Discrete Logic Replacement

Logic Switch with Clock Generator

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APPLICATION OPERATION:

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

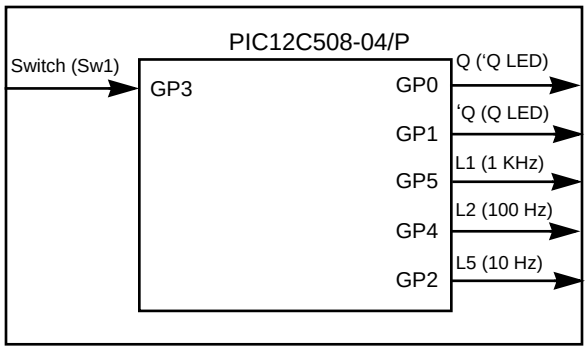
1 - Logic Level Generator:

The momentary switch acts as a debounced switch. Each time you press the switch the outputs toggle. There are also two LED indicators 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 the 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:



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
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                movwf     tmr0
                ;end init
                ;begin master prog
princ           btfss     tmr0,07          ;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
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
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                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
                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
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                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: