



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## LB1868M — Monolithic Digital IC 2-phase Brushless Fan Motor Driver

### 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 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
- ST pin for motor stop/drive (for standby mode of copiers etc.)
- BC pin for kickback noise reduction (with 2 external capacitors)
- FG output pin for rotation detection
- 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
Current flowing into RD, FG	$I_{RD\ max}$		10	mA
RD, FG applied voltage	$V_{RD\ max}$		30	V
ST applied voltage	$V_{ST\ max}$		7.5	V
Allowable power dissipation	$P_d\ max$	Mounted on a specified board *	800	mW
Operating temperature	$T_{opr}$		-30 to +80	$^\circ C$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ C$

\* Specified board: 20mm × 15mm × 1.5mm, glass epoxy board.

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# LB1868M

## Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input current range	I <sub>CC</sub>		6.0 to 50	mA
Common mode input voltage range	V <sub>ICM</sub>		0.2 to V <sub>IN</sub> -1.5	V
ST High voltage	V <sub>STH</sub>		4.5 to 7.0	V
ST Low voltage	V <sub>STL</sub>		0 to 0.5	V

## Electrical Characteristics at Ta = 25°C, I<sub>CC</sub> = 10mA

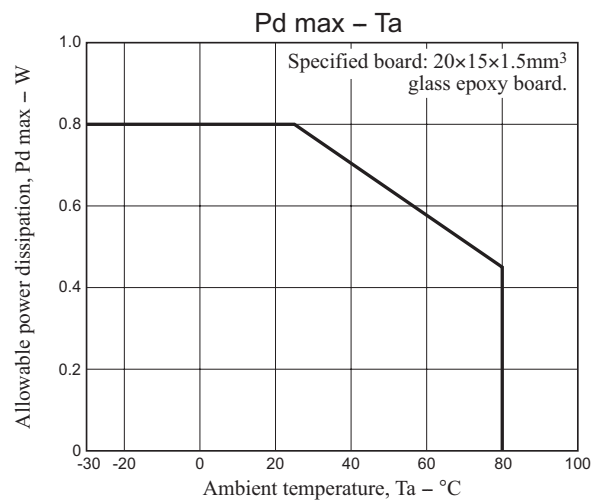
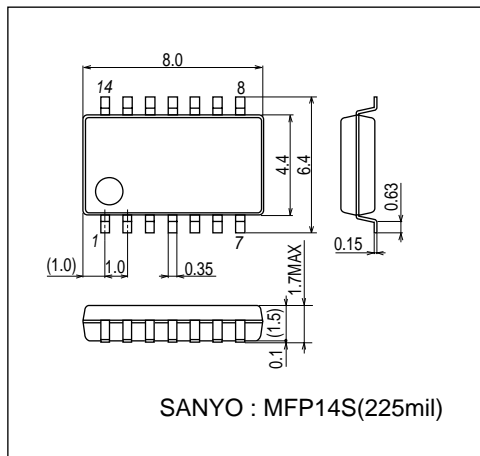
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output limiter withstand voltage	V <sub>OLM1</sub>	Z1, Z2 open	54	57	60	V
	V <sub>OLM2</sub>	Z1, Z2 short	31	33	35	V
Output saturation voltage	V <sub>Osat1</sub>	I <sub>O</sub> = 0.5A		0.95	1.2	V
	V <sub>Osat2</sub>	I <sub>O</sub> = 1.0A		1.15	1.5	V
V <sub>IN</sub> voltage	V <sub>IN</sub>	I <sub>CC</sub> = 7.0mA	6.4	6.7	7.0	V
Hall input sensitivity (at zero peak)	V <sub>HN</sub>	Including offset and hysteresis			20	mV
RD, FG output saturation voltage	V <sub>RDSat</sub>	I <sub>RD</sub> = 5mA		0.1	0.3	V
CT drain current	IC1	C = GND	2.7	3.8	4.9	μA
CT discharge current	IC2	C = V <sub>IN</sub>	0.19	0.30	0.41	μA
Comp input threshold voltage	V <sub>TH1</sub>		0.77	0.8V <sub>IN</sub>	0.83	V
	V <sub>TH2</sub>		0.42	0.45V <sub>IN</sub>	0.48	V
ST input current	I <sub>ST</sub>	V <sub>ST</sub> = 5V		80	120	μA
Thermal protection operating temperature	TSD	Design target value *		180		°C
Thermal protection circuit hysteresis	ΔTSD	Design target value *		40		°C

\* Design target value, Do not measurement.

## Package Dimensions

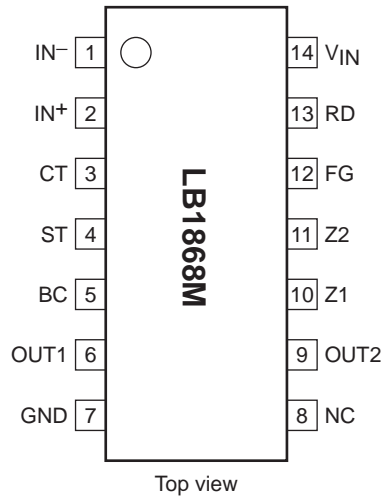
unit : mm (typ)

3111A



# LB1868M

## 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	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: 12V operation).
12	FG	Rotation frequency detector pin.
13	RD	Lockup detection pin (latch type).
14	V <sub>IN</sub>	Regulated power supply input pin (limiting resistor to be inserted between power supply and V <sub>IN</sub> ).

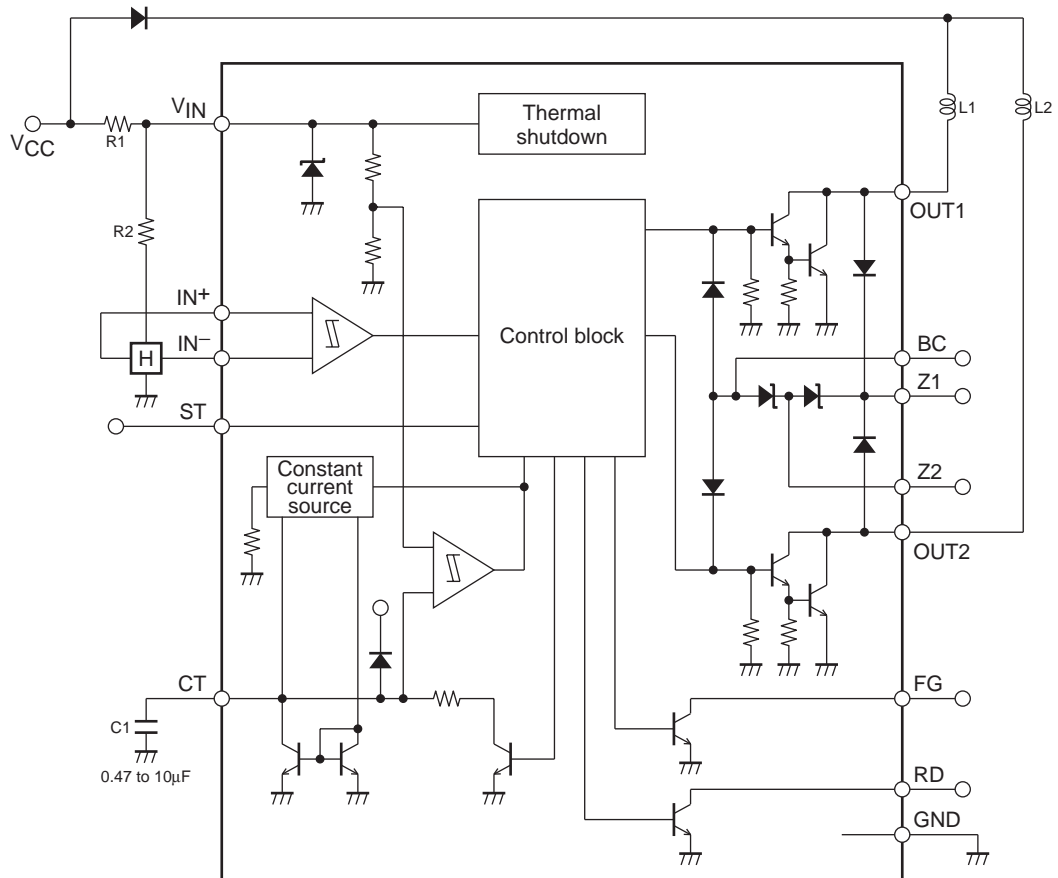
## Truth Table

ST	IN <sup>+</sup>	IN <sup>-</sup>	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

\* RD is a latch type output

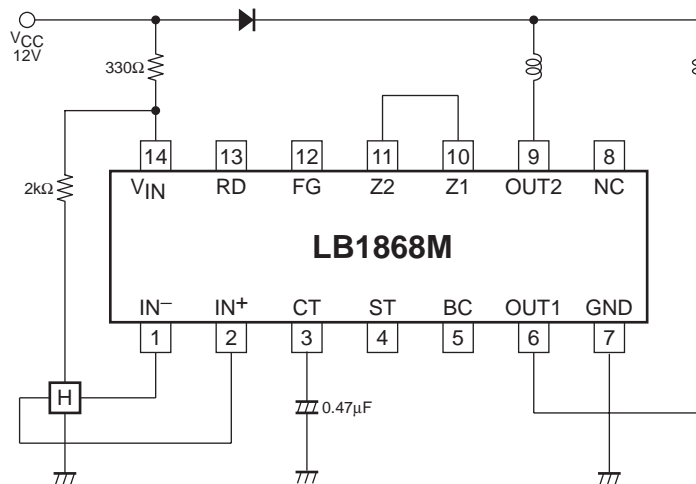
# LB1868M

## Block Diagram



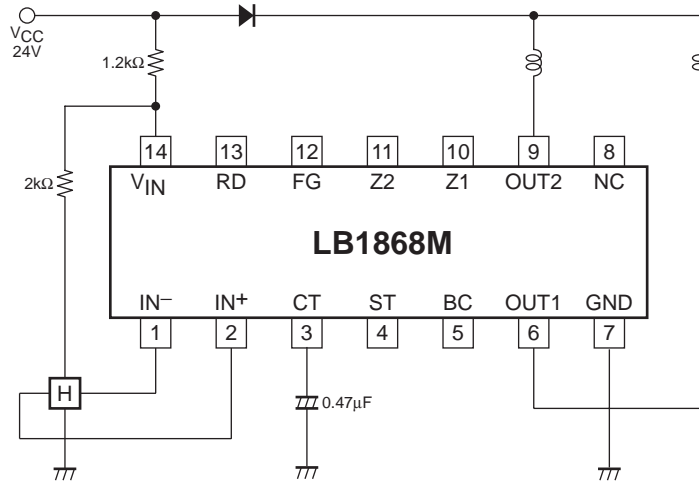
## Application Circuit Example

(1) 12V supply voltage

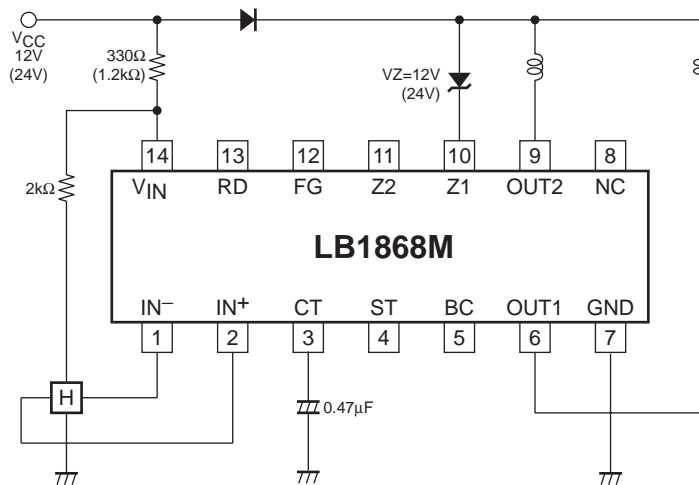


# LB1868M

## (2) 24V supply voltage



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



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