OVERVIEW

The L293D module is a compact motor driver module with two full bridge circuits and individual enable inputs. Each channel can continuously drive up to 600mA and can tolerate up to 1.2A non-repetitive load current. The module accepts 5V up to 20V motor (or other inductive load) voltage. It also has a built-in 5V regulator for the logic circuit that accepts up to 12V input power sourced from either an external power or from the motor power source. This is selected via an on-board micro jumper. Aside from the obvious benefit, the internal regulator may be advantageous in applications without a microcontroller as it readily makes the module useable with just the input signals added. Two additional micro jumpers allows each channel to be permanently enabled or controlled by the host.

The inputs are accessible from standard 2.54mm pin headers and outputs are conveniently derived from screw-in terminal blocks.

The L293D module is part of Layad Circuits' Kimat series of rapid-prototyping products.

Figure 1: The Kimat L293D Module

FEATURE SUMMARY

- Integrated logic circuit regulator
- Drives up 2 reversible motors
- Continuous Drive Current Per Channel: 600mA
- Peak/Non-repetitive current per channel: 1.2A
- Motor Voltage: 5-20V
- Total Idle Current with both channels disabled: ~50mA
- Selectable regulator input between external or motor voltage via jumpers
- Permanent-enable jumper option
- 3.3V/5V-logic compatible inputs
- Board Dimensions: 49.26 x 32.69 mm

PIN FUNCTIONS

REG IN – this is a 3-pin header labeled "REG IN" with a microjumper inserted between the middle pin and the EXT side or between the middle pin and VM side. This allows the user to select where to source the input to the regulator circuit for the logic circuits of the board. This can either come from an external power source between 5-12V and at least 100mA connected to the EXT pin header OR it may come from the VM terminal block so long as VM is between 5 and 12V.

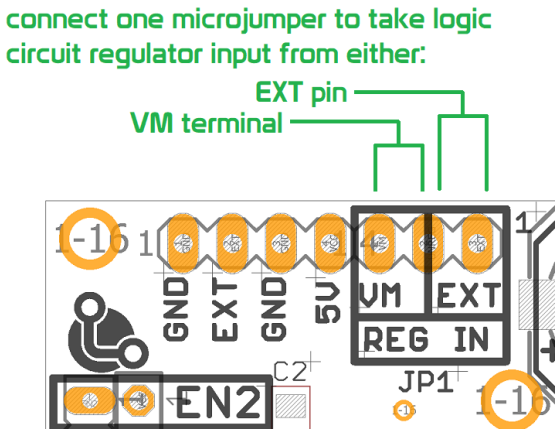

Figure 2: REG IN microjumper option

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If your motor voltage source is between 5 and 12V and is able to adequately supply the current requirements of the motors with some allowance, it is recommended to set the micro-jumper to the VM position for simplicity.

5V – The module has an 800mA onboard regulator with an output of 5V. The internal circuits it supply only draw around 50 to less than 200mA and may therefore be used to supply other external 5V circuits. This regulator output may be accessed from the 5V pin. This comes as a handy extra power source when the internal 5V regulator of an Arduino is fully utilized.

EN1 and EN2 – these are the enable inputs of the drivers. When pulled LOW, the outputs are in high impedance mode and hence, effectively disconnects the motors from the outputs. Pulling these HIGH enables the drivers. These pins may be used to control the speed of the motors by rapidly turning the pins on and off as in a PWM signal (or via analogWrite() in Arduino/Saleng boards). To do this, uninstall the micro-jumpers and then connect the EN1 and EN2 pins to the PWM signal(s).

IN1-IN4 – IN1-IN4 controls OUT1 to OUT4 respectively when EN1/EN2 are pulled high (enabled).These pins may be used by the host microcontroller to turn the motors on/off and control their direction. Use the table below as a guide:

IN1 (or IN3)	IN2 (or IN4)	EN1 (or EN2)	Net Effect
HIGH	LOW	HIGH	Motor rotates in one direction
LOW	HIGH	HIGH	Motor rotates in opposite direction
LOW	LOW	HIGH	Motor stops
HIGH	HIGH	HIGH	Motor stops
x	x	LOW	Motor stops

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PIN FUNCTION SUMMARY

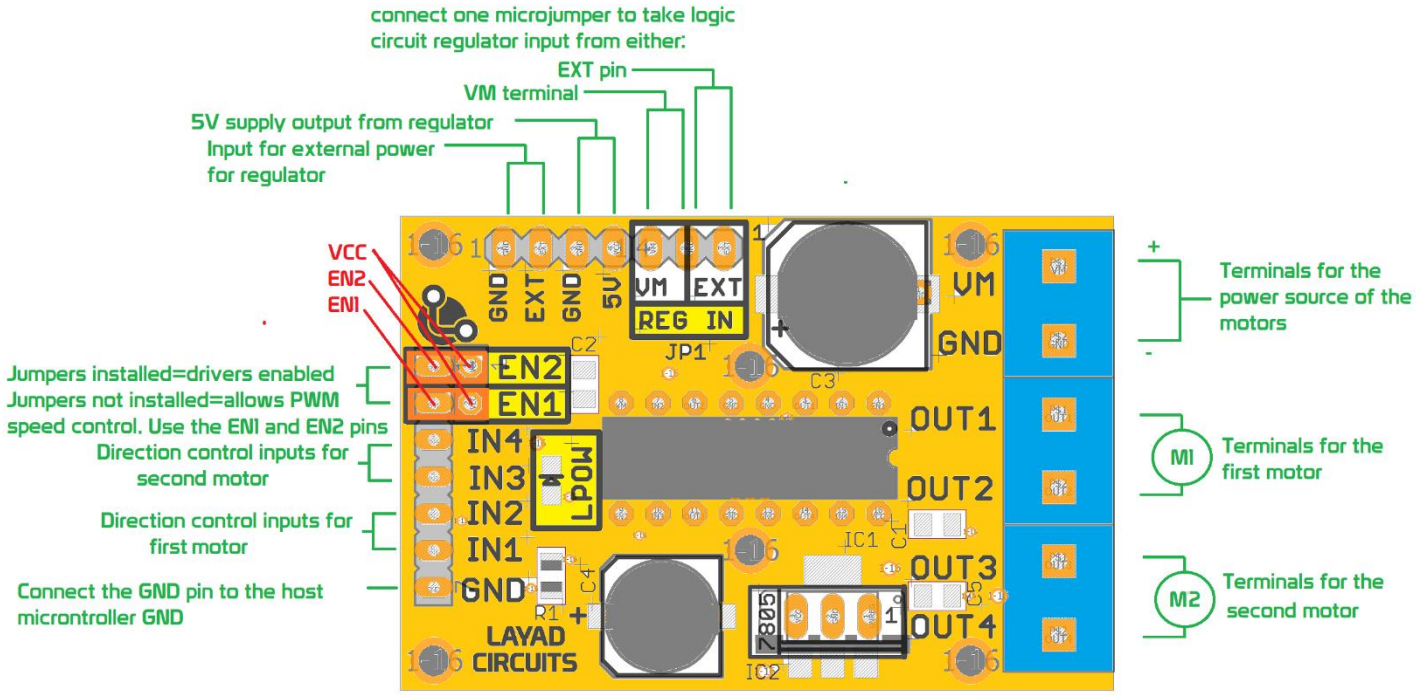

Figure 3: Kimat L293D Pin Functions

Example Code with Wiring

The following wiring diagram and code may be used in a 2-wheel robot to control 2 DC motors. This example turns the robot forward, backward, right then left in a loop. It is used as a base code for implementing other applications (e.g. line-follower, sumobot, obstacle-avoidance robot, or RC-robot, etc..) or as a first test code for testing the functionalities of the L293D module.

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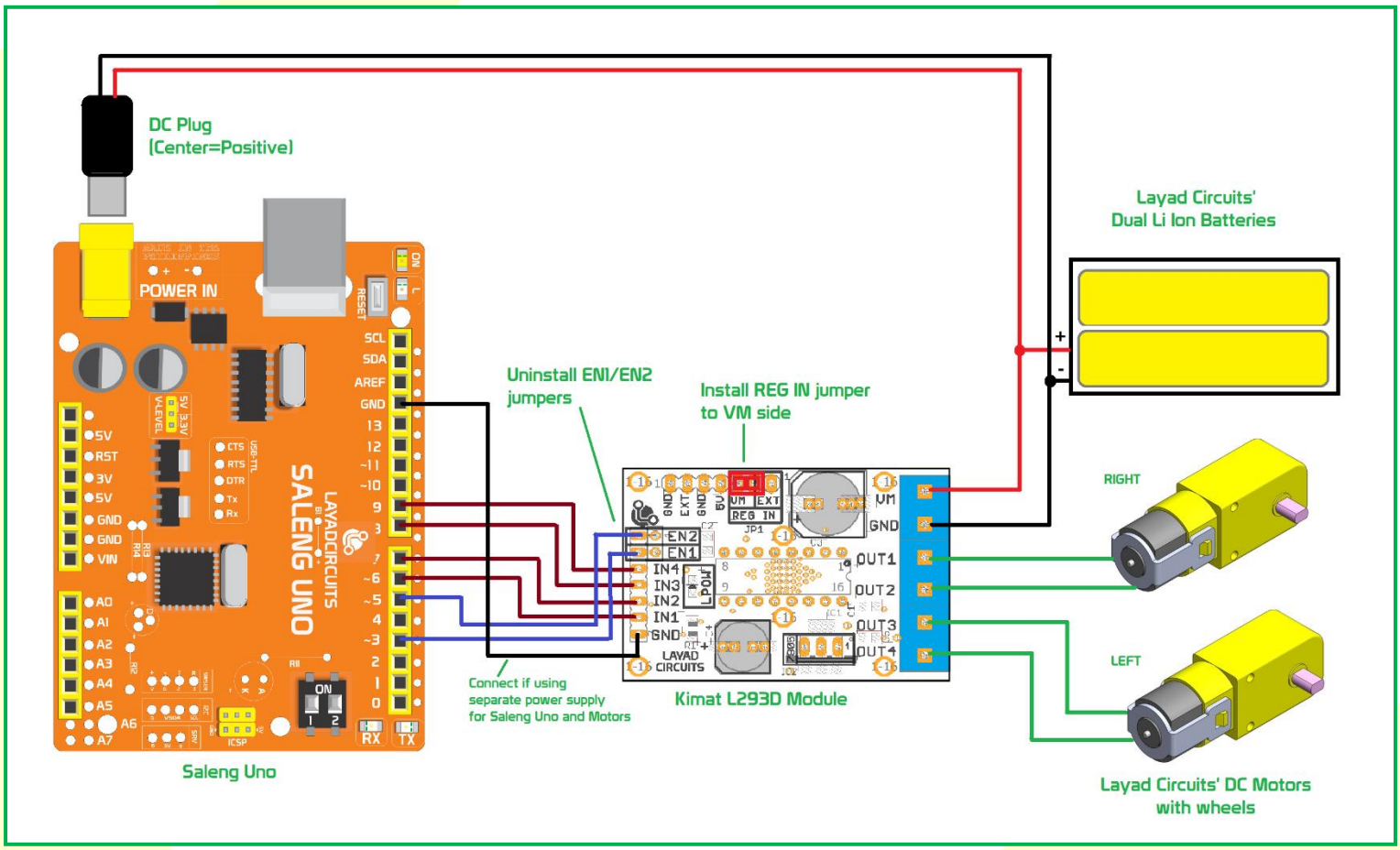

Notes:

1. Note that in this particular example, the Saleng Uno (or Arduino) shares the same battery with the VM terminal of the module. Also notice that the module takes the motor power (and logic power) directly from the battery. This setup greatly simplifies the connection and avoids taxing the microcontroller board's internal regulator with additional load. If you need to separate the power sources, ensure that the modules's GND is wired up to the Saleng Uno GND.
2. If in your setup, the motors rotate in the opposite direction (e.g. robot turns backward instead of forward), then you may simply reverse the motor wirings. For convenience, swap the wires at terminals OUT1 and 2 or at OUT3 and 4.

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Example Code/Sketch:

```
/*************************************************************************
 Example Code to move the motor of a 2 (or 4) wheel robot driven by the Kimat L293D Motor Driver Module.
 This is meant as a first test code. It moves the robot forward, backward, left and right with certain time intervals.
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 Author(s): C.D.Malecdan for Layad Circuits Electronics Engineering
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 * NOTES and WARNINGS:
 * Install right motor(s) on OUT1 and OUT2
 * Install left motor(s) on OUT3 and OUT4
 *
 * REG IN JUMPER
 *
 * 5-12V Motor:
 * If you are working with a 5-12V motor, then set the REG IN jumer to the VM position.
 * This jumper option will take the power for the logic circuit from the Motor Power terminals labeled VM.
 *
 * >12-20V Motor
 * If you are working on a motor above 12V up to 20V, then you must set the REG IN jumper to the EXT position.
 * You will need to connect a 5-12V / >= 100mA power supply for the logic circuit using the EXT and GND pins.
 *
 * MOTOR CURRENT:
 *
 * The L293D is rated for a maximum of 600mA continous motor current and 1.2A surge current per channel.
 * Make sure your motors do not exceed these ratings.
 *
 * SPEED CONTROL / EN1 and EN2 JUMPERS
 *
 * If you do not plan to control speed and want to operate at full speed, leave the EN1 and EN2 jumpers installed.
 * If you want to control speed using PWM, remove the jumpers and connect EN1 and EN2 (beside IN4) to PWM pins of your
 * microcontroller. For the Saleng Uno/Arduino Uno, this pins may be used for the EN1/EN2: pins 3,5,6,9,10,11.
 * If you are using the Arduino Mega2560, use pins 2-13.
 *************************************************************************/

//Pin Assignments:
const byte PIN_IN1 = 6;
const byte PIN_IN2 = 7;
const byte PIN_IN3 = 8;
const byte PIN_IN4 = 9;
const byte PIN_EN1 = 3;
const byte PIN_EN2 = 5;

void speedSetting(byte val)
{
  analogWrite(PIN_EN1,val);
  analogWrite(PIN_EN2,val);
}

void forward()
{
  // move right motor(s) forward
  digitalWrite(PIN_IN1,LOW);
  digitalWrite(PIN_IN2,HIGH);
  // move left motor(s) forward
```

```
  digitalWrite(PIN_IN3,LOW);
  digitalWrite(PIN_IN4,HIGH);
}

void backward()
{
  // move right motor(s) backward
  digitalWrite(PIN_IN1,HIGH);
  digitalWrite(PIN_IN2,LOW);
  // move right motor(s) backward
  digitalWrite(PIN_IN3,HIGH);
  digitalWrite(PIN_IN4,LOW);
}

void turnleft()
{
  // move right motor(s) forward
  digitalWrite(PIN_IN1,LOW);
  digitalWrite(PIN_IN2,HIGH);
  // move left motor(s) backward
  digitalWrite(PIN_IN3,HIGH);
  digitalWrite(PIN_IN4,LOW);
}

void turnright()
{
  // move right motor(s) backward
  digitalWrite(PIN_IN1,HIGH);
  digitalWrite(PIN_IN2,LOW);
  // move left motor(s) forward
  digitalWrite(PIN_IN3,LOW);
  digitalWrite(PIN_IN4,HIGH);
}

void motorstop()
{
  digitalWrite(PIN_IN1,LOW);
  digitalWrite(PIN_IN2,LOW);
  digitalWrite(PIN_IN3,LOW);
  digitalWrite(PIN_IN4,LOW);
}


void setup() {
  pinMode(PIN_IN1,OUTPUT);
  pinMode(PIN_IN2,OUTPUT);
  pinMode(PIN_IN3,OUTPUT);
  pinMode(PIN_IN4,OUTPUT);
  pinMode(PIN_EN1,OUTPUT);
  pinMode(PIN_EN2,OUTPUT);

  motorstop();
  delay(2000);
  speedSetting(128);
```


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```
}

void loop() {
  forward(); // call this function to move the robot forward
  delay(1000);
  motorstop();
  delay(500);
  backward();// call this function to move the robot backward
  delay(1000);
  motorstop();
  delay(500);
  turnright(); // call this function to turn the robot right
  delay(1000);
  motorstop();
  delay(500);
  turnleft(); // call this function to turn the robot left
  delay(1000);
  motorstop();
  delay(500);
}
```

OTHER CONSIDERATIONS

- **4-Wheeled Robot** - If you plan to control a 4-wheeled robot, ensure that the specified continuous motor current of 600mA and non-repetitive current of 1.2A is met by the motors. While certain motors may all look the same (as in the case of popular yellow colored DC motors with gearbox), their performance may differ. In a 4-wheeled setup, the 2 right (or left) motors are in parallel and connected to OUT1&2 (or OUT3&4). Therefore, the total load per channel would be the sum consumed by the 2 motors. If we consider a 50% safety factor, and if your motors run at less than or equal to around 150mA, then you may be able to use this module. Otherwise, if the current is higher, you may need to use the Kimat Motor Shield which has a higher continuous current rating of 1.2A and non-repetitive current of 3A. Find the shield's user guide here. Note that in the setup described here, the codes for a 2-wheel and a 4-wheel robot are the same.

- **Heat Management** – when the load has a demanding current requirement, consider adding a heatsink , or better yet a heatsink+fan combination, on the L293D IC in the module. You may use thermal glue as mounting method or use the two mounting holes at each side of the IC to help mount the heatsink on top of the IC.

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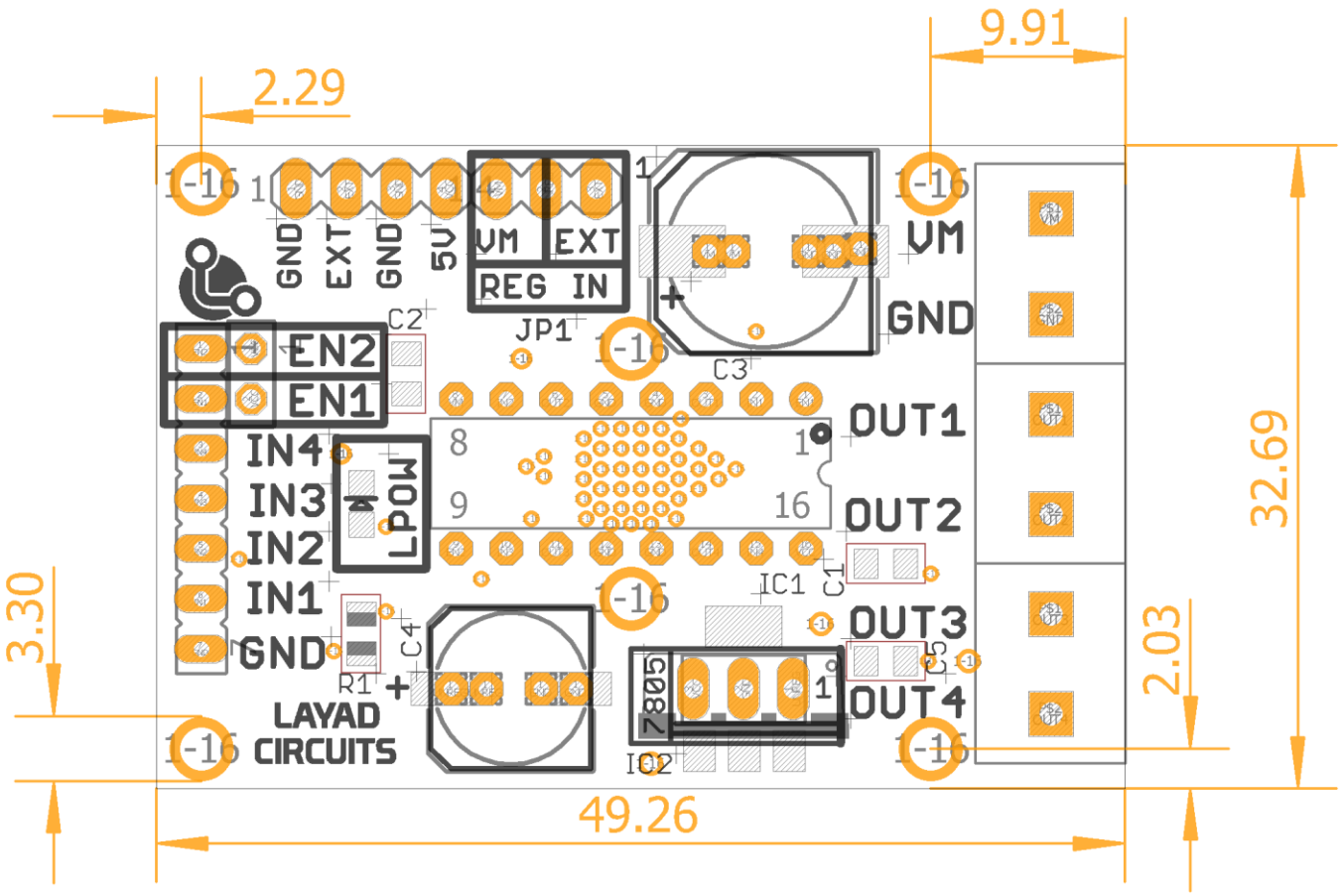
BOARD DIMENSIONS



** Dimensions in millimeters

Need further help? Contact us!

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