

# Compact 31S Hardware Manual



**Boardcon Technology Limited**  
[www.boardcon.com](http://www.boardcon.com)

## **1. Introduction**

### **1.1. About this Manual**

This manual is intended to provide the user with an overview of the board and benefits, complete features specifications, and set up procedures. It contains important safety information as well.

### **1.2. Feedback and Update to this Manual**

To help our customers make the most of our products, we are continually making additional and updated resources available on the Boardcon website ([www.boardcon.com](http://www.boardcon.com) , [www.armdesigner.com](http://www.armdesigner.com)).

These include manuals, application notes, programming examples, and updated software and hardware. Check in periodically to see what's new!

When we are prioritizing work on these updated resources, feedback from customers is the number one influence, If you have questions, comments, or concerns about your product or project, please no hesitate to contact us at [support@armdesigner.com](mailto:support@armdesigner.com).

### **1.3. Limited Warranty**

Boardcon warrants this product to be free of defects in material and workmanship for a period of one year from date of buy. During this warranty period Boardcon will repair or replace the defective unit in accordance with the following process:

A copy of the original invoice must be included when returning the defective unit to Boardcon. This limited warranty does not cover damages resulting from lightning or other power surges, misuse, abuse, abnormal conditions of operation, or attempts to alter or modify the function of the product.

This warranty is limited to the repair or replacement of the defective unit .In no event shall Boardcon be liable or responsible for any loss or damages, including but not limited to any lost profits, incidental or consequential damages, loss of business, or anticipatory profits arising from the use or inability to use this products.

Repairs make after the expiration of the warranty period are subject to a repair charge and the cost of return shipping. Please contact Boardcon to arrange for any repair service and to obtain repair charge information.



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# 1 Compact 31S Introduction

## 1.1 Summary

Compact 31S is an ultra compact embedded board built around the Allwinner A31s quad-core phablet processor, which is a power efficient processor adopted by many tablet PC manufacturers, such as Ramos K1, HP Compaq 7, MSI Primo81, Onda V819mini. Coupled with PowerVR SGX544MP2 GPU with eight logic core, Compact 31S enables powerful 3D computing capability as well as excellent UI experience. The compact board can drive HD resolution up to 1280x800 pixels, decode video up to 2160p, and encode video up to 1080p.

Compact 31S can hold up to 1GB DDR3, 4GB eMMC Flash. A microSD card holder on the board enables the addition of Flash memory cards.

Accommodates rich I/O interfaces in a compact system size (92 x 65mm) include USB host&OTG, Ethernet, VGA, HDMI and Audio IO, in the meanwhile, to support WiFi, camera and Irda function, the Compact 31S is an ideal development platform for experimenting and realizing "low cost" embedded applications.

Compact 31S is provided with full ready-to-run Android4.2.2/Linux3.3 packages and comprehensive documentation.

## 1.2 Allwinner A31s Features

The A31s processor is based on quad-core Cortex-A7 CPU. More importantly, A31s processor integrates a robust Audio Codec that includes two sets of I2S/PCM interface for Baseband and Bluetooth, two integrated differential analog MIC for headset and phone, as well as a digital MIC. It is capable of 3G, 2G, LTE, WiFi, Bluetooth, FM, GPS, AGPS, NFC and other voice and data wireless transmission technology with a minimum of external components.

Additionally, A31s processor provides a wide range of peripheral interfaces, For example, it integrates display interfaces such as HDMI, RGB LCD and LVDS, image input interfaces such as CSI, and data interfaces such as USB OTG, USB EHCI/OHCI, SDC, SPI, UART, etc.

Features:

- Cortex-A7 Quad-core CPU.
- Graphic engine support 3D and 2D.
- The system resources have timer, GIC, HS-Timer, DMA, RTC, CCU.
- Memory subsystem support internal boot rom and DRAM(DDR3/DDR3L/LPDDR2), NAND FLASH, SD/MMMC.
- Image signal processor
  - Support image mirror flip and rotation
  - Support thumb image generation
  - Support two channels output
  - Support valid picture size up to 4096x4096
  - Support speed up to 250M pixel/s

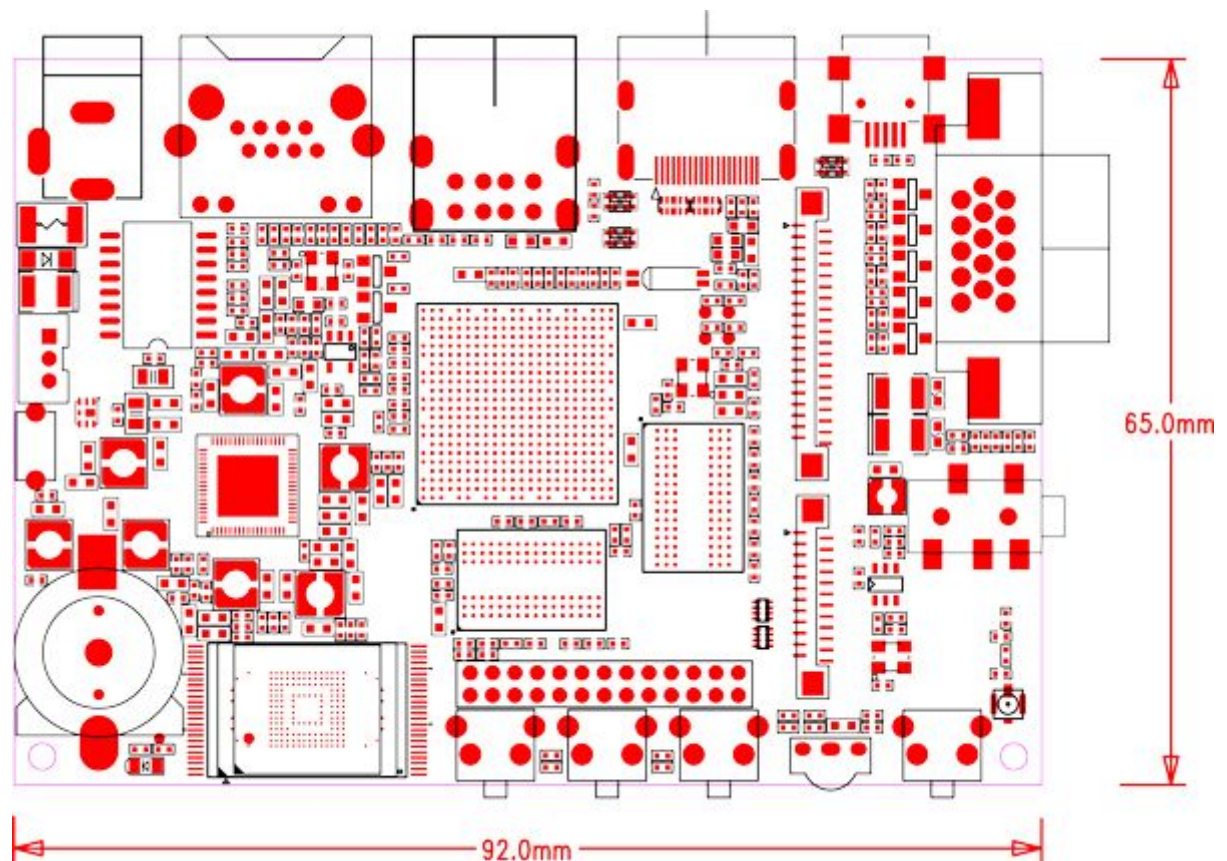
- ISP for YCbCr input
- ISP for RAW RGB input
- Video engine support decoder and encoder can work at the same time.
- Display engine
- Support dual display paths
- Ultra-scaling engine
- Support multiple image input formats
- Support alpha blending/color, key/gamma/hardware cursor
- Support video post processing
- 3D input/output format conversion and display
- Video output
- Support HDMI 1.4 1080P@60fps
- LVDS/RGB/CPU LCD interface 1280x800
- Video input support parallel 12-bit CSI
- Analog audio input
- Analog audio output
- Connectivity support USB2.0 OTG,USB EHCI/OHCI, LRADC, Digital Audio Interface, PWM, Transport stream, CIR, UART, SPI, TWI, P2WI(Push-pull TWI), one wire interface.
- Security system
- Support AES, DES, 3DES, SHA-1, MD5
- Support ECB, CBC, CNT modes for AES/DES/3DES 128-bit, 192-bit and 256-bit key size for AES
- 160-bit hardware PRNG with 192-bit seed
- Security JTAG
- Power management
- Flexible PLL clock generator and 32768HZ OSC
- Flexible clock gate and module reset
- Support DVFS for CPU frequency and voltage adjustment
- Support dynamic frequency adjustment for external DRAM controller
- Support standby mode
- Package is FBGA 460 balls, 0.8mm ball pitch, 18mm x 18mm.

## 1.3 Compact 31S Specifications

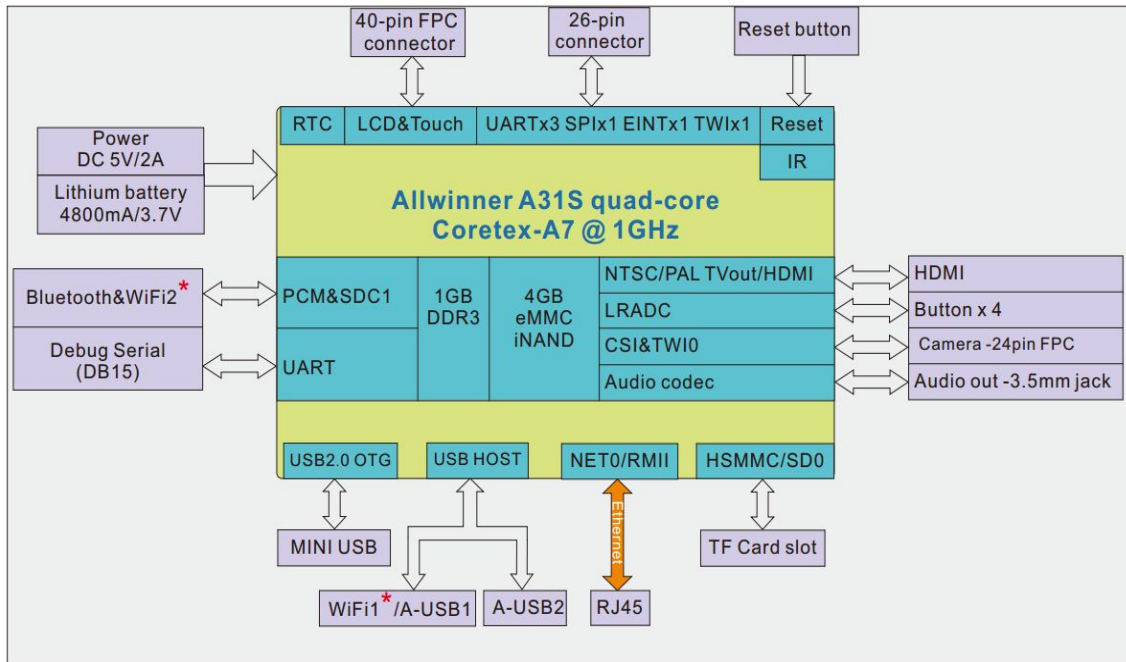
Feature	Specifications
CPU	<ul style="list-style-type: none"> <li>• ARM Cortex-A7 Quad-Core</li> <li>• 256KB L1 Cache</li> <li>• 1MB L2 Cache</li> </ul>
GPU	<ul style="list-style-type: none"> <li>• PowerVR SGX544MP2</li> <li>• Complies with OpenGL ES 2.0, OpenCL 1.x, DX 9_3</li> </ul>
Memory	1GB DDR3, 1866MHz, soldered
Flash	on-board 4GB eMMC Flash
Power	5V/2A

USB	2x USB2.0 Host, 1x USB2.0 OTG
HDMI	HDMI V1.4, 1080p@60fps
VGA	Maximum resolution 1280*800
Audio	MIC/ Phone interface
Ethernet	10/100M/1000M Ethernet, RJ45 interface
LCD	40pin FPC interface, support capacitive touch screen
RTC	Real Time Clock, powered by external lithium battery
SD card	1x TF card slot
Camera(optional)	CMOS camera interface
IrDA	Infrared remote control
User button	3x User buttons, for Volume +/-, menu
GPIO	1x 20-pin expansion connector
Dimension	100 x 72 x 20mm

## 1.4 PCB Dimension



## 1.5 Block Diagram



\* There is only one Welding position for WiFi1 / WiFi2. WiFi1 only WiFi function; WiFi2 incorporates Wi-Fi and Bluetooth into one chip.

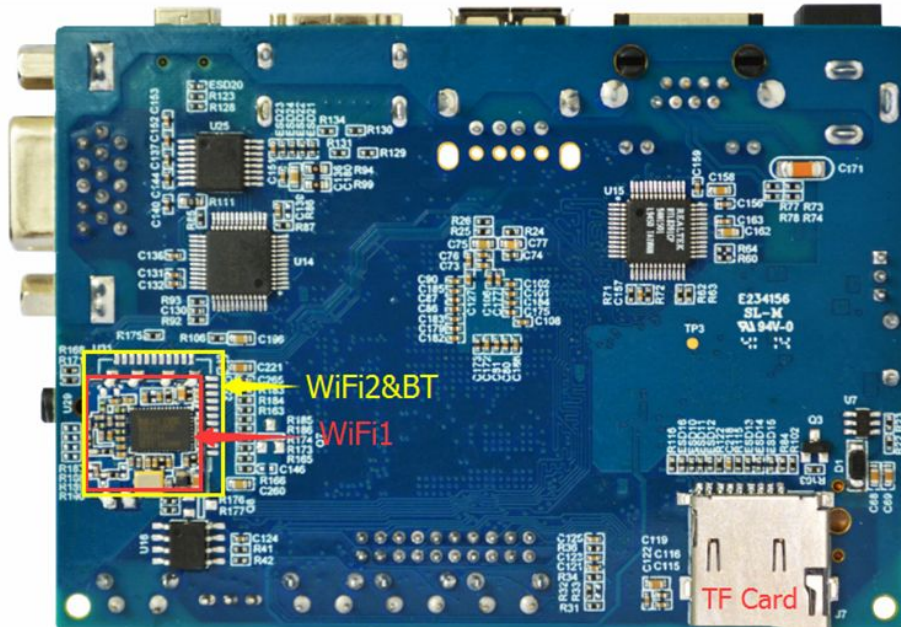
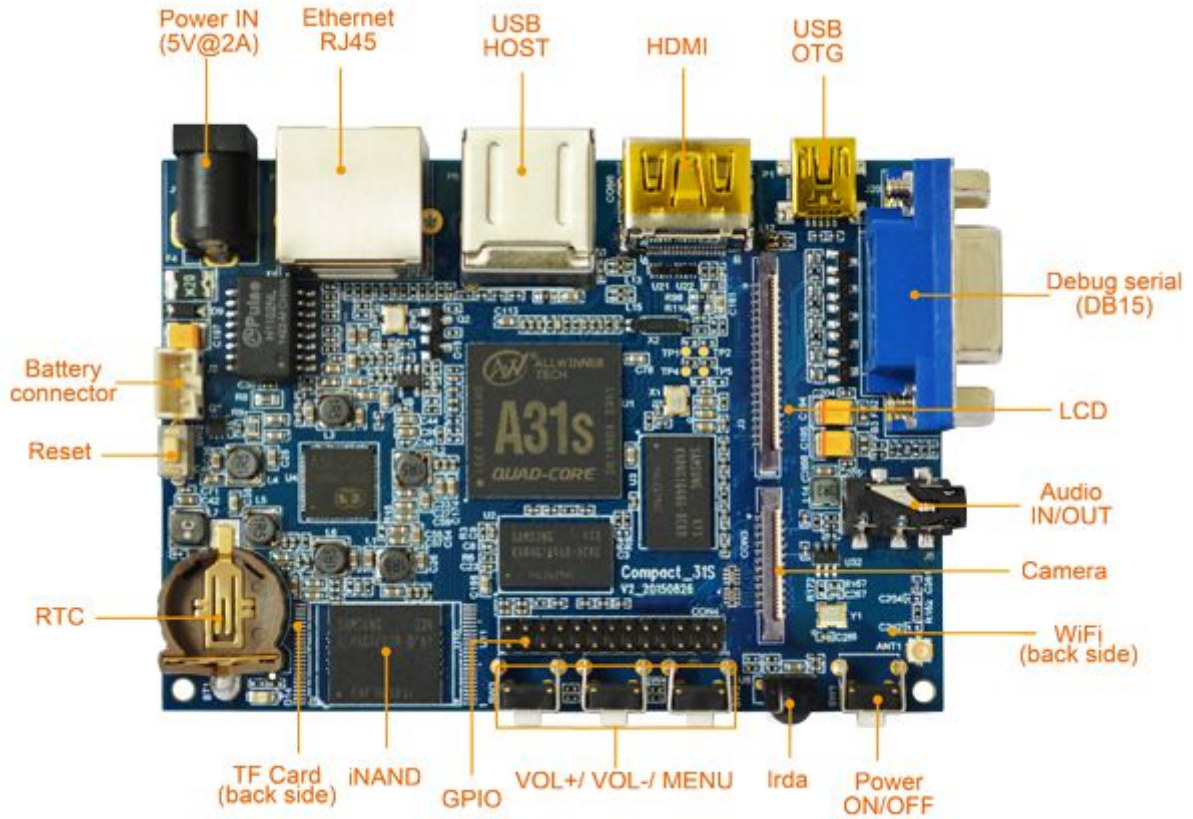
## 1.6 Motherboard Power meter

Support voltage	5v/2A				
System	Connected devices	Electric current(A)	System	Connected devices	Electric current(A)
Android 4.2.2	5v power	0.27	Android 4.2.2	Power, 7 inch capacitive screen	0.82
Android 4.2.2	Power, sd card, play 1080P video, U disk, usb Mouse, debug serial, Ethernet, 7inch capacitive LCD, headphone, OTG	1.21	Android 4.2.2	SLEEP+7inch capacitive LCD	0.5
Android 4.2.2	SLEEP+(Power, sd card, U disk, usb Mouse, debug serial, Ethernet, 7inch capacitive LCD, headphone, OTG )	0.93	Linux	Power, 7 inch capacitive screen	0.87
Linux	Power, sd card, play mp3, U disk, debug serial, Ethernet, 7inch capacitive LCD, headphone, OTG	1.03			





## 2 Peripherals Introduction

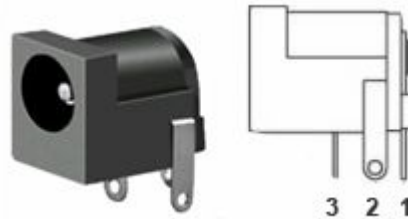




## 2.1 Power (J1&J2)

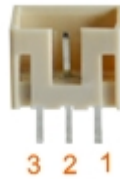
The Compact 31s supports two kinds of power input:

- Regulated DC supply (5V/2A).
- Lithium-ion polymer battery (4800mAH/ 3.7V)



### J1

Pin	Signal	Description	Pin	Signal	Description
1	VDD5V	Main power supply. DC 5V power in	2	GND	Ground
3	GND	Ground			



### J2

Pin	Signal	Description	Pin	Signal	Description
1	VBAT	Main power supply. power in, connect to U4(PIN -BATSENSE)	2	NC	Not Connect
3	GND	Ground			

## 2.2 Power Switch (SW1)

The system will automatically run after power-on.

Press SW1 will power off when the system is running; and if the system is in sleep, press SW1 will wake up.



Pin	Signal	Description	Pin	Signal	Description
1	PWRON	Power on	2	GND	Ground

3	GND	Ground	4	GND	Ground
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## 2.3 Ethernet (P7)

Compact 31s incorporates a full-featured 10/100M Ethernet interface. The platform adopts RTL8201CP as the Ethernet chip.

Features:

- 10/100 BASE-T IEEE 802.3 compliant
- IEEE 802.3u compliant Auto-Negotiation
- Integrated IEEE 1588 time stamping module (inside the MAC).
- Automatic channel swap (ACS)
- Full- and Half-duplex
- Automatic MDI/MDIX crossover
- Automatic polarity correction
- Activity and speed indicator LED controls
- User can set a fixed IP or automatically obtain IP



Pin	Signal	Description	Pin	Signal	Description
1	TXP	Net data send +	2	TXN	Net data send -
3	RXP	Net data receive +	4	TXC/RXC	Connect to R77
5	TXC/RXC	Connect to R77	6	RXN	Net data receive -
7	TXC/RXC	Connect to R78	8	TXC/RXC	Connect to R78
9	LED0	Connect to LED0 Detect link	10	VCC-E TH	ETH power
11	GND	Ground	12	LED3	Connect to LED3 Detect speed
13	GND	Ground	14	GND	Ground

## 2.4 USB HOST (P6)

The Compact 31s supports type A Double-USB2.0 Host work in High Speed (480Mbps), Full Speed

(12Mbps) and Low Speed (1.5Mbps) modes. The HOST is used to connect USB mouse, U disk and other USB devices, hot-plug is supported.

**Note:** Host2 is always available; Host1 is optional (multiplex with WiFi1).

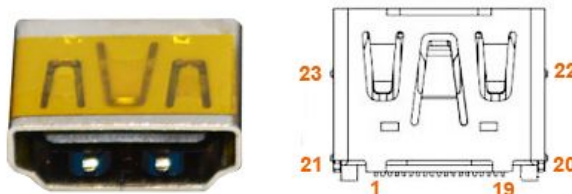


Pin	Signal	Description	Pin	Signal	Description
1	USB-5V	USB Power. DC 5V	2	USB-DM2	USB host port 2 negative data
3	USB-DP2	USB host port 2 positive data	4	GND	Ground
5	USB-5V	USB Power. DC 5V	6	USB-DM1	USB host port 1 negative data
7	USB-DP1	USB host port 1 positive data	8	GND	Ground
9	NC	Not Connect	10	GND	Ground
11	NC	Not Connect	12	GND	Ground

## 2.5 HDMI (CON6)

Compact 31s supports HDMI v1.4,1080p@60fps at 60Hz high-definition digital output, and it also enables audio video synchronization output. The HDMI interface is the regular 19pins HDMI type A, with width 13.9mm and thickness 4.45mm.

The Compact 31s supports HDMI and LCD synchronous display.



Pin	Signal	Description	Pin	Signal	Description
1	HTX2P	hdmi data 2 pair	2	GND	Ground
3	HTX2N		4	HTX1P	hdmi data 1 pair
5	GND	Ground	6	HTX1N	
7	HTX0P	hdmi data 0 pair	8	GND	Ground
9	HTX0N		10	HTXCP	hdmi clock pair

11	GND	Ground	12	HTXCN	
13	NC	Not Connect	14	NC	Not Connect
15	HSCL	VESA Data Display Channel clock signal	16	HSDA	VESA Data Display Channel data signal
17	GND	Ground	18	HDMI_5V	VDD 5V/GND
19	HHPD	Hot Plug Detect signal, 5V tolerant			

## 2.6 USB OTG (P1)

The OTG is used as USB Device by default. Compact 31s supports download code via USB OTG (USB0).

Features:

- Supports USB 2.0 High Speed (480Mbps), Full Speed (12Mbps) and Low Speed (1.5Mbps) operation in host mode
- Supports USB 2.0 High Speed (480 Mbps) and Full Speed (12 Mbps) operation in device mode.
- Hardware support: OTG signaling, session request protocol, and host negotiation protocol



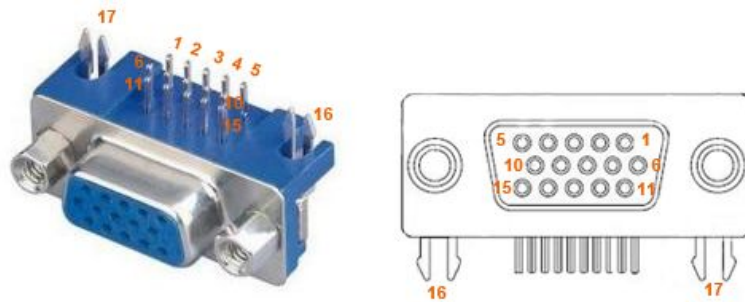
Pin	Signal	Description	Pin	Signal	Description
1	NC	Not connect	2	USB-DM0	USB OTG negative data 0
3	USB-DP0	USB OTG positive data 0	4	USB0-IDDET	USB OTG ID signal
5	GND	Ground	6	NC	NOT CONNECT
7	NC	NOT CONNECT	8	GND	Ground
9	GND	Ground			

## 2.7 UART (J20)

The J20 is DB15 use for debug-port. It is used to input and display interactive command, view system boot information and transfer files.

J20 features:

- 32-entry FIFO for receiver and 32-entry FIFO for transmitter
- Programmable baud rate of up to 250K bit/s
- The serial port operates at RS232 voltage levels.



Pin	Signal	Description	Pin	Signal	Description
1	IOR	Red color I/O port	2	IIOG	Green color I/O port
3	IOB	Blue color I/O port	4	NC	Not connect
5	GND_VGA	Ground	6	GND_VGA	Ground
7	GND_VGA	Ground	8	GND_VGA	Ground
9	VDD-5V	5V voltage	10	GND_VGA	Ground
11	SRXD0	RS232 serial data in	12	STXD0	RS232 serial data out
13	LCD-HSYNC	Lcd line synchronization	14	LCD-VSYNC	Lcd Field synchronization
15	NC	Not connect	16	GND	Ground
17	GND	Ground			

## 2.8 Audio out (J6)

A31s processor integrates a Audio Codec, so the board is not required any additional audio converter chip.

The 3.5mm headphone supports two-channel audio output.



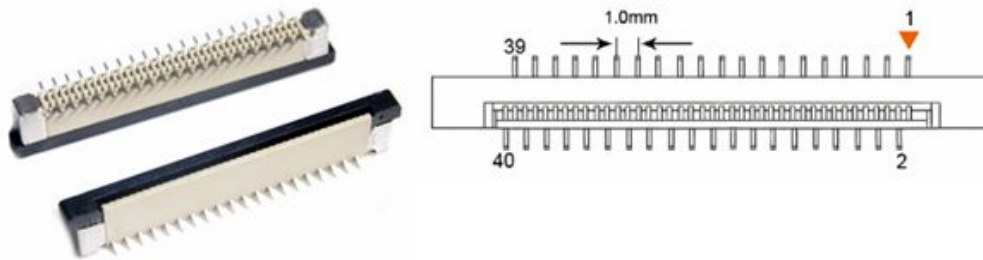
Pin	Signal	Description	Pin	Signal	Description
2	HS-MIC	HS MIC	3	EARGND	Ear ground
4	NC	Not connect	5	HPR/SPKR	Speaker right output
6	HPL/SPKL	Speaker left output			

## 2.9 LCD (J3)

Compact 31S on-board 40pin LCD interface. The board comes with driver for 7" and 10.1" capacitive LCD. User can choose other size of LCD and touch screen.



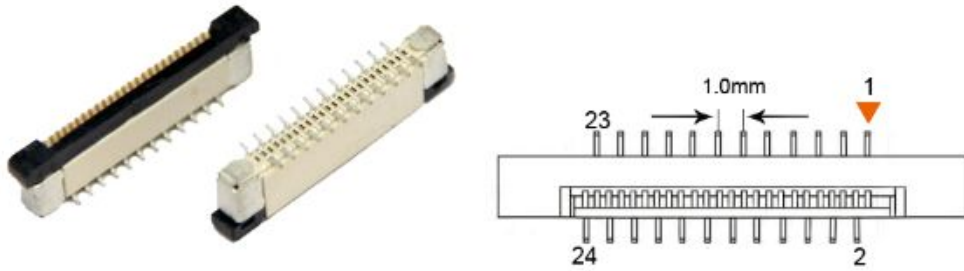
PWM control backlight is supported.



Pin	Signal	Description	Pin	Signal	Description
1	VCC-LCD	LCD POWER	2	VCC-LCD	LCD POWER
3	LCD-D0	LCD data bit 0	4	LCD-D1	LCD data bit 1
5	LCD-D2	LCD data bit 2	6	LCD-D3	LCD data bit 3
7	LCD-D4	LCD data bit 4	8	LCD-D5	LCD data bit 5
9	LCD-D6	LCD data bit 6	10	LCD-D7	LCD data bit 7
11	GND	Ground	12	LCD-D8	LCD data bit 8
13	LCD-D9	LCD data bit 9	14	LCD-D10	LCD data bit 10
15	LCD-D11	LCD data bit 11	16	LCD-D	LCD data bit
17	LCD-D13	LCD data bit 13	18	LCD-D	LCD data bit
19	LCD-D15	LCD data bit 15	20	GND	Ground
21	LCD-D16	LCD data bit 16	22	LCD-D17	LCD data bit 17
23	LCD-D18	LCD data bit 18	24	LCD-D19	LCD data bit 19
25	LCD-D20	LCD data bit 20	26	LCD-D21	LCD data bit 21
27	LCD-D22	LCD data bit 22	28	LCD-D23	LCD data bit 23
29	GND	Ground	30	BL_EN	Blue enable
31	CTP-WAKE	CTP wake	32	GND	Ground
33	LCD-DE	LCD data enable	34	LCD-VSYNC	LCD vertical synchronizing signal
35	LCD-HSYNC	LCD horizontal synchronizing signal	36	LCD-CLK	LCD clock single
37	GND	Ground	38	CTP-INT	CTP Interrupt
39	CTP-SCK	CTP clock	40	CTP-SDA	CTP data

## 2.10 Camera (CON3)

Camera (CON3) is a 1mm pitch 26-pin connector. It can be directly connected to the OV5640 module without any adapter plate. OV5640 is a color CMOS QSXGA (5 megapixel) camera module.



Pin	Signal	Description	Pin	Signal	Description
1	NC	Not connect	2	GND	Ground
3	CAM-SDA	CAM date	4	AVDD-CSI	Analog power supply for CSI
5	CAM-SCK	CAM clock	6	CAM-RESET	CAM RESET
7	CSI-VSYNC	CSI vertical SYNC	8	CAM-STBY-EN	CAM-STBY enable
9	CSI-HSYNC	CSI Horizontal SYNC	10	VDD1V8-CSI	1.8V power supply for CSI
11	VCC-CSI	Power supply for CSI	12	CSI-D11	CSI data bit 11
13	CSI-MCLK/ F-MCLK	CSI Master clock/F Master clock	14	CSI-D10	CSI data bit 10
15	GND	Ground	16	CSI-D9	CSI data bit 9
17	CSI-PCLK/ F-PCLK	CSI pixel clock/F pixel clock	18	CSI-D8	CSI data bit 8
19	CSI-D4	CSI data bit 4	20	CSI-D7	CSI data bit 7
21	CSI-D5	CSI data bit 5	22	CSI-D6	CSI data bit 6
23	NC	Not connect	24	NC	Not connect

## 2.11 Buttons (SW2/3/4/5)

On-board 1 reset key (SW2) and 3 user buttons(SW3, SW4, SW5). Press the reset key will restart the system.



### SW2

Pin	Signal	Description	P in	Signal	Description
1	PWROK/AP-R ESET	Press is PWROK (connect to ground), release is AP-RESET	2	GND	Ground



Button	Function	Button	Function	Button	Function

SW3	Volume UP	SW4	Volume DOWN	SW5	MENU
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## 2.12 GPIO (CON4)

The GPIO is a 26-pin header connector. The pins can be defined as

- Data input / output.
- Interrupt generation.

The CON4 can be expanded to I2S x 1, UART x 3, SPI x 1, EINT x 2, TWI x 1.



Pin	Signal	Description	Pin	Signal	Description
1	VCC-3V0	3V voltage	2	VCC-5V	5V voltage
3	I2S0DI	I2S0 data input	4	I2S0BCLK	I2S0 bit clock
5	I2S0LRCK	I2S0 left/right channel select clock	6	I2S0DO0	I2S0 data output 0
7	I2S0DO1	I2S0 data output 1	8	I2S0MCLK	I2S0 master clock (system clock)
9	RXD3	UART data 3 receive	10	TXD3	UART data 3 transmit
11	RXD4	UART data 4 receive	12	TXD4	UART data 4 transmit
13	RXD5	UART data 5 receive	14	TXD5	UART data 5 transmit
15	CTS5	UART data clear to send 5	16	RTS5	UART data request to send 5
17	SPI2-CLK	SPI2 clock signal	18	SPI2-CS0	SPI2 chip select signal 0
19	SPI2-MISO	SPI2 master data in, slave data out	20	SPI2-MOSI	SPI2 master data out, slave data in
21	EINT2	Interrupt 2	22	EINT1	Interrupt 1
23	TWI3-SDA	TWI3 serial data signal	24	TWI3-SCK	TWI serial clock signal
25	GND	Ground	26	GND	Ground

## 2.13 TF card (J7)

The MINI SD card is used as an external storage device generally, and it also can be used to boot system. The MMC controller interface supports up to 4-bit transfer modes. MMC is always accessible via the carrier board interface.

The compact 31s supports two boot modes:

- A. Boot from eMMC: burn image to eMMC via USB OTG
- B. Boot from SD: burn image to SD card

**Note:** Default boot from eMMC after power-on, and press SW5 will boot from SD card.



Pin	Signal	Description	Pin	Signal	Description
1	SDC0-D2	SD0/MMC0/SDIO0 data 2	2	SDC0-D3	SD0/MMC0/SDIO0 data 3
3	SDC0-CMD	SD0/MMC0/SDIO0 command signal	4	VCC-SDMMC	SDMMC POWER
5	SDC0-CLK	SD0/MMC0/SDIO0 clock	6	GND	Ground
7	SDC0-D0	SD0/MMC0/SDIO0 data 0	8	SDC0-D1	SD0/MMC0/SDIO0 data 1
9	SDC0-DET	SD0/MMC0/SDIO0 Card Detection	10	GND	Ground
11	GND	Ground	12	GND	Ground
13	GND	Ground	14	GND	Ground

## 2.14 RTC



The backup battery (3V) is used to ensure the RTC (frequency 32.768KHz) is still able to work after power off. Lithium cell model: CR1220.

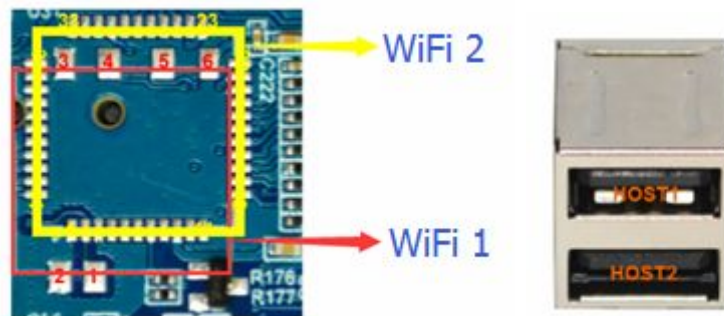
## 2.15 IR

The Compact 31s supports IR data receiver. The signals are transmitted directly to the CPU.



Pin	Signal	Description	Pin	Signal	Description
1	IR-RX	IR data receive	2	GND	Ground
3	VCC-IR	power supply for IR			

## 2.16 WiFi



There is only one Welding position for WiFi1 / WiFi2. WiFi1 only WiFi function; WiFi2 incorporates Wi-Fi and Bluetooth into one chip.

The compact31s supports only two USB host. Host2 is always available; Host1 is optional (multiplex with WiFi1). In other words, if WiFi1 is soldered, Host1 is disabled.

# 3 Product Configurations

## 3.1 Standard Contents

- Compact 31s compact board           x1
- CD-ROM (Linux BSP, Android BSP, Documents, tools, Schematic Drawing, datasheets)   x1
- Ethernet cable                           x1
- Serial Cable                             x1
- USB Cable                                x1
- 5V/2A DC power adaptor            x1





## 2 Optional Parts

- WiFi Module
- WiFi & Bluetooth Module
- Camera Module
- LCD Module (7-inch, 10.1-inch)