

# nRF24L01+

## Single Chip 2.4GHz Transceiver

### Preliminary Product Specification v1.0

#### Key Features

- Worldwide 2.4GHz ISM band operation
- 250kbps, 1Mbps and 2Mbps on air data rates
- Ultra low power operation
- 11.3mA TX at 0dBm output power
- 13.5mA RX at 2Mbps air data rate
- 900nA in power down
- 26µA in standby-I
- On chip voltage regulator
- 1.9 to 3.6V supply range
- Enhanced ShockBurst™
- Automatic packet handling
- Auto packet transaction handling
- 6 data pipe MultiCeiver™
- Drop-in compatibility with nRF24L01
- On-air compatible in 250kbps and 1Mbps with nRF2401A, nRF2402, nRF24E1 and nRF24E2
- Low cost BOM
- ±60ppm 16MHz crystal
- 5V tolerant inputs
- Compact 20-pin 4x4mm QFN package

#### Applications

- Wireless PC Peripherals
- Mouse, keyboards and remotes
- 3-in-1 desktop bundles
- Advanced Media center remote controls
- VoIP headsets
- Game controllers
- Sports watches and sensors
- RF remote controls for consumer electronics
- Home and commercial automation
- Ultra low power sensor networks
- Active RFID
- Asset tracking systems
- Toys

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Data sheet status	
Objective product specification	This product specification contains target specifications for product development.
Preliminary product specification	This product specification contains preliminary data; supplementary data may be published from Nordic Semiconductor ASA later.
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## Writing Conventions

This product specification follows a set of typographic rules that makes the document consistent and easy to read. The following writing conventions are used:

- Commands, bit state conditions, and register names are written in `Courier`.
- Pin names and pin signal conditions are written in **`Courier`**.
- Cross references are [underlined and highlighted in blue](#).

## Revision History

Date	Version	Description
March 2008	1.0	

### Attention!

Observe precaution for handling  
Electrostatic Sensitive Device.



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## 1 Introduction

The nRF24L01+ is a single chip 2.4GHz transceiver with an embedded baseband protocol engine (Enhanced ShockBurst™), suitable for ultra low power wireless applications. The nRF24L01+ is designed for operation in the world wide ISM frequency band at 2.400 - 2.4835GHz.

To design a radio system with the nRF24L01+, you simply need an MCU (microcontroller) and a few external passive components.

You can operate and configure the nRF24L01+ through a Serial Peripheral Interface (SPI). The register map, which is accessible through the SPI, contains all configuration registers in the nRF24L01+ and is accessible in all operation modes of the chip.

The embedded baseband protocol engine (Enhanced ShockBurst™) is based on packet communication and supports various modes from manual operation to advanced autonomous protocol operation. Internal FIFOs ensure a smooth data flow between the radio front end and the system's MCU. Enhanced ShockBurst™ reduces system cost by handling all the high speed link layer operations.

The radio front end uses GFSK modulation. It has user configurable parameters like frequency channel, output power and air data rate. nRF24L01+ supports an air data rate of 250 kbps, 1 Mbps and 2Mbps. The high air data rate combined with two power saving modes make the nRF24L01+ very suitable for ultra low power designs.

nRF24L01+ is drop-in compatible with nRF24L01 and on-air compatible with nRF2401A, nRF2402, nRF24E1 and nRF24E2. Intermodulation and wideband blocking values in nRF24L01+ are much improved in comparison to the nRF24L01 and the addition of internal filtering to nRF24L01+ has improved the margins for meeting RF regulatory standards.

Internal voltage regulators ensure a high Power Supply Rejection Ratio (PSRR) and a wide power supply range.

## 1.1 Features

Features of the nRF24L01+ include:

- Radio
  - ▣ Worldwide 2.4GHz ISM band operation
  - ▣ 126 RF channels
  - ▣ Common RX and TX interface
  - ▣ GFSK modulation
  - ▣ 250kbps, 1 and 2Mbps air data rate
  - ▣ 1MHz non-overlapping channel spacing at 1Mbps
  - ▣ 2MHz non-overlapping channel spacing at 2Mbps
- Transmitter
  - ▣ Programmable output power: 0, -6, -12 or -18dBm
  - ▣ 11.3mA at 0dBm output power
- Receiver
  - ▣ Fast AGC for improved dynamic range
  - ▣ Integrated channel filters
  - ▣ 13.5mA at 2Mbps
  - ▣ -82dBm sensitivity at 2Mbps
  - ▣ -85dBm sensitivity at 1Mbps
  - ▣ -94dBm sensitivity at 250kbps
- RF Synthesizer
  - ▣ Fully integrated synthesizer
  - ▣ No external loop filter, VCO varactor diode or resonator
  - ▣ Accepts low cost  $\pm 60$ ppm 16MHz crystal
- Enhanced ShockBurst™
  - ▣ 1 to 32 bytes dynamic payload length
  - ▣ Automatic packet handling
  - ▣ Auto packet transaction handling
  - ▣ 6 data pipe MultiCeiver™ for 1:6 star networks
- Power Management
  - ▣ Integrated voltage regulator
  - ▣ 1.9 to 3.6V supply range
  - ▣ Idle modes with fast start-up times for advanced power management
  - ▣ 26 $\mu$ A Standby-I mode, 900nA power down mode
  - ▣ Max 1.5ms start-up from power down mode
  - ▣ Max 130 $\mu$ s start-up from standby-I mode
- Host Interface
  - ▣ 4-pin hardware SPI
  - ▣ Max 10Mbps
  - ▣ 3 separate 32 bytes TX and RX FIFOs
  - ▣ 5V tolerant inputs
- Compact 20-pin 4x4mm QFN package