



# ITM-1066A User Manual

IEEE802.11 a/b/g/n 2.4+5GHz 1T1R  
Wi-Fi IoT Module User Manual

***(Preliminary)***

***V0.1***

# Revision History

| Date       | Revision Content                 | Revised By | Version |
|------------|----------------------------------|------------|---------|
| 2020/06/18 | - Initial released (Preliminary) | Issac Chen | 0.1     |
|            | -                                |            |         |
|            | -                                |            |         |
|            | -                                |            |         |
|            |                                  |            |         |

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# 1. General Description

iTM-1066A module features a fully integrated 2.4GHz+5GHz radio transceiver and baseband processor for Wi-Fi 802.11a/b/g/n IOT applications. It can be used as a standalone application-specific communication processor or as a wireless data link in hosted MCU systems.

iTM-1066A module uses a highly integrated dual-band WIFI IOT SoC chipset equipped with a powerful and cost-competitive RISC processor, Andes Technology N10. It can be connected to any external MCU through UART, SPI, SDIO, USB or I2C interfaces and sensors or other devices through GPIOs. It also includes RF switch, balun, power amplifier (PA) and low noise amplifier (LNA), to minimize PCB design area and external component requirement. The block diagram of WIFI IOT SoC is shown as below.

## 1-1 Block Diagram

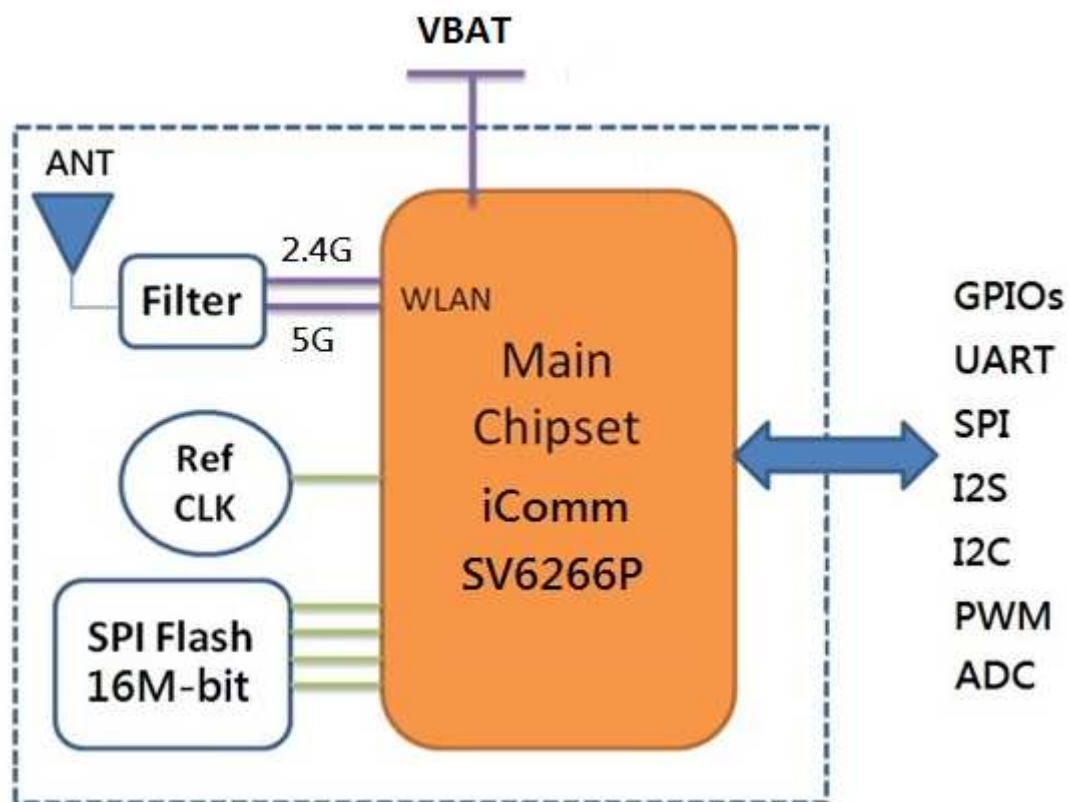


Fig.1. ITM-1066A Module Block Diagram

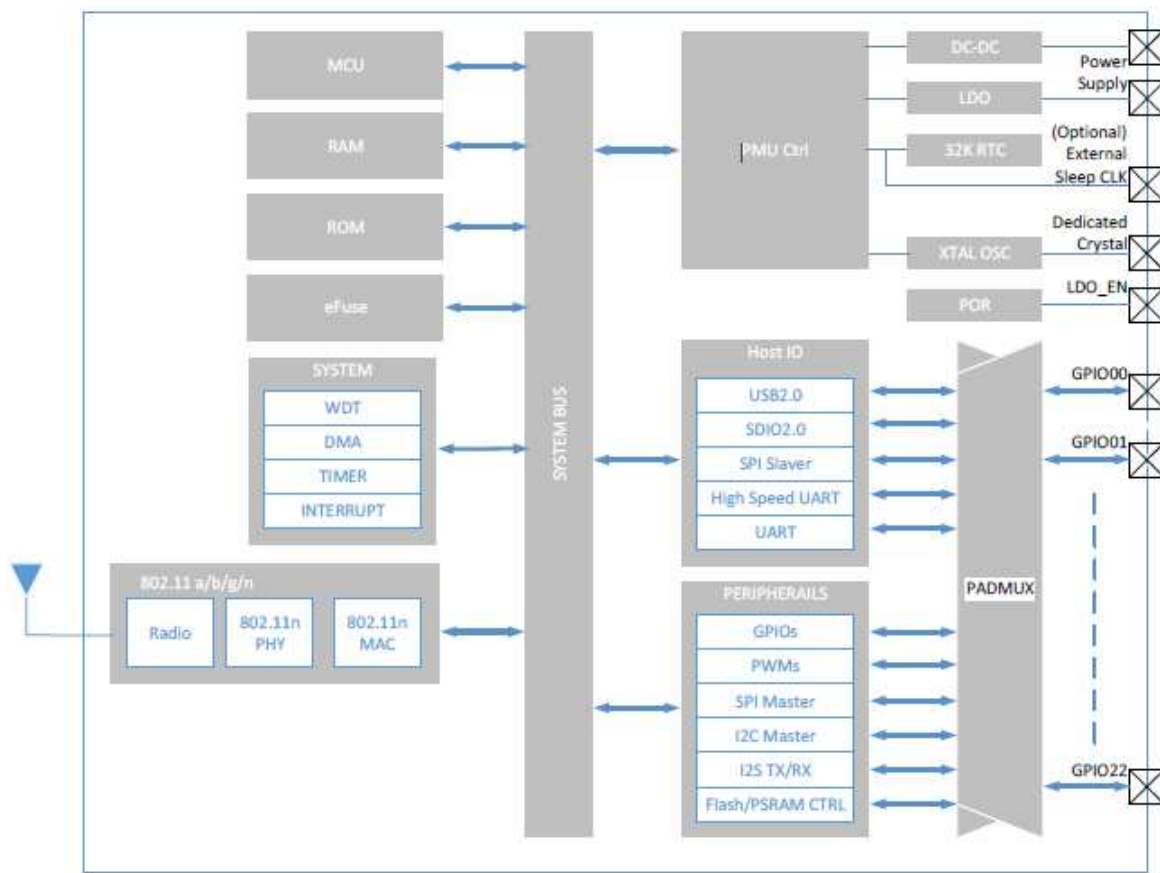


Fig.1. SV6266P WI-FI Chipset Block Diagram

## 2. Features

- Processors
  - Andes Technology N10 processor w/ ILM/DLM and D-cache
- Wi-Fi
  - 2.4G+5G dual-band 1T1R IEEE 802.11a/b/g/n/e/i/d
  - 802.11n features
    - A-MPDU Tx & Rx
    - Support immediate Block-Ack
  - STA/AP mode
    - Soft-AP
  - Rate adaption mechanism
  - WFA features
    - WEP/TKIP/WPA/WPA2
    - WMM/WMM PS
  - Short Guard Interval
  - Greenfield mode
  - RIFS in RX mode
  - STBC in RX mode
  - Enhanced and robust sensitivity for wider coverage range
  - Supports calibration algorithm to handle no-idealities effects from CMOS RF block
- System
  - 128K ROM and 192 KB SRAM for Instruction and data SRAM in total
  - 8KB Retention SRAM
  - Integrate 8M byte (8MB) SPI PSRAM in package
    - Embedded 8MB PSRAM is Only for iTM-1066A-M and iTM-1066A-MX
  - Suspend/Wake-up manger controller.
  - Two channel DMA off load CPU loading.
  - One Flash controller supports both Flash and PSRAM up to 16MB/64Mb with XIP

- One I2S TX/RX channel for 8~32bits/8~192KHz in master/slave mode.
  - One SPI master
  - One I2C master
  - Five PWMs
  - Four millisecond timers
  - Four microsecond timers
  - Two watchdog
  - All pins can be multiplexed to GPIO by user scenario
- Host Interfaces
    - USB 2.0
    - SDIO 2.0
      - Clock rate up to 50MHz
    - SPI slave
      - Provide proprietary/user CMD
    - High Speed UART
      - Support RTSN/CTSN/RX/TX, 4 pins
      - Baud rate up to 4.8MHz
    - UART
      - Support RX/TX, 2 pins
      - Baud rate up to 921600kHz

- Please refer to the table below for different types of ITM-1066A

| P/N          | Flash         | PSRAM        | Antenna Type                     |
|--------------|---------------|--------------|----------------------------------|
| ITM-1066A-P  | 16Mb On-board | N/A          | On-board PCB Antenna             |
| ITM-1066A-M  | 16Mb On-board | 8MB Built-In | On-board PCB Antenna             |
| ITM-1066A-PX | 16Mb On-board | N/A          | IPEX Connector for External Ant. |
| ITM-1066A-MX | 16Mb On-board | 8MB Built-In | IPEX Connector for External Ant. |

\* “Built-in” means the PSRAM is embedded inside Wi-Fi chipset

## 3. General Specification

### 3.1 Voltages

#### 3.1.1 Absolute Maximum Ratings

| Symbol | Description          | Min. | Max. | Unit |
|--------|----------------------|------|------|------|
| VBAT   | Input supply Voltage | -0.3 | 3.6  | V    |
|        |                      |      |      |      |

|                       |               |
|-----------------------|---------------|
| Operating temperature | -10°C to 70°C |
| Storage temperature   | -40°C to 85°C |

#### 3.1.2 Recommended Operating Ratings

| Test conditions: At room temperature |      |      |      |      |
|--------------------------------------|------|------|------|------|
| Symbol                               | Min. | Typ. | Max. | Unit |
| VBAT                                 | 2.0  | 3.3  | 3.6  | V    |
|                                      |      |      |      |      |

## 3.2 Wi-Fi RF Specification (RX)

### 2.4G WLAN

| Parameters                                     | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------------------------|------------|------|------|------|------|
| Frequency Range                                |            | 2412 |      | 2484 | MHz  |
| RX Sensitivity<br>11b @ 8% PER                 | - 1Mbps    |      | -95  |      | dBm  |
|                                                | - 2Mbps    |      | -93  |      | dBm  |
|                                                | - 5.5Mbps  |      | -91  |      | dBm  |
|                                                | - 11Mbps   |      | -88  |      | dBm  |
| RX Sensitivity<br>11g @ 10% PER                | - 6Mbps    |      | -91  |      | dBm  |
|                                                | - 9Mbps    |      | -90  |      | dBm  |
|                                                | - 12Mbps   |      | -88  |      | dBm  |
|                                                | - 18Mbps   |      | -86  |      | dBm  |
|                                                | - 24Mbps   |      | -82  |      | dBm  |
|                                                | - 36Mbps   |      | -79  |      | dBm  |
|                                                | - 48Mbps   |      | -74  |      | dBm  |
|                                                | - 54Mbps   |      | -73  |      | dBm  |
| Receive Sensitivity<br>(11n,20MHz)<br>@10% PER | - MCS0     |      | -91  |      | dBm  |
|                                                | - MCS=1    |      | -88  |      | dBm  |
|                                                | - MCS=2    |      | -86  |      | dBm  |
|                                                | - MCS=3    |      | -81  |      | dBm  |
|                                                | - MCS=4    |      | -79  |      | dBm  |
|                                                | - MCS=5    |      | -74  |      | dBm  |
|                                                | - MCS=6    |      | -73  |      | dBm  |
|                                                | - MCS=7    |      | -72  |      | dBm  |
| Receive Sensitivity<br>(11n,40MHz)<br>@10% PER | - MCS0     |      | -88  |      | dBm  |
|                                                | - MCS=1    |      | -85  |      | dBm  |
|                                                | - MCS=2    |      | -83  |      | dBm  |
|                                                | - MCS=3    |      | -78  |      | dBm  |
|                                                | - MCS=4    |      | -76  |      | dBm  |
|                                                | - MCS=5    |      | -71  |      | dBm  |
|                                                | - MCS=6    |      | -70  |      | dBm  |
|                                                | - MCS=7    |      | -69  |      | dBm  |
| Maximum Receive Level                          | 802.11b    |      | -10  |      | dBm  |
|                                                | 802.11g    |      | -8   |      | dBm  |
|                                                | 802.11n    |      | -8   |      | dBm  |

## 5G WLAN

| Parameters                                     | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------------------------|------------|------|------|------|------|
| Frequency Range                                |            | 5180 |      | 5805 | MHz  |
| RX Sensitivity<br>11a @ 10% PER                | - 6Mbps    |      | -87  |      | dBm  |
|                                                | - 9Mbps    |      | -86  |      | dBm  |
|                                                | - 12Mbps   |      | -84  |      | dBm  |
|                                                | - 18Mbps   |      | -82  |      | dBm  |
|                                                | - 24Mbps   |      | -79  |      | dBm  |
|                                                | - 36Mbps   |      | -75  |      | dBm  |
|                                                | - 48Mbps   |      | -71  |      | dBm  |
|                                                | - 54Mbps   |      | -70  |      | dBm  |
| Receive Sensitivity<br>(11n,20MHz)<br>@10% PER | - MCS=0    |      | -87  |      | dBm  |
|                                                | - MCS=1    |      | -84  |      | dBm  |
|                                                | - MCS=2    |      | -82  |      | dBm  |
|                                                | - MCS=3    |      | -79  |      | dBm  |
|                                                | - MCS=4    |      | -75  |      | dBm  |
|                                                | - MCS=5    |      | -71  |      | dBm  |
|                                                | - MCS=6    |      | -70  |      | dBm  |
|                                                | - MCS=7    |      | -69  |      | dBm  |
| Receive Sensitivity<br>(11n,40MHz)<br>@10% PER | - MCS=0    |      | -84  |      | dBm  |
|                                                | - MCS=1    |      | -81  |      | dBm  |
|                                                | - MCS=2    |      | -79  |      | dBm  |
|                                                | - MCS=3    |      | -76  |      | dBm  |
|                                                | - MCS=4    |      | -72  |      | dBm  |
|                                                | - MCS=5    |      | -68  |      | dBm  |
|                                                | - MCS=6    |      | -67  |      | dBm  |
|                                                | - MCS=7    |      | -66  |      | dBm  |

## 3.3 Wi-Fi RF Specification (TX)

## 2.4G WLAN

| Parameters      | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|------------|------|------|------|------|
| Frequency Range |            | 2412 |      | 2484 | MHz  |
| Output Power    | 802.11b    | 16.0 | 18.0 |      | dBm  |
|                 | 802.11g    | 12.0 | 14.0 |      | dBm  |
|                 | 802.11n    | 12.0 | 14.0 |      | dBm  |

|      |         |  |     |     |    |
|------|---------|--|-----|-----|----|
| @EVM | 802.11b |  | -30 | -10 | dB |
|      | 802.11g |  | -30 | -25 | dB |
|      | 802.11n |  | -30 | -28 | dB |

## 5G WLAN

| Parameters      | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|------------|------|------|------|------|
| Frequency Range |            | 5180 |      | 5805 | MHz  |
| Output Power    | 802.11a    | 12.0 | 14.0 |      | dBm  |
|                 | 802.11n    | 12.0 | 14.0 |      | dBm  |
| @EVM            | 802.11a    |      | -30  | -25  | dB   |
|                 | 802.11n    |      | -30  | -28  | dB   |

### 3.4 Power Consumption

(Using embedded buck switching regulator, DCDC mode)

| WLAN Operational Modes                     | Typ. | Unit |
|--------------------------------------------|------|------|
| OFF <sup>a</sup>                           | 2    | uA   |
| Rx, CCK, 1 Mbps                            | 67   | mA   |
| Rx, OFDM, 54 Mbps                          | 68   | mA   |
| Rx, HT20, MCS7                             | 68   | mA   |
| Rx, HT40, MCS7                             | 75   | mA   |
| Rx, 5.18G HT20, MCS7                       | 88   | mA   |
| Rx, 5.805G HT20, MCS7                      | 88   | mA   |
| Rx, 5.18 G HT40, MCS7                      | 97   | mA   |
| Rx, 5.805G HT40, MCS7                      | 97   | mA   |
| Tx, CCK, 1 Mbps                            | 307  | mA   |
| Tx, 11B, 11 Mbps@18dBm                     | 307  | mA   |
| Tx, OFDM, 54 Mbps@18dBm                    | 256  | mA   |
| Tx, HT20, MCS7@15dBm                       | 260  | mA   |
| Tx, HT40, MCS7@15dBm                       | 261  | mA   |
| Tx, 5.18 G HT20, MCS7                      | 310  | mA   |
| Tx, 5.805G HT20, MCS7                      | 293  | mA   |
| Power-saving(MCU_on) <sup>b</sup> , DTIM1  | 31   | mA   |
| Power-saving(MCU_on) <sup>b</sup> , DTIM3  | 30.5 | mA   |
| Power-saving(MCU_off) <sup>c</sup> , DTIM1 | 3.5  | mA   |
| Power-saving(MCU_off) <sup>c</sup> , DTIM3 | 2.8  | mA   |

a. OFF mode test condition: VBAT=3.3V, VIO=3.3V, LDO\_EN=0V (excluding Flash/PSRAM).

b. Intra-beacon Sleep when MCU is turn on.

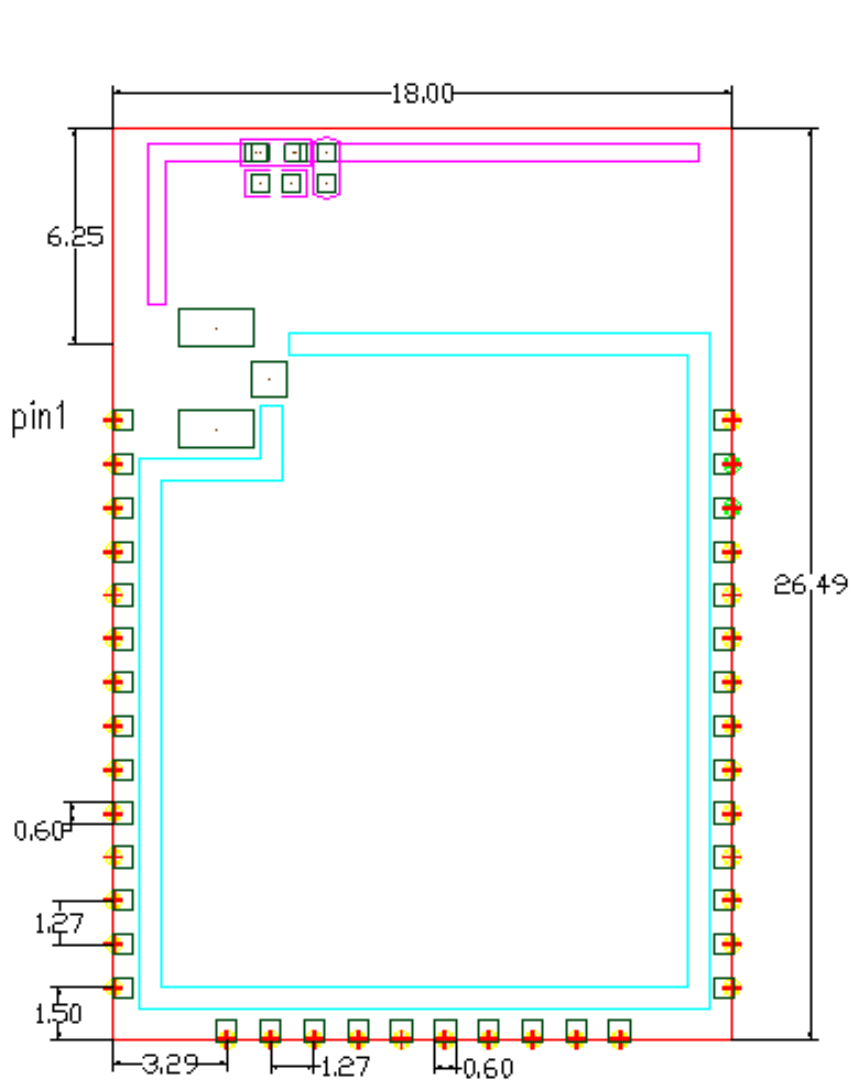
It is used in the applications that require the CPU to be working.

c. Intra-beacon Sleep when MCU is turn off.

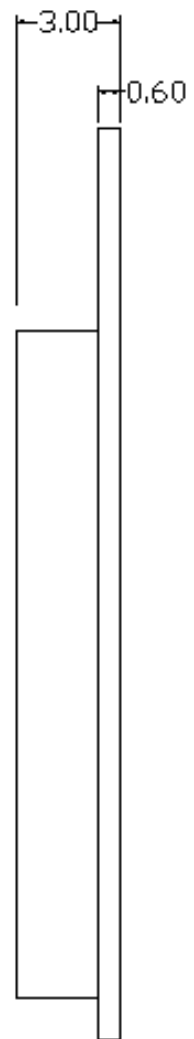
## 4. Pin Assignments

### 4.1 PCB Pin Outline

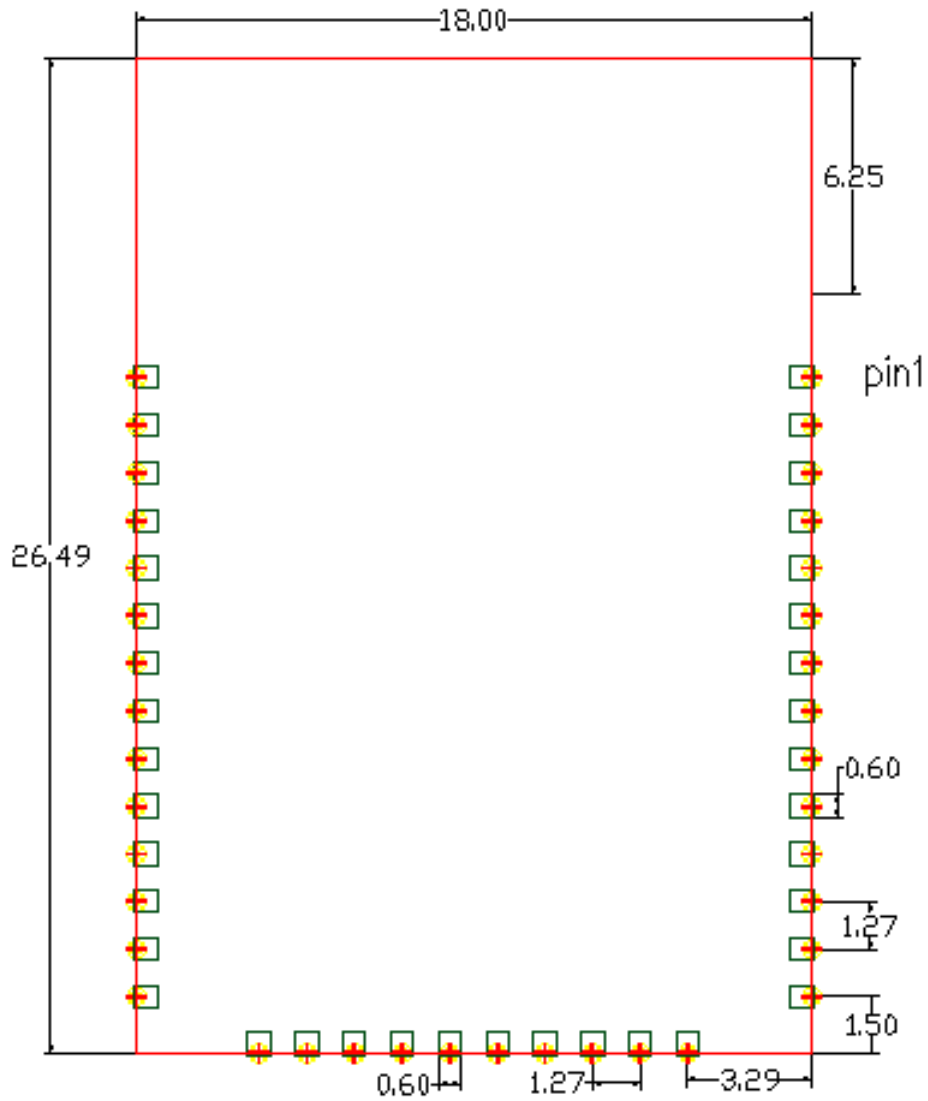
< TOP VIEW >



< SIDE VIEW >



< BOTTOM VIEW >



## 4.2 Pin Function Description

| Pin | Pin-Define                              | Type   | Description                                                                                                    |
|-----|-----------------------------------------|--------|----------------------------------------------------------------------------------------------------------------|
| 1   | GND                                     | P      | Ground                                                                                                         |
| 2   | VBAT                                    | P      | Main Power Supply Input 3.3V                                                                                   |
| 3   | LDO_EN                                  | I      | Active High to Enable Whole Module                                                                             |
| 4   | GPIO22 / ADC0                           | I/O/AI | GPIO22 / I2C_ SDA / UART0_RXD / ADC0                                                                           |
| 5   | GPIO21 / ADC1                           | I/O/AI | GPIO21 / I2C_ SCL / UART0_TXD / ADC1                                                                           |
| 6   | GPIO20 / ADC2 /<br>I2S_ MCLK            | I/O/AI | GPIO20 / ADC2 / I2S_ MCLK                                                                                      |
| 7   | GPIO00 / ADC3 / PWM0                    | I/O/AI | GPIO00 / ADC3 / PWM0                                                                                           |
| 8   | NC                                      | —      | Not connected                                                                                                  |
| 9   | NC                                      | —      | Not connected                                                                                                  |
| 10  | GPIO01 / PWM1                           | I/O    | GPIO01 / PWM1                                                                                                  |
| 11  | GPIO02 / PWM2                           | I/O    | GPIO02 / PWM2                                                                                                  |
| 12  | GPIO05 / UART1_RTS /<br>I2S_ BCLK       | I/O    | GPIO05 / UART1_RTS / I2S_ BCLK                                                                                 |
| 13  | GPIO06 / UART1_RXD /<br>I2S_ DI         | I/O    | GPIO06 / UART1_RXD / I2S_ DI                                                                                   |
| 14  | GPIO07 / UART1_TXD /<br>I2S_ DO         | I/O    | GPIO07 / UART1_TXD / I2S_ DO                                                                                   |
| 15  | GND                                     | GND    | Ground                                                                                                         |
| 16  | NC                                      | —      | Not connected                                                                                                  |
| 17  | GPIO09 / UART1_CTS /<br>I2S_ LRCLK      | I/O    | GPIO09 / UART1_CTS / I2S_ LRCLK                                                                                |
| 18  | GPIO11 / SPI_ S_ CLK                    | I/O    | GPIO11 / SPI_ S_ CLK                                                                                           |
| 19  | NC                                      | —      | Not connected                                                                                                  |
| 20  | NC                                      | —      | Not connected                                                                                                  |
| 21  | NC                                      | —      | Not connected                                                                                                  |
| 22  | NC                                      | —      | Not connected                                                                                                  |
| 23  | GPIO08 / SPI_ M_ CLK                    | I/O    | GPIO08 / SPI_ M_ CLK                                                                                           |
| 24  | GPIO13 / SPI_ M_ CS /<br>SPI_ S_ CS     | I/O    | GPIO13 / SPI_ M_ CS / SPI_ S_ CS<br>(NOT available in iTM-1066AM module because<br>occupied by embedded PSRAM) |
| 25  | GPIO12 / SPI_ M_ MOSI /<br>SPI_ S_ MISO | I/O    | GPIO12 / SPI_ M_ MOSI / SPI_ S_ MISO                                                                           |
| 26  | GPIO10 / SPI_ M_ MISO /                 | I/O    | GPIO10 / SPI_ M_ MISO / SPI_ S_ MOSI                                                                           |

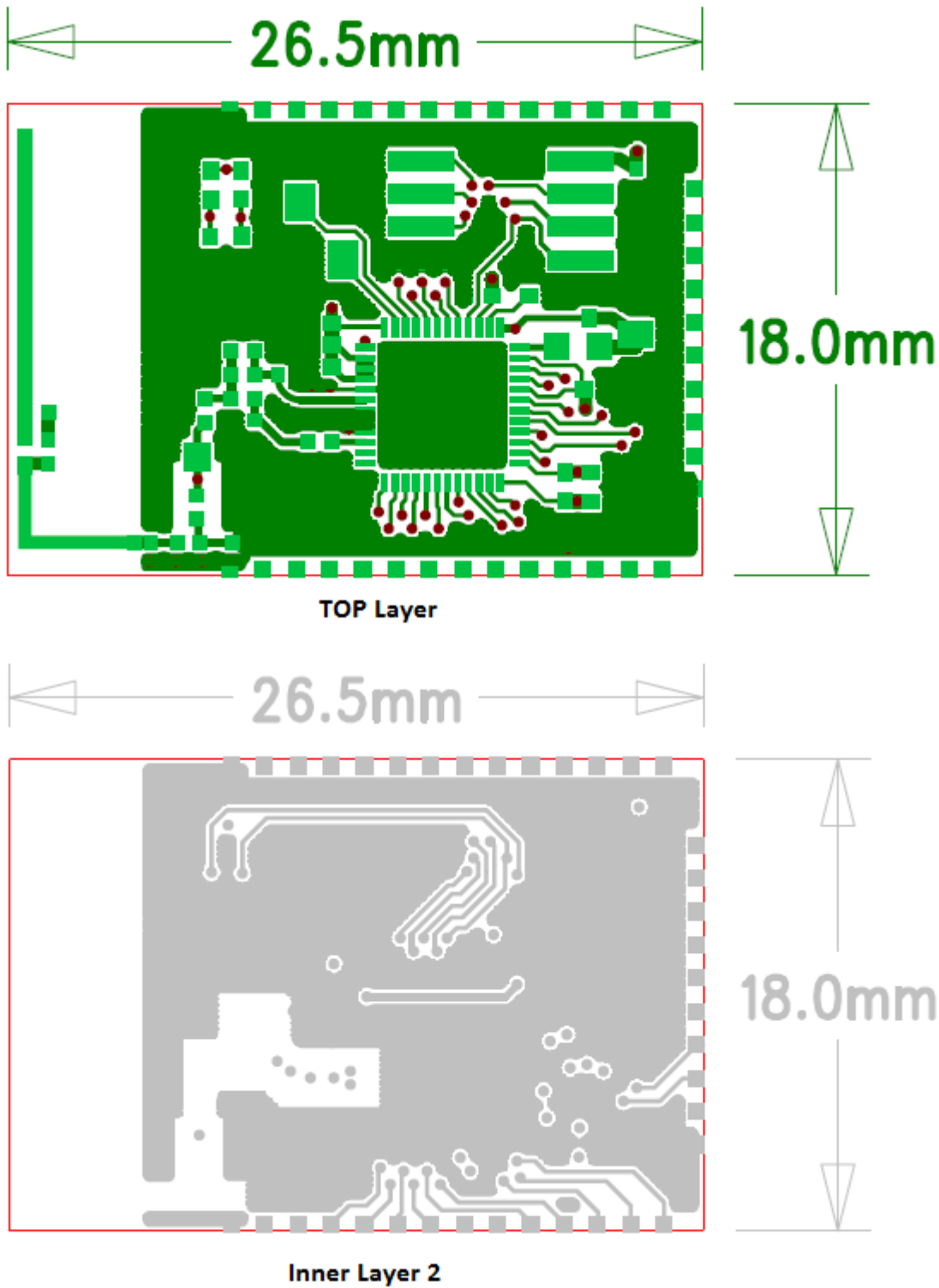
|    |                              |     |                                                                 |
|----|------------------------------|-----|-----------------------------------------------------------------|
|    | SPI_S_MOSI                   |     |                                                                 |
| 27 | NC                           | —   | NC                                                              |
| 28 | USB HSDP                     | AIO | USB DP                                                          |
| 29 | USB HSDM                     | AIO | USB DM                                                          |
| 30 | GPIO14 /<br>SPI_FLASH_IO0_DI | I/O | GPIO14 / SPI_FLASH_IO0_DI<br>(For strapping and debugging only) |
| 31 | GPIO15 /<br>SPI_FLASH_CLK    | I/O | GPIO15 / SPI_FLASH_CLK<br>(For strapping and debugging only)    |
| 32 | NC                           | —   | NC                                                              |
| 33 | NC                           | —   | NC                                                              |
| 34 | GPIO03 / PWM3 /<br>UART0_RXD | I/O | GPIO03 / PWM3 / UART0_RXD (default UART)                        |
| 35 | GPIO04 / PWM4 /<br>UART0_TXD | I/O | GPIO04 / PWM4 / UART0_TXD (default UART)                        |
| 36 | NC                           | —   | NC                                                              |
| 37 | NC                           | —   | NC                                                              |
| 38 | GND                          | P   | GND                                                             |

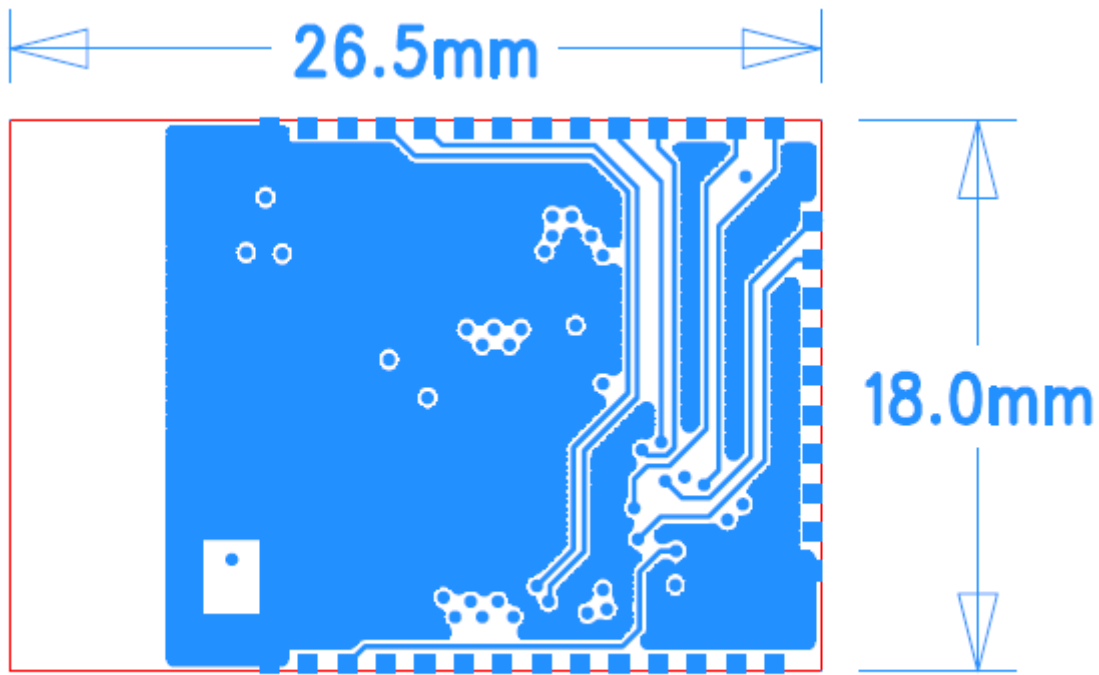
■ IO customization table is shown as below

|     | ALT0  | ALT1  | ALT2 | ALT3  | ALT4 | ALT5   |
|-----|-------|-------|------|-------|------|--------|
| P00 |       | PWM0  |      |       | ADC3 | GPIO0  |
| P01 |       | PWM1  |      |       |      | GPIO1  |
| P02 |       | PWM2  |      |       |      | GPIO2  |
| P03 | UART0 | PWM3  |      |       |      | GPIO3  |
| P04 | UART0 | PWM4  |      |       |      | GPIO4  |
| P05 | UART1 | I2S   |      |       |      | GPIO5  |
| P06 | UART1 | I2S   |      |       |      | GPIO6  |
| P07 | UART1 | I2S   |      |       |      | GPIO7  |
| P08 |       | SPIM  | I2S  |       |      | GPIO8  |
| P09 | UART1 | I2S   |      |       |      | GPIO9  |
| P10 |       | SPIM  | I2S  | I2CM  | SPIS | GPIO10 |
| P11 |       |       |      |       | SPIS | GPIO11 |
| P12 |       | SPIM  | I2S  | I2CM  | SPIS | GPIO12 |
| P13 |       | SPIM  | I2S  | PSRAM | SPIS | GPIO13 |
| P14 | FLASH |       |      | PSRAM |      | GPIO14 |
| P15 | FLASH |       |      | PSRAM |      | GPIO15 |
| P16 | FLASH |       |      | PSRAM |      | GPIO16 |
| P17 | FLASH |       |      | PSRAM |      | GPIO17 |
| P18 | FLASH |       |      | PSRAM |      | GPIO18 |
| P19 | FLASH |       |      | PSRAM |      | GPIO19 |
| P20 |       | I2S   | I2S  |       | ADC2 | GPIO20 |
| P21 | I2CS  | UART0 | I2CM |       | ADC1 | GPIO21 |
| P22 | I2CS  | UART0 | I2CM |       | ADC0 | GPIO22 |

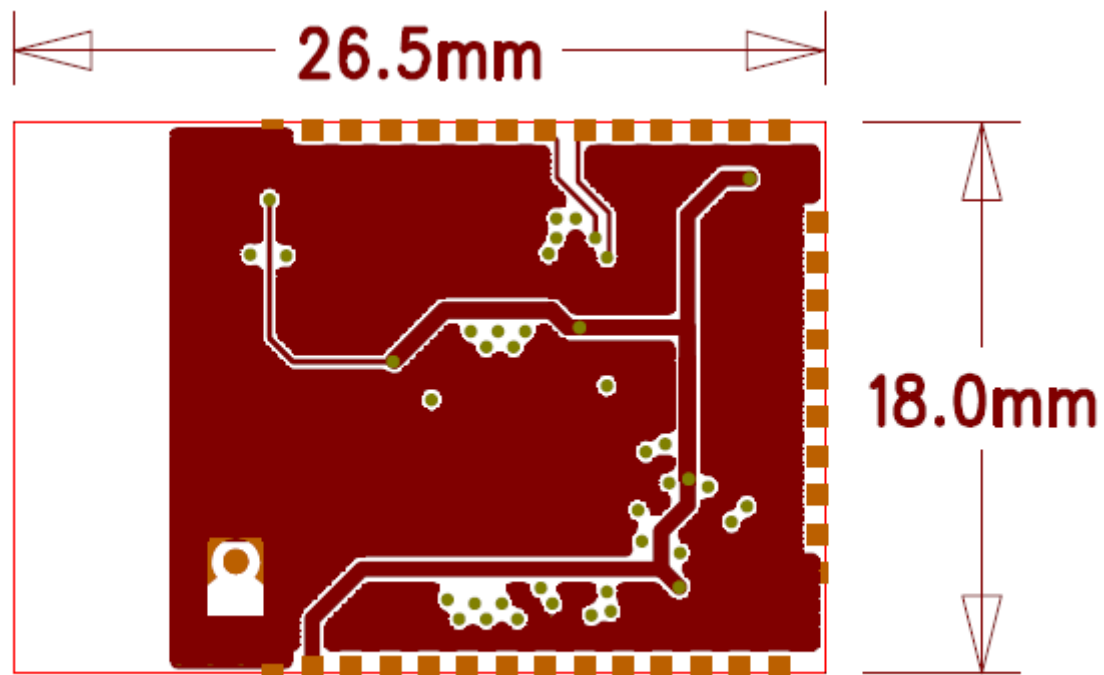
## 5. Dimensions and Layout

### 5.1 Module Layout





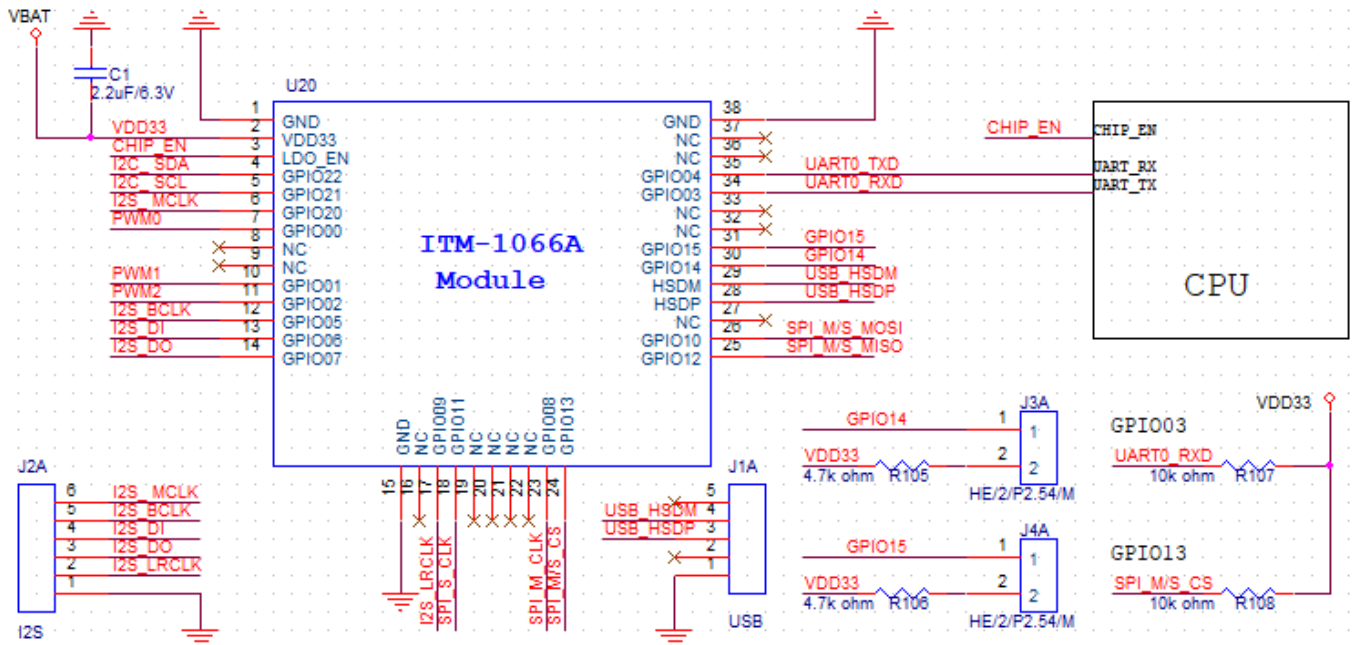
Inner Layer 3



Bottom Layer

## 6. Hardware Design Guidelines

### 6-1 Reference Design



GPIO3 and GPIO13 must be HIGH when power-on.

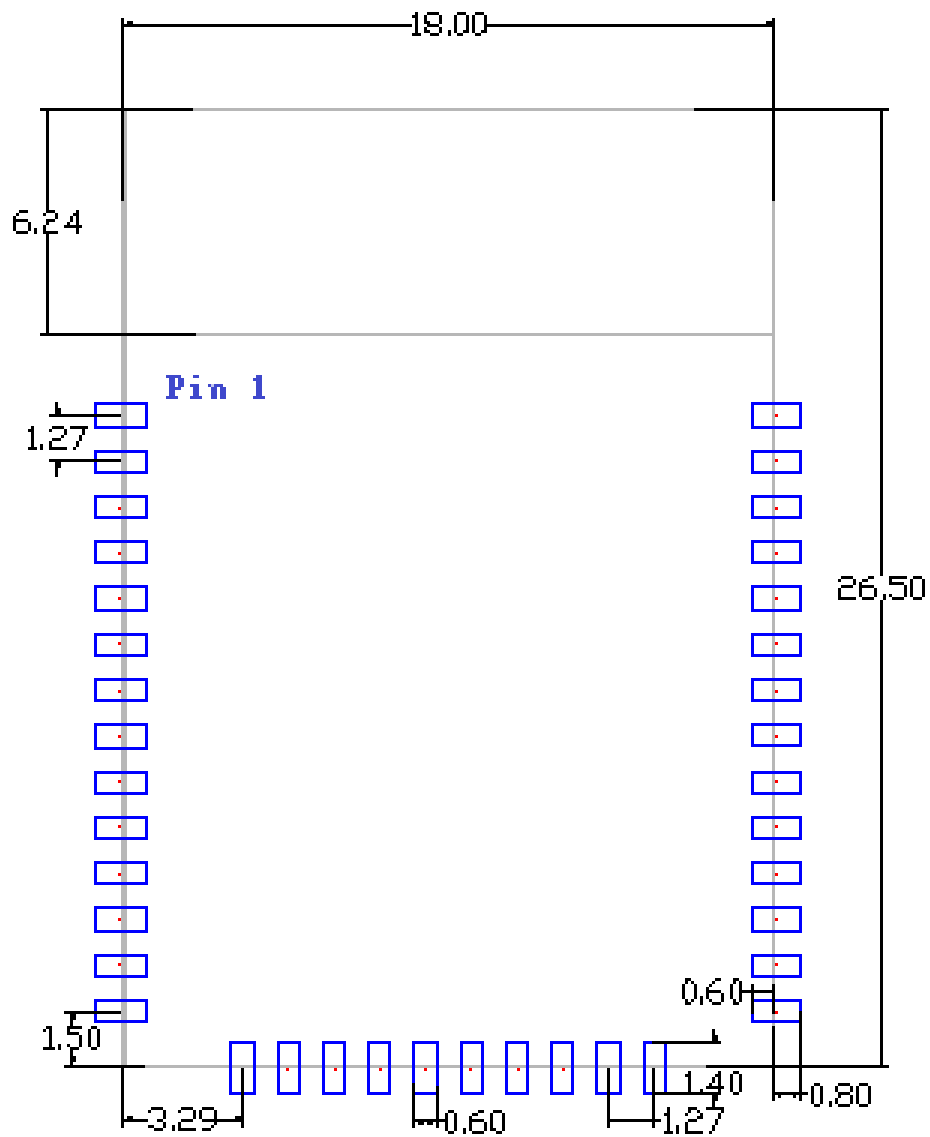
GPIO20 MUST be LOW when power-on (A 100K-ohm pull-low resistor is recommended)

J3A and J4A are for firmware upgrade through USB interface – Pulling up GPIO14/15 when power-on will force the module enter USB mode for firmware upgrade.

However, J3A and J4A must be as close to GPIO14/15 pins as possible. Otherwise, the PCB traces of GPIO14/15 may cause EMI problem, because GPIO14 and GPIO15 are SPI flash clock/data pins when the module is in normal operation mode.

## 6-2 Layout Recommendation

< TOP VIEW >

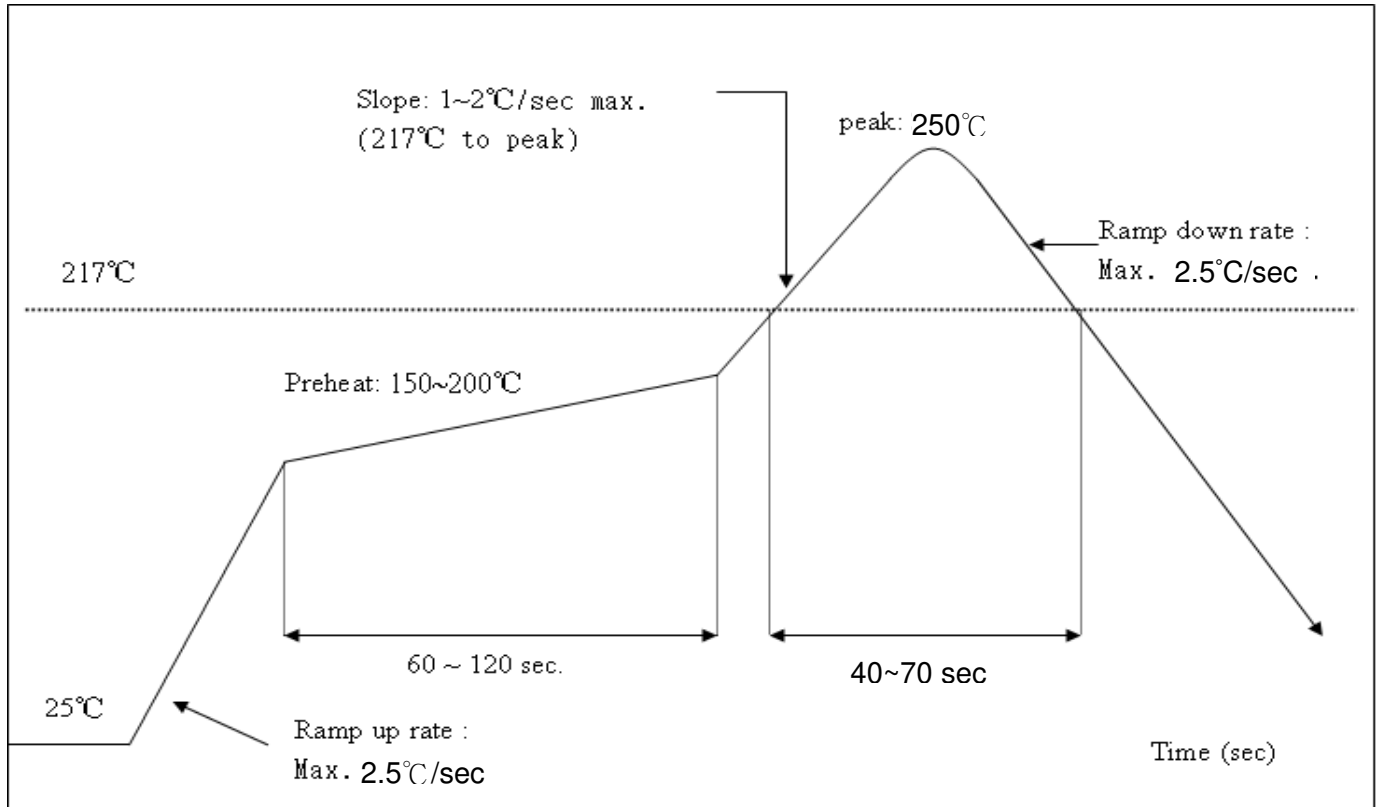


### 6-3 Recommended Reflow Profile

Referred to IPC/JEDEC standard.

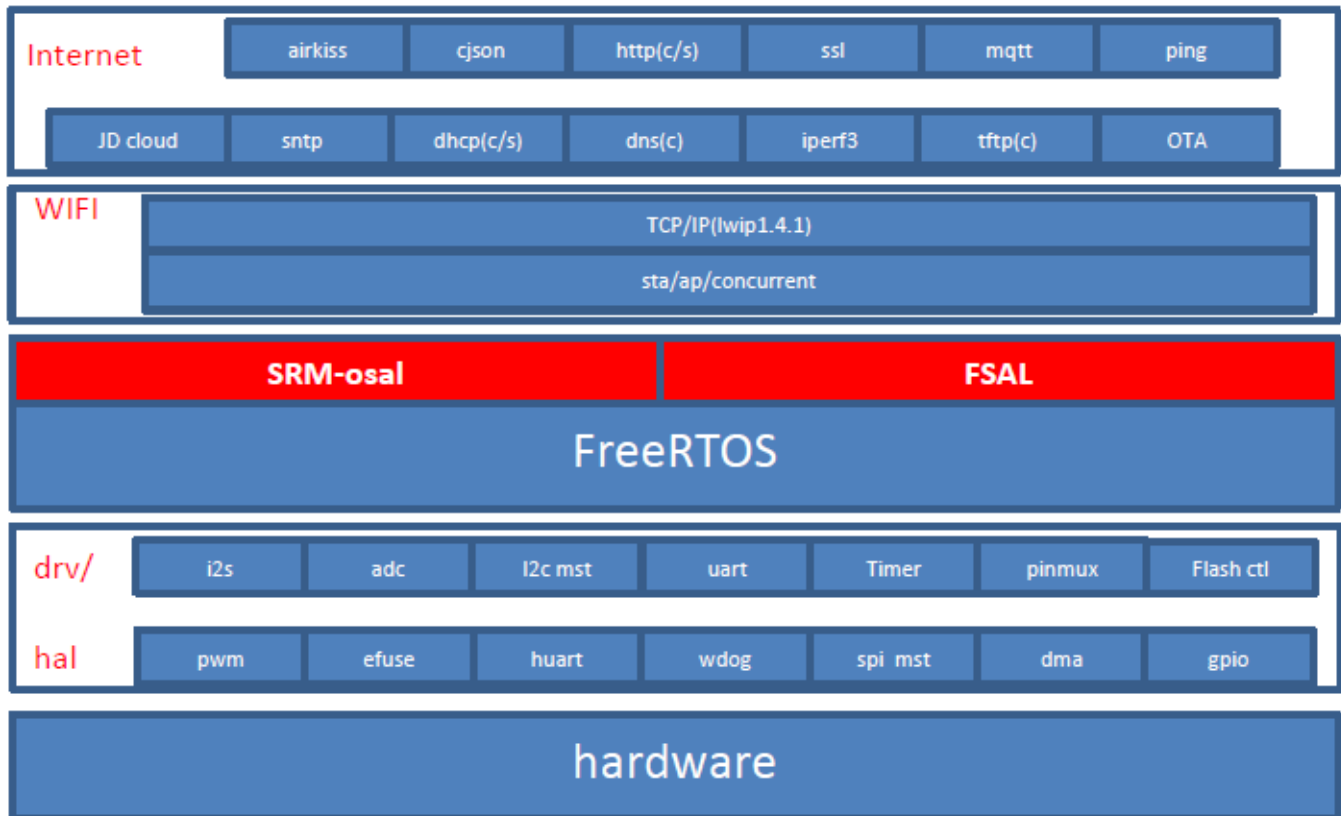
Peak Temperature : <250°C

Number of Times : ≤2 times



## 7. Software Introduction

### 7-1 Software Architecture

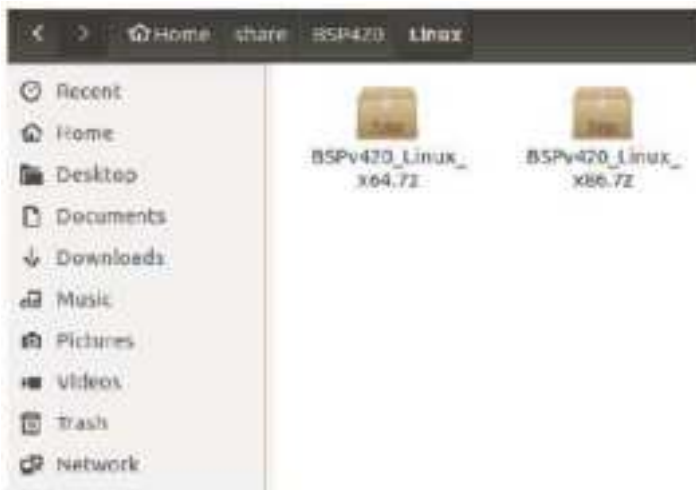


### 7-2 SDK Environment Setup

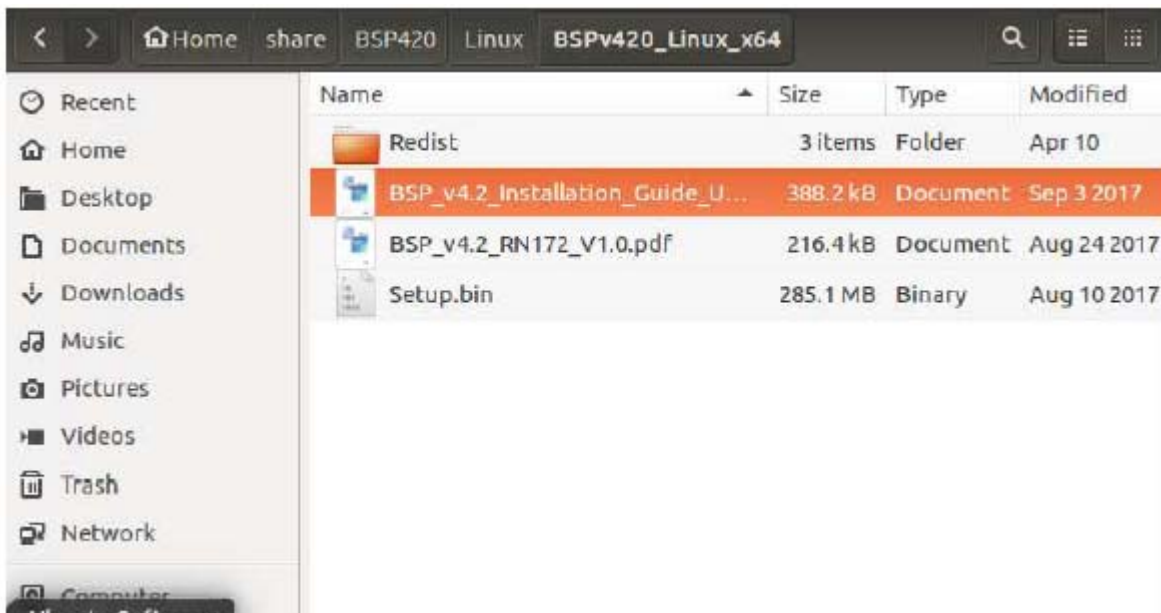
A. Install BSP420 (Here we take Linux OS version as example)



B. Select corresponding OS type and version and decompress the installation file.



C. Refer to the installation guide to complete the installation



D. Set environment variables after BSP installed

```
PATH=$PATH:your_install_pathAndestech/BSPv420/toolchains/nds32le-elf-mculib-v3/bin
```

## 7-3 Build and Program Binary

A. Type 'make distclean'

B. Type 'make list\_projects'. You will see projects supported by SDK as below

```

/home/lee/share/tiramsu_lcomm_18Q1.1813.02_sdk/build/project_cfg.mk not found
Please find project use "make list_projects", set project use "make setup p=9803
ECT_NAME"
make[1]: Entering directory '/home/lee/share/tiramsu_lcomm_18Q1.1813.02_sdk'
projects/pwm
projects/upio
projects/t2c_master
projects/Onac
projects/burst_cli
projects/t2s
projects/tmr
projects/wdt
projects/hsuart
projects/lmdna
projects/adc
projects/spl_master
projects/uart_echo
projects/mac_atcmd
projects/uart
make[1]: Leaving directory '/home/lee/share/tiramsu_lcomm_18Q1.1813.02_sdk'
build end
root@ubuntu:/home/lee/share/tiramsu_lcomm_18Q1.1813.02_sdk#

```

C. You can select the project you want to execute and build up the bin file.

D. Take project 'mac\_atcmd' as example.

E. Type 'make setup p=mac\_atcmd'

F. Type 'make' to build up the bin file

G. The desired bin file is shown as below

```

root@tlm-Latitude-E5450:/home/tlm/share/tiramsu_lcomm_18Q1.1811.00_sdk# ls -al image/mac_atcmd*
-rw-r--r-- 1 root root 8942799 3月 29 13:12 image/mac_atcmd.asm
-rw-r--r-- 1 root root 582400 3月 29 13:12 image/mac_atcmd.bin
-rwxr-xr-x 1 root root 2618644 3月 29 13:12 image/mac_atcmd.elf
-rw-r--r-- 1 root root 1152955 3月 29 13:12 image/mac_atcmd.map
-rw-r--r-- 1 root root 33 3月 29 13:12 image/mac_atcmd.nd5

```

H. Using USB firmware upgrade tool to update this bin file into the module.

I. Reboot the module after firmware upgrade, and connect the module through UART port, then you will see the LOG shown as below

```

?>IF0 44:57:10:3F:09:A1
IF1 44:57:10:3F:09:A2
MAC[44:57:10:3F:09:A1]
MAC[44:57:10:3F:09:A2]
task tcpip_task created
init end 2
task wifi_connect ta created
wifi_mgmt_task
=====
RT Config: 11 11 11 11 11 11 11 0x97 0x97 7 9 10 7 7 7 7 0
HT Config: 11 11 11 11 11 11 11 0x97 0x97 7 9 10 7 7 7 7 0
LT Config: 11 11 11 11 11 11 11 0x97 0x97 7 9 10 7 7 7 7 0
=====
RF Gain: 4
B Rate Gain: 7
G Rate Gain: 13, 11, 9, 7
20M Rate Gain: 13, 11, 9, 7
40M Rate Gain: 13, 11, 9, 7
Temperature Boundary: 35, 90
=====
rf config ch = -1, current ch = 7
rf config tempe state = -1, current tempe state = 2
?>
?>
?>
?>

```

J. Now you can key in AT command to manipulate the module

## 8. Appendix

### Compliance with KDB996369 D03 OEM Manual

#### 2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C & PART 15 SUBPART E has been investigated. It is applicable to the modular transmitter

#### 2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions (example, uses another antenna) for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

#### 2.4 Limited module procedures

This module is single modular.

Not applicable.

#### 2.5 Trace antenna designs

Not applicable.

#### 2.6 RF exposure considerations

This modular transmitter should be used in the mobile conditions and 20cm from a person's body, the host product manufacture should be put those information in the end-product manual to the end users. If RF exposure statement and use conditions are not provided, then the host product manufacture is required to take responsibility of the module through a change in FCC ID(new application)

#### 2.7 Antennas

This radio transmitter FCC ID : 2AWP5WM1066A has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

| Manufacturer | Part No.  | Antenna Type | Maximum antenna gain                                                                |
|--------------|-----------|--------------|-------------------------------------------------------------------------------------|
| IOTTECH      | ITM-1066A | PCB Antenna  | 1.376dBi for 2.4GHz<br>-1.840dBi for 5.150-5.250 GHz<br>0.745dBi for 5.725~5.825GHz |

## 2.8 Label and compliance information

The final end product must be labeled in a visible area with the following "Contains FCC ID: 2AWP5WM1066A ".

## 2.9 Information on test modes and additional testing requirements

Host manufacturer which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15 :15.247 and 15.407 requirement, only if the test result comply with FCC part 15.247 and 15.407 requirement, then the host can be sold legally.

When testing host product, the host manufacture should follow FCC KDB Publication 996369 D04 Module Integration Guide for testing the host products. The host manufacturer may operate their product during the measurements.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

### CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

### RF Exposure Warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

### End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2AWP5WM1066A "

### Information for the OEMs and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator, but should not be distributed to the end user.

- 1) This device is intended for OEM integrators only.
- 2) Please see the full Grant of Equipment document for other res