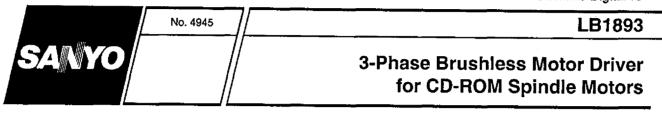
Ordering number: EN 4945

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Monolithic Digital IC



Overview

The LB1893 is a 3-phase brushless motor driver for use in CD-ROM spindle motors.

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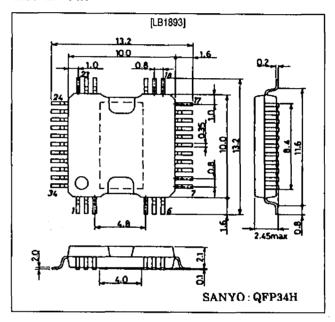
Functions and Features

- 120° voltage linear type
- V-type control voltage
- Switchable control gain
- Control, non-feedback, and speed increment/decrement control pin built-in
- Start/Stop pin built-in
- Hall device bias built-in

Package Dimensions

Unit: mm

3206-QFP34H



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Specifications

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Absolute Maximum Ratings at $Ta = 25^{\circ}C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{CC} 1 max		20	v
Maximum supply voltage	V _{CC} 2 max		7.0	V
Output transistor blocking voltage	V _{O(sus)}	I _{CUT} = 20mA, design value	20	V
Output supply voltage	V _{OU, V, W}		20	v
Output current	Ιουτ		1.2	A
Allowable power dissipation	Pd max	Unmounted IC	0.77	W
Operating temperature	Topr		-20 to +75	0°
Storage temperature	Tsig		-55 to +150	°C

Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Cupply vollage	V _{CC} 1		5 to 18	V
Supply voltage	V _{cc} 2	$V_{CC}1 \ge V_{CC}2$	4.3 to 6.5	ν
V _{Cref} pin input voltage	V _{Cret}		$V_{\rm CC} 2/2 \pm 1.0$	V
V _{NS} pin input voltage	V _{NS}		0 to V _{CC} 2/2 - 1.0	V

Electrical Characteristics at Ta = 25° C, V_{CC} 1 = 12V, V_{CC} 2 = 5V, specified test circuit

Parameter	Cumbal	Conditions		Ratings	Ratings	
Falameter	Symbol	Conditions	min	typ	max	Unit
Supply current 1	l _{cc} 1	$V_{C} = open, V_{Crel} = open, R_{L} = \infty, V_{S/S} = 5V$	-	17	30	mA
Supply current 2	I _{CC} 2	V _C = open, V _{Crel} = open	_	7.5	10.5	mA
Supply current 3	I _{CC} 3	$V_C \simeq$ open, $V_{Crel} =$ open, $R_L \simeq \infty$, $V_{S/S} \simeq 0V$	-	0.9	3	. mA
Output saturation voltage	V _{O(sat)} 1	I _{OUT} = 0.4A, sink + source	-	1.6	2.2	v
Output saturation voltage	V _{O(sat)} 2	I _{OUT} = 0.8A, sink + source	-	2.0	3.0	V
Output center voltage	Voq	V _C = 2.5V, V _{Cref} = 2.5V	5.7	6.0	6.3	v
Hall amplifier input offset voltage	V _{H offset}		5	-	+5	mV
Hall amplifier input bias current	IH bias		_	1	5	μΑ
Hall amplifier common-mode input voltage range	V _{Hch}		1.3	-	2.2	v
Hall amplifier input-output voltage gain	G _{VHO}		40	43	46	dB
Control-output drive gain 1	G _{VCD} 1	RZ1 = RZ2, GC1 = LOW, GC2 = LOW	26	29	_	dB
Control-output channel difference 1	∆G _{VC0} 1	RZ1 = RZ2, GC1 = LOW, GC2 = LOW	-1.5	_	+1.5	dB
Control-output drive gain 2	G _{VCO} 2	RZ1 = RZ2, GC1 = LOW, GC2 = HIGH	32	35	-	dB
Control-output channel difference 2	∆G _{VCO} 2	RZ1 = RZ2, GC1 = LOW, GC2 = HIGH	1.9	-	+1.9	dB
Input dead-zone voltage	V _{DZ}	RZ1 = RZ2, GC1 = LOW, GC2 = LOW	±13	±38	±55	mV
Input bias current 1	IB SERVO	V _C = 1.0V	-	-	500	nA
Input bias current 2	I _{B NS}	V _{NS} = 1.0V	-	-	500	nA

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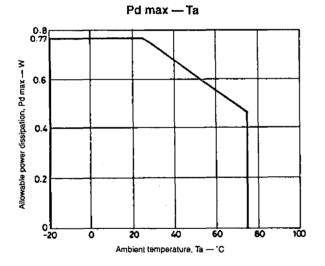
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Parameter .	Symbol	Conditions		Ratings		Unit	
raiailleisi			min typ		max		
S/S pin HIGH-level voltage	V _{S/S H}	CMOS-level input.	4.0	-		V	
S/S pin LOW-level voitage	VSISL	S/S pin threshold V th = $V_{CC}2/2$	-	-	1.0	V	
Gain control 1 HIGH-level voltage	V _{GC1H} ,	CMOS-level input.	4.0	-	-	v	
Gain control 1 LOW-level voltage	V _{GC 1 L}	GC1 pin threshold Vth = 2.0V	-	-	1.0	v	
Gain control 2 HIGH-level voltage	V _{GC2 H}	CMOS-level input.	4.0	-	-	v	
Gain control 2 LOW-level voltage	V _{GC2L}	GC2 pin threshold Vth = 2.0V	-	-	1.0	v	
S/S pin input current	_{S/S}	5V input voltage		50	100	μA	
Gain controls 1 and 2 current	lac	5V input voltage		53	110	μА	
Motor output saturation voltage	V _{(sat)HFG}	$I_0 = -5mA$	-	0.24	0.5	v	
Motor output saturation blocking voltage	V _{(sus)HFG}	Design value	-	-	7	v	
Hall bias voltage	V _{H±}	$I_0 = 5 mA, R_H = 200 \Omega$	0.7	0.97	1.2	V	
CTRL pin HIGH-level voltage	V _{CTRL H}	CTRLo and CTRL1 common,	4.0	-	-	V	
CTRL pin LOW-level voltage	VCTALL	CMOS-level input. CTRL pin threshold Vth = 2.5V		-	1.0	v	
CTRL input current	ICTRL	5V input voltage	-	53	110	μA	
Thermal shutdown operating temperature	TSD	Design value	150	180	210	°C	
TSD hysteresis	ΔTSD	Design value	-"	15		°C	

LB1893

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Performance Characteristics



Mode Switching Truth Table

CTRL _{\$1}	CTRL1 ¹	Mode
LOW	LOW	Control
LOW	HIGH	Non-feedback
HIGH	LOW	Increment
HIGH	HIGH	Decrement

1. LOW = 0 to 1.0V, and HIGH \ge 4.0V.

No. 4945----3/8

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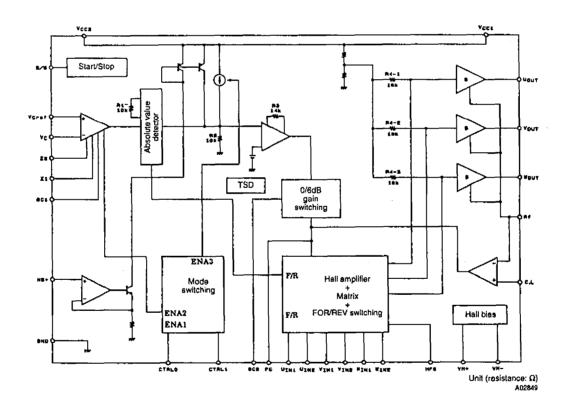
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Hall Element Logic Truth Table

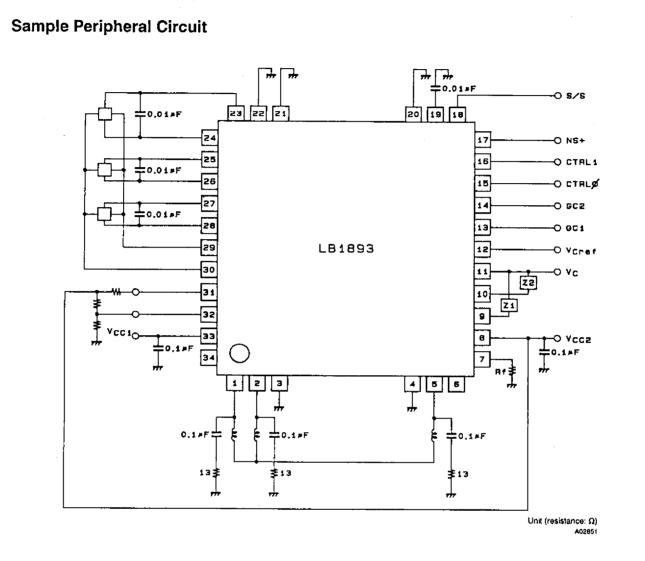
	Source → sink		Kall Input ¹		Forward/Reverse control ²
		ບ _{iN}	V _{IN}	W _{IN}	- Forward/Heverse control-
	W phase \rightarrow V phase	HIGH	HIGH	LOW	Forward
	V phase \rightarrow W phase		ЛІСП	LOW	Reverse
0	W phase \rightarrow U phase		1.014	1011	Forward
2	U phase W phase	HIGH	LOW	LOW	Reverse
	V phase → W phase	1.014	1.011	1101	Forward
3	W phase → V phase	LOW	LOW	HIGH	Reverse
	U phase \rightarrow V phase			1011	Forward
4	V phase → U phase	LOW	HIGH	LOW	Reverse
_	V phase → U phase		1.011		Forward
5	U phase \rightarrow V phase	HIGH	LOW	HIGH	Reverse
	U phase \rightarrow W phase				Forward
6	W phase → U phase	LOW	HIGH	HIGH	Reverse

1. An input is considered to be HIGH when $U_{IN}1 > U_{IN}2$, $V_{IN}1 > V_{IN}2$, and $W_{IN}1 > W_{IN}2$ by 0.2V or more. 2. Forward is selected when $V_C > V_{Crel}$. Reverse is selected when $V_C < V_{Crel}$.

Block Diagram

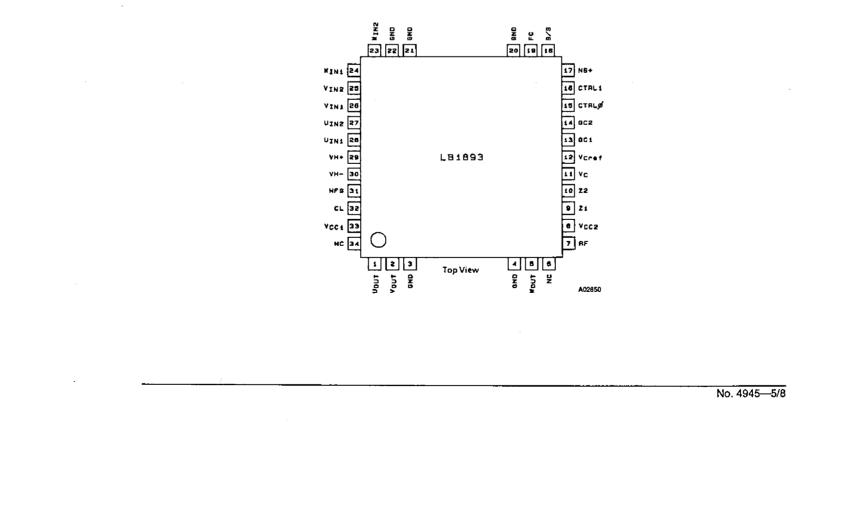


No. 4945-4/8



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Pin Assignment



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Pin Functions

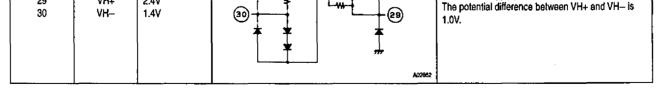
Number	Name	Pin voltage	Equivalent circuit	Function
3, 4, 20, 21	Frame GND			Frame ground. Connected to the common ground.
22	GND			Ground pin
1 2 5	U _{DUT} Vout Wout	-		Output pins. Connected to the motor.
7	Rf		OYCC2	Output transistor ground. A resistor can be connected between this pin and GND to sense the output current as a voltage drop to provide for overcurrent protection.
6, 34	NC			No connection
8	V _{cc} 2	4.3 to 6.5∨		Supply for all circults except the output stage. This supply should be kept stable to prevent noise from entering this pin.
9 10	Z1 Z2		OVCC2	First-stage amplifier gain setting impedance connection. Z1 and Z2 should be in the order of $30k\Omega$ to several hundred $k\Omega$. The gain should be in the order of 6dB.
11 12	V _C V _{Cref}	V _{CC} 2/2 ± 1.0	VCC2 VCC2 VCC2 VCC2 VCC2 SND SND A02355	V_C is the speed control pin; forward when $V_C > V_{Cref}$ and reverse when $V_C < V_{Cref}$. The output voltage is controlled by the V_C voltage. V_{Cref} determines the motor control stop voltage, and is normally set to $V_{CC}2/2$.
13 14	GC1 GC2	0 to V _{CC} 2	VCC2	Input gain control switching pin. GC1 switches the first-stage amplifier impedances Z1 and Z2. Z1 is selected when GC1 is LOW, and Z2 is selected when GC1 is HIGH. GC2 is the second-stage amplifier switching pin.

No. 4945-6/8

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Number	Name	Pin voltage	Equivalent circuit	Function
15 16	CTRL¢ CTRL1	0 to V _{CC} 2	VCC2 VCC2 (13)(15) MO2857	Operating mode switch pin. The mode switching truth table shows how to select control, non-feedback, and speed increment/decrement modes.
17	NS+	0 to V _{CC} 2 - 1V	AC22350	Non-feedback mode input pin. Input-output gain is approximately 14dB (GC2 = LOW) Motor stops when V _{NS} = 0V.
18	S/S	0 to V _{CC} 2		Start/Stop pin. Start when HIGH, and stop when LOW. The threshold is V _{CC} 2/2.
19	FC		(19)	Connect a capacitor between this pin and ground to reduce the input-output gain frequency response and to prevent abnormal oscillation.
23 24	W _{IN} 2 W _{IN} 1		× v _{cc} 2	W-phase Hall device input pins. Logic HIGH is represented by W _{IN} 1 > W _{IN} 2.
25 26	V _{IN} 2 V _{IN} 1	1.3 to 2.2V		V-phase Hall device input pins. Logic HIGH is represented by $V_{\rm IN}$ 1 > $V_{\rm IN}$ 2.
27 28	U _{IN} 2 U _{IN} 1			U-phase Hall device input pins. Logic HIGH is represented by U _{IN} 1 > U _{IN} 2.
29	VH+	2.4V		Hall device supply pins. The potential difference between VH+ and VH– is



No. 4945-7/8

LB1893

Number	Name	Pin voltage	Equivalent circuit	Function
31	HFG	0 to V _{CC} 2	AD2863	Hall device FG pin. The Half device waveform is converted to a pulse and used as the FG pulse.
32	CL	0 to V _{CC} 2	A22864	When the voltage on Rf pin becomes equal to the voltage on CL, the current limiter operates. The CL voltage is determined externally.
33	V _{cc} 1	5 to 18V		Oulput-stage supply pin. This supply should be kept stable to prevent noise from entering this pin.

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No. 4945-8/8