Ordering number : EN5657

Monolithic Digital IC

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.

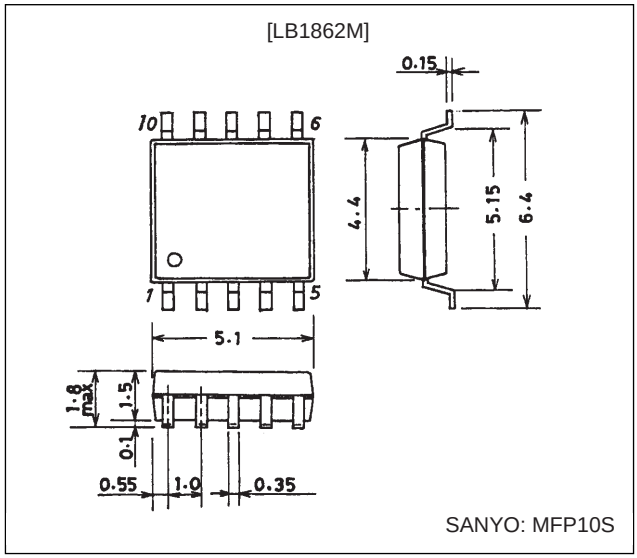
Functions

- 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

Package Dimensions

unit: mm

3086A-MFP10S



Specifications

Absolute Maximum Ratings at Ta = 25°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	Pd max	When mounted on the specified board *	850	mW
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–55 to +150	°C

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

Allowable Operating Ranges at Ta = 25°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

Electrical Characteristics at Ta = 25°C, V_{CC} = 5 V

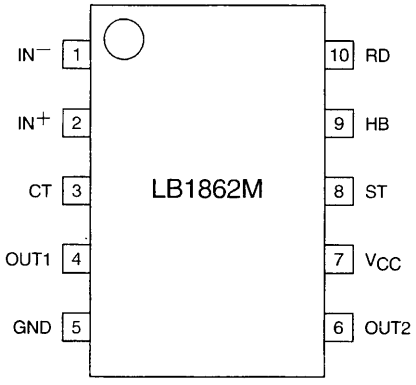
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC}	During drive operation (CT = low, ST = low)		6.5	9.1	mA
		During lock protection (CT = high, ST = low)		2.2	3.1	mA
		Standby mode (ST = high)		110	150	µA
Lock detection capacitor charge current	$I_{CT}1$		1.9	2.8	3.7	µA
Capacitor 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 the offset and hysteresis.)		7	15	mV
RD output pin low-level voltage	V_{RD}	I_{RD} = 5 mA		0.1	0.3	V
RD output pin leakage current	I_{RDL}	V_{RD} = 15 V			30	µA
HB output low-level voltage	V_{HBL}	I_{HB} = 5 mA		1.0	1.3	V
ST pin input current	I_{ST}	V_{ST} = 5 V		75	100	µA

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

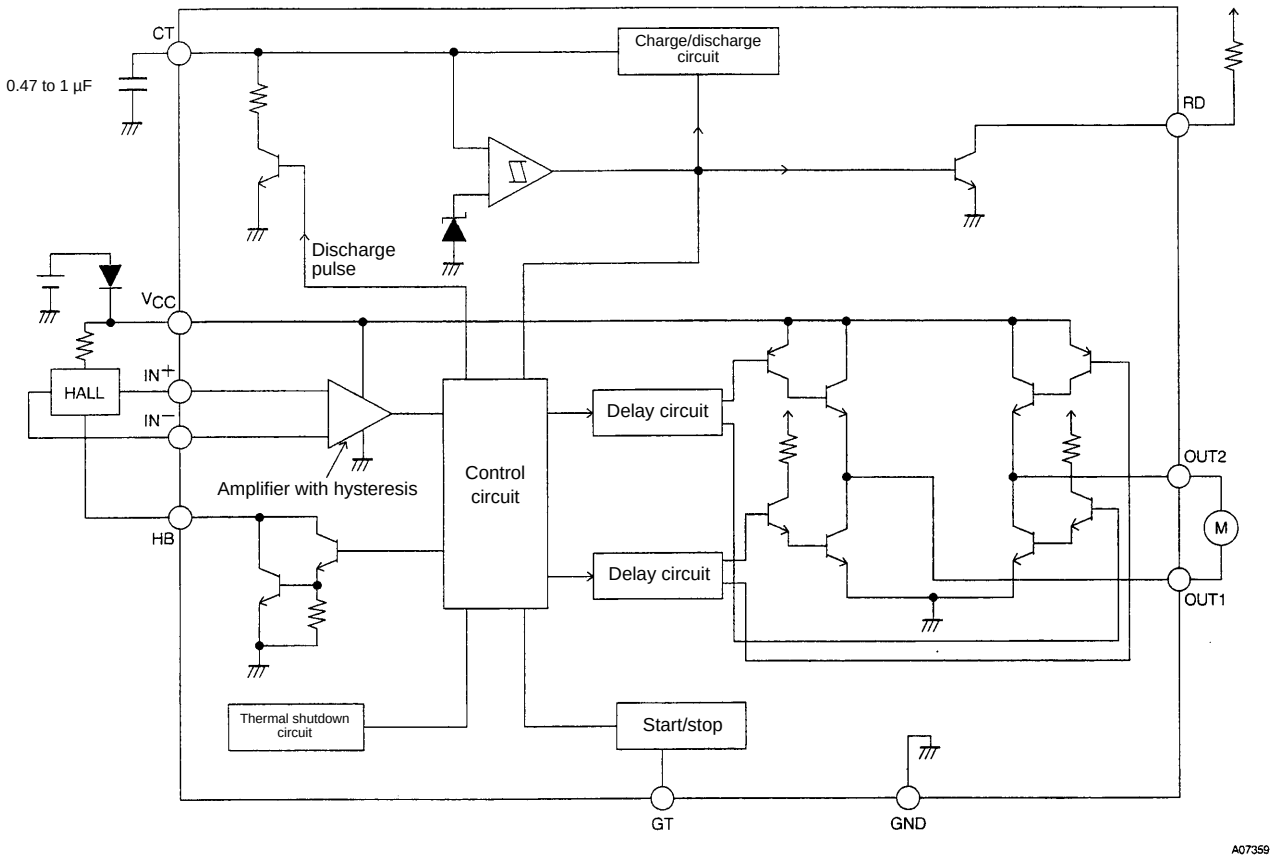
Pin Assignment



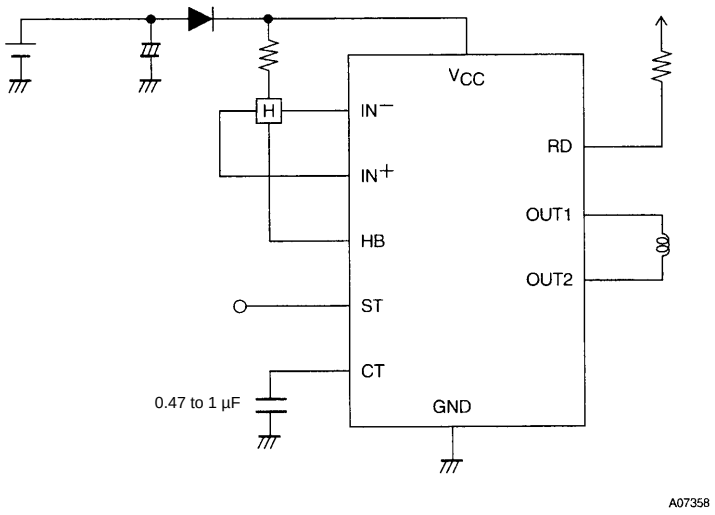
Top view

A07357

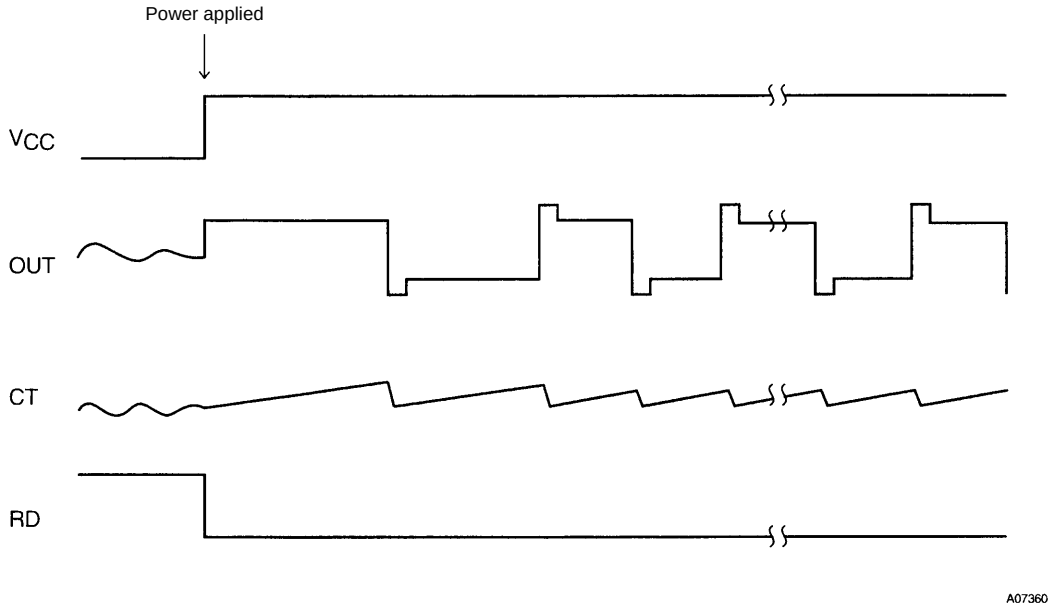
Block Diagram



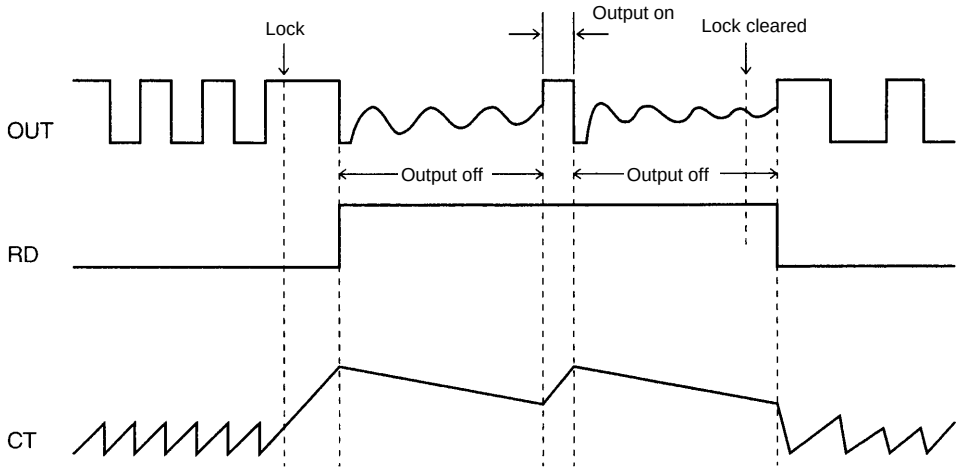
Sample Application Circuit



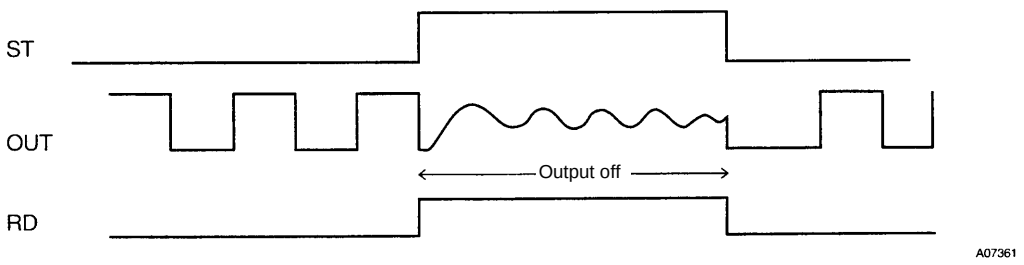
Startup



Lock Protection/Automatic Recovery



Start/Stop



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^- and IN^+ 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 ±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 µF 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 Tj = 180°C.