GPS

locate, communicate, accelerate

NEO-6

u-blox 6 GPS Modules

Data Sheet

Abstract

Technical data sheet describing the cost effective, high-performance u-blox 6 based NEO-6 series of GPS modules, that brings the high performance of the u-blox 6 positioning engine to the miniature NEO form factor.

These receivers combine a high level of integration capability with flexible connectivity options in a small package. This makes them perfectly suited for mass-market end products with strict size and cost requirements.

16.0 x 12.2mm

Document Information	
Title	NEO-6
Subtitle	u-blox 6 GPS Modules
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This document applies to the following products:

Name	Type number	ROM/FLASH version	PCN reference
NEO-6G		ROM6.02	N/A
NEO-6Q		ROM6.02	N/A
NEO-6M		ROM6.02	N/A

Contents

1 Functional description

1.1 Overview

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints.

The 50-channel u-blox 6 positioning engine boasts a Time-To-First-Fix (TTFF) of under 1 second. The dedicated acquisition engine, with 2 million correlators, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environments.

1.2 Product features

Series	Power	Memory	Function						Antenna		Input / Output					
	Voltage range [V]	Programmable (Flash) FW update	Power Save mode	Capture & Process	TCXO	Dead Reckoning	Raw data	Precision Timing	Antenna supply	Antenna supervisor	UART	USB	SPI	DDC (I²C compliant)	Reset input	Configuration pin
NEO-6G	1.8		•		•						1	1	1	1		3
NEO-6Q	2.7 - 3.6		•		•						1	1	1	1		3
NEO-6M	2.7 - 3.6		•								1	1	1	1		3

Table 1: Features of the NEO-6 Series

1.3 GPS performance

Parameter	Specification		
Receiver type	Channels	50	
	Frequency	L1	
	Signals	GPS C/A Code	
Configuration	Time pulse	0.25 Hz to 1 kHz	
	Navigation update rate	up to 5Hz (ROM)	
Time-To-First-Fix[1]		NEO-6G/Q	NEO-6M
	Cold Start (Autonomous)	28 s	32s
	Warm Start (Autonomous)	28 s	32s
	Hot Start (Autonomous)	1 s	1 s
	Aided Starts[2]	1 s	<3 s
Sensitivity[3]		NEO-6G/Q	NEO-6M
	Tracking & Navigation	-160 dBm	-160 dBm
	Reacquisition	-160 dBm	-160 dBm
	Cold Start (Autonomous)	-147 dBm	-146 dBm
Accuracy	Horizontal position[4]	< 2.5 m Autonomous	
		< 2.0 m SBAS	
	RMS	30 ns	
	99%	<60 ns	
	Velocity[5]	0.1m/s	
	Heading[5]	0.5 degrees	
Limits	Acceleration	≤ 4 g	
	Altitude[6]	50000 m	
	Velocity[6]	500 m/s	

Table 2: NEO-6 GPS performance

[1] All satellites at -130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good active antenna
[4] CEP, 50%, 24 hours static, -130dBm, SEP: <3.5m
[5] 50% @ 30 m/s
[6] Assuming Airborne <4g platform

1.4 Block diagram

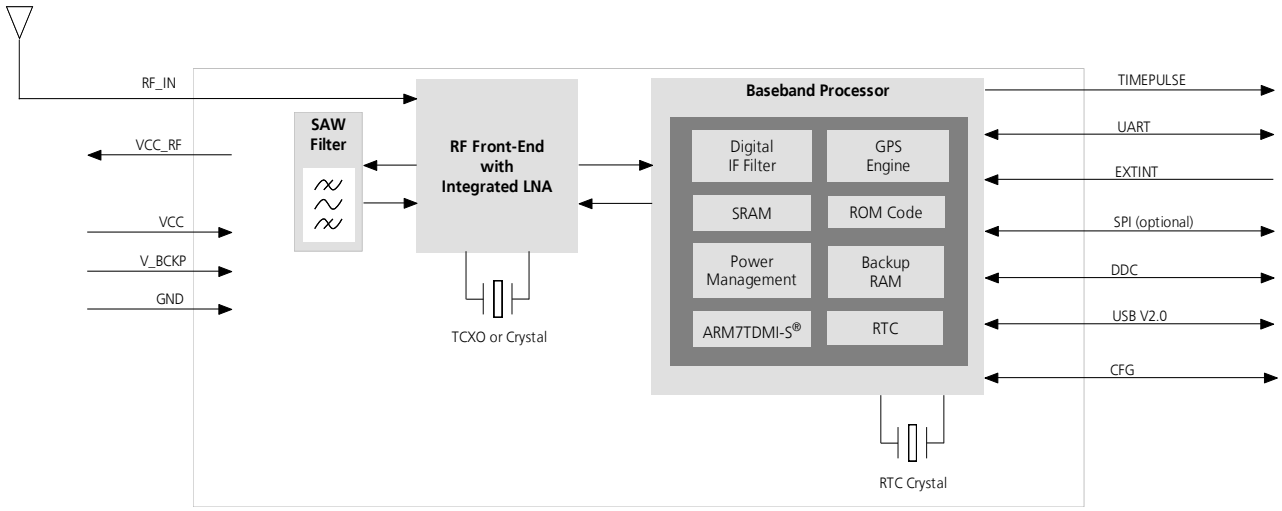


Figure 1: Block diagram (For available options refer to the product features table in section 1.2).

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. All NEO-6 modules support the u-blox AssistNow Online and AssistNow Offline A-GPS services[7] and are OMA SUPL compliant.

1.6 SuperSense Indoor GPS

All NEO-6 modules come with SuperSense, providing improved acquisition/reacquisition and tracking sensitivity. SuperSense enables high performance tracking and navigation even in difficult signal environments such as urban canyons or indoor locations.

1.7 KickStart / Oscillators

An available feature is KickStart. This functionality uses a TCXO to accelerate weak signal acquisition, enabling faster start and reacquisition times. KickStart is available with the NEO-6Q and NEO-6G.

1.8 Protocols and interfaces

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, and DDC. For specification of the various protocols see the u-blox 5/6 Receiver Description including Protocol Specification [2].

[7] Requires external memory.

NEO-6 modules support a number of peripheral interfaces for serial communication. The embedded firmware uses these interfaces according to their respective protocol specifications. For specific applications, the firmware also supports the connection of peripheral devices, such as external memories, to some of the interfaces.

1.8.1 UART

NEO-6 modules include one configurable UART interface for serial communication (for information about configuration see section 1.11).

1.8.2 USB

NEO-6 modules provide a USB version 2.0 FS (Full Speed, 12Mbit/s) interface as an alternative to the UART. The pull-up resistor on USB_DP is integrated to signal a full-speed device to the host. The VDD_USB pin supplies the USB interface.

u-blox provides a Microsoft® certified USB driver for Windows XP, Windows Vista and Windows 7 operating systems.

Operating System	Support level
Windows XP	Certified
Windows Vista	Certified
Windows 7	Certified

Table 4: Operating systems supported by USB driver

1.8.3 Serial Peripheral Interface (SPI)

The SPI interface allows for the connection of external devices with a serial interface, e.g. EEPROM or to interface to a host CPU. The interface can be operated in master or slave mode. In master mode, one chip select signal is available to select external slaves. In slave mode a single chip select signal enables communication with the host.

☞ The maximum bandwidth is 100kbit/s.

1.8.4 Display Data Channel (DDC)

The I^2C compatible DDC interface can be used either to access external devices with a serial interface EEPROM or to interface with a host CPU. It is capable of master and slave operation.

☞ The maximum bandwidth is 100kbit/s.

1.9 Antenna

NEO-6 modules are designed for use with passive and active[8] antennas.

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

Table 5: Antenna Specifications for all NEO-6 modules

1.10 Power management

☞ For more information about power management strategies, see the u-blox 5/6 Receiver Description including Protocol Specification [2].

1.10.1 Operating modes

NEO-6 modules have two continuous operating modes (Maximum Performance and Eco) and one intermittent operating mode (Power Save). Maximum Performance mode freely uses the acquisition engine, resulting in the best possible TTFF, while Eco mode optimizes the use of the acquisition engine to deliver lower current consumption. At medium to strong signals, there is almost no difference for acquisition and tracking performance in these modes.

1.10.2 Maximum Performance mode

In Maximum Performance mode, u-blox 6 receivers use the acquisition engine at full performance to search for all possible satellites until the Almanac is completely downloaded.

As a consequence, tracking current consumption level will be achieved when:

- A valid GPS position is fixed
- Almanac is entirely downloaded
- Ephemeris for all satellites in view are valid

1.10.3 Eco mode

In Eco mode, u-blox 6 receivers use the acquisition engine to search for new satellites only when needed for navigation:

- In cold starts, u-blox 6 searches for enough satellites to navigate and optimizes use of the acquisition engine to download their ephemeris.
- In non-cold starts, u-blox 6 focuses on searching for visible satellites whose orbits are known from the Almanac.

In Eco mode, the u-blox 6 acquisition engine limits use of its searching resources to minimize power consumption. As a consequence the time to find some satellites at weakest signal level might be slightly increased in comparison to Max. Performance mode.

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

u-blox 6 deactivates the acquisition engine as soon as a position is fixed and a sufficient number (at least 4) of satellites are being tracked. The tracking engine continues to search and track new satellites without orbit information.

1.10.4 Power Save mode

NEO-6 modules include intelligent power management that allows reducing the average tracking current consumption by periodically switching off parts of or the complete GPS receiver and waking it up at configurable intervals from one second to one week. This can be done by using a hardware interrupt or by sending a serial command.

1.11 Configuration

1.11.1 Boot-time configuration

NEO-6 modules 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-6 modules include both **CFG_COM0** and **CFG_COM1** pins and can be configured as seen in Table 6. Default settings in bold.

CFG_COM1	CFG_COM0	Protocol	Messages	UARTBaud rate	USB power
1	**1**	**NMEA**	**GSV, RMC, GSA, GGA, GLL, VTG, TXT**	**9600**	**BUS Powered**
1	0	NMEA	GSV, RMC, GSA, GGA, GLL, VTG, TXT	38400	Self Powered
0	1	NMEA	GSV[9], RMC, GSA, GGA, VTG, TXT	4800	BUS Powered
0	0	UBX	NAV-SOL, NAV-STATUS, NAV-SVINFO, NAV-CLOCK, INF, MON-EXCEPT, AID-ALPSERV	57600	BUS Powered

Table 6: Supported COM settings

NEO-6 modules include a **CFG_GPS0** pin, which enables the boot-time configuration of the power mode. These settings are described in Table 7. Default settings in bold.

CFG_GPS0	Power Mode
0	Eco Mode
1	**Maximum Performance Mode**

Table 7: Supported CFG_GPS0 settings

☞ Static activation of the **CFG_COM** and **CFG_GPS** pins is not compatible with use of the SPI interface.

1.12 External serial EEPROM

NEO-6 modules allow an optional external serial EEPROM to be connected to the DDC interface.

☞ For more information see the LEA-6/NEO-6 Hardware Integration Manual [1].

[9] Every 5th fix.

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 8: Dimensions

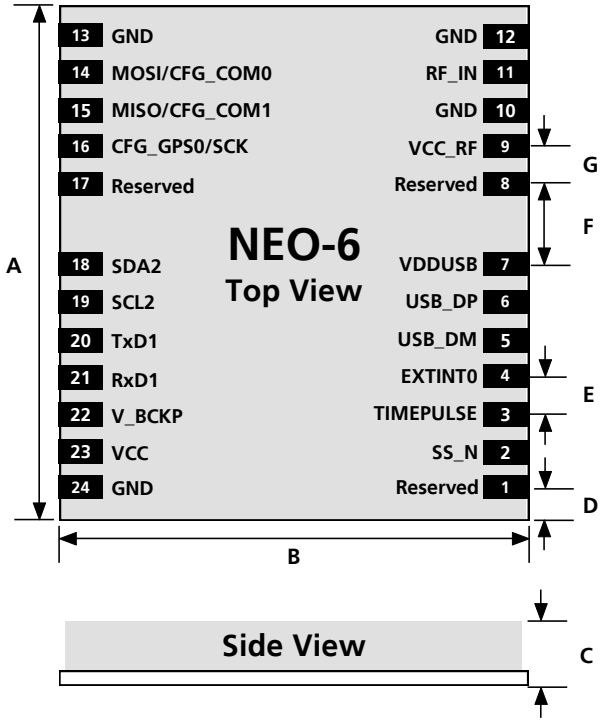


Figure 2: Dimensions (see Table 9 for specification)

For information regarding the Paste Mask and Footprint see the LEA-6/NEO-6 Hardware Integration Manual [1].

2.1 Pin assignment

No	Module	Name	I/O	Description
1	All	Reserved	I	Reserved
2	All	SS_N	I	SPI Slave Select
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 Pin 8 and 9 must be connected together.
9	All	VCC_RF	O	Output Voltage RF section Pin 8 and 9 must be connected together.
10	All	GND	I	Ground
11	All	RF_IN	I	GPS signal input
12	All	GND	I	Ground
13	All	GND	I	Ground
14	All	MOSI/CFG_COM0	O/I	SPI MOSI / Configuration Pin. Leave open if not used.
15	All	MISO/CFG_COM1	I	SPI MISO / Configuration Pin. Leave open if not used.
16	All	CFG_GPS0/SCK	I	Power Mode Configuration Pin / SPI Clock. Leave open if not used.
17	All	Reserved	I	Reserved
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

Table 9: Pinout

☞ Pins designated Reserved should not be used. For more information about Pinouts see the LEA-6/NEO-6 Hardware Integration Manual [1].

3 Electrical specifications

3.1 Absolute maximum ratings

Parameter	Symbol	Module	Condition	Min	Max	Units
Power supply voltage (VCC)	Vcc	NEO-6G		-0.5	2.0	V
		NEO-6Q/ NEO-6M		-0.5	3.6	V
Backup battery voltage (V_BCKP)	Vbckp	All		-0.5	3.6	V
USB supply voltage (VDDUSB)	Vddusb	All		-0.5	3.6	V
Input pin voltage	Vin	All		-0.5	Vcc + 0.5	V
	Vin_usb	All		-0.5	Vddusb	V
VCC_RF output current	Iccrf	All			100	mA
Input power at RF_IN	Prfin	All	source impedance = 50 Ω, continuous wave		-5	dBm
Storage temperature	Tstg	All		-40	85	°C

Table 10: Absolute maximum ratings

GPS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. For more information see the *LEA-6/NEO-6 Hardware Integration Manual* [1].

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.

3.2 Operating conditions

☞ All specifications are at an ambient temperature of 25°C.

Parameter	Symbol	Module	Min	Typ	Max	Units	Condition
Power supply voltage (VCC)	Vcc	NEO-6G	1.75	1.8	1.95	V	
		NEO-6Q, NEO-6M	2.7	3.0	3.6	V	
Backup battery voltage	Vbckp	All	1.4		3.6	V	
Backup battery current	Ibckp	All		22		µA	Vbckp = 1.8 V
Input pin voltage range	Vin	All			Vcc	V	
Input pin low voltage	Vin_low_1	All			0.2x Vcc	V	
Input pin high voltage	Vin_high_1	All	0.7x Vcc			V	
Output pin low voltage	Vout_low	All			0.4	V	Iout = 4 mA
Output pin high voltage	Vout_high	All	Vcc – 0.4			V	Iout = -4 mA
VDDUSB (Pin 24) for USB operation	Vddusb1	All	3.0[10]		3.6	V	
USB_DM, USB_DP	VinU	All	Compatible with USB with 22 Ohms series resistance				
Antenna gain	Gant	All			50	dB	
Receiver Chain Noise Figure	NFtot	All		3.0		dB	
VCC_RF voltage	Vccrf	All		Vcc-0.1		V	
VCC_RF output current	Iccrf	All			50	mA	
Operating temperature	Topr	All	-40		85	°C	

Table 11: Operating conditions

☞ Operation beyond the specified operating conditions can affect device reliability.

[10] If USB not used connect to GND

3.3 Indicative power requirements

Table 12 lists examples of the total system supply current for a possible application.

Parameter	Symbol	Module	Min	Typ	Max	Units	Condition
Max. supply current [11]	Iccp	All			67	mA	Vcc = 3.6 V[12] / 1.95 V[13]
Average supply current[14]	Icc Acquisition	All		47[15]		mA	Vcc = 3.0 V[12] / 1.8 V[13]
	Icc Tracking (Max Performance mode)	NEO-6G/Q		40[16]		mA	
		NEO-6M		39[16]		mA	
	Icc Tracking (Eco mode)	NEO-6G/Q		38[16]		mA	
		NEO-6M		37[16]		mA	
	Icc Tracking (Power Save mode / 1 Hz)	NEO-6G/Q		18[16]		mA	
		NEO-6M		17[16]		mA	

Table 12: Indicative power requirements

☞ Values in Table 12 are provided for customer information only as an example of typical power requirements. Values are characterized on samples, actual power requirements can vary depending on FW version used, external circuitry, number of SVs tracked, signal strength, type of start as well as time, duration and conditions of test.

For more information about power requirements, see the LEA-6/NEO-6 Hardware Integration Manual [1].

[11] Use this figure to dimension maximum current capability of power supply. Measurement of this parameter with 1 Hz bandwidth.
[12] NEO-6Q, NEO-6M
[13] NEO-6G
[14] Use this figure to determine required battery capacity.
[15] FW 6.02, >8 SVs in view, CNo >40 dBHz, current average of 30 sec after cold start.
[16] FW 6.02, with strong signals, all orbits available. For cold starts typical 12 min after first fix. For hot starts typical 15 s after first fix.

3.4 SPI timing diagrams

In order to avoid a faulty usage of the SPI, the user needs to comply with certain timing conditions. The following signals need to be considered for timing constraints:

Symbol	Description
SS_N	Slave Select signal
SCK	Slave Clock signal

Table 13: Symbol description

Figure 3: SPI timing diagram

3.4.1 Timing recommendations

The recommendations below are based on a firmware running from Flash memory.

Parameter	Description	Recommendation
t_{INIT}	Initialization Time	500 µs
t_{DES}	Deselect Time	1 ms
Bitrate		100 kbit/s

Table 14: SPI timing recommendations

☞ The values in the above table result from the requirement of an error-free transmission. By allowing just a few errors, the byte rate could be increased considerably. These timings – and therefore the byte rate – could also be improved by disabling other interfaces, e.g. the UART.

☞ The maximum bandwidth is 100 kbit/s[17].

3.5 DDC timing diagrams

The DDC interface is I²C Standard Mode compliant. For timing parameters consult the I²C standard.

☞ The maximum bandwidth is 100kbit/s.

[17] This is a theoretical maximum, the protocol overhead is not considered.

4 Design-in

In order to obtain the necessary information to conduct a proper design-in, u-blox strongly recommends consulting the LEA-6/NEO-6 Hardware Integration Manual [1].

5 Reliability tests and approvals

5.1 Reliability tests

Tests for product family qualifications according to ISO 16750 "Road vehicles - Environmental conditions and testing for electrical and electronic equipment", and appropriate standards (see Table 15).

Test	Reference	Test Conditions
Temperature step test	ISO16750-4 IEC60068-2-1 IEC60068-2-2	Function tests at stable temperature. The temperature has to decrease in 5K steps from RT to -40°C followed by increase to +85°C in 5K steps.
Temperature cycling	IEC60068-2-14 Na	-40°C / +125°C, 300 cycles, air to air No function
Dry heat I ("desert")	IEC60068-2-2	+60°C / 5%rH,Toper max, Vccmax, 1000 hours, in function
Damp heat II ("tropical")	IEC60068-2-3	+60°C/95%rH, Toper max, Vccmax, 1000 hours, in function
High Temp.Operating Life (Life span)	IEC60068-2-2	1000hrs @ 85°C Ta Toper max, Vccmax
Dry heat II	IEC60068-2-2	+125°C, 1000 hours, no function
Function test at Umin, Unom, Umax	ISO16750-4 IEC60068-2-1 IEC60068-2-2	Function test at Umin, Unom, Umax 1 hour / voltage level Test at -40°C, RT, +85°C
Damp heat cyclic	IEC60068-2-30 Db Variation 1	+25°C...+55°C; >90% rH 6 cycles of 24 hours
Vibration in function	IEC60068-2-6	5-500 Hz; 5g; 2.5 hrs/axis at –40°C 2.5 hrs/axis at +85°C 3 hrs/axis at RT Total: 24 hours, function supervision
Mechanical Shock	IEC60068-2-27 Ea	30g/11ms (halfsine), 3 Shocks/axis, no function
Robustness of terminations of Surface Mounted Devices	IEC60068-2-21 Ue1	1mm/s +/- 0.5mm/s D>2mm 1 Bending cycle Duration on Dmax: 20s +/- 1s
ESD (HBM)	JESD22-A114 AEC-Q100-002	Voltage level: 2000V
ESD (MM)	JESD22-A115 AEC-Q100-003	Voltage level: 200V

Table 15: u-blox qualification requirements

5.2 Approvals

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).

All u-blox 6 GPS modules are RoHS compliant.

6 Product handling & soldering

6.1 Packaging

NEO-6 modules are delivered as hermetically sealed, reeled tapes in order to enable efficient production, production lot set-up and tear-down.

Figure 4: Reeled u-blox 6 modules

6.1.1 Reels

NEO-6 GPS modules are deliverable in quantities of 250pcs on a reel. The dimensions of the reel are shown in Figure 5.

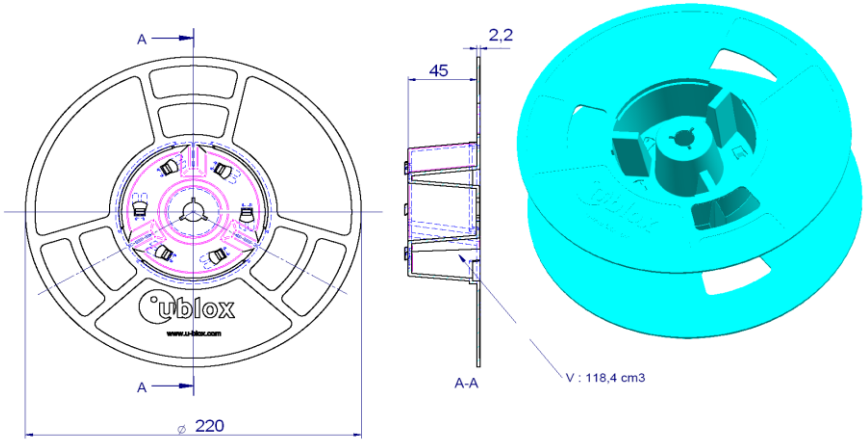


Figure 5: Dimension of reel for 250 pieces (dimensions unless otherwise specified in mm)

6.1.2 Tapes

The dimensions and orientations of the tapes for NEO-6 modules are specified in Figure 6.

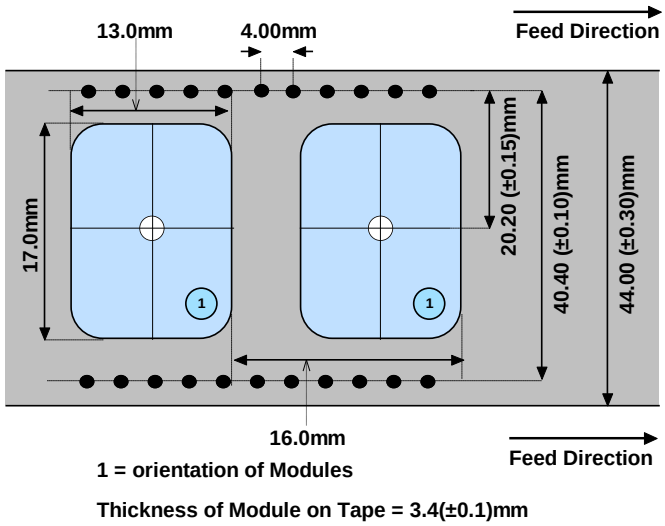


Figure 6: Dimensions and orientation for NEO-6 modules on tape

6.2 Shipment, storage and handling

NEO modules are designed and packaged to be processed in an automatic assembly line, and are shipped in Tape-and-Reel.

NEO-6 modules are Moisture Sensitive Devices (MSD) in accordance to the IPC/JEDEC specification. Appropriate MSD handling instructions and precautions are summarized in Sections 6.2.1 to 6.2.3. Read them carefully to prevent permanent damage due to moisture intake.

GPS receivers contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling NEO-6 modules without proper ESD protection may destroy or damage them permanently. See Section 6.2.6 for ESD handling instructions.

6.2.1 Moisture Sensitivity Levels

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. NEO-6 modules are rated at MSL level 4.

For MSL standard see IPC/JEDEC J-STD-020, which can be downloaded from www.jedec.org.

6.2.2 Shipment

Table 16 summarizes the dry pack requirements for different MSL levels in the IPC/JDEC specification.

MSL Level	Dry Pack Requirement
1	Optional
2	Required
2a	Required
3	Required
4	Required

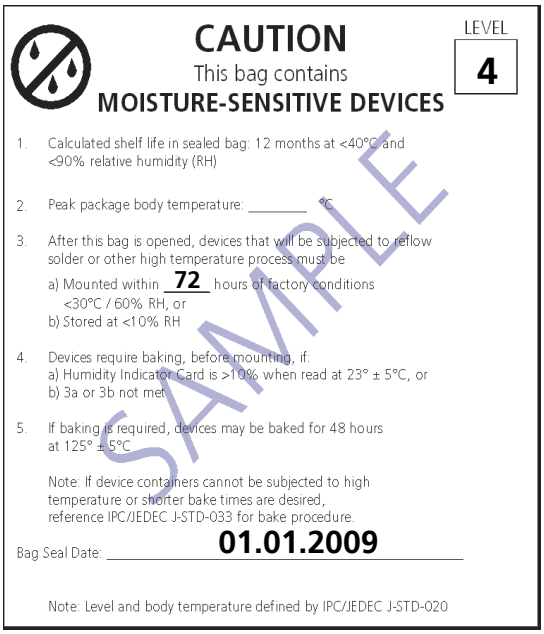
Table 16: JEDEC specification of dry pack requirements

According to IPC/JEDEC specification J-STD-020, if a device passes MSL level 1, it is classified as not moisture sensitive and does not require dry pack. If a device fails level 1 but passes a higher numerical level, it is classified as moisture sensitive and must be dry packed in accordance with J-STD-033.

NEO-6 modules are delivered on Tape-and-Reels in a hermetically sealed package ("dry bag") to prevent moisture intake and protect against electrostatic discharge. For protection from physical damage, the reels are individually packed in cartons.

Carrier materials such as trays, tubes, reels, etc., that are placed in the Moisture Barrier Bag (MBB) can affect the moisture level within the MBB. Therefore, the effect of these materials is compensated by adding additional desiccant in the MBB to ensure the shelf life of the SMD packages.

The dry bag provides an IPC/JEDEC compliant MSD label describing the handling requirements to prevent humidity intake. IPC/JEDEC specifications require that MSD sensitive devices be packaged together with a Humidity Indicator Card (HIC) and desiccant to absorb humidity. If no moisture has been absorbed, the three fields in the HIC indicate blue color. Figure 7 shows examples of an MSD label and HIC.



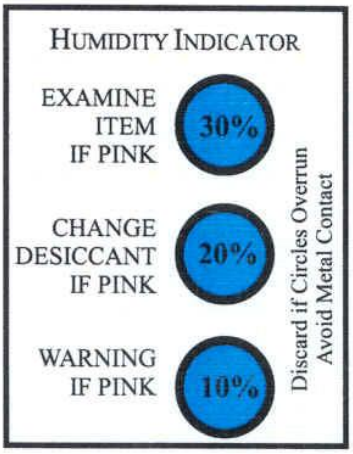


Figure 7: Examples of MSD label and Humidity Indicator Card

6.2.3 Storage and floor life

The calculated shelf life for dry packed SMD packages is a minimum of 12 months from the bag seal date, when stored in a noncondensing atmospheric environment of <40°C/90% RH.

Table 17 lists floor life for different MSL levels in the IPC/JEDEC specification.

MSL level	Floor life (out of bag) at factory ambient ≤30°C/60% RH or as stated
1	Unlimited at ≤30°C/85% RH
2	1 year
2a	4 weeks
3	168 hours
4	72 hours

Table 17: JEDEC specification of floor life

The parts must be processed and soldered within the time specified for the MSL level. If this time is exceeded, or the humidity indicator card in the sealed package indicates that they have been exposed to moisture, the devices need to be pre-baked before the reflow solder process.

6.2.4 Drying

Both encapsulant and substrate materials absorb moisture. IPC/JEDEC specification J-STD-020 must be observed to prevent cracking and delamination associated with the "popcorn" effect during reflow soldering. The popcorn effect can be described as miniature explosions of evaporating moisture. Baking before processing is required in the following cases:

- Humidity indicator card: At least one circular indicator is no longer blue
- Floor life or environmental requirements after opening the seal have been exceeded, e.g. exposure to excessive seasonal humidity.

Refer to Section 4 of IPC/JEDEC J-STD-033 for recommended baking procedures. Table 4-1 of the specification lists the required bake times and conditions for drying. For example, a module that has exceeded its floor life by >72 hours shall be baked at 125°C for 48 hours. (Floor life begins counting at time = 0 after bake).

Do not attempt to bake NEO-6 modules while contained in tape and rolled up in reels. For baking, place parts individually onto oven tray.

Oxidation Risk: Baking SMD packages may cause oxidation and/or intermetallic growth of the terminations, which if excessive can result in solderability problems during board assembly. The temperature and time for baking SMD packages are therefore limited by solderability considerations. The cumulative bake time at a temperature greater than 90°C and up to 125°C shall not exceed 96 hours. If the bake temperature is not greater than 90°C, there is no limit on bake time. Bake temperatures higher than 125°C are not allowed.

6.2.5 Reflow soldering

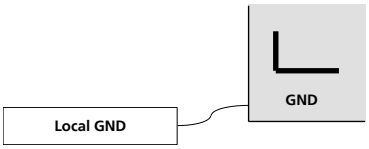
Reflow profiles are to be selected according u-blox recommendations (see LEA-6/NEO-6 Hardware Integration Manual [1]).

6.2.6 ESD handling precautions

NEO-6 modules are Electrostatic Sensitive Devices (ESD). Observe precautions for handling! Failure to observe these precautions can result in severe damage to the GPS receiver!

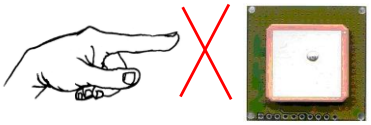
GPS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. Particular care must be exercised when handling patch antennas, due to the risk of electrostatic charges. In addition to standard ESD safety practices, the following measures should be taken into account whenever handling the receiver:

- Unless there is a galvanic coupling between the local GND (i.e. the work table) and the PCB GND, then the first point of contact when handling the PCB shall always be between the local GND and PCB GND.

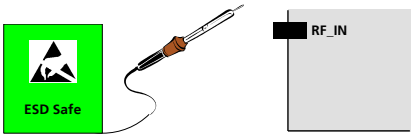


- Before mounting an antenna patch, connect ground of the device
- When handling the RF pin, do not come into contact with any charged capacitors and be careful when contacting materials that can develop charges (e.g. patch antenna ~10pF, coax cable ~50-80pF/m, soldering iron, …)

- To prevent electrostatic discharge through the RF input do not touch the mounted patch antenna.



- When soldering RF connectors and patch antennas to the receiver's RF pin, make sure to use an ESD safe soldering iron (tip).



7 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 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	Maximum Performance mode

Table 18: Available protocols

Refer to the LEA-6/NEO-6 Hardware Integration Manual [1] for information about further settings.

8 Labeling and ordering information

8.1 Product labeling

The labeling of u-blox 6 GPS modules includes important product information. The location of the product type number is shown in Figure 8.

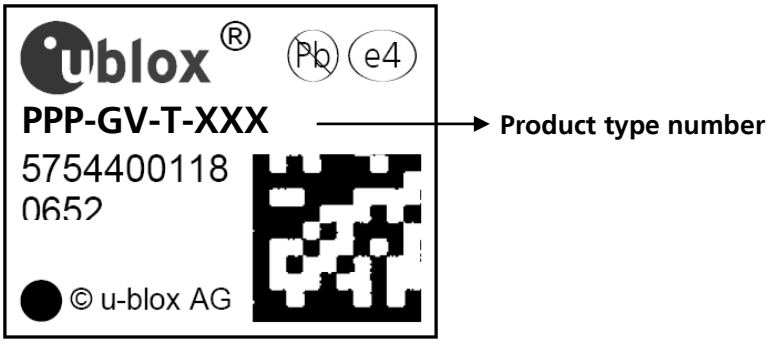


Figure 8: Location of product type number on u-blox 6 module label

8.2 Explanation of codes

3 different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox 6 products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and firmware versions. Table 19 below details these 3 different formats:

Format	Structure
Product Name	PPP-GV
Ordering Code	PPP-GV-T
Type Number	PPP-GV-T-XXX

Table 19: Product Code Formats

The parts of the product code are explained in Table 20.

Code	Meaning	Example
PPP	Product Family	NEO
G	Product Generation	6 = u-blox6
V	Variant	T = Timing, R = DR, etc.
T	Option / Quality Grade	Describes standardized functional element or quality grade such as Flash size, automotive grade etc.
XXX	Product Detail	Describes product details or options such as hard- and software revision, cable length, etc.

Table 20: part identification code

8.3 Ordering information

Ordering No.	Product
NEO-6G-0	ROM-based u-blox 6 GPS Module with TCXO 1.8V, 12x16mm, 250 pcs/reel
NEO-6M-0	ROM-based u-blox 6 GPS Module, 12x16mm, 250 pcs/reel
NEO-6Q-0	ROM-based u-blox 6 GPS Module with TCXO, 12x16mm, 250 pcs/reel

Table 21: Product Ordering Codes

☞ Product changes affecting form, fit or function are documented by u-blox. For a list of Product Change Notifications (PCNs) see our website at: http://www.u-blox.com/customersupport/pcn/ublox5.html.

Related documents

[1] LEA-6/NEO-6 Hardware Integration Manual , Docu. No GPS.G6-HW-09007

[2] u-blox 5/6 Receiver Description including Protocol Specification, Docu. No GPS-SW-09017

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

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

Revision history

Revision	Date	Name	Status / Comments
	31/08/2009	tgri	Initial Version
1	21/09/2009	tgri	update of section 1.3 GPS performance, section 1.4 block diagram, section 3.2 peak supply current
A	25/02/2010	tgri	Change of status to Advance Information. Addition of NEO-6G. Update of section 1.8.2, removed reference to Vddio – added USB driver certification. Update of section 3.2 table 11: average supply current, Added section 3.3-3.4: SPI & DDC timing, section 5.1: addition of table 12.

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