General Description

The Gotop GT-1613-MTGN is a complete GPS/GNSS engine module that features super sensitivity, ultra low power and small form factor. The GPS/GNSS 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/GNSS 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-1613-MTGN Top View

Features

- Build on high performance, low-power MT3333chipset
- Ultra high sensitivity:-165dBm
- Extremely fastTTFFat low signal level
- Built in high gain LNA
- Low power consumption:Max20mA@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:15.9x13.1x2.6mm
- RoHS compliant (Lead-free)

Performance Specification

Parameter	Specification	
Receiver Type	Gps/Glonass/Galileo/Beidou(afterICDreleased)receiver Supports multi-GNSS incl.QZSS,SBAS ranging Supports:WAAS/EGNOS/MSAS/GAGAN	
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-1613-MTGN 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-1613-MTGN GPS/GNSS 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.
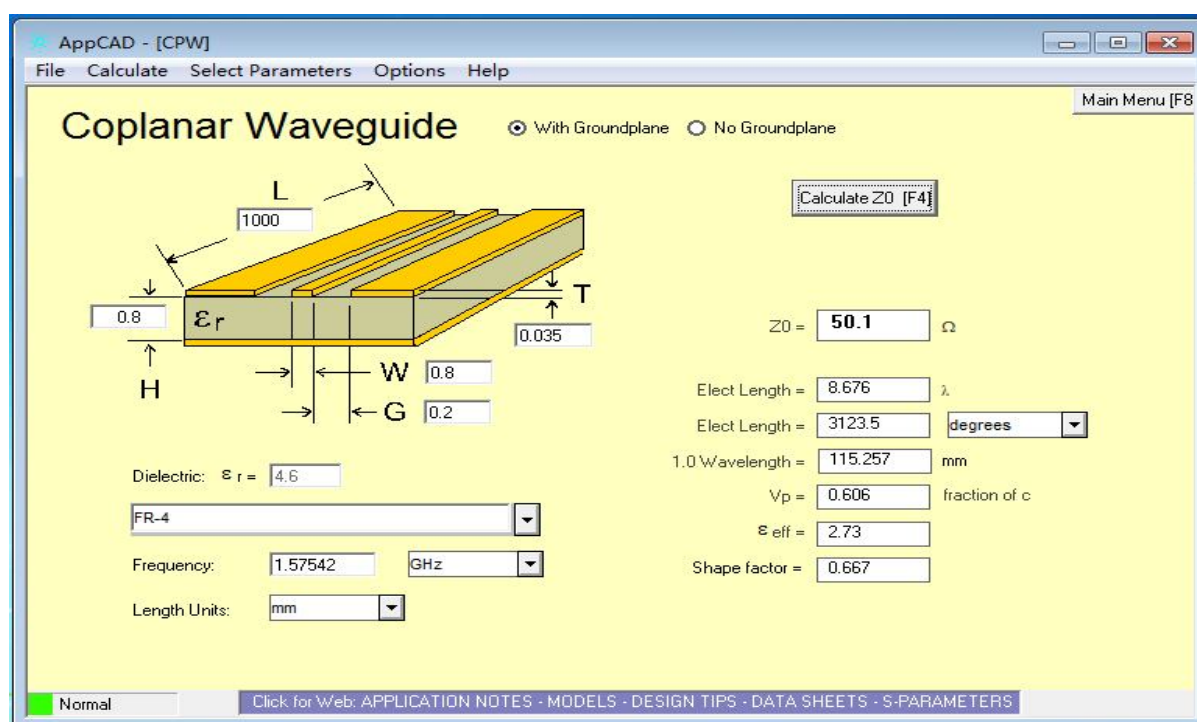
UART Ports: The module supports two full duplex serial channels UART . All serial connections are at 3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X 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, however, the user can change the default baud rate to any value from 4800 bps to 115kbps. UART is used e.g. for booting and NMEA interface.

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-1613-MTGN GPS /GNSS 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	RF_IN	I	GPS&GNSS Signal Input	
2	GND	G	Ground	
3	GND	G	Ground	
4	GND	G	Ground	
5	VBAT	I	RTCBattery input	2.0-3.6V
6	GND	G	Ground	
7	NC		No connection	LeaveOpenifnotused
8	GND	G	Ground	
9	GND	G	Ground	
10	GND	G	Ground	
11	Vcc	I	ModulePower Supply	
12	GND	G	Ground	
13	RST	I	Module Reset (Active Low)	LeaveOpeninnotused
14	GND	G	Ground	
15	GND	G	Ground	
16	NC		No connection	
17	GND	G	Ground	
18	NC		No connection	
19	GND	G	Ground	

| Pin No	Pin name	I/O	Description	Remark
20	PPS	O	Time Pulse(1PPS)	Leave Open in not used
21	GND	G	Ground	
22	GND	G	Ground	
23	GND	G	Ground	
24	GND	G	Ground	
25	NC		No connection	
26	GND	G	Ground	
27	NC		No connection	
28	GND	G	Ground	
29	GND	G	Ground	
30	TXA	O	UART Serial Data Output,Pull up (75KΩ) if not used	
31	RXA	I	UART Serial Data Input, Pull up (75KΩ) if not used	
32	RXB		UART Serial Data Input 1	Pull up if not used
33	GND	G	Ground	
34	TXB		UART Serial Data Output 1	Leave Open in not used
35	GND	G	Ground	
36	GND	G	Ground	

Pin Assignment
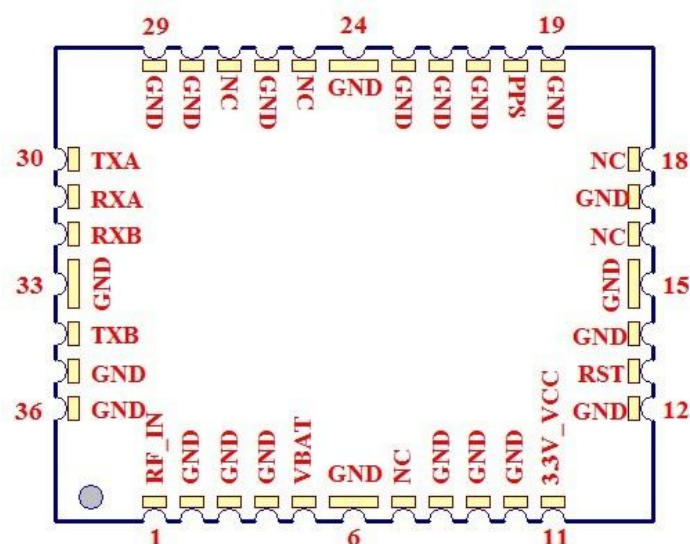
Figure 2: GT-1613-MTGN Pin Package

Mechanical Specification

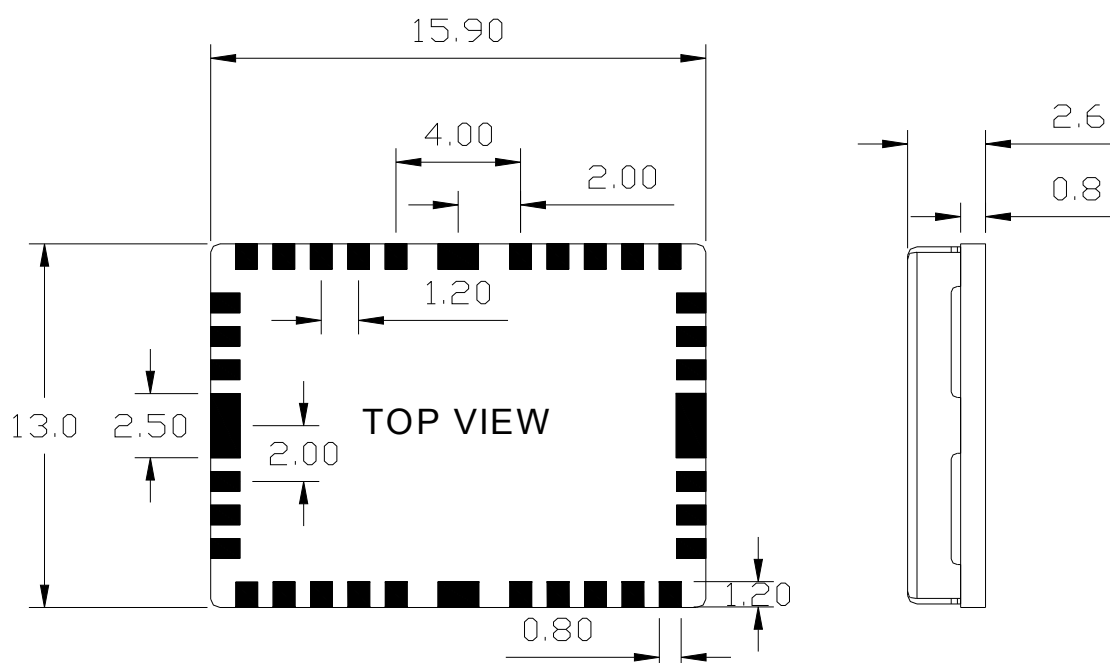**Figure 3: GT-1613-MTGN Dimensions**

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	RXD/TXD	-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&GNSS specific messages all start with $GPxxx/GNxxx 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-1613-MTGN supports the following NMEA-0183 messages: GPGSA. GPRMC.GNGSA.GNRMC.GLGSV

Table 1: NMEA-0183 Output Messages

NMEA Record	DESCRIPTION
GPGSA	GPS DOP and active satellites
GPRMC	Recommended minimum specific GPS data
GNGSA	BeiDou DOP and active satellites
GNRMC	Recommended minimum specific BeiDou data
GLGSV	GPS/BeiDou satellites in view

GPGSA-GPS 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 96
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

GPRMC-Recommended Minimum Specific GPS 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

GNGSA-BeiDou DOP and Active Satellites

Table 4 contains the values of the following example:

$GNGSA , 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	$GNGSA		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 96
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

GNRMC-Recommended Minimum Specific BeiDou Data

Table 6 contains the values of the following example:
$GNRMC, 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	$GNRMC		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

GLGSV-GPS/GNSS Satellites in View

Table 5 contains the values of the following example:

$GLGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71
$GLGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

Table 5: GLGGA   Data Format

Name	Example	Units	Description
Message ID	$GLGSV		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 96)
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 96)
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 GLGSV data may be required.The range oF GPS SVID is 1~32，GNSS SVID is 65~96。

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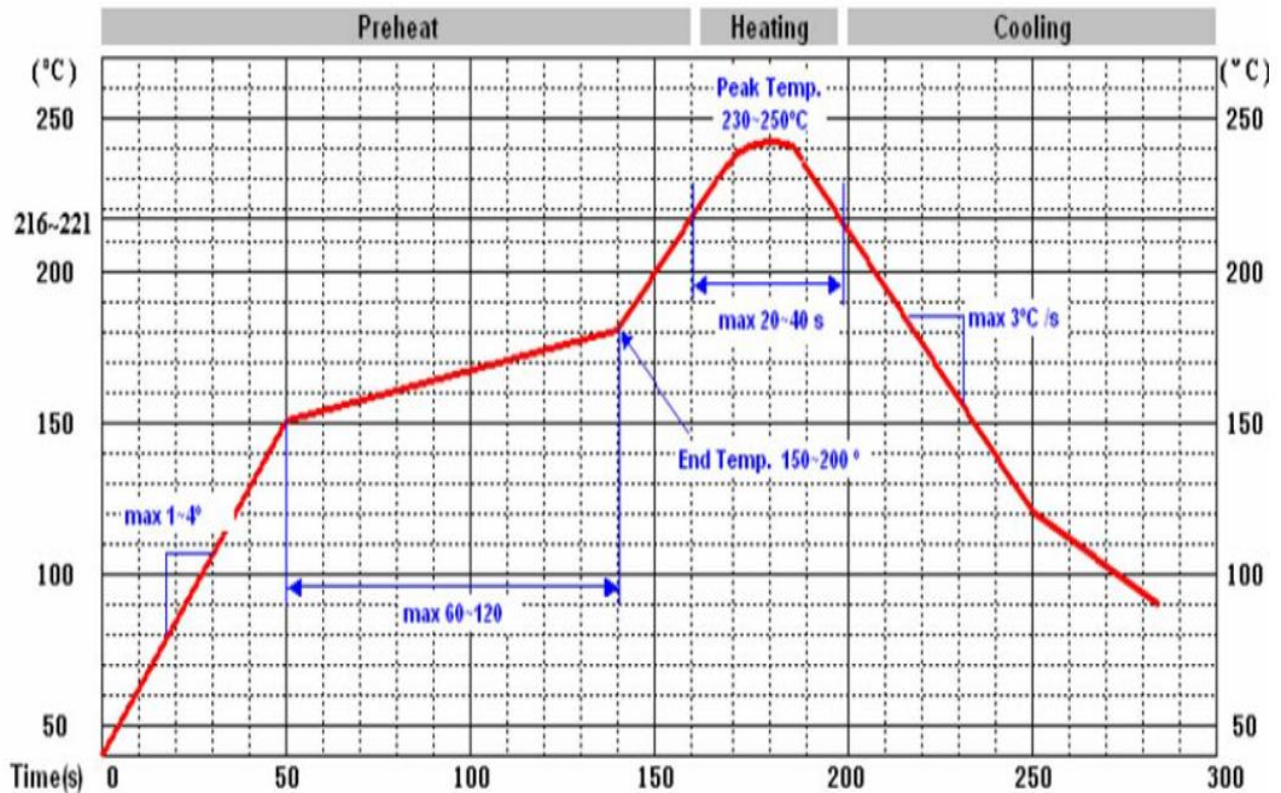
Note：The final soldering temperature chosen at the factory depends on additional external factors like choice ofsoldering paste，size，thickness and properties of the baseboard，etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

The information contained herein is subject to change without notice.

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