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LB1948MC

Monolithic Digital IC 12V Low Saturation Voltage Drive Forward/Reverse Motor Driver

Overview

The LB1948MC is a two-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 two-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: $I_O \text{ max} = 1.6A$, $V_{O(sat)} = 0.6V$ (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 $T_a = 25^\circ C$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|----------------------|-------------------------------|-------------|------------|
| Maximum supply voltage | $V_{CC \text{ max}}$ | | -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 | $P_d \text{ max}$ | Mounted on a specified board* | 870 | mW |
| Operating temperature | T_{opr} | | -20 to +85 | $^\circ C$ |
| Storage temperature | T_{stg} | | -40 to +150 | $^\circ C$ |

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

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 Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|--------------------------|-----------------|------------|--------------|------|
| Supply voltage | VCC | | 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, VCC = 5V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---------------------------|----------------------|---|---------|------|------|------|
| | | | min | typ | max | |
| Current drain | I _{CC0} | IN1, 2, 3, 4 = 0V (Standby mode) | | 0.1 | 10 | μA |
| | I _{CC1} | *1 (Forward or reverse mode) | | 15 | 21 | mA |
| | I _{CC2} | *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 |

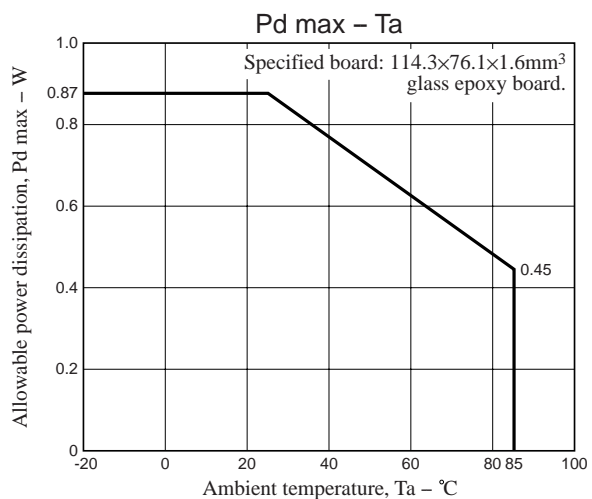
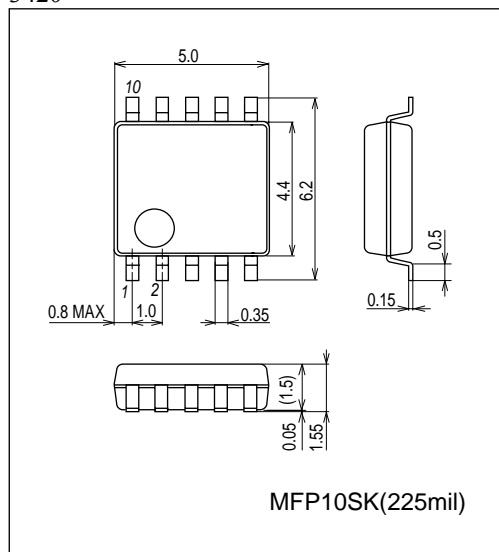
*1:IN1/IN2/IN3/IN4=H/L/L/L or L/H/L/L or L/L/H/L or L/L/L/H.

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

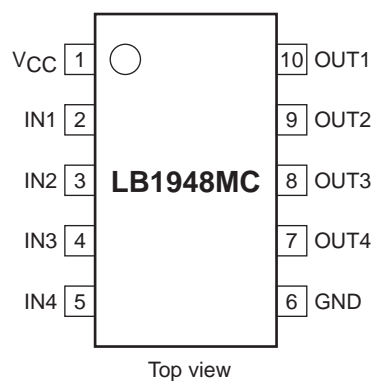
Package Dimensions

unit : mm (typ)

3420



Pin Assignment

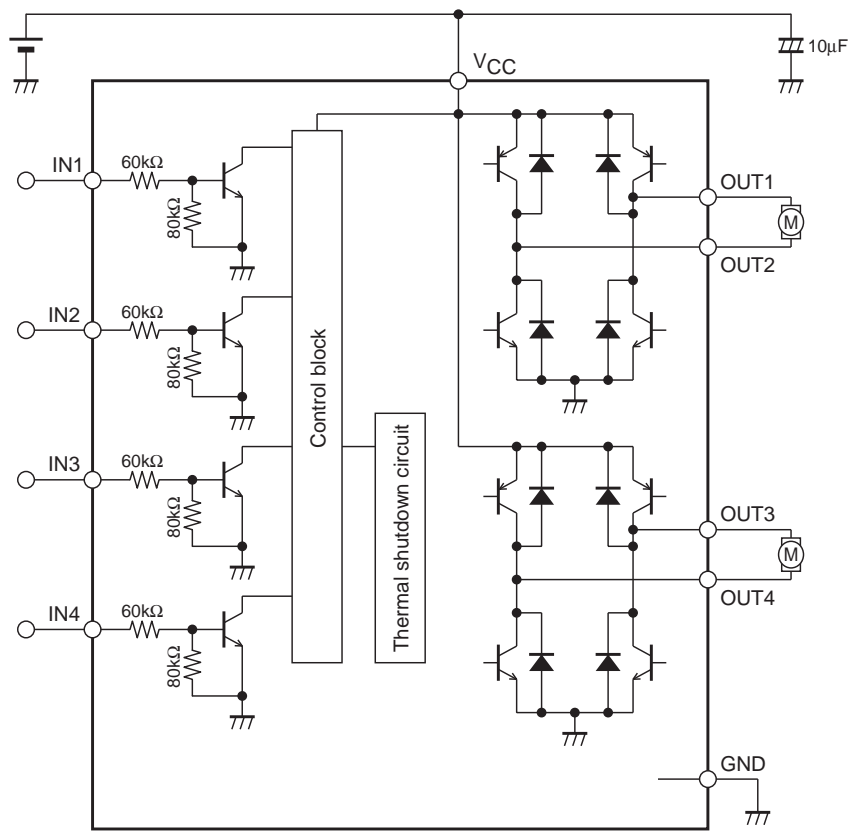


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Truth Table

| 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 | | | Standby mode |
| H | L | | | H | L | | | Forward |
| L | H | | | L | H | | | Reverse |
| H | H | | | L | L | | | Brake |
| | | L | L | | | OFF | OFF | Standby mode |
| | | H | L | | | H | L | Forward |
| | | L | H | | | L | H | Reverse |
| | | H | H | | | L | L | Brake |

Block Diagram



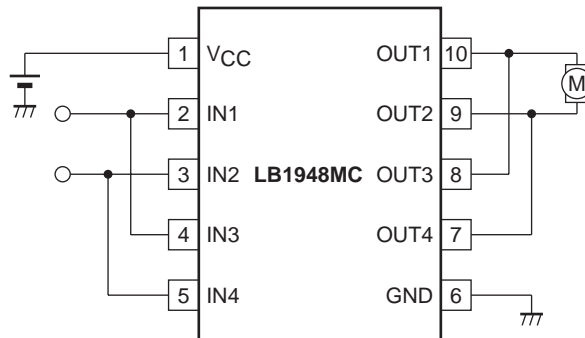
Design Documentation

(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 LB1948MC 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. ($I_{Omax} = 1.6A$, $V_O(sat) = 0.6V$ (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 $10K\Omega$ must be inserted between the CPU output ports and the IN1 to IN4 pins if the microcontroller and the LB1948MC are mounted on different printed circuit boards and the ground potentials differ significantly.

(4) Penetration electric current

At the time of the next mode shift, a penetration electric current is generated in V_{CC} -GND. There are not the deterioration of the IC by, the destruction as follows 1A typ per this penetration electric current (1ch, $1\mu s$; but for the stabilization of the power supply line of the IC is most recent, and, please can enter with a condenser.

- Forward (Reverse) \leftrightarrow Brake
- Forward \leftrightarrow Reverse
- Standby \rightarrow Brake

In addition, the penetration electric current disappears when I put a wait mode of $10\mu s$ at the time of the change of the Forward \leftrightarrow Reverse.

(5) Supplementary matter of the penetration electric current

According to (4), a penetration electric current cannot influence IC life.

Thermal Shutdown Temperature

(1) Thermal shutdown temperature

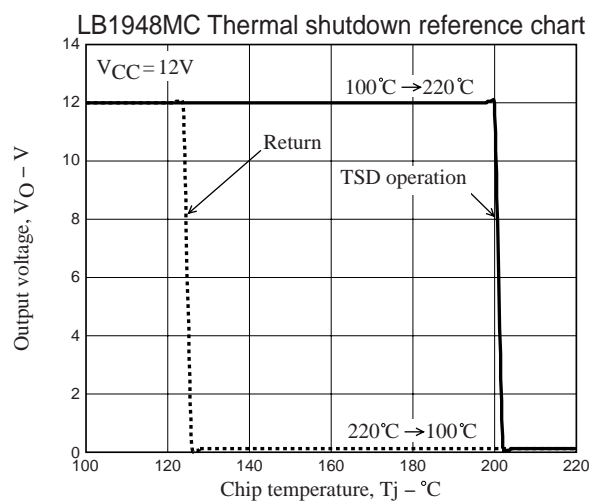
The thermal shutdown temperature T_{tsd} is $200 \pm 20^\circ C$ with fluctuations.

(2) Thermal shutdown operation

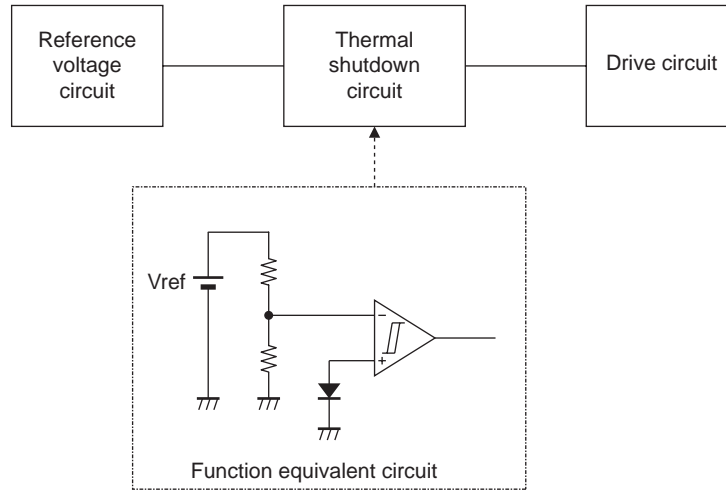
The operation of the thermal shutdown circuit is shown in the figure below.

When the chip temperature T_j is in the direction of increasing (solid line), the output turns off at approximately $200^\circ C$.

When the chip temperature T_j is in the direction of decreasing (dotted line), the output turns on (returns) at approximately $125^\circ C$.



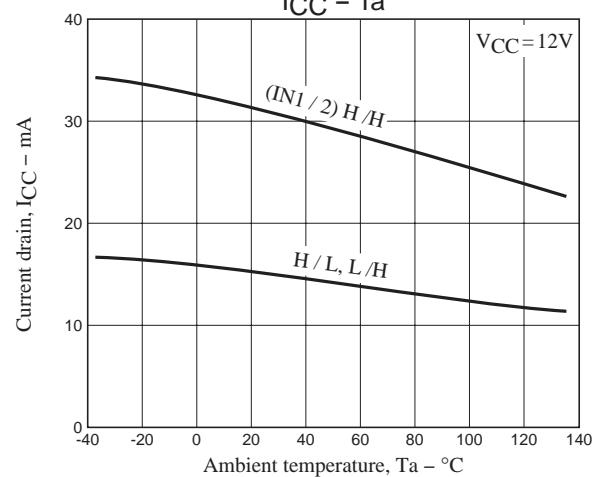
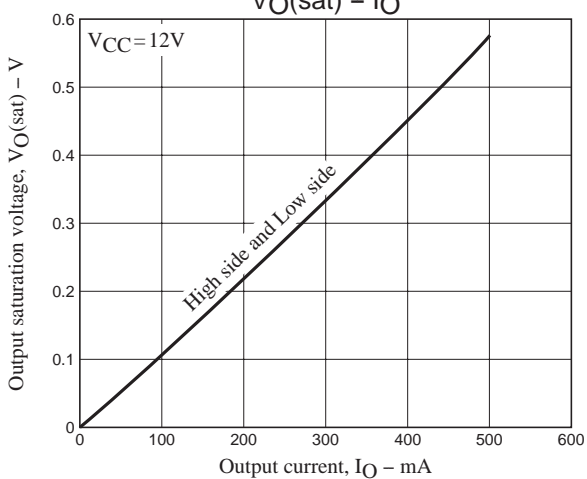
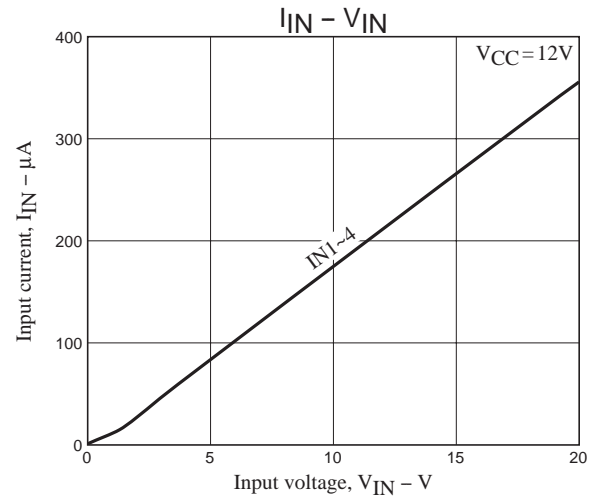
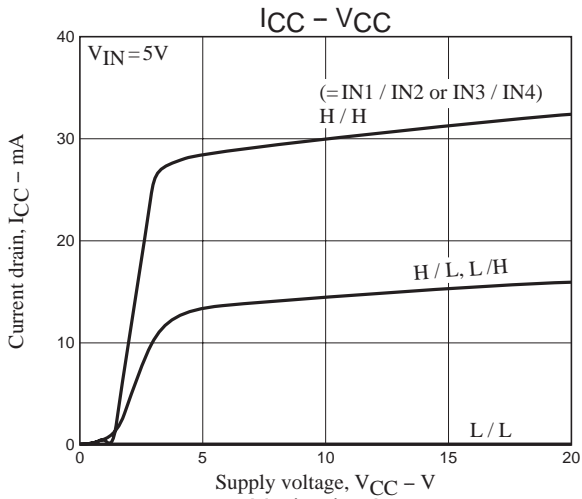
Thermal Shutdown Circuit Block Diagram

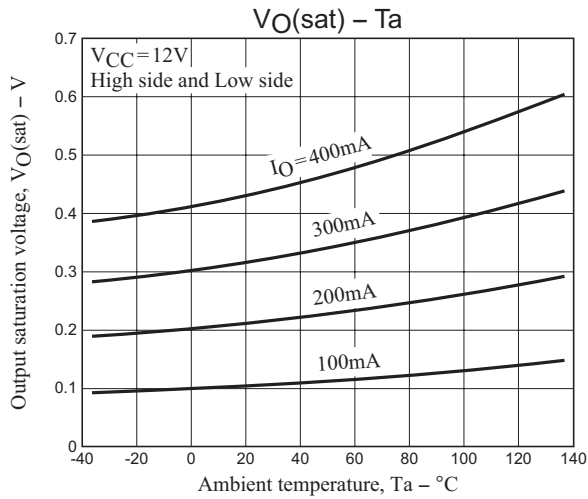


Note: The above is an example of thermal shutdown circuits although there are some differences from the actual internal circuit.

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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