SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

UNIT 2 :**DEVICES AND EMERGING BUS STANDARDS**

TOPIC 2.4 : Communication from serial devices-SPI

Outline

- Introduction to Serial Buses
- UART
- SPI
- I2C

COMMUNICATION FROM SERIAL DEVICES

SPI

Introduction

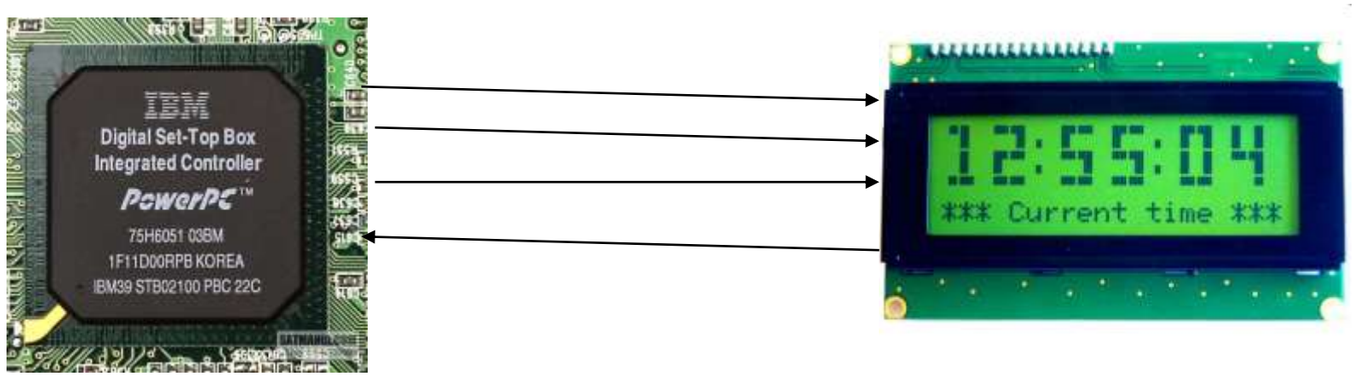
- What is it?
- Basic Serial Peripheral Interface (SPI)
- Capabilities
- Protocol
- Pro / Cons and Competitor
- Uses
- Conclusion

COMMUNICATION FROM SERIAL DEVICES

SPI

What is SPI?

- Serial Bus protocol
- Fast, Easy to use, Simple
- Everyone supports it



SPI Basics

- A communication protocol using 4 wires
  - Also known as a 4 wire bus
- Used to communicate across small distances
- Multiple Slaves, Single Master
- Synchronized

COMMUNICATION FROM SERIAL DEVICES

SPI

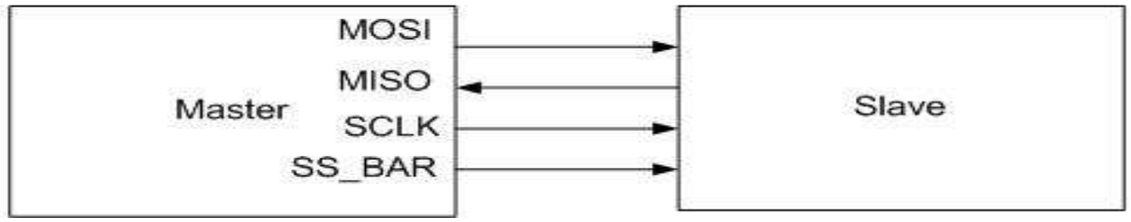
Capabilities of SPI

- Always Full Duplex
  - Communicating in two directions at the same time
  - Transmission need not be meaningful
- Multiple Mbps transmission speed
- Transfers data in 4 to 16 bit characters
- Multiple slaves
  - Daisy-chaining possible

COMMUNICATION FROM SERIAL DEVICES

SPI

Protocol



- Wires:
  - Master Out Slave In (MOSI)
  - Master In Slave Out (MISO)
  - System Clock (SCLK)
  - Slave Select 1…N
- Master Set Slave Select low
- Master Generates Clock
- Shift registers shift in and out data

COMMUNICATION FROM SERIAL DEVICES

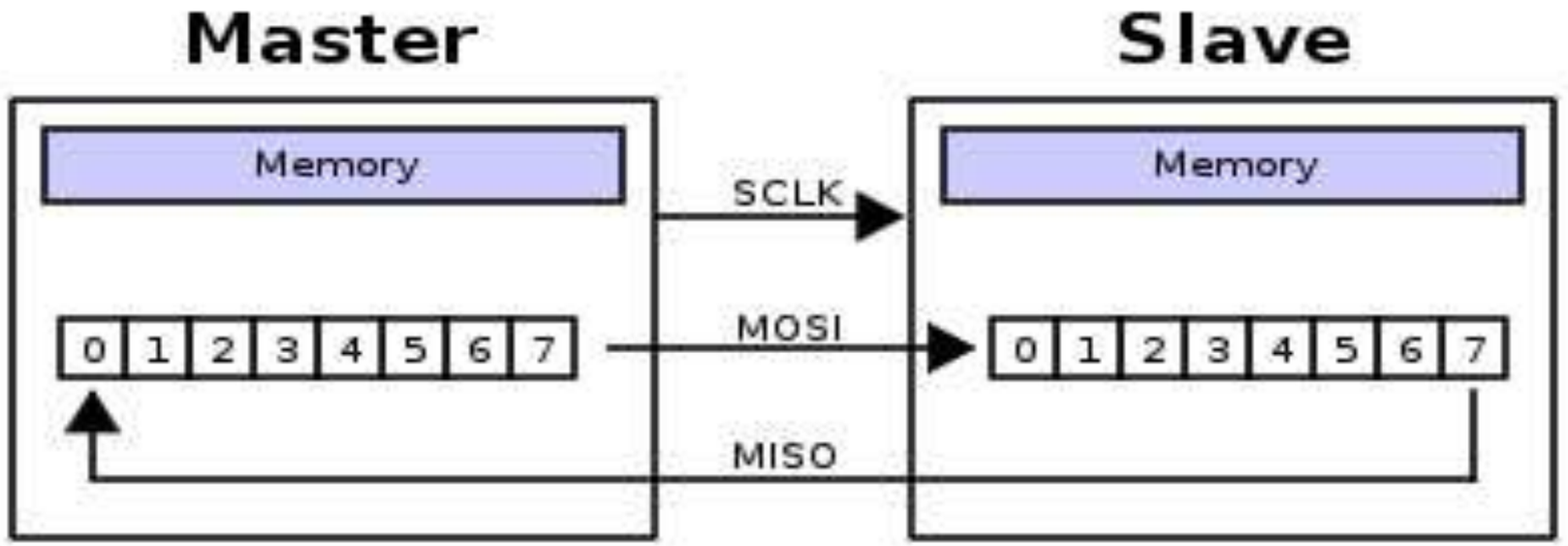
SPI

Wires in Detail

- MOSI – Carries data out of Master to Slave
- MISO – Carries data from Slave to Master
  - Both signals happen for every transmission
- SS_BAR – Unique line to select a slave
- SCLK – Master produced clock to synchronize data transfer

SPI

Shifting Protocol

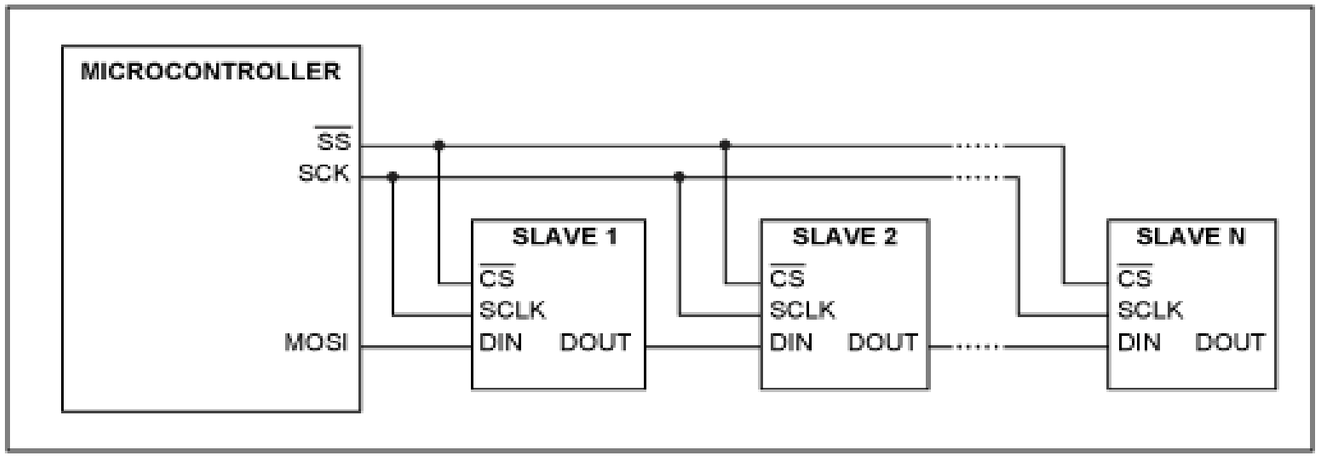


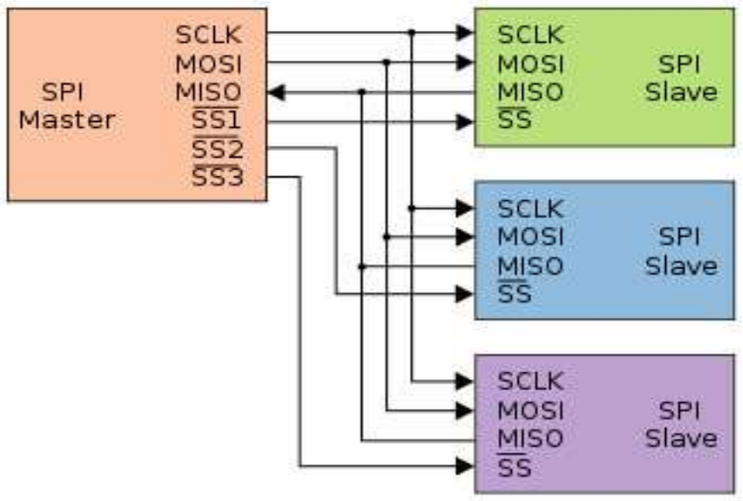
Master shifts out data to Slave, and shift in data from Slave
http://upload.wikimedia.org/wikipedia/commons/thumb/b/bb/SPI_8-bit_circular_transfer.svg/400px-SPI_8-bit_circular_transfer.svg.png

COMMUNICATION FROM SERIAL DEVICES

SPI

Diagram





Some wires have been renamed

Master and multiple daisy-chained slaves
http://www.maxim-ic.com/appnotes.cfm/an_pk/3947

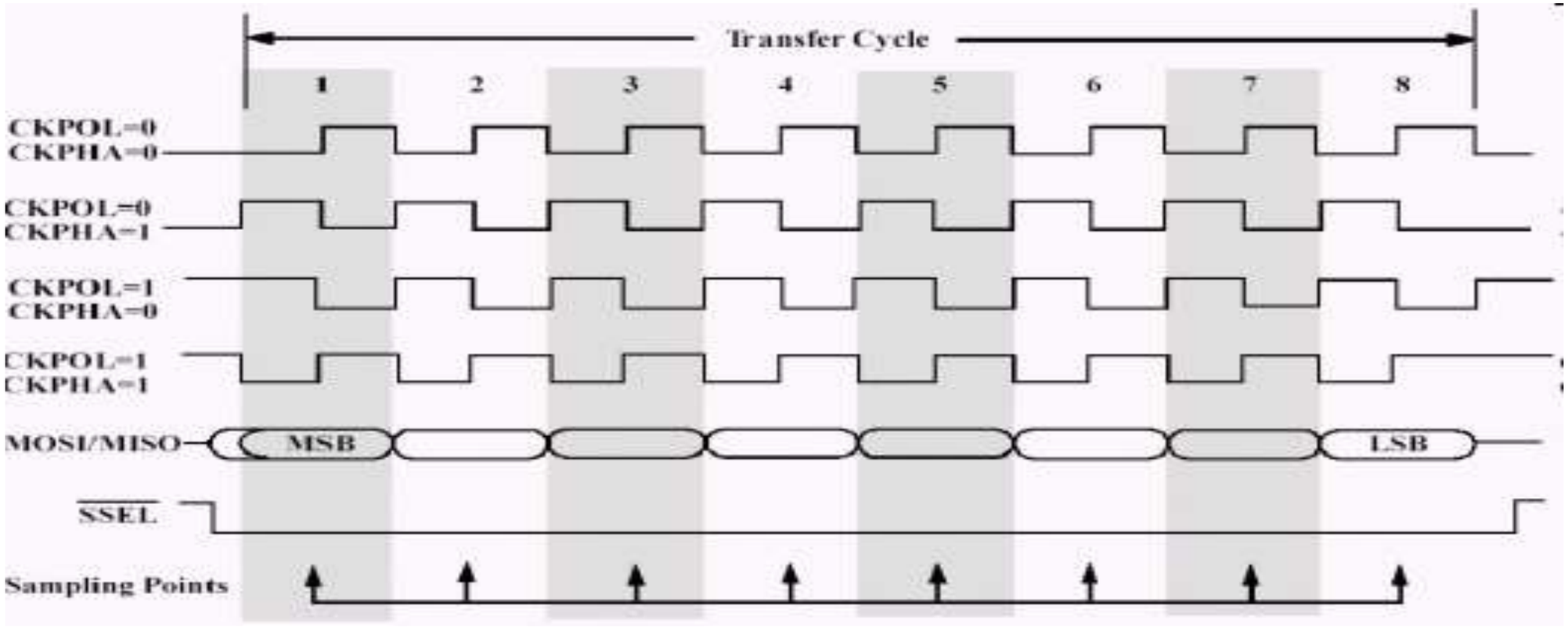
Master and multiple independent slaves
http://upload.wikimedia.org/wikipedia/commons/thumb/f/fc/SPI_three_slaves.svg/350px-SPI_three_slaves.svg.png

Clock Phase (Advanced)

- Two phases and two polarities of clock
- Four modes
- Master and selected slave must be in same mode
- Master must change polarity and phase to communicate with slaves of different numbers

SPI

Timing Diagram



Timing Diagram – Showing Clock polarities and phases
http://www.maxim-ic.com.cn/images/appnotes/3078/3078Fig02.gif

COMMUNICATION FROM SERIAL DEVICES

SPI

Pros and Cons

Pros:

- Fast and easy
  - Fast for point-to-point connections
  - Easily allows streaming/Constant data inflow
  - No addressing/Simple to implement
- Everyone supports it

Cons:

- SS makes multiple slaves very complicated
- No acknowledgement ability
- No inherent arbitration
- No flow control

Uses

- Some Serial Encoders/Decoders, Converters, Serial LCDs, Sensors, etc.
- Pre-SPI serial devices

COMMUNICATION FROM SERIAL DEVICES

SPI

Summary

- SPI – 4 wire serial bus protocol
  - MOSI MISO SS SCLK wires
- Full duplex
- Multiple slaves, One master
- Best for point-to-point streaming data
- Easily Supported

SUMMARY & THANK YOU