

# 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)

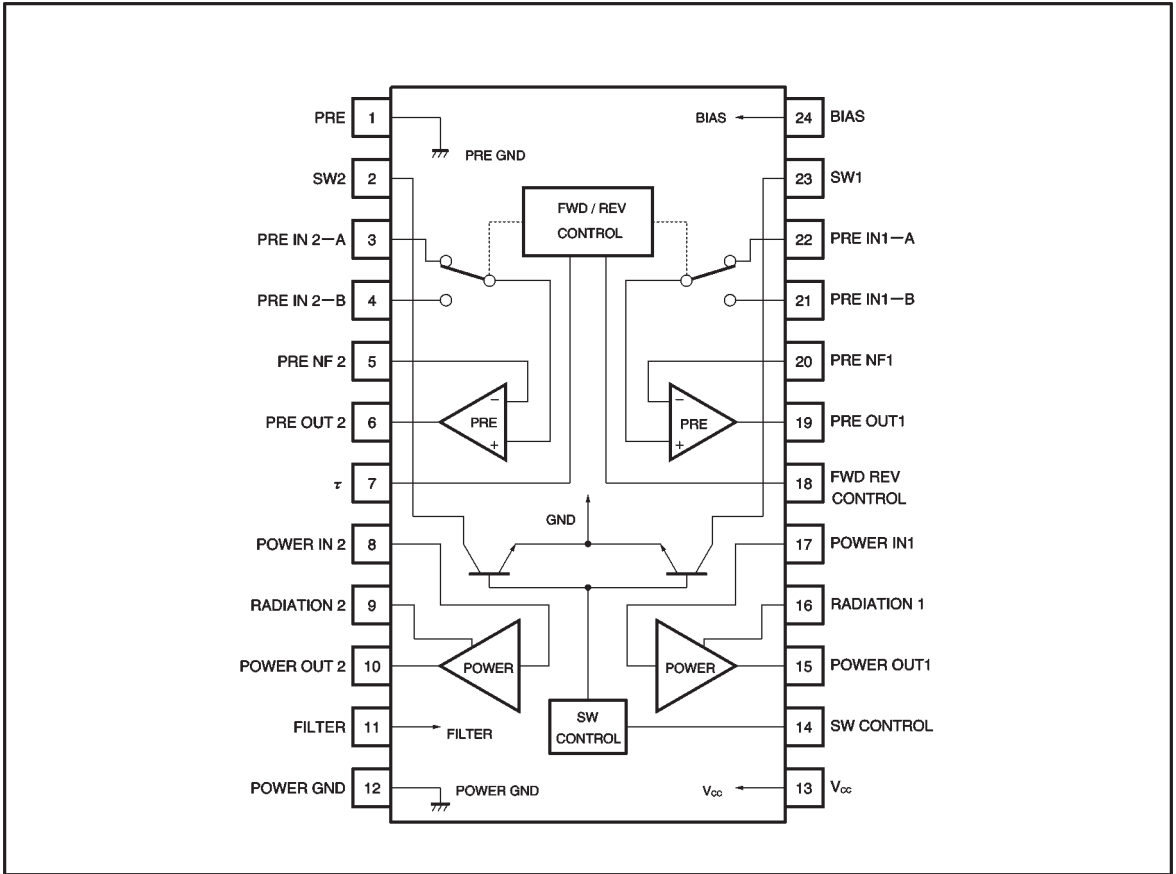
Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>CC</sub>	4.5	V
Power dissipation	P <sub>d</sub>	800*	mW
Operating temperature	T <sub>opr</sub>	-25~+75	°C
Storage temperature	T <sub>stg</sub>	-55~+125	°C

\* When mounted on a 90mm x 50mm x 1.6mm glass epoxy board, 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
Power supply voltage	V <sub>CC</sub>	1.8	2.4	3.6	V

● Block diagram



●Electrical characteristics (unless otherwise noted, Ta = 25°C, Vcc = 2.4V and f = 1kHz)

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

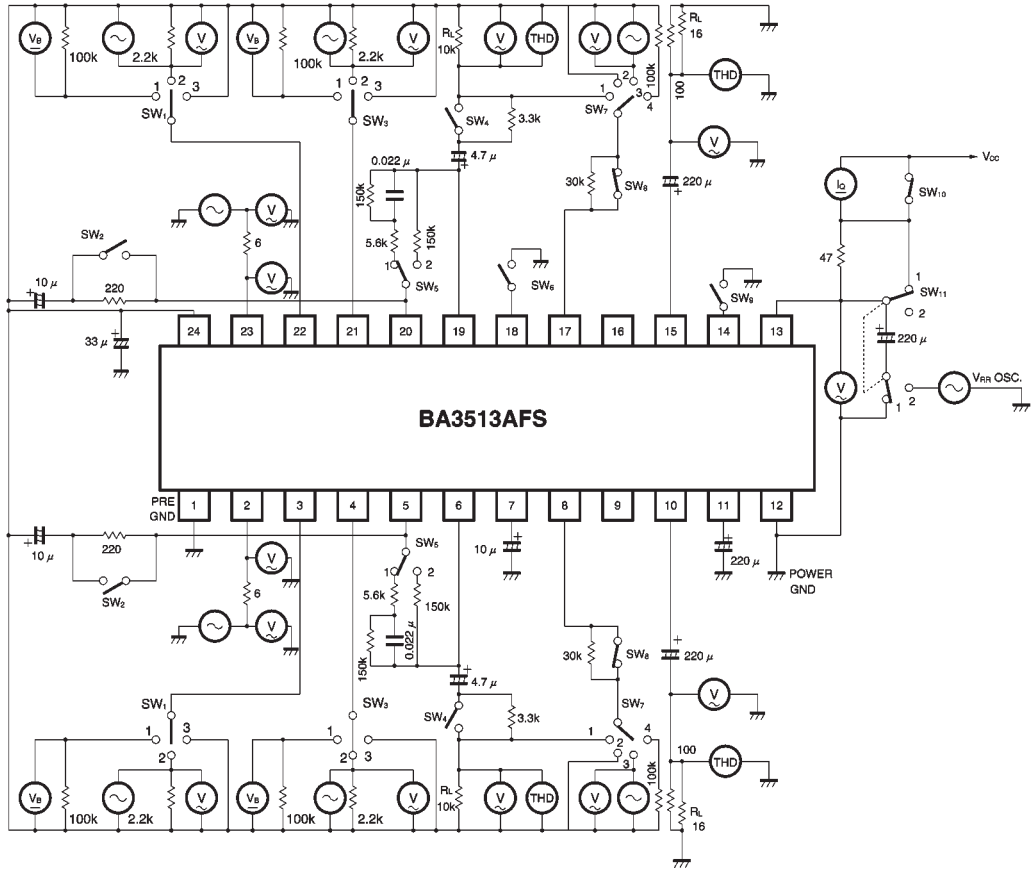
$$*1 \quad I_{B2} = \frac{V_{B2}}{10k\Omega} \times \frac{4}{3}$$

V<sub>B2</sub>: Voltage at each end of R<sub>g</sub> (10Ω).

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

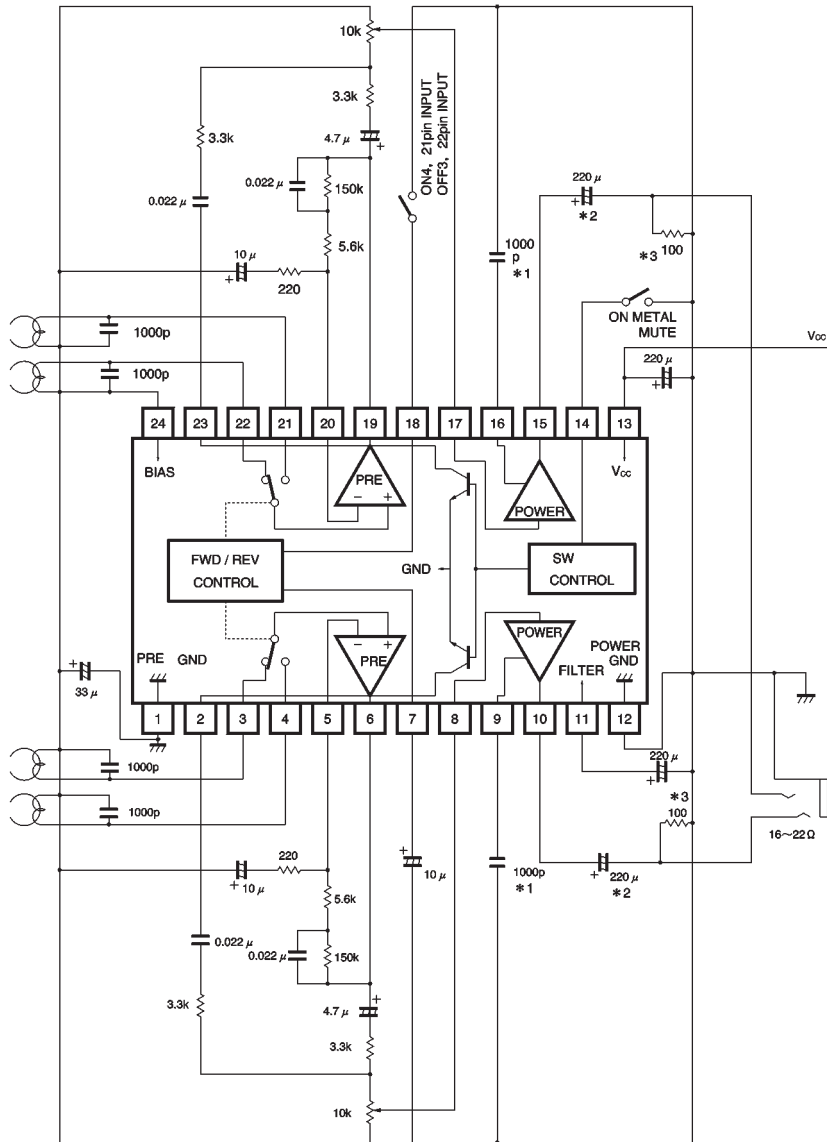
\*3 Power amplifier signal source impedance is 0Ω.

● Measurement circuit



Units:  
 Resistance : Ω (±1%)  
 Capacitance (film) : F (±1%)  
 Capacitance (electrolytic): F (±5%)

● Application example



Units:

Resistance : Ω (±5%)  
 Capacitance (film) : F (±10%)  
 Capacitance (electrolytic): F (±20%)

- \* 1 Connect a 1000pF capacitor as a countermeasure against RF noise. Normally not required.
- \* 2 220 μF for 16Ω headphones.  
100 μF for 32Ω headphones.
- \* 3 Depending on the headphones, connect a 47Ω resistor and 0.01 μF capacitor between pin 10 (pin15) and GND.

● Electrical characteristics curves

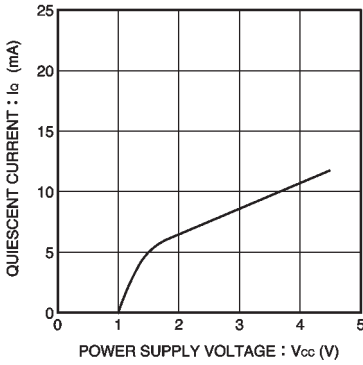


Fig. 1 Quiescent current vs. power supply voltage

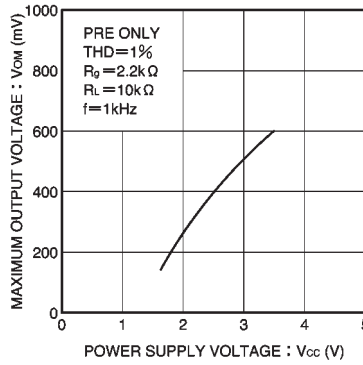


Fig. 2 Maximum output power vs. power supply voltage

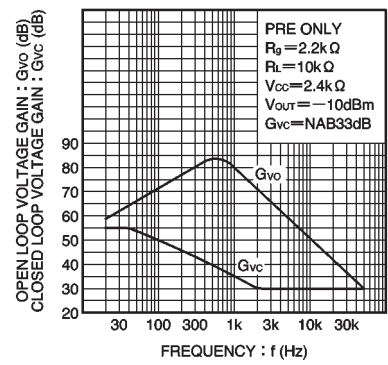


Fig. 3 Voltage gain vs. frequency

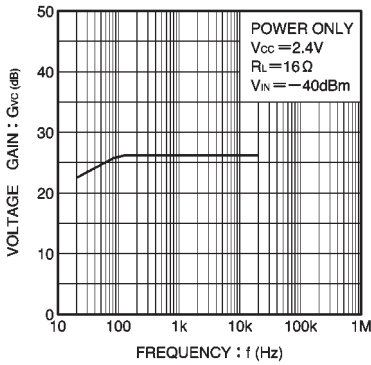


Fig. 4 Voltage gain vs. frequency

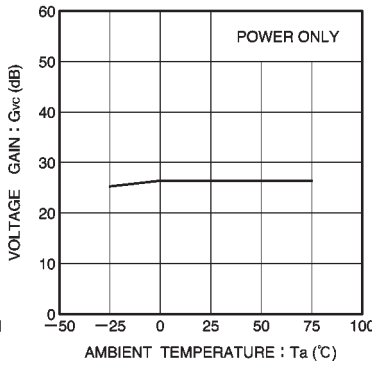


Fig. 5 Voltage gain vs. ambient temperature

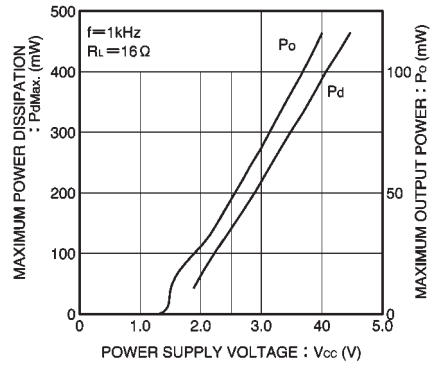


Fig. 6 Maximum power dissipation and output power vs. power supply voltage

● External dimensions (Units: mm)

