Dual preamplifier

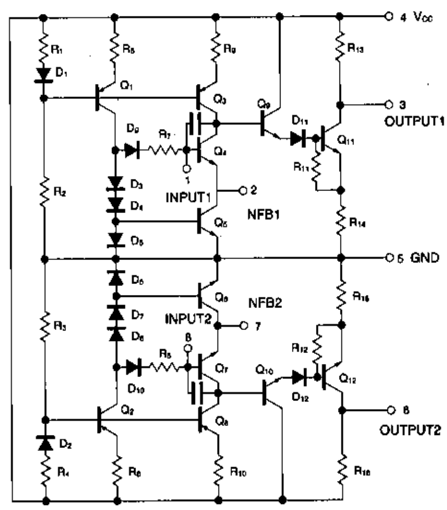
BA328 / BA328F

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

●Internal circuit diagram



●Absolute maximum ratings (Ta = 25℃)

Parameter		Symbol	Limits	Unit
Supply voltage		V_{CC}	18	V
Power dissipation	BA328	Pd	900*1	mW
	BA328F		500*2	
Operating temperature		Topr	−25~75	℃
Storage temperature		Tstg	−55~125	℃

*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℃)

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

●Electrical characteristics (unless otherwise specified Ta = 25℃, Vcc = 8V, f= 1kHz, RL = 10kΩ and RE = 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

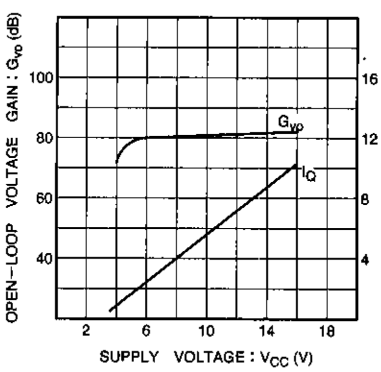


Fig. 1 Quiescent current and voltage gain vs. supply voltage

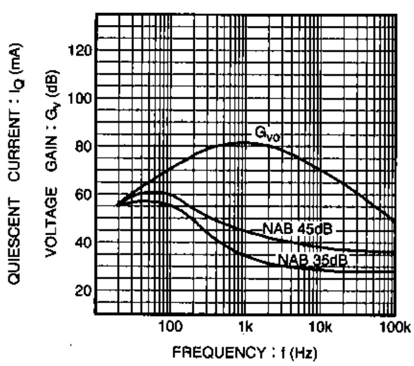


Fig. 2 Voltage gain vs. frequency

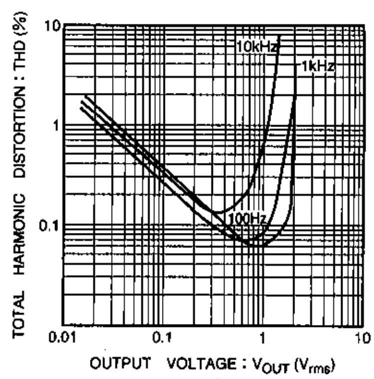


Fig. 3 Distortion vs. output voltage

●Measurement circuit

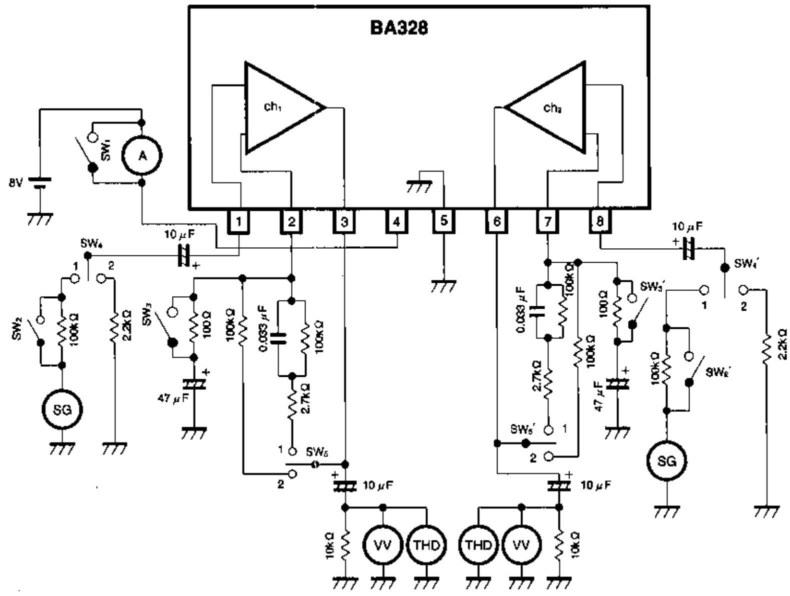


Fig. 4

●Description of external components

C_{IN} : input coupling capacitor

The recommended value is 10 μF. 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 μF is appropriate.

C_E : AC signal bypass capacitor

The recommended value is 47 μF. 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_{nf}/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).

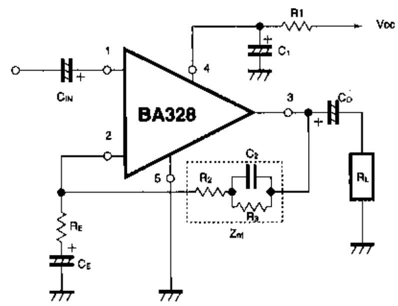
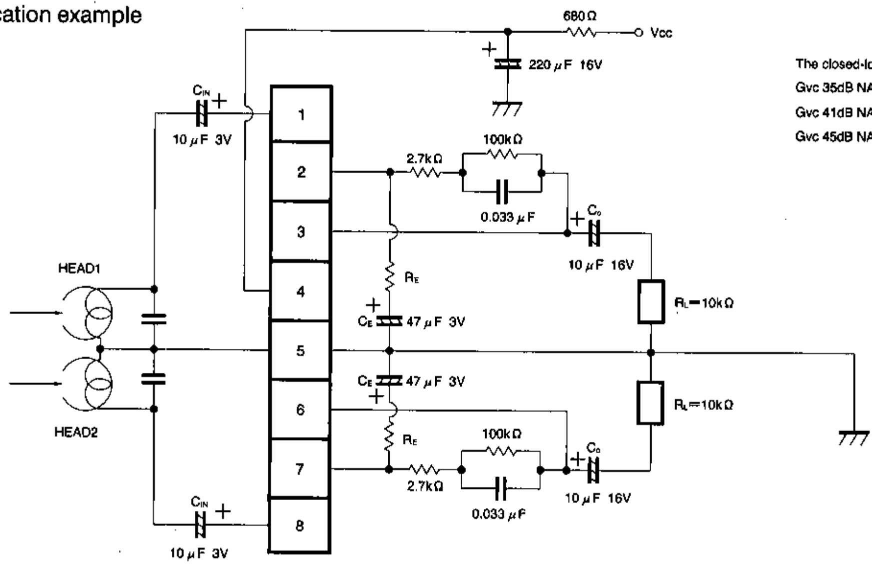


Fig. 5

●Application example



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

Fig. 6 Car stereo application

●Operation notes

Determining the DC output voltage (see Fig. 7)

The DC output voltage is determined as follows :

$V_{ODC} = (Rnt \times Io) + V_{P2}$ (7)

VP2 (7) : DC voltage on pin 2 (7)

R_{nt} : DC feedback resistance

Io 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. VP2 (7) is fixed at about 0.8V. When V_{ODC} is about 1 / 2 the supply voltage, V_{OM} is maximized.

Io 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 (Vcc).

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

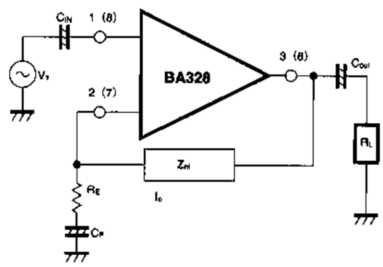
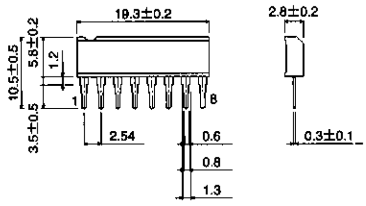


Fig. 7

●External dimensions (Unit: mm)

BA328



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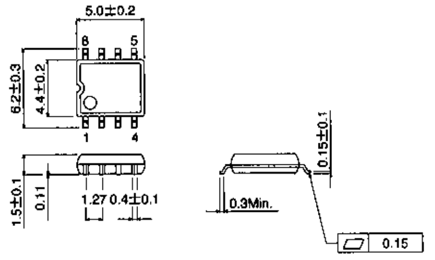
BA328F



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