Ordering number : EN6208B

LB1862

ON Semiconductor®

Monolithic Digital IC
For Fan Motor

Single-Phase Full-Wave Driver

http://onsemi.com

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	٧
Maximum output current	I _{OUT} max		0.8	Α
Maximum output withstand voltage	V _{OUT} max		17	٧
RD maximum output withstand voltage	V _R max		17	٧
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	٧
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

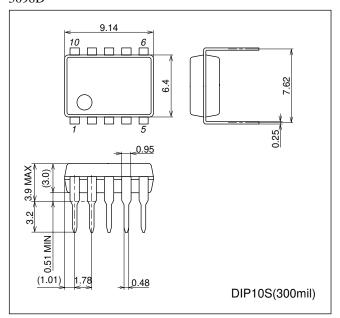
Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V _{CC}		3.8 to 16.8	V
ST input High level voltage	STH		3 to 14	V
ST input Low level voltage	STL		-0.3 to +0.4	٧
Hall input common mode voltage	VICM		0.2 to V _{CC} -1.5	V

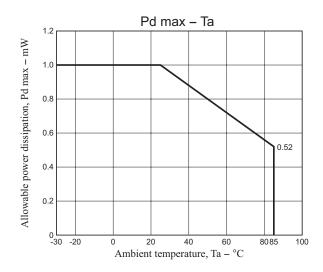
Electrical Characteristics at Ta = 25°C, $V_{CC} = 5V$

D	0	0	Ratings				
Parameter	Symbol	Conditions	min	typ	max	Unit	
Current drain	Icc	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	μΑ	
Lockup detection capacitor charge current	I _{CT} 1		1.9	2.8	3.7	μΑ	
Capacitor discharge current	I _{CT} 2		0.32	0.46	0.60	μΑ	
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	μΑ	
HB output Low voltage	V _{HBL}	I _{HB} = 5mA	_	1.0	1.3	٧	
ST pin input current	I _{ST}	V _{ST} = 5V		75	100	μΑ	

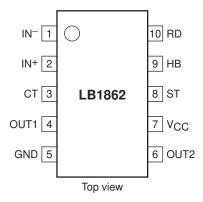
Package Dimensions

unit : mm (typ) 3098D

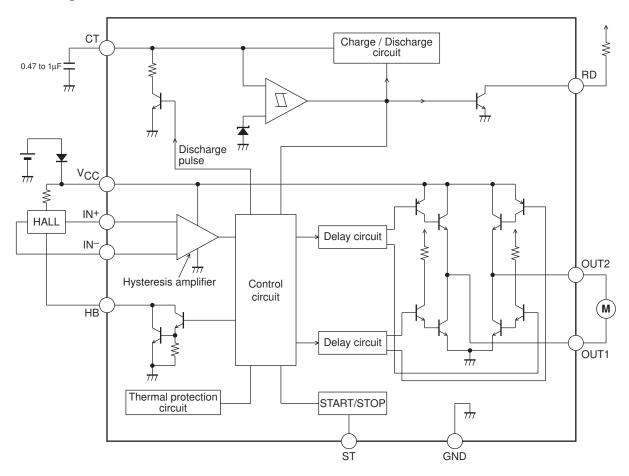




Pin Assignment



Block Diagram

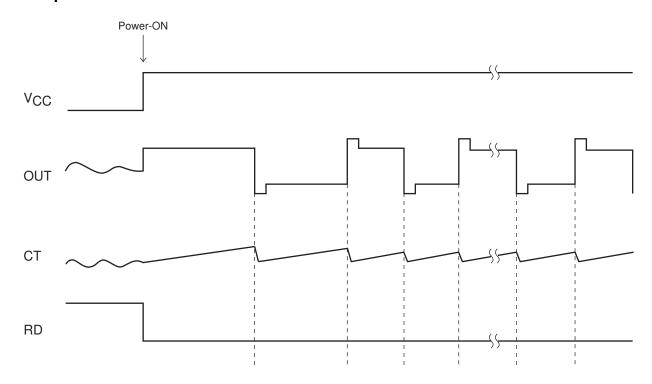


Truth Table

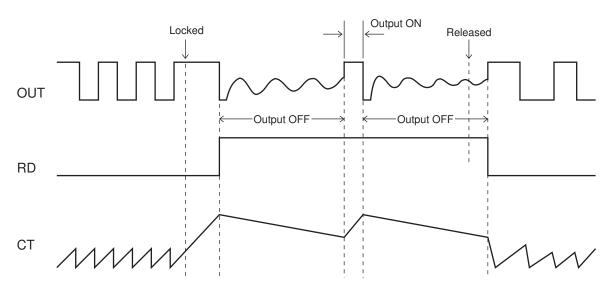
ST	IN-	IN+	CT	OUT1	OUT2	RD	НВ	Mode
Н	-	-	i	OFF	OFF	OFF	OFF	Standby
	Н	L	-	Н	L		L L	Rotating
L	L L	Н	L	L	Н	L		
	-	-	Н	OFF	OFF	OFF	L	Lockup protection activated

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

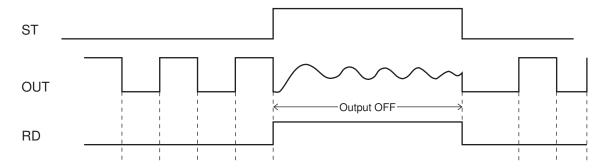
Startup



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 $\pm 3.5 \text{mV}$ (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 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.

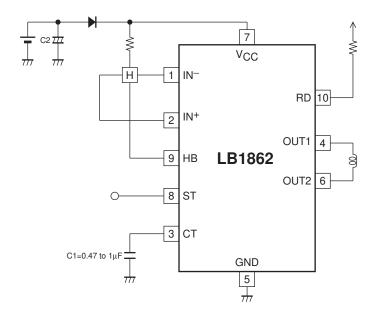
HB pin : Hall bias switching pin. At ST pin High input, Hall bias is switched to reduce current drain in fan standby mode.

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.

ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equa