



LB11983

3-Phase Sensorless Motor Driver for Fan Motor Driver for Refrigerator

Overview

The LB11983 is a 3-phase full-wave current linear sensorless motor driver. It is optimal for refrigerator fan motor drive.

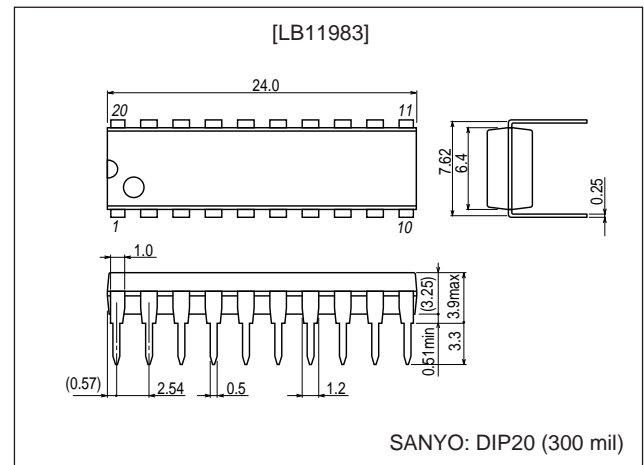
Features

- current linear driving technique
- current limiter circuit
- Over saturation prevention circuit for output stage
- Provides coil back EMF FG output
- Thermal shutdown circuit
- Beat lock pervention circuit

Package Dimensions

unit: mm

3021C-DIP20



Specifications

Absolute Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|----------------------------|--------------|----------------|------------------------|------|
| Supply voltage | V_{CC} max | | 14.5 | V |
| Output application voltage | V_O max | | 14.5 | 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 | P_d max | Independent IC | 1.0 | W |
| Operating temperature | T_{opr} | | -30 to +85 | °C |
| Storage temperature | T_{stg} | | -55 to +150 | °C |

Operating Conditions at Ta = 25°C

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

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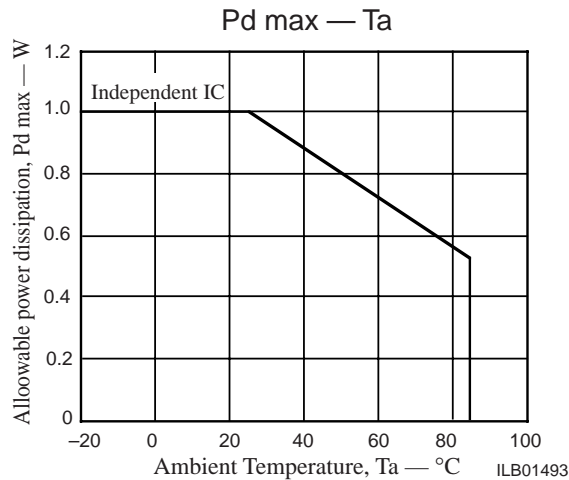
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LB11983

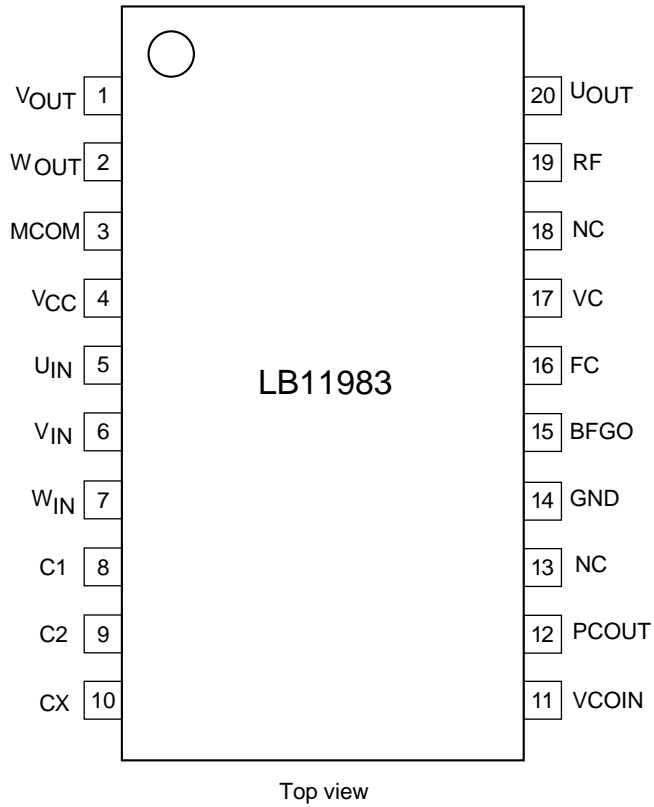
Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 12.0\text{ V}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|--|---------------------|---|---------|------|--------------|------------------|
| | | | min | typ | max | |
| Supply current | I_{CC} | $V_C = V_{CC}$ | | 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-mode 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 |
| VCOIN input current | IVCOIN | VCOIN = 5 V | | 0.1 | 0.2 | μA |
| VCO minimum frequency | fVCOMIN | VCOIN = open | | 400 | | Hz |
| VCO maximum frequency | fVCOMAX | VCOIN = 5 V | | 18.5 | | kHz |
| C1, C2 source current ratio | RSOURCE | IC1SOURCE/IC2SOURCE | -12 | | +12 | % |
| C1, C2 sink current ratio | RSINK | IC1SINK/IC2SINK | -12 | | +12 | % |
| C1 source and sink current ratio | RC1 | IC1SOURCE/IC1SINK | -35 | | +15 | % |
| C2 source and sink current ratio | RC2 | IC2SOURCE/IC2SINK | -35 | | +15 | % |
| Counter FG output ON voltage | V_{OL} | | | | 0.4 | V |
| Counter FG output OFF voltage | V_{OH} | | 4 | | | V |
| Thermal shutdown operating temperature | TTSD | Design target value* | 150 | 180 | 210 | $^\circ\text{C}$ |
| Thermal shutdown hysteresis | ΔTTSD | Design target value* | | 15 | | $^\circ\text{C}$ |

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



Pin Arrangement



Pin Functions

| Pin No. | Symbol | Pin voltage | Description | Equivalent circuit |
|---------|------------------|-------------|---|--------------------|
| 20 | U _{OUT} | | Drum motor driver output pin. | |
| 1 | V _{OUT} | | | |
| 2 | W _{OUT} | | | |
| 19 | RF | | Minimum potential of the drum motor driver output transistor. This voltage is detected for constant-current control. The current limiter is also activated upon detection of this potential. | |
| 4 | V _{CC} | 8 to 13.8 V | Power supply pin | |

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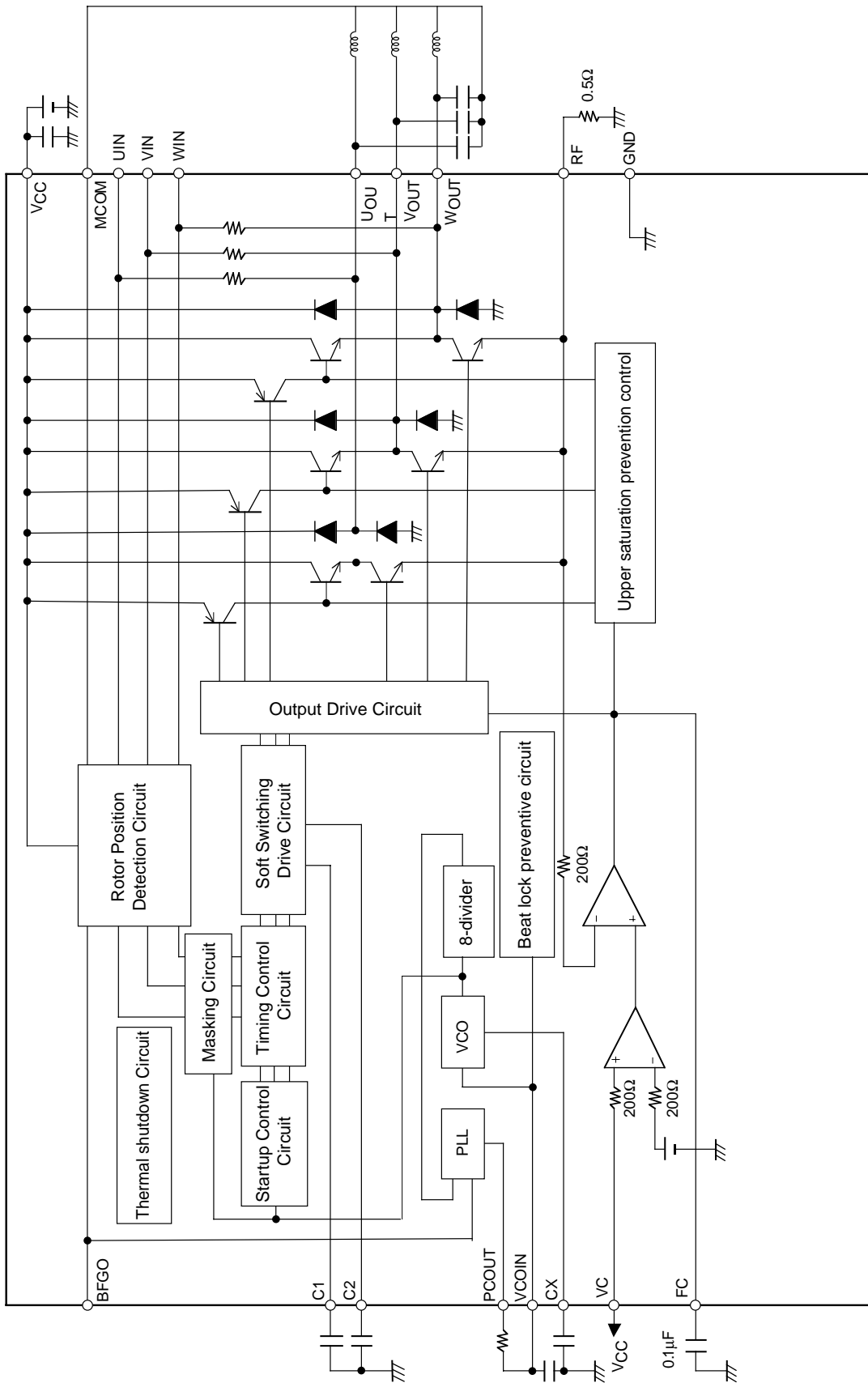
| Pin No. | Symbol | Pin voltage | Description | Equivalent circuit |
|---------|-----------------|-------------|--|--------------------|
| 3 | MCOM | | Middle point input pin of motor coil. The coil waveform is detected with reference to this voltage. | |
| 5 | U _{IN} | | Input pin of the coil waveform detection comparator. Connected to each phase output with a built-in resistor of 10 kΩ | |
| 6 | V _{IN} | | | |
| 7 | W _{IN} | | | |
| 8 | C1 | | Triangular wave generating capacitor connection pin. This triangular wave causes soft switching of coil output waveform. | |
| 9 | C2 | | | |
| 10 | CX | | The operating frequency range and minimum operating frequency are determined from the value of capacitor connected to this pin and GND in the VCO circuit. | |
| 11 | VCOIN | | VCO circuit voltage input pin Inputs the PCOUT pin voltage through CR filtering. | |

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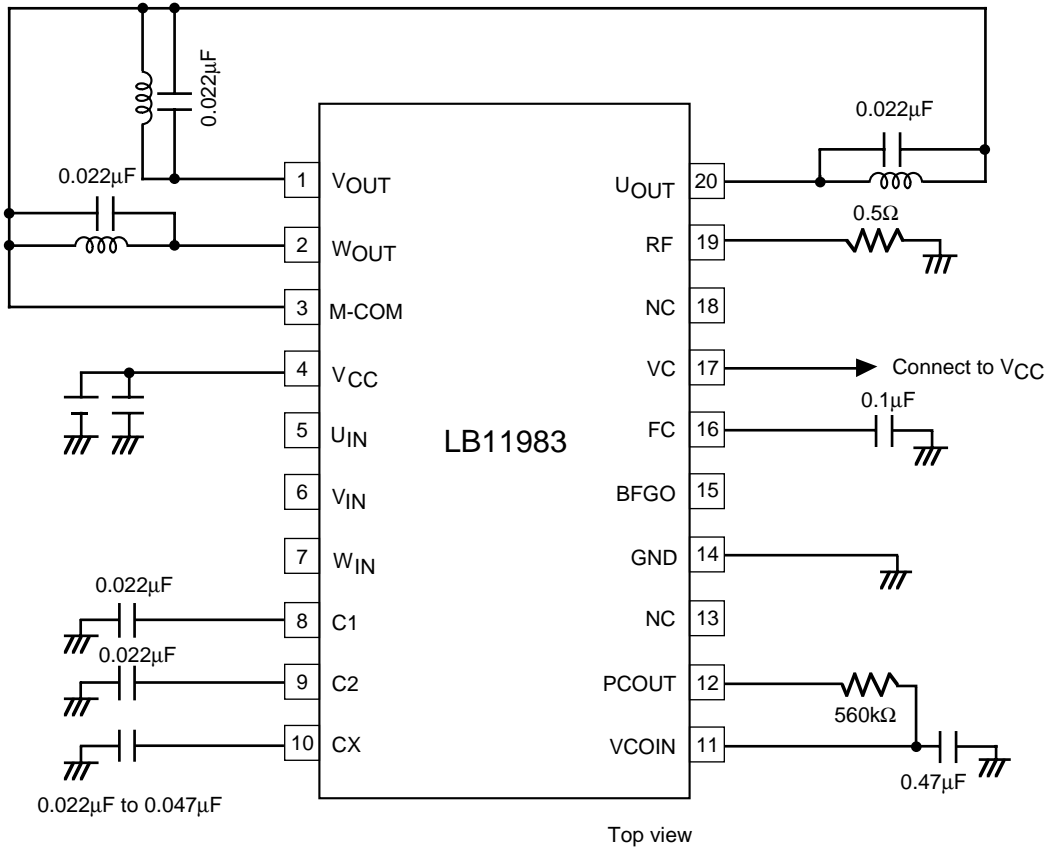
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| Pin No. | Symbol | Pin voltage | Description | Equivalent circuit |
|---------|--------|-------------|--|--------------------|
| 12 | PCOUT | | VCO circuit PLL output pin. | |
| 14 | GND | | GND for others than the output transistor. | |
| 15 | BFGO | | FG output to detect motor reverse feeder voltage. (Composition of three phases) | |
| 16 | FC | | Frequency characteristics compensation pin. Insertion of a capacitor between this pin and GND stops oscillation of the current control closed loop. | |
| 17 | VC | | Speed control pin. The control is a constant-current control under current feedback from RF. Normally, this pin is connected to V _{CC} for use. | |

Block Diagram (External constant may vary depending on the motor used.)



Sample Application Circuit (Reference)



- Notes
1. Be sure to connect the VC pin to V_{CC} directly before use.
 2. For the constant of capacitor, etc., our value established through examination is given for reference. Adjust the value according to the motor to be used when considering this IC.
 3. If the output is not oscillated with the motor used, a capacitor inserted between output coil ends is not necessary.
 4. Pins 5 through 7 (U_{IN}, V_{IN}, and W_{IN}) are not to be used by a user. These are connected inside IC and should always be kept independent and open.
 5. NC pins (14 and 18) are not connected inside IC and can be used as relay pins.

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