



# SANYO Semiconductors

## DATA SHEET

# LB11988H

## Monolithic Digital IC Fan Motor Driver

### Overview

The LB11988H 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 | 0.8         | W    |
| Operating temperature range | T <sub>opr</sub>    |                | -30 to +85  | °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 Ta = 25°C, VCC = 12V, VS = 12V

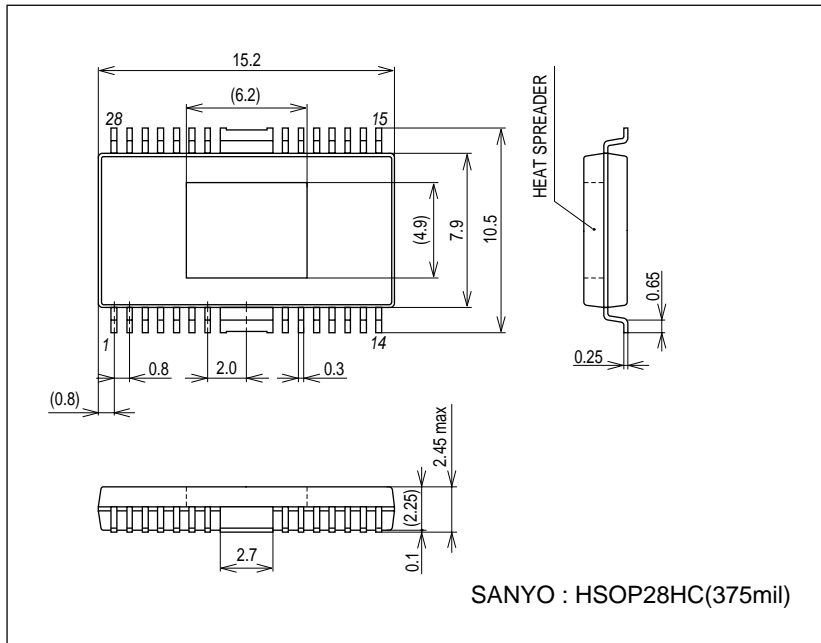
| Parameter                                       | Symbol     | Conditions   | Ratings |      |       | unit |
|---|------------|--|---------|------|-------|------|
|   |            |  | min     | typ  | max   |      |
| VCC supply current                              | ICC        | RL = 560Ω (Y)  |         | 15   | 24    | mA   |
| Output  |            |  |         |      |       |      |
| Output saturation voltage                       | VOsat1     | IO = 500mA, Rf = 0.5Ω,<br>Sink+Source (with saturation prevention) |         | 2.1  | 2.6   | V    |
|   | VOsat2     | IO = 1.0A, Rf = 0Ω,<br>Sink+Source (with saturation prevention)    |         | 2.6  | 3.5   |      |
| Output leakage current                          | Ioleak     |  |         |      | 1.0   | mA   |
| Hall amplifier                                  |            |  |         |      |       |      |
| Input offset voltage                            | Voff(HALL) |  | -6      |      | +6    | mV   |
| Input bias current                              | Ib(HALL)   | VIN, WIN   |         | 1    | 3     | μA   |
| Common-mode input voltage                       | Vcm(HALL)  |  | 3       |      | VCC-3 | V    |
| FR  |            |  |         |      |       |      |
| Threshold voltage                               | VFRTH      |  | 4       |      | 8     | V    |
| Input bias current                              | Ib(FR)     |  | -5      |      |       | μA   |
| Current limit                                   |            |  |         |      |       |      |
| LIM pin current limit level                     | ILIM       | Rf = 0.5Ω, Hall input logic fixed<br>(U, V, W = H, H, L)           |         | 1    |       | A    |
| Saturation                                      |            |  |         |      |       |      |
| Saturation prevention circuit lower set voltage | VOsat(DET) | RL = 560Ω (Y), Rf = 0.5Ω<br>Voltage between each OUT and RF        |         | 0.28 |       | V    |
| FG Amplifier                                    |            |  |         |      |       |      |
| Output "High" voltage                           | VfgoH(SH)  |  | 11.8    |      |       | V    |
| Output "Low" voltage                            | VfgoL(SH)  |  |         |      | 0.3   |      |
| Hysteresis width                                | Vhys       |  |         | 23   |       | mV   |
| TSD operating temperature                       | TTSD       | Design target value*   |         | 170  |       | °C   |

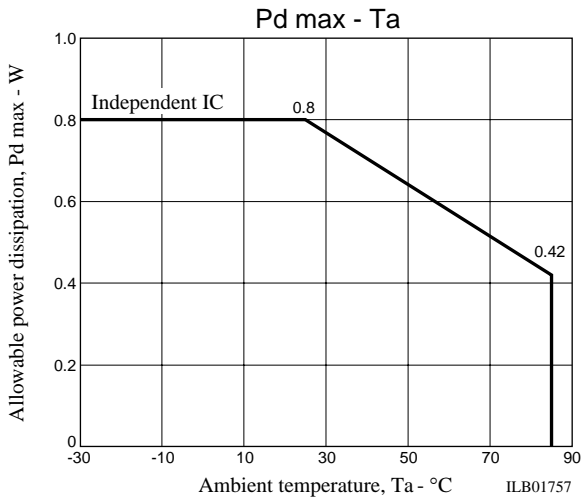
\*: T-TSD is not measured because it stands for design target.

## Package Dimensions

unit : mm (typ)

3234B





**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  |

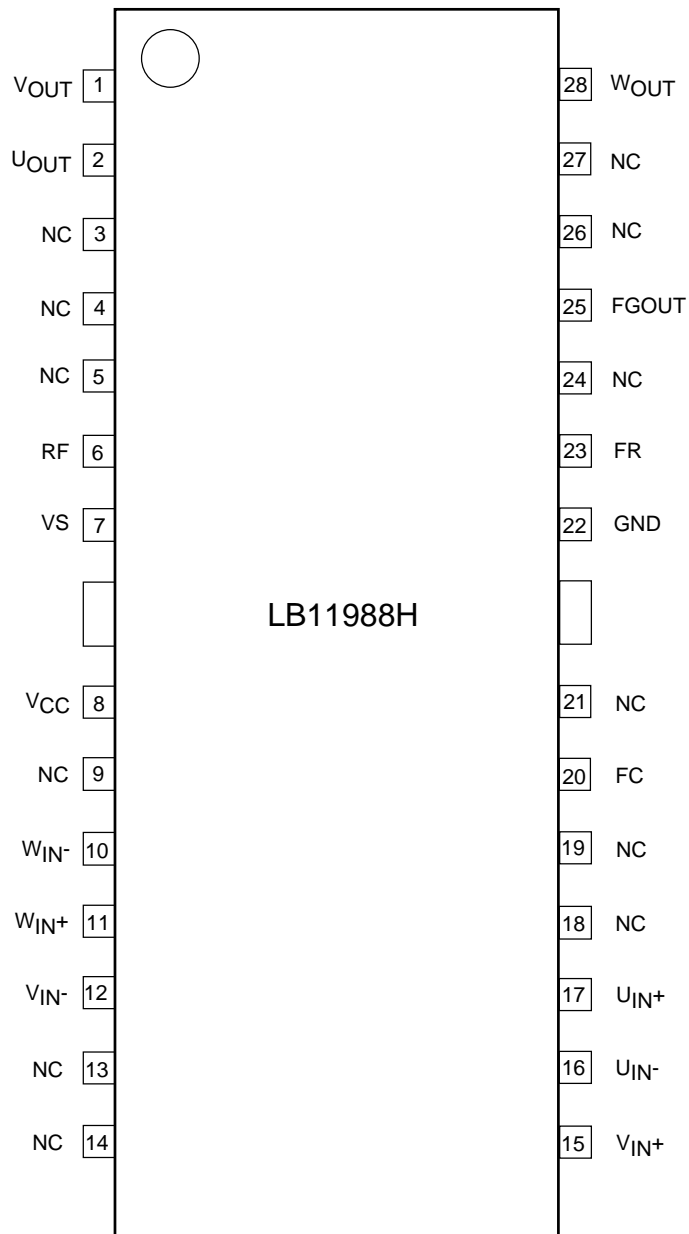
Note: “H” in the FR column represents a voltage of 8V or more. “L” represents a voltage of 4V or less. (At VCC=12V)

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.

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## Pin Assignment



Top view

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## Pin Functions

| Pin Name                            | Pin No. | Input/Output Equivalent Circuit | Pin Functions  |
|-------------------------------------|---------|---------------------------------|--|
| GND                                 | 22      |                                 | GND for others than the output transistor.   |
|                                     | FRAME   |                                 | Minimum potential of output transistor is at RF pin.   |
| FGOUT                               | 25      |                                 | FG amplifier output pin.<br>Resistive load provided internally.  |
| FR                                  | 23      |                                 | Forward/Reverse switching pin.   |
| FC                                  | 20      |                                 | Frequency characteristics compensation pin for over-saturation prevention circuit loop.  |
| U <sub>IN+</sub> , U <sub>IN-</sub> | 17,16   |                                 | U-phase Hall device input pin;<br>logic "H" presents IN+>IN-   |
| V <sub>IN+</sub> , V <sub>IN-</sub> | 15,12   |                                 | V-phase Hall device input pin;<br>logic "H" presents IN+>IN-   |
| W <sub>IN+</sub> , W <sub>IN-</sub> | 11,10   |                                 | W-phase Hall device input pin;<br>logic "H" presents IN+>IN-   |
| V <sub>CC</sub>                     | 8       |                                 | 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. |

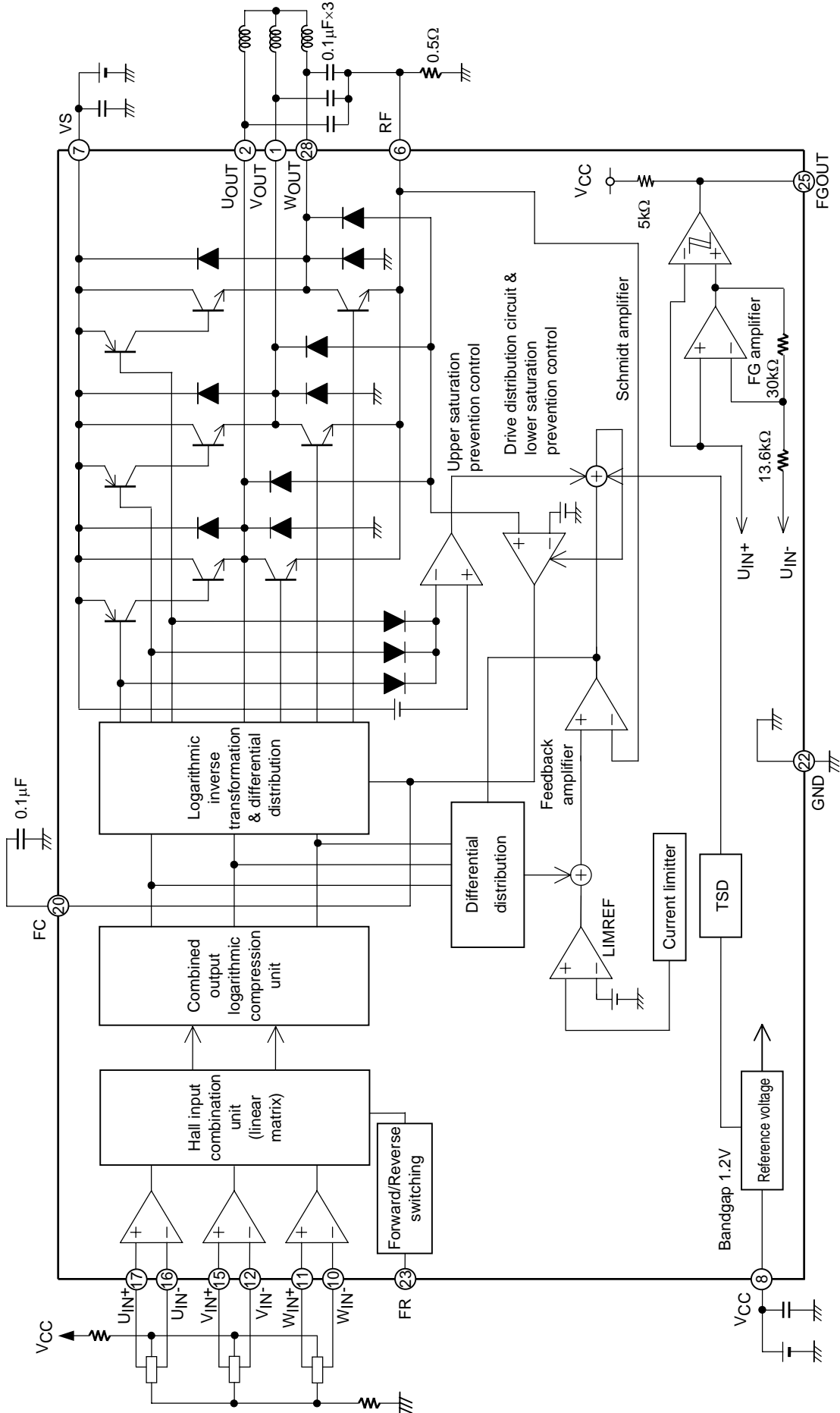
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| Pin Name   | Pin No.      | Input/Output Equivalent Circuit | Pin Functions  |
|--|--------------|---------------------------------|--|
| U <sub>OUT</sub><br>V <sub>OUT</sub><br>W <sub>OUT</sub> | 2<br>1<br>28 |                                 | U-phase output pin.<br>V-phase output pin.<br>W-phase output pin.<br>(Built-in spark killer diode)   |
| RF   | 6            |                                 | Output current detection pin.<br>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   | 7            |                                 | Power supply pin for supplying power to output section in IC.  |

Block Diagram



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