

LB1916

Electrical Characteristics at Ta = 25°C, VCC1 = 12 V, VCC2 = 5 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current drain (I _{CC} for V _{CC1})	I _{CC1}	V _C = 2.5 V, V _{CREF} = 2.5 V, R _L = ∞, VS/S = 5 V, VRF = GND		17	30	mA
	I _{CC2}	V _C = 2.5 V, V _{CREF} = 2.5 V		7.5	10.5	mA
	I _{CC3}	V _C = 2.5 V, V _{CREF} = 2.5 V, R _L = ∞, VS/S = 0 V, VRF = GND		0.9	3	mA
[Drive Block]						
Output saturation voltage	V _{O(sat)1}	I _{OUT} = 0.4 A, sink + source		1.6	2.2	V
	V _{O(sat)2}	I _{OUT} = 0.8 A, sink + source		2.0	3.0	V
Output TRS sustainable voltage	V _{O(sus)}	I _{OUT} = 20 mA, *	14			V
Output center voltage	V _{OQ}	V _C = 2.5 V, V _{CREF} = 2.5 V	5.7	6.0	6.3	V
Hall amplifier input offset voltage	V _H offset		-5		+5	mV
Hall amplifier input bias current	I _H bias			1	5	μA
Hall amplifier common-mode input voltage range	V _{Hch}		1.3		2.2	V
Hall input/output voltage gain	V _{GHO}		38	41	44	dB
Control - output drive gain 1	V _{GCO1}	RZ1 = RZ2, GC1 = L, GC2 = L	23	26		dB
Control - output channel difference 1	ΔV _{GCO1}	RZ1 = RZ2, GC1 = L, GC2 = L	-1.5		+1.5	dB
Control - output drive gain 2	V _{GCO2}	RZ1 = RZ2, GC1 = L, GC2 = H	29	32		dB
Control - output channel difference 2	ΔV _{GCO2}	RZ1 = RZ2, GC1 = L, GC2 = H	-1.9		+1.9	dB
Input dead band voltage	V _{DZ}	RZ1 = RZ2, GC1 = L, GC2 = H V _O (voltage between out and OUT) = 0.1 V		±24	±50	mV
Input bias current 1	I _B SERVO	V _C = 1.0 V			500	nA
S/S pin high-level voltage	VS/S H	Inputs are CMOS level, (See Note.) S/S pin V _{th} = V _{CC2} /2	4.0			V
S/S pin low-level voltage	VS/S L	Inputs are CMOS level, (See Note.) S/S pin V _{th} = V _{CC2} /2			1.0	V
Gain control 1 high-level voltage	V _{GC1} H	Inputs are CMOS level, (See Note.) GC1 pin V _{th} = 2.0 V	4.0			V
Gain control 1 low-level voltage	V _{GC1} L	Inputs are CMOS level, (See Note.) GC1 pin V _{th} = 2.0 V			1.0	V
Gain control 2 high-level voltage	V _{GC2} H	Inputs are CMOS level, (See Note.) GC2 pin V _{th} = 2.0 V	4.0			V
Gain control 2 low-level voltage	V _{GC2} L	Inputs are CMOS level, (See Note.) GC2 pin V _{th} = 2.0 V			1.0	V
S/S pin input current	IS/S	Input voltage = 5 V		50	100	μA
Gain control 1 and 2 current	I _{GC}	Input voltage = 5 V		53	110	μA
Rotation output saturation voltage	V(sat)H.FG1, 2	I _O = -5 mA		0.24	0.5	V
	V(sus)H.FG1, 2	*			7	V
Hall bias voltage	V _{H±}	I _O = 5 mA, R _H = 200 Ω	0.7	0.97	1.2	V
CTRL pin high-level voltage	VS/S H	CTRL1 and CTRL2 are common, Inputs are CMOS level, (See Note.) CTRL pin V _{th} = 2.5 V	4.0			V
CTRL pin low-level voltage	VS/S L	CTRL1 and CTRL2 are common, Inputs are CMOS level, (See Note.) CTRL pin V _{th} = 2.5 V			1.0	V
CTRL input pin	I _{CTRL}	Input voltage = 5 V		53	110	μA
Thermal shutdown operating voltage	TSD	*	150	180	210	°C
Thermal shutdown hysteresis	ΔTSD	*		15		°C

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

LB1916

Hall Logic Truth Table

	Source → Sink	Hall input			Forward/reverse control
		U _{IN}	V _{IN}	W _{IN}	
1	W → V	H	H	L	Forward
	V → W	H	H	L	Reverse
2	W → U	H	L	L	Forward
	U → W	H	L	L	Reverse
3	V → W	L	L	H	Forward
	W → V	L	L	H	Reverse
4	U → V	L	H	L	Forward
	V → U	L	H	L	Reverse
5	V → U	H	L	H	Forward
	U → V	H	L	H	Reverse
6	U → W	L	H	H	Forward
	W → U	L	H	H	Reverse

An input "H" state is defined as $U_{IN1} > U_{IN2}$, $V_{IN1} > V_{IN2}$, and the potential difference is at least 0.2 V.

When $V_C > V_{CREF}$: Forward rotation

When $V_C < V_{CREF}$: Reverse rotation

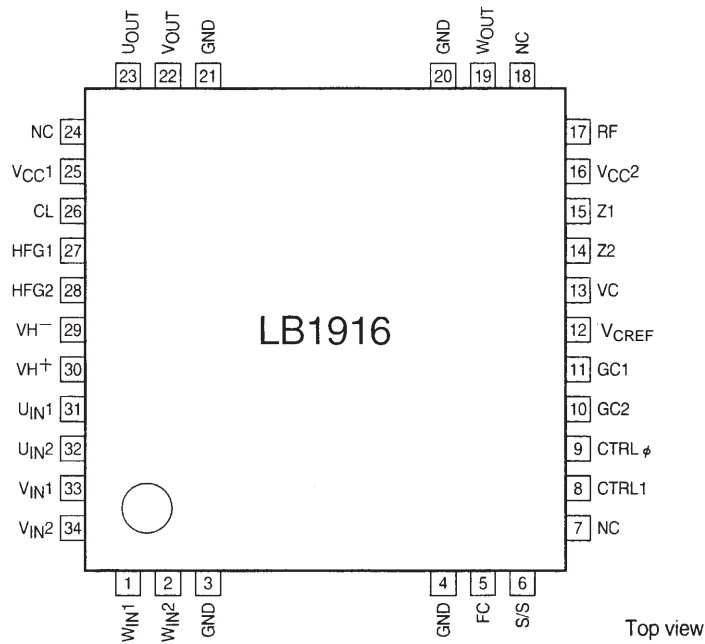
Mode Switching Truth Table

CTRL0	CTRL1	Mode
L	L	Control
L	H	Control
H	L	Acceleration
H	H	Deceleration

The low level is 0 to 1.0 V

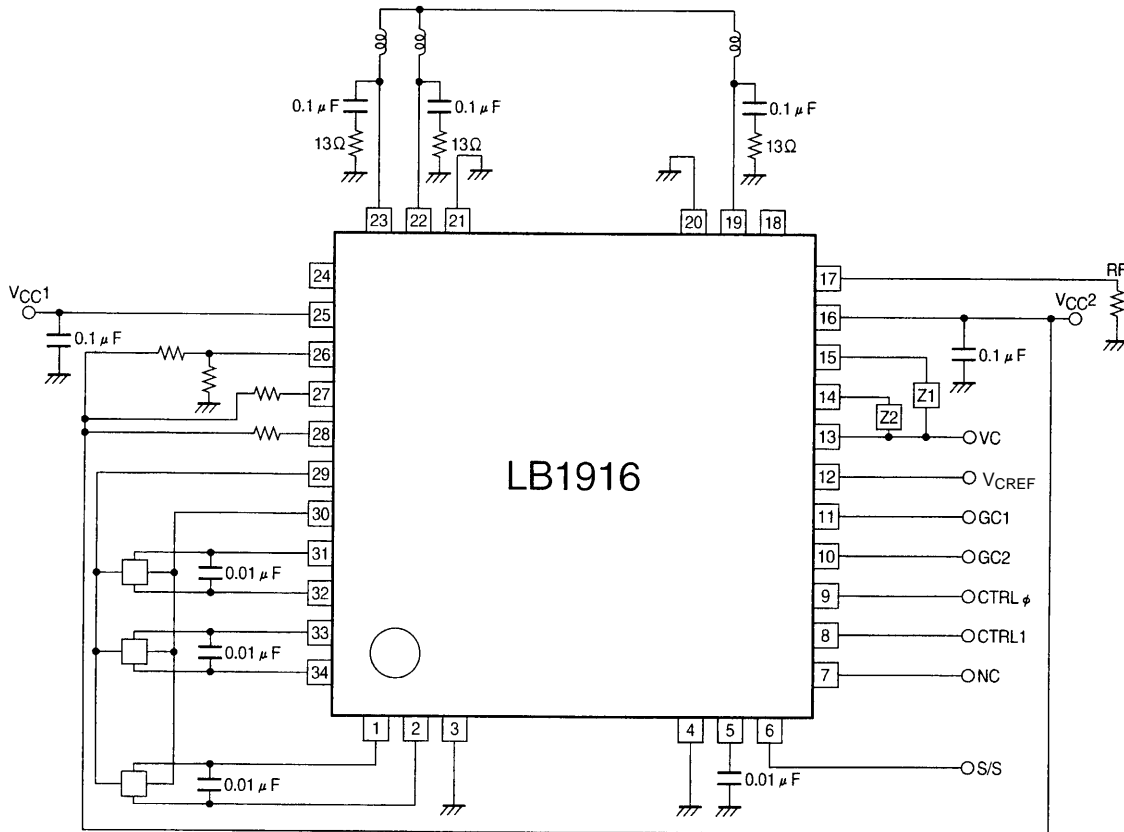
The high level is 4.0 V or higher

Pin Assignment



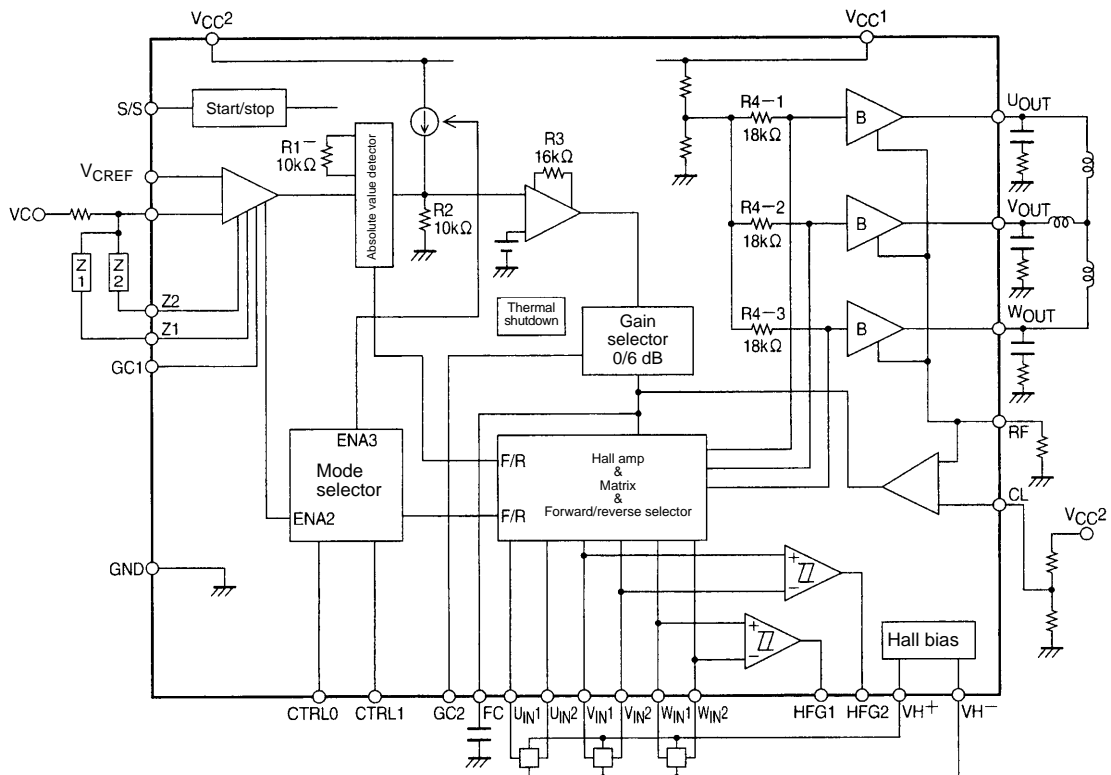
LB1916

Peripheral Circuit Example



A06902

Block Diagram



A06903

Pin Functions

Pin No.	Pin	Pin voltage	Pin function	Equivalent circuit
3, 4, 20, 21	GND		<ul style="list-style-type: none"> GND 	
23, 22, 19	U _{OUT} V _{OUT} W _{OUT}		<ul style="list-style-type: none"> Outputs Connect these pins to the motor. 	
17	Rf		<ul style="list-style-type: none"> Ground for the output transistors The output current can be detected as a voltage by connecting a resistor between the Rf pin and ground. This can then be used to implement overcurrent protection. 	
18, 24, 7	NC		<ul style="list-style-type: none"> No connection 	
16	V _{CC2}	4.3 to 6.5 V	<ul style="list-style-type: none"> Power supply for circuits other than the output block The power supply provided by this pin must be well stabilized so that noise does not occur. 	
15, 14	Z1 Z2		<ul style="list-style-type: none"> Connections for the resistors that set the front-end amplifier gain Z1 and Z2 are common, and have a resistance of between a few tens of kΩ and a few hundreds of kΩ. The gain is about 6 dB. 	
13, 12	V _C V _{CREF}	$\frac{V_{CC2}}{2} \pm 1.0$	<ul style="list-style-type: none"> V_C is the speed control pin. When V_C > V_{CREF}: Forward rotation When V_C < V_{CREF}: Reverse rotation The output voltage is controlled by the V_C voltage. V_{CREF} determines the motor control stop voltage. Normally, this will be V_{CC2}/2. 	
11, 10	GC1 GC2	0 to V _{CC2}	<ul style="list-style-type: none"> I/O gain switching input GC1 switches Z1 and Z2 for the front end amplifier. When GC1 is low, Z1 is selected, and when GC1 is high, Z2 is selected. GC2 switches the amplifier in the second stage. 	

Continued on next page.

LB1916

Continued from preceding page.

Pin No.	Pin	Pin voltage	Pin function	Equivalent circuit
9 8	CTRL ϕ CTRL1	0 to V _{CC2}	<ul style="list-style-type: none"> Operating mode switching input These pins select control, acceleration, or deceleration according to the mode switching truth table. 	<p style="text-align: right;">A06909</p>
6	S/S	0 to V _{CC2}	<ul style="list-style-type: none"> Apply a high level to the S/S pin for start, and a low level for stop. The threshold is V_{CC2}/2. 	<p style="text-align: right;">A06910</p>
5	FC		<ul style="list-style-type: none"> Oscillation can be prevented by connecting a capacitor between the FC pin and ground to lower the I/O gain frequency characteristics. 	<p style="text-align: right;">A06911</p>
2 1 34 33 32 31	W _{IN2} W _{IN1} V _{IN1} V _{IN2} U _{IN2} U _{IN1}	1.3 to 2.2 V	<ul style="list-style-type: none"> W phase Hall element inputs Logic high is when W_{IN1} > W_{IN2}. V phase Hall element inputs Logic high is when V_{IN1} > V_{IN2}. U phase Hall element inputs Logic high is when U_{IN1} > U_{IN2}. 	<p style="text-align: right;">A06912</p>
30 29	VH+ VH-	2.4 V 1.4 V	<ul style="list-style-type: none"> Hall element power supply There is a potential difference of 1.0 V between VH+ and VH-. 	<p style="text-align: right;">A06913</p>

Continued on next page.

LB1916

Continued from preceding page.

Pin No.	Pin	Pin voltage	Pin function	Equivalent circuit
28 27	HFG2 HFG1	0 to V_{CC2}	<ul style="list-style-type: none"> • Hall FG pins • The Hall waveform is modified and used as FG pulses. • The phase relationship between HFG1 and HFG2 is used as a forward/reverse signal. 	<p style="text-align: right;">A06914</p>
26	CL	0 to V_{CC2}	<ul style="list-style-type: none"> • The current limiter operates when the Rf pin voltage reaches the voltage on the CL pin. • The CL potential is determined externally. 	<p style="text-align: right;">A06915</p>
25	V_{CC1}	5 to 12.5 V	<ul style="list-style-type: none"> • Power supply for the output block • The power supply provided to this pin must be well stabilized so that noise does not occur. 	

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use:
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of May, 1997. Specifications and information herein are subject to change without notice.