

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 _{CC}	4.5	V
Power dissipation	P _d	800*	mW
Operating temperature	T _{opr}	-25~+75	°C
Storage temperature	T _{stg}	-55~+125	°C

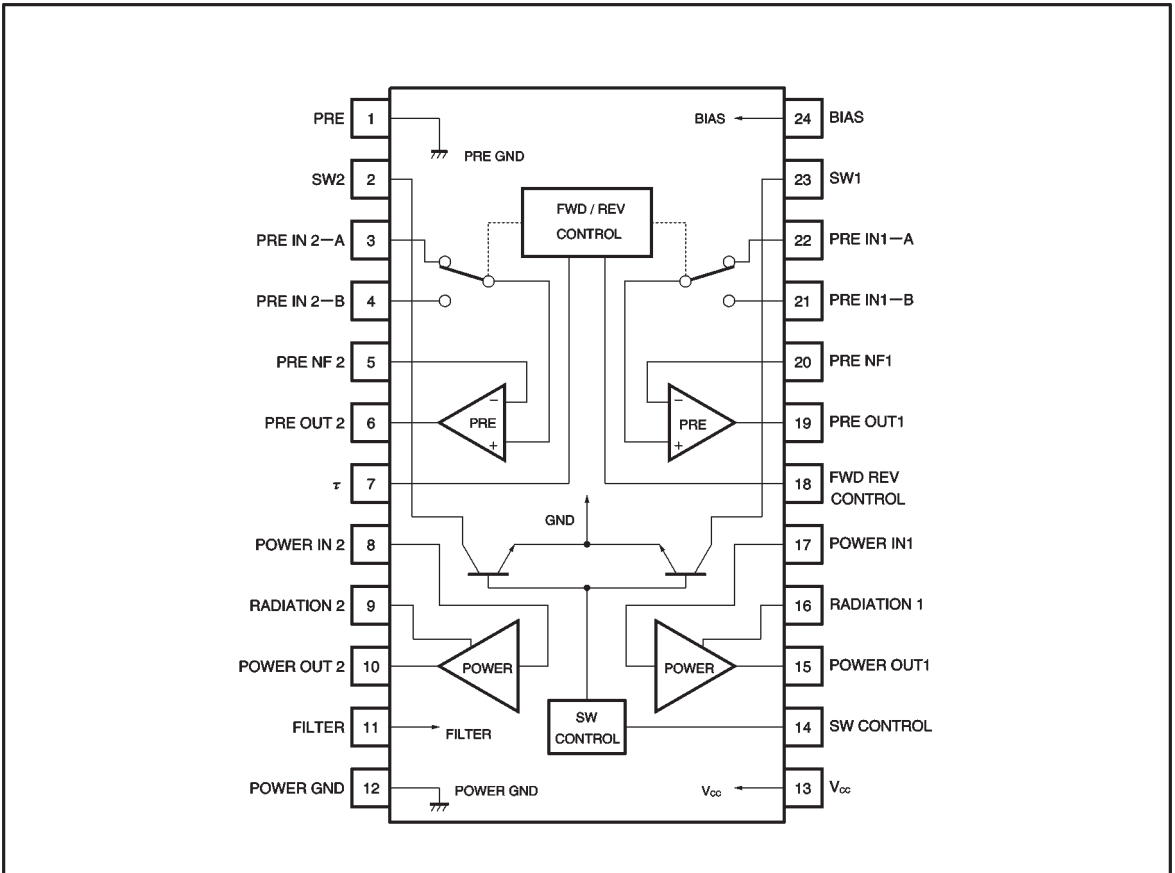
* When mounted on a 90mm x 50mm x 1.6mm glass epoxy board, reduced by 8.0mW for each increase in Ta of 1°C over 25°C

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V _{CC}	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 _Q	—	8	14	mA	V _{IN} =0V _{rms} , 14, 18pin Open
〈Preamplifier〉 R _L =10kΩ						
Open loop voltage gain	G _{VO}	72	78	—	dB	V _O =-10dBm
Maximum output voltage	V _{OM}	200	300	—	mV _{rms}	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	μV _{rms}	R _g =2.2kΩ, BPF20~20kHz
Ripple rejection ratio	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%
Closed loop 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	μV _{rms}	R _g =0Ω, BPF20~20kHz
Ripple rejection ratio	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
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

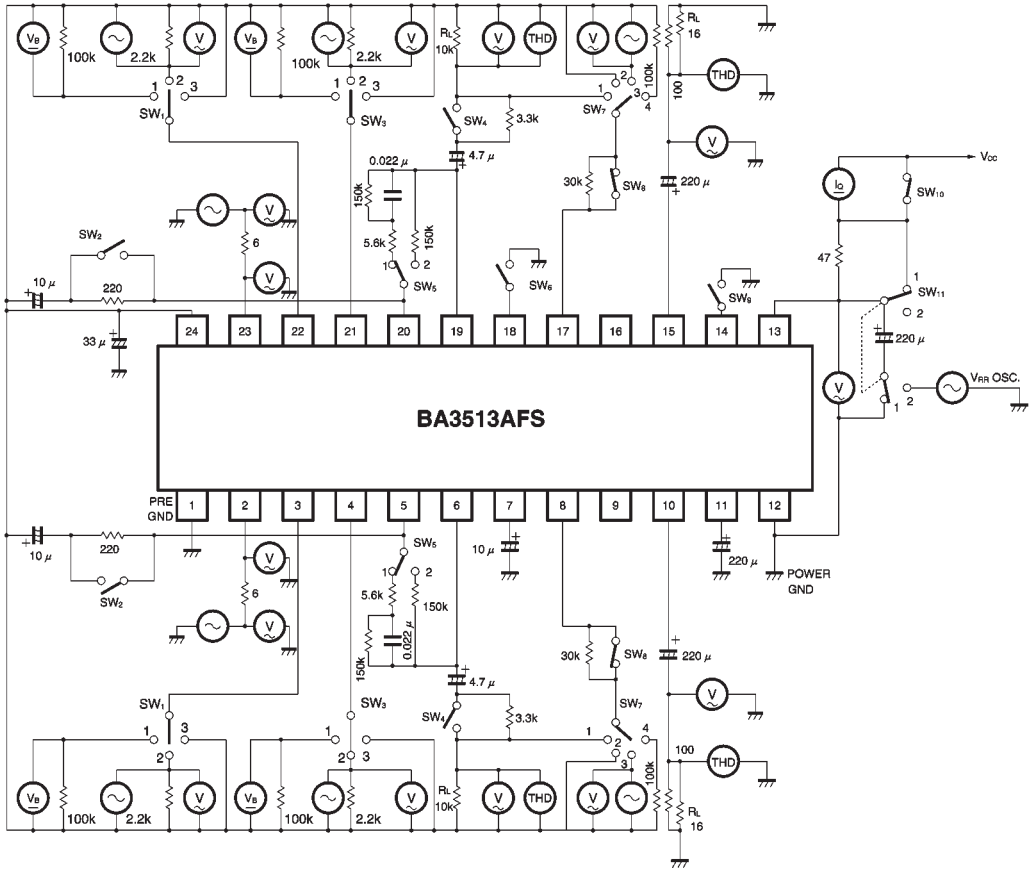
$$*1 \quad I_{B2} = \frac{V_{B2}}{10k\Omega} \times \frac{4}{3}$$

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.

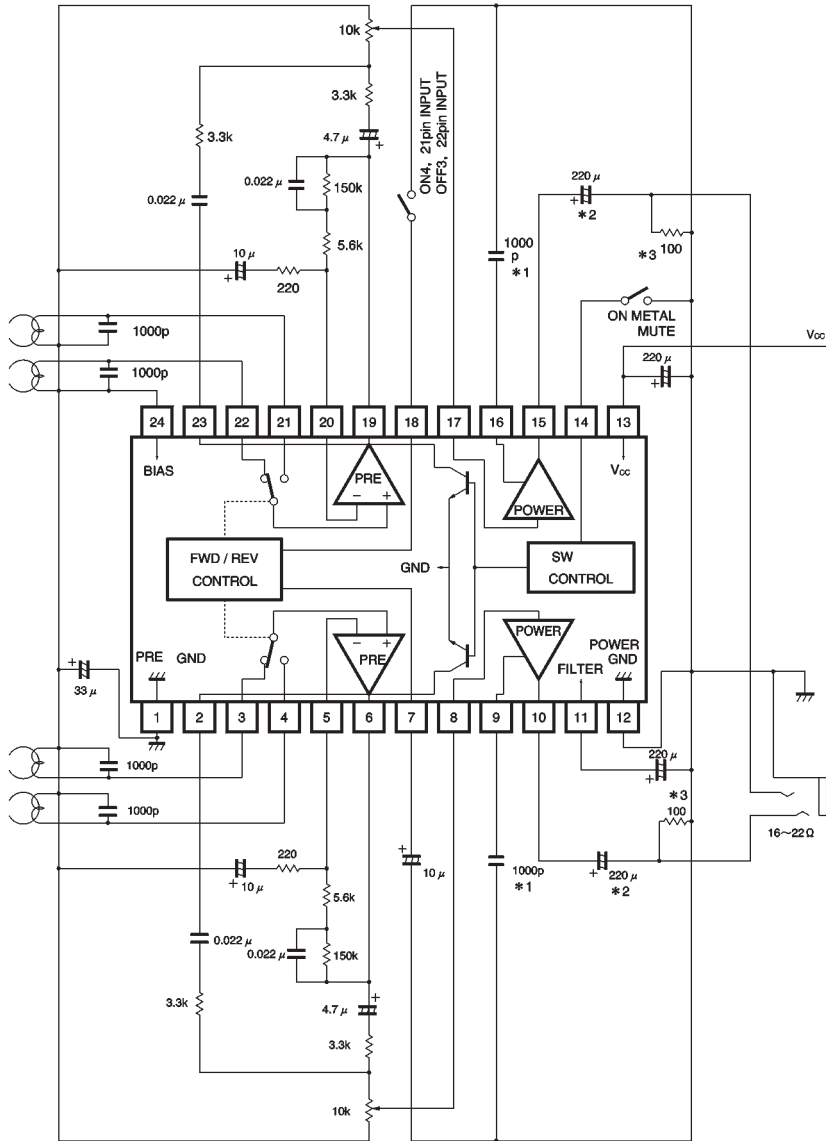
● Measurement circuit



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

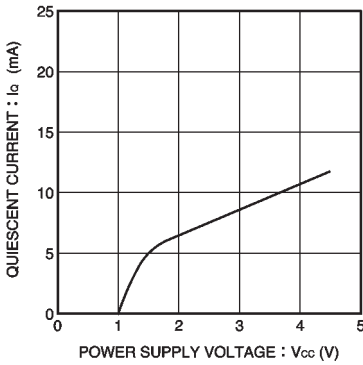


Fig. 1 Quiescent current vs. power supply voltage

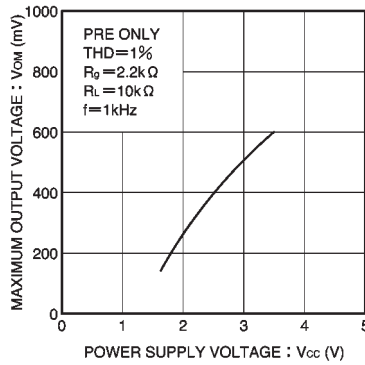


Fig. 2 Maximum output power vs. power supply voltage

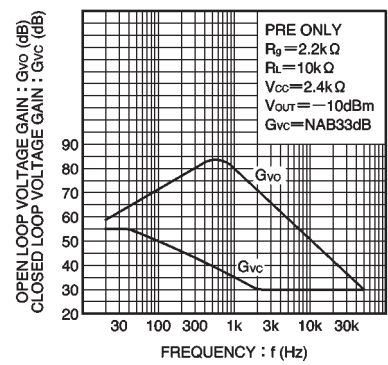


Fig. 3 Voltage gain vs. frequency

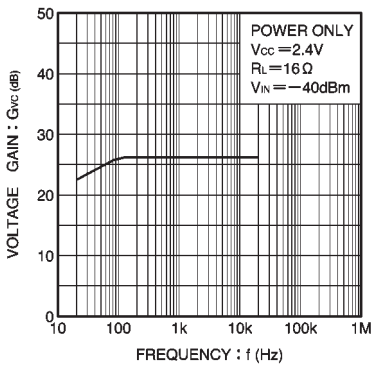


Fig. 4 Voltage gain vs. frequency

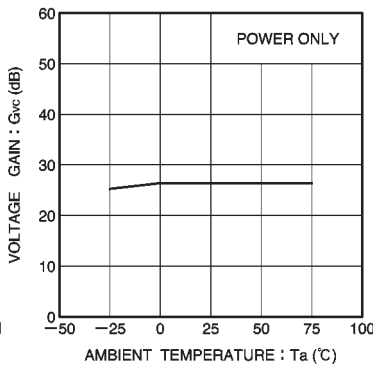


Fig. 5 Voltage gain vs. ambient temperature

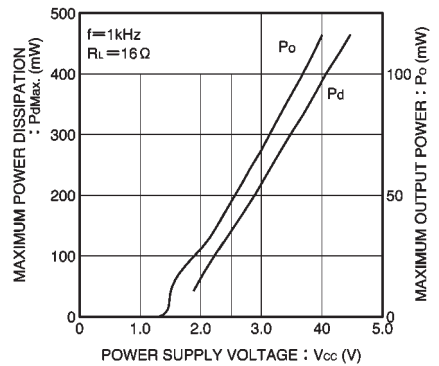


Fig. 6 Maximum power dissipation and output power vs. power supply voltage

● External dimensions (Units: mm)

