



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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Electrical Characteristics at Ta = 25°C, VCC = 12V, VS = 12V

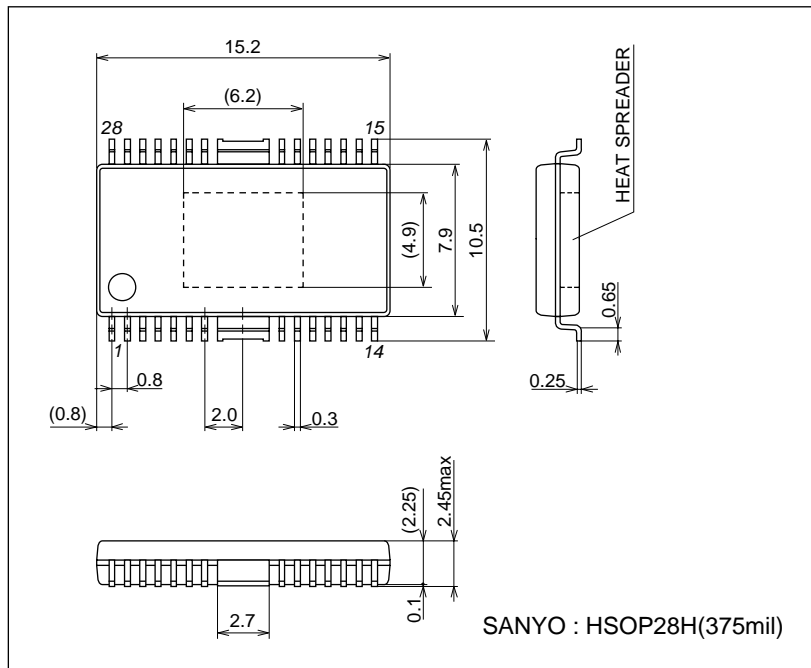
| Parameter | Symbol | Conditions | Ratings | | | unit |
|--|-------------------------|--|---------|------|----------------------|------|
| | | | min | typ | max | |
| V _{CC} supply current | I _{CC} | R _L = 560Ω (Y) | | 15 | 24 | mA |
| Output | | | | | | |
| Output saturation voltage | V _{OSat1} | 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.

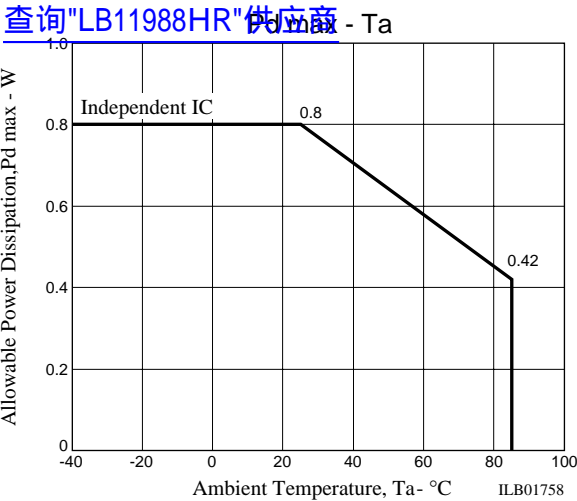
Package Dimensions

unit : mm

3233B



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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 |

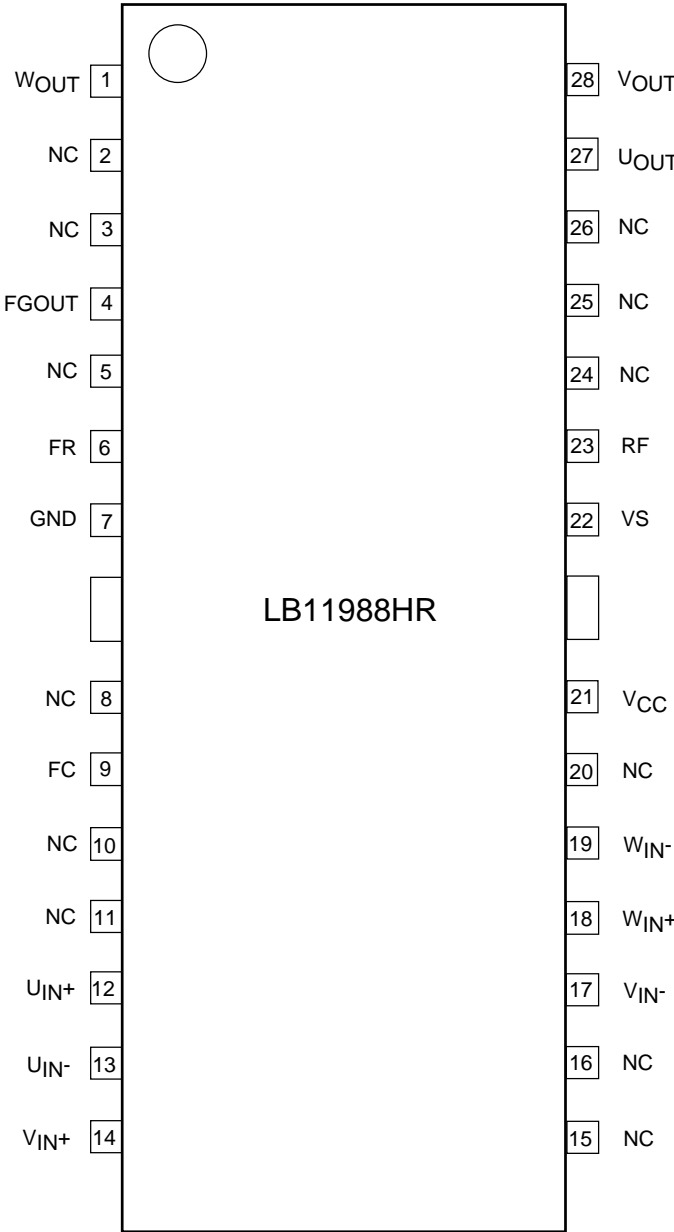
Note: “H” in the FR column represents a voltage of 8V or more. “L” represents a voltage of 4V or less. (At $V_{CC}=12V$)

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.

LB11988HR

[Pin Assignment](#) 供应商



Top view

[Pin Functions](#)

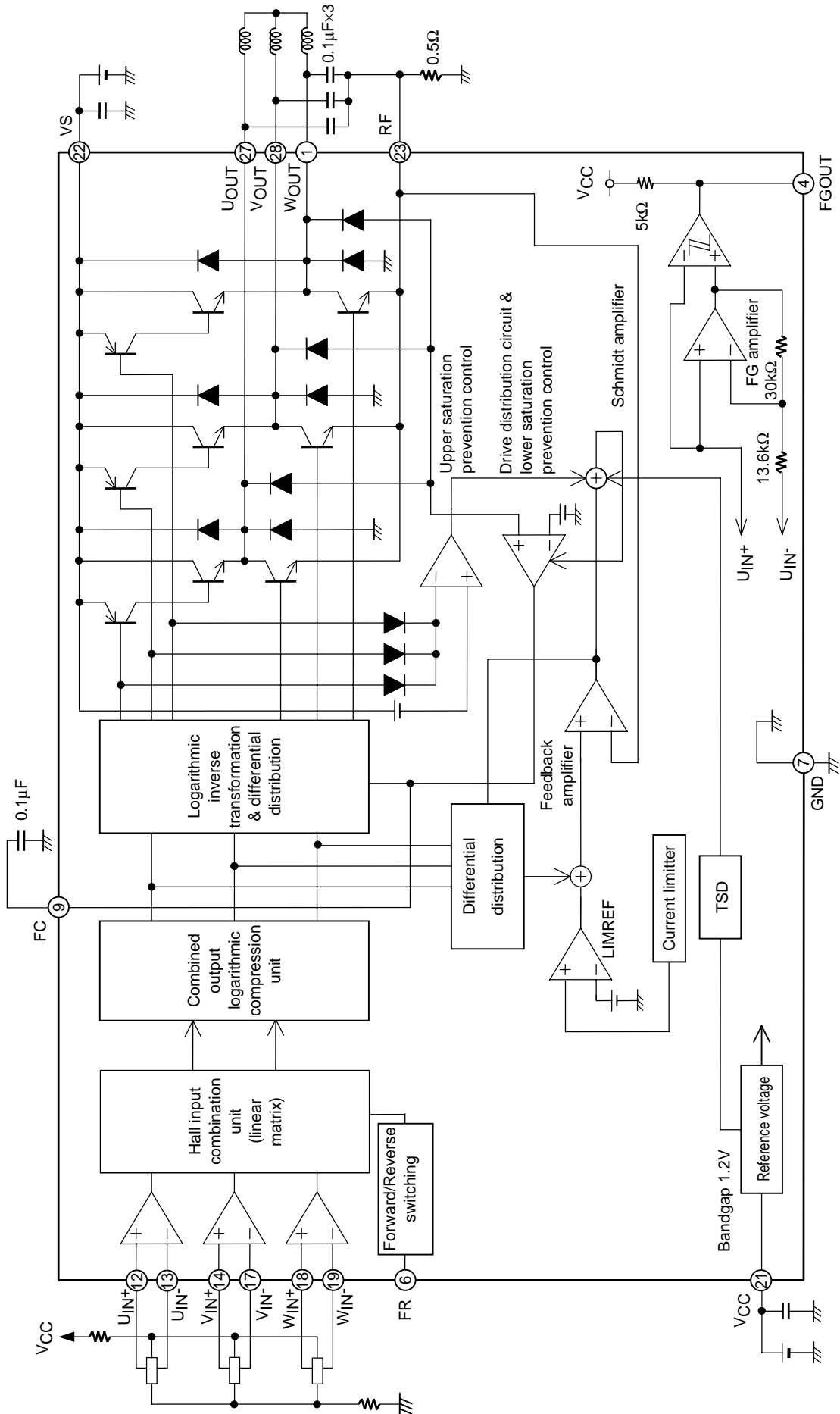
| Pin Name | Pin No. | Input/Output Equivalent Circuit | Pin Functions |
|--|---------------|---------------------------------|--|
| V _{CC} | 21 | | Power supply pin for supplying power to all circuits except output section in IC; this voltage must be stabilized so as to eliminate ripple and noise. |
| 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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LB11988HR

Continued from preceding page
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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. |



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