Stereo Digital Audio Amplifier with Headphone Driver

Features

- 16/18/20/24-bit input with I^2S 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

Applications

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

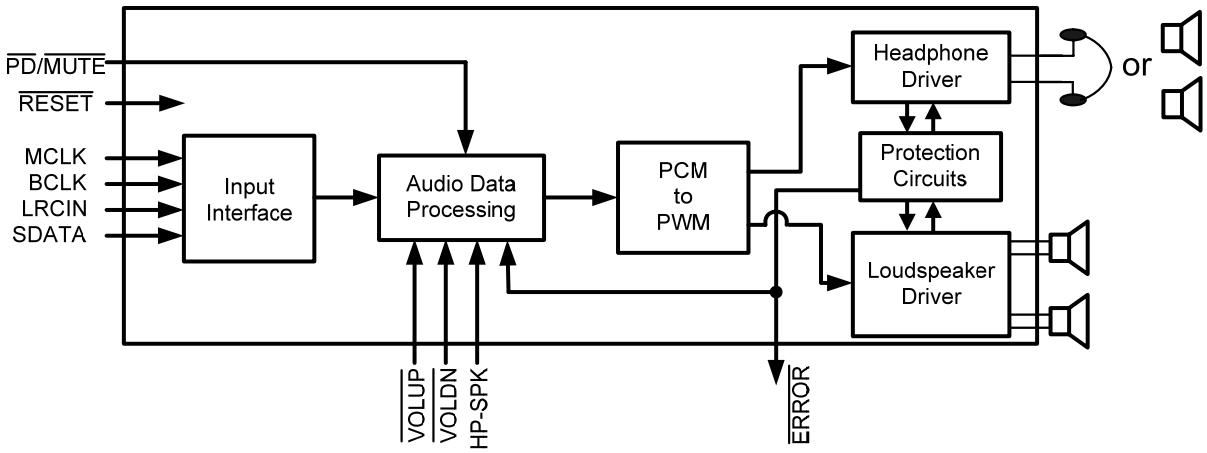
Description

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.

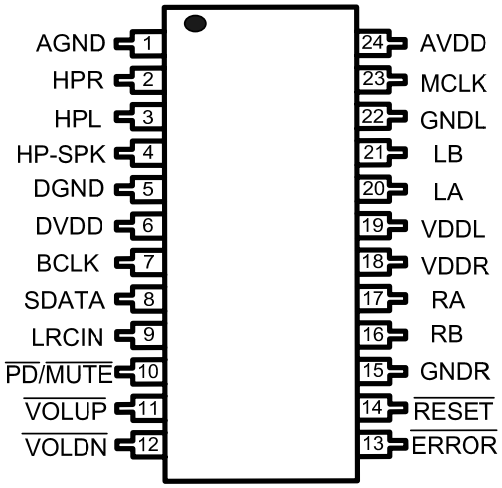
ORDERING INFORMATION

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

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	$\overline{PD}/\overline{MUTE}$	I	Power-down and mute, low active	Schmitt trigger TTL input buffer
11	$\overline{VOLUP}$	I	Volume up, low active	Schmitt trigger TTL input buffer (Note1)
12	$\overline{VOLDN}$	I	Volume down, low active	Schmitt trigger TTL input buffer (Note1)
13	$\overline{ERROR}$	O	Error output	Open-drain output
14	$\overline{RESET}$	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 "$\overline{RESET}$" 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_i	Input Voltage	-0.3	3.6	V
T_{stg}	Storage Temperature	-65	150	°C
T_a	Ambient Operating Temperature	0	70	°C
	Voltage Difference between V_{DDL} and V_{DDR}	-1	1	V
	Voltage Difference between V_{DDL}(V_{DDR}) and	-3	3	V
	V_{DDL}(V_{DDR}) Power-on Voltage Ramp		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_a	Ambient Operating Temperature	0~70	°C

Digital Characteristics

Symbol	Parameter	Min	Typ	Max	Units
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
V_{OH}	High-Level Output Voltage	2.4			V
V_{OL}	Low-Level Output Voltage			0.4	V
C_I	Input Capacitance		6.4		pF

General Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Units
I_{PD}	Supply Current during Power Down			36		μA
	Junction Temperature for Driver Shutdown			150		°C
	Temperature Hysteresis for Recovery from Shutdown			20		°C
UV_H	Under Voltage Disabled (For AVDD)			2.8		V
UV_L	Under Voltage Enabled (For AVDD)			2.7		V
Fsw	Switching Rate of Loudspeakers and Headphones		8Fs	8Fs	8Fs	Hz
T_{PWM}	Minimum PWM pulse width		$\frac{1}{256Fs}$	$\frac{1}{256Fs}$	$\frac{1}{256Fs}$	Sec
R_{SC}	Loudspeaker Short-Circuit Detection (Note2)	VDDR(L)=5V		2.8	3.2	Ω
R_{SCH}	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	θ_{JA} = 64.7 °C/W (Condition: still air, multilayer board)