Ordering number : EN7714A

SANYO Semiconductors
DATA SHEET

An ON Semiconductor Company

Monolithic Digital IC

# LB1948M — 12V Low Saturation Voltage Drive Forward/Reverse Motor Driver

## Overview

The LB1948M is a 2-channel low saturation voltage forward/reverse motor driver IC. It is optimal for motor drive in 12V system products and can drive either two DC motors, one DC motor using parallel connection, or a 2-phase bipolar stepping motor with 1-2 phase excitation mode drive.

## Features

- Supports 12V power supply systems
- Low saturation voltage: $V_O$(sat) = 0.5V (typical) at $I_O$ = 400mA
- Zero current drawn in standby mode
- Braking function
- Supports parallel connection: $I_O$ max = 1.6A, $V_O$(sat) = 0.6V (typical) at $I_O$ = 800mA
- Built-in spark killer diode
- Built-in thermal shutdown circuit
- Miniature package: MFP-10S (6.4mm × 5.0mm)

## Specifications

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

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | | -0.3 to +20 | V |
| Output voltage | $V_{OUT}$ | | -0.3 to +20 | V |
| Input voltage | $V_{IN}$ | | -0.3 to +18 | V |
| Ground pin source current | $I_{GND}$ | Per channel | 800 | mA |
| Allowable power dissipation | Pd max1 | Independent IC | 350 | mW |
| | Pd max2 | Mounted on a specified board* | 870 | mW |
| Operating temperature | Topr | | -20 to +85 | °C |
| Storage temperature | Tstg | | -40 to +150 | °C |

* Specified board: 114.3mm × 76.1mm × 1.6mm, glass epoxy board.


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

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | | 2.5 to 16 | V |
| Input high-level voltage | $V_{IH}$ | | 1.8 to 10 | V |
| Input low-level voltage | $V_{IL}$ | | -0.3 to +0.7 | V |

**Electrical Characteristics** at Ta = 25°C, $V_{CC}$ = 5V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Current drain | $I_{CC}0$ | IN1, 2, 3, 4 = 0V (Standby mode) | | 0.1 | 10 | μA |
| | $I_{CC}1$ | *1 (Forward or reverse mode) | | 15 | 21 | mA |
| | $I_{CC}2$ | *2 (Brake mode) | | 30 | 40 | mA |
| Output saturation voltage | $V_O$(sat)1 | $I_{OUT}$ = 200mA (High Side and Low Side) | | 0.25 | 0.35 | V |
| | $V_O$(sat)2 | $I_{OUT}$ = 400mA (High Side and Low Side) | | 0.50 | 0.75 | V |
| Input current | $I_{IN}$ | $V_{IN}$ = 5V | | 85 | 110 | μA |
| **Spark Killer Diode** | | | | | | |
| Reverse current | $I_S$(leak) | | | | 30 | μA |
| Forward voltage | $V_{SF}$ | $I_{OUT}$ = 400mA | | | 1.7 | V |

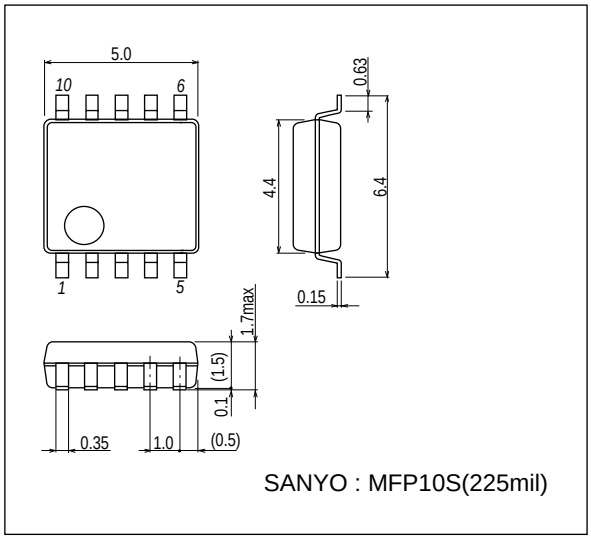
*1:IN1/IN2/IN3/IN4=H/L/L/L or L/H/L/L or L/L/H/L or L/L/L/H.

*2:IN1/IN2/IN3/IN4=H/H/L/L or L/L/H/H.

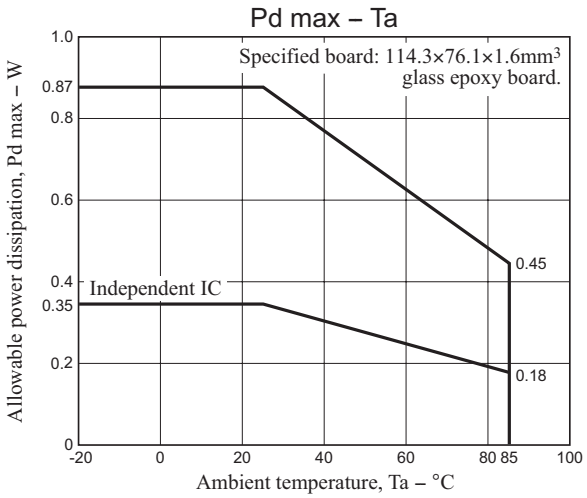
## Package Dimensions

unit : mm (typ)

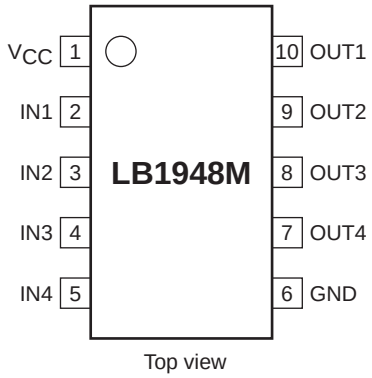
3086B




SANYO : MFP10S(225mil)




## Pin Assignment

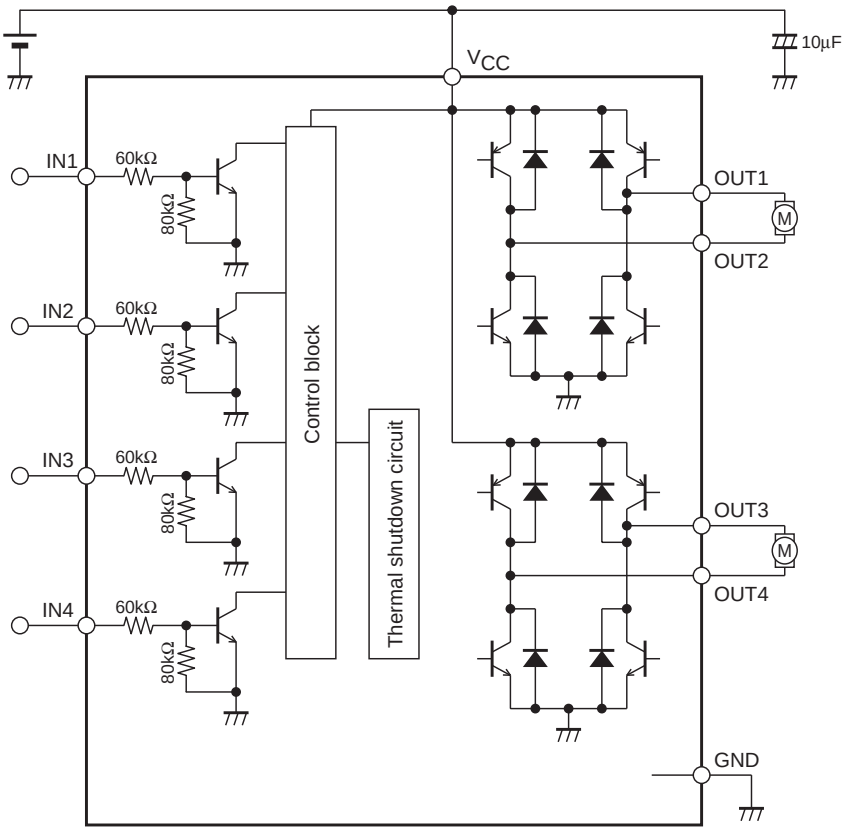



Top view

## Truth Table

| Input | | | | Output | | | | Notes | |
|---|---|---|---|---|---|---|---|---|---|
| IN1 | IN2 | IN3 | IN4 | OUT1 | OUT2 | OUT3 | OUT4 | | |
| L | L | L | L | OFF | OFF | OFF | OFF | Standby mode | |
| L | L | | | OFF | OFF | | | 1CH | Standby mode |
| H | L | | | H | L | | | | Forward |
| L | H | | | L | H | | | | Reverse |
| H | H | | | L | L | | | | Brake |
| | | L | L | | | OFF | OFF | 2CH | Standby mode |
| | | H | L | | | H | L | | Forward |
| | | L | H | | | L | H | | Reverse |
| | | H | H | | | L | L | | Brake |

## Block Diagram



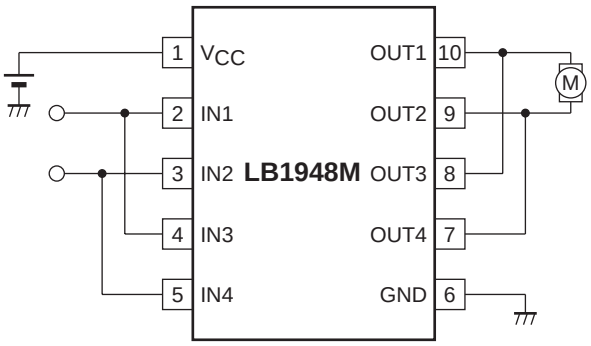
## Design Documentation

(1) Voltage magnitude relationship

There are no restrictions on the magnitude relationships between the voltages applied to $V_{CC}$ and IN1 to IN4.

(2) Parallel connection

The LB1948M can be used as a single-channel H-bridge power supply by connecting IN1 to IN3, IN2 to IN4, OUT1 to OUT3, and OUT2 to OUT4 as shown in the figure. ($I_O$max = 1.6A, $V_O$(sat) = 0.6V (typical) at $I_O$ = 800mA)




(3) Observe the following points when designing the printed circuit board pattern layout.

- Make the $V_{CC}$ and ground lines as wide and as short as possible to lower the wiring inductance.
- Insert bypass capacitors between $V_{CC}$ and ground mounted as close as possible to the IC.
- Resistors of about 10KΩ must be inserted between the CPU output ports and the IN1 to IN4 pins if the microcontroller and the LB1948M are mounted on different printed circuit boards and the ground potentials differ significantly.

### Thermal Shutdown Temperature

(1) Thermal shutdown temperature

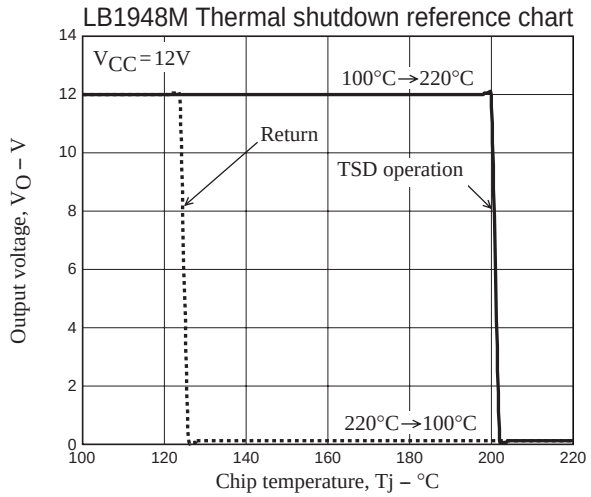
The thermal shutdown temperature Ttsd is 200 ± 20°C with fluctuations.

(2) Thermal shutdown operation

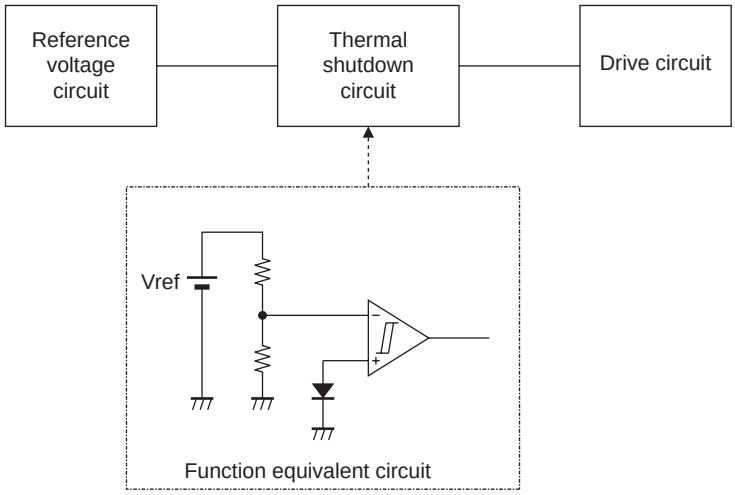
The operation of the thermal shutdown circuit is shown in the figure below.

When the chip temperature Tj is in the direction of increasing (solid line), the output turns off at approximately 200°C.

When the chip temperature Tj is in the direction of decreasing (dotted line), the output turns on (returns) at approximately 125°C.



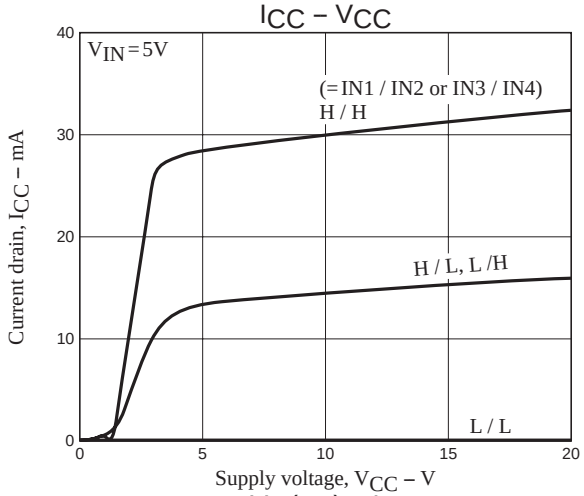
## Thermal Shutdown Circuit Block Diagram

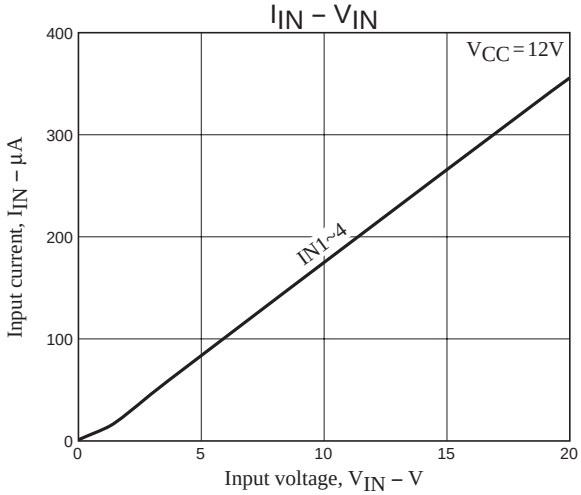


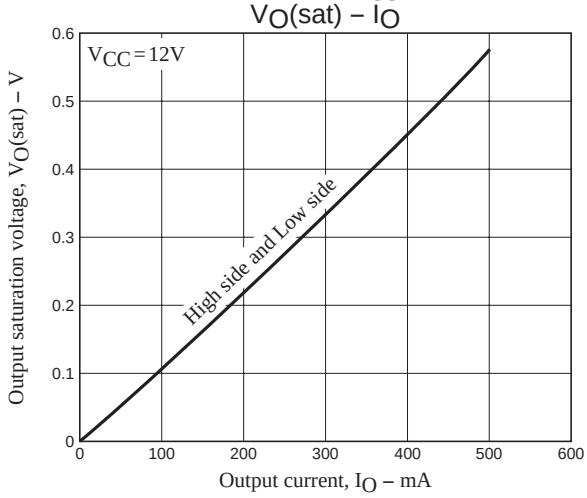

Note: The above is an example of thermal shutdown circuits although there are some differences from the actual internal circuit.

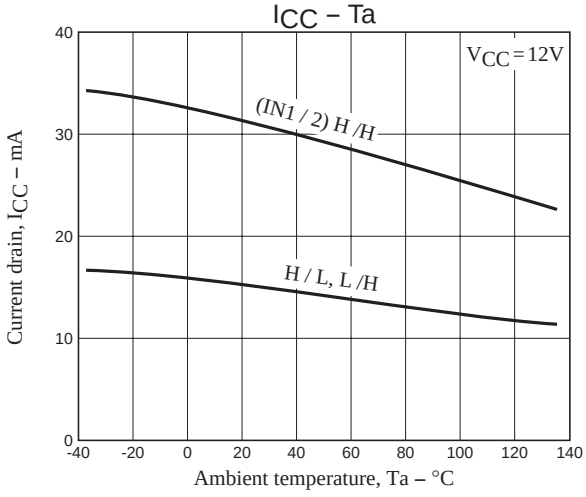
## Thermal Shutdown Operation

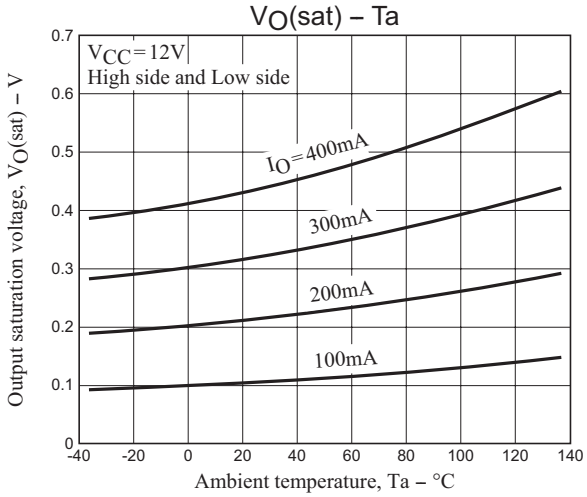
The thermal shutdown circuit compares the voltage of the heat sensitive element (diode) with the reference voltage and shuts off the drive circuit at a certain temperature to protect the IC chip from overheating.







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