

# 3-phase motor driver for VCR cylinders

## BA6467FP-Y

The BA6467FP-Y is a motor driver developed for cylinders. It contains a power supply with a constant voltage 8V, and a start / stop pin that opens the output.

### ●Applications

VCR cylinders

### ●Features

- 1) 3-phase, full-wave, pseudo-linear drive system.
- 2) Internal constant voltage power supply (8V).
- 3) Internal thermal shutdown circuit.

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

| Parameter              | Symbol | Limits   | Unit |
|------------------------|--------|----------|------|
| Applied voltage        | Vcc    | 18       | V    |
| Power dissipation      | Pd     | 1450*1   | mW   |
| Operating temperature  | Topr   | -20~+75  | °C   |
| Storage temperature    | Tstg   | -55~+150 | °C   |
| Allowed output current | Iomax  | 1000*2   | mA   |
| Junction temperature   | Tjmax  | 150      | °C   |

\*1 When mounted on 70mm×70mm ×1.6mm glass epoxy board.  
Reduced by 11.6mW for each increase in Ta of 1°C over 25°C when mounted.

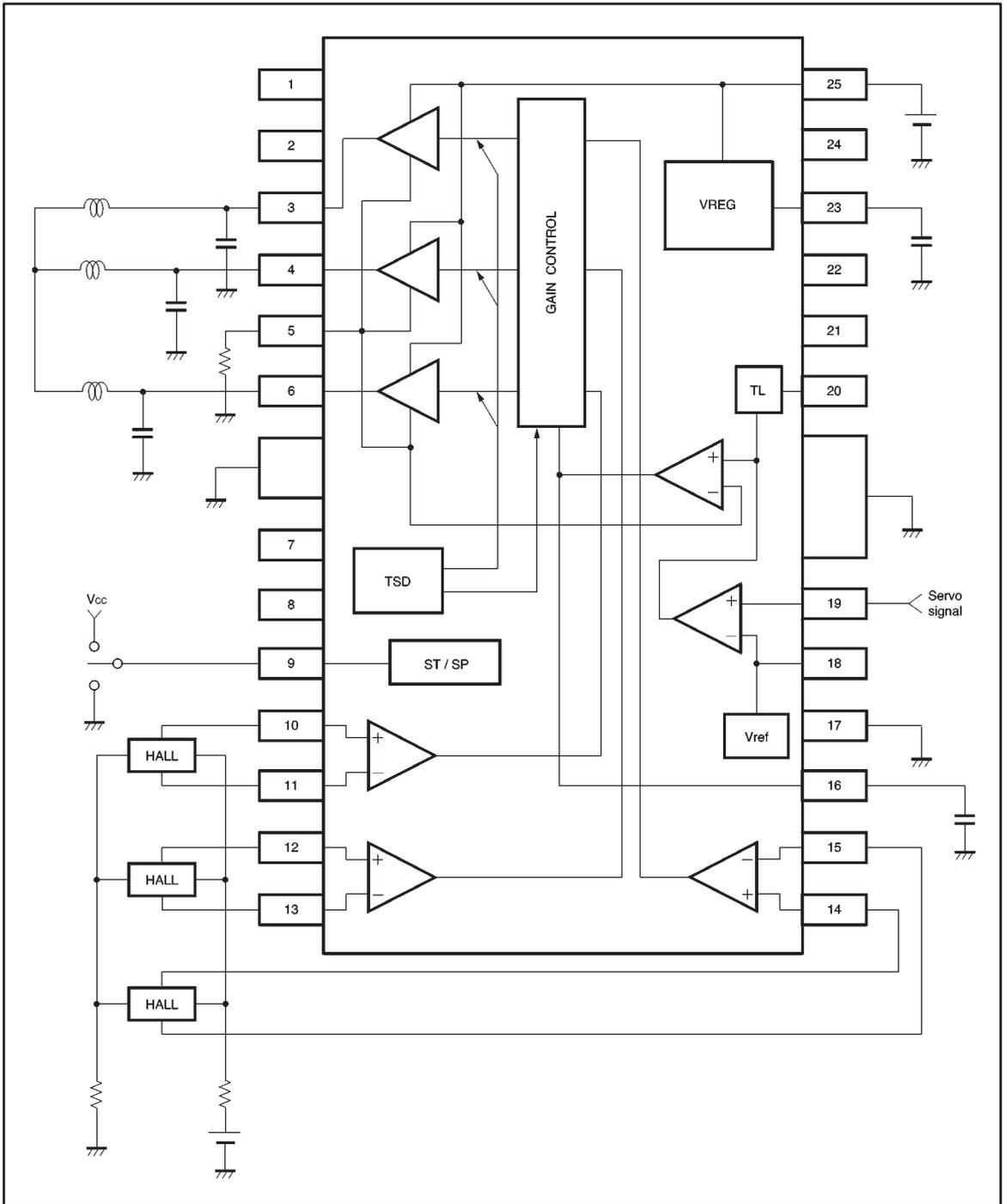
\*2 Should not exceed Pd or ASO values.

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

| Parameter                            | Symbol | Limits       | Unit |
|--------------------------------------|--------|--------------|------|
| Operating power supply voltage       | Vcc    | 10~16*3      | V    |
| Hall input common-mode voltage       | VHB    | 1.5~VREG-1.0 | V    |
| Allowed torque control voltage input | VEC    | 0~VREG       | V    |

\*3 Should not exceed Pd or ASO values.

● Block diagram

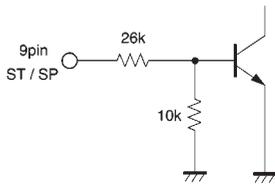


## ● Pin descriptions

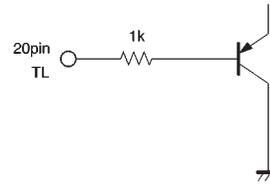
| Pin No. | Pin name | Function   |
|---------|----------|--|
| 1       | N.C.     | N.C.   |
| 2       | N.C.     | N.C.   |
| 3       | A3       | Output   |
| 4       | A2       | Output   |
| 5       | RNF      | Output current detector                              |
| 6       | A1       | Output   |
| 7       | N.C.     | N.C.   |
| 8       | N.C.     | N.C.   |
| 9       | ST / SP  | Start / stop switching                               |
| 10      | H1+      | Hall signal input                                    |
| 11      | H1-      | Hall signal input                                    |
| 12      | H2+      | Hall signal input                                    |
| 13      | H2-      | Hall signal input                                    |
| 14      | H3+      | Hall signal input                                    |
| 15      | H3-      | Hall signal input                                    |
| 16      | CNF      | For connection of capacitor for phase compensation   |
| 17      | GND      | GND  |
| 18      | ECR      | Output current control reference voltage             |
| 19      | EC       | Output current control                               |
| 20      | TL       | Torque limit   |
| 21      | N.C.     | N.C.   |
| 22      | N.C.     | N.C.   |
| 23      | VREG     | Internal constant voltage                            |
| 24      | N.C.     | N.C.   |
| 25      | Vcc      | Power supply   |
| FIN     | FIN      | Be sure to connect this radiation fin to the ground. |

● Input / output circuits

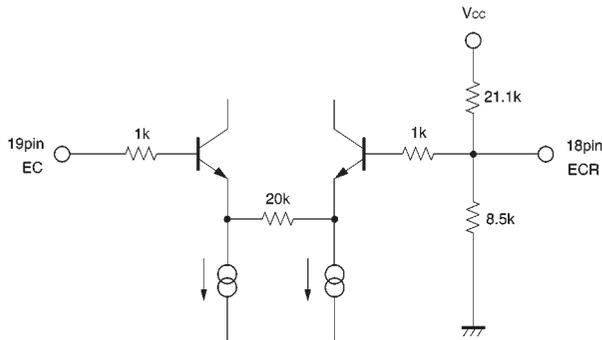
(1) Start / stop (ST / SP: pin 9)



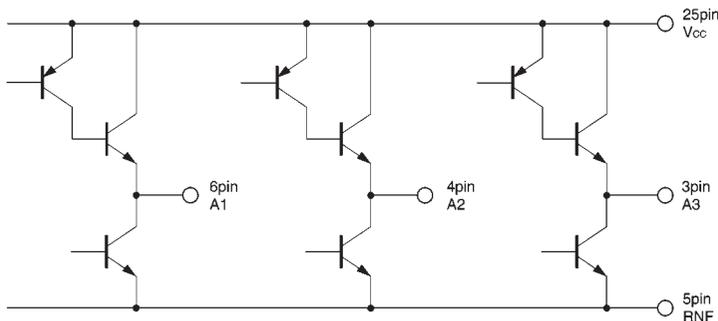
(2) Torque limit (TL: pin20)



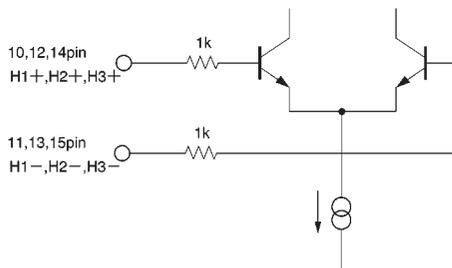
(3) Torque control input (EC: pin19, ECR: pin 18)



(4) Coil output (A1: pin 6, A2: pin4, A3: pin 3)



(5) Hall input (H1 + : pin10, H1-: pin 11, H2 + : pin 12, H2-: pin 13, H3 + : pin 14, H3-: pin 15)



## ●Electrical characteristics (unless otherwise noted, Ta = 25°C, Vcc = 12V)

| Parameter                            | Symbol    | Min.   | Typ. | Max.   | Unit              | Coniditions  |
|--------------------------------------|-----------|--------|------|--------|-------------------|--|
| Circuit current                      | Icc       | —      | 5.0  | 10.0   | mA                |  |
| Constant voltage output              | VREG      | 7.2    | 8.0  | 8.8    | V                 |  |
| Hall input bias current              | IBH       | —      | 0.25 | 5.0    | μA                | H+=H, H-=L or H+=L<br>H-=H                         |
| Hall device minimum input level      | VINM      | 30     | —    | —      | mV <sub>P-P</sub> |  |
| Torque cntrol reference voltage      | VECR      | *-0.15 | *+0  | *+0.15 | V                 | *=VREG×2.3 / 8                                     |
| Torque cntrol voltage offset         | Ecofs     | -150   | —    | 150    | mV                | For ECR pin  |
| Output idle voltage                  | ECidle    | —      | 0    | 10     | mV                | EC=ECR-0.15V, RNF=0.5Ω                             |
| Input / output gain                  | GEC       | 0.41   | 0.50 | 0.59   | A / V             | Measured at EC=ECR + 0.5V and ECR + 1.0V; RNF=0.5Ω |
| Start / stop ON voltage              | Vs / sON  | 3.5    | —    | VREG   | V                 |  |
| Start / stop OFF voltage             | Vs / sOFF | 0      | —    | 1.2    | V                 |  |
| High level output saturation voltage | VOH       | —      | 1.05 | 1.75   | V                 | Io=600mA   |
| Low level output saturation voltage  | VOL       | —      | 0.45 | 1.05   | V                 | Io=600mA   |
| Output drive current capacity        | Io(MAX)   | 800    | —    | —      | mA                | RNF=0.5Ω, Tj=25°C                                  |
| Torque limit current                 | ITL       | 520    | 650  | 780    | mA                | TL=0.4V, RNF=0.5Ω                                  |

©Not designed for radiation resistance.

● 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.

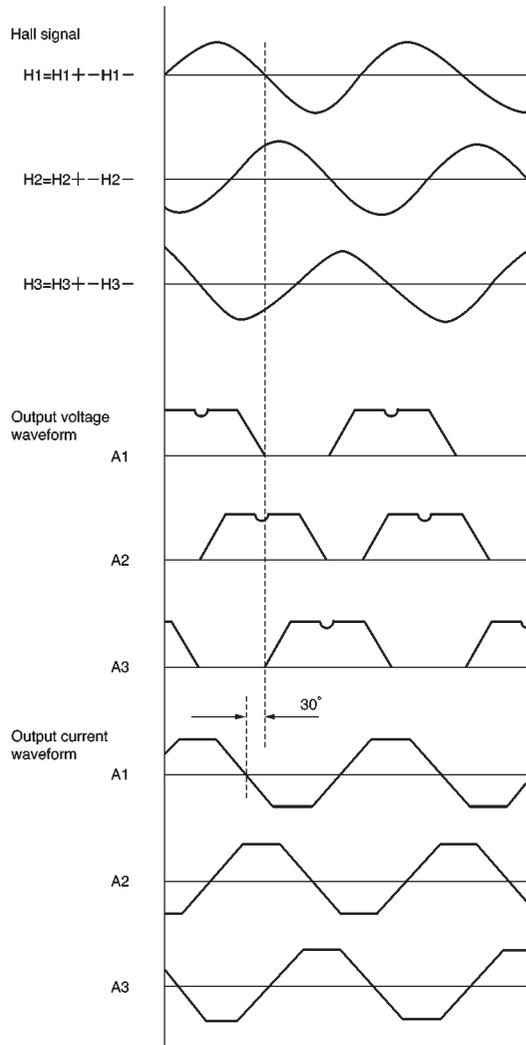
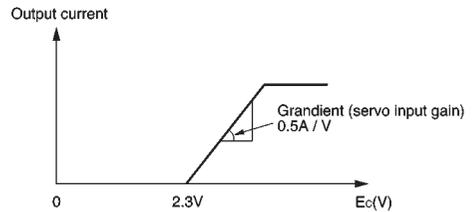


Fig.1

(2) Torque control pin

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



(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 (RNF pin)

The power ground pin is the output stage ground pin. Connect a resistor (0.5Ω recommended) between this pin and the ground to monitor the output current.

(5) Phase compensation pin (CNF pin)

Connect a capacitor between this pin and Vcc if the output tends to oscillate.

●Application example

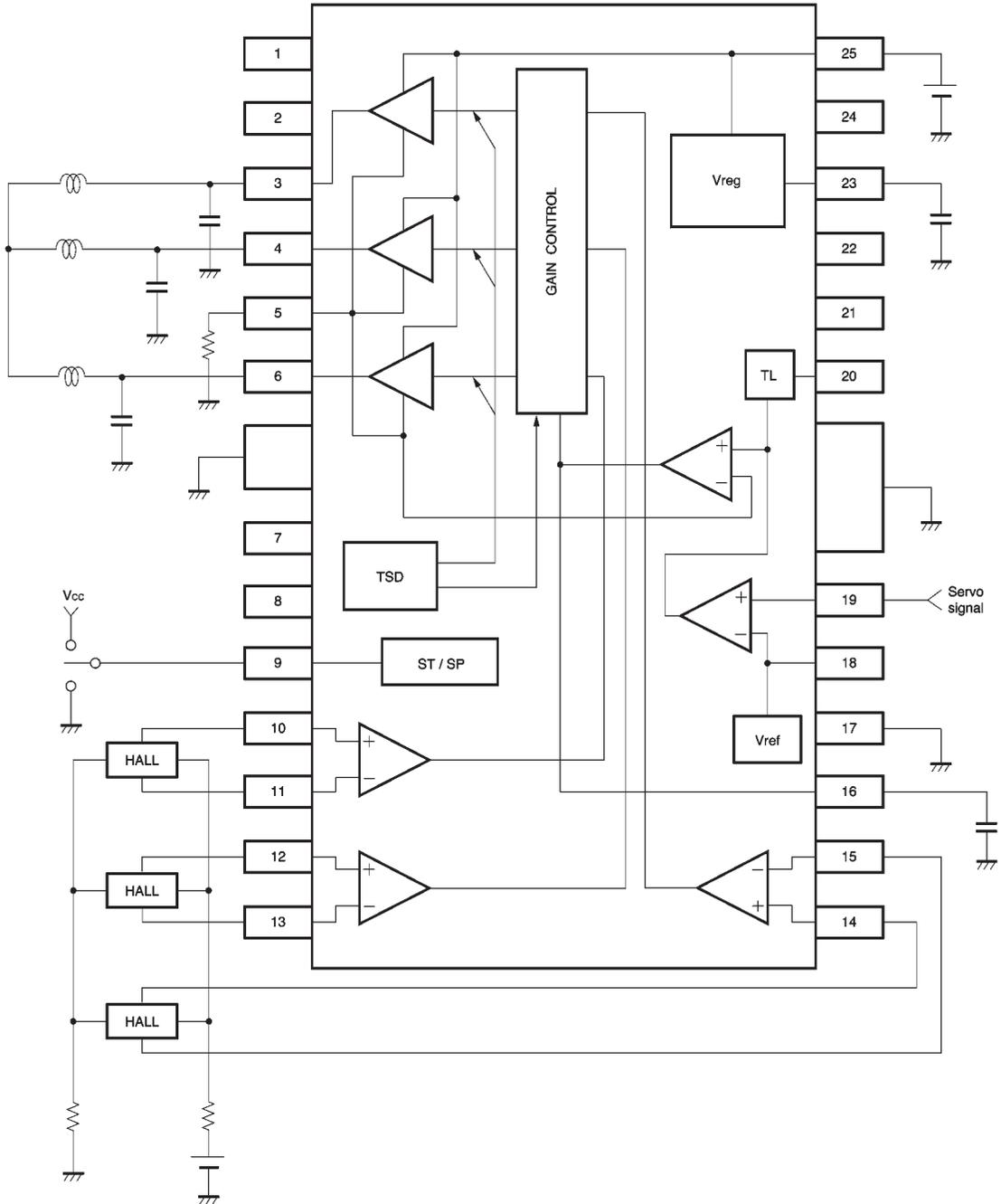


Fig.3

● 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  $-7\text{mV} / ^\circ\text{C}$ , and its resistance can vary  $\pm 30\%$ . The voltage on this pin should be less than  $V_{\text{REG}}$ .

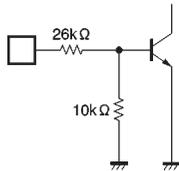


Fig.4

(2) Hall input

The input 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.

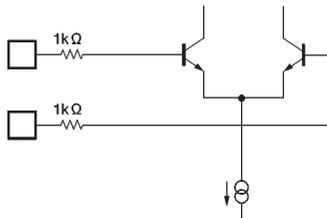


Fig.5

(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 (RNF).

Note that there is a voltage offset on this pin. The RNF-pin voltage is 0.325V when the TL-pin voltage is 0.4V (typical) and the RNF-pin resistance is 0.5Ω. Note that the voltage offset changes with RNF-pin resistance. Connect the TL pin to  $V_{\text{REG}}$  (pin 23) when the TL pin is not used.

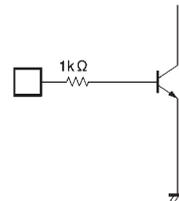
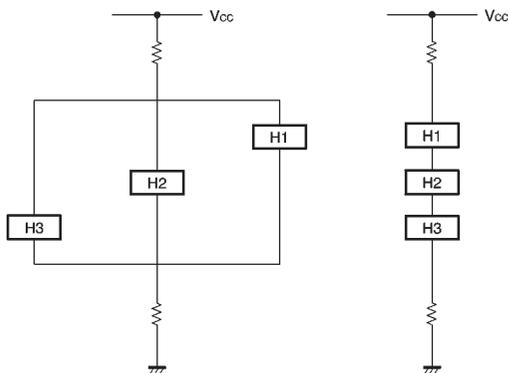


Fig.7

(4) Thermal shutdown circuit (TSD)

The thermal shutdown circuit puts the coil outputs (A1, A2, and A3) to the open state at the temperature of 175°C (typical). There is an approximate 25°C temperature hysteresis.



Parallel connection

Series connection

Fig.6

●Electrical characteristic curves

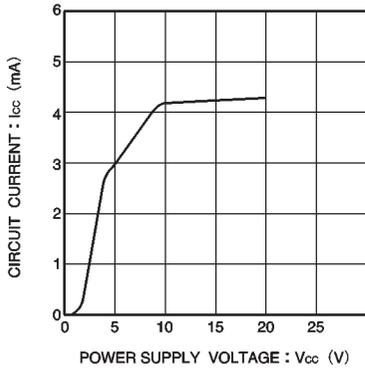


Fig.8 Supply current vs. power supply voltage

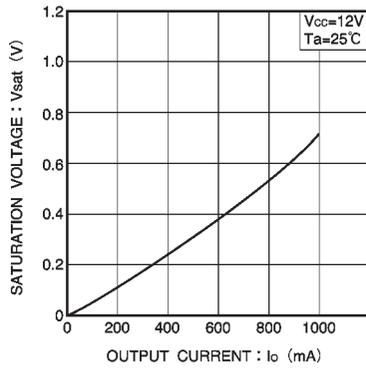


Fig.9 Low output saturation voltage vs. output current

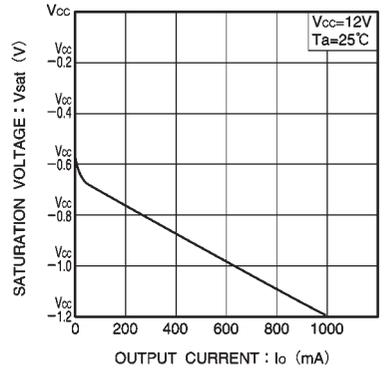


Fig.10 High output saturation voltage vs. output current

●External dimensions (Units: mm)

