



LB11817

Three-Phase Full-Wave Linear Drive

Preliminary

Overview

The LB11817 is a spindle motor driver for use in slim-shaped FDDs that use 5 V power supply.

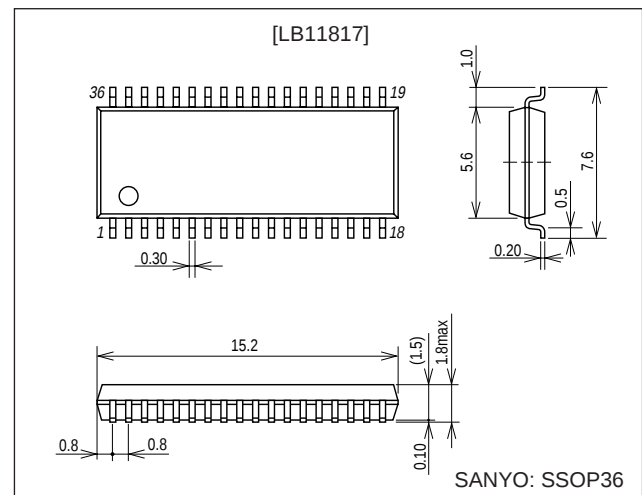
Functions and Features

- Three-phase full-wave linear drive
- Low saturation voltage
- Built-in digital speed control
- Start/stop circuit (active low)
- Speed switching
- Current limiter
- Index processing circuit
- The index timing can be adjustment with a variable resistor.
- Thermal protection circuit

Package Dimensions

unit: mm

3247-SSOP36



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CCmax}		7.0	V
Maximum output current	$I_{O\ max1}$	$t \leq 0.5\ s$	1.5	A
Maximum steady-state output current	$I_{O\ max2}$		1.0	A
Allowable power dissipation 1	P_{dmax1}	Independent IC	0.6	W
Operating temperature	T_{opr}		-20 to +80	°C
Storage temperature	T_{stg}		-40 to +150	°C

Allowable Operating Ranges at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		4.2 to 6.5	V

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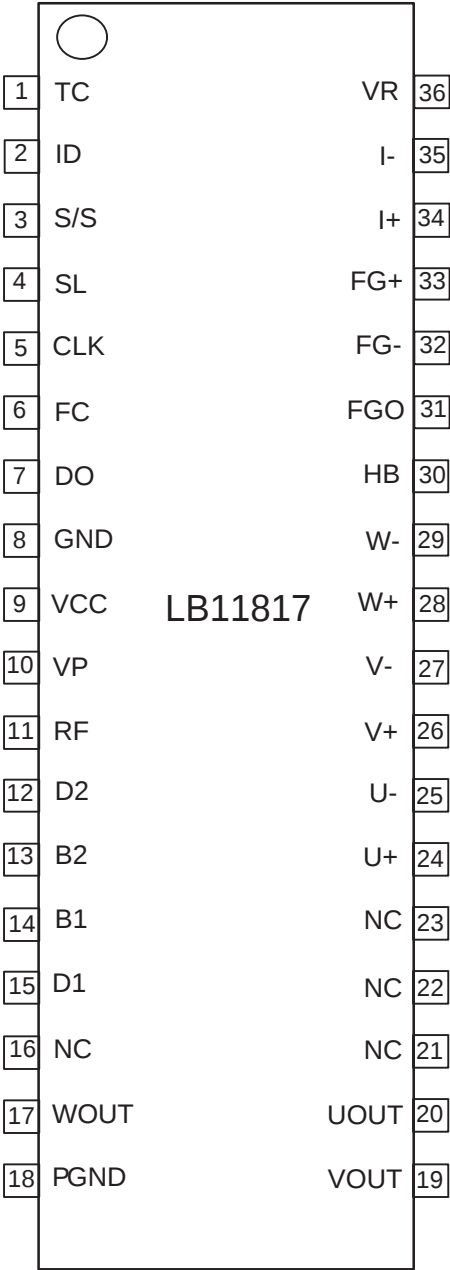
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Electrical Characteristics at Ta = 25°C, V_{CC} = 5 V

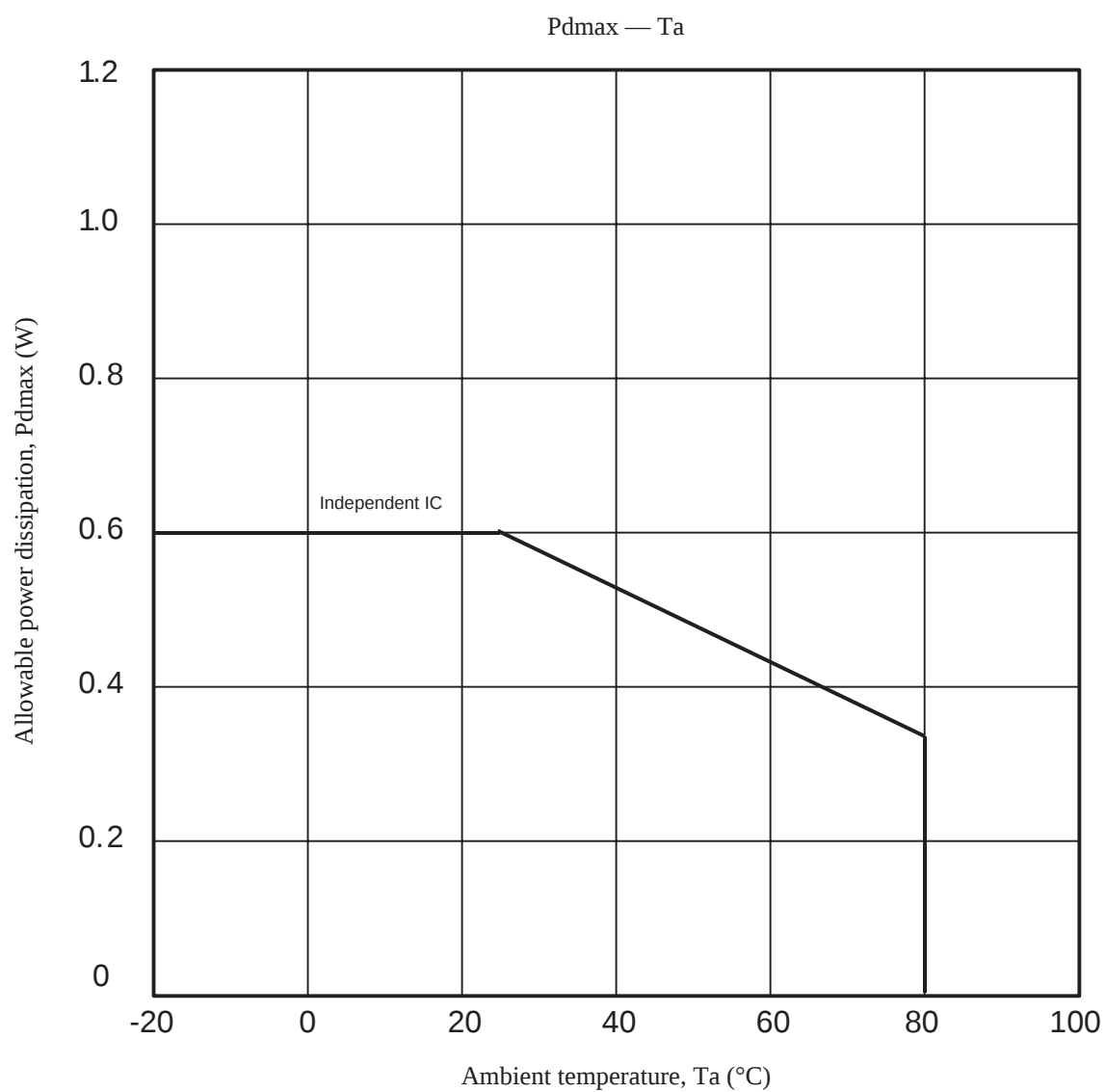
Parameter	Symbol	Conditions	Ratings			Unit	Note
			min	typ	max		
Current drain	I _{CCO}	S/S = 5 V (standby mode)			10	μA	
	I _{CC}	S/S = 0 V (normal operation)		17	25	mA	
SL bias current	I _{SL}	V _{SL} = 0 V			10	μA	
SL low-level input voltage	V _{SLL}		0		1.0	V	
SL high-level input voltage	V _{SLH}		3.5		V _{CC}	V	
S/S bias current	I _{S/S}			150	230	μA	
S/S low voltage	V _{S/SL}		0		0.8	V	
S/S high voltage	V _{S/SH}		3.5		V _{CC}	V	
Hall amplifier input bias current	I _H				10	μA	
Common-mode input voltage range	V _H		1.5		V _{CC} - 1.0	V	
Differential input voltage range	V _{dif}		50		200	mVp-p	
Hall bias output voltage	V _{HB}	I _H = 5 mA	0.5	0.8	1.1	V	
Hall bias leakage current	I _{HBL}	S/S = 5 V			±10	μA	
Output saturation voltage	V _{sat}	I _O = 0.5 A sink+source		0.45	0.67	V	
Output leakage current	I _{OL}				1.0	mA	
Current limiter	V _{lim}		0.27	0.3	0.33	V	
Control amplifier voltage gain	G _C		-9	-7	-5	dB	
Voltage gain inter-phase difference	ΔG _C				±1	dB	
V/I conversion source current	I ⁺		9	14	19	μA	
V/I conversion sink current	I ⁻		-9	-14	-19	μA	
V/I conversion current ratio	I ⁺ /I ⁻		0.8	1.0	1.2		
DSC buffer input current	I _{DSC}				1.0	μA	
FG amplifier voltage gain	G _{FG}			48		dB	*
FG offset amplifier input	V _{FG0}				±10	mV	*
FG amplifier internal reference voltage	V _{FGB}		2.2	2.5	2.8	V	
FG Schmitt hysteresis	ΔV _{sh}			50		mV	*
Speed discriminator counts	N			1041.5			
Discriminator operating frequency	F _D				1.1	MHz	*
Oscillator frequency range	F _{OSC}				1.1	MHz	*
Index output low-level voltage	V _{IDL}	I _O = 2 mA			0.4	V	
Index output leakage current	I _{IDL}				±10	μA	
Index amplifier common-mode input voltage range	V _{ID}		1.0		V _{CC} - 1.0	V	
Index input hysteresis	ΔV _{ID}			25		mV	
Boost voltage	V _P	I _p = -5 mA	1.39	1.55	1.71	V	
Thermal protection circuit operating temperature	TSD		150	180		°C	*
Hysteresis	ΔTSD			40		°C	*

Note: * Items shown to be design target values are not measured.

Pin Assignment



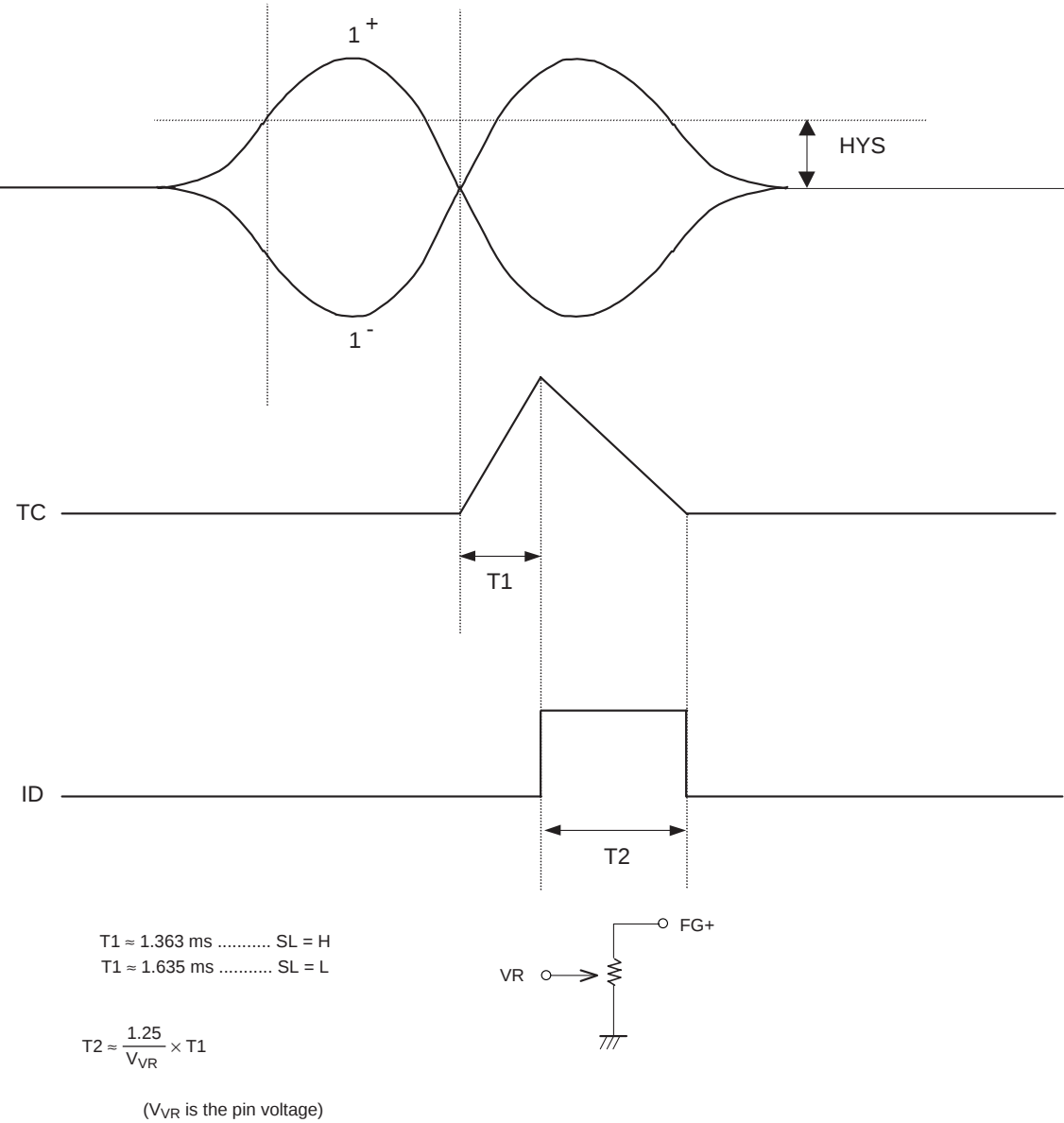
Top view



Truth Table

	Source → sink	Hall input		
		U	V	W
1	V → W	H	H	L
2	V → U	L	H	L
3	W → U	L	H	H
4	W → V	L	L	H
5	U → V	H	L	H
6	U → W	H	L	L

Index Delay Pulse Timing Chart



Pin Functions

Pin No.	Symbol	Pin voltage	Function	Equivalent circuit
1	TC		Connection for the external capacitor used to adjust the index timing.	
2	ID	L: 0.4 Vmax H: 4.5 Vmin	Index output	
3	S/S	L: 1.0 Vmax H: 3.5 Vmin	Start/stop control. This is an active-low input.	
4	SL	L: 1.0 Vmax H: 3.5 Vmin	Speed switching input	
5	CLK	L: 0.5 Vmax H: V _{CC} - 1.0 Vmin	Reference clock input. The threshold voltage is 1.25 V. At 1 MHz, the LB11817 supports speeds of 300 and 360 rpm.	
6	FC		Frequency characteristics correction. Oscillation in the current control closed-loop circuit can be stopped by inserting a capacitor between this pin and ground.	
7	DO		Speed discriminator	

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Pin No.	Symbol	Pin voltage	Function	Equivalent circuit
8	GND		- Ground - This pin and pin 34 must all be connected to the frame ground.	
9	V _{CC}	4.2 to 6.5 V	- Supply voltage - This voltage must be stabilized so that ripple and noise do not enter the IC.	
10	V _P	V _{CC} + 1.55 V _{typ} (I _p = -5 mA)	- Boosted voltage output - Used as the output transistor pre-driver power supply. This boosted voltage is used when a low saturation output is provided. In all other cases this pin will be at the V_{CC} potential.	
11	RF		- Output current detection - An RF resistor inserted between this pin and V_{CC} converts the output current to the voltage used for output current detection. The current limiter circuit operates by detecting the voltage on this pin.	
12 15	D2 D1		Connections for the two diodes used by the voltage boost function.	
13 14	B2 B1		Boost function switching circuit outputs 1 and 2	
17 19 20	W _{OUT} V _{OUT} U _{OUT}		- W-phase output - V-phase output - U-phase output	

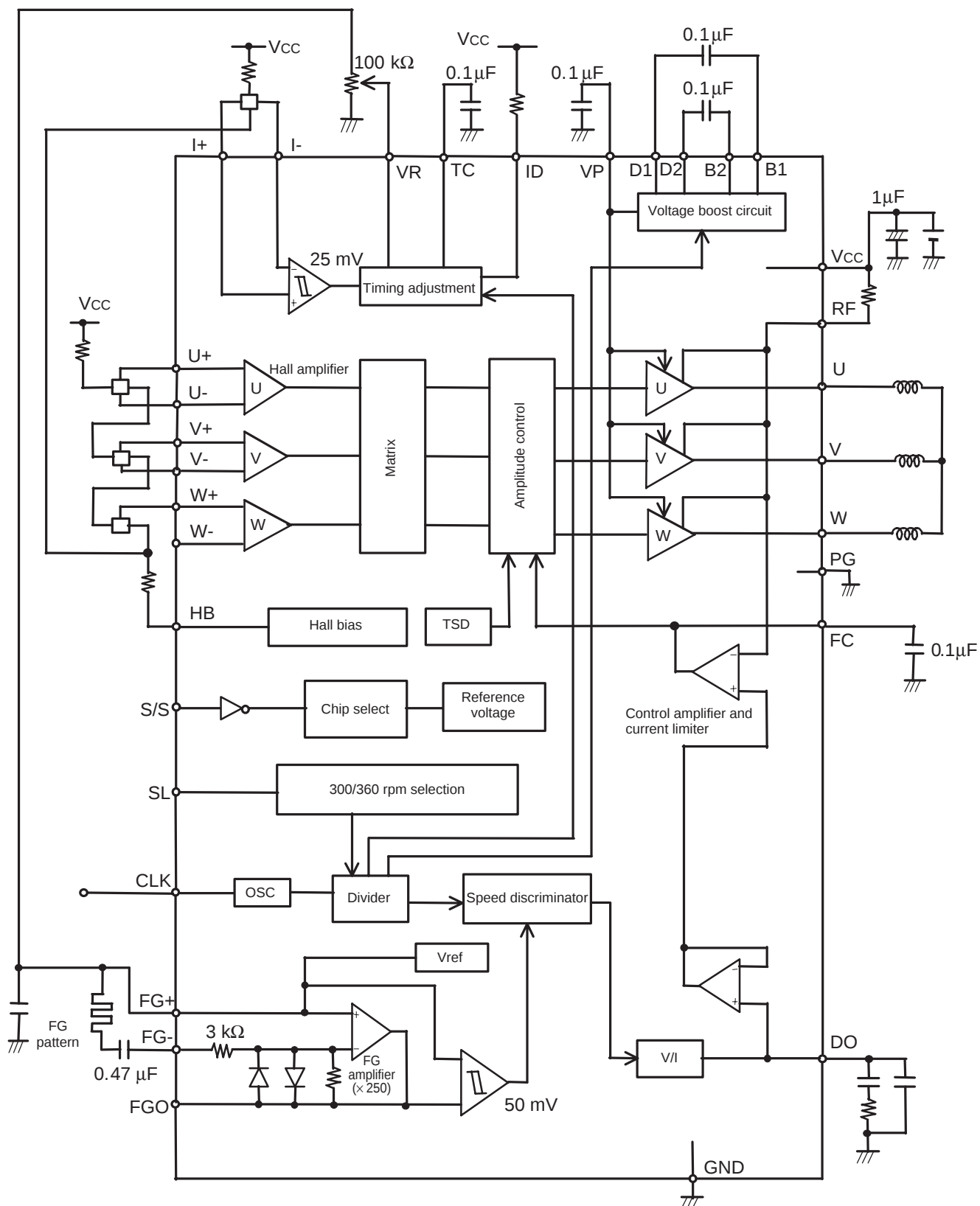
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Pin No.	Symbol	Pin voltage	Function	Equivalent circuit
18	PGND		Output transistor ground	
24 25 26 27 28 29	U _{IN} ⁺ U _{IN} ⁻ V _{IN} ⁺ V _{IN} ⁻ W _{IN} ⁺ W _{IN} ⁻	1.5 V _{min} V _{CC} – 1.0 V _{max}	- U-phase Hall device inputs - V-phase Hall device inputs - W-phase Hall device inputs	
30	HB	0.8 V _{typ} (I _H = 5 mA)	- Negative potential that provides Hall device bias current - In the stopped state, this pin is set to the open state to cut off the Hall device bias current.	
31 32 33	FGO FG+ FG-	2.5 V _{typ}	- FG amplifier output - FG amplifier minus input - FG amplifier plus input A 2.5 V reference voltage is generated internally by the IC.	
34 35	I ⁺ I ⁻		Index inputs	
36	VR		Index timing adjustment voltage input	

Block Diagram

Note that the values of the external components shown here are reference values and are not guaranteed to be appropriate in a given application.



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