



SANYO Semiconductors

# DATA SHEET

## 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 $T_a = 25^\circ\text{C}$

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
ST High voltage	$V_{STH}$		4.5 to 7.0	V
ST Low voltage	$V_{STL}$		0 to 0.5	V

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

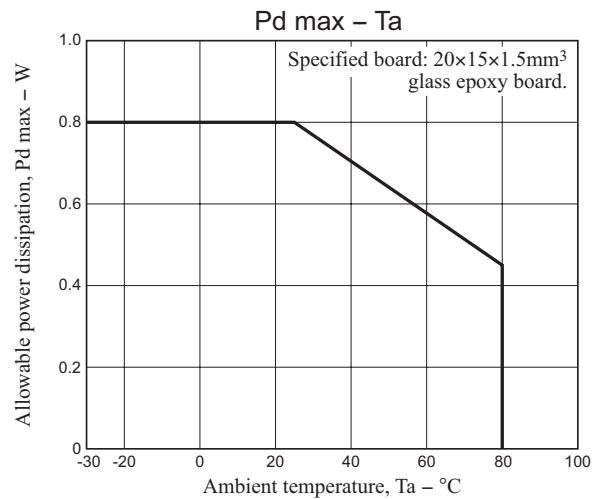
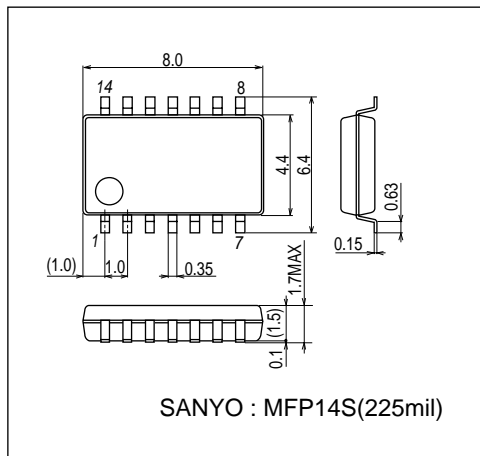
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output limiter withstand voltage	$V_{OLM1}$	Z1, Z2 open	54	57	60	V
	$V_{OLM2}$	Z1, Z2 short	31	33	35	V
Output saturation voltage	$V_{Osat1}$	$I_O = 0.5\text{A}$		0.95	1.2	V
	$V_{Osat2}$	$I_O = 1.0\text{A}$		1.15	1.5	V
$V_{IN}$ voltage	$V_{IN}$	$I_{CC} = 7.0\text{mA}$	6.4	6.7	7.0	V
Hall input sensitivity (at zero peak)	$V_{HN}$	Including offset and hysteresis			20	mV
RD, FG output saturation voltage	$V_{RDSat}$	$I_{RD} = 5\text{mA}$		0.1	0.3	V
CT drain current	IC1	C = GND	2.7	3.8	4.9	$\mu\text{A}$
CT discharge current	IC2	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
ST input current	$I_{ST}$	$V_{ST} = 5\text{V}$		80	120	$\mu\text{A}$
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

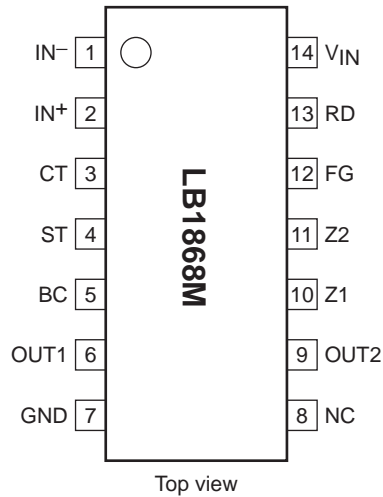
unit : mm (typ)

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> ).

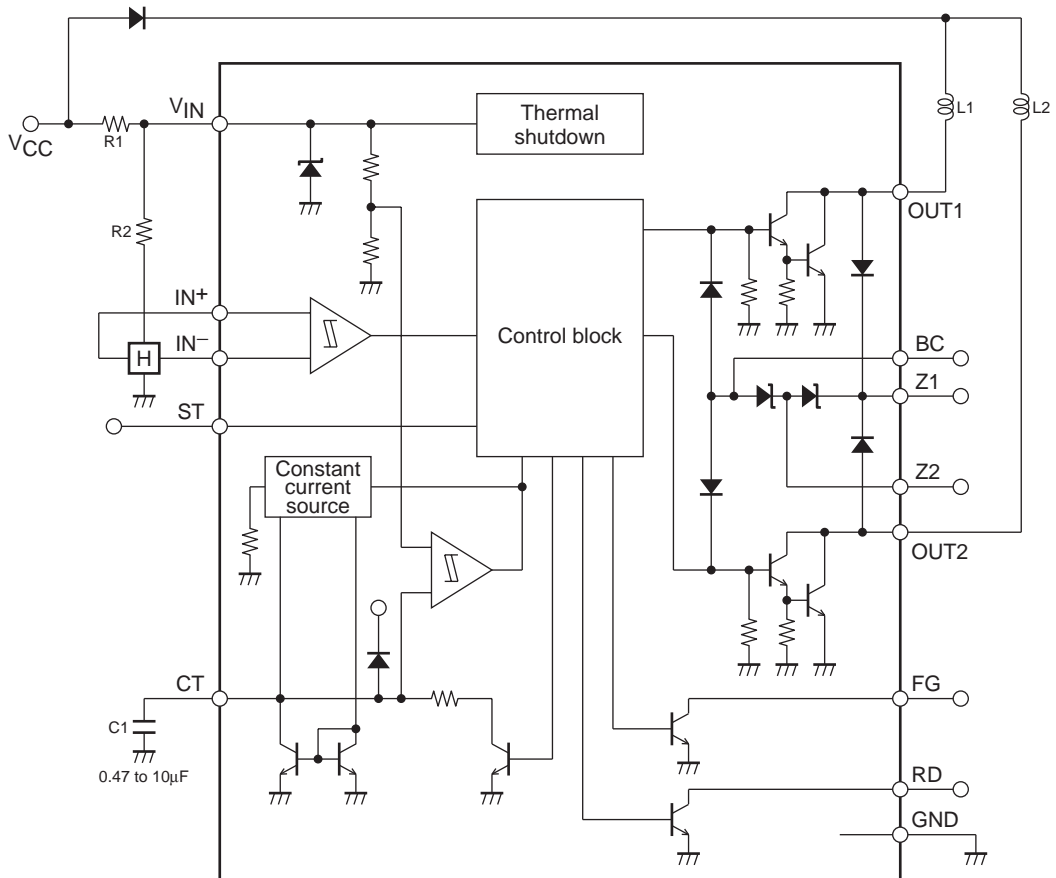
## Truth Table

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

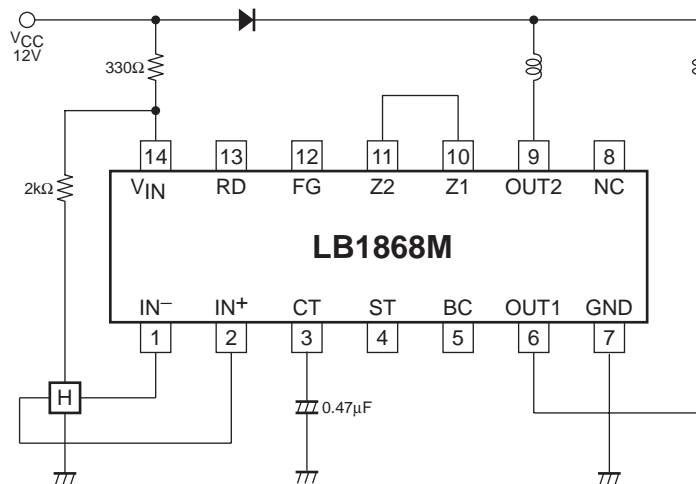
# LB1868M

## Block Diagram



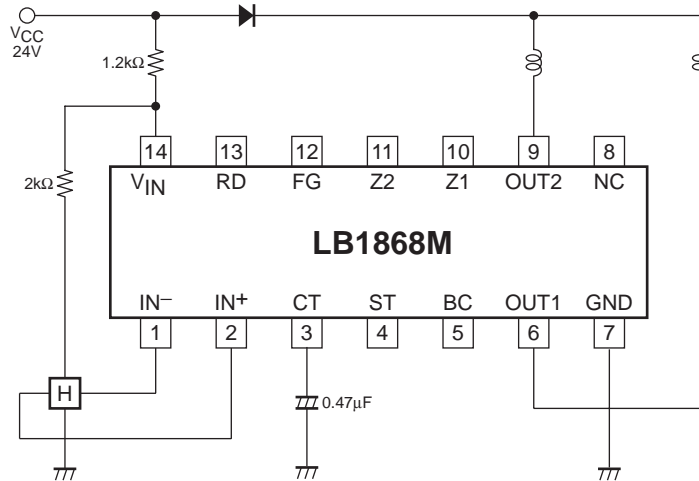
## Application Circuit Example

(1) 12V supply voltage

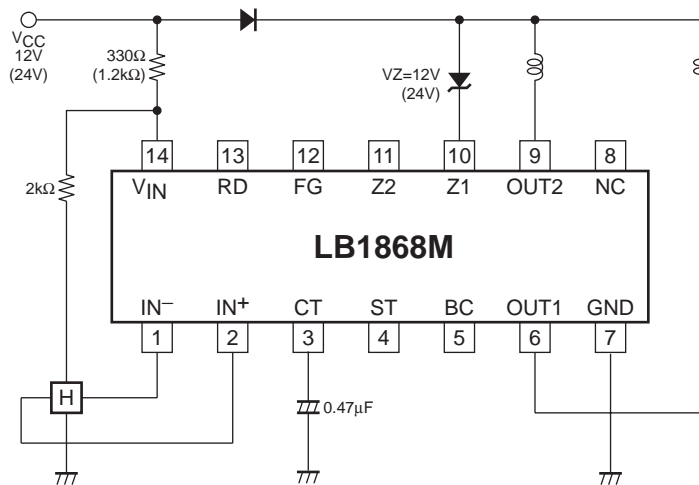


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## (2) 24V supply voltage



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



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