VGdd79TxxxN0M4
wireless transparent transmission
Module Specifications

V1.2

Content

1. Overview

VGdd79TxxxN0M4 series wireless transparent transmission module is a small size, low power consumption, long distance bidirectional serial port transceiver module.

The factory default transparent transmission firmware, you can customize the working parameters through related configuration commands , and flexibly adapt to different application scenarios. Only 4 wires are needed on the hardware to perform data transparent transmission applications, including power supply VCC, GND, serial port Tx, Rx.

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 having an in-depth understanding of RF circuit design. Built-in high-performance M3 core MCU, rich GPIO available for secondary development by developers.

Application:

- Smart meter
- Supply chain and logistics
- Building automation
- Agricultural sensors
- Retail store sensors
- Street lights
- Parking sensor
- Environmental sensors
- Healthcare
- Safety and Security Sensors
- Remote control application

2. Electrical Characteristics

Parameter	Description	Remark
Power Supply	2.0 ~ 3.7V	Typically 3.3V
Frequency Bands	For details, please refer to the description of the serial port command.	
channel	32, see the serial command description for details	
Output Power	- 9dBm to + 22dBm	
Data Rate	For details, please refer to the description of the serial port command.	
Serial port baud rate	For details, please refer to the description of the serial port command.	
TX Current	150 mA	Transmit power = 22dBm, RF + MCU power consumption
RX Current	20mA _	RF+MCU power consumption
Sleep Current	<20uA	RF+MCU
driver interface	TTL /Serial	
maximum packet length	MAX= 64 bytes	The serial port transparent transmission data packet is larger than 64 bytes, and the data packet needs to be sent in sub-packages first.
Antenna impedance	50 ohms	
Antenna connection	Side stamp hole or IPEX seat	Choose one of the two applications. If you choose an external antenna on the

method		IPEX socket, the position of the stamp hole needs to be left in the air.
storage temperature	-55 ℃ ~ + 125 ℃ _	
Operating temperature	-40℃ ~ +85℃	Industrial grade
Size	1 6.0 x 24.0mm	

3. Pin Diagram

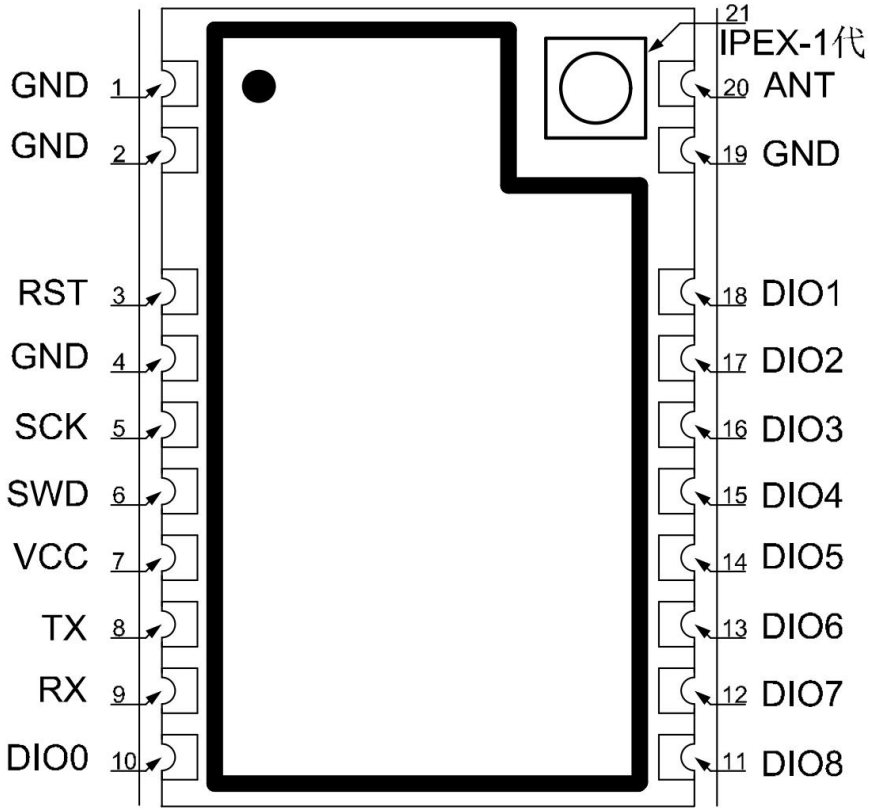


Figure 3-1 Top view

4. Pin Description

Number	Name	Type	Description
1	GND	power supply	power-ground
2	GND	power supply	power-ground
3	RST	I	Reset pin, active low
4	GND	power supply	power-ground
5	SCK	O	Programming interface, communication clock pin
6	SWD	I/O	Programming interface, communication data pin
7	VCC	power supply	Power - Positive
8	Tx	O	Serial port sending pin
9	Rx	I	Serial port receiving pin
10	DIO0	I/O	Reserved function pins
11	DIO8	I/O	Reserved function pins
12	DIO7	I/O	Reserved function pins
13	DIO6	I/O	Reserved function pins
14	DIO5	I	FTRY_KEY, parameter initialization, the IO port keeps the low level for 3.1S to realize the parameter factory setting
15	DIO4	I	AT_STA, configuration operation control pin, when it is high, it needs to enter the configuration mode before sending configuration commands. When it is low, it can directly send related configuration commands
16	DIO3	I/O	Reserved function pins
17	DIO2	I/O	Reserved function pins
18	DIO1	O	BUSY_STA, busy status indication. A high level indicates that the device is currently busy and cannot perform serial port operations, and a low level indicates that the peripherals can perform serial port operations.
19	GND	power supply	power-ground
20	ANT	I/O	Match 50Ω
21	IPEX -1	I/O	IPEX- 1st generation antenna holder

5. Hardware design guide

5.1. Application circuit

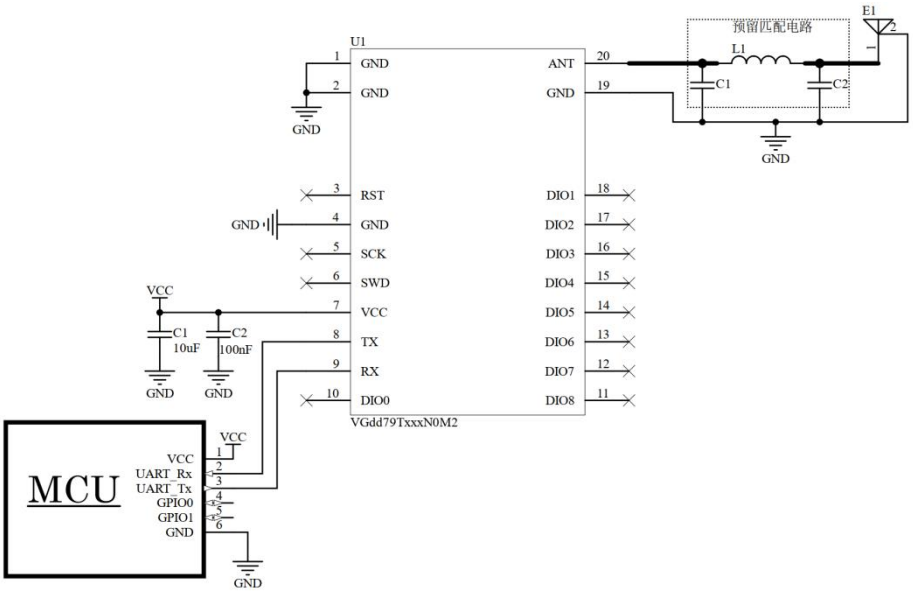


Figure 5-1 Programming development hardware connection

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) .

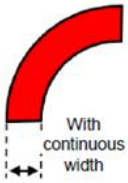
6. The RF module should be kept away from high-voltage devices as far as possible, because the electromagnetic waves of high-voltage devices will also have a certain impact on the RF signal.

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 it 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

When 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
	thickness is 1.0mm , the distance between

RF traces use 30mil line width	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. On 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.

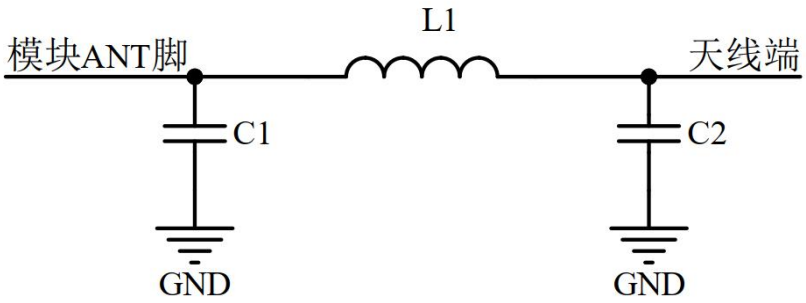
2. The input characteristic impedance of the antenna should be 50ohm.

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、The transmission distance is not ideal

The transmission distance is related to the wireless transmission power, wireless baud rate, antenna performance, and surrounding environment. When the transmission distance is not ideal, it needs to be re-evaluated according to these factors.

2、External Antenna PCB Layout Considerations

The extension cable of the external antenna must be matched with 50Ω.

3、The serial port sends transparent data, and the serial port of the other node device has no data to print.

1) There is no one-to-one correspondence between the two sides of the wireless configuration, for example, the wireless frequency and baud rate are different
2) The serial port configuration of the serial host is inconsistent with the serial port configuration of the wireless module

4、Send serial configuration command, no response

1) Configuration command format is incorrect
2) Incorrect CRC check
3) Serial port configuration is inconsistent
4) Issue other configuration commands without entering configuration mode

7. Serial configuration command

When command configuration is required, you need to enter the configuration mode first (see setting configuration mode for details), or pull the AT_STA pin low to operate other configuration commands. After the operation is completed, you need to pull the AT_STA pin high to perform normal transparent communication.

After sending the configuration command, wait for about 200ms before sending the software reset command or powering on again.

CRC description:

Parametric model: CRC-8, x8+x2+x+1

Polynomial POLY = 0x07

Initial value INIT = 0x55

1、CRC, perform CRC operation on the data before CRC

7.1.Set configuration mode

length	Order	model	Check Digit
0x03	0x26	1byte	CRC
		Range: 0~1 =0, in configuration mode, exit configuration mode, in non-configuration mode, it is considered to be transparent data transmission =1, enter the configuration mode, you can configure other commands at this time Default is non-config mode The setting takes effect immediately	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.2. set wireless channel

length	Order	wireless channel	Check Digit
0x03	0x01	1byte	CRC
		Range: 0~31 The specific corresponding frequency is related to the settings of the wireless frequency band range and channel spacing bandwidth . For example, when the channel interval is 1MHz and the wireless frequency range is 433MHz, =0, corresponding to 433MHz =1, corresponding to 434MHz ... =31, corresponding to 464MHz When the wireless frequency range is the 868MHz frequency band, =0, corresponding to 868MHz =1, corresponding to 869MHz ... =31, corresponding to 899MHz Default is 0 channel The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.3. Set wireless transmit power

length	Order	Wireless transmit power	Check Digit
0x03	0x03	1byte	CRC
		Range: 0~31 =0~5, reserved, unavailable =6, output -3dBm ... =31, output 22dBm (default) = other, invalid Interval 1dBm The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.4. Set the wireless baud rate

length	Order	Wireless baud rate	Check Digit
0x03	0x04	1byte	CRC
		Range: 0~6 =0, reserved =1, reserved =2, corresponds to 1220bps (default) =3, corresponding to 2440bps =4, corresponding to 5000bps =5, corresponding to 12500bps =6, corresponding to 37500bps = other, invalid The setting takes effect after restart, and supports power-off saving The lower the wireless baud rate, the longer the communication distance can be.	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.5. Set the serial port baud rate

length	Order	Serial port baud rate	Check Digit
0x03	0x05	1byte	CRC
		Range: 0~7 =0, not available =1, corresponding to 2400bps =2, corresponding to 4800bps =3, corresponding to 9600bps =4, corresponding to 38400bps =5, corresponding to 576000bps =6, corresponding to 115200bps (default) =7, corresponding to 460800 bps = other, invalid The setting takes effect after restart, and supports power-off saving	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.6. Get the wireless signal strength RSSI

length	Order	data	Check Digit
0x03	0x07	1byte	CRC
		=1 = other, invalid The setting takes effect immediately	

return successfully

length	Order	R ssi value	Check Digit
0x03	0x07	1byte	CRC
		The current ambient signal strength, The signal strength value is generally negative, and the original value has been optimized for the convenience of transmission. When R ssi = 100 is received, the corresponding signal strength is -100.	

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.7. Set the serial port transparent transmission printing packet format

length	Order	Packet Mode	Check Digit
0x03	0x08	1byte	CRC

		Range: 0~1 =0, direct format, that is, the packet is transparently transmitted directly, any data received wirelessly, the serial port will directly print all the data =1, with RSSI format, after receiving wireless data, add RSSI signal strength value at the end of the data packet, see section 7 for signal strength (default) = other invalid The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.8. Set up wireless auto answer

length	Order	state	Check Digit
0x03	0x09	1byte	CRC
		Range: 0~1 =0, disable auto answer function =1, turn on the automatic answering function, after receiving the wireless signal, automatically start the radio frequency to send a series of data (03 55 xx crc) (default)	

		= other invalid The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.9. Set the wireless data output direction

length	Order	output direction	Check Digit
0x03	0x0A	1byte	CRC
		Range: 0~1 =0, after receiving the wireless data, the transparent data will be forwarded and output from the serial port (default =1, after receiving the wireless data, the transparent data will be forwarded and output from the wireless = other invalid The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.10. Set the wireless channel interval bandwidth

length	Order	channel spacing	Check Digit
0x03	0x0B	1byte	CRC
		Range: 25~200, this value is not the actual value, it needs to be converted to get the actual value, default=100 Conversion formula: actual value = setting value * 10 * 1000Hz, for example, when setting 100, the actual channel interval is 1MHz The setting takes effect immediately and supports power-down save	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.11. Set configuration parameters to factory default

length	Order	-	Check Digit
0x03	0x21	1byte	CRC
		=1 = other, invalid The setting takes effect immediately After the setting is completed, the device will automatically restart to take effect	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.12. Set the software to reset the system

length	Order	-	Check Digit
0x03	0x22	1byte	CRC
		=1 = other, invalid The setting takes effect immediately	

return successfully

length	Order	data	Check Digit
0x03	0x55	-	CRC

return on failure

length	Order	data	Check

			Digit
0x03	0xEE	-	CRC

7.13. Get the current configuration information

length	Order	-	Check Digit
0x03	0x24	1byte	CRC
		=1 = other, invalid The setting takes effect immediately	

return successfully

length	Order	configuration information	Check Digit
0x15	0x24	19byte	CRC
		BYTE1: Software version BYTE2~5: reserved BYTE6~9: reserved BYTE10: Reserved BYTE11: Current wireless channel BYTE12: Current wireless frequency range BYTE13: Current wireless transmit power BYTE14: Current wireless baud rate BYTE15: Current serial port baud rate BYTE16: Current packet format BYTE17: Current wireless auto answer BYTE18: Current wireless data output direction BYTE19: Current wireless channel spacing bandwidth For the specific corresponding meaning, please refer to the corresponding configuration description.	

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

7.14. Get the current software version

length	Order	-	Check Digit
0x03	0x25	1byte	CRC
		=1 = other, invalid The setting takes effect immediately	

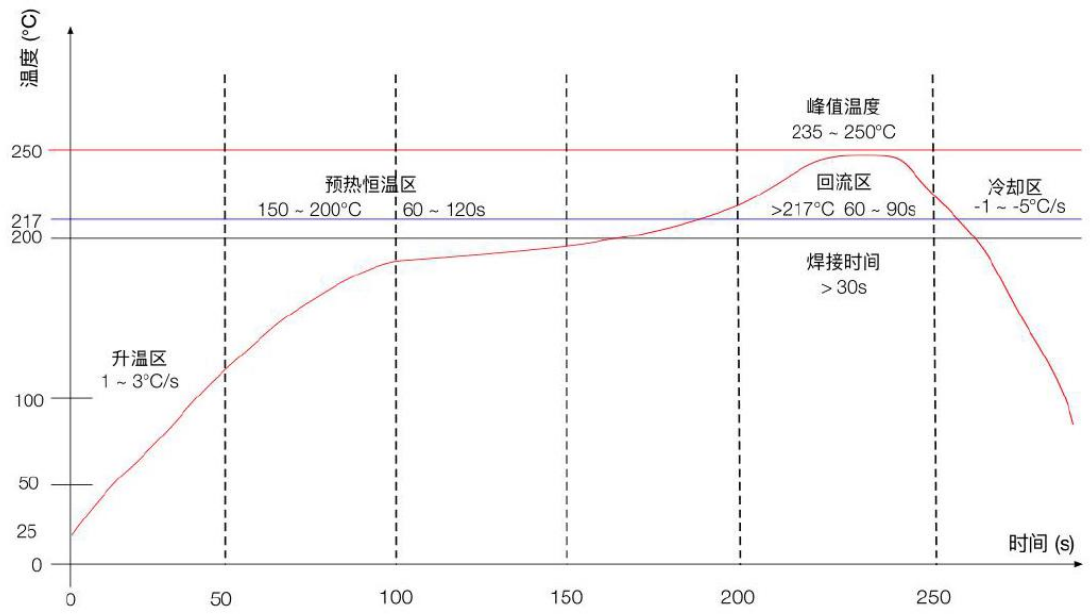
return successfully

length	Order	Software version	Check Digit
0x03	0x25	For example = 0x10, the corresponding version number is V1.0	CRC

return on failure

length	Order	data	Check Digit
0x03	0xEE	-	CRC

8. 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)

9.ESD Notice

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

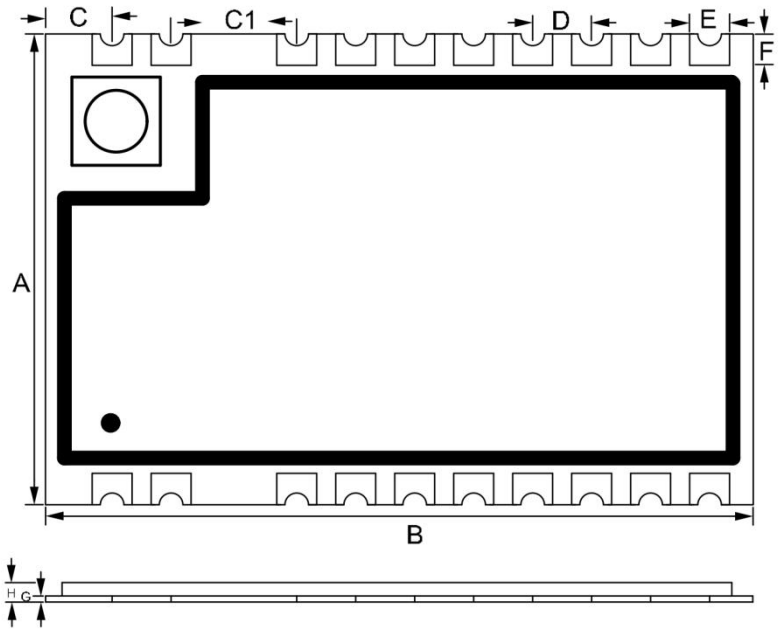
1、Strictly follow anti-static measures, and do not touch the module with bare hands during production.

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.

10. Packaging information

Mechanical Dimensions (unit:mm)



Numbering	Dimensions (mm)	Error (mm)
A	16.0	±0.5
B	24.0	±0.5
C	2.2	± 0.1
C 1	4.2	± 0.1
D	2.0	± 0.1
E	1.2 _	± 0.1
F	0.8 _	± 0.1
G	1.0	± 0.1
H	2.6	± 0.2

11. Revision History

Revision	Comment	Date
V 1.0	first release	January 6, 2020
V1.1	Updated hardware design considerations	December 30, 2020
V1.2	Modify module size description and configuration command description	December 12, 2021

12. Ordering Information

Index	Part Number	Description
1	VGdd7 9T433 N0 M2	433MHz frequency band , tape packing \pallet packing
2	VGdd7 9T490 N0 M2	490MHz frequency band , tape packing \pallet packing
3	VGdd7 9T868 N0 M2	868MHz frequency band , tape packing \pallet packing
4	VGdd7 9T915 N0 M2	915MHz frequency band , tape packing \pallet packing

13. Statement

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