



EM-401

GPS ENGINE BOARD with Active Antenna PRODUCT GUIDE

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EM-401 GPS BOARD with Active Antenna OVERVIEW

- * Compact Size
- * SiRF StarII low power consumption chip set
- * Built-in active antenna
- * Support standard NMEA 0183 protocol
- * All-in-view 12-channel parallel processing
- * Snap Lock 100mc re-acquisition time
- * Enhanced algorithm for navigation stability
- * Superior urban canyon performance
- * Foliage Lock for Weak signal tracking
- * Built-in super cap to reserve system data for rapid satellite acquisition

SPECIFICATIONS

Electrical Characteristics

Receiver

Frequency	L1, 1575.42 MHz
C/A code	1.023 MHz chip rate
Channels	12
Sensitivity	-170dBW

Accuracy

Position	15 meters, 2D RMS, SA off
	10 meters, 2D RMS, WAAS enabled, SA off
Velocity	0.1 m/s 95% (SA off)
Time	1 microsecond synchronized to GPS time

Datum

Default	WGS-84
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Acquisition Time

Reacquisition	0.1 sec., average
Hot start	8 sec., average
Warm start	38 sec., average
Cold start	48 sec., average



Dynamic Conditions

Altitude	18,000 meters (60,000 feet) max
Velocity	515 meters /second (1000 knots) max
Acceleration	Less than 4g
Jerk	20m/sec **3

Power

Main power input	3.3 Vdc ~ 5.5Vdc
Current supply	Continuous mode: 80mA Trickle power mode:27mA

Serial Port

Electrical level	TTL level, Output voltage level: 0V ~ 2.85V
Communication	Full duplex asynchronous
GPS Protocol	NMEA 0183 or SiRf binary
Output NMEA sentences	GGA, GSA, GSV, RMC (VTG and GLL are optional)
GPS transfer rate	Software command setting (Default: 4800,n, 8,1)

Environmental Characteristics

Temperature

Operating	-20 deg. C to +80 deg. C
Storage	-40 deg. C to +85 deg. C
Humidity	5% to 95% non-condensing

Dimension

41*41*14mm

Antenna Specifications

Antenna

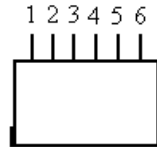
Frequency	1575.42+2MHz
VSWR	1.5 Max.
Bandwidth	10 MHz Min.
Axial Ratio	3 dB Typical
Impedance	50 (OHMS)
Peak Gain	4 dBic Min.
Gain Coverage	≥ -4dBic at 90 deg~ 90deg (over 75% volume)
Power handling	1 watt
Polarization	RHCP

Amplifier Module

Amplifier Gain	27dB Typical
Noise Figure	1.5 dB Typical
Filtering	-25dB (± 100MHz)
Output VSWR	2.0 Max.
Voltage	DC3~5V
Current	20mA Max.

DIMENSIONS

PIN ASSIGNMENT



1 : GND
2 : GND
3 : RESET
4 : RX
5 : TX
6 : VIN

PIN DESCRIPTION

#1 & #2 GND:

GND provides the ground for the engine board. Connect all grounds.

#3 RESET:

This pin provides an active-low reset input to the GPS board it causes the GPS to reset and start searching for satellites

#4 RXA:

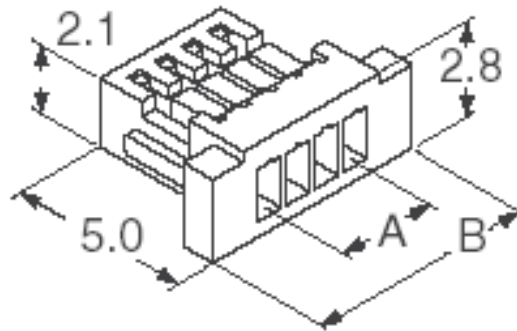
This is the main receive channel for receiving software commands to the engine board from SiRFdemo software or from user written software.

#5 TXA:

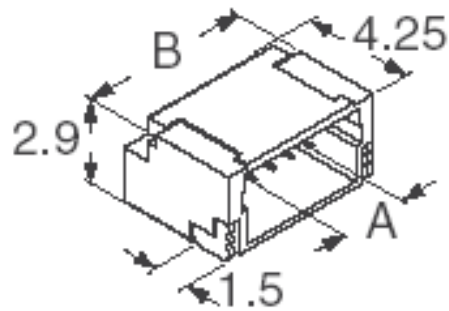
This is the main transmits channel for outputting navigation and measurement data to user's navigation software or user written software.

#6 VIN (DC power input):

This is the main DC supply for a 3.3V ~5.5 DC input power.



Female Cable Connector
Digi-Key Part No: 455-1381-ND



Male PCB Header
Digi-Key Part No: 455-1401-ND

All product specifications subject to change without notice.

NMEA OUTPUT COMMANDS

GGA-Global Positioning System Fixed Data

Table B-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

Table B-2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	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	1		See Table B-3
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude ¹	9.0	meters	
Units	M	meters	
Geoid Separation ¹		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

SiRF Technology Inc. does not support geoid corrections. Values are WGS84 ellipsoid heights.

Table B-3 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 B-4 contains the values for the following example:
 \$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table B-4 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 B-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

Table B-5 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode1	A		See Table B-6
Mode2	3		See Table B-7
Satellite Used ¹	07		Sv on Channel 1
Satellite Used ¹	02		Sv on Channel 2
.....			
Satellite Used ¹			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

(1. Satellite used in solution)

Table B-6 Mode1

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	2Dautomatic-allowed to automatically switch 2D/3D

Table B-7 Mode 2

Value	Description
1	Fix Not Available
2	2D
3	3D



GSV-GNSS Satellites in View

Table B-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

Table B-8 GSV Data Format

Name	Example		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	Channel 1(Maximum90)
Azimuth	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 32)
Elevation	27	Degrees	Channel 4(Maximum90)
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.

MSS-MSK Receiver Signal

Table B-9 contains the values for the following example:

\$GPMSS,55,27,318.0,100,*66

Table B-9 MSS Data Format

Name	Example	Units	Description
Message ID	\$GMSS		MSS protocol header
Signal Strength	55	dB	SS of tracked frequency
Signal-to-Noise Ratio	27	dB	SNR of tracked frequency
Beacon Frequency	318.0	kHz	Currently tracked frequency
Beacon Bit Rate	100		Bits per second

The MSS NMEA message can only be polled or scheduled using the MSK MNEA input message. Reference "MSK-MSK Receiver Interface" (Note: Available upon request, not included in this document).

RMC-Recommended Minimum Specific GNSS Data

Table B-10 contains the values for the following example:

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

Table B-10 RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	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 ²		degrees	E=east or W=west
Checksum	*10		
<CR><LF>			End of message termination

SiRF Technology Inc. does not support magnetic declination. All "course over ground" data are geodetic WGS48 directions.

VTG-Course Over Ground and Ground Speed

Table B-10 contains the values for the following example:

\$GPVTG,309.62,T,,M,0.13,N,0.2,K*6E

Table B-11 RMC 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		Kilometers per hour
Checksum	*6E		
<CR><LF>			End of message termination

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