General Description

The Gotop GT-1513-MTR 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.

Its –165dBm 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: GT-1513-MTR Top View

Features

- Build on high performance, low-power MTK3337chipset
- Ultra high sensitivity: -165dBm
- Extremely fast TTFFat low signal level
- Built in high gain LNA
- Low power consumption: Max 20mA@ 3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.8V to 4.3V
- Operating temperature range:-40to85℃
- SMD type with stamp holes
- Small form factor: 15x13x2.4mm
- RoHS compliant (Lead-free)

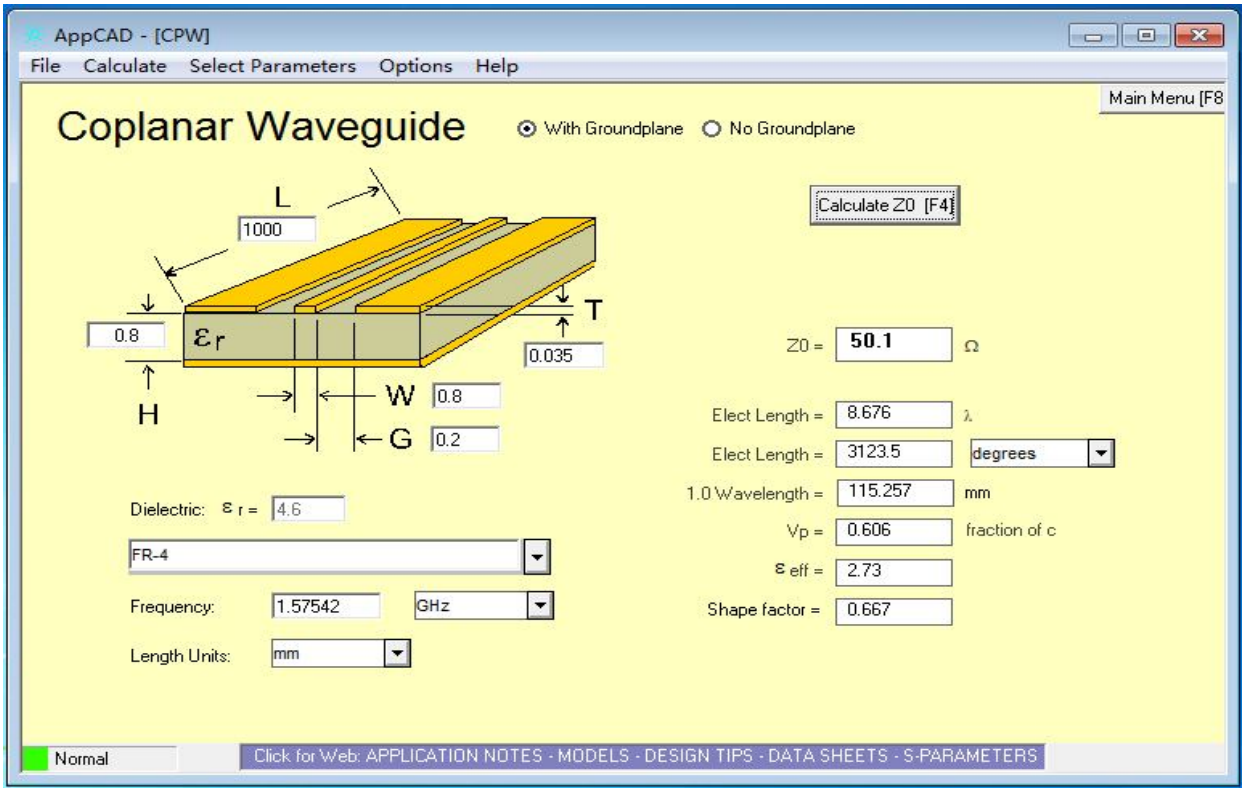
Performance Specification

Parameter	Specification	
Receiver Type	L1 frequency band, 22tracking/66acquisition-channel	
Sensitivity	Tracking Acquisition	-165dBm -163dBm(hot) -148dBm(cold)
Accuracy	Position Velocity Timing (PPS)	5m CEP without SA 0.1m/s without SA 10ns RMS
Acquisition Time	Cold Start Warm Start Hot Start Re-Acquisition	38s 35s 1s <1s
Power Consumption	Tracking Acquisition Sleep/Standby	20mA @3.3V Vcc 18mA TBD
NavigationDataUpdate Rate	1Hz	
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g

Interfaces Configuration

Power Supply: Regulated power for the GT-1513-MTR is required. The input voltage Vcc should be 3.3V ±10%, maximum, current is no less than 20mA. Suitable decoupling must be provided by external decoupling circuitry.

Antenna: The GT-1513-MTR 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 less than 15dB. The maximum noise figure should be no more than 2.5dB and output impedance is at 50 Ohm.



UART Ports: UART is thehas 3 full duplexserial ports. It is used for serial data communication. A UART converts bytes of data to and from asynchronous start-stop bit streams represented as binary electrical impulses.There are several functions in GT-1513-MTRrelatedtoUART communication, such as UART data transmission/receive and NMEA sentences input/output. In general, UART0 is as NMEA output and PMTK command input, UART1 asRTCM input. You can adjust the UART2 port as desired. The receiver (RXA) and transmitter (TXA) side of every port contains a 16-byte FIFO, but only UART0 has256 bytes of URAM. Thebit rates are selectable and range from 4.8 to 921.6 kbps. UART provides signal or messageoutputs.

Backup Battery Power: In case of a power failure on pin Vcc, real-time clock and backup RAM are supplied through pin VBAT. This enables the GT-1513-MTR GPS Receiver to recover from power failure with either a hot start or a warm start (depending on the duration of Vcc outage). If no Backup Battery is connected, the receiver performs a cold start upon powered up.

Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	RXB	I	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mAPDR,Serial input forUART2,Default:75Kpull-up Default:8mA driving	
2	TXB	O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDR,Serial input for UART2,Default:75Kpull-upDefault: 8mA driving	
3	P1PPS	O	Time Pulse(1PPS)	Leave Open in not used
4	TXA	O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mAPDR,Serial input forUART1,Default:75Kpull-up Default:8mA driving	
5	RXA	I	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDR,Serial input forUART1,Default:75Kpull-upDefault:8mA driving	
6	GPIO11	I/O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDRJTAG interface clock Default:75Kpull-downDefault:8mA driving	
7	GPIO9	I/O	Strap pin host_sel[0]Host_sel[1:0] Interfac	
8	GPIO10	I/O	Strap pin host_sel[0]Host_sel[1:0] Interfac	
9	NC		No connection	
10	NC		No connection	
11	V_BAT	P	Backup battery supply voltage	
12	VCC	P	DC suppiy voltage	
13	GPIO8	I/O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDRJTAG interface clockDefault:75Kpull-down Default:8mA driving	
14	GPIO1	I/O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDRJTAG interface clock Default:75Kpull-down Default:8mA driving	
15	GPIO2	I/O	2.8V,LVTTLI/OPPU,PPD,SMT2mA~16mA PDRJTAG interface clock Default:75Kpull-downDefault:8mA driving	
16	NC		No connection	
17	VCC_RF	P	Linear regulator power output, 3.0V (Do not use this as power source of backup battery)	
18	GND	G	Ground	
19	RF_IN	I	GPS Signal Input	
20	GND	G	Ground	
21	GND	G	Ground	
22	GND	G	Ground	

Pin Assignment

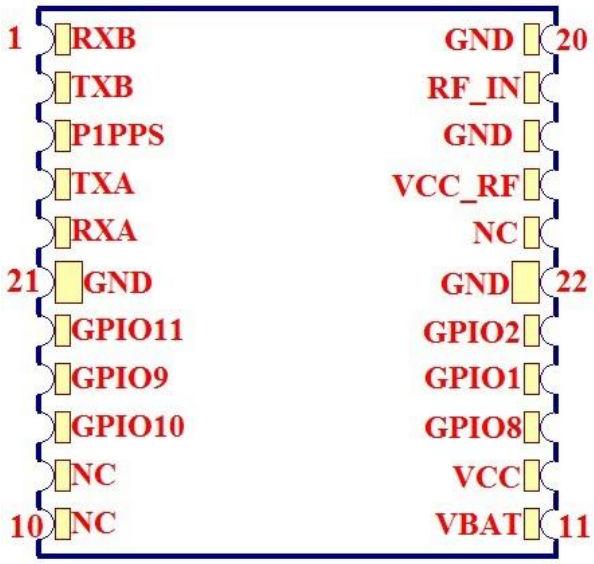


Figure 2: GT-1513-MTR Pin Package

Mechanical Specification

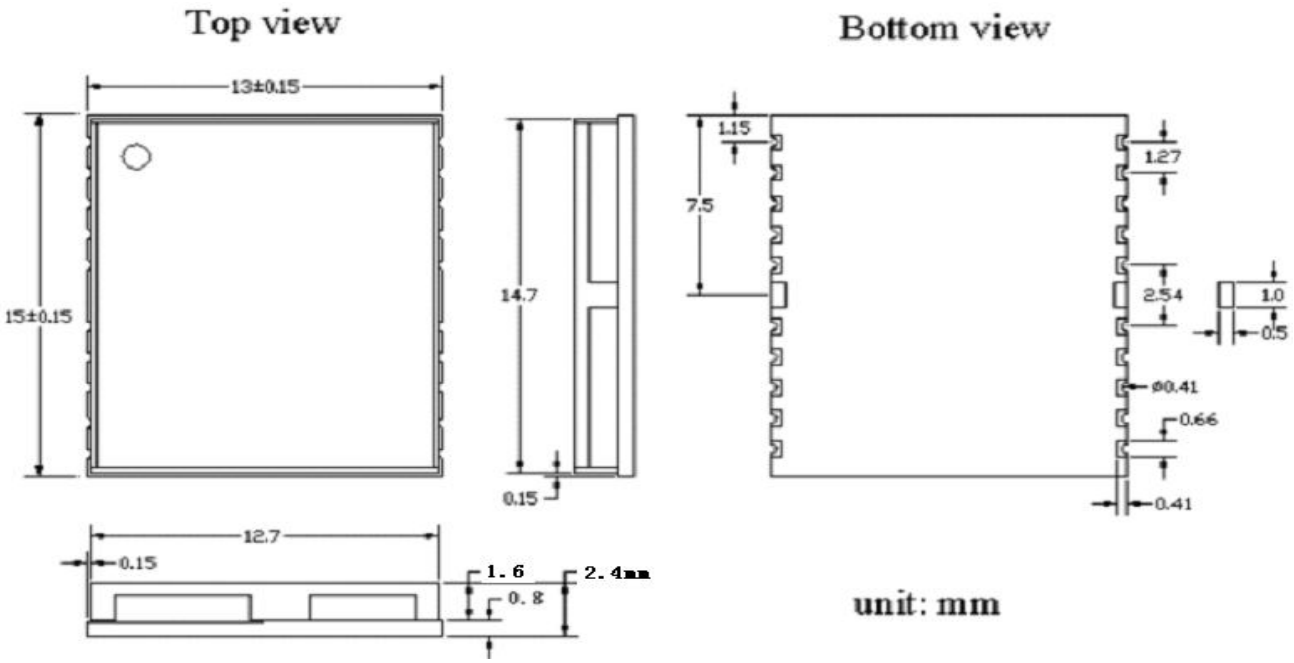


Figure 3: GT-1513-MTR Dimensions

Electrical Characteristics

Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	Vcc	2.8	4.3	V
Input Pins				
Input Pin Voltage I/O	UART	-0.3	3.6	V
Backup Battery	VBAT	2.0	3.6	V
Environment				
Storage Temperature	Tstg	-40	125	°C
PeakReflow Soldering Temperature	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 Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power supply voltage	Vcc		2.8	3.3	4.3	V
Powersupplyvoltageripple	Vcc_PP	Vcc=3.0V			30	mV
Consumption current	Icc	Vcc=3.0V		20	18	mA

Input high voltage	V_{IH}		0.7xVcc		Vcc+1.0	V
Input low voltage	V_{IL}		-0.3		0.3xVcc	V
Output high voltage	V_{OH}		0.8xVcc		Vcc	V
Output low voltage	V_{OL}		0		0.2xVcc	V
Operating temperature	Topr		-40		85	°C

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 Gotop GT-1513-MTR supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC and VTG

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

GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

$GPGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000*18

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
PositionFixIndicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoids Separation		meters	
Units	M	meters	
Age of Diff.Corr.		second	Null fields when DGPS is not Used
Diff.Ref.Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

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,161229.487, 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		dddmm.mmmm
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
Checksum	*2C		
<CR> <LF>			End of message temination

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

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 ofMessage	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

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, 161229.487, 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
UTS Position	161229.487		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		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over	309.62	Degrees	True
Ground			
Date	120598		dummy
Magnetic variation		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

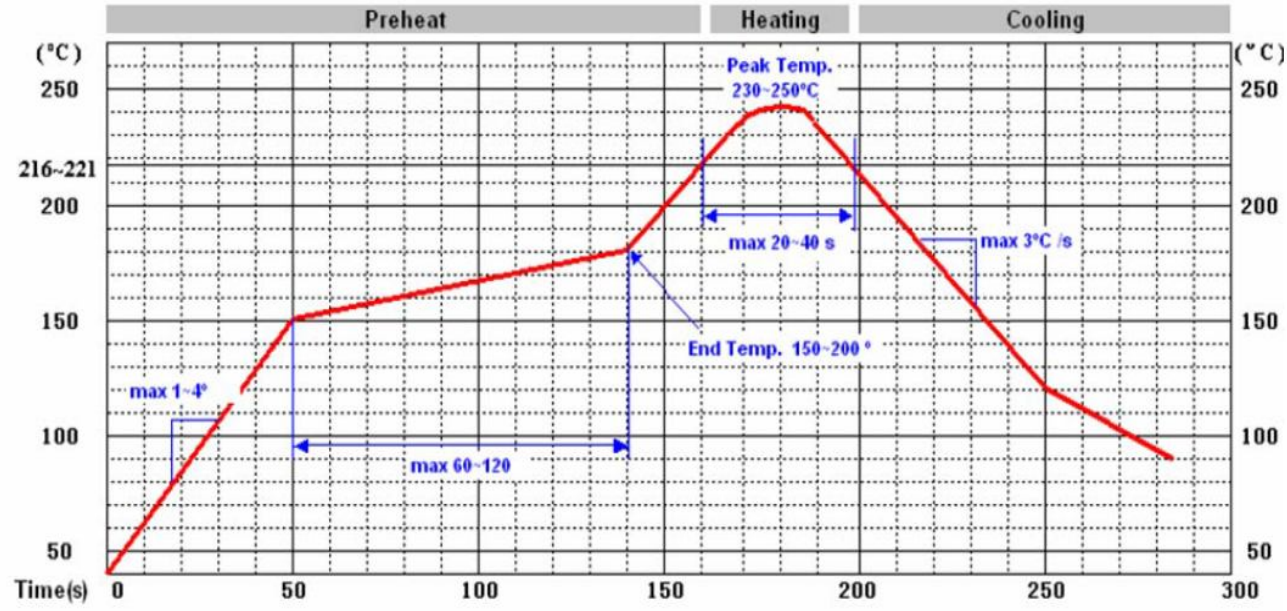
VTG-Course Over Ground and Ground Speed

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

Manufacturing Process Recommendations



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

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