Ordering number : EN6211A

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 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 Ratings at Ta = 25°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	mVo-p

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

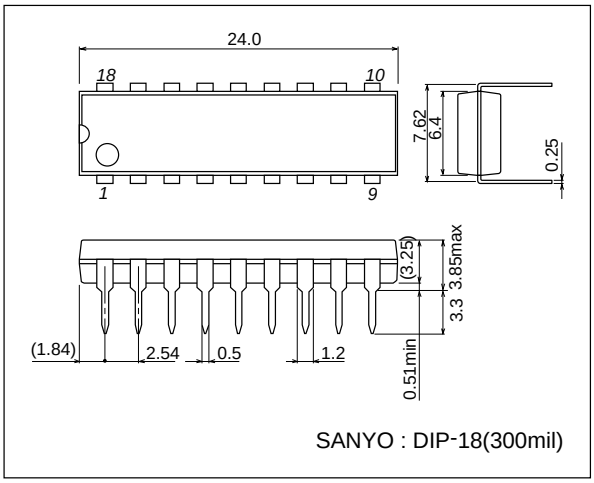
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
V_{CC} current drain	I_{CC}	R_L = 560Ω (Y)		15	24	mA
Output						
Output saturation voltage	$V_O$sat1	I_O = 500mA, Rf = 0.5Ω, Sink + Source (Saturation prevention function included)		2.1	2.6	V
	$V_O$sat2	I_O = 1.0A, Rf = 0.5Ω, Sink + Source (Saturation prevention function included)		2.6	3.5	V
Output leakage current	$I_O$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	Ib (FR)		-5			µA
Current limiter						
LIM pin current limit level	I_{LIM}	Rf = 0.5Ω, With the Hall input logic states fixed (U, V, W = high, high, low)		1		A
Saturation						
Saturation prevention circuit lower side voltage setting	$V_O$sat (DET)	RL = 560Ω (Y), Rf = 0.5Ω, The voltage between each output and the corresponding Rf.		0.28		V
FG amplifier						
Upper side output saturation voltage	Vsatu (SH)		11.8			V
Lower side output saturation voltage	Vsatd (SH)				0.3	V
Hysteresis	Vhys			23		mV
TSD operating temperature	T-TSD	Design target value*		170		°C

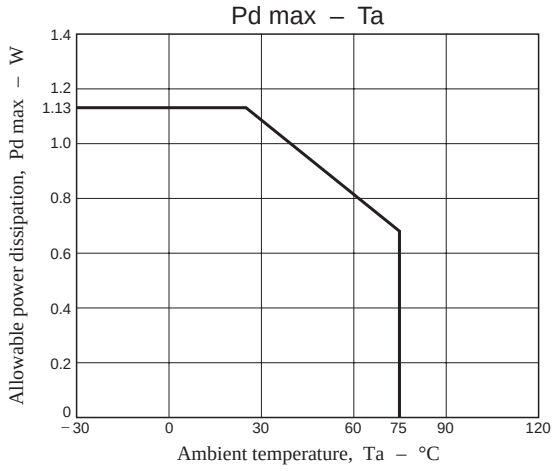
Note * : Items shown to be design target values in the conditions column are not measured.

Package Dimensions

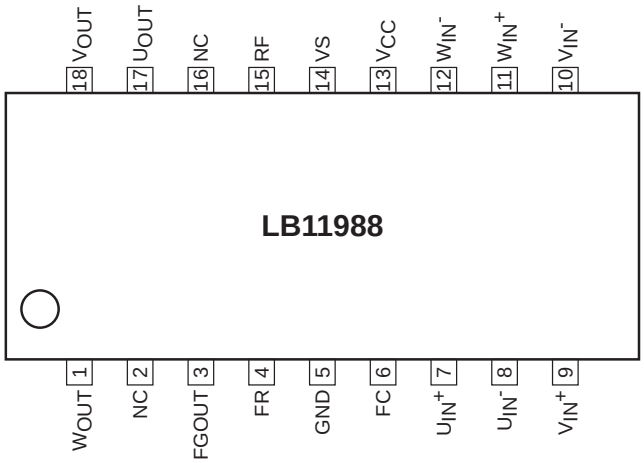
unit : mm (typ)

3007B





Pin Assignment



Top view

Truth Table and Control Functions

	Source→Sink	Hall input			
		U	V	W	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.)

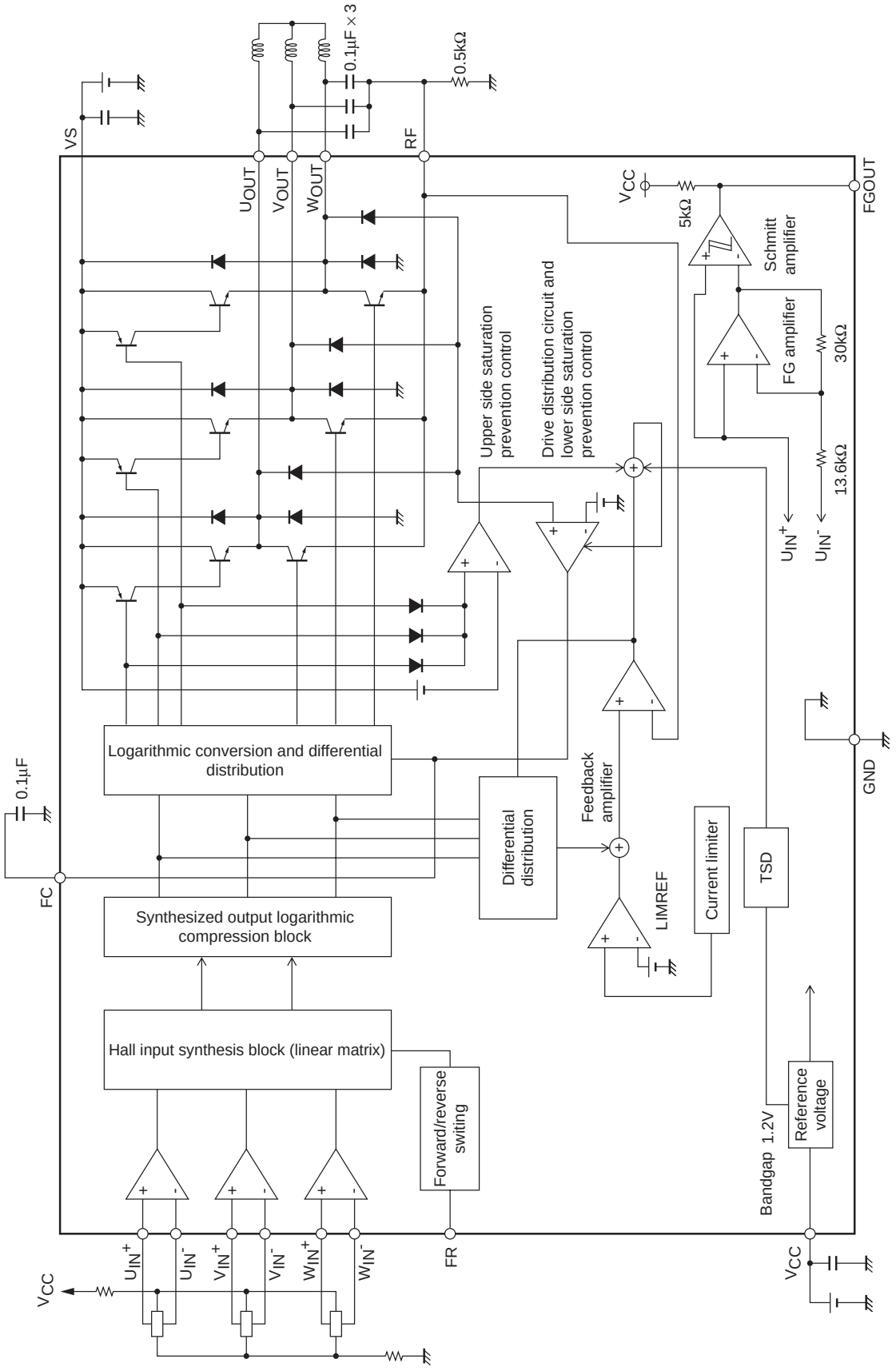
Note : For the Hall inputs, the input high state is defined to be the state where the (+) input is higher than the corresponding (-) input by 0.01V or higher, and the input low state is defined to be the state where the (+) input is lower than the corresponding (-) input by 0.01V or higher.

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.

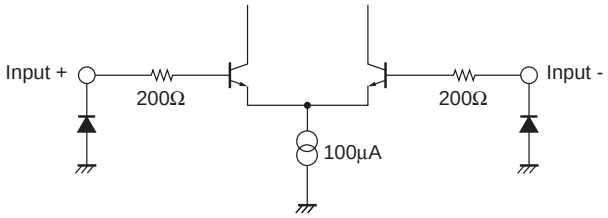
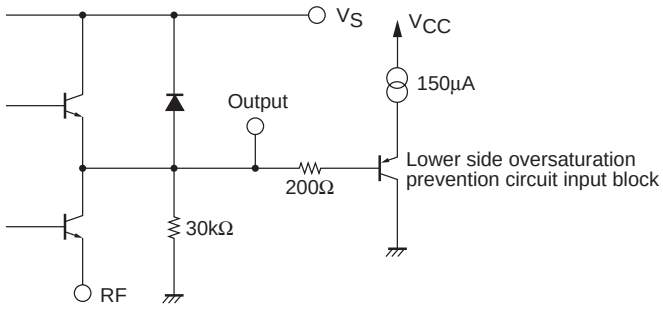
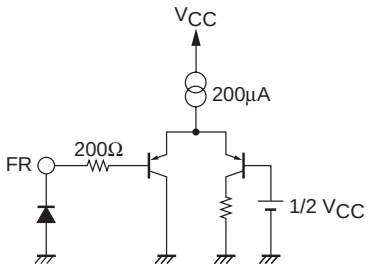
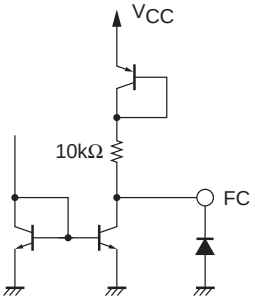
Pin Functions

Pin No.	Pin name	Function
5	GND	Ground for circuits other than the output transistors. Note that the Rf 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 9, 10 11, 12	U_{IN}^+, U_{IN}^- V_{IN}^+, V_{IN}^- W_{IN}^+, W_{IN}^-	U-phase Hall input. Logic high refers to the state where $IN^+ > IN^-$. V-phase Hall input. Logic high refers to the state where $IN^+ > IN^-$. 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	Rf	Used for output current detection. The current limiter circuit operates using the resistor (Rf) 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 Rf is made extremely small.
17 18 1	U_{OUT} V_{OUT} W_{OUT}	U-phase Hall output. V-phase Hall output. W-phase Hall output. (These pins include internal spark killer diodes.)

Block Diagram



Equivalent Circuit

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