

# nRF9160 cellular IoT System-in-Package

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

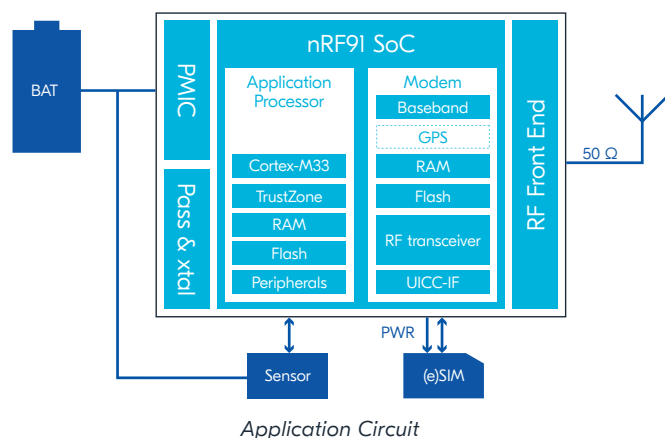
## Product overview

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 GPS. It combines location data from the cellular network with GPS satellite trilateration to allow remote monitoring of the device position.

LTE bands B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28 and B66 have been certified so far, with many more planned: [nordicsemi.com/9160cert](http://nordicsemi.com/9160cert)



## Application processor

The nRF9160 SiP offers a modern and powerful 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
- GPS
- Single variant certified for global operation
  - GCF, PTCRB
  - CE, FCC, ISSED, SRRC RTA, ACMA RCM, Taiwan, IMDA, Japan, South Korea
- Designed for true low power cIoT
- 10×16×1 mm LGA package



## LTE-M/NB-IoT modem

- Integrated RFFE
- 700-2200 MHz LTE band support
- 23 dBm output power
- 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

## 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 protocol, for example CoAP, MQTT or LWM2M, and the application itself.

The nRF9160 LTE modem supports both SIM and eSIM, plug-in or soldered. It provides power 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, with floor currents as low as 3 uA and 7 uA, respectively. In PSM mode, uploading 1 KB every 12 hours, the average current is as low as 5.5 uA. And it is 0.75 mA if GPS coordinates are uploaded every 2.7 minute.

### Get started today

The nRF Connect SDK is the software development kit for the nRF9160 SiP, including everything needed to get started, and more. It includes application layer protocols such as 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.

### KEY DATA

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

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

Power consumption (LTE-M, 3.7 V supply)	
PSM floor current	3 uA
eDRX floor current	7 uA
PSM mode, UL 1 KB every 12 hours	5.5 uA
GPS fix and UL of location data every 2.7 min (DRX)	0.75 mA
Full speed downlink	150 mA

Operating conditions and package	
Supply voltage	3.3-5.5 V
Temperature	-40-85 °C
Package	10×16×1 mm LGA

### RELATED PRODUCTS

nRF9160 DK	Development kit for the nRF9160 SiP
nRF Connect SDK	Software development kit for the nRF9160 DK

### WORLD WIDE OFFICE LOCATIONS

Headquarters:  
Trondheim, Norway  
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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.

