



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## LB11988V — Monolithic Digital IC Fan Motor Driver

### Overview

The LB11988V is a motor driver IC optimal for driving the DC 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 Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		24	V
	V <sub>S</sub> max		24	V
Maximum output current	I <sub>O</sub> max		1.3	A
Allowable power dissipation	P <sub>d</sub> max	Independent IC	0.5	W
Operating temperature range	T <sub>opr</sub>		-30 to +75	°C
Storage temperature range	T <sub>stg</sub>		-55 to +150	°C

### Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>S</sub>		5 to 22	V
	V <sub>CC</sub>		7 to 22	
Hall input amplitude	V <sub>HALL</sub>	Between hall inputs	±30 to ±80	mVo-p

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

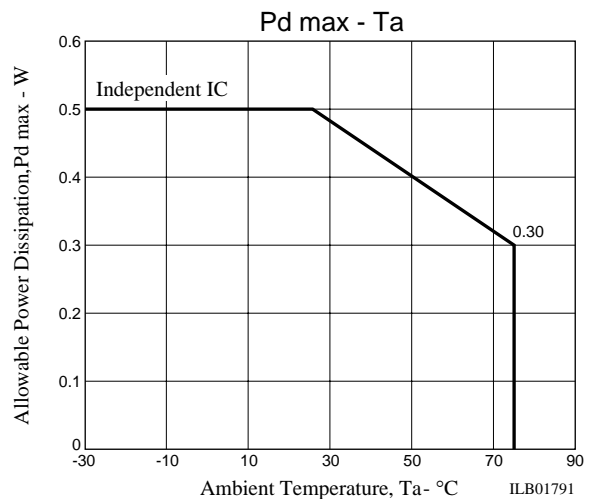
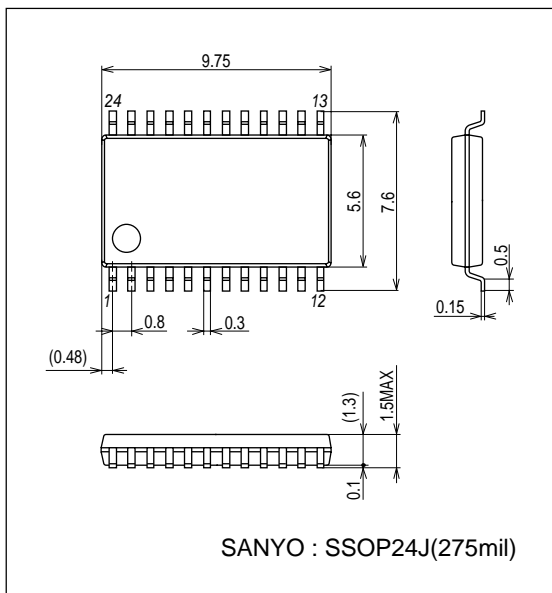
Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
$V_{CC}$ supply current	$I_{CC}$	$R_L = 560\Omega$ (Y)		15	24	mA
Output						
Output saturation voltage	$V_{Osat1}$	$I_O = 500\text{mA}$ , $R_f = 0.5\Omega$ , Sink+Source (with saturation prevention)		2.1	2.6	V
	$V_{Osat2}$	$I_O = 1.0\text{A}$ , $R_f = 0\Omega$ , Sink+Source (with saturation prevention)		2.6	3.5	
Output leakage current	$I_{Oleak}$				1.0	mA
Hall amplifier						
Input offset voltage	$V_{off}(\text{HALL})$		-6		+6	mV
Input bias current	$I_b(\text{HALL})$	$V_{IN}$ , $W_{IN}$		1	3	$\mu\text{A}$
Common-mode input voltage	$V_{cm}(\text{HALL})$		3		$V_{CC}-3$	V
FR						
Threshold voltage	$V_{FRTH}$		4		8	V
Input bias current	$I_b(\text{FR})$		-5			$\mu\text{A}$
Current limit						
LIM pin current limit level	$I_{LIM}$	$R_f = 0.5\Omega$ , Hall input logic fixed (U, V, W = H, H, L)		1		A
Saturation						
Saturation prevention circuit lower set voltage	$V_{Osat}(\text{DET})$	$R_L = 560\Omega$ (Y), $R_f = 0.5\Omega$ Voltage between each OUT and RF		0.28		V
FG Amplifier						
Output "High" voltage	$V_{fgoh}(\text{SH})$		11.8			V
Output "Low" voltage	$V_{fgol}(\text{SH})$				0.3	
Hysteresis width	$V_{hys}$			23		mV
TSD operating temperature	T-TSD	Design target value*		170		$^\circ\text{C}$

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

## Package Dimensions

unit : mm (typ)

3315



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## Truth Table and Control Function

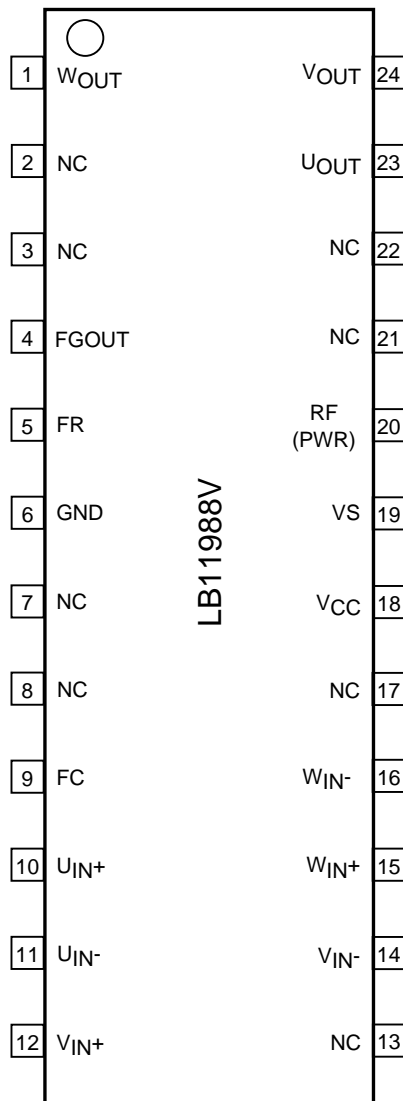
	Source → Sink	Hall Input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

Note: "H" in the FR column represents a voltage of 8V or more. "L" represents a voltage of 4V or less. (At V<sub>CC</sub>=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



Top view

Pin Functions

Pin Name	Pin No.	Pin Functions	Input/Output Equivalent Circuit
GND	6	GND for others than the output transistor. Minimum potential of output transistor is at RF pin.	
U <sub>IN+</sub> , U <sub>IN-</sub>	10,11	U-phase Hall device input pin; logic "H" presents IN+>IN-	
V <sub>IN+</sub> , V <sub>IN-</sub>	12,14	V-phase Hall device input pin; logic "H" presents IN+>IN-	
W <sub>IN+</sub> , W <sub>IN-</sub>	15,16	W-phase Hall device input pin; logic "H" presents IN+>IN-	
U <sub>OUT</sub> V <sub>OUT</sub> W <sub>OUT</sub>	23 24 1	U-phase output pin. V-phase output pin. W-phase output pin. (Built-in spark killer diode)	
RF	20	Output current detection pin. Connecting R <sub>f</sub> 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 <sub>f</sub> value is reduced to an extremely low level.	
VS	19	Power supply pin for supplying power to output section in IC.	
FR	5	Forward/Reverse switching pin.	
FC	9	Frequency characteristics compensation pin for over-saturation prevention circuit loop.	

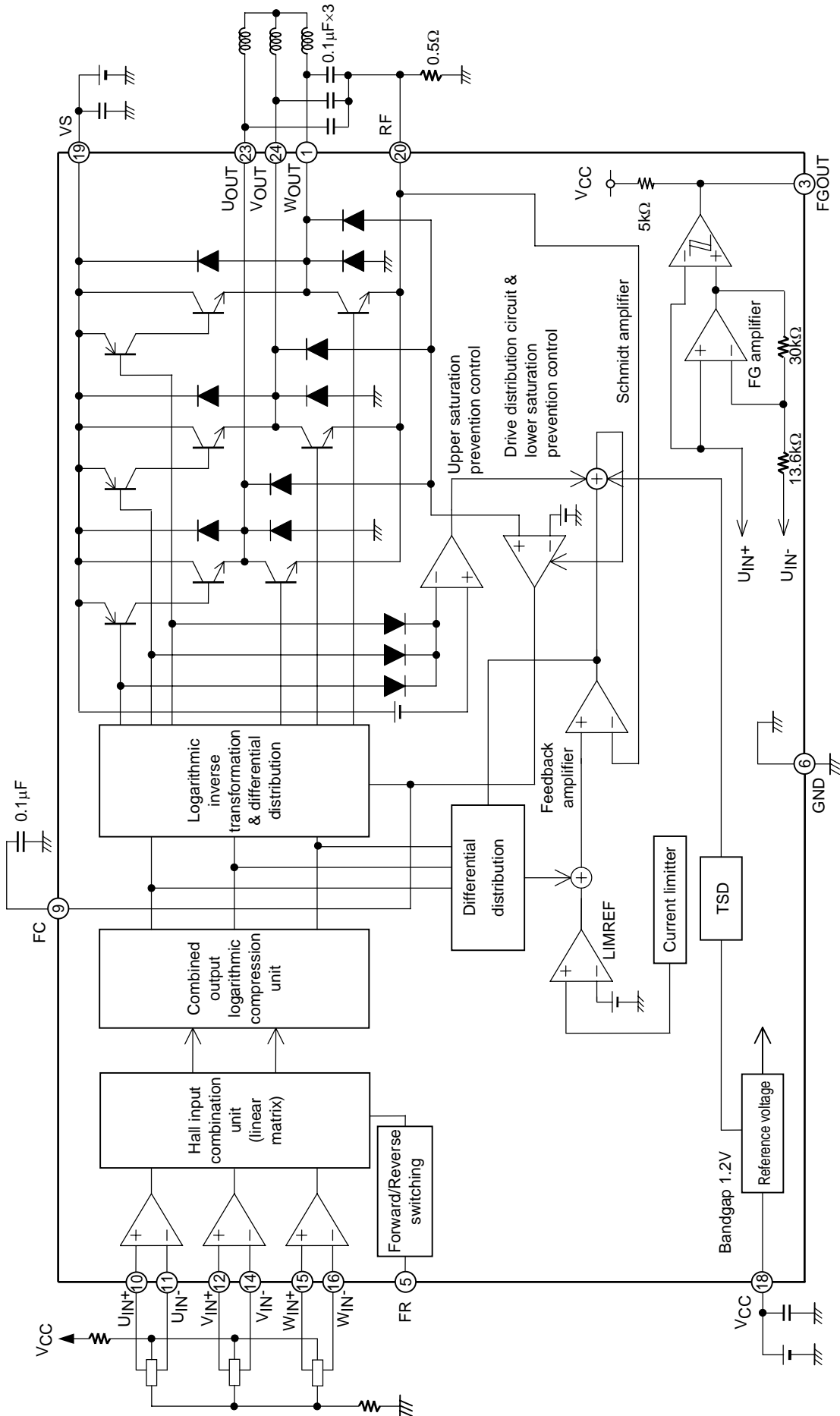
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Pin Name	Pin No.	Pin Functions	Input/Output Equivalent Circuit
VCC	18	Power supply pin for supplying power to all circuits expect output section in IC; this voltage must be stabilized so as to eliminate ripple and noise.	
FGOUT	3	FG amplifier output pin. Resistive load provided internally.	

Block Diagram



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