Single-phase full-wave motor driver for fan motor

BA6908F

BA6908F is a single phase full-wave motor driver for fan motor corresponding to 5V and 12V. Switching noise is reduced by soft switching drive. This IC has lock detection and automatic restart functions as motor protection function.

●Applications

Motor drivers for fan motors

●Features

1) Single-phase full-wave drive system.
2) Built-in power transistor.
3) Soft switching drive.
4) Lock detection and automatic restart circuit.
5) Thermal shut-down circuit.
6) Hall signal output.

●Absolute maximum ratings (Ta=25°C)

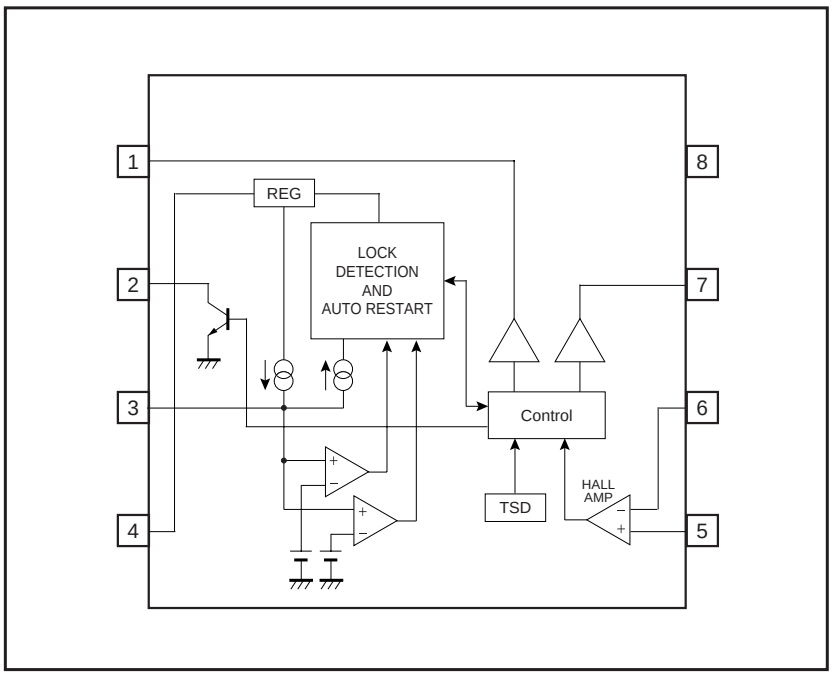
Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC}	15	V
Power dissipation	Pd	687 *1	mW
Operating temperature	Topr	–40 to +85	°C
Storage temperature	Tstg	–55 to +150	°C
Output current	I_{OUT}	0.7 *2	A
Hall signal output current	I_{HO}	15	mA
Output voltage	V_{OUT}	15	V
Hall signal output voltage	V_{HO}	15	V
Junction temperature	Tjmax	150	°C

∗1 To use at temperature above Ta=25°C reduce 5.5mW/°C.
(On 70.0mm×70.0mm×1.6mm glass epoxy board)
∗2 This value is not to be over Pd and ASO.

●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	3	–	14	V

●**Block diagram**



●**Terminal function table**

Pin No.	Pin name	Function
1	OUT2	Output terminal 2
2	HO	Hall signal output terminal
3	LD	Connection terminal of capacitor for lock detection, auto restart
4	V_{CC}	Power supply terminal
5	H+	Hall signal input terminal +
6	H–	Hall signal input terminal –
7	OUT1	Output teminal 1
8	GND	GROUND terminal

●**Input / output circuit**

<Hall input>

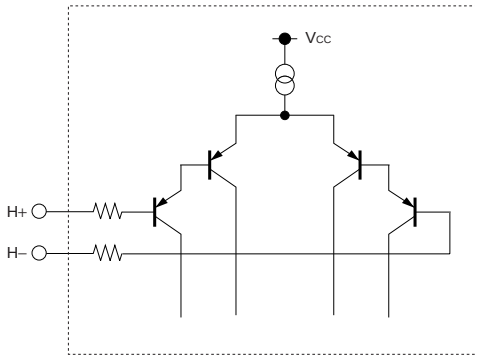


Fig.1

<Coil output>

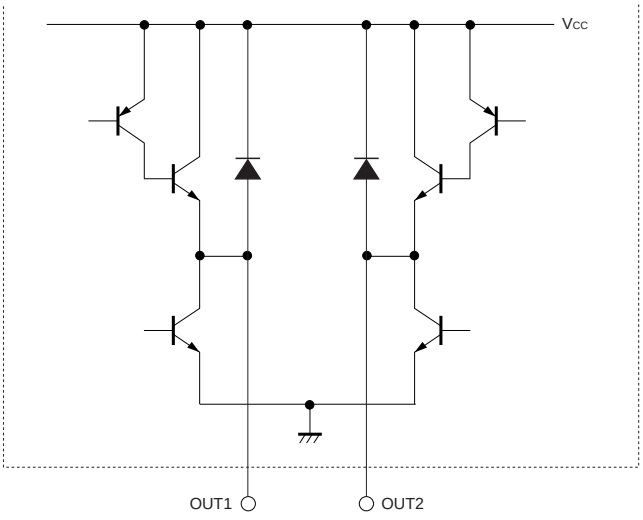


Fig.2

<HO output>

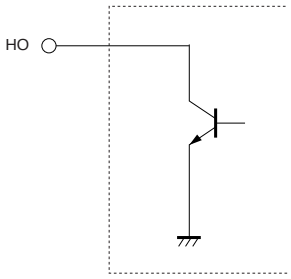


Fig.3

●**Electrical characteristics** (Unless otherwise specified, Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply current	I_{CC}	1.5	3.4	8.7	mA	At output : OFF
Charge current of capacitor for lock detection	ILDC	1.50	2.75	4.50	µA	VLD=1.1V
Discharge current of capacitor for lock detection	ILDD	0.24	0.48	0.90	µA	VLD=1.1V
Charge-discharge current ratio of capacitor for lock detection	rCD	4.2	5.7	9.5	–	rCD=ILDC/ILDD
Clamp voltage of capacitor for lock detection	VLDCL	1.14	1.80	2.47	V	
Comparison voltage of capacitor for lock detection	VLDCP	0.47	0.76	1.06	V	
Output voltage L	VOL	–	0.2	0.3	V	I_O=200mA
Output voltage H	VOH	3.9	4.1	–	V	I_O=200mA
"HO" terminal voltage L	VHOL	–	0.3	0.5	V	IHO=5mA
"HO" terminal leak current	IHOL	–	0	50	µA	VHO=15V
Hall input offset voltage	Hofs	–10	–	10	mV	
Hall input-output gain	GHO	320	500	680	–	

◎ This product is not designed for protection against radioactive rays.

●**Lock detect circuit, automatic restart circuit**

Charge and discharge time at motor lock condition varies with the value of external capacitor at LD terminal and is given by the following equation.

$$\text{Ton (Charge time)} = \frac{C \cdot (VLDCL - VLDCP)}{ILDC}$$

$$\text{Toff (Discharge time)} = \frac{C \cdot (VLDCL - VLDCP)}{ILDD}$$

C : Value of capacitor at LD terminal
VLDCL : Clamp voltage of capacitor lock detection (1.80V Typ.)
VLDCP : Comparison voltage of capacitor lock detection (0.76V Typ.)
ILDC : Charge current of capacitor lock detection (2.75µA Typ.)
ILDD : Discharge current of capacitor lock detection (0.48µA Typ.)

The following value shows charge time and discharge time at C=0.47µF for reference.

Charge time = 0.18SEC (Output : ON)
Discharge time = 1.02SEC (Output : OFF)

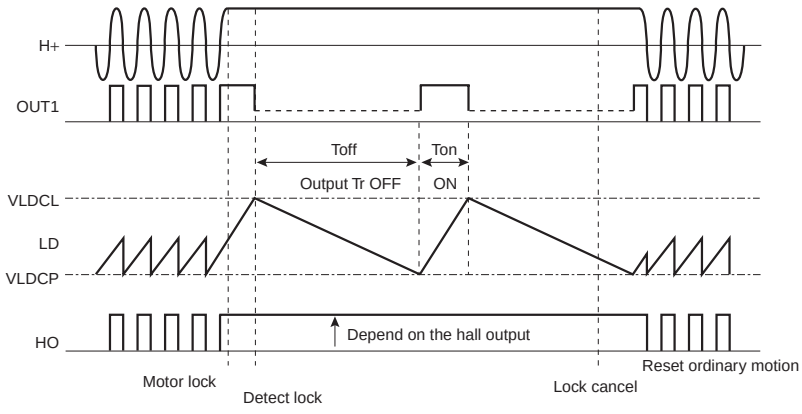


Fig.4 Timing chart

●**Application circuit**

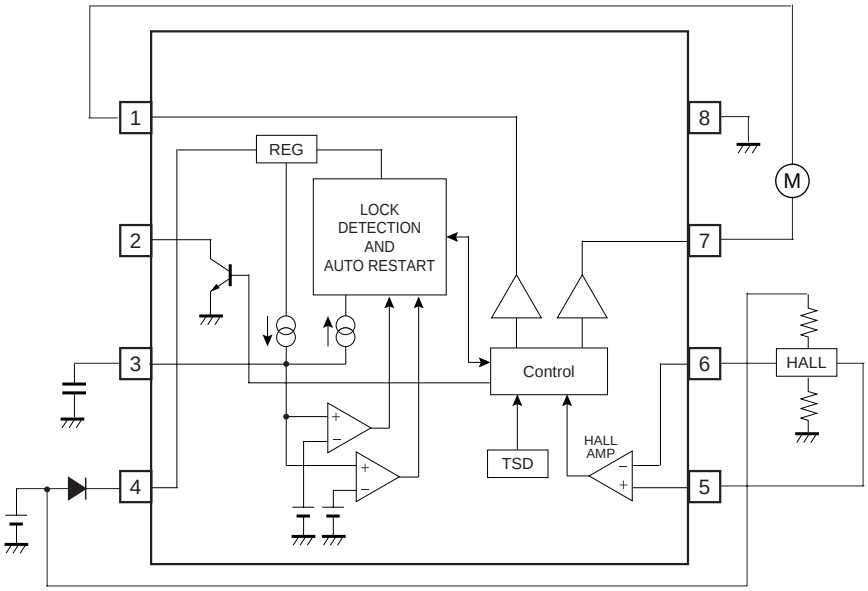
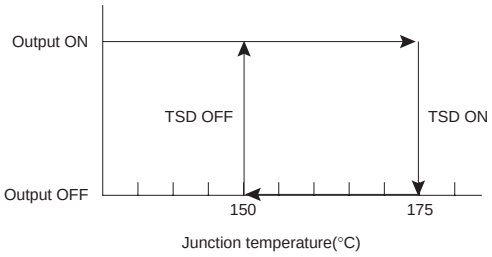


Fig.5

●**Cautions**

1) Thermal shut down(TSD)
This IC is built-in TSD.
TSD has the temperature hysteresis.



TSD ON (Typ. : 175°C)
All output transistor OFF.

TSD OFF (Typ. : 150°C)
Reset ordinary motion.
(It has the temperature hysteresis
of 25°C<TYP>)

Fig.6 TSD

2) Power dissipation
IC power dissipation widely varies with supply voltage, output current and application of IC. Please be careful for the thermal design not to exceed the allowable power dissipation.

3) Hall signal input terminals (H+, H–)

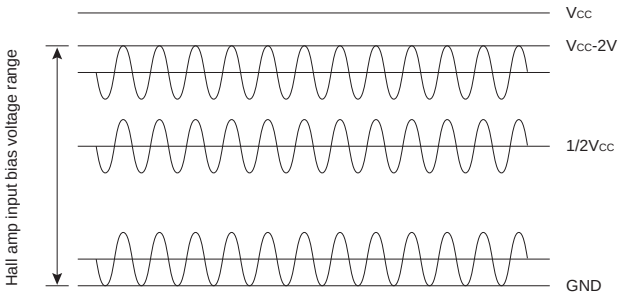


Fig.7 Hall amp input bias voltage range.

A. Please adjust hall input bias voltage by value of resistor for hall element, so that hall signal contains amplitude input within rang from 0V to Vcc-2V. At this time, to set hall amp input bias voltage for Vcc/2 is recommended.
B. Please be careful of input signal because hall amp of this IC doesn't have input hysteresis.
C. The output signal of this IC is the amplified hall input signal. Therefore, the output signal depends on hall input signal. When the amplitude of hall signal is small, the output signal becomes gentle. Oppositely, when the amplitude is big, the output signal becomes steep. The hall-input/output gain is about 500 times (TYP), so please input the hall signal that is suitable to make adequate amplitude of the output signal.

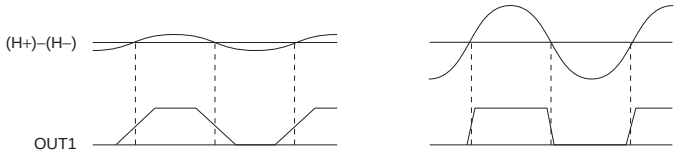


Fig.8 Difference of output signal depending on hall input signal

4) ASO
Please consider output transistors not to exceed absolute maximum ratings and ASO.

5) GND
Please keep up the voltage of GND less than the voltage of another terminal surely.

6) This product is produced with strict quality control, but destroyed in using beyond absolute maximum ratings.
Once IC destroyed, a failure mode cannot be defined (like short-mode or open-mode). Therefore, physical security counter measure like fuse is to be given when a specific mode to be beyond absolute maximum ratings is considered.

●**Electrical characteristic curves**

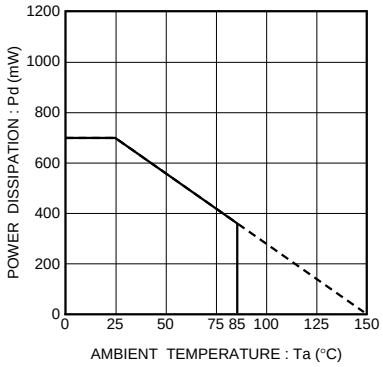


Fig.9 Power dissipation curve

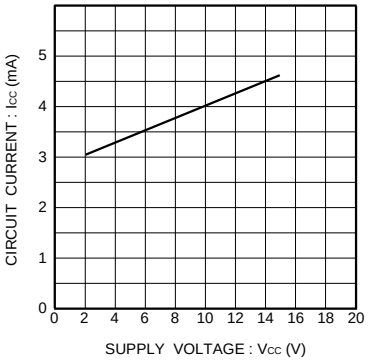


Fig.10 Circuit current vs. Power supply voltage

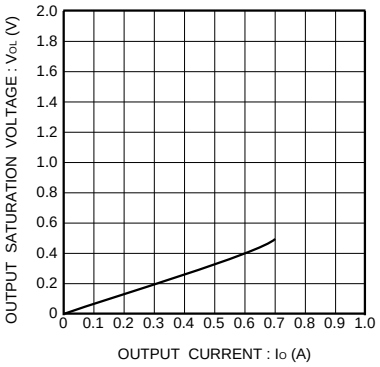


Fig.11 Low level saturation voltage vs. Output current

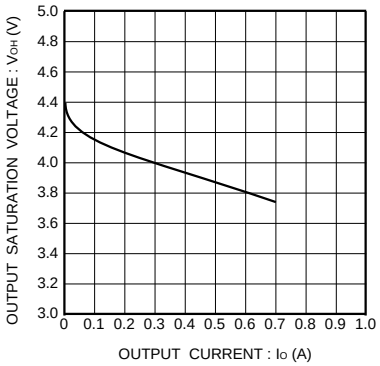
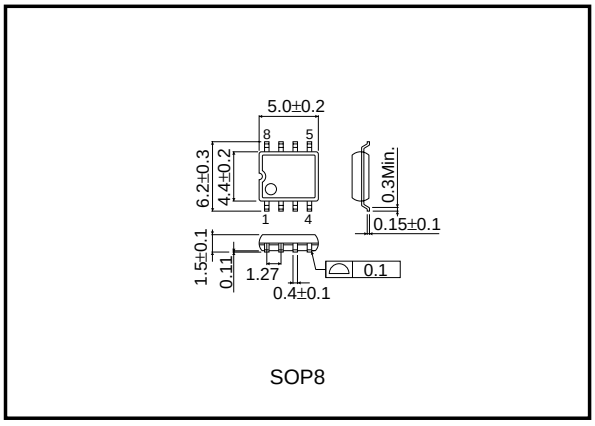


Fig.12 High level saturation voltage vs. Output current

●**External dimensions** (Unit : mm)



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