

Speaker / headphone switch power amplifier

BA5210FS

The BA5210FS is a power amplifier with a built-in monaural speaker/stereo headphone switch. The speaker drive is BTL for large output, and when the headphones are connected, the "center-amp" design means that coupling is not required. This significantly reduces the number of external components required, and makes this IC ideal for compact sets that have high component density. Mute and standby functions are provided, and direct microprocessor control is possible.

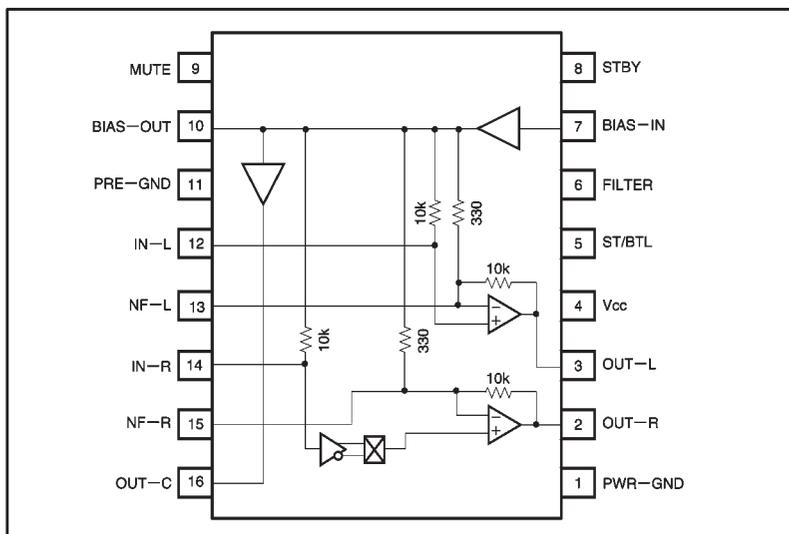
●Applications

Notebook computers, electronic books, portable CD players, video cameras with built-in monitors, LCD TVs, radios, and electronic instruments

●Features

- 1) Built-in BTL/stereo switch circuit.
- 2) Mute function.
- 3) Standby function.
- 4) Few external components required.
- 5) Low current dissipation and good sound quality.

●Block diagram



● Absolute maximum ratings (Ta = 25°C)

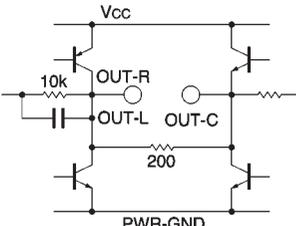
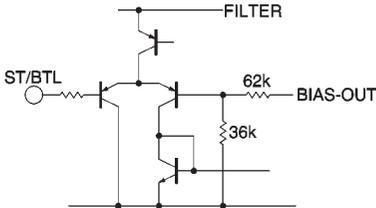
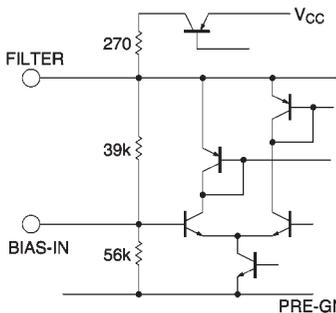
| Parameter | Symbol | Limits | Unit |
|-----------------------|--------|----------|------|
| Power supply voltage | Vcc | 6 | V |
| Power dissipation | Pd | 650* | mW |
| Operating temperature | Topr | -10~+60 | °C |
| Storage temperature | Tstg | -55~+125 | °C |

* When mounted on a 90mm x 50mm x 1.6mm glass epoxy board, reduced by 6.5mW for each increase in Ta of 1°C over 25°C.

● Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|----------------------|--------|---------|------|
| Power supply voltage | Vcc | 2.5~6.0 | V |

● Pin descriptions

| Pin No. | Pin name | Function | Equivalent circuit |
|---------|----------|--|--|
| | | No-signal DC voltage (V) | |
| 1 | PWR—GND | Power amplifier system ground 0 |  |
| 2 | OUT—R | Power amplifier and system amplifier output pin This has low output impedance during operation, so if it is shorted to Vcc or GND the IC will probably be destroyed. |  |
| 3 | OUT—L | | |
| 16 | OUT—C | | |
| 4 | Vcc | Power supply pin 3.3 |  |
| 5 | ST/BTL | Stereo/BTL switch pin The threshold voltage is approximately $0.2 \times V_{cc}$. BTL mode when high, and stereo mode when low. 0.9 (BTL) 0 (stereo) |  |
| 6 | FILTER | Ripple filter During operation a voltage close to the power supply voltage is generated. The output impedance is low, so if it is shorted to GND or low impedance power sources, a large current will flow and destroy the IC. 3.0 |  |
| 7 | BIAS—IN | Bias amplifier input This pin sets the DC operating point for all amplifiers on the IC. 1.8 | |

| Pin No. | Pin name | Function | Equivalent circuit |
|---------|----------|---|--------------------|
| | | o-signal DC voltage (V) | |
| 8 | STBY | Standby control pin The more slowly that the voltage rises on this pin, the lower the noise that occurs when standby is released. | |
| | | 2.6 (E1=3.3V) | |
| 9 | MUTE | Mute control pin The more slowly that the voltage rises and falls on this pin, the lower the noise that occurs when mute is turned on and off. | |
| | | 1.6 (E2=3.3V) 0 (E2=0V) | |
| 10 | BIAS-OUT | Bias amplifier output This is the impedance conversion point for the operating point voltage set by BIAS-IN for supply to the other amplifiers. The output impedance is low, so if it is shorted to Vcc or GND a large current will flow, and the IC will probably be destroyed. | |
| | | 1.8 | |
| 11 | PRE-GND | Small signal GND 0 | |
| 12 | IN-L | Input pin | |
| 14 | IN-R | | |
| 13 | NF-L | Feedback pin | |
| 15 | NF-R | | |

●Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 3.3\text{V}$, $R_L = 8\Omega$, $f = 1\text{kHz}$ and $R_g = 600\Omega$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|-----------------------------|-------------------|------|------|------|------------------|--|
| Circuit current 1 | I _{CC1} | 2 | 8 | 14 | mA | $V_{IN}=0V_{rms}$, $R_L=\infty$ |
| Circuit current 2 | I _{CC2} | 2 | 11 | 22 | mA | $V_{IN}=0V_{rms}$, $R_L=8\Omega$ |
| Voltage gain 1 | G _{V1} | 32 | 35 | 38 | dB | |
| Voltage gain 2 | G _{V2} | 9 | 12 | 15 | dB | Stereo operation, $R_L = 100 + 16\Omega$, measured at end of 16Ω |
| Rated output power 1 | P _{OUT1} | 350 | 450 | — | mW | THD=10% |
| Rated output power 2 | P _{OUT2} | 1.2 | 1.7 | — | mW | Measured at end of 16Ω |
| Maximum output voltage | V _{OM} | 0.9 | 1.2 | — | V _{rms} | Measured between L / R output pin and center amplifier output |
| Total harmonic distortion 1 | THD1 | — | 0.5 | 1.0 | % | P _O =50mW |
| Total harmonic distortion 2 | THD2 | — | 0.2 | 0.6 | % | Stereo operation, $R_L=100 + 16\Omega$, measured between L / R output pin and center amplifier output $V_o=0.5V_{rms}$ |
| Output noise voltage | V _{NO} | — | 50 | 100 | μV_{rms} | Stereo operation, $R_L=100 + 16\Omega$, $R_g=0\Omega$, measured between L / R output pin and center amplifier output |
| Ripple rejection ratio | RR | 58 | 65 | — | dB | Stereo operation, $R_L = 100 + 16\Omega$, $V_{RR}=-20\text{dBm}$, $f_{RR}=1\text{kHz}$, $R_g=0\Omega$, measured at end of 16Ω |
| Channel separation | CS | 55 | 65 | — | dB | Stereo operation, $R_L=100 + 16\Omega$, $V_o=0\text{dBm}$, at end of $100 + 16\Omega$ |
| Input resistance | R _{IN} | 8 | 10 | 12 | k Ω | |
| Standby release threshold | V _{thSA} | — | 1.5 | 2.0 | V | Stereo operation, $R_L=100 + 16\Omega$, measured at end of 16Ω , $G_{V2} > 6\text{dB}$ |
| Standby threshold | V _{thSB} | 0.2 | 0.6 | — | V | $V_{IN}=0V_{rms}$, $R_L=8\Omega$, $I_{CC2} < 10\mu\text{A}$ |
| Mute on threshold | V _{thMA} | — | 0.8 | 2.0 | V | Stereo operation, $R_L=100 + 16\Omega$, $V_{IN}=-25\text{dBm}$, $V_o < -80\text{dB}$ (end of 16Ω) |
| Mute off threshold | V _{thMB} | 0.2 | 0.7 | — | V | Stereo operation, $R_L=100 + 16\Omega$, measured at end of 16Ω , $G_{V2} > 6\text{dB}$ |
| Standby pin source current | I _{SSS} | — | 30 | 100 | μA | |
| Mute pin source current | I _{SSM} | — | 20 | 100 | μA | |

● Measurement circuit

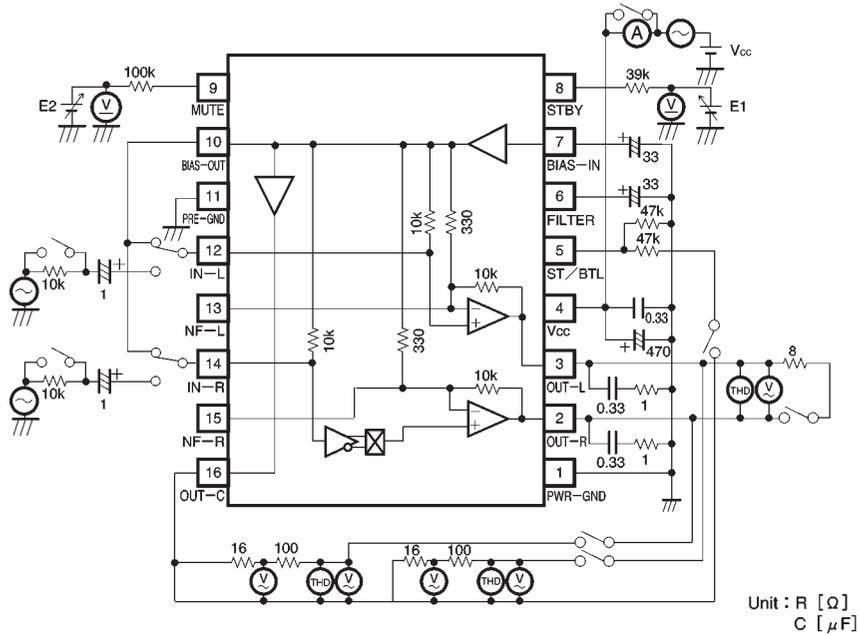
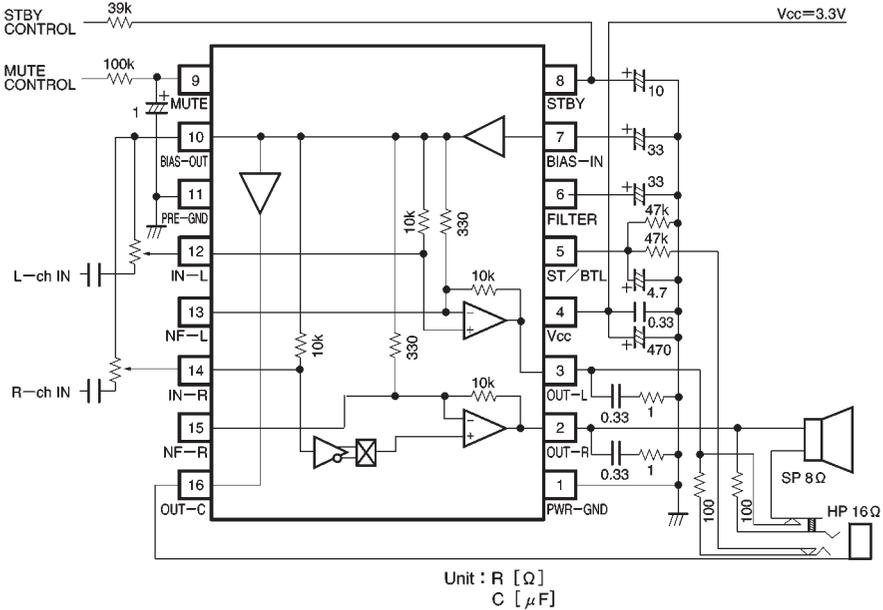


Fig. 1

● Application example



Unit : R [Ω]
C [μF]

STBY: operating when H, standby when L
MUTE: mute on when H, off when L

Fig. 2

● Operation notes

A characteristic of this IC is that if it is used with a supply voltage that is less than the recommended value (2.5V), the OUT-R offset increases. When using the IC with a BTL 8Ω load, if the voltage drops, the supply current will increase accompanied by an increase in power supply impedance, which can lead to low-frequency blocking oscillation. For this reason, we recommend that you use a low-voltage detection circuit that puts the IC in the standby state when the voltage drops below 2.5V.

● Electrical characteristics curves

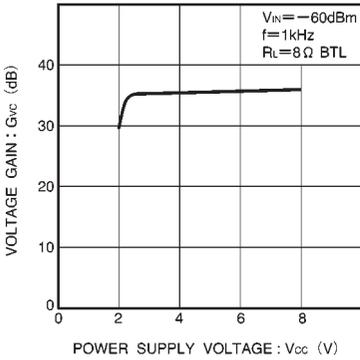


Fig. 3 Voltage gain vs. power supply voltage

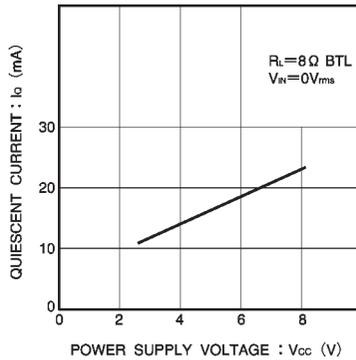


Fig. 4 Quiescent current vs. power supply voltage

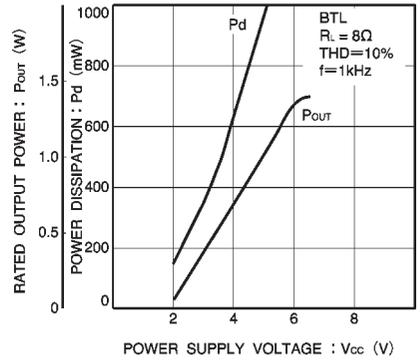


Fig. 5 Power dissipation and rated output power vs. power supply voltage

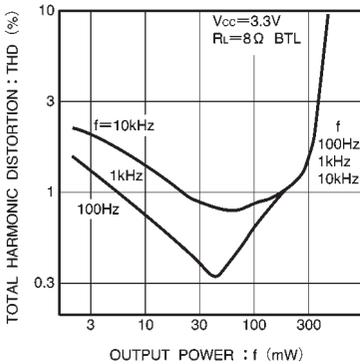


Fig. 6 Distortion vs. output

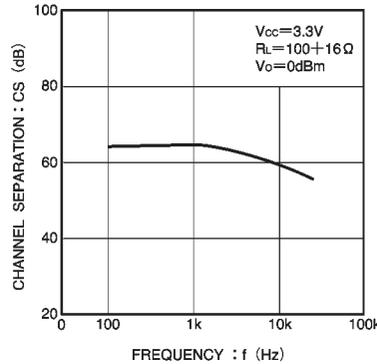


Fig. 7 Channel separation vs. frequency

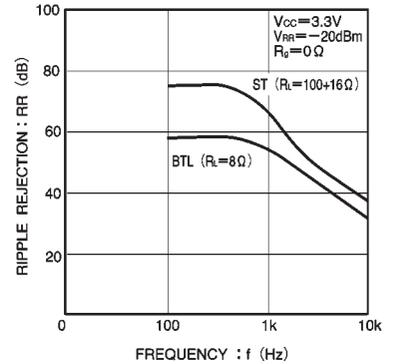


Fig. 8 Ripple rejection vs. frequency

● External dimensions (Units: mm)

