


SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LB11988HR — Monolithic Digital IC Fan Motor Driver

Overview

LB11988HR is a motor driver IC optimal for driving the DC fan motors.

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	P _d max	Independent IC	0.8	W
Operating temperature	T _{opr}		-40 to +85	°C
Storage temperature	T _{stg}		-55 to +150	°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.

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

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment. The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for new introduction or other application different from current conditions on the usage of automotive device, communication device, office equipment, industrial equipment etc. , please consult with us about usage condition (temperature, operation time etc.) prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. 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 Semiconductor Co., Ltd.
<http://semicon.sanyo.com/en/network>

LB11988HR

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

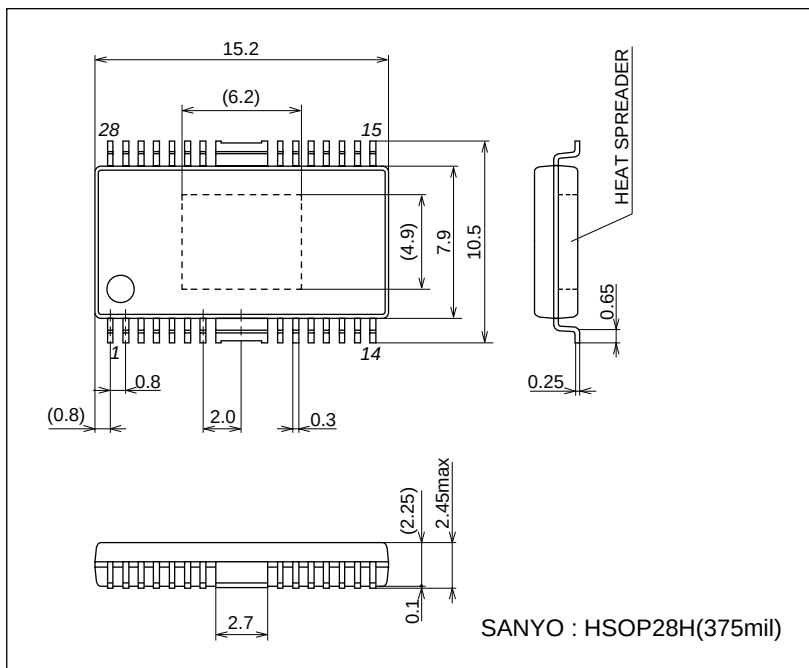
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
V _{CC} current drain	I _{CC}	R _L = 560Ω (Y)		15	24	mA
Output						
Output saturation voltage	V _{OSat1}	I _O = 500mA, R _f = 0.5Ω, Sink + Source (Saturation prevention function included)		2.1	2.6	V
	V _{OSat2}	I _O = 1.0A, R _f = 0.5Ω, Sink + Source (Saturation prevention function included)		2.6	3.5	V
Output leakage current	I _{Oleak}				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 _{cm1} (HALL)	V _{CC} =V _S =12V	3		V _{CC} -3	V
	V _{cm2} (HALL)	V _{CC} =V _S =5V	1.5		V _{CC} -1.5	V
FR						
Threshold voltage	V _{FTH}		4		8	V
Input bias current	I _b (FR)		-5			μA
Current limiter						
LIM pin current limit level	I _{LIM}	R _f = 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 _{OSat} (DET)	R _L = 560Ω (Y), R _f = 0.5Ω, The voltage between each output and the corresponding R _f .		0.28		V
FG amplifier						
Upper side output saturation voltage	V _{satu} (SH)		11.8			V
Lower side output saturation voltage	V _{satd} (SH)				0.3	V
Hysteresis	V _{hys}			23		mV
TSD operating temperature	T-TSD	Design target value*		170		°C

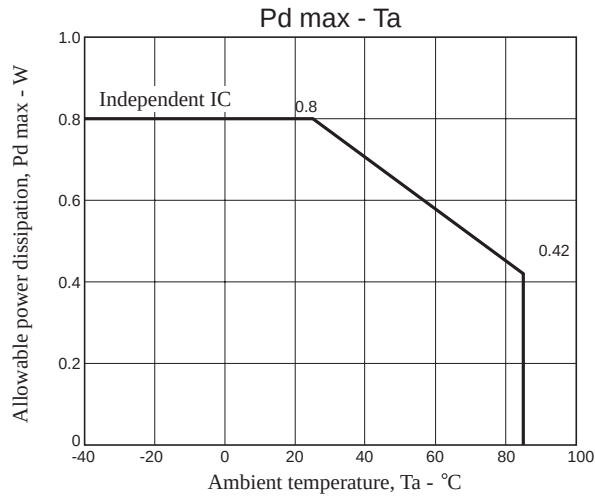
Note * : Items shown to be design target values in the conditions column are not measured.

Package Dimensions

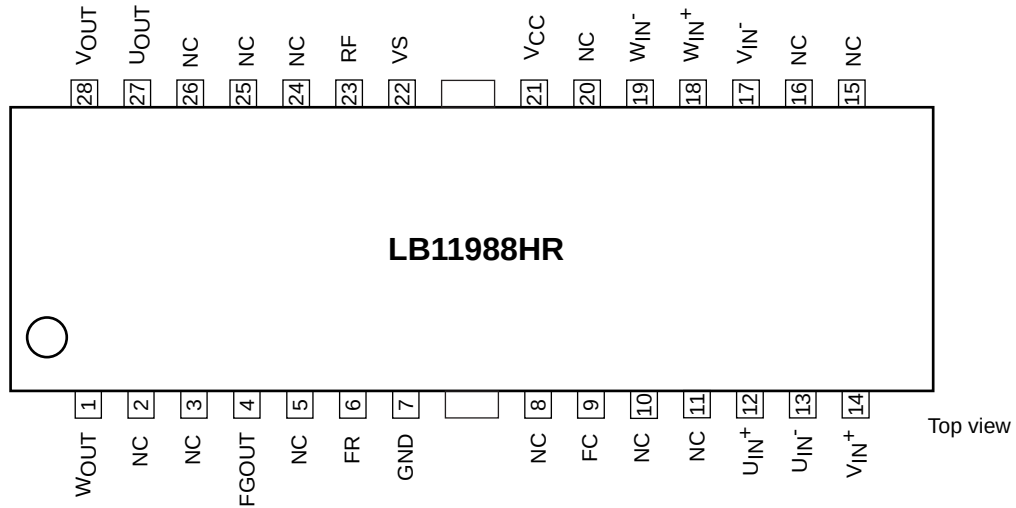
unit : mm (typ)

3233B





Pin Assignment



Truth Table and Control Functions

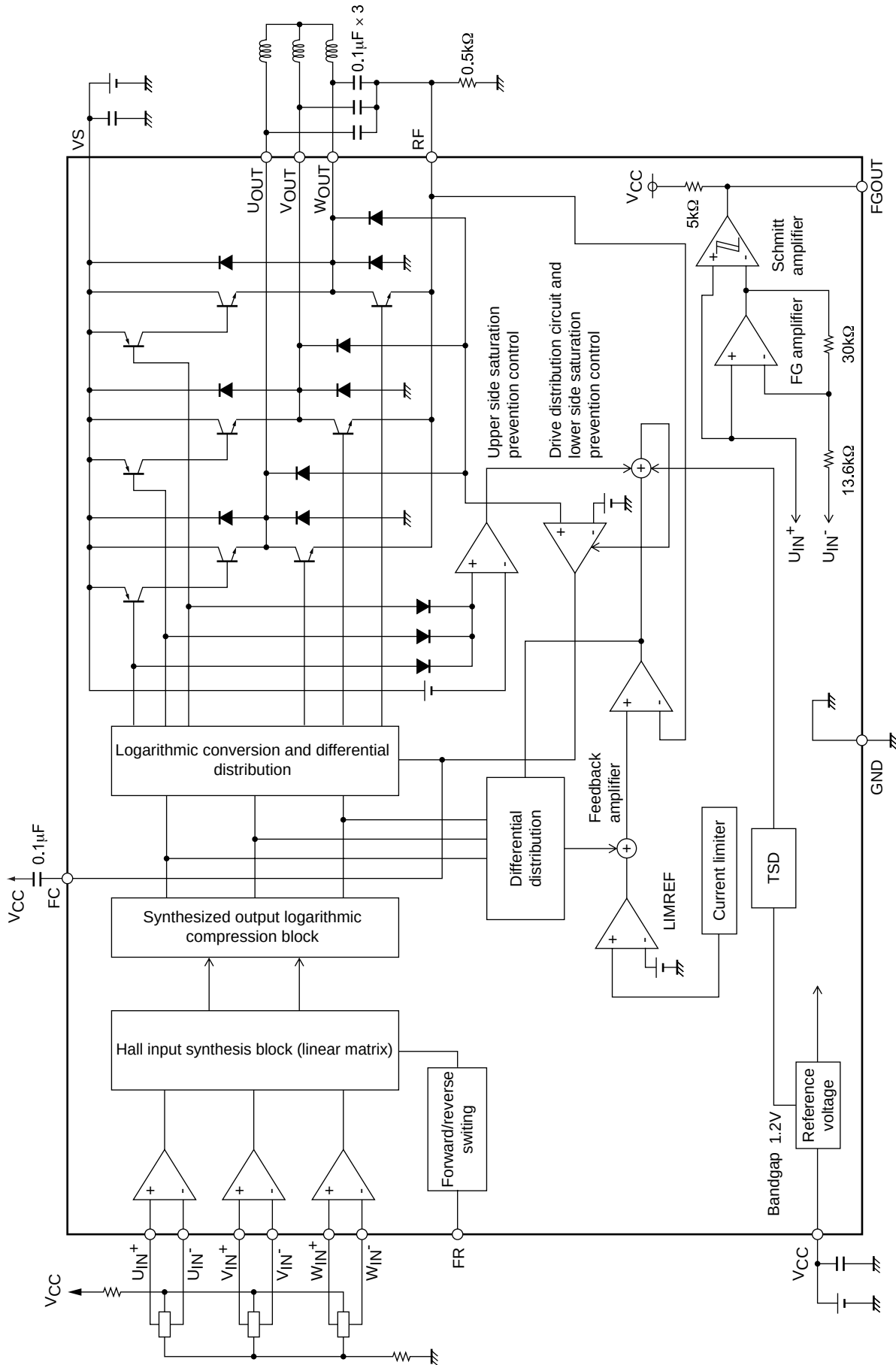
	Source→Sink	Hall input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

Note : The "H" state for FR is defined as a voltage of 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.

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	

Pin Functions

Pin No.	Pin name	Function
7 FRAME	GND	Ground for circuits other than the output transistors. Note that the Rf pin will be at the lowest potential of the output transistors.
4	FGOUT	This is the FG amplifier output pin. Internally, it is a resistive load. (Pull up)
6	FR	Forward/reverse switching pin
9	FC	Corrects the frequency characteristics of the saturation prevention circuit loop and current limiter circuit.
12, 13 14, 17 18, 19	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 $IN^+ > IN^-$.
21	VCC	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.
22	VS	Output block power supply
23	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.
27 28 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.)

- SANYO Semiconductor Co.,Ltd. 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 Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents 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 Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require 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 consent of SANYO Semiconductor 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 Semiconductor Co.,Ltd. product that you intend to use.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of February, 2012. Specifications and information herein are subject to change without notice.