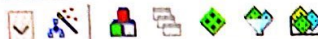


20\Lab3\_EE319K\Lab3.uvprojx - µVision

h Debug Peripherals Tools SVCS Window Help



Lab3



main.s Startup.s

```
66 ; Initialization goes here
67 LDR R0,=SYSTCL_RCGCGPIO_R ; R0 points to SYSTCL_RCGCGPIO_R
68 LDR R1,[R0] ; read SYSTCL_RCGCGPIO_R into R1
69 ORR R1,#0x30 ; turn on clock Bin: 00010000
70 STR R1,[R0] ; write back to SYSTCL_RCGCGPIO_R
71 NOP ; wait for clock to stabilize
72 NOP
73 LDR R0,=GPIO_PORTE_DIR_R
74 MOV R1,#0x04 ; PE2 output, PE1 input
75 STR R1,[R0]
76 LDR R0,=GPIO_PORTE_DEN_R
77 MOV R1,#0x06 ; enable PE2, PE1
78 STR R1,[R0]
79
80 LDR R0,=GPIO_PORTF_LOCK_R
81 LDR R1,=GPIO_LOCK_KEY
82 STR R1,[R0]
83 LDR R0,=GPIO_PORTF_CR_R
84 LDR R1,[R0]
85 ORR R1,#0xFF
86 STR R1,[R0]
87 LDR R0,=GPIO_PORTF_DIR_R
88 BIC R1,#0x10 ; PE4 input for switch
89 STR R1,[R0]
90 LDR R0,=GPIO_PORTF_DEN_R
91 MOV R1,#0x10 ; enable only PF4
```

```

120      LDR R1, [R7] ; read PORT E data for switch
121      AND R1, #0X02
122      CMP R1, #0X02
123      BNE skip
124      BL change
125
126
127
128  afterSkip
129      MOV R0, #0X04 ;
130      STR R0, [R7] ; set PE2 high
131      MOV R0, R9 ; delay for LED high time
132      BL delay
133      MOV R0, #0X00 ; clear PE2 to be low
134      STR R0, [R7]
135      MOV R0, R5
136      BL delay
137      B loop
138
139  skip
140      MOV R12, #0
141      B afterSkip
142
143  change
144
145      MOV R6, R14 ; save linkage

```

I

```

174     SUBS R5, R11, R9
175     MOV R12, #1
176     BX LR
177
178 beforeBreathe
179     LDR R0, =comparison
180     CMP R9, R0
181     BLE breathe
182     MOV R0, #100
183     UDIV R9, R9, R0
184     UDIV R5, R5, R0
185     UDIV R11, R11, R0
186
187 breathe
188
189
190     CMP R6, #1      ;R3 = flag for "is it decrementing" 1= yes , 0 = no
191     BEQ decrement
192
193     LDR R2, =breathIncrement ; increase duty cycle by only 20%
194     ADD R9, R2
195     SUBS R5, R11, R9
196     CMP R9, R11
197     BGE decrement   ;If R9 becomes greater than or equal to total, then go to decrement
198
199

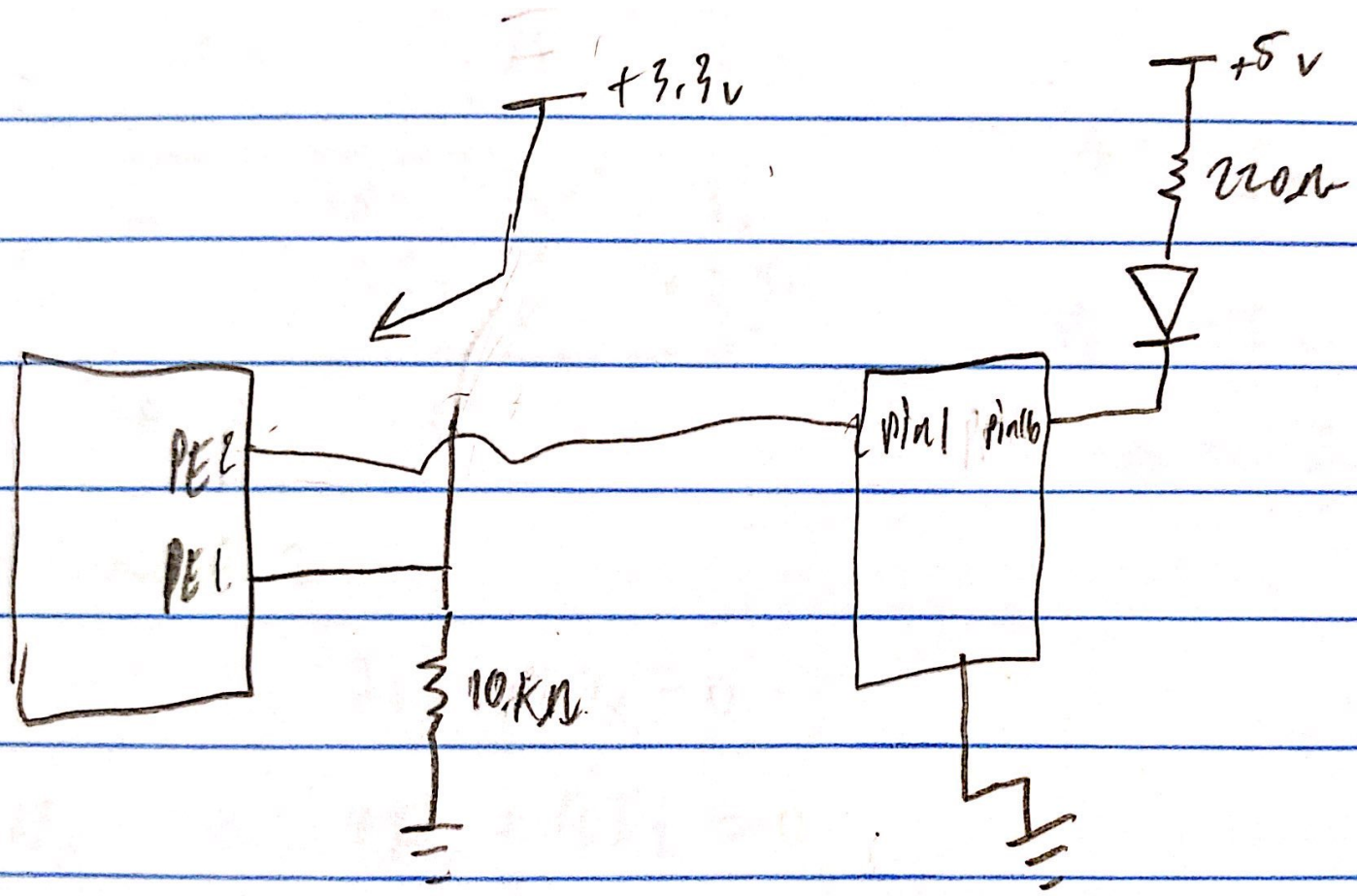
```

```

216      MOV R6, #1          ;set Flag R3 for "is it decrementing"
217      B afterSkip
218
219
220 delay
221
222 dloop  SUBS R0, #1
223      BNE dloop
224      BX LR
225
226
227
228 breatheReset
229      LDR R0, =comparison
230      CMP R9, R0
231      BGE go
232      MOV R0, #100
233      LDR R9, =initHighPulse
234      LDR R5, =initLowPulse
235      LDR R11, =total
236 go
237      B readE
238
239
240
241      ALIGN                ; make sure the end of this section is aligned

```





## Hardware Interfacing LED/Switch

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Warning: NEVER INSERT/REMOVE WIRES/CHIPS WHEN THE POWER IS ON.

Row	Parameter	Value	Units	Conditions
1	Resistance of the 220Ω resistor, R19	216	ohms	with power off and disconnected from circuit (measured with ohmmeter)
2	+5 V power supply $V_{+5}$	5.14	volts	(measured with voltmeter relative to ground, <i>notice that the +5V power is not exactly +5 volts</i> )
3	TM4C123 Output, $V_{PE2}$ input to ULN2003B	0	volts	with PE2 = 0 (measured with voltmeter relative to ground). We call this $V_{OL}$ of the TM4C123.
4	ULN2003B Output, pin 16, $V_k$ LED k-	3.77	volts	with PE2 = 0 (measured with voltmeter relative to ground). This measurement will be weird, because it is floating.
5	LED a+, $V_{a+}$ Bottom side of R19 (anode side of LED)	5.2	volts	with PE2 = 0 (measured with voltmeter relative to ground). This measurement is also weird, because it too is floating.
6	LED voltage	1.35	volts	calculated as $V_{a+} - V_k$
7	LED current (off)	0	mA	calculated as $(V_{+5} - V_{a+})/R19$ and measured with an ammeter
	TM4C123 Output, $V_{PE2}$	3.17		with PE2 = 1 (measured with voltmeter relative to ground). We call this $V_{OH}$ of the



## Hardware Interfacing LED/Switch

Insert Format Tools Add-ons Help All changes saved in Drive

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1	of LED)			
6	LED voltage	1.35	volts	calculated as $V_{a+} - V_k$ .
7	LED current (off)	0	mA	calculated as $(V_{-5} - V_{a-})/R19$ and measured with an ammeter
8	TM4C123 Output, $V_{PE2}$ input to ULN2003B	3.17	volts	with PE2 = 1 (measured with voltmeter relative to ground). We call this $V_{OH}$ of the TM4C123.
9	ULN2003B Output pin 16, $V_k$ LED k-	0.82	volts	with PE2 = 1 (measured with voltmeter relative to ground). We call this $V_{OL}$ or $V_{CE(sat)}$ of the ULN2003B.
10	LED a+, $V_{a-}$ Bottom side of R19 (anode side of LED)	2.68	volts	with PE2 = 1 (measured with voltmeter relative to ground)
11	LED voltage	1.9	volts	calculated as $V_{a+} - V_k$ .
12	LED current (on)	10	mA	calculated as $(V_{-5} - V_{a-})/R19$ and measured with an ammeter

docs.google.com/document/d/13nknYmcX9GFpY0ZUvXRManb8O0M\_Xkb2DkzYhYHOL8U/edit#

## of Lab 3 - Hardware Interfacing LED/Switch

Edit View Insert Format Tools Add-ons Help All changes saved in Drive

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Parameter	Value	Units	Conditions
Resistance of the 10kΩ resistor, R1	9840	ohms	with power off and disconnected from circuit (measured with ohmmeter)
Supply Voltage, $V_{+3.3}$	3.299	volts	Powered (measured with voltmeter)
Input Voltage, $V_{PE1}$	0	volts	Powered, but with switch not pressed (measured with voltmeter)
Resistor current	0	mA	Powered, but switch not pressed $I = V_{PE1} / R1$ (calculated and measured with an ammeter)
Input Voltage, $V_{PE1}$	3.29	volts	Powered and with switch pressed (measured with voltmeter)
			Powered and switch pressed



**Scanned with CamScanner**

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Project Flash Debug Peripherals Tools SVCS Window Help

Logic Analyzer

Value

Setup... Load... Save... Min Time 0 s Max Time 0.386761 s Grid 0.5 s Zoom In Out All Min/Max Auto Undo Update Screen Stop Clear Transition Prev Next Jump to Code Trace Signal Info Show Cycles Amplitude Cursor Timestamps Enable

19.33806 ms 1.619338 s

Disassembly Logic Analyzer

126  
127  
128 afterSkip  
129 MOV  
130 STR  
131 MOV  
132 BL d  
133 MOV  
134 STR  
135 MOV

Port F Hardware

TM4C123

SW1 PF4 PF3 PF2 PF1 PF0 LED LED LED

Port F Registers

DATA: 0x11 PUR: 0x10 LOCK: 0x00  
DIR: 0x0F PDR: 0x00 CR: 0x1F  
DEN: 0x10 RCGCGPIO: 0x00000039 Clock enabled

Port E Hardware

TM4C123

SW PE1 PE2 LED

Port E Registers

DATA: 0x00 PUR: 0x00 LOCK: 0x01  
DIR: 0x04 PDR: 0x00 CR: 0xFF  
DEN: 0x06 RCGCGPIO: 0x00000039 Clock enabled

Grading Controls

Number from EdX: Grade Score: 0  
Copy this to EdX:

BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess

Call Stack + Locals Memory 1

Simulation t1: 0.37892813 sec L:121 C:1 CAP NUM SCRL OVR R