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LB11988D

Monolithic Digital IC Fan Motor Driver

Overview

The LB11988D is a 3-phase motor driver IC that is optimal for driving ventilation fan motors.

Features

- 3-Phase full-wave current-linear drive system.
- Current limiter circuit built in.
- Output stage upper/lower over-saturation prevention circuit built in.
- Forward/backward rotation direction setting circuit built in.
- FG amplifier built in.
- Thermal shutdown circuit built in.

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		24	V
	$V_S\text{ max}$		24	V
Maximum output current	$I_O\text{ max}$		1.3	A
Allowable power dissipation	$P_d\text{ max}$	Independent IC	2.0	W
Operating temperature range	T_{opr}		-30 to +75	$^\circ\text{C}$
Storage temperature range	T_{stg}		-55 to +150	$^\circ\text{C}$

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

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 Range at $T_a = 25^\circ\text{C}$

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

LB11988D

Electrical Characteristics at $T_a = 25^{\circ}\text{C}$, $V_{CC} = 12\text{V}$, $V_S = 12\text{V}$

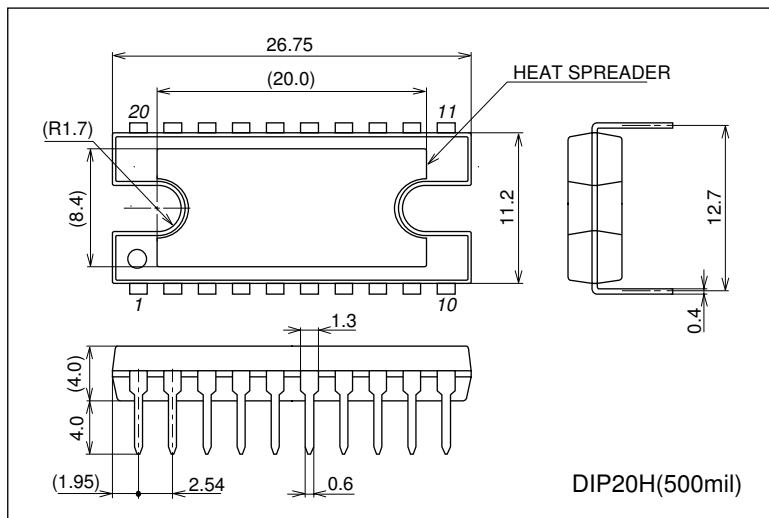
Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
V_{CC} supply current	I_{CC}	$R_L = 560\Omega$ (Y)		15	24	mA
Output						
Output saturation voltage	V_{Osat1}	$I_O = 500\text{mA}$, $R_f = 0.5\Omega$, Sink+Source (with saturation prevention)		2.1	2.6	V
	V_{Osat2}	$I_O = 1.0\text{A}$, $R_f = 0\Omega$, Sink+Source (with saturation prevention)		2.6	3.5	
Output leakage current	I_{Oleak}				1.0	mA
Hall amplifier						
Input offset voltage	$V_{off}(\text{HALL})$		-6		+6	mV
Input bias current	$I_b(\text{HALL})$	V_{IN} , W_{IN}		1	3	μA
Common-mode input voltage	$V_{cm}(\text{HALL})$		3		$V_{CC}-3$	V
FR						
Threshold voltage	V_{FRTH}		4		8	V
Input bias current	$I_b(\text{FR})$		-5			μA
Current limit						
LIM pin current limit level	I_{LIM}	$R_f = 0.5\Omega$, Hall input logic fixed (U, V, W = H, H, L)		1		A
Saturation						
Saturation prevention circuit lower set voltage	$V_{Osat}(\text{DET})$	$R_L = 560\Omega$ (Y), $R_f = 0.5\Omega$ Voltage between each OUT and RF		0.28		V
FG Amplifier						
Output "High" voltage	$V_{fgh}(\text{SH})$		11.8			V
Output "Low" voltage	$V_{fgl}(\text{SH})$				0.3	
Hysteresis width	V_{hys}			23		mV
TSD operating temperature	$TTSD$	Design target value*		170		$^{\circ}\text{C}$

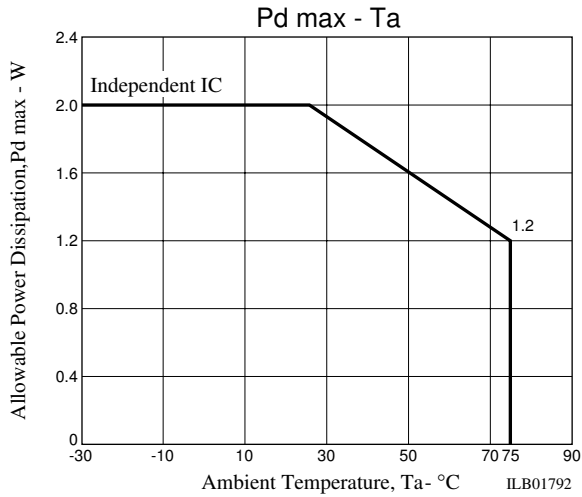
*: T-TSD is not measured because it stands for design target.

Package Dimensions

unit : mm

3037C





Truth Table and Control Function

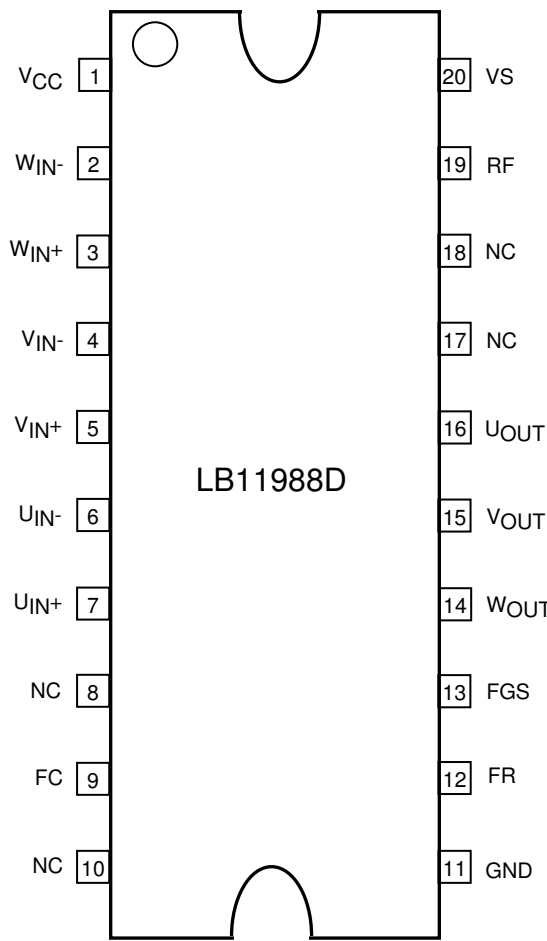
	Source → Sink	Hall Input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

Note: “H” in the FR column represents a voltage of 8V or more. “L” represents a voltage of 4V or less. (At V_{CC}=12V)

Note: “H” under the Hall Input columns represents a state in which “+” has a potential which is higher by 0.01V or more than that of the “-” phase inputs. Conversely “L” represents a state in which “+” has a potential which is lower by 0.01V or more than that of the “-” phase inputs.

Note: Since a 180° energized system is used as a drive system, other phases than the sink and source are not OFF.

Pin Assignment



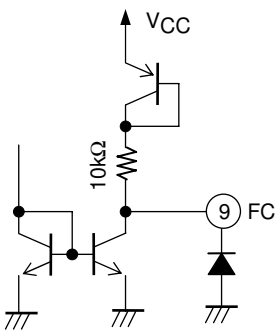
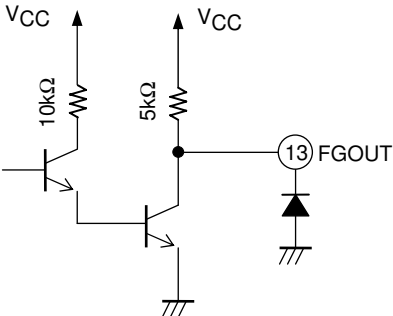
Top view

Pin Functions

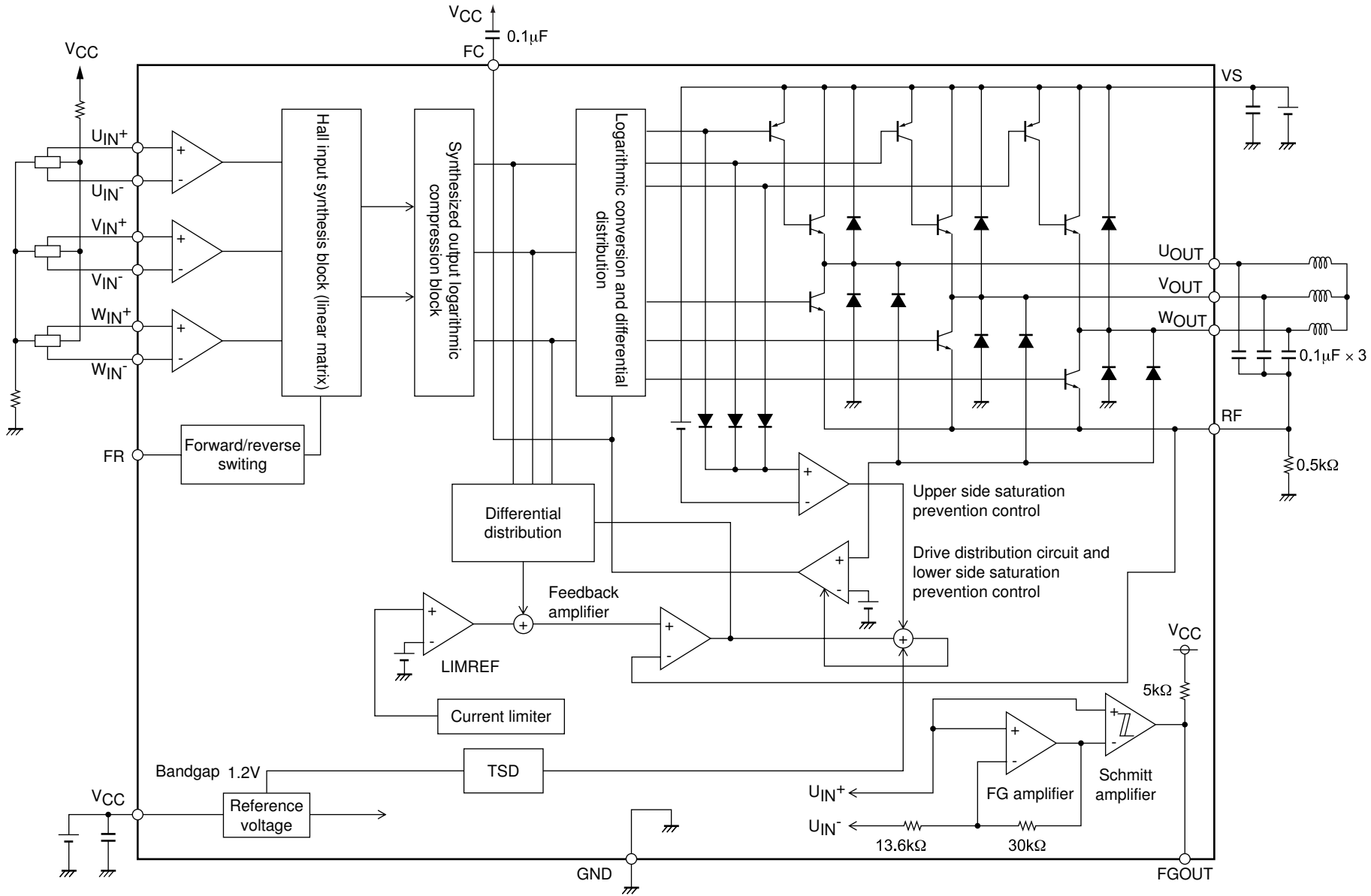
Pin Name	Pin No.	Input/Output Equivalent Circuit	Pin Functions
V _{CC}	1		Power supply pin for supplying power to all circuits except output section in IC; this voltage must be stabilized so as to eliminate ripple and noise.
GND	11		GND for others than the output transistor. Minimum potential of output transistor is at RF pin
U _{IN+} , U _{IN-}	7, 6		U-phase Hall device input pin; logic "H" presents IN+>IN-
V _{IN+} , V _{IN-}	5, 4		V-phase Hall device input pin; logic "H" presents IN+>IN-
W _{IN+} , W _{IN-}	3, 2		W-phase Hall device input pin; logic "H" presents IN+>IN-
U _{OUT} V _{OUT} W _{OUT}	16 15 14		U-phase output pin. V-phase output pin. W-phase output pin. (Built-in spark killer diode)
RF	19		Output current detection pin. Connecting Rf between this pin and GND activates current limiting circuit. Then the lower over-saturation prevention circuit is activated in accordance with this pin voltage. Since the over-saturation prevention level is set with this voltage, the lower over-saturation prevention effect may deteriorate in the high current range if the Rf value is reduced to an extremely low level.
VS	20		Power supply pin for supplying power to output section in IC.
FR	12		Forward/Reverse switching pin.

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Pin Name	Pin No.	Input/Output Equivalent Circuit	Pin Functions
FC	9		Frequency characteristics compensation pin for over-saturation prevention circuit loop.
FGS	13		FG amplifier output pin. Resistive load provided internally.

Block Diagram



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