

3V dual pre/power amplifier

BA3513AFS

The BA3513AFS is a dual, pre/power amplifier designed for headphone stereo applications. It has all of the basic signal circuits required for tape players, and operates off a 3V supply.

The auto-reverse-compatible preamplifier block and fixed-gain power amplifier blocks are independent to facilitate noise reduction.

The preamplifier block can be direct-coupled, and the power amplifiers do not require bootstrap capacitors, and use a fixed-gain negative feedback circuit to reduce the number of external components required and allow compact and reliable set designs.

●Applications

3V headphone stereos and 3V radio cassette players.

●Features

- 1) Dual preamplifiers and power amplifiers on one chip.
- 2) Preamplifier suitable for auto-reverse use.
- 3) Transistor switch provided for metal-tape muting.
- 4) Power amplifier gain is optimized for noise reduction.
- 5) Radiation prevention pin provided.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	V _{CC}	4.5	V
Power dissipation	P _d	800*	mW
Operating temperature	T _{opr}	−25~75	°C
Storage temperature	T _{stg}	−55~125	°C

* When mounted on a 90mm x 50mm x 1.6mm glass-epoxy PCB, reduced by 8.0mW for each increase in Ta of 1°C over 25°C

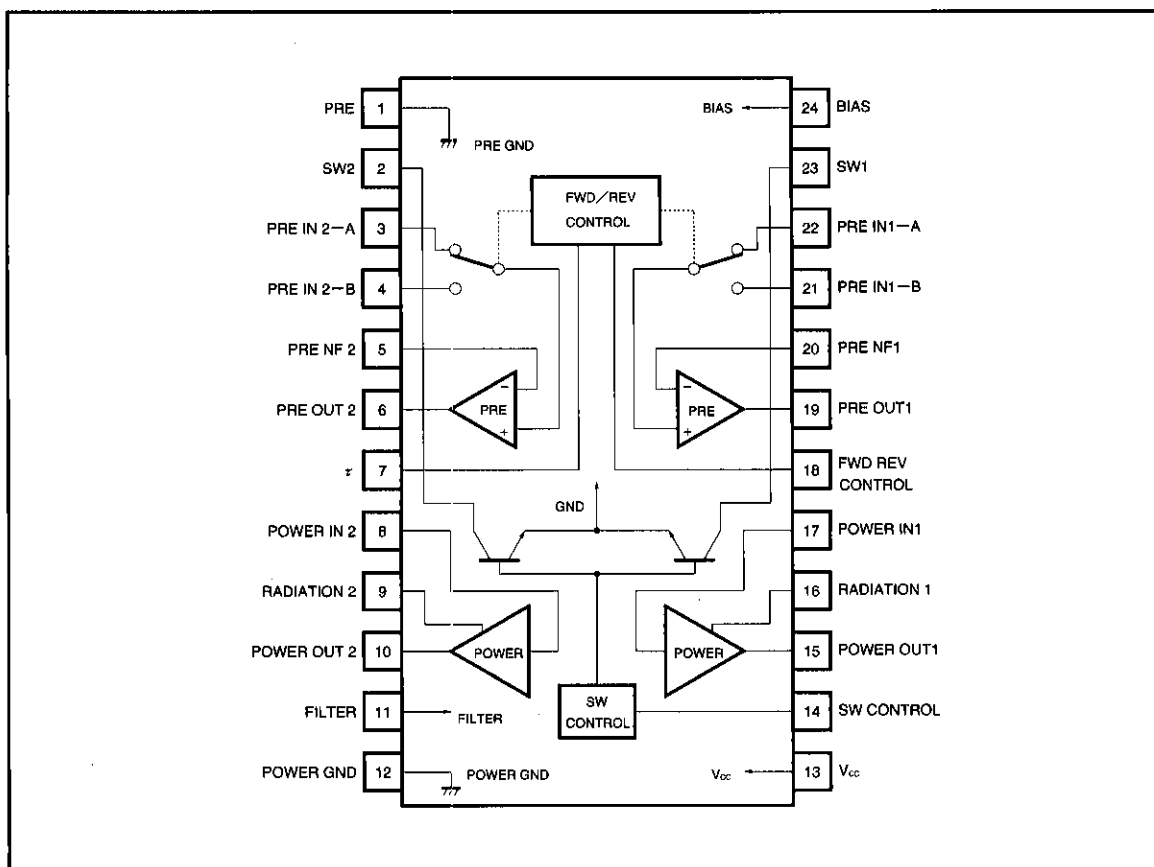
●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V _{CC}	1.8	2.4	3.6	V

Pre/power amplifiers for headphone stereos

Low-frequency amplifiers

● Block diagram



●Electrical characteristics (unless otherwise specified Ta = 25°C, V_{CC} = 2.4V and f = 1kHz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Quiescent circuit current	I _Q	—	8	14	mA	V _{IN} =0V _{rms} , 14, 18pin Open	Fig.7
〈Preamplifier〉 R _L =10kΩ							
Open-circuit voltage gain	G _{VO}	72	78	—	dB	V _O =-10dBm	Fig.7
Maximum output voltage	V _{OM}	200	300	—	mVrms	THD=1%	
Total harmonic distortion	THD ₁	—	0.03	0.15	%	V _O =0.2V _{rms} , NAB33dB	
Input conversion-noise voltage	V _{NIN}	—	1.0	1.8	μVrms	R _g =2.2kΩ, BPF20~20kHz	
Ripple rejection	RR ₁	40	47	—	dB	V _{RR} =-20dBm, f=100Hz NAB33dB, R _g =2.2kΩ	
Forward-reverse crosstalk	CT _{F-R}	65	75.5	—	dB	Single channel V _O = -10dBm R _g =2.2kΩ, BPF20~20kHz	
Input bias current	I _{B1}	—	60	300	nA	V _{IN} =0V _{rms}	
〈Power amplifier〉 R _L =16kΩ							
Rated output	P _{OUT}	30	40	—	mW	THD=10%	Fig.7
Closed-circuit voltage gain	G _{VC}	24.7	26.7	28.7	dB	V _{IN} =-40dBm	
Total harmonic distortion	THD ₂	—	0.2	1.0	%	P _O =1mW	
Output noise voltage	V _{NO}	—	30	39	μVrms	R _g =0Ω, BPF20~20kHz	
Ripple rejection	RR ₂	45	58	—	dB	V _{RR} =-20dBm, f=100Hz, R _g =0Ω	
Input resistance	R _{IN}	21.4	30	38.6	kΩ	—	
Input bias current	I _{B2}	—	22	80	nA	V _{IN} =0V _{rms} , R _g =10kΩ *1	
Channel balance	CB	—	0	0.7	dB	V _O =-10dBm	
Switching transistor ON resistance	R _{TR}	—	6.0	18	Ω	14pin GND, 2pin, 23pin	
Preamplifier + power amplifier (connection as per application example circuit)							
Channel separation	CS	37	47	—	dB	P _{re} -R _g =2.2kΩ, VR Max.*2 Single channel Power-V _O = -5dBm BPF20~20kHz	Fig.7
Leakage from preamp to power amp for signal leak VR Min.	SL	—	-63	-57	dBm	P _{re} -V _O =-12dBm VR Min.*3, When both channels are operating	

$$*1 \quad I_{B2} = \frac{V_{B2}}{10k\Omega} \times \frac{4}{3}$$

V_{B2}: Voltage at each end of R_g (10Ω).

*2 0dB attenuation from the preamplifier output to power amplifier input.

*3 Power amplifier signal source impedance is 0Ω.

Pre/power amplifiers for headphone stereos

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● Electrical characteristics curves

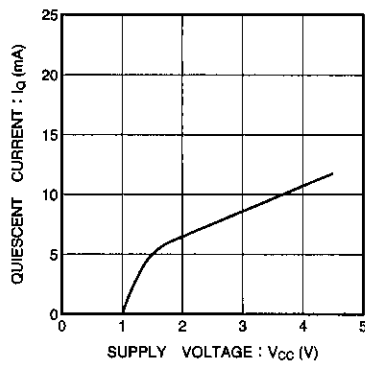


Fig. 1 Quiescent current vs. supply voltage

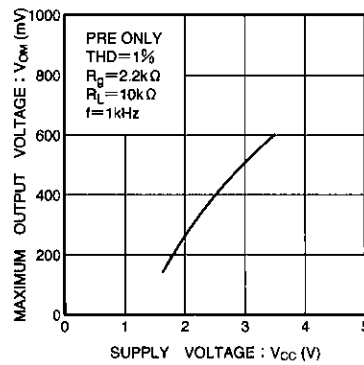


Fig. 2 Maximum output power vs. supply voltage

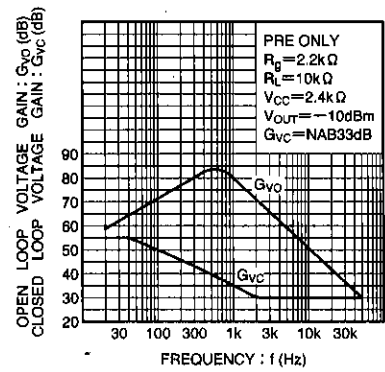


Fig. 3 Voltage gain vs. frequency

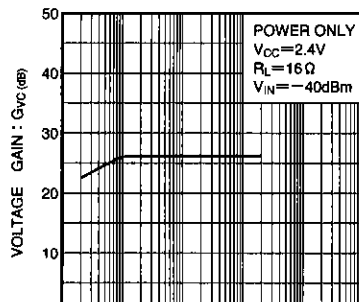


Fig. 4 Voltage gain vs. frequency

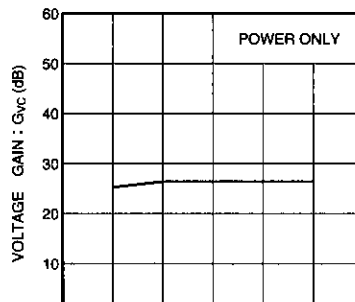


Fig. 5 Voltage gain vs. ambient temperature

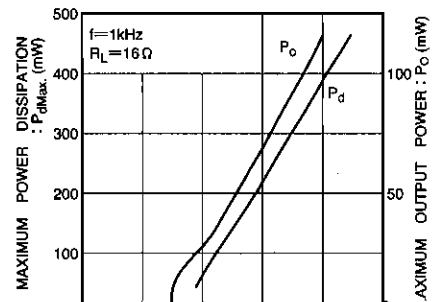


Fig. 6 Maximum power dissipation and output power vs. supply voltage

● Measurement circuit

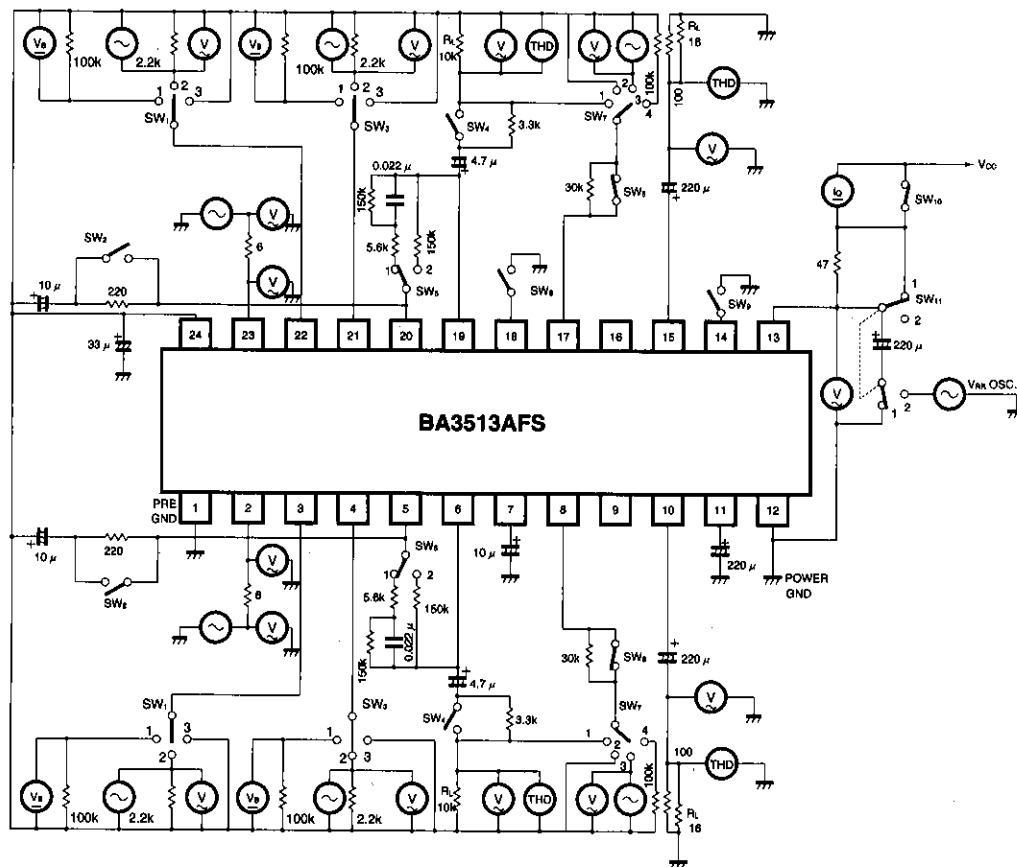


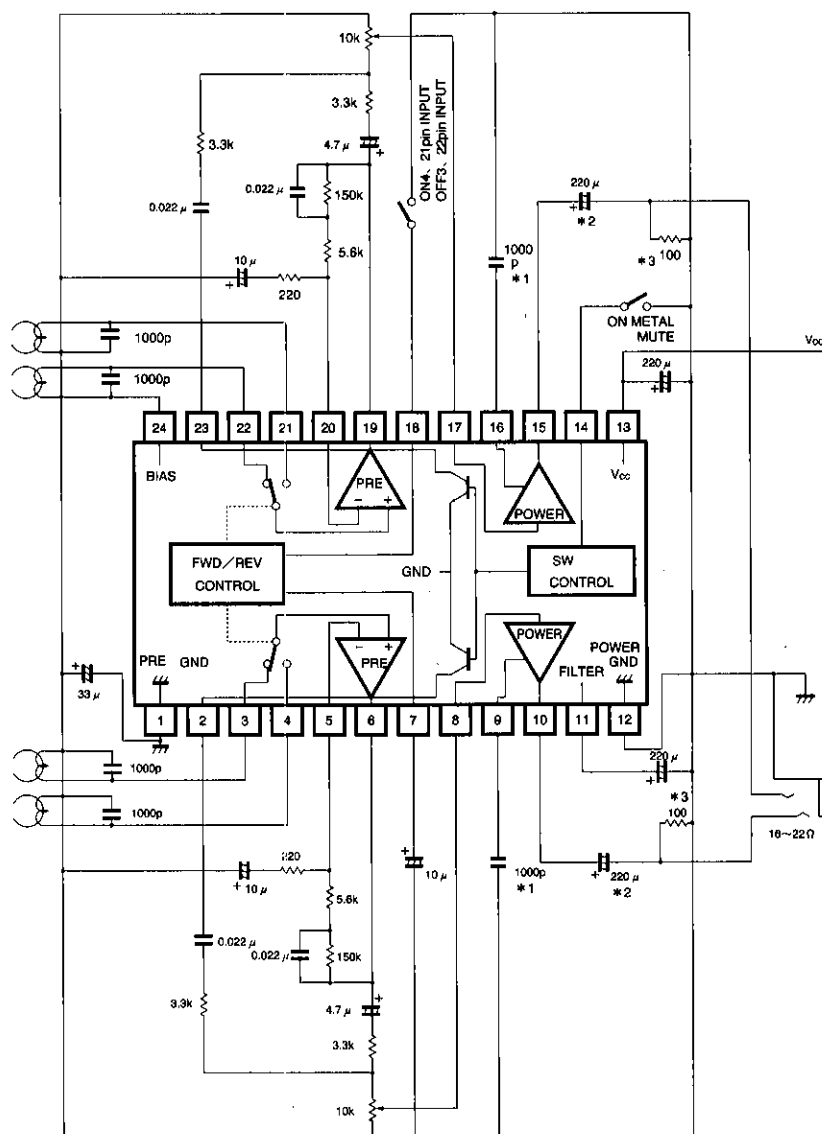
Fig. 7

Units:

Resistance: Ω ($\pm 1\%$)Capacitance (film): F ($\pm 1\%$)

Capacitance (electrolytic): F ($\pm 5\%$)

● Application example



Units:

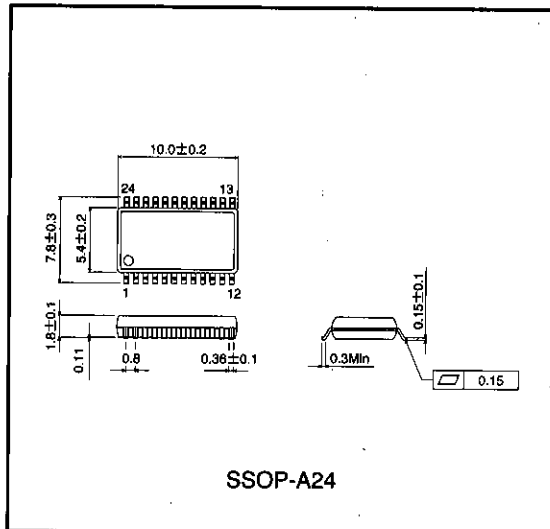
Resistance: Ω ($\pm 5\%$)Capacitance (film): F ($\pm 10\%$)Capacitance (electrolytic): F ($\pm 20\%$)

* 1 Connect a 1000pF capacitor as a countermeasure against RF noise. Normally not required.

* 2 220 μ F for 16 Ω headphones.100 μ F for 32 Ω headphones.* 3 Depending on the headphones, connect a 47 Ω resistor and 0.01 μ F capacitor between pin 10 (pin15) and GND.

Fig. 8

● External dimensions (Unit: mm)



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