Ordering number : ENN5657A

Monolithic Digital IC

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).

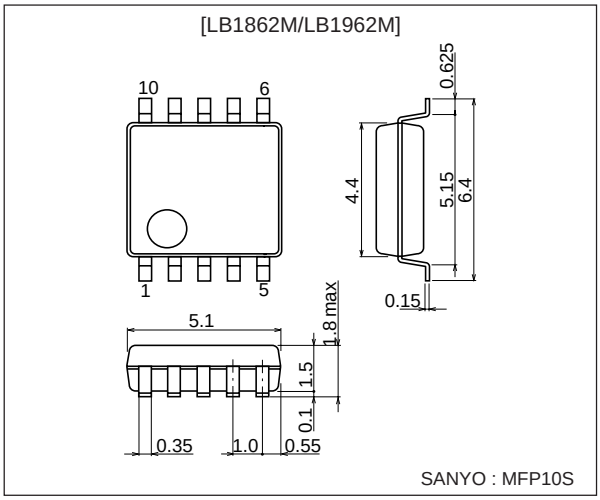
Features

- 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

Package Dimensions

unit: mm

3086A-MFP10S



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	Pd max	With specified substrate*	850	mW
Operating temperature	Topr	(LB1862M)	–20 to +75	°C
		(LB1962M)	–30 to +85	°C
Storage temperature	Tstg		–55 to +150	°C

*Specified substrate: 114.3 × 76.2 × 1.5 mm^3 glass epoxy

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Allowable Operating Ranges at Ta = 25˚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 Ta = 25˚C, V_{CC} = 5V

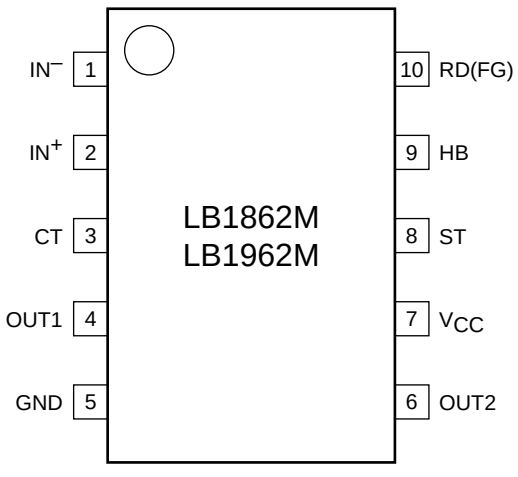
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC}	In drive mode (CT = [L], ST = [L])		6.5	9.1	mA
		In lockup protection mode (CT = [H], ST = [L])		2.2	3.1	mA
		In standby mode (ST = [H])		110	150	µA
Lockup detection capacitor charge current	$I_{CT}1$		1.9	2.8	3.7	µA
Capacitor discharge current	$I_{CT}2$		0.32	0.46	0.60	µA
Capacitor charge/discharge current ratio	R_{CT}	$R_{CD} = I_{CT}1/I_{CT}2$	5.0	6.0	7.0	
CT charge voltage	$V_{CT}1$		2.55	2.75	2.95	V
CT discharge voltage	$V_{CT}2$		1.6	1.8	2.0	V
Output Low level voltage	V_{OL}	I_O = 200 mA		0.2	0.3	V
Output High level voltage	V_{OH}	I_O = 200 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 mA		0.1	0.3	V
RD/FG output pin leakage current	I_{RDL}, I_{FGL}	V_{RD}, V_{FG} = 15V			30	µA
HB output Low voltage	V_{HBL}	I_{HB} = 5 mA		1.0	1.3	V
ST pin input current	I_{ST}	V_{ST} = 5V		75	100	µA

Truth Table

ST	IN⁻	IN⁺	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.

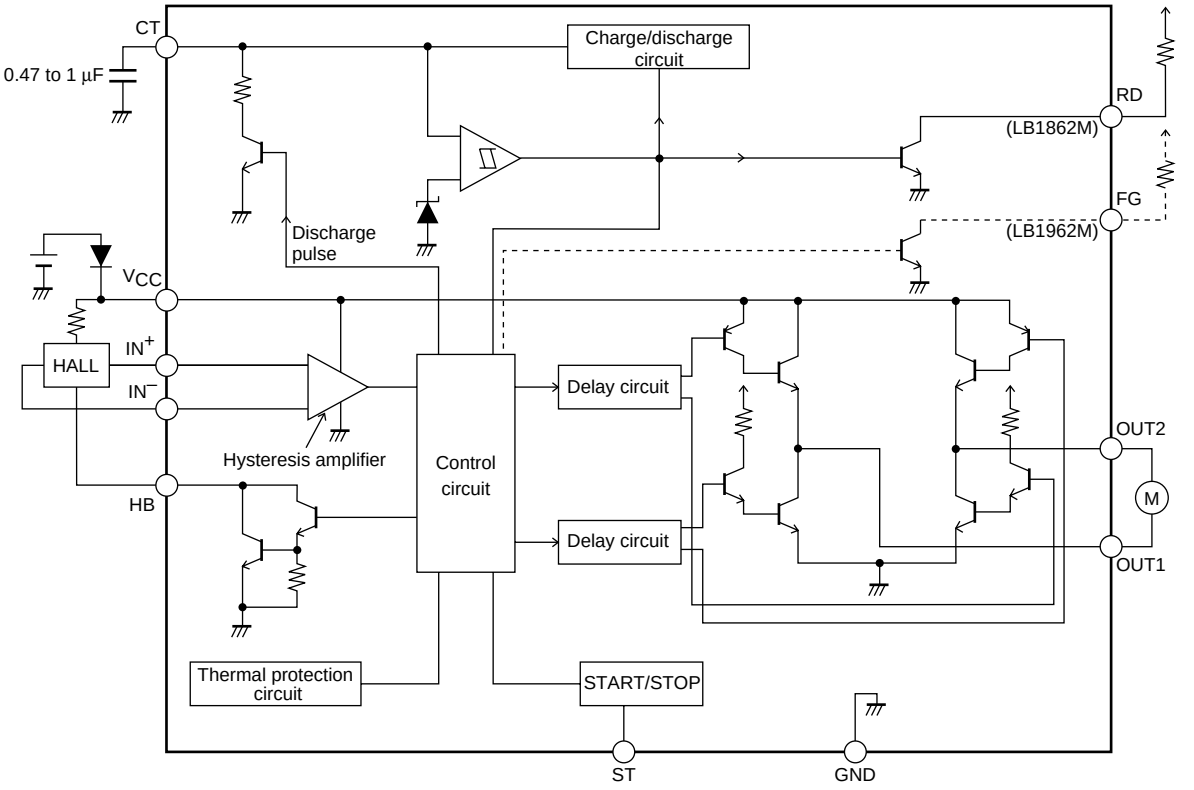
Pin Assignment



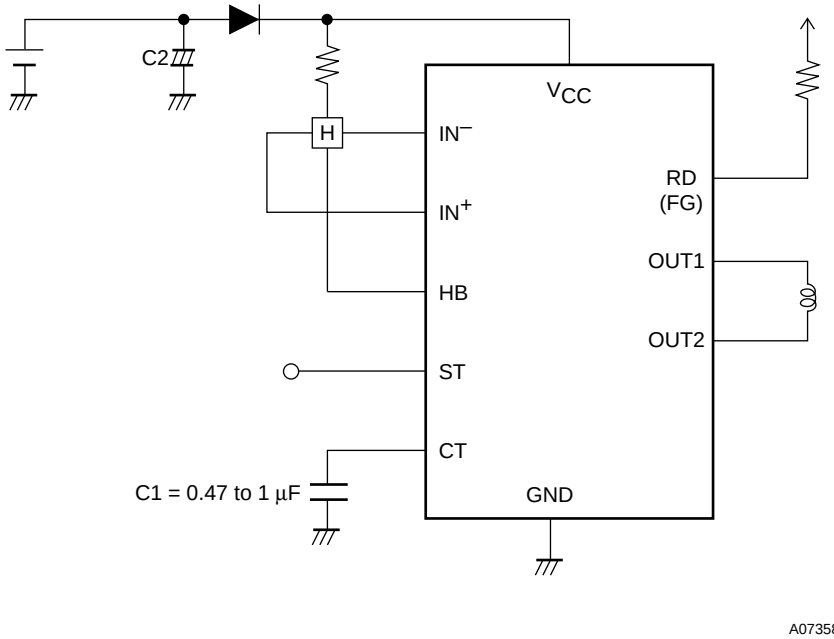
Top view

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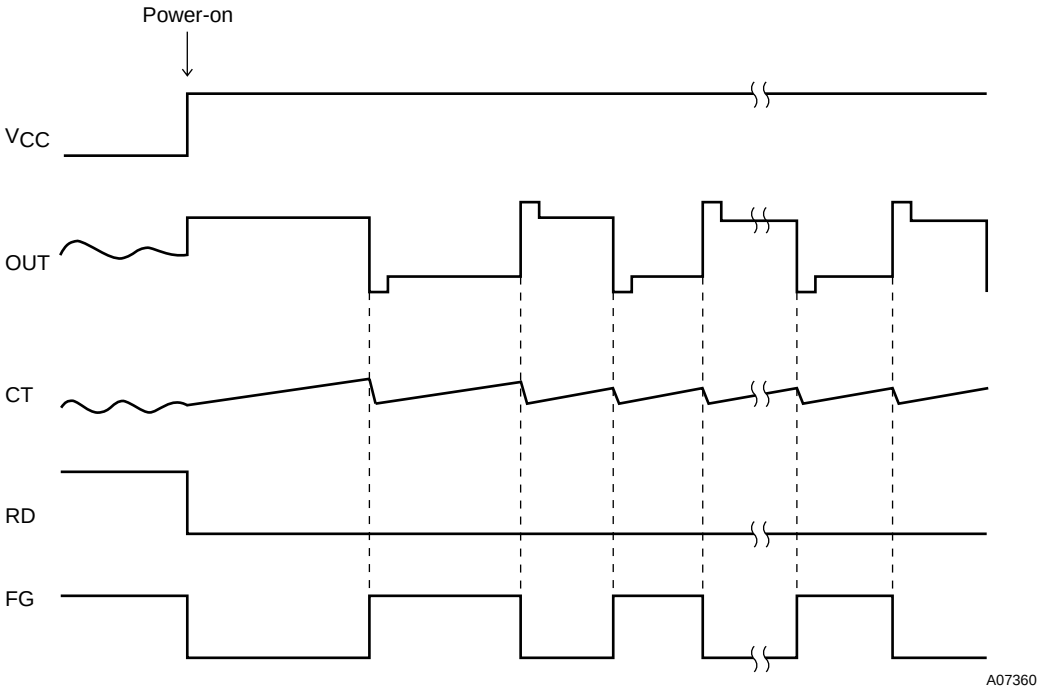
Block Diagram



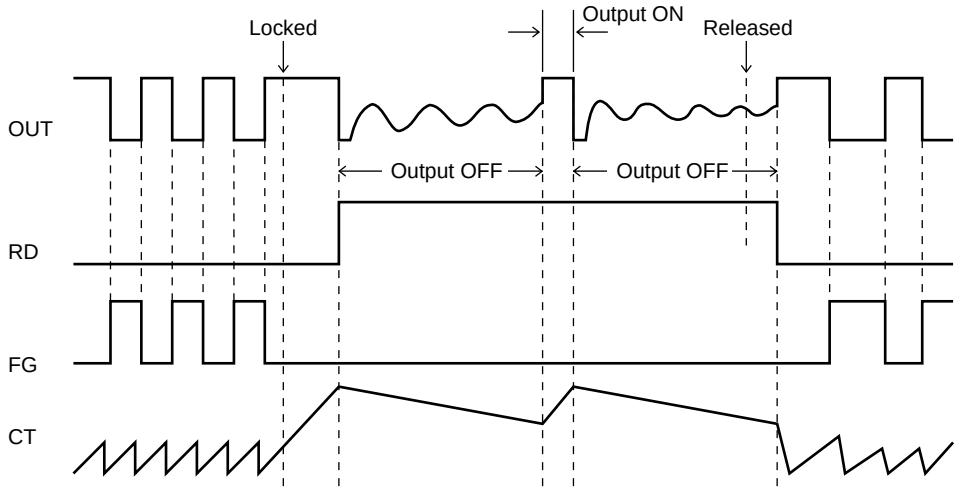
Sample Application Circuit



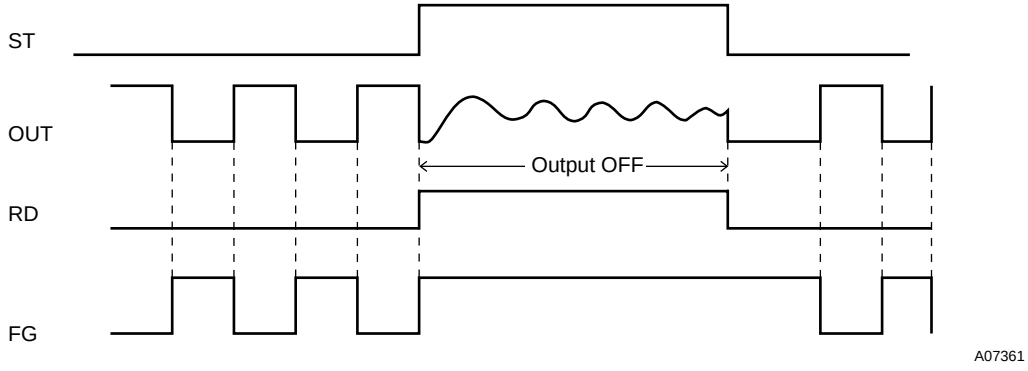
Startup



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 ±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 μF 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.

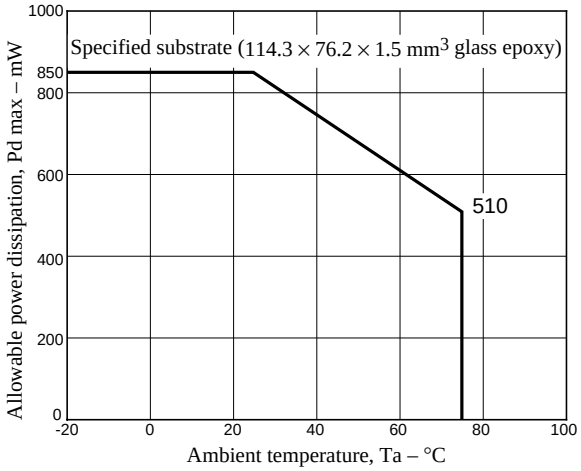
HB pin : Hall bias switching pin. At ST pin High input, Hall bias is switched to reduce current drain in fan standby mode.

If not used, both pins should be open.

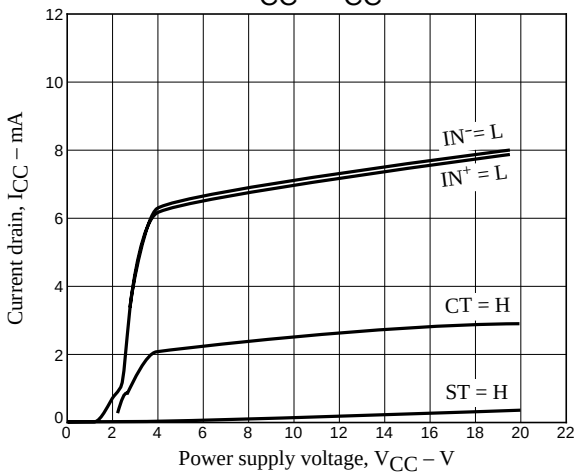
(8) Thermal protection circuit

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

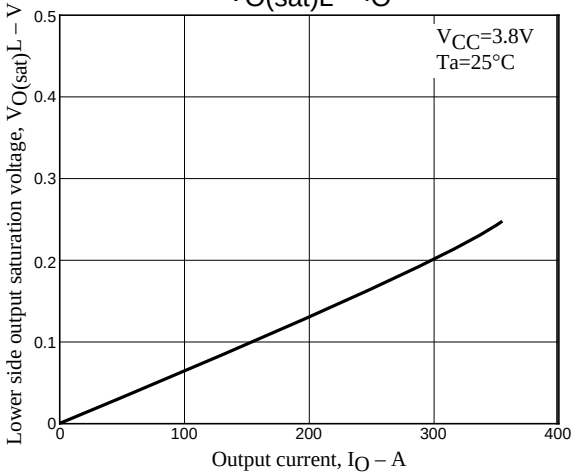
Pdmax – Ta



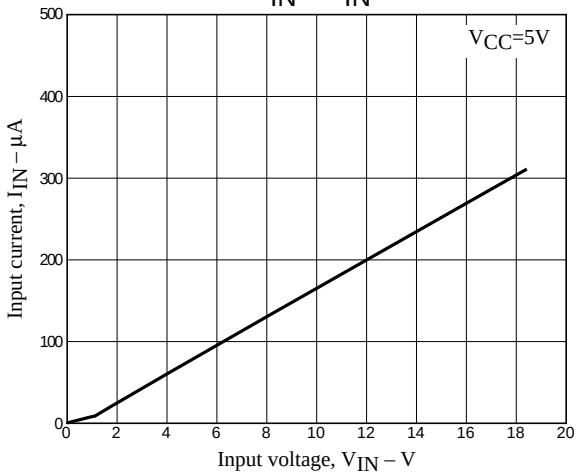
I_{CC} – V_{CC}



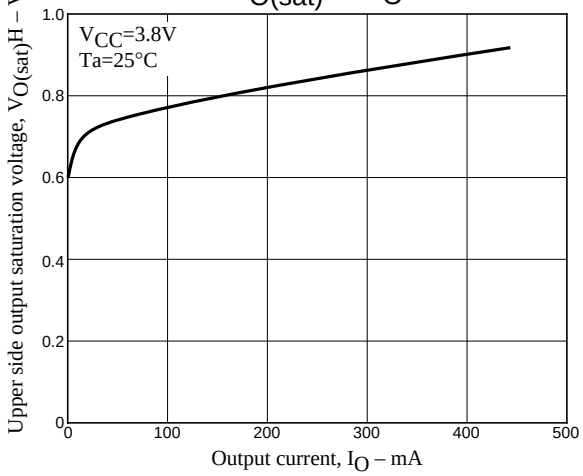
$V_{O(sat)L}$ – I_O



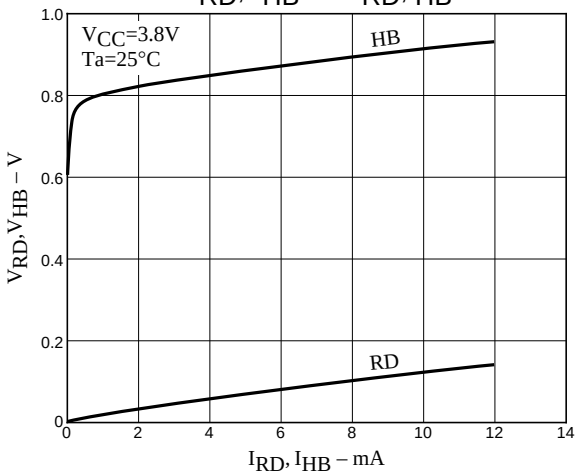
I_{IN} – V_{IN}



$V_{O(sat)H}$ – I_O



V_{RD},V_{HB} – I_{RD},I_{HB}



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