Product Datasheet
ECK31-T13SA Core Board



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Product Overview

1.1.Product Introduction

Ebyte ECK31-T13SA series core board is carefully designed based on Allwinner T113 -S series processor. It is a low-cost, low-power, cost-effective, and highly reliable domestic ally produced industrial embedded core board with stamp hole connection. It can be widel y used in industrial control, HMI, IoT and other fields.

Allwinner T113-S3 is an advanced application processor designed for the automotive a nd industrial control markets. The T113-S processor is composed of three heterogeneous pr ocessors: dual-core ARM Cortex - A7 , RISC-V and HiFi4 DSP, which can provide users with efficient computing power. The T113-S series processors support full-format decodin g such as H.265, H.264, H.263, MPEG-1/2/4, JPEG, etc. The encoder can encode JPEG o r MJPEG format up to 1080@60fps. The T113-S series processors have rich interfaces RG B*1, LVDS*2, MIPI DSI*1, Parallel CSI*1, DAC*2, ADC*3, I2S/PCM*2, USB*2, SDIO* 3, Ethernet*1, TWI*4, UART*6, SPI*2, PWM*8, GPADC*1, TPADC*4, CAN*2, etc.

The ECK31-T13SA series core board includes 4 specific product models, which are d esigned with domestically produced devices. They mainly differ in memory capacity, storag e configuration, etc. Customers can choose the appropriate model according to their needs. For product selection, please refer to the product selection section.

The physical picture of the ECK31-T13SA series core board (without components on the bottom of the product) is as follows:



Core board physical image

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1.2.Features

1. Processor: Allwinner T113-S series processor:
   - Dual-core ARM Cortex-A7, up to 1.2GHz;
   - RISC-V (not supported by T113-S3 processor);
   - HiFi4 DSP ;
2. The processor integrates DDR3 SDRAM, with 128MB/256MB capacity optional;
3. On-board storage: 8GB eMMC or 256MB SPI NAND FLASH optional;
4. Video Output:
   - 1 digital RGB, maximum support 1920×1080@60fps;
   - 1 serial RGB, maximum support 800×480@60fps;
   - 1 dual-channel LVDS, supporting up to 1920×1080@60fps;
   - 1-way 4-Lane MIPI DSI, supporting up to 1920×1200@60fps;
   - 1-channel CVBS, supporting NTSC and PAL formats;

   Note: LVDS0, LVDS1 and digital RGB pins are multiplexed, LVDS0 and MIPI DSI pins are multiplexed, and DBI and SPI1 pins are multiplexed;
5. Video Input:
   - 1 CSI, 8-bit parallel interface, maximum pixel clock 148.5MHz;
   - 2-way CVBS input, supporting NTSC and PAL formats;
6. Audio Interface:
   - Integrated Audio Codec;
   - 1 differential MIC input;
   - 1 dual-channel LINE IN input;
   - 1 dual-channel FM IN input;
   - 1-channel dual-channel Headphone output;
7. Network: 1 10/100/1000 adaptive Ethernet, integrated MAC and PHY, MDI interface;
8. USB: 1-channel USB2.0 DRD, 1-channel USB2.0 HOST;
9. SMHC: Integrates 3 SMHC controllers and leads 1 SDC0 to the stamp hole;
10. 1-channel I2S/PCM, supporting full-duplex;

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11.1-way DMIC, supports up to 8 channels, sampling rate 8KHz~48KHz;

12.1-channel OWA, compatible with S/PDIF protocol;

13.6-channel UART, software compatible with 16450/16550 controller, maximum baud rate 4Mbps;

14.2-way SPI, 1 way is led out to stamp hole , supporting SPI and DBI mode;

15.4-channel TWI, compatible with I2C bus standard, supporting standard mode (100K bps) and high-speed mode (400Kbps);

16.1 CIR, 1x CIR TX interface, 1x CIR RX interface;

17.8- channel PWM, maximum output frequency 24/100MHz, support PWM output and input capture;

18.2-channel GPADC, 12-bit resolution, maximum sampling rate 1MHz;

19.4-channel TPADC, 12-bit resolution, maximum sampling rate 1MHz, support 4-wire resistive touch screen;

20.1 LEDC, supports 1024 LEDs in series, with a maximum data transmission rate of 800Kbps;

21.2 CAN (CAN0, CAN1), supporting CAN 2.0A and CAN 2.0B protocols;

22.3-way JTAG, including ARM, RISC-V and HiFi4 DSP JTAG;

23.Supports up to 50 GPIOs and GPIO interrupt input;

24.Interface form: 116-pin stamp hole, spacing 1.0mm;

25.Power supply: single-channel DC +5V±10%@0.5A power input;

26.Dimensions: 35×29×3.0mm;

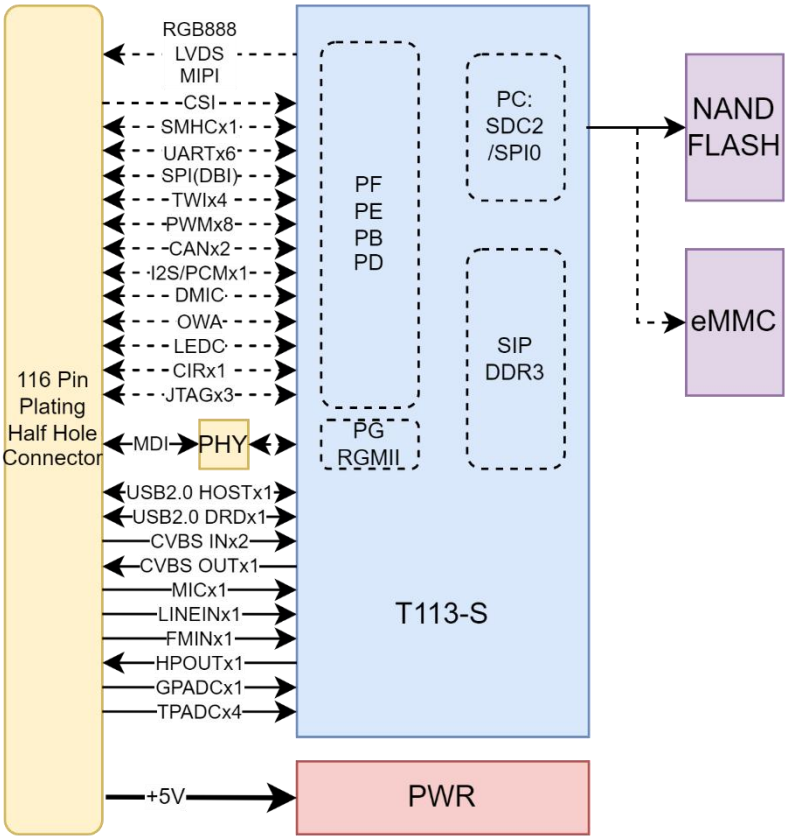
27.Working temperature: -25℃-85℃;

28.PCB technology: 6-layer board design, immersion gold, lead-free technology;

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1.3.Core board functional block diagram



Core board functional block diagram

1.4.Typical applications

- Smart home;
- Smart toys;
- Smart cities;
- Tablet PC;
- IoT gateway;
- Advertising all-in-one machine;
- Industrial all-in-one PC;
- Industrial ControlMotherboard;
- Robots and drones.

1.5. Matching single-board computer

Ebyte has launched the cost-effective single-board computer ECB31-P4T13SA2ME8G based on the Allwinner T113-S series processor. The single-board computer consists of a c

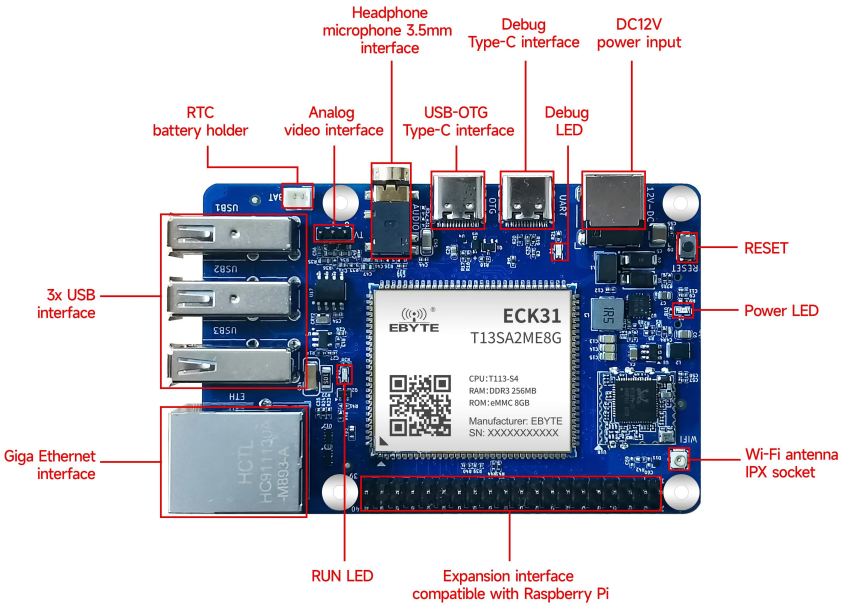
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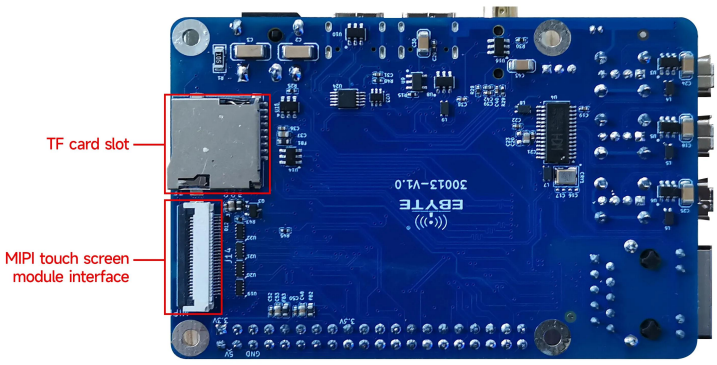
ore board ECK31-T13SA2ME8G and a baseboard. The core board and the baseboard are combined using a stamp hole soldering method, and their form factor is compatible with Raspberry Pi. Its design level is higher than that of ordinary development boards, and it c an be used in batches in industrial scenarios.

Ebyte provides stable and reliable hardware reference designs and a comprehensive so ftware development environment for single-board computers, which can help users efficientl y verify the functions of core boards, significantly improve development efficiency, shorten the development cycle, optimize design quality, and thereby accelerate the product researc h and development process and the pace of market launch.

The functional diagram of the single-board computer is as follows:



Front panel function diagram



Backplane Function Description Diagram

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2. Product Selection

2.1.Model Configuration

The ECK31-T13SA series core board selection and configuration table is as follows:

Core Board Product Selection and Configuration Table

Serial Number	Product Model	Processor Model	Memory	Storage	Operating temperature
1	ECK31-T13SA 1MN2M	T113-S3	128MB DDR3	256MB NAND	Wide temperature grade -25℃ ~ 85℃
2	ECK31-T13SA 1ME8G	T113-S3	128MB DDR3	8GB eMMC	Wide temperature grade -25℃ ~ 85℃
3	ECK31-T13SA 2MN2M	T113M4020DC0	256MB DDR3	256MB NAND	Wide temperature grade -25℃ ~ 85℃
4	ECK31-T13SA 2ME8G	T113M4020DC0	256MB DDR3	8GB eMMC	Wide temperature grade -25℃ ~ 85℃

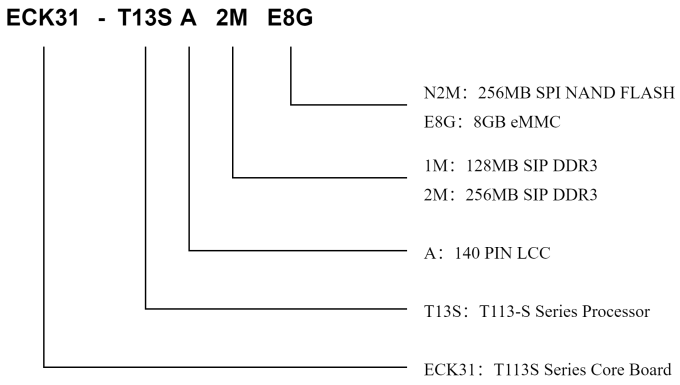
The selection and configuration table for the ECB31-P4T13SA series single-board computers is as follows:

Single-board computer product selection and configuration table

Serial Number	Product Model	Core board model	Memory	storage	Operating temperature
1	ECB31-P4T13SA2ME8G	ECK31-T13SA2ME8G	128MB DDR3L	256MB NAND FLASH	Wide temperature grade -25℃ ~ 85℃

2.2.Model code

The core board product model code explanation is shown in the following figure:

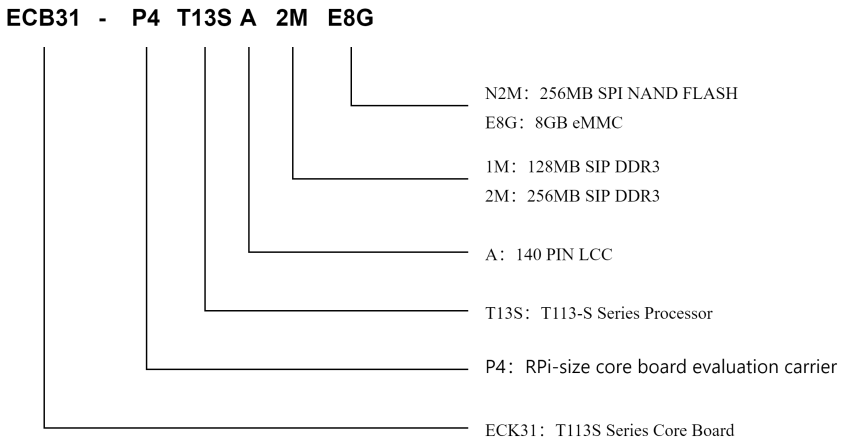


Core board model code explanation

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The product model coding explanation for single-board computers is shown in the foll owing figure:



Single-board computer model coding explanation

3. Functions and parameters

3.1.Core board product functions

The ECK31-T13SA series core board mainly integrates the processor, memory, storage and power system, and leads out all the I/O pins on the processor. Users can design the baseboard to apply the I/O resources on the core board according to their needs and reus e the I/O into the functions they need.

The following table lists the main function parameters of the ECK31-T13SA series co re board integrated on the board, and the function parameters of the reusable I/O resource s. The description of each I/O function is the maximum indicator that the core board can use the I/O function without using other I/O functions (for example, after using the 24-bi t color RGB interface function and the network interface function, all UART functions can not be realized).

Core Board Product Function Table

Function	Quantity	Functional Description
CPU	1	T113-S3 or T113M4020DC0; Dual-core ARM Cortex-A7@1.2GHz; RISC-V CPU (T113-S3 not supported); HiFi4 DSP;
MEM	1	T113-S3 SIP DDR3 128MB or T113M4020DC0 SIP DDR3 256MB;
FLASH	1	On-board 8GB eMMC / on-board 256MB SPI NAND FLASH optional;

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Video Output	1	RGB interface with DE/SYNC mode, up to 1920 x 1080@60fps; serial RGB/dummy RGB interface, up to 800 x 480@60fps; LVDS interface with dual link, up to 1920 x 1080@60fps; LVDS interface with single link, up to 1366 x 768@60fps ; 4 lane MIPI DSI, up to 1920 x 1200@60fps; i8080 interface, up to 800 x 480@60fps; BT 656 interface for NTSC and PAL;
Video Input	1	8 bit digital camera interface, Maximum pixel clock of 148.5 MHz; 2 channel CVBS input and 1 channel CVBS decoder;
Audio Codec	1	One stereo headphone output: HPOUTL/R ; One differential microphone input: MICIN3P/3N; One stereo LINE IN input: LINEINL/R; One stereo FM IN input: FMINL/R;
I2S/PCM	1	I2S/PCM interfaces (I2S2);
DMIC	1	maximum 8 digital PDM microphones, sample rate from 8 kHz to 48 kHz;
OWA	1	OWA TX, Compliance with S/PDIF interface;
SMHC	1	The SMHC0 controls the devices that comply with the protocol Secure Digital Memory (SD mem version3.0);
USB DRD	1	USB 2.0 DRD (USB0), with integrated USB 2.0 analog PHY;
USB HOST	1	USB 2.0 HOST (USB1), with integrated USB 2.0 analog PHY;
GbE	1	10/100/1000 Mbit/s Ethernet(MAC+PHY) port with Media Dependent Interface(MDI);
UART	6	Compatible with industry standard 16450/16550 UARTs, Speed up to 4 Mbit/s;
SPI	1	Supports SPI mode and display bus inter face (DBI) mode; SPI mode Master/slave configurable; DBI mode Maximum resolution of RGB666 240 x 320@30Hz;
TWI(I2C)	4	Compliant with I2C bus standard, up to 400 kbit/s, supports master mode or slave mode;
CIR_RX	1	CIR_RX interface , Sample clock up to 1 MHz;
CIR_TX	1	CIR_TXinterface ;
PWM	8	Supports PWM channels or capture input; Various duty cycle: 0% to 100% ; Output frequency range: 0 to 24 MHz or 100 MHz;
GPADC	1	Successive approximation register (SAR) analog to digital converter (ADC) ; 12 bit sampling resolution and 8 bit precision ; Maximum sampling frequency up to 1 MHz ;
TPADC	4	Supports 4 wire resistive touch panel input detection ; 12 bit SAR type A/D converter; Configurable sample frequency up to 1 MHz;
LEDC	1	LEDC is used to control the external intelligent control LED lamp; Maximum 1024 LEDs serial connect; LED data transfer rate up to 800 kbit/s;

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CAN	2	Supports the CAN 2.0A and 2.0B protocol specification;
JTAG	3	ARM , RISC-V , HiFi4 DSP JTAG ;
GPIO	50	Supports GPIO, Supports Interrupt input;

Note:

SIP: System in Package.

OWA: One Wire Audio .

TWI: Two Wire Interface.

3.2.Single-board computer product functions

Single-board computer product function table

Power Input	12V_1A DC input	
Processor	Allwinner T113-S processor: Dual Arm Cortex-A7 core, 1.2GHz; RISC-V; HiFi4 DSP, 1.2GHz;	
Storage	Memory	512MB, DDR3;
	FLASH	8GB, eMMC;
Display	1-way 26-pin FPC MIPI display interface, supports 4-lane, maximum resolution supports 1080P (1920×1080@60fps), supports touch screen; 1 CVBS output, supporting NTSC and PAL formats; 1 CVBS input, supporting NTSC and PAL formats;	
USB HOST	3-way USB2.0 HOST;	
USB OTG	1-way USB OTG, Type-C interface type;	
Network port	1 10/100/1000M adaptive RJ45 Ethernet port;	
WiFi	1 -way 2.4G & 5G Wi - Fi ;	
TF	1 TF card slot, supports plug-in detection ;	
Audio	1 3.5mm audio interface, supporting headphone output and microphone input;	
Debug	1 debug serial port , Type-C interface type ;	
CAN	2-way CAN interface, TTL level, extended interface lead-out ;	
GPIO	28 GPIOs, multiplexed with some functions, extended interface leads ;	
Serial Port	1 UART communication serial port, TTL level , extended interface lead out ;	
I2C	2-way I2C, expansion interface lead out ;	
Button	1 reset button;	
LED	1 power indicator light ; 1 operation indicator light ; 1 debugging indicator light ;	
Watchdog	Support on-chip watchdog function ;	
RTC	1-way 1.25mm RTC battery holder;	
Power Output	2- way 5V 1A power output, extended interface lead out ; 2- way 3.3V 1A power output, extended interface lead out ;	

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3.3.Environmental characteristics

Environmental Characteristics Table

Operating temperature	-25℃ ~ 85℃;
Storage temperature	-40℃ ~ 85℃;
Operating humidity	5%–95% humidity, non-condensing;
Storage humidity	60℃@95% humidity, non-condensing;

3.4.Power consumption

Note: The following parameters are measured on the ECK31-T13SA1MN2M core board at room temperature. The measured power consumption does not include the baseboard power consumption. When measuring the heavy-load power consumption, the memory and FLASH test programs are run, without display, baseboard SDIO access, and network access. Factors such as test methods, usage functions, and ambient temperature will affect power consumption. The following power consumption data is for reference only.

Power consumption meter

Power Status	Test environment	Supply voltage	Current	Power consumption
BOOT	UBOOT	5.0V	0.194A	0.97W
PWRUP	Login	5.0V	0.159A	0.80W
PWRUP	Full load	5.0V	0.312 A	1.56W
SLEEP	Freeze	5.0V	0.0 85 A	0.43W
SLEEP	Mem	5.0V	0.0 47 A	0.24W

4. Software resource

The ECK31-T13SA series core board is equipped with an operating system based on the Linux 5.4.61 kernel. The development board comes with the cross-compilation tool chain required for embedded Linux system development, U-boot source code, Linux kernel and driver module source code, as well as various development and debugging tools suitable for Windows desktop environment and Linux desktop environment.

operating system:

Ubuntu 18.04 system

System source code:

u-boot 2018.07

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Kernel 5.4.61

Buildroot 201902

Buildroot 202205

O penwrt

Development environment and tools:

USB burning tool: PhoenixSuit

SD card burning tool: PhoenixCard

4.1.System Resources

System Software Resource Table

Item	Name	Description	Source code
SPL	spl-pub	Boot0, boot uboot	<SDK>/ brandy/brandy-2.0/spl-pub /
BOOT	u-boot 2018.07	Bootloader	<SDK>/brandy/brandy-2.0/u-boot-2018/
Kernel	Kernel 5.4.61	Linux Kernel	<SDK>/kernel/linux-5.4/
Device Driver	Audio	Built-in audio driver	sound/soc/sunxi_v2/*
	AWlink	CAN Driver	drivers/net/can/sunxi_awlink.c
	GMAC	Built-in MAC driver	drivers/net/ethernet/allwinner/sunxi-gmac.c
	GPADC	GPADC Driver	drivers/input/sensor/sunxi_gpadc.c
	GPIO	GPIO Driver	drivers/pinctrl/sunxi
	LCD	Disp2 display driver	drivers/video/fbdev/sunxi/disp2/disp/lcd/
	LRADC	Button module driver	drivers/input/keyboard/sunxi-keyboard.c
	SMHC	MMC Driver	drivers/mmc/host/sunxi-mmc.c
	SPI	SPI Driver	drivers/spi/spi-sunxi.c
	SPI-NAND	SPI-NAND Driver	drivers/mtd/awnand/spinand
	TVD	CVBS Input	drivers/media/platform/sunxi-tvd/
	TVE	CVBS output	drivers/video/fbdev/sunxi/disp2/tv/
	TWI	I2C Driver	drivers/i2c/busses/i2c-sunxi.c
	UART	Serial port driver	drivers/tty/serial/sunxi-uart.c
	VIN	CSI Driver	drivers/media/platform/sunxi-vin/
operating system	Buildroot 201902	Buildroot 201902	<SDK>/buildroot/buildroot-201902
	Buildroot 202205	Buildroot 202205 version	<SDK>/buildroot/buildroot-202205
	openwrt	openwrt	<SDK>openwrt/openwrt
Developmen t Tools	PhoenixSuit	USB burning tool	/tools/ PhoenixSuit
	PhoenixCard	SD card burning tool	/tools/PhoenixCard

5. Structural dimensions

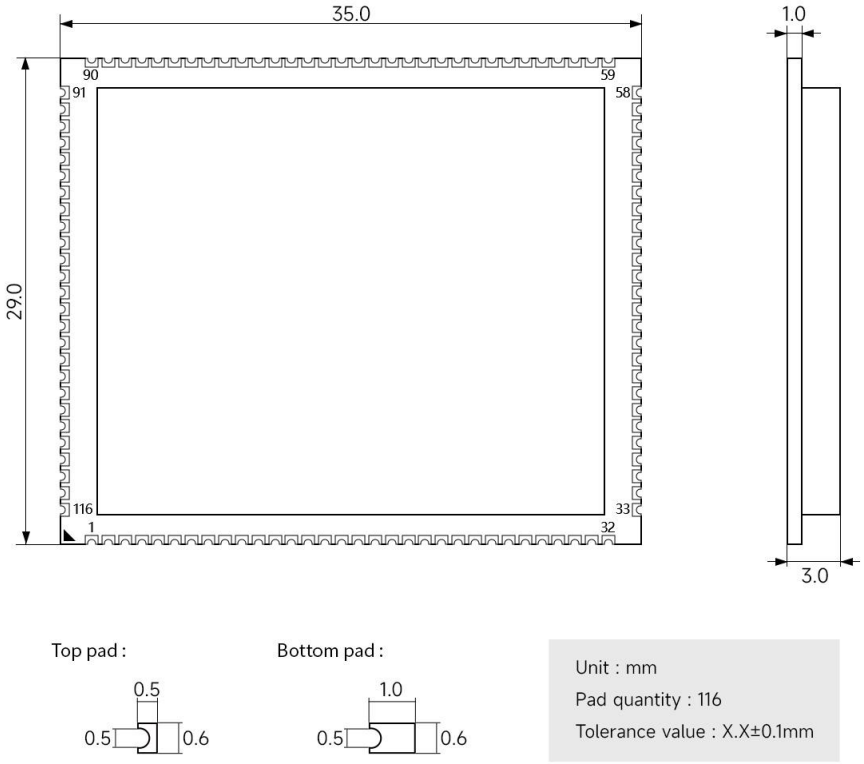
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5.1.Core board structural dimensions

The ECK31-T13SA series core board adopts 116 PIN, 1.0mm pitch stamp hole interface, which can be STM soldered or hand soldered. There are no components and exposed traces on the bottom of the core board, and the bottom board design is simple. The core board structure size is shown in the figure below.

The ECK31-T13SA series core board has a length of 35.0mm and a width of 29.0mm, with its structural dimensions shown in the following figure. The unit of the following dimensions is millimeters (mm), the structural dimension tolerance is ±0.1mm, and the PCB thickness tolerance is 10%.

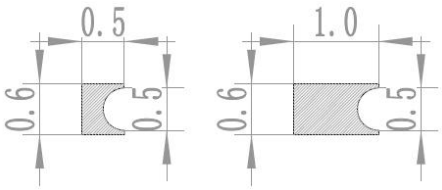


Core board structural dimensions

The dimensions of the castellated hole pads on the bottom surface of the ECK31-T13SA series core boards are shown in the following figure. The units of the following dimensions are millimeters (mm).

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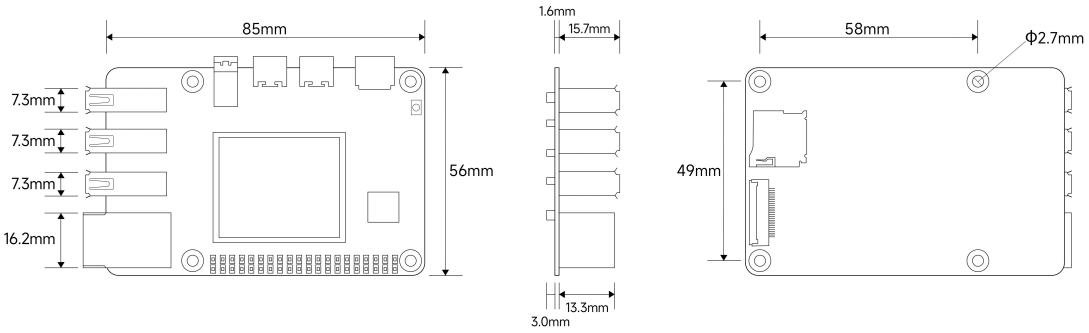
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Core board pad size diagram

5.2.Single-board computer structure dimensions

The ECB31-P4T13SA single board has a length of 85.0mm and a width of 56.0mm, which is compatible with the size of the Raspberry Pi board. The structural dimensions ar e shown in the following figure. The unit of the following dimensions is millimeters (m m), the tolerance of structural dimensions is ±0.1mm, and the tolerance of PCB thickness is 10%.



Single-board computer structural dimension diagram

6. core board welding instructions

6.1.Reflow soldering temperature

Reflow profile characteristics		Leaded process assembly	Lead-free assembly
Preheating/keeping	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin~Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL~Tp)		3℃/sec, max.	3℃/sec, max.
Liquidus temperature (TL)		183℃	217℃
Keep time above TL		60~90 seconds	60~90 seconds
Package peak temperature Tp		Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.	Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.

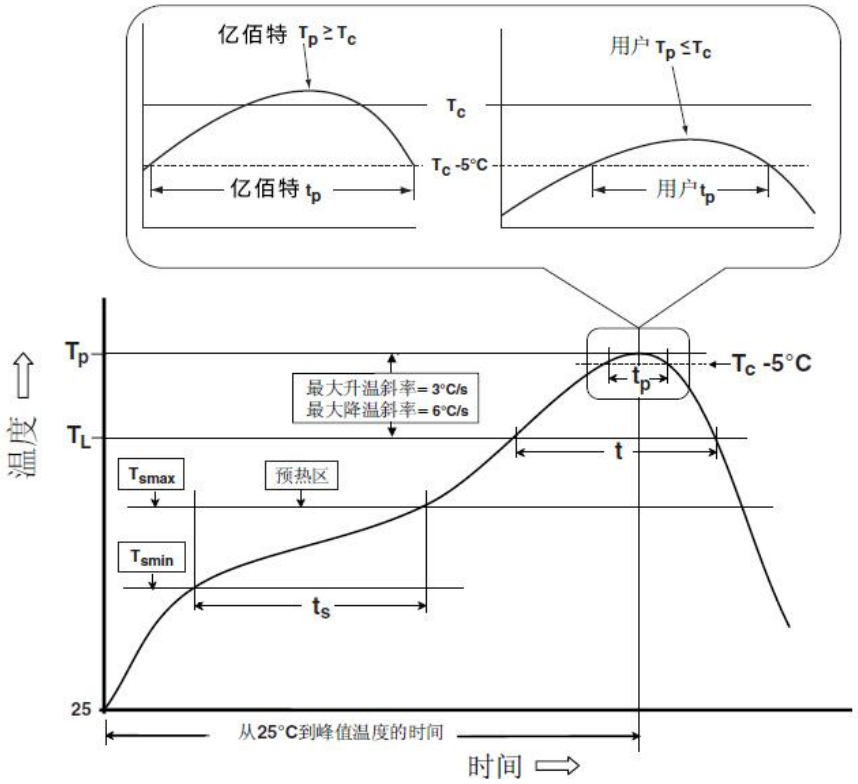
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The time (Tp) within 5°C of the specified classification temperature (Tc) is shown in the figure below.	20 seconds	30 seconds
Cooling slope (Tp~TL)	6℃/sec, max.	6℃/sec, max.
Time from room temperature to peak temperature	6 minutes, longest	8 minutes, longest
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user		

Reflow soldering temperature gauge

6.2.Reflow soldering curve



Reflow soldering curve

7. Revision Notes

Revision Notes

Version	Modifications	Modified time	prepared by	Proofreading	Approval
V1.0	First draft	26-01-08	WFX	WJ	WFX

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