



ANTARIS™ 4 SuperSense GPS Module



User's Manual Ver 1.03

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1. Introduction

1.1. Overview

Modulestek GPS module **MG-A1315** is a high sensitivity ultra low power consumption cost efficient, compact size; plug & play GPS module board designed for a broad spectrum of OEM system applications. This product is based on the ANTARIS™4 supersense technology and it will track up to 16 satellites at a time while providing fast time-to-first-fix. Its far reaching capability meets the sensitivity & accuracy requirements of car navigation as well as other location-based applications, such as AVL system. Handheld navigator, PDAs, Wrist Watches, Personal Locators, Toll collection, Fleet Management, pocket PC, or any battery operated navigation system.

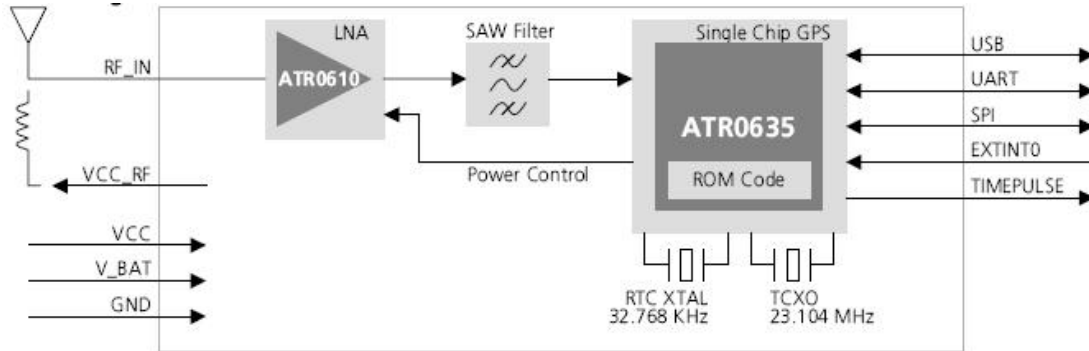
The **MG-A1315** design utilizes the latest surface mount technology and high level circuit integration to achieve superior performance while minimizing dimension and power consumption. This hardware capability combined with software intelligence makes the board easy to be integrated and used in all kinds of navigation applications or products. The module communicates with application system via TTL level with NMEA0183 protocol.

1.2. Main Feature

- Built-in high performance ATMEL chipset. 16 channels “All-in-View” tracking.
- Average Cold Start in 34 seconds.
- -158 dBm weak signal sensitivity with SuperSense™
- Ultra Low power consumption.(38mA)
- Cost-optimized architecture (No Flash EPROM)
- USB Slave V1.1 (V2.0 compatible)
- Support 1 USB and 2 UART ports
- 15 μ A backup current
- Support of SBAS satellites for navigation
- Ultra miniature 15 x 13 mm dimension with SMT pad package
- Full DGPS / WAAS / EGNOS and MSAS support
- 4Hz position update rate

2. Technical Specifications

2.1. Block Diagram



2.2. Electrical Characteristics

2.2.1 General

Frequency	L1, 1575.42 MHz
C/A code	1.023 MHz chip rate
Channels	16

2.2.2 Sensitivity

Cold Starts:	-142dBm
Reacquisition:	-148 dBm
Tracking&Acquisition:	-158 dBm

2.2.3 Accuracy

Position	2.5 meters CEP 2.0 m CEP DGPS / WAAS / EGNOS
Time	50ns RMS

2.2.4 Datum

Default	WGS-84
Other	Support different datum by request

2.2.5 Acquisition Rate (Open sky, stationary requirements)

Hot start	<3.5 sec, average
Warm start	33 sec, average

Cold start	34 sec, average
Reacquisition	< 1s

2.1.6 Dynamic Conditions

Altitude	18,000 meters
Velocity	515 m/s

2.1.7 Power

Main power input	3.3 \pm 5% VDC input.
Supply Current	MG-A1315 < 38mA (1.5 mA in power saving mode)
Backup Power	1.5~3.6V
Backup Current	5 μ A typical

2.1.8 Serial Port

Electrical interface	one full duplex serial communication, TTL interface
Protocol message	NMEA, ublox binary (UBX), RTCM.
Default NMEA	hardware baud rate setting UART1/USB port: 9600 baud, NMEA UART2 port: 38400 baud, UBX

2.3. Environmental Characteristics

Operating temperature range	-40 deg. C to +85 deg. C
Storage temperature range	-40 deg. C to +100 deg. C

2.4. Physical Characteristics

Dimension: **MG-A02S** 15.0 x 13.0 x 2.2 (mm)

2.5. Active antenna

15~ 25 dB Gain recommended

3. Mechanical Dimensions

3.1. MG-A1315

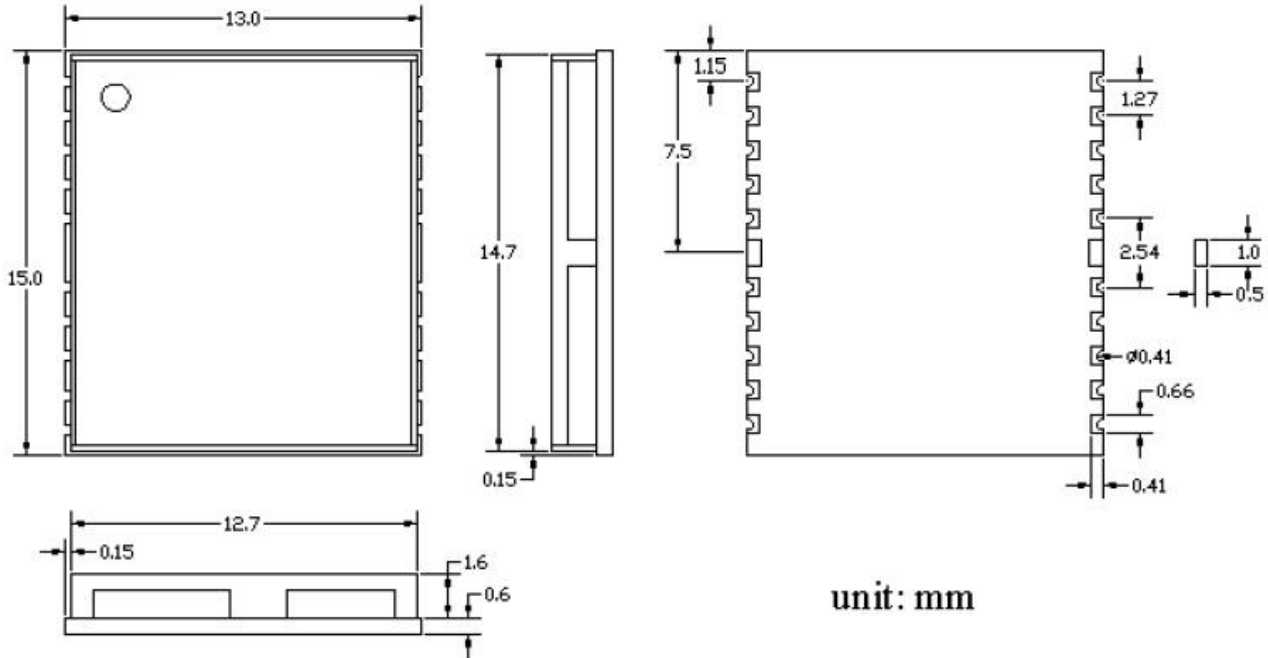


Figure 1: Board dimensions (in mm)

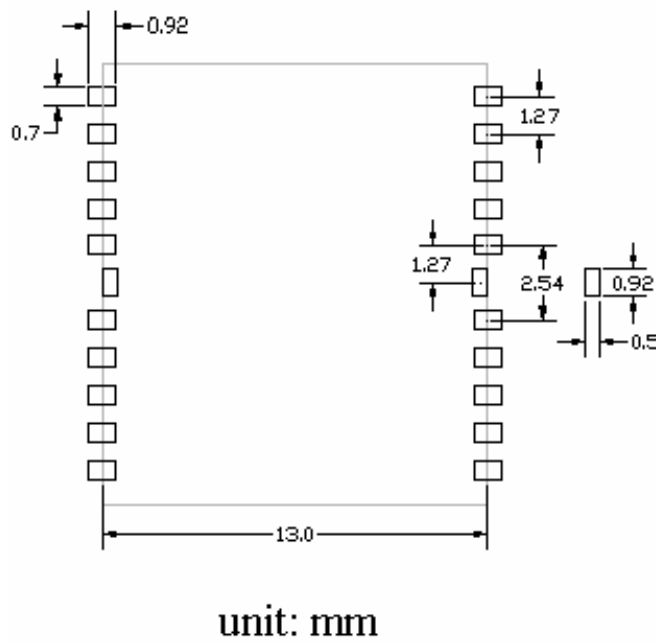


Figure 2: Board connections and placement diagram.

4. Board connections

1	RXB	GND	20
2	TXB	RF_IN	19
3	PPS	GND	18
4	TXA	VCC_RF	17
5	RXA	NRESET	16
21	GND	GND	22
6	STATUS_LED	NC	15
7	USB_DM	GPSMODE6	14
8	USB_DP	GPSMODE5	13
9	RFPWRUP	VCC	12
10	EXTINT0	V_BAT	11

Pin	Name	Type	Description
1	RXB	I	Serial Port B
2	TXB	O	Serial Port B
3	PPS	O	One Pulse Per Second
4	TXA	O	Serial Port A
5	RXA	I	Serial Port A
6	STATUS_LED	O	Fix Status LED, if not used keep floating
7	USB_DM	I/O	USB DM
8	USB_DP	I/O	USB DP
9	RFPWRUP	O	Indicates power state of RF part
10	EXTINT0	I	External Interrupt Pin
11	V_BAT	I	Backup Voltage Supply, 1.5VDC~ 3.6VDC
12	VCC	I	DC Supply Voltage Input DC +3.3V+-5%
13	GPSMODE5 (see table 1, 2)	I	GPSMODE5 configuration, if not used keep floating
14	GPSMODE6 (see table 1, 2)	I	GPSMODE6 configuration, if not used keep floating
15	NC	NC	Not connected
16	NRESET	I	Reset, Active Low
17	VCC_RF	O	Supply Antenna Bias Voltage
18	GND	G	Reference Ground
19	RF_IN	I	GPS Signal Input, 50 ohm @1.57542GHz
20	GND	G	Reference Ground
21	GND	G	Reference Ground
22	GND	G	Reference Ground

Baud Rate Setting

GPSMODE5/GPSMODE6 Configuration

For GPSMODE5 and GPSMODE6, it represents serial I/O configuration (Baud rate/Output NMEA Sentences configuration).

Please refer to Table 1 for detailed description

GPSMODE6	GPSMODE5	UART1/USB Protocol/Baud	UART2 Protocol/Baud	Messages
0	0	NMEA/19200	UBX/57600	High (see table 2)
0	1	NMEA/4800	UBX/19200	Low (see table 2)
1 (default)	0 (default)	NMEA/9600	UBX/38400	Medium (see table 2)

Table 1

Messages

	High	Low	Medium (default)
NMEA port	GGA, GLL, GSA, GSV, RMC, VTG, ZDA, GRS, GST, proprietary PUBX00, PUBX03, PUBX04	GGA, RMC	GGA, GLL, GSA, GSV, RMC, VTG, ZDA
UBX port	UBX-NAV, UBX-MON	UBX-MON	UBX-MON

Table 2

5. Applications

MG-A1315 module board receiver is a high performance, ultra low power consumption, plug & play product. These applications are as follow.

- Car Navigation
- Wrist Watch
- Solar Operated Device
- Marine Navigation
- Fleet Management
- AVL and Location-Based Services
- Radar detector with GPS function
- Hand-Held Device for Personal Positioning and Navigation
- Ideal for PDA, Pocket PC and Other Computing Devices at GPS Application

Appendix A: Data Set 1. GGA data set

GGA--- Global Positioning System Fixed Data

Table 2 contains the values for the following example:

\$GPGGA,161229.487,3723.24751,N,12158.34161,W,1,07,1.0,9.0,M, , , ,0000*18<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.24751		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		0 = invalid 1 = GPS fix (SPS) 2 = DGPS fix 3 = PPS fix 4 = Real Time Kinematic 5 = Float RTK 6 = estimated (dead reckoning) 7 = Manual input mode 8 = Simulation mode
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid 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

2. GLL data set

GLL--- Geographic Position – Latitude/Longitude

Table 4 contains the values for the following example:

\$GPGLL,3723.24751,N,12158.34161,W,161229.487,A*2C<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	3723.24751		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
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 termination

3. GSA data set

GSA---GNSS DOP and Active Satellites

Table 5 contains the values for the following example:

\$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,,,,1.8,1.0,1.5*33<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		M Manual- forced to operate in 2D or 3D mode A Automatic-allowed to automatically switch 2D/3D
Mode 2	3		1 Fix not available 2 2D 3 3D
Satellite Used in solution	07		Sv on Channel 1
Satellite Used in solution	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

4. GSV data set

GSV--GNSS Satellites in View

Table 8 contains the values for 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<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages	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	
Azimuth	048	Degrees	Channel 1 (Maximum 90)
SNR (C/No)	42	DBHz	Channel 1 (True, Range 0 to 359)
Satellite ID	27		Range 0 to 99, null when not tracking
Elevation	27	Degrees	Channel 4 (Range 1 to 32)
Azimuth	138	Degrees	Channel 4 (Maximum 90)
SNR (C/No)	42	DBHz	Channel 4 (True, Range 0 to 359)
Checksum	*71		Range 0 to 99, null when not tracking
<CR> <LF>			End of message termination

Depending on the number of satellites tracked multiple messages of GSV data may be required.

5. RMC data set

RMC---Recommended Minimum Specific GNSS Data

Table 9 contains the values for the following example:

\$GPRMC,161229.487,A,3723.24751,N,12158.34161,W,0.13,309.62,120598, ,*10<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.24751		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west (Not shown)
Checksum	*10		
<CR> <LF>			End of message termination

6. VTG data set

VTG---Course Over Ground and Ground Speed

Table 10 contains the values for the following example:

\$GPVTG,309.62,T, ,M,0.13,N,0.2,K*6E<CR> <LF>

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

7. ZDA data set

ZDA---Contains information on UTC time, the data and local time

An example of a ZDA data set:

\$GPZDA,130305.2,20,06,2001,00,00,*57<CR> <LF>

Name	Example	Units	Description
Message ID	\$GPZDA		ZDA protocol header
UTC	130305.2		UTC Time: 13h 03min 05.2sec
Day	20		Day(00 ... 31)
Month	06		Month(1 ... 12)
Year	2001		Year
Local Zone hour	00		Reserved for data on local time(h)
Local Zone minutes	00		Reserved for data on local time(min)
Checksum	*57		Checksum
<CR> <LF>			End of message termination