



Discrete Logic Replacement

Melody Player

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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.

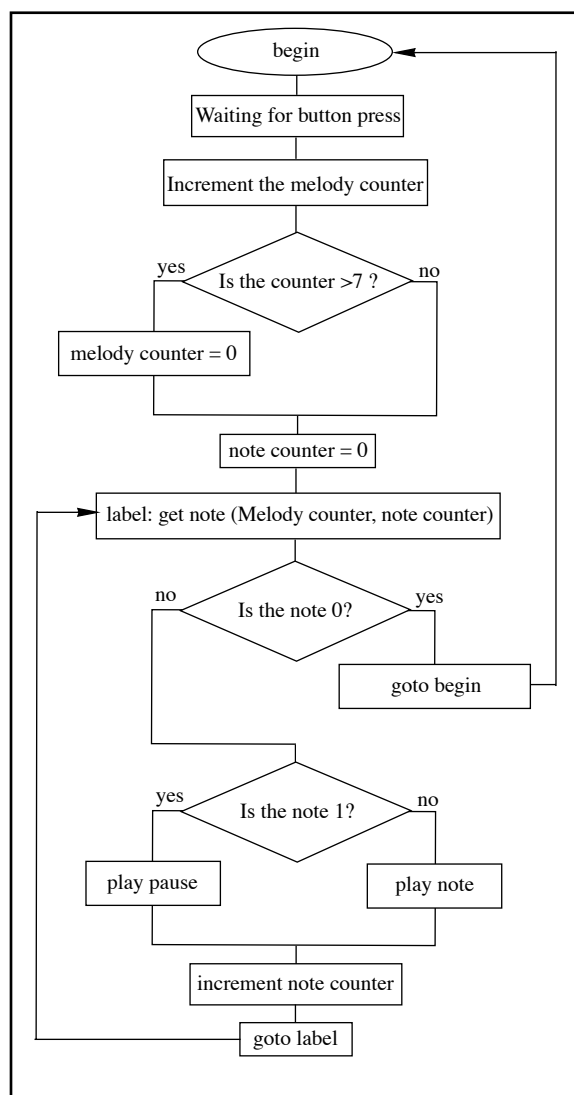
Here is a table of the used frequencies:

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

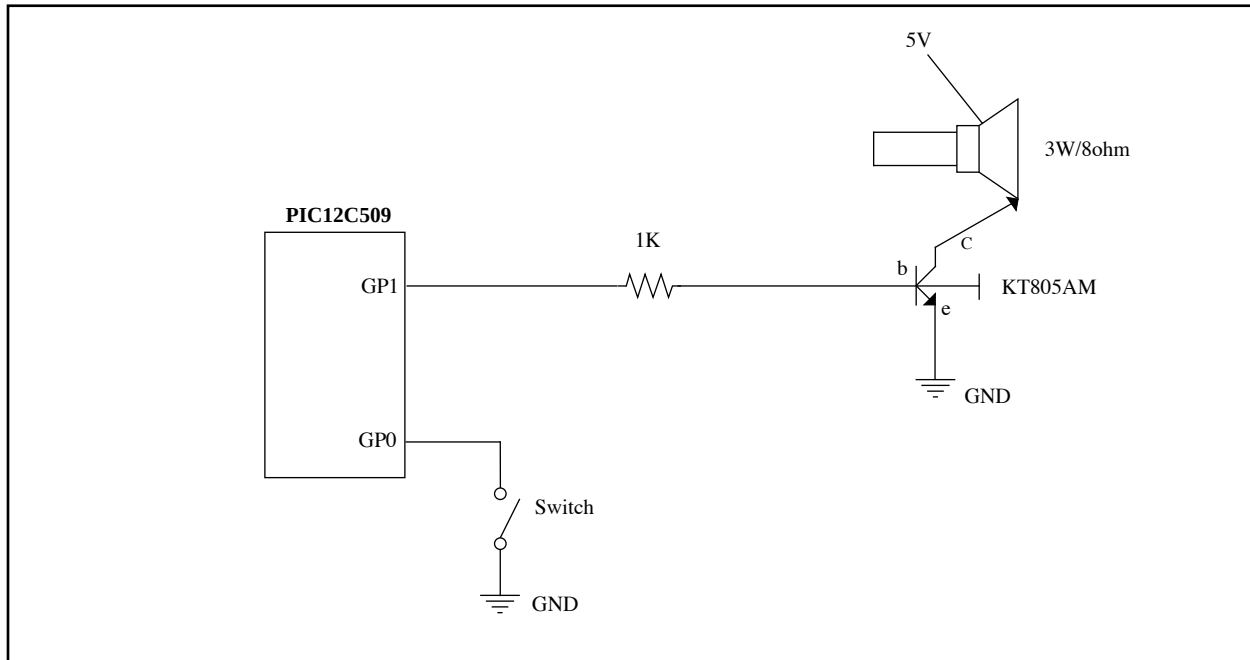
code 0x00 is used for stop mark

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              ;Beginning 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
```

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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 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
```

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```
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
;
-----
```

Discrete Logic Replacement

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   0x80
retlw   0x80
retlw   0x65
retlw   0x65
retlw   0x60
retlw   0x60
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
```

Discrete Logic Replacement

```
    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    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    0x65
    retlw    0x65
    retlw    0x65
    retlw    0x60
    retlw    0x60
    retlw    0x60
    retlw    0x55
    retlw    0x55
    retlw    0x55
    retlw    0x0

begin:    org      0x100
          movwf    OSCCAL           ;calibrating the internal oscillator
          clrf     GPIO
          movlw    B'00111011'
```

Discrete Logic Replacement

```

                                TRIS    GPIO
                                movlw   B'10000111'
                                OPTION

main:                          clr     Melody

                                btfsc   In,Btn
                                goto     $-1

                                clr     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
                                clr     Melody

Loop1:                         clr     Note

                                call     GetNote
                                movwf   Dta

                                movf     Dta,F
                                btfsc   STATUS,Z
                                goto     main

                                incf     Note,F
                                clr     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:
```

Discrete Logic Replacement

```

        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:
```

Discrete Logic Replacement

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

Discrete Logic Replacement

retlw 0x0

```
;-----  
;  
; A MELODY II  
;-----  
Melody6:
```

```
movf    Note,W  
addwfc  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   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
```

Discrete Logic Replacement

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   0x48  
retlw   0x4C  
retlw   0x4C  
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   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
```

Discrete Logic Replacement

```
-----  
;  
;           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    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
```

Discrete Logic Replacement

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

```
END
```