10.5W, built-in high-efficiency boost converter, single-channel, Class G audio power amplifier

ANT8908 characteristics:

• Output power

10.5W (2ÿ, 3.7V, THD+N=10%)

8.5W (3ÿ, 3.7V, THD+N=10%)

6.9W (4ÿ, 3.7V, THD+N=10%)

5.6W (4ÿ, 3.7V, THD+N=1%)

Built-in high-efficiency boost converter

• AVDD provides a stable output of 4.5V/50mA

It can supply power to other systems.

• Boost power supply with 10 adjustable current limiting levels

ÿ Switching between AB/D class working modes

• ALC Anti-Clipping Control

• Excellent pop-click noise suppression during power-on and power-off

• High-frequency dithering design for ultra-low EMI

• Fully differential circuit structure, strong anti-interference capability

• Built-in overheat protection and overcurrent protection

Lead-free and halogen-free package, ESOP8

ANT8908 Applications:

Portable Bluetooth speaker, WIFI speaker

AI Speaker

ÿ Small rolling suitcase

ANT8908 ordering information:

Product model,	packaging form, device identification, packaging method		
ANT8908 ESOP8	ANT8908	Tape	

ANT8908 Overview:

The ANT8908 is a highly integrated high-efficiency boost converter with built-in high efficiency.

Signal-to-noise ratio, low noise floor, G with ALC (anti-clipping) function

Audio-like power amplifier. The boost power supply supports 10 levels of current limiting.

The current limiting value can be adjusted in real time via software during power amplifier operation.

Prevents excessive battery discharge. Driven when powered by a 3.7V lithium battery.

A single-channel 2ÿ load can output a constant power of 10.5W.

The ALC function can automatically detect output distortion and dynamically adjust the amplification.

The gain of the circuit can prevent excessive amplitude input signals, such as music, from causing this problem.

Or output clipping distortion caused by battery voltage fluctuations, significantly

It can improve music quality and enhance the listening experience.

Class AB operating mode ensures operation in applications with radio functionality.

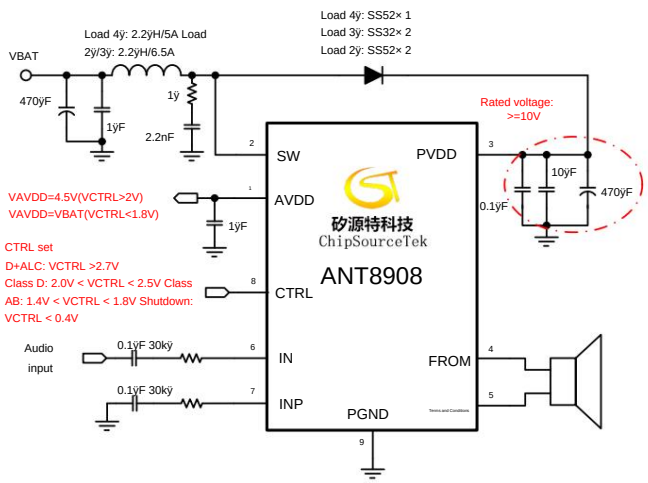
There is no interference during use. The AB/D class switching function is the same as the IC enable pin.

It can be reused and is very flexible in application.

In addition, the ANT8908 has built-in overcurrent protection and overheat protection functions.

Ensure the reliability and stability of the chip in various application environments.

Typical application schematic diagram of ANT8908:



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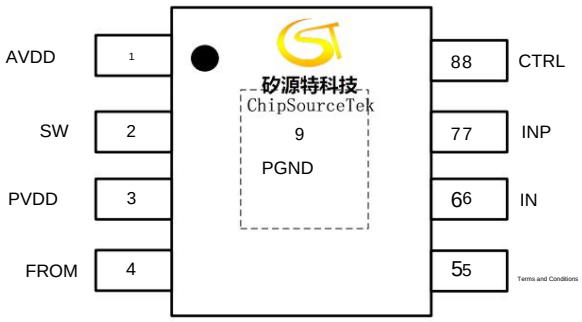
ANT8908 Pin Definitions:



ESOP8 (Top View)

ANT8908 Pin Function Description:

Serial Number	Code **I/O/P/A**		describe
1	AVDD	A is the internal circuit power supply pin; connect an external 1ÿF capacitor to ground.	
2	SW	P	SWITCH ÿ
3	PVDD	P boost output and audio power supply pin	
4	FROM	O Audio Negative Output Terminal	
5	Terms and Conditions	O Audio positive phase output terminal	
6	IN	I. Audio Negative Input Terminal	
7	INP	I. Audio inverting input terminal	
8	CTRL	I. Shutdown control, AB/D class mode selection, ALC and current limiting control pins	
9	PGND	P power ground	

ANT8908 limiting parameters:

parameter	scope		unit	illustrate
	Minimum value	Maximum value		
VBAT power supply voltage	-0.3	6	In	
CTRL control pin voltage		5.5	In	
TA ambient operating temperature	-40	85	ÿ	
Tstg storage temperature	-40	125	ÿ	
ESD voltage withstand (human body model)	2000		In	HBM
Welding temperature		260	ÿ	Within 15 seconds

Note: The chip's performance is not guaranteed outside of the limits or under any other conditions.

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ANT8908 electrical characteristics:

Limitations: (VBAT = 3.7V, TA = 25ÿ, Class D, Rload = 4ÿ, f = 1kHz, unless otherwise specified)

parameter	symbol	condition		Minimum value, typical value, maximum value, unit			
DC parameters							
power supply voltage	VBAT			2.8		5.5	In
Shutdown current	ISD	VCTRL=0			0.1	5	ÿA
Static operating current	IQ	VCTRL=1	Class AB		2		m.a.
			Class D		16		m.a.
Output offset voltage	|YOUR|	VCTRL=1			10	20 mV	
AVDD output voltage	VAVDD	VCTRL>2V			4.5		In
Boost oscillator frequency	Fsw	VCTRL=1			550		kHz
efficiency	or	PO=5.2W (Boost+Class D)			75		%
AC parameters							
Harmonic distortion plus noise	THD+N	PO=0.1W			0.05		%
		PO=5.0W			0.11		
Output power	AFTER	RL=2ÿ	THD+N=10%		10.5		IN
			THD+N=1%		8.5		
		RL=3ÿ	THD+N=10%		8.5		
			THD+N=1%		6.7		
		RL=4ÿ	THD+N=10%		6.9		
			THD+N=1%		5.6		
Idle channel output noise VN		GAIN=20dB, A-wt			75		ÿV
Signal-to-noise ratio	SNR	GAIN=20dB, A-wt			100		dB
Power supply voltage rejection ratio	PSRR	f=1kHz			-72		dB
Oscillator frequency	DARK	Class D			310		kHz
CTRL control level							
Shutdown voltage threshold VSD				0		0.4	In
Class AB voltage threshold VClass AB				1.4		1.8	
Class D voltage threshold VClassD				2.0		2.5	
Class D+ALC Voltage Threshold VClassD+ALC				2.7		5.0	
Protect							
Overheat protection threshold	OTP				150		ÿ
Overheat protection hysteresis					20		ÿ

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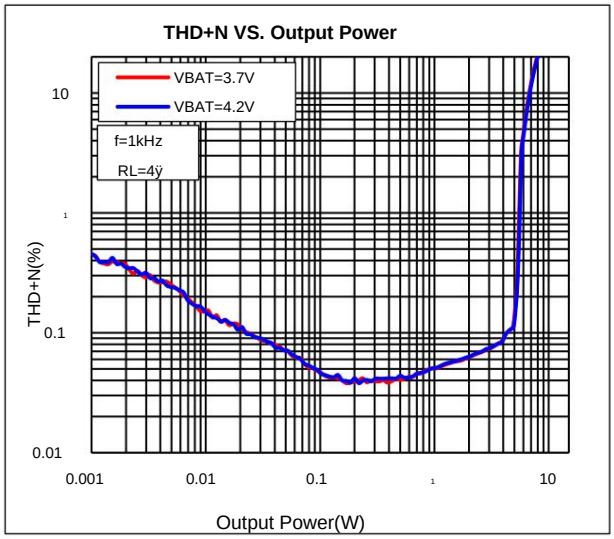
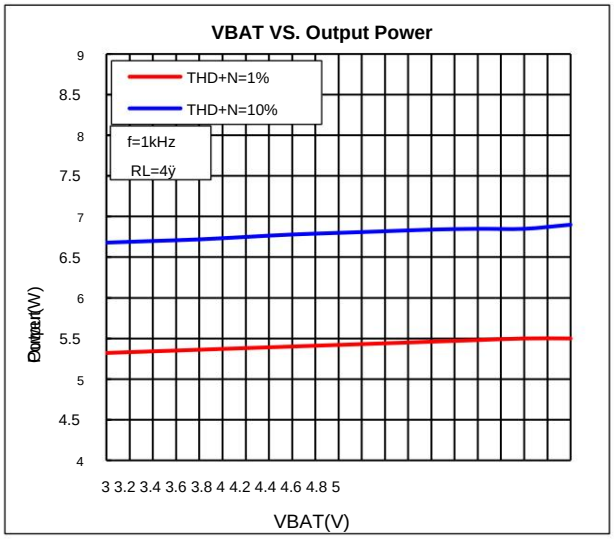
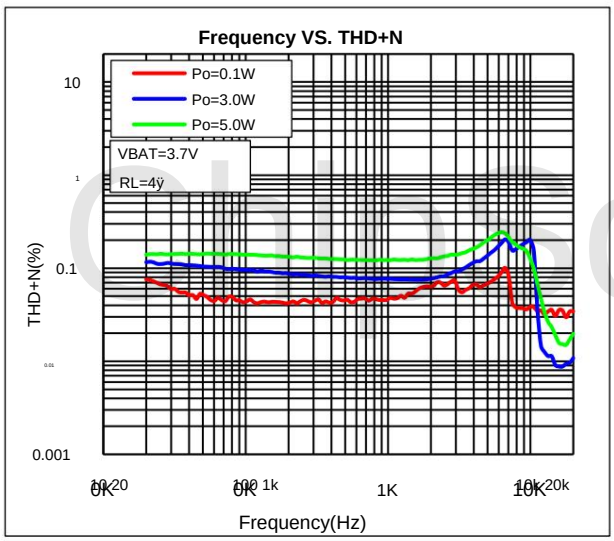
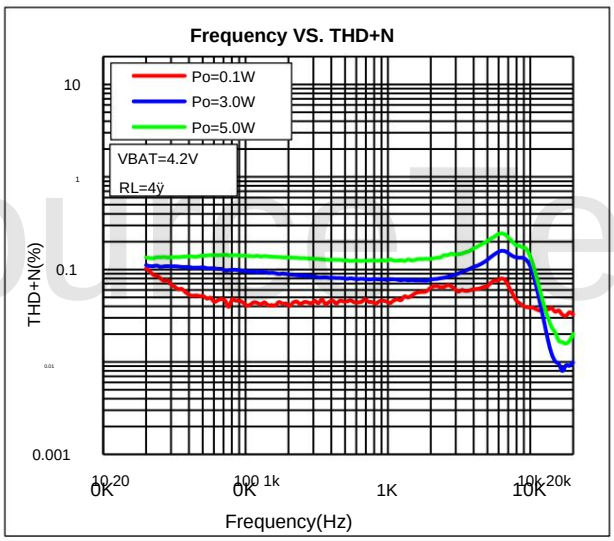
Typical characteristic curves of ANT8908:

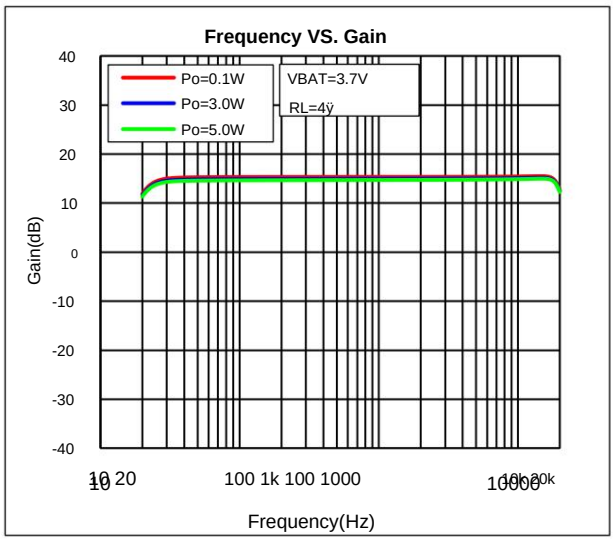
Note: The curves below represent **test values when RLOAD=4ÿ.**

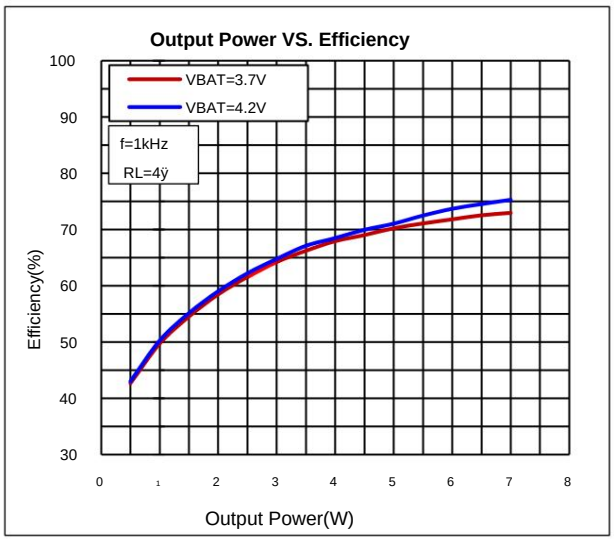












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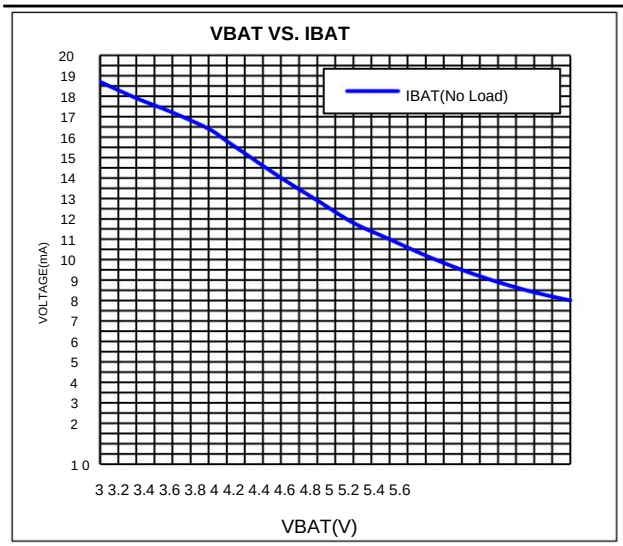
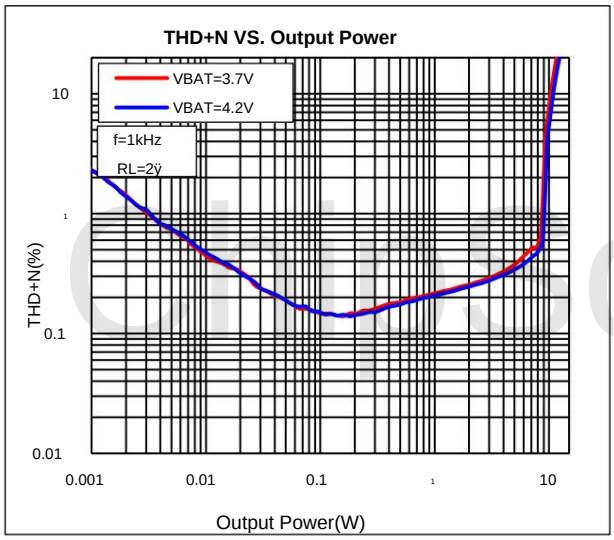
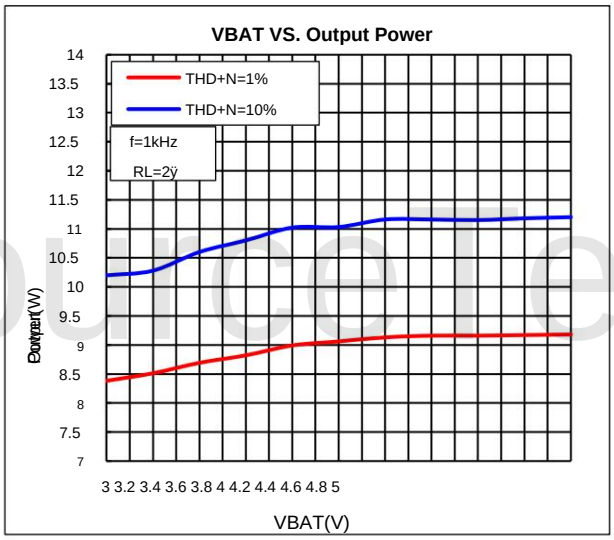
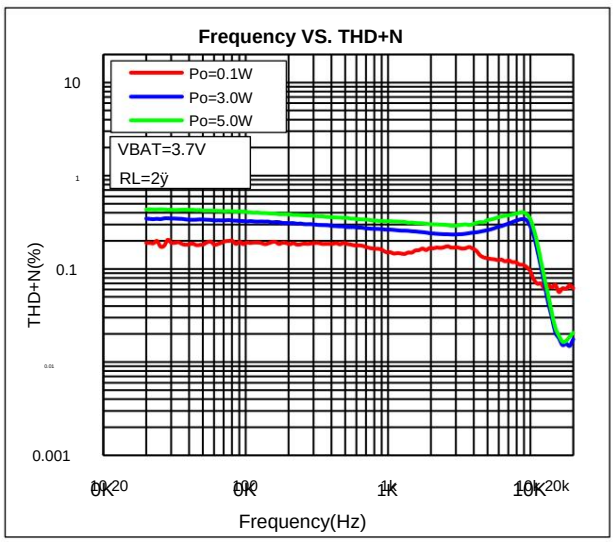
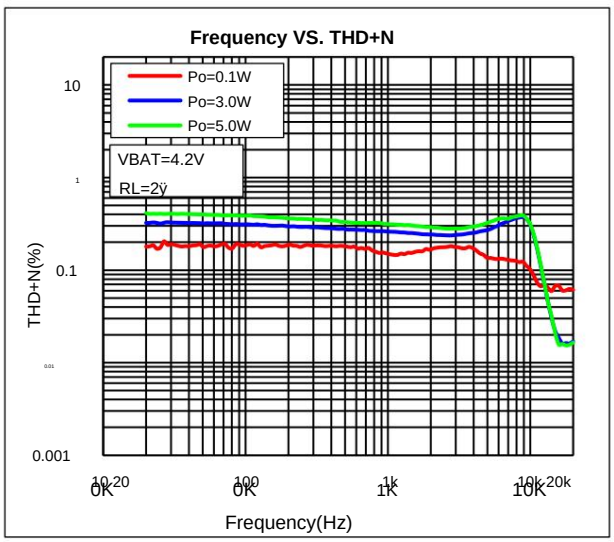


Note: The curves below are **test values when RLOAD=2ÿ.**









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ANT8908 Application Notes:

1. CTRL settings

The CTRL pin is the enable and mode control pin for the ANT8908. A low level disables the chip, and a high level enables it. Internally, this pin...

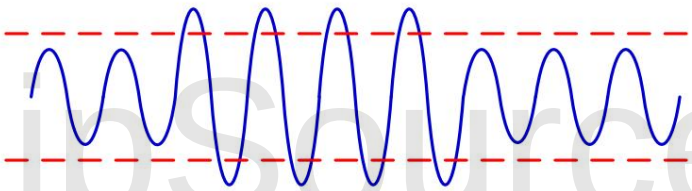
It has a pull-down resistor (81kÝ) and is in the off state when floating. The CTRL pin is also in Class AB mode, and Class D mode ALC is enabled and disabled.

The control pin can be turned on and off via external voltage control.

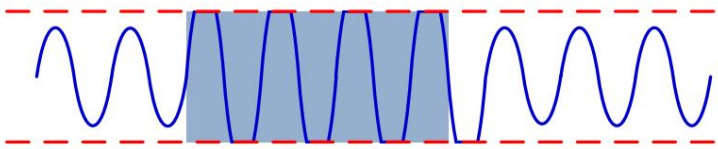
2.7V < VCTRL < 5.0V: Class D anti-clipping on (Class D + ALC ON) 2.0V < VCTRL < 2.5V: Class D anti-clipping	
off (Class D + ALC OFF) 1.4V < VCTRL < 1.8V: Class AB on (Class AB)	
VCTRL < 0.4V	Chip shutdown

The ANT8908 can enter anti-clipping mode via the CTRL pin. The amplifier automatically detects output clipping distortion and automatically adjusts the amplifier accordingly.

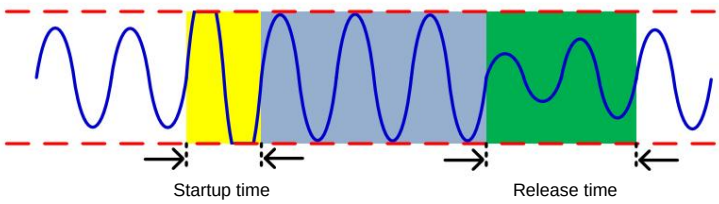
The gain is increased to achieve anti-distortion (anti-clipping) effect. A diagram illustrating the anti-clipping effect is shown below:



Audio output signal when not limited by power supply voltage



Audio output signal in normal working mode



When the ALC anti-distortion function of the ANT8908 is enabled, the audio output signal...

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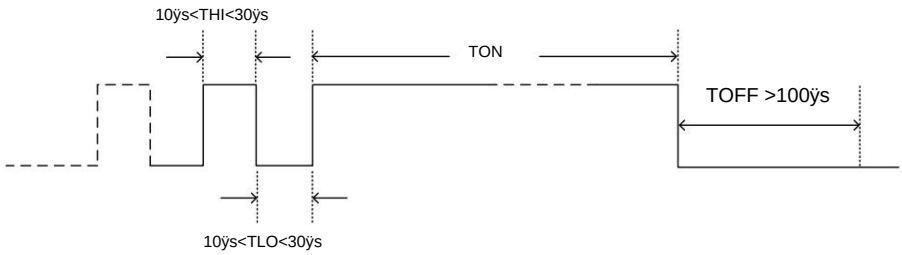
The ANT8908 allows for current limiting settings on the boost power supply (VBAT) via the CTRL pin, supporting 10 adjustable current limiting levels. This is achieved through the number of pulses.

Set the boost supply current (VBAT) to limit the boost output power. If the battery output current is low, then during CTRL power-on...

Power limiting can be implemented. When the battery is low, the maximum power can be further reduced by increasing the number of rising edges to prevent the battery from being overloaded.

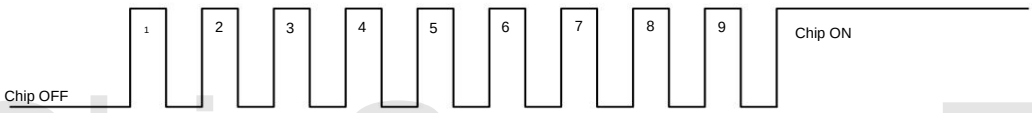
It's so bad it'll kill you.

The timing requirements for current limiting on the CTRL pin are as follows:



Where THI is the pulse high-level width, TLO is the pulse low-level width, TON is the chip operating time, and TOFF is the chip off time.

For example, the timing sequence of the chip after current limiting for nine pulses at the CTRL pin is as follows:



When there is no pulse at the CTRL pin (directly high level), the VBAT pin current limit is 6.3A. For the number of pulses present, refer to the VBAT pin current limit value for the corresponding pulse count.

0 pulses, 1	6.30A	5 pulses 6	5.50A
pulse, 2	6.16A	pulses 7	5.30A
pulses, 3	5.98A	pulses 8	5.14A
pulses, 4	5.84A	pulses 9	4.96A
pulses	5.65A	pulses	4.78A

2. Gain Settings

The ANT8908 uses a differential amplification structure at its input, allowing for both differential and single-ended input connections. The differential and single-ended inputs provide the same amplification factor.

It integrates a feedback resistor, and the gain can be adjusted by modifying the external input resistor. The gain setting follows the formula:

Class ABÿ Off ÿ $\frac{150k\ Ohm}{Also}$

Class Dÿ Off ÿ $\frac{330k\ Ohm}{Also}$

Rin is an external input resistor, and customers can flexibly set the value of Rin according to their own gain requirements.

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3. Input resistance **Cin**

The input resistor Rin and the input capacitor Cin form a high-pass filter, and its cutoff frequency is calculated using the following formula:

$$f_c = \frac{1}{2\pi RinCin}$$

The choice of input capacitor value is crucial, as it is generally believed to directly affect the low-frequency characteristics of the circuit. However, a larger capacitor value is not always better. (Radio)

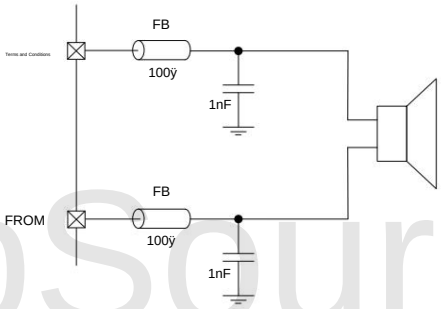
The speaker in the voice is usually not very responsive to low-frequency signals. A larger fC can be selected in the application to filter out the noise introduced at 217Hz.

Interference. Good matching between capacitors helps improve the overall performance of the chip and suppress Pop & Click interference; therefore, a selection accuracy of [insert accuracy here] is required.

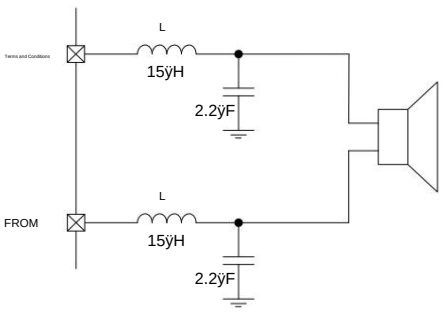
Capacitors with 10% or higher precision.

4. Output Filter

In applications with low EMI requirements, the ANT8908 can be directly connected to a speaker at the output or to a ferrite bead filter at the output, as shown in the diagram below:



If the ANT8908 is used in a system with high EMI requirements, an LC filter can be connected in series at the output, as shown in the following diagram:



5. **AVDD** output

The AVDD pin of the ANT8908 provides a fixed 4.5V output when the CTRL pin is powered from 2.0V to 5.0V, and can handle a 50mA load. The AVDD output...

It can supply power to the main control chip, preventing the main control chip from malfunctioning or crashing when the VBAT voltage is low. The AVDD voltage output is shown in the table below:

2.0V < VCTRL < 5.0V	VAVDD = 4.5V
1.4V < VCTRL < 1.8V	VAVDD = VBAT
VCTRL < 0.4V	VAVDD = 0

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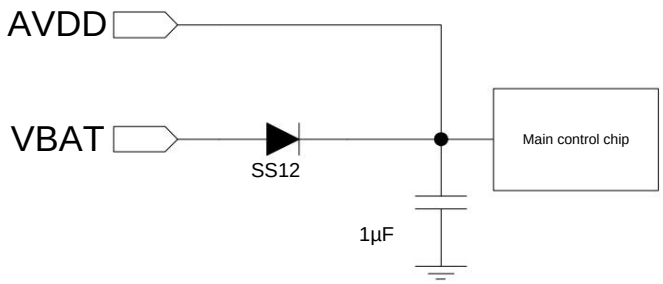
The main control power supply reference circuit is as follows:



6. Selection of Schottky diodes

The ANT8908's Boost section uses a asynchronous rectification architecture, requiring an external Schottky diode for freewheeling. The Schottky diode significantly impacts the overall performance of the IC.

Performance is greatly affected; inappropriate selection may lead to low overall efficiency, or even generate a large reverse overshoot voltage at the SW terminal of the IC, causing...

The IC is burnt out. We recommend using two SS52 diodes when driving a 2ÿ speaker with the ANT8908, and two SS32 diodes when driving a 3ÿ speaker with the ANT8908.

When driving a 4ÿ speaker, use one SS52. During layout, pay attention to making the connections between the Schottky diode, inductor, and PVDD as wide and short as possible. Inappropriate routing will cause overshoot and ringing at the SW terminal, affecting EMI and even burning out the IC.

7. Selection of **Boost** Inductors

Considering factors such as ripple stability and boost conversion efficiency, it is recommended to use an inductor with a 2.2ÿH capacity and a sufficiently small DCR. When driving a 2ÿ or 3ÿ speaker, it is recommended to select a saturation current of 6.5A or higher, and when driving a 4ÿ speaker, it is recommended to select a saturation current of 5A.

8. Selection of PVDD terminal capacitor

The PVDD pin of the ANT8908 is both the boost output and the power input for the built-in amplifier. Two sets of capacitors are required: one set of 0.1ÿF and 10ÿF decoupling capacitors; and one set of 470ÿF electrolytic filter capacitors. The PVDD filter capacitors must have a voltage rating of 10V or higher. The 0.1ÿF capacitors are acceptable.

The 10ÿF capacitor should be placed as close as possible to the PVDD pin, ideally near the negative terminal of the Schottky diode. For the 470ÿF capacitor, it is recommended to use a high-frequency, low-impedance electrolytic capacitor, which can effectively improve efficiency and reduce voltage ripple.

9. Chip **PGND**

The PGND and ANGD wires of the ANT8908 are bonded to the substrate (on the heatsink at the bottom of the chip). During layout, special attention must be paid to ensuring the bottom of the chip is flush with the substrate.

Connection of PGND on the PCB. To prevent solder leakage during production, it is recommended that the diameter of the PGND via directly below the ANT8908 on the PCB not be too large or too narrow.

Intensive measures are taken to prevent solder leakage during surface mount technology (SMT) production, which could lead to insufficient or no solder connection on the PGND of the ANT8908, affecting chip performance or even burning out the IC.

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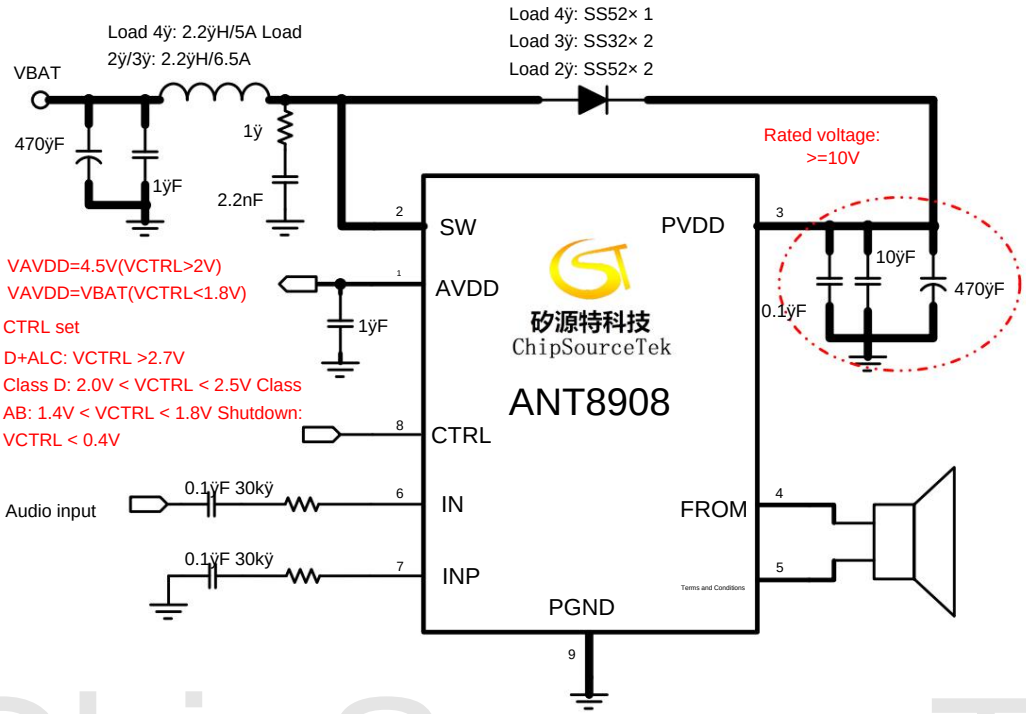
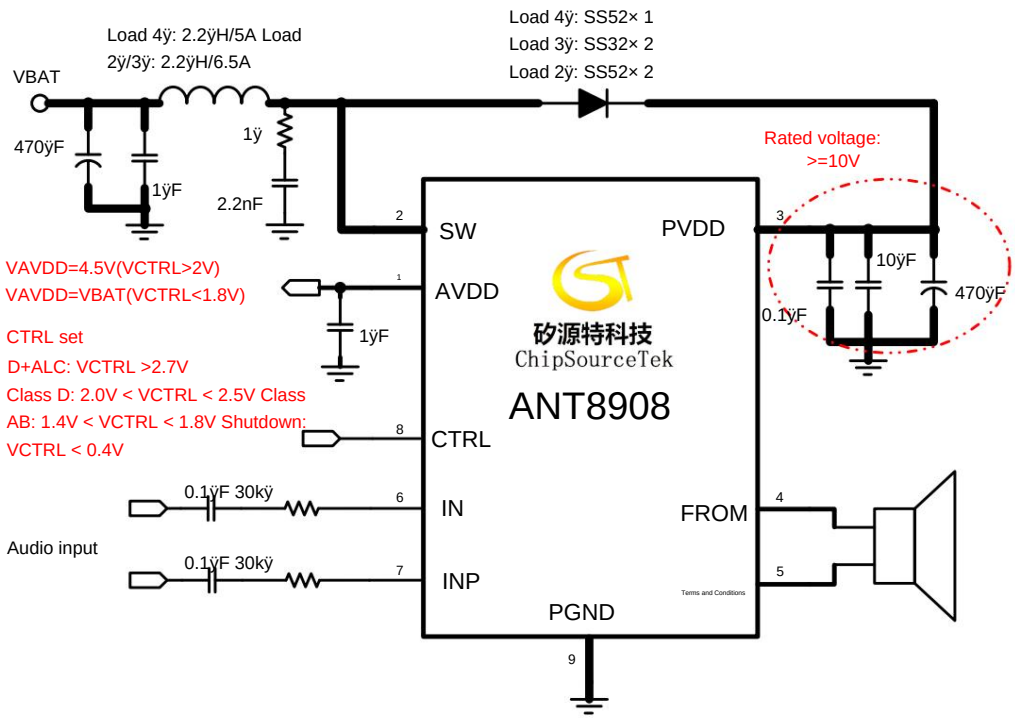
10. Typical Application Circuits

ANT8908 Single-Ended Input Mode Circuit Diagram



ANT8908 Differential Input Mode Circuit Diagram



Note: In typical application circuits, the thick black lines carry high currents. The traces on the PCB should be thick (0.8mm or more recommended) and as short as possible.

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11. Layout Considerations

ý Place the capacitor at pin 1 close to the pin, and make the connection between the capacitor and the pin as thick as possible (0.6mm or more recommended). Connect the capacitor's GND terminal to the chip...

The GND wire should be thick and short.

ý Place the inductor close to pin 2 of the chip, and make sure the connection between the inductor and the pin is thick (0.8mm or more is recommended).

ý The GND terminal of the RC circuit (1ý+2.2nF) at pin 2 should be separated from the ground terminal of the capacitor at pin 1, and should not be directly connected together.

ý The filter capacitor for VBAT power supply should be placed close to the inductor. The connection between the filter capacitor and the inductor should be thick and short. The GND terminal of the filter capacitor should be connected to the GND terminal of the chip.

The connection wires should be thick and short.

ý Place the Schottky diode close to pin 2 (right next to the inductor). The connection between the negative terminal of the Schottky diode and pin 3 should be short and thick (0.8mm or more recommended).

(That's all.)

ý Place the filter capacitor at pin 3 close to the pin, and make the connection between the filter capacitor and the pin as thick as possible. Connect the GND terminal of the filter capacitor to the GND terminal of the chip.

The line should be thick and short.

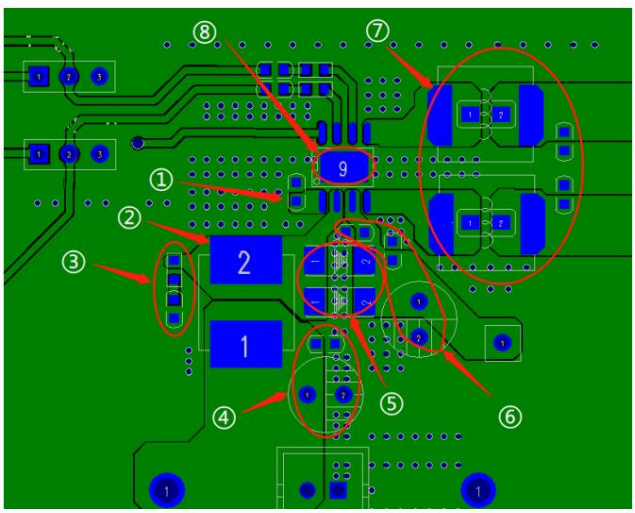
ý The LC (or RC) filter circuit for audio output should be placed as close as possible to the chip pins, and the wiring should be thick (0.8mm or more is recommended).

ý The bottom of the ANT8908 is the GND pin. To avoid solder leakage during surface mount manufacturing, it is recommended that the via directly below the chip on the PCB not be too large (drilling is recommended).

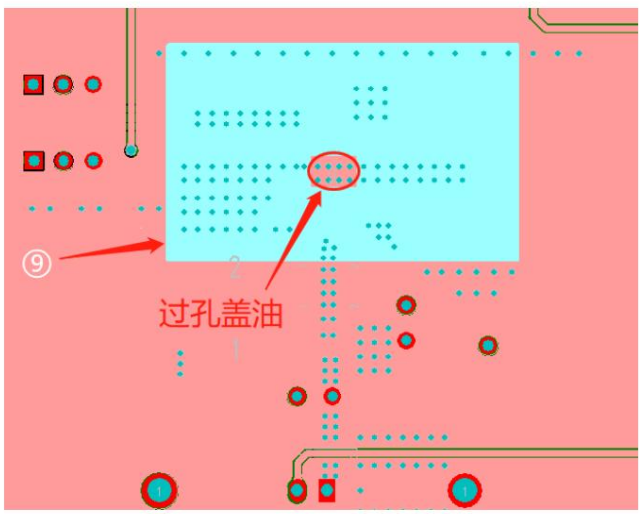
Do not drill holes too densely (holes 0.4mm or less), but spread them out.

9. For the bottom layer, the exposed copper directly beneath the chip provides heat dissipation. It is recommended to use multiple vias for the exposed copper area. If vias have already been placed directly beneath the top layer chip, then the bottom layer chip should be placed directly beneath it.

Fang suggested covering the vias with solder paste to prevent solder leakage from the surface mount chip directly beneath the top-layer chip.



Top floor



bottom layer

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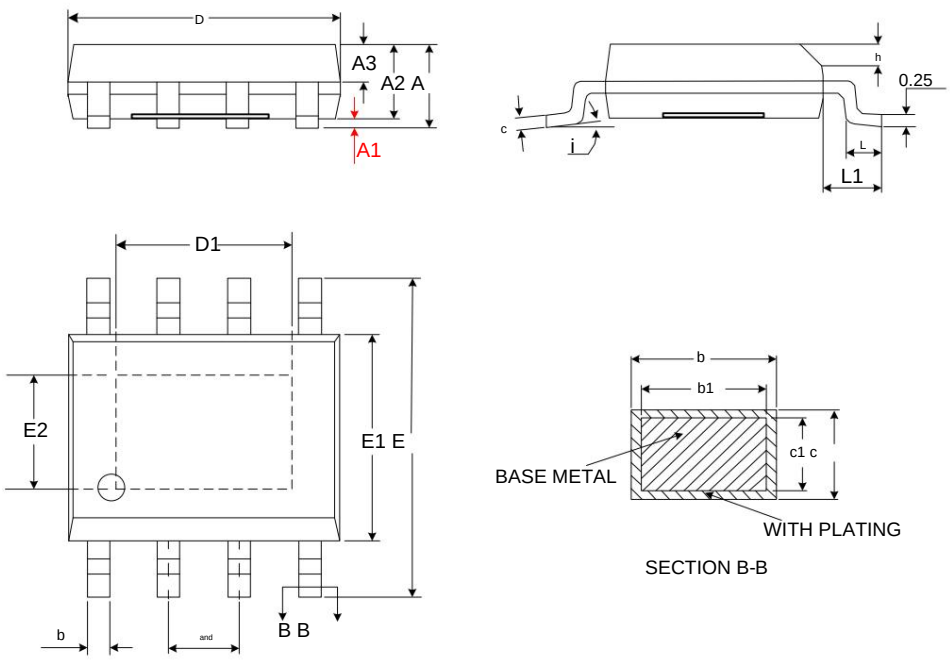
ANT8908 package dimensions:

ESOP8 package dimensions



SYMBOL	MILLIMETER		
	MIN	NAME	MAX
A	—	—	1.75
A1	0.05	0.1	0.15
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.48
b1	0.38	0.41	0.43
c	0.21	—	0.26
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
D1	3.30 BSC		
AND	5.80	6.00	6.20
E1	3.70	3.90	4.10
E2	2.40 BSC		
and	1.27 BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05BSC		
i	0	—	8°

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