Ordering number : ENA0300

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 Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		24	V
	VS max		24	V
Maximum output current	I_O max		1.3	A
Allowable power dissipation	Pd max	Independent IC	0.8	W
Operating temperature range	Topr		-40 to +85	°C
Storage temperature range	Tstg		-55 to +150	°C

Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	VS		5 to 22	V
	V_{CC}		5 to 22	
Hall input amplitude	VHALL	Between hall inputs	±30 to ±80	mVo-p

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

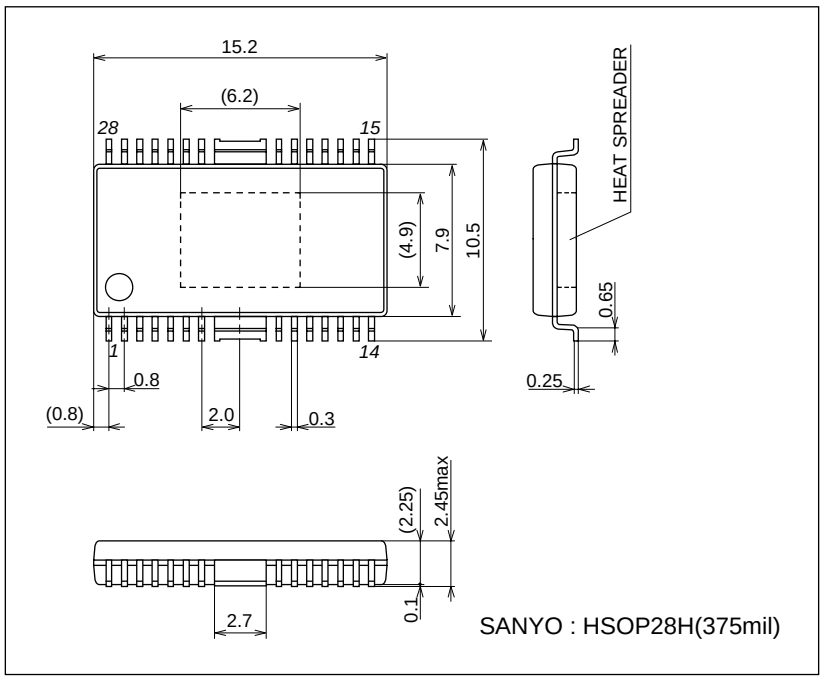
Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
V_{CC} supply current	I_{CC}	R_L = 560Ω (Y)		15	24	mA
Output						
Output saturation voltage	$V_O$sat1	I_O = 500mA, Rf = 0.5Ω, Sink+Source (with saturation prevention)		2.1	2.6	V
	$V_O$sat2	I_O = 1.0A, Rf = 0Ω, Sink+Source (with saturation prevention)		2.6	3.5	
Output leakage current	$I_O$leak				1.0	mA
Hall amplifier						
Input offset voltage	Voff(HALL)		-6		+6	mV
Input bias current	Ib(HALL)	V_{IN}, W_{IN}		1	3	μA
Common-mode input voltage	Vcm1(HALL)	V_{CC} = V_S = 12V	3		V_{CC}-3	V
	Vcm2(HALL)	V_{CC} = V_S = 5V	1.5		V_{CC}-1.5	
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 (U, V, W = H, H, L)		1		A
Saturation						
Saturation prevention circuit lower set voltage	$V_O$sat(DET)	R_L = 560Ω (Y),Rf = 0.5Ω 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

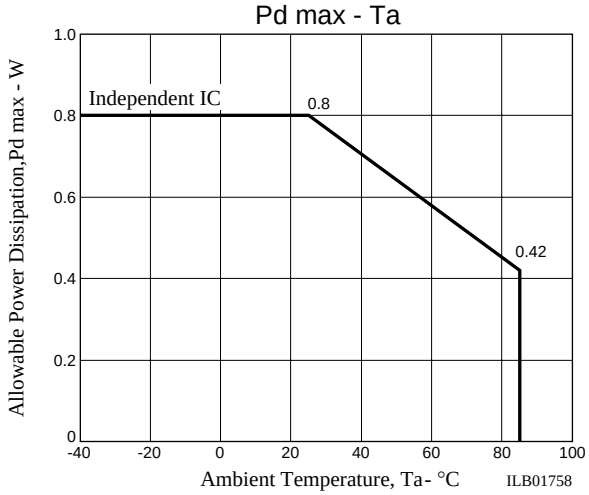
*: T-TSD is not measured because it stands for design target.

Package Dimensions

unit : mm

3233B





Truth Table and Control Function

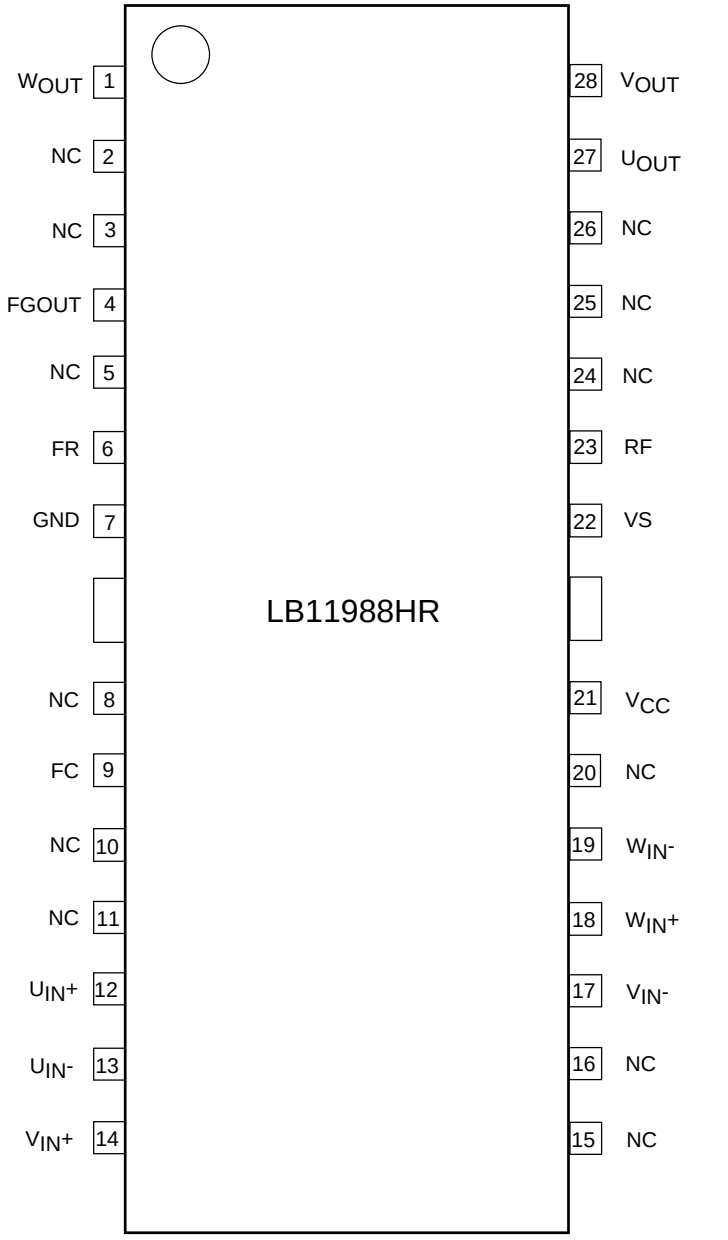
	Source → Sink	Hall Input			FR
		U	V	W	
1	V → W	H	H	L	H
	W → V				L
2	U → W	H	L	L	H
	W → U				L
3	U → V	H	L	H	H
	V → U				L
4	W → V	L	L	H	H
	V → W				L
5	W → U	L	H	H	H
	U → W				L
6	V → U	L	H	L	H
	U → V				L

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.

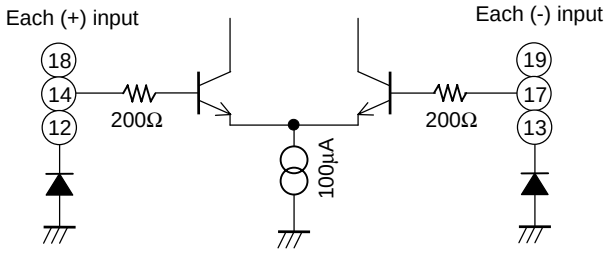
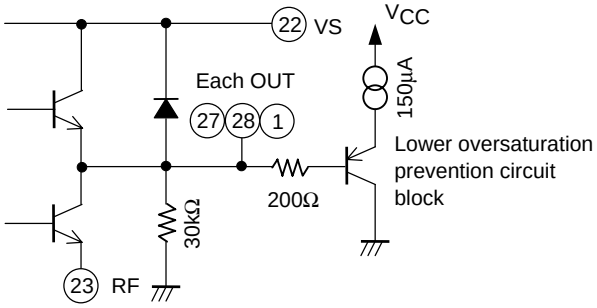
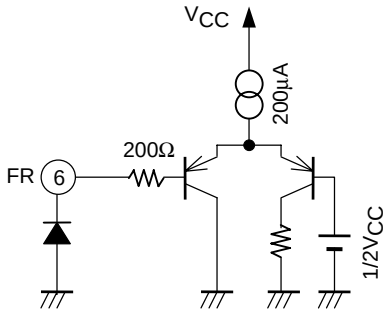
Note: Since a 180° energized system is used as a drive system, other phases than the sink and source are not OFF.

Pin Assignment



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 expect 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 Rf 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 Rf 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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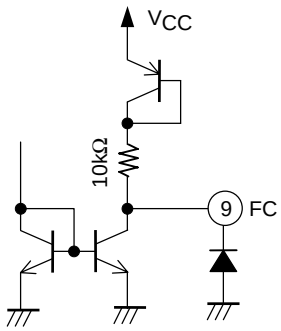
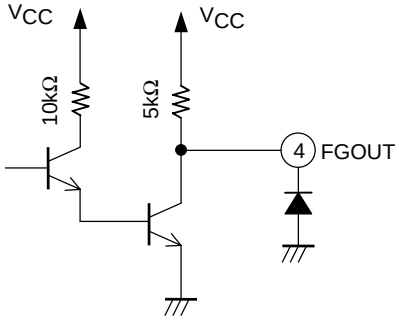
Pin Name	Pin No.	Input/Output Equivalent Circuit	Pin Functions
FC	9		Frequency characteristics compensation pin for over-saturation prevention circuit loop.
FGOUT	4		FG amplifier output pin. Resistive load provided internally.

Block Diagram