Serial Peripheral Interface (SPI)

Serial Peripheral Interface is a 4-wire communication protocol between two or more devices in which one serves as the controller or master while the other(s) serves as the slave. It is a two-way communication protocol enabling exchange of data between the devices. The master initiates communication while the slaves respond.

**Key Features:**

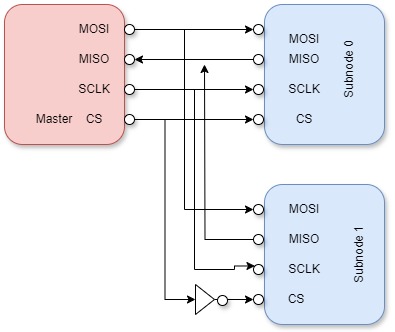
1. Full-duplex communication

2. Master-slave architecture

3. Synchronous data transfer

4. High-speed data transfer (up to 100 Mbps)

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| --- | --- | --- |
|  | Advantages | Disadvantages |
| 1. | Simple and low-cost implementation | Limited distance (typically up to 10 meters) |
| 2. | High-speed data transfer | Requires separate clock and data lines |
| 3. | Flexible communication protocol | Not suitable for multi-master systems |



**Key Components:**

1. Master (initiates communication):

2. Slave (responds to master)

3. Clock (SCK): Clock signal generated by the master

4. Data In (MOSI): port used for data transmission from master to slave

5. Data Out (MISO): port used for data transmission from the slave sub node.

6. Chip Select (CS): Slave select signal (active low).

**SPI Modes:**

1. Mode 0: CPOL=0, CPHA=0 (Clock idle low, data captured on rising edge)

2. Mode 1: CPOL=0, CPHA=1 (Clock idle low, data captured on falling edge)

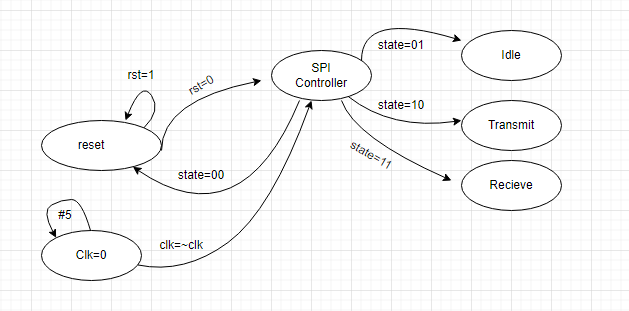
3. Mode 2: CPOL=1, CPHA=0 (Clock idle high, data captured on falling edge)

4. Mode 3: CPOL=1, CPHA=1 (Clock idle high, data captured on rising edge)

**Applications:**

1. Sensor interfaces
2. Display interfaces
3. SD card reader interface
4. Embeeded System and Microcontrollers

**Transition Diagram:**

****MASTER