nRF9160 cellular IoT System-in-Package

Overview
The nRF9160 SiP is making the latest LTE technology accessible for a wide range of applications and developers. Through the high integration and pre-certification for global operation, it solves the complex wireless design challenges as well as comprehensive set of qualifications needed to utilize cellular technology.

By integrating an application processor, multimode LTE-M and NB-IoT modem, RF Front End (RFFE) and power management in a 10x16x1 mm package, it offers the most compact solution for cellular IoT (cIoT) on the market.

Targeting asset tracking applications, the nRF9160 SiP has built-in assisted GPS. It combines location data from the cellular network with GPS satellite trilateration to allow remote monitoring of the device position.

LTE-M and NB-IoT modem
The nRF9160 LTE modem integrates RFFE, radio and baseband. It supports operation worldwide, enabling cIoT products without regional specific variants.

The LTE modem supports half-duplex FDD operation and all power saving and coverage enhancement modes. A single pin antenna interface is available.

The LTE modem integrates IPv4/IPv6 stack layers up to transport and security (ex. TCP/TLS).

IP application layer protocols are located in the application processor, making it easy for a developer to select application protocols and device profiles supported by the chosen cloud service.

APPLICATIONS
- Logistics and asset tracking
- Smart City
- Smart Agriculture
- Industrial & Predictive maintenance
- Wearables
- Medical

KEY FEATURES
- LTE-M and NB-IoT modem
  - Pre-certified for global operation
  - 700 MHz - 2.2 GHz band support
  - 23 dBm output power
  - Assisted GPS
  - eDRX and PSM power saving modes
  - Coverage enhancement modes
  - SMS, IPv4/IPv6
  - TCP/UDP, TLS/DTLS
  - Single pin 50 Ω antenna interface
  - UICC interface

Application Processor
- 64 MHz Arm® Cortex®-M33 CPU
- Arm TrustZone® for trusted execution
- Arm CryptoCell 310 for application layer security
- 1 MB Flash & 256 KB RAM
- 4 x SPI/UART/TWI
- PDM, I2S, PWM, ADC
- Automated power and clock management
- 32 GPIOs

Software Development kit
- LWM2M client
- CoAP, MQTT, HTTP
- Secure boot
- Secure FOTA for application and modem
- Peripheral driver libraries
- Application examples
**Application processor**
The nRF9160 SiP offers a modern and powerful Arm Cortex-M33 CPU processor with on-chip flash and RAM exclusively for application use.

A range of analog and digital peripherals supports the powerful application processor and enables advanced single chip cellular IoT products.

The nRF9160 SiP uses standard Nordic development tools, making porting and development easy.

**Low power**
The nRF9160 SiP is made exclusively for the low power and low data rate LTE standards, introduced in 3GPP release 13. Due to this and the integration of application processor, modem and all memories, it can offer unparalleled low power performance.

It can maintain a connection with the cellular network with less than 15 uA average current and upload data every 20 seconds with 0.5 mA average current.

**Security**
The integrated cryptographic and security features enables the nRF9160 to meet the latest requirements on internet security and authentication. By including trusted execution capability on the application processor, it takes security a step further by securing the most critical processes and peripherals in the application.

The on-chip modem is its own security island.

**SIM and eSIM support**
The nRF9160 LTE modem supports both SIM and eSIM, plug-in or soldered. It provides power and handles all communication automatically.

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**KEY DATA**

### LTE-M and NB-IoT modem

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Frequency</td>
<td>700 MHz – 2.2 GHz</td>
</tr>
<tr>
<td>Throughput</td>
<td>LTE-M: 300/375 kbps</td>
</tr>
<tr>
<td></td>
<td>NB-IoT: 30/60 kbps</td>
</tr>
<tr>
<td>Output power</td>
<td>Up to 23 dBm</td>
</tr>
<tr>
<td>RX sensitivity</td>
<td>LTE-M: -108 dBm</td>
</tr>
<tr>
<td></td>
<td>NB-IoT: -114 dBm</td>
</tr>
<tr>
<td>Mode</td>
<td>HD-FDD</td>
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### Application processor

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<table>
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<tbody>
<tr>
<td>CPU</td>
<td>64 MHz Arm Cortex-M33</td>
</tr>
<tr>
<td></td>
<td>Arm TrustZone</td>
</tr>
<tr>
<td>Flash</td>
<td>1 MB</td>
</tr>
<tr>
<td>RAM</td>
<td>256 KB</td>
</tr>
<tr>
<td>Peripherals</td>
<td>Arm Cryptocell 310</td>
</tr>
<tr>
<td></td>
<td>3 x TIMER, 2 x RTC</td>
</tr>
<tr>
<td></td>
<td>WDT</td>
</tr>
<tr>
<td>Interfaces</td>
<td>4 x SPI (M/S) / UARTE / TWI (M/S)</td>
</tr>
<tr>
<td></td>
<td>4 x PWM, PDM, I2S</td>
</tr>
<tr>
<td></td>
<td>12 bit/200 ksps ADC</td>
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</table>

### Power consumption (LTE-M, 3.7 V supply)

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<table>
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<tbody>
<tr>
<td>Connected with 10 min uplink latency/eDRX interval</td>
<td>15 uA</td>
</tr>
<tr>
<td>Sending tracking data uplink every 20s</td>
<td>0.5 mA</td>
</tr>
<tr>
<td>Full speed downlink</td>
<td>150 mA</td>
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</table>

### Operating conditions and package

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<tr>
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<tr>
<td>Supply voltage</td>
<td>3.3 – 5.5 V</td>
</tr>
<tr>
<td>Temperature</td>
<td>-40 – 85 °C</td>
</tr>
<tr>
<td>Package</td>
<td>10×16×1 LGA</td>
</tr>
</tbody>
</table>

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**For latest status on certifications go to:** nordicsemi.com/9160cert

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**WORLD WIDE OFFICE LOCATIONS**

**Headquarters:**
Trondheim, Norway
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For more information
Visit nordicsemi.com for the complete product specification about this and any other wireless ULP products.

**About Nordic Semiconductor**
Nordic Semiconductor is a fabless semiconductor company specializing in ULP short-range wireless communication. Nordic is a public company listed on the Norwegian stock exchange.