

## GPS/GNSS Antenna Module



### 1. Product Information

1.1 Product Name: YIC51513GM-39

#### 1.2 Product Description:

YIC51513GM-39 is a compact, high performance, and low power consumption GPS/GNSS Antenna Module.

It uses the chipset which can track up to 66 channels at a time and perform fast TTFF in weak signal environments.

YIC51513GM-39 is suitable for the following applications:

- Automotive navigation
- Personal positioning
- Fleet management
- Mobile phone navigation
- Marine navigation

#### 1.3 Product Features:

- High performance and low power consumption GPS Chipset
- Very high sensitivity
- Extremely fast TTFF (Time To First Fix) at low signal level
- Two serial ports
- Built-in LNA
- Compact size suitable for space-sensitive application
- Support NMEA 0183 and ublox binary protocol

## 1.4 Product Specifications

### GPS Performance

| GPS Receiver            |                                      |   |
|-------------------------|--------------------------------------|---|
| Chip                    | MT3339(Flash)                        |   |
| Frequency               | L1 1575.42MHz, C/A code              |   |
| Channels                | Support 66 channels                  |   |
| Update rate             | 1Hz default, up to 10Hz              |   |
| Sensitivity             | Tracking                             | -163dBm, up to -165dBm (with external LNA)              |
|                         | Cold Start                           | -143.5dBm, up to -148dBm (with external LNA)            |
| Acquisition Time        | Hot start (Open Sky)                 | < 1s (typical)  |
|                         | Hot start (Indoor)                   | < 30s   |
|                         | Cold Start (Open Sky)                | 32s (typical) without AGPS                              |
|                         |                                      | < 15s (typical) with AGPS (hybrid ephemeris prediction) |
| Position Accuracy       | Autonomous                           | 3m (2D RMS)   |
|                         | SBAS                                 | 2.5m (depends on accuracy of correction data)           |
| Max. Altitude           | < 18,000 m ,up to 50,000m by request |   |
| Max. Velocity           | < 515 m/s                            |   |
| Protocol Support        | NMEA 0183                            | 9600 bps, 8 data bits, no parity, 1 stop bits (default) |
|                         |                                      | 1Hz: GGA, GLL, GSA, GSV, RMC, VTG                       |
| Physical Characteristic |                                      |   |
| Type                    | 5pin stamp holes                     |   |
| Dimensions              | 15.0.0mm * 13.0 mm * 6.8mm ±0.2mm    |   |

## 1.5 DC Electrical characteristics

| Parameter                    | Symbol | Conditions                                 | Min. | Typ.              | Max.               | Units |
|------------------------------|--------|--|------|-------------------|--------------------|-------|
| Input Voltage                | VCC    |  | 3.0  | 3.3               | 4.3                | V     |
| Input Backup Battery Voltage | V_BCKP |  | 3.0  |                   | 3.6                | V     |
| Supply Current               | Iss    | VCC = 3.3V,<br>w/o active antenna,<br>Peak |      |                   | 150 <sup>(1)</sup> | mA    |
|                              |        | Acquisition                                |      | 35                |                    | mA    |
|                              |        | Tracking                                   |      | 30 <sup>(2)</sup> |                    | mA    |
|                              |        | Standby                                    |      | 350               |                    | uA    |
| Backup Battery Current       | Ibat   | VCC = 0V                                   |      | 7                 |                    | uA    |
| High Level Input Voltage     | VIH    |  | 2.0  |                   | 3.6                | V     |
| Low Level Input Voltage      | VIL    |  | -0.3 |                   | 0.8                | V     |
| High Level Input Current     | IIH    | no pull-up or down                         | -1   |                   | 1                  | uA    |
| Low Level Input Current      | IIL    | no pull-up or down                         | -1   |                   | 1                  | uA    |
| High Level Output Voltage    | VOH    |  | 2.4  |                   | 3.3                | V     |
| Low Level Output Voltage     | VOL    |  |      |                   | 0.4                | V     |
| High Level Output Current    | IOH    |  |      | 2                 |                    | mA    |
| Low Level Output Current     | IOL    |  |      | 2                 |                    | mA    |

**Note 1:** This happens when downloading AGPS data to Module.

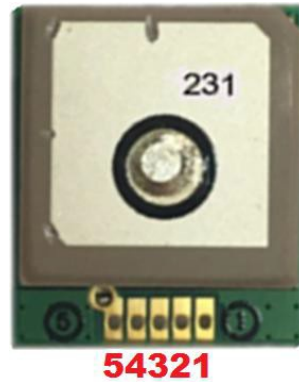
**Note 2:** Measured when position fix (1Hz) is available, input voltage is 3.3V and the function of self-generated ephemeris prediction is inactive.

## 1.6 Temperature characteristics

| Parameter             | Symbol | Min. | Typ. | Max. | Units |
|-----------------------|--------|------|------|------|-------|
| Operating Temperature | Topr   | -40  | 25   | 85   | °C    |
| Storage Temperature   | Tstg   | -40  | 25   | 85   | °C    |

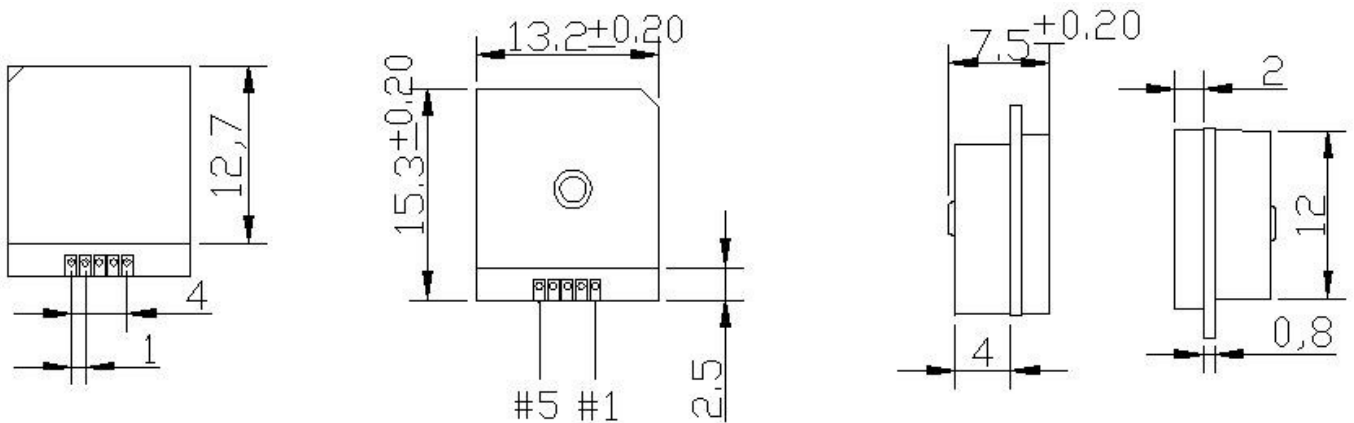
## 2. Technical Information

### 2.1 Module Pin Assignment



| Pin NO. | Pin Name | I/O | Remark                                   |
|---------|----------|-----|--|
| 1.      | VBAT     | I   | RTC Battery Input                        |
| 2.      | TXD      | O   | UART Serial Data Output                  |
| 3.      | RXD      | O   | UART Serial Data Input                   |
| 4.      | VCC      | I   | Module Power Supply, Module Power Supply |
| 5       | GND      | G   | Ground                                   |

### 2.2 Dimensions



Front view

Rear view

Profile view

### 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 checksum, which allows detection of corrupted data transfers.

YIC51513GMGB-33 modules support the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC and VTG.

Table3. 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    |

#### GGA-Global Positioning System Fixed Data

Table3. 2 contains the values of the following example:

\$GPGGA,183015.000,2503.7123,N,12138.7446,E,2,16,0.68,123.2,M,15.3,M,0000,0000\*66

Table3. 2: GGA Data Format

| Name                   | Example    | Units  | Description                       |
|------------------------|------------|--------|-----------------------------------|
| Message ID             | \$GPGGA    |        | GGA protocol header               |
| UTC Position           | 183015.000 |        | hhmmss.sss                        |
| Latitude               | 2503.7123  |        | ddmm.mmmm                         |
| N/S indicator          | N          |        | N=north or S=south                |
| Longitude              | 12138.7446 |        | dddmm.mmmm                        |
| E/W Indicator          | E          |        | E=east or W=west                  |
| Position Fix Indicator | 2          |        | See Table 2-1                     |
| Satellites Used        | 16         |        | Range 0 to 33                     |
| HDOP                   | 0.68       |        | Horizontal Dilution of Precision  |
| MSL Altitude           | 123.2      | meters |                                   |
| Units                  | M          | meters |                                   |
| Geoids Separation      | 15.3       | meters |                                   |
| Units                  | M          | meters |                                   |
| Age of Diff. Corr.     | 0000       | second | Null fields when DGPS is not Used |
| Diff. Ref. Station ID  | 0000       |        |                                   |
| Checksum               | *66        |        |                                   |
| <CR><LF>               |            |        | End of message termination        |

Table3. 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 |
| 3-5   | Not supported                         |
| 6     | Dead Reckoning Mode, fix valid        |

### GLL-Geographic Position – Latitude/Longitude

Table3. 3 contains the values of the following example:

\$GPGLL , 3723.24755, N,12158.34161,W,161229.487, A,D\*2C.

Table 3.3: GLL Data Format

| Name          | Example     | Units | Description   |
|---------------|-------------|-------|---|
| Message ID    | \$GPGLL     |       | GLL protocol header   |
| Latitude      | 3723.24755  |       | ddmm.mmmmm  |
| N/S Indicator | N           |       | N=north or S=south  |
| Longitude     | 12158.34161 |       | dddmm.mmmmm   |
| 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  |
| Mode          | D           |       | A=autonomous, D=DGPS, E=DR,<br>N=Data not valid,R=Coarse Position,<br>S=Simulator |
| Checksum      | *2C         |       |   |
| <CR><LF>      |             |       | End of message termination  |

## GSA-GNSS DOP and Active Satellites

Table3. 4 contains the values of the following example:

```
$GNGSA,A,3,18,193,21,09,12,22,27,15,25,14,,1.44,0.68,1.27*2F
$GNGSA,A,3,76,72,77,75,66,65,,,,,1.44,0.68,1.27*12
```

Table3. 4: GSA Data Format

| Name                 | Example | Units | Description                      |
|----------------------|---------|-------|----------------------------------|
| Message ID           | \$GNGSA |       | GSA protocol header              |
| Mode 1               | A       |       | See Table 4-2                    |
| Mode 2               | 3       |       | See Table 4-1                    |
| ID of satellite used | 18      |       | Sv on Channel 1                  |
| ID of satellite used | 193     |       | Sv on Channel 2                  |
| ...                  | ...     |       | ...                              |
| ID of satellite used |         |       | Sv on Channel 12                 |
| PDOP                 | 1.44    |       | Position Dilution of Precision   |
| HDOP                 | 0.68    |       | Horizontal Dilution of Precision |
| VDOP                 | 1.27    |       | Vertical Dilution of Precision   |
| Checksum             | *2F     |       |                                  |
| <CR><LF>             |         |       | End of message termination       |

Table3. 4.1: Mode 1

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

Table3. 4.2: Mode 2

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

### GSV-GNSS Satellites in View

Table3. 5 contains the values of the following example:

\$GPGSV,3,1,11,18,67,344,48,09,55,031,50,42,54,142,40,193,47,174,45\*4D

\$GPGSV,3,2,11,21,44,219,46,27,39,035,48,12,34,131,44,15,30,057,46\*76

\$GPGSV,3,3,11,22,27,319,47,14,22,285,42,25,19,171,40\*44

\$GLGSV,2,1,07,76,71,201,44,65,57,041,40,75,48,028,39,72,27,108,39\*68

\$GLGSV,2,2,07,66,25,333,43,77,17,207,37,81,02,280,29\*5C

Table3. 5: GSV Data Format

| Name                             | Example | Units   | Description                                       |
|----------------------------------|---------|---------|---|
| Message ID                       | \$GPGSV |         | GSV protocol header (GPGSV and GLGSV)             |
| Number of Message <sup>(1)</sup> | 3       |         | Range 1 to 6                                      |
| Message Number <sup>(1)</sup>    | 1       |         | Range 1 to 6                                      |
| Satellites in View               | 11      |         |   |
| Satellite ID                     | 18      |         | Channel 1(Range 1 to 196)                         |
| Elevation                        | 67      | degrees | Channel 1(Range 0 to 90)                          |
| Azinmuth                         | 344     | degrees | Channel 1( Range 0 to 359)                        |
| SNR(C/NO)                        | 48      | dBHz    | Channel 1( Range 0 to 99,null when not tracking)  |
| ...                              |         |         | ...   |
| Satellite ID                     | 09      |         | Channel 4(Range 1 to 196)                         |
| Elevation                        | 55      | degrees | Channel 4(Range 0 to 90)                          |
| Azimuth                          | 031     | degrees | Channel 4( Range 0 to 359)                        |
| SNR(C/NO)                        | 50      | dBHz    | Channel 4( Range 0 to 99, null when not tracking) |
| Checksum                         | *4D     |         |   |
| <CR><LF>                         |         |         | End of message termination                        |

**Note1:** Depending on the number of satellites tracked multiple messages of GSV data may berequired



## RMC-Recommended Minimum Specific GNSS Data

Table 3.6 contains the values of the following example:

```
$GNRMC,183015.000,A,2503.7123,N,12138.7446,E,0.01,34.92,270812,,D*43
```

Table3. 6: RMC Data Format

| Name               | Example    | Units   | Description  |
|--------------------|------------|---------|--|
| Message ID         | \$GNRMC    |         | RMC protocol header (GNRMC or GPRMC)   |
| UTS Position       | 183015.000 |         | hhmmss.sss   |
| Status             | A          |         | A=data valid or V=data not valid   |
| Latitude           | 2503.7123  |         | ddmm.mmmm  |
| N/S Indicator      | N          |         | N=north or S=south   |
| Longitude          | 12138.7446 |         | dddmm.mmmm   |
| E/W Indicator      | E          |         | E=east or W=west   |
| Speed Over Ground  | 0.01       | Knots   | True   |
| Course OverGround  | 34.92      | Degrees |  |
| Date               | 270812     |         | ddmmyy   |
| Magnetic variation |            | Degrees |  |
| Variation sense    |            |         | E=east or W=west (Not shown)   |
| Mode               | D          |         | A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator |
| Checksum           | *43        |         |  |
| <CR><LF>           |            |         | End of message termination   |

## VTG-Course Over Ground and Ground Speed

Table3.7 contains the values of the following example:

\$GPVTG,34.92,T,,M,0.01,N,0.02,K,D\*07

Table3 . 7: VTG Data Format

| Name       | Example | Units   | Description   |
|------------|---------|---------|---|
| Message ID | \$GPVTG |         | VTG protocol header   |
| Course     | 34.92   | Degrees | Measured heading  |
| Reference  | T       |         | True  |
| Course     |         | Degrees | Measured heading  |
| Reference  | M       |         | Magnetic  |
| Speed      | 0.01    | Knots   | Measured horizontal speed   |
| Units      | N       |         | Knots   |
| Speed      | 0.02    | Km/hr   | Measured horizontal speed   |
| Units      | K       |         | Kilometer per hour  |
| Mode       | D       |         | A=autonomous, D=DGPS, E=DR, N=Data not valid,R=Coarse Position, S=Simulator |
| Checksum   | *07     |         |   |
| <CR><LF>   |         |         | End of message termination  |