# Air101 Chip Specifications

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Modification record:

| Version number modification record | date | author |
|---|---|---|
| **V0.1** New | 2021-8-19 | Loukanghua |
| **V0.2** added flashing process | 2021-8-31 | LiuQingYu |
| **V0.3** Corrected pin multiplexing relationship | 2021-9-6 | Wendal |
| **V0.4** update pin definition diagram | 2021-9-24 | Wendal |
| **V0.5** Organize document format | 2021-9-24 | Wendal |
| **V1.0** organizes the content of the document and supplements the details | 2021-9-30 | Wendal |
| **V1.1** adds hardware design instructions | 2022-3-18 | Guoliang |

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# 1. Introduction

Air101 is an IoT MCU chip.

The chip integrates a 32-bit processor with a main frequency of up to 240MHz, built-in UART, SPI, I2C, GPIO, ADC, PWM, SDIO and other peripheral connections

port, built-in 2MByte Flash memory, support on-chip file system.

Air101 supports LuatOS development.

**2.** Main performance

Table 1: Key Features

| feature | illustrate |
|---|---|
| CPU | ÿ 32-bit processor, maximum operating frequency 240MHz |
| Flash | ÿ 2MByte, with on-chip file system |
| Lua available memory | ÿ 176-232KB, default 176KB |
| serial port | ÿ Support 5-channel UART, one of which is fixed as download and log port<br>ÿ Baud rate range: 1200bps - 2Mbps<br>ÿ Data bits: 5-8bit<br>ÿ Stop bit: 1bit/2bit<br>ÿ Parity: Configurable<br>ÿ RTS/CTS flow control: software control only |
| SPI | ÿ Support 1 SPI interface<br>ÿ Only supports master |
| I2C | ÿ Support 1 channel hardware I2C interface<br>ÿ Rate: 100KHz-400KHz<br>ÿ Only supports master<br>ÿ LuatOS software supports multi-channel soft I2C, the speed is lower |
| ADC | ÿ Support 2 channels of 16-bit ADC, the highest sampling rate is 1KHz<br>ÿ Support reading core temperature |
| GPIO | ÿ Supports up to 18 GPIOs |
| SDIO | ÿ Support 1 channel SDIO interface<br>ÿ Only supports master<br>ÿ Only supports SD card reading and writing |
| PWM | ÿ Support 5 PWM outputs<br>ÿ Frequency range: 3Hz - 160KHz<br>ÿ Duty cycle maximum accuracy: 1/256<br>ÿ The width of the counter inserted in the dead zone: 8bit |
| package | ÿ QFN32 package, 4mm x 4mm |

# 3. Pin Definition

## 合宙Air101芯片PinOut示意图

- V2.21092400 -



图 例 说 明

| 供电 | NC | 特殊引脚 | GPIO | UART |
|------|------|---------|------|------|
| I2C | SPI | PWM | ADC | SDIO |
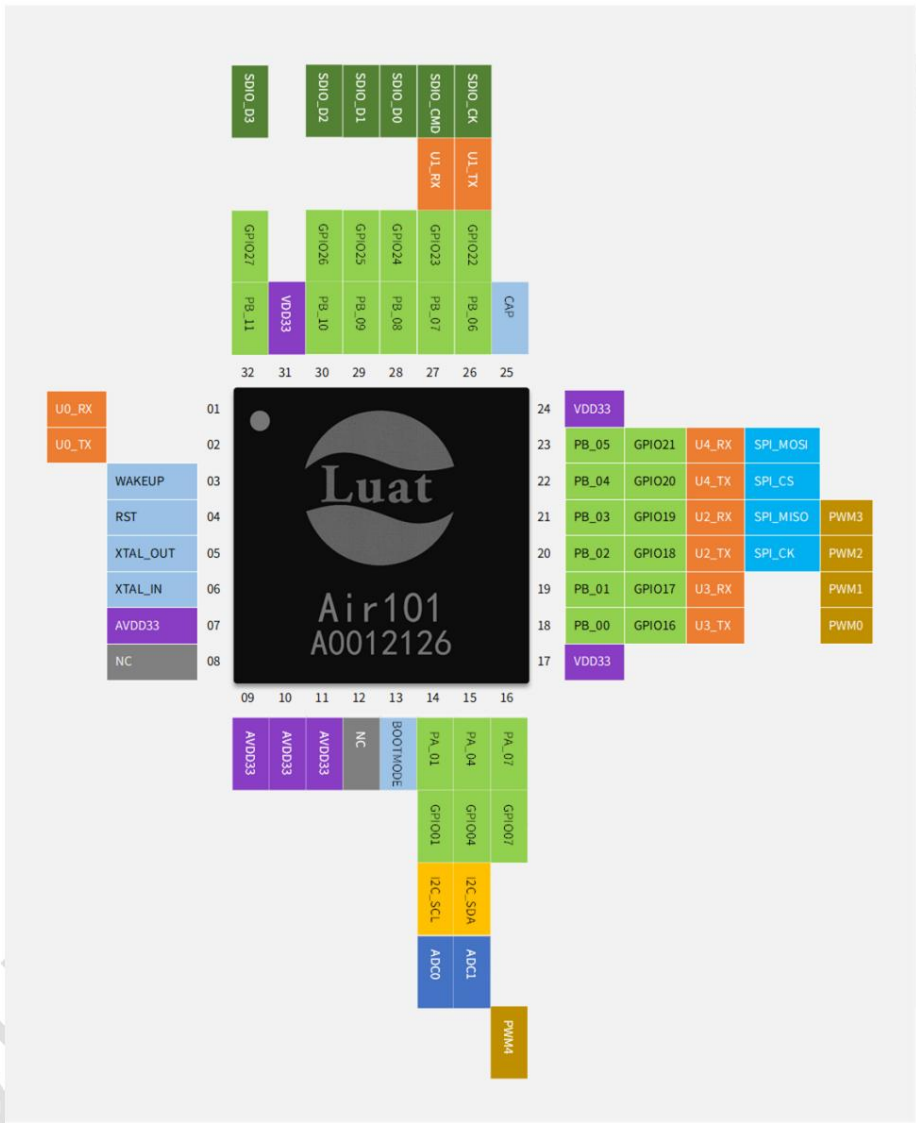
Powered by LuatOS

Figure 1: Air101 pin definition diagram (front view)

| edit No | name | kind type | Alternate function of pin function after reset | | Up and down ability |
|---|---|---|---|---|---|
| 1 PB_20 | | I/O UART0_RX | | | UP/DOWN |
| 2 PB_19 | | I/O UART0_TX | | | UP/DOWN |
| 3 WAKEUP | | I | WAKEUP wakeup function When the chip is sleeping, pull it high to wake up | | DOWN |
| 4 RESET | | I | RESET reset | | UP |
| 5 XTAL_OUT O External crystal oscillator output | | | | | - |
| 6 XTAL_IN I External crystal oscillator input P | | | | | - |
| 7 VDD33 | | chip power supply, 3.3V | | | - |
| 8 NC | | | | | dangling |
| 9 VDD33 | | P chip power supply, 3.3VP | | | - |
| 10 VDD33 | | chip power supply, 3.3VP | | | - |
| 11 VDD33 | | chip power supply, 3.3V | | | - |
| 12 NC | | | | | dangling |
| 13 BOOTMODE I/O BOOTMODE | | | | Pull low at startup to enter download mode | UP/DOWN |
| 14 PA_01 | | I/O | GPIO_01, input, high resistance | PA_01/I2C_SCL/ADC0 | UP/DOWN |
| 15 PA_04 | | I/O | GPIO_04, input, high resistance | PA_04/I2C_SDA/ADC1 | UP/DOWN |
| 16 PA_07 | | I/O | GPIO_07, input, high resistance | PA_07/PWM4 | UP/DOWN |
| 17 VDD33 | | P chip power supply, 3.3V | | | - |
| 18 PB_00 | | I/O | GPIO_16, input, high resistance | PB_00/PWM0/SPI_MISO/UART3_TX | UP/DOWN |
| 19 PB_01 | | I/O | GPIO_17, input, high resistance | PB_01/PWM1/SPI_CLK/UART3_RX | UP/DOWN |
| 20 PB_02 | | I/O | GPIO_18, input, high resistance | PB_02/PWM2/SPI_CLK/UART2_TX | UP/DOWN |
| 21 PB_03 | | I/O | GPIO_19, input, high resistance | PB_03/PWM3/SPI_MISO/UART2_RX | UP/DOWN |
| 22 PB_04 | | I/O | GPIO_20, input, high resistance | PB_04/SPI_CS/UART4_TX | UP/DOWN |
| 23 PB_05 | | I/O | GPIO_21, input, high resistance | PB_05/SPI_MOSI/UART4_RX | UP/DOWN |
| 24 VDD33 | | P chip power supply, 3.3VI | | | - |
| 25 CAP | | external capacitor, 4.7µF | | | - |
| 26 PB_06 | | I/O | GPIO_22, input, high resistance | PB_06/UART1_TX/SDIO_CK | UP/DOWN |
| 27 PB_07 | | I/O | GPIO_23, input, high resistance | PB_07/UART1_RX/SDIO_CMD | UP/DOWN |

| 28 PB_08 | I/O | GPIO_24, input, high resistance | PB_08/SDIO_D0 | UP/DOWN |
|----------|-----|--------------------------------|----------------|---------|
| 29 PB_09 | I/O | GPIO_25, input, high resistance | PB_09/SDIO_D1 | UP/DOWN |
| 30 PB_10 | I/O | GPIO_26, input, high resistance | PB_10/SDIO_D2 | UP/DOWN |
| 31 VDD33 | P chip power supply, 3.3V | | | - |
| 32 PB_11 | I/O | GPIO_27, input, high resistance | PB_11/SDIO_D3 | UP/DOWN |
| 33 GND | P ground | | Bottom center pad | - |

**4.** Firmware download

The download serial port of Air101 is UART0, which does not support modification.

1. Download and install the CH340 driver http://www.wch.cn/downloads/CH341SER_EXE.html

2. Download the flashing tool Luatools2 https://luatos.com/luatools/download/last

3. Open Luatools2 for the first time and need to configure before downloading Air101 firmware
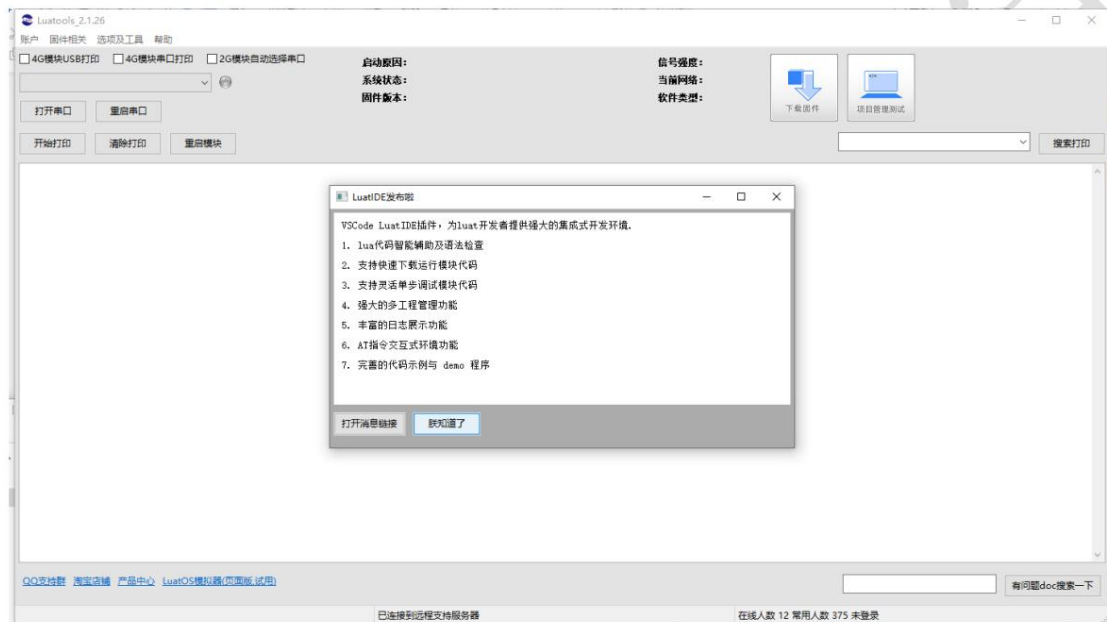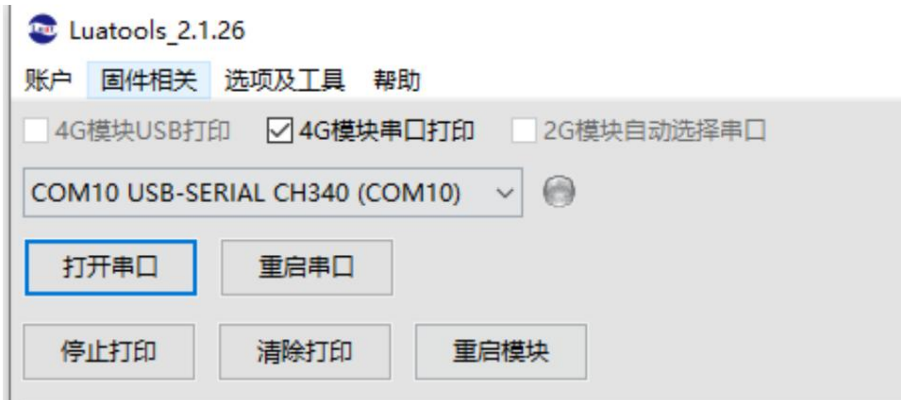


**Click Options and Tools in the upper left corner -> Tool Configuration -> Uart**
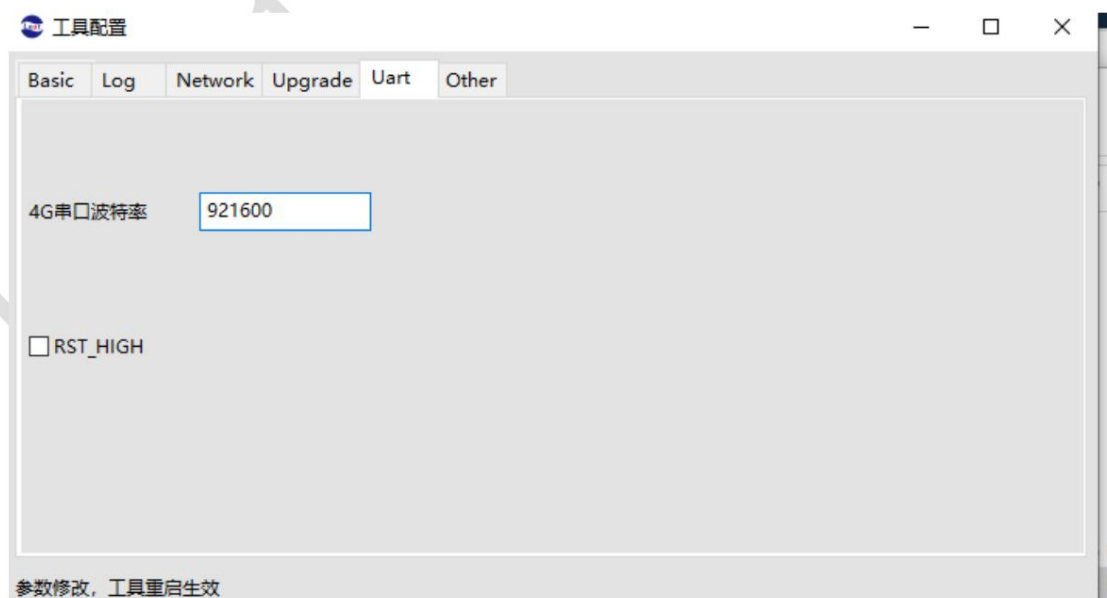


Set to 921600, and restart the tool to take effect.

4. Insert the development board into the computer, you can see that the tool displays the serial port device (if there is no display, the blank space of the serial port device will be refreshed)



Check the **4G** module serial port printing, click to open the serial port
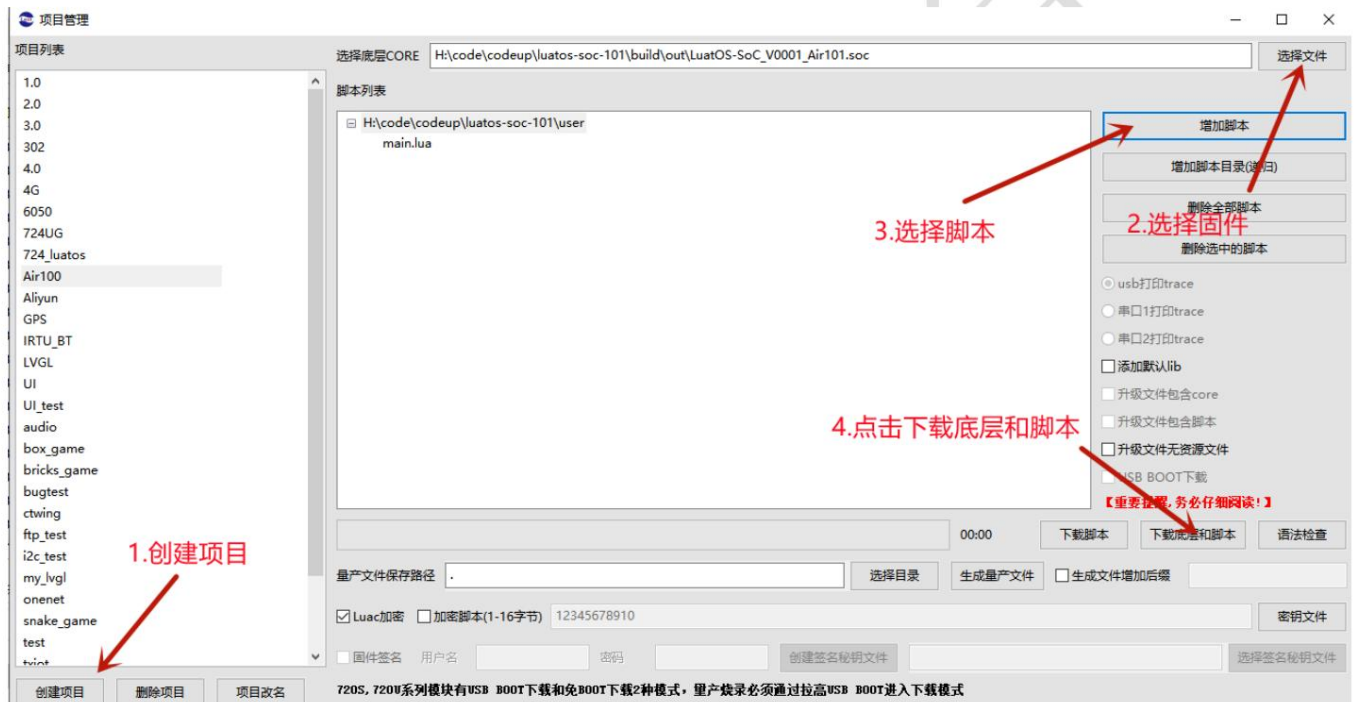


Follow the main interface -> project management -> create a project -> select the firmware (soc file, which can be downloaded from gitee or found in the resource/101_lua_lod directory

to)->select the required script (the demo script is also in the resource/101_lua_lod directory)->click "download firmware and script" to download

Under normal circumstances, the module will automatically reset, if not, please manually pull down the RESET pin to the ground, and wait for the download to complete.

## 5. Design Guidance

### 5.1. Power Design

In order to reduce the damage of ESD to the chip, it is necessary to increase the TVS tube at the entrance of the total power supply of the module to improve the anti-static ability. Corresponding filter capacitors

should be placed on the chip power input pins to improve product performance. It is recommended to use LDO for external power supply to the entire chip, and the total current is recommended to be 500mA and

above. The total power trace width is not less than 30mil.

The power supply range is 3.0V-3.6V. Do not exceed this range. Exceeding 3.6V may cause permanent damage to the chip. Below 3.0V may degrade overall performance.

See the following requirements for placing capacitors on different pins:

A 1uf filter capacitor needs to be placed on pin 7 of the chip.

Pin 9 of the chip needs to be placed with a 1nf filter capacitor.

A 47uf filter capacitor is placed near pin 10 of the chip.

A 47uf filter capacitor is placed near pin 11 of the chip.

It is recommended that customers place a 330uf electrolytic capacitor at the power inlet of the module.

Place 1uf filter capacitors near pins 17, 24, and 31 of the chip.

The 25 - pin CAP of the chip must be connected to a 4.7uf filter capacitor.

### 5.2. Download circuit

The chip defaults to UART0 as the download port. When the chip has no initial firmware download, directly connect to the UART0 interface, and download the firmware through the relevant download software.

When there is firmware in the chip and enter the download mode again, you can pull down PA0 and then power on to enter the download mode. After the download is complete, remove the operation of pulling down

PA0, and need to restart before the firmware can run.

Pull down PA0 before power on, the chip will enter the download mode, UART0_TX will always send ccccc at 115200 baud rate and wait for the download command. The chip will always be in download mode

when the program is not programmed before leaving the factory, and will always send ccccc at 115200 baud rate, which can be used to judge whether the chip can work.

### 5.3. Reset circuit

The reset circuit is recommended to be designed as an RC circuit, which automatically resets when powered on, and the Air101 resets at a low level. If using external control RESET pin, when the level value is

lower than 2.0v, the chip is in reset state. The low level must last for more than 100us during reset.

### 5.4. Clock circuit

The crystal should be placed as close to the chip as possible, the traces should be kept as short as possible away from the interference source, and there are multiple ground holes around the clock for isolation. The layers below the clock

prohibit other traces from passing through to prevent interference with the clock source. The crystal frequency is 40M. Customers choose crystals with different temperature grades, stability and load capacitance values according to actual

product requirements. The load capacitance connected to both ends of the crystal needs to be adjusted according to the crystal of different manufacturers and the frequency offset.

## 5.5. Log debugging

After the chip is powered on, pins 1 and 2 are UART0 ports by default, which provide download and AT command ports and log output ports. customer make

When using it, be careful not to use this port as GPIO at will, to prevent it from being occupied and unable to download and debug. After the system is up, the port

Can be reused for other ports.

# 5.6. ADC circuit

The 14-pin (PA1) and 15-pin (PA4) pins of the chip can be used as ordinary ADC, and the input voltage range is 0~2.4V. When it is higher than 2.4V, the external voltage divider needs to

be processed before entering the ADC interface. When using a voltage divider circuit, be sure to choose a high-precision resistor, and choose a suitable resistor according to the voltage divider.

suitable resistance value.

## 5.7. GPIO

If all GPIOs are configured with pull-up resistors, the typical pull-up resistor value is 40K, and if they are configured as pull-down resistors, the typical pull-down resistor value is 49K.

The Wakeup pin is an external wake-up pin. When the chip enters the sleep state, when the Wakeup pin is at a high level, the chip wakes up. normal working condition

state, the port is low.

**6.** Electrical Characteristics

| parameter | name | minimum | Typical value | Maximum unit | |
|---|---|---|---|---|---|
| Supply voltage | VDD | 3 | 3.3 | 3.6 | V |
| Input logic level low | VIL | -0.3 | | 0.8 | V |
| Input logic level high | VIH | 2 | | VDD+0.3 | V |
| Input pin capacitance | Cpad | | | 2 | pF |
| output logic level low | VOL | | | 0.4 | V |
| output logic level high | VOH | 2.4 | | | V |
| Output maximum drive capability | IMAX | | | twenty four | mA |
| Storage temperature range | TSTR | -40ÿ | | +125ÿ | °C |

| range of working temperature | TOPR | -40ÿ | | +85ÿ | °C |
|---|---|---|---|---|---|
| Standby power consumption | I | | | 10 | uA |

**7.** Package Specifications



TOP VIEW

SIDE VIEW

EXPOSED THERMAL PAD ZONE

BOTTOM VIEW
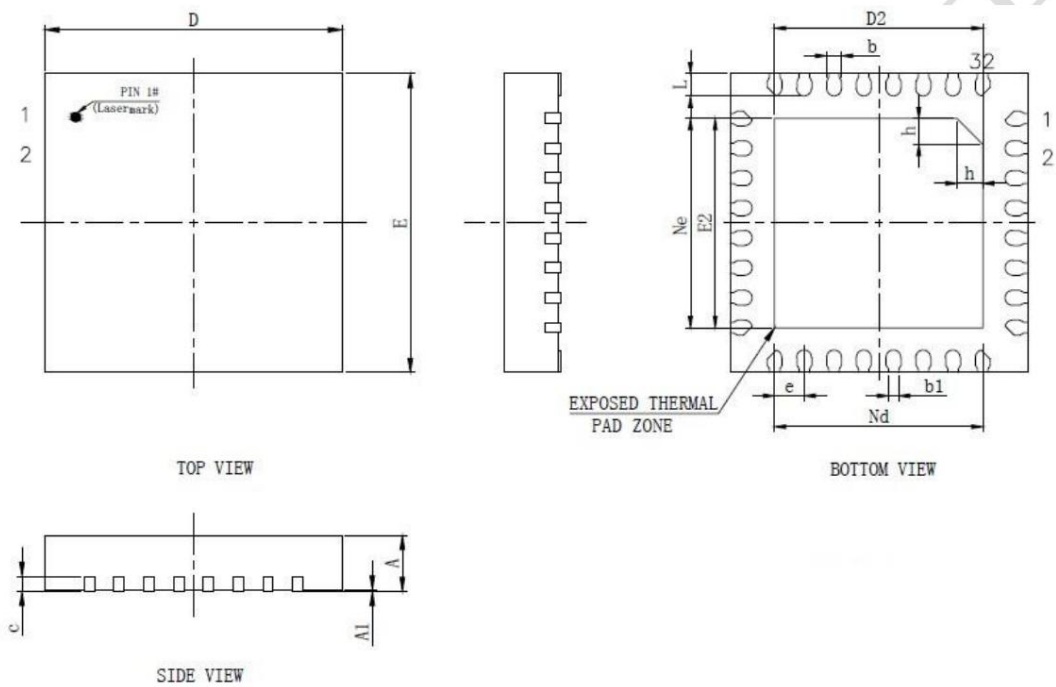
Figure 2: Air101 Package Dimensions

| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.7 | 0.75 | 0.8 |
| A1 | 0 | 0.02 | 0.05 |
| b | 0.15 | 0.2 | 0.25 |
| c | 0.18 | 0.2 | 0.25 |
| D | 3.9 | 4 | 4.1 |
| D2 | 2.7 | 2.8 | 2.9 |
| e | | 0.40BSC | |
| Ne | | 2.80BSC | |
| Nd | | 2.80BSC | |
| E | 3.9 | 4 | 4.1 |
| E2 | 2.7 | 2.8 | 2.9 |
| L | 0.25 | 0.3 | 0.35 |
| h | 0.3 | 0.35 | 0.4 |

**8.** Development board **PinOut**



合宙Air101开发板PinOut示意图

- V2.21091800 -

图例说明

| 供电 | 接地 | 特殊引脚 | GPIO | UART |
|---|---|---|---|---|
| I2C | SPI | PWM | ADC | SDIO |

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