

Ultra Low Power GPS & GLONASS Receiver Module

1. Product Information

1.1 Product Name: YIC71009EBGG



1.2 Product Description:

YIC71009EBGG is a compact, high performance and ultra low power consumption, standalone multiple GNSS module. The module can simultaneously acquire and track multiple satellite constellations that include GPS, GLONASS, BEIDOU, GALILEO, QZSS and SBAS. It features low power and small form factor.

YIC71009EBGG is suitable for the following applications:

- Wearable and portable
- Automotive navigation
- Personal positioning
- Fleet management
- Mobile phone navigation
- Marine navigation
- Any application requires ultra low power consumption

Product Features:

- Ultra low power consumption: 6mA typ.
- Accurate trajectory in harsh environments
- High performance and low power consumption GNSS Chipset
- Very high sensitivity
- Extremely fast TTFF (Time To First Fix) at low signal level
- Built-in LNA
- Embedded SPI flash
- Compact size suitable for space-sensitive application
- One size component, easy to mount on another PCB board
- Support NMEA 0183 and binary protocol
- SMD type with stamp holes

1.3 Product Specifications

GNSS Performance

| GNSS Performance | |
|-------------------------|---|
| Chipset | Sony |
| Receiver type | GPS L1 C/A, GLONASS L10F QZSS L1 C/A, SBAS L1 C/A: WAAS, EGNOS, MSAS |
| Code | C/A Code |
| Protocol | NMEA 0183 1Hz : GGA,GSA,GSV, RMC,VTG,GLL,TXT,ZDA Support : Sony proprietary and NMEA Command |
| Available Baud Rate | 9,600 bps (Default) , 4,800~115,200 bps available |
| Channels | 66 |
| Sensitivity | Tracking:-165dBm Reacquisition:-160dBm Acquisition:-148dBm |
| Cold Start | 33 seconds, average |
| Hot Start | 2 second, average |
| Accuracy | HorizontalPosition:Autonomous<2.5m average, SBAS < 2.0m average Velocity: 0.1 m/s Timepulse signal: ±10 ns |
| Maximum Altitude | 18,000 m |
| Maximum Velocity | 500 m/s(1000 knots) |
| Dynamics | ≦ 4G |
| Update Rate | 1Hz |
| Interface | |
| I/O Pins | 1 serial ports |
| Physical Characteristic | |
| Type | 18 pin stamp holes |
| Dimensions | 10.1mm * 9.7 mm * 2.2mm ±0.2mm |

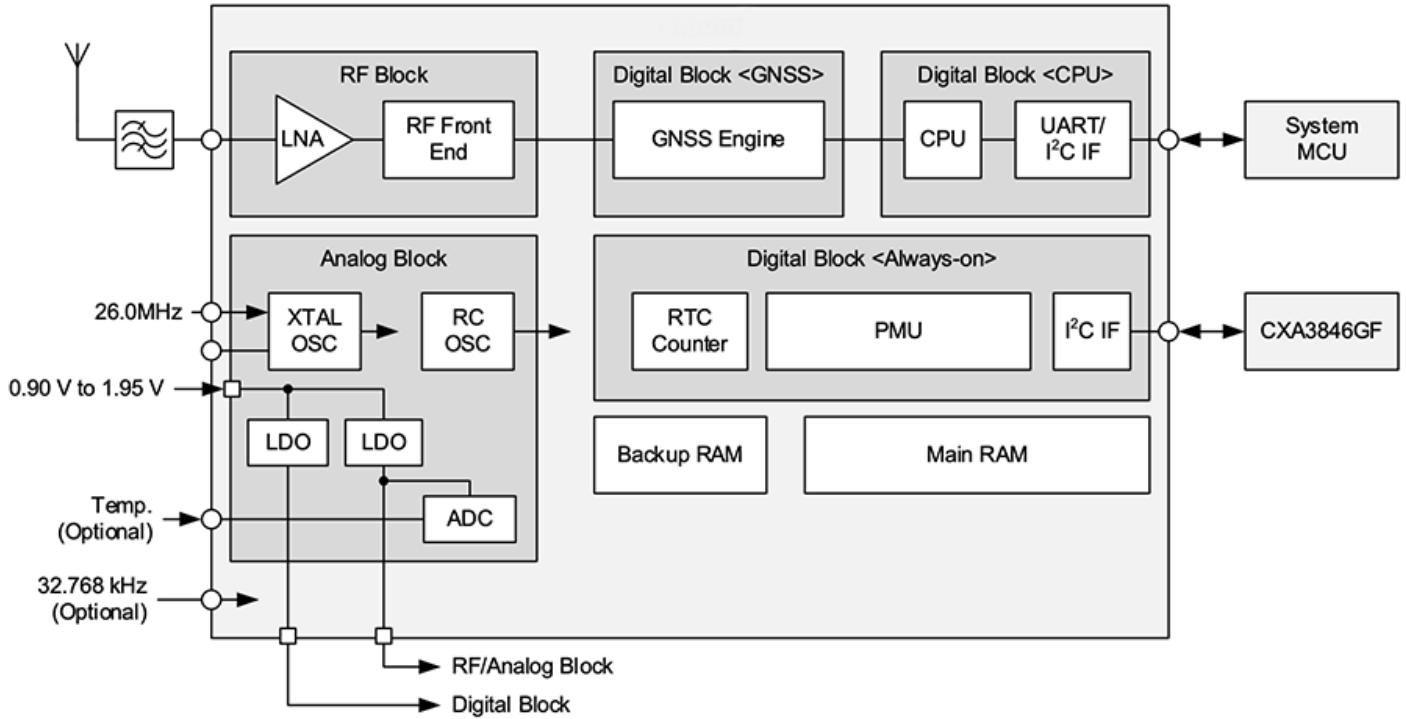
1.4 DC Electrical Characteristics

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---------------------------|--------|--------------------|------|------|------|-------|
| Input Voltage | VCC | | 2.8 | 3.3 | 5.0 | V |
| Supply Current | Iss | Acquisition | | 6.5 | 8 | mA |
| | | Tracking | | 6 | 8 | mA |
| | | Idel | | 1.5 | | mA |
| 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 | | | V |
| Low Level Output Voltage | VOL | | | | 0.4 | V |
| High Level Output Current | IOH | | | 2 | | mA |
| Low Level Output Current | IOL | | | 2 | | mA |

Temperature characteristics

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

2. Block Diagram

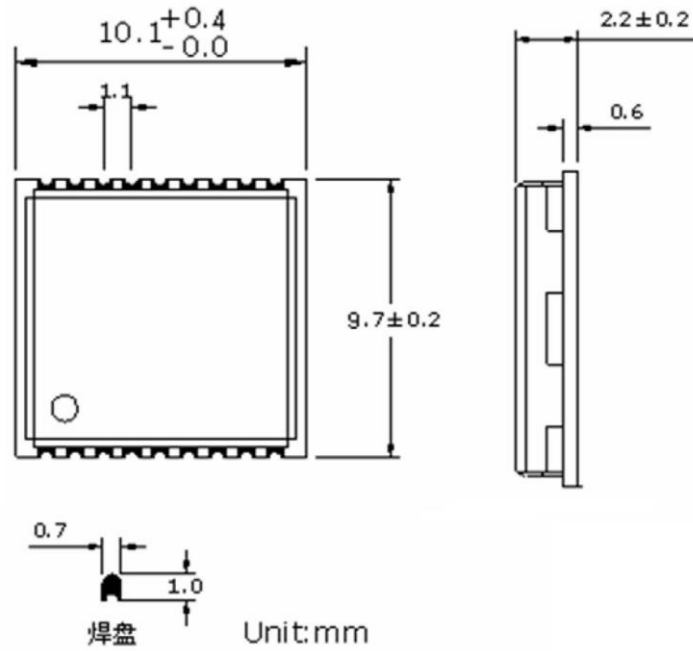


3. Module Pin Assignment

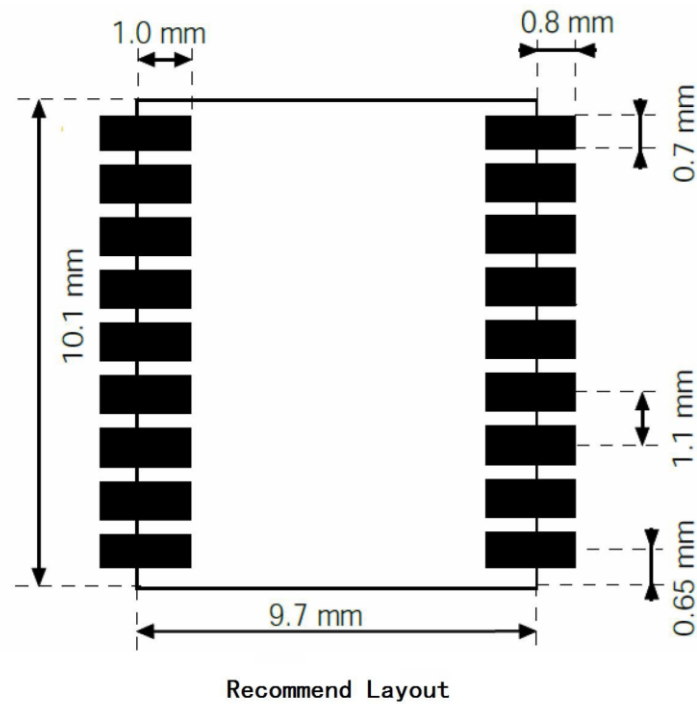
| YIC71009EBGG Top View | | | |
|--------------------------|--------|----------|---|
| 10 | GND | NC | 9 |
| 11 | RF IN | VCC 3.3V | 8 |
| 12 | GND | NC | 7 |
| 13 | NC | NC | 6 |
| 14 | VCC RF | NC | 5 |
| 15 | GND | PPS | 4 |
| 16 | NC | RXD | 3 |
| 17 | NC | TXD | 2 |
| 18 | GND | GND | 1 |

| Pin NO. | Pin Name | I/O | Remark |
|---------|----------|-----|---------------------------|
| 1. | GND | G | Ground. |
| 2. | TXD | O | UART Serial Data Output |
| 3. | RXD | I | UART Serial Data Input |
| 4. | PPS | O | Time Pulse(1PPS) |
| 5. | NC | N | Not Connect |
| 6. | NC | N | Not Connect |
| 7. | NC | N | Not Connect |
| 8. | VCC | P | DC supply voltage |
| 9. | GND | G | Ground. |
| 10. | GND | G | Ground. |
| 11. | RF IN | I | GNSS Signal Input |
| 12. | GND | G | Ground. |
| 13. | NC | N | Not Connect |
| 14. | VCC RF | O | Output Voltage RF section |
| 15. | GND | G | Ground. |
| 16. | NC | N | Not Connect |
| 17. | NC | N | Not Connect |
| 18. | GND | G | Ground. |

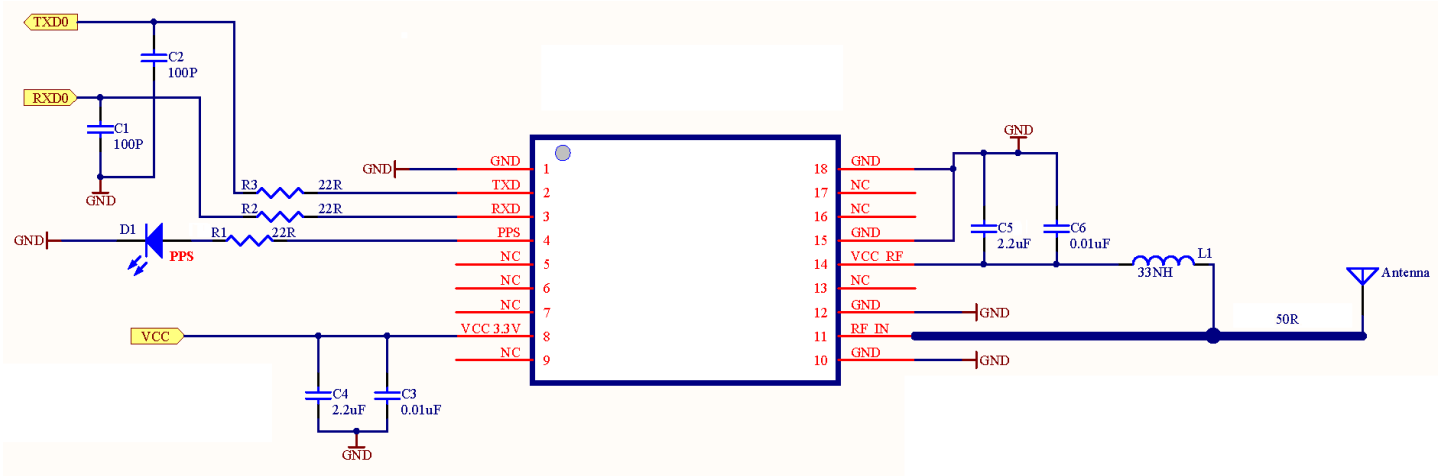
4. Dimensions



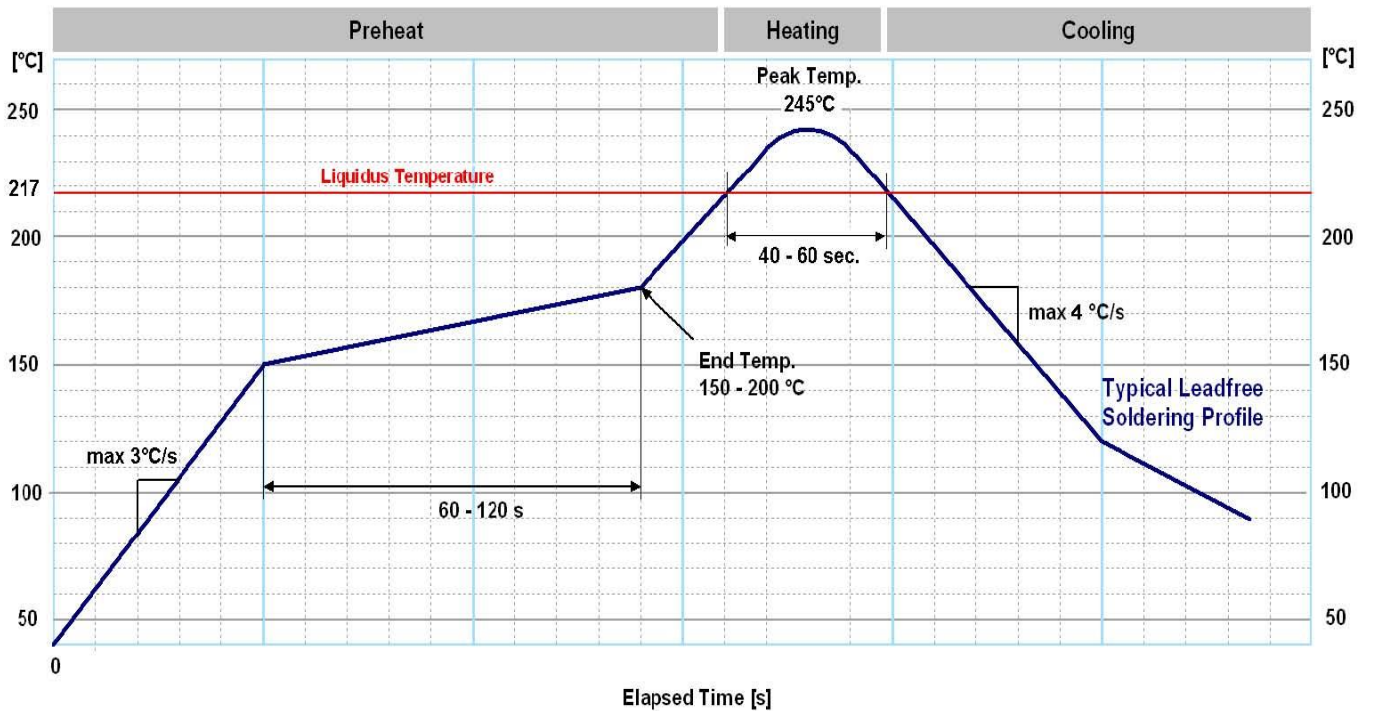
5. Recommended Footprint



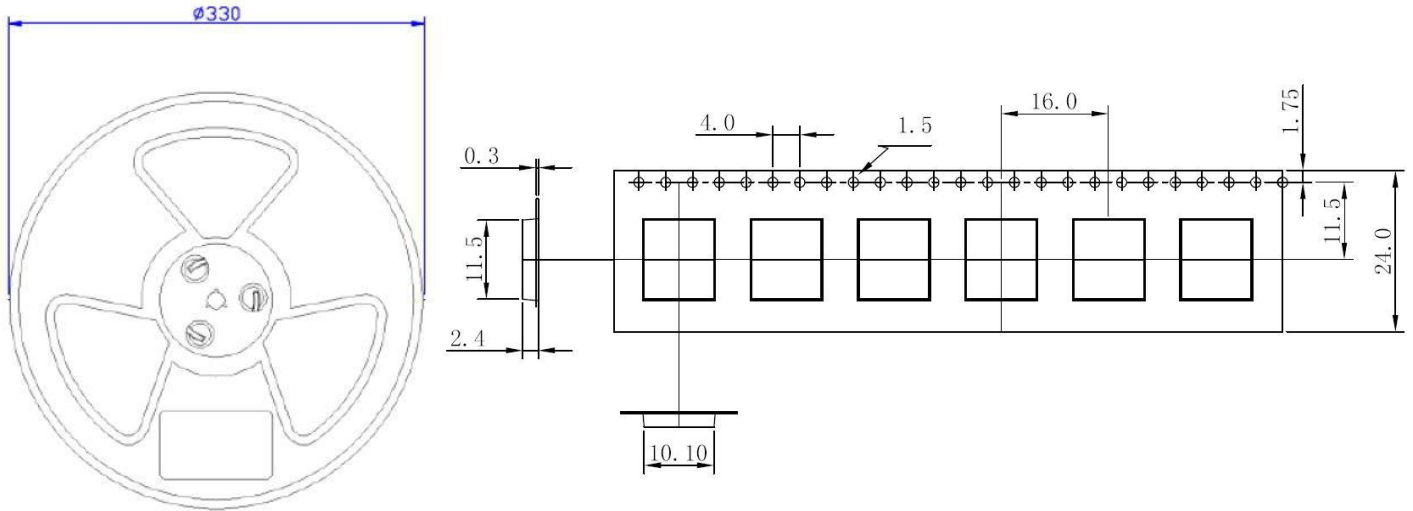
6. Application Circuit



7. Reflow Profile



8. Tape & Reel (unit : mm)



9. Software Protocol NMEA output message

Table 9.1 NMEA output message

| NMEA | 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 |
| ZDA | UTC, day, month and year and time zone. |

GGA--- Global Positioning System Fixed Data

Table 9.2 contains the values for the following example:

\$GPGGA,060406.000,2503.7148,N,12138.7451,E,2,17,0.71,116.7,M,15.3,M,0000,0000*6D

Table 9.2 GGA Data Format

| Name | Example | Units | Description |
|------------------------|------------|--------|-----------------------------------|
| Message ID | \$GPGGA | | GGA protocol header |
| UTC Time | 060406.000 | | hhmmss.sss |
| Latitude | 2503.7148 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 12138.7451 | | dddmm.mmmm |
| E/W Indicator | E | | E=east or W=west |
| Position Fix Indicator | 2 | | See Table 9.3 |
| Satellites Used | 17 | | Range 0 to 33 |
| HDOP | 0.71 | | Horizontal Dilution of Precision |
| MSL Altitude | 116.7 | meters | |
| Units | M | meters | |
| Geoid 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 | *6D | | |
| <CR> <LF> | | | End of message termination |

Table 9.3 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

Table 9.4 contains the values for the following example:

\$GNGLL,2503.7148,N,12138.7451,E,060406.000,A,D*46

Table 9.4 GLL Data Format

| Name | Example | Units | Description |
|---------------|------------|-------|--|
| Message ID | \$GNGLL | | GLL protocol header (GPGLL or GNGLL; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal) |
| Latitude | 2503.7148 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 12138.7451 | | dddmm.mmmm |
| E/W indicator | E | | E=east or W=west |
| UTC Time | 060406.000 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Mode | D | | A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator |
| Checksum | *46 | | |
| <CR> <LF> | | | End of message termination |

GSA---GNSS DOP and Active Satellites

Table 9.5 contains the values for the following example:

```
$GNGSA,A,3,22,21,18,12,24,25,14,15,193,,,,,1.18,0.71,0.95*2C
```

```
$GNGSA,A,3,205,207,210,202,201,203,209,208,,,,,1.18,0.71,0.95*1C
```

Table 9.5 GSA Data Format

| Name | Example | Units | Description |
|----------------------|---------|-------|---|
| Message ID | \$GNGSA | | GSA protocol header (GNGSA or GPGSA; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal). First row of GSA message contains GPS & QZSS satellites and second row of GSA message contains BEIDOU satellites. |
| Mode 1 | A | | See Table 9.6 |
| Mode 2 | 3 | | See Table 9.7 |
| ID of satellite used | 22 | | Sv on Channel 1 |
| ID of satellite used | 21 | | Sv on Channel 2 |
| | | | |
| ID of satellite used | | | Sv on Channel 12 |
| PDOP | 1.18 | | Position Dilution of Precision |
| HDOP | 0.71 | | Horizontal Dilution of Precision |
| VDOP | 0.95 | | Vertical Dilution of Precision |
| Checksum | *2C | | |
| <CR> <LF> | | | End of message termination |

Table 9.6 Mode 1

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

Table 9.7 Mode 2

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

GSV---GNSS Satellites in View

Table 9.8 contains the values for the following example:

\$GPGSV,6,1,21,18,78,169,36,209,72,273,36,22,63,309,38,207,63,328,38*7B

\$GPGSV,6,2,21,203,58,205,39,25,56,138,39,201,55,141,34,206,50,168,*45

\$GPGSV,6,3,21,210,49,282,34,12,48,076,39,204,39,118,,14,38,322,37*77

\$GPGSV,6,4,21,193,37,180,34,202,36,246,29,24,23,041,34,31,21,244,*71

\$GPGSV,6,5,21,21,17,198,33,205,16,258,28,15,12,092,33,208,09,169,30*7B

\$GPGSV,6,6,21,51,,,*7E

Table 9.8 GSV Data Format

| Name | Example | Units | Description |
|---------------------------|---------|---------|---|
| Message ID | \$GPGSV | | GSV protocol header |
| Total number of messages1 | 6 | | Range 1 to 6 |
| Message number1 | 1 | | Range 1 to 6 |
| Satellites in view | 21 | | |
| Satellite ID | 18 | | Channel 1 (Range 01 to 237), GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214 |
| Elevation | 78 | degrees | Channel 1 (Range 00 to 90) |
| Azimuth | 169 | degrees | Channel 1 (Range 000 to 359) |
| SNR (C/No) | 36 | dB-Hz | Channel 1 (Range 00 to 99, null when not tracking) |
| | | | |
| Satellite ID | 207 | | Channel 4 (Range 01 to 237) , GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214 |
| Elevation | 63 | degrees | Channel 4 (Range 00 to 90) |
| Azimuth | 328 | degrees | Channel 4 (Range 000 to 359) |
| SNR (C/No) | 38 | dB-Hz | Channel 4 (Range 00 to 99, null when not tracking) |
| Checksum | *7B | | |
| <CR> <LF> | | | End of message termination |

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

RMC---Recommended Minimum Specific GNSS Data

Table 9.9 contains the values for the following example:

\$GNRMC,060406.000,A,2503.7148,N,12138.7451,E,0.01,0.00,180313,,D*78

Table 9.9 RMC Data Format

| Name | Example | Units | Description |
|--------------------|------------|---------|--|
| Message ID | \$GNRMC | | RMC protocol header (GNRMC or GPRMC; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal) |
| UTC Time | 060406.000 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Latitude | 2503.7148 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12138.7451 | | dddmm.mmmm |
| E/W Indicator | E | | E=east or W=west |
| Speed over ground | 0.01 | knots | True |
| Course over ground | 0.00 | degrees | |
| Date | 180313 | | 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 | *78 | | |
| <CR> <LF> | | | End of message termination |

VTG---Course Over Ground and Ground Speed

Table 9.10 contains the values for the following example:

\$GPVTG,0.00,T,,M,0.01,N,0.02,K,D*3B

Table 9.10 VTG Data Format

| Name | Example | Units | Description |
|--------------------|---------|---------|--|
| Message ID | \$GPVTG | | VTG protocol header |
| Course over ground | 0.00 | degrees | Measured heading |
| Reference | T | | True |
| Course over ground | | degrees | Measured heading |
| Reference | M | | Magnetic |
| Speed over ground | 0.01 | knots | Measured speed |
| Units | N | | Knots |
| Speed over ground | 0.02 | km/hr | Measured speed |
| Units | K | | Kilometer per hour |
| Mode | D | | A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator |
| Checksum | *3B | | |
| <CR> <LF> | | | End of message termination |

ZDA: Time & Date

Format : \$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Fields :

| Field | Format | Description |
|--------------------|-----------|--|
| Header | \$ | |
| Talker ID | -- | GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning |
| Sentence ID | ZDA | |
| UTC | hhmmss.ss | hh [hour] mm [min] ss.ss [sec] |
| Day | xx | |
| Month | xx | |
| Year | xxxx | |
| Local zone hours | xx | NULL |
| Local zone minutes | xx | NULL |
| Checksum | *hh | |
| Termination | <CR><LF | |