

PCI-5S and PCM-5S u-blox 5 GPS Modules

Data Sheet



Abstract

Technical data sheet describing the cost effective, high-performance PCI-5S and PCM-5S GPS receiver modules featuring the high performance u-blox 5 positioning engine.

Features include AssistNow Online and AssistNow Offline A-GPS services, KickStart accelerated acquisition, SuperSense® Indoor GPS providing best-in-class acquisition and tracking sensitivity and an innovative jamming-resistant RF architecture. The PCI-5S and PCM-5S enable simple integration of GPS functionality into MIDs, UMPCs, laptops and similar applications. They are ready-to-use solutions, composed of a GPS receiver chipset incorporated into the industry standard PCI Express Mini and PCI Express Half Mini Card platforms.

The PCI-5S and PCM-5S are designed for use with passive and active antennas.

Title	PCI-5S and PCM-5S		
Subtitle	u-blox 5 GPS Modules		
Doc Type	Data Sheet	Preliminary	
Doc Id	GPS.G5-PS5-07002-C		
Revision Index	Date	Name	Status / Comments
-	06/02/2008	TG	Initial Release
A	14/02/2008	TG	Update of Ordering Information
B	10/11/2008	TG	CI, Pin Assignment, Antenna Specification, Ordering Information
C	14/01/2009	TG	Photos, Chain Noise Figure, Backup Current (Sleep mode), Operational Limits

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Data sheet status	
Objective Specification	This data sheet contains target or goal specification for product development.
Advance Information	This data sheet contains data based on early testing. Values may change.
Preliminary	This data sheet contains preliminary data, revised and supplementary data may be published later.
Released	This data sheet contains the final product specification.

	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).
	This is an Electrostatic Sensitive Device (ESD). Observe precautions for handling.

1 Functional Description

1.1 Overview

The PCI-5S and PCM-5S enable simple integration of GPS functionality into MIDs¹, UMPCs, laptops and similar applications. The PCI-5S and PCM-5S are ready-to-use solutions, composed of a GPS chipset incorporated into the PCI Express Mini or Half Mini Card platform.

The PCI-5S and PCM-5S set the standard for GPS modules. Featuring the high performance 50-channel u-blox 5 positioning engine, these receivers provide excellent performance and flexibility at an economical price. A 32-channel acquisition engine with over 1 million effective correlators is capable of massive parallel searches. This enables a Time To First Fix (TTFF) of less than 1 second, while long correlation/dwell times make possible the best-in-class acquisition and tracking sensitivity. The PCI-5S and PCM-5S include KickStart, a new feature enabling accelerated acquisition of weak signals. Once acquired, satellites are passed on to a power-optimized dedicated tracking engine. This arrangement allows the GPS engine to simultaneously track up to 16 satellites while searching for new ones.

u-blox 5's advanced jamming suppression mechanism and innovative RF architecture provides a high level of immunity to jamming, ensuring maximum GPS performance.

The PCI-5S and PCM-5S are not designed for life saving or supporting devices or for aviation and should not be used in products that could in any way negatively impact the security or health of the user or third parties or that could cause damage to goods.

1.2 Highlights and Features

Highlights

- 50-channel u-blox 5 engine with over 1 million effective correlators
- <1 second TTFF for Hot and Aided Starts
- -160dBm SuperSense® Indoor GPS acquisition and tracking sensitivity
- Accelerated startup at weak signals with KickStart feature
- A-GPS: AssistNow Online and AssistNow Offline; OMA SUPL compliant
- High immunity to jamming
- Receives GPS and GALILEO signals
- SBAS (WAAS, EGNOS, MSAS, GAGAN)
- 1 USB V2.0
- PCI-Express Mini or Half Mini Card form factor
- RoHS compliant

¹ Mobile Information Devices

1.3 Block Diagram

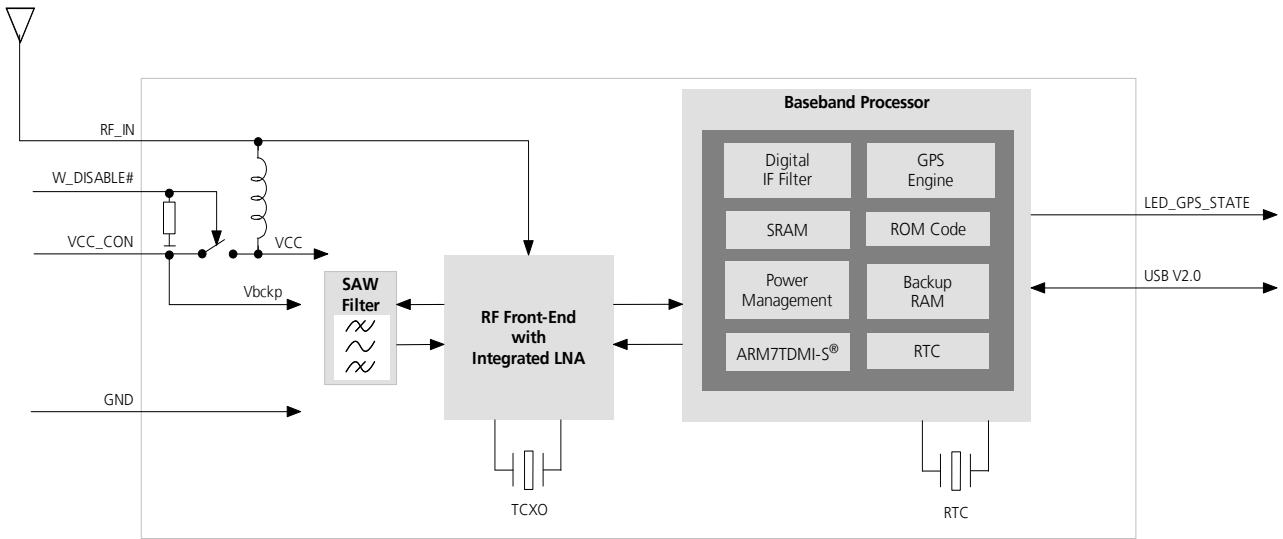


Figure 1: PCI-5S and PCM-5S Hardware Block Schematic

1.4 Assisted GPS (A-GPS)

Supply of aiding information like ephemeris, almanac, rough last position, time, and satellite status reduces time to first fix significantly and improves the acquisition sensitivity. The PCI-5S and PCM-5S support the u-blox AssistNow Online and Offline-GPS services.

1.5 KickStart

A new feature available with u-blox5 receivers is KickStart. This functionality uses a TCXO to accelerate weak signal acquisition, enabling faster start and reacquisition times.

1.6 On/Off Control (W_Disable)

The PCI-5S and PCM-5S include a W_DISABLE pin, which allows the board to be turned off when not needed.

1.7 Protocols

The PCI-5S and PCM-5S support different serial protocols.

Protocol	Type
NMEA	Input/output, ASCII, 0183, 2.3 (compatible to 3.0)
UBX	Input/output, binary, u-blox proprietary

Table 1: Available Protocols

For specification of the various protocols see the *u-blox5 Protocol Specification* [1].

1.8 Antenna

The PCI-5S and PCM-5S are designed for use with either passive or active antennas.

An antenna supervisor is available. In the default operation mode the antenna supervisor is activated and enables the receiver to detect 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.

Parameter	Specification	
Antenna Type	Passive and Active Antennas	
Antenna Supply	Using VCC_RF or external voltage source	
Antenna Supervisor	Short circuit detection	Built in
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

Table 2: Antenna Specification



Open circuit detection is not supported.

2 GPS Performance

Parameter	Specification
Receiver Type	50 Channels GPS L1 frequency, C/A Code
Time-To-First-Fix ²	Cold Start (Autonomous) 29 s Warm Start (Autonomous) 29 s Hot Start (Autonomous) <1 s Aided Starts ³ <1 s
Sensitivity ⁴	Tracking & Navigation -160 dBm Reacquisition -160 dBm Cold Start (Autonomous) -144 dBm
Horizontal Position Accuracy ⁵	Autonomous < 2.5 m SBAS < 2.0 m
Accuracy of Timepulse Signal	RMS 30 ns 99% <60 ns Time Pulse Configurable: 0.25 ... 1000 Hz
Max Navigation Update Rate	4 Hz
Velocity Accuracy ⁶	0.1m/s
Heading Accuracy ⁶	0.5 degrees
Dynamics	≤ 4 g
Operational Limits	Velocity 600 m/s

Table 3: PCI-5S and PCM-5S GPS Performance

² All satellites at -130 dB

³ Dependent on aiding data connection speed and latency

⁴ Demonstrated with a good active antenna

⁵ CEP, 50%, 24 hours static, -130dBm. SEP: <3.5m

⁶ 50% @ 30 m/s

3 Mechanical Specifications

All mechanical specifications according to “PCI Express® Mini Card Electromechanical Specification Revision1.2”

Dimension	Specification (mm)
A	30.00
B	24.20
C	2.60
D	48.05
E	50.95
F	25.70
G	2.15
H	3.20
I	2.0
J	1.0

Table 4: PCI-5S Dimensions

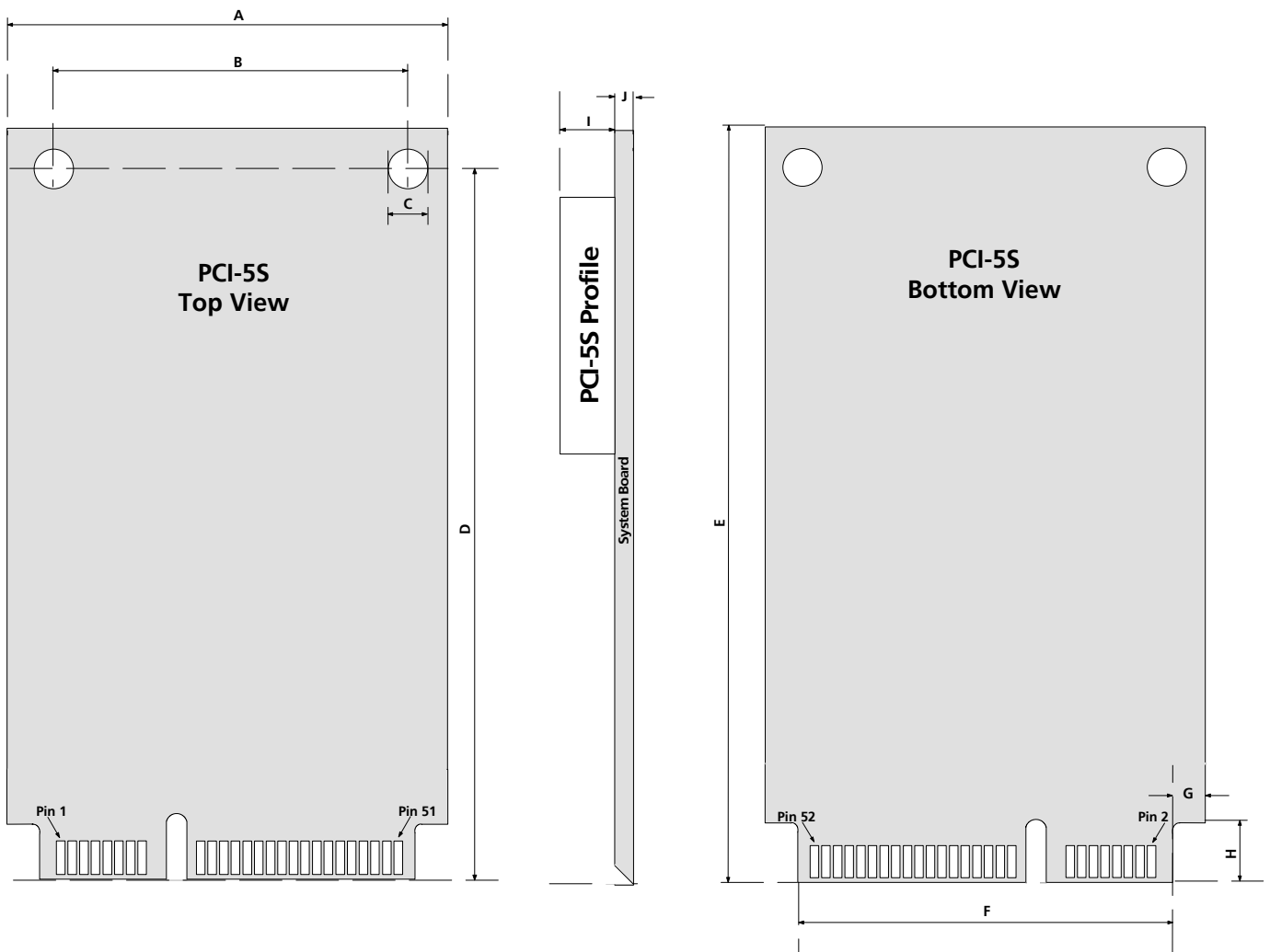


Figure 2: PCI-5S Dimensional Diagrams (see Table 4 for specification)

Dimension	Specification (mm)
A	30.00
B	24.20
C	2.60
D	23.90
E	26.80
F	25.70
G	2.15
H	3.20
I	2.0
J	1.0

Table 5: PCM-5S Dimensions

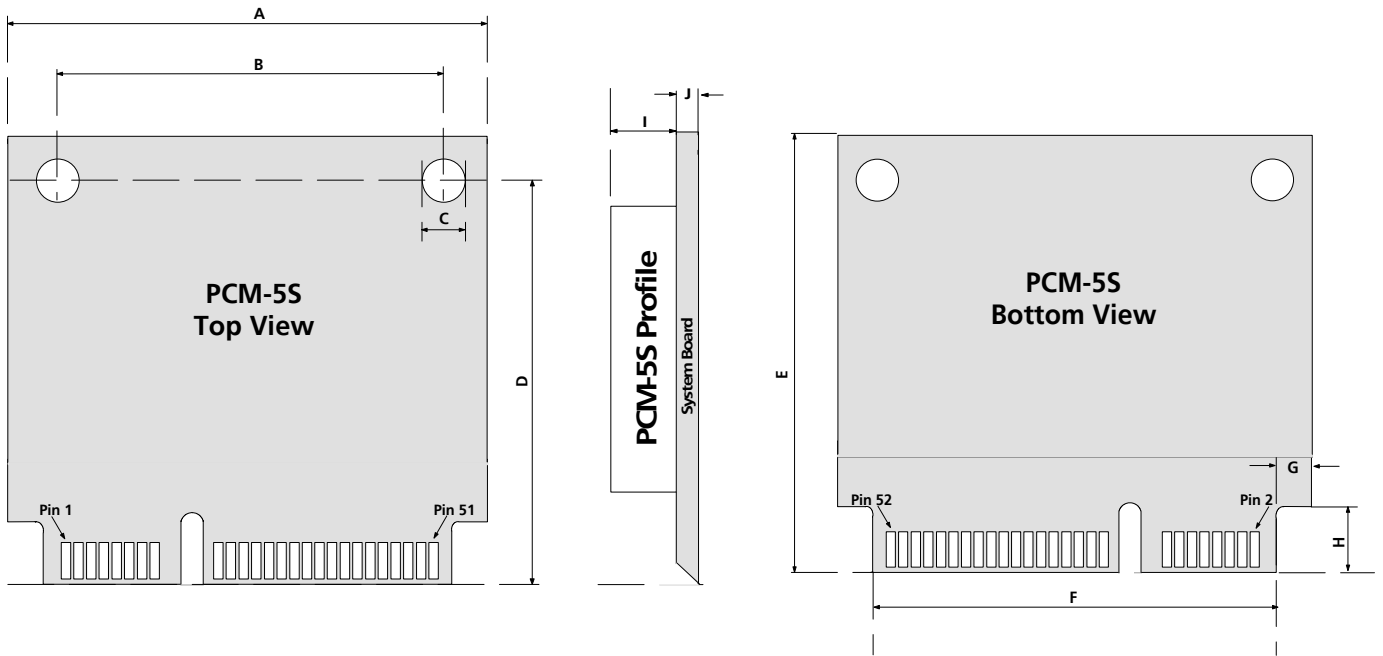


Figure 3: PCM-5S Dimensional Diagrams (see Table 5 for specification)

3.1 Pin Assignment

No	Name	I/O	Description	No	Name	I/O	Description
1	NC		Not Connected	2	VCC_CON	PWR	Vcc Connect
3	NC		Not Connected	4	GND	PWR	
5	NC		Not Connected	6	NC		Not Connected
7	NC		Not Connected	8	NC		Not Connected
9	GND	PWR		10	NC		Not Connected
11	NC		Not Connected	12	NC		Not Connected
13	NC		Not Connected	14	NC		Not Connected
15	GND	PWR		16	NC		Not Connected
17	NC		Not Connected	18	GND	PWR	
19	NC		Not Connected	20	W_DISABLE ⁷		Power Disconnect
21	GND	PWR		22	NC		Not Connected
23	NC		Not Connected	24	VCC_CON	PWR	Vcc Connect
25	NC		Not Connected	26	GND	PWR	
27	GND	PWR		28	NC		Not Connected
29	GND	PWR		30	NC		Not Connected
31	NC		Not Connected	32	NC		Not Connected
33	NC		Not Connected	34	GND	PWR	
35	GND	PWR		36	USB_DM	IO	
37	GND	PWR		38	USB_DP	IO	
39	VCC_CON	PWR	Vcc Connect	40	GND	PWR	
41	VCC_CON	PWR	Vcc Connect	42	LED_GPS_STATE	O	Radio State Indicator
43	GND	PWR		44	NC		Not Connected
45	NC		Not Connected	46	NC		Not Connected
47	NC		Not Connected	48	NC		Not Connected
49	NC		Not Connected	50	GND	PWR	
51	NC		Not Connected	52	VCC_CON	PWR	Vcc Connect

Table 6: Pinout ⁸

⁷ The PCI-5S is backwards compatible to previous versions. The Power Disconnect pin (W_DISABLE) is an addition to PCI-5S-1-004 and above.

⁸ This pinout does not apply to early PCI samples (e.g. PCI-5S-0-000). For more information contact u-blox customer support.

4 Electrical Specifications

4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Power Supply Voltage (VCC)	Vcc	-0.5	3.6	V
Input Pin Voltage	Vin_usb	-0.5	Vcc +0.5	V
Storage Temperature	Tstg	-40	85	°C

Table 7: Absolute Maximum Ratings



GPS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling.



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 ⁹	Symbol	Min	Typ	Max	Units	Condition
Power supply voltage (VCC)	Vcc	3.0	3.3	3.6	V	
Power supply voltage ripple	Vcc_PP			50	mV	
Peak supply current ¹⁰	Iccp			150	mA	Vcc = 3.6V
Sustained supply current ¹¹	Icc Acquisition (Eco Mode)		67		mA	Vcc= 3.0V
	Icc Tracking (Eco Mode)		41 ¹²			
Backup current (Sleep mode)	Vbckp_s		62		uA	
Input pin voltage range	Vin			Vcc +0.5	V	
Input pin low voltage	Vin_low_1			0.2x Vcc	V	
Input pin high voltage	Vin_high_1	0.7x Vcc			V	
Output pin voltage range	Vout				V	
Output pin low voltage	LED_GPS_STATE pin42			0.4	V	Iout = 16mA
Output pin high voltage	Vout_high	Vcc - 0.4			V	Iout = -4 mA
USB_DM, USB_DP	VinU	Complies to USB 2.0 Standards				
Antenna gain	Gant			50	dB	
Receiver Chain Noise Figure	NFtot		3.2		dB	including 1.6dB SAW-Filter Insertion Loss between LNAOUT and MIX_IN
RF Input Power	Prfin			-5	dBm	
Antenna Supply Voltage	Iccrf			Vcc - 0.6	V	Iccrf=6mA
Operating temperature	Topr	-40		85	°C	

Table 8: Operating Conditions



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

⁹ All specification are at an ambient temperature of 25°C.

¹⁰ Use this figure to dimension maximum current capability of power supply.

¹¹ Use this figure to determine required battery capacity.

¹² FW 5.00, with strong signals. For Cold Starts typical 1 min after First Fix. For Hot Starts typical 15 sec after First Fix

5 Reliability Tests

Tests for product family qualifications:

Test	Standard
Visual inspection	IPC-A-610 D, class 2 "Acceptability of electronic assemblies"
Temperature step	-40°C...+85°C, steps of 5K, operating
Metallographic investigations	IPC-A-600 F, Class 2 "Acceptability of printed boards"
Dry heat	+60°C, 5% rH, 1000 hours, operating
Damp heat	+60°C, 95% rH, 1000 hours, operating
Thermal shock	-40°C...+125°C, 500 cycles, non-operating
Lifespan test	+85°C/1000 hours, operating
Dry heat	+125°C, 1000 hours, non-operating
Damp heat, cyclic	+25°C...+55°C; >90% rH, operating
Vibration	5-500 Hz, 5g, 2.5 hours/axis at -40°C, +25° and 85°C, operating
Shock	30g/11ms (half sine), 3 shocks/axis; non-operating

Table 9: Reliability Tests



This specification is preliminary and subject to confirmation.

6 Default Settings

Interface	Settings
USB Output	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, TXT USB Power Mode: Bus Powered
USB Input	Automatically accepts following protocols without need of explicit configuration: UBX, NMEA The GPS receiver supports interleaved UBX and NMEA messages. USB Power Mode: Bus Powered
Power Mode	Eco Mode

Table 10: Available Protocols.

For information about further settings, please refer to the *u-blox 5 Protocol Specification* [1].

7 Ordering Information

The PCI-5S and PCM-5S are products manufactured to order only. Lead-time and minimum order quantity restrictions apply. For information regarding product availability and other related questions, please contact your nearest u-blox office.

Ordering No.	Product
PCI-5S-1	ROM-based u-blox 5 PCI Express Full Mini Card
PCM-5S-1	ROM-based u-blox 5 PCI Express Half Mini Card
EVK-5H-0	u-blox 5 Evaluation Kit

Table 11: Ordering Information

Related Documents

[1] u-blox 5 Protocol Specification, Docu. No GPS.G5-X-07036

All these documents are available on our website (www.u-blox.com).



For regular updates to u-blox documentation and to receive product change notifications please register on our homepage.

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