RAK11200 WisBlock WiFi Module Datasheet

Overview

Description

RAK11200 is a **WisBlock Core** module for RAK **WisBlock** based on Espressif ESP32-WROVER. It is a powerful, generic WiFi-BLE MCU module that targets a wide variety of applications. There are two CPU cores that can be individually controlled and the CPU clock frequency is adjustable from 80 MHz to 240 MHz. The low-power deep-sleep current consumption of the ESP32-WROVER is about 10 uA. This makes the **RAK11200** an ultra-low-power communication solution. **RAK11200** can be comfortably programmed with the Arduino™ IDE or PlatformIO.

Features

- Two low-power Xtensa® 32-bit LX6 microprocessors
- Up to 240 MHz CPU clock
- Built-in PCB antenna
- 4 MB External SPI Flash, 520 KB RAM
- 8 MB SPI Pseudo static RAM (PSRAM)
- WiFi 802.11 b/g/n (802.11n up to 150 Mbps)
- Bluetooth v4.2 BR/EDR and BLE specification
- Rich set of peripherals: RTC, UART, I2C, SPI, SD card interface
- low-power deep-sleep mode

Specifications

Overview

Board Overview

The RAK11200 WisBlock WiFi Module back view and front view (top) can be seen in Figure 1.
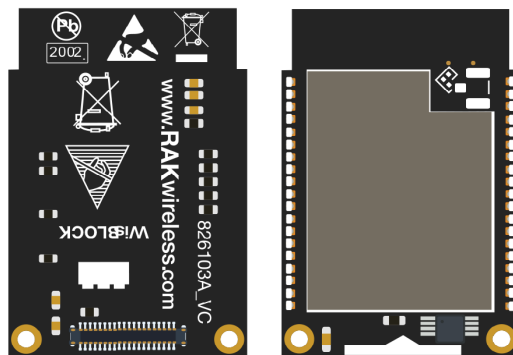

Figure 1: RAK11200 WiFi Module Overview

Mounting Sketch

Figure 2 shows RAK11200 module mounting sketch with the WisBase RAK5005-O board.
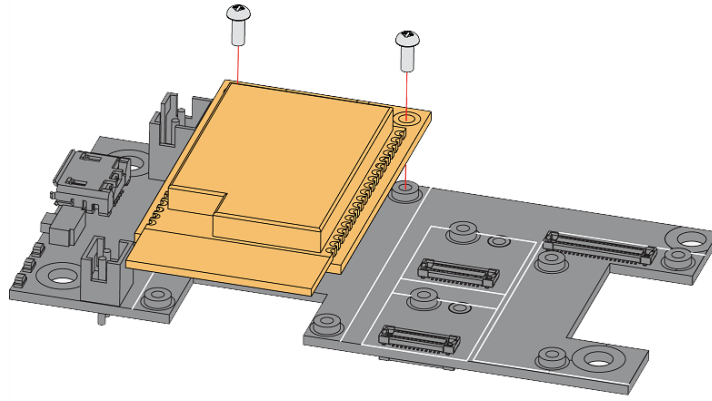
Figure 2: RAK11200 WiFi Module Mounting Sketch

Hardware

The hardware specification is categorized into four parts. It discuses the interfacing of the module and its corresponding functions and diagrams. It also covers the electrical and mechanical parameters that include the tabular data of the functionalities and standard values of the RAK11200 WisBlock WiFi Module.

> ⚠️ **WARNING**
>
> - Different from other ESP32 boards, the RAK11200 needs to be put *manually* into **download mode**. If you do not force the RAK11200 into **download mode**, you cannot upload your sketch from Arduino IDE (or PlatformIO) to the board.
>
> - To force the RAK11200 into **download mode**, you need to connect the pin *BOOT0* on the WisBlock Base RAK5005-O to *GND* and push the reset button.
>
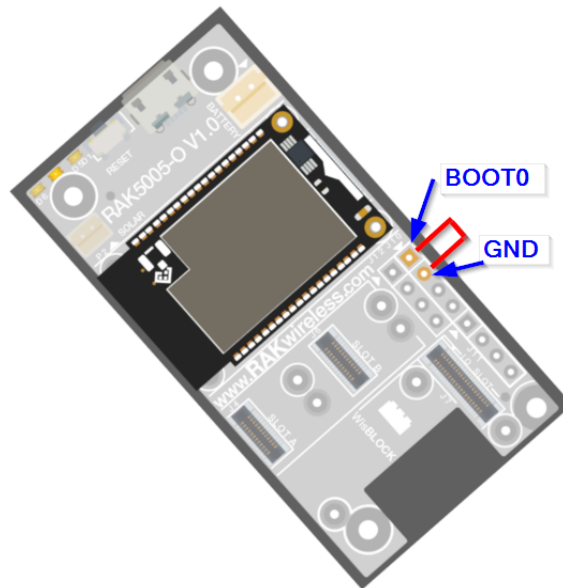> - The *BOOT0* pin is on the J10 pin header, the *GND* pin is next to it.

Figure 3: Force ESP32 Download mode

Interfaces

UART Interface

The RAK11200 module provides two UART interfaces: UART0 and UART1. The UART0 can be used for firmware upgrades or to access console output through the WisBlock baseboard USB interface. The UART1 is the main communication interface with WisIO or WisSensor modules.

UART0 Programming Port

To support USB, the RAK11200 has a USB-to-UART converter onboard to connect the ESP32's UART0 to the USB connector. Figure 4 shows the RAK11200 module UART programming circuit.
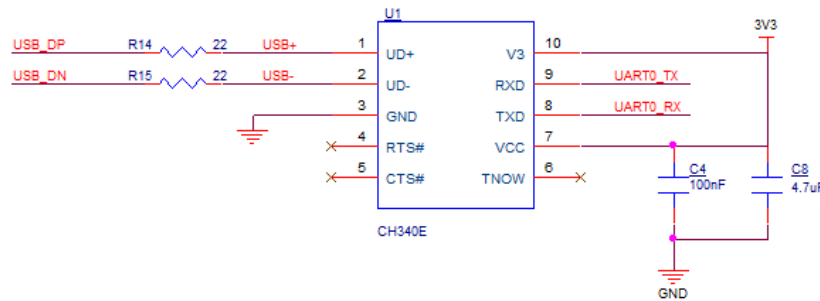

Figure 4: RAK11200 USB to UART schematic

SPI Interface

The RAK11200 supports one single SPI Interface in full-duplex or half-duplex communication modes. The SPI interface supports the following features:

- Both master and slave modes;
- Configurable SPI frequency;
- Four SPI transfer modes, which is defined by the polarity (CPOL) and the phase (CPHA) of the SPI clock;
- An internal FIFO buffer of 64-byte.

I2C Interface

The RAK11200 module provides two I2C bus interfaces. The module allows you to access directly the registers to control I2C interfaces, which adds more flexibility to the design of the final product. Depending on your configuration, it can serve as an I2C master mode. The I2C interface supports:

- Standard mode (100 Kbit/s) and Fast mode (400 Kbit/s);
- Up to 5 MHz, constrained by the SDA pull-up strength;
- 7-bit/10-bit addressing mode.

Pin Definition

The RAK11200 module has an ESP32-WROVER module at its core. Figure 5 shows the core module pins and connection information.
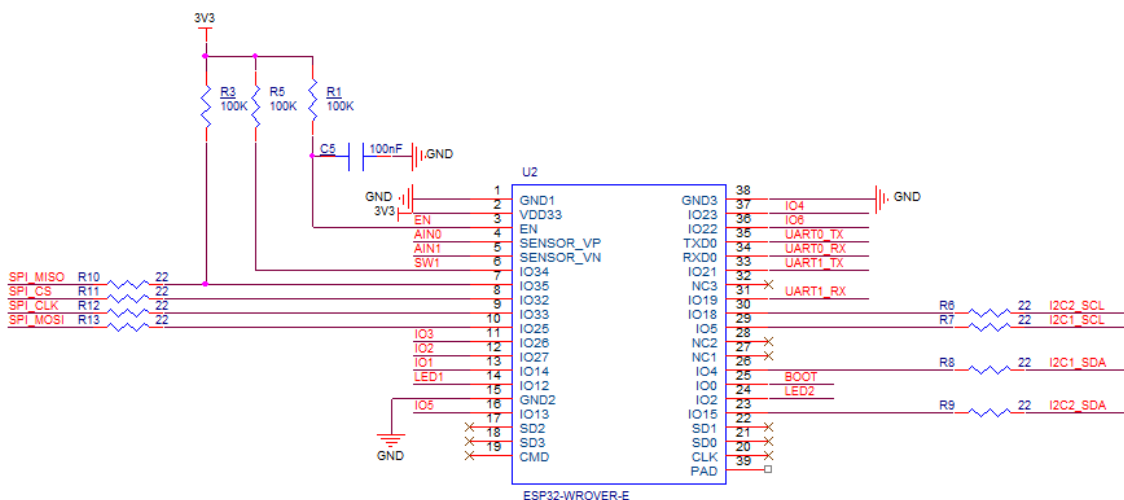

Figure 5: RAK11200 Core module pin connection

WisBlock Core RAK11200 Pin Assignment

Pin number WisBlock	Function	Pin name	Pin number ESP32
1	VBAT	VBAT	--
2	VBAT	VBAT	--
3	GND	GND	1, 15, 38
4	GND	GND	1, 15, 38
5	3V3	3V3	2
6	3V3	3V3	2
7	USB_DP	USB_DP	--
8	USB_DN	USB_DN	--
9	NC	NC	--
10	SW1	GPIO34	6
11	UART0_TX	GPIO1	35
12	UART0_RX	GPIO3	34
13	EN	EN	3
14	LED1	GPIO12	14
15	LED2	GPIO2	24
16	NC	NC	--
17	3V3	3V3	2
18	3V3	3V3	2
19	I2C1_SDA	GPIO4	26
20	I2C1_SCL	GPIO5	29
21	AIN0	GPIO36	4
22	AIN1	GPIO39	5
23	BOOT	GPIO0	25
24	NC	NC	--

Pin number WisBlock	Function	Pin name	Pin number ESP32
25	SPI_CS	GPIO32	8
26	SPI_CLK	GPIO33	9
27	SPI_MISO	GPIO35	7
28	SPI_MOSI	GPIO25	10
29	IO1	GPIO14	13
30	IO2	GPIO27	12
31	IO3	GPIO26	11
32	IO4	GPIO23	37
33	UART1_TX	GPIO21	33
34	UART1_RX	GPIO19	31
35	I2C2_SDA	GPIO15	23
36	I2C2_SCL	GPIO18	30
37	IO5	GPIO13	16
38	IO6	GPIO22	36
39	GND	GND	1, 15, 38
40	GND	GND	1, 15, 38

RF Specifications

BLE Radio

Receiver

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity @30.8% PER	-	-94	-93	-92	dBm
Maximum received signal @30.8% PER	-	0	-	-	dBm
Co-channel C/I	-	-	+10	-	dBm
Intermodulation	-	-36	-	-	dBm

Transmitter

Parameter	Conditions	Min	Typ	Max	Unit
RF transmit power	-	-	0	0	dBm
Gain control step	-	-	3	-	dBm
RF power control range	-	-12	-	+9	dBm
Drift rate	-	-	0.7	-	kHz/50us
Drift	-	-	2	-	kHz

WiFi Radio

Parameter	Condition	Min	Typ	Max	Unit
Operating frequency range	-	2412	-	2484	MHz
TX power	11b mode	17.5	18.5	20	dBm
TX power	11n MCS7	12	13	14	dBm
Sensitivity	11b, 1 Mbps	-	-97	-	dBm

Electrical Characteristics

Absolute Maximum Ratings

Symbol	Description	Min.	Typical	Max.	Unit
V_{BAT}	Power supply for the module	0.5	-	4.2	V
V_{DD}	Power supply for ESP32 module	2.3	3.3	3.6	V
I_{out}	Step down IC output current	-	-	700	mA

Recommended Operating Conditions

Symbol	Description	Min.	Typical	Max.	Unit
V_{BAT}	Power supply for the module	3.1	-	4.2	V
V_{DD}	Power supply for ESP32 module	3.0	3.3	3.6	V
T_{OPR}	Operation Temperature	-40	-	85	°C

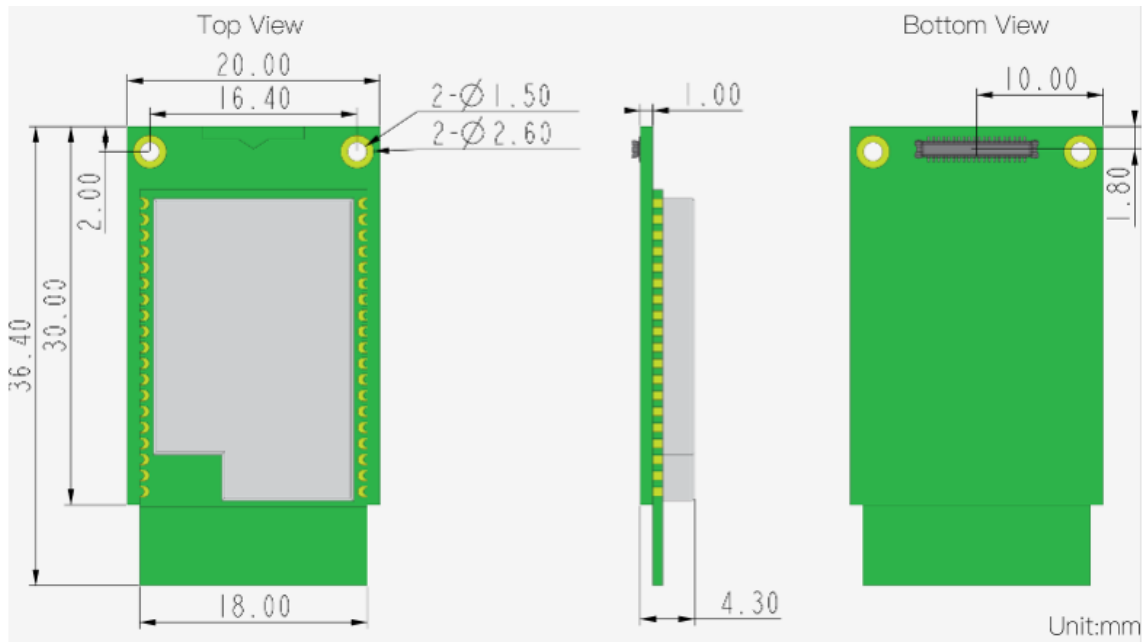# Mechanical Characteristics

Board Dimensions

Figure 6: RAK11200 Board Dimensions
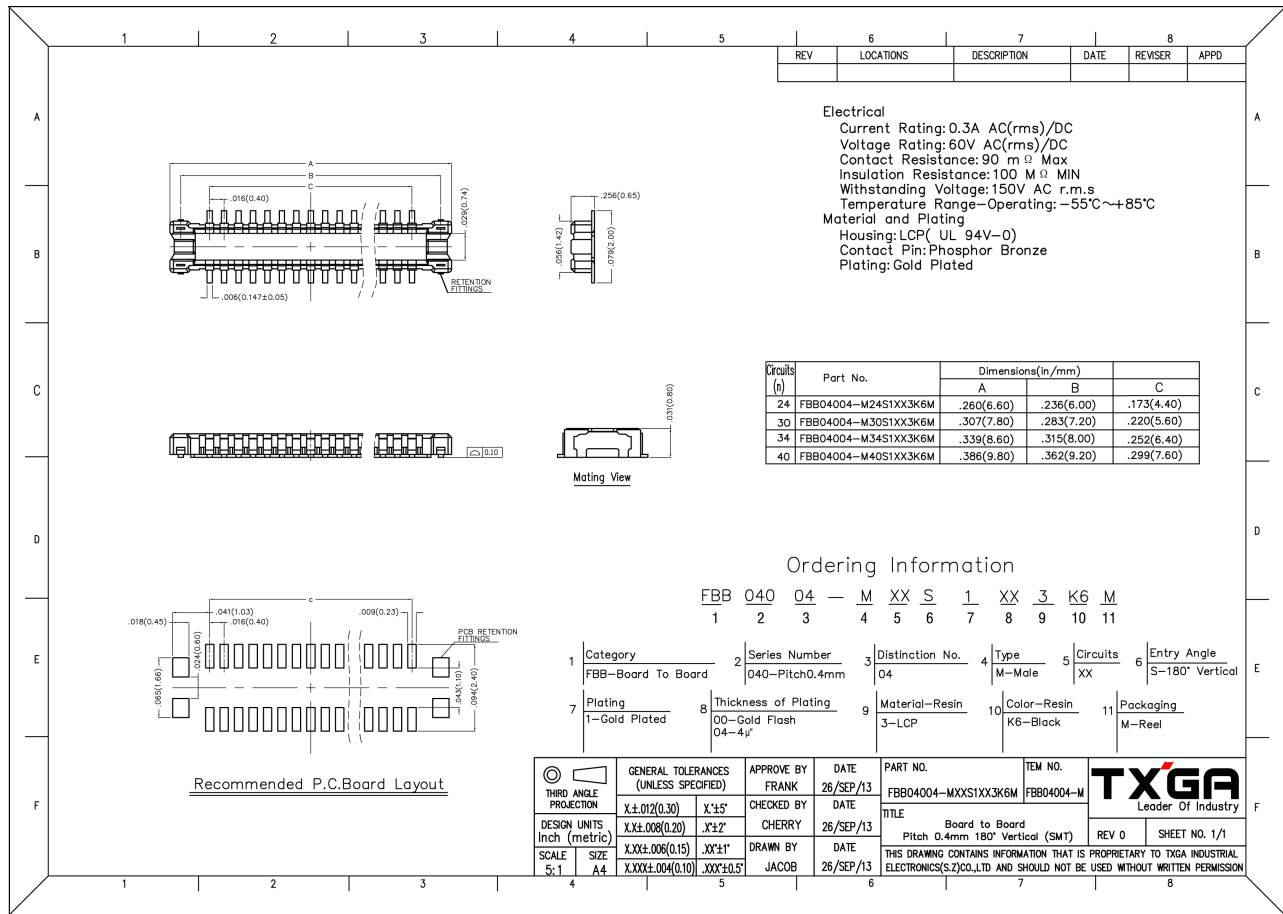
WisConnector PCB Layout

Figure 7: WisConnector PCB footprint and recommendations
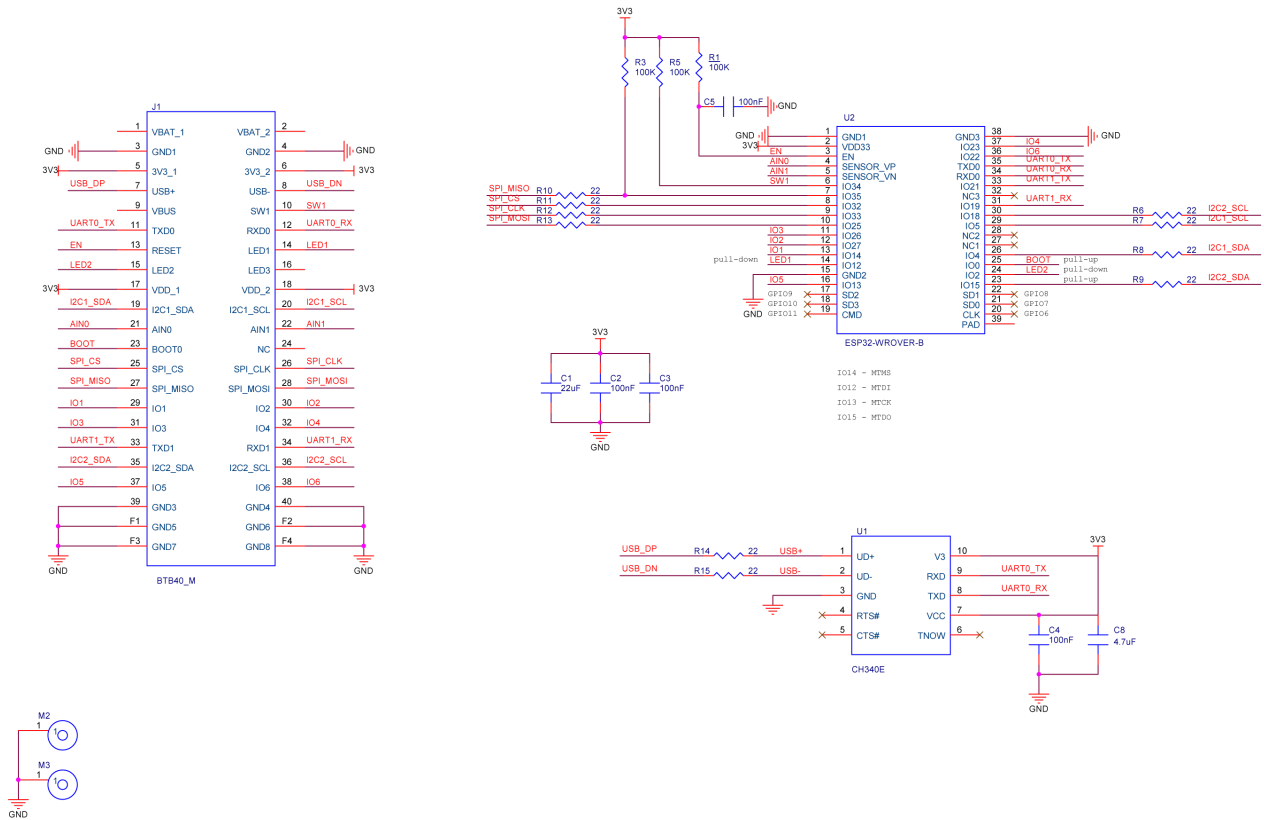
Schematic Diagram

Figure 8: RAK11200 Schematic Diagram

RAK11200 is a **WisBlock Core** module for RAK **WisBlock** based on Espressif ESP32-WROVER. It is a powerful, generic WiFi-BLE MCU module that targets a wide variety of applications. There are two CPU cores that can be individually controlled and the CPU clock frequency is adjustable from 80 MHz to 240 MHz. The low-power deep-sleep current consumption of the ESP32-WROVER is about 10 uA. This makes the **RAK11200** an ultra-low-power communication solution. **RAK11200** can be comfortably programmed with the Arduino™ IDE or PlatformIO.

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