



SISO Hornet (ORG4402) GPS RECEIVER MODULE

Datasheet

OriginGPS.com



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1. SCOPE

This document describes the features and specifications of SISO Hornet ORG4402 GPS receiver module.

2. DISCLAIMER

All trademarks are properties of their respective owners.

Performance characteristics listed in this document do not constitute a warranty or guarantee of product performance. OriginGPS assumes no liability or responsibility for any claims or damages arising out of the use of this document, or from the use of integrated circuits based on this document.

OriginGPS assumes no liability or responsibility for unintentional inaccuracies or omissions in this document. OriginGPS reserves the right to make changes in its products, specifications and other information at any time without notice.

OriginGPS reserves the right to conduct, from time to time, and at its sole discretion, firmware upgrades. As long as those FW improvements have no material change on end customers, PCN may not be issued. OriginGPS navigation products are not recommended to use in life saving or life sustaining applications.

3. SAFETY INFORMATION

Improper handling and use can cause permanent damage to the product.

4. ESD SENSITIVITY

This product is ESD sensitive device and must be handled with care.



5. CONTACT INFORMATION

Support - info@origingps.com or [Online Form](#)

Marketing and sales - marketing@origingps.com

Web – www.origingps.com

6. RELATED DOCUMENTATION

No	DOCUMENT NAME
1	Micro Spider – ORG4475 Evaluation Kit Datasheet
2	Micro Spider – ORG4475 Product Change Notification
3	Spider and Hornet - Software User Manual for CSR® based receivers
4	Spider and Hornet - NMEA Protocol Reference Manual for CSR® based receivers
5	Spider and Hornet - One Socket Protocol Reference Manual for CSR® based receivers
6	Spider and Hornet - Host Interface Application Note
7	Spider and Hornet - Low Power Modes Application Note
8	Spider and Hornet - Jammer Detector and Remover Application Note
9	Spider and Hornet - Client Generated Extended Ephemeris Application Note
10	Spider and Hornet - Server Generated Extended Ephemeris Application Note
11	Spider and Hornet - Ephemeris Push Application Note

TABLE 1 – RELATED DOCUMENTATION

7. REVISION HISTORY

REVISION	DATE	CHANGE DESCRIPTION
B00	February 2, 2011	First release
2.0	January 14, 2015	Format update

TABLE 2 – REVISION HISTORY



8. GLOSSARY

A-GNSS Assisted GNSS
BPF Band Pass Filter
CE European Community conformity mark
CGEE™ Client Generated Extended Ephemeris
CMOS Complementary Metal-Oxide Semiconductor
COMPASS PRC GNSS (same as **BDS** BeiDou-2 Navigation Satellite System)
EGNOS European Geostationary Navigation Overlay Service
EMC Electro-Magnetic Compatibility
ESD Electro-Static Discharge
EVB Evaluation Board
EVK Evaluation Kit
FCC Federal Communications Commission
GALILEO EU GNSS
GLONASS Global Navigation Satellite System
GNSS Global Navigation Satellite System
GPS Global Positioning System
I²C Inter-Integrated Circuit
IC Integrated Circuit
ISO International Organization for Standardization
LDO Low Dropout regulator
LGA Land Grid Array
LNA Low Noise Amplifier
MSAS Multi-functional Satellite Augmentation System
MSL Moisture Sensitivity Level
NFZ™ Noise-Free Zones System
NMEA National Marine Electronics Association
MEMS MicroElectroMechanical Systems
PCB Printed Circuit Board
PPS Pulse Per Second
QZSS Quasi-Zenith Satellite System
REACH Registration, Evaluation, Authorisation and Restriction of Chemical substances
RF Radio Frequency
RHCP Right-Hand Circular Polarized
RoHS Restriction of Hazardous Substances directive
ROM Read-Only Memory
RTC Real-Time Clock
SAW Surface Acoustic Wave
SBAS Satellite-Based Augmentation Systems
SGEE™ Server Generated Extended Ephemeris
SIP System In Package
SMD Surface Mounted Device
SMT Surface-Mount Technology
SOC System On Chip
SPI Serial Peripheral Interface
TCXO Temperature-Compensated Crystal Oscillator
TTF Time To First Fix
TTL Transistor-Transistor Logic
UART Universal Asynchronous Receiver/Transmitter
WAAS Wide Area Augmentation System



9. ABOUT HORNET FAMILY

OriginGPS' Hornet family is offering the industry's smallest fully-integrated, highly-sensitive GPS and GNSS modules with integrated antennas or on-board RF connectors.

Hornet family features OriginGPS' proprietary NFZ™ technology for high sensitivity and noise immunity even under marginal signal condition, commonly found in urban canyons, under dense foliage or when the receiver's position in space rapidly changes.

Hornet family enables the shortest TTM (Time-To-Market) with minimal design risks.

Just connect power supply on a single layer PCB.

10. ABOUT SISO HORNET MODULE

SISO Hornet offers an optimized receiver and antenna combination with unconditional frequency stability, improved noise immunity, higher sensitivity, and enhanced SNR (Signal to Noise) levels. The optimized combination not only decreases the footprint, but also minimizes design risks and reduces time to market.

Measuring only 17x17x4.8mm and weighing 11 gr., SISO Hornet is a small fully integrated GPS antenna module. Despite its small size and weight, the Hornet family integrates a patch antenna element, LNA, SAW filter, TCXO, RTC crystal, RF shield and Power Management Unit with SiRFStarIV™ GPS processor.

The SISO Hornet module offers superior sensitivity and outstanding performance, achieving rapid time to first fix (TTFF) in less than 1sec., accuracy of approximately 1m, and tracking sensitivity down to -163dB

11. ABOUT ORIGINGPS

OriginGPS is a world leading designer, manufacturer and supplier of miniature positioning modules, antenna modules and antenna solutions.

OriginGPS modules introduce unparalleled sensitivity and noise immunity by incorporating Noise Free Zone system (NFZ™) proprietary technology for faster position fix and navigation stability even under challenging satellite signal conditions.

Founded in 2006, OriginGPS is specializing in development of unique technologies that miniaturize RF modules, thereby addressing the market need for smaller wireless solutions.



12. INTERFACE

12.1. PIN ASSIGNMENT

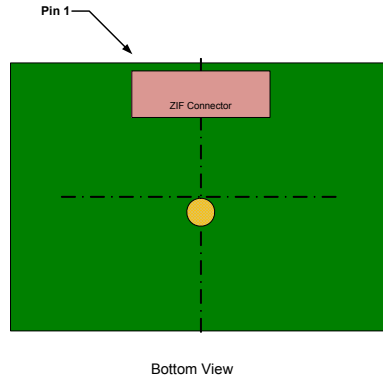


FIGURE 1 – ORG4402

Pad Number	Pad Name	Pad Description	Direction	Default	Notes
1	GND	System Ground	Power		
2	1PPS	UTC Time Mark	Output	Low	1.8V compatible
3	GPS_nRESET	Asynchronous Reset	Input	High	
4	GPS_RX	UART Receive	Input	High	VIH(max) = 3.6V
5	WAKEUP	Power State Indicator	Output		High for Full Power, Low for Hibernate
6	GPS_ON	Power State Control	Input	Low	Toggle Low-High-Low for power up
7	GPS_EN	Module Enable	Input	High	Drive low to inhibit the module
8	GPS_TX	UART Transmit	Output	Low	VOH = VCC – 0.1V
9	VCC	System Power	Power		2.1- 5.5V
10	NC	Not Connected			

TABLE 3 – ORG4402 PIN-OUT

12.2. CONNECTIVITY

Interface connector

The ORG4402 interface connector is 10 position, 0.50mm (.020") Pitch, FFC/FPC ZIF Right Angle Molex p/n 527461071



Power

The ORG4402 series module requires only one power supply VCC, which can be supplied directly from a battery since the module has internal regulators.

It is recommended to keep the power supply on all the time in order to maintain the non-volatile RTC and RAM active for fastest possible TTF. When the VCC is powered off settings are reset to factory default and the receiver performs Cold Start on next power up.

Power supply

VCC range is 2.1 to 5.5V DC.



Typical ICC current is 23mA@3.3V during acquisition. Peak ICC current is 50 mA.
 Power supply current consumption varies according to the processor load and satellite acquisition.
 Typical ICC current in Hibernate state is 50µA.
 Voltage ripple below 50mVPP allowed for frequency between 100KHz and 3MHz.
 Voltage ripple below 15mVPP allowed for frequency above 3MHz.
 Higher voltage ripple may compromise the ORG4402 module performance.
 The under voltage lockout (UVLO) circuit prevents the device from misoperation at low input voltages.
 The UVLO circuit prevents the integrated DC-DC switch-mode regulator from turning on the switch or rectifier MOSFET under undefined conditions. It has a UVLO threshold set to 1.8V.
 Fully functional operation is permitted for input voltage down to the falling UVLO threshold level. The converter starts operation again once the input voltage trips the rising UVLO threshold level.

Ground

Single Ground pad should be connected to the main Ground with shortest possible trace or via.

Enable input

The Enable control input can be used to fully inhibit the ORG4402 module.
 Enable signal is active low and has internal 81kΩ pull-up resistor.
 Do not connect to this input if the feature is not in use.

Host Control Interface

ON OFF input

The ON_OFF control input can be used to switch the receiver between Hibernate or Full Power states and also to generate interrupt in Push-to-Fix operation.
 The ON_OFF interrupt is generated by a low-high-low toggle, which should be longer than 62µs and less than 1s (100ms pulse length recommended).
 ON_OFF interrupts with less than 1 sec intervals are not recommended. Multiple switch bounce pulses are recommended to be filtered out.
 Input levels are 1.8 to 3.6V.
 ON_OFF input is rising edge triggered. Do not drive high permanently or pull-up this input.

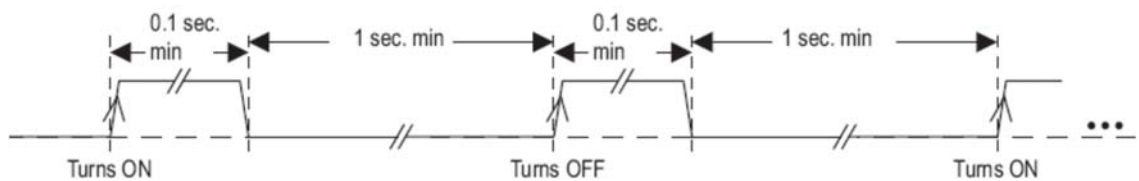


FIGURE 2 – ON_OFF TIMING

WAKEUP output

The WAKEUP pad is an output from the ORG4402 used to flag for power state.
 A low on this output indicates that the module is in one of its low-power states: Hibernate or Standby.
 A high on this output indicates that the module is in Full Power state.
 Wakeup output is LVCMOS 1.8V compatible.
 Do not load this output if the feature is not in use.

nRESET input



The Power-on-Reset (POR) is generated internally in the ORG4402 module. Additionally, manual reset option is available through nRESET pad. Resetting the module clears the RTC block and configuration settings become default. nRESET pad is active low and has internal pull-up resistor. nRESET signal should be applied for at least 1 μ s. nRESET input has internal pull-up of 86K Ω . Do not drive this input high. Do not connect to this input if the feature is not in use.

1PPS output

The pulse-per-second (PPS) output provides a pulse signal for timing purposes. Pulse length (high state) is 200ms about 1 μ s synchronized to full UTC second. The UTC time message is generated and put into output FIFO 300ms after PPS. The exact time between the PPS and UTC time message delivery depends on message rate, message queue and communication baud rate. 1PPS output is LVCMOS 1.8V compatible. Do not connect to this output if the feature is not in use

Host Data Interface

UART

TX used for GPS data reports. RX used for receiver control. The default protocol is NMEA@4,800bps 8-N-1. Baud rates are selectable from 1200bps to 1.25Mbps. The configuration for baud rates and respective protocols can be changed by commands via NMEA or OSP (SiRF Binary) protocols. Input levels are 1.8 to 3.6V. Output level of the UART TX is VCC – 0.1V

13. SOFTWARE FUNCTIONS

The ORG4402 series module supports NMEA-0183 ASCII protocol and One Socket Protocol (SiRF Binary).

13.1. NMEA

NMEA Output Messages

Message	Description
GGA	Time, position and fix type data
GLL1	Latitude, longitude, UTC time of position fix and status
GSA	GPS receiver operating mode, satellites used in the position solution and DOP values
GSV	The number of GPS satellites in view, satellite ID, elevation, azimuth and SNR values
RMC	Time, date, position, course and speed data
VTG1	Course and speed information relative to the ground
ZDA2	PPS timing message (synchronized to PPS)
155	Extended Ephemeris Proprietary Message
156,0x20	ECLM ACK/NACK
156,0x21	ECLM EE Get Age response
156,0x22	ECLM Get SGEE Age response
156,0x23	ECLM Download Initiate Request



156,0x24	ECLM Erase Storage File
156,0x25	ECLM Update File Content
156,0x26	ECLM Request File Content
1602	Watchdog Timeout and Exception Condition

TABLE 4 – NMEA PROTOCOL OUTPUT MESSAGES

NMEA Input Messages

Message ID	Message	Description
100	Set Serial Port	Set UART parameters and protocol
101	Navigation Initialization	Parameters required for start using X/Y/Z
103	Query/Rate Control	Query standard NMEA message and/or set output rate
104	LLA Navigation Initialization	Parameters required for start using Lat/Lon/Alt
105	Development Data On/Off	Development Data messages On/Off
106	Select Datum	Selection of an alternative map datum
107	Extended ephemeris proprietary message	
108	Extended ephemeris proprietary message	
110	Extended ephemeris debug	
114,0x16	ECLM start download	
114,0x17	ECLM file size	
114,0x18	ECLM packet data	
114,0x19	ECLM Get EE Age	
114,0x1A	ECLM Get SGEE Age	
114,0x1B	ECLM Host File Content	
114,0x1C	ECLM Host ACK/NACK	
1172	System Turn Off	
120	Storage Configuration Setting	

TABLE 5 – NMEA PROTOCOL INPUT MESSAGES

Note:

1. Not transmitted by default, can be enabled by \$PSRF103 command
2. Not implemented in current firmware

13.2. OSP (SiRF) BINARY

OSP Binary Output Messages

MID (hex)	MID (dec)	Definition	Sub ID (hex)	Sub ID (dec)	Definition
0 x 02	2	Measured Navigation Data			
0 x 03	3	True Tracker Data			
0 x 04	4	Measured Tracking Data			
0 x 06	6	SW Version			
0 x 07	7	Clock Status			
0 x 08	8	50 BPS Subframe Data			
0 x 09	9	Throughput			
0 x 0A	10	Error ID			
0 x 0B	11	Command Acknowledgement			



0 x °C	12	Command No Acknowledgement			
0 x 0D	13	Visible List			
0 x 0E	14	Almanac Data			
0 x 0F	15	Ephemeris Data			
0 x 10	16	Test Mode 1			
0 x 12	18	Ok To Send			
0 x 13	19	Navigation Parameters			
0 x 14	20	Test Mode 2			
0 x 1B	27	DGPS Status			
0 x 1C	28	Nav. Lib. Measurement Data			
0 x 1E	30	Nav. Lib. SV State Data			
0 x 1F	31	Nav. Lib. Initialization Data			
0 x FF	255	Development Data			

TABLE 6 – OSP BINARY OUTPUT MESSAGES

OSP Binary Input Messages

MID (hex)	MID (dec)	Definition	Sub ID (hex)	Sub ID (dec)	Definition
0 x 35	53	Advanced Power Management			
0 x 80	128	Initialize Data Source			
0 x 81	129	Switch to NMEA Protocol			
0 x 82	130	Set Almanac (upload)			
0 x 84	132	Software Version (Poll)			
0 x 86	134	Set Main Serial Port			
0 x 87	135	Switch Protocol			
0 x 88	136	Mode Control			
0 x 89	137	DOP Mask			
0 x 8A	138	MID_SET_DGPS_MODE			
0 x 8B	139	Elevation Mask			
0 x 8C	140	Power Mask			
0 x 8D	141	Editing Residual			
0 x 8E	142	Steady-State Detection			
0 x 8F	143	Static Navigation			
0 x 90	144	Poll Clock Status			
0 x 92	146	Poll Almanac			
0 x 93	147	Poll Ephemeris			
0 x 95	149	Set Ephemeris (upload)			
0 x 96	150	Switch Operating Mode			
0 x 97	151	Set Trickle Power Parameters			
0 x 98	152	Poll Navigation Parameters			
0 x A5	165	Set UART Configuration			
0 x A6	166	Set Message Rate			



0 x A7	167	Low Power Acquisition Parameters			
0 x A8	168	MID_POLL_CMD_PARAM			
0 x A9	169	Set Datum			
0 x AA	170	Set SBAS Parameters			
0 x AC	172	MID_DrIn	0 x 01	1	Set DrNavInit
			0 x 02	2	Set DrNavMode
			0 x 03	3	Set GyrFactCal
			0 x 04	4	Set DrSensParam
			0 x 05	5	Poll DrValid
			0 x 06	6	Poll GyrFactCal
			0 x 07	7	Poll DrSensParam
			0 x 13	19	DR Debug Information
0 x AF	175	Send Command String			
0 x B2	178	SIRF_MSG_SSB_TRACKER_IC	0 x 14	20	Patch Storage Control
			0 x 22	34	Patch Memory Load Request
			0 x 26	38	Patch Memory Exit Request
			0 x 28	40	Patch Memory Start Request
			0 x 90	144	Patch Manager Prompt
			0 x 91	145	Patch Manager Ack.
0 x CD	205	Set Generic Software Control	0 x 10	16	Software Commanded OFF
0 x D1	209	MID_QUERY_REQ			
0 x D2	210	MID_POS_REQ			

TABLE 7 – OSP BINARY INPUT MESSAGES

MID (hex)	MID (dec)	Definition	Sub ID (hex)	Sub ID (dec)	Definition
0 x D3	211	MID_SET_AIDING	0 x 01	1	SET_IONO
			0 x 02	2	SET_EPH_CLOCK
			0 x 03	3	SET_ALM
			0 x 04	4	SET_ACQ_ASSIST
			0 x 05	5	SET_RT_INTEG
			0 x 06	6	SET_UTC_MODEL
			0 x 07	7	SET_GPS_TOW_ASSIST
			0 x 08	8	SET_AUX_NAV
			0 x 09	9	SET_AIDING_AVAIL
0 x D4	212	MID_STATUS_REQ	0 x 01	1	EPH_REQ
			0 x 02	2	ALM_REQ
			0 x 03	3	B_EPH_REQ
			0 x 04	4	TIME_FREQ_APPROX_POS_REQ
			0 x 05	5	CH_LOAD_REQ
			0 x 06	6	CLIENT_STATUS_REQ
			0 x 07	7	OSP_REV_REQ



			0 x 08	8	SERIAL_SETTINGS_REQ
0 x D5	213	MID_SESSION_CONTROL_REQ	0 x 01	1	SESSION_OPEN_REQ
			0 x 02	2	SESSION_CLOSE_REQ
0 x D6	214	MID_HW_CONFIG_RESP			
0xD7	215	MID_AIDING_RESP	0 x 01	1	APPROX_MS_POS_RESP
			0 x 02	2	TIME_TX_RESP
			0 x 03	3	FREQ_TX_RESP
			0 x 04	4	SET_NBA_SF1_2_3
			0 x 05	5	SET_NBA_SF4_5
0xD8	216	MID_MSG_ACK_IN	0 x 01	1	ACK_NACK_ERROR
			0 x 02	2	REJECT
0xD9	217		0 x 01	1	SENSOR_ON_OFF
0xDA	218	MID_PWR_MODE_REQ	0 x 00	0	FP_MODE_REQ
			0 x 01	1	APM_REQ
			0 x 02	2	MPM_REQ
			0 x 03	3	TP_REQ
			0 x 04	4	PTF_REQ
0xDB	219	MID_HW_CTRL_IN	0 x 01	1	VCTCXO
			0 x 02	2	ON_OFF_SIG_CONFIG
0xDC	220	MID_CW_CONTROLLER_REQ	0 x 01	1	CONFIG
			0 x 02	2	EVENT_REG
			0 x 03	3	COMMAND_SCAN
			0 x 04	4	CUSTOM_MON_CONFIG
			0 x 05	5	FFT_NOTCH_SETUP
0xE1	225	MID_SiRFOutput	0 x 06	6	STATISTICS
			0 x 07	7	Statistics with Aiding

Table 2-4: OSP BINARY INPUT MESSAGES

MID (hex)	MID (dec)	Definition	Sub ID (hex)	Sub ID (dec)	Definition
0xE8	232	MID_EE_INPUT	0 x 01	1	SSB_EE_SEA_PROVIDE_EPH
			0 x 02	2	SSB_EE_POLL_STATE
			0 x 10	16	SSB_EE_FILE_DOWNLOAD
			0 x 11	17	SSB_EE_QUERY_AGE
			0 x 12	18	SSB_EE_FILE_PART
			0 x 13	19	SSB_EE_DOWNLOAD_TCP
			0 x 14	20	SSB_EE_SET_EPHEMERIS
			0 x 15	21	SSB_EE_FILE_STATUS
			0 x 16	22	ECLM Start Download
			0 x 17	23	ECLM File Size
			0 x 18	24	ECLM Packet Data



			0 x 19	25	Get EE Age
			0 x 1A	26	Get SGEE Age
			0 x 1B	27	ECLM Host File Content
			0 x 1C	28	ECLM Host ACK/NACK
			0 x 1D	29	ECLM Get NVM Header
			0 x FD	253	EE_STORAGE_CONTROL
			0 x FE	254	SSB_EE_DISABLE_EE_SECS

TABLE 8 – OSP BINARY INPUT MESSAGES

14. HANDLING INFORMATION

14.1. PRODUCT PACKAGING AND DELIVERY

-TBA-

14.2. ESD SENSITIVITY

The ORG4402 modules are ESD sensitive devices and should be handled with care.



14.3. COMPLIANCES

The ORG4402 modules comply with the following standards:

- + Pb-Free/RoHS (Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment)
- + ISO 9001:2000 accredited manufacturing facility



14.4. SAFETY INFORMATION

Improper handling and use can cause permanent damage to the device.

There is also the possible risk of personal injury from mechanical trauma or shocking hazard.

14.5. DISPOSAL INFORMATION

The product should not be treated as household waste.

For more detailed information about recycling electronic components, please contact your local waste management authority.





15. MECHANICAL SPECIFICATIONS

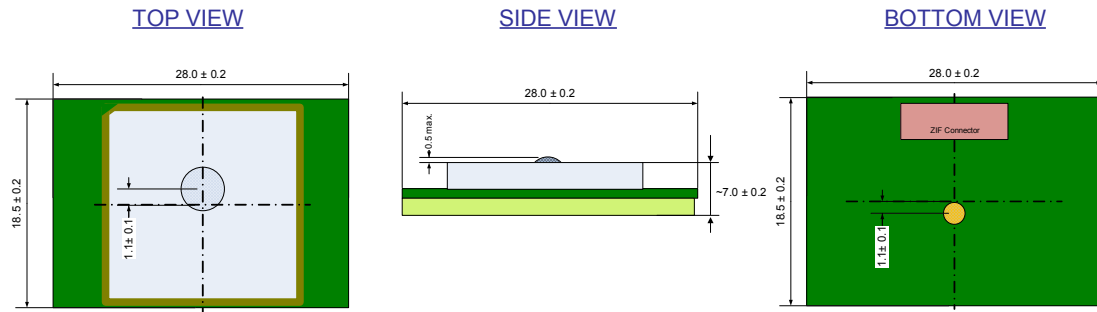


FIGURE 3 – ORG4402 MECHANICAL DRAWING

Dimensions	Length	Width	Height	Weight	
	mm	28.0 ± 0.2	18.5 ± 0.2	7.0 ± 0.2	gr
inch	1.102 ± 0.008	0.728 ± 0.008	0.276 ± 0.008	oz	0.28

TABLE 9 – ORG4402 MECHANICAL INFORMATION