GPS Module Series Model: GT-750RS

SMD type ROM version

Technical Manual

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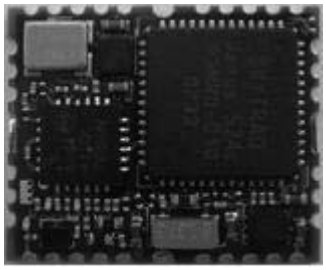


GT-750RS

Fast-Acquisition High-Sensitivity 44-Channel SMD GPS Receiver Module

GT-750RS is a miniature 44-channel OEM GPS receiver module. It is optimized for high-performance, ease-of-use, flexibility, and low-cost. The GPS receiver is suitable for a wide range of navigation and tracking applications.

44 parallel channels and 20000+ correlators provide fast satellite signal acquisition and short start-up time. Acquisition sensitivity of -155dBm and tracking sensitivity of -158 dBm offer good performance even under difficult environments.

The **GT-750RS** offers RFIN pad for connecting to an active antenna.

Sub-150mW power consumption makes the **GT-750RS** ideal for battery-operated portable devices.

Satellite-based augmentation systems, such as WAAS and EGNOS, are supported to yield improved accuracy.

Small size and SMD mounting allow standard SMT assembly process, making it ideal for high volume production.

1. FEATURES

- Acquires and track 44 satellites simultaneously
- SMD type packaging
- Industry-leading TTFF speed
- Signal detection better than -158 dBm
- 0.5 PPM TCXO for quick cold start
- SBAS (WAAS/EGNOS) capable
- Cold start < 45sec
- Hot start < 1sec
- Accuracy 5m CEP
- 13.1 mm x 15.9 mm x 2.8 mm
- RoHS compliance

EVA-750RS GT-750RS Evaluation Board

- GT-750RS
- USB output adapter board for PC/Notebook
- USB power/signal cable
- GPS active antenna (SMA, 3.3V)
- CD user manual and UniTraQ testing programming

RoHS compliance.

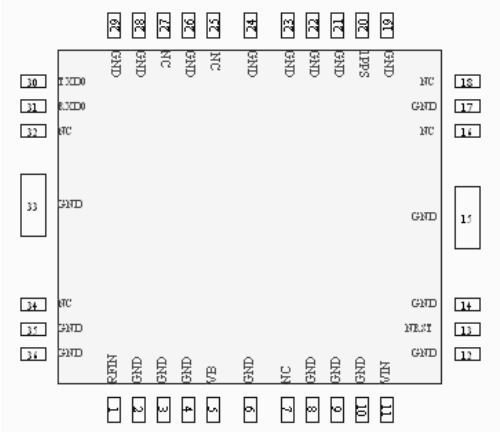
2. PERFORMANCE

2.1 RECEIVER SPECIFICATIONS

Parameter	Specification
Receiver Type	44 channel
Re-acquisition sensitivity	-155dBm
Tracking sensitivity	-158dBm
Cold start sensitivity	-137dBm
Receiver frequency	1575.42MHz
Code	C/A code
Accuracy (1) Position (2) Velocity	 5m CEP 0.1m/sec
Startup Time hot start warm start cold start	 < 1 sec < 35 sec < 45 sec
Signal Reacquisition	<1s
Update Rate	1Hz
Operational Limits (1) Altitude (2) velocity	 < 18,000m < 500m/s
Dynamics	4G (39.2m/sec^2)
Datum	WGS-84
Protocol	NMEA-0183 V3.01

2.2 ELECTRIC SPECIFICATIONS

2.2.1 PIN ASSIGNMENT



NO.	Signal name	I/O	V	Description	Notes
1	RF IN	P	3.3	Receive RF signal input Antenna power supply	Antenna spec
2	GND	P	0	System ground	
3	GND	P	0	System ground	
4	GND	P	0	System ground	
5	VB	P	3.3	Back up power input	
6	GND	P	0	System ground	
7	NC	-	-	Not use	
8	GND	P	0	System ground	
9	GND	P	0	System ground	
10	GND	P	0	System ground	
11	VIN	P	3.3	Main power supply	3.3V
12	GND	P	0	System ground	
13	NRST	I	0/ 3.3	Manual Reset IN (active Low) Not use keep it floating	
14	GND	P	0	System ground	
15	GND	P	0	System ground	
16	NC	-	-	Not use	
17	GND	P	0	System ground	
18	NC	-	-	Not use	

NO.	Signal name	I/O	V	Description	Notes
19	GND	P	0	System ground	
20	1PPS	O	0/ 3.3	1 pulse per second	
21	GND	P	0	System ground	
22	GND	P	0	System ground	
23	GND	P	0	System ground	
24	GND	P	0	System ground	
25	NC	-	-	Not use	
26	GND	P	0	System ground	
27	NC	-	-	Not use	
28	GND	P	0	System ground	
29	GND	P	0	System ground	
30	TXD0	O	0/ 3.3	Serial data port transmit line	
31	RXD0	I	0/ 3.3	Serial data port transmit line	
32	NC	-	-	Not use	
33	GND	P	0	System ground	
34	NC	-	-	Not use	
35	GND	P	0	System ground	
36	GND	P	0	System ground	

2.2.2 ABSOLUTE MAXIMUM RATINGS

Item	Absolute maximum ratings	Unit
RXD0 input voltage	0~ 3.3V (Max 4.0V)	V
VB input voltage	0~3.3V (Max 6.0V)	V
VIN input voltage	0~3.3V (Max 6.0V)	V

2.2.3 DC ELECTRICAL CHARACTERISTICS

Item			Min.	TYP	Max	Unit	Notes
TXD0 (Output)	H	Voltage	2.6	-	3.3	V	
	L	Voltage	0	-	0.4	V	
RXD0 (Input)	H	Voltage	2.6	-	3.3	V	
	L	Voltage	0	--	0.4	V	
VB	Voltage		3.0	3.3	3.6	V	
VIN	Voltage		3.0	3.3	3.6	V	
	Current		-	45mA	120mA	mA	@3.3V
RF IN	Voltage		3.0	3.3	3.6	V	
	Impedance		-	50	-	Ohm	
	Center frequency		-	1.57542	-	GHz	

2.2.4 ANTTENNA POWER SUPPLY

The **GT-750RS** No.1 pin, RF IN, receives RF signal input and antenna power supply which must be connected to an external active antenna.

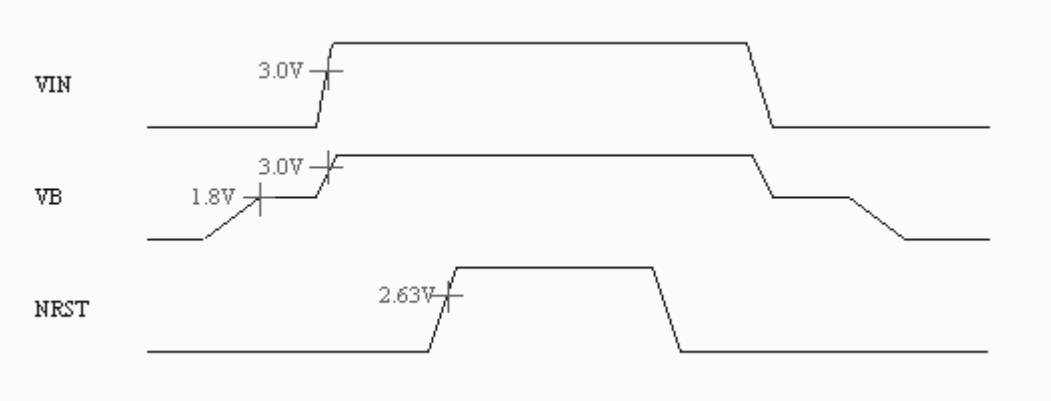
2.2.5 ONE PLUS PER SECOND (1PPS)

The **GT-750RS** provides a 500 microsecond wide, CMOS compatible TTL level Pulse-Per-Second (PPS). The PPS is a positive pulse available on pin 20. The rising edge of the PPS pulse is synchronized with respect to UTC. The timing accuracy is ±50 nanoseconds when valid position fixes are being reported.

2.2.6 ADAPTOR ANTENNA

Parameter	Condition
Impedance	50 Ohm
NF	1.5dB or less
VSWR	2.0 or less
Element profit	0dBi or more (at zenith)
	-6dBi or more (elevation ≧10 degree)
Axial ratio	3dB or less
Gain	16dBi~30dBi
Out of band rejection	25dB or more
Operation voltage	3.3V

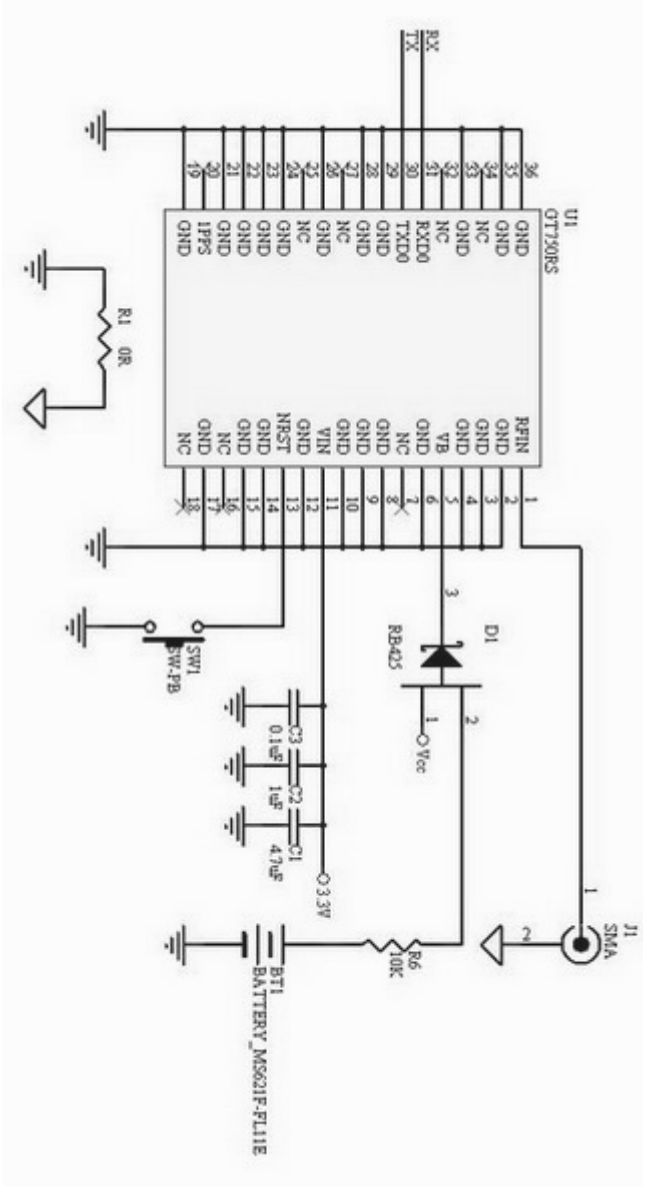
2.2.7 INPUT AND OUTPUT TIMING



2.3 ENVIRONMENT SPECIFICATION

Parameter		Specification
Temperature	Operating	-20℃~+70℃
	Storage	-40℃~+80℃
Humidity		5%~95%

3. REFERANCE DESIGN

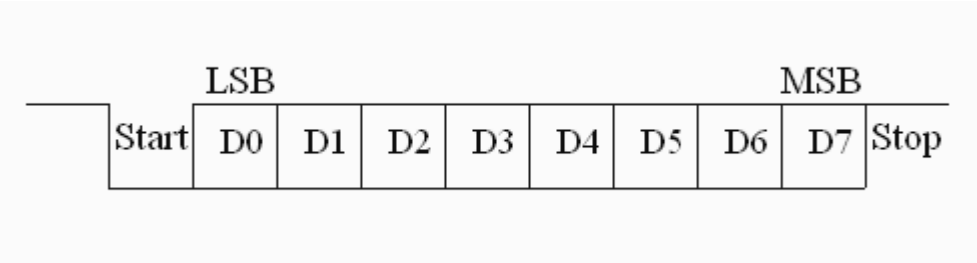


NOTE:

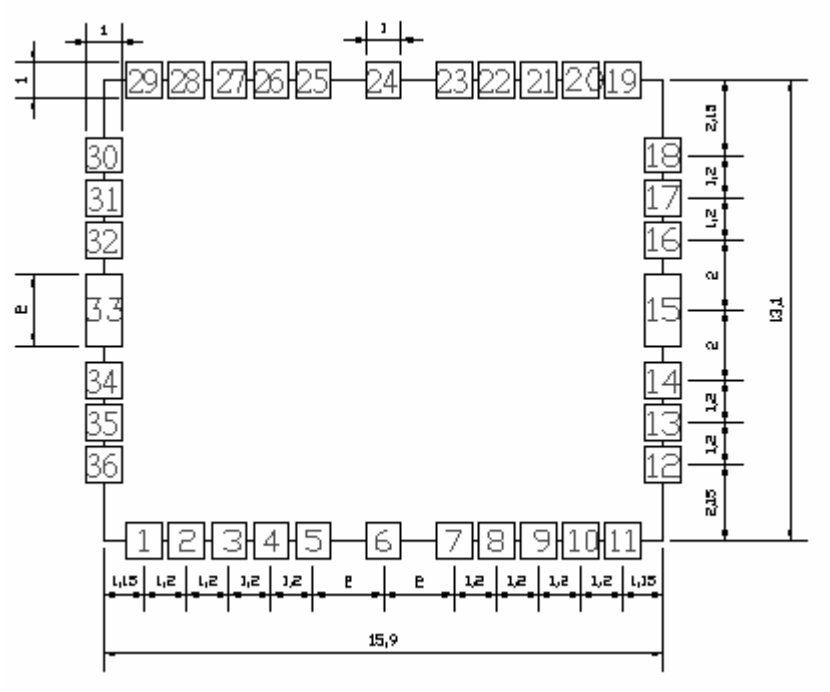
1. In the Reference Design, the Battery can be replaced by a super capacitor.
2. In the Reference Design, RFIN Pad is to provide 3.3V DC and receives RF signal.
   3.3 V power supply is from RF circuit of the module. Impendence of Transmit Line located between the RFIN pad and antenna's connector has to be 50Ω.
3. In the Reference Design, push bottom is for system reset. When it is pushed, boots-up will begin from hot-start.

4. COMMUNICATION SEPECIFICATIONS

Item	Description
Interface	Full duplex serial interface
Bit rate	4800/9600bps
Start bit	1bit
Stop bit	1bit
Data bit	8bit
Parity	none
Transmission data	ASCII NMEA0183 Ver:3.01
Update rate	1Hz
Output sentence	GGA/GSA/GSV/RMC



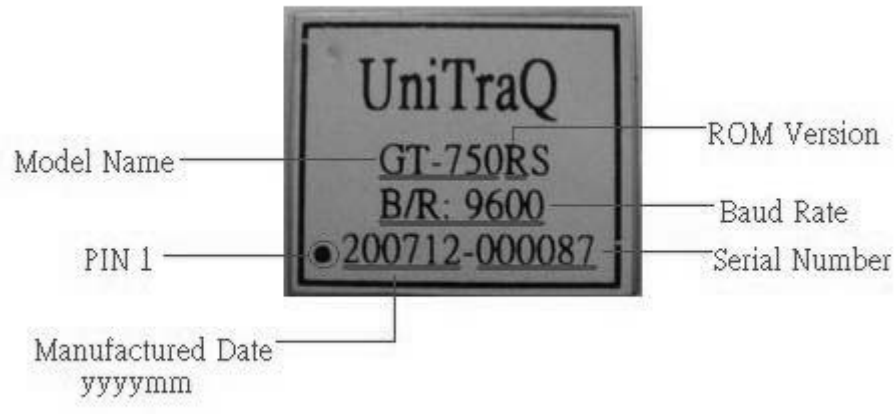
5. FOOT PRINT



Unit:mm

TopView

6. OUTLINE



7. APPROVED NMEA MESSAGE

The serial interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification. This standard is fully define in "NMEA 0183, Version 3.01" The standard may be obtained from NMEA, www.nmea.org

7.1 GGA – GLOBAL POSITIONING SYSTEM FIX DATA

Time, position and fix related data for a GPS receiver.

Structure:

$GPGGA,hhmmss.sss,ddmm.mmmm,a,dddmm.mmmm,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>
1 2 3 4 56 7 8 9 10 11 12 13

Example:

$GPGGA,060932.448,2447.0959,N,12100.5204,E,1,08,1.1,108.7,M,,,,0000*0E<CR><LF>

Field	Name	Example	Description
1	UTC Time	060932.448	UTC of position in hhmmss.sss format, (000000.00 ~ 235959.99)
2	Latitude	2447.0959	Latitude in ddmm.mmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12100.5204	Longitude in dddmm.mmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	GPS quality indicator	1	GPS quality indicator 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode 3: GPS PPS Mode, fix valid 4: Real Time Kinematic. System used in RTK mode with fixed integers 5: Float RTK. Satellite system used in RTK mode. Floating integers 6: Estimated (dead reckoning) Mode 7: Manual Input Mode 8: Simulator Mode
7	Satellites Used	08	Number of satellites in use, (00 ~ 12)
8	HDOP	1.1	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.7	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	Geoid Separation		Geoid separation in meters according to WGS-84 ellipsoid (-999.9 ~ 9999.9)
11	DGPS Age		Age of DGPS data since last valid RTCM transmission in xxx format (seconds) NULL when DGPS not used
12	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
13	Checksum	0E	

Note: The checksum field starts with a '*' and consists of 2 characters representing a hex number. The checksum is the exclusive OR of all characters between '$' and '*'.

7.2 GLL - LATITUDE AND LONGITUDE, WITH TIME OF POSITION FIX AND STATUS

Latitude and longitude of current position, time, and status.

Structure:

$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,A,a*hh<CR><LF>
1 2 3 4 5 6 7 8

Example:

$GPGLL,4250.5589,S,14718.5084,E,092204.999,A,A*2D<CR><LF>

Field	Name	Example	Description
1	Latitude	4250.5589	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	S	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.99)
6	Status	A	Status, 'A' = Data valid, 'V' = Data not valid
7	Mode Indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
8	Checksum	2D	

7.3 GSA - GPS DOP AND ACTIVE SATELLITES

GPS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence and DOP values.

Structure:

$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh<CR><LF>
1 2 3 3 3 3 3 3 3 3 3 3 3 3 4 5 6 7

Example:

$GPGSA,A,3,01,20,19,13,,,,,,,,,40.4,24.4,32.2*0A<CR><LF>

Field	Name	Example	Description
1	Mode	A	Mode 'M' = Manual, forced to operate in 2D or 3D mode 'A' = Automatic, allowed to automatically switch 2D/3D
2	Mode	3	Fix type 1 = Fix not available 2 = 2D 3 = 3D
3	Satellite used 1~12	01,20,19,13,,,,,,,,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	40.4	Position dilution of precision (00.0 to 99.9)
5	HDOP	24.4	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	32.2	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	0A	

7.4 GSV - GPS SATELLITE IN VIEW

Number of satellites in view, PRN number, elevation angle, azimuth angle, and C/No. Four satellites details are transmitted per message. Additional satellite in view information is send in subsequent GSV messages.

Structure:

$GPGSV,x,x,xx,xx,xx,xxx,xx,…,xx,xx,xxx,xx *hh<CR><LF>
1 2 3 4 5 6 7 4 5 6 7 8

Example:

$GPGSV,3,1,09,28,81,225,41,24,66,323,44,20,48,066,43,17,45,336,41*78<CR><LF>
$GPGSV,3,2,09,07,36,321,45,04,36,257,39,11,20,050,41,08,18,208,43*77<CR><LF>

Field	Name	Example	Description
1	Number of message	3	Total number of GSV messages to be transmitted (1-3)
2	Sequence number	1	Sequence number of current GSV message
3	Satellites in view	09	Total number of satellites in view (00 ~ 12)
4	Satellite ID	28	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	81	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	225	Satellite azimuth angle in degrees, (000 ~ 359)
7	SNR	41	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	78	

7.5 RMC - RECOMMANDED MINIMUM SPECIFIC GPS/TRANSIT DATA

Time, date, position, course and speed data provided by a GNSS navigation receiver.

Structure:

$GPRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,x.x,a,a*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 1112 13

Example:

$GPRMC,092204.999,A,4250.5589,S,14718.5084,E,0.00,89.68,211200,,A*25<CR><LF>

Field	Name	Example	Description
1	UTC time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	4250.5589	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	S	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	000.0	Speed over ground in knots (000.0 ~ 999.9)
8	Course over ground	000.0	Course over ground in degrees (000.0 ~ 359.9)
9	UTC Date	211200	UTC date of position fix, ddmmyy format
10	Magnetic variation		Magnetic variation in degrees (000.0 ~ 180.0)
11	Magnetic Variation		Magnetic variation direction 'E' = East 'W' = West
12	Mode indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
13	checksum	25	

7.6 VTG - COURSE OVER GROUND AND GROUND SPEED

The Actual course and speed relative to the ground.

Structure:

GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>
1 2 3 4 5 6

Example:

$GPVTG,89.68,T,,M,0.00,N,0.0,K,A*5F<CR><LF>

Field	Name	Example	Description
1	Course	89.68	True course over ground in degrees (000.0 ~ 359.9)
2	Course		Magnetic course over ground in degrees (000.0 ~ 359.9)
3	Speed	0.00	Speed over ground in knots (000.0 ~ 999.9)
4	Speed	0.00	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
5	Mode	A	Mode indicator 'N' = not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
6	Checksum	5F	

7.7 ZDA -TIME AND DATE

Structure:

$GPRMC,hhmmss.sss,dd,mm.yyyy, , ,xxx<CR><LF>
1 2 3 4 5 6 7

Example:

$GPZDA,104548.04,25,03,2004,,*6C<CR><LF>

Field	Name	Example	Description
1	UTC time	104548.04	UTC time in hhmmss.ss format, 000000.00 ~ 235959.99
2	UTC time: day	25	UTC time: day (01 ... 31)
3	UTC time: month	03	UTC time: month (01 ... 12)
4	UTC time: year	2004	UTC time: year (4 digit year)
5			Local zone hour Not being output by the receiver (NULL)
6			Local zone minutes Not being output by the receiver (NULL)
7	6C	6C	Checksum

7.8 BINARY MESSAGES

See *Binary Message Protocol User's Guide* for detailed descriptions.

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