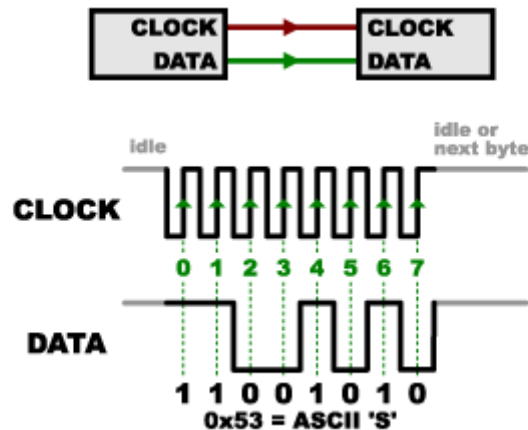
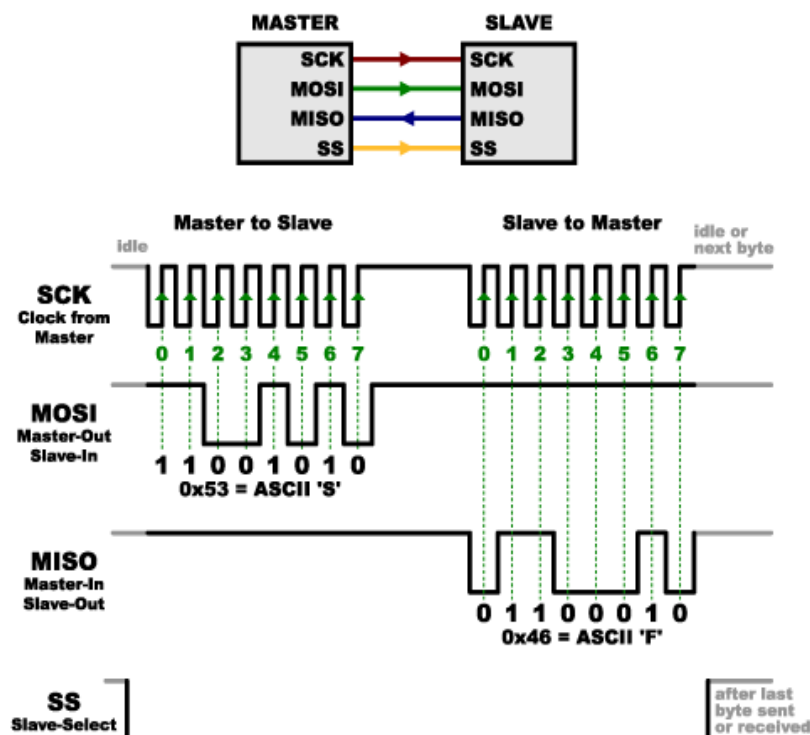


SERIAL PERIPHERAL INTERFACE (SPI)

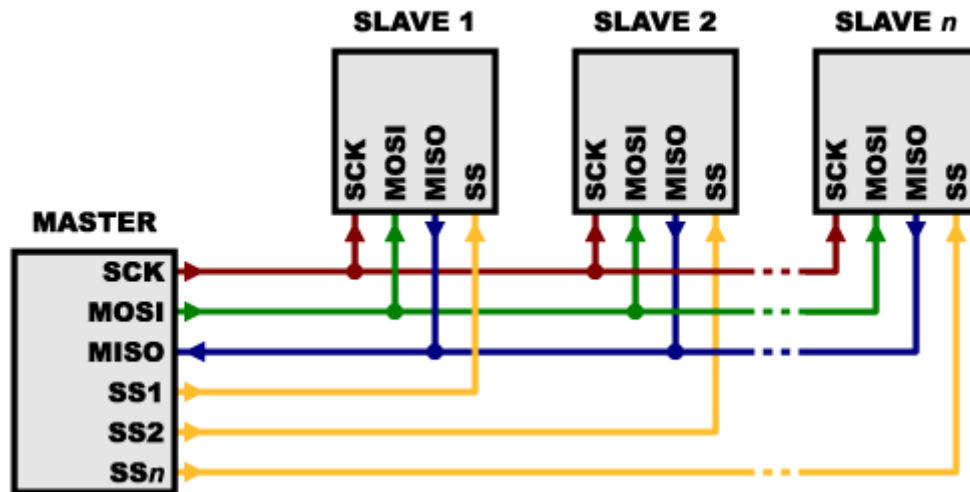
- SPI is an interface bus commonly used to send data between microcontrollers and small peripherals such as shift registers, sensors and SD cards.
- SPI has synchronous solution to receive data.



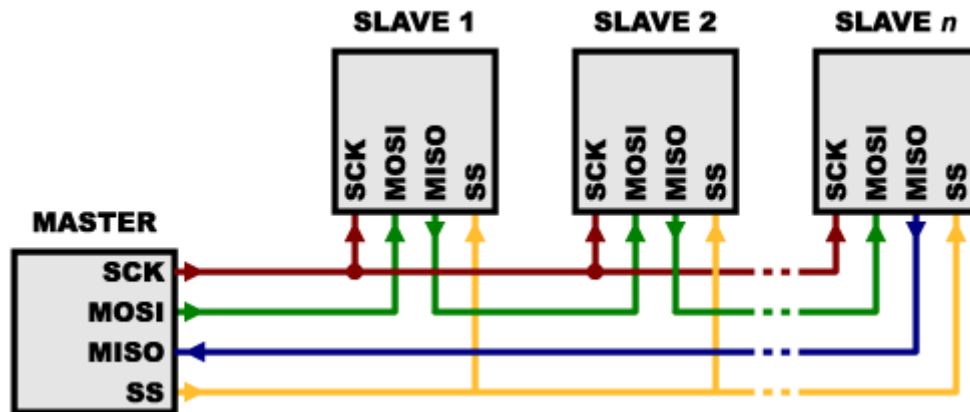
- SPI has four lines:
 - SCK / CLK – generates clock signal.
 - MOSI – data sent from master to slave, Master Out Slave In
 - MISO – data sent from slave to master, Master In Slave Out
 - SS – used to select the required slave
- SPI generates clock in only one side i.e., master generates clock and other side is called slave.



- Multiple slaves : 2 ways
 - separate slave lines:



- single SS line (daisy chain configuration):



- SPI transfer example
 - when master wants to initiate transfer, it must pull SS signal low for the slave it wants to communicate with
 - once SS signal is low, that slave will be listening on the bus
 - master is free to start sending data
- There are 4 different types of SCK signal. The four modes are categorized into two:
 - CPOL (clock polarity) – value low/high will decide the idle state of bus
 - CPHA (clock phase) – sampling of data during rising or falling edge of the clock

SPI Mode	Clock Polarity (CPOL/CKP)	Clock Phase (CPHA)	Clock Edge (CKE/NCPHA)
0	0	0	1
1	0	1	0
2	1	0	1
3	1	1	0