

Lab 3 Deliverables

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Section: 16085

Spring 2016

Schematic

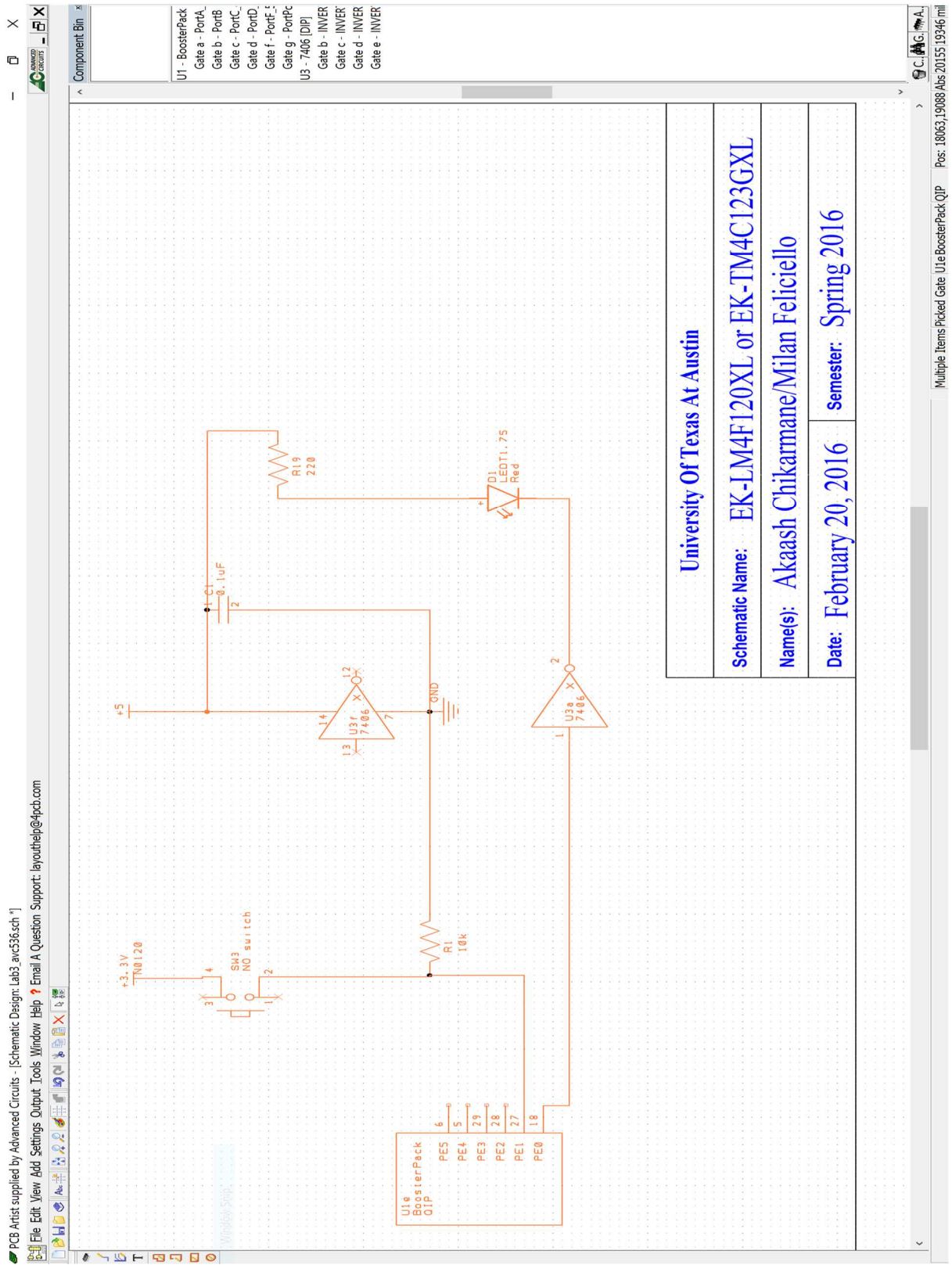


Table 3.1 (Switch Measurements)

Parameter	Value	Units	Conditions
Resistance of the 10k Ω resistor, R1	9.89 k Ω	ohms	with power off and disconnected from circuit (measured with ohmmeter)
Supply Voltage, V _{+3.3}	3.285 V	volts	Powered (measured with voltmeter)
Input Voltage, V _{PE1}	3.4 mV	volts	Powered, but with switch not pressed (measured with voltmeter)
Resistor current	Calculated: ~ 0.0 mA Measured: 0 mA	mA	Powered, but switch not pressed $I = V_{PE1}/R1$ (calculated and measured with an ammeter)
Input Voltage, V _{PE1}	3.28 V	volts	Powered and with switch pressed (measured with voltmeter)
Resistor current	Calculated: .33 mA Measured: .33 mA	mA	Powered and switch pressed $I = V_{PE1}/R1$ (calculated and measured with an ammeter)

Table 3.2 (LED Measurements)

Row	Parameter	Value	Units	Conditions
1	Resistance of the 220 Ω resistor, R19	219.8 V	ohms	with power off and disconnected from circuit (measured with ohmmeter)
2	+5 V power supply V_{+5}	5.04 V	volts	(measured with voltmeter relative to ground, <i>notice that the +5V power is not exactly +5 volts</i>)
3	TM4C123 Output, V_{PE0} input to 7406	93.7 mV	volts	with PE0 = 0 (measured with voltmeter relative to ground)
4	7406 Output, V_{k-} LED k-	3.71	volts	with PE0 = 0 (measured with voltmeter relative to ground)
5	LED a+, V_{a+} Bottom side of R19	5.03	volts	with PE0 = 0 (measured with voltmeter relative to ground)
6	LED voltage	1.32	volts	calculated as $V_{a+} - V_{k-}$
7	LED current	.045	mA	calculated as $(V_{+5} - V_{a+})/R19$ and measured with an ammeter
		0.00		
8	TM4C123 Output, V_{PE0} input to 7406	3.28	volts	with PE0 = 1 (measured with voltmeter relative to ground)
9	7406 Output, V_{k-} LED k-	128.5 mV	volts	with PE0 = 1 (measured with voltmeter relative to ground)

10	LED a+, V_{a+} Bottom side of R19	2.055	volts	with PE0 = 1 (measured with voltmeter relative to ground)
11	LED voltage	1.9265	volts	calculated as $V_{a+} - V_{k-}$
12	LED current	13.58	mA	calculated as $(V_{+5} - V_{a+})/R19$ and measured with an ammeter
		13.26		

Assembly Source Code

```
***** main.s *****
```

```
; Program written by: Akaash Chikarmane
```

```
; Date Created: 1/22/2016
```

```
; Last Modified: 2/22/2016
```

```
; Section: Tuesday 2-3
```

```
; Instructor: Ramesh Yerraballi
```

```
; Lab number: 3
```

```
; Brief description of the program
```

```
; If the switch is presses, the LED toggles at 8 Hz
```

```
; Hardware connections
```

```
; PE1 is switch input (1 means pressed, 0 means not pressed)
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```
; PE0 is LED output (1 activates external LED on protoboard)
```

```
;Overall functionality of this system is the similar to Lab 2, with six changes:
```

```
;1- the pin to which we connect the switch is moved to PE1,
```

```
;2- you will have to remove the PUR initialization because pull up is no longer needed.
```

```
;3- the pin to which we connect the LED is moved to PE0,
```

```
;4- the switch is changed from negative to positive logic, and
```

```
;5- you should increase the delay so it flashes about 8 Hz.
```

;6- the LED should be on when the switch is not pressed

; Operation

; 1) Make PE0 an output and make PE1 an input.

; 2) The system starts with the LED on (make PE0 =1).

; 3) Wait about 62 ms

; 4) If the switch is pressed (PE1 is 1), then toggle the LED once, else turn the LED on (0).

; 5) Steps 3 and 4 are repeated over and over

GPIO_PORTE_DATA_R EQU 0x400243FC

GPIO_PORTE_DIR_R EQU 0x40024400

GPIO_PORTE_AFSEL_R EQU 0x40024420

GPIO_PORTE_DEN_R EQU 0x4002451C

GPIO_PORTE_AMSEL_R EQU 0x40024528

GPIO_PORTE_PCTL_R EQU 0x4002452C

SYSCTL_RCGCGPIO_R EQU 0x400FE608

IMPORT TExaS_Init

AREA |.text|, CODE, READONLY, ALIGN=2

THUMB

EXPORT Start

Start

; TExaS_Init sets bus clock at 80 MHz

BL TExaS_Init ; voltmeter, scope on PD3

LDR R0,=SYSCTL_RCGCGPIO_R

LDR R1, [R0]

ORR R1, #0x10 ;enable clock for Port E (0001 0000)

STR R1, [R0]

NOP ;stabilize clock

NOP

```

LDR R0,=GPIO_PORTE_DEN_R
LDR R1, [R0]
ORR R1, #0x03                ;enable digital I/O for PF3, PF4
STR R1, [R0]

```

```

LDR R0,=GPIO_PORTE_DIR_R
LDR R1, [R0]
ORR R1, #0x01                ;PE0=output (1)
BIC R1, #0x02                ;PE1=input (0)
STR R1, [R0]

```

```

LDR R0,=GPIO_PORTE_AFSEL_R
LDR R1, [R0]
BIC R1, #0x03                ;no alternate function for PF3,4
STR R1, [R0]

```

```

LDR R0,=GPIO_PORTE_DATA_R
LDR R1, [R0]
ORR R1, #0x01                ;LED initially on
STR R1, [R0]

```

CPSIE 1 ; TExaS voltmeter, scope runs on interrupts

loop

```

    BL DELAY

```

```

LDR R0,=GPIO_PORTE_DATA_R
LDR R1, [R0]                ;read the switch (R1 = adjusting PE0)

```



```

MOV R2, R1           ;R2 = checking PE1
MOV R3, R1           ;R3 = original data
AND R2, #0x02        ;clear all but PE1
SUBS R2, #0x02

```

```

BNE      SETON           ;if PE1 = 0, turn on LED
AND R1, #0x01          ;clear all but PE0
EOR R1, #0x01          ;toggle PE0
BIC R3, #0x01          ;clear original PE0
ORR R3, R1, R3          ;recombine
STR R3, [R0]
B        loop

```

SETON

```

ORR R3, #0x01
STR R3, [R0]
B  loop

```

DELAY

```

LDRR0,=COUNT          ;start of delay subroutine (62 ms)
LDRR1, [R0]

```

REPEAT

```

SUBS R1, R1, #1
BNE REPEAT
BX  LR

```

```

COUNT DCD      0x130000

```

ALIGN ; make sure the end of this section is aligned

END ; end of file