# Fan motor driver IC

## BA6811F/BA6812FS

The BA6811F and BA6812FS are 2-phase, half-wave motor drivers suited for 12V fan motors. Built-in lock detection and automatic restart mechanisms protect motors. Compact SOP8 (BA6811F) and SSOP-A16 (BA6812FS) packages reduce the number of external components required.

●Applications

2-phase fan motors

●Features

1) Built-in power transistors.
2) Lock detection and automatic restart mechanisms.
3) Built-in thermal shutdown circuit.
4) Alarm output pin. (BA6811F/BA6812FS)
5) Hall signal output pin. (BA6812FS)
6) Built-in reverse current protection diode.

●Absolute maximum ratings (Ta=25℃)

| Parameter | Symbol | Limits | Unit |
|---|---|---|---|
| Power supply voltage | $V_{CC}$ | 18 | V |
| Power dissipation | Pd | 800*2 (BA6812FS) | mW |
| | | 550*3 (BA6811F) | |
| Operating temperature | Topr | −25~85 | ℃ |
| Storage temperature | Tstg | −55~150 | ℃ |
| Output current | $I_{OUT}$ | 1.0*4 | A |
| Alarm output pin current * | $I_{AL}$ | 10 | mA |
| Alarm output pin withstanding voltage * | $V_{AL}$ | 36 | V |
| Hall signal output pin current *1 | $I_{HO}$ | 10 | mA |
| Hall signal output pin withstanding voltage *1 | $V_{HO}$ | 36 | V |

*1 BA6812FS only

*2 Reduce power by 6.4 mW for each degree above 25℃. Mounted on a glass epoxy PCB (50.0 X 50.0 X 1.6 mm).

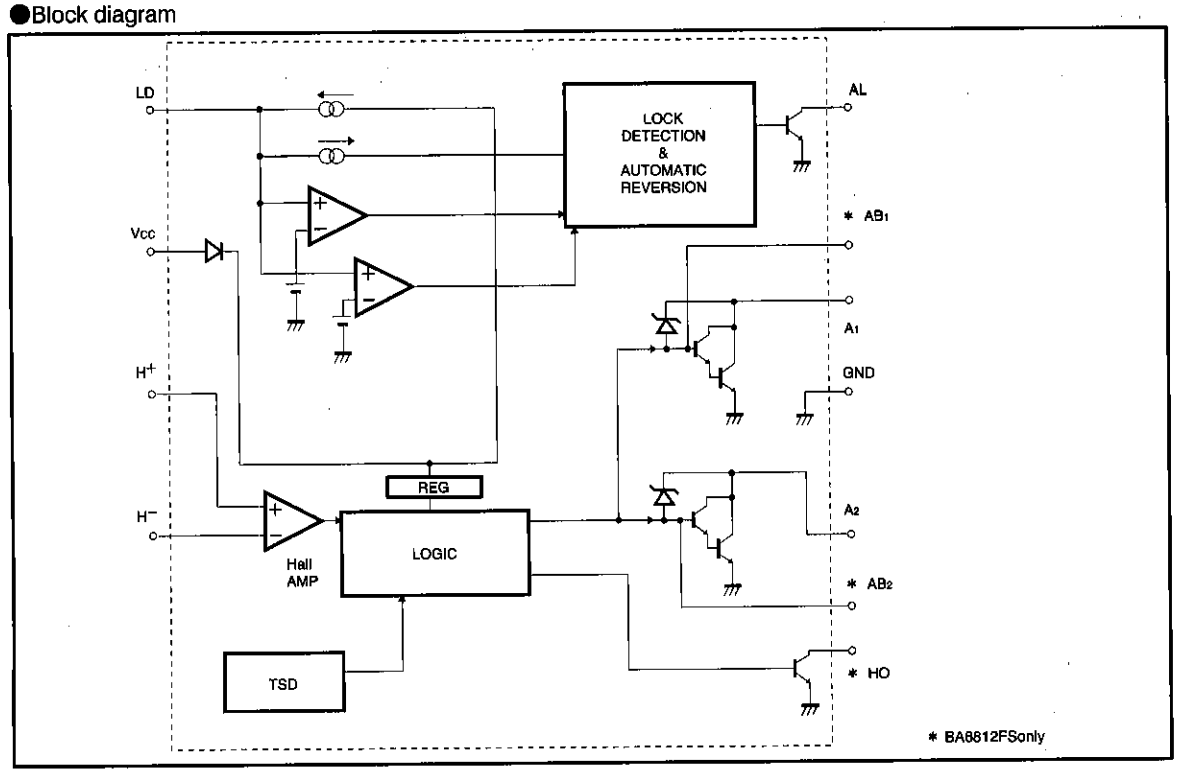
*3 Reduce power by 4.4 mW for each degree above 25℃. Mounted on a glass epoxy PCB (50.0 X 50.0 X 1.6 mm).

*4 Should not exceed Pd- or ASO-value.

●Recommended operating conditions (Ta=25℃)

| Parameter | Symbol | Range | Unit |
|---|---|---|---|
| Operating power supply voltage | $V_{CC}$ | 4.0~15.0 | V |

●Block diagram




●Pin description

BA6811F

| Pin No. | Pin name | Function |
|---|---|---|
| 1 | $A_2$ | Output pin 2 |
| 2 | AL | Alarm output pin |
| 3 | LD | Capacitor connection pin for lock detection and automatic restart |
| 4 | Vcc | Power supply pin |
| 5 | $H^+$ | Hall input pin (+) |
| 6 | $H^-$ | Hall input pin (-) |
| 7 | $A_1$ | Output pin 1 |
| 8 | GND | GROUND |

BA6812FS

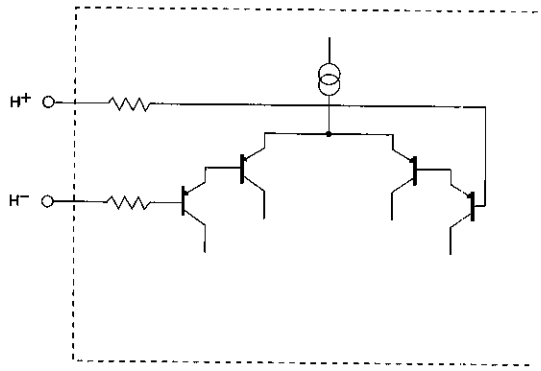
| Pin No. | Pin name | Function |
|---|---|---|
| 1 | GND | GROUND |
| 2 | NC | |
| 3 | $AB_2$ | Output 2 transistor base pin |
| 4 | $A_2$ | Output pin 2 |
| 5 | HO | Hall signal output pin |
| 6 | AL | Alarm output pin |
| 7 | LD | Capacitor connection pin for lock detection and automatic restart |
| 8 | NC | |
| 9 | Vcc | Power supply pin |
| 10 | $H^+$ | Hall input pin (+) |
| 11 | $H^-$ | Hall input pin (-) |
| 12 | NC | |
| 13 | $A_1$ | Output pin 1 |
| 14 | $AB_1$ | Output 1 transistor base pin |
| 15 | NC | |
| 16 | NC | |

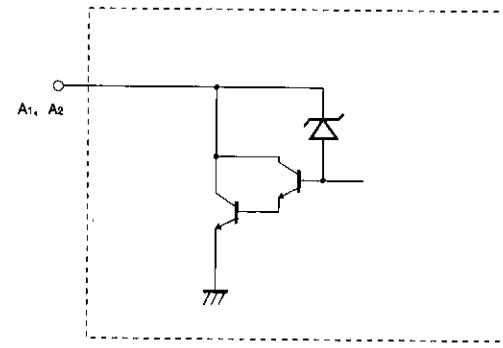
●Hall input/output truth table

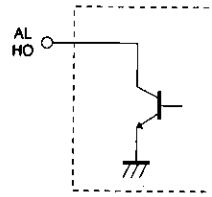
| $H^+$ | $H^-$ | $A_1$ | $A_2$ | HO |
|---|---|---|---|---|
| H | L | HIGH (output transistor OFF) | LOW (output transistor ON) | LOW (output transistor ON) |
| L | H | LOW (output transistor ON) | HIGH (output transistor OFF) | HIGH (output transistor OFF) |

Note: LD = 0 V

●Input/output equivalent circuits



●Electrical characteristics (Unless otherwise noted, Ta=25℃, $V_{CC}$=12V)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Circuit current | $I_{CC}$ | 1.8 | 4.5 | 9.0 | mA | When output is OFF |
| Lock detection capacitor charge current | $I_{LDC}$ | 1.6 | 2.9 | 4.64 | μA | $V_{LD}$=1.2V |
| Lock detection capacitor discharge current | $I_{LDD}$ | 0.26 | 0.52 | 0.87 | μA | $V_{LD}$=1.2V |
| Lock detection capacitor charge/discharge ratio | $r_{CD}$ | 2.8 | 5.7 | 9.9 | — | $r_{CD}=I_{LDC}/I_{LDD}$ |
| Lock detection capacitor clamp voltage | $V_{LDCL}$ | 1.27 | 1.93 | 2.60 | V | |
| Lock detection capacitor comparator voltage | $V_{LDCP}$ | 0.47 | 0.76 | 1.06 | V | |
| LOW level output voltage | $V_{OL}$ | — | 0.8 | 1.3 | V | $I_O$=200mA |
| Output leakage current | $I_{OL}$ | — | — | 100 | μA | $V_O$=20V |
| Output zener voltage | $V_{OZ}$ | 28 | 30 | 32 | V | Clamp current = 10 mA |
| Alarm output pin LOW level voltage | $V_{ALL}$ | — | 0.13 | 0.5 | V | $I_O$=5mA |
| Alarm output pin leakage current | $I_{ALL}$ | — | — | 50 | μA | $V_{AL}$=15V |
| Hall signal output pin LOW level voltage * | $V_{HOL}$ | — | 0.13 | 0.5 | V | $I_O$=5mA |
| Hall signal output pin leakage current * | $I_{HOL}$ | — | — | 50 | μA | $V_{HO}$=15V |
| Hall input pin offset voltage | $V_{OFF}$ | — | — | 10 | mV | $V_{COM}$=6.0V |

* BA6812FS only

◎ Not designed for radiation resistance

●Circuit operation

The BA6811F and BA6812FS have motor lock detection and automatic restart circuits. The timing of lock detection and automatic restart is determined by the external capacitor connected to the LD pin. The charge time of the external capacitor is given by :

$$T_{ON}\ (\text{Charge time}) = \frac{C \cdot (V_{LDCL} - V_{LDCP})}{I_{LDC}}$$

$$T_{OFF}\ (\text{Discharge time}) = \frac{C \cdot (V_{LDCL} - V_{LDCP})}{I_{LDD}}$$

(Typical value)

where

$V_{LDCL}$ is the LD-pin clamp voltage (1.93V),

$V_{LDCP}$ is the LD-pin comparator voltage (0.76V),

$I_{LDC}$ is the LD-pin charge current (2.9 μA),

$I_{LDD}$ is the LD-pin discharge current (0.52 μA),

C is the capacitance of the LD-pin external capacitor.

For C=1 μF, for example, the charge (output ON) and discharge (output OFF) times are 0.40s and 2.25s, respectively.

The timing chart for an occasion of motor locking is shown in Fig. 1.

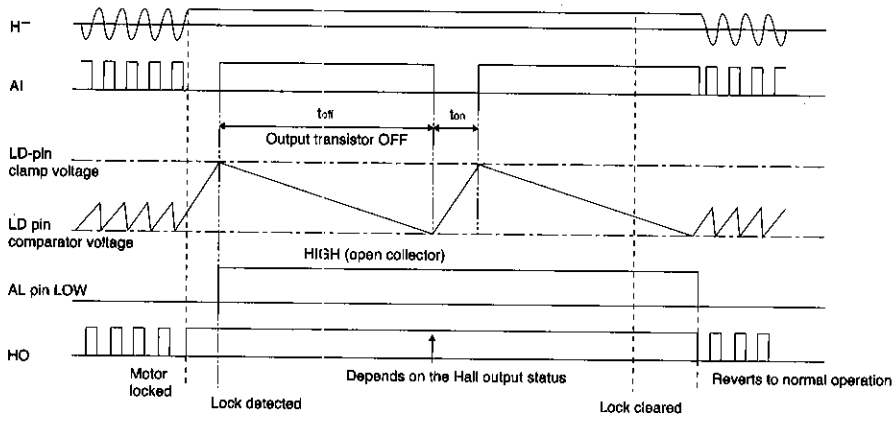



Fig.1 Timing chart for motor locking

●Application example

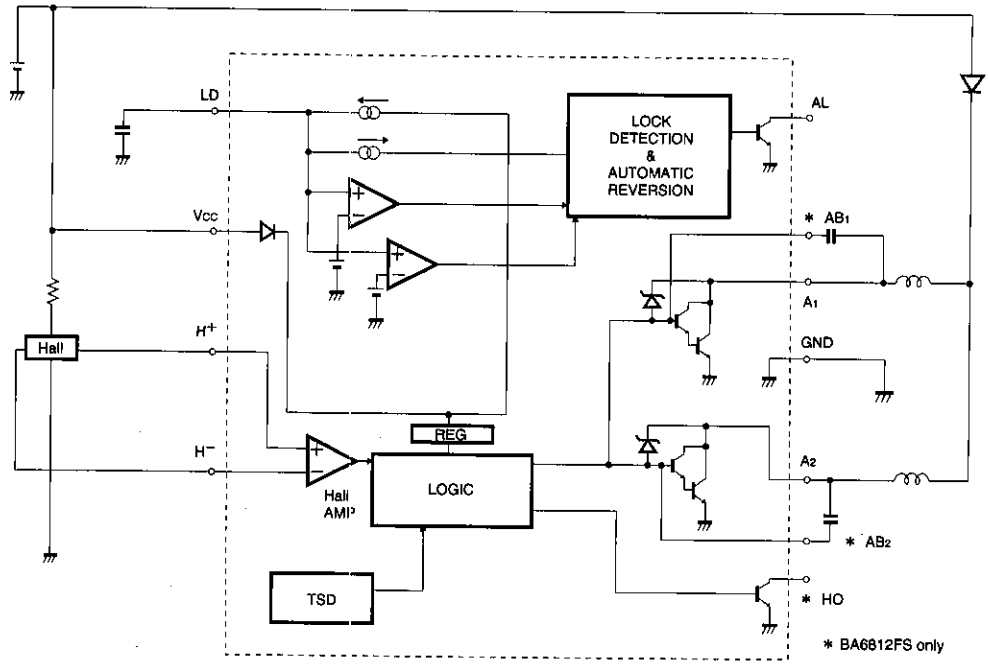



Fig.2

●Operation notes

1. Thermal shutdown circuit

The IC has a built-in thermal shutdown circuit. The is a temperature difference of 25℃ (typical) between the temperatures at which the circuit is activated and deactivated.

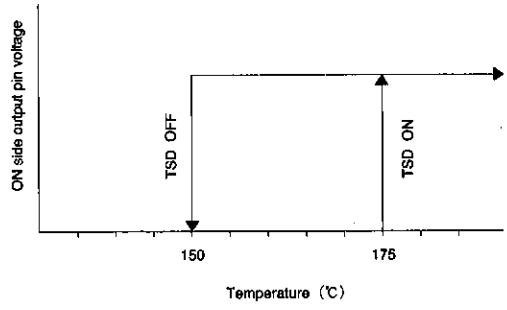



Fig.3 Temperature setting of the thermal shutdown circuit

The circuit is activated at the temperature of about 175℃ (typical), so that all outputs are turned OFF. Normal operation resumes when the circuit is deactivated.

2. Power consumption

Power consumed in the IC can be calculated from the following equation :

$P_C = P_{C1} + P_{C2} + P_{C3}$

$P_{C1}$ is power consumed by the circuit current.

$P_{C1} = V_{CC} \times I_{CC}$

$P_{C2}$ is the output current consumption.

$P_{C2} = V_{OL} \times I_O$

$V_{OL}$ is the LOW level output voltage of output pins 1 and 2, and $I_O$ is the sink current of pins 1 and 2.

$P_{C3}$ is power consumed by the AL and HO pins.

$P_{C3} = V_{ALL} \times I_{AL} + V_{HOL} \times I_{HO}/2$

where

$V_{ALL}$ is the AL-pin LOW level voltage,

$I_{AL}$ is the AL-pin sink current,

$V_{HOL}$ is the HO-pin LOW level voltage,

$I_{HO}$ is the HO-pin sink current.

Make sure that your application does not exceed the allowable power dissipation of the IC.

3. Hall amplifier input voltage

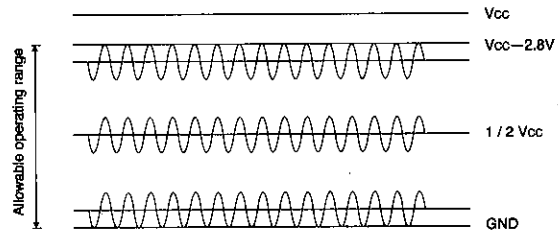



Fig.4 Hall amplifier input bias voltage

The R1 and R2 resistances must be set so as to maintain the Hall amplifier input bias voltage within the range of 0V to ($V_{CC}$~2.8V) including the signal amplitude.

The Hall device may be affected by power supply noise due to the PCB conductor pattern. If you have this problem, insert a capacitor C1 as shown in Fig. 5.

If the conductor lines from the Hall device output terminals to the Hall inputs of the IC are particularly long, noise can be picked up and fed into the inputs. If you have this problem, insert a capacitor C2 as shown in Fig. 5. Note that the Hall inputs have no hysteresis in this IC.

Hall current is given by : $\dfrac{V_{CC}}{R1+R2+RH}$

where RH is the Hall device impedance.

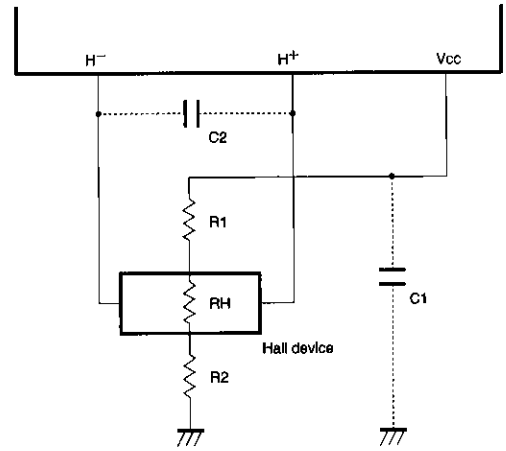
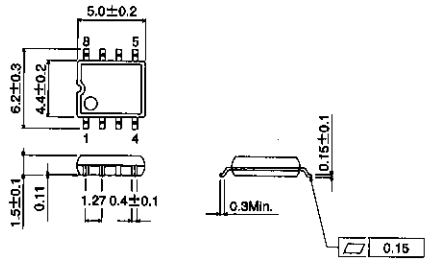



Fig.5

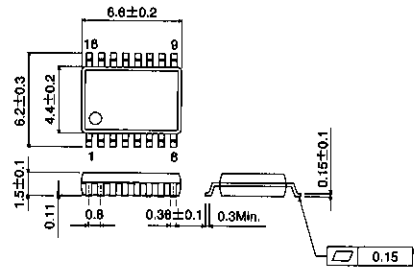
●External dimensions (Units: mm)

BA6811F




SOP8

BA6812FS




SSOP - A16

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