Infrared remote control

This tutorial demonstrates: Print the key value of infrared remote control via **serial port (USART1)**

1、software-hardware

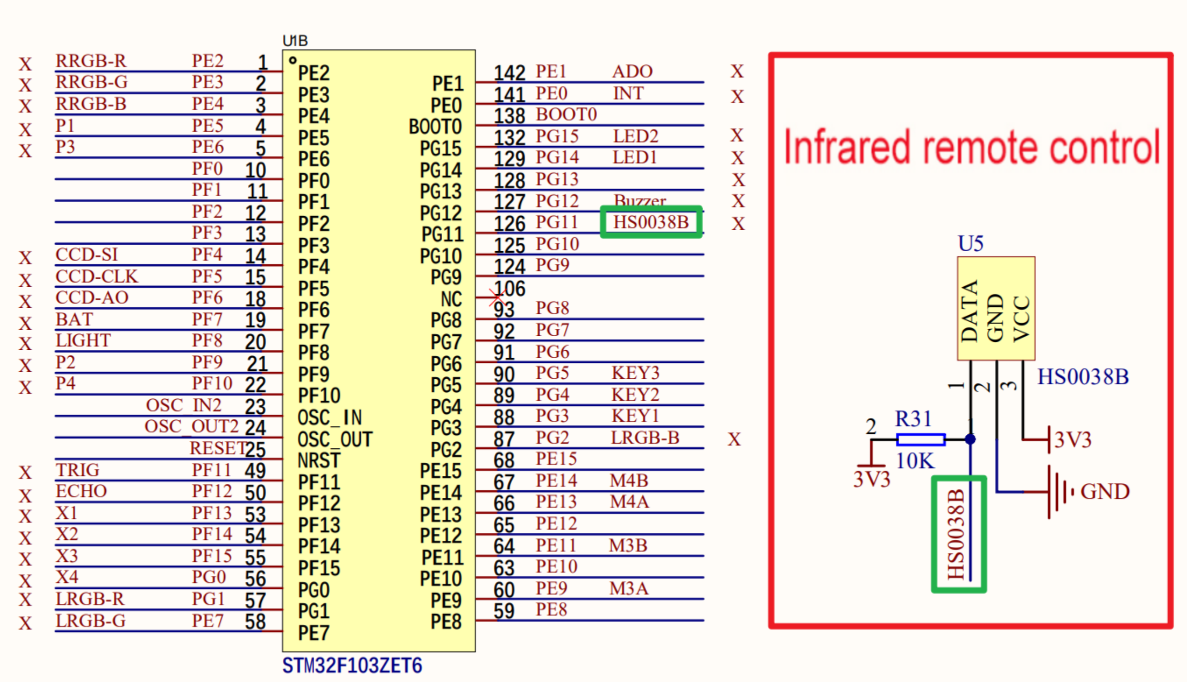
- **STM32F103CubeIDE**
- **STM32 robot expansion board**

  The infrared receiver (HS0038B) is integrated on the development board
- **Type-C cable or ST-Link**

  Download or simulate the program of the development board

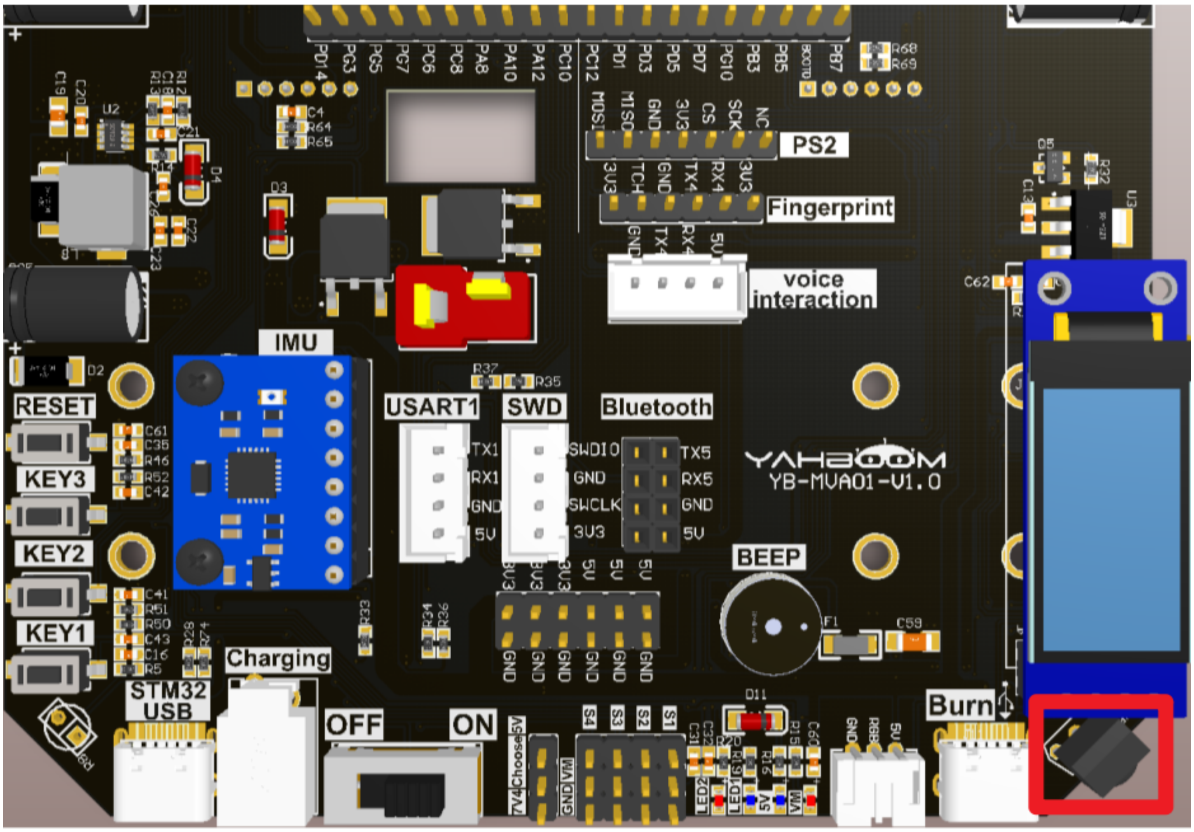
2、Brief principle

2.1、Hardware schematic diagram



2.2、Physical connection diagram

Integrated infrared receiver (HS0038B) on the development board



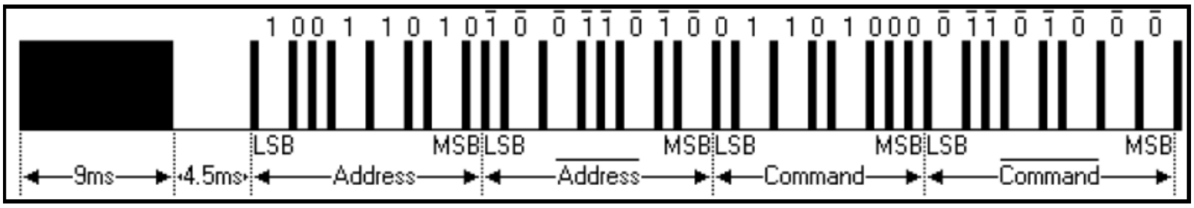
2.3、Principle of control

The receiving of infrared data is triggered by interruption, and the data is judged to be 0 or 1 according to the high level time of the output pin of the infrared receiver, so as to realize the data reading of the key value of the infrared remote control.

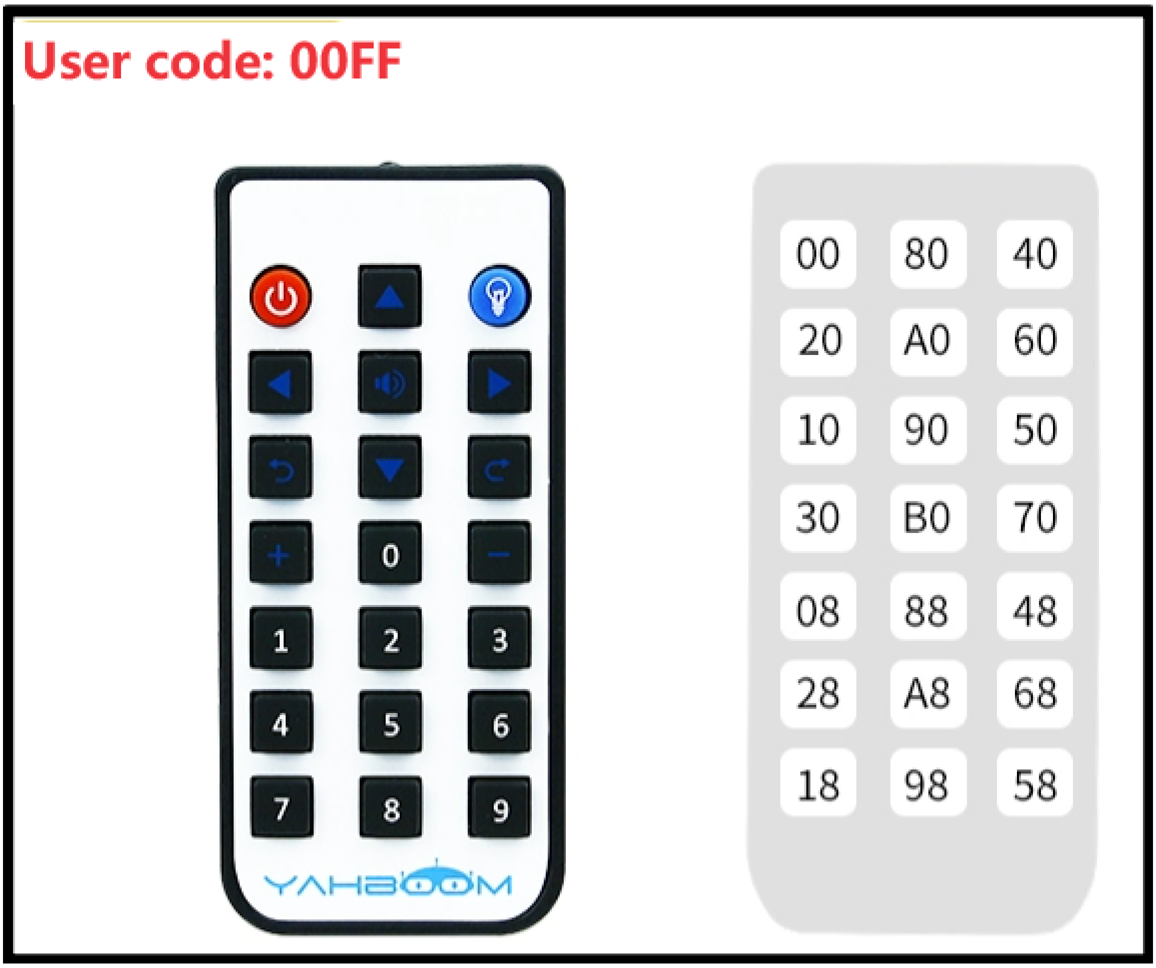
- **NEC protocol**

  The remote control attached to the development board uses the NEC protocol with a carrier frequency of 38KHz.

Format	Role
Boot code	Identifies the beginning of the instruction
Address code (user code)	Identifies the device address of the remote control
Address inverse code	Enhance data transmission reliability
Data code	Specific remote control instructions
Data inverse code	Data inverse code



- **Infrared remote control**



00	80	40
20	A0	60
10	90	50
30	B0	70
08	88	48
28	A8	68
18	98	58

0： 38KHz carrier of 560us + 560us of the carrier-free interval composition

1： 38KHz carrier of 560us + carrier-free interval composition of 1680us

- **Infrared receiver**

0： 560us low level + 560us high level

1： 560us low level + 1680us high level

When the IR receiver receives the IR carrier signal, the DATA output pin of HS0038B outputs a low level

When the IR receiver does not receive the IR carrier signal, the DATA output pin of HS0038B outputs a high level

Infrared receiver (development board integrated)	Corresponding pin
HS0038B	PG11（Infrared receiver signal output pin）

3、Engineering configuration

Project Configuration: Prompts for configuration options in the STM32CubeIDE project configuration process

3.1、Notes

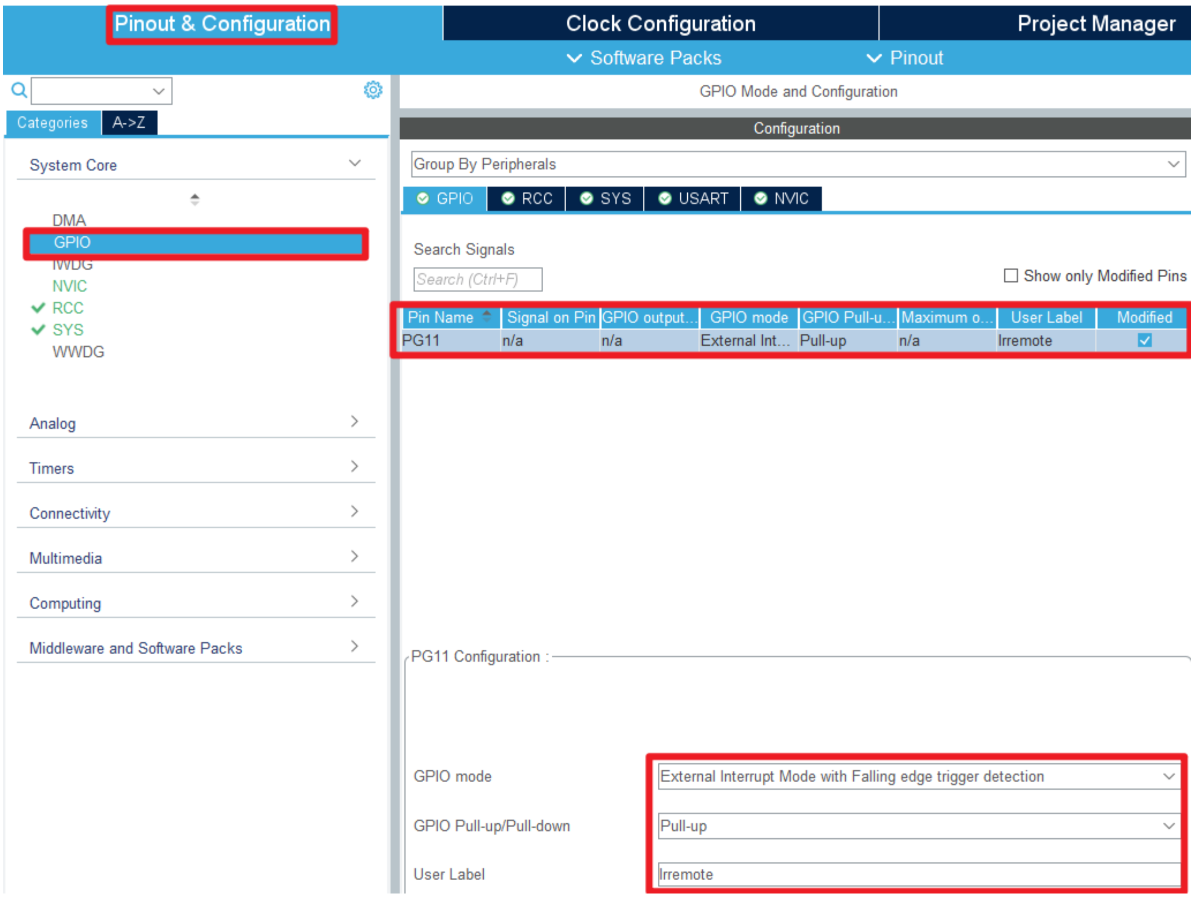
Omitted project configuration: **New project, chip selection, project configuration, SYS for pin configuration, RCC configuration, clock configuration, and project configuration** content

The project configuration part, which is not omitted, is the key point to configure in this tutorial.

```
Please refer to [2, development environment construction and use: STM32CubeIDE
installation - Use] to understand how to configure the omitted part of the
project
```

3.2、Pin configuration

- **GPIO**



Pin Name	Signal on Pin	GPIO output...	GPIO mode	GPIO Pull-u...	Maximum o...	User Label	Modified
PG11	n/a	n/a	External Int...	Pull-up	n/a	Irremote	☑

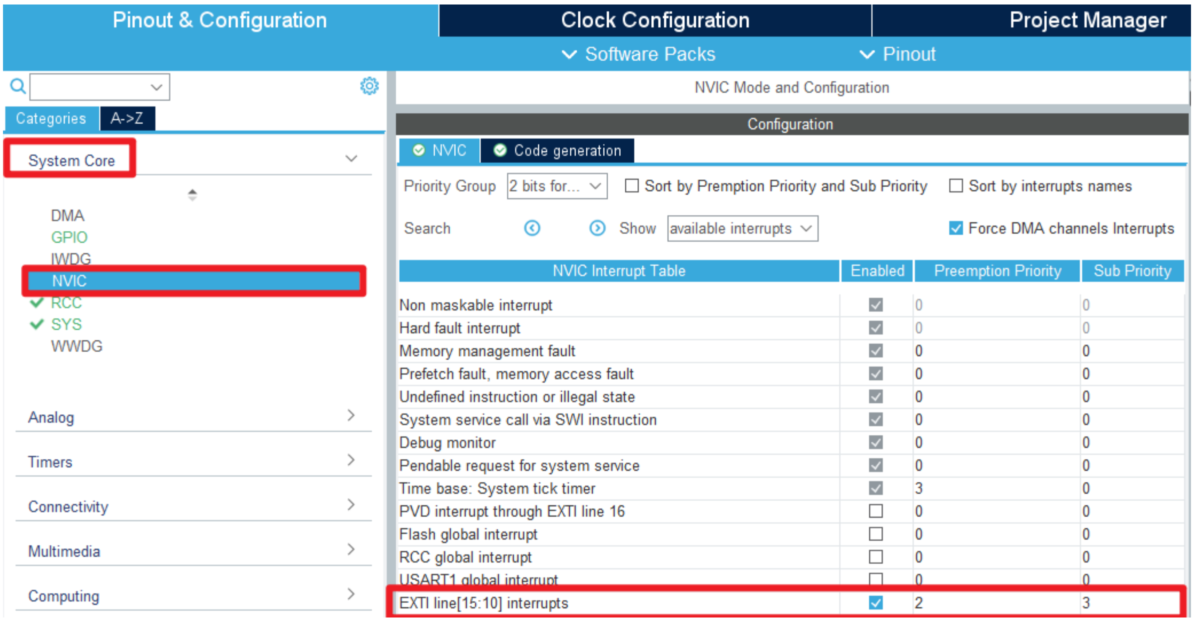
PG11 Configuration :

GPIO mode: External Interrupt Mode with Falling edge trigger detection

GPIO Pull-up/Pull-down: Pull-up

User Label: Irremote

- **USART**

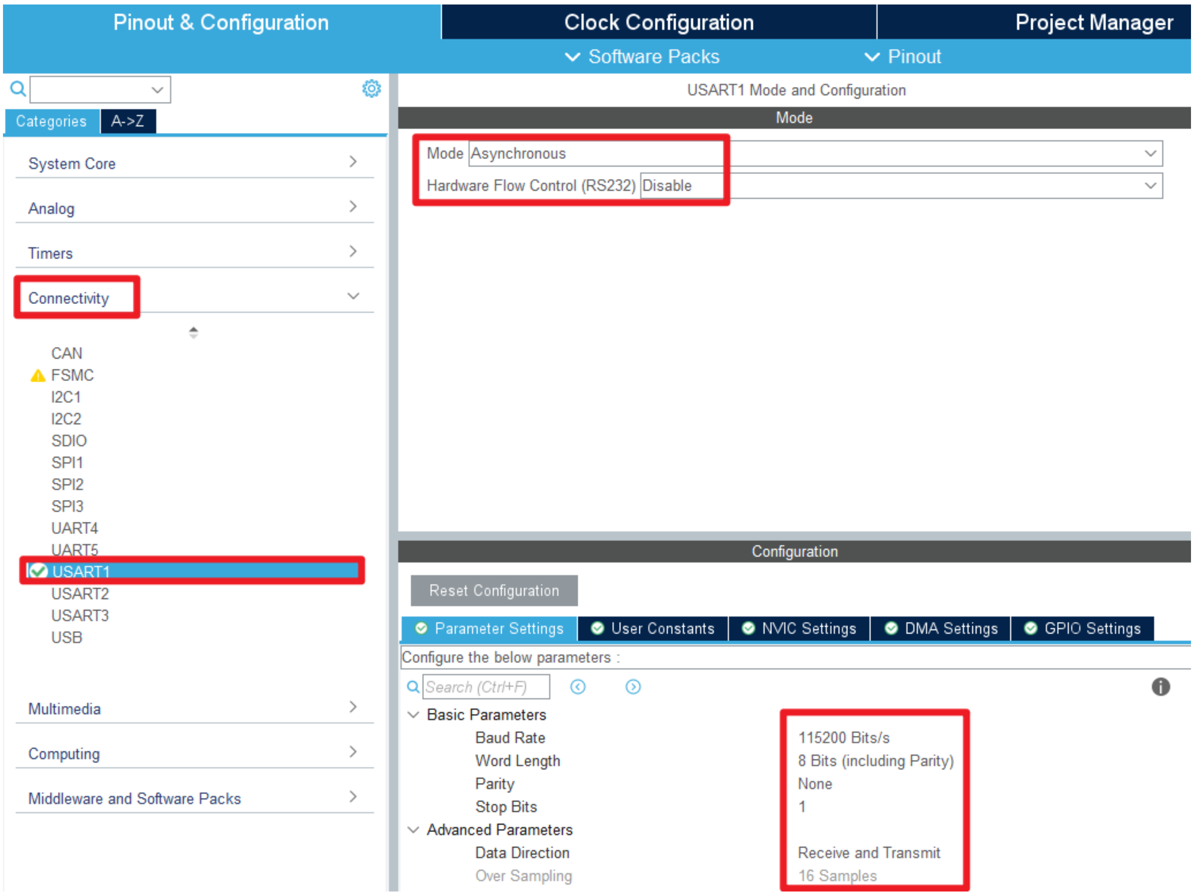


Priority Group: 2 bits for... □ Sort by Premption Priority and Sub Priority □ Sort by interrupts names

Search Show: available interrupts ☑ Force DMA channels Interrupts

NVIC Interrupt Table	Enabled	Preemption Priority	Sub Priority
Non maskable interrupt	☑	0	0
Hard fault interrupt	☑	0	0
Memory management fault	☑	0	0
Prefetch fault, memory access fault	☑	0	0
Undefined instruction or illegal state	☑	0	0
System service call via SWI instruction	☑	0	0
Debug monitor	☑	0	0
Pendable request for system service	☑	0	0
Time base: System tick timer	☑	3	0
PVD interrupt through EXTI line 16	□	0	0
Flash global interrupt	□	0	0
RCC global interrupt	□	0	0
USART1 global interrupt	□	0	0
EXTI line[15:10] interrupts	☑	2	3

- **NVIC**



Mode: Asynchronous

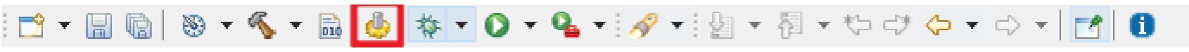
Hardware Flow Control (RS232): Disable

Configure the below parameters :

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

- **Generating code**



4、Main Function

This paper mainly introduces the functional code written by users. **Detailed code can be opened by yourself in the project file we provide, and enter the Bsp folder to view the source code.**

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User function

Many of the common HAL library functions were covered in Chapter 3, but they will not be covered here.

> **function：InfraredRecvLowTime**

Function prototypes	**uint16_t InfraredRecvLowTime(void)**
Functional Description	Calculate the duration of the low level
Input parameters	None
Return value	Count value (about 17us for one count)

> **function：InfraredRecvHighTime**

Function prototypes	**uint16_t InfraredRecvHighTime(void)**
Functional Description	Calculate the duration of the high level
Input parameters	None
Return value	Count value (about 17us for one count)

> **function：InfraredDataRecv**

Function prototypes	**uint8_t InfraredDataRecv(void)**
Functional Description	Obtain infrared remote control data
Input parameters	None
Return value	The corresponding key value of the remote control

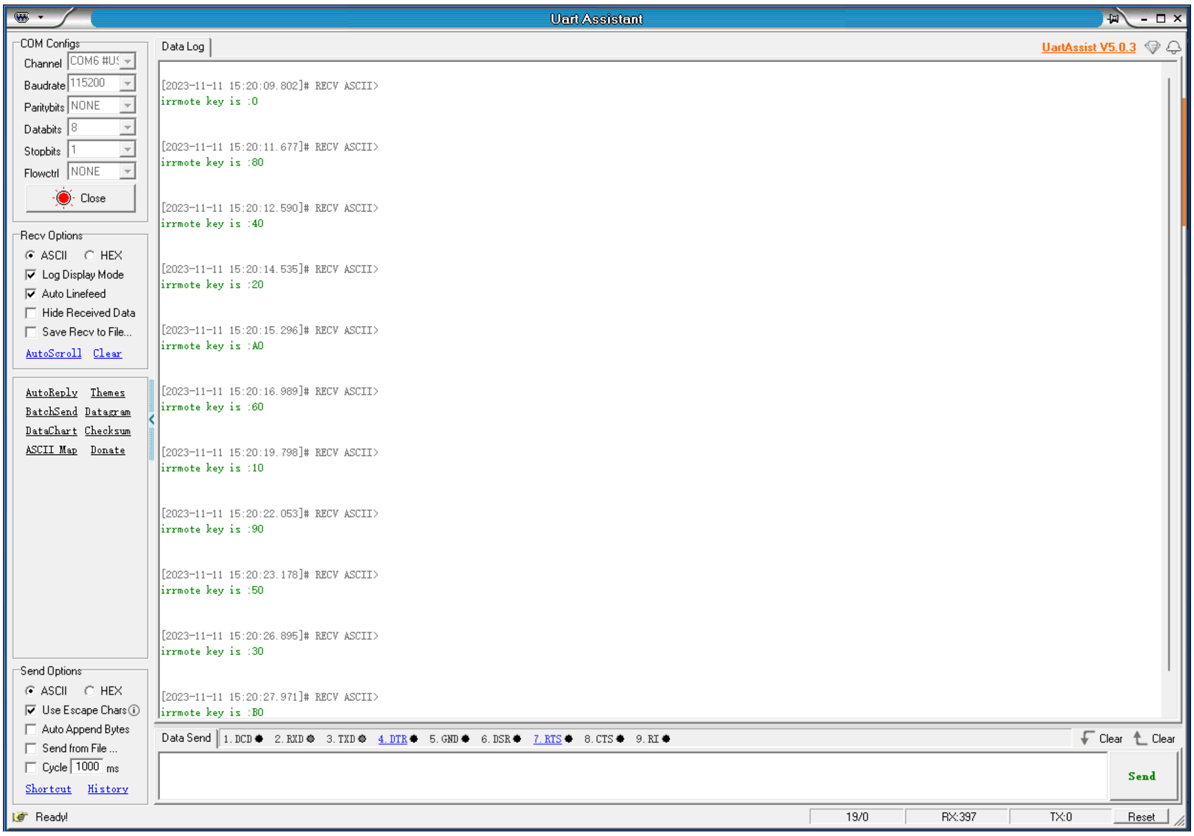
5、Experimental phenomenon

After downloading the program successfully, press the RESET button of the development board to observe the phenomenon of serial debugging assistant

```
Program download can refer to [2, development environment construction and use:
program download and simulation]
```

phenomenon:

Press different key values on the infrared remote control, and the serial port will print data corresponding to different key values.



COM Configs

Channel COM6 #U

Baudrate 115200

Paritybits NONE

Databits 8

Stopbits 1

Flowctrl NONE

Recv Options

● ASCII ○ HEX

☑ Log Display Mode

☑ Auto Linefeed

□ Hide Received Data

□ Save Recv to File...

Send Options

● ASCII ○ HEX

☑ Use Escape Chars

□ Auto Append Bytes

□ Send from File ...

□ Cycle 1000 ms

```
[2023-11-11 15:20:09.802]# RECV ASCII>
irrmote key is :0


[2023-11-11 15:20:11.677]# RECV ASCII>
irrmote key is :80


[2023-11-11 15:20:12.590]# RECV ASCII>
irrmote key is :40


[2023-11-11 15:20:14.535]# RECV ASCII>
irrmote key is :20


[2023-11-11 15:20:15.296]# RECV ASCII>
irrmote key is :A0


[2023-11-11 15:20:16.989]# RECV ASCII>
irrmote key is :60


[2023-11-11 15:20:19.798]# RECV ASCII>
irrmote key is :10


[2023-11-11 15:20:22.053]# RECV ASCII>
irrmote key is :90


[2023-11-11 15:20:23.178]# RECV ASCII>
irrmote key is :50


[2023-11-11 15:20:26.895]# RECV ASCII>
irrmote key is :30


[2023-11-11 15:20:27.971]# RECV ASCII>
irrmote key is :B0
```

Ready! 19/0 RX:397 TX:0