

**LB1839M**

## Low-voltage/Low-saturation Bidirectional Constant-Voltage Regulated Motor Driver

### Overview

The LB1839M is a low-voltage, low-saturation, three-input type two-channel bidirectional motor driver that permits switching between constant-voltage regulated output and saturated output. The design of the LB1839M is ideal for a two-phase bipolar driver for stepping motors.

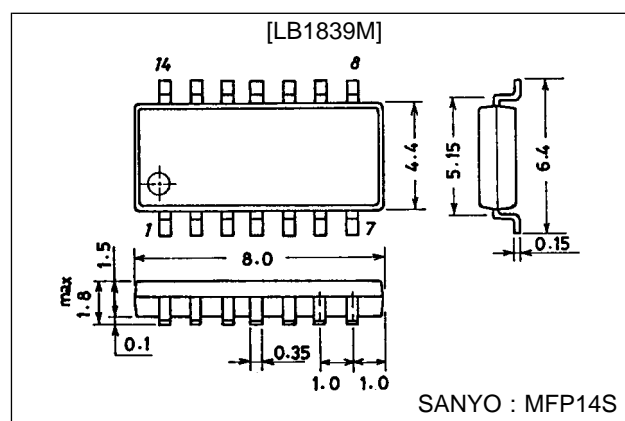
### Features

- Wide operating voltage range (3.0 to 9.0 V).
- Low saturation voltage  
 $V_O(\text{sat}) = 0.40 \text{ V}$  at  $I_O = 200 \text{ mA}$ .
- Consumes almost no current in standby mode (0.1  $\mu\text{A}$  or less).
- Permits setting of bidirectional constant-voltage regulated value.
- Three-input type that is ideal for a two-phase bipolar driver.
- Permits switching between constant-voltage regulated output and saturated output.
- Built-in reference voltage coupled to input.
- Compact MFP14S package.

### Package Dimensions

unit: mm

#### 3111-MFP14S



### Specifications

#### Absolute Maximum Ratings at $T_a = 25 \text{ }^\circ\text{C}$

| Parameter                   | Symbol               | Conditions                                   | Ratings     | Unit             |
|-----------------------------|----------------------|--|-------------|------------------|
| Maximum supply voltage      | $V_{CC \text{ max}}$ |  | 10.5        | V                |
| Output current              | $I_m \text{ max}$    |  | 250         | mA               |
| Applied input voltage       | $V_{IN}$             |  | -0.3 to +10 | V                |
| Allowable power dissipation | $P_d \text{ max}$    | With board ( 30 x 30 x 1.5 mm <sup>3</sup> ) | 800         | mW               |
| Operating temperature       | $T_{opr}$            |  | -20 to +80  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$            |  | -40 to +125 | $^\circ\text{C}$ |

#### Allowable Operating Ranges at $T_a = 25 \text{ }^\circ\text{C}$

| Parameter         | Symbol   | Conditions | Ratings      | Unit |
|-------------------|----------|------------|--------------|------|
| Supply voltage    | $V_{CC}$ |            | 3.0 to 9.0   | V    |
| Input [H] voltage | $V_{IH}$ |            | 3.0 to 9.0   | V    |
| Input [L] voltage | $V_{IL}$ |            | -0.3 to +0.7 | V    |
| Control voltage   | $V_C$    |            | 0.2 to 6.0   | V    |

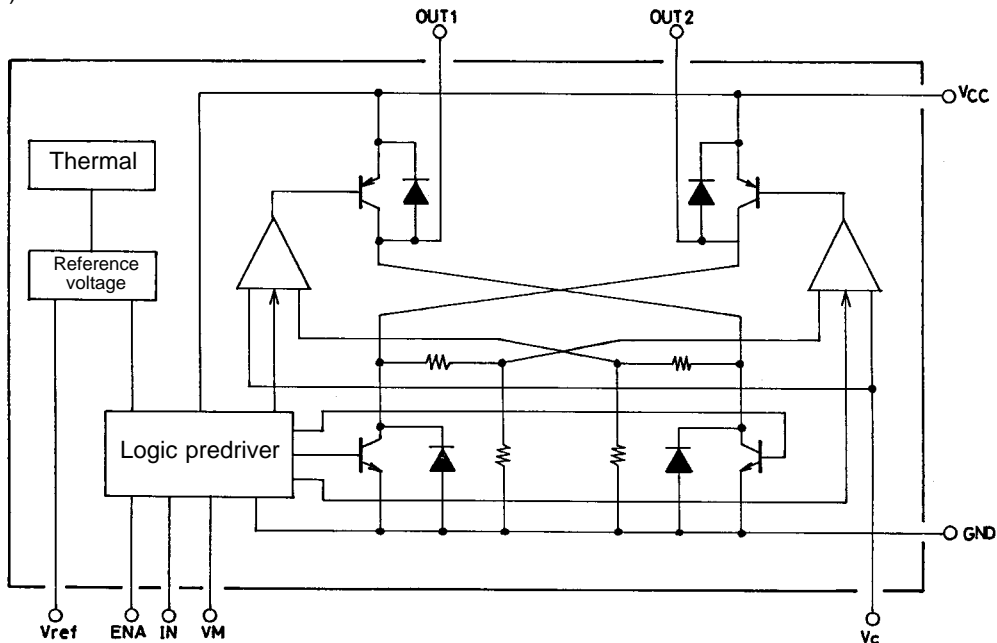
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## Electrical Characteristics at $T_a = 25\text{ }^\circ\text{C}$ , $V_{CC} = 6\text{ V}$

| Parameter                              | Symbol                             | Conditions   | min              | typ  | max              | Unit          |
|--|------------------------------------|--|------------------|------|------------------|---------------|
| Supply current                         | $I_{CC0}$                          | During standby   |                  | 0.1  | 10               | $\mu\text{A}$ |
|  | $I_{CC1}$                          | (For two channel) During bidirectional operation, during control, load open      |                  | 3.5  | 5.0              | $\text{mA}$   |
|  | $I_{CC2}$                          | (For two channel) During bidirectional operation, during saturation, load open   |                  | 4.0  | 6.0              | $\text{mA}$   |
| Output saturation voltage              | $V_{sat1}$                         | $I_O = 100\text{ mA}$ (upper side + lower side)                                  |                  | 0.30 | 0.40             | V             |
|  | $V_{sat2}$                         | $I_O = 200\text{ mA}$ (upper side + lower side)                                  |                  | 0.40 | 0.55             | V             |
|  | $V_{sat3}$                         | $I_O = 200\text{ mA}$ (lower side)   | 0.07             | 0.10 | 0.15             | V             |
| Reference voltage                      | $V_{ref}$                          | $I_{vref} = 1\text{ mA}$   | 1.85             | 2.0  | 2.15             | V             |
| Output voltage voltage characteristics | $\frac{\Delta V_O}{\Delta V_{CC}}$ | $V_O = 5\text{ V}$ , $V_{CC} = 5.5\text{ to }9\text{ V}$ , $I_O = 100\text{ mA}$ |                  |      | 20               | $\text{mV}$   |
| Output voltage current characteristics | $\frac{\Delta V_O}{\Delta I_{CC}}$ | $V_O = 5\text{ V}$ , $V_{CC} = 6\text{ V}$ , $I_O = 10\text{ to }100\text{ mA}$  |                  |      | 50               | $\text{mV}$   |
| Input current                          | $I_{IN}$                           | $V_{IN} = 5\text{ V}$  |                  | 90   | 150              | $\mu\text{A}$ |
| Output voltage                         | $V_O$                              | Between OUT and GND  | $2.5 \times V_C$ |      | $2.7 \times V_C$ | V             |

### Equivalent Circuit Block Diagram

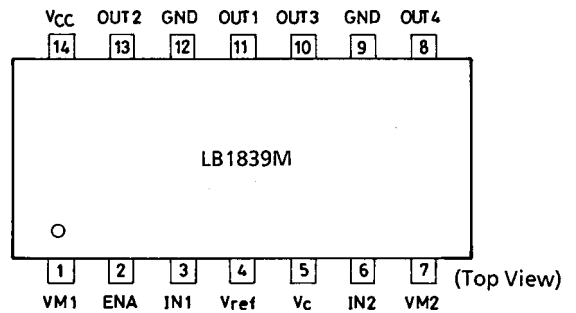
(For one channel)



### Truth Table

| Input |        |        | Output  |         | Mode   |
|-------|--------|--------|---------|---------|--|
| ENA   | IN 1/2 | VM 1/2 | OUT 1/3 | OUT 2/4 |  |
| L     | —      | —      | OFF     | OFF     | Standby                                      |
| H     | L      | L      | H       | L       | Constant-voltage regulated forward operation |
| H     | L      | H      | H       | L       | Saturated forward operation                  |
| H     | H      | L      | L       | H       | Constant-voltage regulated reverse operation |
| H     | H      | H      | L       | H       | Saturated reverse operation                  |

### Pin Assignment



Note: Both GND pins must be grounded.

The constant-voltage regulated output  $V_O$  (= voltage between H side output and GND) is controlled by  $2.5 \times V_C$ . The output is in the saturated state when the  $V_C$  input range is 0.2 to 6 V and  $V_O \cong V_{CC}$ .

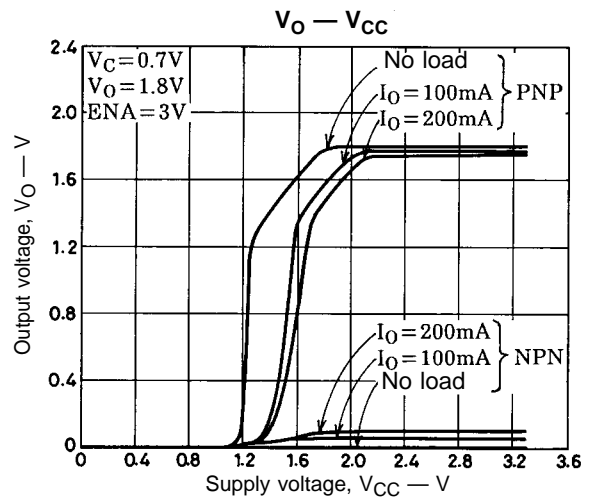
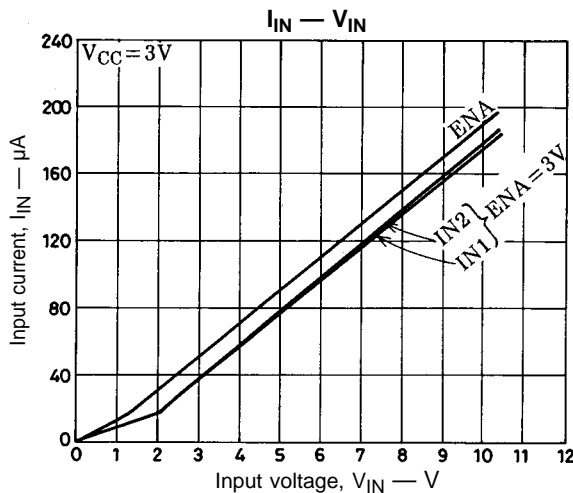
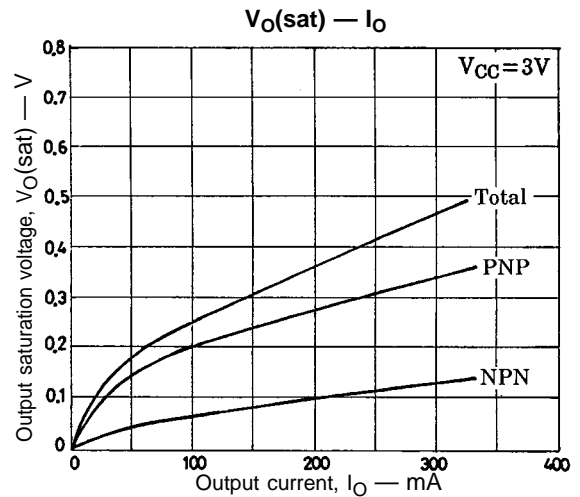
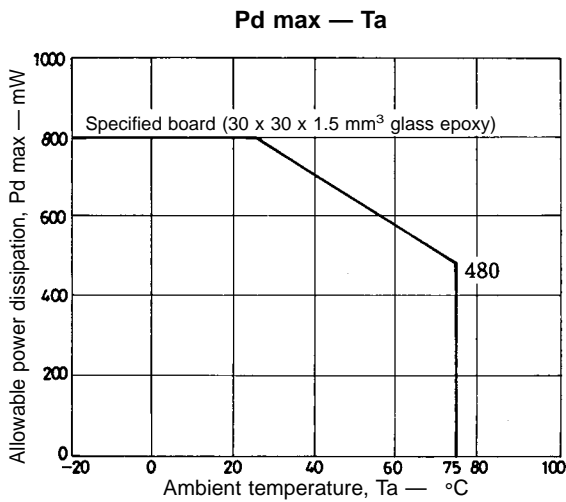
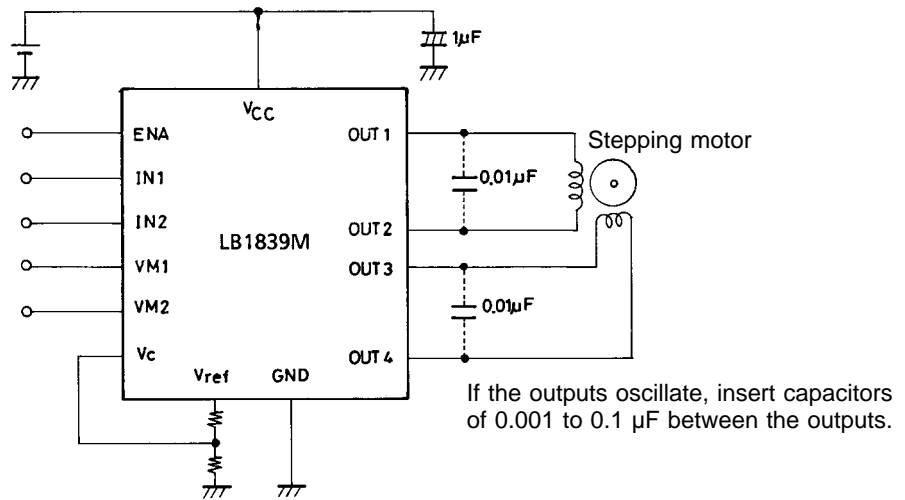
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## Pin Functions

| Pin No.             | Symbol                       | Equivalent Circuit Diagram | Pin Function   |
|---------------------|------------------------------|----------------------------|--|
| 14                  | V <sub>CC</sub>              |                            | Power supply pin for output and controller.  |
| 9<br>12             | GND                          |                            | GND pins for output and controller. Both must be grounded.   |
| 3<br>6              | IN2<br>IN1                   |                            | <p>Input pins that determine the excitation of the outputs.</p> <p>IN1 control outputs OUT1 and OUT2; IN2 control outputs OUT3 and OUT4.</p> <p>L: -0.3 to +0.7 V<br/>H: 3.0 to 9.0 V</p> <p>There are no limitations on the magnitude relationships between the V<sub>CC</sub> and V<sub>IN</sub> supply voltages.</p>  |
| 8<br>10<br>11<br>13 | OUT4<br>OUT3<br>OUT1<br>OUT2 |                            | <p>Output pins.</p> <p>Have built-in spark killer diodes.</p>  |
| 4                   | V <sub>ref</sub>             |                            | Reference voltage (= 2.0 V).   |
| 5                   | V <sub>C</sub>               |                            | <p>Input pins that determine the constant-voltage regulated output level.</p> <p>The constant-voltage regulated output V<sub>O</sub> (= voltage between H side output and GND) is controlled by V<sub>O</sub> = 2.5 × V<sub>C</sub>. There are no limitations on the magnitude relationships between the V<sub>CC</sub> and V<sub>C</sub> supply voltages.</p>             |
| 2                   | ENA                          |                            | <p>Standby/drive control input pin</p> <p>Current consumption in standby mode is 10 μA or less.</p> <p>L: -0.3 to + 0.7 V<br/>H: 3.0 to 9.0 V</p>  |
| 1<br>7              | VM1<br>VM2                   |                            | <p>Output voltage setting</p> <p>Control input pin for switching between constant voltage output and saturated output. There are no limitations on the magnitude relationships between the V<sub>CC</sub>, V<sub>M1</sub> and V<sub>M2</sub> supply voltages.</p> <p>L: -0.3 to + 0.7 V<br/>(constant-voltage regulated output)<br/>H: 3.0 to 9.0 V (saturated output)</p> |

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## Sample Application Circuit



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