

# RAK4270 WisDuo LPWAN Module Datasheet

## Overview

### Description

The RAK4270 LoRa Module includes an **STM32L071 MCU** and an **SX1262** LoRa chip, which supports eight (8) spreading factors (SF5 ~ SF12) and signal bandwidth that can be adjusted between 7.8 kHz to 500 kHz. It has Ultra-Low Power Consumption of 2.31  $\mu$ A (down to 1.61  $\mu$ A @ 2.0 V) in sleep mode, but during the Transmit Mode, it can reach the maximum output power of 22 dBm. As a receiver, it can achieve a sensitivity of -148 dBm.

The module complies with Class A and C of LoRaWAN 1.0.2 specifications, and it also supports LoRa Point to Point (P2P) communications. The module is suitable for various applications that require long-range data acquisition and low power consumption, such as smart meters, supply chain and logistics tracking, agricultural sensors, and smart cities.

You can configure the mode and operation of the RAK4270 module using [RAK4270 AT Commands](#) via a UART interface. Also, it offers low power features which is very suitable for battery powered applications.

### Product Features

- LoRa module is suitable for applications in Smart City, Smart Agriculture, Smart Industry
- Compact form factor: **15 x 15.5 x 2.5 mm** (LxWxH)
- 20 pin stamp pad for PCB SMT board-to-board soldering
- I/O ports: **UART/I2C/GPIO/ADC**
- AT commands control interface
- Temperature range: **-30 °C to +85 °C**
- Supply voltage: **2.0 to 3.6 V**
- **Supported bands:** (EU433, CN470, IN865, EU868, AU915, US915, KR920, and AS923)
- LoRa bandwidth range of 7.8 kHz to 500 kHz, SF5 to SF12, BR=0.018~62.5 kb/s
- Ultra-Low Power Consumption of 2.31  $\mu$ A (down to 1.61  $\mu$ A @ 2.0 V) in sleep mode
- Arm Cortex-M0+ 32-bit RISC core
- 128 kbytes flash memory with ECC
- 20 kbytes RAM
- 6 kbytes of data EEPROM with ECC

## Specifications

### Overview

The overview shows the module top view and its block diagram where the core and external interfaces of the module are shown.

### Board Overview

Figure 1 shows the top view of the RAK4270 LoRa module. The dimensions of the module are 15 x 15.5 x 2.5 mm

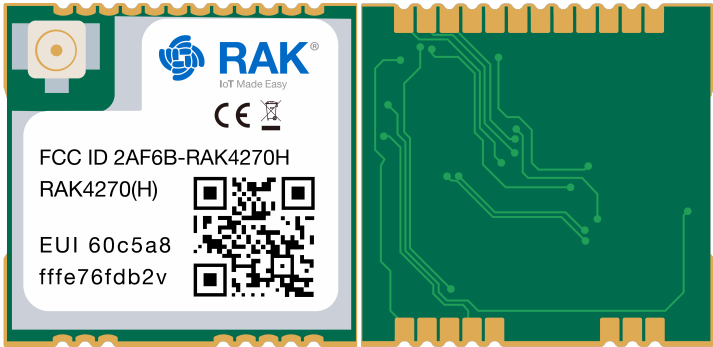


Figure 1: RAK4270 Module

## Block Diagram

The block diagram representing the RAK4270 LoRa module is shown in Figure 2. External interfaces are outlined in the diagram.

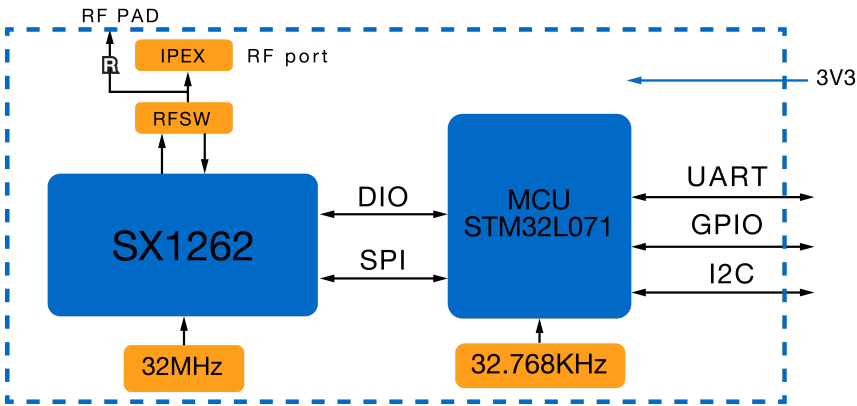


Figure 2: RAK4270 Module

## Hardware

The hardware specification discusses the interfaces, pinouts and its corresponding functions and diagrams. It also covers the parameters of RAK4270 Module in terms of RF, electrical, mechanical, and environmental characteristics.

## Interfaces

Module	Interfaces
RAK4270	UART1, UART2, I2C, GPIO

## Pin Definition



Figure 3: RAK4270 Pinout

Pin	Name	Type	Description	Alternate Functions
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Pin	Name	Type	Description	Alternate Functions
1	PA3/UART2_RX	I	UART2 Interface (AT Commands)	USART1_RX, I2C1_SDA
2	PA2/UART2_TX	O	UART2 Interface (AT Commands)	MCO, USART1_TX, I2C1_SCL, I2C3_SMBA
3	PA1	I/O	GPIO	Reserved for internal use. Do not connect external circuit.
4	PA9/UART1_TX	I/O	UART1 Interface (AT Commands and FW Update)	TIM21_CH1,TIM2_CH3, USART2_TX,LPUART1_TX, COMP2_OUT,COMP2_INM, ADC_IN2
5	PA10/UART1_RX	I/O	UART1 Interface (AT Commands and FW Update)	TIM21_CH2,TIM2_CH4, USART2_RX,LPUART1_RX, COMP2_INP,ADC_IN3
6	PA12/UART1_DE	I/O	GPIO	EVENTOUT,TIM2_CH2,USART2_RTS_DE, TIM21_ETR, USART4_RX,COMP1_INP, ADC_IN1
7	PA13/SWDIO	I/O	SWD debug pin (SWDIO)	SWDIO, LPUART1_RX
8	PA14/SWCLK	I/O	SWD debug pin (SWCLK)	SWCLK, USART2_TX, LPUART1_TX
9	I2C_SCL	I/O	I2C interface	USART1_TX,I2C1_SCL, LPTIM1_ETR,COMP2_INP
10	I2C_SDA	I/O	I2C interface	USART1_RX,I2C1_SDA, LPTIM1_IN2,USART4_CTS, COMP2_INP,VREF_PVD_IN
11	GND		Ground	
12	RF	I/O	RF port (reserved), default RF out by IPEX	
13	GND		Ground	
14	GND		Ground	
15	PA11/ANT_SW	I/O	ANT_SW	leave it unconnected on mainboard
16	PB4	I/O	GPIO	Reserved for internal use. Do not connect external circuit.
17	PA8	I/O	GPIO	USART1_CK,I2C3_SCL, MCO,EVENTOUT
18	MCU_NIRST	I/O	MCU reset (STM32L071KBU6 NRST)	
19	GND		Ground	Ground


Pin	Name	Type	Description	Alternate Functions
20	VDD		DC3V3	Supply voltage 2.0~3.3 V

## LoRa Transceiver IC Connection to RAK4270 Internal STM32

LoRa IC Pin	STM32 GPIO
DIO1	PB1
DIO2	PB5
SPI1_SCK	PA5
SPI1_MISO	PA6
SPI1_MOSI	PA7
SPI1_NSS	PA4
BUSY	PB0
NRESET	PA0
ANT_SW	PA11

## RF Switch Control Logic table

ANT_SW	DIO2	Condition
1	0	RX mode
0	1	TX mode

 **Note**

- Set Dio2AsRfSwitchControl = false
- Set Dio3AsTxcoControl = enable

## SWD Programming Tool

To upgrade the firmware, the SWD (Serial Wire Debug) interface must be used. A 5-pin JLINK cable has to be connected to the SWD port. These pins are 3v3, GND, SWDIO, SWCLK, and MCU\_NRST.

## UARTS Ports

There are two UART ports on the RAK4270 module. UART2 (pin1 and pin2) can be used as the AT command port, while the UART1 (pin4 and pin5) can be used both as AT command port and firmware upgrade port. It is recommended to connect the UART2 port to an external MCU and reserve UART1 for debugging and or future firmware upgrade purposes.

## I2C Port

The RAK4270 exposes an I2C port, in which the SDA line is assigned to the pin9, and the SCL line is assigned to pin10. This I2C port allows you to control additional slave sensors with the RAK4270 using I2C protocol. The RAK4270 will be the master. If the I2C port is used, then external pull-up resistors must be added to the SDA and SCL lines. The recommended value of the resistors is 10 kΩ. You can develop your own firmware or use [RUI \(RAKwireless Unified Interface\) Online compiler](#) to use this port.

## RF Port

The RAK4270 module exposes two types of RF antenna: IPEX and PAD. The most straightforward way is to use the IPEX antenna port. In such a case, you just connect the antenna to the IPEX connector on the module directly. On the other hand, for specific needs, you can design a PCB trace antenna, Chip antenna, SMA antenna, or spring type antenna. In the latter case, you should use the PAD type antenna port exposed by this module. The external antenna should be matched to the 50 Ω RF transmission line.

## VDD Power In

It is recommended to add four decoupling capacitors near the RAK4270 power supply pins. The recommended values of the capacitors are two 10 uF and two 100 nF connected in parallel.

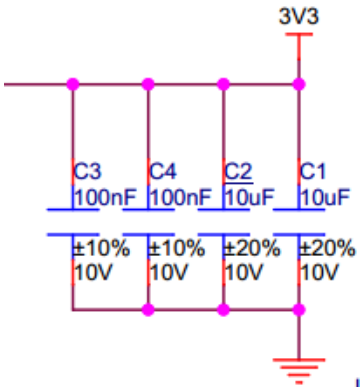


Figure 4: RAK4270 VDD port

## RF Characteristics

### Operating Frequencies

Module	Region	Frequency
RAK4270(L)	Europe	EU433
	China	CN470
RAK4270(H)	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923

Module

Region

Frequency

India

IN865

Electrical Characteristics

Schematic Diagram

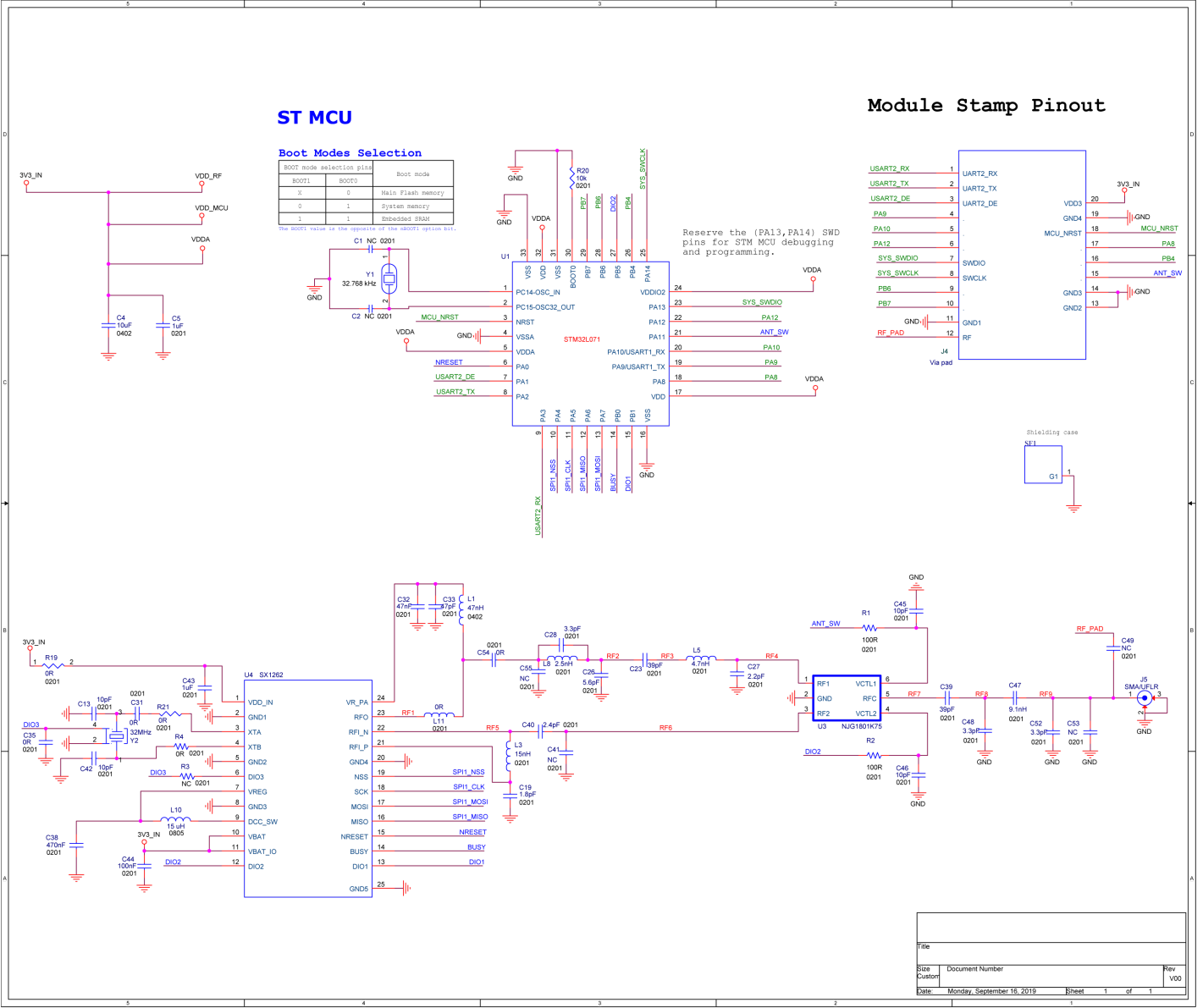


Figure 5: RAK4270 Schematic Diagram

Operating Voltage

Feature	Minimum	Typical	Maximum	Unit
VCC	2.0	3.3	3.45	Volts (V)

Operating Current

Feature	Condition	Minimum	Typical	Maximum	Unit
Operating Current	TX Mode	35.4 (@ 1 dBm SF7 868Mhz)			mA
	RX Mode	15.8			mA

Sleep Current

Feature	Condition	Minimum (2.0V)	Typical (3.3V)	Maximum	Unit
Current Consumption	EU868	1.74	2.19		μA
	US915	1.61	2.31		μA

Mechanical Characteristics

Dimensions

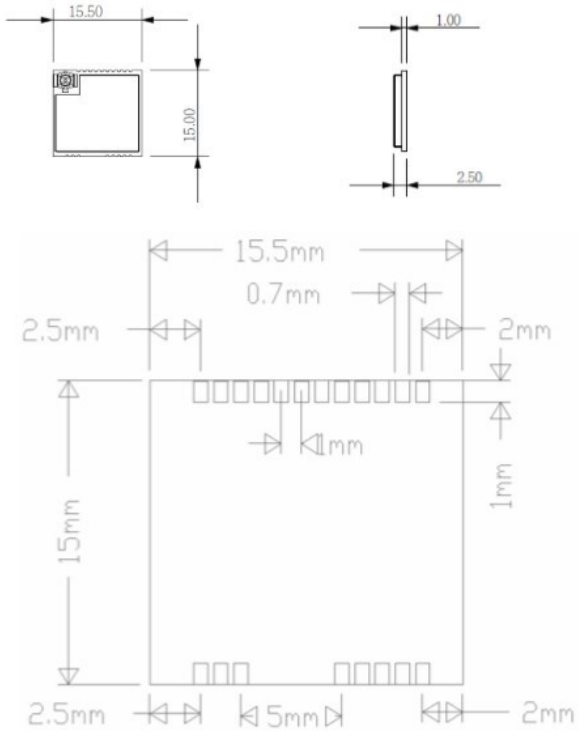


Figure 6: RAK4270 Mechanical Dimensions

Recommended Footprint

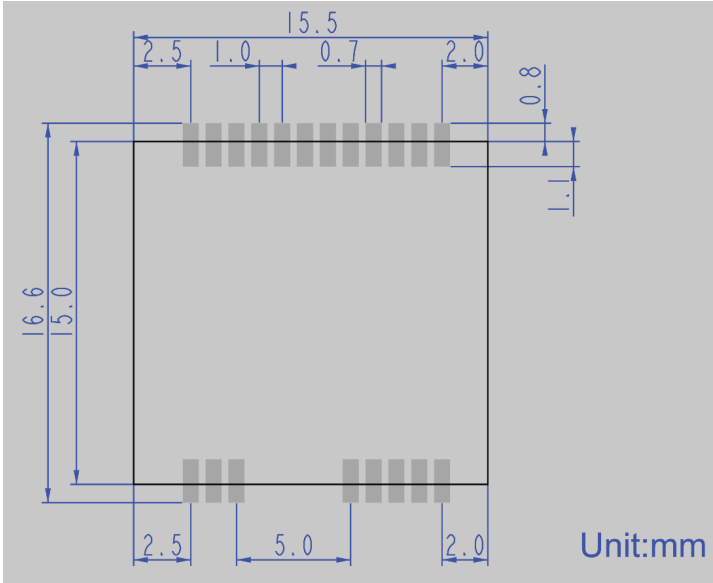


Figure 7: RAK4270 Recommended PCB footprint

Environmental Characteristics

Operating Temperature

Feature	Minimum	Typical	Maximum	Unit
Operating Temperature	-30	25	85	°C

## Storage Temperature

Feature	Minimum	Typical	Maximum	Unit
Storage Temperature	-40		85	°C

## Recommended Reflow Profile

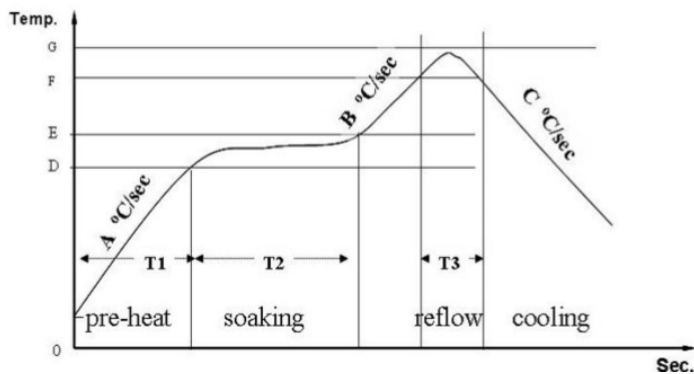


Figure 8: RAK4270 Recommended Reflow Profile

Standard conditions for reflow soldering:

- Pre-heating Ramp (A) (Initial temperature: 150 °C): **1~2.5 °C/sec**
- Soaking Time (T2) (150~180 °C): **60~100 sec**
- Peak Temperature (G): **230~250 °C**
- Reflow Time (T3) (>220 °C): **30~60 sec**
- Ramp-up Rate (B): **0~2.5 °C/sec**
- Ramp-down Rate (C): **1~3 °C/sec**

## Software

Download the latest firmware of the RAK4270 WisDuo LPWAN Module as provided in the table below.

## Firmware

Model	Version	Source
RAK4270	V3.3.0.15	<a href="#">Download</a> 

## Certification





