nRF24E1/nRF24E2
2.4GHz single chip component for wireless communication

System on Chip 0.18u CMOS
2.4GHz transceiver
2.4GHz transmitter
Microcontroller
9 channel 12 bit-ADC
125 channels
ShockBurst
DuoCeiver
Digital I/O
SPI
UART’s
RC Osc
Introducing the 2.4GHz nRF24E1™ transceiver and nRF24E2™ transmitter with embedded 8051 MCU, 9 channel 12-bit ADC, and peripherals

Based on the market leading nRF2401 and 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 world’s first complete low cost System on Chip (SoC) IC’s for global 2.4GHz operation. The new components from Nordic VLSI 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.

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 4kHz 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 and nRF24E2
- Worldwide 2.4GHz operation
- 125 channels
- 1.9 - 3.6V voltage supply
- 0 - 1Mbit/sec datarate
- 0dBm output power
- ShockBurst/direct mode
- Single chip RF, MCU & ADC

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

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

Embedded peripherals nRF24E1 and nRF24E2
- 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 4K EEPROM
- No trimming in production
- No need for external SAW filter
- Smallest available BOM & footprint

RF Performance and quality
- GFSK modulation
- Efficient output spectrum
- Channel switching time <200us
- On chip mirror image cancellation
- -40°C to +85°C operation
- 100% RF tested
nRF24E1 and nRF24E2 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.

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.

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 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.

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.

BUILDING AUTOMATION
Controlling the environment inside buildings can be done at a low installation cost, and without wires running through rooms and walls.

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 and nRF24E2 with all external components needed

Extremely low current consumption

<table>
<thead>
<tr>
<th>Data rate - mode</th>
<th>Current consumption mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX @ -5dBm POUT</td>
<td>0.8mA</td>
</tr>
<tr>
<td>TX @ 0dBm POUT</td>
<td>8.8mA</td>
</tr>
<tr>
<td>TX @ -10dBm POUT</td>
<td>9.4mA</td>
</tr>
<tr>
<td>TX @ -5dBm POUT</td>
<td>10.5mA</td>
</tr>
<tr>
<td>TX @ 0dBm POUT</td>
<td>13mA</td>
</tr>
<tr>
<td>RX - receiving on one channel</td>
<td>18mA</td>
</tr>
<tr>
<td>RX - receiving simultaneously on two channels</td>
<td>25mA</td>
</tr>
<tr>
<td>Supply current for ADC @ 100 KSPS</td>
<td>0.9mA</td>
</tr>
<tr>
<td>Supply current for 8051 MCU @ 16 MHz @ 3V</td>
<td>3mA</td>
</tr>
<tr>
<td>Complete system standby with timer or external pin wake up</td>
<td>2µA</td>
</tr>
</tbody>
</table>

Actual size - the smallest there is 6 mm
Embedded features in nRF24E1™ and nRF24E2™ to reduce bill of material (Bom) and current consumption

Dual receiver 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.

ShockBurst technology to drastically reduce current consumption and Bom
The nRF24E1 uses ShockBurst technology to allow the embedded 8051 MCU to clock 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.

Nordic VLSI embedded RF
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.
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

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

nRF24E1/nRF24E2 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.

The nRF24E1-EVKIT consists of the following

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

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