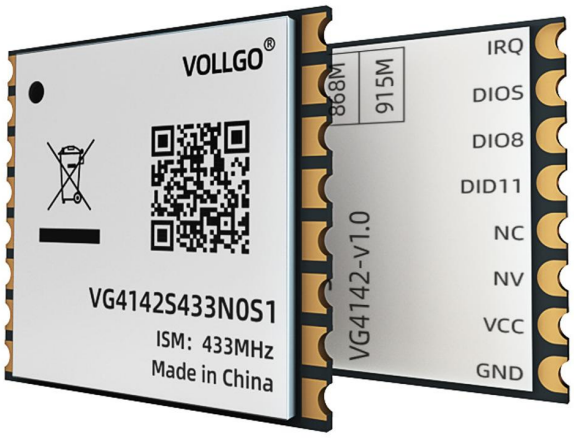
VG4142SxxxN0S1 wireless module Hardware Specifications

V1.0 _



Content

1. Overview

VG4142SxxxN0S1 series wireless module, based on PANCHIP's PAN3031 high-performance wireless transceiver chip design, is a compact, low-power, long-distance two-way wireless transceiver module. PAN3031 is a low-power long-distance wireless transceiver chip using Chirp-IOT modulation and demodulation technology. It supports half-duplex wireless communication. The working frequency band is 400 ~ 510MHz/768 ~ 1020MHz . The chip has high anti-interference and high sensitivity. , low power consumption and ultra-long distance.

This series of modules integrates all RF-related functions and devices. Users can easily develop wireless solutions and wireless IoT devices with stable performance and high reliability using the modules without in-depth knowledge of RF circuit design.

Features:

- Chirp-IOT modulation
- Maximum link budget up to 149 dB
- Maximum transmit power 20 dBm, programmable configuration
- High receive sensitivity: -129 dBm
- Wide operating voltage range: 1.8～3.6V
- Support bandwidth 125KHz , 250KHz , 500KHz
- Support spreading factor SF: 7～9

Application:

- smart meter
- Supply Chain and Logistics
- building automation
- agricultural sensor
- Smart City
- retail store sensor
- Asset tracking
- security system
- remote control application

2. Electrical Characteristics

Parameter	Description	Remark
Power Supply	1.8 ~ 3.6V	Typically 3.3V
Frequency Bands	433MHz , 490MHz , 868MHz , 915MHz	The applicable frequency band is determined by the module model
Crystal frequency	32MHz	Passive crystal oscillator
Output Power	-7dBm to + 20dBm	Programmable configuration, step value 1dBm
Data Rate	1.04 kbps to 20.4 kbps	Programmable configuration
RF Modulation	Chirp-IOT	
Receive sensitivity	-1 29dBm _	SF=9 ,BW= 125kHz
receive bandwidth	125KHz , 250KHz , 500KHz	Programmable configuration
TX Current	110mA	Transmit power = 20dBm
RX Current	18 mA	Non-DC-DC mode
sleep Current	<1uA	
driver interface	SPI	
Antenna impedance	50 ohms	
Antenna connection method	side stamp hole	
storage temperature	-55 ℃ ~ + 125 ℃	
Operating temperature	-40℃ ~ + 85℃	Industrial grade

Size	13.5x12.0mm	

3. Pin Diagram

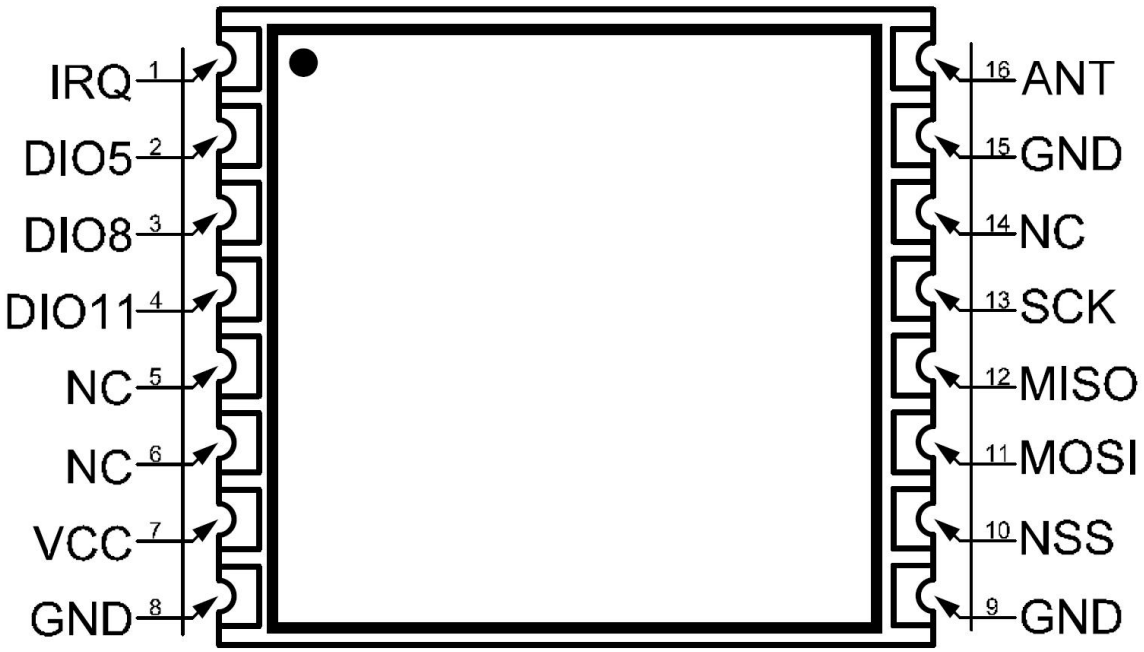


Figure 3-1 Top view

4.Pin Description

Number	Name	Type	Description
1	IRQ	O	interrupt signal pin
2	DIO 5	I/O	Digital IO, software configurable , directly connected to chip GPIO5
3	DIO 8	I/O	Digital IO, software configurable , directly connected to chip GPIO8
4	DIO 11	I/O	Digital IO, software configurable , directly connected to chip GPIO11
5	NC	--	The module is left floating
6	NC	--	The module is left floating
7	VCC	power supply	Positive power supply
8	GND	power supply	land
9	GND	power supply	land
10	NSS	I	SPI interface chip select input
11	MOSI	I	SPI interface MOSI data input
12	MISO	O	SPI interface MISO data output
13	SCK	I	SPI interface clock input
14	NC	--	The module is left floating
15	GND	power supply	land
16	ANT	I/O	RF signal input/output, connect to 50Ω

			antenna

5. Hardware design guide

5.1. Application circuit

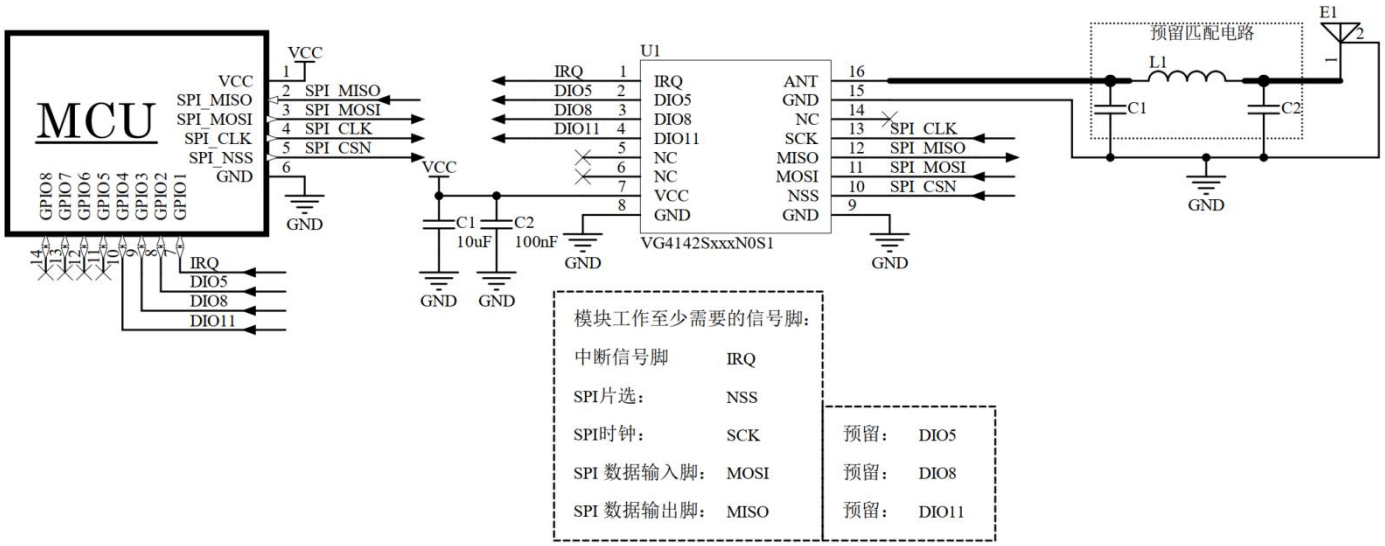


Figure 5-1 Programming development hardware connection

5.2. Power supply design

1. Please pay attention to the correct connection of the positive and negative poles of the power supply, and ensure that the power supply voltage is within the recommended power supply voltage range. If it exceeds the maximum allowable power supply range of the module, the module will be permanently damaged; the filter capacitor of the module power supply pin should be as close as possible to the module power supply pin.

2. In the power supply system of the module, the excessive ripple may be coupled to the line that is easily interfered by the wire or the ground plane, such as the sensitive signal line such as the antenna, feeder, clock line, etc., which may easily cause the radio frequency performance of the module to

deteriorate, so We recommend using LDO as the power supply for the wireless module.

3. When selecting the LDO voltage regulator chip, it is necessary to pay attention to the heat dissipation of the power supply and the driving capability of the LDO stable output current; considering the long-term stable operation of the whole machine, it is recommended to reserve more than 50% of the current output margin.

4. It is best to use a single LDO for the module to supply power; if a DC-DC power supply chip is used, an LDO must be added behind as the isolation of the module power supply to prevent the noise of the switching power supply chip from interfering with the working performance of the radio frequency.

5. If the communication line between the MCU and the module uses a 5V level, a 1K-5.1K resistor must be connected in series (not recommended, there is still a risk of damage) .

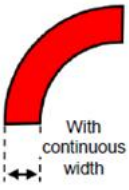
6. The RF module should be kept away from high-voltage devices as far as possible, because the electromagnetic waves of high-voltage devices will also have a certain impact on the RF signal.

7. High-frequency digital wiring, high-frequency analog wiring, and high-current power supply wiring should be avoided under the module as much as possible. If it is necessary to pass under the module, the wiring should be placed on another layer of the PCB bottom plate where the module is placed, and ensure that the module is under the module. The copper is well grounded.

5.3. Antenna Design and Guidance

5.3.1 Guidelies for bends in RF lines and RF trace

the RF output interface of the module is selected in the form of a stamp hole , a 50ohm characteristic impedance trace is used to connect the antenna on the backplane PCB during design. Considering the attenuation of high-frequency signals, it should be noted that the length of the RF traces on the backplane PCB should be as short as possible. It is recommended that the longest trace length should not exceed 20 mm , and the trace width should be kept continuous. When turning, try not to take acute or right angles. , it is recommended to take a circular arc.

The first recommended way of	

turning the RF traces	
Second, the recommended way of turning the RF traces	
Bad way of turning RF traces , not recommended	

In order to ensure that the RF trace impedance of the backplane is 50 ohms, the following parameters can be adjusted according to different board thicknesses. The following simulation values are for reference only.

RF traces use 20mil line width	thickness is 1.0mm , the spacing between ground copper and traces is 5.3mil
	thickness is 1.2mm , the spacing between ground copper and traces is 5.1mil
	the board thickness is 1.6mm , the distance between ground copper and trace is 5mil
RF traces use 25mil line width	thickness is 1.0mm , the distance between ground copper and trace is 6.3mil

	the board thickness is 1.2mm , the distance between ground copper and trace is 6mil
	thickness is 1.6mm , the distance between ground copper and trace is 5.7mil
RF traces use 30mil line width	thickness is 1.0mm , the distance between ground copper and trace is 7.6mil
	thickness is 1.2mm , the distance between ground copper and trace is 7.1mil
	thickness is 1.6mm , the distance between ground copper and trace is 6.6mil

5.3.2 Internal Antenna

The built-in antenna refers to the antenna soldered on the PCB bottom plate and placed inside the product shell, including chip ceramic antenna, spring antenna, etc. When using the built-in antenna, the structure of the product and the installation position of the antenna have a great influence on the RF performance. Under the premise that the structure space of the product shell is sufficient, the spring antenna should be placed vertically upward as much as possible; Or the circuit board below the antenna can be hollowed out, because the metal has a very strong ability to absorb and shield RF signals, which will seriously affect the communication distance. In addition, the antenna should be placed on the edge of the bottom plate as much as possible.

5.3.3 External Antenna

External antenna refers to the antenna that the module is installed on the outside of the product casing through IPEX extension cable, SMA and other standard RF interfaces, including rod antenna, suction cup antenna, fiberglass antenna, etc. The external antenna is basically a standard product. In order

to better choose an antenna suitable for the module, in the process of antenna selection, the parameters of the antenna should be selected as follows:

1. The working frequency of the antenna should be consistent with the working frequency of the corresponding module.

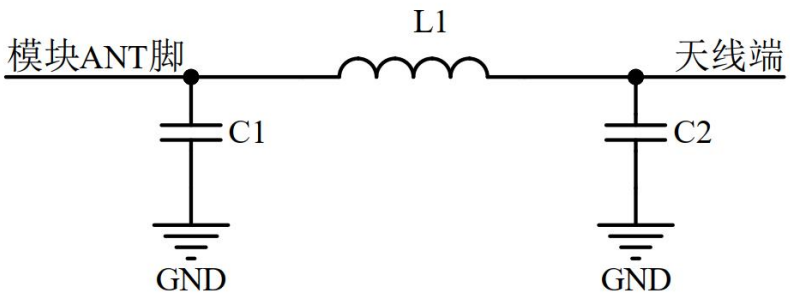
2. The input characteristic impedance of the antenna should be 50ohm.

3. The interface size of the antenna should match the size of the antenna interface of the module.

4. The standing wave ratio (VSWR) of the antenna is recommended to be less than 2, and the antenna should have a suitable frequency bandwidth (covering the frequency points used in the actual application of specific products) .

5.3.4 Antenna matching

The antenna is critical to the transmission distance of the RF module. In practical applications, in order to facilitate the user's later antenna matching adjustment. It is recommended that users reserve a simple π-type matching circuit between the antenna and the ANT pin output of the module when designing the schematic diagram. If the antenna is already a standard 50Ω, the component L1 is attached with a 0R resistor, and the components C1 and C2 do not need to be soldered. Otherwise, you need to use a network analyzer to measure the actual impedance of the antenna and perform matching to determine the values of C1, L1, and C2. The trace from the ANT pin of the module to the antenna end should be as short as possible. It is recommended that the longest trace length should not exceed 20 mm .

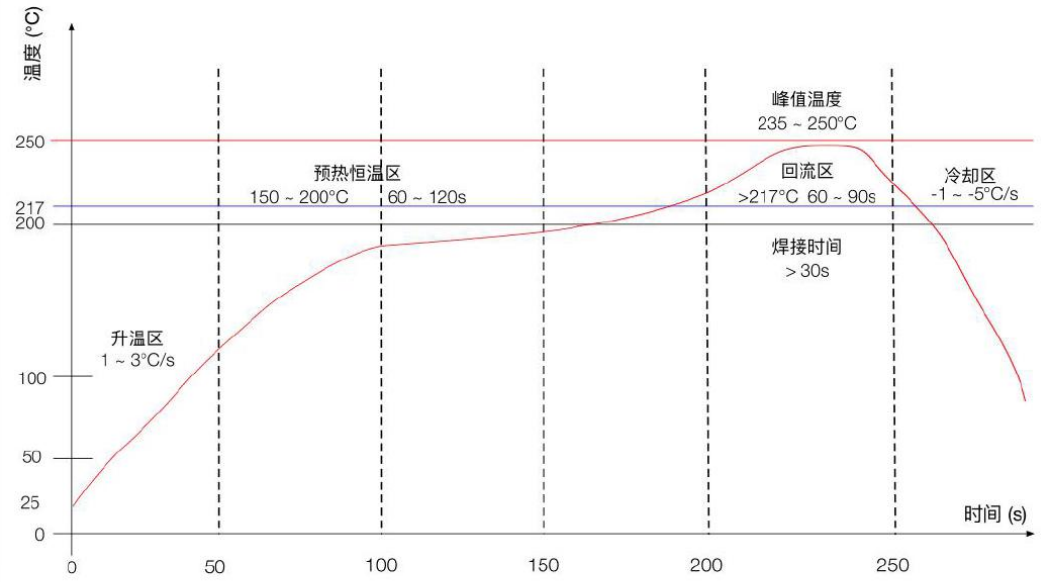


5-2 π-type matching circuit

6. Programming development

Generally speaking, the receiving sensitivity of the RF chip is relatively poor at the integer multiple of its crystal oscillator operating frequency. It is recommended that users avoid the mirror frequency point of the module crystal oscillator when selecting the operating frequency point, that is, the integer multiple of the crystal oscillator frequency. Point, the crystal frequency of this module is 32MHz .

7. Reflow Profile



升温区 — 温度：25 ~ 150°C 时间：60 ~ 90s 升温斜率：1 ~ 3°C/s
预热恒温区 — 温度：150 ~ 200°C 时间：60 ~ 120s
回流焊接区 — 温度：>217°C 时间：60 ~ 90s；峰值温度：235 ~ 250°C 时间：30 ~ 70s
冷却区 — 温度：峰值温度 ~ 180°C 降温斜率 -1 ~ -5°C/s
焊料 — 锡银铜合金无铅焊料 (SAC305)

8.ESD Notice

The RF module is a high-voltage electrostatic sensitive device, in order to prevent damage to the module by static electricity

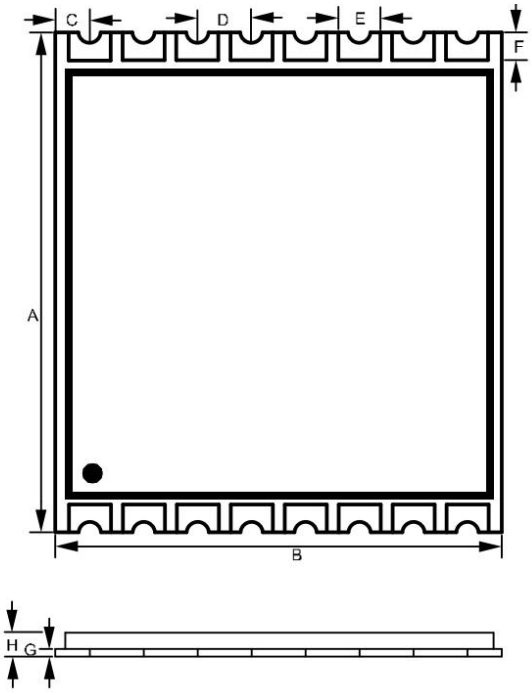
1、Strictly follow anti-static measures, and do not touch the module with bare hands during production.

2、Modules should be placed in a placement area that can prevent static electricity.

3、The anti-static protection circuit at the high voltage input should be considered in product design.

9. Packaging information

Mechanical size (unit:mm)



Numbering	Dimensions (mm)	Error (mm)
A	13.5	±0.5
B	12.0	±0.5
C	0.9	±0.1
D	1.45	±0.1
E	1.0	±0.1
F	0.6	±0.1
G	0.8	±0.1
H	2.2	±0.2

10. Revision History

Revision	Comment	Date
V1.0 _	Initial release version	December 3, 2020

11. Ordering Information

Index	Part Number	Description
1	VG4142S433N0S1	433MHz frequency band, tape packing\pallet packing
2	VG4142S490N0S1	490MHz frequency band, tape packing\pallet packing
3	VG4142S868N0S1	868MHz frequency band, tape packing\pallet packing
4	VG4142S915N0S1	915MHz frequency band, tape packing\pallet packing

12. Statement

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13. Contact us

Company: Shenzhen Wojin Technology Co., Ltd.

Address : Room 205-208, Building C, Smart Cloud Valley, No. 1, Sanhe Road, Gaofeng Community, Dalang Street , Longhua District, Shenzhen

Tel: 0755-23040053

Fax: 0755-21031236

Official website: www.vollgo.com

Business cooperation: sales@vollgo.com