

# nRF9160 cellular IoT System-in-Package

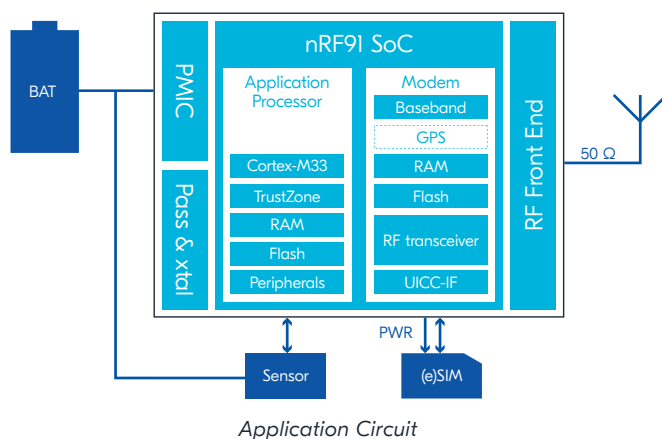
Low power SiP with integrated LTE-M and NB-IoT wireless modem

## 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 the comprehensive set of qualifications needed to utilize cellular technology.

By integrating an application processor, multimode LTE-M/NB-IoT modem, RF front end (RFFE), GPS and power management in a 10×16×1 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 Cloud with GPS satellite trilateration to allow remote monitoring of the device position.



## Application processor

The nRF9160 SiP offers a modern and powerful 64 MHz Arm Cortex-M33 CPU 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 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.

## KEY FEATURES

- Fully integrated SiP for cellular IoT
- Dedicated application processor and memory
- Multimode LTE-M/NB-IoT modem with integrated RFFE
- Assisted GPS
- Single variant certified for global operation
- Certified LTE bands: B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28 and B66
- Mobile network operator certifications: AIS, AT&T, Bell, China Telecom, Deutsche Telekom, Telstra, Verizon and Vodafone
- Global and regulatory certifications: GCF, PTCRB, FCC, CE, ISSED, ACMA RCM, NCC, IMDA, MIC, MSIP, IFT, ICASA, NBTC
- Overview of all certifications: [nordicsemi.com/9160cert](http://nordicsemi.com/9160cert)
- 10×16×1 mm LGA package



## LTE-M/NB-IoT modem

- Integrated RFFE
- 700-2200 MHz LTE 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 accelerated cryptography
- 1 MB Flash & 256 KB RAM
- 4 x SPI/UART/TWI
- PDM, I2S, PWM, ADC
- Automated power and clock management
- 32 GPIOs

## APPLICATIONS

- Logistics and asset tracking
- Smart city
- Smart agriculture
- Predictive maintenance & industrial
- Wearables & medical

## LTE-M/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 stack layers L1-L3, IPv4/IPv6, TCP/UDP, TLS/DTLS are all part of the modem firmware. The application processor communicates with the LTE modem through a BSD secure sockets API and contains the application layer protocols such as HTTP, CoAP, MQTT or LWM2M, and the application itself.

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

### Designed for true low power cIoT

The nRF9160 SiP is specifically designed to take full advantage of the energy efficiency possibilities associated with the LTE-M and NB-IoT standards. Nordic designs all hardware and software, and as such offers an unparalleled, high efficient and optimized low power cIoT solution.

It supports both the PSM and eDRX power saving modes, enabling the nRF9160 to sleep for longer periods of time. For both LTE-M and NB-IoT the PSM floor current is as low as 2.7 uA, and with an eDRX interval of 655 seconds the average current is 6 uA for LTE-M and 9 uA for NB-IoT.

### Get started today

The nRF Connect SDK is the software development kit for the nRF9160 SiP, including everything needed to get started, and much more. It integrates the Zephyr RTOS, application layer protocols such as HTTP, CoAP, MQTT and LWM2M, and application examples covering a wide range of use cases. It also includes software for secure boot, and secure firmware over-the-air (FOTA) for both application and modem firmware. The necessary firmware for the LTE modem is offered as pre-certified and precompiled downloads.

The nRF9160 DK is an affordable, pre-certified single board development kit for the nRF9160 SiP, facilitating development with LTE-M, NB-IoT and GPS.

## RELATED PRODUCTS

|                  |                                       |
|------------------|---------------------------------------|
| nRF9160 DK       | Development kit for the nRF9160 SiP   |
| Nordic Thingy:91 | Cellular IoT prototyping platform     |
| nRF Connect SDK  | Cellular IoT software development kit |

## KEY DATA

| LTE-M/NB-IoT modem |  |
|--------------------|--|
| Frequency range    | 700-2200 MHz   |
| Throughput (DL/UL) | LTE-M: 300/375 kbps<br>NB-IoT: 30/60 kbps            |
| Output power       | Up to 23 dBm   |
| RX sensitivity     | LTE-M: -108 dBm<br>NB-IoT: -114 dBm<br>GPS: -155 dBm |
| Mode               | HD-FDD   |

| Application processor |   |
|-----------------------|---|
| CPU                   | 64 MHz Arm Cortex-M33<br>Arm TrustZone  |
| Flash                 | 1 MB  |
| RAM                   | 256 KB  |
| Peripherals           | Arm Cryptocell 310<br>3 × TIMER, 2 × RTC<br>WDT                               |
| Interfaces            | 4 × SPI (M/S) / UARTe / TWI (M/S)<br>4 × PWM, PDM, I2S<br>12 bit/200 ksps ADC |

| Current consumption (23 dBm TX power, 3.7 V supply) |                                 |
|---|---------------------------------|
| PSM floor current                                   | LTE-M: 2.7 uA<br>NB-IoT: 2.7 uA |
| eDRX, 655 seconds                                   | LTE-M: 6 uA<br>NB-IoT: 9 uA     |

| Operating conditions and package |                |
|----------------------------------|----------------|
| Supply voltage                   | 3.0-5.5 V      |
| Temperature                      | -40-85 °C      |
| Package                          | 10×16×1 mm LGA |

## WORLD WIDE OFFICE LOCATIONS

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### For more information

Visit [nordicsemi.com](http://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.

