

3-phase motor driver

BA6840BFS/BA6840BFP-Y/BA6840BFP/ BA6842BFS

The BA6840BFS, BA6840BFP-Y, BA6840BFP, and BA6842BFS are one-chip ICs designed for driving CD-ROM motors. They are high performance-ICs with a 3-phase, full-wave, pseudo-linear drive system.

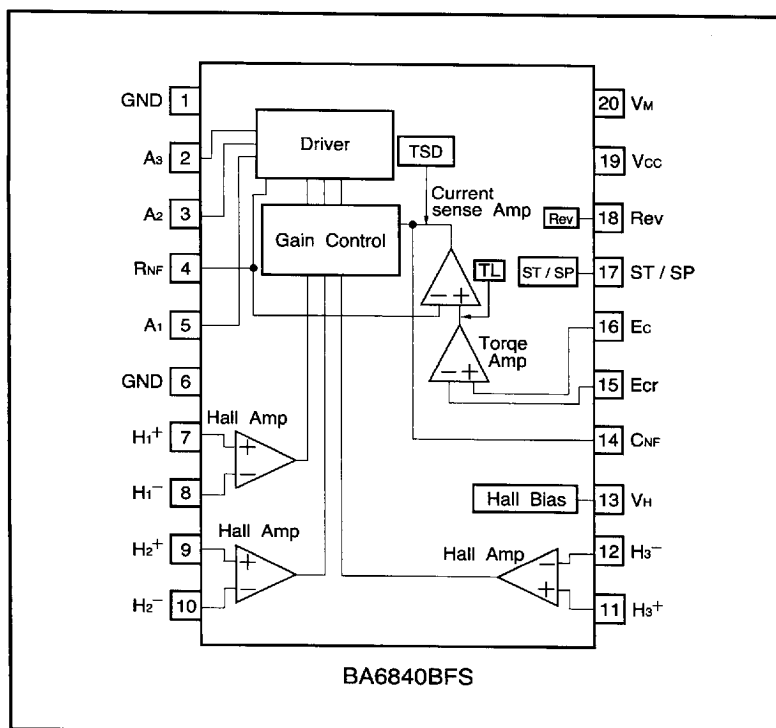
●Applications

CD-ROM motors

●Features

- 1) 3-phase, full-wave, pseudo-linear drive system.
- 2) Start/stop pin; power saving during stop mode.
- 3) Internal current limit circuit.
- 4) Internal thermal shutdown circuit.
- 5) Internal hall bias circuit.

●Block diagram



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● Absolute maximum ratings (Ta=25°C)

Parameter		Symbol	Limits	Unit
Power supply voltage		V _{CC}	7	V
		V _M	16	
Power dissipation	BA6840BFS	P _d	930*1	mW
	BA6840BFP-Y		1450*2	
	BA6840BFP		1700*3	
	BA6842BFS		1000*4	
Operating temperature		T _{opr}	-20~75	°C
Storage temperature		T _{stg}	-55~150	°C
Output current		I _{OUT}	1300*5	mA

*1 Reduced by 7.5 mW for each increase in Ta of 1°C over 25°C.

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

*3 Reduced by 13.6 mW for each increase in Ta of 1°C over 25°C.

*4 Reduced by 8.0 mW for each increase in Ta of 1°C over 25°C.

*5 When mounted to a 90 × 50 × 1.6mm glass epoxy board.

Should not exceed P_d- or A_{SO}-values.

● Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating power supply voltage	V _{CC}	4.25	—	5.50	V
	V _M	3.0	—	15	V

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● Electrical characteristics (Unless otherwise noted, Ta=25°C, V_{CC}=5V, V_M=12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈Overall〉						
Circuit current 1	I _{CC1}	—		0.2	mA	Power save ON
Circuit current 2	I _{CC2}	—	3.6	6.0	mA	Power save OFF Inputs: H, M and L
〈Power save〉						
ON voltage range	V _{PSON}	3.5	—	—	V	
OFF voltage range	V _{PSOFF}	—	—	1.5	V	
〈Hall bias〉						
Hall bias voltage	V _{HB}	—	0.9	1.5	V	I _{HB} =10mA
〈Hall amplifier〉						
Input bias current	I _{HA}	—	0.25	1.0	μA	
In-phase input voltage range	V _{HAR}	1.5	—	4.0	V	
Minimum input level	V _{INH}	50	—	—	mVpp	
〈Torque command〉						
Input voltage range	E _C	1.0	—	4.0	V	
Offset voltage +	E _{cofs+}	20	50	80	mV	For E _{CR} = 2.5 V
Offset voltage -	E _{cofs-}	-80	-50	-20	mV	For E _{CR} = 2.5 V
Input current	E _{CIN}	—	0.5	2.0	μA	E _C =E _{CR} =2.5V
Input/output gain	G _{EC}	0.41	0.51	0.61	A/V	R _{nf} =0.5 Ω, when measured at E _C = 2 points: 1.5 V and 2.0 V E _C =2 points: 3.0 V and 3.5 V
〈Output〉						
Output saturation voltage "H"	V _{OH}	—	1.0	1.6	V	I _O =-600mA
Output saturation voltage "L"	V _{OL}	—	0.4	0.9	V	I _O =600mA
Torque limit current	I _{TL}	560	700	840	mA	R _{nf} =0.5 Ω

◎ Not designed for radiation resistance.

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●Electrical characteristic curves

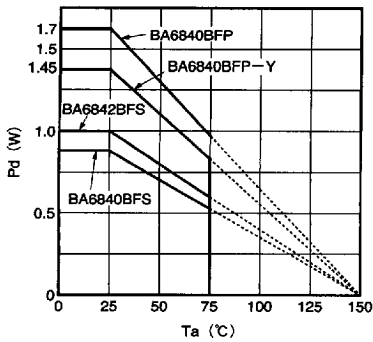


Fig. 1 Power dissipation curves

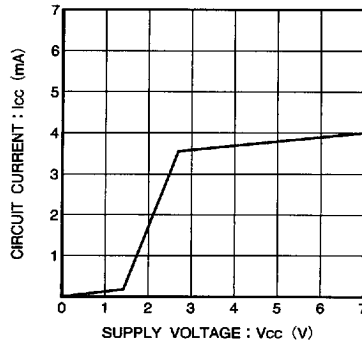


Fig. 2 Circuit current vs. power supply voltage

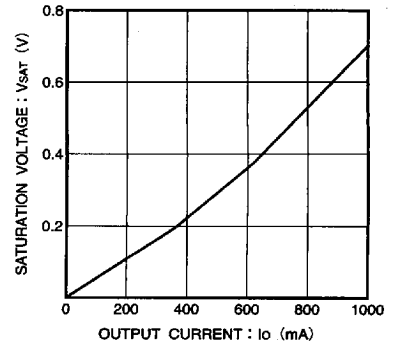


Fig. 3 Low-side output saturation voltage vs. output current

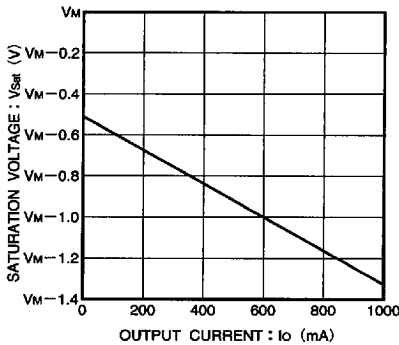


Fig. 4 High-side output saturation voltage vs. output current

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● Circuit operation

(1) Hall input ~ output

The 3-phase Hall signal is amplified in the hall amplifiers and sent to the matrix section, 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. 5.

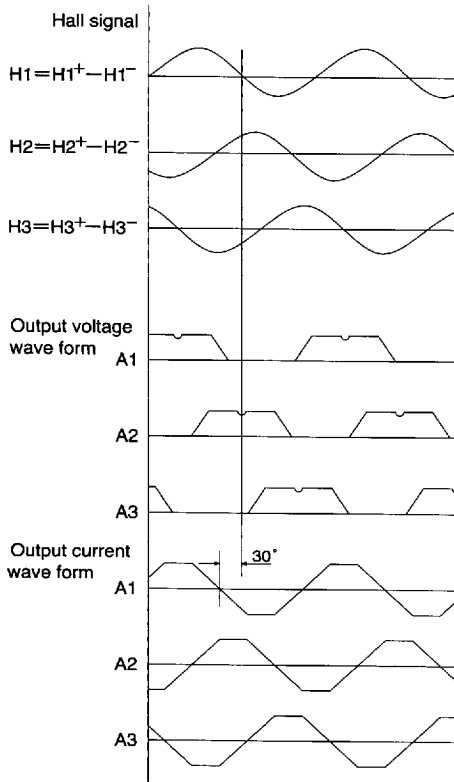


Fig. 5

(2) Torque control pin

The R_{NF} -pin current depends on the torque control input voltage (E_c) as shown in Fig. 6.

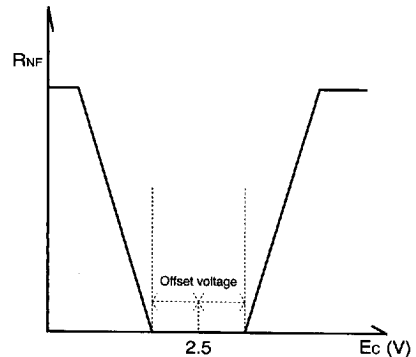


Fig. 6

	Reverse pin voltage	
	Hi	Low
$E_{cr} < E_c$	Reverse	Forward
$E_{cr} > E_c$	Stop	Reverse

(3) Start/stop pin

The motor is in the run mode when the pin input voltage is 3.5V or more, and in the idle mode (all output transistors are off) when the voltage is 1.5V or less.

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

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

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

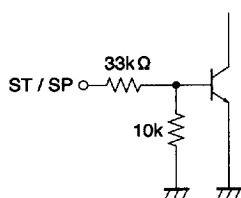
Connect and adjust a capacitor between this pin and the ground if the output tends to oscillate.

● Pin descriptions

Pin name	BA6840BFS	BA6840BFP-Y	BA6840BFP	BA6842BFS	Function
GND	1	FIN	FIN	8, 9, 23, 24, 25	Ground pin
A ₃	2	3	3	1	Output pin
A ₂	3	4	4	4	Output pin
R _{nf}	4	6	5	5	Current detector output pin
A ₁	5	7	6	7	Output pin
GND	6	8	7	10	Ground pin
H ₁ ⁺	7	9	9	11	Hall signal input pin
H ₁ ⁻	8	10	10	12	Hall signal input pin
H ₂ ⁺	9	11	13	13	Hall signal input pin
H ₂ ⁻	10	12	14	15	Hall signal input pin
H ₃ ⁺	11	13	15	16	Hall signal input pin
H ₃ ⁻	12	14	16	17	Hall signal input pin
V _H	13	15	17	18	Hall bias pin
C _{NF}	14	17	20	21	Capacitor for phase compensation connection pin
E _{CR}	15	18	21	22	Standard output current control pin
E _C	16	19	22	26	Output current control pin
ST / SP	17	20	23	27	Start/stop switch pin
REV	18	22	24	29	Reverse pin
V _{CC}	19	23	25	30	Power supply pin
V _M	20	24	26	31	Motor power supply pin

● Input/output circuits

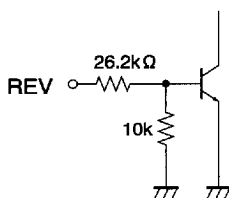
1) Start/stop



(Resistances are typical values.)

Fig. 7

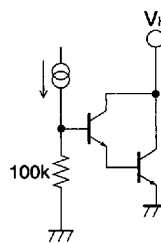
2) Reversing pin



(Resistances are typical values.)

Fig. 8

3) Hall bias

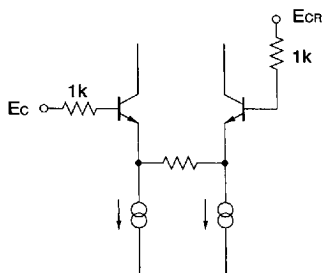


(Resistances are typical values.)

Fig. 9

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4) Torque control input



(Resistances are typical values.)

Fig. 10

5) Coil output

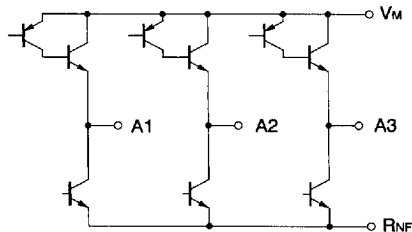
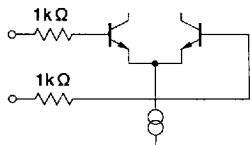


Fig. 11

6) Hall input (H1⁺, H1⁻, H2⁺, H2⁻, H3⁺, H3⁻)

(Resistances are typical values.)

Fig. 12

● Operation notes

(1) Start/stop

The I/O equivalent circuit of the start/stop pin is shown in Fig. 7. The pin has a temperature dependence of $-7\text{mV}/^{\circ}\text{C}$, and the resistance can vary $\pm 30\%$. Take the temperature effect into consideration when designing your application.

(2) Hall input

The Hall input equivalent circuit is shown in Fig. 12. The Hall devices can be connected in either series or parallel.

(3) Thermal shutdown circuit (TSD)

The circuit puts the coil outputs (A₁, A₂, and A₃) to the open state at the temperature of 175°C (typical). There is a temperature difference of about 15°C between the temperatures at which the circuit is activated and deactivated.

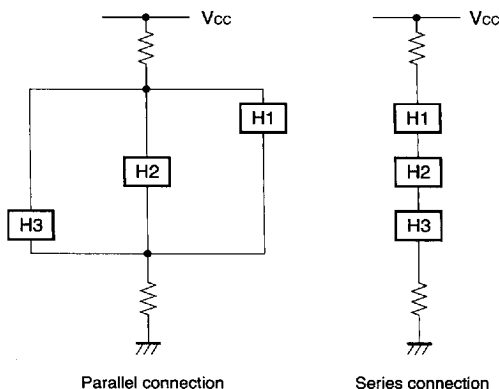


Fig. 13

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● Application example

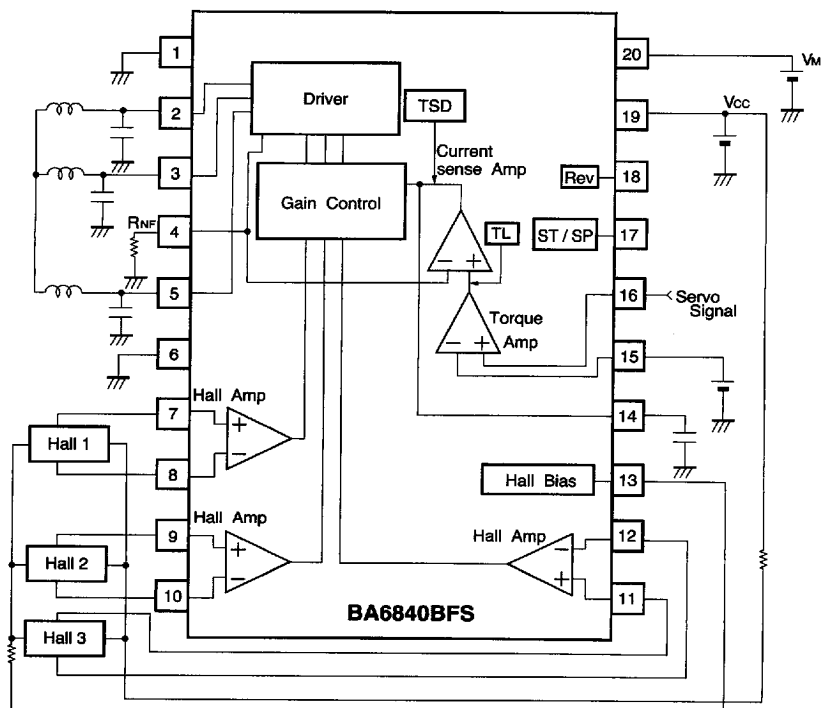


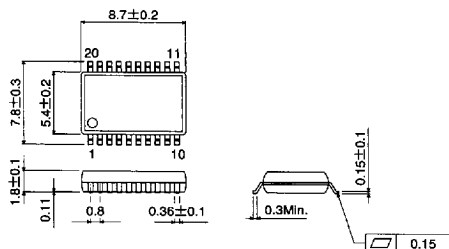
Fig. 14

Note: Figure for BA6840BFS.

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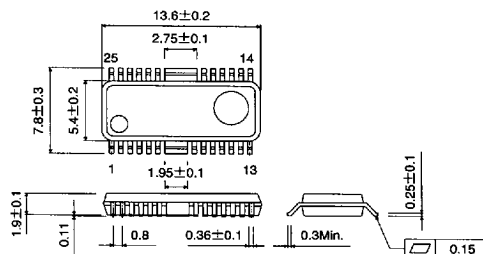
● External dimensions (Units: mm)

BA6840BFS



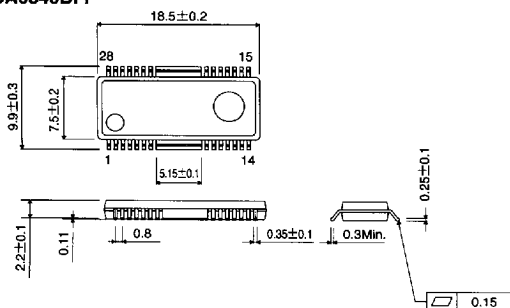
SSOP - A20

BA6840BFP-Y



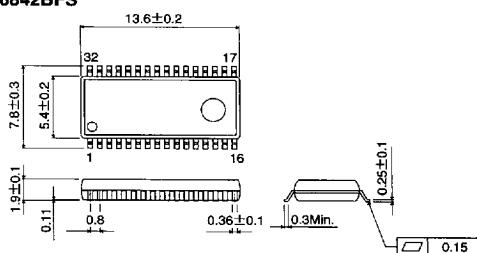
HSOP25

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HSOP28

BA6842BFS



SSOP - P32

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