

SANYO**LB11988N****Fan Motor Driver for Refrigerator Fans****Overview**

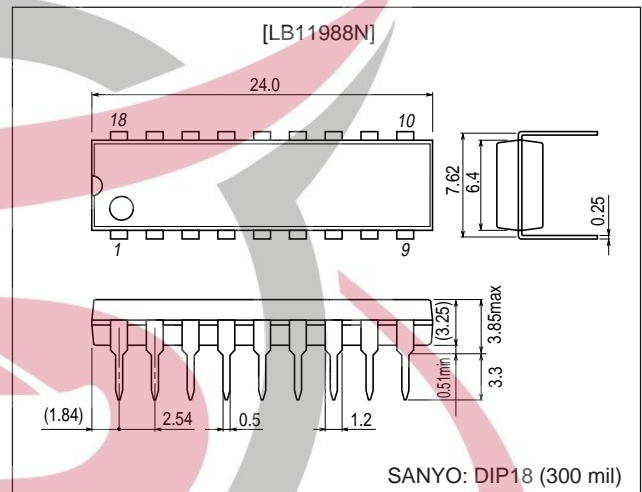
The LB11988N is a fan motor driver IC that is optimal for driving the fans used in refrigerators.

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)**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	P _d max	Independent IC	1.13	W
Operating temperature	T _{opr}		-30 to +75	°C
Storage temperature	T _{stg}		-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 ≤ V _{CC}	
Hall input amplitude	V _{HALL}	Between the Hall inputs	±30 to ±80	mVo-p

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co.,Ltd. Semiconductor Company

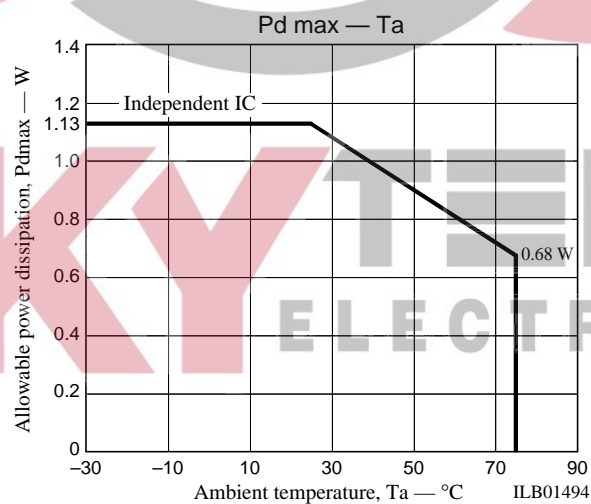
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

90503TN (OT) No. 7118-1/6

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}	V_S open		20	150	μA
[Outputs]						
Output saturation voltage	$V_{O\text{sat}1}$	$I_O = 500\text{ mA}$, $R_f = 0.5\ \Omega$, Sink + Source (with saturation prevention)		2.1	2.6	V
	$V_{O\text{sat}2}$	$I_O = 1.0\text{ A}$, $R_f = 0\ \Omega$, Sink + Source (with saturation prevention)		2.6	3.5	V
Output leakage current	$I_{O\text{leak}}$				1.0	mA
[Hall amplifier]						
Input offset voltage	$V_{\text{off}}(\text{HALL})$		-6		+6	mV
Input bias current	$I_b(\text{HALL})$	$V_{\text{IN}}, W_{\text{IN}}$		1	3	μA
Common-mode input voltage	$V_{\text{cm}}(\text{HALL})$		3		$V_{CC} - 3$	V
[FR]						
Threshold voltage	V_{FRTH}		1		2	V
Input bias current	$I_b(\text{FR})$		-5			μA
[Current limiter]						
LIM pin current limiter level	I_{LIM}	$R_f = 0.5\ \Omega$, with the Hall input logic state held fixed (U, V, W = H, H, L)		1		A
[Saturation]						
Saturation prevention circuit low side voltage setting	$V_{O\text{sat}}(\text{DET})$	$R_L = 560\ \Omega$ (Y), $R_f = 0.5\ \Omega$ The voltage between each OUT/RF pair.		0.28		V
[FG comparator]						
Hysteresis	V_{hys}		± 8	± 18	± 28	mV
Thermal shutdown circuit operating temperature	T_{TSD}	Design target value*		170		$^\circ\text{C}$

*: 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).

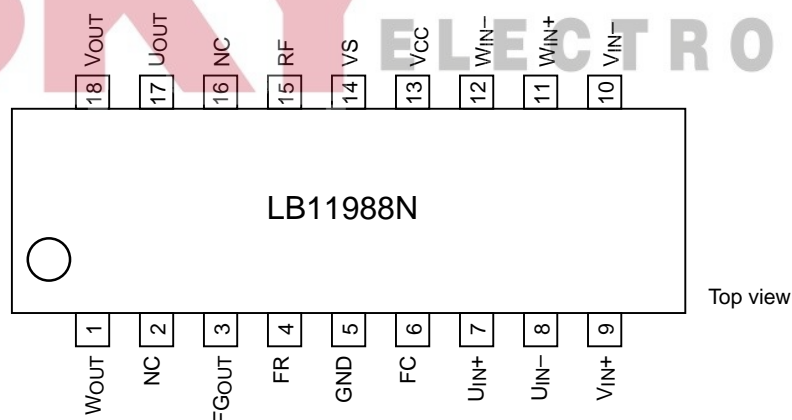
Note: For the Hall inputs, the input "H" state means the state in which the (+) input for that phase is at least 0.01 V higher than the (–) input for that phase. Similarly, the "L" state means the state in which the (+) input for that phase is at least 0.01 V lower than the (–) input for that phase.

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-}	7, 8	U phase Hall element input. The logic high level indicates the state $IN+ > IN-$.
V_{IN+} , V_{IN-}	9, 10	V phase Hall element input. The logic high level indicates the state $IN+ > IN-$.
W_{IN+} , W_{IN-}	11, 12	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 R_f 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 R_f is reduced excessively.
U_{OUT} V_{OUT} W_{OUT}	17 18 1	U phase output V phase output W phase output (Spark killer diodes are built in the output circuits.)

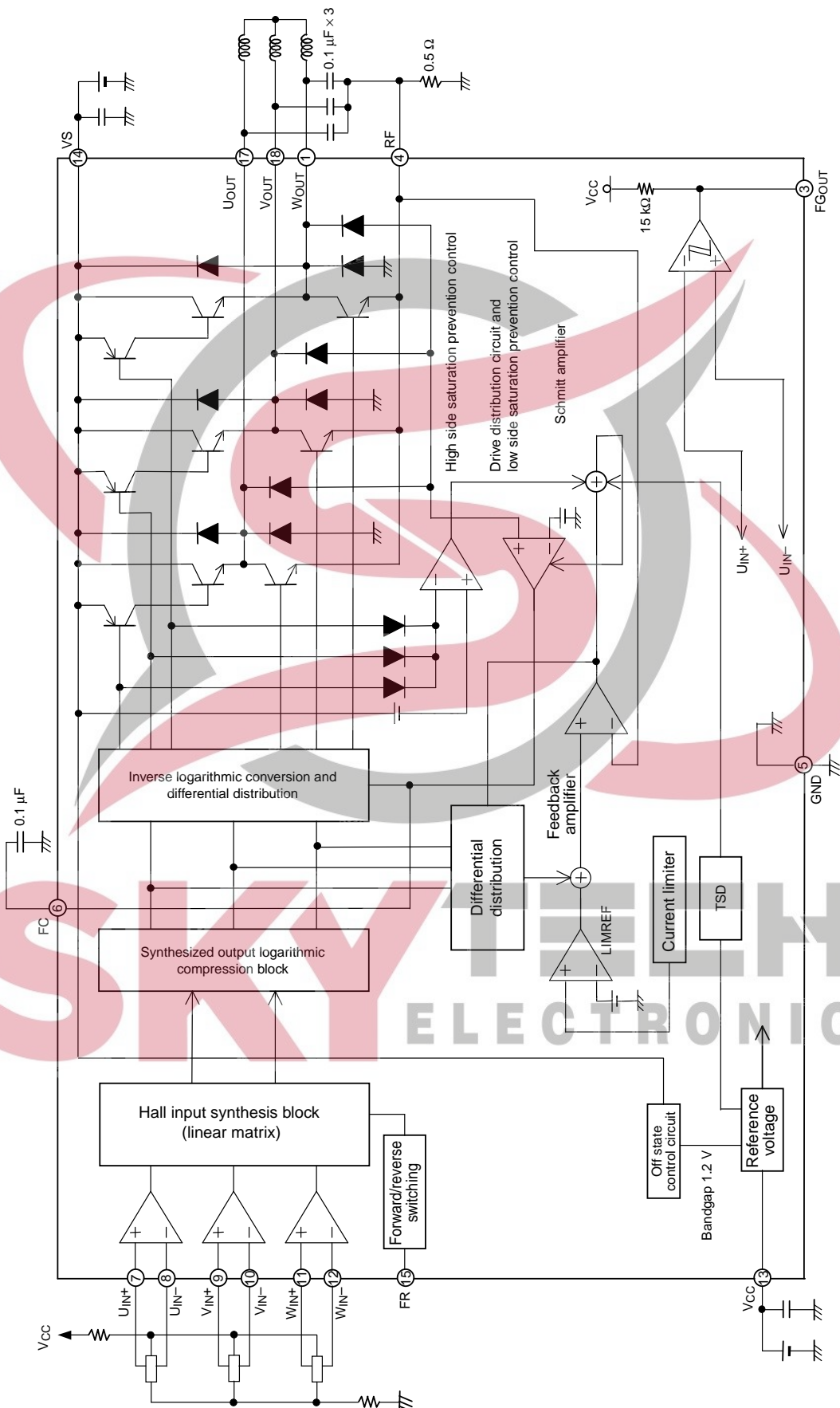
Pin Assignments




Pin I/O Equivalent Circuits

Pin	I/O equivalent circuit
$U_{IN} (+)$ $U_{IN} (-)$ $V_{IN} (+)$ $V_{IN} (-)$ $W_{IN} (+)$ $W_{IN} (-)$	<p>(+) input</p> <p>200 Ω</p> <p>100 μA</p> <p>(-) input</p>
U_{-OUT} V_{-OUT} W_{-OUT} RF VS	<p>33 kΩ</p> <p>20 kΩ</p> <p>30 kΩ</p> <p>200 Ω</p> <p>150 μA</p> <p>200 μA</p> <p>1.25 V</p> <p>Off state control circuit</p> <p>Low side saturation prevention circuit input block</p>
FR	<p>200 Ω</p> <p>200 μA</p> <p>1.25 V</p>
FC	<p>10 kΩ</p>
FGOUT	<p>15 kΩ</p>

Block Diagram



- 
- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
 - SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
 - In the event that any or all SANYO products (including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
 - No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
 - Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
 - Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

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