AC825A Datasheet

Zhuhai Jieli Technology Co.,LTD

Version 1.2

Date 2025.04.07

Revision History

Date	Revision	Author	Description
2024.06.05	V1.0	zh-jieli	Initial Release
2024.11.23	V1.1	zh-jieli	Add Peripherals Description
2025.04.07	V1.2	zh-jieli	Update Pin Description for APAN , APAP

Table of Contents

AC825A Features

SYSTEM

- 32bit CPU 160MHz
- I-cache
- Support EMU
- On-chip SRAM 56kbyte
- Support MPU
- Built-In Flash
- 32KHz crystal oscillator
- Internal RC oscillator,PLL

Audio

- 1 x 16bit Class-D Speaker Driver
  - SNR 96dB
  - Sampling rate 22.05~48kHz
  - Drive speaker directly 320mW @ 8Ω

Precise Measurement

- 1 x 24bit delta-sigma ADC
  - Single-ended or differential input
  - 2 channels external analog input
  - 5 channels internal analog input
  - PGIA 1x/4x/8x/16x/32x/64x/128x
  - ENOB 21bits
  - Sampling rate 15Hz~7.7kHz
- 2 x OPA

Peripherals

- 1 x Full speed USB
- 3 x UART interface
- 2 x I^2C Master/Slave interface
- 2 x SPI Master/Slave interface
- 1 x 12bit 1Msps ADC(7 Channel)
- 11 x GPIO Support function remapping
- 6 x MCPWM
- 1 x Quadrature Rotate Decoder
- 1 x IR RX

PMU

- Support deep sleep mode with RTC
- Automatic wake-up of weighing scales
- VPWR range 2.7V to 5.5V
- IOVDD range 2.1V to 3.6V

Packages

- SSOP24L(8.65mm*6mm)

Temperature

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

Applications

- Sphygmomanometer

1 Block Diagram

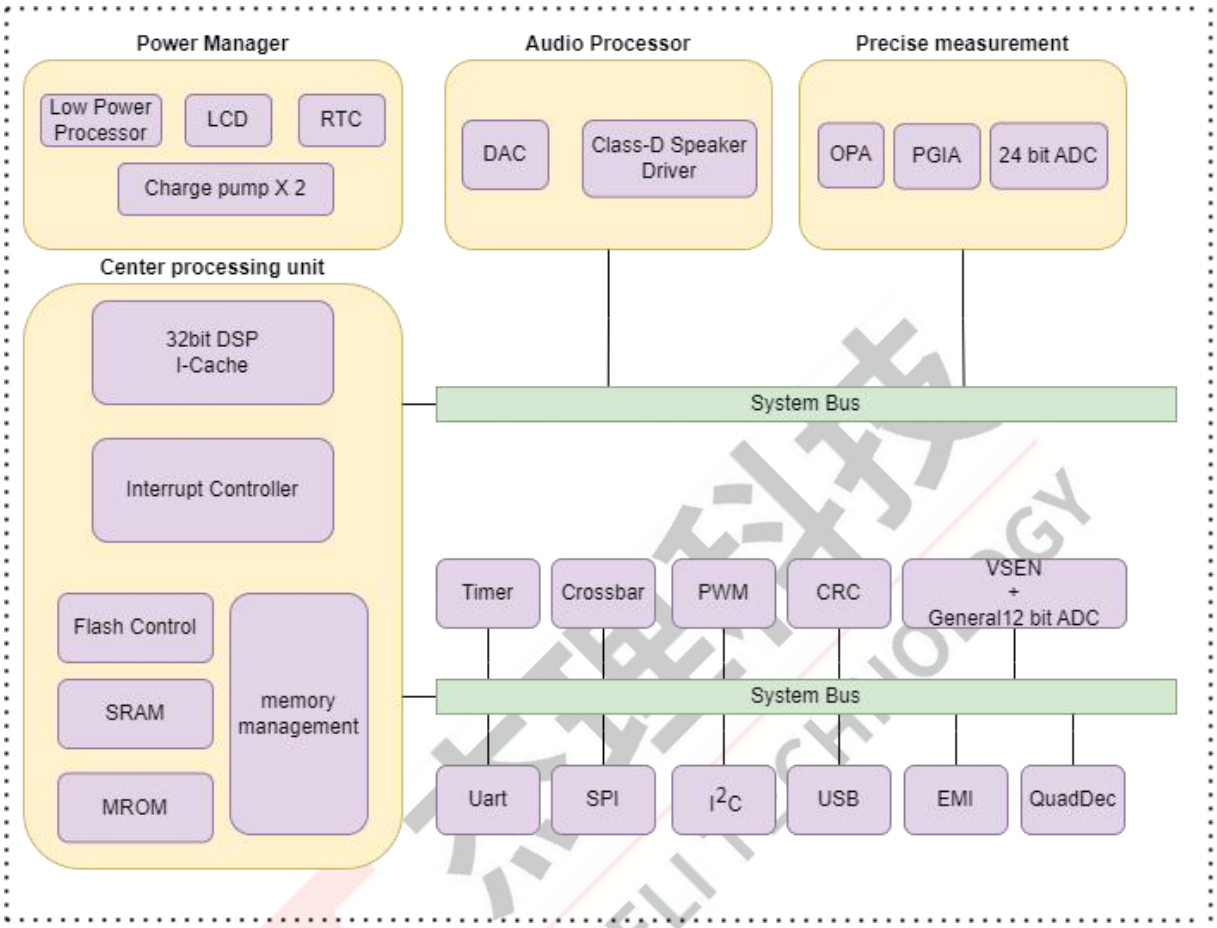


Figure 1-1 AC825A Block Diagram

2 Pin Definition

2.1 Pin Assignment

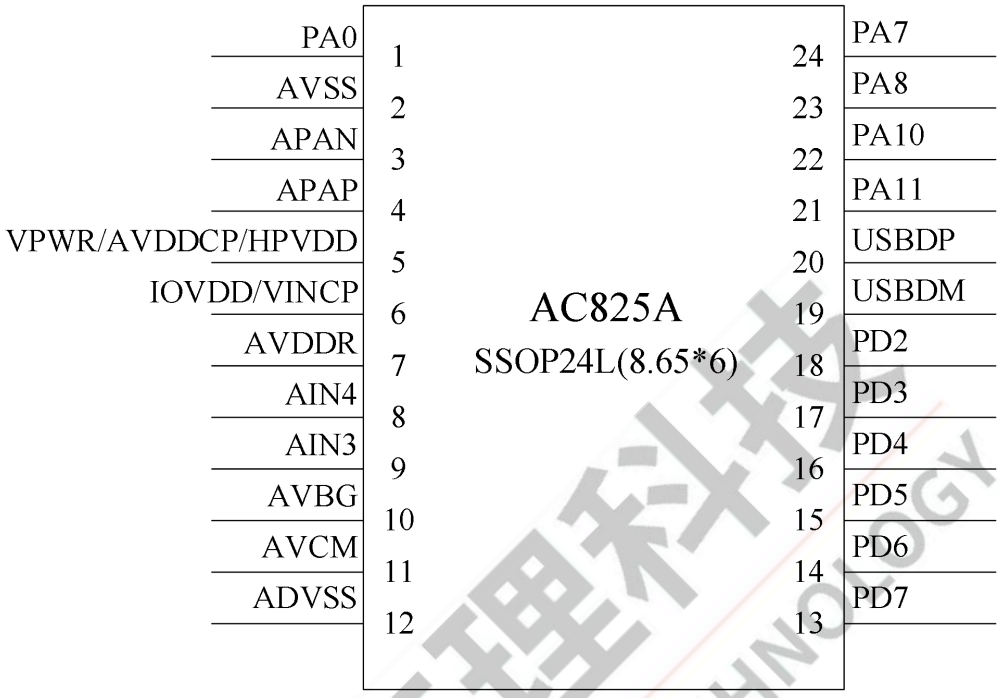


Figure 2-1 AC825A Pin Assignment

2.2 Pin Description

Table 2-2-1 AC825A Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	PA0	I/O	10kΩ Pull-up	ADC0(ADC Input Channel 0) Hold down 0 to reset
2	AVSS	G	--	Audio Ground
3	APAN	O	--	Class-D Speaker Driver Negative Output
4	APAP	O	--	Class-D Speaker Driver Positive Output
5	VPWR	P	--	Power Input
	AVDDCP	P	--	--
	HPVDD	P	--	Class-D Speaker Driver Power
6	IOVDD	P	--	IO Power
	VINCP	P	--	--
7	AVDDR	P	--	--
8	AIN4	I	--	PGIA Analog Input Channel4
9	AIN3	I	--	PGIA Analog Input Channel3
10	AVBG	P	--	Audio and 24bit delta-sigma ADC Reference Voltage
11	AVCM	P	--	24bit delta-sigma ADC Common-Mode Voltage
12	ADVSS	G	--	24bit delta-sigma ADC Ground
13	PD7	I/O	Z	MCPWM5 L
14	PD6	I/O	Z	MCPWM5 H
15	PD5	I/O	Z	MCPWM4 L
16	PD4	I/O	Z	MCPWM4 H
17	PD3	I/O	Z	MCPWM3 L
18	PD2	I/O	Z	MCPWM3 H
19	USBDM	I/O	15kΩ Pull-down	ADC14(ADC Input Channel 14)
20	USBDP	I/O	15kΩ Pull-down	ADC13(ADC Input Channel 13)
21	PA11	I/O	Z	ADC11(ADC Input Channel 11) LVD(External Low Voltage Detection Input)
22	PA10	I/O	Z	ADC10(ADC Input Channel 10)
23	PA8	I/O	Z	ADC8(ADC Input Channel 8) 32k Crystal Oscillator Output MCPWM0_CKI
24	PA7	I/O	Z	ADC7(ADC Input Channel 7) 32k Crystal Oscillator Input

Note

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

2. MCPWM0/1/2, UART, I^2C, I^2S, SPI1/2, IR RX functions can be remapped to any I/O.

3.PAP_WRE, PAP_RDE, TIMER functions also 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
RF	RF antenna	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
AVDDCP		-0.3	6	V
AVDDR		-0.3	3.6	V
HPVDD		-0.3	6	V
AVBG	Audio Reference Voltage	-0.3	3.6	V
AVCM	Common-Mode Voltage	-0.3	3.6	V
GPIO	Input voltage of GPIO (except PD2~PD7)	-0.3	3.6	V
HVTIO	Input voltage of HVT-IO (PD2~PD7)	-0.3	6	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	JEDEC EIA/JESD22-C101F

3.3 PMU Characteristics

Table 3-3-1 PMU Characteristics under VPWR supply

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VPWR	Power supply	--	2.7	--	5.5	V
HPVDD	Power supply	--	2.7	--	5.5	V
Operating mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Voltage output	--	--	3	--	V
	Loading current	IOVDD=3.0V@VPWR = 3.7V	--	--	120	mA
Low Power mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Loading current	IOVDD=3.0V@VPWR = 3.7V	--	--	10	mA

Table 3-3-2 PMU Characteristics under IOVDD supply

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Power supply	--	2.1	--	3.6	V

Table 3-3-3 PMU Sub-module Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
AVDDR	Voltage output	--	--	3.0	--	V
	Loading current	AVDDCP=3.6V@IOVDD = 3.0V	--	--	20	mA

Note

1.Power on sequence rule: VPWR and HPVDD are powered on simultaneously, or VPWR is powered on earlier than HPVDD.

3.4 IO Characteristics

Table 3-4 IO Characteristics

Input Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Min**	**Max**	**Unit**
V_{IL}	Low-Level Input Voltage	IOVDD = 3.0V	PA0, PA7, PA8 PA10, PA11 PD2~PD7 USBDP USBDM	-0.3	1.4	V
V_{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA0, PA7, PA8 PA10, PA11 USBDP USBDM	1.7	3.3	V
		IOVDD = 3.0V	PD2~PD7	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, PA7, PA8 PA10, PA11	2(HD=0) 6(HD=1) 20(HD=2) 45(HD=3)		mA
		IOVDD = 3.0V Voutput = 0.3V	PD2~PD7 USBDP USBDM	8		mA
$\lvert I_{OH} \rvert$	Output Current	IOVDD = 3.0V Voutput = 2.7V	PA0, PA7, PA8 PA10, PA11	2(HD=0) 6(HD=1) 20(HD=2) 45(HD=3)		mA

		IOVDD = 3.0V Voutput = 2.7V	PD2~PD7 USBDP USBDM	8	mA
Internal Resistance Characteristics					
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**	**Unit**
R_{pu}	Pull-up Resistance	IOVDD = 3.0V	PA0, PA7, PA8 PA10, PA11 PD2~PD7	10k(PU=1) 100k(PU=2) 1M(PU=3)	Ω
		IOVDD = 3.0V	USBDP	1.5k	Ω
		IOVDD = 3.0V	USBDM	180k	Ω
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**	**Unit**
R_{pd}	Pull-down Resistance	IOVDD = 3.0V	PA0, PA7, PA8 PA10, PA11 PD2~PD7	10k(PD=1) 100k(PD=2) 1M(PD=3)	Ω
		IOVDD = 3.0V	USBDP USBDM	15k	Ω

Note

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

3.5 Class-D Speaker Driver Characteristics

Table 3-5 Class-D Speaker Driver Characteristics under HPVDD 3.7V

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	--	16	bits
Input Sample Rate	--	22.05	--	48	kHz
SNR	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	96	--	dB
	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω	--	96	--	dB
THD+N	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	-75	--	dB
	Differential Mode Fin=1kHz@0dBFS	--	-45	--	dB

Parameter	Conditions	Min	Typ	Max	Unit
	Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω				
Noise Floor	Differential Mode B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	30	--	uVrms
	Differential Mode B/W=20Hz~20kHz A-Weighted Load=8Ω	--	32	--	uVrms
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	89	--	dB
	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω	--	89	--	dB

3.6 12bit ADC Characteristics

Table 3-6-1 12bit ADC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
AVDD(ADC Supply Voltage)	AVDD=IOVDD	2.1	3	3.6	V
AVREF(ADC Positive reference voltage)	--	2.1	3	AVDD	V
AVSSREF(ADC Negative reference voltage)	--	--	0	--	V
I_{AVDD}(Current of the ADC on AVDD and AVREF)	Single-ended f_{ADC} =12MHz AVDD=AVREF=3V	--	310	--	uA
	Diff-ended with DiffAMP f_{ADC} =12MHz AVDD=AVREF=3V	--	780	--	uA
f_{ADC}(ADC Clock Frequency)	--	0.25	--	12	MHz
Ts(ADC Sampling Time)	--	1.5	--	--	$1/f_{ADC}$
ADC Conversion Time	Including Sampling Time	8	14	14	$1/f_{ADC}$
ADC Input Voltage Range	--	0	--	AVREF	V
ADC Internal Sample and Hold Capacitor	--	--	--	5	pF
Sampling Switch Resistance	--	--	--	1	kΩ
External Input Impedance	Ts=1.5/f_{ADC}	--	--	1.5	kΩ

Parameter	Conditions	Min	Typ	Max	Unit
	Ts>=50/f_{ADC}	--	--	50	kΩ
ADC Resolution	Programmable	6	12	12	bit
INL	AVDD=3V, f_{ADC}=12MHz	-1	--	3	LSB
DNL	AVDD=3V, f_{ADC}=12MHz	-1	--	1	LSB
ADC Offset Error	AVDD=3V, f_{ADC}=12MHz	--	--	2.4	LSB
Gain Error	AVDD=3V, f_{ADC}=12MHz	--	--	5.8	LSB
ENOB(Effective number of bits)	Single-ended AVDD=AVREF=3V fIN =1kHz, f_{ADC}=12MHz	--	10.6	--	bit
	Diff-ended with DiffAMP AVDD=AVREF=3V fIN =1kHz, f_{ADC}=12MHz	--	11	--	bit

Table 3-6-2 12bit ADC Characteristics

Tsample(1/f_{ADC})	Tsample(us)	Max.Rext-input(kΩ)
1.5	0.125	1.5
7.5	0.625	10
13.5	1.125	15
25.5	2.125	25
49.5	4.125	50
97.5	8.125	--

3.7 24bit delta-sigma ADC Characteristics

Table 3-7-1 24bit delta-sigma ADC Characteristics

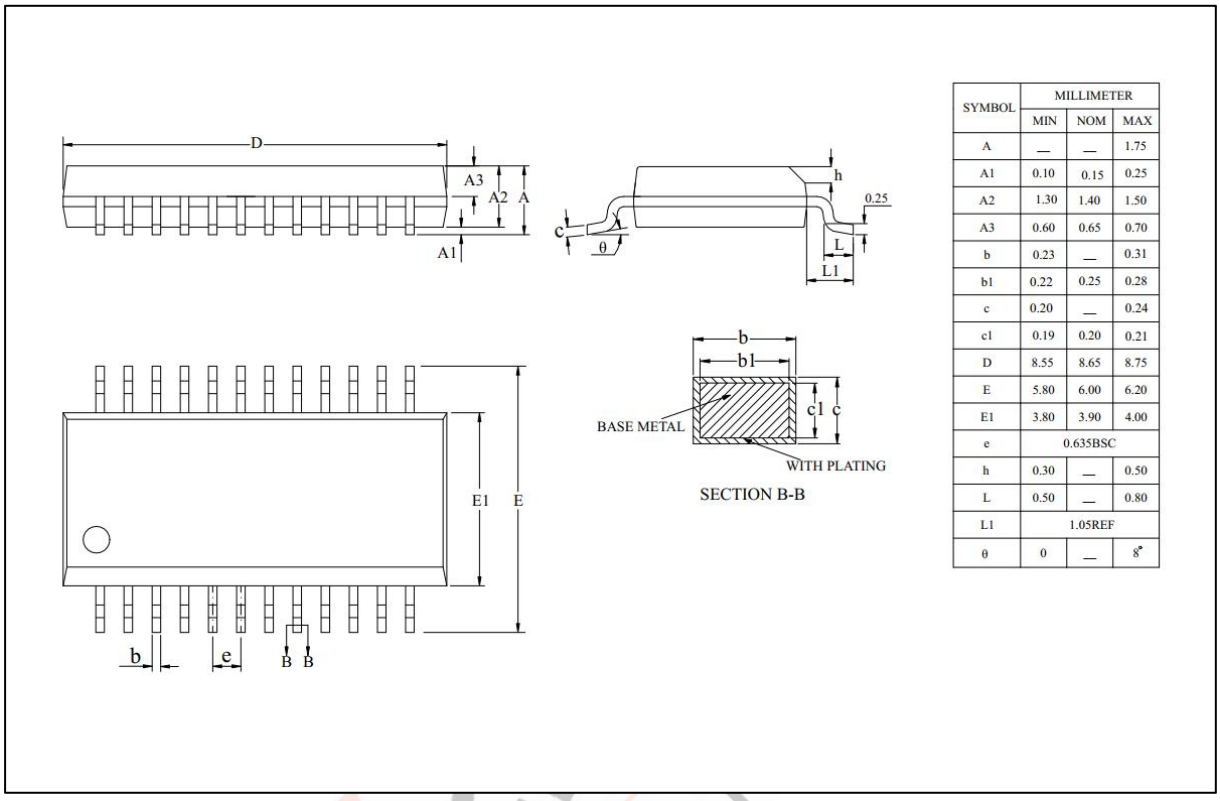
Parameter	Conditions	Min	Typ	Max	Unit
I_{ADC}(Current of the ADC on AVDDR)	AVDD=IOVDD	--	1.4	--	mA
F_{SMP}(Data rate)	--	15	--	7692	Hz
V_{AIN_MAX}(Full-scale input voltage)	Differential(Vip-Vin)	--	--	1.4	V
V_{AIN}(PGIA input absolute voltage)	PGA_INP and PGA_INN absolute input voltage	0.2	--	AVDDR-1	V
V_x(PGIA output absolute voltage)	PGIA absolute output voltage	0.2	--	AVDDR-0.2	V
Noise Free Bits	Gain = 1,Vref = 2.0V,F_{SMP} = 15Hz, Positive and Negative input internally Connect to AVCM	--	18.7	--	bit
	Gain = 128,Vref = 2.0V,F_{SMP}=15Hz, Positive and Negative input internally Connect to AVCM	--	14.6	--	bit
ENOB	Gain = 1,Vref = 2.0V,F_{SMP} = 15Hz, Positive and Negative input internally Connect to AVCM	--	21	--	bit
	Gain = 128, Vref = 2.0V,F_{SMP} = 15Hz, Positive and Negative input internally Connect to AVCM	--	17	--	bit

Table 3-7-2 24bit delta-sigma ADC Characteristics

24bit delta-sigma ADC Performance Noise Free Bit vs. Output Rate and Gain								
Output Sample Rate(Hz)	15.3	30.6	61.2	122	489	1976	3875	7692
PGIA GAIN 1x1	18.8	18.4	18.0	17.5	16.3	15.1	13.9	12.3
PGIA GAIN 4x1	18.5	18.1	17.7	17.2	15.9	14.9	13.9	12.3
PGIA GAIN 8x1	18.0	17.8	17.4	16.9	15.7	14.7	13.8	11.6
PGIA GAIN 16x1	17.3	17.1	16.8	16.4	15.2	13.9	13.3	11.8
PGIA GAIN 32x1	16.4	16.4	16.0	15.7	14.4	13.4	12.5	10.9
PGIA GAIN 64x1	15.5	15.3	15.2	14.6	13.5	12.4	11.8	10.6
PGIA GAIN 128x1	14.7	14.5	14.1	13.8	12.5	11.4	10.8	9.8

4 Package Information

4.1 SSOP24L_8.65×6mm



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 AC825A Package

5 IC Marking Information

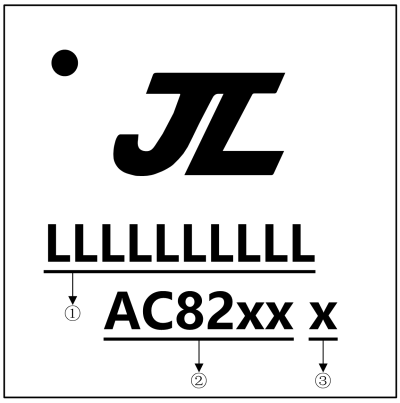


Figure 5-1 AC825A Package Outline

① Production Batch
② Chip Model
③ Built-in flash size
4 4Mbit Flash
8 8Mbit Flash

6 Solder-Reflow Condition

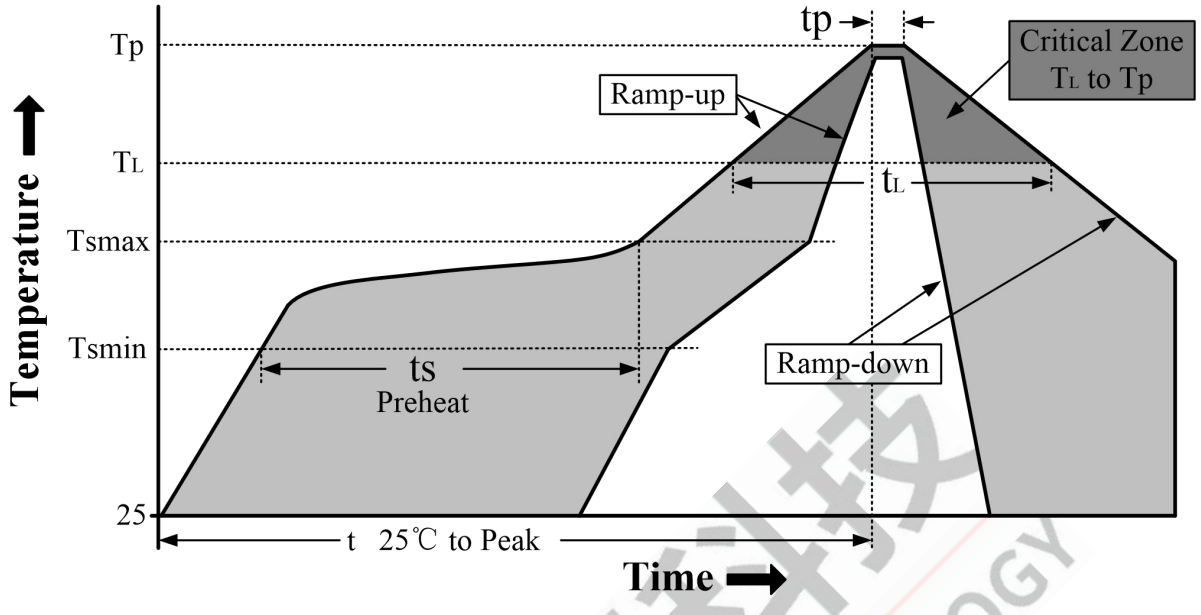


Figure 6-1 Classification Reflow Profile

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
Liquidus 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.