

Dual preamplifier

BA328 / BA328F

The BA328 and BA328F are monolithic, dual-preamplifier ICs designed for car-audio systems. They require few external components and allow compact set designs while reducing the number of assembly processes.

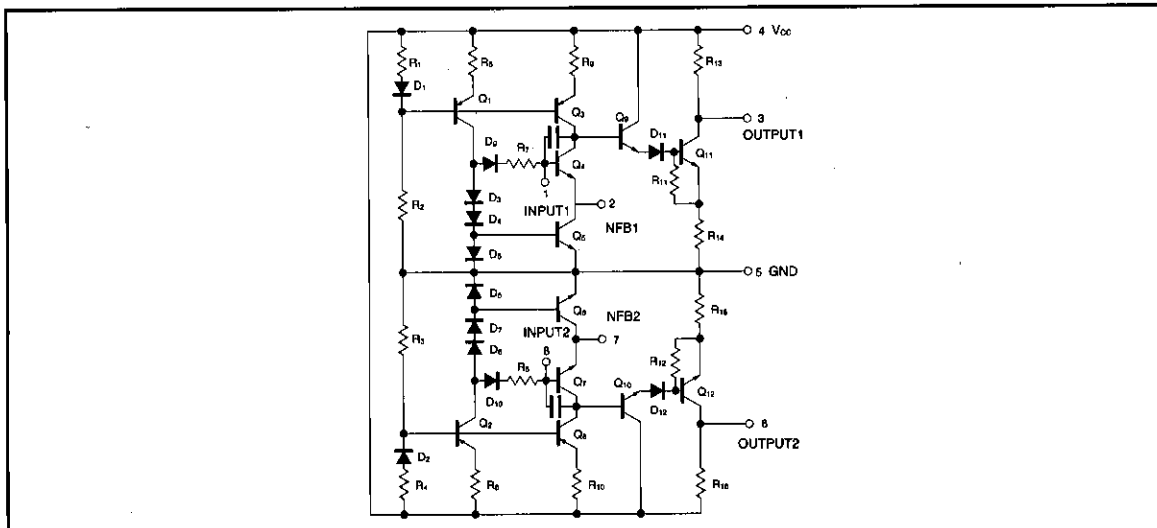
●Applications

Car and home stereos

●Features

- | | |
|--|--------------------------|
| 1) Low noise. | 4) High open-loop gain. |
| 2) Wide operating voltage range. | 5) Good channel balance. |
| 3) Built-in bias circuit minimizes the number of external components required. | |

●Internal circuit diagram



● Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|-----------------------|------------------|---------|------|
| Supply voltage | V _{CC} | 18 | V |
| Power dissipation | BA328 | Pd | mW |
| | BA328F | | |
| Operating temperature | T _{opr} | -25~75 | °C |
| Storage temperature | T _{stg} | -55~125 | °C |

*1 Reduced by 9.0mW for each increase in Ta of 1°C over 25°C.

*2 Reduced by 5.0mW for each increase in Ta of 1°C over 25°C. (When mounted on a 50mm x 50mm x 1.6mm glass-epoxy PCB)

● Recommended operating voltage range (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|----------------|-----------------|------|------|------|------|
| Supply voltage | V _{CC} | 6 | 8 | 16 | V |

● Electrical characteristics (unless otherwise specified Ta = 25°C, V_{CC} = 8V, f = 1kHz, R_L = 10kΩ and R_E = 100Ω)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions | Measurement Circuit |
|--------------------------------|------------------|------|------|------|-------------------|--|---------------------|
| Quiescent circuit current | I _Q | 2 | 5 | 8 | mA | V _{IN} =0V _{rms} | Fig.4 |
| Open-circuit voltage gain | G _{VO} | 65 | 80 | — | dB | V _{OUT} =0.3V _{rms} , R _E =0Ω | Fig.4 |
| Maximum output voltage | V _{OM} | 1.0 | 1.5 | — | V _{rms} | THD=1% | Fig.4 |
| Input resistance | R _{IN} | 50 | — | — | kΩ | — | Fig.4 |
| Total harmonic distortion | THD | — | 0.1 | 0.3 | % | V _{OUT} =0.3V _{rms} | Fig.4 |
| Input conversion-noise voltage | V _{NIN} | — | 1.2 | 2.0 | μV _{rms} | R _g =2.2kΩ BPF (30Hz~20kHz) | Fig.4 |
| Crosstalk level | CT | — | -65 | -50 | dB | Other channel V _{OUT} =0.3V _{rms} , R _g =2.2kΩ | Fig.4 |
| Channel balance | CB | — | 0 | 1.5 | dB | V _{OUT} =0.3V _{rms} | Fig.4 |

● Electrical characteristics curves

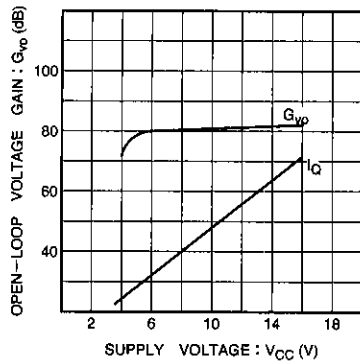


Fig. 1 Quiescent current and voltage gain vs. supply voltage

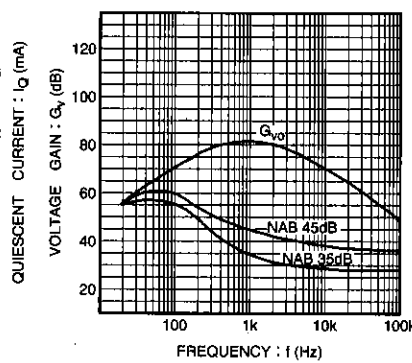


Fig. 2 Voltage gain vs. frequency

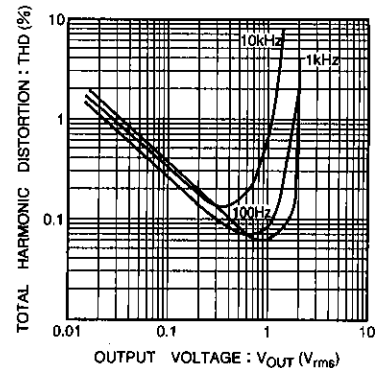


Fig. 3 Distortion vs. output voltage

Pre-amplifiers

Low-frequency amplifiers

● Measurement circuit

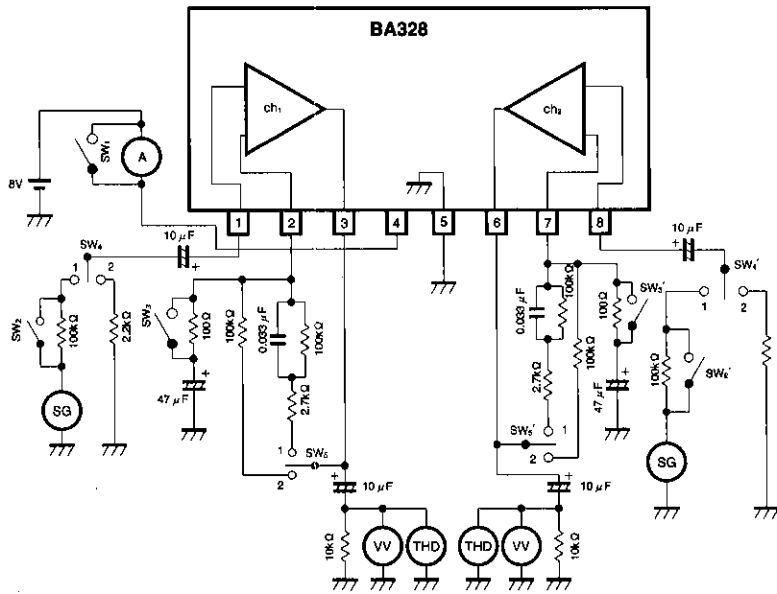


Fig. 4

● Description of external components

C_{IN} : input coupling capacitor

The recommended value is $10 \mu F$. If the value of the capacitor is too small the characteristics at power on will deteriorate.

C_O : Output coupling capacitor

No particular requirements. A value of 4.7 to $22 \mu F$ is appropriate.

C_E : AC signal bypass capacitor

The recommended value is $47 \mu F$. This capacitor sets the bass gain.

If a capacitor larger than the recommended value is used, the bass-region gain will increase, but the characteristics at power on will deteriorate. If the value of the capacitor is made smaller than the recommended value, the bass-region gain will be lower, but the power on characteristics will improve.

C_1 and R_1 Ripple filter components

The larger R_1 and C_1 are made, the better the ripple rejection ratio will be. However, if R_1 is made too large, the voltage drop that results will influence the maximum output.

Feedback pin : The closed-loop gain is roughly Z_n/R_E .

| Item | SW ₁ | SW ₂ SW ₂ ' | SW ₃ SW ₃ ' | SW ₄ SW ₄ ' | SW ₅ SW ₅ ' |
|------------------|-----------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| I _Q | OFF | ON | OFF | 2 | 1 |
| G _{VO} | ON | ON | ON | 1 | 2 |
| V _{OM} | ON | ON | OFF | 1 | 1 |
| R _{IN} | ON | ON · OFF | OFF | 1 | 1 |
| THD | ON | ON | OFF | 1 | 1 |
| V _{NIN} | ON | ON | OFF | 2 | 1 |
| CT | ON | ON | OFF | 2(1) | 1 |
| CB | ON | ON | OFF | 1 | 1 |

Note: Bandpass filter used (30Hz to 20kHz).

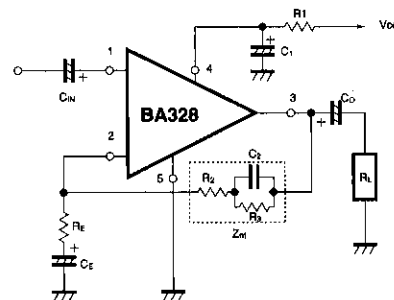
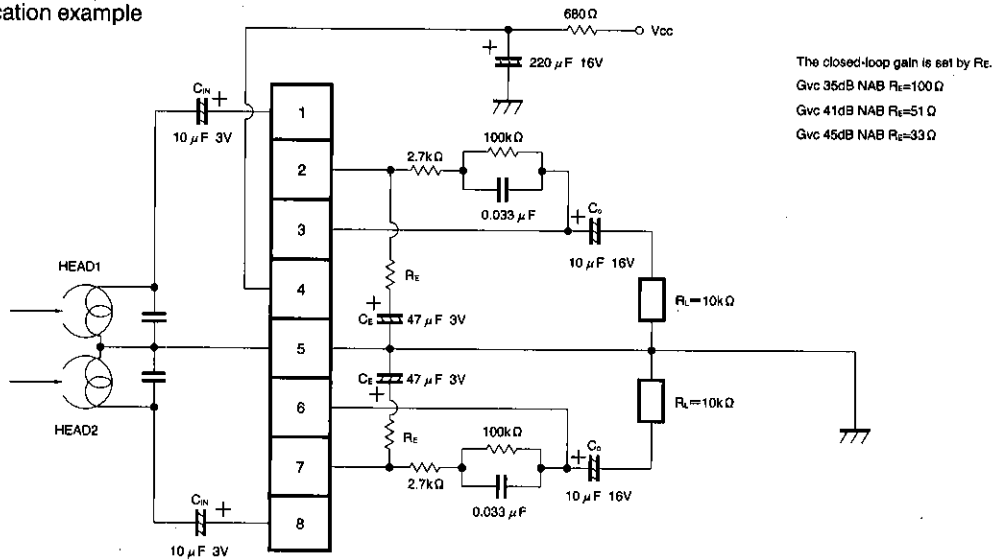


Fig. 5

●Application example



The closed-loop gain is set by R_E .
 Gvc 35dB NAB $R_E=100\Omega$
 Gvc 41dB NAB $R_E=51\Omega$
 Gvc 45dB NAB $R_E=33\Omega$

Fig. 6 Car stereo application

●Operation notes

Determining the DC output voltage (see Fig. 7)

The DC output voltage is determined as follows :

$$V_{ODC} = (R_{nt} \times I_o) + V_{P2} (7)$$

$V_{P2} (7)$: DC voltage on pin 2 (7)

R_{nt} : DC feedback resistance

I_o is set internally.

In other words, pin 7 is a fixed current source, and when that current flows into the feedback pin, the voltage generated becomes the DC voltage. $V_{P2} (7)$ is fixed at about 0.8V. When V_{ODC} is about 1/2 the supply voltage, V_{OM} is maximized.

I_o is fixed regardless of the supply voltage. Therefore, it is possible to set the DC feedback resistance after considering the required dynamic range and the minimum voltage applied to pin 4 (V_{CC}).

The recommended value is 100kΩ for a supply voltage of 6V to 16V.

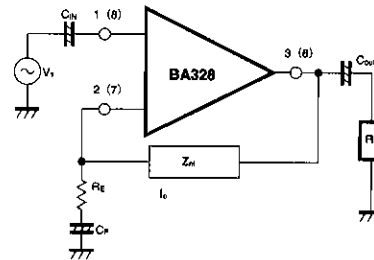
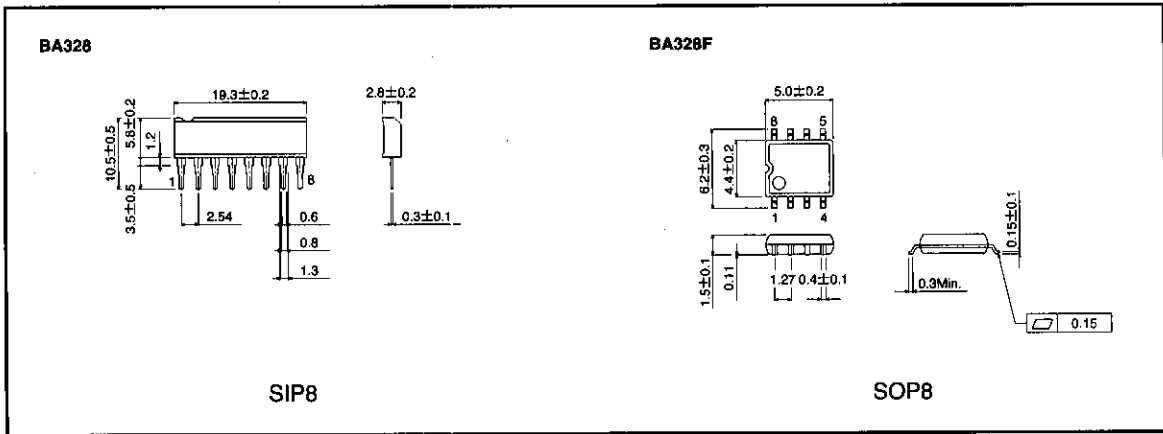


Fig. 7

Preamplifiers

Low-frequency amplifiers

●External dimensions (Unit: mm)



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