



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

# LB1868

## Monolithic Digital IC 2-phase Brushless Fan Motor Driver

### Overview

The LB1868 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 12V or 24V operation and a wide range of variations, from Low speed to H-High speed and from 60cm to 120cm 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:  $V_{OLM} = 57V$  (24V specification)  
Z1, Z2 pins shorted:  $V_{OLM} = 32V$  (12V specification)  
External Zener diode connected across Z1 –  $V_{CC}$  pins: support for fans with large drive current
- External resistor allows configuration for 12V or 24V
- Direct Hall element connection possible (built-in Hall amplifier with hysteresis supports core without auxiliary electrode)
- Built-in output transistor with 1.0A 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
- Built-in thermal shutdown

### Specifications

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

| Parameter                           | Symbol         | Conditions    | Ratings     | Unit       |
|-------------------------------------|----------------|---------------|-------------|------------|
| Maximum input current               | $I_{CC\ max}$  | $t \leq 20ms$ | 200         | mA         |
| Maximum applied output voltage      | $V_{OUT\ max}$ |               | Internal    | V          |
| Maximum output current              | $I_{OUT\ max}$ |               | 1.0         | A          |
| Maximum current flowing into RD pin | $I_{RD\ max}$  |               | 10          | mA         |
| Maximum RD applied voltage          | $V_{RD\ max}$  |               | 30          | V          |
| Allowable power dissipation         | $P_d\ max$     |               | 1.1         | W          |
| Operating temperature               | $T_{opr}$      |               | -30 to +95  | $^\circ C$ |
| Storage temperature                 | $T_{stg}$      |               | -55 to +150 | $^\circ C$ |

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

| Parameter                       | Symbol    | Conditions | Ratings             | Unit |
|---------------------------------|-----------|------------|---------------------|------|
| Input current range             | $I_{CC}$  |            | 6.0 to 50           | mA   |
| Common mode input voltage range | $V_{ICM}$ |            | 0.2 to $V_{IN}-1.5$ | V    |

## Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $I_{CC} = 10\text{mA}$

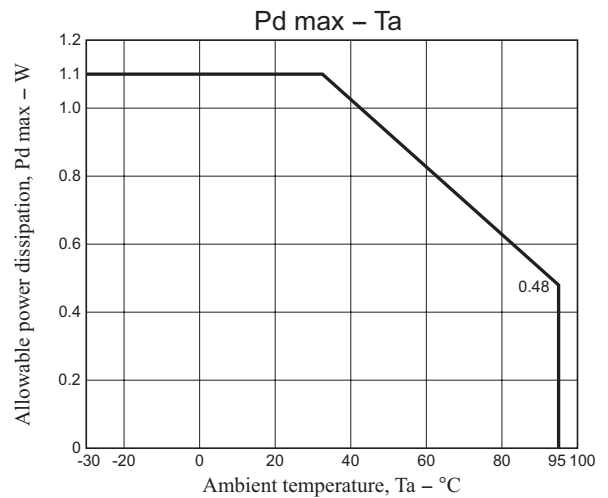
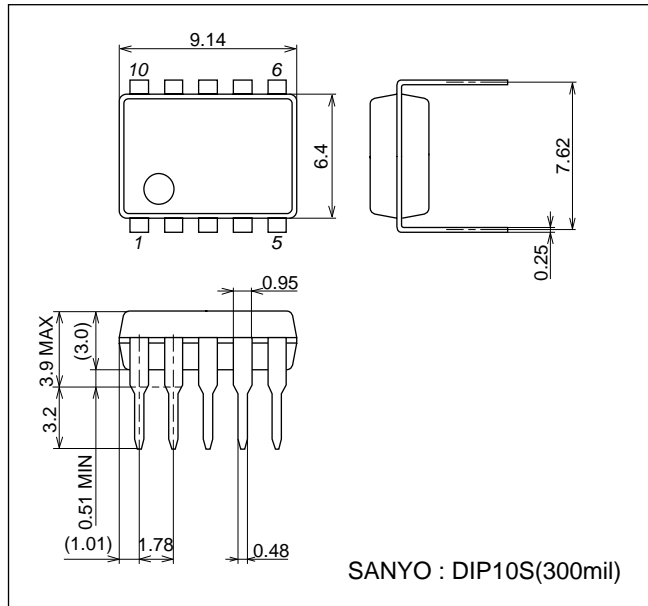
| Parameter                                | Symbol             | Conditions                      | Ratings |              |      | Unit             |
|------------------------------------------|--------------------|---------------------------------|---------|--------------|------|------------------|
|                                          |                    |                                 | min     | typ          | max  |                  |
| Output limiter withstand voltage         | $V_{OLM1}$         | Z1, Z2 open                     | 54      | 57           | 60   | V                |
|                                          | $V_{OLM2}$         | Z1, Z2 short                    | 31      | 33           | 35   | V                |
| Output saturation voltage                | $V_{Osat1}$        | $I_O = 0.5\text{A}$             |         | 0.95         | 1.2  | V                |
|                                          | $V_{Osat2}$        | $I_O = 1.0\text{A}$             |         | 1.15         | 1.5  | V                |
| $V_{IN}$ voltage                         | $V_{IN}$           | $I_{CC} = 7.0\text{mA}$         | 6.4     | 6.7          | 7.0  | V                |
| Hall input sensitivity (at zero peak)    | $V_{HN}$           | Including offset and hysteresis |         |              | 20   | mV               |
| RD output saturation voltage             | $V_{RDSat}$        | $I_{RD} = 5\text{mA}$           |         | 0.1          | 0.3  | V                |
| CT drain current                         | $I_{C1}$           | C = GND                         | 2.7     | 3.8          | 4.9  | $\mu\text{A}$    |
| CT discharge current                     | $I_{C2}$           | C = $V_{IN}$                    | 0.19    | 0.30         | 0.41 | $\mu\text{A}$    |
| Comp input threshold voltage             | $V_{TH1}$          |                                 | 0.77    | $0.8V_{IN}$  | 0.83 | V                |
|                                          | $V_{TH2}$          |                                 | 0.42    | $0.45V_{IN}$ | 0.48 | V                |
| Thermal protection operating temperature | TSD                | Design target value *           |         | 180          |      | $^\circ\text{C}$ |
| Thermal protection circuit hysteresis    | $\Delta\text{TSD}$ | Design target value *           |         | 40           |      | $^\circ\text{C}$ |

\* Design target value, Do not measurement.

## Package Dimensions

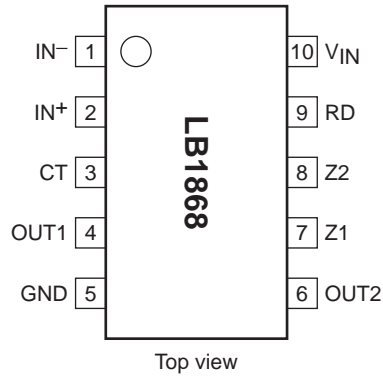
unit : mm (typ)

3098D



# LB1868

## Pin Assignment



## Pin Function

| Pin No. | Pin name        | Function                                                                                                       |
|---------|-----------------|----------------------------------------------------------------------------------------------------------------|
| 1       | IN <sup>-</sup> | Hall input + pin. Hysteresis amplifier                                                                         |
| 2       | IN <sup>+</sup> | Hall input - pin. Hysteresis amplifier                                                                         |
| 3       | CT              | Lockup protection time setting capacitor pin (0.47 to 4.7 $\mu$ F).                                            |
| 4       | OUT1            | Output 1 pin.                                                                                                  |
| 6       | OUT2            | Output 2 pin.                                                                                                  |
| 5       | GND             | GND pin.                                                                                                       |
| 7       | Z1              | External Zener diode pin (external Zener diode to be connected between power supply and Z1).                   |
| 8       | Z2              | Kickback absorption voltage alteration pin (shorted to Z1: 12V operation).                                     |
| 9       | RD              | Lockup detection pin (latch type).                                                                             |
| 10      | V <sub>IN</sub> | Regulated power supply input pin (limiting resistor to be inserted between power supply and V <sub>IN</sub> ). |

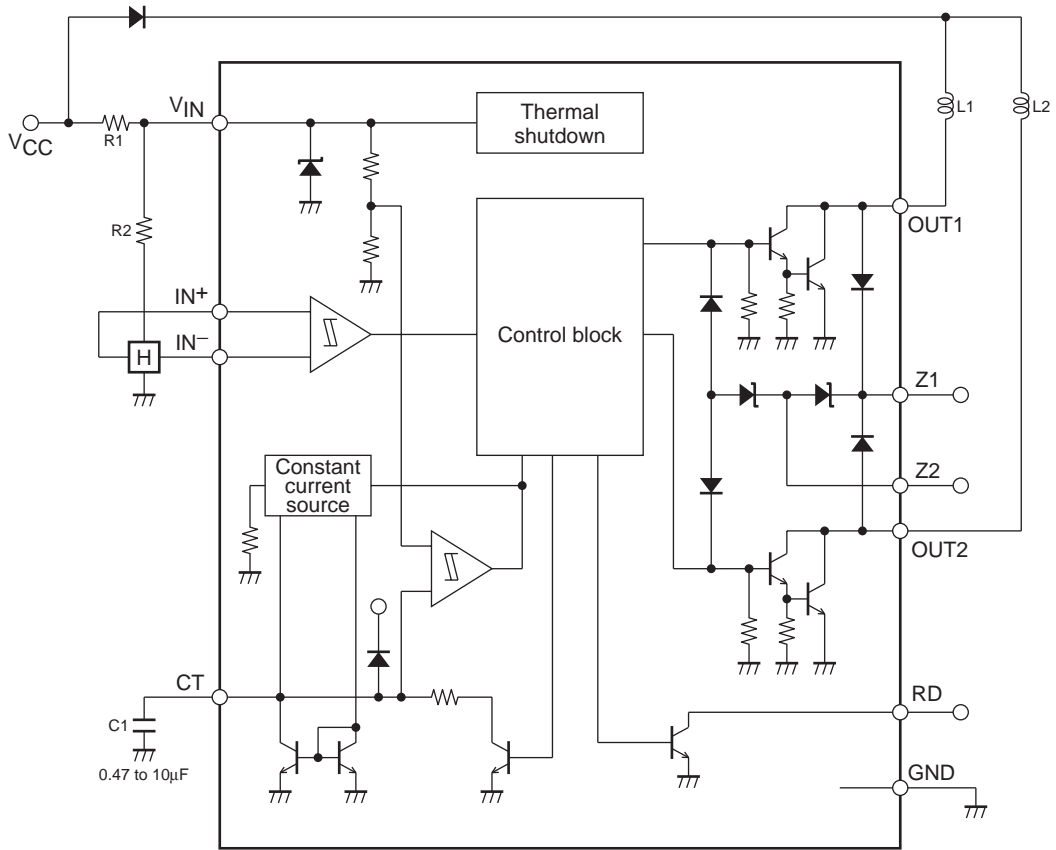
## Truth Table

| IN <sup>+</sup> | IN <sup>-</sup> | CT | OUT1 | OUT2 | RD |
|-----------------|-----------------|----|------|------|----|
| H               | L               | L  | H    | L    | L  |
| L               | H               | L  | L    | H    | L  |
| H               | L               | H  | H    | H    | H  |
| L               | H               | H  | H    | H    | H  |

\* RD is a latch type output

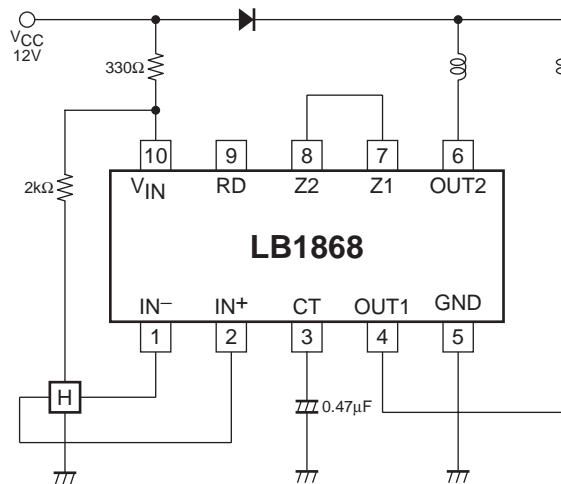
# LB1868

## Block Diagram

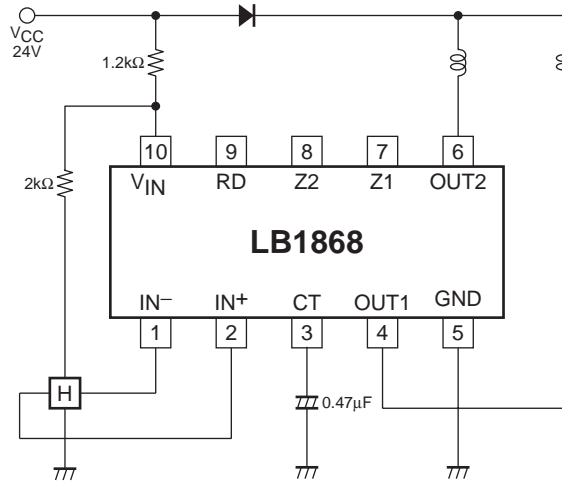


## Application Circuit Example

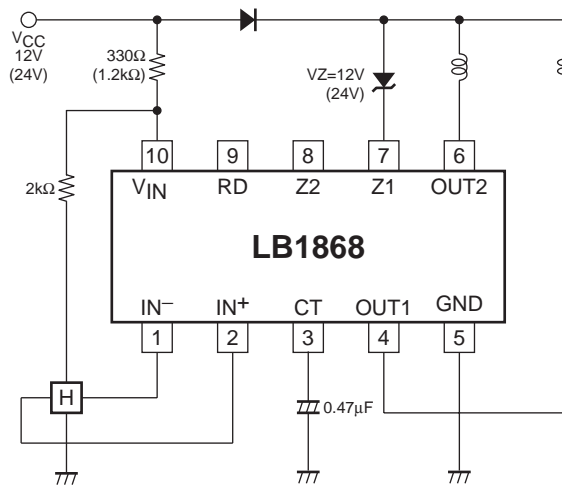
(1) 12V supply voltage



(2) 24V supply voltage



(3) High-Power Fan (120mm-HH-Speed)



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