µ-blox GPS-PS1
GPS Receiver Board based on SiRFstar I/LX™
-Datasheet-

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1 Features

- Full Implementation of the SiRFstar I/LX™ Architecture, Including:
  - GRF1/LX Low-power RF front-end IC
  - GSP1/LX Low-power GPS DSP with Integrated Real Time Clock (RTC)
  - Hitachi RISC CPU SH-7020
  - 1 MBit SRAM
  - 4 MBit FLASH memory
  - Low Noise Amplifier
  - Filter, Crystals, etc.
- Differential GPS (RTCM-SC104) input
- Dimensions: 82.5mm × 32mm × 8.5mm
- M/A-Com SSMT coax connector for RF-Input or standard SMB
- Bias Voltage for active antenna 4.75V
- 2 bi-directional Serial Interfaces
- Operating voltage 5 Volts, 0.75 Watt
- Industrial operating temperature range (–40 - +85°C)
- Minimum external requirements:
  - 5 Volt power supply, 0.75 Watt
  - Backup battery for real time clock and SRAM
  - Serial interface for NMEA or SiRF binary data
  - Passive or active Antenna
- Customer specific code can be implemented on the Hitachi SH-1 processor using the µ-blox Software Customization Kit.

Revision History		
Date	Section	Changes
Mar. 16,98		Initial version
Mar. 18, 98	Section 6 Table 8	Complete section added. Vbat connection specification for unused case added.
July 29, 98	Layout Table 9: Matching Connectors Figure 2 Section 3 & Table 2: Ordering Options	New Font, all tables small font Complete table added Figure added Options changed
Dec. 10, 98	Section 4	Text changes.
June 23, 99	Version GPS-DS-0699	new Layout, Flash size up-dated, Ordering options added, Figure External wiring added

Table 1: Revision History

2 Overview

GPS-PS1 is a fully self-contained receiver module for the Global Positioning System (GPS). Based on the SiRFstar I/LX™ chip set manufactured by SiRF Technology, Inc., the module supports all features, and maintains the technical specifications of the SiRFstar I/LX™ architecture.

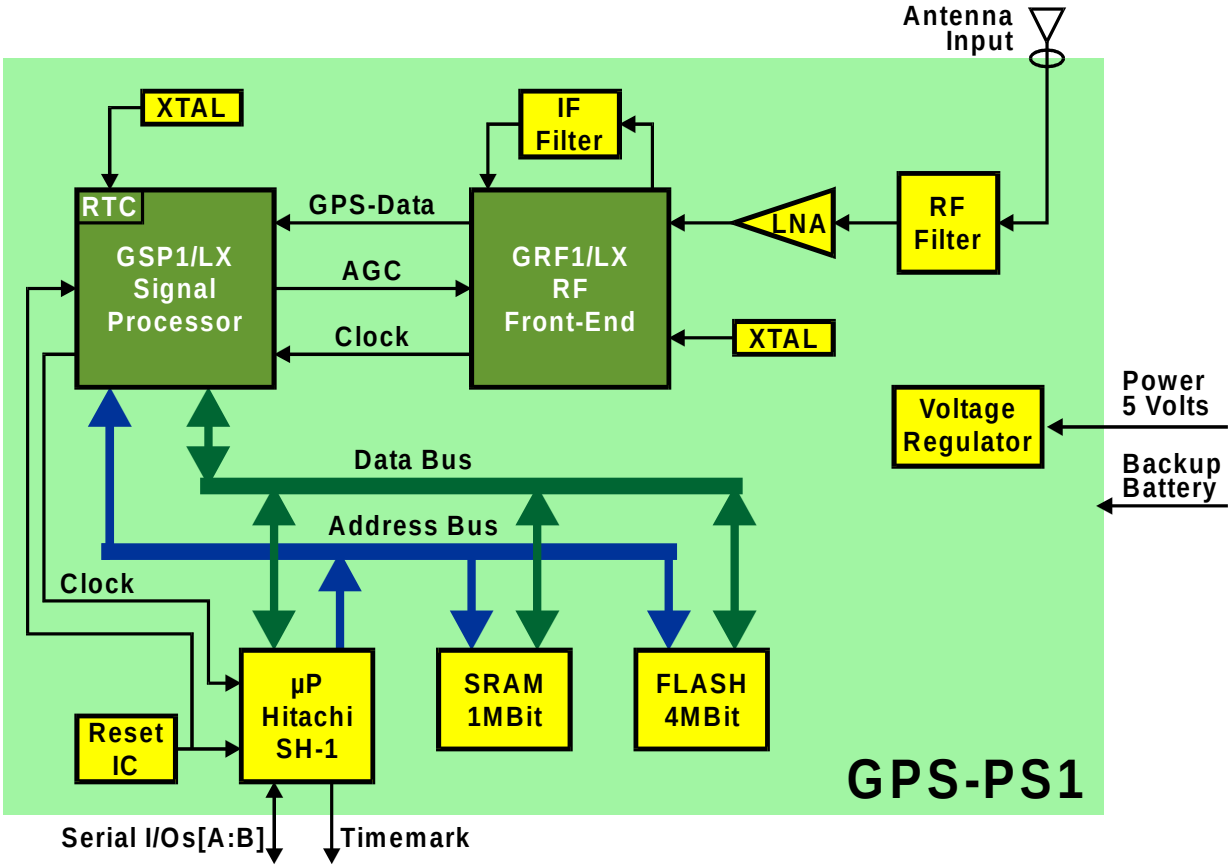

Figure 1: Blockdiagram of GPS-PS1

The module, which is 82.5mm × 32mm in size, provides complete GPS signal processing from antenna input to serial data output (NMEA or SiRF proprietary data format). A second serial port accepts differential GPS data (RTCM).

The receiver runs at an external operating voltage of 5 Volts. Internally this is converted to the operating voltage of 3.3 Volts, so the module consumes less than 0.75 Watts in continuous operation mode. Featuring the GRF1/LX RF front-end chip and an integrated Low-Noise Amplifier (LNA), the module connects seamlessly to low-cost passive antennas. Active antennas can be connected to the GPS-PS1 as well. An antenna bias voltage (4.75V) is internally generated. Sufficient CPU power of the module's Hitachi SH-1 RISC CPU allow integration of additional customer specific functionality. For many applications, the functionality of an external micro-controller can be transferred to GPS-PS1. The µ-blox Software Customization Kit is required to change the firmware or implement additional functionality on the on-board microprocessor.

3 Product Lineup

For the GPS-PS1 an integrated datalogger is available as an ordering option. This option enables the user to take advantage of the on-board FLASH memory to store position data.

The standard GPS-PS1 is supplied in the following start-up configuration:

- SiRF binary protocol
- 19'200 Baud
- 8 data bits, 1 stop bit, no parity

A utility available at the µ-blox homepage enables you to download new firmware up-dates and start-up configurations to your µ-blox GPS receiver.

Refer to Table 2 for ordering information. Options are available in higher quantities.

Option	Features
None	Standard version with M/A-Com SSMT/OSMT antenna connector
S	SMB antenna connector instead of SSMT/OSMT
DL	Adds datalogging capability

Table 2: Ordering Options

Ordering example: **GPS-PS1-S-DL** GPS-PS1 with datalogger and SMB connector.

4 Operating Modes

In the current version of the GPS-PS1 the TricklePower mode is not implemented. In Normal Mode, the module is continuously running as long as the operating voltage Vcc is supplied. Position fixes are generated at the maximum update rate. An external backup battery must be connected to enable the module to keep the internal Real Time Clock running and to hold the SRAM data (ephemeris and almanac data) during power supply interruption. Use of an external backup battery is recommended to reduce the system's startup time. However, under good visibility conditions cold- and warm start times do not differ significantly.

4.1 Customized Operation

The Hitachi SH-7020 RISC-CPU provides enough computational power to allow the implementation of additional customer specific software into the module. The current datasheet only provides basic information on the availability of I/O signals to the customer's application. In order to implement software on the on-board processor the Software Customization Kit (GPS-SCK) is required. The Software Customization Kit includes a development platform (compiler) and a sub-license of the firmware on the receiver. Contact µ-blox for a detailed discussion of the feasibility of implementing a particular application.

5 Technical Specifications

5.1 Electrical Specifications

5.1.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	Vcc	-0.3	16	V
Input Pin Voltage	Vin	-0.3	6	V
Storage Temperature	Tstg	-55	125	°C

Table 3: Absolute Maximum Ratings

Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only.

! GPS-PS1 is not protected against overvoltage or inverse voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be reduced by using appropriate protection diodes.

5.1.2 Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Power Supply Voltage	Vcc	4.5[1]	5.0	5.5	V
Power Supply Voltage Ripple	Vcc		100		mV
Backup Battery Voltage	Vbat	2.0		3.6	V
Input Pin Voltage	Vin	0		Vcc	V
Supply Current	Icc		150		mA
TricklePower Sleep Mode Supply Current	Itps		0.5		mA
Standby Battery Current	Ibat		20		µA
Operating Temperature	Topr	-40		85	°C

Table 4: Operating Conditions

Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.

5.2 Pin Description

Please see Table 5 for the pin identification for the 2 connectors of the GPS-PS1.

Pin	Type	Name
1	O	TX_B
2	I	Vcc
3	O	TX_A
4	I	Vbat
5	I	RX_A
6	O	TIMEMARK
7	I	RX_B
8	I	GND

Table 5: Pin Identification CON A

Pin	Type	Name
1		NC (reserved)
2	I/O	RESET
3		NC (reserved)
4		NC (reserved)
5		NC (reserved)
6		NC (reserved)
7	O	Vcc 3.3V
8	I	Test_I

Table 6: Pin Identification CON B

[1] Without active antenna, with active antenna 4.9 V

5.2.1 Serial Interface Signals

All serial interface signals TX_A, RX_A, TX_B and TX_B operate on 3.3V CMOS compatible signal levels. The Inputs RX_A and RX_B are 5V tolerant. The outputs are also 5V TTL compatible. If RS-232 compatible signal levels are required an external driver (e.g. MAX232) must be provided.

Default operation includes sending out SiRF binary data format compatible position data on Serial Port A and accepting RTCM SC-104 differential correction data on Serial Port B. NMEA 0183 position data format can optionally be used instead of SiRF binary data format. See the µ-blox GPS receiver protocol specifications for detailed information on the serial protocols.

The configuration of the receiver can also be changed by using the SiRF binary communication protocol. In order to change the default start-up configuration of the receiver, the firmware on the receiver has to be up-dated. During this up-date the default start-up configuration is set.

Unused Serial Input Ports should be pulled-down.

Port	Baud Rate
A and B	4800 9600 19200 (default) 38400

Table 7: Available Baud rates

Using SiRF binary protocol, the lowest baud rate that can be achieved is 9600. NMEA protocol allows using baud rates down to 4800, depending on the messages used. Special Function Signals

A **1PPS**[2] signal is available at the timemark pin. This signal is 3.3V CMOS and 5V TTL compatible.

5.2.2 Special Power Pins

A DC-bias voltage for an active antenna is supplied internally. Typically, the voltage required by an active antenna is 4.5V or 5V. The bias voltage supplied by the GPS-PS1 is 4.75V.

An external backup battery must be connected to pin **Vbat**. This enables RTC operation and SRAM backup and allows GPS warm or hot starts after power supply interruption.

Pin	Signals	Description
Serial I/O		
1,3,5,7	TX_A, RX_A, TX_B, RX_B,	Serial I/O ports. In default configuration, GPS data is output on port A, DGPS data is input on port B.
Special Functions		
6	TIMEMARK	1 pulse per second (1PPS) signal of GPS-PS1.
Power Pins		
2	Vcc	5V Supply Voltage
8	GND	Module Ground
4	Vbat	Backup voltage supply for RTC and SRAM. Connect to GND, if not used.

Table 8: GPS-PS1 Signal Description

[2] 1 pulse-per-second

6 How to Make it Run

The following are the minimum outside connections one has to provide to allow basic operation of GPS-PS1. If you plan to use more of GPS-PS1's functionality within your application, please contact µ-blox support.

1. **Antenna** Use a cable fitted with M/A-Com SSMT coaxial connector to connect the antenna to the module (see Table 9). For the GPS-PS1-S version use a SMB connector.
2. **Power** Connect Vcc pin 2 to 5V. And, connect GND pin 8 to ground. No special decoupling capacitors are necessary. The power supply should be capable of delivering a sustained current of at least 150mA. A proper RESET signal is internally generated.
3. **Serial Interface** Pins 1,3,5 and 7 (RX_[A:B] and TX_[A:B]) are 3.3V CMOS compatible. The RX inputs are also 5V tolerant. The TX outputs are also 5V TTL compatible. If you need different voltage levels, use appropriate level shifters. E.g. in order to obtain RS-232 compatible levels use the 3V compatible MAX232 from Maxim or equivalent. GPS data will come out of port A. You can use port B to feed in DGPS correction data. Connect the RX pin of any unused serial interface to GND.
4. **Backup Battery** Connect a backup battery to pin 4 (Vbat) if you intend to use this feature. You can also use a supercap. The voltage at this pin can be anywhere between 2.0V and 3.6V. For charging of the supercap, connect its positive pole through a diode to Vcc. If you don't intend to use a backup battery, connect this pin to GND.
5. **1PPS Signal** On pin 6 (TIMEMARK), a one-pulse-per-second signal is available.

That's all!

7 Mechanical Specifications

Figure 2 shows the mechanical dimensions of the module.

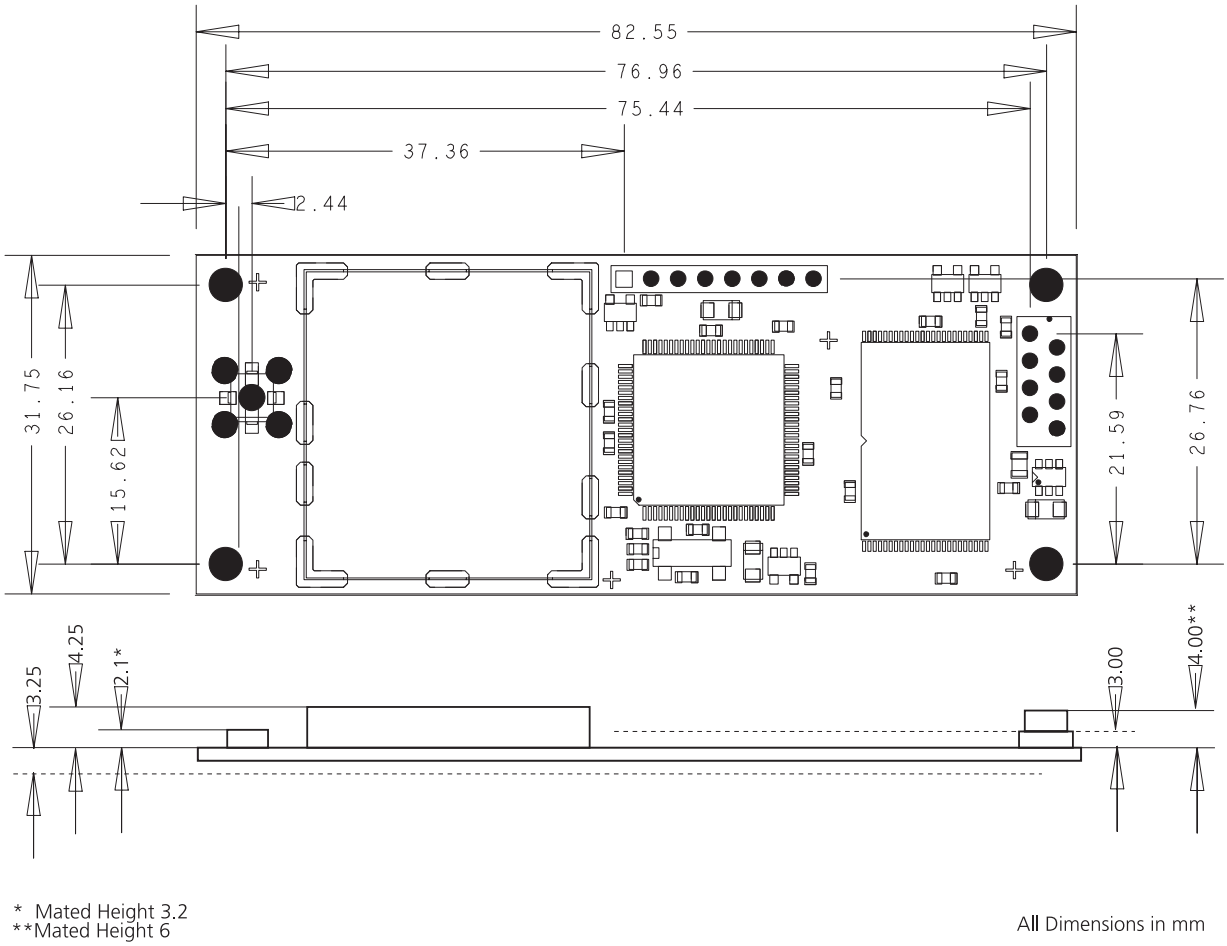

Figure 2: Mechanical Dimensions GPS-PS1 (with M/A-Com SSMT connector)

The weight of the module is approximately 13[3] grams including the metal shield. See Table 9 for matching RF connectors for the GPS-PS1.

Connector on module	Matching Connector
AMP MicroMatch 215079-8	Ribbon connector AMP215083-8
M/A-COM SSMT plug receptable	M/A-COM SSMT/OSMT Right Angle Jack Pigtail Part Number 9960-2100-24
SMB connector male	SMB connector female

Table 9: Matching Connectors

Check URL below for more information:

M/A-COM RF-Connectors: WWW: http://www.macom.com

AMP MicroMatch Series **WWW: http://www.amp.com**

[3] 16 grams with SMB connector (GPS-PS1-S)

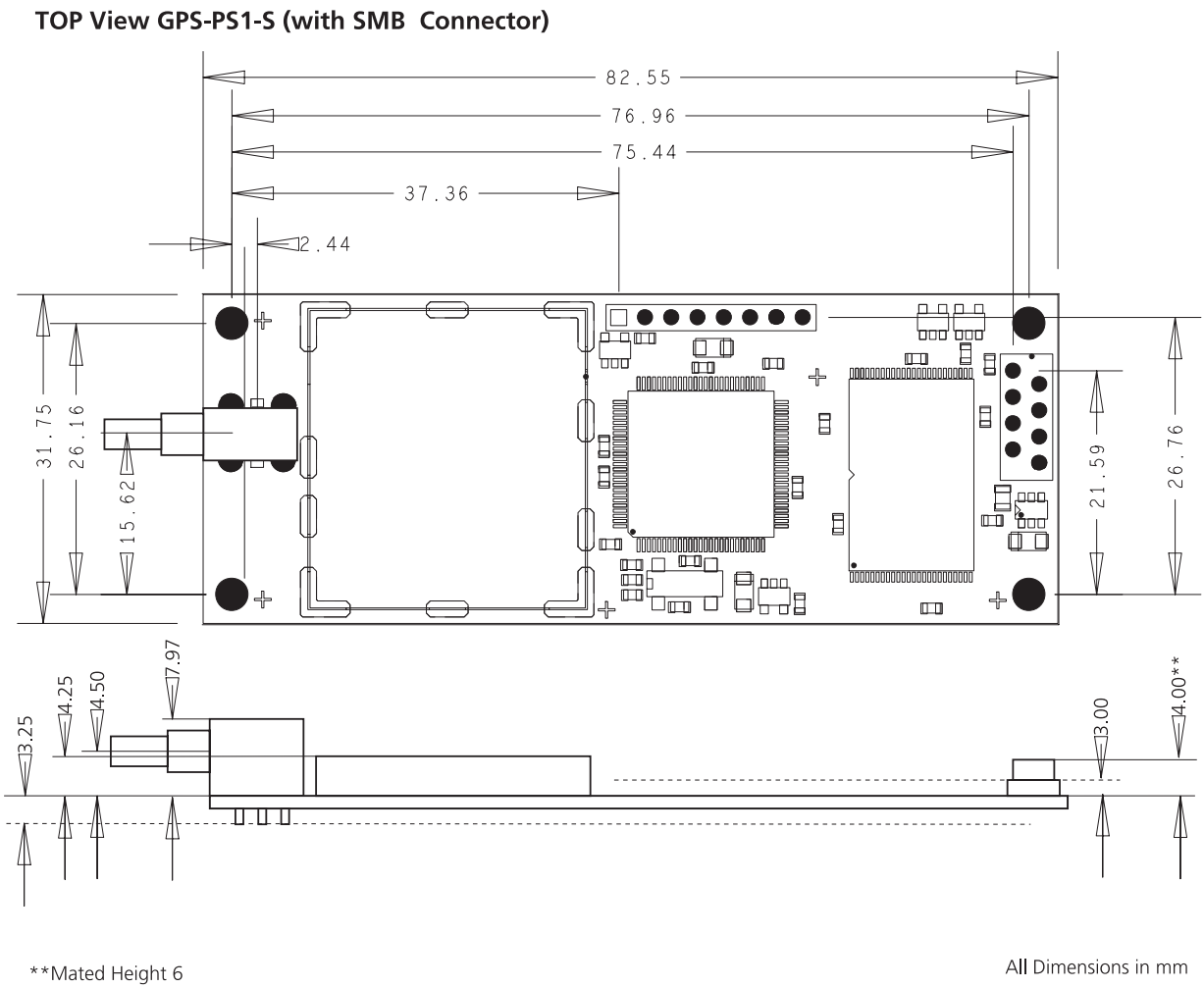

Figure 3: Mechanical Dimensions GPS-PS1-S (with SMB connector)

Figure 4 shows the recommended footprint.

Footprint GPS-PS1

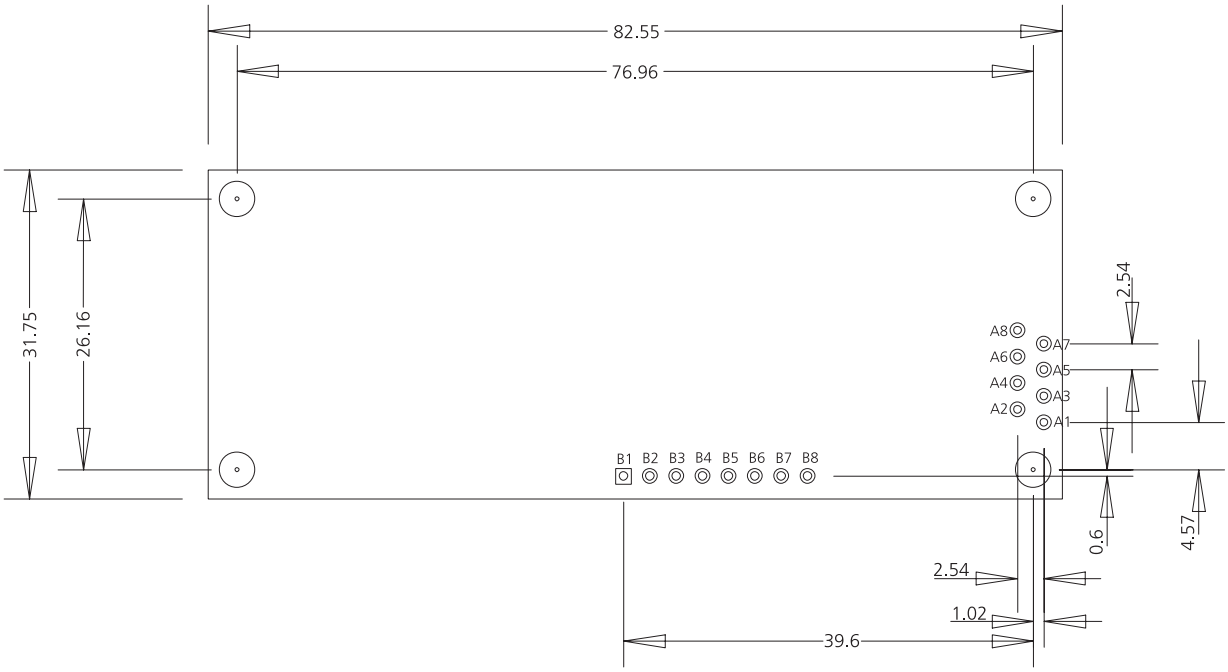

Figure 4: Recommended Footprint

8 Related Documents

- GPS-xS1 Protocol Specification
- Logging Option on µ-blox GPS receivers
- Performance of µ-blox GPS receivers Application Note
- GPS-xS1 Firmware Update Manual

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

9 Contact

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