Ordering number : ENA1773A

LB11685VH

ON Semiconductor®

http://onsemi.com

Monolithic Digital IC

3-phase sensor less Motor driver

Overview

The LB11685VH is a three-phase full-wave current-linear-drive motor driver IC. It adopts a sensor less control system without the use of a Hall Effect device. For quieter operation, the LB11685VH features a current soft switching circuit and be optimal for driving the cooling fan motors used in refrigerators, etc.

Functions

- Three-phase full-wave linear drive (Hall sensor-less method)
- Built-in three-phase output voltage control circuit
- Motor lock protection detection output
- Built-in thermal shut down circuit
- Built-in current limiter circuit
- Built-in motor lock protection circuit
- FG output made by back EMF
- Beat lock prevention circuit

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		19	V
Input applied voltage	V_{IN} max		-0.3 to V_{CC} +0.3	V
Maximum output current	I_O max *1		1.2	A
Allowable power dissipation	Pd max	Mounted on a board *2	1.4	W
Operating temperature	Topr		-40 to 85	°C
Storage temperature	Tstg		-55 to 150	°C
Junction temperature	Tj max		150	°C

*1: The I_O is a peak value of motor-current.

*2: Specified board: 76.1mm × 114.3mm × 1.6mm, glass epoxy board.

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended Supply voltage	V_{CC}		12.0	V
Operating supply voltage	V_{CC} op		4.5 to 18.0	V

Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current	I_{CC}	FC1 = FC2 = 0V	5	10	20	mA
Internal regulate voltage	VREG		3.0	3.3	3.6	V
Output voltage (source)	VOSOUR	I_O = 0.8A *3		1.3	1.7	V
Output voltage (sink)	VOSINK	I_O = 0.8A *3		0.5	1.3	V
Current limiter	VOLIM		0.268	0.300	0.332	V
MCOM pin common-input voltage range	VINCOM		0		V_{CC} - 2	V
MCOM pin Source current for hysteresis	ICOM+	MCOM = 7V	30		80	µA
MCOM pin Sink current for hysteresis	ICOM-	MCOM = 7V	30		80	µA
MCOM pin hysteresis current ratio	RTCOM	RTCOM = ICOM+ / ICOM-	0.6		1.4	
VCO input bias current	I_{VCO}	V_{CO} = 2.3V			0.2	µA
VCO oscillation minimum frequency	$f_{VCO}min$	V_{CO} = 2.1V, CX = 0.015µF Design target *2		930		Hz
VCO oscillation maximum frequency	$f_{VCO}max$	V_{CO} = 2.7V, CX = 0.015µF Design target *2		8.6		kHz
CX charge / discharge current	I_{CX}	V_{CO} = 2.5V, CX = 1.6V	70	100	140	µA
CX hysteresis voltage	ΔVCX		0.35	0.55	0.75	
C1 (C2) charge current	IC1(2)+	V_{CO} = 2.5V, C1(2) = 1.3V	12	20	28	µA
C1 (C2) discharge current	IC1(2)-	V_{CO} = 2.5V, C1(2) = 1.3V	12	20	28	µA
C1 (C2) charge / discharge current ratio	RTC1(2)	RTC1(2) = IC1(2)+ / IC1(2)-	0.8	1.0	1.2	
C1/C2 charge current ratio	RTCCHG	RTCCHG = IC1+ / IC2+	0.8	1.0	1.2	
C1/C2 discharge current ratio	RTCDIS	RTCDIS = IC1- / IC2-	0.8	1.0	1.2	
C1 (C2) cramp voltage width	VCW1(2)		1.0	1.3	1.6	V
FG output low level voltage	VFGL	IFG = 3mA			0.5	V
RD output low level voltage	VRDL	IRD = 3mA			0.5	v
Thermal shut down operating temperature *1	TTSD	Junction temperature Design target *2	150	180		°C
Thermal shut down hysteresis temperature *1	ΔTTSD	Junction temperature Design target *2		15		°C

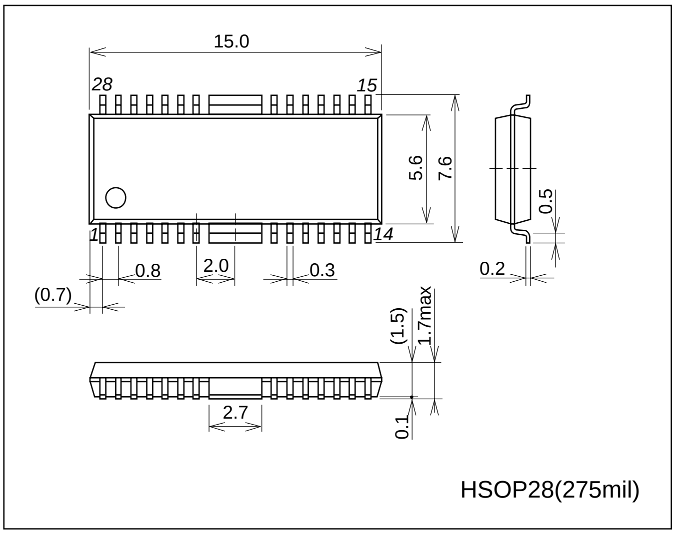
*1: The thermal shut down circuit is built-in for protection from damage of IC. But its operation is out of Topr. Design thermal calculation at normal operation.

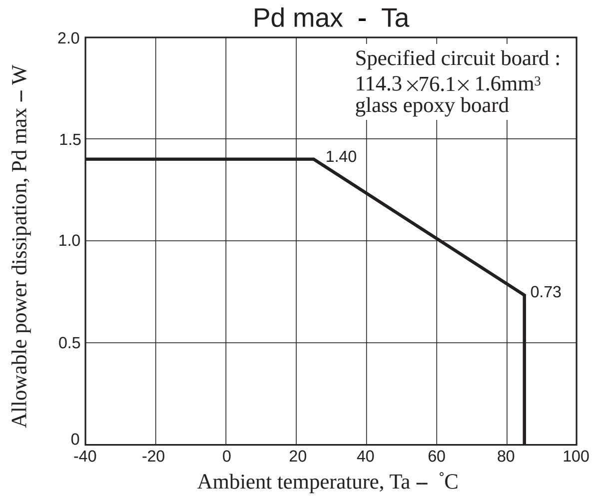
*2: Design target value and no measurement is made.

*3: The I_O is a peak value of motor-current.

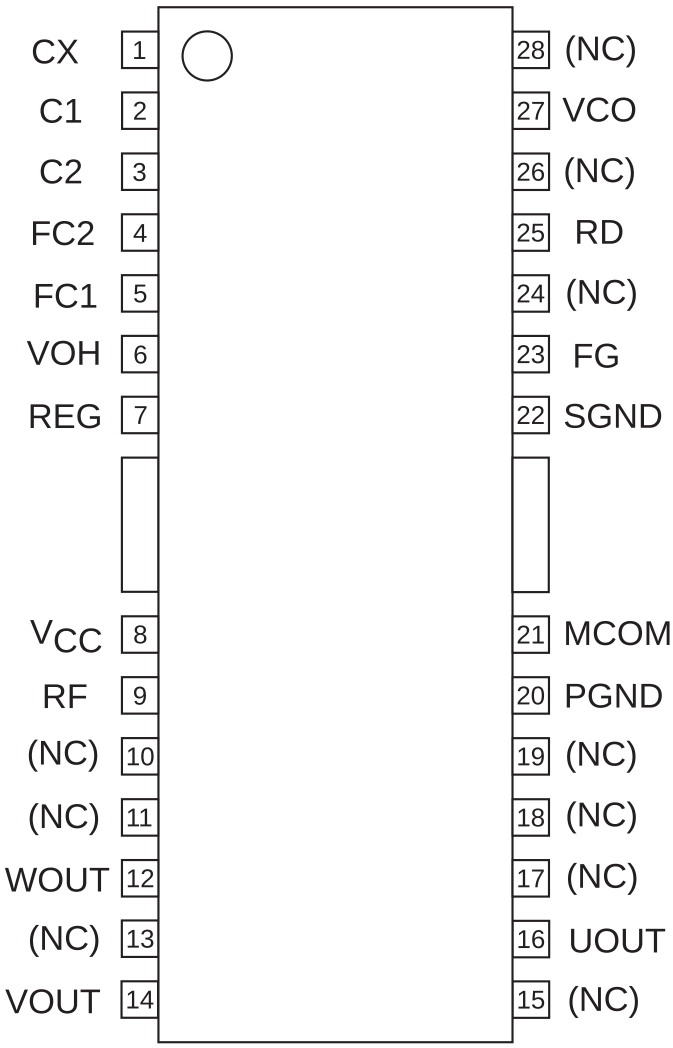
Package Dimensions

unit : mm (typ)
3222A

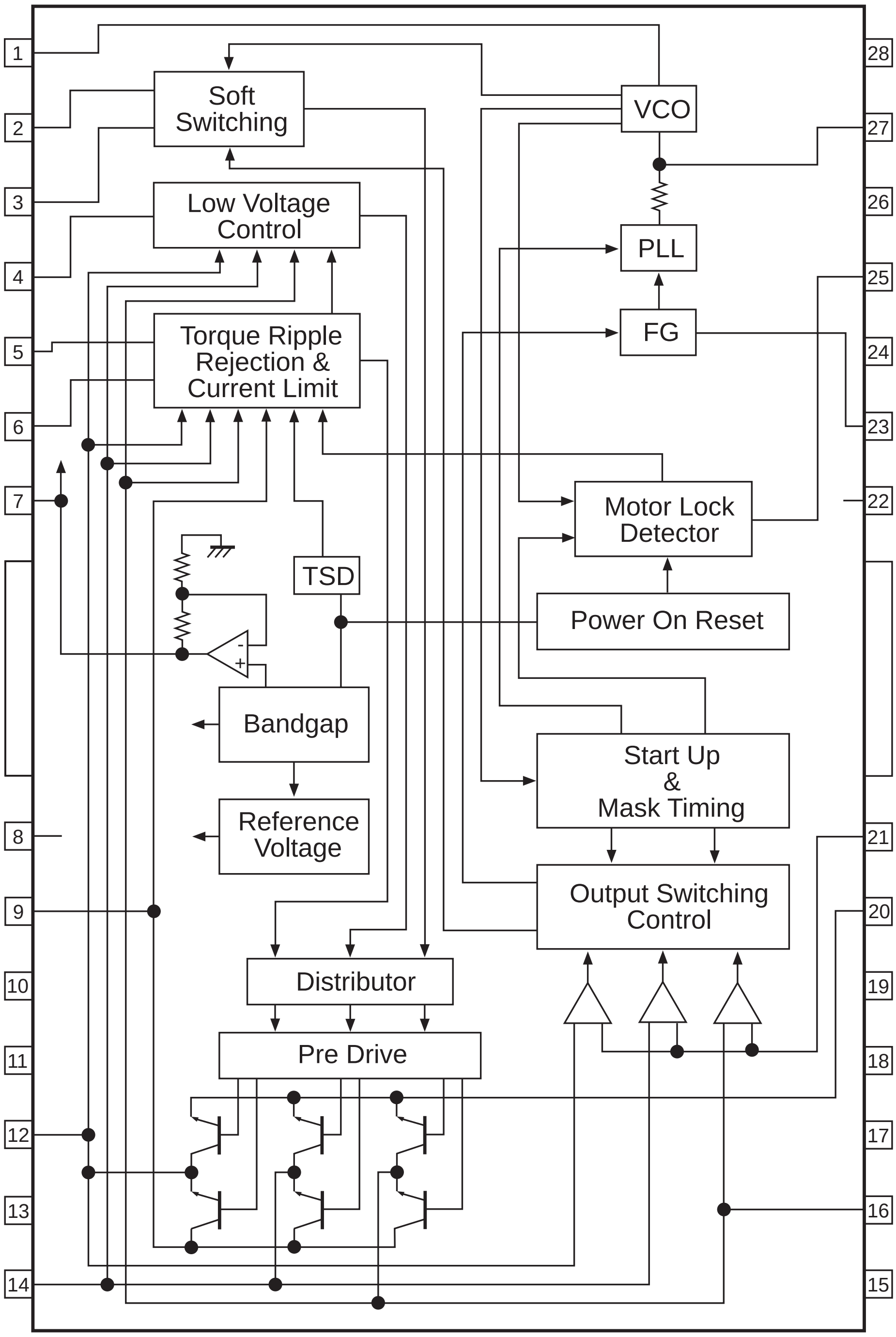




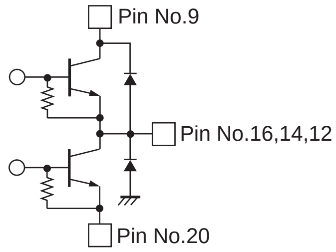
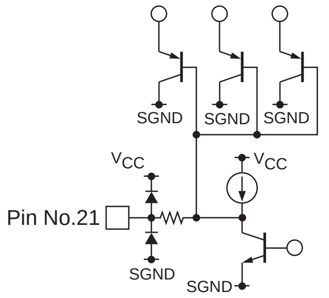
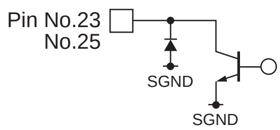
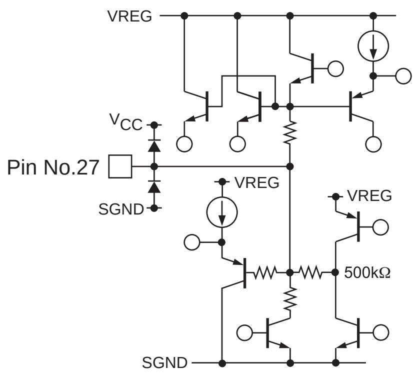
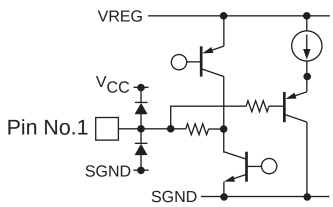
Pin Assignment



Block Diagram

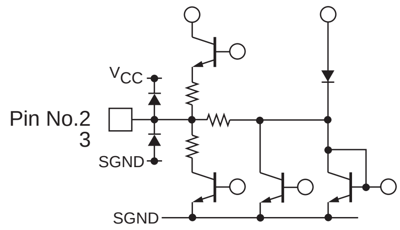
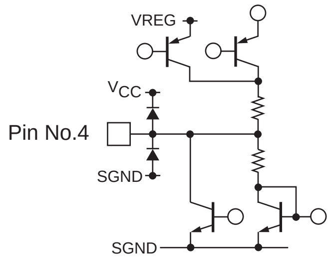
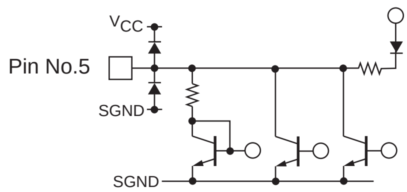
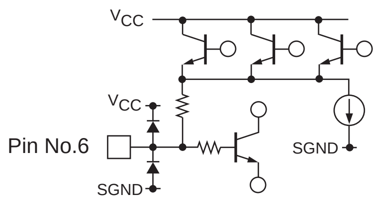
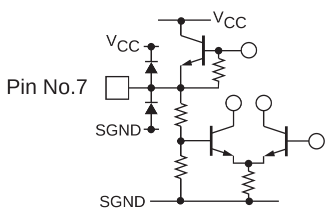


Pin Function

Pin No.	Pin name	Function	Equivalent circuit
16 12 14	UOUT WOUT VOUT	Each output pin of three phases.	
20	PGND	GND pin in the output part. This pin is connected to GND. The SGND pin is also connected to GND	
9	RF	Pin to detect output current. By connecting a resistor between this pin and V_{CC}, the output current is detected as a voltage. The current limiter is operated by this voltage.	
21	MCOM	Motor coil midpoint input pin. The coil voltage waveform is detected based on this voltage.	
22	SGND	Ground pin (except the output part) This pin is connected to GND. The PGND pin is also connected to GND.	
23	FG	FG out made by back EMF pin. It synchronizes FG out with inverted V-phase. When don't use this function, open this pin.	
25	RD	Motor lock protection detection output pin. Output with L during rotation of motor. Open during lock protection of motor (High-impedance). When don't use this function, open this pin.	
27	VCO	PLL output pin and VCO input pin. To stabilize PLL output, connect a capacitor between this pin and GND.	
1	CX	VCO oscillation output pin. Operation frequency range and minimum frequency are determined by the capacity of the capacitor connected to this pin.	

Continue to the next page.

Continue from the former page.

Pin No.	Pin name	Function	Equivalent circuit
2 3	C1 C2	Soft switching adjustment pin. The triangular wave from is form formed by connecting a capacitor with this pin. And, the switching of three-phase output is adjusted by the slope.	
4	FC2	Frequency characteristic correction pin 2. To suppress the oscillation of control system closed loop of sink-side, connect a capacitor between this pin and GND.	
5	FC1	Frequency characteristic correction pin 1. To suppress the oscillation of control system closed loop of source-side, connect a capacitor between this pin and GND.	
6	VOH	Three-phase output high level output pin. To stabilize the output voltage of this pin, connect a capacitor between this pin and the V_{CC} pin.	
7	VREG	DC voltage (3.3V) output pin. Connect a capacitor between this pin and GND for stabilization.	
19	VCC	Pin to supply power-supply voltage. To curb the influence of ripple and noise. The voltage should be stabilized.	

Application Circuit Example

* Each fixed number in the following FIG, is the referential value.