Ordering number : EN5562

Monolithic Digital IC

LB1910N

FDD Spindle Motor Driver

Overview

The LB1910N is a 3-phase disc drive motor driver that is optimal for use as a 3.5-inch FDD spindle motor driver.

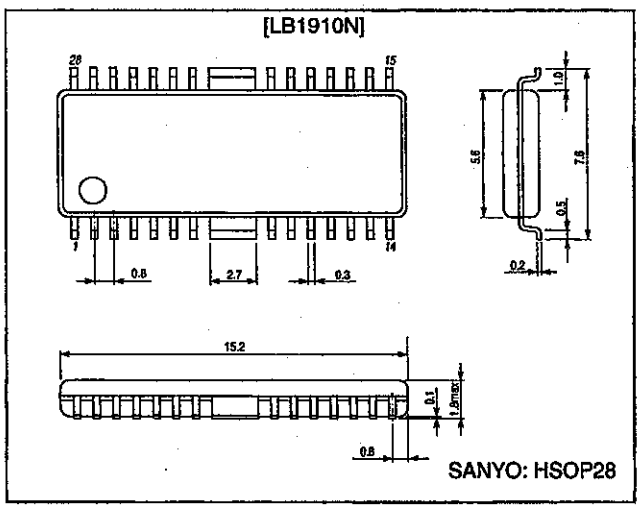
Functions and Features

- Three-phase full-wave linear driver
- Digital speed control circuit
- Start and stop circuits (active low)
- RPM switching H: 300 rpm
  L: 360 rpm
- Current limiter circuit
- Built-in index comparator
- Thermal shutdown circuit

Package Dimensions

unit: mm

3222-HSOP28



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		7.0	V
Maximum output current	I_O max1	t ≤ 0.5 s	1.0	A
Maximum steady-state output current	I_O max2		0.7	A
Allowable power dissipation	Pd max	Independent IC	0.5	W
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		4.2 to 6.5	V

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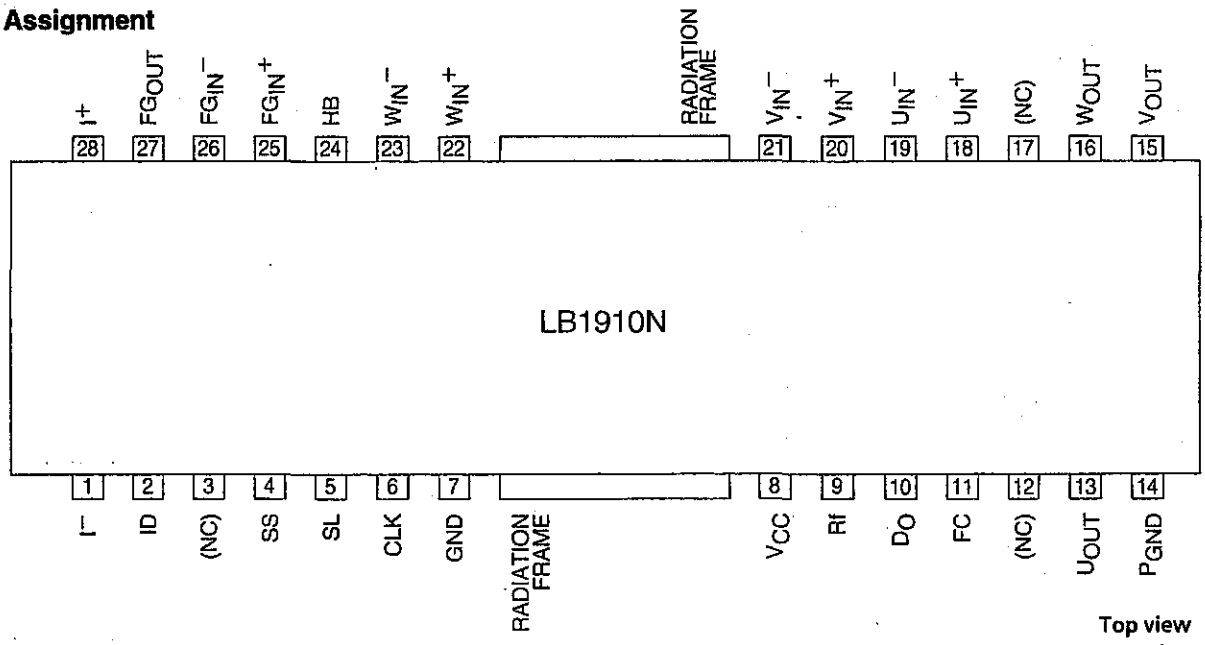
Electrical Characteristics at Ta = 25°C, V_{CC} = 5 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Current drain	I_{CCO}	S/S = 5 V (standby)			10	μA
	I_{CC}	S/S = 0 V (steady state)		12	18	mA
SL bias current	I_{SL}	V_{SL} = 0 V			10	μA
SL input low-level voltage	V_{SLL}		0		1.0	V
SL input high-level voltage	V_{SLH}		3.5		V_{CC}	V
S/S bias current	$I_{S/S}$			180	270	μA
S/S low-level voltage	$V_{S/SL}$		0		0.8	V
S/S high-level voltage	$V_{S/SH}$		3.5		V_{CC}	V
Hall amplifier input bias current	I_{HB}				10	μA
Common-mode input voltage range	Vh		1.5		V_{CC} – 1.0	V
Differential input voltage range	Vdif		50		200	mVp-p
Hall bias output voltage	V_H	I_H = 5 mA		0.8		V
Leakage current	I_{HL}	S/S = 5 V			±10	μA
Output saturation voltage	Vsat	I_O = 0.7 A, sink + source		1.3	1.8	V
Output leakage current	I_{OL}				1.0	mA
Current limiter	Vlim		0.27	0.3	0.33	V
Control amplifier voltage gain	G_C			–7		dB
Voltage gain difference between phases	ΔG_C				±1	dB
V/I conversion source current	I^+		9	14	19	μA
V/I conversion sink current	I^-		–9	–14	–19	μA
V/I conversion current ratio	I^+/I^-		0.8	1.0	1.2	
DSC buffer input current	I_{DSC}				1.0	μA
FG Schmitt hysteresis	ΔVsh	*		50		mV
Speed discriminator counts	N			1041.5		
Discriminator operating frequency	F_D	*			1.1	MHz
Oscillator frequency range	F_{OSC}	*			1.1	MHz
Index input hysteresis	V_{IDH}		18	23	28	mV
Index input	V_{IDO}	I_O = 2 mA	–5	0	+5	mV
Index output low-level voltage	V_{IDL}	I_O = 2 mA			0.4	V
Index output leakage current	I_{IDL}				±10	μA
FG amplifier voltage gain	G_{FG}	*		48		dB
FG amplifier input offset	$V_{FG\,O}$				±10	mV
FG amplifier internal reference voltage	$V_{FG\,B}$		2.2	2.5	2.8	V
Thermal shutdown temperature	TSD	*	150	180		°C
Hysteresis	ΔTSD	*		40		°C

Note: * Items marked with an asterisk are design target values and are not measured.

Pin Assignment



Top view

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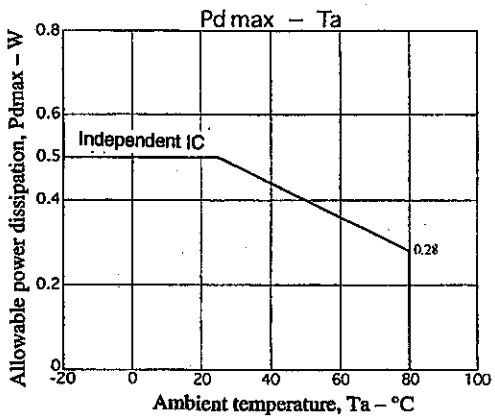
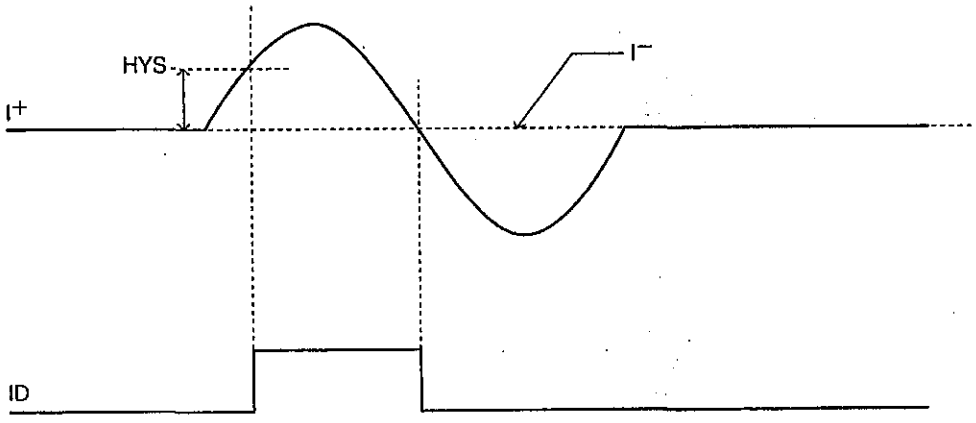
Truth Table

	Source → sink	Hall input		
		U	V	W
1	V phase → W phase	H	H	L
2	V phase → U phase	L	H	L
3	W phase → U phase	L	H	H
4	W phase → V phase	L	L	H
5	U phase → V phase	H	L	H
6	U phase → W phase	H	L	L

Note: Hall input high levels are defined as: $U_{IN}^{+} > U_{IN}^{-}$
$V_{IN}^{+} > V_{IN}^{-}$
$W_{IN}^{+} > W_{IN}^{-}$



Index Pulse Timing Chart



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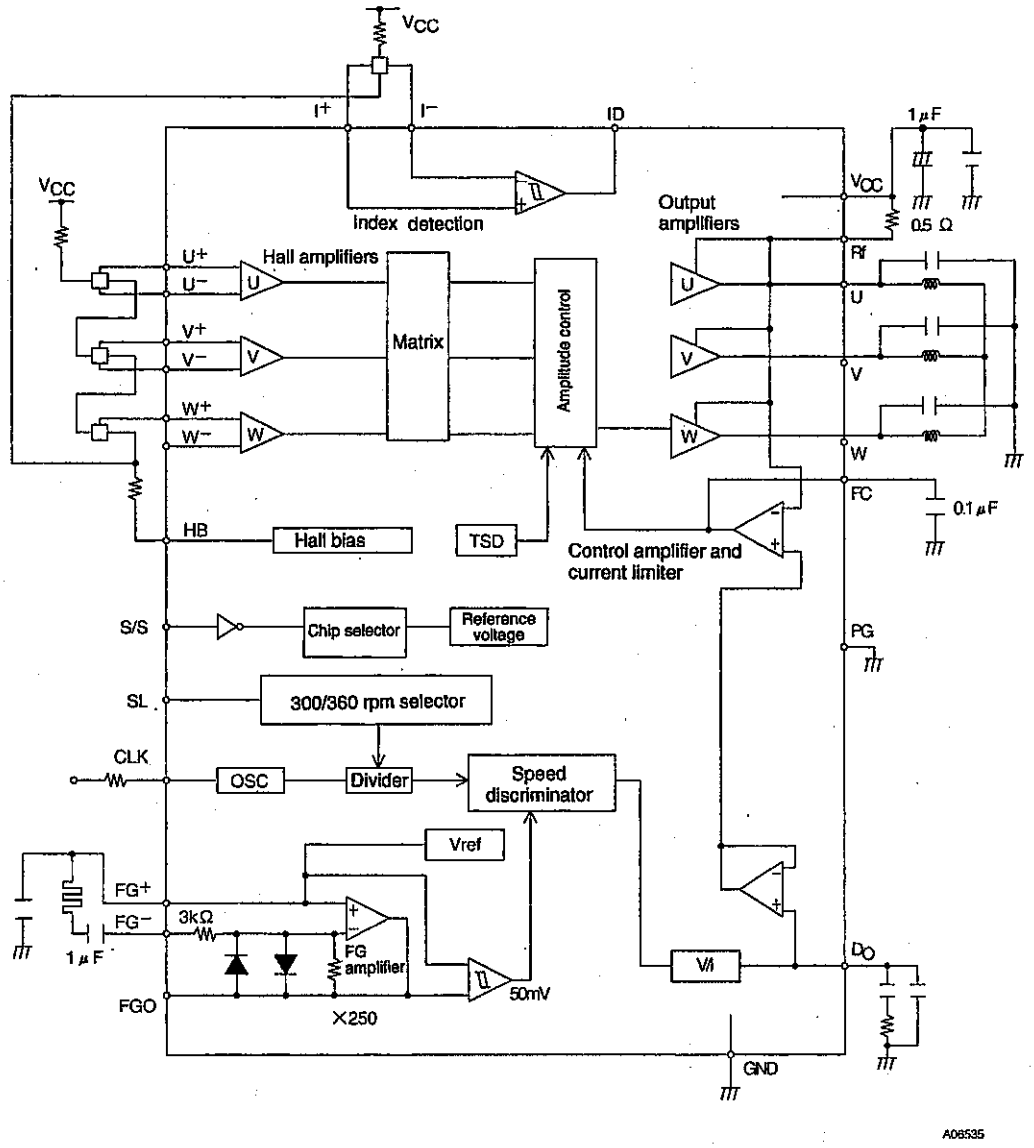
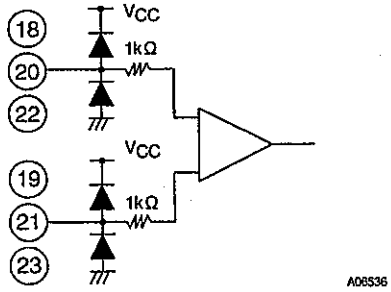
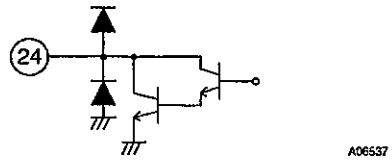
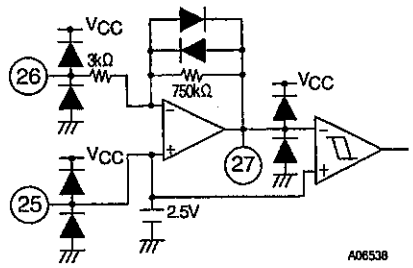
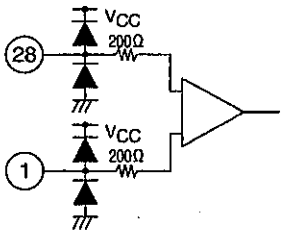
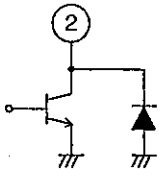
Block Diagram



Pin Functions

Pin No.	Symbol	Pin voltage	Equivalent circuit diagram	Function
18 19 20 21 22 23	U_{IN}^+ U_{IN}^- V_{IN}^+ V_{IN}^- W_{IN}^+ W_{IN}^-	1.5 V min V_{CC} – 1.0 V max		U phase Hall element input V phase Hall element input W phase Hall element input
24	HB	0.8 V typ (I_H = 5 mA)		Minus side connection for providing the Hall bias current This pin becomes open in the stopped state, thus cutting the Hall bias current.
25 26 27	FG_{IN}^+ FG_{IN}^- FG_{OUT}	2.5 V		• FG amplifier plus input A 2.5-V reference voltage is generated internally. • FG amplifier minus input • FG amplifier output
28 1	I^+ I^-			Index input
2	ID	L: 0.4 V max H: 4.5 V min		Index output

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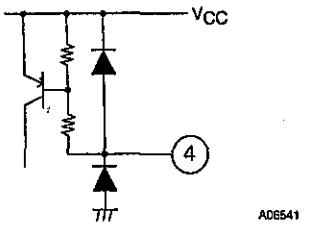
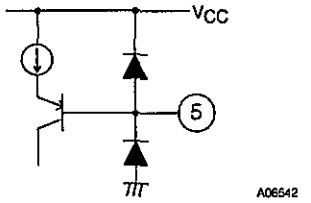
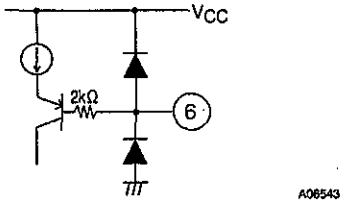
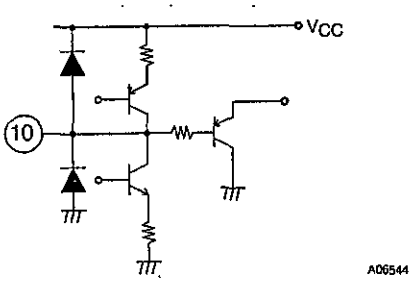
Pin No.	Symbol	Pin voltage	Equivalent circuit diagram	Function
4	SS	L: 0.8 V max H: 3.5 V min		Start/stop mode switching This is an active-low input.
5	SL	L: 1.0 V max H: 3.5 V min		Rotational speed switching
6	CLK	L: 1.0 V max H: V_{CC} – 1.0 V min		Reference clock input A 1-MHz input frequency corresponds to speeds of 300 and 360 rpm.
7	GND			• Ground • This pin, pin 14, and the frame must all be grounded together.
8	V_{CC}			Power supply This voltage must be stabilized so that ripple and noise do not enter the IC.
9	Rf			Output current detection The output current is detected as a voltage by connecting the resistor Rf between this pin and V_{CC}. The current limiter operates by detecting the voltage on this pin.
10	D_O			Speed discriminator
11	F_C			Frequency characteristics compensation Current control system loop oscillation is prevented by connecting a capacitor between this pin and ground.

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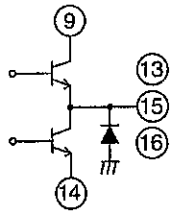
Pin No.	Symbol	Pin voltage	Equivalent circuit diagram	Function
13 15 16	U_{OUT} V_{OUT} W_{OUT}			U phase output V phase output W phase output
14	P_{GND}			Output transistor ground connection