# 4-channel BTL driver for CD players
## BA6898S / BA6898FP

The BA6898S / BA6898FP ICs contain a 4-channel BTL driver , 5V regulator (which requires an externally connected PNP transistor), multi-purpose operational amplifier, and reset output for use with CD players. Also equipped with an input pin for gain adjustment for all channels of the driver block so that the gain can be adjusted to the desired value for your application. Furthermore, a built-in level shift circuit exists to further reduce the amount of external components required.

●Applications

CD players, CD-ROM, and other optical disc equipment

●Features

1) 4-channel BTL driver.
2) Gain is adjustable with externally connected resistor.
3) Internal thermal shutdown circuit.
4) Internal 5V regulator (requires external PNP transistor).
5) Internal multi-purpose operational amplifier.
6) Equipped with reset output pin.

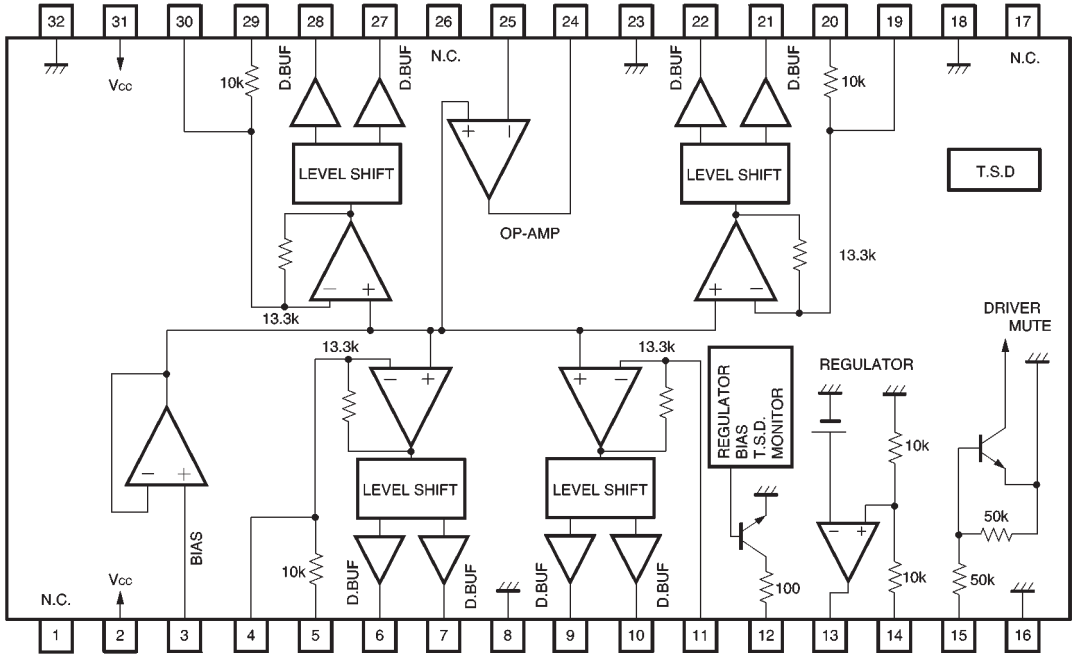
●Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|---|---|---|---|
| Power supply voltage | $V_{CC}$ | 13.5 | V |
| Power dissipation | Pd | 1.7* | W |
| Operating temperature | Topr | −35～+85 | ℃ |
| Storage temperature | Tstg | −55～+150 | ℃ |

* 6V to 9V (driver block is operable up to 5.5V).
BA6898S: Values when IC is unmounted.
BA6898FP: When mounted on a 70mm×70mm×1.6mm glass epoxy board with copper foil coverage of less than 3%.
Reduced by 13.6mW for each increase in Ta of 1℃ over 25℃.

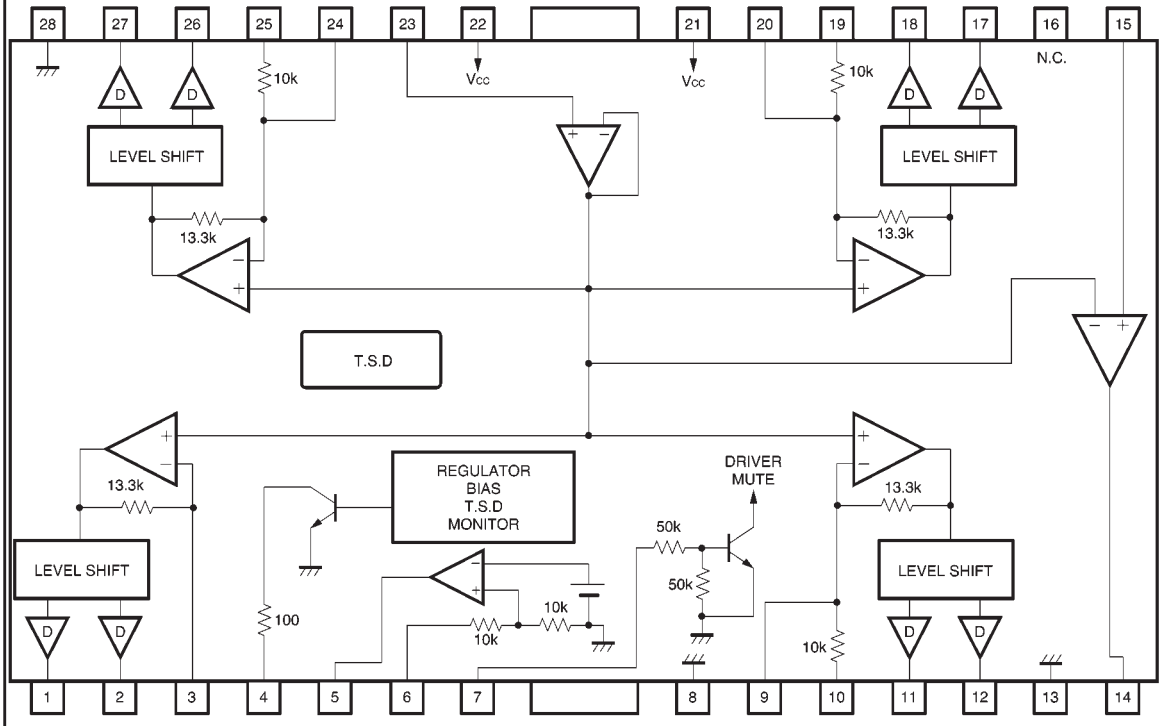
●Block diagram

BA6898S




T.S.D. : Thermal shutdown
D. BUF : Drive buffer
Resistor units: Ω

BA6898FP




T.S.D. : Thermal shutdown
D : Drive buffer
Resistor units: Ω

●Pin descriptions

BA6898S

| Pin No. | Pin name | Function |
|---|---|---|
| 1 | N.C. | N.C. |
| 2 | Vcc | Power supply |
| 3 | BIAS IN | Bias amplifier input |
| 4 | VIN1' | Input for driver channel 1 gain adjustment |
| 5 | VIN1 | Driver channel 1 input |
| 6 | VO1 (+) | Driver channel 1 positive output |
| 7 | VO1 (−) | Driver channel 1 negative output |
| 8 | GND | Substrate GND |
| 9 | VO2 (−) | Driver channel 2 negative output |
| 10 | VO2 (+) | Driver channel 2 positive output |
| 11 | VIN2' | Input for driver channel 2 gain adjustment |
| 12 | RESET | Reset output |
| 13 | REG-B | For connection of external transistor base for regulator |
| 14 | REG OUT | Constant voltage output (for connection of external transistor collector) |
| 15 | MUTE | Mute control |
| 16 | SUB | Substrate GND |
| 17 | N.C. | N.C. |
| 18 | GND | GND |
| 19 | VIN3' | Input for driver channel 3 gain adjustment |
| 20 | VIN3 | Driver channel 3 input |
| 21 | VO3 (+) | Driver channel 3 positive output |
| 22 | VO3 (−) | Driver channel 3 negative output |
| 23 | GND | Substrate GND |
| 24 | OP OUT | Op-amp output |
| 25 | OP IN (−) | Op-amp negative input |
| 26 | N.C. | N.C. |
| 27 | VO4 (−) | Driver channel 4 negative output |
| 28 | VO4 (+) | Driver channel 4 positive output |
| 29 | VIN4 | Driver channel 4 input |
| 30 | VIN4' | Input for driver channel 4 gain adjustment |
| 31 | Vcc | Power supply |
| 32 | SUB | Substrate GND |

Note: Positive output and negative output are the polarities with respect to the input.

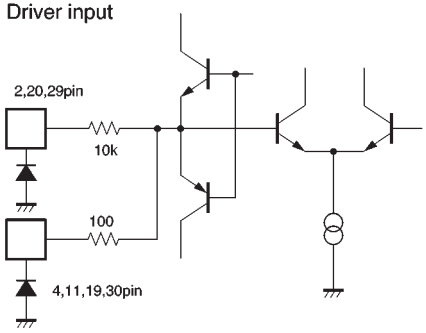
BA6898FP

| Pin No. | Pin name | Function |
|---|---|---|
| 1 | OUT1-B | Channel 1 negative output |
| 2 | OUT1-A | Channel 1 positive output |
| 3 | IN1 | Input for channel 1 gain adjustment |
| 4 | RESET | Reset output |
| 5 | REG-B | For connection of external transistor base for regulator |
| 6 | REGOUT | For connection of external transistor collector for regulator (output) |
| 7 | MUTE | Mute control |
| 8 | GND | GND |
| 9 | IN2' | Input for channel 2 gain adjustment |
| 10 | IN2 | Channel 2 input |
| 11 | OUT2-A | Channel 2 positive output |
| 12 | OUT2-B | Channel 2 negative output |
| 13 | GND | Substrate GND |
| 14 | OPOUT | Op-amp out |
| 15 | OPIN-B | Op-amp negative input |
| 16 | N.C. | N.C. |
| 17 | OUT3-B | Channel 3 negative output |
| 18 | OUT3-A | Channel 3 positive output |
| 19 | IN3 | Channel 3 input |
| 20 | IN3' | Input for channel 3 gain adjustment |
| 21 | Vcc | Vcc |
| 22 | Vcc | Vcc |
| 23 | VREFIN | Reference amplifier input (bias) |
| 24 | IN4' | Input for channel 4 gain adjustment |
| 25 | IN4 | Channel 4 input |
| 26 | OUT4-A | Channel 4 positive output |
| 27 | OUT4-B | Channel 4 negative output |
| 28 | GND | Substrate GND |

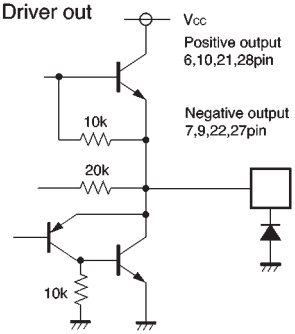
Note: Positive output and negative output are the polarities with respect to the input.
If the input pin is high, the negative output pin is low and the positive output pin is high.

●Input / output circuits

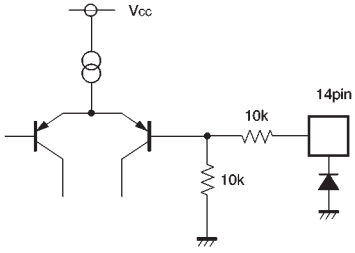
Driver input



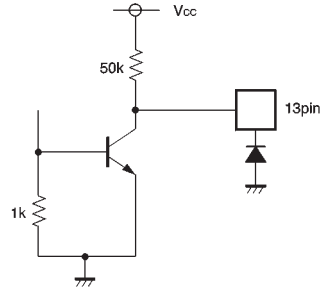

Driver out



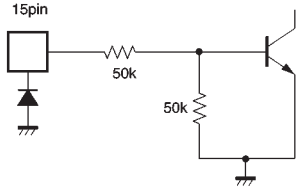

Regulator output



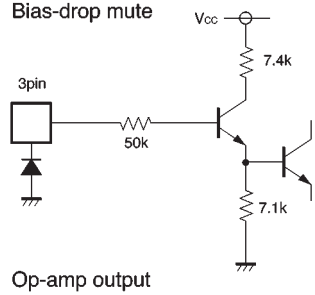

Regulator (base connection)



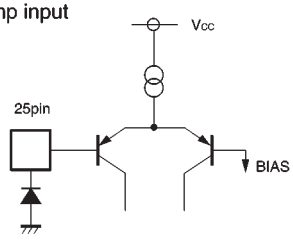

Mute



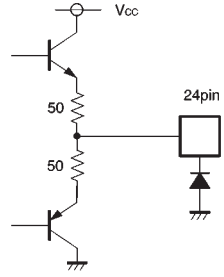

Bias-drop mute



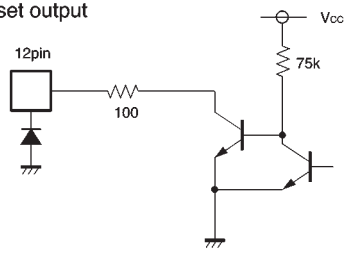

Op-amp input




Op-amp output




Reset output




Pin numbers are those for the BA6898S.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, $V_{CC}$ = 8V, f = 1kHz, $R_L$ = 8Ω)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Circuit current | $I_{CC}$ | 6.0 | 10.0 | 14.0 | mA | No load |
| Output offset voltage | $V_{OO}$ | −40 | − | 40 | mV | − |
| Maximum output high level voltage | VOHD | 5.6 | 6.0 | − | V | − |
| Maximum output low level voltage | VOLD | − | 1.2 | 1.45 | V | − |
| Closed-loop voltage gain | GVC | 7.4 | 8.4 | 9.4 | dB | $V_{IN}$=0.1Vrms, 1kHz (excluding channel 2) |
| Ripple rejection | RR | − | 60 | − | dB | $V_{IN}$=0.1Vrms, 100Hz |
| Slew rate | SR | − | 1.0 | − | V/μs | 100kHz rectangular wave, $3V_{P-P}$ output |
| Mute off voltage | VMOFF | 2.0 | − | − | V | − |
| 〈5V regulator〉 | | | | | | |
| Output voltage | Vreg | 4.75 | 5.00 | 5.25 | C | $I_L$=100mA |
| Output load regulation | ΔVRL | −70 | 0 | 10 | mV | $I_L$=0～200mA |
| Power supply voltage regulation | $\Delta V_{CC}$ | −10 | 0 | 35 | mV | ($V_{CC}$=6～9V), $I_L$=100mA |
| 〈OP-AMP〉 | | | | | | |
| Offset voltage | VOFOP | −5 | 0 | 5 | mV | − |
| Input bias current | IBIAS | − | − | 300 | nA | − |
| Output high level voltage | VOHOP | 7.0 | − | − | V | − |
| Output low level voltage | VOLOP | − | − | 1.1 | V | − |
| Output drive current source | ISOU | 10 | 40 | − | mA | 50Ω at GND |
| Output drive current sink | ISIN | 10 | 50 | − | mA | 50Ω at $V_{CC}$ |
| Open-loop voltage gain | GVO | − | 78 | − | dB | $V_{IN}$=−75dBV, 1kHz |
| Slew rate | SROP | − | 1 | − | V/μs | 100kHz rectangular wave, $4V_{P-P}$ output |
| Ripple rejection | RROP | 50 | 65 | − | dB | $V_{IN}$=−20dBV, 100Hz |
| 〈Reset output〉 | | | | | | |
| Reset on threshold voltage | VTHR | − | 4.0 | − | V | From regulator voltage |
| Reset on output voltage | VRON | − | − | 0.5 | V | Connect to 5V at 10kΩ |

◎Not designed for radiation resistance.

●Measurement circuit

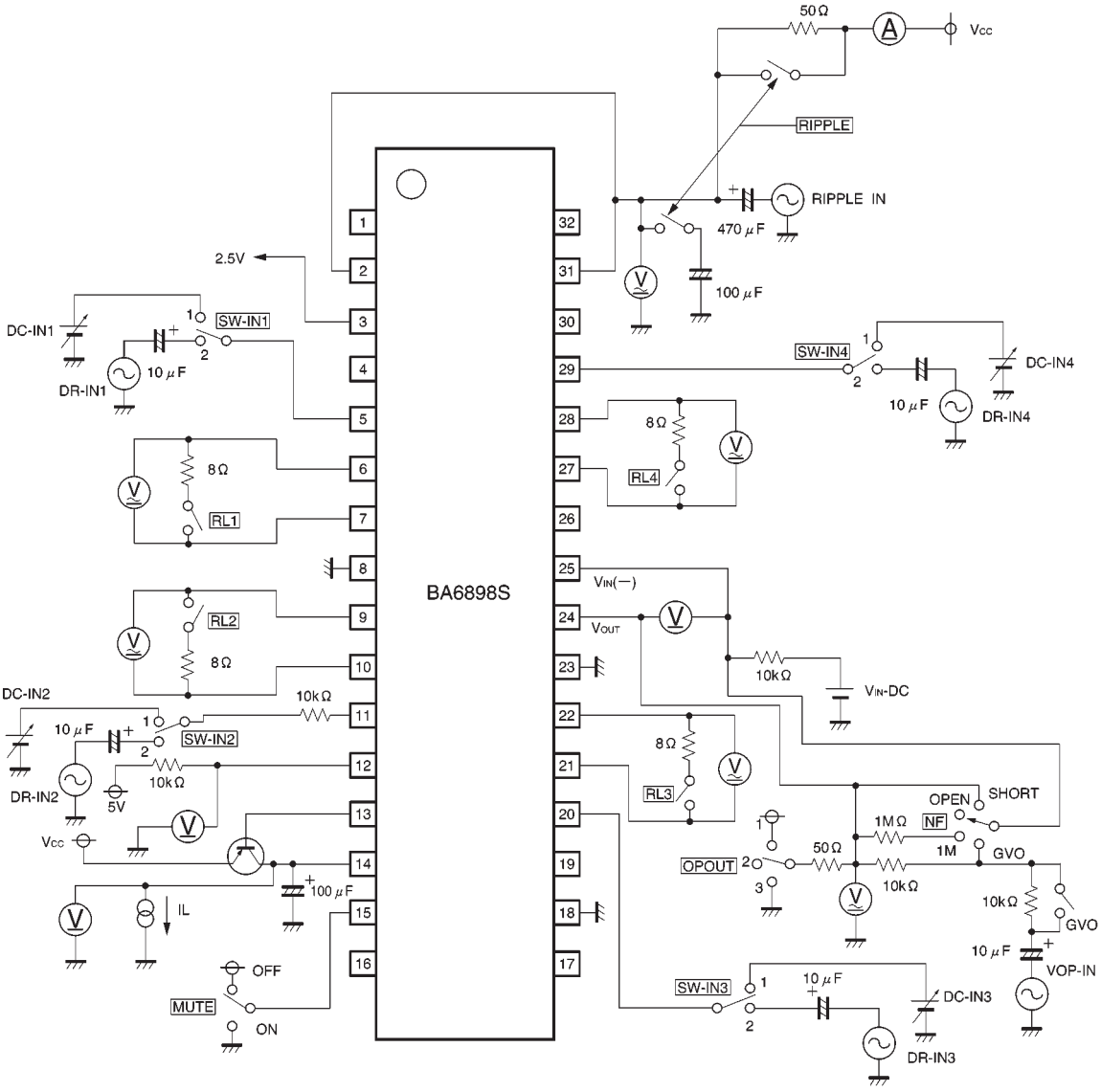



Fig.1

●Circuit operation

(1) Driver block

The input is the focus and tracking error signals from the servo pre-amplifier and the control signals for the motor system. The input signal is normally centered at 2.5V, and at the pre-amplifier, it undergoes V / I conversion to generate the current corresponding to the input voltage. This is then passed through a resistor and sent to the internal reference voltage block. This results in the output from the pre-amplifier being the signal at the center of the internal reference voltage. Furthermore, at the V / I conversion, forward and reverse phases are generated and the BTL output is then gained through the driver buffer.

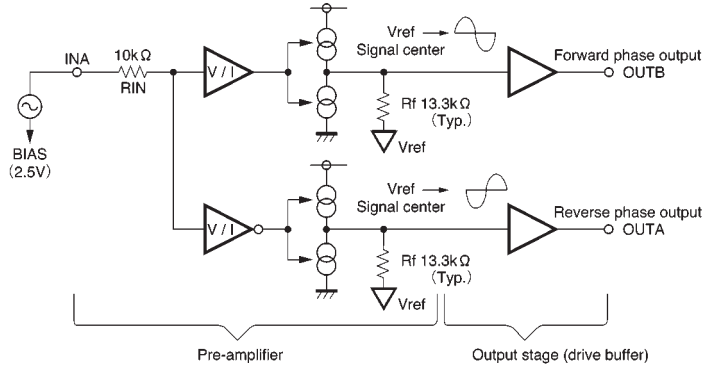



Fig.2

(2) Regulator block

The configuration is that of a normal series-type regulator and the reference voltage is provided internally. A PNP low-saturation transistor is connected externally.

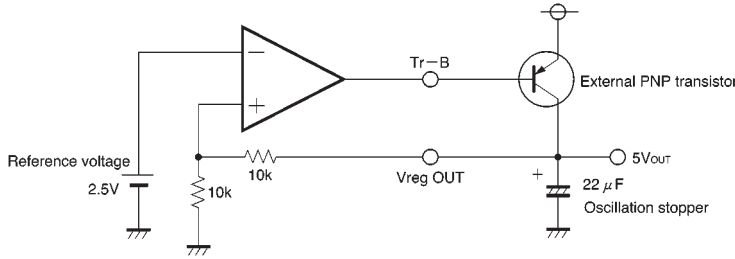



Fig.3

●Application example

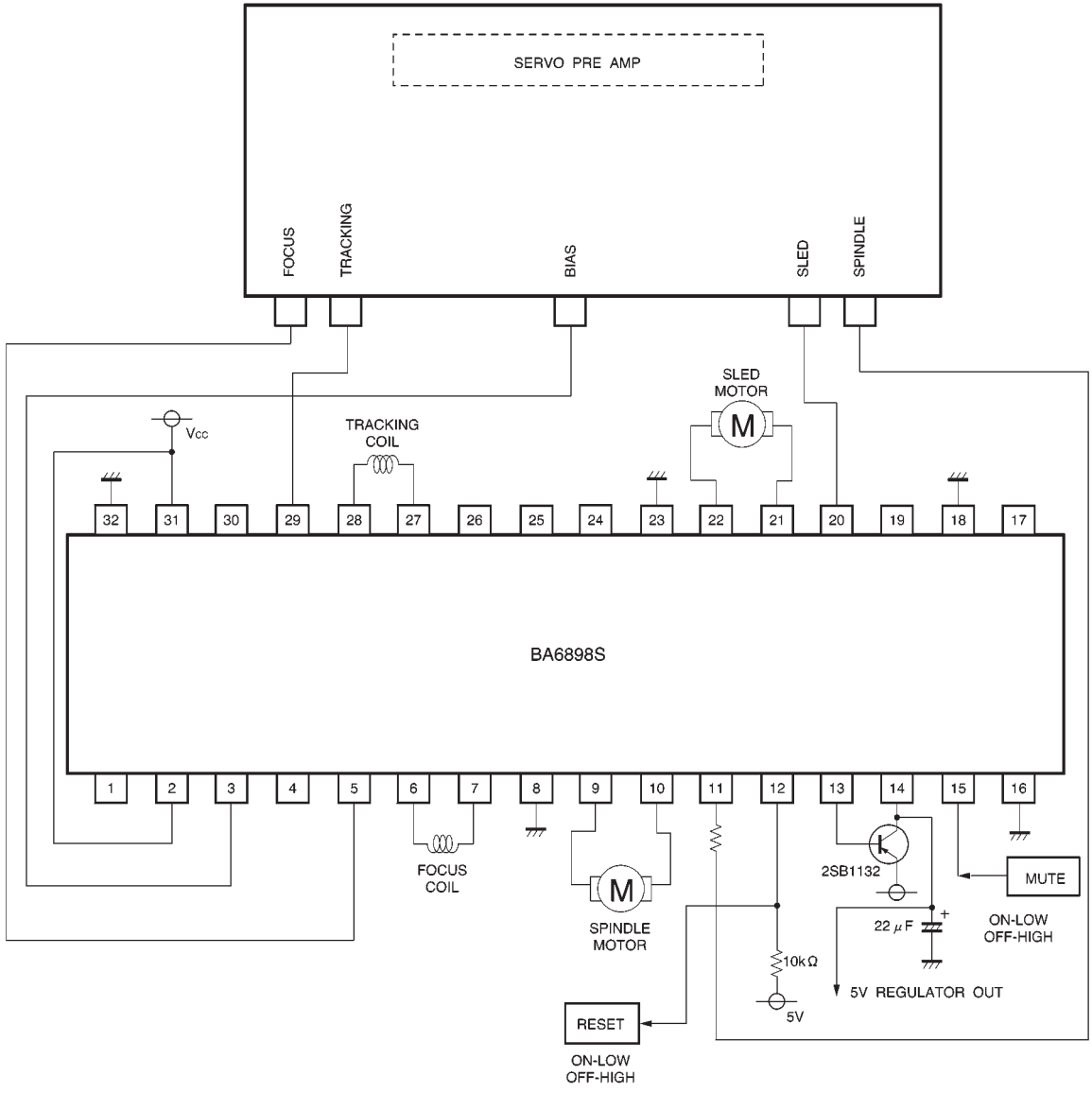



Fig.4

●Operation notes (pin Nos. are those for the BA6898S)

(1) Relationship between mute and reset output

| Function | Mute operation | Reset output |
|---|---|---|
| Regulator voltage drop | Turns on for all conditions | "H" → "L" |
| Bias voltage drop | | "H" → "L" |
| Thermal shutdown | | "H" → "L" |
| Mute (pin 15) | | No change |

Regulator voltage drop . . . . . If the regulator voltage drops to 4.0V (Typ.) or below, the reset output turns low and the mute turns on. If the voltage then rises again to 4.2V (Typ.), the reset output turns high and the mute turns off.

Bias voltage drop . . . . . If the bias pin (pin 3) voltage lowers to 1.4V (Typ.) or below, the mute turns on and the reset output turns low. For normal operations, have the voltage at 1.6V or greater.

Thermal shutdown . . . . . When the chip temperature reaches 175°C (Typ.), the mute turns on and the reset output turns low. If the chip temperature then drops below 150°C (Typ.), then the mute turns off and the reset output turns high.

Mute (pin 15) . . . . . If the mute pin (pin 15) voltage is open or lowers to 0.5V or below, the mute turns on but the reset output does not change.

(2) If the voltage of the thermal shutdown, mute ON, or bias pin drops, or if the regulator voltage drops, the mute is activated; however, in these situations, only the drivers are muted. Also, the output pin voltage becomes the internal bias voltage (approx. $(V_{CC} - V_F) / 2$).

(3) Connect a bypass capacitor (approx. 0.1μF) between the bases of the power supply pins of this IC.

(4) Even though pins 16 and 32 are connected to ground within the package, be sure to also connect them to a ground externally as well.

(5) The capacitor connected between the regulator output pin (pin 14) and GND also serves to prevent oscillation, so be sure to use a capacitor with excellent thermal characteristics.

(6) If the regulator is not used, short the regulator output pin (pin 14) to $V_{CC}$ and have the pin for the externally connected transistor base (pin 13) open.

(7) Of the ground pins, only pin 18 is not connected to the IC substrate. Therefore, design the PC board pattern so that the potential of GND pin 18 does not go below the substrate GND (including transient conditions).

●Electrical characteristic curves

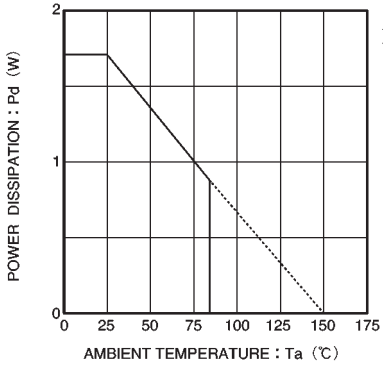



Fig.5 Thermal derating curve (unmounted)

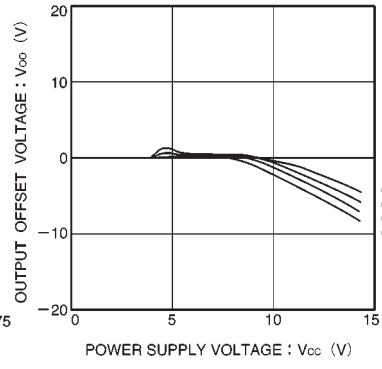



Fig.6 Power supply voltage vs. driver output offset voltage

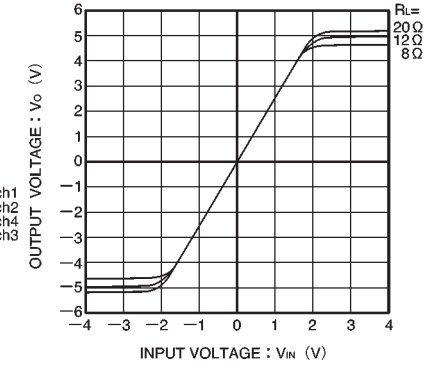



Fig.7 Driver I / O characteristics (during load regulation)

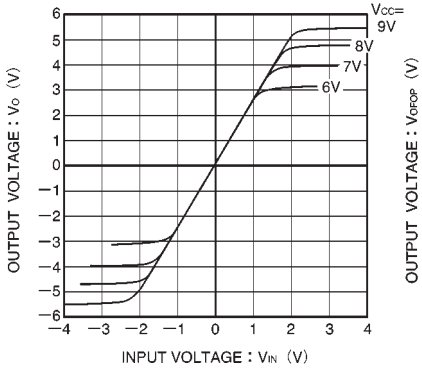



Fig.8 Driver I / O characteristics (power supply regulation)

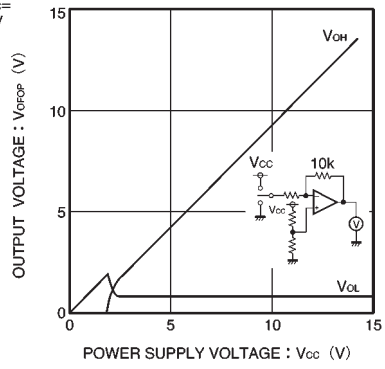



Fig.9 Op-amp high / low level output voltage

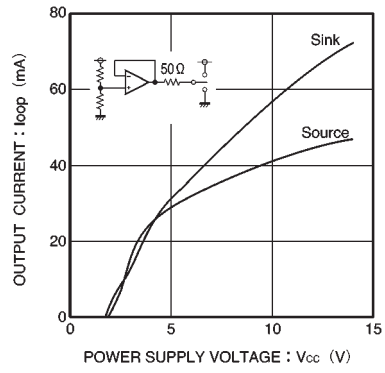



Fig.10 Power supply voltage vs. op-amp output drive voltage

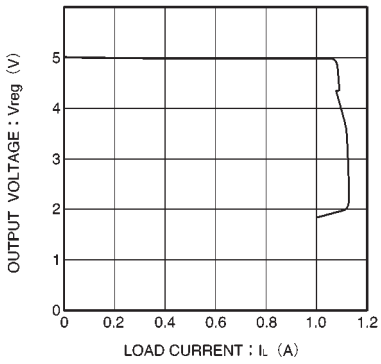
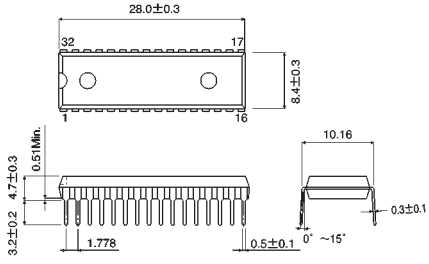



Fig.11Load current vs. regulator voltage

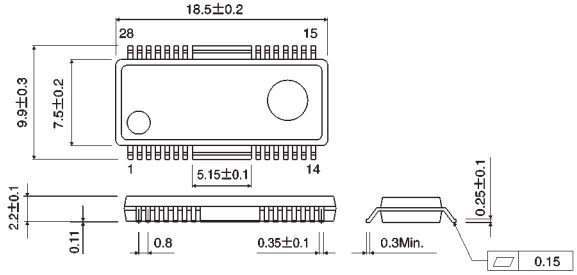
●External dimensions (Units: mm)

BA6898S




SDIP32

BA6898FP




HSOP28/HSOP-M28