



## NANO SPIDER (ORG4400) EVALUATION KIT

Datasheet

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## 1. SCOPE

This document describes the features and specifications of Nano Spider ORG4400 evaluation kit.

## 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 -or [Online Form](#) Marketing and sales -

[marketing@origingps.com](mailto:marketing@origingps.com) Web –

[www.origingps.com](http://www.origingps.com)

## 6. RELATED DOCUMENTATION

No	DOCUMENT NAME
1	Nano Spider – ORG4400 Datasheet
2	Spider and Hornet - NMEA Protocol Reference Manual
3	Spider and Hornet - OSP® Reference Manual
4	Spider and Hornet - OSP® GNSS Extensions Reference Manual
5	Spider and Hornet - Low Power Modes Application Note
6	Spider and Hornet - Client Generated Extended Ephemeris Application Note
7	Spider and Hornet - Server Generated Extended Ephemeris Application Note
8	Spider and Hornet - Ephemeris Push Application Note

TABLE 1 – RELATED DOCUMENTATION



## 7. REVISION HISTORY

REVISION	DATE	CHANGE DESCRIPTION
A00	March 10, 2015	First release

TABLE 2 – REVISION HISTORY

## 8. ABOUT SPIDER FAMILY

OriginGPS GNSS receiver modules have been designed to address markets where size, weight, stand-alone operation, highest level of integration, power consumption and design flexibility - all are very important. OriginGPS' Spider family breaks size barrier, offering the industry's smallest fully-integrated, highly-sensitive GPS / GNSS modules.

Spider 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.

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

Just connect an antenna and power supply on a 2-layer PCB.

## 9. ABOUT NANO SPIDER MODULE

Nano Spider is a complete SiP featuring LGA SMT footprint designed to commit unique integration features for high volume cost sensitive applications.

Designed to support ultra-compact applications such as smart watches, wearable devices, trackers and digital cameras, Nano Spider ORG4400 module is a miniature multi-channel GPS with SBAS, QZSS and other regional overlay systems receiver that continuously tracks all satellites in view, providing real-time positioning data in industry's standard NMEA format.

Nano Spider ORG4400 module offers superior sensitivity and outstanding performance, achieving rapid TTFF in less than one second, accuracy of approximately two meters, and tracking sensitivity of -163dBm. Sized only 4.1mm x 4.1mm Nano Spider ORG4400 module is industry's small sized, record breaking solution. ORG4400 module integrates LNA, SAW filter, TCXO, RTC crystal shield with market-leading SiRFstarIV™ GPS SoC.

Nano Spider ORG4400 module is introducing industry's lowest energy per fix ratio, unparalleled accuracy and extremely fast fixes even under challenging signal conditions, such as in built-up urban areas, dense foliage or even indoor. Integrated GPS SoC incorporating high-performance microprocessor and sophisticated firmware keeps positioning payload off the host, allowing integration in embedded solutions with low computing resources.

Innovative architecture can detect changes in context, temperature, and satellite signals to achieve a state of near continuous availability by maintaining and opportunistically updating its internal fine time, frequency, and satellite ephemeris data while consuming mere microwatts of battery power.



## 10. 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.

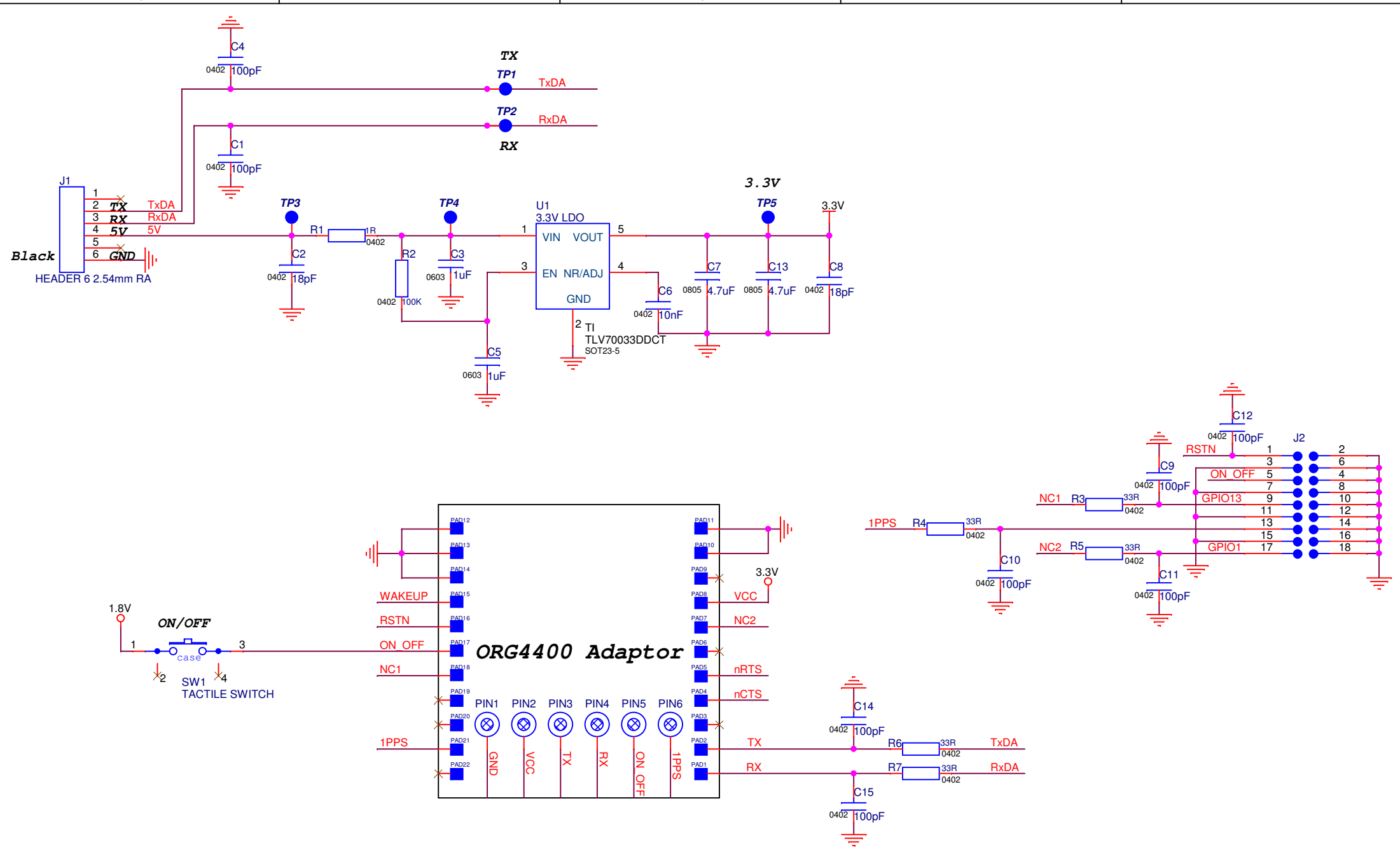
## 11. DESCRIPTION

Evaluation Kit of the ORG4400 GPS Module comprises the Demo Board, USB to UART Serial Converter Cable, ORG9802 Miniature Passive Antenna Assembly, I-PEX MHFIII to SMA-type Coaxial Cable Adaptor, ORG9805 External Active Antenna, support CD with GPS simulator software for PC and documentation.

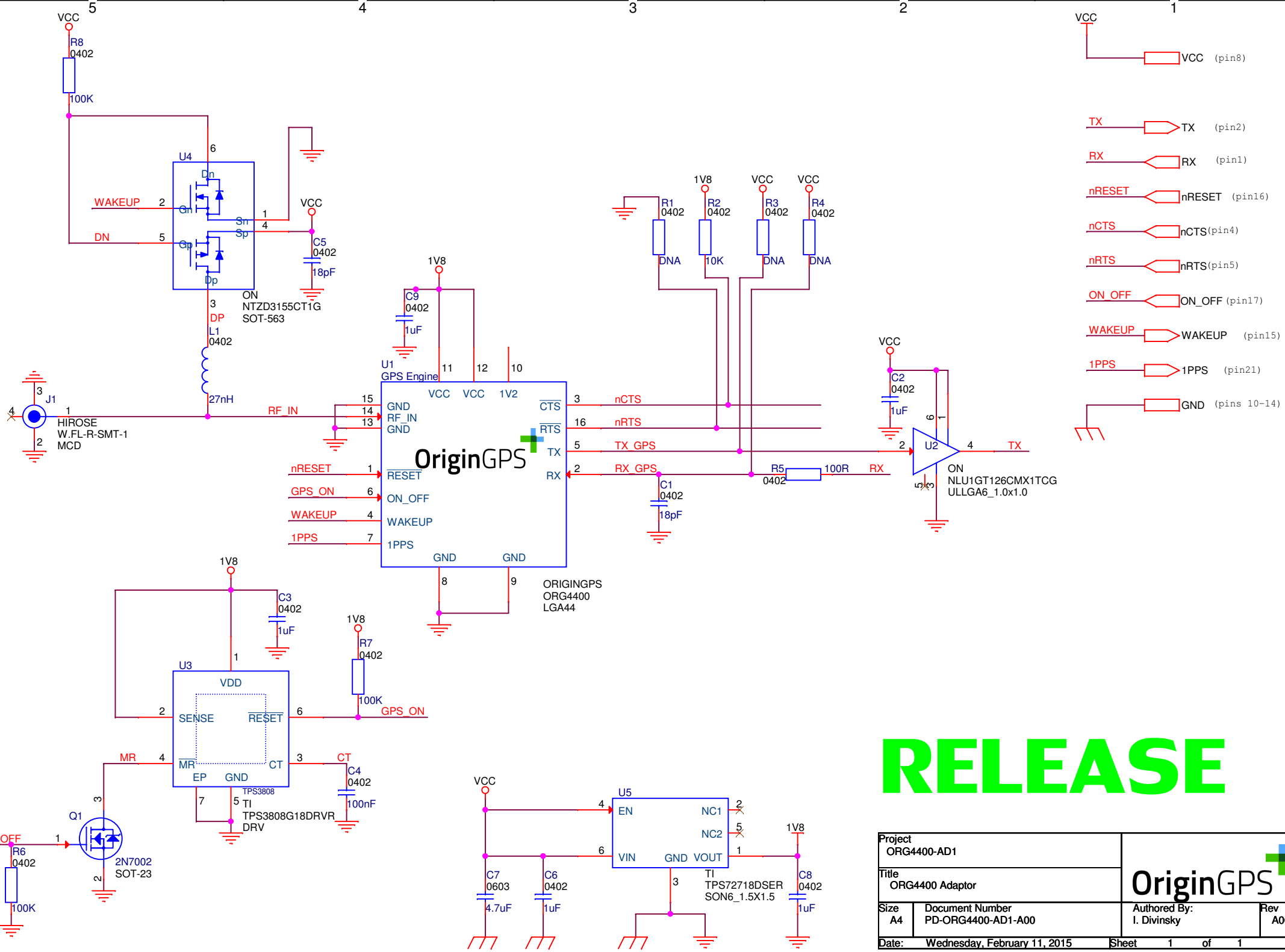
The Demo Board assembly is built of Main Board, incorporating 3.3V LDO voltage regulator, UART connector, push-button tactile switch for Push-To-Fix™ interrupt and various test points.

The ORG4400 GPS Module is soldered onto the Main Board through the Interface Adaptor.


The Interface Adaptor includes a single-bit buffer for voltage level translation of TX line, 1.8V LDO voltage regulator, Load Switch for active antenna T-bias and a voltage supervisor for autonomous power-on pulse generation.



Project ORG4400 UART Evaluation Board			
Title ORG4400 UART Demo Board			
Size A4	Document Number PD-ORG4400-DBUA-A00	Author By: I. Divinsky	Rev A00
Date: Thursday, February 12, 2015		Sheet 1 of 1	



# RELEASE

Project ORG4400-AD1			
Title ORG4400 Adaptor			
Size A4	Document Number PD-ORG4400-AD1-A00	Authored By: I. Divinsky	Rev A00
Date: Wednesday, February 11, 2015		Sheet	1 of 1





## 13. BILL OF MATERIALS

### 13.1 MAIN BOARD BILL OF MATERIALS

Reference	Value	Description	P/N	MFG
C2, C8	18pF	CAP SMT 0402 18pF ±5% 50V COG	GRM1555C1H180JZ01D	MURATA
C1, C4, C9, C10, C11, C12, C14, C15	100pF	CAP SMT 0402 100pF ±5% 50V COG	GRM1555C1H101JA01D	MURATA
C6	10nF	CAP SMT 0402 10nF ±10% 25V X7R	GRM155R71E103KA01D	MURATA
C3, C5	1µF	CAP SMT 0603 1µF ±10% 10V X5R	GRM188R60J105KA01J	MURATA
C7, C13	4.7µF	CAP SMT 0805 4.7µF ±10% 16V X5R	GRM21BR61C475KA88L	MURATA
R1	1Ω	RES SMT 0402 1Ω ±1%	RM04FTN0010	TA-I
R3, R4, R5, R6, R7	33Ω	RES SMT 0402 33Ω ±1%	RM04FTN0330	TA-I
R2	100KΩ	RES SMT 0402 100KΩ ±1%	RM04FTN1003	TA-I
J1	HDR	HEADER 6 POS. 0.1" RIGHT ANGLE	2211S-06G-F1	NELTRON
SW1	TSW	TACT SWITCH SMT	KSC222JLFS	C&K
U1	LDO	LDO REG. SMT SOT23-5 3.3V 200mA	TLV70033DDCT	TI

TABLE 3 - MAIN BOARD BILL OF MATERIALS

### 13.2 INTERFACE ADAPTOR BILL OF MATERIALS

Reference	Value	Description	P/N	MFG
C1, C5	18pF	CAP SMT 0402 18pF ±5% 50V COG	GRM1555C1H180JZ01D	MURATA
C4, C6	100nF	CAP SMT 0402 100nF ±10% 16V X7R	GRM155R71C104KA88D	MURATA
C2, C3, C8, C9	1µF	CAP SMT 0402 1µF ±10% 10V X5R	GRM155R61A105KE15D	MURATA
J1	W.FL	CONN. RF SMT W.FL	W.FL-R-SMT-1	HIROSE
L1	27nH	IND SMT 0402 27nH ±5% CER	LQG15HS27NJ02	MURATA
R5	100Ω	RES SMT 0402 100Ω ±1%	RM04FTN1000	TA-I
R2, R6	10KΩ	RES SMT 0402 10KΩ ±1%	RM04FTN1002	TA-I
R7, R8	100KΩ	RES SMT 0402 100KΩ ±1%	RM04FTN1003	TA-I
Q1	2N7002	N-CH MOSFET SOT-23	2N7002KT1G	ON
U1	MODULE	MINIATURE GPS MODULE SMT LGA	ORG4400	ORIGINGPS
U2	NLU1GT126	SINGLE BUFFER 3-STATE	NLU1GT126CMX1TCG	ON
U3	TPS3808	LOW IQ POR SUPERVISOR W. MAN. RST	TPS3808G18DRVR	TI
U4	NTZD3155C	N-CH+P-CH CMPL. MOSFET SOT-563	NTZD3155CT1G	ON
U5	TPS72718	1.8V 200mA Low Iq Low N RF LDO	TPS72718DSER	TI

TABLE 4 - INTERFACE ADAPTOR BILL OF MATERIALS



## 14. ASSEMBLY AND LAYOUT

### 14.1 MAIN BOARD PCB

Main Board for the ORG4400 GPS Module is 2-layer 1.6mm thickness FR4 PCB.

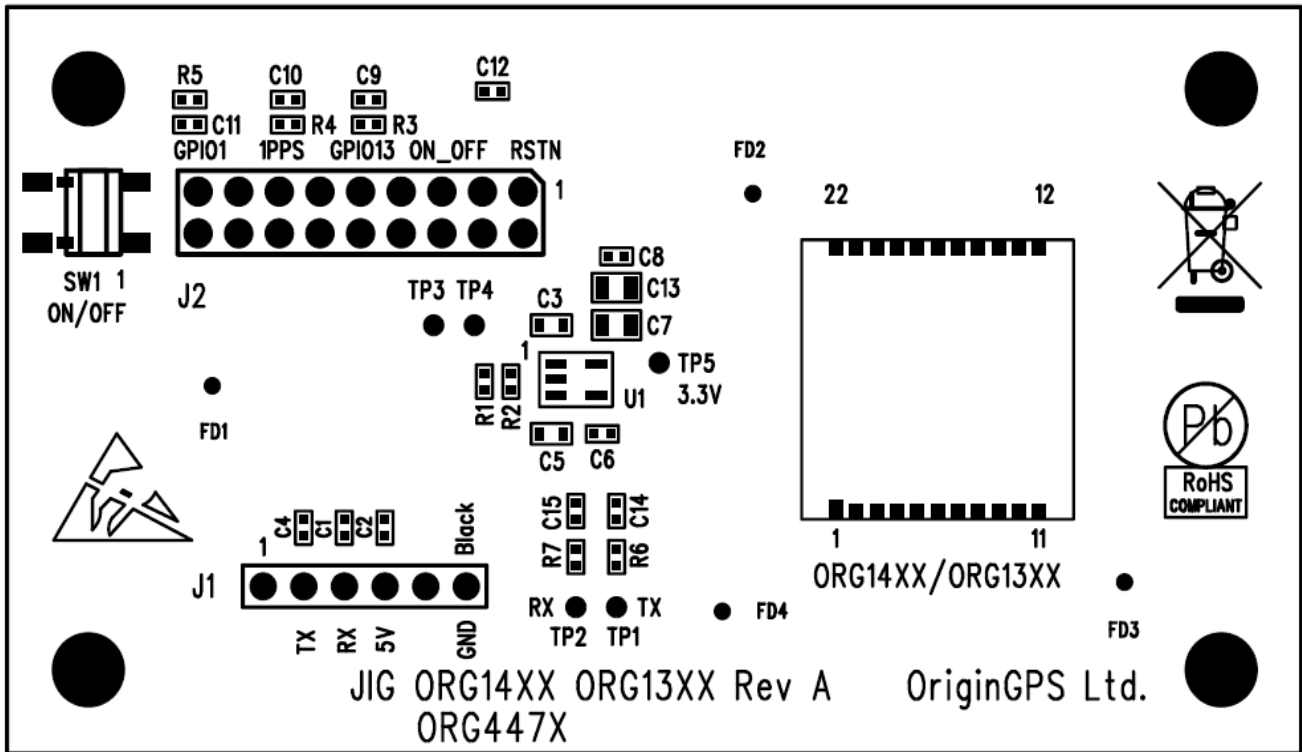


FIGURE 3 - MAIN BOARD COMPONENTS PLACEMENT

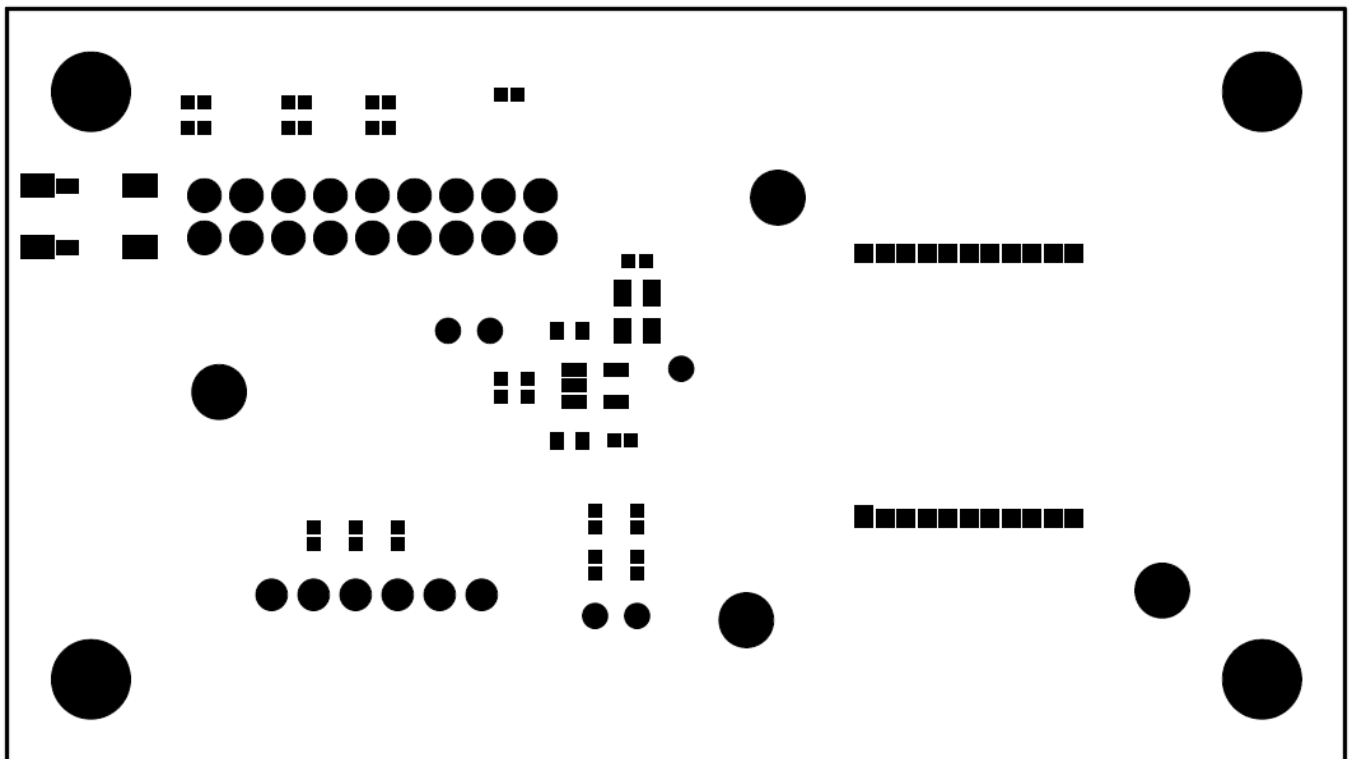


FIGURE 4 - MAIN BOARD SOLDER MASK

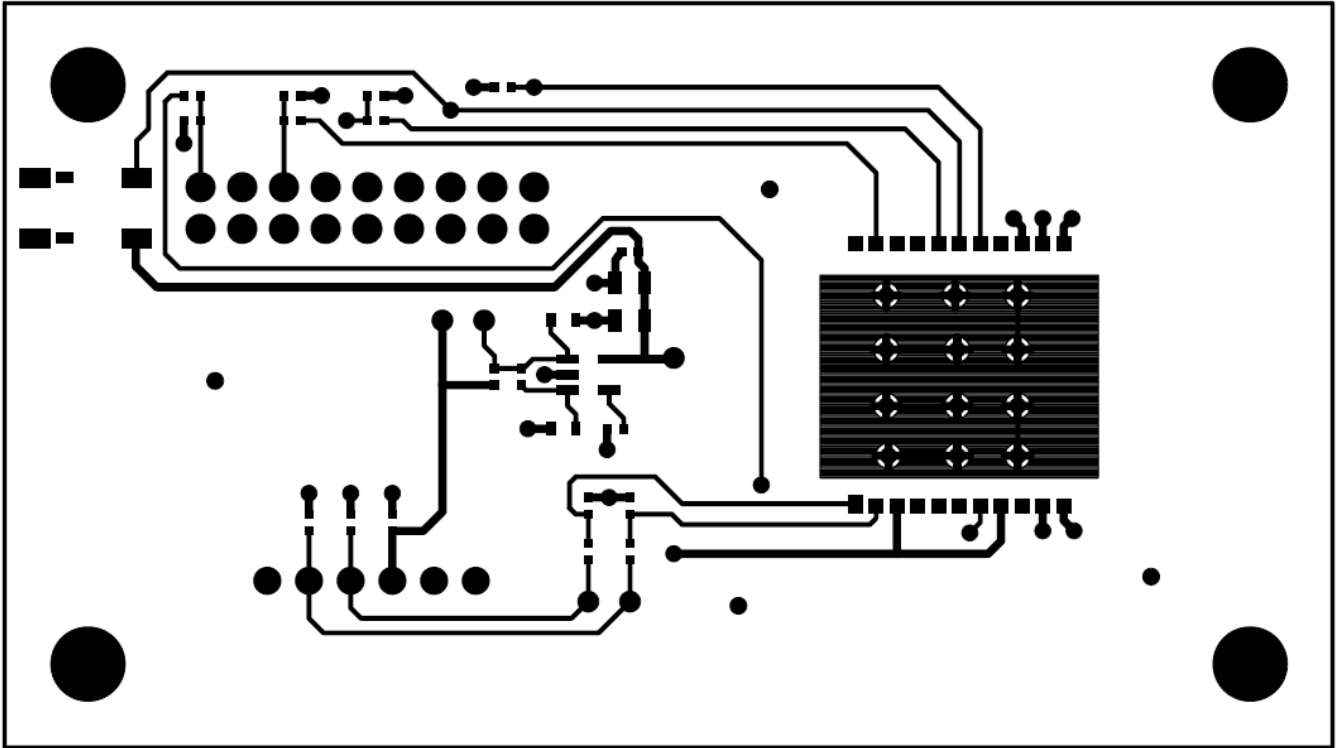


FIGURE 5 – MAIN BOARD TOP LAYER ROUTING

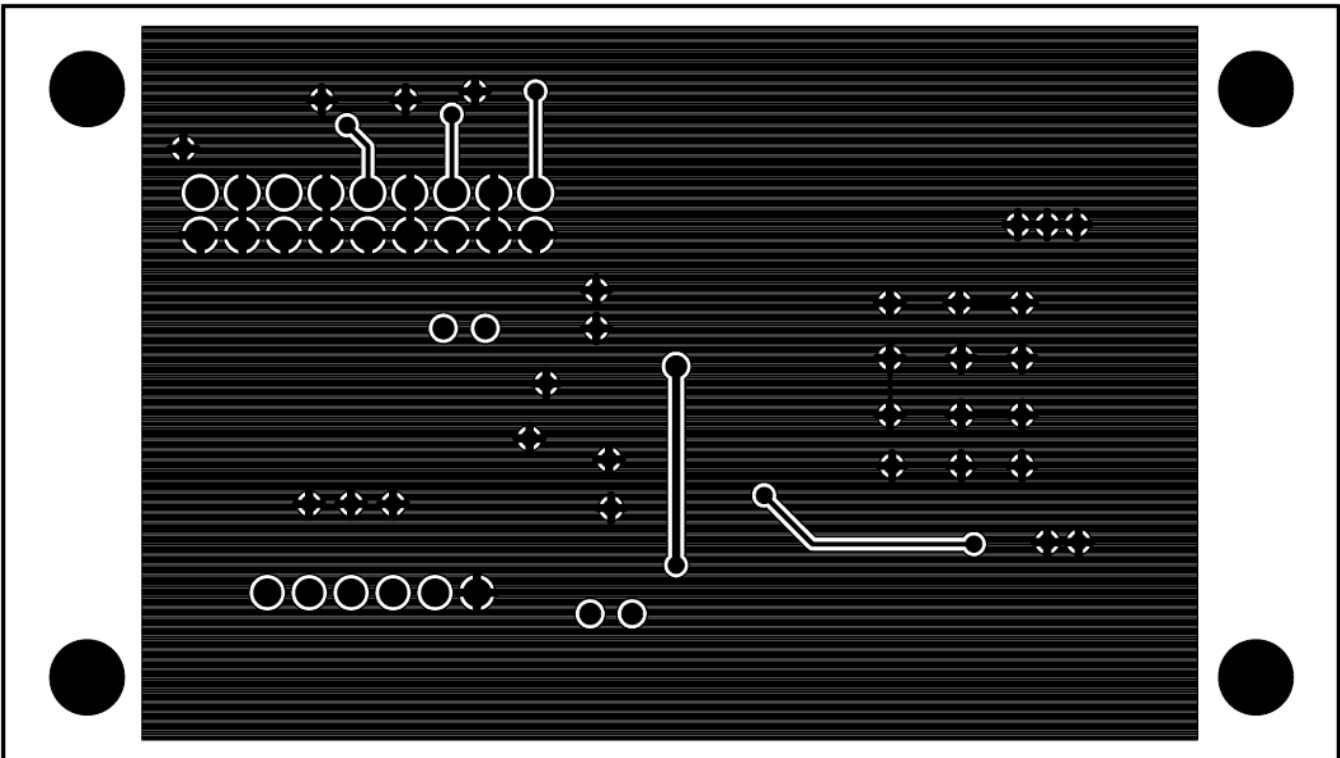


FIGURE 6 – MAIN BOARD BOTTOM LAYER ROUTING



### 14.2 INTERFACE ADAPTOR PCB

Interface Adaptor Board for the ORG4400 GPS Module is 17mm x 17mm 22 pads 4 layers 0.6mm thickness FR4 PCB.

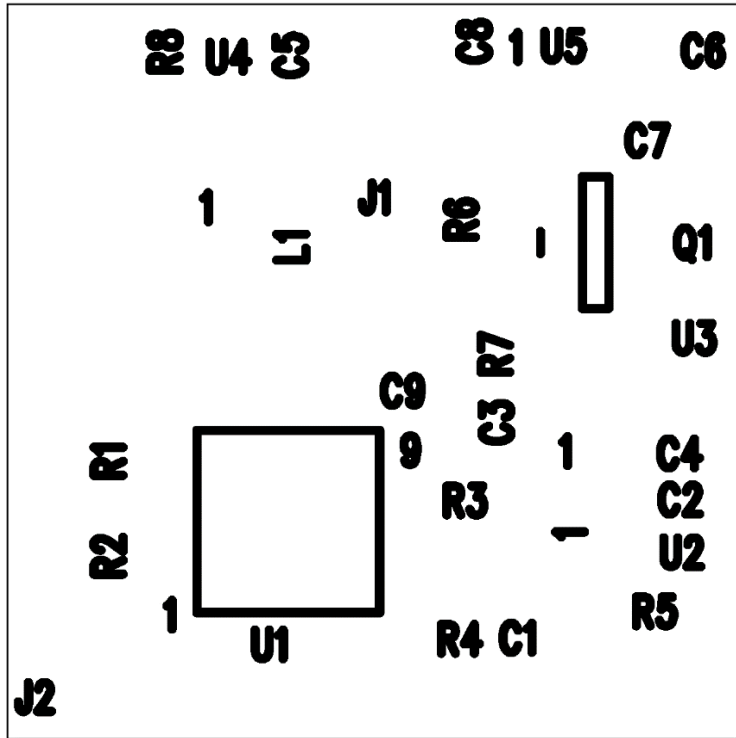


FIGURE 7 - INTERFACE ADAPTOR BOARD COMPONENTS PLACEMENT

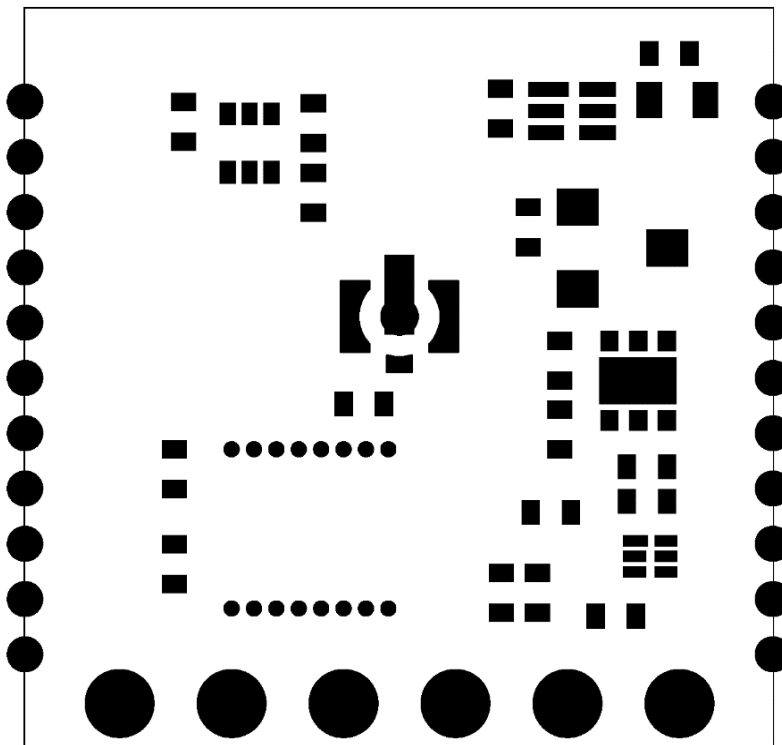


FIGURE 8 - INTERFACE ADAPTOR BOARD SOLDER MASK

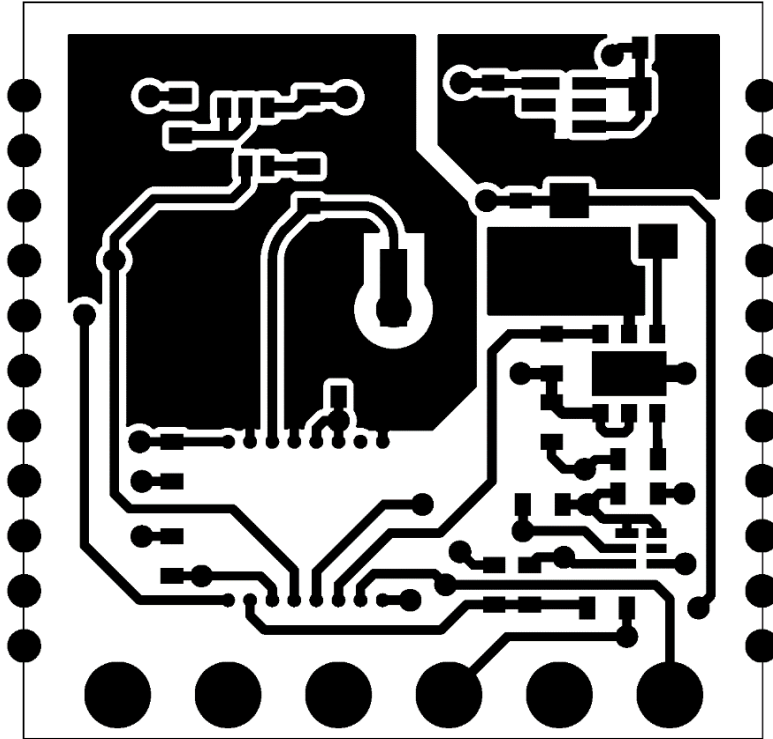


FIGURE 9 - INTERFACE ADAPTOR BOARD TOP LAYER ROUTING

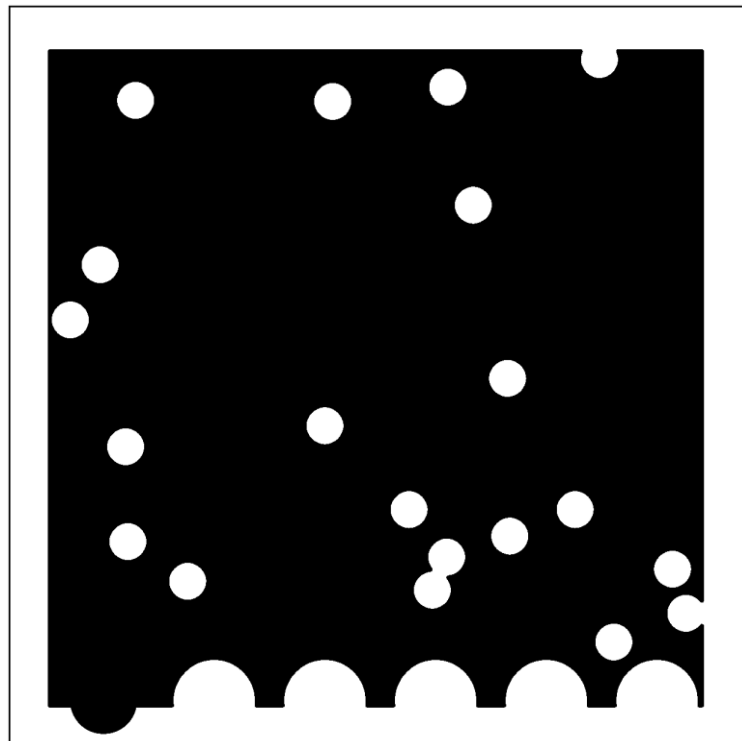


FIGURE 10 - INTERFACE ADAPTOR INNER LAYER 1 ROUTING

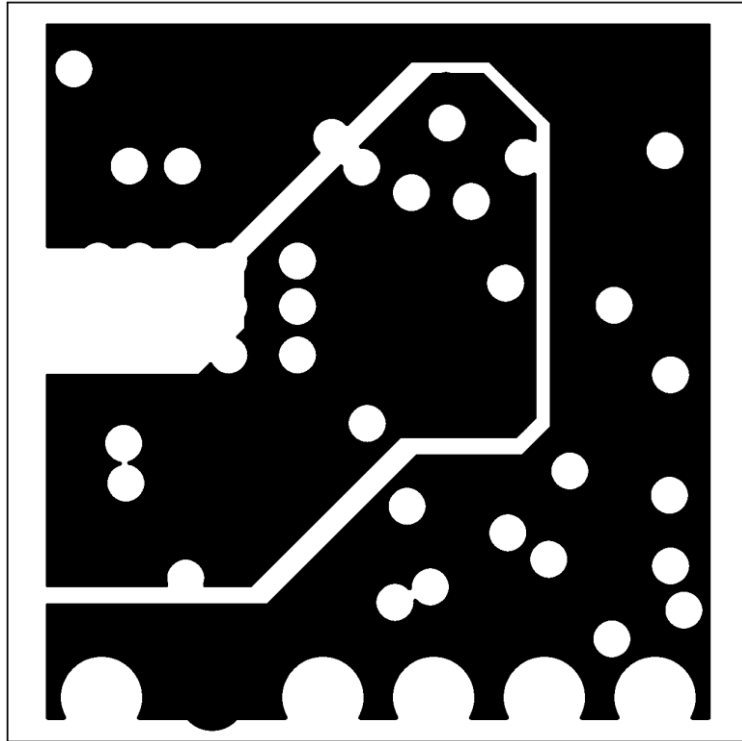


FIGURE 11 - INTERFACE ADAPTOR INNER LAYER 2 ROUTING

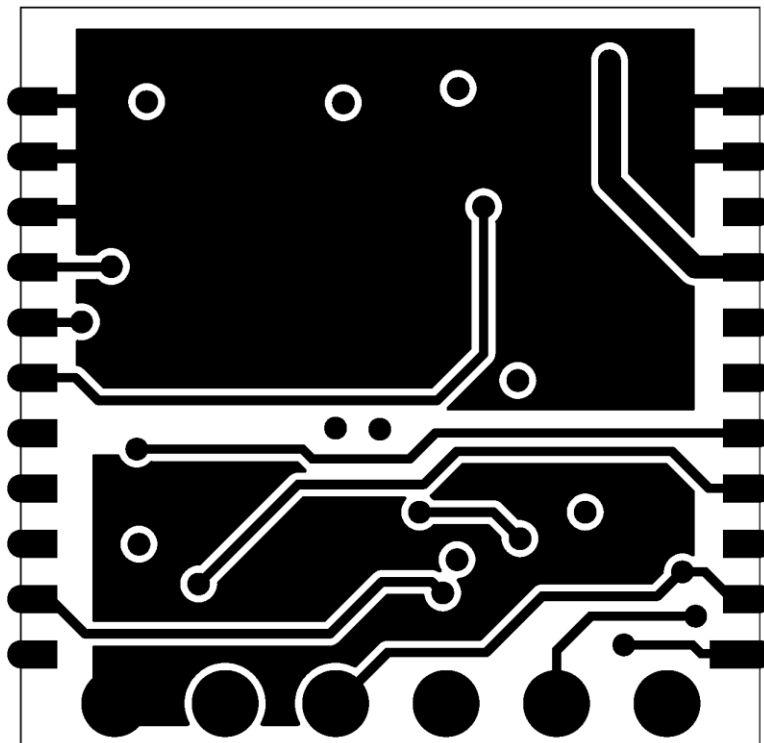


FIGURE 12 - INTERFACE ADAPTOR BOTTOM LAYER ROUTING



## 15. TTL-232R-3V3 USB-Serial CONVERTER CABLE\*

The TTL-232R-3V3 is a USB to Serial converter cable that provides a simple way to connect devices with UART interface to PC.

The TTL-232R-3V3 uses an FTDI FT232RQ IC which is housed inside the USB Type 'A' connector and is terminated at the end of a 1.8 meter cable (6 ft.) with a 2.54mm (0.1) pitch header socket which provides an access to UART standard Transmit Data (TxD) and Receive Data (RxD). These lines are operating at 3.3V LVTTTL levels. Also brought out on the header are +5V and GND.



FIGURE 13 - PIN HEADER SOCKET BOTTOM VIEW

Pin Number	Name	Type	Colour	Description
1	GND	Power	Black	Ground supply pin
2	CTS	Input	Brown	Clear To Send input – not in use
3	VCC	Power	Red	+5V power source, USB specified
4	TXD	Output	Orange	Asynchronous Data output – GPS input
5	RXD	Input	Yellow	Asynchronous Data input – GPS output
6	RTS	Output	Green	Request To Send output – not in use

TABLE 5 - USB-SERIAL CONVERTER CABLE HEADER PIN-OUT

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Power Supply Voltage	$V_{CC}$	Defined by USB $V_{BUS}$	4.25	5.0	5.25	V
Power Supply Current	$I_o$		-	-	75	mA
Output Voltage Low State	$V_{OL}$	$I_{OL} = 8mA$	0.3	0.4	0.6	V
Output Voltage High State	$V_{OH}$	$I_{OH} = -3mA$	2.2	2.8	3.2	V
Input Voltage State Switching Threshold	$V_{IN}$	Low → High	1.0	1.2	1.5	V
Input Voltage State Switching Hysteresis	$V_{HYST}$	High → Low	20	25	30	mV
Operating Temperature	$T_{AMB}$		-40	+25	+85	°C

TABLE 6 - USB-SERIAL CONVERTER CABLE OPERATING PARAMETERS

\*Note: For more information refer to FTDI Ltd. TTL-232R TTL To USB Serial Converter Range Of Cables Datasheet, Document Reference No.: FT\_000054



## 16. ORG9802 MINIATURE PASSIVE ANTENNA ASSEMBLY\*

### 16.1 GENERAL

ORG9802 is a miniature antenna assembly, comprising four components:

1. Ceramic patch antenna element
2. Adaptor PCB
3. Coaxial cable
4. Connector

### 16.2 MECHANICAL SPECIFICATIONS

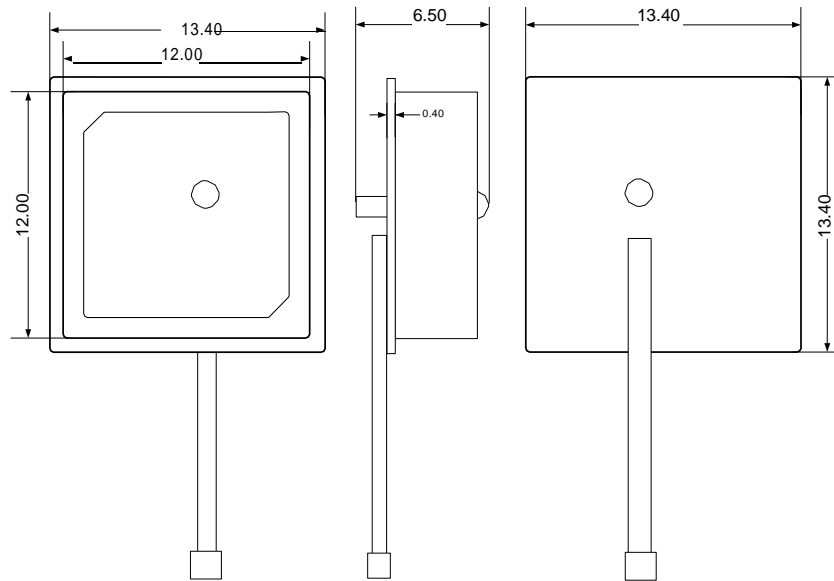


FIGURE 14 - ORG9802 MECHANICAL OUTLINE

Dimensions	Length	Width	Thickness	Weight	
	mm	$13.4 \pm 0.2$	$13.4 \pm 0.2$	$6.5 \pm 0.1$	gr
inch	$0.528 \pm 0.008$	$0.528 \pm 0.008$	$0.256 \pm 0.004$	oz	0.14

TABLE 7 - ORG9802 MECHANICAL SPECIFICATIONS

\*Note: For more information refer to OriginGPS ORG9802 Patch Antenna Assembly Datasheet, Document number 300311





### 16.3 ELECTRICAL SPECIFICATIONS

Parameter		Value	Unit	Notes
Center frequency ( $f_c$ )		$1575 \pm 3$	MHz	
Return Loss ( $S_{11}$ )		-15 (min)	dB	@ $f_c$
Bandwidth (BW)		7 (min)	MHz	@ $f(S_{11}=-9\text{dB})$
VSWR		1.2 (max)		
Impedance ( $Z_A$ )		50	$\Omega$	
Axial Ratio (AR)		2.5 (max)	dB	Properties of antenna element
Gain @ $f_c$	90° Elevation	-1.0 (typ)	dBic	
	10° Elevation	-6.5 (typ)	dBic	
Polarization		R.H.C.P		
Insertion Loss ( $S_{21}$ )		3	dB/m	Property of coaxial cable
Operating Temperature		-40 to +85	°C	

TABLE 8 - ORG9802 ELECTRICAL SPECIFICATIONS

#### TYPICALS $S_{11}$

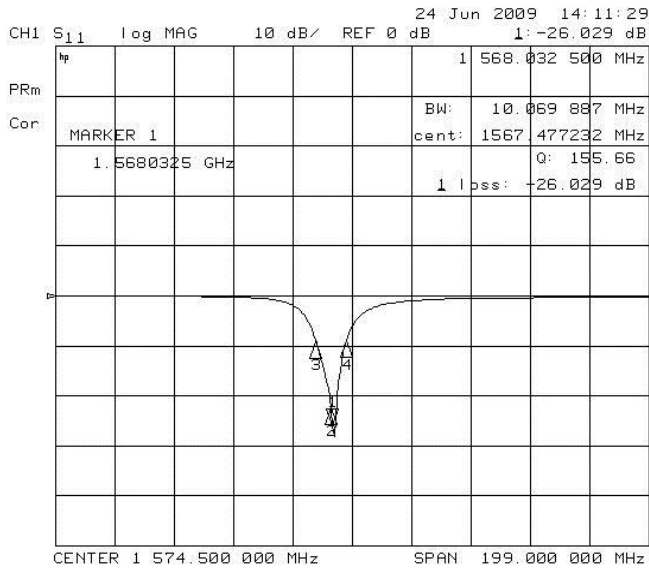


FIGURE 15 - ORG9802  $S_{11}$  LOG MAGNITUDE

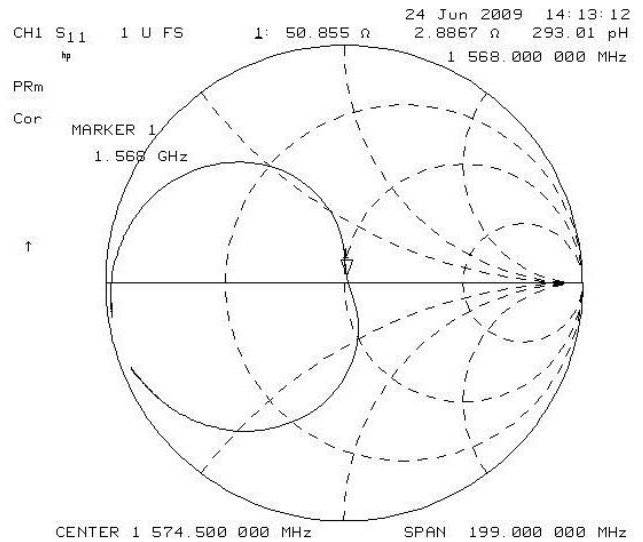


FIGURE 16 - ORG9802  $S_{11}$  SMITH CHART



## 17. ORG9805 External Active Antenna\*

### 17.1 DESCRIPTION

The ORG9805 External Active Antenna incorporates high-efficiency ceramic patch antenna element, high out-of-band rejection band-pass Surface Acoustic Wave (SAW) filter, low Noise Figure and high gain Low Noise Amplifier (LNA), enclosed in plastic case, with coaxial cable terminated by standard SMA-type plug. The ORG9805 Active Antenna with highest GPS-band performance and notch filtering for out-of-band signals provides exceptional sensitivity, high selectivity and noise immunity. The ORG9805 Active Antenna is built of highest quality materials and components. The ORG9805 Active Antenna is the perfect match to the OriginGPS GPS receiver modules.

### 17.2 FEATURES

- Antenna element with high efficiency for excellent coverage of GPS satellites
- SAW filter for rejection of out-of-band signals
- LNA with low Noise Figure and high gain for high sensitivity
- Plastic case with magnetic base
- RG-174 flexible coaxial cable of 5m length
- SMA-type gold plated plug

### 17.3 BENEFITS

- High performance
- Compact size
- Easy integration

### 17.4 BLOCK DIAGRAM

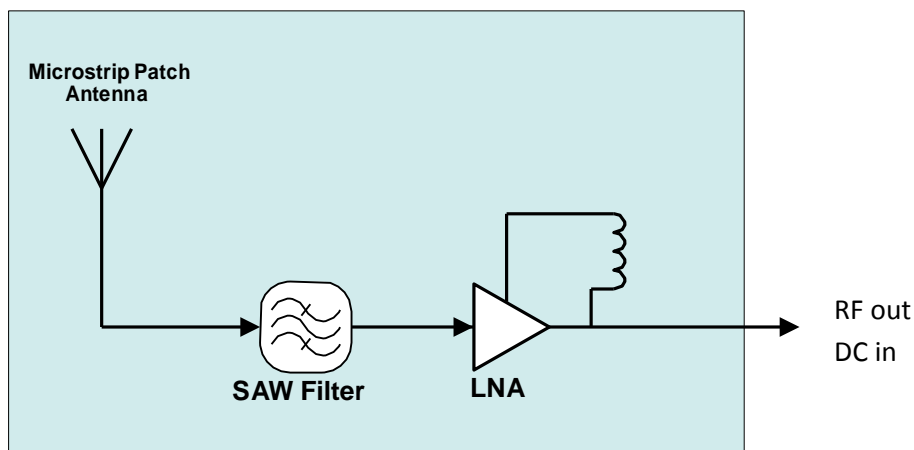


FIGURE 17 - ORG9805 BLOCK DIAGRAM

\*Note: For more information refer to OriginGPS ORG9805 External Active Antenna Datasheet, Document number 160112



## 17.5 ELECTRICAL SPECIFICATIONS

Parameter	Value	Unit	Notes
Center Frequency ( $f_c$ )	1575 $\pm$ 3	MHz	
Bandwidth (BW)	10 (min)	MHz	
Peak Gain	4 (min)	dBic	@ $f_c$ , 70mm x 70mm GP
Gain Coverage	-4 (min)	dBic	@ $f_c$ , $-90^\circ < \theta < 90^\circ$ (over 75% volume)
Axial Ratio (AR)	2.0 (max)	dB	
Polarization	R.H.C.P		
Filter Attenuation	7 (min) 20 (min) 25 (min) 40 (min)	dB	@ $f_c + 20$ MHz, @ $f_c - 20$ MHz @ $f_c + 50$ MHz, @ $f_c - 50$ MHz @ $f_c + 100$ MHz @ $f_c - 100$ MHz
Power Handling	30	dBm	out of band signal
LNA Gain	27 (typ)	dB	without cable loss
LNA Noise Figure	1.5 (max)	dB	
DC Voltage	3 - 5	V	supplied via coaxial cable
DC Current	8.5 (typ)	mA	@3.3V
Cable Insertion Loss	1.2 (typ)	dB/m	
VSWR	2.0 (max)		@output
Impedance	50 $\pm$ 1	$\Omega$	@output

TABLE 9 - ORG9805 ELECTRICAL SPECIFICATIONS



### 17.6 MECHANICAL SPECIFICATIONS

Parameter	Value	Unit	Notes
Size ( L x W x H )	48.6 x 39.2 x 15.2	mm	tolerance: $\pm 0.5\text{mm}$
Weight	106 (approx.)	g	including cable
Housing	PC		
Color	Black		
Mounting	Magnetic base		
Orientation	Horizontal surface		
Cable Type	RG-174		diameter: $2.7 \pm 0.1\text{mm}$
Cable Length	5	m	
Connector Type	SMA Plug		Gold plated

TABLE 10 - ORG9805 MECHANICAL SPECIFICATIONS

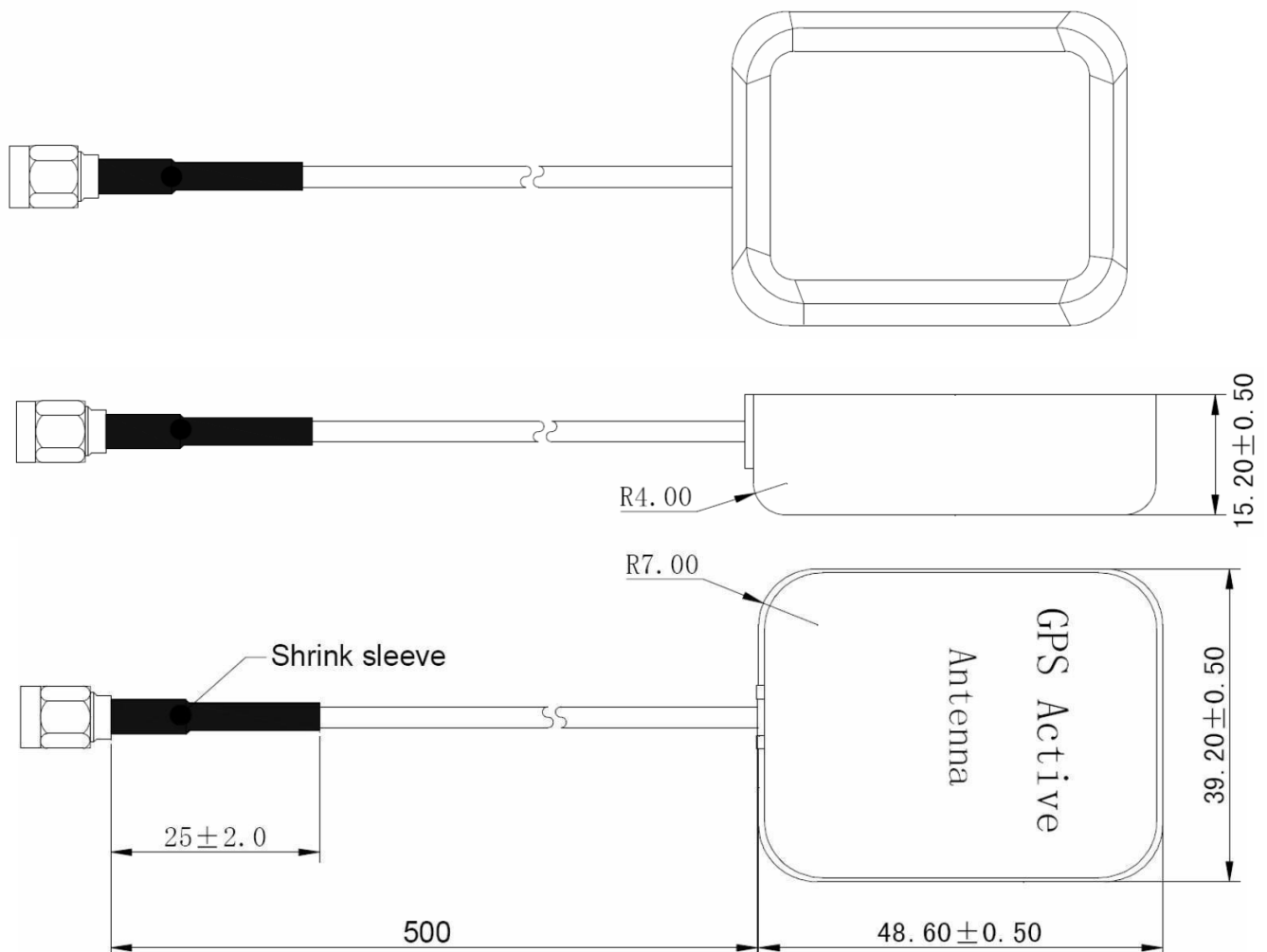


FIGURE 18 - ORG9805 MECHANICAL OUTLINE



## 18. I-PEX MHFIII TO SMA-TYPE COAXIAL CABLE ADAPTOR

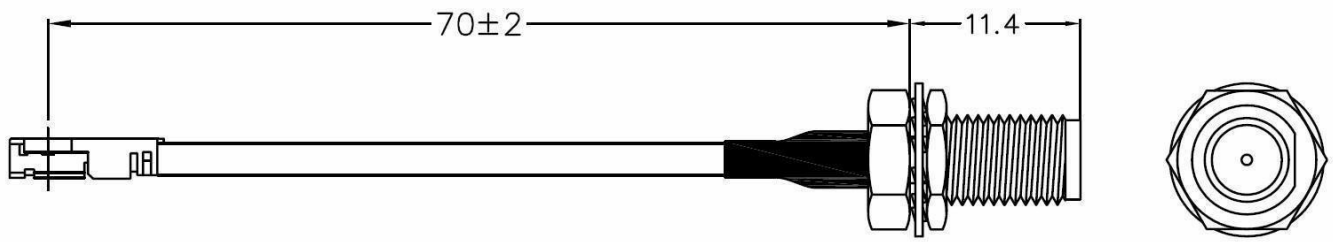


FIGURE 19 - I-PEX MHFIII TO SMA-TYPE ADAPTOR MECHANICAL OUTLINE