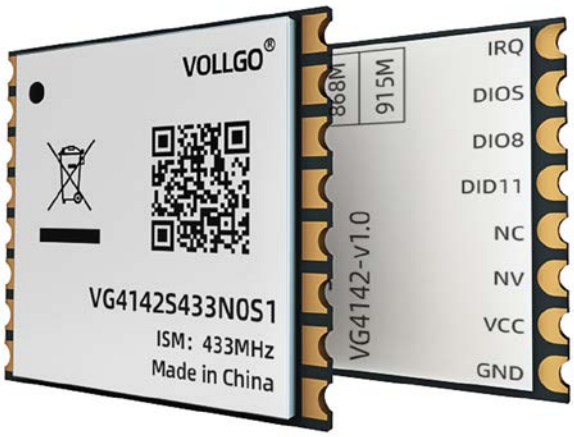
VG4142SxxxN0S1 wireless module

Hardware Specifications

V1.0



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I. Overview

VG4142SxxxN0S1 series wireless module, based on PANCHIP's PAN3031 high-performance wireless transceiver chip design, is a small size, low power consumption, long-range PAN3031 is a low-power long-distance wireless transceiver chip that uses Chirp-IOT modulation and demodulation technology and supports half-duplex wireless communication. The operating frequency band is 400~510MHz/768~1020MHz. The chip has the characteristics of high anti-interference, high sensitivity, low power consumption and ultra-long distance.

This series of modules integrates all RF related functions and devices. Users can use the modules to easily develop high-performance Stable and highly reliable wireless solutions and wireless IoT devices.

Main features of the product:

- Chirp-IOT Modulation
- The maximum link budget can reach 149dB
- Maximum transmit power 20dBm, programmable
- High receiving sensitivity: -129 dBm
- Wide operating voltage range: 1.8～3.6V
- Support bandwidth 125KHz, 250KHz, 500KHz
- Support spreading factor SF: 7 to 9

application:

- Smart Meter
- Supply Chain and Logistics
- Building Automation
- Agricultural Sensors
- Smart City
- Retail Store Sensors
- Asset Tracking
- Security System
- Remote Control App

2. Technical parameters

Technical indicators	parameter	Remark
Voltage range	1.8～3.6V	Generally 3.3V
Frequency range	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
Wireless rate	1.04kbps～20.4kbps	Programmable configuration
Modulation	Chirp-IOT	
Receiving sensitivity	- 129dBm	SF=9,BW=125kHz
Receiving bandwidth	125KHz, 250KHz, 500KHz	Programmable configuration
Emission current	110mA	Transmit power = 20dBm
Receiving current	18mA	Non-DC-DC Mode
Sleep current	<1uA	
Driver interface	SPI	
Antenna impedance	50 Ohm	
Antenna connection method	Side stamp hole	
Storage temperature	-55℃～+125℃	
Operating temperature	-40℃～+85℃	Industrial Grade
Size	13.5x12.0mm	

3. Pin location diagram

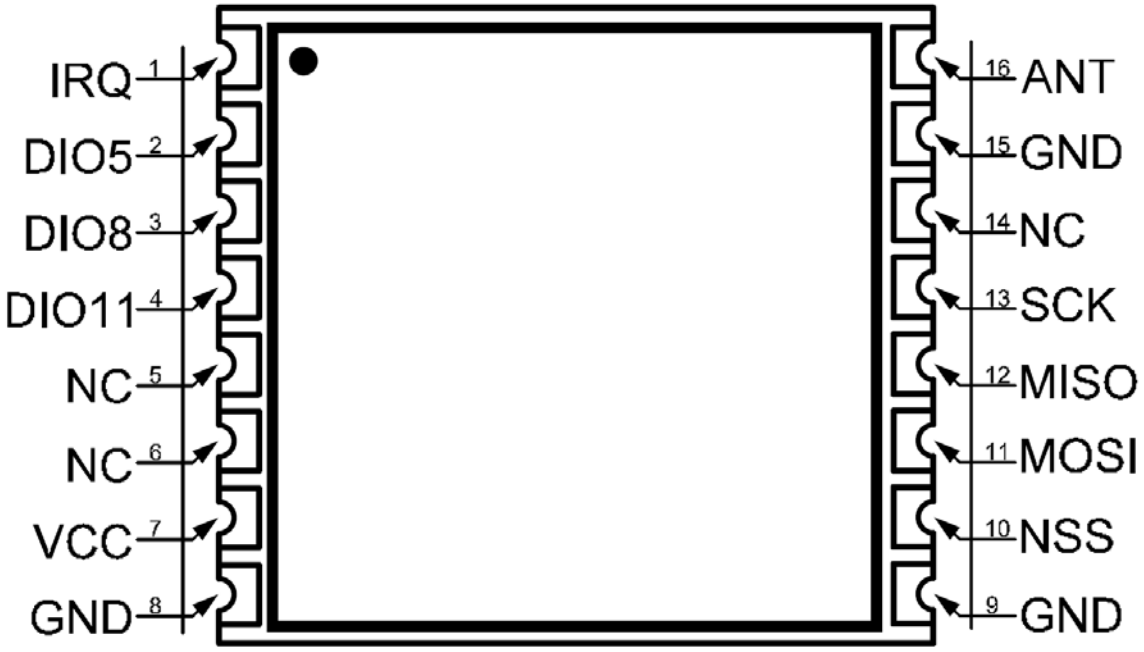


Figure 3-1 Top view

4. Pin Description

Serial number	Pinout	type	describe
1	IRQ	O	Interrupt signal pin
2	DIO5	I/O	Digital IO, software configurable, directly connected to chip GPIO5
3	DIO8	I/O	Digital IO, software configurable, directly connected to chip GPIO8
4	DIO11	I/O	Digital IO, software configurable, directly connected to chip GPIO11
5	NC	- -	Module internal suspension
6	NC	- -	Module internal suspension
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	- -	Module internal suspension
15	GND	power supply	land
16	ANT	I/O	RF signal input/output, connected to 50Ω antenna

5. Hardware Design Guidelines and Precautions

5.1, Hardware connection diagram

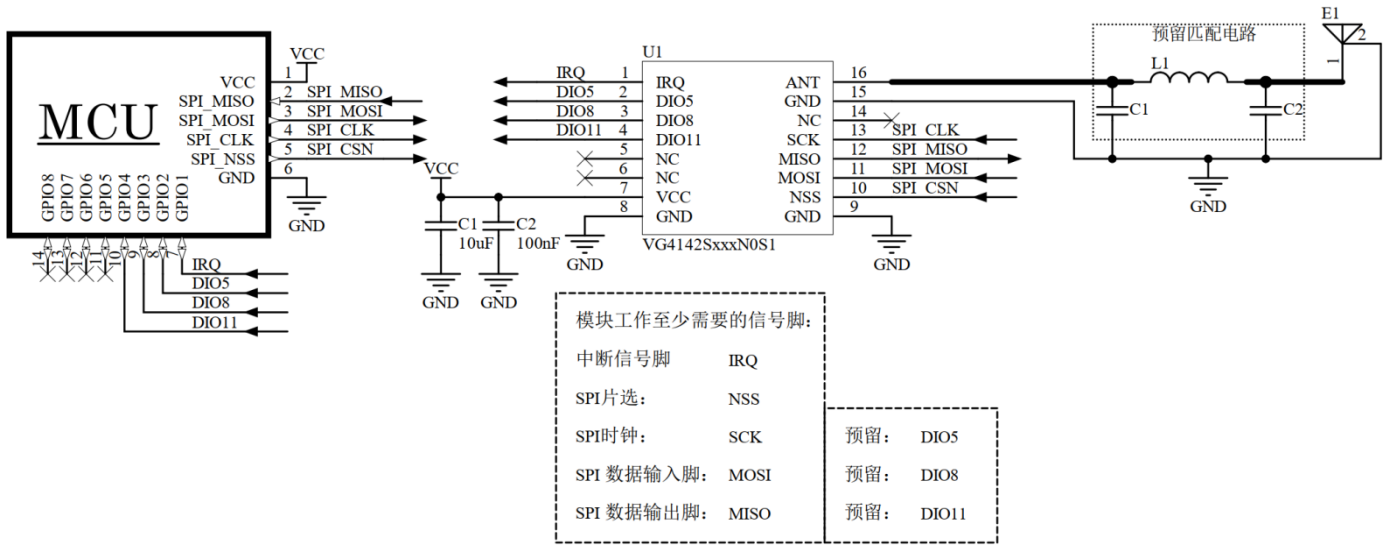


Figure 5-1 Programming development hardware connection

5.2, power supply design and related considerations

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, it will cause the

The module will be permanently damaged; the filter capacitor of the module power pin should be as close to the module power pin as possible.

2. In the module power supply system, excessive ripple may be coupled to lines that are susceptible to interference through wires or ground planes, such as antennas, feeders, clock lines, etc.

Sensitive signal lines can easily cause the module's RF performance to deteriorate, so we recommend using LDO as the power supply for the wireless module.

3. When selecting LDO voltage regulator chip, you need to pay attention to the heat dissipation of the power supply and the driving ability of LDO stable output current; considering the long-term stable operation of the whole machine, it is recommended to pre-

Leave more than 50% current output margin.

4. It is best to use a LDO voltage regulator to supply power to the module. If a DC-DC power chip is used, an LDO must be added to isolate the module power supply to prevent

Prevent the noise of the switching power chip from interfering with the working performance of the RF.

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

6. Keep the RF module as far away from high-voltage devices 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 wiring should be kept away from under the module as much as possible. If it is necessary to pass under the module, the wiring should be placed under the module.

Add another layer of the PCB bottom plate of the module and ensure that the copper under the module is well grounded.

5.3, Antenna Design and Guidance

5.3.1Stamp hole interfaceRFdesign

When the module RF output interface is in the form of a stamp hole, a 50ohm characteristic impedance trace is used to connect the antenna on the bottom PCB board.

To reduce the attenuation of the RF signal, it is necessary to pay attention to the shortest possible length of the PCB RF trace. It is recommended that the longest trace length should not exceed 20mm, and the trace width should be continuous.

When you need to turn, try not to take sharp angles or right angles. It is recommended to take an arc.

The first recommended RF routing turning method	
The second recommended RF routing turning method	
A relatively bad RF routing turning method, not recommended	

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

RF routing uses20milLine Width	Plate thickness1.0mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is5.3mil
	Plate thickness1.2mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is5.1mil
	Plate thickness1.6mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is5mil
RF routing uses25milLine Width	Plate thickness1.0mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is6.3mil
	Plate thickness1.2mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is6mil
	Plate thickness1.6mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is5.7mil
RF routing uses30milLine Width	Plate thickness1.0mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is7.6mil
	Plate thickness1.2mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is7.1mil
	Plate thickness1.6mmWhen the ground copper is placed on the ground, the distance between the ground copper and the trace is6.6mil

5.3.2Internal antenna

Built-in antenna refers to the antenna that is soldered on the PCB bottom board and placed inside the product housing, including patch ceramic antenna, spring antenna, etc. When using a built-in antenna,

The structure of the product and the installation position of the antenna have a great impact on the RF performance. Under the premise that there is enough space in the product shell structure, the spring antenna should be placed vertically upward as much as possible;

Copper cannot be laid around the base plate where the antenna is placed, or the circuit board under the antenna can be hollowed out, because metal has a very strong ability to absorb and shield RF signals.

It will seriously affect the communication distance. In addition, the antenna should be placed on the edge of the base plate as much as possible.

5.3.3External antenna

External antenna refers to the antenna installed outside the product shell through IPEX extension cable, SMA and other standard RF interfaces, including rod antenna, suction cup antenna, etc.

wire, fiberglass antenna, etc. The external antenna is basically a standard product. In order to better choose an antenna suitable for the module, the antenna parameters are selected during the antenna selection process.

When choosing, please note the following:

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

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

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

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

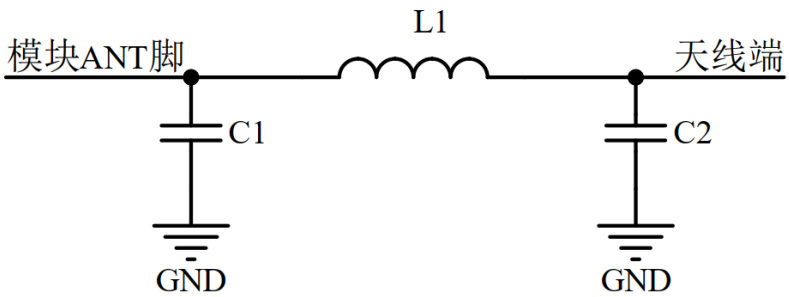
5.3.4Antenna Matching

The antenna is crucial 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 the user

A simple π-type matching circuit is reserved between the line and the module ANT pin output. If the antenna is already a standard 50Ω, the component L1 is attached with a 0R resistor, and the components C1, C2

No welding is required. Otherwise, a network analyzer is needed to measure the actual impedance of the antenna and perform matching to determine the values of C1, L1, and C2.

The wiring should be as short as possible, and the recommended maximum wiring length should not exceed 20mm.



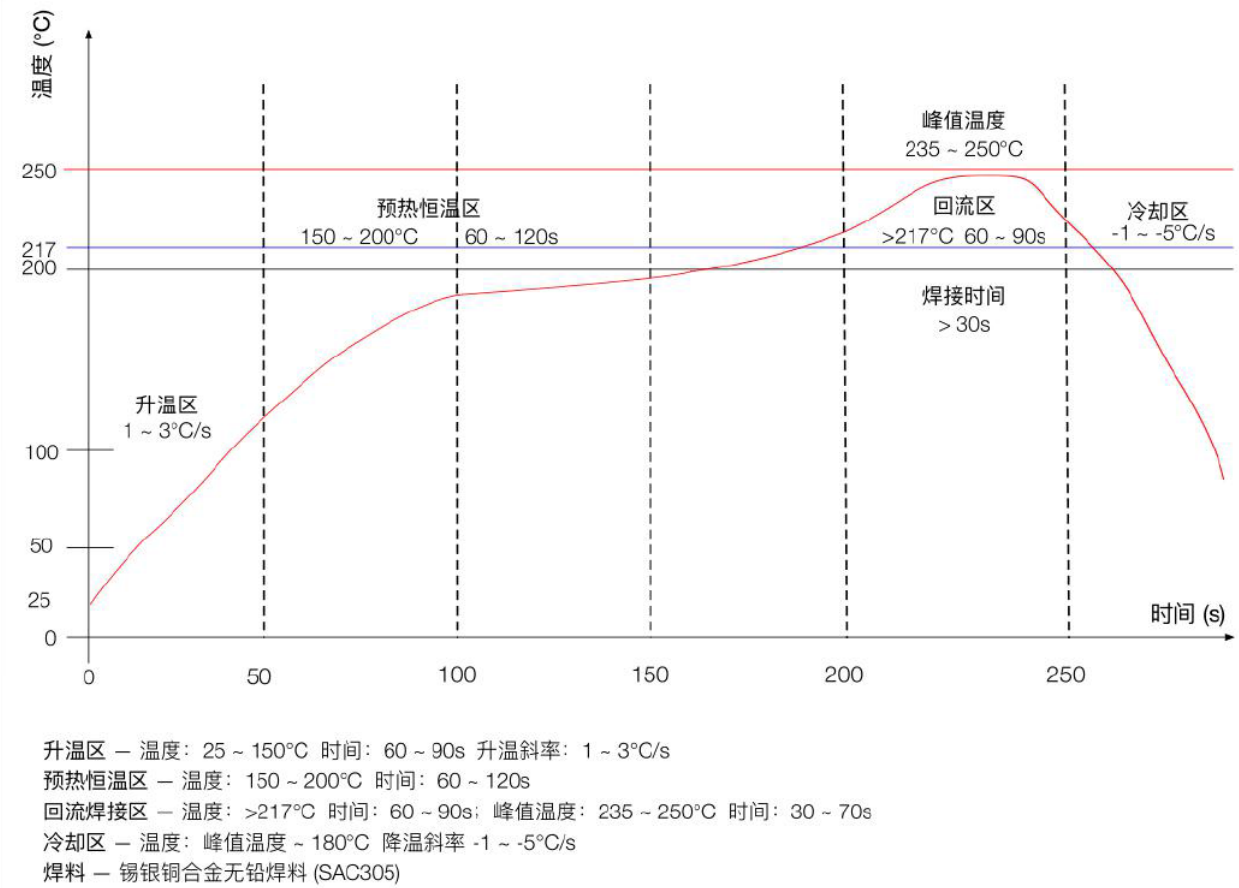
5-2 π-type matching circuit

6. Notes on programming development

Generally speaking, the receiving sensitivity of the RF chip is relatively poor at the integer multiple operating frequency of its crystal oscillator. It is recommended that users avoid

The mirror frequency of the module crystal oscillator, that is, the integer multiple frequency of the crystal oscillator frequency, the crystal oscillator frequency of this module is 32MHz.

7. Reflow Oven Curve



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. Warning of electrostatic damage

The RF module is a high-voltage electrostatic sensitive device. To prevent static electricity from damaging the module

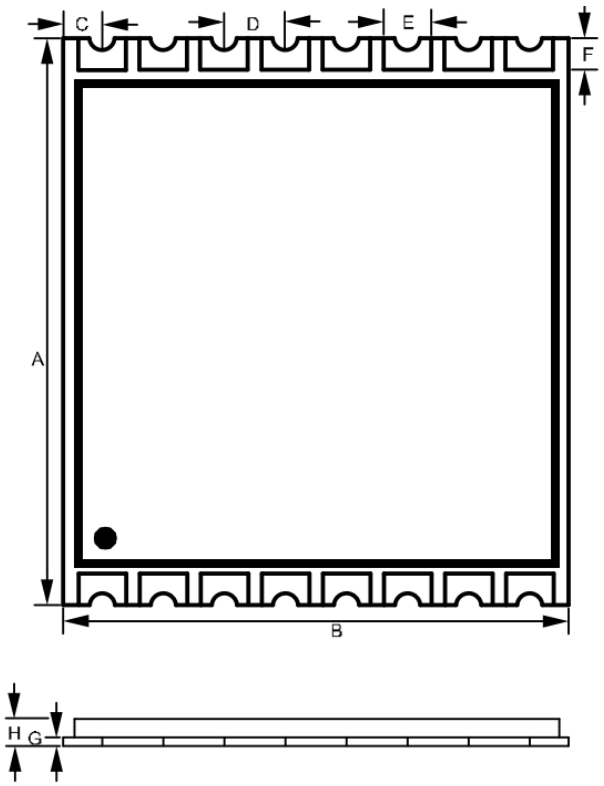
1. Strictly follow anti-static measures and do not touch the module with bare hands during the production process.

2. The module should be placed in an area that can prevent static electricity.

3. Anti-static protection circuits at high voltage inputs should be considered during product design.

9. Packaging information

Mechanical dimensions (unit: mm)



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

10. Version update instructions

Version	Updates	Updated Date	Person in charge
V1.0	Initial release	December 3, 2020	Dyming

11. Purchase Selection Table

Serial number	model	illustrate
1	VG4142S433N0S1-B\D	433MHz frequency band, taping packaging\tray packaging
2	VG4142S490N0S1-B\D	490MHz frequency band, taping packaging\tray packaging
3	VG4142S868N0S1-B\D	868MHz frequency band, taping packaging\tray packaging
4	VG4142S915N0S1-B\D	915MHz frequency band, taping packaging\tray packaging

12. Statement

1. Due to product version upgrades or other reasons, the content of this document will be updated from time to time. Unless otherwise agreed, this document is only used as a guide.

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