Discrete Logic Replacement

Melody Player

Author: *Slav Slavov*
Sliven
email: ell@sliven.osf.acad.bg

APPLICATION OPERATION :

This application generates a melody. It was a little bit difficult to place the tables because of the program counter's 8 bits, but I found a way to do this. There are 8 melodies programmed in the PIC12C509 device. When you push the button a melody is played. Every melody finishes with "retlw 0x0" which is the mark to stop playing. When the button is pressed again the next melody is played.

There are two software generators of 7.5Hz and 100KHz. The first defines the continuation of the played note and the second gives the frequency of the played note.

The 7.5Hz generator uses TMR0 and two flags (Flag.0 and Flag.1) to make the frequency.

The 100KHz generator uses 10 instruction cycles to make the frequency.

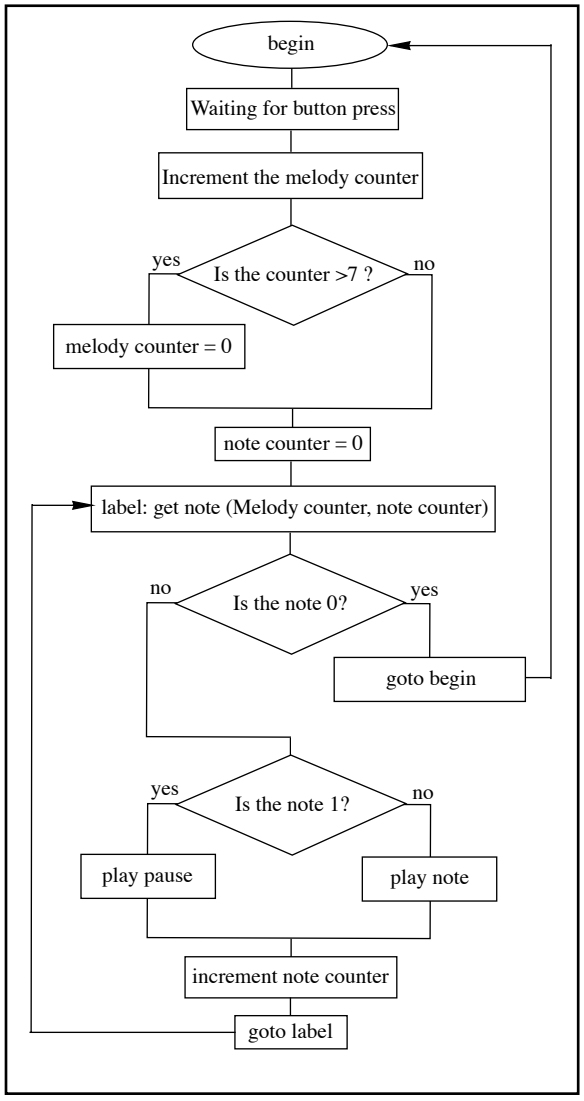
Here is a table of the used frequencies:

B	0xCA	0x65	0x33
A#	0xD6	0x6B	0x36
A	0xE4	0x72	0x39
G#	0xF0	0x78	0x3C
G	0xFF	0x80	0x40
F#		0x87	0x44
F		0x8F	0x48
E		0x98	0x4C
D#		0xA1	0x50
D		0xAA	0x55
C#		0xB4	0x5A
C		0xBF	0x60

code 0x01 is used for pause

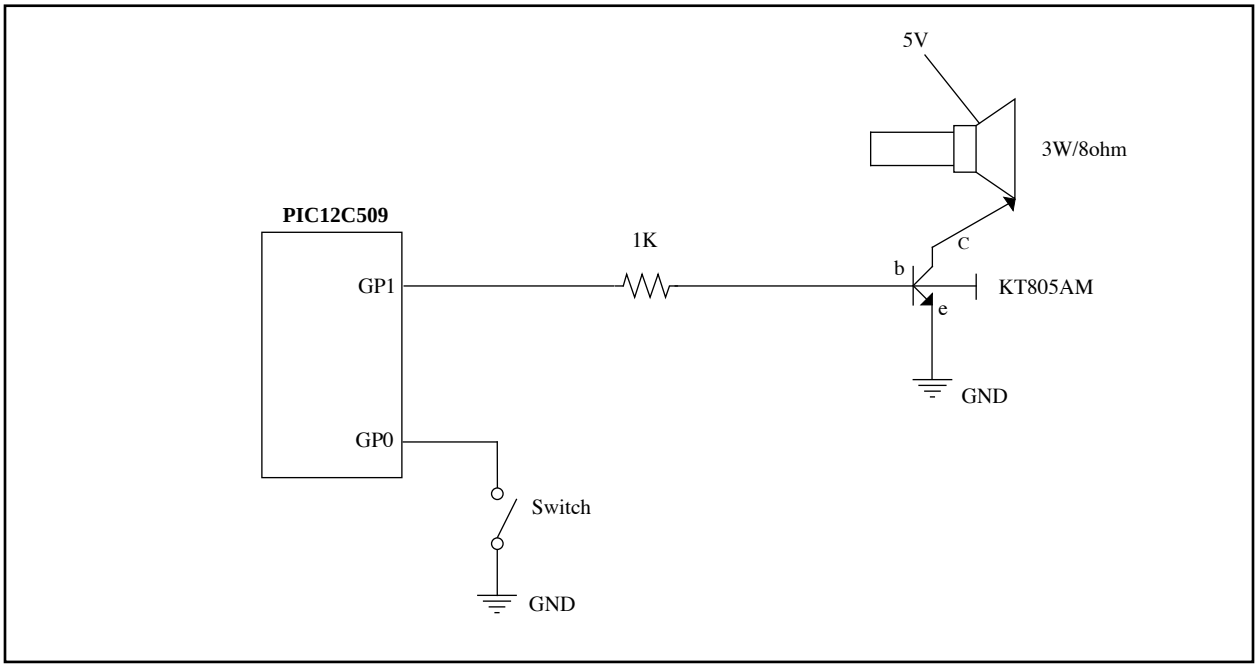
code 0x00 is used for stop mark

Flow Chart:



Discrete Logic Replacement

Graphical hardware representation:



Bill of Materials (BOM):

Part#	Manufacturer
PIC12C509	MICROCHIP
Switch	
Speaker	
Resistor 1K	
KT805AM	

APPENDIX A: SOURCE CODE

```
;*****************************************************************
;                         MLDY509.ASM
;
;*****************************************************************


        LIST    p=12C509

#include         "..\inc\p12c509.inc"


                __config  _WDT_OFF & _IntRC_OSC & _MCLRE_OFF & _CP_OFF

RAM             equ       0x07             ;Begining of RAM

NumSongs        equ       .8

Out             equ       GPIO
Speaker         equ       2
In              equ       GPIO
Btn             equ       0


         cblock           RAM

                Counter
                Flag
                Dta
                Melody
                Note
                Count1
                Count2
         endc

         org     0x00

         goto    begin


ProgLp:
         goto    ProgLoop
;-----------------------------------------

GetNote:
         bcf     STATUS,5
         bcf     STATUS,C
         rlf     Melody,W
         addwf   PCL,F

         bcf     STATUS,5
         goto    Melody1
         bcf     STATUS,5
         goto    Melody2
         bcf     STATUS,5
         goto    Melody3
         bcf     STATUS,5
         goto    Melody4

         bsf     STATUS,5
         goto    Melody5
         bsf     STATUS,5
         goto    Melody6
         bsf     STATUS,5
         goto    Melody7
```

```
                bsf     STATUS,5
                goto    Melody8

;---------------------------------------
; PINCO
;---------------------------------------

Melody1:
                movf    Note,W
                addwf   PCL,F
                retlw   0xCA
                retlw   0xBF
                retlw   0x01
                retlw   0x01
                retlw   0x01
                retlw   0x01
                retlw   0xAA
                retlw   0xA1
                retlw   0x01
                retlw   0x01
                retlw   0x01
                retlw   0x01
                retlw   0xCC
                retlw   0xBF
                retlw   0x01
                retlw   0xAA
                retlw   0xA1
                retlw   0x01
                retlw   0x78
                retlw   0x80
                retlw   0x01
                retlw   0xBF
                retlw   0xA1
                retlw   0x01
                retlw   0x80
                retlw   0x87
                retlw   0x87
                retlw   0x87
                retlw   0x87
                retlw   0x87
                retlw   0x01

                retlw   0x01
                retlw   0x87
                retlw   0x8F
                retlw   0xA1
                retlw   0xBF
                retlw   0xD6
                retlw   0xBF
                retlw   0xBF
                retlw   0xBF
                retlw   0xBF
                retlw   0xBF
                retlw   0xBF
                retlw   0

;-----------------------------------------
;               MENDELSON
;-----------------------------------------
Melody2:
                movf    Note,W
                addwf   PCL,F
                retlw   0x48
                retlw   0x48
                retlw   0x48
                retlw   0x48
```

```
                retlw    0x4C
                retlw    0x4C
                retlw    0x4C
                retlw    0x65
                retlw    0x55
                retlw    0x55
                retlw    0x60
                retlw    0x60
                retlw    0x6B
                retlw    0x6B
                retlw    0x80
                retlw    0x80
                retlw    0x8F
                retlw    0x8F
                retlw    0x98
                retlw    0x8F
                retlw    0x80
                retlw    0x80
                retlw    0x8F
                retlw    0x80
                retlw    0x72
                retlw    0x72
                retlw    0x8F
                retlw    0x72
                retlw    0x60
                retlw    0x8F
                retlw    0x72
                retlw    0x60
                retlw    0x48
                retlw    0x48
                retlw    0x48
                retlw    0x48
                retlw    0x4C
                retlw    0x4C
                retlw    0x4C
                retlw    0x65
                retlw    0x55
                retlw    0x55
                retlw    0x60
                retlw    0x60
                retlw    0x6B
                retlw    0x6B
                retlw    0x80
                retlw    0x80
                retlw    0x8F
                retlw    0x8F
                retlw    0x98
                retlw    0x8F
                retlw    0x72
                retlw    0x72
                retlw    0x80
                retlw    0x72
                retlw    0x80
                retlw    0x80
                retlw    0x80
                retlw    0x80
                retlw    0x8F
                retlw    0x8F
                retlw    0x8F
                retlw    0x8F
                retlw    0x0

;-------------------------------------------------------
;               A MELODY I
;-------------------------------------------------------
```

```
Melody3:
                movf     Note,W
                addwf    PCL,F
                retlw    0x80
                retlw    0x80
                retlw    0x65
                retlw    0x65
                retlw    0x60
                retlw    0x60
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x80
                retlw    0x80
                retlw    0x65
                retlw    0x65
                retlw    0x60
                retlw    0x60
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x80
                retlw    0x80
                retlw    0x65
                retlw    0x65
                retlw    0x60
                retlw    0x60
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x80
                retlw    0x80
                retlw    0x80
                retlw    0x80
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x0


;-------------------------------------------------------
;               ENGLISH WALTZ
;-------------------------------------------------------
Melody4:
                movf     Note,W
                addwf    PCL,F
                retlw    0x80
                retlw    0x80
                retlw    0x80
                retlw    0x4C
```

```
                retlw   0x4C
                retlw   0x4C
                retlw   0x55
                retlw   0x55
                retlw   0x55
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x55
                retlw   0x55
                retlw   0x55
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x72
                retlw   0x72
                retlw   0x72
                retlw   0x80
                retlw   0x80
                retlw   0x80
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x98
                retlw   0x80
                retlw   0x80
                retlw   0x80
                retlw   0x4C
                retlw   0x4C
                retlw   0x4C
                retlw   0x55
                retlw   0x55
                retlw   0x55
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x65
                retlw   0x65
                retlw   0x65
                retlw   0x60
                retlw   0x60
                retlw   0x60
                retlw   0x55
                retlw   0x55
                retlw   0x55
                retlw   0x0


                org     0x100
begin:
                movwf   OSCCAL                  ;calibrating the internal oscillator

                clrf    GPIO

                movlw   B'00111011'
```

```
                TRIS    GPIO

                movlw   B'10000111'
                OPTION

                clrf    Melody
main:

                btfsc   In,Btn
                goto    $-1

                clrf    Count1
                movlw   .52
                movwf   Count2
Loop
                decfsz  Count1,F
                goto    $-1

                decfsz  Count2,F
                goto    Loop

                btfsc   In,Btn
                goto    main
                btfsc   In,Btn
                goto    main

                incf    Melody,F
                movlw   NumSongs
                subwf   Melody,w
                btfsc   STATUS,C
                clrf    Melody

                clrf    Note
Loop1:
                call    GetNote
                movwf   Dta

                movf    Dta,F
                btfsc   STATUS,Z
                goto    main

                incf    Note,F
                clrf    Flag
                call    ProgLp
                goto    Loop1

;-------------------------------------------------
;               Software cycle for 10 us that implements
;  the hardware generator of 100KHz. Also a timer
;  for about 7.5Hz is made for the continuation of the
;  notes that are played.
;
;-------------------------------------------------

ProgLoop:

                movf    Dta,W
                movwf   Counter
                xorlw   1
                btfss   STATUS,Z
                bsf     Out,Speaker             ;sets the output to high

;-----------------------------------
;100KHz (10us) generator

ProgLoop1:
```

```
                btfsc    TMR0,7
                bsf      Flag,0

                btfss    Flag,0
                goto     ProgDelay1

                movf     TMR0,W
                btfsc    STATUS,Z
                bsf      Flag,1

BackProgDelay1:

                decfsz   Counter,F
                goto     ProgLoop1
                goto     Prog2

ProgDelay1:
                goto     BackProgDelay1
;
;-------------------------------------


Prog2:
                movf     Dta,W
                movwf    Counter

                bcf      Out,Speaker             ;sets the output to low

ProgLoop2:

                btfsc    TMR0,7
                bsf      Flag,0

                btfss    Flag,0
                goto     ProgDelay2

                movf     TMR0,W
                btfsc    STATUS,Z
                bsf      Flag,1

BackProgDelay2:

                decfsz   Counter,F
                goto     ProgLoop2
                goto     ProgLoop3

ProgDelay2:
                goto     BackProgDelay2

ProgLoop3
                btfss    Flag,1
                goto     ProgLoop

                btfsc    Flag,7
                return
                clrf     Flag
                bsf      Flag,7
                goto     ProgLoop


                org      0x200

;-------------------------------------------------------
;               SLEEP BABE SLEEP
;-------------------------------------------------------
Melody5:
```

```
movf     Note,W
addwf    PCL,F
retlw    0x65
retlw    0x65
retlw    0x65
retlw    0x65
retlw    0x80
retlw    0x80
retlw    0x80
retlw    0x80
retlw    0x72
retlw    0x72
retlw    0x72
retlw    0x72
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x87
retlw    0x87
retlw    0x98
retlw    0x98
retlw    0xAA
retlw    0xAA
retlw    0x87
retlw    0x87
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0xAA
retlw    0xAA
retlw    0xAA
retlw    0xAA
retlw    0x65
retlw    0x65
retlw    0x65
retlw    0x65
retlw    0x80
retlw    0x80
retlw    0x80
retlw    0x80
retlw    0x72
retlw    0x72
retlw    0x72
retlw    0x72
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x87
retlw    0x87
retlw    0x98
retlw    0x98
retlw    0xAA
retlw    0xAA
retlw    0x87
retlw    0x87
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0x98
retlw    0xAA
retlw    0xAA
retlw    0xAA
retlw    0xAA
```

```
                retlw    0x0

;-------------------------------------------------------
;               A MELODY II
;-------------------------------------------------------
Melody6:
                movf     Note,W
                addwf    PCL,F
                retlw    0x84
                retlw    0xB4
                retlw    0xB4
                retlw    0xB4
                retlw    0x8F
                retlw    0x8F
                retlw    0x78
                retlw    0x78
                retlw    0x6B
                retlw    0x6B
                retlw    0x6B
                retlw    0x8F
                retlw    0x6B
                retlw    0x6B
                retlw    0x6B
                retlw    0x6B
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x50
                retlw    0x50
                retlw    0x78
                retlw    0x78
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x6B
                retlw    0x6B
                retlw    0x6B
                retlw    0x6B
                retlw    0x5A
                retlw    0x5A
                retlw    0x6B
                retlw    0x6B
                retlw    0x78
                retlw    0x78
                retlw    0x6B
                retlw    0x6B
                retlw    0x60
                retlw    0x60
                retlw    0x5A
                retlw    0x5A
                retlw    0x48
                retlw    0x78
                retlw    0x80
                retlw    0x78
                retlw    0x50
                retlw    0x78
                retlw    0x80
                retlw    0x78
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
                retlw    0x5A
```

```
                retlw    0x0


;-------------------------------------------------------
;               FINAL COUNTDOWN
;-------------------------------------------------------
Melody7:
                movf     Note,W
                addwf    PCL,F
                retlw    0x4C
                retlw    0x55
                retlw    0x4C
                retlw    0x4C
                retlw    0x4C
                retlw    0x4C
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x48
                retlw    0x4C
                retlw    0x4C
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x55
                retlw    0x01
                retlw    0x01
                retlw    0x48
                retlw    0x4C
                retlw    0x48
                retlw    0x48
                retlw    0x48
                retlw    0x48
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x72
                retlw    0x4C
                retlw    0x55
                retlw    0x4C
                retlw    0x4C
                retlw    0x60
                retlw    0x60
                retlw    0x65
                retlw    0x65
                retlw    0x55
                retlw    0x55
                retlw    0x60
                retlw    0x60
                retlw    0x60
                retlw    0x60
                retlw    0x0
```

```
;-------------------------------------------------------
;               IN THE MORNING
;-------------------------------------------------------
Melody8:
                movf     Note,W
                addwf    PCL,F
                retlw    0x98
                retlw    0x98
                retlw    0x87
                retlw    0x87
                retlw    0x78
                retlw    0x78
                retlw    0x98
                retlw    0x98
                retlw    0x98
                retlw    0x98
                retlw    0x87
                retlw    0x87
                retlw    0x78
                retlw    0x78
                retlw    0x98
                retlw    0x98
                retlw    0x78
                retlw    0x78
                retlw    0x72
                retlw    0x72
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x78
                retlw    0x78
                retlw    0x72
                retlw    0x72
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x65
                retlw    0x5A
                retlw    0x65
                retlw    0x72
                retlw    0x78
                retlw    0x78
                retlw    0x98
                retlw    0x98
                retlw    0x65
                retlw    0x5A
                retlw    0x65
                retlw    0x72
                retlw    0x78
                retlw    0x78
                retlw    0x98
                retlw    0x98
                retlw    0x87
                retlw    0x87
                retlw    0xA1
                retlw    0xA1
                retlw    0x98
                retlw    0x98
                retlw    0x98
                retlw    0x98
                retlw    0x87
                retlw    0x87
                retlw    0xA1
                retlw    0xA1
```

```
        retlw   0x98
        retlw   0x98
        retlw   0x98
        retlw   0x98
        retlw   0x0


        END
```