Interfacing Display Devices: LED, Seven-Segment Display and LCD

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Fig. 18.1 *LED interfacing with 8051*

Light Emitting Diodes

When the anode of an LED is made positive with respect to the cathode, it will be forward-biased and will emit the light. The specifications of an LED are its forward voltage VF and forward current IF.

The typical values of VF are from 2 to 3 V and that of IF are from 10 to 20 mA, depending upon the type and size of the LED. The LEDs are normally operated around IF.

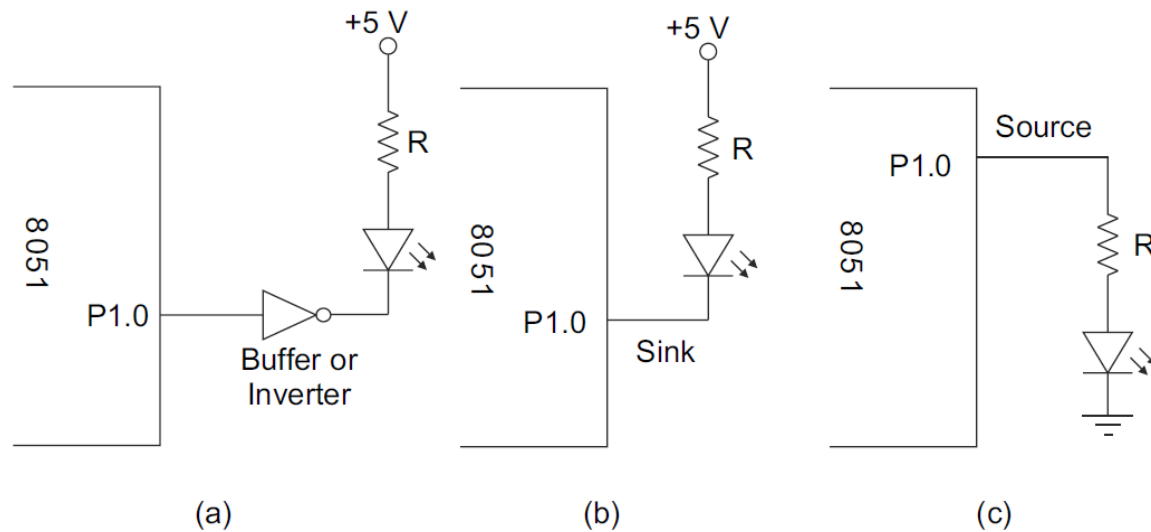The resistor R will limit the current through the LED and protects it from damage. The value of R for a LED having VF =2 V and IF = 10 mA can be calculated as follows:

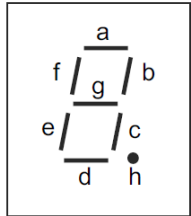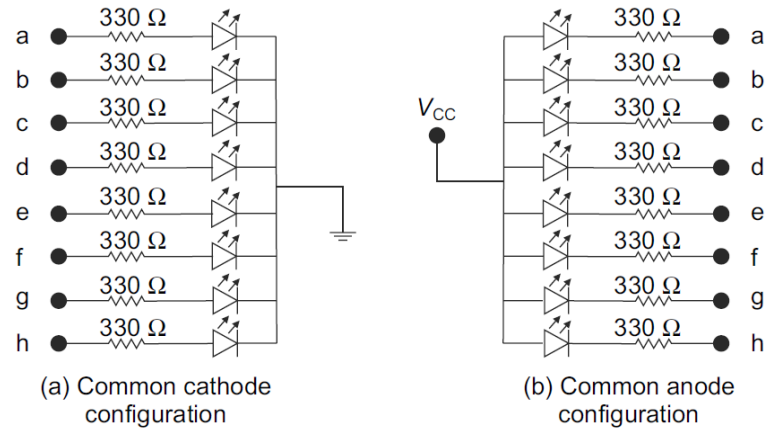$$R = \frac{5 - V_F}{I_F} = \frac{5 - 2}{0.01} = 300 = 330$$

Seven-Segment Display

Fig. 18.3   Seven-segment module

(a) Common cathode configuration

(b) Common anode configuration

Fig. 18.4   Common cathode and anode configurations

A seven-segment display is used to display the decimal (or hexadecimal) numbers. They consist of a group of seven LEDs (rectangular), they also have LED for a dot point (decimal point), therefore, they contain eight LEDs in a module which are arranged as shown in Figure 18.3.

The LEDs are assigned names as a to h as shown. Seven-segment displays are used for displaying the numeric information in the electronic meters, digital clocks, and other electronic devices. There are two types of seven-segment display modules: (i) common cathode: where all the LEDs in the module have common cathode and, (ii) common anode: where all the LEDs have common anode.

Fig. 18.5 Interfacing four seven-segment common cathode modules with 8051

Digit Multiplexing

When two or more digits are required for an application, we need to use digit multiplexing. In this approach, only one display module (digit) is activated at a time and all the modules are refreshed one by one at a fast rate so that all the display modules appear to be simultaneously active.
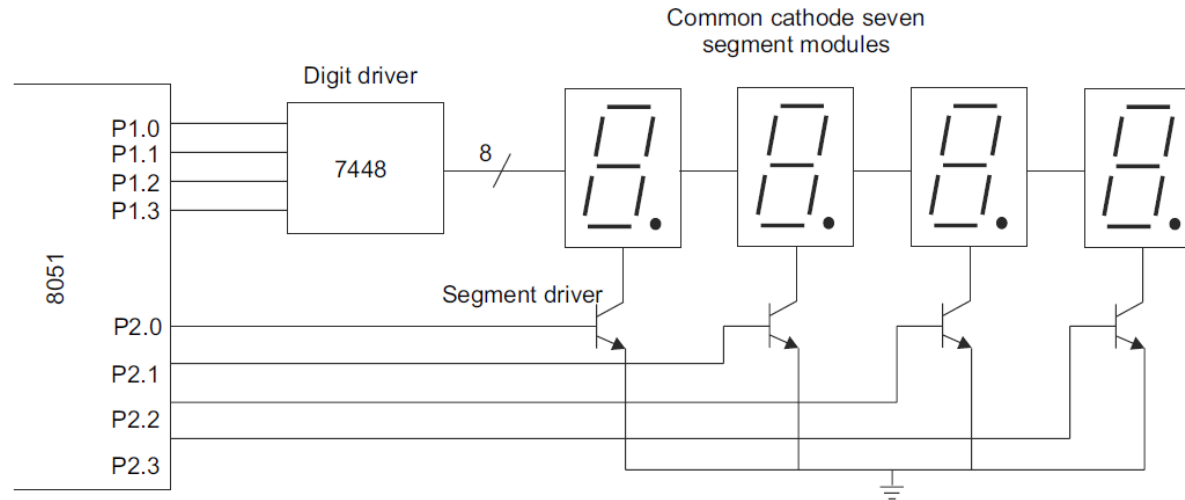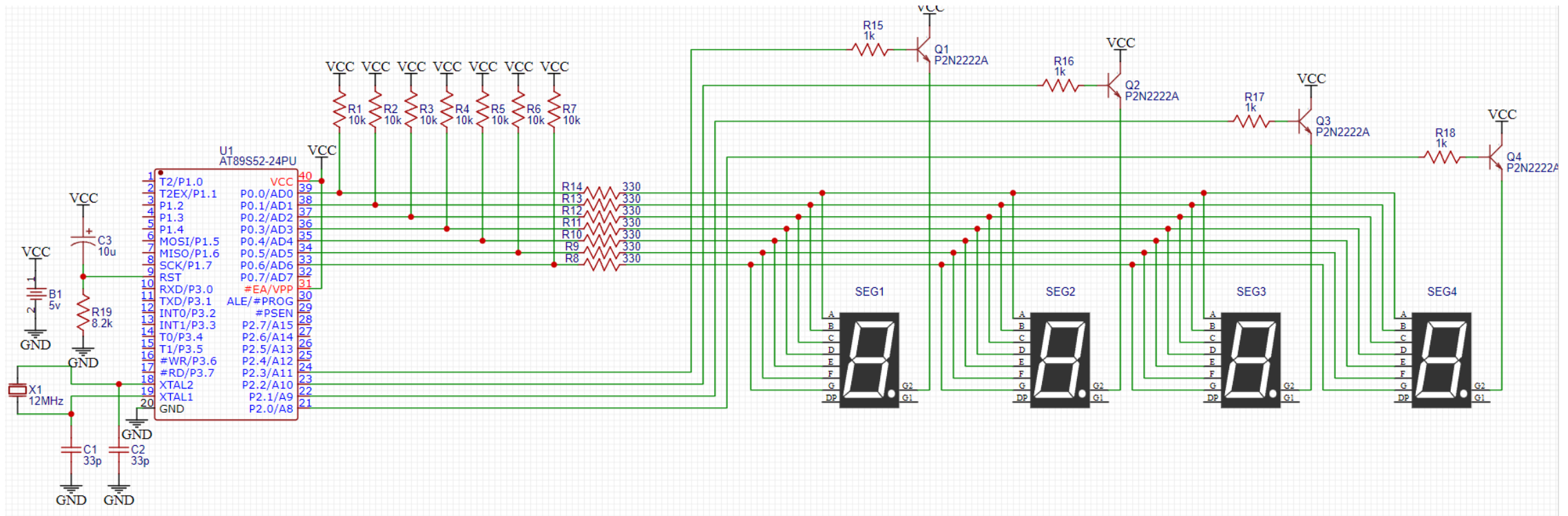
Digit Multiplexing

Example

Write a program to display numbers from 0 to 9 repeatedly in a sequence on seven-segment modules.

Solution

```
          ORG 0000h
          MOV DPTR, #0100H
          MOV P2, #0FFH
REPEAT:   MOV R0, #00H
NEXT:     MOV A, R0// display 0 first
          MOVC A, @A+DPTR
          MOV P0, A // send BCD code to 7448
          MOV R5, #200 // delay
```

Solution cont.

```
THERE2: MOV R6, #255
THERE1: NOP
        NOP
        NOP
        NOP
        DJNZ R6,THERE1
        DJNZ R5,THERE2
        INC R0
        CJNE R0, #0AH, NEXT // display up to 9 only
        SJMP REPEAT // repeat the sequence
```

Solution cont.

```
ORG 0100h
DB 0C0H
DB 0F9H
DB 0A4H
DB 0B0H
DB 099H
DB 092H
DB 082H
DB 0F8H
DB 080H
DB 090H
END
```

Manish K Patel (2014). *The 8051 Microcontroller Based Embedded Systems*. McGraw Hill Education

References