

## Implementing Wake-up on Key Stroke

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### INTRODUCTION

In certain applications, the PIC16CXXX is exercised only when a key is pressed, (e.g., remote keyless entry). In such applications, the battery life can be extended by putting the PIC16CXXX to sleep during inactive states and when a key is pressed, the PIC16CXXX wakes up, performs the task, and then goes back to sleep.

### IMPLEMENTATION

The circuit, shown Figure 1, depicts an application with two keys. The PIC16C54 is normally in SLEEP mode consuming very little operating current. If either of the two keys is pressed, the PIC16C54 “wakes up”, scans the keys and turns on one or both of the LED's. When SW1 is pressed, the green LED is lit and when SW2 is pressed the red LED is lit. The LED's are used purely for demonstration purposes. In real life applications, a transmission would be completed before putting the PIC16C54 back to sleep. This example can be extended to handle more than two keys.

In sleep mode, the scan outputs (SCAN1 and SCAN2)

are both set to a low logic level. In this state, the capacitor C is fully charged and a high logic level is present at the  $\overline{\text{MCLR}}$  pin. When a key is pressed, C discharges through either R2 or R3 (depending on which switch is being pressed). The voltage across C falls rapidly (approx. 1 ms), causing a low level at the  $\overline{\text{MCLR}}$  pin, which in turn causes the device to wake-up and enter its reset state. In reset, the SCAN1 and SCAN2 outputs default to a hi-impedance mode, which blocks the discharge path for capacitor C which it charges to a high level through resistor R1. Note that the RC values have been chosen such that the discharge and charge cycles times are less than the reset time for the device (approx. 18 ms), and certainly far less than the minimum duration of a key-press (approx. 50-100 ms).

After the reset cycle is completed, the code execution momentarily takes the SCAN1 and SCAN2 outputs low in order to sample the key stroke(s). This does not cause the capacitor to discharge since the duration of the low is of the order of 10  $\mu\text{s}$ .

Once the keystroke function has been executed, the program loops until the key has been released, sets the SCAN1 and SCAN2 outputs low and “goes back to sleep”. Resistors R4-R8 are not required for functionality, but are recommended to provide protection from electrostatic discharge (ESD). Switches SW1 and SW2, when pressed, may pass ESD to the PIC16C54.

**FIGURE 1: TWO-KEY INTERFACE TO PIC16C5X**

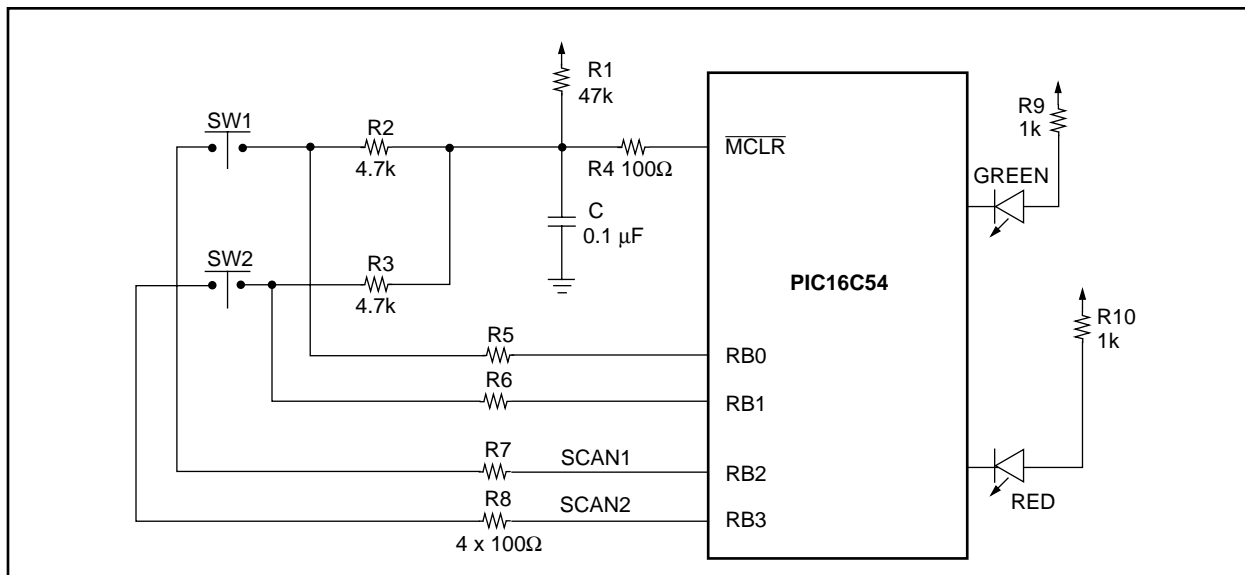


FIGURE 2: TWO KEY SCAN/WAKE-UP TIMING DIAGRAM

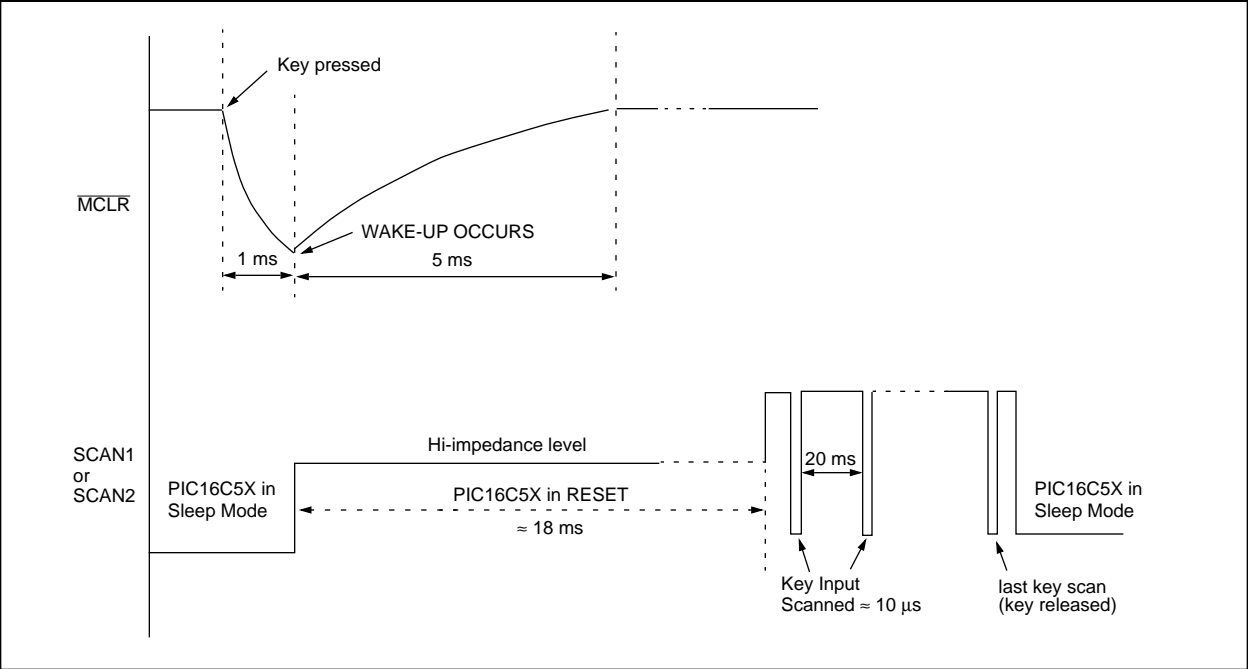
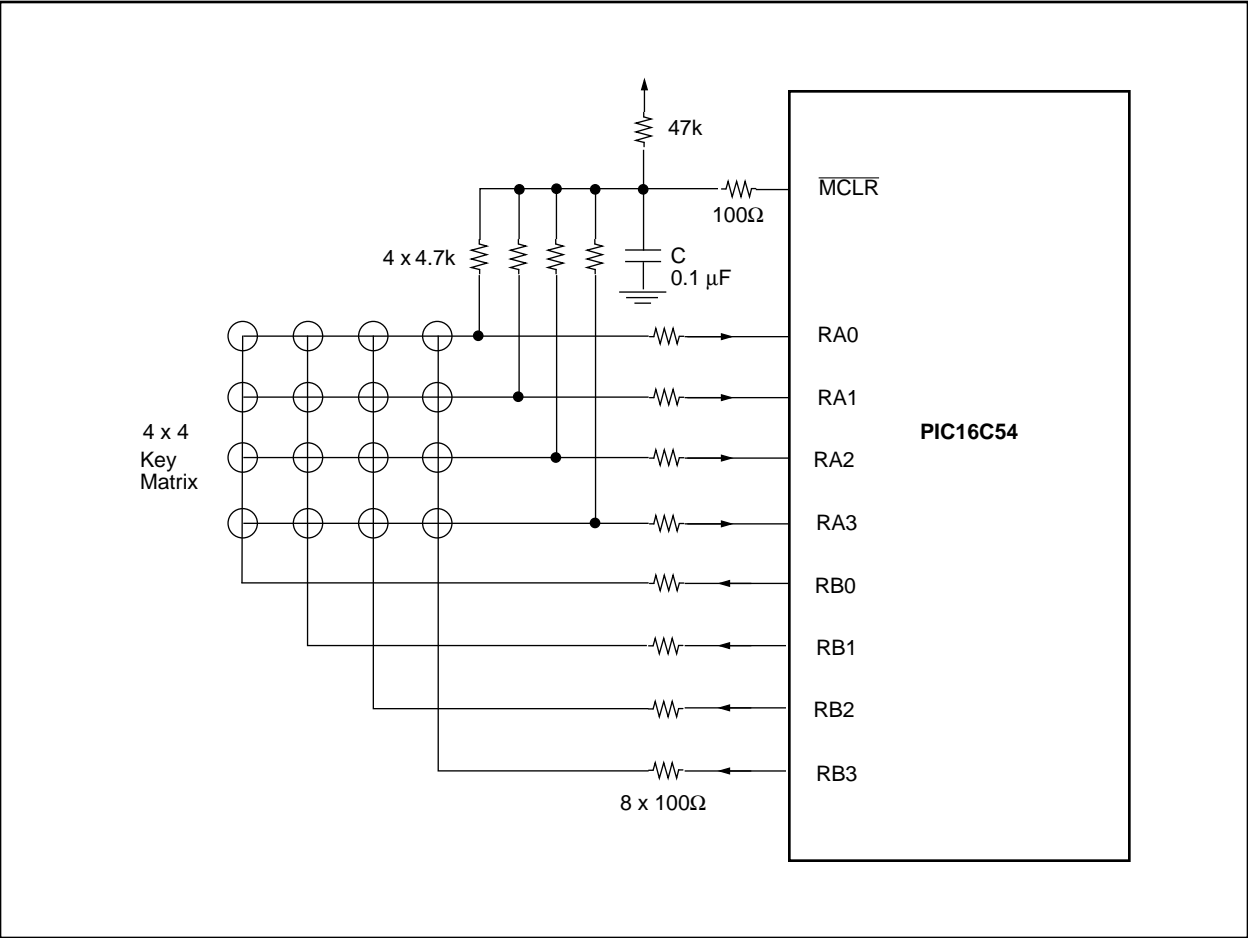


FIGURE 3: PIC16C5X INTERFACE TO 4 x 4 KEY MATRIX



Please check the Microchip BBS for the latest version of the source code. Microchip's Worldwide Web Address: [www.microchip.com](http://www.microchip.com); Bulletin Board Support: MCHIPBBS using CompuServe® (CompuServe membership not required).

## APPENDIX A: KEY STROKE WAKE-UP SAMPLE PROGRAM

MPASM 01.40 Released

WU.ASM 1-16-1997 13:05:36

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LOC  OBJECT CODE      LINE SOURCE TEXT
VALUE

00001          TITLE          "Key Stroke Wake Up"
00002      LIST  P = 16C54
00003 ;*****
00004 ;      Program demonstrating key stroke wake up for
00005 ;      the PIC16CXXX. Program has been implemented for
00006 ;      two keys, but can be extended for more keys.
00007 ;      When SW1 is pressed a green LED lights up.
00008 ;      When SW2 is pressed a red LED lights up.
00009 ;
00010 ;      Program:          WU.ASM
00011 ;      Revision Date:
00012 ;                      1-13-97      Compatibility with MPASMWIN 1.40
00013 ;
00014 ;*****
00015 ;
00016 ;
00017 ; Define equates
00018 ;
00000002      00019 PC      EQU      2
00000006      00020 PORT_B EQU      6
00000002      00021 SCAN1  EQU      2
00000003      00022 SCAN2  EQU      3
00000000      00023 SW1    EQU      0
00000001      00024 SW2    EQU      1
00000004      00025 GRN_LED EQU      4
00000005      00026 RED_LED EQU      5
00000014      00027 MSEC_20 EQU      D'20'
00000008      00028 DB1    EQU      8
00000008      00029 GP      EQU      8
00000009      00030 DB2    EQU      9
00000000      00031 ;
00000001      00032 F      EQU      1
00000000      00033 ;
00000000      00034 ;PORT_B ASSIGNMENTS:
00000000      00035 ;      0 --> SW1      INPUT
00000000      00036 ;      1 --> SW2      INPUT
00000000      00037 ;      2 --> SCAN1     OUTPUT
00000000      00038 ;      3 --> SCAN2     OUTPUT
00000000      00039 ;      4 --> GRN_LED    OUTPUT
00000000      00040 ;      5 --> RED_LED    OUTPUT
00000000      00041 ;      6&7 --> ASSIGNED AS DUMMY OUTPUTS
00000000      00042      PAGE
00000000      00043 ;
00000000      00044 ;
0000      00045      ORG      0
00000000      00046 ;
0000      00047 START
0000 0910      00048      CALL    INIT_PORT_B    ;INITIALIZE PORT B
0001 0920      00049      CALL    DELAY          ;DELAY 20 MSECS
0002 0915      00050      CALL    SCAN_KEYS       ;GET KEY VALUES
0003 0028      00051      MOVWF   GP              ;SAVE IN RAM
0004 0608      00052      BTFSC   GP,SW1          ;SKIP IF SW1 NOT PRESSED
0005 0929      00053      CALL    TURN_GREEN_ON    ;ELSE DO ROUTINE
0006 0628      00054      BTFSC   GP,SW2          ;SKIP IF SW2 NOT PRESSED

```

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0007 092B      00055      CALL      TURN_RED_ON      ;ELSE DO ROUTINE
0008           00056      CHK_FOR_KEY
0008 0920      00057      CALL      DELAY              ;DELAY FOR 20 MSEC
0009 0915      00058      CALL      SCAN_KEYS          ;GET KEY HIT
000A 0F00      00059      XORLW    0                  ;EXCL. OR WITH 0
000B 0743 0A08 00060      BNZ      CHK_FOR_KEY          ;KEY STILL PRESSED
000B           00061      ;THEN LOOP
000D           00062      NO_KEY_PRESSED
000D 0446      00063      BCF      PORT_B,SCAN1          ;SET SCAN LINES LOW
000E 0466      00064      BCF      PORT_B,SCAN2          ;      /
000F 0003      00065      SLEEP                          ;SLEEP
000F           00066      ;
000F           00067      PAGE
000F           00068      ;
0010           00069      INIT_PORT_B
0010 0C03      00070      MOVLW    B'00000011'          ; CONFIG RB0, 1 AS I/P'S
0011 0006      00071      TRIS     PORT_B                ; AND RB2-7 AS O/P'S
0012 0CFF      00072      MOVLW    0FFh
0013 0026      00073      MOVWF    PORT_B                ;DEFAULT VALUES FOR PORT_B
0014 0800      00074      RETLW    0                    ;RETURN WITH NO ERROR
0014           00075      ;
0014           00076      ;This routine, scans two keys and returns the following:
0014           00077      ;      0 if no key is pressed
0014           00078      ;      1 if SW1 is pressed
0014           00079      ;      2 if SW2 is pressed
0014           00080      ;      3 if SW1 and SW2 are pressed
0014           00081      ;
0015           00082      SCAN_KEYS
0015 0446      00083      BCF      PORT_B,SCAN1          ;ENABLE SCAN FOR SW1
0016 0466      00084      BCF      PORT_B,SCAN2          ;ENABLE SCAN FOR SW2
0017 0C03      00085      MOVLW    B'00000011'          ;LOAD MASK IN W
0018 0146      00086      ANDWF    PORT_B,0              ;AND WITH PORT
0019 0546      00087      BSF      PORT_B,SCAN1          ;DISABLE SCAN
001A 0566      00088      BSF      PORT_B,SCAN2          ;      /
001B 01E2      00089      ADDWF    PC,1                  ;GET OFFSET TO TABLE
001C 0803      00090      RETLW    3                    ;SW1 AND SW2 PRESSED
001D 0802      00091      RETLW    2                    ;SW2 PRESSED
001E 0801      00092      RETLW    1                    ;SW1 PRESSED
001F 0800      00093      RETLW    0                    ;NO KEY PRESSED
001F           00094      ;
001F           00095      ;DELAY, IS A APPROX. WAIT FOR 20.4mSECS, FOR A SYSTEM
001F           00096      ;USING A 2 Mhz CRYSTAL CLOCK.
0020           00097      DELAY
0020 0C14      00098      MOVLW    MSEC_20
0021 0028      00099      MOVWF    DB1
0022           00100      DLY1
0022 0069      00101      CLRF     DB2
0023 02E8      00102      DECFSZ   DB1, F
0024 0A26      00103      GOTO     DLY2
0025 0800      00104      RETLW    0
0026           00105      DLY2
0026 02E9      00106      DECFSZ   DB2, F                ;INNER LOOP = 1.02 MSEC.
0027 0A26      00107      GOTO     DLY2                  ;      /
0028 0A22      00108      GOTO     DLY1
0028           00109      ;
0028           00110      ;
0029           00111      TURN_GREEN_ON
0029 0486      00112      BCF      PORT_B,GRN_LED
002A 0800      00113      RETLW    0
002A           00114      ;
002B           00115      TURN_RED_ON
002B 04A6      00116      BCF      PORT_B,RED_LED
002C 0800      00117      RETLW    0
002C           00118      ;
002C           00119      END

```

MEMORY USAGE MAP ('X' = Used, '-' = Unused)

0000 : XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX--- -----

All other memory blocks unused.

Program Memory Words Used: 45

Program Memory Words Free: 467

Errors : 0

Warnings : 0 reported, 0 suppressed

Messages : 0 reported, 0 suppressed

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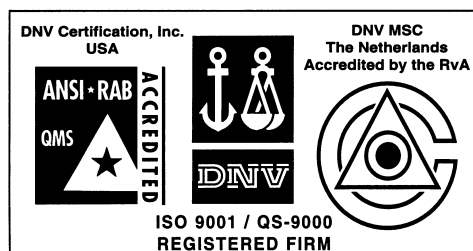
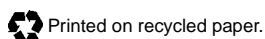
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