Ordering number : ENN7118

Monolithic Digital IC

LB11988N

Fan Motor Driver for Refrigerator Fans

Overview

The LB11988N is a fan motor driver IC that is optimal for driving the fans used in refrigerators.

Functions

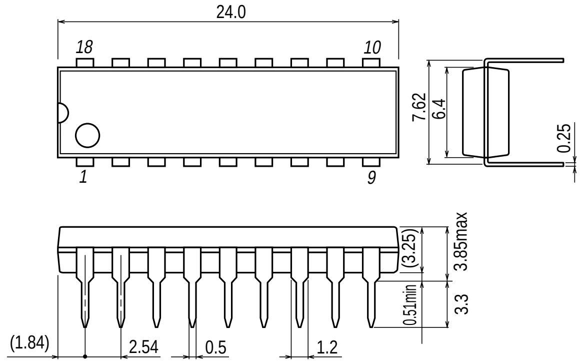
- Three-phase full-wave current linear drive
- Built-in current control circuit
- Output stage high side and low side saturation prevention circuit
- Forward/reverse direction setting circuit
- Built-in FG comparator
- Thermal shutdown circuit

Package Dimensions

unit: mm

3007B-DIP18 (300 mil)

[LB11988N]



SANYO: DIP18 (300 mil)

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		24	V
	V_S max		24	V
Maximum output current	I_O max		1.3	A
Allowable power dissipation	Pd max	Independent IC	1.13	W
Operating temperature	Topr		–30 to +75	°C
Storage temperature	Tstg		–55 to +150	°C

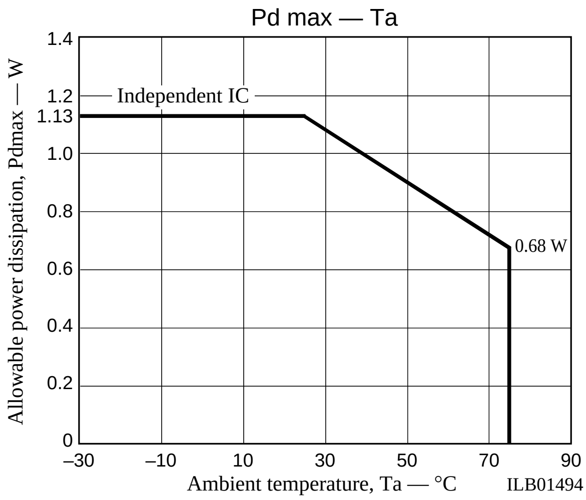
Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_S		5 to 22	V
	V_{CC}		7 to 22	
	V_S conditions		$V_S \leq V_{CC}$	
Hall input amplitude	V_{HALL}	Between the Hall inputs	±30 to ±80	mVo-p

Electrical Characteristics at Ta = 25°C, V_{CC} = 12 V, VS = 12 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
V_{CC} supply current	I_{CC}	V_S open		20	150	µA
[Outputs]						
Output saturation voltage	$V_O$sat1	I_O = 500 mA, Rf = 0.5 Ω, Sink + Source (with saturation prevention)		2.1	2.6	V
	$V_O$sat2	I_O = 1.0 A, Rf = 0 Ω, Sink + Source (with saturation prevention)		2.6	3.5	V
Output leakage current	$I_O$leak				1.0	mA
[Hall amplifier]						
Input offset voltage	Voff (HALL)		–6		+6	mV
Input bias current	Ib (HALL)	V_{IN}, W_{IN}		1	3	µA
Common-mode input voltage	Vcm (HALL)		3		V_{CC} – 3	V
[FR]						
Threshold voltage	VFRTH		1		2	V
Input bias current	Ib (FR)		–5			µA
[Current limiter]						
LIM pin current limiter level	ILIM	Rf = 0.5 Ω, with the Hall input logic state held fixed (U, V, W = H, H, L)		1		A
[Saturation]						
Saturation prevention circuit low side voltage setting	$V_O$sat (DET)	R_L = 560 Ω (Y), Rf = 0.5 Ω The voltage between each OUT/RF pair.		0.28		V
[FG comparator]						
Hysteresis	Vhys		±8	±18	±28	mV
Thermal shutdown circuit operating temperature	TTSD	Design target value*		170		°C

*: This is a design target value and is not measured.



Truth Table and Control Function

	Source → sink	Hall input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

Note: The "H" state for FR is defined as a voltage of 8 V or higher, and the "L" state for FR is defined as a voltage of 4 V or lower (when V_{CC} is 12 V).

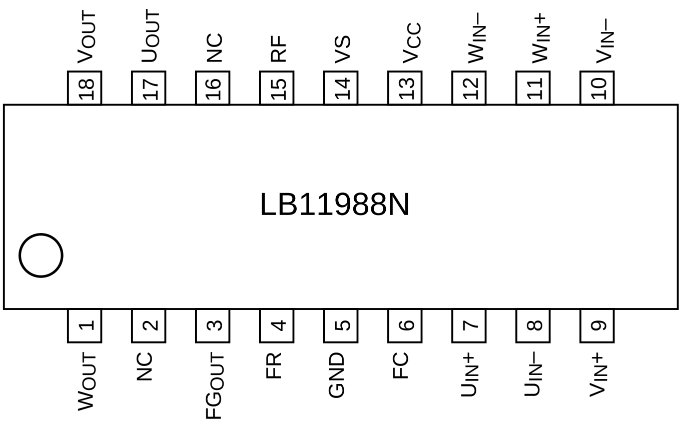
Note: For the Hall inputs, the input "H" state means the state in which the (+) input for that phase is at least 0.01 V higher than the (–) input for that phase. Similarly, the "L" state means the state in which the (+) input for that phase is at least 0.01 V lower than the (–) input for the that phase.

Note: Since this drive system adopts a 180° current application technique, phases other than the sink and source phase will not necessarily go to the off state.

Pin Functions

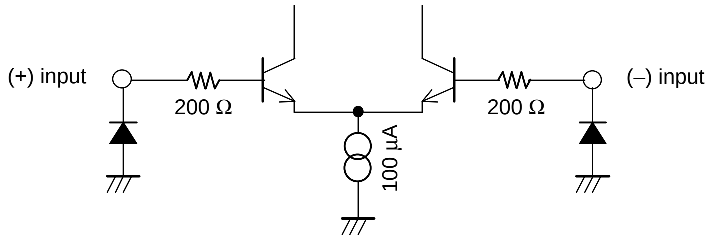
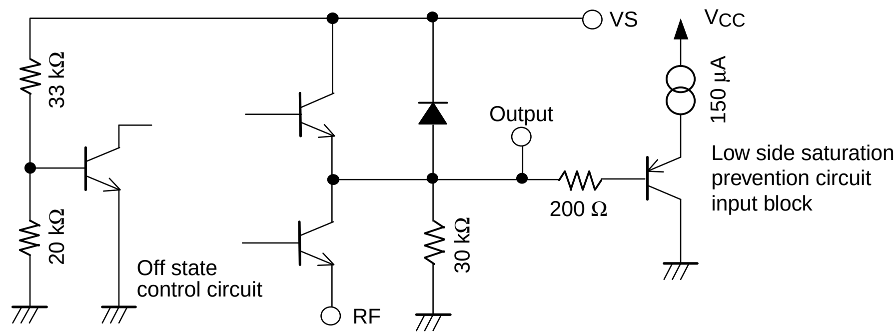
Pin	Pin No.	Pin function
GND	5	Ground for circuits other than the output transistors. The lowest potential of the output transistors will be that of the RF pin.
FG-OUT	3	FG comparator output
FR	4	Forward/reverse direction switching input
FC	6	Corrects the frequency characteristics of the saturation prevention circuit and the current limiter circuit.
$U_{IN}+$, $U_{IN}-$ $V_{IN}+$, $V_{IN}-$ $W_{IN}+$, $W_{IN}-$	7, 8 9, 10 11, 12	U phase Hall element input. The logic high level indicates the state IN+ > IN–. V phase Hall element input. The logic high level indicates the state IN+ > IN–. W phase Hall element input. The logic high level indicates the state IN+ > IN–.
V_{CC}	13	Power supply for IC internal circuits other than the output block. This voltage must be stabilized so that ripple and noise do not enter the IC.
V_S	14	Output block power supply
Rf	15	Output current detection. The current limiter circuit operates using the resistor Rf connected between this pin and ground. The lower side saturation prevention circuit operates according to the voltage that appears on this pin. Since the saturation prevention level is set with this voltage, the operation of the low side saturation prevention circuit will become less sensitive if the value of the resistor Rf is reduced excessively.
U_{OUT} V_{OUT} W_{OUT}	17 18 1	U phase output V phase output (Spark killer diodes are built in the output circuits.) W phase output

Pin Assignments



Top view

Pin I/O Equivalent Circuits

<table>
<tr><th>Pin</th><th>I/O equivalent circuit</th></tr>
<tr><td>U_{IN} (+)
U_{IN} (–)
V_{IN} (+)
V_{IN} (–)
W_{IN} (+)
W_{IN} (–)</td><td>
</td></tr>
<tr><td>U-OUT
V-OUT
W-OUT
RF
VS</td><td>
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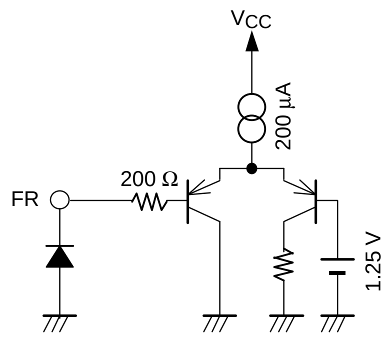
<tr><td>FR</td><td>
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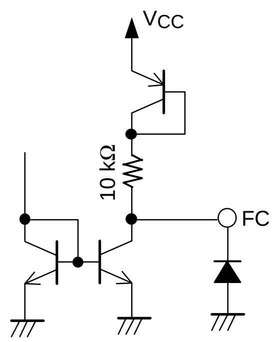
<tr><td>FC</td><td>
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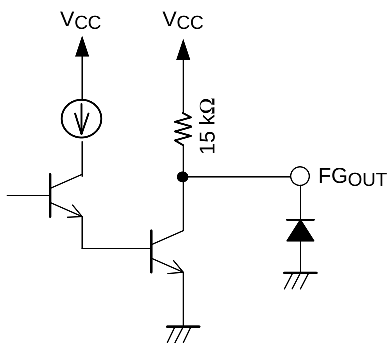
<tr><td>FG_{OUT}</td><td>
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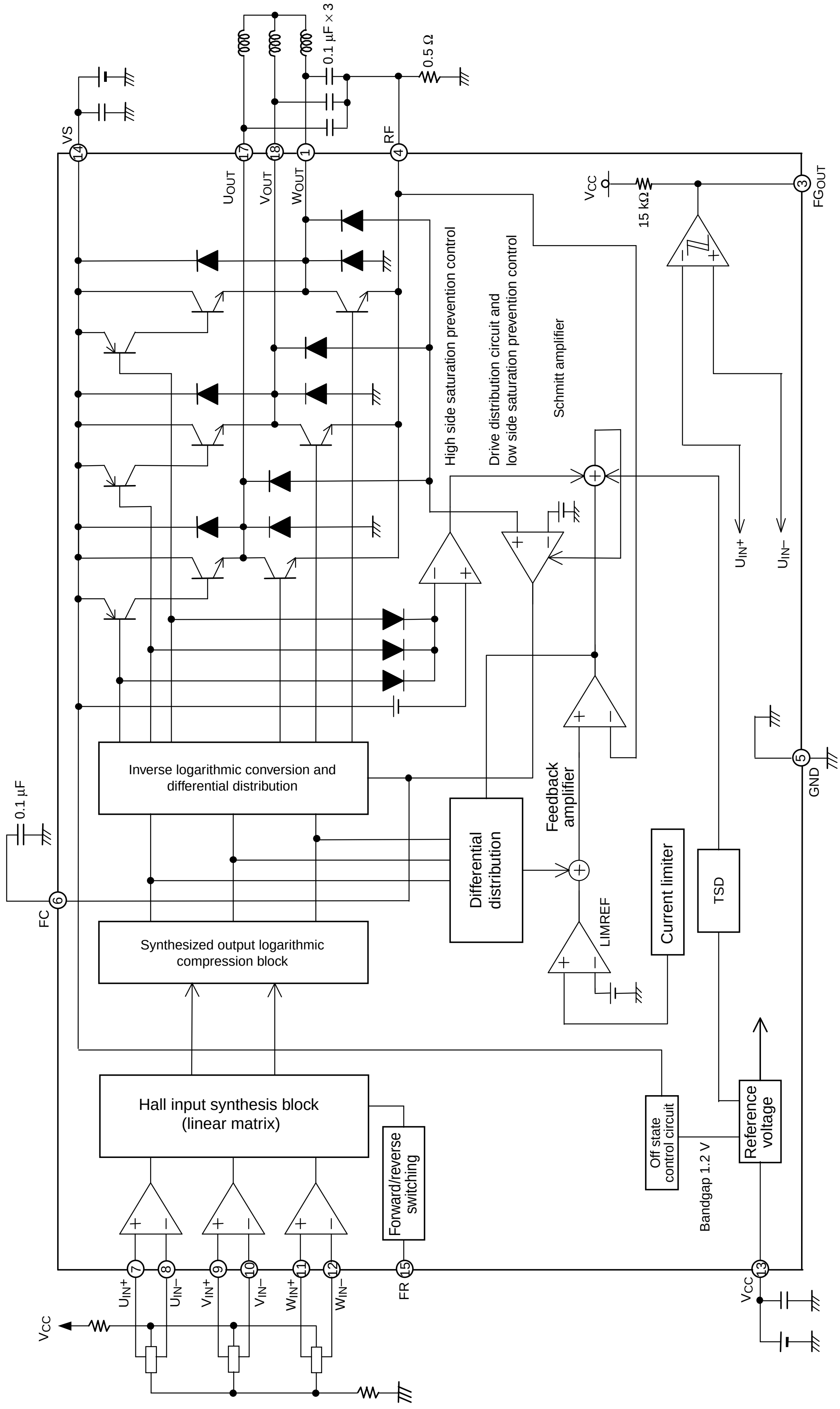
Block Diagram



This catalog provides information as of September, 2003. Specifications and information herein are subject to change without notice.