

**SANYO****LB1862M, 1962M****Fan Motor Single-Phase Full-Wave Drivers****Overview**

Single-phase full-wave drive design and a compact package make these ICs optimal for small fans (especially CPU cooling fans). Low switching noise and effective motor drive are further advantages. The LB1862M features a lockup detection output (RD) and the LB1962M features a rotation detection output (FG).

**Features**

- Support for 5V/12V dual power supply voltage
- Built-in regenerative circuit allows use of reverse-connection protection diode
- Built-in Hall amplifier with hysteresis (supports core without auxiliary electrode)
- Built-in lockup protection and automatic recovery circuits
- Latch-type lockup detection output (RD) is Low during rotation and High during stop (LB1862M)
- Rotation detection output (FG) (LB1962M)
- Hall bias pin and start/stop pin allow reduced current drain in standby mode
- Built-in thermal protection circuit

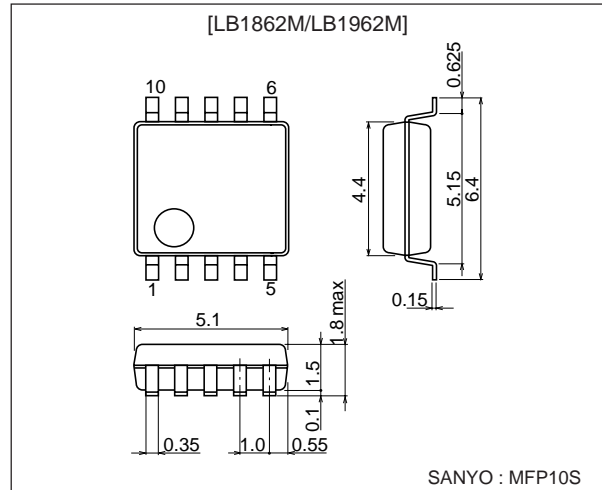
**Specifications****Absolute Maximum Ratings at Ta = 25°C**

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max		17	V
Maximum output current	$I_{OUT}$ max		0.5	A
Maximum output withstand voltage	$V_{OUT}$ max	(LB1862M)	15	V
		(LB1962M)	15	V
RD/FG maximum output withstand voltage	$V_R$ max	(LB1862M)	15	V
	$V_F$ max	(LB1962M)	17	V
RD/FG maximum output current	$I_R$ max		5	mA
	$I_F$ max		5	mA
HB maximum output current	$I_B$ max		10	mA
ST maximum input voltage	$V_{ST}$ max		15	V
Allowable power dissipation	$P_d$ max	With specified substrate*	850	mW
Operating temperature	$T_{opr}$	(LB1862M)	-20 to +75	°C
		(LB1962M)	-30 to +85	°C
Storage temperature	$T_{stg}$		-55 to +150	°C

\*Specified substrate: 114.3 × 76.2 × 1.5 mm<sup>3</sup> glass epoxy

**Package Dimensions**

unit: mm

**3086A-MFP10S**

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## LB1862M, LB1962M

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

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	$V_{CC}$		3.8 to 16.8	V
ST input High level voltage	$ST_H$		3 to 14	V
ST input Low level voltage	$ST_L$		-0.3 to +0.4	V
Hall input common mode voltage range	$V_{ICM}$		0.2 to $V_{CC}-1.5$	V

### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 5\text{V}$

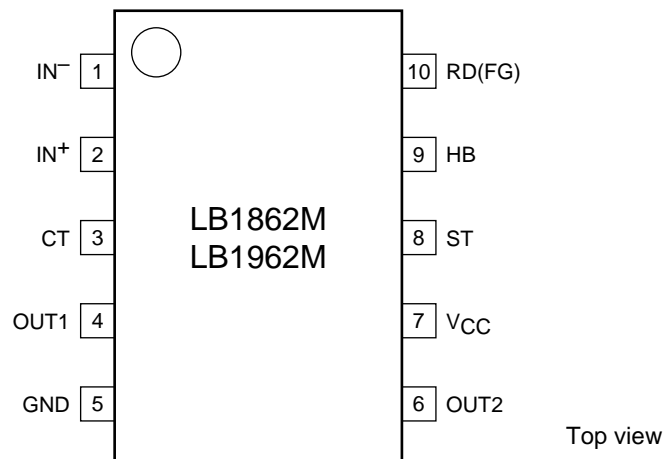
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}$	In drive mode (CT = [L], ST = [L])		6.5	9.1	mA
		In lockup protection mode (CT = [H], ST = [L])		2.2	3.1	mA
		In standby mode (ST = [H])		110	150	$\mu\text{A}$
Lockup detection capacitor charge current	$I_{CT1}$		1.9	2.8	3.7	$\mu\text{A}$
Capacitor discharge current	$I_{CT2}$		0.32	0.46	0.60	$\mu\text{A}$
Capacitor charge/discharge current ratio	$R_{CT}$	$R_{CD} = I_{CT1}/I_{CT2}$	5.0	6.0	7.0	
CT charge voltage	$V_{CT1}$		2.55	2.75	2.95	V
CT discharge voltage	$V_{CT2}$		1.6	1.8	2.0	V
Output Low level voltage	$V_{OL}$	$I_O = 200\text{ mA}$		0.2	0.3	V
Output High level voltage	$V_{OH}$	$I_O = 200\text{ mA}$	3.9	4.1		V
Hall input sensitivity	$V_{HN}$	Zero peak value (Including offset and hysteresis)		7	15	mV
RD/FG output pin Low voltage	$V_{RD}, V_{FG}$	$I_{RD}, I_{FG} = 5\text{ mA}$		0.1	0.3	V
RD/FG output pin leakage current	$I_{RDL}, I_{FGL}$	$V_{RD}, V_{FG} = 15\text{V}$			30	$\mu\text{A}$
HB output Low voltage	$V_{HBL}$	$I_{HB} = 5\text{ mA}$		1.0	1.3	V
ST pin input current	$I_{ST}$	$V_{ST} = 5\text{V}$		75	100	$\mu\text{A}$

### Truth Table

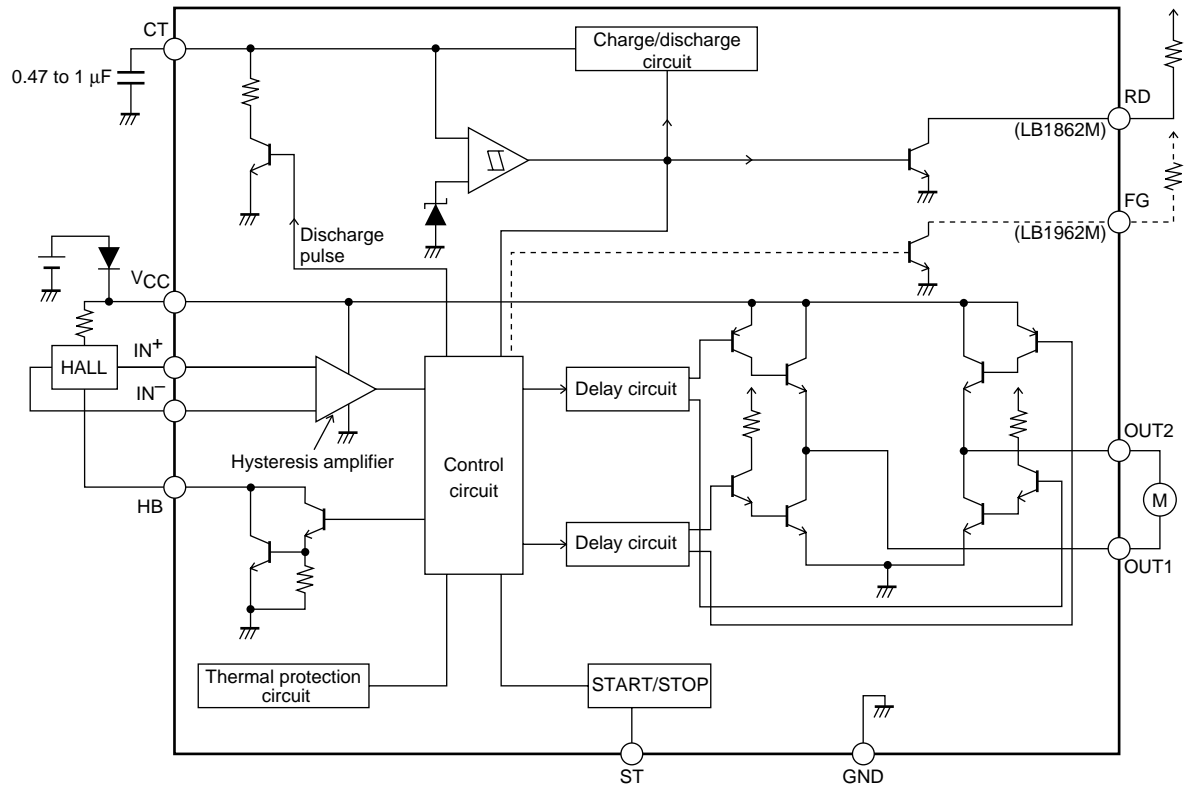
ST	IN <sup>-</sup>	IN <sup>+</sup>	CT	OUT1	OUT2	RD	FG	HB	Mode
H	—	—	—	off	off	off	off	off	Standby
L	H	L	L	H	L	L	L	L	Rotating
	L	H		L	H		H		
	—	—	H	off	off	off	—	L	Lockup protection activated

Latch-type RD output is Low during rotation and High during stop.

### Pin Assignment

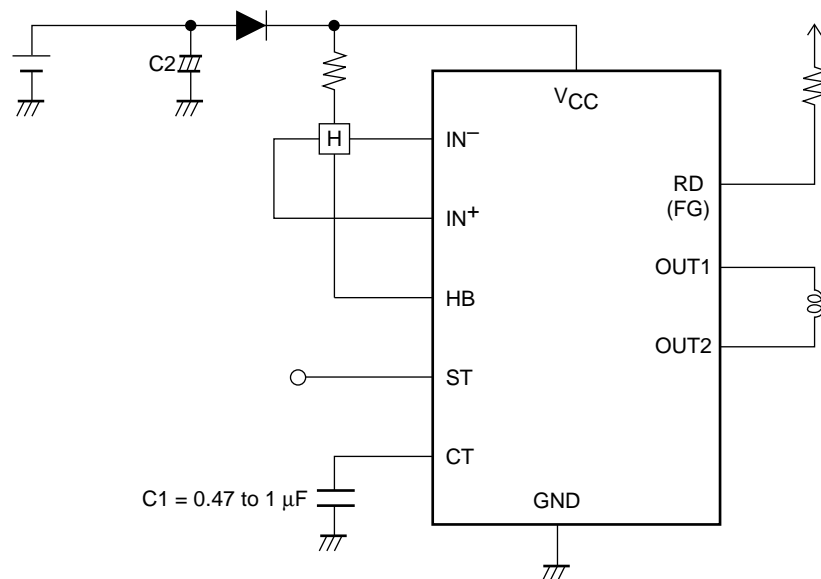


## Block Diagram



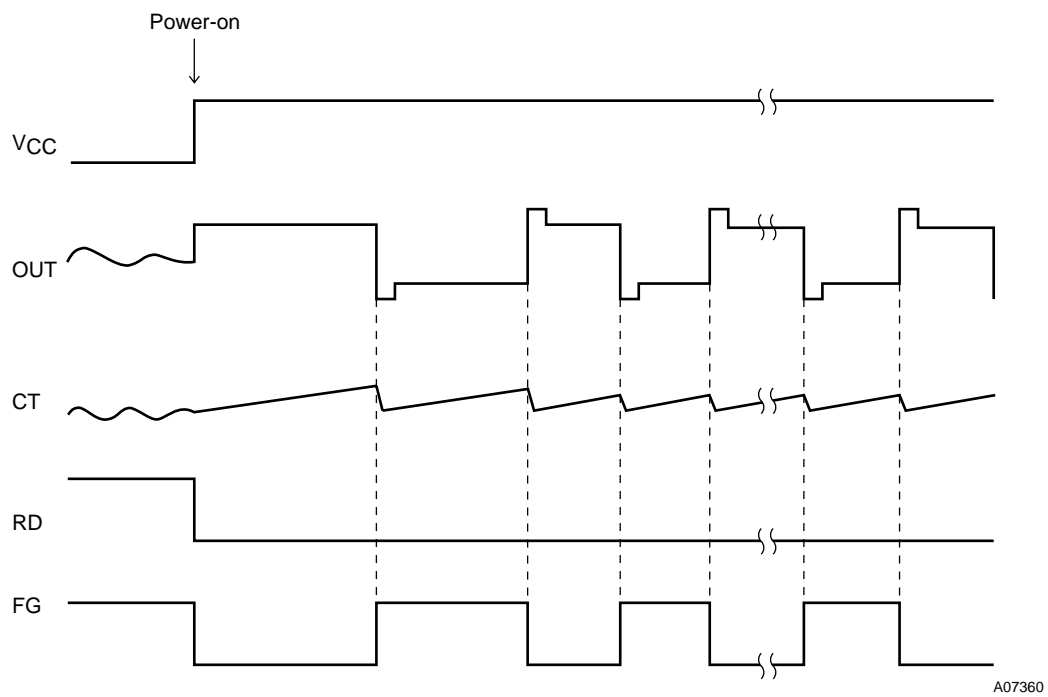
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## Sample Application Circuit

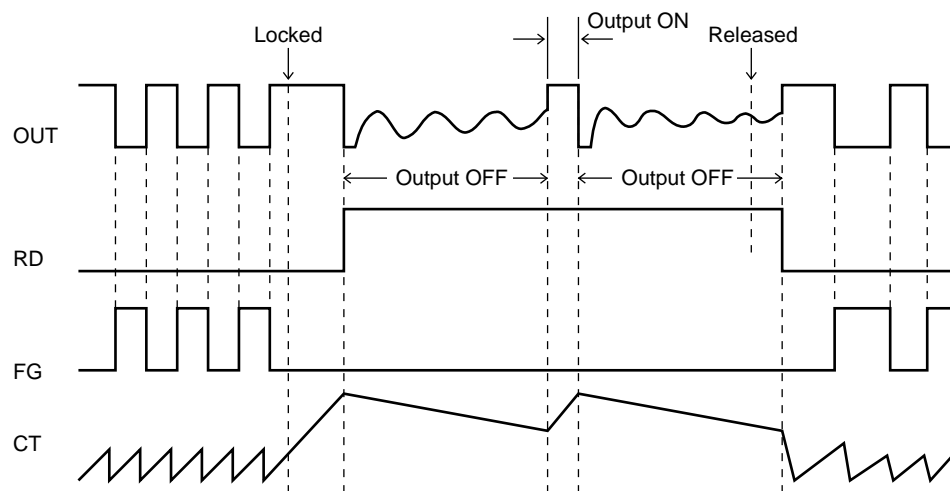


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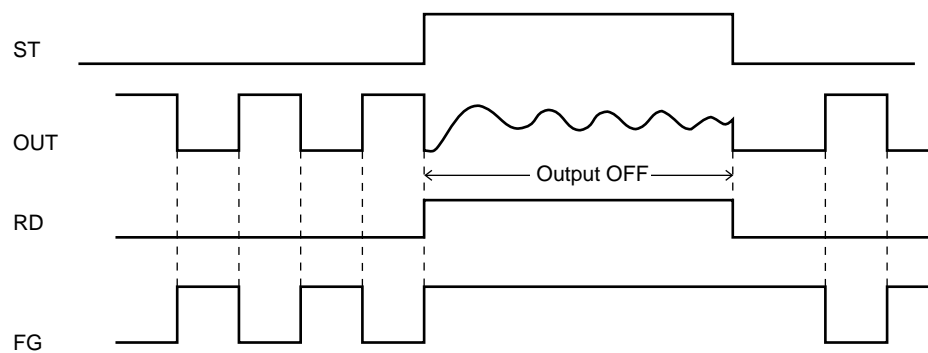
## Startup



## Lockup protection/automatic recovery



## Start/stop



**Design reference****(1)  $V_{CC}$  pin**

Power supply pin for control block and motor drive.

Accepts a wide operation voltage range from 3.8 to 16.8V, for 5V/12V dual power supply support.

**(2) OUT1, OUT2 pins**

Single-phase coil output pins.

Bipolar drive output with upper side inverted and lower side single output. Built-in regenerative circuit regenerates kickback current between lower side NPN outputs when a diode is used for protection against reverse connection.

**(3)  $IN^-$ ,  $IN^+$  pins**

Hall input signal pins

The Hall signal is amplified into a square wave by the Hall amplifier with hysteresis characteristics of  $\pm 3.5$  mV (typ.). The Hall input signal amplitude should be 70 mV or more.

**(4) CT pin**

This pin serves for connecting a capacitor between CT and GND.

The capacitor determines the characteristics of the built-in lockup protection circuit for preventing coil burnout in the case of motor restraint. Once normal motor load is restored, the automatic recovery circuit resets itself.

Changing the capacitance alters the lockup detection time.

When a 0.47  $\mu$ F capacitor is connected between CT and GND

Lockup detection time : approx. 0.5s

Lockup protection time/automatic recovery time : approx. 0.16s (output ON)

approx. 1s (output OFF)

When not using lockup protection function, this pin should be connected to ground.

**(5) RD pin (LB1862M)**

Open-collector output pin that is Low during rotation and OFF when lockup is detected.

The output is a latch type which stays OFF also when the automatic recovery circuit has restored drive mode unless the rotation actually resumes.

**(6) FG pin (LB1962M)**

Open-collector output pin for rotation frequency detection.

When  $IN^-$  = High and  $IN^+$  = Low, then FG = Low

When  $IN^-$  = Low and  $IN^+$  = High, then FG = High

**(7) ST pin and HB pin**

ST pin : When input to this pin is High, motor drive is stopped (OUT is high impedance).

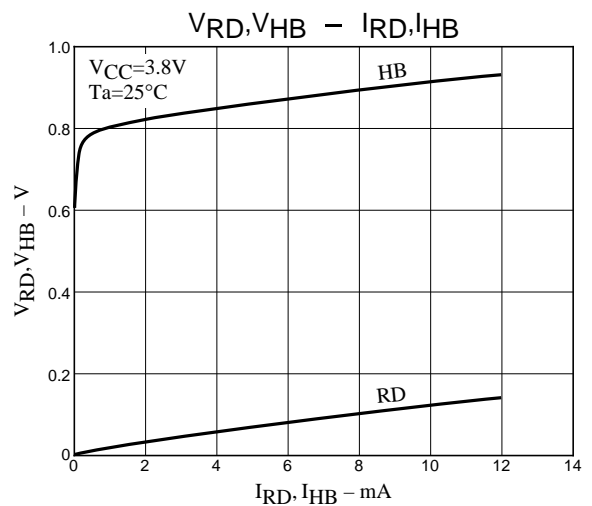
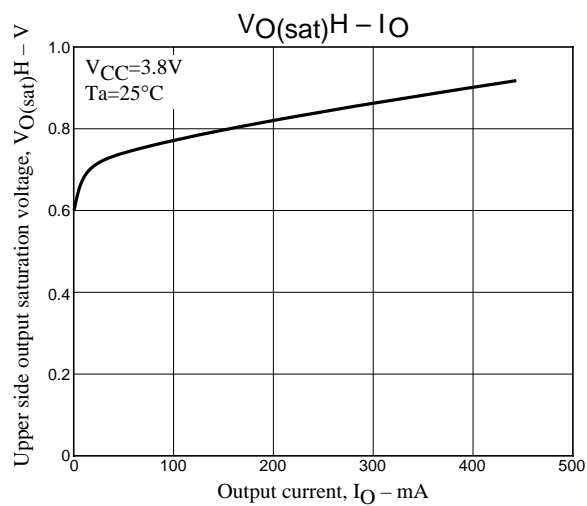
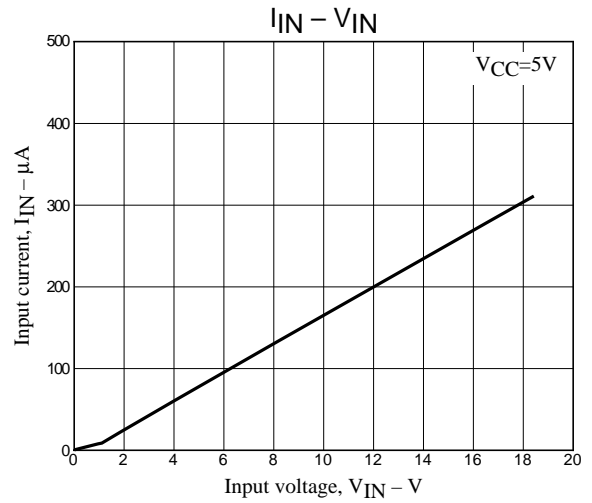
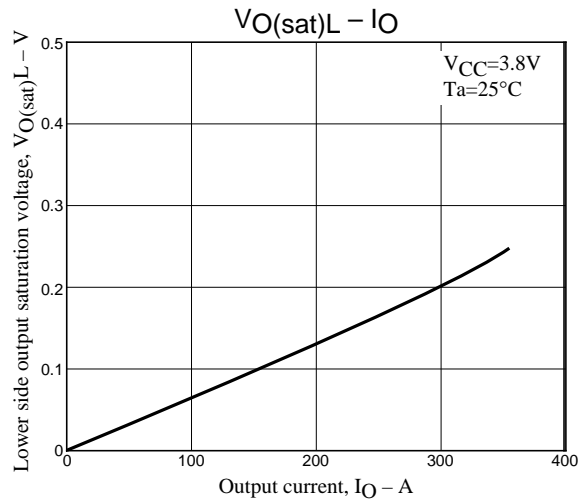
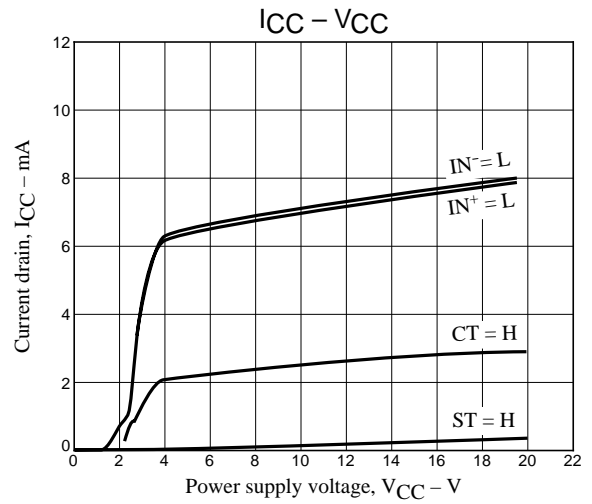
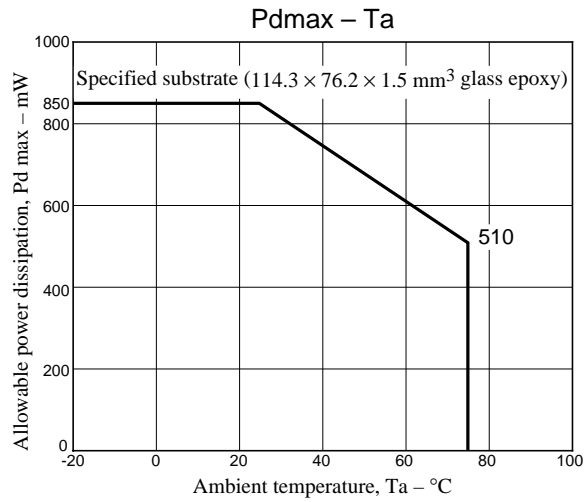
At this time, RD output indicates lockup protection mode OFF.

HB pin : Hall bias switching pin. At ST pin High input, Hall bias is switched to reduce current drain in fan standby mode.

If not used, both pins should be open.

**(8) Thermal protection circuit**

When internal temperature  $T_j$  of IC reaches 180°C, output current limiter is activated to protect against damage.



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