

AC981A Datasheet

Zhuhai Jieli Technology Co.,LTD

Version: 1.2

Date: 2023.07.25

AC981A Features

CPU

- 8051 CPU

Memory

- On-chip RAM
- On-chip OTP
- Optional built-in flash memory

Clocks

- On-chip 200 KHz low-power-consumption clock oscillator
- On-chip 32 MHz lower-temperature-drift clock oscillator

Peripherals

- One low voltage detector
- 8-channel 10-bit general purpose ADC
- One multi-function 8-bit timer0, support capture and PWM mode
- One multi-function 16-bit timer1, support capture and PWM mode
- Three PWM generator for LED driving
- Two UART interface
- One Lightning charging host
- One Qi Wireless Charge protocol controller
- Support Off-Chip NTC Resistance
- 16 Individually programmable and multiplexed GPIO pins
- Up to 4 external interrupt / wake-up source

PMU

- 5uA standby current
- 8uA Timed wake-up current
- 3mA Operating current
- 12V input withstand voltage
- Linear charger, programmable chargecurrent Up to 400mA
- Support 4.2V and 4.35V lithium batteries
- Trickle / constant current / constant voltage three-stage charging
- Cut-off charge current: C/10
- Synchronous boost output 5V/200mA, efficiency up to 91%@0.1A
- Support Earphone communication
- Overcurrent, Short circuit and overvoltage protection of discharge module
- VPWR range : 4.5V to 5.5V
- VBAT range : 3.0V to 4.5V
- IOVDD range : 2.7V to 3.4V

Packages

- QFN24(4mm*4mm)

Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

Applications

- Bluetooth TWS charging Box

1 Block Diagram

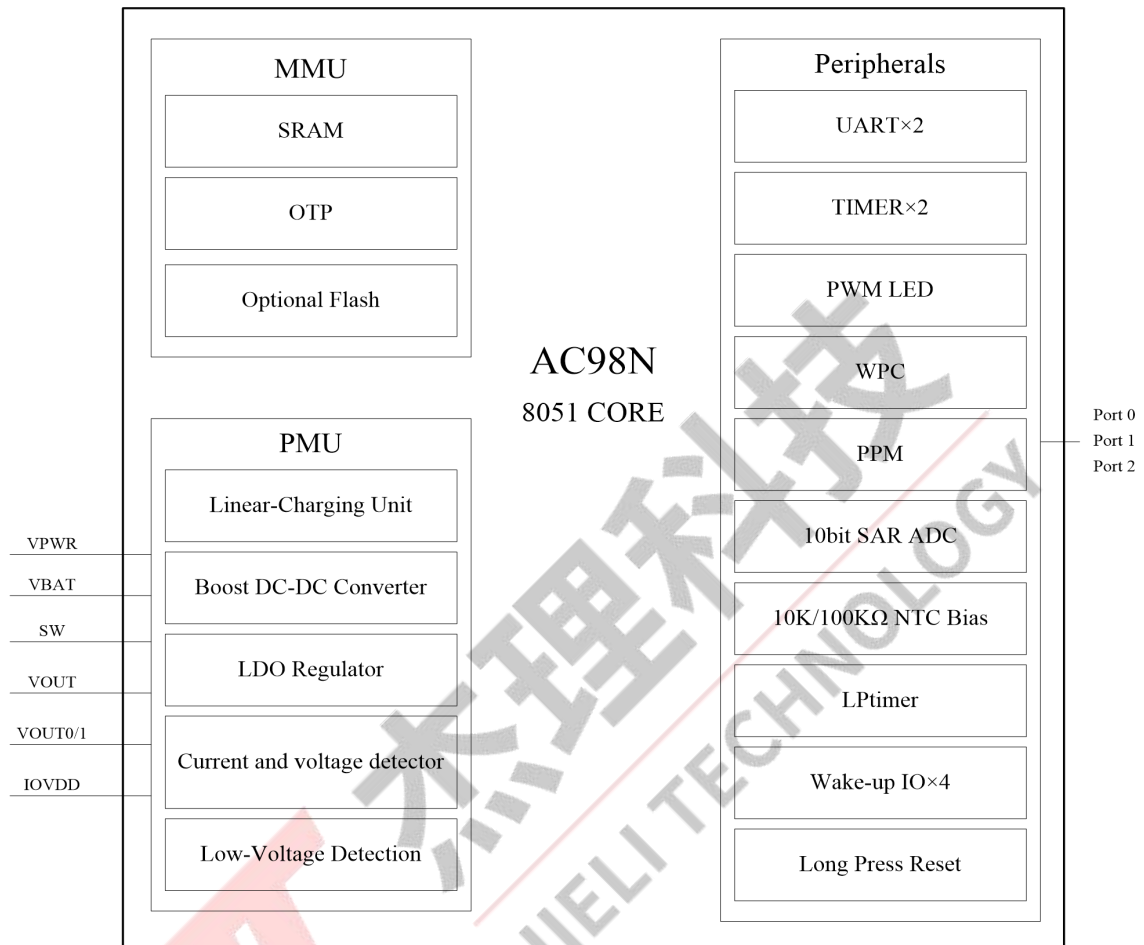


Figure 1-1 AC981A Block Diagram

2 Pin Definition

2.1 Pin Assignment

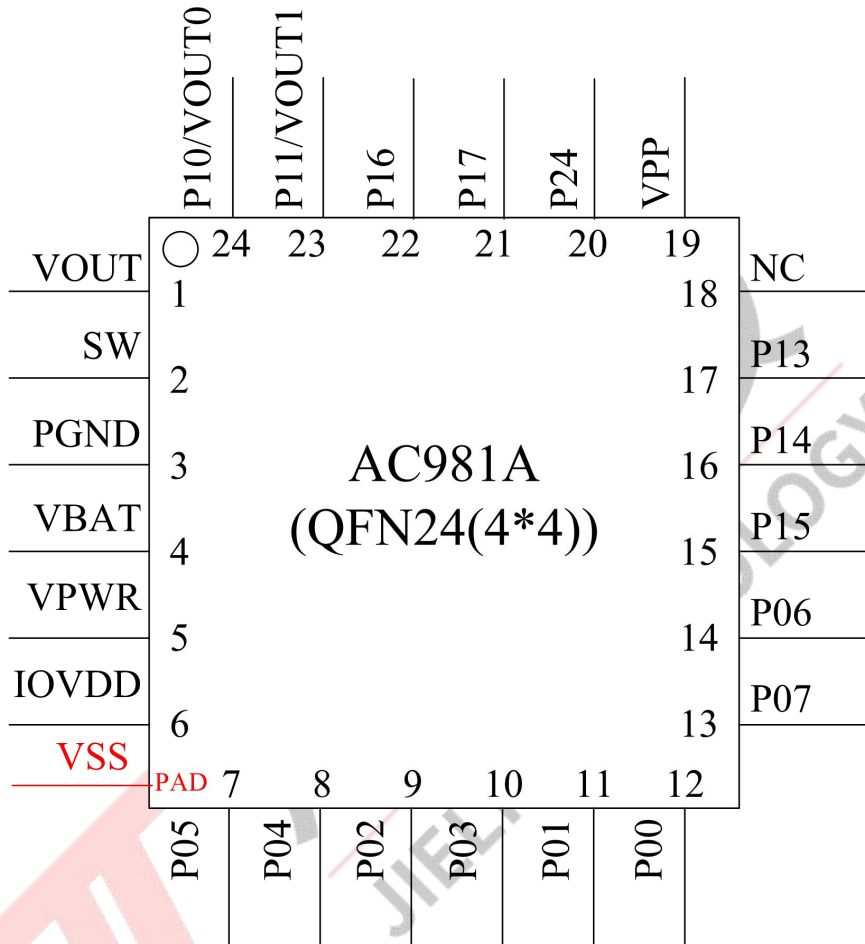


Figure 2-1 AC981A Package Diagram

2.2 Pin Description

Table 2-1 AC981A Pin Description

PIN NO.	Name	Type	Function	Other Function
1	VOUT	PO		Boost Power Output;
2	SW	O		Switch signal of the Buck converter, Connected to inductor;
3	PGND	G		The ground of Buck DC-DC converter;
4	VBAT	P		Battery interface;
5	VPWR	PI		Charge Power Input;
6	IOVDD	PO	Power supply for GPIO	Built-in linear voltage regulator output;
7	P05	I/O	GPIO	WPR_TX0: Wireless Power Receiver Data0;
8	P04	I/O	GPIO	CAP1: Timer1 Capture;
9	P02	I/O	GPIO	LED2_A: LED2 Controller Output(A); ADC2: ADC Input Channel 2;
10	P03	I/O	GPIO	TMR0_PWM : Timer0 PWM Output; TMR0_CIN: Timer0 Clock In; ADC3: ADC Input Channel 3;
11	P01	I/O	GPIO	LED1_A: LED1 Controller Output(A); UART0TXB: Uart0 Data Output(B); TMR1_PWM : Timer1 PWM Output; TMR1_CIN: Timer1 Clock In; ADC1: ADC Input Channel 1;
12	P00	I/O	GPIO (pull down)	LED0_A: LED0 Controller Output(A); UART0RXB: Uart0 Data Input(B); ADC0: ADC Input Channel 0;
13	P07	I/O	GPIO	CAP0: Timer0 Capture;
14	P06	I/O	GPIO	
15	P15	I/O	GPIO (pull up)	MCLR: Master Clear; LED2_B: LED2 Controller Output(B); ADC6: ADC Input Channel 6;
16	P14	I/O	GPIO	UART1TXB: Uart1 Data Output(B); LED1_B: LED1 Controller Output(B); ADC5: ADC Input Channel 5;
17	P13	I/O	GPIO	UART1RXB: Uart1 Data Input(B); LED0_B: LED0 Controller Output(B); ADC4: ADC Input Channel 4;
18	NC			
19	VPP			OTP program voltage input;
20	P24	I/O	GPIO (High Voltage Resistant)	PPM_DAT(A): Power protocol master control(A);

21	P17	I/O	GPIO	WPR_TX1:Wireless Power Receiver Data1; Updata:Support built-in flash memory Updata;
22	P16	I/O	GPIO	NTC:Built-in 10KΩ or 100KΩ bias resistors; LVD:Low Voltage Detection; ADC7:ADC Input Channel 7;
23	VOUT1	PO		VOUT1:Boost Output Path 1;
	P11	I/O	GPIO (High Voltage Resistant)	UART1TXA:Uart1 Data Output(A); UART1RXA:Uart1 Data Input(A);
24	VOUT0	PO		VOUT0:Boost Output Path 0;
	P10	I/O	GPIO (High Voltage Resistant)	UART0TXA:Uart0 Data Output(A); UART0RXA:Uart0 Data Input(A);
PAD	VSS	G		System ground;

Pin Type	Description	Pin Type	Description
P	Power	I/O	Input or Output
PI	Power Input	I	Input
PO	Power Output	O	Output
AO	Analog Output	G	Ground

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3-1

Symbol	Parameter	Min	Max	Unit
T _{opt}	Operating temperature	-40	+85	°C
T _{stg}	Storage temperature	-65	+150	°C
V _{BAT}	Supply Voltage	-0.3	5.5	V
V _{PWR}	Charger Voltage	-0.3	12	V
V _{IOVDD}	Voltage applied at IOVDD	-0.3	3.6	V
V _{GPIO}	Voltage applied to GPIO	-0.3	IOVDD+0.3	V
V _{HVIO}	Voltage applied to High Voltage Resistant IO	-0.3	+5.5	V

Note : The chip can be damaged by any stress in excess of the absolute maximum ratings listed below.

3.2 ESD Protectio

Table 3-2

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
Latch up	±200mA	All GPIO pins	JEDEC STANDARD NO.78E
	1.5xV _{opmax}	All power pins	

Note : 1.5xV_{opmax} = 1.5 times maximum operating voltage.

3.3 PMU Characteristics

Table 3-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{BAT}	Voltage Input	3.0	3.7	4.5	V	—
V _{PWR}	Charger supply Voltage	4.5	5.0	5.5	V	—
IOVDD	Voltage output	2.7	3.0	3.4	V	V _{BAT} = 4.2V, 10mA loading
	Loading current	—	—	100	mA	IOVDD=3.3V@V _{BAT} = 3.6V
V _{LVD}	Voltage input	2.4	2.8	3.0	V	Low-Voltage Detection of IOVDD

3.4 Battery Charge

Linear Charger

Table 3-4

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{PWR}	Charge Input Voltage Range	4.5	5	5.5	V	V _{BAT} =3.7V
V _{PWR_{OV}}	VPWR Overvoltage	–	–	12	V	
V _{PWR_{w-up}}	VPWR Wake-up voltage	2.0	–	–	V	V _{BAT} =3.7V
V _{PWR_{UV}}	Charging Undervoltage	–	3.0	–	V	
V _{BAT_{Float}}	Battery Charge Termination Voltage	4.15	4.2	4.25	V	VPWR=5.0V
		4.30	4.35	4.40	V	
I _{CC}	Fast Charge Current	50	–	400	mA	V _{BAT} =3.7V@VPWR=5.0V
I _{END}	Charge Termination Current Threshold	5	–	40	mA	
V _{Trikl}	Trickle Charge Voltage	–	3.0	–	V	VPWR=5.0V
I _{Trikl}	Trickle Charge Current	5	–	40	mA	V _{BAT} <V _{Trikl}
V _{RCH}	Recharging Voltage	4.0	4.1	4.15	V	

3.5 Boost Discharge

TA=25°C,L=2.2uH

Table 3-5

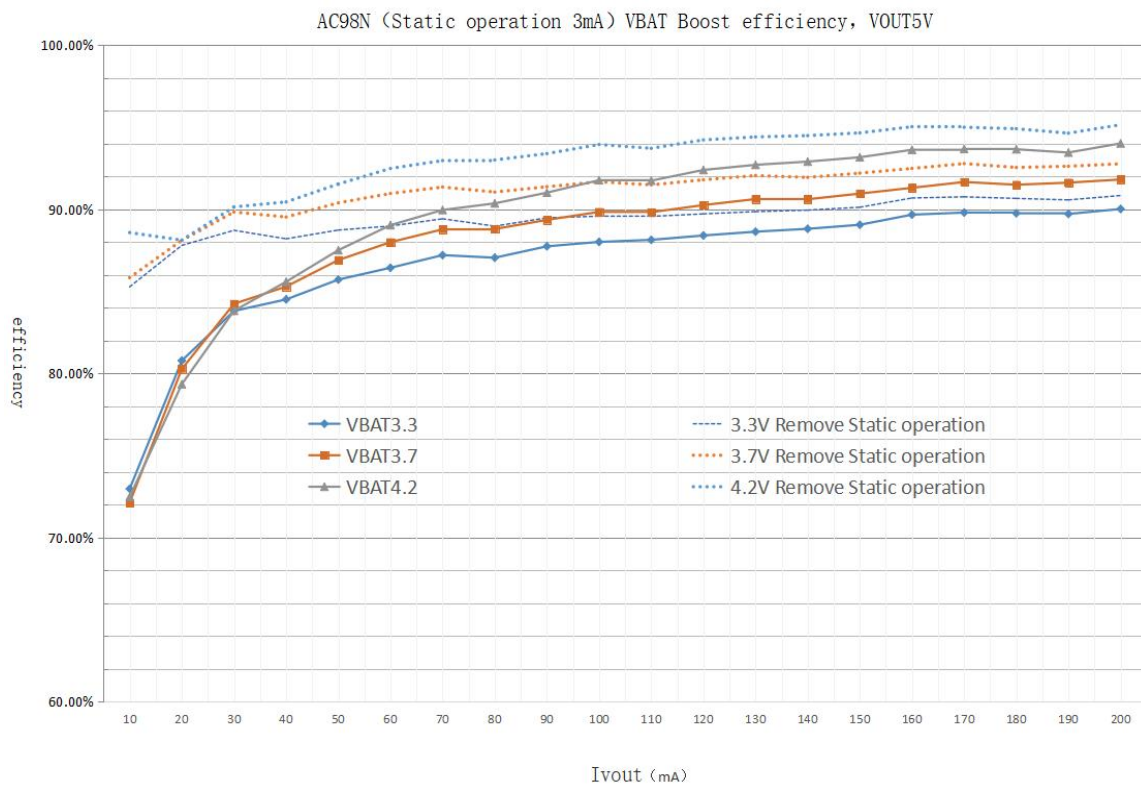
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{BAT}	Supply Voltage	3	3.7	4.5	V	
V _{OUT}	Output Voltage Range	–	5	–	V	200mA@V _{BAT} =3.7V
I _{VOUT}	Output Current	–	–	200	mA	V _{BAT} =3.7V@V _{OUT} =5V
η	Conversion efficiency	–	91	–	%	V _{BAT} =3.7V@V _{OUT} 5V/100mA
V _{UV_{BAT}}	Battery undervoltage latching threshold voltage	3.0	3.3	–	V	I _{VOUT} =200mA
F _{SW}	Switching Frequency	–	–	1.0	MHz	
V _{OVP}	Output overvoltage protection	–	5.5	–	V	

V _{OUV}	Output undervoltage protection	–	3.3	–	V	
I _{Max-VOUT0/1}	Overcurrent shutdown current	–	100	–	mA	
R _{VOUT0/1}	VOUT0/1 impedance	–	1.2	–	Ω	

3.6 Boost efficiency curve

(V_{OUT}=5V, C_{IN}=1μF, C_{OUT}=10μF, L=2.2μH, T_A=25°C, unless otherwise noted.)

Table 3-6



3.7 IO Input/Output Electrical Logical Characteristics

Table 3-7

GPIO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{IL}	Low-Level Input Voltage	-0.3	–	0.3* IOVDD	V	IOVDD = 3.0V
V _{IH}	High-Level Input Voltage	0.7* IOVDD	–	IOVDD+0.3	V	IOVDD = 3.0V
High Voltage Resistant IO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{IL}	Low-Level Input Voltage	-0.3	–	0.3* IOVDD	V	IOVDD = 3.0V
V _{IH}	High-Level Input Voltage	0.7* IOVDD	–	+5V	V	IOVDD = 3.0V

GPIO & High Voltage Resistant IO output characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V _{OL}	Low-Level Output Voltage	-	-	0.1* IOVDD	V	IOVDD = 3.0V
V _{OH}	High-Level Output Voltage	0.9* IOVDD	-	-	V	IOVDD = 3.0V
Resistant IO output characteristics						
Symbol	Parameter	GPIO	Typ	Unit	Test Conditions	
V _{OL}	0.1*IOVDD Drive current	P00~P07 P13~P17	HD=0 : -3.5 HD=1 : -33	mA	IOVDD = 3.0V	
		P10~P11 P24	-10			
V _{OH}	0.9*IOVDD Drive current	P00~P07 P13~P17	HD=0 : 3.5 HD=1 : 10	mA	IOVDD = 3.0V	
		P10~P11 P24	8.5			

3.8 Internal Resistor Characteristics

Table 3-8

Port	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
P00~P07,P10~P11,P13~P17,P24	10K	10K	1. P15 default pull up 2. P00 default pull down 3. Internal pull-up/pull-down resistance accuracy ±20%

4 Package Information

4.1 QFN24_4×4mm

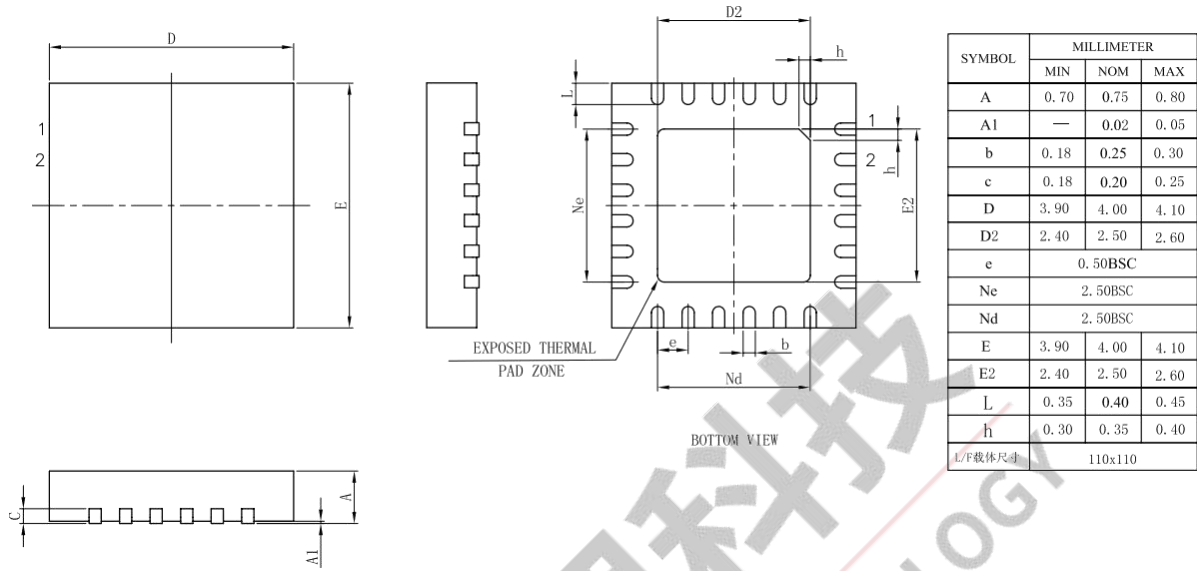
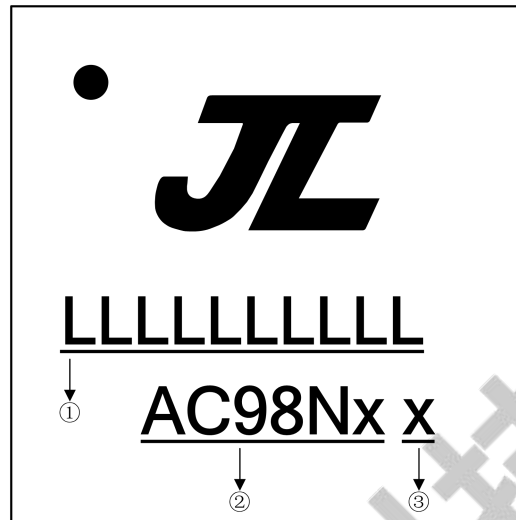


Figure 4-1 AC981A Package

5 IC Marking Information



- ① LLLLLLLLLL : Production Batch
- ② AC98Nx : Chip Model
- ③ Built-in flash size
0: No Flash Memory
1: 1Mbit Flash

6 Solder-Reflow Condition

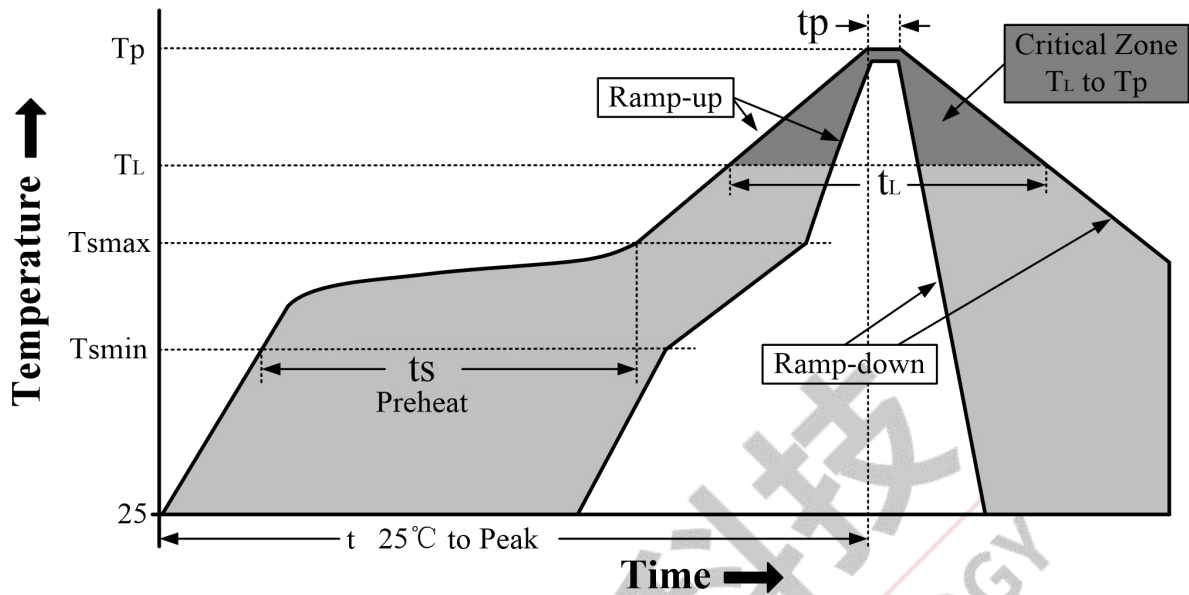


Figure 6-1 Classification Reflow Profile

Classification Profiles

Table 6-1

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)		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.

Note 2: Time within 5°C of actual peak temperature (t_p) specified for the reflow profiles is a “supplier” minimum and “user” maximum.

SnPb - Classification Temperature

Table 6-2

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

Pb-free - Classification Temperature **Table 6-3**

Package Thickness	Volume mm³ < 350	Volume mm³ 350 - 2000	Volume mm³ > 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



7 Revision History

Date	Revision	Description
2023.03.15	V1.0	Initial Release.
2023.04.07	V1.1	Electrical Characteristics modification
2023.07.25	V1.2	Increase Boost efficiency curve

