



# LB1822

## 3-Phase Brushless Motor Predriver with Digital Speed Control

### Overview

The LB1822 is a monolithic predriver IC for controlling three-phase brushless motors and has an on-chip digital speed control circuit. The LB1822 is ideally suited for driving the motor of laser beam printers, facsimiles, plain paper copiers, and so on.

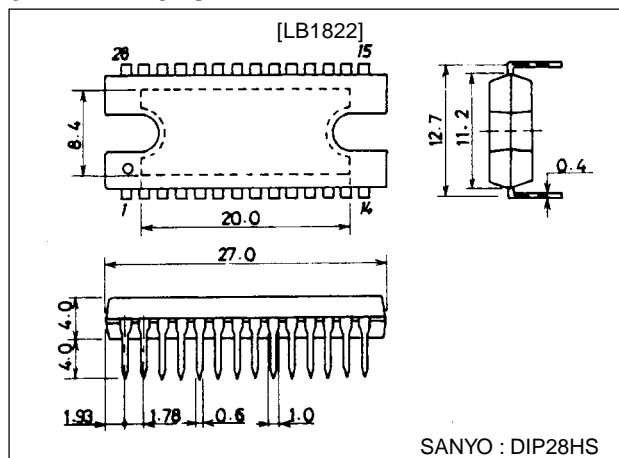
### Features

- 30V withstand voltage and 30mA output current.
- Current limiter.
- Low-voltage protection circuit.
- Thermal shutdown circuit.
- Hall amp with hysteresis characteristic.
- Start/Stop terminals.
- Crystal oscillator and divider.
- Digital speed control circuit.
- Lock detector.

### Package Dimensions

unit:mm

3147A-DIP28HS



SANYO : DIP28HS

### Specifications

#### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage 1	V <sub>CC</sub>		30	V
Maximum supply voltage 2	V <sub>M</sub>		30	V
Output current	I <sub>O</sub>		30	mA
Allowable power dissipation1	Pd max1	Independent IC	3	W
Allowable power dissipation2	Pd max2	With infinite heat sink	20	W
Operating temperature	T <sub>opr</sub>		-20 to +80	°C
Storage temperature	T <sub>stg</sub>		-55 to +150	°C

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	V <sub>CC</sub>		9.5 to 28	V
Supply voltage2	V <sub>M</sub>		5 to 28	V
Voltage regulator output current	I <sub>VH</sub>		0 to 20	mA
Comparator output current	I <sub>OSC</sub>		0 to 30	mA
Lock detector output current	I <sub>LD</sub>		0 to 20	mA

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## Electrical Characteristics at Ta = 25°C, VCC=VM=24V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current 1	I <sub>CC1</sub>			33	50	mA
Supply current 2	I <sub>CC2</sub>	Stop mode		3	5	mA
Output saturation voltage	V <sub>O sat1</sub>	I <sub>O</sub> =10mA		1.5	2.0	V
Output leak current	I <sub>O leak</sub>				100	μA
[Voltage regulator]						
Output voltage	V <sub>H</sub>	I <sub>VH</sub> =10mA	3.8	4.15	4.5	V
Voltage fluctuation	ΔV <sub>H1</sub>	V <sub>CC</sub> =9.5 to 28V		60	150	mV
Load fluctuation	ΔV <sub>H2</sub>	I <sub>VH</sub> =5 to 20V		60	150	mV
Temperature Coefficient				-2		mV/°C
[Hall amplifier]						
Input bias current	I <sub>HB</sub>			1	4	μA
Common-mode input voltage	V <sub>ICH</sub>		1.5		2.8	V
Hall input sensitivity			100			mVp-p
Hysteresis width	ΔV <sub>IN</sub>		24	33	42	mV
Low to high input voltage	V <sub>SLH</sub>		8	20	32	mV
High to low input voltage	V <sub>SHL</sub>		-25	-13	-1	mV
[Oscillator]						
High-level output voltage	V <sub>OH(CR)</sub>		2.9	3.2	3.5	V
Low-level output voltage	V <sub>OL(CR)</sub>		0.9	1.1	1.3	V
Oscillation amplitude			1.8	2.1	2.4	V
Oscillation frequency	f	R=300kΩ, C=1500pF		18.5		kHz
Temperature coefficient	Δf			0.1		%/°C
[Comparator]						
Output voltage	V <sub>OSC</sub>	I <sub>OSC</sub> =20mA			1.5	V
[Current limiter]						
Limiter1	V <sub>RF1</sub>		0.42	0.5	0.6	V
Limiter2	V <sub>RF2</sub>		0.4	0.44	0.48	V
Thermal shutdown temperature	TSD	Design target	150	180		°C
Hysteresis width	ΔTSD			30		°C
Low-voltage protection voltage	V <sub>LVSD</sub>		7.5	8.1	8.7	V
Hysteresis width	ΔV <sub>LVSD</sub>		0.45	0.6	0.75	V
[FG amplifier]						
Input offset voltage	V <sub>IO(FG)</sub>		-10		+10	mV
Input bias current	I <sub>B(FG)</sub>		-1		+1	μA
High-level output voltage	V <sub>OH(FG)</sub>	I <sub>FG</sub> =-2mA	5.6	6.2	6.8	V
Low-level output voltage	V <sub>OL(FG)</sub>	I <sub>FG</sub> =2mA		1	1.5	V
FG input sensitivity		10x Gain	5			mV
Schmitt width at next stage				16		mV
Operating frequency range					5	kHz
Open-loop voltage gain			60			dB
[Speed Discriminator]						
High-level output voltage	V <sub>OH(D)</sub>			4.7		V
Low-level output voltage	V <sub>OL(D)</sub>			0.3		V
Maximum clock frequency		T <sub>J</sub> =100°C	1.05			MHz
Count pulses			2044	2046	2048	
[Integrator]						
Input offset voltage	V <sub>IO(INT)</sub>		-10		10	mV
Input bias current	I <sub>B(INT)</sub>		-0.4		+0.4	μA
High-level output voltage	V <sub>OH(INT)</sub>		3.7	4.3	4.9	V
Low-level output voltage	V <sub>OL(INT)</sub>			0.8	1.2	V
Open-loop gain			60			dB
Gain-bandwidth product				1.6		MHz
Reference voltage			-5%	V5/2	+5%	V
5V supply	V5		4.6	5	5.4	V
[Lock detection]						
Low-level output voltage	V <sub>OL(LD)</sub>	I <sub>LD</sub> =10mA			0.5	V
Locking range				±3.125		%

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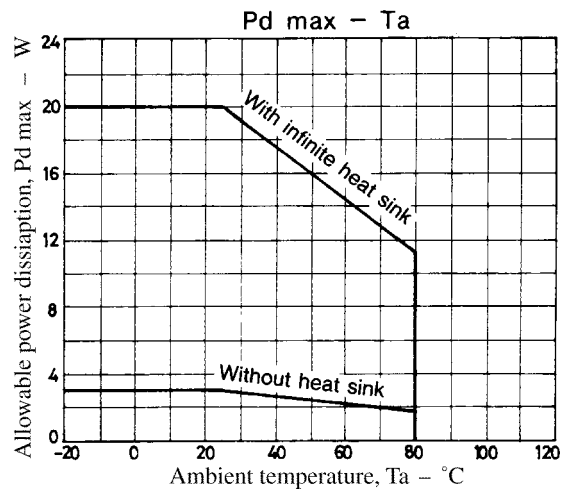
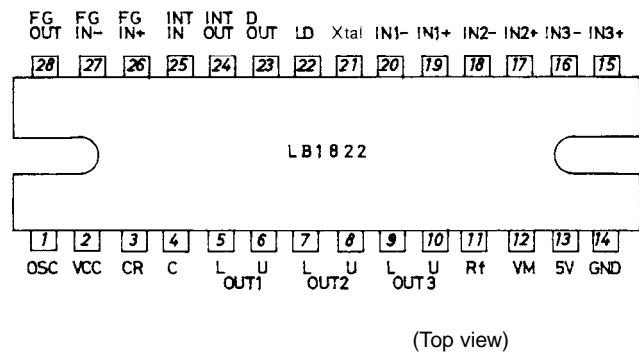
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Start/Stop]						
Operating voltage			0.4	0.5	0.6	V
[Crystal Oscillator]						
Precision of oscillating frequency		Referenced to indicated frequency	-500		500	ppm
Temperature coefficient				-3		ppm/°C
Drift in rotation speed				±0.01		%

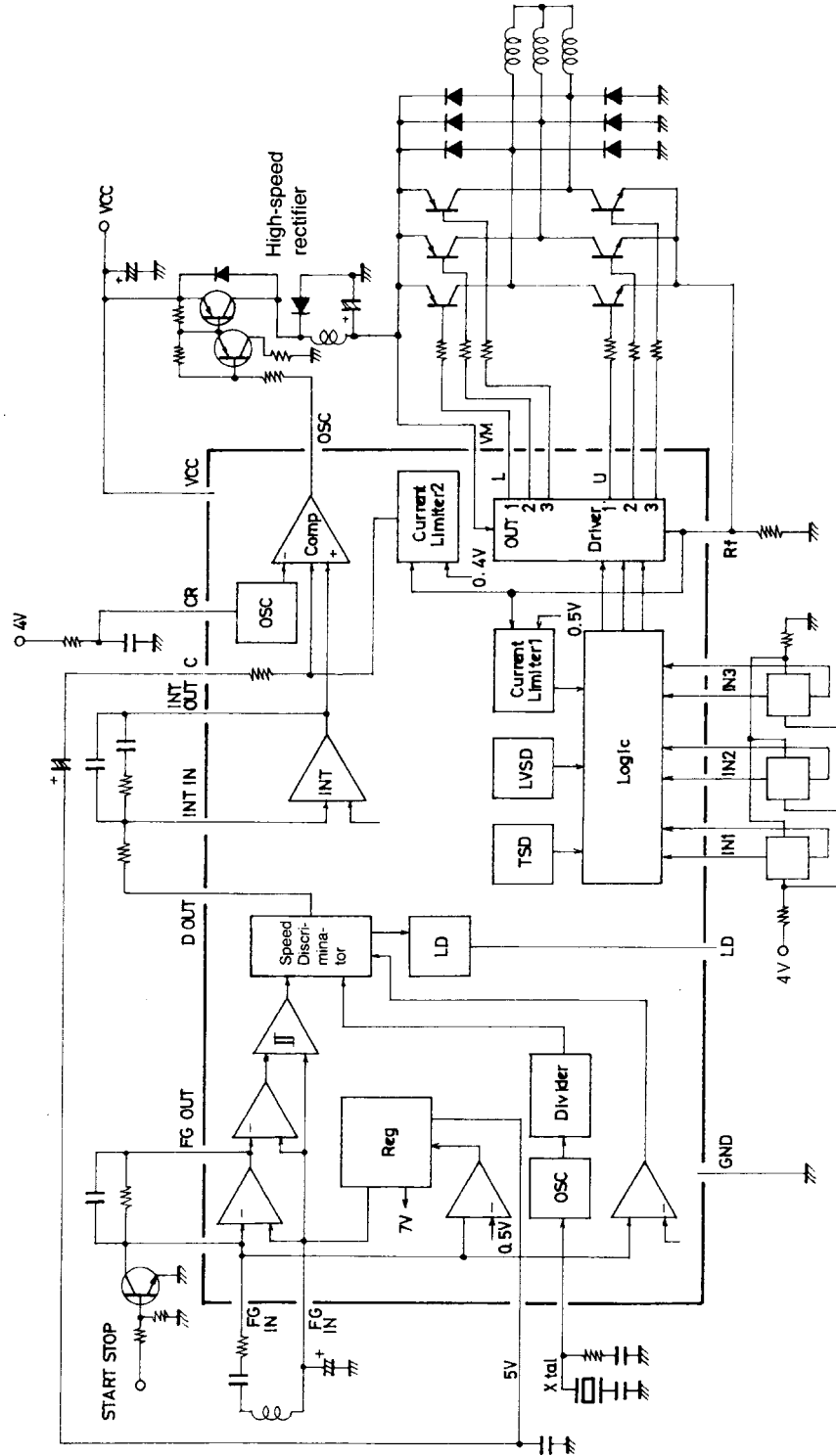
## Truth Table

Item	Source Sink	Input		
		IN1	IN2	IN3
1	OUT 3 → OUT 2	H	H	L
2	OUT 3 → OUT 1	H	L	L
3	OUT 2 → OUT 3	L	L	H
4	OUT 1 → OUT 2	L	H	L
5	OUT 2 → OUT 1	H	L	H
6	OUT 1 → OUT 3	L	H	H

## Pin Assignment



Block Diagram



## Description of Terminal Function

Pin Name	Pin No.	Description
IN <sup>+</sup> 1, IN <sup>-</sup> 1	19, 20	OUT1: Hall element input terminals for Phase 1. "H" logic is the state when IN <sup>+</sup> > IN <sup>-</sup> .
IN <sup>+</sup> 2, IN <sup>-</sup> 2	17, 18	OUT2: Hall element input terminals for Phase 2. "H" logic is the state when IN <sup>+</sup> > IN <sup>-</sup> .
IN <sup>+</sup> 3, IN <sup>-</sup> 3	15, 16	OUT3: Hall element input terminals for Phase 3. "H" logic is the state when IN <sup>+</sup> > IN <sup>-</sup> .
OUT1	5, 6	Output terminals for Phase 1. U...source
OUT2	7, 8	Output terminals for Phase 2. L...sink
OUT3	9, 10	Output terminals for Phase 3.
V <sub>CC</sub>	2	Power supply for everything, except outputs.
V <sub>M</sub>	12	Power supply for outputs.
R <sub>f</sub>	11	Output current detection terminal. An R <sub>f</sub> is connected across this terminal and GND, and the output current is detected as voltage.
CR	3	Sets the oscillating frequency of the switching regulator.
OSC	1	Outputs duty-controlled pulses. Open-collector output.
INT. OUT	24	Integrator output terminal (speed control terminal). Varies the switching regulator output voltage.
INT. IN	25	Integrator input terminal.
D. OUT	23	Speed discriminator output terminal. Goes LOW when the specified speed is exceeded.
C	4	Suppresses ripples in the motor current during operation of current limiter 2.
LD	22	Lock detection terminal. Goes LOW when the motor rotation speed is within the locking range.
FG IN <sup>-</sup>	27	FG pulse input (Start/Stop control) terminal.
FG IN <sup>+</sup>	26	FG pulse input (4V supply) terminal.
FGOUT	28	FG amp output terminal.
X' tal	21	Crystal oscillator terminal to which a crystal resonator is connected.
5V	13	5V supply terminal.

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