

# FZT6090 Module Specifications

V1.00

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## Versions History

| Versions | Date       | Description   | Updater |
|----------|------------|---------------|---------|
| V1.00    | 2022.09.14 | First release | Kluas   |

## Catalogue

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## 1 Terminal Configuration And Functions

### 1.1 Hardware Description

| Specification                   | Parameter       |
|---------------------------------|-----------------|
| Dimensions (depth×width×height) | 16mm×24mm×2.3mm |

### 1.2 Hardware Picture

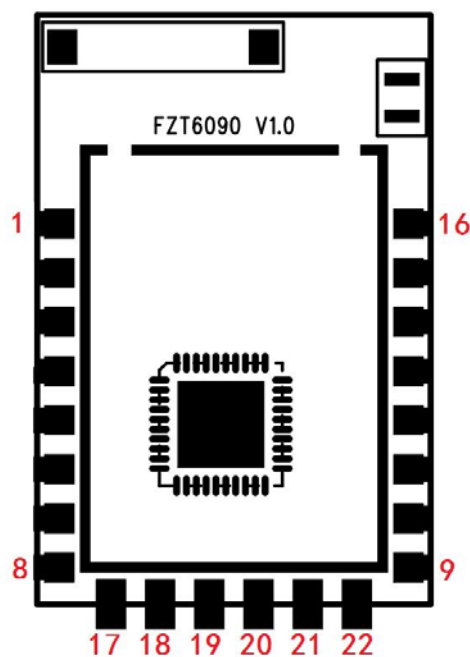


### 1.3 Hardware Specifications

| Performances                                        | Specification                         |
|-----------------------------------------------------|---------------------------------------|
| Transmitted Power of Zigbee                         | +12dBm                                |
| Receiver Sensitivity of Zigbee                      | -95dBm                                |
| Outdoor Accessible<br>Communication Range of Zigbee | 150m                                  |
| Outdoor Accessible Network<br>Range of Zigbee       | 100m                                  |
| Transmitted Power of BLE                            | +6dBm                                 |
| Receiver Sensitivity of BLE                         | -94dBm@1Mbps, -91dBm@2Mbps            |
| Outdoor Accessible Network<br>Range of BLE          | 10M                                   |
| Working Temperature                                 | -20°C ~ + 85°C                        |
| Supply Voltage                                      | +1.8V ~ +3.6V (Recommend Value:+3.3V) |

|                  |                   |
|------------------|-------------------|
| Standby Current  | 25mA              |
| Sleeping Current | 3uA               |
| Protocol         | ZigBee 3.0/BLE5.1 |

## 1.4 Pin Assignments and Pin Attributes



| Pin Number | Name   | I/O | Description                     |
|------------|--------|-----|---------------------------------|
| 1          | RESETn | I   | System reset signal, active low |
| 2          | PB10   | I/O | GPIO/ADC1/PWM3                  |
| 3          | NC     | -   | -                               |
| 4          | PB1    | I/O | GPIO/PWM2/Interrupt             |
| 5          | PB2    | I/O | GPIO/PWM3/Interrupt             |
| 6          | PB0    | I/O | GPIO/PWM1/Interrupt             |
| 7          | PB9    | I/O | GPIO/PWM                        |

| Pin Number | Name | I/O | Description         |
|------------|------|-----|---------------------|
| 8          | VCC  | P   | Power (+3.3V)       |
| 9          | GND  | P   | Ground              |
| 10         | PB10 | I/O | GPIO/ADC1/PWM3      |
| 11         | PB12 | I/O | GPIO                |
| 12         | PB11 | I/O | GPIO/PWM4/Interrupt |
| 13         | PB4  | I/O | GPIO/PWM5/UART2_TX  |
| 14         | PB5  | I/O | GPIO/PWM6/UART2_RX  |
| 15         | PB3  | I/O | GPIO/PWM4/Interrupt |
| 16         | PB13 | I/O | GPIO/Interrupt      |
| 17         | GND  | P   | Ground              |
| 18         | PA4  | I   | SWD_CLK             |
| 19         | PA5  | I/O | SWD_DA              |
| 20         | VCC  | P   | Power (+3.3V)       |
| 21         | PB6  | O   | UART0_TX            |
| 22         | PB7  | I   | UART0_RX            |

Comments:

P: Power Pin , I/O: Input/Output.

## 1.5 Debug Interface

Debug interface use Pin13, Pin17, Pin18, Pin19;

| FZT6090 Debug Interface |          |               |
|-------------------------|----------|---------------|
| Pin17                   | GND      | Ground        |
| Pin20                   | VCC      | Power(+3.3V)  |
| Pin21                   | UART0_TX | Debug Uart TX |
| Pin22                   | UART0_RX | Debug Uart RX |

## 2 Electrical Characteristics

The load applied to the device in excess of the value given in the "absolute maximum rating" tables (Tables 2-1, 2-2, and 2-3) may cause permanent damage to the device. The maximum allowable load is given here, but it does not mean that the functions of the device work well under these conditions. The device reliability will be affected if the device works at the maximum conditions for a long time.

### 2.1 Voltage Characteristics

Table 2-1 Voltage Characteristics

| Symbol                | Description                                              | Min     | Max     | Unit |
|-----------------------|----------------------------------------------------------|---------|---------|------|
| VCC-VSS               | External main supply voltage                             | -0.3    | 3.6     | V    |
| V <sub>IN</sub>       | Input voltage on other pins                              | VSS-0.3 | VCC+0.3 |      |
| V <sub>ESD(HBM)</sub> | Electrostatic discharge (ESD) voltage (human body model) |         | 2000    |      |

### 2.2 Current Characteristics

Table 2-2 Current Characteristics

| Symbol           | Description                                                    | Max | Unit |
|------------------|----------------------------------------------------------------|-----|------|
| I <sub>VCC</sub> | Total current (supply current) passing through VCC power cable | 150 | mA   |
| I <sub>VSS</sub> | Total current (output current) passing through VSS ground wire | 150 |      |
| I <sub>IO</sub>  | Output sink current of any I/O and control pins                | 12  |      |
|                  | Output current of any I/O and control pins                     | -12 |      |

## 2.3 Temperature Characteristics

Table 2-3 Temperature Characteristics

| Symbol    | Description                  | Value        | Unit |
|-----------|------------------------------|--------------|------|
| $T_{STG}$ | Storage temperature range    | -40 to + 125 | °C   |
| $T_J$     | Maximum junction temperature | 105          |      |

## 2.4 I/O port characteristics

Table 2-4 Characteristics of I/O

| Symbol   | Parameter                | Condition                                   | Min | Max | Unit |
|----------|--------------------------|---------------------------------------------|-----|-----|------|
| $V_{IL}$ | Input low level voltage  | VCC=3.3V                                    | VSS | 0.8 | V    |
| $V_{IH}$ | Input high level voltage |                                             | 2   | VCC |      |
| $V_{OL}$ | Output low level         | VCC=3.3V, $I_{OH}$ =2mA, 4mA, 8mA, 12mA     | VSS | 0.4 |      |
| $V_{OH}$ | Output high level        | VCC=3.3V, $I_{OH}$ =-2mA, -4mA, -8mA, -12mA | 2.4 | VCC |      |

## 3 Characteristics of RF

### 3.1 Characteristics of BLE

Table 3-1 BLE Receiving Characteristics<sup>(1)</sup>

| No. | Parameter                                     | Test Condition            | Min | Typical Value | Max | Unit |
|-----|-----------------------------------------------|---------------------------|-----|---------------|-----|------|
| 1   | Sensitivity, 1 Mbps                           | VCC=3.3V,<br>$T_A$ =25 °C |     | -94           |     | dBm  |
| 2   | Sensitivity, 2 Mbps                           |                           |     | -91           |     | dBm  |
| 3   | Co-channel interference                       |                           |     | 8             |     | dB   |
| 4   | Adjacent channel interference, +-1 MHz        |                           |     | 1             |     | dB   |
| 5   | Adjacent channel interference, +-2 MHz        |                           |     | -31           |     | dB   |
| 6   | Adjacent channel interference, >=+-3 MHz      |                           |     | -40           |     | dB   |
| 7   | Mirror channel interference                   |                           |     | -24           |     | dB   |
| 8   | Adjacent mirror channel interference, +-1 MHz |                           |     | -28           |     | dB   |
| 9   | Maximum input power                           |                           |     |               | 6   | dBm  |

(1) They are obtained from laboratory tests and are not tested in production.

Table 3-2 BLE Transmitting Characteristics <sup>(1)</sup>

| No. | Parameter                          | Test Condition                     | Min | Typical Value | Max | Unit         |
|-----|------------------------------------|------------------------------------|-----|---------------|-----|--------------|
| 1   | Output power                       | VCC=3.3V,<br>T <sub>A</sub> =25 °C |     |               | 6   | dBm          |
| 2   | Frequency accuracy                 |                                    |     | 7.5           |     | kHz          |
| 3   | Frequency drift rate               |                                    |     | -9.4          |     | kHz/<br>50us |
| 4   | Frequency drift                    |                                    |     | -15.1         |     | kHz          |
| 5   | Initial frequency drift            |                                    |     | -13.2         |     | kHz          |
| 6   | Δf1 average                        |                                    |     | 258           |     | kHz          |
| 7   | Δf2 99.9%                          |                                    |     | 218           |     | kHz          |
| 8   | Δf2/Δf1                            |                                    |     | 1.06          |     | -            |
| 9   | Harmonic power, second harmonic    |                                    |     | -26           |     | dBm          |
| 10  | Harmonic power, third harmonic     |                                    |     | -28           |     | dBm          |
| 11  | Harmonic power, fourth harmonic    |                                    |     | -54           |     | dBm          |
| 12  | Harmonic power, quintuple harmonic |                                    |     | -55           |     | dBm          |

(1) They are obtained from laboratory tests and are not tested in production.

## 3.2 Characteristics of Zigbee

Unless otherwise specified, the parameters below are obtained by measuring at the ambient temperature and VCC supply voltage listed in Table 3-3. **VCC=3.3V** , **T<sub>A</sub>=25°C**, **LO frequency=2.445GHz**

Table 3-3 Zigbee Receiving Characteristics

| No. | Parameter          | Test Condition                  |         | Min   | Typical Value | Max   | Unit |
|-----|--------------------|---------------------------------|---------|-------|---------------|-------|------|
| 1   | RF input frequency | Compatible to IEEE802.15.4-2006 |         | 2.405 |               | 2.480 | GHz  |
| 2   | RF sensitivity     | At antenna input                | 250Kbps |       | -94           |       | dBm  |
|     |                    | with O-QPSK signal              | 2Mbps   |       | -91           |       |      |

|   |                             |                        |  |    |  |     |
|---|-----------------------------|------------------------|--|----|--|-----|
| 3 | Maximum RF input            | @250Kbps               |  | 5  |  | dBm |
| 4 | Adjacent channel rejection  | @+/-5 MHz, 250 Kbps    |  | 20 |  | dB  |
| 5 | Alternate channel rejection | @+/-10 MHz, 250 Kbps   |  | 45 |  |     |
| 6 | RSSI range                  | Normal mode (250 Kbps) |  | 45 |  | dB  |
|   |                             | Turbo mode (2M bps)    |  |    |  |     |

Table 3-4 Zigbee Transmitting Characteristics

| No | Parameter                               | Test Condition                                                                                         | Min   | Typical Value | Max   | Unit |
|----|-----------------------------------------|--------------------------------------------------------------------------------------------------------|-------|---------------|-------|------|
| 1  | RF carrier frequency                    | Compatible to IEEE802.15.4-2006                                                                        | 2.405 |               | 2.480 | GHz  |
| 2  | Maximum RF output power                 |                                                                                                        |       | 12            |       | dBm  |
| 3  | RF output power control range           | 12 to -2 dBm TX power control range<br>in 2 dB step -14 to -29 dBm TX power control range in 5 dB step |       | 41            |       | dB   |
| 4  | TX spectrum mask for O - QPSK signal    | Offset frequency > 3.5 MHz At 0 dBm output power                                                       |       |               | -30   | dBm  |
|    |                                         |                                                                                                        | 20    |               |       | dBc  |
| 5  | TX offset EVM for O-QPSK 250 Kbps modes |                                                                                                        |       | 7             |       | %    |

## FCC Regulatory notices

### Modification statement

**SHENZHEN FEIBIT ELECTRONIC 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. 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 radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20cm between the radiator and your body. Antenna gain must be below 3.53dBi(Zigbee), 1.73dBi(BLE).

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 ISED of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Model: FZT6090 module

Contains FCC ID: 2BB9L-FZT6090

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.

Model: FZT6090 module

Contains FCC ID: 2BB9L-FZT6090

#### 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 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 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: 3.53dBi(Zigbee), 1.73dBi(BLE).

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:

2BB9L-FZT6090

## 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: 3.53dBi(Zigbee), 1.73dBi(BLE).

## 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 the following texts: "Contains FCC ID: 2BB9L-FZT6090

## 2.9 Information on test modes and additional testing requirements

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