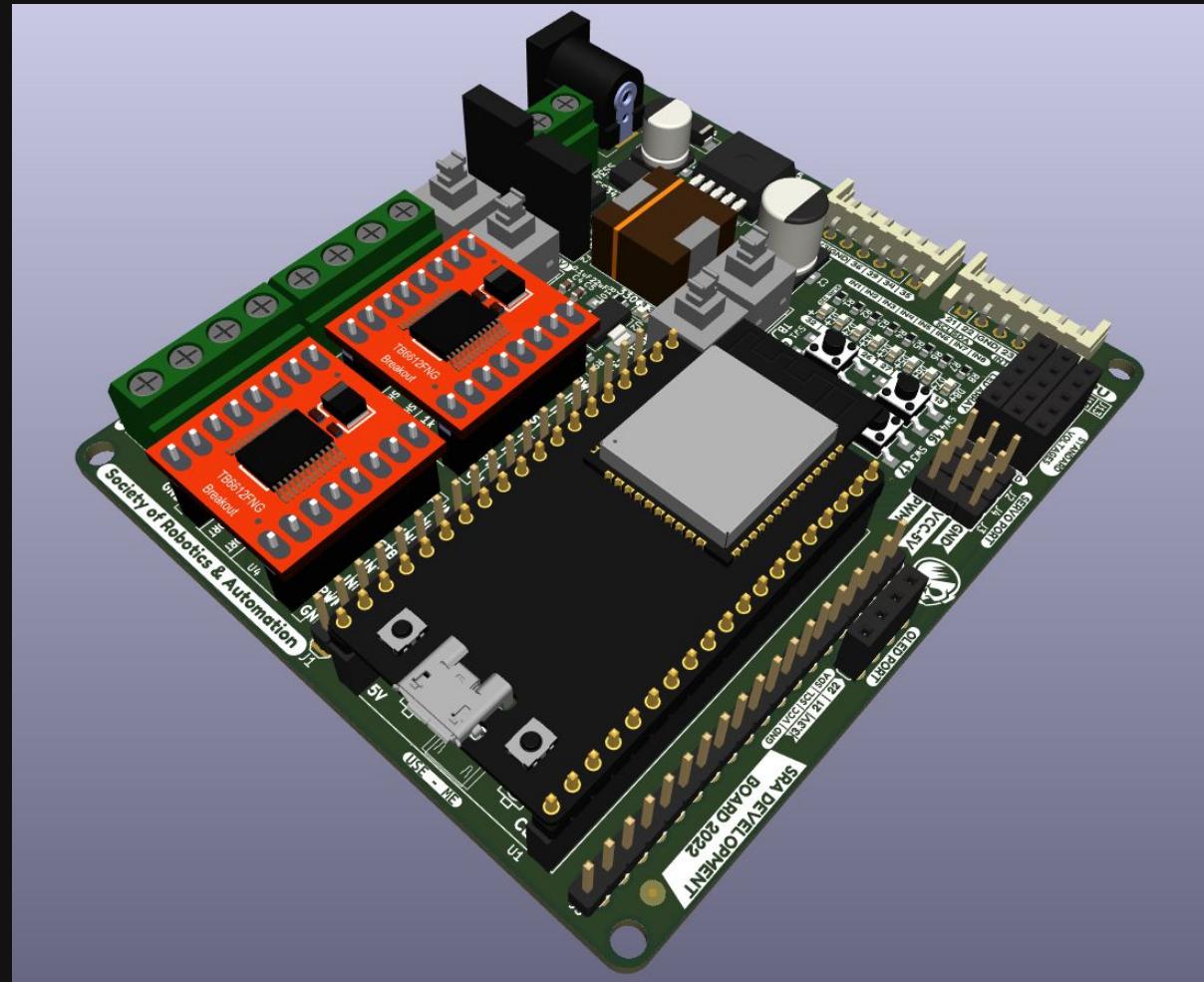
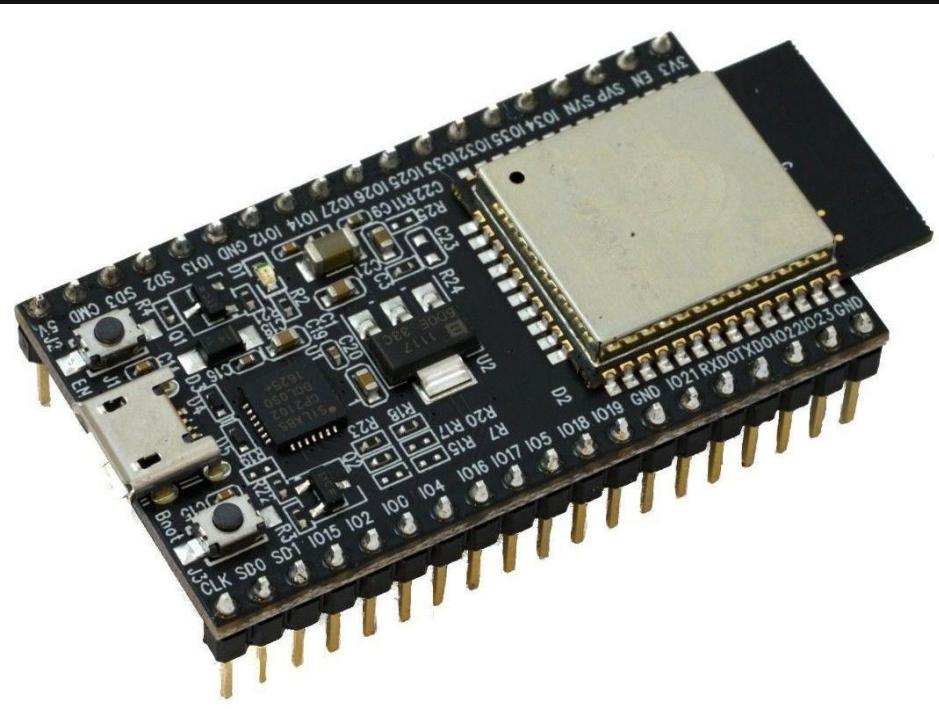
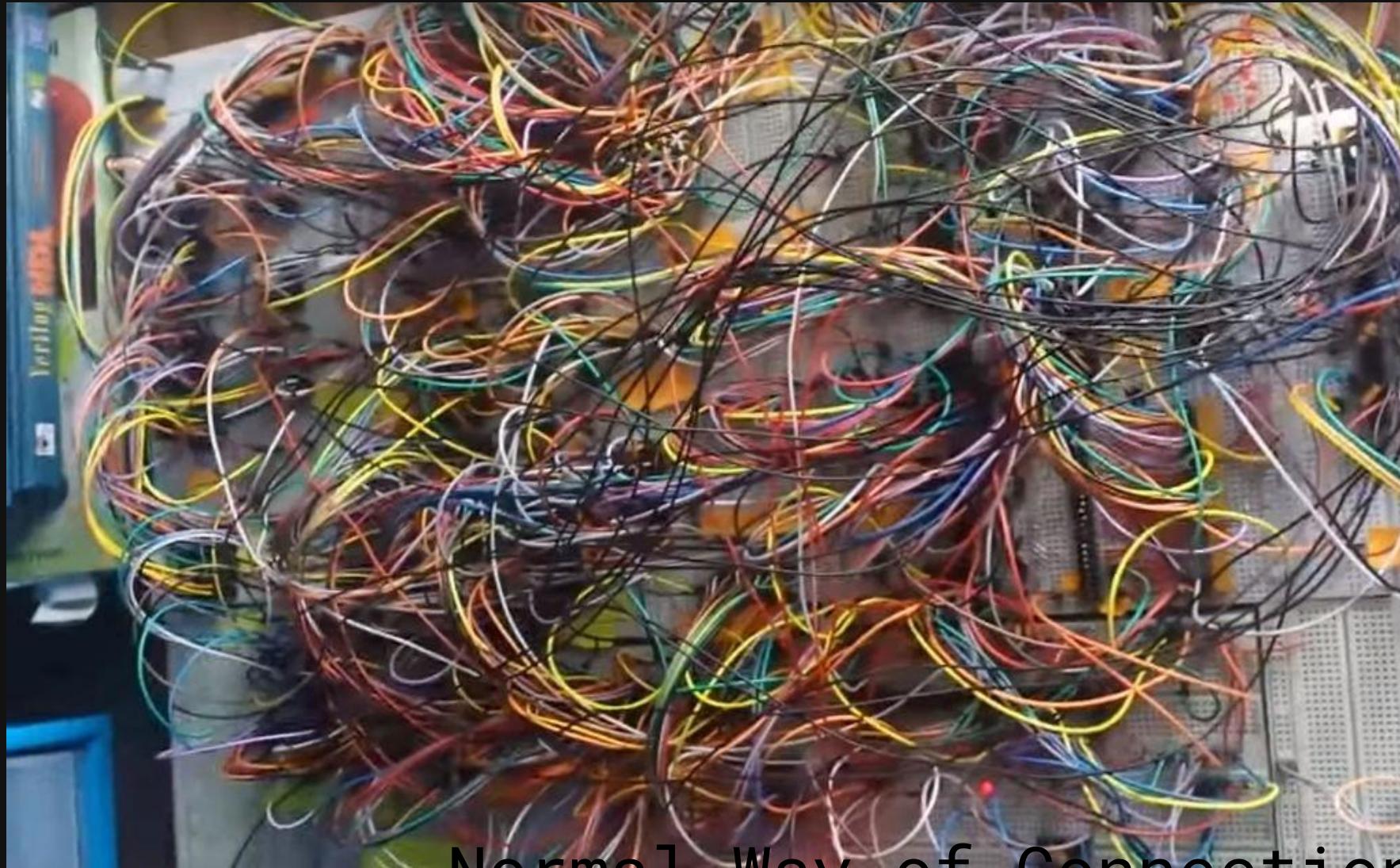


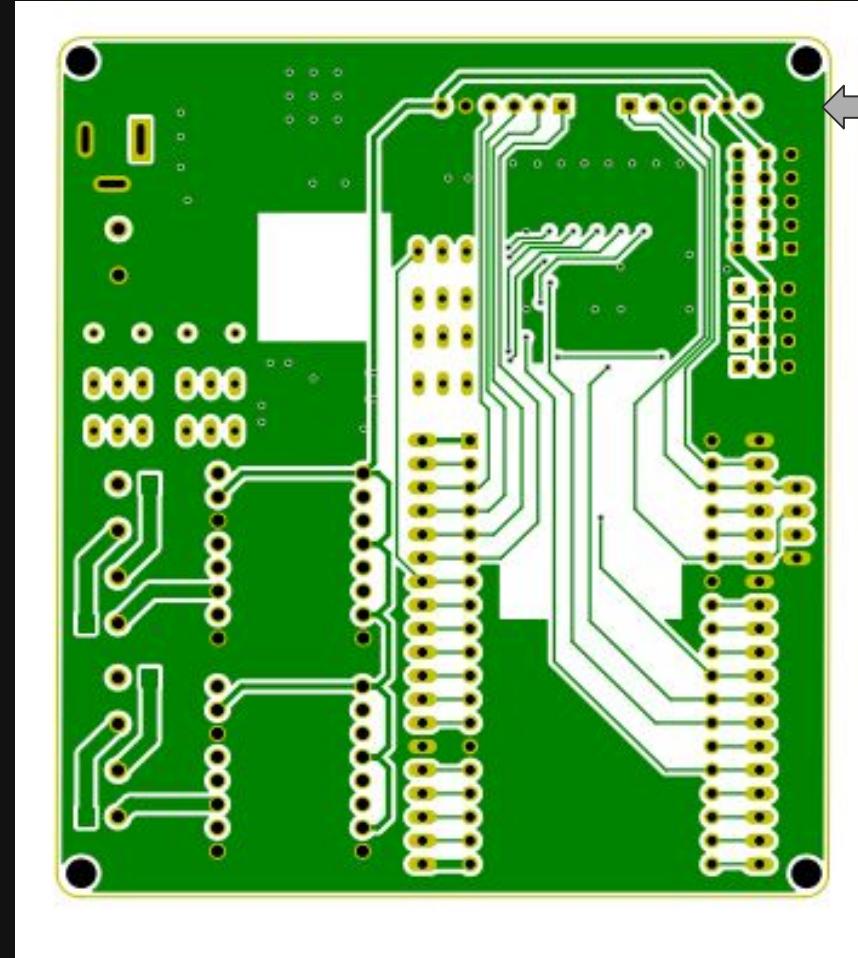
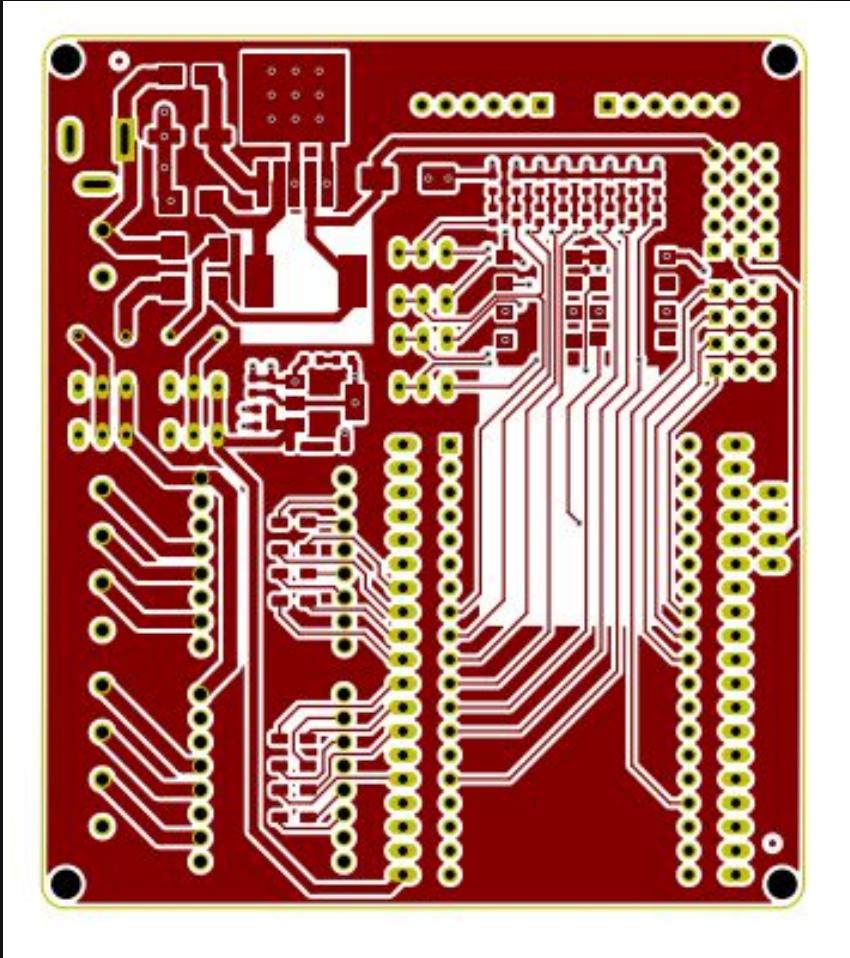
SRA DEVELOPMENT BOARD and ESP32





Normal Way of Connection

Printed Circuit Board (PCB):



Copper traces
(Brown and
green lines
or tracks)

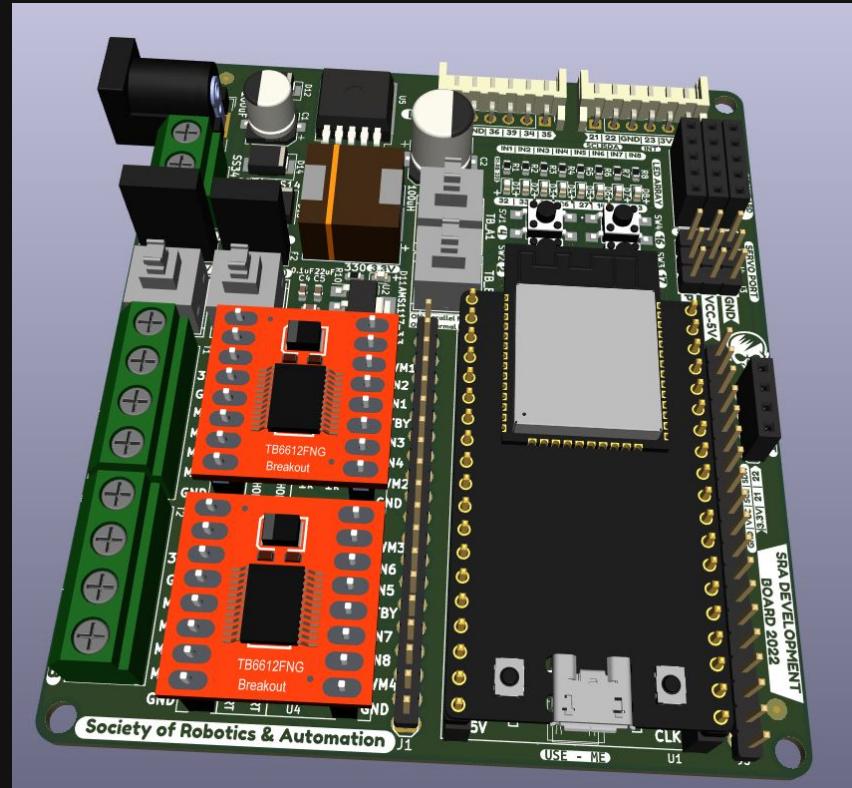
SRA-Dev Board 2022



- SRA-Dev-Board is a PCB(printed circuit board) designed by our SRA team.
- This board is developed for learning and exploring various fields of robotics and it also provides breakout for various hardware peripherals which can be connected with onboard microcontroller.

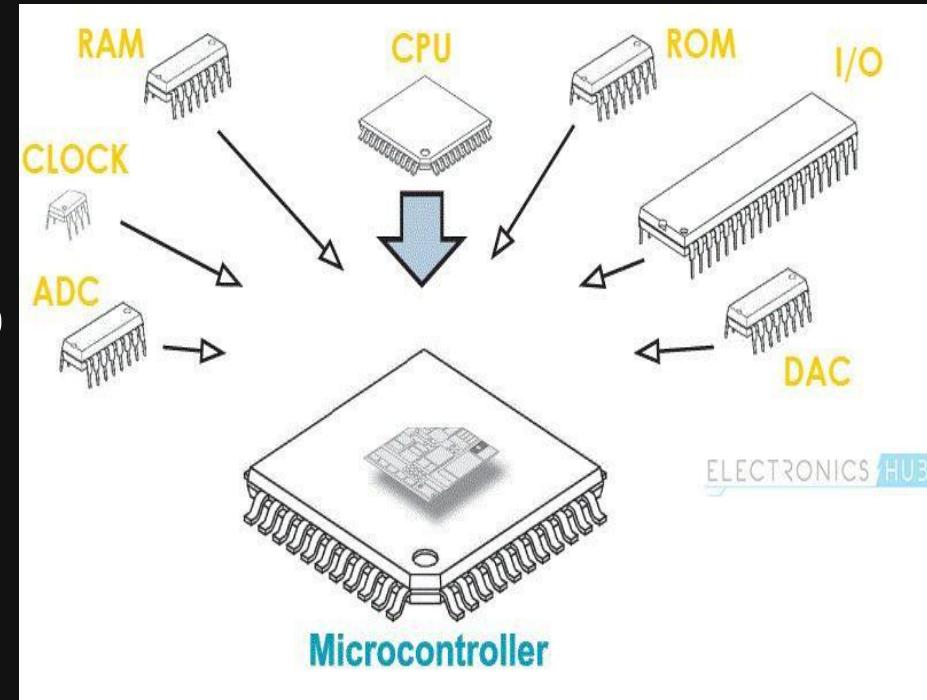
The SRA-dev-Board includes...

- Microcontroller (ESP32)
- Motor Drivers (TB6612FNG)
- Push buttons (which can be used for various applications)
- MPU and line sensor array breakouts
- Onboard Power management system
- OLED and servo motor breakouts



What is a Microcontroller?

- A microcontroller is a single Integrated Circuit (IC) that is typically used for a specific application and designed to implement certain tasks.
- Peripheral or Input/Output devices generally can't work on their own and hence need a HEAD or CONTROL device which controls its working.
- Just like Human **brain** controls the body
- CPU controls the RAM, Memory, ROM, Peripherals, etc
- Similarly to control and co-ordinate between electronic, electrical and other devices, microcontrollers(MCU) do the needful.
- Examples - ESP32, ESP8266, Arduino(ATMEGA ...)



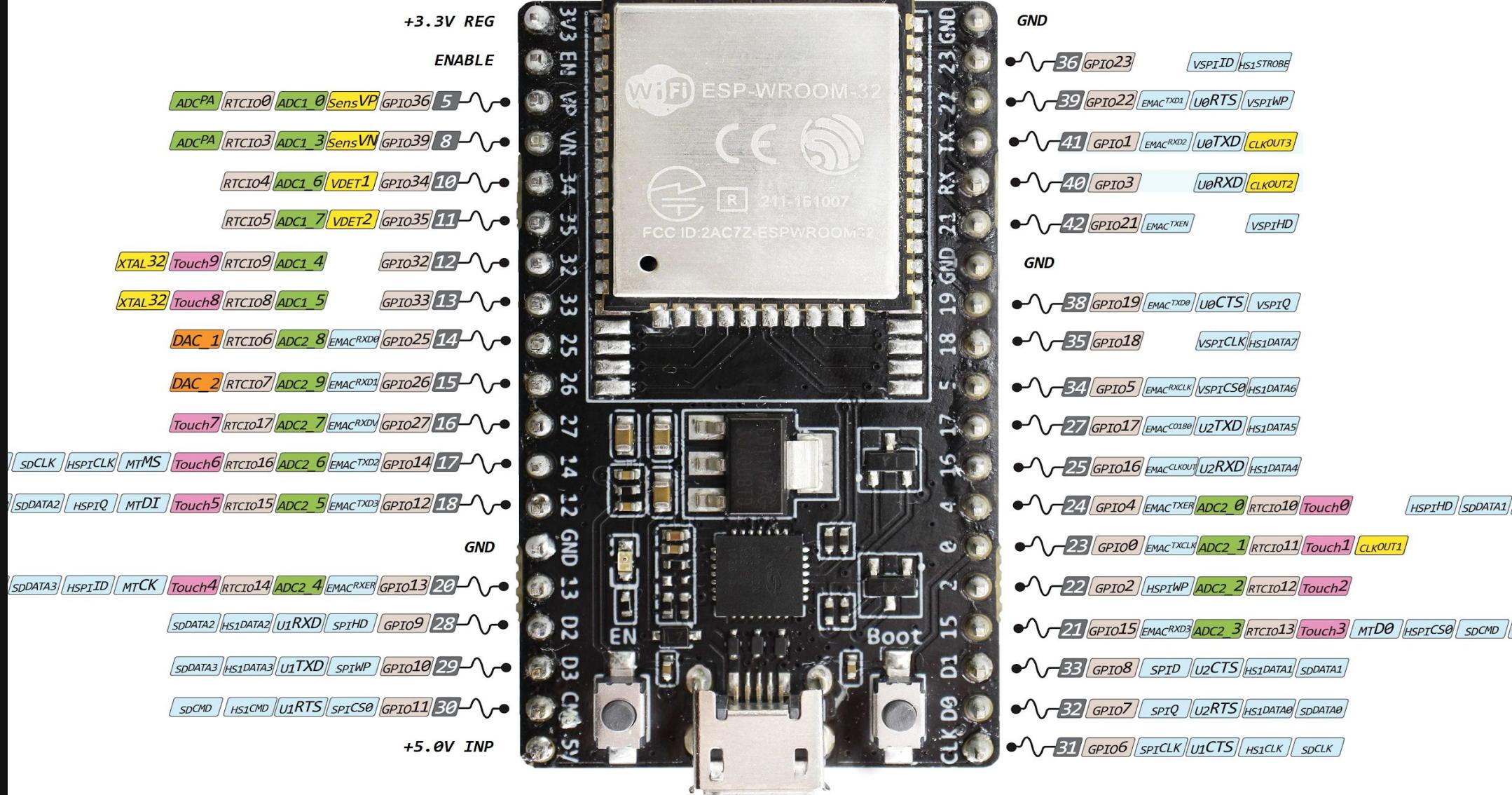
ESP32 and its features

ESP32 is a system on a chip that integrates the following features:

- Wi-Fi (2.4 GHz band)
- ESP32 clock frequency 160-240Mhz
- Bluetooth 4.2
- Dual high performance cores
- Temperature Sensor
- Hall Sensor
- Touch Sensor
- RAM, ROM etc



ESP-WROOM-32 DEV KIT



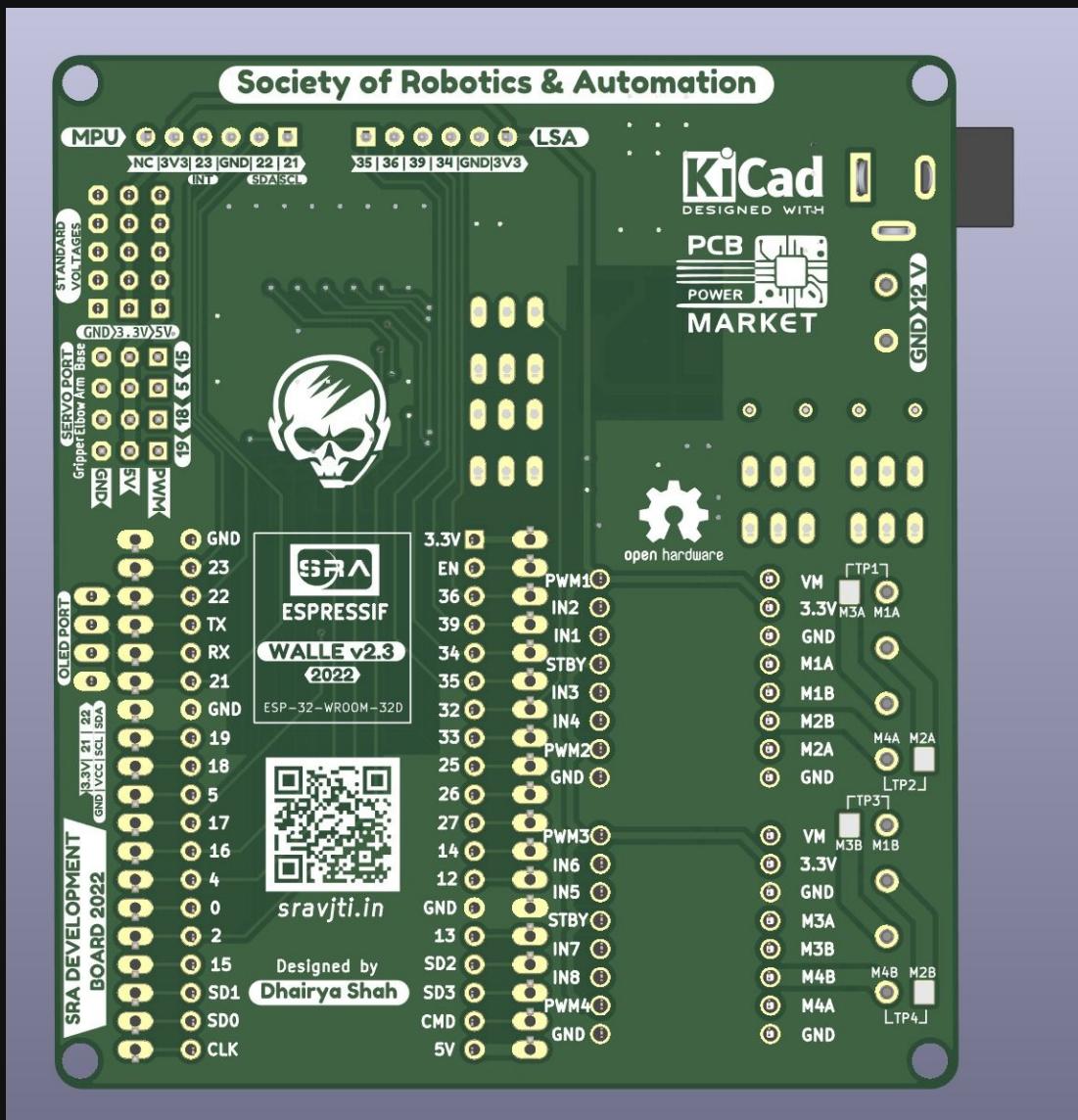
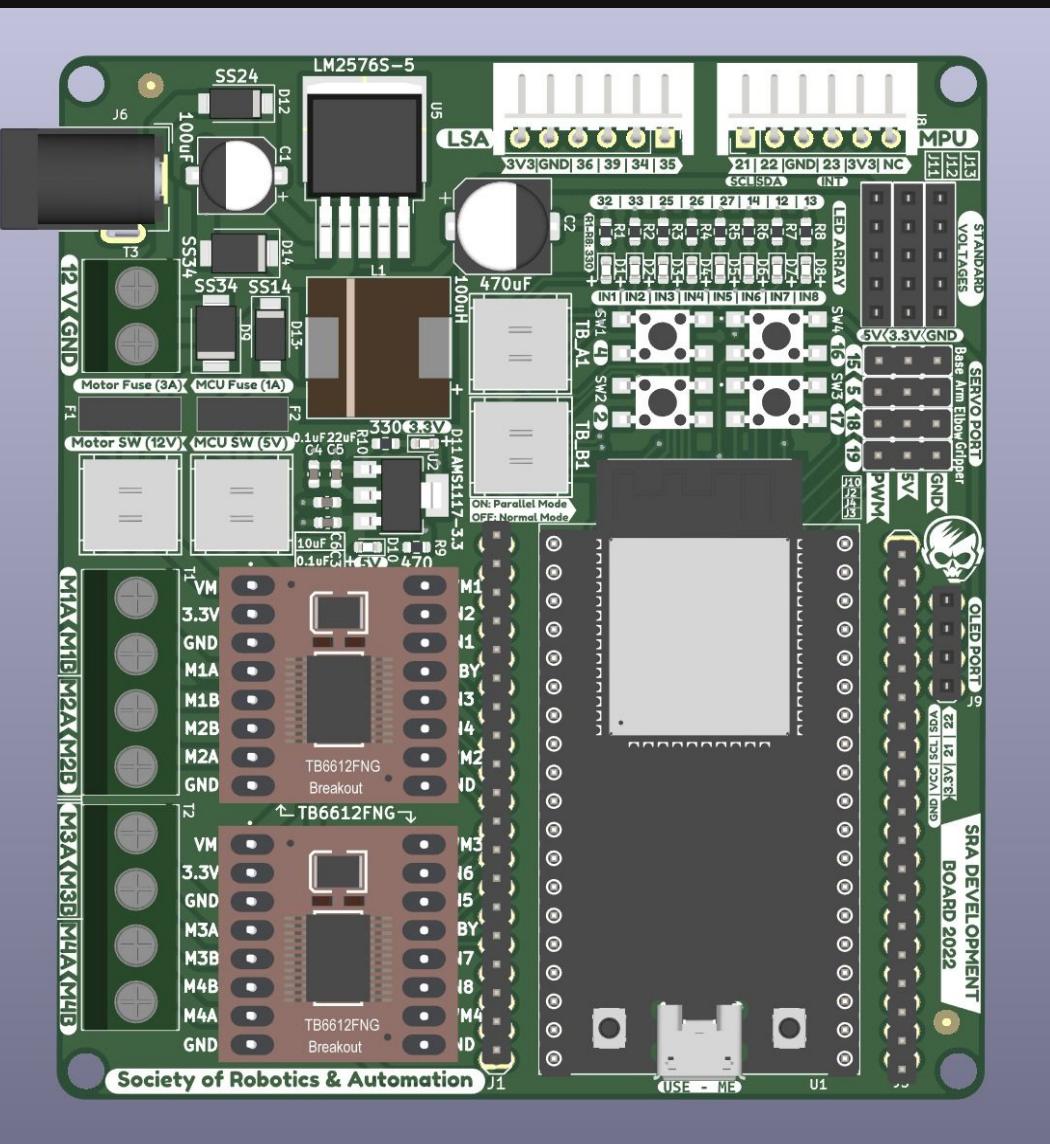
MADE BY GUSTAVO MURTA BASED ON JAN 2018
www.pighixxx.com/test/portfolio-items/new-esp32-wroom32-module/

ESP-IDF

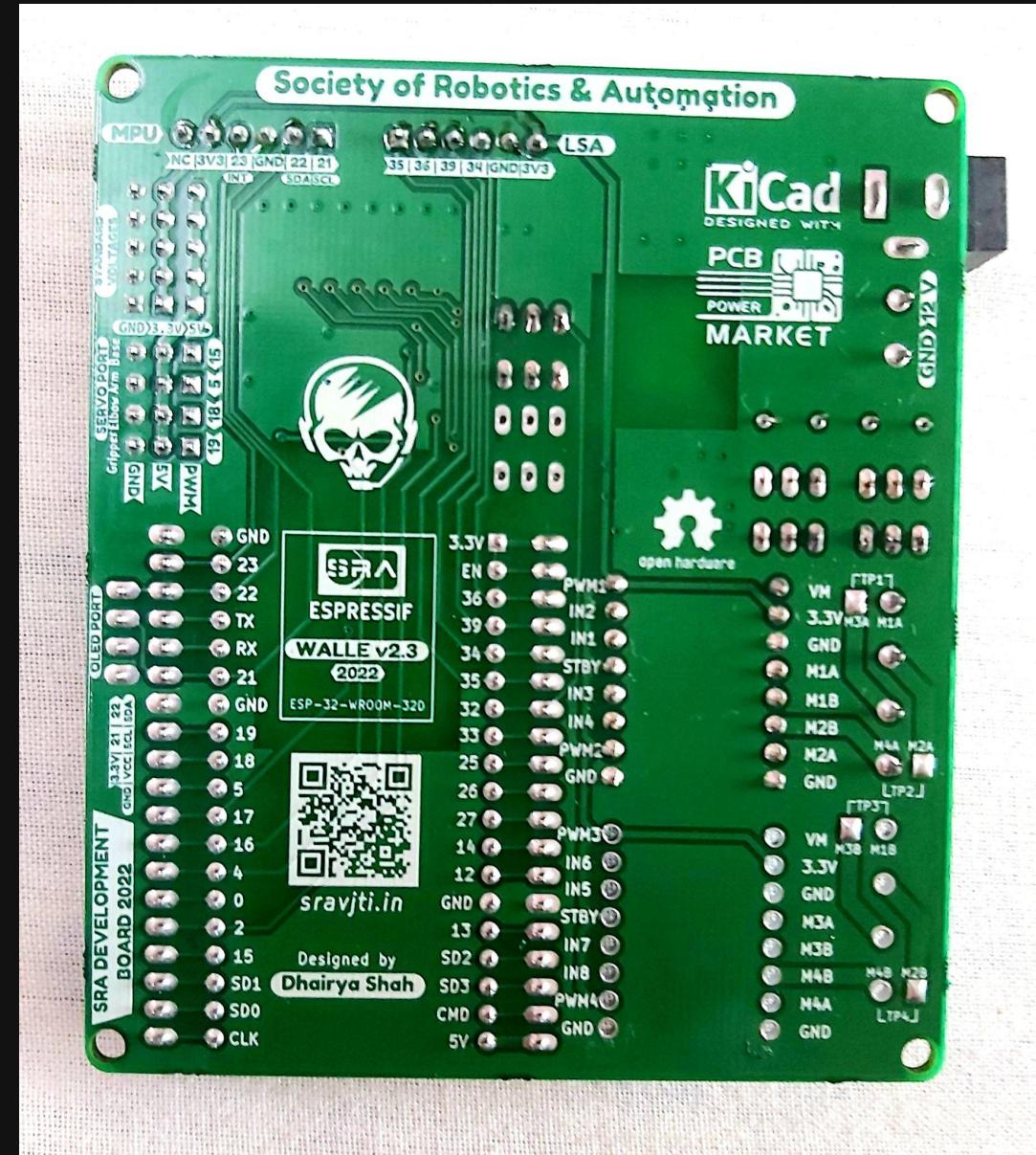
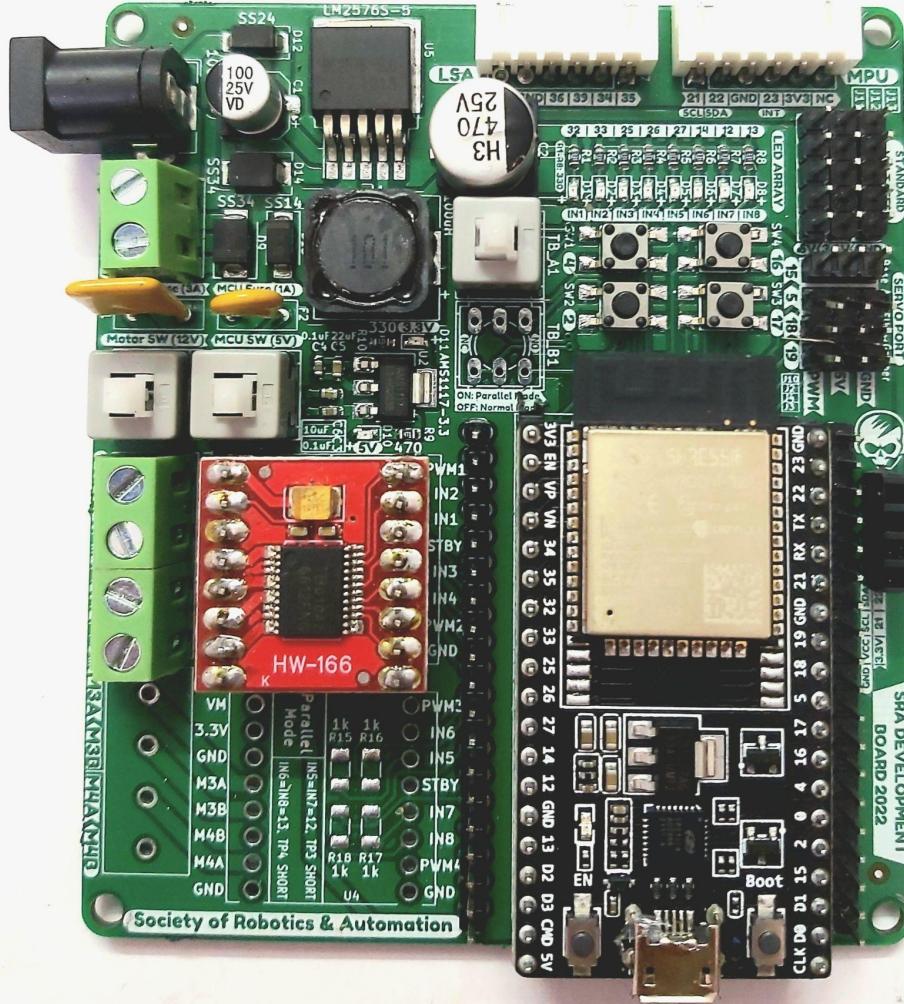


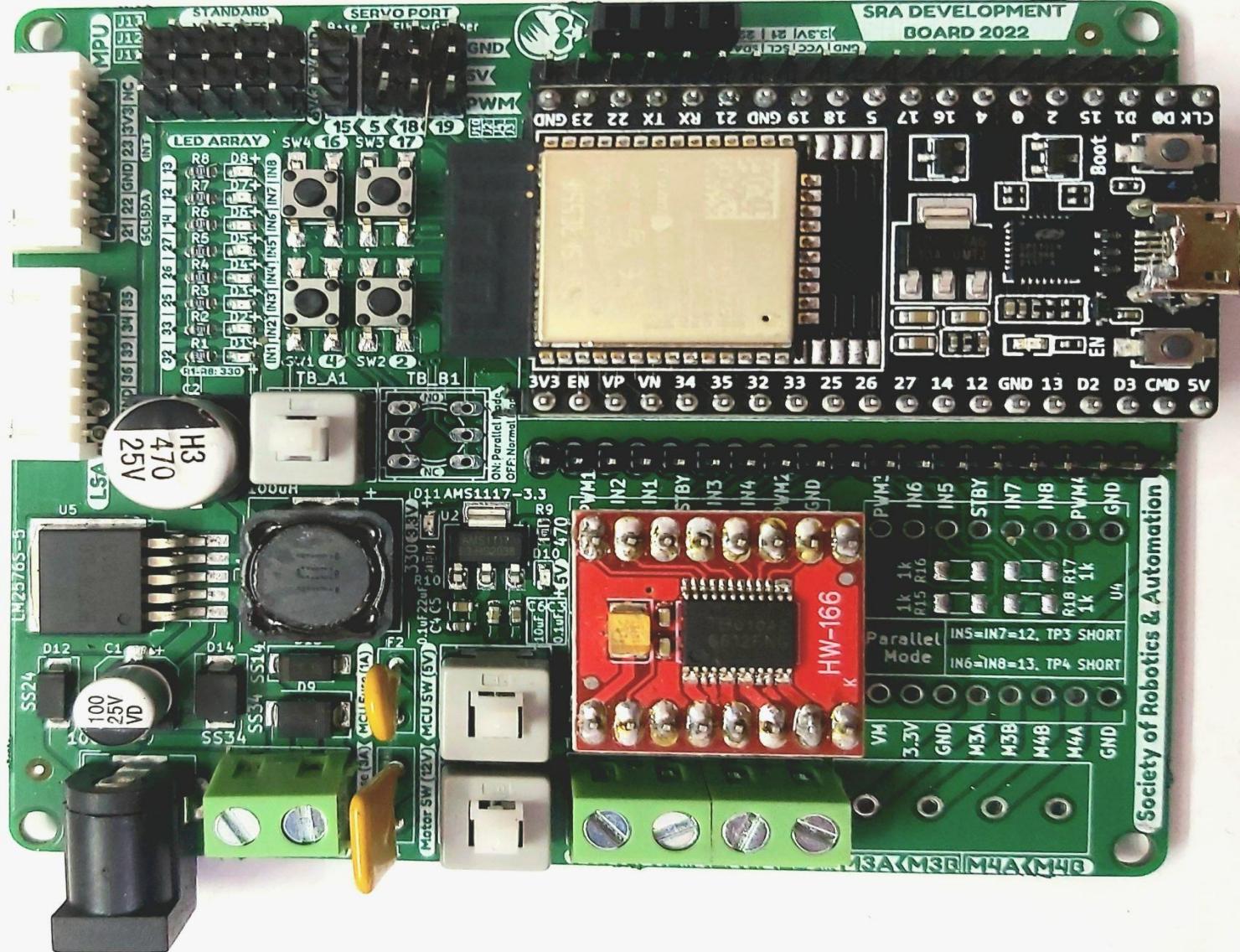
- IDF stands for IoT development framework.
- IDF is ESP's i.e Espressif's own authentically created official toolchain to work on and program, build compile code on ESP based microcontrollers.
- IDF is better than any 3rd party IDE or toolchain like Arduino IDE because:
 1. IDF receives all the updates and compatibility first. It is recommended by the manufacturers of ESP.
 2. IDF gives the user the freedom to configure and modify the microcontroller up till the smallest register level.
 3. Has a proper and simple file structure.

SRA BOARD :

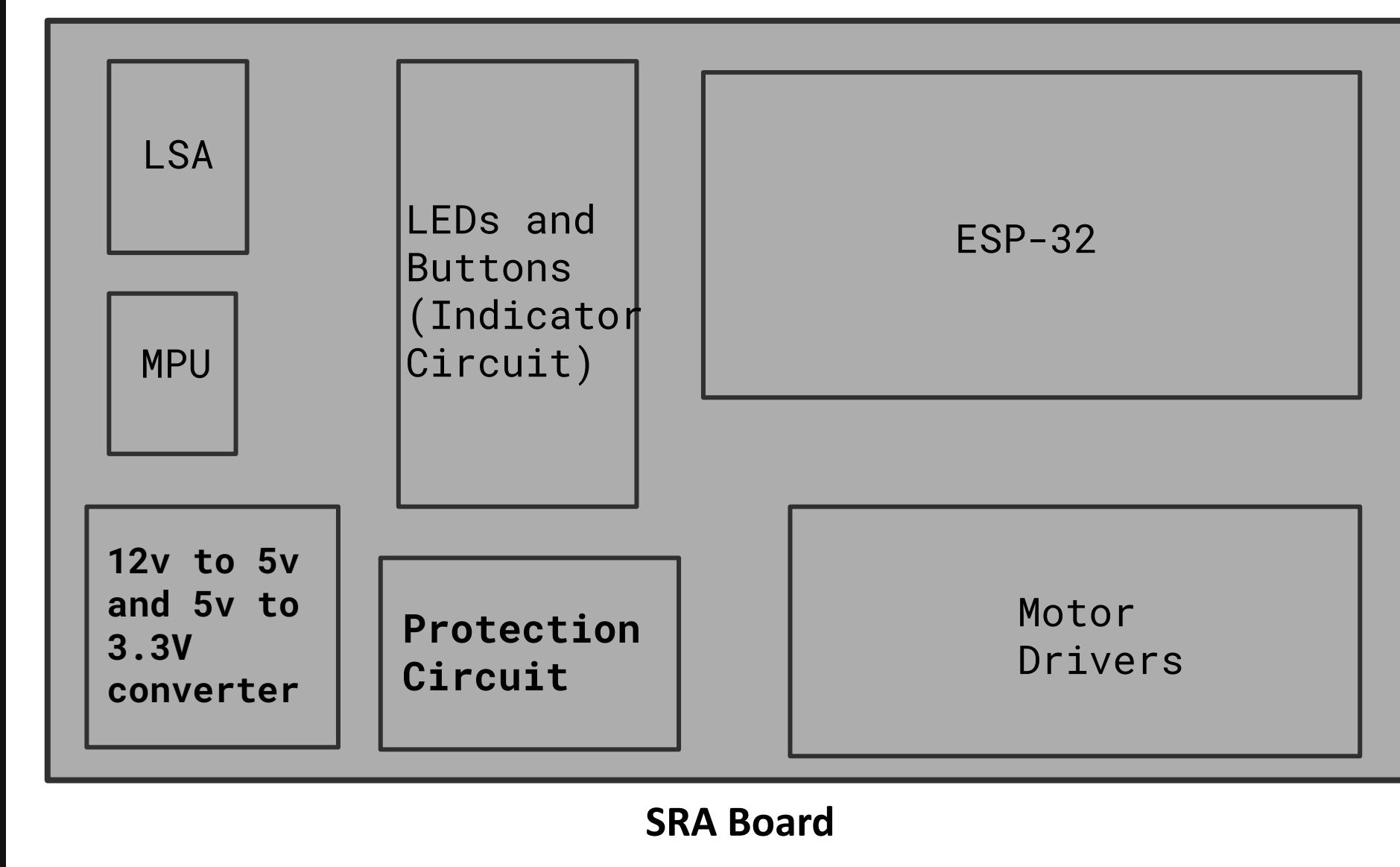


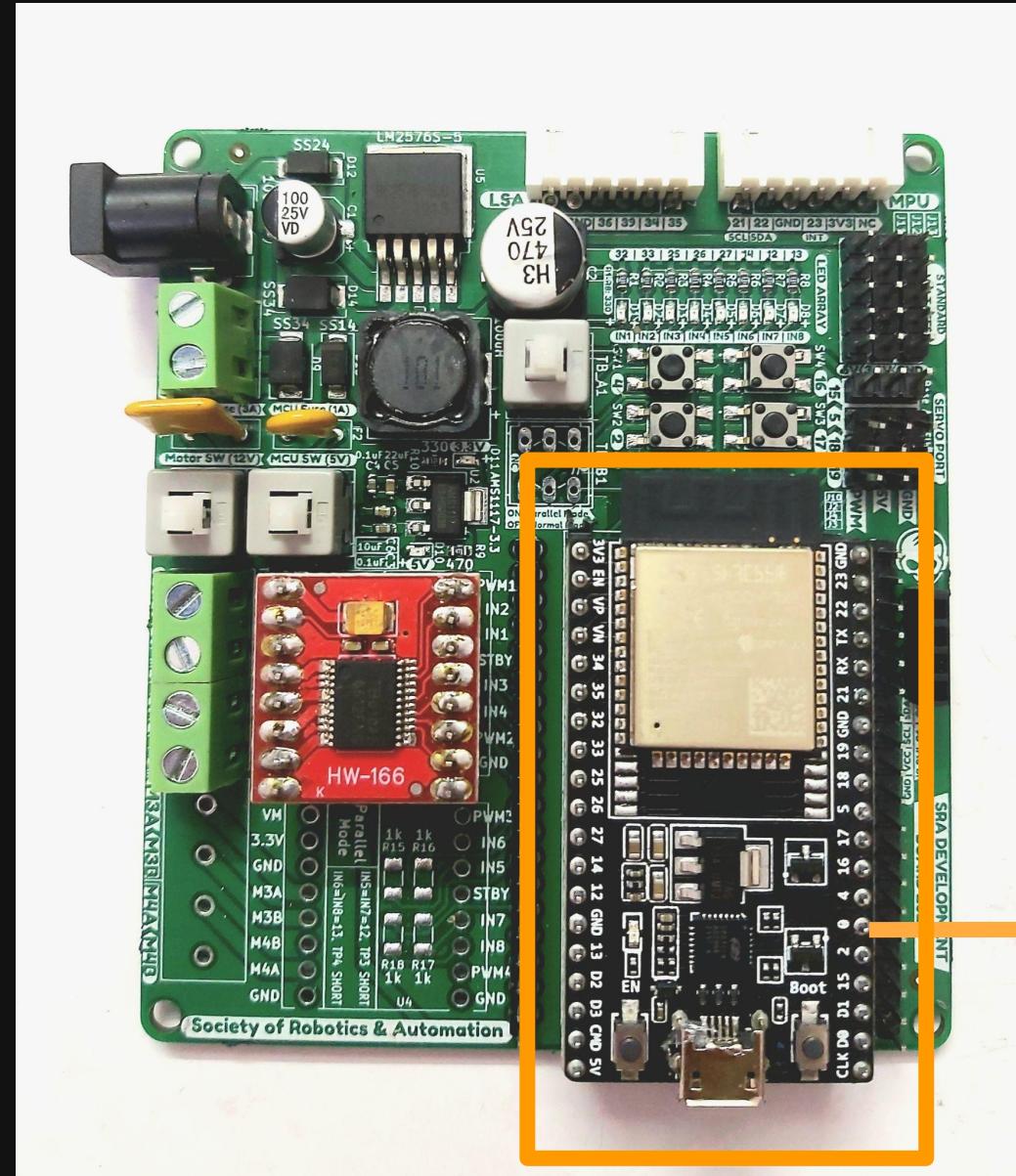
SRA BOARD:





Society of Robotics & Automation



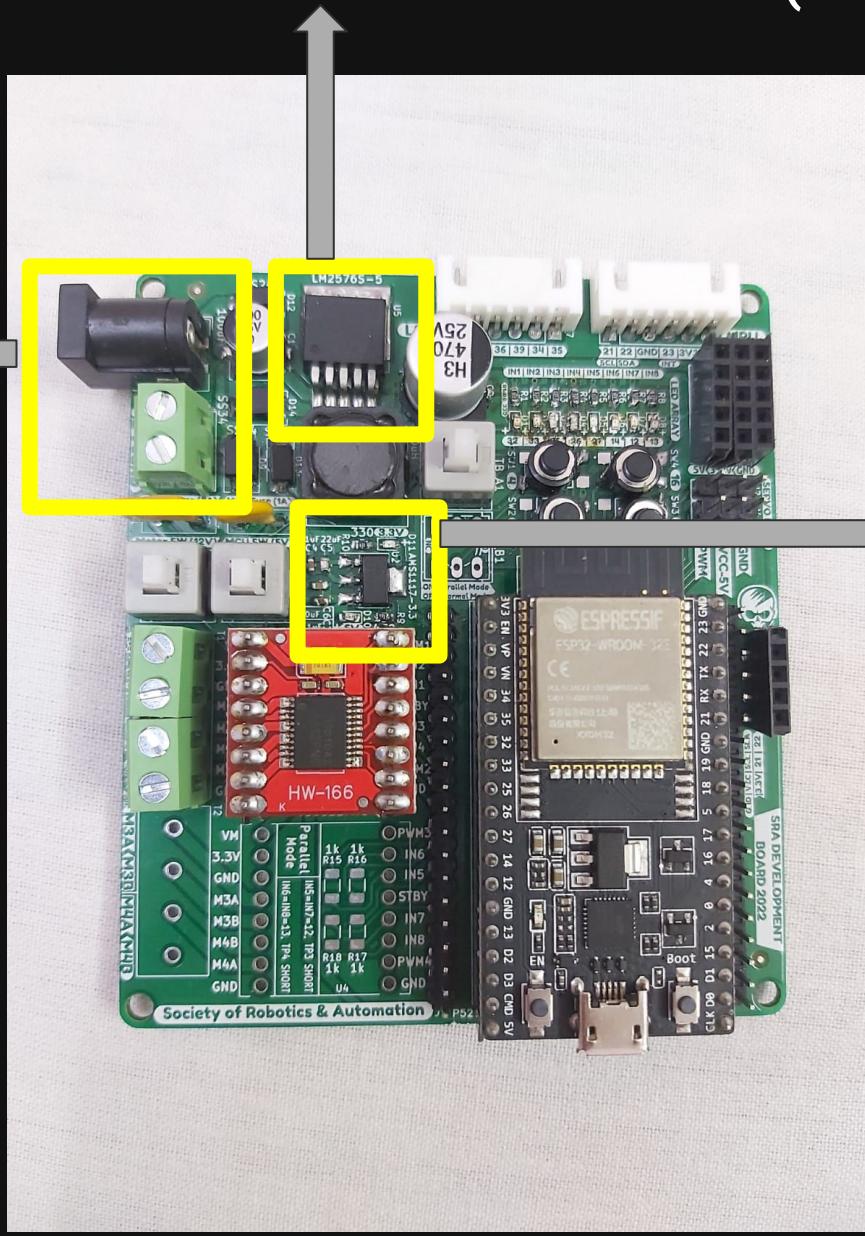


ESP 32

VOLTAGE REGULATOR: LM2596 Buck Converter (12v to 5v)



INPUT
VOLTAGE
WHY 12V?



VOLTAGE REGULATOR:
AMS1117 (5v to 3.3v)





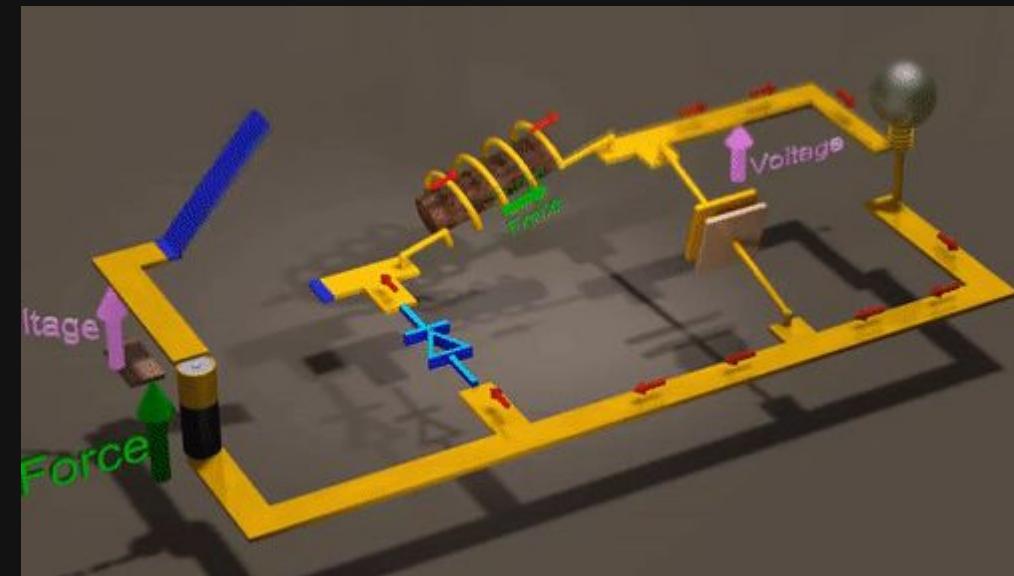
VOLTAGE REGULATOR

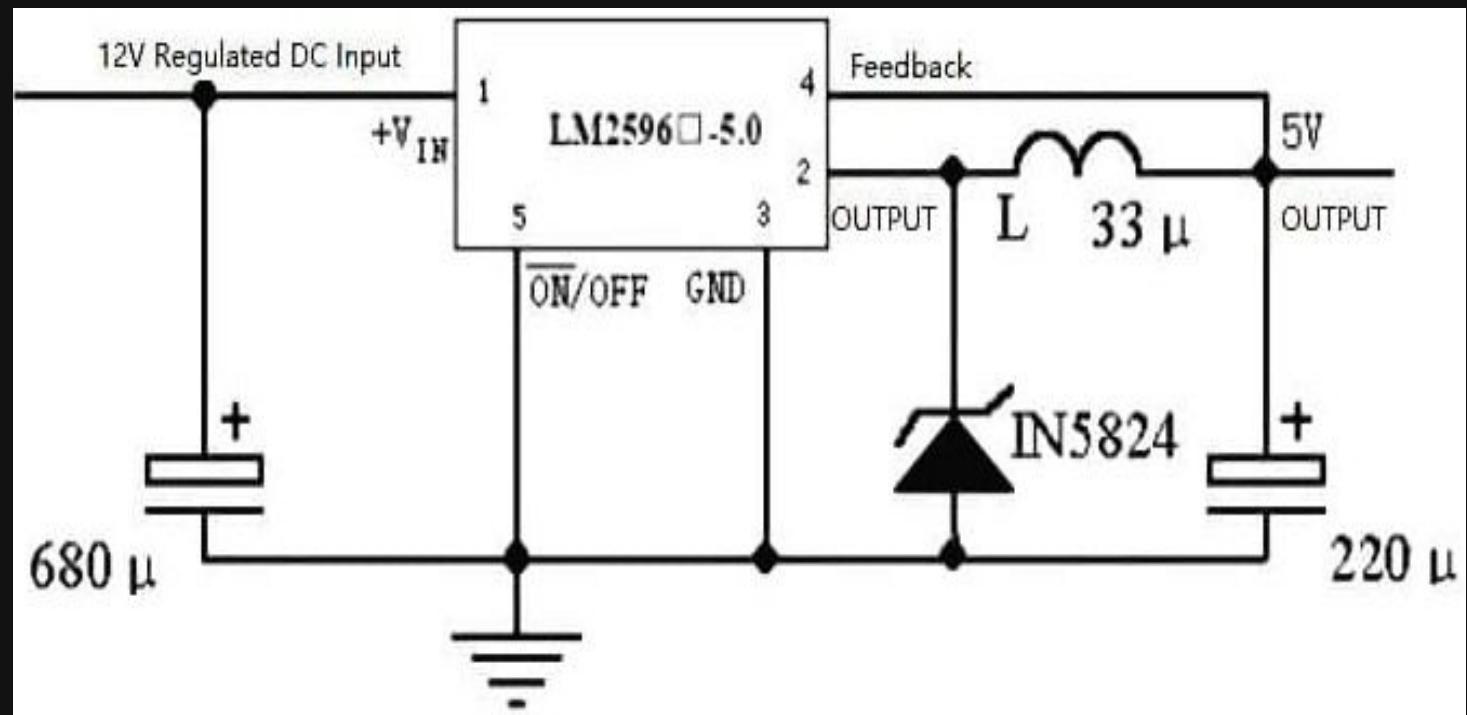
- Voltage regulator automatically maintains a constant voltage even though the input voltage changes
- It compares the output voltage with a precise reference voltage and adjusts the pass device to maintain a constant output voltage
- Input voltage is between a specific range. eg 2 - 20V
- Output Voltage of the regulator is fixed and constant

LM2596 Buck Converter : Converts Input Voltage to 5V



1. This is a voltage regulator.(Output Voltage is fixed)
2. Input Voltage Can be anywhere less than 40 V DC (Range - 40 V DC)
3. Output Voltage is fixed to 5V. (Microcontroller i/p voltage = 5V)
4. This is better over other regulators as :
 1. It has better efficiency of about 92%.
 2. Less power wastage -> Less Heat release
 3. Provides high output current upto 3A.

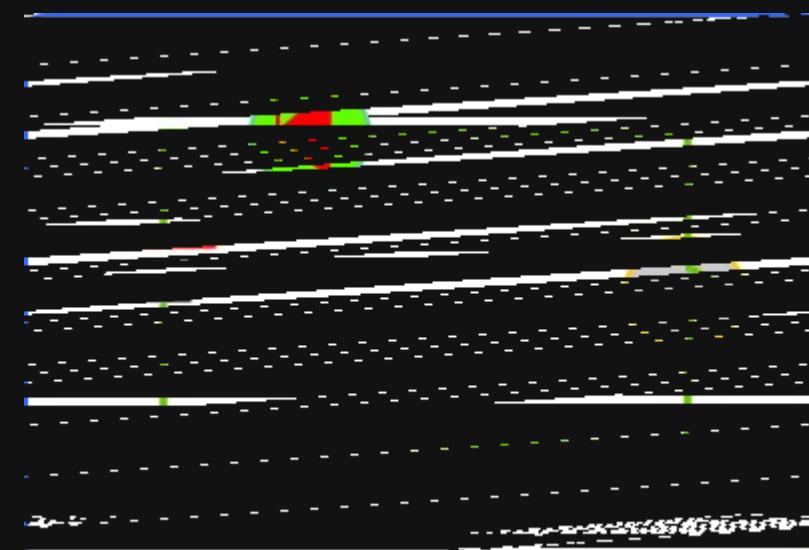
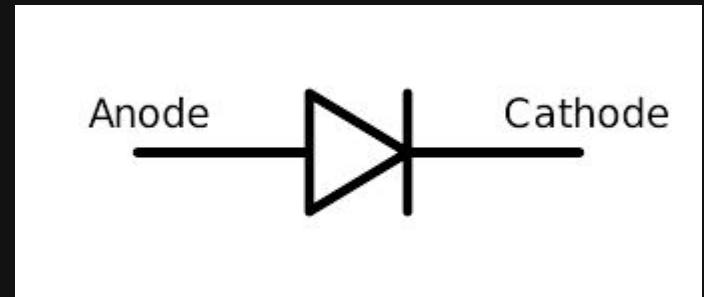




DIODE

Diode, an electrical component that allows the flow of current in only one direction.

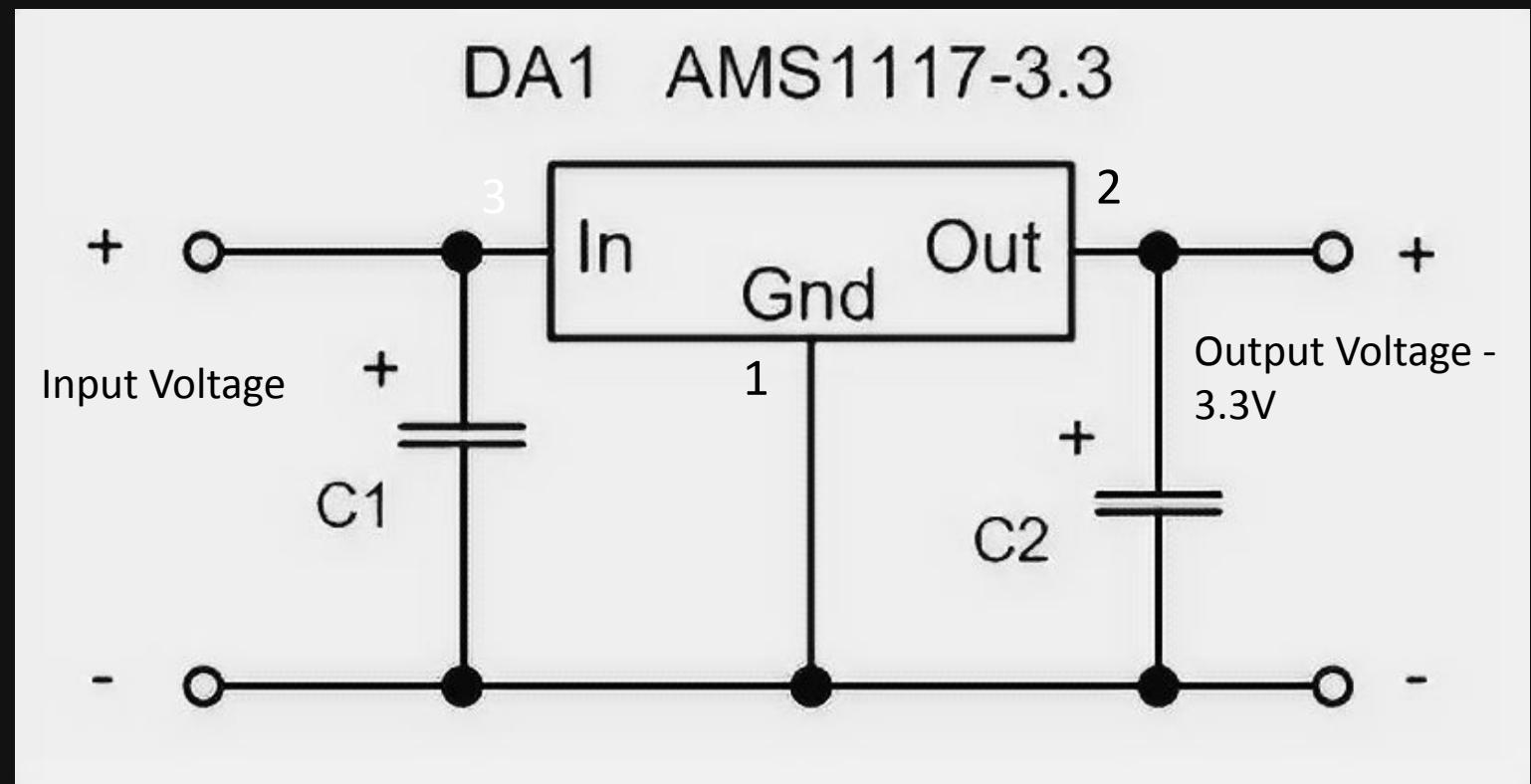
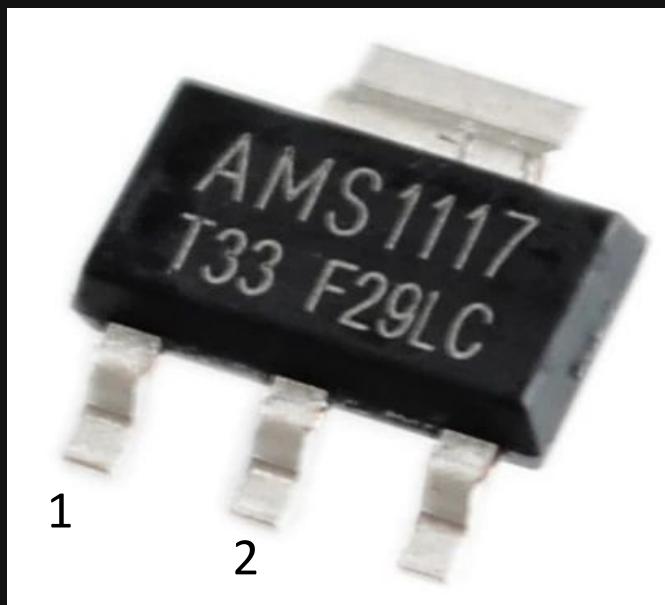
It contains P and N junctions which are doped with impurities. This configuration allows unidirectional flow of current.

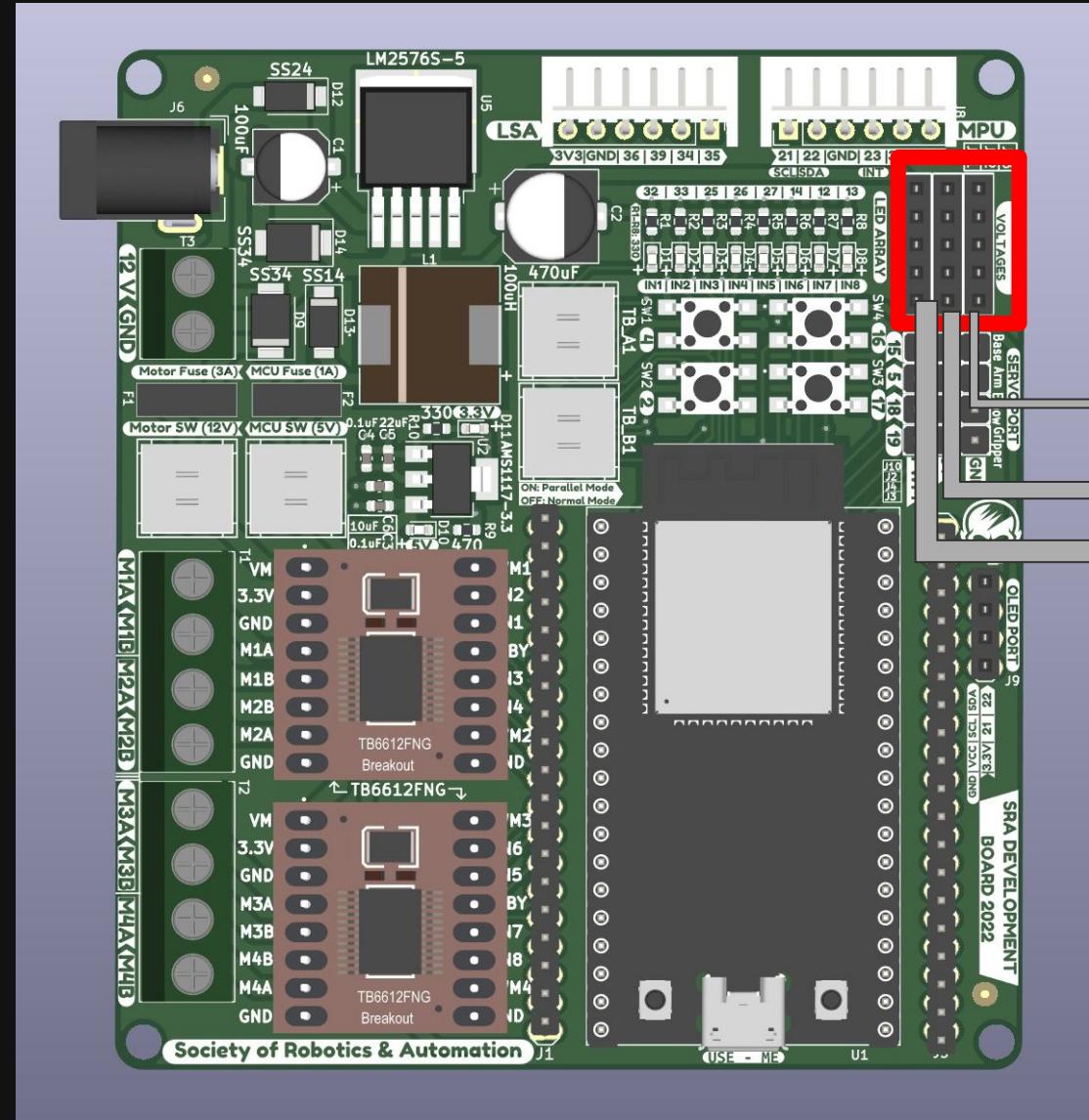


AMS1117 : Converts Input Voltage to 3.3V



1. Input working voltage for the MCU is 5V.
2. The output voltage of the MCU is 3.3V.
3. AMS1117 is an efficient voltage regulator which outputs constant voltage of 3.3V.





Ground(GND)

3.3V

5V

Standard Voltages position on board.

FUSE

- Fuse is an electrical safety device used for the protection of circuit against overcurrent
- Fuse consists of a metal wire which melts down when there is excess current and therefore protecting the circuit from any damage



Fuses used Earlier



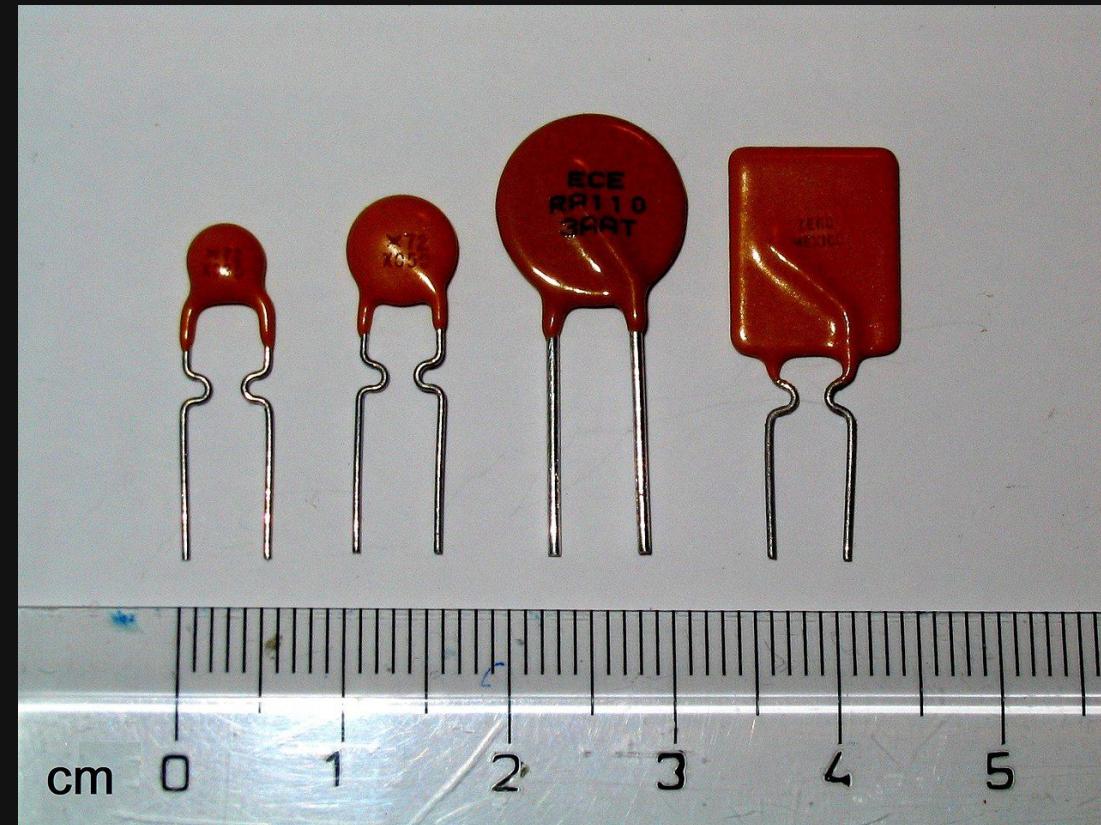
WORKING FUSE



BLOWN FUSE

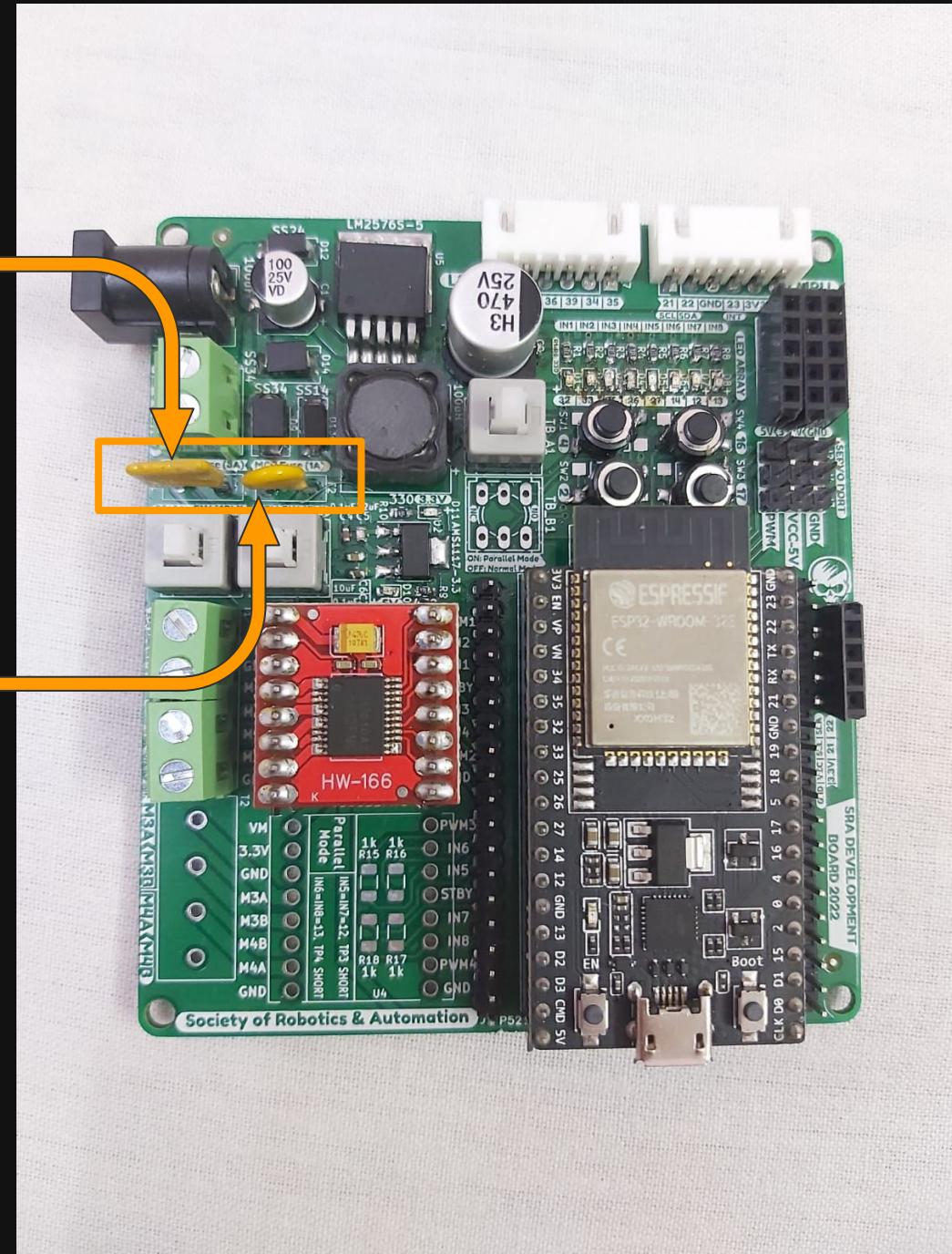
PTC Resettable Fuse

- Resettable fuse or positive temperature coefficient device (PTC) is a electronic component used to protect against overcurrent faults in electronic circuits.



Fuse On 12V Line
Trip Current - 3A

Fuse On 5V Line
Trip Current - 1A



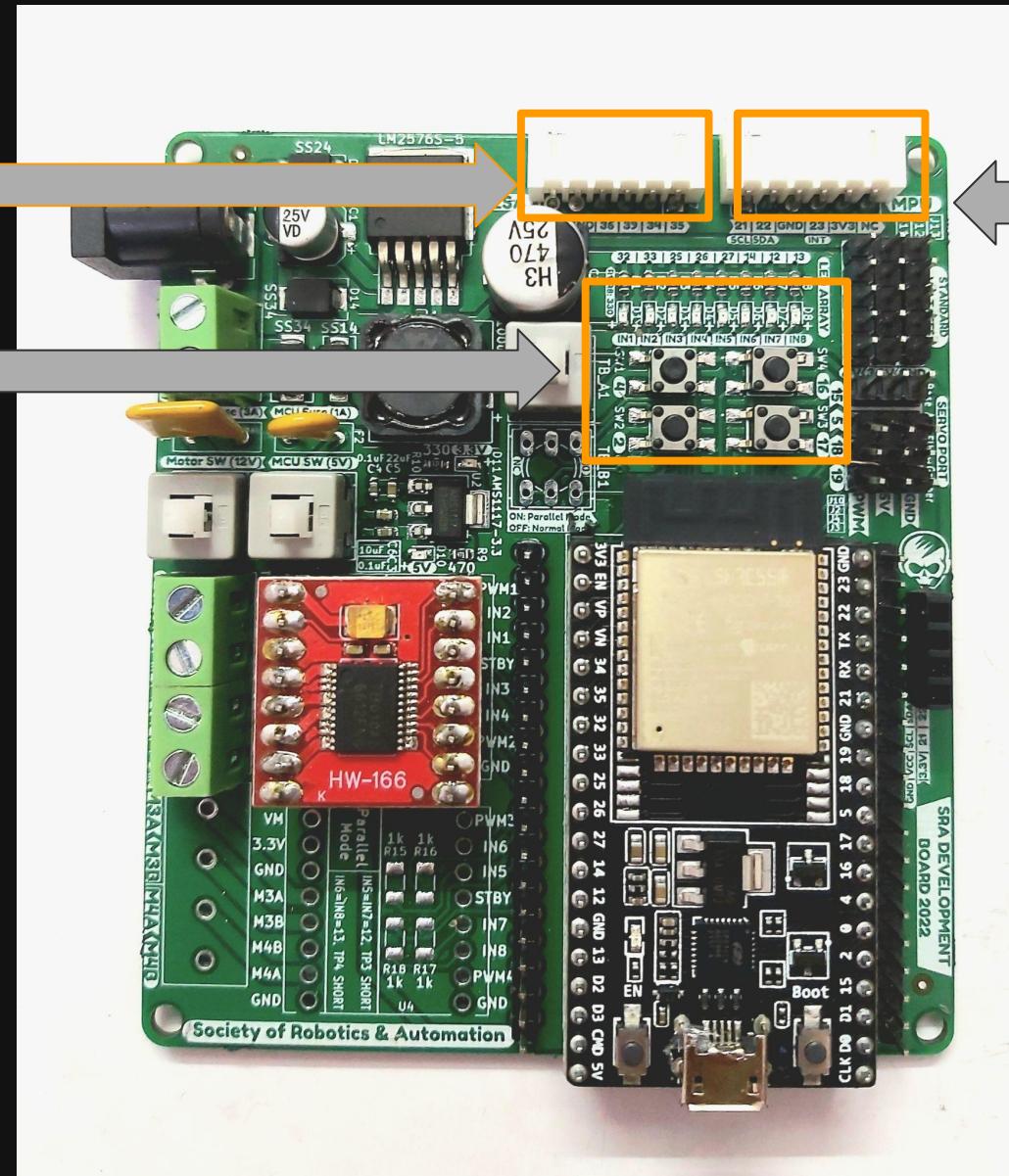
Sensor port and Indicator Circuits

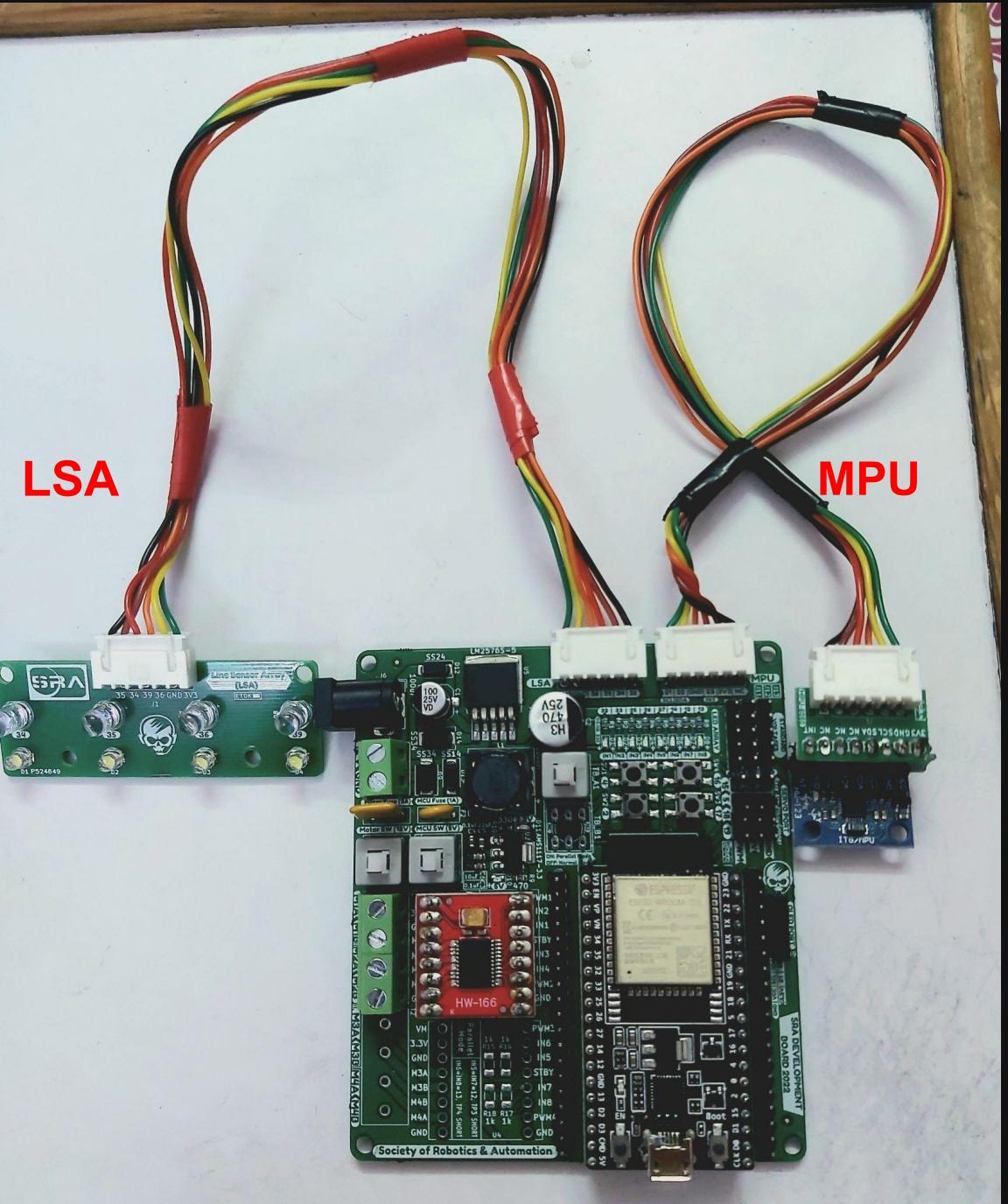


LSA PORT

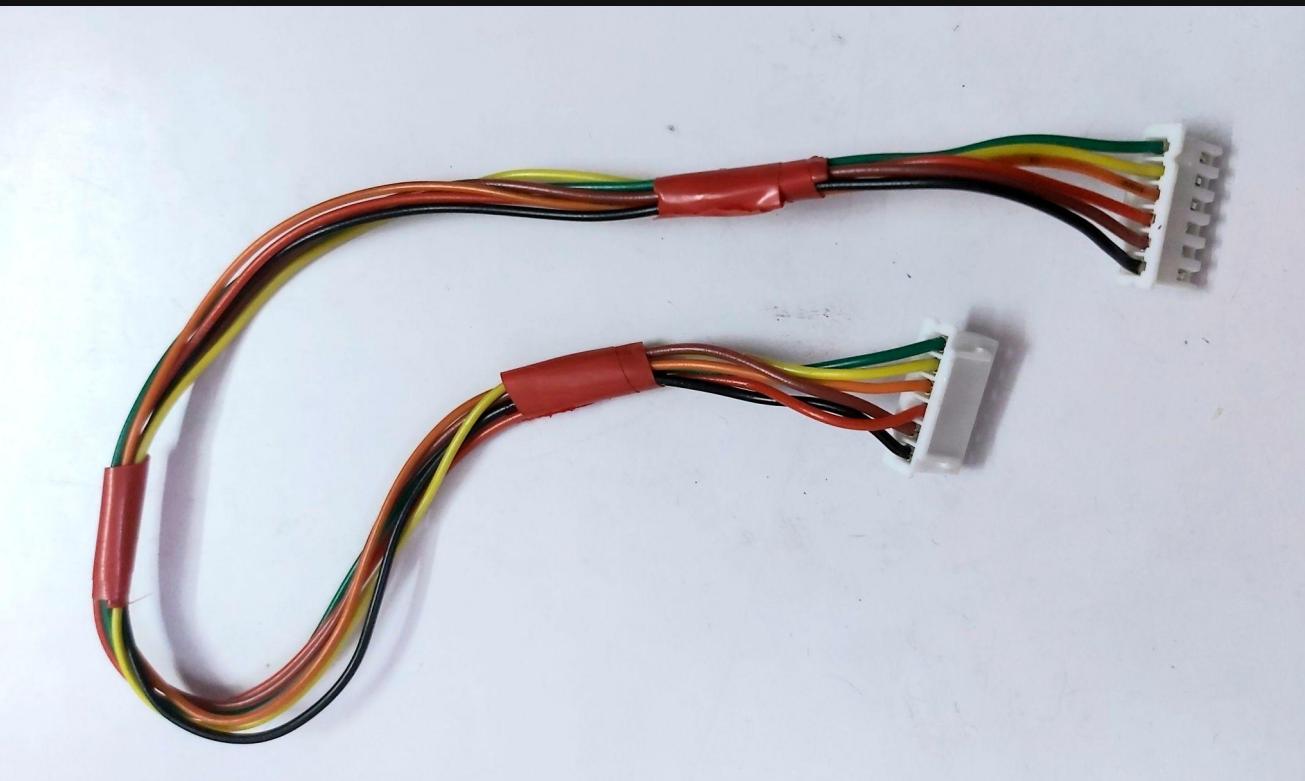
Switches
and
Leds

MPU PORT





JST female to female connectors

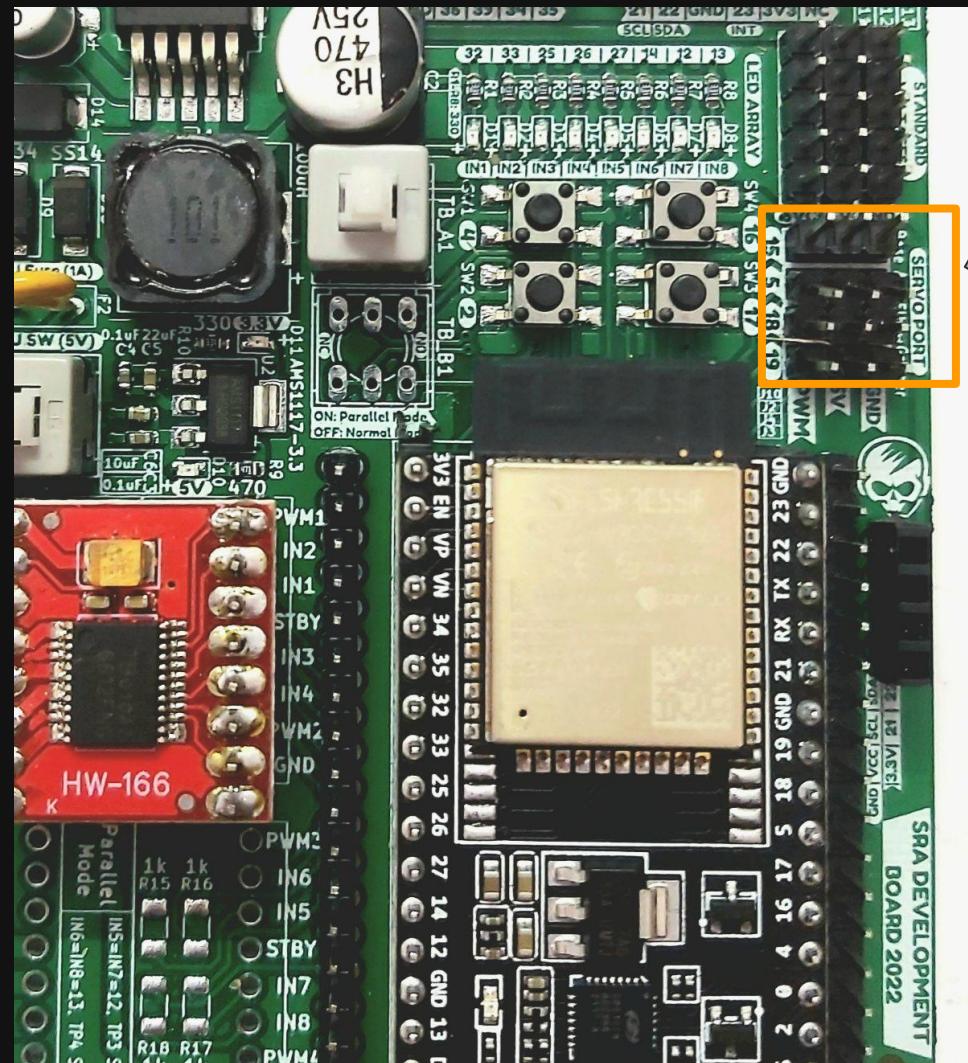




PWM(drives motors)

5V

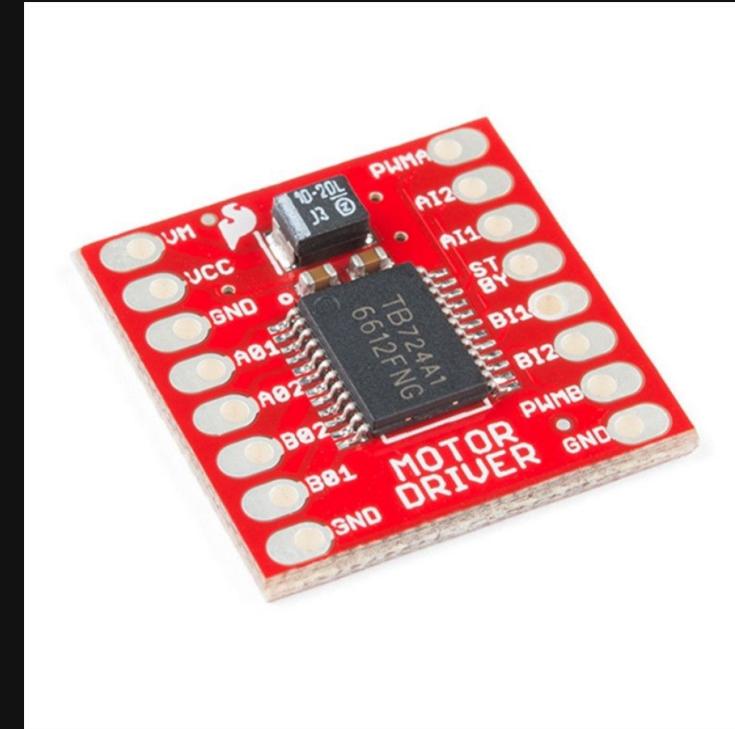
Ground(GND)



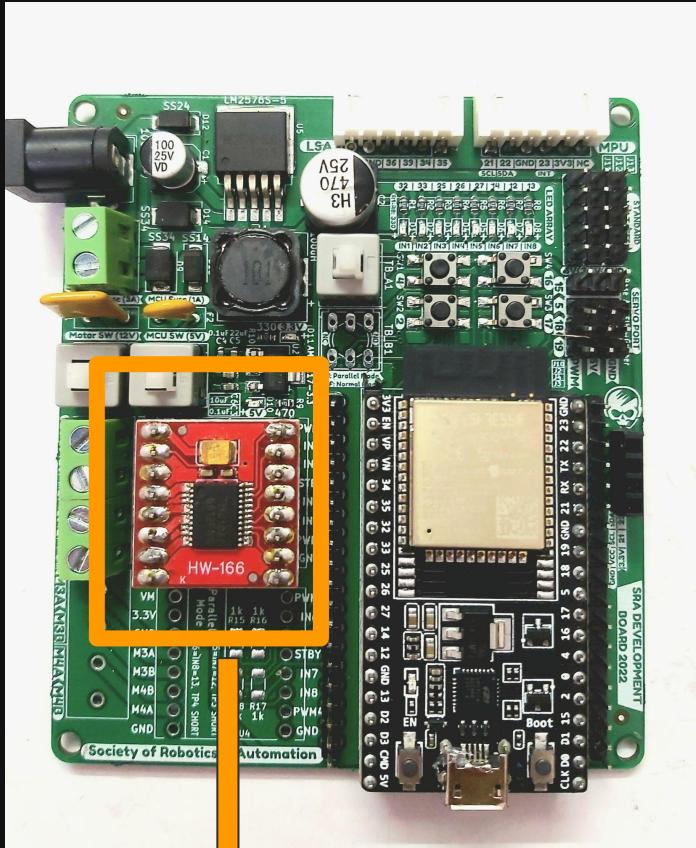
WHY DO WE NEED MOTOR DRIVER?



- Microprocessors operate on low-level voltage/current, unlike motors. For example the popular Arduino microcontrollers or ESP32 microcontroller has an operating voltage of 5V or 3.3V, but a decent DC motor requires 5V or 12V to operate.
- In our case, motors runs on 12V and MCU output is 3.3V. So basically, if we want to supply the power to the motor, we need a high voltage. But we know that MCU output is low, and it cannot give enough power from its I/O pin to drive a motor. To supply this voltage/current from MCU to the motor, we need this Motor driver IC in between our motor and controller.
- On our board, we have 2 motor drivers in the IC for controlling 2 motors.



Motor Driver: TB6612FNG



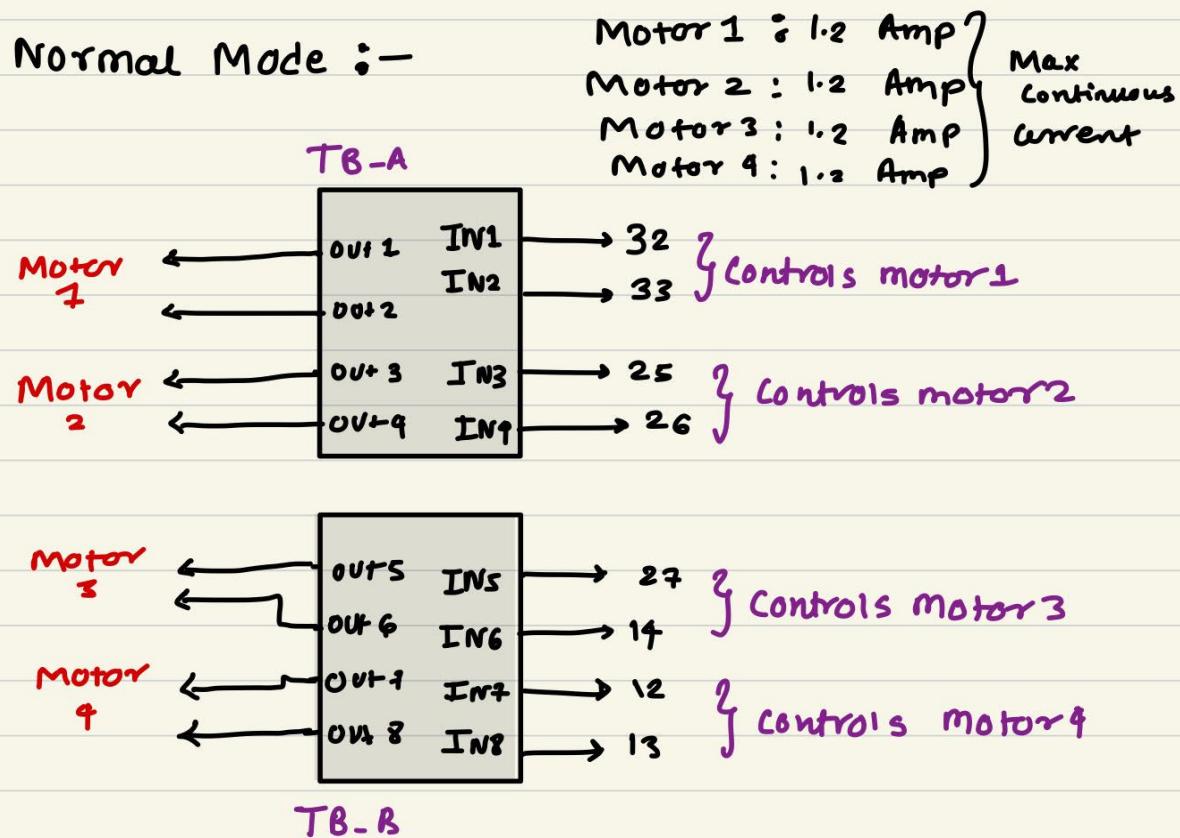
MOTOR DRIVER:
TB6612FNG

- The motor driver IC is an integrated circuit chip used as a motor controlling device (as it adjusts the voltage applied to the motors) in autonomous robots and embedded circuits.
- It basically listens to the low voltage (3.3V) from the microcontroller /processor and controls an actual motor which needs high input voltage(12V). In simple words, a motor driver IC controls the direction of the motor based on the commands or instructions it receives from the controller.



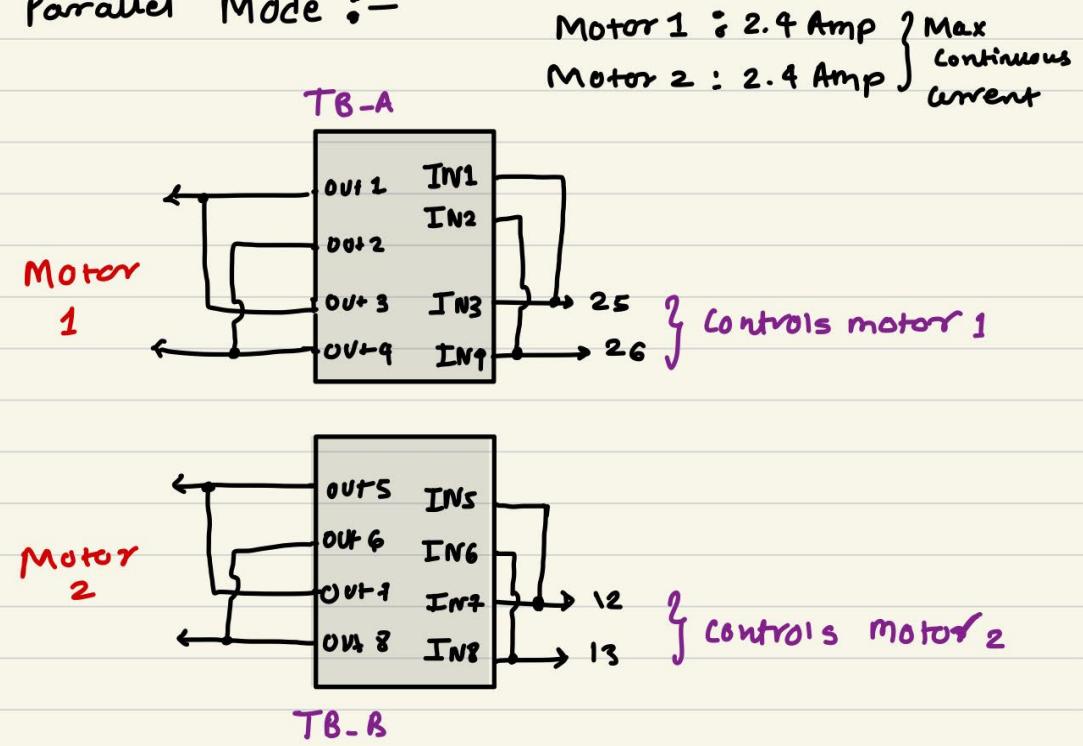
NORMAL MODE

Normal Mode :-

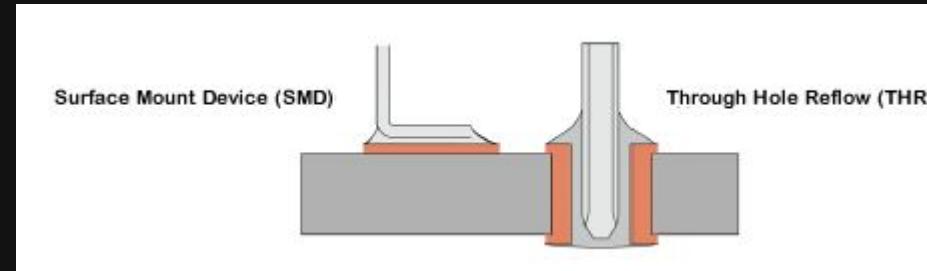


PARALLEL MODE

Parallel Mode :-



THT vs SMD



THT (through hole technology) involves mounting electronic components on the PCB through drilled holes, so it requires more space for mounting. But in case of SMD(surface mount device), the component is directly soldered to the surface of PCB layer.

This surface mounting keeps the layer used efficiently and the opposite layer of surface also remains unused.

SMD



THT

