

## Using the 8-Bit Parallel Slave Port

### INTRODUCTION

The PIC16C64/C74 microcontrollers from Microchip Technology Inc., can be interfaced in a multi-microprocessor environment with ease using the built-in Parallel Slave Port. With their very high operating speeds (cycle times as low as 200ns with a clock rate of 20MHz), and an array of on-chip peripherals, they make ideal smart interfaces to the real world.

### IMPLEMENTATION

PortD operates as an 8-bit wide parallel slave port, with PortE providing the control signals when bit PSPMODE (TRISE<4>) is set. In parallel slave mode, PortD is asynchronously readable and writable by the external world through the CS (RE2/CS), RD (RE0/RD), and WR (RE1/WR) control inputs.

In order to use the parallel slave port, the data direction bits in the TRISE register corresponding to RD, WR, and CE (TRISE<2:0>) must be configured as inputs (set=1).

The port pins are connected to two 8-bit latches, one for data output (from the PIC16CXX) and one for data input. The PIC16CXX sends data by writing to the output latch,

and receives data by reading the input latch (note that the input and output latches are at the same address). In this mode the TRISD register is ignored, since the external device connected to the slave port controls the direction of data flow.

When the external device performs either a read or a write operation to the PIC16CXX, the interrupt flag, PSPIF (PIR1<7>), will be set and the processor interrupted if PSPIE (PIE1<7>) is set and interrupts are enabled (GIE and PEIE, (INTCON<7:6>) set). When the interrupt is serviced, PSPIF must be cleared by software.

The read-only status flag IBF, Input Buffer Full (TRISE<7>), is set if a received word is waiting to be read. IBF is cleared upon read of the input buffer latch. If another word is received prior to the first being read, status flag IBOV (TRISE<5>) is set. IBOV can be cleared by software.

The Output Buffer Full status bit, OBF (TRISE<6>), is set if a word written to PortD latch is waiting to be read by the external bus.

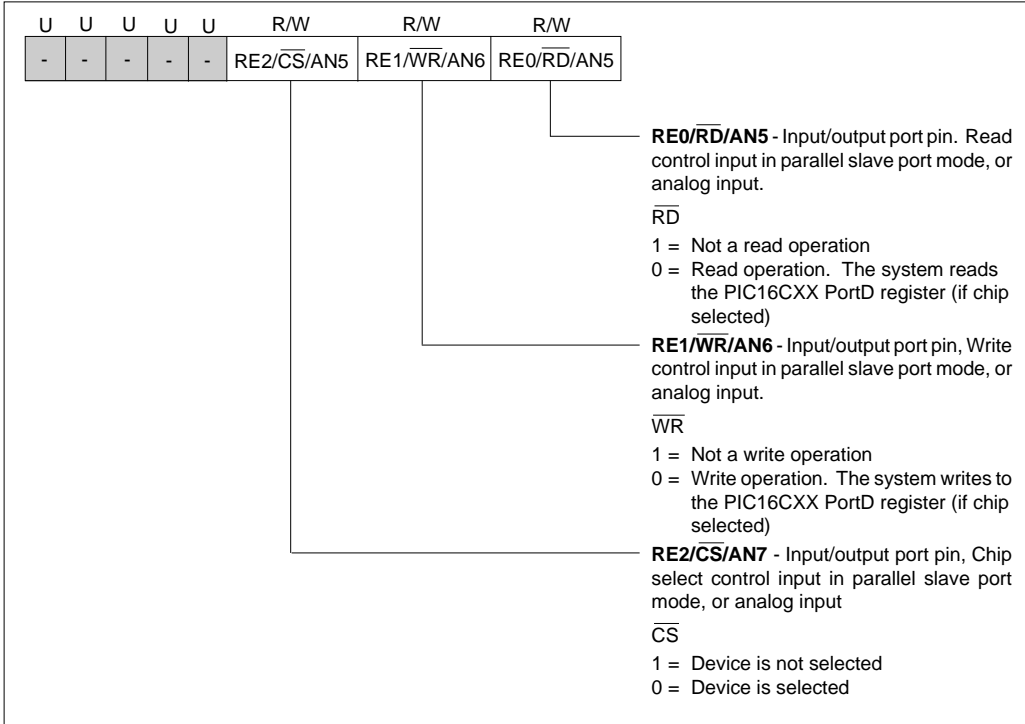
When not in PSPMODE the IBF and OBF bits are cleared. If the IBOV flag was previously set, however, it must be cleared by software.

**FIGURE 1: SUMMARY OF PARALLEL SLAVE PORT REGISTERS**

| Register Name | Function   | Address | Power-On Reset Value |
|---------------|--|---------|----------------------|
| PORTD         | Parallel slave port Read/Write Data                | 08h     | X X X X X X X X      |
| TRISD         | PortD data direction register                      | 88h     | 1 1 1 1 1 1 1 1      |
| PORTE         | Parallel slave port Read/Write/Chip Select signals | 09h     | - - - - - X X X      |
| TRISE         | Control bits for PortD slave port                  | 89h     | 0 0 0 0 - 1 1 1      |
| INTCON        | Global Interrupt Enable                            | 0Bh     | 0 0 0 0 0 0 0 X      |
| PIR1          | Interrupt register (PSPIF bit)                     | 0Ch     | 0 0 0 0 0 0 0 0      |
| PIE1          | Interrupt Enable register (PSPIE bit)              | 8Ch     | 0 0 0 0 0 0 0 0      |

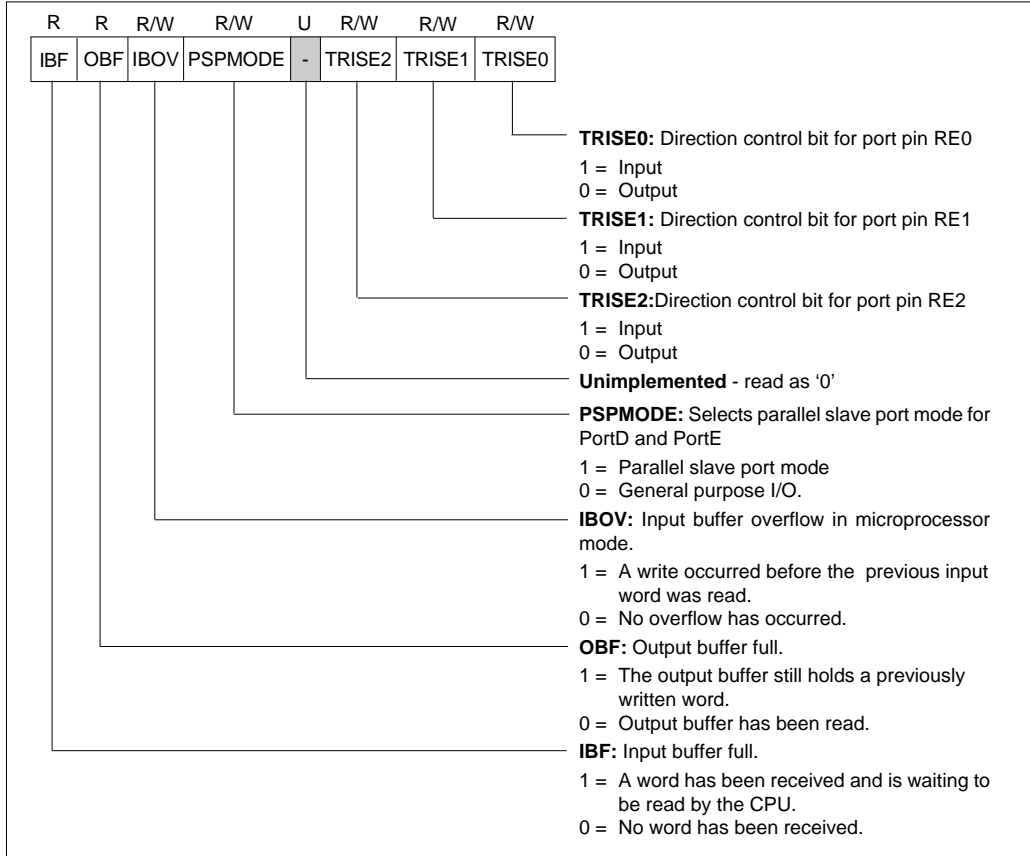
# Using the 8-Bit Parallel Slave Port

**FIGURE 2: PORT E FUNCTIONS**



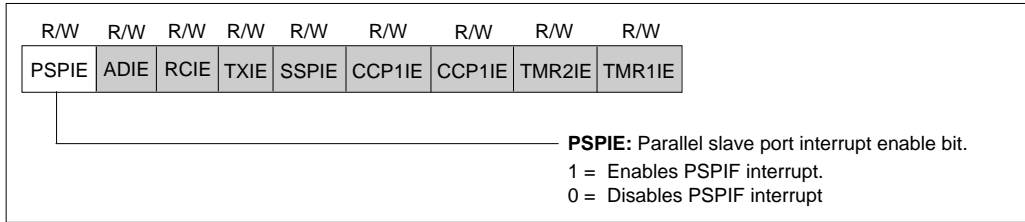
# Using the 8-Bit Parallel Slave Port

**FIGURE 3: TRISE REGISTER**

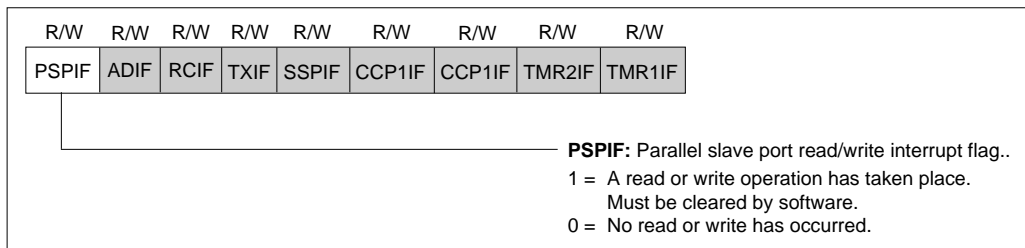


# Using the 8-Bit Parallel Slave Port

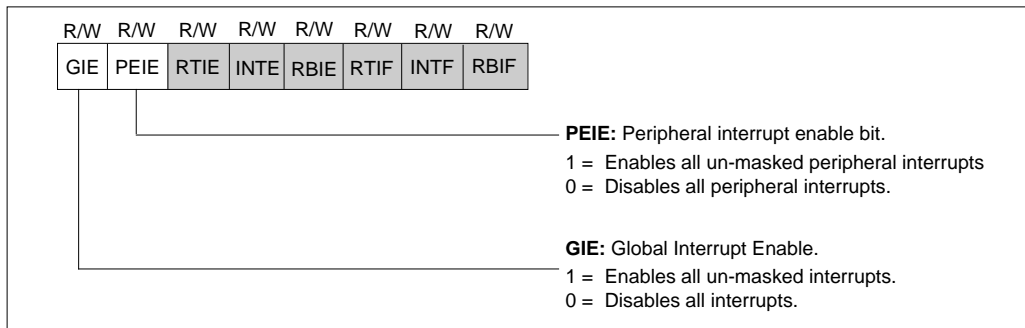
**FIGURE 4: PIE1 REGISTER**



**FIGURE 5: PIR1 REGISTER**



**FIGURE 6: INTCON REGISTER**



*AUTHOR: Scott Fink, Logic Products Division*

# Using the 8-Bit Parallel Slave Port

```
*****
;* 16C64/74 Parallel Slave port
;*
;* This program demonstrates the Parallel Slave Port function of
;* the PIC16C64/74. The program is interrupt driven, when the PIC16CXX
;* is either read from or written to, an interrupt is generated. If the
;* interrupt was caused by a read, a register is incremented, and
;* the new count is placed in an output queue. If the interrupt was
;* caused by a write, the data is put on the Port B pins
*****
list p=16c64,f=inhx8m
;
include "c:\16C74.inc"

;Register definitions
FLAGREG equ 20h ;Flag bit register
OUTDATA equ 21h ;Output data
INDATA equ 22h ;Input data
COUNT equ 23h ;Count of times output register read

;Bit definitions for flag register
ERROR equ 00h ;Error flag bit
OUTRDY equ 01h ;Output data ready flag
INFULL equ 02h ;Input data received flag

org 0000h ;Reset Vector
goto Start

org 0005h ;Interrupt Vector
goto Service_Int

Start
    clrf OUTDATA ;Clear data registers
    clrf INDATA
    bsf STATUS,RP0 ;Select register page 1
    movlw b'00010111' ;Set RD, WR, and CS as
    movwf TRIS_E ; inputs, Enable Parallel Slave port
    movlw 0FFh
    movwf TRIS_B ;Set Port_B to all outputs
    movlw b'10000000' ;
    movwf PIE1 ;Enable Parallel Slave Port interrupt
    bcf STATUS,RP0 ;Select register page 0

    movf OUTDATA,W ;Set output Data in PORTD
    movwf PORT_D
    movlw b'11000000' ;Set GIE, PEIE (enable interrupts)
    movwf INTCON

Loop
    btfsc FLAGREG,INFULL ;Check if input data received
    goto Checkout ;No data ready, check output
    bcf FLAGREG,INFULL ;Clear input data ready flag
    movf Indata,W ;Get Input data
    movwf PORT_B ;Output input data to Port_B

Checkout
    btfsc FLAGREG,OUTRDY ;Check if data output already
    goto Loop ;Not output yet, loop
    incf COUNT ;Increment output data
    movf COUNT,W ;Get output data
    movwf OUTDATA ;Put data in output queue
    bsf FLAGREG,OUTRDY ;Set flag for interrupt routine
    goto Loop
```

# Using the 8-Bit Parallel Slave Port

```
*****
;*Interrupt Service Routine
;*      Inputs:   FLAGREG - Flag register to/from the main routine:
;*                Bit 1: OUTRDY - To Service_Int, indicates data
;*                               ready in output queue
;*                OUTDATA - Output data queue
;*                PIR1     - Interrupt flag register
;*                TRIS_E   - Parallel slave port flag register
;*                PORT_D   - Input data from slave port
;*
;*      Outputs:
;*                PORT_D   - Output data to slave port
;*                INDATA  - Input data queue
;*                FLAGREG - Flag register to/from the main routine:
;*                Bit 0: ERROR - From Service_Int, indicates input
;*                               buffer overflow
;*                Bit 2: INFULL- From Service_Int, indicates data
;*                               received and in INDATA
*****

Service_Int
    btfss    PIR1,PSPIF    ;Test for Peripheral interrupt
    goto    Intout        ;Not a Peripheral interrupt, exit
    bcf     PIR1,PSPIF    ;Clear Peripheral interrupt
    bsf     STATUS,RP0    ;Select Page 1
    btfss   TRIS_E,IBF    ;Check if input data ready
    goto    Notinput     ;No input, check output
    bcf     STATUS,RP0    ;Input ready, select Page 0
    bsf     FLAGREG,INFULL ;Set flag for main routine
    movf    PORT_D,W      ;Get input data
    movwf   INDATA       ;Put byte in input queue

Notinput
    btfsc   TRIS_E,OBF    ;Check if output data read
    goto    Intout       ;Not read, exit
    bcf     STATUS,RP0    ;Select Page 0
    btfss   FLAGREG,OUTRDY ;Check if data in output queue
    goto    Intout       ;Output not read, exit
    movf    OUTDATA,W    ;Get data from queue
    movf    PORT_D       ;Put data in output buffer
    bcf     FLAGREG,OUTRDY ;Clear flag for main routine

Intout
    bsf     STATUS,RP0    ;Select Page 1
    btfsc   TRIS_E,IBOV   ;Check input buffer overflow flag
    goto    Interror     ;If not clear, error
    bcf     STATUS,RP0    ;Select Page 0
    retfie                    ;Re-enable GIE and return

Interror
    bcf     STATUS,RP0    ;Select Page 0
    bsf     FLAGREG,ERROR ;Set error flag for main routine
    retfie                    ;Re-enable GIE and return

end
```

---

---

# WORLDWIDE SALES & SERVICE

---

---

## AMERICAS

### Corporate Office

Microchip Technology Inc.  
2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 602 786-7200 Fax: 602 786-7277  
Technical Support: 602 786-7627  
Web: <http://www.mchip.com/microhip>

### Atlanta

Microchip Technology Inc.  
500 Sugar Mill Road, Suite 200B  
Atlanta, GA 30350  
Tel: 770 640-0034 Fax: 770 640-0307

### Boston

Microchip Technology Inc.  
5 Mount Royal Avenue  
Marlborough, MA 01752  
Tel: 508 480-9990 Fax: 508 480-8575

### Chicago

Microchip Technology Inc.  
333 Pierce Road, Suite 180  
Itasca, IL 60143  
Tel: 708 285-0071 Fax: 708 285-0075

### Dallas

Microchip Technology Inc.  
14651 Dallas Parkway, Suite 816  
Dallas, TX 75240-8809  
Tel: 214 991-7177 Fax: 214 991-8588

### Dayton

Microchip Technology Inc.  
35 Rockridge Road  
Englewood, OH 45322  
Tel: 513 832-2543 Fax: 513 832-2841

### Los Angeles

Microchip Technology Inc.  
18201 Von Karman, Suite 455  
Irvine, CA 92715  
Tel: 714 263-1888 Fax: 714 263-1338

### New York

Microchip Technology Inc.  
150 Motor Parkway, Suite 416  
Hauppauge, NY 11788  
Tel: 516 273-5305 Fax: 516 273-5335

## AMERICAS (continued)

### San Jose

Microchip Technology Inc.  
2107 North First Street, Suite 590  
San Jose, CA 95131  
Tel: 408 436-7950 Fax: 408 436-7955

## ASIA/PACIFIC

### Hong Kong

Microchip Technology  
Unit No. 3002-3004, Tower 1  
Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T. Hong Kong  
Tel: 852 2 401 1200 Fax: 852 2 401 3431

### Korea

Microchip Technology  
168-1, Youngbo Bldg. 3 Floor  
Samsung-Dong, Kangnam-Ku,  
Seoul, Korea  
Tel: 82 2 554 7200 Fax: 82 2 558 5934

### Singapore

Microchip Technology  
200 Middle Road  
#10-03 Prime Centre  
Singapore 188980  
Tel: 65 334 8870 Fax: 65 334 8850

### Taiwan

Microchip Technology  
10F-1C 207  
Tung Hua North Road  
Taipei, Taiwan, ROC  
Tel: 886 2 717 7175 Fax: 886 2 545 0139

## EUROPE

### United Kingdom

Arizona Microchip Technology Ltd.  
Unit 6, The Courtyard  
Meadow Bank, Furlong Road  
Bourne End, Buckinghamshire SL8 5AJ  
Tel: 44 0 1628 851077 Fax: 44 0 1628 850259

### France

Arizona Microchip Technology SARL  
2 Rue du Buisson aux Fraises  
91300 Massy - France  
Tel: 33 1 69 53 63 20 Fax: 33 1 69 30 90 79

### Germany

Arizona Microchip Technology GmbH  
Gustav-Heinemann-Ring 125  
D-81739 Muenchen, Germany  
Tel: 49 89 627 144 0 Fax: 49 89 627 144 44

### Italy

Arizona Microchip Technology SRL  
Centro Direzionale Colleoni  
Palazzo Pegaso Ingresso No. 2  
Via Paracelso 23, 20041  
Agrate Brianza (MI) Italy  
Tel: 39 039 689 9939 Fax: 39 039 689 9883

## JAPAN

Microchip Technology Intl. Inc.  
Benex S-1 6F  
3-18-20, Shin Yokohama  
Kohoku-Ku, Yokohama  
Kanagawa 222 Japan  
Tel: 81 45 471 6166 Fax: 81 45 471 6122

9/22/95

All rights reserved. © 1995, Microchip Technology Incorporated, USA.

Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. No representation or warranty is given and no liability is assumed by Microchip Technology Incorporated with respect to the accuracy or use of such information, or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Microchip's products as critical components in life support systems is not authorized except with express written approval by Microchip. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights. The Microchip logo and name are registered trademarks of Microchip Technology Inc. All rights reserved. All other trademarks mentioned herein are the property of their respective companies.