



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.

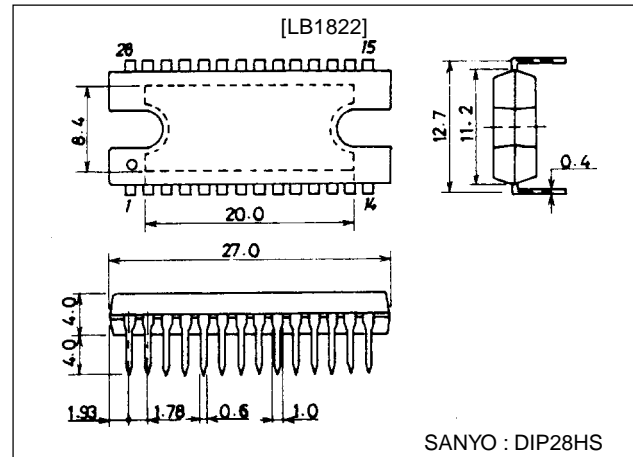
Features

- 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



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage 1	V_{CC}		30	V
Maximum supply voltage 2	V_M		30	V
Output current	I_O		30	mA
Allowable power dissipation1	$P_d \text{ max1}$	Independent IC	3	W
Allowable power dissipation2	$P_d \text{ max2}$	With infinite heat sink	20	W
Operating temperature	T_{opr}		-20 to +80	°C
Storage temperature	T_{stg}		-55 to +150	°C

Allowable Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	V_{CC}		9.5 to 28	V
Supply voltage2	V_M		5 to 28	V
Voltage regulator output current	I_{VH}		0 to 20	mA
Comparator output current	I_{OSC}		0 to 30	mA
Lock detector output current	I_{LD}		0 to 20	mA

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LB1822

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current 1	ICC1			33	50	mA
Supply current 2	ICC2	Stop mode		3	5	mA
Output saturation voltage	VO sat1	IO=10mA		1.5	2.0	V
Output leak current	IO leak				100	µA
[Voltage regulator]						
Output voltage	VH	IYH=10mA	3.8	4.15	4.5	V
Voltage fluctuation	ΔVH1	VCC=9.5 to 28V		60	150	mV
Load fluctuation	ΔVH2	IYH=5 to 20V		60	150	mV
Temperature Coefficient				-2		mV/°C
[Hall amplifier]						
Input bias current	IHB			1	4	µA
Common-mode input voltage	VICH		1.5		2.8	V
Hall input sensitivity			100			mVp-p
Hysteresis width	ΔVIN		24	33	42	mV
Low to high input voltage	VSLH		8	20	32	mV
High to low input voltage	VSHL		-25	-13	-1	mV
[Oscillator]						
High-level output voltage	VOH(CR)		2.9	3.2	3.5	V
Low-level output voltage	VOL(CR)		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	VOSC	IOSC=20mA			1.5	V
[Current limiter]						
Limiter1	VRf1		0.42	0.5	0.6	V
Limiter2	VRf2		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	VLVSD		7.5	8.1	8.7	V
Hysteresis width	ΔVLVSD		0.45	0.6	0.75	V
[FG amplifier]						
Input offset voltage	VI0(FG)		-10		+10	mV
Input bias current	IB(FG)		-1		+1	µA
High-level output voltage	VOH(FG)	IFG=-2mA	5.6	6.2	6.8	V
Low-level output voltage	VOL(FG)	IFG=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	VOH(D)			4.7		V
Low-level output voltage	VOL(D)			0.3		V
Maximum clock frequency		Tj=100°C	1.05			MHz
Count pulses			2044	2046	2048	
[Integrator]						
Input offset voltage	VI0(INT)		-10		10	mV
Input bias current	IB(INT)		-0.4		+0.4	µA
High-level output voltage	VOH(INT)		3.7	4.3	4.9	V
Low-level output voltage	VOL(INT)			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	VOL(LD)	ILD=10mA			0.5	V
Locking range				±3.125		%

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LB1822

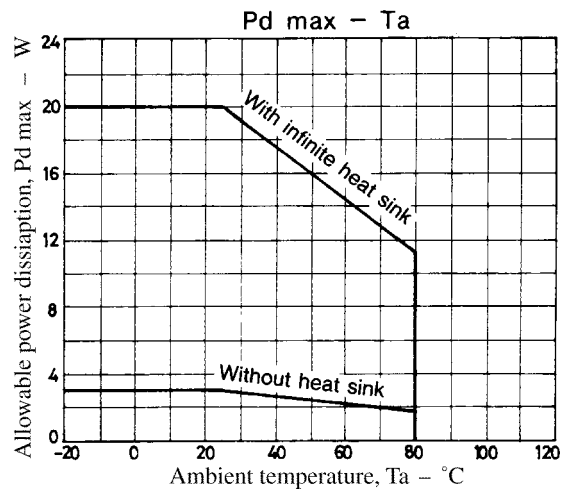
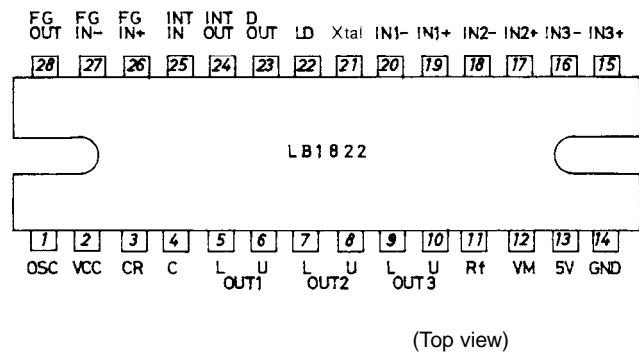
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Start/Stop]						
Operating voltage			0.4	0.5	0.6	V
[Crystal Oscillator]						
Precision of oscillating frequency		Referenced to indicated frequency	-500		500	ppm
Temperature coefficient	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

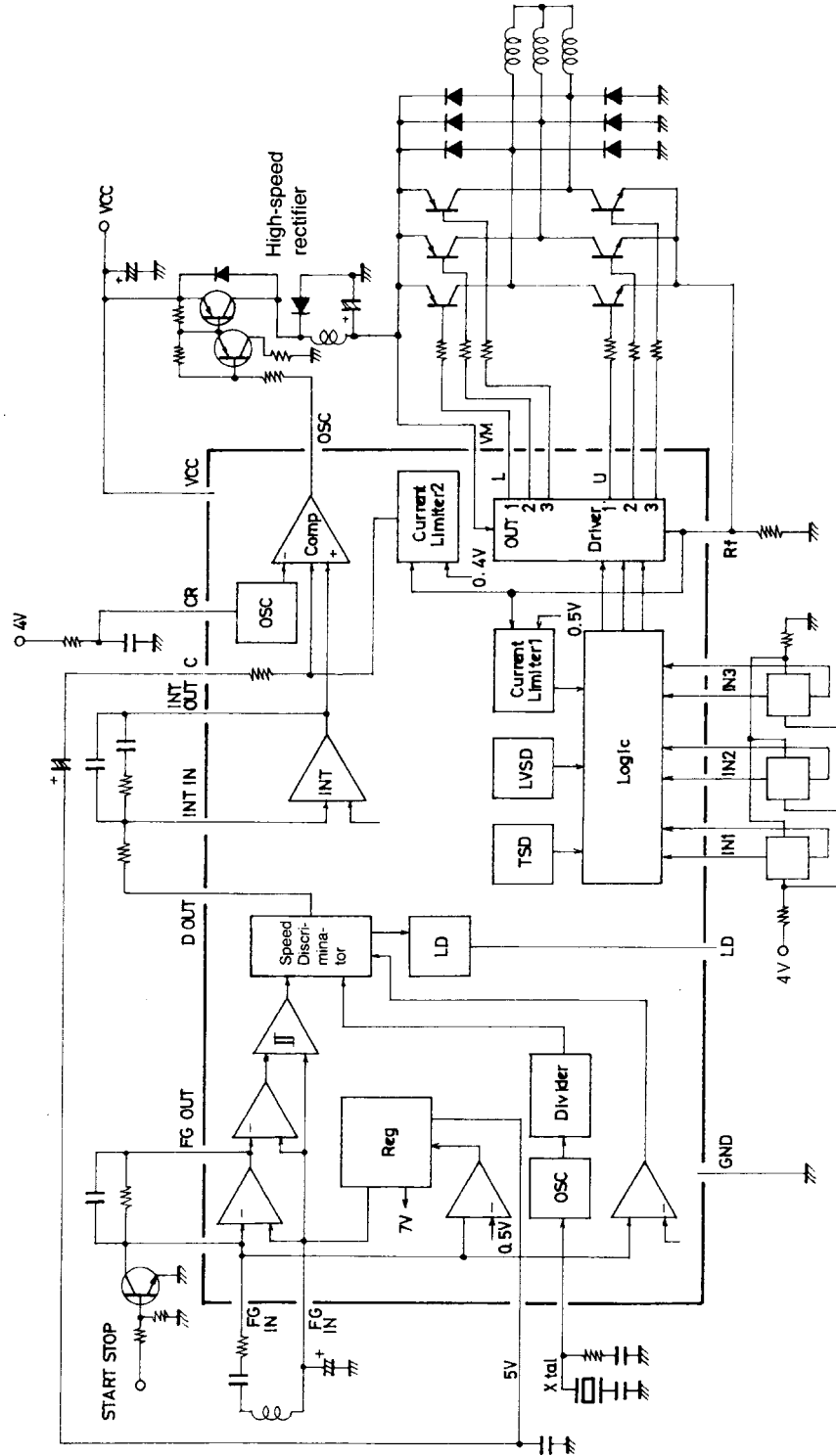
Truth Table

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 ⁺ 1, IN ⁻ 1	19, 20	OUT1: Hall element input terminals for Phase 1. "H" logic is the state when IN ⁺ > IN ⁻ .
IN ⁺ 2, IN ⁻ 2	17, 18	OUT2: Hall element input terminals for Phase 2. "H" logic is the state when IN ⁺ > IN ⁻ .
IN ⁺ 3, IN ⁻ 3	15, 16	OUT3: Hall element input terminals for Phase 3. "H" logic is the state when IN ⁺ > IN ⁻ .
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 _{CC}	2	Power supply for everything, except outputs.
V _M	12	Power supply for outputs.
R _f	11	Output current detection terminal. An R _f 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 ⁻	27	FG pulse input (Start/Stop control) terminal.
FG IN ⁺	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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