

The BA6890FP is a 4-channel H-bridge-type, BTL driver for the motors or actuators on a CD player.

### Features

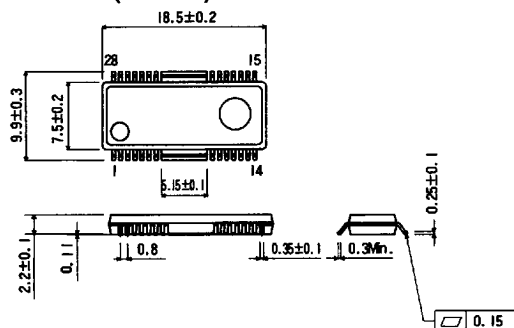
- available in a HSOP28 package
- supply voltage range (1.5 ~ 9 V)
- wide dynamic range (2.5 V typically at  $V_{CC} = 4V$ ,  $R_L = 8\ \Omega$ )
- gain of driver output can be changed by changing a single external resistor
- independent power supply for each preamplifier and power amplifier.
- internal mute circuit provided for each of the 4 channels
- built-in thermal shutdown circuit

### Applications

- CD player
- CD radio cassette players

### Dimensions (Units : mm)

BA6890FP (HSOP28)



Block diagram

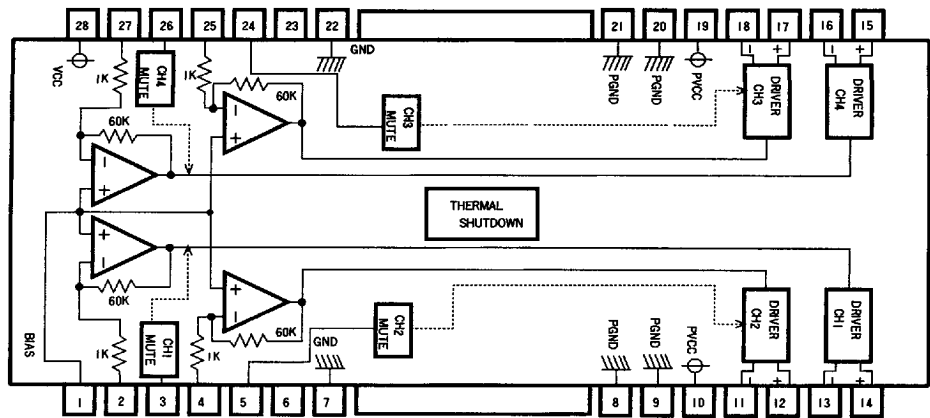


Table 1 Pin description (Sheet 1 of 2)

| Pin no. | Symbol              | Description                                                                           |
|---------|---------------------|---------------------------------------------------------------------------------------|
| 1       | BIAS                | Bias input                                                                            |
| 2       | IN1                 | Driver CH1 input                                                                      |
| 3       | MUTE1               | Driver CH1 mute                                                                       |
| 4       | IN 2                | Driver CH2 input                                                                      |
| 5       | MUTE2               | Driver CH2 mute                                                                       |
| 6       | TEST                | Test input. Nothing should be connected to this pin.                                  |
| 7       | PREGND              | Preamplifier ground                                                                   |
| 8       | PWGND               | Power amplifier ground. IC heat dissipation fins are connected to this pin internally |
| 9       | PWGND               | Power amplifier ground                                                                |
| 10      | V <sub>CC</sub> POW | Power amplifier supply                                                                |
| 11      | OUT2-               | Driver CH2 negative output                                                            |
| 12      | OUT2+               | Driver CH2 positive output                                                            |
| 13      | OUT1-               | Driver CH1 negative output                                                            |
| 14      | OUT1+               | Driver CH1 positive output                                                            |
| 15      | OUT4+               | Driver CH4 positive output                                                            |
| 16      | OUT4-               | Driver CH4 negative output                                                            |
| 17      | OUT3+               | Driver CH3 positive output                                                            |
| 18      | OUT3-               | Driver CH3 negative output                                                            |
| 19      | V <sub>CC</sub> POW | Power amplifier supply                                                                |
| 20      | PWGND               | Power amplifier ground                                                                |

**Table 1 Pin description (Sheet 2 of 2)**

| Pin no. | Symbol              | Description                 |
|---------|---------------------|-----------------------------|
| 21      | PWGND               | Power amplifier ground      |
| 22      | PREGND              | Preamplifier ground         |
| 23      | NC                  | Not used                    |
| 24      | MUTE3               | Driver CH3 mute             |
| 25      | IN3                 | Driver CH3 input            |
| 26      | MUTE4               | Driver CH4 mute (brake pin) |
| 27      | IN4                 | Driver CH4 input            |
| 28      | V <sub>CC</sub> PRE | Preamplifier supply         |

**Note:** The driver output has the same polarity as the corresponding input (for instance: when pin 2 input is HIGH, pin 14 is HIGH).

**Absolute maximum ratings (T<sub>a</sub> = 25°C)**

| Parameter             | Symbol           | Limits     | Unit | Conditions                                                                                         |
|-----------------------|------------------|------------|------|----------------------------------------------------------------------------------------------------|
| Power supply voltage  | V <sub>CC</sub>  | 18         | V    | For both V <sub>CC</sub> PRE, V <sub>CC</sub> POW                                                  |
| Power dissipation     | P <sub>d</sub>   | 1.7        | W    | Reduce power by 13.6 mW for each degree above 25°C, on a phenol paper PCB (50 × 50 × 1.0 mm thick) |
| Operating temperature | T <sub>opr</sub> | −30 ~ +85  | °C   |                                                                                                    |
| Storage temperature   | T <sub>stg</sub> | −55 ~ +150 | °C   |                                                                                                    |

**Recommended operating conditions (T<sub>a</sub> = 25°C)**

| Parameter                      | Symbol              | Min | Typical | Max | Unit | Conditions |
|--------------------------------|---------------------|-----|---------|-----|------|------------|
| Preamplifier supply voltage    | V <sub>CC</sub> PRE | 3   |         | 9   | V    |            |
| Power amplifier supply voltage | V <sub>CC</sub> POW | 1.5 |         | 9   | V    |            |

**Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 8\text{ V}$ ,  $R_L = 8\ \Omega$ ,  $f = 1\text{ kHz}$ )**

| Parameter                                        | Symbol          | Min  | Typical | Max | Unit          | Conditions                            |
|--------------------------------------------------|-----------------|------|---------|-----|---------------|---------------------------------------|
| Quiescent current 1 ( $V_{CCPRE}$ )              | $I_{Q1}$        | 2.2  | 3.8     | 5.4 | mA            | Input open                            |
| Quiescent current 2 ( $V_{CCPOW}$ )              | $I_{Q2}$        |      |         | 1   | mA            | Input open                            |
| Standby current                                  | $I_{ST}$        |      |         | 1   | $\mu\text{A}$ |                                       |
| Input voltage, offset                            | $V_{OI}$        | -5   |         | 5   | mV            |                                       |
| Output voltage, offset                           | $V_{OO}$        | -30  |         | 30  | mV            |                                       |
| Dead zone width                                  | $V_{DB}$        | 1    | 4       | 10  | mV            | Total for positive and negative sides |
| Output amplitude                                 | $V_{OM}$        | 2.0  | 2.5     |     | V             |                                       |
| Gain (close circuit)                             | $G_{VC}$        | 12   | 14      | 16  | dB            |                                       |
| Gain, positive and negative voltage differential | $\Delta G_{VC}$ | -1.5 | 0       | 1.5 | dB            |                                       |
| Mute-on voltage                                  | $V_{MON}$       | 2.0  |         |     | V             |                                       |
| Mute-off voltage                                 | $V_{MOFF}$      |      |         | 0.5 | V             |                                       |

### Figure 1 Test circuit

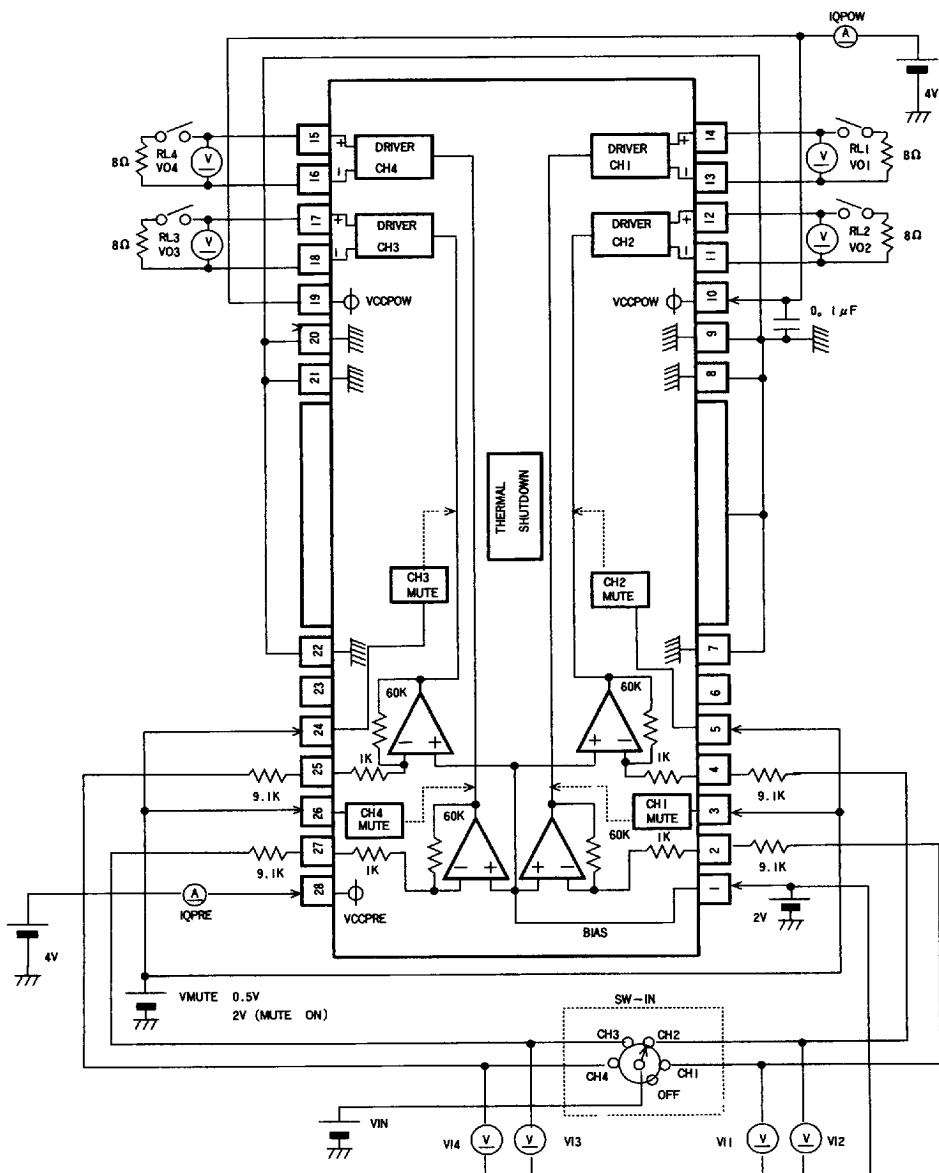


Table 2 Test circuit switch states

| Test     | VIN                | IN       | VPRE | RL  | Test point                                   |
|----------|--------------------|----------|------|-----|----------------------------------------------|
| $I_{Q1}$ | OFF                | OFF      | ON   | OFF | IQPRE                                        |
| $I_{Q2}$ | OFF                | OFF      | ON   | OFF | IQPOW                                        |
| $I_{ST}$ | OFF                | OFF      | OFF  | OFF | IQPOW                                        |
| $V_{OI}$ | OFF                | CH 1 ~ 4 | ON   | OFF | VI 1 ~ 4                                     |
| $V_{OO}$ | 0 V                | CH 1 ~ 4 | ON   | ON  | VO 1 ~ 4                                     |
| $V_{DB}$ | -50 ~ +50 mV sweep | CH 1 ~ 4 | ON   | ON  | Confirms $V_{IN}$ range for VO 1 ~ 4 at 0 mV |
| $V_{OM}$ | $\pm 0.7$ V        | CH 1 ~ 4 | ON   | ON  | VO 1 ~ 4                                     |
| $G_{VC}$ | $\pm 0.3$ V        | CH 1 ~ 4 | ON   | ON  | $20 \log (VO 1 \sim 4)/V_{IN}$               |
| $G_{VC}$ | $\pm 0.3$ V        | CH 1 ~ 4 | ON   | ON  | $G_{VC} + G_{VC}$ - differential             |

**Note:** The input offset is also the center of the dead zone. If this moves away from the dead zone width (4 mV), output occurs at the point  $V_{IN} = V_{BIAS}$ . This is the output offset voltage. See following illustration.

Figure 2 Dead zone

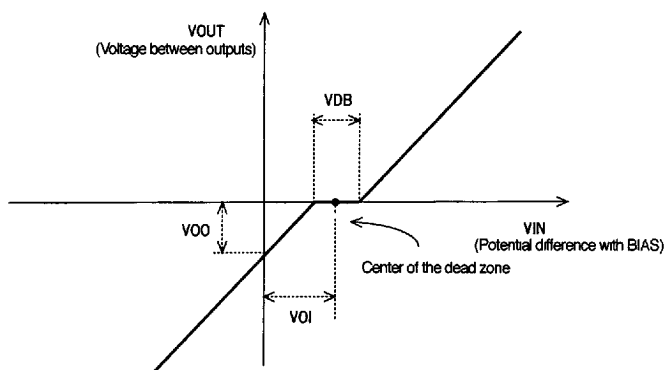
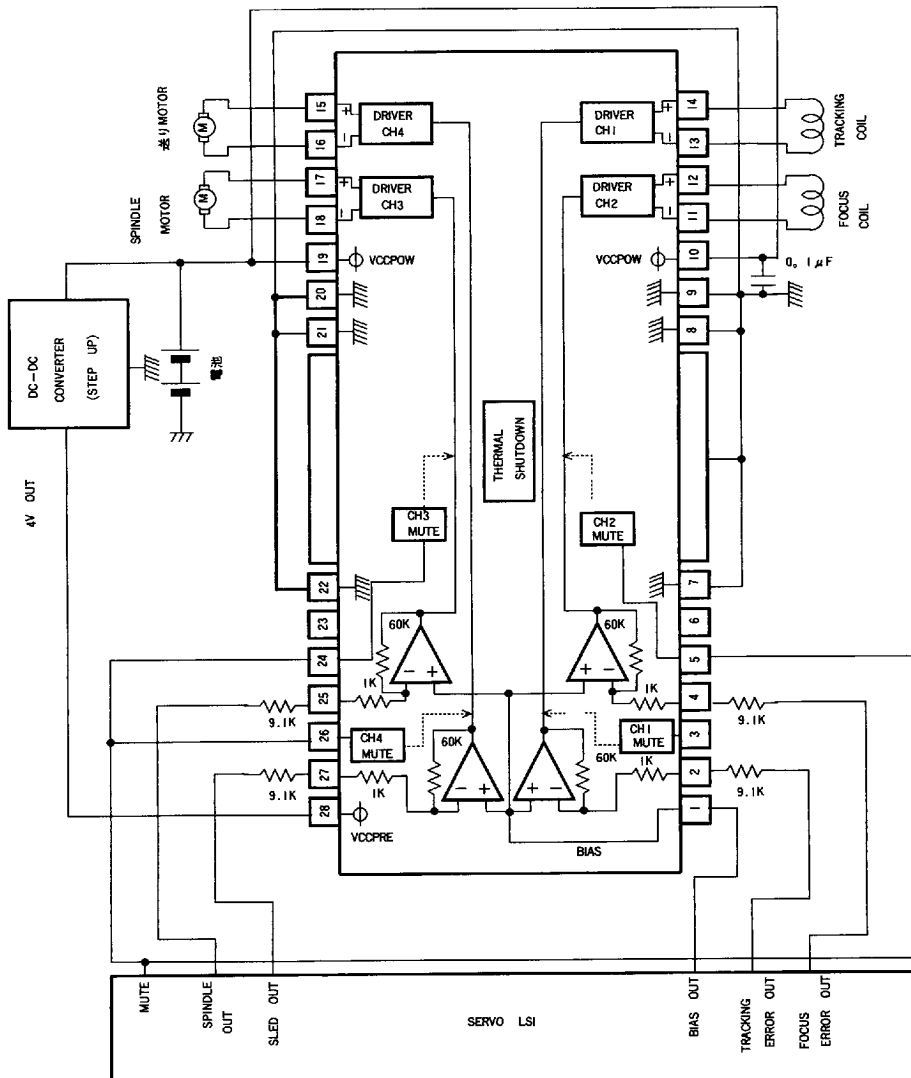


Figure 3 Application example



## Operation

### Precautions for use

- A thermal shut down circuit is built into the BA6890FP. When the temperature of the chip reaches 175°C (typically), the output current is muted. The thermal shutdown switch resets when the temperature falls below 155°C
- If any mute pin voltage is greater than 2.0 V, the output current can be muted. Under normal operating conditions, make sure to pull all mute pins to less than 0.5 V. Each channel is muted independently
- The dead zone width width is determined as follows:  
Dead zone width = input resistance  $\times$  0.2  $\mu$ A

Input resistance = external resistance + internal resistance (1 K $\Omega$ )

Example: If the external input resistance 9.1 K $\Omega$ :

$V_{DB} = (9.1 \text{ K} + 1 \text{ K}) \times 0.2 \mu = 2 \text{ mV}$ ; with the total for each positive and negative side, this is a 4 mV dead zone. When the output is in the dead zone, the output pin is in the high impedance state

- Make sure to connect a 0.1  $\mu$ F capacitor to the dc supplied power main input to filter out voltage ripples.
- Because the gain is high, if a long wire is connected to the pin that adjusts the gain, the output may oscillate due to free capacitance. Consequently, keep these wires as short as possible in your designs.
- Heat dissipation fins are attached to the GND on the inside of the package. Make sure to connect these to the external GND.

### Electrical characteristic curves

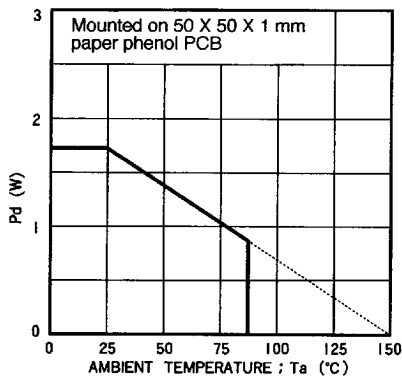


Figure 4