

# ESP-WROOM-5C

## User Manual



Version 0.1  
Espressif Systems  
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# About This Guide

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This document provides introduction to the specifications of ESP-WROOM-5C hardware.

## Release Notes

| Date    | Version | Release notes           |
|---------|---------|-------------------------|
| 2019.01 | V0.1    | For certification only. |

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## 1.

## Overview

Espressif now offers a side-mounted module ESP-WROOM-5C based on ESP8285.

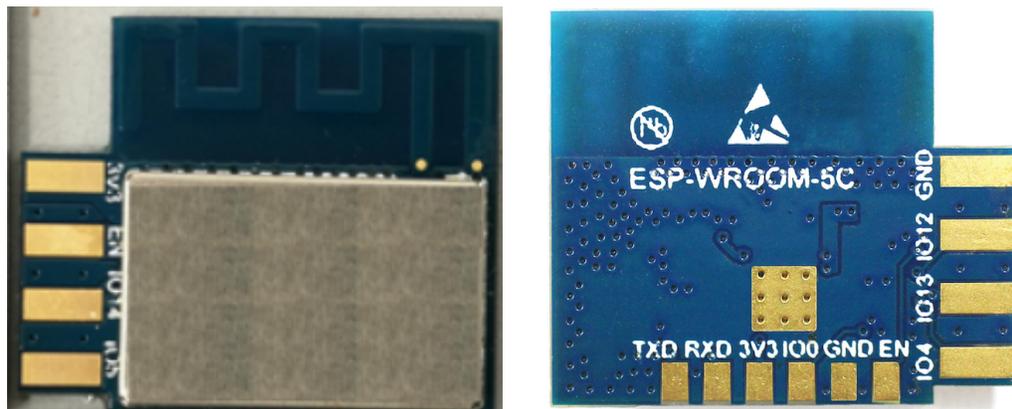


Figure 1-1. ESP-WROOM-5C Module

Table 1-1. ESP-WROOM-5C Specifications

| Categories | Items                                     | Specifications                  |
|------------|-------------------------------------------|---------------------------------|
| Test       | Reliability                               | HTOL/HTSL/uHAST/TCT/ESD         |
| Wi-Fi      | Wi-Fi protocols                           | 802.11 b/g/n20                  |
|            | Frequency range                           | 2412 MHz ~ 2462MHz              |
| Hardware   | Peripheral interface                      | I2C/IR Remote Control           |
|            |                                           | GPIO/PWM                        |
|            | Operating voltage                         | 2.7V ~ 3.6V                     |
|            | Operating current                         | Average: 80 mA                  |
|            | Minimum current delivered by power supply | 500 mA                          |
|            | Operating temperature range               | -40°C ~ 105°C                   |
|            | Storage temperature                       | -40°C ~ 105°C                   |
| Software   | External interface                        | -                               |
|            | Wi-Fi mode                                | Station/SoftAP/SoftAP + Station |
|            | Security                                  | WPA/WPA2                        |
|            | Encryption                                | WEP/TKIP/AES                    |
| Software   | Firmware upgrade                          | UART Download/OTA (via network) |



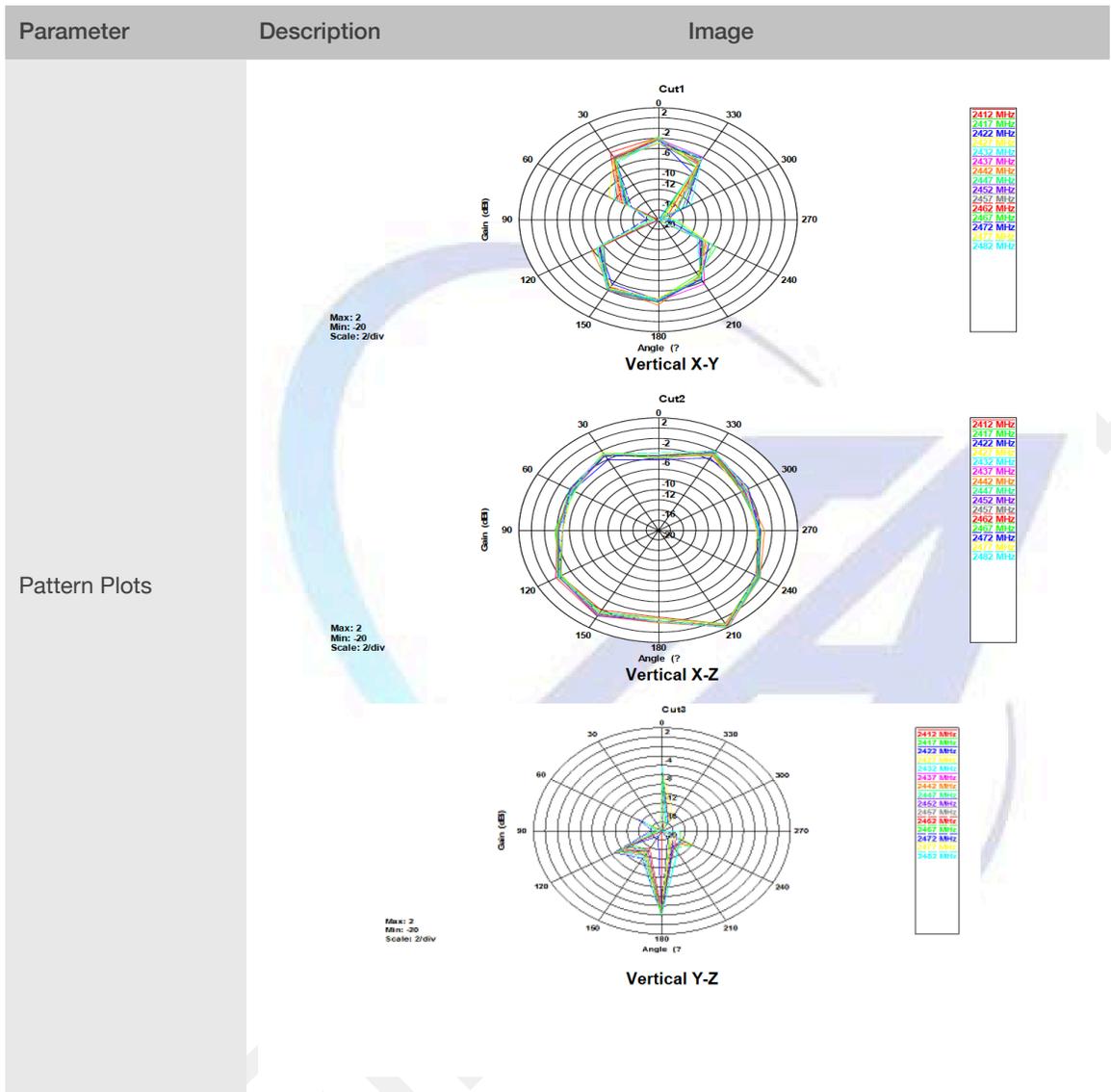
| Categories | Items                | Specifications                                                        |
|------------|----------------------|-----------------------------------------------------------------------|
|            | Software development | Supports Cloud Server Development/SDK for custom firmware development |
|            | Network protocols    | IPv4, TCP/UDP/HTTP                                                    |
|            | User configuration   | Cloud Server, Android/iOS app                                         |

Table 1-2. Antenna Specifications

| Parameter             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Image                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|--|
| Model                 | ESP ANT B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| Type                  | PCB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| Assembly              | PTH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| Gain                  | <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Efficiency (%)</th> <th>Gain (dB)</th> </tr> </thead> <tbody> <tr><td>2412</td><td>73.79</td><td>2.39</td></tr> <tr><td>2417</td><td>77.04</td><td>2.97</td></tr> <tr><td>2422</td><td>79.83</td><td>2.80</td></tr> <tr><td>2427</td><td>81.19</td><td>2.89</td></tr> <tr><td>2432</td><td>80.54</td><td>3.04</td></tr> <tr><td>2437</td><td>76.86</td><td>2.86</td></tr> <tr><td>2442</td><td>76.17</td><td>2.99</td></tr> <tr><td>2447</td><td>73.99</td><td>2.96</td></tr> <tr><td>2452</td><td>72.00</td><td>2.80</td></tr> <tr><td>2457</td><td>70.71</td><td>2.72</td></tr> <tr><td>2462</td><td>71.31</td><td>2.94</td></tr> <tr><td>2467</td><td>71.32</td><td>3.12</td></tr> <tr><td>2472</td><td>72.03</td><td>3.28</td></tr> <tr><td>2477</td><td>72.71</td><td>3.24</td></tr> <tr><td>2482</td><td>75.42</td><td>3.42</td></tr> </tbody> </table> | Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Efficiency (%) | Gain (dB) | 2412 | 73.79 | 2.39 | 2417 | 77.04 | 2.97 | 2422 | 79.83 | 2.80 | 2427 | 81.19 | 2.89 | 2432 | 80.54 | 3.04 | 2437 | 76.86 | 2.86 | 2442 | 76.17 | 2.99 | 2447 | 73.99 | 2.96 | 2452 | 72.00 | 2.80 | 2457 | 70.71 | 2.72 | 2462 | 71.31 | 2.94 | 2467 | 71.32 | 3.12 | 2472 | 72.03 | 3.28 | 2477 | 72.71 | 3.24 | 2482 | 75.42 | 3.42 |  |
|                       | Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Efficiency (%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Gain (dB)      |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2412                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 73.79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.39           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2417                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 77.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.97           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2422                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 79.83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.80           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2427                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 81.19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.89           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2432                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 80.54                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.04           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2437                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 76.86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.86           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2442                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 76.17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.99           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2447                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 73.99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.96           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2452                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 72.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.80           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2457                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 70.71                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.72           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2462                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 71.31                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.94           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | 2467                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 71.32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.12           |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| 2472                  | 72.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3.28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| 2477                  | 72.71                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3.24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| 2482                  | 75.42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3.42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| Dimensions<br>unit:mm |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <table border="1"> <tbody> <tr><td>L1</td><td>3.94</td></tr> <tr><td>L2</td><td>2.70</td></tr> <tr><td>L3</td><td>5.00</td></tr> <tr><td>L4</td><td>2.64</td></tr> <tr><td>L5</td><td>2.00</td></tr> <tr><td>L6</td><td>4.90</td></tr> <tr><td>W1</td><td>0.90</td></tr> <tr><td>W2</td><td>0.50</td></tr> <tr><td>D1</td><td>0.50</td></tr> <tr><td>D2</td><td>0.30</td></tr> <tr><td>D3</td><td>0.30</td></tr> <tr><td>D4</td><td>0.50</td></tr> <tr><td>D5</td><td>1.40</td></tr> <tr><td>D6</td><td>1.70</td></tr> </tbody> </table> | L1             | 3.94      | L2   | 2.70  | L3   | 5.00 | L4    | 2.64 | L5   | 2.00  | L6   | 4.90 | W1    | 0.90 | W2   | 0.50  | D1   | 0.50 | D2    | 0.30 | D3   | 0.30  | D4   | 0.50 | D5    | 1.40 | D6   | 1.70  |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
|                       | L1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.94                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| L2                    | 2.70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| L3                    | 5.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| L4                    | 2.64                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| L5                    | 2.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| L6                    | 4.90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| W1                    | 0.90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| W2                    | 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D1                    | 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D2                    | 0.30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D3                    | 0.30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D4                    | 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D5                    | 1.40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |
| D6                    | 1.70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |           |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |      |       |      |  |



| Parameter     | Description | Image                                                                                                                                                                                                                                                                                                                             |
|---------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pattern Plots |             | <p>Cut1</p> <p>Max: 2<br/>Min: -20<br/>Scale: 2/div</p> <p>Gain (dB)</p> <p>Angle (°)</p> <p>Horizontal X-Y</p> <p>Legend:<br/>2412 MHz<br/>2417 MHz<br/>2422 MHz<br/>2427 MHz<br/>2432 MHz<br/>2437 MHz<br/>2442 MHz<br/>2447 MHz<br/>2452 MHz<br/>2457 MHz<br/>2462 MHz<br/>2467 MHz<br/>2472 MHz<br/>2477 MHz<br/>2482 MHz</p> |
|               |             | <p>Cut2</p> <p>Max: 2<br/>Min: -20<br/>Scale: 2/div</p> <p>Gain (dB)</p> <p>Angle (°)</p> <p>Horizontal X-Z</p> <p>Legend:<br/>2412 MHz<br/>2417 MHz<br/>2422 MHz<br/>2427 MHz<br/>2432 MHz<br/>2437 MHz<br/>2442 MHz<br/>2447 MHz<br/>2452 MHz<br/>2457 MHz<br/>2462 MHz<br/>2467 MHz<br/>2472 MHz<br/>2477 MHz<br/>2482 MHz</p> |
|               |             | <p>Cut3</p> <p>Max: 2<br/>Min: -20<br/>Scale: 2/div</p> <p>Gain (dB)</p> <p>Angle (°)</p> <p>Horizontal Y-Z</p> <p>Legend:<br/>2412 MHz<br/>2417 MHz<br/>2422 MHz<br/>2427 MHz<br/>2432 MHz<br/>2437 MHz<br/>2442 MHz<br/>2447 MHz<br/>2452 MHz<br/>2457 MHz<br/>2462 MHz<br/>2467 MHz<br/>2472 MHz<br/>2477 MHz<br/>2482 MHz</p> |





# 2. Pin Description

Figure 2-1 and Figure 2-2 show the pin distribution of the ESP-WROOM-5C.

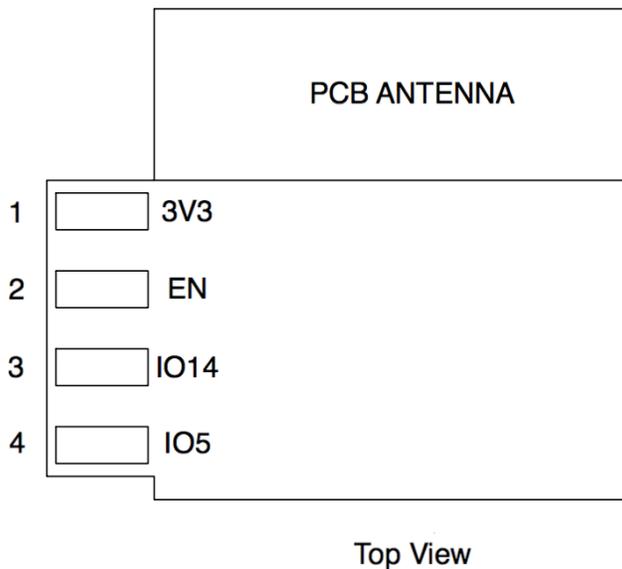


Figure 2-1. ESP-WROOM-5C Pin Layout (Top View)

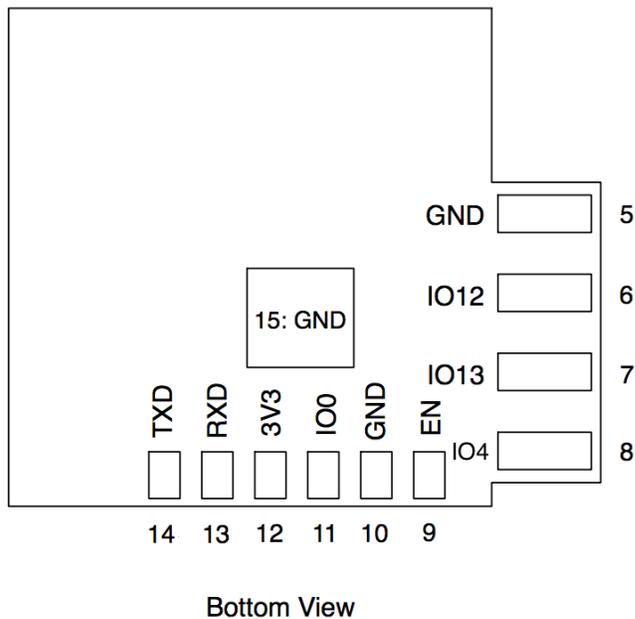


Figure 2-2. ESP-WROOM-5C Pin Layout (Bottom View)



ESP-WROOM-5C has 15 pins. Please see the pin definitions in Table 2-1.

Table 2-1. ESP-WROOM-5C Pin Definitions

| No. | Pin Name | Functional Description                                                                                                                        |
|-----|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | 3V3      | 3.3V power supply (VDD)<br><b>Note:</b><br><i>It is recommended the maximum output current a power supply provides be of 500 mA or above.</i> |
| 2   | EN       | Chip enable pin. Active high.                                                                                                                 |
| 3   | IO14     | GPIO14                                                                                                                                        |
| 4   | IO5      | GPIO5                                                                                                                                         |
| 5   | GND      | GND                                                                                                                                           |
| 6   | IO12     | GPIO12                                                                                                                                        |
| 7   | IO13     | GPIO13                                                                                                                                        |
| 8   | IO4      | GPIO4                                                                                                                                         |
| 9   | EN       | Chip enable pin. Active high.                                                                                                                 |
| 10  | GND      | GND                                                                                                                                           |
| 11  | IO0      | GPIO0<br>• UART download: pull down.<br>• Flash boot: floating or pull up.                                                                    |
| 12  | 3V3      | 3.3V power supply (VDD)<br><b>Note:</b><br><i>It is recommended the maximum output current a power supply provides be of 500 mA or above.</i> |
| 13  | RXD      | UART0_RXD, receive end in UART download;<br>GPIO3                                                                                             |
| 14  | TXD      | UART0_TXD, transmit end in UART download, floating or pull up;<br>GPIO1                                                                       |
| 15  | GND      | GND                                                                                                                                           |

**Note:**

*Pins 1 ~ 8 are pluggable pads that can be welded to your own development board, while pins 9 ~ 15 are reserved for testing and cannot be welded to the development board.*



# 3. Functional Description

## 3.1. CPU

The ESP8285 integrates a Tensilica L106 32-bit RISC processor, which achieves extra- low power consumption and reaches a maximum clock speed of 160 MHz. The Real-Time Operating System (RTOS) and Wi-Fi stack allow 80% of the processing power to be available for user application programming and development. The CPU includes the interfaces as below:

- Programmable RAM/ROM interfaces (iBus), which can be connected with memory controller, and can also be used to visit flash;
- Data RAM interface (dBus), which can connected with memory controller;
- AHB interface which can be used to visit the register.

## 3.2. Memory

### 3.2.1. Internal SRAM and ROM

ESP8285 SoC integrates the memory controller including ROM and SRAM. MCU can access the memory controller through iBus, dBus, and AHB interfaces. All memory units can be accessed upon request. A memory arbiter determines the running sequence in the arrival order of requests.

### 3.2.2. SPI Flash

ESP8285 has a built-in SPI flash to store user programs.

- Memory size: 1 MB
- SPI mode: Dual SPI

## 3.3. Crystal Oscillator

ESP-WROOM-5C uses a 26-MHz crystal oscillator. The accuracy of the crystal oscillator should be  $\pm 10$  PPM.

When using the download tool, please select the right type of crystal oscillator. In circuit design, capacitors C1 and C2 which connect to the earth are added to the input and output terminals of the crystal oscillator respectively. The values of the two capacitors can be flexible, ranging from 6 pF to 22 pF, however, the specific capacitive values depend on further testing of, and adjustment to, the overall performance of the whole circuit. Normally, the capacitive values of C1 and C2 are within 10 pF for the 26-MHz crystal oscillator.



## 3.4. Interface Description

Table 3-1. Interface Description

| Interface | Pin                          | Functional Description                                                                                                                                                                                                                                                      |
|-----------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PWM       | IO12 (R), IO15 (G), IO13 (B) | Currently the PWM interface has four channels, but users can extend it to five channels. PWM interface can realize the control of LED lights, buzzers, relays, electronic machines, etc.                                                                                    |
| IR        | IO14 (IR_T), IO5 (IR_R)      | The functionality of the infrared remote control interface can be realized via software programming. The interface uses NEC coding, modulation, and demodulation. The frequency of the modulated carrier signal is 38 kHz. (You can configure this interface to other GPIO) |
| I2C       | IO14 (SCL), IO5 (SDA)        | Connects to external sensors and display screens, etc. (You can configure this interface to other GPIO)                                                                                                                                                                     |

| Interface | Pin                               | Functional Description                                                                                                                                                                                            |
|-----------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UART      | UART0: IO15 (U0TXD), IO13 (U0RXD) | Communicates with the UART device.<br>Downloading: U0TXD + U0RXD or GPIO2 + U0RXD<br>Communicating (UART0): You need to exchange the inner pins of UART in the software before use IO15 (U0TXD) and IO13 (U0RXD). |



# 4. Electrical Characteristics

**Note:**

Unless otherwise specified, measurements are based on  $VDD = 3.3V$ ,  $TA = 25^{\circ}C$ .

## 4.1. Electrical Characteristics

Table 4-1. Electrical Characteristics

| Parameter                                                         | Symbol          | Min      | Typ    | Max       | Unit |
|-------------------------------------------------------------------|-----------------|----------|--------|-----------|------|
| Storage temperature                                               | -               | -40      | Normal | 105       | °C   |
| Operating temperature                                             | -               | -40      | 20     | 105       | °C   |
| Maximum soldering temperature<br>(Condition: IPC/JEDEC J-STD-020) | -               | -        | -      | 260       | °C   |
| Supply voltage                                                    | VDD             | 2.7      | 3.3    | 3.6       | V    |
| Input logic level low                                             | V <sub>IL</sub> | -0.3     | -      | 0.25 VDD  | V    |
| Input logic level high                                            | V <sub>IH</sub> | 0.75 VDD | -      | VDD + 0.3 | V    |
| Output logic level low                                            | V <sub>OL</sub> | -        | -      | 0.1 VDD   | V    |
| Output logic level high                                           | V <sub>OH</sub> | 0.8 VDD  | -      | -         | V    |

## 4.2. Wi-Fi Radio

Table 4-2. Wi-Fi Radio Characteristics

| Description         | Min                                                        | Typ | Max  | Unit |
|---------------------|------------------------------------------------------------|-----|------|------|
| Input frequency     | 2412                                                       | -   | 2462 | MHz  |
| Input reflection    | -                                                          | -   | -10  | dB   |
| Output Impedance    | -                                                          | 50  | -    | Ω    |
| <b>Output Power</b> |                                                            |     |      |      |
| RF output power     | 802.11b:18.09dBm<br>802.11g:22.84dBm<br>802.11n20:22.68dBm |     |      |      |
| <b>Sensitivity</b>  |                                                            |     |      |      |
| DSSS, 1 Mbps        | -                                                          | -96 | -    | dBm  |



| CCK, 11 Mbps                    | - | -87 | - | dBm |
|---------------------------------|---|-----|---|-----|
| 6 Mbps (1/2 BPSK)               | - | -90 | - | dBm |
| 54 Mbps (3/4 64-QAM)            | - | -73 | - | dBm |
| HT20, MCS7 (65 Mbps, 72.2 Mbps) | - | -69 | - | dBm |
| Adjacent channel rejection      |   |     |   |     |
| OFDM, 6 Mbps                    | - | 37  | - | dB  |
| OFDM, 54 Mbps                   | - | 21  | - | dB  |
| HT20, MCS0                      | - | 37  | - | dB  |
| HT20, MCS7                      | - | 20  | - | dB  |

### 4.3. Power Consumption

The following power consumption data were obtained from the tests with a 3.3V power supply and a voltage stabilizer, in 25°C ambient temperature. All data are based on 50% duty cycle in continuous transmission mode.

Table 4-3. Power Consumption

| Modes                                                | Min | Typ | Max | Unit |
|------------------------------------------------------|-----|-----|-----|------|
| Tx 802.11b, CCK 11 Mbps, P <sub>OUT</sub> = +17 dBm  | -   | 170 | -   | mA   |
| Tx 802.11g, OFDM 54 Mbps, P <sub>OUT</sub> = +15 dBm | -   | 140 | -   | mA   |
| Tx 802.11n, MCS7, P <sub>OUT</sub> = +13 dBm         | -   | 120 | -   | mA   |
| Rx 802.11b, 1024 bytes packet length, -80 dBm        | -   | 50  | -   | mA   |
| Rx 802.11g, 1024 bytes packet length, -70 dBm        | -   | 56  | -   | mA   |
| Rx 802.11n, 1024 bytes packet length, -65 dBm        | -   | 56  | -   | mA   |
| Modem-sleep <sup>①</sup>                             | -   | 15  | -   | mA   |
| Light-sleep <sup>②</sup>                             | -   | 0.9 | -   | mA   |
| Deep-sleep <sup>③</sup>                              | -   | 20  | -   | μA   |
| Power Off                                            | -   | 0.5 | -   | μA   |

**Notes:**

- ① **Modem-sleep** mode is used in the applications that require the CPU to be working, as in PWM or I2S applications. According to 802.11 standards (like U-APSD), it shuts down the Wi-Fi Modem circuit while maintaining a Wi-Fi connection with no data transmission to optimize power consumption. E.g. in DTIM3, maintaining a sleep of 300 ms with a wakeup of 3 ms cycle to receive AP's Beacon packages at interval requires about 15 mA current.
- ② During **Light-sleep** mode, the CPU may be suspended in applications like Wi-Fi switch. Without data transmission, the Wi-Fi Modem circuit can be turned off and CPU suspended to save power consumption according to the 802.11 standards (U-APSD). E.g. in DTIM3, maintaining a sleep of 300 ms with a wakeup of 3 ms to receive AP's Beacon packages at interval requires about 0.9 mA current.
- ③ During **Deep-sleep** mode, Wi-Fi is turned off. For applications with long time lags between data transmission, e.g. a temperature sensor that detects the temperature every 100s, sleeps for 300s and wakes up to connect to the AP (taking about 0.3 ~ 1s), the overall average current is less than 1 mA. The current of 20  $\mu$ A is acquired at the voltage of 2.5V.

## 4.4. Reflow Profile

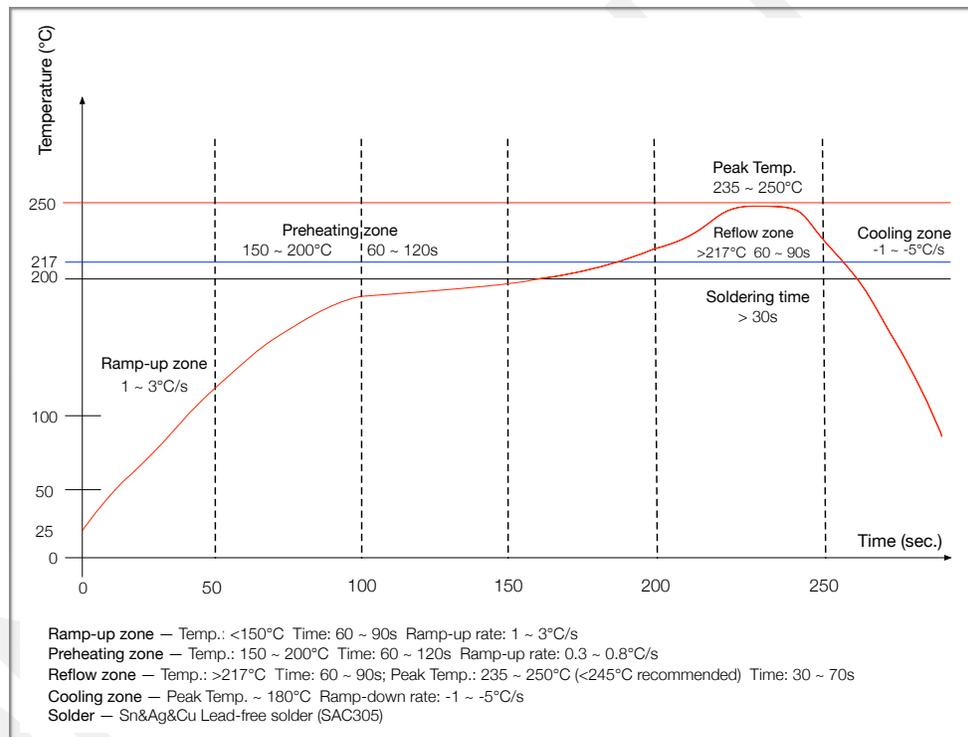


Figure 4-1. ESP-WROOM-5C Reflow Profile



## 4.5. Electrostatic Discharge

Table 4-4. Electrostatic Discharge Parameters

| Name                                                | Symbol             | Reference                                                                           | Level | Max  | Unit |
|-----------------------------------------------------|--------------------|-------------------------------------------------------------------------------------|-------|------|------|
| Electrostatic Discharge<br>(Human - Body Model)     | $V_{ESD}$<br>(HBM) | Temperature: $23 \pm 5^{\circ}\text{C}$<br>Based on ANSI/ESDA/JEDEC JS - 001 - 2014 | 2     | 2000 | V    |
| Electrostatic Discharge<br>(Charged - Device Model) | $V_{ESD}$<br>(CDM) | Temperature: $23 \pm 5^{\circ}\text{C}$<br>Based on JEDEC EIA/JESD22 - C101F        | C2    | 500  |      |



# 5.

# Dimensions

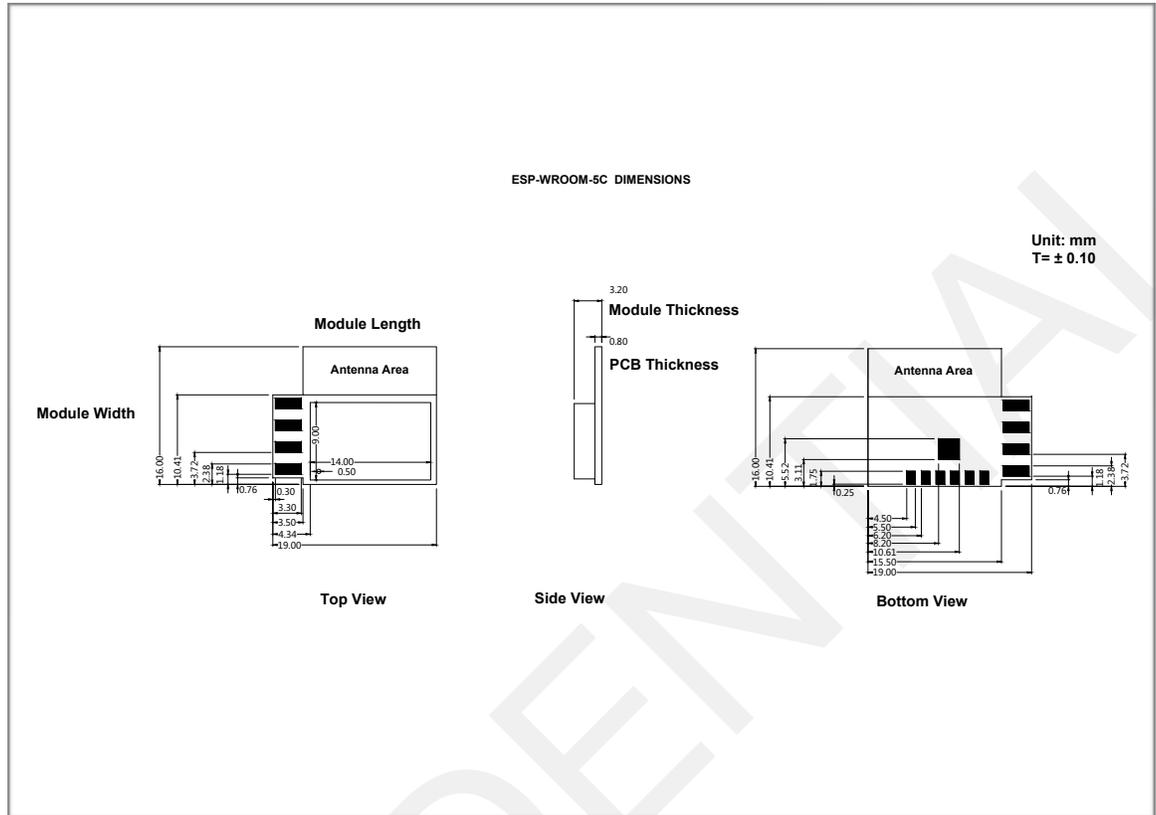


Figure 7-1. ESP-WROOM-5C Dimensions



# 6. Recommended PCB Land Pattern

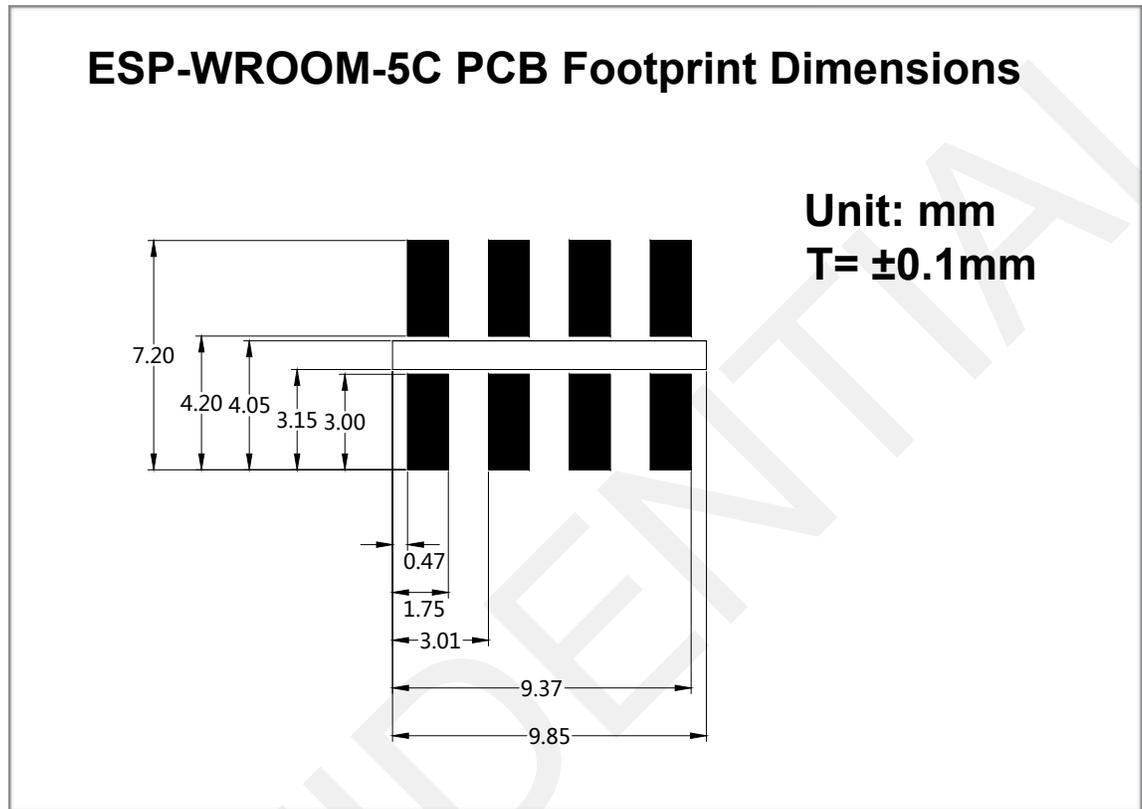


Figure 8-1. Recommended PCB Land Pattern of ESP-WROOM-5C

## FCC Statement

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

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.

## FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

## FCC Label Instructions:

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as: "Contains Transmitter Module

FCC ID: 2AC7Z-ESPWROOM5C", or "Contains

FCC ID: 2AC7Z-ESPWROOM5C", Any similar wording that expresses the same meaning may be used.

## Regulatory Module Integration Instructions

This device complies with part 15.247 of the FCC Rules.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The antenna is integral PCB Antenna and maximum gain is 3.42dBi.

This Wi-Fi module has been granted modular approval for mobile applications. OEM integrators for host products may use the module in their final products without additional FCC certification if they meet the following conditions. Otherwise, additional FCC approvals must be obtained.

The host product with the module installed must be evaluated for simultaneous transmission requirements.

The user's manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, use this module only with the included onboard antenna.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.



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