

AD242A Datasheet

Zhuhai Jieli Technology Co.,LTD

Version 1.0

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Revision History

| Date | Revision | Description |
|------------|----------|------------------|
| 2025.03.05 | V1.0 | Initial Release. |
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AD242A 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

Peripherals

- 1 x Full speed USB
- 1 x SD host controller
- 3 x Multi-function 16bit timer
- 2 x UART interface
- 1 x I²C Master/Slave interface
- 2 x SPI Master/Slave interface
- 4 x MCPWM
- 1 x GPCRC
- 1 x 10bit GPADC(10 Channels)
- 8 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

- SOP16

Temperature

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

Applications

- Sound Toy
- Audio player

1 Block Diagram

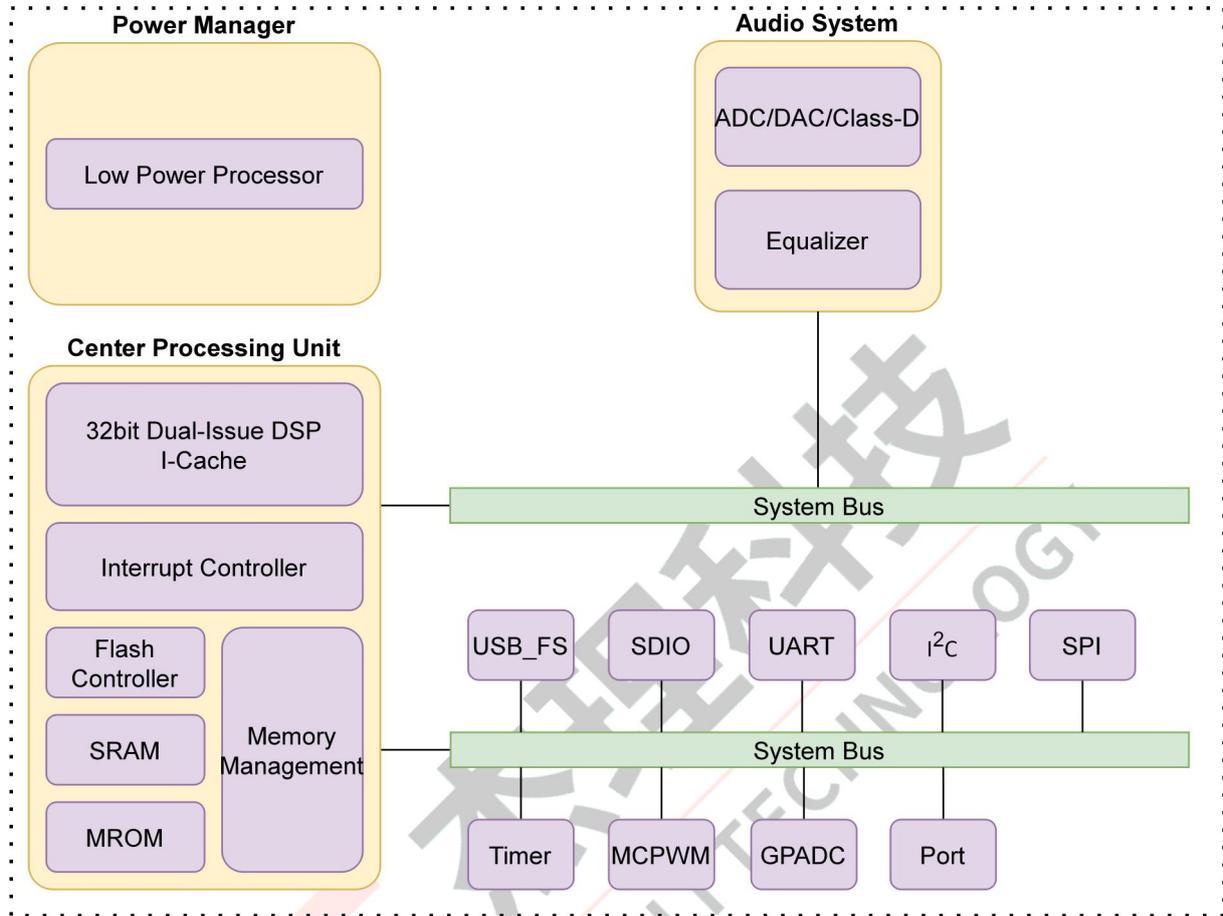


Figure 1-1 AD242A Block Diagram

2 Pin Definition

2.1 Pin Assignment

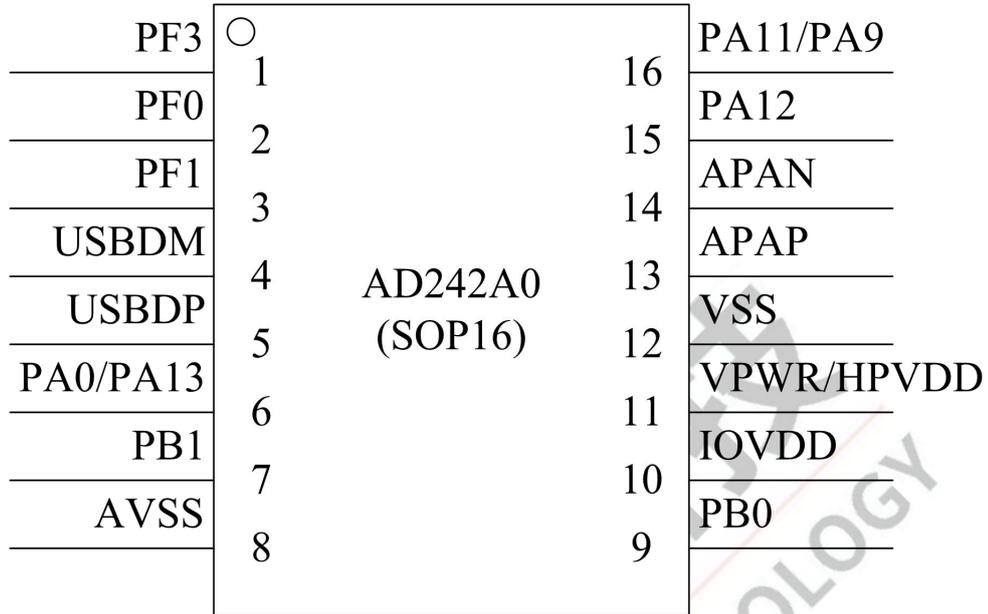


Figure 2-1 AD242A0 Pin Assignment

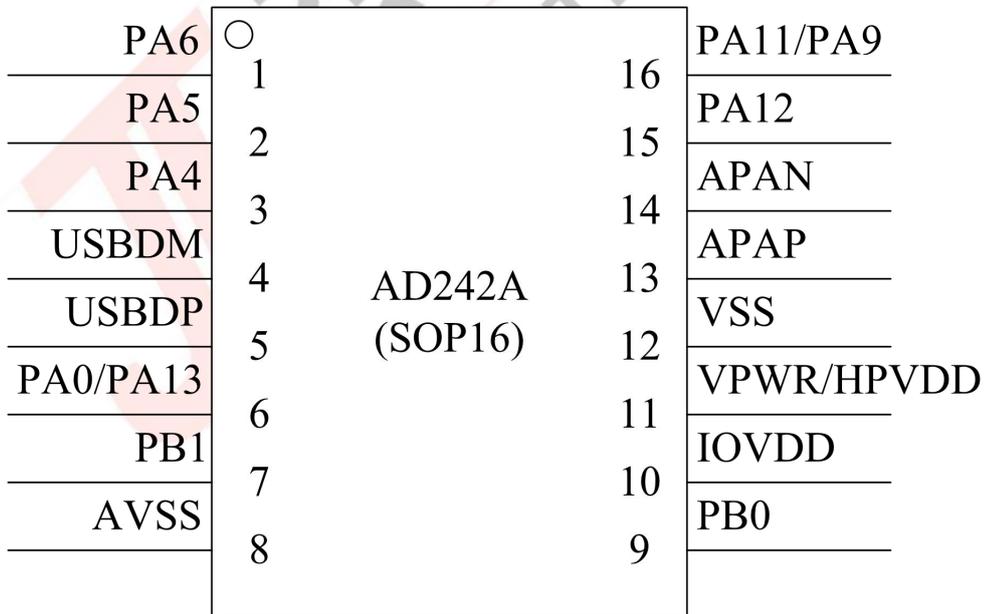


Figure 2-1 AD242A2/4 Pin Assignment

2.2 Pin Description

Table 2-2-1 AD242A Pin Description

| Pin No. | Name | Type | IO Initial State | Description | |
|---------|-------|---------------|------------------------|---|--------------------------------|
| 1 | A0 | PF3 *Note2 | NIO | -- | NOR Flash CSA NOR Flash D0B |
| | A2/4 | PA6 | I/O | Z | ADC8(ADC Input Channel 8) |
| 2 | A0 | PF0 *Note2 | NIO | -- | NOR Flash D0A NOR Flash CSB |
| | A2/4 | PA5 | I/O | Z | ADC7(ADC Input Channel 7) |
| 3 | A0 | PF1 *Note2 | NIO | -- | NOR Flash CLKA NOR FlashD1B |
| | A2/4 | PA4 | I/O | Z | ADC6(ADC Input Channel 6) |
| 4 | USBDM | I/O | 15kΩ Pull-down | USB Negative Data ADC5(ADC Input Channel 5) | |
| 5 | USBDP | I/O | 15kΩ Pull-down | USB Positive Data ADC4(ADC Input Channel 4) | |
| 6 | PA0 | I/O | 10kΩ Pull-up *Note1 | ADC0(ADC Input Channel 0) Hold down 0 to reset*Note1 | |
| | PA13 | I/O | Z | AIN_A0(Audio ADC Positive Input) MICBIAS(MIC Bias Output) ADC12(ADC Input Channel 12) | |
| 7 | PB1 | I/O | Z | AIN_A1(Audio ADC Positive Input) | |
| 8 | AVSS | G | -- | Audio Ground | |
| 9 | PB0 | I/O | Z | DAC(AUDIO DAC output) ADC15(ADC Input Channel 15) LVD(External Low Voltage Detection Input) | |
| 10 | IOVDD | P | -- | IO Power | |
| 11 | VPWR | P | -- | Chip main power supply | |
| | HPVDD | P | -- | Audio Power | |
| 12 | VSS | G | -- | Ground | |
| 13 | APAP | O | -- | Class-D Speaker Driver Positive Output | |
| 14 | APAN | O | -- | Class-D Speaker Driver Negative Output | |
| 15 | PA12 | I/O | Z | ADC11(ADC Input Channel 11) | |
| 16 | PA11 | I/O | Z | ADC10(ADC Input Channel 10) | |
| | PA9 | I/O(HVT) | 10kΩ Pull-down | I2S_DATA0 Firmware Download Interface | |

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, I²C, 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 | °C |
| Tstg | Storage temperature | -65 | +150 | °C |
| VPWR | Supply Voltage | -0.3 | 6 | V |
| HPVDD | | -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,PA4~PA6 PA9,PA11~PA13 PB0~PB1 USBDP USBDM | -0.3 | 1.3 | V |
| V_{IH} | High-Level Input Voltage | IOVDD = 3.0V | PA0,PA4~PA6,PA11~PA13 PB0~PB1 | 1.7 | 3.3 | V |
| | | IOVDD = 3.0V | PA9 USBDP USBDM | 1.7 | 5.5 | V |
| Output Characteristics | | | | | | |
| Symbol | Parameter | Conditions | IO | Typ | Unit | |
| $ I_{OL} $ | Output Current | IOVDD = 3.0V Voutput = 0.3V | PA0,PA4~PA6 PA11~PA13 PB0~PB1 | 3(HD=0) 9(HD=1) 15(HD=2) 28(HD=3) | mA | |
| | | IOVDD = 3.0V Voutput = 0.3V | PA9 USBDP USBDM | 8 | mA | |
| $ I_{OH} $ | Output Current | IOVDD = 3.0V Voutput = 2.7V | PA0,PA4~PA6 PA11~PA13 PB0~PB1 | 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,PA4~PA6 | 10k(PU=1) | Ω | |
| | | | PA9,PA11~PA13 | 100k(PU=2) | | |
| | | | PB0~PB1 | 1M(PU=3) | | |
| | | | USBDP | 1.5k | Ω | |
| | | | USBDM | 180k | Ω | |
| R_{pd} | Pull-down Resistance | IOVDD = 3.0V | PA0,PA4~PA6 | 10k(PD=1) | Ω | |
| | | | PA9,PA11~PA13 | 100k(PD=2) | | |
| | | | PB0~PB1 | 1M(PD=3) | | |
| | | | USBDP | 15k | Ω | |
| | | | USBDM | | | |

Note

1.Internal pull-up/pull-down resistance accuracy $\pm 20\%$

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 | -- | K Ω |
| 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 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 Fin=1kHz@0dBFS Fs=48kHz B/W=20Hz~20kHz A-Weighted load=8Ω | -- | 93 | -- | dB |
| Dynamic Range | Differential Mode Fin=1kHz@0dBFS Fs=48kHz B/W=20Hz~20kHz A-Weighted load=8Ω | -- | 92 | -- | dB |
| THD+N | Differential Mode Fin=1kHz@0dBFS Fs=48kHz B/W=20Hz~20kHz A-Weighted load=8Ω | -- | -26 | -- | dB |
| Noise Floor | Differential Mode B/W=20Hz~20kHz A-Weighted load=8Ω | -- | 45 | -- | uVrms |
| Max Output Power | Differential Mode Fin=1kHz@0dBFS Fs=48kHz B/W=20Hz~20kHz A-Weighted 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 Fin=1kHz@1600mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB | -- | 96 | -- | dB |
| | 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 | Differential input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB | -- | 96 | -- | dB |
| | 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 | Differential input Mode Fin=1kHz@1600mVrms Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB | -- | -80 | -- | dB |
| | Single-ended input Mode Fin=1kHz@800mVrms | -- | -78 | -- | dB |

| Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|---|-----|-----|-----|------|
| | Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB | | | | |
| | 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 |
| Max Input Level | Differential input Mode ADC gain=0dB | -- | 1.6 | -- | Vrms |
| | Single-ended input Mode ADC gain=0dB | -- | 0.8 | -- | Vrms |

4 Package Information

4.1 SOP16

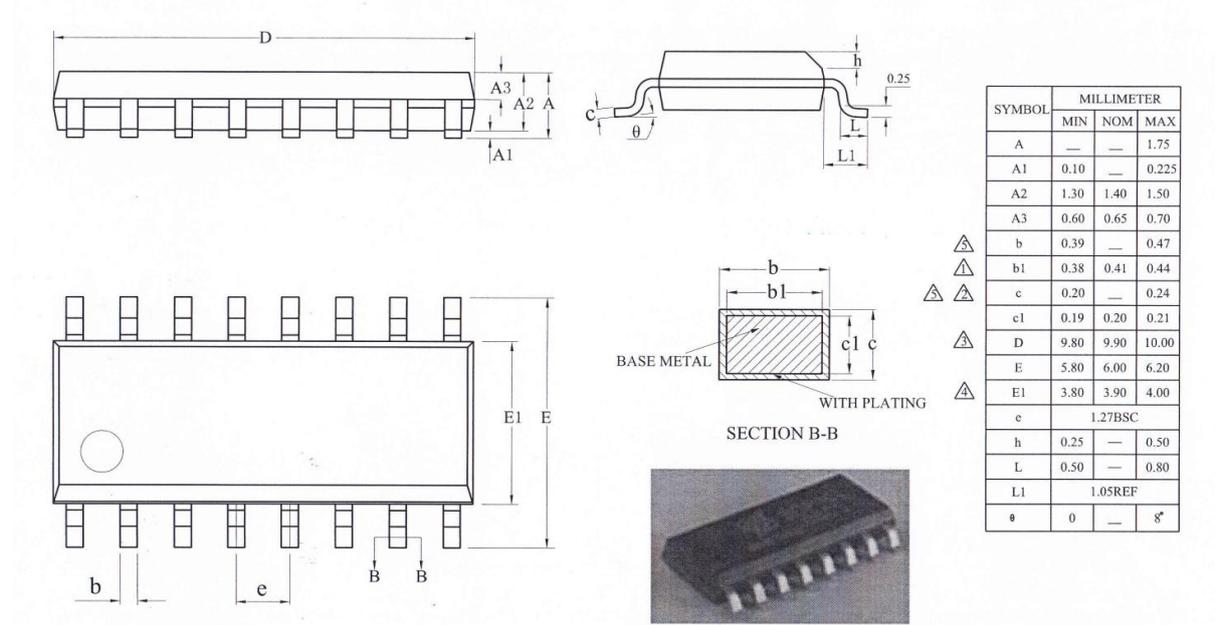


Figure 4-1 AD242A Package

5 IC Marking Information

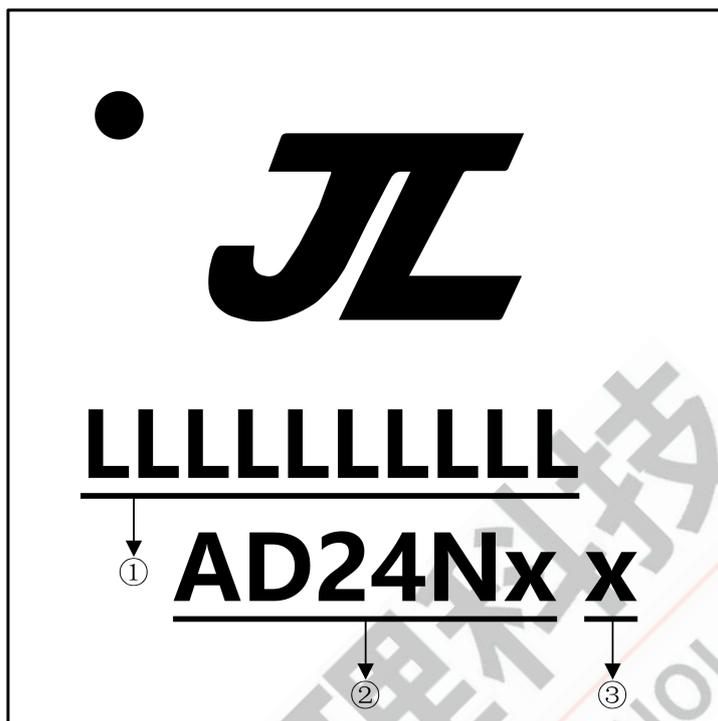


Figure 5-1 AD242A Package Outline

- 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

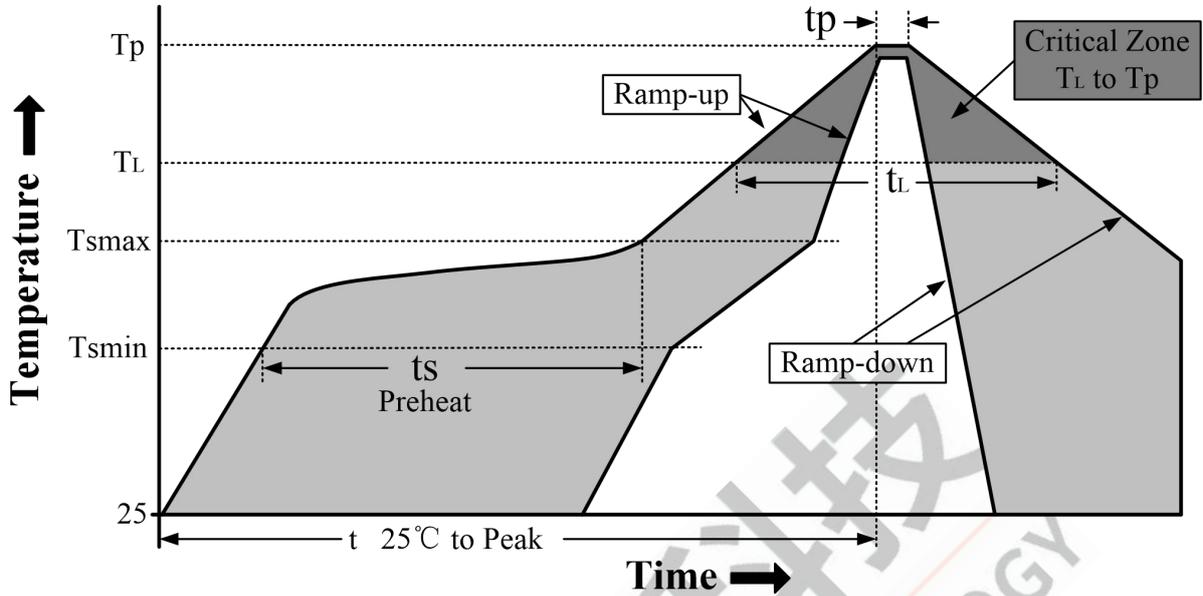


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

| Profile Feature | | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|--|-------------------------|------------------|
| Preheat/Soak | Temperature Min (T_{smin}) | 100°C | 150°C |
| | Temperature Max (T_{smax}) | 150°C | 200°C |
| | Time (t_s) from (T_{smin} to T_{smax}) | 60-120 seconds | 60-180 seconds |
| Average ramp-up rate (T_{smax} to T_p) | | 3°C/second max | 3°C/second max |
| Liquidous temperature (T_L) | | 183°C | 217°C |
| Time (t_L) maintained above T_L | | 60-150 seconds | 60-150 seconds |
| Peak package body temperature (T_p) | | See Table 6-2 | See Table 6-3 |
| Time within 5°C of actual Peak Temperature (t_p) ² | | 10-30 seconds | 20-40 seconds |
| Ramp-down rate (T_p to T_L) | | 6°C/second max | 6°C/second max |
| Time 25°C 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°C of actual peak temperature (t_p) specified for the reflow profiles is a “supplier” and “user” maximum.

Table 6-2 SnPb Classification Temperature

| Package Thickness | Volume mm ³ | Volume mm ³ |
|-------------------|------------------------|------------------------|
| | < 350 | ≥ 350 |
| <2.5 mm | 240 +0/-5°C | 225 +0/-5°C |
| ≥2.5 mm | 225 +0/-5°C | 225 +0/-5°C |

Table 6-3 Pb-free - Classification Temperature

| Package Thickness | Volume mm ³ < 350 | Volume mm ³ 350 - 2000 | Volume mm ³ > 2000 |
|-------------------|---------------------------------|--------------------------------------|----------------------------------|
| < 1.6mm | 260°C | 260°C | 260°C |
| 1.6 mm - 2.5mm | 260°C | 250°C | 245°C |
| > 2.5mm | 250°C | 245°C | 245°C |

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°C.For example 260°C+0°C)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.