

Experiment Name: Multiplexing 7 segment displays using PIC Microcontroller

Theory: The seven segments were driven individually through separate I/O pins of the microcontroller. If we do just like that then for 4 seven segment LED displays, 28 I/O pins will be required, which is quite a bit of resources and is not affordable by mid-range PIC microcontrollers. That's why a multiplexing technique is used for driving multiple seven segment displays. This tutorial shows how to multiplex 4 common anode type seven segment LED displays with a PIC16F628A microcontroller.

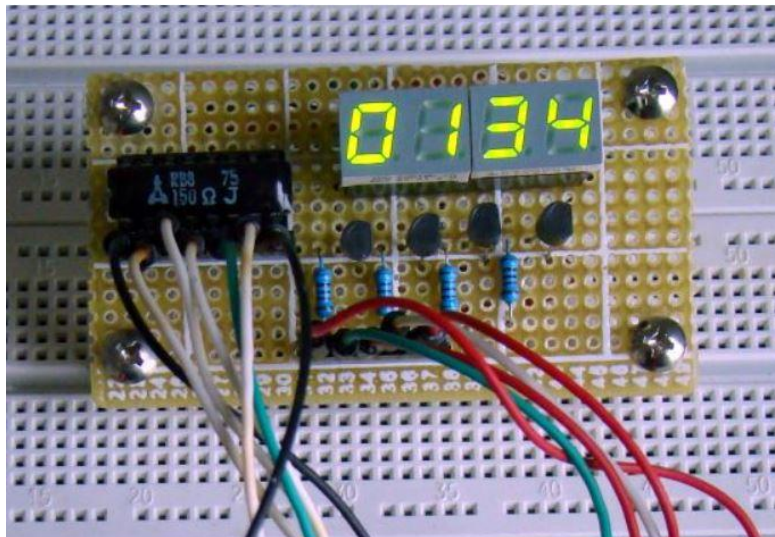


Figure-1: Multiplexing 4 common anode seven segment LED displays

The theory behind the multiplexing technique is simple. All the similar segments of multiple LED displays are connected together and driven through a single I/O pin. In the circuit below, the seven segments are connected to PORTB through current limiting resistors R_s . A particular segment is active when the corresponding PORTB pin is low. However, it will not glow until its anode is connected to V_{cc} . You can see the anodes of the four LED displays are not directly connected to V_{cc} . Instead, 4 PNP transistors are used as switches to connect or disconnect the anode terminals from V_{cc} . When the base of the PNP transistor is low, the transistor conducts and corresponding digit's common anode is connected to V_{cc} . Therefore, the transistor selects which displays is active. The conduction of the transistors are controlled by RA0 through RA3 pins of PORTA. Suppose, if we want to display 7 in the units digit place, then segments a, b, and c should be turned on first (which means RB0, RB1, RB2 are 0 and RB3-RB6 are 1) and then RA0 should be pulled low (while keeping RA1-RA3 high) so that only units digit display will be active. In order to display all 4 digits, each seven-segment display is activated sequentially using an appropriate refresh frequency so that it will appear that all they are turned on at the same time.

Circuit Diagram:

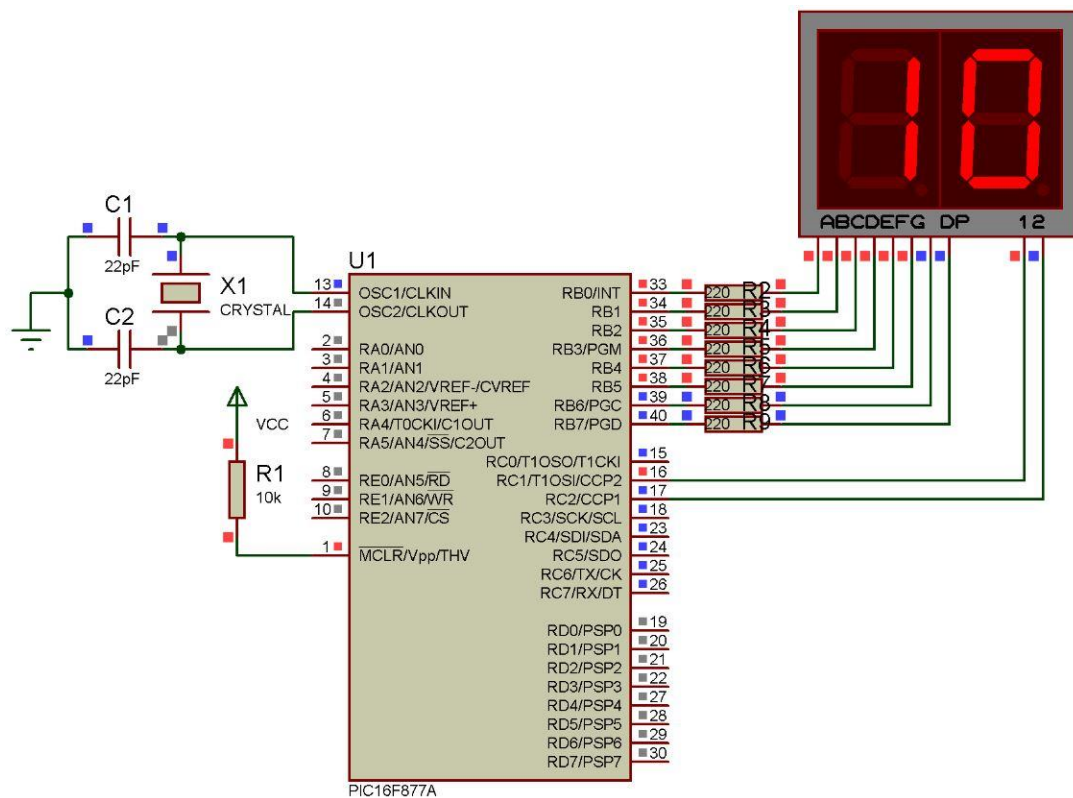


Figure-2: Multiplex of 7 segment display using PIC16F877A

MikroC Code:

```
#define digitL portc.f1
#define digitR portc.f2
unsigned char array[]={0x3f, 0x06, 0x5b, 0x4f, 0x66, 0x6d, 0x7d, 0x07, 0x7f, 0x6f};
void main()
{
    int i=0;
    int j, Left_digit=0, Right_digit=0, count;
    TRISB=0x00;
    TRISC=0x00;

    portb=0x00;
    portc=0x00;
    while(1)
    {
        Left_digit=i/10;
        Right_digit=i%10;

        for(j=0; j<50; j++)
        {
```

```
    portb=array[Left_digit];
    digitL=0;
    delay_ms(10);
    digitL=1;

    portb=array[Right_digit];
    digitR=0;
    delay_ms(10);
    digitR=1;
}
i++;
if(i>99)
    i=0;
}
}
```