

Pre-power amplifier for headphone stereos

BA3612AKV

The BA3612AKV is configured of a pre-amplifier and a headphone amplifier, and contains internal AMS, B.B, AVLS, and BEEP amplifier functions. Also, this IC can be used in combination with the BA3641FV to enable configuration of recording and playback sets.

●Applications

Portable cassette players

●Features

- 1) Low current consumption.
- 2) Internal AMS function.
- 3) Internal B.B function.
- 4) Internal AVLS function.
- 5) Internal BEEP amplifier.
- 6) Supports Dolby-B.
- 7) Supports OCL output.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V _{DD}	5.0	V
Power dissipation	P _d	400*	mW
Operating temperature	T _{opr}	-15~+60	°C
Storage temperature	T _{stg}	-55~+125	°C

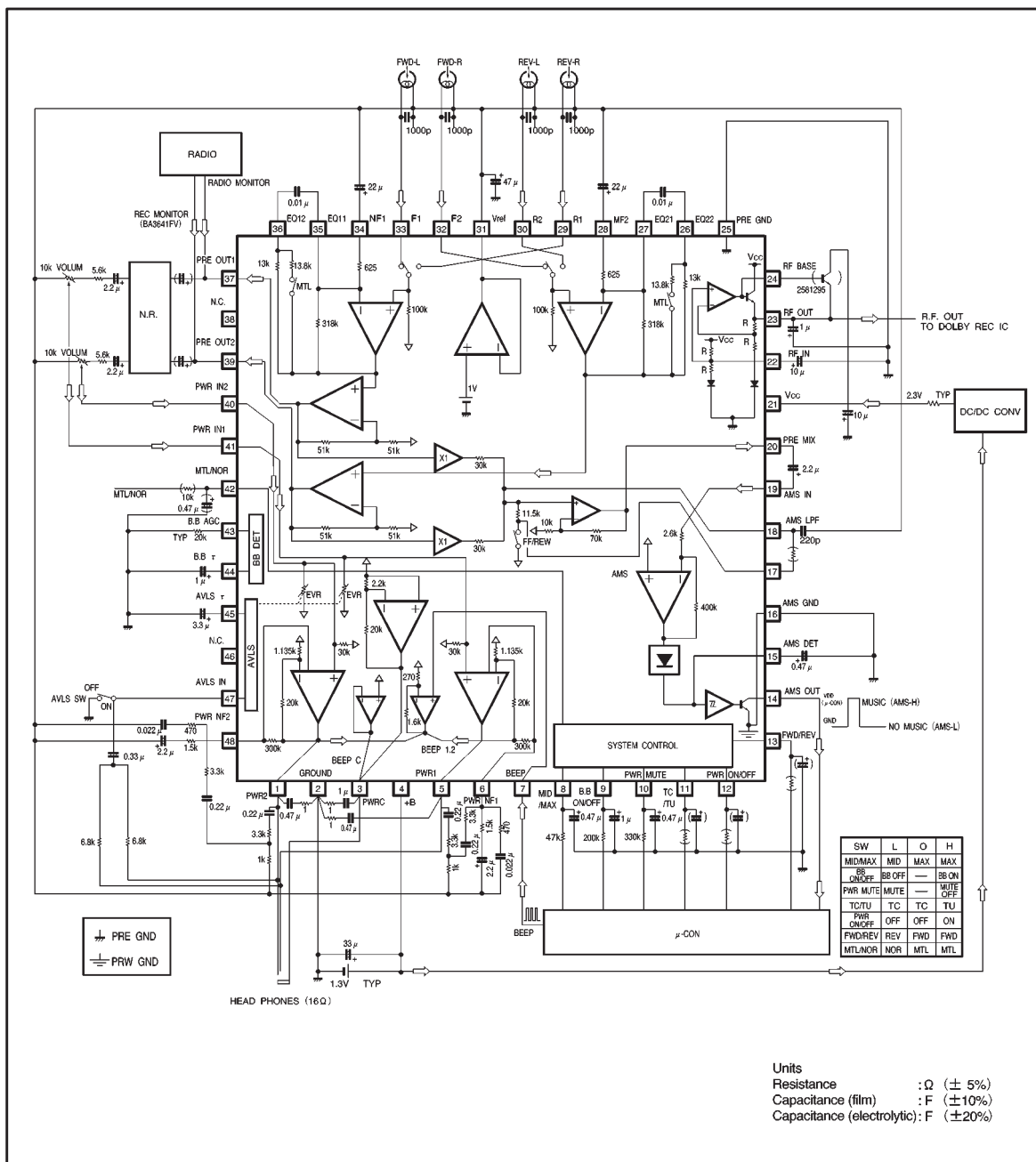
*Reduced by 4.0mW for each increase in Ta of 1°C over 25°C.
when mounted on a 70mm × 70mm × 1.6mm glass epoxy board.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage 1	+B	0.90~2.20	V
Power supply voltage 2	V _{CC}	1.70~4.40*	V

* In terms of basic operation, normally a high voltage of 0.4V higher than +B is applied for V_{CC}.
A relation of V_{CC}=+B × 2 is recommended.

●Block diagram



●Electrical characteristics

(unless otherwise noted, +B = 1.3V, V_{CC} = 2.3V, f = 1kHz, PreOutR_L = 5k Ω , PWROutR_L = 16 Ω (OCL), Ta = 25°C, and measurement condition pertaining to ripple: V_{CC} and +B are common-mode input)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Total〉							
Quiescent current		Icc1B	—	3.0	4.5	mA	Power On, PWR-Mute OFF, TC B.B-OFF, AVLS-OFF
		Icc1V	—	4.9	6.0		
		Icc2B	—	0.3	0.8	mA	Power On, PWR-Mute ON, TC B.B-OFF, AVLS-OFF
		Icc2V	—	4.1	5.5		
		Icc3B	—	3.0	4.5	mA	Power On, PWR-Mute OFF, Tuner B.B-OFF, AVLS-OFF
		Icc3V	—	4.2	5.5		
		Icc4B	—	0	5.0	μA	Power OFF, PWR-Mute OFF, TC B.B-OFF, AVLS-OFF
		Icc4V	—	0	5.0		
Current consumption at 0.5mW		Icc5B	—	14.0	15.5	mA	PWR input=−45.8dBV OCL, TC, B.B-OFF, AVLS-OFF
		Icc5V	—	4.9	6.0		
〈Pre block〉							
Closed-loop voltage gain		Gvc1	34.6	35.6	36.6	dB	Vo=−20.0dBv
Max. output voltage		Vom1	185	250	—	mV	+B=0.9V, Vcc=1.7V, THD=1%
Total harmonic distortion		THD1	—	0.12	0.5	%	+B=0.9V, Vcc=1.7V, Vo=−20.0dBv
Input reduced noise voltage		VNIN	—	1.25	2.0	μVrms	Rg=1.0kΩ, DIN-AUDIO Converted using NAB 1kHz gain
Crosstalk between channels		CTc1	65	—	—	dB	Do=−20.0dBv, Rg=1kΩ
Crosstalk between F/R		CTfr	68	—	—	dB	1kHz BPF+DIN-AUDIO
AMS threshold	Mute - OFF	amsP	−69.5	−67.0	−64.5	dBv	Cams=2.2 μF, Rams=0 Ω, TU-ON PRE OUT input value, VAMSOUT>0.3V
	Mute - ON	amsF	−62.5	−60.0	−57.5		
Ripple leak (Pre+R.F.)		RL1	—	—	−76	dBv	+B=1.0V+(−26dBv), f=130Hz Vcc=2.0V+(−20dBv), f=130Hz Irf=−1.5mA 130Hz BPF+DIN-AUDIO
Pre-muting attenuation		Mute1	75	—	—	dB	Vcc=1.7V, Rg=1kΩ, Vo=−20dBv 1kHz BPF+DIN-AUDIO
Metal-f characteristic		Δ GvM	−5.44	−4.54	−3.64	dB	Deviation at 10kHz, Vo=−20dBv

©Not designed for radiation resistance.

(unless otherwise noted, $+B = 1.3V$, $V_{CC} = 2.3V$, $f = 1kHz$, $PreOutR_L = 5k\Omega$, $PWROutR_L = 16\Omega$ (OCL), $T_a = 25^\circ C$, and measurement condition pertaining to ripple: V_{CC} and $+B$ are common-mode input)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Power block〉						
Closed-loop voltage gain	G_{vc2}	22.5	24.0	25.5	dB	$V_o = -20.0dB_v$
Interchannel balance	CB	-1.5	0.0	1.5		
Output power	P_o	6.5	10.0	—	mW	$+B = 1.5V$, THD=10%, $R_L = 16\Omega$
Total harmonic distortion 1	THDp1	—	0.3	0.9	%	$P_o = 1mW$, 400~30kHz BPF
Total harmonic distortion 2	THDp2	—	0.4	1.0	%	$P_o = 1mW$, $f = 10kHz$, 30kHz LPF
Output noise voltage	V_{NO}	—	19.0	32.0	μV_{rms}	$R_g = 600\Omega$, DIN-AUDIO
Crosstalk	CT_{c2}	28.0	—	—	dB	$R_g = 3.3\Omega$, $V_o = -40dB_v$ 1kHz BPF+DIN-AUDIO
Ripple leak	RL2	—	-92.5	-87.0	dBv	$+B = 1.0V + (-26dB_v)$, $f = 130Hz$ $V_{cc} = 2.0V + (-20dB_v)$, $f = 130Hz$ $R_g = 600\Omega$, 130HzBPF, $I_{rf} = -1.5mA$
Muting attenuation	Mute2	80	—	—	dB	$f = 1kHz$, $V_o = -20dB_v$ B.B-MAX, 1kHz BPF+DIN-AUDIO
Input resistance	Z_{IN}	25	30	35	k Ω	—
DC offset voltage	ΔV_o	-25	0.0	15	mV	A/B-Amp in relation to C-Amp
〈Ripple filter〉						
Ripple rejection	RR	26.0	—	—	dB	$V_{cc} = 2.0V + (-20dB_v)$, $f = 130Hz$ 130Hz BPF+DIN-AUDIO, $I_{rf} = -1.5mA$
DC output voltage	V_{ri}	1.42	1.50	—	V	$V_{cc} = 1.7V$, $I_{rf} = 0mA$
〈Boost〉						
Boost ON / OFF voltage gain deviation	$\Delta B.B$	-2.0	0.0	1.0	dB	$f = 1kHz$, $V_{IN} = -60dB_v$
Boost amount 1*	BG1	17.5	20.0	—	dB	$f = 50Hz$, $V_{IN} = -60dB_v$, B.B-MAX
Boost amount 2**	BG2	3.7	5.2	6.7	dB	$f = 10kHz$, $V_{IN} = -60dB_v$, B.B-MAX
Boost amount 3*	BG3	5.0	6.5	8.0	dB	$f = 50Hz$, $V_{IN} = -60dB_v$, B.B-MID
Total harmonic distortion	THDB	—	0.3	1.0	%	$f = 1kHz$, $V_{IN} = -40dB_v$, 30kHz LPF
Ripple leak	RLB	—	-82.5	-75.0	dBv	$+B = 1.0V + (-26dB_v)$, $f = 130Hz$ $V_{cc} = 2.0V + (-20dB_v)$, $f = 130Hz$ $R_g = 600\Omega$, 130Hz BPF+DIN-AUDIO

* This is the amount of boost in relation to a gain of 1kHz, when the secondary LPF (low-pass filter) is attached as specified by the measurement circuit example.

** This is the amount of boost in relation to a gain of 1kHz, when the HPF (high-pass filter) is attached as specified by the measurement circuit example.

(unless otherwise noted, +B = 1.3V, V_{CC} = 2.3V, f = 1kHz, PreOutR_L = 5kΩ(OCL), PWROutR_L = 16Ω (OCL), Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈AVLS〉						
AVLS suppression level	AV _o	−44.0	−41.0	−40.0	dBv	V _{IN} =−30dBv R _{av} =6.8kΩ, R _L =16Ω
AVLS start input level	AV _{IN}	−67.8	−64.8	−61.8	dBv	V _{IN} =−64.8dBv R _{av} =6.8kΩ, R _L =16Ω
AVLS distortion	AVTHD	—	0.4	1.5	%	V _{IN} =−20dBv, B.B-OFF R _{av} =6.8kΩ, R _L =16Ω
BEEP output level	VBeep	−61	−58	−55	dBv	R _L =16Ω, I _{Beep} =5μA _{O-P} f=1kHz

Conditions applied to control pins

(Unless otherwise noted, +B = 0.9V, V_{CC} = 1.7V, f = 1kHz, PreOutR_L = 5k Ω , PWROutR_L = 16 Ω (OCL), Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions	
(Pre block)							
Tuner / TC	Tuner	SW1	0.77	—	7.0	V	HIGH
	TC		—0.2	—	0.4	V	LOW / OPEN
	ISWIN		4	9	15	μA	V11pin=0.77V
FWD / REV	FWD	SW2	0.65	—	7.0	V	HIGH / OPEN
	REV		—0.2	—	0.2	V	LOW
	ISWOUT		0.5	2.3	3.5	μA	V13pin=0.2V
MTL / NOR	MTL	SW3	0.7	—	7.0	V	HIGH / OPEN
	NOR		—0.2	—	0.2	V	LOW
	ISWOUT		0.5	2.3	3.5	μA	V42pin=0.2V
(Power block)							
PWR ON / OFF	ON	SW4	0.77	—	7.0	V	HIGH
	OFF		—0.2	—	0.4	V	LOW / OPEN
	ISWIN		5	11	17	μA	V12pin=0.77V
MUTE ON / OFF	OFF	SW5	0.65	—	7.0	V	HIGH
	ON		—0.2	—	0.2	V	LOW
	ISWIN		—	0.25	1.0	μA	V10pin=0.65V
B.B ON / OFF	ON	SW6	0.75	—	7.0	V	HIGH
	OFF		—0.2	—	0.3	V	LOW
	ISWOUT		—	0.0	1.0	μA	V9pin=0.3V
	ISWIN1		—	0.0	1.0	μA	V9pin=1.5V, V10pin=0.6V
	ISWIN2		3	7	11	μA	V10pin=0V
AVLS ON / OFF	ON	SW7	—	—	—	V	PWR1 and PWR2 signals input
	OFF		—0.2	—	0.2	V	LOW
	ISWOUT		5	25	30	μA	V47pin=0.2V
B.B MAX / MID	MAX	SW8	0.65	—	7.0	V	HIGH / OPEN
	MID		—0.2	—	0.2	V	LOW
	ISWOUT		0.5	2.3	3.5	μA	V8pin=0.2V

ISWIN : Indicates current flowing to the interior of the IC.

ISWOUT: Indicates current flowing to the exterior of the IC.

● Measurement circuit

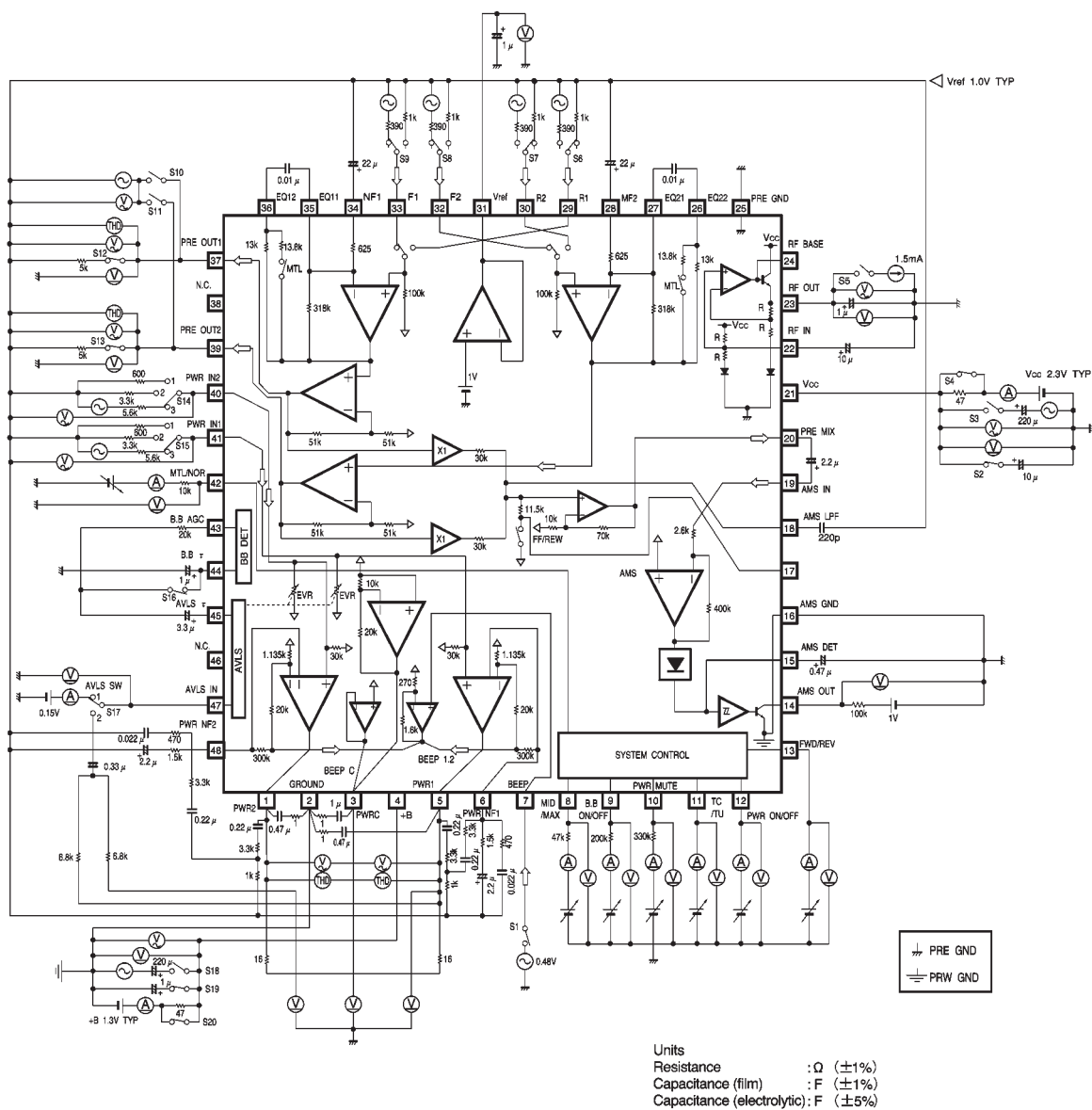


Fig.1