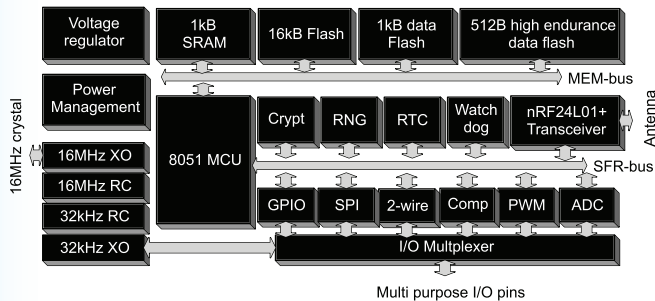


## Single chip ultra low power wireless

### Ultra low power wireless system-on-chip solution

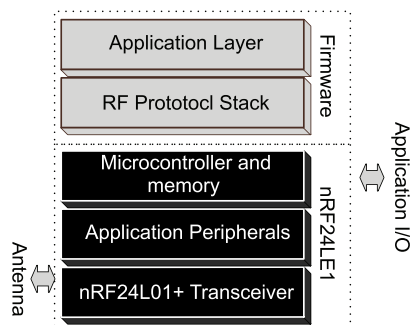
The nRF24LE1 is a unique solution offering a complete ultra low power (ULP) wireless system-on-chip (SoC) solution. It integrates the industry best nRF24L01+ 2.4GHz transceiver core, an enhanced 8051 microcontroller, flash memory and a wide range of analog and digital peripherals.

#### Block diagram



The 8-bit microcontroller is powerful enough to run both the RF protocol stack and the application layer, enabling a true single chip implementation of ULP wireless applications.

#### System diagram



## Optimized for ultra low power wireless

### Advanced power management and on-chip peripherals

The nRF24LE1 is optimized to provide a single chip solution for ULP wireless applications. The combination of processing power, memory, low power oscillators, real-time counter, AES encryption accelerator, random generator, plus a range of power saving modes provides an ideal platform for implementation of RF Protocols. Benefits include tighter protocol timing, security, lower power consumption and improved co-existence performance. For the application layer the nRF24LE1 offers a rich set of peripherals including: SPI, 2-wire, UART, 6 to 12-bit ADC, PWM, and an ultra low power analog comparator for voltage level system wake-up.

### Three package sizes for different applications

#### Same core but different package and I/O count

The nRF24LE1 comes in three different package variants:

- An ultra compact 4x4mm 24-pin QFN (7 generic I/O pins)
- A compact 5x5mm 32-pin QFN (15 generic I/O pins)
- A 7x7mm 48-pin QFN (31 generic I/O pins)

The 4x4mm 24-pin QFN with 7 generic I/O pins is ideal for low I/O count applications where small size is key. Examples include wearable sports sensors and watches. The 5x5mm 32-pin QFN with 15 generic I/O pins is ideal for medium I/O count applications such as wireless mice, remote controls and toys. The 7x7mm 48-pin QFN with 31 generic I/O pins is for high I/O count products like wireless keyboards.



RF Silicon

Software

Reference Design

Development Tools

## PRODUCT BRIEF

# nRF24LE1

nRF24LE1-F16Q24

nRF24LE1-F16Q32

nRF24LE1-F16Q48

## KEY FEATURES

- Fully featured ultra low power nRF24L01+ 2.4GHz transceiver core
- Worldwide 2.4GHz ISM band operation
- Enhanced ShockBurst™ hardware link layer
- 250 kbps, 1 Mbps and 2 Mbps on-air data rate options
- Air compatible with nRF24L01; nRF24L01+; nRF24LU1; and nRF2401A, -02, -E1 and -E2
- Low cost external  $\pm 60$ ppm 16MHz crystal
- Enhanced 8-bit 8051 compatible microcontroller
- 32-bit multiplication-division unit
- AES encryption/decryption accelerator
- 16 kbytes on-chip flash memory
- 1 kbyte on-chip data flash memory
- 512 bytes high-endurance data flash memory
- 1 kbytes on SRAM plus 256 bytes of IRAM
- Low power 16MHz crystal and RC oscillators
- Ultra low power 32kHz crystal and RC oscillators
- Flexible real-time counter and three 16-bit timers/counters
- Ultra low power analog comparator for system wake-up
- Rich set of digital interfaces including: SPI master/slave, 2-wire master/slave, and UART
- 2-channel PWM
- Programmable resolution ADC: 6, 8, 10, or 12-bits
- Random Number Generator based on thermal noise
- Supports the Nordic nRFProbe hardware debugger
- Programmable generic I/O pins
- Three package options:
  - 4x4mm 24-pin QFN (7 Generic I/O pins)
  - 5x5mm 32-pin QFN (15 Generic I/O pins)
  - 7x7mm 48-pin QFN (31 Generic I/O pins)

## APPLICATIONS

- PC peripherals – mice, keyboards and remotes
- Gaming controllers
- RF remote controls for consumer electronics devices such as set-top boxes, media players and TVs
- Sports and healthcare sensors
- Sport watches, bike computers, and gym equipment
- Remote controlled toys
- Active RFID

## A complete development platform

### For firmware and hardware engineers

The nRF24LE1 is supported by a complete development platform enabling designers to easily develop hardware and firmware for the chip. The platform comprises two key elements: the nRFGo Starter Kit and the nRF24LE1 Development Kit. One of each is required to get started with nRF24LE1.



nRFGo Starter Kit



nRF24LE1 Development Kit

The nRFGo Starter Kit provides a generic development platform including motherboards with sockets for radio modules, and the nRFGo Studio evaluation PC application. The nRF24LE1 Development Kit comes in three versions: one for each package variant. These include the nRF24LE1 radio modules, complete Software Development Kit (SDK), and nRFProbe hardware debug support.

### For more information

Please visit [www.nordicsemi.com](http://www.nordicsemi.com) for the complete product specification and more information about this or any other ULP wireless products.

### About Nordic Semiconductor ASA

#### Ultra low power RF silicon solutions

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.

Nordic provides RF Silicon Solutions for ultra low power wireless including:

- Highly integrated RF silicon
- Sophisticated and flexible development tools
- Application specific communication software
- Complete reference designs

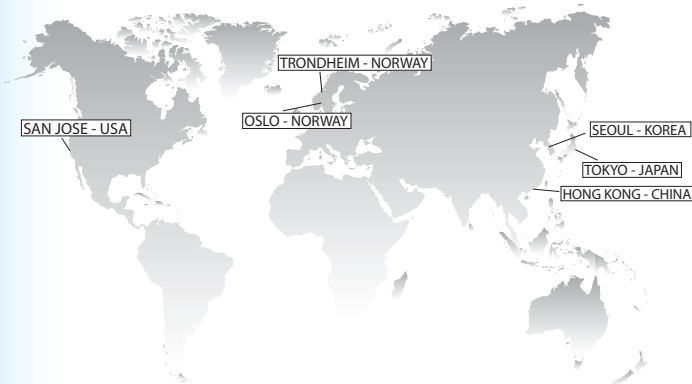
### Worldwide office locations

#### Headquarter

Trondheim, Norway

Telephone: +47 72 89 89 00

[www.nordicsemi.com](http://www.nordicsemi.com)



## SPECIFICATIONS

Frequency band	2.4GHz ISM ( 2.40000 – 2.4835GHz)
On-air data rate	250 kbps, 1 Mbps or 2 Mbps
Modulation	GFSK
Channel bandwidth	1MHz for 250 kbps and 1 Mbps mode, 2MHz for 2 Mbps mode
RF channels	126
Output power	Programmable: 0, -6, -12 or -18 dBm
External crystal	16MHz ±60ppm
Hardware Link layer	Enhanced ShockBurst™
Microcontroller	Enhanced 8-bit 8051 compatible microcontroller - Reduced instruction cycle time - Up to 16MHz operation - 32-bit multiplication/division unit
Program Memory	16 kbytes flash (1k endurance)
Data memory	1 kbytes (1k endurance) plus 512 bytes high endurance flash
RAM	1 kbytes SRAM plus 256 bytes IRAM
Oscillators	16MHz crystal oscillator 16MHz RC oscillator 32kHz crystal oscillator 32kHz RC oscillator
Hardware Security	8 x 8 Gaolis field multiplier for AES acceleration
Digital I/O	Flexible general purpose data port - Hardware SPI master/slave - 2-wire master/slave - UART
Analog peripherals	Programmable resolution ADC 2-channel PWM Analog comparator Random Number Generator
General purpose I/O	7 for 24-pin 4x4mm variant 15 for 32-pin 5x5mm variant 31 for 48-pin 7x7mm variant
Hardware debuggers support	nRFProbe, System Navigator from First Silicon Solutions (FS2)
Voltage regulator	On-chip 1.9 to 3.6V operation
Package options	RoHS compliant 24-pin 4x4mm QFN (nRF24LE1-F16Q24) 32-pin 5x5mm QFN (nRF24LE1-F16Q32) 48-pin 7x7mm QFN (nRF24LE1-F16Q48)

## Related Products

nRF6700	nRFGo Starter Kit
nRF24LE1-F16Q24-DK	nRFGo compatible Development Kit for 4x4mm 24-pin nRF24LE1
nRF24LE1-F16Q32-DK	nRFGo compatible Development Kit for 5x5mm 32-pin nRF24LE1
nRF24LE1-F16Q48-DK	nRFGo compatible Development Kit for 7x7mm 48-pin nRF24LE1

Visit [www.nordicsemi.com](http://www.nordicsemi.com) for Nordic Semiconductor sales offices and distributors worldwide.