

DRV8870 Dual DC Motor Driver Module

Version: 0.1 (Draft)

1. Overview

This module is a compact dual-channel DC motor driver based on two TI DRV8870 single H-bridge motor driver ICs. It enables independent control of two brushed DC motors using low-voltage logic signals from a microcontroller. Each channel supports direction control and PWM-based speed control with built-in current regulation.

The module is designed and manufactured by KAMAN and is intended for robotics applications, including mobile robots, educational platforms, and embedded motor control systems.

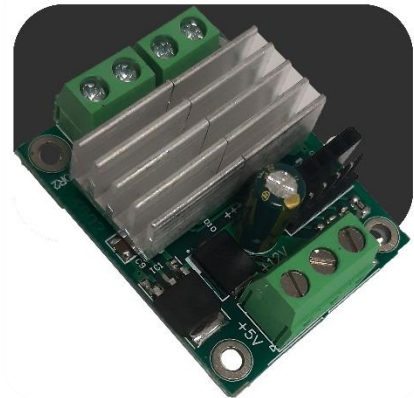


Figure 1

2. Key Features

- Dual DC motor control (2 × DRV8870)
- Independent direction and speed control per motor
- Wide motor supply voltage range
- Logic-level compatible control inputs
- Integrated current regulation and protection
- Thermal shutdown and overcurrent protection
- Compact PCB design suitable for embedded systems

3. Applications

- Line follower and mobile robots
- Educational and training kits
- Small automation systems
- Mechatronics projects
- General-purpose DC motor control

4. Absolute Maximum Ratings (per channel – refer to TI DRV8870 datasheet)

Table 1

Parameter	Min	Max	Unit
Motor Supply Voltage (VM)	—	45	V
Logic Input Voltage	-0.3	5.5	V
Output Current (Peak)	—	6.5	A

Important: This module does NOT include reverse-polarity protection. Applying reverse voltage to VM will permanently damage the module.

5. Recommended Operating Conditions

Table 2

Parameter	Min	Typ	Max	Unit
Motor Supply Voltage (VM)	7	12	24	V
Logic Input Voltage	3.3	5	5	V
Continuous Output Current (per motor)	—	—	2.5	A
PWM Frequency	—	20	100	kHz

6. Electrical Characteristics (Typical)

Table 3

Parameter	Typical Value
RDS(ON) (HS + LS)	~565 mΩ
Current Regulation Setpoint (VREF = 5V)	~2.5 A
VREF Input Voltage Range	0.5 – 5 V
Thermal Shutdown Threshold	~150 °C

7. Pin Configuration and Description

7.1 Motor 1

Table 4

Pin Name	Description
IN1	Direction / PWM input Motor 1 (3.3V / 5V compatible)
IN2	Direction / PWM input Motor 1 (3.3V / 5V compatible)
OUT1_A	Motor 1 terminal (KF128)
OUT1_B	Motor 1 terminal (KF128)

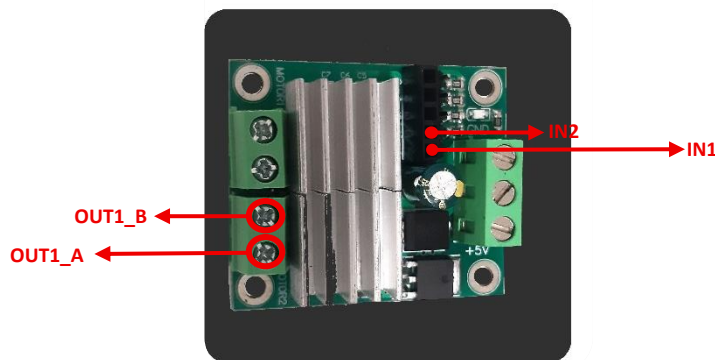


Figure 2

7.2 Motor 2

Table 5

Pin Name	Description
IN3	Direction / PWM input Motor 2 (3.3V / 5V compatible)
IN4	Direction / PWM input Motor 2 (3.3V / 5V compatible)
OUT2_A	Motor 2 terminal (KF128)
OUT2_B	Motor 2 terminal (KF128)

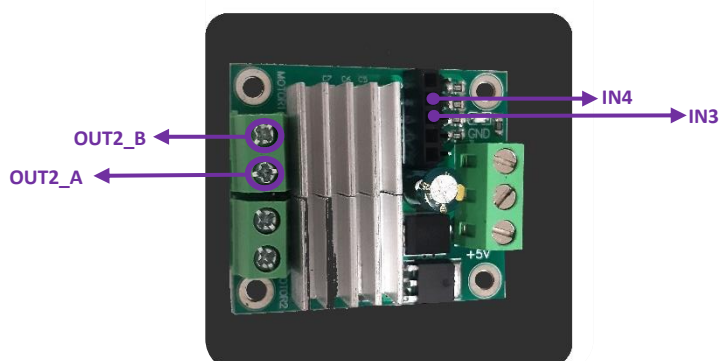


Figure 3

7.3 Power Pins

Table 6

Pin Name	Description
VCC	Motor supply voltage (12V)
GND/P	Ground Power
OUT 5V	DC output Power 5 v
GND/S	Ground Signal

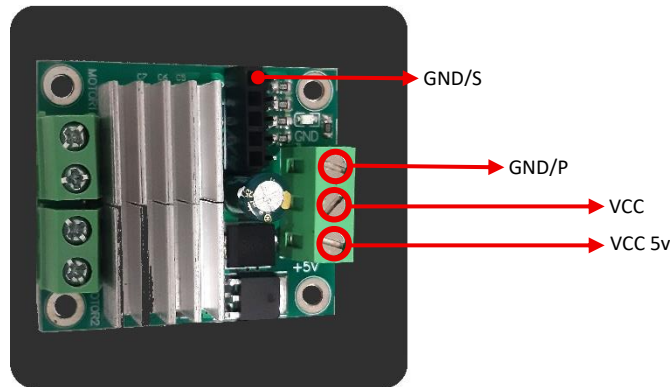


Figure 4

7.4 Connectors

- Motor Outputs: KF128 screw terminal
- Logic Inputs: 2.54 mm pin header
- VREF Input: Routed to the 2.54 mm signal header (intended to be driven directly from a microcontroller DAC or filtered PWM)

8. Control Logic

Table 7

IN1	IN2	Operation
0	0	Coast (Hi-Z)
1	0	Forward
0	1	Reverse
1	1	Brake

Speed control is achieved by applying a PWM signal to either IN1 or IN2 while holding the other input low.

9. Current Regulation via VREF

The output current limit of each motor channel is programmable via the **VREF** pin.

According to the DRV8870 internal current regulation architecture, the approximate current limit is defined as:

$$I_{LIMIT} \approx V_{REF} \times 0.5 \text{ (A/V)}$$

Where: - VREF is the voltage applied to the VREF pin (0.5 V to 5 V) - I_{LIMIT} is the peak current limit per motor channel

Example: - $V_{REF} = 5 \text{ V} \rightarrow I_{LIMIT} \approx 2.5 \text{ A}$ - $V_{REF} = 3 \text{ V} \rightarrow I_{LIMIT} \approx 1.5 \text{ A}$ - $V_{REF} = 1 \text{ V} \rightarrow I_{LIMIT} \approx 0.5 \text{ A}$

The VREF pin may be driven by: - A fixed voltage reference - A DAC output - A filtered PWM signal

10. Protection Features

- Overcurrent protection with automatic current limiting
- Thermal shutdown
- Undervoltage lockout (UVLO)
- Motor short-to-ground and short-to-supply protection

11. Mechanical Information

Table 8

Parameter	Value
PCB Dimensions	41.1 mm × 43.5 mm
Mounting Holes	4 × M3
Motor Connector	KF127 Screw Terminal
Signal Connector	2.54 mm Header

12. Typical Application Circuit

Each motor channel follows the standard DRV8870 reference design with: - Bulk capacitor on VM - Local ceramic decoupling capacitors - Optional current regulation resistor (if implemented)

12.1 Basic Educational Wiring Example

The following wiring method is recommended for educational and robotics use:

VM: Connect to a 7–24 V DC power supply

GND: Connect to system ground (common with microcontroller)

Motor 1 / 2: Connect DC motors to KF128 screw terminals

IN1 / IN2/ IN3/ IN4: Connect to microcontroller digital output pins

VREF: Connect to: Microcontroller DAC output, or PWM output filtered by an RC low-pass filter

12.2 Example Control Configuration (per motor)

IN1 → PWM output (speed control)

IN2 → GPIO output (direction control)

VREF → Fixed voltage or MCU-controlled analog level

This configuration allows full control of direction, speed, and current limit using minimal MCU resources.

12.3 Example Code

// PIN Number

```
int IN1=2;
```

```
int IN2=3;
```

```
int IN3=4;
```

```
int IN4=5;
```

```
int Speed=200;
```

```
void setup() {
```

```
  pinMode(IN1, OUTPUT);
```

```
  pinMode(IN2, OUTPUT);
```

```
  pinMode(IN3, OUTPUT);
```

```
  pinMode(IN4, OUTPUT);
```

```
  // put your setup code here, to run once:
```

```
}
```

```

void loop() {
  // Forward Direction
  digitalWrite(IN1, LOW);
  analogWrite(IN2, Speed);
  digitalWrite(IN3, LOW);
  analogWrite(IN4, Speed);
  delay(500);
  // Backward Direction
  digitalWrite(IN1, HIGH);
  analogWrite(IN2, (255-Speed));
  digitalWrite(IN3, HIGH);
  analogWrite(IN4, (255-Speed));
  delay(500);
}

```

13. Notes

- motor channel.
- Internal current regulation is enabled and configured via the VREF pin, which is routed to the signal header for direct connection to a microcontroller.
- VREF operating range is 0.5 V to 5 V; typical configuration uses 5 V for ~2.5 A current limit.
- Logic inputs are compatible with both 3.3 V and 5 V microcontrollers.
- The module does not include reverse-polarity protection on the VM input; applying reverse voltage will permanently damage the module.
- For detailed internal operation, refer to the official Texas Instruments DRV8870 datasheet.

14. Ordering Information

Table 9

Module Name	Description
DRV8870-DUAL	Dual DC Motor Driver Module

15. Revision History

Table 10

Version	Date	Description
0.1	—	Initial draft