VG2392S240N0M1 Wireless Module Hardware Specifications

V1.2

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1. Overview

VG239 2 S240N0M 1 series wireless module is a 2.4G LORA two-way wireless transceiver module based on SEMTECH's SX1281 high-performance wireless transceiver chip design with small size, low power consumption and long distance . SX1281 is an ultra-long-distance communication wireless transceiver chip that supports LORA spread spectrum in the 2.4 GHz frequency band. It has the characteristics of high linearity and strong anti-interference. Its excellent communication link budget and ultra-low current consumption make it the first choice for the industry's small-volume, long-distance, low-power wireless wearable device solutions.

This radio complies with all 2.4 GHz radio regulations worldwide, including EN 300 440, FCC CFR 47 Part 15 and Japan ARIB STD-T66. The module integrates all RF-related functions and devices. Users can use this module to easily develop wireless solutions and wireless IoT devices with stable performance and high reliability without in-depth understanding of RF circuit design.

Features:

- Long-distance 2.4G transceiver communication
- High receive sensitivity : -132 dBm
- Programmable transmit power , the maximum transmit power can reach 12.5dBm
- Low current consumption, integrated DC-DC power supply
- At the same time support LoRa ®, FLRC, (G)FSK and other modulation methods
- Programmable data transfer rate

Application:

- Home Automation and Appliances
- IIoT asset management and security
- Logistics Tracking App
- Motion/fitness sensors and smartwatches
- Radio Controlled Toys and Drones
- Smart Agriculture
- medical insurance

2. Electrical Characteristics

Parameter	Description	Remark
Power Supply	1.8～3.7V	Typically 3.3V
Frequency Bands	2.4GHz	2400MHz-2500MHz
Output Power	-18dBm _ to +12.5dBm	Programmable configuration
Data Rate	125～2000Kbps@FSK 260～1300Kbps@FLRC 0.476～202Kbps@LoRa _ _	Programmable configuration
RF Modulation	LoRa® , FLRC, (G)FSK	Recommend LORA, FLRC
Receive sensitivity	-130dBm _ _	LORA, SF12, BW=203kHz, CR=4/5
receive bandwidth	300～ 2400kHz @FSK 300～ 1200kHz @FLRC 203～ 1625kHz @LoRa	Programmable configuration
TX Current	24mA	Transmit Power = 12.5dBm
RX Current	5.5mA	LoRa BW=203KHz
sleep Current	<1uA	
driver interface	SPI	Standard 4-wire SPI, SPI clock: <=10MHz, CPOL = 0, CPHA = 0
Antenna impedance	50 ohms	
Antenna connection method	IPEX-1 Seat or Stamp Half Hole or Onboard PCB Antenna	The default onboard PCB antenna, if you need IPEX-1 socket or stamp half hole, you need to modify the selection resistor
storage temperature	-55 ℃～ + 125 ℃	

Operating temperature	-40℃～ + 85℃	Industrial grade
Size	16.0x 24.0mm	

3. Pin Diagram

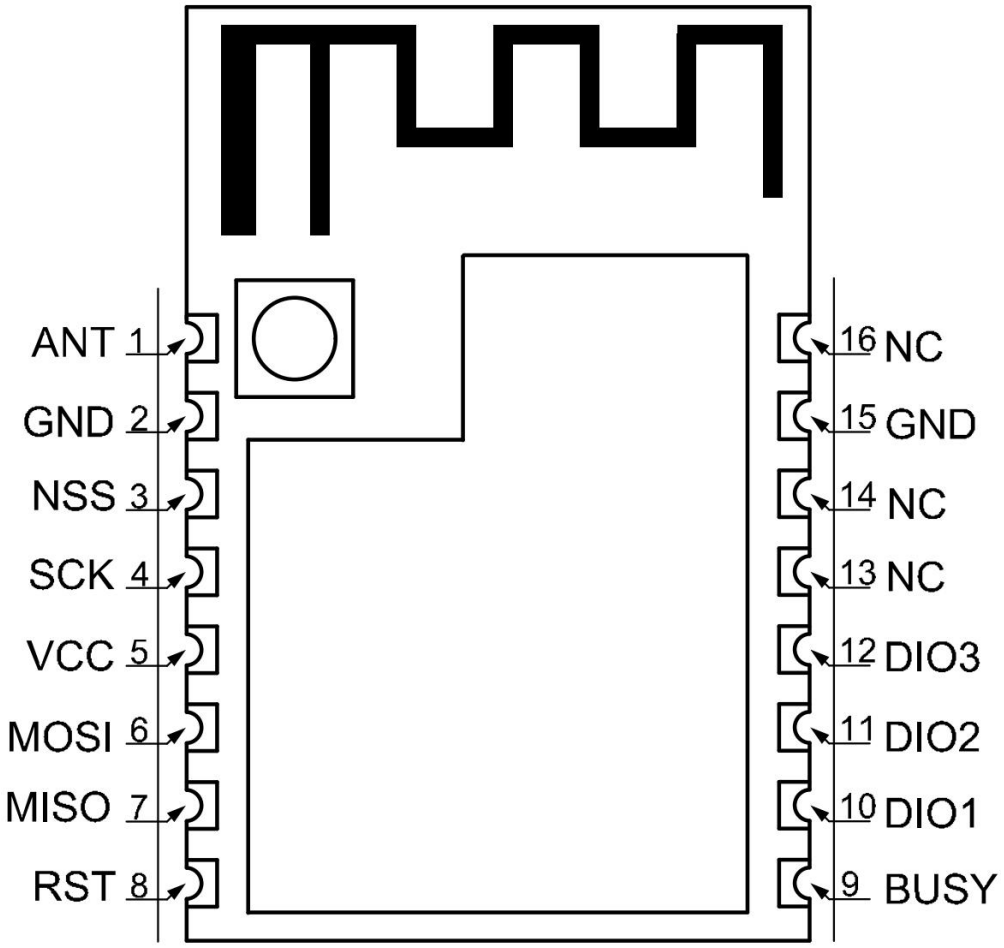


Figure 3-1 Top view

4. Pin Description

Number	Name	Type	Describe
1	ANT	I/O	Antenna external interface, matching 50Ω, need to adjust the internal jump selection resistance of the module
2	GND	power supply	land
3	NSS	I	SPI interface SPI chip select
4	SCK	I	SPI interface SCLK clock input
5	VCC	power supply	Positive power supply
6	MOSI	I	SPI interface MOSI data input
7	MISO	O	SPI interface MISO data output
8	RST	I	Reset signal, active low
9	BUSY	O	Chip working status indication, busy status
10	DIO1	I/O	Directly connected to the chip DIO1 digital I/O pin, software configurable function
11	DIO2	I/O	Directly connected to the chip DIO2 digital I/O pin, software configurable function
12	DIO3	I/O	Directly connected to the chip DIO3 digital I/O pin, software configurable function
13	NC	--	Internal suspension
14	NC	--	Internal suspension
15	GND	power supply	land
16	NC	- -	Internal suspension

5. Hardware design guide

5.1. Application circuit

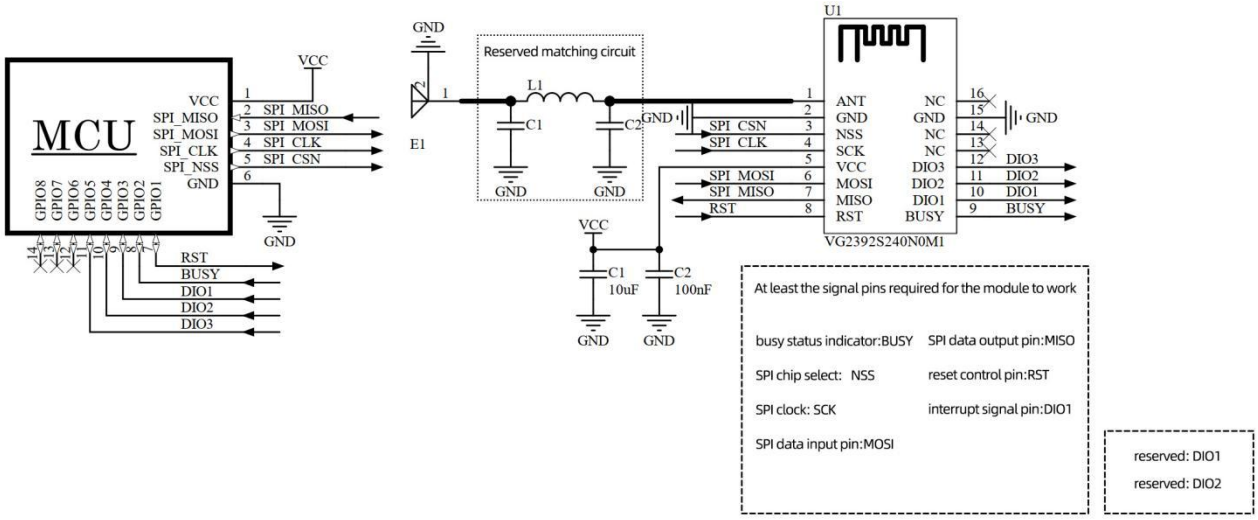


Figure 5-1 Programming development hardware connection (stamp hole external antenna)

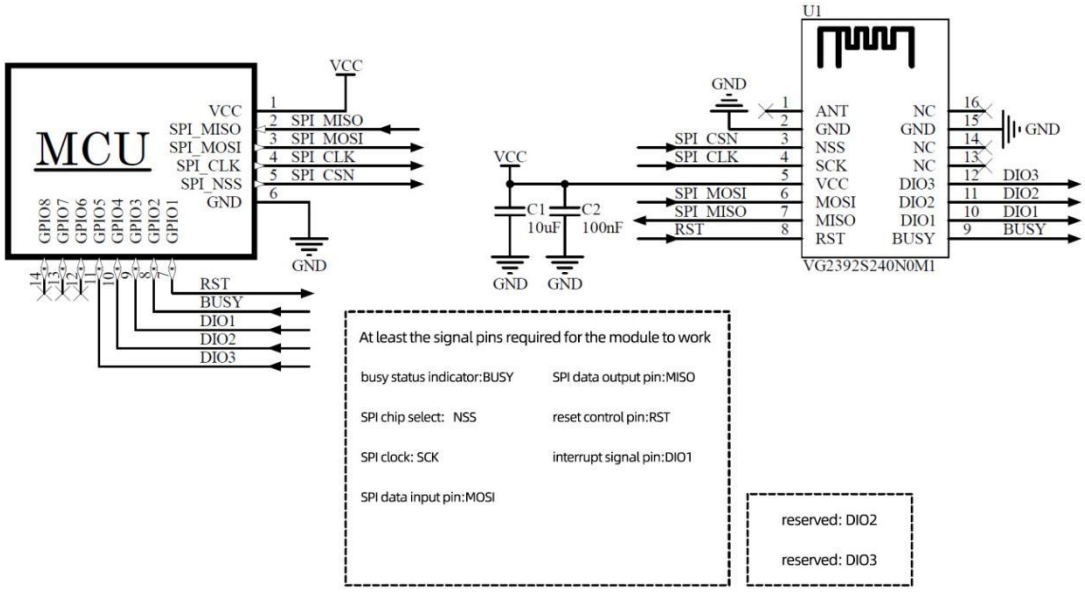


Figure 5- 2 Programming development hardware connection (on-board PCB antenna)

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) .

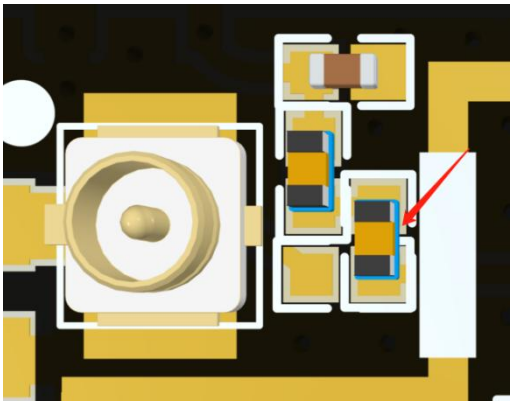
6. The RF module should be kept away from high-voltage devices as far as possible, because the electromagnetic waves of high-voltage devices will also have a certain impact on the RF signal.

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. Selection of external antenna and PCB antenna

module factory default is to select the on-board PCB antenna path. If you need to use an external antenna, you need to jump the transfer resistor to the external antenna path, as shown in the following figure:



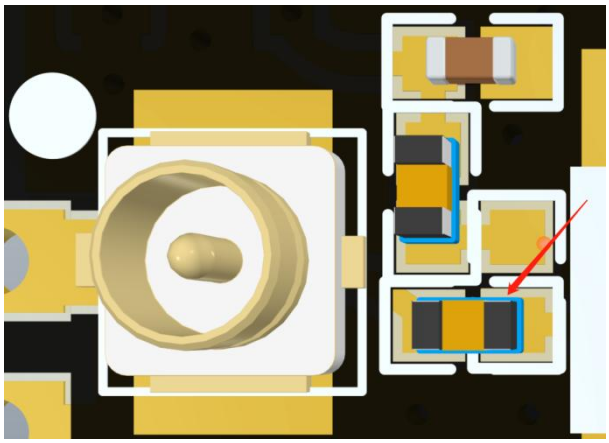
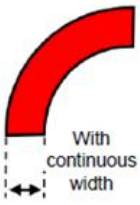


Figure 5- 3 Onboard PCB Antenna Jump Resistor Connection Figure 5- 4 IPEX-1 Seat or Stamp Half Hole Jumper Resistor Connection

5.3.2. RF Design of Stamp Hole Interface

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. It should be noted that the RF traces on the backplane PCB should be as short as possible. The 2.4G signal is more sensitive to the trace length. It is recommended that the longest trace length should not exceed 10 mm, and the trace width should be kept continuous; Right angles, circular arcs are recommended.

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 on 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
	thickness is 1.0mm , the distance between ground

RF traces use 30mil line width	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

5.3.3 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) .

5.4 Layout of modules

The radiation and reception of radio frequency signals are realized by the antenna. The grounded copper sheet has a strong absorption effect on radio frequency, so the PCB onboard antenna cannot be covered by the copper sheet on the bottom plate, nor can it be covered by batteries or other metals and other devices. Surrounded, otherwise the communication distance will be greatly reduced.

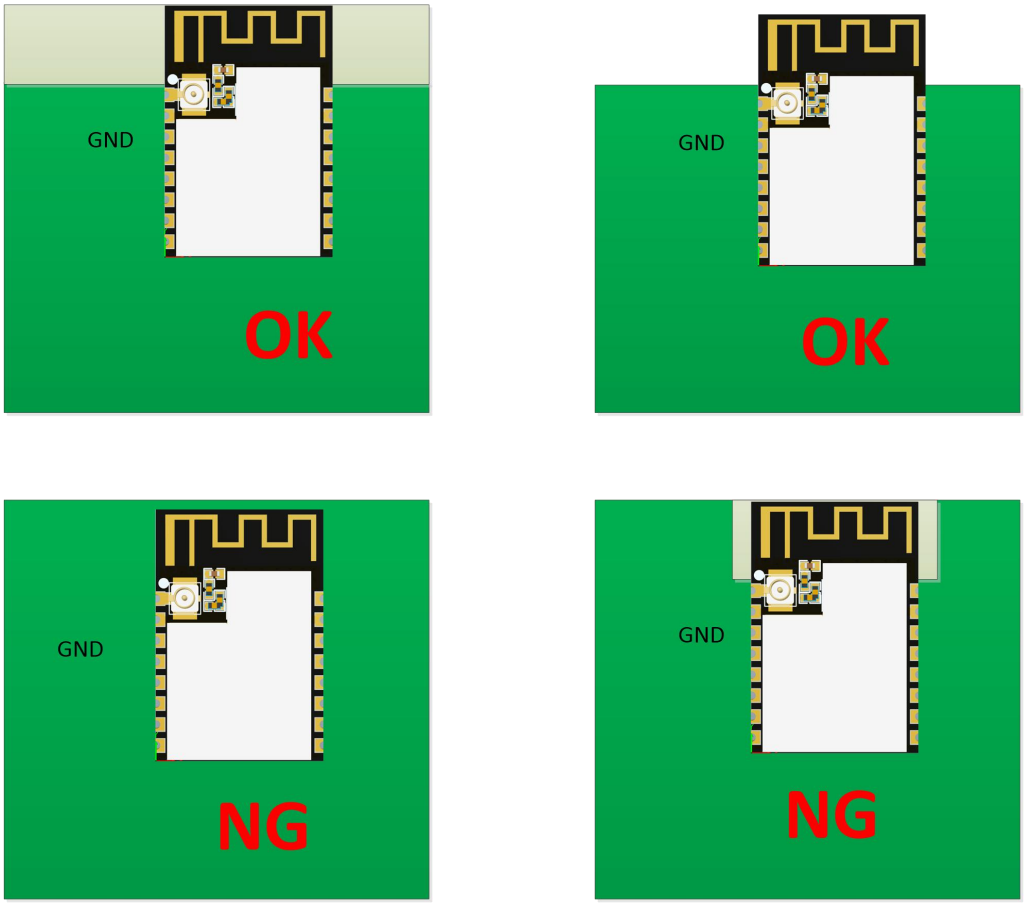
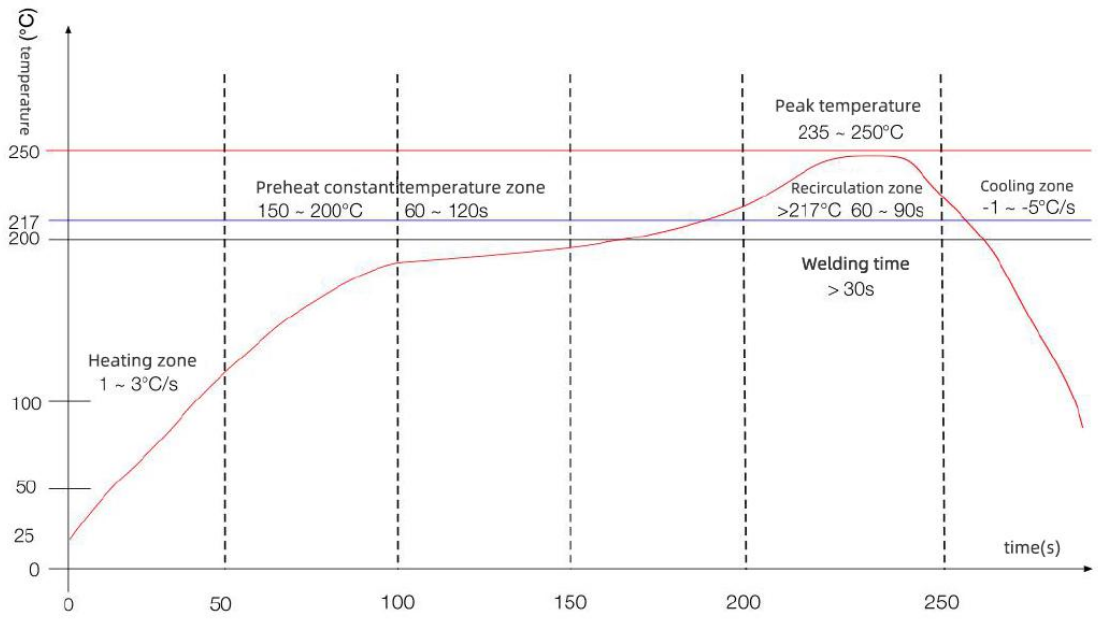


Figure 5- 5 Suggested layout of modules

6.Programming development

7. Reflow Profile



Heating zone-temperature: 25-150℃ time: 60-90s Ramp rate: 1-3℃/s
Preheat constant temperature zone-temperature: 150-200℃ time: 60-120s
Reflow soldering area-temperature >217℃ time: 60-90s; Peak temperature: 235-250℃ time: 30-70s
Cooling zone-temperature:Peak temperature -25-150℃ Cooling slope -1--5℃/s
Solder-tin-silver-copper alloy lead-free solder(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

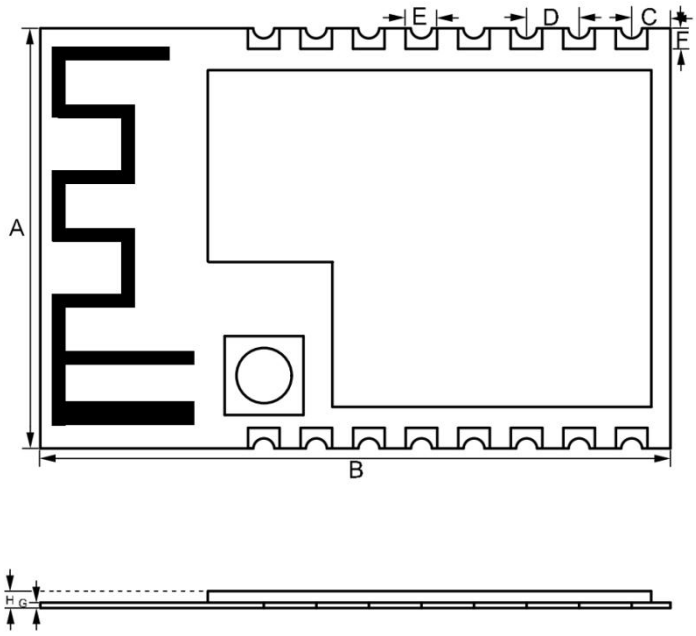
1、Strictly follow anti-static measures, and do not touch the module with bare hands during production.

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	16.0	±0.5
B	24.0	±0.5
C	1.46	±0.1
D	2.0	±0.1
E	1.2 _	±0.1
F	0.6	±0.1
G	1.0 _	±0.1
H	2.6	±0.2

10.Revision History

Revision	Comment	Date
V1.0	first release	January 6, 2020
V1.1	Reformat	October 16, 2020
V1.2	Updated Hardware Design Notes	December 30, 2020

11. Ordering Information

Index	Part Number	Description
1	VG2392S240N0M1	Tape packaging \pallet packaging Factory Default PCB Onboard Antenna Version

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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