Data Sheet / GE-A103

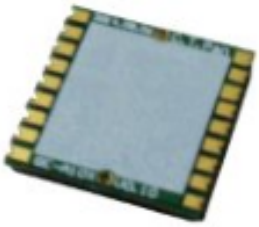
SiRFstarV

Tiny,

SMT-Mountable,

Ultra-High Performance,

GNSS Engine Board



RoHS
Compliant

Version 1.1

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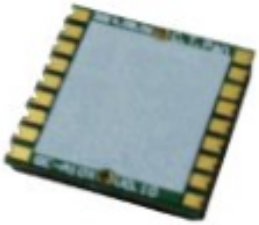
Revision History

Ver.	Date	Description
1.0	Jun. 25th, 2014	Initial release
1.1	Oct. 3rd , 2016	Support web page update

Contents

1 Introduction

1.1 Overview



As shown in above pictures, NaviSys GE-A103 is a thin, low-power, ultra-high performance, SMT-Mountable, easy to use GNSS engine board based on SiRF's 5th generation single chip. It fixes position based on multi-constellation satellite systems – GPS, GLONASS, QZSS and also SBAS (WAAS, EGNOS, MSAS, GAGAN).

Its low power consumption and high performance enables the adoption of various applications. The thin design allows it to be used in size-demanding device while still keeps its outstanding performance.

Antenna short circuit protection prevents it from incidental damage. Both active & passive antennas are supported. It is very easy to power active antenna – only connect pins 14 and 15, external RLC circuit is not required. Fast adoption and high yield production becomes possible.

1.2 Main Features

Not only portable devices but also any other GNSS applications can share the following major features of GE-A103.

- Multi-constellation support: GPS/GLONASS/QZSS
- SBAS (WAAS, EGNOS, MSAS, GAGAN) support
- Small: **9.7 (W) x 10.1 (L) x 2 (H)** (mm)
- Fully implementation of ultra-high performance **SiRFstarV** single chip architecture
- High tracking sensitivity of **-165dBm**
- Low power consumption of **29mA** at full tracking (42dB-Hz, 8 SVs)
- Up to 5Hz update rate
- Local ephemeris prediction
- Built-in flash for firmware patch/customization

- External backup power by pin V_BAT for faster position fix.
  - Only a current limit resistor is required. Do not need additional charging circuit.
- Support both passive and active antennas
  - Built-in filtered power for active antenna. Do not need external filtering circuit.
- External active antenna **short circuit protection**
- Supply power of external active antenna **without extra RLC component demand**
- Easy adoption with best performance
- Minimum RF and EMI efforts
- Multi-mode AGPS support

1.3 Receiver Specifications

Features	Specifications[!]
GPS receiver type	52 channels, GPS/QZSS: L1 1575.42MHz GLONASS: L1OF 1598.0625 ~ 1605.375 MHz
Horizontal Position Accuracy	< 2.5m (Autonomous) (50% 24hr static, -130dBm)
Velocity Accuracy	<0.01 m/s (speed) <0.01° (heading) (50%@30m/s)
Time accuracy	1μs or less
TTFF (Time to First Fix) (50%, -130dBm, autonomous)	Hot Start: 1s Warm Start: 30s Cold Start: 35s
Sensitivity (Autonomous)	Tracking: –165dBm Acquisition: -146dBm
Datum	WGS-84 (default)
Measurement data output	Update time: 1 second NMEA output protocol: V.4.00 Baud rate: 9600 (default), 19200, 38400, 115200 bps Datum: WGS-84 Default: GGA, GSA, GSV, RMC, VTG Other options: GLL, ZDA, or OSP protocol
Max. Altitude	<18,000 m
Max. Velocity	<1,852 km/hr
SBAS Support	WAAS, EGNOS, MSAS, GAGAN
Dynamics	<4g
Power consumption	29mA, continuous tracking mode, (42dB-Hz, 8 SVs)

Power supply	2.7~3.3V
Dimension (mm)	9.7 (W) x 10.1 (L) x 2 (H)
Operating temperature	-40°C ~ +85°C
Storage temperature	-40°C ~ +85°C

[1]Note. Data is from chip vendor.

1.4 Protocols

Both NMEA and OSP protocols could be supported via serial UART I/O port – RXD/TXD. The default supported protocol is NMEA protocol.

1. Serial communication channel
    i. No parity, 8-data bit, 1-stop bit (N-8-1)
    ii. User selectable baud rates among 1200, 2400, 4800, 9600 (default), 19200, 38400, 57600, 115200 bps.
2. NMEA 0183 Version 4.00 ASCII output
    i. Default GGA (1 sec), GSA (1 sec), GSV (5 sec), RMC (1 sec), VTG(1sec)
    ii. Optional GLL, ZDA
3. Baud rate, NMEA sentences, and update rate
    i. The baud rate of UART port is limited. More NMEA sentences or higher update rates may require higher baud rate. E.g.
        1. 4800bps is ok for GPS only output: GGA, GSA, RMC, VTG@1Hz, GSV@1/5Hz. However, the speed is too low to output GPS & GLONASS information simultaneously. In this case, at least 9600bps is required.
        2. Similarly, if 3 position updates per second is required in above GNSS example, baud rate of above 38400bps is suggested.

1.5 Antenna

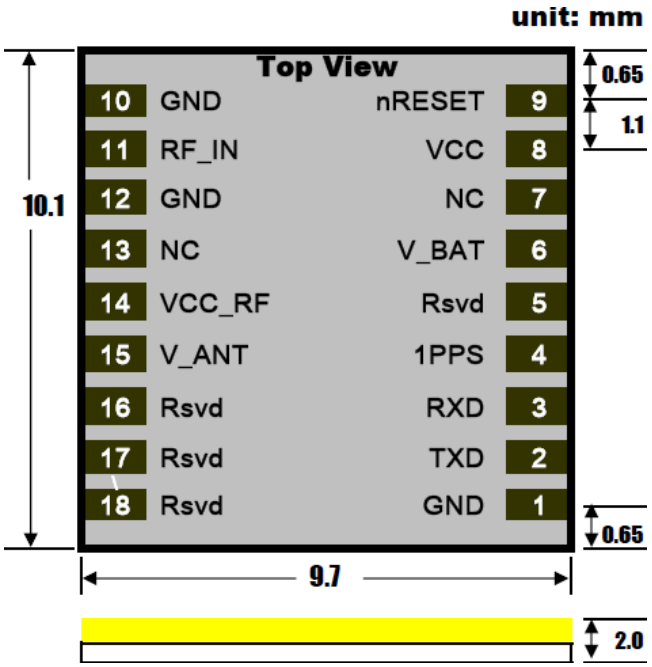
GE-A103 supports both active and passive antennas. For active antenna, suggest use

- gain between 16 and 30 dB
    - Gain of 16 dB is ok for cable length below 1m
    - For cable length of 3m or longer, suggest gain of above 26 dB
- noise figure less than 1.5 dB

2 Hardware Interface

2.1 Dimension

9.7 mm (W) x 10.1 mm (L) x 2 mm (H)



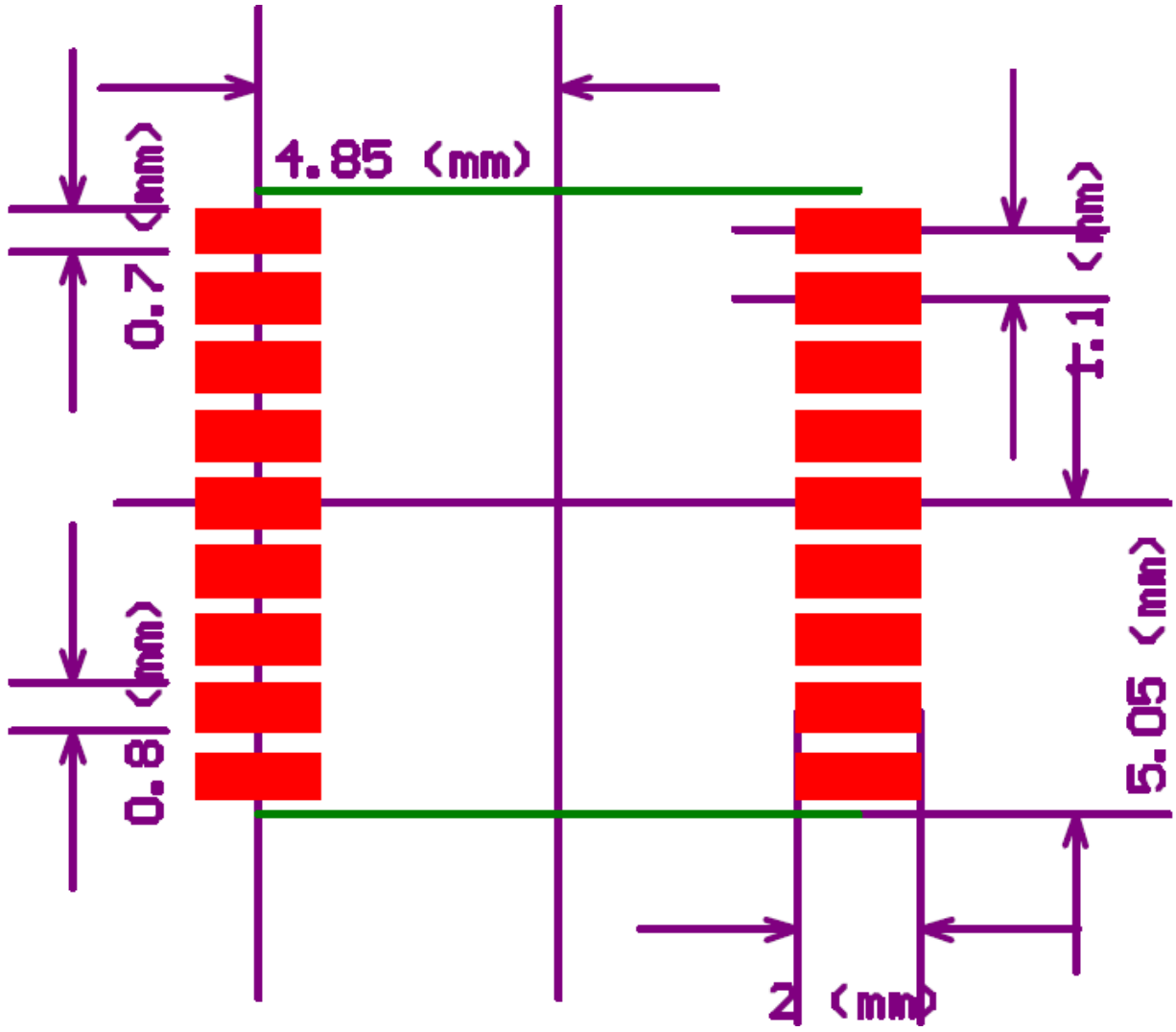
2.2 Pin Assignment

48-pin Interface

Pin	Name	Function	I/O
1	GND	Ground	Input
2	TXD	Serial data output (from GNSS)	Output
3	RXD	Serial data input (to GNSS)	Input
4	1PPS	1 Pulse Per Second signal	Output
5	Rsvd	Reserved pin, do not use.	Output
6	V_BAT	Backup power connection	Input
7	NC	No connection	-
8	VCC	3 ± 0.3 V power supply	Input
9	nRESET	Active low, at least 50us	Input
10	GND	Ground	Input
11	RF_IN	GPS signal from antenna	Input
12	GND	Ground	Input
13	NC	No connection	-

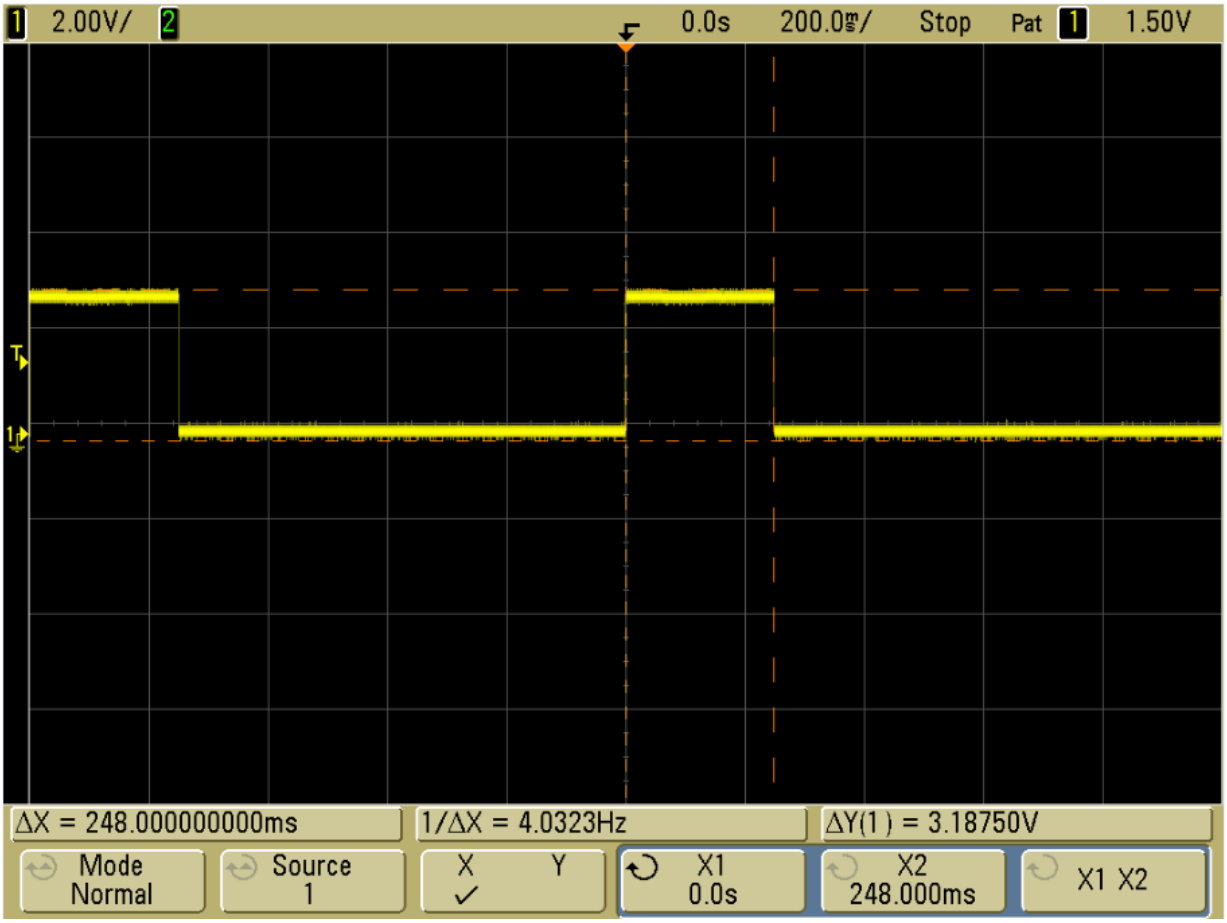
14	VCC_RF	VCC antenna power supply option. Connect it to V_ANT if VCC is used to supply an active antenna. Leave it open if this pin is not used, e.g. passive antenna is adopted.	Output
15	V_ANT	Active antenna power source option. Connect it to VCC_RF if VCC is used to supply an active antenna. Leave it open if it is not used, e.g. passive antenna is adopted.	Input
16	Rsvd	Reserved pin, do not use.	Input
17	Rsvd	Reserved pin, do not use.	Output
18	Rsvd	Reserved pin, do not use.	Output

2.3 Layout Suggestion



2.4 1PPS

In addition to the time synchronization function, the 1PPS signal could also be used to drive a LED for indicating the position fix status.



3 Software Interface

3.1 NMEA Output Messages

The NMEA-0183 Output Messages are shown as below:

NMEA Record	Descriptions
GGA	Global positioning system fixed data: time, position, fixed type
GLL	Geographic position: latitude, longitude, UTC time of position fix and status
GSA	GNSS receiver operating mode, active satellites, and DOP values
GSV	GNSS satellites in view: ID number, elevation, azimuth, and SNR values
RMC	Recommended minimum specific GNSS data: time, date, position, course, speed
VTG	Course over ground and ground speed
ZDA	PPS timing message (synchronized to PPS)

The GE-A103 adopts interface protocol of National Marine Electronics Association's NMEA-0183 Version 4.00 interface specification. GE-A103 supports 7 types of NMEA sentences (GGA, GLL, GSA, GSV, RMC, VTG, and ZDA).

The default output sentences are GGA, GSA, GSV, RMC and VTG. The UART communication parameters are 9600 bps, 8 data bits, 1 stop bit, and no parity. Other output sentences, baud rate, and related configurations could be requested based on MOQ.

Single message example

$GPGGA,062335.000,2446.4233,N,12100.4403,E,1,10,0.9,121.7,M,15.0,M,,0000*57

$GLGGA,062335.000,2446.4233,N,12100.4403,E,1,01,0.9,121.7,M,15.0,M,,0000*4B

$GNGLL,2446.4233,N,12100.4403,E,062335.000,A,A*45

$GNGSA,A,3,16,23,27,03,13,19,11,57,07,31,,,1.6,0.9,1.4*2A

$GNGSA,A,3,87,,,,,,,,,,,,1.6,0.9,1.4*28

$GPGSV,4,1,13,16,39,040,41,23,39,232,40,27,62,020,40,03,72,316,39*71

$GPGSV,4,2,13,13,40,276,38,19,76,255,37,11,29,192,36,57,26,146,33*7D

$GPGSV,4,3,13,07,18,321,33,31,13,132,26,30,24,070,,01,06,190,*7B

$GPGSV,4,4,13,21,02,040,*4E

$GLGSV,2,1,06,87,41,026,20,88,82,221,23,81,24,209,22,77,56,059,*6D

$GLGSV,2,2,06,78,31,341,,76,21,115,*6F

$GNRMC,062335.000,A,2446.4233,N,12100.4403,E,0.00,265.29,110614,,,A*7B

$GNVTG,265.29,T,,M,0.00,N,0.0,K,A*19

$GNZDA,062336.000,11,06,2014,,*4B

3.2 GGA - Global Positioning System Fix Data

- Example

  $GPGGA,062335.000,2446.4233,N,12100.4403,E,1,10,0.9,121.7,M,15.0,M,,0000*57

  $GLGGA,062335.000,2446.4233,N,12100.4403,E,1,01,0.9,121.7,M,15.0,M,,0000*4B

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GPGGA $GLGGA		GGA protocol header
UTC Time	064427.000		hhmmss.sss hh: hour, mm: minute, ss: second
Latitude	2446.4669		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.4261		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
Position Fix Indicator	1		0: Fix not available or invalid, 1: GPS SPS Mode, fix valid, 2: Differential GPS, SPS Mode, fix valid, 3~5: Not supported, 6: Dead Reckoning Mode, fix valid
Satellites Used	07		Number of satellites used in positioning calculation (0 to 12)
HDOP	1.2		Horizontal Dilution of Precision
MSL Altitude	251.0	meters	
Unit	M		Meters
Geoidal separation	15.0	meters	
Units	M		Meters
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
checksum	*53		
<CR><LF>			End of sentence

3.3 GLL - Geographic Position - Latitude / Longitude

- Example

  $GNGLL,2446.4233,N,12100.4403,E,062335.000,A,A*45

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNGLL		GLL protocol header
Latitude	2446.8619		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.2579		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
UTC Time	060725.000		hhmmss.sss hh: hour, mm: minute, ss: second
Status	A		A: Data valid, V: Data invalid
Mode Indicator	A		A: Autonomous, D: DGPS, E: DR
checksum	*7E		
<CR><LF>			End of sentence

3.4 GSA - GNSS DOP and Active Satellites

- Example

$GNGSA,A,3,16,23,27,03,13,19,11,57,07,31,,,1.6,0.9,1.4*2A

$GNGSA,A,3,87,,,,,,,,,,,,1.6,0.9,1.4*28

- Explanation

Contents	Example	Explanation
Message ID	$GNGSA	GSA protocol header
Mode 1	A	M: Manual—forced to operate in 2D or 3D mode A: 2D Automatic—allowed to automatically switch 2D/3D
Mode 2	3	1: Fix not available 2: 2D (< 4 Satellites used) 3: 3D (> 3 Satellite s used)
Satellite used in solution	05	Satellite on Channel 1
Satellite used in solution	02	Satellite on Channel 2
…		Display of quantity used (12 max)
PDOP	1.8	Position Dilution of Precision
HDOP	1.0	Horizontal Dilution of Precision
VDOP	1.5	Vertical Dilution of Precision
checksum	*11	
<CR><LF>		End of sentence

3.5 GSV - GNSS Satellites in View

- Example

$GPGSV,4,1,13,16,39,040,41,23,39,232,40,27,62,020,40,03,72,316,39*71

$GPGSV,4,2,13,13,40,276,38,19,76,255,37,11,29,192,36,57,26,146,33*7D

$GPGSV,4,3,13,07,18,321,33,31,13,132,26,30,24,070,,01,06,190,*7B

$GPGSV,4,4,13,21,02,040,*4E

$GLGSV,2,1,06,87,41,026,20,88,82,221,23,81,24,209,22,77,56,059,*6D

$GLGSV,2,2,06,78,31,341,,76,21,115,*6F

- Explanation

Contents	Example	Unit	Explanation

Message ID	$GPGSV $GLGSV		GSV protocol header
Number of messages	2		Range 1 to 8
Message number	1		Range 1 to 8
Satellites in view	07		Number of satellites visible from receiver
Satellite ID number	07		Channel 1 (GPS: Range 1 to 32)
Elevation	79	degrees	Elevation angle of satellite as seen from receiver channel 1 (00 to 90)
Azimuth	048	degrees	Satellite azimuth as seen from receiver channel 1 (000 to 359)
SNR (C/No)	42	dBHz	Received signal level C/No from receiver channel 1 (00 to 99, null when not tracking)
…			
Satellite ID number	27		Channel 4 (GPS: Range 1 to 32)
Elevation	27	degrees	Elevation angle of satellite as seen from receiver channel 4 (00 to 90)
Azimuth	138	degrees	Satellite azimuth as seen from receiver channel 4 (000 to 359)
SNR (C/No)	42	dBHz	Received signal level C/No from receiver channel 4 (00 to 99, null when not tracking)
checksum	*71		
<CR><LF>			End of sentence

3.6 RMC - Recommended Minimum Specific GNSS Data

- Example

  $GNRMC,062335.000,A,2446.4233,N,12100.4403,E,0.00,265.29,110614,,,A*7B

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNRMC		RMC protocol header
UTC Time	151229.487		hhmmss.sss hh: hour, mm: minute, ss: second
Status	A		A: Data valid, V: Data invalid
Latitude	3723.2475		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12148.3416		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	W		E: East Longitude, W: West Longitude
Speed over ground	0.13	knots	Receiver's speed
Course over ground	309.62	degrees	Receiver's direction of travel Moving clockwise starting at due north
Date	120598		ddmmyy dd: Day, mm: Month, yy: Year
Magnetic variation		degrees	This receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.
Mode Indicator	A		A: Autonomous M: Manual D: DGPS S: Simulation E: Dead Reckoning N: Data Invalid
checksum	*5F		
<CR><LF>			End of sentence

3.7 VTG - Course over Ground and Ground Speed

- Example

  $GNVTG,265.29,T,,M,0.00,N,0.0,K,A*19

- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNVTG		VTG protocol header
Course over ground	309.62	degrees	Receiver's direction of travel Moving clockwise starting at due north (geodetic WGS84 directions)
Reference	T		True
Course over ground		degrees	Receiver's direction of travel
Reference	M		Magnetic
Speed over ground	0.18	knots	Measured horizontal speed
Unit	N		Knots
Speed over ground	0.5	km/hr	Measured horizontal speed
Unit	K		km/hr
Mode Indicator	A		A: Autonomous, D: DGPS, E: DR
checksum	*0F		
<CR><LF>			End of sentence

3.8 ZDA - SiRF Timing Message

- Example

  $GNZDA,062336.000,11,06,2014,,*4B

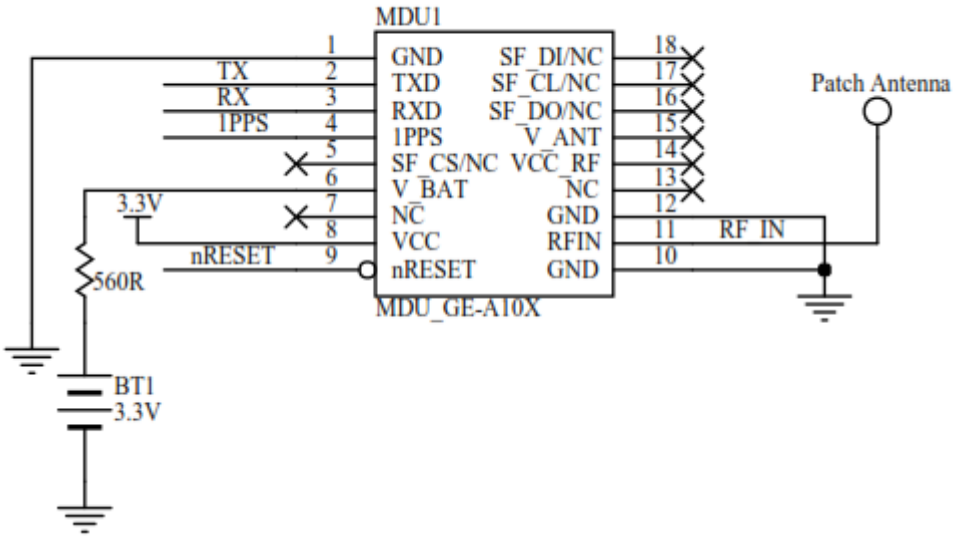
- Explanation

Contents	Example	Unit	Explanation
Message ID	$GNZDA		ZDA protocol header
UTC time	093330.000		Either using valid IONO/UTC or estimated from default leap seconds
Day	20		Day according to UTC time (01 to 31)
Month	05		Month according to UTC time (01 to 12)
Year	2013		Year according to UTC time (1980 to 2079)
Local zone hour		hour	Offset from UTC (set to 00)
Local zone minutes		minute	Offset from UTC (set to 00)
checksum	*5B		
<CR><LF>			End of sentence

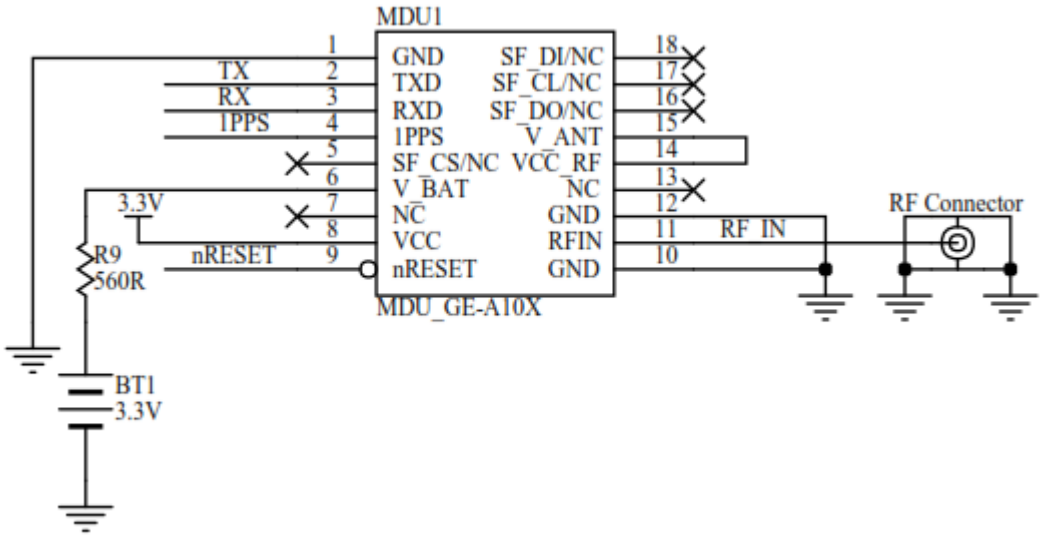
4 Applications

4.1 Application of Passive Antenna

Connect RF_IN pin to a passive antenna, e.g. patch antenna. Please note that the signal from passive antenna is very weak and thus the path should be well protected from noise signal and the length should be as short as possible.



4.2 Application of Active Antenna

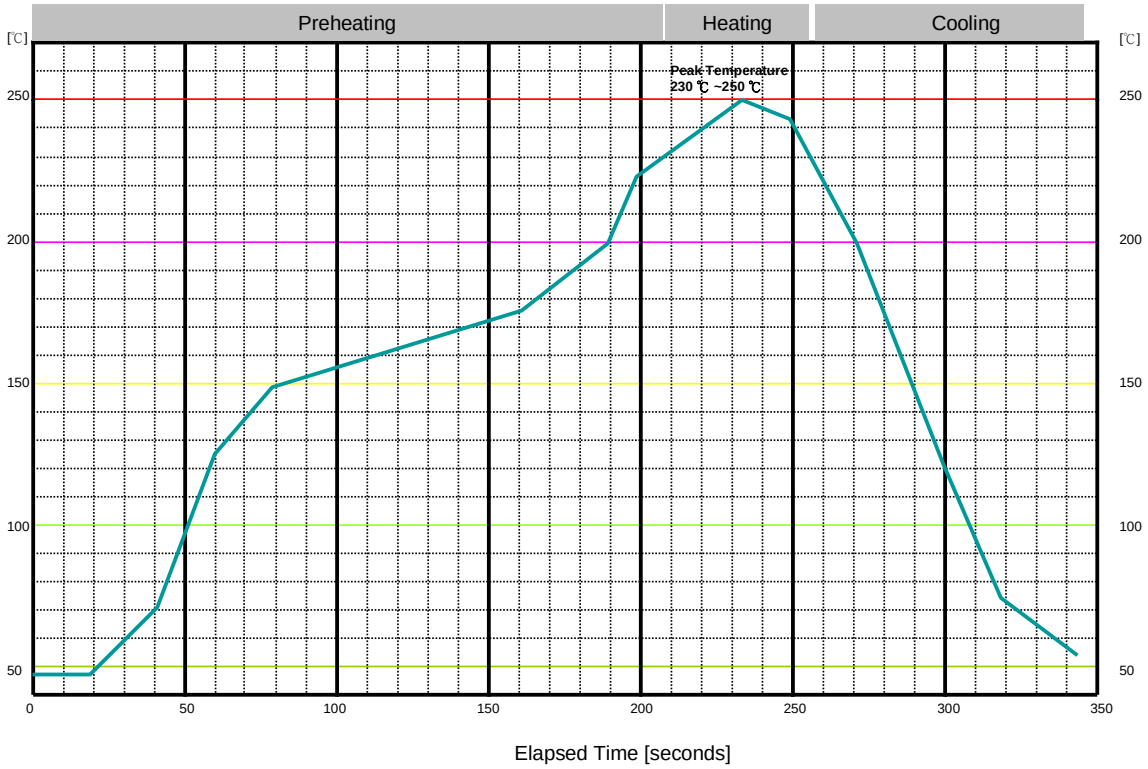


With our special design, it's very easy to power an external active antenna with the internal power (derived from VCC) of GE-A103. Just connecting VCC_RF (pin 14) and V_ANT (pin 15) is enough to power an external active antenna. The working voltage of external antenna is same as VCC. In addition, external active antenna short circuit protection is provided.

4.3 Reference Soldering Profile

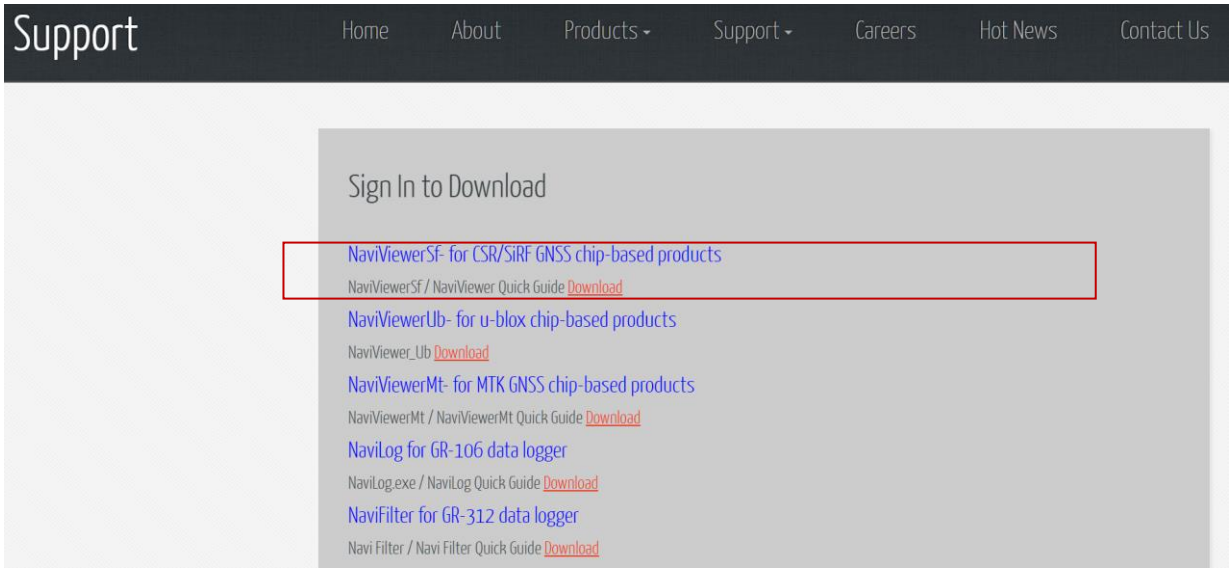
The following soldering profile is for the reference purpose only. The best profile depends on the reflow equipment.

Reference Lead-free Soldering Profile



4.4 Navisys GNSS Viewer Tool

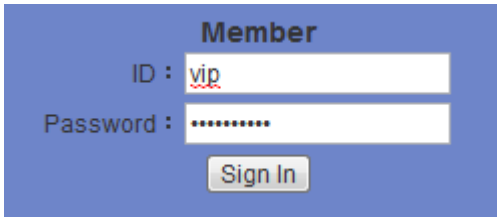
The GNSS viewer tool, **NaviViewerSf,** is ready for download from Navisys support web page - http://www.navisys.com.tw/support.html.

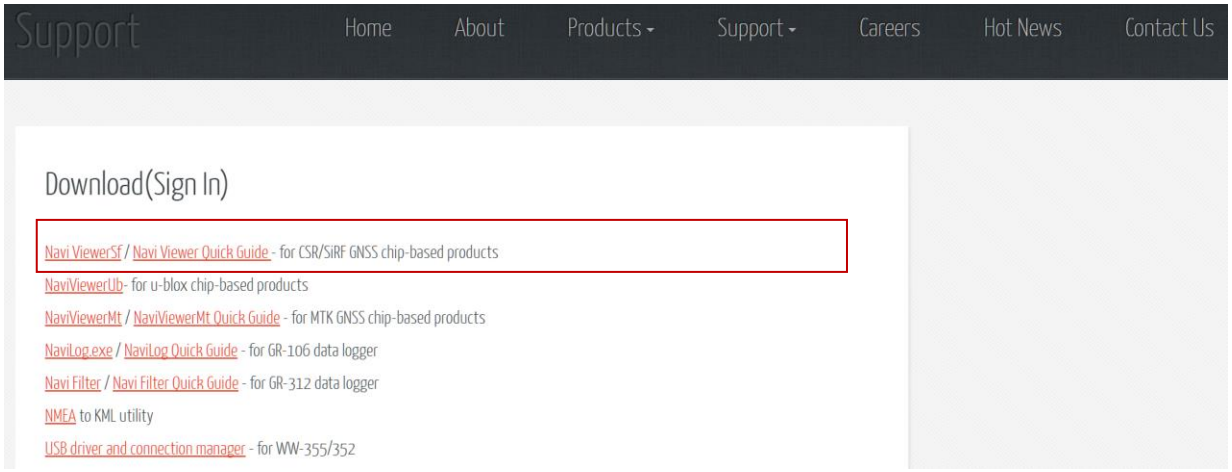


Please sign in to download the NaviViewerSf with

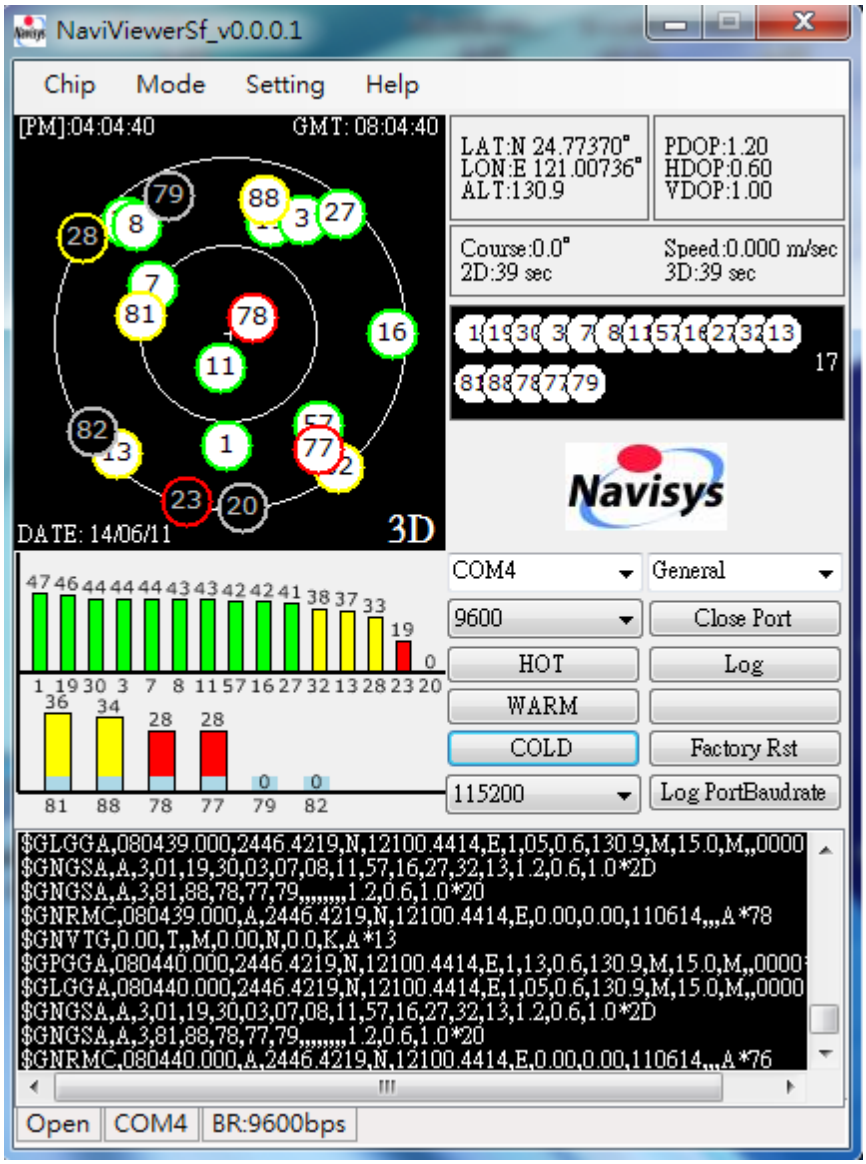
ID: vip

Password: navi-utility





NaviViewerSf GNSS Viewer Tool



1. Signal strength is represented by the bar length and color
   - Blue: ≧ 50, green: ≧ 40, yellow: ≧ 30, red: < 30
2. Satellites of different systems are displayed by different bar colors:
   - GPS: one color
   - QZSS: purple rectangle at the bottom
   - GLONASS: cyan rectangle at the bottom

5 Electrical and Environmental Data

Electrical Data

Power Supply	2.7 ~ 3.3 VDC
Power Consumption	29 mA/average tracking (42dB-Hz, 8 SVs)
Backup Battery Supply	VCC – 0.2V ~ 3.6V
Digital I/O	V_{IH}: 0.7 x V_BAT ~ 3.6V, V_{IL}: 0 ~ 0.4V V_{OH}: ≧ 0.75 x V_BAT, V_{OL}: ≦ 0.4V
Protocols	NMEA (default), OSP

Environmental Data

Operating temperature	-40 ~ 85℃
Storage temperature	-40 ~ 85℃
Vibration	5Hz to 500Hz, 5g
Shock	Half sine 30g/11ms

6 Ordering Information

Each product has a default configuration. Customer is highly advised to check the product configuration before ordering.

GE-A103X,

X=A	9600bps GGA, GSA, RMC, VTG@1Hz, GSV@1/5Hz