Ordering number: EN 3318

Monolithic Digital IC

SANYO No. 3318

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

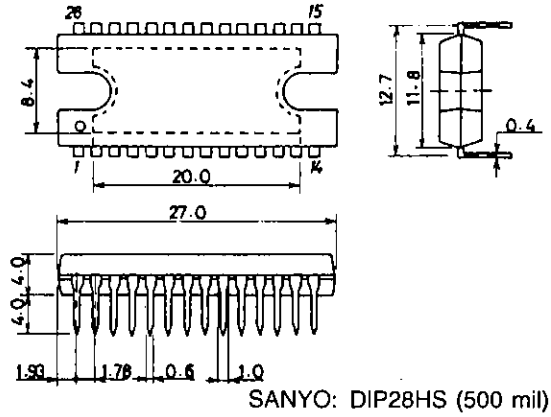
Absolute Maximum Ratings at Ta = 25°C

				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 Dissipation 1	Pd max1	IC alone	3	W
Allowable Power Dissipation 2	Pd max2	With infinte heat sink	20	W
Operating Temperature	Topr		−20 to +80	°C
Storage Temperature	T_{stg}		−55 to +150	°C

Allowable Operating Conditions at Ta = 25°C

			unit
Supply Voltage 1	V_{CC}	9.5 to 28	V
Supply Voltage 2	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

Package Dimensions 3147-D28HSLSI
(unit: mm)



SANYO: DIP28HS (500 mil)

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Electrical Characteristics at Ta = 25°C, V_{CC} = V_M = 24V

			min	typ	max	unit
Supply Current 1	I_{CC1}			33	50	mA
Supply Current 2	I_{CC2}	Stop mode		3	5	mA
Output Saturation Voltage	V_O sat1	I_O=10mA		1.5	2.0	V
Output Leak Current	I_o leak				100	μA
Voltage Regulator						
Output Voltage	V_H	I_{VH} = 10mA	3.8	4.15	4.5	V
Voltage Fluctuation	ΔV_{H1}	V_{CC} = 9.5 to 28V		60	150	mV
Load Fluctuation	ΔV_{H2}	I_{VH} = 5 to 20V		60	150	mV
Temperature Coefficient				−2		mV/°C
Hall Amp						
Input Bias Current	I_{HB}			1	4	μA
Common-Mode Input Voltage	V_{ICM}		1.5		2.8	V
Hall Input Sensitivity			100			mVp-p
Hysteresis Width	ΔV_{IN}		24	33	42	mV
Low to High Input Voltage	V_{SLH}		8	20	32	mV
High to Low Input Voltage	V_{SHL}		−25	−13	−1	mV
Oscillator						
High-Level Output Voltage	$V_{OH(CR)}$		2.9	3.2	3.5	V
Low-Level Output Voltage	$V_{OL(CR)}$		0.9	1.1	1.3	V
Oscillation Amplitude			1.8	2.1	2.4	V
Oscillation Frequency	f	R = 30kΩ, C = 1500pF		18.5		kHz
Temperature Coefficient	Δf			0.1		%/°C
Comparator						
Output Voltage	V_{OSC}	I_{OSC}=20mA			1.5	V
Current Limiter						
Limiter 1	V_{Rf1}		0.42	0.5	0.6	V
Limiter 2	V_{Rf2}		0.4	0.44	0.48	V
Thermal Shutdown Temperature	TSD	Design goals	150	180		°C
Hysteresis Width	ΔTSD			30		°C
Low-Voltage Protection Voltage	V_{LVSD}		7.5	8.1	8.7	V
Hysteresis Width	ΔV_{LVSD}		0.45	0.6	0.75	V
FG Amp						
Input Offset Voltage	$V_{IO(FG)}$		−10		10	mV
Input Bias Current	$I_{B(FG)}$		−1		1	μA
High-Level Output Voltage	$V_{OH(FG)}$	I_{FG} = −2 mA	5.6	6.2	6.8	V
Low-Level Output Voltage	$V_{OL(FG)}$	I_{FG} = 2 mA		1	1.5	V
FG Input Sensitivity		10 × 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	$V_{OH(D)}$			4.7		V
Low-Level Output Voltage	$V_{OL(D)}$			0.3		V
Maximum Clock Frequency		Tj = 100°C	1.05			MHz
Count Pulses			2044	2046	2048	

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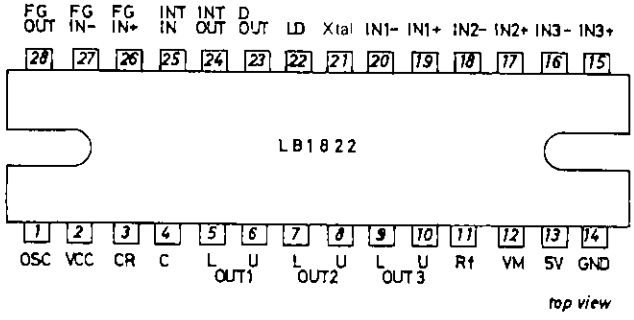
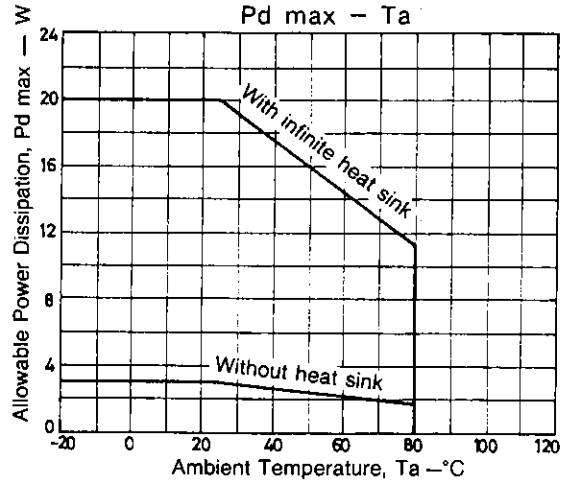
			min	typ	max	unit
Integrator						
Input Offset Voltage	$V_{IO(INT)}$		−10		10	mV
Input Bias Current	$I_{B(INT)}$		−0.4		0.4	μA
High-Level Output Voltage	$V_{OH(INT)}$		3.7	4.3	4.9	V
Low-Level Output Voltage	$V_{OL(INT)}$			0.8	1.2	V
Open-Loop Gain			60			dB
Gain-Bandwidth Product				1.6		MHz
Reference Voltage			−5%	V5/2	5%	V
5V Supply	V5		4.6	5	5.4	V
Lock Detection						
Low-Level Output Voltage	$V_{OL(LD)}$	I_{LD} = 10mA			0.5	V
Locking Range				±3.125		%
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

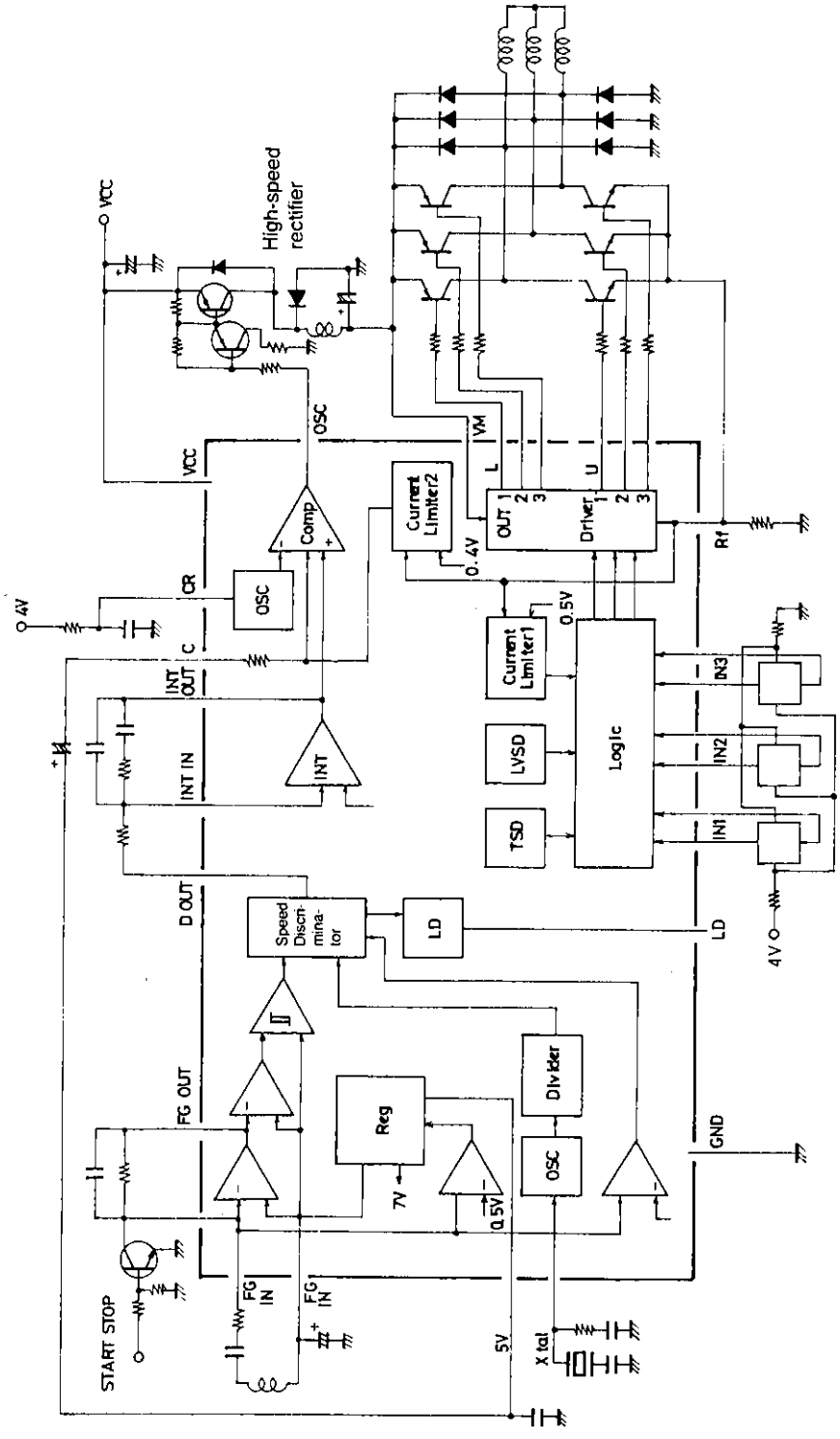
Item	Source Sink	Input		
		IN1	IN2	IN3
1	OUT 3 → OUT 2	H	H	L
2	OUT 3 → OUT 1	H	L	L
3	OUT 2 → OUT 3	L	L	H
4	OUT 1 → OUT 2	L	H	L
5	OUT 2 → OUT 1	H	L	H
6	OUT 1 → OUT 3	L	H	H

Pin Assignment





Block Diagram



Description of Terminal Functions

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 OUT2 OUT3	5, 6 7, 8 9, 10	Output terminals for Phase 1. U ... source Output terminals for Phase 2. L ... sink Output terminals for Phase 3.
Vcc	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.
GND	14	Ground for everything, except outputs. The minimum potential for output transistors is the voltage at R_f.
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^- FG, IN^+	27 26	FG pulse input (Start/Stop control) terminal. 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.