

CP-M00-12E

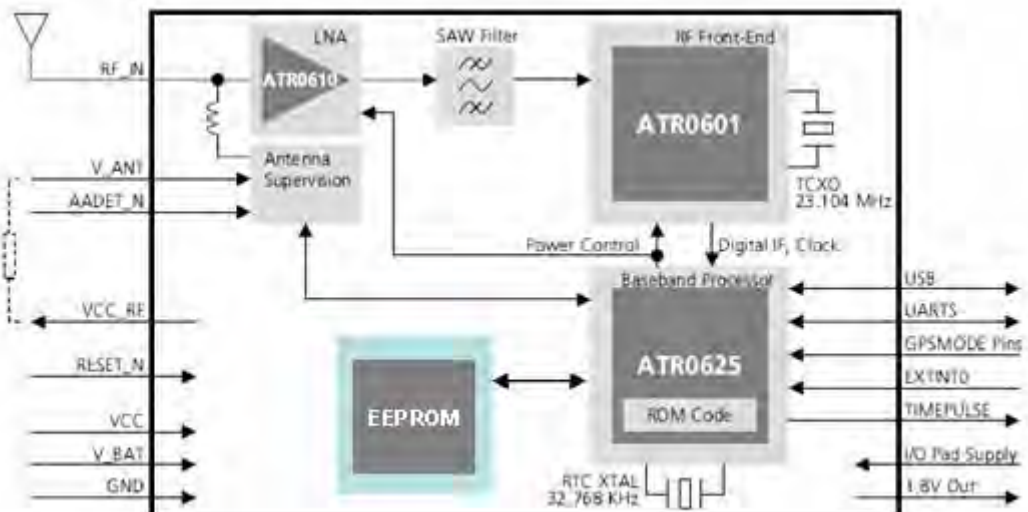
Enhanced ANTARIS4 GPS Module with ultra high sensitivity and antenna open/short detection/protection



Features

- ✓ 16 channel ANTARIS4 positioning engine
- ✓ Ultra high sensitivity to -158 dBm
- ✓ Supports DGPS, WAAS, EGNOS and MSAS
- ✓ Support 1 USB and 1 USART ports
- ✓ Customized and configurable serial I/O architecture (using on-board EEPROM)
- ✓ Support 4 Hz position update rate capability (using on-board EEPROM)
- ✓ Support power saving modes (using on-board EEPROM)
- ✓ Support external interrupt pin (wake up) in power saving mode
- ✓ Antenna short/open circuit detection and protection
- ✓ Ultra low power consumption 39mA
- ✓ 5 μ A backup current
- ✓ Low position/velocity drift in static mode
- ✓ Small form factor 22.4 x 17.0 mm with SMT pads (micro package)
- ✓ RoHS compliant (lead-free)

Block diagram



CP-M00-12E GPS module

Technical Specifications

1. Electrical Characteristics

1.1 Chipset	ATR0601, ATR0625	ATMEL ANTARIS4 GPS chipset family (ARM7TDMI Thumb processor core embedded)
1.2 General	Frequency Channels, C/A code	L1, 1575.42MHz 16, 1.023 MHz chip rate, 8192 time/frequency search windows
1.3 Accuracy	Position Time	2.5 meters CEP 50 nanosecond rms (1 PPS)
1.4 DGPS Accuracy	Position	2.0 meters CEP
1.5 Acquisition Rate	Reacquisition Cold start Warm start Hot start	< 1 sec, typical 34 sec, typical 33 sec, typical 3.5 sec, typical
1.6 Sensitivity	Tracking Acquisition/Reacquisition	-158dBm -148dBm
1.7 Dynamic Condition	Altitude Velocity	18,000 meters (60,000 Feet) max. 515 meters /sec (1000 Knots) max.
1.8 Power	Main Power Supply current	3.3 VDC 39 mA
	Backup power	80uA in "power saving" mode, (using on-board EEPROM). 1.5 ~ 3.6V
1.9 Serial Port	Backup current Electrical interface Protocols	5µA typical USART, USB NMEA, UBX (ublox proprietary), RTCM
		Default I/O configuration 8 data bits, no parity, 1 stop bits USART1/USB: 9600 baud, output NMEA Low position/velocity drift in static mode 4 Hz position update rate capability (using on-board EEPROM) Customized and configurable I/O (using on-board EEPROM).

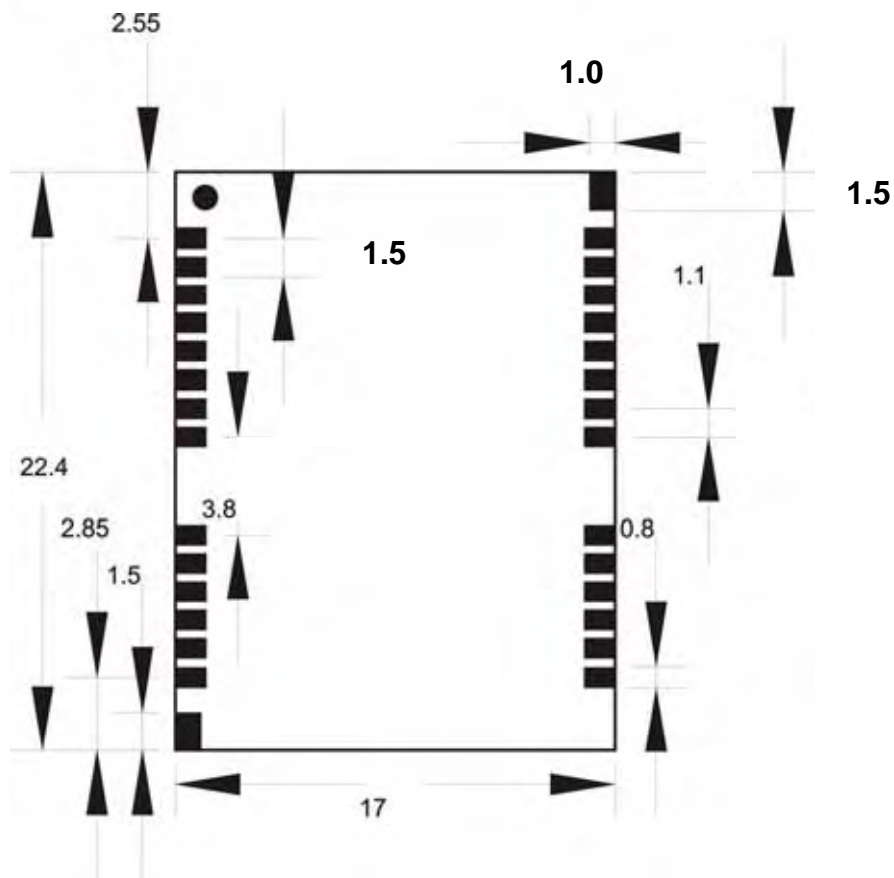
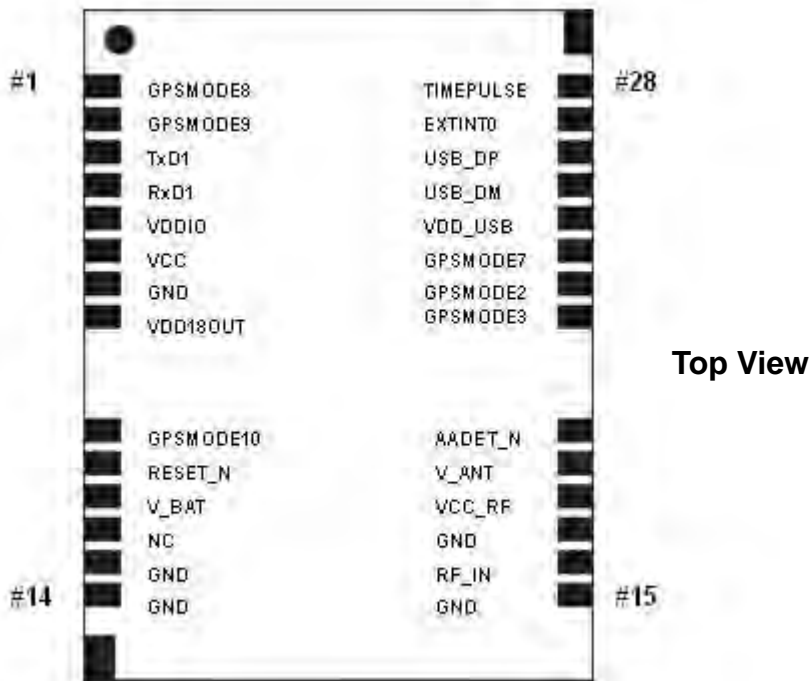
2. Environmental Characteristics

2.1 Temperature	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

Pin Assignment



Unit: mm

Pin Definition

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)

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

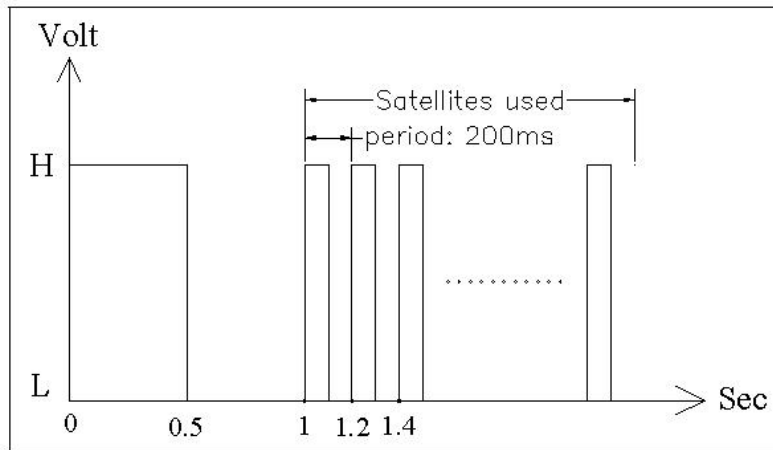


Figure 1

Customized and Configurable Serial I/O (using on-board EEPROM)

In principle, customized and configurable serial I/O can be properly set by sending proprietary input NMEA/UBX messages to CP-M00-12E on-board EEPROM memory. The serial I/O to be configured can be 1) Baud rate, 2) Output messages, 3) Navigation mode (including static hold threshold), 4) Power mode, 5) 4 Hz position update rate, 6) and other parameters.

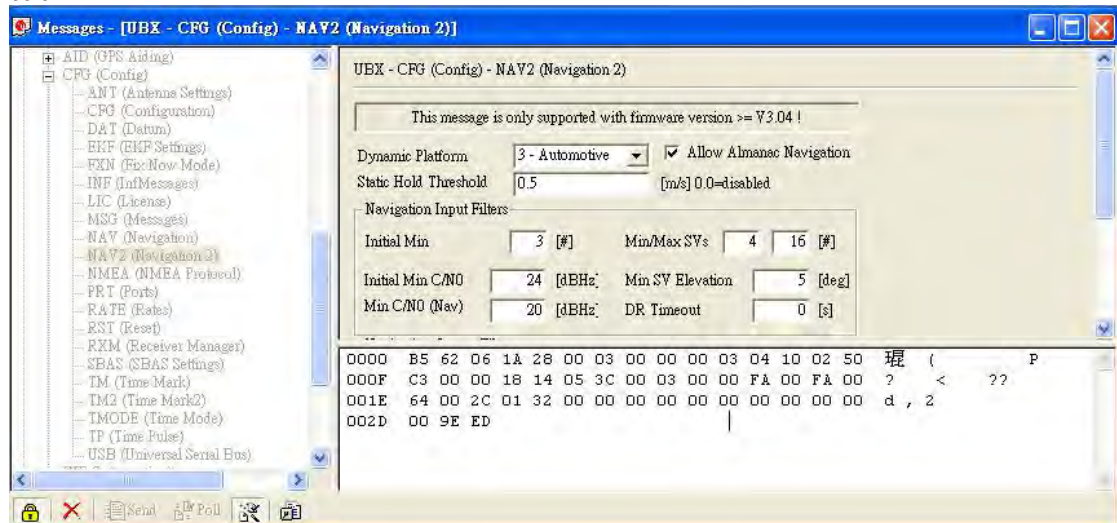
For detailed description, please refer to proprietary input NMEA/UBX protocol manual.

Here we present some typical examples

1. Change static hold threshold value (Item 3) to 0.5 m/s (factory: 0.9 m/s):

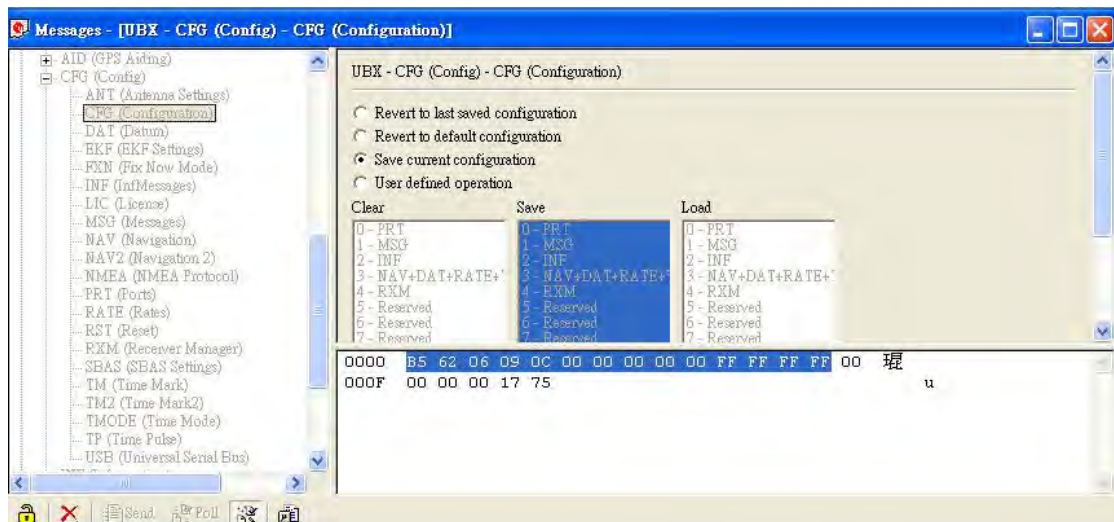
Send input UBX messages as follows

```
B5 62 06 1A 28 00 03 00 00 00 03 04 10 02 50
C3 00 00 18 14 05 3C 00 03 00 00 FA 00 FA 00
64 00 2C 01 32 00 00 00 00 00 00 00 00 00 00
00 9E ED
```



Then send

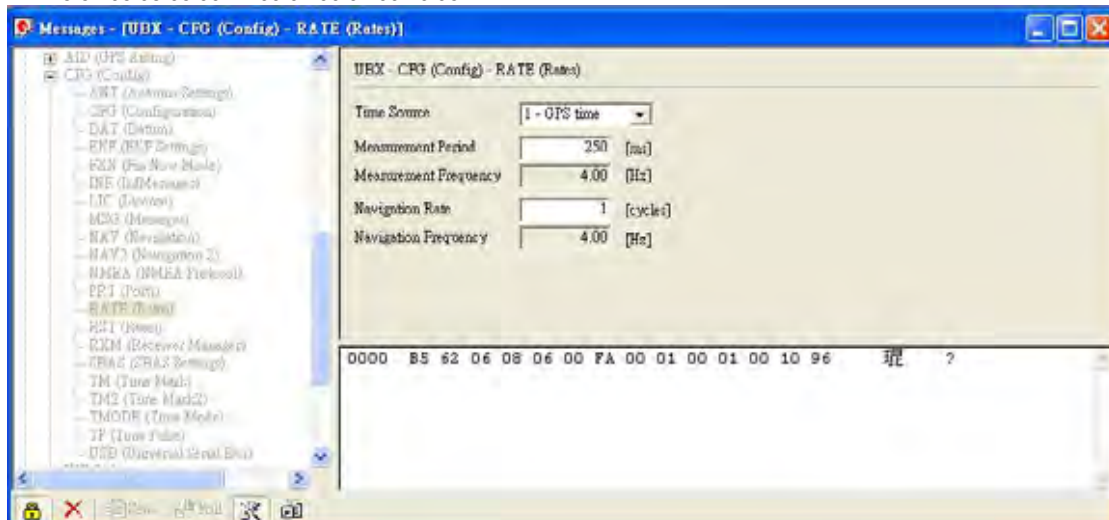
```
B5 62 06 09 0C 00 00 00 00 00 FF FF FF FF 00
00 00 00 17 75
```



2. Change position update rate (Item 5) to 4 Hz (factory: 1 Hz)

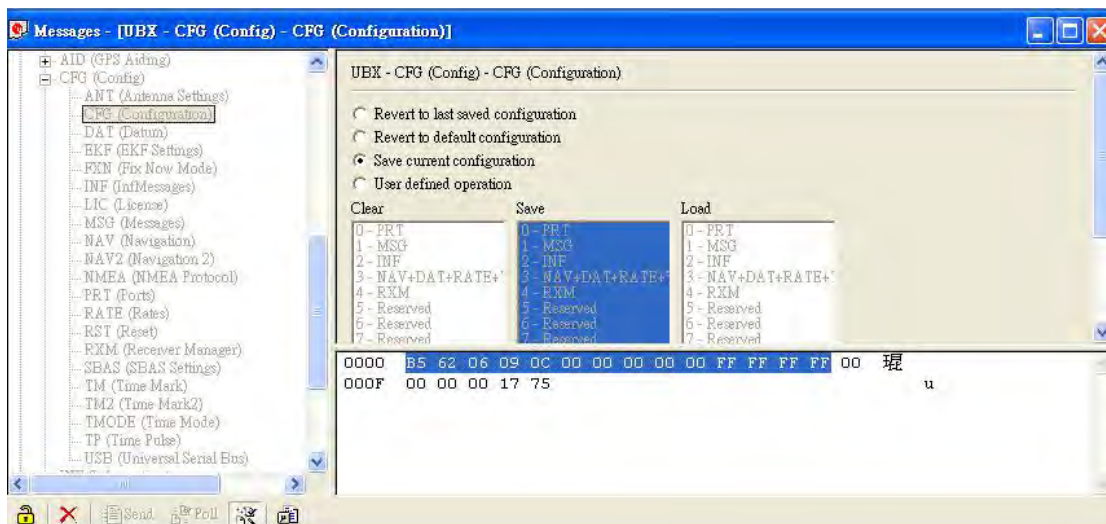
Send input UBX messages as follows

B5 62 06 08 06 00 FA 00 01 00 01 00 10 96



Then send

B5 62 06 09 0C 00 00 00 00 00 FF FF FF FF 00
00 00 00 17 75



However, the more preferable business model for serial I/O configuration is:
Customized requirement highlighted by “customer”, and
Customized implementation executed by “factory”!

Output NMEA Messages

Table 3 NMEA-0183 Output Messages

NMEA Sentence	Description
GGA (default)	Global positioning system fixed data
GLL (default)	Geographic position - latitude/longitude
GSA (default)	GNSS DOP and active satellites
GSV (default)	GNSS satellites in view
RMC (default)	Recommended minimum specific GNSS data
VTG (default)	Course over ground and ground speed
ZDA (default)	Time and date

GGA--- Global Positioning System Fixed Data

Table 4 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

Table 4 GGA Data Format

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		See Table 5
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

Table 5 Position Fix Indicator

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 6 contains the values for the following example:

\$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table 6 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 termination

GSA---GNSS DOP and Active Satellites

Table 7 contains the values for the following example:

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

Table 7 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 8
Mode 2	3		See Table 9
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

Table 9 Mode 2

Value	Description
1	Fix not available
2	2D
3	3D

Table 8 Mode 1

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 10 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

Table 10 GSV Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages ¹	2		Range 1 to 3
Message Number ¹	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

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

RMC---Recommended Minimum Specific GNSS Data

Table 11 contains the values for the following example:

\$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table 11 RMC Data Format

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

VTG---Course Over Ground and Ground Speed

Table 12 contains the values for the following example:
\$GPVTG,309.62,T, ,M,0.13,N,0.2,K,A*6E

Table 12 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
Mode	A		N=no fix, A=autonomous, D=DGPS, E=DR
Checksum	*6E		
<CR> <LF>			End of message termination

ZDA---Time and Date

Table 13 contains the values for the following example:
\$GPZDA,081727.00,01,02,2006,00,00*6A

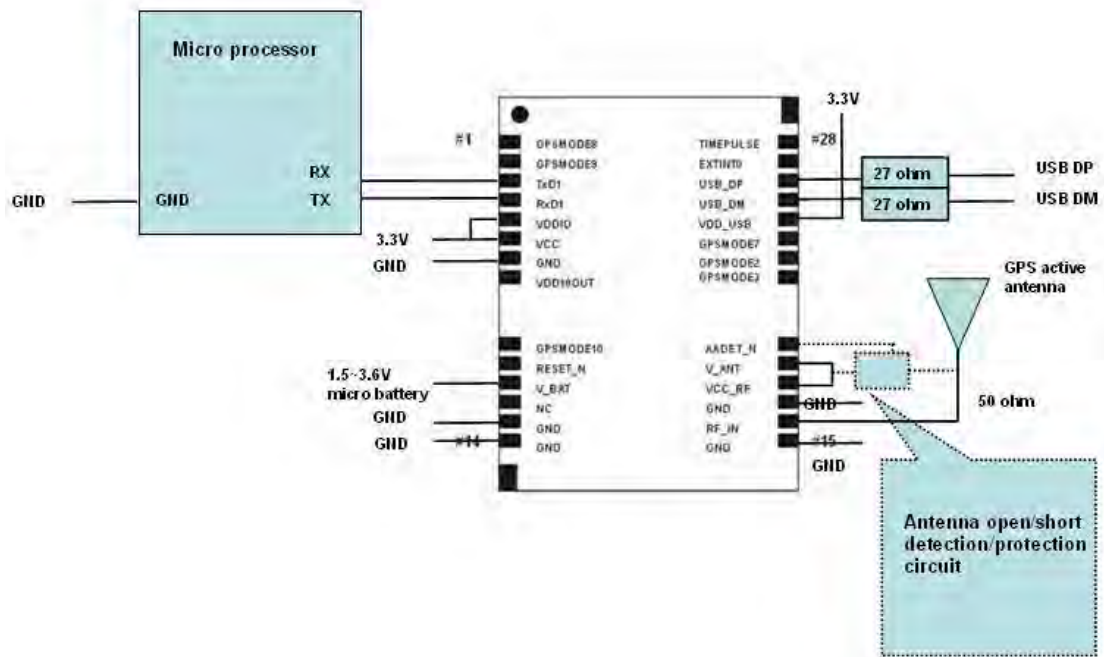
Table 13 ZDA Data Format

Name	Example	Units	Description
Message ID	\$GPZDA		ZDA protocol header
UTC position	081727.00	degrees	hhmmss.sss
Day	01		01 to 31
Month	02		01 to 12
Year	2006		4 digit year
Local zone hour	00		Not supported
Local zone minutes	00		Not supported
Checksum	*6A		
<CR> <LF>			End of message termination

Proprietary NMEA/UBX Messages

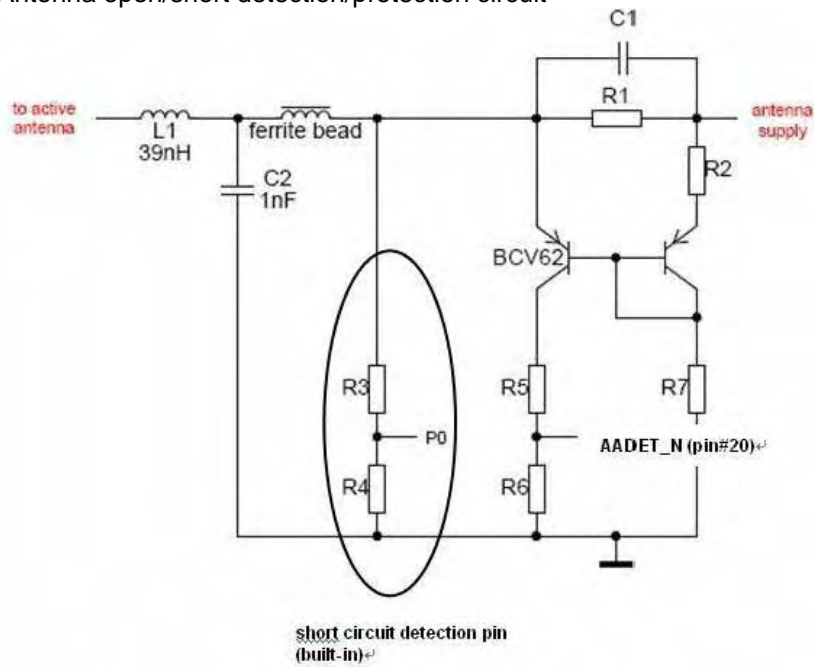
Please refer to detailed protocol manual.

Application Circuit



Application Circuit

Antenna open/short detection/protection circuit



component	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	C ₁
value	10 Ω	56 Ω	0	5.6 kΩ	0	5.6 kΩ	5.6 kΩ	1uF

Active/Passive antenna switch circuit

