Slide 1

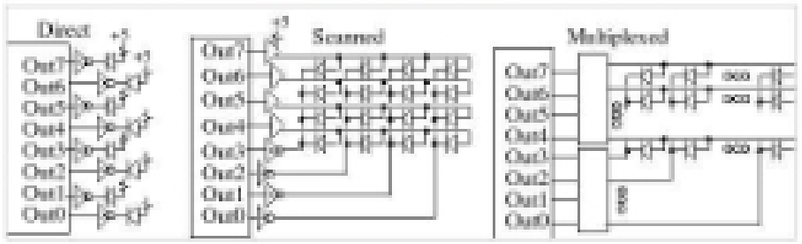
ECE/CE 3720: Embedded System Design

Chris J. Myers

Lecture 17: Output LEDs and LCDs

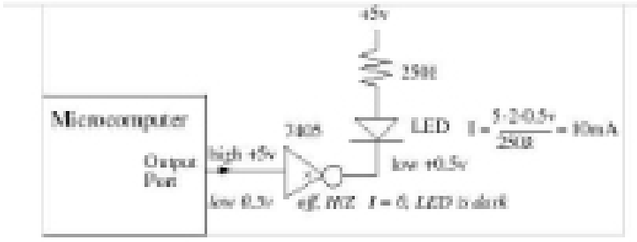
Slide 2

Interfacing Multiple LEDs



Slide 3

Single LED Interface



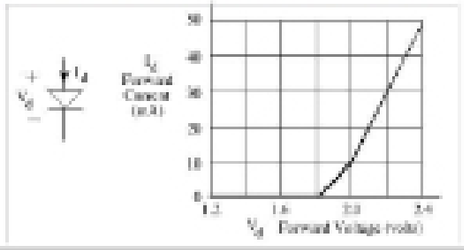
Slide 4

Output Param. for Open-Collector/Emitter Gates

(See Tables 8.4 and 8.5)

Slide 5

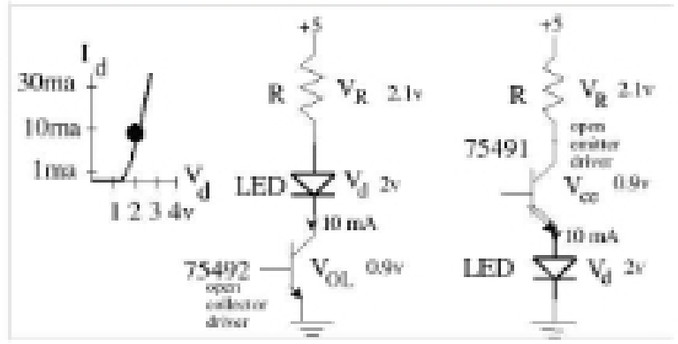
Typical Voltage/Current Response of a LED



Parameter	red	green	yellow	orange	units
Max power	55	75	60	75	mW
Peak current	160	100	80	100	mA
Max current	25	25	20	25	mA

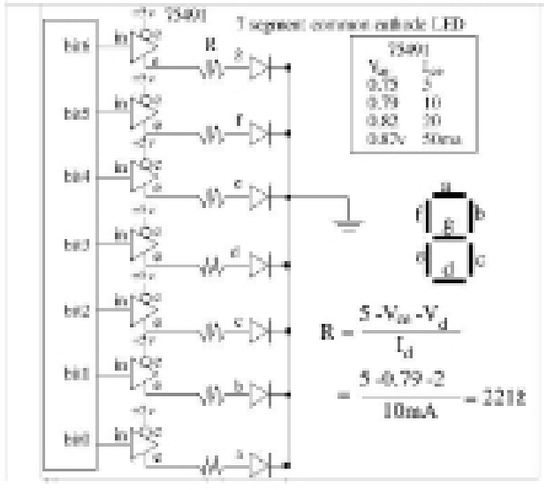
Slide 6

Calculating the Resistor Value



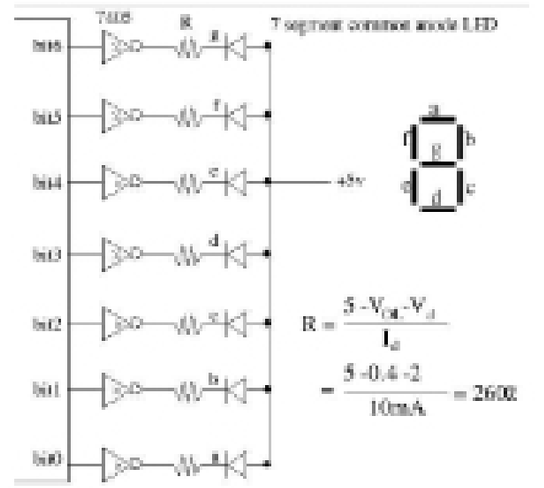
Slide 7

Seven-Segment LED Interfaces (Common-Cathode)



Slide 8

Seven-Segment LED Interfaces (Common-Anode)



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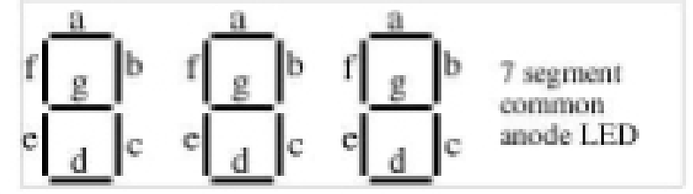
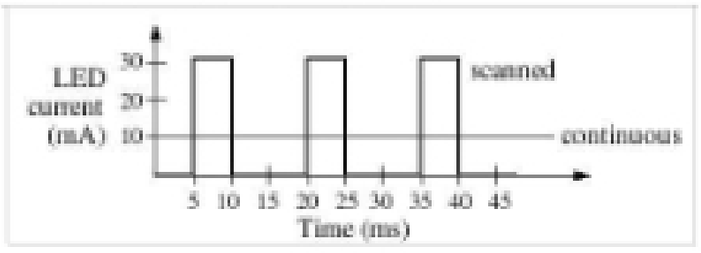
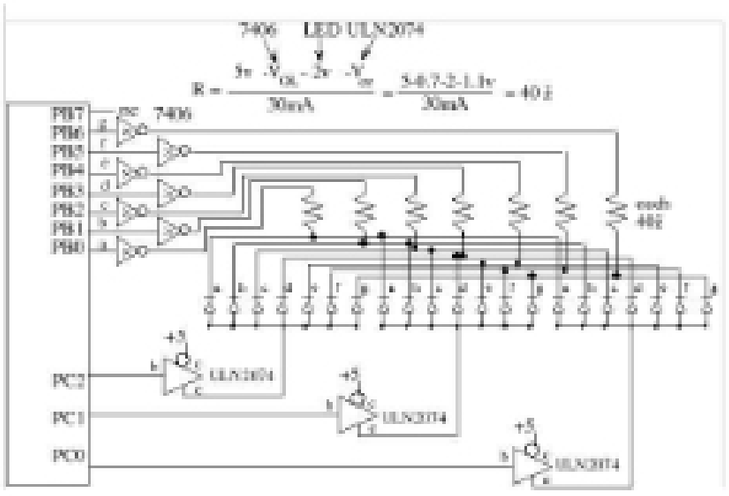
Scanned Seven-Segment LED Interface





Slide 10

Circuit Used to Scan a LED Interface



Slide 11

Software for Scanned LED Display

```
// PB7-PB0 output, 7 bit pattern
// PC2-PC0 output, selects LED digit
unsigned char code[3]; // binary codes
static unsigned char select[3]={4,2,1};
unsigned int index;    // 0,1,2
#define OC5F 0x08
void ritual(void) {
asm(" sei");      // make atomic
   index=0;
   DDRC=0xFF;     // outputs
   TMSK1|=OC5F;   // Arm OC5
   TFLG1=OC5F;    // clear OC5F
   TOC5=TCNT+10000;
asm(" cli"); }
```

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Software for Scanned LED Display

```
#pragma interrupt_handler TOC5handler()
void TOC5handler(void){
   TFLG1=OC5F;       // Acknowledge
   TOC5=TOC5+10000; // every 5 ms
   PORTC=select[index]; // which LED?
   PORTB=code[index];   // enable
   if(++index==3) index=0;}
```