

**Stereo Digital Audio Amplifier with Headphone Driver**

**Features**

- 16/18/20/24-bit input with I<sup>2</sup>S data format
- PSNR & DR (A-weighting)  
Loudspeaker: 98dB (PSNR), 102dB (DR)  
Headphone: 87dB (PSNR), 96dB (DR)
- Multiple sampling frequencies (Fs)  
8kHz, 12kHz, 16kHz, 22.05kHz, 24kHz  
32kHz, 44.1kHz, 48kHz,  
64kHz, 88.2kHz and 96kHz
- System clock = 256Fs
- 8Fs switching for loudspeakers and headphones
- Single or dual supply  
Single supply: 3.0~3.3V for the whole chip  
Dual supply: 3.0~5V for loudspeaker drivers  
3.0~3.3V for others
- Loudspeaker power  
2.3W into 4Ω load @ 0dB 1kHz sinewave input  
1.3W into 8Ω load @ 0dB 1kHz sinewave input
- Loudspeaker power efficiency (η)  
86% for 4Ω @ 0dB 1kHz sinewave input  
91% for 8Ω @ 0dB 1kHz sinewave input
- Headphone power  
35mW into 32Ω @ 1kHz and 1% THD+N  
65mW into 16Ω @ 1kHz and 1% THD+N  
113mW into 8Ω @ 1kHz and 1% THD+N
- Volume control  
53steps: 0~-40dB(1dB/step) -42~-64dB(2dB/step)
- Mute function
- Power down function
- Anti-pop design
- Over-temperature protection
- Under-voltage shutdown
- Short-circuit detection

- CD and DVD
- TV audio
- Internet audio
- USB speaker
- MP3
- Headphone Amplifier
- PDA
- Portable / Handheld
- Mobile phone
- Car audio

**Description**

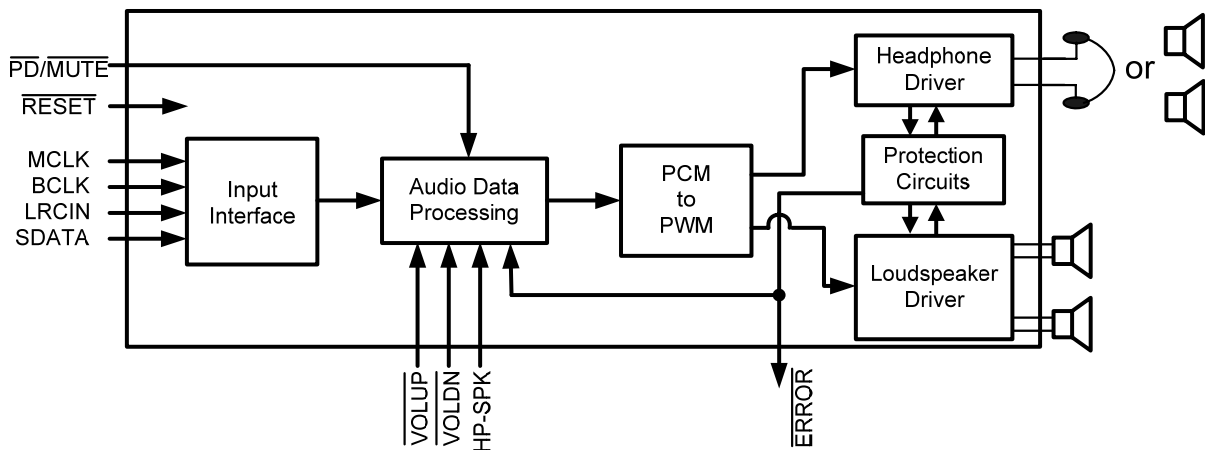
This is a stereo digital audio amplifier with high power efficiency, which leads to longer battery life, less heat sink requirement, smaller board size and lower system cost. AD82551A can detect headphone connection and choose to drive either stereo loudspeakers or stereo headphones. Operating with 3.0/3.3/5V loudspeaker driver supply, each loudspeaker channel can typically deliver 0.8/1.0/2.3W to a 4Ω loudspeaker, respectively, with less than 1% THD+N. Operating with 3.0/3.3V headphone driver supply, each headphone channel can typically deliver 29/35mW to 32Ω, 54/65mW to 16Ω and 94/113mW to 8Ω, respectively, with less than 1% THD+N.

**ORDERING INFORMATION**

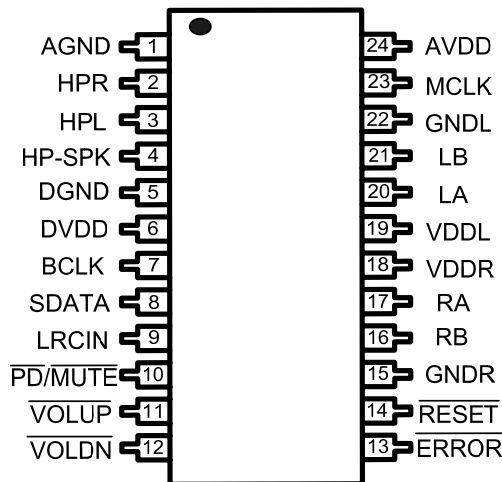
Product Number	Package	Comments
AD82551A-CG	24L SSOP 209mil	Pb-free

**Applications**

**Functional Block Diagram**



**Pin Assignment**



**Pin Description**

Pin	Name	Type	Description	Characteristics
1	AGND	P	Analog ground	
2	HPR	O	Headphone right channel output	
3	HPL	O	Headphone left channel output	
4	HP-SPK	I	Headphone/loudspeaker switch	Schmitt trigger input with a 380kΩ pull-up resistor (Note 1)
5	DGND	P	Digital ground	
6	DVDD	P	Digital supply	
7	BCLK	I	Bit clock (64Fs) input	Schmitt trigger TTL input buffer
8	SDATA	I	Serial audio data input	Schmitt trigger TTL input buffer
9	LRCIN	I	Left/right sampling clock (Fs) input	Schmitt trigger TTL input buffer
10	$\overline{\text{PD/MUTE}}$	I	Power-down and mute, low active	Schmitt trigger TTL input buffer
11	$\overline{\text{VOLUP}}$	I	Volume up, low active	Schmitt trigger TTL input buffer (Note1)
12	$\overline{\text{VOLDN}}$	I	Volume down, low active	Schmitt trigger TTL input buffer (Note1)
13	$\overline{\text{ERROR}}$	O	Error output	Open-drain output
14	$\overline{\text{RESET}}$	I	Reset, low active	Schmitt trigger TTL input buffer
15	GNDR	P	Ground for loudspeaker right channel	
16	RB	O	Loudspeaker right channel output (-)	
17	RA	O	Loudspeaker right channel output (+)	
18	VDDR	P	Supply for loudspeaker right channel	
19	VDDL	P	Supply for loudspeaker left channel	
20	LA	O	Loudspeaker left channel output (+)	
21	LB	O	Loudspeaker left channel output (-)	
22	GNDL	P	Ground for loudspeaker left channel	
23	MCLK	I	Master clock (256Fs) input	Schmitt trigger TTL input buffer
24	AVDD	P	Analog supply	

Note1: May become bi-directional with less than 30μA output current when “ $\overline{\text{RESET}}$ ” pin is low.

**Absolute Maximum Ratings**

Symbol	Parameter	Min	Max	Units
DVDD	Supply for Digital Circuit	0	3.6	V
AVDD	Supply for Analog Circuit	0	3.6	V
VDDL(R)	Supply for Left (Right) Channel	0	5.5	V
V <sub>i</sub>	Input Voltage	-0.3	3.6	V
T <sub>stg</sub>	Storage Temperature	-65	150	°C
T <sub>a</sub>	Ambient Operating Temperature	0	70	°C
	Voltage Difference between V <sub>DDL</sub> and V <sub>DDR</sub>	-1	1	V
	Voltage Difference between V <sub>DDL</sub> (V <sub>DDR</sub> ) and V <sub>DDL</sub> (V <sub>DDR</sub> ) Power-on Voltage Ramp	-3	3	V
			0.2	V/μs

**Recommended Operating Conditions**

Symbol	Parameter	Typ	Units
DVDD	Supply for Digital Circuit	3.0~3.3	V
AVDD	Supply for Analog Circuit	3.0~3.3	V
VDDL(R)	Supply for Driver Stage	3.0~5.0	V
T <sub>a</sub>	Ambient Operating Temperature	0~70	°C

**Digital Characteristics**

Symbol	Parameter	Min	Typ	Max	Units
V <sub>IH</sub>	High-Level Input Voltage	2.0			V
V <sub>IL</sub>	Low-Level Input Voltage			0.8	V
V <sub>OH</sub>	High-Level Output Voltage	2.4			V
V <sub>OL</sub>	Low-Level Output Voltage			0.4	V
C <sub>i</sub>	Input Capacitance		6.4		pF

**General Electrical Characteristics**

Symbol	Parameter	Condition	Min	Typ	Max	Units
I <sub>PD</sub>	Supply Current during Power Down			36		μA
	Junction Temperature for Driver Shutdown			150		°C
	Temperature Hysteresis for Recovery from Shutdown			20		°C
UV <sub>H</sub>	Under Voltage Disabled (For AVDD)			2.8		V
UV <sub>L</sub>	Under Voltage Enabled (For AVDD)			2.7		V
F <sub>sw</sub>	Switching Rate of Loudspeakers and Headphones		8Fs	8Fs	8Fs	Hz
T <sub>PWM</sub>	Minimum PWM pulse width		$\frac{1}{256Fs}$	$\frac{1}{256Fs}$	$\frac{1}{256Fs}$	Sec
R <sub>SC</sub>	Loudspeaker Short-Circuit Detection (Note2)	VDDR(L)=5V		2.8	3.2	Ω
R <sub>SCH</sub>	Headphone Output Short-Circuit Detection	Steady State		3.0	3.4	Ω

Note2: Loudspeaker short-circuit protection is effective only when LC or ferrite bead filters are properly used. Long time short circuit will reduce device reliability. AD82551A protects itself from short-circuit damage only when the lines connected to loudspeakers are shorted to each other or to GND. AD82551A will be burnt if the lines connected to loudspeakers are shorted to VDDL(VDDR).

**Package Options**

Package Type	Part Number	Thermal Information
24L SSOP 209mil	AD82551A-CG	$\theta_{JA} = 64.7 \text{ } ^\circ\text{C/W}$ (Condition: still air, multilayer board)