nRF24EX™

2.4GHz single chip component for wireless communication - including Pb free alternatives

NORDIC SEMICONDUCTOR

nRF24E1/nRF24E2 - Nordic Semiconductor
All in one - single chip solution

1.9 - 3.6V

2.4GHz transciever

2.4GHz transmitter

ShockBurst™

6x6mm size

-90dBm sensitivity

125 channels

System on Chip 0.18μ CMOS

nRF24E2G Pb free

nRF24E1G Pb free

Up to 1Mbit/sec

DuoCeiver™

Introducing the 2.4GHz nRF24E1(G) transceiver and nRF24E(G) transmitter with embedded 8051 MCU, 9 channel 12-bit ADC, and peripherals

Based on the market leading nRF2401and nRF2402, the nRF24E1 and nRF24E2 bring the level of integration one step further. In a unique market leading design, the most sophisticated low cost 2.4GHz ISM wireless components are paired with the industry standard 8051 MCU core, and leading peripherals to create the worlds first complete low cost System-on-Chip (SoC) IC's for global 2.4GHz operation.

The new components from Nordic Semiconductor ASA, are manufactured in an ultra modern 0.18μm process, and have included all the great benefits of the nRF2401/02, such as ShockBurst™, DuoCeiver™, on-chip CRC and address computation/encoding.

A "green" Pb (lead) free alternative
Both the nRF24E1 and the nRF24E2 are offered in a "green" Pb (lead) free alternative, the nRF24E1G and the nRF24E2G. Both of these confirm to current and future environmental standards.

Global application enabler – low cost and small size
The entire radio, MCU, peripherals, inductors and filters, are integrated in a single chip that gives the lowest cost solution to the end-user. The only external components needed to make a complete system are a crystal, resistor, and a low cost external 4KB EEPROM for initial program storage. The total solution fits into a 36-pin QFN package, measuring 6x6mm.

Using the worldwide 2.4GHz frequency band the nRF24E1 and nRF24E2 eliminates the need for several hardware platforms to cover a global market -easing logistics and ensuring portability for products.

Common features nRF24E1(G) and nRF24E2(G)
- Worldwide 2.4GHz operation
- 125 channels
- 1.9 - 3.6V voltage supply
- 0 -1Mbit/sec datarate
- 0dBm output power
- ShockBurst™ *
- Single chip RF, MCU & ADC
- "Green" Pbfree versionavailable

Common MCU features nRF24E1(G) and nRF24E2(G)
- 8051 MCU
- 4Kbyte program RAM
- 256byte data RAM
- 16MHz Clock
- 4-20 clock cycle instruction
- Mask programmable version
- available
- On Chip RC OSC

nRF24E1(G) specific features
- CRC computation in RX
- Address stripping
- Clock recovery on data

Embedded peripherals nRF24E1(G) and nRF24E2(G)
- Programmable PWM (Pulse Width
- Modulation)
- UART
- SPI
- 3 timers
- 9 channel 12 bit ADC
- Battery Monitoring

High integration
- 36 pin QFN package 6x6mm
- 3 external components, Crystal, resistor
- and 4KB EEPROM
- No trimming in production
- No need for external SAW filter
- Smallest available PCB footprint
- Low cost BOM
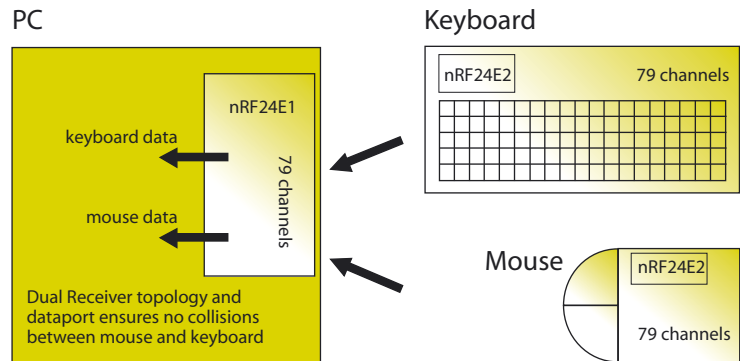
RF Performance and quality
- GFSK modulation
- Channel switching time <200us
- On chip mirror image cancellation
- -40°C to + 85°C operation
- 100% RF tested

* See description on page for "Embedded features"

nRF

Embedded features in nRF24E1(G) and nRF24E2(G) to reduce bill of material (Bom) and current consumption
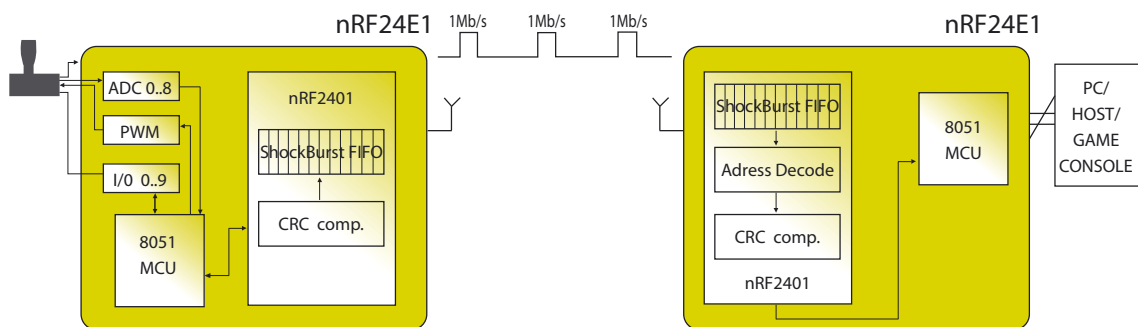
DuoCeiver™ topology - receiving simultaneously from 2 sources:

With the nRF24E1 and the nRF24E2 the receiver can receive at 2 channels simultaneously, for instance from a wireless mouse and keyboard transmitting at the same time, thus eliminating the need for adding 2 separate RX modules, eliminating extra costs and saving space.

PC

nRF24E1

keyboard data

mouse data

79 channels

Dual Receiver topology and dataport ensures no collisions between mouse and keyboard

Keyboard

nRF24E2   79 channels
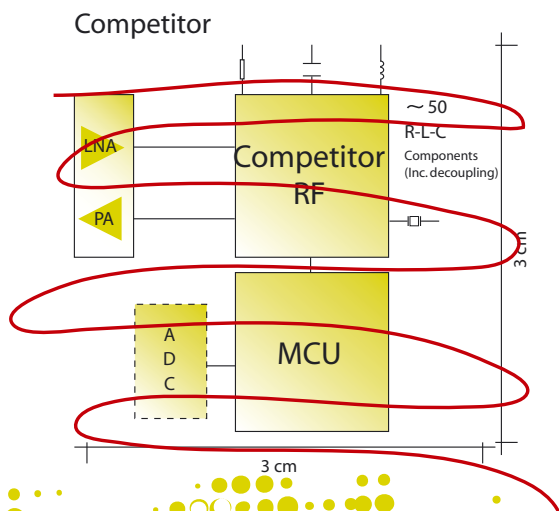
Mouse

nRF24E2

79 channels

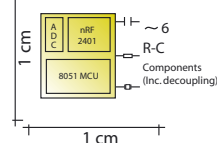### ShockBurst™ technology to drastically reduce current consumption and Bom

The nRF24E1 uses ShockBurst™ technology to allow the embedded 8051 MCU to clock in data at a very low speed into the RF -interface which in turn computes the CRC checksum and buffers up data in an on-chip FIFO for transmission at up to 1Mbit/sec. At the receiving end the opposite takes place, the RF front end buffers up data, decodes the address and computes the CRC checksum, allowing the embedded 8051 MCU to clock out data at a low speed. The net result is an extreme reduction in active TX current, as well as freeing up extensive resources for the embedded 8051 MCU.

nRF24E1   1Mb/s   1Mb/s   1Mb/s   nRF24E1

ADC 0..8
PWM
I/0 0..9
8051 MCU

nRF2401
ShockBurst FIFO
CRC comp.

ShockBurst FIFO
Adress Decode
CRC comp.
nRF2401

8051 MCU

PC/ HOST/ GAME CONSOLE

Nordic Semiconductor embedded RF

Competitor

LNA

PA

Competitor RF

~ 50
R-L-C
Components
(Inc.decoupling)

A
D
C

MCU

3 cm

3 cm

nRF24E1/nRF24E2

1 cm

A
D
C

nRF 2401

8051 MCU

~ 6
R-C
Components
(Inc.decoupling)

1 cm

Using the nRF24E1/nRF24E2 for an embedded RF design will allow substantial savings in cost, component count and board size, whilst easing design and increasing reliability.

nRF24E1(G) and nRF24E2(G) applications

nRF24E1 and nRF24E2 is used in applications where size and price and power consumption are important parameters. The high datarate may be used with advantage in applications either to transfer large amounts of data, such as audio or to achieve low power consumption through the use of the ShockBurst™ mode.

Toys
Covering a global frequency band the nRF24E1 and nRF24E2 can be used in various types of toys which are by nature portable, and sensitive to size and cost.

Interactive educational equipment
With a very low cost point and high integration the nRF24E1 and nRF24E2 can easily synchronize interactive learning terminals connected to each other or to a PC.

Wireless gamepads and PC peripherals
With the extremely high integration, speed and low cost the nRF24E1 and nRF24E2 are well suited for integration into wireless PC peripherals. The dual receiver architecture of the nRF24E1 can be used to receive from 2 gamepads, or keyboard and mouse simultaneously. On chip MCU and ADC, and other peripherals provides a single chip solution, further cutting cost and size.

Audio Solutions
The nRF24E1/nRF24E2 are ideally suited for wireless audio headsets for portable MP3/CD players, for transferring audio, as well as for controlling the player itself -acting as a remote control if a nRF24E1 is used at both sides.
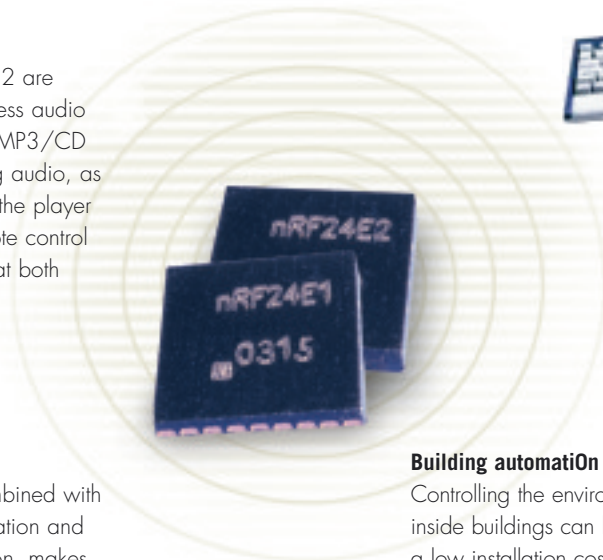
Wireless handsfree
The high datarate combined with small size, high integration and low power consumption, makes the nRF24E1 ideal for use in a wireless headset or hearing aid for clear and undistorted speech quality.
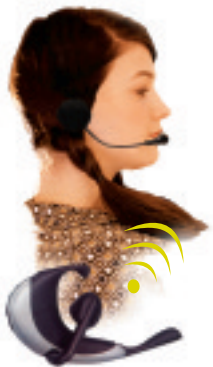
Building automatiOn
Controlling the environment inside buildings can be done a low installation cost, and w out wires running through roor and walls.

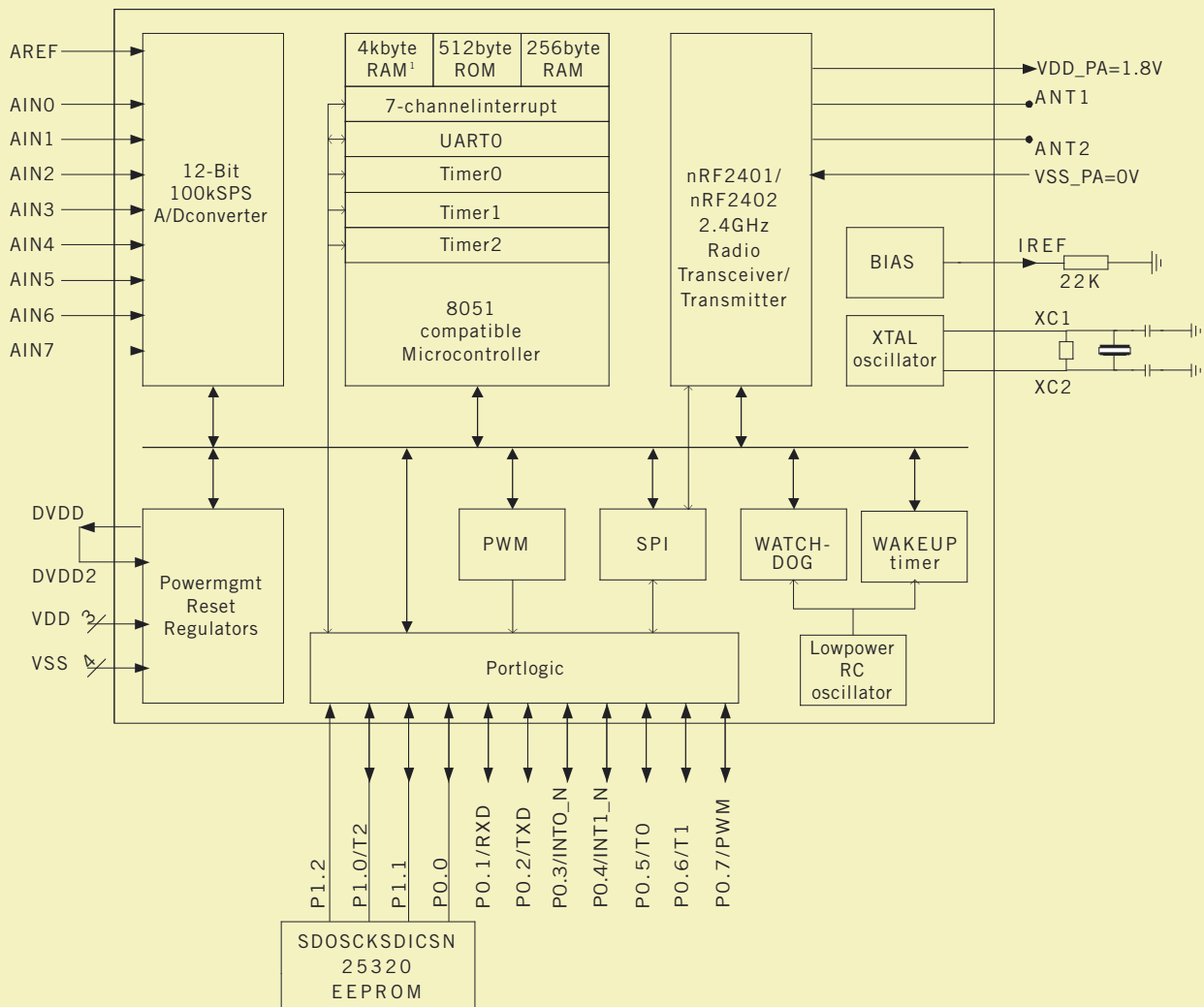### Sports and leisure equipment
Sports and activities are gradually growing more technical. With the nRF24E1 and the nRF24E2 more functionality can be added to any sports "computer" offering a global approval and the most competitive power consumption.

Remote control
The nRF24E1 and nRF24E2 are ideal replacements for the traditional InfraRed (IR) technology used in remote control applications. The nRF24E1/nRF24E2 solves problems typically associated by IR - whilst at the same time offering a global and low cost solution.

# nRF24E1(G) and nRF24E2(G) with all external components needed

Block diagram labels

Inputs on left:
- AREF
- AIN0
- AIN1
- AIN2
- AIN3
- AIN4
- AIN5
- AIN6
- AIN7

Blocks:
- 12-Bit 100kSPS A/D converter
- 4kbyte RAM[1]
- 512byte ROM
- 256byte RAM
- 7-channel interrupt
- UART0
- Timer0
- Timer1
- Timer2
- 8051 compatible Microcontroller
- nRF2401/ nRF2402 2.4GHz Radio Transceiver/ Transmitter
- BIAS
- XTAL oscillator
- Powermgmt Reset Regulators
- PWM
- SPI
- WATCH-DOG
- WAKEUP timer
- Lowpower RC oscillator
- Portlogic

Outputs on right:
- VDD_PA=1.8V
- ANT1
- ANT2
- VSS_PA=0V
- IREF 22K
- XC1
- XC2

Left bottom labels:
- DVDD
- DVDD2
- VDD
- VSS

Port labels:
- P1.2
- P1.0/T2
- P1.1
- P0.0
- P0.1/RXD
- P0.2/TXD
- P0.3/INT0_N
- P0.4/INT1_N
- P0.5/T0
- P0.6/T1
- P0.7/PWM

SDOSCKSDICSN 25320 EEPROM

6 mm
Actual size
- the smallest there is

Extremely low current consumption

Datarate -mode	Current consumption mA
TX @ -5dBmPOUT - 10kbit/sec continuous - ShockBurst™ mode	0.8mA
TX @ -20dBm POUT 1Mbit/sec	8.8mA
TX @ -10dBm POUT 1Mbit/sec	9.4mA
TX @ -5dBmPOUT - 1Mbit/sec	10.5mA
TX @ 0dBm POUT - 1Mbit/sec	13mA
RX - receiving on one channel 1Mbit/sec	19mA
RX -receiving simultaneously on two channels 1Mbit/sec	25mA
Supply current for ADC @ 100 KSPS	0.9mA
Supply current for 8051 MCU @ 16 MHz @ 3V	3mA

nRF 24E1/24E2

6 mm   0,8 mm

6 mm
nRF 24E1
nRF 24E2
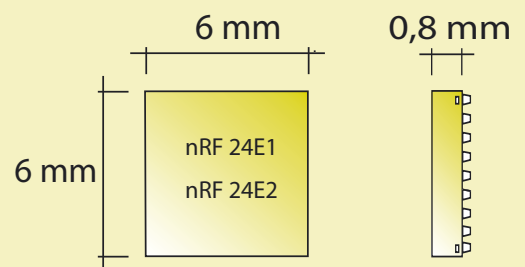
Features and benefits:

- Single chip transceiver and transmitter with embedded MCU
- 9 channel 12 bit ADC & peripherals
- Short time to market
- Low power consumption
- 3 external components - crystal, resistor and EEPROM
- Small PCB size, nRF24E1 and nRF24E2, 6x6mm
- Easy to use interface
- Performance, range, reliability and security
- Made for volume production - surface mount & RF tested
- High datarate - up to 1Mbit/sec
- No Manchester encoding or training sequence
- Layout and PCB antenna solution available for free
- Toolkits and technical support
- Compliance with ETSI, FCC and other local regulations worldwide
- ShockBurst™ mode for extreme low current operation
- DuoCeiver™ - Dual simultaneous receiver architecture
- Low cost BOM
- On Chip voltage regulators
- "Green" Pb (lead) free alternative available

Wireless solutions
Have you ever wanted to...?
- Link devices together
- Monitor the state of a machine
- Remote control something
- Be warned of a critical event
- Transfer data

BUT faced problems with...?
- Distance
- Rugged terrain
- Hazardous areas
- Physical obstructions
- Battery powered applications

WIRELESS SOLUTIONS give:
- Flexibility
- Portability
- Low cost installation
- Scalability

Development tools

nRF24E1-EVKIT development kit provides the user with an easy to use start platform for the nRF24E1 and nRF24E2. The kit can be operated in PC mode where all downloads and communication is performed via a PC USB interface, or in stand-alone mode where the on board EEPROM can be programmed via the USB interface, and then detached from the PC. All I/O and features of nRF24E1/E2 are available on external connectors on the nRF24E1-EVKIT.

Two boards with nRF24E1 transceiver
- Connectors for ADC interface
- Connectors for Digital I/O and peripherals
- SMA connector for antenna
- Two antennas for SMA connector

Two USB interface boards
- Connects to nRF24E1-EVBOARD
- Connects to PC USB port

CD-ROM with Software and documentation
- PC Interface SW
- Example programmes
- Support for 3rd party development tools:
  - Assemblers
  - Compilers
  - Linkers
  - Debuggers
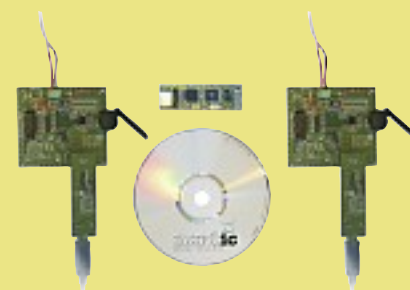
Ordering code

Tray	Reel
nRF24E1	nRF24E1-REEL
nRF24E2	nRF24E2-REEL
nRF24E1G	nRF24E1G-REEL
nRF24E2G	nRF24E2G-REEL

NORDIC SEMICONDUCTOR

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