

NEO-M9L module



u-blox M9 automotive dead reckoning module with 3D sensors

Ultra-robust ADR receiver for accurate navigation in all signal conditions

- Extended operating range up to 105 °C for maximum robustness
- Unmatched 50 Hz update rate for real-time positioning
- AEC-Q104 compliant to meet latest automotive standard
- Advanced spoofing detection using sensors and OS-NMA
- ADR and GNSS-only dual output to serve a variety of applications



Product description

The NEO-M9L module is built on the robust u-blox M9 GNSS chip, which provides exceptional sensitivity and acquisition times for all L1 GNSS systems. The u-blox M9 standard precision GNSS platform, which delivers meter-level accuracy, succeeds the well-known u-blox M8 product platform.

NEO-M9L is an ultra-robust dead reckoning module with an integrated Inertial Measurement Unit (IMU) that can also output GNSS-only positioning data in parallel to the sensor-fused data. The sophisticated built-in algorithms fuse IMU data, GNSS measurements, wheel ticks, and vehicle dynamics to provide optimal positioning accuracy where GNSS alone would fail.

NEO-M9L supports concurrent reception of four GNSS constellations. The high number of visible satellites enables the receiver to select the best signals. This maximizes position accuracy, particularly under challenging conditions, such as in deep urban canyons.

The device is a turnkey, self-contained solution that provides the best possible performance and accuracy with low latency. The u-blox approach provides a transparent evaluation of the positioning solution and clear lines of responsibility for design support, while reducing the supply chain complexity during production.

In addition to RF-based jamming and spoofing detection, NEO-M9L implements sensor-based spoofing detection and in addition informs applications about possible security attacks. NEO-M9L offers backwards pin-to-pin compatibility with the previous u-blox generations' modules, and uses GNSS chips qualified according to AEC-Q100 and manufactured in ISO/TS 16949-certified sites. Module qualification tests are performed as stipulated in the AEC-Q104 standard.

NEO-M9L

Grade	
Automotive	•
Professional	
Standard	
GNSS	
GPS + QZSS/SBAS	•
GLONASS	•
Galileo	•
BeiDou	•
Number of concurrent GNSS	4
Interfaces	
UART	2
USB	1
SPI	1
I2C	1
Features	
Firmware upgrade	•
RTC crystal	•
Oscillator	T
Sensor-based spoofing detection	•
Automotive dead reckoning	•
Dual output	•
Wake on motion	•
Low-latency sensor data	•
Timepulse	1
Power supply	
3.0 V – 3.6 V	•

T = TCXO



Product performance

Receiver type	92-channel u-blox M9 engine GPS L1 C/A, QZSS L1 C/A/S, GLONASS L10F BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS	
Nav. update rate	Up to 50 Hz (4 concurrent GNSS)	
Horizontal position accuracy	1.5 m CEP	
ADR position error	<2% of distance traveled without GNSS	
Acquisition ¹	Cold start	26 s
	Aided start	4 s
	Hot start	2 s
Sensitivity ¹	Tracking & Nav.	-160 dBm ²
	Reacquisition	-159 dBm
	Cold start	-148 dBm
	Hot start	-158 dBm

Tracking features

Data batching	Autonomous tracking for up to 5 min
Geofencing	Up to 4 circular areas GPIO for waking up the host CPU
Raw data	IMU sensor data at 100 Hz

Security features

Signal integrity	RF interference & jamming detection and reporting Active GNSS in-band filtering Spoofing detection and reporting
Device integrity	Secure boot of firmware downloaded from host or flash Receiver configuration lock by command
Secure interface	Signed UBX messages (SHA-256) JTAG debug interface disabled by default
Spoofing detection	Sensor-based spoofing

Electrical data

Power supply	3.0 V to 3.6 V
Power Consumption	36 mA at 3.0 V (4 GNSS continuous) 31 mA at 3.0 V (2 GNSS continuous) 27 mA at 3.0 V (1 GNSS continuous)
Backup Supply	2.7 V to 3.6 V

1 = For default mode: GPS/GLONASS/BeiDou/Galileo + SBAS/QZSS

2 = Limited by FW for best DR performance

Package

24-pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Environmental data, quality & reliability

Operating temp.	-40 °C to +105 °C
Storage temp.	-40 °C to 105 °C
Environmental grade	2015/863/EU RoHS-3
EMC	2014/53/EU RED
Environmental testing	ISO 16750
Quality management	Manufactured and fully tested in IATF 16949-certified production sites

Interfaces

Serial interfaces	2 UART 1 USB (NEO-M9N) 1 SPI (optional) 1 I2C
Digital I/O	Configurable timepulse Configurable wake on motion (WOM) pin
Timepulse	Configurable: 0.25 Hz to 10 MHz
Supported antennas	Active and passive
Protocols	NMEA 4.11 (default), UBX binary

Services

Assistance GNSS	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant
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Support products

EVK-M9DR	u-blox NEO-M9L Evaluation Kit with I/O interface, supports ADR and UDR operation mode
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Product variants

NEO-M9L-01A	u-blox M9 LCC module with 3D dead reckoning and onboard sensors, up to +105 °C operating temperature, automotive grade AEC-Q104
NEO-M9L-20A	u-blox M9 LCC module with 3D dead reckoning and onboard sensors, up to +85 °C operating temperature, automotive grade AEC-Q104

Further information

For contact information, see www.u-blox.com/contact-u-blox.

For more product details and ordering information, see the product data sheet.

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