VG4142SxxxX0M1 Wireless Module Hardware Specifications

V1.0

Content

1. Overview

VG4142SxxxX0M1 series wireless module, based on PANCHIP's PAN3031 high-performance wireless transceiver chip design, is an ultra-long-distance two-way wireless transceiver module with built-in power amplifier (PA) and low noise amplifier (LNA) . 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 module adds a power amplifier (PA) and a low noise amplifier (LNA) on the original basis , so that the maximum transmit power reaches 1W and the receiving sensitivity is further improved. The overall communication distance and stability are compared with ordinary power modules . raised dramatically.

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 1 64dB
- Maximum transmit power 30 dBm , programmable configuration
- High Receive Sensitivity: -1 34 dBm
- Wide operating voltage range: 4.5 to 5.5 V
- Support bandwidth 125KHz , 250KHz , 500KHz
- Support spreading factor SF: 7～9

Application:

- Supply Chain and Logistics
- Smart City
- Smart Agriculture
- Industrial remote control
- street light
- Remote control application
- building automation
- security system

2. Electrical Characteristics

Parameter	Description	Remark
Power Supply	4.5 - 5.5 V	Typically 5 V
Frequency Bands	433MHz , 868MHz , 915MHz	The applicable frequency band is determined by the module model
Crystal frequency	32MHz	Passive crystal oscillator
Output Power	30dBm _	1000mW
Data Rate	1.04 kbps to 20.4 kbps	Programmable configuration
RF Modulation	Chirp-IOT	
Receive sensitivity	-1 34dBm _	SF=9 ,BW= 125kHz
receive bandwidth	125KHz , 250KHz , 500KHz	Programmable configuration
TX Current	600mA	Transmit power = 3 0dBm
RX Current	30 mA	Non-DC-DC mode
sleep Current	< 5 uA	
driver interface	SPI	
Antenna impedance	50 ohms	
Antenna connection method	side stamp hole	
storage temperature	-55 ℃ ~ + 125 ℃	
Operating temperature	-40℃ ~ + 85℃	Industrial grade
Size	29.9 x 20.5 mm	

3. Pin Diagram

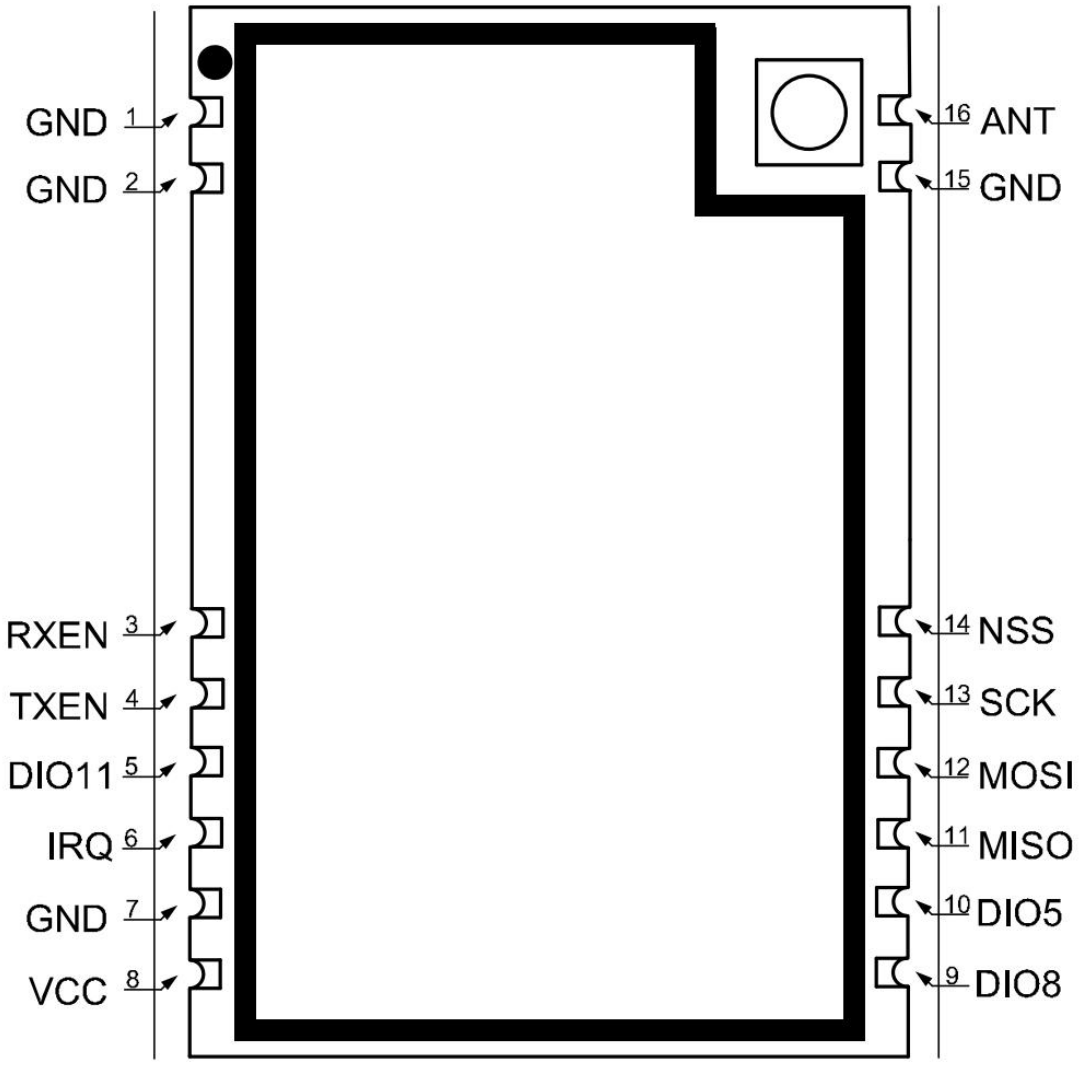


Figure 1-1 Top view

4. Pin Description

Number	Name	Type	Description
1	GND	power supply	land
2	GND	power supply	land
3	RXEN	I	Module LNA amplifier work control pin, the level control logic is RXEN=1, TXEN=0 when receiving; RXEN=0, TXEN=0 during sleep
4	TXEN	I	Module PA amplifier work control pin, the level control logic is TXEN=1, RXEN=0; TXEN=0, RXEN=0 during sleep
5	DIO11	I/O	Digital IO, software configurable , directly connected to chip GPIO11
6	IRQ	O	interrupt signal pin
7	GND	power supply	land
8	VCC	power supply	Positive power supply
9	DIO8	I/O	Digital IO, software configurable , directly connected to chip GPIO8
10	DIO5	I /O	Digital IO, software configurable , directly connected to chip GPIO5
11	MISO	O	SPI interface MISO data output
12	MOSI _	I	SPI interface MOSI data input
13	SCK	I	SPI interface clock input
14	NSS	I	SPI interface chip select input
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

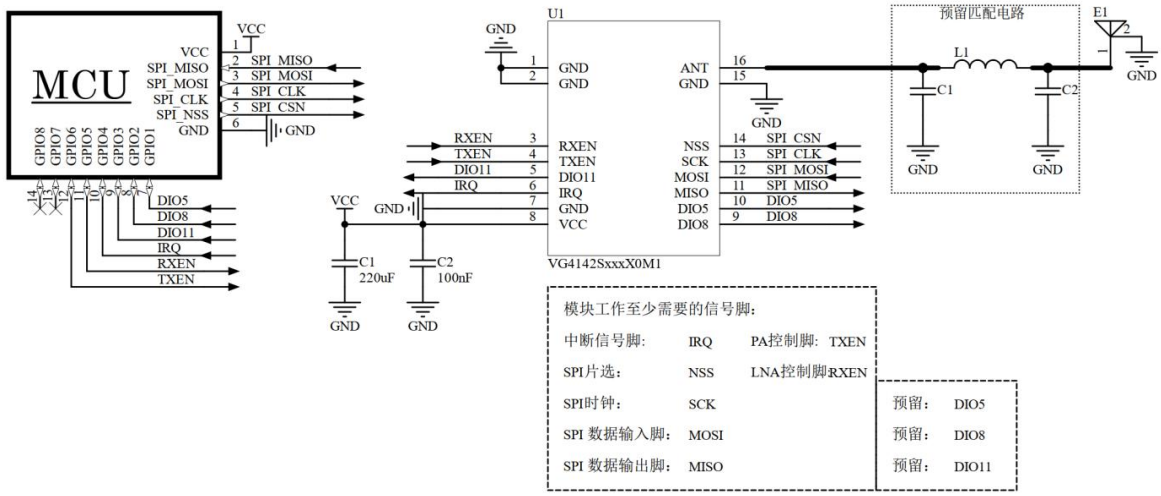


Figure 5-1 Programming development hardware connection

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 decoupling 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 an LDO or linear regulator as the power supply for the wireless module.

3. When choosing LDO or linear voltage regulator chip, it is necessary to pay attention to the heat dissipation of the power supply and the driving ability of the stable output current of the power supply; 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 or linear voltage regulator for power supply to the module; if a DC-DC power supply chip is used, an LDO or linear voltage regulator can be added later as the isolation of the module power supply to prevent the noise of the switching power supply chip from interfering with the radio frequency. work performance.

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.

8. This module is a high-power RF power device, and the current consumption is relatively large during maximum power transmission. In order to ensure its high-power transmission drive performance, it is necessary to ensure the stability of the power supply voltage of the module's power pins and the current flow capacity of the power traces on the PCB backplane ; In addition, when the module transmits, the antenna will generate a strong electromagnetic field. In order to reduce the electromagnetic interference to sensitive devices such as MCU on the bottom plate, the RF module and the antenna should be kept away from the sensitive devices on the bottom plate as far as possible.

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	thickness is 1.0mm , the distance between ground copper and trace is 6.3mil

width	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.

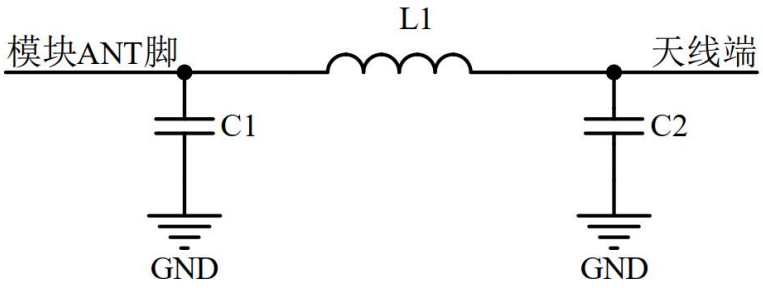
2. The input characteristic impedance of the antenna should be 50ohm.

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

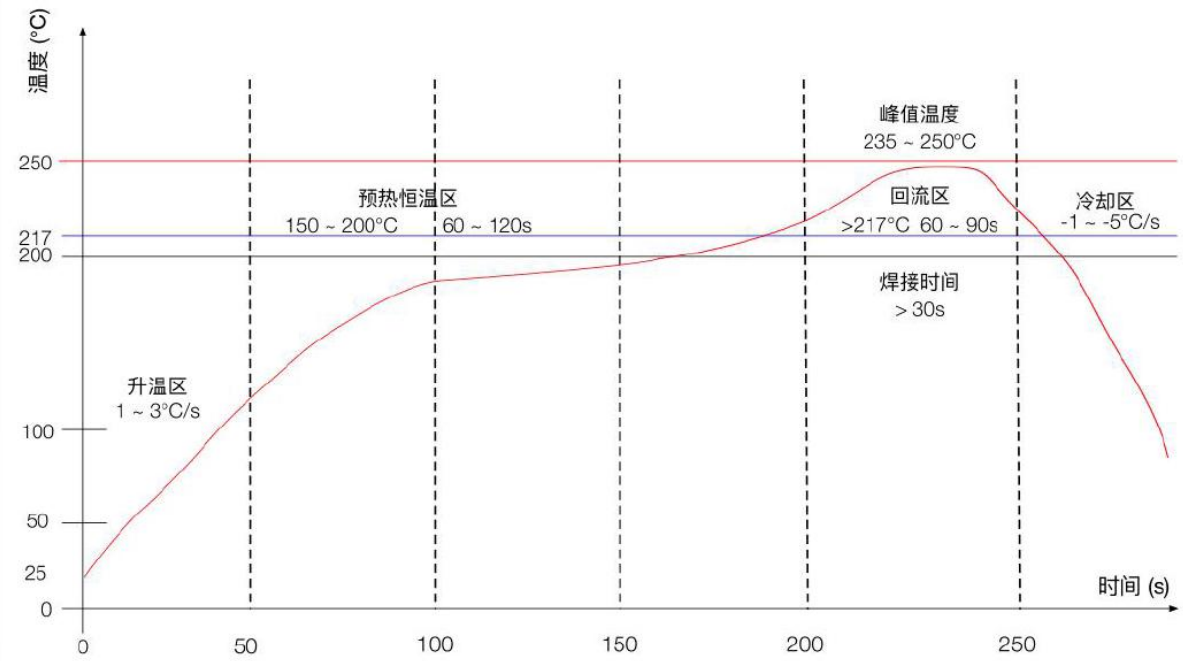
1) Since the PA amplifier is added outside the chip, it is recommended to set the output power of the front- end PAN3031 chip to a maximum of 15 dBm to achieve the PA saturation output power of 30dBm. If it increases, it will increase the power consumption of the module.

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

3) The TXEN pin and RXEN pin of the module are the logic control pins of the PA&LNA device inside the control module. Please pay attention to the control level of the TXEN and RXEN pins of the module when using it. Its control logic is listed as follows:

model	TXEN	RXEN
emission	1	0
take over	0	1
hibernate	0	0

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

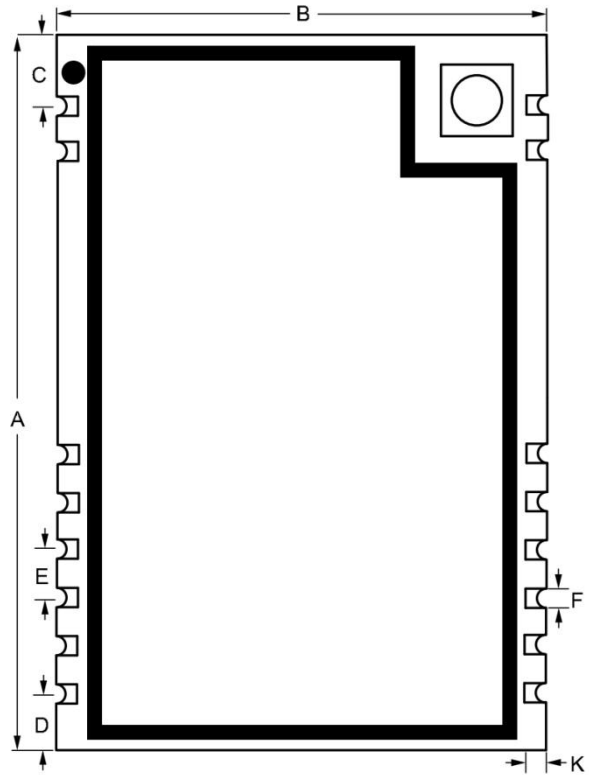
1、Strictly follow anti-static measures, and do not touch the module with bare hands during production.

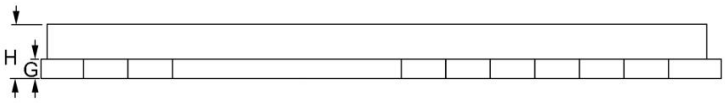
2、Modules should be placed in a placement area that can prevent static electricity.

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	29.9	±0.5
B	20.5 _	±0.5
C	3.0	±0.1
D	2.3	±0.1
E	2.0 _	±0.1
F	1.2	±0.1
K	0.8	±0.1
G	1.0	±0.1
H	2.8 _	±0.2

10. Revision History

Revision	Comment	Date
V1.0 _	Initial release version	December 3, 2021

11. Ordering Information

Index	Part Number	Description
1	VG 4142 S 433X 0 M 1	433 MHz Band, Tape Packing\Pallet Packing
2	VG 4142 S 868X 0 M 1	868 MHz Band, Tape Packing\Tray Packing
3	VG 4142 S 915X 0 M 1	915 MHz Band, Tape Packing\Pallet Packing

12. Statement

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