

4-channel BTL driver for CD player and CD-ROM drives

BA5921FP

The BA5921FP is an IC with an internal 4-channel BTL driver for CD players and CD-ROM driver actuators and motors, as well as an internal standard operational amplifier. In addition, the 28-pin HSOP package allows for application miniaturization.

●Applications

CD players, CD-ROM drives

●Features

- 1) 4-channel BTL driver.
- 2) HSOP 28-pin power package allows for application miniaturization.
- 3) Wide dynamic range. (typically 3.6V when $V_{CC} = 5V$ and $R_L = 8\Omega$)
- 4) Internal thermal shutdown circuit.
- 5) Gain is adjustable with an attached resistor.
- 6) Internal standard operational amplifier.
- 7) Output current is mutable with an external mute pin.

●Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

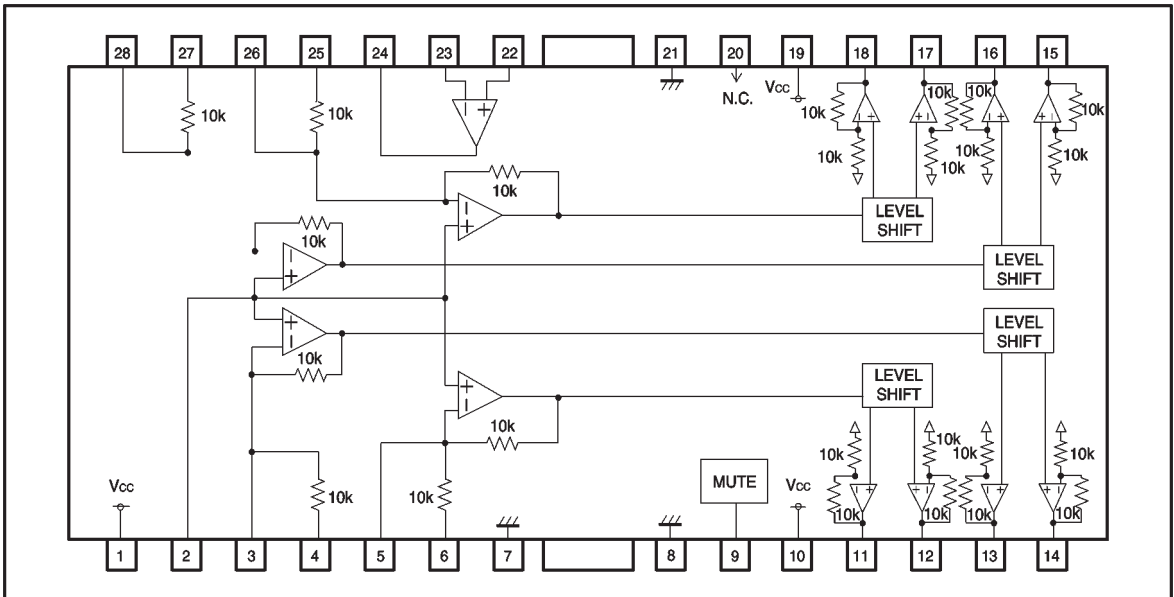
| Parameter | Symbol | Limits | Unit |
|-----------------------|-----------|-----------------|------------------|
| Power supply voltage | V_{CC} | 7 | V |
| Power dissipation | P_d | 1.7*1 | W |
| Operating temperature | T_{opr} | $-35 \sim +85$ | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | $-35 \sim +150$ | $^\circ\text{C}$ |

*1 Reduced by 13.6 mW for each increase in T_a of 1°C over 25°C .
When mounted on a $50 \times 50 \times 1$ mm paper phenol board.

●Recommended operating conditions ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|----------|------|------|------|------|
| Power supply voltage | V_{CC} | 4.3 | — | 6.6 | V |

● Block diagram



● Pin descriptions

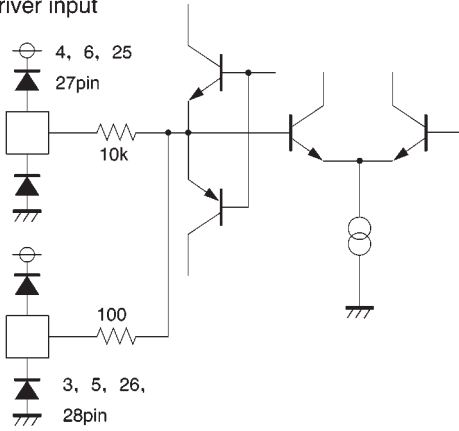
| Pin No. | Pin name | Function | Pin No. | Pin name | Function |
|---------|-----------------|--|---------|-----------------|--|
| 1 | V _{cc} | V _{cc} | 15 | VO4 (+) | Driver channel 4 positive output |
| 2 | BIAS IN | Bias amplifier input | 16 | VO4 (-) | Driver channel 4 negative output |
| 3 | VIN1' | Driver channel 1 gain adjustment input | 17 | VO3 (+) | Driver channel 3 positive output |
| 4 | VIN1 | Driver channel 1 input | 18 | VO3 (-) | Driver channel 3 negative output |
| 5 | VIN2' | Driver channel 2 gain adjustment input | 19 | V _{cc} | V _{cc} |
| 6 | VIN2 | Driver channel 2 input | 20 | N.C. | — |
| 7 | GND | Ground | 21 | GND | Ground |
| 8 | GND | Ground | 22 | OP IN (+) | Operational amplifier positive input |
| 9 | MUTE | Mute control | 23 | OP IN (-) | Operational amplifier negative input |
| 10 | V _{cc} | V _{cc} | 24 | OP OUT | Operational amplifier output |
| 11 | VO2 (-) | Driver channel 2 negative output | 25 | VIN3 | Driver channel 3 input |
| 12 | VO2 (+) | Driver channel 2 positive output | 26 | VIN3' | Driver channel 3 gain adjustment input |
| 13 | VO1 (-) | Driver channel 1 negative output | 27 | VIN4 | Driver channel 4 input |
| 14 | VO1 (+) | Driver channel 1 positive output | 28 | VIN4' | Driver channel 4 gain adjustment input |

Note: Positive and negative output of the driver is relative to the polarity of the input pins.

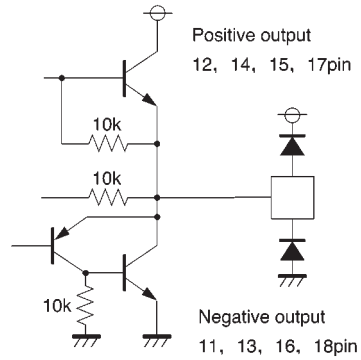
When the input pin is at the high level, the negative output pin is at the low level and the positive output pin at the high level.

● Pin equivalent circuit diagrams

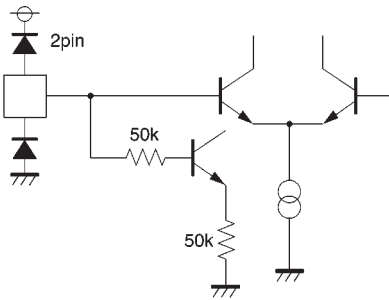
Driver input



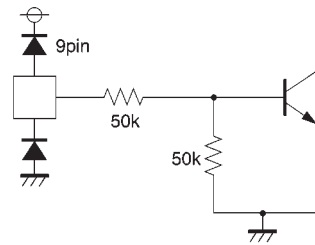
Driver output



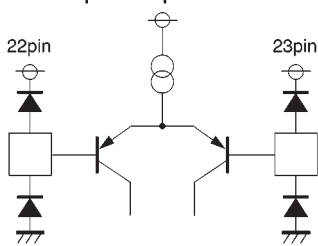
Bias



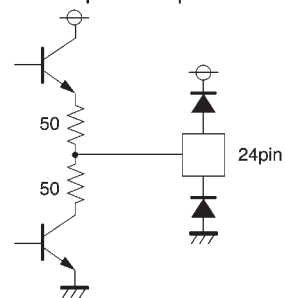
Mute



Operational amplifier input



Operational amplifier output



● Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $\text{BIAS} = 2.5\text{V}$, $R_L = 8\Omega$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|-------------------------------|------------|------|------|------|------------------|---|
| Quiescent current dissipation | I_{CC} | — | 13 | 20 | mA | No load |
| Output offset voltage | V_{OO} | −40 | — | 40 | mV | |
| Maximum output amplitude | V_{OM} | 3.1 | 3.6 | — | V | |
| Closed loop voltage gain | G_{VC} | 10.4 | 11.8 | 13.2 | dB | $V_{in} = 0.1V_{rms}$, 1kHz |
| Mute-on voltage | V_{MON} | — | — | 0.5 | V | |
| Mute-off voltage | V_{MOFF} | 2.0 | — | — | V | |
| 〈Operational amplifier〉 | | | | | | |
| Offset voltage | V_{OFOP} | −6 | 0 | 6 | mV | |
| Input bias current | V_{BOP} | — | — | 300 | nA | |
| Output high level voltage | V_{OHOP} | 3.9 | 4.35 | — | V | |
| Output low level voltage | V_{OLOP} | — | 0.75 | 1.1 | V | |
| Output drive current (sink) | I_{SI} | 10 | 30 | — | mA | V_{CC} at 50Ω |
| Output drive current (source) | I_{SO} | 10 | 25 | — | mA | Ground at 50Ω |
| Slew rate | SR_{OP} | — | 1 | — | V/ μs | 100 kHz square wave, 2 V_{P-P} output |

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● Measurement circuit

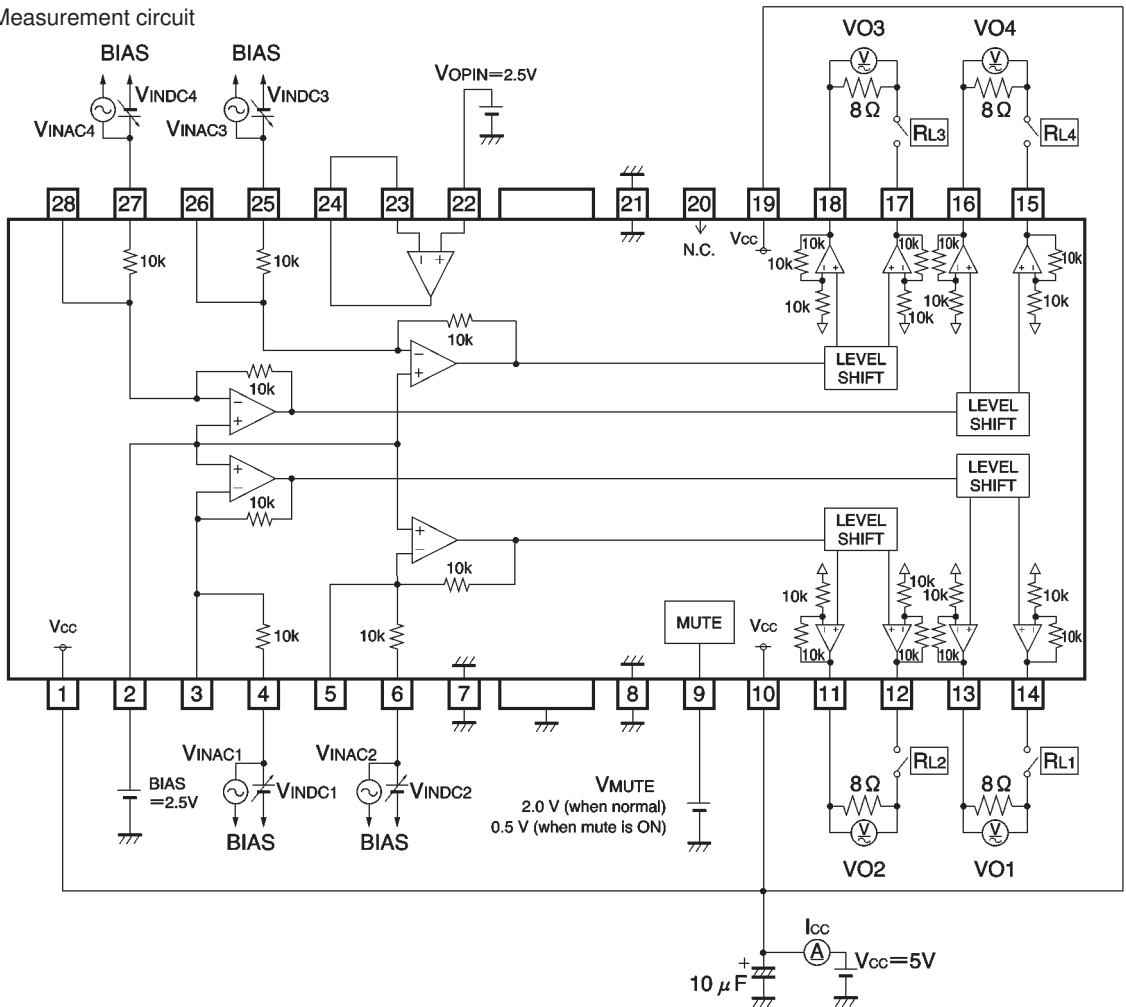


Fig. 1 Driver measurement circuit

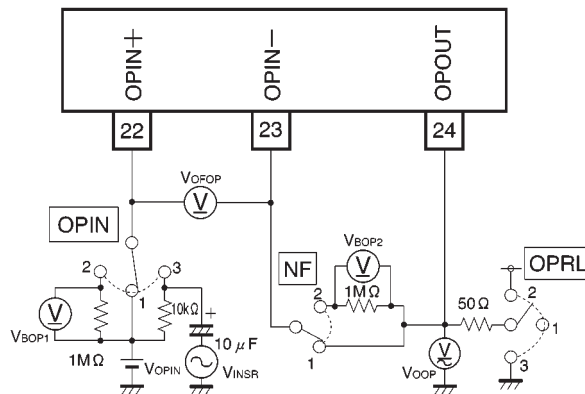


Fig. 2 Operational amplifier measurement circuit

● Measurement circuit switch table

(1) Driver (OPIN→1, NF→1, OPRL→1, VOPIN = 2.5V)

| Symbol | Switch | Input | Note | Test point |
|-----------------|--------|-------------------|---|-------------------|
| | RL | V _{INDC} | | |
| I _{CC} | OFF | — | | I _{CC} |
| V _{OO} | ON | 0V | | V _{O1~4} |
| V _{OM} | ↓ | ±2.5V | | V _{O1~4} |
| G _{VC} | ↓ | — | V _{INAC} =0.1V _{rms} , 1kHz | V _{O1~4} |

(2) Operational amplifier (R_L→OFF)

| Symbol | Switch | | | Input | Note | Test point |
|-------------------|--------|----|------|-------|---|---------------------|
| | OPIN | NF | OPRL | VOPIN | | |
| V _{OFOP} | 1 | 1 | 1 | 2.5V | | V _{OFOP} |
| V _{BOP} | 2 | 2 | 1 | 2.5V | | V _{BOP1~2} |
| V _{OHOP} | 1 | 1 | 1 | 5V | | V _{OOP} |
| V _{OLOP} | 1 | 1 | 1 | 0V | | V _{OOP} |
| I _{SI} | 1 | 1 | 2 | 2.5V | | V _{OOP} |
| I _{SO} | 1 | 1 | 3 | 2.5V | | V _{OOP} |
| S _{ROP} | 3 | 1 | 1 | 2V | V _{INSR} = 100 kHz, square wave, 2 V _{P-P} output | V _{OOP} |

●Application example

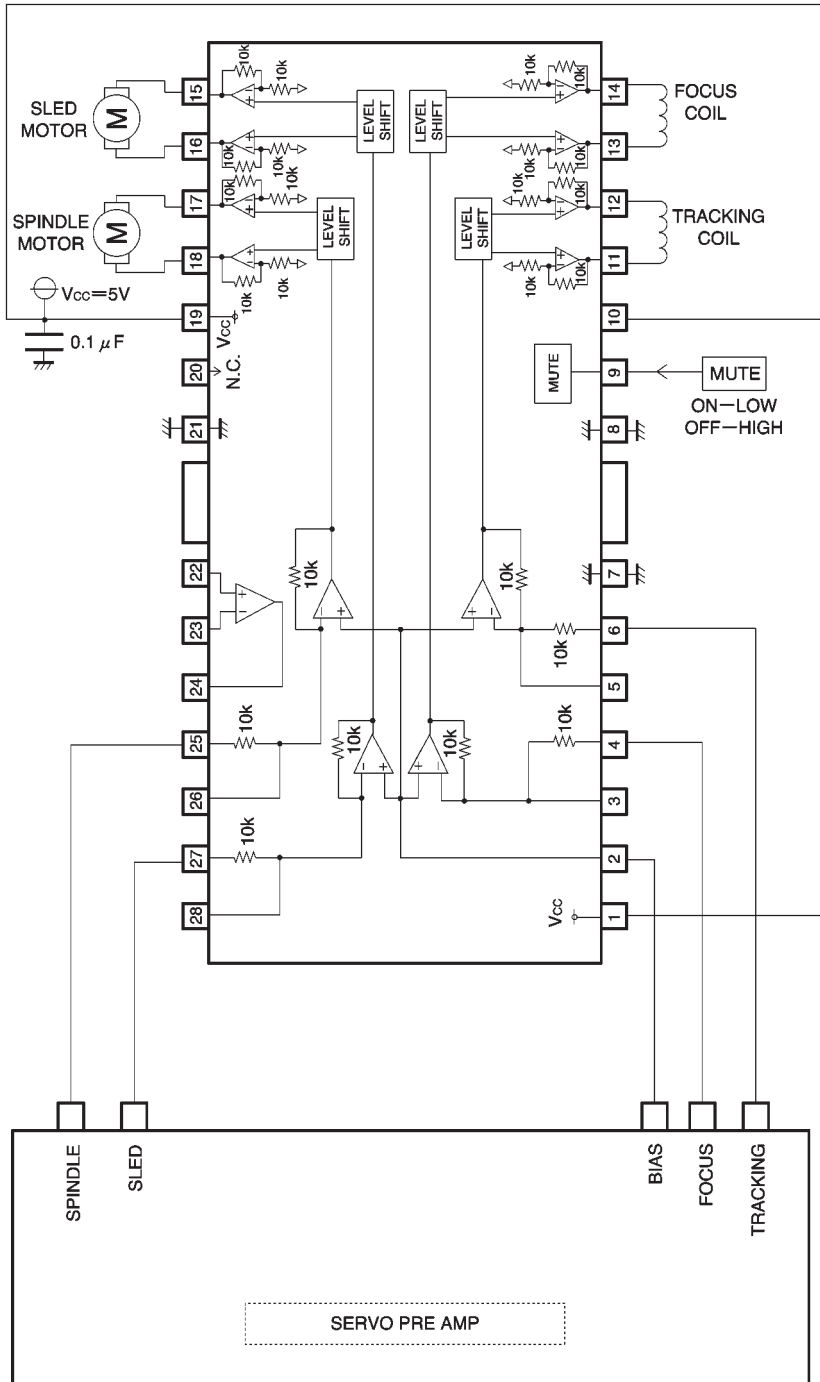


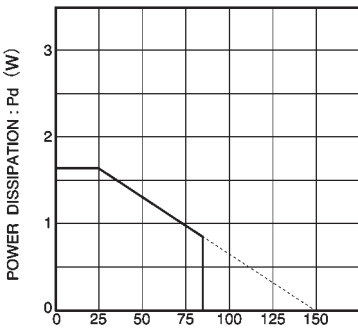
Fig. 3

● Operation notes

- (1) The BA5921FP has a thermal shutdown circuit. The output current is muted when the chip temperature rises above 175°C (typically). When the chip temperature falls to 150°C (typically), the driver circuit starts up again.
- (2) The output current can be muted by opening the mute pin (pin 9) or lowering it below 0.5V. During ordinary use, pin 9 should be pulled up above 2.0V.
- (3) Muting also occurs when the bias pin (pin 2) drops below 1.4V (typically). Make sure it stays above 1.7V during normal use.

- (4) The internal circuits turn off when the supply voltage drops below 3.8V (typically), and turn on again when it rises above 4.0V (typically).
- (5) Muting occurs during thermal shutdown, mute-on operations or a drop in the bias pin voltage or supply voltage. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly $(V_{CC} - V_F)/2$.
- (6) Connect the IC to a 0.1μF bypass capacitor between power supplies, at the base of the IC.
- (7) The radiating fin is connected to the package's internal GND, but should also be connected to an external ground.

● Electrical characteristic curves



AMBIENT TEMPERATURE : T_a (°C)
When mounted on a 50×50×1 mm paper phenol board.

Fig. 4 Thermal derating curve

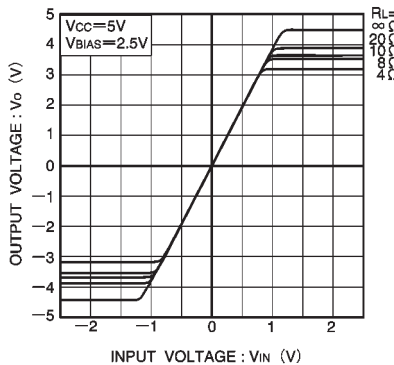


Fig. 5 Driver I/O characteristics

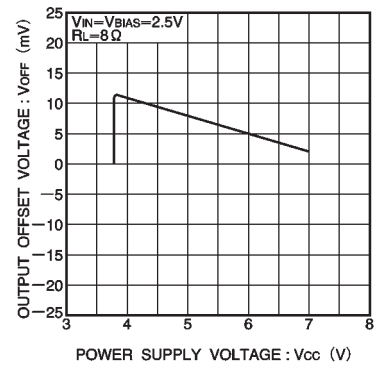


Fig. 6 Power supply voltage vs. output offset voltage

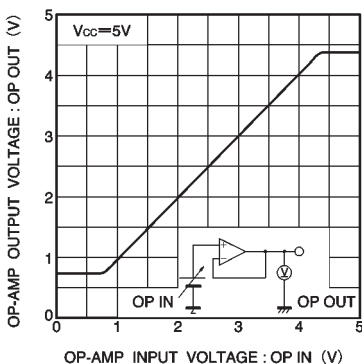


Fig. 7 Operational amplifier I/O characteristics

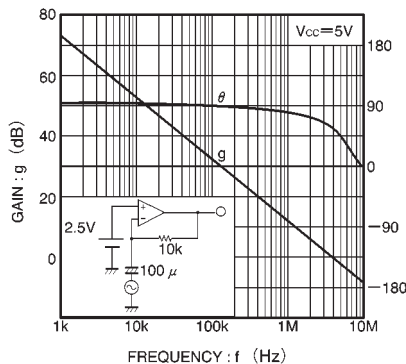


Fig. 8 Operational amplifier vs. open loop

● External dimensions (Units: mm)

