

# 5-channel BTL driver for CD players

## BA6796FP

The BA6796FP, an IC designed for CD and MD players, has a 5-channel BTL power driver and a standard operational amplifier. The spindle and tray driver share a single output buffer, and are specified with a control pin. In addition, the internal level shift circuit reduces the number of attached components.

### ●Applications

CD players, CD-ROM drives, MD players and other optical disc devices

### ●Features

- 1) 5-channel BTL driver in a 28-pin HSOP package, allowing for application miniaturization.
- 2) The five drivers are turned on and off according to control pin logic combinations.
- 3) The tray driver operates even when the servo power supply drops.
- 4) Internal thermal shutdown circuit.
- 5) Gain is adjustable with an attached resistor.
- 6) Internal standard operational amplifier.

### ●Absolute maximum ratings (Ta=25°C)

| Parameter                   | Symbol | Limits  | Unit |
|-----------------------------|--------|---------|------|
| Power supply voltage        | Vcc    | 18      | V    |
| Power dissipation           | Pd     | 1.7*    | W    |
| Operating temperature range | Topr   | −35~85  | °C   |
| Storage temperature range   | Tstg   | −55~150 | °C   |

\* When mounted to a 50 × 50 × 1 mm paper phenol board  
Reduced by 13.6 mW for each increase in Ta of 1°C over 25°C.

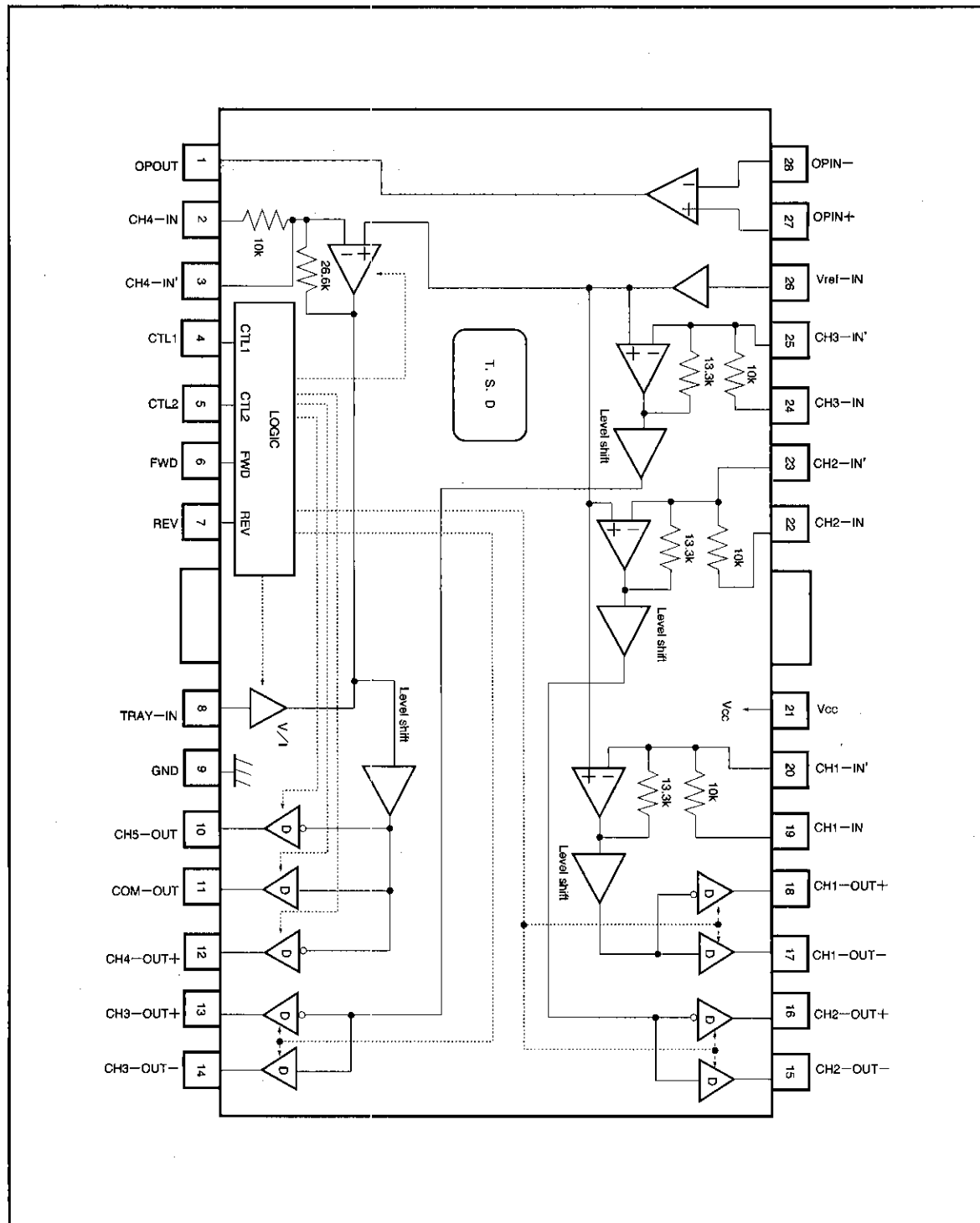
### ●Recommended operating conditions (Ta=25°C)

| Parameter            | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|--------|------|------|------|------|
| Power supply voltage | Vcc    | 4.8  | —    | 12   | V    |

CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs

## ●Block diagram



## ● Pin description

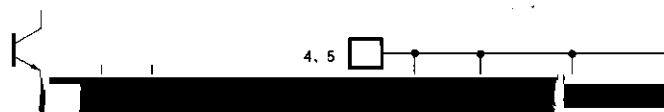
| Pin No. | Pin name        | Function                                       |
|---------|-----------------|------------------------------------------------|
| 1       | OPOUT           | Operational amplifier                          |
| 2       | CH4—IN          | Channel 4 input                                |
| 3       | CH4—IN'         | Channel 4 gain adjustment input                |
| 4       | CTL1            | Control 1 input                                |
| 5       | CTL2            | Control 2 input                                |
| 6       | FWD             | Tray forward input                             |
| 7       | REV             | Tray reverse input                             |
| 8       | TRAY—IN         | Tray input                                     |
| 9       | GND             | Substrate ground                               |
| 10      | CH5—OUT—        | Tray negative output                           |
| 11      | COM—OUT         | Tray positive output/channel 4 negative output |
| 12      | CH4—OUT+        | Channel 4 positive output                      |
| 13      | CH3—OUT+        | Channel 3 positive output                      |
| 14      | CH3—OUT—        | Channel 3 negative output                      |
| 15      | CH2—OUT—        | Channel 2 negative output                      |
| 16      | CH2—OUT+        | Channel 2 positive output                      |
| 17      | CH1—OUT—        | Channel 1 negative output                      |
| 18      | CH1—OUT+        | Channel 1 positive output                      |
| 19      | CH1—IN          | Channel 1 input                                |
| 20      | CH1—IN'         | Channel 1 gain adjustment                      |
| 21      | V <sub>CC</sub> | V <sub>CC</sub>                                |
| 22      | CH2—IN          | Channel 2 input                                |
| 23      | CH2—IN'         | Channel 2 gain adjustment                      |
| 24      | CH3—IN          | Channel 3 input                                |
| 25      | CH3—IN'         | Channel 3 gain adjustment input                |
| 26      | VREF—IN         | Bias amplifier input                           |
| 27      | OPIN+           | Operational amplifier non-inverted input       |
| 28      | OPIN—           | Operational amplifier inverted input           |

\* "Driver positive output" and "driver negative output" indicate polarity relative to input.  
(For example, pin 18 outputs the high level when the high level is input to pin 19.)

CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs

## ● Input/output circuits



● Electrical characteristics (Unless otherwise noted, Ta=25°C, Vcc=8V, f=1kHz, RL=8Ω)

| Parameter                  | Symbol | Min. | Typ. | Max. | Unit | Conditions                              |
|----------------------------|--------|------|------|------|------|-----------------------------------------|
| Quiescent current          | Icc    | 8.5  | 11.5 | 14.5 | mA   | No load                                 |
| Output offset voltage 1    | Voo    | -40  | —    | 40   | mV   | CH1~CH3                                 |
| Output offset voltage 2    | Voo    | -100 | —    | 100  | mV   | CH4                                     |
| Max. output pin voltage 1  | VOHD1  | 3.7  | 4.3  | —    | V    | Vin=Vcc                                 |
| Max. output pin voltage 2  | VOHD2  | —    | -4.3 | -3.7 | V    | Vin=GND                                 |
| Closed loop voltage gain 1 | GVC1   | 6.5  | 8.0  | 9.5  | dB   | Vin=0.1Vrms, 1kHz (excluding channel 4) |
| Closed loop voltage gain 2 | GVC2   | 11.5 | 14.0 | 16.5 | dB   | Vin=0.1Vrms, 1kHz (CH4)                 |
| Ripple rejection rate      | RR     | —    | 60   | —    | dB   | Vin=0.1Vrms, 100Hz                      |
| Slew rate                  | SR     | —    | 2.0  | —    | V/μS | 100 Hz square wave, 3 Vp-p output       |

〈Tray driver〉

|                        |      |      |      |      |    |                                        |
|------------------------|------|------|------|------|----|----------------------------------------|
| Output voltage F       | Vof  | 2.5  | 3.0  | 3.5  | V  | Pin 8 voltage = 3 V                    |
| Output voltage R       | VOR  | -3.5 | -3.0 | -2.5 | V  | Pin 8 voltage = 3 V                    |
| Output voltage range F | VOMF | 3.7  | 4.3  | —    | V  | Pin 8 voltage = 5 V                    |
| Output voltage range R | VOMR | —    | -4.3 | -3.7 | V  | Pin 8 voltage = 5 V                    |
| Load regulation F      | ΔVFI | —    | 250  | 500  | mV | IL = 100-400 mA, pin 8 voltage = 2.5 V |
| Load regulation R      | ΔVRI | —    | 250  | 500  | mV | IL = 100-400 mA, pin 8 voltage = 2.5 V |
| Line regulation F      | ΔVFL | —    | 300  | 600  | mV | Vcc=5V~12V                             |
| Line regulation R      | ΔVRL | —    | 300  | 600  | mV | Vcc=5V~12V                             |
| Output offset voltage  | VOOL | -50  | —    | 50   | mV | Braked, output voltage                 |

〈Logic: CTL1, CTL2, FWD, REV〉

|                           |     |      |   |     |    |                         |
|---------------------------|-----|------|---|-----|----|-------------------------|
| Input voltage, high level | VIH | 2.0  | — | 8.0 | V  | Maximum value up to Vcc |
| Input voltage, low level  | VIL | -0.3 | — | 0.5 | V  |                         |
| Input current, high level | IiH | —    | — | 500 | μA |                         |
| Input current, low level  | IiL | —    | — | 500 | μA |                         |

〈Operational amplifier〉

|                               |       |     |    |     |      |                                   |
|-------------------------------|-------|-----|----|-----|------|-----------------------------------|
| Offset voltage                | VOFOP | -5  | 0  | 5   | mV   |                                   |
| Input bias current            | IbIAS | —   | —  | 300 | nA   |                                   |
| Output voltage, high level    | VOHOP | 6.0 | —  | —   | V    |                                   |
| Output voltage, low level     | VOLOP | —   | —  | 1.8 | V    |                                   |
| Output drive current (source) | IosO  | 10  | 40 | —   | mA   | 50Ω at GND                        |
| Output drive current (sink)   | IosI  | 10  | 50 | —   | mA   | 50Ω at Vcc                        |
| Open loop voltage gain        | Gvo   | —   | 78 | —   | dB   | Vin=-75dBV, 1kHz                  |
| Slew rate                     | SRop  | —   | 1  | —   | V/μS | 100 Hz square wave, 4 Vp-p output |
| Ripple rejection              | RRop  | —   | 65 | —   | dB   | Vin=0.1Vrms, 100Hz                |
| Common mode rejection ratio   | CMRR  | —   | 84 | —   | dB   | Vin=0.1Vrms, 1kHz                 |

◎ Not designed for radiation resistance.

CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs

The diagram illustrates the BA6796FP integrated circuit with various test points and measurement locations. Key components and connections include:

- Power and Ground Connections:** Vcc and GND connections are shown at the top and bottom of the circuit.
- Measurement Points:** Numerous test points are labeled with 'V' (voltage) and 'A' (current) symbols, indicating where measurements should be taken.
- Control and Test Signals:** Signals like CH1 IN, CH2 IN, CH3 IN, and TRAY are shown with their respective connections to the IC pins.
- Resistors and Capacitors:** Various passive components are specified, including resistors (e.g., 10kΩ, 1MΩ, 100kΩ) and capacitors (e.g., 10μF, 100μF, 1000μF).
- Switches and Relays:** Switches labeled 'OFF' and 'ON' are used to control different parts of the circuit, along with relays like RL and RL'.
- Internal Circuitry:** The diagram shows the internal structure of the IC, including various functional blocks and their interconnections.

Fig. 1

## ● Measurement circuit switch table

| Parameter                     | Symbol            | RL  | RL' | CH1IN                   | CH2IN | CH3IN | CH4IN | TRAY | NF    | IB  | OPIN            | OPI             | GVO | RIP  |
|-------------------------------|-------------------|-----|-----|-------------------------|-------|-------|-------|------|-------|-----|-----------------|-----------------|-----|------|
| Quiescent current             | I <sub>CC</sub>   | OFF |     | OFF                     |       |       |       | OFF  | SHORT | ON  | OPEN            | OPEN            | OFF | NORM |
| Output offset voltage         | V <sub>OO</sub>   | ON  |     | DC (BIAS)               |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Max. output pin voltage 1     | V <sub>OH1</sub>  | ↓   |     | DC (GND)                |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Max. output pin voltage 2     | V <sub>OH2</sub>  | ↓   |     | DC (V <sub>CC</sub> )   |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Closed loop voltage gain 1    | G <sub>VC1</sub>  | ↓   |     | AC (0.1Vrms, 1kHz)      |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Closed loop voltage gain 2    | G <sub>VC2</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Ripple rejection rate         | RR                | ↓   |     | DC (BIAS)               |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | RIP  |
| Slew rate                     | SR                | ↓   |     | AC (100 Hz square wave) |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | NORM |
| 《Tray driver》                 |                   |     |     |                         |       |       |       |      |       |     |                 |                 |     |      |
| Output voltage F              | V <sub>OF</sub>   | ON  |     | DC (BIAS)               |       |       |       | ON   | SHORT | ON  | OPEN            | OPEN            | OFF | NORM |
| Output voltage R              | V <sub>OR</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Output voltage range F        | V <sub>OMF</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Output voltage range R        | V <sub>OMR</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Load regulation F             | ΔV <sub>FL</sub>  | ON  | OFF | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Load regulation R             | ΔV <sub>RL</sub>  | ↓   | ↓   | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Line regulation F             | ΔV <sub>FL</sub>  | ON  |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Line regulation R             | ΔV <sub>RL</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Output offset voltage         | V <sub>OO</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| 《Logic: CTL1, CTL2, FWD, REV》 |                   |     |     |                         |       |       |       |      |       |     |                 |                 |     |      |
| Input voltage, high level     | V <sub>IH</sub>   | OFF |     | OFF                     |       |       |       | OFF  | SHORT | ON  | OPEN            | OPEN            | OFF | NORM |
| Input voltage, low level      | V <sub>IL</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Input current, high level     | I <sub>IH</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| Input current, low level      | I <sub>IL</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | ↓               | ↓   | ↓    |
| 《Operational amplifier》       |                   |     |     |                         |       |       |       |      |       |     |                 |                 |     |      |
| Offset voltage                | V <sub>OFOP</sub> | OFF |     | OFF                     |       |       |       | OFF  | SHORT | ON  | OPEN            | OPEN            | OFF | NORM |
| Input bias current            | I <sub>BIAS</sub> | ↓   |     | ↓                       |       |       |       | ↓    | 1M    | OFF | ↓               | ↓               | ↓   | ↓    |
| Output voltage, high level    | V <sub>OHOP</sub> | ↓   |     | ↓                       |       |       |       | ↓    | 10k   | ON  | GND             | ↓               | ↓   | ↓    |
| Output voltage, low level     | V <sub>LOP</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | V <sub>CC</sub> | ↓               | ↓   | ↓    |
| Output drive current (source) | I <sub>OSO</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | SHORT | ↓   | OPEN            | GND             | ↓   | ↓    |
| Output drive current (sink)   | I <sub>OSI</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ↓   | ↓               | V <sub>CC</sub> | ↓   | ↓    |
| Open loop voltage gain        | G <sub>VO</sub>   | ↓   |     | ↓                       |       |       |       | ↓    | 10k   | ↓   | ↓               | OPEN            | ON  | ↓    |
| Slew rate                     | S <sub>ROP</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | SHORT | OFF | ↓               | ↓               | OFF | ↓    |
| Ripple rejection              | R <sub>ROP</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | ↓     | ON  | ↓               | ↓               | ↓   | RIP  |
| Common mode rejection ratio   | C <sub>MRR</sub>  | ↓   |     | ↓                       |       |       |       | ↓    | 1M    | OFF | ↓               | ↓               | ↓   | NORM |

\*1 Switch SG is on only when measuring the operational amplifier's S<sub>ROP</sub>.

\*2 Switch CMRR is on only when measuring the operational amplifier's CMRR.

CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs

● Functions  
CTL and CTL2

| CTL1 | CTL2 | CH1 | CH2 | CH3 | CH4 | CH5 |
|------|------|-----|-----|-----|-----|-----|
| L    | L    | OFF |     |     |     | ON  |
| L    | H    |     |     |     |     | ON  |
| H    | L    | ON  |     |     |     | OFF |
| H    | H    | OFF | ON  | OFF | ON  | ON  |

\* High-impedance output when off.

F and R (channel 5 control enabled only when channel 5 is on)

| F | R | Output mode    |
|---|---|----------------|
| L | L | High impedance |
| L | H | Reverse        |
| H | L | Forward        |
| H | H | Brake          |

## ● Application example

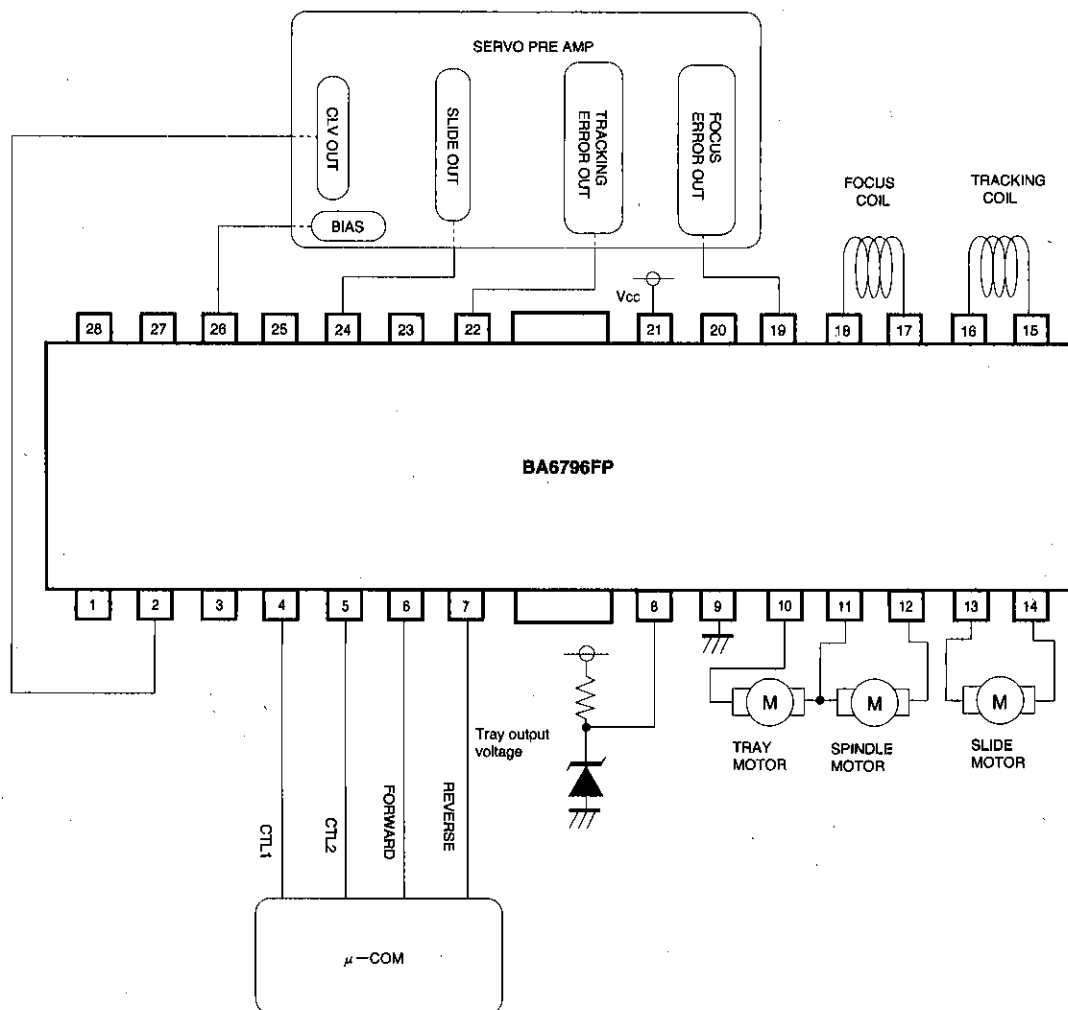


Fig. 2

CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs

## ● Operation notes

## 1. Setting the tray motor driver voltage (forward mode)

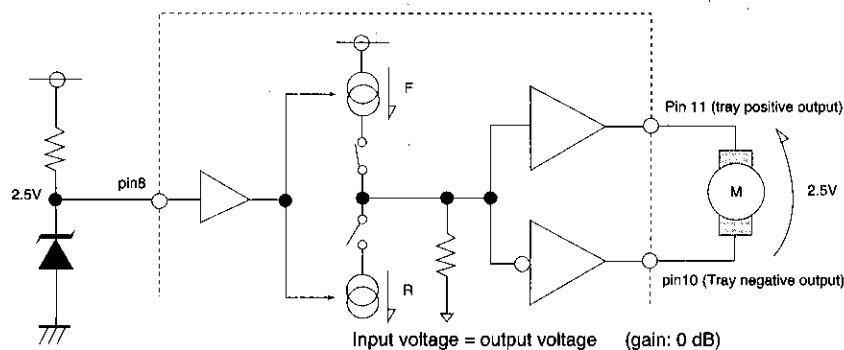


Fig. 3

Note: The tray driver output voltage will not exceed the power supply's maximum output voltage, even if set above this maximum voltage (refer to the following page). The example above applies only when setting below the maximum output voltage. Maximum output voltage for the power supply can be output by pulling up the tray Input pin (pin 8), or by connecting it to  $V_{CC}$ .

## 2. Mute functions

| Mute function                     | Muted channels |
|-----------------------------------|----------------|
| Thermal shutdown                  | All channels   |
| Muting during supply voltage drop | All channels   |
| Muting during bias voltage drop   | CH1-CH4        |

## 《Thermal shutdown》

The output current is muted when the chip temperature exceeds 175°C (typically).

## 《Supply voltage drop muting》

The internal circuits turn off when the supply voltage drops below 4.3V (typically), and turn on again when it rises above 4.5V (typically).

## 《Bias drop muting》

Muting also occurs when the bias pin voltage (26 pin) is lowered below 1.4V (typically). Be sure the voltage stays between 1.6V and 6.5V during normal operation.

3. Muting occurs during thermal shutdown and when the supply voltage or bias pin voltage drops. In each case, only the driver is muted. The output pin voltage during muting is the internal bias voltage, roughly  $V_{CC} - V_F/2$ .

4. Attach a 0.1  $\mu F$  bypass capacitor to the power supply, at the base of the IC.

5. Connect the radiating fin to an external ground.

## ● Electrical characteristic curves

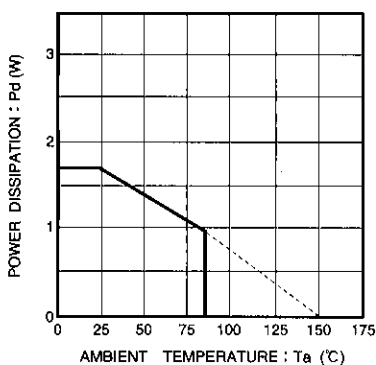
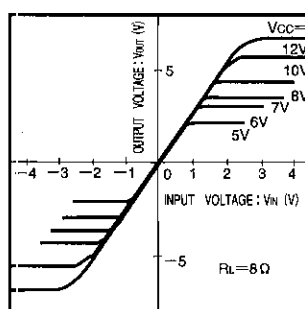
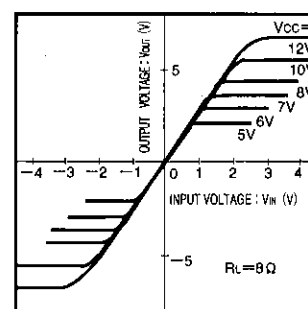


Fig. 4 Thermal derating curve

Fig. 5 CH1-CH3 Driver I/O characteristics  
(when variable supply voltage changes)Fig. 6 CH4 Driver I/O characteristics  
(when variable supply voltage changes)

### ●Electrical characterisitic curves

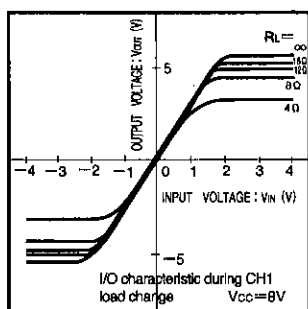
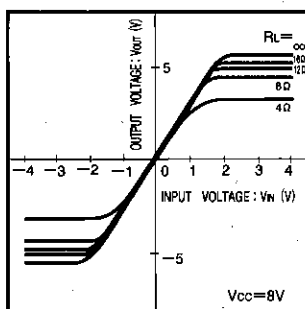
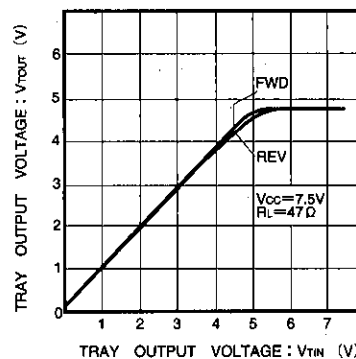


Fig. 7 CH1-CH3 Driver I/O characteristics (when load changes)



**Fig. 8 CH<sub>4</sub> Driver I/O characteristics (when load changes)**



**Fig. 9 Tray driver output characteristics**

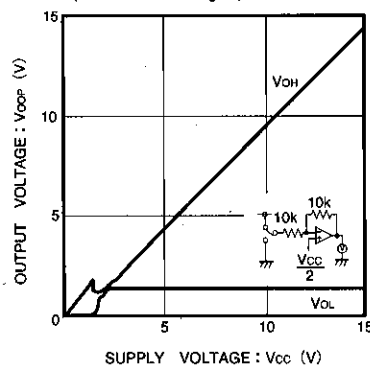
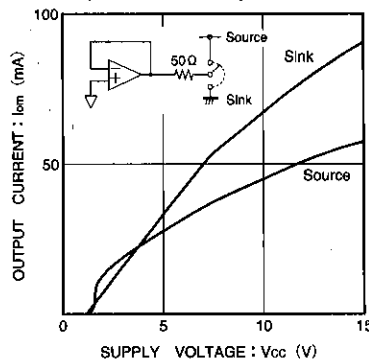
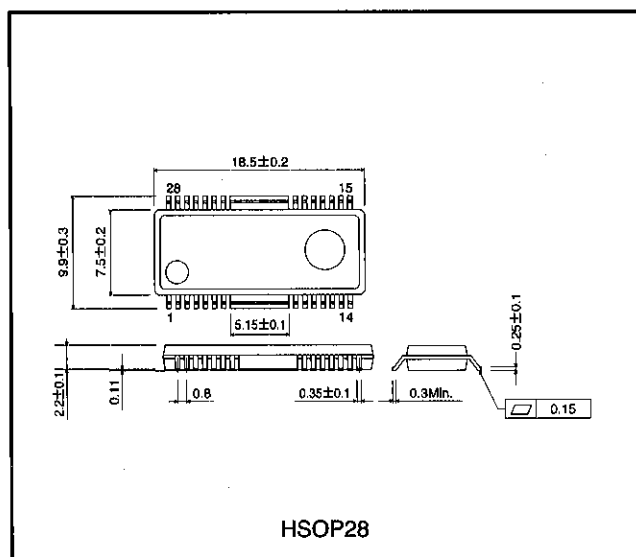


Fig. 10 Supply voltage vs.  
HIGH output/LOW output  
voltage



**Fig. 11 Supply voltage vs. operational amplifier output operating current**

●External Dimensions (Units: mm)



CD/CD-ROM Drivers (5~6 channels)

For CDs/CD-ROMs