



## PA3212

CMOS IC

### 2.6W STEREO AUDIO AMPLIFIER WITH FOUR SELECTABLE GAIN SETTINGS AND MUX CONTROL

#### DESCRIPTION

As operating on a single 5V supply, the UTC **PA3212** is capable of delivering 2.6W of output power per channel into 3Ω loads. In Bridge-Tied Load (BTL) mode the UTC **PA3212** has less than 1% THD+N, and it also has less than 0.65% THD+N across its specified frequency range when driving 1 W into 8-Ω speakers.

Way of two terminals (GAIN0 and GAIN1) can configure and control the amplifier gain. It also provides BTL gain settings of 2, 6, 12 and 24 V/V.

Other features included that the SHDN mode is provided to disable UTC **PA3212** for the low current consumption applications and the current consumption can be reduced to typically 150μA.

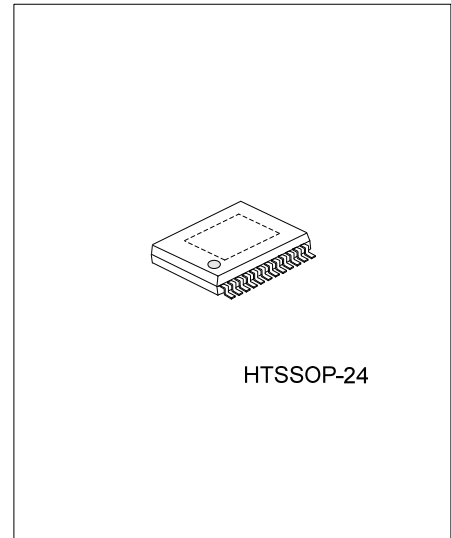
#### FEATURES

- \* Output power at 0.65% THD+N, V<sub>DD</sub>=5V(TYP)
  - 2.6W/CH (typical) into a 3Ω load
  - 1.0W/CH (typical) into a 8Ω load
- \* Bridge-tied load (BTL) supported
- \* Gain control internally
- \* Differential Input fully
- \* Depop circuitry Inside
- \* Shutdown protection
- \* Stereo input

#### ORDERING INFORMATION

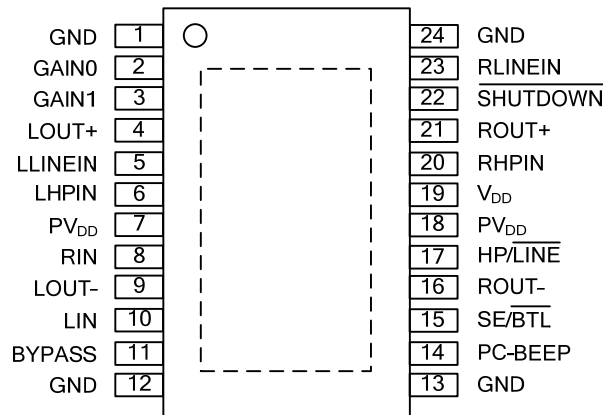
Ordering Number			Package	Packing
Normal	Lead Free	Halogen Free		
PA3212-N24-R	PA3212L-N24-R	PA3212G-N24-R	HTSSOP-24	Tape Reel
PA3212-N24-T	PA3212L-N24-T	PA3212G-N24-T	HTSSOP-24	Tube

<p>PA3212L-N24-R</p> <p>(1)Packing Type (2)Package Type (3)Lead Plating</p>	<p>(1) R: Tape Reel, T: Tube (2) N24: HTSSOP-24 (3) G: Halogen Free, L: Lead Free, Blank: Pb/Sn</p>
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Lead-free: PA3212L  
Halogen-free: PA3212G

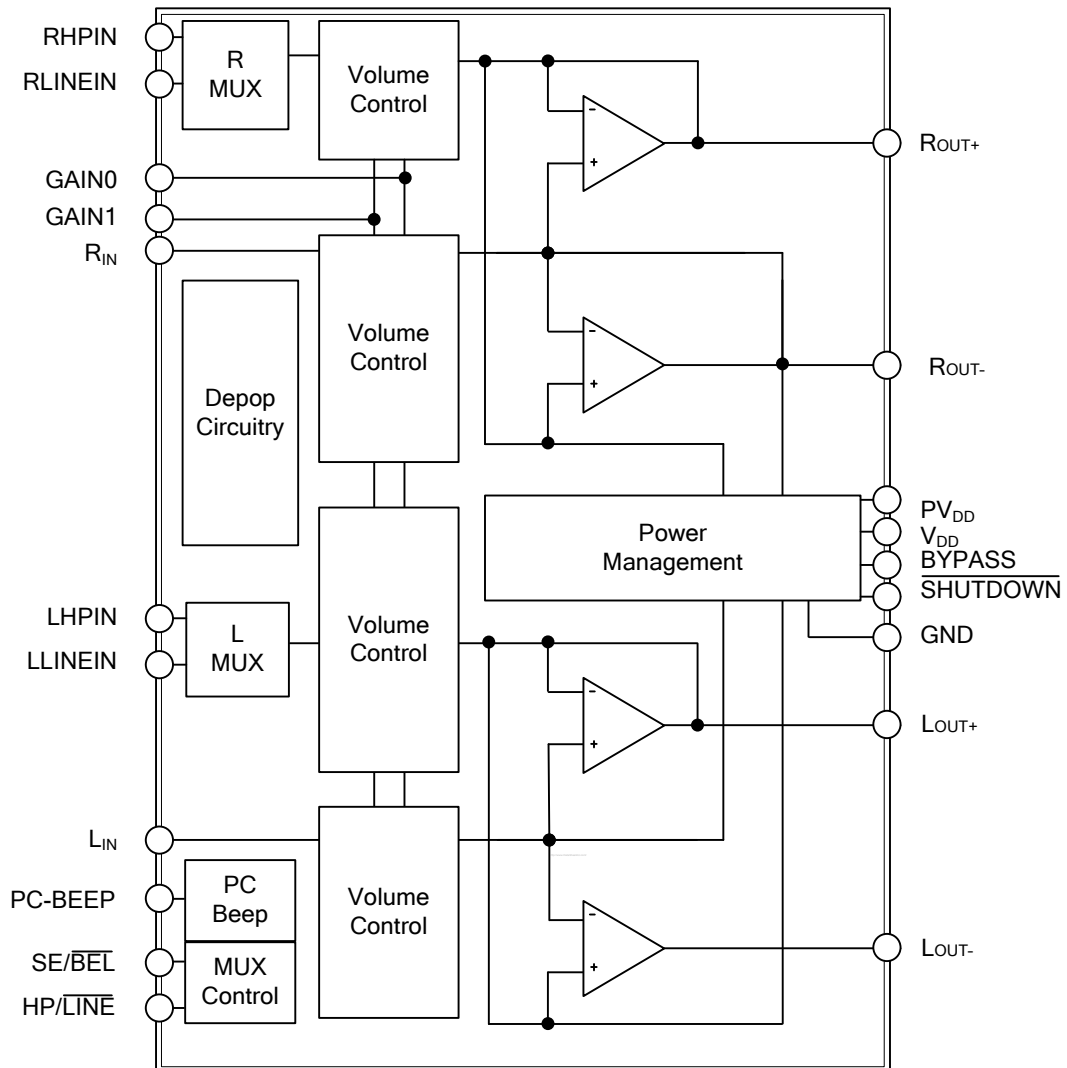
## ■ PIN CONFIGURATION



## ■ PIN DESCRIPTION

PIN NO.	PIN NAME	I/O	DESCRIPTION
1,12,13,24	GND		Ground.
11	BYPASS		Connected to voltage divider
2	GAIN0	I	For gain control: Bit 0
3	GAIN1	I	For gain control: Bit 1
5	LLINEIN	I	Line input for Left channel, available when pin15 is held low.
6	LHPIN	I	Headphone input Left channel, available when pin15 is held high.
7,18	PV <sub>DD</sub>	I	Power supply voltage.
8	RIN	I	Differential input for right channel. And for single-ended inputs is also AC ground.
10	LIN	I	Differential input for Left channel. And for single-ended inputs is also AC ground.
14	PC-BEEP	I	PC-BEEP mode input. When at least eight continuous > 1-V <sub>PP</sub> square waves is input to this pin, PC-BEEP is enabled.
17	HP/ $\overline{\text{LINE}}$	I	Input of MUX control. Being high to select the inputs of Pin6, 20, and low to select inputs of PIN 5, 23.
15	$\overline{\text{SE/BTL}}$	I	Low for BTL mode, high for SE mode.
19	V <sub>DD</sub>	I	Analog V <sub>DD</sub> supply voltage
20	RHPIN	I	Right channel headphone input, selected when pin17 is held high.
23	RLINEIN	I	Headphone input right channel, available when pin17 is held low.
22	$\overline{\text{SHUTDOWN}}$	I	In shutdown mode when held low, expect PC-BEEP remains active.
4	L <sub>OUT+</sub>	O	In BTL mode: left channel + output; In SE mode: left channel + output
9	L <sub>OUT-</sub>	O	In BTL mode: left channel - output; In SE mode: high impedance
16	R <sub>OUT-</sub>	O	In BTL mode: right channel + output; In SE mode: right channel + output
21	R <sub>OUT+</sub>	O	In BTL mode: right channel - output; In SE mode: high impedance

■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{DD}$	6	V
Input Voltage	$V_{IN}$	-0.3 ~ $V_{DD}$ ~ +0.3	V
Junction Temperature	$T_J$	+150	°C
Operating Temperature	$T_{OPR}$	-40 ~ +85	°C
Storage Temperature	$T_{STG}$	-65 ~ +85	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

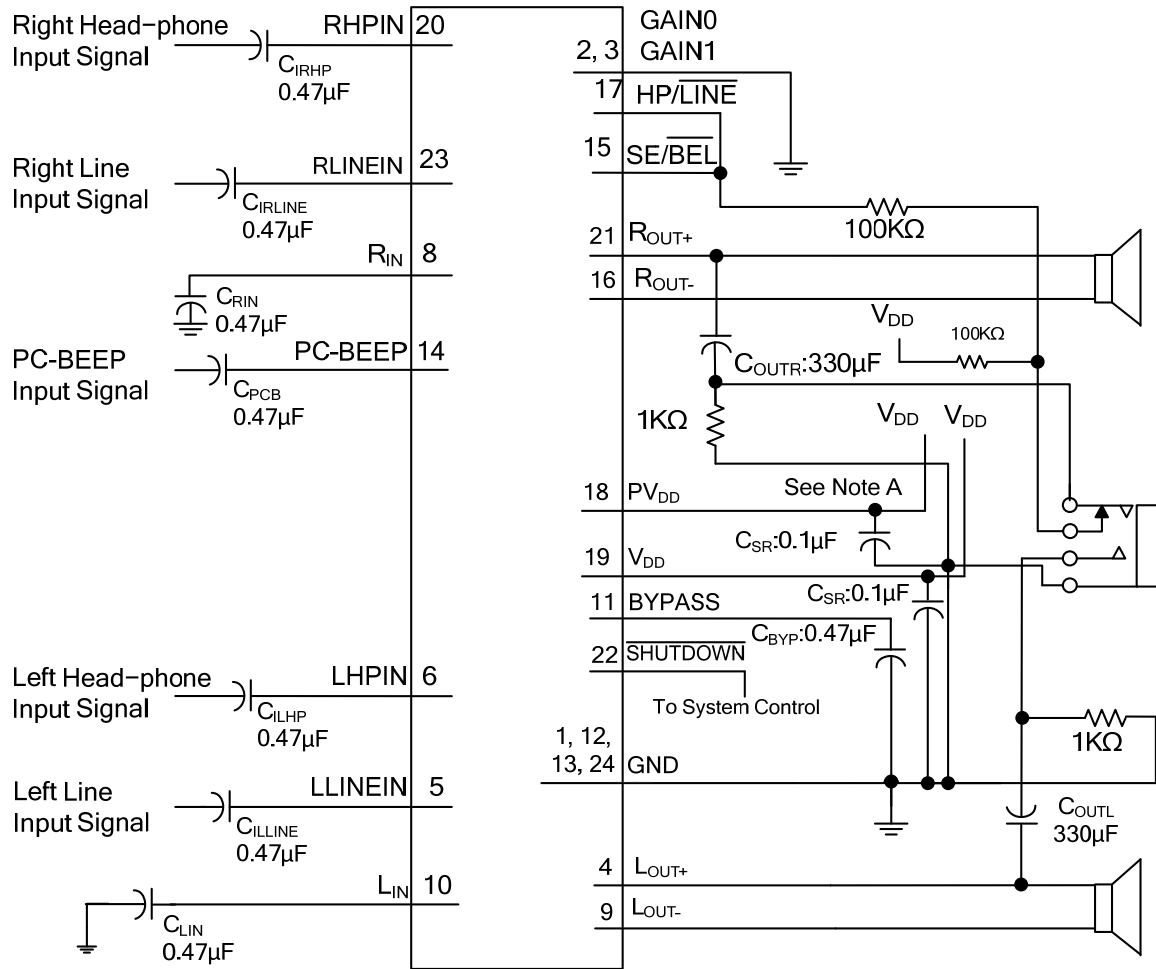
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ , unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DC ELECTRICAL CHARACTERISTICS</b>						
Supply Voltage	$V_{DD}$		4.5	5	5.5	V
High-Level Input voltage	$V_{IH}$	SHUTDOWN	2			V
		SE/BTL, HP/LINE, GAIN0, GAIN1	$0.8 \times V_{DD}$			V
Low-Level Input voltage	$V_{IL}$	SHUTDOWN			0.8	V
		GAIN0, GAIN1			$0.4 \times V_{DD}$	V
		SE/BTL, HP/LINE			$0.6 \times V_{DD}$	V
DC Differential Output Voltage	$V_{OUT(DIFF)}$	$V_{IN}=0V, \text{Gain}=2V/V$			25	mV
Supply Current in Mute Mode	$I_{DD}$	BTL Mode		6	8	mA
		SE Mode		3	4	mA
Supply Current, Shutdown Mode	$I_{DD(SD)}$	$V_{DD}=5V$		150	300	$\mu\text{A}$
High-Level Input Current	$ I_{IH} $	$V_{DD}=5.5V, V_{IN}=V_{DD}$			900	nA
Low-Level Input Current	$ I_{IL} $	$V_{DD}=5.5V, V_{IN}=0V$			900	nA
Operating Free-Air Temperature	$T_a$		-40		85	°C
<b>AC ELECTRICAL CHARACTERISTICS (<math>V_{DD} = 5.0V, R_L = 8\Omega</math>, unless otherwise noted )</b>						
Output Power	$P_{OUT}$	THD=1%, BTL, $R_L=3\Omega, G=2V/V$		2.05		W
		THD=10%, BTL, $R_L=3\Omega, G=2V/V$		2.6		
Total Harmonic Distortion Plus Noise	THD+N	$P_{OUT}=1W, \text{BTL}, R_L=8\Omega, G=2V/V$		0.65		%
Max Output Power Bandwidth	$B_{OM}$	THD= 5%		15		kHz
Power Supply Ripple Rejection	PSRR	$f=1\text{kHz}, \text{BTL}, G=2V/V, C_{BYP}=0.47\mu\text{F}$		72		dB
Output Noise Voltage	eN	$C_{BYP}=0.47\mu\text{F}, \text{BTL}, G=2V/V$		20		$\mu\text{V}_{RMS}$
		$C_{BYP}=0.47\mu\text{F}, \text{SE}, G=2V/V$		18		$\mu\text{V}_{RMS}$
Signal-to-Noise Ratio	SNR			105		dB

Note: Output power is measured at the output terminals of the IC at 1kHz.

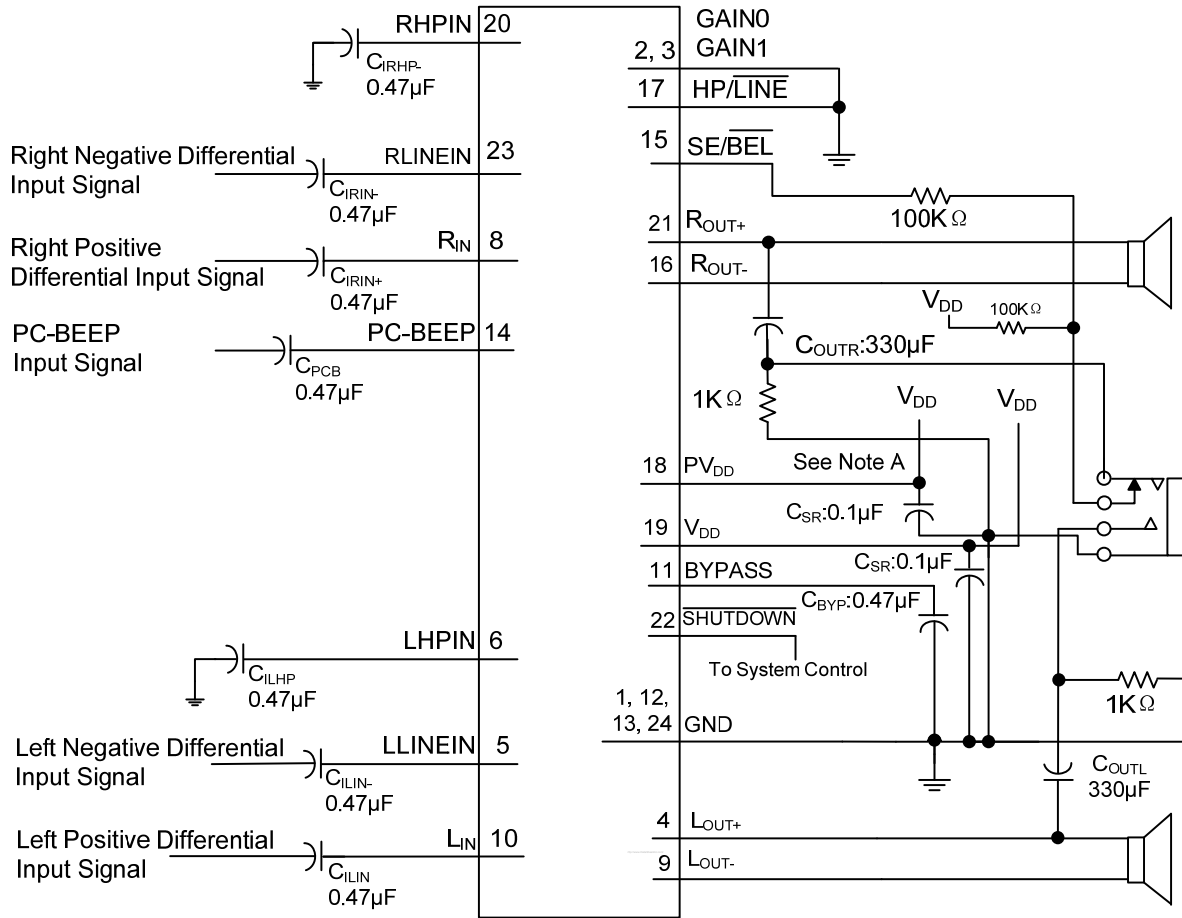
■ TYPICAL APPLICATION CIRCUITS



A 0.1-μF ceramic capacitor should be placed very close to the IC.  
 A larger electrolytic capacitor of 10 μF or greater should be placed near the audio power amplifier for filtering lower frequency noise signals, .

Typical PA3212 Application Circuit Using Single-Ended Inputs and Input MUX

## ■ TYPICAL APPLICATION CIRCUITS(Cont.)



A  $0.1\mu F$  ceramic capacitor should be placed as close as possible to the IC.  
 A larger electrolytic capacitor of  $10\mu F$  or greater should be placed near the audio power amplifier for filtering lower frequency noise signals.

Typical PA3212 Application Circuit Using Differential Inputs

■ APPLICATION INFORMATION

**Shutdown Mode Operating**

INPUT			AMPLIFIER	
HP/LINE	SE/BTL	SHUTDOWN	INPUT	OUTPUT
X	X	L	X	MUTE
L	L	H	LINE	BTL
L	H	H	LINE	SE
H	L	H	HEADPHONE	BTL
H	H	H	HEADPHONE	SE

X: Don't care

L: Low

H: High

**C<sub>i</sub> (Input Capacitor)**

The value of C<sub>i</sub> is important to consider as it directly affects the bass performance of the application circuit. When C<sub>i</sub> is required to allow the amplifier to bias the input signal to the proper dc level for optimum operation, it's value can be calculate by this equation:

$$C_i = 1 / (2\pi R_i F_c)$$

R<sub>i</sub>: Input Impedance

F<sub>c</sub>: High-pass Filter's Frequency

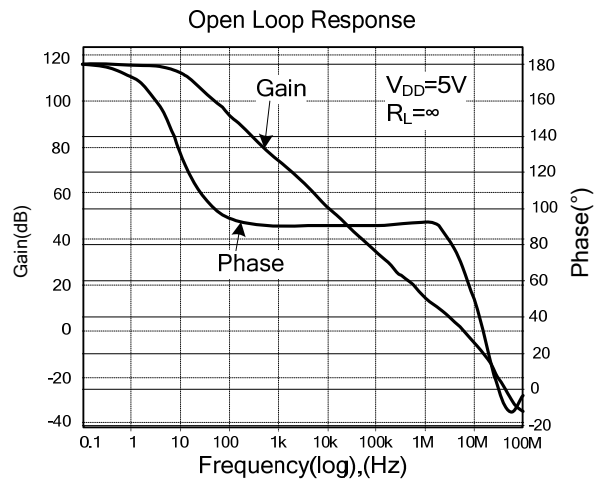
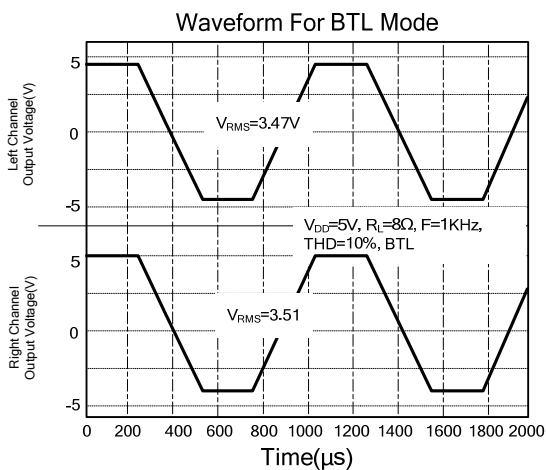
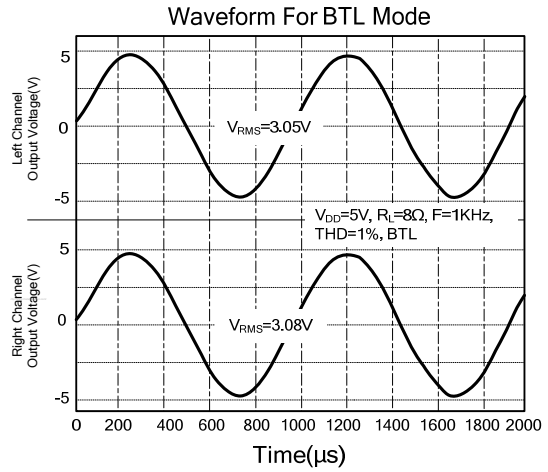
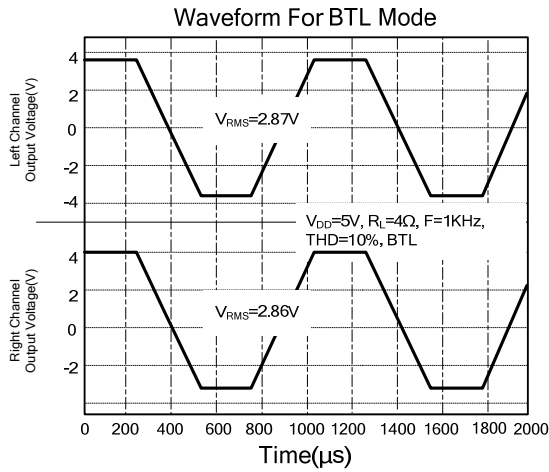
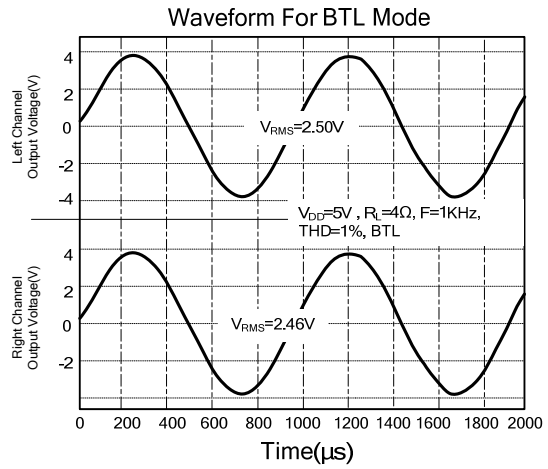
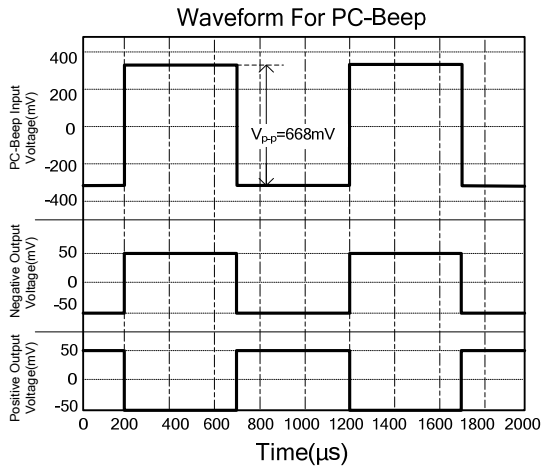
The low leakage tantalum or ceramic capacitors are suggested to be used as the input coupling capacitors, because of the small leakage current of the input capacitors will cause the dc offset voltage at the input to the amplifier that reduces the operation headroom, especially at the high gain applications. It is important to let the positive side connecting to the higher dc level of the application when using the polarized capacitors.

**Gain setting (VS Gain0, Gain1 and R<sub>i</sub>)**

Gain setting is determined by GAIN0 and GAIN1. The gains listed in the next table are realized by changing the taps on the input resistors inside the amplifier which will cause the internal input impedance(R<sub>i</sub>) to be dependent on the gain setting as we can see listed in the next table.

GAIN0	GAIN1	R <sub>i</sub> (kΩ)	A <sub>v</sub> (V/V)	SE/BTL
0	0	91	2	0
0	1	45.5	6	0
1	0	26	12	0
1	1	14	24	0
X	X		1	1

■ TYPICAL CHARACTERISTICS





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