2.5W/CH Stereo Filter-less Class-D Audio Amplifier with Headphone Driver

Features

- Supply voltage range: 2.5 V to 5.5 V
- Support single-ended or differential analog input
- Low static operation current
- Low shut-down current
- Short power-on transient time
- Two volume control modes
  - DC volume control from -38dB to +20dB
  - 4-step volume gain of +6, +12, +18, +24dB
- Independent power-down control for left or right channel
- Overload and thermal protection
- Loudspeaker power within 10% THD+N
  - 1.5W/ch into 8Ω loudspeaker
  - 2.5W/ch into 4Ω loudspeaker
- Loudspeaker efficiency
  - 89% @ 8Ω, $P_{o,10\% THD+N}$
  - 84% @ 4Ω, $P_{o,10\% THD+N}$
- Headphone power within 1% THD+N
  - 120mW/ch into 16Ω headphone

Applications

- Monitor audio
- PDA
- Portable multimedia devices
- Notebook computer
- Mobile phone

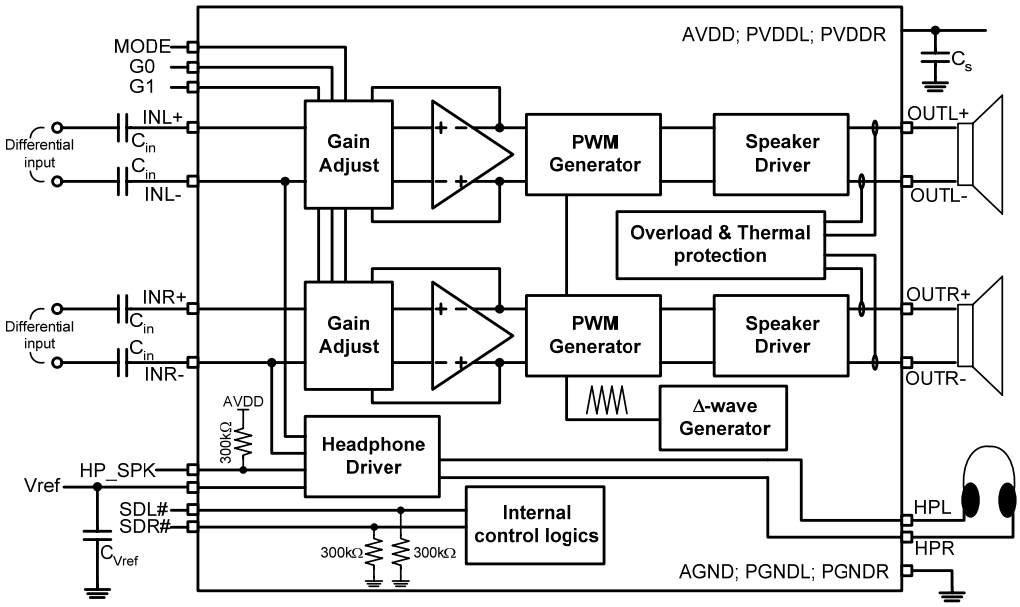
Description

The AD52651A is a stereo, filter-less class-D audio amplifier with headphone driver. Operating with 5.0V loudspeaker driver supply, it can deliver 2.5W/CH output power into 4 Ω loudspeaker within 10% THD+N and 120mW/CH output power into 16Ω headphone within 1% THD+N.

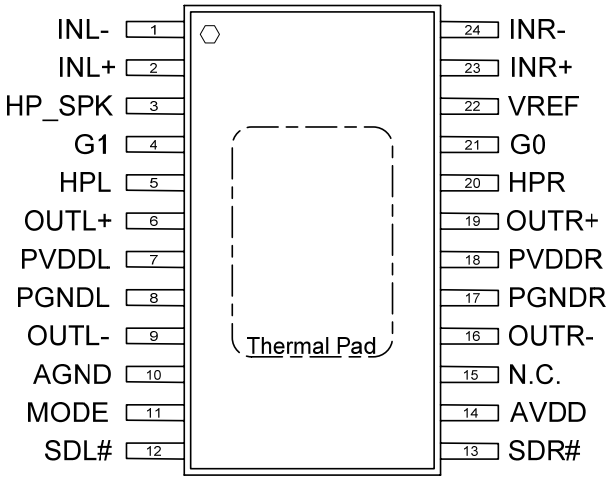
The AD52651A has two volume control modes by setting MODE pin. While MODE pin is set logic high, AD52651A is in DC volume control mode with 31-step volume gain from -38 dB to +20dB, adjusted by the DC voltage applied on G0 pin. Otherwise, AD52651A is the 4-step volume gain mode with +6dB, +12dB, +18dB, and +24dB gain, selected by setting G0 and G1 pins. The two volume adjustment modes are designed to fit the different volume control requirements in various applications. Beside stereo class-D amplifier, AD52651 has built-in an inverted stereo class-AB headphone driver. With the independent power-down control for left or right channel, the AD52651 is more convenient to control the left and right channels.

The AD52651A packaged as E-TSSOP 24L is a stereo audio amplifier with high efficiency, which leads to longer battery left, less heat sink requirement, smaller board size and lower system cost, and suitable for the notebook computer, and portable multimedia devices.

Functional Block Diagram



Pin Assignments



Pin Description

NAME		TYP	DESCRIPTION	CHARACTERISTIC
1	INL-	I	Left channel Input (-)	
2	INL+	I	Left channel Input (+)	
3	HP_SPK	I	0: SPK mode; 1: HP mode	with 300 kΩ pull-high resistor
4	G1	I	Gain selection	with 300 kΩ pull-low resistor
5	HPL	O	Left channel headphone driver	
6	OUTL+	O	Left channel output (+)	
7	PVDDL	P	High current power supply	
8	PGNDL	G	High current ground	
9	OUTL-	O	Left channel output (-)	
10	AGND	G	Ground	
11	MODE	I	4-gain/DC Vol. control	with 300 kΩ pull-low resistor
12	SDL#	I	Shut-down left channel	with 300 kΩ pull-low resistor
13	SDR#	I	Shut-down right channel	with 300 kΩ pull-low resistor
14	AVDD	P	Power supply	
15	N.C.	x	N.C.	
16	OUTR-	O	Right channel output (-)	
17	PGNDR	G	High current ground	
18	PVDDR	P	High current power supply	
19	OUTR+	O	Right channel output (+)	
20	HPR	O	Right channel headphone driver	
21	G0	I	Gain selection/DC vol. level	
22	VREF	O	Reference voltage	
23	INR+	I	Right channel Input (+)	
24	INR-	I	Right channel Input (-)	
Thermal Pad		G	Must be soldered to PCB's ground plane	

Available Package

Package Type	Device no.	θ_{JA} (°C/W)	Exposed Thermal Pad
E-TSSOP 24L	AD52651A	43.8	Yes ***(Note1)***

Note1: The thermal pad is at the bottom of package. To optimize the performance of thermal dissipation, solder the thermal pad to PCB's ground plane is suggested.

Absolute Maximum Ratings

SYMBOL	PARAMETER	MIN	MAX	UNIT
AVDD	Power supply for lower power analog cells	2.5	5.5	V
PVDDL(R)	Power supply for loudspeaker driver	2.5	5.5	V
	Input voltage	-0.3	AVDD	V
T_{stg}	Storage temperature	-65	150	°C
T_a	Ambient operating temperature	0	70	°C

Recommended Operating Conditions

SYMBOL	PARAMETER	TYP	UNIT
AVDD	Power supply for lower power analog cells	2.5~5.0	V
PVDDL(R)	Power supply for Driver Stage	2.5~5.0	V
V_{IH}	High-Level Input Voltage	2.0	V
V_{IL}	Low-Level Input Voltage	0.8	V
T_a	Ambient Operating Temperature	0~70	°C

General Electrical Characteristics

SYMBOL	PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
I_{PD_SKP}	Supply current during power-down mode @ Speaker mode	AVDD=PVDDR(L)=5.0V; HP_SPK=0V; SDL#=SDR#=0V		20	50	μA
I_{PD_HP}	Supply current during power-down mode @ Headphone mode	AVDD=PVDDR(L)=5.0V; HP_SPK=5V; SDL#=SDR#=0V		1	10	μA
V_{offset}	Output offset voltage @ Speaker mode	Input ac grounded, VDD=2.5V~5.0V		5	25	mV
	Junction temperature for driver shutdown		145	150	155	°C
	Temperature hysteresis for recovery from shutdown		115	120	125	°C
f_{sw}	Switching rate of loudspeakers driver		300	450	600	kHz
R_{SC}	Loudspeaker short-circuit detect resistance	PVDDR(L) = 5 V		2.8	3.2	Ω