

DS12418

RHF0M62H 模组技术规格书

V1.0

Document information

Info	Content
Keywords	RisingHF, 纯射频模组, 超小尺寸
Abstract	本文档是 RHF0M62 模组技术规格书

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## 1 介绍

RHF0M62H 是瑞兴恒方网络(深圳)有限公司设计的低成本，超低功耗，超小尺寸的 LoRa 纯射频模组，模组内嵌了 Semtech 超高性能 LoRa 无线通信芯片 SX1262。该模组的目标应用是无线传感网络和其他物联网设备，尤其是有电池供电要求低功耗和远距离的场合。

本规格书主要描述模组的硬件信息、硬件性能和应用信息。

RHF0M62H LoRa 纯射频模组主要适用于远距离，超低功耗的应用，比如无线抄表，传感网络和其他低功耗广域物联网场景。



### 1.1 主要特点

- 超低功耗：低至 1.62uA 睡眠电流
- 低成本
- 小尺寸: 11.6mm \*11mm \*2.95mm @12 pins SMT
- 射频通信接口：IPEX 端、SMT Pin，默认 IPEX

高性能：

RHF0M62H-LF22:

- ✓ TXOP=22dBm@470-510MHz
- ✓ -136.5dBm sensitivity for SF12 with 125KHz BW,included line loss

RHF0M62H-HF22:

- ✓ TXOP=22dBm@862-930MHz
- ✓ -136.73dBm sensitivity for SF12 with 125KHz BW,included line loss

- 交互通信接口
  - ✓ SPI

2 总体描述

RHF0M62H 内嵌高性能 LoRa 无线通信芯片，非常适合于各种物联网节点的设计。

RHF0M62H 模组支持(G)FSK 和 LoRa®调制模式，LoRa®模式下可以使用 7.8 - 500kHz 带宽。

RHF0M62H 模组提供 SPI 通信接口与外部 MCU 通信。

SX1262 芯片电源分配方案支持两种硬件设计：DC-DC 转换和线性稳压器 LDO，RHF0M62H 模组硬件采用了 DC-DC 配电设计。

RHF0M62H 模组内部射频参考频率采用有源 TCXO，且 TCXO 通过 SX1262 DIO3 供电。

RHF0M62H 目前包含两个子型号，RHF0M62H-LF22 和 RHF0M62H-HF22，RHF0M62H-LF22 支持 22dBm@LF band (470-510MHz); RHF0M62H-HF22 支持 22dBm@HF band (862-930MHz)。

原理框图：

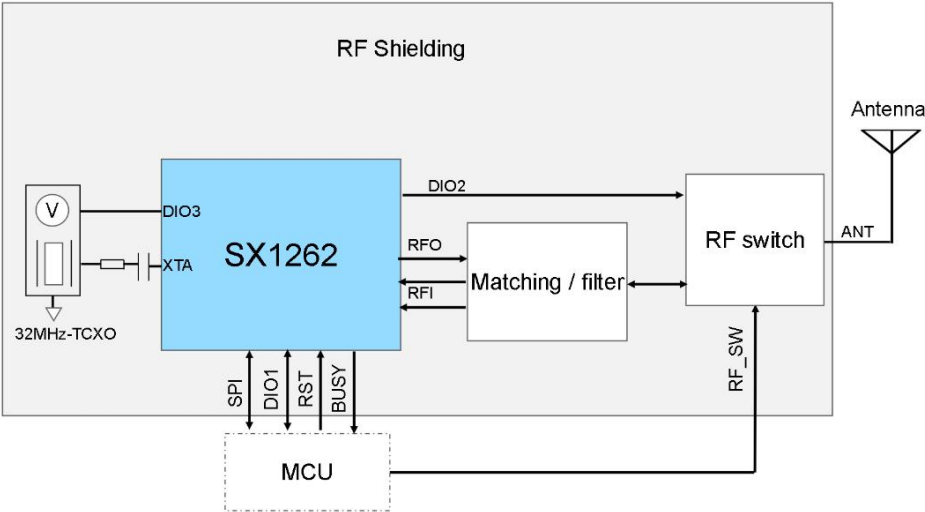


Figure 1 RHF0M62H Schematic diagram

2.1 管脚定义

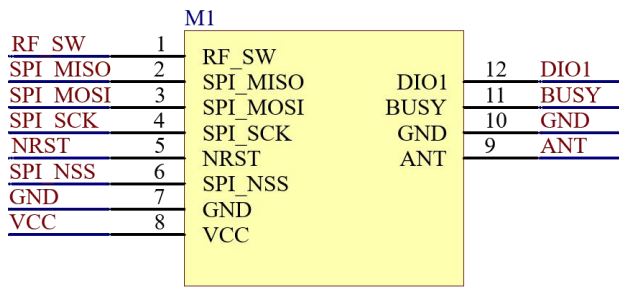


Figure 2 RHF0M62H Pin arrangement

Table 1 RHF0M62H pinout

Number	Name	Type	Description
1	RF_SW	I	External IO control internal gate RF switch Logic high=Enable Receiver mode, other mode =low level

2	MISO	I/O	SPI_MISO
3	MOSI	I/O	SPI_MOSI
4	SCK	I/O	SPI_SCK
5	NRST	I	Reset signal, active low
6	NSS	I/O	SPI_NSS
7	GND	-	Ground
8	VCC	I	Supply voltage for the module
9	ANT	I/O	RF input/output,NC <sup>1</sup>
10	GND	-	Ground
11	BUSY	O	Busy indicator of IC SX1262
12	DIO1	I/O	Multi-purpose digital IO,DIO1of IC SX1262

<sup>1</sup> 该射频通信引脚默认使用 IPEX 接口，不做焊接，若需要 RF SMT-Pin 版本请咨询我司销售。

3 电气特性

3.1 极限工作条件

达到或超过下表列出的额定最大值会导致设备损坏。

Table 2 Absolute Maximum Ratings

Item	Description	min	max	unit
VCCmr	供电电压	-0.5	+3.9	V
Tmr	工作温度	-40	+85	℃
Tstore	存储温度	-40	+105	℃
Pmr	射频输入功率	-	+10	dBm

3.2 正常工作条件

Table 3 Recommended Operating Conditions

Item	Description	min	max	unit
VCCop	供电电压	+1.8	+3.6	V
Top	工作温度	-40	+85	℃
Pop	射频输入功率	-	0	dBm

3.3 模组规格指标

Table 4 RHF0M62H features

Items	Parameter	Specifications	Unit
Structure	Size	11.6(W) X 11(L) X 2.95(H)	mm
	Package	12 pins, SMT	
Electrical Characteristics	Supply voltage	3.3V typical	V
	Sleep current	1.62uA	uA
	SX1262 power distribution mode	DC-DC Mode	
	TCXO supply mode	By SX1262 DIO3	
	TCXO supply voltage	1.7-3.3V	V
	Frequency range	LF@470-510	MHz
		HF@862-930	
	Maximum operation current (Transmitter)	106mA @22dBm in 470-510MHz typical	mA
		125mA @22dBm in 862-930MHz typical	

	Maximum operation current (Receiver)	6.3mA @BW125kHz, 470-510MHz typical				
		7.6mA @BW125kHz, 862-930MHz typical				
	Output power	22dBm max @470-510MHz				dBm
		22dBm max @862-930MHz				
	Receiver sensitivity included line loss	@SF12, BW125kHz				dBm
		Fr(MHz)	min	typical	max	
		470-510	-	-136.5	-136.5	
		862-930	-	-136.73	-136.73	
Harmonics @HF	≤-45dBm above 1GHz				dBm	
Harmonics @LF	≤-43dBm below 1GHz ≤-31dBm above 1GHz				dBm	
Interface	ANT	RF port of IPEX or SMT pin,default IPEX@50 ohm impedance				
	DIO1	Multi-purpose digital IO				
	Busy	Busy signal indicator				
	SPI	1 group of SPI, include 4 pins				
Other	DIO2	Multi-purpose digital IO,Internally connected to RF switch Logic high=Enable Transmitter mode, other mode =low level				
	DIO3	DIO3 is used as TCXO voltage power supply configure through software,TCXO voltage should always be 200 mV less than the VCC to ensure proper operation				

4 典型射频性能测试

4.1 RHF0M62H-LF22 性能测试

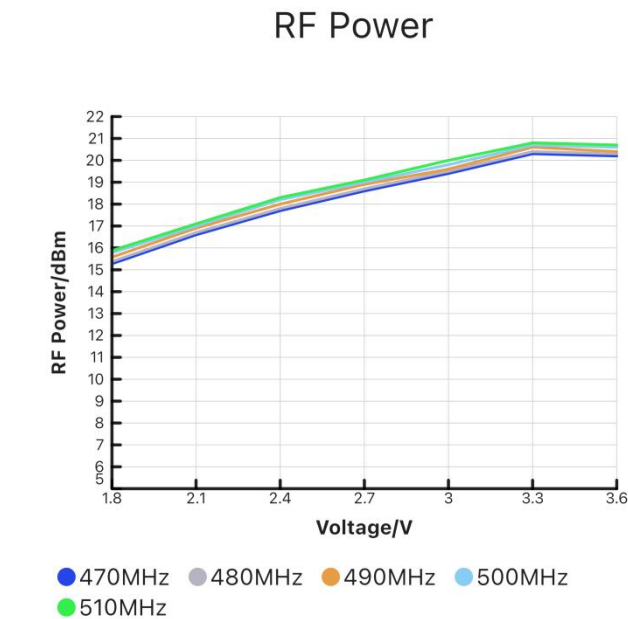


Figure 3 Max RF Power vs Voltage (470~510MHz)

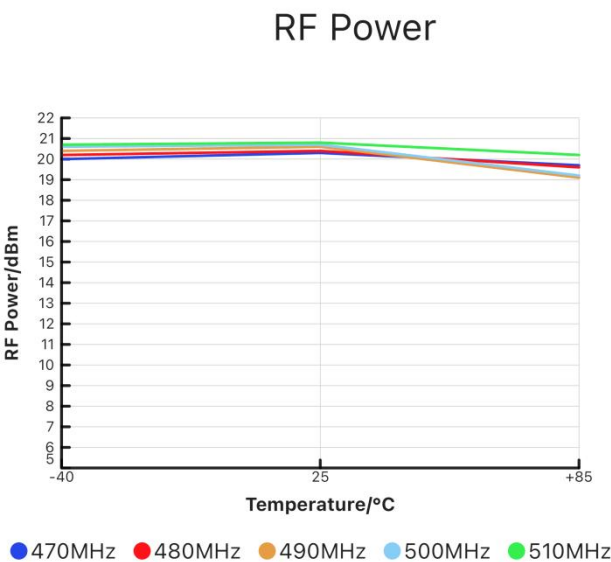


Figure 4 Max RF Power VS Temperature (470~510MHz)



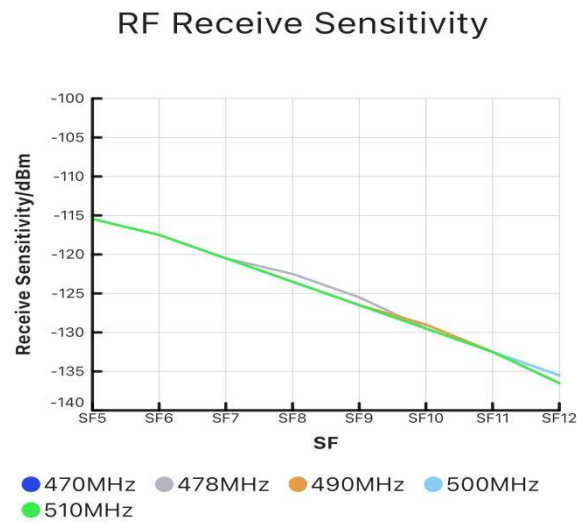


Figure 5 RF Receiver Sensitivity vs Spreading factor (470~510MHz@BW125KHz)

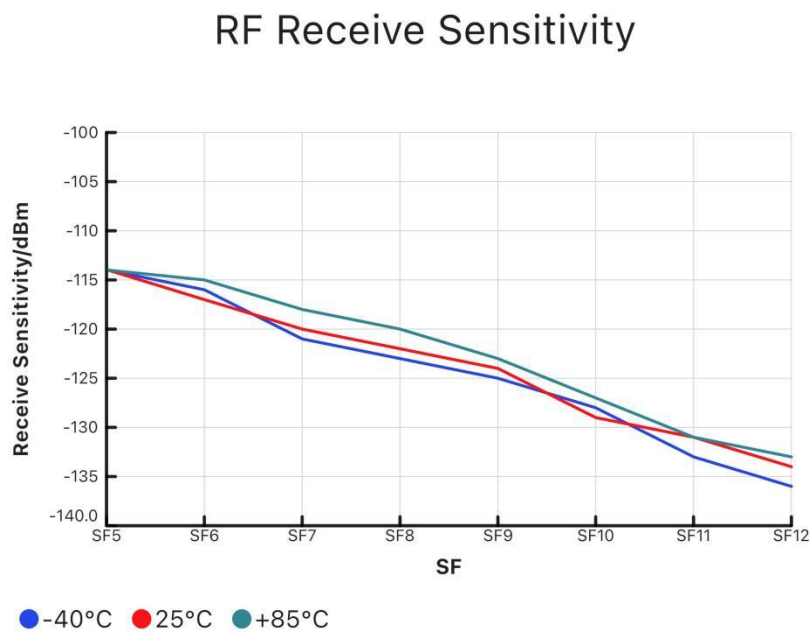


Figure 6 RF Receiver Sensitivity VS Temperature (470MHz@BW125KHz)

4.2 RHF0M62H-HF22 性能测试

RF Power

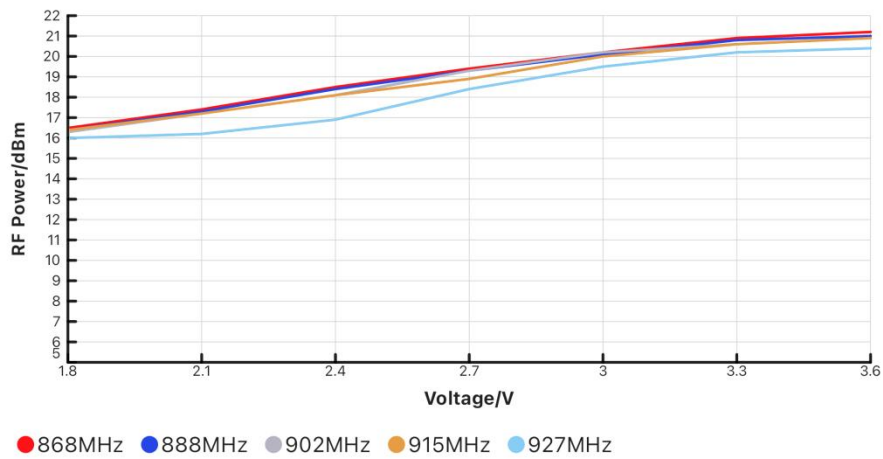


Figure 7 Max RF Power vs Voltage (868~927MHz)

RF Power

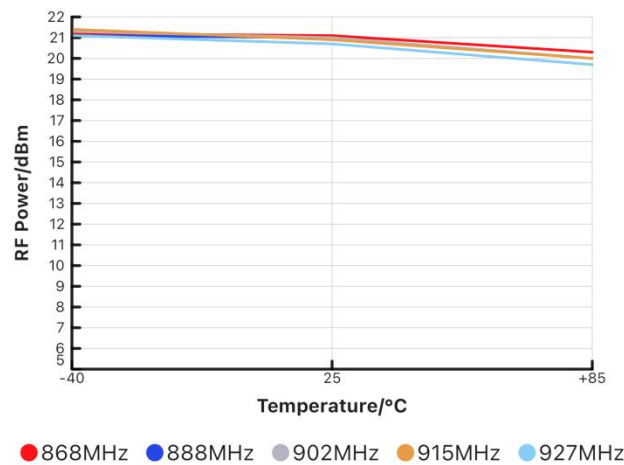


Figure 8 Max RF Power VS Temperature (868~927MHz)

RF Receive Sensitivity

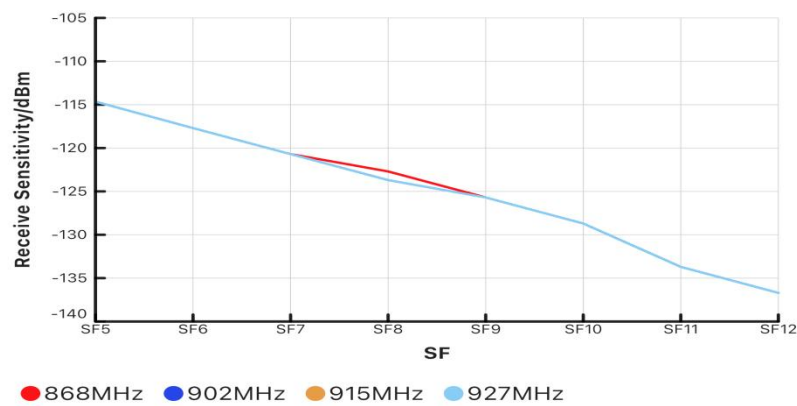


Figure 9 RF Receiver Sensitivity vs Spreading factor (868~927MHz@BW125KHz)

RF Receive Sensitivity

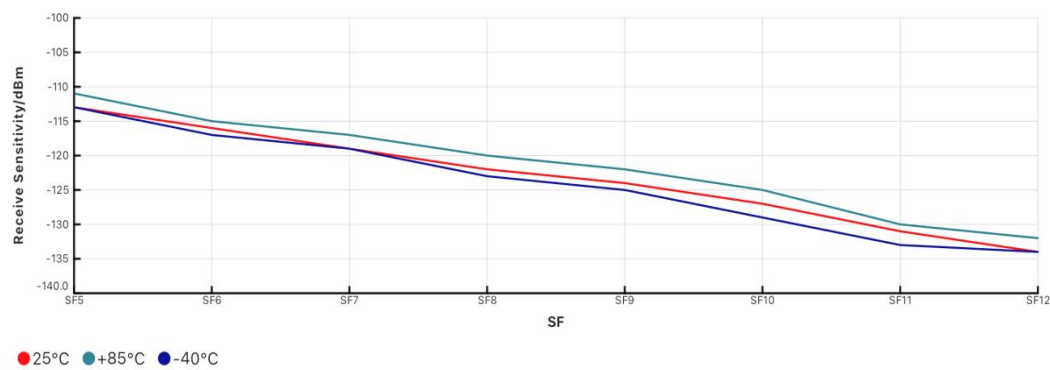


Figure 10 RF Receiver Sensitivity VS Temperature (868MHz@BW125KHz)

# RF Receive Sensitivity

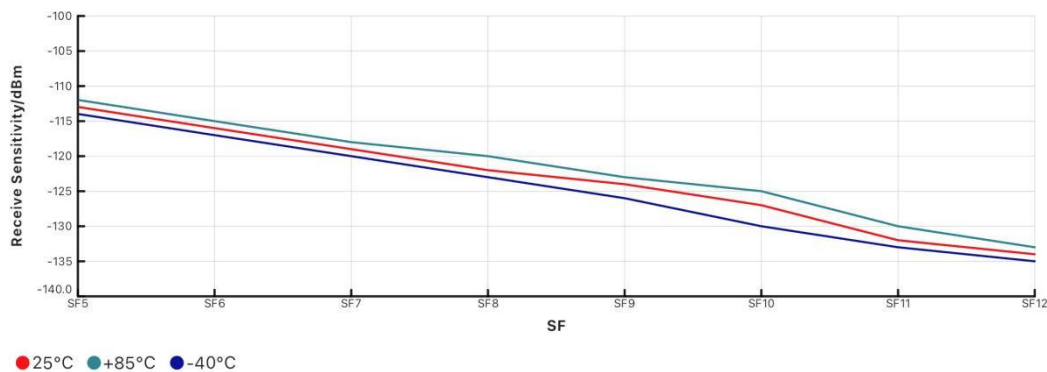


Figure 11 RF Receiver Sensitivity VS Temperature (915MHz@BW125KHz)

## 5 应用信息

### 5.1 封装信息

RHF0M62H 模组共有 12pins 的贴片封装: (Tolerance:  $\pm 0.2\text{mm}$ )

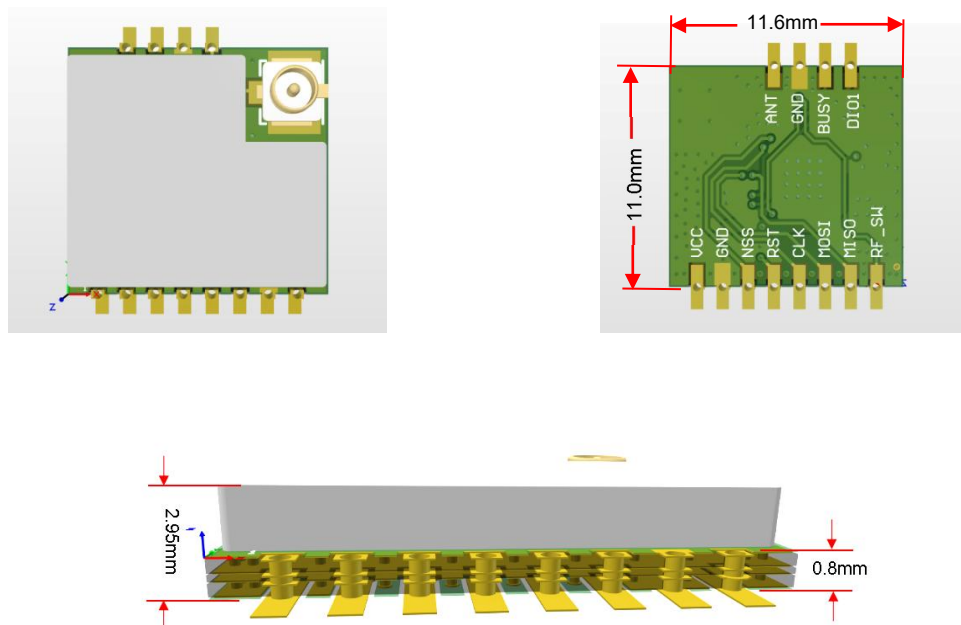


Figure 12 RHF0M62H Module appearance

下图给出了建议的 Layout 封装尺寸图 (in mm) :

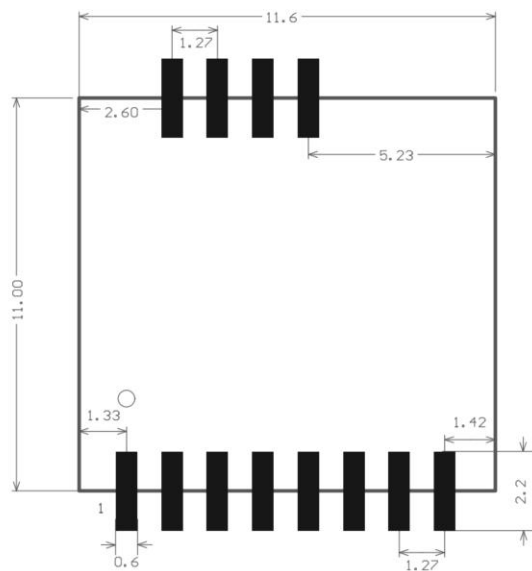


Figure 13 PCB layout

## 5.2 模组对外接口

- 一组SPI接口，用于控制内部射频收发机
- DIO1是中断请求线
- 一路由外部控外制内部射频开关选通GPIO
- BUSY用作忙碌信号，仅当该信号为低时，表示模组已准备好接收新命令
- 射频通信接口输出阻抗为50Ω且兼容IPEX、SMT-Pin，默认IPEX，RF SMT-Pin不做焊接，若需要RF SMT-Pin版本请咨询我司

## 5.3 基于 RHF0M62H 模组的参考设计

以下是使用 RHF0M62H 模组的典型硬件参考设计，只需按照参考设计将模组连接到主机 MCU 并发送 AT 命令即可。

RHF0M62H 模块天线设计注意事项：天线接口为 50Ω阻抗设计，建议用户预留天线π型匹配网络。

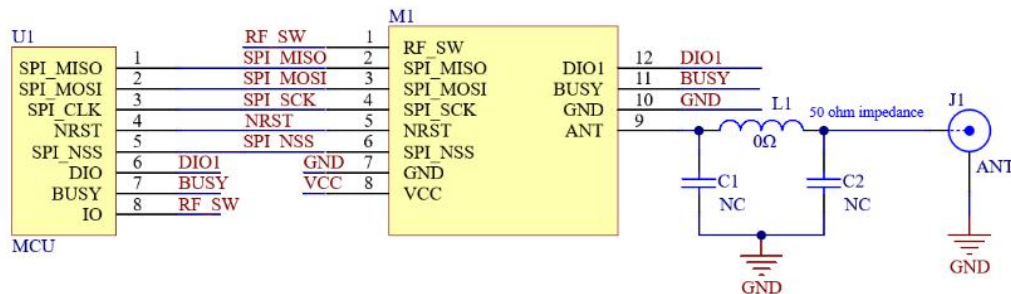


Figure 14 Reference design based on RHF0M62H

# 6 LoRaWAN®应用信息

## 6.1 LoRaWAN®应用

LoRaWAN®网络的拓扑结构是星形网络，网关作为节点和网络服务器之间的中继。网关通过标准的IP链路连接到网络服务器，而节点设备使用LoRa®或者FSK与一个或者多个网关通信。通信是双向的，尽管主要是从节点到网络服务器的上行通信。

节点和网关之间的通信使用不同的频率和速率，速率的选择是功耗和距离的折中，不同的速率之间互不干扰。根据不同的扩频因子和带宽，LoRa®的速率可以从300bps到50Kbps。为了使电池寿命和网络容量最大化，网络服务器通过速率自适应(ADR)管理节点的速率和输出功率。

节点设备可能任何时间，以任何速率，在随机的一个信道上发射，只要符合以下条件：

- 1) 节点当前使用的信道是伪随机的。这使得系统抗干扰的能力更强
- 2) 节点每次的最大传输时间(信道的驻留时间)和占空比取决于所用的频段和当地的规范

RHF0M62H 模组内嵌了 Semtech 超性能低功耗 IC SX1262. 在睡眠模式下电流仅 1.62uA, 该模组非常适合于 LoRaWAN®的各种应用。

## 6.2 基于 RHF0M62H 设计 LoRaWAN®无线传感器

RHF0M62H 纯射频模组只需要一颗简单的 MCU 作为主控，便可通过 SPI 接口来控制 RHF0M62H，模组从而轻松实现 LoRaWAN®协议。这有助于帮助客户快速地将传感器产品推向 LoRaWAN®市场。

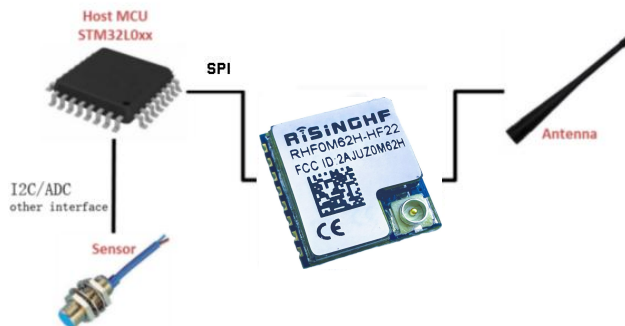


Figure 15 Design of LoRaWAN® wireless sensor based on RHF0M62H module

## 7 回流焊参数

RHF0M62H 模组的设计使其可以非常便利的应用于生产，包括利用回流焊工艺将其焊接至 PCB 板。一个基本要素，用户需要选择合适的焊锡膏并且在过炉时保证焊锡膏对温度的要求。RHF0M62H 遵从 J-STD-020D1 标准中对回流焊温度的规定。

**注意：**建议模组只过一次回流焊，回流焊中模组温度不得超过 260℃。回流区时长不超过 30 秒。

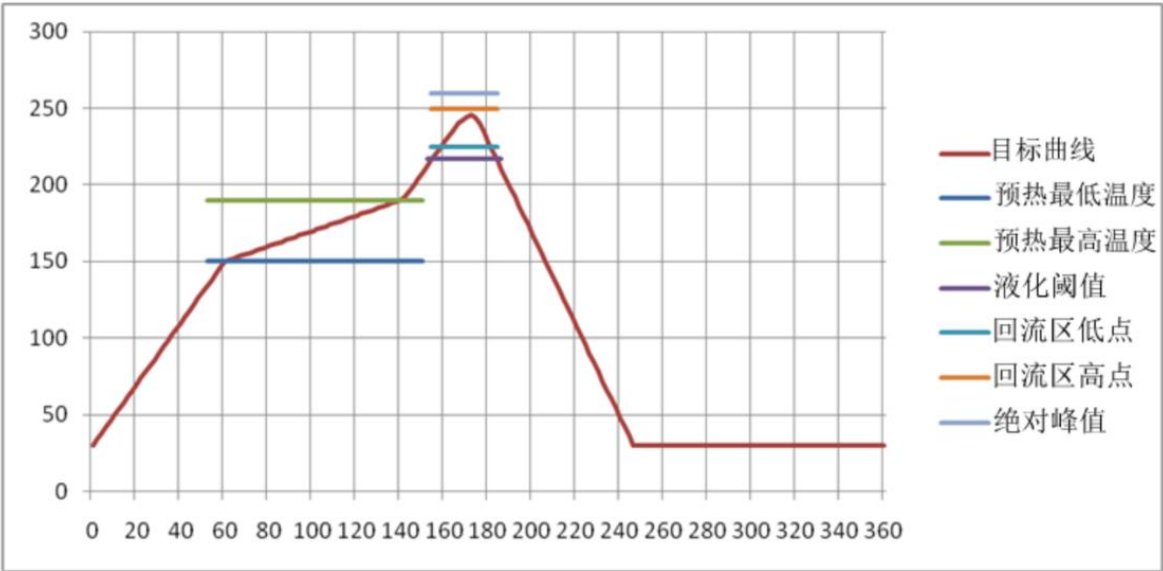


Figure 16 Reflow profile

项目规格	值	单位
升温率	1 ~ 3	°C/Sec
冷却率	2 ~ 4	°C/Sec
预热区升温率	0.5 ~ 1	°C/Sec
预热区时长 MIN	70	Sec
预热区时长 MAX	120	Sec
预热温度 MIN	150	°C
预热温度 MAX	190	°C
锡膏液化温度以上驻留时间 MAX	70	Sec
锡膏液化温度以上驻留时间 MIN	50	Sec
回流区驻留时长	30	Sec
峰值温度驻留时长最大值	5	Sec
建议液化区阈值	218	°C
回流区低点温度	240	°C
回流区高点温度	250	°C
绝对峰值温度	260	°C

Figure 17 Reflow soldering temperature parameters



8 订购信息

技术支持: support@risinghf.com

中国销售: salescn@risnghf.com

海外销售: salesww@risinghf.com

Table 5 RHF0M62H Ordering Information

Part Number	TX Power (dBm)
RHF0M62H-LF22	22@LF (470-510MHz) with IPEX
RHF0M62H-HF22	22@HF (862-930MHz) with IPEX

## 9 Revision

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V1.0 2024-7-12

+ 编写

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## Conformity

### FCC regulatory conformance:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

### FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

- English: "

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device."

## ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2AJUZ0M62H". Additionally, the following statement should be included on the label and in the final product's user manual: "This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interferences, and
- (2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.

Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user.

## Requirement per KDB996369 D03

### 2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.<sup>3</sup>

**Explanation:** This module meets the requirements of FCC part 15C(15.247).

### 2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

**Explanation:** The EUT has a FPC antenna or Dipole antenna or Spring antenna , and the antenna use a permanently attached antenna which is not replaceable.

### 2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

**Explanation:** The module is not a limited module.

### 2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit(PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

**Explanation:** Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

## 2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person’s body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

**Explanation:** This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2AJUZ0M62H.

## 2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type” )).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

**Explanation:** The EUT has a FPC antenna or Dipole antenna or Spring antenna, and the antenna use a permanently attached antenna which is unique.

## 2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

**Explanation:** The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID:2AJUZ0M62H” .

## 2.9 Information on test modes and additional testing requirements5

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

**Explanation:** Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

**Explanation:** The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.