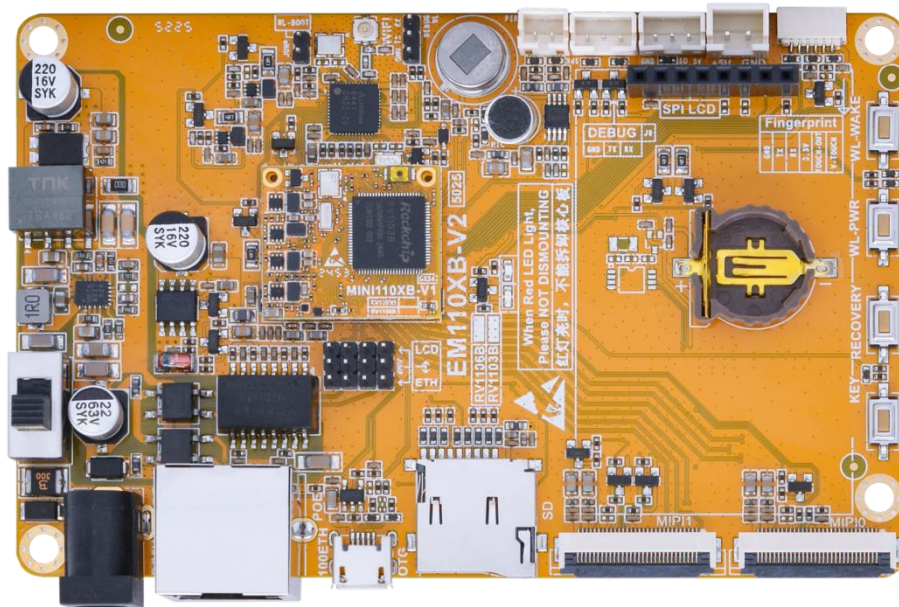


EM1103B Hardware Manual

V2.202602



Boardcon Embedded Design

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,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.

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 lighting 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 product.

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 EM1103B Introduction

1.1 Summary

The EM1103B is powered by the Rockchip RV1103B processor, featuring a 1.2GHz ARM Cortex-A7 core and 0.5 TOPS NPU computing power. It supports H.265/H.264 video encoding and offers a rich set of interfaces, including 100M Ethernet, Wi-Fi, speaker, microphone, and dual 2-lane MIPI camera inputs and more. Unique features include a fingerprint sensor interface (compatible with FPM383C modules) and an onboard PIR sensor for motion detection. The EM1103B is well-suited for AI-driven applications such as smart IP cameras, intelligent doorbells, and battery-powered IPCs.

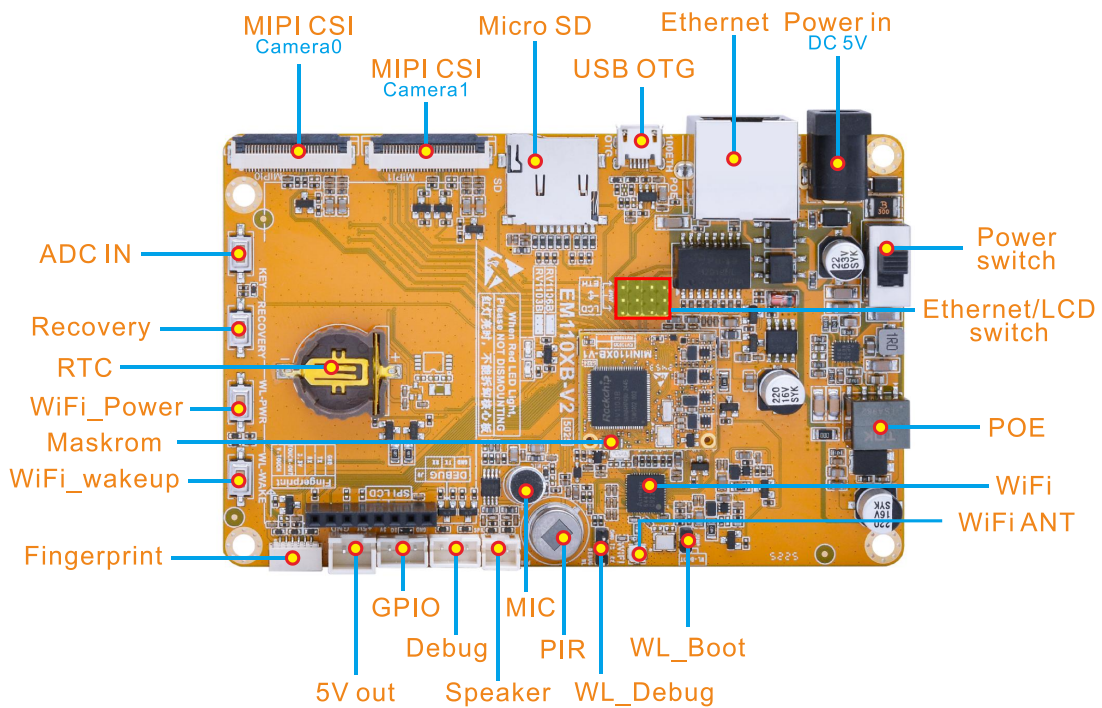
EM1103B is implemented with a MINI1103B computer-on-module providing most of the functions and interfaces. The rich feature set of EM1103B is customizable according to the price/performance needs of the target application. EM1103B contains expansion connectors which accommodate a wide range of standard peripheral devices. EM1103B is provided with full ready-to-run Linux SW packages and comprehensive user manual and designing guide.

1.2 Rockchip RV1103B Features

- **Microprocessor**
 - ARM Cortex-A7 core, 1.2GHz.
 - 32KB L1 I-Cache and 32KB L1 D-Cache.
 - Unified 128KB L2 Cache for Cortex-A7.
- **Memory Organization**
 - Embedded 128MB (up to 256MB).
 - 8GB EMMC (up to 32GB).
- **PWM**
 - Three PWM interface (PWM0-PWM2).
 - Four channel PWMs with interrupt-based operation.
 - Support continuous mode or one-shot mode.
 - Embedded 32-bit timer/counter facility.
- **Watchdog**
 - 32-bit watchdog counter.

- One Watchdog for non-secure application and one for secure application.
- **Interrupt Controller**
 - Support 128 SPI interrupt sources input.
 - Support 16 software-triggered interrupts.
- **PMU (power management unit)**
 - Support Multiple configurable work modes to save power by different frequency or automatic clock gating control or power domain on/off control.
 - Support 3 separate voltage domains: CPU_NPU_DVDD, VDD_LOGIC, VDD_PMU
- **Temperature**
 - 40~125°C temperature range and +/-5°C temperature accuracy

1.3 EM1103B Specifications

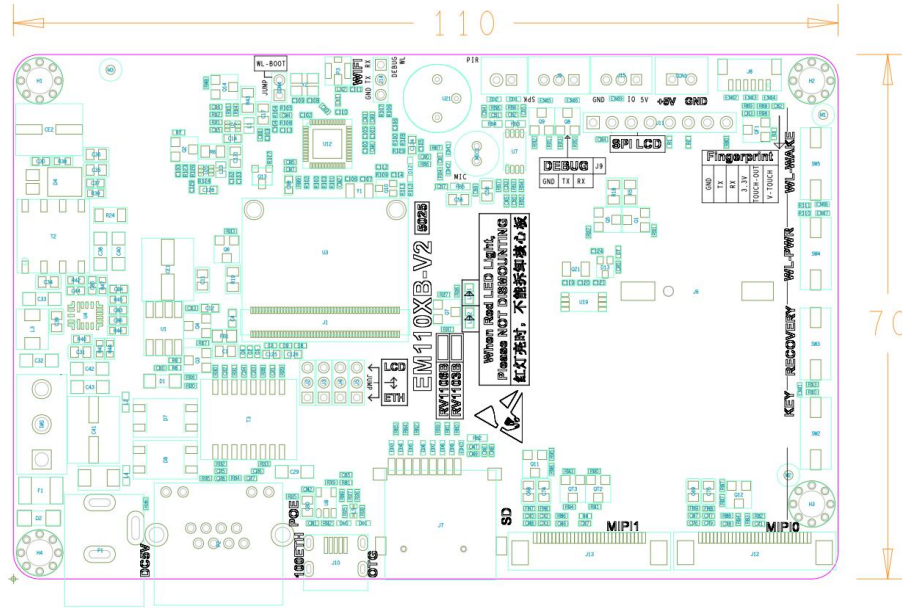


Feature	Specifications
CPU	<p>Rockchip RV1103B processor.</p> <ul style="list-style-type: none"> -ARM Cortex-A7 core, 1.2GHz -RISC-V

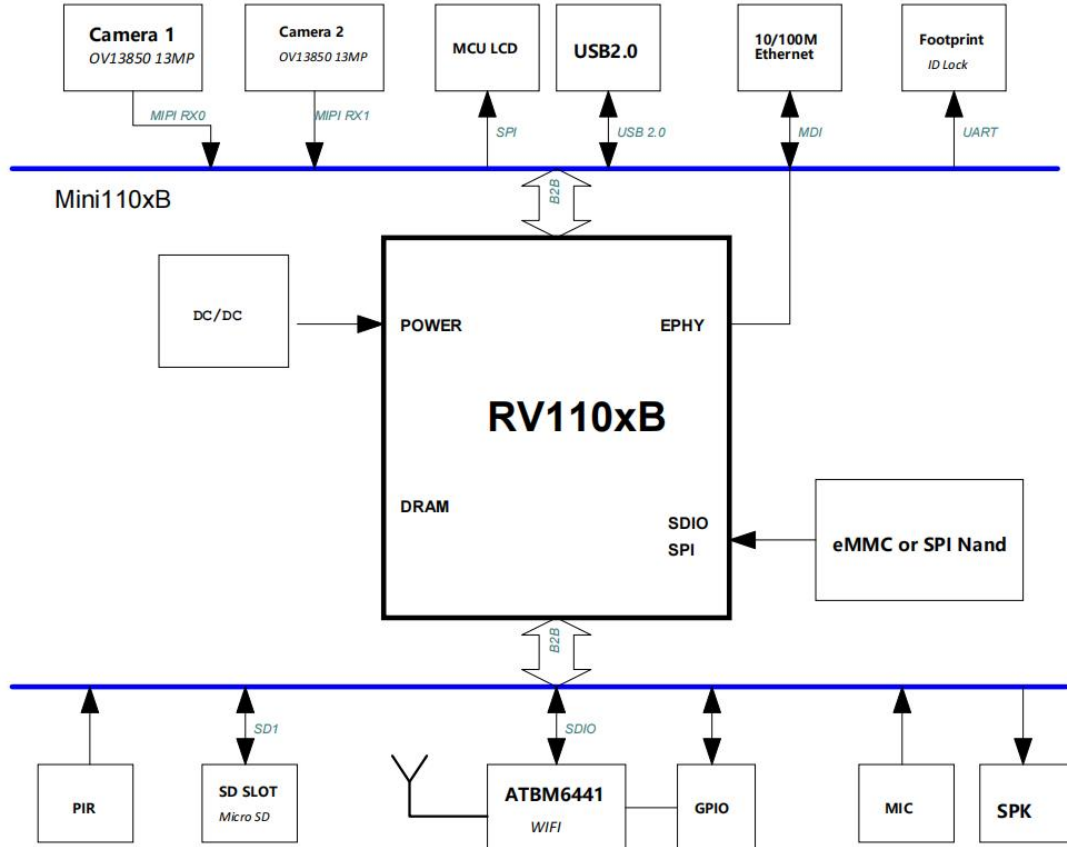
NPU	0.5 TOPS (int8)
Memory	Embedded 128MB (up to 256MB)
Flash	8GB eMMC flash (up to 32GB)
Power	5V/3A DC input jack POE
USB	1x USB2.0 OTG, Micro USB
Ethernet	1x 10/100 Mbps Ethernet RJ45 port
RTC	Real Time Clock, powered by external lithium battery
Serial Port	1x Debug, 3-pin connector 1x WiFi_Debug, 3-pin header
MicroSD	MicroSD card slot
Fingerprint	Requires separate FPM383C module. 6-pin connector
Audio	1x differential MIC 1x Speaker, 2-pin connector
Camera	2x 2-lane MIPI CSI, 24-pin FPC connector
Keys&Switch	Maskrom(on CPU module), Recovery, ADC_IN, WiFi_Power, WiFi_Wakeup, Power switch
WIFI&BT	2.4G WiFi (802.11b/g/n) with 512KB SRAM and 2MB SPI Flash
Other features	GPIO, WiFi boot/download select, PIR, +5V output
Dimension	Based board–110 x 70 mm; CPU module–22 x 19 mm



1.4 PCB Dimension



1.5 Block Diagram



1.6 CPU Introduction

The CPU module Rockchip RV1103B is equipped with 128MB DDR3 (up to 256MB) and offers 8GB eMMC flash (up to 32GB) storage.

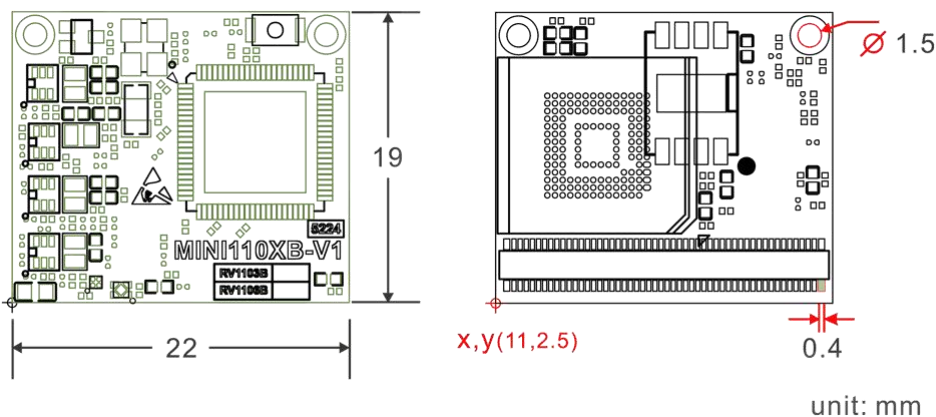
MINI1103B specifications

Pin number–100 pins

Dimension–22mm x 19mm

Power supply–DC 5V

Application–Edge AI vision and IoT security applications, such as Smart Door Security, IP Cameras.



Pin Definition

Pin	Signal	Pin	Signal
1	VCC_SYS_IN	2	VCC_SYS_IN
3	VCC_SYS_IN	4	VCC_SYS_IN
5	VCC_SYS_IN	6	VCC_SYS_IN
7	VCC_SYS_IN	8	VCC_SYS_IN
9	NC	10	NC
11	PMU_PWREN	12	GND
13	GND	14	GND
15	VCC3V3_STB	16	GND
17	VCC3V3_STB	18	GND
19	VCC3V3_STB	20	VBAT
21	VCC_3V3	22	PG1
23	VCC_3V3	24	GND
25	GND	26	SOC_32K_CLKO/ GPIO0_A0_z
27	UART0_TX_DBG	28	GND
29	UART0_RX_DBG	30	WIFI_WAKEUP_SOC/ GPIO0_A4_d
31	VCC_1V8	32	SOC_WAKEUP_WIFI/ GPIO0_A2_d

Pin	Signal	Pin	Signal
33	GND	34	GND
35	SDIO_CLK	36	SDIO_D1
37	GND	38	SDIO_D0
39	SDIO_CMD	40	GND
41	SDIO_D3	42	SARADC_IN0_1V8
43	SDIO_D2	44	W_LED_PWM
45	GND	46	IR_LED_PWM
47	LUX_EN/ GPIO0_B0_d	48	LED_PWREN
49	SDMMC0_PWREN	50	MIPI_PDN
51	FEPHY_TXP_SPK_CTRL	52	IRCUT_A/ GPIO2_B2_d
53	FEPHY_TXN_GPIO0_B3_u	54	IRCUT_B/ GPIO2_B3_d
55	FEPHY_RXP_GPIO0_B4_d/ I2C3_SCL_M0	56	GND
57	FEPHY_RXN_GPIO0_B5_u/ I2C3_SDA_M0	58	VCC_MICBIAS
59	GND	60	MICIN_P
61	MIPI_RX_D3N	62	MICIN_N
63	MIPI_RX_D3P	64	GND
65	GND	66	LINEOUT
67	MIPI_RX_CLK1N	68	CODEC_AVSS
69	MIPI_RX_CLK1P	70	GND
71	GND	72	USB_DP
73	MIPI_RX_D2N	74	USB_DM
75	MIPI_RX_D2P	76	GND
77	GND	78	SDMMC_D2
79	MIPI_RX_D1N	80	SDMMC_D3
81	MIPI_RX_D1P	82	SDMMC_CMD
83	GND	84	SDMMC_CLK
85	MIPI_RX_CLKN	86	GND
87	MIPI_RX_CLKP	88	SDMMC_D0
89	GND	90	SDMMC_D1
91	MIPI_RX_D0N	92	GND
93	MIPI_RX_D0P	94	SDMMC_DET
95	GND	96	MIPI_RST
97	MIPI_I2C_SCL	98	GND
99	MIPI_I2C_SDA	100	MIPI_MCLK

2 Peripherals Introduction

2.1 Power in(P1)



The DC JACK is black enclosure full package, 3-pin plug Type 5V/3A DC adapter.

Pin	Signal	Description	Pin	Signal	Description
1	DCIN	Direct Current Input	2	GND	Ground
3	GND	Ground			

2.2 USB OTG(J10)



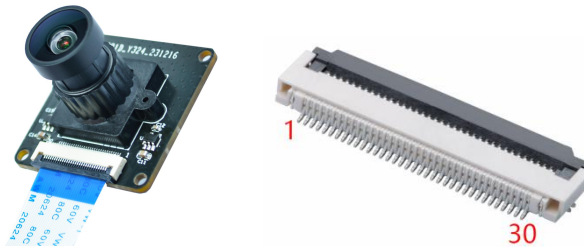
EM1103B OTG is a Micro USB2.0 port, it is used to download image and ADB transfer file.

Feature

- Compatible with USB OTG2.0 specification.
- Supports USB 2.0 High Speed (480Mbps), Full Speed (12Mbps) and Low Speed (1.5Mbps) operation in host mode.
- Hardware support for OTG signaling, session request protocol, and host negotiation protocol.

Pin	Signal	Description	Pin	Signal	Description
1	OTG_5V	5V power supply for OTG function	2	USB_DM	USB Data Minus (D-)
3	USB_DP	USB Data Plus (D+)	4	NC	Not Connect
5	GND	Ground			

2.3 Camera(J12, J13)



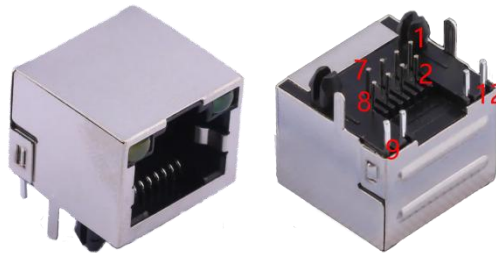
EM1103B features two 30-pin, 0.5mm-spaced FPC connectors, used for connecting camera (SC500AI) modules.

J12					
Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	MIPI_RX_CLKN	MIPI CSI Clock Negative
3	MIPI_RX_CLKP	MIPI CSI Clock Positive	4	GND	Ground
5	MIPI_RX_D0N	MIPI CSI Data Lane 0-	6	MIPI_RX_D0P	MIPI CSI Data Lane 0+
7	GND	Ground	8	MIPI_RX_D1N	MIPI CSI Data Lane 1-
9	MIPI_RX_D1P	MIPI CSI Data Lane 1+	10	GND	Ground
11	NC	Not Connect	12	NC	Not Connect
13	GND	Ground	14	NC	Not Connect
15	NC	Not Connect	16	GND	Ground
17	NC	Not Connect	18	CAM0_RESET	Camera 0 Reset Signal
19	MIPI_I2C_SDA	MIPI I2C Data Line	20	MIPI_I2C_SCL	MIPI I2C Clock Line
21	GND	Ground	22	MIPI_MCLK	MIPI Master Clock
23	GND	Ground	24	NC	Not Connect
25	NC	Not Connect	26	CAM0_PWDN	Camera 0 Power Down
27	GND	Ground	28	VDD_5V	5V Power Supply for Camera Module
29	VDD_5V	5V Power Supply for Camera Module	30	VDD_3V3	3V3 Power Supply for Camera Module

J13					
Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	MIPI_RX_CLK1N	MIPI CSI Clock 1-

3	MIPI_RX_CLK1P	MIPI CSI Clock 1+	4	GND	Ground
5	MIPI_RX_D2N	MIPI CSI Data Lane 2-	6	MIPI_RX_D2P	MIPI CSI Data Lane 2+
7	GND	Ground	8	MIPI_RX_D3N	MIPI CSI Data Lane 3-
9	MIPI_RX_D3P	MIPI CSI Data Lane 3+	10	GND	Ground
11	NC	Not Connect	12	NC	Not Connect
13	GND	Ground	14	NC	Not Connect
15	NC	Not Connect	16	GND	Ground
17	NC	Not Connect	18	CAM1_RESET	Camera 1 Reset Signal
19	I2C3_SDA_1V8	I2C3 Data Line	20	I2C3_SCL_1V8	I2C3 Clock Line
21	GND	Ground	22	MIPI_MCLK	MIPI Master Clock
23	GND	Ground	24	NC	Not Connect
25	NC	Not Connect	26	CAM1_PWDN	Camera 0 Power Down
27	GND	Ground	28	VDD_5V	5V Power Supply for Camera Module
29	VDD_5V	5V Power Supply for Camera Module	30	VDD_3V3	3V3 Power Supply for Camera Module

2.4 Ethernet(P2)



EM1103B adopts an RJ45 connector as its Ethernet interface.

Feature

- Support 10/100-Mbps data transfer rates with the RMII interfaces.
- Supports both full-duplex and half-duplex operation.

Pin	Signal	Description	Pin	Signal	Description
1	TX+	Transmit Positive	2	TX-	Transmit Negative
3	RX+	Receive Positive	4	CTB+	Connection Type B Positive
5	CTB+	Connection Type B	6	RX-	Receive Negative

		Positive			
7	CTB-	Connection Type B Negative	8	CTB-	Connection Type B Negative
9	ETH_LED_LNK (GR-)	Ethernet LED Link (Green)	10	VCC3V3_STB	3.3V Stable Voltage Supply
11	VCC3V3_STB	3.3V Stable Voltage Supply	12	ETH_LED_SPD (YE+)	Ethernet LED Speed (Yellow)

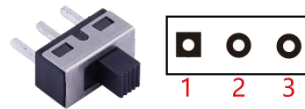
2.5 Debug(J9)



3-pin connector. The debug serial port baud rate is 115200.

Pin	Signal	Description	Pin	Signal	Description
1	DEBUG_RX	Debug Receive Data	2	DEBUG_TX	Debug Transmit Data
3	GND	Ground			

2.6 Power switch(SW1)



The power switch is 3-pin Single Pole Double Throw slide switch, This switch allows the device to select between two power input methods:

- DC5V Mode: Use external DC adapter.
- PoE Mode: Use Ethernet cable power.

Pin	Signal	Description	Pin	Signal	Description
1	DC5V	5V Direct Current power supply	2	VCC_POE5V	5V Power over Ethernet supply
3	POWER-OFF	Power-off signal			

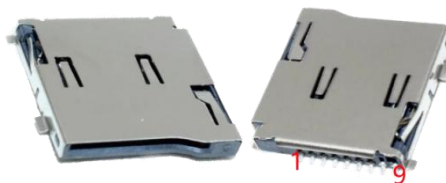
2.7 User Buttons(SW1, SW2, SW3, SW4, SW5)



Pressing SW1 on the MINI1103B enters Maskrom mode, SW3 enters Loader mode, while SW4 and SW5 enable WiFi power management and quick wake-up functionality.

Key	Signal	Description	Key	Signal	Description
SW1	Maskrom	Maskrom Mode Trigger	SW2	ADC_IN	Analog-to-Digital Converter Input
SW3	Recovery	Recovery Mode Trigger	SW4	WiFi_Power	WiFi Power Control
SW5	WiFi_wakeup	WiFi Wakeup Signal			

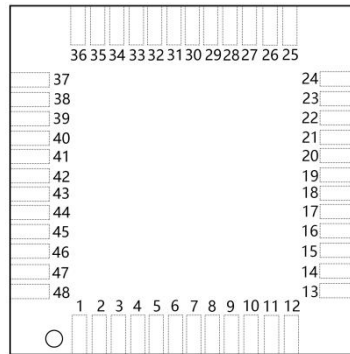
2.8 Micro SD(J7)



The Micro SD card is used as an external storage device. The MMC controller interface supports up to 4-bit transfer modes. MMC is always accessible through the carrier board interface.

Pin	Signal	Description	Pin	Signal	Description
1	SDMMC_D2	SD Memory Card Data Line 2	2	SDMMC_D3	SD Memory Card Data Line 3
3	SDMMC_CMD	SD Memory Card Command Line	4	SD_3V3	3.3V Power Supply for SD Card
5	SDMMC_CLK	SD Memory Card Clock Line	6	GND	Ground
7	SDMMC_D0	SD Memory Card Data Line 0	8	SDMMC_D1	SD Memory Card Data Line 1
9	SDMMC_DET	SD Memory Card Detection Signal			

2.9 WiFi(U12)



The ATBM6441 is a low-power MCU processor designed for Wi-Fi networking, supporting IEEE 802.11b/g/n standards with features like single-space stream transmission and 20MHz bandwidth. It includes MAC layer support for 802.11e, 802.11i, and 802.11n, along with aggregation and power-saving technologies. It also complies with WiFi-Alliance and WMM standards and supports SmartConfig and P2P functionalities.

Features

- IEEE Standards: IEEE 802.11b/g/n 1T1R Wi-Fi chip.
- Supports transmission with a channel bandwidth of 20 MHz.
- Compatible with the traditional mode of 802.11n, the Mixed mode and the Green Field mode.

Pin	Signal	Description	Pin	Signal	Description
1	DVDDIO_1	Digital I/O Power Supply 1	2	WL_WAKE	Wake-up signal for WLAN module
3	USB_DET_IN	USB Detection Input	4	ATBM6441_GPIO 11	General Purpose I/O 11
5	ATBM6441_GPIO10	General Purpose I/O 10	6	ATBM6441_GPIO 9	General Purpose I/O 9
7	JTAG0_TCK/UART2_TXD/SPI3_MISO/I2S2_SDATA/GPIO8	JTAG Test Clock/UART2 Transmit/SPI3 Master In Slave Out/I2S2 Serial Data/GPIO 8	8	ATBM6441_GPIO 7	General Purpose I/O 7
9	ATBM6441_GPIO6	General Purpose I/O 6	10	SOC_WAKEUP_WFI	System Wake-up signal for WiFi
11	WiFi_WAKEUP_SOC	WiFi Wake-up signal for SoC	12	CVDDCAP	Power supply for core voltage
13	DVDDIO_2	Digital I/O Power Supply 2	14	NC	Not Connect

15	VCC_3V3/SDIO_D1	3.3V Power Supply/SDIO Data Line 1	16	VCC_3V3/SDIO_D0	3.3V Power Supply/SDIO Data Line 0
17	SDIO_CLK	SDIO Clock Line	18	VCC_3V3/SDIO_CMD	3.3V Power Supply/SDIO Command Line
19	VCC_3V3/SDIO_D3	3.3V Power Supply/SDIO Data Line 3	20	VCC_3V3/SDIO_D2	3.3V Power Supply/SDIO Data Line 2
21	DVDDIO_3	Digital I/O Power Supply 3	22	WL_PWR_ON	Power On signal for WLAN module
23	WL_OSC32_IN	32 kHz Oscillator Input for WLAN	24	WL_OSC32_OUT	32 kHz Oscillator Output for WLAN
25	NC	Not Connect	26	NC	Not Connect
27	ATBM6441_GPIO1	General Purpose I/O 1	28	ATBM6441_GPIO0	General Purpose I/O 0
29	ATBM6441_GPIO12	General Purpose I/O 12	30	NC	Not Connect
31	AVDDIO	Analog I/O Power Supply	32	DVDD	Digital Core Power Supply
33	WL_1V4_EN	1.4V Enable for WLAN module	34	NC	Not Connect
35	NC	Not Connect	36	AVDD_TX	Power Supply for Transmit
37	AVDD33_PA	Power Supply for 3.3V PA	38	NC	Not Connect
39	WL_ANT	Antenna connection for WLAN	40	AVDD_RX	Power Supply for Receive
41	NC	Not Connect	42	AVDD_PLL	Power Supply for PLL
43	XTAL_N	Negative side of crystal oscillator	44	XTAL_P	Positive side of crystal oscillator
45	AVDD_ADC	Power Supply for ADC	46	NC	Not Connect
47	NC	Not Connect	48	WL_BOOT_SEL	Boot selection for WLAN module

2.10 RTC(J6)



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.

Pin	Signal	Description	Pin	Signal	Description
1	VBAT	3V battery	2	GND	Ground

2.11 PIR(U21)



PIR can sense the infrared signals generated by human body movements in the environment, and the processed signals are directly output.

Pin	Signal	Description	Pin	Signal	Description
1	VCC3V3_WIFI	3.3V Power Supply for WiFi Module	2	PIR_INT	Passive Infrared Sensor Interrupt
3	GND	Ground			

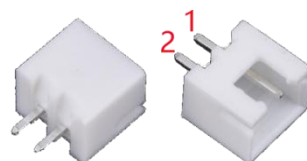
2.12 MIC(MIC1)



The EM1103B provide one microphone inputs, It is used for recording.

Pin	Signal	Description	Pin	Signal	Description
1	MICIN_P	Microphone Input Positiv	2	MICIN_N	Microphone Input Negative

2.13 Speaker(CON2)



Using a 2-pin connector to connect an external speaker, can effectively amplify the audio signal.

Pin	Signal	Description	Pin	Signal	Description
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1	VOP	Speaker Positive (+)	2	VON	Speaker Negative (-)
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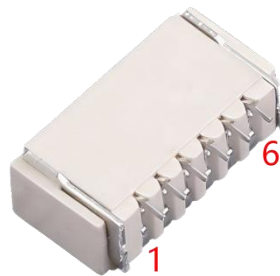
2.14 GPIO(J15)



J15 is a PH-3A 2.0mm pitch through-hole 3-pin connector that enables bidirectional communication control via the GPIO10 pin (Pin2) of the ATBM6441 WiFi/Bluetooth module.

Pin	Signal	Description	Pin	Signal	Description
1	VDD_5V	5V power supply voltage	2	ATBM6441_GPIO10	General-purpose input/output pin 10 of the ATBM6441 chip
3	GND	Ground			

2.15 Fingerprint(J8)



J8 is a 1.0mm pitch horizontal SMD 6-pin connector, primarily used for connecting touch button or touch panel modules to achieve touch detection signal acquisition and UART data communication functions.

Pin	Signal	Description	Pin	Signal	Description
1	VT TOUCH 3.3V	Touch sensor 3.3V power supply	2	TOUCHOUT	Touch sensor output signal
3	VCC3V3_STB	3.3V stable power supply	4	UART2_RX_M1	UART2 receive signal for module 1
5	UART2_TX_M1	UART2 transmit signal for module 1	6	GND	Ground

3 Product Configurations

3.1 Standard Contents

NO.	Item	Qty.(PCS)	Description
1	EM1103B board	1	Standard Content (128MB RAM, 8GB eMMC)
2	U-disk/CD-ROM	1	Linux SDK, Documents, tools, etc.
3	Ethernet cable	1	1.5m Crossover cable
4	Serial Cable	1	CH9102X
5	USB Cable	1	USB2.0 OTG
6	Power adaptor	1	5V/3A DC
7	Antenna	1	WIFI&Bluetooth Antenna

3.2 Optional Parts

- Camera (SC500AI module, 5-Megapixel).