

## DS01862

### RHF0M062 Datasheet

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V3.0

#### Document information

Info	Content
<b>Keywords</b>	<i>RisingHF, LoRaWAN, RHF0M062, Small size AT command</i>
<b>Abstract</b>	This document is the RHF0M062 Datasheet

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### Ultra-low power and small size LoRaWAN Module RHF0M062

#### Description

RHF0M062 is a low-cost, ultra-low power, ultra-small LoRaWAN module designed by RisingHF. The module uses low power and high-performance LoRa chip SX1262 and Cypress ultra-low power MCU.

The module's target applications are wireless sensor networks and other IoT devices, especially battery powered which requires low power and long distance.

#### Applications

The RHF0M062 LoRaWAN module is ideal for long-range, ultra-low-power applications such as wireless meter reading, sensor networks and other IoT applications.

#### Features

- ◆ Low power consumption: down to 2.7uA sleep current (WOR mode);
- ◆ low cost;

- ◆ SX1262 and cost-effective MCU;
- ◆ Small size: 14mm \* 15mm \*3.15mm with 18 pins SMT
- ◆ High performance:  
RHF0M062-LF22:  
TXOP=21dBm@470MHz  
RHF0M062-HF22:  
TXOP=22dBm@868MHz/915MHz  
160dB link budget, suitable for long range use cases
- ◆ User-friendly interface  
USART;  
I2C;  
SWD;  
ADC;
- ◆ Support global LoRaWAN protocol  
EU868;  
US915 and US915 Hybrid;  
CN779;  
AU915;  
CN470 and CN470 Prequel;  
AS923;  
KR920;  
IN865;

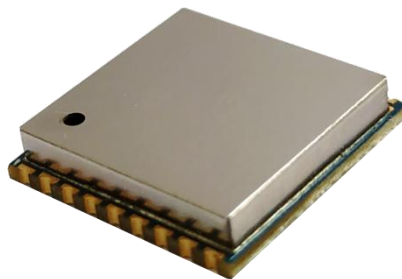


Figure 1 RHF0M062 Module Outline

This product specification describe the performance and functions of the RHF0M062 module in details. Please contact RisingHF for the latest FW, product updates or errata.

## 1 Description

The RHF0M062 embeds the high-performance LoRa Chip SX1262 and Cypress 4100s MCU, which is suitable for end device of IOT.

Based on the powerful functions and performance of SX1262, the RHF0M062 could operate in both (G)FSK and LoRa mode. In LoRa mode, BW with 62.5kHz, 125kHz, 250kHz and 500kHz could be used. The module could provide UART, I2C, ADC and some others GPIOs for customer to extend their application. Two wire interface (SWIM) is suggested to be used for programming.

RHF0M062 is available in two optional models, RHF0M062-LF22 and RHF0M062-HF22. The RHF0M062-LF22 supports 21dBm@LF band (470MHz), while the RHF0M062-HF22 supports 22dBm@HF band (868MHz/915MHz).

### 1.1 Schematic diagram

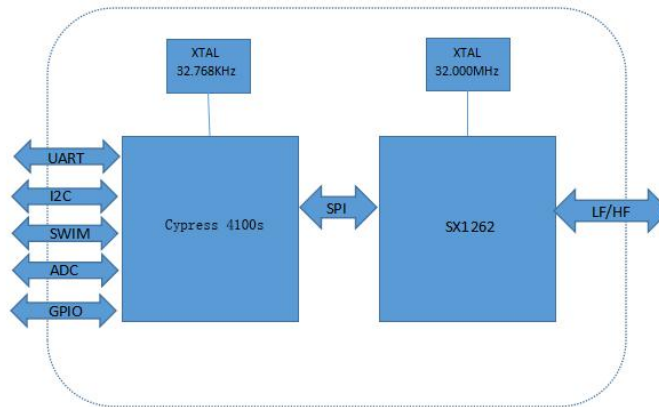


Figure 2 RHF0M062 schematic diagram

### 1.2 Pin definition

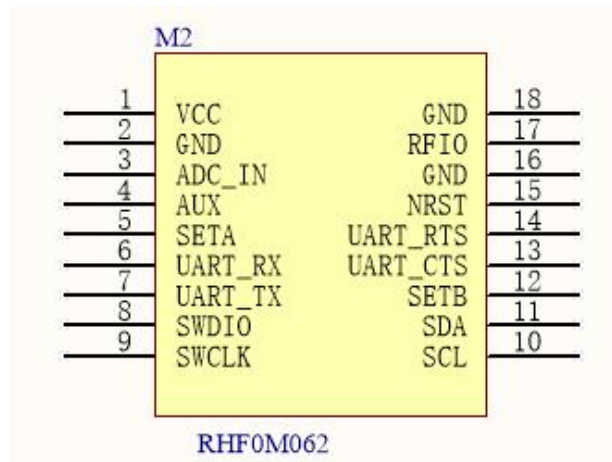


Figure 3 Pin definition of RHF0M062

**Table 1 Pin description**

Number	Name	Type	Description
1	VCC	-	Supply voltage for the module
2	GND	-	Ground
3	ADC_IN	I	ADC Input;P2.3
4	AUX	I/O	MCU GPIO;P6.2
5	SETA	I/O	MCU GPIO;P6.4
6	UART_RX	I/O	UART_RX from MCU;P3.0
7	UART_TX	I/O	UART_TX from MCU;P3.1
8	SWDIO	I/O	SWDIO of SWIM for program download
9	SWCLK	I/O	SWCLK of SWIM for program download
10	SCL	I/O	SCL of I2C from MCU;P0.0
11	SDA	I/O	SDA of I2C from MCU;P0.1
12	SETB	I/O	MCU GPIO;P0.2; Boot pin(Active low)
13	UART_CTS	I/O	UART CTS PIN;P0.6
14	UART_RTS	I/O	UART RTS PIN;P0.7
15	NRST	I	Reset trigger input for MCU
16	GND	-	Ground
17	RFIO	I/O	RF input/output
18	GND	-	Ground

## 2 Electrical Characteristics

### 2.1 Absolute Maximum Ratings

As stated that the values listed below may cause permanent device failure. Exposure to absolute maximum ratings for extended periods may affect device reliability.

**Table 2 Absolute Maximum Ratings**

Item	Description	min	max	unit
VCCmr	Supply voltage	-0.3	+3.9	V
Tmr	Temperature	-55	+115	°C
Pmr	RF input level	-	+10	dBm

### 2.2 Operating Range

**Table 3 Operating Range**

Item	Description	min	max	unit
VCCop	Supply voltage	+1.8	+3.6	V
Top	Temperature	-40	+85	°C
Pop	RF input level	-	+10	dBm

### 2.3 Module Specifications

Table 4 Module Specifications

ITEMs	Parameter	Specifications	Unit
<b>Structure</b>	Size	14(W) X 15(L) X 3(H)	mm
	Package	18 pins, SMT	
<b>Electrical Characteristics</b>	power supply	Typical 3.3V	V
	Sleep current	2.7uA (WDT off);4.3uA(WDT on)	uA
	TX current	100mA @21dBm in 470MHz typical	mA
		130mA @22dBm in 868MHz/915MHz typical	
	RX current	5.7mA @BW125kHz, 470MHz type	mA
		5.7mA @BW125kHz, 868MHz/915MHz type	
	Output power	21dBm max @470MHz	dBm
		22dBm max @868MHz/915MHz	
	Sensitivity	-138dBm @SF12, BW125kHz, 470MHz	dBm
		-137.5dBm @SF12, BW125kHz, 868MHz/915MHz	
Harmonics (LF Output)	<-36dBm below 1GHz	dBm	
	<-40dBm above 1GHz		
Harmonics (HF output)	<-40dBm above 1GHz		
<b>Interface</b>	RFIO	RF port	
	UART	1 group of UART, include 2pins	
	I2C	1 group of I2C, include 2 pins	
	ADC	1 ADC Input, include 1pins,12-bit 1Msps	
	NRST	Manual reset pin input	



## 3 Typical Performance

### 3.1 RHF0M062-LF22 measurement

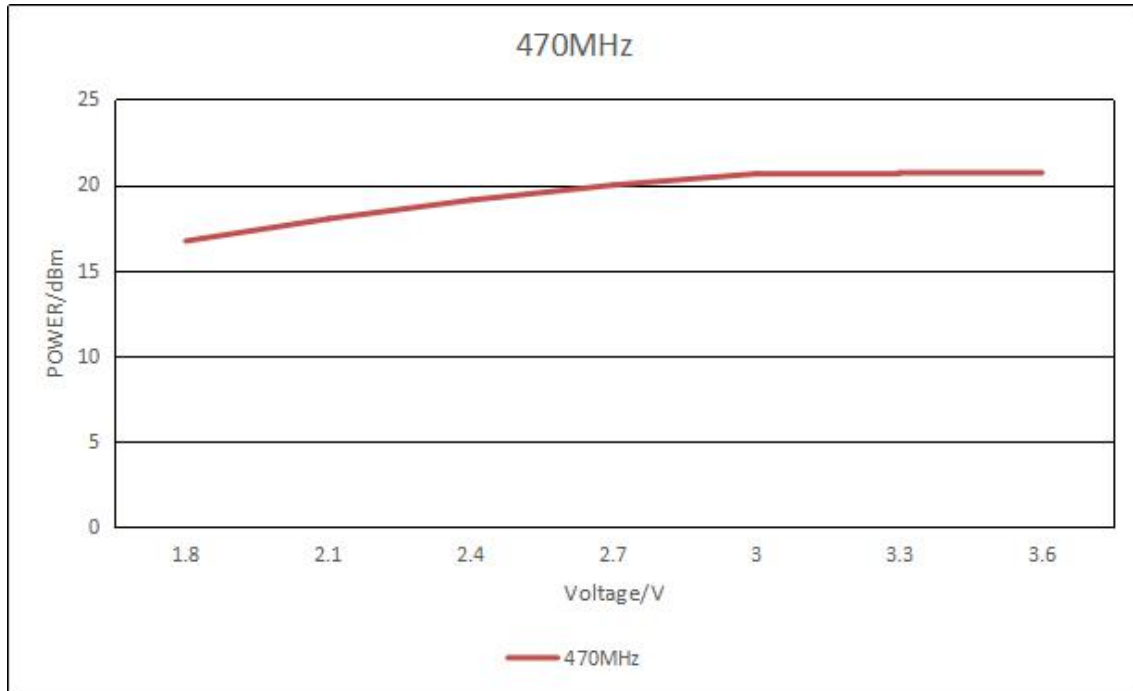


Figure 4 TXOP vs Supply voltage (470MHz)

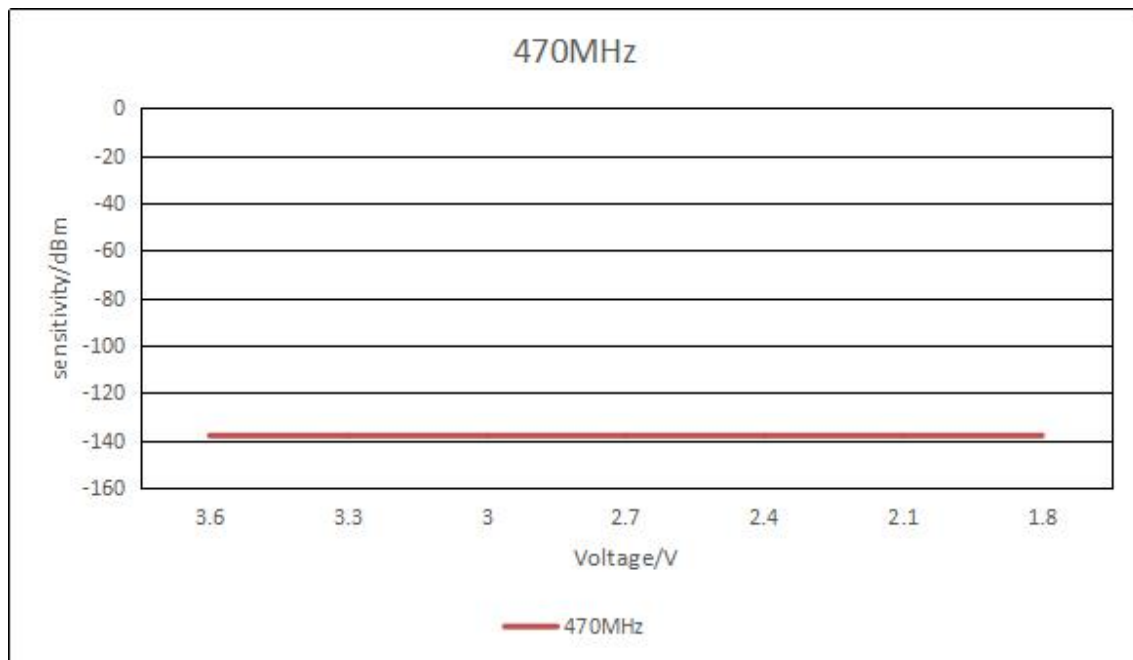


Figure 5 Sensitivity (SF12,125kHz) vs Supply voltage (470MHz)

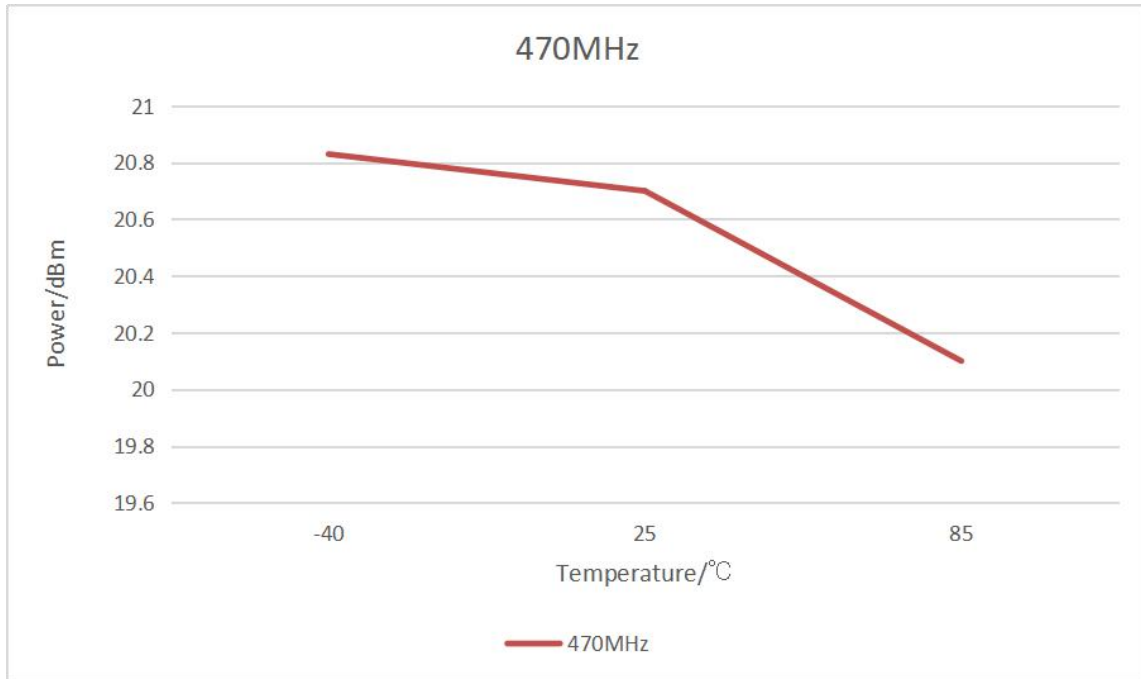


Figure 6 TXOP vs Temperature

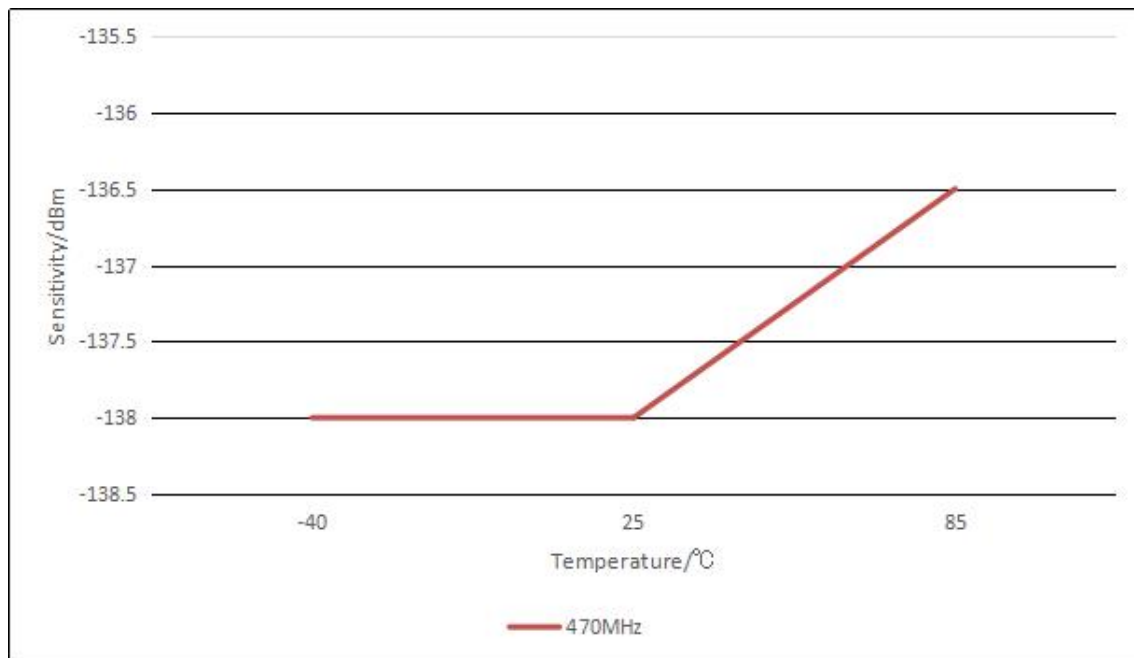


Figure 7 Sensitivity (SF12,125kHz) vs temperature



Figure 8 Harmonics measurement @Frf=470MHz, TXOP=21dBm (470MHz)

## 3.2 RHF0M062-HF22 measurement

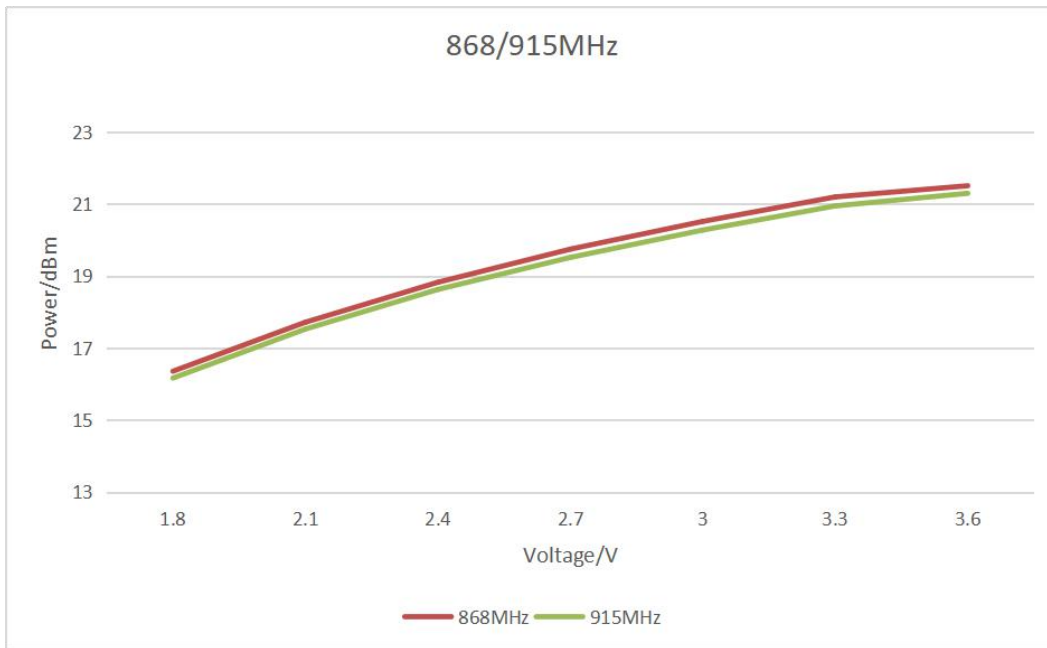


Figure 9 TXOP vs Supply voltage (868/915MHz)

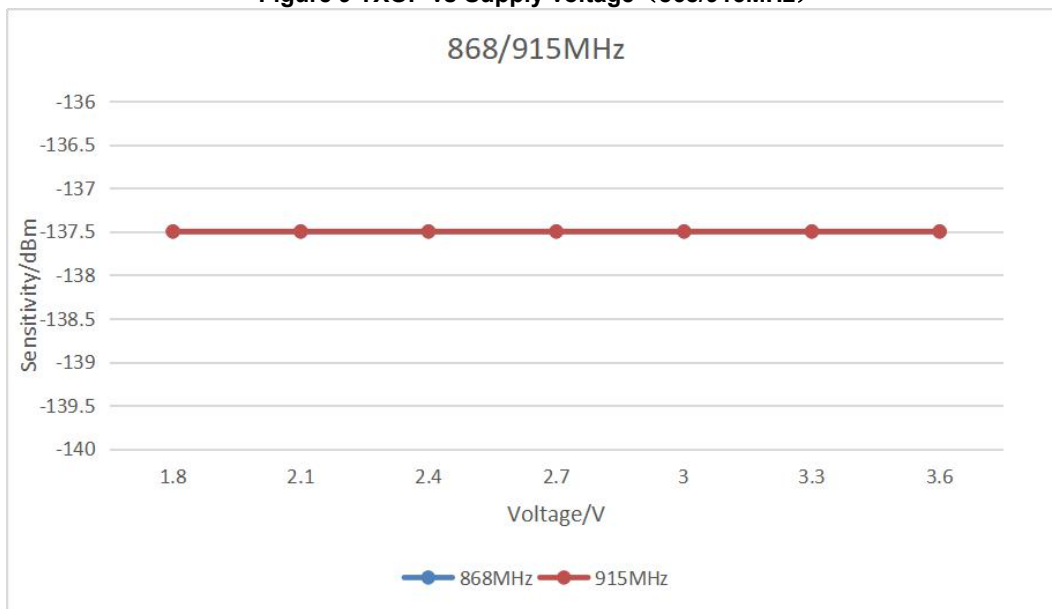


Figure 10 Sensitivity (SF12,125kHz) vs Supply voltage (868/915MHz)

Remarks: 868/915 receiving sensitivity test data overlap

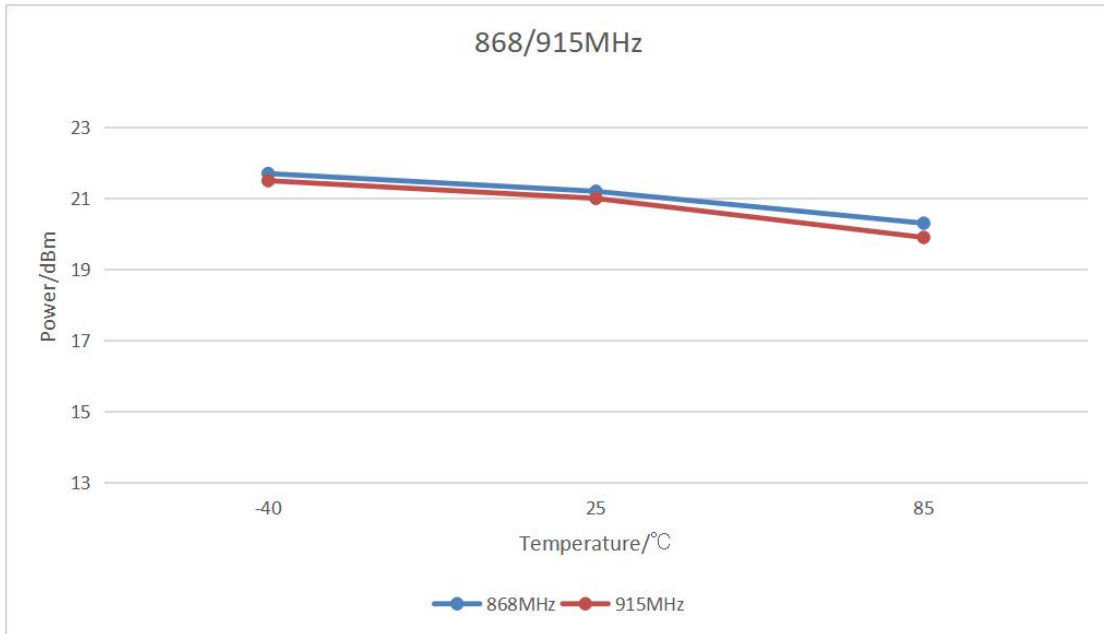


Figure 11 TXOP vs Temperature (868/915MHz)

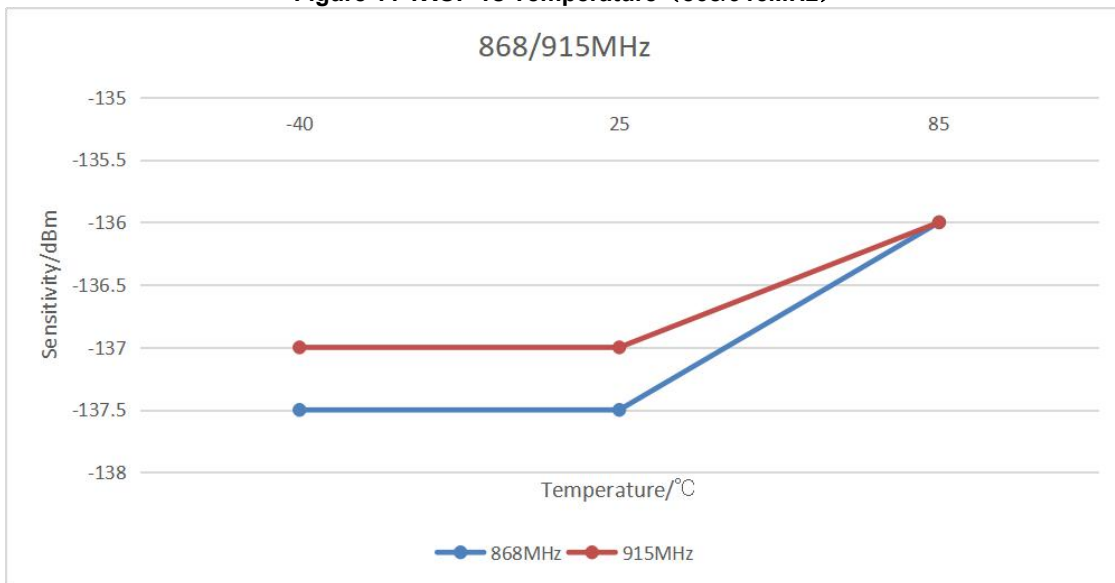


Figure 12 Sensitivity (SF12,125kHz) vs temperature

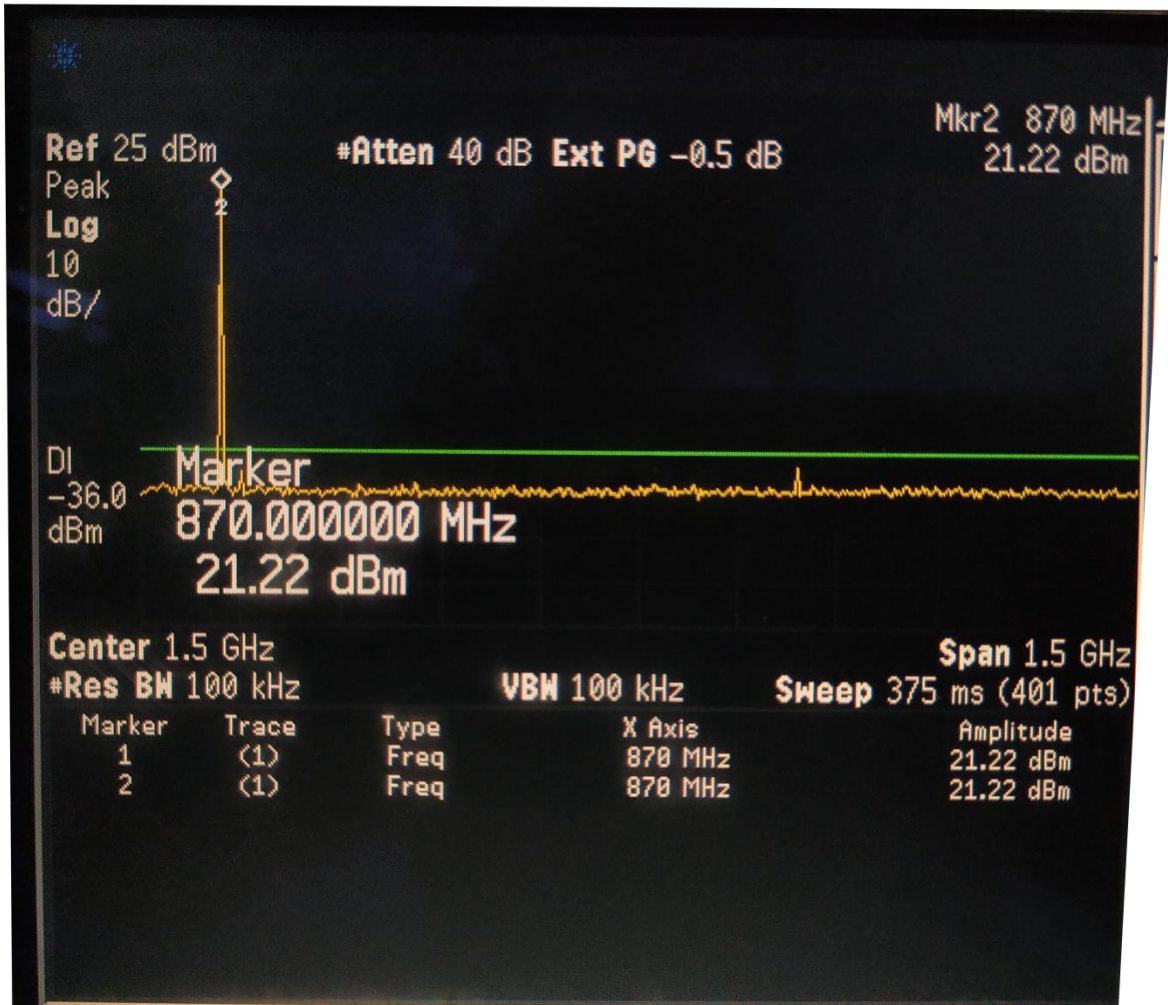


Figure 13 Harmonics measurement @Frf=868MHz, TXOP=22dBm (868MHz)

## 4 Application Information

### 4.1 Package Information

THE RHF0M062 is available in a 18-lead SMD package as shown below:

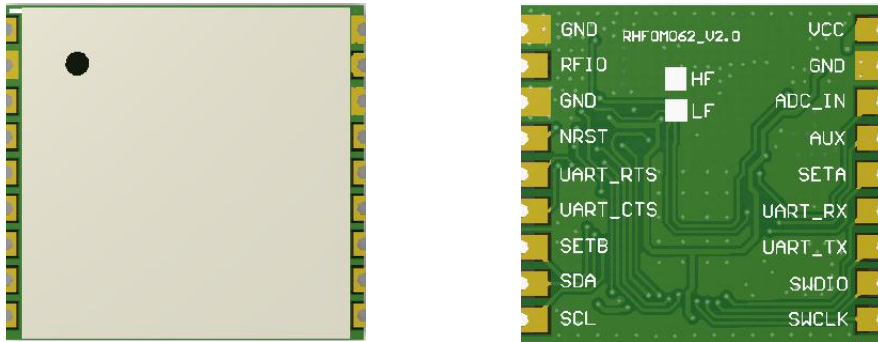


Figure 14 RHF0M062 package outline drawing

Below is the recommended land pattern for layout.

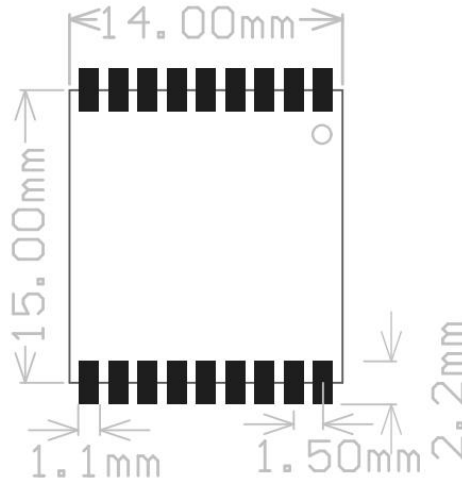


Figure 15 Recommended land pattern

### 4.2 Interface of Module

Except that several essential GPIOs and one group of SPI would be used for internal transceiver control, all others GPIOs and interface of the MCU would be connected to external pins of the module, which includes UART, I2C, ADC and so on.

### 4.3 Reference design with RHF0M062 Module

RHF0M062 is integrated with LoRaWAN protocol and AT command. LoRaWAN node design with RHF0M062 is very simple. Just connect the UART and NRST to their host MCU with AT command.

In addition, the module's Pin12 grounding will force the module into the Boot upgrade mode.

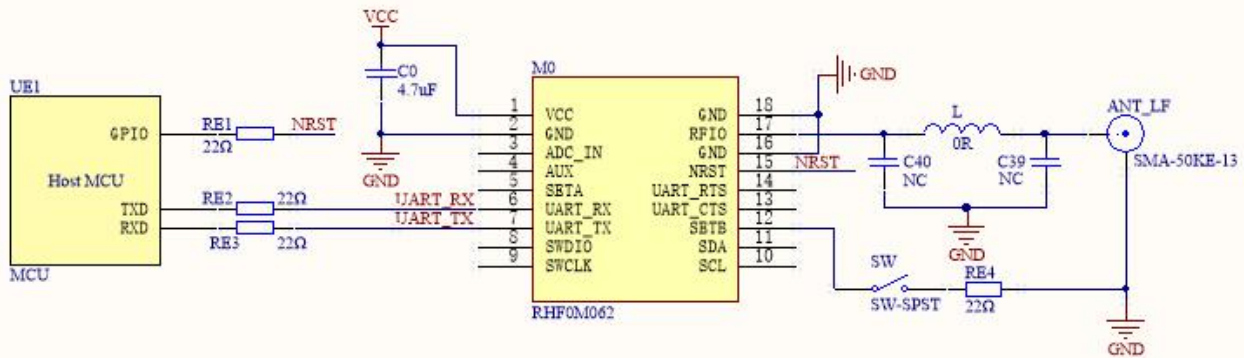


Figure 16 Reference design with RHF0M062

## 5 Application in LoRaWAN

### 5.1 LoRaWAN

LoRaWAN network is typically a star topology in which gateways relay messages between end-devices and a central network server. Gateways are connected to the network server via standard IP connections while end devices use single-hop LoRa™ or FSK communication to one or many gateways. All communication is generally bi-directional, although uplink communication from an end device to the network server is expected to be the predominant traffic.

Communication between end-devices and gateways is spread out on different frequency channels and data rates. The selection of the data rate is a trade-off between communication range and message duration, communications with different data rates do not interfere with each other. LoRa data rates range from 0.3 kbps to 50 kbps, with different Bandwidth and Spreading Factor. To maximize both battery life of the end-devices and overall network capacity, the LoRa network infrastructure can manage the data rate and RF output for each end-device individually by means of an adaptive data rate (ADR) scheme.

End-devices may transmit on any channel available at any time, using any available data rate, as long as the following rules are respected:

- 1) The end-device changes channel in a pseudo-random sequence for each transmission. This results in frequency diversity and makes the system more robust to interference.
- 2) The end-device respects the maximum transmit duty cycle relative to the sub-band used and local regulations.



RHF0M062 module integrates Semtech SX126x chip and Cypress ultra-low-power MCU. With a current of only 2.7uA in sleep mode, this module is ideal for a wide range of applications in LoRaWAN.

### 5.2 LoRaWAN sensor with RHF0M062

RHF0M062 is AT command based LoRaWAN modem, which is LoRaWAN protocol integrated. Customer just need to use a simple host MCU with application to control the modem via UART so that a LoRaWAN sensor could be designed easily. This will help customer to design and promote their sensor devices to market quickly.

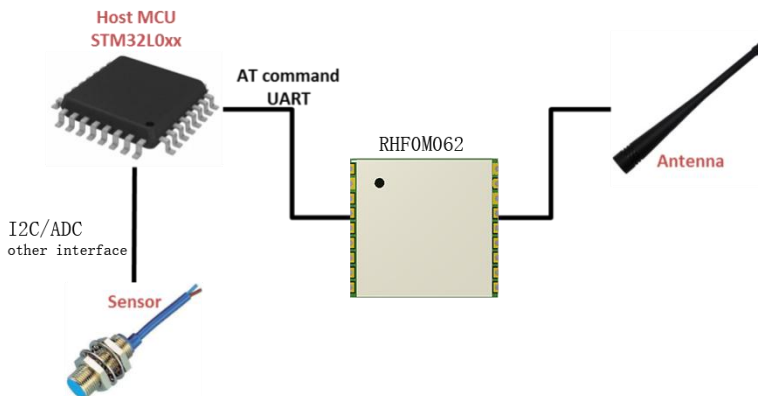


Figure 17 LoRaWAN sensor with RHF0M062

## 6 Ordering information

Technical Support: [support@risinghf.com](mailto:support@risinghf.com)

Business:

China: [Salescn@RisingHF.com](mailto:Salescn@RisingHF.com)

Others: [Salesww@RisingHF.com](mailto:Salesww@RisingHF.com)

Website: [www.risinghf.com](http://www.risinghf.com)

Table 5 Ordering information

Part Number	MCU	TX Power (dBm)	AT Modem
RHF0M062-LF22	ROM 128KB / RAM 16KB	21@LF (470MHz)	Yes
RHF0M062-HF22	ROM 128KB / RAM 16KB	22@HF (868/915MHz)	Yes

## Revision

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V3.0 2019-04-02

+Add test data and final review of RHF0M062\_HF22;

V2.0 2018-12-18

+Correct the test data and delete the related content of RHF0M062\_HF22;

V1.0 2018-11-18

+ Draft Creation

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