

Description of SPI

Serial Peripheral Interface is a synchronous serial method to transfer data between two or more devices. These devices are the Master device (such as the microcontroller) and the slave devices (such as ADC or DAC).

SPI has at least four channels for allowing communications between the master and the slave devices which are shown on the below image as well **[1]**:

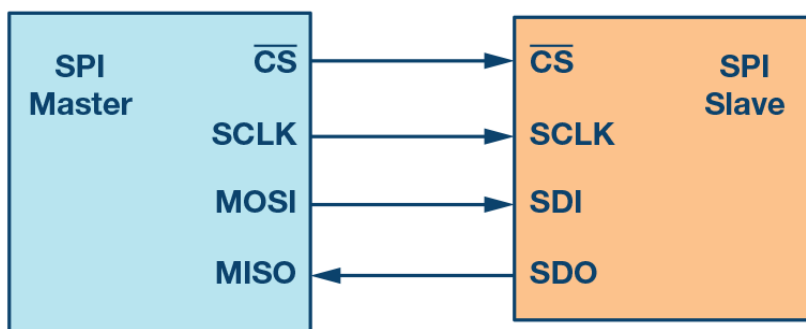
1. **Serial Clock (SCK):** This is the constant clock channel which synchronises the transferred data.
2. **Master In Slave Out (MISO):** This channel transfer data from the Master block to the Slave block which depends on the SIMO instruction whether to read or write.
3. **Slave In Master Out (SIMO):** This channel transfers data from the Slave block to the Master block. These data usually start with instruction bits (e.g. read or write) followed by the address to be read from or write to. Finally, it sends the data if it is in the write mode.
4. **Slave Select (SS):** This is the channel which selects which slave block can communicate with the Master block. This line is active low.

SPI has four modes which can operate on depending on the requirement of the communication **[2]**:

1. **Mode 0:** the clock starts with low status and it triggers the data on the falling edge of the clock.
2. **Mode 1:** the clock starts with low status and it triggers the data on the rising edge of the clock.
3. **Mode 2:** the clock starts with high status and it triggers the data on the falling edge of the clock.
4. **Mode 3:** the clock starts with high status and it triggers the data on the rising edge of the clock.

Some of the advantages of SPI over the I2C are **[3]**:

- SPI uses less power
- SPI has the ability to communicate with multiple slave devices unlike I2C which is only capable of communicating with one Slave device. However, this might be considered as a disadvantage because every slave should have a special Slave Select (SS) channel which means more pins required.
- Communication using SPI is much faster than I2C.
- Communication between the master and the master devices are full duplex which means they can send data to each other at the same time.



References:

- [1] <https://www.analog.com/en/analog-dialogue/articles/introduction-to-spi-interface.html#>
- [2] <https://www.allaboutcircuits.com/technical-articles/spi-serial-peripheral-interface/>
- [3] <https://www.circuitbasics.com/basics-of-the-spi-communication-protocol/>