ALEX-R5 series

Ultra-small LTE-M / NB-IoT SiP with Secure Cloud

Product description
The very small ALEX-R510M8S delivers LTE-M and NB-IoT connectivity with GNSS positioning. It combines the secure u-blox UBX-R5 IoT chipset and the u-blox UBX-M8230 GNSS chipset with the highest level of integration in a System-in-Package (SiP). Measuring just 14 x 14 x 1.5 mm, ALEX-R510M8S occupies less than 50% of SARA-R5’s PCB without affecting the overall LTE and positioning performance. It is ideal for size-constrained devices like people and animal wearables, small asset trackers, portable healthcare systems and other small IoT applications.

The Super-E mode of the GNSS receiver provides ALEX-R510M8S with an ideal balance between low power and good performance. It is optimized for power-sensitive and battery-powered applications, featuring a market-leading sub-μA current consumption in PSM mode.

ALEX-R510M8S offers a dedicated GNSS serial interface and a dedicated GNSS antenna interface, which provides highly reliable and accurate positioning data concurrent with LTE communication. In addition, the module offers unique hybrid positioning, in which the GNSS position is enhanced with u-blox CellLocate® data, providing location always and everywhere.

u-blox Secure Cloud functionality, which supports IoT-Security-as-a-Service, makes ALEX-R510M8S the ideal choice for devices that transmit critical and confidential information.

With all in-house technology and full hardware and software ownership, u-blox can guarantee long-term device availability and provide lifetime support of the entire platform, down to the chipset level. u-blox R5 series modules are the only products in the market with a real LTE and GNSS chip-down integration, supporting the standard LTE-M and NB-IoT Power Class 3 of 23 dBm maximum output power, yielding better performance at cell edges and under more challenging network conditions.

The LTE-M and NB-IoT module supports a comprehensive set of 3GPP Rel. 14 features that are relevant for IoT applications, like improvements to power consumption, coverage, data rate, mobility, and positioning. It is 5G-ready, meaning customers will be able to upgrade software on their deployed devices once 5G LTE has been rolled out by mobile operators, which greatly improves product scalability and lifetime.

Product summary

**Miniature form factor with integrated u-blox UBX-R5 and UBX-M8 chipsets**
- Designed to last an IoT lifetime and 5G-ready
- Super low power, accurate, and reliable positioning with u-blox M8 GNSS receiver
- Optimized for ultra-low power IoT applications
- Built-in, hardware-based Secure Cloud functionality supporting IoT-Security-as-a-Service
- Concurrent accurate positioning and LTE signalling, as needed by tracking applications

**Product description**

**Grade**
- Automotive
- Professional
- Standard

**Regions**
- Multi-region

**Access technology**
- LTE bands
- Data rate M1/NB2
- LTE Power class 23 dBm

**Positioning**
- Integrated GNSS receiver
- Dedicated GNSS antenna interface
- External GNSS control
- AssistNow software
- CellLocate®

**Interfaces**
- UART 2
- USB (for diagnostics) 1
- DDC (I2C) 1
- USIM 1
- GPIO 11
- Digital audio

**Features**
- IoT-Security-as-a-Service
- Root of trust: secure element
- Antenna dynamic tuning
- CellTime
- Ultra low PSM
- TOPUDP
- HTTP, FTP
- TLS/DTLS
- FW update via serial (FOAT)
- uFOTA
- LwM2M, dynamically loaded objects
- MQTT, MQTT-SN
- CoAP
- Last gasp
- Jamming detection
- Antenna and SIM detection

* = LTE-M/NB-IoT bands: 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28, 66, 71, 85
□ = Available in future FW version
NB2 = Cat NB2 (125 kbit/s DL, 140 kbit/s UL)
M1 = LTE Cat M1 (375 kbit/s DL, 1200 kbit/s UL)
ALEX-R5 series

Features

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<tr>
<th>Feature</th>
<th>Description</th>
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| LTE                         | 3GPP Release 13 LTE Cat M1 and NB1  
3GPP Release 14 LTE Cat M1: Coverage enhancement mode B, Uplink TBS of 2984b, and CIoT optimizations  
3GPP Release 14 LTE Cat NB2: Higher data rate (TBS of 2536b), mobility enhancement (RRC connection re-establishment), E-Cell ID, lower power class P0 (14 dBm), two HARQ processes, release assistant, random access on non-anchor carrier, and CIoT optimizations  
Cat M1 Half-duplex, 375 kbit/s DL, 1200 kbit/s UL  
Cat NB2 Half-duplex, 125 kbit/s DL, 140 kbit/s UL |
| SMS                         | MT/MO PDU / text mode  
SMS over SG/NAS |
| Security                    | Foundation Security  
Root of trust - embedded secure element  
EAL5+ high certified  
Secure boot, updates and production  
Antionciling detection and rejection  
Device automatic enrollment and change of ownership  
Design Security  
Local data protection  
Local chip-to-chip (C2C) security  
End-to-End Security  
E2E symmetric key management system (KMS)  
E2E data protection  
Access Control  
Zero touch provisioning for AWS and Azure |
| Software features           | Protocols  
Dual stack IPv4 and IPv6  
PPP over IPv4 and IPv6  
Embedded TCP/IP, UDP/IP, FTP, HTTP, DNS  
Embedded secure MQTT and MQTT-SN  
Embedded CoAP and LwM2M  
Embedded TLS/DTLS  
SIM provisioning (BIP)  
Device management  
LwM2M with dynamically loaded objects  
Positioning  
Integrated u-blox M8 chipset with concurrent GNSS (GPS, GLONASS, Beidou, Galileo)  
Dedicated GNSS antenna interface  
AssistNow for fastest time-to-first-fix  
CellLocate® and hybrid positioning  
Functionality  
Antenna dynamic tuning  
CellTime for robust and accurate timing reference  
Last gasp  
Jamming detection  
Antenna and SIM detection  
Firmware upgrade  
Via UART  
uFOTA client/server solution (firmware upgrade over the air) |

Package

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<th>Specification</th>
<th>Description</th>
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<td>133-pin LGA</td>
<td>14.0 x 14.0 x 1.5 mm</td>
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Environmental data, quality, and reliability

- Operating temperature: -40 °C to +85 °C
- RoHS compliant (lead-free)
- Qualification according to ISO 16750

Certifications and approvals

- ALEX-R5 series: FCC, ISED, GCF, PTCRB, Verizon, AT&T, T-Mobile, RED, Vodafone, Deutsche Telekom, KCC, SKT, Giteki, Softbank, RCM, Telstra, ICASA, NCC

Electrical data

- Power supply: 3.8 V nominal, range 3.0 V to 4.5 V
- PSM current consumption: 0.5 µA
- eDRX current consumption: 130 µA
- LTE Cat M1 Connected mode current consumption: 195 mA (at 23 dBm)

Interfaces

- Serial: 8-wire UART, configurable as 2x 4-wire UART with ring indication
- DCC (I2C)  
- USB for diagnostics
- GPIO: Up to 11 GPIOs, configurable
- (U)SIM: Supports 1.8 V and 3.0 V

Support products

- EVK-ALEXR510M8S: Evaluation kit for ALEX-R510M8S

Product variants

- ALEX-R510M8S: Ordering code: ALEX-R510M8S-01B  
Secure Cloud LTE-M and NB-IoT SiP with integrated u-blox M8 GNSS receiver for multi-regional use

Further information

For contact information, see www.u-blox.com/contact-us.
For more product details and ordering information, see the product data sheet.