

## General Description

The Gotop GGM-3325-MTR is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

Its  $-165\text{dBm}$  tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

### Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone



**Figure1:GGM-3325-MTR Top View**

### Features

- Build on high performance, low-power MediaTek MT3337 chip set
- Ultra high Track sensitivity:  $-165\text{dBm}$
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max  $28\text{mA}@3.3\text{V}$
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage:  $3.0\text{V}$  to  $5.0\text{V}$
- Operating temperature range:  $-40$  to  $85^\circ\text{C}$
- Patch Antenna Size:  $25 \times 25 \times 4\text{mm}$
- Small form factor:  $33.6 \times 25.5 \times 14\text{mm}$
- Communication type: UART/TTL
- Wire interface type: Audio head 4Pin,  $L=50\text{cm}$
- RoHS compliant (Lead-free)

# 1 Description

## 1.1. Key Features

| Parameter                                 | Specification   |
|---|---|
| Power Supply                              | <ul style="list-style-type: none"> <li>Supply voltage: 3.0V~5.0V Typical: 3.3V</li> </ul>   |
| Power Consumption                         | <ul style="list-style-type: none"> <li>Acquisition: 28mA @VCC=3.3V</li> <li>Tracking: 25mA @VCC=3.3V</li> <li>Standby: 2.0mA @VCC=3.3V</li> <li>Backup: 15uA @VBAT=3.3V</li> </ul>  |
| Receiver Type                             | <ul style="list-style-type: none"> <li>Code 66 search channels, GPS&amp;QZSS L1 1575.42MHz C/A</li> <li>22 simultaneous tracking channels</li> </ul>  |
| Sensitivity                               | <ul style="list-style-type: none"> <li>Tracking: -165dBm</li> <li>Re-acquisition: -156dBm</li> <li>Acquisition: -148dBm</li> </ul>  |
| TTF (Autonomous)                          | <ul style="list-style-type: none"> <li>Cold start: 35s typ @-130dBm</li> <li>Warm start: 30s typ @-130dBm</li> <li>Hot start: 1s typ @-130dBm</li> </ul>  |
| Horizontal Position Accuracy (Autonomous) | <ul style="list-style-type: none"> <li>&lt;2.5m CEP @-130 dBm</li> </ul>  |
| Update Rate                               | <ul style="list-style-type: none"> <li>1Hz</li> </ul>   |
| Accuracy of 1PPS Signal                   | <ul style="list-style-type: none"> <li>not enabled</li> </ul>   |
| Acceleration Accuracy                     | <ul style="list-style-type: none"> <li>Without aid: 0.1m/s<sup>2</sup></li> </ul>   |
| Dynamic Performance                       | <ul style="list-style-type: none"> <li>Maximum altitude: 18,000m</li> <li>Maximum velocity: 515m/s</li> <li>Acceleration: 4G</li> </ul>   |
| UART Port                                 | <ul style="list-style-type: none"> <li>UART Port: TXD and RXD</li> <li>Supports baud rate from 4800bps to 115200bps, 9600bps by default</li> <li>UART port is used for NMEA output, MTK proprietary commands input</li> </ul> |
| Temperature Range                         | <ul style="list-style-type: none"> <li>Normal operation: -40°C ~ +85°C</li> <li>Storage temperature: -45°C ~ +125°C</li> </ul>  |
| Physical Characteristics                  | <ul style="list-style-type: none"> <li>Size: 22.1±0.20 × 22.1±0.20 × 8.6±0.20mm</li> <li>Weight: Approx. 8.6g</li> </ul>  |

## 1.2 Power Supply

Regulated power for the GGM-3325-MTR is required. The VCC Pin Need a stable DC voltage supply. Power supply ripple must be less than 30mV. The input voltage Vcc should be 3.0V~5.0V, Recommended power supply voltage is 3.3V . maximum current is 28mA. Suitable decoupling must be provided by external decoupling circuitry.

## 1.3 UART Ports

The module supports two full duplex serial channels UART. All serial connections are at 3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps, however, the user can change the default baud rate to any value from 4800 bps to 115kbps. UART port can be used for firmware upgrade, NMEA output and PMTK proprietary commands input.

## 2 Application

The module is equipped with a 6-pin 1.0mm distance Connector that connects to your application platform. The GGM-3325-MTR module It consists of a MediaTek MT3337 single chip GPS IC which includes the RF part and Baseband part, a patch antenna, a LNA, a SAW filter, a TCXO, a crystal oscillator, Also comes with a 0.22F crystal capacitor ,can backup satellite ephemeris about 2 hour.

### 2.1. Pin Assignment

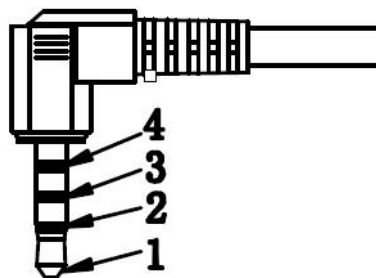


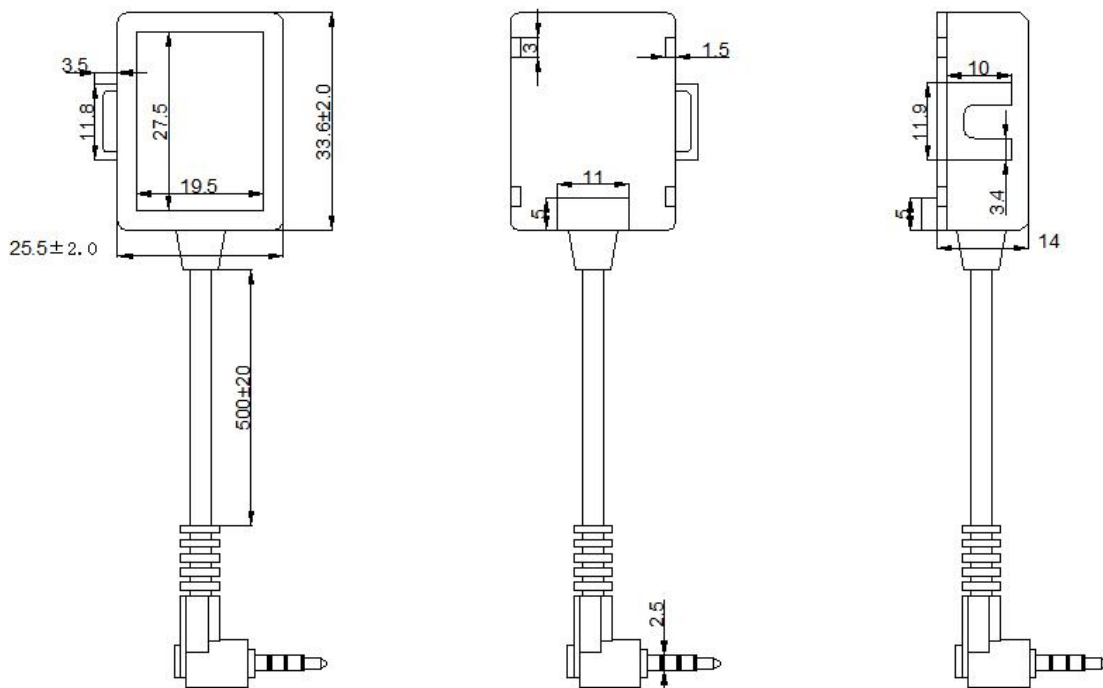
Figure 2: Pin Assignment

**CON Pin Description**

| Pin No. | Pin name | I/O | Description             | Remark                   |
|---------|----------|-----|-------------------------|--------------------------|
| 1       | VCC      | I   | Module Power Supply     | Voltage range: 3.0V~5.0V |
| 2       | TXD      | O   | UART Serial Data output |                          |
| 3       | GND      | G   | Ground                  |                          |
| 4       | RXD      | O   | UART Serial Data input  |                          |

**2.2 Mechanical Dimensions**

This chapter describes the mechanical dimensions of the GGM-3325-MTR module. Size unit (mm)



**Figure 3:** Specification size chart

### 3 NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GPxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a check sum, which allows detection of corrupted data transfers.

The Gotop GGM-3325-MTR supports the following NMEA-0183 messages: \$GPGGA, \$GPGLL,\$GPGSA,\$GPSV, \$GPRMC and \$GPVTG.

**Table 1: NMEA-0183 Output Messages**

| NMEA Record | DESCRIPTION                            |
|-------------|--|
| GGA         | Global positioning system fixed data   |
| GLL         | Geographic position—latitude/longitude |
| GSA         | GNSS DOP and active satellites         |
| GSV         | GNSS satellites in view                |
| RMC         | Recommended minimum specific GNSS data |
| VTG         | Course over ground and ground speed    |

#### 3.1 GGA-Global Positioning System Fixed Data

\$GPGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000\*18

**Table 2: GGA Data Format**

| Name                   | Example    | Units  | Description                       |
|------------------------|------------|--------|-----------------------------------|
| Message ID             | \$GPGGA    |        | GGA protocol header               |
| UTC Position           | 161229.487 |        | hhmmss.sss                        |
| Latitude               | 3723.2457  |        | ddmm.mmmm                         |
| N/S indicator          | N          |        | N=north or S=south                |
| Longitude              | 12158.3416 |        | dddmm.mmmm                        |
| E/W Indicator          | W          |        | E=east or W=west                  |
| Position Fix Indicator | 1          |        | See Table 2-1                     |
| Satellites Used        | 07         |        | Range 0 to 12                     |
| HDOP                   | 1.0        |        | Horizontal Dilution of Precision  |
| MSL Altitude           | 9.0        | meters |                                   |
| Units                  | M          | meters |                                   |
| Geoids Separation      |            | meters |                                   |
| Units                  | M          | meters |                                   |
| Age of Diff.Corr.      |            | second | Null fields when DGPS is not Used |

|                     |      |  |                            |
|---------------------|------|--|----------------------------|
| Diff.Ref.Station ID | 0000 |  |                            |
| Check sum           | *18  |  |                            |
| <CR> <LF>           |      |  | End of message termination |

**Table 2-1: Position Fix Indicators**

| Value | Description                           |
|-------|---------------------------------------|
| 0     | Fix not available or invalid          |
| 1     | GPS SPS Mode, fix valid               |
| 2     | Differential GPS, SPS Mode, fix valid |
| 3     | GPS PPS Mode, fix valid               |

### 3.2 GLL-Geographic Position - Latitude/Longitude

\$GPGLL , 3723.2475, N,12158.3416, W,161229.487, A\*2C.

**Table 3: GLL Data Format**

| Name          | Example    | Units | Description                      |
|---------------|------------|-------|----------------------------------|
| Message ID    | \$GPGLL    |       | GLL protocol header              |
| Latitude      | 3723.2475  |       | ddmm.mmmm                        |
| N/S Indicator | N          |       | N=north or S=south               |
| Longitude     | 12158.3416 |       | dddmm.mmmm                       |
| E/W Indicator | W          |       | E=east or W=west                 |
| UTC Position  | 161229.487 |       | hhmmss.sss                       |
| Status        | A          |       | A=data valid or V=data not valid |
| Check sum     | *2C        |       |                                  |
| <CR> <LF>     |            |       | End of message termination       |

### 3.3 GSA-GNSS DOP and Active Satellites

\$GPGSA , A, 3, 07, 02, 26,27, 09, 04,15, , , , , , 1.8,1.0,1.5\*33.

**Table 4: GSA Data Format**

| Name           | Example | Units | Description                      |
|----------------|---------|-------|----------------------------------|
| Message        | \$GPGSA |       | GSA protocol header              |
| Mode 1         | A       |       | See Table 4-2                    |
| Mode 2         | 3       |       | See Table 4-1                    |
| Satellite Used | 07      |       | Sv on Channel 1                  |
| Satellite Used | 02      |       | Sv on Channel 2                  |
| ...            | ...     |       | ...                              |
| Satellite Used |         |       | Sv on Channel 12                 |
| PDOP           | 1.8     |       | Position Dilution of Precision   |
| HDOP           | 1.0     |       | Horizontal Dilution of Precision |

|           |     |  |                                |
|-----------|-----|--|--------------------------------|
| VDOP      | 1.5 |  | Vertical Dilution of Precision |
| Check sum | *33 |  |                                |
| <CR> <LF> |     |  | End of message termination     |

**Table 4-1**

| Value | Description       |
|-------|-------------------|
| 1     | Fix not available |
| 2     | 2D                |
| 3     | 3D                |

**Table 4-2**

| Value | Description                                     |
|-------|---|
| M     | Manual-forced to operate in 2D or 3D mode       |
| A     | Automatic-allowed to automatically switch 2D/3D |

### 3.4 GSV-GNSS Satellites in View

\$GPGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42\*71

\$GPGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42\*41.

**Table 5: GGA Data Format**

| Name               | Example | Units   | Description                           |
|--------------------|---------|---------|---------------------------------------|
| Message ID         | \$GPGSV |         | GSV protocol header                   |
| Number of Message  | 2       |         | Range 1 to 3                          |
| Message Number     | 1       |         | Range 1 to 3                          |
| Satellites in View | 07      |         |                                       |
| Satellite ID       | 07      |         | Channel 1(Range 1 to 32)              |
| Elevation          | 79      | degrees | Channel 1(Maximum 90)                 |
| Azinmuth           | 048     | degrees | Channel 1(True, Range 0 to 359)       |
| SNR(C/NO)          | 42      | dBHz    | Range 0 to 99,null when not tracking  |
| ...                |         |         | ...                                   |
| Satellite ID       | 27      |         | Channel 4(Range 1 to 32)              |
| Elevation          | 27      | degrees | Channel 4(Maximum 90)                 |
| Azimuth            | 138     | degrees | Channel 4(True, Range 0 to 359)       |
| SNR(C/NO)          | 42      | dBHz    | Range 0 to 99, null when not tracking |
| Check sum          | *71     |         |                                       |
| <CR> <LF>          |         |         | End of message termination            |

✧ Depending on the number of satellites tracked multiple messages of GSV data may be required.

### 3.5 RMC-Recommended Minimum Specific GNSS Data

\$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598,, \*10

**Table 6: RMC Data Format**

| Name               | Example    | Units   | Description                      |
|--------------------|------------|---------|----------------------------------|
| Message ID         | \$GPRMC    |         | RMC protocol header              |
| UTS Position       | 161229.487 |         | hhmmss.sss                       |
| Status             | A          |         | A=data valid or V=data not valid |
| Latitude           | 3723.2475  |         | ddmm.mmmm                        |
| N/S Indicator      | N          |         | N=north or S=south               |
| Longitude          | 12158.3416 |         | dddmm.mmmm                       |
| E/W Indicator      | W          |         | E=east or W=west                 |
| Speed Over Ground  | 0.13       | Knots   |                                  |
| Course Over Ground | 309.62     | Degrees | True                             |
| Date               | 120598     |         | dummy                            |
| Magnetic variation |            | Degrees | E=east or W=west                 |
| Check sum          | *10        |         |                                  |
| <CR> <LF>          |            |         | End of message termination       |

### 3.6 VTG-Course Over Ground and Ground Speed

\$GPVTG, 309.62, T, M, 0.13, N, 0.2, K\*6E

**Table 7: VTG Data Format**

| Name       | Example | Units   | Description               |
|------------|---------|---------|---------------------------|
| Message ID | \$GPVTG |         | VTG protocol header       |
| Course     | 309.62  | Degrees | Measured heading          |
| Reference  | T       |         | True                      |
| Course     |         | Degrees | Measured heading          |
| Reference  | M       |         | Magnetic                  |
| Speed      | 0.13    | Knots   | Measured horizontal speed |
| Units      | N       |         | Knots                     |
| Speed      | 0.2     | Km/hr   | Measured horizontal speed |



|           |     |  |                            |
|-----------|-----|--|----------------------------|
| Units     | K   |  | Kilometer per hour         |
| Check sum | *6E |  |                            |
| <CR> <LF> |     |  | End of message termination |

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