VG3214TxxxN0M1 Wireless Transparent Transmission Module Specification

V1.1

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1. Overview

VG3214TxxxN0M1 The series of wireless transparent transmission modules is a low-cost, compact, low-power, long-distance two-way serial port receiver.Development module.

Transparent transmission firmware has been defaulted at the factory. Working parameters can be customized through relevant configuration commands . Flexible to adapt to different application scenarios. The hardware only requires 5 Data transparent transmission applications can be carried out with a root cable connection. Includes power supply VCC, GND, TX, RX, CE, if you need to control Module sleep needs to be connected CE Enable the pin, otherwise you can let CE Just connect the feet directly to the ground . Each module has its own unique device ID.

The module integrates all radio frequency related functions and devices. Users do not need to have an in-depth understanding of radio frequency circuit design to use this module. It is easy to develop wireless solutions and wireless IoT node devices with stable performance and high reliability. Built-in module 32 High performance and low power consume M0+ core MCU, rich GPIO Extensions can be used by developers for secondary development.

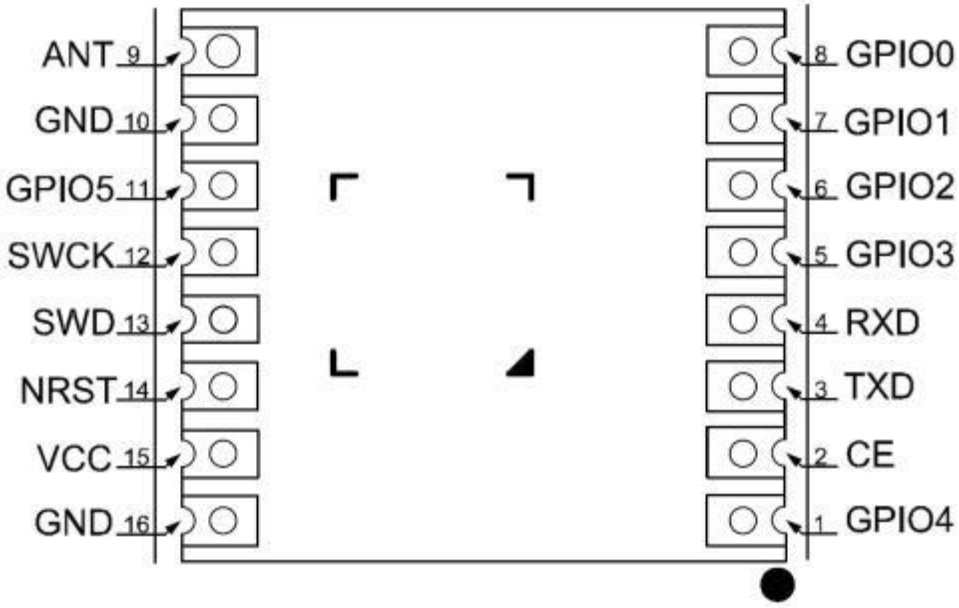
application:

1. Smart meter
2. Supply chain and logistics
3. Building automation
4. Agricultural sensors
5. Retail store sensors
6. Street lights
7. Parking sensor
8. Environmental sensors
9. Medical care
10. Safety and Security Sensors
11. Remote control application

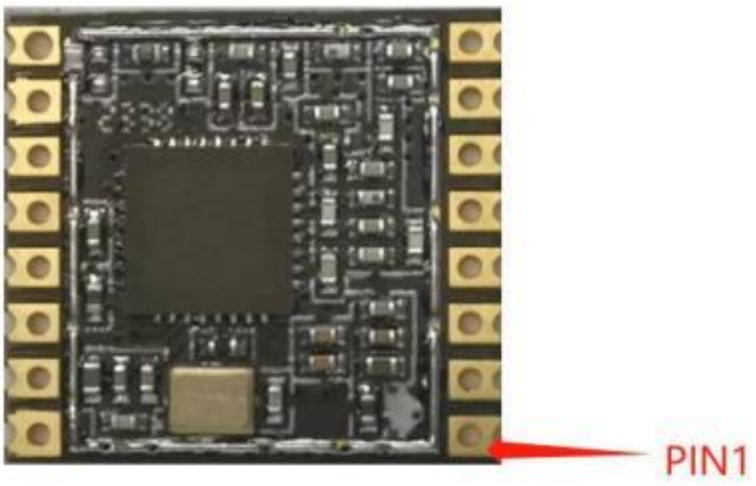
2.Technical Parameters

Technical indicators	parameter	Remark
voltage range	2.0V～3.6V	recommend 3.3V
Frequency Range	See the serial port command description for details.	
channel	32 For details, please refer to the serial port command description.	
Maximum output power	+20dBm	Can be set
Wireless speed	See the serial port command description for details.	
Serial port baud rate	See the serial port command description for details.	
Emission current	110mA	20dBm Transmit power
receive current	27mA	
Sleep current	10uA	
Serial interface	TTL	
Maximum packet length	MAX=220 byte	One-time maximum 220 bytes wireless Transmission length
Antenna impedance	50 ohm	
Antenna connection method	Side stamp hole or spring antenna straight jack	
storage temperature	-55℃~ +125℃	
Operating temperature	-40℃~ +85℃	Industrial grade
Size	16.5x18.0x1.8mm	wxya

3. Pin location diagram



picture3-1 top view



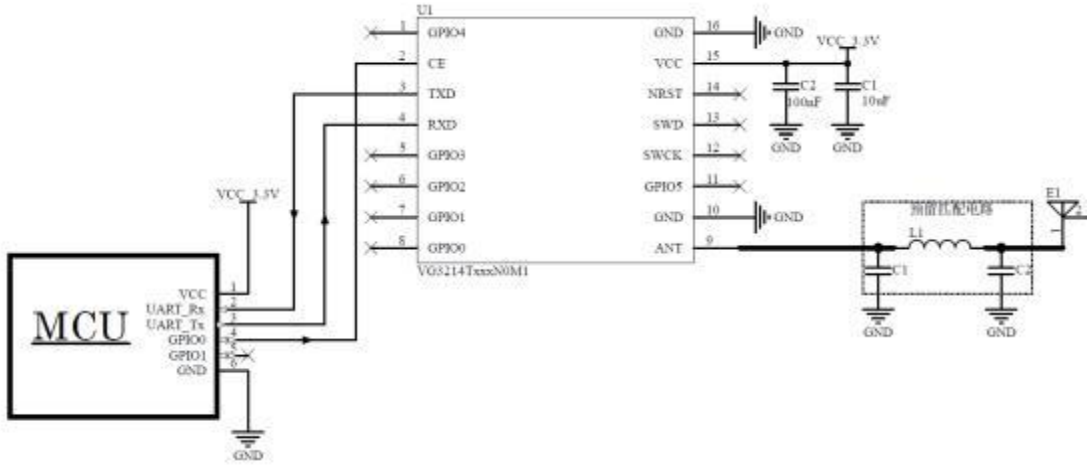
4. Pin description

number	pin	type	describe
1	GPIO4	I/O	Reserved function pins
2	CE	I	Module enable pin High level (or floating) The module enters sleep mode, Low level enters normal working state state
3	TxD	0	Serial data sending pin
4	RXD	I	Serial data receiving pin
5	GPIO3	I/O	Reserved function pins
6	GPIO2	I/O	FTRY_KEY, parameter initialization, the IO port remains low 3.1S Parameters can be realized Number of factory settings
7	GPIO1	I/O	BUSY_STA, busy status indication. High level indicates that the current working status of the device is busy and not Serial port operation is available. Low level indicates that the peripheral device can perform serial port operation.
8	GPIO0	I/O	AT_STA, configuration operation control pin, needs to be entered before sending configuration commands when the level is high. Configuration mode , when the level is low, relevant configuration commands can be sent directly, and the default internal There is a pull-up
9	ANT	antenna	Characteristic impedance 50Ω antenna input and output port
10	GND	power supply	land
11	GPIO5	I/O	Reserved function pins

12	SWCK	Burn	Programming and burning interface, communication clock pin
13	SWD	Burn	Programming and burning interface, communication data pin
14	NRST	I	Module reset pin, active low level
15	VCC	power supply	power supply 3.3V
16	GND	power supply	land

5. Hardware design guidance and precautions

5.1. Hardware connection diagram



picture 5-1 Hardware connection diagram

5.2. Power supply design and related precautions

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 the maximum allowed value of the module is exceeded The power supply range will cause permanent damage to the module; the decoupling capacitor of the module power pin should be as close as possible to the module power pin.

2. In the module power supply system, Excessive ripple may be coupled to lines susceptible to interference through wires or ground planes. For example, day Lines, feeders, clock lines and other sensitive signal lines, It is easy to cause the module' s radio frequency performance to deteriorate. So we recommend using LDO or linear The voltage regulator serves as the power supply for the wireless module.

3. Select LDO or linear regulator chip, It is necessary to pay attention to the heat dissipation of the power supply and the driving ability of the power supply to stabilize the output current; Consider the whole For long-term stable operation of the machine, it is recommended to reserve More than 50% current output margin.

4. It is best to use one module separately LDO Or linear regulator power supply; If adopted DC-DC power supply chip, you can add one later LDO Or a linear voltage regulator is used 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. MCU If the communication line between the module and the module is used 5V level, must be connected in series 1K-5.1K Resistor (not recommended, still 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 RF signals.

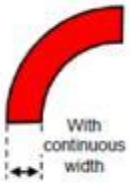
7. High-frequency digital traces, high-frequency analog traces, and high-current power traces should be kept away from the bottom of the module. If you have no choice, you must go through the module square, the wiring needs to be routed where the module is placed PCB Another layer of the bottom board, and ensure that the copper underneath the module is well grounded.

5.3. Antenna design and guidance

5.3.1 stamp hole interfaceRFdesign

connect to the base plate during design.Antenna on the PCB . Considering the attenuation of high -frequency signals, attention needs to be paid to the base plate PCBThe length of RF traces needs to be as short as possible, and it is recommended that the longest trace is long degree does not exceed20mm, and the trace width needs to maintain continuity; When you need to turn, try not to make sharp or right angles. It is recommended to walk in an arc

Wire.

The primary recommended turning method for RF cabling	
The second recommended RF wiring turning method	
Worse way to turn RF wiring, don’ t recommend it recommend	

In order to ensure that the impedance of the backplane RF trace is50Ohm can be adjusted according to the following parameters according to different plate thicknesses.
The following simulation values are for reference only.

RF wiring adopts 20mil Line width	The plate thickness is 1.0mm When , the spacing between ground copper and traces is 5.3mil
	The plate thickness is 1.2mm When , the spacing between ground copper and traces is 5.1mil
	The plate thickness is 1.6mm When , the spacing between ground copper and traces is 5mil
RF wiring adopts 25mil Line width	The plate thickness is 1.0mm When , the spacing between ground copper and traces is 6.3mil
	The plate thickness is 1.2mm When , the spacing between ground copper and traces is 6mil
	The plate thickness is 1.6mm When , the spacing between ground copper and traces is 5.7mil

RF wiring adopts 30mil Line width	The plate thickness is 1.0mm When , the spacing between ground copper and traces is 7.6mil
	The plate thickness is 1.2mm When , the spacing between ground copper and traces is 7.1mil
	The plate thickness is 1.6mm When , the spacing between ground copper and traces is 6.6mil

5.3.2 Built-in antenna

The built-in antenna refers to the one welded on PCB The antenna placed inside the product shell on the base plate specifically includes patch ceramic antennas, spring antennas , 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 radio frequency performance . As long as the structural space of the product shell is sufficient, the spring antenna should be placed vertically upward as much as possible; copper should not be laid around the base plate where the antenna is placed. , or you can hollow out the circuit board under the antenna, because metal has a strong ability to absorb and shield radio frequency signals , which will seriously affect the communication distance.The external antenna should be placed on the edge of the base plate as much as possible.

5.3.3 external antenna

External antenna means the module passes IPEXExtension cable, SMA and other standard radio frequency interfaces are installed outside the product housing , specifically Including rod antenna, suction cup antenna, fiberglass antenna, etc. External antennas are basically standard products. To better choose one suitable for the module When selecting an antenna, you should pay attention to the following when selecting antenna parameters:

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

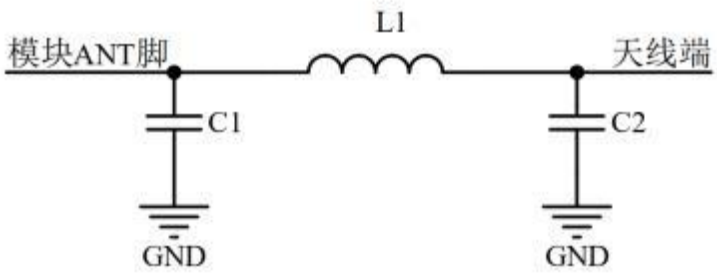
2. The input characteristic impedance of the antenna should be 50ohm.

3. The size of the antenna interface 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 actual application of specific products frequency points used).

5.3.4Antenna matching

Antennas are critical to the transmission distance of RF modules. In practical applications, it is to facilitate users' later antenna matching adjustments. It is recommended that when designing the schematic diagram, users ANT A simple π-type matching circuit is reserved between the pin outputs . If the antenna is already marked Accurate 50Ω, Components L1 stick 0R resistor, device C1 ,C2 No welding is required, otherwise you need to use a network analyzer to measure the actual resistance of the antenna. resist and match to determine C1,L1,C2 The value of . module ANT The trace from the pin to the antenna end should be as short as possible. Recommended longest route The length does not exceed 20mm.



5-2 π type matching circuit

6. Precautions for programming development

1. The transmission distance is not ideal

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

2. The serial port sends transparent data, but no data is printed on the serial port of the other node device.

1) There is no one-to-one correspondence between the two parties in wireless configuration. For example, the wireless frequency and baud rate are different.

2) The serial port configuration of the serial host is inconsistent with that of the wireless module.

3) Protocol mode does not match

3. No response when sending serial port configuration command

1) The configuration command format is incorrect

2) CRCIncorrect test

3) Serial port configuration is inconsistent

4) Send other configuration commands without entering configuration mode

4. Default configuration table of module main parameters

sequence	Module parameters	Factory default parameters
1	Serial port parameters	Baud rate: 115200bps, stop bit: 1, data bits: 8, parity: none
2	wireless channel	channel 0
3	Wireless transmission power	+20dBm
4	Wireless communication baud rate	2.4Kbps
5	Wireless channel spacing	250kHz

5. Serial port framing mechanism

The serial port framing mechanism is based on the packaging time and packaging length. When any one of the two conditions is met, the packet is packaged and sent.

Serial port packaging time: 10ms, when the module serial port is idle 10ms If the next byte of data is not received, the serial port number currently received will be The data is packaged and sent wirelessly.

Serial port packaging length: 220 Bytes, when the module serial port continuously receives 220 Bytes are then packaged and sent wirelessly.

6. Module sleep and wake-up

When module CE When floating or high level, the module enters sleep mode. The entire module doesn't work.

When the module wakes up from sleep mode (the module CE pin changes from high level to low level) a delay greater than 2ms, waiting for module MCU Only after stable operation can data be sent to the module serial port.

7. Serial port configuration commands

When command configuration is required, you need to enter the configuration mode first (see setting the configuration mode for details), or change AT_STA Pull the pin low to operate it He configures the command, To complete the operation, you need to AT_STA Only when the pin is pulled high can normal transparent communication be carried out. After sending the configuration command, need to wait 200ms You can only send a software reset command or power on again.

CRC instruction of:

1). The last byte of the configuration command frame is CRC Check byte, that is, pair CRC Perform previous data CRC The value obtained by the operation, with The body calculation method is as shown in the code in the chapter "8. Calculation of CRC" .

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

3), CRC Polynomial POLY = 0x07

4), CRC initial value INIT = 0x55

1,Set configuration mode

length	Order	model	Check Digit
0x03	0x26	1byte	CRC
		scope: 0~1 =0, in configuration mode, exit configuration mode, in non- configuration mode, it is considered to be transparent transmission of data. =1, enter the configuration mode, and other commands can be configured at this time. Default is non-configuration mode Settings take effect immediately	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

2,Set up wireless channel

length	Order	wireless channel	Check Digit
0x03	0x01	1byte	CRC
		scope: 0~31 The specific corresponding frequency is related to the wireless frequency band range and channel spacing bandwidth settings. Such as channel spacing 1MHz, the wireless frequency band range is 433MHz Frequency band: =0, corresponding to 433.92MHz =1, corresponding to 434.92MHz … =31, corresponding to 464.92MHz The wireless frequency range is 868MHz Frequency band: =0, corresponding to 868.92MHz =1, corresponding to 869.92MHz … =31, corresponding to 899.92MHz The default is 0 channel The settings take effect after restarting and support saving after power failure.	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

3.Set wireless transmission power

length	Order	Wireless transmission power	Check Digit
0x03	0x03	1byte	CRC
		scope: 0~26 =0, output 20dBm (default) =1, output 19dBm =2, output 18dBm =3, output 17dBm =4, output 16dBm =5, output 15dBm … =26, output -6dBm =0ther, invalid interval 1dBm Settings take effect after restart, support power-off save	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

4.Set wireless baud rate

length	Order	Wireless baud rate	Check Digit
0x03	0x04	1byte	CRC

		scope: 0~6 =0, reserved =1, corresponding to 2400bps (default) =2, corresponding to 4800bps =3, corresponding to 5000bps =4, corresponding to 10000bps =5, corresponding to 19200bps =6, corresponding to 100000bps =Other, invalid Settings take effect upon restart and support power-off protection live The lower the wireless baud rate you can get	

		Longer communication distance	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

5.Set serial port baud rate

length	Order	Serial port baud rate	Check Digit
0x03	0x05	1byte	CRC
		scope: 0~7 =0, unavailable =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 recognize) =7, corresponding to 460800bps =Other, invalid Settings take effect after restart, support power-off save	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

6. Set the serial port printing packet format

length	Order	Packet mode	check
			Bit
0x03	0x08	1byte	CRC
		=0, direct format, That is, the packet is directly transmitted transparently. What data is received wirelessly? The serial port will print all directly (default) . =1, with RSSI format, after receiving wireless data , add at the end of the data packet RSSI signal strength Value, serial port printing format: serial port data packet + RSSI. =2, with RSSI and equipment ID, serial port printing format: serial port data packet + RSS I + device ID. =Others are invalid. The settings take effect immediately and can be saved after power off. The data type of signal strength is signed short integer	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

7. Set protocol mode

length	Order	protocol mode	check Bit
0x03	0x0A	1byte	CRC
		=0, the wireless transmission layer does not have a protocol, and the serial port data format is: User data packet. =1, reserved. =2, serial port data with target device id, serial port input data format: device id(4 bytes) + user data Bag. =3, serial port data with target device ID and channel, Serial port input data format: equipment id(4 Bytes) + None line channel(1 bytes) + user data packet. =4, general protocol mode, Wireless transport layer protocol, Serial port input data format: User data package (default recognize). =5, point-to-point communication protocol, One-way binding target ID, please see the application scenario display for details. Serial port input data format	
		Type: User data packet. =Others are invalid. The settings take effect immediately and can be saved after power off.	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

8. Set the wireless channel interval bandwidth

length	Order	channel spacing	check Bit
0x03	0x0B	1byte	CRC
		Range: 25~200, this value is not the actual value and needs to be converted to get the actual value. Default = 100 Conversion formula: Actual value = setting value * 10 * 1000Hz, such as setting 100 When , the actual channel spacing is 1MHz The settings take effect immediately and can be saved after power off.	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

9. Set configuration parameters to factory settings

length	Order	_	Check Digit
0x03	0x21	1byte	CRC
		=1 =0ther, invalid Settings take effect immediately After the setting is completed, the device will automatically restart to take effect.	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

10. Set software to reset the system

length	Order	–	Check Digit
0x03	0x22	1byte	CRC
		=1 =Other, invalid Settings take effect immediately	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

11. Get current configuration information

length	Order	–	Check Digit
0x03	0x24	1byte	CRC
		=1 =Other, invalid Settings take effect immediately	

Return successfully

length	Order	Configuration information	Check Digit
0x1E	0x24	28byte	CRC

		BYTE1: software version BYTE2~5: reserved BYTE6~9: reserved BYTE10: reserved BYTE11 : Current wireless channel BYTE12 : Current wireless frequency band range BYTE13 : Current wireless transmission power BYTE14 : Current wireless baud rate	
		BYTE15: Current serial port baud rate BYTE16: Current serial port data output format BYTE17: reserved BYTE18: Current protocol mode BYTE19 : Current wireless channel interval bandwidth BYTE20~23: Current device ID BYTE24~27: Current target ID BYTE28: Current group ID For specific corresponding meanings, please refer to the corresponding configuration instructions.	

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

12. Get the current software version

length	Order	_	Check Digit
0x03	0x25	1byte	CRC
		=1 =Other, invalid Settings take 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 Bit
0x03	0Xee	_	CRC

13. Set the target device ID

length	Order	ID	check Bit
0x06	0x0E	4byte	CRC
		Range: 0x00000001~ 0xFFFF FFFF , low byte first set up 0xFFFFFFFF When the serial port data packet is sent out, all devices can receive this data. Bag. Set non 0 When sending a data packet to the specified device, only the ID Only the device can receive the data normally Data packets can facilitate users to create star networking.	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

14. Set up groups ID

length	Order	ID	Check Digit
0x03	0x28	1byte	CRC
		scope: 0~15 Only in protocol mode is 2/3/4 It works when sending broadcast data	

Return successfully

length	Order	data	check Bit
0x03	0x55	_	CRC

Return on failure

length	Order	data	check Bit
0x03	0Xee	_	CRC

8. CRC calculation

```
/**
 * @funtion:crc8 polynomial redundancy check
 * @param 1:pData, calculate data source address
 * @param 2:dataLen, calculate the length of the data source
 * @param 3:initialValue,crc Result initial value
 * @param 4:polynomial,polynomial
 * @return
:Verification result
*/
uint8_t crc8( uint8_t *pData,
                    uint16_t dataLen,
                    uint8_t initialValue,
                    uint8_t polynomial )
{
   uint8_t i;
```

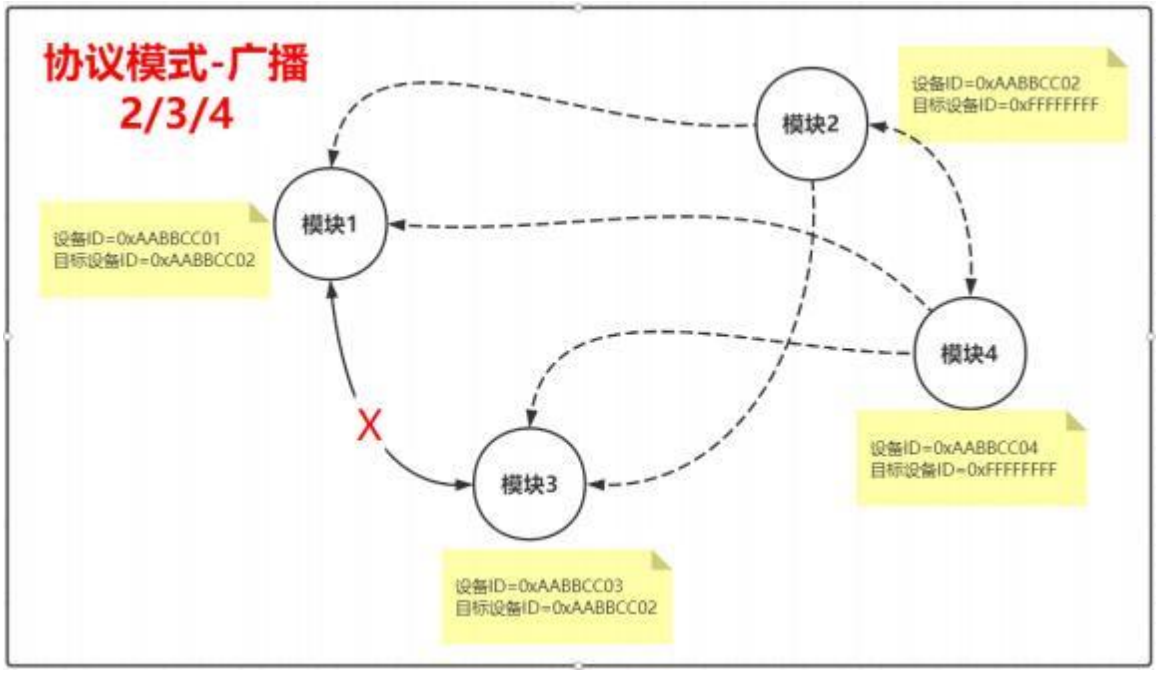
```
    uint8_t crc;

    crc = initialValue;
    while (dataLen --)
    {
        crc ^= *pData ++;
        for( i = 0; i < 8; i++ )
        {
            if(crc& 0x80)
            {
                crc <<= 1; // shift left once
                crc ^= polynomial; // XOR with polynomial
            }
            else
            {
                crc <<= 1; // shift left once
            }
        }
    }
    return crc;
}

/**
 * @funtion :
 * @param 1:pData, calculate data source address
 * @param 2:dataLen, calculate the
 length of the data source *
 * @return :return CRC
result */
int get_crc8( uint8_t *pData, uint16_t dataLen)
{
    return crc8(pData, dataLen, 0x55, 0x07);
}
```

9. Application scenario display

Schematic diagram of data broadcast scenario



When data needs to be sent to all devices, the following conditions need to be met:

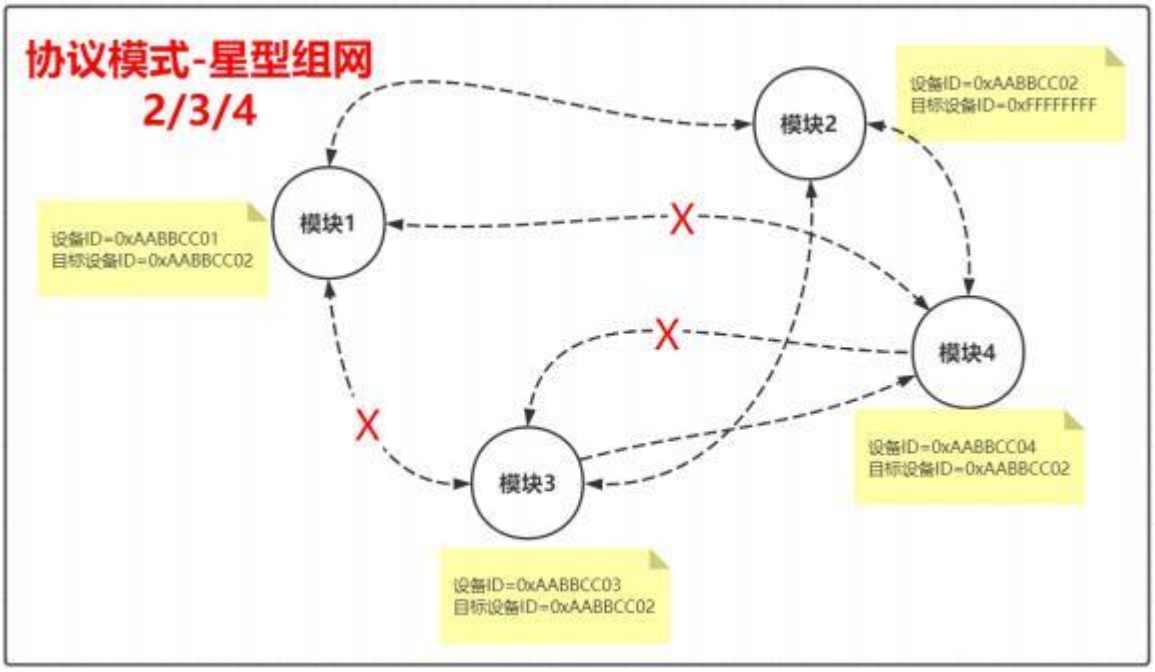
1. Protocol mode=2or3or4

2,target device ID=0xFFFFFFFF

3. Grouping ID=0x0F

If you want to send in groups, you can use grouping ID to distinguish

Star networking diagram



Star networking, that is, one-to-many application scenarios, One master manages multiple slaves, and the configuration is as follows:

Scenario 1: Broadcast data to all devices

1. Protocol mode=2or3or4

2,target device ID=0xFFFFFFFF

3. Grouping ID=0x0F

Scenario 2: The host sends data to the target node device

1. Protocol mode=2or3or4

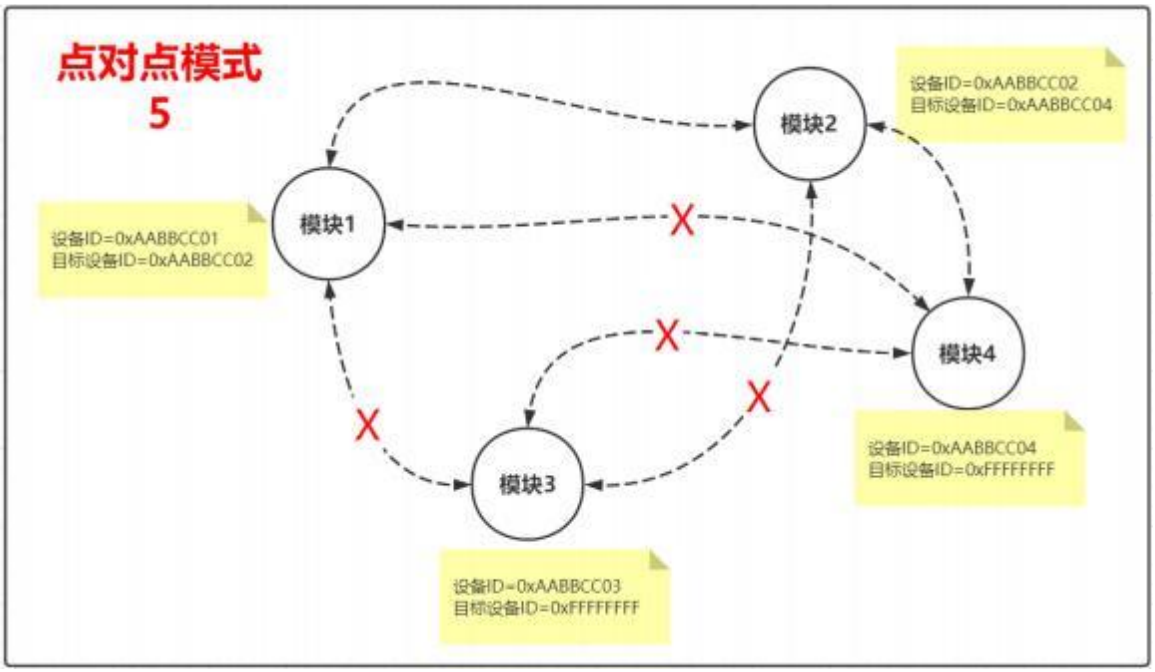
2, target device ID=specified node device ID

Scenario 3: Slave device sends data to host device

1. Protocol mode=2or3or4

2,target device ID=gateway host device ID

Point-to-point communication diagram

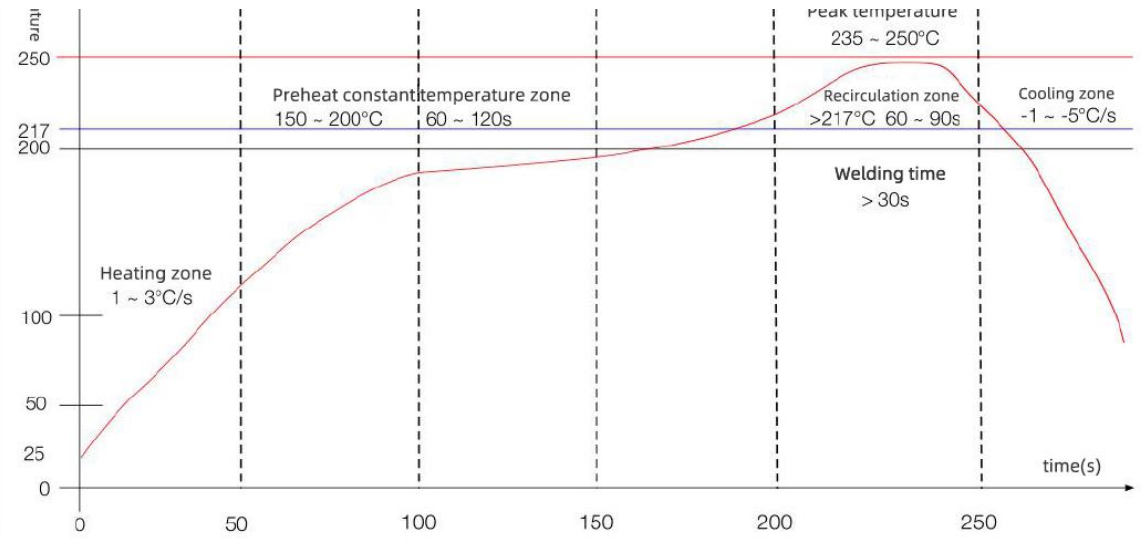


Point-to-point communication means that only paired devices can communicate with each other . The configuration is as follows:

1. Protocol mode=5
2. Equipment 1 target device ID=0xFFFFFFFF
3. Equipment 2 target device ID=device 1 device of ID

Pay attention to the target device of one of the devices ID Must be 0xFFFFFFFF _

10. Reflow soldering curve



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)

11. Static electricity damage warning

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

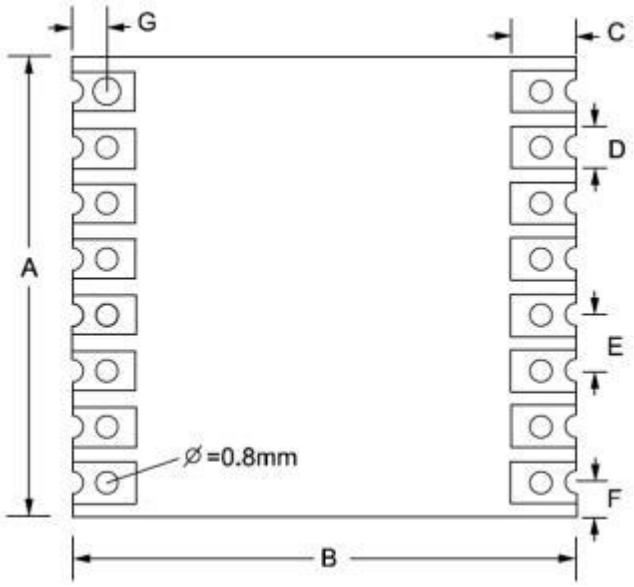
1. Strictly follow anti-static measures, and it is prohibited to touch the module with bare hands during the production process .

2. The module 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 during product design.

12. Packaging information

Mechanical dimensions (unit: mm)



serial number	Dimensions(mm)	Error(mm)
A	16.5	±0.5
B	18.0	±0.5
C	2.2	±0.1
D	1.4	±0.1
E	2.0	±0.1
F	1.2	±0.1
G	1.2	±0.1
H(height)	1.8	±0.2

13. Version update instructions

Version	update content	Updated
V1.0	first release	2023 Year 9 moon 23rd
V1.1	Update protocol mode description	2023 Year 10 moon 20th

14. Procurement selection table

number	model	illustrate
1	VG3214T433N0M1	433MHz Band, tape packaging\tray packaging
2	VG3214T490N0M1	490MHz Band, tape packaging\tray packaging
3	VG3214T868N0M1	868MHz Band, tape packaging\tray packaging
4	VG3214T915N0M1	915MHz Band, tape packaging\tray packaging

15. Statement

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16. Contact us

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