

# **YIC**



**GU-504GGB**

**Multi-Constellation GNSS Receiver (G-Mouse)**

**Datasheet**

### Revision History

| Date                       | Reversion | Description                                     |
|----------------------------|-----------|-------------------------------------------------|
| <a href="#">2022/10/13</a> | 1.0       | <a href="#">First Draft, Based on GU-504GGB</a> |
|                            |           |                                                 |
|                            |           |                                                 |

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## 1. Product Information

### 1.1 Product Description

The GU-504GGB features multi-constellation and low power consumption, with a highly integrated GNSS receiver chip built in to support multi-system Cortex®-M4F.

The GU-504GGB supports concurrent reception of four GNSS (GPS, GLONASS, BeiDou, and Galileo) and augmentation systems (SBAS and QZSS). The multi-constellation enables the module to achieve an accuracy of approximately 1.5M and stable GNSS performance especially in challenging environments.

### Applications

- Automotive Navigation
- Personal Positioning
- Fleet Management
- Marine Navigation

### 1.2 Product Features

- IP67 Waterproof Rating
- Multi-constellation GPS/GLONASS/Galileo/BeiDou, QZSS and SBAS
- Low Power Consumption: 32 mA@3.3V
- Ultra High Track Sensitivity: -165dBm
- LED Indicating Light for GPS Status
- Communication Type: USB
- Extremely Fast TTFF at Low Signal Level (Cold start ≤24s, Hot start ≤1s)
- NMEA-0183 Compliant Protocol or Custom Protocol
- RoHS Compliant

## 1.3 Product Specifications

| GPS Receiver             |                                                                                                                   |                              |
|--------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------|
| Chip                     | MediaTek                                                                                                          |                              |
| GNSS Reception           | GPS/QZSS                                                                                                          | L1 C/A, L1C                  |
|                          | GLONASS                                                                                                           | L1                           |
|                          | Galileo                                                                                                           | E1                           |
|                          | BeiDou                                                                                                            | B1I                          |
|                          | SBAS                                                                                                              | WAAS, EGNOS, MSAS, GAGAN     |
| Update Rate              | GNSS                                                                                                              | 10 Hz(Default)               |
| Position Accuracy        | GNSS                                                                                                              | 1.5 m CEP                    |
|                          | SBAS                                                                                                              | 1.5 m CEP                    |
| Velocity & Time Accuracy | GNSS                                                                                                              | 0.01 m/s CEP                 |
|                          | SBAS                                                                                                              | 0.05 m/s                     |
|                          | 1PPS                                                                                                              | 25 ns                        |
| Accuracy Time            | Hot start                                                                                                         | 1 sec                        |
|                          | Cold start                                                                                                        | 24 sec                       |
| Sensitivity              | Cold start                                                                                                        | -148dBm                      |
|                          | Hot start                                                                                                         | -155dBm                      |
|                          | Tracking                                                                                                          | -165dBm                      |
|                          | Reacquisition                                                                                                     | -158dBm                      |
| GNSS Operating limit     | Velocity                                                                                                          | 515 m/s                      |
|                          | Altitude                                                                                                          | 18,000 m                     |
| Protocol Support         | USB Port: USB_DP and USB_DM<br>115200bps (default), Supports baud rate 4800bps to 921600bps<br>NMEA 0183 Protocol |                              |
| Environment              | Operation temperature                                                                                             | -40°C ~ +85°C                |
|                          | Storage temperature                                                                                               | -55°C ~ +100°C               |
| Physical Characteristics | Size                                                                                                              | 36.3±0.5 ×36.4±0.5 ×13.5±1mm |
|                          | Weight                                                                                                            | Approx. 48g                  |

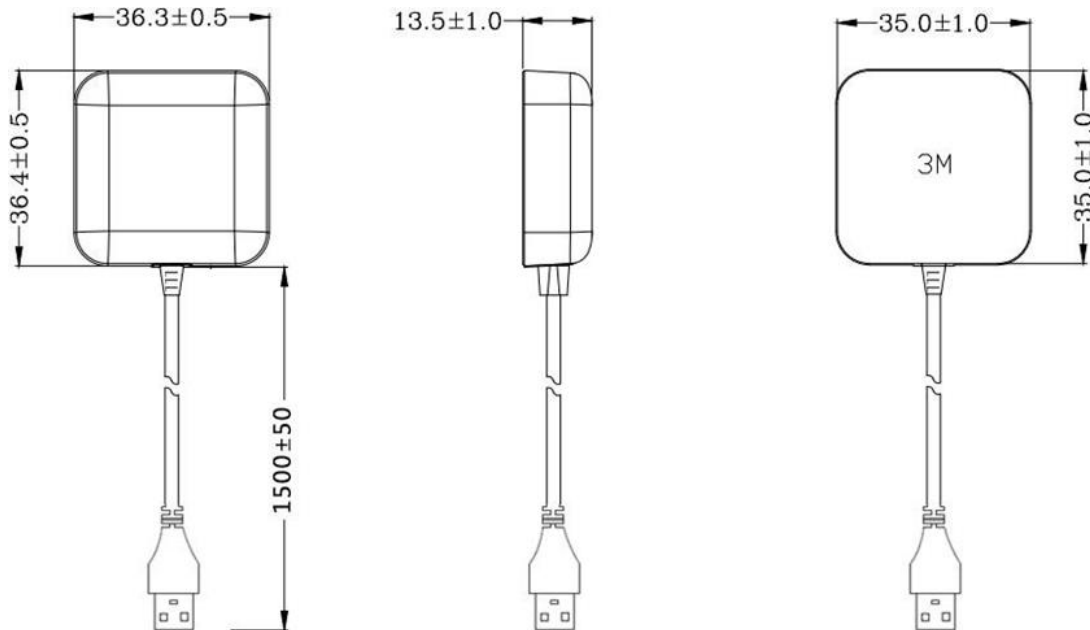
### 1.4 DC Electrical Characteristics

| Parameter                           |                              | Min.    | Typ. | Max.    | Units |
|-------------------------------------|------------------------------|---------|------|---------|-------|
| Input Voltage                       |                              | 3.0     | 3.3  | 5.5     | Volt  |
| Power Supplier Current <sup>1</sup> |                              |         |      |         |       |
| Acquisition                         | GPS L1 + GL + GA + BD + QZSS |         | 30   |         | mA    |
| Tracking                            | GPS L1 + GL + GA + BD + QZSS |         | 32   |         | mA    |
| UART Port Working Voltage           |                              |         |      |         |       |
| Low Level Output Voltage (VOL)      |                              |         |      | 0.2xVCC | Volt  |
| High Level Output Voltage (VOH)     |                              | 0.8xVCC |      |         | Volt  |
| Low Level Input Voltage (VIL)       |                              |         |      | 0.3xVCC | Volt  |
| High Level Input Voltage (VIH)      |                              | 0.7xVCC |      |         | Volt  |
| Low Level Output Current (IOL)      |                              |         | 3    |         | mA    |
| High Level Output Current (IOH)     |                              |         | 3    |         | mA    |

## 2. Physical Dimensions

(Different Cables & Connectors can be Specified According to Requirements)

| P/N           | Mount    | Description           |
|---------------|----------|-----------------------|
| GU-504GGB-USB | Adhesive | Connector: USB A Male |



### 2.1 Pin Descriptions

| Pin NO. | Pin Name   | Remark                                                                                            |
|---------|------------|---------------------------------------------------------------------------------------------------|
| 1       | VCC        | Module Power Supply                                                                               |
| 2       | USB_DM     | USB Data (D-)                                                                                     |
| 3       | USB_DP     | USB Data (D+)                                                                                     |
| 4       | GND        | Ground                                                                                            |
| LED     | GPS Status | LED Off: G-Mouse is No Power<br>LED On: Searching for GPS Signals<br>LED Blinking: Position Fixed |

### 3. Software Protocol

#### 3.1 NMEA output message

| NMEA                                                                 | Description                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>\$GNGGA</b>                                                       | Time, position, and fix related data of the receiver.                                                                                                                                                                                                                                               |
| <b>\$GNGLL</b>                                                       | Position, time and fix status.                                                                                                                                                                                                                                                                      |
| <b>\$GNGSA</b>                                                       | Used to represent the ID of satellites which are used for position fix. When GPS & GLONASS & Galileo & BDS satellites are used for positioning solutions, the ID of available positioning satellites is counted and output with multiple statements.                                                |
| <b>\$GPGSV</b><br><b>\$GLGSV</b><br><b>\$GAGSV</b><br><b>\$GBGSV</b> | Satellite information about elevation, azimuth and CNR, satellites are used in position solution, \$GPGSV sentence is used for GPS satellites, a \$GLGSV sentence is used for GLONASS satellites, \$GAGSV sentence is used for GALILEO satellites. And \$GBGSV sentence is used for BDS satellites. |
| <b>\$GNRMC</b>                                                       | Time, date, position, course and speed data.                                                                                                                                                                                                                                                        |
| <b>\$GNVTG</b>                                                       | Course and speed relative to the ground.                                                                                                                                                                                                                                                            |
| <b>\$GNZDA</b>                                                       | UTC, day, month and year and time zone.                                                                                                                                                                                                                                                             |



## 3.2 GGA – Global Positioning System Fix Data

Time, position and fix related data for a GNSS receiver.

Structure:

\$GNGGA,hhmmss.sss,ddmm.mmmmm,a,dddmm.mmmmm,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx\*hh

example: \$GNGGA,175258.000,2447.0870,N,12100.5221,E,2,15,0.7,95.2,M,19.6,M,,0000\*72

| Field | Name                         | Example     | Description                                                                                                                                                                                             |
|-------|------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | UTC Time                     | 175258.000  | UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)                                                                                                                                         |
| 2     | Latitude                     | 2447.08700  | Latitude in ddmm.mmmmm format Leading zeros transmitted                                                                                                                                                 |
| 3     | N/S Indicator                | N           | Latitude hemisphere indicator, 'N' = North, 'S' = South                                                                                                                                                 |
| 4     | Longitude                    | 12100.52210 | Longitude in dddmm.mmmmm format Leading zeros transmitted                                                                                                                                               |
| 5     | E/W Indicator                | E           | Longitude hemisphere indicator, 'E' = East, 'W' = West                                                                                                                                                  |
| 6     | Quality Indicator            | 2           | Quality Indicator<br>0: position fix unavailable<br>1: valid position fix, SPS mode<br>2: valid position fix, differential<br>GPS mode 3: GPS PPS Mode, fix valid<br>6: Estimated (dead reckoning) Mode |
| 7     | Satellites Used              | 15          | Number of satellites in use, (00 ~ 56)                                                                                                                                                                  |
| 8     | HDOP                         | 0.7         | Horizontal dilution of precision, (0.0 ~ 99.9)                                                                                                                                                          |
| 9     | Altitude                     | 95.2        | mean sea level (geoid), (-9999.9 ~ 17999.9)                                                                                                                                                             |
| 10    | Geoidal Separation           | 19.6        | Geoidal separation in meters                                                                                                                                                                            |
| 11    | Age pf Differential GPS data |             | Age of Differential GPS data NULL when DGPS not used                                                                                                                                                    |
| 12    | DGPS Station ID              | 0000        | Differential reference station ID, 0000 ~ 1023                                                                                                                                                          |
| 13    | Checksum                     | 72          |                                                                                                                                                                                                         |

## 3.3 GLL – Latitude/Longitude

Latitude and longitude of current position, time, and status.

Structure: \$GNGLL,ddmm.mmmmm,a,dddmm.mmmmm,a,hhmmss.sss,A,a\*hh

For example: \$GNGLL,2447.0870,N,12100.5221,E,175258.000,A,D\*42

| Field | Name           | Example     | Description                                                                                                                         |
|-------|----------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Latitude       | 2447.08700  | Latitude in ddmm.mmmmm format Leading zeros transmitted                                                                             |
| 2     | N/S Indicator  | N           | Latitude hemisphere indicator 'N' = North<br>'S' = South                                                                            |
| 3     | Longitude      | 12100.52210 | Longitude in dddmm.mmmmm format Leading zeros transmitted                                                                           |
| 4     | E/W Indicator  | E           | Longitude hemisphere indicator 'E' = East<br>'W' = West                                                                             |
| 5     | UTC Time       | 175258.000  | UTC time in hhmmss.sss format (000000.000 ~ 235959.999)                                                                             |
| 6     | Status         | A           | Status, 'A' = Data valid, 'V' = Data not valid                                                                                      |
| 7     | Mode Indicator | D           | Mode indicator<br>'N' = Data not valid<br>'A' = Autonomous mode<br>'D' = Differential mode<br>'E' = Estimated (dead reckoning) mode |
| 8     | Checksum       | 42          |                                                                                                                                     |

## 3.4 GSA – GNSS DOP and Active Satellites

GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA sentence and DOP values.

Structure: \$GNGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x,x\*hh

For example: \$GNGSA,A,3,21, 12,15,18,20,24,10,32,25,13,,,1.2,0.7,1.0,1\*18

| Field | Name                | Example                                     | Description                                                                                                                                                                                                                                                                                                                                    |
|-------|---------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Mode                | A                                           | Mode<br>'M' = Manual, forced to operate in 2D or 3D mode<br>'A' = Automatic, allowed to automatically switch 2D/3D                                                                                                                                                                                                                             |
| 2     | Mode                | 3                                           | Fix type<br>1 = Fix not available<br>2 = 2D<br>3 = 3D                                                                                                                                                                                                                                                                                          |
| 3     | Satellite used 1~12 | 21, 12, 15, 18,<br>20, 24, 10,<br>32,25, 13 | 01 ~ 32 are for GPS; 33 ~ 64 are for WAAS (PRN minus 87); 193 ~ 197 are for QZSS; 65 ~ 88 are for GLONASS (GL PRN) ; 01 ~ 36 are for GALILEO (GA PRN); 01 ~ 37 are for BDS (BD PRN). GPS, GLONASS, GALILEO and BDS satellites are differentiated by the. GNSS system ID in table 3. Maximally 12 satellites are included in each GSA sentence. |
| 4     | PDOP                | 1.2                                         | Position dilution of precision (0.0 to 99.9)                                                                                                                                                                                                                                                                                                   |
| 5     | HDOP                | 0.7                                         | Horizontal dilution of precision (0.0 to 99.9)                                                                                                                                                                                                                                                                                                 |
| 6     | VDOP                | 1.0                                         | Vertical dilution of precision (0.0 to 99.9)                                                                                                                                                                                                                                                                                                   |
| 7     | GNSS System ID      | 1                                           | 1 for GPS, 2 for GLONASS, 3 for GALILEO, 4 for BDS                                                                                                                                                                                                                                                                                             |
| 8     | Checksum            | 18                                          |                                                                                                                                                                                                                                                                                                                                                |

## 3.5 GSV – GNSS Satellites in View

Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. Four satellites maximum per transmission.

Structure: \$GPGSV , x , x , xx , xx , xx , xx , xx , ... , xx , xx , xx , xx , xx , x\*hh

For example: \$GPGSV , 4,1 , 13 , 02,72 , 109 , 43,24 , 69,035 , 48,18 , 52,330 , 42,21 , 49,246 , 43 , 1\*69

| Field | Name               | Example | Description                                                                                                                                                                                                                                                                                                                                  |
|-------|--------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Number of message  | 4       | Total number of GSV messages to be transmitted (1-5)                                                                                                                                                                                                                                                                                         |
| 2     | Sequence number    | 1       | Sequence number of current GSV message                                                                                                                                                                                                                                                                                                       |
| 3     | Satellites in view | 13      | Total number of satellites in view (00 ~ 20)                                                                                                                                                                                                                                                                                                 |
| 4     | Satellite ID       | 02      | 01 ~ 32 are for GPS; 33 ~ 64 are for WAAS (PRN minus 87); 193 ~ 197 are for QZSS; 65 ~ 88 are for GLONASS (GL PRN) ; 01 ~ 36 are for GALILEO (GA PRN); 01 ~ 37 are for BDS (BD PRN). GPS, GLONASS, GALILEO and BDS satellites are differentiated by the GNSS system ID in table 3. Maximally 12 satellites are included in each GSA sentence |
| 5     | Elevation          | 72      | Satellite elevation in degrees, (00 ~ 90)                                                                                                                                                                                                                                                                                                    |
| 6     | Azimuth            | 109     | Satellite azimuth angle in degrees, (000 ~ 359 )                                                                                                                                                                                                                                                                                             |
| 7     | SNR                | 43      | C/No in dB (00 ~ 99) Null when not tracking                                                                                                                                                                                                                                                                                                  |
| 8     | Signal ID          | 1       | 1 for L1/CA                                                                                                                                                                                                                                                                                                                                  |
| 9     | Checksum           | 69      |                                                                                                                                                                                                                                                                                                                                              |

## 3.6 RMC – Recommended Minimum Specific GNSS Data

Time, date, position, course and speed data provided by a GNSS navigation receiver.

Structure: \$GNRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,,,a\*hh For example:  
\$GNRMC,175258.000,A,2447.0870,N,12100.5220,E,000.0,000.0,220617,,,D\*75

| Field | Name               | Example     | Description                                                                                                                      |
|-------|--------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1     | UTC time           | 175258.000  | UTC time in hhmmss.sss format (000000.00 ~ 235959.999)                                                                           |
| 2     | Status             | A           | Status<br>'V' = Navigation receiver warning<br>'A' = Data Valid                                                                  |
| 3     | Latitude           | 2447.08700  | Latitude in dddmm.mmmmm format Leading zeros transmitted                                                                         |
| 4     | N/S indicator      | N           | Latitude hemisphere indicator 'N' =North 'S' = South                                                                             |
| 5     | Longitude          | 12100.52210 | Longitude in dddmm.mmmmm format Leading zeros transmitted                                                                        |
| 6     | E/W Indicator      | E           | Longitude hemisphere indicator 'E' = East 'W' = West                                                                             |
| 7     | Speed over ground  | 000.0       | Speed over ground in knots (000.0 ~ 999.9)                                                                                       |
| 8     | Course over ground | 000.0       | Course over ground in degrees (000.0 ~ 359.9)                                                                                    |
| 9     | UTC Date           | 220617      | UTC date of position fix, ddmmyy format                                                                                          |
| 10    | Mode indicator     | D           | Mode indicator<br>'N' = Data not valid<br>'A' = Autonomous mode 'D' = Differential mode<br>'E' = Estimated (dead reckoning) mode |
| 11    | checksum           | 75          |                                                                                                                                  |

### 3.7 VTG – Course Over Ground and Ground Speed

The actual course and speed relative to the ground.

Structure: \$GNVTG,x.x,T,,M,x.x,N,x.x,K,a\*hh

For example: \$GNVTG,000.0,T,,M,000.0,N,000.0,K,D\*16

| Field | Name     | Example | Description                                                                                                                         |
|-------|----------|---------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Course   | 000.0   | True course over ground in degrees (000.0 ~ 359.9)                                                                                  |
| 2     | Speed    | 000.0   | Speed over ground in knots (000.0 ~ 999.9)                                                                                          |
| 3     | Speed    | 000.0   | Speed over ground in kilometers per hour (000.0 ~ 1800.0)                                                                           |
| 4     | Mode     | D       | Mode indicator<br>'N' = Data not valid<br>'A' = Autonomous mode 'D' =<br>Differential mode<br>'E' = Estimated (dead reckoning) mode |
| 5     | Checksum | 16      |                                                                                                                                     |

### 3.8 ZDA – TIME AND DATE

UTC, day, month, year and local time zone

Structure:

\$GNZDA,hhmmss.sss,xx,xx,xxxx,xx,xx\*hh<CR><LF>

For example:

\$GNZDA,175258.000,30,08,2022,00,00\*46<CR><LF>

| Field | Name               | Example    | Units | Description                                          |
|-------|--------------------|------------|-------|------------------------------------------------------|
| 1     | UTC time           | 175258.000 |       | UTC time in hhmmss.ss format (000000.00 ~ 235959.99) |
| 2     | UTC Day            | 30         |       | UTC time: day (01 ~ 31)                              |
| 3     | UTC Month          | 28         |       | UTC time: month (01 ~ 12)                            |
| 4     | UTC Year           | 2022       |       | UTC time: year (4 digit format)                      |
| 5     | Local zone hour    | 00         |       | Local zone hours (00 ~ +/- 13)                       |
| 6     | Local zone minutes | 00         |       | Local zone minutes (00 ~59)                          |
| 7     | Checksum           | 46         |       | Checksum                                             |

★ZDA is optional