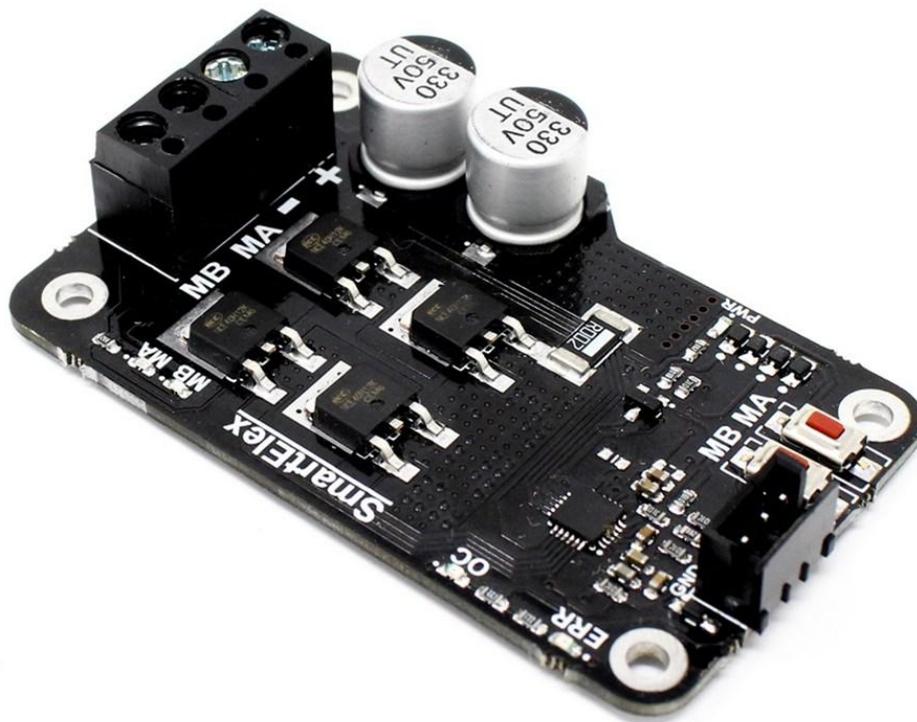# SmartElex

User Manual

SmartElex 15S DC Motor Driver 15A (30A Peak)

QUICK OVERVIEW

The SmartElex 15S DC Motor Driver 15A (30A Peak) is a powerful motor driver board. It has a lot of great features and specifications that make it useful for a wide variety of mechatronics projects. Its wide operating voltage range and ease in interfacing with micro-controllers allow customers to quickly adopt them into applications.

Features

1. Wide 6 V to 30 V motor operating voltage
2. Continuous 15A maximum current without a heat sink and 30 A peak current for 10 seconds
3. One brushed DC motor bidirectional control
4. Current limiting at 35 A
5. PWM frequency up to 32 kHz
6. Supports TTL PWM from micro-controller
7. Internal thermal shutdown
8. Under-voltage lockout
9. PWM and direction controlled driving of four externally powered NMOS transistors
10. 3.3V and 5V logic level input

Applications

- In robotics
- Wipers
- Versatile electronic devices
- Electronics DIY projects

Dimensions of PCB
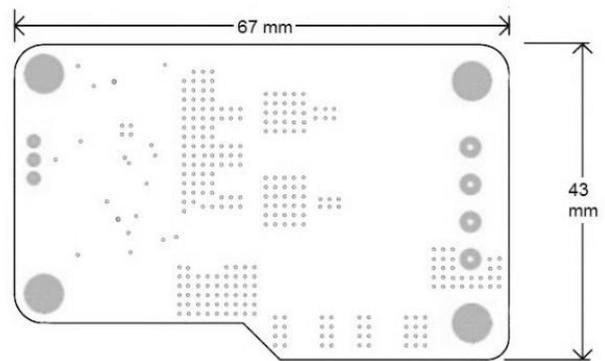
Specifications

Sr. No.	Parameter	Min	Max	Unit
1	Input voltage	6	30	V
2	Maximum continuous current I_{max}	-	15	A
3	Peak motor current for 10 Sec	-	30	A
4	VIOH (Logic Input – High Level)	3	5.5	V
5	VIOL (Logic Input – Low Level)	0	0.5	V
6	PWM frequency	-	32	kHz

Scan here to see more products by **SmartElex.**

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A GENERAL INFORMATION

1.1 About SmartElex

The 'SmartElex' is a range of advanced electronic boards, modules, and circuits. These are designed & manufactured in India. They are highly reliable, robust, and competitively priced. You can use these products in multiple applications.

These products are very popular among electronics enthusiasts. Those who are learning micro-controllers and want to quickly develop embedded projects often use SmartElex's products.

To get more information regarding our products, visit **robu.in**.

1.2 Introduction

Motor drivers are those circuits that are used to run a motor. In other words, they are commonly used for interfacing motors to them. Brush DC motors are the most widely used drivers due to their low cost and simple drive control options.

The SmartElex 15S DC Motor Driver 15A (30A Peak) is a powerful motor driver board. This motor driver has a lot of great features and specifications that make it useful for a wide variety of mechatronics projects. Its wide operating voltage range and ease in interfacing with micro-controllers allow customers to quickly adopt them into applications.
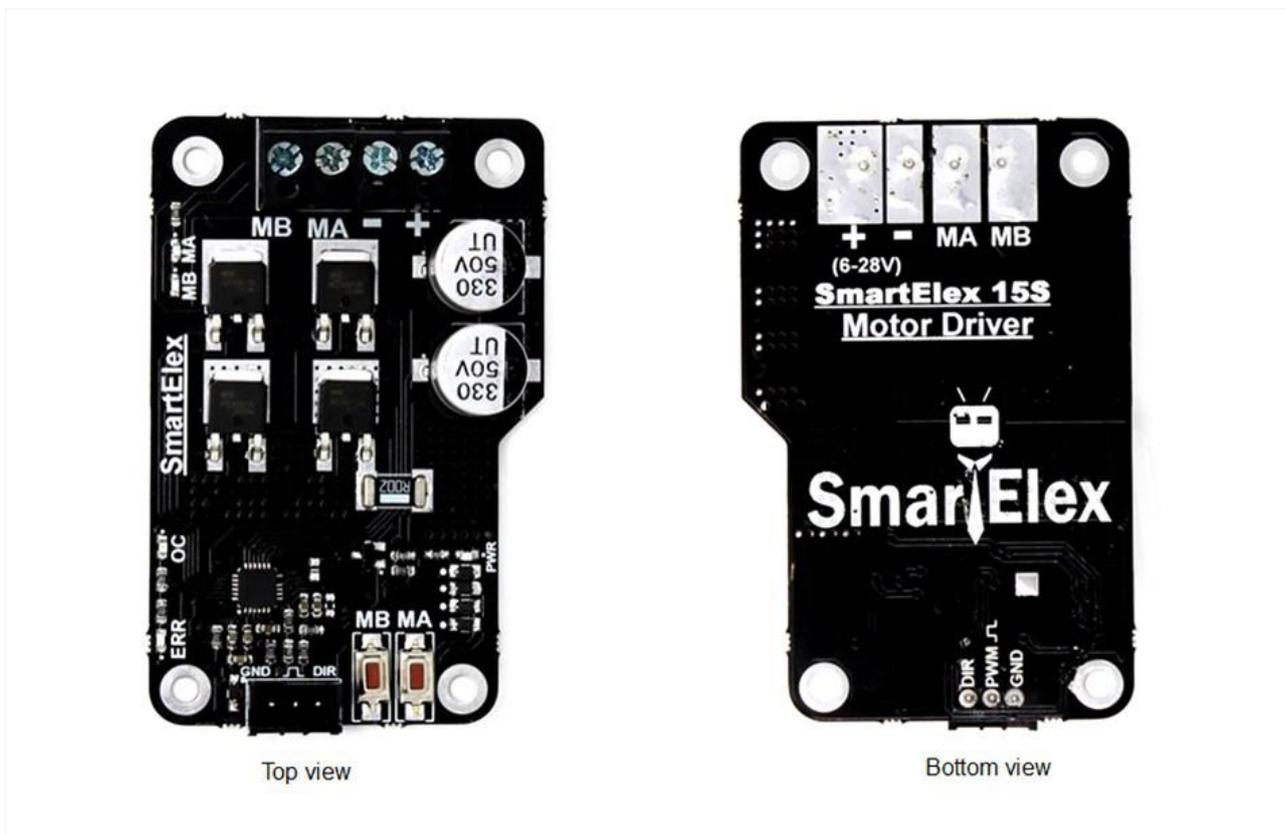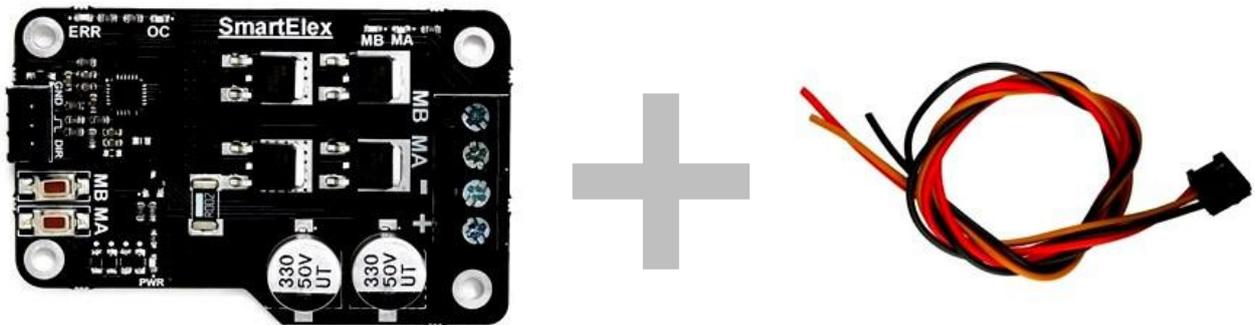

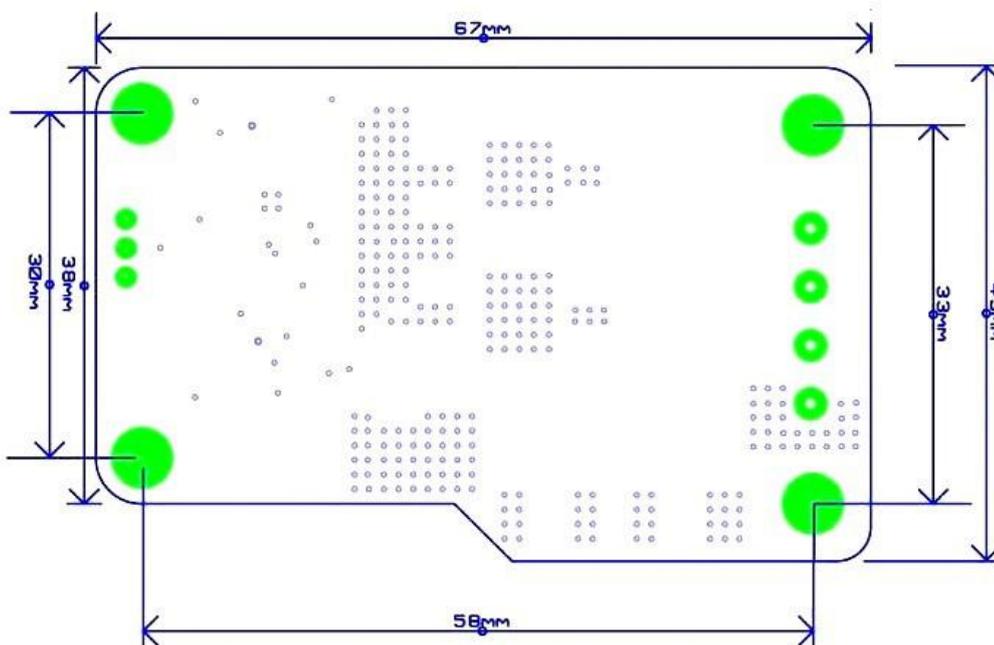The top and bottom views of the Motor Driver are as shown above.

2.1 What's in the Package?

The package includes SmartElex 15S DC Motor Driver 15A (30A Peak) and a 3 pin JST female connector cable.
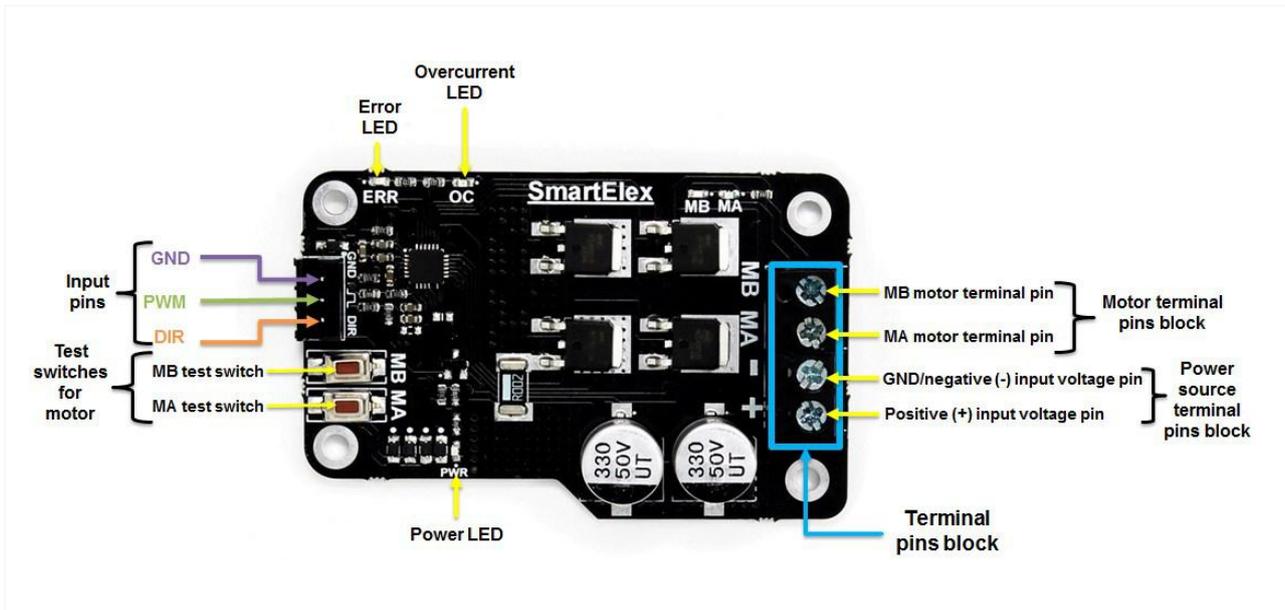

2.2 Board Layout

The overall length and breadth of the PCB are 67 mm and 43 mm respectively. Other dimensions are as shown in the figure below.

2.3 PCB Key Functions

The PCB key functions are as shown in the figure below.

1. Input pins: These pins provide 2 input signals namely PWM signal and logic signal.

Pin name	Description
GND pin	Logic ground
PWM pin	To get PWM input for speed control
DIR pin	For rotational direction control

2. Test switches for motor: When these buttons are pressed, the current flows from output and the motor starts rotating.

Pin name	Description
MA test switch	Turns motor in CW (or CCW depending on the motor connection)
MB test switch	Turns motor in CCW (or CW depending on the motor connection)

3. LEDs: LEDs are used to indicate the user about current status of motor driver and any issues or errors in the circuit. There are 3 LEDs on this driver board.

LED name	Description
Error LED	Illuminates when there is an error in the circuit
Overcurrent LED	Illuminates when the board is facing an overcurrent issue. Possible causes for over current include short circuits, excessive load, or a ground fault.
Power LED	Illuminates when the board is powered on.

4. Terminal pins block: Used for connecting motor terminals and power supply to the board. There are 2 types of terminal pins block used in this motor driver board. They are as follows:

   i) Motor terminal pins block: This block is used to connect a motor to the board.
   ii) Power source terminal pins block: This block is used to connect a power supply to the board.

Block type	Pin name	Description
Motor terminal pins block	MA motor terminal pin	To connect one terminal of the motor to the board
	MA motor terminal pin	To connect another terminal of the motor to the board
Power source terminal pins block	Positive (+) input voltage pin	To connect positive terminal of power supply to the board
	GND/negative (-) input voltage pin	To connect GND terminal of power supply to the board

Note: As a power supply, you can use a battery with voltage ranging from 5V to 30VDC. Please ensure the voltage polarity (positive and negative) is correctly connected before applying power to the board. This motor driver does not come with Reverse Polarity Protection.

3.1 Control Action of the Motor Driver

There are two modes in which you can control the speed and the rotational direction of a motor using SmartElex 15S DC Motor Driver 15A (30A Peak). They are as follows:

1. Sign-Magnitude Pulse Width Modulation (PWM)
2. Locked Anti-Phase PWM

1. Sign-Magnitude PWM mode:

   i) In this mode, you need to use 2 control signals, **PWM signal** and **logic signal (LOW/HIGH).**
   ii) To control the speed, apply the **PWM signal** to the PWM pin.
   iii) To control the rotational direction, connect the DIR pin to logic **LOW/HIGH** depending on the clockwise (CW)/counterclockwise (CCW) direction you want your motor to rotate in.
   iv) As the value of the **PWM signal** increases, the speed of the motor also goes on increasing.

2. Locked Anti-Phase PWM mode:

   i) Here, you will need only 1 control signal, the **PWM signal.**
   ii) Connect the PWM pin to **logic HIGH.**
   iii) Now, apply the **PWM signal** to the DIR pin.
   iv) The rotational direction of a motor depends on whether the duty cycle of the **PWM signal** is less than or more than 50%.
   v) If the **PWM signal** has less than 50% duty cycle, the motor will turn CW (or CCW depending on the connection). If the PWM signal has more than 50% duty cycle, the motor will turn CCW (or CW depending on the connection).
   vi) When the **PWM signal** has approximately 50% duty cycle, the motor stops running. Here, the speed depends on the percentage of the duty cycle.
   vii) In the beginning, the motor will run at maximum speed when there is no **PWM signal.** You will have to provide a **PWM signal** to DIR pin at 50% duty cycle or set PWM pin to logic **LOW** state in the beginning. The speed of motor changes with increment or decrement in PWM value and also depends on the direction in which the motor is rotating.

> *Note:*
> 1. *In digital electronics, signals are used in rectangular waveforms which are represented by logic 1 (HIGH) and logic 0 (LOW). Logic 1 (here, supply voltage V) stands for presence of an electric pulse and logic 0 (here, 0 V) for absence of an electric pulse.*
> 2. *Duty cycle is the percentage of the ratio of pulse duration, or pulse width (PW) to the total period (T) of the waveform. It is generally used to represent time duration of a pulse when it is HIGH (1).*

3.2 Connecting with Arduino UNO Board

For connecting SmartElex 15S DC Motor Driver 15A (30A Peak) with Arduino UNO Board, refer to the following figure.
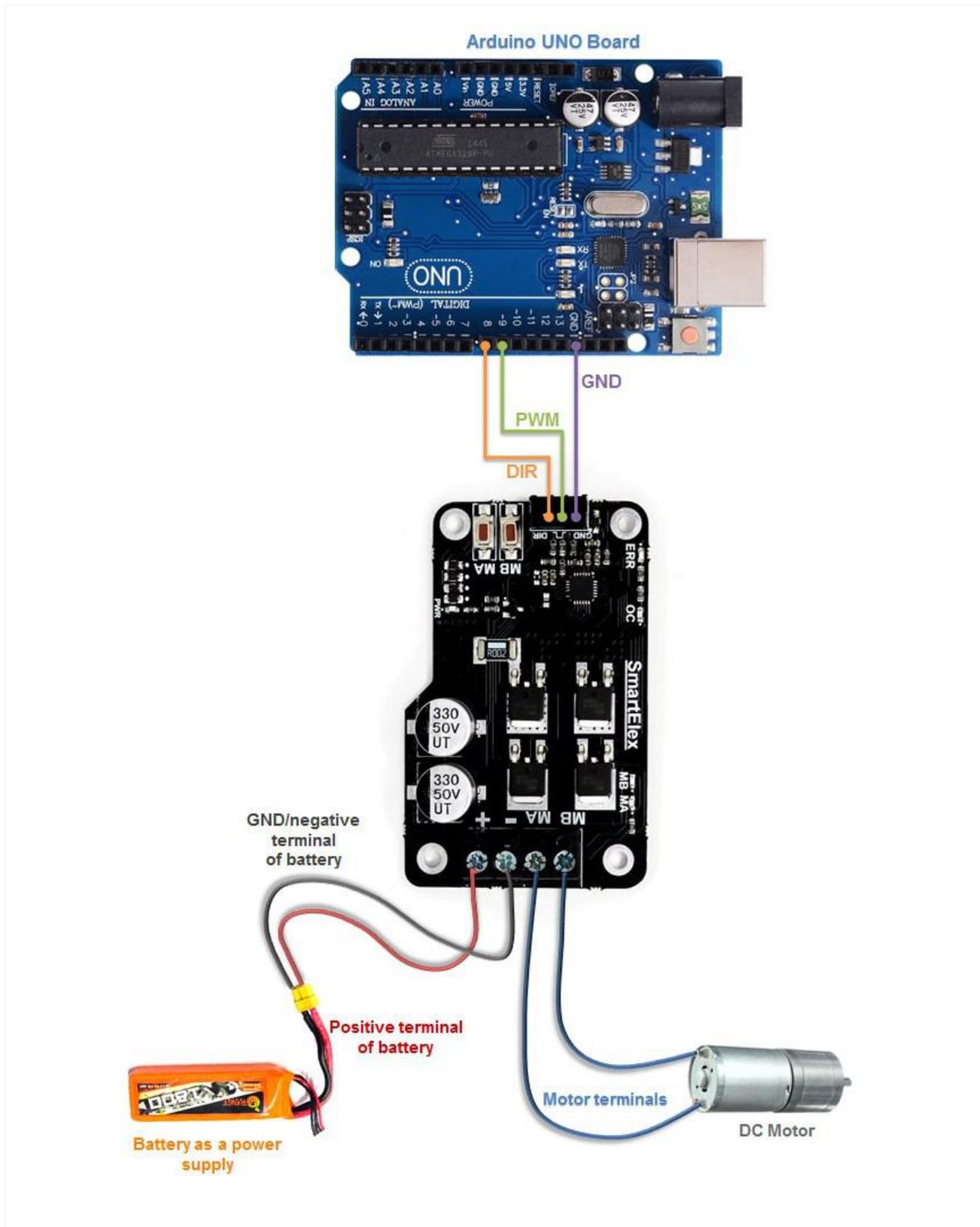
A connection table is as given below.

SmartElex 15S DC Motor Driver 15 A (30 A Peak)	Connection
PWM pin	9 pin of Arduino UNO Board
DIR pin	8 pin of Arduino UNO Board
GND pin	GND pin of Arduino UNO Board
MA pin	One terminal of motor
MB pin	Another terminal of motor
Positive (+) input voltage pin	Positive terminal of power supply
GND/negative (-) input voltage pin	GND/negative terminal of power supply

A sample code for connecting the motor driver with Arduino UNO Board is as given below.

Sample code

```
#define PWM 9
#define DIR 8

void setup()
{
  pinMode(PWM,OUTPUT);
  pinMode(DIR,OUTPUT);
}

void loop()
{

  int i=0;
  digitalWrite(DIR,HIGH);
  for(i=0;i<255; i++)
  {
    analogWrite(PWM,i);
    delay(2);
  }
  delay(2000);

  digitalWrite(DIR,LOW);
    for(int j=0;j<255;j++)
  {
      analogWrite(PWM,j);
      delay(2);
  }
  delay(2000);
}
```
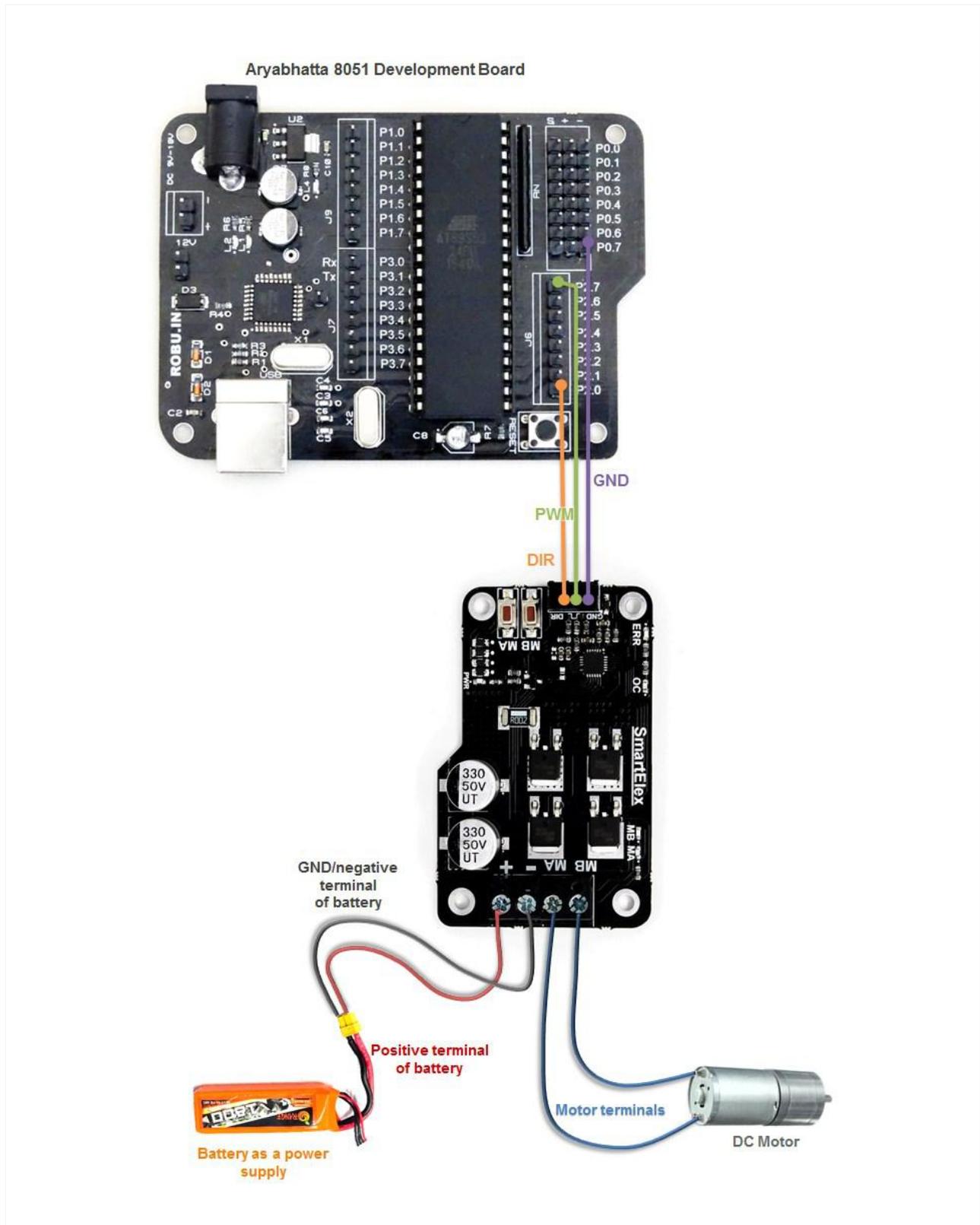
3.3 Connecting with Aryabhatta 8051 Development Board

For connecting SmartElex 15S DC Motor Driver 15A (30A Peak) with Aryabhatta 8051 Development Board, refer to the figure below.

A connection table is as given below.

SmartElex 15S DC Motor Driver 15 A (30 A Peak)	Connection
GND pin	GND pin of Aryabhatta Board
PWM pin	P2.7 of Aryabhatta Board
DIR pin	P2.0 of Aryabhatta Board
MA pin	One terminal of motor
MB pin	Another terminal of motor
Positive (+) input voltage pin	Positive terminal of power supply
GND/negative (-) input voltage pin	GND/negative terminal of power supply

D WARRANTY

This item is covered with a supplier warranty of **6 months** from the time of delivery against manufacturing defects only. This is a quality product from the original manufacturer. Only manufacturing defects are covered under this warranty. Reimbursement or replacement will be done against manufacturing defects.

What voids the warranty: If the product is subject to misuse, tampering, static discharge, accident, water or fire damage, use of chemicals & soldered or altered in any way.