BA6840AFS

3-phase motor driver

The BA6840AFS is an IC used for driving CD-ROM motors.

Features

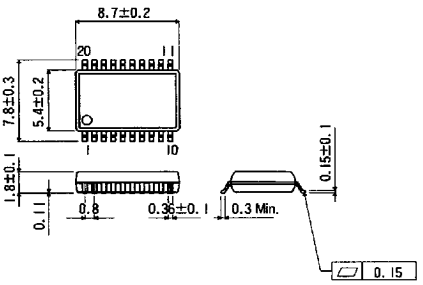
- available in a SSOP-A20 package
- supply voltage range 4.25 ~ 5.5 V (control block) and 3 ~ 20 V (output block)
- power dissipation is 930 mW
- maximum output current up to 1300 mA
- three-phase full-wave pseudo linear driving system
- built-in thermal shutdown circuit (TSD)
- forward and reverse control
- reversing brake
- start/stop terminal with built-in power saving circuit to minimize current consumption when motor stopped
- internal current limit circuit

Applications

- CD-ROM motors

Dimensions (Units : mm)

BA6840AFS (SSOP-A20)



Block diagram

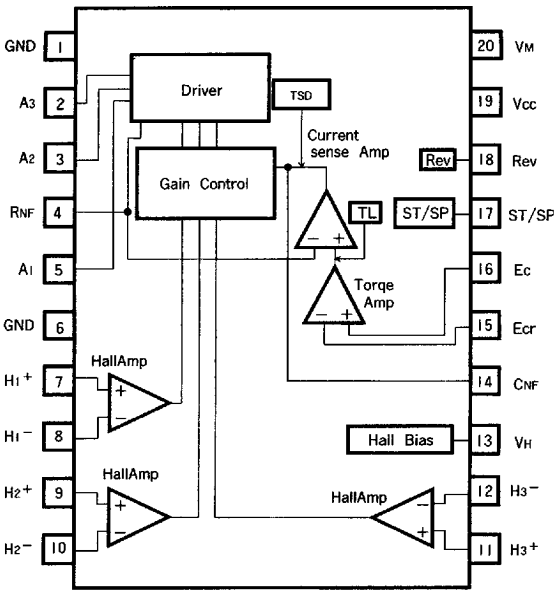


Table 1 Pin description

Pin no	Pin name	Function	Pin no	Pin name	Function
1	GND	Ground pin	11	H_3+	Hall signal input
2	A_3	Output pin	12	H_3-	Hall signal input
3	A_2	Output pin	13	V_H	Hall bias pin
4	R_{NF}	Output current sensing pin	14	C_{NF}	Connection point for phase compensation capacitor
5	A_1	Output pin	15	E_{CR}	Output current control reference voltage pin
6	GND	Ground pin	16	E_C	Output current control pin
7	H_1+	Hall signal input	17	ST/SP	Start/stop switching pin
8	H_1-	Hall signal input	18	REV	Reverse pin
9	H_2+	Hall signal input	19	V_{CC}	Supply voltage pin
10	H_2-	Hall signal input	20	V_M	Motor supply voltage pin

Absolute maximum ratings (T_a = 25°C)

Parameter	Symbol	Limit	Unit	Conditions
Supply voltage	V_{CC}	7	V	
	V_M	24	V	
Power dissipation	P_d	930	mW	Reduce power by 7.5 mW for each degree above 25°C. Mounted on a 90 × 50 × 1.6 mm glass-epoxy PCB.
Output current	I_{OUT}	1300	mA	The output current must not exceed the maximum P_d or ASO ratings.
Operating temperature	T_{opr}	−20 ~ +75	°C	
Storage temperature	T_{stg}	−55 ~ +150	°C	

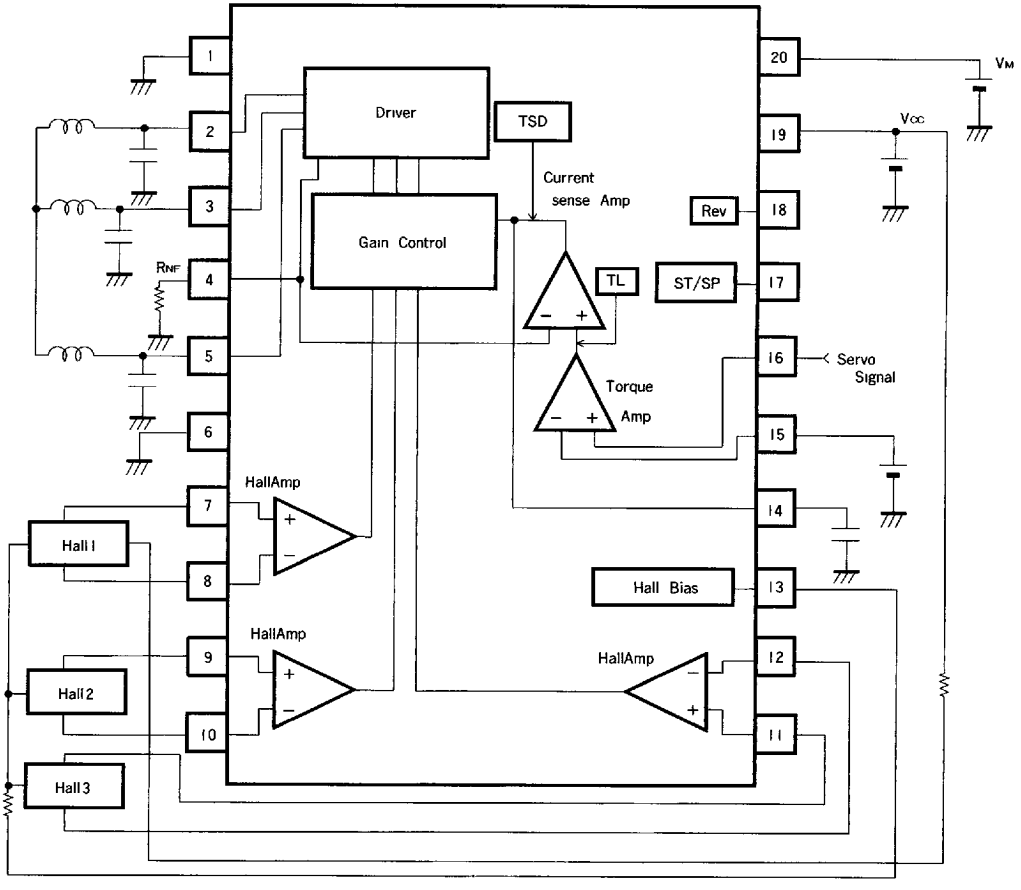
Recommended operating conditions (T_a = 25°C)

Parameter	Symbol	Min	Typical	Max	Unit
Power supply voltage	V_M	3.0		20	V
	V_{CC}	4.25		5.50	V

Electrical characteristics (unless otherwise noted, T_a = 25°C, V_{CC} = 5 V, V_M = 12 V)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Supply current	I_{CC1}		0	0.2	mA	Powersaver ON
Supply current	I_{CC2}		3.6	6.0	mA	Powersaver OFF, inputs H, M, 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}		1.3	2.0	V	I_{HB} = 10 mA
Hall amplifier						
Input bias current	I_{HA}		0.25	1.0	µA	
In-phase input voltage range	V_{HAR}	1.5		4.0	V	
Hall element minimum input level	V_{INH}	60			mV_{pk-pk}	
Torque command						
Input voltage range	E_C	1.0		4.0	V	
Offset voltage	E_{cofs}	−150		150	mV	For E_C = 2.3 V
Offset voltage amplitude	E_{cofsa}	50		150	mV	
Input current	E_{CIN}		0.5	2.0	µA	$E_C = E_{CR}$ = 2.3 V
Input/ output gain	G_{EC}	0.41	0.51	0.61	A/V	Measured for E_C = 1.3 V, 1.8 V and E_C = 2.8 V, 3.3 V R_{NF} = 0.5 Ω
Output						
Output saturation voltage HIGH	V_{OH}		1.0	1.6	V	I_o = −600 mA
Output saturation voltage LOW	V_{OL}		0.4	0.9	V	I_o = 600 mA
Torque limit current	I_{TL}	560	700	840	mA	R_{NF} = 0.5 Ω

Figure 1 Application example



Input and output equivalent circuits

Figure 2 REV and ST/SP (pins 17 & 18)

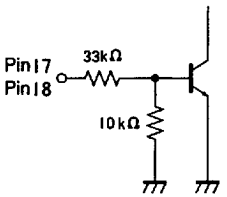


Figure 3 Hall bias (pin 13)

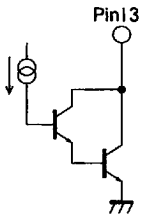


Figure 4 Torque command input (pins 15 & 16)

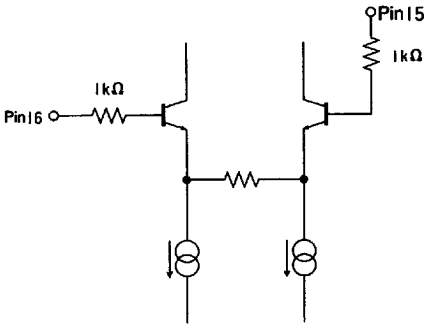


Figure 5 Driver output (A1, pin 5; A2, pin 3; A3, pin 2)

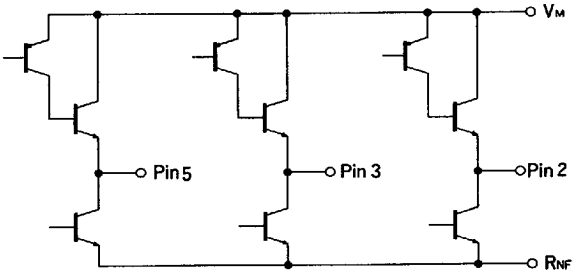
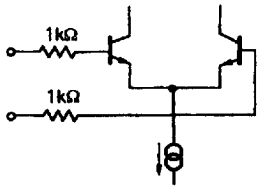


Figure 6 Hall inputs (H1+, pin 7: H1-, pin 8; H2+, pin 9: H2-, pin 10; H3+, pin 11: H3-, pin 12)



Circuit operation

Hall inputs to driver outputs

Three Hall-effect element signals (from the three phases of the motor) are amplified in the Hall amplifiers and applied to a gain control section, see Figure 6). After amplification and signal averaging, the voltage signals are used to set the motor drive current out of the motor driver. Figure 7 shows the phase relationships between the Hall signal inputs and the current and voltage waveforms at the outputs of the drivers.

The Hall-effect elements can connected either in series or in parallel. (See Figure 8)

Figure 7 Motor drive signal phase relationships

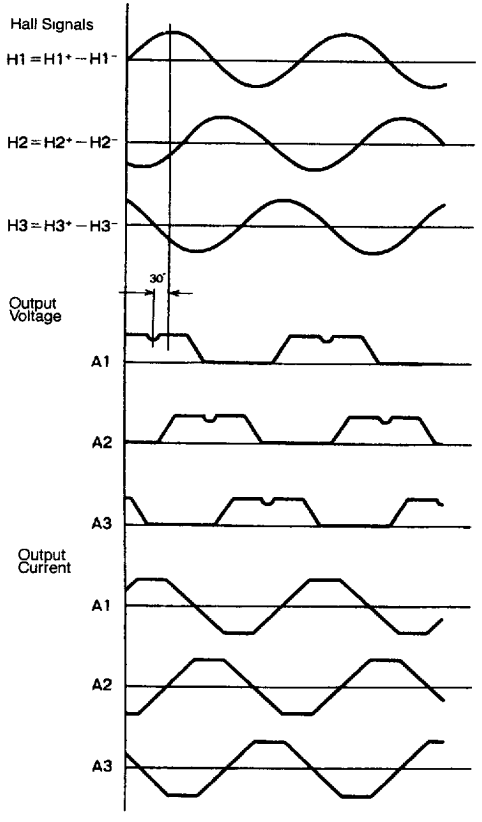
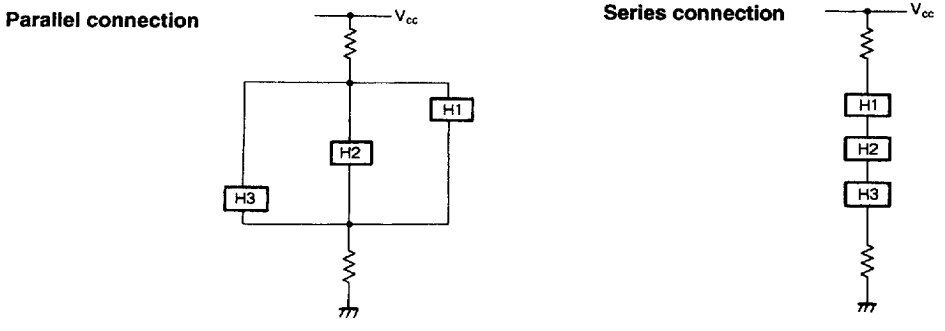


Figure 8 Hall effect element electrical connections



Torque command

Figure 9 shows the relationship between the torque command input (EC) and R_{NF} pin voltage.

Figure 9 Torque command voltage relationship

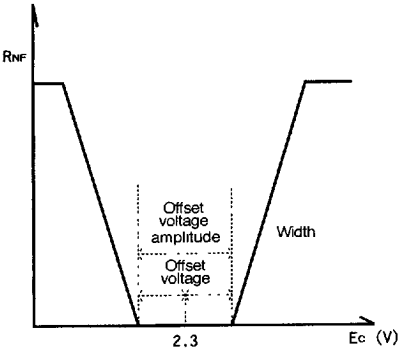


Table 2

	REV pin voltage	
	HIGH	LOW
$E_{CR} < E_C$	Reverse	Forward
$E_{CR} > E_C$	Stop	Reverse

Start/stop pin

The Run state is entered when a voltage ≥ 3.5 V is applied to the ST/SP pin. The Idle state (all output transistors off) is entered when a voltage ≤ 1.2 V is applied.

The ST/SP pin equivalent input circuit is shown in Figure 2. The ST/SP pin has a −7 mV/°C temperature characteristic, and a resistance variance of ±30%. This temperature characteristic should be accounted for during circuit design.

Power ground (R_{NF} pin)

This is the output stage ground connection. To monitor the output current, a small resistor (0.5 Ω) should be connected between this pin and ground.

Phase compensation (CNF) pin

If the output tends to oscillate in normal operation, connect a capacitor between this pin and V_{CC}.

Precautions for use

Thermal shutdown (TSD)

Regardless of the operating mode as defined by the input, the thermal shutdown circuit turns off the driver output (A1, A2, and A3) if the junction temperature of the IC exceeds 175°C (typical). There is a 15°C difference (typical) between the temperatures at which the TSD circuit trips and resets. The shutdown signal is not latched. This means the IC automatically turns on again when it cools down. When the trip resets, the outputs assume the states defined by the logic input.

Electrical characteristic curves

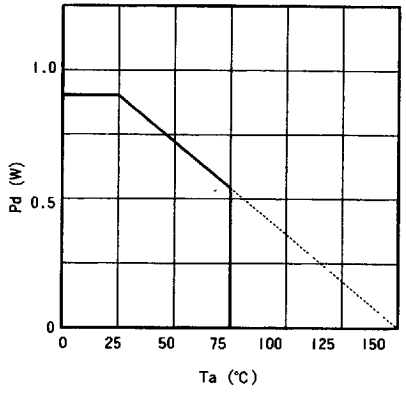


Figure 10

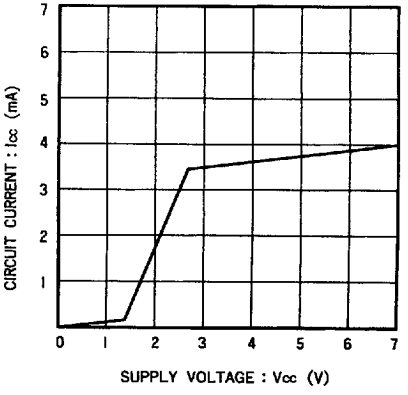


Figure 11

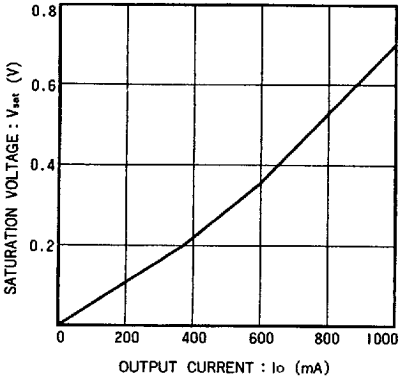


Figure 12

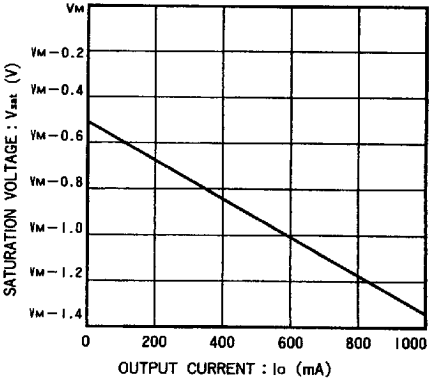


Figure 13