



LB1981V

Three-Phase Brushless Motor Driver

Overview

The LB1981V is a three-phase brushless motor driver especially suited for use mainly with drum motors of portable VCRs.

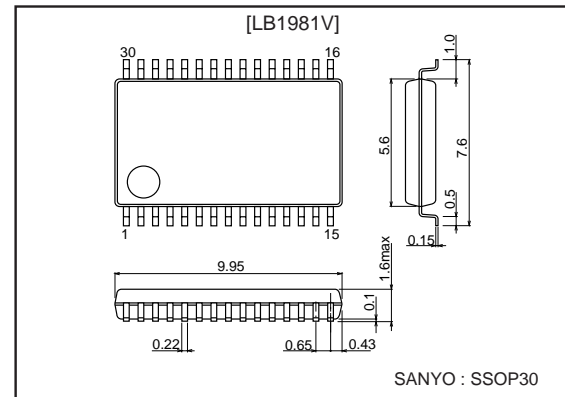
Features

- Three-phase full-wave drive brushless sensorless motor drive
- Soft switching drive
- Power-saving speed control function due to motor voltage
- Use with 3V power supply possible
- Output residual voltage can be set in 4 ways
- Forward/reverse switching possible
- Built-in standby function (FG and PG amplifier only remain operative)
- Built-in braking circuit
- Built-in thermal shutdown circuit
- Built-in FG and PG amplifiers
- Built-in saturation prevention amplifier and midpoint control circuit

Package Dimensions

unit: mm

3191-SSOP30



Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V_{CC1} max		7	V
	V_{CC2} max		12	V
	V_S max		V_{CC2}	V
Applied output voltage	V_O max		V_S+2	V
Applied input voltage	V_{IN1} max	Control circuits	-0.3 to $V_{CC1}+0.3$	V
	V_{IN2} max	U, V, W, COM	V_S+2	V
Output current	I_O max		1.0	A
Allowable power dissipation	P_d max		0.5	W
Operating temperature	T_{opr}		-20 to $+75$	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to $+150$	$^\circ\text{C}$

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Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V _{CC1}		2.7 to 6.0	V
	V _{CC2}		2.7 to 10.0	V
	V _S		0 to V _{CC2}	V

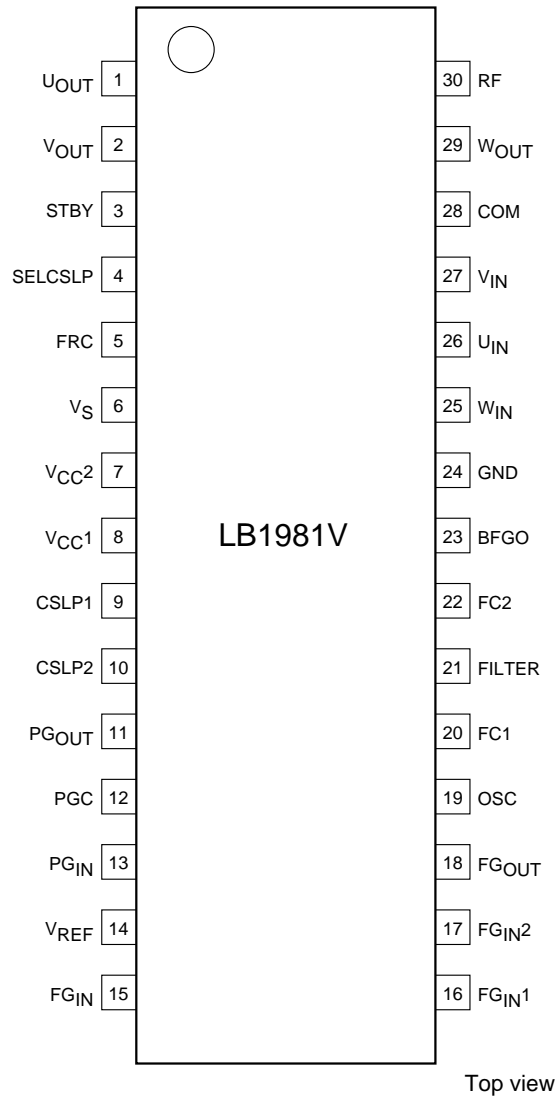
Electrical Characteristics at Ta = 25°C, V_{CC1} = 3V, V_{CC2} = 4.75V, V_S = 3V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply current	I _{CC1}	I _O = 76 mA		5	7.5	mA
	I _{CC2}	I _O = 76 mA		1.2	2.5	mA
Output idle current	I _{CC10Q}	V _{STBY} = 0V		1.0	1.5	mA
	I _{CC20Q}	V _{STBY} = 0V			10	μA
	I _{S30Q}	V _{STBY} = 0V		60	120	μA
Output saturation voltage, upper side 1	V _{OU1}	I _O = 0.1A		0.2	0.5	V
Output saturation voltage, lower side 1	V _{OD1}	I _O = 0.1A		0.2	0.5	V
Output saturation voltage, upper side 2	V _{OU2}	I _O = 0.4A		0.4	0.8	V
Output saturation voltage, lower side 2	V _{OD2}	I _O = 0.4A		0.4	0.8	V
COM pin common mode input voltage range	V _{IC}		0.3		V _{CC2} -0.9	V
Standby pin High level voltage	V _{STBYH}		2		V _{CC1}	V
Standby pin Low level voltage	V _{STBYL}		-0.2		+0.7	V
Standby pin input current	I _{STBYH}	V _{STBY} = 3V			50	μA
Standby pin leakage current	I _{STBYL}	V _{STBY} = 0V	-10			μA
FRC pin High level voltage	V _{FRCH}		2		V _{CC1}	V
FRC pin Low level voltage	V _{FRCL}		-0.2		+0.7	V
FRC pin input current	I _{FRCI}	V _{FRC} = 3V			50	μA
FRC pin leakage current	I _{FRCL}	V _{FRC} = 0V	-10			μA
Slope pin source current ratio	R _{SOURCE}	I _{C_{SLP1}} source/I _{C_{SLP2}} source	-12		+12	%
Slope pin sink current ratio	R _{SINK}	I _{C_{SLP1}} sink/I _{C_{SLP2}} sink	-12		+12	%
C _{SLP1} source - sink current ratio	R _{C_{SLP1}}	I _{C_{SLP1}} source/I _{C_{SLP1}} sink	-35		+15	%
C _{SLP2} sink - source current ratio	R _{C_{SLP2}}	I _{C_{SLP2}} source/I _{C_{SLP2}} sink	-35		+15	%
Startup frequency	Freq	C _{OSC} = 0.1 μF, OSC frequency *1		11.5		Hz
Phase delay width	Dwidth	*1		30		deg
Thermal shutdown operating temperature	T _{TSD}	*1	150	180	210	°C
Thermal shutdown hysteresis	ΔT _{TSD}	*1		15		°C
SEL _{C_{SLP}} pin High level voltage	V _{SELH}		2		V _{CC}	V
SEL _{C_{SLP}} pin Low level voltage	V _{SELL}		-0.2		+0.7	V
SEL _{C_{SLP}} input current	I _{SELH}	V _{SEL_{C_{SLP}}} = 3V			50	μA
SEL _{C_{SLP}} pin leakage current	I _{SELL}	V _{SEL_{C_{SLP}}} = 0V	-10			μA
[FG amplifier]						
Input offset voltage	V _{IO}	*1		±1	±5	mV
Input bias current	I _{BIN-}				250	nA
Common mode input voltage range	V _{ICOM}	*1	1		2	V
Open loop gain	G _{VFG}	f = 1 kHz *1		55		dB
Input ON voltage	V _{OL}	I _O = 10 μA			0.4	V
Input OFF voltage	V _{OH}	I _O = 10 μA	V _{CC1} -0.5			V
Schmitt amplifier hysteresis width	V _{SHIS}	*1		20		mV
Output duty	Duty	f = 720 Hz, V _{IN} = 20 mVp-p	30		70	%
Reference voltage	V _{REF}		1.15	1.30	1.45	V
[PG amplifier]						
Input offset voltage	V _{IO}	*1		±1	±5	mV
Input bias voltage	I _{BIN-}	*1			250	nA
Common mode input voltage range	V _{ICOM}	*1	1		2	V
Open loop gain	G _{VPG}	f = 1 kHz *1		55		dB
Output ON voltage	V _{OL}	I _O = 10 μA			0.4	V
Output OFF voltage	V _{OH}	I _O = 10 μA	V _{CC1} -0.5			V
Schmitt amplifier hysteresis width	V _{SHIS}	*1		50		mV

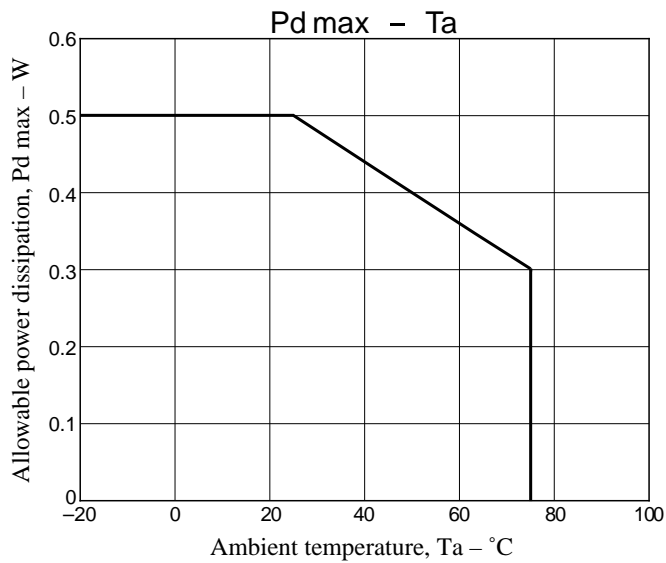
Note: Items shown to be "*1" are not measured.

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Pin Assignment



A10857



Pin Descriptions

Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
3	STBY	V_{CC1} max -0.2V min	<p>A10858</p>	When this pin is at 0.7V or less or when it is open, only the FG/PG amplifier operates. In the motor drive state, the pin should be at 2V or higher.
4	SEL CSLP	V_{CC1} max -0.2V min	<p>A10859</p>	CSLP pin charge/discharge current switching pin. Setting this pin to 2V or higher switches the triangular wave slope that determines soft switching.
5	FRC	V_{CC1} max -0.2V min	<p>A10860</p>	Motor forward/reverse switching pin. Low: reverse (-0.2V to +0.7V or open) High: forward (2V to V_{CC1})
6	V_S	0V to V_{CC2}		Power supply pin for determining output amplitude by supplying motor voltage. Must be lower than V_{CC2} voltage.
7	V_{CC2}	2.7V to 10V		Power supply pin for supplying source side predriver voltage and coil waveform detect comparator voltage.
8	V_{CC1}	2.7V to 6V		Power supply pin for circuits except motor voltage, source side predriver voltage, and coil waveform detect comparator voltage.
9	CLSP1		<p>A10861</p>	Pins for connecting triangular wave oscillator capacitor. This triangular wave coil output performs waveform soft switching.
10	CLSP2			

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Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
11	PG _{OUT}		<p style="text-align: right;">A10862</p>	PG amplifier output pin.
12	PGC		<p style="text-align: right;">A10863</p>	PG amplifier peak hold capacitor connection pin.
13	PG _{IN}	2.0V max 1.0V min (V _{CC1} = 3V)	<p style="text-align: right;">A10864</p>	PG amplifier input pin. Connect PG coil between this pin and V _{REF} .
14	V _{REF}		<p style="text-align: right;">A10865</p>	Internal 1.3V reference voltage. Used as reference voltage for FG and PG amplifiers.
15	FG _{IN}	2.0V max 1.0V min (V _{CC1} = 3V)	<p style="text-align: right;">A10866</p>	FG amplifier input pin. Connect FG coil between this pin and V _{REF} .
16	FG _{IN1}			FG amplifier input signal noise filter capacitor connection pin.
17	FG _{IN2}			FG amplifier input signal noise filter capacitor pin.

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Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
18	PG _{OUT}		<p style="text-align: right;">A10867</p>	FG amplifier output pin.
19	OSC		<p style="text-align: right;">A10868</p>	Pin for connecting triangular wave oscillator capacitor. Serves for forced startup waveform generation.
20	FC1		<p style="text-align: right;">A10869</p>	Frequency characteristics pin. Connecting a capacitor between this pin and ground serves to prevent closed-loop oscillation in the current control circuitry. (Lower-side output transistor drive current)
22	FC2		<p style="text-align: right;">A10870</p>	Frequency characteristics pin. Connecting a capacitor between this pin and ground serves to prevent closed-loop oscillation in the current control circuitry. (Lower-side output transistor drive current)
21	FILTER		<p style="text-align: right;">A10871</p>	Connecting a capacitor between this pin and ground activates the coil output saturation prevention function. In this condition, the VS pin is controlled for motor voltage control. By adjusting the external capacitor, torque ripple compensation can be varied.

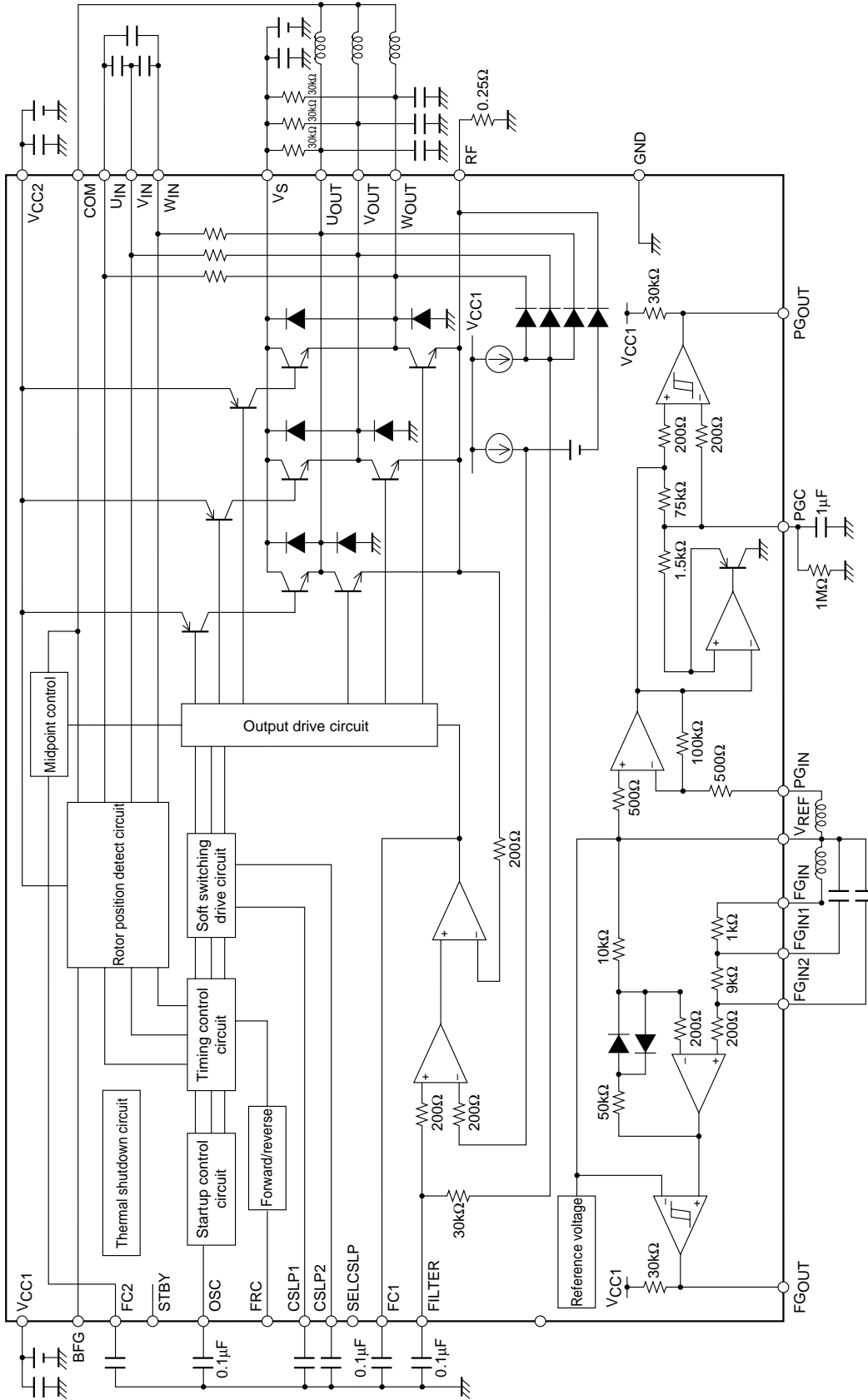
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Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
23	BFG0		<p style="text-align: right;">A10872</p>	<p>Motor counterelectromotive voltage FG pulse pin. Outputs a pulse using W phase counterelectromotive voltage as FG. Connect to ground if not used.</p>
24	GND			Ground for all circuits except output.
25	W _{IN}		<p style="text-align: right;">A10873</p>	Coil waveform detect comparator input pins.
26	U _{IN}			
27	V _{IN}			
28	COM			Motor coil midpoint input pin. Using this voltage as a reference, the coil voltage waveform is detected.
29	W _{OUT}		<p style="text-align: right;">A10874</p>	<p>W phase coil output pin.</p> <p>U phase coil output pin.</p> <p>V phase coil output pin.</p>
1	U _{OUT}			
2	V _{OUT}			
30	RF			Output transistor ground. Constant current drive is performed by detecting the voltage at this pin.

Block Diagram (Constants for external components depend on motor.)



A10875

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