

Non-Crack-Noise, Ultra-Low-EMI, 3W, Mono, Filter-Free, Class-D Audio Amplifier

Features

- **NCN Function Protects the Speaker**
- **EEE Function, Greatly reduces EMI over the full bandwidth**
- **Excellent Pop-Click Suppression**
- **3W into 3Ω (10% THD+N, V_{DD}=5V)**
- 0.04% THD+N (P_{out}=1W, V_{DD}=5V)
- Filter-Free Class-D Architecture
- Up to 90% Efficiency
- High PSRR (-80dB at 217Hz)
- Low Quiescent Current (2.8mA)
- Low Shutdown Current (<0.1μA)
- Power Supply Range: 2.5V~5.5V
- Over-Current Protection
- Over-Temperature Protection
- Undervoltage Protection
- Small 1.45mm×1.45mm CSP9 Package
- RoHS compliant, lead-free packages

Applications

- Cellular Phones
- MP3/PMP
- GPS
- Digital Photo Frame

General Description

The AW8110 is a Non-Crack-Noise (NCN), Ultra-Low-EMI, filter-free, 3W, mono, Class-D audio amplifier. Unique NCN function, which adjusts the system gain automatically while detecting the “Crack” distortion of output signal, protects the speaker from damage at high power levels and brings the most comfortable listening experience to the customers.

The AW8110 features the EEE (Enhanced Emission Elimination) function which greatly reduces EMI over the full bandwidth. The AW8110 achieves better than 20dB margin under FCC limits with 24 inch of cable.

The filter-free PWM architecture and internal gain setting reduces external components count, board area consumption, system cost and simplifies the design. In addition, The AW8110 offers efficiencies above 90%. The over-current, over-temperature and under-voltage protection is prepared inside of the device.

The AW8110 is available in an ultra small 1.45mm×1.45mm CSP9 package. The AW8110 is specified over the industrial temperature range of -40°C to +85°C.

Pin Configuration and Top Mark

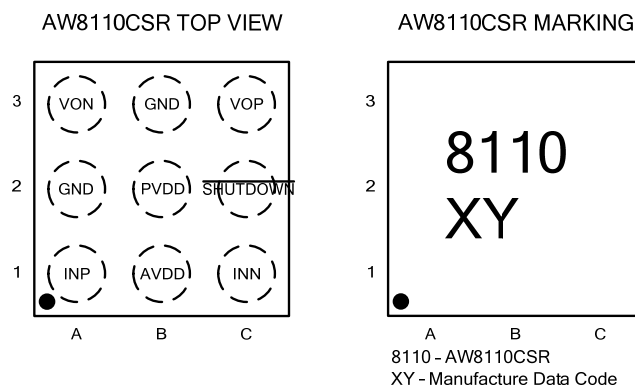


Figure 1 Pin Configuration and Top Mark of AW8110

Typical Application

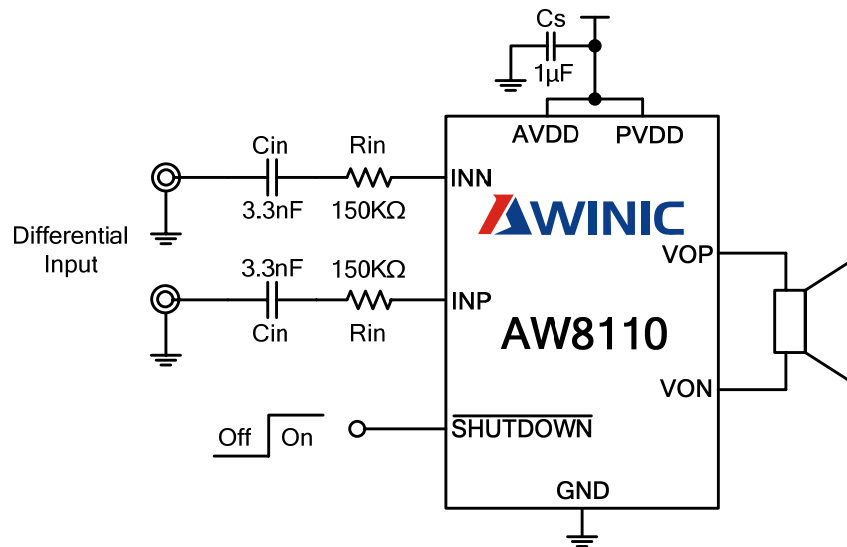


Figure 2 AW8110 Application Schematic With Differential Input

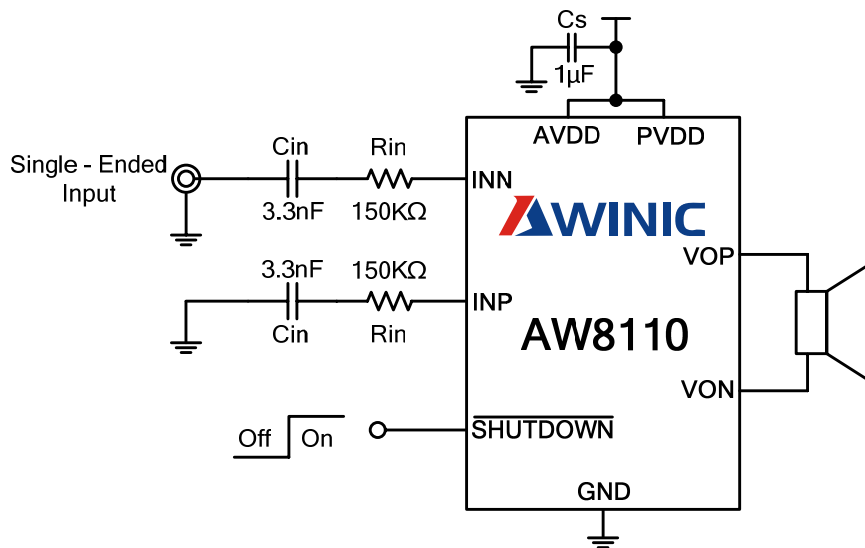
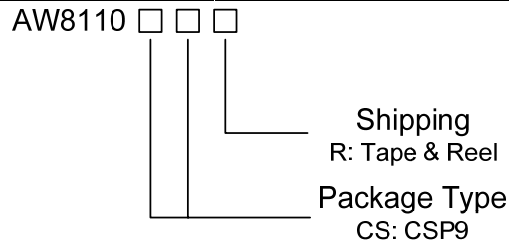


Figure 3 AW8110 Application Schematic With Single-Ended Input

Ordering Information

Part Number	Temperature	Package	Marking	Packing Type
AW8110CSR	-40°C ~ 85°C	CSP9	8110	3000 units/Tape and Reel



Absolute Maximum Ratings(1)

Parameter	Unit
Supply voltage V_{DD}	-0.3V to 6V
Input Voltage	-0.3V to $V_{DD}+0.3V$
Package Thermal Resistance $\theta_{JA}(2)$	90°C/W
Operating free-air temperature	-40°C to 85°C
Maximum Junction Temperature T_{JMAX}	125°C
Storage Temperature Range T_{STG}	-65°C to 150°C
Lead Temperature (Soldering 10 Seconds)	260°C
ESD Rating(3)	
HBM(human body model)	±8KV
Latch-up	
Test Condition :JEDEC STANDARD NO.78B DECEMBER 2008	+IT:450mA -IT:-450mA

note1: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

note2: For the 9-Pin Flip-Chip CSP package, the θ_{JA} is highly dependent of the PCB Heatsink area. For example, θ_{JA} can equal 195°C/W with 50 mm² total area and also 135°C/W with 500 mm². When using ground and power planes, the value is around 90°C/W, as specified in table.

note3: The human body model is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin. Test method: MIL-STD-883G Method 3015.7.

Electrical Characteristics

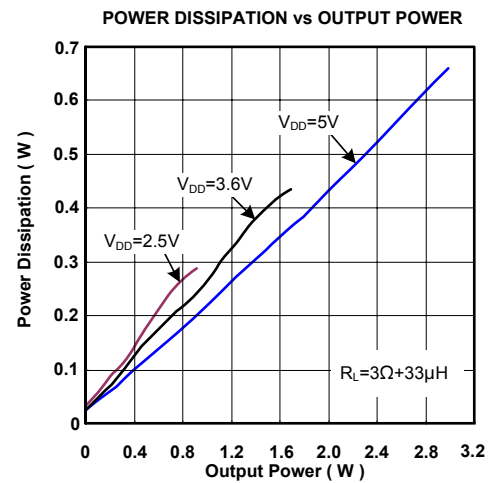
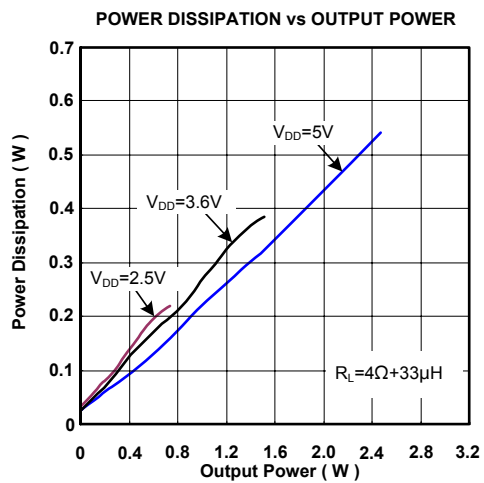
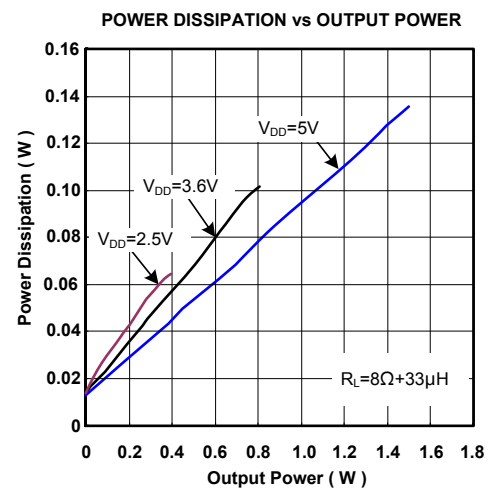
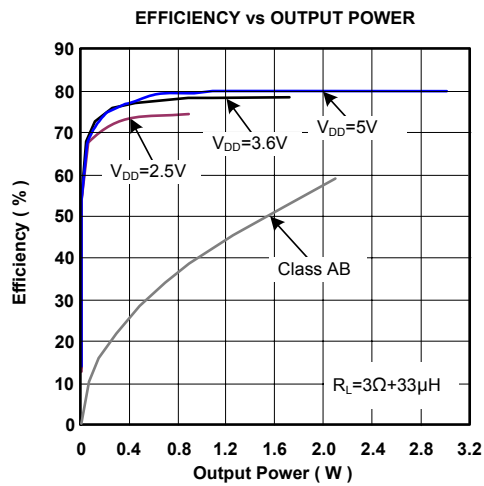
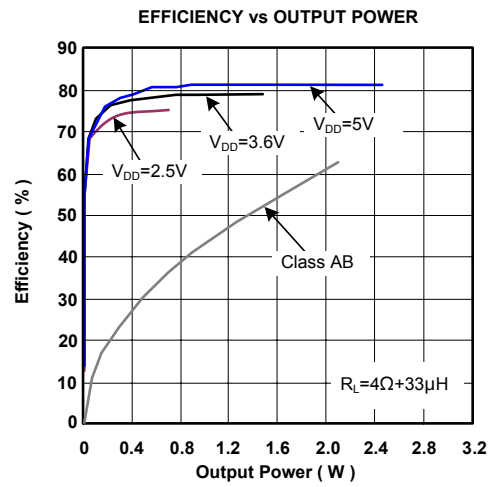
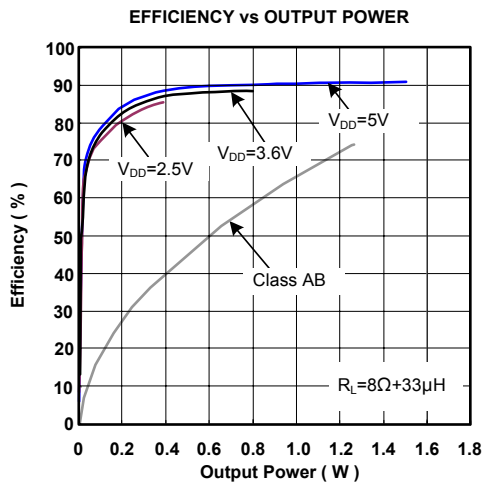
Test Condition: $T_A=25^{\circ}\text{C}$ (Unless otherwise specified)

Parameter	Conditions	Min	Typ	Max	Units	
Electrical Characteristics						
VDD	Power voltage	2.5		5.5	V	
V _{IH}	High-level input voltage	1.3				
V _{IL}	Low-level input voltage			0.35		
V _{OS}	Output offset voltage	V _{IN} =0V, A _V =3V/V, V _{DD} =2.5V to 5.5V		5	25	mV
I _Q	Quiescent current	V _{DD} =3.6V		2.8		mA
I _{SD}	Shutdown current	V _{DD} =3.6V, $\overline{\text{SHUTDOWN}}=0\text{V}$		0.1		μA
PSRR	Power supply rejection ratio	217Hz		-80		dB
CMRR	Common mode rejection ratio			-70		dB
f _{sw}	Switching frequency	V _{DD} =2.5V to 5.5V		800		kHz
A _V	Gain			$\frac{3 \times 150\text{k}\Omega}{R_{in}}$		V/V
	$\overline{\text{SHUTDOWN}}$ pin pull-down res			300		k Ω
Operating Characteristics						
P _O	Output power (NCNOFF mode)	R _L =8 Ω , THD+N=1%, f=1kHz, V _{DD} =5V		1.25		W
		R _L =8 Ω , THD+N=1%, f=1kHz, V _{DD} =4.2V		0.85		W
		R _L =8 Ω , THD+N=10%, f=1kHz, V _{DD} =5V		1.5		W
		R _L =8 Ω , THD+N=10%, f=1kHz, V _{DD} =4.2V		1.05		W
		R _L =4 Ω , THD+N=1%, f=1kHz, V _{DD} =5V		2.0		W
		R _L =4 Ω , THD+N=1%, f=1kHz, V _{DD} =4.2V		1.45		W
		R _L =4 Ω , THD+N=10%, f=1kHz, V _{DD} =5V		2.45		W
		R _L =4 Ω , THD+N=10%, f=1kHz, V _{DD} =4.2V		1.8		W
		R _L =3 Ω , THD+N=1%, f=1kHz, V _{DD} =5V		2.4		W
		R _L =3 Ω , THD+N=1%, f=1kHz, V _{DD} =4.2V		1.7		W
		R _L =3 Ω , THD+N=10%, f=1kHz, V _{DD} =5V		3.0		W
		R _L =3 Ω , THD+N=10%, f=1kHz, V _{DD} =4.2V		2.2		W
THD+N	Total harmonic distortion plus noise	V _{DD} =5V, P _O =0.5W, R _L =8 Ω , f=1kHz		0.04		%
		V _{DD} =5V, P _O =1W, R _L =4 Ω , f=1kHz		0.04		%
η	Efficiency	V _{DD} =5V, P _O =0.8W, R _L =8 Ω , f=1kHz		90		%
t _{ST}	Start-up time			32		ms
NCN						
A _{MAX}	Maximum attenuation gain			-10		dB

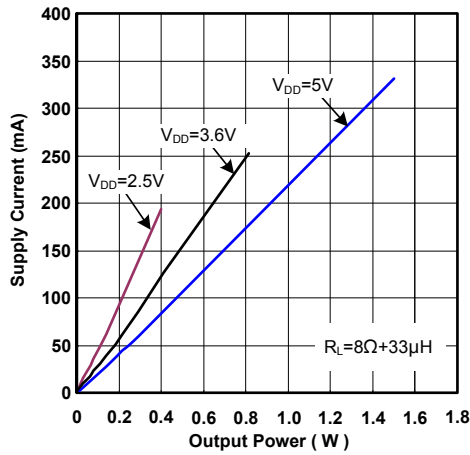
Pin Definition

No.	Symbol	Description
A1	INP	Positive audio input
A2	GND	Ground
A3	VON	Negative audio output
B1	AVDD	Analog power supply
B2	PVDD	Power supply for output
B3	GND	Ground
C1	INN	Negative audio input
C2	$\overline{\text{SHUTDOWN}}$	Shutdown pin
C3	VOP	Positive audio output

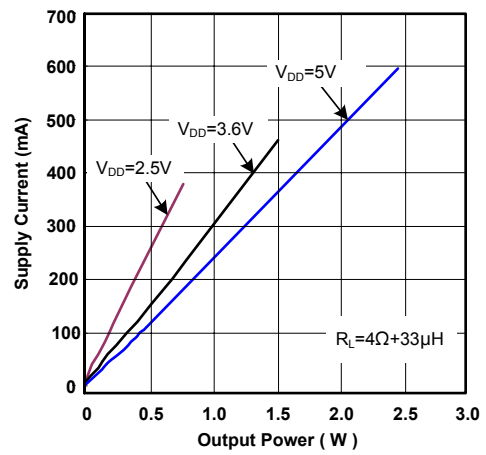
Typical Operating Characteristics



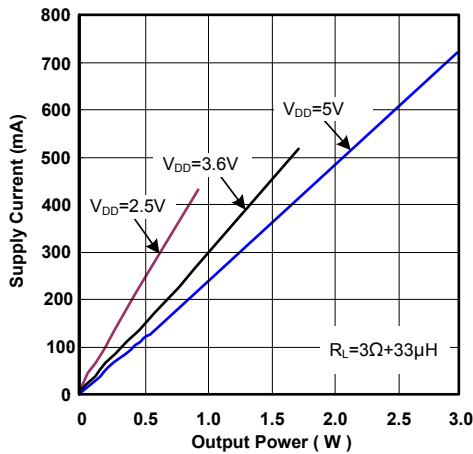
SUPPLY CURRENT vs OUTPUT POWER



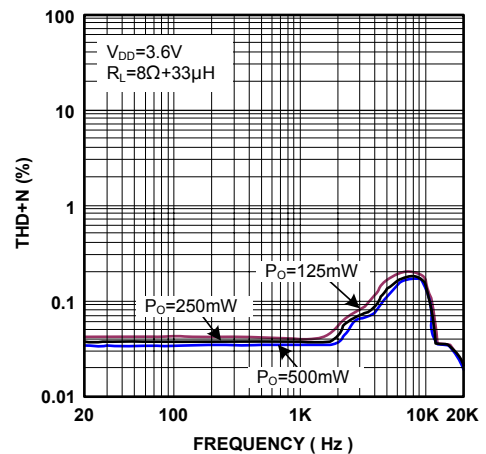
SUPPLY CURRENT vs OUTPUT POWER



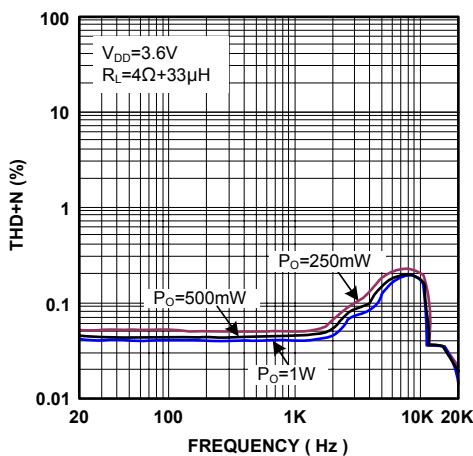
SUPPLY CURRENT vs OUTPUT POWER



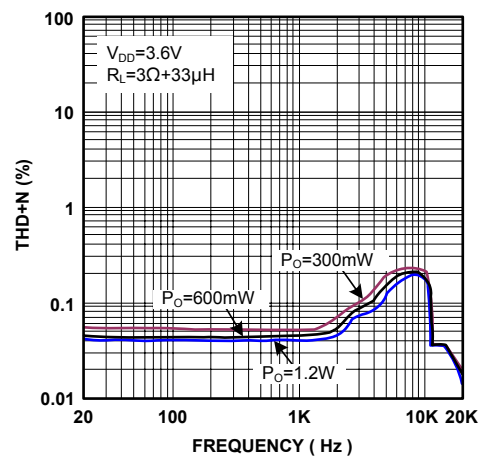
THD+N vs FREQUENCY

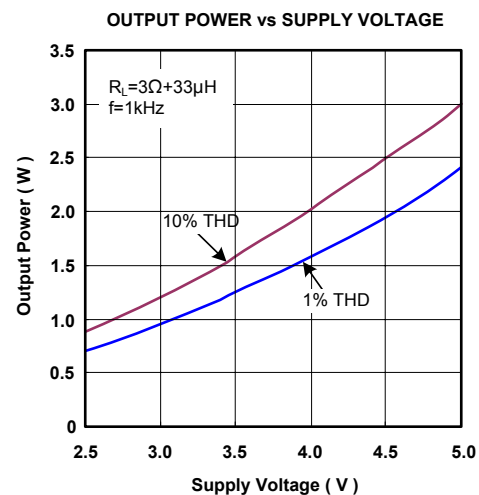
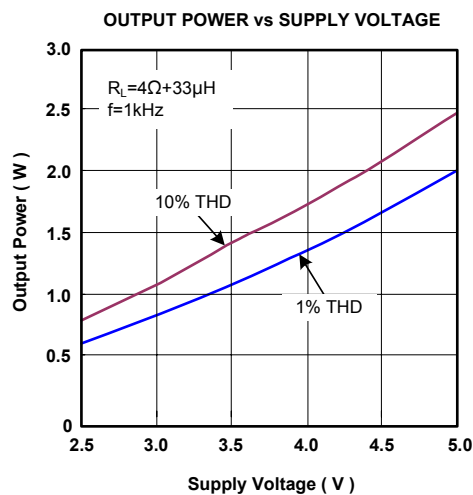
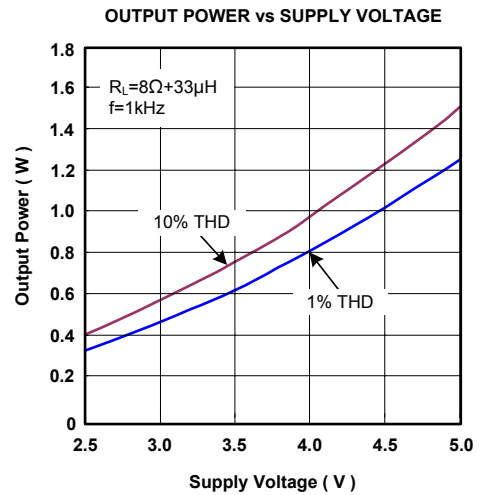
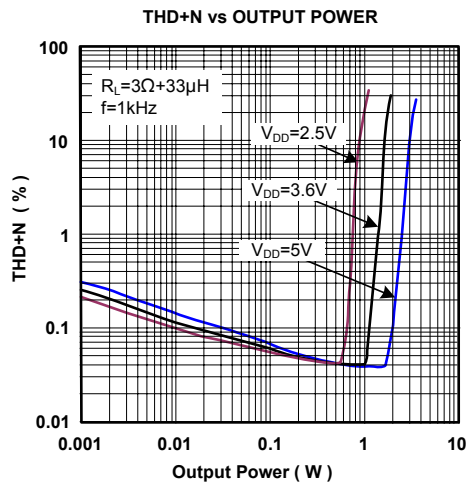
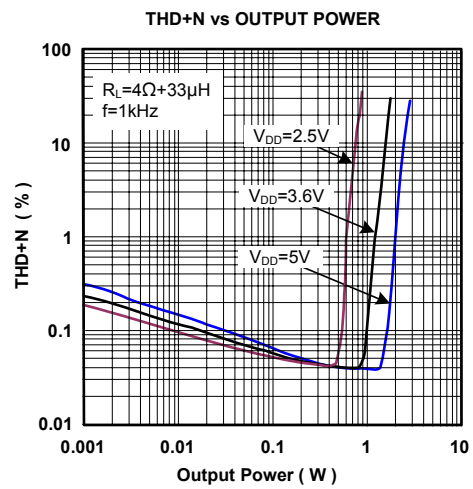
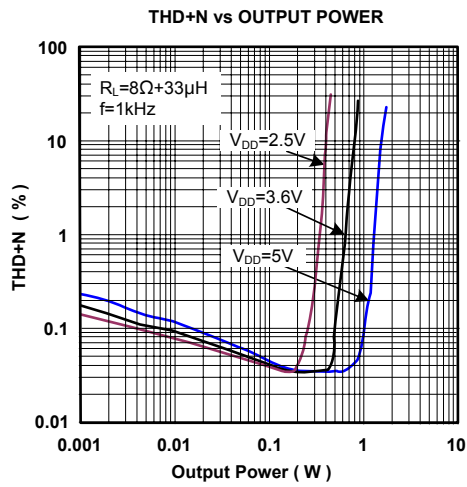


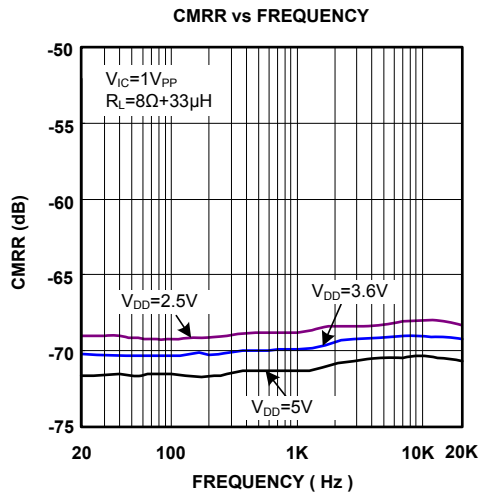
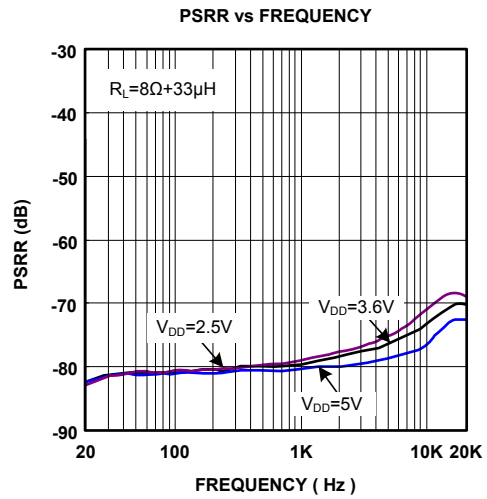
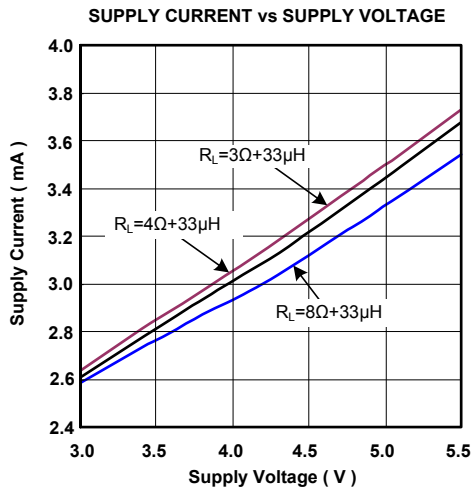
THD+N vs FREQUENCY



THD+N vs FREQUENCY







Block Diagram

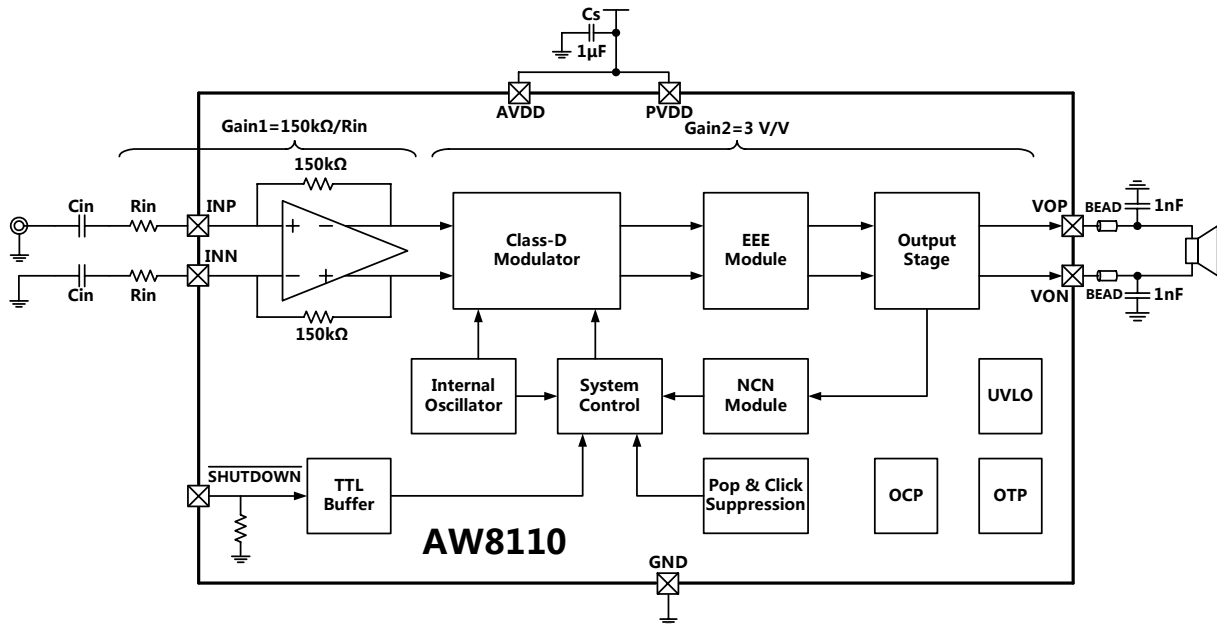


Figure 4 Functional Block Diagram of AW8110

Operation

The AW8110 is a non-crack-noise (NCN), ultra-low-EMI, filter-free, 3W, mono, Class-D audio amplifier. It is capable of delivering 3 W of continuous output power with efficiency of 90% driving a 3Ω load from a 5.0 V supply. Unique NCN function, which adjusts the system gain automatically while detecting the “Crack” distortion of output signal, protects the speaker from damage at high power levels and brings the most comfortable listening experience to the customers.

The AW8110 features the EEE (Enhanced Emission Elimination) function which greatly reduces EMI over the full bandwidth. The AW8110 achieves better than 20dB margin under FCC limits with 24 inch of cable.

The filter-free PWM architecture and internal gain setting reduces external components count, board area consumption, system cost and simplifies the design. The over-current, over-temperature and undervoltage protection is prepared inside of the

device, which prevent the device from damage during fault conditions. When the fault condition is removed, the AW8110 reactivate itself again.

Filter-Free Modulation Scheme

The AW8110 features a filter-free PWM architecture that reduces the LC filter of the traditional Class-D amplifier, increasing efficiency, reducing board area consumption and system cost.

Pop-Click Suppression

The AW8110 features unique timing control circuit, that comprehensively suppresses pop-click noise, eliminates audible transients on shutdown, wake-up, and power-up/down

EEE Technology

The AW8110 features a unique Enhanced Emission Elimination (EEE) technology, that controls fast transition on the output, greatly reduces EMI over the full bandwidth. The AW8110 achieves better than 20dB margin under FCC limits with 24 inch of cable, as shown in Figure 5.

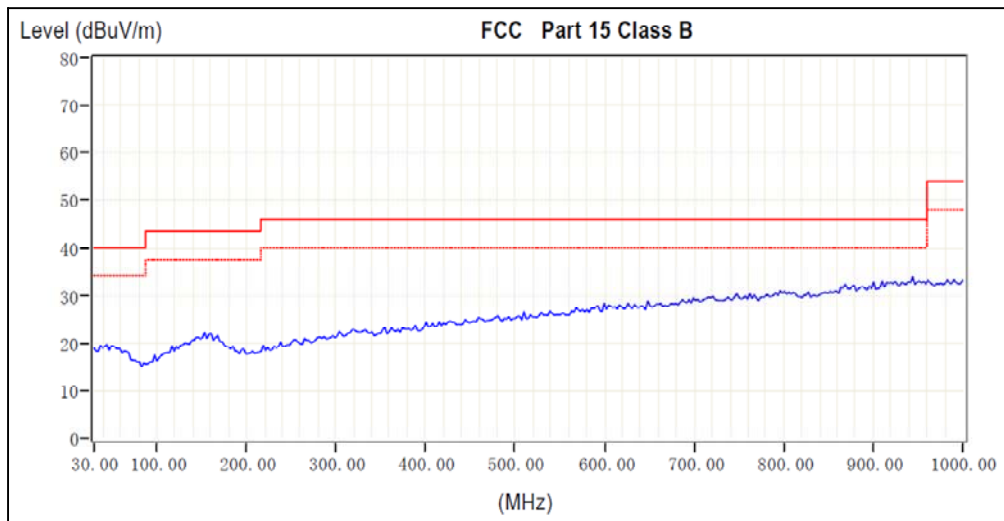


Figure 5 EMI Test Spectrum Diagram

NCN Function

In audio application, output signal will be undesirable distortion caused by too large input and power supply voltage down with battery, and clipped output signal may cause permanent damage to the speaker. The AW8110 features unique Non-Crack-Noise (NCN) Function, which adjusts system gain automatically to generate desired output by detecting the “Crack” distortion of output signal, protects the speaker from damage at high power levels and brings the most comfortable listening experience to the customers.

Attack Time is the time it takes to reduce the gain after the output has clipped.

Release Time is the time it takes for the gain to return to its normal level after clipped.

Table 1 NCN Parameter

Attack Time	Release Time
45ms	2.6s

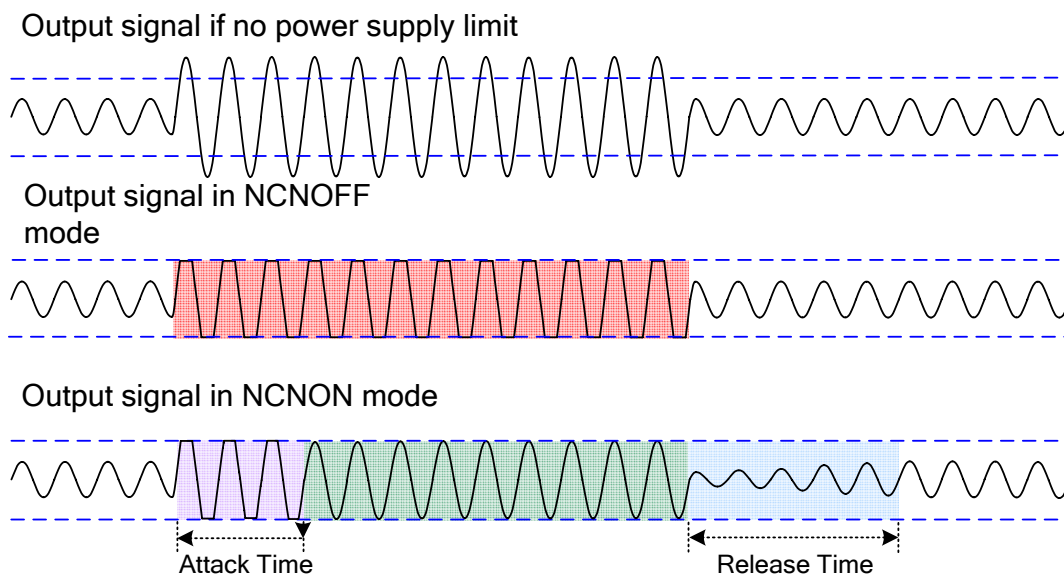


Figure 6 NCN Function Diagram

Efficiency

Efficiency of a Class D amplifier is attributed to the switching operation of the output stage transistors. In a Class D amplifier, the output transistors act as current steering switches and consume negligible additional power. Any power loss associated with the Class D output stage is mostly due to the I^2R loss of the MOSFET on-resistance and supply current. The AW8110 features efficiency of 90%.

Protection Function

When a short-circuit occurs between VOP/VON pin and VDD/GND or VOP and VON, the over-current circuit shutdown the device, preventing the device from being damaged. When the condition is removed, the AW8110 reactivate itself. When the junction temperature is high, the over-temperature circuit shutdown the device. The circuit switches back to normal operation when the temperature decreases to safe levels. The UVLO circuit will shutdown the device when power supply is low. AW8110 wake-up again when power supply becomes high.

Applications Information

Supply Decoupling Capacitor

The AW8110 is a high-performance class-D audio amplifier that requires adequate power supply decoupling to ensure the efficiency is high and Total Harmonic Distortion (THD) is low. For higher frequency transients, a good low Equivalent-Series-Resistance (ESR) ceramic capacitor, typically 1μF, placed as close as possible to the device VDD pin works best. For filtering lower-frequency noise signals, a 10 μF or greater capacitor placed near the audio power amplifier would also help.

Input Resistors

The input resistors set the gain of the amplifier according to equation as follow.

$$\text{Gain} = \frac{3 \times 150 \text{ k}\Omega}{R_{in}} \left(\frac{V}{V} \right)$$

The resistor matching is very important. CMRR, PSRR and THD diminish if resistor mismatch occurs. Therefore, it is recommended use 1% tolerance resistors or better to keep the performance optimized. Place the input resistors very close to the AW8110 to limit noise injection on the high-impedance nodes.

Input Capacitor

The input coupling capacitor blocks the DC vol-

tage at the amplifier input terminal. The input capacitors and input resistors form a high-pass filter with the corner frequency, f_c .

$$f_c = \frac{1}{2\pi R_{in} C_{in}}$$

Setting the high-pass filter point high can block the 217Hz GSM noise coupled to inputs. Better matching of the input capacitors improves performance of the circuit and also help to suppress pop-click noise.

Ferrite Chip Bead and Capacitor

The AW8110 passed FCC and CE radiated emissions with no ferrite chip beads and capacitors with speaker trace wires 24 inch. Use ferrite chip beads and capacitors if device near the EMI sensitive circuits and/or there are long leads from amplifier to speaker, placed as close as possible to the output pin.

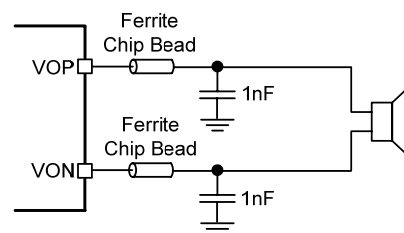
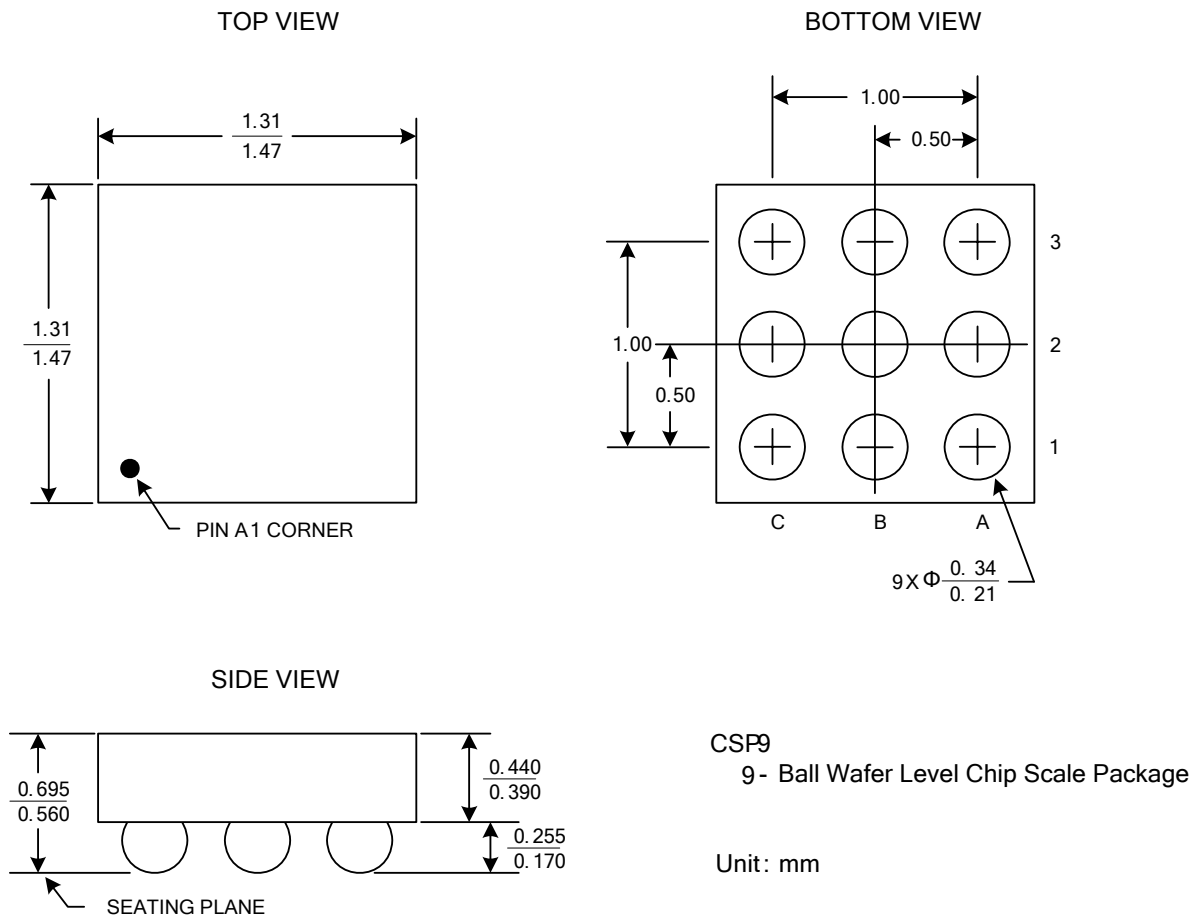


Figure 7 Ferrite Chip Bead and capacitor

Package Description



AWINIC Technology cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in an AWINIC Technologies product. No intellectual property or circuit patent licenses are implied. AWINIC Technology reserves the right to change the circuitry and specifications without notice at any time.

单击下面可查看定价，库存，交付和生命周期等信息

[>>AWINIC\(艾为\)](#)