Single-phase full-wave motor driver
BA6424FS

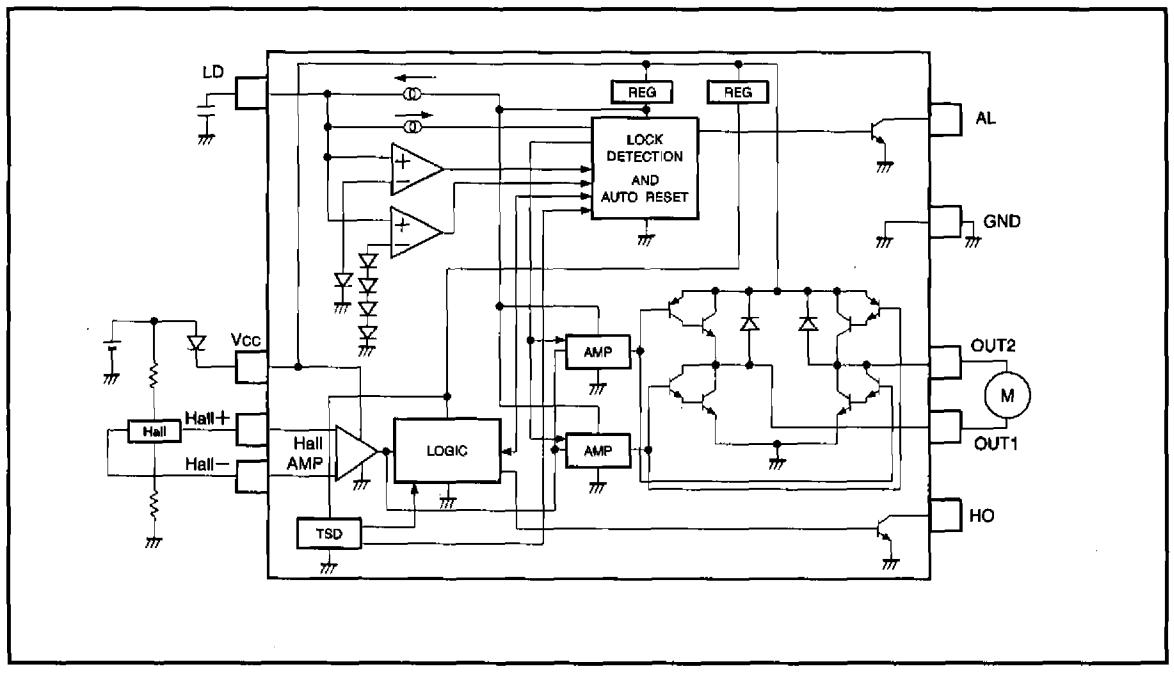
(The package of the BA6424FS is exchangeable)

The BA6424FS is a single-phase full wave motor driver suitable for fan motors. By using this driver, a single-phase, full-wave motor driver circuit can be built with fewer components than a circuit using operational amplifiers. Lock detection and automatic restart mechanisms, which are required for fan motors, are also built in.
In addition to the lock detection output pin installed in all types, the BA6424FS has a built-in rotational-speed sensing output pin. Three types are available in different packages.

●Applications
Single-phase, full-wave fan motors

●Features
1) Output pins for lock detection and rotational speed sensing.
2) Compact SSOP-A16 package reduces the number of external components required.
3) Automatic restart when the motor lock is undone.

●Block diagram



●Pin description

Pin No.	Pin name	Function
1	GND	GND
2	N. C.	
3	OUT2	Output pin 2
4	Vcc	Power supply pin
5	HO	Hall signal output pin
6	AL	Alarm output pin
7	LD	Capacitor connection pin for lock detection and automatic restart
8	N. C.	
9	Hall+	Hall input pin (+)
10	Hall−	Hall input pin (-)
11	N. C.	
12	N. C.	
13	N. C.	
14	OUT1	Output pin 1
15	N. C.	
16	N. C.	

●Truth table

Hall+	Hall−	OUT1	OUT2	HO
H	L	H	L	H
L	H	L	H	L

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Applied voltage	V_{CC}	30	V
Power dissipation	Pd	850*1	mW
Operating temperature	Topr	−25～75	℃
Storage temperature	Tstg	−55～150	℃
Output current	$I_{OMax.}$	1000*2	mA
Output withstanding voltage	V_{OUT}	30	V
Alarm output pin withstanding voltage	V_{AL}	30	V
Hall signal output pin withstanding voltage	V_{HO}	30	V

*1 Reduce power by 6.8 mW for each degree above 25℃.
When a glass epoxy PCB (50 X 50 X 1.6 mm) is used.

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

●Recommended operating conditions

Parameter	Symbol	Limits	Unit
Operating power supply voltage	V_{CC}	6.0 ~ 28.0	V

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Circuit current	I_{CC}	2.7	5.4	8.1	mA	When output OFF
Lock detection capacitor charge current	I_{LDC}	1.55	3.10	4.65	μA	V_{LD}=1.8V
Lock detection capacitor discharge current	I_{LDD}	0.33	0.66	0.99	μA	V_{LD}=1.8V
Lock detection capacitor charge/discharge ratio	r_{CD}	3.0	4.7	6.4	—	$r_{CD}=I_{LDC}/I_{LDD}$
Lock detection capacitor clamp voltage	V_{LDCL}	2.0	2.48	3.0	V	
Lock detection capacitor comparator voltage	V_{LDCP}	0.7	0.99	1.3	V	
LOW level output voltage	V_{OL}	—	0.8	1.2	V	I_O=200mA
HIGH level output voltage	V_{OH}	10.6	11.1	—	V	I_O=200mA
Alarm output LOW level voltage	V_{ALL}	—	0.1	0.3	V	I_{AL}=10mA
Alarm output leakage current	I_{ALL}	—	0	10	μA	V_{AL}=30V
Hall signal output LOW level voltage	V_{HOL}	—	0.1	0.3	V	I_{HO}=10mA
Hall signal output leakage current	I_{HOL}	—	0	10	μA	V_{HO}=30V

●Lock detection

The automatic restart circuit detects a motor lock condition and automatically turns off the output power. When the lock condition is cleared, the IC automatically restarts and allow the motor to run.

In the BA6424FS, automatic restart is performed as follows.

A motor lock condition is detected when the Hall signal stops switching. The output is OFF when the LD pin is being charged.

- The AL pin is ON during normal operation, and OFF when the motor is locked.
- The AL pin is an open collector output.
- The HO pin outputs a signal synchronized with the Hall signal.
- The HO pin is an open collector output.

The time required for the external capacitor at the LD pin to charge or discharge when the motor is locked varies with the capacitor size. The charge and discharge times are obtained by :

$$T_{ON}\ (\text{charge time}) = \frac{C\ (V_{DDCL} - V_{LDCP})}{I_{LDC}}$$

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

where

C is the capacitance of the external capacitor connected to the LD pin,

V_{LDCL} is the LD pin clamp voltage (2.48V typically),

V_{LDCP} is the LD pin comparator voltage (0.99V typically),

I_{LDC} is the LD pin charge current (3.10 μA typically),

I_{LDD} is the LD pin discharge current (0.66 μA typically).

For C=0.47 μF, for example, the charge and discharge times are 0.26 s (output ON) and 1.06 s (output OFF), respectively.

The timing of the LD pin is shown in Fig. 1.

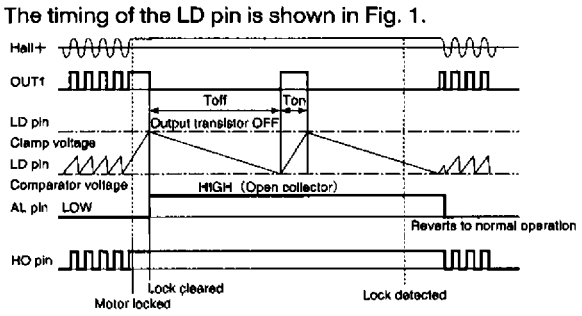


Fig.1 Timing chart of the LD, AL, and HO pins

●Operation notes

1) Thermal shutdown circuit

The IC has a built-in thermal shutdown circuit. There is a temperature difference of about 15℃ (typical) between the temperatures at which the circuit is activated and deactivated.

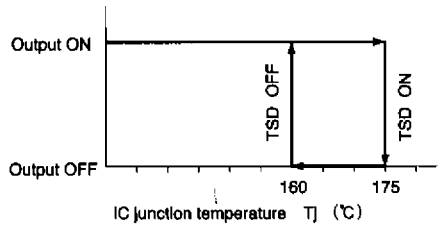


Fig.2 Thermal shutdown characteristic

The circuit is activated at the temperature of about 175℃ (typical), so that all outputs are turned OFF. The circuit is deactivated when the chip temperature drops to about 160℃, and normal operation resumes.

2) Current consumption

The power dissipated by the IC varies widely with the supply voltage and the output current. Make sure that your application does not exceed the allowable power dissipation of the IC package.

3) Hall input pins

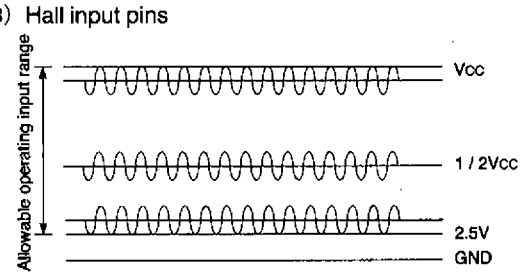


Fig.3 Allowable range of the hall amplifier input voltage

A. The values of the Hall device bias resistors (see the block diagram) must be set so as to maintain the Hall amplifier input bias voltage within the range of 2.5V to Vcc including the signal amplitude. It is recommended that the same value be used for both resistors so that the Hall device output signal is centered around Vcc/2.

B. Note that the Hall inputs have no hysteresis in this IC.

4) ASO
Make sure that the output current will not exceed the absolute maximum rating or the ASO value.
5) Ground pin potential
Be sure to keep the GND potential lower than the potentials of the other pins.

●Electrical characteristic curves

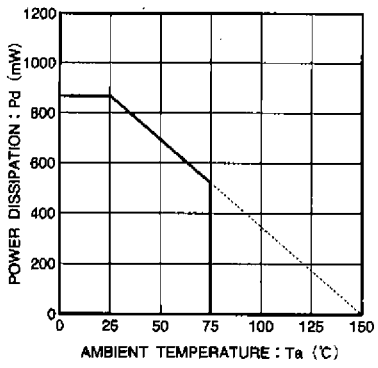


Fig.4 Power dissipation curve

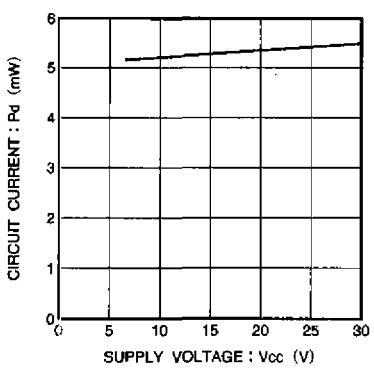


Fig.5 Circuit current vs. supply voltage

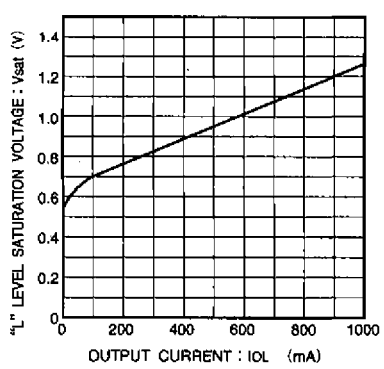


Fig.6 Low level saturation voltage vs. output current

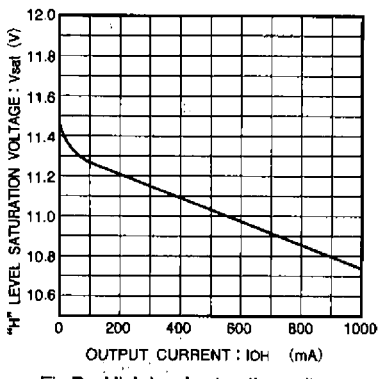
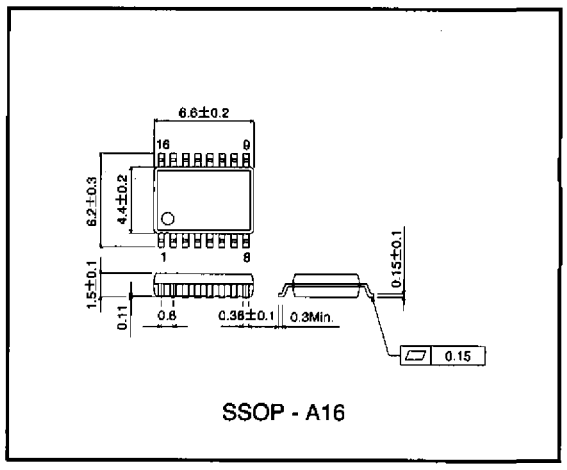


Fig.7 High level saturation voltage vs. output current

●External dimensions (Units: mm)



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