



## PA0202

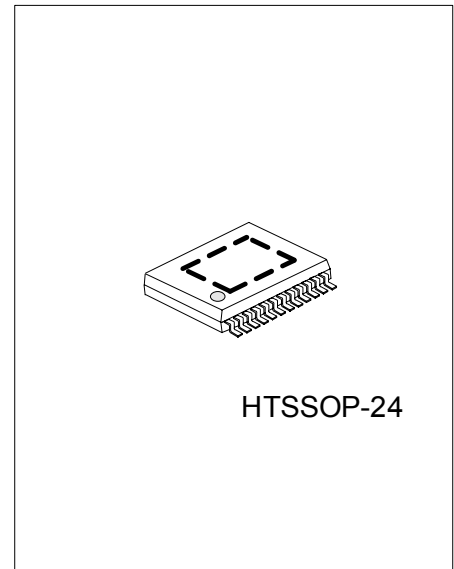
CMOS IC

### 2-W STEREO AUDIO POWER AMPLIFIER WITH MUTE

#### DESCRIPTION

The UTC **PA0202** is a monolithic integrated circuit that stereo bridged audio power amplifiers capable of producing 2 W into 3Ω with a 5V supply voltage or 800mW into 3Ω with a 3.3V supply voltage .The UTC **PA0202** simplifies design and frees up board space for other features. Both of the depop circuitry and the thermal shutdown protection circuitry are integrated in UTC **PA0202**, that reduce clicks and pops noise during power up or shutdown mode operation.

A MUX control terminal (HP/LINE) allows selection between the two sets of stereo input signals. To simplify the audio system design, UTC **PA0202** combines a stereo bridge-tied loads (BTL)mode for speaker drive and a stereo single-end (SE)mode for headphone drive into a single chip, where both modes are easily switched by the SE/BTL input control pin signal.



\*Pb-free plating product number: PA0202L

#### FEATURES

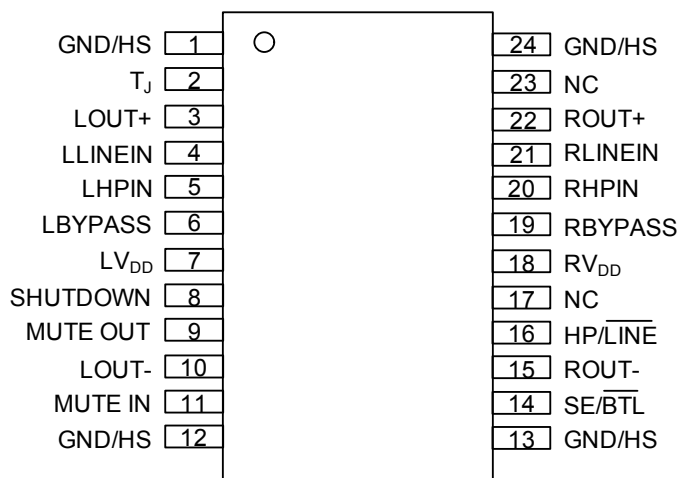
- \* Improves depop circuitry to eliminate turn-on and turn-off transients in output
- \* Output power:
  - 2W(typ.)@5V into 3Ω with 0.2% THD+N max (1kHz)
  - 800mW(typ.)@3.3V into 3Ω with 0.2% THD+N max (1kHz)
- \* Fully specified for use with 3-Ω Loads
- \* Stereo switchable bridged/single-ended power amplifiers
- \* Input MUX select terminal
- \* Thermal-shutdown protection
- \* Shutdown mode available

#### ORDERING INFORMATION

Order Number		Package	Packing
Normal	Lead Free Plating		
PA0202-N24-R	PA0202L-N24-R	HTSSOP-24	Tape Reel
PA0202-N24-T	PA0202L-N24-T	HTSSOP-24	Tube

<p>PA0202L-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) L: Lead Free Plating, Blank: Pb/Sn</p>
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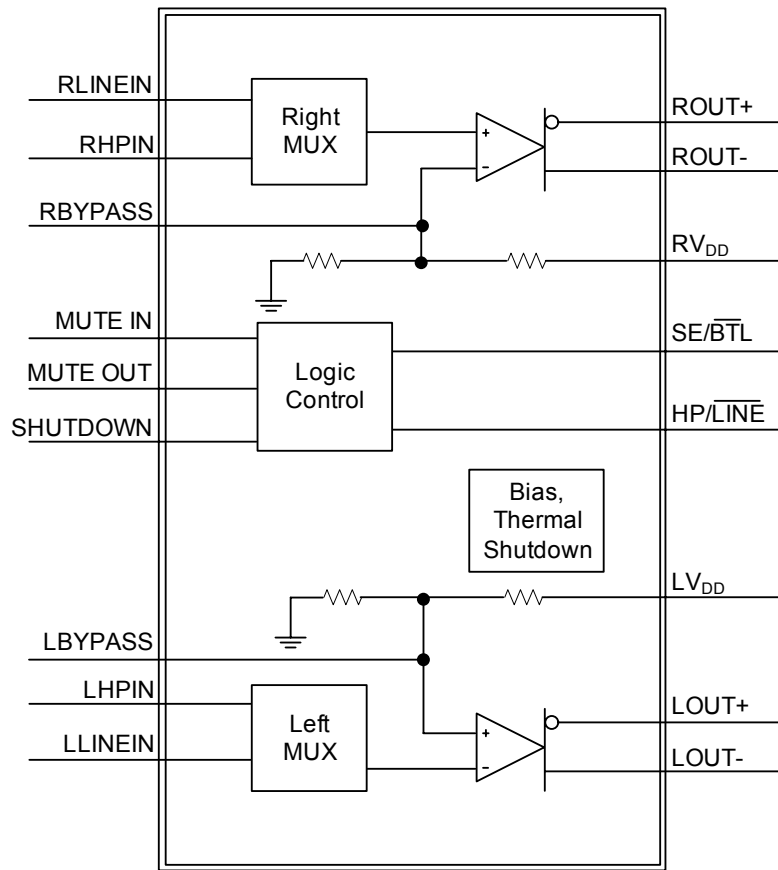
## ■ PIN CONFIGURATION



## ■ PIN DESCRIPTION

PIN NO	PIN NAME	I/O	DESCRIPTION
1, 12, 13, 24	GND/HS		Power ground; directly connected to thermal pad.
6	LBYPASS		Tap to left channel internal mid-supply voltage divider bias
17, 23	NC		No connection
19	RBYPASS		Tap to right channel internal mid-supply voltage divider bias
4	LLINE IN	I	Left channel line input; selected when HP/LINE is held low
5	LHP IN	I	Left channel headphone input; selected when HP/LINE is held high
7	LV <sub>DD</sub>	I	Left channel power supply and for primary bias circuits
8	SHUTDOWN	I	Places entire IC in shutdown mode when held high, I <sub>DD</sub> = 5μA
9	MUTE OUT	I	Follows MUTE IN, provides buffered output
11	MUTE IN	I	Mute all amplifiers input; high active to mute amplify, low active to normal operation
14	SE/BTL	I	SE & BTL mode selection; active high for SE mode, active low for BTL mode
16	HP/LINE	I	MUX control input, active high to select headphone input, active low to select line input
18	RV <sub>DD</sub>	I	Right channel power supply
20	RHPIN	I	Right channel headphone input, selected when HP/LINE is held high
21	RLINEIN	I	Right channel line input, selected when HP/LINE is held low
2	T <sub>J</sub>	O	Sources current proportional to the junction temperature. Left floating for normal operation.
3	LOUt+	O	Left channel + output in BTL & SE mode
10	LOUt-	O	Left channel – output in BTL mode & high-impedance in SE mode
22	ROUt+	O	Right channel + output in BTL & SE mode
15	ROUt-	O	Right channel – output in BTL mode & high impedance in SE mode

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{DD}$	6	V
Input Voltage	$V_{IN}$	$-0.3 \sim V_{DD} \sim +0.3$	V
Continuous Total Power Dissipation	$P_D$	Internally limited	
Junction Temperature	$T_J$	+150	
Operating Temperature	$T_{OPR}$	-40 ~ +85	
Storage Temperature	$T_{STG}$	-65 ~ +150	

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.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL		MIN	NOM	MAX	UNIT
Supply Voltage	$V_{DD}$		3	5	5.5	V
Operating Temperature	$T_{OPR}$	$V_{DD} = 5\text{ V}$ , 250 mW/ch average power, 4- $\Omega$ stereo BTL drive, with proper PCB design	-40		85	
		$V_{DD} = 5\text{ V}$ , 2 W/ch average power, 3- $\Omega$ stereo BTL drive, with proper PCB design	-40		85	
Common Mode Input Voltage	$V_{ICM}$	$V_{DD}=5\text{V}$	1.25		4.5	V
		$V_{DD}=3.3\text{V}$	1.25		2.7	

■ DC ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT	
Supply Current	$I_{DD}$	$V_{DD}=5\text{V}$	Stereo BTL		19	30	mA
			Stereo SE		9	18	
			Mono BTL		9	18	
			Mono SE		3	10	
	$I_{DD}$	$V_{DD}=3.3\text{V}$	Stereo BTL		13	20	mA
			Stereo SE		5	10	
			Mono BTL		5	10	
			Mono SE		3	6	
Output Offset Voltage (Measured Differentially)	$V_{O(OFF)}$	$V_{DD} = 5\text{ V}$ , Gain = 2, See Note 1		5	25	mV	
Supply Current in Mute Mode	$I_{DD(MUTE)}$	$V_{DD}=5\text{V}$		1		mA	
$I_{DD}$ in Shutdown	$I_{DD(SD)}$	$V_{DD}=5\text{V}$		5	19	$\mu\text{A}$	

Note 1. At  $3\text{ V} < V_{DD} < 5\text{ V}$  the dc output voltage is approximately  $V_{DD}/2$ .

### ■ AC OPERATING CHARACTERISTICS

$V_{DD} = 5\text{ V}$ ,  $T_A = 25$ ,  $R_L = 3\Omega$

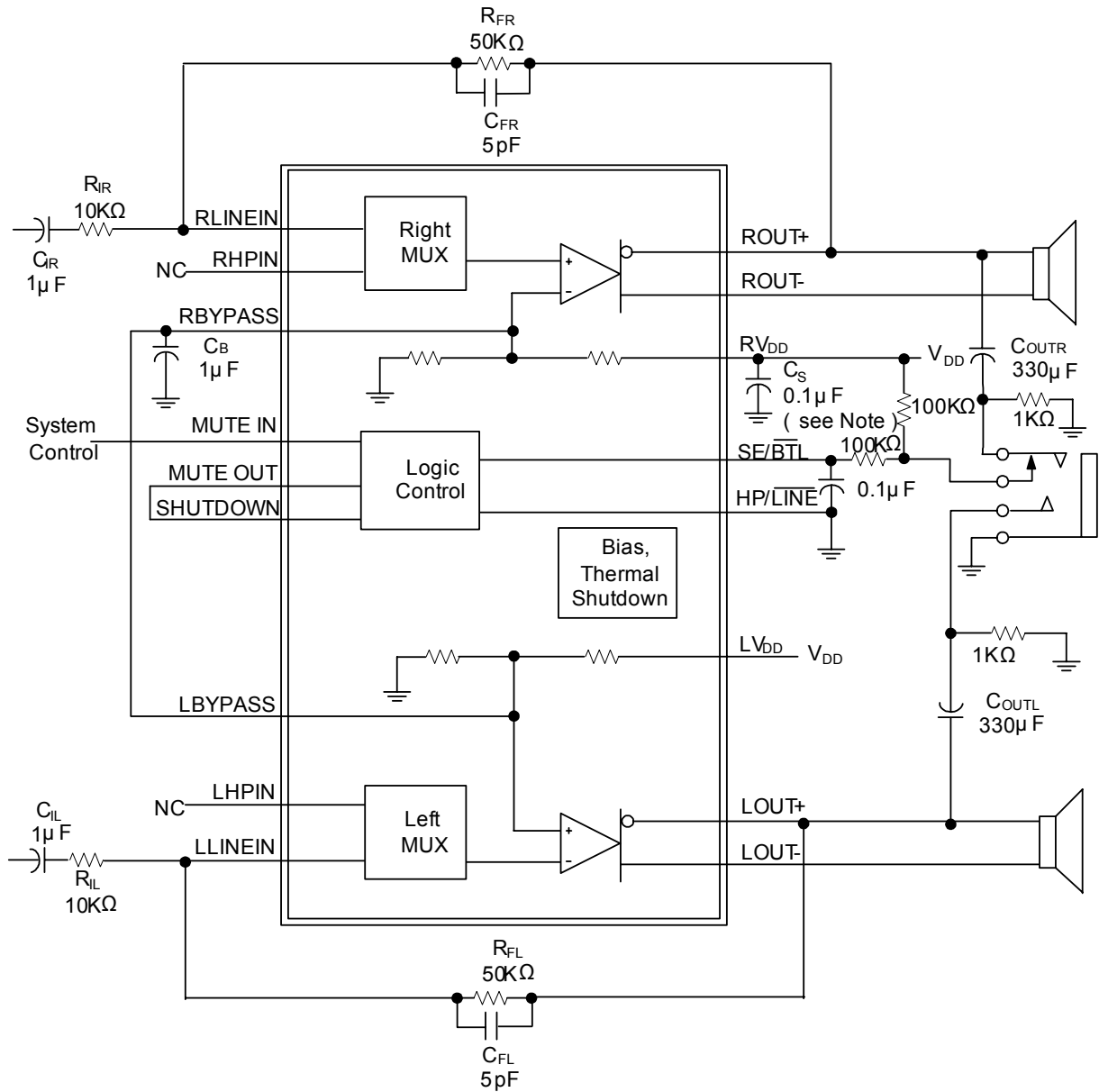
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Power (Each Channel) See Note 2	$P_{OUT}$	THD =0.2% BTL		2		W
		THD =1% BTL		2.2		
Total Harmonic Distortion Plus Noise	TDH+N	$P_{OUT} = 2\text{ W}$ , $f = 20 \sim 20\text{ kHz}$		200		m%
		$V_{IN} = 1\text{ V}$ , $R_L = 10\text{ K}\Omega$ , $A_V = 1\text{ V/V}$		100		m%
Maximum Output Power Bandwidth	$B_W$	$A_V = 10\text{ V/V}$ , THD < 1 %,		>20		KHz
Phase Margin		$R_L = 4\ \Omega$ , Open Loop,		85°		
Supply Ripple Rejection Ratio	RR	$f = 1\text{ kHz}$		80		dB
		$f = 20 \sim 20\text{ kHz}$ ,		60		
Mute Attenuation				85		dB
Channel-to-Channel Output Separation		$f = 1\text{ kHz}$		85		dB
Line/HP Input Separation				100		dB
BTL Attenuation in SE Mode				100		dB
Input Impedance	$Z_{IN}$			2		M $\Omega$
Signal-to-Noise Ratio		$P_{OUT} = 500\text{ mW}$ , BTL		95		dB
Output Noise Voltage	eN			21		$\mu\text{V}_{(RMS)}$

$V_{DD} = 3.3\text{ V}$ ,  $T_A = 25$ ,  $R_L = 3\Omega$

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Power ( Each Channel) See Note 2	$P_{OUT}$	THD =0.2% BTL		800		mW
		THD =1% BTL		900		
Total Harmonic Distortion Plus Noise	TDH+N	$P_{OUT} = 800\text{ mW}$ , $f = 20 \sim 20\text{ kHz}$		350		m%
		$V_{IN} = 1\text{ V}$ , $R_L = 10\text{ K}\Omega$ , $A_V = 1\text{ V/V}$		200		m%
Maximum Output Power Bandwidth	$B_W$	$A_V = 10\text{ V/V}$ , THD < 1 %,		>20		KHz
Phase Margin		$R_L = 4\ \Omega$ , Open Loop		85°		
Supply Ripple Rejection Ratio	RR	$f = 1\text{ kHz}$		70		dB
		$f = 20 \sim 20\text{ kHz}$ ,		55		
Mute Attenuation				85		dB
Channel-to-Channel Output Separation		$f = 1\text{ kHz}$		85		dB
Line/HP Input Separation				100		dB
BTL Attenuation in SE Mode				100		dB
Input Impedance	$Z_{IN}$			2		M $\Omega$
Signal-to-Noise Ratio		$P_{OUT} = 500\text{ mW}$ , BTL		95		dB
Output Noise Voltage	eN			21		$\mu\text{V}_{(RMS)}$

Note 2. Output power is measured at the output terminals of the IC at 1 kHz.

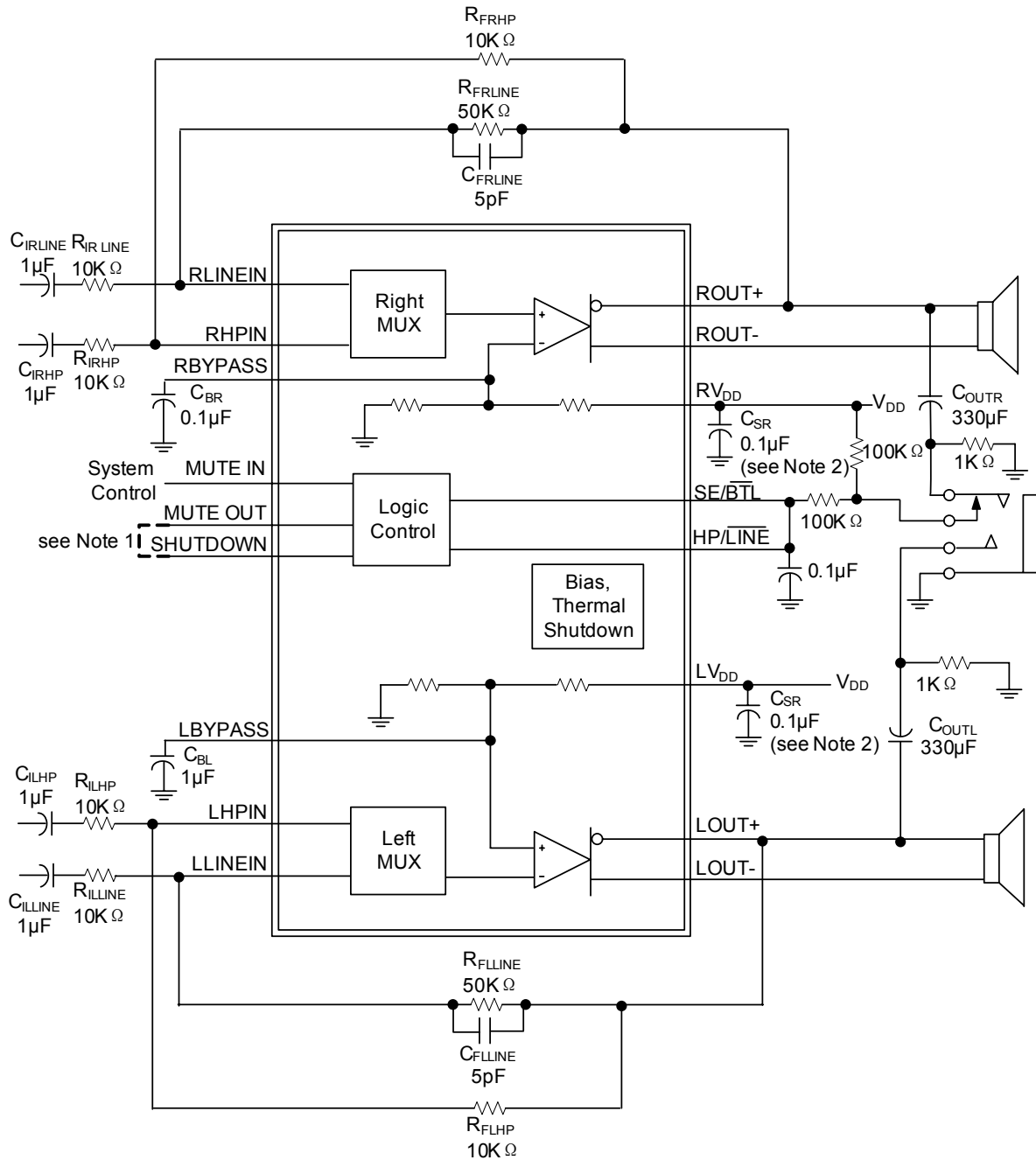
## ■ TYPICAL APPLICATION CIRCUIT



Note: 0.1 µ F ceramic capacitor should be placed as close as possible to the IC. For filtering lower frequency noise signals, a larger aluminum electrolytic capacitor of 10 µF or greater should be placed near the audio power amplifier.

PA0202 Minimum Configuration Application Circuit

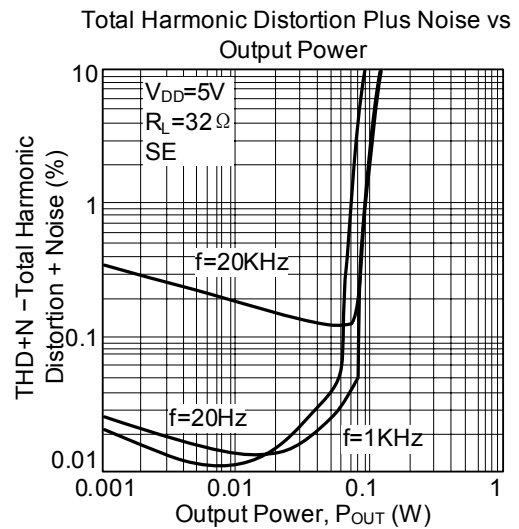
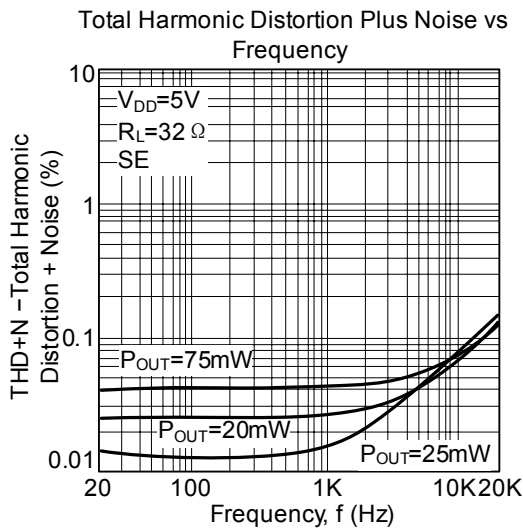
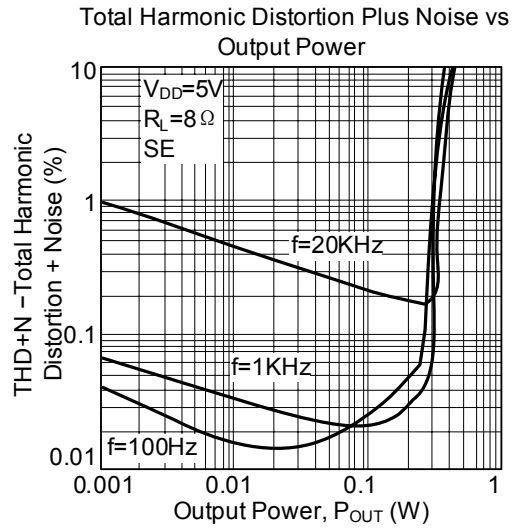
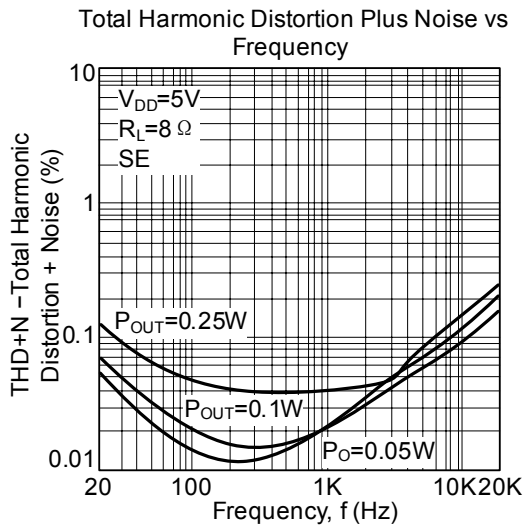
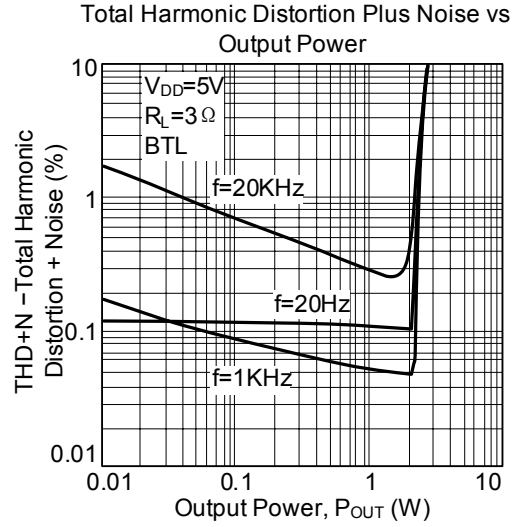
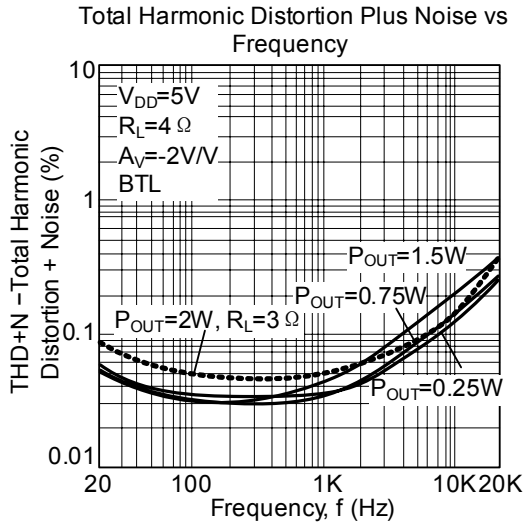
■ TYPICAL APPLICATION CIRCUIT



- Note:1. This connection is for ultra-low current in shutdown mode  
 2. A 0.1 μF ceramic capacitor should be placed as close as possible to the IC for filtering lower frequency noise signals a larger aluminum electrolytic capacitor of 10 μF or greater should be placed near the audio power amplifier

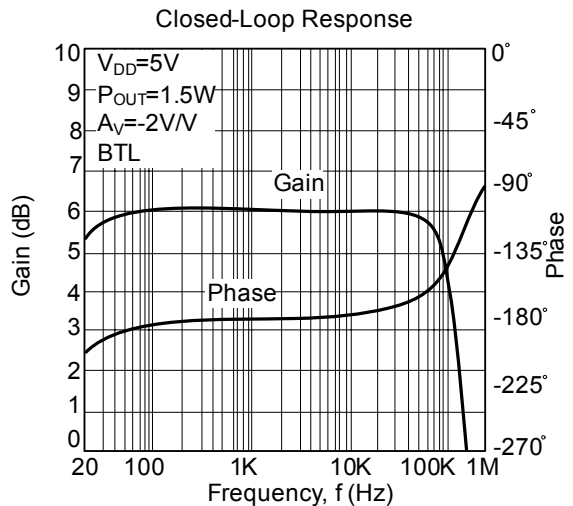
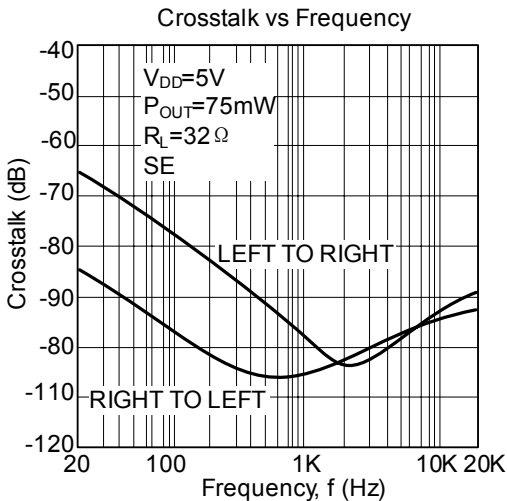
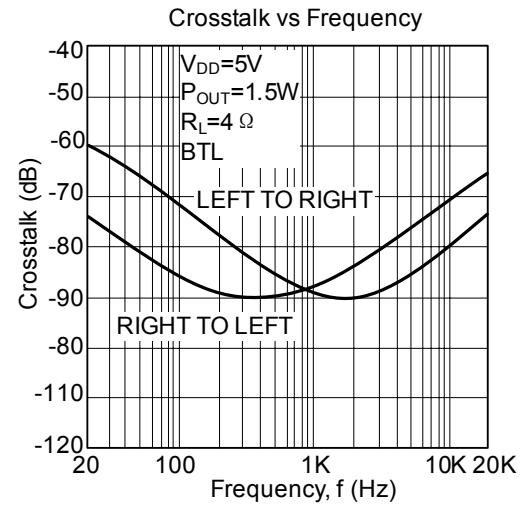
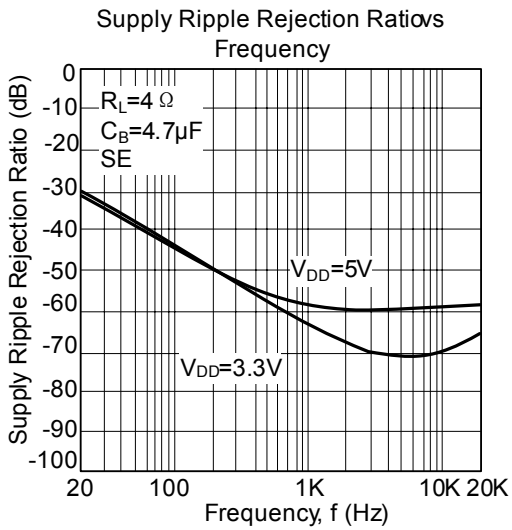
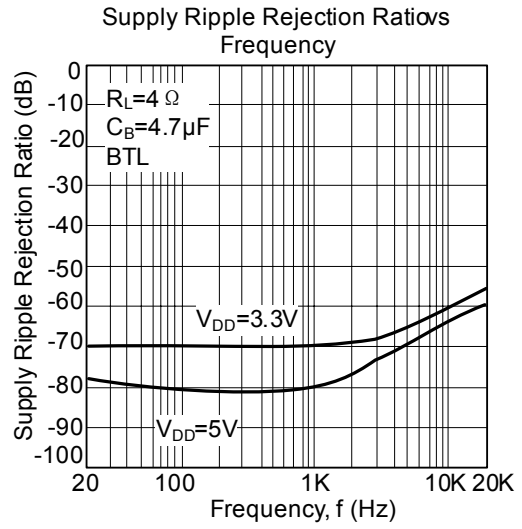
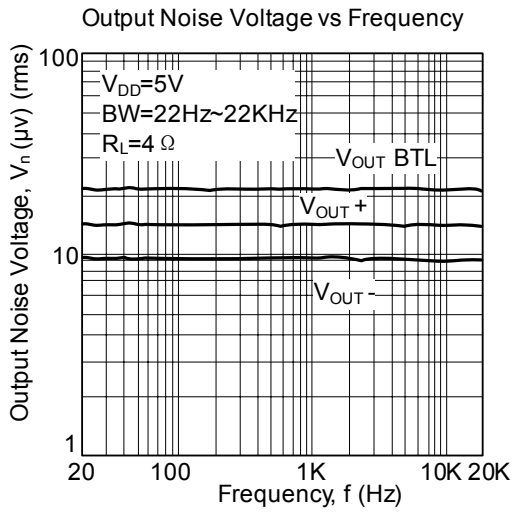
PA0202 Full Configuration Application Circuit

■ TYPICAL CHARACTERISTICS

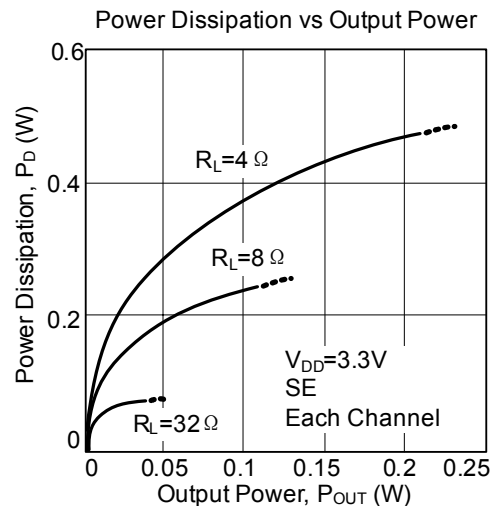
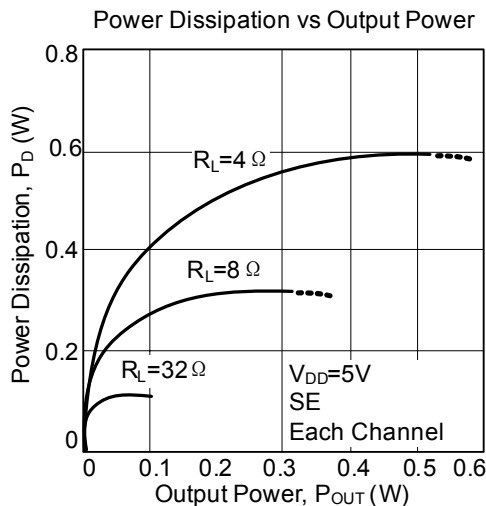
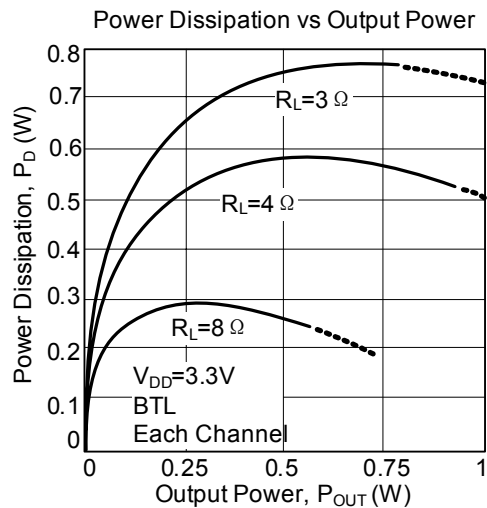
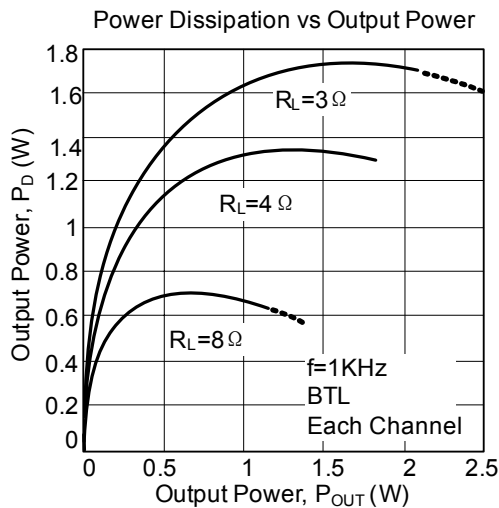
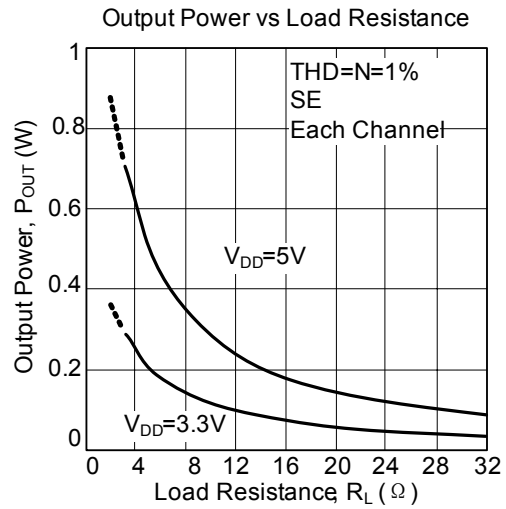
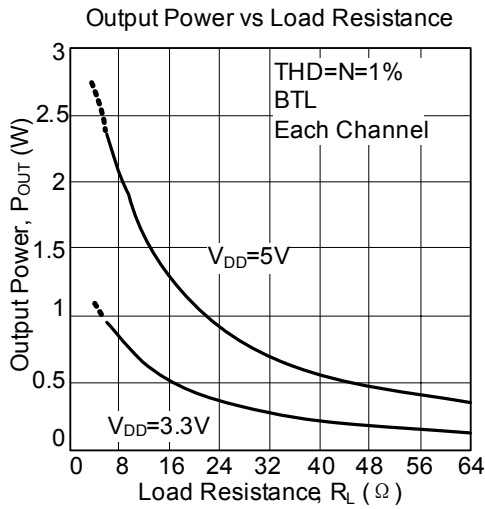




■ TYPICAL CHARACTERISTICS(Cont.)



■ TYPICAL CHARACTERISTICS(Cont.)



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