



# LB1862M

## Single-Phase Full-Wave Driver for Fan Motors

### Overview

The LB1862M is a single-phase full-wave driver provided in a miniature package that is optimal for driving miniature fans such as CPU cooling fans. It provides motor drive with low switching noise and high efficiency.

### Functions

- Supports both 5- and 12-V power supplies.
- Allows the use of reverse connection prevention diodes by including a regeneration circuit on chip.
- On-chip Hall amplifier with hysteresis characteristics (Supports commutator-free cores.)
- Lock protection and automatic recovery circuits
- Lock detection pin  
(Latch type – Low: drive, High: stopped)
- Supports low current drain in standby mode by providing a Hall bias pin and a start/stop pin.
- Thermal shutdown circuit

### Specifications

#### Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC}$ max		17	V
Output current	$I_{OUT}$ max		0.5	A
Output voltage	$V_{OUT}$ max		15	V
RD output voltage	$V_R$ max		15	V
RD output current	$I_R$ max		5	mA
HB output current	$I_B$ max		10	mA
ST input voltage	$V_{ST}$ max		15	V
Allowable power dissipation	$P_d$ max	When mounted on the specified board *	850	mW
Operating temperature	$T_{opr}$		-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

Note: \* Specified board: 114.3 × 76.2 × 1.5 mm epoxy glass laminate board

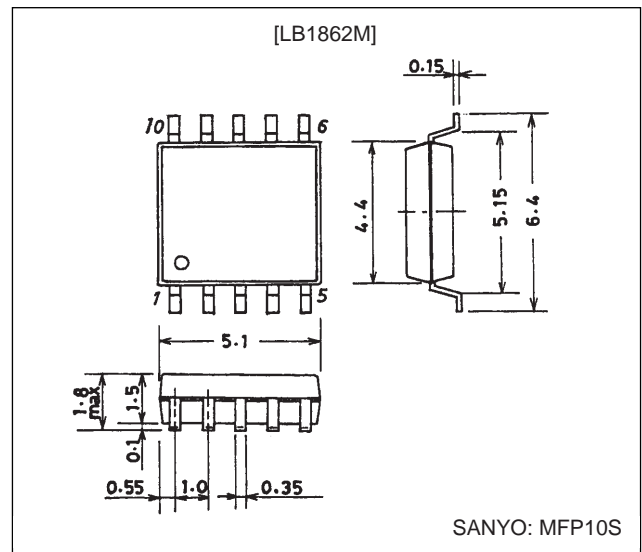
#### Allowable Operating Ranges at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
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 input voltage range	$V_{ICM}$		0.2 to $V_{CC} - 1.5$	V

### Package Dimensions

unit: mm

#### 3086A-MFP10S



## LB1862M

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

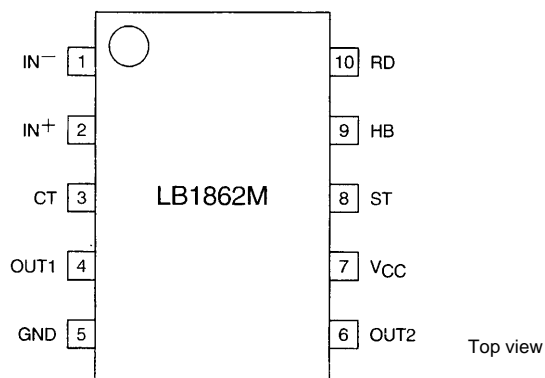
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}$	During drive operation (CT = low, ST = low)		6.5	9.1	mA
		During lock protection (CT = high, ST = low)		2.2	3.1	mA
		Standby mode (ST = high)		110	150	$\mu\text{A}$
Lock detection capacitor charge current	$I_{CT1}$		1.9	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 the offset and hysteresis.)		7	15	mV
RD output pin low-level voltage	$V_{RD}$	$I_{RD} = 5\text{ mA}$		0.1	0.3	V
RD output pin leakage current	$I_{RD L}$	$V_{RD} = 15\text{ V}$			30	$\mu\text{A}$
HB output low-level 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-	IN+	CT	OUT1	OUT2	RD	HB	Mode
H	—	—	—	off	off	off	off	Standby
L	H	L	L	H	L	L	L	Drive
	L	H		L	H			
			H	off	off	off	L	Lock protection

The RD output is a latch-type output; Low: drive, High: stopped

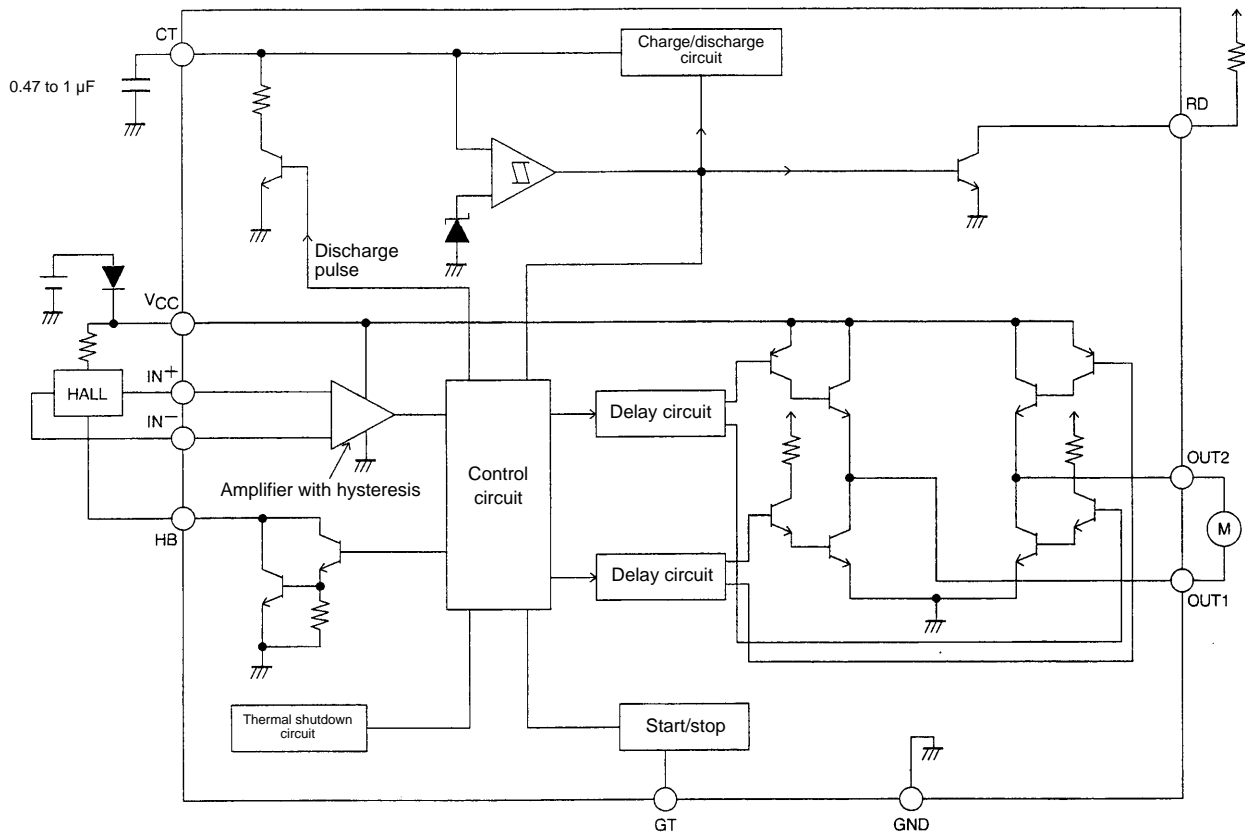
### Pin Assignment



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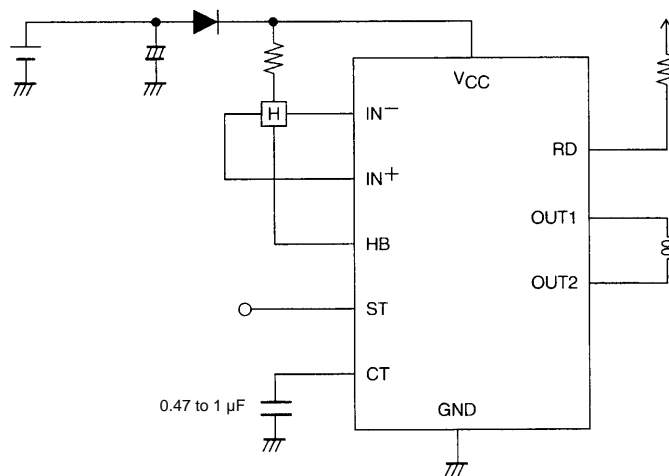
# LB1862M

## Block Diagram



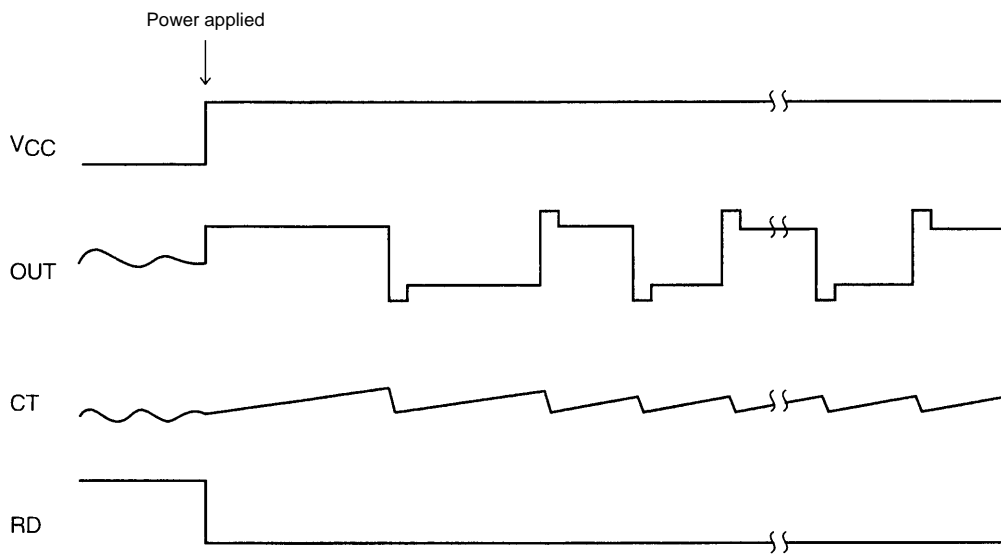
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## Sample Application Circuit



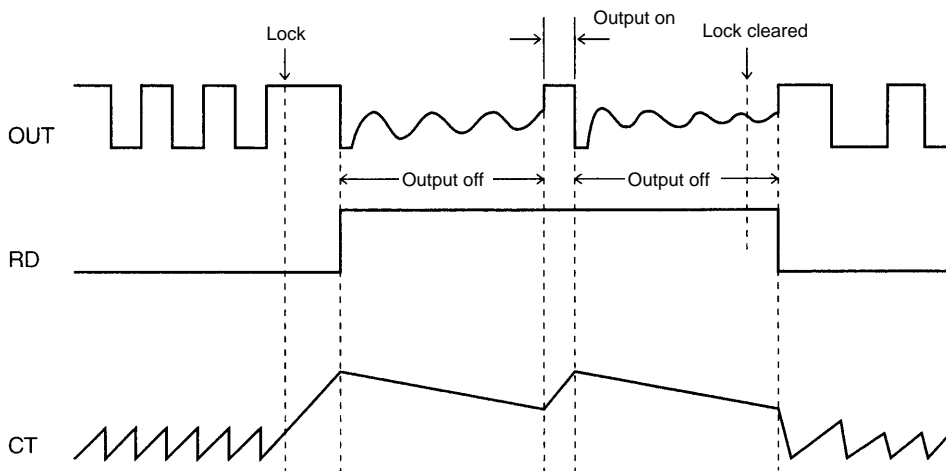
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**Startup**

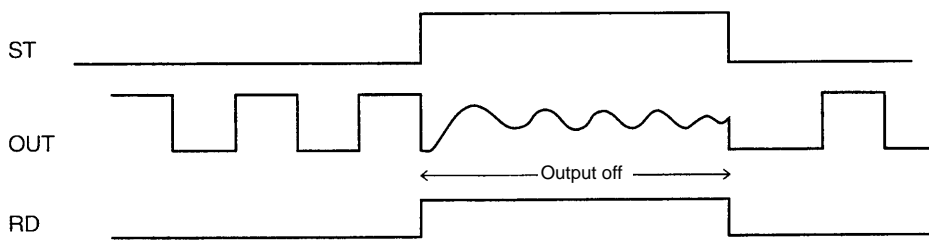


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**Lock Protection/Automatic Recovery**



**Start/Stop**



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**Design Notes**1.  $V_{CC}$  pin

This pin provides power for motor drive and the control circuits.

The LB1862M supports a wide range of operating voltages, from 3.8 to 16.8 V, and thus can be used in applications that support both 5-V and 12-V systems.

## 2. OUT1 and OUT2 pins

Single-phase coil outputs.

The output is a high side inverted, low side single bipolar output. Since a regeneration circuit is included on chip, the kickback current is regenerated across the low side NPN output even if a diode is used to protect the circuit against being destroyed by reversed polarity connection.

3. IN<sup>-</sup> and IN<sup>+</sup> pins

Hall element inputs.

The Hall signal is amplified to be a square wave by the Hall amplifier, which has hysteresis characteristics.

A hysteresis of  $\pm 3.5$  mV (typical) is applied. A Hall input signal amplitude of 70 mV or higher is recommended.

## 4. CT pin

The capacitor connected between this pin and ground forms a protection circuit that prevents coil burnout if the motor locks.

If the motor load returns to an appropriate level, the automatic recovery circuit will restart motor rotation. The lock detection time can be set by changing the value of the capacitor.

If a 0.47  $\mu$ F capacitor is used:

Lock detection time:	About 0.5 second
Lock protection time/automatic recovery time:	About 0.16 second (output on) About 1 second (output off)

This pin should be tied to ground if the lock protection function is not used.

## 5. RD pin

This is an open collector output that is low while the motor is turning and high impedance when the locked state is detected.

This is a latch type output that holds the output high-impedance state if motor rotation is not restarted by the automatic recovery circuit.

## 6. ST and HB pins

ST pin: Stops motor drive when a high level is input.

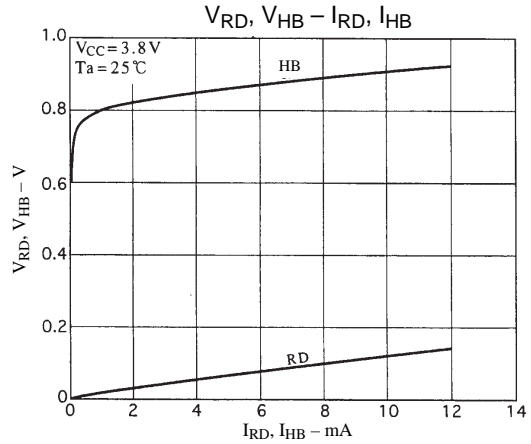
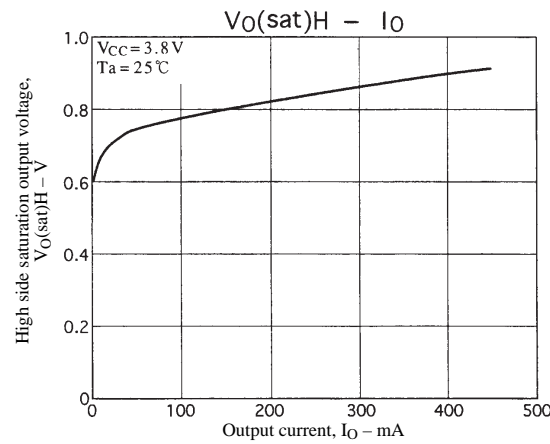
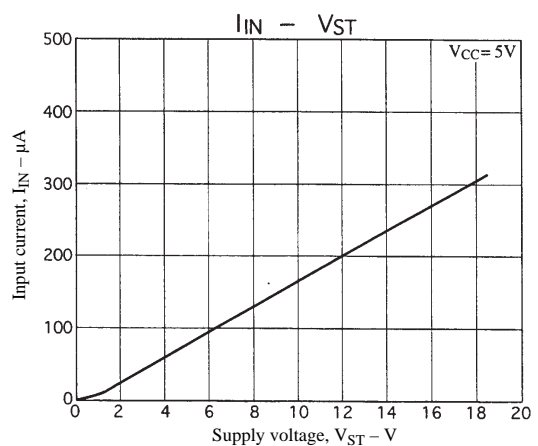
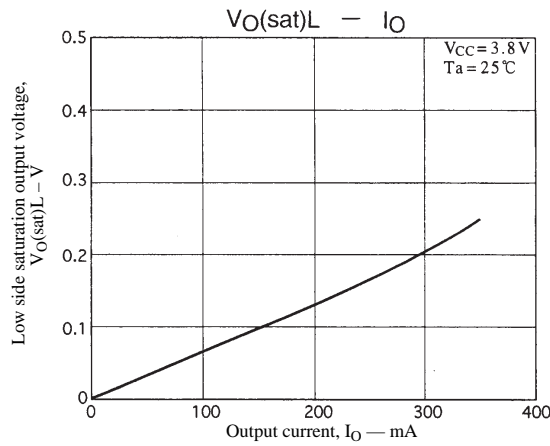
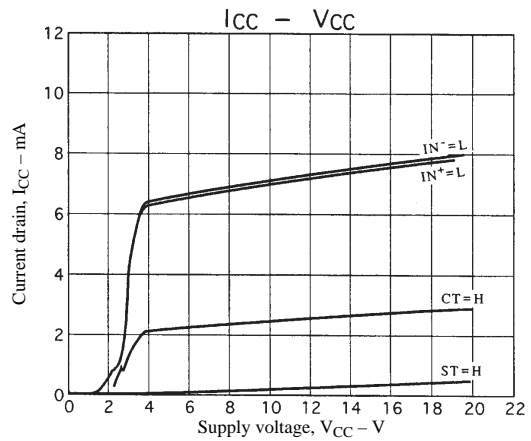
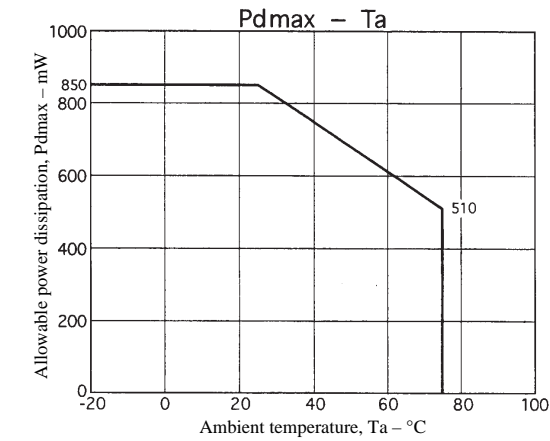
When ST is high, the RD pin output will go to the high-impedance state indicating lock protection mode.

HB pin: Switches the Hall bias. When a high level is input to the ST pin, applications should switch the Hall bias to suppress standby mode current drain.

Both these pins should be left open if unused.

## 7. Thermal shutdown circuit

This circuit protects the IC by limiting the output current if the IC internal temperature reaches  $T_j = 180^\circ\text{C}$ .



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