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)

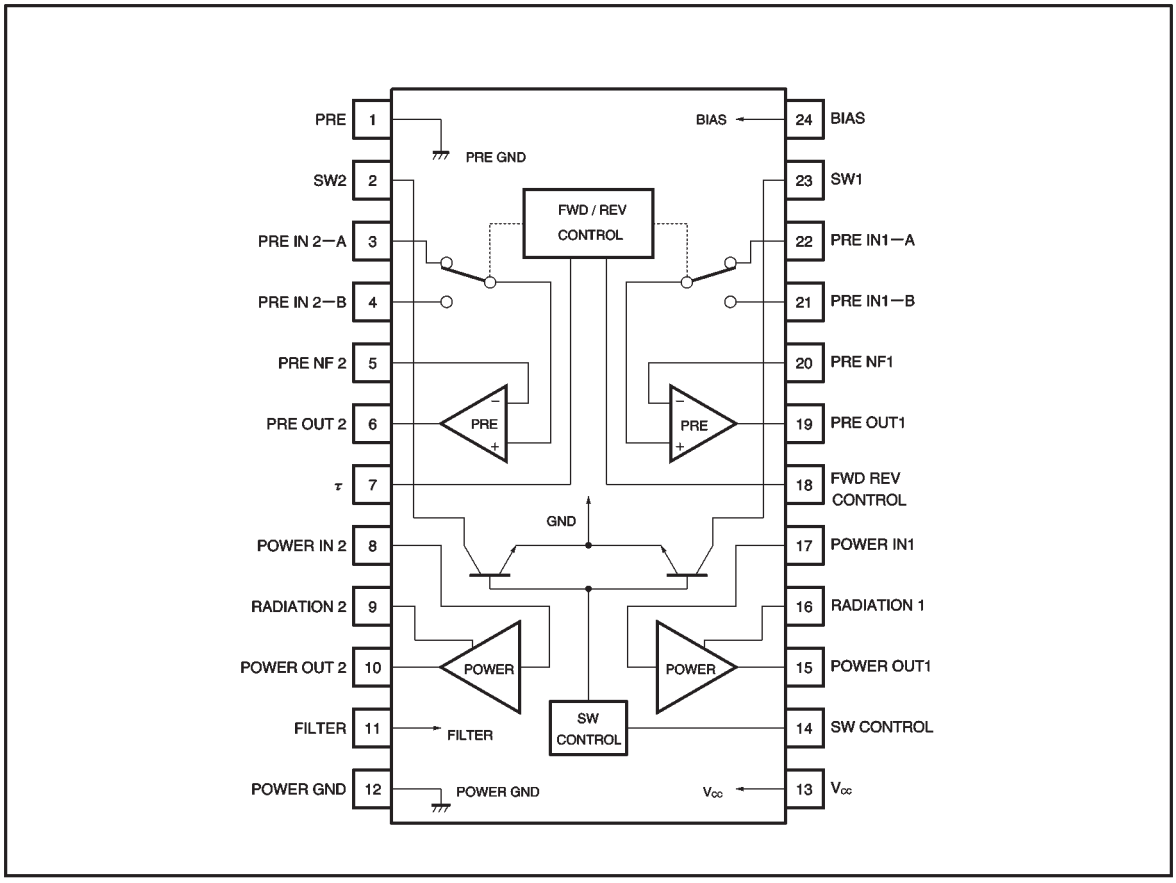
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	4.5	V
Power dissipation	Pd	800*	mW
Operating temperature	Topr	−25～+75	℃
Storage temperature	Tstg	−55～+125	℃

* 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, V_{CC} = 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 Vo=−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-Vo=−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

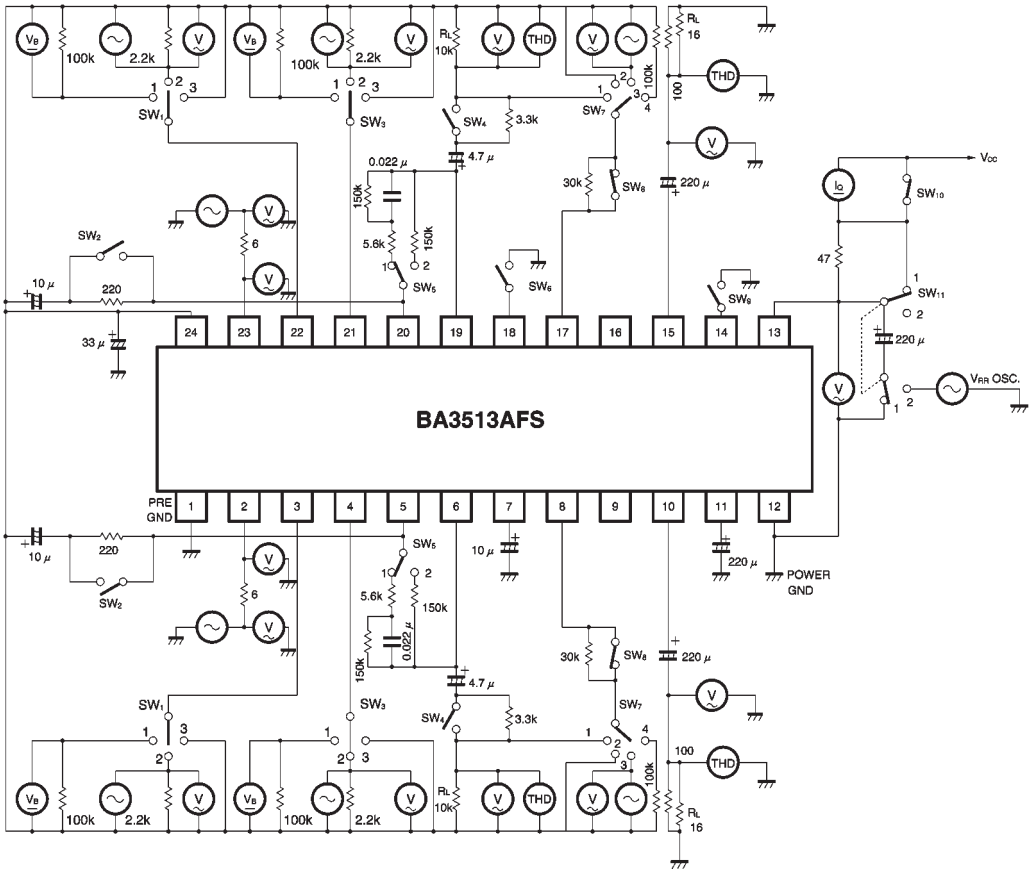
*1 $I_{B2}=\frac{V_{B2}}{10k\Omega}\times\frac{4}{3}$

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

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

*3 Power amplifier signal source impedance is 0Ω.

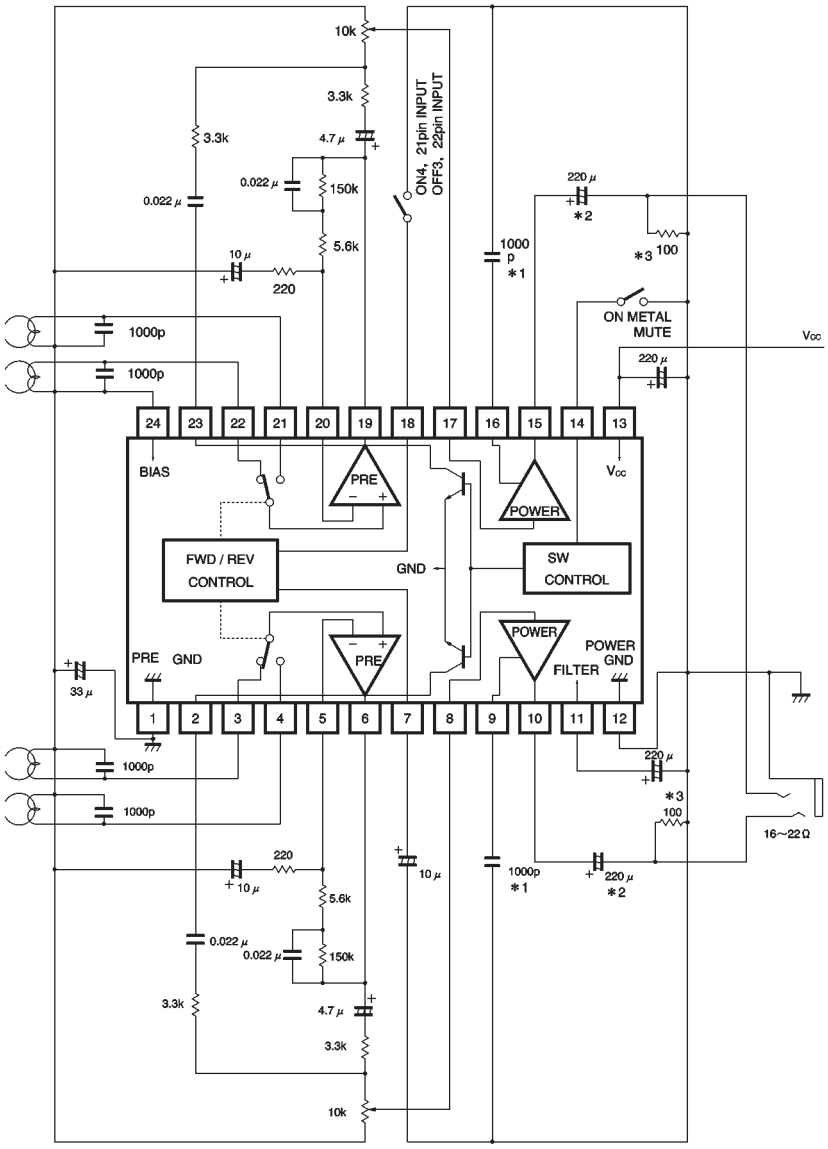
●Measurement circuit



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

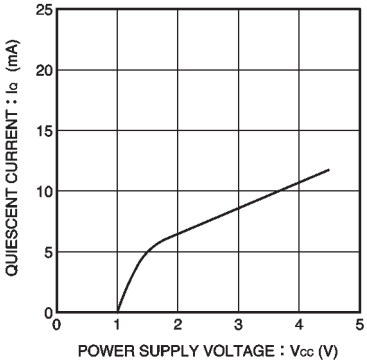


Fig. 1 Quiescent current vs. power supply voltage

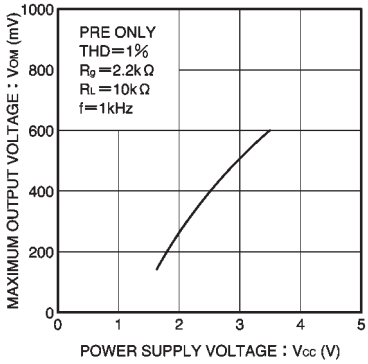


Fig. 2 Maximum output power vs. power supply voltage

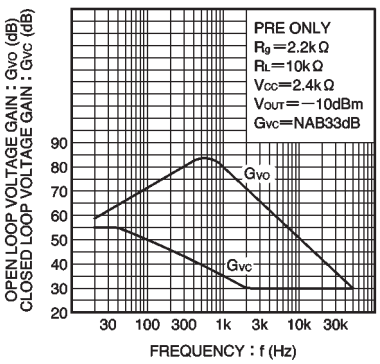


Fig. 3 Voltage gain vs. frequency

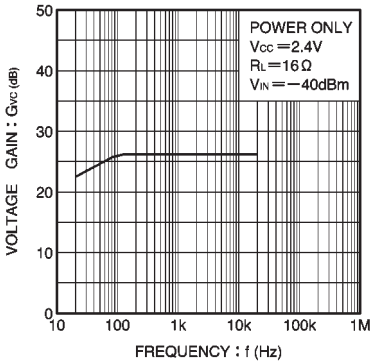


Fig. 4 Voltage gain vs. frequency

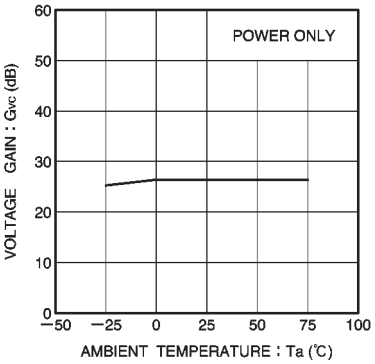


Fig. 5 Voltage gain vs. ambient temperature

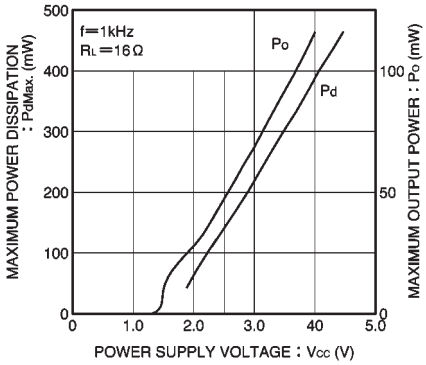


Fig. 6 Maximum power dissipation and output power vs. power supply voltage

●External dimensions (Units: mm)