



Flaircomm Microelectronics, Inc.

## FLC-WFM011 Datasheet

[www.flairmicro.com](http://www.flairmicro.com)

|                   |                        |
|-------------------|------------------------|
| Document Type:    | Wi-Fi Module Datasheet |
| Document Number:  | FLC-WFM011-DS          |
| Document Version: | V1.0                   |
| Release Date:     | 2015/12/14             |

Copyright 2014~ 2016 by Flaircomm Microelectronics Inc., All Right Reserved

Without written permission from Flaircomm Microelectronics Inc., reproduction, transfer, distribution or storage of part or all of the contents in this document in any form is prohibited

## Release Record

| Version | Release Date | Comments      |
|---------|--------------|---------------|
| 1.0     | 2015/12/14   | First Release |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |
|         |              |               |

# CONTENTS

|                                                             |           |
|-------------------------------------------------------------|-----------|
| <b>1. INTRODUCTION .....</b>                                | <b>5</b>  |
| 1.1 BLOCK DIAGRAM.....                                      | 5         |
| 1.2 FEATURES.....                                           | 5         |
| 1.3 APPLICATIONS .....                                      | 6         |
| <b>2. GENERAL SPECIFICATION.....</b>                        | <b>7</b>  |
| <b>3. PIN DEFINITION.....</b>                               | <b>8</b>  |
| 3.1 PIN CONFIGURATION.....                                  | 8         |
| 3.2 PIN DEFINITION.....                                     | 8         |
| <b>4. PHYSICAL INTERFACES.....</b>                          | <b>11</b> |
| 4.1 POWER MANAGEMENT.....                                   | 11        |
| 4.2 RESET.....                                              | 11        |
| 4.3 ANTENNA INTERFACE .....                                 | 11        |
| 4.4 UNIVERSAL PROGRAMMABLE IO INTERFACE .....               | 11        |
| 4.5 SDIO INTERFACE.....                                     | 11        |
| 4.6 SPI PORT .....                                          | 12        |
| 4.7 I <sup>2</sup> C INTERFACE.....                         | 13        |
| 4.8 I <sup>2</sup> S INTERFACE.....                         | 13        |
| 4.9 UART INTERFACE.....                                     | 13        |
| 4.10 PWM INTERFACE.....                                     | 14        |
| 4.11 IR REMOTE CONTROL INTERFACE.....                       | 14        |
| 4.12 ADC INTERFACE.....                                     | 14        |
| <b>5. ELECTRICAL CHARACTERISTIC .....</b>                   | <b>15</b> |
| 5.1 ABSOLUTE MAXIMUM RATINGS .....                          | 15        |
| 5.2 RECOMMENDED OPERATING CONDITIONS .....                  | 15        |
| 5.3 WLAN 2.4G RF PARAMETER .....                            | 15        |
| 5.3.1 Transmitted power.....                                | 15        |
| 5.3.2 EVM.....                                              | 16        |
| 5.3.3 Receiving sensitivity .....                           | 16        |
| <b>6. REFERENCE DESIGN .....</b>                            | <b>17</b> |
| <b>7. MECHANICAL CHARACTERISTIC.....</b>                    | <b>18</b> |
| <b>8. RECOMMENDED PCB LAYOUT AND MOUNTING PATTERN .....</b> | <b>19</b> |
| 8.1 ANTENNA CONNECTION AND GROUNDING PLANE DESIGN .....     | 19        |
| <b>9. RECOMMENDED REFLOW PROFILE.....</b>                   | <b>21</b> |
| <b>10. ORDER INFORMATION .....</b>                          | <b>23</b> |
| 10.1 PRODUCT PACKAGING INFORMATION .....                    | 23        |
| 10.2 ORDER INFORMATION.....                                 | 23        |
| 10.2.1 Product Version.....                                 | 24        |
| 10.2.2 Transportation Package .....                         | 24        |
| 10.2.3 Product Package.....                                 | 24        |
| 10.2.4 Product Grade .....                                  | 25        |

## TABLES AND FIGURES

|                                                                     |    |
|---------------------------------------------------------------------|----|
| Table 1: General Specification .....                                | 7  |
| Table 2: Pin Definition.....                                        | 10 |
| Table 3: SDIO interface .....                                       | 11 |
| Table 4: Definition of universal SPI (Slave/Master) interface ..... | 12 |
| Table 5: Definition table of SDIO/SPI (Slave) interface .....       | 12 |
| Table 6: Definition table of HSPI (Slave/Master) interface.....     | 12 |
| Table 7: I2C interface.....                                         | 13 |
| Table 8: I2S interface.....                                         | 13 |
| Table 9: UART interface.....                                        | 14 |
| Table 10: PWM interface.....                                        | 14 |
| Table 11: IR Remote Control interface.....                          | 14 |
| Table 12: ADC port.....                                             | 14 |
| Table 13: Absolute rated value.....                                 | 15 |
| Table 14: Recommended Operating Conditions.....                     | 15 |
| Table 15: Transmitted power .....                                   | 16 |
| Table 16: EVM .....                                                 | 16 |
| Table 17: Receiving sensitivity .....                               | 16 |
| Table 19: Product Version.....                                      | 24 |
| Table 20: Transportation Package.....                               | 24 |
| Table 21: Product Package.....                                      | 25 |
| Table 22: Product Grade .....                                       | 25 |

|                                                                   |    |
|-------------------------------------------------------------------|----|
| Figure 1: Block Diagram.....                                      | 5  |
| Figure 2: Pin Configuration .....                                 | 8  |
| Figure 3: Reference Design .....                                  | 17 |
| Figure 4: WFM011 Package .....                                    | 18 |
| Figure 5: Module on system board .....                            | 19 |
| Figure 6: Leave 5mm Clearance Space from the Antenna .....        | 19 |
| Figure 7: Recommended Trace Connects Antenna and the Module ..... | 20 |
| Figure 8: Recommended reflow profile .....                        | 21 |
| Figure 9: Product package information .....                       | 23 |
| Figure 10: Order Information.....                                 | 24 |

## 1. Introduction

WFM011 module is a highly integrated WIFI communication module (supporting 802.11 b/g/n) specific for IOT market, with its low power consumption, it makes it simple to design into other embedded WiFi solutions with lowest cost and maximum practicability.

WFM011 module is designed with compact size and QFN package. It applies to SMT manufacturing technique, supports standard pick- and- place and fully automatic integration with reflow soldering.

### 1.1 Block Diagram

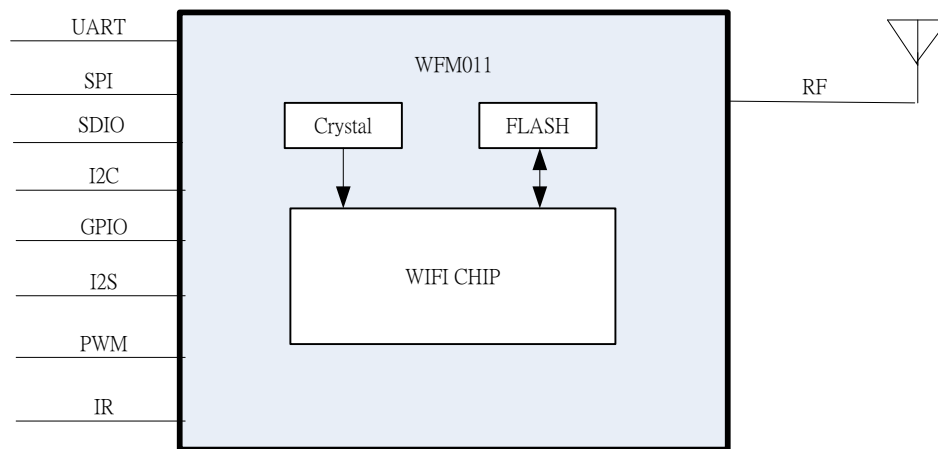


Figure 1: Block Diagram

### 1.2 Features

- Support 802.11b/g/n;
- Support antenna diversity;
- Built-in 32-bit low-power consumption CPU and can act as a processor currently;
- Built-in 10-bit high-precision ADC;
- Built-in TCP/IP protocol stack, TR switch, Balun, LNA, power amplifier and match circuit;
- Built-in PLL, voltage stabilizer and power management module;
- Support WPA/WPA2 safety mode;
- Support STA/AP/STA+AP working mode;

- Support Smart Config function;
- Small size, 62 pins, package size: 15.5\*22\*3.66mm.

## 1.3 Applications

- Industrial wireless control
- Smart home;
- Wearable electronics;
- IP camera

## 2. General Specification

| Module Specification  |                                  |                |
|-----------------------|----------------------------------|----------------|
| Frequency band        | 2.4GHz-2.5GHz                    |                |
| Wilress standard      | 802.11b/g/n                      |                |
| Transmitted power     | 802.11b                          | 18dBm          |
|                       | 802.11g                          | 16dBm          |
|                       | 802.11n                          | 13dBm          |
| Receiving sensitivity | 802.11b                          | -89dBm（11Mbps） |
|                       | 802.11g                          | -74dBm（54Mbps） |
|                       | 802.11n                          | -71dBm（MCS7）   |
| Interface             | UART SDIO I2C SPI I2S ADC PWM IR |                |
| RF input impedance    | 50 ohm                           |                |
| Power supply          |                                  |                |
| Working Voltage       | 3.0~3.6V DC                      |                |
| Working current       | 80mA                             |                |
| Operating Environment |                                  |                |
| Temperature           | -40℃ to +85℃                     |                |
| Humidity              | 10%~90% Non-condensation         |                |
| Dimension and Weight  |                                  |                |
| Dimension             | 15.5*22*3.66mm                   |                |
| Weight                | 1.05g                            |                |

Table 1: General Specification

## 3. Pin Definition

### 3.1 Pin Configuration

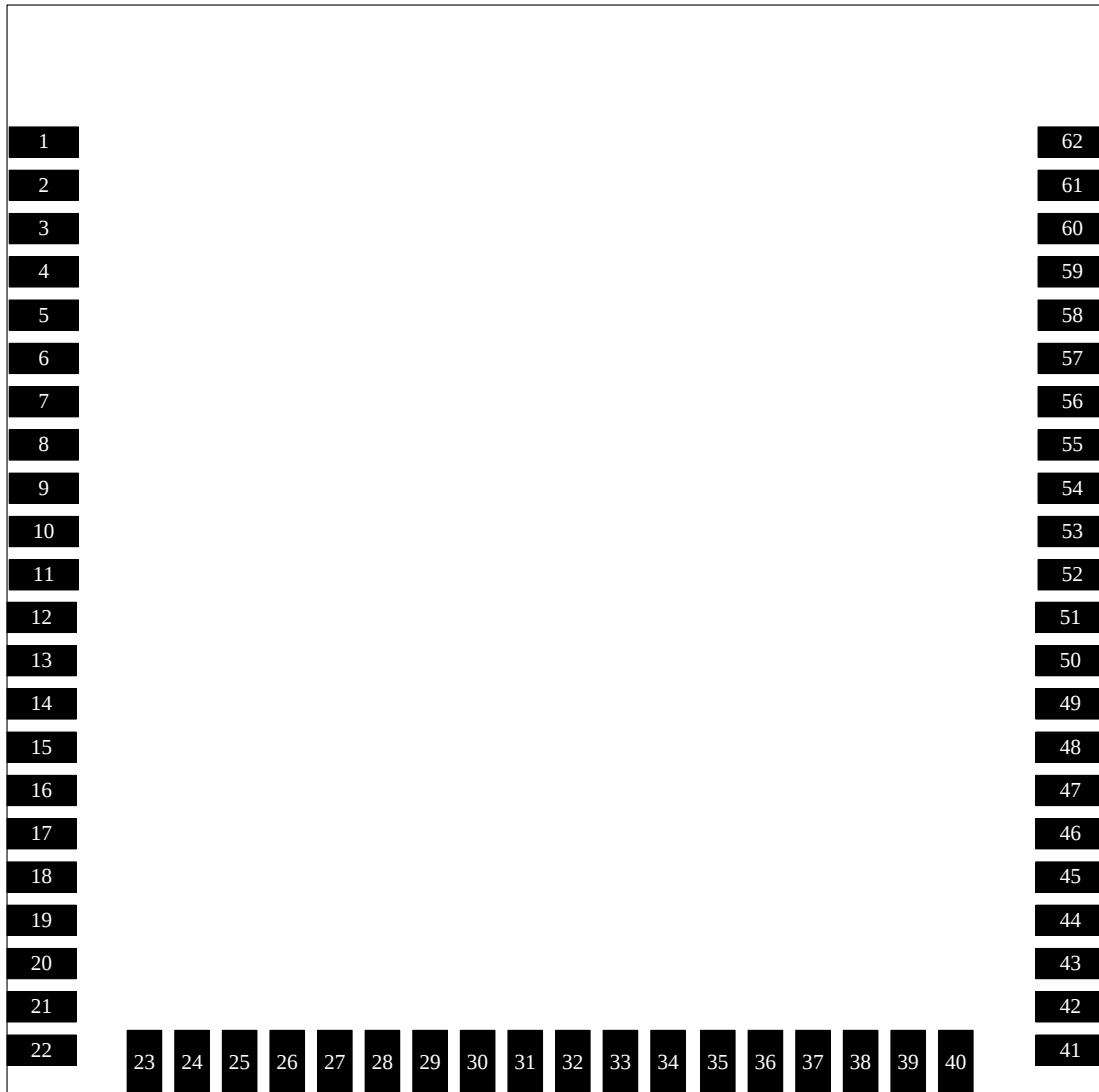


Figure 2: Pin Configuration

### 3.2 Pin Definition

| Pin No | Pin Name | I/O Type | Description                |
|--------|----------|----------|----------------------------|
| 1      | GND      | I        | Ground                     |
| 2      | Reserved | I        | Make it open if not use it |
| 3      | Reserved | I        | Make it open if not use it |
| 4      | GND      | I        | Ground                     |

|    |          |     |                                                   |
|----|----------|-----|---------------------------------------------------|
| 5  | RF_EXT   | I/O | Wi-Fi Signal connect external antenna             |
| 6  | GND      | I   | Ground                                            |
| 7  | Reserved |     | Make it open if not use it                        |
| 8  | Reserved |     | Make it open if not use it                        |
| 9  | UART0_TX | O   | Serial Port 1 Send Data, FW update, GPIO1,SPI_CS1 |
| 10 | UART0_RX | I   | Serial Port 1 Receive Data, FW update,GPIO3       |
| 11 | VDD      | I   | Supply voltage                                    |
| 12 | Reserved |     | Make it open if not use it                        |
| 13 | GND      | I   | Ground                                            |
| 14 | GND      | I   | Ground                                            |
| 15 | GND      | I   | Ground                                            |
| 16 | Reserved |     | Make it open if not use it                        |
| 17 | GND      | I   | Ground                                            |
| 18 | GND      | I   | Ground                                            |
| 19 | Reserved |     | Make it open if not use it                        |
| 20 | Reserved |     | Reserve pin for vacancy                           |
| 21 | GPIO4    | I/O | General Purpose IO (vacant if not in use)         |
| 22 | GND      | I   | Ground                                            |
| 23 | GND      | I   | Ground                                            |
| 24 | GND      | I   | Ground                                            |
| 25 | Reserved |     | Make it open if not use it                        |
| 26 | RST#     | I   | RESET                                             |
| 27 | TOUT     | I   | ADC                                               |
| 28 | GND      | I   | Ground                                            |
| 29 | GND      | I   | Ground                                            |
| 30 | SDIO_D1  | I/O | SDIO DATA1,GPIO8, SPI_MOSI                        |
| 31 | SDIO_CLK | I/O | SDIO CLOCK,GPIO6,SPI_CLK                          |
| 32 | Reserved |     | Make it open if not use it                        |
| 33 | GND      | I   | Ground                                            |
| 34 | SDIO_D2  | I/O | SDIO DATA2,GPIO9,SPIHD,HSPiHD,                    |
| 35 | SDIO_D3  | I/O | SDIO DATA3,GPIO10,SPIWP,HSPiWP                    |
| 36 | SDIO_D0  | I/O | SDIO DATA0,GPIO7,SPI_MISO                         |

|    |          |     |                                                               |
|----|----------|-----|---------------------------------------------------------------|
| 37 | SDIO_CMD | I/O | SDIO CONTROL,GPIO11,SPI_CS0                                   |
| 38 | Reserved |     | Make it open if not use it                                    |
| 39 | Reserved |     | Make it open if not use it                                    |
| 40 | GND      | I   | Ground                                                        |
| 41 | GND      | I   | Ground                                                        |
| 42 | Reserved |     | Make it open if not use it                                    |
| 43 | CH_PD    | I   | CHIP ENABLE                                                   |
| 44 | GPIO16   | I/O | General Purpose IO (vacant if not in use)                     |
| 45 | GPIO5    | I/O | General Purpose IO(vacant if not in use)                      |
| 46 | GND      | I   | Ground                                                        |
| 47 | Reserved |     | Make it open if not use it                                    |
| 48 | GPIO12   | I/O | General Purpose IO (vacant if not in use), HSPI_MISO          |
| 49 | GPIO13   | I/O | General Purpose IO (vacant if not in use), SPI_MOSI,UART0_CTS |
| 50 | GPIO15   | I/O | General Purpose IO (vacant if not in use) HSPI_CS,UART0_RTS   |
| 51 | Reserved |     | Make it open if not use it                                    |
| 52 | Reserved |     | Make it open if not use it                                    |
| 53 | Reserved |     | Make it open if not use it                                    |
| 54 | Reserved |     | Make it open if not use it                                    |
| 55 | GPIO2    | I/O | General Purpose IO (vacant if not in use) ,UART1_TX           |
| 56 | GPIO14   | I/O | General Purpose IO(vacant if not use it),HSPI_CLK             |
| 57 | GPIO0    | I/O | General Purpose IO (vacant if not in use) ,SPI_CS2            |
| 58 | Reserved |     | Make it open if not use it                                    |
| 59 | Reserved |     | Make it open if not use it                                    |
| 60 | Reserved |     | Make it open if not use it                                    |
| 61 | VDD      | I   | Supply voltage                                                |
| 62 | Reserved |     | Make it open if not use it                                    |

**Table 2: Pin Definition**

## 4. Physical Interfaces

### 4.1 Power management

The module is provided with two power input pins VDD (pin11, pin61) with input voltage of 3.3V.

### 4.2 Reset

Module is externally provided with reset signal (RST), active-low level and if external reset signal is provided, the minimum low level period shall be larger than 100us.

### 4.3 Antenna Interface

Module's antenna interface (RF\_ OUT) can be directly used to receive and transmit WIFI signal. Module is designed with PCB antenna on own board and may be externally equipped with WIFI antenna, both antenna are different in their models, namely the on-board antenna module WFM011IQ2A and external antenna module WFM011IQ2B.

### 4.4 Universal programmable IO interface

Module provides 17 GPIO ports in combination with other functions such as I2C, I2S, SPI, UART, PWM, IR infrared control, etc.

### 4.5 SDIO interface

Module is equipped with a group of SDIO slave ports, it supports 4-bit 25MHz SDIO v1.0 and 4-bit 50MHz SDIO v2.0.

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| SDIO_CLK | 31      | GPIO6  | SDIO_CLK      |
| SDIO_D0  | 36      | GPIO7  | SDIO_DATA0    |
| SDIO_D1  | 30      | GPIO8  | SDIO_DATA1    |
| SDIO_D2  | 34      | GPIO9  | SDIO_DATA2    |
| SDIO_D3  | 35      | GPIO10 | SDIO_DATA3    |
| SDIO_CMD | 37      | GPIO11 | SDIO_CMD      |

Table 3: SDIO interface

## 4.6 SPI port

The module defines a universal Slave/Master SPI, a SPI port (SDIO/SPI) and a universal Slave/Master HSPI port defined in Slave SDIO standard. Universal SPI and HSPI is subject to hardware implementation, supports highest clock rate up to 80MHz; SPI Slave interface defined in SDIO Slave standard is subject to hardware implementation, supports linked list DMA with less software overhead; while universal SPI and HSPI has high software overhead since it has no linked list DMA, data transmission therefore is limited by the processing speed.

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| SDIO_CLK | 31      | GPIO6  | SPI_CLK       |
| SDIO_D0  | 36      | GPIO7  | SPI_MISO      |
| SDIO_D1  | 30      | GPIO8  | SPI_MOSI      |
| SDIO_D2  | 34      | GPIO9  | SPIHD         |
| SDIO_D3  | 35      | GPIO10 | SPIWP         |
| SDIO_CMD | 37      | GPIO11 | SPI_CS0       |
| UART_TX  | 9       | GPIO1  | SPI_CS1       |
| GPIO0    | 57      | GPIO0  | SPI_CS2       |

Table 4: Definition of universal SPI (Slave/Master) interface

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| SDIO_CLK | 31      | GPIO6  | SPI_CLK       |
| SDIO_D0  | 36      | GPIO7  | SPI_MISO      |
| SDIO_D1  | 30      | GPIO8  | SPIWP         |
| SDIO_D2  | 34      | GPIO9  | NC            |
| SDIO_D3  | 35      | GPIO10 | SPI_CS        |
| SDIO_CMD | 37      | GPIO11 | SPI_MOSI      |

Table 5: Definition table of SDIO/SPI (Slave) interface

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| GPIO14   | 58      | GPIO14 | HSPI_CLK      |
| GPIO12   | 48      | GPIO12 | HSPI_MISO     |
| GPIO13   | 49      | GPIO13 | HSPI_MOSI     |
| GPIO15   | 50      | GPIO15 | HSPI_CS       |

Table 6: Definition table of HSPI (Slave/Master) interface

## 4.7 I<sup>2</sup>C interface

The module defines a I2C interface (implemented by software), it supports I2C Master and I2C Slave and 100kb/s standard mode.

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| GPIO14   | 58      | GPIO14 | I2C_SCL       |
| GPIO2    | 55      | GPIO2  | I2C_SDA       |

Table 7: I2C interface

## 4.8 I<sup>2</sup>S interface

The module defines one I2S input and output interface, mainly used for audio data collection, processing and transmission, and also for serial data input and output.

| I2S interface input  |         |        |               |
|----------------------|---------|--------|---------------|
| Pin Name             | Pin NUM | IO     | Function Name |
| GPIO12               | 48      | GPIO12 | I2SI_DATA     |
| GPIO13               | 49      | GPIO13 | I2SI_BCK      |
| GPIO14               | 58      | GPIO14 | I2SI_WS       |
| I2S interface output |         |        |               |
| Pin Name             | Pin NUM | IO     | Function Name |
| GPIO15               | 50      | GPIO15 | I2SO_BCK      |
| UART_RX              | 10      | GPIO3  | I2SO_DATA     |
| GPIO2                | 55      | GPIO2  | I2SO_WS       |

Table 8: I2S interface

## 4.9 UART interface

Module defines 2 UART interface completed by hardware, with speed up to 115,200\*40 (4.5Mbps).

| UART0    |         |        |               |
|----------|---------|--------|---------------|
| Pin Name | Pin NUM | IO     | Function Name |
| UART0_RX | 10      | GPIO3  | UART0_RX      |
| UART0_TX | 9       | GPIO1  | UART0_TX      |
| GPIO15   | 50      | GPIO15 | UART0_RTS     |
| GPIO13   | 49      | GPIO13 | UART0_CTS     |

| UART1    |         |       |               |
|----------|---------|-------|---------------|
| Pin Name | Pin NUM | IO    | Function Name |
| GPIO2    | 55      | GPIO2 | UART1_TX      |
| SD_D1    | 30      | GPIO8 | UART1_RX      |

Table 9: UART interface

#### 4.10 PWM interface

Module defines 4 PWM output interfaces that can be expanded.

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| GPIO12   | 48      | GPIO12 | PWM0          |
| GPIO15   | 50      | GPIO15 | PWM1          |
| GPIO14   | 56      | GPIO14 | PWM2          |
| GPIO2    | 55      | GPIO2  | PWM3          |

Table 10: PWM interface

#### 4.11 IR Remote Control interface

The module defines one IR infrared remote-control interface.

| Pin Name | Pin NUM | IO     | Function Name |
|----------|---------|--------|---------------|
| GPIO12   | 48      | GPIO12 | IR TX         |
| GPIO5    | 45      | GPIO5  | IR RX         |

Table 11: IR Remote Control interface

#### 4.12 ADC interface

The module defines one universal 10bit ADC, with detectable input voltage range of 0-1V.

| Pin Name | Pin NUM | Function Name |
|----------|---------|---------------|
| TOUT     | 27      | ADC port      |

Table 12: ADC port

## 5. Electrical Characteristic

### 5.1 Absolute Maximum Ratings

| Parameters                         |          | Min           | Max          | Unit |
|------------------------------------|----------|---------------|--------------|------|
| Storage Temperature                |          | -40           | +125         | °C   |
| VCC Power supply voltage           |          | -0.3          | 3.6          | V    |
| Digital IO                         | VIL/ VIH | -0.3/0.75 VIO | 0.25VIO /3.6 | V    |
|                                    | VOL/ VOH | N/0.8 VIO     | 0.1 VIO /N   | V    |
|                                    | IMAX     |               | 12           | mA   |
| ESD Stress VoltageHuman Body Model |          |               | 2000         | V    |

Table 13: Absolute rated value

### 5.2 Recommended Operating Conditions

| Operating Condition         | Min | Typical | Max | Unit |
|-----------------------------|-----|---------|-----|------|
| Operating Temperature Range | -40 | 25      | +85 | °C   |
| VCC Power supply voltage    | 3.0 | 3.3     | 3.6 | V    |

Table 14: Recommended Operating Conditions

### 5.3 WLAN 2.4G RF parameter

#### 5.3.1 Transmitted power

| Mode | Rate   | CH1      | CH6      | CH13     |
|------|--------|----------|----------|----------|
| 11b  | 2Mbps  | 18.7dBm  | 17.5dBm  | 17.2dBm  |
|      | 11Mbps | 19.1dBm  | 18.4dBm  | 17.6dBm  |
| 11g  | 24Mbps | 18.28dBm | 19.05dBm | 18.3dBm  |
|      | 54Mbps | 15.59dBm | 16.65dBm | 16.32dBm |

|            |      |          |          |          |
|------------|------|----------|----------|----------|
| 11n(20MHz) | MCS0 | 18.68dBm | 18.57dBm | 18.56dBm |
|            | MCS7 | 13.32dBm | 14.15dBm | 14.2dBm  |

**Table 15: Transmitted power**

### 5.3.2 EVM

| Mode       | Rate   | CH1    | CH6    | CH13   |
|------------|--------|--------|--------|--------|
| 11b        | 2Mbps  | 11.01% | 11.37% | 11.44% |
|            | 11Mbps | 8.9%   | 9.8%   | 9.27%  |
| 11g        | 24Mbps | -18.36 | -16.68 | -16.91 |
|            | 54Mbps | -26.68 | -25.94 | -25.4  |
| 11n(20MHz) | MCS0   | -16.2  | -17.08 | -16.92 |
|            | MCS7   | -31.93 | -31.98 | -31.77 |

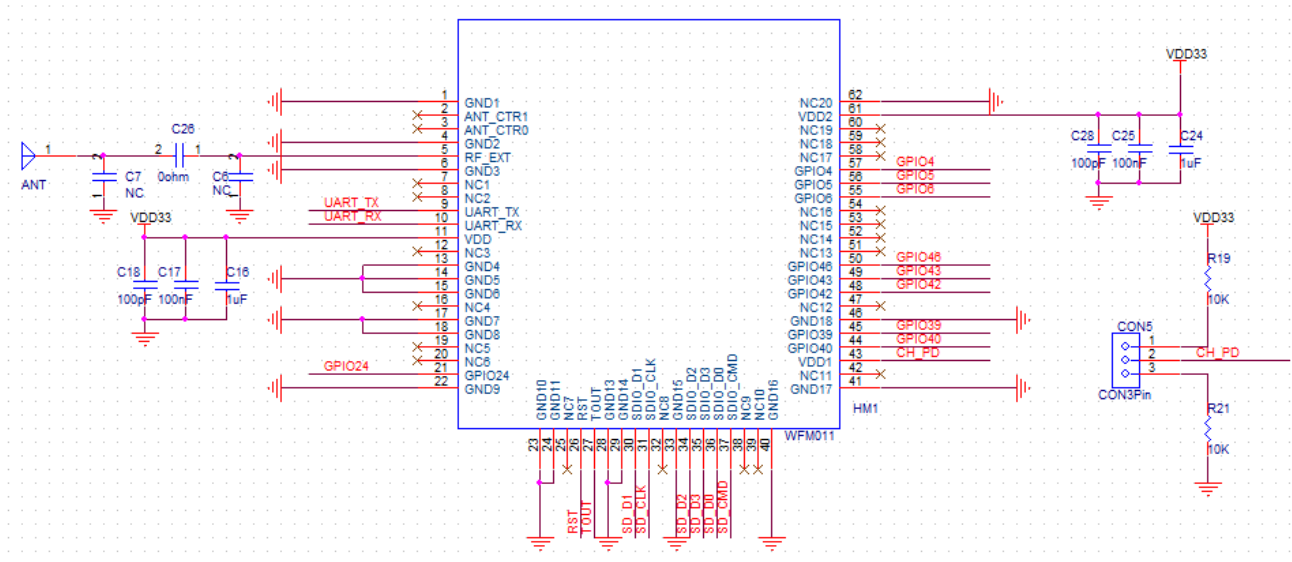
**Table 16: EVM**

### 5.3.3 Receiving sensitivity

| Mode       | Rate   | CH1    | CH6    | CH13   |
|------------|--------|--------|--------|--------|
| 11b        | 11Mbps | -89dBm | -89dBm | -89dBm |
| 11g        | 24Mbps | -84dBm | -84dBm | -85dBm |
|            | 54Mbps | -75dBm | -74dBm | -74dBm |
| 11n(20MHz) | MCS0   | -91dBm | -91dBm | -90dBm |
|            | MCS7   | -71dBm | -70dBm | -70dBm |

**Table 17: Receiving sensitivity**

## 6. Reference Design



### Figure 3: Reference Design

7. Mechanical Characteristic

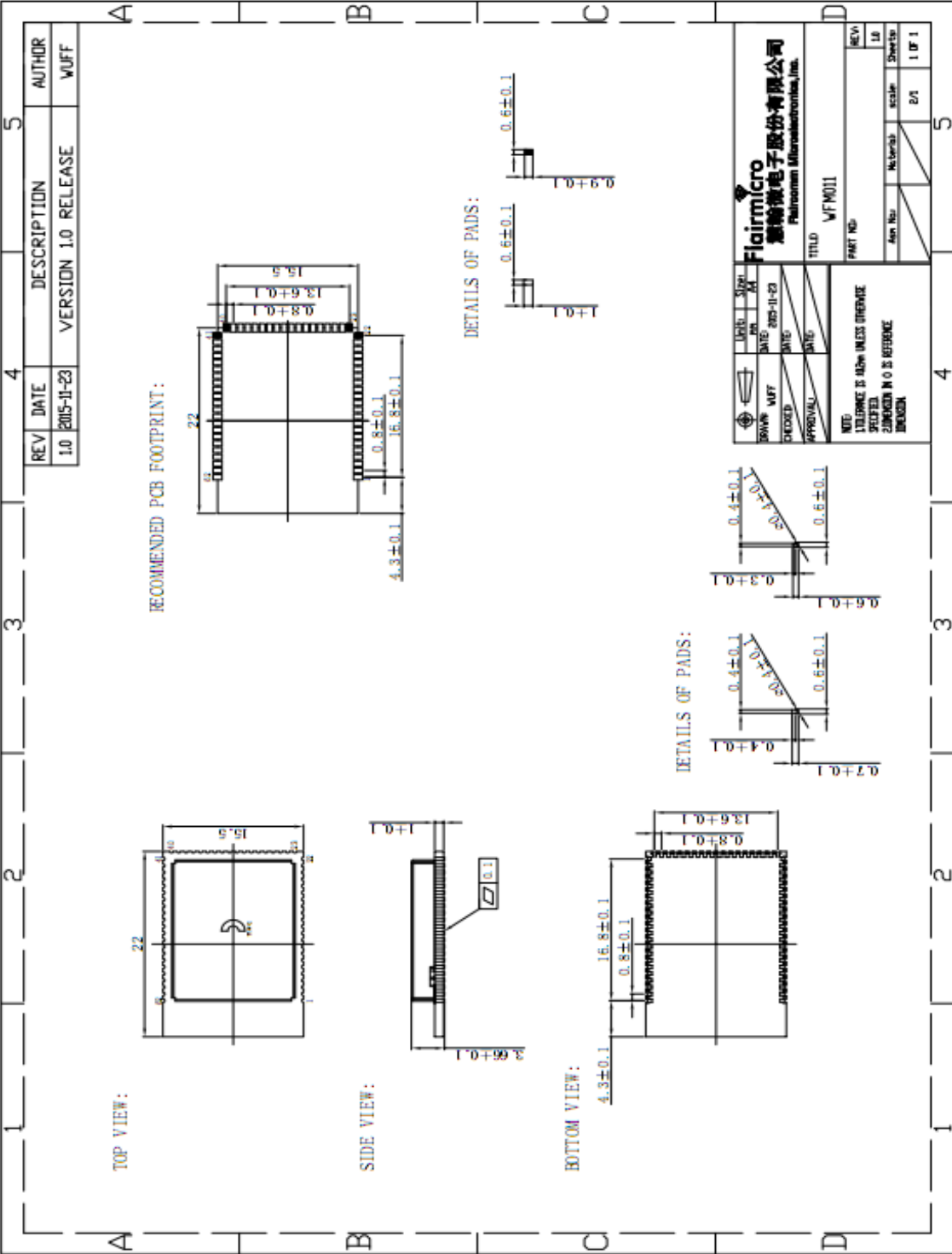


Figure 4: WFM011 Package

## 8. Recommended PCB layout and mounting pattern

Placement and PCB layout are critical to optimize the performances of a module without on-board antenna designs. The trace from the antenna port of the module to an external antenna should be 50Ω

the transceiver of the module. The location of the external antenna and RF-IN port of the module should be kept away from any noise sources and digital traces. A matching network might be needed in between the external antenna and RF-IN port to better match the impedance to minimize the return loss.

As indicated in Figure 12 below, RF critical circuits of the module should be clearly separated from any digital circuits on the system board. All RF circuits in the module are close to the antenna port. The module, then, should be placed in this way that module digital part towards your digital section of the system PCB.

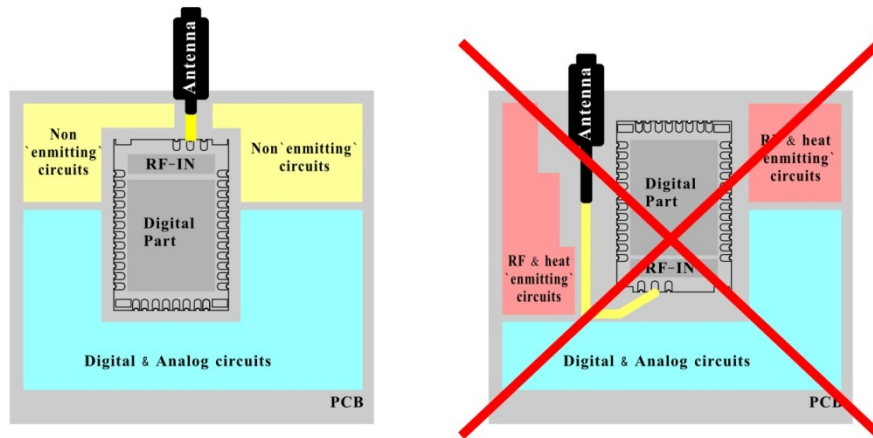


Figure 5: Module on system board

### 8.1 Antenna connection and grounding plane design

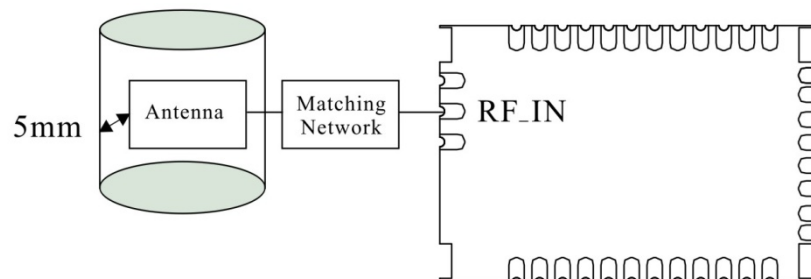
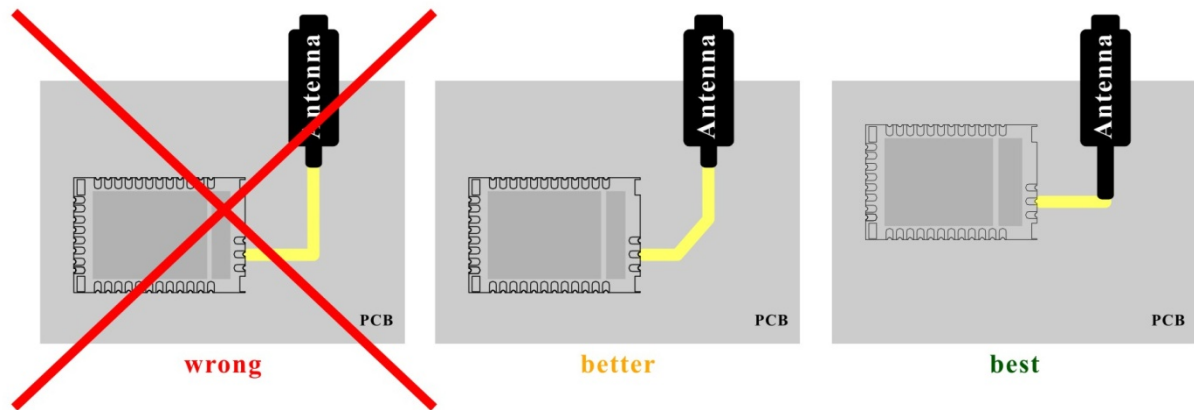


Figure 6: Leave 5mm Clearance Space from the Antenna

General design recommendations are:

- The length of the trace or connection line should be kept as short as possible.

- Distance between RF line connection and ground area on the top layer should at least be as large as the dielectric thickness
- Routing the RF close to digital sections of the system board should be avoided.
- To reduce signal reflections, sharp angles in the routing of the micro strip line should be avoided. Chamfers or fillets are preferred for rectangular routing; 45-degree routing is preferred over Manhattan style 90-degree routing.



**Figure 7: Recommended Trace Connects Antenna and the Module**

- Routing of the RF-connection underneath the module should be avoided. The distance of the micro strip line to the ground plane on the bottom side of the receiver is very small and has huge tolerances. Therefore, the impedance of this part of the trace cannot be controlled.

## 9. Recommended reflow profile

The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder reflow.

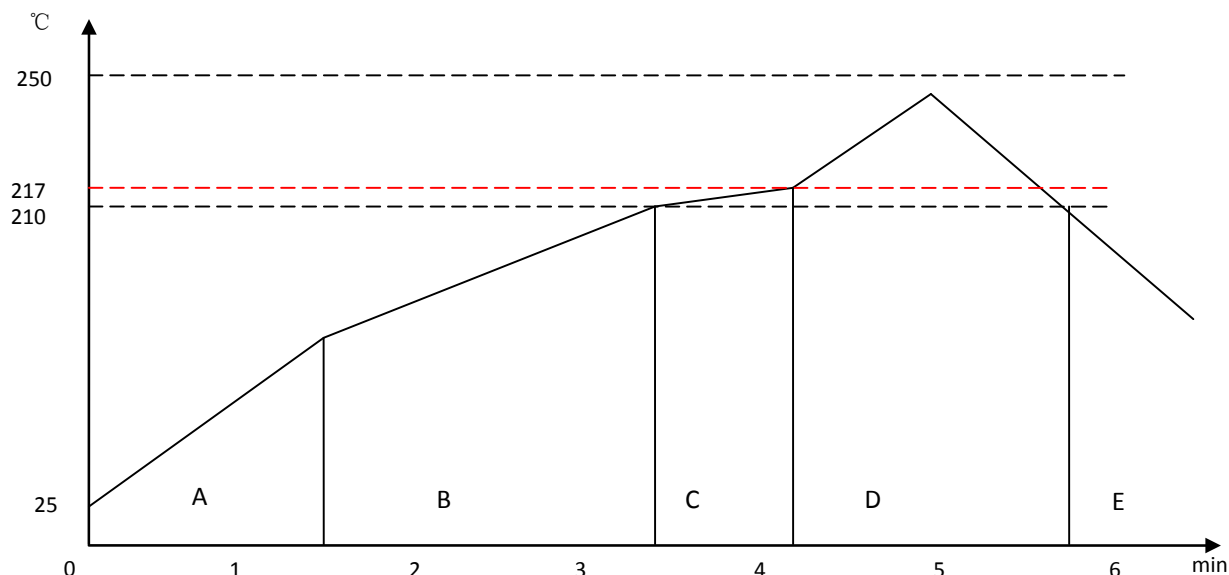


Figure 8: Recommended reflow profile

**Pre-heat zone (A)-** The purpose of this zone is to preheat the PCB board and components to 120~150°C. This zone raises the temperature to 150°C at a controlled rate, typically 0.5~2°C. This stage is required to distribute the heat uniformly to the PCB board and completely remove solvent to reduce the heat shock to components. Quick temperature rise will give rise to solder ball because of flying vaporized solvent, and cause component deflection.

**Equilibrium zone 1(B)-** In this stage the flux becomes soft and uniformly encapsulates solder particles and spread over PCB board.. Compared with infrared oven, hot wind reflow oven commonly applied nowadays enable more uniform temperature transmission, linear temperature rise curve therefore is selected, the board dimension and density and oven efficiency would also be considered. The temperature is recommended to be 150°C to 210°C for about 60 to 120 seconds for this zone.

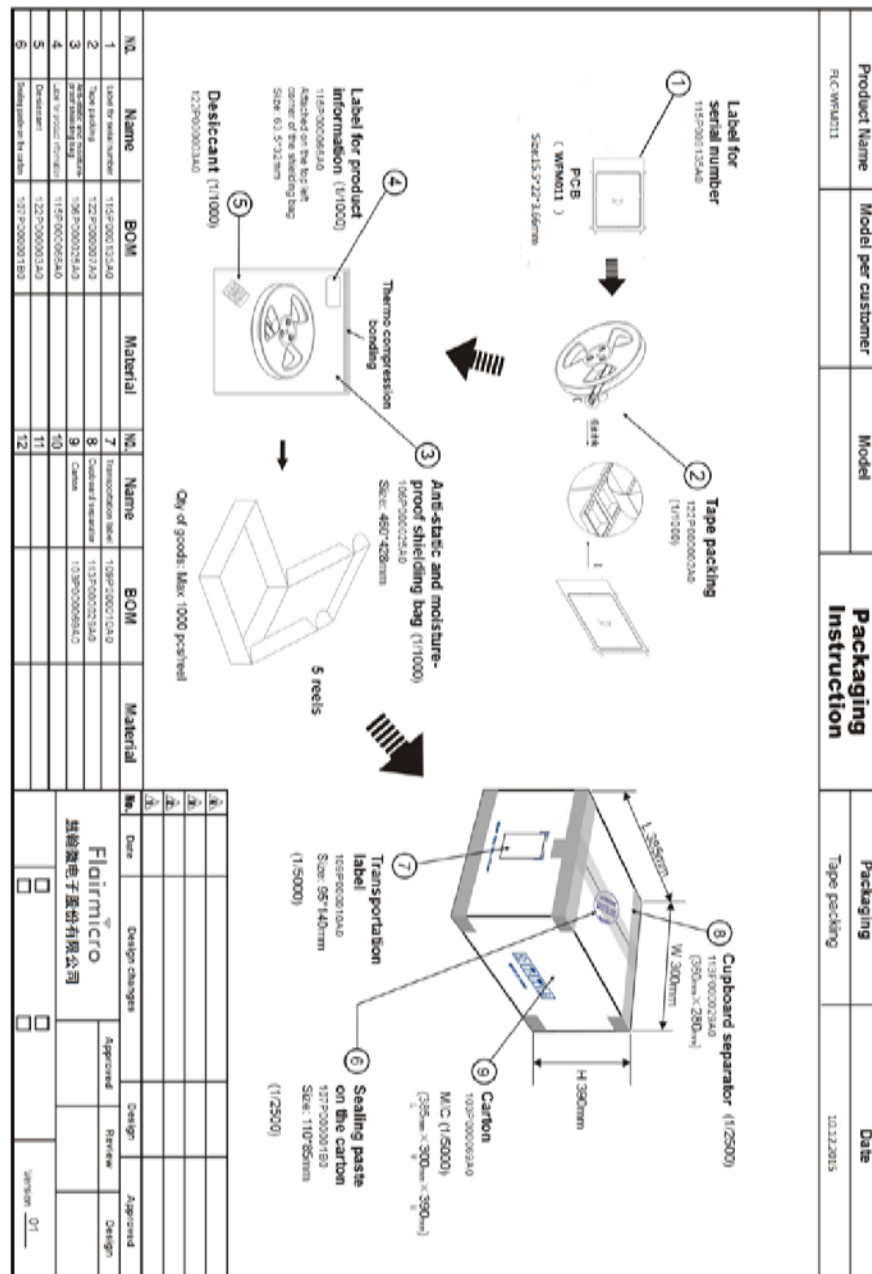
**Equilibrium zone 2(C) (optional)-** In order to resolve the upright component issue, it is recommended to keep the temperature in 210 - 217 °C for about 20-30s.

**Reflow zone (D)-** reflow zone D-The profile in the figure is designed for Sn/Ag3.0/Cu0.5. It can be a reference for other lead-free solder. And it is necessary to adjust the profile according to technical requirement. The recommended peak temperature (Tp) is 230 ~ 250 °C. The soldering time should be 30 to 90 seconds when the temperature is above 217°C.

**Cooling zone E-** To quickly cool off board and consolidate welding spot to minimize intermetallic compound layer, facilitate hand-holding and keep volatile matter of scaling powder out from workshop, cooling speed is recommended to be 4°C/s. Quick cooling speed helps to form the fine and compact granular structure, since the large granular structure caused by slow cooling speed would have relatively poor reliability.

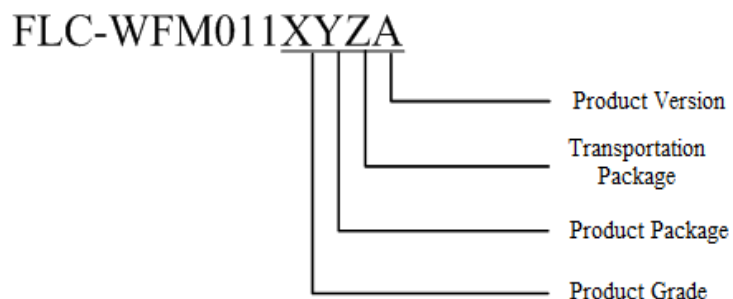
## 10. Order information

## 10.1 Product packaging information



### Figure 9: Product package information

## 10.2 Order information



**Figure 10: Order Information**

| Host Interface | Package |                | Order Number |
|----------------|---------|----------------|--------------|
|                | Type    | Transportation | WFM011IQ2A   |
| UART           | QFN     | Tape           |              |

### 10.2.1 Product Version

| Product Version | Description      | Availability |
|-----------------|------------------|--------------|
| A               | On-board antenna | Yes          |
| B               | External antenna | Yes          |

**Table 18: Product Version**

### 10.2.2 Transportation Package

| Transportation Package | Description  | Quantity | Availability |
|------------------------|--------------|----------|--------------|
| 0                      | Foam Tray    | —        | No           |
| 1                      | Plastic Tray | —        | No           |
| 2                      | Tape         | 1000     | Yes          |

**Table 19: Transportation Package**

### 10.2.3 Product Package

| Product Package | Description | Availability |
|-----------------|-------------|--------------|
| Q               | QFN         | Yes          |

|   |         |    |
|---|---------|----|
| L | LGA     | No |
| B | BGA     | No |
| C | Plug-in | No |

**Table 20: Product Package**

## 10.2.4 Product Grade

| Product Grade | Description              | Availability |
|---------------|--------------------------|--------------|
| C             | Consumer                 | Yes          |
| I             | Industrial               | Yes          |
| V             | Automobile After-Market  | No           |
| A             | Automobile Before-Market | No           |

**Table 21: Product Grade**