Introduction to SPI and I2C

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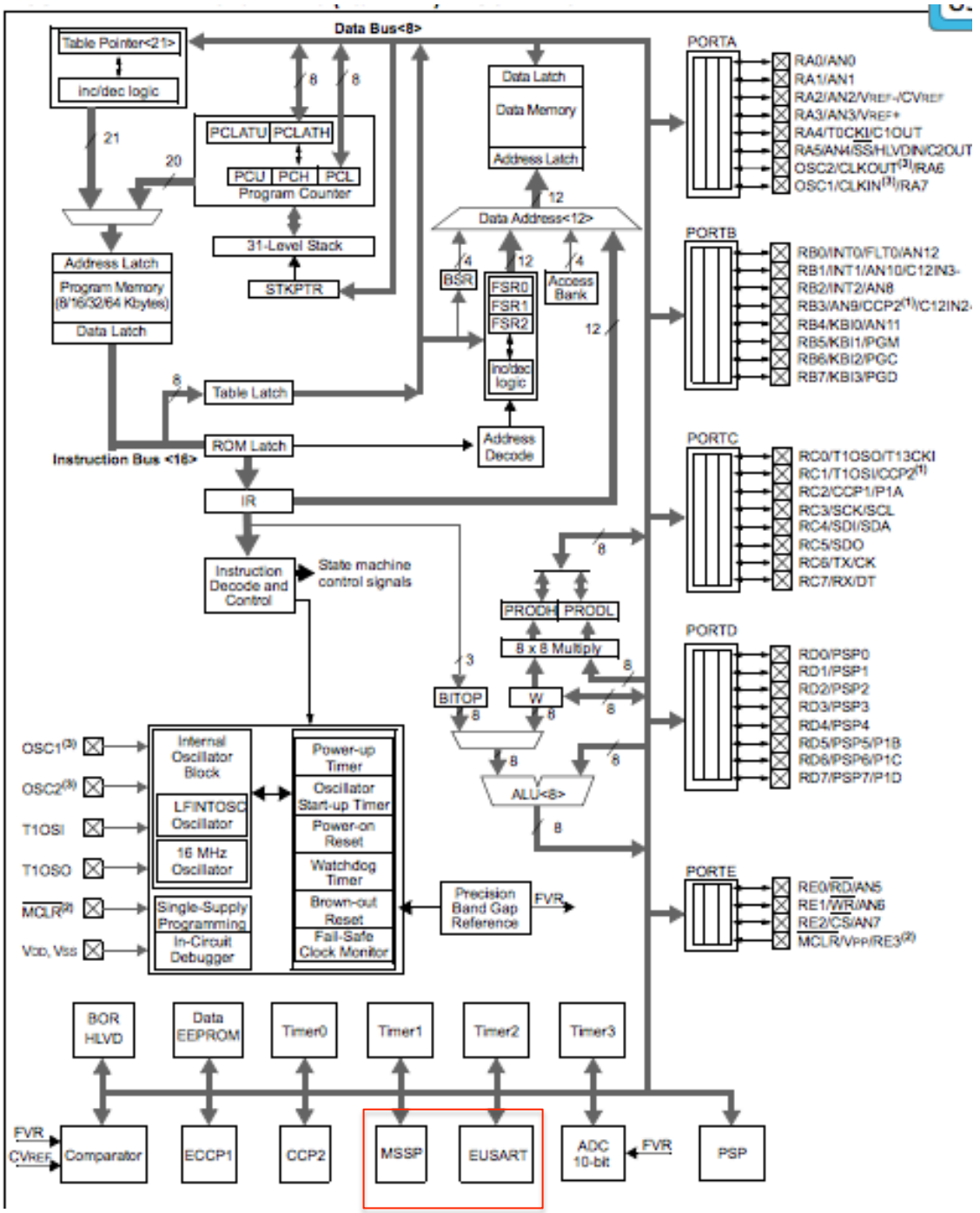
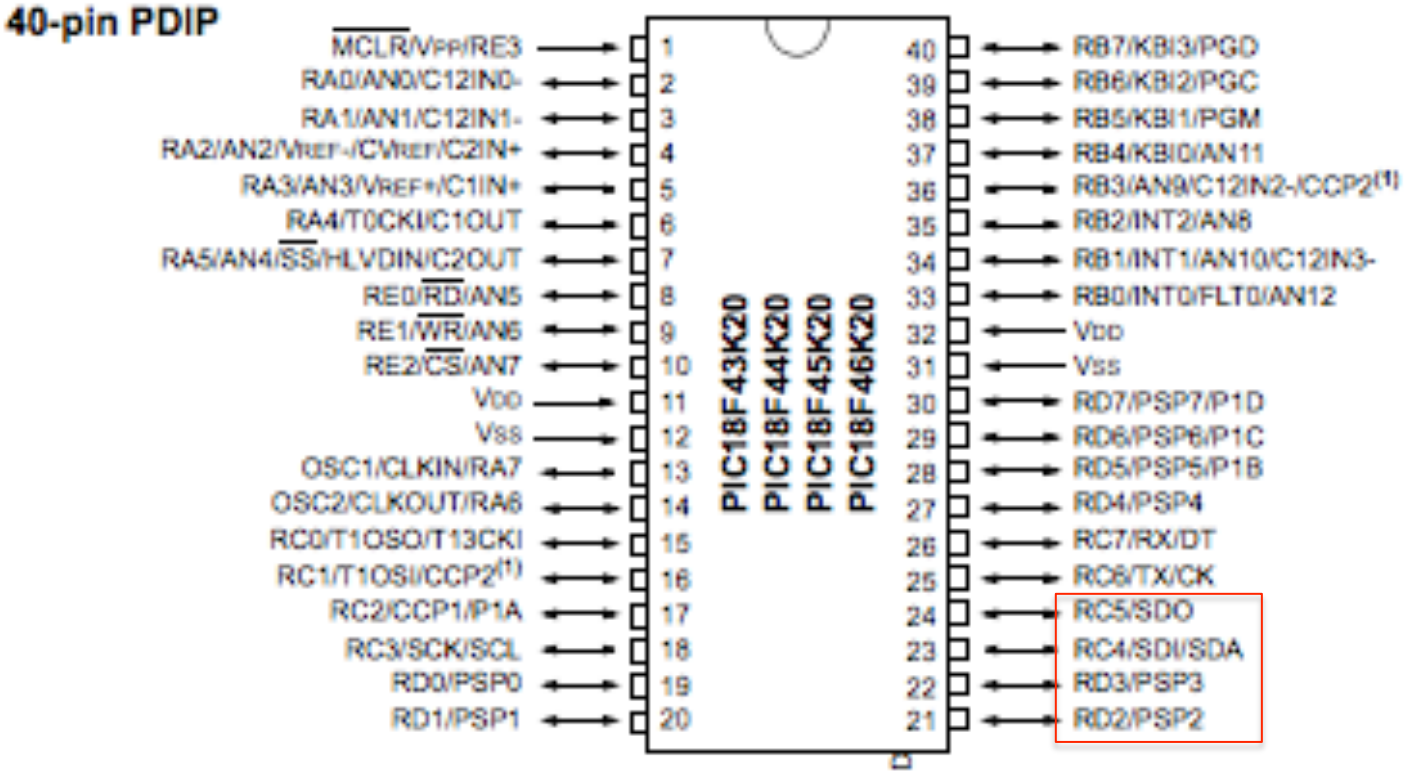
PIC Serial Interface



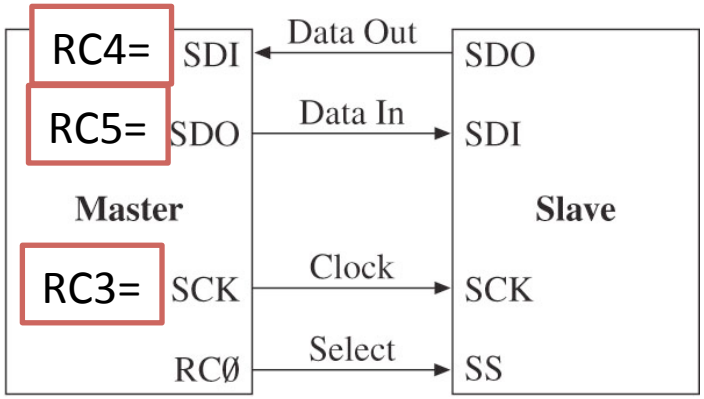
PIC Out for MSSP
(Master Synchronous Serial Port)



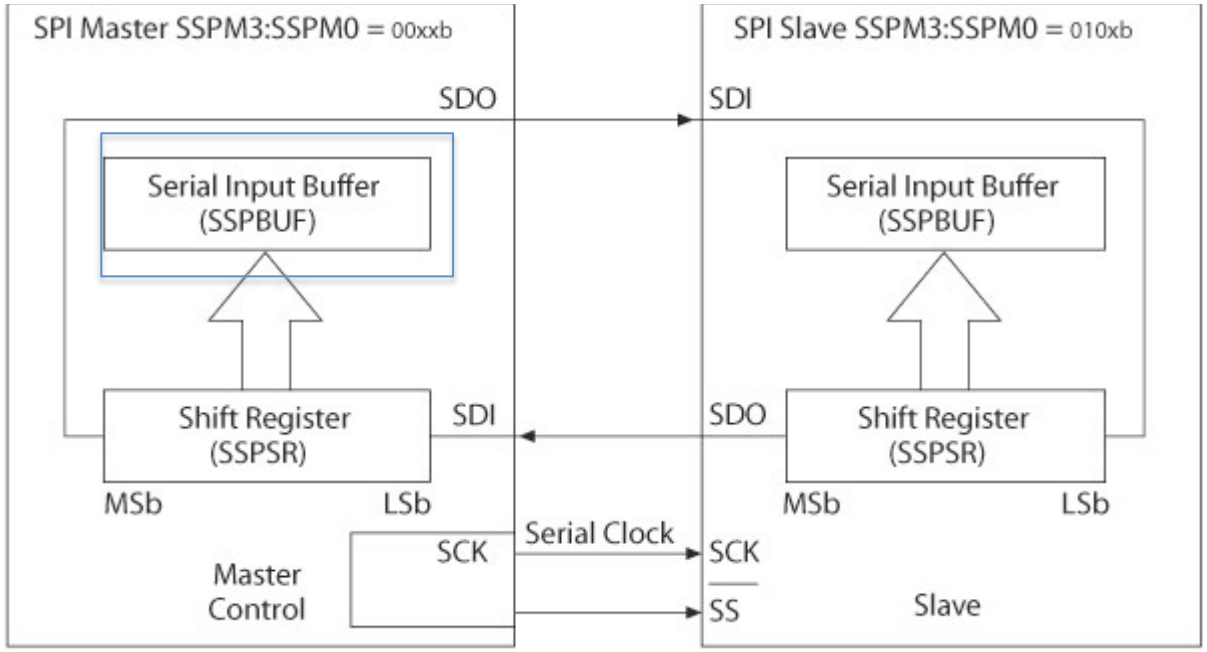
MSSP Module - SPI

- Supports SPI and I2C Protocols
- SPI: Serial Peripheral Interface
  - Applications: Interface to EEPROM, ADC, Sensors, LCD
  - Characteristics: Slower than parallel port, fewer signals
- SPI General Operation:
  - 4- Wire communication (clock, data in, data out, CS)
  - Synchronous → high speed interfaces can be handled
  - Master/Slave configuration – the master chip controls all the slaves and provided clock
  - Uses serial data exchange protocols (MSB goes out first)
  - Data exchange can be on rising or falling edge of the clock

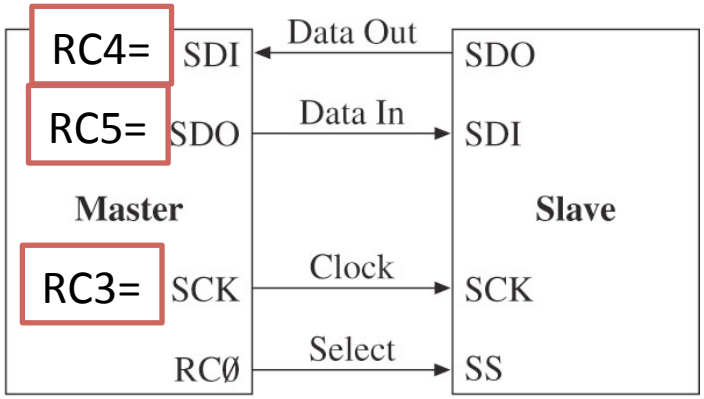
SPI Protocol Interface

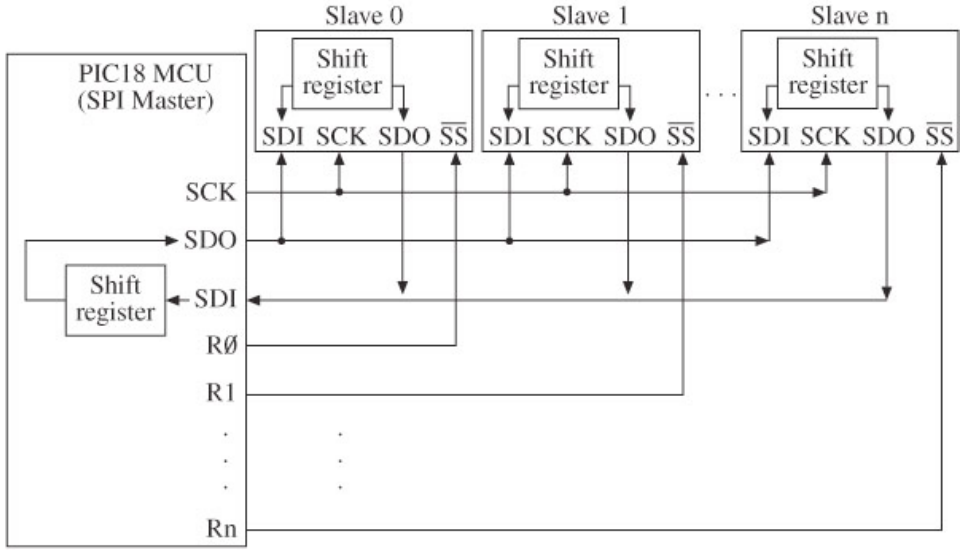


Write/Read Characters into SSPBUFF

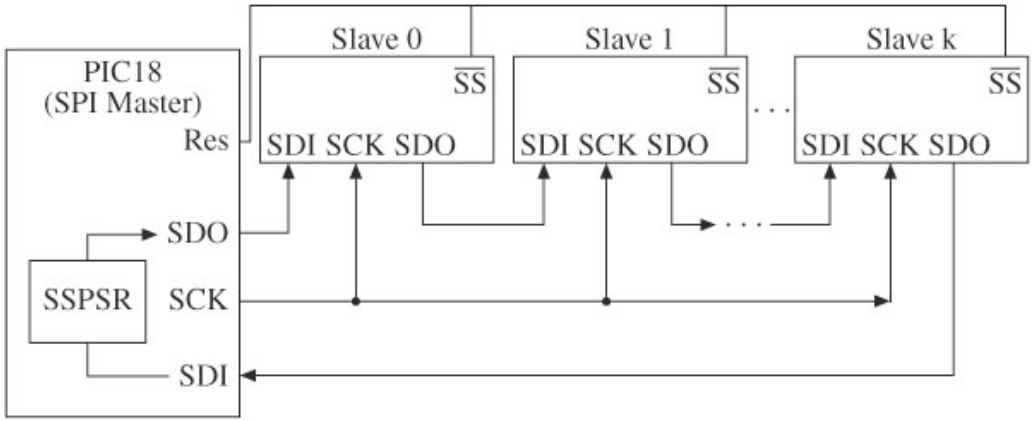


SPI Protocol Interface



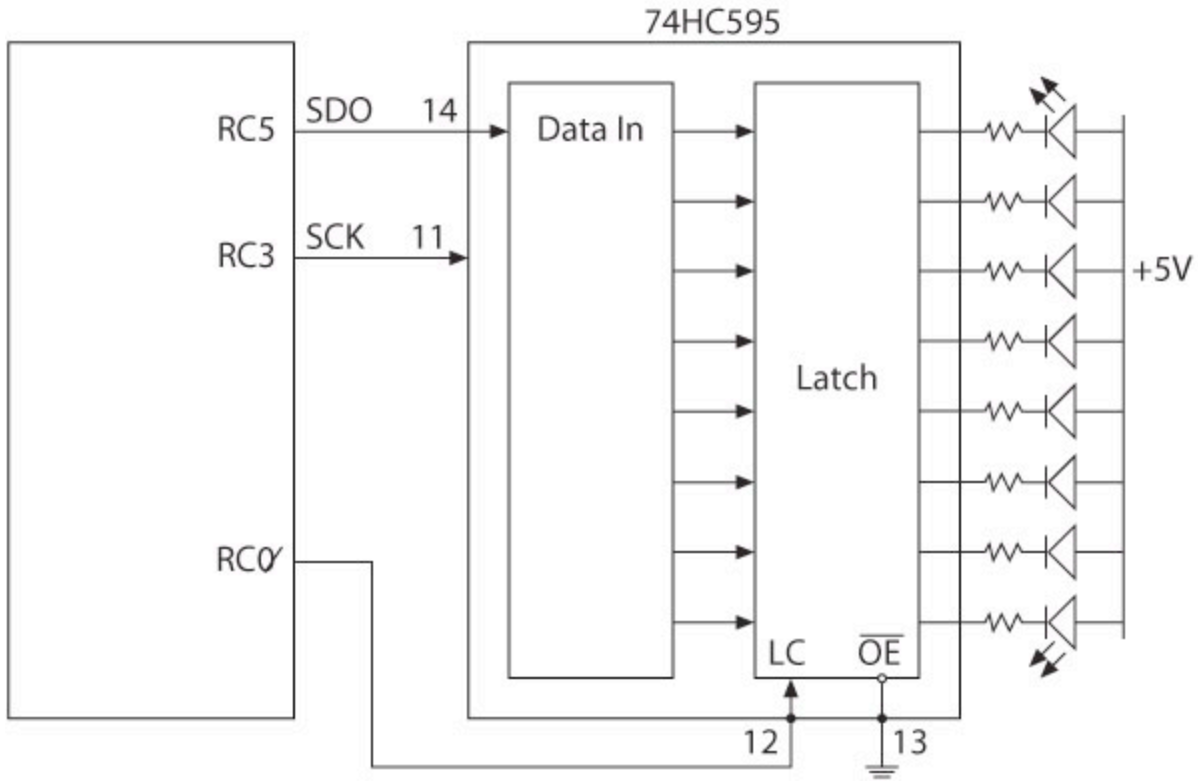


Data is being broadcasted to all chips



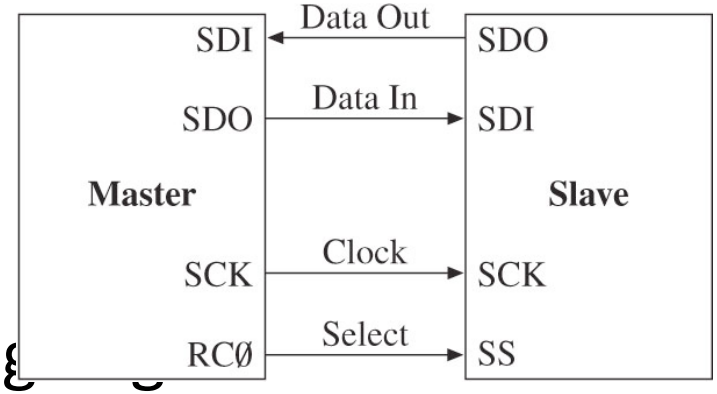
SPI Application Example

Registers:
SSPCON1
SSPSTAT
TRISC



SPI Programing Example

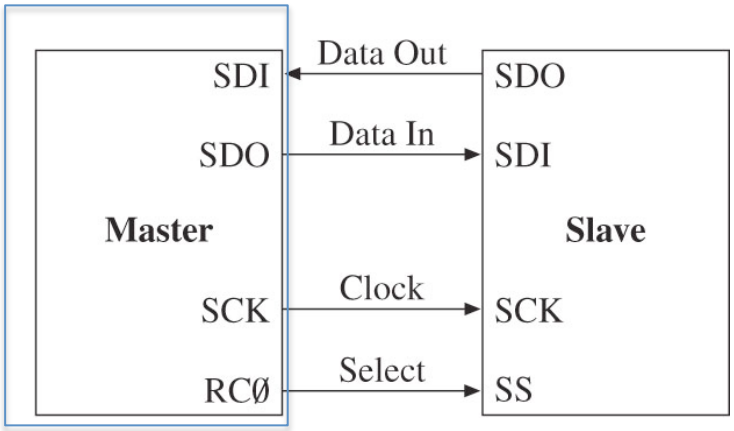
- Assume:
  - Fosc = 10 MHz;
  - Data Transfer is 2.5 MHz
  - Data is sampled at the falling
  - Data sent at the rising edge of the clock
  - Idle clock state is HIGH



- What will be the configuration for the Master and Slave Chips
- Write the code to transmit characters

SPI Programing Example (solution)

Master Mode



- SSPCON1 Register
- Set to SPI Mater Mode Fosc/4 = 2.5 MHz
- SSPCON1 bit.CKP = 1
- SSPCON1 bit.EN = 1
- → SSPCON1 = 0011 0000

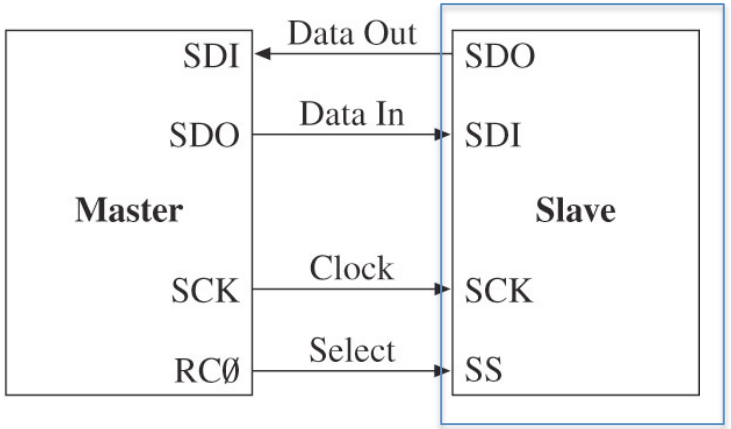
- SSPSTAT Register
- SSPSTAT bit.SMP = 0 ; rising edge; idle is high
- SSPSTAT bit.CKE = 1
- SSPSTAT bit.BF = 0
- → SSPSTAT = 0100 0000

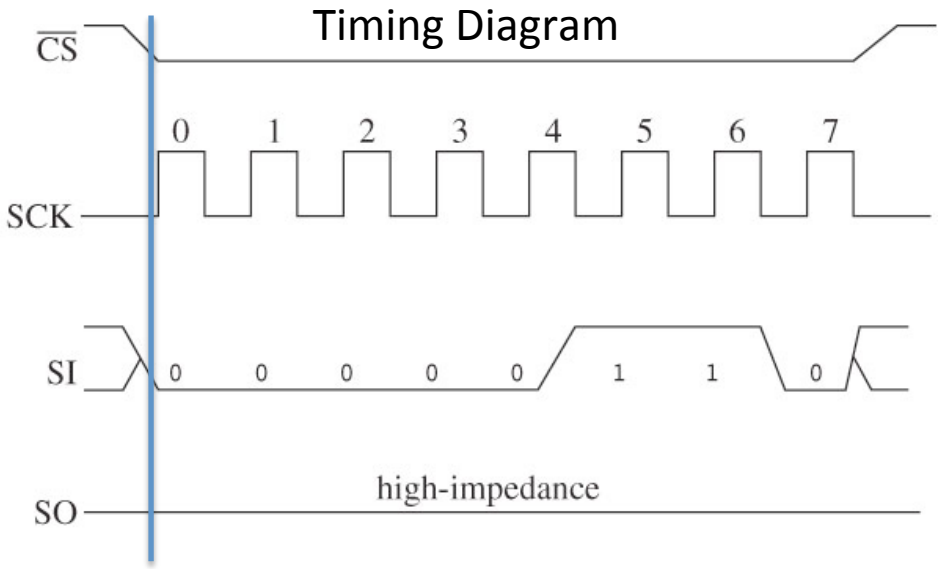
- TRISC Register
- TRISCbit.SDO (RC5) = 0
- TRISCbit.SDI (RC4) = 1
- TRISCbit.SCK (RC3) = 0
- TRISCbit.SS (RC0) = 0
- → TRSC = 0001 0000

SPI Programing Example (solution)
Slave Mode

- SSPCON1 Register
- → SSPCON1 = 0011 0100

- SSPSTAT Register (same)
- → SSPSTAT = 0100 0000



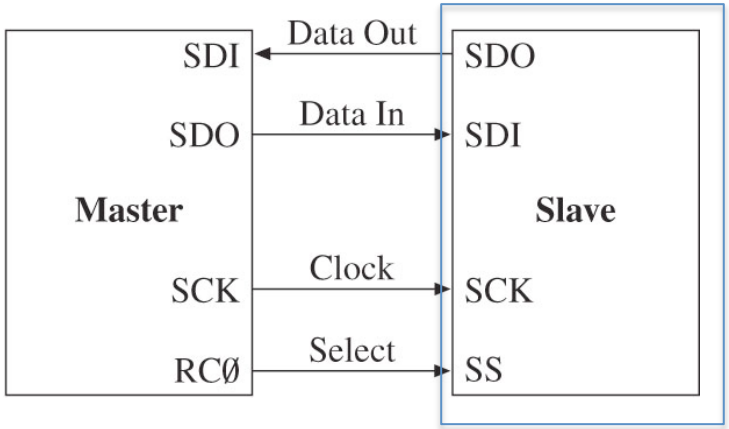


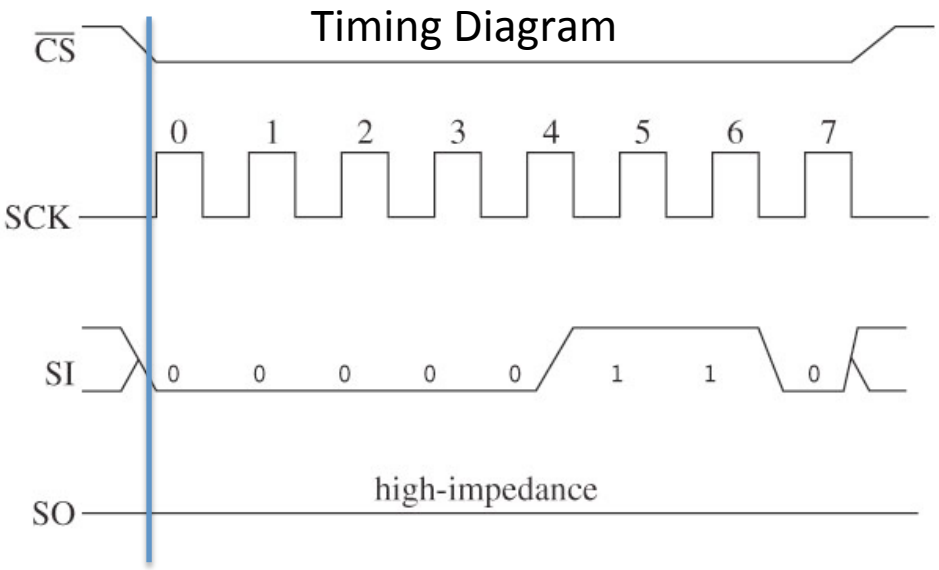
- TRISC Register
- TRISCbit.SDO (RC5) = 0
- TRISCbit.SDI (RC4) = 1
- TRISCbit.SCK (RC3) = 1
- TRISCbit.SS (RC0) = 1
- → TRSC = 0001 1001

SPI Programing Example (solution)

Master Mode Program

- Setup TRISC, SSPCON1, & SSPSTAT
- Set ChiSel=0
- Write a charcter (0x55) into SSPBUF
- Loop: Check if SSPBUF.bit.BF = 1 (buffer is full)
- IF so : MOVF SSPBUF→WREG
- Set ChipSel = 1 (deactivate the slave chip)

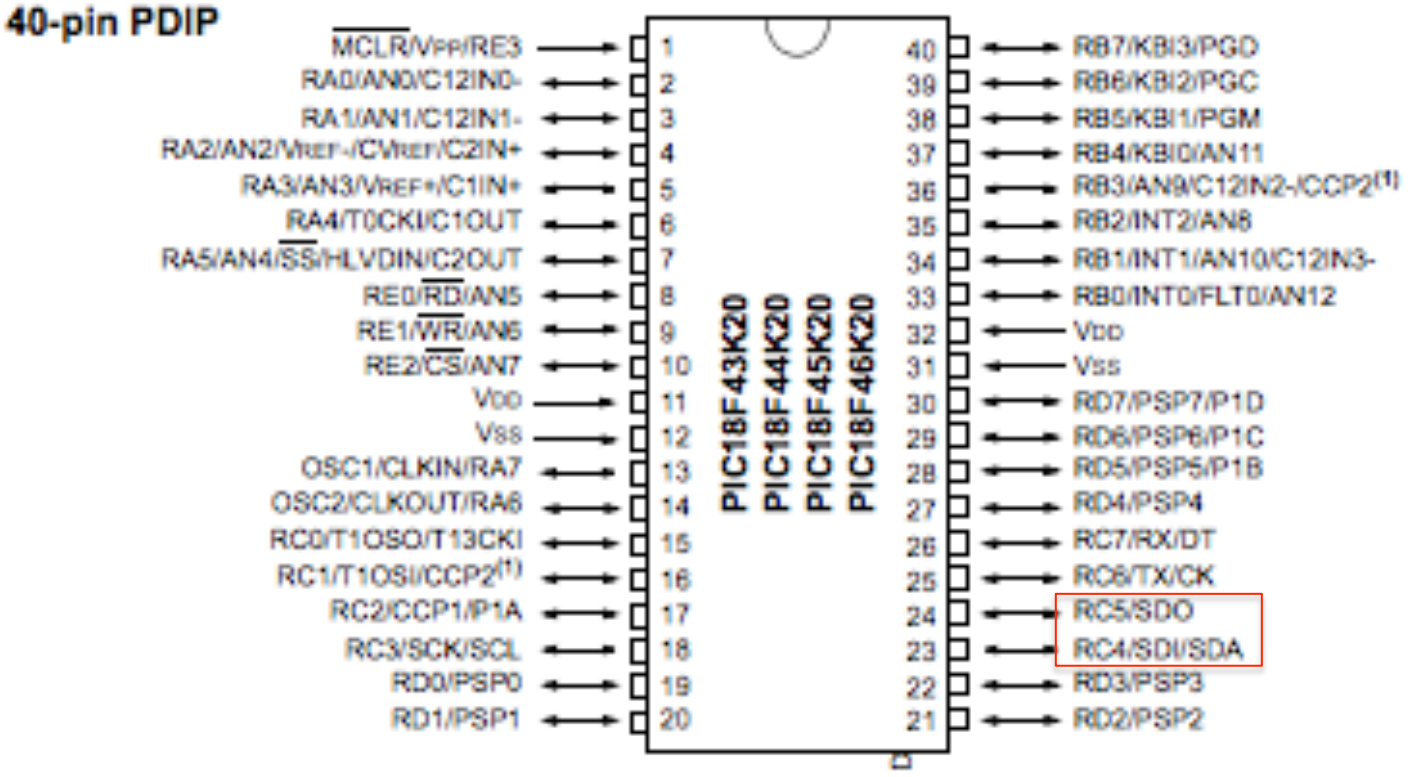




Inter-Integrated Circuit (I2C) Interface

- Created by Philips Inc
- Designed to interface ICs on PCB boards (I2C)
- Characteristics:
  - 2-Wire (SCK & SDA)
  - Synchronous (100 Kbs or 400 Kbps)
  - Master/Slave modes of operation
  - Addressing can be 7 or 10 bit

Pin Out for MSSP
I2C Interface

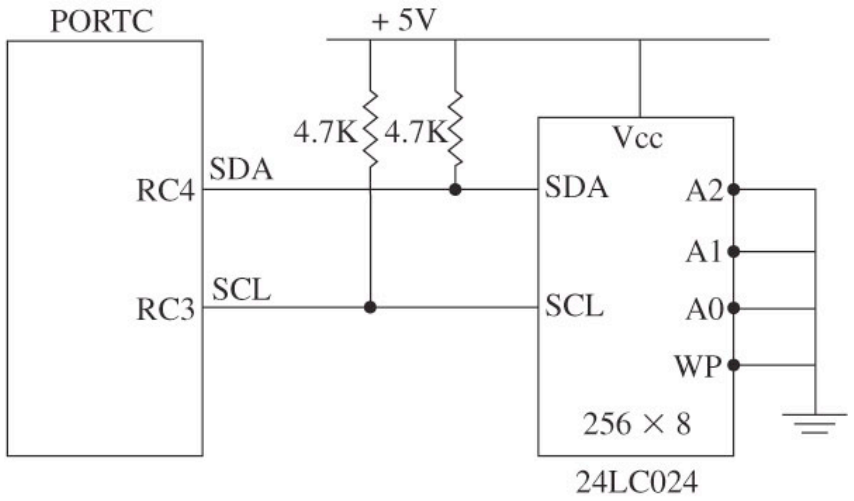


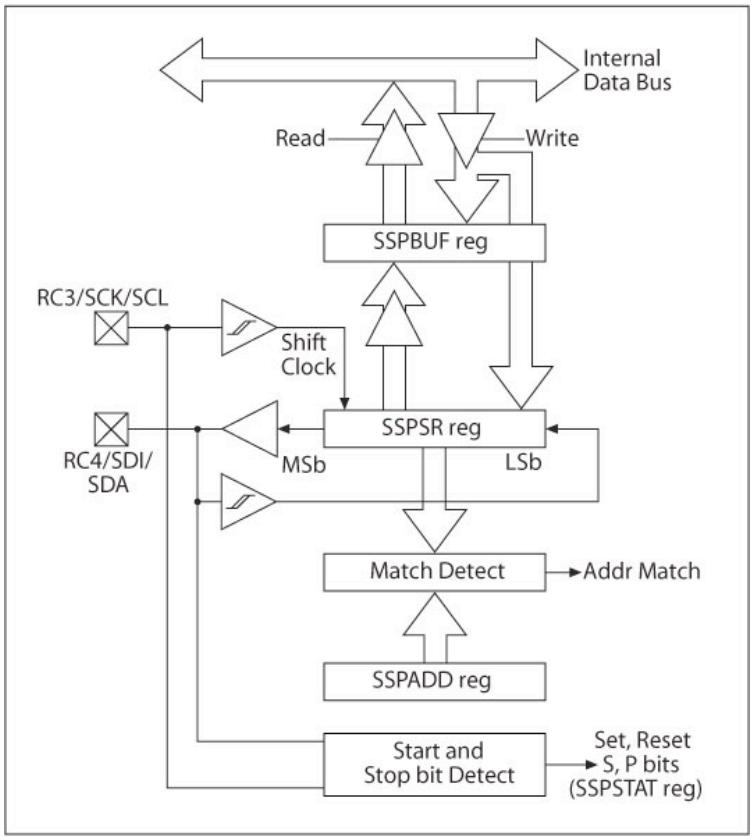
I2C Interface

- 2- Wire Interface

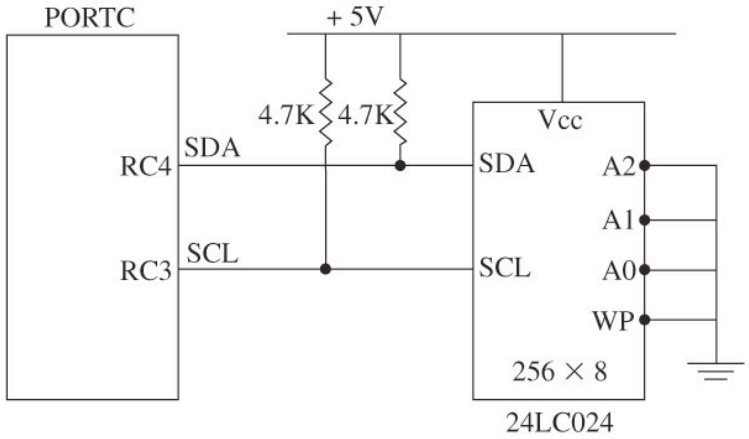
Registers:
SSPCON1
SSPSTAT
TRISC

SSPCON2 (port idle or not)
SSPADD (address)
SSPSR
SSPBUF (data read/write)





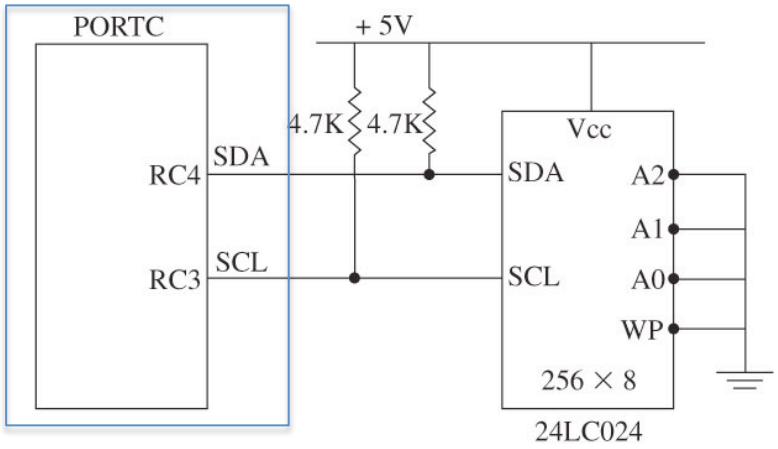
I2C Programing Example



- Assume:
  - Fosc = 10 MHz;
  - I2C Master Mode
  - Transmission Rate is 100 KHz
  - Enable slew rate for high speed
  - No error detection
- What will be the configuration for the Master
- Write the code to transmit characters

I2C Programing Example (solution)

Master Mode



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- TRISC Register
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- TRISCbit.SCK (RC3) = 0
- TRISCbit.SS (RC0) = 0
- → TRSC = 0001 0000

Programing Example

W = SSCON2
If bit0-bit 4 of SSPCON2 = 1 → not in idle mode
Else: Check SSPSTATbit.RW; If 1 → Transmit

W = Character
MOVWF SSPBUF

Check SSPSTATbit.BF = 0
Go to next Character Transmission