# AD245A Datasheet

## Zhuhai Jieli Technology Co.,LTD

**Version 1.0**

**Date 2025.03.05**

# Revision History

| Date | Revision | Description |
|---|---|---|
| 2025.03.05 | V1.0 | Initial Release. |
| | | |
| | | |

# Table of Contents

# AD245A 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 Class-D Speaker Driver
  - SNR 95dB
  - Sampling rate 8~96kHz
  - Drive speaker directly 500mW@4Ω
- 1 x 16bit ADC
  - SNR 96dB
  - Sampling rate 8~48kHz
  - Support Speaker for microphone
- $I^2S$ AUDIO Master/Slave interface

## 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
- 3 x SPI Master/Slave interface
- 4 x MCPWM
- 1 x GPCRC
- 1 x 10bit GPADC(16 Channels)
- 16 x GPIO Support function remapping

## PMU

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

## Packages

- QSOP24

## 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

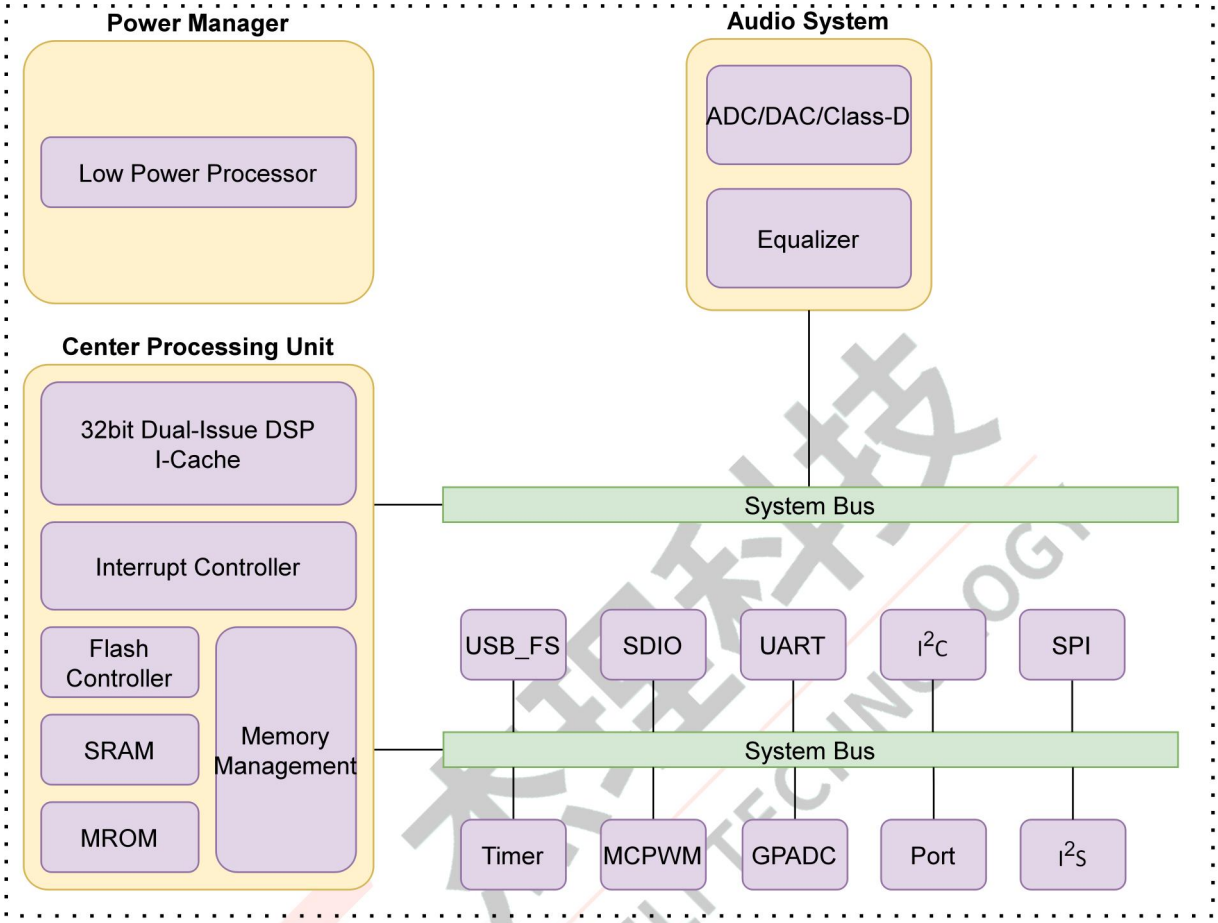



**Figure 1-1 AD245A Block Diagram**

# 2 Pin Definition

## 2.1 Pin Assignment

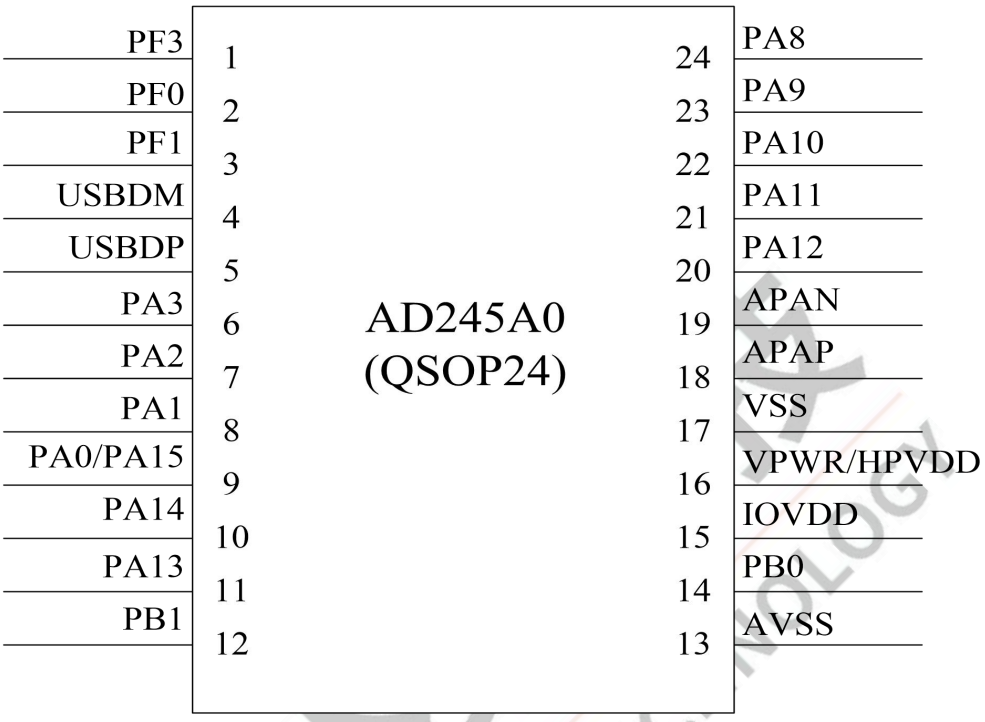



**Figure 2-1 AD245A0 Pin Assignment**

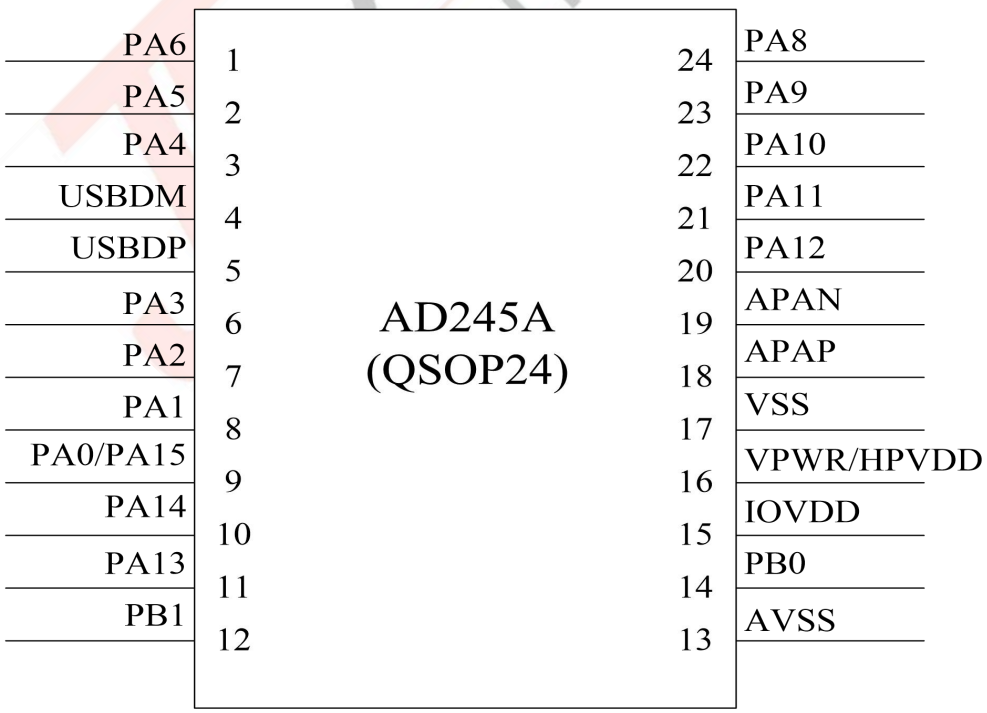



**Figure 2-1 AD245A2/4 Pin Assignment**

## 2.2 Pin Description

**Table 2-2-1 AD245A Pin Description**

| Pin No. | Name | | Type | IO Initial State | Description |
|---|---|---|---|---|---|
| 1 | A0 | PF3<br>***Note2** | NIO | -- | NOR Flash CSA<br>NOR Flash D0B |
| | A2/4 | PA6 | I/O | Z | ADC8(ADC Input Channel 8) |
| 2 | A0 | PF0<br>***Note2** | NIO | -- | NOR Flash D0A<br>NOR Flash CSB |
| | A2/4 | PA5 | I/O | Z | ADC7(ADC Input Channel 7)<br>SPI0_DATA3(C) |
| 3 | A0 | PF1<br>***Note2** | NIO | -- | NOR Flash CLKA<br>NOR FlashD1B |
| | A2/4 | PA4 | I/O | Z | ADC6(ADC Input Channel 6)<br>SPI0_DATA2(C) |
| 4 | USBDM | | I/O | 15kΩ Pull-down | USB Negative Data<br>ADC5(ADC Input Channel 5) |
| 5 | USBDP | | I/O | 15kΩ Pull-down | USB Positive Data<br>ADC4(ADC Input Channel 4) |
| 6 | PA3 | | I/O | Z | ADC3(ADC Input Channel 3)<br>SPI0_DATA1(C) |
| 7 | PA2 | | I/O | Z | ADC2(ADC Input Channel 2)<br>SPI0_DATA0(C) |
| 8 | PA1 | | I/O | Z | ADC1(ADC Input Channel 1)<br>SPI0_CLK(C) |
| 9 | PA0 | | I/O | 10kΩ Pull-up<br>***Note1** | ADC0(ADC Input Channel 0)<br>Hold down 0 to reset***Note1** |
| | PA15 | | I/O | Z | AIN_AN(Audio ADC negative Input)<br>ADC14(ADC Input Channel 14) |
| 10 | PA14 | | I/O | Z | AIN_A2(Audio ADC Positive Input)<br>ADC13(ADC Input Channel 13) |
| 11 | PA13 | | I/O | Z | AIN_A0(Audio ADC Positive Input)<br>MICBIAS(MIC Bias Output)<br>ADC12(ADC Input Channel 12) |
| 12 | PB1 | | I/O | Z | AIN_A1(Audio ADC Positive Input) |
| 13 | AVSS | | G | -- | Audio Ground |
| 14 | PB0 | | I/O | Z | DAC(AUDIO DAC output)<br>ADC15(ADC Input Channel 15)<br>LVD(External Low Voltage Detection Input) |
| 15 | IOVDD | | P | -- | IO Power |
| 16 | VPWR | | P | -- | Chip main power supply |
| | HPVDD | | P | -- | Audio Power |

| Pin No. | Name | Type | IO Initial State | Description |
|---|---|---|---|---|
| 17 | VSS | G | -- | Ground |
| 18 | APAP | O | -- | Class-D Speaker Driver Positive Output |
| 19 | APAN | O | -- | Class-D Speaker Driver Negative Output |
| 20 | PA12 | I/O | Z | ADC11(ADC Input Channel 11)<br>$I^2S$_LRCK |
| 21 | PA11 | I/O | Z | ADC10(ADC Input Channel 10)<br>$I^2S$_SCLK |
| 22 | PA10 | I/O | Z | ADC9(ADC Input Channel 9)<br>$I^2S$_DATA1 |
| 23 | PA9 | I/O(HVT) | 10kΩ Pull-down | I2S_DATA0<br>Firmware Download Interface |
| 24 | PA8 | I/O(HVT) | 10kΩ Pull-up<br>***Note1** | $I^2S$_MCLK<br>MCLR(Device Reset)***Note1** |

**Note**

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

**2.The GPIO is uncontrollable during the initial process.**

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

**4.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 |
| NIO | NOR Flash IO | 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 |
| HPVDD | | -0.3 | 6 | V |
| IOVDD | | -0.3 | 3.6 | V |
| GPIO | Input voltage of GPIO (except PA8/PA9) | -0.3 | 3.6 | V |
| HVTIO | Input voltage of HVT-IO (PA8/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~PA6,PA8~PA15<br>PB0~PB1<br>USBDP<br>USBDM | -0.3 | 1.3 | V |
| $V_{IH}$ | High-Level Input Voltage | IOVDD = 3.0V | PA0~PA6<br>PA10~PA15<br>PB0~PB1 | 1.7 | 3.3 | V |
| | | IOVDD = 3.0V | PA8~PA9<br>USBDP<br>USBDM | 1.7 | 5.5 | V |
| **Output Characteristics** | | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **IO** | **Typ** | | **Unit** |
| $\lvert I_{OL} \rvert$ | Output Current | IOVDD = 3.0V<br>Voutput = 0.3V | PA0~PA6<br>PA10~PA15<br>PB0~PB1 | 3(HD=0)<br>9(HD=1)<br>15(HD=2)<br>28(HD=3) | | mA |
| | | IOVDD = 3.0V<br>Voutput = 0.3V | PA8~PA9<br>USBDP<br>USBDM | 8 | | mA |
| $\lvert I_{OH} \rvert$ | Output Current | IOVDD = 3.0V<br>Voutput = 2.7V | PA0~PA6<br>PA10~PA15<br>PB0~PB1 | 3(HD=0)<br>9(HD=1)<br>15(HD=2)<br>28(HD=3) | | mA |
| | | IOVDD = 3.0V<br>Voutput = 2.7V | PA8~PA9<br>USBDP<br>USBDM | 8 | | mA |
| **Internal Resistance Characteristics** | | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **IO** | **Typ** | | **Unit** |
| $R_{pu}$ | Pull-up Resistance | IOVDD = 3.0V | PA0~PA6,PA8~PA15<br>PB0~PB1 | 10k(PU=1)<br>100k(PU=2)<br>1M(PU=3) | | Ω |
| | | | USBDP | 1.5k | | Ω |
| | | | USBDM | 180k | | Ω |
| $R_{pd}$ | Pull-down Resistance | IOVDD = 3.0V | PA0~PA6,PA8~PA15<br>PB0~PB1 | 10k(PD=1)<br>100k(PD=2)<br>1M(PD=3) | | Ω |
| | | | USBDP<br>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<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=100kΩ | -- | 680 | -- | mVrms |
| Output Resistance | -- | -- | 5 | -- | KΩ |
| SNR | Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=100kΩ | -- | 93 | -- | dB |
| Dynamic Range | Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=100kΩ | -- | 92 | -- | dB |
| THD+N | Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=100kΩ | -- | -75 | -- | dB |
| Noise Floor | B/W=20Hz~20kHz A-Weighted<br>load=100kΩ | -- | 15 | -- | uVrms |

## 3.6 Class-D Speaker Driver Characteristics

**Table 3-6 Class-D Speaker Driver Characteristics Under HPVDD 3.7v**

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Resolution | -- | -- | 16 | -- | bit |
| Output Sample Rate | -- | 8 | -- | 96 | kHz |
| SNR | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=48kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=8Ω | -- | 93 | -- | dB |
| Dynamic Range | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=48kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=8Ω | -- | 92 | -- | dB |
| THD+N | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=48kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=8Ω | -- | -26 | -- | dB |
| Noise Floor | Differential Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=8Ω | -- | 45 | -- | uVrms |
| Max Output Power | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=48kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=4Ω | -- | 500 | -- | mW |

## 3.7 Audio ADC Characteristics

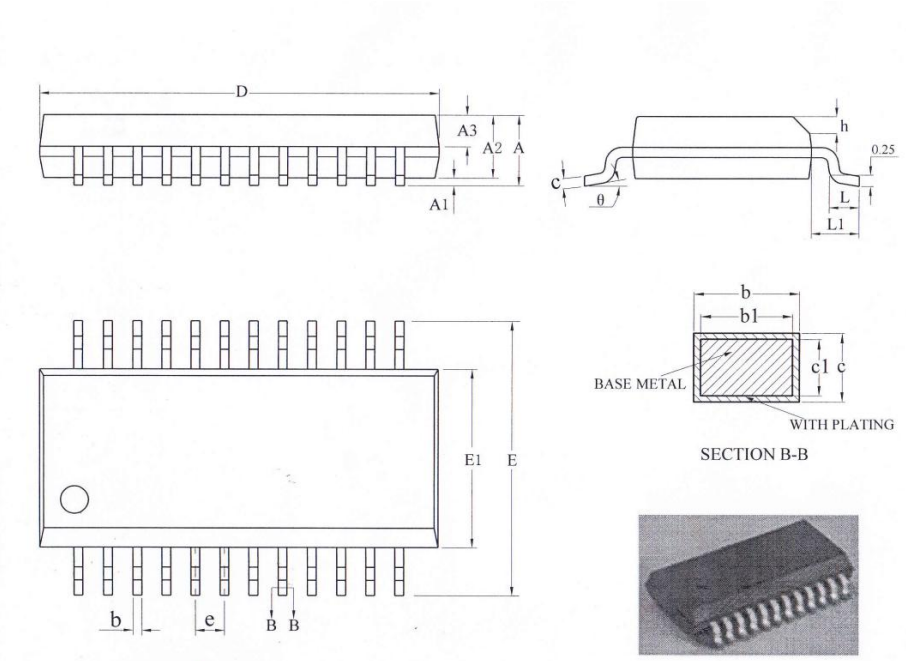
**Table 3-7 Audio ADC Characteristics Under VCM 1.3v**

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Resolution | -- | -- | 16 | -- | bit |
| Output Sample Rate | -- | 8 | -- | 48 | kHz |
| SNR | Differential input Mode<br>Fin=1kHz@1600mVrms<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 96 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@800mVrms<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 92 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@40mVrms<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=27dB | -- | 71 | -- | dB |
| Dynamic Range | Differential input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 96 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 92 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=27dB | -- | 72 | -- | dB |
| THD+N | Differential input Mode<br>Fin=1kHz@1600mVrms<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | -80 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@800mVrms | -- | -78 | -- | dB |

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| | Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | | | | |
| | Single-ended input Mode<br>Fin=1kHz@40mVrms<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=27dB | -- | -72 | -- | dB |
| Analogue Gain | -- | -3 | -- | 27 | dB |
| Max Input Level | Differential input Mode<br>ADC gain=0dB | -- | 1.6 | -- | Vrms |
| | Single-ended input Mode<br>ADC gain=0dB | -- | 0.8 | -- | Vrms |

# 4 Package Information

## 4.1 QSOP24




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | — | — | 1.75 |
| A1 | 0.10 | 0.15 | 0.25 |
| A2 | 1.30 | 1.40 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.23 | — | 0.31 |
| b1 | 0.22 | 0.25 | 0.28 |
| c | 0.20 | — | 0.24 |
| c1 | 0.19 | 0.20 | 0.21 |
| D | 8.55 | 8.65 | 8.75 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | 0.635BSC | | |
| h | 0.30 | — | 0.50 |
| L | 0.50 | — | 0.80 |
| L1 | 1.05REF | | |
| θ | 0 | — | 8° |

**Figure 4-1 AD245A Package**

# 5 IC Marking Information

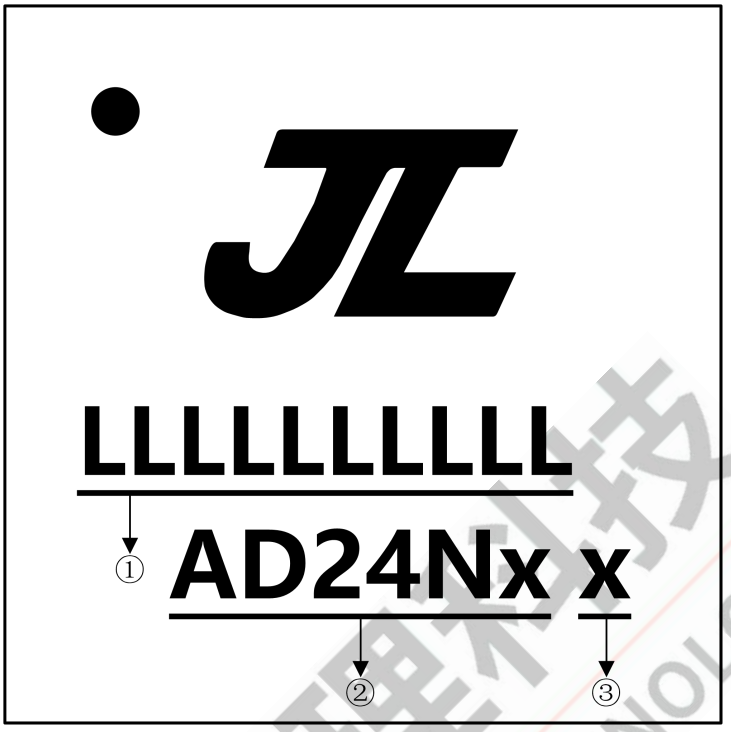



**Figure 5-1 AD245A Package Outline**

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

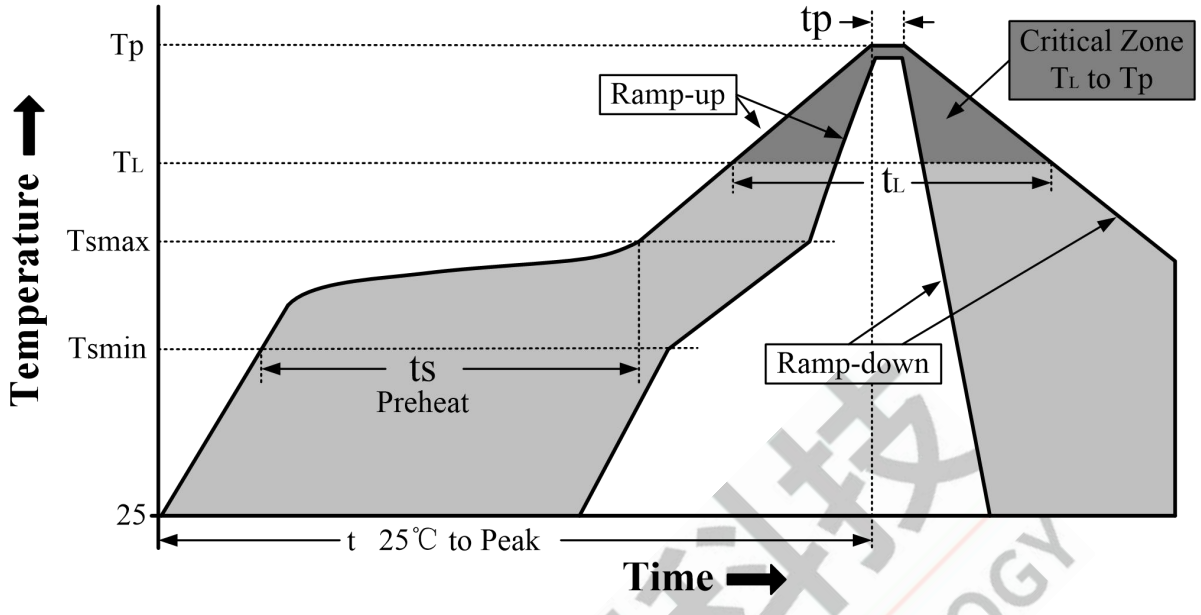



**Figure 6-1 Classification Reflow Profile**

**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 ($T_L$)<br>Time ($t_L$) maintained above $T_L$ | | 183℃<br>60-150 seconds | 217℃<br>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.