Ordering number : ENA1772

SANYO Semiconductors
DATA SHEET

An ON Semiconductor Company

Monolithic Digital IC

LB11685AV — 3-phase sensor less Motor driver

Overview

The LB11685AV 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 LB11685AV 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
- Built-in current limiter circuit
- Built-in motor lock protection circuit
- Motor lock protection detection output
- FG output made by back EMF
- Built-in thermal shut down circuit
- 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	1.05	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.

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 or 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.

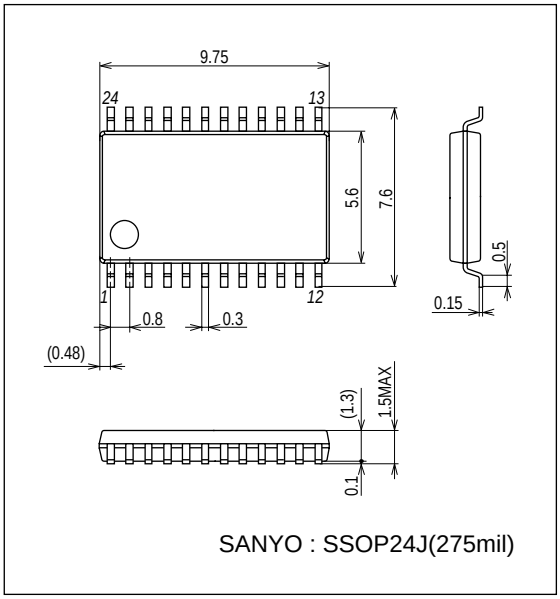
*2: Design target value and no measurement is made.

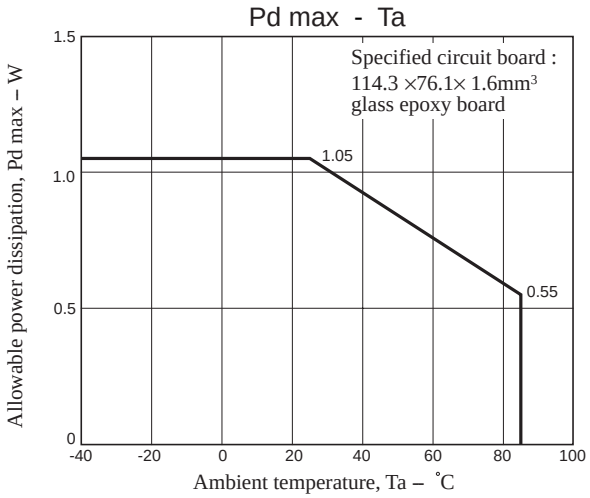
*3: The I_O is a peak value of motor-current.

Package Dimensions

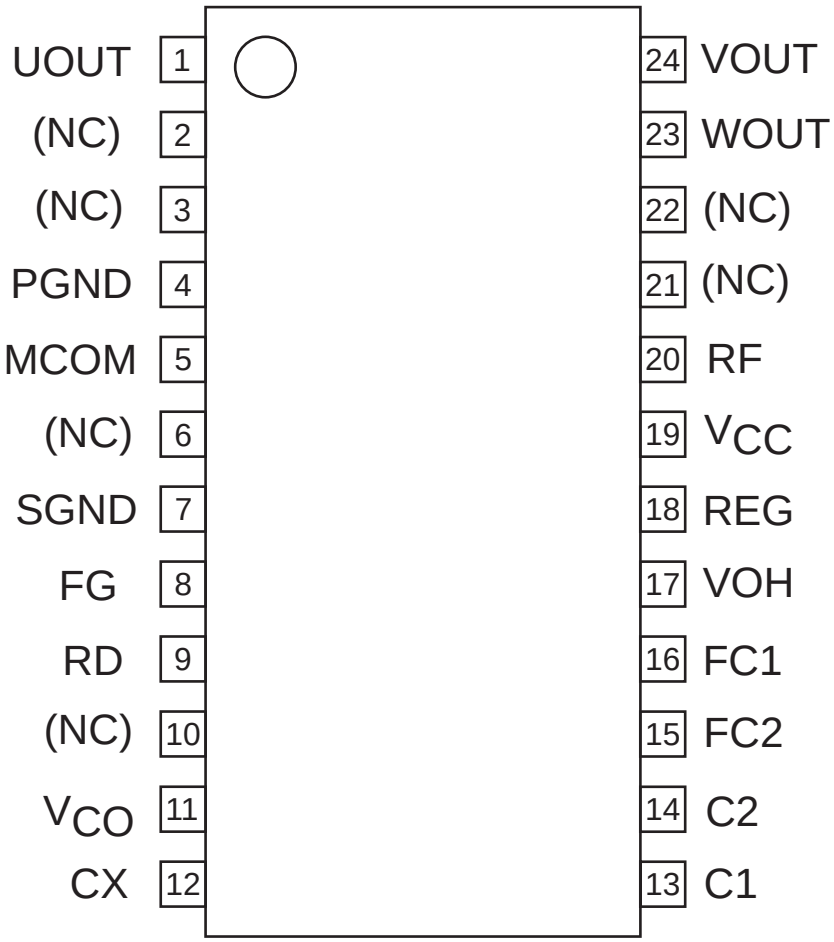
unit : mm (typ)

3315

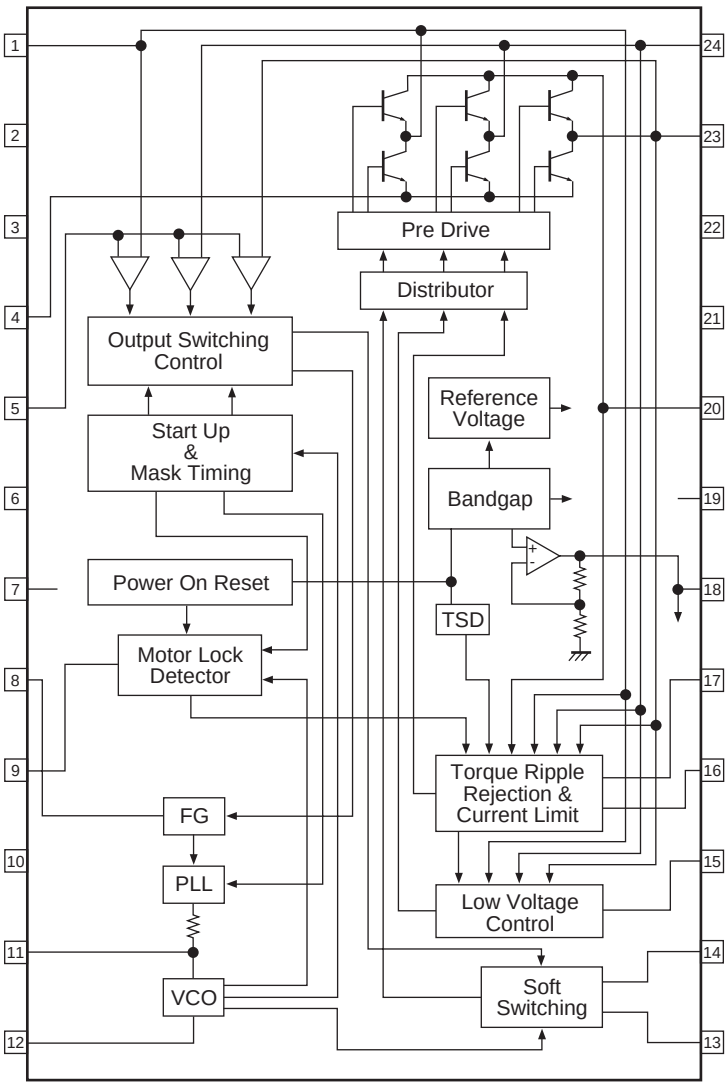




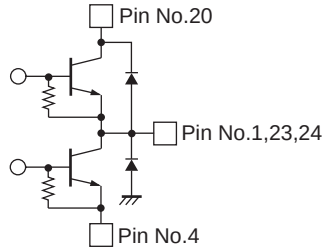
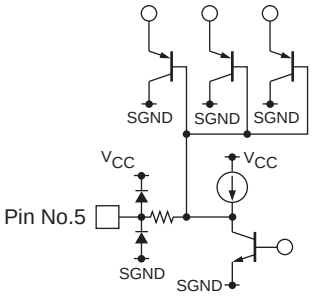
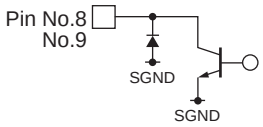
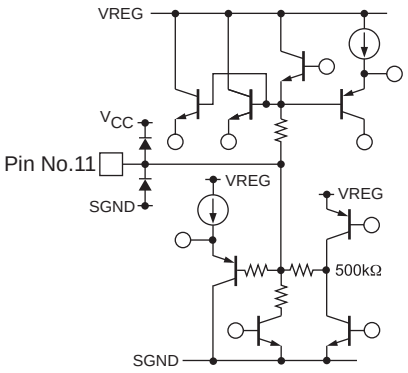
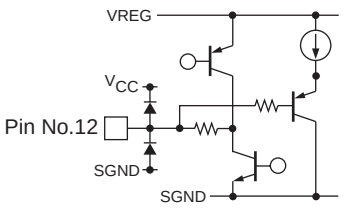
Pin Assignment



Block Diagram



Pin Function

Pin No.	Pin name	Function	Equivalent circuit
1 23 24	UOUT WOUT VOUT	Each output pin of three phases.	
4	PGND	GND pin in the output part. This pin is connected to GND. The SGND pin is also connected to GND	
20	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.	
5	MCOM	Motor coil midpoint input pin. The coil voltage waveform is detected based on this voltage.	
7	SGND	Ground pin (except the output part) This pin is connected to GND. The PGND pin is also connected to GND.	
8	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.	
9	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.	
11	VCO	PLL output pin and VCO input pin. To stabilize PLL output, connect a capacitor between this pin and GND.	
12	CX	VCO oscillation output pin. Operation frequency range and minimum frequency are determined by the capacity of the capacitor connected to this pin.	

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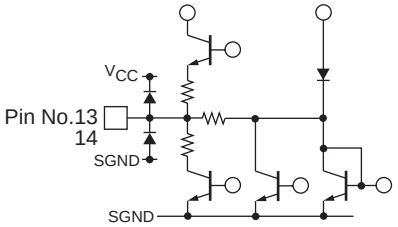
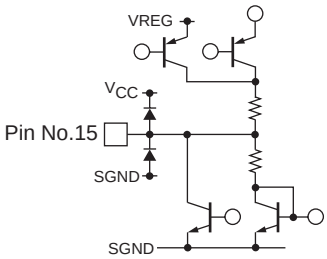
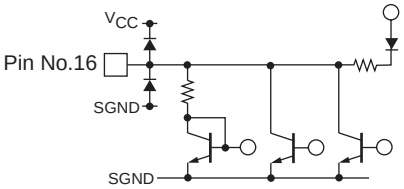
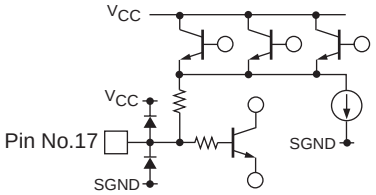
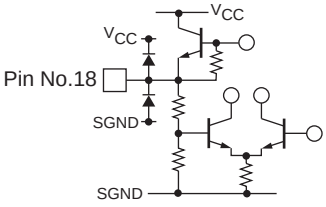
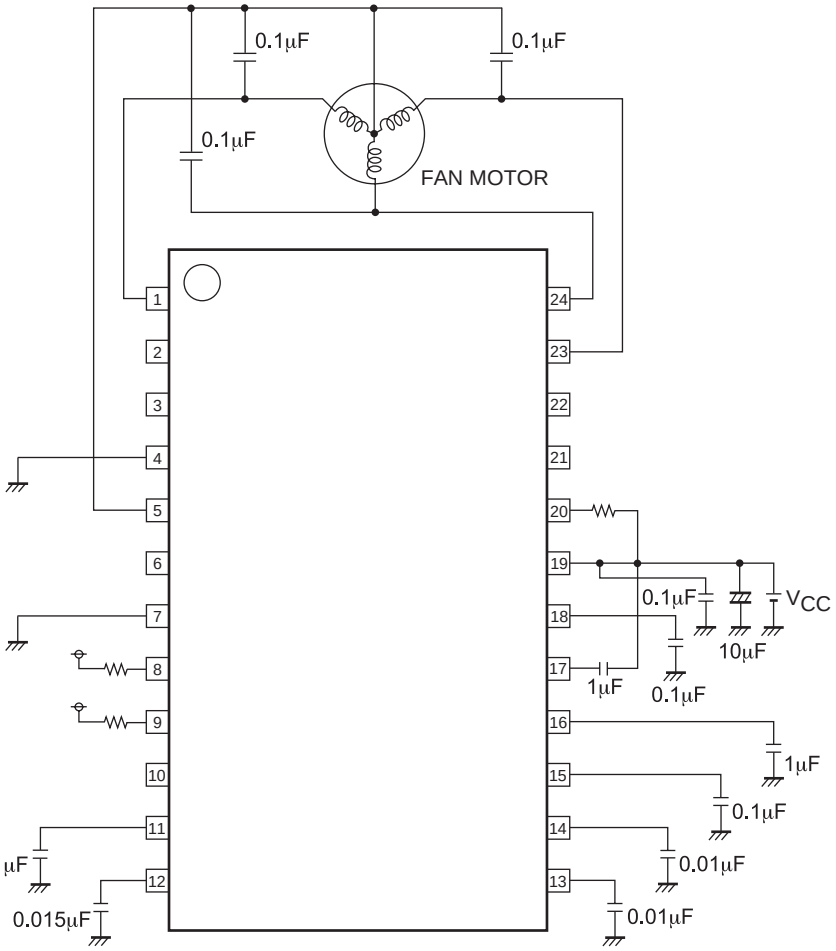
Pin No.	Pin name	Function	Equivalent circuit
13 14	C1 C2	Soft switching adjustment pin. The triangular wave from is form formed by connecting a capacitor with this pin. And, the switching of three-phase output is adjusted by the slope.	
15	FC2	Frequency characteristic correction pin 2. To suppress the oscillation of control system closed loop of sink-side, connect a capacitor between this pin and GND.	
16	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.	
17	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.	
18	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.



Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9