ORG130X series

Fully Integrated

Mold GPS Modules

Data Sheet

1. Description

OriginGPS has revised and enhanced the architecture of classic GPS receivers.
In-house designed microstrip patch antenna with highest GPS-band performance and notch filtering for out-of band signals provides high selectivity.
Furthermore, combined with internal shielding and built-in ground plane the ORG130X series modules reveal good noise immunity and exceptional sensitivity.
Carefully selected key components including TCXO and LNA resulted in faster TTFF and operation stability under rapid environmental changes.

1.1. Features

- Fully integrated multi channel GPS engine
- Fully mold for supreme high shock and vibration damage threshold
- Special firmware with 49,000m altitude limitation
- Embedded Microstrip Patch antenna (ORG1301)
- 50Ω passive or active antenna input through miniature coaxial cable (ORG1306)
- Noise Free Zone System™ Technology
- SiRFstarIII GSC3LTf chipset
- L1 frequency, C/A code
- 20 channels searching, 12 channels parallel tracking
- Acquisition sensitivity: -157dBm
- Tracking sensitivity: -159dBm for indoor fixes
- Fast TTFF: <35s (typical) under Cold Start conditions
- Rapid TTFF by aiding information upload capability
- Multipath mitigation
- Indoor tracking
- SBAS (WAAS, MSAS, EGNOS) support
- Automatic and user programmable power saving scenarios
- Low power consumption: 100mW during acquisition
- ARM7 baseband CPU
- UART interface
- Programmable UART protocol and message rate
- Selectable NMEA-0183 or SiRF Binary communication standards
- Single operating voltage: 3.3V to 5.5V
- Small footprint: 18mm x 20mm
- Surface Mount Device (SMD) and Through Hole pads
- Industrial operating temperature range: -40^0 to 85^0C
- Pb-Free RoHS compliant

2. Electrical Specifications

2.1. Absolute Maximum Ratings

Absolute Maximum Ratings are stress ratings only.

Stresses exceeding Absolute Maximum Ratings may damage the device.

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	V_{CC}	0	5.5	V
UART Input Voltage	V_{RX}	-0.5	7	V
UART Output Source/Sink Current	I_{TX}	-10	+10	mA
ON_OFF Input Voltage	V_{ON_OFF}		3.78	V
Storage Temperature	T_{ST}	-55	+125	^{0}C

Table 2-1: Absolute maximum ratings

2.2. Recommended Operating Conditions

Functional operation above the Recommended Operating Conditions is not implied.

Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Parameter	Symbol	Mode / Pin	Test Conditions	Min	Typ	Max	Units
Power supply voltage	V_{CC}			3.25	3.3	5.5	V
Power Supply Current	I_{CC}	Acquisition	V_{CC} = 3.3V		30	35	mA
		Tracking	T_{AMB} = 25^{0}C	9		23	mA
		Hibernate			24	25	µA
Input Voltage Low State	V_{IL}	UART				0.5	V
		ON_OFF				0.6	V
Input Voltage High State	V_{IH}	UART		1.4			V
		ON_OFF		2.7			V
Output Voltage Low State	V_{OL}	UART	I_{OL} = 8mA			0.36	V
Output Voltage High State	V_{OH}	UART	I_{OH} = -50µA	3.2			V
			I_{OH} = -4mA	3.25			V
Input Capacitance	C_{IN}	UART			4	10	pF
Operating Temperature[1]	T_{AMB}			-40	+25	+85	^{0}C
Relative Humidity	RH		Oper. Temp.	5		95	%

Table 2-2: Operating conditions

Note:

1. Operation below -20^{0}C to -40^{0}C and above +70^{0}C to +85^{0}C is accepted, but TTFF may increase

3. Performance

3.1. Acquisition times

TTFF (Time To First Fix) – is the period of time from GPS power-up till position estimation.

Hot Start

A hot start results from software reset after a period of continuous navigation or a return from a short idle period that was preceded by a period of continuous navigation.
In this state, all of the critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in SRAM.

Warm Start

A warm start typically results from user-supplied position and time initialization data or continuous RTC operation with an accurate last known position available in memory.
In this state, position and time data are present and valid, but ephemeris data validity has expired.

Cold Start

A cold start acquisition results when either position or time data is unknown.
Almanac information is used to identify previously healthy satellites.

Aided Start

Aiding is a method of effectively reducing the TTFF by making every start Hot or Warm.

	TTFF	Signal Level
Hot Start	< 1s	-130 dBm (Outdoor)
Warm Start	< 32s	-130 dBm (Outdoor)
Cold Start	< 35s	-130 dBm (Outdoor)
Signal Reacquisition	< 1s	-130 dBm (Outdoor)

Table 3-1: Acquisition times

3.2. Sensitivity

	Signal Level
Acquisition	-157 dBm (Deep Indoor)
Tracking	-159 dBm (Deep Indoor)
Cold Start	-142 dBm

Table 3-2: Sensitivity

3.3. Power Consumption

Operation Mode	Power Consumption
Acquisition	100mW
Tracking	30-75mW
Hibernate	80µW

Table 3-3: Power consumption

3.4. Accuracy

		Method	Accuracy	Units	Test Conditions
Position	Horizontal	CEP (50%)	< 2.5	m	-130 dBm (Outdoor), Static
			< 2	m	-130 dBm (Outdoor), SBAS, Static
		2dRMS (95%)	< 5	m	-130 dBm (Outdoor), Static
			< 4	m	-130 dBm (Outdoor), SBAS, Static
	Vertical	VEP (50%)	< 4	m	-130 dBm (Outdoor), Static
			< 3	m	-130 dBm (Outdoor), SBAS, Static
		2dRMS (95%)	<7.5	m	-130 dBm (Outdoor), Static
			< 6	m	-130 dBm (Outdoor), SBAS, Static
Velocity	Horizontal	50%	< 0.01	m/s	-130 dBm (Outdoor), 30 m/s
Heading		50%	< 0.01	^{0}	-130 dBm (Outdoor), 30 m/s
Time		1 PPS	< 1	µs	-130 dBm (Outdoor)

Table 3-4: Accuracy

3.5. Dynamic Constrains

Velocity[1]	< 515m/s
Acceleration	< 4g
Altitude	< 49,000m

Table 3-5: Dynamic constrains

Note:

1. Standard dynamic constrain according to regulatory limitations

4. Power Management

The ORG130X series modules have three main operating modes which are controlled by internal state-machine. These modes provide different levels of power and performance.

4.1. Normal Mode

In Normal Mode the ORG130X module is fully powered and will automatically acquire and track GPS satellites.

4.2. Power Saving Modes

Adaptive Trickle Power™

Adaptive Trickle Power (ATP™) is best suited for applications that require navigation solutions at a fixed rate as well as low power consumption and an ability to track weak signals.
In ATP mode the ORG130X series module is intelligently cycled between three states to optimize low power operation:

Full Power State

This is the initial state of the ORG130X series module.
The module stays in full power until a position solution is made and estimated to be reliable.
During the acquisition mode, processing is more intense, thus consuming more power.

CPU Only State

This is the state when the RF and DSP sections are partially powered off.
The state is entered when the satellites measurements have been acquired but the navigation solution still needs to be computed.

Standby State

This is the state when the RF and DSP sections are completely powered off and baseband clock is stopped.

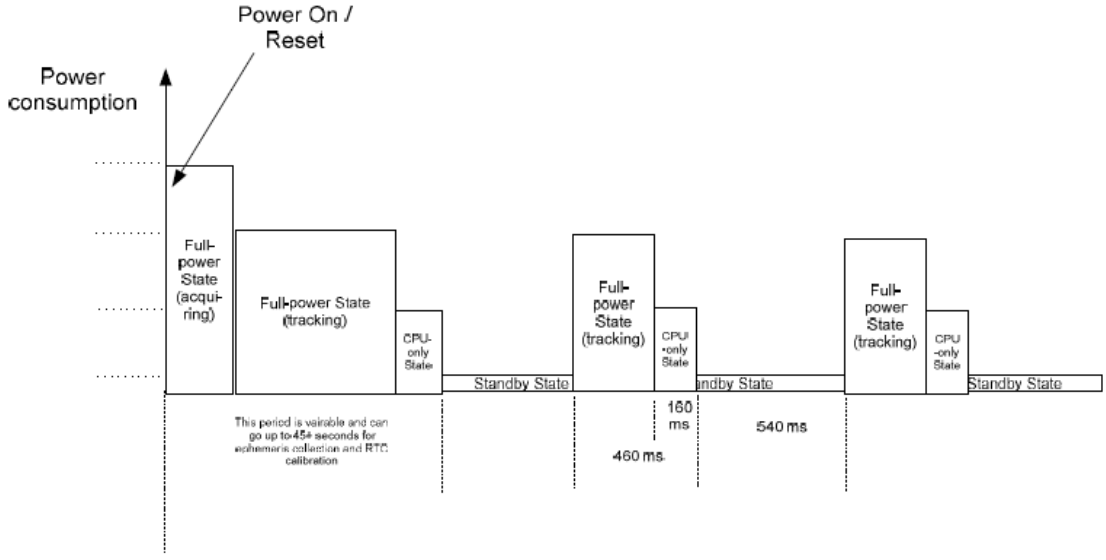


Figure 4-1: ATP timing

Push-to-Fix™

Push-to-Fix (PTF™) is best suited for applications that require infrequent navigation solutions, optimizing battery life time.

In PTF mode the ORG130X series module is mostly in Hibernate Mode, waked up for Ephemeris and Almanac refresh in fixed periods of time. The PTF period is 30 minutes by default but can be anywhere between 10 seconds and 2 hours. When the PTF mode is enabled the receiver well stay on full power until the good navigation solution is computed.

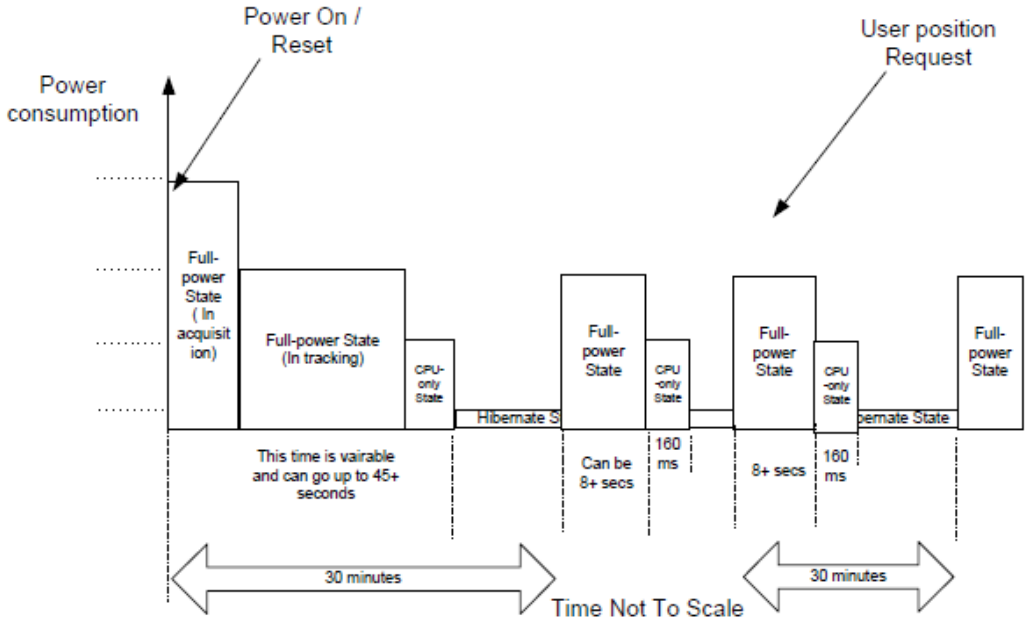


Figure 4-2: PTF timing

Hibernate State

In this state the RF, DSP and baseband sections are completely powered off leaving only the RTC and Battery-backed RAM running. When the application needs a position report it can toggle the ON_OFF pin to wake up the module. In this case, a new PTF cycle with default settings begins.

5. Interface

5.1. Pin Assignment

Pin Number	Pin Name	Pin Description	Direction	Default	Notes
1	nRESET	Asynchronous Reset	Input	High	Do not drive high
2	ON_OFF	Soft Power On/Hibernate	Input	Low	3.3V compatible
3	1PPS	1 Pulse Per Second	Output	Low	1.8V compatible
4	GND	System Ground	Power		
5	TX	UART Transmit	Output	Low	1.8V/2.5V/3.3V compatible
6	RX	UART Receive	Input	High	1.8V/2.5V/3.3V compatible
7	V_{IO-EXT}	UART buffers power	Power		Connect to V_{CC} if powered 3.3V
8	V_{CC}	System Power	Power		

Table 5-1: ORG130X-F49 pin-out

5.2. Power-up Defaults

Power On State	UART data format	UART settings	Navigation			
			SBAS	Static Filter	Track Smoothing	Internal DR
Full Power	NMEA	9,600 bps 8-N-1	OFF	OFF	OFF	OFF

Table 5-2: ORG130X-F49 power up defaults

5.3. Connectivity

Power supply

The ORG130X series module requires only one power supply V_{CC}, 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 TTFF.
When the V_{CC} is powered off settings are reset to factory default and the receiver performs Cold Start on next power up.
Power supply current varies according to the processor load and satellite acquisition.
V_{CC} range is 3.3V to 5.5V DC.
Typical I_{CC} current is 30mA during acquisition. Peak I_{CC} current is 150 mA.
Typical I_{CC} current in Hibernate state is 25µA.
Voltage ripple below 300mV_{P-P} allowed for frequency under 10KHz.
Voltage ripple below 30mV_{P-P} allowed for frequency between 10KHz and 100KHz.
Voltage ripple below 10mV_{P-P} allowed for frequency between 100KHz and 1MHz.
Voltage ripple below 3mV_{P-P} allowed for frequency above 1MHz.
High voltage ripple may compromise the ORG130X module performance.
In case of powering the ORG130X module from switching mode (DC-DC) power source carefully follow manufacturer's application note and apply passive low pass filtering.

Ground

Ground pin should be connected to main Ground with shortest possible trace or via.

UART

The device supports full duplex 8-N-1 UART communication without flow control.
The default protocol is NMEA. The default baud rate is 9,600bps.
The default configuration for baud rates and respective protocols can be changed by commands via NMEA or SiRF binary protocols.
UART port is buffered. I/O levels in the serial port are CMOS 1.8V/2.5V/3.3V compatible.
I/O levels are defined by applying appropriate voltage to V_{IO-EXT} pin.

nRESET Input

The Power-on-Reset (POR) is generated internally in the ORG130X series module.
Additionally, manual reset option is available through nRESET pad.
Resetting the ORG13XX 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 1µs.

ON OFF Control Input

The ON_OFF control input can be used to switch the receiver between Normal or Hibernate modes 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 level is 3.3V compatible.

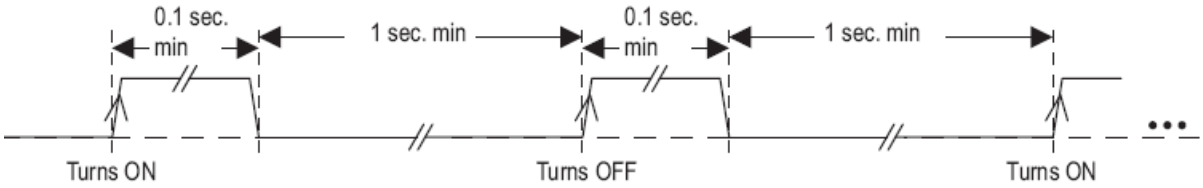


Figure 5-1: ON_OFF timing

1PPS Output

The pulse-per-second (PPS) output provides a pulse signal for timing purposes.

Pulse length (high state) is about 1µs 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.

I/O level is CMOS 1.8V compatible.

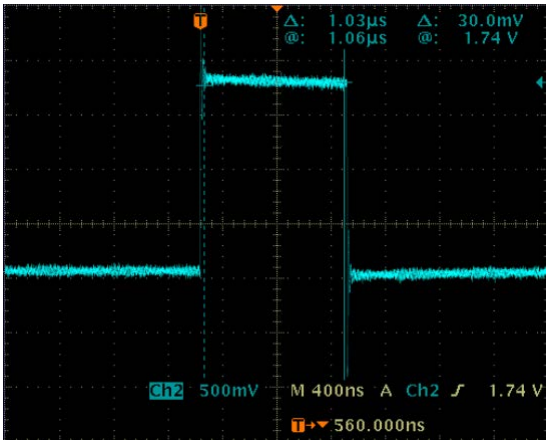
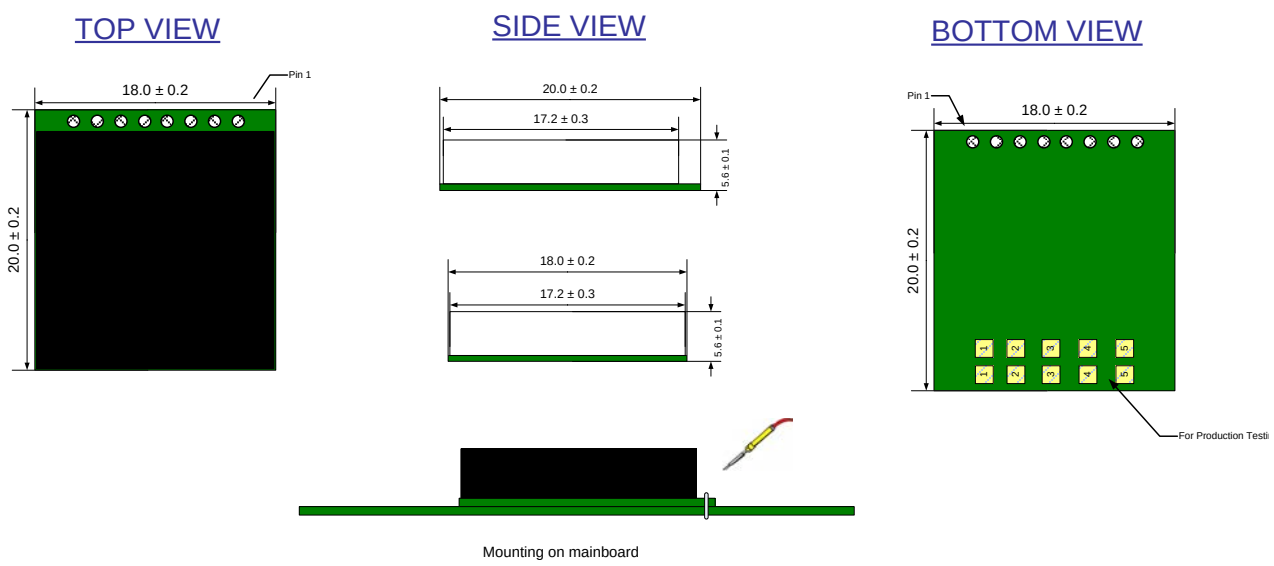


Figure 5-2: 1PPS Output

6. Mechanical Specifications

6.1. ORG1301

ORG1301-F49-001



Dimensions	Length	Width	Height
mm	18.0 ± 0.2	20.0 ± 0.2	5.6 ± 0.1
inch	0.708 ± 0.008	0.787 ± 0.008	0.220 ± 0.004

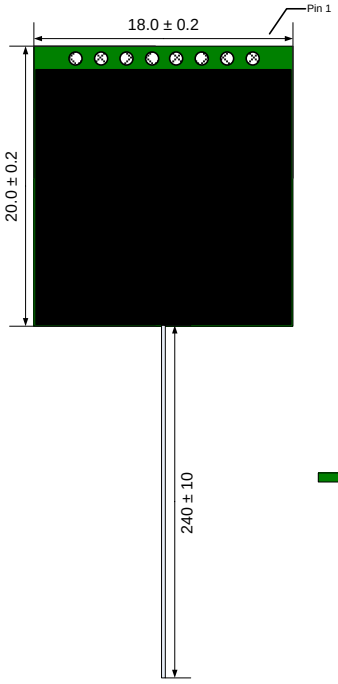
Weight	
gr	4.2
oz	0.15

Table 6-1: ORG1301-F49 mechanical information

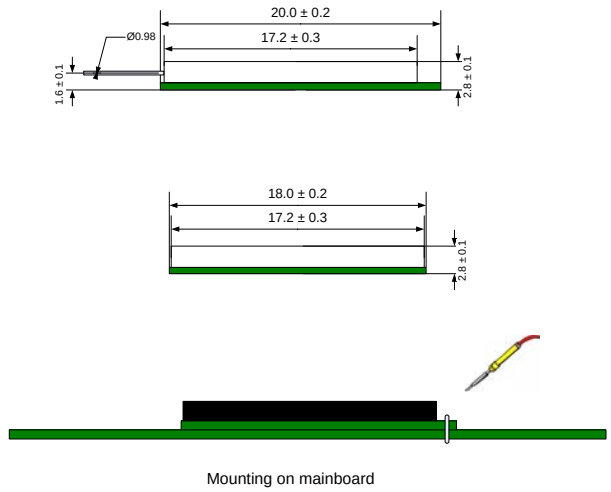
6.2. ORG1306

ORG1306-F49-001

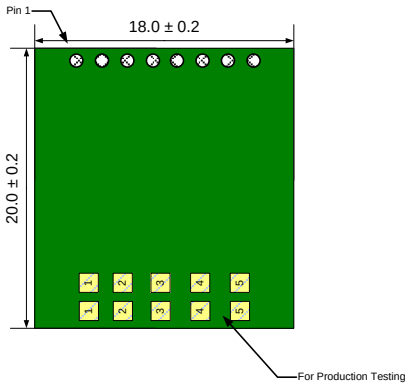
TOP VIEW



SIDE VIEW



BOTTOM VIEW



Dimensions	Length	Width	Height
mm	18.0 ± 0.2	20.0 ± 0.2	2.8 ± 0.1
inch	0.708 ± 0.008	0.787 ± 0.008	0.110 ± 0.004

Weight	
gr	2.0
oz	0.07