

## IR receive data

### 1. Learning target

- 1.1 In this course, we will learn how to use pins of the Raspberry Pi Pico board.
- 1.2 How to use infrared receiver module and remote control.

### 2. Preparation

Raspberry Pi Pico board \*1  
 Pico sensor expansion board \*1  
 PC \*1  
 USB data cable \*1  
 IR receiver module \*1  
 IR controller \*1



Infrared sending and receiving codes are divided into: **guide code**, **user code**, **user reverse code**, **operation code(data code)**, **operation reverse code(data reverse code)**.

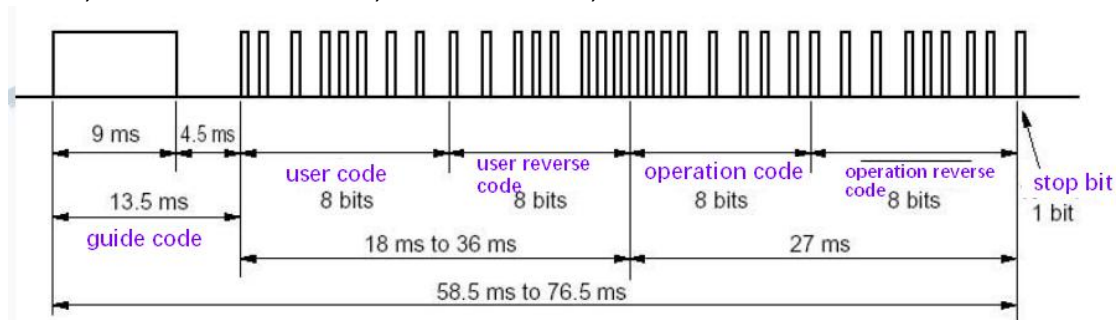
Below we will introduce these kinds of encoded waveform:

For the part of infrared transmission, the infrared remote control we provided has been set up. Therefore, we do not explain the knowledge about infrared transmission here, but mainly explain some points of infrared reception.

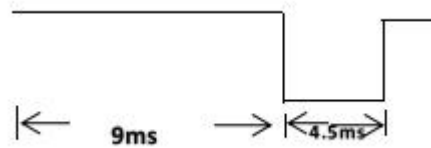
We mainly use the NCE protocol:

The protocol stipulates that the lower bits are transmitted first.

A string of information first sends a 9ms high pulse of AGC (Automatic Gain Control) . Then, send a 4.5ms low level. Next, send four-byte address code and a command code. These four bytes are : Address code, address reverse code; command code; command reverse code.



1)Guide code:The guide code defined by the uPD6121G of the NEC protocol is 9ms high level+ 4.5ms low level, waveform as shown in the figure below:

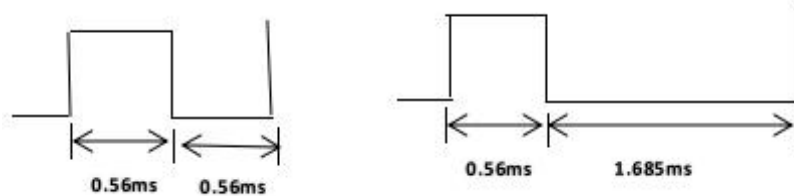


2)User code and operation code: The user code and operation code defined by the uPD6121G of the NEC protocol is:

"Logic 0" : 0.56ms high level + 0.565ms low level;

"Logic1" : 0.56ms high level + 1.685ms low level;

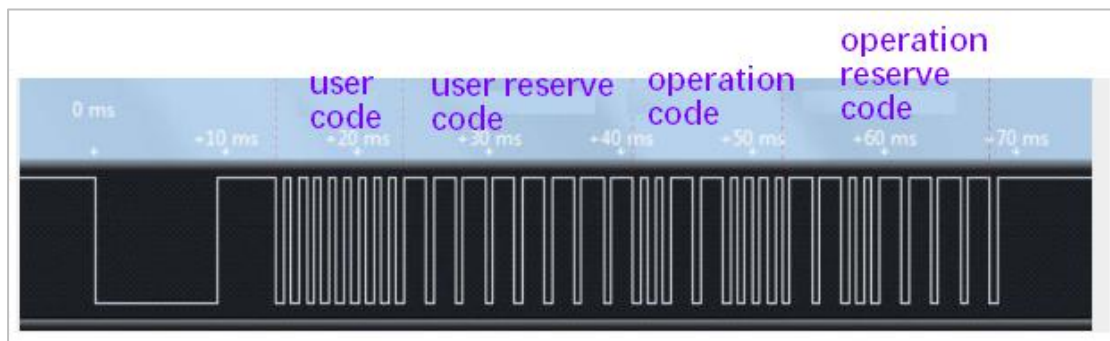
Waveform as shown below :



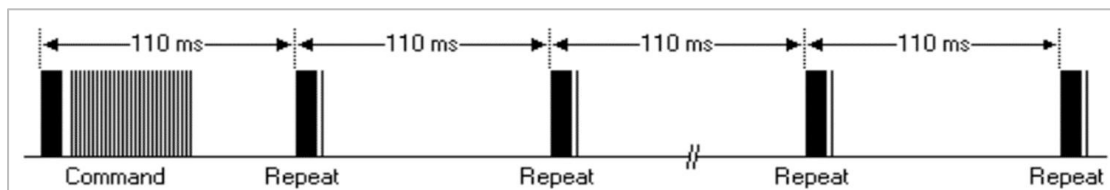
Logic 0 --waveform

Logic 1--waveform

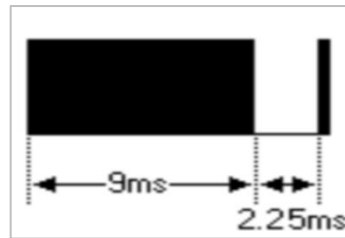
The wave output after passing through the infrared receiver, as shown below:



If you keep pressing that button, a series of messages can only be sent once. If you keep pressing, the repeating code is sent with a period of 110ms. Waveform as shown below.



The repeat code is composed of a high AGC level of 9ms, a low level of 2.25ms, and a high level of 560us, until the key is released. Waveform as shown below:



The process of infrared receiving and controlling the car is as follows:

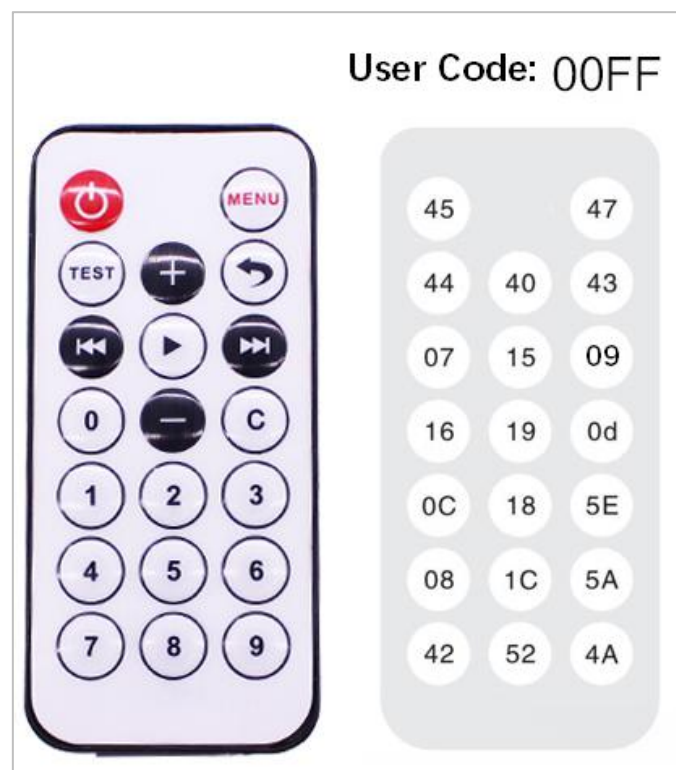
Generate a falling edge, enter the interrupt function of external interrupt 0, and check whether the IO port is still low level after delay time. If it is low level, wait for the low level of 9ms to pass. Wait for the 9ms low level to pass, and then wait for the 4.5ms high level to pass.

Start receiving the 4 sets of data transmitted, wait for the low level of 560us to pass, and detect the duration of the high level. If it exceeds 1.12ms, it is high level (the duration of the high level is 1.69ms, the low level Duration is 5.65ms.)

Detect whether the received data is the same as the data reverse code (operation reverse code), and wait for the same data. If it is the same, it is proved that the corresponding data sent by the infrared remote control is received. Then, the car moves according to the function set in the program.

The code value corresponding to each key is shown in the figure below:

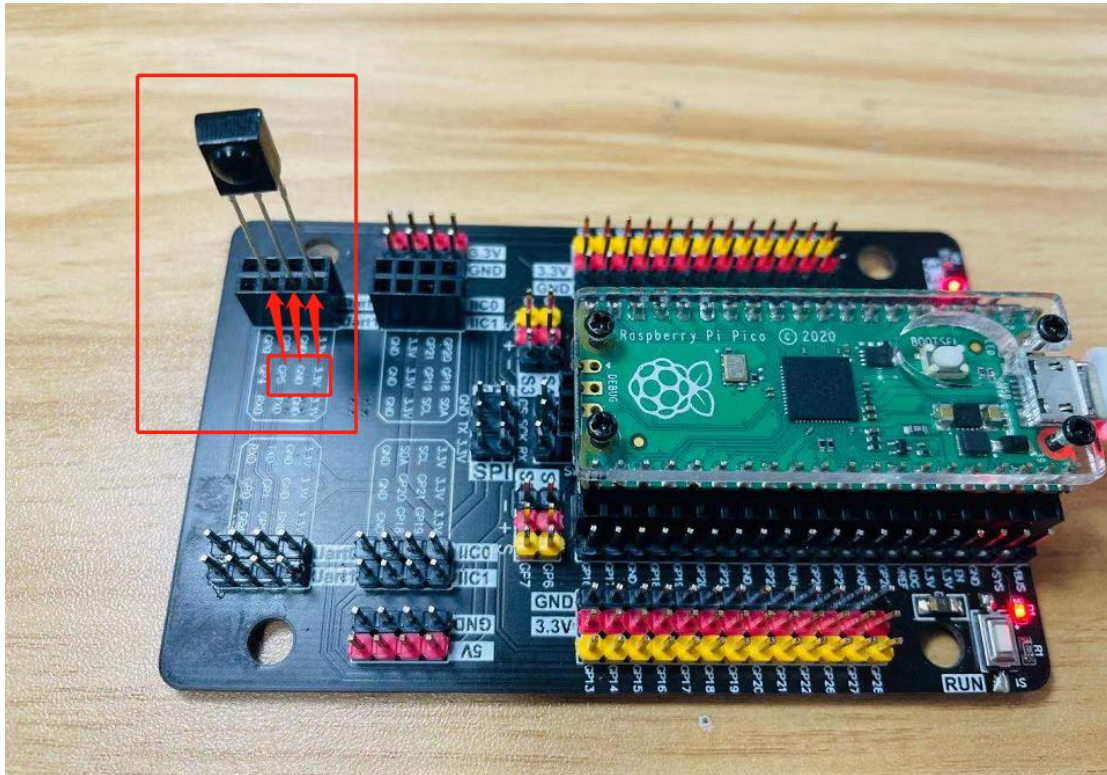
You can use the serial port to display the corresponding key code first, and then modify the program to match it to suit different remote controls.



### 3. About wiring

Insert IR receiver module into expansion board, as shown below.

IR receiver connect GP5 of Raspberry Pi Pico.



**Note: Do not insert the infrared receiver in the wrong direction!**

Inserting it in the wrong direction will destroy the infrared receiver module. If the module is hot, it means that the module has been damaged.

### 4. About code

#### Thonny programming

About how to using ThonnyIDE, please check the tutorials in 【2.Development environment】

```
from machine import Pin
import time
from ir import ir

#Configure infrared receiving pin
pin = Pin(5, Pin.IN, Pin.PULL_UP)

#Configure infrared receiver library
Ir = ir(pin)


while True:
    #Read remote control data
```

```
value = Ir.Getir()  
if value != None:  
    print(value)
```

Before running this program, you need to load IR library, please check the specific steps in **【2.Development environment】**

## 5. Phenomenon

Click the green run button  of Thonny IDE to start running the program. Click the red stop

button  to stop the program. When the program is running, point the transmitter of the infrared remote control at the infrared receiving head, press the keys on IR controller, the shell window will print the currently received key code value.