SPI

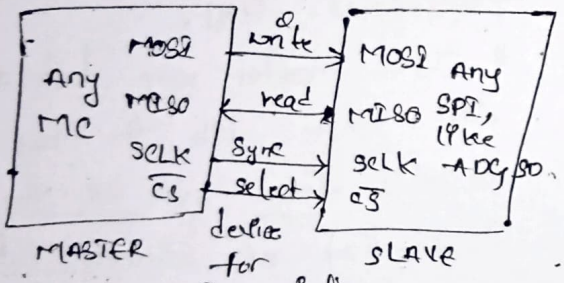
Serial Peripheral Interface (SPI)

SPI is designed by Motorola Company for on-board IC Communication or short distance communication

Features

1. SPI is designed by Motorola.
2. It is 4 wired Communication protocol.
   (i) Master in, slave out (MISO)
   (ii) Master out, slave in (MOSI)
   (iii) Serial clock (CLK/SCLK)
   (iv) Chip select / slave select (CS/SS)

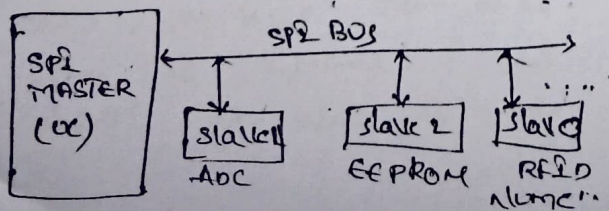
Hardware setup



O(1)

CS = 0; enable slave
read/write op on slave
CS = 1; disable slave

3. SPI is full duplex, Synchronous serial Communication protocol.
4. SPI is multi-slave Communication protocol.



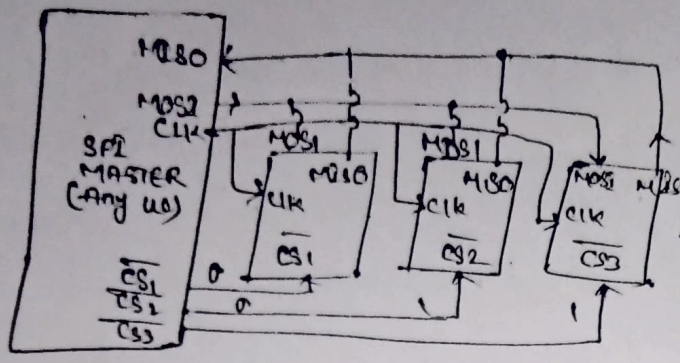
NOTE:- No Multi-master hence no arbitration in SPI protocol.

5. Maximum number of slaves that can be connected on the slave bus are decided by the hardware.
6. Speed of Communication
   * SPI does not define any speed limit; implementations often go over 10Mbps.
   (SPI speed is more than I2C)
7. Acknowledgement is not supported by the SPI.
8. Direction of data transmission can be MSB first or LSB first.
   It is depends (direction) only on the slave
9. SPI has 4 Modes of Operations. And modes are depends on the two parameters.
   (i) Clock phase (CPHA)
   (ii) clock polarity (CPOL)

CPHA: on which edge (rising / falling edge) of the clock pulse data has to sampled (read).

CPOL :- Base value of the clock (0/1).

H/w Setup: MASTER & 3 Independent Slaves



I2C bus is wired AND logic

0: dominant bit (High Priority)

1: Recessive bit. (low Priority)

IMP. Note:-

* If Both Masters sends data frame at the same time then only Arbitration comes into the Picture

* The master who will write first dominant bit (0) becomes a winner in the arbitration process.

* And winners data will be transmitted first.

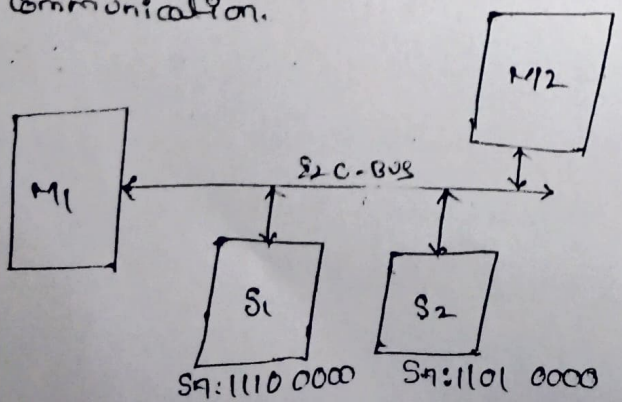
* The master who lost arbitration will wait till the bus becomes free or till the Completion of winners data transmission

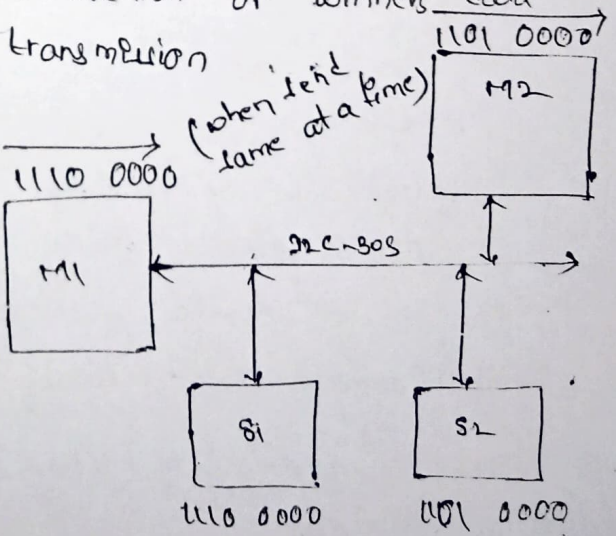
LIST of SPI Devices

* ADC (MCP 3204)
* EEPROM (Microchip 25AAXXX series)
* RFID Reader
* MICRO SD CARD
* Ext. CAN Controller
* Sensors
* Touch screen display
* etc.,

I2C Arbitration

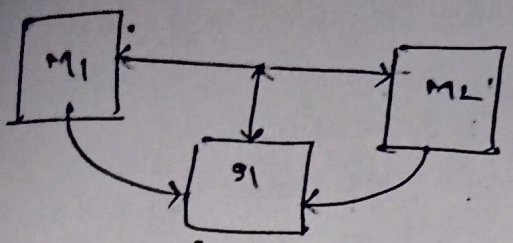
Note:- This arbitration Concept Comes into picture only in the case of multi-master communication.





→ In this M1 & M2, which is send 0 (dominant bit) write from the slave form MSB to LSB i.e.,

Exceptional Case



SA:- 1100 011

→ when both are writing at the ~~same~~ same slave (address also)

→ Both are winners

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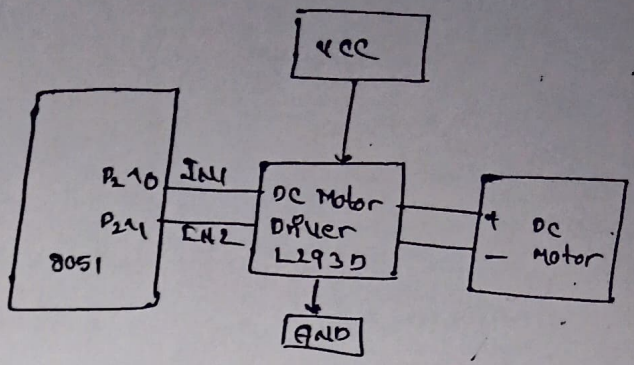
* wt is the max Current for a pout pin in the Micro-Controller

Ans:- Max 20mA and ideally 10-50mA

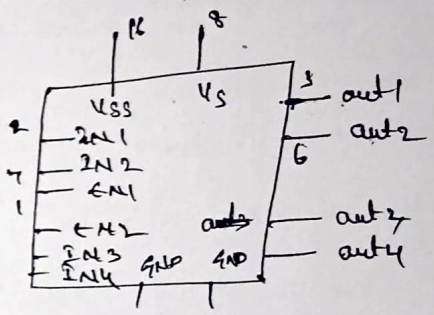
Interfacing of DC Motor



case 1:- IN1 = high & IN2 = low, then motor Rotates clockwise.

case 2:- IN1 = low & IN2 = high, then motor rotates Anticlockwise

case 3:- If IN1 = IN2 then no Rotation.



→ VSS → for L293D operation (5V)

→ VS → Motor (speed) & (4.5-36V)

* Duty cycle is directly proportional to avg power

* i.e., when duty cycle is higher, Motor speed is also higher.

→ when duty cycle is lower, Motor speed is also lower