

## B128 user manual

## 1 Product description;

### 1.1 Product Introduction

B128-2G4M08S1C is a small-sized, low-power Bluetooth module developed by Feiteng Cloud. It adopts the nRF52840 radio frequency chip imported by Nordic, supports Bluetooth 4.2. The chip comes with a high-performance ARM CORTEX-M4 core and uses 32M industrial-grade crystal. And has rich peripheral resources such as UART, I2C, SPI, ADC, DMA, PWM and so on; nRF52840 leads to most I / O ports please check the pin definition for details, which is convenient for users to develop in multiple directions.

B128-2G4M08S1C is a hardware platform, there is no program out of the factory, users need to carry out secondary development; nRF52840 chip characteristics please see the official Datasheet, the module has maximized the chip's RF characteristics.

### 1.2 Features

- Ultra-small size, only 13x18mm;;
- Support BLE4.2;
- Maximum transmit power 6mW, software multi-level adjustable;
- Support global license-free ISM2.4GHz band;
- Built-in 32.768kHz clock crystal oscillator;
- Built-in high-performance low-power ARM® Cortex®-M4 processor;
- Rich resources, 1024KB FLASH, 256KBRAM;
- Support 1.7 ~ 5.5V power supply, power supply greater than 3.3V can ensure the best performance;
- Industrial standard design, support long-term use at -40 ~ + 85 °C;
- Comes with ceramic antenna, no need for external antenna.
- Under ideal conditions, the communication distance can reach 120m;

### 1.3 Application scenario

- Smart home and industrial sensors;
- Security system, positioning system;
- Wireless remote control, UAV;
- Wireless game remote control;
- Healthcare products;
- Wireless voice, wireless headset;
- Automotive industry applications.

## 2 Specifications

### 2.1 Limit parameter

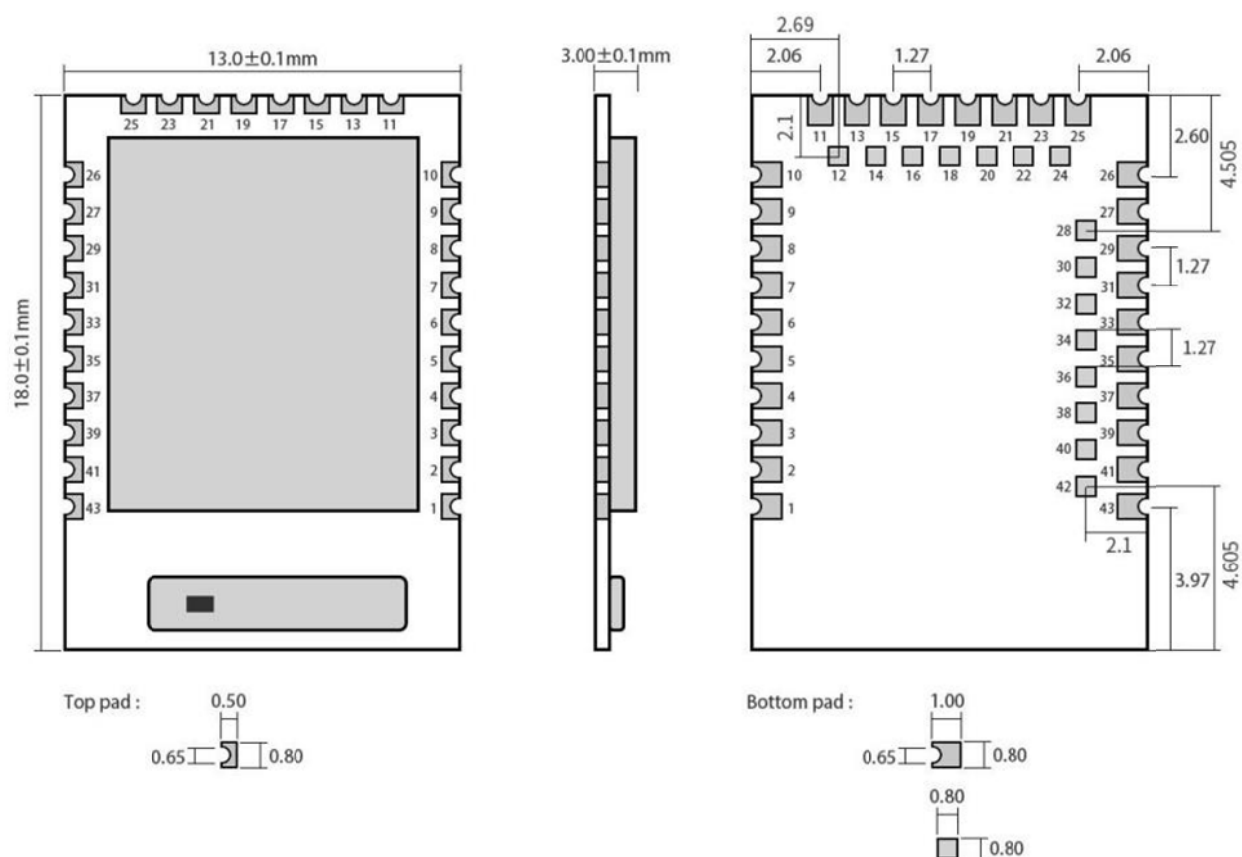
| Main parameters            | Performance |     | Remark                              |
|----------------------------|-------------|-----|-------------------------------------|
|                            | Min         | Max |                                     |
| Voltage (V)                | 0           | 5.5 | Module burned permanently over 5.5V |
| Power (dBm)                | -           | 10  | Low probability                     |
| Operating temperature (°C) | -40         | +85 | Industrial                          |

### 2.2 Working parameter

| Main parameters              |                                                        | Performance        |         |      | Remark                     |
|------------------------------|--------------------------------------------------------|--------------------|---------|------|----------------------------|
|                              |                                                        | Min.               | Typical | Max  |                            |
| Working Voltage (V)          |                                                        | 1.7                | 3.3     | 5.5  | ≥3.3V                      |
| Communication level (V)      |                                                        |                    | 3.3     |      | Used 5VTTL Risk of burning |
| Operating temperature (°C)   |                                                        | -40                | -       | +85  | Industrial                 |
| Working frequency (MHz)      |                                                        | 2402               | -       | 2480 | Support ISM band           |
|                              | TXonlyruncurrent<br>(DC/DC, 3V) PRF=+8dBm              |                    | 17.05   |      | mA                         |
|                              | TXonlyruncurrent<br>(DC/DC, 3V) PRF=+4dBm              |                    | 12.68   |      | mA                         |
|                              | TXonlyruncurrent<br>(DC/DC, 5V, REG0out=3.3V) PRF=0dBm |                    | 7.25    |      | mA                         |
|                              | TXonlyruncurrent<br>(DC/DC, 3V) PRF=0dBm               |                    | 7.63    |      | mA                         |
|                              | TXonlyruncurrent<br>(DC/DC, 3V) PRF=+8dBm              |                    | 17.05   |      | mA                         |
|                              | RXonlyruncurrent (DC/DC, 3V)<br>1Mbps/1MbpsBLE         |                    | 7.71    |      | mA                         |
|                              | RXonlyruncurrent (DC/DC, 3V)<br>2Mbps/2MbpsBLE         |                    | 8.27    |      | mA                         |
| Transmit power (dBm)         |                                                        | 7                  | 8       | 9    | dBm                        |
| Receive sensitivity<br>(dBm) |                                                        | -103dBm@BLE125kbps |         |      | 长距离模式                      |
|                              |                                                        | -95dBm@BLE1Mbps    |         |      |                            |

| Main parameters      | 描述                      | 备注    |
|----------------------|-------------------------|-------|
| Reference distance   | 120m                    | 1Mbps |
| Crystal frequency    | 32MHz/32.768KHz         |       |
| Supporting agreement | BLE                     |       |
| Packaging method     | SMD                     |       |
| Interface method     | 1.27mm                  |       |
| IC Name              | nRF52840-QIAAC0/aQFN™73 |       |
| FLASH                | 1024KB                  |       |
| RAM                  | 256KB                   |       |
| Kernel               | ARM®Cortex®-M4          |       |
| Dimensions           | 13*18mm                 |       |
| Antenna interface    | Ceramic antenna50Ω      |       |

### 3 Mechanical dimensions and pin definition



Pad quantity : 43  
Unit: mm

| SN | Name | Chip pin name | Direction | Pin usage |
|----|------|---------------|-----------|-----------|
|----|------|---------------|-----------|-----------|

|    |       |             |            |                                             |
|----|-------|-------------|------------|---------------------------------------------|
| 1  | P1.11 | P1.11       | GeneralI/O | See the official chip manual for details    |
| 2  | P1.10 | P1.10       | GeneralI/O | LF I/O, Standard drive                      |
| 3  | P0.03 | P0.03/AIN1  | GeneralI/O | Simulation1, LF I/O, Standard drive         |
| 4  | AI4   | P0.28/AIN4  | GeneralI/O | Analog input 4                              |
| 5  | GND   | -           | -          | reference ground                            |
| 6  | P1.13 | P1.13       | GeneralI/O | LF I/O, Standard drive                      |
| 7  | AI0   | P0.02/AIN0  | GeneralI/O | Simulation0, LF I/O, Standard drive         |
| 8  | AI5   | P0.29/AIN5  | GeneralI/O | Simulation5, LF I/O, Standard drive         |
| 9  | AI7   | P0.31/AIN7  | GeneralI/O | Simulation7, LF I/O, Standard drive         |
| 10 | AI6   | P0.30/AIN6  | GeneralI/O | Simulation6, LF I/O, Standard drive         |
| 11 | XL1   | P0.00/XL1   | GeneralI/O | 32.768kHz                                   |
| 12 | P0.26 | P0.26       | GeneralI/O | See the official chip manual for details    |
| 13 | XL2   | P0.01/XL2   | GeneralI/O | 32.768kHz                                   |
| 14 | P0.06 | P0.06       | GeneralI/O | See chip manual                             |
| 15 | AI3   | P0.05/AIN3  | GeneralI/O | Simulation3                                 |
| 16 | P0.08 | P0.08       | GeneralI/O | See chip manual                             |
| 17 | P1.09 | P1.09       | GeneralI/O | See chip manual                             |
| 18 | AI2   | P0.04/AIN2  | GeneralI/O | Simulation2                                 |
| 19 | VCC   | -           | -          | Power                                       |
| 20 | P12   | P0.12       | GeneralI/O | See chip manual                             |
| 21 | GND   | -           | -          | GND                                         |
| 22 | P0.07 | P0.07       | GeneralI/O | See chip manual                             |
| 23 | VDH   | VDDH        |            | High power                                  |
| 24 | GND   | -           | -          | GNS                                         |
| 25 | DCH   | DCCH        | -          | DC/DCConverter output                       |
| 26 | RST   | P0.18/RESET | GeneralI/O | QSPI/CSN/External reset                     |
| 27 | VBS   | VBUS        |            | USB power, 5V input, used USB3.3VStabilizer |
| 28 | P15   | P0.15       | GeneralI/O | See chip manual                             |
| 29 | D-    | D-          | USBD-      |                                             |
| 30 | P17   | P0.17       | GeneralI/O | See chip manual                             |
| 31 | D+    | D+          |            | USBD+                                       |
| 32 | P0.20 | P0.20       | GeneralI/O | See chip manual                             |
| 33 | P0.13 | P0.13       | GeneralI/O | See chip manual                             |
| 34 | P0.22 | P0.22       | GeneralI/O | QSPI                                        |
| 35 | P0.24 | P0.24       | GeneralI/O |                                             |
| 36 | P1.00 | P1.00       | GeneralI/O | See chip manual                             |
| 37 | SWD   | SWDIO       | -          | Serial debug programming port data          |
| 38 | P1.02 | P1.02       | GeneralI/O | See chip manual                             |
| 39 | SWC   | SWDCLK      | -          | Serial debug programming port clock         |
| 40 | P1.04 | P1.04       | GeneralI/O | LF I/O, Standard drive                      |
| 41 | NF1   | P0.09/NFC1  | GeneralI/O | NFC Input                                   |
| 42 | P1.06 | P1.06       | GeneralI/O | LF I/O, Standard drive                      |
| 43 | NF2   | P0.10/NFC2  | GeneralI/O | NFC Input                                   |

# FCC Regulatory notices

## **Modification statement**

**Shenzhen Phaten Technology Co., Ltd.** has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment. **Interference statement**

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

## **RF exposure**

This equipment complies with FCC and ICSED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 5mm between the radiator and your body. Antenna gain must be below 3 dBi.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093.

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

## **FCC Class B digital device notice**

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

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

## **Labelling Requirements for the Host device**

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID and ICSED of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Model: BLE module

Contains FCC ID: 2AU7O-B128V10

The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID and ISED.

Model: BLE module

Contains FCC ID: 2AU7O-B128V10

## OEM Statement

- a. The module manufacturer must show how compliance can be demonstrated only for specific host or hosts
- b. The module manufacturer must limit the applicable operating conditions in which the transmitter will be used, and
- c. The module manufacturer must disclose that only the module grantee can make the evaluation that the module is compliant in the host. When the module grantee either refuses to make this evaluation, or does not think it is necessary, the module certification is rendered invalid for use in the host, and the host manufacturer has no choice other than to use a different module, or take responsibility (§ 2.929) and obtain a new FCC ID for the product.
- d. The module manufacturer must provide the host manufacturer with the following requirements:
  - i. The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions).

## 2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies.

DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition

of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.<sup>3</sup>

Explanation: This module meets the requirements of Part 15 Subpart C Section 15.247

## 2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT uses Ceramic antenna, antenna gain: 0dBi. There is no restriction on the installation method.

## 2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible

for approving the host environment that the limited module is used with. The manufacturer of a limited

module must describe, both in the filing and in the installation instructions, the alternative means that the

limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the

module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited

module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance

of the product is always ensured. For additional hosts other than the specific host originally granted with a

limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is not a limited module

## 2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.<sup>4</sup>

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes. The module without trace antenna designs

## 2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable –

xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide

to end users in their end-product manuals. If RF exposure statements and use conditions are not provided,

then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This module is designed to comply with the FCC statement, FCC ID is: 2AU70-B128V10

## 2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example

with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique

antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT uses Ceramic antenna, antenna gain: 0dBi.

## 2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC

ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated by the following texts: "Contains FCC ID: 2AU7O-B128V10

## 2.9 Information on test modes and additional testing requirements<sup>5</sup>

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a standalone

modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for

different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Data transfer module demo board can control the EUT work in RF test mode at specified test channel

## 2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B