# SkyNav SKG25B
# Ultra High Sensitivity and Low Power GPS Receiver Module

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## General Description

The SkyNav SKG25B 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.

It is based on the high performance features of the MediaTek MT3179+MT3301 chipset architecture, Its –159dBm 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


**Figure 1: SKG25B Top View**

## Features

- Ultra high sensitivity: -159dBm
- Extremely fast TTFF (Time To First Fix) at low signal level
- Low power consumption: Typical 45mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 3.0V to 3. 6V
- Operating temperature range: -40 to 85℃
- SMD type with stamp holes
- Small form factor: 25x25x3.2mm
- RoHS compliant (Lead-free)

## Pin Assignment

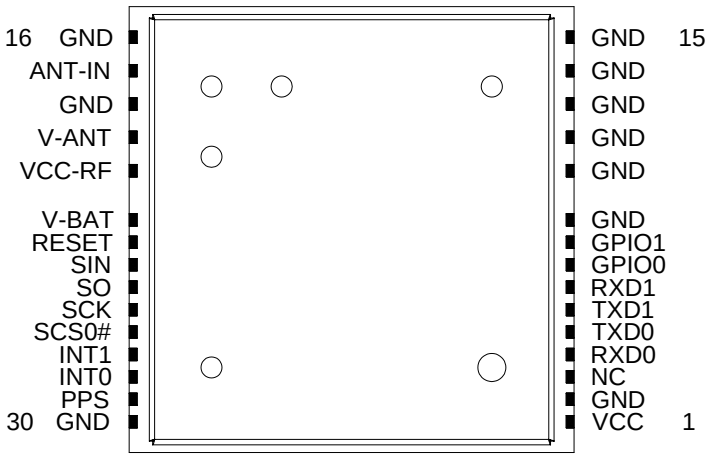



**Figure 2: SKG25B Pin Package**

## Performance Specification

| Parameter | Specification | |
|---|---|---|
| Receiver Type | L1 frequency band, C/A code, 32 Channels | |
| Sensitivity | Tracking | -159dBm |
| | Acquisition | -146dBm |
| Accuracy | Position | 3.0m CEP50 without SA(Typical Open Sky) |
| | Velocity | 0.1m/s without SA |
| | Timing (PPS) | 60ns RMS |
| Acquisition Time | Cold Start | 36s(Typical Open Sky) |
| | Warm Start | 33s |
| | Hot Start | 1s |
| | Re-Acquisition | <1s |
| Power Consumption | Tracking | 45mA @3.3V Typical |
| | Acquisition | 45mA @3.3V |
| Navigation Data Update Rate | Max5Hz | Default 1Hz |
| Operational Limits | Altitude | Max 18,000m |
| | Velocity | Max 515m/s |
| | Acceleration | Less than 4g |

## Interfaces Configuration

**Power Supply:** Regulated power for the SKG25B is required. The input voltage Vcc should be 3.3V ±10%, maximum, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry(10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

**Antenna:** The SKG25B GPS receiver is designed for supporting the active antenna or passive antenna connected with pin RF_IN. The gain of active antenna should be no more than 25dB. The maximum noise figure should be no more than 1.5dB and output impedance is at 50 Ohm.

**UART Ports:** The module supports two full duplex serial channels UART. All serial connections are at 2.85V LVTTL logic levels, if need different voltage levels, use appropriate level shifters. 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. The RXD0(1) & TXD0(1) recommended to pull up (10KΩ). It can increase the stability of serial data.

**V_BAT:** In case of a power failure on pin Vcc, real-time clock and backup RAM are supplied through pin V_BAT. This enables the Receiver to recover from power failure with either a hot start or a warm start (depending on the duration of Vcc outage). It is important to if V_BAT no Backup Battery or Power supply is connected, the module can not start . If you use backup battery, should be adding a bypassing capacitor (10uF) at V_BAT pin. It can reduce noise and increase the stability.

**ANT_IN:** The transmission line must to be control impedance from ANT_IN pin to the antenna or antenna connector of your choice. (Impedance 50Ω)

**GPIO:** The GPIOs functions are for customer used. it recommended to connect to serial resistance(220Ω), if use the GPIO function. If no use GPIO functions, it don't connect anything.

## Pin Description

| Pin No. | Pin name | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | VCC | I | Module Power Supply | |
| 2 | GND | G | Ground | |
| 3 | NC | | Reserved for future use | No Connection |
| 4 | RXD0 | I | UART0 Serial Data Input | Leave Open in not used |
| 5 | TXD0 | O | UART0 Serial Data Output | Leave Open in not used |
| 6 | TXD1 | O | UART1 Serial Data Output | Not Open |
| 7 | RXD1 | I | UART1 Serial Data Input | Not Open |
| 8 | GPIO0 | I/O | General purpose I/O | Leave Open in not used |
| 9 | GPIO1 | I/O | General purpose I/O | Leave Open in not used |
| 10 | GND | G | Ground | |
| 11 | GND | G | Ground | |
| 12 | GND | G | Ground | |
| 13 | GND | G | Ground | |
| 14 | GND | G | Ground | |
| 15 | GND | G | Ground | |
| 16 | GND | G | Ground | |
| 17 | ANT_IN | I | Antenna Input | 50Ω@1.57542GHz |
| 18 | GND | G | Ground | |
| 19 | V_ANT | I | Active Antenna External Voltage Supply | |
| 20 | VCC_RF | O | Voltage Output for Active Antenna | Leave Open in not used |
| 21 | V_BAT | I | RTC and backup SRAM power | Must be connect to Battery or Power Supply |
| 22 | RESET | I | Module Reset (Active Low) | Leave Open in not used |
| 23 | SIN | I | Synchronous serial interface(SPI) | Leave Open in not used |
| 24 | SO | O | Synchronous serial interface(SPI) | Leave Open in not used |
| 25 | SCK | I/O | Synchronous serial interface(SPI) | Leave Open in not used |
| 26 | SCS0# | I | SPI slave select 0 (Active low) | Leave Open in not used |
| 27 | INT1 | I | External interrupt 1 | Leave Open in not used |
| 28 | INT0 | I | External interrupt 0 | Leave Open in not used |
| 29 | PPS | O | Time Pulse(1PPS) | Leave Open in not used |
| 30 | GND | G | Ground | |

## Electrical Characteristics

### Absolute Maximum Rating

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| **Power Supply** | | | | |
| Power Supply Volt. | VCC | -0.3 | 3.63 | V |
| **Input Pins** | | | | |
| Input Pin Voltage I/O | RST | -0.3 | 3.63 | V |
| Input Pin Voltage I/O | RX | -0.3 | 3.63 | V |
| Antenna Bias DC Voltage | RF_IN | -0.3 | 5.0 | V |
| Backup Battery | V_BAT | -0.3 | 4.2 | V |
| **Environment** | | | | |
| Storage Temperature | Tstg | -40 | 125 | ˚C |
| Peak Reflow Soldering Temperature <10s | Tpeak | | 260 | ˚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 Condition

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Power supply voltage | Vcc | | 3.0 | 3.3 | 3.6 | V |
| Power supply voltage ripple | Vcc_PP | Vcc=3.0V | | | 30 | mV |
| Consumption current | Icc | Vcc=3.0V | | 45 | 50 | mA |
| 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 | | -40 | | 85 | ˚C |

## Mechanical Specification

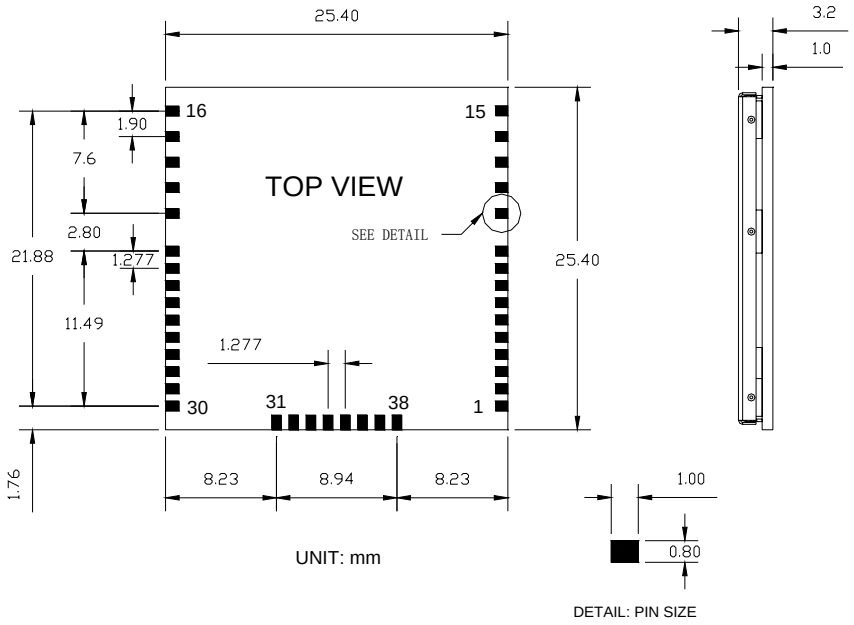



**Figure 3: SKG25B Dimensions**

## Packaging Specification

SKG25B modules are shipped in tray and with 40 units per tray. Each tray is 'dry' package.

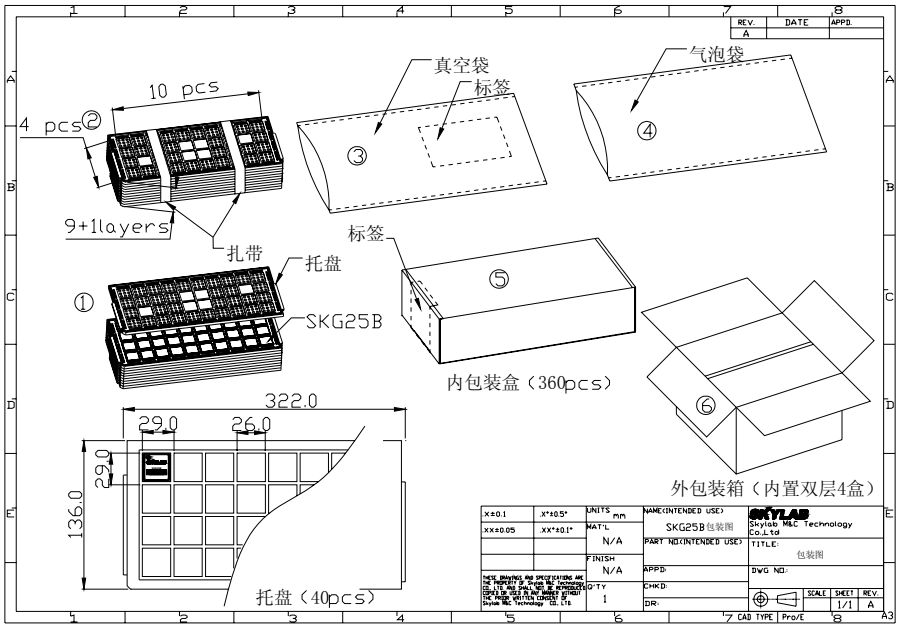



**Figure 4: SKG25B Packaging**

## Manufacturing Process Recommendations

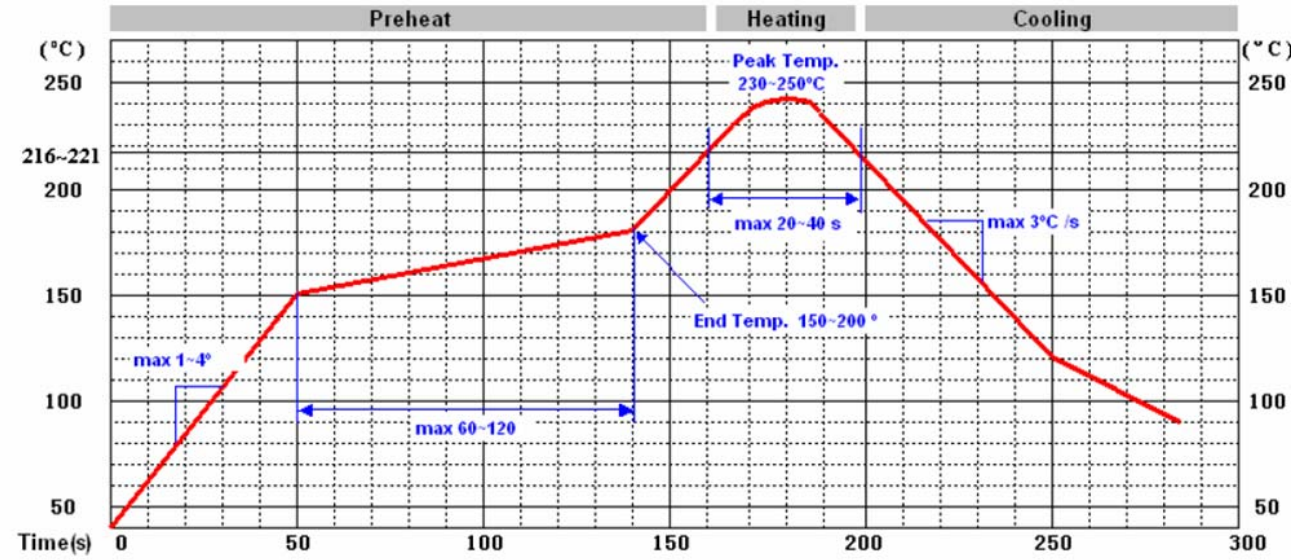
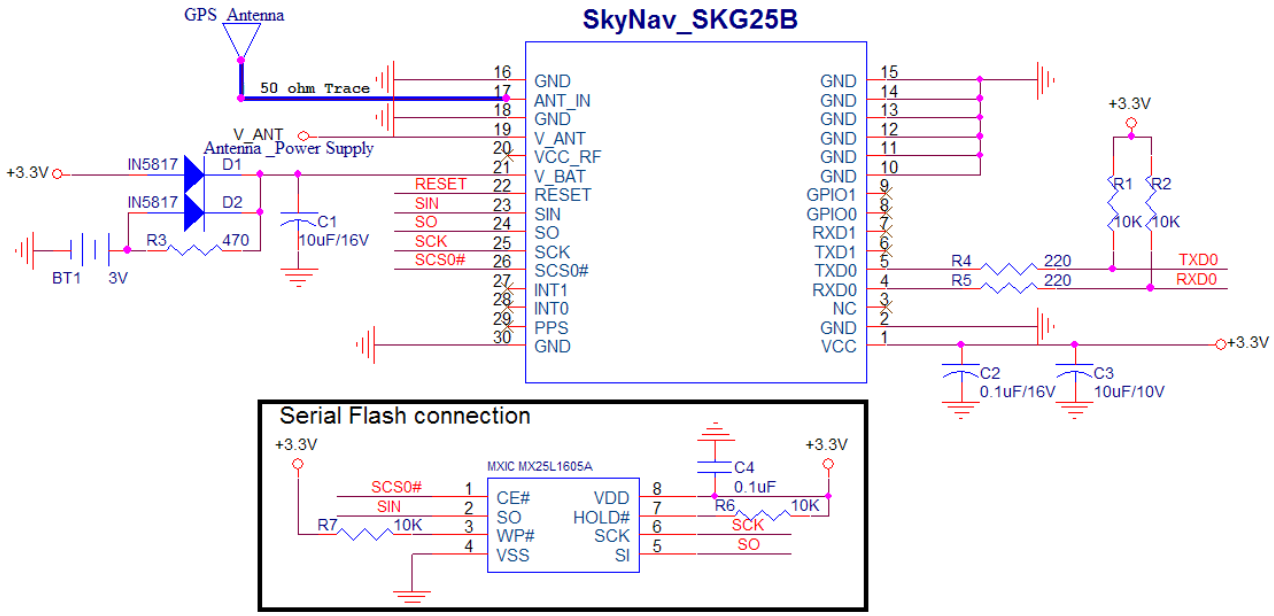



**Figure 5: SKG25B Typical Leadfree Soldering Profile**

**Note:** The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste，size，thickness and properties of the baseboard，etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

## Reference design schematic




## Software Protocol

### 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 SkyNav SKG25B supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC VTG, ZDA. 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 |
| 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 | Time and Date |

### GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:
$GPGGA, 083559.00,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M, ,M, ,0000*18

Table 2: GGA Data Format

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGGA | | GGA protocol header |
| UTC Time | 083559.00 | | hhmmss.sss |
| Latitude | 3723.2457 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | ddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Position Fix Indicator | 1 | | See Table 2-1 |
| Satellites Used | 07 | | Range 00 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | 9.0 | 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 | *18 | | |
| <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 |

### GLL-Geographic Position – Latitude/Longitude

Table 3 contains the values of the following example:
$GPGLL , 3723.2475, N,12158.3416, W, 083559.00, 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 | | Ddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| UTC Time | 083559.00 | | Hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Checksum | *2C | | |
| <CR> <LF> | | | End of message temination(ASCII 13, ASCII 10) |

### 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: 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 |
| 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, 083559.00, 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 |
| UTC Time | 083559.00 | | 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 | | Ddmm.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 | 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) |

### VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:
$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 |
| Checksum | *6E | | |
| <CR> <LF> | | | End of message termination |

### ZDA-Date and Time

Table 8 contains the values of the following example:
$GPZDA, 082710.00,04,07,2002,00,00*60

| Name | Example | Units | Description |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Message ID | $GPZDA | | ZDA protocol header |
| UTC Time | 082710.00 | | hhmmss.sss |
| Day | 04 | | UTC time: day （01 ... 31） |
| Month | 07 | | UTC time: month （01 ... 12） |
| Year | 2002 | | UTC time: year （4 digit year） |
| local zone hours | 00 | | Not supported (fixed to 00) |
| local zone minutes | 00 | | Not supported (fixed to 00) |
| Checksum | *60 | | |
| <CR> <LF> | | | End of message termination |

## How to Reach Us:

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