



SANYO Semiconductors

DATA SHEET

LB11988 — Monolithic Digital IC For Refrigerator Fan Motor Driver

Overview

LB11988 is a Fan motor driver for refrigerator.

Functions

- Three-phase full-wave current linear drive
- Built-in current limiter circuit
- Built-in saturation prevention circuits in both the upper and lower sides of the output stage
- Forward/backward rotation direction setting circuit built in
- FG amplifier
- Thermal shutdown circuit

Specifications

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

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	P_d max	Independent IC	1.13	W
Operating temperature	T_{opr}		-30 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

Allowable Operating Ratings 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	V
Hall input amplitude	V_{HALL}	Between Hall inputs	± 30 to ± 80	mV _{o-p}

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LB11988

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

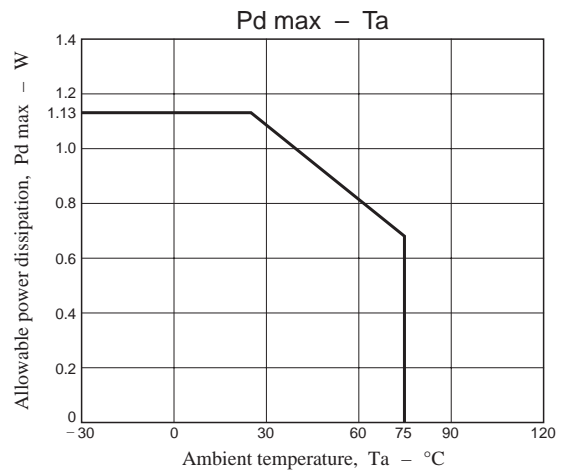
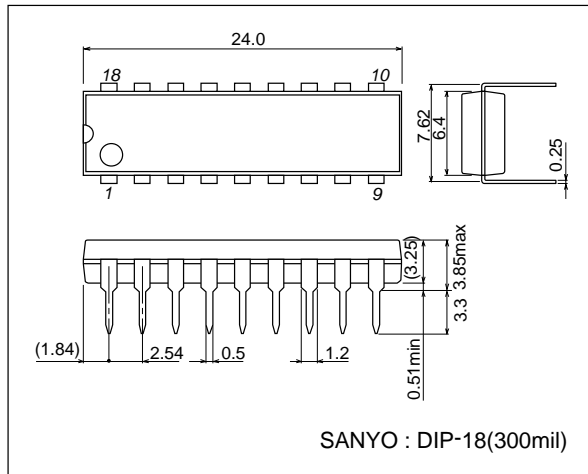
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
V_{CC} current drain	I_{CC}	$R_L = 560\Omega$ (Y)		15	24	mA
Output						
Output saturation voltage	$V_{O\text{sat}1}$	$I_O = 500\text{mA}$, $R_f = 0.5\Omega$, Sink + Source (Saturation prevention function included)		2.1	2.6	V
	$V_{O\text{sat}2}$	$I_O = 1.0\text{A}$, $R_f = 0.5\Omega$, Sink + Source (Saturation prevention function included)		2.6	3.5	V
Output leakage current	$I_{O\text{leak}}$				1.0	mA
Hall amplifier						
Input offset voltage	V_{off} (HALL)		-6		+6	mV
Input bias current	V_b (HALL)	V_{IN} , W_{IN}		1	3	μA
Common-mode input voltage	V_{cm} (HALL)		3		$V_{CC}-3$	V
FR						
Threshold voltage	V_{FRTH}		4		8	V
Input bias current	I_b (FR)		-5			μA
Current limiter						
LIM pin current limit level	I_{LIM}	$R_f = 0.5\Omega$, With the Hall input logic states fixed (U, V, W = high, high, low)		1		A
Saturation						
Saturation prevention circuit lower side voltage setting	$V_{O\text{sat}}$ (DET)	$R_L = 560\Omega$ (Y), $R_f = 0.5\Omega$, The voltage between each output and the corresponding R_f .		0.28		V
FG amplifier						
Upper side output saturation voltage	$V_{\text{sat}u}$ (SH)		11.8			V
Lower side output saturation voltage	$V_{\text{sat}d}$ (SH)				0.3	V
Hysteresis	V_{hys}			23		mV
TSD operating temperature	T-TSD	Design target value*		170		$^\circ\text{C}$

Note * : Items shown to be design target values in the conditions column are not measured.

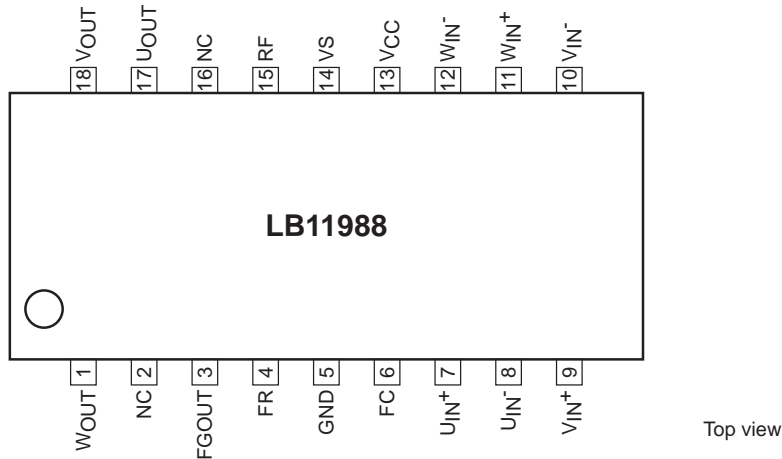
Package Dimensions

unit : mm (typ)

3007B



Pin Assignment



Truth Table and Control Functions

	Source→Sink	Hall input			W
		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 8V or higher, and the "L" state for FR is defined as a voltage of 4V or lower. (When V_{CC} = 12V.)

Note : For the Hall inputs, the input high state is defined to be the state where the (+) input is higher than the corresponding (-) input by 0.01V or higher, and the input low state is defined to be the state where the (+) input is lower than the corresponding (-) input by 0.01V or higher.

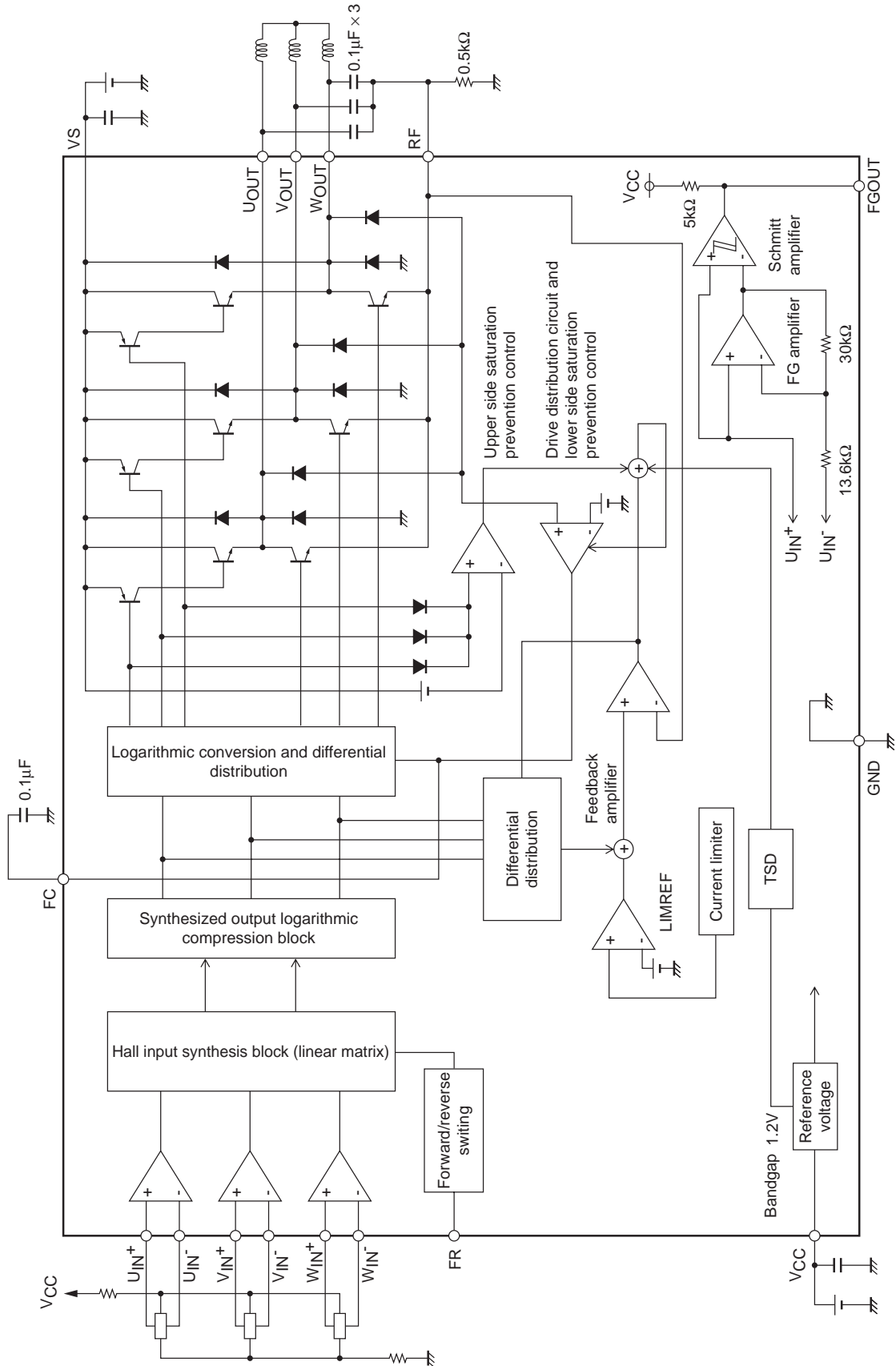
Note : Since this drive technique is a 180° current application scheme, the phases other than the sink and the source phases will not turn off.

Pin Functions

Pin No.	Pin name	Function
5	GND	Ground for circuits other than the output transistors. Note that the R _f pin will be at the lowest potential of the output transistors.
3	FGOUT	This is the FG amplifier output pin. Internally, it is a resistive load. (Pull up)
4	FR	Forward/reverse switching pin
6	FC	Corrects the frequency characteristics of the saturation prevention circuit loop and current limiter circuit.
7, 8	U _{IN} ⁺ , U _{IN} ⁻	U-phase Hall input. Logic high refers to the state where IN ⁺ > IN ⁻ .
9, 10	V _{IN} ⁺ , V _{IN} ⁻	V-phase Hall input. Logic high refers to the state where IN ⁺ > IN ⁻ .
11, 12	W _{IN} ⁺ , W _{IN} ⁻	W-phase Hall input. Logic high refers to the state where IN ⁺ > IN ⁻ .
13	V _{CC}	Power supply provided to all IC internal circuits other than the output block. This voltage must be stabilized so that ripple and noise do not enter the IC.
14	V _S	Output block power supply
15	R _f	Used for output current detection. The current limiter circuit operates using the resistor (R _f) connected between this pin and ground. Note that the lower side saturation prevention circuit operates according to the voltage that appears on this pin. Since the over-saturation level is set by this voltage, the level of the lower side saturation prevention circuit may be degraded in the large current region if the value of R _f is made extremely small.
17	U _{OUT}	U-phase Hall output.
18	V _{OUT}	V-phase Hall output.
1	W _{OUT}	W-phase Hall output.

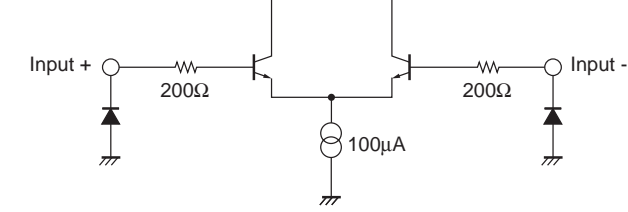
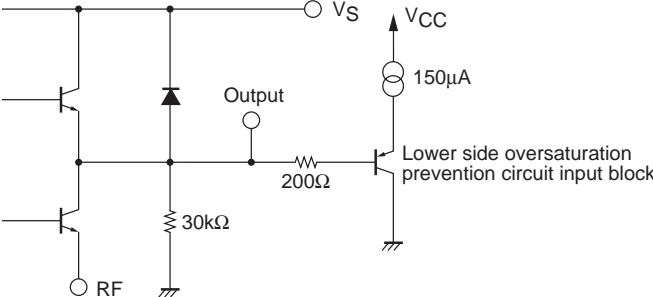
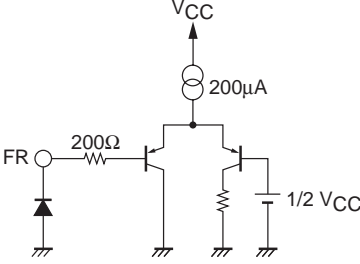
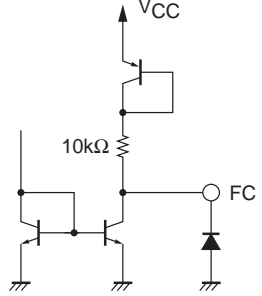
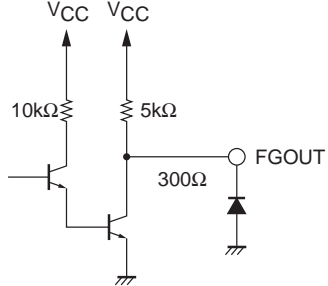
(These pins include internal spark killer diodes.)

Block Diagram



LB11988

Equivalent Circuit

Pin name	Equivalent circuit
U_{IN}^+ U_{IN}^- V_{IN}^+ V_{IN}^- W_{IN}^+ W_{IN}^-	
U_{OUT} V_{OUT} W_{OUT} R_f V_S	
FR	
FC	
FGOUT	

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