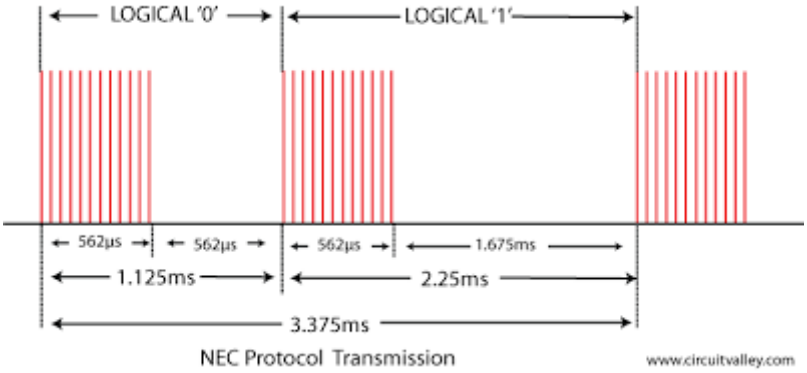
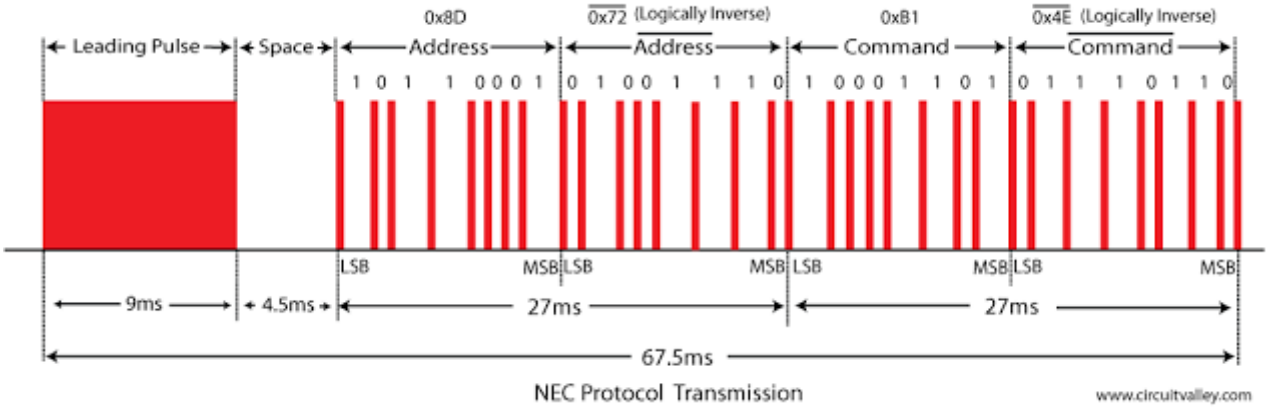
NEC Infrared Protocol

- A 9ms leading pulse burst (16 times the pulse burst length used for a logical data bit)
- A 4.5ms space
- The 8-bit address for the receiving device
- The 8-bit logical inverse of the address
- The 8-bit command
- The 8-bit logical inverse of the command
- Final 562.5µs pulse burst to show end of message transmission.
- Logical '0' – a 562.5µs pulse burst followed by a 562.5µs space, with a total transmit time of 1.125ms
- Logical '1' – a 562.5µs pulse burst followed by a 1.6875ms space, with a total transmit time of 2.25

The transmission of 0 and 1 is shown in the image blow



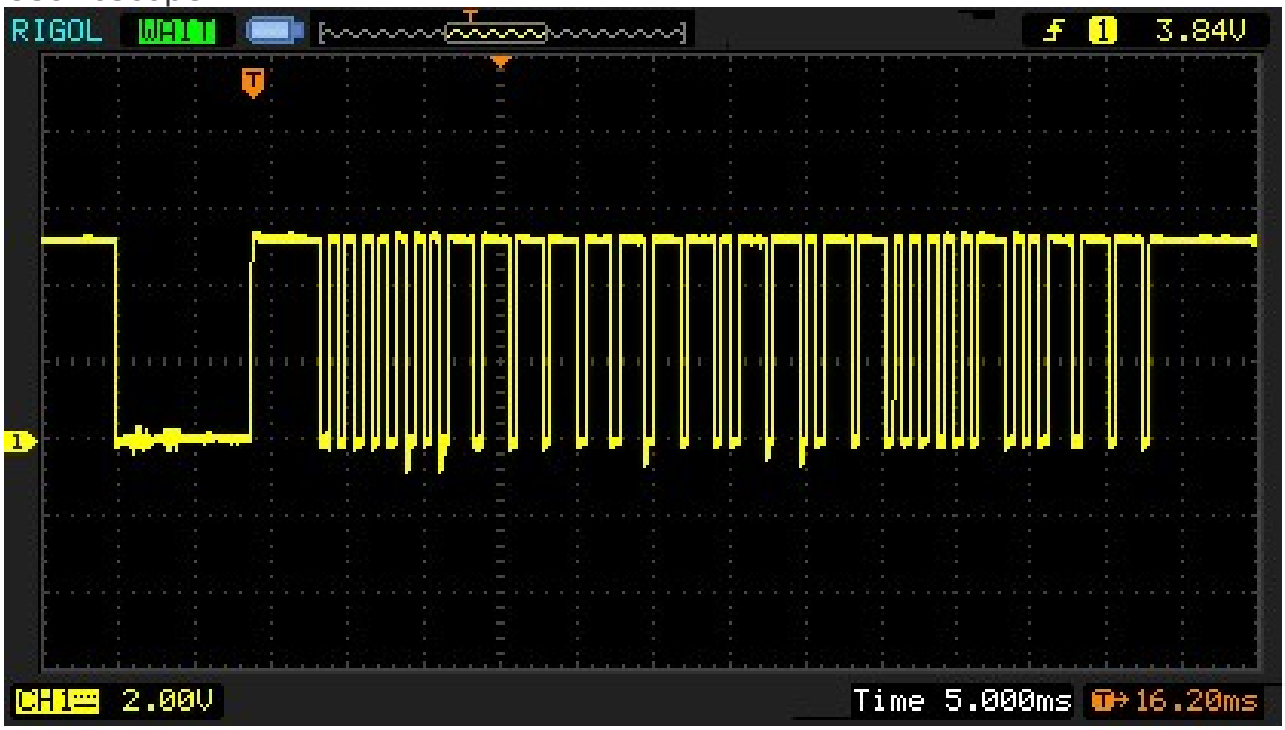
There are four bytes of data bits are being sent in **least significant bit first order** the figure blow shows the format of an NEC IR transmission frame, for a command of 0xB1 (10110001b) and an address of 0x8D (10001101b) .



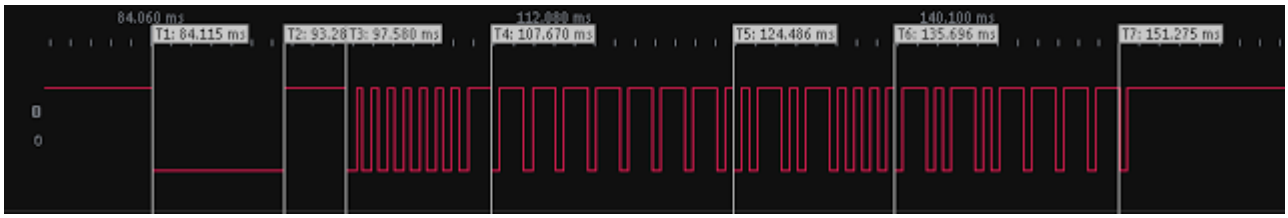
16 bits for the address (address + inverse) require 27ms to transmit time .and the 16 bits for the command (command + inverse) also require 27ms to transmit time.
because (address + address inverse) or (command+command inverse) will always contain 8 '0's and 8 '1's so (8 * 1.125ms) + (8 * 2.25ms) == 27 ms . according to this total time required to transmit the frame is (9ms +4.5ms +27ms+27ms) = 67.5 ms.

Verify with Oscilloscope and logic analyser

the image give blow is take by Rigol DS1052E Oscilloscope

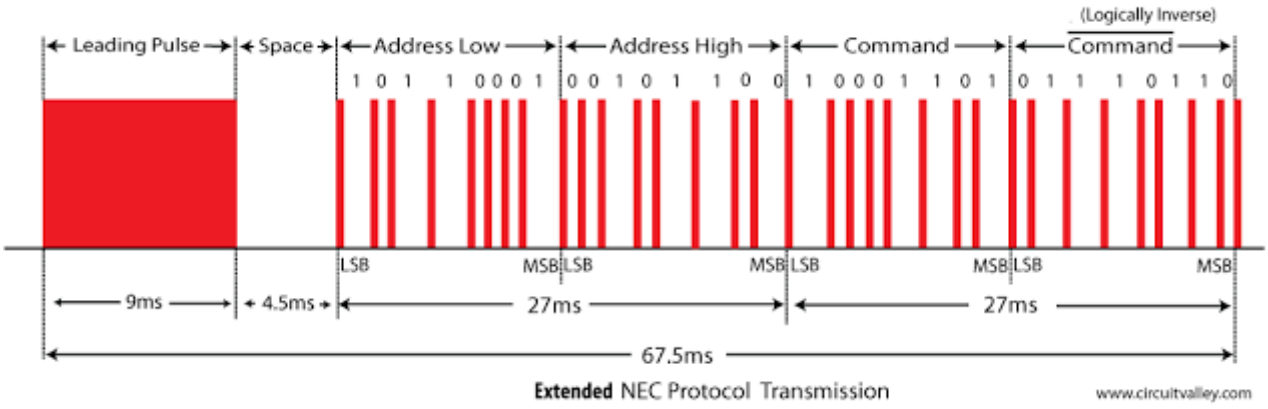


Logic Analyser shows the timing details	
T1	leading pulse at 84.115ms
T2	space on 93.28ms
T3	Address starts at 97.580ms
T4	Address ends , address inverse starts 107.670ms
T5	address inverse ends , command starts at 124.486ms
T6	Command ends, command inverse starts 135.696ms
T7	Command inverse ends and last 562.5µs pulse to show end of transmission



Extended NEC protocol (not used in this demonstration)

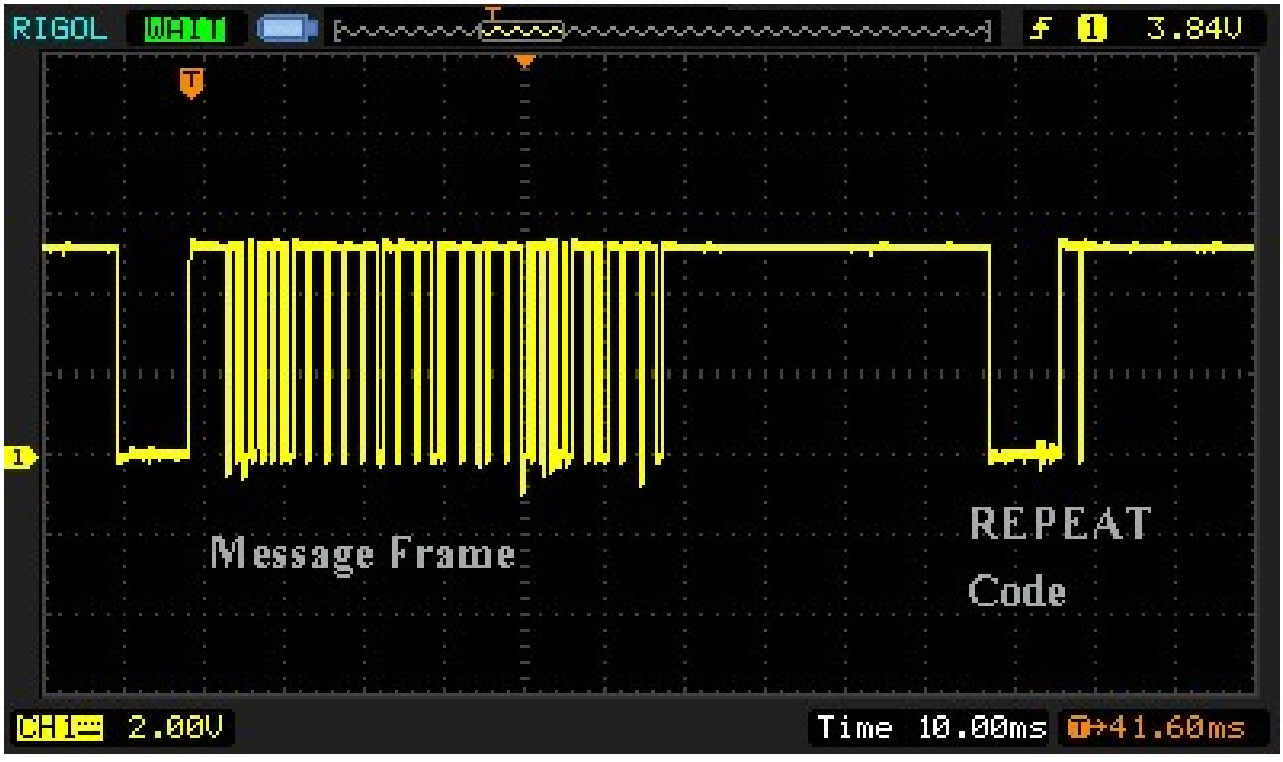
The NEC protocol is so widely used that soon all possible addresses were used up. By sacrificing the address redundancy the address range was extended from 256 possible values to approximately 65000 different values. This way the address range was extended from 8 bits to 16 bits without changing any other property of the protocol. The command redundancy is still preserved. Therefore each address can still handle 256 different commands.in extended protocol instead of sending address and address inverse we send address low and address high as shown in the image blow.



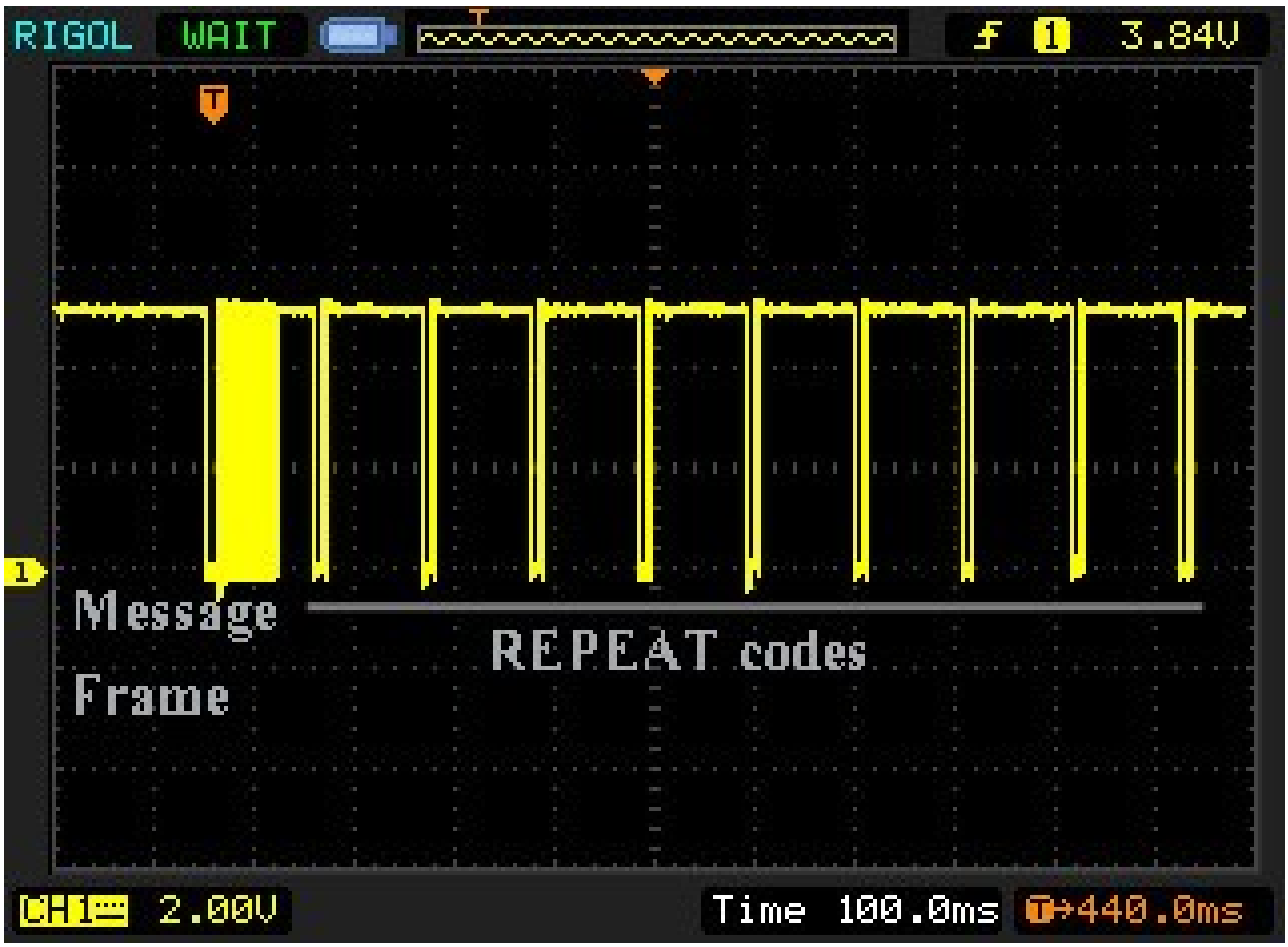
Repeat Codes

If the key on the remote controller is kept depressed, a repeat code will be issued, typically around 40ms after the pulse burst that signified the end of the message. A repeat code will continue to be sent out at 108ms intervals, until the key is finally released. The repeat code consists of the following, in order:

A 9ms leading pulse burst. A 2.25ms space A 562.5µs pulse burst to mark the end of the space (and hence end of the transmitted repeat code). the figures give blow show the timing of repeat codes



if user keeps the key depressed the repeat codes keep coming



T8 shows the timing of repeat code

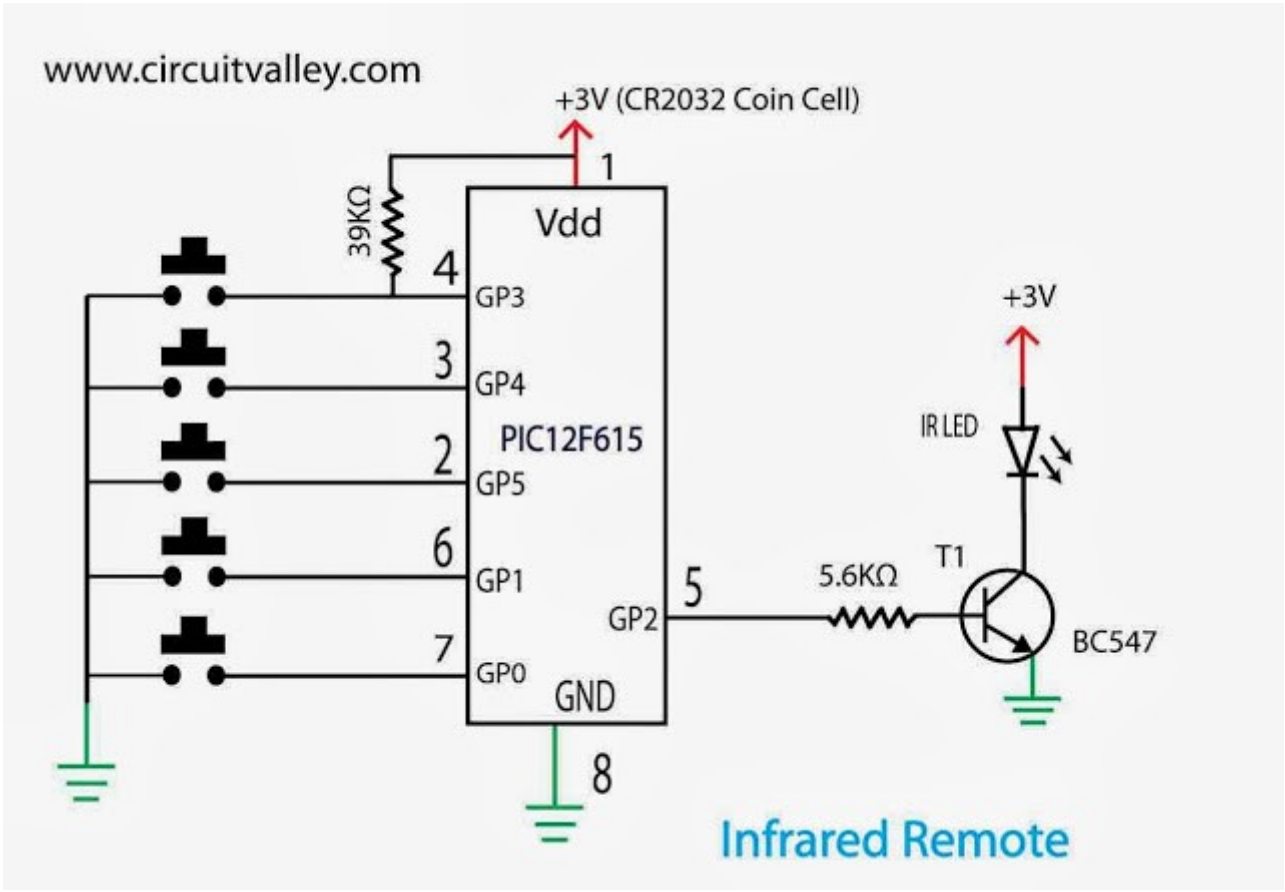
Encoding NEC Protocol with microcontroller

Schematic

As shown in the schematic and the pcb images this circuit use PIC12F615 as infrared encoder , the IR LED is driven by a separate npn transistor for longer range and the Coin cell Battery CR2032 is used to power the whole infrared remote. battery nominal voltage is 3.0V volts but as the datasheet says the PIC12F615 can work down to 2.0V.

for GP4,GP5,GP1,GP0 internal pullups are being used but the GP3 pullup can't be used for GIPO as its is internally connected to MCLRE

The current Consumption of the Circuit in sleep mode is around 35nA which is less then what datasheet claims. the CR2032 coin cell battery will last quite some time.


www.circuitvalley.com
+3V (CR2032 Coin Cell)
1
Vdd
39KΩ
4
GP3
3
GP4
PIC12F615
2
GP5
6
GP1
5
GP2
7
GP0
GND
8
+3V
IR LED
T1
5.6KΩ
BC547
Infrared Remote