Ordering number : EN3947F

# LB1836M

**Monolithic Digital IC**

## Low-Saturation Bidirectional Motor Driver for Low-Voltage Drive

ON Semiconductor®

http://onsemi.com

### Overview

The LB1836M is a low-saturation two-channel bidirectional motor driver IC for use in low-voltage applications. The LB1836M is a bipolar stepper-motor driver IC that is ideal for use in printers, FDDs, cameras and other portable devices.

### Features

- Low voltage operation (2.5V min)
- Low saturation voltage (upper transistor + lower transistor residual voltage ; 0.40V typ at 400mA).
- Parallel connection (Upper transistor + lower transistor residual voltage ; 0.5V typ at 800mA).
- Separate logic power supply and motor power supply
- Brake function
- Spark killer diodes built in
- Thermal shutdown circuit built in
- Compact package (14-pin MFP)

### Specifications

**Absolute Maximum Ratings** at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | | -0.3 to +10.5 | V |
| | $V_S$ max | | -0.3 to +10.5 | V |
| Output supply voltage | $V_{OUT}$ | | $V_S + V_{SF}$ | V |
| Input supply voltage | $V_{IN}$ | | -0.3 to +10 | V |
| GND pin flow-out current | IGND | Per channel | 1.0 | A |
| Allowable power dissipation | Pd max | * Mounted on a board. | 800 | mW |
| Operating temperature | Topr | | -40 to +85 | °C |
| Storage temperature | Tstg | | -55 to +150 | °C |

* Mounted on a substrate: 30×30×1.5mm$^3$, glass epoxy board.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Allowable Operating Ranges** at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | | 2.5 to 9.0 | V |
| | $V_S$ | | 1.8 to 9.0 | V |
| Input "H"-level voltage | $V_{IH}$ | | 1.8 to 9.0 | V |
| Input "L"-level voltage | $V_{IL}$ | | -0.3 to +0.7 | V |

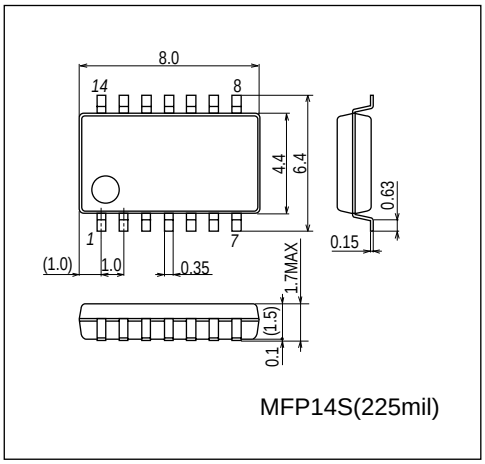
**Electrical Characteristics** at Ta = 25°C, $V_{CC}$ = VS = 3V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Supply current | $I_{CC}0$ | $V_{IN}1$, 2, 3, 4 = 0V, $I_{CC}$ + $I_S$ | | 0.1 | 10 | µA |
| | $I_{CC}1$ | $V_{IN}1$ = 3V, $V_{IN}2$, 3, 4 = 0V, $I_{CC}$ + $I_S$ | | 14 | 20 | mA |
| | $I_{CC}2$ | $V_{IN}1$, 2 = 3V, $V_{IN}3$, 4 = 0V, $I_{CC}$ + $I_S$ | | 22 | 35 | mA |
| Output saturation voltage (upper + lower) | $V_{OUT}1$ | $I_{OUT}$ = 200mA | | 0.20 | 0.28 | V |
| | $V_{OUT}2$ | $I_{OUT}$ = 400mA | | 0.40 | 0.60 | V |
| | $V_{OUT}3$ | $I_{OUT}$ = 400mA, Parallel connection | | 0.25 | 0.35 | V |
| | $V_{OUT}4$ | $I_{OUT}$ = 800mA, Parallel connection | | 0.50 | 0.70 | V |
| Output sustain voltage | $V_O$ (SUS) | $I_{OUT}$ = 400mA | 9 | | | V |
| Input current | $I_{IN}$ | $V_{IN}$ = 2V, $V_{CC}$ = 6V | | | 80 | µA |
| **Spark killer diode** | | | | | | |
| Reverse current | $I_S$ (leak) | $V_{CC}$1, 2 = 9V | | | 30 | µA |
| Forward voltage | $V_{SF}$ | $I_{OUT}$ = 400mA | | | 1.7 | V |

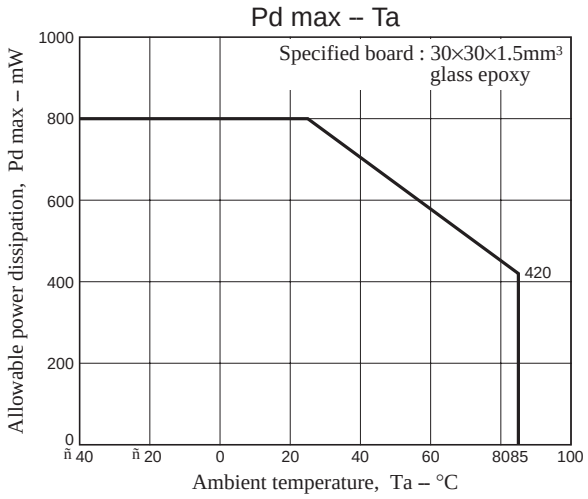
## Package Dimensions

unit : mm (typ)

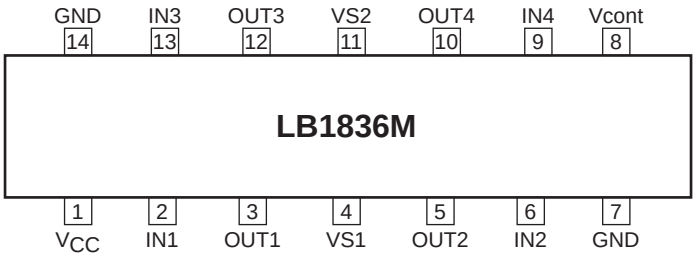
3111A




MFP14S(225mil)



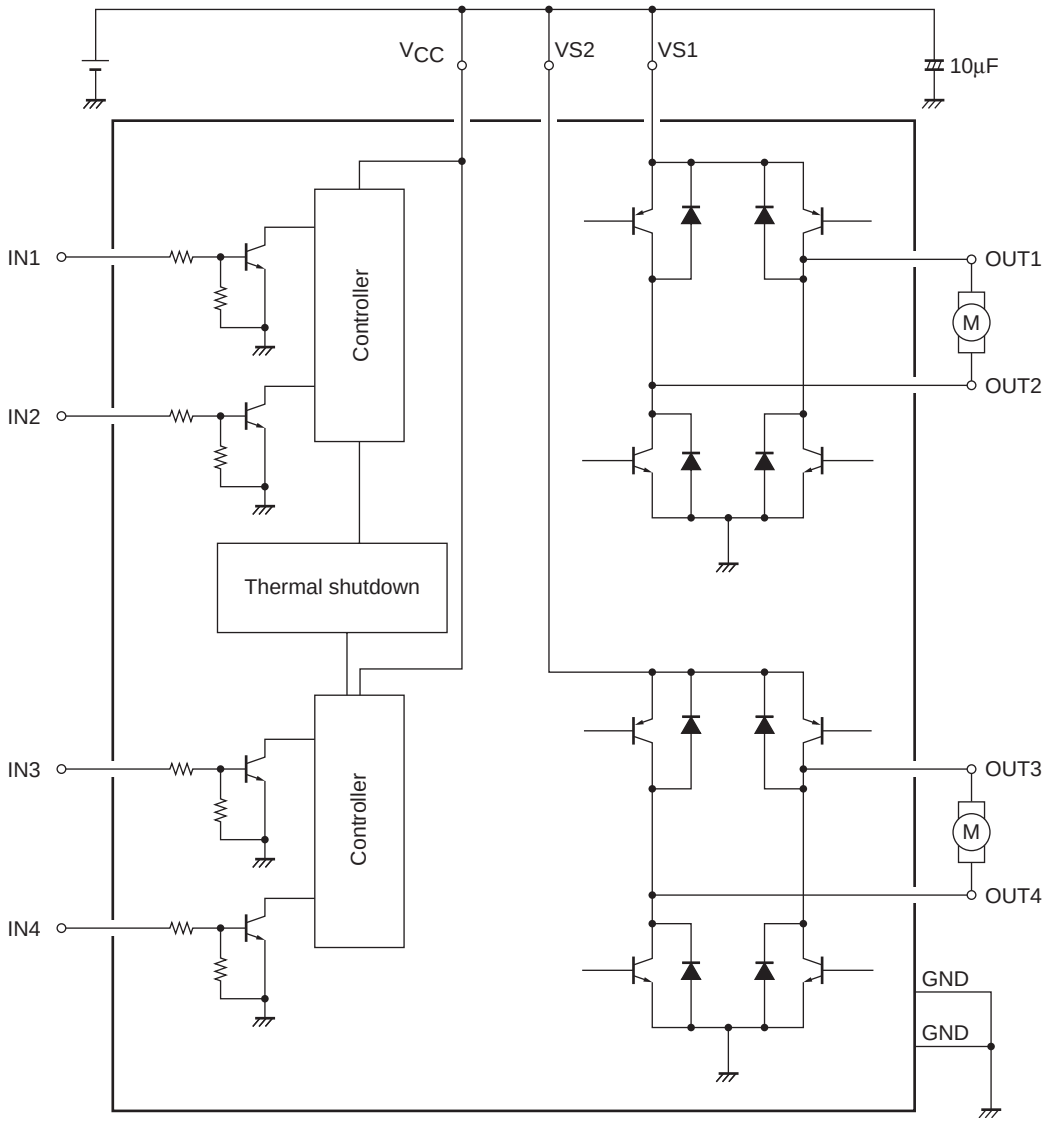

## Pin Assignment




Top view

Note) Ground both GND pins.

## Block Diagram




### Truth Table

| IN1/3 | IN2/4 | OUT1/3 | OUT2/4 | Mode |
|---|---|---|---|---|
| H | L | H | L | Forward |
| L | H | L | H | Reverse |
| H | H | L | L | Brake |
| L | L | OFF | OFF | Standby |

## Design Notes

If large current flows on the power supply ($V_S$) line and the GND line, then in some applications and layouts, misoperation due to line oscillation may result.

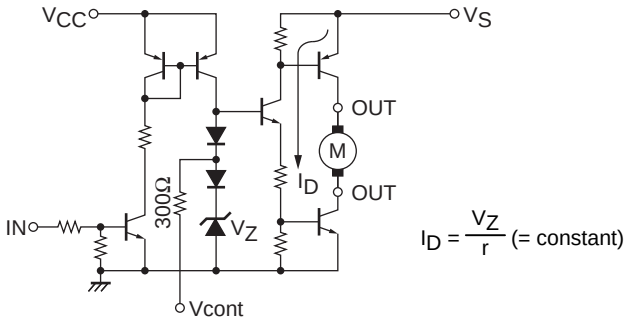
The modes during which large current flows are as follows :

- Motor surge current when the DC motor starts up or when it shifts rotation directions (forward ↔ reverse).
- Passthrough current generated within the IC when shifting rotation directions (forward ↔ reverse) or when shifting from forward/reverse rotation to braking, or vice versa.

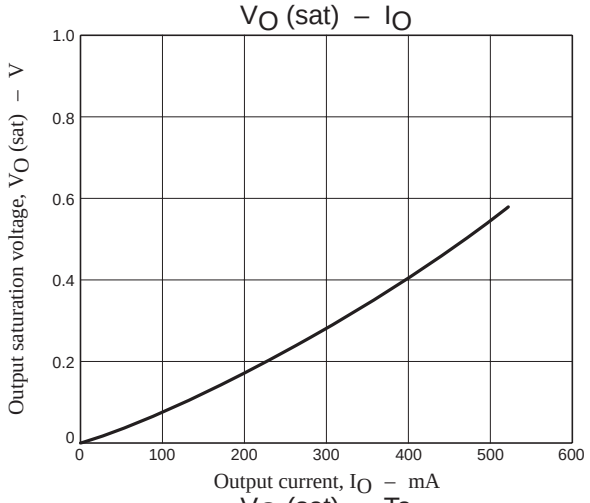
The following points should be kept in mind regarding the pattern layout :

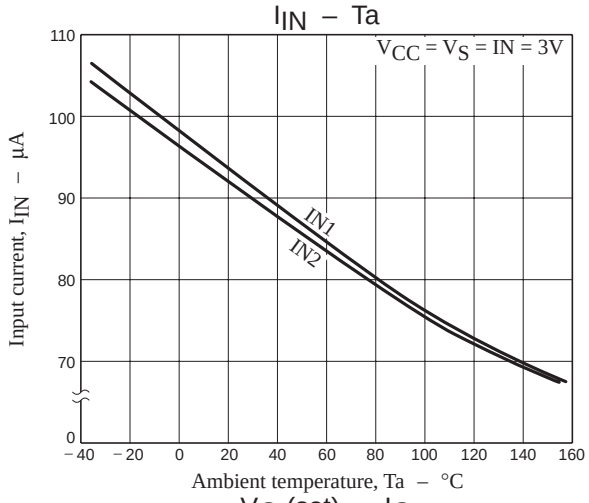
- Keep the wiring lines thick and short in order to reduce wiring inductance between the power supply ($V_S$) and GND.
- Insert a passthrough capacitor near the IC. (Maximum effect is obtained by inserting the passthrough capacitor between VS and the pin 7 GND at the closest distance possible.
- If the CPU and the LB1836M are mounted on separate boards and the difference between the ground potential of each board is large, install resistors of about 10kΩ in series between the CPU and the LB1836M inputs.

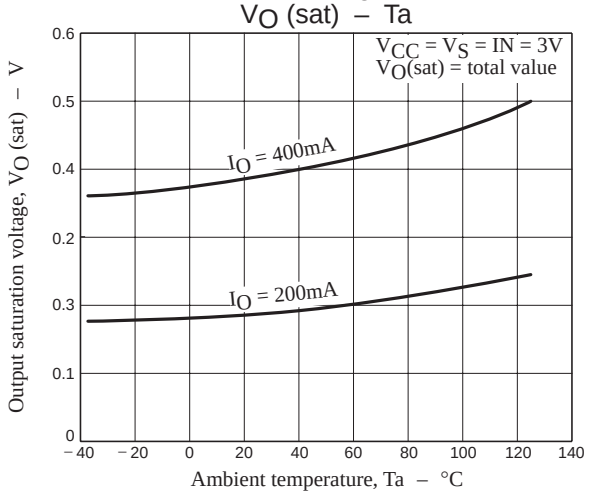
## Vcont pin

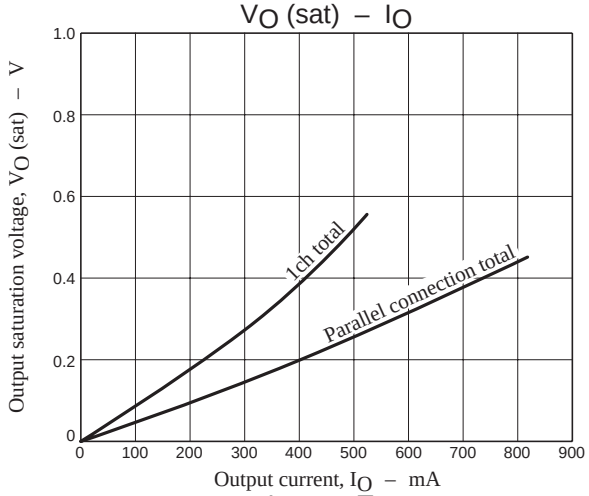


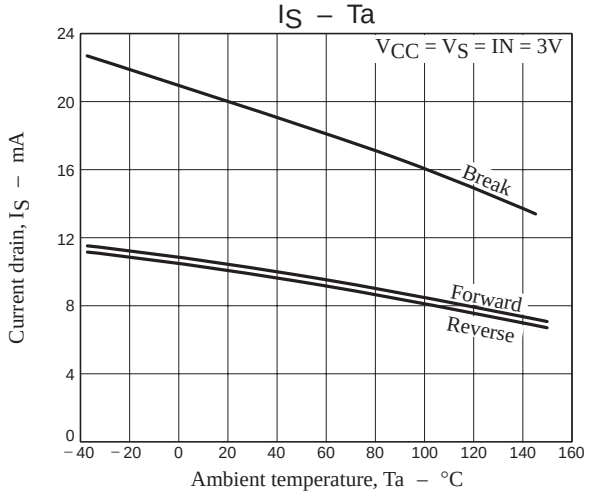

As shown in the above diagram, the Vcont pin outputs the voltage of the band gap Zener $V_Z + V_F$ (=1.93V).
In normal use, this pin is left open.
The drive current ID is varied by the Vcont voltage. However, because the band gap Zener is shared, it functions as a bridge.

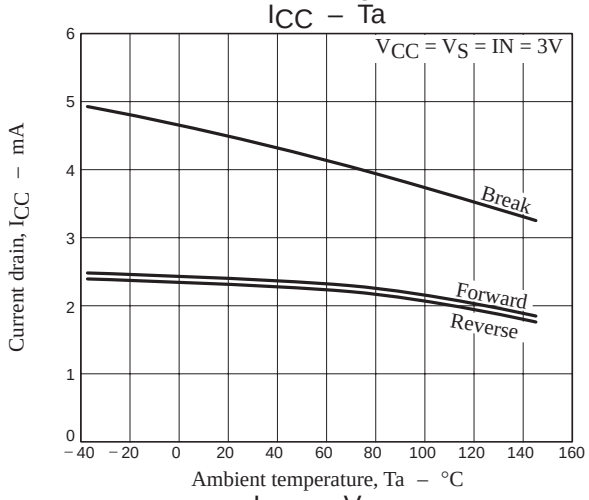

VO (sat) – IO
Output saturation voltage, VO (sat) – V
1.0
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
Output current, IO – mA

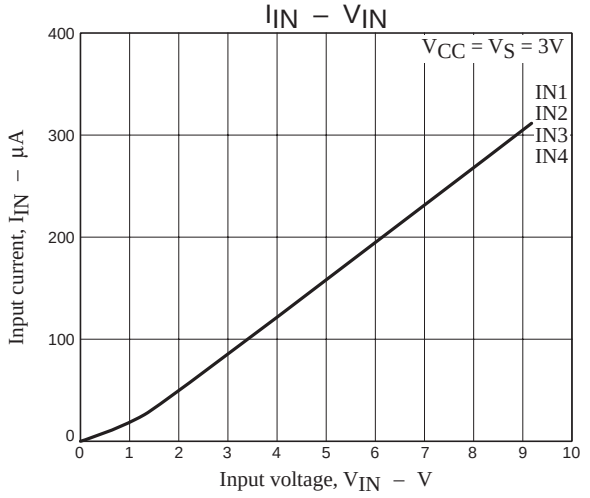

IIN – Ta
VCC = VS = IN = 3V
Input current, IIN – µA
110
100
90
80
70
0
IN1
IN2
–40
–20
0
20
40
60
80
100
120
140
160
Ambient temperature, Ta – °C

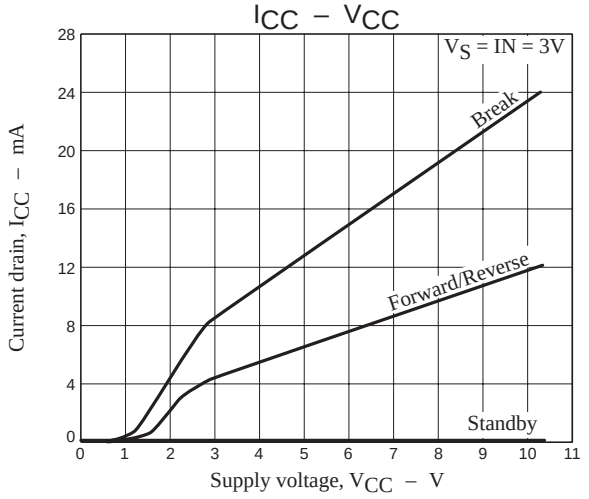

VO (sat) – Ta
VCC = VS = IN = 3V
VO(sat) = total value
Output saturation voltage, VO (sat) – V
0.6
0.5
0.4
0.3
0.2
0.1
0
IO = 400mA
IO = 200mA
–40
–20
0
20
40
60
80
100
120
140
Ambient temperature, Ta – °C

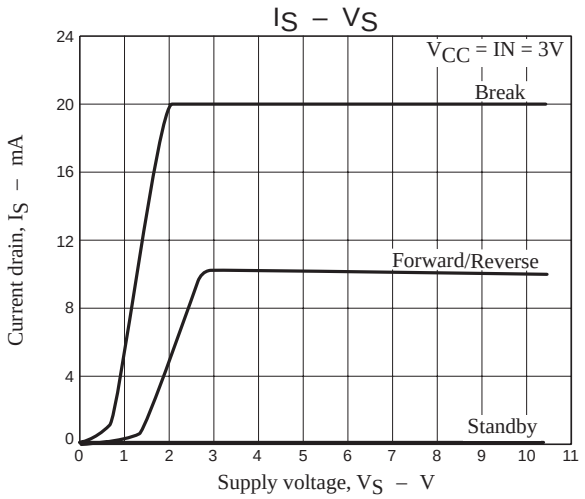

VO (sat) – IO
Output saturation voltage, VO (sat) – V
1.0
0.8
0.6
0.4
0.2
0
1ch total
Parallel connection total
0
100
200
300
400
500
600
700
800
900
Output current, IO – mA


IS – Ta
VCC = VS = IN = 3V
Current drain, IS – mA
24
20
16
12
8
4
0
Break
Forward
Reverse
–40
–20
0
20
40
60
80
100
120
140
160
Ambient temperature, Ta – °C


ICC – Ta
VCC = VS = IN = 3V
Current drain, ICC – mA
6
5
4
3
2
1
0
Break
Forward
Reverse
–40
–20
0
20
40
60
80
100
120
140
160
Ambient temperature, Ta – °C


IIN – VIN
VCC = VS = 3V
Input current, IIN – µA
400
300
200
100
0
IN1
IN2
IN3
IN4
0
1
2
3
4
5
6
7
8
9
10
Input voltage, VIN – V


ICC – VCC
VS = IN = 3V
Current drain, ICC – mA
28
24
20
16
12
8
4
0
Break
Forward/Reverse
Standby
0
1
2
3
4
5
6
7
8
9
10
11
Supply voltage, VCC – V



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