

# 4-channel BTL driver for CD players and CD-ROM drives

## BA5913FP-Y

The BA5913FP-Y 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 25-pin HSOP package allows for application miniaturization.

### ●Applications

CD players, CD-ROM drives

### ●Features

- 1) 4-channel BTL driver.
- 2) Wide dynamic range (typically 3.6V when  $V_{CC} = 5V$  and  $R_L = 8\Omega$ ).
- 3) Internal thermal shutdown circuit.
- 4) Gain is adjustable with attached resistor.
- 5) Internal standard operational amplifier.
- 6) Can enter power save mode with standby pin.
- 7) HSOP 25-pin power package allows for application miniaturization.

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

| Parameter             | Symbol    | Limits          | Unit             |
|-----------------------|-----------|-----------------|------------------|
| Power supply voltage  | $V_{CC}$  | 7               | V                |
| Power dissipation     | $P_d$     | 1.45*1          | W                |
| Operating temperature | $T_{opr}$ | $-35 \sim +85$  | $^\circ\text{C}$ |
| Storage temperature   | $T_{stg}$ | $-55 \sim +150$ | $^\circ\text{C}$ |

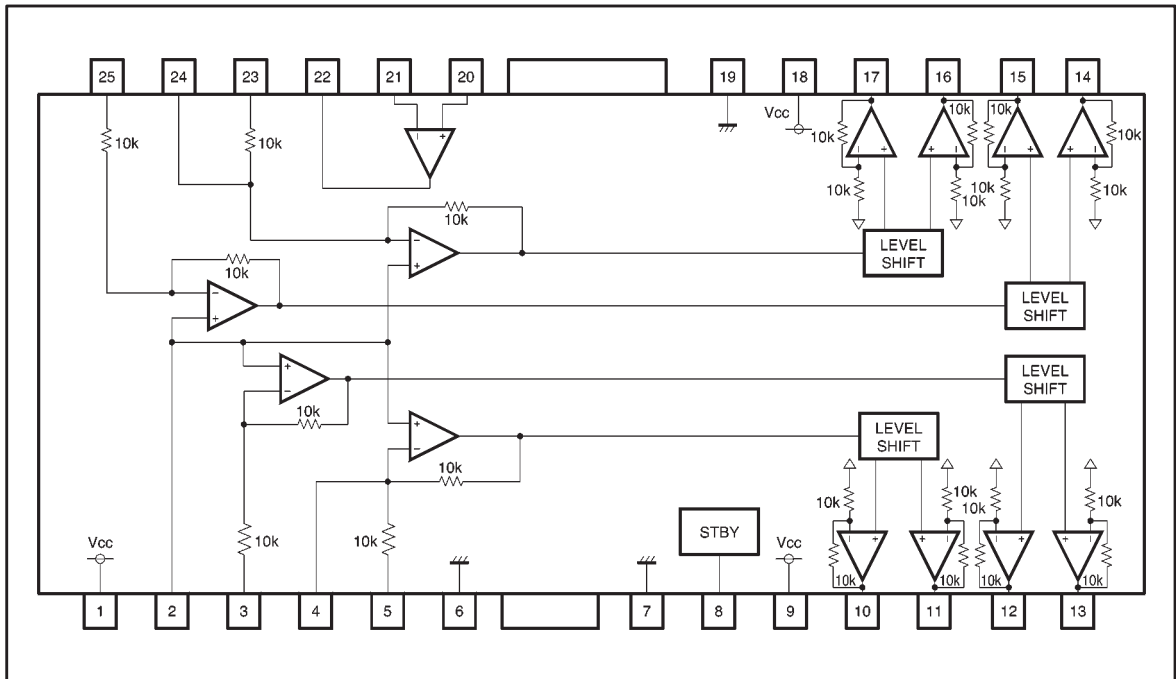
\*1 When mounted on a 70mm×70mm×1.5mm glass epoxy board with less than 3% foil coverage.

Reduced by 11.6mW for each increase increase in  $T_a$  of  $1^\circ\text{C}$  over  $25^\circ\text{C}$ .

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

| Parameter            | Symbol   | Min. | Typ. | Max. | Unit |
|----------------------|----------|------|------|------|------|
| Power supply voltage | $V_{CC}$ | 4.3  | 5    | 6.6  | V    |

## ●Block diagram



## ●Pin descriptions

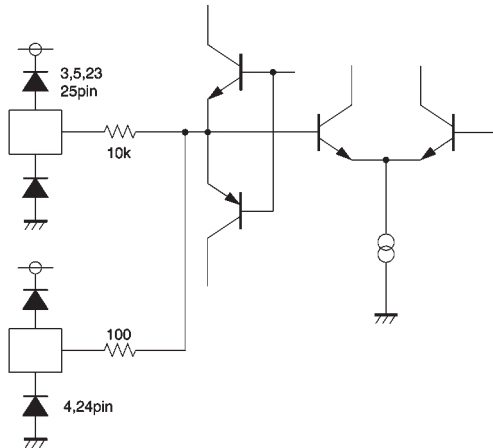
| Pin No. | Pin name           | Function                               | Pin No. | Pin name           | Function                               |
|---------|--------------------|----------------------------------------|---------|--------------------|----------------------------------------|
| 1       | V <sub>CC</sub>    | V <sub>CC</sub>                        | 14      | VO4 (+)            | Driver channel 4 positive output       |
| 2       | BIAS IN            | Bias amplifier input                   | 15      | VO4 (-)            | Driver channel 4 negative output       |
| 3       | V <sub>IN1</sub>   | Driver channel 1 input                 | 16      | VO3 (+)            | Driver channel 3 positive output       |
| 4       | V <sub>IN2</sub> ' | Driver channel 2 gain adjustment input | 17      | VO3 (-)            | Driver channel 3 negative output       |
| 5       | V <sub>IN2</sub>   | Driver channel 2 input                 | 18      | V <sub>CC</sub>    | V <sub>CC</sub>                        |
| 6       | GND                | Ground                                 | 19      | GND                | Ground                                 |
| 7       | GND                | Ground                                 | 20      | OP IN (+)          | Operational amplifier positive input   |
| 8       | STBY               | Standby control                        | 21      | OP IN (-)          | Operational amplifier negative input   |
| 9       | V <sub>CC</sub>    | V <sub>CC</sub>                        | 22      | OP OUT             | Operation amplifier output             |
| 10      | VO2 (-)            | Driver channel 2 negative output       | 23      | V <sub>IN3</sub>   | Driver channel 3 input                 |
| 11      | VO2 (+)            | Driver channel 2 positive output       | 24      | V <sub>IN3</sub> ' | Driver channel 3 gain adjustment input |
| 12      | VO1 (-)            | Driver channel 1 negative output       | 25      | V <sub>IN4</sub>   | Driver channel 4 input                 |
| 13      | VO1 (+)            | Driver channel 1 positive output       |         |                    |                                        |

Note : The "driver positive output " and "driver negative output " indicate polarity relative the input.

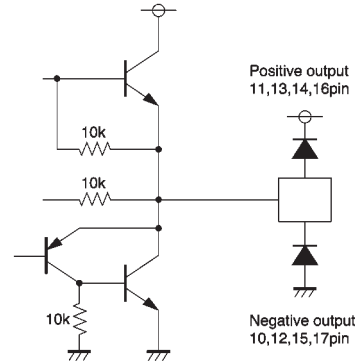
When the input pin is at the high level, the negative output pin is at the low level and the positive output pin is at the high level.

## ● Input / output circuit diagrams

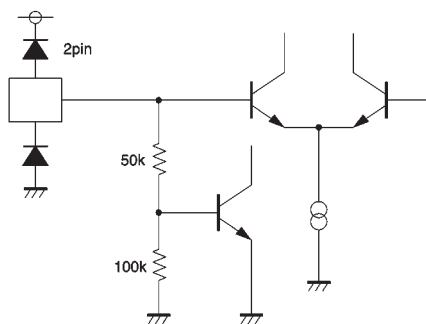
Driver input



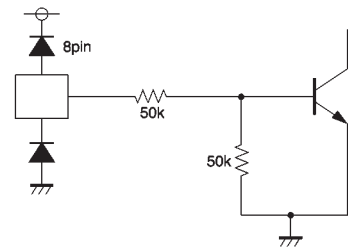
Driver output



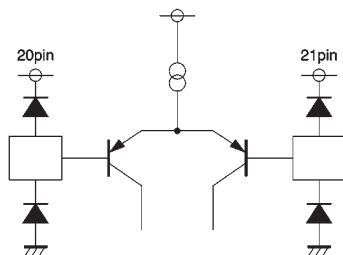
Bias



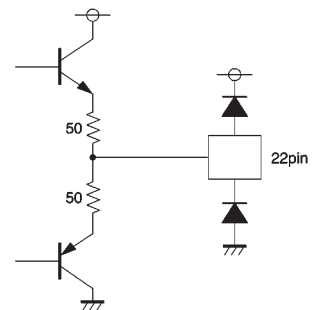
Standby



Operational amplifier input



Operational amplifier output



●Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>CC</sub> = 5V, BIAS = 2.5V, R<sub>L</sub> = 8Ω)

| Parameter                          | Symbol             | Min. | Typ. | Max. | Unit   | Conditions                                   | Measurement circuit |
|------------------------------------|--------------------|------|------|------|--------|----------------------------------------------|---------------------|
| Current dissipation during standby | I <sub>ST</sub>    | —    | —    | 200  | μA     | —                                            | Fig.1               |
| Quiescent current                  | I <sub>CC</sub>    | —    | 13   | 20   | mA     | No load                                      | Fig.1               |
| Output offset voltage              | V <sub>OO</sub>    | —40  | —    | 40   | mV     | —                                            | Fig.1               |
| Maximum output amplitude           | V <sub>OM</sub>    | 3.1  | 3.6  | —    | V      | —                                            | Fig.1               |
| Closed loop voltage gain           | G <sub>VC</sub>    | 10.4 | 11.8 | 13.2 | dB     | V <sub>IN</sub> =0.1Vrms, 1kHz               | Fig.1               |
| Standby voltage                    | V <sub>STBY</sub>  | —    | —    | 0.5  | V      | —                                            | Fig.1               |
| Standby release voltage            | V <sub>STOFF</sub> | 2.0  | —    | —    | V      | —                                            | Fig.1               |
| 〈Operation amplifier〉              |                    |      |      |      |        |                                              |                     |
| Offset voltage                     | V <sub>OFOF</sub>  | —6   | 0    | 6    | mV     | —                                            | Fig.2               |
| Input bias current                 | V <sub>BOP</sub>   | —    | —    | 300  | nA     | —                                            | Fig.2               |
| Output high level voltage          | V <sub>OHO</sub>   | 3.9  | 4.35 | —    | V      | —                                            | Fig.2               |
| Output low level voltage           | V <sub>OLO</sub>   | —    | 0.75 | 1.1  | V      | —                                            | Fig.2               |
| Output drive current (sink)        | I <sub>SI</sub>    | 10   | 30   | —    | mA     | V <sub>CC</sub> at 50 Ω                      | Fig.2               |
| Output drive current (source)      | I <sub>SO</sub>    | 10   | 25   | —    | mA     | Ground at 50 Ω                               | Fig.2               |
| Slew rate                          | S <sub>ROP</sub>   | —    | 1    | —    | V / μs | 100kHz square wave, 2V <sub>P-P</sub> output | Fig.2               |

©Not designed for radiation resistance.

Fig.1 Driver measurement circuit

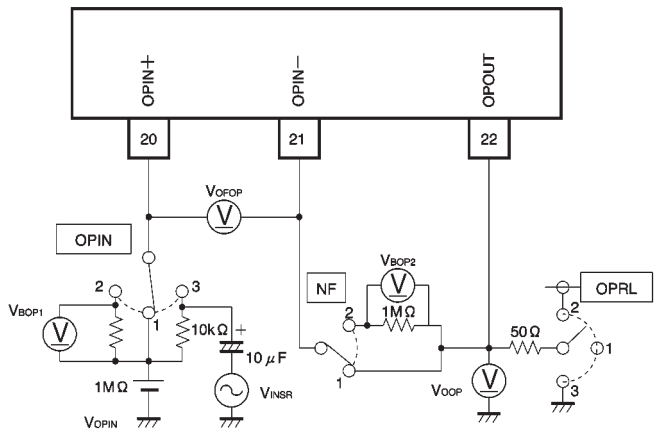


Fig.2 Operational amplifier measurement circuit

Measurement circuit switch table

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

| Symbol          | Switch | Input | Note                                          | Test point        |
|-----------------|--------|-------|-----------------------------------------------|-------------------|
|                 | RL     | VINDC |                                               |                   |
| I <sub>ST</sub> | OFF    | —     | V <sub>STBY</sub> =0.5V                       | I <sub>CC</sub>   |
| I <sub>CC</sub> | OFF    | —     | —                                             | I <sub>CC</sub>   |
| V <sub>OO</sub> | ON     | 0V    | —                                             | V <sub>O1~4</sub> |
| V <sub>OM</sub> | ↓      | ±2.5V | —                                             | V <sub>O1~4</sub> |
| G <sub>VC</sub> | ↓      | —     | V <sub>INAC</sub> =0.1V <sub>rms</sub> , 1kHz | V <sub>O1~4</sub> |

(2) Operational amplifier (RL → OFF)

| Symbol            | Switch |    |      | Input             | Note                                                             | Test point          |
|-------------------|--------|----|------|-------------------|------------------------------------------------------------------|---------------------|
|                   | OPIN   | NF | OPRL | V <sub>OPIN</sub> |                                                                  |                     |
| V <sub>OFOp</sub> | 1      | 1  | 1    | 2.5V              | —                                                                | V <sub>OFOp</sub>   |
| V <sub>BOP</sub>  | 2      | 2  | 1    | 2.5V              | —                                                                | V <sub>BOP1~2</sub> |
| V <sub>OHOp</sub> | 1      | 1  | 1    | 5V                | —                                                                | V <sub>OOp</sub>    |
| V <sub>OLOp</sub> | 1      | 1  | 1    | 0V                | —                                                                | V <sub>OOp</sub>    |
| I <sub>SI</sub>   | 1      | 1  | 2    | 2.5V              | —                                                                | V <sub>OOp</sub>    |
| I <sub>SO</sub>   | 1      | 1  | 3    | 2.5V              | —                                                                | V <sub>OOp</sub>    |
| S <sub>ROp</sub>  | 3      | 1  | 1    | 2V                | V <sub>INSR</sub> =100kHz, square wave, 2V <sub>P-P</sub> output | V <sub>OOp</sub>    |

## ●Application example

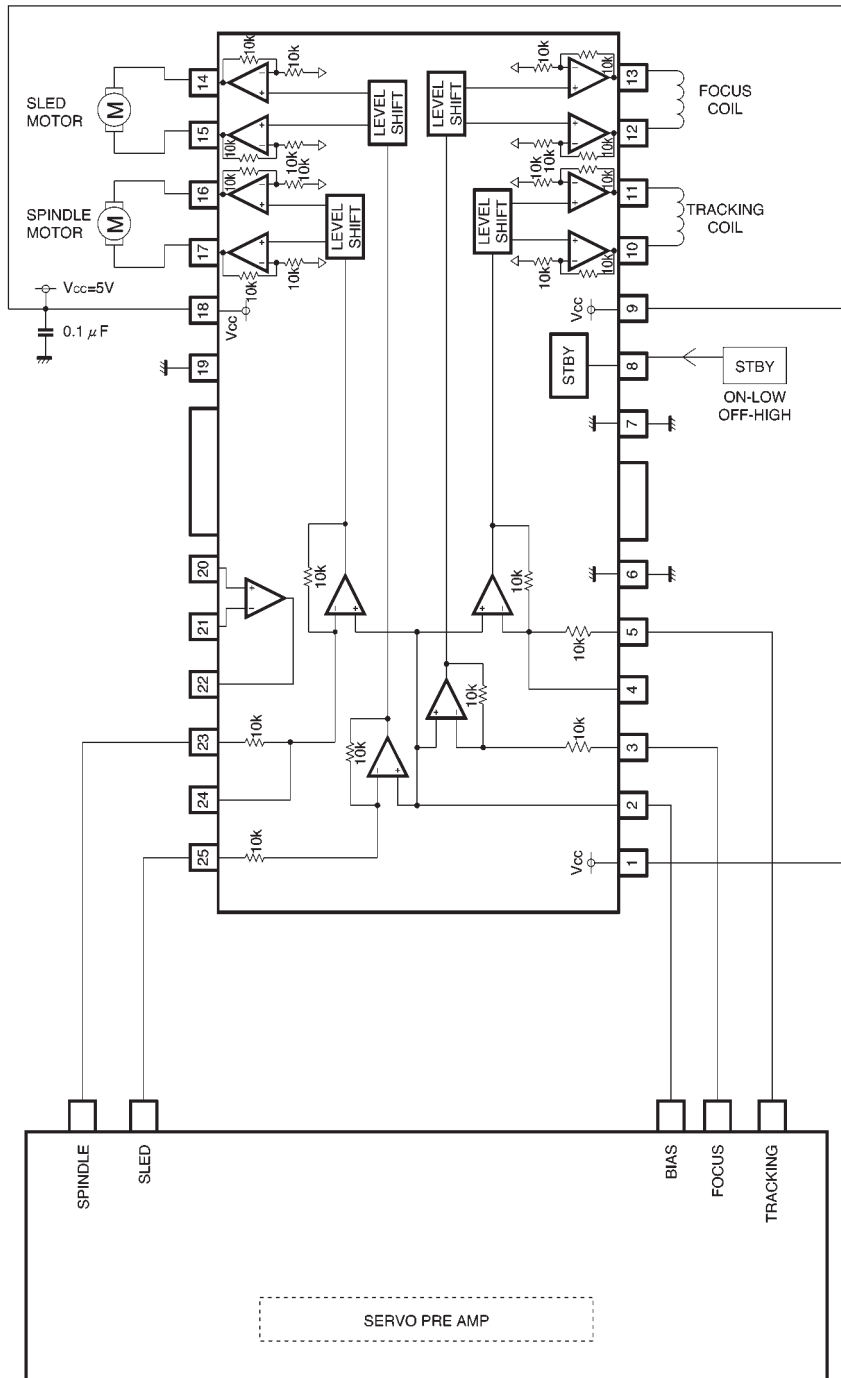


Fig.3

### ● Operation notes

(1) The BA5913FP-Y 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) Can be set that if the voltage of the standby pin (pin 8) is open or falls below 0.5V, the driver turns off and enters the power save mode. During normal operation, have pin 8 pulled up to over 2.0V.

(3) Muting occurs when the bias pin (pin 2) drops below 1.0V (typically). Make sure it stays above 1.4V during normal use.

(4) Muting occurs during thermal shutdown or a drop in the bias pin voltage. In each case, only drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly  $(V_{CC}-V_F) / 2$ .

(5) Connect the IC to a 0.1μF bypass capacitor between power supplies, at the base of the IC.

(6) Connect the heat radiation fin to an external ground.

### ● Electrical characteristic curves

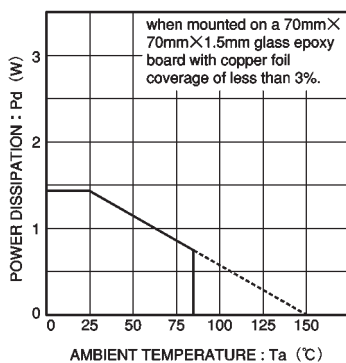


Fig.4 Thermal derating curve

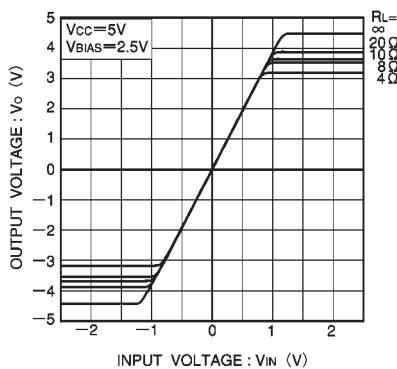


Fig.5 Driver I/O characteristics

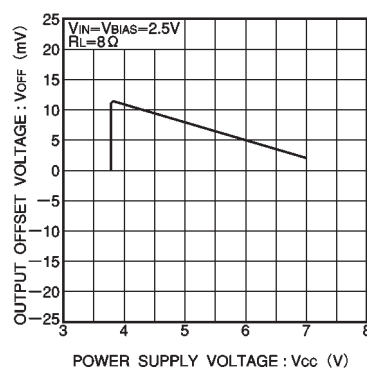


Fig.6 Power supply voltage vs. output offset voltage

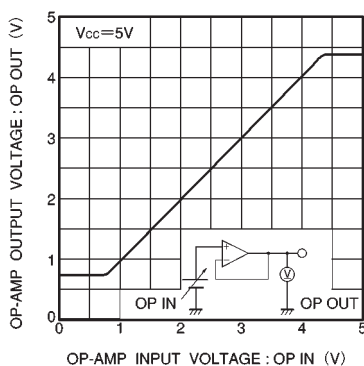


Fig.7 Operational amplifier I/O characteristics

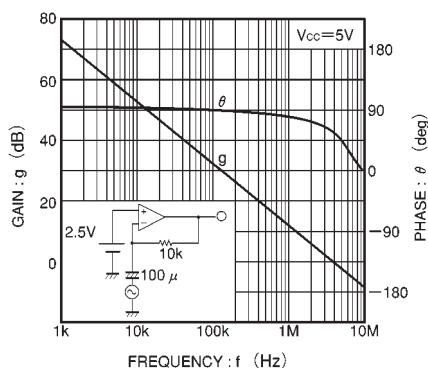


Fig.8 Operational amplifier open loop characteristics

●External dimensions (Units: mm)

