



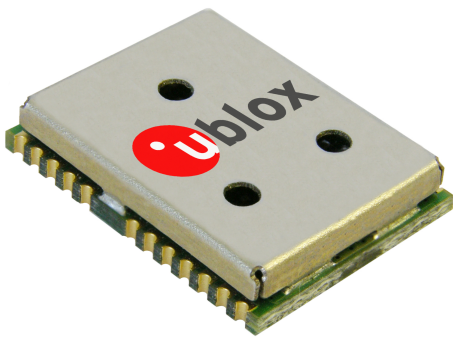
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NEO-5

u-blox 5 ROM-Based GPS Modules

Data Sheet



Abstract

Technical data sheet describing the cost effective, high-performance u-blox 5 based NEO-5 series of GPS modules.

Features include AssistNow Online and AssistNow Offline A-GPS services, KickStart accelerated acquisition, SuperSense® Indoor GPS providing best-in-class acquisition and tracking sensitivity, small size and an innovative jamming-resistant RF architecture.

The miniature 12.2 x 16.0 mm form factor of the highly successful NEO-4S module is maintained, enabling easy migration. NEO-5 modules support passive and active antennas.

Data Sheet

your position is our focus

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Subtitle	u-blox 5 ROM-Based GPS Modules		
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Revision Index	Date	Name	Status / Comments
P1	18/08/2007	TG	Initial Version
P2	22/08/2007	TG	
P3	11/04/2008	TG	New Naming, TTFF, Reliability Tests, Ordering Numbers, Power Modes
P4	16/04/2008	TG	EEPROM
P5	23/04/2008	TG	USB
P6	5/05/2008	TG	Thickness
P7	26/06/2008	TG	Power Consumption, Active Antenna Gain



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Data Sheet Revisions	Identification of applicable hardware	Comments
-	All data codes	

Data sheet status	
Objective Specification	This data sheet contains target or goal specification for product development.
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 NEO-5 series by u-blox sets a new standard for GPS receiver modules. Powered by the high performance 50-channel u-blox 5 technology, these modules provide excellent performance at an economical price. A 32-channel acquisition engine with over 1 million effective correlators is capable of massive parallel searches across the time/frequency space. 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. An available functionality is 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 miniature 12.2 x 16 mm form factor of the successful NEO-4S module is maintained, permitting easy migration. An I²C compatible DDC interface is provided to connect an optional external serial E²PROM to store power-up configuration settings.

The NEO-5 series is 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

- **Time To First Fix (TTFF): < 1 sec**
- **Best-in-class acquisition and tracking sensitivity**
- **High immunity to jamming**
- **UART serial port, USB, DDC**
- **A-GPS: Supports u-blox AssistNow Online and Offline**

Features

	Voltage Range (V)	Thickness (mm)	50-channel engine	KickStart	SuperSense	FW Update / FLASH	Low Power Modes	UART	USB	SPI	DDC	AssistNow Online	AssistNow Offline	Dead Reckoning	Raw Data	Precision Timing	1PPS	CFG Pin	Reset Input	Antenna Supply	Antenna Supervisor
NEO-5M	2.7-3.6	2.4	✓		✓			1	1		1	✓	✓				✓	1			
NEO-5Q	2.7-3.6	2.4	✓	✓	✓			1	1	1	1	✓	✓				✓	2			

Table 1: Features of the NEO-5 Series

1.3 GPS Performance

Parameter	Specification		
Receiver Type		50 Channels	
		GPS L1 frequency, C/A Code	
Time-To-First-Fix ¹		NEO-5Q	NEO-5M
	Cold Start (Autonomous)	29 s	32 s
	Warm Start (Autonomous)	29 s	32 s
	Hot Start (Autonomous)	<1 s	<1 s
	Aided Starts ²	<1 s	<3 s
Sensitivity ³	Tracking & Navigation	NEO-5Q	NEO-5M
		-160 dBm	-160 dBm
	Reacquisition	-160 dBm	-160 dBm
	Cold Start (Autonomous)	-144 dBm	-143 dBm
Horizontal Position Accuracy ⁴	Autonomous	< 2.5 m	
	SBAS	< 2.0 m	
Accuracy of Timepulse Signal	RMS	30 ns	
	Time Pulse	Configurable: 0.25 ... 1000 Hz	
Max Navigation Update Rate		4 Hz	
Velocity Accuracy ⁵		0.1m/s	
Heading Accuracy ⁵		0.5 degrees	
Dynamics		≤ 4 g	
Operational Limits	Velocity	515 m/s (1000 knots)	

Table 2: NEO-5 GPS Performance

1.4 Block Diagram

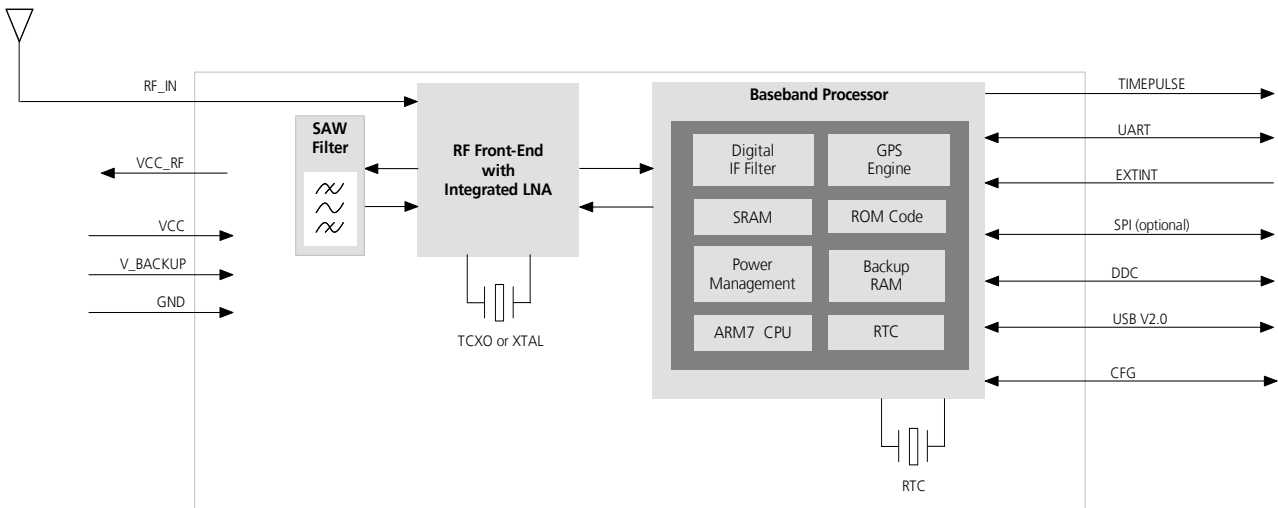


Figure 1: NEO-5 Hardware Block Schematic

¹ All satellites at -130 dB
² Dependent on aiding data connection speed and latency
³ Demonstrated with a good active antenna
⁴ CEP, 50%, 24 hours static, -130dBm
⁵ 50% @ 30 m/s

1.5 Assisted GPS (A-GPS)

Supply of aiding information like ephemeris, almanac, rough last position and time and satellite status and an optional time synchronization signal will reduce time to first fix significantly and improve the acquisition sensitivity. NEO-5 modules support the u-blox AssistNow Online and AssistNow Offline-GPS services.

1.6 SuperSense Indoor GPS

All u-blox 5 modules come with SuperSense, providing ultra-fast acquisition/reacquisition and exceptional tracking sensitivity. SuperSense enables best-in-class tracking and navigation in difficult signal environments such as urban canyons or indoor locations.

1.7 KickStart

A new feature available with u-blox 5 receiver modules is KickStart. This functionality uses a TCXO to accelerate weak signal acquisition, enabling faster start and reacquisition times. KickStart is available with the NEO-5Q.

1.8 GALILEO

u-blox 5 technology has been developed with GALILEO in mind. When GALILEO-L1 signals become available, u-blox 5 receivers will be capable of receiving these signals. The necessary software to process the signals will be included in the ROM of future NEO module versions. The ability to receive and track GALILEO satellite signals will result in higher coverage, improved reliability and better accuracy.

1.9 Protocols

The NEO-5 modules 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 3: Available Protocols

Both protocols are available on UART, USB, DDC and SPI. For specification of the various protocols see the *u-blox5 Protocol Specification* [2].

1.10 Antenna

NEO-5 modules are designed for use with passive and active⁶ antennas.

Parameter	Specification	
Antenna Type	Active and passive antennas	
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 4: Antenna Specification

⁶ For information on using active antennas with NEO-5 modules, see the *NEO-5 Hardware Integration Manual* [1].

1.11 Configuration

1.11.1 Power Modes

u-blox 5 technology offers power optimized architecture with built-in autonomous power saving functions that minimize power consumption at any given time.

u-blox 5 can be operated in two different power modes: Maximum Performance and Eco Mode. In both cases, the receiver is operated in continuous mode. The difference lies in how the acquisition engine is used. Maximum Performance Mode freely uses the acquisition engine, resulting in the best possible TTFF at weak signals. With Eco Mode the use of the acquisition engine is optimized to deliver lower current consumption.

Low Power Modes are planned for Q1/09.

For more information, see the *u-blox 5 Protocol Specification* [2].

1.11.2 Boot-Time Configuration

The NEO-5Q and NEO-5M provide configuration pins for boot-time configuration. These become effective immediately after start-up. Once the module has started, the configuration settings may be modified with UBX configuration messages. The modified settings remain effective until power-down or reset. If these settings have been stored in battery-backup RAM, then the modified configuration will be retained, as long as the backup battery supply is not interrupted.

NEO-5Q and NEO-5M include a **CFG_COM0** pin, which can be configured as seen in Table 5.

CFG_COM0	Protocol	Messages	UART Baud rate	USB Power
1	NMEA	GSV, RMC, GSA, GGA, GLL, VTG, TXT	9600	BUS Powered ⁷
0			38400	Self Powered

Table 5: Supported COM settings (NEO-5Q, NEO-5M)

The NEO-5Q provides a **CFG_GPS0** pin for power mode configuration. This can be configured as seen in Table 6.

CFG_GPS0	Power Mode
0	Eco Mode
1	Maximum Performance Mode

Table 6: Supported CFG_GPS0 settings (NEO-5Q)



The **CFG_GPS0** pin is shared with the SPI Clock pin. When using Eco Mode and SPI, pull **CFG_GPS0** low during startup and then release it.

⁷ Bus powered mode not supported at this time. Planned availability Q1/09

2 Mechanical Specifications

Parameter	Specification	
A	16.0 +0.6/-0.1mm	[628.8 +24/-4mil]
B	12.2 ±0.1mm	[479.5 ±4mil]
C	2.4 ±0.2mm	[94.3 ±8mil]
D	1.0 +0.3/-0.1mm	[39.3 +18/-4mil]
E	1.1 ±0.1mm	[43.2 ±4mil]
F	3.0 ±0.1mm	[117.9 ±4mil]
G	1.1 ±0.1mm	[43.2 ±4mil]
Weight	1.6 g	

Table 7: NEO-5 Dimensions

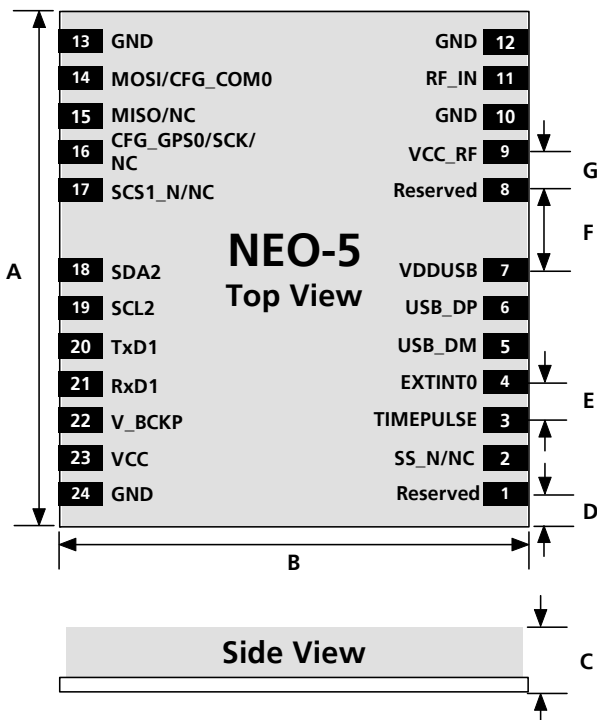


Figure 2: NEO-5 Dimensional Diagram (see Table 7 for specification)



For more information regarding the Footprint and Paste Mask consult the *NEO-5 Hardware Integration Manual* [1].

2.1 Pin Assignment

No	Module	Name	I/O	Description
1	All	Reserved	I	
2	NEO-5Q	SS_N	I	SPI Slave Select
	NEO-5M	NC	I	Not Connected
3	All	TIMEPULSE	O	Time pulse (1PPS)
4	All	EXTINT0	I	External Interrupt Pin
5	All	USB_DM	I/O	USB Data
6	All	USB_DP	I/O	USB Data
7	All	VDDUSB	I	USB Supply
8	All	Reserved		See Hardware Integration Manual
9	All	VCC_RF	O	Output Voltage RF section
10	All	GND	I	Ground
11	All	RF_IN	I	GPS signal input
12	All	GND	I	Ground
13	All	GND	I	Ground
14	NEO-5Q	MOSI/CFG_COM0	O/I	SPI MOSI / Configuration Pin
	NEO-5M	CFG_COM0	I	Configuration Pin
15	NEO-5Q	MISO	I	SPI MISO
	NEO-5M	NC	I	Not Connected
16	NEO-5Q	CFG_GPS0 SCK	I/O	Power Mode Configuration Pin SPI Clock
	NEO-5M	NC	I/O	Not Connected
17	NEO-5Q	SCS1_N	O	SPI chip select
	NEO-5M	NC	O	Not Connected
18	All	SDA2	I/O	DDC Data
19	All	SCL2	I/O	DDC Clock
20	All	TxD1	O	Serial Port 1
21	All	RxD1	I	Serial Port 1
22	All	V_BCKP	I	Backup voltage supply
23	All	VCC	I	Supply voltage
24	All	GND	I	Ground

Must be connected

Table 8: Pinout



Pins designated Reserved should only be used with caution. For more information about Pinouts see the *NEO-5 Hardware Integration Manual* [1].

3 Electrical Specifications

3.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Power supply voltage (VCC)	Vcc	-0.5	3.6	V
Backup battery voltage (V_BCKP)	Vbckp	-0.5	4.8	V
Input pin voltage	Vin	-0.5	Vcc +0.5	V
	Vin_usb	-0.5	Vddusb +0.5	V
VCC_RF output current	Iccrf		100	mA
Input power at RF_IN ¹⁰	Prfin			dBm
Storage temperature	Tstg	-40	85	°C

Table 9: Absolute Maximum Ratings



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.

¹⁰ Source impedance 50Ω, continuous wave

3.2 Operating Conditions

Parameter ¹¹	Symbol	Min	Typ	Max	Units	Condition
Power supply voltage (VCC)	Vcc	2.7		3.6	V	
Peak supply current ¹²	Iccp			150	mA	Vcc = 3.6 V
Sustained supply current ¹³	Maximum Performance Mode	Icc Acquisition		102	mA	Vcc = 3.0 V
		Icc Tracking		47 ¹⁴		
	Eco Mode	Icc Acquisition		67		
		Icc Tracking		42 ¹⁵		
Backup battery voltage	Vbckp	1.4		4.8	V	
Backup battery current	Ibckp		25		μA	Vbckp = 1.8V
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	
Input pin low voltage for Rx D1	Vin_low_2			0.22	V	
Input pin high voltage for Rx D1	Vin_high_2	0.91			V	
Output pin low voltage	Vout_low			0.4	V	Iout = 4 mA
Output pin high voltage	Vout_high	Vcc - 0.4			V	Iout = -4 mA
VDDUSB (Pin 7) for USB operation	Vddusb1	3.0 ¹⁶		3.6	V	
USB_DM, USB_DP	VinU	Compatible with USB with 27 Ohms series resistance				
Antenna gain	Gant			30	dB	
V_ANT antenna bias voltage	Vant	2.7		5.5	V	I _{ANT} < -50 mA
Antenna bias voltage drop	Vant_drop		0.1		V	Iccrf=50mA
VCC_RF voltage	Vccrf		Vcc-0.1		V	
VCC_RF output current	Iccrf			50	mA	
Operating temperature	Topr	-40		85	°C	

Table 10: Operating Conditions



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

¹¹ All specification are at an ambient temperature of 25°C.

¹² Use this figure to dimension maximum current capability of power supply.

¹³ Use this figure to determine required battery capacity.

¹⁴ All orbits available. Given value with FW 5.0. For earlier FW versions Icc Tracking Typ: 55mA.

¹⁵ Typical 1 minute after First Fix.

¹⁶ If USB not used connect to GND

4 Reliability Tests

Tests for product family qualifications:

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 (halfsine); 3 Shock/axis; no function	IEC 68-2-27
Metallographic investigations		IPC-QE-650

Table 11: Reliability Tests



This specification is preliminary and subject to confirmation.

5 Design-In

In order to obtain the necessary information to conduct a proper design-in, u-blox strongly recommends consulting the *NEO-5 Hardware Integration Manual* [1].

6 Default 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, TXT
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
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 The GPS receiver supports interleaved UBX and NMEA messages.
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
TIMEPULSE (1Hz Nav)	1 pulse per second, synchronized at rising edge, pulse length 100ms
Power Mode	NEO-5Q: Maximum Performance Mode NEO-5M: Eco Mode

Table 12: Available Protocols.

Please refer to the *u-blox5 Protocol Specification [2]* for information about further settings.

7 Ordering Information

Ordering No.	Product
NEO-5Q-0	NEO-5Q GPS Module, Tape on reel, 250 pieces per reel
NEO-5M-0	NEO-5M GPS Module, Tape on reel, 250 pieces per reel
EVK-5H-0	u-blox 5 Evaluation Kit with KickStart
EVK-5P-0	u-blox 5 Evaluation Kit with SuperSense®

Table 13: Ordering Information

Related Documents

[1] NEO-5 Hardware Integration Manual, Docu. No GPS.G5-MS5-08003

[2] u-blox5 Protocol Specification, Docu. No GPS-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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