

# ZED-F9R module



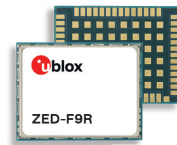
## u-blox F9 high precision dead reckoning module

### High precision GNSS positioning in challenging environments

- Multi-band GNSS receiver delivers centimeter-level accuracy
- Fully integrated solution for fast time-to-market
- Dynamic models for slow-moving service robots and electric scooters
- SPARTN-format SSR corrections for easy and efficient implementation



17.0 × 22.0 × 2.4 mm



### Product description

The ZED-F9R positioning module features the u-blox F9 receiver platform providing a reliable multi-band GNSS sensor fusion solution for industrial applications in a compact form factor. The wide bandwidth allows receiving many satellites simultaneously, resulting in high availability of RTK solutions and quick convergence time.

The high-performance sensor fusion module has an integrated inertial measurement unit (IMU) for RTK positioning. The sophisticated built-in algorithms fuse the IMU data, GNSS measurements, wheel ticks, correction data, and a vehicle dynamics model to provide optimal positioning accuracy where GNSS alone would fail.

The module operates under open sky, in the wooded countryside, in difficult multipath environments, and even in covered areas. Designed for industrial applications like agricultural machinery or heavy trucks, ZED-F9R is the ultimate solution for a data-driven economy where control and position availability are key to success. Low-speed ground robotics are also supported by allowing low-speed calibration. Specialized dynamic models optimize performance for different classes of wheeled vehicles.

The device is a turnkey self-contained solution. This eliminates the technical risk and effort of selecting and integrating RF components and third-party libraries such as precise positioning engines. ZED-F9R offers support for a range of correction services allowing each application to optimize performance according to the application's unique needs. ZED-F9R comes with built-in support for RTCM or SPARTN-formatted corrections, enabling high precision navigation using internet or satellite data.

The ZED-F9R modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment". The ZED-F9R professional grade module adheres to industrial standard quality specifications and production flow.

ZED-F9R

|                           | ZED-F9R |
|---------------------------|---------|
| <b>Grade</b>              |         |
| Automotive                |         |
| Professional              | •       |
| Standard                  |         |
| <b>GNSS</b>               |         |
| GPS / QZSS                | •       |
| GLONASS                   | •       |
| Galileo                   | •       |
| BeiDou                    | •       |
| Number of concurrent GNSS | 4       |
| Multi-band                | •       |
| <b>Interfaces</b>         |         |
| UART                      | 2       |
| USB                       | 1       |
| SPI                       | 1       |
| DDC (I2C compliant)       | 1       |
| <b>Features</b>           |         |
| Programmable (flash)      | •       |
| Carrier phase output      | •       |
| Additional SAW            | •       |
| RTC crystal               | •       |
| Oscillator                | T       |
| RTK rover                 | •       |
| RTK base station          |         |
| Moving base               |         |
| Survey-in and fixed mode  |         |
| Timepulse                 | 1       |
| <b>Power supply</b>       |         |
| 2.7 V – 3.6 V             | •       |

T = TCXO

# ZED-F9R module



## Features

|                    |  |                      |
|--------------------|--|----------------------|
| Receiver type      | 184-channel u-blox F9 engine<br>GPS L1C/A L2C, GLO L1OF L2OF,<br>GAL E1B/C E5b, BDS B1I B2I,<br>QZSS L1C/A L2C |                      |
| Nav. update rate   | Up to 30 Hz  |                      |
| Position accuracy  | RTK  | < 0.01 m + 1 ppm CEP |
| ADR position error | < 2% of distance traveled without GNSS   |                      |
| Convergence time   | RTK  | <10 s                |
| Acquisition        | Cold starts  | 24 s                 |
|                    | Aided starts   | 4 s                  |
|                    | Reacquisition  | 2 s                  |
| Built-in           | TCXO, RTC, flash memory, 3D accelerometer,<br>3D gyroscope, diplexer, SAW filters                              |                      |
| Sensitivity        | Tracking & nav. <sup>1</sup>   | -160 dBm             |
|                    | Cold starts  | -147 dBm             |
|                    | Hot starts   | -158 dBm             |
| Supported antennas | Active   |                      |

<sup>1</sup> Limited by firmware for best DR performance

## Software features

|               |   |  |
|---------------|---|--|
| Assistance    | AssistNow Online<br>OMA SUPL & 3GPP compliant               |  |
| Anti-jamming  | Active CW detection and removal<br>Onboard band pass filter |  |
| Anti-spoofing | Advanced anti-spoofing algorithms                           |  |
| Raw data      | Carrier phase, Code phase, Pseudoranges, IMU<br>data output |  |
| Protocols     | NMEA, UBX binary, RTCM version 3.3, SPARTN                  |  |

## Interfaces

|                   |  |
|-------------------|--|
| Serial interfaces | 2 UART<br>1 USB<br>1 SPI (optional)<br>1 DDC (I2C compliant) |
| Digital I/O       | Configurable timepulse                                       |
| Timepulse         | Configurable: 0.25 Hz to 10 MHz                              |

## Electrical data

|                   |                             |
|-------------------|-----------------------------|
| Supply voltage    | 2.7 V to 3.6 V              |
| Power consumption | 85 mA at 3.0 V (continuous) |
| Backup supply     | 1.65 V to 3.6 V             |

## Package

54-pin LGA (Land Grid Array)  
17 x 22 x 2.4 mm

## Environmental data, quality & reliability

|  |                  |
|--|------------------|
| Operating temp.  | -40 °C to +85 °C |
| Storage temp.  | -40 °C to +85 °C |
| RoHS compliant (lead-free, 2015/863/EU)                                  |                  |
| Green (halogen-free)   |                  |
| ETSI-RED compliant   |                  |
| Qualification according to ISO 16750                                     |                  |
| Manufactured and fully tested in ISO/TS 16949 certified production sites |                  |
| Uses u-blox F9 chips qualified according to AEC-Q100                     |                  |

## Support products

|          |  |
|----------|--|
| C102-F9R | Easy to use evaluation board with various communication interfaces |
|----------|--|

## Product versions

|             |   |
|-------------|---|
| ZED-F9R-00B | u-blox F9 dual-band GNSS module with high precision sensor fusion   |
| ZED-F9R-01B | u-blox F9 dual-band GNSS module with high precision sensor fusion and with SBAS and SLAS  |
| ZED-F9R-02B | u-blox F9 dual-band GNSS module with high precision sensor fusion and with SBAS and SLAS. Supports SPARTN format as suited for slow-moving service robotics and e-scooters. |

## Further information

For contact information, see [www.u-blox.com/contact-u-blox](http://www.u-blox.com/contact-u-blox).

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

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