DESCRIPTION

The PAM8202 is a 2 Watt per channel, 8-pin, stereo class D audio amplifier, which offers low THD+N (0.10%), allowing it to produce high-quality sound reproduction.

The PAM8202 runs off of a 5 Volt supply at much higher efficiencies than their class AB cousins, making it ideal for many portable applications.

The PAM8202 only requires very few external components (as few as three tiny capacitors), results in significant cost and board space savings.

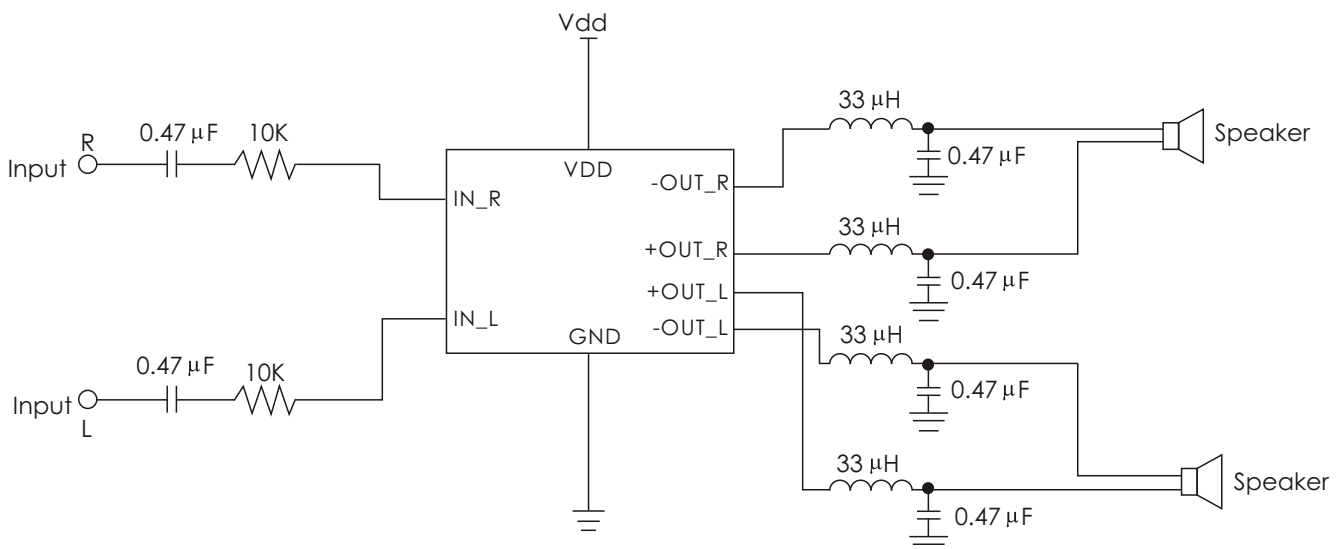The PAM8202 is available in a SOP8 package.

FEATURES

- 2 Watts @ 10% THD per channel output into a 4 Ohm load at 5V
- Support speakers or earphone (4Ω to 32Ω).
- Superior low noise without input.
- Supply voltage from 2.5V to 5.5 V.
- 85% efficiency above.
- Short Circuit Protection.
- Less output capacitor and inductor to save the space and cost.
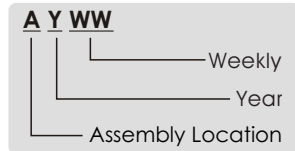- Low THD+N
- Low quiescent current < 10 mA

APPLICATIONS

- Notebook Computers.
- PDAs/GPS Navigator/e-Dictionary
- Portable DVD Players, Game Machines.
- Cellular Phones,VoIP Phones,Screen Phones
- MP3 or PMP Players.
- Portable Speaker Systme,Portable Amplifier
- LCD monitor / TV.
- Bluetooth Car-Kit

TYPICAL APPLICATION CIRCUIT

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TOP MARKING & PIN CONFIGURATION

SOP8

A Y WW
— Weekly
— Year
— Assembly Location

Pin Description

Pin No.	Pin Name	Description
1	IN_R	Right channel audio input.
2	GND	GNDChip ground.
3	VDD	Supply voltage, need a 1uF ceramic decouple capacitor very close bet ween this pin to GND pin.
4	IN_L	Left channel audio input.
5	-OUT_L	Inverted output, left channel.
6	+OUT_L	Non-inverted output, left channel
7	+OUT_R	Non-inverted output, right channel.
8	- OUT_R	Inverted output, right channel.

Absolute Maximum Ratings:

Supply voltage: **6V (Without Input Signal)**
Input voltage: **-0.3V to VDD +0.3V**
Operation Temperature range: **-40°C to 85°C**
Operation junction temperature: **-40°C to 125°C**
Storage Temperature: **-65°C to 150°C**
Maximum Junction Temperature: **150°C**
Soldering temperature: **250°C, 10 secretary**

Recommended operating Conditions:

Supply voltage Range: **2.5V to 5.5V**
Operation Temperature Range: **-40°C to 85°C**
Junction Temperature Range: **-40°C to 125°C**

Thermal Information:

Thermal Resistance (θ_{JC}):
SOP8: θ_{JA} **90 °C/W**
DIP8: **°C/W**

## ORDERING INFORMATION

Ordering Number	Package	Shipping
PAM8202S8R	SOP-8	2,500 Units/ Reel

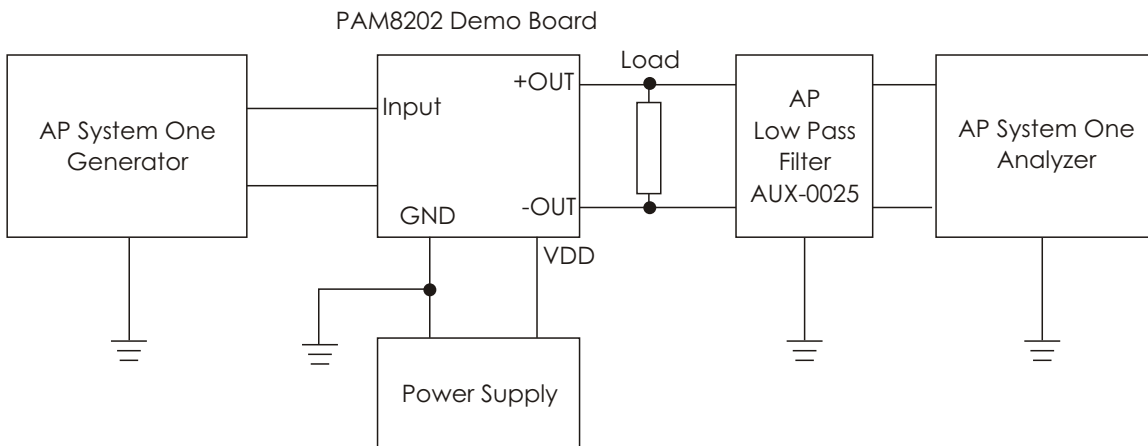## ELECTRONIC SPECIFICATIONS

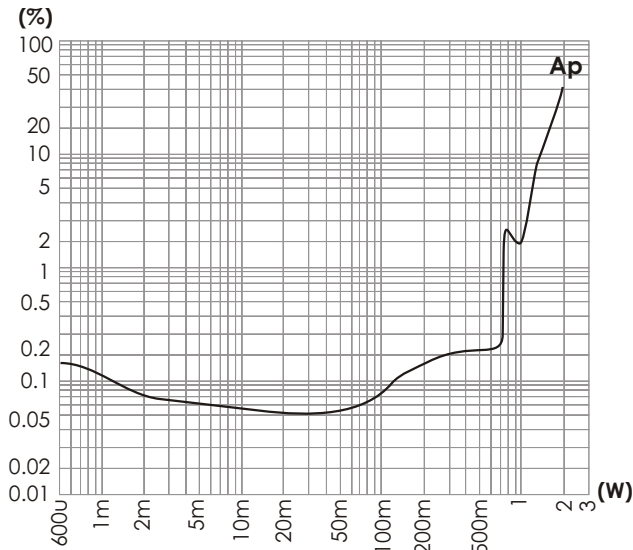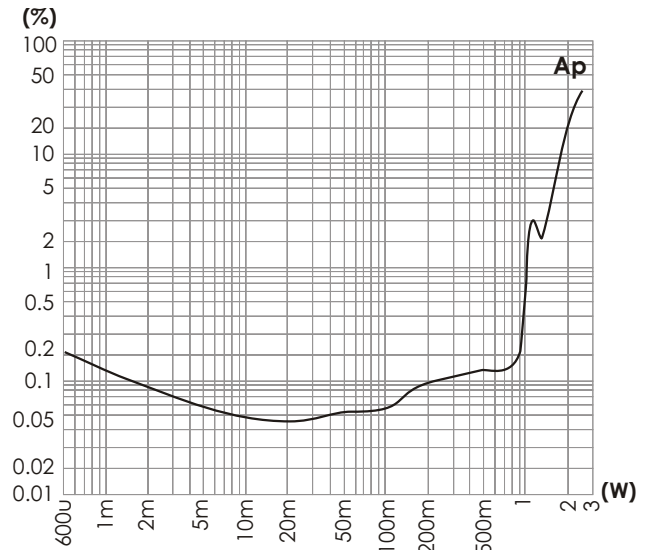| PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Vdd Range		2.5	5	5.5	V
Vdd Quiescent current	Each channel			10	mA
SW On Resistance	VDD = 5V		0.4		Ω
SW Frequency	No Input Signal		500		kHz
PSRR	VDD = 2.5V to 5.5V		-45		dB
Gain	VDD = 2.5V to 5.5V, 0Ω input resistor		10		V/V
SNR	VDD = 5V, Po = 1.5W, 8Ω Load		60		dB
Input impedance		100			$K\Omega$

BLOCK DIAGRAM
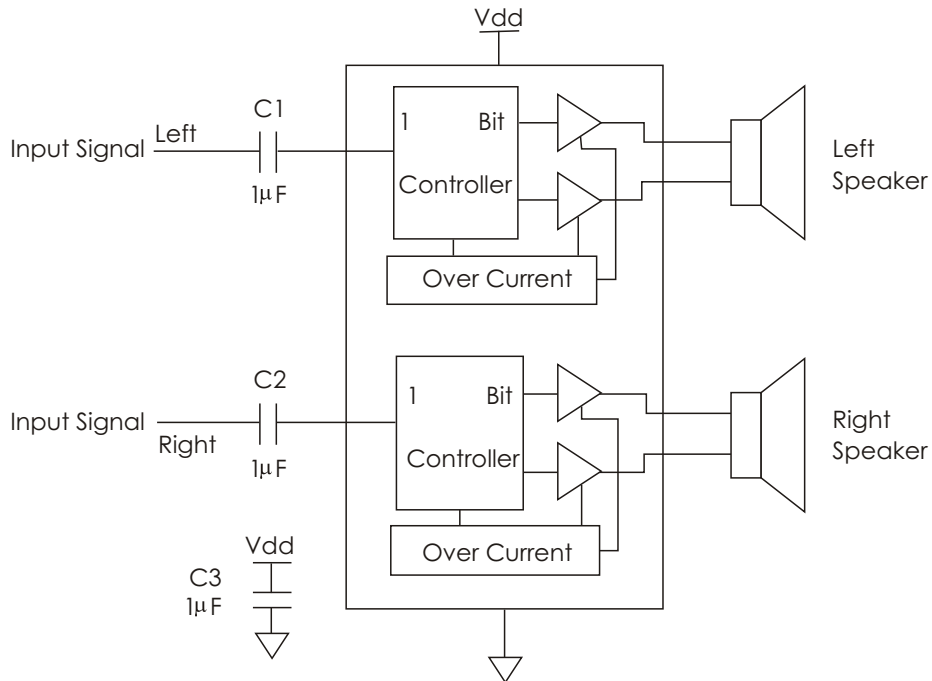
TEST CIRCUIT FOR GRAPHS
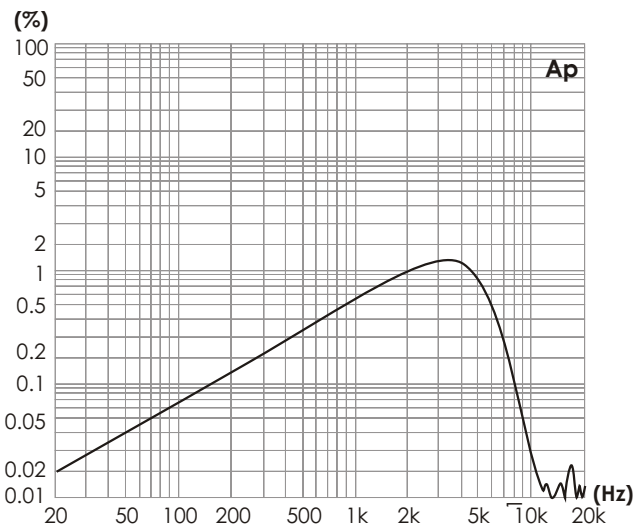

Notes:
1. The AP AUX-0025 low pass filter is necessary for every class D amplifier measurement done by AP analyzer.
2. A 33uH inductor is used in series with load resistor to emulate the small speaker for efficiency measurement.

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THD+N vs. Output Power
8Ω , 1kHz, VDD = 5V

THD+N vs. Output Power
4Ω , 1kHz, VDD = 5V

THD+N vs. Frequency
8Ω , 500mW output, VDD = 5V

Efficiency VS Output Power
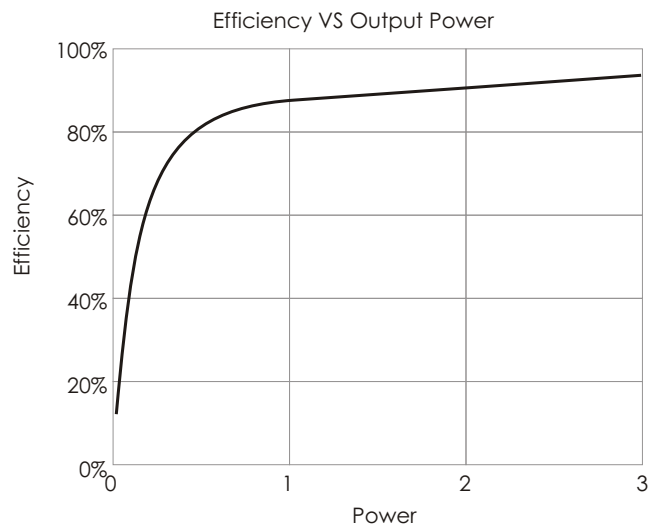
Power Dissipation vs. Output Power
4Ω , 1kHz, VDD = 5V
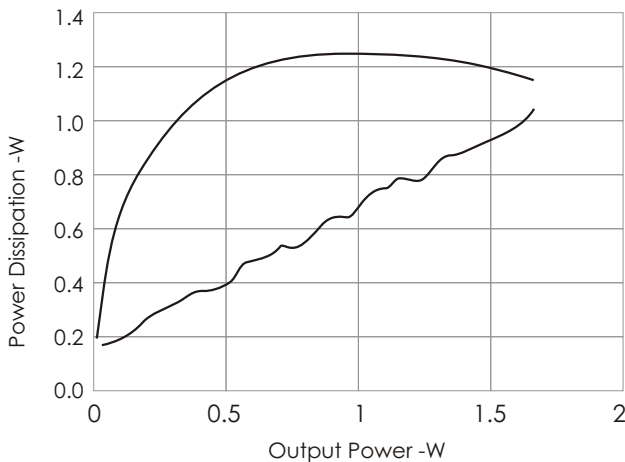
Power Dissipation vs. Output Power
8Ω , 1kHz, VDD = 5V

FFT Noise Floor
(16k FFT)

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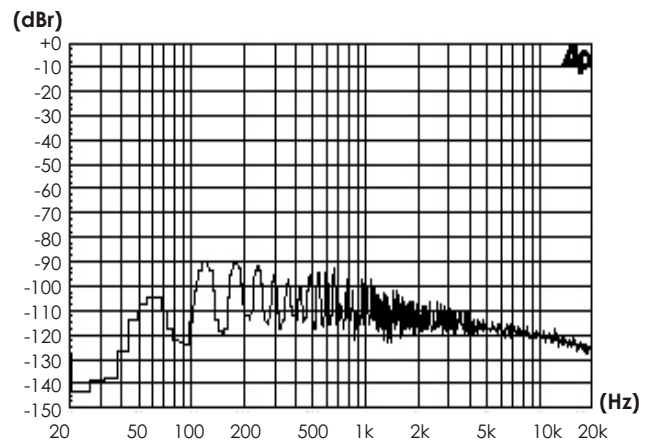
PRELIMIARY DATASHEET

OPERATION INFORMATION

Calculating Output Power of BTL amplifier
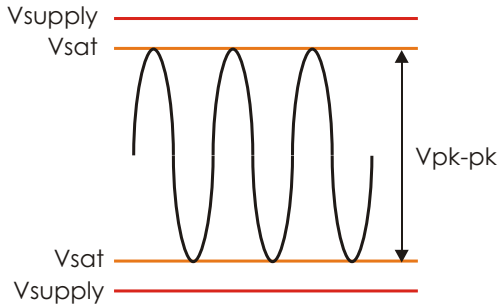
Output power is related to supply voltage and the saturation voltage (Vsat). The Maximum peak-to-peak output voltage on one side of BTL amplifier output is

Vp-p = (Vsupply 2 X Vsat)

$$Vrms = \frac{Vp\text{-}p}{2\sqrt{2}} \quad \text{One side}$$

Maximum output power of a BTL amplifier with 1% THD is
Pout (1%) = 4 X $Vrms^2$/ Rload

Maximum output power of a BTL amplifier with 10% THD is
Pout (10%) = Pout (1%) X 1.25

Output Power vs. Vp-p

BTL Output Power

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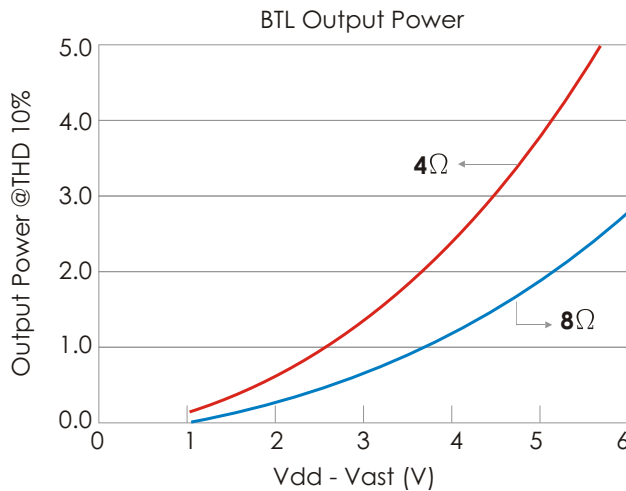
Fig. 1

Setting Amplifier voltage gain

It is very important to know the maximum output level (0dB) of the signal source connected to a power amplifier in order to prevent hard clipping during operation.

Gain (max) = Vsupply/ Vin (p-p)

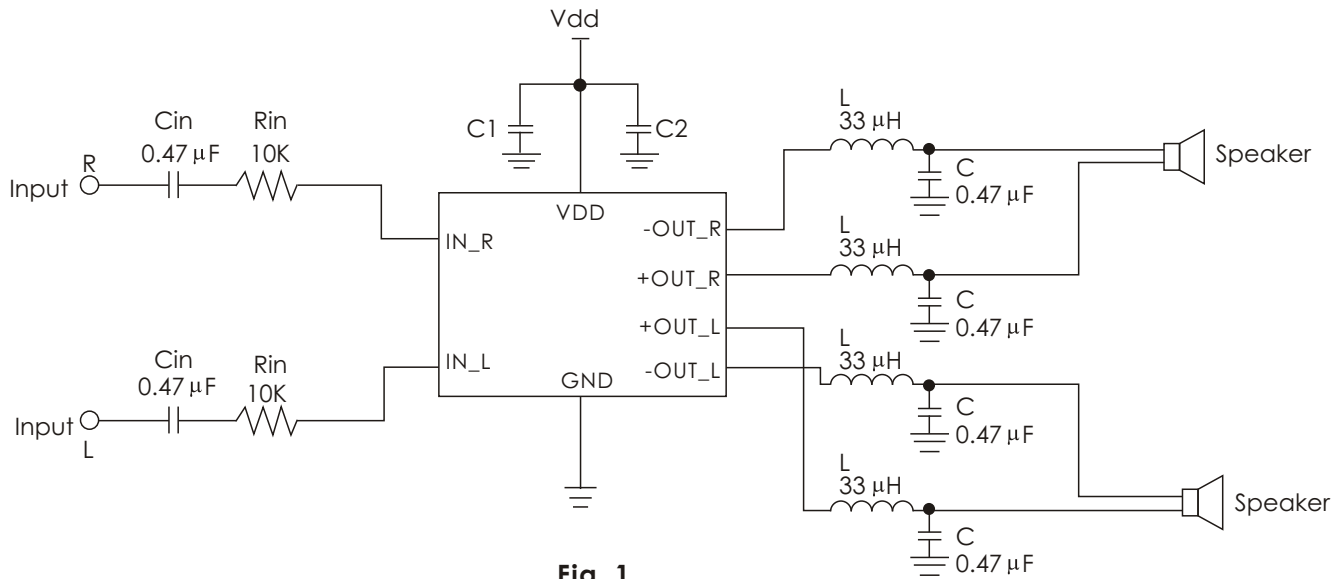Insufficient voltage gain will cause low output level and maybe not enough to drive speaker properly. On the other hand, the distortion will be very high if the voltage gain is too high in an audio system.

There is a 10kΩ input resistor integrated in side IN (input) node, and since the integrated feedback resistor is 100kΩ, so the maximum voltage gain of PAM8202 is limited at 10V/V (100k/10k, one output). With an external input resistor (Rin) placed between signal source & input node, the voltage gain will be

Gain = 100k/ (10k + Rin) = Vsupply/ Vin (p-p)

Actual voltage gain is two times of this calculation because of BTL connection.

Decouple capacitor

PAM8202 is a high performance, high speed class D amplifier, and it requires a 1uF, X7R ceramic decouple capacitor (C1) placed very close between VDD & GND pins to ensure the total harmonic distortion plus noise (THD+N) performance is as designed. This is also very important for efficiency and lowering noise floor. Another 100μF to 1000μF main decouple capacitor (C2) should be placed close to supply pin for low frequency Ecoupling.

Input capacitor
Input capacitor (Cin) blocks the DC voltage between signal source & amplifier to ensure the DC balancing will not be broken between two systems. It also form a high-pass-filter (HPF) with input resistors (Rin + 10k), the lower corner frequency (FCL) is determine by equation below.

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FCL = 1/ [2π X Cin X (Rin + 10k)]

FCL is the lower corner on frequency response curve.

Cin is very important consider to the lower frequency performance. The Cin should not be too large with small speakers as the load, because such small speakers usually can not response with lower frequency, delivering too much low frequency energy into a small speaker which usually got resonant frequency (Fs) around 150Hz is meaningless and dangerous. This will easily over drive the small speakers. The movement of speaker cone will be too much under such condition and this also creates unnecessary distortion on mid-to high frequency range because the speaker is now operating in non-linear area. Speakers can only generate heat but not low frequency sound when it is over driven, the will cause speaker or amplifier failure in some cases.
Cin should have 10% tolerance or less because the tolerance can cause the input impedance mismatch at FCL and below.

Output filter
The L and C on each output node of PAM8202 form the low-pass-filter (LPF), the higher corner frequency (FCH) is determine by equation below.

FCH = 1/ [2π X sqr (L X C)]

FCH is the higher corner on frequency response curve.
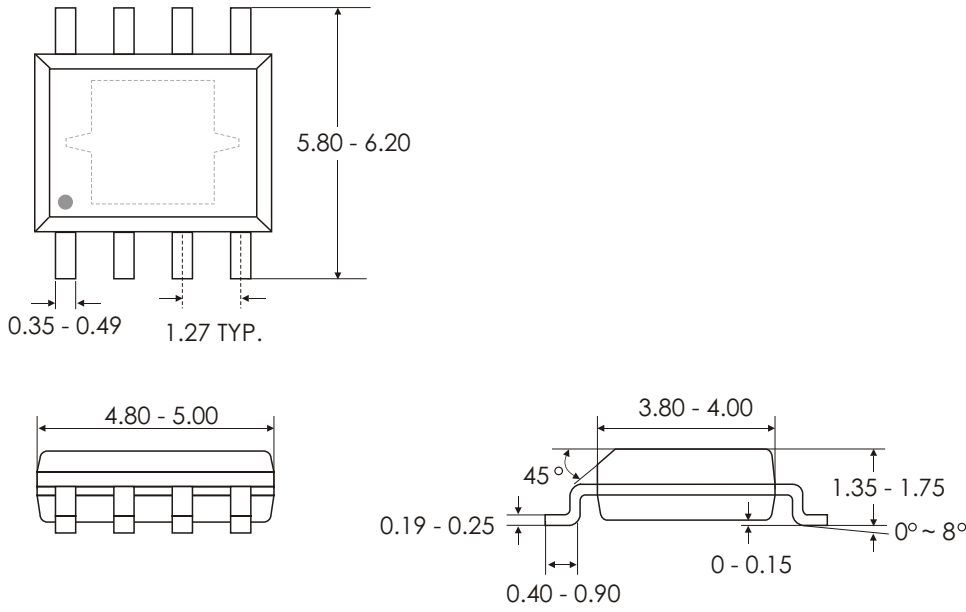
Important Notice
The L-C filters (-12dB/Oct) gives twice much attenuation and lower impedance (means lower insertion loss) compare to those R-C filters (-6dB), but remember, the FCH above is also the resonant frequency of this LC network. The quality factor (Q) of this resonant network can be very high, depended on the Q of L and C. The high resonant Q which is usually caused by open-load can generate a very high voltage on speaker terminal, and the impedance of the L-C network can be very low, thus induces large amount of current flows from output stage of PAM8202. This always causes part failure. So Do Not test open-load on any class D amplifier with output filters.

LC filter calculator with output load impedance and cut-off frequency

$$f = \frac{1}{2\pi \sqrt{LC}} \, , \ X_L = 2\pi f L \, , \ X_C = \frac{1}{2\pi f C}$$

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OUTLINE DIMENSION

SOP8

5.80 - 6.20

0.35 - 0.49

1.27 TYP.

4.80 - 5.00

3.80 - 4.00

45°

0.19 - 0.25

1.35 - 1.75

0° ~ 8°

0 - 0.15

0.40 - 0.90

Note: Package outline exclusive of mold flash and metal burr.

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