

nRF9160 cellular IoT System-in-Package

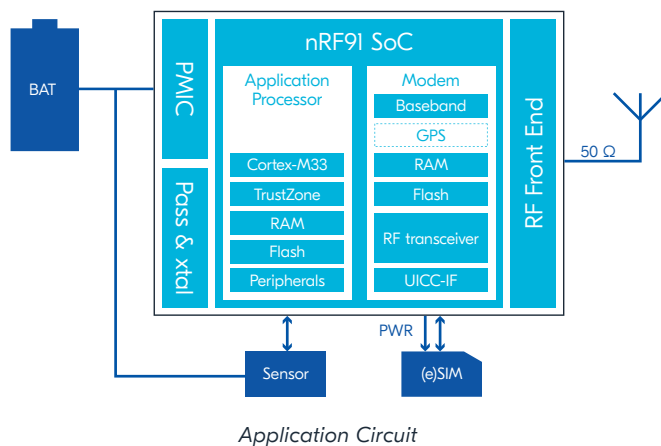
Low power SiP with integrated LTE-M, NB-IoT and GNSS wireless modem

Overview

The nRF9160 SiP is making the latest LTE technology accessible for a wide range of applications and developers. With the fully integrated SiP 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/GNSS modem, RF front-end (RFFE) and power management in a 10×16×1.04 mm package, it offers the most compact solution for cellular IoT on the market.

Targeting asset tracking applications, the nRF9160 SiP has built-in support for [nRF Cloud Location Services](#). These services provide built in GNSS and LTE location support with assisted GPS, predicted GPS, single-cell and multi-cell location services.



Application processor

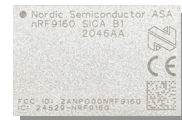
The nRF9160 SiP offers a modern and powerful 64 MHz Arm Cortex-M33 CPU with on-chip flash and RAM exclusively for application use.

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 SiP 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. In addition, the on-chip modem is its own security island.

Key features

- Multimode LTE-M/NB-IoT modem with integrated RF front-end
- Certified LTE bands: B1-B5, B8, B12-B14, B17-B20, B25-B26, B28 and B66
- 10×16×1.04 mm LGA package



nRF9160 SiP

- Certified for global operation:
 - AT&T, Bell, China Telecom, Deutsche Telekom, KDDI, Telstra, Verizon, Vodafone, etc.
 - GCF, PTCRB
 - FCC (USA), CE (EUR), UKCA (UK), ISED (CAN), SRRC (CHN), ACMA RCM (AUS), NCC (TWN), MIC (JPN), MSIP (KOR), (IND) and more
 - More info: nordicsemi.com/9160cert
- Multimode LTE-M/NB-IoT modem
 - 700-2200 MHz LTE band support
 - +23 dBm output power
 - GNSS (GPS, QZSS)
 - eDRX and PSM power saving features
 - Coverage enhancement modes
 - Single pin 50 Ω antenna interface
 - UICC interface
- Dedicated application processor and memory
 - 64 MHz Arm® Cortex®-M33 CPU
 - Arm TrustZone® for trusted execution
 - Arm CryptoCell 310 for application layer security
 - 1 MB Flash & 256 KB RAM

Applications

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

LTE-M/NB-IoT/GNSS modem

The nRF9160 LTE modem integrates RFFE, radio and baseband. It supports worldwide operation, enabling cellular IoT 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 BSD secure sockets APIs and contains the application layer protocols such as HTTP(S), CoAP, MQTT and 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 cellular IoT

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, highly efficient and optimized low power Cellular IoT solution.

It supports both the PSM and eDRX power saving features, enabling the nRF9160 SiP 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 idle 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(S), 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.

nRF Cloud is our IoT optimized cloud that works seamlessly with the nRF9160 SiP. It enables the use of nRF Cloud Location Services, services which provide different ways of computing location data with a lower power consumption compared with regular GNSS.

The nRF9160 DK is our recommended starting point for development. It is an affordable, pre-certified single board development kit for the nRF9160 SiP, facilitating development with LTE-M, NB-IoT and GNSS.

Key data

LTE-M/NB-IoT modem	
Frequency range	700-2200 MHz
Throughput (DL/UL)	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 GPS: -155 dBm
Mode	HD-FDD

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

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

Operating conditions and package	
Supply voltage	3.0-5.5 V
Temperature	-40 to 85 °C
Package	10×16×1.04 mm LGA

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
nRF Cloud	IoT cloud optimized for ultra-low power Nordic devices

Order information

nRF9160	low power cellular IoT SiP
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