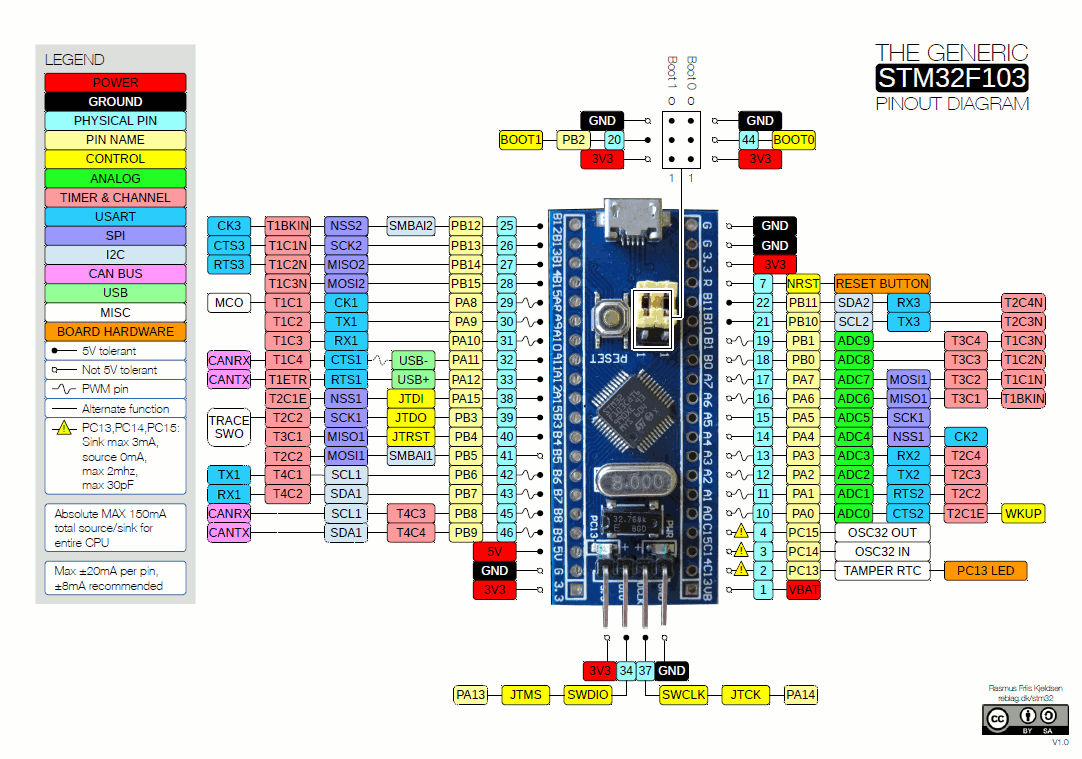
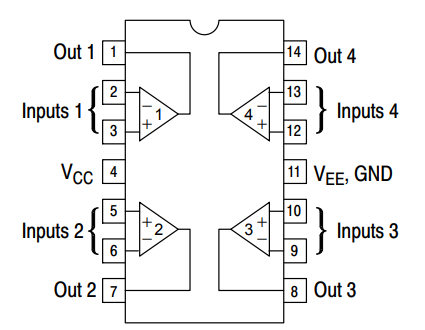
Task (1)

Documentation

1. Bluepill Pinout



The **LM324** is a popular quad operational amplifier (op-amp) integrated circuit (IC). It contains **four independent op-amps** **in a single package**.



The **L293D** is a dual H-bridge motor driver integrated circuit that allows you to control the speed and direction of two DC motors or a bipolar stepper motor by managing current flow through two independent coils.

**DC Motor vs. Stepper Motor – Pinout Comparison**

* **DC Motor:**
  + **Wiring:** Typically has 2 wires. One Coil.
  + **Control:** Requires 2 outputs (via an H-bridge) to set direction; a PWM signal can modulate speed.
* **Stepper Motor (Bipolar):**
  + **Wiring:** Has 4 wires (2 coils).
  + **Control:** Needs 4 outputs (using 2 H-bridges) to independently control current direction in each coil for precise stepping.

What’s the H-Bridge?

It’s a circuit used to control the speed and direction of a DC Motor.

It consists of 4 switches

It can be used to:

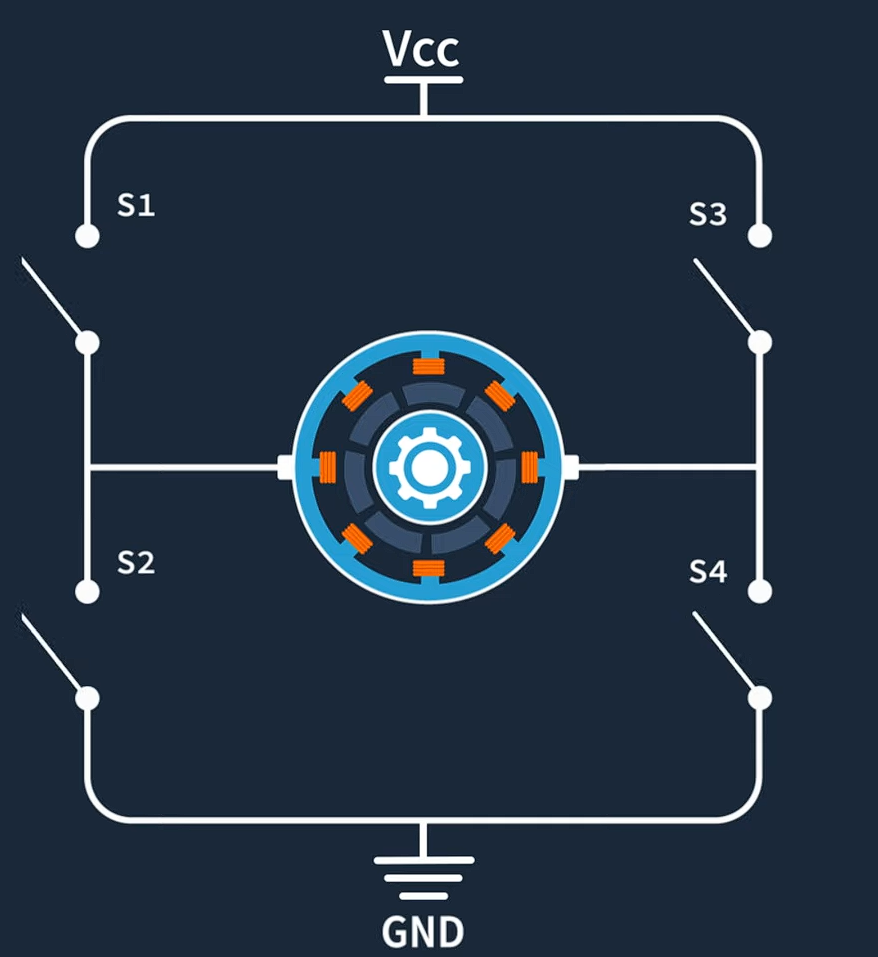
1. Control the speed.
2. Control the direction.
3. Can be used as the stopping mechanism.

As for the speed, to use the H-bridge to control the speed of the DC Motor, we have to used switches that can be controlled using signal with the feature of PWM (Pulse Width Modulation).

i.e., by controlling the duty cycle we control the speed of the motor.

As for the direction Control, we can use different combinations of the switches to run the DC motor in both directions.

Finally, as for the stopping mechanism, we can apply the source volage to both terminals of the motor. This can also be done by applying the ground to both terminals.



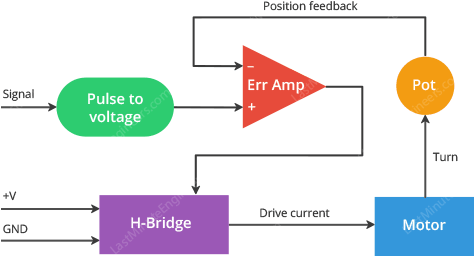
Servo Motor

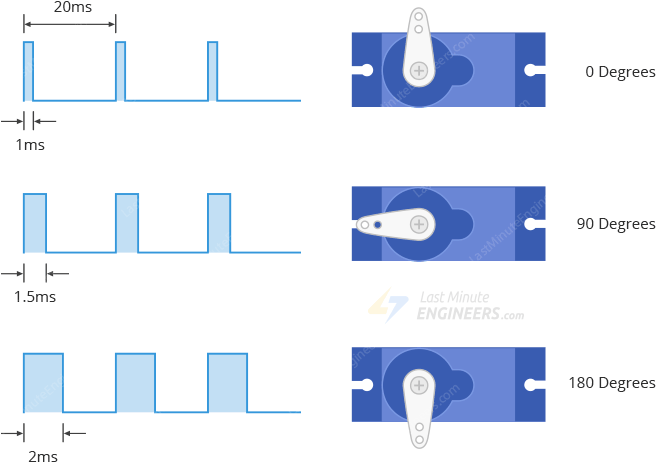
A typical servo has three wires:

* **Power (Vcc):** Usually 5V.
* **Ground (GND).**
* **Control Signal:** Receives the PWM signal.

**PWM Signal Details:**

* **Frequency:** Usually around **50 Hz** (20 ms period).
* **Pulse Width:**
  + **~1 ms** pulse positions the servo at one extreme.
  + **~1.5 ms** centers the servo.
  + **~2 ms** pulse moves it to the opposite extreme.
* The exact pulse width corresponding to an angle can vary between servos.





**Servo** **pinout**:

