

11 SPI communication

SPI is an abbreviation for Serial Peripheral Interface. The SPI bus can have one single master and multiple slaves on the same bus.

Unlike I²C the master doesn't use addresses to select which slave it wants to talk to. Instead each slave has an extra wire that runs from that slave directly to the master.

This wire (ss or slave select⁹⁰) is used to indicate for which slave the message is meant. The disadvantage is obvious: you need extra wires, and the master has no idea if the slave actually listens (or even exists). But there is also a big advantage. There is no addressing required on the bus itself, only data. That makes the bus faster because no time is lost on the bus for addressing related communication. Beware that a low slave select line means the slave is selected, and a high line means it is not selected. This reversed logic is often indicated with a line over the letters ss, or a slash in front of them, like this /ss.

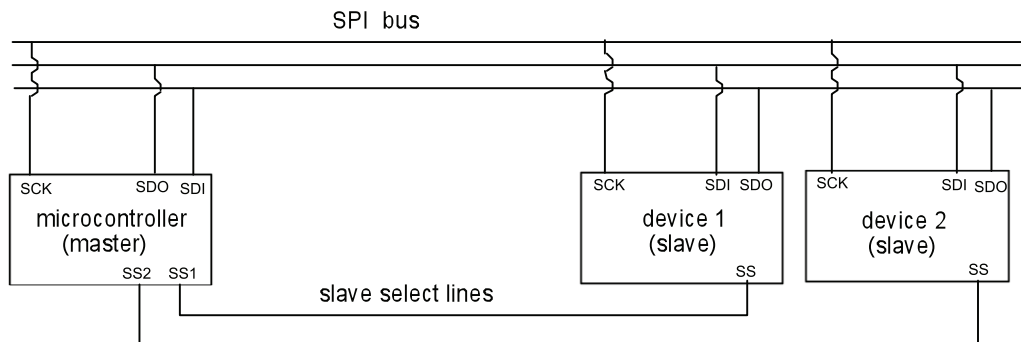


Figure 372, SPI master with two slaves.

The bus itself contains an extra wire compared to I²C. This extra wire is an additional data line, which means SPI has one clock line and two data lines⁹¹. One data line is for data from the master to the slaves, and the other data line is for data from the slaves to the master. That means that the SDO (SPI Data Out) of the master needs to be connected to the SDI (SPI Data In) of the slaves, and vice versa.

There is another advantage to SPI. The communication structure is set up in such a way that sending a single bit and receiving a single bit takes place at the exact same time. So if a chip sends data it can (and in fact must) receive data at the same time. This is a very important difference between SPI and other protocols.

Imagine a situation where a slave is a memory device that has data stored. The master needs to get that data. The two way communication (this is called full duplex) means that the master sends the memory addresses from which it wants to receive the next data to the slave, while the slave is sending out the data from the previous request at the same time. No delays in between chunks of data, no need to wait. Uninterrupted data transfer like this is often called "streaming". SPI is ideally suited for applications where data flow cannot be interrupted for any reasons, such as sound or video.

The next table compares the three different serial protocols that we have discussed so far.

⁹⁰ This wire is also called cs, chip select in some documentation.

⁹¹ In device documentation SPI is often called a 'three wire interface' even though technically this is incorrect.