**Shenzhen Fuwit Technology Co.,Ltd**

# Product Approval Datasheet

## P/N: FU-GT3-1612 Module

# Contents

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## Functional Overview

The **FU-GT3-1612** designed by Dragon basing on the MT3339 is a new generation of GPS receiving module. It's up to 66 acquisition and 22 simultaneously tracking channel,ultra-high sensitive GPS receiving module. Based on new highly integrated MTK chips and meticulously integration key parts of Dragon. In the same chip specifications, this product has faster GPS signals ability to capture, lower power consumption, more strong anti-jamming performance and more wide working voltage range.

**FU-GT3-1612** module designed with industrial requirements, using stamps package, can adapt to wet high temperature, electromagnetic interference etc. odiously working environment. It is widely used in monitoring, positioning, mapping, navigation, security applications.
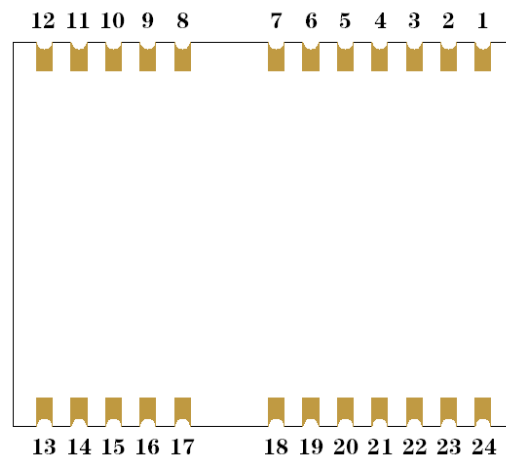
## Applications

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

## Product Features

- MTK3339 high performance GPS Chipset
- Very high sensitivity (Tracking Sensitivity: -165 dBm)
- Extremely fast TTFF (Time To First Fix) at low signal level
- Support UART interface
- Built-in LNA(with in CHIP)
- Compact size (16mm x 12.2 mm x 2.6mm) suitable for space-sensitive application
- One size component, easy to mount on another PCB board
- Support NMEA 0183 V3.0 (GGA, GSA, GSV, RMC)
- Support OSP protocol
- MEMS Support: 3-axis Magnetometer for compass heading for "Point and Tell" feature
- MicroPower Mode (MPM) : Reduce MPM current consumption from <500 uA
- Support SBAS (WASS, EGNOS, MSAS, GAGAN)

## Pin Assignment



## Pin Description

| PIN | Name | Type | Description | Remark |
|---|---|---|---|---|
| 1.2.4.5.6.7.8.14.15.16.17.18.19 | NC | | Reverse PIN, just NC | No Connection |
| 3 | 1PPS | O | TIMESYNC signal output | Leave open if not used |
| 10.12.13.24 | RF GND | P | Ground. | |
| 11 | RF_IN | RF | GPS antenna input | 50Ω@1.57542GHz |
| 20 | TX | O | UART Serial Data Outpu | NMEA Protocol |
| 21 | RX | I | UART Serial Data Input | NMEA Protocol |
| 22 | VBAT | P | RTC and backup SRAM power | May be connect to Battery |
| 23 | VCC | P | Module Power Supply | |

## Electrical Characteristics

Absolute Maximum Rating

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| Power Supply | | | | |
| Power Supply Volt. | VCC | 3.0 | 3.63 | V |
| Backup Battery Volt | VBAT | 3.0 | 3.63 | V |
| Input Pins | | | | |
| Input Pin Voltage I/O | RESET | -0.3 | 3.63 | V |
| Input Pin Voltage I/O | RXA | -0.3 | 3.63 | V |
| Antenna Bias DC Voltage | RF_IN | -0.3 | 5.0 | V |
| Environment | | | | |
| Storage Temperature | $T_{stg}$ | -40 | 125 | $^\circ$C |
| Peak Reflow Soldering Temperature | $T_{peak}$ | | 260 | $^\circ$C |
| Humidity | | | 95 | % |

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

Operating Conditio

| Parameter | Symbol | Condition | Min | Type | Max | Units |
|---|---|---|---|---|---|---|
| Power supply voltage | VCC | Relative to GND | 3.0 | 3.3 | 3.6 | V |
| Power supply voltage ripple | VCC_PP | Vcc=3.0V | | | 30 | mV |
| Consumption current | Icc | Vcc=3.0V | | 15 | 18 | mA |
| Backup Battery voltage | VBAT | Relative to GND | 3.0 | 3.3 | 3.6 | V |
| Input high voltage | $V_{IH}$ | | 2.0 | | 3.6 | V |
| Input low voltage | $V_{IL}$ | | -0.3 | | 0.8 | V |
| Output high voltage | $V_{OH}$ | | 2.4 | | 3.15 | V |
| Output low voltage | $V_{OL}$ | | -0.3 | | 0.4 | V |
| Operating temperature | Topr | | -35 | | 80 | $^\circ$C |

## Product Specifications

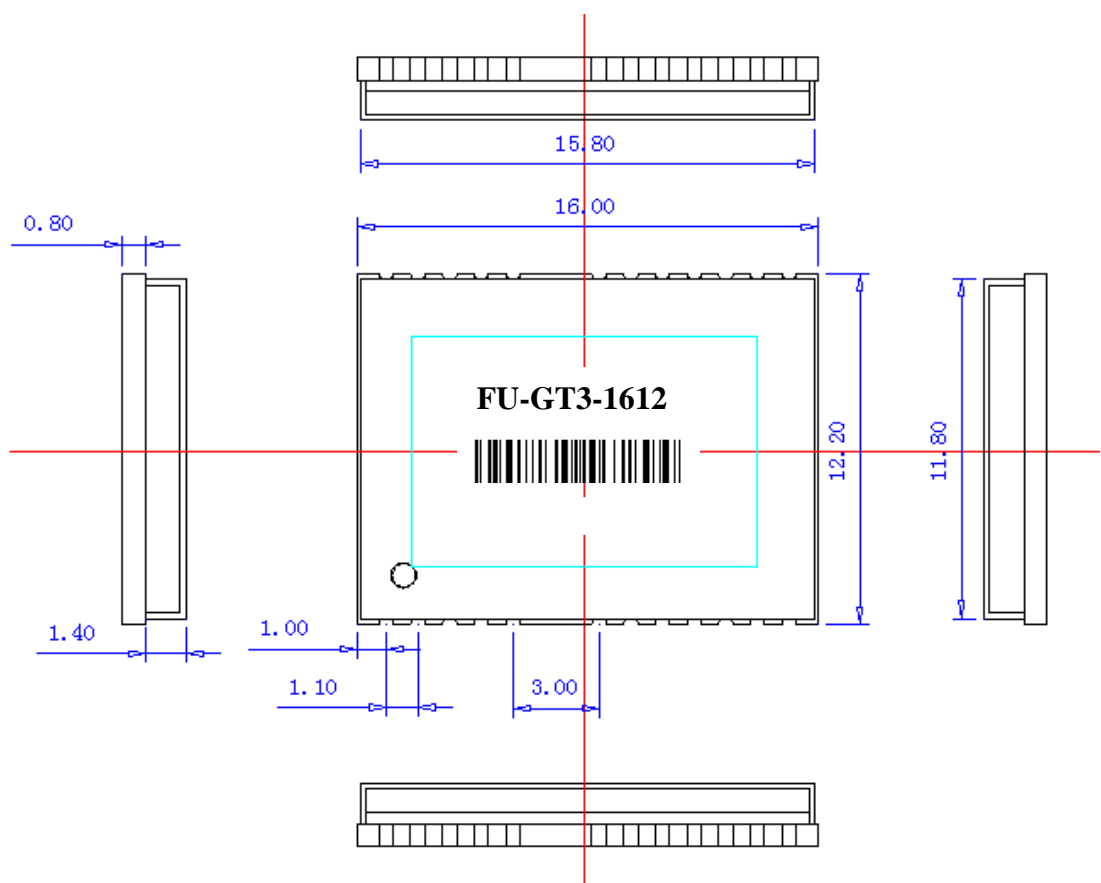| Parameter | Specification |
|---|---|
| Chip | MTK3339 |
| Receiver Type | L1 frequency band 1575.42 MHz, C/A code, 12 Channels |
| Sensitivity | Tracking               -165dBm<br>Acquisition             -148dBm(cold)/-163dBm(hot) |
| Accuracy | Position < 5 M (Typical Open Sky)<br>Velocity   0.1m/s |
| Acquisition Time | Cold Start          36s (Typical Open Sky)<br>Warm Start        36s<br>Hot Start           1s |
| Power Consumption | Tracking            18mA @3.3V Typical<br>Acquisition         25mA @3.3V |
| Navigation Data Update Rate | 1Hz |
| Operational Limits | Altitude          Max 18,000m<br>Velocity           Max 515m/s<br>Acceleration     Less than 4g |
| Protocol Support | NMEA 0183 Ver.3.0    Default: 9600bps<br>1Hz: GGA,GSA,GSV,RMC |

Mechanical Specification



**Figure 3: FU-GT3-1612    Dimensions          Unit: mm**
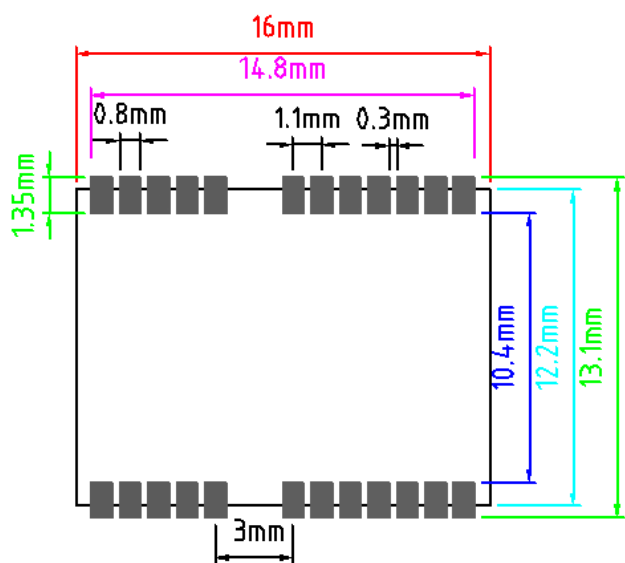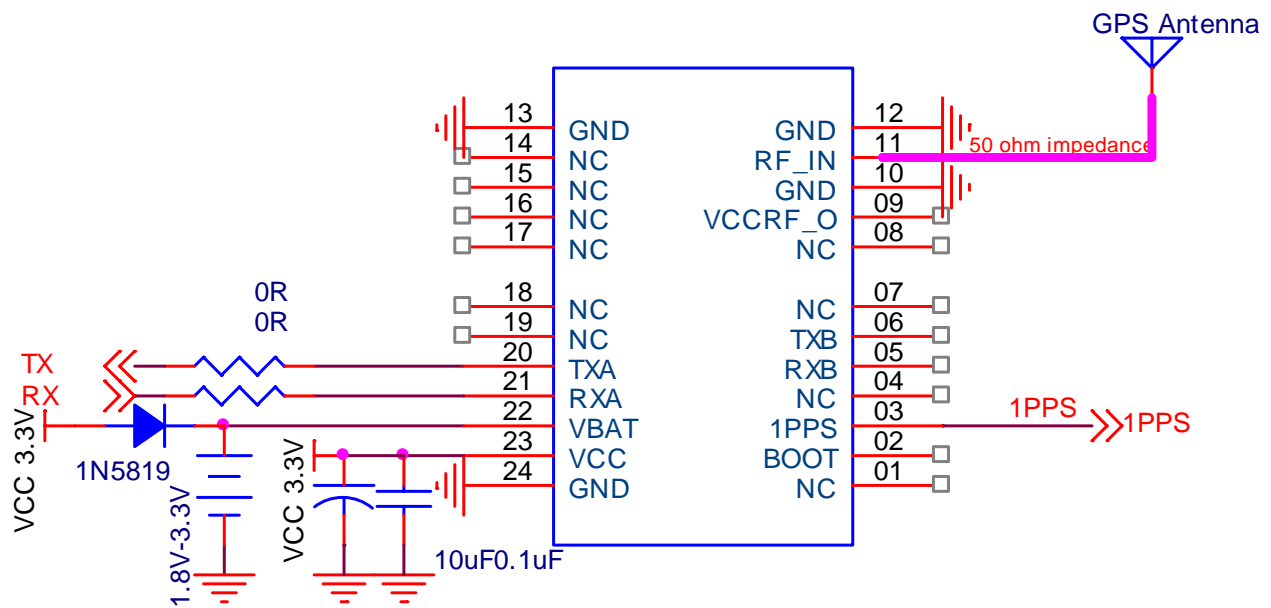
Recommended Layout PAD



**Figure 4: FU-GT3-1612 PAD Style& Dimensions**

## Application

## Application Circuit



## GPS Active Antenna Specifications (Recommendation)

| Frequency: | 1575.42 ± 2MHz | Amplifier Gain: | 18~22dB Typical |
|---|---|---|---|
| Axial Ratio: | 3 dB Typical | Output VSWR: | 2.0 Max. |
| Output Impedance: | 50Ω | Noise Figure: | 2.0 dB Max |
| Polarization: | RHCP | Antenna Input Voltage: | 3.3V (Typ.) |

## OPERATING Description

**TIMEMARK**

This pin provides one pulse-per-second output from the board, which is synchronized to GPS time. This is not available in Trickle Power mode. If do not use it, Just NC.

**Wake Up**

System power controller, when **FU-GT3-1612** Power ON, this pin will output 3.3V$_{dc}$.

**RF_IN**

This pin receives signal of GPS analog via external active antenna. It has to be a controlled impedance trace at 50ohm. Do not have RF traces closed the other signal path and routing it on the top layer. Keep the RF traces as short as possible.

**TX**

This is the main transmits channel for outputting navigation and measurement data to user's navigation software or user written software. Output is TTL level, 0V ~ 3.3V.

**RX**

This is the main channel for receiving software commands from MTK demo software or from your proprietary software.

**VBAT**

This is the battery backup power input for the SRAM and RTC when main power is off. Without the external backup battery, **FU-GT3-1612** will always execute a cold star after turning on. To achieve the faster start-up offered by a hot or warm start, a battery backup must be connected. The battery voltage should be between 2.5V and 3.6V.

**VCC**

This is the main power supply to the engine board. (3.1Vdc to 3.6Vdc)

## SOFTWARE COMMAND

## NMEA Output Command

### 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.

The **FU-GT3-1612** supports the following NMEA-0183 messages: GGA, GSA, RMC. The module default NMEA-0183 output is set up GGA, GSA, GSV, RMC and default baud rate is set up 9600bps.

Table 1: NMEA-0183 Output Messages

| NMEA Record | DESCRIPTION |
|---|---|
| GGA | Global positioning system fixed data |
| GSA | GNSS DOP and active satellites |
| GSV | GNSS satellites in view |
| RMC | Recommended minimum specific GNSS data |

### GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

$GPGGA, 025438.000, 2232.8557,N, 11355.7438,E, 1,04,1.0, 65.5,M, ,M, ,0000*75

Table 2: GGA Data Format

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGGA | | GGA protocol header |
| UTC Time | 025438.000 | | hhmmss.sss |
| Latitude | 2232.8557 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 11355.7438 | | ddmm.mmmm |
| E/W Indicator | E | | E=east or W=west |
| Position Fix Indicator | 1 | | See Table 2-1 |
| Satellites Used | 04 | | Range 00 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | 65.5 | meters | Altitude above mean seal level |
| Units | M | meters | |
| Geoids Separation | | meters | Separation from Geoids can be bank |
| Units | M | meters | |
| Age of Diff.Corr. | | second | Null fields when DGPS is not Used |
| Diff.Ref.Station ID | 0000 | | Null fields when DGPS is not Used |
| Checksum | *75 | | |
| <CR> <LF> | | | End of message termination(ASCII 13, ASCII 10) |

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 |

**GSA-GNSS DOP and Active Satellites**

Table 4 contains the values of the following example:

$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 |
| Checksum | *33 | | |
| <CR> <LF> | | | End of message termination(ASCII 13, ASCII 10) |

Table 4-1: Mode 1

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

Table 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

Table 5 contains the values of the following example:

$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: GSV 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 |
| Checksum | *71 | | |
| <CR> <LF> | | | End of message termination(ASCII 13, ASCII 10) |

Depending on the number of satellites tracked multiple messages of GSV data may be required.
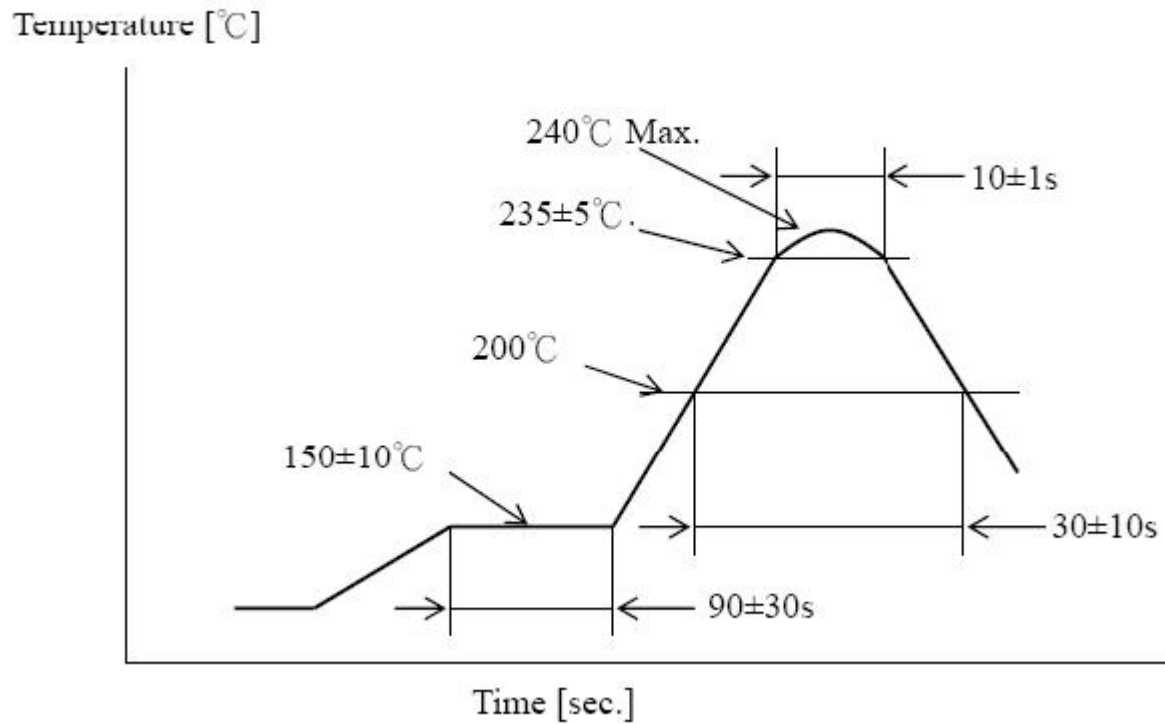
### RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example:

$GPRMC, 025439.000, A, 2232.8557, N, 11355.7438, E, 0.13, 309.62, 031209, , *10

Table 6: RMC Data Format

| Name | Example | Units | Description |
|------|---------|-------|-------------|
| Message ID | $GPRMC | | RMC protocol header |
| UTC Time | 025439.000 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Latitude | 2232.8557 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 11355.7438 | | Ddmm.mmmm |
| E/W Indicator | E | | E=east or W=west |
| Speed Over Ground | 0.13 | Knots | |
| Course Over Ground | 309.62 | Degrees | True |
| Date | 031209 | | Dummy |
| Magnetic variation | | Degrees | Not used |
| E/W indicator | | | Not used |
| Mode | | | Only NMEA0183 version 3.00 output |
| Checksum | *10 | hexadecimal | |
| <CR> <LF> | | | End of message termination(ASCII 13, ASCII 10) |

## Recommended Reflow Profile:

Temperature [℃]

240℃ Max.

235±5℃.

10±1s

200℃

150±10℃

30±10s

90±30s

Time [sec.]

Pre heating temperature:    150±10[℃]           Pre heating time:    90±30[sec.]
Heating temperature:        235±5[℃]             Heating time:       10±1[sec.]
Peak temperature must not exceed 240 and the ℃ he duration of over 200℃ should be 30±10
Seconds.