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WHAT IS SPI PROTOCOL?

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synchronous protocol, whose transmission speed is high. The SPI protocol is also considered a master-slave type protocol because it is very simple and a perfect one for interfacing between microcontrollers and their peripherals. The main purpose of using SPI protocol is to interact with microprocessors and microcontrollers with some memories, like – PROM, EPROM, ADC (analog to digital converter), DAC (digital to analog converter), RTC (Real-time clock), several sensors, memory cards and with other types of microcontrollers.

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What is the SPI protocol?

SPI protocol is a convenient communication process, which was introduced by Motorola. The purpose of serial peripheral interface protocol can be seen in transmitting data within a short distance. After considering the matter of short-distance communication, it describes the communication process from one device to another device that exists on the same board. This protocol takes the assistance of a dedicated clock signal for synchronizing the transmitter and receiver or master and slave of these protocols in terms of transmitting data. On the other hand, the transmitter and receiver of this protocol are connected with different data and clock lines. The clock lines will facilitate the receivers for observing the data on the bus.

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Working of the SPI protocol

In 1980, SPI was introduced and it used to provide services at a low cost and it was considered as a reliable word for interfacing between the microcontrollers and its peripherals. It follows a simple interfacing process and which is much easier to use. Within a short period of time, the SPI protocol was considered as a standard and gradually different semiconductor manufacturers use this protocol for transmitting data in a reliable way.

When the devices are connected to the SPI for transmitting data, they actually interact with a master-slave relationship through a multipoint interface. In this context, one device is selected as the master of the bus, and its opponent is considered a slave. But, in the case of the SPI, the number of slaves may be many, but the master will be only one. The bus of the SPI consists of 4 signals or pins, which are:


1. Master – Out / Slave – In (MOSI)
2. Master – In / Slave – Out (MISO)
3. Serial Clock (SCLK) and
4. Chip Select (CS) or Slave Select (SS)

These four signals of the SPI that is implemented with the help of 4 wires, and it is known as a four-wire interface. The details of the four pins and their working as described below:

Master – Out / Slave – In or MOSI: through it, the data can be created with the help of the master and it is received by the slave. The MOSI pins are considered for both master and slave to make a connection. This pin is created in data labs and then it is transferred to the master. After creating the data by the master with the help of a clock, the data is transferred and managed by the master.

Baud rate of SPI protocol

The baud rate is considered as rate, which describes a change of polarity, depending on the baseband. Therefore, the baud rate can be considered as a bit rate, and it is near about 76 kilobits per second.



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Is SPI bidirectional?

The SPI protocol takes the assistance of a single bidirectional data line for transmitting the data, and it is known as a single in single output process. Sometimes it is known as master out/master in (MOMI). Some of the SPI protocol Texas supports bidirectional mode, which is dependent on both MOSI and MISO.

Speed of SPI protocol

The maximum speed of the SPI protocol is 60 Mbps, and it is considered as high speed for a serial protocol. It is compatible with transmitting data at a high speed for a short distance, for example, chips on the board. This is serial protocol is simple and user-friendly, it consists of a clock, two lines, and a cheap select signal.

Advantages of SPI protocol

From the above discussion, the characteristics and a brief of SPI protocol have been discussed already. In the below section, the industrial advantages of this protocol will be discussed for the convenience of the users, before considering this protocol for the communication purpose. The advantages are:

- The flexibility of the SPI protocol is superior and the advantages can be seen for transferring the bits, as it does not provide any limitation of sending 8-bit data.
- The harder interfacing of this protocol is very simple and user-friendly.
- It does not put any maximum clock speed for transmitting data.
- It can transmit the data at a high speed.
- After making and comparison with asynchronous serial, it can be said that the SPI protocol is faster.
- SPI protocol can support multiple slaves.
- it sends the data by following full-duplex communication mode, in which communication from transmitter and receiver at the same time is possible.
- It has some unique bus signal for each device, which is known as chip select, and through this, the other signals are shared.
- Any kind of arbitration failure modes can not be seen in this protocol.
- To transmit the data this protocol does not need any transceivers.
- It does not have any specific start and stop bits. Therefore, the data can be arranged continuously without any interaction.
- it has different MISO and MOSI lines for sending and receiving data at the same time.
- It does not have any difficult slave addressing system.

Disadvantages of SPI protocol

- Some disadvantages of the SPI protocol create some issues, which are described below:
- The SPI protocol needs wires for transmitting data.
- After transmitting the data no acknowledgement can be seen.

- It only provides access for a single master, not more than that.
- Error checking is not possible through SPI protocol, in the case of UART, the users can check errors through parity bits.
- After comparing the SPI protocol with the I2C protocol, It is seen that this protocol needs more pins for IC packages.
- It cannot support the process of hot-swapping.
- It needs different SS lines for each slave, it is really difficult.
- This protocol can not maintain the official standards, that is why the limitation in the application can be seen.

Programming of the SPI protocol

As most of the time, the application of SPI protocol can be seen on the microcontrollers, so maximum microcontrollers have a built-in program in them. Otherwise, the users may easily create adequate programming for controlling the I/O lines for transmitting the data. The proper programming is required for bringing the I/O lines in an appropriate sequence. The users may take the assistance of Arduino for writing programs.

Applications of SPI protocol

The primary usage of the [SPI protocol](#) can be seen in sending data between one microcontroller to other microcontrollers or its peripherals, including shift registers, memory cards, and sensors. This protocol requires a select line, separate clock, and data lines for selecting the devices. In the case of memory, the usage of the SPI protocol can be seen as SD card, MMC, EEPROM, and Flash. As sensors, the SPI protocol can be seen as sensing

temperature and pressure. In the case of control devices, the SPI protocol is used as A to D converter, D to A converter, digital POTS, and Audio Codec. Sometimes, the SPI protocol can be used as a camera lens mount, LCD, video game controller, and touch screen of several electronic devices.



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