

2.4G Communication Embedded Project User Manual (Group 30)

1. Hardware connection

The hardware used in this project: STM32F103RC embedded development board (Figure 1), NRF24L01 module (Figure 2).



Figure 1 STM32F103RC

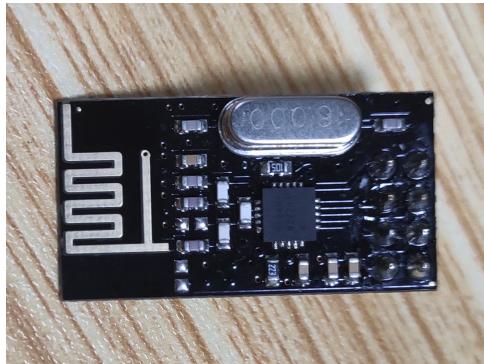


Figure 2 NRF24L01

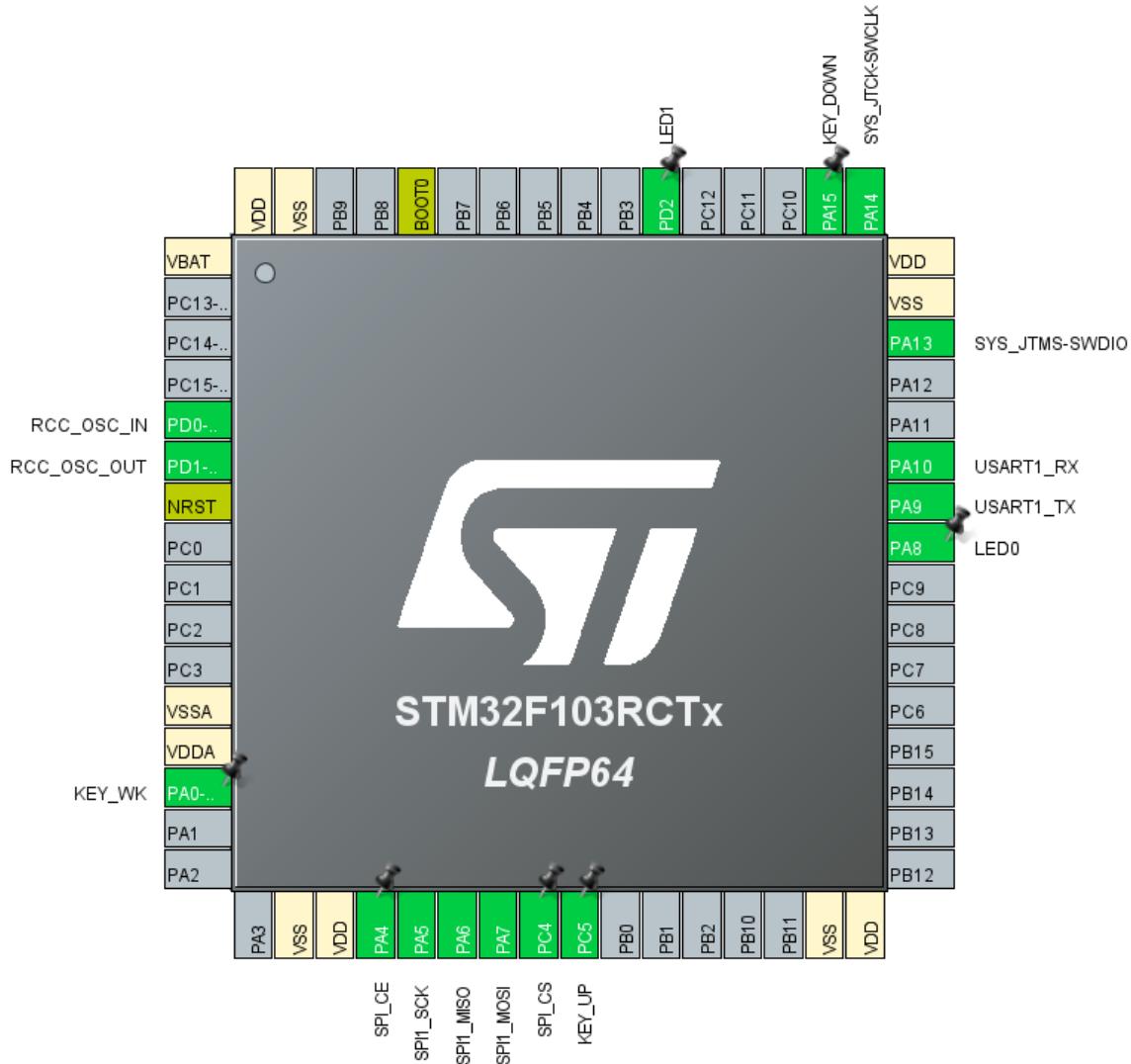
The location of the red box in Figure 1 is the 2.4G module installation location, and the module will be installed to the development board in the form of Figure 3.



图3 Installation completed

2. Software Configuration

The pinout configuration view is as follows.



In this project, we used the USART serial port connection to transfer data and the SPI interface for connecting the module with the following connection configuration.

USART1 Mode and Configuration

Mode

Mode Asynchronous

Hardware Flow Control (RS232) Disable

Configuration

Reset Configuration

NVIC Settings

DMA Settings

GPIO Settings

Parameter Settings

User Constants

Configure the below parameters :

 Search (Ctrl+F)



▼ Basic Parameters

Baud Rate 115200 Bits/s

Word Length 8 Bits (including Parity)

Parity None

Stop Bits 1

▼ Advanced Parameters

Data Direction Receive and Transmit

Over Sampling 16 Samples

USART Configuration

SPI1 Mode and Configuration

Mode

Mode: Full-Duplex Master

Hardware NSS Signal: Disable

Configuration

Reset Configuration

Parameter Settings (Selected)

User Constants

Configure the below parameters :

Search (Ctrl+F)

- ✓ Basic Parameters

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First
- ✓ Clock Parameters

Prescaler (for Baud Rate)	64
Baud Rate	1.125 MBits/s
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge
- ✓ Advanced Parameters

CRC Calculation	Disabled
NSS Signal Type	Software

SPI Configuration

GPIO Configuration:

GPIO (Selected) **RCC** **SPI** **SYS** **USART** **NVIC**

Search Signals Show only Modified Pins

Search (Ctrl+F)

Pin ...	Signal o...	GPIO ou...	GPIO m...	GPIO P...	Maximu...	User Label	Modified
PA0-W...	n/a	n/a	External...	Pull-down	n/a	KEY_WK	<input checked="" type="checkbox"/>
PA4	n/a	Low	Output ...	No pull-...	Low	SPI_CE	<input checked="" type="checkbox"/>
PA8	n/a	Low	Output ...	No pull-...	Low	LED0	<input checked="" type="checkbox"/>
PA15	n/a	n/a	External...	Pull-up	n/a	KEY_D...	<input checked="" type="checkbox"/>
PC4	n/a	Low	Output ...	No pull-...	Low	SPI_CS	<input checked="" type="checkbox"/>
PC5	n/a	n/a	External...	Pull-up	n/a	KEY_UP	<input checked="" type="checkbox"/>
PD2	n/a	Low	Output ...	No pull-...	Low	LED1	<input checked="" type="checkbox"/>

NVIC Configuration:

Configuration

NVIC Code generation

Priority Group 2 bits for pre... Sort by Preemption Priority and Sub Priority

Search Show only enabled interrupts Force DMA

NVIC Interrupt Table	Enabled	Preemption Pri
Non maskable interrupt	<input checked="" type="checkbox"/>	0
Hard fault interrupt	<input checked="" type="checkbox"/>	0
Memory management fault	<input checked="" type="checkbox"/>	0
Prefetch fault, memory access fault	<input checked="" type="checkbox"/>	0
Undefined instruction or illegal state	<input checked="" type="checkbox"/>	0
System service call via SWI instruction	<input checked="" type="checkbox"/>	0
Debug monitor	<input checked="" type="checkbox"/>	0
Pendable request for system service	<input checked="" type="checkbox"/>	0
Time base: System tick timer	<input checked="" type="checkbox"/>	0
PVD interrupt through EXTI line 16	<input type="checkbox"/>	0
Flash global interrupt	<input type="checkbox"/>	0
RCC global interrupt	<input type="checkbox"/>	0
EXTI line0 interrupt	<input checked="" type="checkbox"/>	1
EXTI line[9:5] interrupts	<input checked="" type="checkbox"/>	1
SPI1 global interrupt	<input checked="" type="checkbox"/>	2
USART1 global interrupt	<input checked="" type="checkbox"/>	0
EXTI line[15:10] interrupts	<input checked="" type="checkbox"/>	1

3. Operation instructions

After turning on the power, the LCD screen displays the initial interface, the upper display address of the sender and receiver and RF communication frequency.

The upper right rectangle color shows three connection status: red for the module does not exist, yellow for the communication status abnormal, green for the communication status normal.

The number shown on the left side of the rectangle is the upper limit of the connection time.

LED lights have three modes: not connected when the LED lights are not on, the red light blinks to indicate that the connection is being attempted, and the two LED lights blink alternately when the connection is successful.



Press KEY1 to try to connect actively, and turn to connect passively after connection failure.

Chat window is displayed at the bottom of the LCD screen after successful connection, and chat messages can be sent by serial port. The sending message text color is brownish red and displayed on the right side; the receiving message color is black and displayed on the left side. New messages are displayed below the old messages.



```

DEBUG: Module pass check
DEBUG: data input from UART --> 4:80
DEBUG: Change send_ch to 80
DEBUG: data input from UART --> 3:88
DEBUG: Change recv_ch to 88
DEBUG: Try active conn
DEBUG: Try conn other.
DEBUG: Active request connection successful.
DEBUG: recv --> hello!
DEBUG: data input from UART --> hi!
DEBUG: send --> hi!

```

content in serial connection assistant

Press KEY0 to actively disconnect and the message window disappears.

The status can be changed by entering a specific form of message through the serial connection assistant, in the following form.

Modify message receive address:

1:xxxxxxxxxx(Ten digit hexadecimal number)

Modify message send address:

2:xxxxxxxxxx(Ten digit hexadecimal number)

Modify receive RF communication frequency:

3:xxx(Decimal number less than 255)

Modify send RF communication frequency:

4:xxx(Decimal number less than 255)

Modify the upper limit of the connection time:

5:xxx(Integer number in decimal, unit is second)