



SANYO Semiconductors DATA SHEET

LB11972V — Monolithic Digital IC 3-Phase Sensorless Motor Driver for Fan Motor Driver for Refrigerator

Overview

The LB11972V is a 3-phase full-wave current linear sensorless motor driver.
It is optimal for refrigerator fan motor drive.

Functions

- Three-phase sensor-less motor driver
- Current linear drive
- Built-in current limiting circuit
- Built-in output stage saturation preventive circuit
- With coil counter-electromotive FG output
- Built-in thermal shutdown circuit
- Built-in beat lock preventive circuit

Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC} max		15.0	V
Output application voltage	V_O max		15.0	V
Input application voltage	V_I max		-0.3 to $V_{CC}+0.3$	V
Output current	I_O max		1.0	A
Internal allowable loss	Pd max1	Independent IC	0.5	W
	Pd max2	Mounted on a specified board.*	1.0	W
Operating temperature	T_{opr}		-30 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

* Specified board (114.3×76.1×1.6mm : Glass epoxy)

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		7 to 13.8	V

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Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$

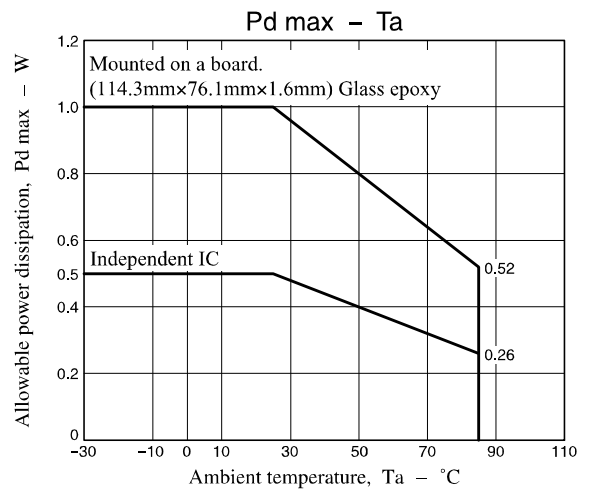
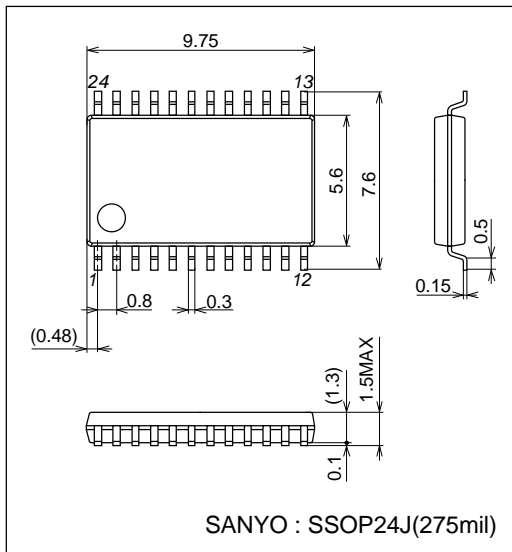
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit current	I_{CC}			20	30	mA
Output saturation voltage 1	V_{OSAT1}	$I_O = 0.4\text{A}$, Source+Sink		1.4	2.0	V
Output saturation voltage 2	V_{OSAT2}	$I_O = 0.8\text{A}$, Source+Sink, $R_F = 0\Omega$		1.8	2.6	V
MCOM pin common-phase input voltage range	VIC		0		$V_{CC}-2$	V
PCOUT output current 1	IPCOU	Source side		-90		μA
PCOUT output current 2	IPCOD	Sink side		90		μA
VCONIN input current	IVCOIN	VCOIN = 5V		0.1	0.2	μA
VCO minimum frequency	FVCOMIN	VCOIN = open		400		Hz
VCO maximum frequency	FVCOMAX	VCOIN = 5V		18.5		kHz
C1, C2 source current ratio	RSOURCE	1- ($IC1SOURCE/IC2SOURCE$)	-12		+12	%
C1, C2 sink current ratio	RSINK	1- ($IC1SINK/IC2SINK$)	-12		+12	%
C1 source, sink current ratio	RC1	$IC1SOURCE/IC1SINK$		50		%
C2 source, sink current ratio	RC2	$IC2SOURCE/IC2SINK$		50		%
Counter-electromotive FG output ON voltage	V_{OL}	IFGO = 1mA			0.4	V
Thermal shutdown operation temperature	TTSD	Design target value*	150	180	210	$^\circ\text{C}$
Thermal shutdown hysteresis	$\Delta TTSD$	Design target value*		15		$^\circ\text{C}$
Current limiter operation voltage	VRFILIM	$R_L = 1\text{k}\Omega$, $R_F = 100\Omega$	0.38	0.44	0.50	V

Note* : These items are design target values and are not tested.

Package Dimensions

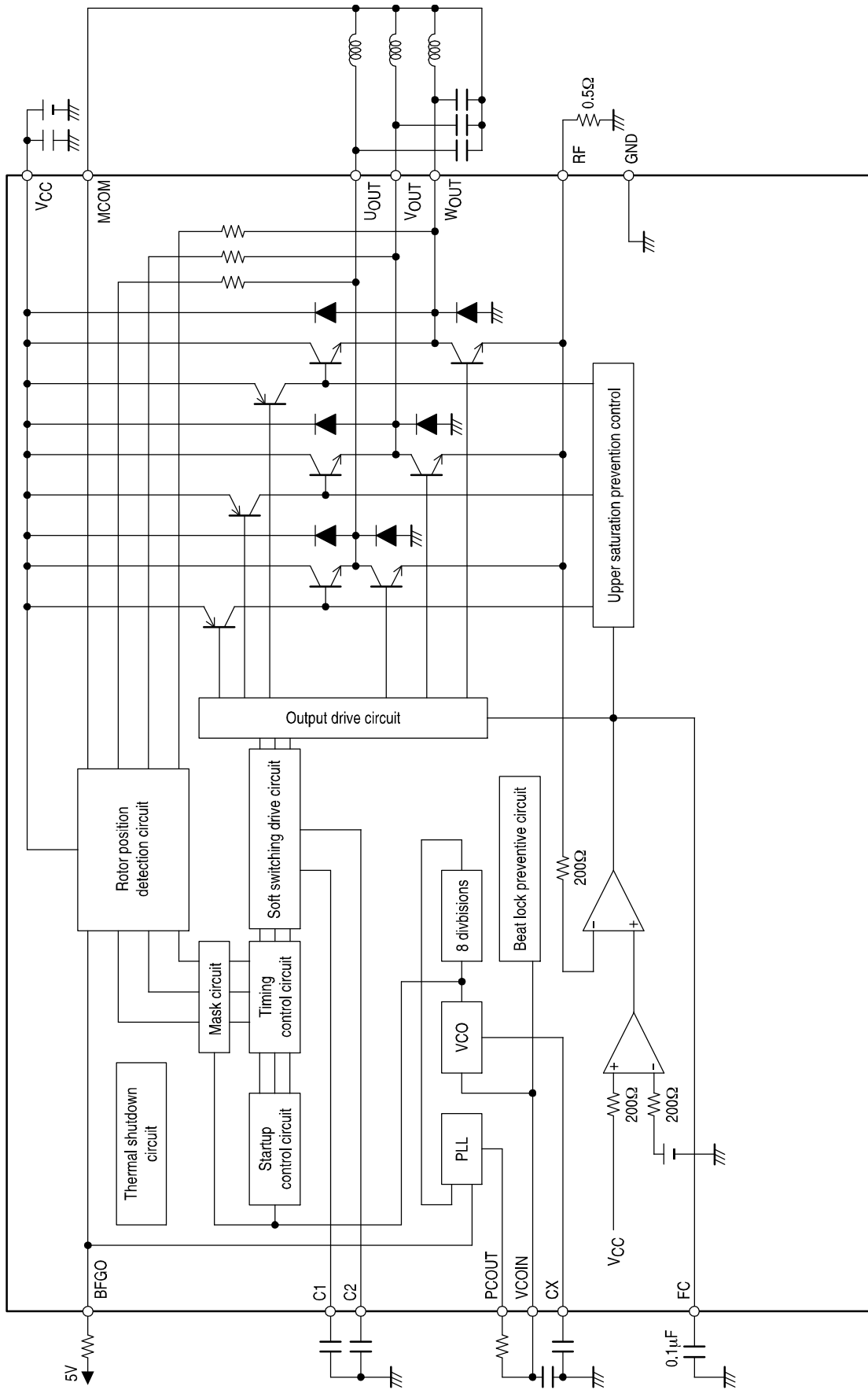
unit : mm

3315



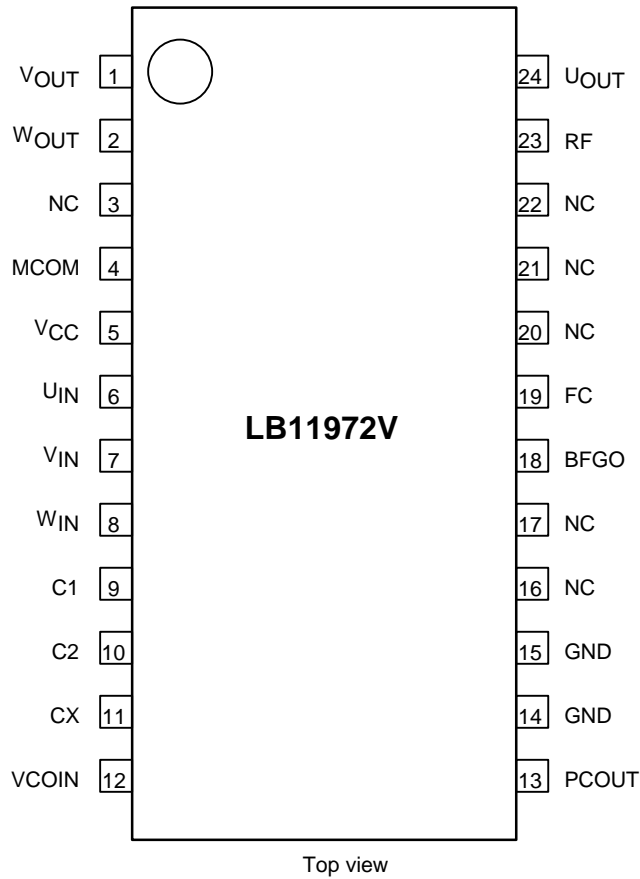
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Block Diagram (The external constant may vary depending on the motor.)



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Pin Assignment



Pin Description

Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit Diagram	Pin Description
24	UOUT			Drum motor driver output pin
1	VOUT			
2	WOUT			
23	RF			Minimum potential of drum motor driver output transistor. Constant current control is made by detecting this voltage. The current limiter operates by detecting this potential, too.
5	VCC	7 to 13.8V		Power pin

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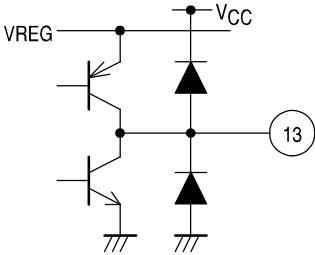
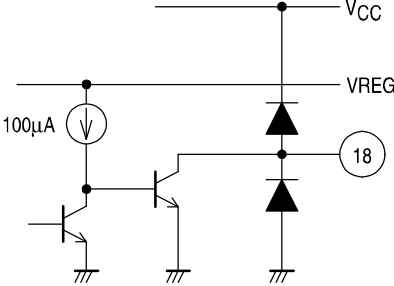
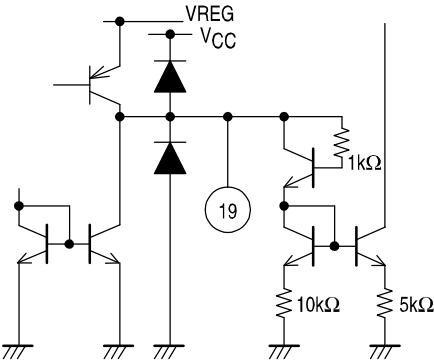
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Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit Diagram	Pin Description
4	MCOM			<p>Motor coil middle input pin. Coil voltage waveform is detected with reference to this voltage.</p> <p>Coil waveform detection comparator input pin Connected to the output of each phase via built-in resistor of 10kΩ.</p>
6	U _{IN}			
7	V _{IN}			
8	W _{IN}			
9	C1			<p>Pin connected to the capacitor to generate triangular wave. This triangular wave is used for soft switching of the coil output waveform.</p>
10	C2			
11	CX			<p>Value of the capacitor connected to this pin and GND in the VCO circuit, determining the operation frequency range and minimum operation frequency.</p>
12	VCOIN			<p>VCO circuit voltage input pin. Enters the PCOUT pin voltage after CR filtering</p>

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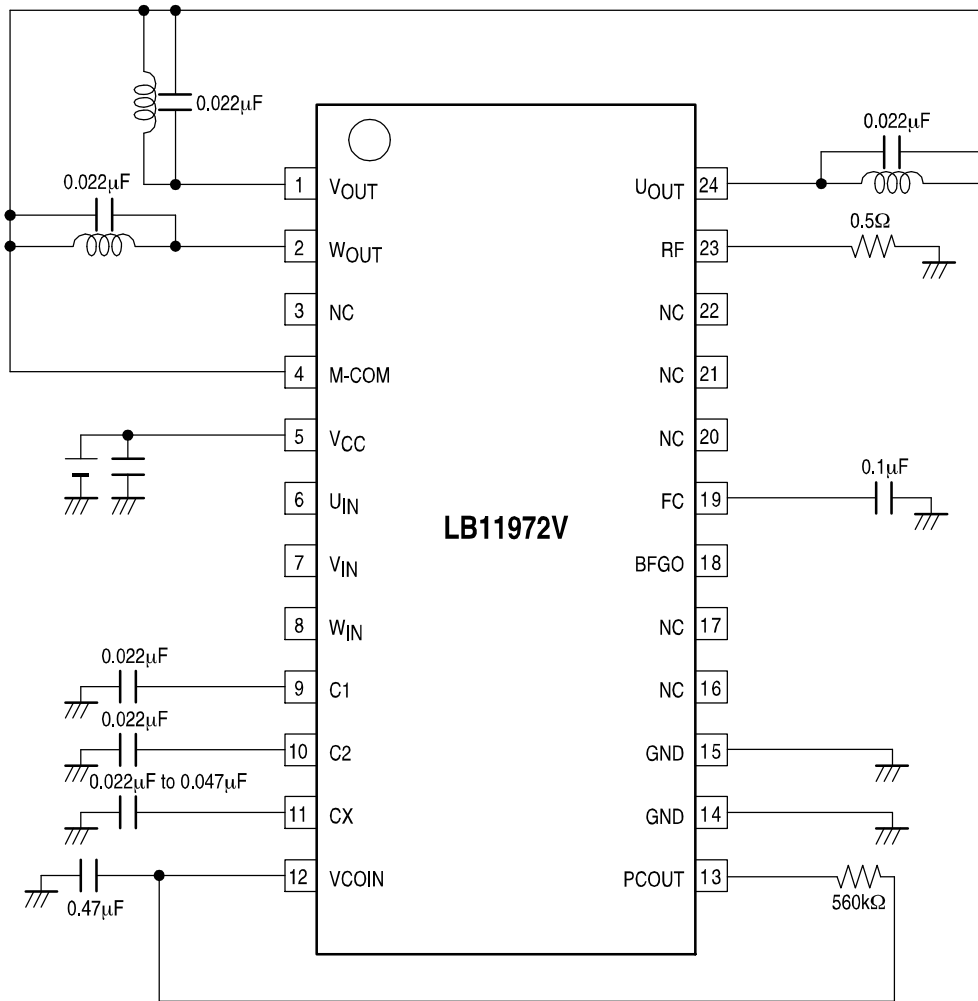
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Pin No.	Pin Symbol	Pin Voltage	Equivalent Circuit Diagram	Pin Description
13	PCOUT			VCO circuit PLL output pin
14	GND			All GNDs other than the output transistor
15				
18	BFGO			Motor couter-electromotive voltage detection FG output (single phase only)
19	FC			Frequency characteristics compensation pin Prevents oscillation of the closed loop of current control system by inserting the capacitor between this pin and GND.

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Sample Application Circuit (Reference)



- Note 1) The constant values for capacitors, etc. are given here for reference after review by Sanyo. When reviewing this IC, adjust the value according to the motor used.
- Note 2) If the output is not oscillated with the motor used, the capacitor provided at both ends of output coil are not necessary.
- Note 3) Pins Nos. 6 to 8 (U_{IN} , V_{IN} , W_{IN}) are not to be used by the customer. Be sure to keep these pins independent and open because they are connected inside IC.
- Note 4) NC pins (Nos. 3, 16, 17, 20, 21, and 22) are not connected inside IC and thus can be used as relay pins.

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