



**WEILA**

# **BeiDou Positioning Module**

**WKG035BR09Y01**

**User Manual**

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## Table of Contents

|                                          |      |
|------------------------------------------|------|
| 1. Functional Description .....          | 4th  |
| 1.1. Overview .....                      | 4th  |
| 1.2. Key Features .....                  | 4th  |
| 1.3. Applications .....                  | 5th  |
| 1.4. Assisted GNSS .....                 | 6th  |
| 1.5. Output Protocol .....               | 6th  |
| 1.6. Performance Specifications .....    | 6th  |
| 2. Product Description .....             | 7th  |
| 2.1. Module Appearance .....             | 7th  |
| 2.2. Dimensions .....                    | 8th  |
| 2.3. Pin Definition .....                | 8th  |
| 3. Electrical Characteristics .....      | 9th  |
| 3.1. Absolute Maximum Ratings .....      | 9th  |
| 3.2. Operating Conditions .....          | 9th  |
| 4. NMEA Protocol .....                   | 10th |
| 4.1. NMEA Protocol Characteristics ..... | 10th |
| 4.2. Frame Structure .....               | 10th |
| 4.3. NMEA Identifiers .....              | 11th |
| 4.4. Support Messages .....              | 12th |
| 5. Contact Us .....                      | 14th |

# 1. Functional Description

## 1.1. Overview

WKG035BR09Y01 is a high-performance BeiDou (BDS) single-constellation positioning module with a compact size of 43 × 43 × 11.7 mm. It is based on the AT9850B-F7N22 SoC from Zhongke Micro, which integrates an RF front-end, digital baseband, multi-frequency BeiDou signal processing engine, and power management unit, providing high integration and simplified external circuitry. The module supports BeiDou-2 and BeiDou-3 signals.

Leveraging proprietary fast acquisition technology, WKG035BR09Y01 can quickly capture a large number of visible satellites, enabling fast and accurate positioning. It significantly improves positioning performance in challenging environments such as urban canyons. The module integrates a high-performance embedded CPU and supports a maximum position update rate of up to 10 Hz, making it suitable for high-dynamic applications sensitive to positioning latency. It also features dedicated anti-interference hardware acceleration circuitry for rapid detection and suppression of RF interference.

With high sensitivity, low power consumption, and cost efficiency, WKG035BR09Y01 is suitable for applications such as vehicle navigation, handheld positioning devices, and automotive rearview mirrors. Based on an integrated navigation SoC architecture, the module supports high-accuracy positioning and timing applications while offering high integration, high performance, and low power consumption. It is applicable to automotive navigation, smartphones, IoT devices, and UAV applications.

## 1.2. Key Features

- Supports BDS-2 / BDS-3 (B1I/B1C/B2I/B3I/B2a/B2b)
- Supports A-BDS
- Cold start sensitivity: -148 dBm
- Hot start sensitivity: -156 dBm
- Reacquisition sensitivity: -160 dBm
- Tracking sensitivity: -162 dBm
- Position accuracy: 1m (CEP50)
- TTFF: ≤20s

- Operating Current:  $\leq 45$  mA
- Standby Current:  $\leq 30$   $\mu$ A
- Integrated LNA
- Stacked Ceramic Antenna ( $25 \times 25 \times 4$  mm +  $35 \times 35 \times 4$  mm)
- Fast hot start ( $<1.5$ s) with onboard capacitor
- Standard NMEA-0183 output

### 1.3. Applications

- Vehicle navigation and tracking
- Power timing / 4G/5G synchronization
- IoT positioning devices
- UAV (drones)
- Portable device

## 1.4. Assisted GNSS

Supports A-BDS, providing assistance data such as ephemeris, approximate position, and time.

This significantly reduces Time-To-First-Fix (TTFF), even in weak signal environments.

## 1.5. Output Protocol

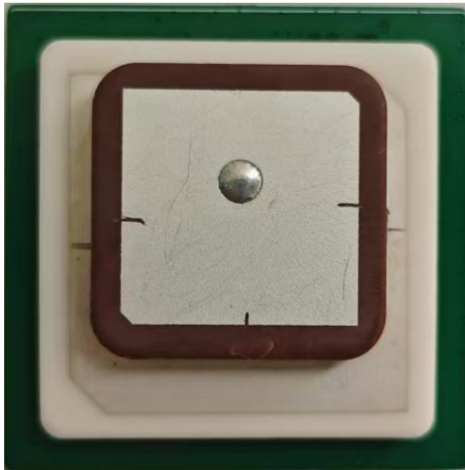
The module outputs data via RS232 interface using NMEA-0183 protocol.

## 1.6. Performance Specifications

| Parameter                          | Specification        |
|------------------------------------|----------------------|
| Signal Reception                   | BDS-2 / BDS-3        |
| RF Channels                        | 88                   |
| Cold Start TTFF                    | ≤20s                 |
| Hot Start TTFF                     | ≤1.5s                |
| Reacquisition TTFF                 | ≤1s                  |
| Cold Start Acquisition Sensitivity | -148dBm              |
| Hot Start Acquisition Sensitivity  | -156dBm              |
| Reacquisition Sensitivity          | -160dBm              |
| Tracking Sensitivity               | -162dBm              |
| Positioning Accuracy               | <1m (CEP50)          |
| Velocity Accuracy                  | <0.05m/s (1σ)        |
| Update Rate                        | 1Hz (max 10Hz)       |
| Baud Rate                          | 115200 bps (default) |
| Interface Protocol                 | NMEA0183             |
| Power Supply                       | 3.3V – 5.5V          |
| Power Consumption                  | ~45mA @5V            |
| Operating Temperature              | -35℃ to +85 ℃        |
| Storage Temperature                | -40℃ to +80 ℃        |
| Dimensions                         | 43x43x11.7mm         |

## 2. Product Description

### 2.1. Module Appearance



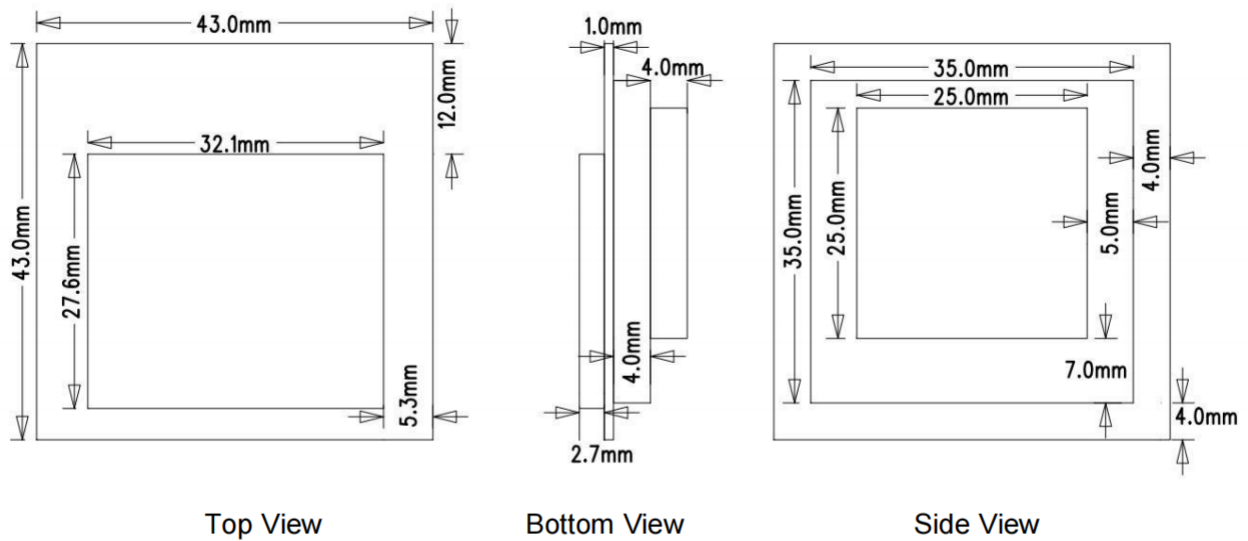
Front



Back

- stacked ceramic antenna (25 × 25 × 4 mm + 35 × 35 × 4 mm)
- The back side of the module is equipped with a 32.1x27.6x2.7mm shielding cover.
- backup coin cell battery for fast hot start
- 1PPS LED indicator (flashes after positioning fix)
- The back side includes a 5-pin 1.25 mm connector (pin from left to right: GND, RX, TX, 5V, PPS), and is also compatible with a 4-pin 1.25 mm connector (without 1PPS), as well as 5-pin solder pads (pin from left to right: GND, RX, TX, 5V, GND).

## 2.2. Dimensions



## 2.3. Pin Definition

| Pin  | Type | Description            |
|------|------|------------------------|
| 5V   | P    | Power supply, 3.0-5.5V |
| TX   | IO   | RS232 output           |
| RX   | IO   | RS232 input            |
| 1PPS | IO   | 1PPS Output            |
| GND  | P    | Ground                 |

### 3. Electrical Characteristics

#### 3.1. Absolute Maximum Ratings

| Parameter                 | Symbol     | Min  | Max  | Unit |
|---------------------------|------------|------|------|------|
| Voltage                   | VDD        | -0.3 | 5.5  | V    |
| Digital I/O Voltage Level | Tx/Rx/1PPS | -0.3 | 4.1  | V    |
| ESD Protection (HBM)      | VESD(HBM)  | -    | 2000 | V    |

#### 3.2. Operating Conditions

| Parameter                 | Symbol     | Min         | Typ | Max | Unit |
|---------------------------|------------|-------------|-----|-----|------|
| Supply Voltage            | VDD        | 3.3         | 5   | 5.5 | V    |
| Input Voltage             | Vil        | RS232 level |     |     | V    |
| Output Voltage            | Vol        | RS232 level |     |     | V    |
| Average Operating Current | Io @VDD=5V | -           | 45  | -   | mA   |
| Supply Voltage            | Temp       | -35         | -   | 85  | °C   |

## 4. NMEA Protocol

### 4.1. NMEA Protocol Characteristics

WKG035BR09Y01 complies with the international standard NMEA 0183 protocol, as well as a proprietary binary protocol.

The module outputs positioning data such as longitude, latitude, and time via the NMEA 0183 protocol. The proprietary binary protocol is used for module configuration, including parameters such as update rate, baud rate, etc.

Data is transmitted via an asynchronous serial interface. The transmission format consists of a start bit, followed by data bits. The data bits are transmitted in least significant bit (LSB) first order.

Data transmission format:

|           |    |    |    |    |    |    |    |    |          |
|-----------|----|----|----|----|----|----|----|----|----------|
| Start Bit | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | Stop Bit |
|-----------|----|----|----|----|----|----|----|----|----------|

Data Transmission Parameters:

|                 |                   |
|-----------------|-------------------|
| Baud Rate (bps) | Default 115200bps |
| Data Bits       | 8bits             |
| Stop Bit        | 1bits             |
| Parity Bit      | /                 |

### 4.2. Frame Structure

| NMEA Frame Structure           |                                                    |                                                                                                     |                                                                               |                                  |
|--------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|
|                                | Checksum Calculation Range                         |                                                                                                     |                                                                               |                                  |
| \$                             | <Address >                                         | {, <Data >}                                                                                         | *<Checksum >                                                                  | <CR><LF>                         |
| Start Delimiter                | Address Field                                      | Data Field                                                                                          | Checksum Field                                                                | End Sequence                     |
| Each sentence begins with '\$' | Consists of two parts: Talker ID and Sentence Type | As <input checked="" type="checkbox"/> Begins, contains variable-length or fixed-length data fields | XOR result of all characters between '\$' and '*', represented in hexadecimal | Each sentence ends with <CR><LF> |

## 4.3. NMEA Identifiers

NMEA distinguishes different GNSS modes by transmitting different talker IDs, as shown below:

| System                  | ID |
|-------------------------|----|
| BDS                     | BD |
| GPS SBAS QZSS           | GP |
| GLONASS                 | GL |
| GNSS                    | GN |
| Proprietary Information | P  |

## 4.4. Support Messages

WKG035BR09Y01 supports the following message fields. When multi-GNSS positioning is used, the talker identifier “GN” is applied; otherwise, a single-system identifier is used.

An overview of the supported NMEA messages is as follows:

| Message                   | Class/ID  | Description                                                       |
|---------------------------|-----------|-------------------------------------------------------------------|
| NMEA Standard Message     |           | Standard Message                                                  |
| GGA                       | 0x4E 0x00 | Receiver Position Data                                            |
| GLL                       | 0x4E 0x01 | Geographic Position – Latitude / Longitude                        |
| GSA                       | 0x4E 0x02 | Dilution of Precision (DOP) and Active Satellites                 |
| GSV                       | 0x4E 0x03 | Satellites in View                                                |
| RMC                       | 0x4E 0x04 | Recommended Minimum Specific GNSS Data                            |
| VTG                       | 0x4E 0x05 | Speed Over Ground and Course Over Ground                          |
| GST                       | 0x4E 0x07 | Receiver Pseudorange Error Statistics                             |
| ZDA                       | 0x4E 0x08 | Time and Date                                                     |
| ANT                       | 0x4E 0x11 | Antenna Status                                                    |
| LPS                       | 0x4E 0x12 | GNSS System Leap Second Correction Information                    |
| DHV                       | 0x4E 0x13 | Receiver Velocity Information                                     |
| UTC                       | 0x4E 0x16 | Receiver Status and Simplified Leap Second Correction Information |
| NMEA Proprietary Messages |           | Proprietary Messages                                              |
| CAS00                     | -         | Save Configuration Parameters                                     |
| CAS01                     | -         | Communication Protocol and UART Configuration                     |
| CAS02                     | -         | Set Positioning Update Rate                                       |
| CAS03                     | -         | Enable or Disable Message Output and Configure Output Frequency   |
| CAS04                     | -         | Set System Initialization and Channel Configuration               |
| CAS05                     | -         | Set NMEA Talker Identifier                                        |
| CAS06                     | -         | Query Module Software and Hardware Information                    |
| CAS10                     | -         | Startup Mode and Assisted Data Configuration                      |
| CAS12                     | -         | Standby Mode Control                                              |
| CAS20                     | -         | Firmware Upgrade Command (OTA Supported)                          |

Among all supported NMEA messages, RMC is the most commonly used. It provides essential information including longitude, latitude, UTC time, and positioning status.

The TXT message provides additional information such as manufacturer identification, software and hardware versions, firmware release date, and antenna status (open, connected, or short circuit).

## 5. Contact Us

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