3-phase motor driver

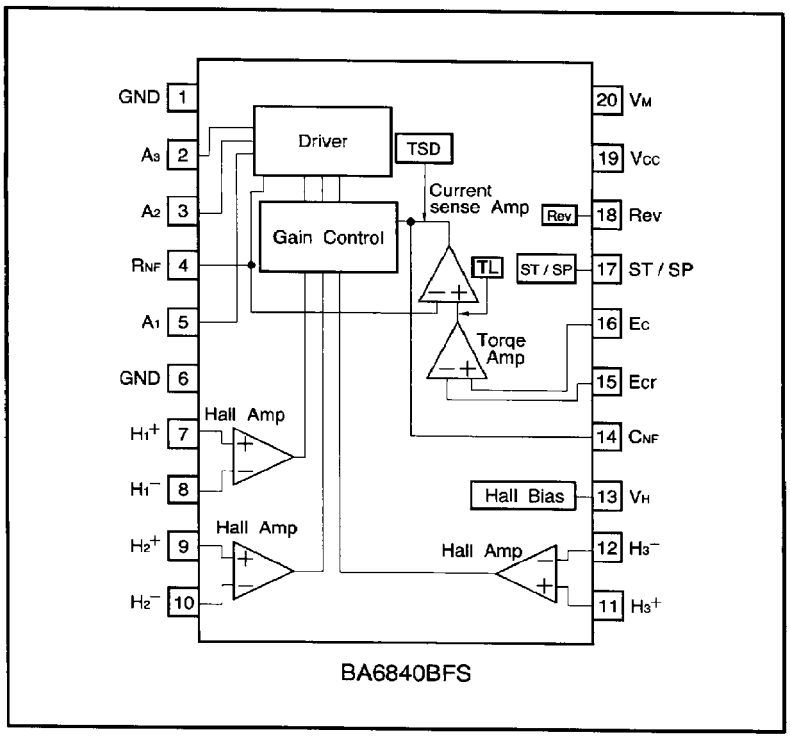
BA6840BFS/BA6840BFP-Y/BA6840BFP/ BA6842BFS

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



BA6840BFS

●Absolute maximum ratings (Ta=25℃)

Parameter		Symbol	Limits	Unit
Power supply voltage		V_{CC}	7	V
		V_M	16	
Power dissipation	BA6840BFS	Pd	930*1	mW
	BA6840BFP−Y		1450*2	
	BA6840BFP		1700*3	
	BA6842BFS		1000*4	
Operating temperature		Topr	−20~75	℃
Storage temperature		Tstg	−55~150	℃
Output current		I_{OUT}	1300*5	mA

*1 Reduced by 7.5 mW for each increase in Ta of 1℃ over 25℃.
*2 Reduced by 11.6 mW for each increase in Ta of 1℃ over 25℃.
*3 Reduced by 13.6 mW for each increase in Ta of 1℃ over 25℃.
*4 Reduced by 8.0 mW for each increase in Ta of 1℃ over 25℃.
*5 When mounted to a 90 × 50 × 1.6mm glass epoxy board.
Should not exceed Pd- or ASO-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

●Electrical characteristics (Unless otherwise noted, Ta=25℃, 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	Rnf =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	Rnf=0.5Ω

◎ Not designed for radiation resistance.

●Electrical characteristic curves

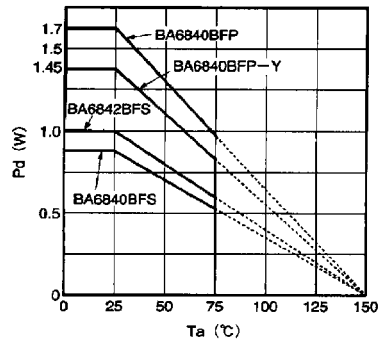


Fig. 1 Power dissipation curves

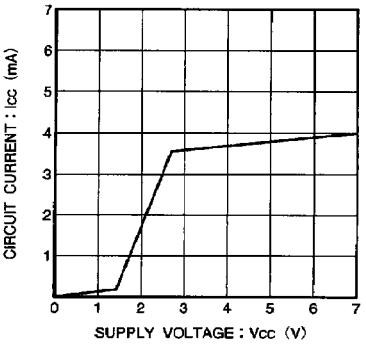


Fig. 2 Circuit current vs. power supply voltage

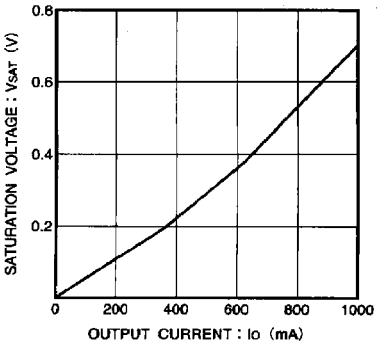


Fig. 3 Low-side output saturation voltage vs. output current

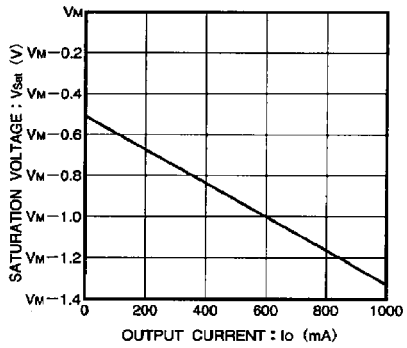


Fig. 4 High-side output saturation voltage vs. output current

●Circuit operation

(1) Hall linput ~ 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.

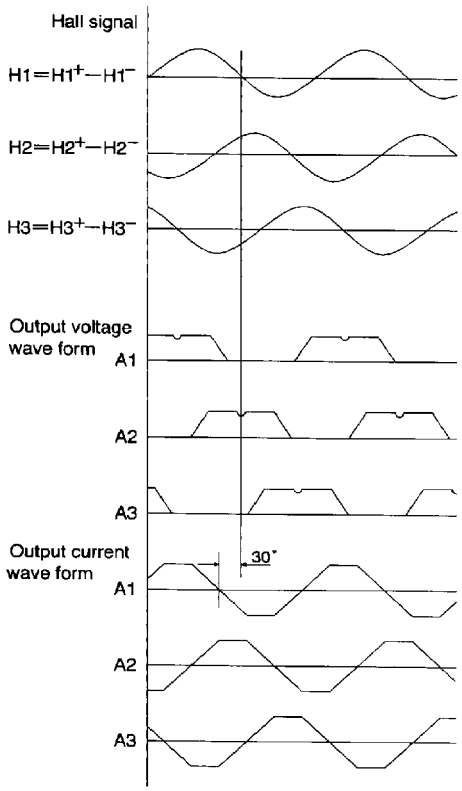


Fig. 5

(2) Torque control pin

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

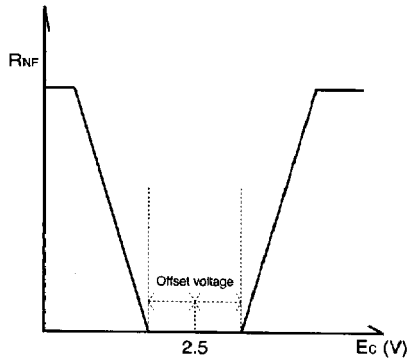


Fig. 6

	Reverse pin voltage	
	Hi	Low
Ecr < Ec	Reverse	Forward
Ecr > Ec	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 (0.5Ω recommended) between this pin and the ground to monitor the output current.

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

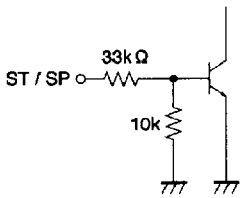
Connect and adjust a capacitor between this pin and the ground if the output tends to oscillate.

●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
Rnf	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
Ec	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

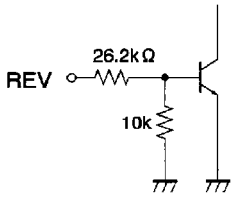
1) Start/stop



(Resistances are typical values.)

Fig. 7

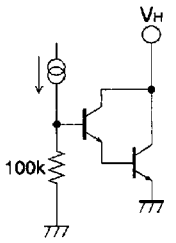
2) Reversing pin



(Resistances are typical values.)

Fig. 8

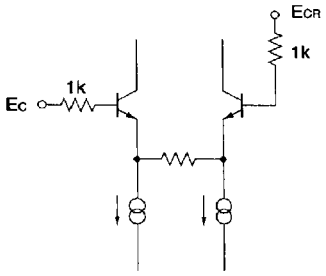
3) Hall bias



(Resistances are typical values.)

Fig. 9

4) Torque control input



(Resistances are typical values.)

Fig. 10

5) Coil output

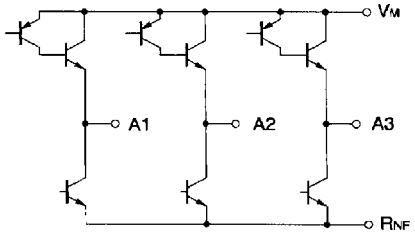
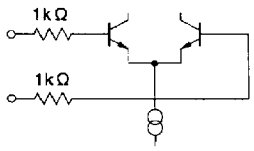


Fig. 11

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 −7mV/℃, and the resistance can vary ±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 (A_1, A_2, and A_3) to the open state at the temperature of 175℃ (typical). There is a temperature difference of about 15℃ between the temperatures at which the circuit is activated and deactivated.

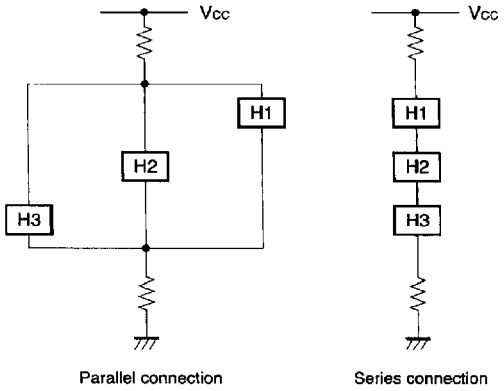


Fig. 13

●Application example

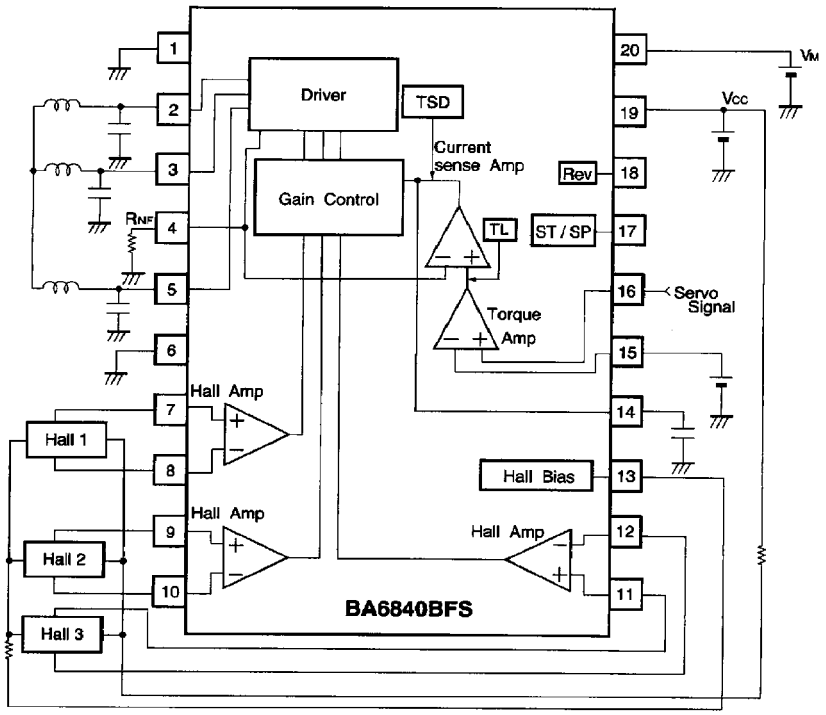
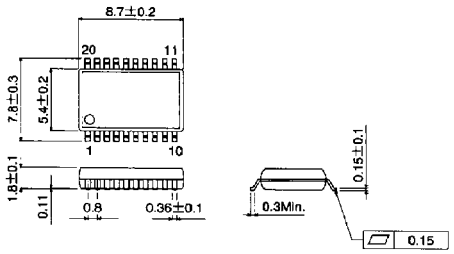


Fig. 14

Note: Figure for BA6840BFS.

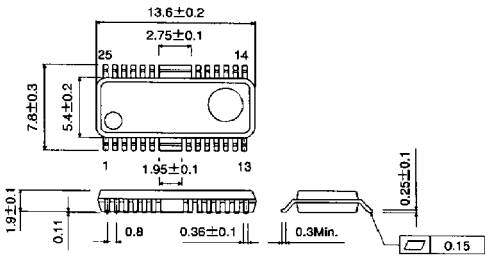
●External dimensions (Units: mm)

BA6840BFS



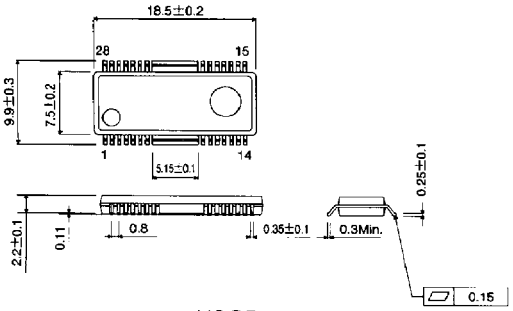
SSOP - A20

BA6840BFP-Y



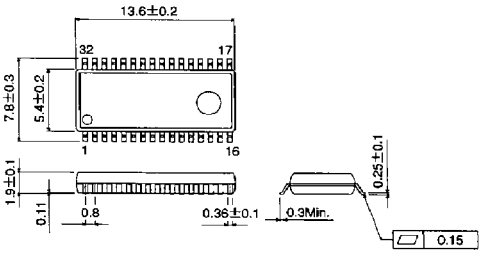
HSOP25

BA6840BFP



HSOP28

BA6842BFS



SSOP - P32