

# 4-channel BTL driver for CD players

## BA6790FP / BA6791FP

The BA6790FP and BA6791FP are 4-channel BTL drivers for CD player actuators and motors. These ICs have internal 5 V regulators and general purpose operational amplifiers, and are mounted to a 28-pin HSOP package, allowing for the miniaturization of applications.

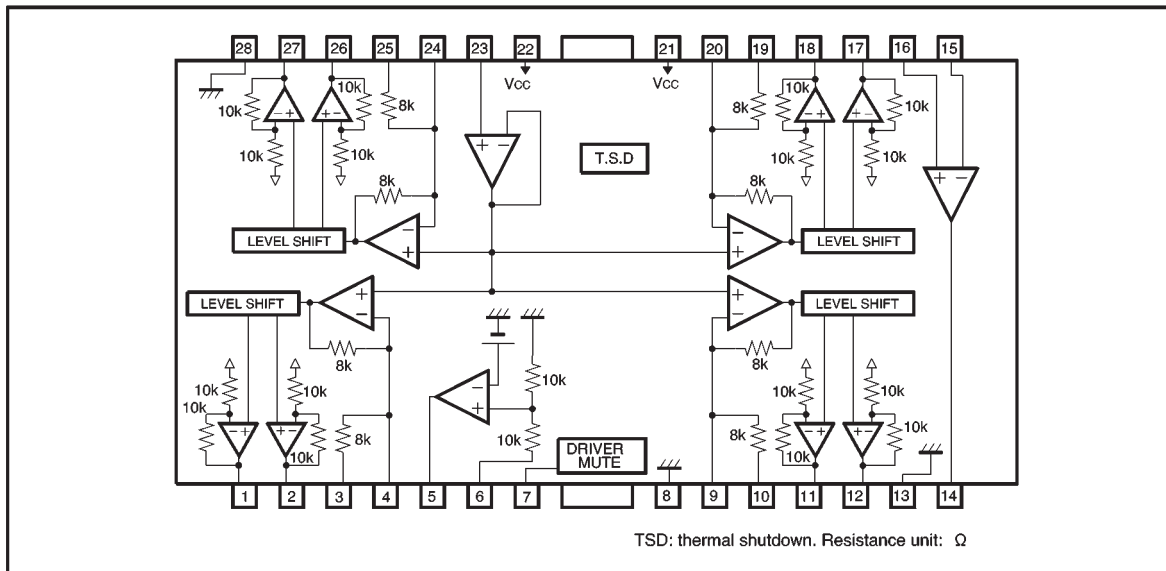
● Applications

CD players and portable CD

● Features

- 1) 4-channel BTL driver.
- 2) HSOP 28-pin package allows for miniaturization of applications.
- 3) Wide dynamic range. (typically 5.4V when  $V_{CC} = 8V$  and  $R_L = 8\Omega$ )
- 4) Internal thermal shutdown circuit.
- 5) Gain is adjustable with a single attached resistor.
- 6) Internal 5V regulator. (requires attached PNP transistor)
- 7) Internal general purpose operational amplifier.

● Block diagram



## ● Pin descriptions

| Pin No. | Pin name | Function   | Pin No. | Pin name        | Function                              |
|---------|----------|--|---------|-----------------|---------------------------------------|
| 1       | VO1 (−)  | Driver channel 1 negative output                                   | 15      | OP IN (−)       | Operational amplifier input, negative |
| 2       | VO1 (+)  | Driver channel 1 positive output                                   | 16      | OP IN (+)       | Operational amplifier input, positive |
| 3       | VIN1     | Driver channel 1 input   | 17      | VO3 (−)         | Driver channel 3 negative output      |
| 4       | VIN1'    | Driver channel 1 input, gain adjustment pin                        | 18      | VO3 (+)         | Driver channel 3 positive output      |
| 5       | REG−B    | Connect to external transistor base                                | 19      | VIN3            | Driver channel 3 input                |
| 6       | REG OUT  | Constant voltage output, connects to external transistor collector | 20      | VIN3'           | Driver channel 3 gain adjustment pin  |
| 7       | MUTE     | Mute control pin   | 21      | V <sub>CC</sub> | Power supply                          |
| 8       | GND      | Ground   | 22      | V <sub>CC</sub> | Power supply                          |
| 9       | VIN2'    | Driver channel 2 input, gain adjustment pin                        | 23      | BIAS IN         | Bias amplifier input                  |
| 10      | VIN2     | Driver channel 2 input   | 24      | VIN4'           | Driver channel 4 gain adjustment pin  |
| 11      | VO2 (+)  | Driver channel 2 positive output                                   | 25      | VIN4            | Driver channel 4 input                |
| 12      | VO2 (−)  | Driver channel 2 negative output                                   | 26      | VO4 (+)         | Driver channel 4 positive output      |
| 13      | GND      | Substrate ground   | 27      | VO4 (−)         | Driver channel 4 negative output      |
| 14      | OP OUT   | Operational amplifier output                                       | 28      | GND             | Substrate ground                      |

Note: Positive and negative output of the driver is relative to the polarity of the input pins  
When the input pin is HIGH, negative output pin is LOW and positive output pin is HIGH.

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

| Parameter             | Symbol           | Limits   | Unit |
|-----------------------|------------------|----------|------|
| Power supply voltage  | V <sub>CC</sub>  | 18       | V    |
| Power dissipation     | P <sub>d</sub>   | 1.7*1    | W    |
| Operating temperature | T <sub>opr</sub> | −35~+85  | °C   |
| Storage temperature   | T <sub>stg</sub> | −55~+150 | °C   |

\*1 Reduced by 13.6 mW for each increase in Ta of 1°C over 25°C.  
When mounted on a 50 mm × 50 mm × 1.0 mm paper phenol board.

## ● Recommended operating conditions

| Parameter            | Symbol          | Limits    | Unit |
|----------------------|-----------------|-----------|------|
| Power supply voltage | V <sub>CC</sub> | 6.0~9.0*2 | V    |

\*2 4.5-9 V without regulator (pins 5 and 6 may be opened)

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

| Parameter                     | Symbol           | Min. | Typ. | Max. | Unit             | Conditions                                      | Measurement Circuit |
|-------------------------------|------------------|------|------|------|------------------|---|---------------------|
| Quiescent current dissipation | $I_{CC}$         | —    | 9.0  | 12.0 | mA               | No load   | Fig. 1              |
| Output voltage, offset        | $V_{OO}$         | −50  | —    | 50   | mV               |   | Fig. 1              |
| Maximum output amplitude      | $V_{OM}$         | 5.0  | 5.4  | —    | V                |   | Fig. 1              |
| Closed loop voltage gain      | $G_{VC}$         | 10.5 | 12.0 | 13.5 | dB               | $V_{IN}=0.1V_{rms}$ , 1kHz                      | Fig. 1              |
| Ripple rejection              | $RR$             | —    | 60   | —    | dB               | $V_{IN}=0.1V_{rms}$ , 100Hz                     | Fig. 1              |
| Slew rate                     | $SR$             | —    | 2.0  | —    | V/ $\mu\text{s}$ | 100 kHz square wave, 3 $V_{P-P}$ output         | Fig. 1              |
| Mute On voltage               | $V_{MON}$        | —    | —    | 0.5  | V                |   | Fig. 1              |
| Mute Off voltage              | $V_{MOFF}$       | 2.0  | —    | —    | V                |   | Fig. 1              |
| 〈5 V regulator〉               |                  |      |      |      |                  |   |                     |
| Output voltage                | $V_{REG}$        | 4.75 | 5.00 | 5.25 | V                | $I_L=100\text{mA}$                              | Fig. 1              |
| Output load variation         | $\Delta V_{RL}$  | −50  | 0    | 10   | mV               | $I_L=0\sim 200\text{mA}$                        | Fig. 1              |
| Supply voltage variation      | $\Delta V_{VCC}$ | −10  | 0    | 25   | mV               | ( $V_{CC}=6\sim 9\text{V}$ ) $I_L=100\text{mA}$ | Fig. 1              |
| 〈Operational amplifier〉       |                  |      |      |      |                  |   |                     |
| Offset voltage                | $V_{OFOP}$       | −5   | 0    | 5    | mV               |   | Fig. 1              |
| Input bias current            | $I_{BOP}$        | —    | —    | 300  | nA               |   | Fig. 1              |
| Output high level voltage     | $V_{OHOP}$       | 6.0  | —    | —    | V                |   | Fig. 1              |
| Output low level voltage      | $V_{OLOP}$       | —    | —    | 1.8* | V                | BA6790FP  | Fig. 1              |
| Output drive current (sink)   | $I_{SINK}$       | 10   | 50   | —    | mA               | $V_{CC}$ at $50\Omega$                          | Fig. 1              |
| Output drive current (source) | $I_{SOURCE}$     | 10   | 40   | —    | mA               | $50\Omega$ at ground                            | Fig. 1              |
| Open loop voltage gain        | $G_{VO}$         | —    | 78   | —    | dB               | $V_{IN}=-75\text{dBV}$ , 1kHz                   | Fig. 1              |
| Slew rate                     | $SR_{OP}$        | —    | 1    | —    | V/ $\mu\text{s}$ | 100 kHz square wave, 4 $V_{P-P}$ output         | Fig. 1              |
| Ripple rejection              | $RR_{OP}$        | —    | 65   | —    | dB               | $V_{IN}=-20\text{dBV}$ , 100Hz                  | Fig. 1              |
| Common mode rejection ratio   | $CMRR$           | —    | 84   | —    | dB               | $V_{IN}=-20\text{dBV}$ , 1kHz                   | Fig. 1              |

\* Low-level output voltage ( $V_{olop}$ ) of BA6791FP = 1.1 V

● Measurement circuit

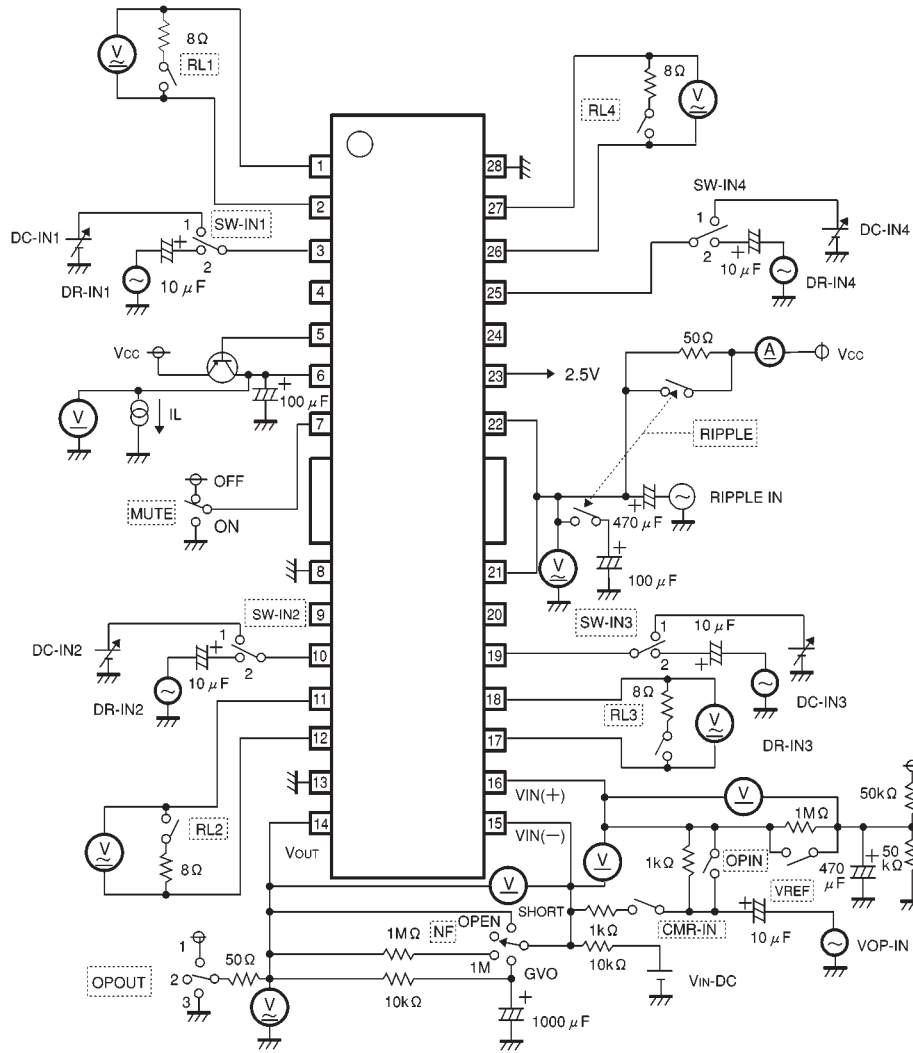


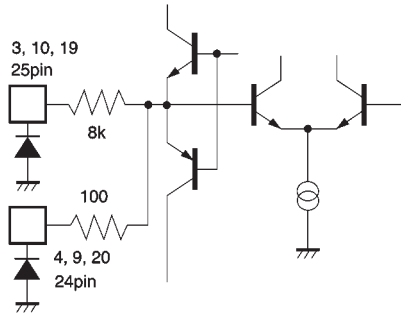
Fig.1

● Measurement circuit switch table

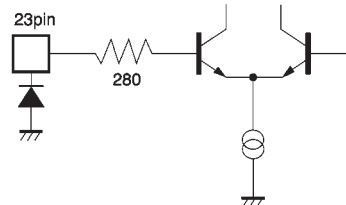
| Parameter                      | Switch |      |     |      |      |        |       |       |       |                     | Input |                     |                     |       | Condition                     |
|--------------------------------|--------|------|-----|------|------|--------|-------|-------|-------|---------------------|-------|---------------------|---------------------|-------|-------------------------------|
|                                | RIPPLE | MUTE | RL  | OPIN | VREF | CMR-IN | NF    | OPOUT | SW-IN | DR-IN               | DC-IN | RIPPLEIN            | VOPIN               | VINDC |                               |
| Quiescent current dissipation  | ON     | OFF  | OFF | ON   | ON   | OFF    | SHORT | 2     | 2     | 0                   | 0     | 0                   | 0                   | OFF   |                               |
| Output offset voltage          | ↓      | ↓    | ON  | ↓    | ↓    | ↓      | ↓     | ↓     | 1     | ↓                   | 2.5V  | ↓                   | ↓                   | ↓     |                               |
| Maximum output amplitude       | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | 0V,5V | ↓                   | ↓                   | ↓     | Only one channel on at a time |
| Closed loop voltage gain       | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | 2     | 0.1V <sub>rms</sub> | 0     | ↓                   | ↓                   | ↓     |                               |
| Ripple rejection               | OFF    | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | 1     | 0                   | 2.5V  | 0.1V <sub>rms</sub> | ↓                   | ↓     |                               |
| Slew rate                      | ON     | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | 2     | ↓                   | 0     | 0                   | ↓                   | ↓     |                               |
| Output voltage                 | ↓      | ↓    | OFF | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | 0                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Output load variation          | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Supply voltage variation       | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Offset voltage                 | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Input bias current             | ↓      | ↓    | ↓   | ↓    | OFF  | ↓      | 1M    | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Output high level voltage      | ↓      | ↓    | ↓   | ↓    | ON   | ↓      | OPEN  | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     | 2V                            |
| Output low level voltage       | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     | 6V                            |
| Output driver current (sink)   | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | SHORT | 1     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     | OFF                           |
| Output driver current (source) | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | 3     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Open loop voltage gain         | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | GVO   | ↓     | ↓     | ↓                   | ↓     | ↓                   | -75dBV              | ↓     |                               |
| Slew rate                      | ↓      | ↓    | ↓   | ↓    | ↓    | ↓      | SHORT | ↓     | ↓     | ↓                   | ↓     | ↓                   | ↓                   | ↓     |                               |
| Ripple rejection               | OFF    | ↓    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓     | ↓     | ↓                   | ↓     | 0.1V <sub>rms</sub> | 0                   | ↓     |                               |
| Common mode rejection ratio    | ON     | ↓    | ↓   | OFF  | OFF  | ON     | 1M    | ↓     | ↓     | ↓                   | ↓     | 0                   | 0.1V <sub>rms</sub> | ↓     |                               |

● Input/output circuits

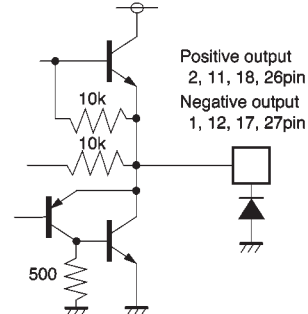
Driver input



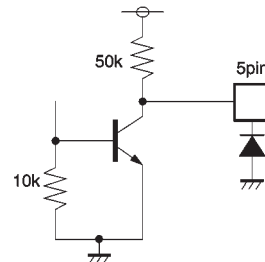
Bias



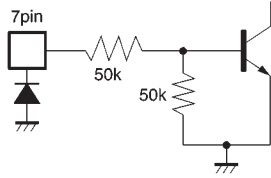
Driver output



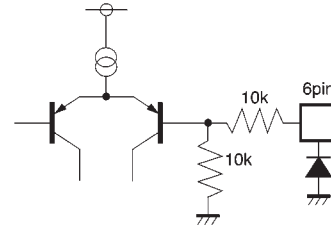
Regulator (base connection)



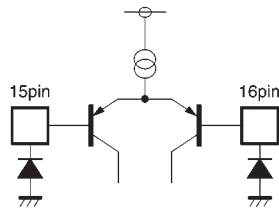
Mute



Regulator output



Operational amplifier input



Operational amplifier output

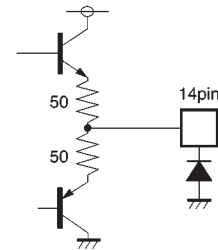


Fig. 2

●Application example

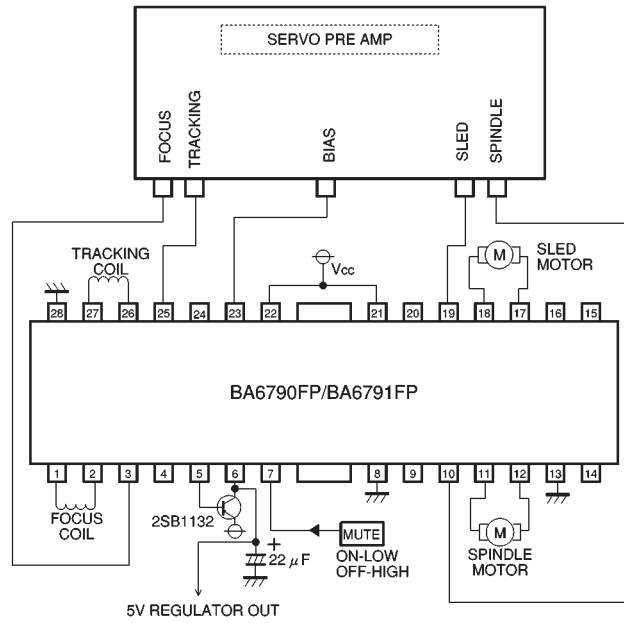
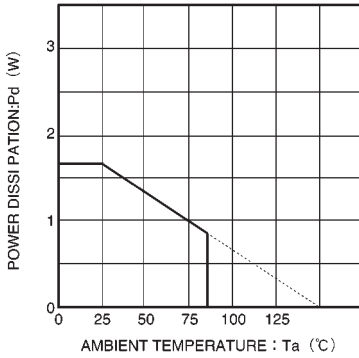


Fig.3



● Thermal derating curve



When mounted on a 50 mm × 50 mm × 1.6 mm board  
Fig. 4

● Operation notes

- (1) The BA6790FP and BA6791FP have an internal thermal shutdown circuit. Output current is muted when the chip temperature exceeds 175°C (typically) and restored when the chip temperature falls to 150°C (typically).
- (2) If the mute pin (pin 7) voltage is opened or lowered below 0.5V, the output current will be muted. Pin 7 should be pulled up above 2.0V during normal use.
- (3) The bias pin (pin 23) is muted when lowered below 1.4V (typically). Make sure it stays above 1.6V during normal use.
- (4) Muting occurs during thermal shutdown, mute-on operations or a drop in the bias pin voltage. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly  $(V_{CC}/2)$ .
- (5) Be sure to connect the IC to a 0.1μF bypass capacitor to the power supply, at the base of the IC.
- (6) The radiating fin is connected to the packages internal GND, but should also be connected to an external ground.
- (7) The capacitor between regulator output (pin 6) and GND also serves to prevent oscillation of the IC, so select one with good temperature characteristics.

● External dimensions (Units: mm)

