ANTARIS™4 SuperSense

GPS Module

MG-LE4S

User's Manual Ver 1.02

No.208, Zhengkang 1st St., Taoyuan City,
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Introduction

1. Overview

Modulestek GPS module **MG-LE4S** 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-LE4S** 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.

Main Feature

16 channel ANTARIS4 positioning engine

Ultra high sensitivity to -158 dBm

Supports DGPS, WAAS, EGNOS and MSAS

Supports Power saving modes

Support 1 USB and 1 USART ports

Cost-optimized architecture (No Flash EPROM)

Configurable serial I/O baud/sentences setting (GPSMODE pins)

Antenna short/open circuit detection and protection

Ultra low power consumption 39mA

5 µA backup current

Small form factor 22.4 x 17.0 mm with SMT pads (micro package)

RoHS compliant (lead-free)

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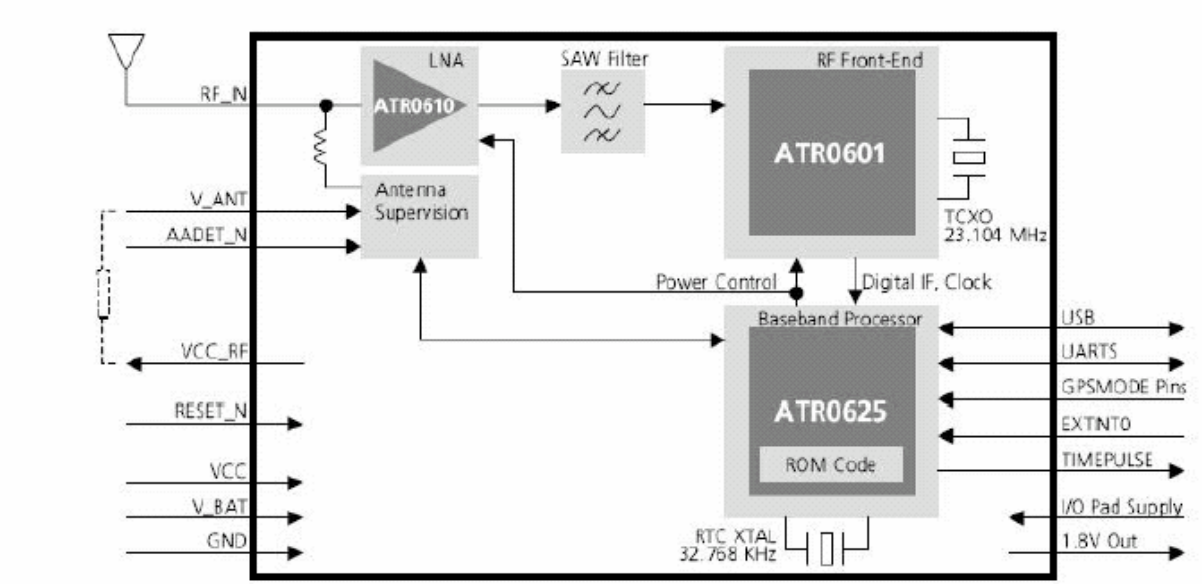
Block Diagram



Technical Specifications

1. Electrical Characteristics

1.1 Chipset	ATR0601, ATR0625	ATMEL ANTARIS4 GPS chipset family (ARM7TDMI Thumb processor core embedded)
1.2 General	Frequency	L1, 1575.42MHz
	Channels, C/A code	16, 1.023 MHz chip rate, 8192 time/frequency search windows
1.3 Accuracy	Position	2.5 meters CEP
	Time	50 nanosecond rms (1 PPS)
1.4 DGPS Accuracy	Position	2.0 meters CEP
1.5 Acquisition Rate	Reacquisition	< 1 sec, typical
	Cold start	34 sec, typical
	Warm start	33 sec, typical
	Hot start	3.5 sec, typical
1.6 Sensitivity	Tracking	-158dBm
	Acquisition/Reacquisition	-148dBm
1.7 Dynamic Condition	Altitude	18,000 meters (60,000 Feet) max.
	Velocity	515 meters /sec (1000 Knots) max.
1.8 Power	Main Power	3.3 VDC
	Supply current	39 mA 80uA in "power saving" mode
	Backup power	1.5 ~ 3.6V
	Backup current	5μA typical
1.9 Serial Port	Electrical interface	USART, USB
	Protocols	NMEA, UBX (ublox proprietary), RTCM
		Default I/O configuration 8 data bits, no parity, 1 stop bits USART1/USB: 9600 baud, output NMEA

2. Environmental Charateristics

2.1Temperature	Operating range	- 40 ℃ to + 85 ℃
2.2 Mechanical dimensions	L x W x H	22.4 x 17.0 x 3.0 mm
2.3 Interface	I/O connector	28 pin SMD micro package

3. Antenna

Parameter	Specification
3.1 Antenna type	Passive and/or active antenna
3.2 Active Antenna	15 ~ 20 dB Gain recommended (50dB max.) 1.5 dB noise figure max.
3.3 Antenna Supply	Using VCC_RF (pin #18) or external voltage source (pin#19)
3.4 Antenna Supervisor (see application circuit)	Short circuit detection (built-in) Open circuit detection enabled with external circuit

Mechanical Dimensions

MG-LE4S

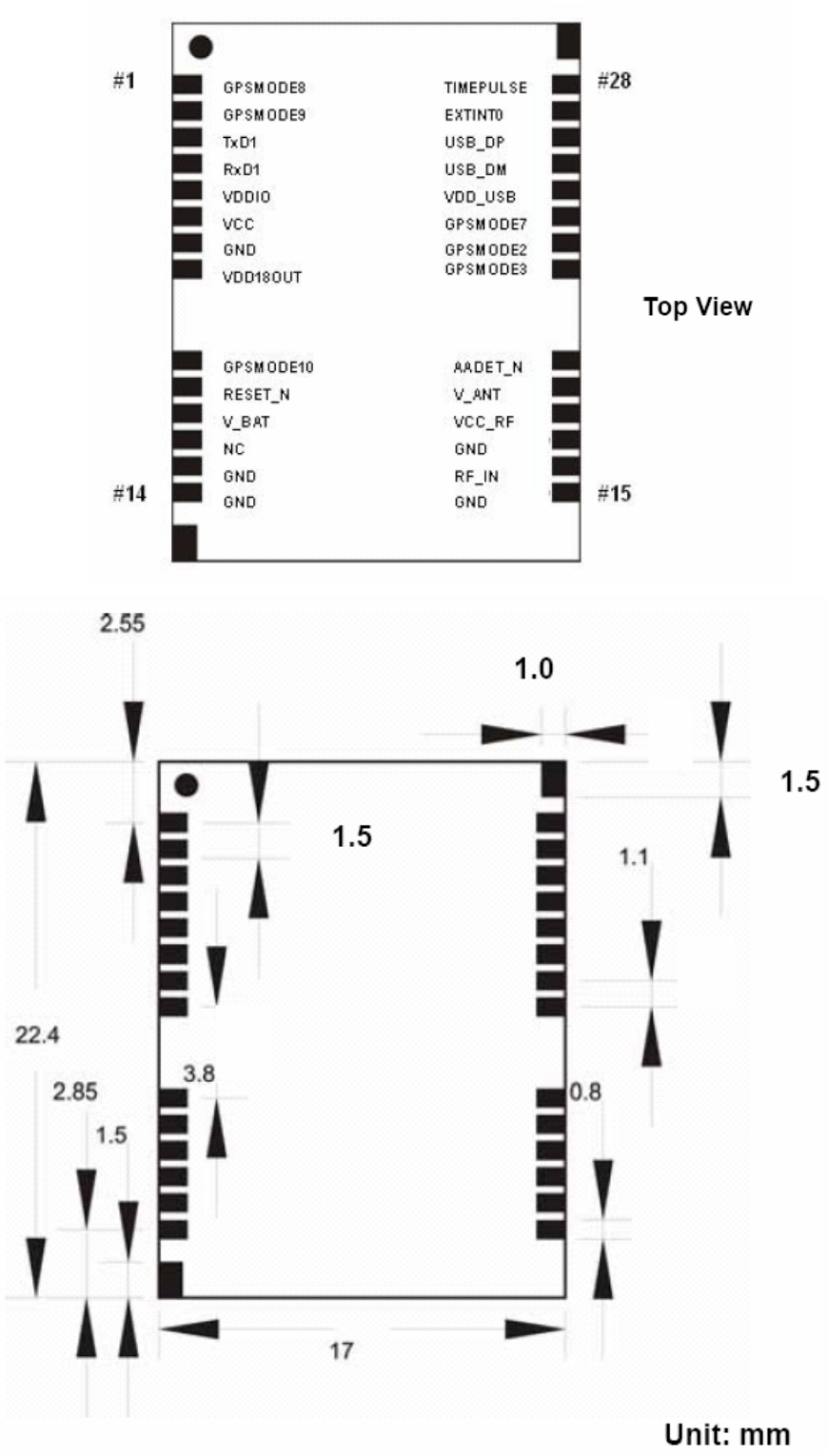


Figure 1: Board dimensions

Pin Define

Pin#	Name	Type	Description
1	GPSMODE8	I	Antenna detection configuration, keep floating
2	GPSMODE9	I	Antenna detection configuration, keep floating
3	TxD1	O	Serial Port 1, if not used keep floating
4	RxD1	I	Serial Port 1, if not used keep floating
5	VDDIO	I	Pad voltage supply, 3.3V typical
6	VCC	I	Supply voltage, 3.3V typical
7	GND	I	Ground
8	VDD18OUT	O	Internal 1.8V regulator output, if not used keep floating
9	GPSMODE10	I	Antenna detection configuration, keep floating
10	RESET_N	I	Reset Pin, active low, if not used keep floating
11	V_BAT	I	1.5V~ 3.6V Input for backup RTC&SRAM
12	NC		Not Connected, keep floating
13~15	GND	I	Ground
16	RF_IN	I	GPS signal input
17	GND	I	Ground
18	VCC_RF	O	Output Voltage RF section
19	V_ANT	I	Antenna Bias voltage
20	AADET_N	I	Active Antenna Detect (see application circuit)
21	GPSMODE3	I	Sensitivity mode configuration, keep floating
22	GPSMODE2	I	Sensitivity mode configuration, keep floating
23	GPSMODE7	I	USB Power Mode configuration, keep floating (Default is self-powered) (“0” is bus-powered)
24	VDD_USB	I	USB Supply, 3.3V typical
25	USB_DM	I/O	USB data
26	USB_DP	I/O	USB data
27	EXTINT0	I	External Interrupt Pin
28	TIMEPULSE	O	Time pulse (1 PPS)

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Default Serial I/O Configuration

USART1 Port Baud, Protocol	USB Port Baud, Protocol	Messages
9600, Output: NMEA, Input: NMEA, UBX, RTCM	9600, Output: NMEA, Input: NMEA, UBX	Medium (see Table 2)

Table 1

Messages

NMEA Protocol	GGA, GLL, GSA, GSV, RMC, VTG, ZDA
UBX Protocol	UBX-NAV, UBX-MON

Table 2

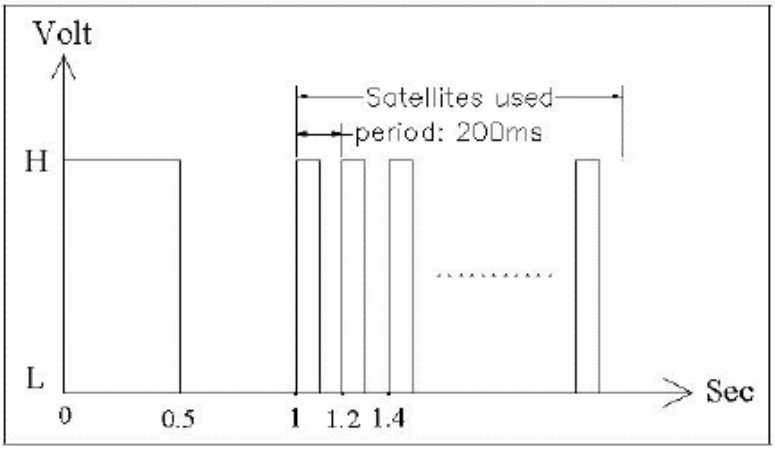

Figure 1

1. GGA data set

GGA--- Global Positioning System Fixed Data

Table 2 contains the values for the following example:

$GPGGA,161229.487,3723.2475,N,12158.3416,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	3723.2475		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
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

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2. GLL data set

GLL--- Geographic Position – Latitude/Longitude

Table 4 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C<CR> <LF>

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 termination

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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

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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 Messages1	2		Range 1 to 3
Message Number1	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.

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5. RMC data set

RMC---Recommended Minimum Specific GNSS Data

Table 9 contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,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	3723.2475		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 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

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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

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1. 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 mimutes	00		Reserved for data on local time(min)
Checksum	*57		Checksum
<CR> <LF>			End of message termination

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