AD248B Datasheet

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Version 1.1

Date 2025.03.05

Revision History

Date	Revision	Description
2025.01.03	V1.0	Initial Release.
2025.03.05	V1.1	1.Update Features modification. 2.Modify the parameters of Audio DAC and Audio ADC

Table of Contents

AD248B Features

SYSTEM

- 32bit Dual-Issue DSP 240MHz
- I-cache
- Support SDTAP/EMU
- On-chip SRAM 52kbyte(share cache ram 20k)
- NOR Flash controller
- Internal RC oscillator,PLL

Audio

- 1 x 16bit DAC
  - SNR 96dB
  - Noise 11uVrms
  - Sampling rate 8~96kHz
- 1 x 16bit ADC
  - SNR 96dB
  - Sampling rate 8~48kHz
  - Support Speaker for microphone

Peripherals

- 1 x Full speed USB
- 1 x SD host controller
- 3 x Multi-function 16bit timer
- 2 x UART interface
- 1 x I^2C Master/Slave interface
- 1 x SPI Master/Slave interface
- 4 x MCPWM
- 1 x GPCRC
- 1 x 10bit GPADC(4 Channels)
- 5 x GPIO Support function remapping

PMU

- Soft off current: <3uA
- Music mode: <6mA@HSB 96M
- LVD range(3bit):1.7V~2.4V, step100mV
- VPWR range 1.8V to 5.5V
- IOVDD range 2.1V to 3.6V

Packages

- SOP8

Temperature

- Operating temperature
  TC = -20℃ to +85℃(standard range)
  TC = -40℃ to +105℃(extended range)
- Storage temperature -65℃ to +150℃

Applications

- Sound Toy
- Audio player

1 Block Diagram

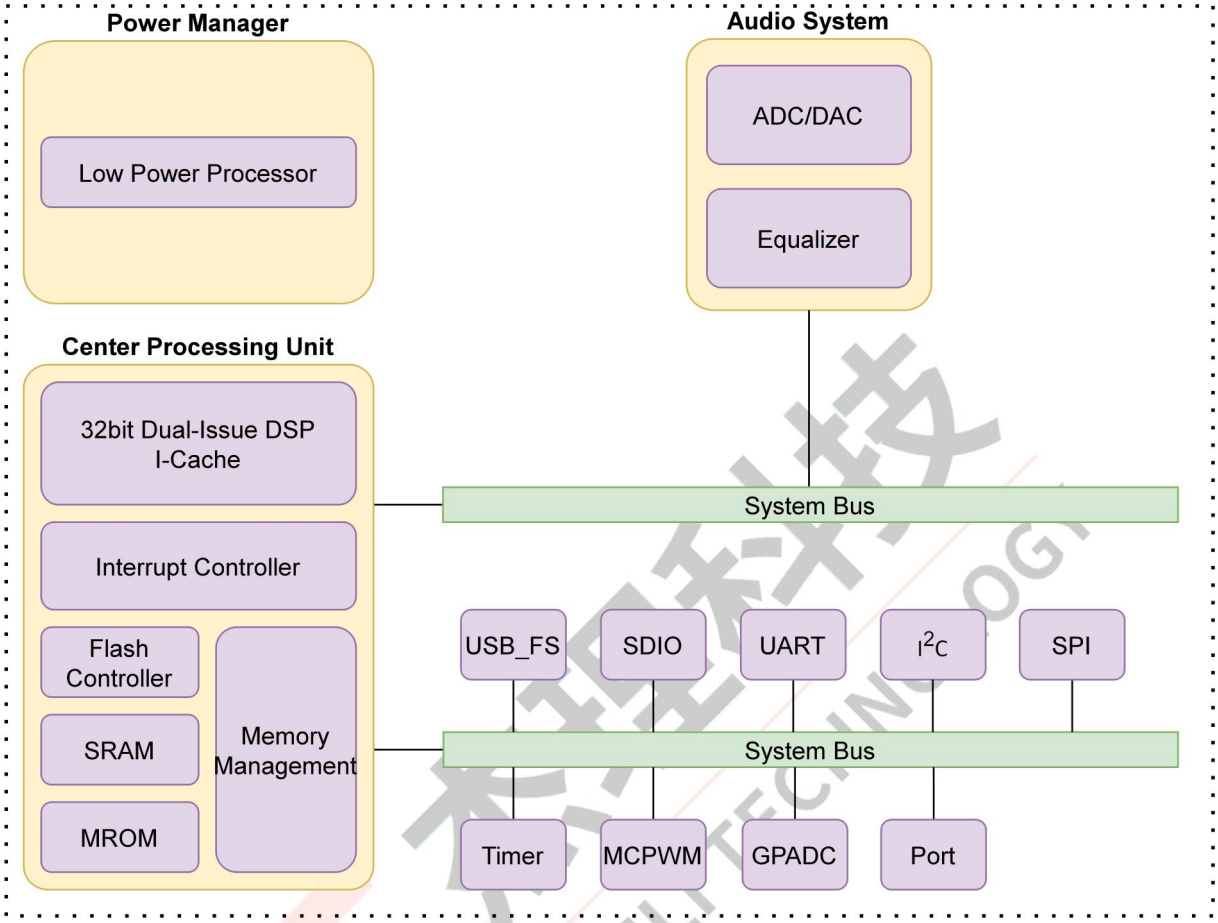


Figure 1-1 AD248B Block Diagram

2 Pin Definition

2.1 Pin Assignment

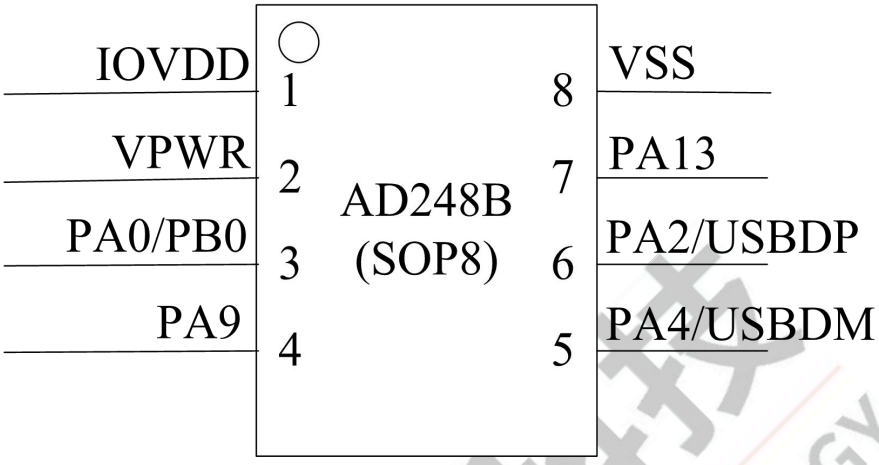


Figure 2-1 AD248B Pin Assignment

2.2 Pin Description

Table 2-2-1 AD248B Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	IOVDD	P	--	IO Power
2	VPWR	P	--	Chip main power supply
3	PB0	I/O	Z	DAC(AUDIO DAC output) ADC15(ADC Input Channel 15) LVD(External Low Voltage Detection Input)
	PA0	I/O	10kΩ Pull-up ***Note1**	ADC0(ADC Input Channel 0) Hold down 0 to reset***Note1**
4	PA9	I/O(HVT)	10kΩ Pull-down	Firmware Download Interface
5	USBDM	I/O	15kΩ Pull-down	USB Negative Data ADC5(ADC Input Channel 5)
	PA4	I/O	Z	ADC6(ADC Input Channel 6)
6	USBDP	I/O	15kΩ Pull-down	USB Positive Data ADC4(ADC Input Channel 4)
	PA2	I/O	Z	ADC2(ADC Input Channel 2)
7	PA13	I/O	Z	AIN_A0(Audio ADC Positive Input) MICBIAS(MIC Bias Output) ADC12(ADC Input Channel 12)
8	VSS	G	--	Ground

Note

1.10kΩ Pull-up and Hold down 0 to reset function can be disable by efuse in IO Initial State.

2.IO initial state abbreviations Z--High resistance, H--High level, L--Low level, X--May be changed during power on.

3.Timer, MCPWM, UART, I^2C, SPI1/2 and SDIO functions can be remapped to any I/O.

Table 2-2-2 Pin Types Description

Pin Type	Description	Pin Type	Description
P	Power	I/O	Input or Output
G	Ground	I	Input
		O	Output

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3-1 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
Topt	Operating temperature	-20	+85	℃
Tstg	Storage temperature	-65	+150	℃
VPWR	Supply Voltage	-0.3	6	V
IOVDD		-0.3	3.6	V
GPIO	Input voltage of GPIO (except PA9)	-0.3	3.6	V
HVTIO	Input voltage of HVT-IO (PA9)	-0.3	5.5	V

Note

1.Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device.

3.2 ESD Ratings

Table 3-2 ESD Ratings

Parameter	Typ	Test pin	Reference standard
Human Body Mode	±4kV	All pins	JEDEC EIA/JESD22-A114
Machine Mode	±200V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±2kV	All pins	ANSI/ESDA/JEDEC JS-002-2022

3.3 PMU Characteristics

Table 3-3 PMU Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VPWR	Power supply	--	1.8	5	5.5	V
Operating mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Voltage output	--	--	3	--	V
	Loading current	IOVDD=3.0V@VPWR = 5V	--	--	120	mA
Low Power mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Loading current	IOVDD=3.0V@VPWR = 5V	--	--	10	mA

Note

1. When powered by two dry batteries, the VPWR needs to be merged with IOVDD.

3.4 IO Characteristics

Table 3-5 IO Characteristics

Input Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Min**	**Max**	**Unit**
V_{IL}	Low-Level Input Voltage	IOVDD = 3.0V	PA0,PA2,PA4 PA9,PA13 USBDP USBDM	-0.3	1.3	V
V_{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA0,PA2,PA4,PA13	1.7	3.3	V
		IOVDD = 3.0V	PA9 USBDP USBDM	1.7	5.5	V
Output Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**		**Unit**
$\lvert I_{OL} \rvert$	Output Current	IOVDD = 3.0V Voutput = 0.3V	PA0,PA2,PA4,PA13	3(HD=0) 9(HD=1) 15(HD=2) 28(HD=3)		mA
		IOVDD = 3.0V Voutput = 0.3V	PA9 USBDP USBDM	8		mA
$\lvert I_{OH} \rvert$	Output Current	IOVDD = 3.0V Voutput = 2.7V	PA0,PA2,PA4,PA13	3(HD=0) 9(HD=1) 15(HD=2) 28(HD=3)		mA
		IOVDD = 3.0V Voutput = 2.7V	PA9 USBDP USBDM	8		mA
Internal Resistance Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**		**Unit**
R_{pu}	Pull-up Resistance	IOVDD = 3.0V	PA0,PA2,PA4 PA9,PA13	10k(PU=1) 100k(PU=2) 1M(PU=3)		Ω
			USBDP	1.5k		Ω
			USBDM	180k		Ω
R_{pd}	Pull-down Resistance	IOVDD = 3.0V	PA0,PA2,PA4 PA9,PA13	10k(PD=1) 100k(PD=2) 1M(PD=3)		Ω
			USBDP USBDM	15k		Ω

Note

1.Internal pull-up/pull-down resistance accuracy ±20%

3.5 Audio DAC Characteristics

Table 3-5 Mono DAC Characteristics Under VCM 1.3v

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	--	bit
Input Sample Rate	--	8	--	96	kHz
Output Swing	Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=100kΩ	--	680	--	mVrms
Output Resistance	--	--	5	--	KΩ
SNR	Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=100kΩ	--	93	--	dB
Dynamic Range	Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=100kΩ	--	92	--	dB
THD+N	Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=100kΩ	--	-75	--	dB
Noise Floor	B/W=20Hz~20kHz A-Weighted load=100kΩ	--	15	--	uVrms

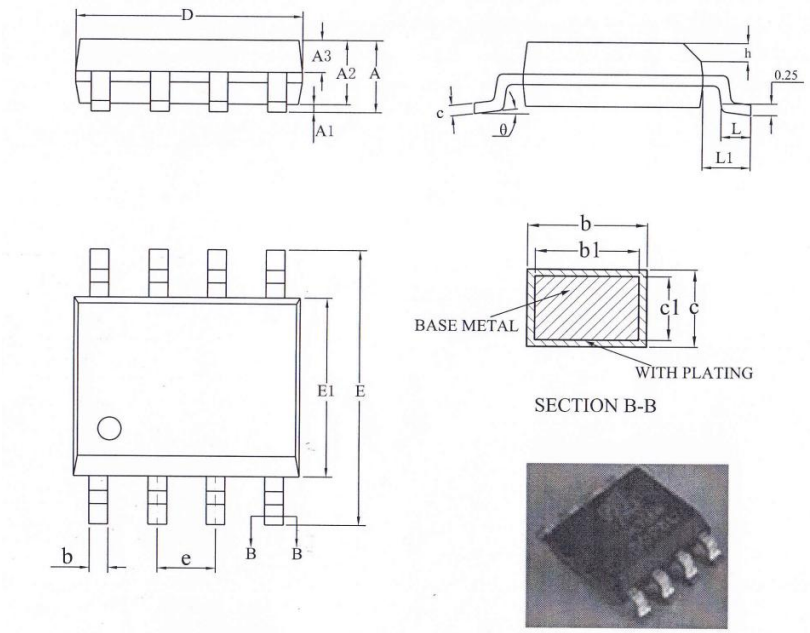
3.6 Audio ADC Characteristics

Table 3-6 Audio ADC Characteristics Under VCM 1.3v

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	--	bit
Output Sample Rate	--	8	--	48	kHz
SNR	Single-ended input Mode Fin=1kHz@800mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	92	--	dB
	Single-ended input Mode Fin=1kHz@40mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=27dB	--	71	--	dB
Dynamic Range	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	92	--	dB
	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=27dB	--	72	--	dB
THD+N	Single-ended input Mode Fin=1kHz@800mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	-78	--	dB
	Single-ended input Mode Fin=1kHz@40mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=27dB	--	-72	--	dB
Analogue Gain	--	-3	--	27	dB
	Single-ended input Mode ADC gain=0dB	--	0.8	--	Vrms

4 Package Information

4.1 SOP8



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
⚠1 b	0.39	—	0.47
⚠1 b1	0.38	0.41	0.44
⚠1 c	0.20	—	0.24
c1	0.19	0.20	0.21
⚠1 D	4.80	4.90	5.00
E	5.80	6.00	6.20
⚠1 E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

Figure 4-1 AD248B Package

5 IC Marking Information

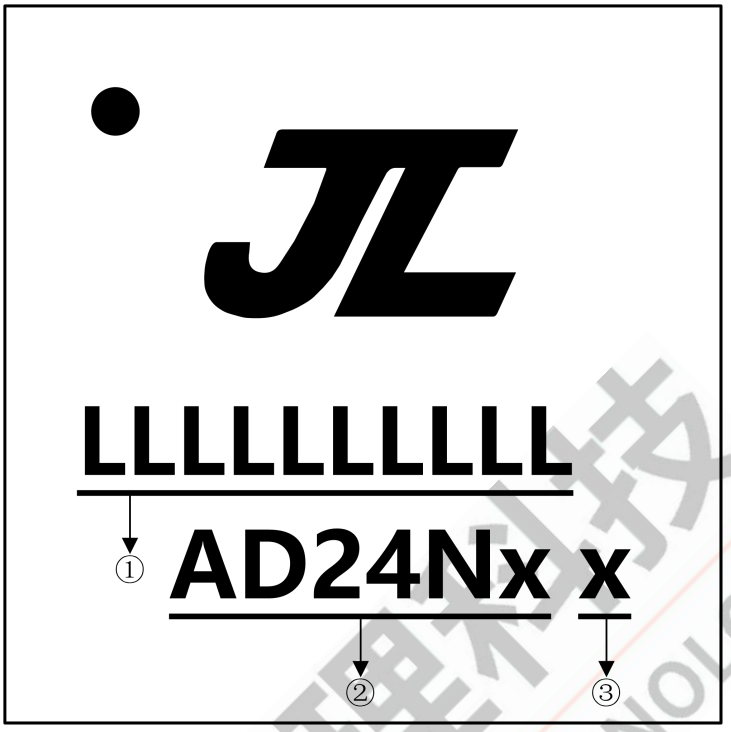


Figure 5-1 AD248B Package Outline

① Production Batch
② AD24Nx Chip Model
③ x: Built-in flash size
0: No Flash Memory
2: 2Mbit Flash
4: 4Mbit Flash
8: 8Mbit Flash
6: 16Mbit Flash
3: 32Mbit Flash
5: 64Mbit Flash
7: 128Mbit Flash

6 Solder-Reflow Condition

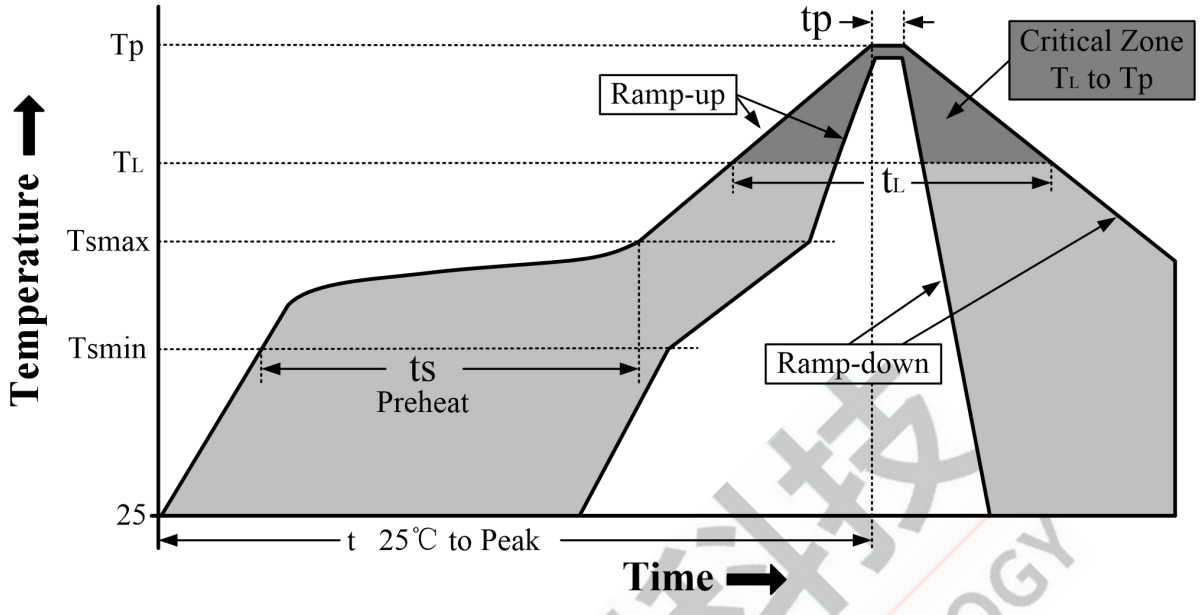


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak	Temperature Min (T_{smin})	100℃	150℃
	Temperature Max (T_{smax})	150℃	200℃
	Time (ts) from (T_{smin} to T_{smax})	60-120 seconds	60-180 seconds
Average ramp-up rate (T_{smax} to T_p)		3℃/second max	3℃/second max
Liquidous temperature (T_L) Time (t_L) maintained above T_L		183℃ 60-150 seconds	217℃ 60-150 seconds
Peak package body temperature (T_p)		See Table 6-2	See Table 6-3
Time within 5℃ of actual Peak Temperature (tp)[2]		10-30 seconds	20-40 seconds
Ramp-down rate (T_p to T_L)		6℃/second max	6℃/second max
Time 25℃ to peak temperature		6 minutes max	8 minutes max

Note

1.All temperatures refer to topside of the package, measured on the package body surface

2.Time within 5℃ of actual peak temperature (tp) specified for the reflow profiles is a "supplier" and "user" maximum.

Table 6-2 SnPb Classification Temperature

Package Thickness	Volume mm^3 < 350	Volume mm^3 ≥ 350
<2.5 mm	240 +0/-5℃	225 +0/-5℃
≥2.5 mm	225 +0/-5℃	225 +0/-5℃

Table 6-3 Pb-free - Classification Temperature

Package Thickness	Volume mm³ < 350	Volume mm³ 350 - 2000	Volume mm³ > 2000
< 1.6mm	260℃	260℃	260℃
1.6 mm - 2.5mm	260℃	250℃	245℃
> 2.5mm	250℃	245℃	245℃

Note

1.*Tolerance The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0℃.For example 260℃+0℃)at the rated MSL level.

7 Storage Condition

7.1 Moisture Sensitivity Level

AD24N is qualified to moisture sensitivity level MSL3 in accordance with JEDEC J-STD-033.

7.2 Storage Alert

1. Calculated shelf life in sealed bag 12 months at＜40°C and 90% relative humidity (RH).
2. Peak package body temperature≤260°C.
3. After bag is opened,devices that will be subjected to reflow solder or other high temperature process must be mounted within 168 hours of factory conditions≤30°C/60%RH or stored per J-STD-033.
4. Devices require bake before mounting if humidity indicator card reads＞10% for level 2a-5a devices or＞60% for level 2 devices when read at 23±5°C,or 3a or 3b are not met.
5. Please refer to IPC/JEDEC J-STD-033 for baking procedure if necessary.