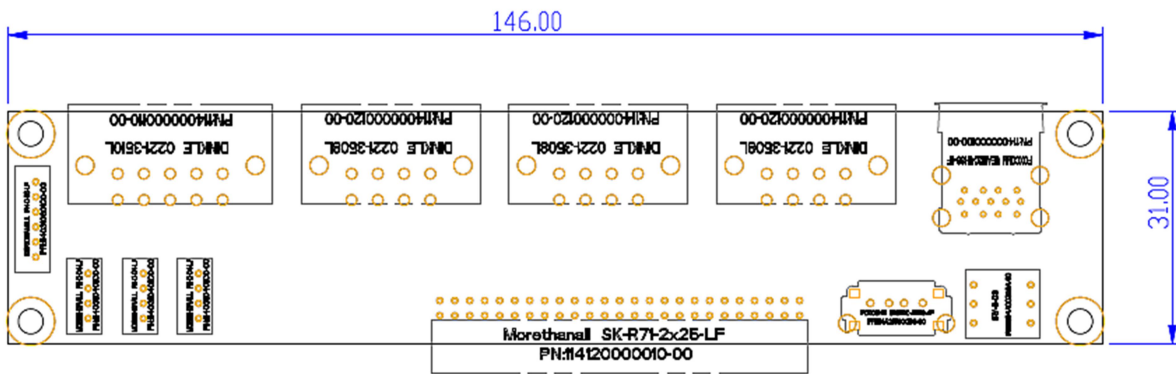
Figure 6: Mechanical Drawing (Top View)

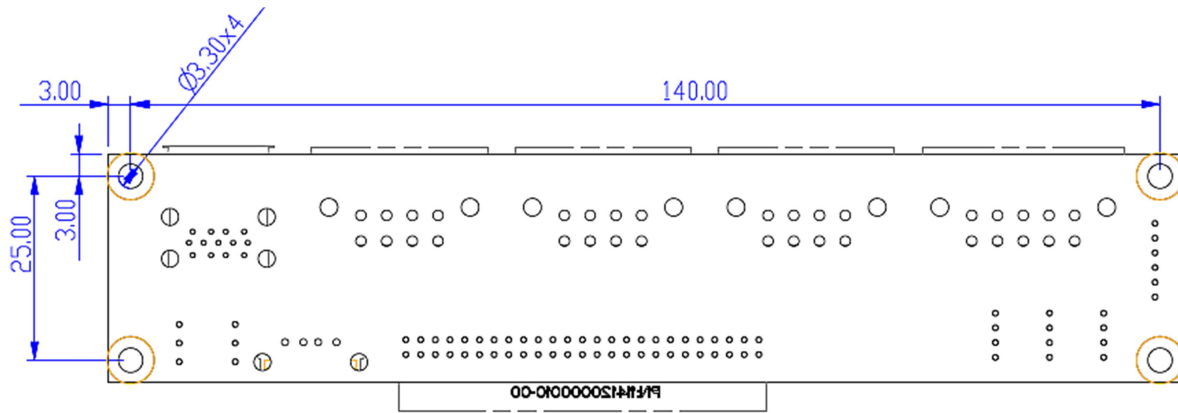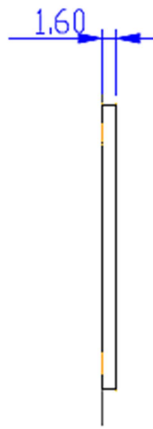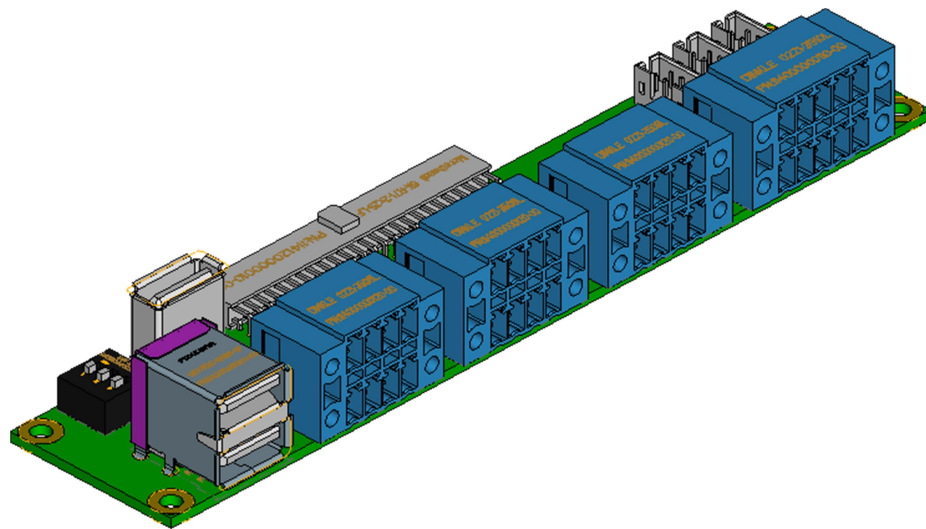Figure 7: Mechanical Drawing (Bottom View)
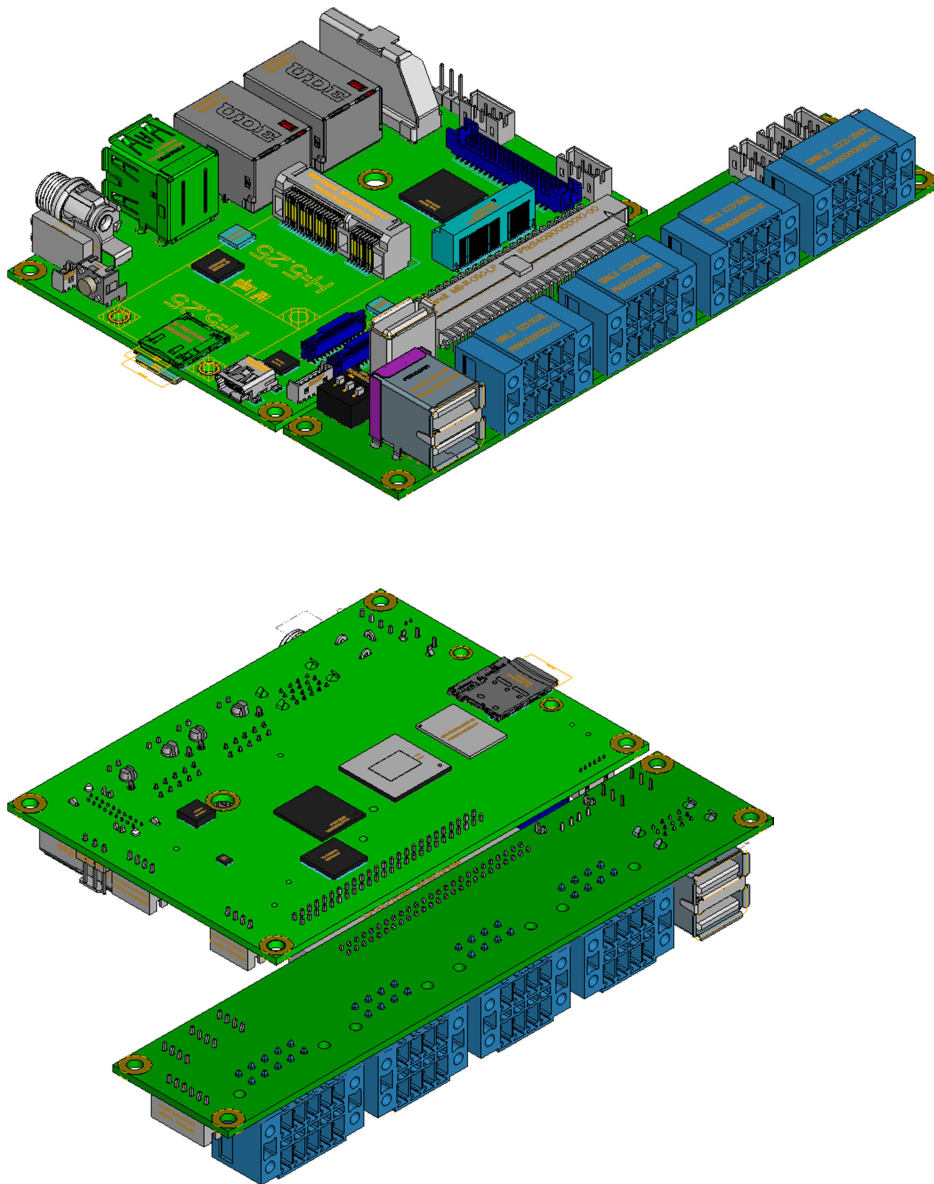
Figure 8: Mechanical Drawing (Side View)

3D .stp or .igs model are available from Embedian's website.

1.6 Overall System illustration

Overall system illustration that combines Embedian Pico-ITX SBC and pITX-IOB-2201 expansion board is shown below.

Figure 9: Overall System Illustration

Chapter 2

EIO50 Connector

This Chapter gives EIO50 connector detail information. Section includes:

➢ Connector Locations

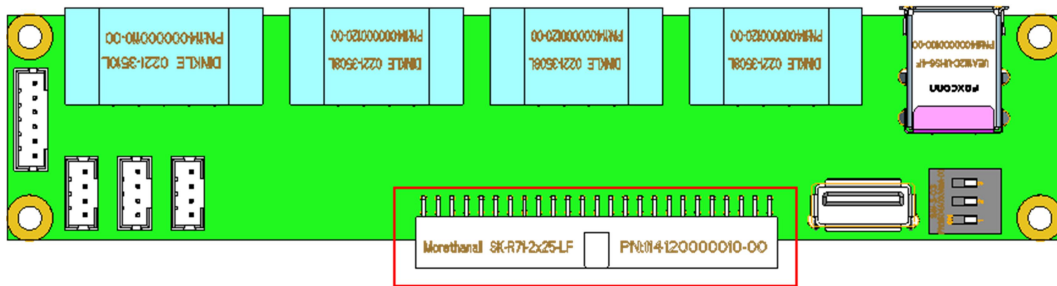➢ Connector Pin Assignments

Chapter 2 EIO50 Connector

A 50-pin 90-degree 2.00mm box female header EIO50 expansion connector is implemented on pITX-IOB-2201 expansion board. It is used to interface the signals from Embedian Pico-ITX SBC and extend more IO functions like RS232, RS485, CAN, USB, GPIOs, capacitive touch and SPI devices.
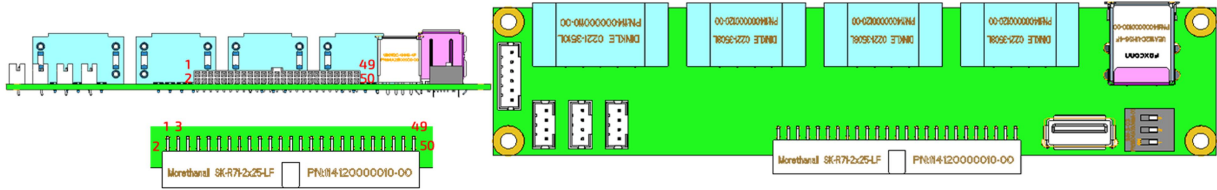
2.1 Connector Locations

Figure 10 Connector Locations

2.2 Connector Pin Assignments

Figure 11 Connector Pin Assignments

EIO50: EIO50 expansion Connector (Connector: 2 row 2.00mm 2x25 box female header)

pin	Signal	Description
1	CAN1_TXD	CAN1 Transmit Output
2	GND	Ground
3	CAN1_RXD	CAN1 Receive input
4	UART1_TXD	Transmit Data Output
5	CAN2_TXD	CAN2 Transmit Output
6	UART1_RXD	Receive Data Input
7	CAN2_RXD	CAN2 Receive input
8	+12V	+12V Power Supply
9	+3.3V	+3.3V Power Supply
10	UART1_RTS#	Request to Send handshake line
11	SPI_MOSI	SPI Master Data output (output from CPU, input to SPI device)
12	UART1_CTS#	Clear to Send handshake line
13	SPI_MISO	SPI Master Data input (input to CPU, output from SPI device)
14	TS_RST#	Capacitive Touch Reset Pin
15	SPI_SCLK	SPI Master Clock output
16	UART2_TXD	Transmit Data Output
17	SPI_SS0#	SPI Master Chip Select 0 output
18	UART2_RXD	Receive Data Input
19	OUT1	GPO1
20	TS_INT#	Capacitive Touch Interrupt Pin
21	USB1_D+	differential USB 2.0 data+
22	UART3_TXD	UART Transmit Data Output[Note1]
23	USB1_D-	differential USB 2.0 data-
24	UART3_RXD	UART Receive Data Input[Note1]
25	GND	Ground
26	GND	Ground
27	USB2_D+	differential USB 2.0 data+

pin	Signal	Description
28	UART4_TXD	UART Transmit Data Output[Note1]
29	USB2_D-	differential USB 2.0 data-
30	UART4_RXD	UART Receive Data Input[Note1]
31	+5V_USB12	USB 5V Power Distribution to downstream device for USB1/USB2
32	+5V	+5V Power Supply
33	USB3_D+	USB2.0 differential data+ from i.MX8M Plus USB1[Note3]
34	I2C1_SCL	I2C1 Clock
35	USB3_D-	USB2.0 differential data-
36	I2C1_SDA	I2C1 Data
37	OUT2	GPO2
38	I2C2_SCL	I2C2 Clock
39	USB3_SS_TX+	USB3.0 differential transmit data+
40	I2C2_SDA	I2C2 Data
41	USB3_SS_TX-	USB3.0 differential transmit data-
42	GND	Ground
43	GND	Ground
44	OUT3	GPO3
45	USB3_SS_RX+	USB3.0 differential receive data+
46	IN1	GPI1
47	USB3_SS_RX-	USB3.0 differential receive data-
48	IN2	GPI2
49	+V5_USB3	USB3 5V Power Distribution to downstream device for USB3
50	IN3	GPI3

Chapter 3

Headers and Connectors

This Chapter gives detail information of header and connectors. Section includes:

➢ Header and Connector Locations

➢ List of Headers and Connectors

➢ Header and Connector Pin Assignments

Chapter 3 Headers and Connectors

Headers and connectors of pITX-IOB-2201 are described in this section.

3.1 Header and Connector Locations

Figure 12 Header and Connector Locations
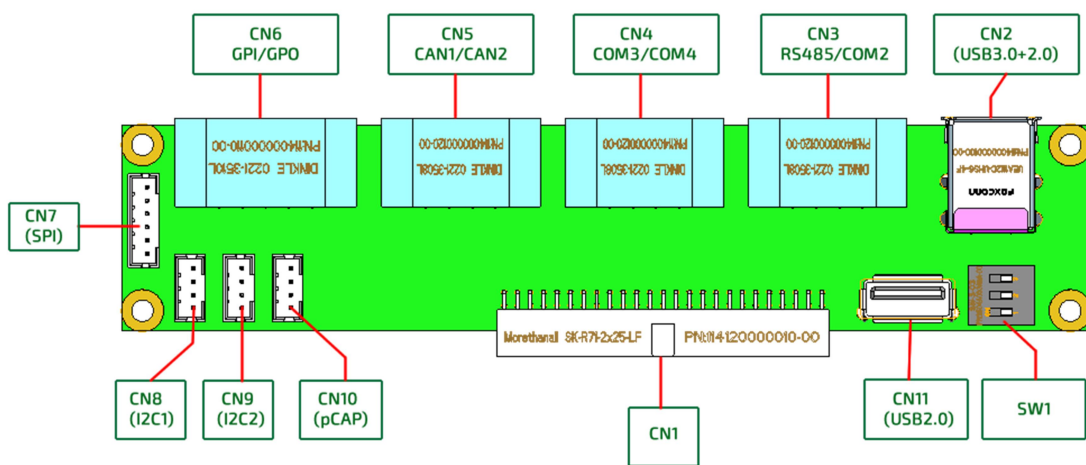
3.2 List of Header and Connectors

The table below lists the function of various connectors.

Reference	Location	Description
EIO50	CN1	50-pin 2.00mm expansion female header
USB3.0+USB2.0	CN2	USB 3.0 + 2.0 Type A Dual-Stacked Connector
RS485+COM2	CN3	RS485 and COM2 Terminal Block
COM3+COM4	CN4	COM3 and COM4 Terminal Block
CAN1+CAN2	CN5	CAN1 and CAN2 Terminal Block
GPI+GPO	CN6	GPI and GPO Terminal Block
SPI	CN7	6-pin 2.00mm box header
I2C1	CN8	4-pin 2.00mm box header
I2C2	CN9	4-pin 2.00mm box header
pCAP	CN10	4-pin 2.00mm box header for reset and interrupt of capacitive touch panel
USB2.0	CN11	USB2.0 type-A vertical
SW1	SW1	DIP Switch for RS485 and CAN 120 Ohm Termination

3.3 Header and Connector Pin Assignments

3.3.1 CN2 (USB3.0+2.0 dual-stacked type A)

pITX-IOB-2201 board supports one dual-stacked USB3.0+2.0 type A connector.

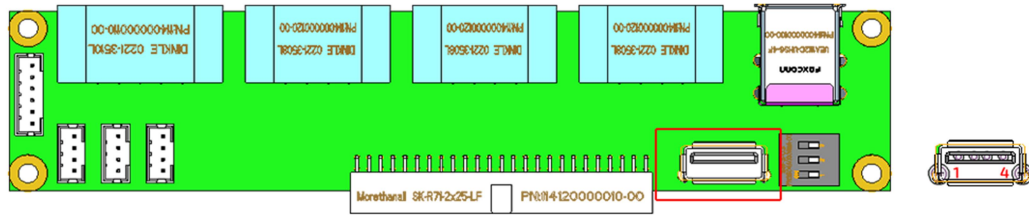Figure 13 Dual-Stacked USB 3.0+2.0 Type A Connector
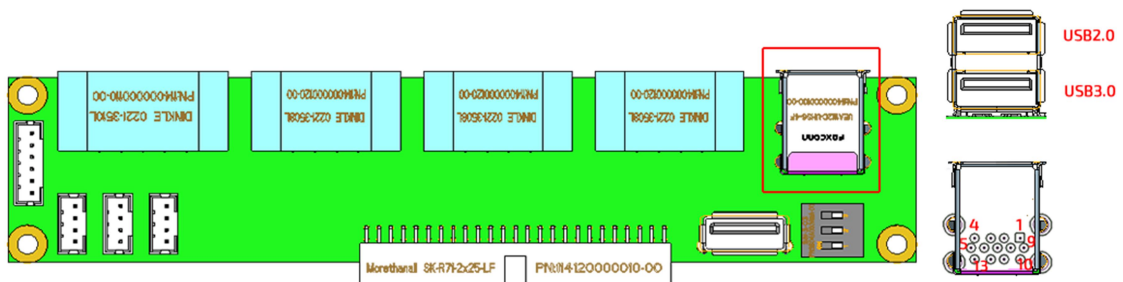
pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V5_USB3_OUT	PWR		USB3 5V Power Distribution to downstream device.
2	USB3_Z_D-	BIDIR	35	USB3 differential USB 2.0 data-.
3	USB3_Z_D+	BIDIR	33	USB3 differential USB 2.0 data+.
4	GND	PWR		Ground
5	USB3_Z_SS_RX-	INPUT	47	USB3 differential USB 3.0 receive data-.
6	USB3_Z_SS_RX+	INPUT	45	USB3 differential USB 3.0 receive data+.
7	GND	PWR		Ground
8	USB3_Z_SS_TX-	OUTPUT	41	USB3 differential USB 3.0 transmit data -.
9	USB3_Z_SS_TX+	OUTPUT	39	USB3 differential USB 3.0 transmit data +.
10	+V5_USB2_OUT	PWR		USB2 5V Power Distribution to downstream device.
11	USB2_Z_D-	BIDIR	29	USB2 differential USB 2.0 data-.
12	USB2_Z_D+	BIDIR	27	USB2 differential USB 2.0 data+.
13	GND	PWR		Ground

3.3.2 CN11 (USB2.0 Type A Vertical)

pITX-IOB-2201 board supports one USB 2.0 type A vertical connector.

Figure 14 USB 2.0 Type A Vertical Connector

pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V5_USB1_OUT	PWR		USB1 5V Power Distribution to downstream device.
2	USB1_Z_D-	BIDIR	23	USB1 differential USB 2.0 data-.
3	USB1_Z_D+	BIDIR	21	USB1 differential USB 2.0 data+.
4	GND	PWR		Ground

3.3.3 CN7 (SPI)

pITX-IOB-2201 supports one SPI instance that allows users to connect SPI devices.

Figure 15 SPI Connector
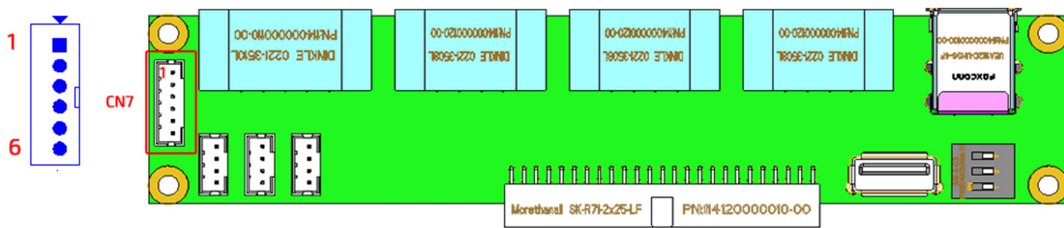
pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V3.3_OUT	PWR		SPI 3.3V Power
2	SPI_SCLK	OUTPUT	15	SPI Master Clock Output
3	SPI_MOSI	OUTPUT	11	SPI Master Data Output
4	SPI_MISO	INPUT	13	SPI Master Data Input
5	SPI_CS#	OUTPUT	17	SPI Master Chip Select output,
6	GND	PWR		Ground

3.3.4 CN8 (I2C1)

pITX-IOB-2201 supports two I2C instances I2C1 and I2C2 at 3.3V VDD. I2C1 also connects to an EEPROM at slave address 0x57.

Figure 16 I2C1 Connector
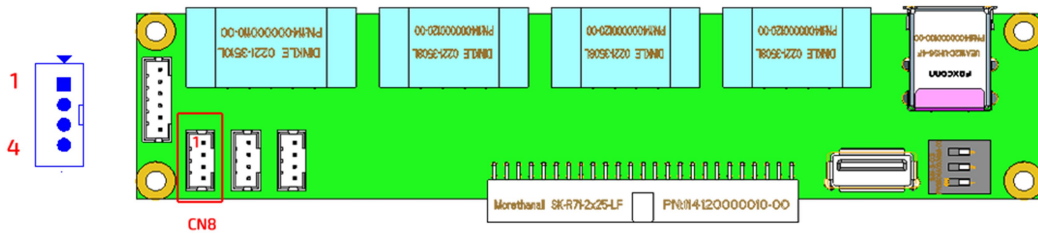
pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V3.3_OUT	PWR		I2C1 3.3V Power
2	I2C1_SCL	BIDIR	34	I2C1 Clock
3	I2C1_SDA	BIDIR	36	I2C1 Data
4	GND	PWR		Ground Power

3.3.5 CN9 (I2C2)

I2C2 location and pinouts are described as follows.

Figure 17 I2C2 Connector
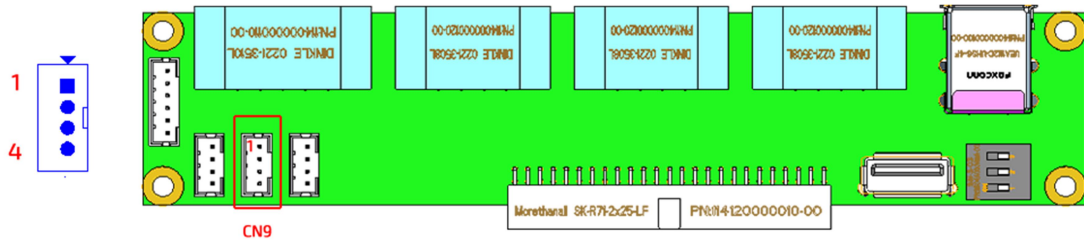
pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V3.3_OUT	PWR		I2C2 3.3V Power
2	I2C2_SCL	BIDIR	38	I2C2 Clock
3	I2C2_SDA	BIDIR	40	I2C2 Data
4	GND	PWR		Ground Power

3.3.6 CN10 (pCAP)

Capacitive touch panel usually requires a reset and interrupt signals in addition to i2c bus. CN10 gives a reset and interrupt GPIO.

Figure 18 pCAP Connector
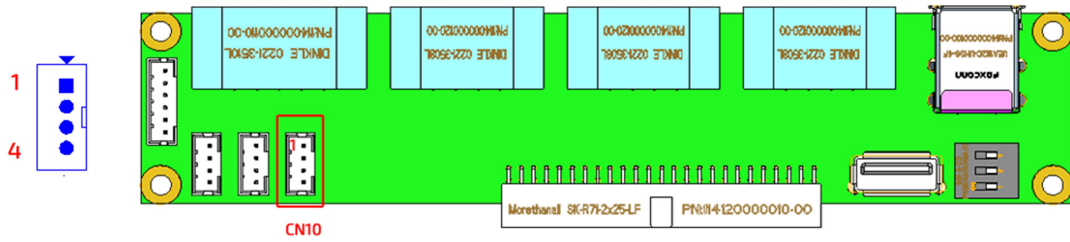
pin	Signal	Assignment	EIO50 Pin Mapping	Description
1	+V3.3_OUT	PWR		3.3V Power
2	TS_RST#	OUTPUT	14	Capacitive Touch Reset Pin
3	TS_INT#	INPUT	20	Capacitive Touch Interrupt Pin
4	GND	PWR		Ground Power

3.3.7 CN3 (RS485+COM2)

CN3 (RS485 + COM2) detail information is described in this section. A 4 Pos 3.5mm terminal block is used. The malting plug is Phoenix Contact P/N FMC15/4-STF-35 or compatible.
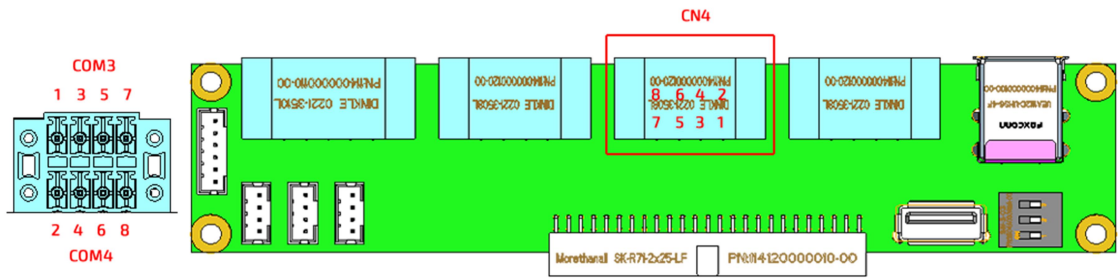
Figure 19 CN3 (RS485+COM2) Connector
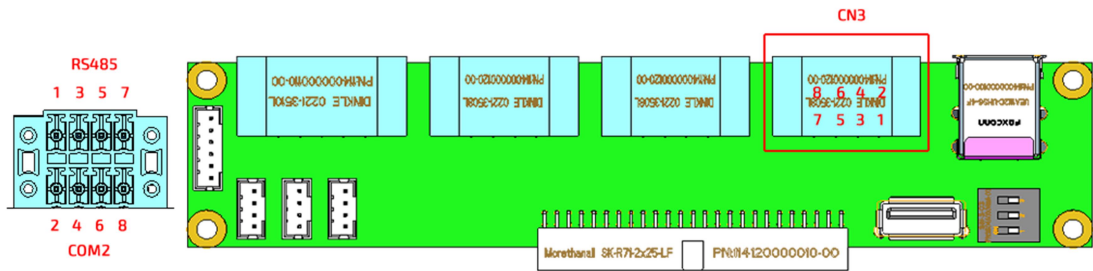
pin	RS485			pin	COM2 (RS232)		
	Signal	EIO50 Pin Mapping	Description		Signal	EIO50 Pin Mapping	Description
1	GND		Ground Power	2	GND		Ground Power
3	RS485_D-	6	RS485 Data-	4	COM2_RXD	18	COM2 Receive Data
5	RS485_D+	4	RS485 Data+	6	COM2_TXD	16	COM2 Transmit Data
7	+V5_OUT		5V Power	8	+V5_OUT		5V Power

3.3.8 CN4 (COM3+COM4)

CN4 (COM3 + COM4) detail information is described in this section. A 4 Pos 3.5mm terminal block is used. The malting plug is Phoenix Contact P/N FMC15/4-STF-35 or compatible.
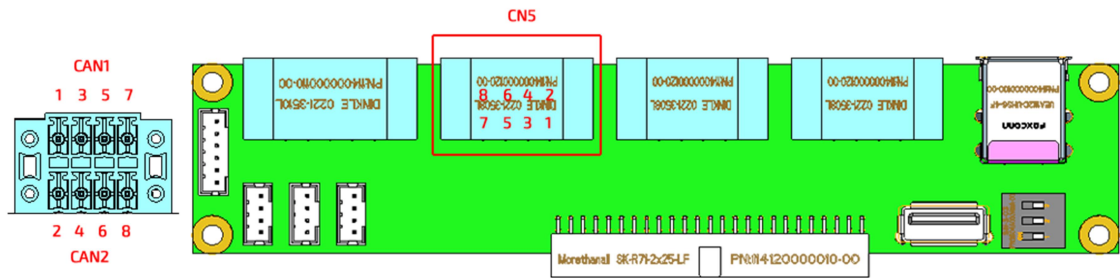
Figure 20 CN4 (COM3+COM4) Connector

pin	COM3 (RS232)			pin	COM4 (RS232)		
	Signal	EIO50 Pin Mapping	Description		Signal	EIO50 Pin Mapping	Description
1	GND		Ground Power	2	GND		Ground Power
3	COM3_RXD	24	COM3 Receive Data	4	COM4_RXD	30	COM4 Receive Data
5	COM3_TXD	22	COM3 Transmit Data	6	COM4_TXD	28	COM4 Transmit Data
7	+V5_OUT		5V Power	8	+V5_OUT		5V Power

3.3.9 CN5 (CAN1+CAN2)

CN5 (CAN1 + CAN2) detail information is described in this section. A 4 Pos 3.5mm terminal block is used. The malting plug is Phoenix Contact P/N FMC15/4-STF-35 or compatible.
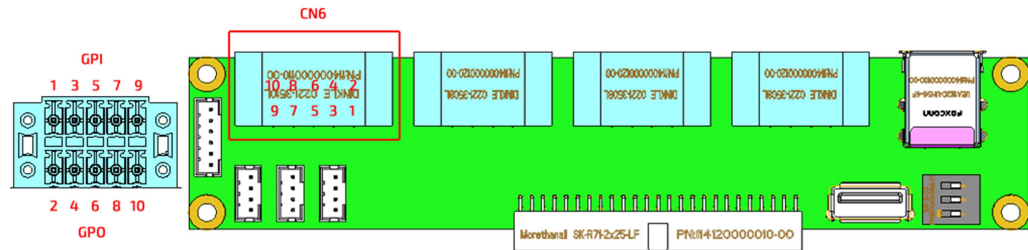
Figure 21 CN5 (CAN1+CAN2) Connector

pin	CAN1			pin	CAN2		
	Signal	EIO50 Pin Mapping	Description		Signal	EIO50 Pin Mapping	Description
1	GND		Ground Power	2	GND		Ground Power
3	CAN1_D-	3	CAN1 Signal Low	4	CAN2_D-	7	CAN2 Signal Low
5	CAN1_D+	1	CAN1 Signal High	6	CAN2_D+	5	CAN2 Signal High
7	+V5_OUT		5V Power	8	+V5_OUT		5V Power

3.3.10 CN6 (GPI+GPO)

CN6 (GPI + GPO) detail information is described in this section. A 5 Pos 3.5mm terminal block is used. The malting plug is Phoenix Contact P/N FMC15/5-STF-35 or compatible.

The GPIOs are designed in opposite polarity and are designed as an open drain (Note: not push pull). When served as input pins, 2.5V-24V will be treated as one state and -24V-1V will be treated as the other state. If input voltage between 1-2.5V, it will be treated as unknown state. When served as output pin, the working voltages are 3.3V-24V@20mA and sink rate is 24V 20mA. A pull-up is necessary at the device side when serve as output function (open-drain without pull-up).

Figure 22 CN6 (GPI + GPO) Connector

pin	CAN1			pin	CAN2		
	Signal	EIO50 Pin Mapping	Description		Signal	EIO50 Pin Mapping	Description
1	GND		Ground Power	2	GND		Ground Power
3	EXT_IN1#	46		4	EXT_OUT1#	19	
5	EXT_IN2#	48		6	EXT_OUT2#	37	
7	EXT_IN3#	50		8	EXT_OUT3#	44	
9	+V12_DIO		12V Power	10	+V12_DIO		12V Power

3.3.11 SW1

SW1 offers 120 ohm termination for RS485, CAN1 and CAN2 when switch to ON. Defaults are set to ON. Switch to OFF if users do not need terminations.

Figure 23 SW1 DIP Switch
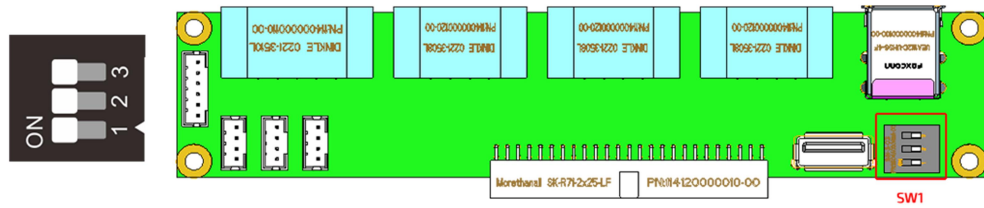
port	Function	ON/OFF	Description
1	RS485	ON	120 ohm termination
2	CAN1	ON	120 ohm termination
3	CAN2	ON	120 ohm termination