Monolithic Digital IC

LB1662D, 1662M

DC Fan Motor Drivers

Overview

The LB1662D, 1662M are 2-phase brushless motor drivers operated from 5 V power supply. Motor Lock protection and automatic return can be provided with a minimum number of external parts.

Features and Functions

· Designed to be operated from 5 V power supply, making stable operation possible at a reduced voltage.
· Direct connection to a Hall element possible.
· Built-in output transistors with output current 1.5 A
· Built-in rotation detect function (Drive mode: "L", Stop mode: "H")
· Built-in motor lock protector and automatic return function
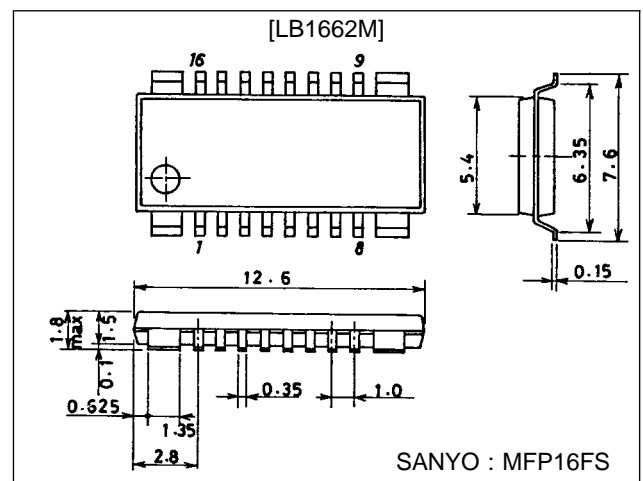· With radio noise reduction pin

Package Dimensions

unit : mm

3098B-DIP10S

SANYO : DIP10S
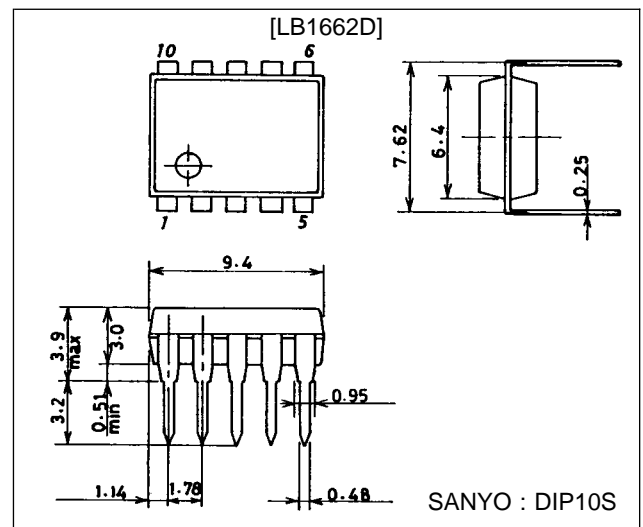
unit : mm

3097-MFP16FS

SANYO : MFP16FS

SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquarters
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

Specifications

Absolute Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{IN} max		7	V
Output voltage	V_{OUT}		−0.3 to +85	V
Output current	I_{OUT}		1.5	A
RD flow-in current	I_{RD}		10	mA
RD voltage	V_{RD}		50	V
Allowable power dissipation	Pd max	LB1662D	1.2	W
		LB1662M (Independent IC)	0.9	W
		LB1662M with Specified board*	1.2	W
Operating temperature	Topr		−40 to +80	°C
Storage temperature	Tstg		−55 to +125	°C

* Specified board ($20 \times 30 \times 1.5$ mm^3 glass epoxy resin)

Allowable Operating Ranges at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range	V_{IN}		3.8 to 6.0	V
Common-mode input voltage range	V_{ICM}		0 to V_{IN} −1.5	V

Electrical Characteristics at Ta = 25 °C, V_{IN} = 4.3 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Output withstand voltage 1	V_{OR}		80			V
Output withstand voltage 2	$V_{O(SUS)}$	I_O = 0.1	65			V
Output saturation voltage	V_O sat 1	I_O = 0.5 A		0.95	1.2	V
	V_O sat 2	I_O = 1.0 A		1.15	1.5	V
	V_O sat 3	I_O = 1.5 A, V_{IN} = 4.8 V		1.4	2.0	V
V_{IN} flow-in range	I_{IN}		1.4	2.5	3.7	mA
Amp input offset voltage	V_{OFF}		−7	0	7.0	mV
Amp input bias current	I_{BA}		−250			nA
RD output saturation voltage	V_{RD} (sat)	I_{RD} = 5 mA		0.1	0.2	V
C flow-out current	I_C 1		1.5	2.8	4.1	µA
C discharge current	I_C 2		0.21	0.38	0.61	µA
Comparator input threshold voltage	V_{TH} 1		0.67	0.7V_{IN}	0.73	V
	V_{TH} 2		0.34	0.38V_{IN}	0.42	V

Pin Assignments

```
IN-  1        10  VIN
IN+  2         9  RD
C    3  LB1662D  8  B1
OUT1 4         7  B2
GND  5         6  OUT2
```

```
FRAME           FRAME
FRAME  1    16  FRAME
NC     2    15  VIN
IN-    3    14  RD
IN+    4  LB1662M  13  B1
C      5    12  B2
OUT1   6    11  OUT2
GND    7    10  NC
FRAME  8     9  FRAME
FRAME           FRAME
```
Top view

Pd max − Ta

Allowable power dissipation, Pd max − W (y-axis)
Ambient temperature, Ta − °C (x-axis)

20×20×1.5mm3 Glass epoxy resin (LB1662M)
LB1662D (Independent IC)
LB1662M (Independent IC)
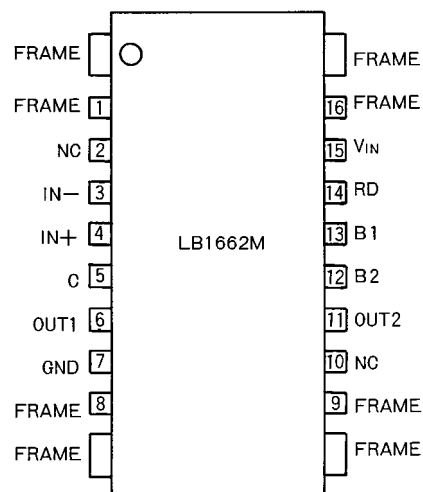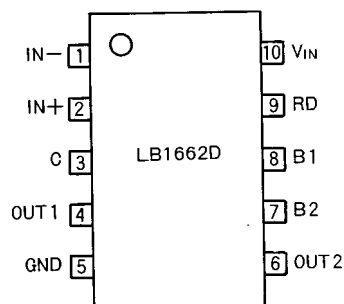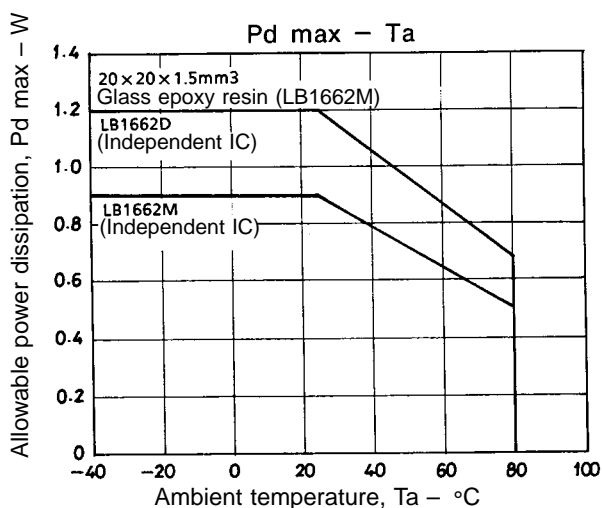
Pin Functions

Pin No.	Pin name	Function
1 2	IN– IN+	Input pins for hall element outputs. Common-mode input voltage range is 0 to V_{IN}–1.5 V, offset voltage is ±7 mV
3	C	Capacitor pin (1 to 10 µF) that forms automatic return circuit. When rotation is stopped due to overload, the pin voltage increases and output stops. After proper load adjustment, the output returns from "stop" mode to "drive" mode automatically. The lock detect time can be set by changing the capacitor constant.
4 6	OUT1 OUT2	Output pins. The output transistor is Darlington connected. Connect either an external capacitor or an external Zener diode for output transistor protection.
5	GND	Ground pin.
8 7	B1 B2	Base pins for Darlington connected output transistors. If radio noise is a problem, add a capacitor (0.01 to 0.1 µF).
9	RD	Open collector output. Drive mode: "L", Stop mode: "H"
10	V_{IN}	Insert a limiting resistor between V_{CC} and V_{IN} and use the voltage applied between V_{IN} and ground in a range from 3.8 to 6.0 V. In this case, the current consumption I_{CC} at the V_{IN} pin is 1.4 to 3.7 mA (when V_{IN} = 4.3 V).

Truth Table

IN+	IN–	C	OUT1	OUT2
H	L	L	H	L
L	H	L	L	H
H	L	H	H	H
L	H	H	H	H

Usage Notes

(See the Sample Application Circuits.)

(1) Supply voltage (V_{IN} pin)

Use these ICs with the voltage applied between V_{IN} and ground in the range from 3.8 to 6.0 V. The current consumption, I_{CC}, at the V_{IN} pin is from 1.4 to 3.7 mA (when V_{IN} = 4.3 V). Insert diode D1 to keep coil kickback out of the power line. This diode also prevents breakdown due to reverse connections. Also, inserting R1 limits the reverse connection current flowing into ground and V_{IN}. These ICs have a reverse connection withstand current, I_{CC} = 200 mA. Check R1 around the range from 50 to 200 Ω.

(2) Hall input pin voltage (IN– and IN+ pins)

Set the voltage levels of the input pin for the Hall element output and the Hall element output voltage to within the range of 0 V to V_{IN}–1.5 V.

The gain between the Hall input pin and the output pin is 100 dB or greater. The offset voltage of the Hall input amp is ±7 mV. Therefore, the Hall element output must be set with the offset voltage (±7 mV) considered.

(3) Output transistors (OUT1 and OUT2 pins)

Output current I_O = 1.5 A max.

Output saturation voltage V_O sat = 1.15 V/1.0 A (typ.)

The LB1662D, 1662M requires one of the three types of output protection.

① When external capacitors are connected between OUT and ground, the capacitance should not exceed 10 μF. Use capacitance that will hold kickback voltage and back voltage to 80 V or less.

② When external Zener diodes are connected, use one that will have a cutoff voltage of 65 V or less. If radio noise is a problem, insert a 0.01 μF to 0.1 μF capacitor between B1 and B2.

③ When external capacitors are connected between OUT and B, use one that will hold kickback voltage to 65 V or less. If it oscillates, insert resistance in series with the capacitor.

(4) Output protection function (C pin)

Capacitor pin used in forming an automatic return circuit.

If rotation is stopped due to overload, the pin voltage increases and then forces the output to become inactive. In this case, after proper load adjustment, the output returns to the 'drive' mode from the 'stop' mode automatically. By changing the capacitor value, the lock detect time period can be set.

Automatic return circuit C pin voltage

For 1 μF   lock detection time about 1 seconds

   lock protection time (output ON) about 0.5 second

                                             (output OFF) about 3.5 seconds
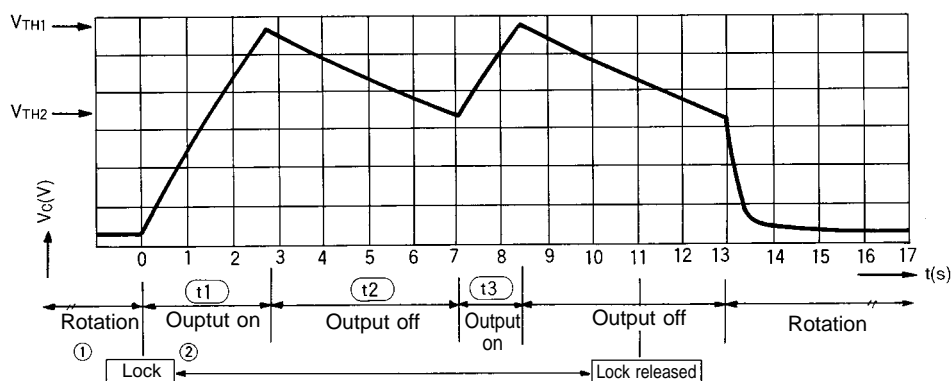
① When a fan is rotating, the capacitor is charge at 2.8 μA (typ) and discharged through the C with pulses according to the rotational speed.

② When a fan is locked, no discharge occurs through the C and the C voltage rises, turning OFF the output at $V_{TH}1$ (0.7 × V_{IN}).

③ When the output is turned OFF, discharge occurs through the C at 0.38 μA (typ). If the lock is not released when the C voltage drops to $V_{TH}2$ (0.38 × V_{IN}), the capacitor is charged to $V_{TH}1$ again. (At this moment, the output is turned ON.) These operations ② and ③ repeated at a cycle of approximately $t_{ON} : t_{OFF}$ = 1 : 7 protect a motor.

④ If the lock is released when the C voltage drops to $V_{TH}2$, the output is turned ON, starting rotation.

(5) Rotation detect signal (RD pin)
Open collector output (Drive mode: "L", Stop mode: "H")

(6) Radio noise reducing (B1 and B2 pins)
These are the base pins for Darlington connected output transistors. If radio noise is a problem, add a capacitor of approximately 0.01 to 0.1 μF between B1 and B2, or 0.001 μF to 0.01 μF between OUT and B.

Block Diagram and Sample Application Circuit – ①
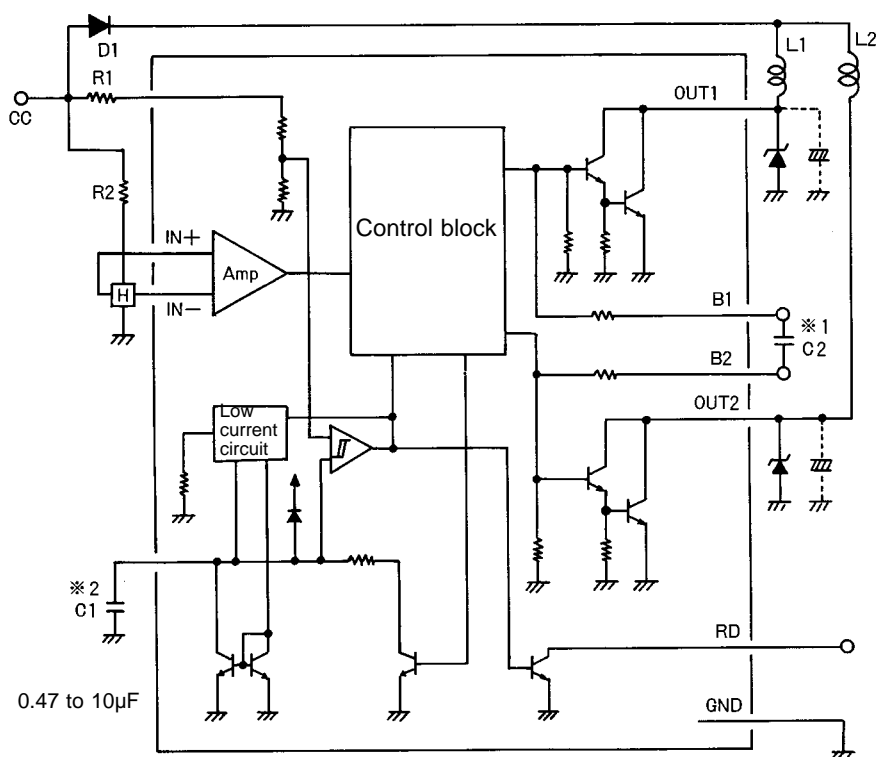
*1 Use (10,000 to 100,000 pF) if radio noise is a problem.
*2 Use a Zener diode or capacitor for output stage protection.

Sample Application Circuit – ②
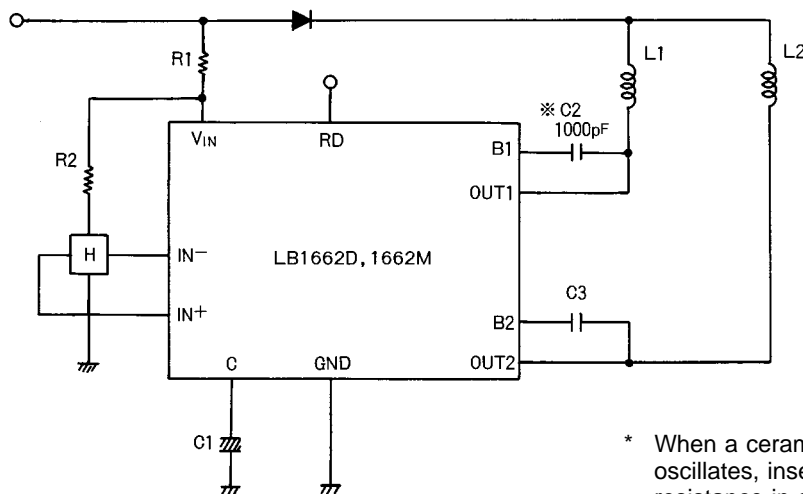
*   When a ceramic capacitor oscillates, insert resistance in series with the capacitor.