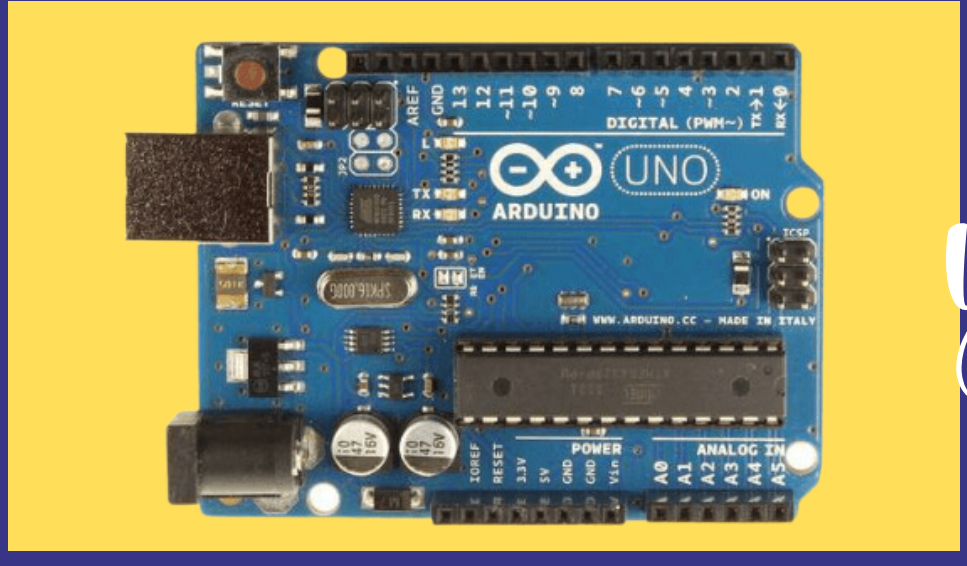
ROBO DYNAMICS



Build Your Own Robot

Chapter 3
Arduino UNO

What is Arduino UNO

- The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian.
- It was named as UNO to label the first release of Arduino Software.
- It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects.
- Arduino.cc developed the Arduino UNO board.
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What is Arduino UNO

- Arduino UNO is based on an ATmega328P microcontroller.
- It is easy to use compared to other boards, such as the Arduino Mega board, etc.
- The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.
- The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.
- The IDE is common to all available boards of Arduino.
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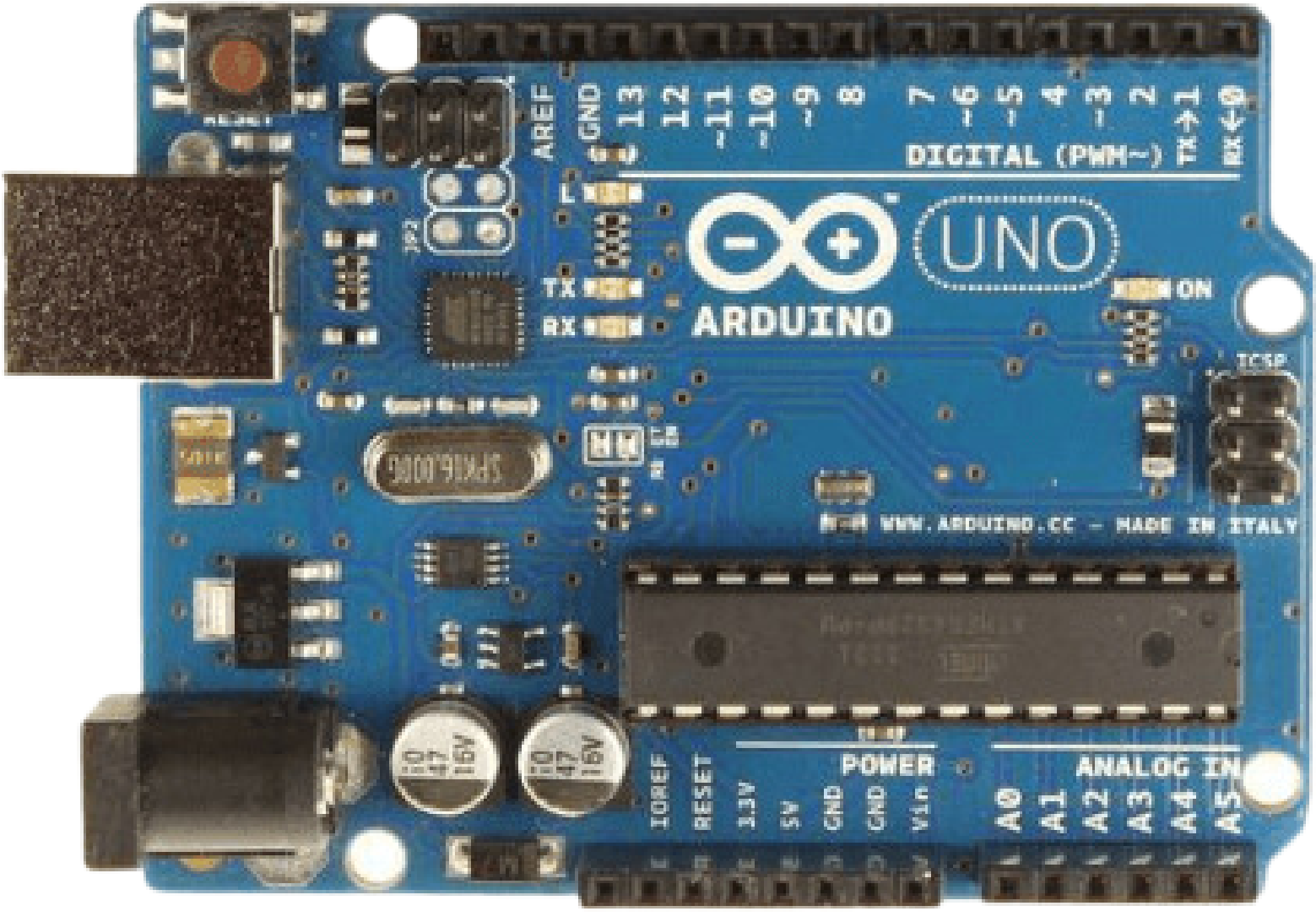
Arduino UNO Board



What is Arduino UNO

- **The components of Arduino UNO board are shown below:**
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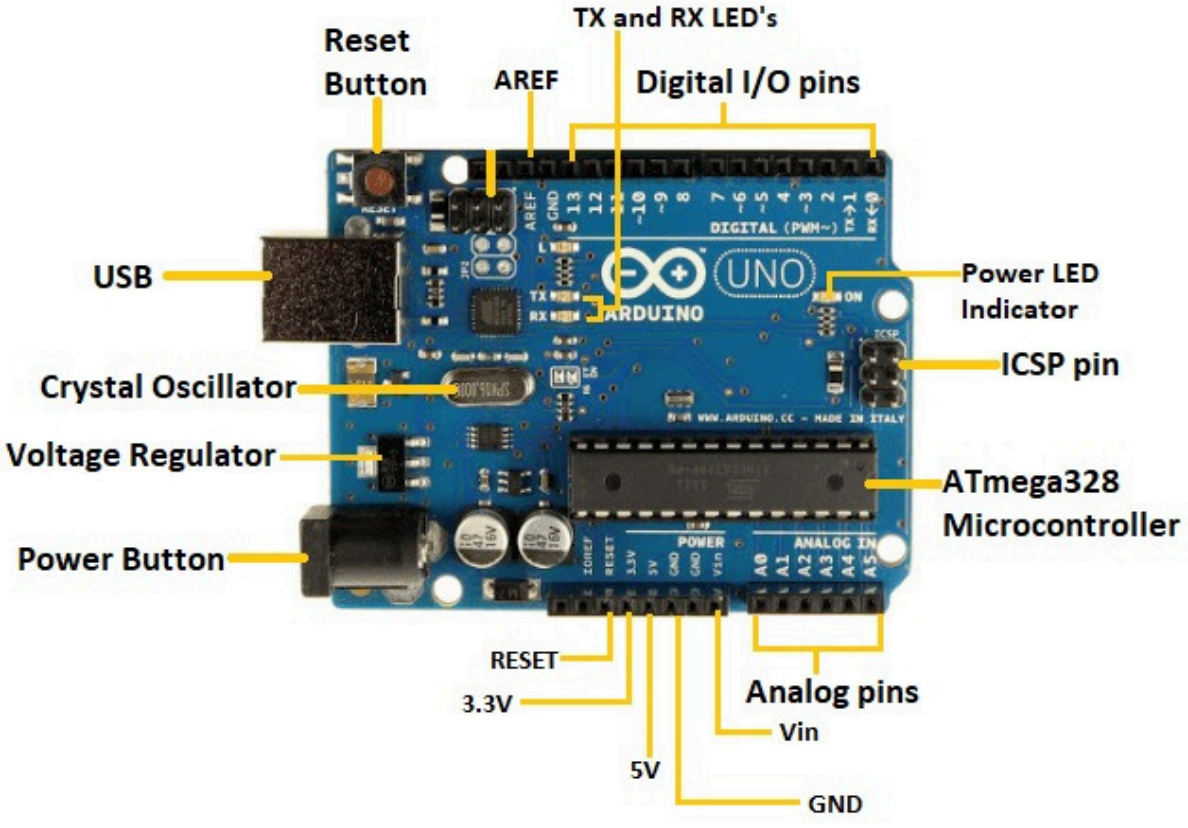

Arduino UNO Components

- **ATmega328 Microcontroller-**
  - **It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin -**
  - **The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.**
- **Power LED Indicator-**
  - **The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.**
-

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Arduino UNO Components

- **Digital I/O pins-**
  - **The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.**
- **TX and RX LED's-**
  - **The successful flow of data is represented by the lighting of these LED's.**
- **AREF-**
  - **The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.**
- **Reset button-**
  It is used to add a Reset button to the connection.
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Arduino UNO Components

- **USB-**
  - **It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.**
- **Crystal Oscillator-**
  - **The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.**
- **Voltage Regulator-**
  - **The voltage regulator converts the input voltage to 5V.**
- **GND-**
  - **Ground pins. The ground pin acts as a pin with zero voltage.**
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Arduino UNO Components

- **Vin-**
  It is the input voltage.
- **Analog Pins-**
  - **The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.**
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Arduino UNO Pin out

- The Arduino UNO is a standard board of Arduino, which is based on an ATmega328P microcontroller. It is easier to use than other types of Arduino Boards.
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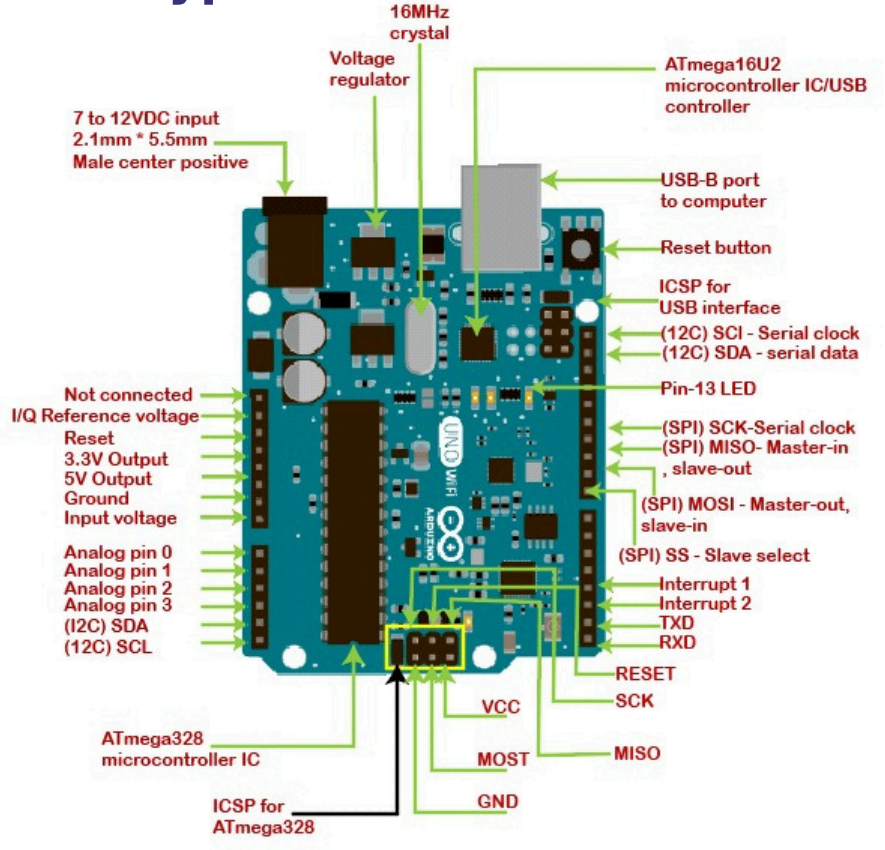

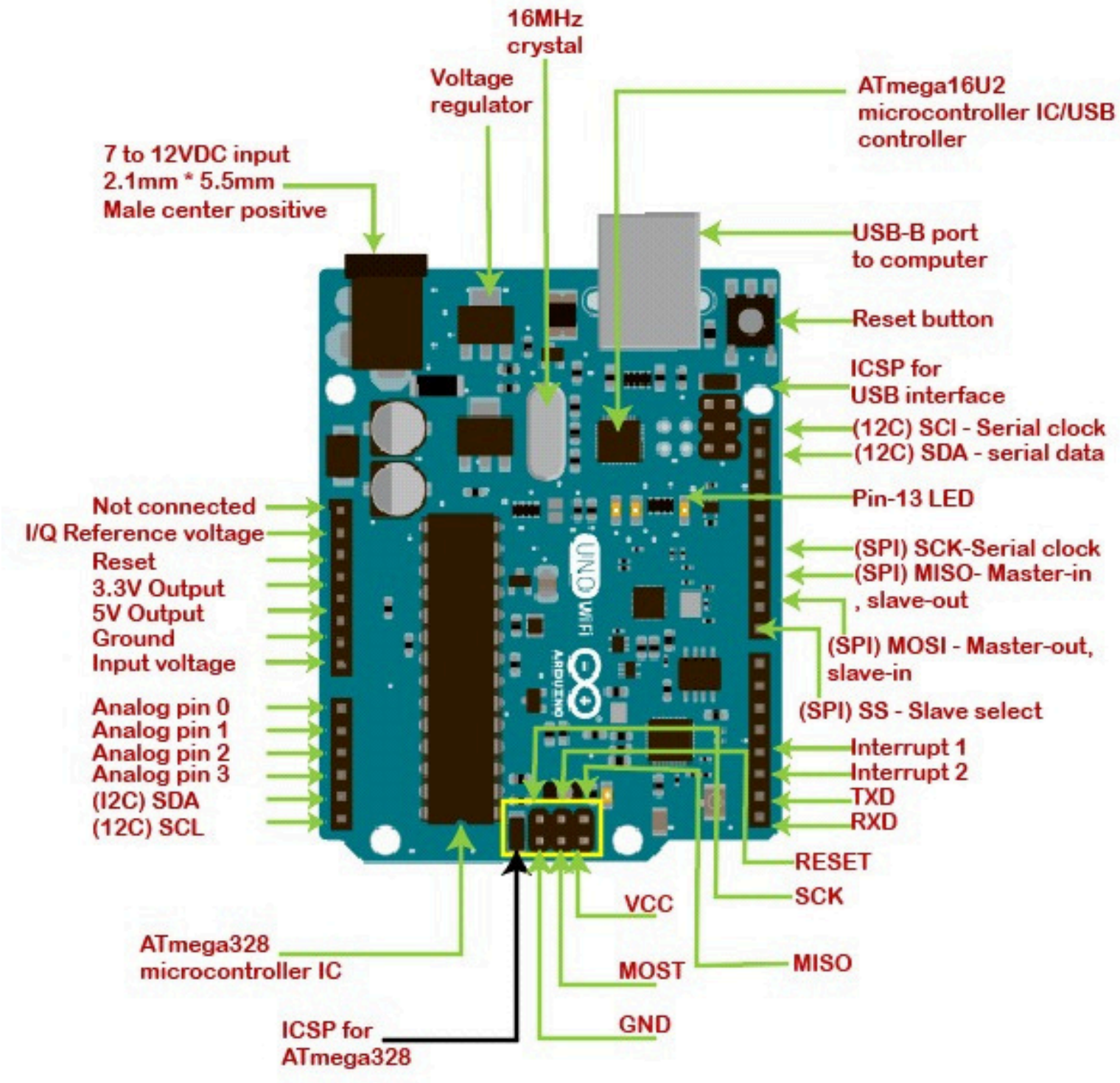
16MHz
crystal
Voltage
regulator
ATmega16U2
microcontroller IC/USB
controller
7 to 12VDC input
2.1mm * 5.5mm
Male center positive
USB-B port
to computer
Reset button
ICSP for
USB interface
(12C) SCl - Serial clock
(12C) SDA - serial data
Pin-13 LED
(SPI) SCK-Serial clock
(SPI) MISO- Master-in
, slave-out
(SPI) MOSI - Master-out,
slave-in
(SPI) SS - Slave select
Interrupt 1
Interrupt 2
TXD
RXD
RESET
SCK
MISO
VCC
MOST
GND
Not connected
I/Q Reference voltage
Reset
3.3V Output
5V Output
Ground
Input voltage
Analog pin 0
Analog pin 1
Analog pin 2
Analog pin 3
(I2C) SDA
(12C) SCL
ATmega328
microcontroller IC
ICSP for
ATmega328

Arduino UNO Pin out

- **ATmega328 Microcontroller-**
  - **It is a single chip Microcontroller of the ATmel family. The processor core inside it is of 8-bit. It is a low-cost, low powered, and a simple microcontroller. The Arduino UNO and Nano models are based on the ATmega328 Microcontroller.**
- **Voltage Regulator**
  - **The voltage regulator converts the input voltage to 5V. The primary function of voltage regulator is to regulate the voltage level in the Arduino board. For any changes in the input voltage of the regulator, the output voltage is constant and steady.**
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Arduino UNO Pin out

- **GND - Ground pins.**
  The ground pins are used to ground the circuit.
- **TXD and RXD**
  - **TXD and RXD pins are used for serial communication. The TXD is used for transmitting the data, and RXD is used for receiving the data. It also represents the successful flow of data.**
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Arduino UNO Pin out

- **USB Interface**
  - **The USB Interface is used to plug-in the USB cable. It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.**
- **RESET**
  It is used to add a Reset button to the connection
- **SCK**
  - **It stands for Serial Clock. These are the clock pulses, which are used to synchronize the transmission of data**
- **MISO**
  - **It stands for Master Input/ Slave Output. The save line in the MISO pin is used to send the data to the master.**
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Arduino UNO Pin out

- **VCC**
  - **It is the modulated DC supply voltage, which is used to regulate the IC's used in the connection. It is also called as the primary voltage for IC's present on the Arduino board. The Vcc voltage value can be negative or positive with respect to the GND pin.**
- **Crystal Oscillator-**
  - **The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.**
- **ICSP**
  - **It stands for In-Circuit Serial Programming. The users can program the Arduino board's firmware using the ICSP pins.**
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Arduino UNO Pin out

- The program or firmware with the advanced functionalities is received by microcontroller with the help of the ICSP header.
- The ICSP header consists of 6 pins.
- The structure of the ICSP header is shown below
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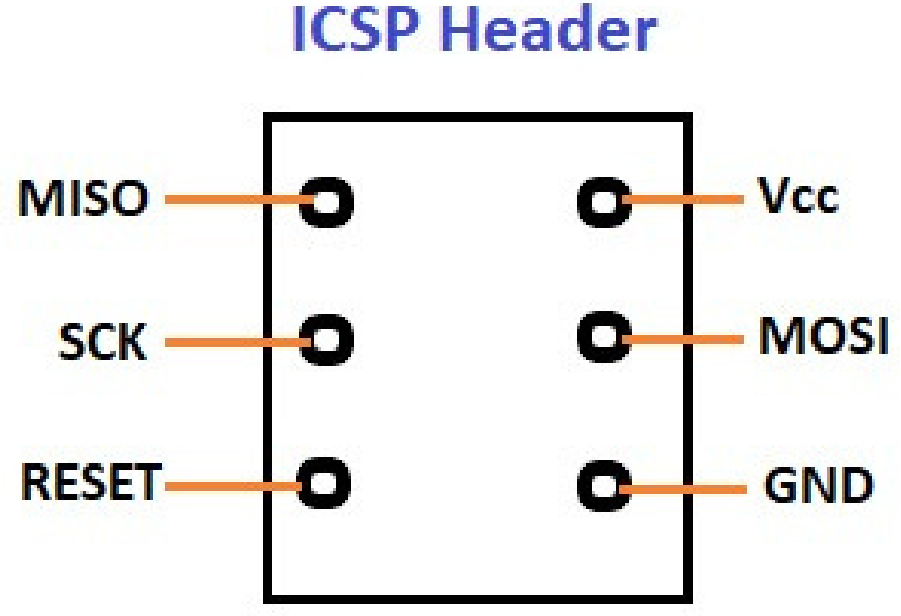

Arduino UNO Pin out

- It is the top view of the ICSP header.
- SDA
  - It stands for Serial Data. It is a line used by the slave and master to send and receive data. It is called as a data line, while SCL is called as a clock line.
- SCL
  - It stands for Serial Clock. It is defined as the line that carries the clock data. It is used to synchronize the transfer of data between the two devices. The Serial Clock is generated by the device and it is called as master
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Arduino UNO Pin out

- **SPI**
  - **It stands for Serial Peripheral Interface. It is popularly used by the microcontrollers to communicate with one or more peripheral devices quickly. It uses conductors for data receiving, data sending, synchronization, and device selection (for communication).**
- **MOSI**
  It stands for Master Output/ Slave Input
- **The MOSI and SCK are driven by the Master.**

Arduino UNO Pin out

- **SS**
  - **It stands for Slave Select. It is the Slave Select line, which is used by the master. It acts as the enable line.**
- **I2C**
  - **It is the two-wire serial communication protocol. It stands for Inter Integrated Circuits. The I2C is a serial communication protocol that uses SCL (Serial Clock) and SDA (Serial Data) to receive and send data between two devices**
- **3.3V and 5V are the operating voltages of the board.**
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