

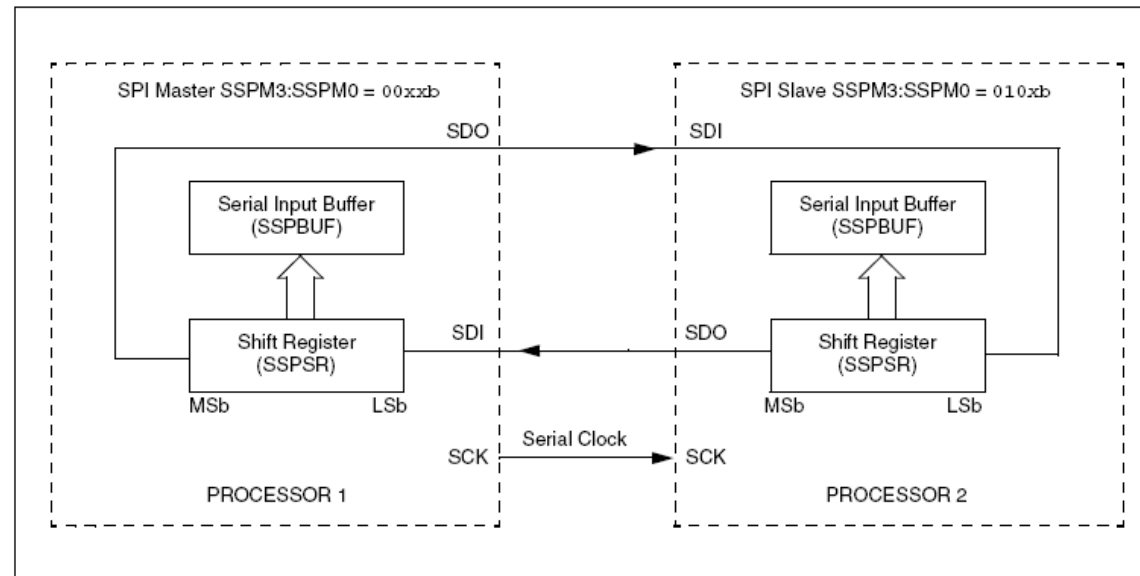
Questions?

- Project
 - Justify your claims;
 - Illustrate what you have done
 - Start early!
- Show and Tell

SPI

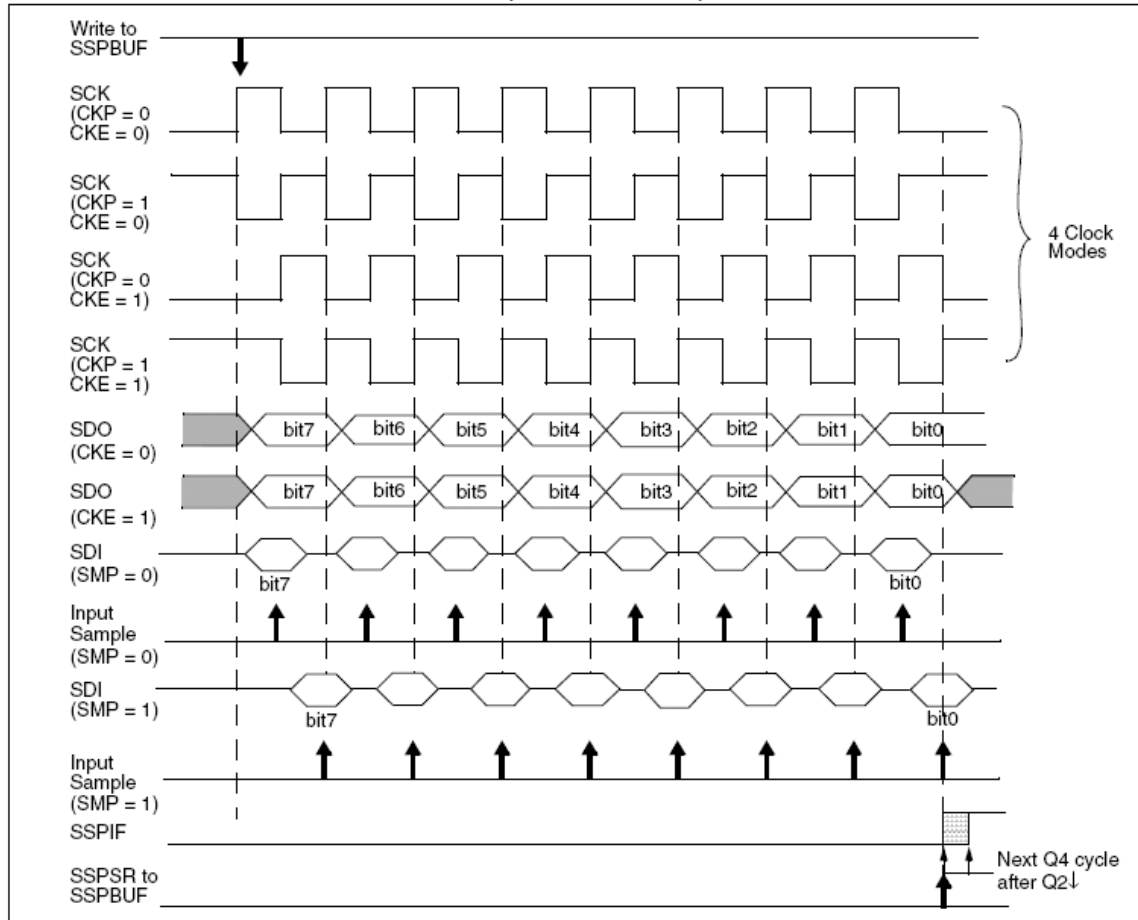
- Key points
 - Data is transmitted one bit at a time, both ways
 - Synchronous: Both party are sharing a clock
 - 4 wires protocol
 - *Transmit (SDO), Receive (SDI), Clock (SCK) and Chip Select (CS)*
 - *SDO and SDI need to be crossed over!*

FIGURE 15-2: SPI MASTER/SLAVE CONNECTION



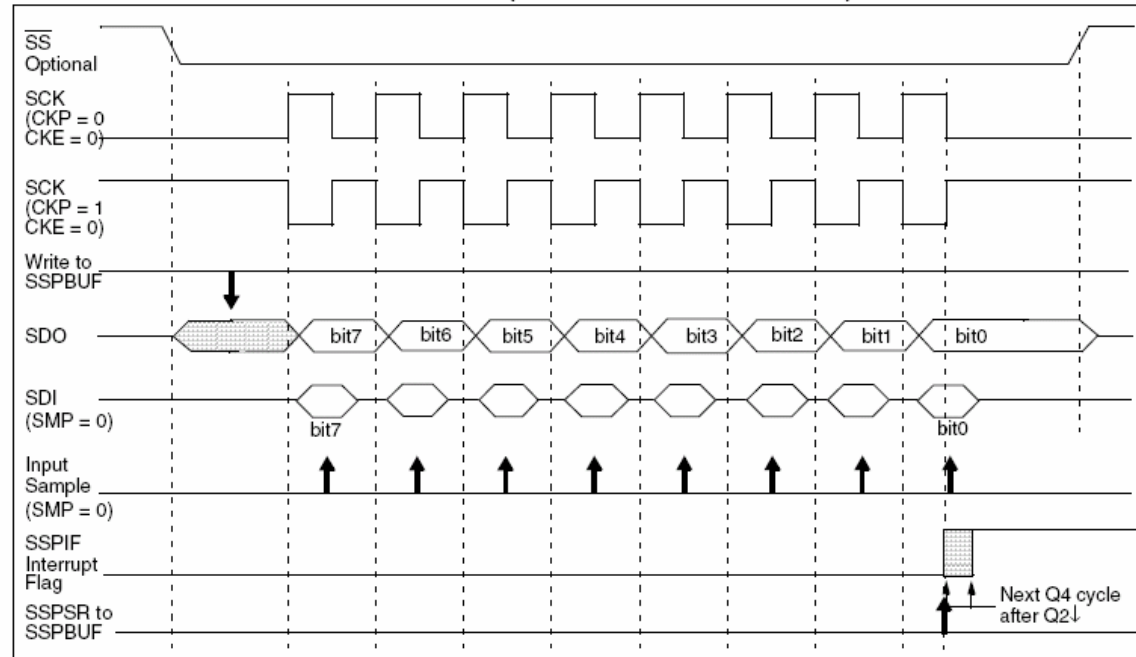
SPI wave form (Master)

FIGURE 15-3: SPI MODE WAVEFORM (MASTER MODE)



SPI wave form (Slave)

FIGURE 15-5: SPI MODE WAVEFORM (SLAVE MODE WITH CKE = 0)



SPI setting

- To do:
 - Set direction for CS (RD0), SDO (RC5), SCK (RC3)
 - Disable the SPI subsystem (SSPCON1bits.SSPEN)
 - Set Sample setting (SSPSTATbits.SMP = 1)
 - Set bus mode (SSPSTATbits.CKE, SSPCON1bits.CKP)
 - *We pick mode 1,1 compatible with the slave*
 - Clear collision detection (SSPCON1bits.WCOL)
 - Set Master clock SSPCON1bits.SSPM3:0)
 - *Fosc/16*
 - Enable the module

SPI writes and reads

- Writes
 - Load the SSPBUF
 - Check SSPSTATbits.BF to monitor the end of transmission
- Read
 - In master mode, you must write data to the SSPBUF first
 - Wait until the SSPSTATbits.BF is set (or SSPIF)
 - Read SSPBUF

MCP4821

- Digital to Analog Converter
 - SPI interface
 - One output
- Register structure

REGISTER 5-1: WRITE COMMAND REGISTER

Upper Half:							
W-x	W-x	W-x	W-0	W-x	W-x	W-x	W-x
$\overline{A/B}$	—	\overline{GA}	\overline{SHDN}	D11	D10	D9	D8
bit 15							bit 8

Lower Half:							
W-x	W-x	W-x	W-x	W-x	W-x	W-x	W-x
D7	D6	D5	D4	D3	D2	D1	D0
bit 7							bit 0

- bit 15 $\overline{A/B}$: DAC_A or DAC_B Select bit
 1 = Write to DAC_B
 0 = Write to DAC_A
- bit 14 — Don't Care
- bit 13 \overline{GA} : Output Gain Select bit
 1 = $1x (V_{OUT} = V_{REF} * D/4096)$
 0 = $2x (V_{OUT} = 2 * V_{REF} * D/4096)$
- bit 12 \overline{SHDN} : Output Power-down Control bit
 1 = Output Power-down Control bit
 0 = Output buffer disabled, Output is high-impedance
- bit 11-0 **D11:D0**: DAC Data bits
 12-bit number "D" which sets the output value. Contains a value between 0 and 4095.

Assignment

- Set the output value to reflect an A/D line
 - Potentiometer, light sensor...
- Generate a sine wave
- Check with the oscilloscope