WisDuo LPWAN SiP
RAK3272-SiP Breakout Board Datasheet
Overview

Description

The RAK3272-SiP Breakout Board was designed to allow easy access to the RAK3172-SiP pins to simplify development and testing. The microcontroller GPIO pins are accessible via 2.54 mm headers. The breakout board itself has a RAK3172-SiP (based on STM32WLE5) as its core. The STM32WLE5 is part of **STM32WLE5x** family. This core is based on an Arm® Cortex®-M4 core running at 48 MHz, and a sub-GHz radio based on Semtech SX126x.

The board complies with Class A, B, & C of LoRaWAN 1.0.3 specifications and also features LoRa Point-to-Point (P2P) communication mode, which helps you in implementing your own customized long-range LoRa network quickly. It is also RUI3 compatible which allows you to create custom firmware using RUI3 APIs.

Features

- 32-bit Arm® Cortex®-M4 48 MHz MCU and sub-GHz Semtech SX126x radio
- Chipset STM32WLE5 (single-core)
- I/O ports: UART/I2C/GPIO/SPI
- 32 MHz TXCO and 32 KHz xtal
- RUI3 API compatible
- Easy to use AT Command set via UART interface
- Serial Wire Debug (SWD) interface
- **LoRaWAN 1.0.3** specification compliant
- **Supported bands**: IN865, EU868, AU915, US915, KR920, RU864, and AS923
- Supply voltage: 1.8 V ~ 3.6 V
- Temperature range: -40 °C ~ 85 °C
- Size: 25.4 mm x 41.8 mm

Specifications

Overview

The top view of the RAK3272-SiP Breakout Board is shown in **Figure 1**.

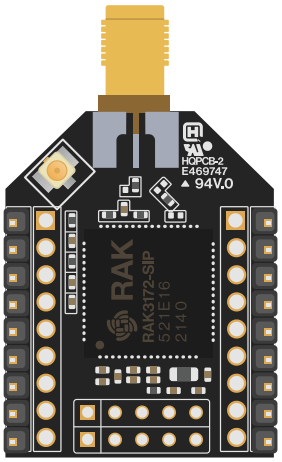

Figure 1: RAK3272-SiP Breakout Board top view

The bottom view of the RAK3272-SiP Breakout Board is shown in **Figure 2**.

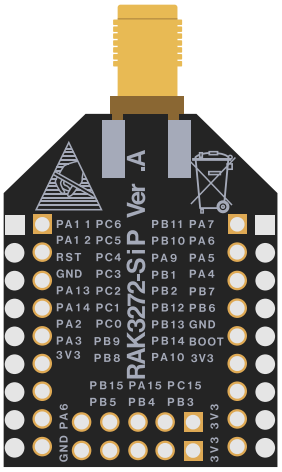

Figure 2: RAK3272-SiP Breakout Board bottom view

Hardware

The hardware specification is categorized into five parts. It discusses the interfacing, pinouts, and their corresponding functions and diagrams. It also covers the RF, electrical and mechanical parameters, including the tabular data of the functionalities and standard values of the RAK3272-SiP Breakout Board.

Interface

SWD Programing Interface

When programming via an **ST-Link** tool, it is required to have all of the following four pins connected to your ST-Link tool:

- 3V3
- SWDIO
- SWCLK
- GND

For more information refer to the **Upload firmware using ST-Link** section.

UART Interface

This board has two UART interfaces:

- UART2 (default interface for firmware uploading and AT Commands)
- UART1

RF Interface

J2 is the RP-SMA antenna connector.

> ⚠️ **WARNING**
>
> Before powering the RAK3272-SiP Breakout Board, you should install the LoRa antenna first. Not doing so might damage the board.

Make sure to use a LoRa antenna with RP-SMA male connector and compatible with the chosen LoRa frequency.

Figure 3: LoRa antenna with RP-SMA male connector

Pin Definition

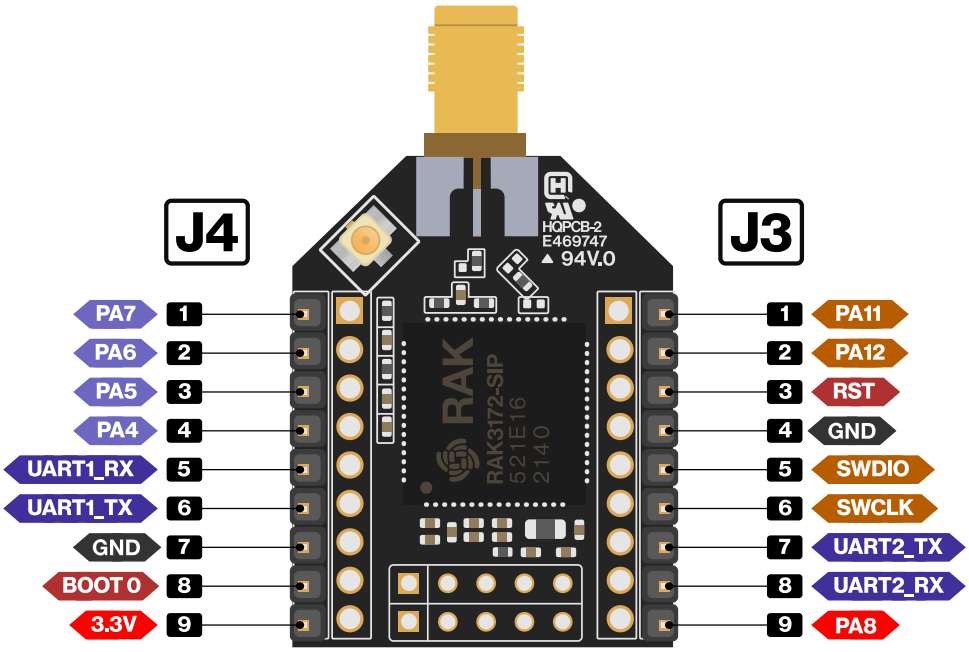

Figure 4: RAK3272-SiP Breakout Board J3 and J4 header

The pin 1 of the headers are highlighted in a blue rectangle.

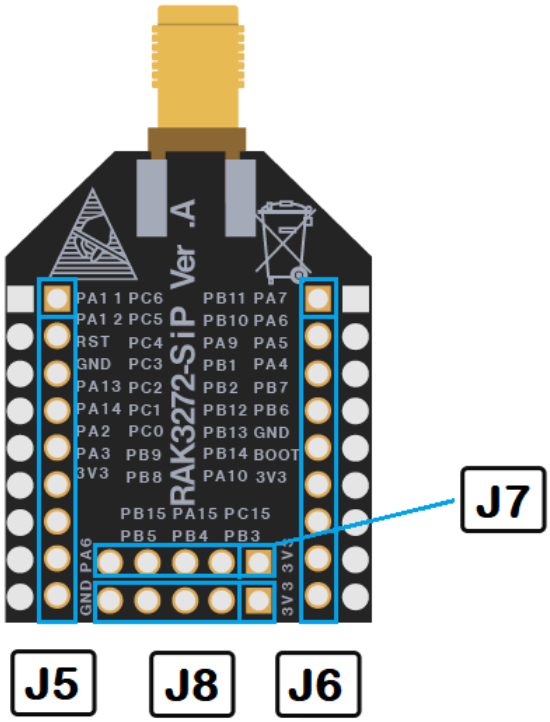

Figure 5: RAK3272-SiP Breakout Board J5 to J8 header

Pin on RAK3272-SiP Connection on UART-USB Adapter

Pin on RAK3272-SiP	Connection on UART-USB adapter
PA2	RX
PA3	TX
3V3	3.3 V
GND	Ground

The tables below show the header definitions of the RAK3272-SiP Breakout Board:

J3 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	I2C2_SDA	I2C2 interface	PA11
2	I2C2_SCL	I2C2 interface	PA12
3	RST	MCU Reset	RST
4	GND	Ground	-
5	SWDIO	PA13/SWD debug pin (SWDIO)	PA13
6	SWCLK	PA14/SWD debug pin (SWCLK)	PA14
7	UART2_TX	UART2/LPUART1 Interface (AT Commands and FW Update)	PA2
8	UART2_RX	UART2/LPUART1 Interface (AT Commands and FW Update)	PA3
9	PA8	MCU pin PA8	PA8

J4 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	SPI1_MOSI	GPIO or SPI1 (MOSI)	PA7
2	SPI1_MISO	GPIO or SPI1 (MISO)	PA6
3	SPI1_CLK	GPIO or SPI1 (CLK)	PA5
4	SPI1_NSS	GPIO or SPI1 (NSS)	PA4
5	UART1_RX	UART1 Interface	PB7
6	UART1_TX	UART1 Interface	PB6
7	GND	Ground	-
8	BOOT0	BOOT0 mode enable pin - active high	-
9	3V3	Power Supply	-

J5 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	PC6	MCU pin PC6	PC6
2	PC5	MCU pin PC5	PC5
3	PC4	MCU pin PC4	PC4
4	PC3	MCU pin PC3	PC3
5	PC2	MCU pin PC2	PC2
6	PC1	MCU pin PC1	PC1
7	PC0	MCU pin PC0	PC0
8	PB9	MCU pin PB9	PB9
9	PB8	MCU pin PB8	PB8

J6 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	PB11	MCU pin PB11	PB11
2	PB10	MCU pin PB10	PB10
3	PA9	MCU pin PA9	PA9
4	PB1	MCU pin PB1	PB1
5	PB2	MCU pin PB2	PB2
6	PB12	MCU pin PB12	PB12
7	PB13	MCU pin PB13	PB13
8	PB14	MCU pin PB14	PB14
9	PA10	MCU pin PA10	PA10

J7 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	3V3	Power Supply	-
2	PC13	MCU pin PC13	PC13
3	PA15	MCU pin PA15	PA15
4	PB15	MCU pin PB15	PB15
5	GND	Ground	-

J8 Pin Definitions

Pin	Name	Description	RAK3272-SiP Pin
1	3V3	Power Supply	-
2	PB3	MCU pin PB3	PB3
3	PB4	MCU pin PB4	PB4
4	PB5	MCU pin PB5	PB5
5	GND	Ground	-

RF Characteristics

The RAK3272-SiP Breakout Board supports the LoRaWAN bands 863 MHz to 930 MHz

Operating Frequencies

Module	Region	Frequency
RAK3272-SiP	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923
	India	IN865
	Russia	RU864

Electrical Characteristics

RAK3272-SiP Power Supply Scheme

The RAK3272-SiP Breakout Board can use two different power supply regulators: **LDO** or **DCDC** (SMPS) - Switch Mode Power Supply.

The use of **DCDC** is optional but improve the power efficiency. If you want to disable the **DCDC** mode, then you need to remove the L1 inductor as shown in the **Figure 6**.

Figure 6: RAK3272-SiP Breakout Board DCDC inductor

Absolute Maximum Ratings

Parameter	Minimum	Typical	Maximum	Unit
VDD and GPIO	-0.3 V		3.9	Volts (V)

Operating Voltage

Parameter	Minimum	Typical	Maximum	Unit
VCC	1.8		3.6	Volts (V)
VDDA (ADC or COMP used)	1.71		3.6	Volts (V)
VDDA (VREFBUF used)	2.4		3.6	Volts (V)
VDDA (ADC, COMP or VREFBUF not used)	0		3.6	Volts (V)
VBAT	1.55		3.6	Volts (V)
VDDSMPS	1.8		3.6	Volts (V)
VDDRF	1.8		3.6	Volts (V)
VDDPA	1.8		3.6	Volts (V)
VREF+	2.0		VDDA	Volts (V)
VREF+ (VDDA < 2V)	VDDA		VDDA	Volts (V)

Operating Current

Feature	Condition	Minimum	Typical	Maximum	Unit
Operating Current	TX Mode	87 (@ 20 dBm 868 Mhz)			mA
	RX Mode	5.22			mA

Sleep Current

Feature	Condition	Minimum	Typical (3.3V)	Maximum	Unit
Current Consumption	EU868		1.69		µA
	US915		-		µA

Power Consumption

Feature	Condition	Minimum	Typical	Maximum	Unit
Operating Current	TX Mode	87(@ 20 dBm 8680 MHz)	-	-	mA
	RX Mode	5.22	-	-	mA
Sleep Current	EU868	-	1.41		uA

Schematic Diagram

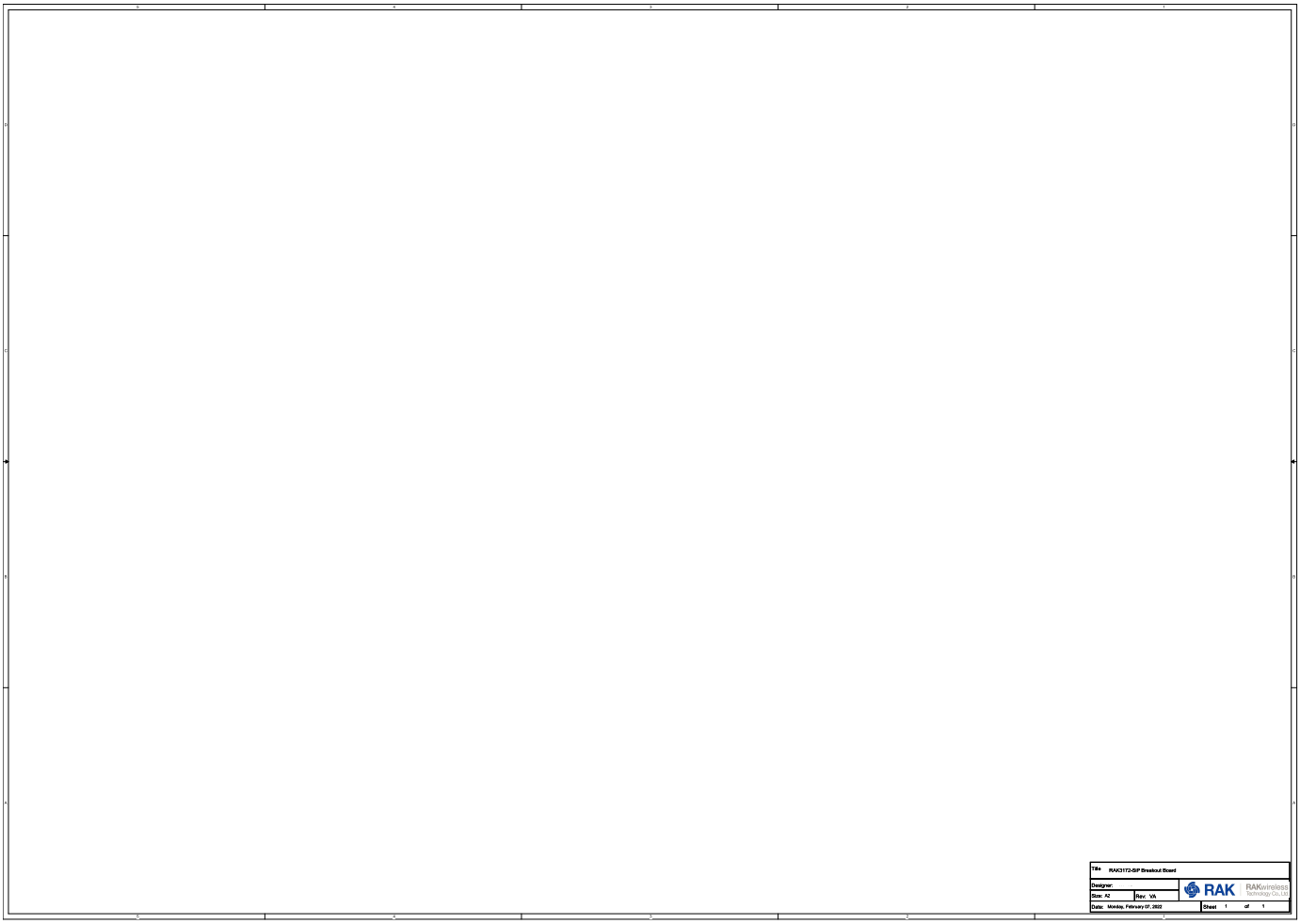

Figure 7: RAK3272-SiP schematic diagram

Mechanical Characteristics

Figure 8 shows RAK3272-SiP Breakout Board dimensions.

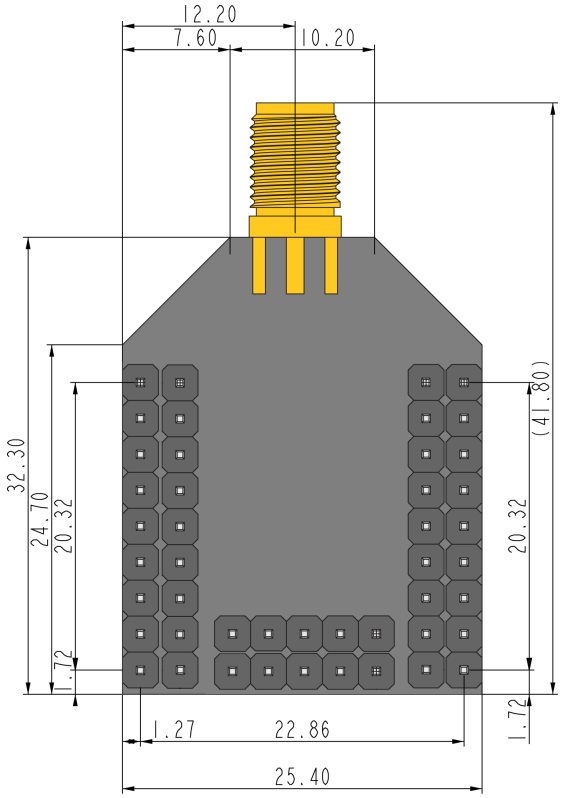

Figure 8: RAK3272-SiP Breakout Board mechanical dimensions

Software

Upload Firmware Using RAK DFU

The **bin file** contains the application code only, and you need the **RAK DFU Tool** to upload this file to RAK3272-SiP Breakout Board via UART2.

RAK3272-SiP Breakout Board uses UART2 serial pins to upload the latest firmware. Refer to the **Connect to the RAK3272-SiP Breakout Board** section.

Upload Firmware Using ST-Link

The **hex file** contains both the bootloader and the application code.

You need to use **STM32CubeProgrammer** and **ST-Link** tool to upload the hex file. Use the diagram shown in **Figure 9** to connect the **ST-Link**.

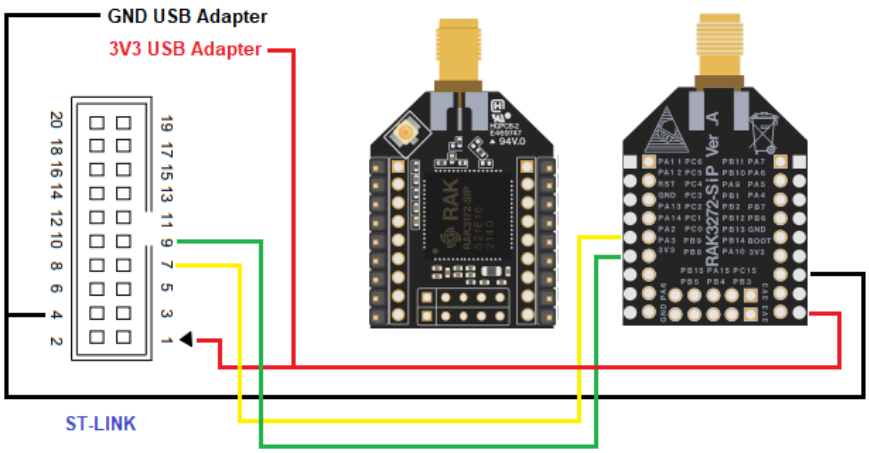

Figure 9: RAK3272-SiP Breakout Board ST-Link connection

Firmware / OS

Download the latest RAK3272-SiP Breakout Board firmware provided below.

Model	Version	Source
RAK3272-SiP (.bin)	V3.2.0	Download
RAK3272-SiP (.hex)	V3.2.0	Download

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