baokGeneral Description

The Gotop GT-1612-UMBD is a complete GPS/BeiDou engine module that features super sensitivity, ultra low power and small form factor. The GPS/BeiDou 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/BeiDou 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-1612-UMBD Top View

Features

- Build on high performance, low-power UM220chipset
- Ultra high sensitivity: -163dBm
- Extremely fast TTFFat low signal level
- Built in high gain LNA
- Low power consumption:Max74mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.8V to 3.6V
- Operating temperature range:-40to85℃
- SMD type with stamp holes
- Small form factor:16x12x2.4mm
- 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	-163dBm -160dBm(hot) -148dBm(cold)
Accuracy	Position Velocity Timing (PPS)	5m CEP without SA 0.1m/s without SA 20ns RMS
Acquisition Time	Cold Start Warm Start Hot Start Re-Acquisition	38s 35s 1s <1s
Power Consumption	Tracking Acquisition Sleep/Standby	74mA @3.3V Vcc 70mA TBD
NavigationDataUpdate Rate	1Hz	
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g

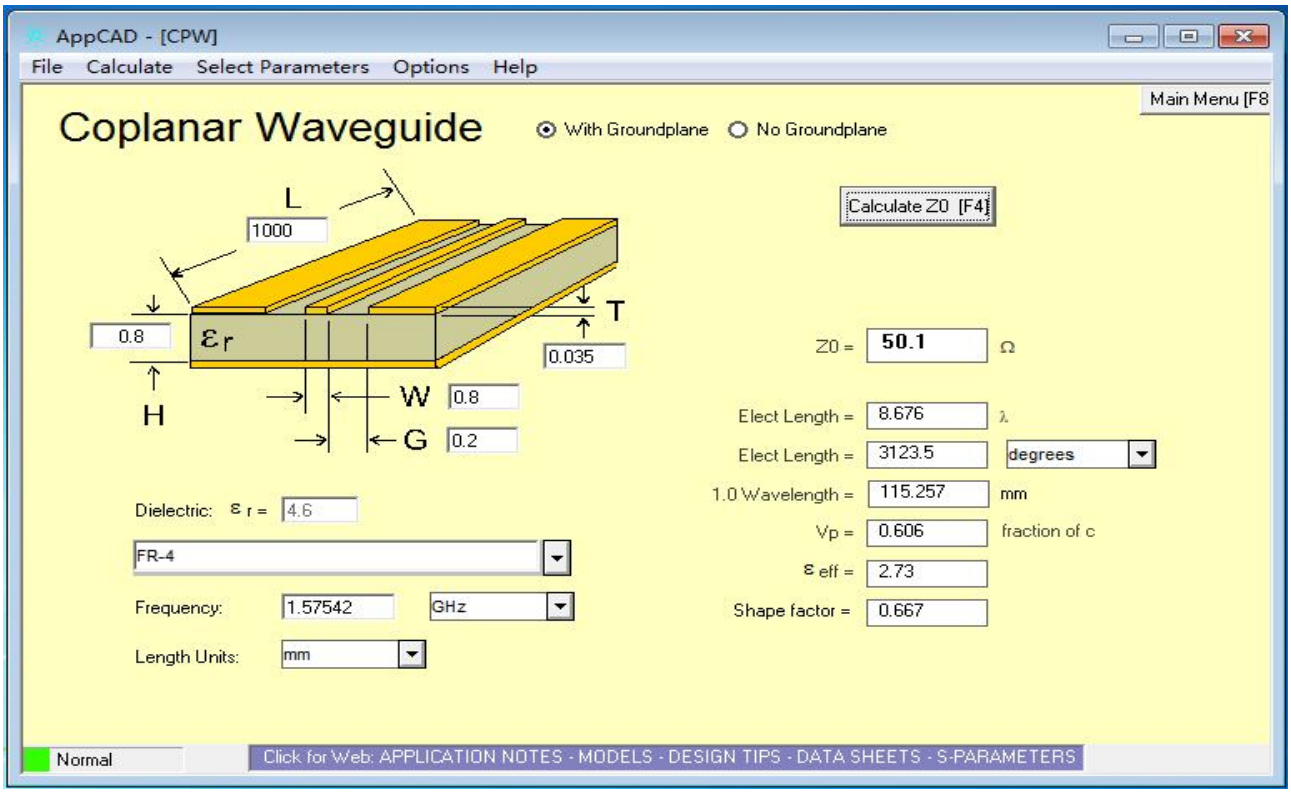
Interfaces Configuration

Power Supply: Regulated power for the GT-1612-UMBD 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.

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.

Antenna: The GT-1612-UMBD GPS/BeiDou 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.



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-1612-UMBD GPS /BeiDou 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	nRESET	I	Leave Open if not used	
2	ADDET_N	I	Active Antenna Detect	
3	PPS	o	Time Pulse(1PPS)	Leave Open in not used
4	EXTINTO	I	External Interrupt Pin	
5	GPIO2	I	Antenna Short Circuit Detect	
6	TXD2	o	UARTSerialData Output	Pullup(75KΩ) if not used
7	RXD2	I	UART Serial Data Input	Pullup(75KΩ) if not used
8	NC		No connection	
9	VCC_RF	P	Linear regulator power output, 3.3V (Do not use this as power source of backup battery)	
10	GND	G	Ground	
11	RF_IN	I	GPS/BeiDou Signal Input	
12	GND	G	Ground	
13	GND	G	Ground	
14	SPI_SDO	o	SPI data output pin	
15	SPI_SDI	I	SPI data input pin	
16	SPI_SCK	o	SPI clock pin	
17	SPI_CS1	o	SPI chip select 1	
18	SDA	o	DDC Data	
19	SCL	o	DDC Clock	
20	TXD1	o	UARTSerialData Output	Pull up (75KΩ) if not used
21	RXD1	I	UART Serial Data Input	Pull up (75KΩ) if not used
22	VBAT	P	Backup battery supply voltage	
23	VCC	P	DC suppiy voltage	
24	GND	G	Ground	

Pin Assignment

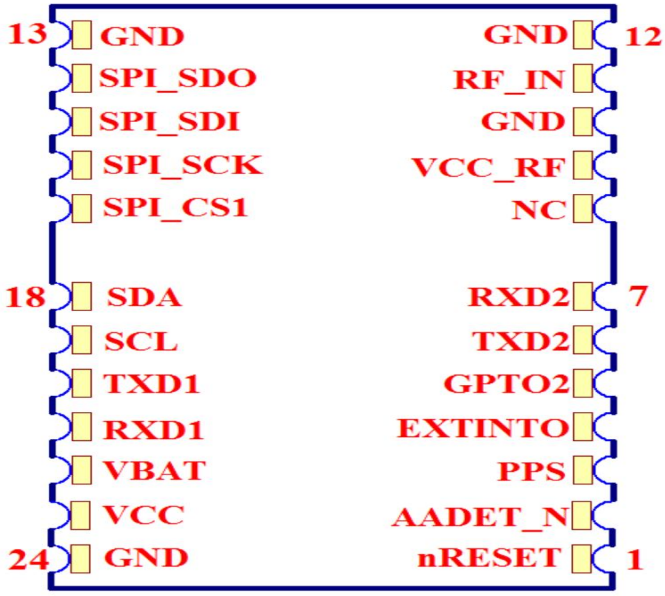
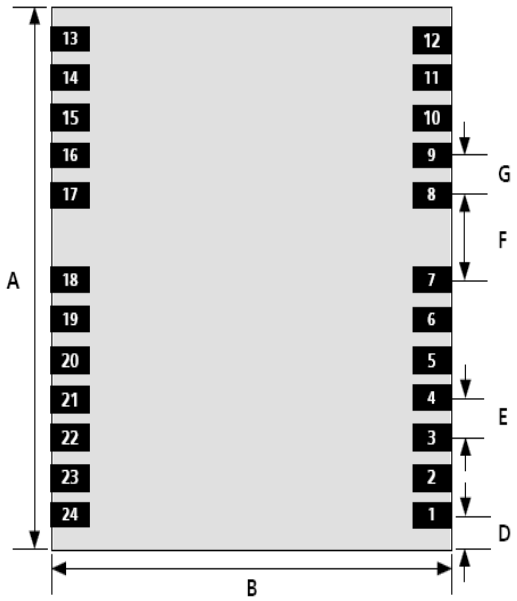


Figure 2: GT-1612-UMBD Pin Package

Mechanical Specification



Parameter	Specification	
A	16.0 +0.6/-0.1mm	[628.8 +24/-4mil]
B	12.2 ±0.1mm	[479.5 ±4mil]
C	2.4 ±0.2mm	[94.3 ±8mil]
D	1.0 +0.3/-0.1mm	[39.3 +18/-4mil]
E	1.1 ±0.1mm	[43.2 ±4mil]
F	3.0 ±0.1mm	[117.9 ±4mil]
G	1.1 ±0.1mm	[43.2 ±4mil]
Weight	1.6 g	

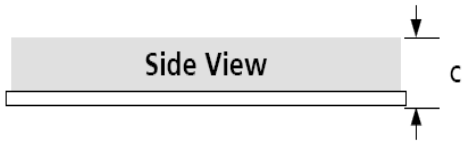


Figure 3: GT-1612-UMBD Dimensions

Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	Vcc	2.8	3.6	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	3.6	V
Powersupplyvoltageripple	Vcc_PP	Vcc=3.0V			30	mV
Consumption current	Icc	Vcc=3.0V		74	74	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&BeiDou specific messages all start with $GPxxx/GNxxx/BDxxx 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-1612-UMBD supports the following NMEA-0183 messages: GGA. RMC.GSA.GLL.GSV.VTG

Table 1: NMEA-0183 Output Messages

NMEA Record	DESCRIPTION
BD only mode : $CFGSYS,H10 NMEAOutPut:**BDRMC.BDGGA.BDGSV.BDGSA.BDGLL**	
GPS only mode: $CFGSYS,H01 NMEAOutPut:**GPRMC.GPGGA.GPGSV.GPGSA.GPGLL**	
GPS+BD onlymode: $CFGSYS,H11 NMEAOutPut:**GNRMC.GNGGA.GPGSV.BDGSV.GNGSA.GNGLL**	
xxGGA	Global positioning system fixed data
xxGLL	Geographic position—latitude/longitude
xxGSA	GNSS DOP and active satellites
xxGSV	GNSS satellites in view
xxRMC	Recommended minimum specific GNSS data

GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

$xxGGA, 161229.487,3723.247523,N, 12158.341623,W, 1,07,1.0,9.0,M.0000*18

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	$xxGGA		GGA protocol header

UTC Position	161229.487		hhmmss.sss
Latitude	3723.245723		ddmm.mmmmmm
N/S indicator	N		N=north or S=south
Longitude	12158.341623		dddmm.mmmmmm
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 &BDSPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS&BD PPS Mode, fix valid

GLL-Geographic Position – Latitude/Longitude

Table 3 contains the values of the following example:

$xxGLL , 3723.247523, N,12158.341623, W,161229.487, A*2C.

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	$xxGLL		GLL protocol header
Latitude	3723.247523		ddmm.mmmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.341623		dddmm.mmmmmm
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:

$xxGSA , 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	$xxGSA		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 66

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:

$xxGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71

$xxGSV, 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	$xxGSV		GSV protocol header
Number ofMessage	2		Range 1 to 4
Message Number	1		Range 1 to 4
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 66)
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 66)
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:

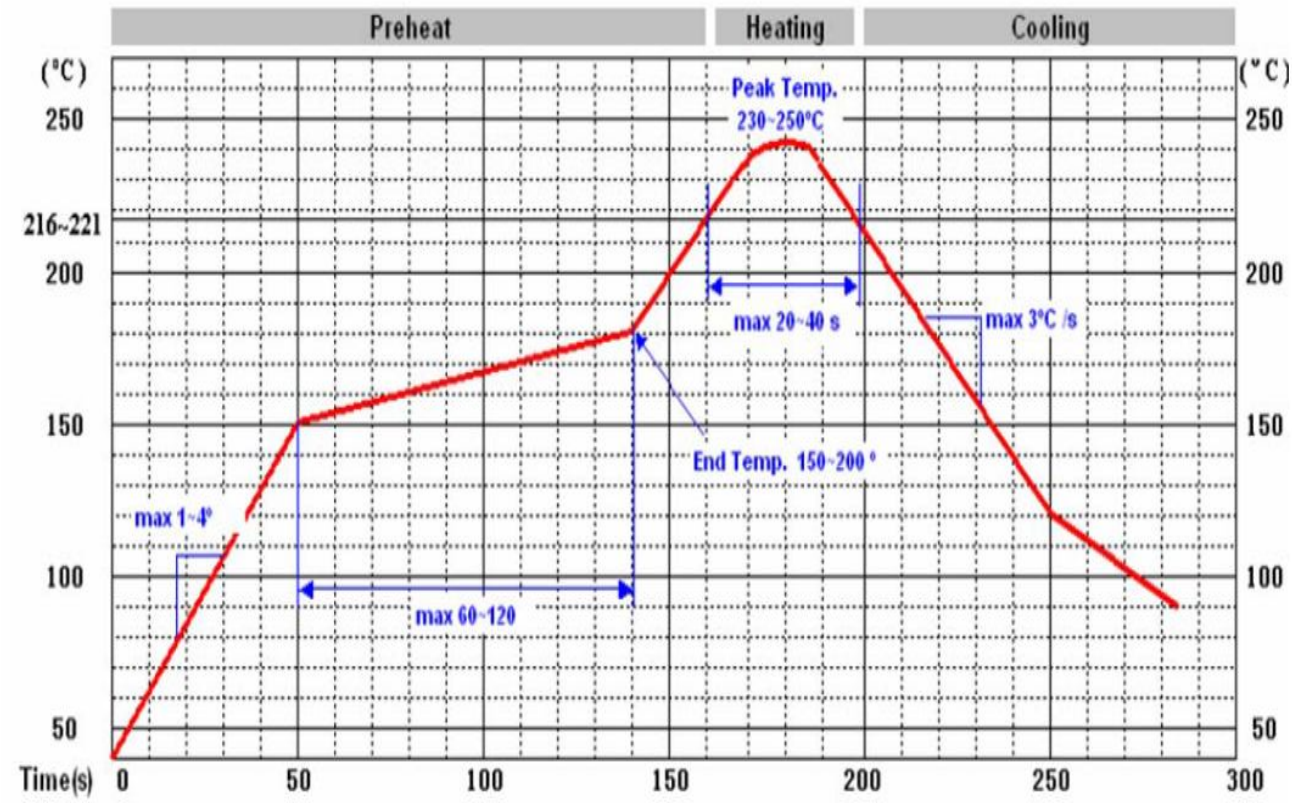
$xxRMC, 161229.487, A, 3723.247523, N, 12158.341623, W, 0.13,309.62, 120598,, *10

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	$xxRMC		RMC protocol header
UTS Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.247523		ddmm.mmmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.341623		dddmm.mmmmmm
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

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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