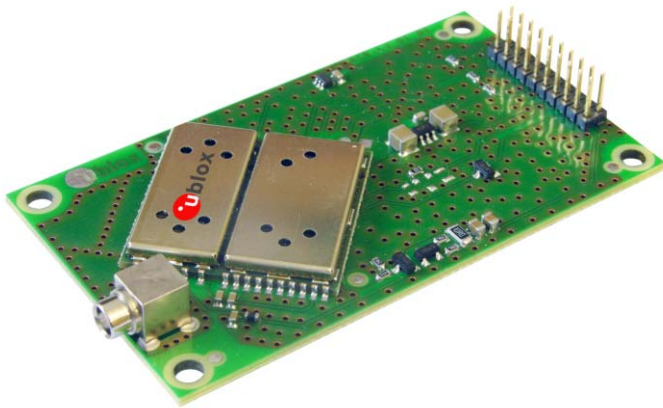


RCB-4H ANTARIS[®] 4 Programmable GPS Receiver Board with SuperSense[®]

Data Sheet

PRELIMINARY



Abstract

This document describes the features and specifications of the GPS receiver board RCB-LJ. Based on the 16-channel ANTARIS[®] GPS technology, it offers best GPS performance at very low power consumption.

Title	RCB-4H		
Subtitle	ANTARIS® 4 Programmable GPS Receiver Board with SuperSense®		
Doc Type	Data Sheet	PRELIMINARY	
Doc Id	GPS.G4-MS4-06034-P1		
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Data Sheet Revisions	Identification of applicable hardware	Comments
P1	All data codes	

	<p>Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).</p>
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Semiconductor technology provided by ATMEL.

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1 Functional Description

1.1 Overview

The RCB-4H is an ultra-low power GPS receiver board featuring the ANTARIS 4 positioning engine with SuperSense Indoor GPS. It is the pin-compatible successor product of the RCB-LJ. The RCB-4H is equipped with a MCX/OSX RF connector and a 20-pin connector for power and digital I/O. The supported Assisted GPS (A-GPS) functionality provides fast time to first fix even in difficult signal conditions.

The ANTARIS 4 GPS Engine provides high navigation performance even in indoor environments and other weak signal environments. Satellite based augmentation systems like WAAS, EGNOS and MSAS is fully supported. The combination of high performance and flexibility fulfill the requirements for cost efficiency and fast and straightforward plug-in system integration.

1.2 Block Diagram

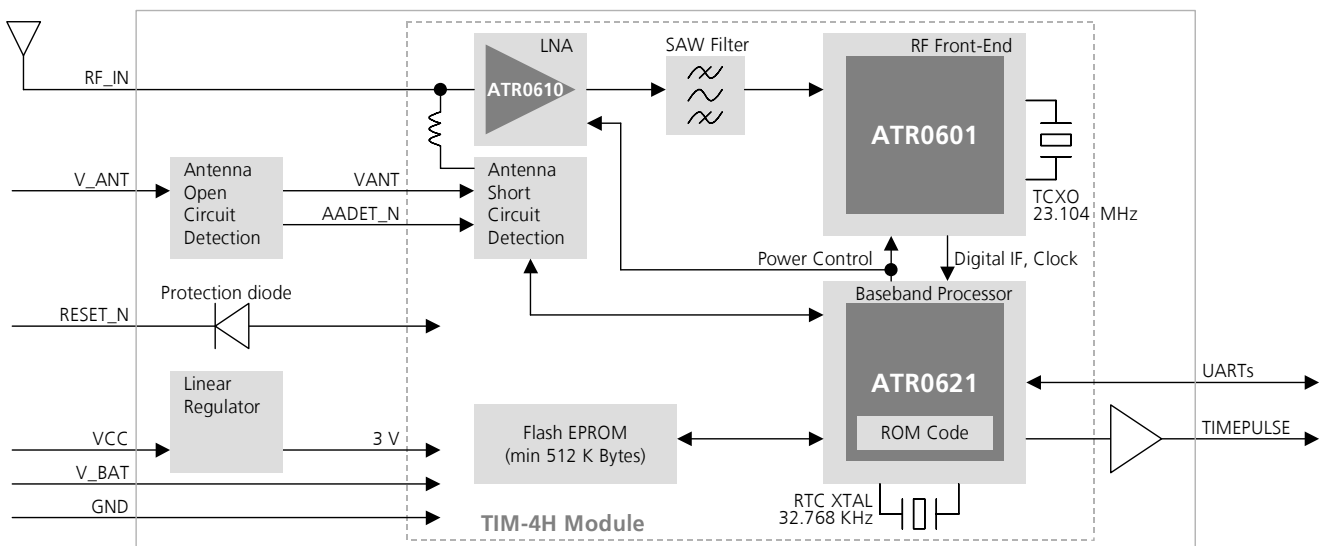


Figure 1: Block Diagram

1.3 Highlights

- **SuperSense® Indoor GPS**
- **Ultra low power consumption**
- **A-GPS and Autonomous GPS operation, AssistNow™ ready**
- **Flash EPROM: programmable and configurable**
- **4 Hz position update rate**
- **2 UART ports**

1.4 Features

- 16 channel ANTARIS 4 positioning engine
- Supports DGPS, WAAS, EGNOS and MSAS
- Power saving modes
- Supports passive and active antennas
- Antenna short and open circuit detection and protection
- Wide supply voltage range: 3.15 to 5.25 V
- Battery voltage supply pin for internal backup memory and real time clock
- Power brown-out protection: No external reset hardware needed
- Industry standard PCB form factor for easy plug-in integration
- Operating temperature range: -40 to 85°C
- RoHS compliant (lead-free)

1.5 Operating Modes

The ANTARIS 4 GPS Technology supports following Operating Modes:

Operating Modes	Description
Continuous Tracking Mode (CTM)	In this mode, the Autonomous Power Management (APM) automatically optimizes power consumption. It powers off parts of the receiver when they are not used. Also, the CPU speed is reduced when the CPU workload is low.
Power Saving Modes	A configurable power saving mode is available where the GPS is put into sleep mode and activated up on a selectable time interval or upon external request (signal activity on serial port or EXTINT input). This mode is ideally suited in applications with stringent power budget requirements in mobile and battery operated end products.

Table 1: Operating Modes

For details, please refer to the *System Integration Manual for ANTARIS 4* [1].

1.6 Protocols

The RCB-4h supports different serial protocols. These can be assigned to any serial interface port.

Protocol	Type	Runs on
NMEA	Input/output, ASCII, 0183, 2.3 (compatible to 3.0) Standard \$GPxxx and u-blox-specific \$PUBX messages	All serial ports
UBX	Input/output, binary, u-blox proprietary	All serial ports
RTCM	Input, messages 1,2,3,9	All serial ports

Table 2: Available Protocols

For specification of the various protocols see the *Protocol Specification* [2].

1.7 Assisted GPS (A-GPS)

The ANTARIS 4 GPS engine supports both MS assisted (output of raw tracking information for position computation by the service provider) and MS based (accelerated acquisition and position computation in the GPS receiver) A-GPS. Supply of aiding information like ephemeris, almanac, rough last position and time and satellite status will reduce time to first fix significantly.

1.8 Antenna

This GPS receiver is designed for use with passive and active antennas. An antenna supervisor is provided. If activated, the GPS receiver is capable of detecting short circuits to the active antenna by checking the bias voltage level and can shut down the voltage bias immediately. A series resistor is needed in front of the **V_ANT** input. UBX and NMEA messages are provided to report the condition of the antenna supply. Open circuit detection can also be supported with an additional external circuit. For details, please refer to the *System Integration Manual for ANTARIS 4* [1].

Parameter	Specification	
Antenna Type	Passive and active antenna	
Active Antenna Recommendations	Minimum gain	15 - 20 dB (to compensate signal loss in RF cable)
	Maximum noise figure	1.5 dB
	Maximum gain	50 dB
Antenna Supply	Using VCC_RF or external voltage source	
Antenna Supervisor	Short circuit detection	Built-in
	Open circuit detection	Enabled with external circuit

Table 3: Antenna Specification

2 Performance Specification

Parameter	Specification				
Receiver Type	L1 frequency, C/A Code, 16-Channels 8192 time / frequency search windows				
Max Navigation Update Rate	4 Hz				
Accuracy	Position	2.5 m CEP ²	5.0 m SEP ³		
	Position DGPS / SBAS ¹	2.0 m CEP	3.0 m SEP		
Acquisition ^{4,5}	GPS Mode (UBX-CFG Msg):	Fast Acquisition Mode	Normal Mode	High Sensitivity Mode	Auto Mode
	Cold Start	34 s	36 s	41 s	34 s
	Warm Start	33 s			
	Hot Start	<3.5 s			
	Reacquisition	<1 s			
Sensitivity ⁶	Tracking	-158 dBm			
	Acquisition & Reacquisition	-148 dBm	Includes aided starts (A-GPS)		
	Cold Starts	-142dBm			
Accuracy of Timepulse Signal	RMS	50 ns			
	99%	<100 ns			
	Granularity	43 ns			
Dynamics	Strong signals	≤ 4 g			
	Weak signals	typ. 1 g			
Operational Limits (COCOM)	Altitude	18,000 m			
	Velocity	515 m/s			
	One of the limits may be exceeded but not both.				

Table 4: GPS Performance Specification

¹ Depends on accuracy of correction data of DGPS or SBAS service

² CEP = Circular Error Probability: The radius of a horizontal circle, centered at the antenna's true position, containing 50% of the fixes.

³ SEP = Spherical Error Probability. The radius of the sphere, centered at the true position, contains 50% of the fixes.

⁴ The different start-up modes like cold, warm and hot start are described in the System Integration Manual [1]

⁵ Measured with good visibility and -125 dBm signal strength

⁶ Demonstrated with a good active antenna

3 Mechanical Specification

3.1 Dimensions

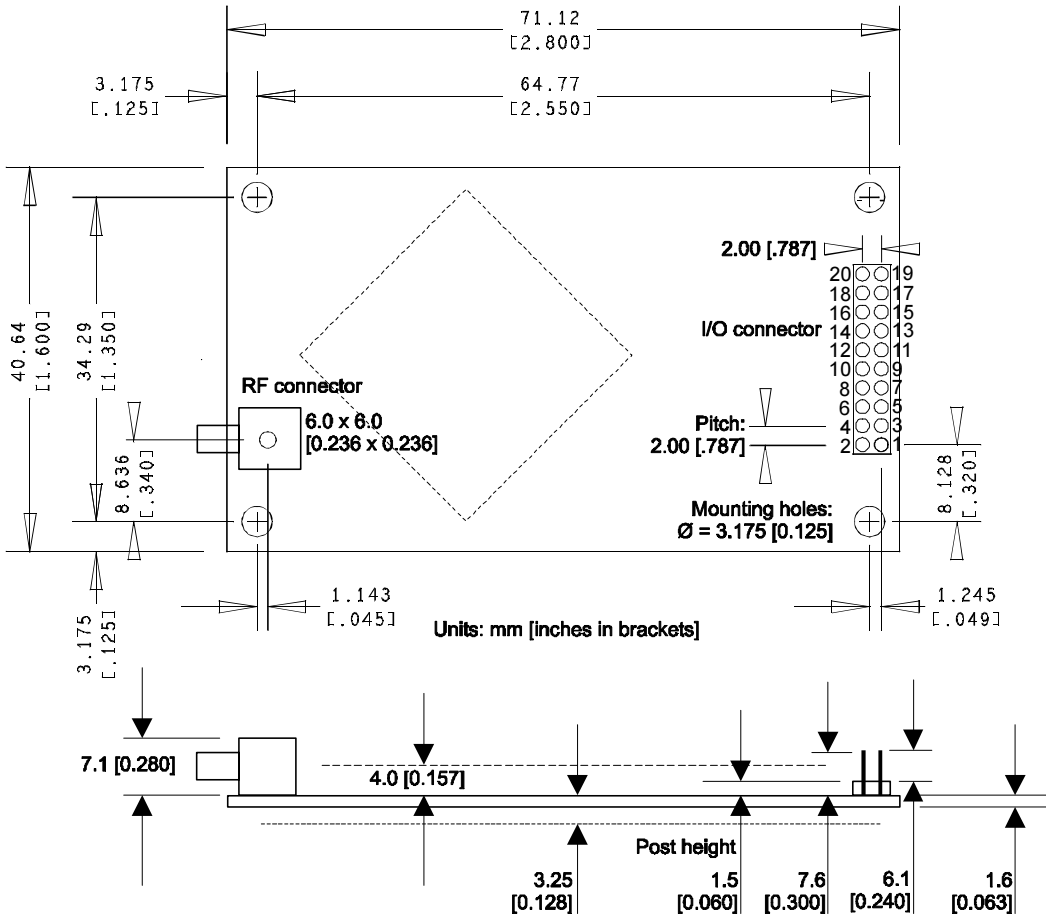
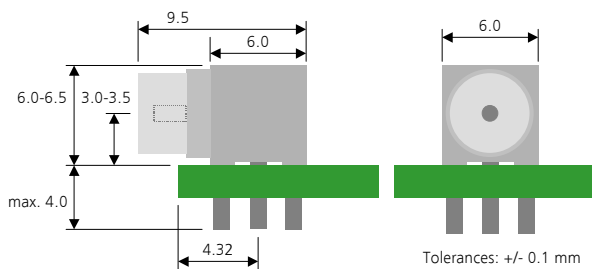


Figure 2: RCB-4H Dimensions (Height of RF connector may vary)



Right-angle MCX / OSX connector

Figure 3: RF Connector Dimensions

3.2 Specification

Parameter	Specification	Tolerance	Unit
Length	71.12	±0.3	mm
Width	40.64	±0.3	mm
Thickness	11.0	±0.3	mm
Weight	17		g

Table 5: Mechanical Specification

3.3 Pinout

RF interface: OSX / MCX, right angle with stand-off, 50 Ohm

Standard Function				Remarks
Pin	Name	I/O	Description	
1	RF_IN	I	GPS signal input	Apply no DC through this pin
-	GND		Shield: Ground	

Table 6: Pinout of RF Jack

Digital interface: 20 pin 2mm pitch header

Standard Function				Remarks
Pin	Name	I/O	Description	
1	V_ANT	I	Antenna Bias voltage	Connect to GND if not used
2	VCC	I	Supply Voltage	Internally shorted with pin 4
3	V_BAT	I	Backup voltage supply	Connect to GND if not used
4	VCC	I	Supply Voltage	Internally shorted with pin 2
5	RESET_N	I	Reset (Active low)	Concerning use of RESET_N signal, please refer to the ANTARIS System Integration Manual [1]
6	Reserved		Not connected	
7	Reserved		Not connected	
8	Reserved		Not connected	
9	Reserved		Not connected	
10	GND	I	Ground	
11	TxD1	O	Serial Port 1	
12	RxD1	I	Serial Port 1	Internal pull-up
13	GND	I	Ground	
14	TxD2	O	Serial Port 2	
15	RxD2	I	Serial Port 2	Internal pull-up
16	GND	I	Ground	
17	GND	I	Ground	
18	GND	I	Ground	
19	TIMEPULSE	O	Timepulse signal	
20	GND	I	Ground	

Table 7: Pinout of I/O Connector

4 Electrical Specification

4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Power supply				
Power supply voltage (VCC)	Vcc	-0.3	7.0	V
Battery backup supply voltage (V_BAT)	Vbat	-0.3	3.6	V
Digital Inputs (RxD1, RxD2)				
Digital Input pin voltage	Vin	-0.3	8	V
BOOT_INT Input				
Digital Input pin voltage	Vinb	-0.3	5	V
RF Input				
Antenna bias voltage (applied via Vant)	Vant	0	6	V
Antenna bias current (applied via Vant)	Iant		100	mA
Input power at RF_IN (source impedance 50Ω, continuous wave)	Prfin		-5	dBm
Environment				
Storage temperature	Tstg	-40	125	°C

Table 8: Absolute Maximum Ratings

! Warning Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

4.2 Operating Conditions

Parameter ⁷	Symbol	Condition	Min	Typ	Max	Units
Power Supply						
Power supply voltage	Vcc		3.15		5.25	V
Power supply voltage ripple	Vcc_PP				50	mV
Sustained Supply Current ⁸	Icc	Vcc = 3.0 V		39		mA
Peak Supply Current ⁹	Iccp	Vcc = 3.3 V			70	mA
Sleep Mode current	Iccs	Vcc = 3.3 V Vant = 0 V		170		μA
Backup battery voltage (without and with voltage limiter)	Vbat		1.5		3.6	V
Backup battery current	Ibat	Vbat = 3.3 V		5		μA
UART and all I/O Signals¹⁰						
Input pin voltage range	Vin		0		5	V
Input pin low voltage	Vin_low				0.41	V
Input pin high voltage	Vin_high		1.46			V
Output pin voltage range	Vout		0		3.1	V
Output pin low voltage	Vout_low	Iout = 0.3 mA			0.1	V
Output pin high voltage	Vout_high	Iout = 0.3 mA	2.8			V
RESET_N Input						
Input and output pin voltage range	VinR		0		5.25	V
Input pin low voltage	Vin_lowR				0.4	V
Input pin high voltage	Vin_highR		1.3			V
RF input						
Antenna gain	Gant				50	dB
V_ANT antenna bias voltage (must connect to ground if not used)	Vant		2		6	V
Antenna bias voltage drop	Vant_drop	Iant=10mA		130		mV
Antenna bias current drawn by the RCB-4H, antenna not connected	Iant	Vant = 5 V	1.5		2.0	mA
Environment						
Operating temperature	Topr		-40		85	°C

Table 9: Operating Conditions

Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability. The technical data apply to products where standard ANTARIS firmware is running.

⁷ All specification are at an ambient temperature of 25°C.

⁸ Average current drawn during Continuous Tracking Mode with 1 Hz update rate, using 6 satellites for tracking and navigation. Use this figure to determine required battery capacity

⁹ Peak current drawn during initial acquisition phase. Use this figure to dimension maximum current capability of power supply

¹⁰ RxD1, RxD2 provide internal pull-up to V_BAT18 (Battery supply regulated to 1.8V) and not VCC.

5 Environmental Specification

Detailed description of the test series:

Test		Standard
Visual inspection		IPC-A-610 "Acceptability of electronic assemblies" I.T.R.I. Publication No. 700 IPC-SM-840B Class 2.
Thermal shock	-40°C...+125°C, 100 cycles	IEC 68-2-14
Function at various temperatures	-40°C/2 hours; RT/2 hours; +85°C/2 hours; function tests at stable temperature	IEC 68-2-1 and IEC 68-2-2
Lifespan test	+85°C/1000 hours, in function	IEC 68-2-2
Damp heat, cyclic	+25°C...+55°C; >90% rH	IEC 68-2-30
Vibration	10-500 Hz; 2 hours/axis; 5g	IEC 68-2-6
Shock	30g/11ms (half sine); 3 Shock/axis; no function	IEC 68-2-27
Metallographic investigations		IPC-QE-650

Note: This specification is preliminary and yet subject to confirmation.

Table 10: Environmental Specification

6 Product Lineup

6.1 Default Settings

Please refer to the *System Integration Manual for ANTARIS 4* [1] for information about further settings.

Interface	Settings
Serial Port 1 Output	9600 Baud, 8 bits, no parity bit, 1 stop bit Configured to transmit both NMEA and UBX protocols, but only following NMEA and no UBX messages have been activated at start-up: GGA, GLL, GSA, GSV, RMC, VTG, ZDA, TXT Additional messages can be activated with appropriate input messages.
Serial Port 1 Input	9600 Baud, 8 bits, no parity bit, 1 stop bit, Autobauding disabled Automatically accepts following protocols without need of explicit configuration: UBX, NMEA, RTCM The GPS receiver supports interleaved UBX and NMEA messages.
Serial Port 2 Output	57600 Baud, 8 bits, no parity bit, 1 stop bit Configured to transmit both NMEA and UBX protocols, but only following UBX and no NMEA messages have been activated at start-up: NAV-POSLH, NAV-SOL, NAV-SVINFO, NAV-STATUS MON-IO, MON-SCHD, MON-TXBUF, INF-Warning, INF-Error, INF-Notice Additional messages can be activated with appropriate input messages.
Serial Port 2 Input	57600 Baud, 8 bits, no parity bit, 1 stop bit, Autobauding disabled Automatically accepts following protocols without need of explicit configuration: UBX, NMEA, RTCM The GPS receiver supports interleaved UBX and NMEA messages.
TIMEPULSE	1 pulse per second, synchronized at rising edge, pulse length 100ms

Table 11: Available Protocols

6.2 Ordering Information

Ordering No.	Product
RCB-4H-0-000-0	RCB-4H Programmable GPS Receiver Board with SuperSense <u>Delivery Packing</u> 0 = Single samples 1 = Packing unit (100 pieces) <u>RF Connectors</u> 0 = Right-angle MCX/OSX

Table 12: Ordering Information

Parts of this product are patent protected.

Related Documents

- [1] System Integration Manual for ANTARIS 4, Docu. No GPS.G4-MS4-05007
- [2] ANTARIS 4 Protocol Specification, Docu. No GPS.G3-X-03002

All these documents are available on our homepage (<http://www.u-blox.com>).

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