

# 3-phase motor driver

## BA6463FP-Y

The BA6463FP-Y is a motor driver developed for cylinders, which a constant power supply of 5V, and the start and stop pins which opens output are incorporated.

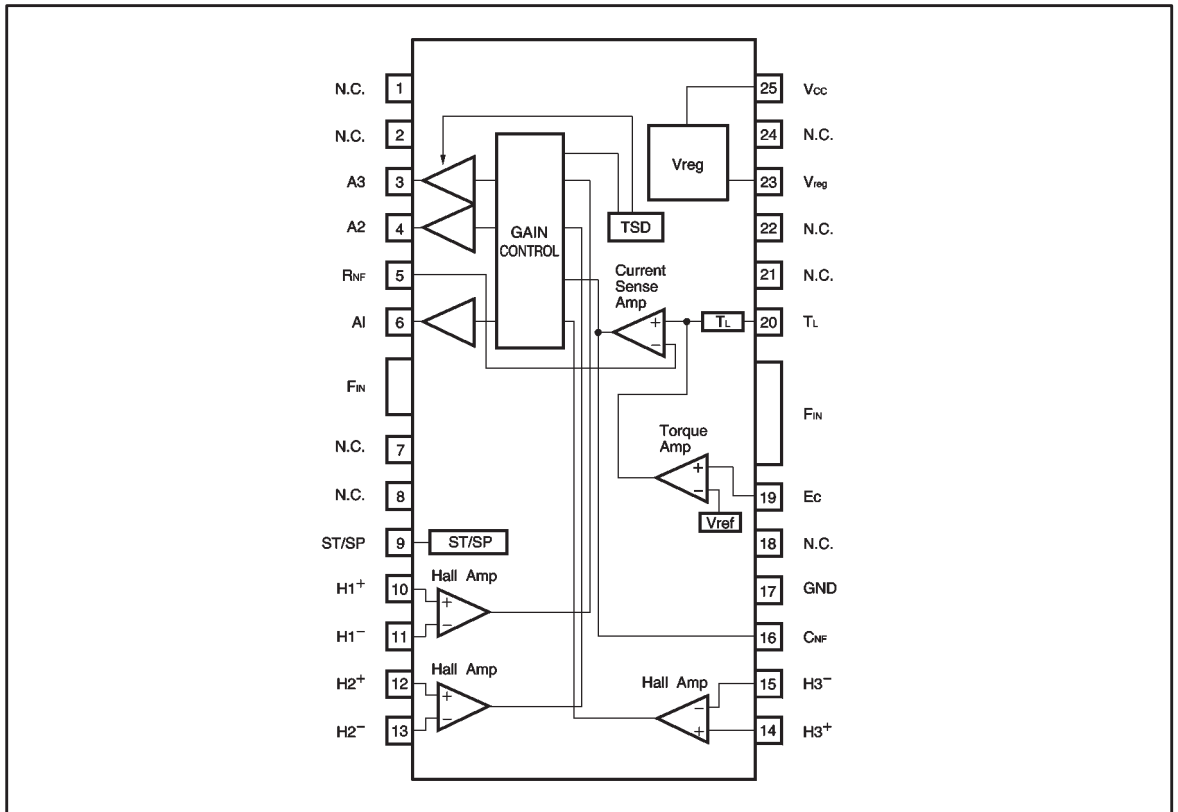
●Applications

VCR cylinder motors

●Features

- 1) 3-phase, full-wave, pseudo-linear drive system.
- 2) Internal constant voltage power supply. (5V)
- 3) Internal thermal shutdown circuit.

●Block diagram



## ● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>CC</sub>	24	V
Power dissipation	P <sub>d</sub>	1450*1	mW
Operating temperature	T <sub>opr</sub>	-20~+75	°C
Storage temperature	T <sub>stg</sub>	-55~+150	°C
Output current	I <sub>OUT</sub>	1000*2	mA

\*1 When mounted on a glass epoxy board (90×50×1.6 mm).

Reduced by 11.6 mW for each increase in Ta of 1°C over 25°C.

\*2 Should not exceed Pd or ASO values.

## ● Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating power supply voltage	V <sub>CC</sub>	8.0	—	20.0	V

● Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>CC</sub> = 12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply current	I <sub>CC</sub>	—	5.0	10.0	mA	
Constant output voltage	V <sub>reg</sub>	4.5	5.0	5.5	V	
〈MDA〉						
Hall input bias current	I <sub>BH</sub>	—	0.25	5.0	μA	H <sup>+</sup> =High, H <sup>-</sup> =Low or H <sup>-</sup> =Low, H <sup>+</sup> =High
Hall common-mode input voltage	V <sub>HB</sub>	1.5	—	V <sub>reg</sub> -1.0	V	
Hall element minimum input level	V <sub>NH</sub>	60	—	—	mV <sub>P-P</sub>	
Allowable torque command input voltage	E <sub>c</sub>	0	—	V <sub>reg</sub>	V	
Torque control voltage offset	E <sub>cofs</sub>	-150	0	+150	mV	For E <sub>c</sub> =V <sub>reg</sub> ×0.46
Output idle voltage	E <sub>idle</sub>	—	0	10	mV	E <sub>c</sub> =2V, R <sub>NF</sub> =0.5Ω
I/O gain	G <sub>EC</sub>	0.41	0.5	0.59	A/V	Measured at E <sub>c</sub> =2.8V, 3.3V; R <sub>NF</sub> =0.5Ω
Start / stop ON voltage	V <sub>S/S ON</sub>	3.5	—	V <sub>reg</sub>	V	
Start / stop OFF voltage	V <sub>S/S OFF</sub>	0	—	1.2	V	
Output saturation high level voltage	V <sub>OH</sub>	—	1.05	1.75	V	I <sub>o</sub> =600mA
Output saturation low level voltage	V <sub>OL</sub>	—	0.45	1.05	V	I <sub>o</sub> =600mA
Output drive current capacity	I <sub>O (Max.)</sub>	800	—	—	mA	R <sub>NF</sub> =0.5Ω *T <sub>J</sub> =25°C
Torque limit current	I <sub>TL</sub>	520	650	780	mA	TL=0.4V, R <sub>NF</sub> =0.5Ω

## ● Pin descriptions

Pin No.	Pin name	Function
1	N.C.	Not used
2	N.C.	Not used
3	A <sub>3</sub>	Output
4	A <sub>2</sub>	Output
5	R <sub>NF</sub>	Output current sensing
6	A <sub>1</sub>	Output
7	N.C.	Not used
8	N.C.	Not used
9	ST/SP	Start/stop switching
10	H <sub>1</sub> <sup>+</sup>	Hall signal input
11	H <sub>1</sub> <sup>-</sup>	Hall signal input
12	H <sub>2</sub> <sup>+</sup>	Hall signal input
13	H <sub>2</sub> <sup>-</sup>	Hall signal input
14	H <sub>3</sub> <sup>+</sup>	Hall signal input
15	H <sub>3</sub> <sup>-</sup>	Hall signal input
16	C <sub>NF</sub>	Capacitor connection pin for phase compensation
17	GND	GND
18	N.C.	Not used
19	E <sub>c</sub>	Output current control
20	TL	Torque limit
21	N.C.	Not used
22	N.C.	Not used
23	V <sub>reg</sub>	Internal constant voltage
24	N.C.	Not used
25	V <sub>cc</sub>	Power supply
FIN	FIN	Be sure to connect this radiation fin to the ground.

● Input/output circuits

Pin No.	Pin name	Pin description	I/O equivalent circuit
9	ST / SP	Start / stop switching pin	
20	TL	Torque limit pin	
19	Ec	Output current control pin	
3, 4, 6	A <sub>3</sub> , A <sub>2</sub> , A <sub>3</sub>	Output pin	
10, 11, 12, 13, 14, 15	H <sub>1</sub> <sup>+</sup> , H <sub>1</sub> <sup>-</sup> , H <sub>2</sub> <sup>+</sup> , H <sub>2</sub> <sup>-</sup> , H <sub>3</sub> <sup>+</sup> , H <sub>3</sub> <sup>-</sup>	Hall signal input pin	

● Circuit operation

(1) Hall I/O

The 3-phase Hall signal is amplified in the hall amplifiers and sent to the matrix circuit, where the signal is further amplified and combined. After the signal is converted to a current in the amplitude control circuit, the current is supplied to the output driver, which then provides a motor drive current. The phases of the Hall input signal, output voltage, and output current are shown in Fig. 1.

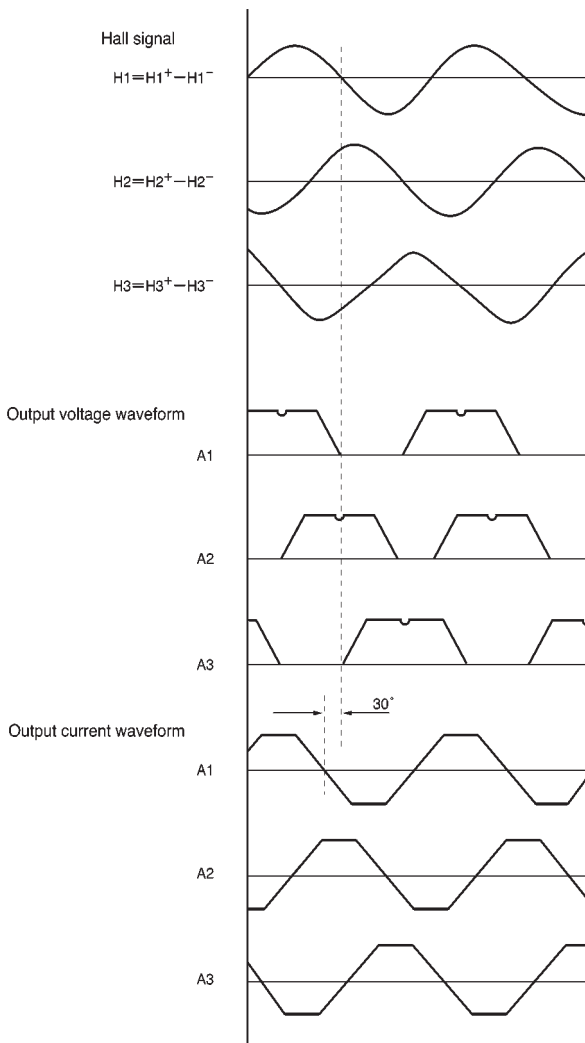


Fig.1

(2) Torque control pin (EC pin)

The output current can be controlled by adjusting the voltage applied to the torque control pin.

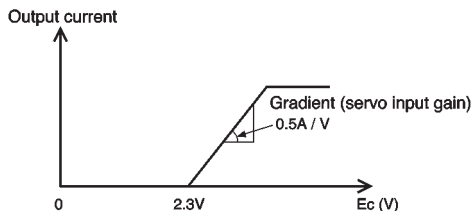


Fig.2

(3) Start/stop pin

The motor is in the run mode when the pin input voltage is 3.5V or more and in the standby mode (all output transistors are off) when the voltage is 1.2V or less.

(4) Power ground pin ( $R_{NF}$  pin)

The  $R_{NF}$  pin is the output stage ground pin. Connect a resistor ( $0.5\Omega$  recommended) between this pin and the ground to monitor the output current.

(5) Phase compensation pin ( $C_{NF}$  pin)

Connect a capacitor between this pin and  $V_{CC}$  if the output tends to oscillate.

● Application example

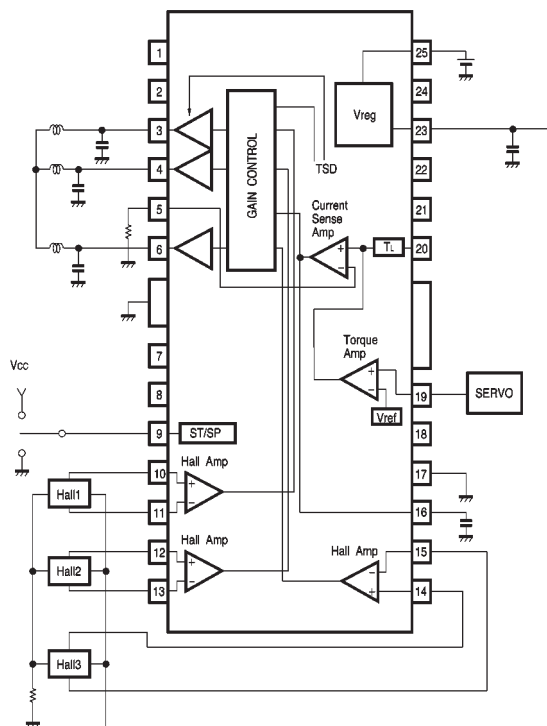


Fig.3

● Operation notes

(1) Start/stop pin

The I/O equivalent circuit of the start/stop pin is shown in Fig. 4. The pin has a temperature dependence of  $-7\text{mV}/\text{C}$ , and its resistance can vary  $\pm 30\%$ . The voltage on this pin should be less than  $V_{\text{reg}}$ .

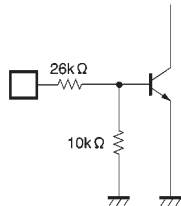


Fig.4

(2) Hall input

The I/O equivalent circuit of the Hall input pins is shown in Fig. 5. The Hall devices can be connected in either series or parallel. The input Hall signal should be within the range of the Hall input common-mode voltage.

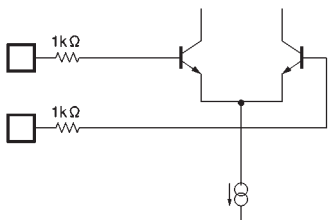


Fig.5

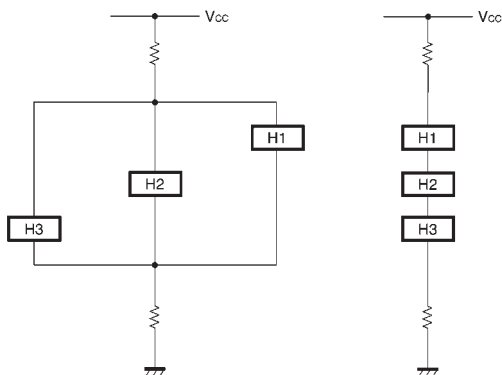


Fig.6

(3) Torque limit pin

The output current can be limited by applying a voltage to the torque limit pin. Control is provided so that this pin will have the same potential as the power ground pin ( $R_{\text{NF}}$ ). Note that there is a voltage offset on this pin. The  $R_{\text{NF}}$ -pin voltage is  $0.325\text{V}$  when the TL-pin voltage is  $0.4\text{V}$  (typical) and the  $R_{\text{NF}}$ -pin resistance is  $0.5\Omega$ . Note that the voltage offset changes with the  $R_{\text{NF}}$ -pin resistance. Connect the TL Vreg (pin 23) when the TL pin is not used.

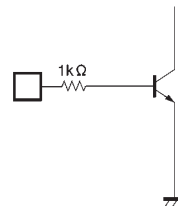


Fig.7

(4) Thermal shutdown circuit

The thermal shutdown circuit puts the driver outputs ( $A_1$ ,  $A_2$ , and  $A_3$ ) to the open state at the temperature of  $175^\circ\text{C}$  (typical). The circuit is deactivated when the temperature drops to about  $150^\circ\text{C}$ .

● Thermal derating curve

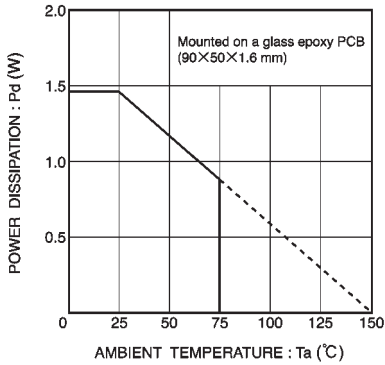


Fig.8

● Electrical characteristic curves

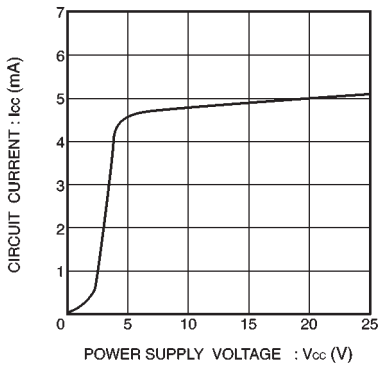


Fig.9 Supply current vs. power supply voltage

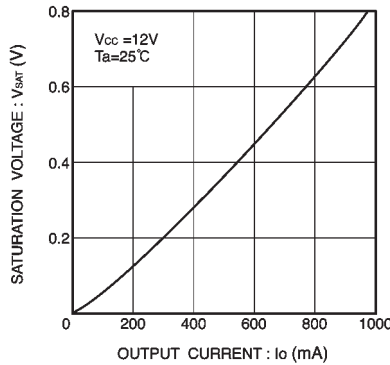


Fig.10 Low-side output saturation voltage vs. output current

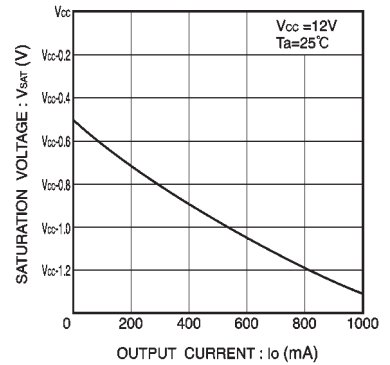


Fig.11 High-side output saturation voltage vs. output current

● External dimensions (Units: mm)

