Logic Switch with Clock Generator

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APPLICATION OPERATION

The first application of my Logic Switch is to help prototypes of digital circuit. There are two main functions:

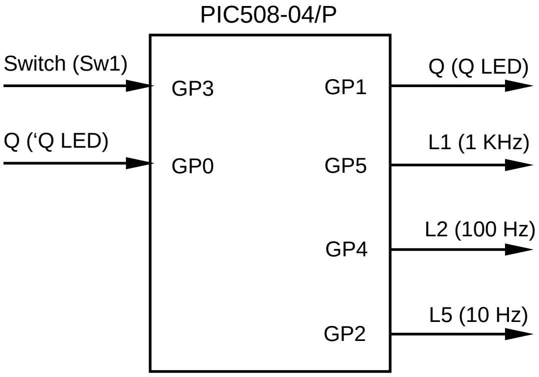
1 – Logic Level Generator

The momentary switch acts as a debounced switch. Each time you press the switch the outputs toggle. There are also two led indictors to show the state of the outputs Q and ‘Q.

2 – Clock Generator

To enter or exit this mode you need to press the switch at least 2 seconds. The first time you enter this mode the outputs oscillate at 1 Hz. Pressing again will change frequency to 10 Hz (LED L5 On). Pressing a second time for 100 Hz (LED L2 On) and a third time for 1 KHz (LED L1 On). Pressing the switch again will reset frequency to 1 Hz. Note that duty cycle is 50% for all frequencies.

BLOCK DIAGRAM



MICROCHIP HARDWARE DEVELOPMENT TOOLS USED

Assemble/Complier version:

MPlab 3.22, MPasm 1.5

BILL OF MATERIAL

Part	Description
C1	Ceramic Capacitor 0.1uF 50v
R1-R2 R4-R6	680 Ohms resistor 1/4 watt
R3	4.7 K Ohms resistor 1/4 watt
L1-L2-L5	Rectangular LED (2mm x 5mm)
L3-L4	Round LED T1 3/4
SW1	Momentary Switch E-Switch #520-03-1
U1	PIC12C508-04/P

APPENDIX A: SOURCE CODE

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;***************************************************************
;
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;   Project: Logic Switch
;   date   : august 23  1997
;
;***************************************************************


list p=12c508, f=inhx8m ;uC number
                                             ;and inhx8m output format file

decfreq     equ 0x07    ;low register use for frequency generation
decfreqh    equ 0x0e    ;high register use for frequency generation
freqscale   equ 0x08    ;low prescale value for frequency generation
freqscaleh  equ 0x0f    ;high prescale value for frequency generation
                        ;1  =  1 Khz
                                             ;10 =100 Hz
                                             ;100= 10 Hz
                                             ;1000=  1 Hz     3e8  hexa
timeswp     equ 0x09    ;switch time pressed
                                             ;each unit = 16 msec
swcourte    equ 0x0a    ;1 = switch pressed detected
swprescale  equ 0x0b    ;switch prescale 0 to 31 = 16 msec
funct       equ 0x0c    ;0 = 0 logic output (stable)
                                             ;1 = 1 logic output (stable)
                ;2 = output = freq 1 Hz
                ;3 = output = freq 10 Hz
                ;4 = output = freq 100 Hz
                ;5 = output = freq 1 KHz

functtmp    equ 0x0d    ;temp register

gpio        equ 0x06    ;adrs  io
tmr0        equ 0x01;adrs  timer
status      equ 0x03    ;status register adrs
osccal           equ 0x05;oscillator calibration register

             org        0000
        ;begin init

begin
             movwf      osccal               ;save oscillator calibration value

             movlw      0x08    ;gp0 gp1 gp2 gp4 gp5 output  gp3 input
             tris       6                    ;
        movlw   0xd1    ;prescale =1/4 for RC internal
             option     ;
             clrf    decfreqh;
             clrf    decfreq ;
             clrf       freqscaleh;0 = freq. stop
             clrf       freqscale;0 = freq. stop
             clrf       timeswp ;time switch pressed = 0
             clrf       swcourte
             clrf       funct   ;function = 0 = ouput = 0
             movlw   0x1f    ;31 decimal
             movwf   swprescale;init prescale switch pressed to 31
             movlw      0x36                 ;logic 0 on gpi0 and 1 on gpi1
                                             ;gp2, gp4 et gp5 at 1 log ->led freq. off
             movwf      gpio
             movlw      0x05                 ;init value for timer0
             movwf      tmr0
             ;end init

             ;begin master prog
princ   btfsstmr0,07    ;test bit 7 of tmr0
             goto       princ                ;wait until tmr0 = 128

             ;each 500 Usec the program will go here
             movlw      0x05                 ;init value of tmr0 to 5 to give a  good 500 usec
                                             ;for time base
             movwf      tmr0
             movf    freqscale,0;mov freqscale in w
             btfss      status,2;check the z bit in status
             goto       freqact ;if freqscale <> 0 the freq. is running

             ;here the freq. is off and a logic 0 or 1 is steady to the output

suite        btfss      gpio,3               ;test switch pressed=1 log  open=0 log.
             goto       open                 ;

             ;goto here if switch pressed ---> gp3 = 1 log.
             decfsz     swprescale,1;var decrement from  31 to 0
             goto       princ                ;if <> 0 we return to princ

             ;here the switch is pressed since 16 msec
             movlw      0x1f                 ;value 31 decimal
             movwf      swprescale;re-init swprescale to 31
             incf       timeswp              ;inc value time switch pressed
             btfsc      timeswp,2;test if timeswp = 4  (64 msec pressed ?)
             goto       rendu4               ;branch if timeswp = 4 (from 4 to 7 it’s ok)

             ;here we check the 2 second switch pressed
             movlw      0x80                 ;w <-- 128  for 2 sec.
             subwf      timeswp,0;compare w and timeswp
             btfss      status,2;skip if z bit = 1
             goto       princ                ;if z bit = 0  the switch not pressed for 2 second

             ;here the switch is pressed since 2 second
             movf       freqscale,1;move to affect the z flag
             btfss      status,2;skip if z flag is 1
             goto       tologic;if z is 0 then freqscale<>0 then freq is running

             ;here the logic mode is on... we stop it to make a freq. running
             bcf        gpio,5               ;led 1 KHz on
             movlw      0x05                 ;5 = 1 Khz
             movwf      funct                ;funct = 5 = 1 KHz
             movlw      0xc8                 ;c8 = 200 dec. prescale before output toggle
             movwf      freqscale
             movwf      decfreq
             clrf       freqscaleh
             clrf       decfreqh
scansw
             btfsc      gpio,3               ;test if switch open
             goto       scansw               ;scan while sw not open
             movlw      0x1f                 ;31 decimal
             movwf      swprescale;re-init prescale
             clrf       timeswp              ;time switch pressed

             goto       princ                ;return to princ to scan tmr0
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tologic                                 ;here the freq. will be stopped and
                                        ;a steady logic 0 will be at the output
             clrf       funct           ;function = 0
             clrf       freqscale;deactive the frequency
             clrf       freqscaleh;
             movlw      0x36            ;output gpi0 = 0    gpi1 (inverse)= 1
                                        ;and frequency led OFF
             goto       princ           ;return to master program to scan tmr0


rendu4                                  ;branch here when the switch is pressed for 64 msec
             movlw      0x01            ;
             movwf      swcourte;init variable swcourte to 1  (the switch is good)
             goto       princ           ;reture to master program to scan tmr0

;-------------------------------------------------------------------
open                                    ;jump here when the switch in not pressed
             movlw      0x1f            ;31 decimal
             movwf      swprescale;re-init prescale for switch
             clrf       timeswp         ;reset timeswp because swith is open
             movf       swcourte,1;check if swcourte=0
             btfsc      status,2;test le z flag si 0 logique
             goto       princ           ;branch if z flag equal 1 log.

             ;here swcourte = 1 log. then switch good
             clrf       swcourte;reset swcourteto 0
             movf       funct,0         ;move funct in w register
             movwf      functtmp;put a copy of funct in functtmp
             btfsc      status,2;check the z flag
             goto       funct1          ;if z = 1 then branche to funct1
             decf       functtmp,1
             btfsc      status,2;check z flag
             goto       funct0          ;if z = 1 then branch to funct0
             decf       functtmp,1
             btfsc      status,2;check z flag
             goto       funct3          ;if z = 1 then branch to funct3
             decf       functtmp,1
             btfsc      status,2;check z flag
             goto       funct4          ;if z = 1 then branch to funct4
             decf       functtmp,1
             btfsc      status,2;check z flag
             goto       funct5          ;if z = 1 then branch to funct5

             ;here the function if 5

                                        ;here the next funct will be 2 --> 1 Hz
             movlw      0x02
             movwf      funct           ;function = 2 now
             movlw      0xe8            ;3e8 = 1000 dec
             movwf      freqscale
             movwf      decfreq
             movlw      0x03
             movwf      freqscaleh
             movwf      decfreqh;
             bsf        gpio,5          ;led 500-1000 Hz  off.  no led for 1 Hz rate

             goto       princ           ;return to main program to scan tmr0


funct1                  ;here the active function will be 1
             incf       funct,1         ;funct = 1
             movlw      0x35            ;output = 1 and leds off
             movwf      gpio            ;
             goto       princ           ;return to main program to scan tmr0

funct0                  ;here the active function will be 0
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             clrf       funct                ;funct = 0
             movlw      0x36                 ;output q= 0
             movwf      gpio                 ;
             goto       princ                ;return to main program to scan tmr0

funct3                  ;here the active function will be 3   10 Hz
             incf       funct                ;incremente funct --> 3
             movlw      0x64                 ;64 = 100 dec
             movwf      freqscale
             movwf      decfreq
             clrf       freqscaleh
             clrf       decfreqh;reset high byte
             bcf        gpio,2               ;led 10 Hz on
             goto       princ                ;return to main program to scan tmr0

funct4                  ;here the active function will be 4   100Hz
             incf       funct                ;incremente funct --> 4
             movlw      0x0a                 ;0a = 10 dec
             movwf      freqscale
             movwf      decfreq
             clrf       freqscaleh
             clrf       decfreqh;reset high byte
             bsf        gpio,2               ;led 10Hz off
             bcf        gpio,4               ;led 100 Hz on
             goto       princ                ;return to main program to scan tmr0

funct5                  ;here the active function will be 5   1000 Hz
             incf       funct                ;incremente funct --> 5
             movlw      0x01                 ;01 = 1 dec = 1 KHz
             movwf      freqscale
             movwf      decfreq
             clrf       freqscaleh
             clrf       decfreqh;reset high byte
             bsf        gpio,4               ;led 100 Hz off
             bcf        gpio,5               ;led 1000 Hz on

             goto       princ                ;return to main program to scan tmr0


;------------------------------------------------------------------

freqact                                      ;here frequency mode is active
             decf       decfreq,1;decremente decfreq
             btfss      status,2;test z flag
             goto       suite                ;branche if z <> 0

             movf       decfreqh,0;check high byte if = 0
             btfss      status,2;check z flag
             goto       decfreqhigh;branch if > 0

             ;here we toggle the output
             movf       gpio,0               ;load w with gpio : clock out
             xorlw      0x03                 ;2 last bits to toggle
             movwf      gpio                 ;
             movf       freqscale,0;freqscale --> w
             movwf      decfreq              ;re-init decfreq for next toggle
             movf       freqscaleh,0
             movwf      decfreqh;init byte high
             goto       suite

decfreqhigh
             decf       decfreqh,1;decremente byte high
             goto       suite

             end
```

NOTES: