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# LB1938FA

Monolithic Digital IC

## 1ch, Low-saturation Forward/Reverse Motor Driver

### Overview

The LB1938FA is an H-bridge motor driver that supports low-voltage drive and features low-saturation outputs in an ultraminiature slim package. The LB1938FA provides forward, reverse, brake, and standby modes controlled by two input signals, and is an optimal DC motor driver for notebook personal computers, digital cameras, cell phones, and other portable equipment.

### Features

- Ultraminiature Micro8 package
- The low saturation voltage means that the voltage applied to the motor is higher and IC heat generation is reduced. This allows this IC to be used in environments with higher ambient operating temperatures. Output saturation voltage (high side + low side):  $V_{O\text{sat}} = 0.15\text{V}$  typical ( $I_O = 100\text{mA}$ )
- The wide usable voltage range and the low standby mode current drain of  $0.1 \mu\text{A}$  make this IC optimal for battery operated equipment.
- There are no constraints on the relationship between the input signal voltage and the supply voltage. For example, this IC can be use at  $V_{CC} = 3\text{V}$  and  $V_{IN} = 5\text{V}$ .
- Thermal protection circuit limits the drive current and prevents the IC from causing a fire or being destroyed if the IC chip temperature reaches or exceeds  $180^\circ\text{C}$  due to large currents flowing when the outputs are shorted due to, for example, motor layer shorting or other phenomena.

### Specifications

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

| Parameter                   | Symbol        | Conditions                     | Ratings           | Unit             |
|-----------------------------|---------------|--------------------------------|-------------------|------------------|
| Supply voltage              | $V_{CC}$ max  |                                | 10.5              | V                |
| Output current              | $I_{OUT}$ max |                                | 800               | mA               |
| Output voltage              | $V_{OUT}$ max |                                | $V_{CC} + V_{SF}$ | V                |
| Input applied voltage       | $V_{IH}$ max  |                                | 10                | V                |
| Allowable power dissipation | $P_d$ max     | Mounted on a specified board * | 400               | mW               |
| Operating temperature range | $T_{opr}$     |                                | -30 to +85        | $^\circ\text{C}$ |
| Storage temperature range   | $T_{stg}$     |                                | -55 to +150       | $^\circ\text{C}$ |

Note \*: Mounted on a specified board: 114.3mm×76.1mm×1.5mm, glass epoxy resin, wiring density 20%

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

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.

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

| Parameter                | Symbol   | Conditions | Ratings      | Unit |
|--------------------------|----------|------------|--------------|------|
| Supply voltage           | $V_{CC}$ |            | 2.2 to 10    | V    |
| Input high-level voltage | $V_{IH}$ |            | 2.0 to 9.5   | V    |
| Input low-level voltage  | $V_{IL}$ |            | -0.3 to +0.3 | V    |

## Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 3\text{V}$

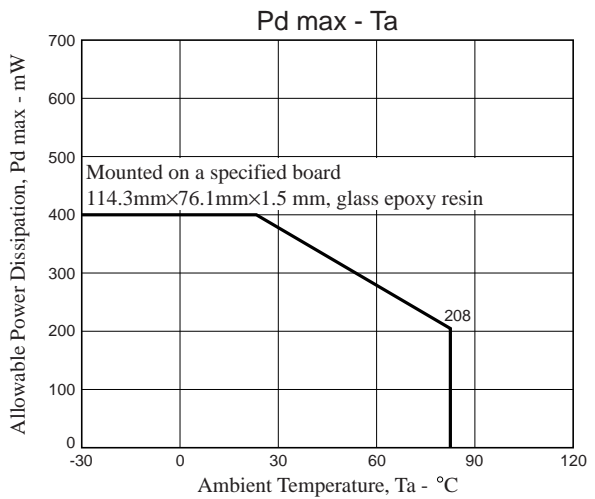
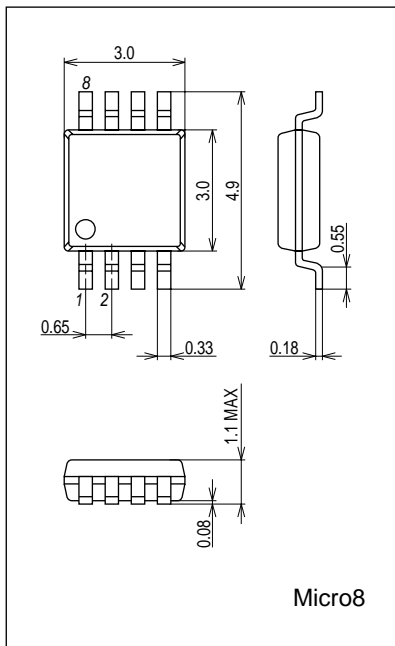
| Parameter                                | Symbol      | Conditions   | Ratings |      |      | Unit             |
|--|-------------|--|---------|------|------|------------------|
|  |             |  | min     | typ  | max  |                  |
| Circuit current                          | $I_{CC1}$   | Standby  |         | 0.1  | 5    | $\mu\text{A}$    |
|  | $I_{CC2}$   | Forward/reverse drive  |         | 14   | 19   | mA               |
|  | $I_{CC3}$   | Brake  |         | 20   | 29   | mA               |
| Output saturation voltage                | $V_{Osat1}$ | Upper+lower $I_O = 100\text{mA}$<br>for forward/reverse rotation |         | 0.15 | 0.2  | V                |
|  | $V_{Osat2}$ | Upper+lower $I_O = 300\text{mA}$<br>for forward/reverse rotation |         | 0.35 | 0.5  | V                |
|  | $V_{Osat3}$ | Upper $I_O = 100\text{mA}$ for braking                           |         | 0.1  | 0.15 | V                |
| Spark killer diode forward voltage       | $V_{SF}$    | $I_O = 300\text{mA}$   |         | 0.9  | 1.7  | V                |
| Spark killer diode inverse current       | $I_{RS}$    | $V_{OUT} = 10\text{V}$   |         | 0.1  | 5    | $\mu\text{A}$    |
| Input current                            | $I_{IN}$    | $V_{IN} = 5\text{V}$   |         | 75   | 98   | $\mu\text{A}$    |
| Thermal protection operating temperature | TSD         | Design target value *  |         | 180  |      | $^\circ\text{C}$ |

Note \*: Design target value: Measurement with a single unit not made.

## Package Dimensions

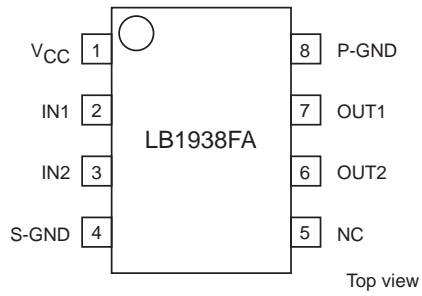
unit : mm (typ)

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## Pin Assignment



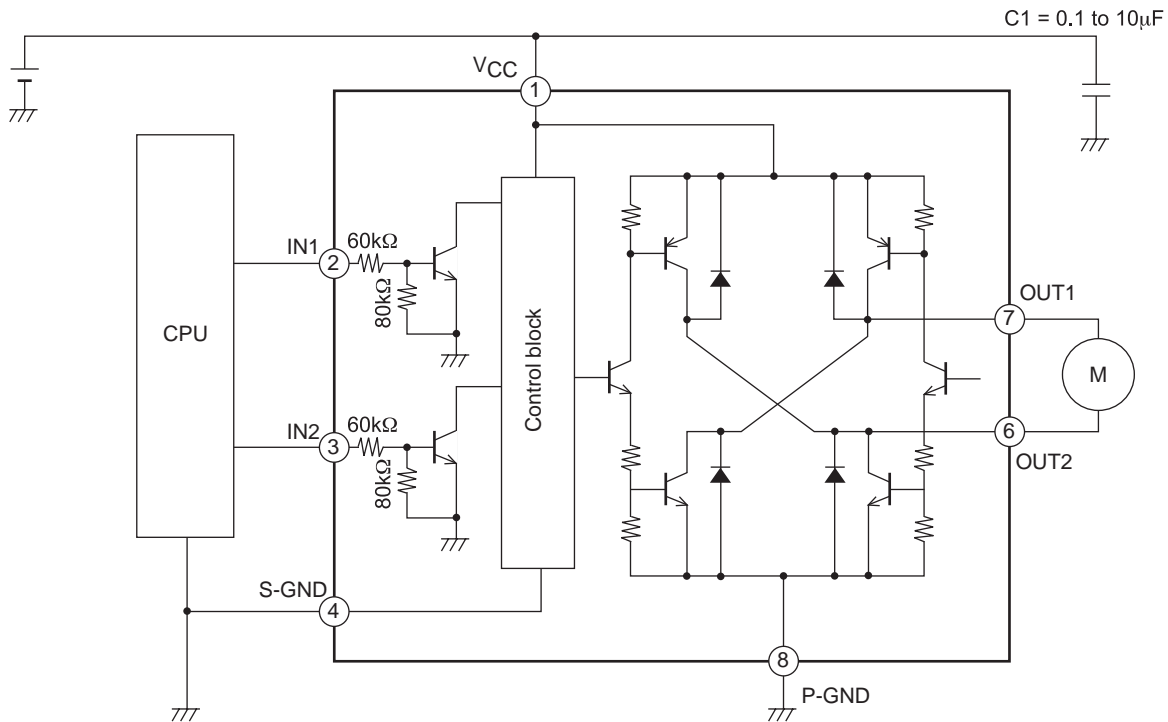
S-GND: GND for the control system

P-GND: GND for the power system

## Truth Table

| IN1 | IN2 | OUT1 | OUT2 | Mode             |
|-----|-----|------|------|------------------|
| L   | L   | OFF  | OFF  | Standby          |
| H   | L   | H    | L    | Forward rotation |
| L   | H   | L    | H    | Reverse rotation |
| H   | H   | H    | H    | Brake            |

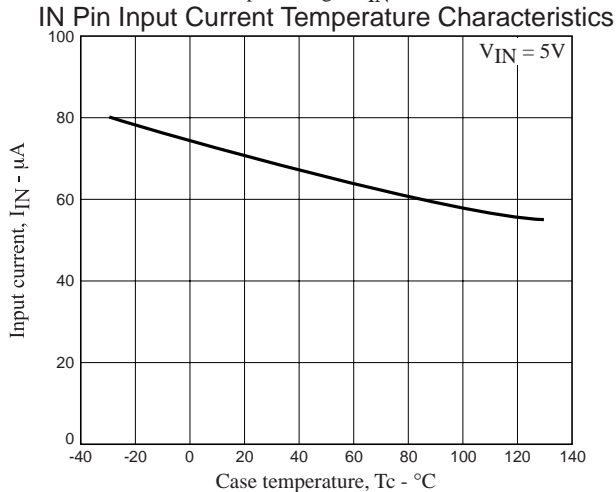
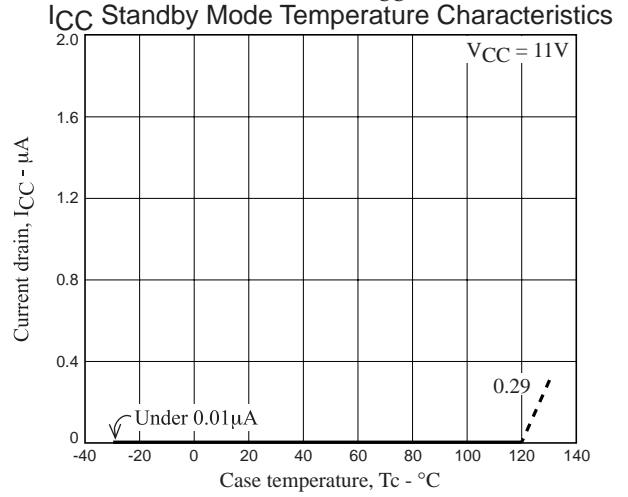
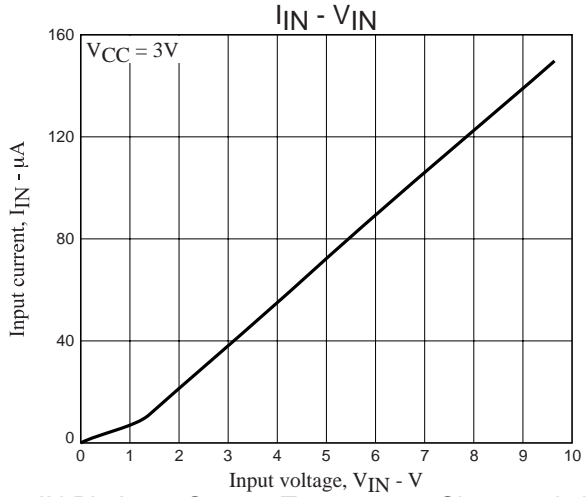
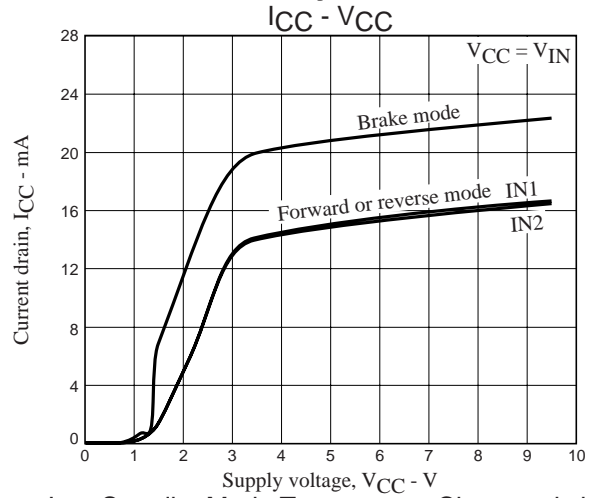
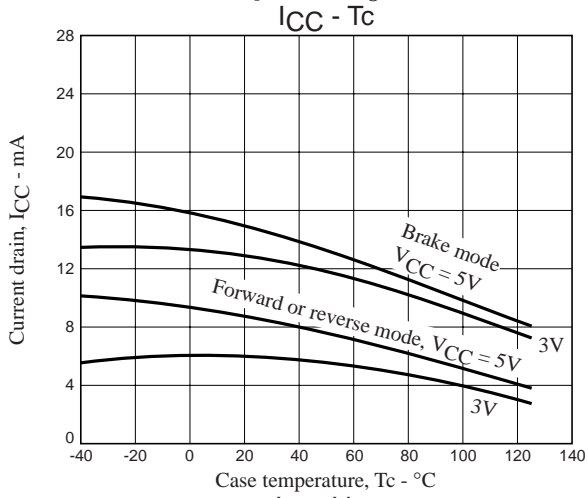
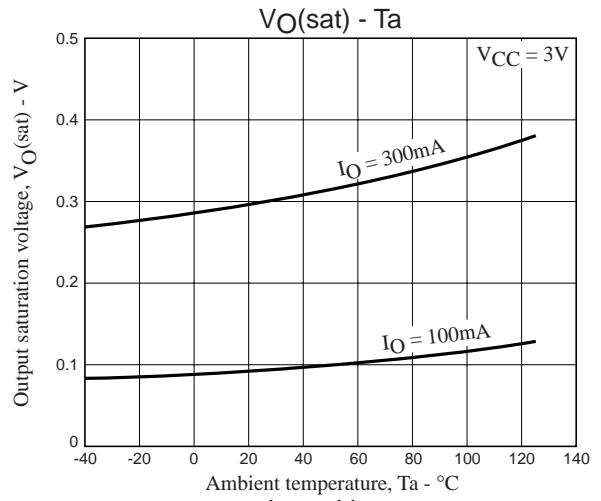
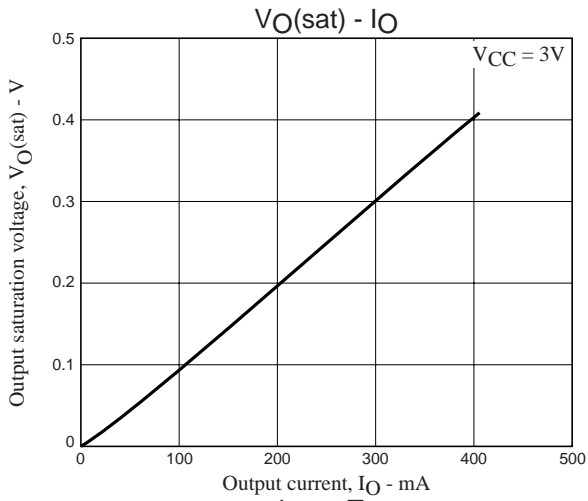
## Sample Application Circuit



## Cautions:

- VCC and GND lines suffer substantial fluctuation in the current quantity, causing a problem of line oscillation in certain cases. In this case, take following points into account:
  - (1) Use a thick and short wiring to reduce the wiring inductance.
  - (2) Insert a capacitor with satisfactory frequency characteristics near IC.
  - (3) Connect S-GND to the control system GND on the CPU side and P-GND to the power system GND.


# LB1938FA



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