

LB1868M

2-phase Brushless Fan Motor Driver

Monolithic Digital IC

Overview

The LB1868M is a 2-phase unipolar brushless motor driver. With only a few peripheral parts, lockup protection and automatic recovery can be implemented. The IC can be configured for 12 V or 24 V operation and a wide range of variations, from Low speed to H-High speed and from 60 cm to 120 cm square using the same PCB. This makes it easy to design highly reliable fan motor installations.

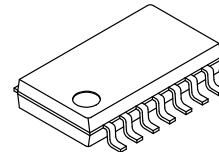
Features

- Output Protection Zener Diode with Variable Withstand Voltage
 - ◆ Z1, Z2 Pins Open: $V_{OLM} = 57\text{ V}$ (24 V Specification)
 - ◆ Z1, Z2 pins shorted: $V_{OLM} = 32\text{ V}$ (12 V Specification)
 - ◆ External Zener Diode Connected across Z1 – V_{CC} Pins:
Support for Fans with Large Drive Current
- External Resistor Allows Configuration for 12 V or 24 V
- Direct Hall Element Connection Possible (Built-in Hall Amplifier with Hysteresis Supports Core without Auxiliary Electrode)
- Built-in Output Transistor with 1.0 A Output Current (Strengthened Negative-current Support for Core without Auxiliary Electrode)
- Built-in Rotation Detection Function: Low during Rotation and High during Stop
- Built-in Lockup Protection with Automatic Recovery
- ST Pin for Motor Stop/Drive (for Standby Mode of Copiers etc.)
- FG Output Pin for Rotation Detection
- BC Pin for Kickback Noise Reduction (with 2 External Capacitors)
- Built-in Thermal Shutdown



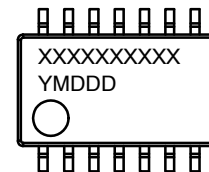
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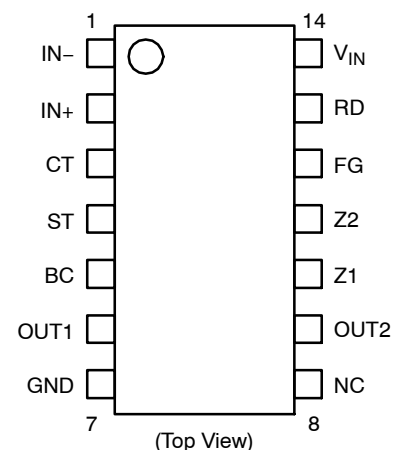
MFP14S
CASE 751CB

MARKING DIAGRAM



XXXXX = Specific Device Code
Y = Year
M = Month
DDD = Additional Traceability Data

PIN ASSIGNMENT



ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

LB1868M

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

| Symbol | Parameter | Conditions | Ratings | Unit |
|---------------|--------------------------------|---------------------------------------|-------------|------------------|
| I_{CC} max | Maximum Input Current | $t \leq 20$ ms | 200 | mA |
| V_{OUT} max | Maximum Applied Output Voltage | | Internal | V |
| I_{OUT} max | Maximum Output Current | | 1.0 | A |
| I_{RD} max | Current Flowing into RD, FG | | 10 | mA |
| V_{RD} max | RD, FG Applied Voltage | | 30 | V |
| V_{ST} max | ST Applied Voltage | | 7.5 | V |
| P_d max | Allowable Power Dissipation | Mounted on a specified board (Note 1) | 800 | mW |
| T_{opr} | Operating Temperature | | -30 to +80 | $^\circ\text{C}$ |
| T_{stg} | Storage Temperature | | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. .Specified board: 20 mm \times 15 mm \times 1.5 mm, glass epoxy board.

ALLOWABLE OPERATING RANGES ($T_A = 25^\circ\text{C}$)

| Symbol | Parameter | Conditions | Ratings | Unit |
|-----------|---------------------------------|------------|---------------------|------|
| I_{CC} | Input Current Range | | 6.0 to 50 | mA |
| V_{ICM} | Common Mode Input Voltage Range | | 0.2 to $V_{IN}-1.5$ | V |
| V_{STH} | ST High Voltage | | 4.5 to 7.0 | V |
| V_{STL} | ST Low Voltage | | 0 to 0.5 | V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, $I_{CC} = 10$ mA)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|--|---------------------------------|------|--------------|------|------------------|
| V_{OLM1} | Output Limiter Withstand Voltage | Z1, Z2 open | 54 | 57 | 60 | V |
| V_{OLM2} | | Z1, Z2 short | 31 | 33 | 35 | V |
| V_{Osat1} | Output Saturation Voltage | $I_O = 0.5$ A | - | 0.95 | 1.2 | V |
| V_{Osat2} | | $I_O = 1.0$ A | - | 1.15 | 1.5 | V |
| V_{IN} | V_{IN} Voltage | $I_{CC} = 7.0$ mA | 6.4 | 6.7 | 7.0 | V |
| V_{HN} | Hall Input Sensitivity (at Zero Peak) | Including offset and hysteresis | - | - | 20 | mV |
| V_{RDsat} | RD, FG Output Saturation Voltage | $I_{RD} = 5$ mA | - | 0.1 | 0.3 | V |
| IC1 | CT Drain Current | C = GND | 2.7 | 3.8 | 4.9 | μA |
| IC2 | CT Discharge Current | C = V_{IN} | 0.19 | 0.30 | 0.41 | μA |
| V_{TH1} | Comp Input Threshold Voltage | | 0.77 | $0.8V_{IN}$ | 0.83 | V |
| V_{TH2} | | | 0.42 | $0.45V_{IN}$ | 0.48 | V |
| I_{ST} | ST Input Current | $V_{ST} = 5$ V | - | 80 | 120 | μA |
| TSD | Thermal Protection Operating Temperature | Design target value (Note 2) | - | 180 | - | $^\circ\text{C}$ |
| ΔTSD | Thermal Protection Circuit Hysteresis | Design target value (Note 2) | - | 40 | - | $^\circ\text{C}$ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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2. Design target value, Do not measurement.

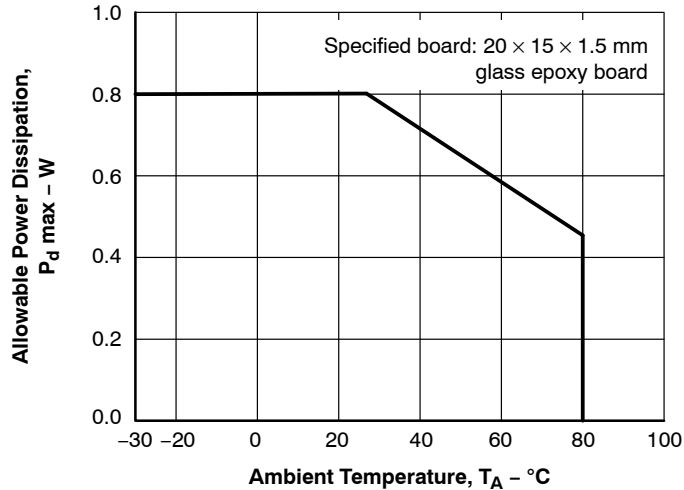


Figure 1. $P_d \text{ max} - T_A$

PIN FUNCTION

| Pin No. | Pin Name | Function |
|---------|----------|--|
| 1 | IN- | Hall input + pin. Hysteresis amplifier |
| 2 | IN+ | Hall input - pin. Hysteresis amplifier |
| 3 | CT | Lockup protection time setting capacitor pin (0.47 to 4.7 μF) |
| 4 | ST | Start/stop pin |
| 5 | BC | Output transistor common base pin |
| 6 | OUT1 | Output 1 pin |
| 9 | OUT2 | Output 2 pin |
| 7 | GND | GND pin |
| 10 | Z1 | External Zener diode pin (external Zener diode to be connected between power supply and Z1) |
| 11 | Z2 | Kickback absorption voltage alteration pin (shorted to Z1: 12 V operation) |
| 12 | FG | Rotation frequency detector pin |
| 13 | RD | Lockup detection pin (latch type) |
| 14 | V_{IN} | Regulated power supply input pin (limiting resistor to be inserted between power supply and V_{IN}) |

TRUTH TABLE

| ST | IN+ | IN- | CT | OUT1 | OUT2 | RD | FG |
|-----------|-----|-----|----|------|------|----|----|
| H | H | L | L | H | H | L | L |
| | L | H | L | H | H | L | H |
| L or OPEN | H | L | L | H | L | L | L |
| | L | H | L | L | H | L | H |
| | H | L | H | H | H | H | L |
| | L | H | H | H | H | H | H |

NOTE: RD is a latch type output.

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BLOCK DIAGRAM

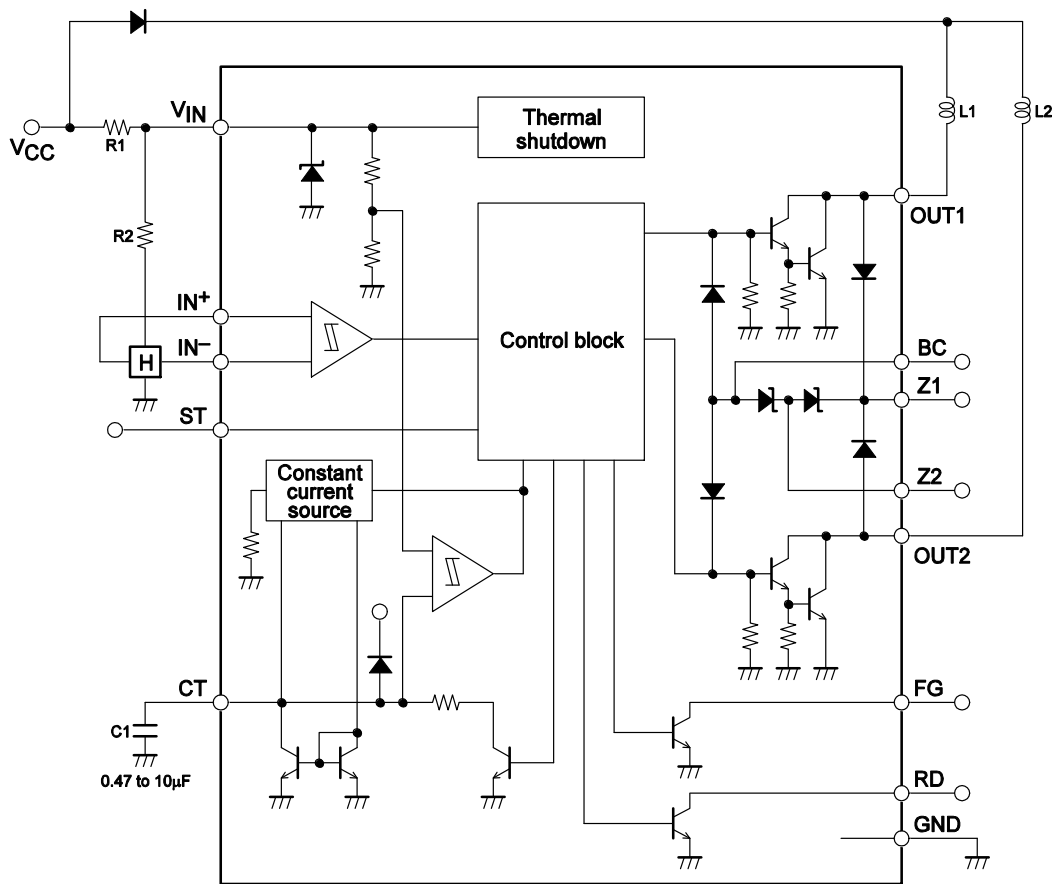


Figure 2. Block Diagram

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APPLICATION CIRCUIT

1. 12 V Supply Voltage

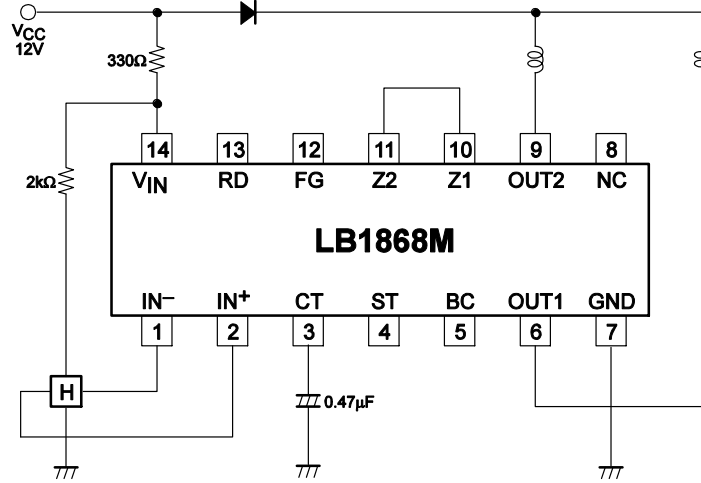


Figure 3. 12 V Supply Voltage

2. 24 V Supply Voltage

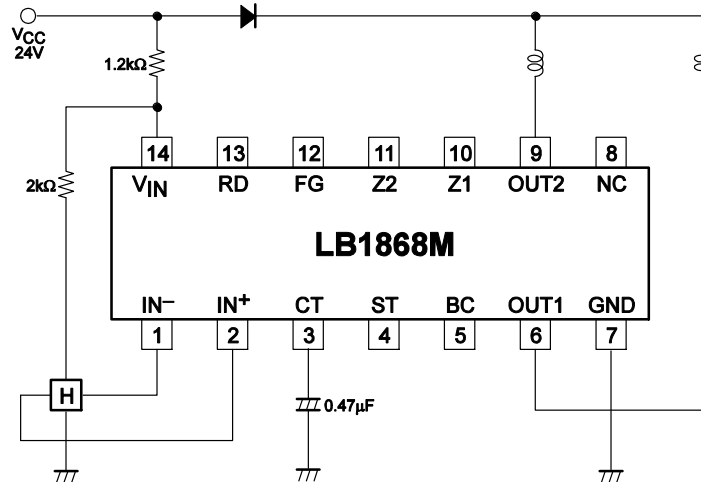


Figure 4. 24 V Supply Voltage

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3. High-power Fan (120 mm-HH-Speed)

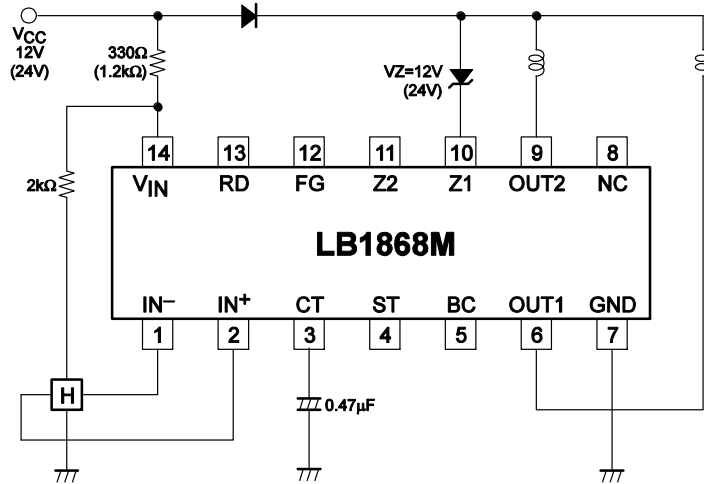


Figure 5. High-power Fan (120 mm-HH-Speed)

ORDERING INFORMATION

| Device | Package | Wire Bond | Shipping [†] (Qty / Packing) |
|---------------|--|-----------|---------------------------------------|
| LB1868M-TLM-E | MFP14S (225 mil) (Pb-Free) | Au wire | 1,000 / Tape & Reel |
| LB1868M-TLM-H | MFP14S (225 mil) (Pb-Free / Halogen Free) | Au wire | 1,000 / Tape & Reel |
| LB1868M-W-AH | MFP14S (225 mil) (Pb-Free / Halogen Free) | Cu wire | 1,000 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

MECHANICAL CASE OUTLINE

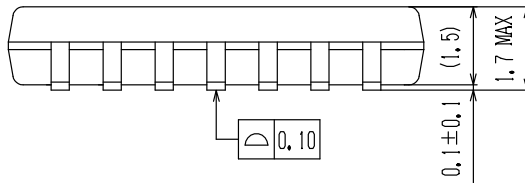
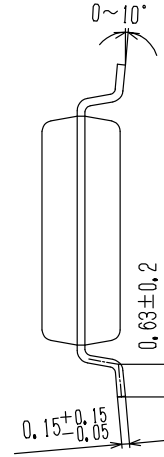
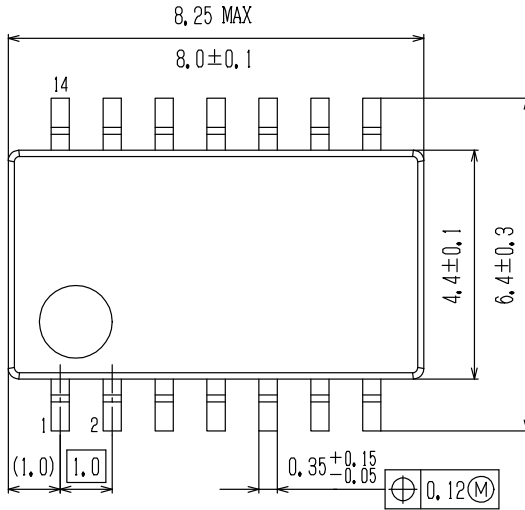
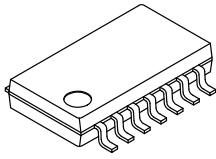
PACKAGE DIMENSIONS

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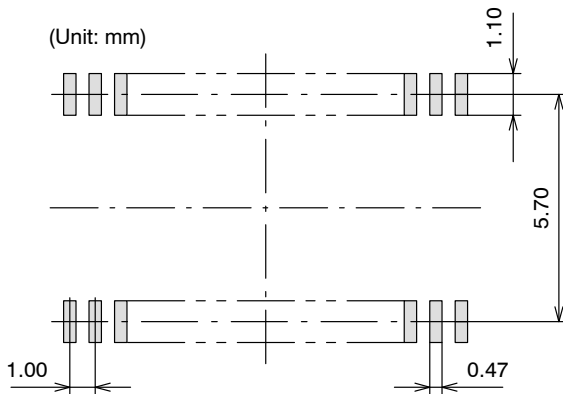


SOIC14 W / MFP14S (225 mil)
CASE 751CB
ISSUE A

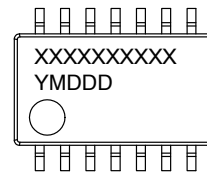
DATE 25 OCT 2013



SOLDERING FOOTPRINT*



GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
 Y = Year
 M = Month
 DDD = Additional Traceability Data

NOTE: The measurements are not to guarantee but for reference only.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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| DESCRIPTION: | SOIC14 W / MFP14S (225 MIL) | PAGE 1 OF 1 |

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