



SANYO Semiconductors

DATA SHEET

LB11988HR — Monolithic Digital IC

Fan Motor Driver

Overview

The LB11988HR is a motor driver IC optimal for driving the automotive 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	0.8	W
Operating temperature range	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature range	T_{stg}		-55 to +150	$^\circ\text{C}$

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}		5 to 22	
Hall input amplitude	V_{HALL}	Between hall inputs	± 30 to ± 80	mVo-p

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LB11988HR

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

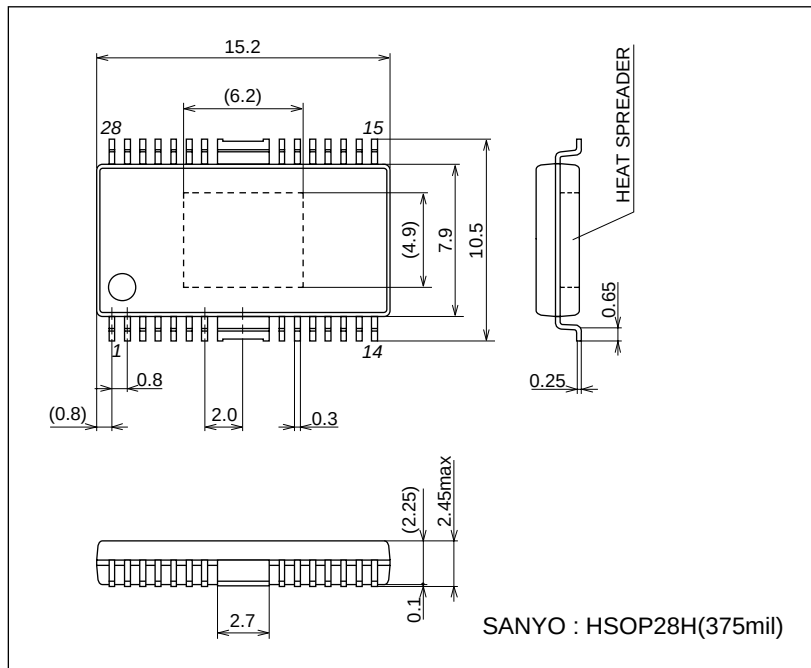
Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
V _{CC} supply current	I _{CC}	R _L = 560Ω (Y)		15	24	mA
Output						
Output saturation voltage	V _{OSat1}	I _O = 500mA, R _f = 0.5Ω, Sink+Source (with saturation prevention)		2.1	2.6	V
	V _{OSat2}	I _O = 1.0A, R _f = 0Ω, Sink+Source (with saturation prevention)		2.6	3.5	
Output leakage current	I _{Oleak}				1.0	mA
Hall amplifier						
Input offset voltage	V _{off} (HALL)		-6		+6	mV
Input bias current	I _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	
FR						
Threshold voltage	V _{FRTH}		4		8	V
Input bias current	I _b (FR)		-5			μA
Current limit						
LIM pin current limit level	I _{LIM}	R _f = 0.5Ω, Hall input logic fixed (U, V, W = H, H, L)		1		A
Saturation						
Saturation prevention circuit lower set voltage	V _{OSat} (DET)	R _L = 560Ω (Y),R _f = 0.5Ω Voltage between each OUT and RF		0.28		V
FG Amplifier						
Output "High" voltage	V _{fgoH} (SH)		11.8			V
Output "Low" voltage	V _{fgoL} (SH)				0.3	
Hysteresis width	V _{hys}			23		mV
TSD operating temperature	TTSD	Design target value*		170		°C

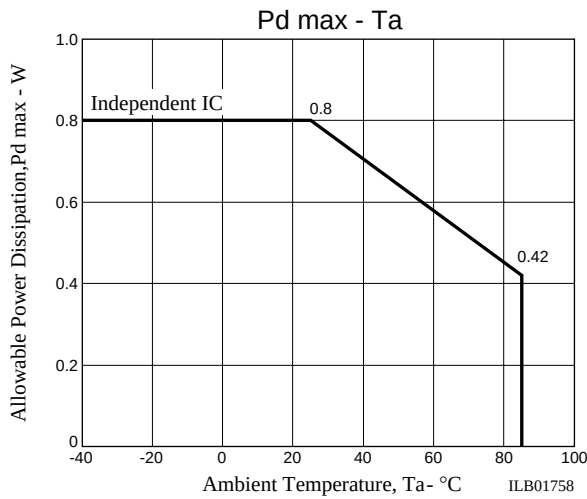
*: T-TSD is not measured because it stands for design target.

Package Dimensions

unit : mm

3233B





Truth Table and Control Function

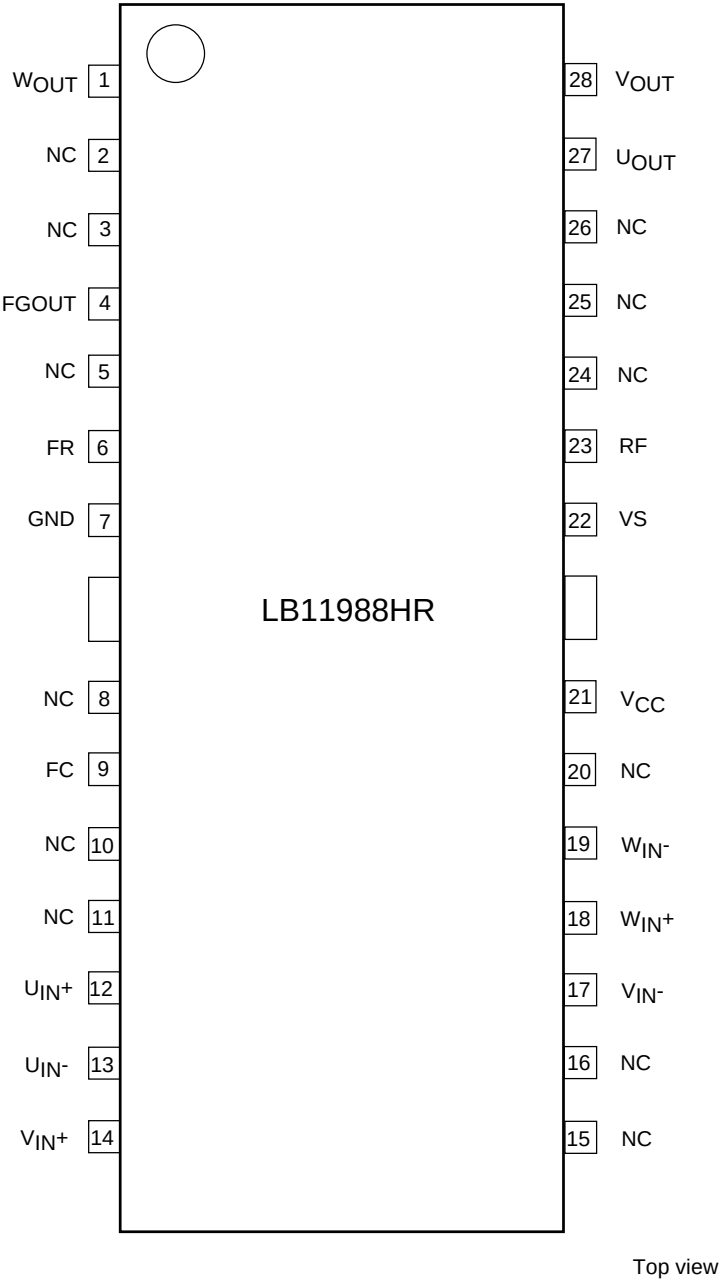
	Source → Sink	Hall Input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

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



Pin Functions

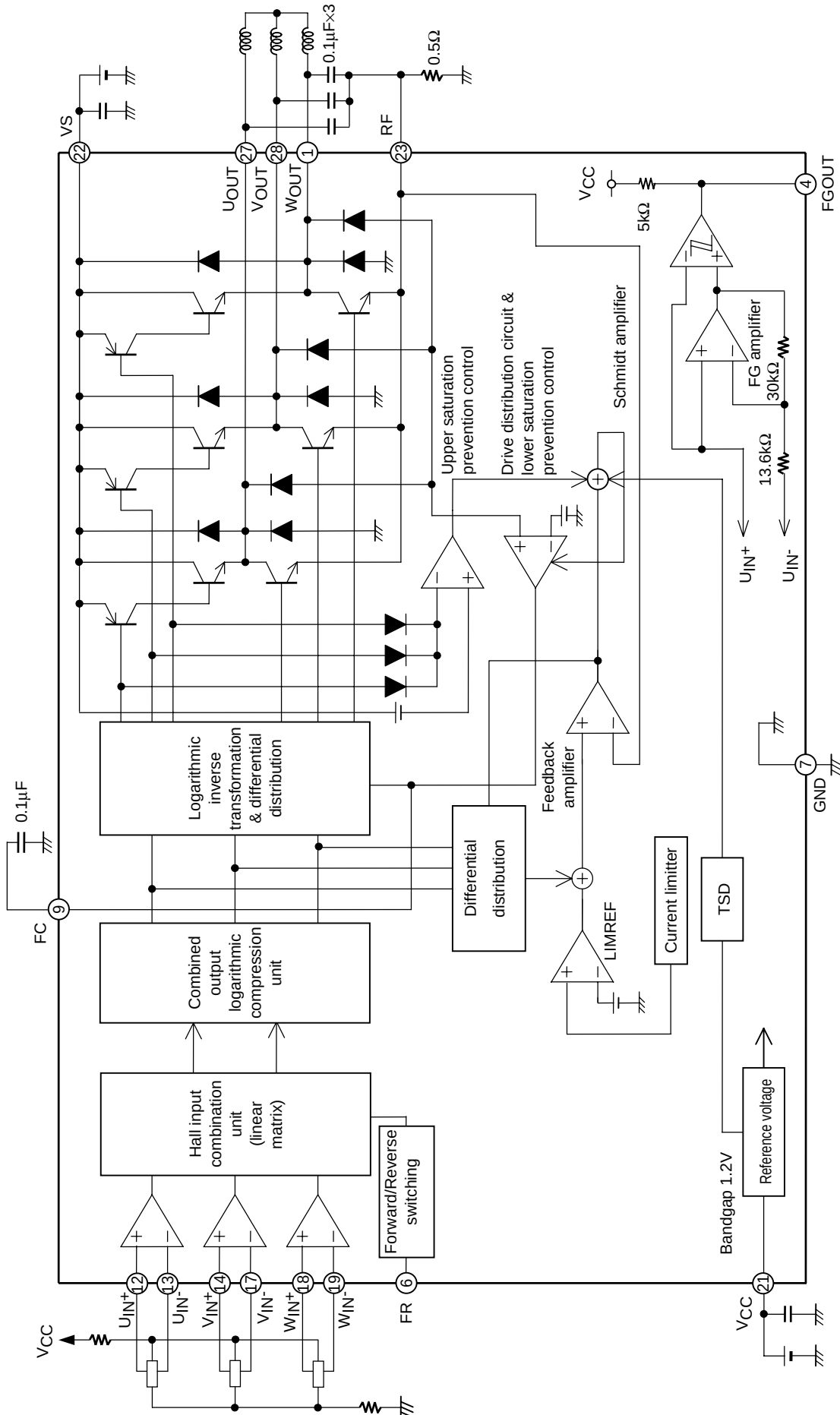
Pin Name	Pin No.	Input/Output Equivalent Circuit	Pin Functions
V _{CC}	21		Power supply pin for supplying power to all circuits except output section in IC; this voltage must be stabilized so as to eliminate ripple and noise.
GND	7		GND for others than the output transistor.
	FRAME		Minimum potential of output transistor is at RF pin.
U _{IN} ⁺ , U _{IN} ⁻	12,13		U-phase Hall device input pin; logic "H" presents IN+>IN-
V _{IN} ⁺ , V _{IN} ⁻	14,17		V-phase Hall device input pin; logic "H" presents IN+>IN-
W _{IN} ⁺ , W _{IN} ⁻	18,19		W-phase Hall device input pin; logic "H" presents IN+>IN-
U _{OUT} V _{OUT} W _{OUT}	27 28 1		U-phase output pin. V-phase output pin. W-phase output pin. (Built-in spark killer diode)
RF	23		Output current detection pin. Connecting R _f 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 R _f value is reduced to an extremely low level.
VS	22		Power supply pin for supplying power to output section in IC.
FR	6		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.
FGOUT	4		FG amplifier output pin. Resistive load provided internally.

Block Diagram



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