Product summary

# NEO-M9V module

## u-blox M9 standard precision GNSS module with dead reckoning

Standard

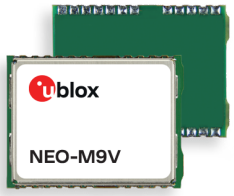
Professional

Automotive

**First GNSS receiver with UDR and ADR for fleet management and micromobility applications**

- Three times better positioning accuracy for a smooth urban navigation experience
- Maximum position availability with dead reckoning technology and AssistNow Live Orbits lifetime access
- Easy-to-use UDR and advanced ADR for high flexibility and fast time to market
- Reduced RF design efforts thanks to integrated SAW/LNA
- Pin-compatible with all NEO modules

12.2 × 16.0 × 2.4 mm




### Product description

Based on the ultra-robust M9 platform, NEO-M9V is the first u-blox module to include both UDR and ADR options integrated into one receiver. The module also includes various dynamic models for after-market vehicles, motorcycles, and micromobility applications. All the components needed are on the module, including IMU. This makes the dead reckoning technology accessible and easy to use. Furthermore, the whole solution runs on the module which means that it is not necessary to run external libraries on the host.

This innovative u-blox M9 standard precision GNSS module with dead reckoning technology delivers three times better accuracy than GNSS-only receivers, enabling a smooth urban navigation or tracking experience. In challenging environments, GNSS-only receivers typically have many outliers. In such conditions, statistical accuracy can easily exceed 10 meters. With NEO-M9V, there are few or no outliers. In typical urban scenarios, NEO-M9V offers sub-5-meter accuracy.

Maximum position availability is guaranteed, thanks to dead reckoning technology and AssistNow Live Orbits. Lifetime access to the premium-level assistance service is included in NEO-M9V and provides fastest time-to-first-GNSS-fix combined with best position accuracy from the first fix.

UDR enables fast time to market, and ADR improves the accuracy performance if there are long GNSS outages. Excellent RF interference mitigation thanks to SAW/LNA enables simple and fast RF designs including considerable cost savings from reduced design efforts.

NEO-M9V offers backwards pin-to-pin compatibility with previous u-blox generations (NEO-M8L and NEO-M8U), which saves designers time and cost when upgrading their design. Thanks to the continuous support of UBX messages across product generations, software migration requires little effort. u-blox M9 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites.

| | NEO-M9V |
|---|---|
| **Grade** | |
| Automotive | |
| Professional | • |
| Standard | |
| **GNSS** | |
| GPS + QZSS/SBAS | • |
| GLONASS | • |
| Galileo | • |
| BeiDou | • |
| Number of concurrent GNSS | 4 |
| **Interfaces** | |
| UART | 1 |
| USB | 1 |
| SPI | 1 |
| DDC (I2C compliant) | 1 |
| **Features** | |
| Upgradeable firmware | • |
| AssistNow lifetime access | L |
| RTC crystal | • |
| Oscillator | T |
| Additional SAW | • |
| Additional LNA | • |
| Integrated IMU | • |
| Automotive Dead Reckoning (ADR) | • |
| Untethered Dead Reckoning (UDR) | • |
| Wake-on motion | • |
| IMU data output | • |
| Automatic alignment | • |
| Weak signal compensation | • |
| Timepulse | 1 |
| **Power supply** | |
| 2.7 V – 3.6 V | • |

T = TCXO
L = Live Orbits

# NEO-M9V module

## Product performance

| | |
|---|---|
| Receiver type | 92-channel u-blox M9 engine<br>GPS L1 C/A, QZSS L1 C/A/S, GLONASS L1OF<br>BeiDou B1I (1561.098 MHz) only, Galileo E1B/C<br>SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN |
| Nav. update rate | Up to 50 Hz (4 concurrent GNSS) |
| Horizontal position accuracy | 1.5 m CEP (with SBAS)<br>2.0 m CEP (without SBAS) |
| ADR position error | 2% of distance traveled without GNSS |
| UDR position error | 10% of distance traveled without GNSS (duration < 60 s) |
| Acquisition[1] | Cold start 24 s<br>Aided start 3 s<br>Hot start 2 s |
| Sensitivity[1] | Tracking & Nav. –159 dBm<br>Reacquisition –158 dBm<br>Cold start –147 dBm<br>Hot start –159 dBm |

## Tracking features

| | |
|---|---|
| Geofencing | Up to 4 circular areas<br>Software message or GPIO for waking up the host CPU |

## Security features

| | |
|---|---|
| Signal integrity | RF interference and jamming detection and reporting<br>Active GNSS in-band filtering<br>Spoofing detection and reporting (consistency checks based on GNSS and sensors) |
| Device integrity | Secure boot of firmware<br>Receiver configuration lock by command |
| Secure interface | Signed UBX messages (SHA-256)<br>JTAG debug interface port locked |

## Electrical data

| | |
|---|---|
| Power supply | 2.7 V to 3.6 V |
| Power consumption | 49 mA at 3.0 V (4 GNSS continuous)<br>43 mA at 3.0 V (2 GNSS continuous)<br>0.5 mA at 3.0 V (Software backup mode) |
| Backup supply | 1.65 V to 3.6 V |

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

## Package

| |
|---|
| 24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.0 g |

## Environmental data, quality & reliability

| | |
|---|---|
| Operating temp. | –40 °C to +85 °C |
| Storage temp. | –40 °C to +85 °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 | 1 UART<br>1 USB<br>1 SPI (optional)<br>1 DDC (I2C compliant) |
| Digital I/O | Configurable timepulse |
| Raw data output | Code phase data |
| Timepulse | Configurable: 0.25 Hz to 10 MHz |
| Supported antennas | Active and passive |
| Protocols | NMEA 4.11, UBX binary |

## Compatible u-blox services

| | |
|---|---|
| Assistance GNSS | AssistNow Live Orbits with included lifetime access |

## Support products

| | |
|---|---|
| EVK-M9DR | u-blox NEO-M9V evaluation kit with I/O interface, supports ADR and UDR operation mode |

## Product variants

| | |
|---|---|
| NEO-M9V | u-blox M9 concurrent GNSS module with dead reckoning, UDR and ADR, multiple dynamic models, upgradeable firmware, SAW filter, LNA, and IMU |

## 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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