Ordering number :EN*6213A

Monolithic Digital IC

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.

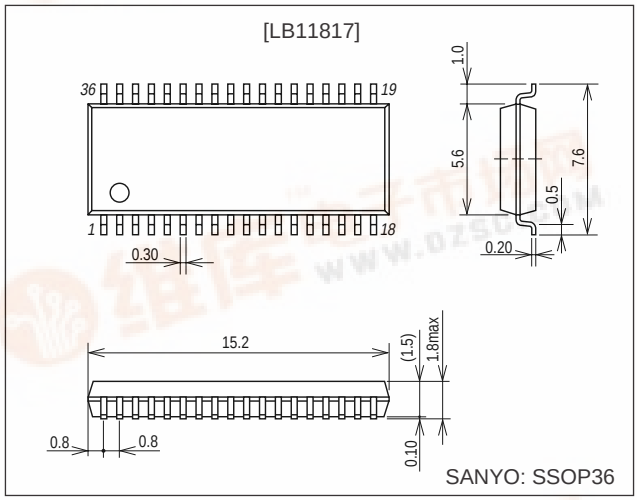
Functions and Features

- 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_{CC}max		7.0	V
Maximum output current	$I_{O\ max}1$	t ≤ 0.5 s	1.5	A
Maximum steady-state output current	$I_{O\ max}2$		1.0	A
Allowable power dissipation 1	Pdmax1	Independent IC	0.6	W
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

Allowable Operating Ranges at Ta = 25°C

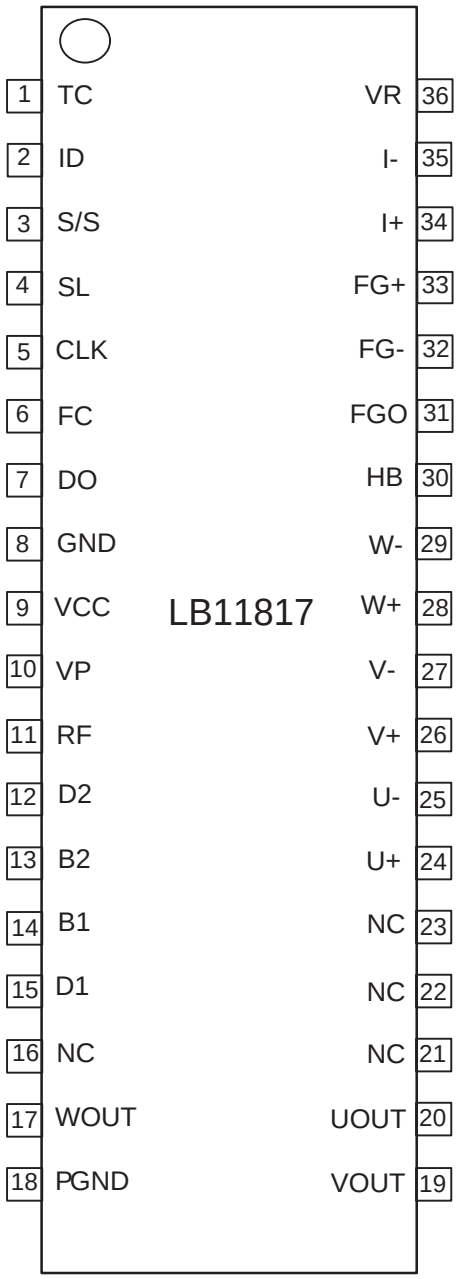
Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		4.2 to 6.5	V

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	ΔVsh			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	VP	Ip = –5 mA	1.39	1.55	1.71	V	
Thermal protection circuit operating temperature	TSD		150	180		°C	*
Hysteresis	ΔTSD			40		°C	*

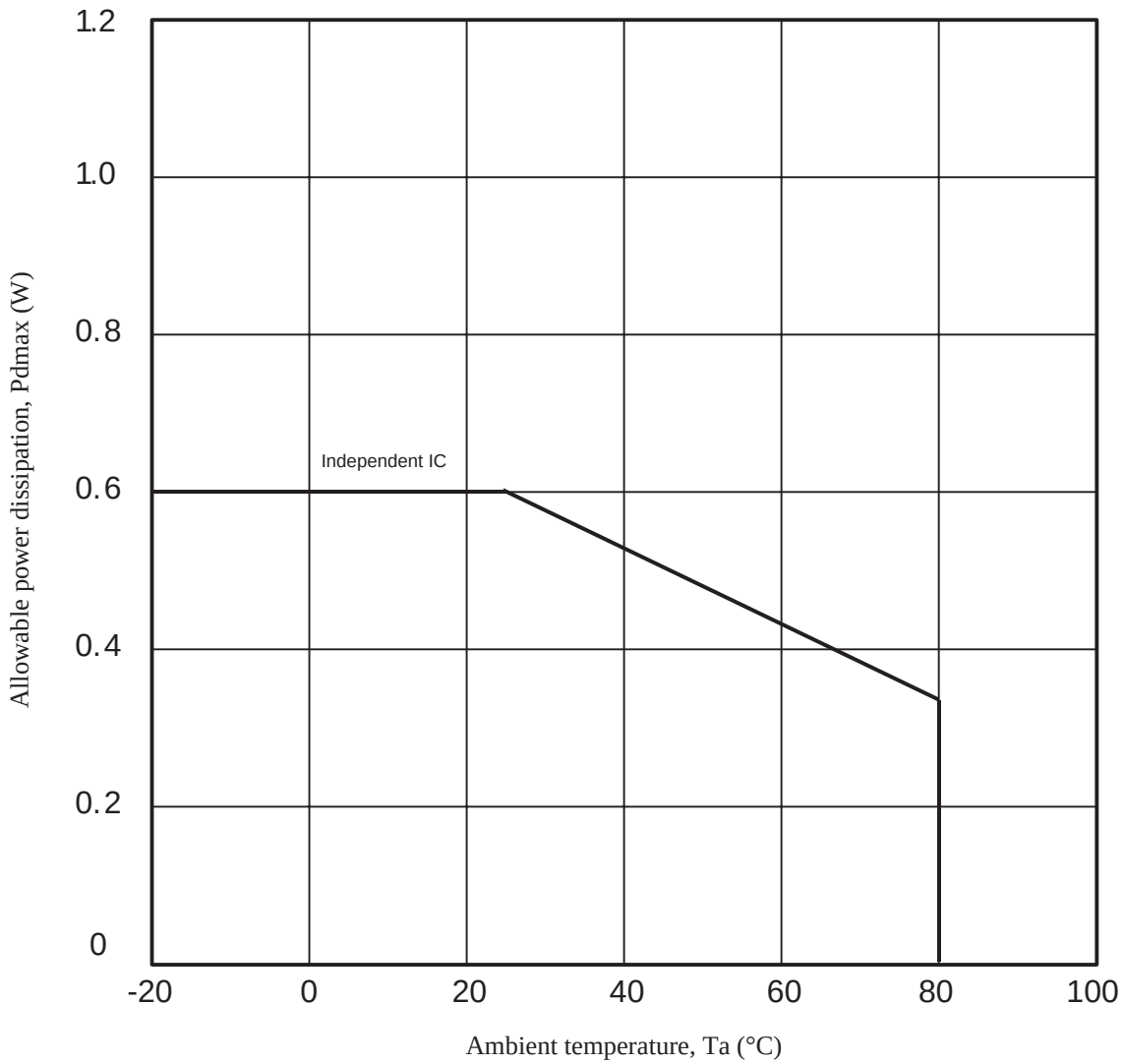
Note: * Items shown to be design target values are not measured.

Pin Assignment



Top view

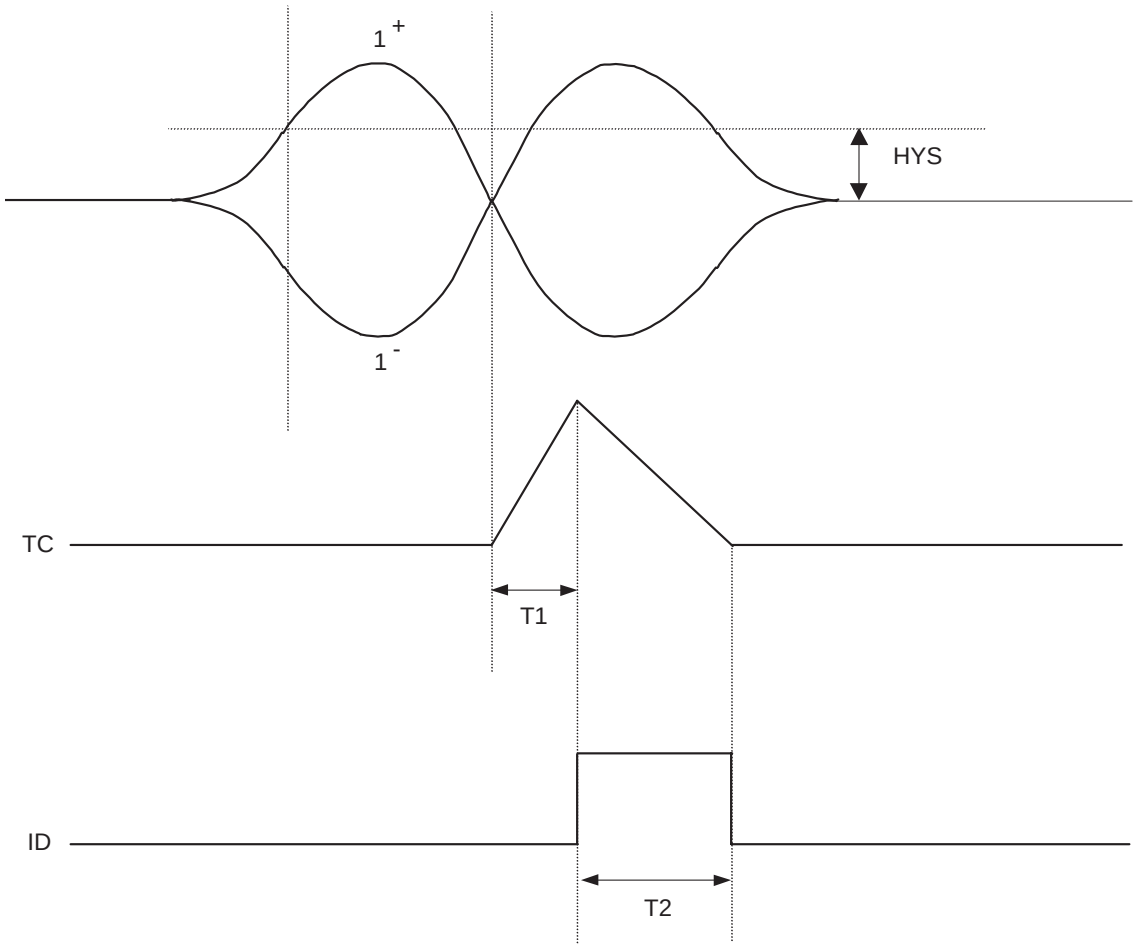
Pdmax — Ta


1.2
1.0
0.8
0.6
0.4
0.2
0
Allowable power dissipation, Pdmax (W)
Independent IC
-20
0
20
40
60
80
100
Ambient temperature, Ta (°C)

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

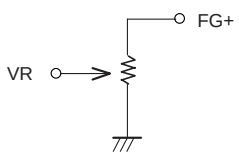
Index Delay Pulse Timing Chart



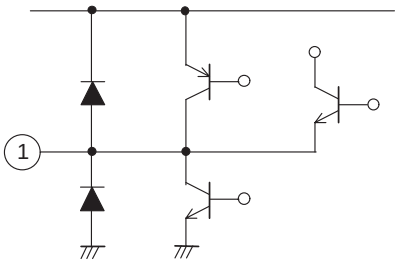
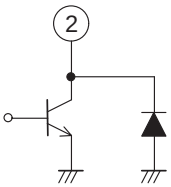
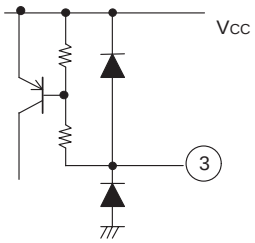
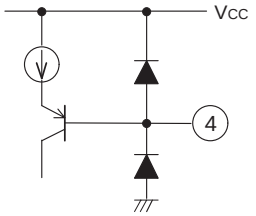
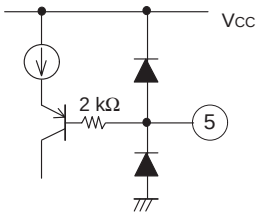
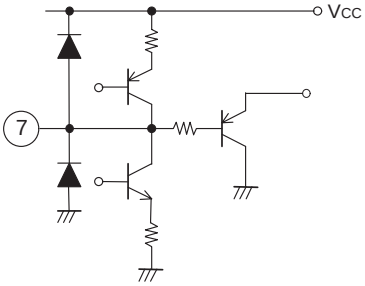
T1 ≈ 1.363 ms ..... SL = H
T1 ≈ 1.635 ms ..... SL = L

$$T2 \approx \frac{1.25}{V_{VR}} \times T1$$

(V_{VR} is the pin voltage)

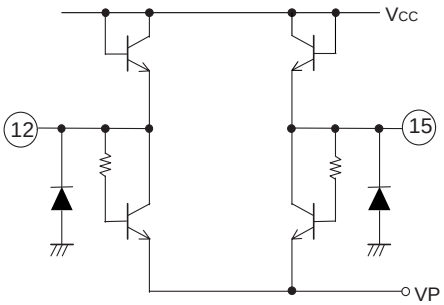
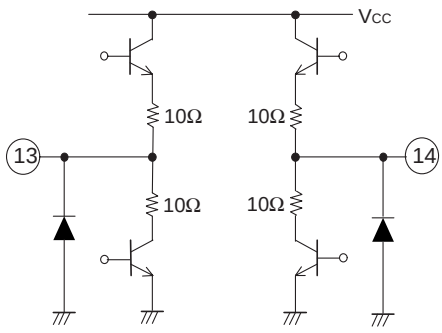
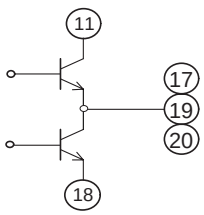


Pin Functions

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	

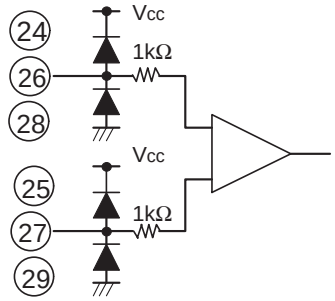
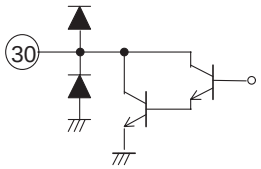
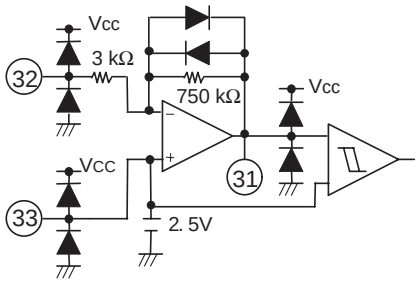
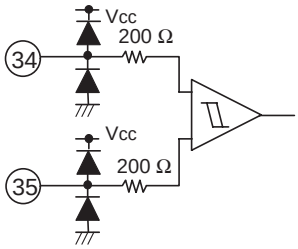
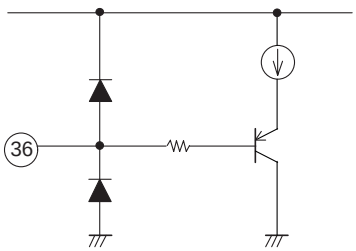
Continued on next page.

Continued from preceding page.

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	VP	V_{CC} + 1.55 Vtyp (Ip = –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	

Continued on next page.

Continued from preceding page.

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 Vmin V_{CC} – 1.0 Vmax	• U-phase Hall device inputs • V-phase Hall device inputs • W-phase Hall device inputs	
30	HB	0.8 Vtyp (IH = 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 Vtyp	• 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.