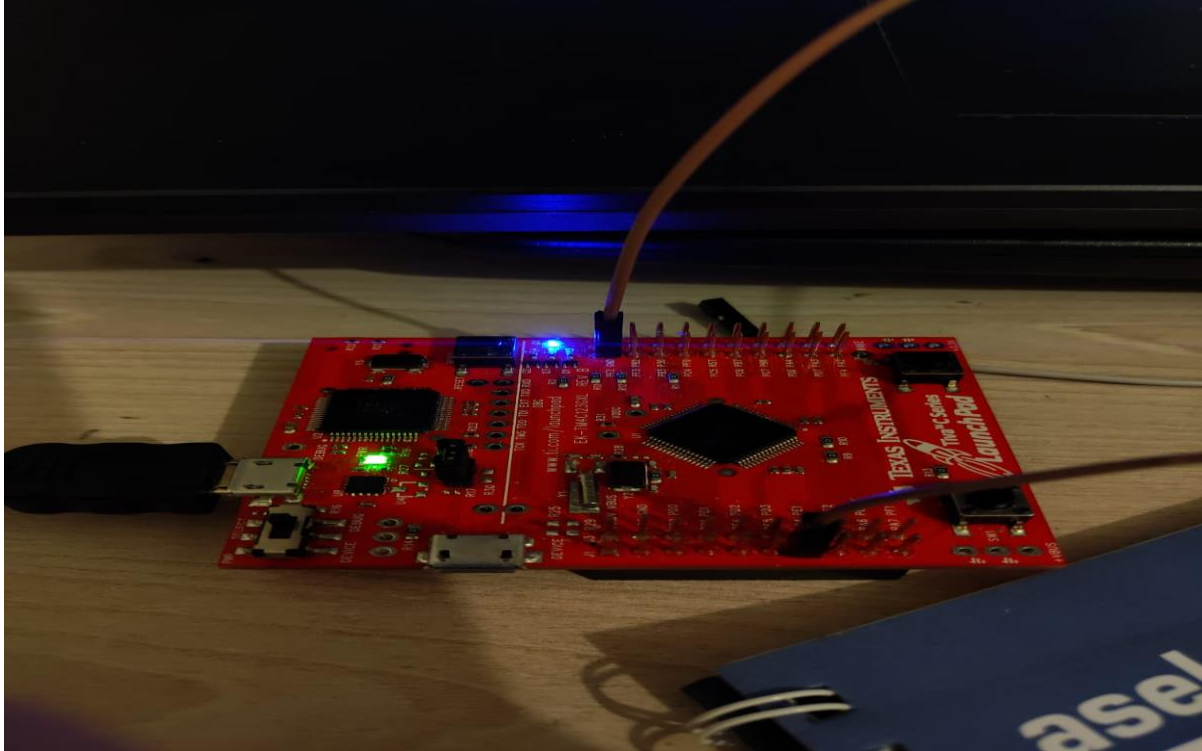


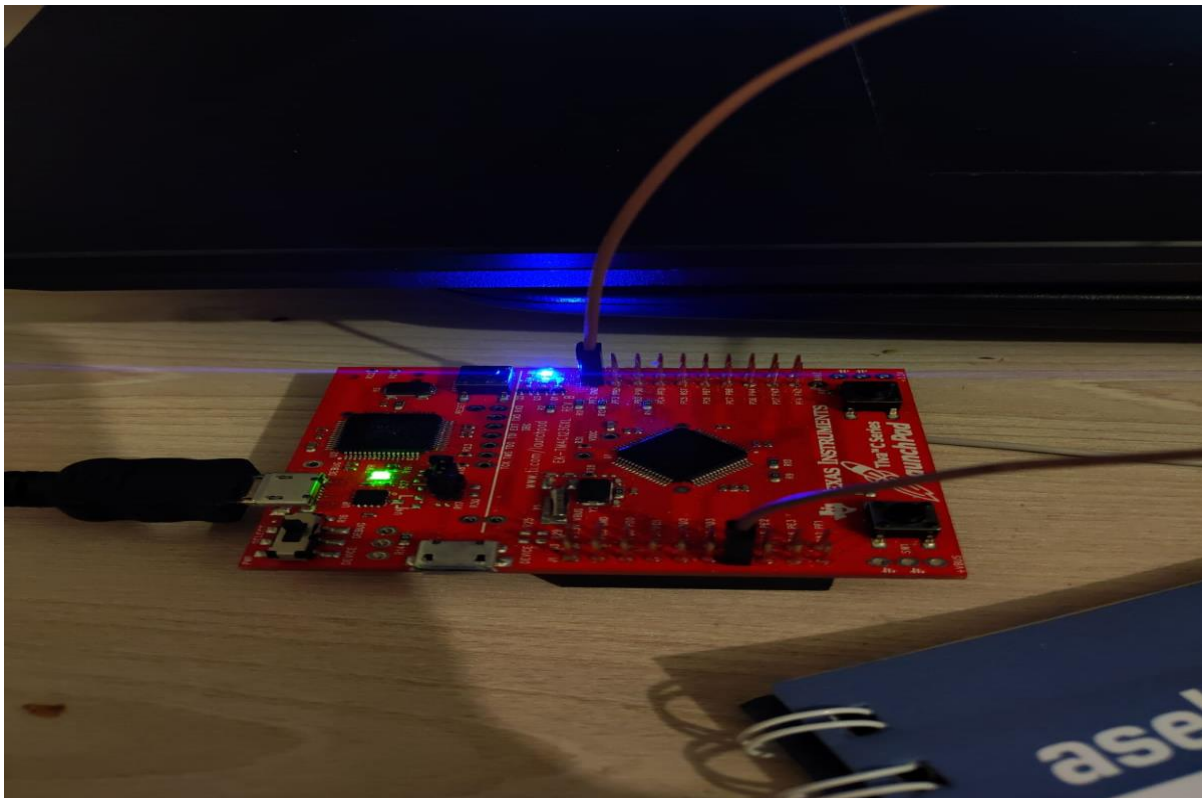
# EE447 PRELIM4

EFE BERKAY YITIM 2305761

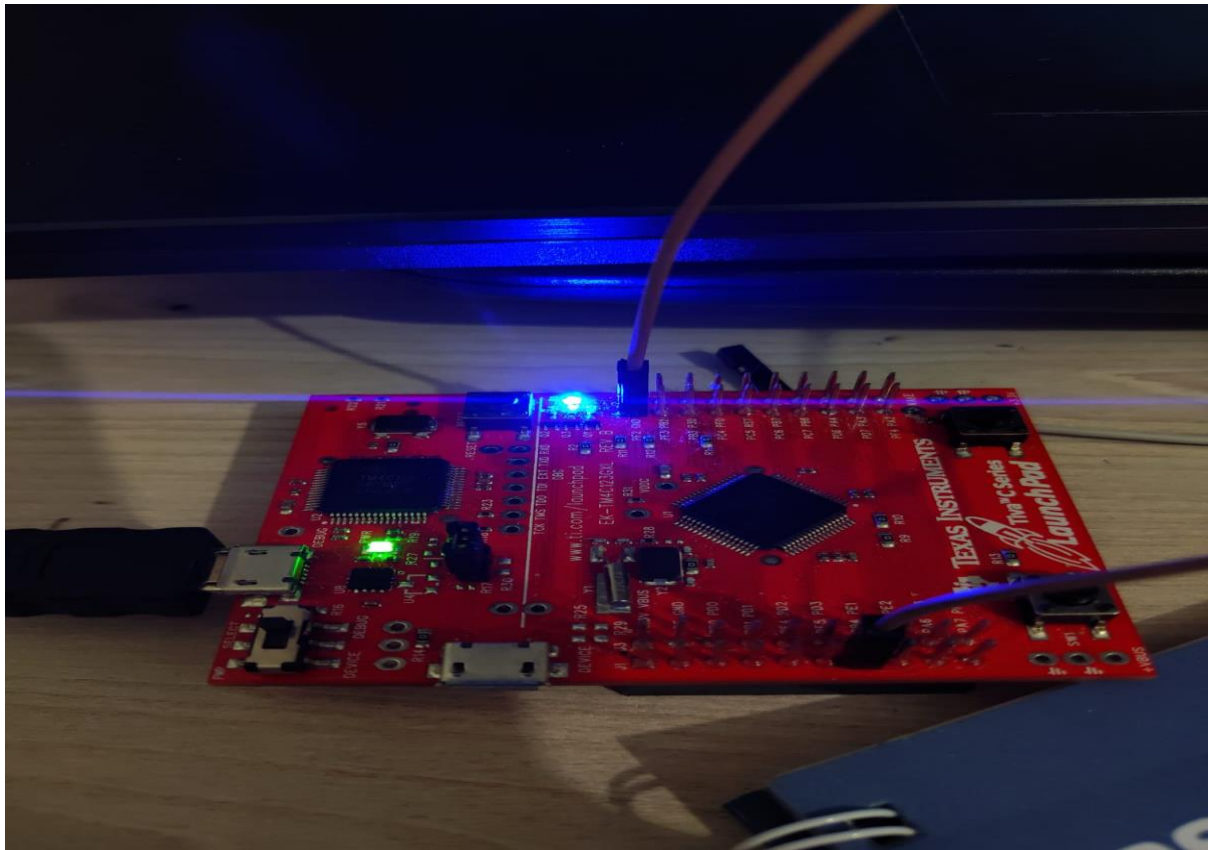
Q1) DUTY CYCLE 5.88%



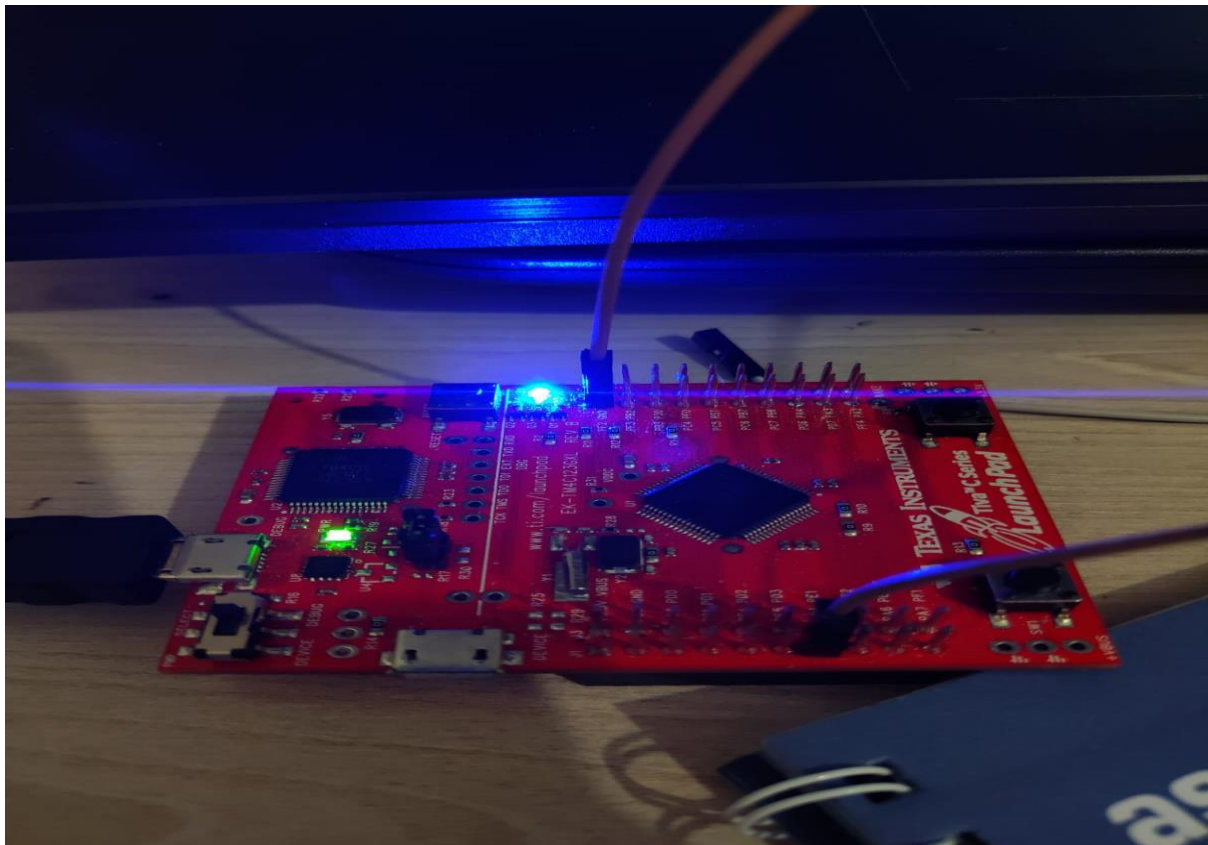
DUTY CYCLE 20%



DUTY CYCLE 50%



DUTY CYCLE 93.75%



```
1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                MAIN OF THE Q1                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ;LABEL          DIRECTIVE    VALUE          COMMENT
6                AREA main,    CODE,    READONLY,    ALIGN=2
7                THUMB
8
9                IMPORT        PULSE_INIT
10               EXPORT        __main
11
12
13  __main          PROC
14                BL            PULSE_INIT
15  LOOP            WFI
16                B            LOOP
17
18                ENDP
19                END
20
```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                PULSE OF THE Q1                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ; Pulse.s
6  ; Routine for creating a pulse train using interrupts
7  ; This uses Channel 0, and a 1MHz Timer Clock ( _TAPR = 15 )
8  ; Uses Timer1A to READ EDGES on PB4
9
10 ;Nested Vector Interrupt Controller registers
11 NVIC_EN0_INT19      EQU 0x00080000 ; Interrupt 19 enable
12 NVIC_EN0             EQU 0xE000E100 ; IRQ 0 to 31 Set Enable Register
13 NVIC_PRI4            EQU 0xE000E410 ; IRQ 16 to 19 Priority Register
14
15 ; 16/32 Timer Registers
16 TIMER0_CFG          EQU 0x40031000
17 TIMER0_TAMR          EQU 0x40031004
18 TIMER0_CTL           EQU 0x4003100C
19 TIMER0_IMR           EQU 0x40031018
20 TIMER0_RIS           EQU 0x4003101C ; Timer Interrupt Status
21 TIMER0_ICR           EQU 0x40031024 ; Timer Interrupt Clear
22 TIMER0_TAILR         EQU 0x40031028 ; Timer interval
23 TIMER0_TAPR          EQU 0x40031038
24 TIMER0_TAR           EQU 0x40031048 ; Timer register
25
26 ;GPIO Registers
27 GPIO_PORTF_DATA      EQU 0x40025010 ; Access BIT2
28 GPIO_PORTF_DIR        EQU 0x40025400 ; Port Direction
29 GPIO_PORTF_AFSEL      EQU 0x40025420 ; Alt Function enable
30 GPIO_PORTF_DEN        EQU 0x4002551C ; Digital Enable
31 GPIO_PORTF_AMSEL      EQU 0x40025528 ; Analog enable
32 GPIO_PORTF_PCTL       EQU 0x4002552C ; Alternate Functions
33
34 ;System Registers
35 SYSCCTL_RCGCGPIO      EQU 0x400FE608 ; GPIO Gate Control
36 SYSCCTL_RCGCTIMER     EQU 0x400FE604 ; GPTM Gate Control
37
38 ;-----
39 LOW                   EQU 0x00000100
40 HIGH                  EQU 0x00000040
41 ;-----
42
43         AREA      routines, CODE, READONLY
44         THUMB
45         EXPORT    My_Timer0A_Handler
46         EXPORT    PULSE_INIT
47
48 ;-----
49 My_Timer0A_Handler  PROC
50                     ;...
51                     ADD     R10,#1
52                     CMP     R10,#1
53                     BEQ     HIGHX
54
55 LOWX                LDR     R0,=GPIO_PORTF_DATA
56                     LDR     R1,[R0]
57                     MOV     R1,#0
58                     STR     R1,[R0]
59                     LDR     R1,=TIMER0_TAILR ; initialize match clocks
60                     LDR     R2,=LOW
61                     STR     R2,[R1]
62                     MOV     R10,#0
63                     B       EXIT
64
65 HIGHX               LDR     R0,=GPIO_PORTF_DATA
66                     LDR     R1,[R0]
67                     MOV     R1,#4
68                     STR     R1,[R0]
69                     LDR     R1,=TIMER0_TAILR ; initialize match clocks
70                     LDR     R2,=HIGH
71                     STR     R2,[R1]
72                     B       EXIT

```

```

73
74 EXIT                LDR R0,=TIMER0_ICR
75                     ORR R1,#0x01
76                     STR R1,[R0]
77                     BX  LR
78                     ENDP
79 ;-----
80
81 PULSE_INIT  PROC
82             LDR R1, =SYSCTL_RCGCGPIO ; start GPIO clock
83             LDR R0, [R1]
84             ORR R0, R0, #0x20 ; set bit 5 for port F
85             STR R0, [R1]
86             NOP ; allow clock to settle
87             NOP
88             NOP
89             LDR R1, =GPIO_PORTF_DIR ; set direction of PF2
90             LDR R0, [R1]
91             ORR R0, R0, #0x04 ; set bit2 for output
92             STR R0, [R1]
93             LDR R1, =GPIO_PORTF_AFSEL ; regular port function
94             LDR R0, [R1]
95             BIC R0, R0, #0x04
96             STR R0, [R1]
97             LDR R1, =GPIO_PORTF_PCTL ; no alternate function
98             LDR R0, [R1]
99             BIC R0, R0, #0x00000F00
100            STR R0, [R1]
101            LDR R1, =GPIO_PORTF_AMSEL ; disable analog
102            MOV R0, #0
103            STR R0, [R1]
104            LDR R1, =GPIO_PORTF_DEN ; enable port digital
105            LDR R0, [R1]
106            ORR R0, R0, #0x04
107            STR R0, [R1]
108
109            LDR R1, =SYSCTL_RCGCTIMER ; Start Timer0
110            LDR R2, [R1]
111            ORR R2, R2, #0x01
112            STR R2, [R1]
113            NOP ; allow clock to settle
114            NOP
115            NOP
116            LDR R1, =TIMER0_CTL ; disable timer during setup LDR R2, [R1]
117            BIC R2, R2, #0x01
118            STR R2, [R1]
119            LDR R1, =TIMER0_CFG ; set 16 bit mode
120            MOV R2, #0x04
121            STR R2, [R1]
122            LDR R1, =TIMER0_TAMR
123            MOV R2, #0x02 ; set to periodic, count down
124            STR R2, [R1]
125            LDR R1, =TIMER0_TAILR ; initialize match clocks
126            LDR R2, =LOW
127            STR R2, [R1]
128            LDR R1, =TIMER0_TAPR
129            MOV R2, #15 ; divide clock by 16 to
130            STR R2, [R1] ; get 1us clocks
131            LDR R1, =TIMER0_IMR ; enable timeout interrupt
132            MOV R2, #0x01
133            STR R2, [R1]
134            ; Configure interrupt priorities
135            ; Timer0A is interrupt #19.
136            ; Interrupts 16-19 are handled by NVIC register PRI4.
137            ; Interrupt 19 is controlled by bits 31:29 of PRI4.
138            ; set NVIC interrupt 19 to priority 2
139            LDR R1, =NVIC_PRI4
140            LDR R2, [R1]
141            AND R2, R2, #0x00FFFFFF ; clear interrupt 19 priority
142            ORR R2, R2, #0x40000000 ; set interrupt 19 priority to 2
143            STR R2, [R1]
144            ; NVIC has to be enabled

```

```
145 ; Interrupts 0-31 are handled by NVIC register EN0
146 ; Interrupt 19 is controlled by bit 19
147 ; enable interrupt 19 in NVIC
148     LDR R1, =NVIC_EN0
149     MOVT R2, #0x08 ; set bit 19 to enable interrupt 19
150     STR R2, [R1]
151 ; Enable timer
152     LDR R1, =TIMER0_CTL
153     LDR R2, [R1]
154     ORR R2, R2, #0x03 ; set bit0 to enable
155     STR R2, [R1] ; and bit 1 to stall on debug
156     BX LR ; return
157     ENDP
158     END
```



Q2) R0=PERIOD, R1=DUTY CYCLE, R7=PULSE WIDTH, WE SHOULD DIVIDE R0 AND R7 BY 16 TO GET THE CORRECT RESULT IN NANoseconds BECAUSE PULSE IS 1MHZ. (SHIFT 1 BYTE RIGHT)

TEST1 %20 DUTY CYCLE, LOW = 0X00000100, HIGH=0X00000040

The screenshot shows the Keil uVision IDE with the following assembly code:

```

106: 0x0000031C FB81F0B UDIV      r1,r1,r0      R1,R1,R0
107: 0x00000320 F04F0500 MOV      r5,#0x00      R5,#0
108: 0x00000324 F04F0600 MOV      r6,#0x00      R6,#0
109: 0x00000328 F04F0700 MOV      r7,#0x00      R7,#0
110: 0x0000032C F04F0800 MOV      r8,#0x00      R8,#0
111: 0x00000330 F04F0900 MOV      r9,#0x00      R9,#0
112: 0x00000334 F04F0A00 MOV      r10,#0x00     R10,#0
113: 0x00000338 F04F0B00 MOV      r11,#0x00     R11,#0
114: 0x0000033C F04F0C00 MOV      r12,#0x00     R12,#0
115: 0x00000340 F04F0D00 MOV      r13,#0x00     R13,#0
116: 0x00000344 F04F0E00 MOV      r14,#0x00     R14,#0
117: 0x00000348 F04F0F00 MOV      r15,#0x00     R15,#0
118: 0x0000034C F04F1000 MOV      r16,#0x00     R16,#0
119: 0x00000350 F04F1100 MOV      r17,#0x00     R17,#0
120: 0x00000354 F04F1200 MOV      r18,#0x00     R18,#0
121: 0x00000358 F04F1300 MOV      r19,#0x00     R19,#0
122: 0x0000035C F04F1400 MOV      r20,#0x00     R20,#0
123: 0x00000360 F04F1500 MOV      r21,#0x00     R21,#0
124: 0x00000364 F04F1600 MOV      r22,#0x00     R22,#0
125: 0x00000368 F04F1700 MOV      r23,#0x00     R23,#0
126: 0x0000036C F04F1800 MOV      r24,#0x00     R24,#0
127: 0x00000370 F04F1900 MOV      r25,#0x00     R25,#0
128: 0x00000374 F04F1A00 MOV      r26,#0x00     R26,#0
129: 0x00000378 F04F1B00 MOV      r27,#0x00     R27,#0
130: 0x0000037C F04F1C00 MOV      r28,#0x00     R28,#0
131: 0x00000380 F04F1D00 MOV      r29,#0x00     R29,#0
132: 0x00000384 F04F1E00 MOV      r30,#0x00     R30,#0
133: 0x00000388 F04F1F00 MOV      r31,#0x00     R31,#0
134: 0x0000038C F04F2000 MOV      r32,#0x00     R32,#0
135: 0x00000390 F04F2100 MOV      r33,#0x00     R33,#0
136: 0x00000394 F04F2200 MOV      r34,#0x00     R34,#0
137: 0x00000398 F04F2300 MOV      r35,#0x00     R35,#0
138: 0x0000039C F04F2400 MOV      r36,#0x00     R36,#0
139: 0x000003A0 F04F2500 MOV      r37,#0x00     R37,#0
140: 0x000003A4 F04F2600 MOV      r38,#0x00     R38,#0
141: 0x000003A8 F04F2700 MOV      r39,#0x00     R39,#0
142: 0x000003AC F04F2800 MOV      r40,#0x00     R40,#0
143: 0x000003B0 F04F2900 MOV      r41,#0x00     R41,#0
144: 0x000003B4 F04F2A00 MOV      r42,#0x00     R42,#0
145: 0x000003B8 F04F2B00 MOV      r43,#0x00     R43,#0
146: 0x000003BC F04F2C00 MOV      r44,#0x00     R44,#0
147: 0x000003C0 F04F2D00 MOV      r45,#0x00     R45,#0
148: 0x000003C4 F04F2E00 MOV      r46,#0x00     R46,#0
149: 0x000003C8 F04F2F00 MOV      r47,#0x00     R47,#0
150: 0x000003CC F04F3000 MOV      r48,#0x00     R48,#0
151: 0x000003D0 F04F3100 MOV      r49,#0x00     R49,#0
152: 0x000003D4 F04F3200 MOV      r50,#0x00     R50,#0
153: 0x000003D8 F04F3300 MOV      r51,#0x00     R51,#0
154: 0x000003DC F04F3400 MOV      r52,#0x00     R52,#0
155: 0x000003E0 F04F3500 MOV      r53,#0x00     R53,#0
156: 0x000003E4 F04F3600 MOV      r54,#0x00     R54,#0
157: 0x000003E8 F04F3700 MOV      r55,#0x00     R55,#0
158: 0x000003EC F04F3800 MOV      r56,#0x00     R56,#0
159: 0x000003F0 F04F3900 MOV      r57,#0x00     R57,#0
160: 0x000003F4 F04F3A00 MOV      r58,#0x00     R58,#0
161: 0x000003F8 F04F3B00 MOV      r59,#0x00     R59,#0
162: 0x000003FC F04F3C00 MOV      r60,#0x00     R60,#0
163: 0x00000400 F04F3D00 MOV      r61,#0x00     R61,#0
164: 0x00000404 F04F3E00 MOV      r62,#0x00     R62,#0
165: 0x00000408 F04F3F00 MOV      r63,#0x00     R63,#0
166: 0x0000040C F04F4000 MOV      r64,#0x00     R64,#0
167: 0x00000410 F04F4100 MOV      r65,#0x00     R65,#0
168: 0x00000414 F04F4200 MOV      r66,#0x00     R66,#0
169: 0x00000418 F04F4300 MOV      r67,#0x00     R67,#0
170: 0x0000041C F04F4400 MOV      r68,#0x00     R68,#0
171: 0x00000420 F04F4500 MOV      r69,#0x00     R69,#0
172: 0x00000424 F04F4600 MOV      r70,#0x00     R70,#0
173: 0x00000428 F04F4700 MOV      r71,#0x00     R71,#0
174: 0x0000042C F04F4800 MOV      r72,#0x00     R72,#0
175: 0x00000430 F04F4900 MOV      r73,#0x00     R73,#0
176: 0x00000434 F04F4A00 MOV      r74,#0x00     R74,#0
177: 0x00000438 F04F4B00 MOV      r75,#0x00     R75,#0
178: 0x0000043C F04F4C00 MOV      r76,#0x00     R76,#0
179: 0x00000440 F04F4D00 MOV      r77,#0x00     R77,#0
180: 0x00000444 F04F4E00 MOV      r78,#0x00     R78,#0
181: 0x00000448 F04F4F00 MOV      r79,#0x00     R79,#0
182: 0x0000044C F04F5000 MOV      r80,#0x00     R80,#0
183: 0x00000450 F04F5100 MOV      r81,#0x00     R81,#0
184: 0x00000454 F04F5200 MOV      r82,#0x00     R82,#0
185: 0x00000458 F04F5300 MOV      r83,#0x00     R83,#0
186: 0x0000045C F04F5400 MOV      r84,#0x00     R84,#0
187: 0x00000460 F04F5500 MOV      r85,#0x00     R85,#0
188: 0x00000464 F04F5600 MOV      r86,#0x00     R86,#0
189: 0x00000468 F04F5700 MOV      r87,#0x00     R87,#0
190: 0x0000046C F04F5800 MOV      r88,#0x00     R88,#0
191: 0x00000470 F04F5900 MOV      r89,#0x00     R89,#0
192: 0x00000474 F04F5A00 MOV      r90,#0x00     R90,#0
193: 0x00000478 F04F5B00 MOV      r91,#0x00     R91,#0
194: 0x0000047C F04F5C00 MOV      r92,#0x00     R92,#0
195: 0x00000480 F04F5D00 MOV      r93,#0x00     R93,#0
196: 0x00000484 F04F5E00 MOV      r94,#0x00     R94,#0
197: 0x00000488 F04F5F00 MOV      r95,#0x00     R95,#0
198: 0x0000048C F04F6000 MOV      r96,#0x00     R96,#0
199: 0x00000490 F04F6100 MOV      r97,#0x00     R97,#0
200: 0x00000494 F04F6200 MOV      r98,#0x00     R98,#0
201: 0x00000498 F04F6300 MOV      r99,#0x00     R99,#0
202: 0x0000049C F04F6400 MOV      r100,#0x00    R100,#0
203: 0x000004A0 F04F6500 MOV      r101,#0x00    R101,#0
204: 0x000004A4 F04F6600 MOV      r102,#0x00    R102,#0
205: 0x000004A8 F04F6700 MOV      r103,#0x00    R103,#0
206: 0x000004AC F04F6800 MOV      r104,#0x00    R104,#0
207: 0x000004B0 F04F6900 MOV      r105,#0x00    R105,#0
208: 0x000004B4 F04F6A00 MOV      r106,#0x00    R106,#0
209: 0x000004B8 F04F6B00 MOV      r107,#0x00    R107,#0
210: 0x000004BC F04F6C00 MOV      r108,#0x00    R108,#0
211: 0x000004C0 F04F6D00 MOV      r109,#0x00    R109,#0
212: 0x000004C4 F04F6E00 MOV      r110,#0x00    R110,#0
213: 0x000004C8 F04F6F00 MOV      r111,#0x00    R111,#0
214: 0x000004CC F04F7000 MOV      r112,#0x00    R112,#0
215: 0x000004D0 F04F7100 MOV      r113,#0x00    R113,#0
216: 0x000004D4 F04F7200 MOV      r114,#0x00    R114,#0
217: 0x000004D8 F04F7300 MOV      r115,#0x00    R115,#0
218: 0x000004DC F04F7400 MOV      r116,#0x00    R116,#0
219: 0x000004E0 F04F7500 MOV      r117,#0x00    R117,#0
220: 0x000004E4 F04F7600 MOV      r118,#0x00    R118,#0
221: 0x000004E8 F04F7700 MOV      r119,#0x00    R119,#0
222: 0x000004EC F04F7800 MOV      r120,#0x00    R120,#0
223: 0x000004F0 F04F7900 MOV      r121,#0x00    R121,#0
224: 0x000004F4 F04F7A00 MOV      r122,#0x00    R122,#0
225: 0x000004F8 F04F7B00 MOV      r123,#0x00    R123,#0
226: 0x000004FC F04F7C00 MOV      r124,#0x00    R124,#0
227: 0x00000500 F04F7D00 MOV      r125,#0x00    R125,#0
228: 0x00000504 F04F7E00 MOV      r126,#0x00    R126,#0
229: 0x00000508 F04F7F00 MOV      r127,#0x00    R127,#0
230: 0x0000050C F04F8000 MOV      r128,#0x00    R128,#0
231: 0x00000510 F04F8100 MOV      r129,#0x00    R129,#0
232: 0x00000514 F04F8200 MOV      r130,#0x00    R130,#0
233: 0x00000518 F04F8300 MOV      r131,#0x00    R131,#0
234: 0x0000051C F04F8400 MOV      r132,#0x00    R132,#0
235: 0x00000520 F04F8500 MOV      r133,#0x00    R133,#0
236: 0x00000524 F04F8600 MOV      r134,#0x00    R134,#0
237: 0x00000528 F04F8700 MOV      r135,#0x00    R135,#0
238: 0x0000052C F04F8800 MOV      r136,#0x00    R136,#0
239: 0x00000530 F04F8900 MOV      r137,#0x00    R137,#0
240: 0x00000534 F04F8A00 MOV      r138,#0x00    R138,#0
241: 0x00000538 F04F8B00 MOV      r139,#0x00    R139,#0
242: 0x0000053C F04F8C00 MOV      r140,#0x00    R140,#0
243: 0x00000540 F04F8D00 MOV      r141,#0x00    R141,#0
244: 0x00000544 F04F8E00 MOV      r142,#0x00    R142,#0
245: 0x00000548 F04F8F00 MOV      r143,#0x00    R143,#0
246: 0x0000054C F04F9000 MOV      r144,#0x00    R144,#0
247: 0x00000550 F04F9100 MOV      r145,#0x00    R145,#0
248: 0x00000554 F04F9200 MOV      r146,#0x00    R146,#0
249: 0x00000558 F04F9300 MOV      r147,#0x00    R147,#0
250: 0x0000055C F04F9400 MOV      r148,#0x00    R148,#0
251: 0x00000560 F04F9500 MOV      r149,#0x00    R149,#0
252: 0x00000564 F04F9600 MOV      r150,#0x00    R150,#0
253: 0x00000568 F04F9700 MOV      r151,#0x00    R151,#0
254: 0x0000056C F04F9800 MOV      r152,#0x00    R152,#0
255: 0x00000570 F04F9900 MOV      r153,#0x00    R153,#0
256: 0x00000574 F04F9A00 MOV      r154,#0x00    R154,#0
257: 0x00000578 F04F9B00 MOV      r155,#0x00    R155,#0
258: 0x0000057C F04F9C00 MOV      r156,#0x00    R156,#0
259: 0x00000580 F04F9D00 MOV      r157,#0x00    R157,#0
260: 0x00000584 F04F9E00 MOV      r158,#0x00    R158,#0
261: 0x00000588 F04F9F00 MOV      r159,#0x00    R159,#0
262: 0x0000058C F04FA000 MOV      r160,#0x00    R160,#0
263: 0x00000590 F04FA100 MOV      r161,#0x00    R161,#0
264: 0x00000594 F04FA200 MOV      r162,#0x00    R162,#0
265: 0x00000598 F04FA300 MOV      r163,#0x00    R163,#0
266: 0x0000059C F04FA400 MOV      r164,#0x00    R164,#0
267: 0x000005A0 F04FA500 MOV      r165,#0x00    R165,#0
268: 0x000005A4 F04FA600 MOV      r166,#0x00    R166,#0
269: 0x000005A8 F04FA700 MOV      r167,#0x00    R167,#0
270: 0x000005AC F04FA800 MOV      r168,#0x00    R168,#0
271: 0x000005B0 F04FA900 MOV      r169,#0x00    R169,#0
272: 0x000005B4 F04FAA00 MOV      r170,#0x00    R170,#0
273: 0x000005B8 F04FAB00 MOV      r171,#0x00    R171,#0
274: 0x000005BC F04FAC00 MOV      r172,#0x00    R172,#0
275: 0x000005C0 F04FAD00 MOV      r173,#0x00    R173,#0
276: 0x000005C4 F04FAE00 MOV      r174,#0x00    R174,#0
277: 0x000005C8 F04FAF00 MOV      r175,#0x00    R175,#0
278: 0x000005CC F04FB000 MOV      r176,#0x00    R176,#0
279: 0x000005D0 F04FB100 MOV      r177,#0x00    R177,#0
280: 0x000005D4 F04FB200 MOV      r178,#0x00    R178,#0
281: 0x000005D8 F04FB300 MOV      r179,#0x00    R179,#0
282: 0x000005DC F04FB400 MOV      r180,#0x00    R180,#0
283: 0x000005E0 F04FB500 MOV      r181,#0x00    R181,#0
284: 0x000005E4 F04FB600 MOV      r182,#0x00    R182,#0
285: 0x000005E8 F04FB700 MOV      r183,#0x00    R183,#0
286: 0x000005EC F04FB800 MOV      r184,#0x00    R184,#0
287: 0x000005F0 F04FB900 MOV      r185,#0x00    R185,#0
288: 0x000005F4 F04FBA00 MOV      r186,#0x00    R186,#0
289: 0x000005F8 F04FBB00 MOV      r187,#0x00    R187,#0
290: 0x000005FC F04FBC00 MOV      r188,#0x00    R188,#0
291: 0x00000600 F04FBD00 MOV      r189,#0x00    R189,#0
292: 0x00000604 F04FBE00 MOV      r190,#0x00    R190,#0
293: 0x00000608 F04FBF00 MOV      r191,#0x00    R191,#0
294: 0x0000060C F04FC000 MOV      r192,#0x00    R192,#0
295: 0x00000610 F04FC100 MOV      r193,#0x00    R193,#0
296: 0x00000614 F04FC200 MOV      r194,#0x00    R194,#0
297: 0x00000618 F04FC300 MOV      r195,#0x00    R195,#0
298: 0x0000061C F04FC400 MOV      r196,#0x00    R196,#0
299: 0x00000620 F04FC500 MOV      r197,#0x00    R197,#0
300: 0x00000624 F04FC600 MOV      r198,#0x00    R198,#0
301: 0x00000628 F04FC700 MOV      r199,#0x00    R199,#0
302: 0x0000062C F04FC800 MOV      r200,#0x00    R200,#0
303: 0x00000630 F04FC900 MOV      r201,#0x00    R201,#0
304: 0x00000634 F04FCA00 MOV      r202,#0x00    R202,#0
305: 0x00000638 F04FCB00 MOV      r203,#0x00    R203,#0
306: 0x0000063C F04FCC00 MOV      r204,#0x00    R204,#0
307: 0x00000640 F04FCD00 MOV      r205,#0x00    R205,#0
308: 0x00000644 F04FCE00 MOV      r206,#0x00    R206,#0
309: 0x00000648 F04FCE00 MOV      r207,#0x00    R207,#0
310: 0x0000064C F04FCE00 MOV      r208,#0x00    R208,#0
311: 0x00000650 F04FCE00 MOV      r209,#0x00    R209,#0
312: 0x00000654 F04FCE00 MOV      r210,#0x00    R210,#0
313: 0x00000658 F04FCE00 MOV      r211,#0x00    R211,#0
314: 0x0000065C F04FCE00 MOV      r212,#0x00    R212,#0
315: 0x00000660 F04FCE00 MOV      r213,#0x00    R213,#0
316: 0x00000664 F04FCE00 MOV      r214,#0x00    R214,#0
317: 0x00000668 F04FCE00 MOV      r215,#0x00    R215,#0
318: 0x0000066C F04FCE00 MOV      r216,#0x00    R216,#0
319: 0x00000670 F04FCE00 MOV      r217,#0x00    R217,#0
320: 0x00000674 F04FCE00 MOV      r218,#0x00    R218,#0
321: 0x00000678 F04FCE00 MOV      r219,#0x00    R219,#0
322: 0x0000067C F04FCE00 MOV      r220,#0x00    R220,#0
323: 0x00000680 F04FCE00 MOV      r221,#0x00    R221,#0
324: 0x00000684 F04FCE00 MOV      r222,#0x00    R222,#0
325: 0x00000688 F04FCE00 MOV      r223,#0x00    R223,#0
326: 0x0000068C F04FCE00 MOV      r224,#0x00    R224,#0
327: 0x00000690 F04FCE00 MOV      r225,#0x00    R225,#0
328: 0x00000694 F04FCE00 MOV      r226,#0x00    R226,#0
329: 0x00000698 F04FCE00 MOV      r227,#0x00    R227,#0
330: 0x0000069C F04FCE00 MOV      r228,#0x00    R228,#0
331: 0x000006A0 F04FCE00 MOV      r229,#0x00    R229,#0
332: 0x000006A4 F04FCE00 MOV      r230,#0x00    R230,#0
333: 0x000006A8 F04FCE00 MOV      r231,#0x00    R231,#0
334: 0x000006AC F04FCE00 MOV      r232,#0x00    R232,#0
335: 0x000006B0 F04FCE00 MOV      r233,#0x00    R233,#0
336: 0x000006B4 F04FCE00 MOV      r234,#0x00    R234,#0
337: 0x000006B8 F04FCE00 MOV      r235,#0x00    R235,#0
338: 0x000006BC F04FCE00 MOV      r236,#0x00    R236,#0
339: 0x000006C0 F04FCE00 MOV      r237,#0x00    R237,#0
340: 0x000006C4 F04FCE00 MOV      r238,#0x00    R238,#0
341: 0x000006C8 F04FCE00 MOV      r239,#0x00    R239,#0
342: 0x000006CC F04FCE00 MOV      r240,#0x00    R240,#0
343: 0x000006D0 F04FCE00 MOV      r241,#0x00    R241,#0
344: 0x000006D4 F04FCE00 MOV      r242,#0x00    R242,#0
345: 0x000006D8 F04FCE00 MOV      r243,#0x00    R243,#0
346: 0x000006DC F04FCE00 MOV      r244,#0x00    R244,#0
347: 0x000006E0 F04FCE00 MOV      r245,#0x00    R245,#0
348: 0x000006E4 F04FCE00 MOV      r246,#0x00    R246,#0
349: 0x000006E8 F04FCE00 MOV      r247,#0x00    R247,#0
350: 0x000006EC F04FCE00 MOV      r248,#0x00    R248,#0
351: 0x000006F0 F04FCE00 MOV      r249,#0x00    R249,#0
352: 0x000006F4 F04FCE00 MOV      r250,#0x00    R250,#0
353: 0x000006F8 F04FCE00 MOV      r251,#0x00    R251,#0
354: 0x000006FC F04FCE00 MOV      r252,#0x00    R252,#0
355: 0x00000700 F04FCE00 MOV      r253,#0x00    R253,#0
356: 0x00000704 F04FCE00 MOV      r254,#0x00    R254,#0
357: 0x00000708 F04FCE00 MOV      r255,#0x00    R255,#0
358: 0x0000070C F04FCE00 MOV      r256,#0x00    R256,#0
359: 0x00000710 F04FCE00 MOV      r257,#0x00    R257,#0
360: 0x00000714 F04FCE00 MOV      r258,#0x00    R258,#0
361: 0x00000718 F04FCE00 MOV      r259,#0x00    R259,#0
362: 0x0000071C F04FCE00 MOV      r260,#0x00    R260,#0
363: 0x00000720 F04FCE00 MOV      r261,#0x00    R261,#0
364: 0x00000724 F04FCE00 MOV      r262,#0x00    R262,#0
365: 0x00000728 F04FCE00 MOV      r263,#0x00    R263,#0
366: 0x0000072C F04FCE00 MOV      r264,#0x00    R264,#0
367: 0x00000730 F04FCE00 MOV      r265,#0x00    R265,#0
368: 0x00000734 F04FCE00 MOV      r266,#0x00    R266,#0
369: 0x00000738 F04FCE00 MOV      r267,#0x00    R267,#0
370: 0x0000073C F04FCE00 MOV      r268,#0x00    R268,#0
371: 0x00000740 F04FCE00 MOV      r269,#0x00    R269,#0
372: 0x00000744 F04FCE00 MOV      r270,#0x00    R270,#0
373: 0x00000748 F04FCE00 MOV      r271,#0x00    R271,#0
374: 0x0000074C F04FCE00 MOV      r272,#0x00    R272,#0
375: 0x00000750 F04FCE00 MOV      r273,#0x00    R273,#0
376: 0x00000754 F04FCE00 MOV      r274,#0x00    R274,#0
377: 0x00000758 F04FCE00 MOV      r275,#0x00    R275,#0
378: 0x0000075C F04FCE00 MOV      r276,#0x00    R276,#0
379: 0x00000760 F04FCE00 MOV      r277,#0x00    R277,#0
380: 0x00000764 F04FCE00 MOV      r278,#0x00    R278,#0
381: 0x00000768 F04FCE00 MOV      r279,#0x00    R279,#0
382: 0x0000076C F04FCE00 MOV      r280,#0x00    R280,#0
383: 0x00000770 F04FCE00 MOV      r281,#0x00    R281,#0
384: 0x00000774 F04FCE00 MOV      r282,#0x00    R282,#0
385: 0x00000778 F04FCE00 MOV      r283,#0x00    R283,#0
386: 0x0000077C F04FCE00 MOV      r284,#0x00    R284,#0
387: 0x00000780 F04FCE00 MOV      r285,#0x00    R285,#0
388: 0x00000784 F04FCE00 MOV      r286,#0x00    R286,#0
389: 0x00000788 F04FCE00 MOV      r287,#0x00    R287,#0
390: 0x0000078C F04FCE00 MOV      r288,#0x00    R288,#0
391: 0x00000790 F04FCE00 MOV      r289,#0x00    R289,#0
392: 0x00000794 F04FCE00 MOV      r290,#0x00    R290,#0
393: 0x00000798 F04FCE00 MOV      r291,#0x00    R291,#0
394: 0x0000079C F04FCE00 MOV      r292,#0x00    R292,#0
395: 0x000007A0 F04FCE00 MOV      r293,#0x00    R293,#0
396: 0x000007A4 F04FCE00 MOV      r294,#0x00    R294,#0
397: 0x000007A8 F04FCE00 MOV      r295,#0x00    R295,#0
398: 0x000007AC F04FCE00 MOV      r296,#0x00    R296,#0
399: 0x000007B0 F04FCE00 MOV      r297,#0x00    R297,#0
400: 0x000007B4 F04FCE00 MOV      r298,#0x00    R298,#0
401: 0x000007B8 F04FCE00 MOV      r299,#0x00    R299,#0
402: 0x000007BC F04FCE00 MOV      r300,#0x00
```

The screenshot displays the EkePC IDE interface. The main window shows the assembly code for the 'main' function. The code includes instructions such as MOV, LDR, and STR, along with comments and labels. The 'Registers' window on the left shows the state of various registers, and the 'Memory' window on the right shows the memory dump starting at address 0x400310C.

**Registers Window:**

Register	Value
R0	0x00000000
R1	0x00000004
R2	0x00000004
R3	0x00000000
R4	0x00000000
R5	0x00000000
R6	0x00000004
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (PC)	0x00000000
R15 (PC)	0x00000000

**Assembly View:**

```

1: LABEL DIRECTIVE VALUE COMMENT
2: AREA main, CODE, READONLY, ALIGN=2
3: THUMB
4:
5: IMPORT PULSE_INIT
6: IMPORT EDGE_TIMER
7: EXPORT _main
8:
9: TIMER1_ICR EQU 0x40031004 ; Timer Interrupt Clear
10: TIMER1_PIS EQU 0x4003101C ; Timer Interrupt Status
11: GPIO_PORTB_DATA EQU 0x40000040 ; Access B17
12: TIMER1_TAR EQU 0x40031048 ; Timer register
13: ;R5 RACINICI EDGE
14: ;R6 BIR ONKERI TIME
15: ;R7 HIGH = PULSE WIDTH
16: ;R8 LOW
17: ;R0 PERIOD
18: ;R1 DUTY CYCLE
19:
20:
21: _main PROC
22: BL PULSE_INIT
23: BL EDGE_TIMER
24: MOV R5, #0 ;RACINICI EDGE OLUOSUNU ANLAYACAGI
25:
26: LOOP LDR R1,=TIMER1_ICR
27: LDR R0, [R1]
28: CMP R0, #0x04
29: BNE LOOP
30:
31: LDR R1,=TIMER1_ICR

```

**Memory Window:**

Address: 0x400310C

Memory dump showing hexadecimal values and their corresponding ASCII representations.

**Command Window:**

Running with Code Size Limit: 512K

Connecting: Mode=RTAG, Speed=1000000HzLoad "C:\\Users\\EkePC\\Desktop\\LAB\\LW4\\Q2\\Objects\\pre2.asm"

BS \\pre2\\main.s106

**Bottom Bar:**

ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE COVTOFILE DEFINE DIR Display Enter

Stellaris ICD1 11: 0.00000000 sec L:13 C:1 CAP NUM SCR1 OVR: R/W

21:49 20.12.2020



```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                      MAIN OF THE Q2                      ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ;LABEL                DIRECTIVE    VALUE                COMMENT
6                      AREA main,    CODE,    READONLY,    ALIGN=2
7                      THUMB
8
9                      IMPORT        PULSE_INIT
10                     IMPORT        EDGE_TIMER
11                     EXPORT        __main
12
13 TIMER1_ICR            EQU 0x40031024 ; Timer Interrupt Clear
14 TIMER1_RIS            EQU 0x4003101C ; Timer Interrupt Status
15 GPIO_PORTB_DATA      EQU 0x40005040 ; Access BIT4
16 TIMER1_TAR            EQU 0x40031048 ; Timer register
17 ;R5 KACINCI EDGE
18 ;R6 BIR ONCEKI TIME
19 ;R7 HIGH = PULSE WIDTH
20 ;R8 LOW
21 ;R0 PERIOD
22 ;R1 DUTY CYCLE
23
24
25 __main                PROC
26                     BL            PULSE_INIT
27                     BL            EDGE_TIMER
28                     MOV            R5, #0                ;KACINCI EDGE OLDUGUNU ANLAYACAGIZ
29
30 LOOP                  LDR            R1,=TIMER1_RIS
31                     LDR            R0, [R1]
32                     CMP            R0, #0X04
33                     BNE            LOOP
34
35                     LDR            R1,=TIMER1_ICR
36                     LDR            R0, [R1]
37                     ORR            R0, #0X04
38                     STR            R0, [R1]
39
40                     LDR            R1,=GPIO_PORTB_DATA
41                     LDR            R0, [R1]
42                     LSR            R0, #4
43
44                     ADD            R5, #1
45                     CMP            R5, #1
46                     BEQ            FIRST
47                     CMP            R5, #2
48                     BEQ            SECOND
49                     B              THIRD
50
51 FIRST                 LDR            R1,=TIMER1_TAR
52                     LDR            R6, [R1]
53                     B              FINISH
54
55
56
57 SECOND               LDR            R1,=TIMER1_TAR
58                     LDR            R2, [R1]
59                     CMP            R0, #0
60                     BEQ            POSEDGE
61                     B              NEGEDGE
62
63
64
65 THIRD                LDR            R1,=TIMER1_TAR
66                     LDR            R2, [R1]
67                     CMP            R0, #0
68                     BEQ            POSEDGE
69                     B              NEGEDGE
70
71
72

```

```
73
74     POSEDGE         SUB     R7,R6,R2
75                     CMP     R6,R2
76                     CPYHI   R6,R2
77                     BHI     EXIT
78                     SUB     R7,R2,R6
79                     LDR     R0,=0X10000 ;FULL CYCLE
80                     ADD     R7,R0
81                     CPY     R6,R2
82                     B       EXIT
83
84
85
86     NEGEDGE         SUB     R8,R6,R2
87                     CMP     R6,R2
88                     CPYHI   R6,R2
89                     BHI     EXIT
90                     SUB     R8,R2,R6
91                     LDR     R0,=0X10000 ;FULL CYCLE
92                     ADD     R8,R0
93                     CPY     R6,R2
94                     B       EXIT
95
96     CALC             ADD     R0,R7,R8           ;PERIOD
97                     ;MOV     R3,#625
98                     ;MOV     R4,#10
99                     ;MUL     R2,R3
100                    ;UDIV    R2,R4           ;PERIOD IN NANoseconds
101
102                    ;CPY     R0,R7           ;PULSE WIDTH
103                    ;MUL     R0,R3
104                    ;UDIV    R0,R4           ;PULSE WIDTH IN NANoseconds
105                    ;R7      ;PULSE WIDTH
106
107                    MOV     R1,#100
108                    MUL     R1,R7
109                    ADD     R8,R7
110                    UDIV    R1,R8           ;DUTY CYCLE
111                    MOV     R5,#0
112                    MOV     R6,#0
113                    MOV     R7,#0
114                    MOV     R8,#0
115                    B       FINISH
116
117
118     EXIT             CMP     R5,#0X03
119                     BEQ     CALC
120     FINISH           LDR     R0,=TIMER1_ICR
121                     ORR     R1,#0X04           ;CLEAR BIT2, BECAUSE CAPTURE MODE
122                     STR     R1,[R0]
123
124                     B       LOOP
125
126                     ENDP
127                     END
128
```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                PULSE OF THE Q2                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ; Pulse.s
6  ; Routine for creating a pulse train using interrupts
7  ; This uses Channel 0, and a 1MHz Timer Clock ( _TAPR = 15 )
8  ; Uses Timer1A to READ EDGES on PB4
9
10 ;Nested Vector Interrupt Controller registers
11 NVIC_EN0_INT19      EQU 0x00080000 ; Interrupt 19 enable
12 NVIC_EN0             EQU 0xE000E100 ; IRQ 0 to 31 Set Enable Register
13 NVIC_PRI4            EQU 0xE000E410 ; IRQ 16 to 19 Priority Register
14
15 ; 16/32 Timer Registers
16 TIMER0_CFG          EQU 0x40030000
17 TIMER0_TAMR         EQU 0x40030004
18 TIMER0_CTL          EQU 0x4003000C
19 TIMER0_IMR          EQU 0x40030018
20 TIMER0_RIS          EQU 0x4003001C ; Timer Interrupt Status
21 TIMER0_ICR          EQU 0x40030024 ; Timer Interrupt Clear
22 TIMER0_TAILR        EQU 0x40030028 ; Timer interval
23 TIMER0_TAPR         EQU 0x40030038
24 TIMER0_TAR          EQU 0x40030048 ; Timer register
25
26 ;GPIO Registers
27 GPIO_PORTF_DATA      EQU 0x40025010 ; Access BIT2
28 GPIO_PORTF_DIR       EQU 0x40025400 ; Port Direction
29 GPIO_PORTF_AFSEL     EQU 0x40025420 ; Alt Function enable
30 GPIO_PORTF_DEN       EQU 0x4002551C ; Digital Enable
31 GPIO_PORTF_AMSEL     EQU 0x40025528 ; Analog enable
32 GPIO_PORTF_PCTL      EQU 0x4002552C ; Alternate Functions
33
34 ;System Registers
35 SYSCCTL_RCGCGPIO     EQU 0x400FE608 ; GPIO Gate Control
36 SYSCCTL_RCGCTIMER    EQU 0x400FE604 ; GPTM Gate Control
37
38 ;-----
39 LOW                   EQU 0x00000100
40 HIGH                  EQU 0x00000040
41 ;-----
42
43         AREA      routines, CODE, READONLY
44         THUMB
45         EXPORT    My_Timer0A_Handler
46         EXPORT    PULSE_INIT
47
48 ;-----
49 My_Timer0A_Handler  PROC
50                     ;...
51                     ADD     R10,#1
52                     CMP     R10,#1
53                     BEQ     HIGHX
54
55 LOWX                LDR     R0,=GPIO_PORTF_DATA
56                     LDR     R1,[R0]
57                     MOV     R1,#0
58                     STR     R1,[R0]
59                     LDR     R1,=TIMER0_TAILR ; initialize match clocks
60                     LDR     R2,=LOW
61                     STR     R2,[R1]
62                     MOV     R10,#0
63                     B       EXIT
64
65 HIGHX               LDR     R0,=GPIO_PORTF_DATA
66                     LDR     R1,[R0]
67                     MOV     R1,#4
68                     STR     R1,[R0]
69                     LDR     R1,=TIMER0_TAILR ; initialize match clocks
70                     LDR     R2,=HIGH
71                     STR     R2,[R1]
72                     B       EXIT

```

```

73
74 EXIT                LDR R0,=TIMER0_ICR
75                     ORR R1,#0x01
76                     STR R1,[R0]
77                     BX LR
78                     ENDP
79 ;-----
80
81 PULSE_INIT PROC
82     LDR R1, =SYSCTL_RCGCGPIO ; start GPIO clock
83     LDR R0, [R1]
84     ORR R0, R0, #0x20 ; set bit 5 for port F
85     STR R0, [R1]
86     NOP ; allow clock to settle
87     NOP
88     NOP
89     LDR R1, =GPIO_PORTF_DIR ; set direction of PF2
90     LDR R0, [R1]
91     ORR R0, R0, #0x04 ; set bit2 for output
92     STR R0, [R1]
93     LDR R1, =GPIO_PORTF_AFSEL ; regular port function
94     LDR R0, [R1]
95     BIC R0, R0, #0x04
96     STR R0, [R1]
97     LDR R1, =GPIO_PORTF_PCTL ; no alternate function
98     LDR R0, [R1]
99     BIC R0, R0, #0x00000F00
100    STR R0, [R1]
101    LDR R1, =GPIO_PORTF_AMSEL ; disable analog
102    MOV R0, #0
103    STR R0, [R1]
104    LDR R1, =GPIO_PORTF_DEN ; enable port digital
105    LDR R0, [R1]
106    ORR R0, R0, #0x04
107    STR R0, [R1]
108
109    LDR R1, =SYSCTL_RCGCTIMER ; Start Timer0
110    LDR R2, [R1]
111    ORR R2, R2, #0x01
112    STR R2, [R1]
113    NOP ; allow clock to settle
114    NOP
115    NOP
116    LDR R1, =TIMER0_CTL ; disable timer during setup LDR R2, [R1]
117    BIC R2, R2, #0x01
118    STR R2, [R1]
119    LDR R1, =TIMER0_CFG ; set 16 bit mode
120    MOV R2, #0x04
121    STR R2, [R1]
122    LDR R1, =TIMER0_TAMR
123    MOV R2, #0x02 ; set to periodic, count down
124    STR R2, [R1]
125    LDR R1, =TIMER0_TAILR ; initialize match clocks
126    LDR R2, =LOW
127    STR R2, [R1]
128    LDR R1, =TIMER0_TAPR
129    MOV R2, #15 ; divide clock by 16 to
130    STR R2, [R1] ; get 1us clocks
131    LDR R1, =TIMER0_IMR ; enable timeout interrupt
132    MOV R2, #0x01
133    STR R2, [R1]
134    ; Configure interrupt priorities
135    ; Timer0A is interrupt #19.
136    ; Interrupts 16-19 are handled by NVIC register PRI4.
137    ; Interrupt 19 is controlled by bits 31:29 of PRI4.
138    ; set NVIC interrupt 19 to priority 2
139    LDR R1, =NVIC_PRI4
140    LDR R2, [R1]
141    AND R2, R2, #0x0FFFFFFF ; clear interrupt 19 priority
142    ORR R2, R2, #0x40000000 ; set interrupt 19 priority to 2
143    STR R2, [R1]
144    ; NVIC has to be enabled

```

```
145 ; Interrupts 0-31 are handled by NVIC register EN0
146 ; Interrupt 19 is controlled by bit 19
147 ; enable interrupt 19 in NVIC
148     LDR R1, =NVIC_EN0
149     MOVT R2, #0x08 ; set bit 19 to enable interrupt 19
150     STR R2, [R1]
151 ; Enable timer
152     LDR R1, =TIMER0_CTL
153     LDR R2, [R1]
154     ORR R2, R2, #0x03 ; set bit0 to enable
155     STR R2, [R1] ; and bit 1 to stall on debug
156     BX LR ; return
157     ENDP
158     END
```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                EDGE TIMER OF THE Q2                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ; edgeTimer.s
6  ; Uses Timer1A to COUNT EDGES on PB4
7
8  ;Nested Vector Interrupt Controller registers
9  NVIC_EN0_INT19      EQU 0x00080000 ; Interrupt 19 enable
10 NVIC_EN0             EQU 0xE000E100 ; IRQ 0 to 31 Set Enable Register
11 NVIC_PRI5           EQU 0xE000E414 ; IRQ 16 to 19 Priority Register
12
13 ; 16/32 Timer Registers
14 TIMER1_CFG          EQU 0x40031000
15 TIMER1_TAMR         EQU 0x40031004
16 TIMER1_CTL          EQU 0x4003100C
17 TIMER1_IMR          EQU 0x40031018
18 TIMER1_RIS          EQU 0x4003101C ; Timer Interrupt Status
19 TIMER1_ICR          EQU 0x40031024 ; Timer Interrupt Clear
20 TIMER1_TAILR        EQU 0x40031028 ; Timer interval
21 TIMER1_TAPR         EQU 0x40031038
22 TIMER1_TAR          EQU 0x40031048 ; Timer register
23
24 ;GPIO Registers
25 GPIO_PORTB_DATA      EQU 0x40005040 ; Access BIT4
26 GPIO_PORTB_DIR       EQU 0x40005400 ; Port Direction
27 GPIO_PORTB_AFSEL     EQU 0x40005420 ; Alt Function enable
28 GPIO_PORTB_DEN       EQU 0x4000551C ; Digital Enable
29 GPIO_PORTB_AMSEL     EQU 0x40005528 ; Analog enable
30 GPIO_PORTB_PCTL      EQU 0x4000552C ; Alternate Functions
31 GPIO_PORTB_PDR       EQU 0x40005514 ;PULL DOWN REGISTER
32
33
34 ;System Registers
35 SYSCCTL_RCGCGPIO     EQU 0x400FE608 ; GPIO Gate Control
36 SYSCCTL_RCGCTIMER    EQU 0x400FE604 ; GPTM Gate Control
37
38 ;-----
39 LOW                  EQU 0x00000100
40 HIGH                 EQU 0x00000040
41 ;-----
42
43         AREA      routines, CODE, READONLY
44         THUMB
45         ;EXPORT    My_Timer1A_Handler
46         EXPORT    EDGE_TIMER
47
48 ;-----
49 ;My_Timer1A_Handler PROC
50
51
52
53
54
55
56 ;EXIT          LDR R0,=TIMER1_ICR
57 ;              ORR R1,#0X04          ;CLEAR BIT2, BECAUSE CAPTURE MODE
58 ;              STR R1,[R0]
59 ;              BX  LR
60 ;              ENDP
61 ;-----
62
63 EDGE_TIMER  PROC
64             LDR R1, =SYSCCTL_RCGCGPIO ; start GPIO clock
65             LDR R0, [R1]
66             ORR R0, R0, #0x02 ; set bit 1 for port B
67             STR R0, [R1]
68             NOP ; allow clock to settle
69             NOP
70             NOP
71             LDR R1, =GPIO_PORTB_DIR ; set direction of PB4
72             LDR R0, [R1]

```

```
73      BIC R0, R0, #0x10 ; SET BIT4 AS INPUT
74      STR R0, [R1]
75      LDR R1, =GPIO_PORTB_AFSEL ; ALTERNATE PB4
76      LDR R0, [R1]
77      ORR R0, R0, #0x10 ;PB4
78      STR R0, [R1]
79      LDR R1, =GPIO_PORTB_PCTL ; ALTERNATE PB4
80      LDR R0, [R1]
81      ORR R0, R0, #0x00070000 ;PB4
82      STR R0, [R1]
83      LDR R1, =GPIO_PORTB_AMSEL ; disable analog
84      MOV R0, #0
85      STR R0, [R1]
86      LDR R1, =GPIO_PORTB_DEN ; enable port digital
87      LDR R0, [R1]
88      ORR R0, R0, #0x10
89      STR R0, [R1]
90      LDR R1, =GPIO_PORTB_PDR ;PULL DOWN PB4
91      LDR R0, [R1]
92      ORR R0, #0x10
93      STR R0, [R1]
94
95      LDR R1, =SYSCTL_RCGCTIMER ; Start Timer1
96      LDR R2, [R1]
97      ORR R2, R2, #0x02
98      STR R2, [R1]
99      NOP ; allow clock to settle
100     NOP
101     NOP
102     LDR R1, =TIMER1_CTL ; disable timer during setup
103     LDR R2, [R1]
104     BIC R2, R2, #0x01
105     STR R2, [R1]
106     LDR R1, =TIMER1_CFG ; set 16 bit mode
107     MOV R2, #0x04
108     STR R2, [R1]
109     LDR R1, =TIMER1_TAMR
110     MOV R2, #0x07 ; CAPTURE, EDGE TIME, COUNT DOWN 00111
111     STR R2, [R1]
112     LDR R1, =TIMER1_TAILR ; initialize match clocks
113     LDR R2, =0xFFFF
114     STR R2, [R1]
115     ;LDR R1, =TIMER1_TAPR
116     ;MOV R2, #15 ; divide clock by 16 to
117     ;STR R2, [R1] ; get lus clocks
118     ;LDR R1, =TIMER1_IMR ; enable timeout interrupt
119     ;MOV R2, #0x01
120     ;STR R2, [R1]
121     ; Configure interrupt priorities
122     ; Timer0A is interrupt #19.
123     ; Interrupts 16-19 are handled by NVIC register PRI4.
124     ; Interrupt 19 is controlled by bits 31:29 of PRI4.
125     ; set NVIC interrupt 19 to priority 2
126     ;LDR R1, =NVIC_PRI5
127     ;LDR R2, [R1]
128     ;AND R2, R2, #0xFFFF00FF ; clear interrupt 21 priority
129     ;ORR R2, R2, #0x00004000 ; set interrupt 21 priority to 2
130     ;STR R2, [R1]
131     ; NVIC has to be enabled
132     ; Interrupts 0-31 are handled by NVIC register EN0
133     ; Interrupt 19 is controlled by bit 19
134     ; enable interrupt 19 in NVIC
135     ;LDR R1, =NVIC_EN0
136     ;MOVT R2, #0x20 ; set bit 21 to enable interrupt 21
137     ;STR R2, [R1]
138     ; Enable timer
139     LDR R1, =TIMER1_CTL
140     LDR R2, [R1]
141     ORR R2, R2, #0x0F ; set bit0 to enable
142     STR R2, [R1] ; and bit 1 to stall on debug, SET BIT 3:2 TO DETECT BOTH EDGES
143     BX LR ; return
144     ENDP
```

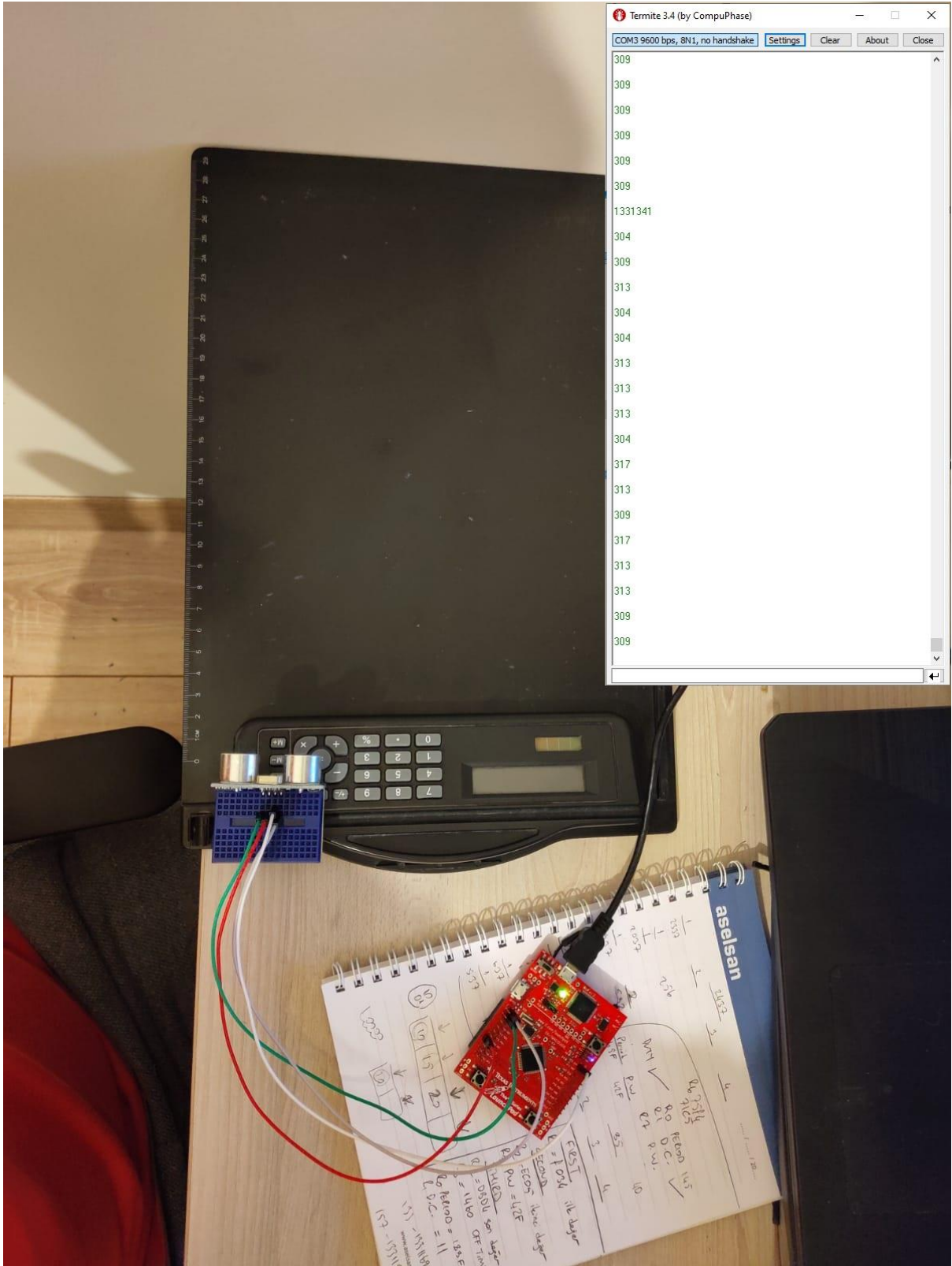


145

END

146





```
Termite 3.4 (by CompuPhase)
COM3 9600 bps, 8N1, no handshake [Settings] [Clear] [About] [Close]
309
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```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                MAIN OF THE Q3                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ;LABEL          DIRECTIVE  VALUE          COMMENT
6                AREA main,  CODE,    READONLY,  ALIGN=2
7                THUMB
8
9                IMPORT      OutStr
10               IMPORT      CONVRT
11               IMPORT      PULSE_INIT
12               IMPORT      EDGE_TIMER
13               EXPORT      __main
14
15  TIMER1_ICR      EQU 0x40031024 ; Timer Interrupt Clear
16  TIMER1_RIS      EQU 0x4003101C ; Timer Interrupt Status
17  GPIO_PORTB_DATA EQU 0x40005040 ; Access BIT4
18  TIMER1_TAR      EQU 0x40031048 ; Timer register
19  TIMER0_CTL      EQU 0x4003000C
20
21  NUM              EQU 0X20000500
22  ;R5 KACINCI EDGE
23  ;R6 BIR ONCEKI TIME
24  ;R7 HIGH = PULSE WIDTH
25  ;R8 LOW
26  ;R0 PERIOD
27  ;R1 DUTY CYCLE
28
29  MSG              DCB          "DISTANCE IN MM: "
30                  ;DCB          0x0D          ; Carriage return is like new line
31                  DCB          0x04          ; it is like EOF or \0
32
33
34  __main           PROC
35                  BL          EDGE_TIMER
36                  BL          PULSE_INIT
37                  MOV         R5,#0          ;KACINCI EDGE OLDUGUNU ANLAYACAGIZ
38
39  LOOP             LDR         R1,=TIMER1_RIS
40                  LDR         R0,[R1]
41                  CMP         R0,#0X04
42                  BNE         LOOP
43
44
45                  LDR         R1,=TIMER1_ICR
46                  LDR         R0,[R1]
47                  ORR         R0,#0X04
48                  STR         R0,[R1]
49
50                  LDR         R1,=GPIO_PORTB_DATA
51                  LDR         R0,[R1]
52                  ;LSR         R0,#4
53
54                  ;ADD         R0,R0,R5
55                  ;CMP         R0,#1
56                  ;BNE         LOOP
57
58                  ADD         R5,#1
59                  CMP         R5,#1
60                  BEQ         FIRST
61                  B           SECOND
62
63  FIRST            LDR         R1,=TIMER1_TAR
64                  LDR         R6,[R1]
65                  LDR R1, =TIMER0_CTL ; disable timer during setup LDR R2, [R1]
66                  BIC R2, R2, #0x01
67                  STR R2, [R1]
68                  B           FINISH
69
70
71
72  SECOND           LDR         R1,=TIMER1_TAR

```

```
73      LDR      R2,[R1]
74      B        POSEDGE
75
76  POSEDGE      SUB      R7,R6,R2
77                ;CMP      R6,R2
78                ;CPYHI    R6,R2
79                ;BHI      EXIT
80                ;SUB      R7,R2,R6
81                ;LDR      R0,=0X10000 ;FULL CYCLE
82                ;ADD      R7,R0
83      CPY      R6,R2
84      B        EXIT
85
86
87  CALC      LDR      R5,=34
88            LDR      R6,=3200
89            MUL      R7,R5
90            UDIV     R7,R6 ;MM DISTANCE
91            CPY      R4,R7
92            ;LDR      R5,=MSG
93            ;BL      OutStr
94            LDR      R5,=NUM
95            BL      CONVRT
96            LDR      R5,=NUM
97            BL      OutStr
98
99            MOV      R5,#0
100           MOV      R6,#0
101           MOV      R7,#0
102           LDR      R1,=TIMER0_CTL
103           LDR      R2,[R1]
104           ORR      R2,R2,#0x03 ; set bit0 to enable
105           STR      R2,[R1] ; and bit 1 to stall on debug
106           B        FINISH
107
108
109  EXIT      CMP      R5,#0X02
110           BEQ      CALC
111  FINISH    LDR      R0,=TIMER1_ICR
112           ORR      R1,#0X04 ;CLEAR BIT2, BECAUSE CAPTURE MODE
113           STR      R1,[R0]
114
115           B        LOOP
116
117           ENDP
118           END
119
```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                PULSE OF THE Q3                ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ; Pulse.s
6  ; Routine for creating a pulse train using interrupts
7  ; This uses Channel 0, and a 1MHz Timer Clock ( _TAPR = 15 )
8  ; Uses Timer1A to READ EDGES on PB4
9
10 ;Nested Vector Interrupt Controller registers
11 NVIC_EN0_INT19      EQU 0x00080000 ; Interrupt 19 enable
12 NVIC_EN0             EQU 0xE000E100 ; IRQ 0 to 31 Set Enable Register
13 NVIC_PRI4            EQU 0xE000E410 ; IRQ 16 to 19 Priority Register
14
15 ; 16/32 Timer Registers
16 TIMER0_CFG          EQU 0x40030000
17 TIMER0_TAMR         EQU 0x40030004
18 TIMER0_CTL          EQU 0x4003000C
19 TIMER0_IMR          EQU 0x40030018
20 TIMER0_RIS          EQU 0x4003001C ; Timer Interrupt Status
21 TIMER0_ICR          EQU 0x40030024 ; Timer Interrupt Clear
22 TIMER0_TAILR        EQU 0x40030028 ; Timer interval
23 TIMER0_TAPR         EQU 0x40030038
24 TIMER0_TAR          EQU 0x40030048 ; Timer register
25
26 ;GPIO Registers
27 GPIO_PORTF_DATA      EQU 0x40025010 ; Access BIT2
28 GPIO_PORTF_DIR       EQU 0x40025400 ; Port Direction
29 GPIO_PORTF_AFSEL     EQU 0x40025420 ; Alt Function enable
30 GPIO_PORTF_DEN       EQU 0x4002551C ; Digital Enable
31 GPIO_PORTF_AMSEL     EQU 0x40025528 ; Analog enable
32 GPIO_PORTF_PCTL      EQU 0x4002552C ; Alternate Functions
33
34 ;System Registers
35 SYSCCTL_RCGCGPIO     EQU 0x400FE608 ; GPIO Gate Control
36 SYSCCTL_RCGCTIMER    EQU 0x400FE604 ; GPTM Gate Control
37
38 ;-----
39 LOW                  EQU 0xFFFFFFFF
40 HIGH                 EQU 0x0000000F
41 ;-----
42
43         AREA      routines, CODE, READONLY
44         THUMB
45         IMPORT    DELAY100
46         EXPORT    My_Timer0A_Handler
47         EXPORT    PULSE_INIT
48
49 ;-----
50 My_Timer0A_Handler  PROC
51                     ;...
52                     ADD     R10,#1
53                     CMP     R10,#1
54                     BEQ     HIGHX
55
56
57 LOWX                LDR R0,=GPIO_PORTF_DATA
58                     LDR R1,[R0]
59                     MOV R1,#0
60                     STR R1,[R0]
61                     LDR R1,=TIMER0_TAILR ; initialize match clocks
62                     LDR R2,=LOW
63                     STR R2,[R1]
64                     MOV R10,#0
65                     B      EXIT
66
67 HIGHX               LDR R0,=GPIO_PORTF_DATA
68                     LDR R1,[R0]
69                     MOV R1,#4
70                     STR R1,[R0]
71                     LDR R1,=TIMER0_TAILR ; initialize match clocks
72                     LDR R2,=HIGH

```

```

73             STR R2, [R1]
74             B     EXIT
75
76 EXIT        LDR R0,=TIMER0_ICR
77             ORR R1,#0x01
78             STR R1,[R0]
79             BX   LR
80             ENDP
81 ;-----
82
83 PULSE_INIT  PROC
84             LDR R1, =SYSCTL_RCGCGPIO ; start GPIO clock
85             LDR R0, [R1]
86             ORR R0, R0, #0x20 ; set bit 5 for port F
87             STR R0, [R1]
88             NOP ; allow clock to settle
89             NOP
90             NOP
91             LDR R1, =GPIO_PORTF_DIR ; set direction of PF2
92             LDR R0, [R1]
93             ORR R0, R0, #0x04 ; set bit2 for output
94             STR R0, [R1]
95             LDR R1, =GPIO_PORTF_AFSEL ; regular port function
96             LDR R0, [R1]
97             BIC R0, R0, #0x04
98             STR R0, [R1]
99             LDR R1, =GPIO_PORTF_PCTL ; no alternate function
100            LDR R0, [R1]
101            BIC R0, R0, #0x00000F00
102            STR R0, [R1]
103            LDR R1, =GPIO_PORTF_AMSEL ; disable analog
104            MOV R0, #0
105            STR R0, [R1]
106            LDR R1, =GPIO_PORTF_DEN ; enable port digital
107            LDR R0, [R1]
108            ORR R0, R0, #0x04
109            STR R0, [R1]
110
111            PUSH {LR}
112            BL  DELAY100
113            POP {LR}
114            LDR R1, =SYSCTL_RCGCTIMER ; Start Timer0
115            LDR R2, [R1]
116            ORR R2, R2, #0x01
117            STR R2, [R1]
118            NOP ; allow clock to settle
119            NOP
120            NOP
121            LDR R1, =TIMER0_CTL ; disable timer during setup LDR R2, [R1]
122            BIC R2, R2, #0x01
123            STR R2, [R1]
124            LDR R1, =TIMER0_CFG ; set 16 bit mode
125            MOV R2, #0x04
126            STR R2, [R1]
127            LDR R1, =TIMER0_TAMR
128            MOV R2, #0x02 ; set to periodic, count down
129            STR R2, [R1]
130            LDR R1, =TIMER0_TAILR ; initialize match clocks
131            LDR R2, =LOW
132            STR R2, [R1]
133            LDR R1, =TIMER0_TAPR
134            MOV R2, #15 ; divide clock by 16 to
135            STR R2, [R1] ; get 1us clocks
136            LDR R1, =TIMER0_IMR ; enable timeout interrupt
137            MOV R2, #0x01
138            STR R2, [R1]
139 ; Configure interrupt priorities
140 ; Timer0A is interrupt #19.
141 ; Interrupts 16-19 are handled by NVIC register PRI4.
142 ; Interrupt 19 is controlled by bits 31:29 of PRI4.
143 ; set NVIC interrupt 19 to priority 2
144             LDR R1, =NVIC_PRI4

```



```
145         LDR R2, [R1]
146         AND R2, R2, #0x00FFFFFF ; clear interrupt 19 priority
147         ORR R2, R2, #0x40000000 ; set interrupt 19 priority to 2
148         STR R2, [R1]
149     ; NVIC has to be enabled
150     ; Interrupts 0-31 are handled by NVIC register EN0
151     ; Interrupt 19 is controlled by bit 19
152     ; enable interrupt 19 in NVIC
153         LDR R1, =NVIC_EN0
154         MOVT R2, #0x08 ; set bit 19 to enable interrupt 19
155         STR R2, [R1]
156     ; Enable timer
157         LDR R1, =TIMER0_CTL
158         LDR R2, [R1]
159         ORR R2, R2, #0x03 ; set bit0 to enable
160         STR R2, [R1] ; and bit 1 to stall on debug
161         BX LR ; return
162     ENDP
163     END
```

```

1  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2  ;                      ECHO OF THE Q3                      ;
3  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
4
5  ; edgeTimer.s
6  ; Uses Timer1A to COUNT EDGES on PB4
7
8  ;Nested Vector Interrupt Controller registers
9  NVIC_EN0_INT19      EQU 0x00080000 ; Interrupt 19 enable
10 NVIC_EN0             EQU 0xE000E100 ; IRQ 0 to 31 Set Enable Register
11 NVIC_PRI5            EQU 0xE000E414 ; IRQ 16 to 19 Priority Register
12
13 ; 16/32 Timer Registers
14 TIMER1_CFG           EQU 0x40031000
15 TIMER1_TAMR          EQU 0x40031004
16 TIMER1_CTL           EQU 0x4003100C
17 TIMER1_IMR           EQU 0x40031018
18 TIMER1_RIS           EQU 0x4003101C ; Timer Interrupt Status
19 TIMER1_ICR           EQU 0x40031024 ; Timer Interrupt Clear
20 TIMER1_TAILR         EQU 0x40031028 ; Timer interval
21 TIMER1_TAPR          EQU 0x40031038
22 TIMER1_TAR           EQU 0x40031048 ; Timer register
23
24 ;GPIO Registers
25 GPIO_PORTB_DATA      EQU 0x40005040 ; Access BIT4
26 GPIO_PORTB_DIR       EQU 0x40005400 ; Port Direction
27 GPIO_PORTB_AFSEL     EQU 0x40005420 ; Alt Function enable
28 GPIO_PORTB_DEN       EQU 0x4000551C ; Digital Enable
29 GPIO_PORTB_AMSEL     EQU 0x40005528 ; Analog enable
30 GPIO_PORTB_PCTL      EQU 0x4000552C ; Alternate Functions
31 GPIO_PORTB_PDR       EQU 0x40005514 ;PULL DOWN REGISTER
32
33
34 ;System Registers
35 SYSCTL_RCGCGPIO      EQU 0x400FE608 ; GPIO Gate Control
36 SYSCTL_RCGCTIMER    EQU 0x400FE604 ; GPTM Gate Control
37
38 ;-----
39 LOW                  EQU 0x00000100
40 HIGH                 EQU 0x00000040
41 ;-----
42
43         AREA      routines, CODE, READONLY
44         THUMB
45         ;EXPORT      My_Timer1A_Handler
46         EXPORT     EDGE_TIMER
47
48 ;-----
49 ;My_Timer1A_Handler PROC
50
51
52
53
54
55
56 ;EXIT          LDR R0,=TIMER1_ICR
57 ;              ORR R1,#0X04          ;CLEAR BIT2, BECAUSE CAPTURE MODE
58 ;              STR R1,[R0]
59 ;              BX  LR
60 ;              ENDP
61 ;-----
62
63 EDGE_TIMER  PROC
64             LDR R1, =SYSCTL_RCGCGPIO ; start GPIO clock
65             LDR R0, [R1]
66             ORR R0, R0, #0x02 ; set bit 1 for port B
67             STR R0, [R1]
68             NOP ; allow clock to settle
69             NOP
70             NOP
71             LDR R1, =GPIO_PORTB_DIR ; set direction of PB4
72             LDR R0, [R1]

```

```
73      BIC R0, R0, #0x10 ; SET BIT4 AS INPUT
74      STR R0, [R1]
75      LDR R1, =GPIO_PORTB_AFSEL ; ALTERNATE PB4
76      LDR R0, [R1]
77      ORR R0, R0, #0x10 ;PB4
78      STR R0, [R1]
79      LDR R1, =GPIO_PORTB_PCTL ; ALTERNATE PB4
80      LDR R0, [R1]
81      ORR R0, R0, #0x00070000 ;PB4
82      STR R0, [R1]
83      LDR R1, =GPIO_PORTB_AMSEL ; disable analog
84      MOV R0, #0
85      STR R0, [R1]
86      LDR R1, =GPIO_PORTB_DEN ; enable port digital
87      LDR R0, [R1]
88      ORR R0, R0, #0x10
89      STR R0, [R1]
90      LDR R1, =GPIO_PORTB_PDR ;PULL DOWN PB4
91      LDR R0, [R1]
92      ORR R0, #0x10
93      STR R0, [R1]
94
95      LDR R1, =SYSCTL_RCGCTIMER ; Start Timer1
96      LDR R2, [R1]
97      ORR R2, R2, #0x02
98      STR R2, [R1]
99      NOP ; allow clock to settle
100     NOP
101     NOP
102     LDR R1, =TIMER1_CTL ; disable timer during setup
103     LDR R2, [R1]
104     BIC R2, R2, #0x01
105     STR R2, [R1]
106     LDR R1, =TIMER1_CFG ; set 16 bit mode
107     MOV R2, #0x04
108     STR R2, [R1]
109     LDR R1, =TIMER1_TAMR
110     MOV R2, #0x07 ; CAPTURE, EDGE TIME, COUNT DOWN 00111
111     STR R2, [R1]
112     LDR R1, =TIMER1_TAILR ; initialize match clocks
113     LDR R2, =0xFFFF
114     STR R2, [R1]
115     LDR R1, =TIMER1_TAPR
116     MOV R2, #15 ; divide clock by 16 to
117     STR R2, [R1] ; get 1us clocks
118     ;LDR R1, =TIMER1_IMR ; enable timeout interrupt
119     ;MOV R2, #0x01
120     ;STR R2, [R1]
121     ; Configure interrupt priorities
122     ; Timer0A is interrupt #19.
123     ; Interrupts 16-19 are handled by NVIC register PRI4.
124     ; Interrupt 19 is controlled by bits 31:29 of PRI4.
125     ; set NVIC interrupt 19 to priority 2
126     ;LDR R1, =NVIC_PRI5
127     ;LDR R2, [R1]
128     ;AND R2, R2, #0xFFFF00FF ; clear interrupt 21 priority
129     ;ORR R2, R2, #0x00004000 ; set interrupt 21 priority to 2
130     ;STR R2, [R1]
131     ; NVIC has to be enabled
132     ; Interrupts 0-31 are handled by NVIC register EN0
133     ; Interrupt 19 is controlled by bit 19
134     ; enable interrupt 19 in NVIC
135     ;LDR R1, =NVIC_EN0
136     ;MOVT R2, #0x20 ; set bit 21 to enable interrupt 21
137     ;STR R2, [R1]
138     ; Enable timer
139     LDR R1, =TIMER1_CTL
140     LDR R2, [R1]
141     ORR R2, R2, #0x0F ; set bit0 to enable
142     STR R2, [R1] ; and bit 1 to stall on debug, SET BIT 3:2 TO DETECT BOTH EDGES
143     BX LR ; return
144     ENDP
```

145

END

146