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## nRF24Z1 Evaluation board

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## nRF24Z1-EVB

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### 1. General description

This document describes the **nRF24Z1-EVBOARD** and its use with the Nordic Semiconductor **nRF24Z1** Single Chip 2.4 GHz RF Audio streamer.

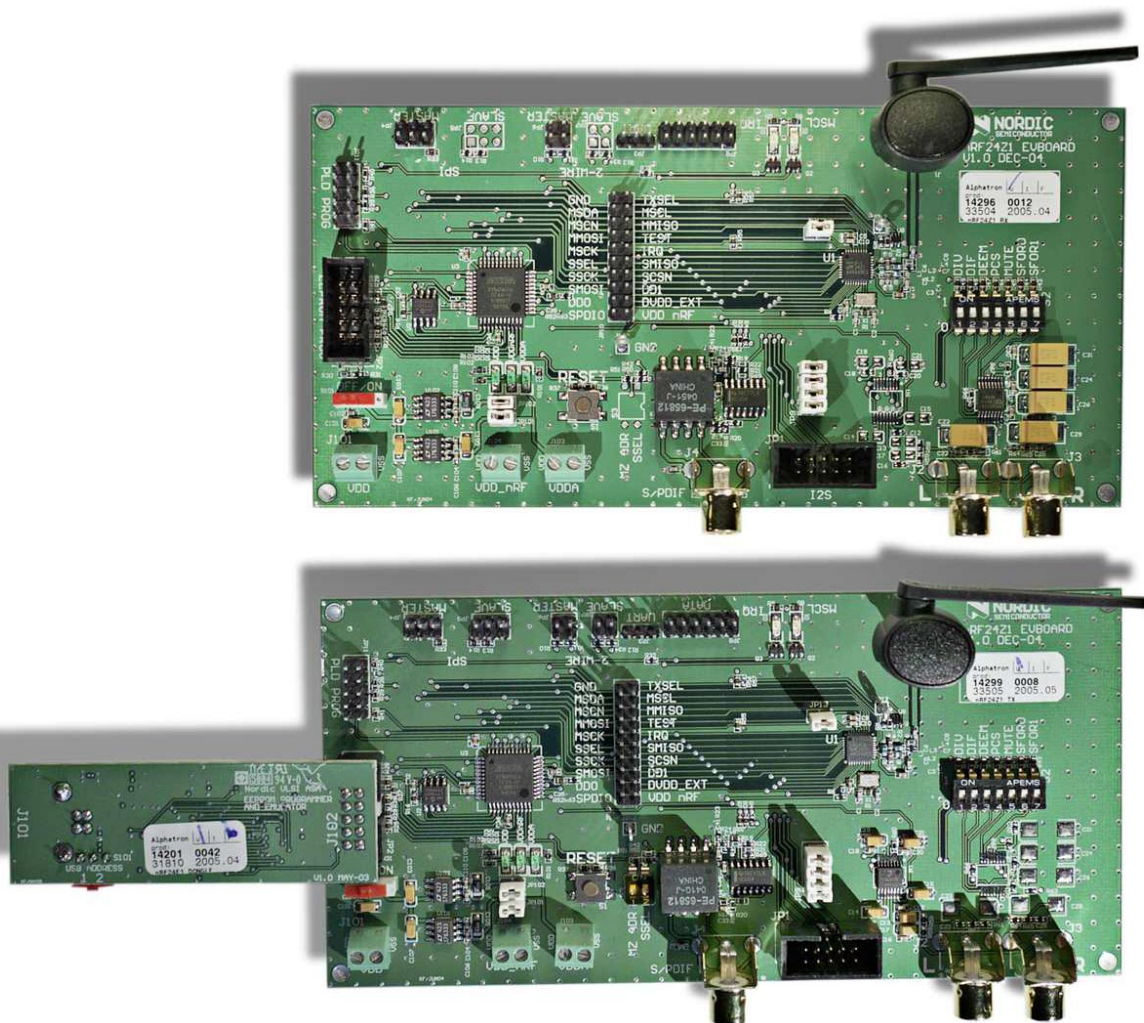


Figure 1: The **nRF24Z1-EVBOARD**

There are two versions of the nRF24Z1-EVBOARD. One is fitted with the nRF24Z1 in audio receiver (ARX) mode (Figure 1, top) the other with the nRF24Z1 set in audio transmitter (ATX) mode (Figure 1, bottom). The two boards are also populated differently in the audio front end section. The reason for the differences will be explained further in the following sections.



## 2. Introduction

The Evaluation Board for the **nRF24Z1** Single Chip 2.4 GHz RF audio streamer has been developed to enable customers to test functionality, run communication and verify the performance parameters of the device. This document describes the usage of the **nRF24Z1-EVBOARD**.

The **nRF24Z1-EVBOARD** is intended for evaluation and development purposes only. It is not intended for incorporation into an end product.

## 3. Getting started

The **nRF24Z1-EVBOARD** V1-0 is shipped with an EEPROM programmer and emulator (programming dongle). The nRF programming dongle enables you to download register settings and access the control link offered by **nRF24Z1**.

The following equipment is needed to work efficiently with the **nRF24Z1-EVBOARD**:

- PC with 1 free USB port
- Z1config PC software (supplied)
- 1 nRF EEPROM programmer and emulator (supplied)
- Two 2.0 V - 3.6V or one 4.6 – 12V DC voltage supply
- 1 male A/B USB cable (supplied)

To evaluate the performance of the device the following instrumentation should be available:

- Audio source, analog or digital. Analog audio input is AC coupled, with a maximum swing of 2.6Vpp (0.9Vrms). Minimum input resistance is 10k $\Omega$ . Digital audio input is via S/PDIF RCA phono connector (0.5Vpp, 75 $\Omega$ )
- Audio amplifier and loudspeakers. Analog audio out is 2.1Vpp (0.75Vrms) at a load of 5k $\Omega$ . Digital audio output is via S/PDIF RCA phono connector (0.5Vpp, 75 $\Omega$ )
- Oscilloscope
- 2.4 GHz Spectrum analyzer



## 4. Programming dongle description

The programming dongle is fitted 'on-top' (Figure 2) of the **nRF24Z1-EVBOARD** and controlled through PC software. The **Z1config** software is documented in Z1config user manual [1].

The dongle will mainly be fitted on the **nRF24Z1** audio transmitter (ATX) board. Through this interface the user also has full control of the audio receiver board through the control/data RF link offered by **nRF24Z1**. The dongle needs to be connected to the audio receiver board only if default configuration in the audio receiver EEPROM is to be changed.

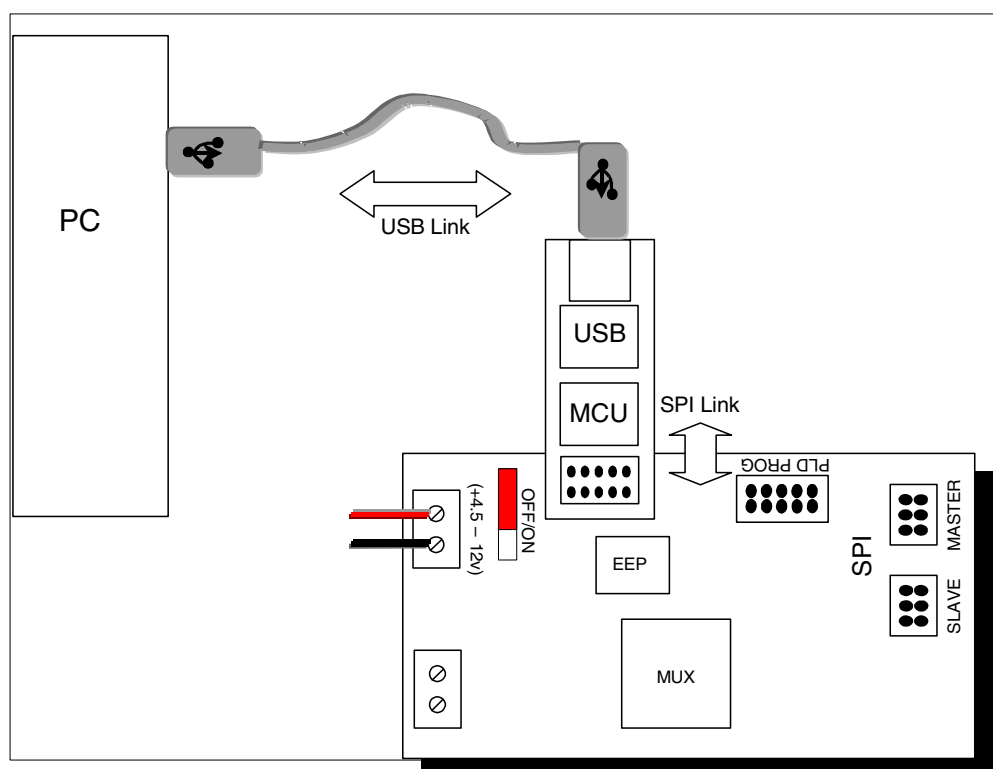


Figure 2: **nRF24Z1-EVBOARD** with programming dongle

### 4.1. Supply

Main power supply is fed to the nRF programming dongle through the USB interface (J101). Supply voltage to the **nRF24Z1-EVBOARD** interface stage runs through J102 from the **nRF24Z1-EVBOARD**. The programming dongle must hence be plugged in the EVBOARD connector JP2 in order to have proper signal levels on J102.



### 4.2. nRF24Z1-EVBOARD interface

The pin-out of the interface (J102) to the **nRF24Z1-EVBOARD** can be found under the **nRF24Z1-EVBOARD** description (EVBOARD connector JP2). The PC interface (J101) is a standard USB B-connector interface.

### 4.3. USB addressing (S101)

The dongle has an option to use 2 different USB addresses set by S101. This option is only needed if the same USB hub is to interface two dongles. The position of S101 is hence not important in the **nRF24Z1-EVKIT** unless you have two audio transmitter boards connected to the same PC (2 different EVKIT's) at the same time.



## 5. nRF24Z1-EVBOARD DESCRIPTION

Figure 3 shows the block diagram of the **nRF24Z1-EVBOARD**.

Further details can be found in appendix 1 (circuit diagram and PCB layout) and appendix 2 (component list).

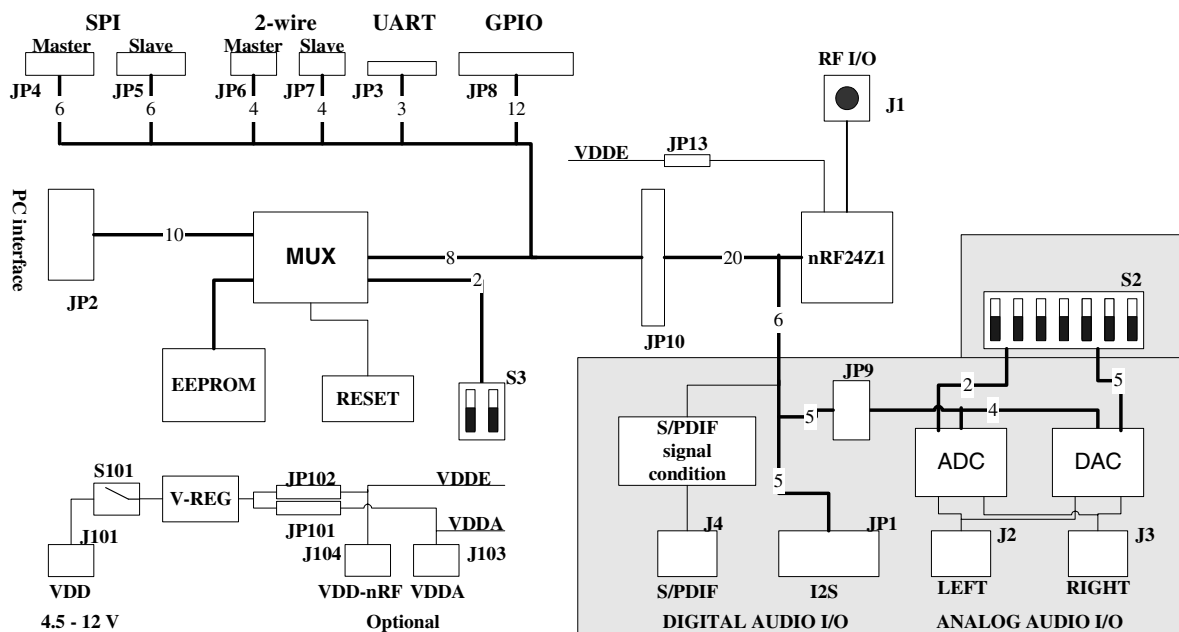


Figure 3: Block diagram of the **nRF24Z1-EVBOARD**

Due to the significant difference in functionality when the **nRF24Z1** is configured in audio transmitter mode (found at audio source side like the CD player) and in audio receiver mode (loud speaker side) the two EVBOARD's in the EVKIT are preset as audio transmitter and receiver. The audio section of the two versions of the EVBOARD are populated differently (S/PDIF and ADC/DAC section), but note that the section around **nRF24Z1** (device and external components) are identical on the two boards.

To enable convenient control of the **nRF24Z1-EVBOARD** from a computer, a MUX (Altera PLD) is put on the **nRF24Z1-EVBOARD** to ease PC interfacing with **nRF24Z1** and the on board EEPROM. The on board mux is hence only for EVBOARD versatility and not needed in a final design.

### 5.1. Supply (J101, J103, J104)

Power supply and ground is fed to the **nRF24Z1-EVBOARD** either through on-board voltage regulators (connector J101) or directly from external supplies (J103, J104). J101 is the primary VDD to be used with the **nRF24Z1-EVBOARD**.

If jumper JP101 (leave JP102) are removed, connector J104 supplies, supply to all circuitry except on the board ADC/DAC. J104 supplies VDDA, analog power for the on board ADC or



DAC. Supply on J104 is of course only needed if the analog audio front ends (ADC/DAC) are used.

S101 is the board ON/OFF switch for power fed through J101.

Note that VDD fed through J103 and J104 are fed directly to the circuitry ON/OFF must hence be managed from the power supplies.

ON is shown by lit green LED's. Note that if the supply voltage is ~2.0 V the light from the LED will be weak.

Please note the voltage limitations on the connectors. The on-board voltage regulator accepts an input voltage between 4.5 and 12 V, the regulated output voltage is 3.3V.

For device testing over the supply range (2.0 – 3.6V), J103 and J104 must be utilized.

The voltage on these two connectors must always be equal, and there is NO protection on these VDD inputs. Pay special attention to the max value (3.6V) since this is also the absolute maximum rating of the **nRF24Z1**.

**NOTE:**

Voltages above 3.6V on J104 for extended time will destroy the **nRF24Z1**!

## **5.2. RESET**

A **nRF24Z1** reset is forced either by pressing the RESET button (S1) on the PCB or manually through the PC software to the on board EEPROM via the USB dongle connected to JP2.

When the **nRF24Z1** is reset, configuration data is re-loaded from external memory and new RF link initialization is started.

In a final application external reset circuitry is not necessary, the reset circuitry on the EVBOARD is included to force re-load of configuration data and re-initialization of link during testing.

## **5.3. nRF24Z1 voltage and current measurements (JP13)**

To enable accurate measurement of **nRF24Z1** current consumption a jumper (JP13) is put in the **nRF24Z1** supply line. This jumper is never to be removed, except when replaced by an ampere meter for measurements. The exact supply voltage to the **nRF24Z1** can also be measured on JP13.

## **5.4. I/O ports**

For convenience, the digital I/O signals of the **nRF24Z1** are routed to separate connectors depending on functionality. Due to sharing of pins and different functionality in audio transmitter and audio receiver mode the same signals can be found in multiple connectors.

All signals can be accessed on JP10.



## 5.5. AUDIO I/O

The available audio interfaces of the **nRF24Z1** are available on separate connectors on the EVBOARD. The components in the **nRF24Z1-EVBOARD** audio section (grayed out in *Figure 3*) will vary depending on the mode (audio transmitter or receiver) the fitted **nRF24Z1** is set in.

### NOTE:

Only one of the audio interfaces (I2S or S/PDIF) may be used at one time.

### 5.5.1. S/PDIF (J4)

The **nRF24Z1** SPDIO pin offers timing wise true S/PDIF input in audio transmitter (ATX) mode and similar output in audio receiver (ARX) mode. The SPDIO pin operates however with CMOS signal level so to get a true S/PDIF coax signal (0.5Vpp @ 75  $\Omega$ ) a level shift and impedance match must be done. This is realized on board on the **nRF24Z1-EVBOARD** and connector J4 hence offers a true S/PDIF coax interface to external equipment.

### 5.5.2. I2S (JP1)

The **nRF24Z1** I2S interface can be accessed directly on JP1.

| JP8 pin # | Signal name | Comment                              |
|-----------|-------------|--------------------------------------|
| 1         | MCLK        | 256x sample rate clock to ADC or DAC |
| 2         | GND         |                                      |
| 3         | CLK         | I2S bit clock                        |
| 4         | GND         |                                      |
| 5         | WS          | I2S word clock                       |
| 6         | GND         |                                      |
| 7         | DATA        | I2S data                             |
| 8         | GND         |                                      |
| 9         | REQ         | I2S data request                     |
| 10        | GND         |                                      |

Table 1 **nRF24Z1-EVBOARD** JP1 I2S interface pin out

The **nRF24Z1-EVBOARD** connector JP1 offers a interface compatible with industry standard audio ADC and DAC's.

### 5.5.3. Analog line I/O (JP9, J2, J3)

By fitting jumpers on JP9 the I2S bus is also fed to an on board stereo ADC (ATX board) or a stereo DAC (ARX board). When using the on-board data converters left and right analog line I/O signals can be fed through J2 and J3 RCA connectors.





- Analog audio input is AC coupled, with a maximum swing of 2.6V<sub>pp</sub> (0.9V<sub>rms</sub>). Minimum input resistance is 10kΩ.
- Analog audio out is 2.1V<sub>pp</sub> (0.75V<sub>rms</sub>) at a load of 5kΩ.

#### 5.5.4. DATA CONVERTER CONTROL (S2)

| S2 switch | Signal name                    |
|-----------|--------------------------------|
| DIV       | ADC MCLK divide                |
| DIF       | ADC digital audio format       |
| DEEM      | DAC de-emphasize               |
| PCS       | DAC mode                       |
| MUTE      | DAC mute                       |
| SFOR1     | DAC digital audio format bit 1 |
| SFOR0     | DAC digital audio format bit 0 |

Table 2 nRF24Z1-EVBOARD JP1 I2S interface pin out

The audio transmitter board is equipped with a Crystal CS5333 AD converter [3] and the audio receiver board is equipped with a Philips UDA1334TS DA converter [4].

S2 provides access to various controls settings for the ADC and DAC. Please refer to the respective datasheets ([3], [4]).

Setting all S2 switches to ON, gives default function in ADC and DAC.

## 5.6. SERIAL CONTROL INTERFACES

### 5.6.1. Selecting control interface (S3)

The nRF24Z1 can be controlled as a slave on either SPI or 2-wire external serial interface. The SSEL pin selects which. In a final application this pin is clamped either high or low, but on the EVBOARD it is controlled by a switch found in S3. S3 also contains a switch setting one of two possible addresses nRF24Z1 answers to as 2-wire slave.

| S3 switch name | Switch OFF       | Switch ON        | Functionality                                                                                    |
|----------------|------------------|------------------|--------------------------------------------------------------------------------------------------|
| SSEL           | 2-wire           | SPI              | Selects serial control interface                                                                 |
| MZ ADR         | Address bit a= 1 | Address bit a= 0 | Setting nRF24Z1 2-wire slave address. See nRF24Z1 product specification [2] for further details. |

Table 3: nRF24Z1-EVBOARD, S3 functionality

### 5.6.2. SPI (JP4, JP5)

The SPI master and slave ports of nRF24Z1 are routed to JP4 and JP5.





In audio transmitter mode the SPI master is intended for connection of external memory (FLASH or EEPROM) holding configuration register data. This memory is connected through the MUX on the **nRF24Z1-EVBOARD**.

In audio receiver mode the SPI master port is controlled via the RF control channel offered between two **nRF24Z1** linked to each other. Please refer to the **nRF24Z1** product specification [2] for further details. To interface multiple slave units, GPIO pins (connector JP8) must be used as additional chip selects.

| JP4 pin # | Signal name | Functionality                       |
|-----------|-------------|-------------------------------------|
| 1         | VDD         | Power supply                        |
| 2         | MSCK        | SPI master clock                    |
| 3         | MMOSI       | SPI master out slave in             |
| 4         | MCSN        | SPI master chip select (active low) |
| 5         | MMISO       | SPI Master in slave out             |
| 6         | GND         | Ground                              |

Table 4: **nRF24Z1-EVBOARD**, JP4 SPI master pin out

The SPI slave port (JP5), enable external control of the **nRF24Z1** from a micro controller in audio transmitter mode.

In **nRF24Z1** audio receiver mode the SPI slave pins are used as GPIO (connector JP8), JP5 is hence not mounted on the **nRF24Z1** audio receiver mode board.

| JP5 pin # | Signal name | Functionality            |
|-----------|-------------|--------------------------|
| 1         | VDD         | Power supply             |
| 2         | SSCK        | SPI slave clock          |
| 3         | SMOSI       | master out slave in      |
| 4         | SCSN        | chip select (active low) |
| 5         | SMISO       | Master in slave out      |
| 6         | GND         | Ground                   |

Table 5: **nRF24Z1-EVBOARD**, JP5 SPI slave pin out

### 5.6.3. 2-wire (JP6, JP7)

The 2-wire master and slave ports of **nRF24Z1** are routed to JP6 and JP7. The 2 wire interfaces of **nRF24Z1** are compatible with I2C.

In audio transmitter mode the 2-wire master is intended for connection of external memory (FLASH or EEPROM) holding configuration register data. This memory is connected on the SPI on the EVBOARD.

In audio receiver mode the 2-wire master port is controlled via the RF control channel offered between two **nRF24Z1** linked to each other. Please refer to the **nRF24Z1** product specification [2] for further details. Multiple 2-wire slaves can hence be connected to JP6



| JP6 pin # | Signal name | Functionality             |
|-----------|-------------|---------------------------|
| 1         | MSCL        | 2-wire master clock       |
| 2         | VDD         | Power supply              |
| 3         | MSDA        | 2-wire master serial data |
| 4         | GND         | Ground                    |

Table 6: nRF24Z1-EVBOARD, JP6 2-wire master pin out

The 2-wire slave port (JP7), enable external control of the nRF24Z1 in audio transmitter (ATX) mode.

In nRF24Z1 audio receiver (ARX) mode these pins are used as GPIO (connector JP8), JP7 is hence not mounted on the nRF24Z1 ARX board.

| JP7 pin # | Signal name | Functionality            |
|-----------|-------------|--------------------------|
| 1         | SSCL        | 2-wire slave clock       |
| 2         | VDD         | Power supply             |
| 3         | SSDA        | 2-wire slave serial data |
| 4         | GND         | Ground                   |

Table 7: nRF24Z1-EVBOARD, JP7 2-wire slave pin out

#### 5.6.4. GPIO (JP8)

The nRF24Z1 offers a number of GPIO pins. The number and functionality of these pins differs between nRF24Z1 audio transmitter and audio receiver mode.

Audio transmitter:

2 inputs (3 if 2-wire serial interface is used) DD[0-2], the level on these inputs are re-created on DO[0-2] on a connected nRF24Z1 in ARX mode.

Audio receiver:

4 inputs DI[0-3] level on these inputs are mirrored in registers in a linked nRF24Z1 in ATX.

4 outputs DO[0-3]; DO[0-2] are reflecting the input level on DI[0-2] on a linked nRF24Z1 in audio transmitter mode. DO[3] can be controlled from a linked audio transmitter or set up as a PWM output.



Please refer to **nRF24Z1** product specification [2].

| JP8 pin # | Signal name       |                | Comment                                    |
|-----------|-------------------|----------------|--------------------------------------------|
|           | Audio transmitter | Audio receiver |                                            |
| 1         | VDD               | VDD            |                                            |
| 2         | TEST              | TEST           | Must be left open                          |
| 3         | DD0               | DI0            |                                            |
| 4         | DD1               | DI1            |                                            |
| 5         | DI2 (SMOSI)       | DI2            | SMOSI if SPI control interface is selected |
| 6         | SCSN/SADR         | DI3            |                                            |
| 7         | SSCK/SSCL         | DO0            |                                            |
| 8         | SMISO/SSDA        | DO1            |                                            |
| 9         | SSEL              | DO2            |                                            |
| 10        | IRQ               | DO3/PWM        |                                            |
| 11        | TEST              | TEST           | Must be left open                          |
| 12        | GND               | GND            |                                            |

Table 8: **nRF24Z1-EVBOARD**, JP8 GPIO pin out

As can be seen in *Table 8*, pin 5-10 in JP8 is GPIO in audio receiver mode but carries the serial slave interface when in audio transmitter. The serial slave interfaces are also available at connector JP5 and JP7.

### 5.6.5. PC interface (JP2)

JP2 enables **nRF24Z1-EVBOARD** control from PC software. JP2 only interacts with the MUX, and only the USB dongle supplied with the EVKIT must be plugged in here.

The pin out of JP2 is listed in table *Table 9*.

| Pin number | Pin name   | Comment                               |
|------------|------------|---------------------------------------|
| 1          | VDD        | <b>nRF24Z1-EVBOARD</b> supply voltage |
| 2          | VER        | <b>nRF24Z1-EVBOARD</b> rev. code      |
| 3          | DG_CSCNTRL |                                       |
| 4          | DG_CSN     |                                       |
| 5          | DG_SO      |                                       |
| 6          | DG_WPN     |                                       |
| 7          | DG_SI      |                                       |
| 8          | DG_SCK     |                                       |
| 9          | RESET      |                                       |
| 10         | GND        |                                       |

Table 9 **nRF24Z1-EVBOARD** J7 pin out

#### Note:

For the USB dongle / evboard to function properly, **nRF24Z1-EVBOARD** supply voltage must be turned on.



### 5.6.6. RF I/O (J1)

For convenient connection of the differential antenna output/input pins to a single ended antenna or  $50\Omega$  test equipment, a differential to single ended matching network is included. This network matches the  $50\Omega$  single end antenna or  $50\Omega$  test equipment impedance at the SMA connector J1 to the recommended differential load impedance at the nRF24Z1's RF I/O stage (pins ANT1 & ANT2). The employed matching network introduces an insertion loss of approximately 1dB at 2.4 GHz..

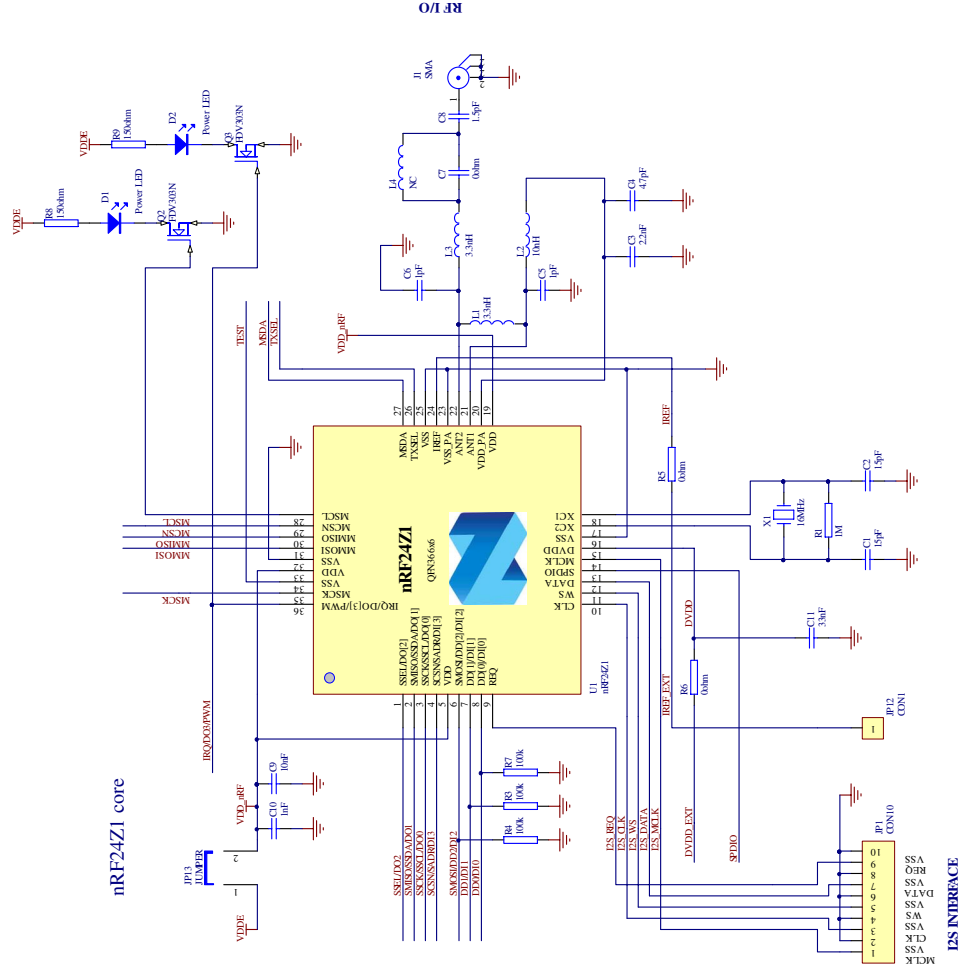
## 6. REFERENCES

- [1] Z1config user manual, Nordic Semiconductor
- [2] nRF24Z1-prelim-rev1\_2.doc, Nordic Semiconductor
- [3] Cirrus Logic: [http://www.cirrus.com/en/products/pro/areas/mixedsig\\_av.html](http://www.cirrus.com/en/products/pro/areas/mixedsig_av.html)
- [4] Philips Semiconductor:  
[http://www.semiconductors.philips.com/pip/UDA1334TS\\_N1.html](http://www.semiconductors.philips.com/pip/UDA1334TS_N1.html)

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## nRF24Z1 Evaluation board

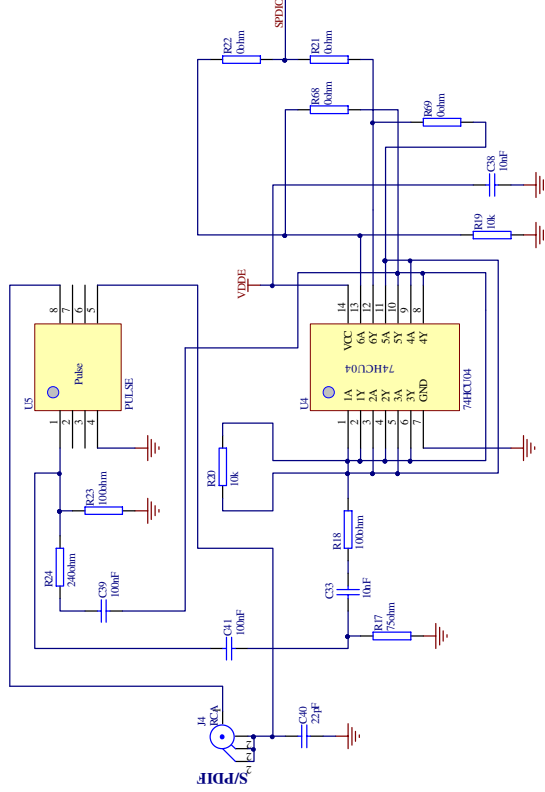
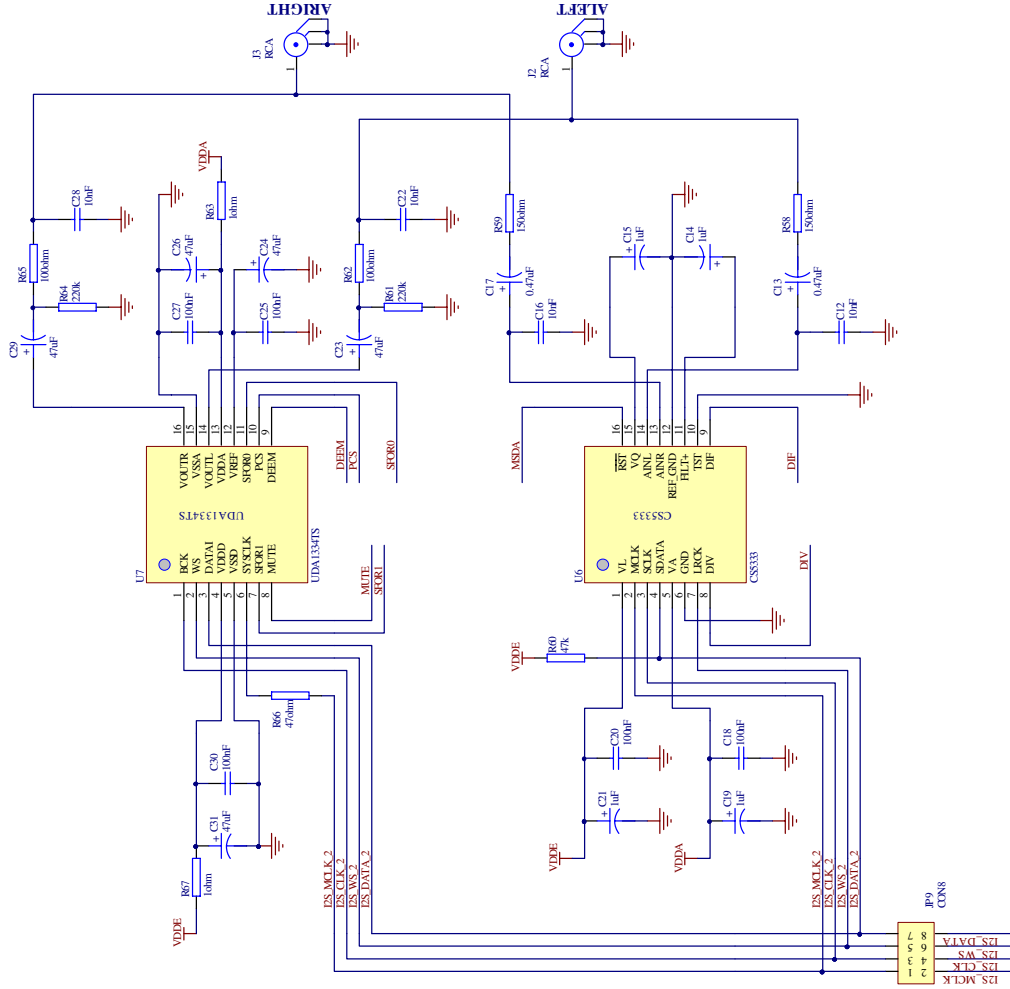
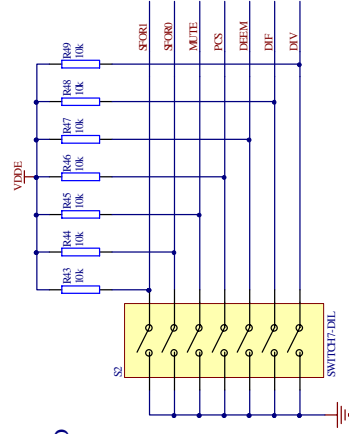
## APPENDIX 1: CIRCUIT DIAGRAM AND PCB LAYOUT



# USER MANUAL

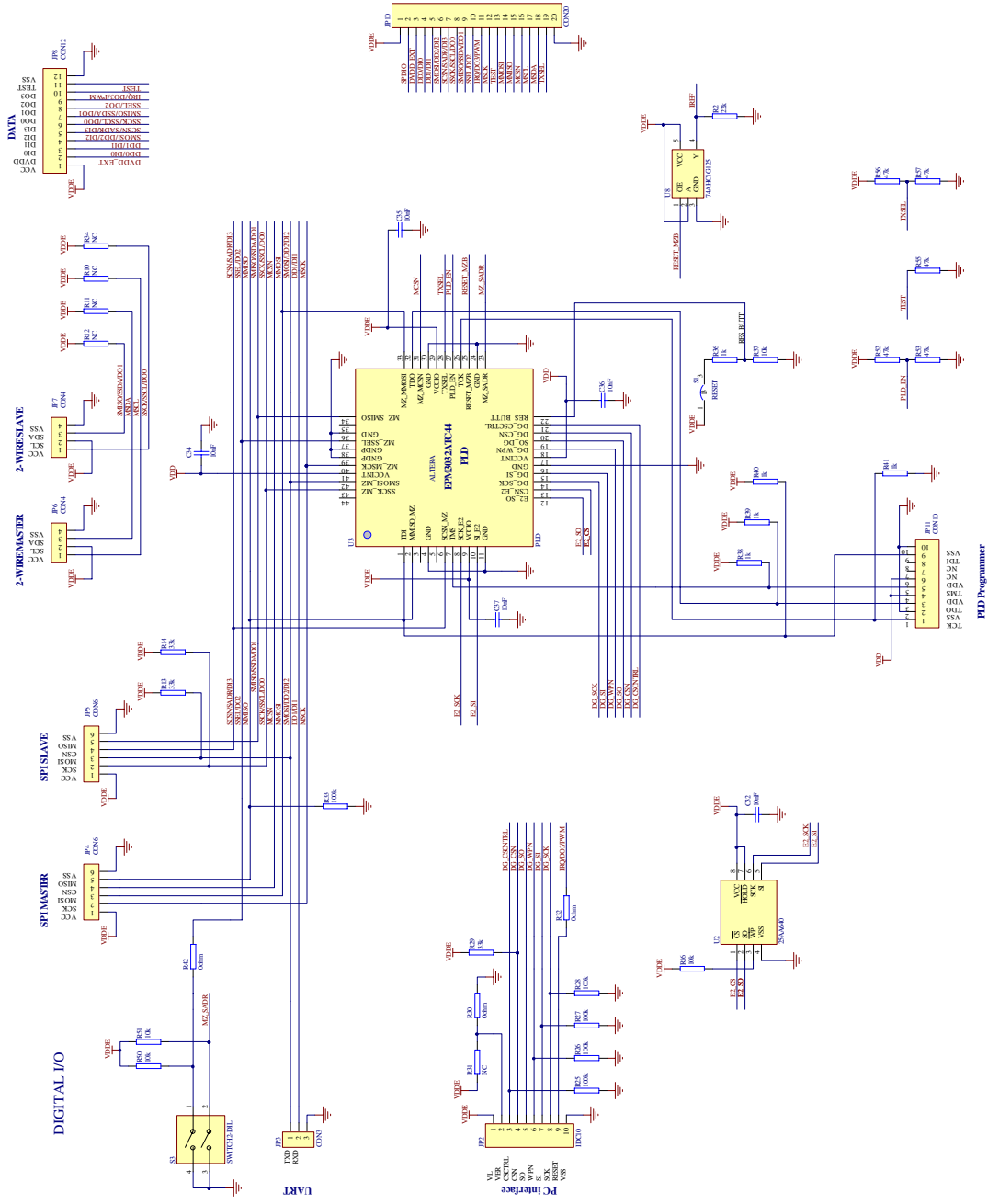
## nRF24Z1 Evaluation board

### AUDIO FRONT END



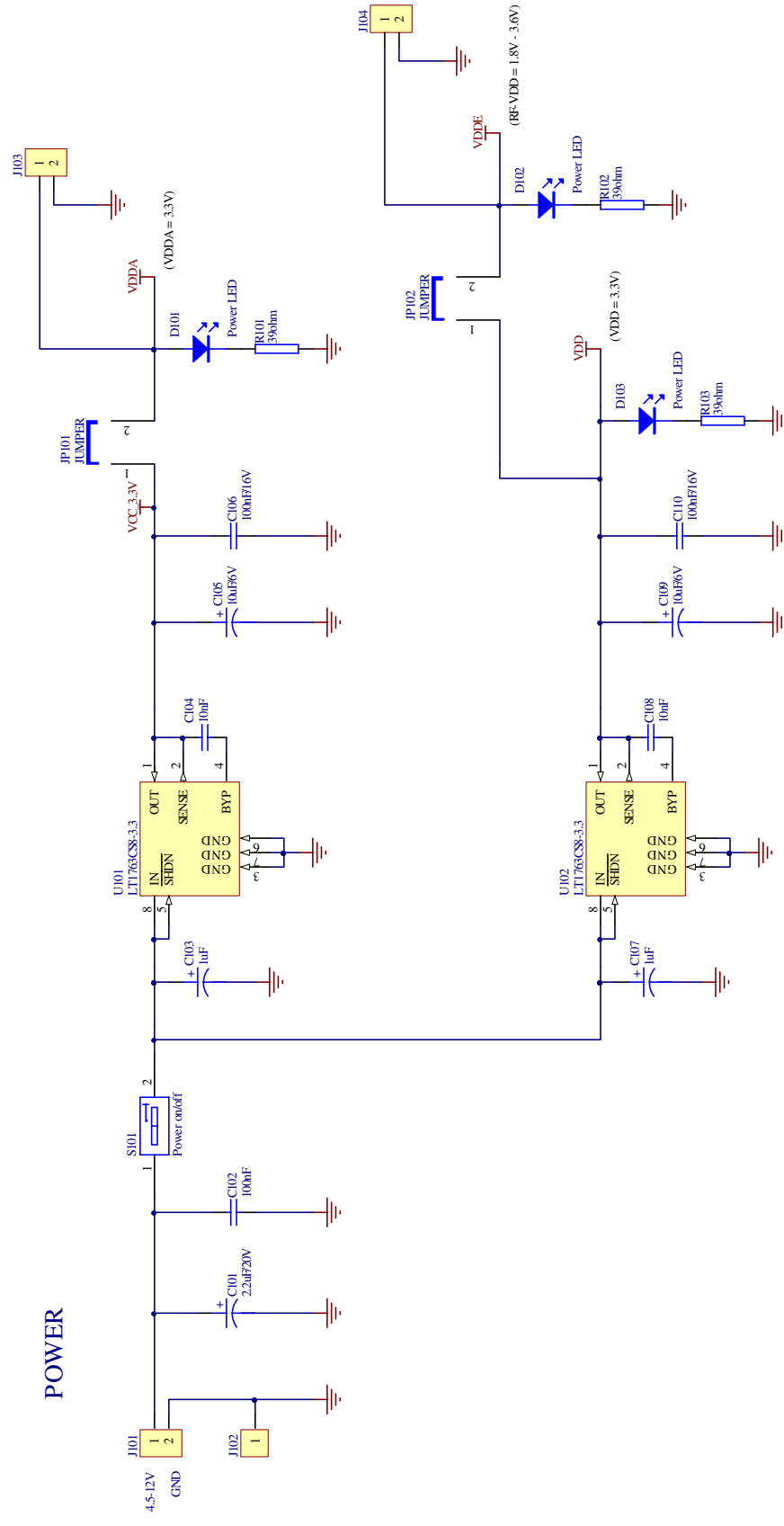


## nRF24Z1 Evaluation board

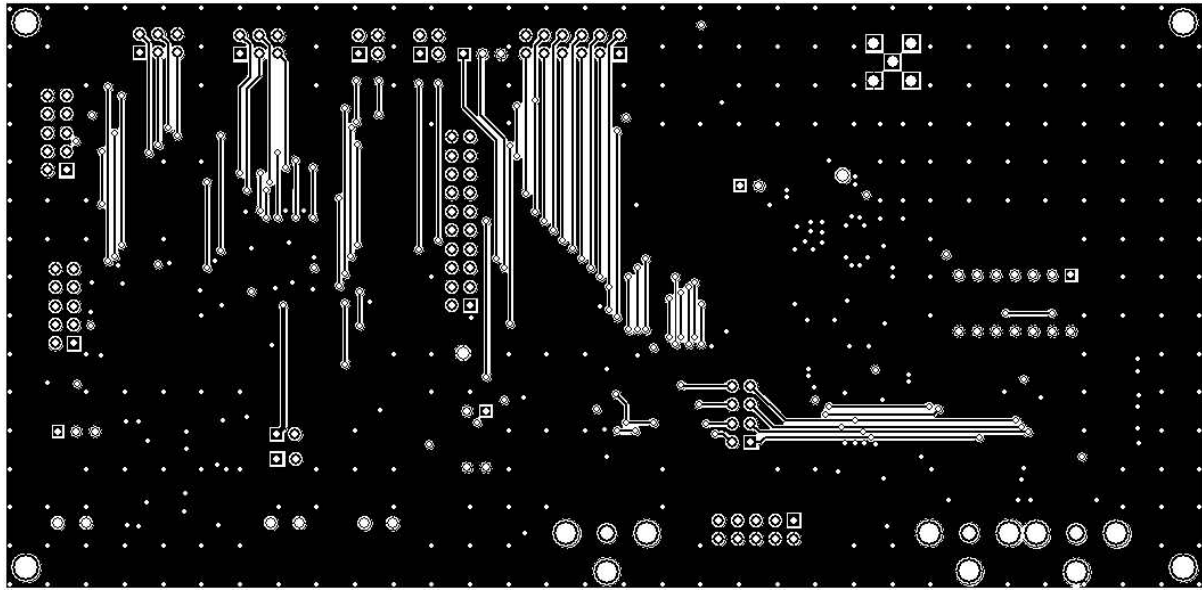




# POWER



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Bottom signal layer

Figure 4 nRF24Z1-EVBOARD Circuit diagram and PCB layout

There are no components in bottom layer. The board is 4 layers with a ground plane in inner-layer 1 and a split power plane (VDD and VDDA) in inner-layer 2.



## APPENDIX 2: COMPONENT LIST

| Designator | Description        | Part Type | Footprint | Comment                        |
|------------|--------------------|-----------|-----------|--------------------------------|
| C1         | Capacitor Ceramic  | 15pF      | 0603      |                                |
| C2         | Capacitor Ceramic  | 15pF      | 0603      |                                |
| C3         | Capacitor Ceramic  | 2.2nF     | 0603      |                                |
| C4         | Capacitor Ceramic  | 4.7pF     | 0603      |                                |
| C5         | Capacitor Ceramic  | 1.0pF     | 0603      |                                |
| C6         | Capacitor Ceramic  | 1.0pF     | 0603      |                                |
| C7         | Capacitor Ceramic  | 2.2pF     | 0603      | replaced by a 0 ohm resistor   |
| C8         | Capacitor Ceramic  | 1.5pF     | 0603      |                                |
| C9         | Capacitor Ceramic  | 10nF      | 0603      |                                |
| C10        | Capacitor Ceramic  | 1nF       | 0603      |                                |
| C11        | Capacitor Ceramic  | 33nF      | 0603      |                                |
| C12        | Capacitor Ceramic  | 10nF      | 0603      | only for TX, not mounted on RX |
| C13        | Capacitor Tantalum | 0.47uF    | 3216      | only for TX, not mounted on RX |
| C14        | Capacitor Tantalum | 1uF       | 3216      | only for TX, not mounted on RX |
| C15        | Capacitor Tantalum | 1uF       | 3216      | only for TX, not mounted on RX |
| C16        | Capacitor Ceramic  | 10nF      | 0603      | only for TX, not mounted on RX |
| C17        | Capacitor Tantalum | 0.47uF    | 3216      | only for TX, not mounted on RX |
| C18        | Capacitor Ceramic  | 100nF     | 0603      | only for TX, not mounted on RX |
| C19        | Capacitor Tantalum | 1uF       | 3216      | only for TX, not mounted on RX |
| C20        | Capacitor Ceramic  | 100nF     | 0603      | only for TX, not mounted on RX |
| C21        | Capacitor Tantalum | 1uF       | 3216      | only for TX, not mounted on RX |
| C22        | Capacitor Ceramic  | 10nF      | 0603      | only for RX, not mounted on TX |
| C23        | Capacitor Tantalum | 47uF      | 7343      | only for RX, not mounted on TX |
| C24        | Capacitor Tantalum | 47uF      | 7343      | only for RX, not mounted on TX |
| C25        | Capacitor Ceramic  | 100nF     | 0603      | only for RX, not mounted on TX |
| C26        | Capacitor Tantalum | 47uF      | 7343      | only for RX, not mounted on TX |
| C27        | Capacitor Ceramic  | 100nF     | 0603      | only for RX, not mounted on TX |
| C28        | Capacitor Ceramic  | 10nF      | 0603      | only for RX, not mounted on TX |



|      |                    |               |              |                                |
|------|--------------------|---------------|--------------|--------------------------------|
| C29  | Capacitor Tantalum | 47uF          | 7343         | only for RX, not mounted on TX |
| C30  | Capacitor Ceramic  | 100nF         | 0603         | only for RX, not mounted on TX |
| C31  | Capacitor Tantalum | 47uF          | 7343         | only for RX, not mounted on TX |
| C32  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C33  | Capacitor Ceramic  | 10nF          | 0603         | only for TX, not mounted on RX |
| C34  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C35  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C36  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C37  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C38  | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C39  | Capacitor Ceramic  | 100nF         | 0603         | only for RX, not mounted on TX |
| C40  | Capacitor Ceramic  | 22pF          | 0603         |                                |
| C41  | Capacitor Ceramic  | 100nF         | 0603         | only for TX, not mounted on RX |
| C101 | Capacitor Tantalum | 2.2uF         | 3216         |                                |
| C102 | Capacitor Ceramic  | 100nF         | 0603         |                                |
| C103 | Capacitor Tantalum | 1uF           | 3216         |                                |
| C104 | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C105 | Capacitor Tantalum | 10uF          | 3216         |                                |
| C106 | Capacitor Ceramic  | 100nF         | 0603         |                                |
| C107 | Capacitor Tantalum | 1uF           | 3216         |                                |
| C108 | Capacitor Ceramic  | 10nF          | 0603         |                                |
| C109 | Capacitor Tantalum | 10uF          | 3216         |                                |
| C110 | Capacitor Ceramic  | 100nF         | 0603         |                                |
| D1   | LED, yellow        | If,max = 30mA | LED_1206     |                                |
| D2   | LED, yellow        | If,max = 30mA | LED_1206     |                                |
| D101 | LED, green         | If,max = 30mA | LED_1206     |                                |
| D102 | LED, green         | If,max = 30mA | LED_1206     |                                |
| D103 | LED, green         | If,max = 30mA | LED_1206     |                                |
| J1   | RF I/O             | SMA connector | through-hole |                                |



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|       |                                     |                                 |              |                                |
|-------|-------------------------------------|---------------------------------|--------------|--------------------------------|
| J2    | Left Channel Analog Connector       | RCA connector                   | through-hole |                                |
| J3    | Right Channel Analog Connector      | RCA connector                   | through-hole |                                |
| J4    | S/PDIF Connector                    | RCA connector                   | through-hole |                                |
| JP1   | I2S Interface Connector             | Flat Cable Connector, 10 pin    | through-hole |                                |
| JP2   | Programming Interface Connector     | Flat Cable Connector, 10 pin    | through-hole |                                |
| JP3   | RS232 Interface Connector           | Pin-header, 2.54 pitch, 3x1 pin | through-hole |                                |
| JP4   | SPI Interface Master Connector      | Pin-header, 2.54 pitch, 2x3 pin | through-hole |                                |
| JP5   | SPI Interface Slave Connector       | Pin-header, 2.54 pitch, 2x3 pin | through-hole | only for TX, not mounted on RX |
| JP6   | 2-Wire Interface Master Connector   | Pin-header, 2.54 pitch, 2x2 pin | through-hole |                                |
| JP7   | 2-Wire Interface Slave Connector    | Pin-header, 2.54 pitch, 2x2 pin | through-hole | only for TX, not mounted on RX |
| JP8   | Measurement Connector               | Pin-header, 2.54 pitch, 2x6 pin | through-hole |                                |
| JP9   | Audio Codec I2S Connector           | Pin-header, 2.54 pitch, 2x4 pin | through-hole |                                |
| JP10  | Measurement Connector               | Pin-header, 2.54 pitch, 2x5 pin | through-hole |                                |
| JP11  | PLD Programming Interface Connector | Pin-header, 2.54 pitch, 2x5 pin | through-hole |                                |
| JP12  | Testpoint                           | Soldering tag                   | through-hole |                                |
| JP13  | VDD_nRF                             | Pin-header, 2.54 pitch, 2x1 pin | through-hole |                                |
| J101  | Power Connector                     | 2 pin                           | through-hole |                                |
| J102  | Testpoint                           | Soldering tag                   | through-hole |                                |
| J103  | Power Connector                     | 2 pin                           | through-hole |                                |
| J104  | Power Connector                     | 2 pin                           | through-hole |                                |
| JP101 | VDDA                                | Pin-header, 2.54 pitch, 2x1 pin | through-hole |                                |
| JP102 | VDDE                                | Pin-header, 2.54 pitch, 2x1 pin | through-hole |                                |
| L1    | Chip Inductor                       | 3.3nH, TOKO, LL1608-FS3N3S      | 0603         |                                |
| L2    | Chip Inductor                       | 10nH, TOKO, LL1608-FS10NJ       | 0603         |                                |
| L3    | Chip Inductor                       | 3.3nH, TOKO, LL1608-FS3N3S      | 0603         |                                |
| L4    | Chip Inductor                       |                                 | 0603         | NC                             |
| Q2    | DMOS N-channel                      | FDV303N                         | SOT-23D      |                                |
| Q3    | DMOS N-channel                      | FDV303N                         | SOT-23D      |                                |



|     |          |         |      |                                |  |
|-----|----------|---------|------|--------------------------------|--|
| R1  | Resistor | 1M      | 0603 |                                |  |
| R2  | Resistor | 22k     | 0603 |                                |  |
| R3  | Resistor | 1k      | 0603 |                                |  |
| R4  | Resistor | NC      | 0603 | NC                             |  |
| R5  | Resistor | NC      | 0603 | NC                             |  |
| R6  | Resistor | NC      | 0603 | NC                             |  |
| R7  | Resistor | 100k    | 0603 |                                |  |
| R8  | Resistor | 150ohm  | 0603 |                                |  |
| R9  | Resistor | 150ohm  | 0603 |                                |  |
| R10 | Resistor | NC      | 0603 | NC                             |  |
| R11 | Resistor | NC      | 0603 | NC                             |  |
| R12 | Resistor | NC      | 0603 | NC                             |  |
| R13 | Resistor | 33k     | 0603 | only for TX, not mounted on RX |  |
| R14 | Resistor | 33k     | 0603 | only for TX, not mounted on RX |  |
| R16 | Resistor | 10k     | 0603 |                                |  |
| R17 | Resistor | 75ohm   | 0603 | only for TX, not mounted on RX |  |
| R18 | Resistor | 100 ohm | 0603 | only for TX, not mounted on RX |  |
| R19 | Resistor | 10k     | 0603 | only for TX, not mounted on RX |  |
| R20 | Resistor | 10k     | 0603 | only for TX, not mounted on RX |  |
| R21 | Resistor | 0ohm    | 0603 | only for TX, not mounted on RX |  |
| R22 | Resistor | 0ohm    | 0603 | only for RX, not mounted on TX |  |
| R23 | Resistor | 100ohm  | 0603 | only for RX, not mounted on TX |  |
| R24 | Resistor | 240ohm  | 0603 | only for RX, not mounted on TX |  |
| R25 | Resistor | 100k    | 0603 |                                |  |
| R26 | Resistor | 100k    | 0603 |                                |  |
| R27 | Resistor | 100k    | 0603 |                                |  |
| R28 | Resistor | 100k    | 0603 |                                |  |
| R29 | Resistor | 33k     | 0603 |                                |  |
| R30 | Resistor | 0ohm    | 0603 |                                |  |
| R31 | Resistor | NC      | 0603 | NC                             |  |



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|     |          |        |      |                                |  |
|-----|----------|--------|------|--------------------------------|--|
| R32 | Resistor | NC     | 0603 | NC                             |  |
| R33 | Resistor | 100k   | 0603 |                                |  |
| R34 | Resistor | NC     | 0603 | NC                             |  |
| R36 | Resistor | 1k     | 0603 |                                |  |
| R37 | Resistor | 10k    | 0603 |                                |  |
| R38 | Resistor | 1k     | 0603 |                                |  |
| R39 | Resistor | 1k     | 0603 |                                |  |
| R40 | Resistor | 1k     | 0603 |                                |  |
| R41 | Resistor | 1k     | 0603 |                                |  |
| R42 | Resistor | 0ohm   | 0603 | only for TX, not mounted on RX |  |
| R43 | Resistor | 10k    | 0603 |                                |  |
| R44 | Resistor | 10k    | 0603 |                                |  |
| R45 | Resistor | 10k    | 0603 |                                |  |
| R46 | Resistor | 10k    | 0603 |                                |  |
| R47 | Resistor | 10k    | 0603 |                                |  |
| R48 | Resistor | 10k    | 0603 |                                |  |
| R49 | Resistor | 10k    | 0603 |                                |  |
| R50 | Resistor | 10k    | 0603 | only for TX, not mounted on RX |  |
| R51 | Resistor | 10k    | 0603 | only for TX, not mounted on RX |  |
| R52 | Resistor | 47k    | 0603 |                                |  |
| R53 | Resistor | NC     | 0603 | NC                             |  |
| R55 | Resistor | 47k    | 0603 |                                |  |
| R56 | Resistor | 47k    | 0603 | only for TX, not mounted on RX |  |
| R57 | Resistor | 47k    | 0603 | only for RX, not mounted on TX |  |
| R58 | Resistor | 150ohm | 0603 | only for TX, not mounted on RX |  |
| R59 | Resistor | 150ohm | 0603 | only for TX, not mounted on RX |  |
| R60 | Resistor | 47k    | 0603 | only for TX, not mounted on RX |  |
| R61 | Resistor | 220k   | 0603 | only for RX, not mounted on TX |  |
| R62 | Resistor | 100ohm | 0603 | only for RX, not mounted on TX |  |
| R63 | Resistor | 1ohm   | 0603 | only for RX, not mounted on TX |  |
| R64 | Resistor | 220k   | 0603 | only for RX, not mounted on TX |  |





|      |                                         |                            |              |                                |
|------|-----------------------------------------|----------------------------|--------------|--------------------------------|
| R65  | Resistor                                | 100ohm                     | 0603         | only for RX, not mounted on TX |
| R66  | Resistor                                | 47ohm                      | 0603         | only for RX, not mounted on TX |
| R67  | Resistor                                | 1ohm                       | 0603         | only for RX, not mounted on TX |
| R68  | Resistor                                | 0ohm                       | 0603         | only for TX, not mounted on RX |
| R69  | Resistor                                | 0ohm                       | 0603         | only for RX, not mounted on TX |
| R101 | Resistor                                | 39ohm                      | 0603         |                                |
| R102 | Resistor                                | 39ohm                      | 0603         |                                |
| R103 | Resistor                                | 39ohm                      | 0603         |                                |
| S1   | RESET, Push button                      | Alps, SKHUAD               |              |                                |
| S2   | DIL switch                              | NDIR-07ST                  | through-hole |                                |
| S3   | DIL switch                              | NDIR-02ST                  | through-hole | only for TX, not mounted on RX |
| S101 | Power, Slide switch                     | Eao, 1K2                   | through-hole |                                |
| U1   |                                         | nRF24Z1                    | QFN 36L      |                                |
| U2   | EEPROM                                  | Microchip, 25AA640         | SO-8         |                                |
| U3   | Programmable Logic Device               | Altera, EPM3032ATC44-47/10 | 44-pin TQFP  |                                |
| U4   | Hex Inverter                            | 74HCU04                    | SO14         |                                |
| U5   | 1:1 Pulse Transformer                   | PE-65812                   |              |                                |
| U6   | Cirrus Logic, Stereo A/D Converter      | CS5333                     | 16L TSSOP    | only for TX, not mounted on RX |
| U7   | Philips, Stereo D/A Converter           | UDA1334TS                  | SSOP16       | only for RX, not mounted on TX |
| U8   | Philips, 3-state bus buffer/line driver | 74HAC1G125                 | SOT353-5     |                                |
| U101 | Linear Voltage Regulator                | LT1763CS8-3.3              | SO-8         |                                |
| U102 | Linear Voltage Regulator                | LT1763CS8-3.3              | SO-8         |                                |
| X1   | Crystal                                 | 16MHz                      | OFM          |                                |

Table 10: nRF24Z1-EVBOARD component list

The **nRF24Z1-EVBOARD** is manufactured on a 1.6mm thick, 4 layer, FR4 substrate.



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User manual, Revision: 1.3, Date: 2005-05-02.

User manual Note order code: nRF24Z1-EVB 20050502

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