

```

1  ;*****
2  ; Program pulse_probe.s
3
4
5  ;*****
6  ; EQU Directives
7
8  ;*****
9  ;LABEL      DIRECTIVE    VALUE      COMMENTS
10 TIMER1_CFG      EQU 0x40031000
11 TIMER1_TAMR     EQU 0x40031004
12 TIMER1_CTL      EQU 0x4003100C
13 TIMER1_IMR      EQU 0x40031018
14 TIMER1_RIS      EQU 0x4003101C ; Timer Interrupt Status
15 TIMER1_ICR      EQU 0x40031024 ; Timer Interrupt Clear
16 TIMER1_TAILR    EQU 0x40031028 ; Timer interval
17 TIMER1_TAMATCHR EQU 0x40031030 ; Match Register
18 TIMER1_TAPR     EQU 0x40031038
19 TIMER1_TAR      EQU 0x40031048 ; Timer register
20
21 ;GPIO Registers
22 GPIO_PORTB_DATA EQU 0x40005040 ; Access PB4
23 GPIO_PORTB_DIR  EQU 0x40005400 ; Port Direction
24 GPIO_PORTB_AFSEL EQU 0x40005420 ; Alt Function enable
25 GPIO_PORTB_DEN  EQU 0x4000551C ; Digital Enable
26 GPIO_PORTB_AMSEL EQU 0x40005528 ; Analog enable
27 GPIO_PORTB_PCTL EQU 0x4000552C ; Alternate Functions
28
29 ;System Registers
30 SYSCCTL_RCGCGPIO EQU 0x400FE608 ; GPIO Gate Control
31 SYSCCTL_RCGCTIMER EQU 0x400FE604 ; GPTM Gate Control
32
33 ;*****
34 ;LABEL      DIRECTIVE    VALUE      COMMENT
35             AREA          main, READONLY, CODE
36 THUMB
37 EXTERN      My_Timer0A_Handler ; Reference external subroutines
38 EXTERN      PULSE_INIT        ;
39 EXTERN      PULSE_PROBE
40 EXTERN      My_Timer1A_Handler
41 EXTERN      CONVRT
42 EXPORT      __main            ; Make available
43
44 __main      BL              PULSE_INIT
45
46             LDR R1, =SYSCCTL_RCGCGPIO ; start GPIO clock
47             LDR R0, [R1]
48             ORR R0, R0, #0x02 ; set bit 2 for port B
49             STR R0, [R1]
50             NOP ; allow clock to settle
51             NOP
52             NOP
53             LDR R1, =GPIO_PORTB_DIR ; set direction of PB4
54             LDR R0, [R1]
55             BIC R0, #0x10 ; clear bit 4 for INPUT
56             STR R0, [R1]
57
58             LDR R1, =GPIO_PORTB_AFSEL ; enable port function
59             LDR R0, [R1]
60             ORR R0, #0x10 ; set bit4 for alternate fuction on PB4
61             STR R0, [R1]
62             ; Set bits 27:24 of PCTL to 7 to enable TIMER1A on PB4
63             LDR R1, =GPIO_PORTB_PCTL
64             LDR R0, [R1]
65             ORR R0, R0, #0x00070000
66             STR R0, [R1]
67             ; clear AMSEL to disable analog
68             LDR R1, =GPIO_PORTB_AMSEL
69             MOV R0, #0
70             STR R0, [R1]
71
72             LDR R1, =GPIO_PORTB_DEN ; enable port digital
73             LDR R0, [R1]
74             ORR R0, R0, #0x10
75             STR R0, [R1]
76
77             LDR R1, =SYSCCTL_RCGCTIMER ; Start Timer1

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78         LDR R2, [R1]
79         ORR R2, R2, #0x02
80         STR R2, [R1]
81         NOP ; allow clock to settle
82         NOP
83         NOP
84
85         LDR R1, =TIMER1_CTL ; disable timer during setup
86         LDR R2, [R1]
87         BIC R2, R2, #0x01
88         STR R2, [R1]
89     ; set to 16bit Timer Mode
90         LDR R1, =TIMER1_CFG
91         MOV R2, #0x04 ; set bits 2:0 to 0x04 for 16bit timer
92         STR R2, [R1]
93     ; set to EDGE TIME, count DOWN
94         LDR R1, =TIMER1_TAMR
95         MOV R2, #0x1F
96         STR R2, [R1]
97     ; set edge detection to both
98         LDR R1, =TIMER1_CTL
99         LDR R2, [R1]
100        ORR R2, R2, #0x0E ; set bits 3:2 to 0x03
101        STR R2, [R1]
102
103        LDR R1, =TIMER1_TAPR
104        MOV R2, #15 ; divide clock by 16 to
105        STR R2, [R1] ; get 1us clocks
106        ; set start value
107        LDR R1, =TIMER1_TAILR
108        LDR R2, =0xFFFFFFFF
109        STR R2, [R1]
110
111        LDR R1, =TIMER1_IMR ; disable timeout interrupt
112        MOV R2, #0x00
113        STR R2, [R1]
114
115    ; Enable timer
116        LDR R1, =TIMER1_CTL
117        LDR R2, [R1]
118        ORR R2, R2, #0x01 ; set bit0 to enable, bit 1 to stall on debug
119        STR R2, [R1] ; and bit2:3 to trigger on BOTH EDGES
120
121
122        ; Await edge capture event
123    loop    LDR R1, =TIMER1_RIS
124           LDR R2, [R1]
125           ANDS R2, #0x04 ; isolate CAERIS bit
126           BEQ loop ; if no capture, then loop
127
128           LDR R0, =GPIO_PORTB_DATA
129           LDR R0, [R0]
130           AND R0, #0x10
131           CMP R0, #0x10
132           BNE _negedge
133
134    _posedge    LDR R1, =TIMER1_RIS
135               LDR R2, [R1]
136               ANDS R2, #0x01 ; isolate TATORIS bit
137               BNE skip
138
139    skip        LDR R0, =TIMER1_TAR
140               LDR R0, [R0]
141               MOV R11, R0
142               ; PULSE WIDTH
143               SUB R7, R12, R11
144               PUSH {LR}
145               BL CONVRT
146               POP {LR}
147               ; PERIOD
148               SUB R7, R11, R0
149               PUSH {LR}
150               BL CONVRT
151               POP {LR}
152               ; DUTY CYCLE
153               UDIV R7, R1, R7
154               MOV R2, #100

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```
155         MUL R7, R2
156         PUSH {LR}
157         BL  CONVRT
158         POP {LR}
159
160
161         B    finish
162
163 _negedge
164         LDR R1, =TIMER1_RIS
165         LDR R2, [R1]
166         ANDS R2, #0x01 ; isolate TATORIS bit
167         ; BNE skip
168
169         LDR R0, =TIMER1_TAR
170         LDR R0, [R0]
171         MOV R12, R0
172
173 finish    LDR R0, =TIMER1_ICR ; clear interrupt flag
174         MOV R1, #0x05
175         STR R1, [R0]
176
177         B    loop
178
179
180         END
181
```