



# Product Specification

**Model: FLC8720FRA-B**

Jiangsu Fulian Communication Technology Co., Ltd.

| Approved By | Reviewed By | Prepared By | Version | Date       |
|-------------|-------------|-------------|---------|------------|
|             |             |             | V1.2    | 2025.04.30 |



## 1、 Version History

| Date       | Version | Updates  |
|------------|---------|--|
| 2024-12-20 | V1.0    | Initial Release  |
| 2025-03-05 | V1.1    | Add timing diagrams, reference designs, and power consumption data |
| 2025-04-30 | V1.2    | Update module size   |



## 2、 Product Overview

The FLC8720FRA-B module integrates the RTL8720DF dual-core Cortex-M33 & M23 processor platform (up to 200MHz), supporting IEEE 802.11a/b/g/n Wi-Fi and Bluetooth Low Energy (BLE 5.0) across 2.4 GHz and 5 GHz bands. With built-in 512KB RAM and 4MB Flash, it delivers high-speed data processing capabilities.

Featuring an LGA package (13.2×12.5×2.0mm) and superior RF performance, it is widely used in IoT applications:

- Consumer IP cameras
- Dashcams
- Entry-level smart TVs
- Robotic vacuums
- Drones

## 3、 Key Features

- Dual-band support: 2.4GHz (802.11b/g/n) & 5GHz (802.11a/n)
- Compact dimensions: (13.2±0.2) x(12.5±0.2) x(2.0±0.15)mm
- LGA package design
- Power input: 3.0V–3.6V (Typ. 3.3V)
- Operating temperature: -40°C to +85°C
- 40MHz external crystal oscillator



## 4、 Technical Specifications

| Parameter          | Description   |
|--------------------|---|
| Model Number       | FLC8720FRA-B  |
| Module Type        | Wi-Fi 1T1R and BT/BLE Combo Module  |
| Main Chip          | RTL8720DF   |
| Standards          | 802.11 a/b/g/n, BLE 5.0   |
| Data Rates         | 802.11b: 1 Mbps、2 Mbps、5.5 Mbps、11 Mbps<br>802.11a/g: 6 Mbps、9 Mbps、12 Mbps、18 Mbps、24 Mbps、36 Mbps、48 Mbps、54 Mbps<br>802.11n: HT20/HT40 (MCS 0~MCS 7) |
| Modulation Schemes | DBPSK、DQPSK、CCK、BPSK、QPSK、16QAM、64QAM、GFSK  |
| Frequency Bands    | 2.4 GHz: 2.400~2.4835 GHz<br>5 GHz: 5.150~5.850 GHz   |
| Security           | WPA-PSK、WPA2-PSK、WPA3-SAE、AES-128、DES、SHA、TrustZone、Secure Boot   |
| Interface          | SDIO\UART\USB\SPI\I2C\PWM   |
| Power Supply       | DC3.3V (3.0V - 3.6V)  |
| Operation temp     | -40~+85° C  |
| Storage Temp       | -20 ~ 95° C   |
| Dimensions         | (13.2±0.2) x (12.5±0.2) x (2.0±0.15)mm  |



## 5、 Hardware Architecture

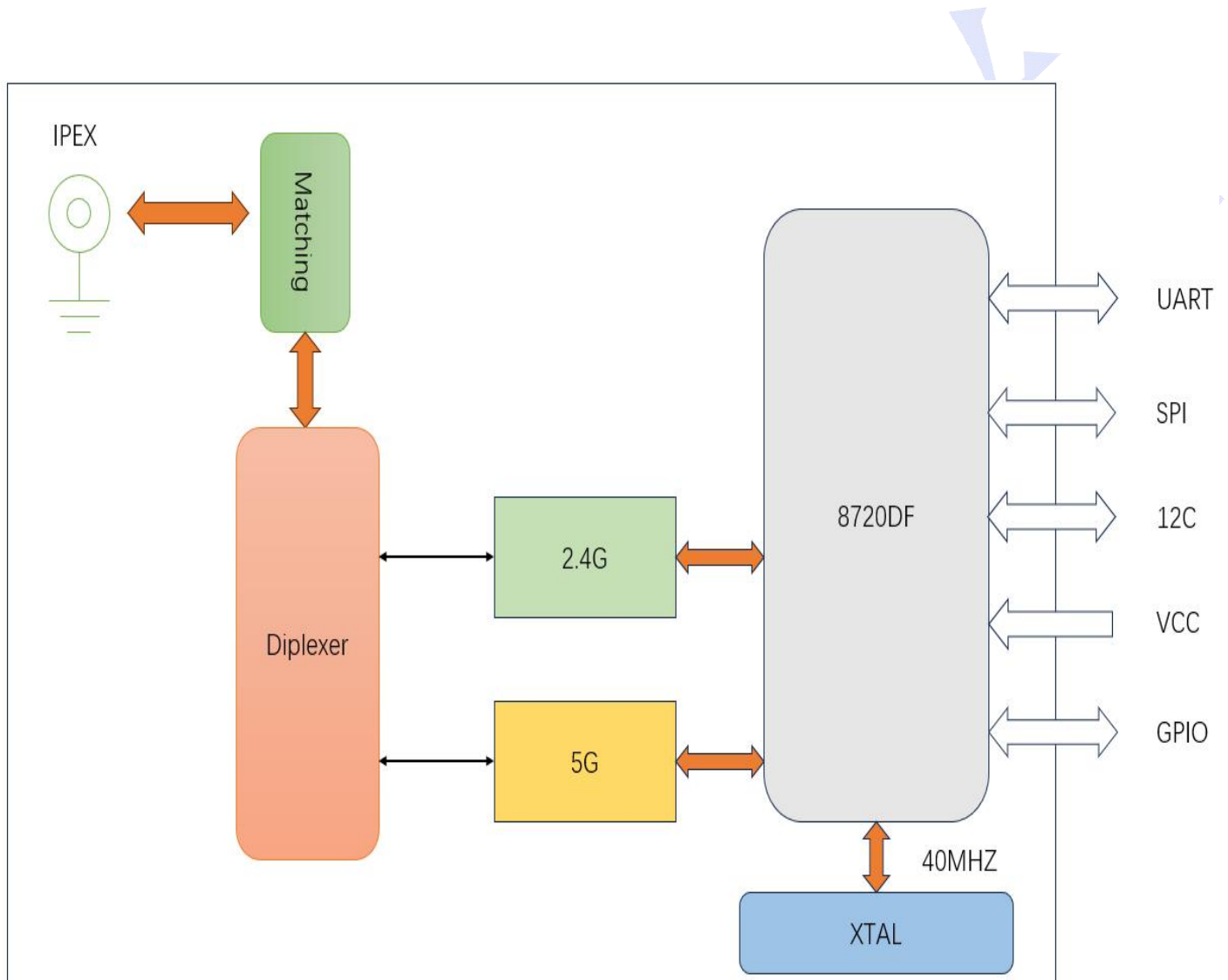


Figure 1 FLC8720FRA-B Block Diagram



## 6、 Hardware Architecture ( $(13.2 \pm 0.2) \times (12.5 \pm 0.2) \times (2.0 \pm 0.15) \text{mm}$ )

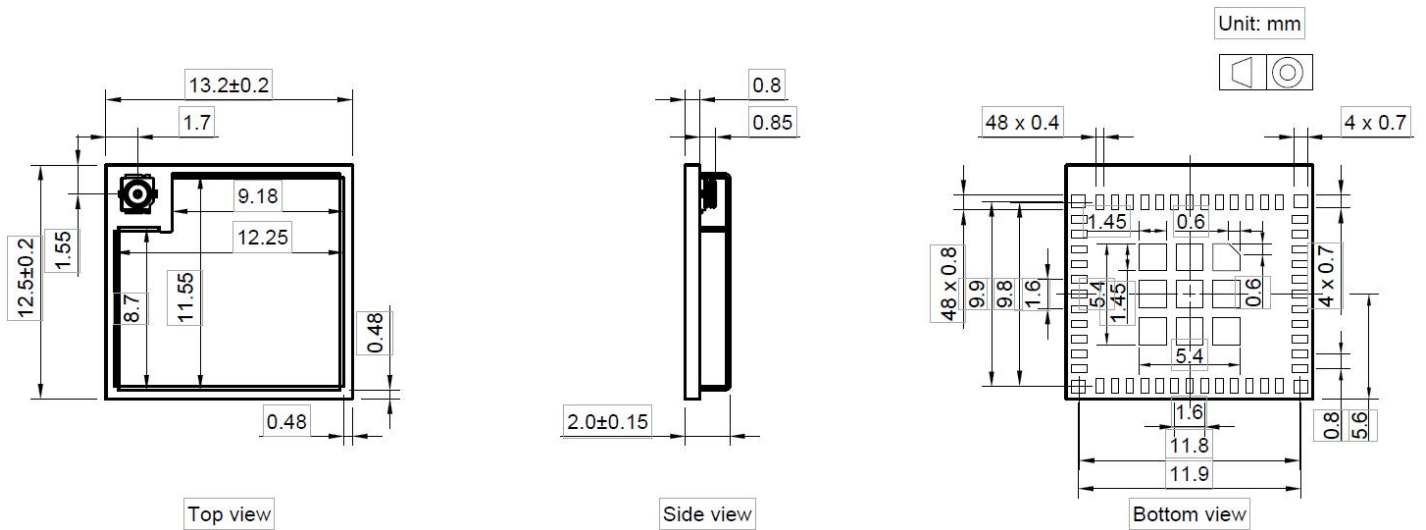
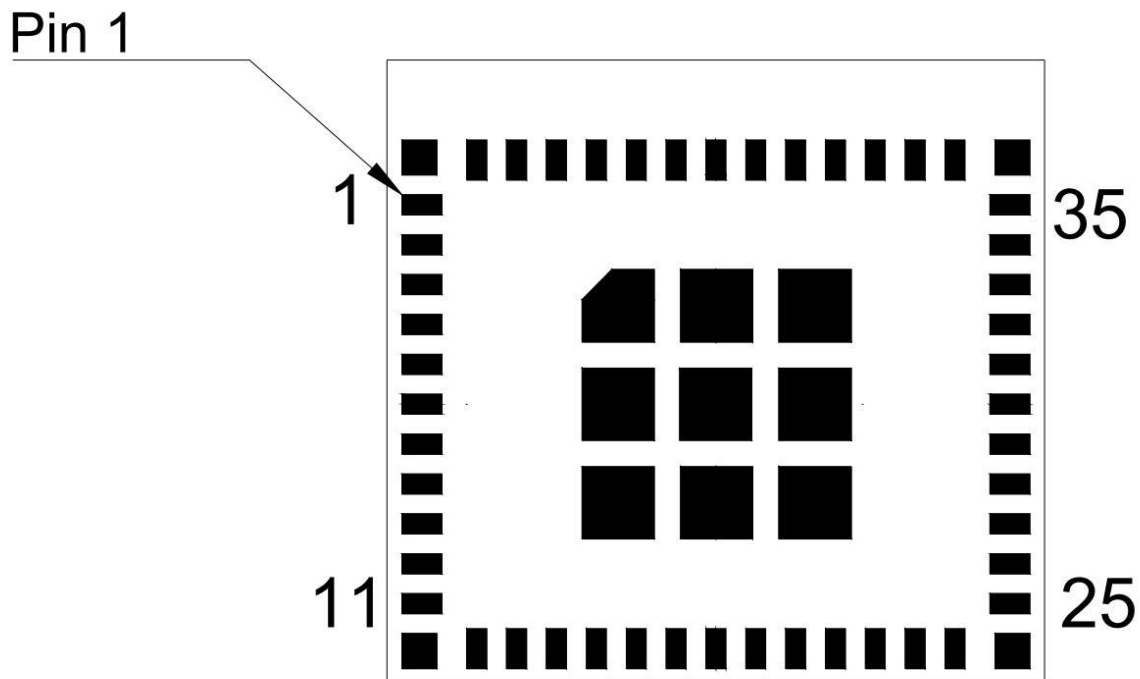


Figure 2. FLC8720FRA-B Physical Dimensions

## 7、 Pin Layout



Pin Definition Top View



Table 1 Pin Definitions

| No.                             | Name        | Function  | 备注          |
|---------------------------------|-------------|---|-------------|
| 1, 2, 11, 14, 36~46, 48~61      | GND         | GND   |             |
| 3                               | VCC         | Power:Vmax=3.6V Vmin=3.0V                         |             |
| 8                               | CHIP_EN     | High: on, enable chip<br>Low: off, chip power off |             |
| 31                              | UART1_TXD   | UART1 TXD   | UART        |
| 30                              | UART1_RXD   | UART1 RXD   |             |
| 19                              | UART2_TXD   | UART2 TXD   |             |
| 20                              | UART2_RXD   | UART2 RXD   |             |
| 5                               | GPIO10      | GPIO  |             |
| 6                               | GPIO9       | GPIO  |             |
| 12                              | GPIO15      | GPIO  |             |
| 13                              | GPIO14      | GPIO  |             |
| 16                              | GPIO3       | GPIO  |             |
| 17                              | GPIO2       | GPIO  |             |
| 18                              | GPIO1       | GPIO  |             |
| 21                              | GPIO0       | GPIO  |             |
| 22                              | GPIO6       | GPIO  |             |
| 23                              | GPIO8       | GPIO  |             |
| 26                              | GPIO7       | GPIO  |             |
| 27                              | GPIO5       | GPIO  |             |
| 28                              | GPIO4       | GPIO  |             |
| 33                              | GPIO16      | GPIO  |             |
| 34                              | GPIO17      | GPIO  |             |
| 35                              | GPIO11      | GPIO  |             |
| 47                              | ANT_WIFI/BT | WiFi/BLE Ant                                      | 50 $\Omega$ |
| 4, 7, 9, 10, 15, 24, 25, 29, 32 | RESERVED    | NC  | suspended   |



## GPIO Functions

| 引脚号 | 引脚名       | GPIO | 功能 1     | 功能 2       | 功能 3   | 功能 4     |
|-----|-----------|------|----------|------------|--------|----------|
| 19  | UART2_TXD | PA7  | /        | /          | /      | /        |
| 20  | UART2_RXD | PA8  | /        | /          | /      | /        |
| 21  | GPI00     | PA12 | SPI_MOSI | /          | /      | /        |
| 18  | GPI01     | PA13 | SPI_MISO | /          | /      | /        |
| 17  | GPI02     | PA14 | SPI_CLK  | /          | /      | /        |
| 16  | GPI03     | PA15 | SPI_CS   | /          | /      | /        |
| 28  | GPI04     | PA25 | USB_DM   | /          | /      | I2C1_SCL |
| 27  | GPI05     | PA26 | USB_DP   | /          | /      | I2C1_SDA |
| 22  | GPI06     | PA27 | /        |            | SWDIO1 | /        |
| 26  | GPI07     | PA28 | RREF     | /          | /      | /        |
| 23  | GPI08     | PA30 | /        | /          | /      | /        |
| 6   | GPI09     | PB1  | ADC4     | /          | /      | /        |
| 5   | GPI010    | PB2  | ADC5     | /          | /      | /        |
| 35  | GPI011    | PB3  | ADC6     | /          | SWCLK1 | /        |
| 30  | UART1_RXD | PB18 | /        | SDIO_DATA2 | SWCLK2 | /        |
| 31  | UART1_TXD | PB19 | /        | SDIO_DATA3 | SWDIO2 | /        |
| 13  | GPI014    | PB20 | /        | SDIO_CMD   | PWM0   | I2C_SCL  |
| 12  | GPI015    | PB21 | /        | SDIO_CLK   | PWM1   | I2C_SDA  |
| 33  | GPI016    | PB22 | /        | SDIO_DATA0 | PWM2   | /        |
| 34  | GPI017    | PB23 | /        | SDIO_DATA1 | PWM3   | /        |





## 8、 RF Performance

## • BLE TX/RX Characteristics (VCC=3.3V 25°C)

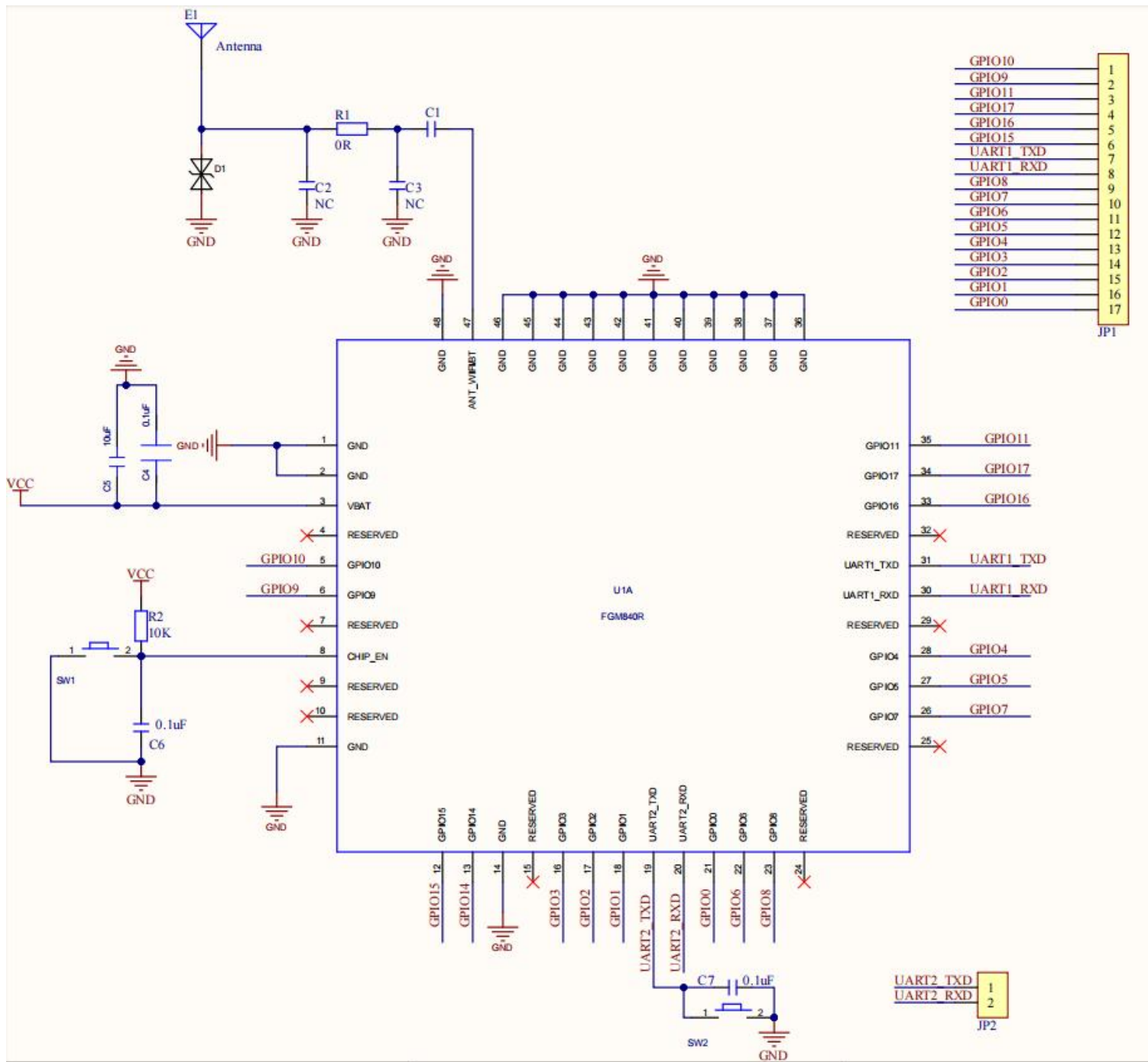
| Item | Metric       | Condition       | Value             |
|------|--------------|-----------------|-------------------|
| TX   | Output Power | BLE 1Mbps (dBm) | 4.5               |
|      |              | BLE 2Mbps (dBm) | 4.5               |
| RX   | Sensitivity  | LE1M (dBm)      | $\leq -100 \pm 3$ |
|      |              | LE2M (dBm)      | $\leq -96 \pm 3$  |

## • WiFi Specifications

|        | Protocol | Data Rate | Power (dBm) | EVM                 | Sensitivity (dBm) |
|--------|----------|-----------|-------------|---------------------|-------------------|
| 2.4GHz | 11b      | 1M        | 18          | $\leq 35\%$         | -99               |
|        |          | 11M       | 18          | $\leq 35\%$         | -90               |
|        | 11g      | 6Mbps     | 18          | $\leq -5\text{dB}$  | -94               |
|        |          | 54Mbps    | 17          | $\leq -25\text{dB}$ | -77.5             |
|        | 11n20    | MCS0      | 18          | $\leq -5\text{dB}$  | -94               |
|        |          | MCS7      | 16          | $\leq -27\text{dB}$ | -75               |
| 5GHz   | 11a      | 6Mbps     | 16          | $\leq -5\text{dB}$  | -94               |
|        |          | 54Mbps    | 14          | $\leq -25\text{dB}$ | -76.5             |
|        | 11n20    | MCS0      | 16          | $\leq -5\text{dB}$  | -94               |
|        |          | MCS7      | 13          | $\leq -27\text{dB}$ | -74.5             |



## 9、Reference Design



### Description:

- ◆ UART2 interface can be used as debug UART with debugging tools for downloading, debugging and AT command communication. It supports debugging command input of chip manufacturers and some AT command applications, and supports log printing output. TVS devices can be connected to improve the anti-static ability of the system.
- ◆ Reset: CHIP\_EN pin is pulled low ( $<0.2 \times VCC$ ) for at least 1ms
- ◆ Download mode: After the module is powered on, it is necessary to pull down the CHIP\_EN and

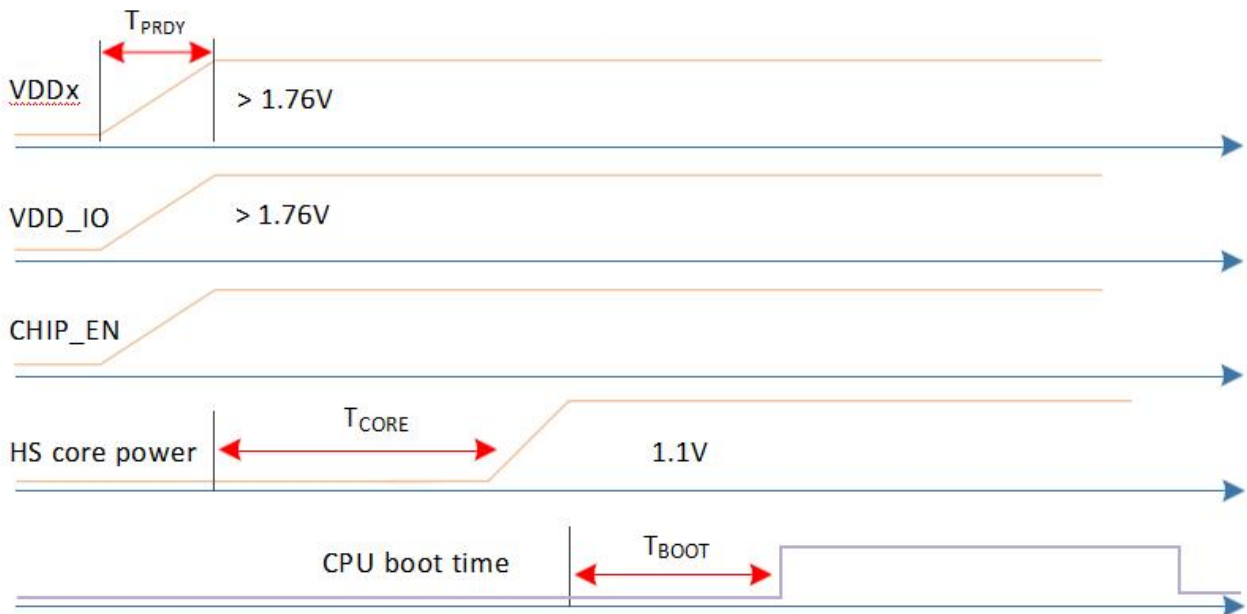


UART2\_TXD pins for at least 1ms, and then release the CHIP\_EN and UART2\_TXD pins in turn. The module will enter the download mode and download the firmware through the debug UART

## 10、Timing diagram

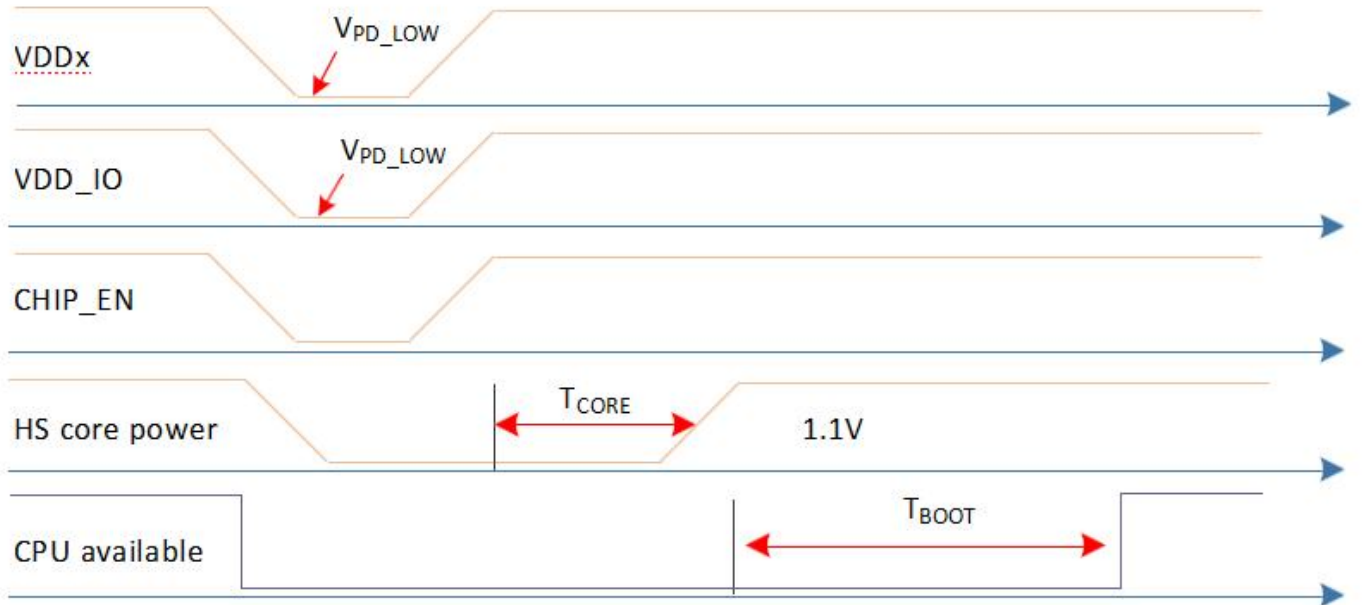
| Symbol        | Parameter   | Min. | Typ. | Max.          | Unit |
|---------------|---|------|------|---------------|------|
| $T_{PRDY}$    | VDD <sub>x</sub> ready time                           | 0.1  | 0.6  | 4.6           | ms   |
| $T_{CORE}$    | HS core power ready time                              |      | 15   | –             | ms   |
| $T_{BOOT}$    | HS MCU boot time                                      | 200  | 200  | –             | ms   |
| $V_{PD\_LOW}$ | Power-down low voltage                                | 0    | 0    | 0.3           | V    |
| $V_{RST}$     | Shutdown occurs after CHIP_EN lower than this voltage | 0    | 0    | $0.2 * VDD_X$ | V    |
| $T_{RST}$     | Required time that CHIP_EN lower than $V_{RST}$       | 1    | 1    | –             | ms   |

### A、Power on or deep sleep wake-up timing

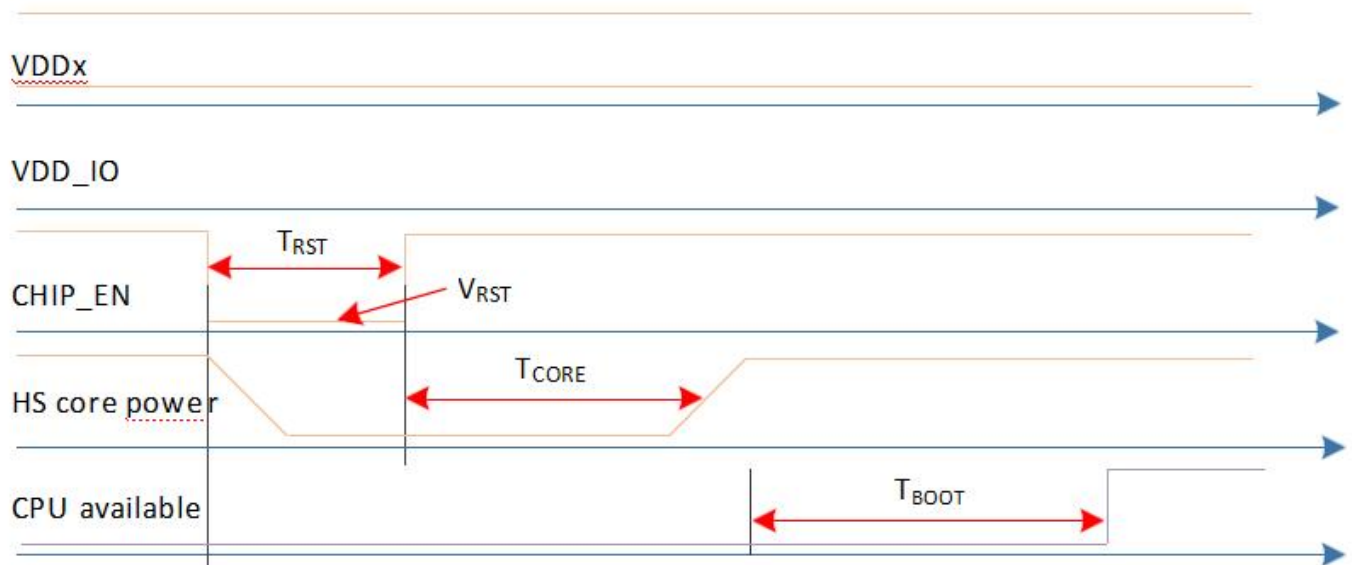




## B、Power off timing



## C、Power down timing





## 11、Power consumption data

| Power consumption |         |           |             |             |
|-------------------|---------|-----------|-------------|-------------|
| Mode              |         | Rate      | Power (dBm) | Current(mA) |
| 2.4GHz            | 802.11b | TX-1Mbps  | 18          | 281         |
|                   |         | TX-11Mbps | 18          | 268         |
|                   | 802.11g | TX-6M     | 18          | 274         |
|                   |         | TX-54M    | 17          | 198         |
|                   | 802.11n | TX-MCS0   | 18          | 271         |
|                   |         | TX-MCS7   | 16          | 187         |
| 5G                | 802.11a | TX-6M     | 16          | 285         |
|                   |         | TX-54M    | 14          | 203         |
|                   | 802.11n | TX-MCS0   | 16          | 286         |
|                   |         | TX-MCS7   | 13          | 192         |
| BT                | BLE     | TX-1Mbps  | 4.5         | 86          |
|                   |         | TX-2Mbps  | 4.5         | 63          |

## 12、Reflow Profile

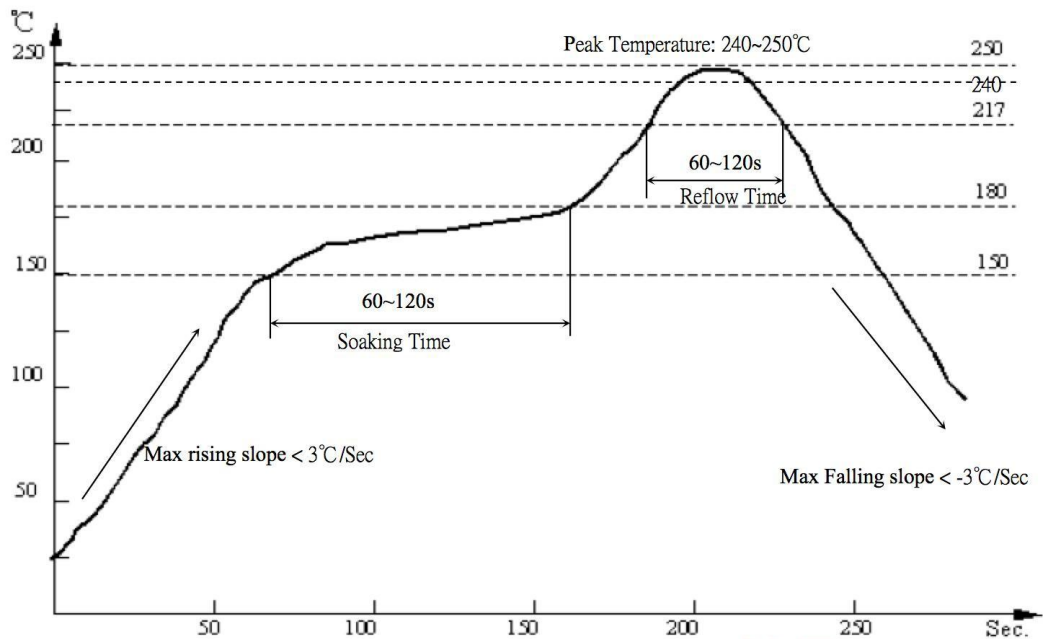


Figure 3.FLC8720FRA-B Reflow Temperature



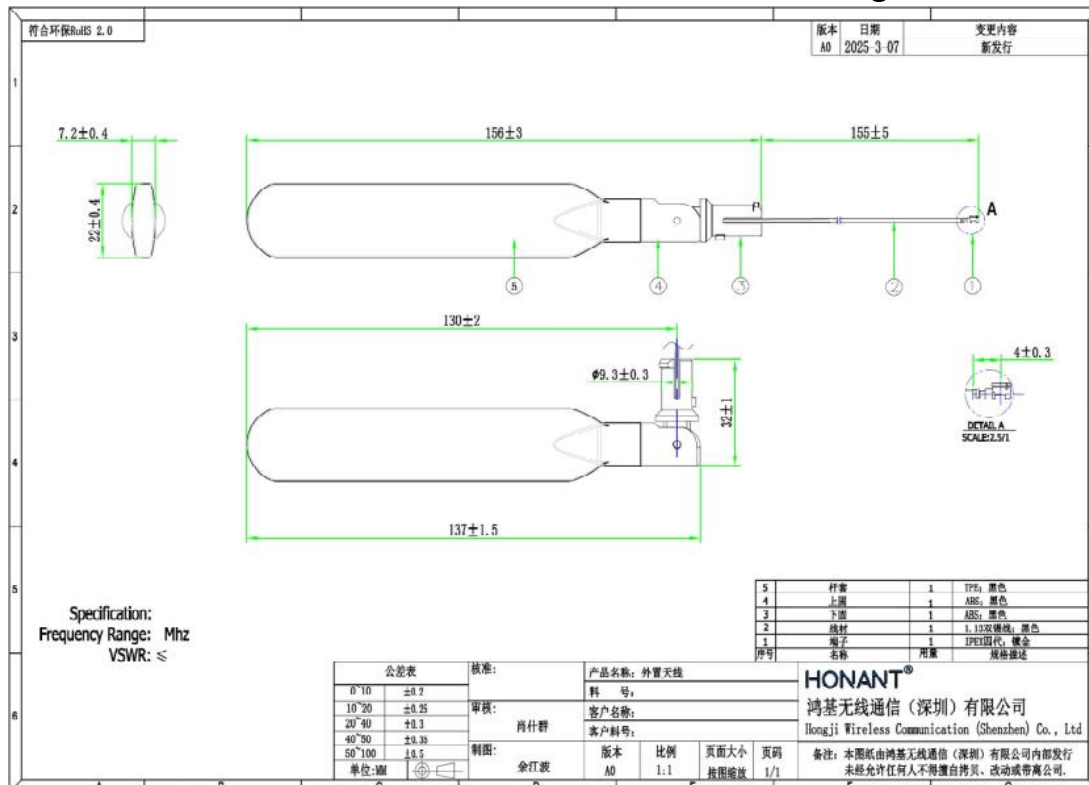
## 13、Antenna

- ◆ Manufacturer name: Hongji Wireless Communication (Shenzhen) Co., Ltd
- ◆ Product P/N: FLA2A5
- ◆ Product type: External Flat Antenna
- ◆ Description: 2.4/5.8G External Black Flat Antenna 1.13 Black Wire IPEX-4 Generation

Specification Table:

| Main technical specifications |                               |
|-------------------------------|-------------------------------|
| Frequency Range (MHZ)         | 2400~2500/5150~5850           |
| Impedance( $\Omega$ )         | 50                            |
| Peak Gain(dBi)                | 2/3                           |
| VSWR                          | $\leq 2.0$                    |
| Max Power                     | 10W                           |
| Polarization                  | Line Polarization             |
| Radiation Direction           | 360°                          |
| Physical Properties           |                               |
| Antenna size(mm)              | $\varnothing 21.6 \times 156$ |
| Antenna cover material        | ABS                           |
| Connector Type                | IPEX-4                        |
| Operating Temp                | -30°C ~+85°C                  |
| Storage Temp                  | -30°C ~+85°C                  |

Product Drawing





### Test data

| Frequency ( MHZ) | Gain ( dBi) | Efficiency ( %) |
|------------------|-------------|-----------------|
| 2400             | 2.14        | 70.3            |
| 2450             | 2.63        | 67.3            |
| 2500             | 2.81        | 66.3            |
| 5150             | 3.67        | 65.4            |
| 5350             | 3.12        | 63.2            |
| 5750             | 3.23        | 64.8            |
| 5850             | 3.15        | 63              |

## 14、 Packaging & Storage

Tape-and-reel packaging with desiccant and humidity indicator.

Storage:

Sealed: 12 months at  $\leq 40^{\circ}\text{C}/90\% \text{ RH}$

Post-opening: Mount within 168 hrs ( $\leq 30^{\circ}\text{C}/60\% \text{ RH}$ )



Figure 4. FLC8720FRA-B Packing





ESD Protection: Mandatory during handling

|  |   |              |
|--|---|--------------|
|  | <b>CAUTION</b>  | <b>LEVEL</b> |
|  | <b>This bag contains<br/>MOISTURE-SENSITIVE DEVICES</b> | <b>3</b>     |
| <small>If Blank, see adjacent bar code label</small>   |   |              |
| 1. Calculated shelf life in sealed bag: 12 months at $< 40^{\circ}\text{C}$ and $< 90\%$ relative humidity (RH)  |   |              |
| 2. Peak package body temperature: <u>260</u> $^{\circ}\text{C}$<br><small>If Blank, see adjacent bar code label</small>                                |   |              |
| 3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must   |   |              |
| a) Mounted within: <u>168</u> hrs. of factory conditions<br><small>If Blank, see adjacent bar code label</small>                                       |   |              |
| $\leq 30^{\circ}\text{C}/60\%\text{RH}$ , OR   |   |              |
| b) Stored at $<10\%$ RH  |   |              |
| 4. Devices require bake, before mounting, if:  |   |              |
| a) Humidity Indicator Card is $> 10\%$ when read at $23 \pm 5^{\circ}\text{C}$   |   |              |
| b) 3a or 3b not met.   |   |              |
| 5. If baking is required, devices may be baked for 48 hrs. at $125 \pm 5^{\circ}\text{C}$  |   |              |
| Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure |   |              |
| Bag Seal Date: _____<br><small>If Blank, see adjacent bar code label</small>   |   |              |
| Note: Level and body temperature defined by IPC/JEDEC J-STD-020  |   |              |



Figure 5. FLC8720FRA-B storage and ESD protection

## Support & Contact

Jiangsu Fulian Communication Technology Co., Ltd.

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Business Hours: Mon–Sat 8:00–12:00 & 13:00–17:00 (GMT+8)





## FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

PCB antenna with antenna gain 3.67dBi

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AXS5-FLC8720FRA-B Or Contains FCC ID: 2AXS5-FLC8720FRA-B"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
  - (1) This device may not cause harmful interference.
  - (2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission,etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, then the host can be sold legally.