Ordering number : EN6208B

LB1862

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Monolithic Digital IC

For Fan Motor

Single-Phase Full-Wave Driver

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.

Functions

- 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
- 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		0.8	A
Maximum output withstand voltage	V_{OUT} max		17	V
RD maximum output withstand voltage	V_R max		17	V
RD maximum output current	I_R 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		1.0	W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Allowable Operating Conditions 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	V_{ICM}		0.2 to V_{CC}-1.5	V

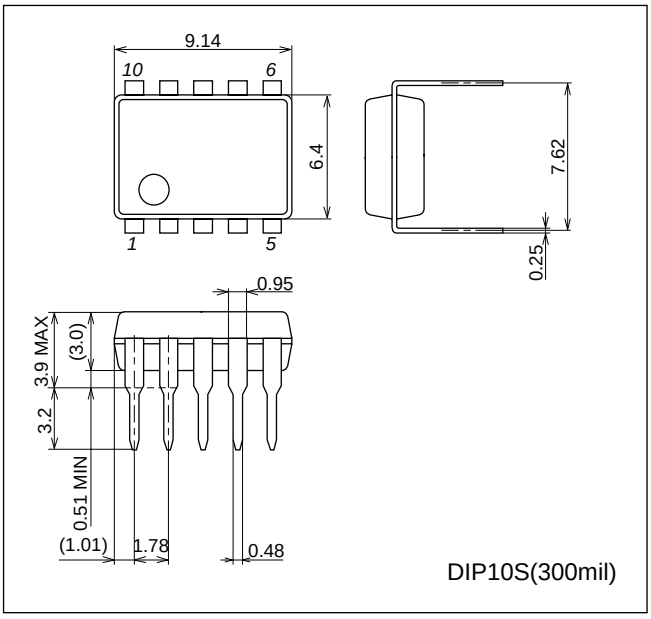
Electrical Characteristics at Ta = 25°C, V_{CC} = 5V

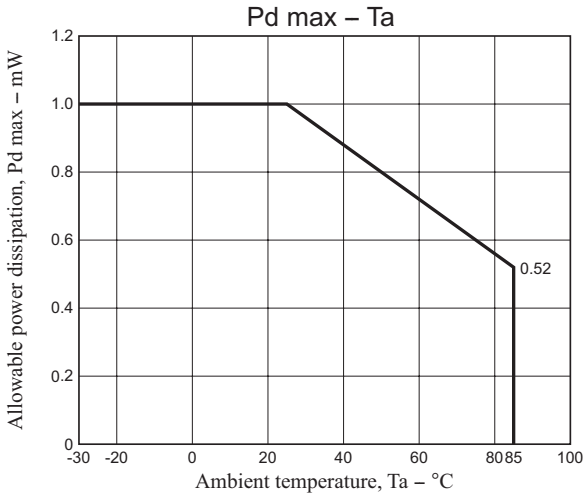
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC}	In drive mode (CT = "L", ST = "L")		6.5	9.1	mA
		In lockup protection mode (CT = "H", ST = "L")		2.2	3.1	mA
		In standby mode (ST = "H")		110	150	μA
Lockup detection capacitor charge current	$I_{CT}1$		1.9	2.8	3.7	μA
Capacitor discharge current	$I_{CT}2$		0.32	0.46	0.60	μA
Capacitor charge/discharge current ratio	R_{CT}	$R_{CT} = I_{CT}1/I_{CT}2$	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 = 200mA		0.2	0.3	V
Output High level voltage	V_{OH}	I_O = 200mA	3.9	4.1		V
Hall input sensitivity	V_{HN}	Zero peak value (Including offset and hysteresis)		7	15	mA
RD output pin Low voltage	V_{RD}	I_{RD} = 5mA		0.1	0.3	V
RD output pin leakage current	I_{RD}	V_{RD} = 15V			30	μA
HB output Low voltage	V_{HBL}	I_{HB} = 5mA		1.0	1.3	V
ST pin input current	I_{ST}	V_{ST} = 5V		75	100	μA

Package Dimensions

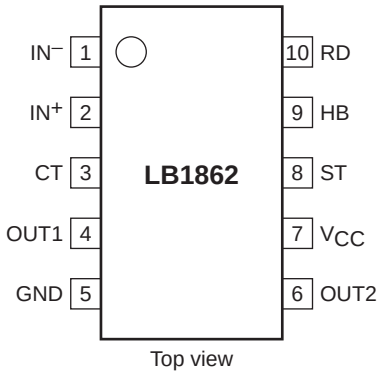
unit : mm (typ)

3098D



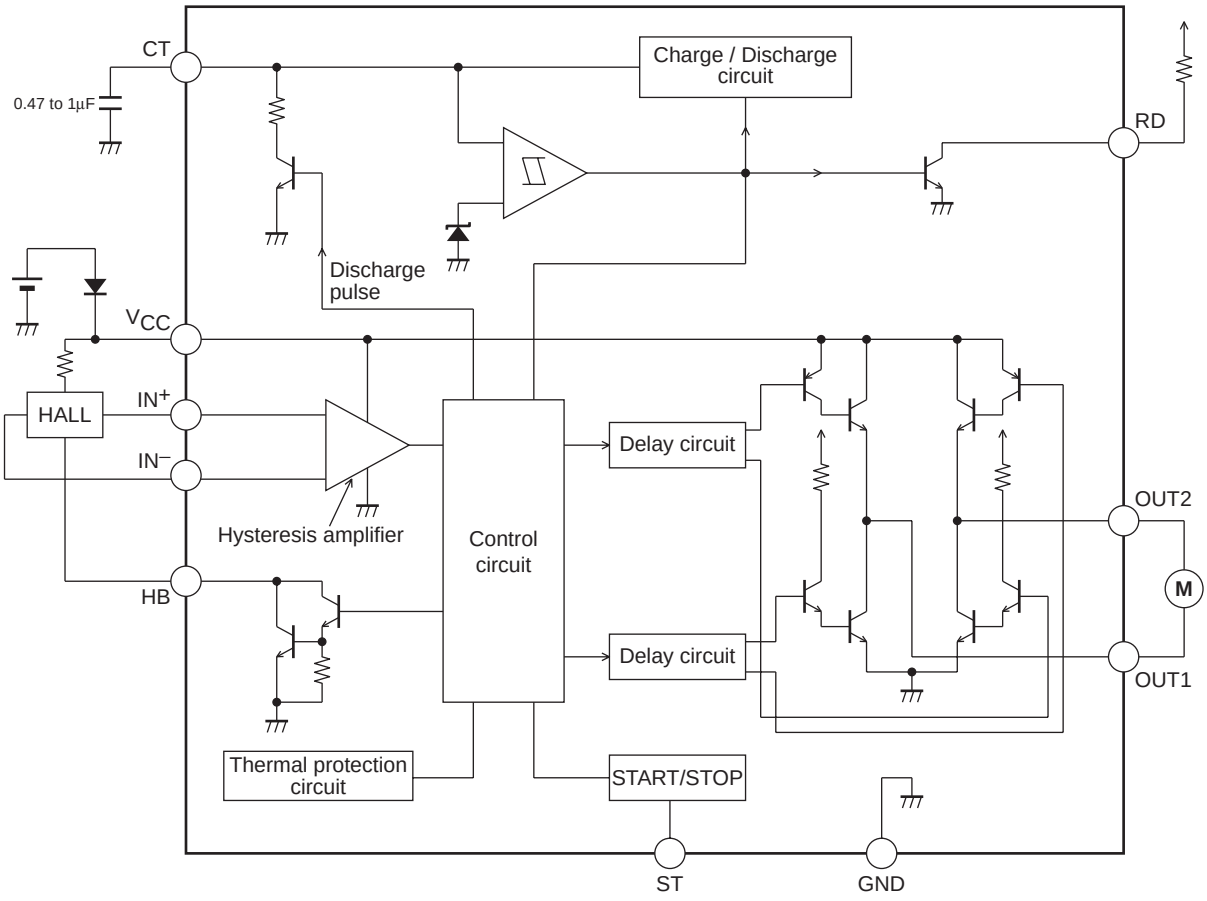


Pin Assignment



Top view

Block Diagram

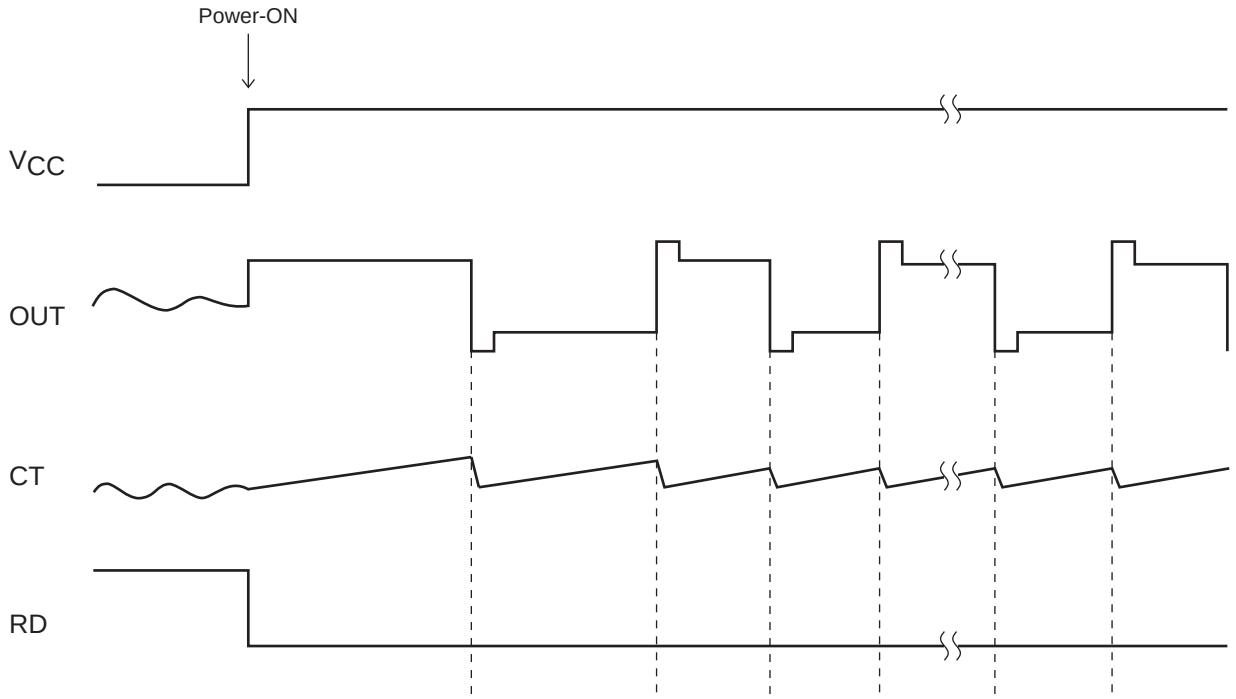


Truth Table

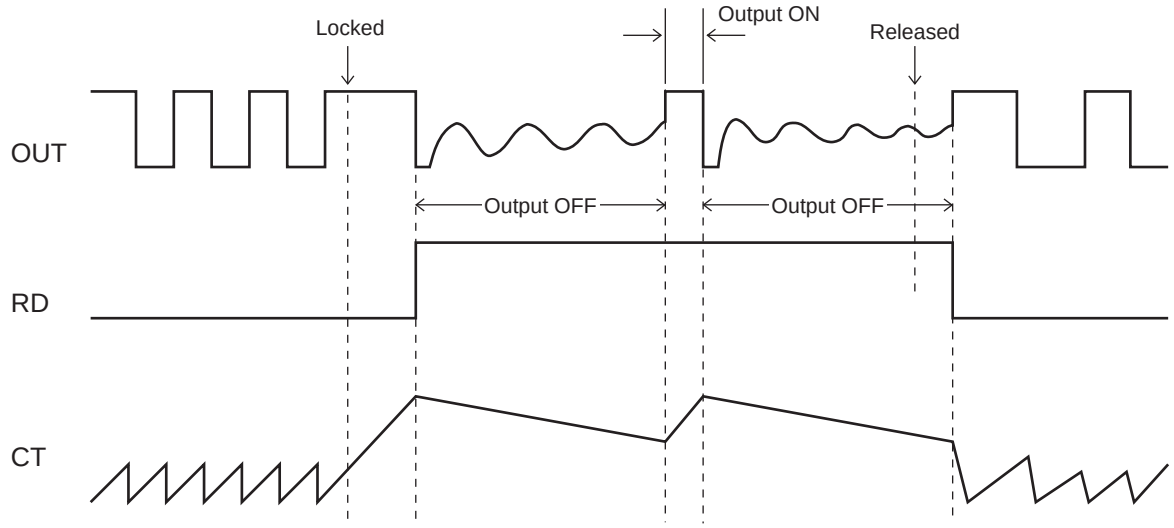
ST	IN-	IN+	CT	OUT1	OUT2	RD	HB	Mode
H	-	-	-	OFF	OFF	OFF	OFF	Standby
L	H	L	L	H	L	L	L	Rotating
	L	H		L	H			
	-	-	H	OFF	OFF	OFF	L	Lockup protection activated

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

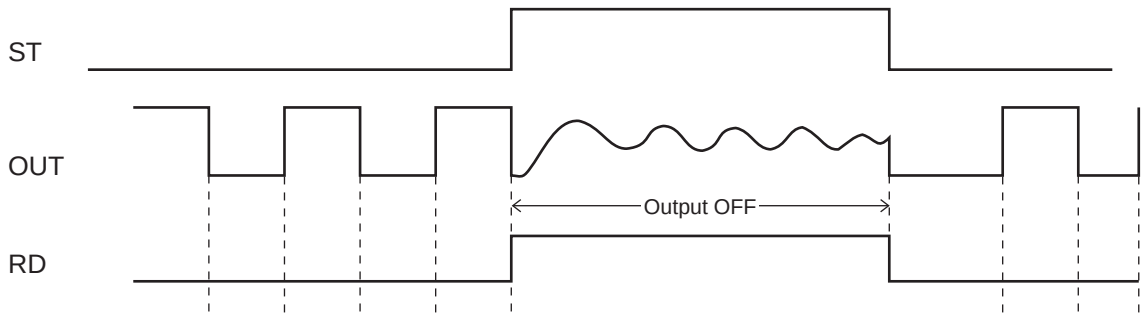
Startup



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 ±3.5mV (typ.).
The Hall input signal amplitude should be 70mV 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 mF 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

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.

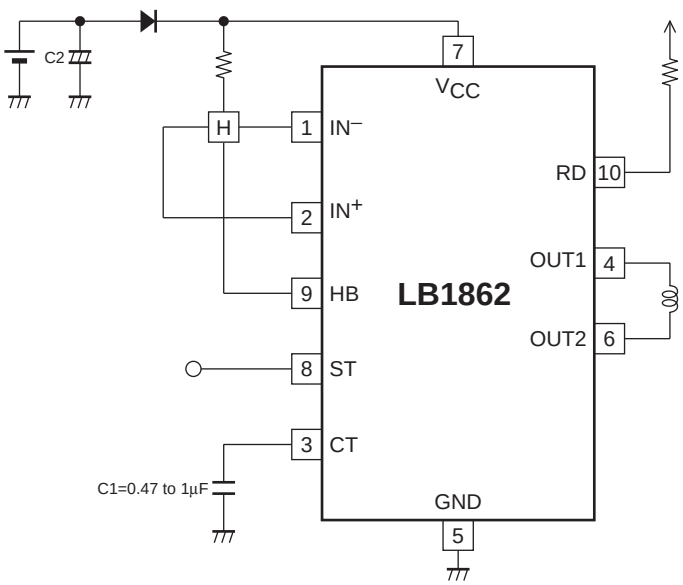
(6) ST pin and HB pin

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.

(7) Thermal protection circuit

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

Application Circuit Example



(1) D1 is used to prevent IC destruction caused by reverse-connection. It can be omitted if no problems are expected.
(2) C2 would not be required for the internal fan PCB but required for the power supply line in order to reduce the power line impedance and pass the regenerative current because a motor is basically an inductive load and it has a possibility of large current when the power is first applied or in other cases.
(3) When CT is not used, it should be connected to ground.
(4) When RD, ST, and HB are not used, they should be left open or connected to ground.