RAK19001 Quick Start Guide

This guide introduces the RAK19001 WisBlock Base Board and how to use it.

Prerequisite

What Do You Need?

Before going through each and every step on using the RAK19001 WisBlock Base Board, make sure to prepare the necessary items listed below:

Hardware

- RAK19001 WisBlock Dual IO Base Board
- Your choice of WisBlock Core
- Your choice of WisBlock Modules .
  It is highly recommended to also check the dedicated quick start guide that you can follow on various WisBlock Modules. Each quick start guide of these modules contains the detailed steps on how to open the example codes and upload them to the WisBlock Core.
- Li-Ion/LiPo battery (optional)
- Solar charger (optional)
- Type-C USB cable for programming and debugging

Software

Based on the choice of the WisBlock Core, select a Development Environment:

Programming via Arduino IDE

- RAKwireless BSP support for Arduino
  In Arduino IDE, once you installed the BSP, the examples for WisBlock Core will be automatically included on the list of examples.

Programming via PlatformIO IDE:

- RAKwireless WisBlock modules in PlatformIO

Product Configuration

Overview

To give you a better understanding of how the WisBlock Base works, the block diagram RAK19001 is provided in this section.

Block Diagram

The block diagram shown in **Figure 1** shows the internal architecture and external interfaces of the RAK19001 board.

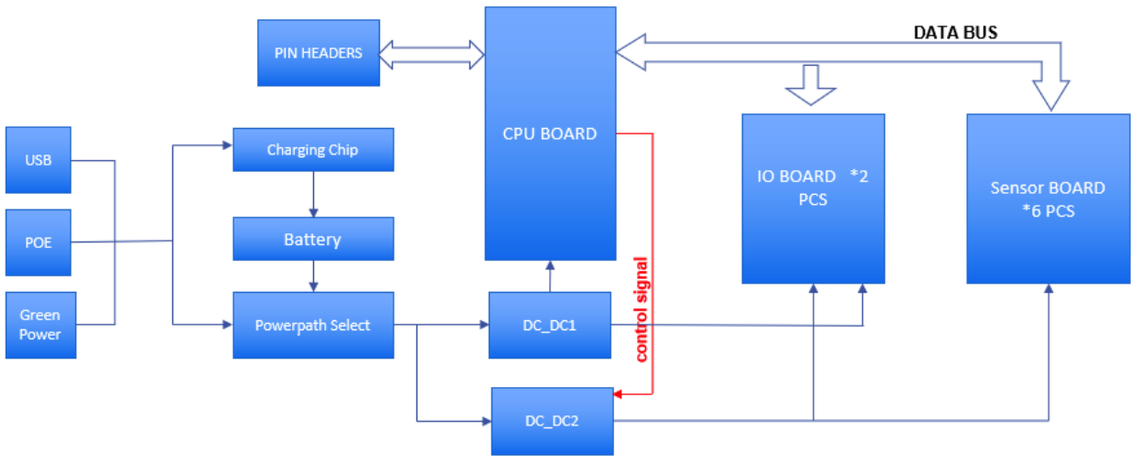


Figure 1: RAK19001 WisBlock Base block diagram

The MCU in the WisBlock Core module offers the I2C, UART, and SPI data buses to the sensor and IO modules. Through these buses, the MCU can control and retrieve data from the sensors. The RAK19001 WisBlock Base board connects all these modules.

The RAK19001 is designed to be powered by either rechargeable or non-rechargeable battery. The rechargeable battery it supports is Li-Ion and provides the necessary charger IC on-board. The charger circuitry can be connected to a wall outlet charger through the Type-C USB connector or via the solar panel connector.

A high-efficiency step-down converter with a low quiescent current is used for generating 3.3 V. This 3.3 V power supply drives the consumption of the WisBlock Core module and the sensor modules.

3V3_S is another 3.3 V power supply, it can be controlled by the MCU to disconnect the power to the sensor and interface modules during idle periods. 3V3_S is controlled by an IO2 pin on the WisBlock Core board.

- Set **IO2=1**, 3V3_S is on.
- Set **IO2=0**, 3V3_S is off.

Hardware Setup

RAK19001 WisBlock Base Board Installation Guide

RAK19001 WisBlock Base Board is the main board that allows you to attach MCU, sensors, and IO modules through the standardized expansion connectors. These connectors provide a data bus interconnection between the modules attached to the RAK19001 Base Board.

This guide shows the details related to the installation of modules into the RAK19001 Base board.

Attaching a WisConnector

The WisConnector is the interface between the RAK19001 module and the WisBlock Core, Sensor, and IO modules. Before connecting these modules, read the following instructions:

> 📝 **NOTE:**
>
> This guide uses two arrows. Refer to **Figure 2** for its representation.

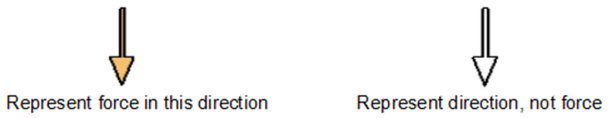


Figure 2: Notation within the guide

1. Align the connectors. Keep the header parallel and place it lightly in the corresponding lap joint of the socket.

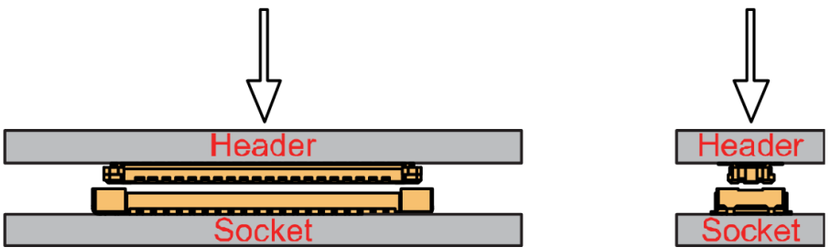


Figure 3: Alignment of WisConnector

2. Fit the connector. Tilt one end of the connector (header) less than 20 degrees, while do not apply force during this process, gently place the other end in parallel.

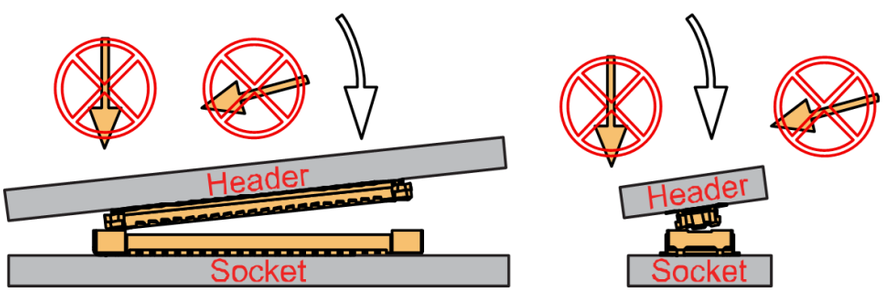


Figure 4: Fit the WisConnector's header inside of the socket

3. After the above alignment steps, the header and socket are matched but still not buckled.

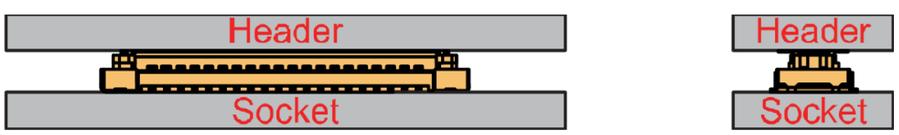


Figure 5: WisConnector's header matched inside of the socket

4. Apply forces evenly by pressing in parallel, then there will be a sound confirming the completion of the buckling.

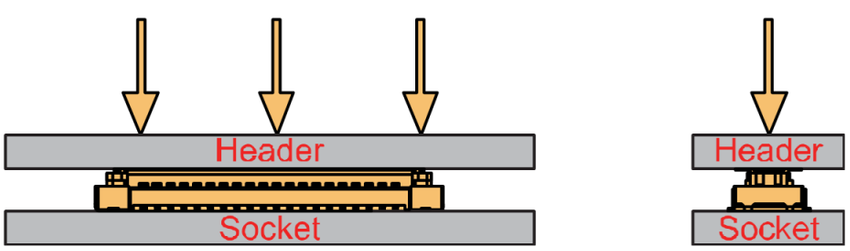


Figure 6: Apply forces to buckle the heard to the socket

5. In the process of buckling and applying force, avoid the application of uneven force on both sides.

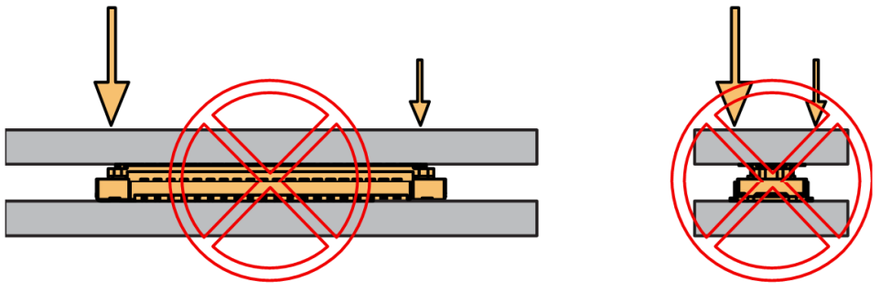


Figure 7: Avoid applying uneven forces

6. When the buckling process is completed, check that the header and socket are kept in parallel.

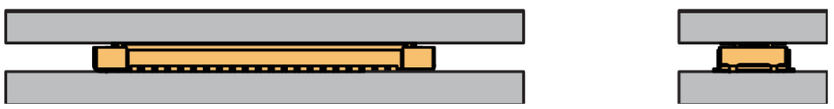


Figure 8: Correct way to buckle the WisConnector's header to the socket

7. If after buckling, the header and socket are not in a parallel state (not fully assembled in one place), then press the even force on both sides of the long side to complete the correct buckling.

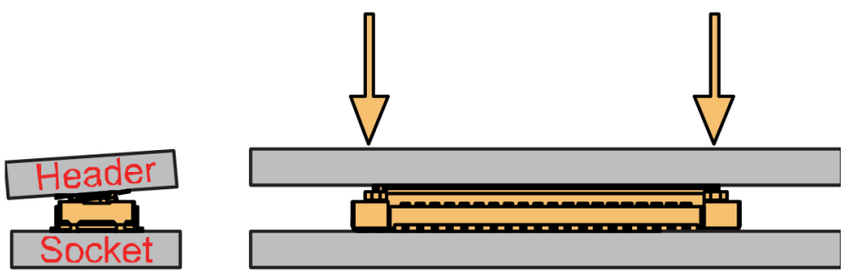


Figure 9: WisConnector's header is not parallel to the socket

8. When the aforementioned steps are not completed yet, do not apply force to buckle. Otherwise, there will be a risk to damage the connector. When the connector cannot be smoothly buckled down, repeat the alignment step.

Detaching a WisConnector

1. To disconnect the header from the socket, pull out in parallel with even forces.

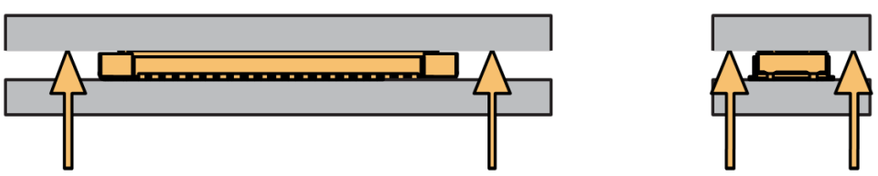


Figure 10: Correct way: Applying even forces to detach the header from the socket

2. Avoid pulling out the header asymmetrically in the long-side direction.

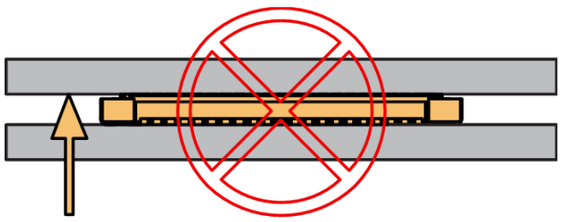


Figure 11: Wrong way: Applying uneven forces to detach the header from the socket

3. The short-side of the connector can be pulled out asymmetrically, but apply the force vertically and avoid rotating the header.

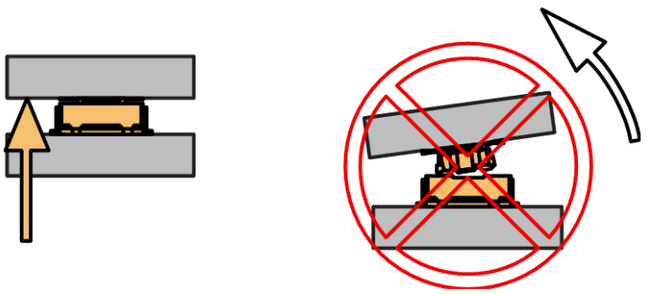


Figure 12: Wrong way: Do not rotate the header

4. Avoid applying forces in a single corner.

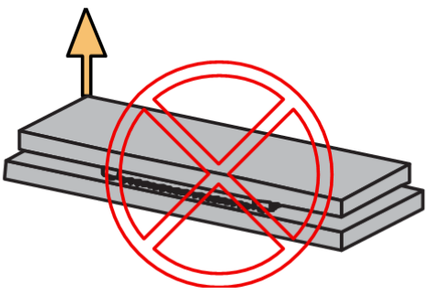


Figure 13: Wrong way: Do not apply force in a single corner of the header

Assembling a WisBlock Module

WisBlock Core

A WisBlock Core module is designed to be installed on the CPU slot of the RAK19001 Base Board. As shown in **Figure 14**, the location is properly marked by silkscreen. Follow carefully the procedure defined in attaching a WisConnector section in order to attach a Core module. Once attached, fix the module with one or more pieces of M1.2 x 3 mm screws depending on the WisBlock Core.

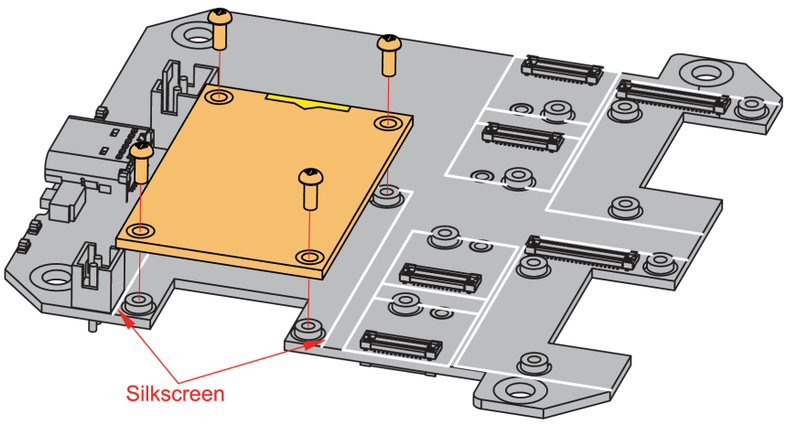


Figure 14: WisBlock Core silkscreen on the RAK19001 Base Board

WisBlock Sensor

A WisBlock Sensor module is designed to be installed on the sensor slot of the RAK19001 Base Board. There are six (6) available sensor slots in the RAK19001 Base Board. As shown in **Figure 15**, the location of the slots is properly marked by silkscreen. Follow carefully the procedure of the section, attaching a WisConnector, to attach a WisBlock Sensor module. Once attached, fix the module with an M1.2 x 3 mm screw.

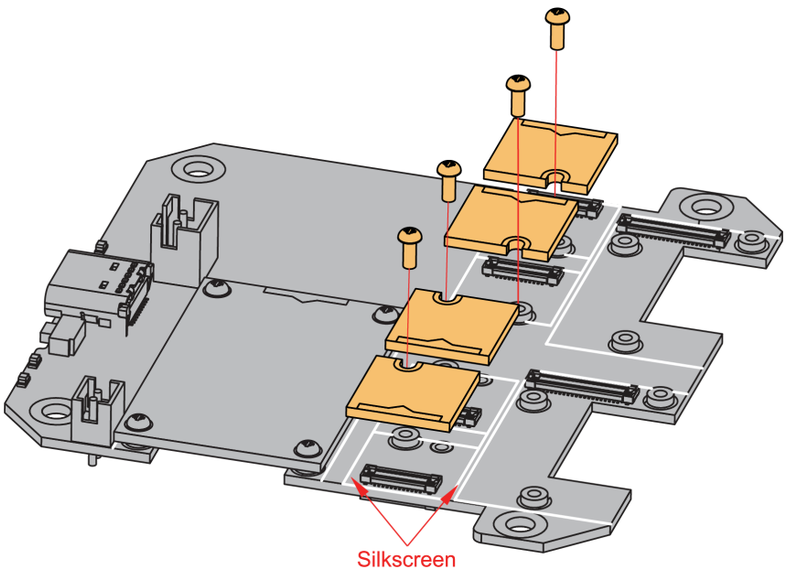


Figure 15: WisBlock Sensor silkscreen on the RAK19001 Base Board

WisBlock IO

A WisBlock IO module is designed to be installed on the IO slot of the RAK19001 Base Board. There are two (2) IO slots in the RAK19001 Base Board. As shown in **Figure 16**, the location is properly marked by silkscreen. Follow carefully the procedure of the section, attaching a WisConnector, to attach a WisBlock IO module. Once attached, fix the module with three pieces of M1.2 x 3 mm screws.

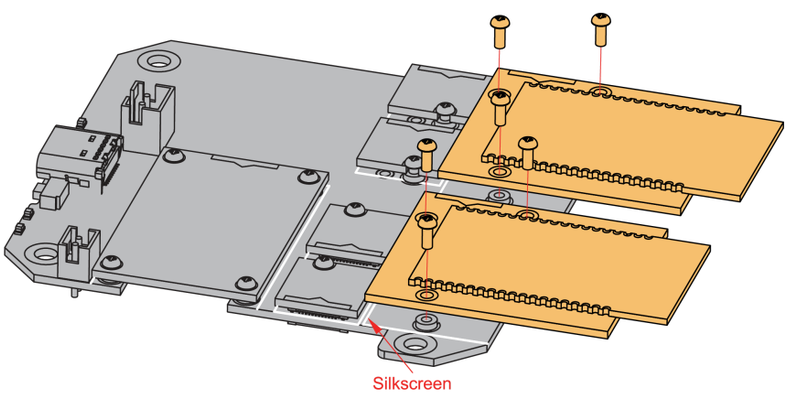


Figure 16: WisBlock IO silkscreen on the RAK19001 Base Board

Disassembling a WisBlock Module

1. The procedure to disassemble any type of WisBlock modules is the same. As shown in **Figure 17**, first, remove the screws.

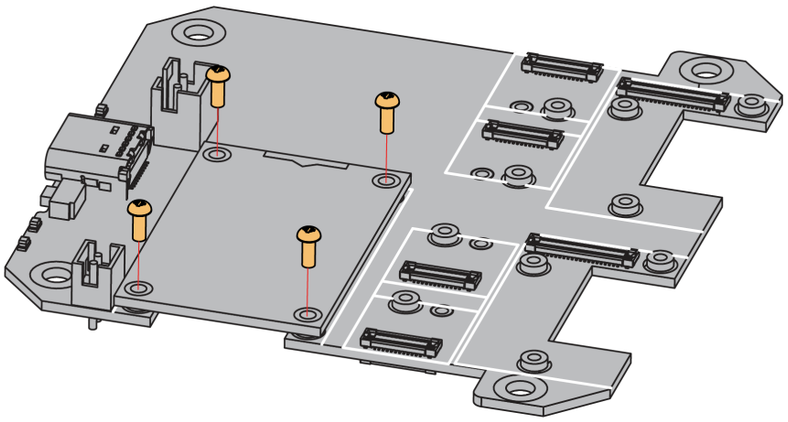


Figure 17: Removing screws from the WisBlock module

2. Once the screws are removed, on the PCB of a WisBlock module, there is a silkscreen that shows the correct location where force can be applied. By applying even force under the marked area, the module can be detached from the Base Board. See **Figure 18** and **Figure 19**.

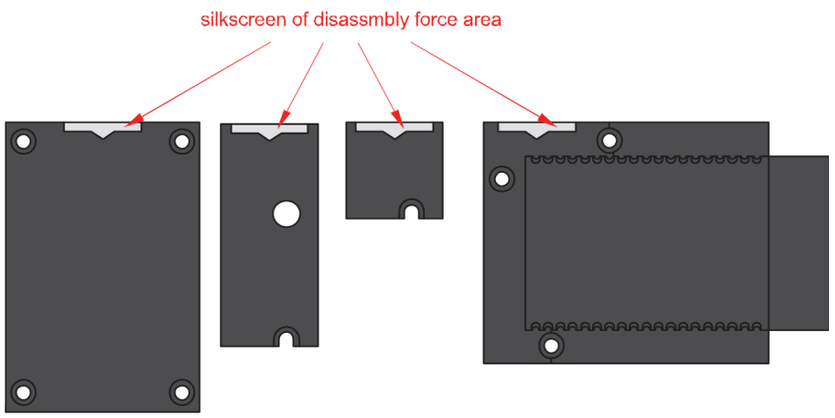


Figure 18: Detaching silkscreen on the WisBlock module

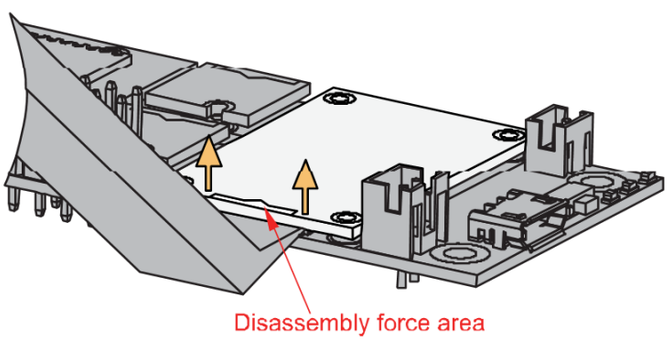


Figure 19: Applying even forces on the proper location of a WisBlock module to detach the module from the Base Board

Battery Selector

The RAK19001 supports both rechargeable and non-rechargeable batteries. You can also use this slide switch as a power on/off switch to disconnect the battery from the board.

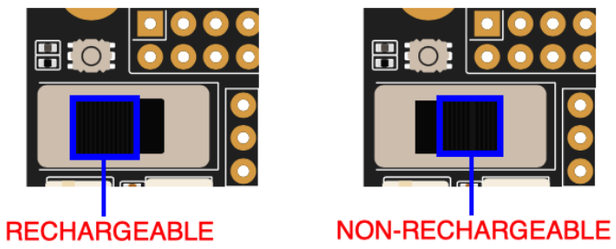


Figure 20: Battery selector switch

Non-Rechargeable Battery

Various non-rechargeable batteries are supported by the RAK19001 as long as it is in the voltage range of 3.3 to 5.5 V. The onboard connector used on the non-rechargeable battery is FWF20009-S02S22W1B . The matching connector housing is FHG20005-S02M2W1B , and the connector tin-plate pin is FT20004-F2H .

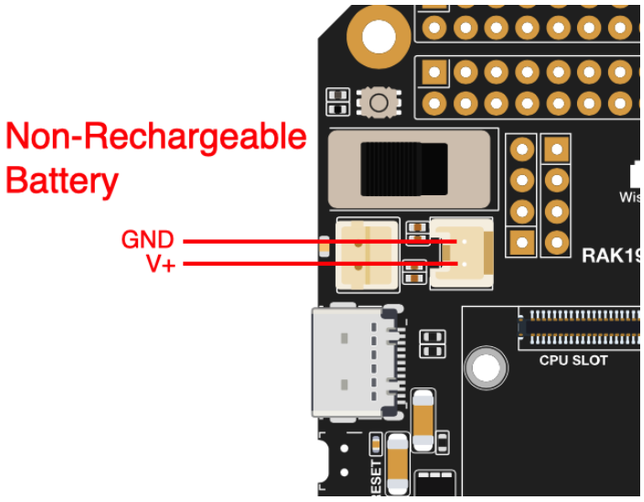


Figure 21: Non-Rechargeable battery connector pin

Rechargeable Battery

RAK19001 can be powered by a rechargeable Li-Ion/LiPo battery via the dedicated connectors, as shown in **Figure 22**. The matching connector for the rechargeable battery wires is a JST PHR-2 2 mm pitch female . A cable assembly for the rechargeable battery connector is also available for purchase in RAK store .

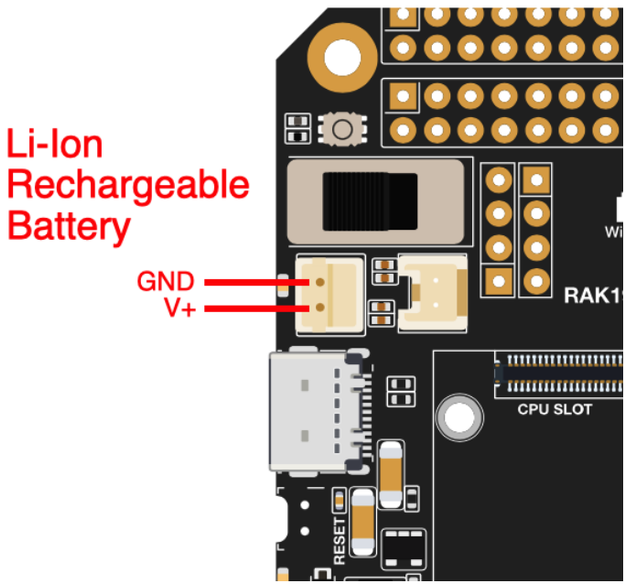


Figure 22: Rechargeable battery connector pin

⚠ **WARNING**

- Battery can cause harm if not handled properly.
- Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
- Make sure the battery wires, both rechargeable and non-rechargeable, match the polarity on the RAK19001 board. Not all batteries have the same wiring.

Solar Panel Connection

The battery can be recharged, as well, via a small Solar Panel, as shown in **Figure 23**. The matching connector for the solar panel wires is an JST ZHR-2 1.5 mm pitch female . A cable assembly for the solar panel connector is also available for purchase in RAK store .

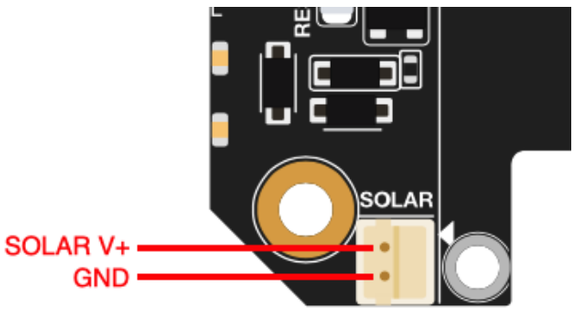


Figure 23: Solar panel connector V+ and GND

⚠ **WARNING**

- Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.
- The GND pin of the Solar Panel Connector is located on edge of the board. Make sure the solar panel wires match the polarity on the RAK19001 board.

Software Setup

The WisBlock Core is designed to be interfaced with other WisBlock Modules like sensors, displays, and other interfaces. To make useful devices, you need to upload a source code to the WisBlock Core. Before you continue, you should have already set up either an Arduino BSP or PlatformIO .

WisBlock Examples Repository

To quickly build your IoT device with less hassle, example codes for WisBlock Core are provided. You can access the codes on the WisBlock Example code repository . The example codes on folder `common` are compatible with RAK4631, RAK11200, and RAK11310 WisBlock cores.

Last Updated: 7/29/2022, 10:17:19 PM

RAK19001 WisBlock Dual IO Base Board Datasheet

WisBlock Dual IO Base Board Overview

RAK19001 is a **WisBlock Base** board that connects **WisBlock Core** and **WisBlock Modules**. It provides the power supply and interconnection to the modules attached to it. It has one slot reserved for the WisBlock Core module, two IO slots, and six sensor slots A to F for WisBlock Modules. Also, there are two **2.54 mm pitch headers** that expose all key input-output pins of the WisBlock Core that includes UART, I2C, SPI, and many IO Pins.

For convenience, there is a Type-C USB connector that is connected directly to WisBlock Core MCU's USB port (if supported) or to a USB-UART converter depending on the WisBlock Core. The USB-C connection can be used for uploading firmware, serial communication, and charging A rechargeable battery. RAK19001 also includes a slide switch to select between rechargeable and non-rechargeable batteries.

WisBlock Modules are connected to the RAK19001 WisBlock Base board via **high-speed board-to-board connectors**. They provide secure and reliable interconnection to ensure the signal integrity of each data bus. A set of screws are used for fixing the modules, which makes it reliable even in an environment with lots of vibrations.

Additionally, it has two user-definable LEDs, one power supply/charging indicator LED, and one user-defined button.

If you can't find a module that fits your IoT requirements, use the standard connectors of WisBlock to develop your own specific function module. WisBlock supports open-source hardware architecture and you can find tutorials showing how to create your own Awesome WisBlock module.

Main Features

- Flexible building block design, which enables modular functionality and expansion
- High-speed interconnection connectors in the WisBlock Base board to ensure signal integrity
- **Multiple headers and modules slots** for WisBlock modules
  - Two (2) IO slots
  - Six (6) sensor (A to F) slots
  - All key input-output pins of WisBlock Core are exposed via headers
  - Access to various communication bus via headers: I2C, SPI, UART, and USB
  - One user-defined push button switch
- **Power supply**
  - Supports both 5 V USB, 3.7 V rechargeable battery, and 3.3 to 5.5 V non-rechargeable battery as power supply
  - The power supply for the **WisBlock modules** boards can be controlled by the **WisBlock Core** modules to minimize power consumption
  - Slide switch to select between a rechargeable or non-rechargeable battery
- **Size**
  - 60 x 67 mm

Specifications

Overview

Board Overview

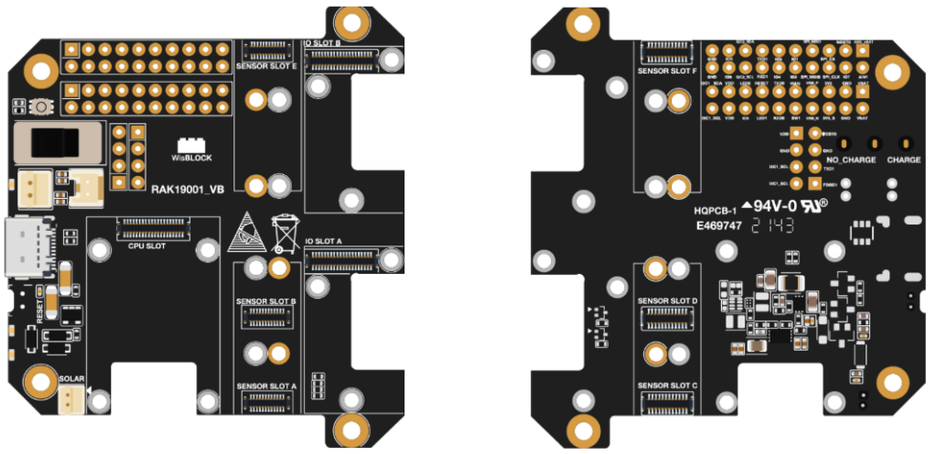


Figure 1: RAK19001 WisBlock Base top (left) and bottom (right) view

Block Diagram

The block diagram in **Figure 2** shows the internal architecture and external interfaces of the RAK19001 board.

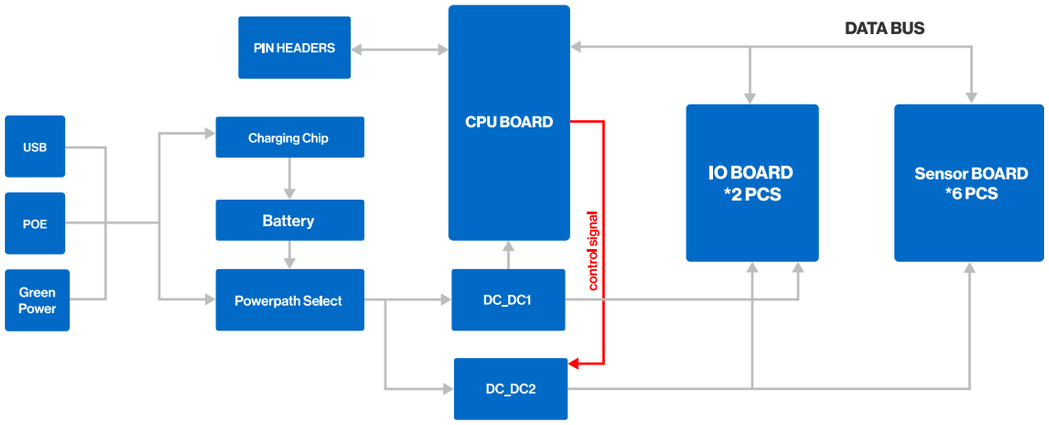


Figure 2: RAK19001 WisBlock Base block diagram

Hardware

The hardware specification is categorized into six parts. It discusses the interfacing, pinouts, and their corresponding functions and diagrams. It also covers the electrical, mechanical, and environmental parameters that include the tabular data of the functionalities and standard values of the RAK19001 WisBlock Dual IO Base Board.

Interfaces

RAK19001 WisBlock Base board provides the following interfaces, headers, a button, and WisConnectors:

- 1 WisBlock Core module
- 2 IO slots for WisBlock modules
- 6 Sensor slots A-F for WisBlock modules
- 1 Type-C USB port for programming and debugging
- 3.7 V rechargeable battery connector
- Non-rechargeable battery connector
- 5 V Solar panel connector
- 2 Headers for complete access to BOOT, I2C, SPI, UART, USB, and IO pins
- 2 User-defined LEDs
- 1 Power supply/charging indicator LED

- 1 User-defined button
- 1 Reset button

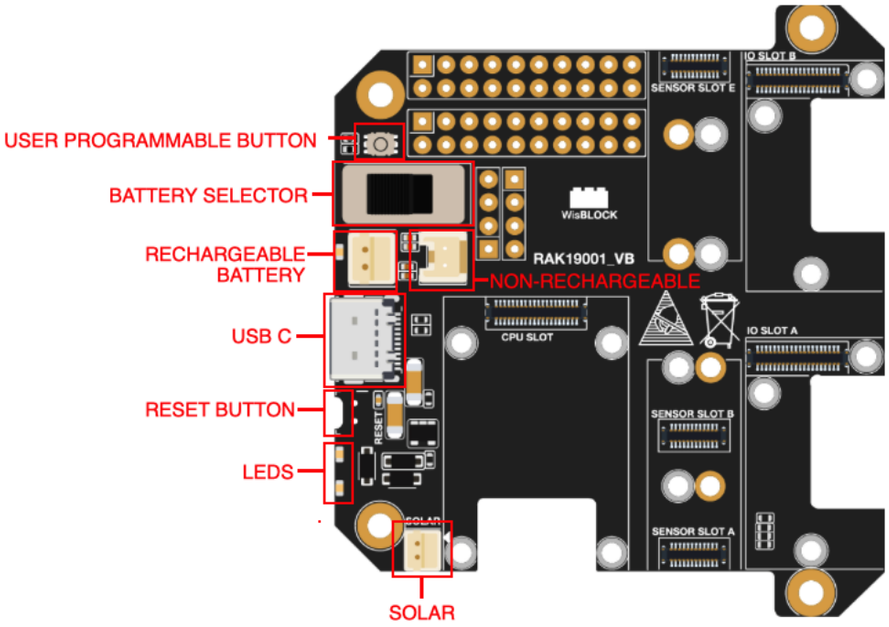


Figure 3: RAK19001 part labels

Type-C USB Port

The Type-C USB connector is compliant with the USB 2.0 specification. This USB interface directly communicates with the connected **WisBlock Core** module. It is also used as a charging input port for the battery. Here are some of the advantages of the Type-C USB connector:

- Smaller and reversible connector shape
- Port can be input or output
- Fast battery charging

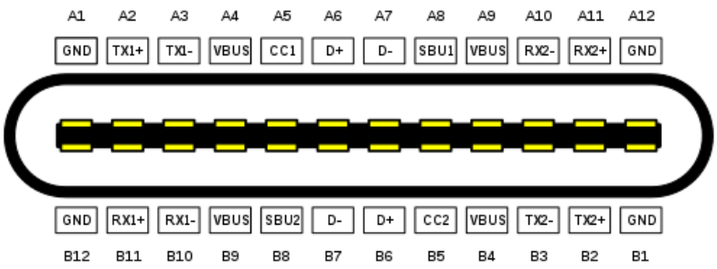


Figure 4: USB Type-C receptacle pinout

J10 and J15 Headers (Core IO Pins)

On the WisBlock Dual IO Base board, there are a total of 40 2.54 mm pitch headers for IO access and extension. These IO pins are distributed to J10 and J15 pin headers with the corresponding label at the back of the board. The arrangement of the pins is based on the 40-pin WisConnector of the WisBlock Core.

> 📝 **NOTE**
>
> BOOT pin is used on startup configuration or sequence of the WisBlock Core connected to it. It is commonly used for uploading the bootloader and/or application firmware. The requirements of the state of the BOOT pin depend on the specific model of the WisBlock Core used.

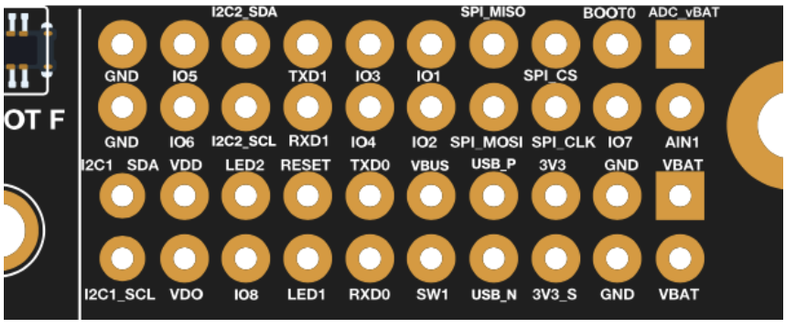


Figure 5: J10 and J15 pin header label in bottom side

J11 and J12 Headers (I2C and UART)

A dedicated header is available as well to have access to commonly used serial interfaces **I2C** and **UART**.

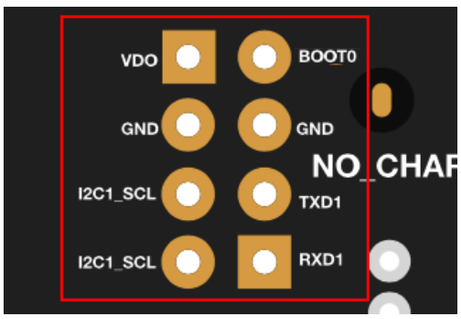


Figure 6: J11 and J12 (I2C and UART) pin header label in bottom side

Battery Connectors

Figure 7 and **Figure 8** show the battery connectors V+(positive) and GND on both rechargeable and non-rechargeable batteries.

The matching connector for the rechargeable battery wires is a JST PHR-2 2 mm pitch female . A cable assembly for the rechargeable battery connector is also available for purchase in RAK store .

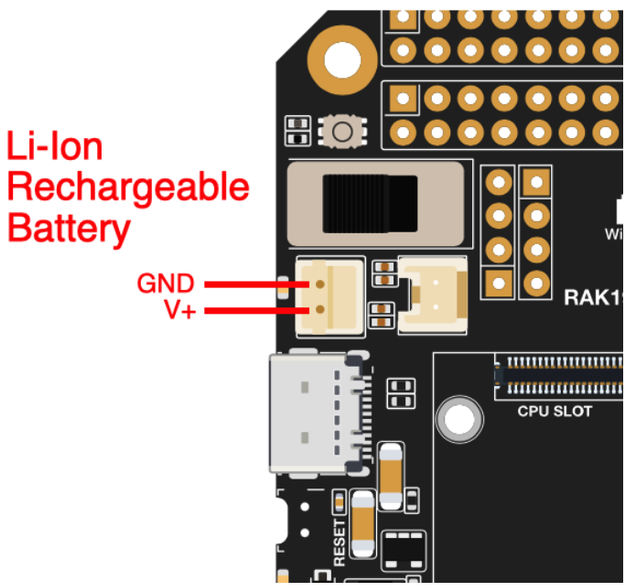


Figure 7: Rechargeable battery connector pin label V+ and GND

The onboard connector used on the non-rechargeable battery is FWF20009-S02S22W1B . The matching connector housing is FHG20005-S02M2W1B , and the connector tin-plate pin is FT20004-F2H .

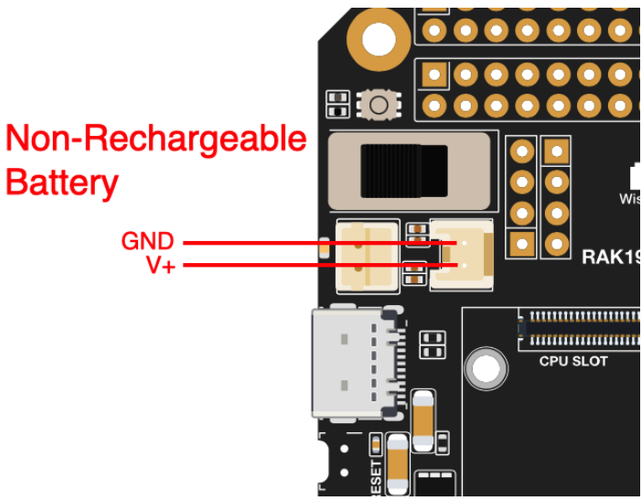


Figure 8: Non-Rechargeable battery connector pin label V+ and GND

Figure 9 shows how to select the battery type used for the project. The battery selector is based on the SS-12D10 slide SPDT switch . You can also use this slide switch as a power on/off switch to disconnect the battery from the board.

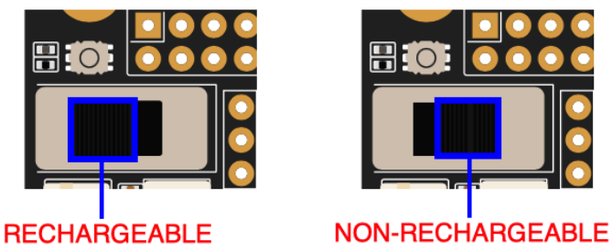


Figure 9: Battery selector switch

> ⚠ **WARNING**
>
> - The voltage of the rechargeable battery **must not exceed 4.3 V**.
> - The voltage of the non-rechargeable battery **must not exceed 5.5 V**.

Solar Panel Connector

Figure 10 shows the solar panel connector V+(Vin) and GND. The matching connector for the solar panel wires is an JST ZHR-2 1.5 mm pitch female . A cable assembly for the solar panel connector is also available for purchase in RAK store .

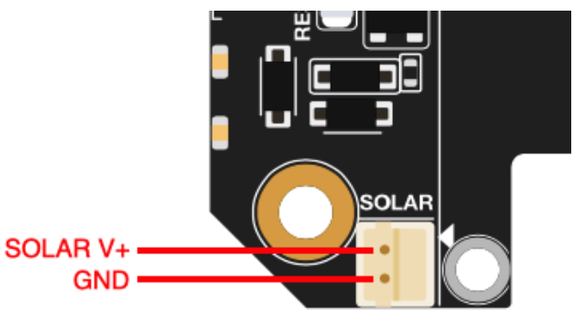


Figure 10: Solar panel connector V+ and GND

> ⚠ **WARNING**
>
> The output voltage of the solar panel **must not exceed 5.5 V**. Otherwise, it may cause permanent damage to the board.

LEDs

Three LEDs are used to indicate the operating status. Below are the functions of the LEDs:

- 🔴 **Red LED** - Connected to the charger chip to indicate the charger status. When the battery is charging, this red LED is on. When the battery is full, this LED is weak light or off.
- **Green LED** - Connected to the MCU module, controlled by MCU defined by the user.
- 🔵 **Blue LED** - Connected to the MCU module, controlled by MCU defined by the user.

RESET Push Button

The Reset Push Button shown in Figure 3 of interfaces section is connected to the MCU module. When pushed, it resets the MCU.

User Programmable Push Button

The User Programmed Push Button shown in Figure 3 of interfaces section is connected to the SW1 pin of the WisBlock Core.

Pin Definition

Connector for WisBlock Core

The **WisCore module connector** is a 40-pin board-to-board connector. It is a high-speed and high-density connector, with an easy attaching mechanism.

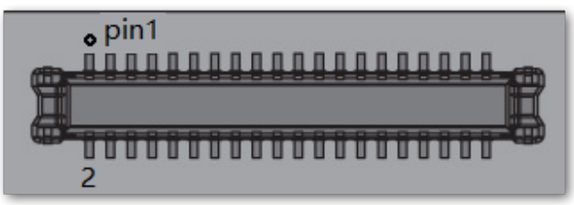


Figure 11: WisBlock Core module 40-pin connector

The table below shows the pinout of the 40-pin MCU module connector:

Pin Number	Function Name of WisBlock Base	Pin Number	Function Name of WisBlock Base
1	VBAT	2	VBAT
3	GND	4	GND
5	3V3	6	3V3
7	USB+	8	USB–
9	VBUS	10	SW1
11	TXD0	12	RXD0
13	RESET	14	LED1
15	LED2	16	LED3
17	VDD	18	VDD
19	I2C1_SDA	20	I2C1_SCL
21	ADC_VBAT	22	AIN1
23	BOOT0	24	IO7
25	SPI_CS	26	SPI_CLK
27	SPI_MISO	28	SPI_MOSI
29	IO1	30	IO2
31	IO3	32	IO4
33	TXD1	34	RXD1
35	I2C2_SDA	36	I2C2_SCL
37	IO5	38	IO6
39	GND	40	GND

As for the following table, it shows the definition of each pin of the WisBlock Core connector:

Pin Number	Pin Name	Type	Description
1	VBAT	S	Power supply from battery
2	VBAT	S	Power supply from battery
3	GND	S	Ground
4	GND	S	Ground
5	3V3	S	3.3 V power supply
6	3V3	S	3.3 V power supply
7	USB+	I/O	USB D+
8	USB–	I/O	USB D–
9	VBUS	S	USB VBUS
10	SW1	I/O	Not connected
11	TXD0	I/O	MCU UART0 TX signal
12	RXD0	I/O	MCU UART0 RX signal
13	RESET	I	Connected to the reset switch, for MCU reset
14	LED1	I/O	LED for battery charging indication
15	LED2	I/O	LED for custom usage
16	LED3	I/O	LED for custom usage
17	VDD	S	Generated by MCU module for power sensor board if the MCU IO level is not 3.3 V
18	VDD	S	Generated by MCU module for power sensor board if the MCU IO level is not 3.3 V
19	I2C1_SDA	I/O	The first set of I2C data signal
20	I2C1_SCL	I/O	The first set of I2C clock signal
21	ADC_VBAT	A	Analog input for ADC (Connected to a battery)
22	AIN1	A	Analog input for ADC
23	BOOT0	I	For ST MCU only. The MCU will enter boot mode if this pin is connected to VDD.

Pin Number	Pin Name	Type	Description
24	IO7	I/O	Not connected
25	SPI_CS	I/O	SPI chip select signal
26	SPI_CLK	I/O	SPI clock signal
27	SPI_MISO	I/O	SPI MISO signal
28	SPI_MOSI	I/O	SPI MOSI signal
29	IO1	I/O	General purpose IO
30	IO2	I/O	Used for 3V3_S enable
31	IO3	I/O	General purpose IO
32	IO4	I/O	General purpose IO
33	TXD1	I/O	MCU UART1 RX signal
34	RXD1	I/O	MCU UART1 RX signal
35	I2C2_SDA	I/O	The second set of I2C data signal
36	I2C2_SCL	I/O	The second set of I2C clock signal
37	IO5	I/O	General purpose IO
38	IO6	I/O	General purpose IO
39	GND	S	Ground
40	GND	S	Ground

Connectors for WisBlock Sensor

The WisBlock sensor module connector is a 24-pin board-to-board connector.

> ⚠**WARNING**
>
> The WisBlock 24-pin connectors have the same connections for **3V3_S**, **GND**, **I2C**, and **SPI**. However, **UART** and **IO** pins are not the same for all slots.

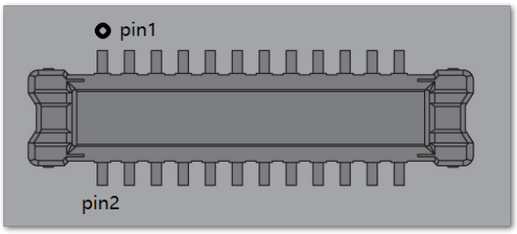


Figure 12: WisBlock 24-pin module connector

Pinout definition for standard size slot (A-D):

D	C	B	A	Pin Number	Pin Number	A	B
NC	NC	NC	TXD0	1	2	GND	GND
SPI_CS	SPI_CS	SPI_CS	SPI_CS	3	4	SPI_CLK	SPI_
SPI_MISO	SPI_MISO	SPI_MISO	SPI_MISO	5	6	SPI_MOSI	SPI_
I2C1_SCL	I2C1_SCL	I2C1_SCL	I2C1_SCL	7	8	I2C1_SDA	I2C1
VDD	VDD	VDD	VDD	9	10	IO2	IO1
3V3_S	3V3_S	3V3_S	3V3_S	11	12	IO1	IO2
NC	NC	NC	NC	13	14	3V3_S	3V3_
NC	NC	NC	NC	15	16	VDD	VDD
NC	NC	NC	NC	17	18	NC	NC
NC	NC	NC	NC	19	20	NC	NC
NC	NC	NC	NC	21	22	NC	NC
GND	GND	GND	GND	23	24	RXD0	NC

Pinout definition for double size sensor slot (E and F):

Connector F	Connector E	Pin Number	Pin Number	Connector E	Connector F
TXD1	TXD0	1	2	GND	GND
SPI_CS	SPI_CS	3	4	SPI_CLK	SPI_CLK
SPI_MISO	SPI_MISO	5	6	SPI_MOSI	SPI_MOSI
I2C1_SCL	I2C1_SCL	7	8	I2C1_SDA	I2C1_SDA
VDD	VDD	9	10	IO3	IO5
3V3_S	3V3_S	11	12	IO4	IO6
NC	NC	13	14	3V3_S	3V3_S
NC	NC	15	16	VDD	VDD
NC	NC	17	18	NC	NC
NC	NC	19	20	NC	NC
NC	NC	21	22	NC	NC
GND	GND	23	24	RXD0	RXD1

As for the following table, it shows the pin name and description of each pin in the 24-pin WisBlock module connector.

Pin Number	Pin Name	Type	Description
1	TXD1	I/O	UART TX signal
2	GND	S	Ground
3	SPI_CS	I/O	SPI chip select signal
4	SPI_CLK	I/O	SPI clock signal
5	SPI_MISO	I/O	SPI MISO signal
6	SPI_MOSI	I/O	SPI MOSI signal
7	I2C1_SCL	I/O	I2C clock signal
8	I2C1_SDA	I/O	I2C data signal
9	VDD	S	Generated by CPU module. Used to power sensor board if MCU IO level is not 3.3 V
10	IOx	I/O	General purpose IO pin. When 3V3_S is used, this pin cannot be used as an interrupt input.
11	3V3_S	S	3.3 V power supply. This power pin is controlled by IO2 from the WisBlock Core module.
12	IOx	I/O	General purpose IO pin. When 3V3_S is used, this pin cannot be used as an interrupt input.
13	NC	NC	Not connected
14	3V3_S	S	3.3 V power supply. This power pin is controlled by IO2 from the WisBlock Core module.
15	NC	NC	Not connected
16	VDD	S	Generated by CPU module. Used to power sensor board if the MCU IO level is not 3.3 V.
17	NC	NC	Not connected
18	NC	NC	Not connected
19	NC	NC	Not connected
20	NC	NC	Not connected
21	NC	NC	Not connected
22	NC	NC	Not connected

Pin Number	Pin Name	Type	Description
23	GND	S	Ground
24	RXD1	I/O	UART RX signal

Connector for WisBlock IO Slot

The WisBlock Module IO Slot connector, as shown in **Figure 13**, is a 40-pin board-to-board connector.

> 📝 **NOTE**
>
> The two WisBlock 40-pin connectors have the same connections for all IO, signal, and serial pins (UART, SPI, I2C).

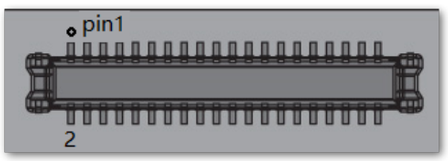


Figure 13: WisBlock IO slot connector

Pinout definition for IO slot:

Connector B	Connector A	Pin Number	Pin Number	Connector A	Connector B
VBAT	VBAT	1	2	VBAT	VBAT
GND	GND	3	4	GND	GND
3V3	3V3	5	6	3V3_S	3V3_S
USB+	USB+	7	8	USB–	USB–
VBUS	VBUS	9	10	SW1	SW1
TXD0	TXD0	11	12	RXD0	RXD0
RESET	RESET	13	14	LED1	LED1
LED2	LED2	15	16	LED3	LED3
VDD	VDD	17	18	VDD	VDD
I2C1_SDA	I2C1_SDA	19	20	I2C1_SCL	I2C1_SCL
AIN0	AIN0	21	22	AIN1	AIN1
NC	NC	23	24	NC	NC
SPI_CS	SPI_CS	25	26	SPI_CLK	SPI_CLK
SPI_MISO	SPI_MISO	27	28	SPI_MOSI	SPI_MOSI
IO1	IO1	29	30	IO2	IO2
IO3	IO3	31	32	IO4	IO4
TXD1	TXD1	33	34	RXD1	RXD1
I2C2_SDA	I2C2_SDA	35	36	I2C2_SCL	I2C2_SCL
IO5	IO5	37	38	IO6	IO6
GND	GND	39	40	GND	GND

As for the following table, it shows the pin name and description of the WisBlock IO module connector.

Pin Number	Pin Name	Type	Description
1	VBAT	S	Power supply from battery
2	VBAT	S	Power supply from battery
3	GND	S	Ground
4	GND	S	Ground
5	3V3	S	3.3 V power supply
6	3V3_S	S	3.3 V power supply. Can be shut down by a CPU module.
7	USB+	I/O	USB D+
8	USB–	I/O	USB D–
9	VBUS	S	5 V input for USB
10	SW1	I/O	Switch signal for custom used
11	TXD0	I/O	MCU UART0 TX signal
12	RXD0	I/O	MCU UART0 RX signal
13	RESET	I	Connected to the reset switch, for MCU reset
14	LED1	I/O	LED for battery charge indicator
15	LED2	I/O	LED for custom used
16	LED3	I/O	LED for custom used
17	VDD	S	Generated by CPU module - Used for power sensor board if the MCU IO level is not 3.3 V
18	VDD	S	Generated by CPU module - Used for power sensor board if the MCU IO level is not 3.3 V.
19	I2C1_SDA	I/O	The first set of I2C data signal
20	I2C1_SCL	I/O	The first set of I2C clock signal
21	AIN0	A	Analog input for ADC
22	AIN1	A	Analog input for ADC
23	NC	NC	Not connect

Pin Number	Pin Name	Type	Description
24	NC	NC	Not connect
25	SPI_CS	I/O	SPI chip select signal
26	SP_CLK	I/O	SPI clock
27	SPI_MISO	I/O	SPI MISO signal
28	SPI_MOSI	I/O	SPI MOSI signal
29	IO1	I/O	General purpose IO
30	IO2	I/O	Used for 3V3_S enable
31	IO3	I/O	General purpose IO
32	IO4	I/O	General purpose IO
33	TXD1	I/O	MCU UART1 TX signal
34	RXD1	I/O	MCU UART1 RX signal
35	I2C2_SDA	I/O	The second set of I2C data signal
36	I2C2_SCL	I/O	The second set of I2C clock signal
37	IO5	I/O	General purpose IO
38	IO6	I/O	General purpose IO
39	GND	S	Ground
40	GND	S	Ground

Electrical Characteristics

Absolute Maximum Ratings

The Absolute Maximum Ratings of the device are shown in the table below. The stress ratings are the functional operation of the device.

> ⚠**WARNING**
>
> 1. If the stress rating goes above what is listed, it may cause permanent damage to the device.
> 2. Exposure to maximum rating conditions may affect the device reliability.

Ratings	Maximum Value	Unit
Power Supply on the USB port (**VBUS**)	–0.3 to 5.5	V
Battery Voltage (**VBAT**)	–0.3 to 4.3	V
Solar Panel Voltage (**CONN_S**)	–0.3 to 5.5	V
IOs of WisConnector	–0.3 to VDD+0.3	V
ESD	2000	V

> 📝 **NOTE**
>
> The RAK19001, as any electronic equipment, is sensitive to **electrostatic discharge (ESD)**. Improper handling can cause permanent damage to the module.

Current Consumption

The RAK19001 is designed for **low-power IoT products**. Its power supply uses a high-efficiency low ground current regulator. When there is no module on RAK19001, the **leakage current is lower than 2 µA**. With WisBlock Core and WisBlock sensor on it, the sleep current is **lower than 10 µA**. When a LoRa module is transmitting, the current may reach **130 mA**.

Conditions	Current	Unit
Leakage current, without any module on RAK19001	2	µA
Idle current, with WisBlock Core and WisBlock Modules in sleep mode	10	µA
Working current, with LoRa module transmitting	130	mA

Rechargeable Battery Connector

The RAK19001 WisBlock Base Board can be powered by a rechargeable battery connected to the **P1 connector**. The nominal operating voltage of the battery should be within the range shown in the following table. The matching connector for the battery wires is an JST PHR-2 2 mm pitch female

Minimum	Typical	Maximum	Unit
3.3	3.7	4.3	V

If a rechargeable battery is used, the USB connector is used as a charging port. The voltage and current fed to the battery through the port should not exceed its charging limits, as shown in the table below.

Parameter	Value
Charging Voltage	4.5 – 5.5 V
Charging Current	500 mA

A suitable Li-Ion battery should have the following parameters as shown in the table below:

Parameter	Value
Standard Voltage	3.7 V
Charging Voltage	4.2 V
Capacity	As required
Discharge current	At least 500 mA

Non-Rechargeable Battery Connector

The RAK19001 WisBlock Base Board can be powered by a Non-rechargeable battery connected to the **P3 connector**. The nominal operating voltage of the battery should be within the range shown in the following table. The matching connector for the battery wires is an

Minimum	Typical	Maximum	Unit
3.3	3.7	5.5	V

Solar Panel Connector

A 5 V solar panel can be connected to the board via the **P2 connector** to also serve the purpose of charging the battery. The matching connector for the solar panel wires is an JST ZHR-2 1.5 mm pitch female

Mechanical Characteristics

Board Dimensions

Figure 14 shows the detailed mechanical dimensions of RAK19001.

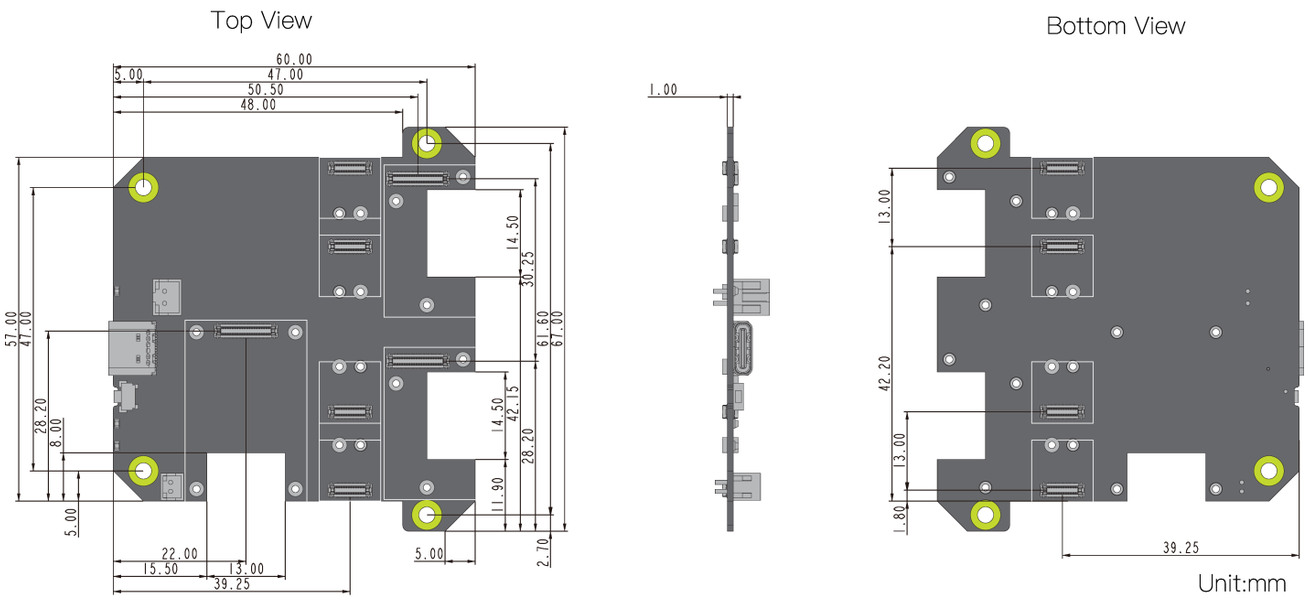


Figure 14: RAK19001 board dimensions

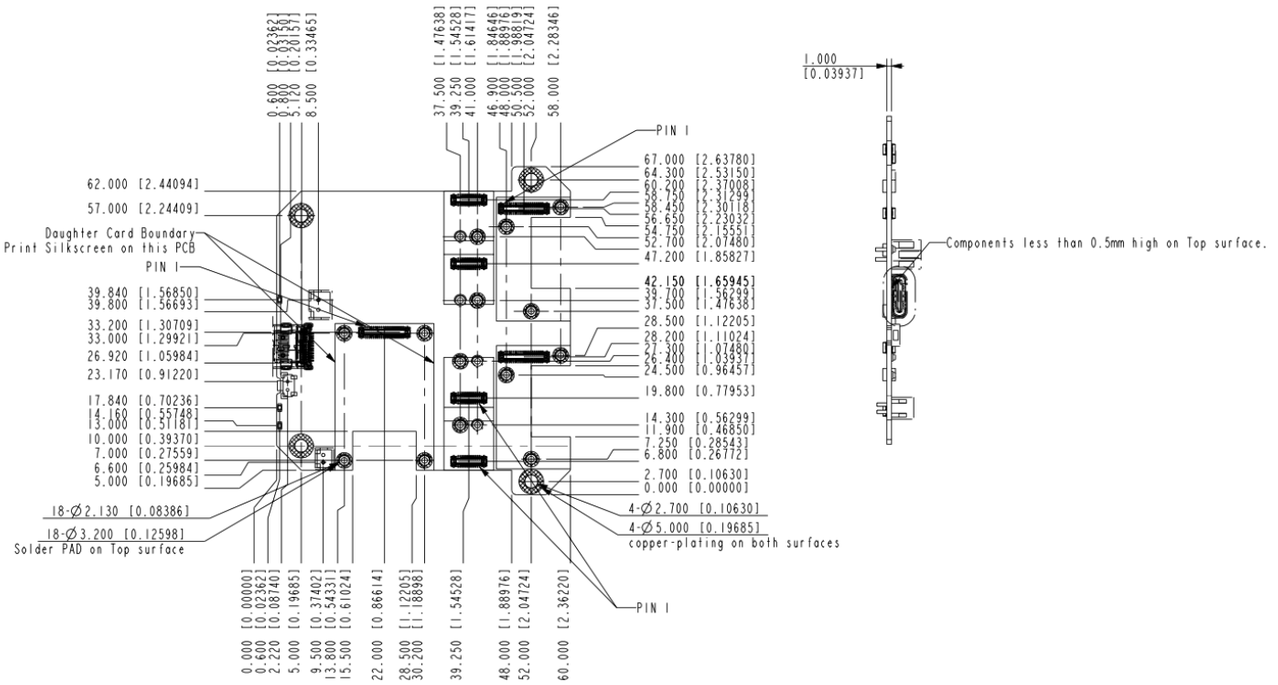
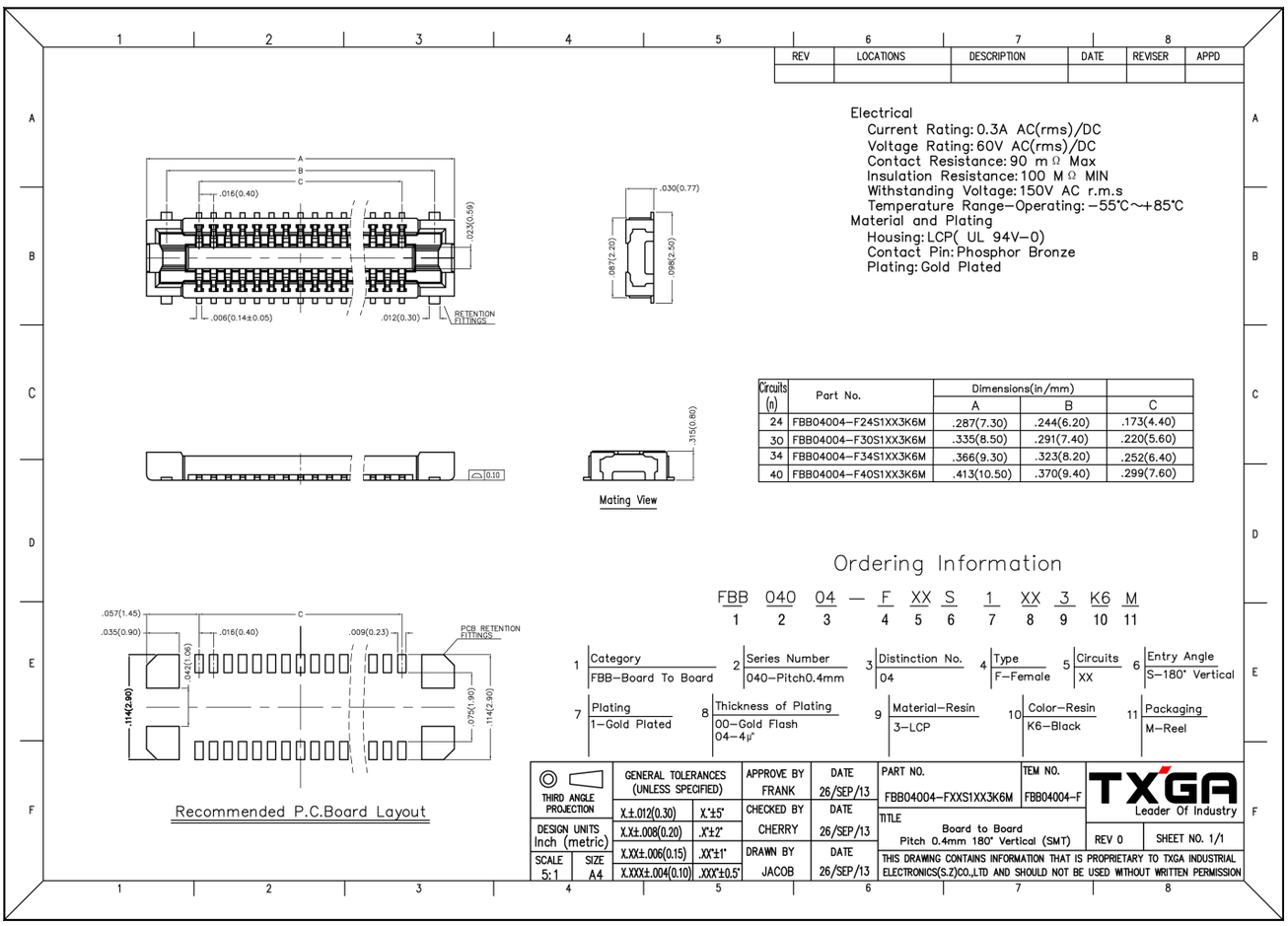


Figure 15: RAK19001 mechanical dimensions

WisConnector PCB Layout



Circuits (n)	Part No.	Dimensions(in/mm) A	B	C
24	FBB04004−F24S1XX3K6M	.287(7.30)	.244(6.20)	.173(4.40)
30	FBB04004−F30S1XX3K6M	.335(8.50)	.291(7.40)	.220(5.60)
34	FBB04004−F34S1XX3K6M	.366(9.30)	.323(8.20)	.252(6.40)
40	FBB04004−F40S1XX3K6M	.413(10.50)	.370(9.40)	.299(7.60)

Figure 16: WisConnector PCB footprint and recommendations

Environmental Characteristics

The table below lists the operation and storage temperature requirements of RAK19001:

Parameter	Minimum	Typical	Maximum
Operational Temperature Range	–35 ºC	+25 ºC	+75 ºC
Extended Temperature Range	–40 ºC	+25 ºC	+80 ºC
Storage Temperature Range	–40 ºC	+25 ºC	+80 ºC

Schematic Diagram

The component schematics diagram of the RAK19001 are shown in **Figure 14** and **Figure 15**.

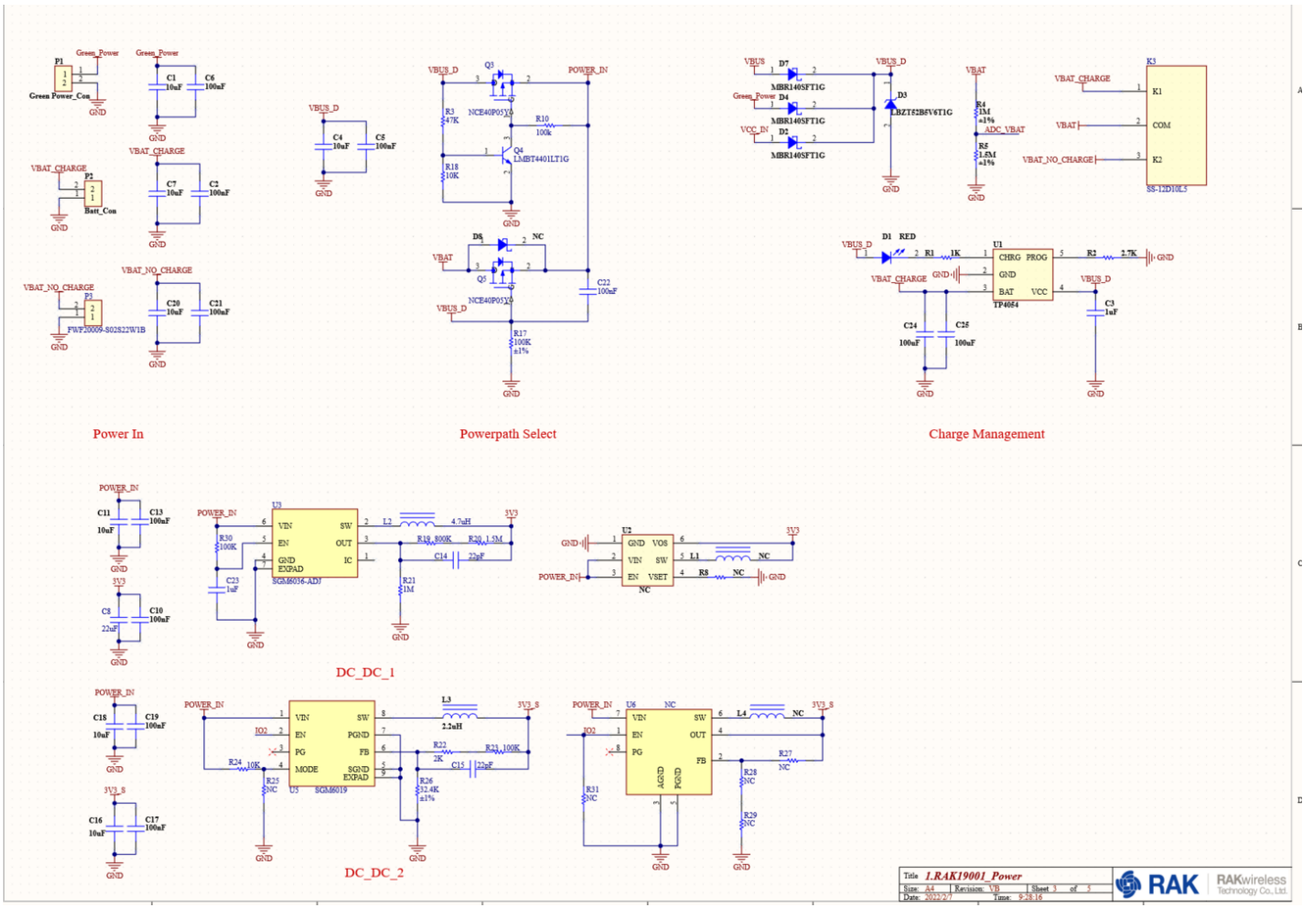


Figure 17: RAK19001 schematic diagram

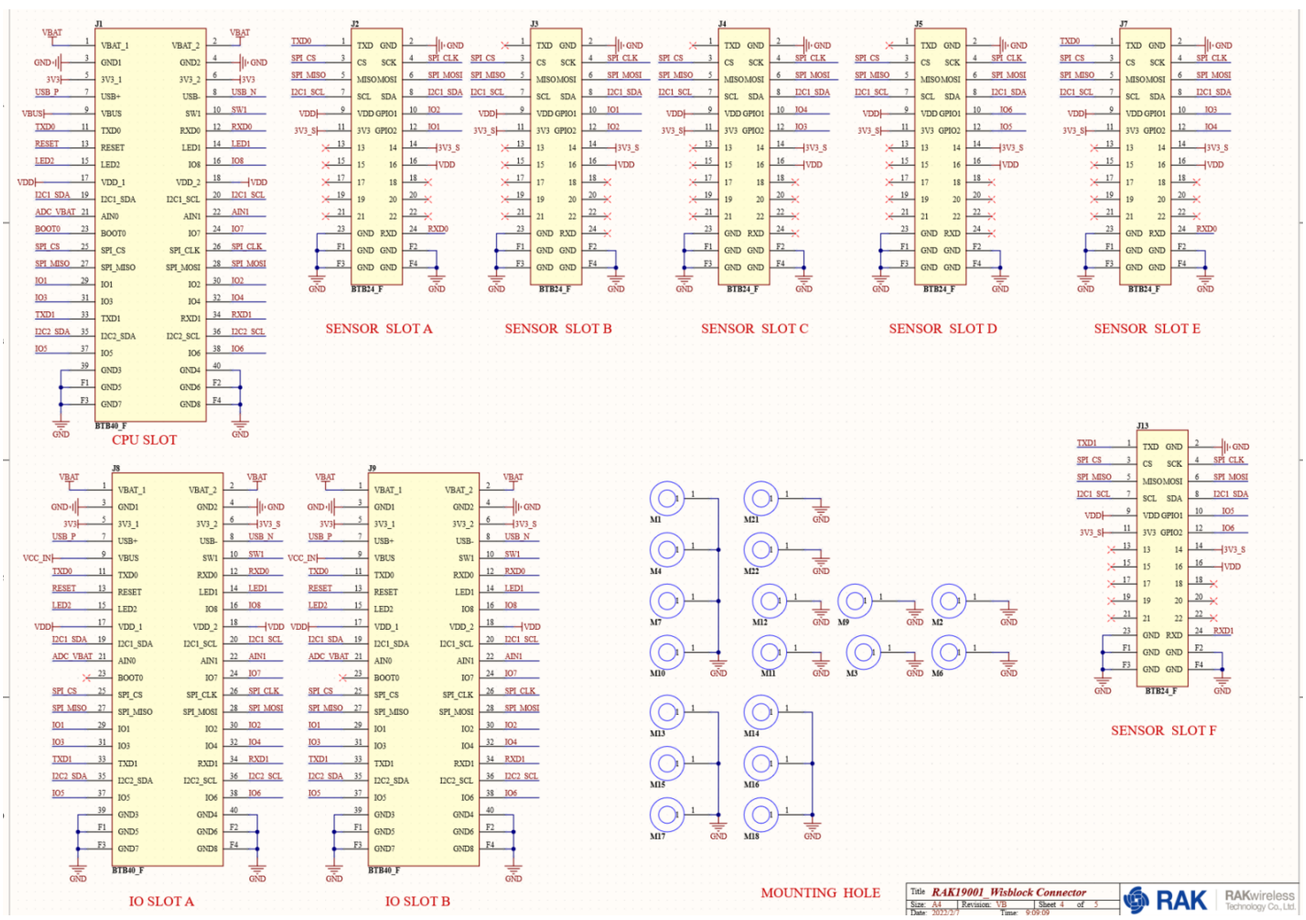


Figure 18: RAK19001 schematic diagram

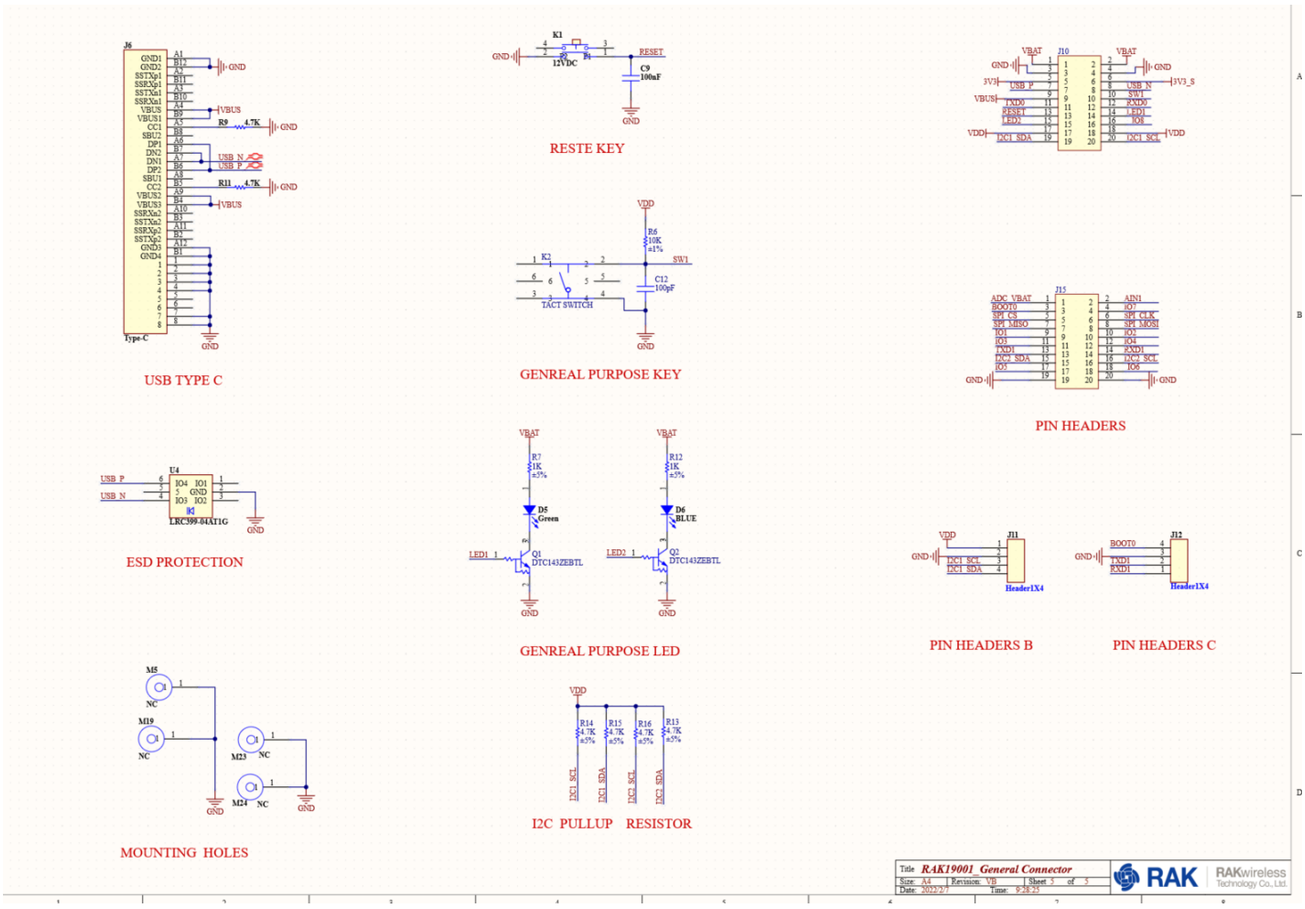


Figure 19: RAK19001 schematic diagram (Connectors)

Last Updated: 7/29/2022, 10:17:19 PM