



RAK4630 WisBlock LPWAN+BLE Module Datasheet

Overview

Description

The RAK4630 is a low-power, long-range transceiver module featuring the Nordic nRF52840 MCU, which supports Bluetooth 5.0 (Bluetooth Low Energy) and the latest SX1262 LoRa transceiver from Semtech. This module adheres to Class A, B, & C specifications of LoRaWAN 1.0.3 and also facilitates LoRa Point-to-Point (P2P) communication mode, enabling rapid implementation of custom LoRa networks.

With its dual RF communication capabilities (LoRa + BLE), the module is well-suited for diverse IoT applications including home automation, sensor networks, building automation, and various IoT network scenarios.

The default firmware of the RAK4630 is built on RUI3 (RAKwireless Unified Interface), which simplifies using the RAK4630 as a standalone module by enabling the development of custom firmware through RUI APIs. This setup allows direct interfacing with sensors and other external peripherals without requiring an additional MCU. Additionally, the RAK4630 can communicate with an external host MCU using AT commands via USB, UART, or BLE connection.

Features

- **LoRaWAN 1.0.3** specification compliant
- **Supported bands:** IN865, EU868, AU915, US915, KR920, RU864, and AS923
- LoRaWAN Activation by OTAA/ABP
- LoRa Point-to-Point (P2P) communication
- Custom firmware using Arduino via RUI3 API
- Easy-to-use AT Command set via UART interface
- TCXO crystal for LoRa chip
- IO ports: UART, I2C, GPIO, USB



- Temperature range: -40° C to +85° C
- Supply voltage: 2.0 ~ 3.6 V
- Low-Power Wireless Systems with 7.8 kHz to 500 kHz bandwidth
- Ultra-Low Power Consumption 4.23 uA in sleep mode
- LoRa PA Boost mode with 22 dBm output power
- BLE 5.0 (Tx power -20 to +4 dBm in 4 dB steps)
- Serial Wire Debug (SWD) interface
- Module size: 15 mm x 23 mm x 3 mm

Specifications

Overview

Hardware

The hardware specification is categorized into three parts, covering the RF, electrical, and mechanical parameters. This includes tabular data detailing the functionalities and standard values of the RAK4630 WisBlock LPWAN Module.

Interfaces

Module	Interfaces
RAK4630	USB, UART1

Pin Definition

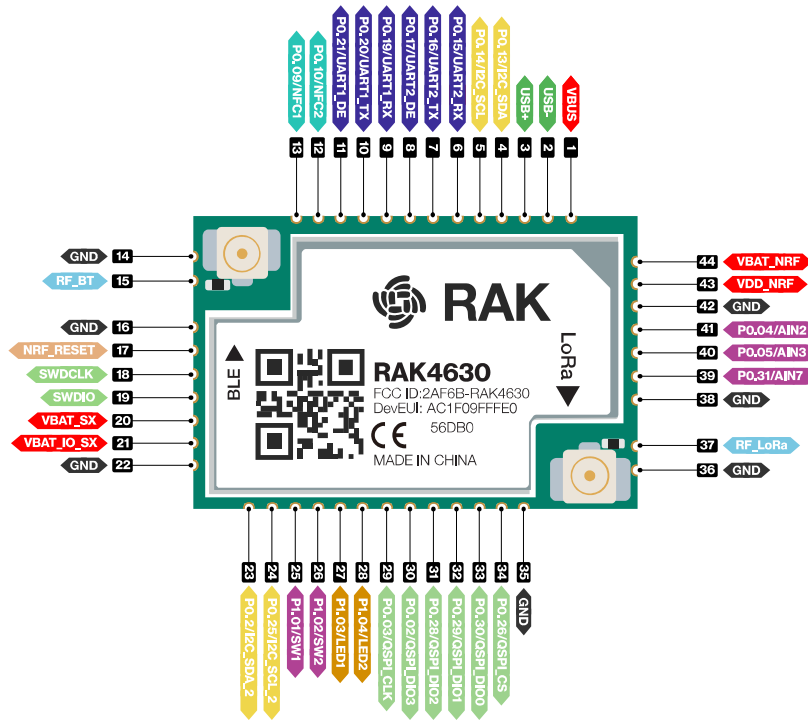


Figure 1: RAK4630 module pinout diagram

! WARNING

When using `RF_LoRa` and `RF_BT` pins for antenna and not the IPEX connector variant, there are design considerations to make sure optimum RF performance.

- RF trace must be away from interference (switching node of DC-DC supply, high current/voltage pulses from controllers of inductive load like motor, signal generators, etc.)
- RF trace must have 50 Ohms impedance. It is advisable to use an impedance simulation software tool to achieve this requirement.
- If using an external antenna connector, make it close to the `RF_LoRa` and `RF_BT` pins.
- Ground plane optimization is critical on certain antenna types like monopole.
- GND trace used for RF path return must be directly connected to the GND plane and not be treated as thermal relief.
- It is recommended for the RF trace to be routed in a curve and not in a sharp 90 degrees.

In addition, with a commitment to making IoT easy, RAK offers a dedicated service for [Antenna RF Design](#) which includes PCB design, tuning, matching, and RF testing.

Pin No.	Name
1	VBUS
2	USB-
3	USB+
4	P0.13/I2C_SDA
5	P0.14/I2C_SCL
6	P0.15/UART2_RX
7	P0.16/UART2_TX
8	P0.17/UART2_DE
9	P0.19/UART1_RX (AT Command)
10	P0.20/UART1_TX (AT Command)
11	P0.21/UART1_DE
12	P0.10/NFC2
13	P0.09/NFC1
14	GND
15	RF_BT
16	GND
17	NRF_RESET
18	SWDCLK

Pin No.	Name
19	SWDIO
20	VBAT_SX
21	VBAT_IO_SX
22	GND
23	P0.24/I2C_SDA_2
24	P0.25/I2C_SCL_2
25	P1.01/SW1
26	P1.02/SW2
27	P1.03/LED1
28	P1.04/LED2
29	P0.03/QSPI_CLK
30	P0.02/QSPI_DIO3
31	P0.28/QSPI_DIO2
32	P0.29/QSPI_DIO1
33	P0.30/QSPI_DIO0
34	P0.26/QSPI_CS
35	GND
36	GND

Pin No.	Name
37	RF_LoRa
38	GND
39	P0.31/AIN7
40	P0.05/AIN3
41	P0.04/AIN2
42	GND
43	VDD_NRF
44	VBAT_NRF

Setup of the SX1262

Information for writing custom firmware for the RAK4630 includes details about the internal connections between the RAK4630 and the necessary initialization parameters for the SX1262 LoRa Transceiver.

nRF52840 GPIO	SX1262 Pin	function
P1.10	NSS	SPI NSS
P1.11	SCK	SPI CLK
P1.12	MOSI	SPI MOSI
P1.13	MISO	SPI MISO
P1.14	BUSY	BUSY signal

nRF52840 GPIO	SX1262 Pin	function
P1.15	DIO1	DIO1 event interrupt
P1.06	NRESET	NRESET manual reset of the SX1262

Important for a successful SX1262 initialization:

- Set up DIO2 to control the antenna switch.
- Set up DIO3 to control the TCXO power supply.
- Set up the SX1262 to use it's DCDC regulator and not the LDO.
- The RAK4630 schematics show GPIO P1.07 connected to the antenna switch, but it should not be initialized, as DIO2 will control the antenna switch.

RF Characteristics

When purchasing a RAK4630 module, it's essential to specify the correct core module RAK4630 H/L for your region, where H indicates high-frequency regions, and L indicates low-frequency regions. The RAK4630 module supports LoRaWAN bands as outlined in the table below.

NOTE

Detailed information about the RAK4630 BLE and LoRa antenna can be found on the [antenna datasheet](#) .

Region	Frequency (MHz)	Core Module
India	IN865	RAK4630(H)
Europe	EU868	RAK4630(H)
Europe	EU433	RAK4630(L)
North America	US915	RAK4630(H)
Canada	US915	RAK4630(H)

Region	Frequency (MHz)	Core Module
Australia	AU915	RAK4630(H)
Korea	KR920	RAK4630(H)
Asia	AS923-1/2/3/4	RAK4630(H)
China	CN470	RAK4630(L)

Electrical Characteristics

Power Consumption

Item	Current Average	Condition - Voltage and Dwell Time
RAK4630 Module in One-Time Sleep	4.42 uA	3.3V 10seconds
RAK4630 Module System up in Idle mode	3.35 mA	3.3V 10seconds
RAK4630 Module in LoRaWAN One-Time Sleep	4.23 uA	3.3V 10seconds
RAK4630 Module 15 Bytes Data TX Sending	67.8 mA	3.6V 1second (in RAK5005-O board)
RAK4630 Module in RX Window Received	2.22 mA	3.6V 1second (in RAK5005-O board)

Absolute Maximum Ratings

Symbol	Description	Min.	Nom.	Max.	Unit
VBAT_SX	LoRa chip supply voltage	-0.5		3.9	V

Symbol	Description	Min.	Nom.	Max.	Unit
VBAT_SX_IO	LoRa chip supply for I/O pins	-0.5		3.9	V
VDD_NRF	MCU power supply	-0.3		3.9	V
VBUS	USB supply voltage	-0.3		5.8	V
VBAT_NRF	MCU high voltage power supply	-0.3		5.8	V

Recommended Operating Conditions

Symbol	Description	Min.	Nom.	Max.	Unit
VBAT_SX	SX1262 supply voltage	2.0	3.3	3.7	V
VBAT_SX_IO	SX1262 supply for I/O pins	2.0	3.3	3.7	V
VDD_NRF	NRF52840 power supply	2.0	3.3	3.6	V
VBUS	VBUS USB supply voltage	4.35	5.0	5.5	V
VBAT_NRF	NRF52840 high voltage power supply	2.5		5.5	V

Schematic Diagram

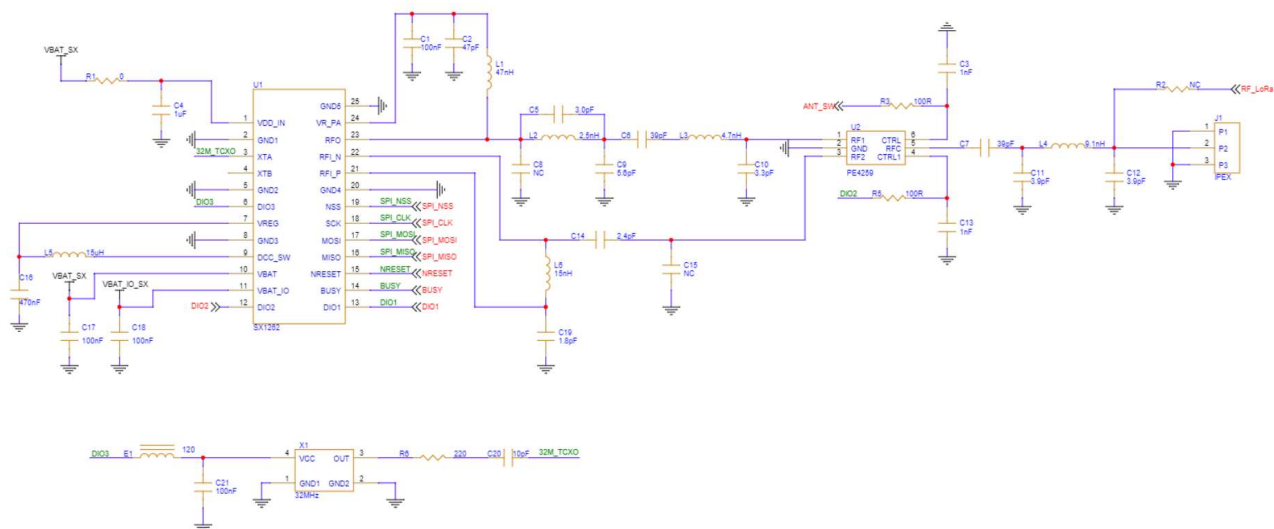


Figure 2: SX1262 Section

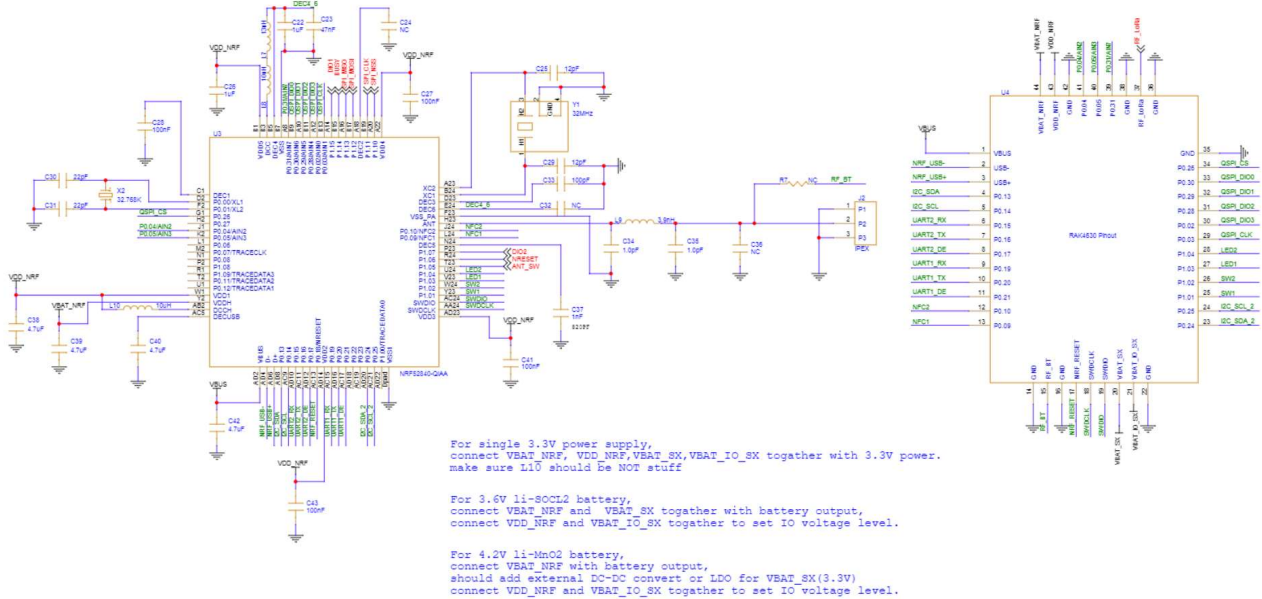


Figure 3: nRF51840 and Module Pinout

Mechanical Characteristics

Module Dimensions

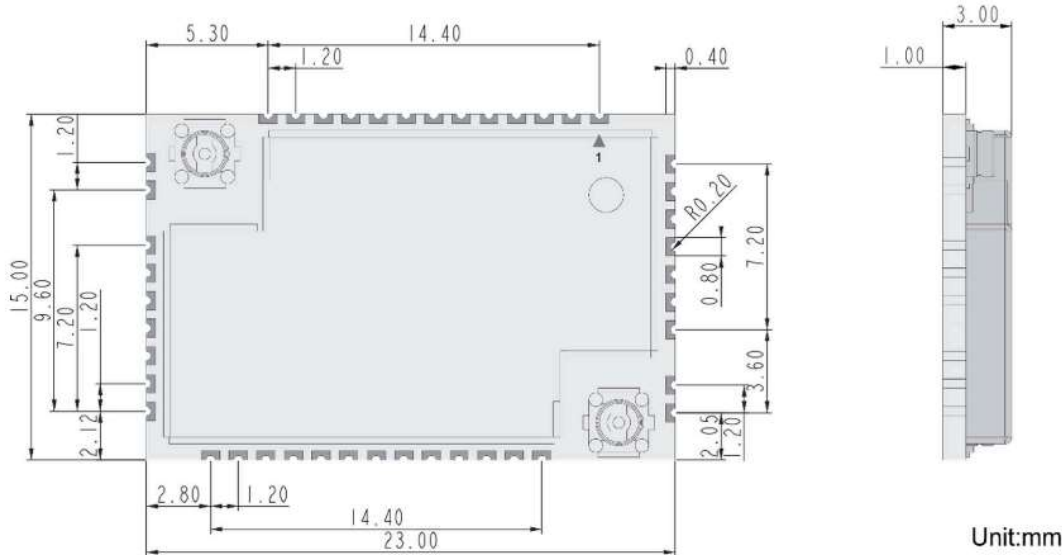


Figure 4: Board dimension

Layout Recommendation

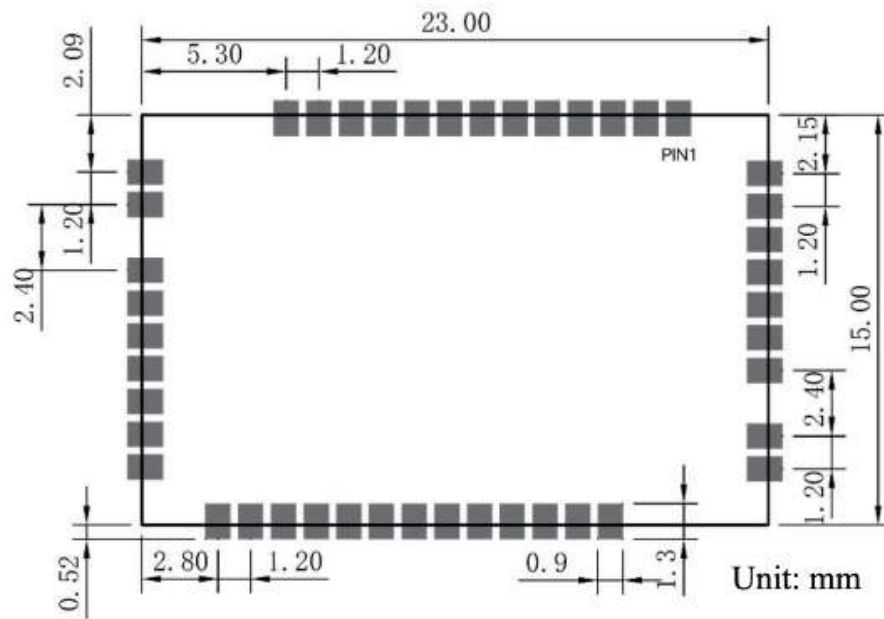


Figure 5: PCB footprint and recommendations

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