Hardware Description Flamingo™ RF Design Kit

1. Introduction

The Flamingo™ RF Design Kit helps customers to conveniently evaluate the functionality of Atmel's UHF FSK/ASK remote control transmitters and receivers combined with AVR® Flash microcontrollers.

The RF Design Kit consists of the Flamingo interface board ATAB-STK®-F, an RF receiver (receiver design board), an RF transmitter (transmitter design board), and various other components as listed in "Kit Contents" on page 2. The Flamingo interface board has to be mounted on the AVR Starter Kit STK500 (has to be ordered separately), and forms the hardware connection between Atmel's remote control boards, ATABxx, and AVR Flash microcontrollers.

To build up an RF communication link, the configuration of the RF receiver and transmitter is programmable via the PC with the RF Design Kit software.

The Flamingo gives designers a quick start to developing RF-based solutions, allowing them to focus on developing software code rather than worrying about RF-related issues such as RF board layout and RF fine tuning. Combined with features for rapid prototyping and testing, which come along with the STK500, the design cycle for new designs can be dramatically reduced.

This document helps to quickly cope with mounting and configuring the hardware to use the Flamingo with the remote control boards ATABxx.

2. Features

- **Modular Starter Kit and Development System for Various Transmitter and Receiver Boards**
- **Easy Plug-and-Play via Expansion Slot to AVR Starter Kit STK500**
- **Demonstration Capabilities and Stand-alone Operation**
- **Liquid Crystal Display (LCD)**
- **Joystick**

3. Supported RF Chipsets

Transmitter:	T5750, T5753, T5754, ATA5756, ATA5757, ATAM862-3, ATAM862-4, ATAM862-8
Receiver:	T5743, ATA5743, T5760, T5761

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Application Note

Rev. 4886B–RKE–01/06

4. Kit Contents

The Flamingo RF Design Kit is built up in a modular manner, i.e. with one Flamingo interface board in conjunction with the AVR Starter Kit STK500, can operate almost the whole transmitter and receiver family.

Please bear in mind that the Flamingo interface board, the STK500, the desired transmitter board and receiver board have to be ordered separately. Hence, a complete kit set, as illustrated in Figure 4-1 on page 3, may look slightly different for the various versions.

The various kit versions and the corresponding board order numbers can be found in the selection guide at http://www.atmel.com/products/Auto/.

4.1 Flamingo Interface Board ATAB-STK-F

- Flamingo interface board ATAB-STK-F
- AVR microcontroller for STK500
- 8-MHz crystal for STK500
- Atmel CD-ROM with software and documentation
- Atmel CD-ROM *Products*

4.2 Transmitter Board

- Transmitter design board including lithium battery

4.3 Receiver Board

- Receiver design board including whip antenna

Figure 4-1. Kit Contents

5. Configuration of STK500

To work with the RF Design Kit, the included and fully programmed AVR microcontroller has to be plugged into the DIL socket *SCKT3100A3*, and the 8-MHz quartz crystal into the socket *CRYSTAL*. Additionally, the connections need to be made as listed in Table 5-1.

Figure 5-1. Connections on STK500

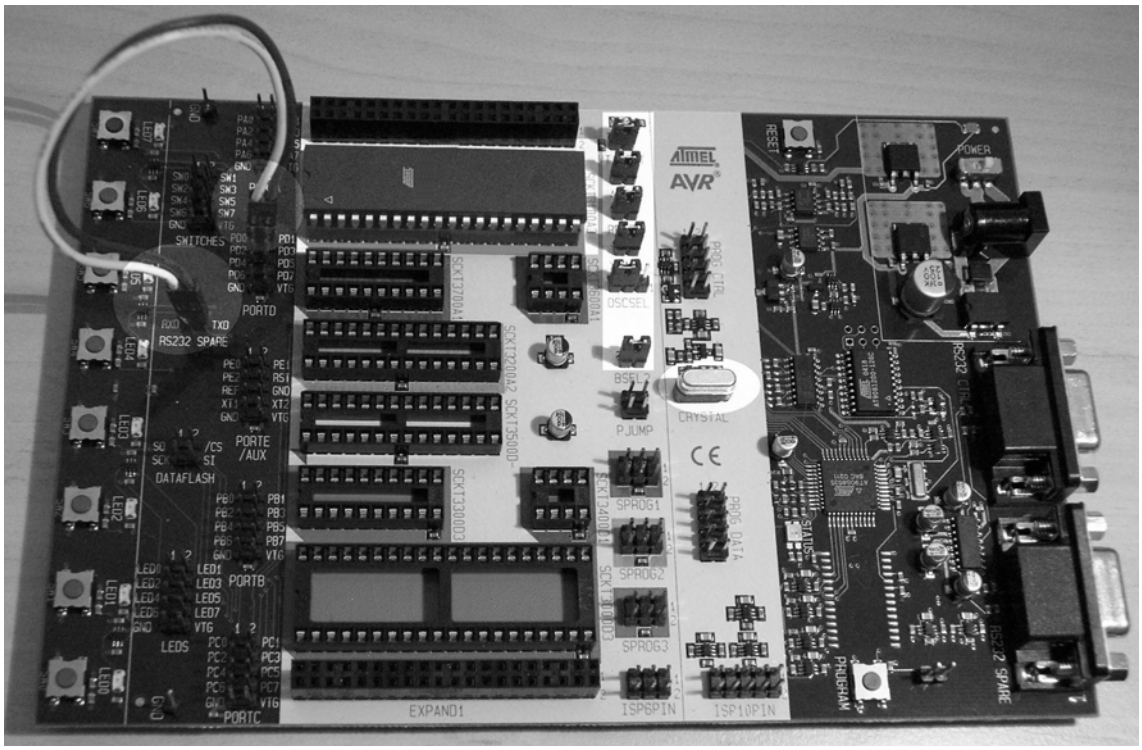


Table 5-1. Required Connections

Label	Connection
VTARGET	Closed
AREF	Closed
RESET	Closed
XTAL1	Closed
OSCSEL	2 — 3
BSEL2	Closed
RS232 SPARE to PORTD	RXD-PD0 TXD-PD1
PORTD to J8 of Flamingo™ interface	PD6 — pin 2 (J8)

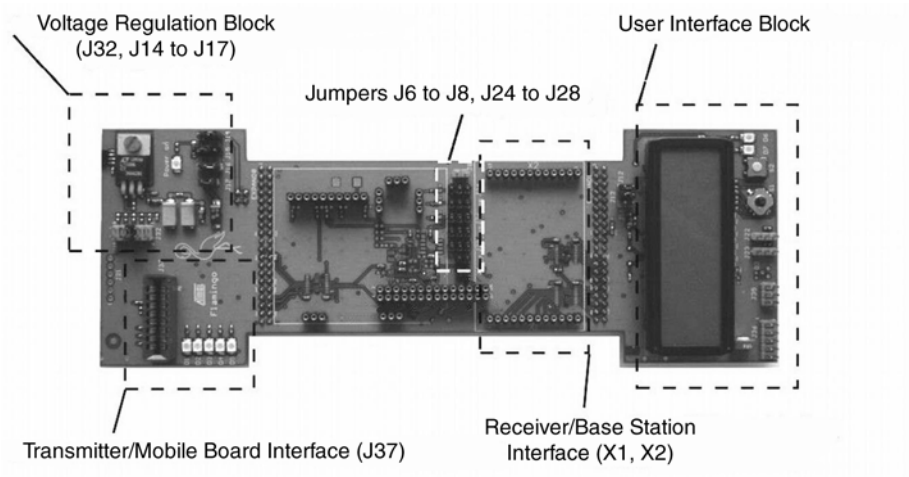
The programmable supply voltage on the STK500 must be set to 5.0V. For more information regarding setting the voltage, please refer to the *STK500 User Guide*.

6. Flamingo™ Interface

6.1 Overview

To make the Flamingo™ compatible with a wide range of Atmel's RF products, different connectors and interfaces have been mounted on the board. Through these interfaces each RF module is connected to the underlying microcontroller unit on the STK500.

Figure 6-1. Connectors and Interfaces



6.2 Application Board Interfaces (X1, X2, J37)

When using devices of the ATAB5xxx/ATAB862xx series, there are usually two modules involved: a receiver and a transmitter. The receiver is plugged into sockets X1 and X2 mounted on the Flamingo. An enlarged picture is shown in the right half of Figure 6-2 on page 6.

The transmitter is configured by the STK500 microcontroller. Therefore, it must be plugged into the socket J37, mounted in the area enlarged in the left part of Figure 6-2 on page 6. For protection against short circuits, socket J37 is fitted with a polarizing key between pin 3 and pin 4.

The RF Design Kit software is used to configure the transmitter and receiver.

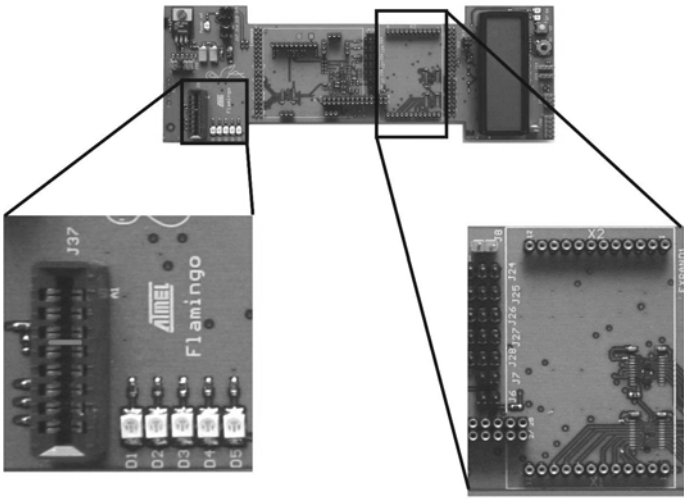
The LEDs mounted next to J37 are used to indicate different states. Table 6-1 describes the function of each LED.

Table 6-1. Function of the LEDs

Label	Color	Function
D1	Blue	Constant → AVR is ready to receive data from the connected receiver Flashing → data is being received
D2	Orange	Testword incorrect (microcontroller limits ok)
D3	Yellow	Timing of received testword out of selected microcontroller limit borders
D4	Green	Testword ok and microcontroller limits ok
D5	Red	Communication over RS-232 active

Note: Note: Jumper J8 (mounted next to port X2) has to be connected when the AVR microcontroller plugged into the STK500 is capable of recognizing interrupts on its pin PE0 (PE0 = ICP) (for example, the ATmega8515). It has to be disconnected when using, for example, the ATmega8535.

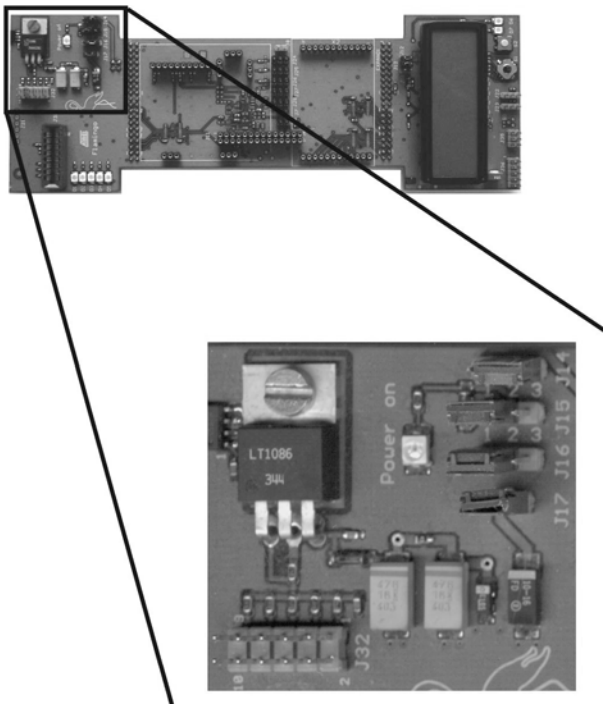
Figure 6-2. Application Board Interface



6.3 Voltage Regulation Block

There are two voltage regulators in the voltage regulation block for future use and for RF modules with supply voltages other than 5V. For the RF Design Kit, both voltage regulators are not used. Hence, pin 1 and pin 2 of J15 and J16 have to be connected. To use the supply voltage provided by the STK500, a connection between pin 2 and pin 3 is necessary. J17 offers the possibility to loop in a current meter to measure the RF module's input current. During normal operation, J17 should be connected; otherwise, the RF module should be disconnected from the power supply. The complete configuration of the jumpers is depicted in Figure 6-3.

Figure 6-3. Voltage Regulation Block



6.4 User Interface Block

In this area of the Flamingo, the user interface devices are mounted. To control the LCD and the joystick, an ATmega16 is used. The joystick provides a flexible way of dealing with user input and making use of menu functions, for convincing demonstration strategies. The menu depicted in the flowchart in Figure 6-5 on page 8 is accessible via the joystick.

The small potentiometer next to J36 is used to adjust the contrast level of the 20 x 4 LCD (4 lines with 20 characters).

The pushbutton and the LEDs are not used and are intended for future applications.

Figure 6-4. User Interface Devices

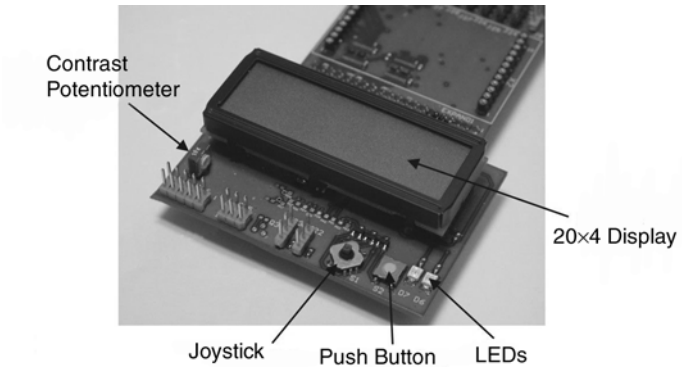
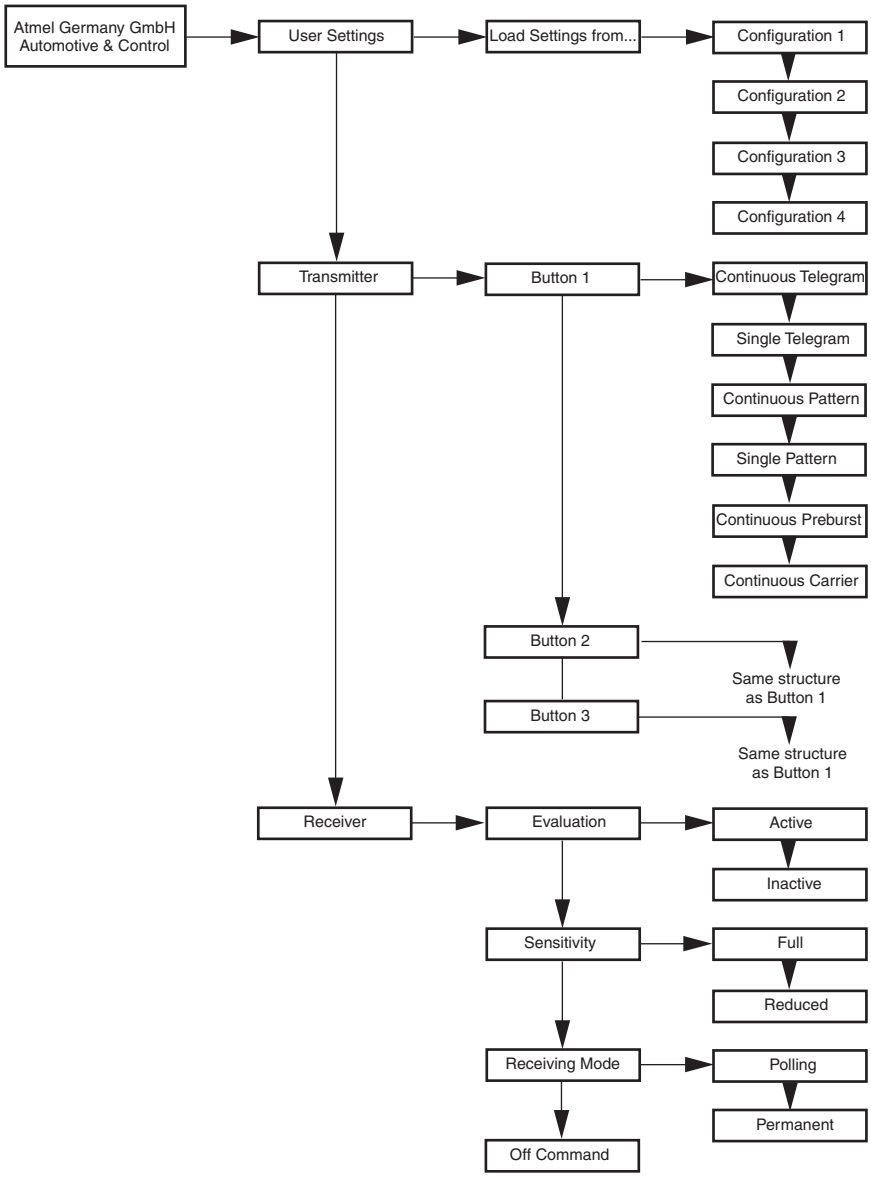


Figure 6-5. Menu Structure



7. Operation of the RF Design Kit

7.1 Assembly of the Kit's Components

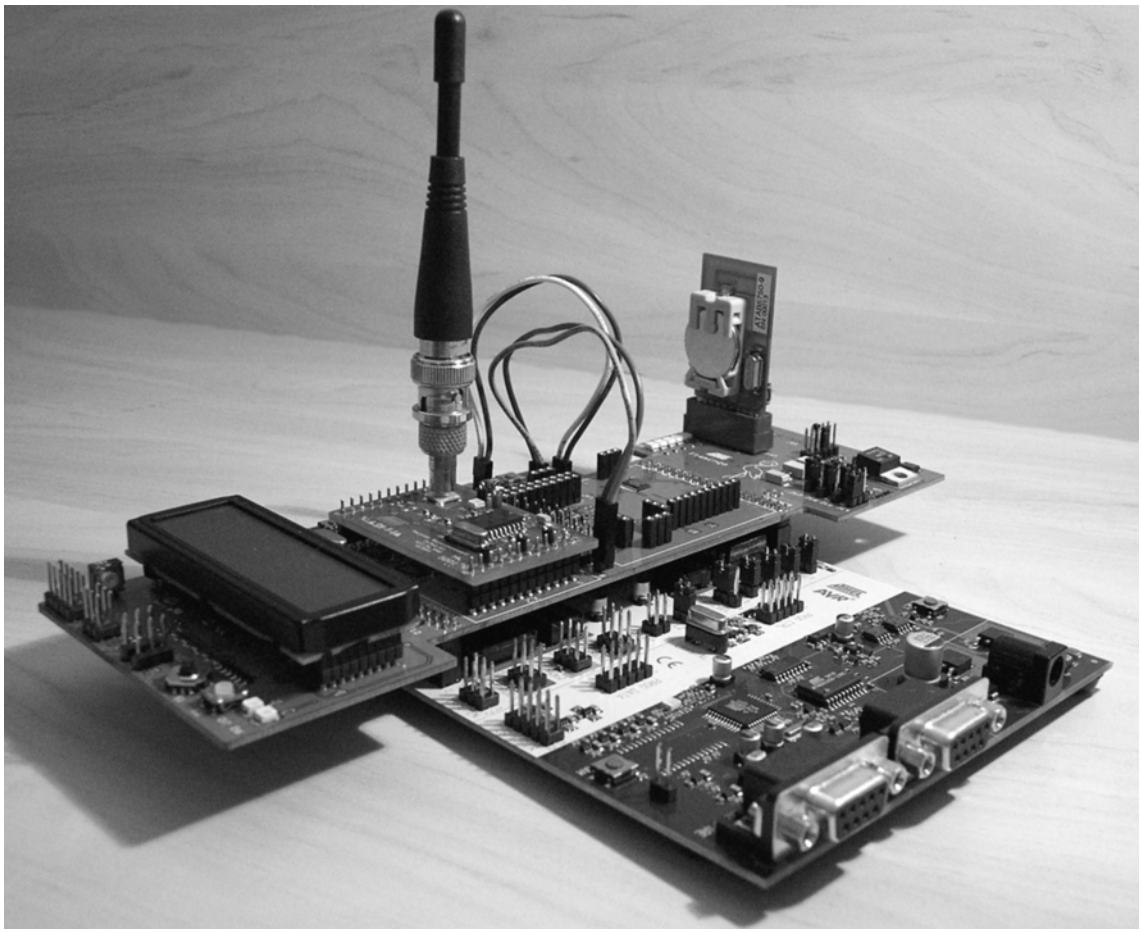
To configure the RF transmitter or receiver, the appropriate design board must be connected to the Flamingo™ interface board that is plugged into the AVR Starter Kit STK500. To prevent damage, the design boards must be plugged in as shown in Figure 7-1 on page 9. The STK500 has to be connected to a PC via a serial port (RS-232). The configuration will be set by the RF Design Kit software.

During configuration, the AVR microcontroller on the STK500 handles the data communication with the PC, the receiver design board, and the transmitter design board.

Once configured, the transmitter design board operates stand-alone and can be removed.

The installation of the RF Design Kit software is explained in the document *Software Description.*

Figure 7-1. Assembly of the Components



7.2 Starting the RF Design Kit

7.2.1 Connecting the RF Design Kit

To ensure proper operation, the following steps should be carried out before starting the RF Design Kit software:

1. Insert the lithium cell into the battery holder of the Transmitter Design Board.
2. Check that the RF Design Kit is assembled as shown in Figure 7-1.
3. Connect the 9-pin RS-232 cable from the STK500 *RS232 SPARE* to an unused serial port.
4. Connect the DC power cable to a 12V DC power supply unit on STK500.
5. Switch on the 12V DC power supply on the STK500.
6. Switch on the PC and start the operating system.
7. Start the RF Design Kit software with the command *RF-Designkit.exe*

7.2.2 Configuration of the Transmitter Design Board

1. Remove the PCB jack from the Transmitter Design Board.
2. Plug the Transmitter Design Board into socket J37 of the Transmitter/Mobile Board Interface.
3. Write the desired settings via the RF Design Kit software.
4. Remove the Transmitter Design Board from socket J37.
5. Plug in the PCB jack to supply the transmitter IC from battery.
6. The Transmitter Design Board can now be operated stand-alone.

7.2.3 Configuration of the Receiver Design Board

The Receiver Design Board operates only in conjunction with the STK500, therefore, proceed as follows:

1. Switch off the power supply on the STK500.
2. Plug the Receiver Design Board into the contact strips (Figure 7-1 on page 9).
3. Connect the whip antenna to the Receiver Design Board
4. Switch on the power supply of the STK500.
5. Write the desired settings via the RF Design Kit software.

7.3 Principal Function

After power on, the AVR microcontroller on the STK500 configures the RF receiver. This puts the receiver in polling mode, and verifies the presence of a valid transmitter signal. The parameters for the bit check (BR_Range, $N_{bitcheck}$, T_{sleep}, Lim_min, Lim_max) are programmable with the RF Design Kit software. If a valid transmitter signal is detected, the receiver remains active and transfers the data stream to the connected AVR microcontroller on the STK500.

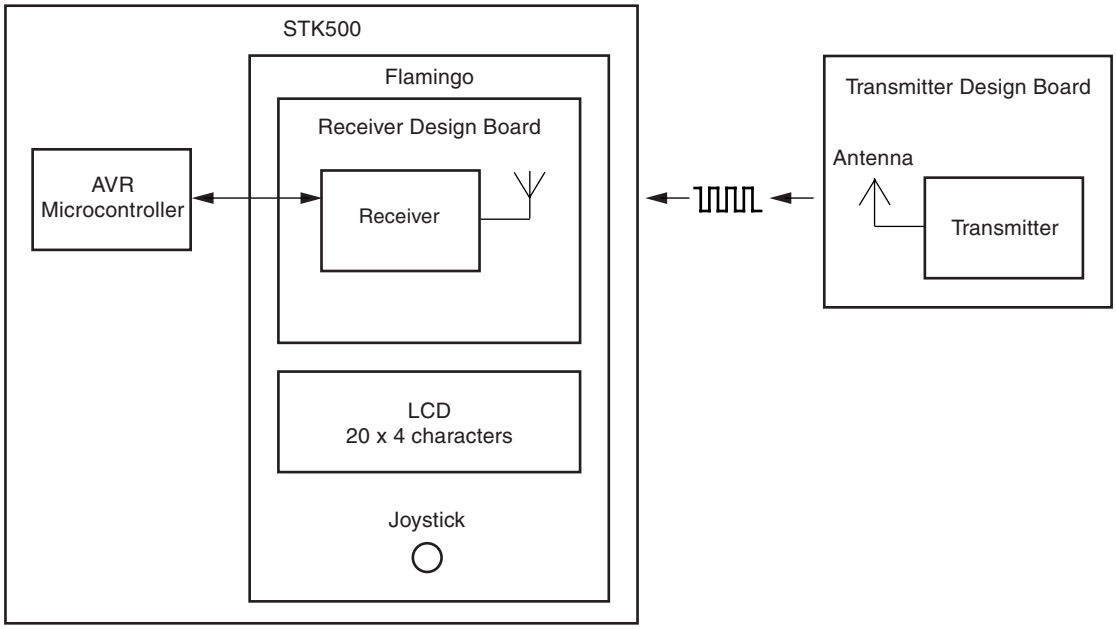
The AVR microcontroller continuously measures the distance between two signal edges (1 sample). If the distance $t \geq 1$ / Baudrate, the following 64 samples will be stored in the RAM of the microcontroller (start of measurement / end of measurement, Figure 7-2 on page 11). Then the RF receiver will be set back to polling mode by the microcontroller pulling pin DATA to 0 for a time t1. The timing limits of 1 / Baudrate are programmable in the RF Design Kit software.

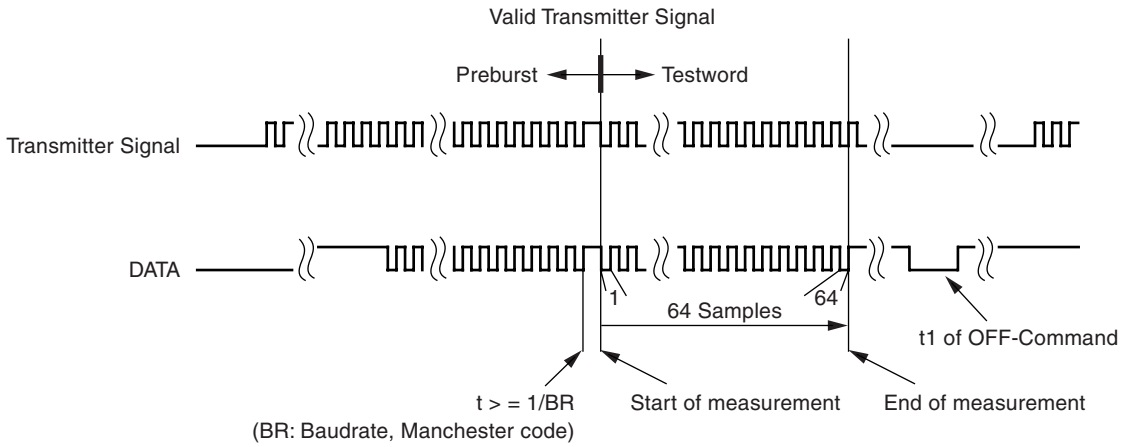
The 64 samples will be examined in the microcontroller to distinguish between a valid signal from a corresponding transmitter and signals due to noise. This is done by a time frame check where the samples are continuously compared to a programmable time window (µC_Limits).

If the samples are within the time window and the received data stream is equal to a programmable testword (*Testword*), this will be indicated by LED D4 on the interface board. After evaluation of the received data stream, the RF receiver is set back to polling mode.

The timing information (64 samples) can also be evaluated using the functions *Testword*, *Histogram* and *Timing_List* in the RF Design Kit software menus.

Figure 7-2. Principal Function





8. Flamingo™ Board Schematics

Figure 8-1. Main Unit Schematic (Expand 0)

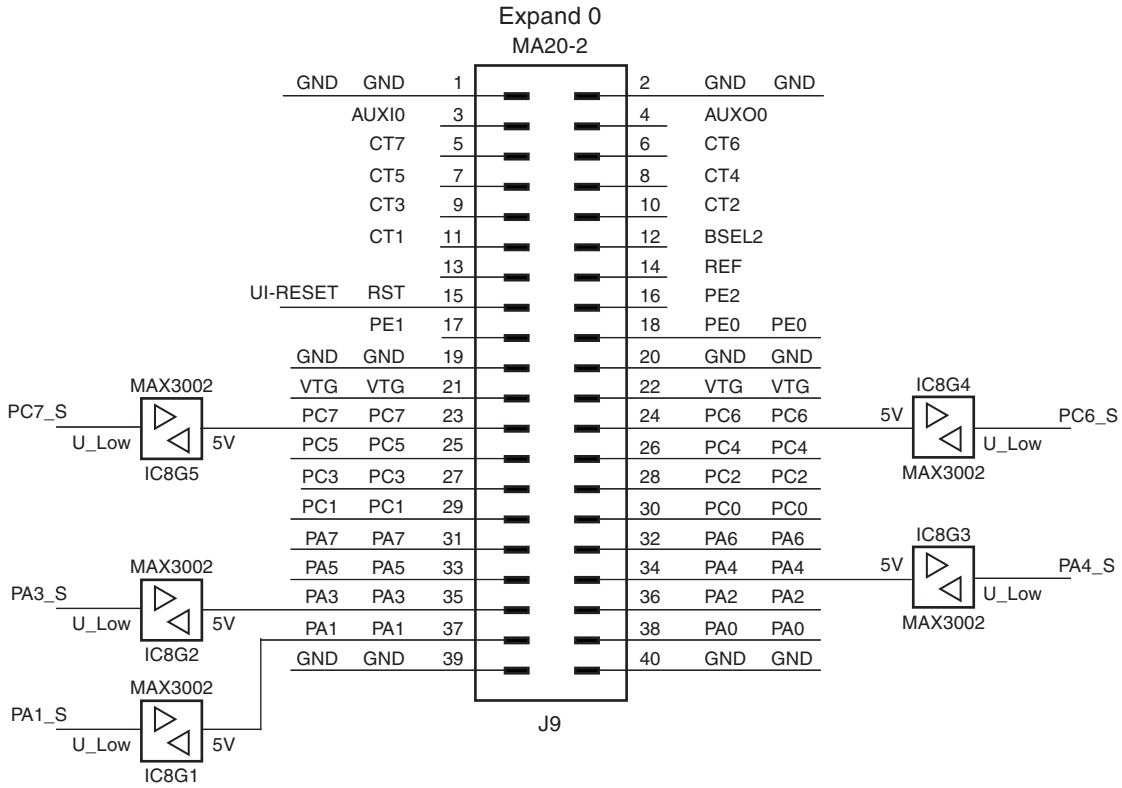


Figure 8-2. Main Unit Schematic (Expand 1)

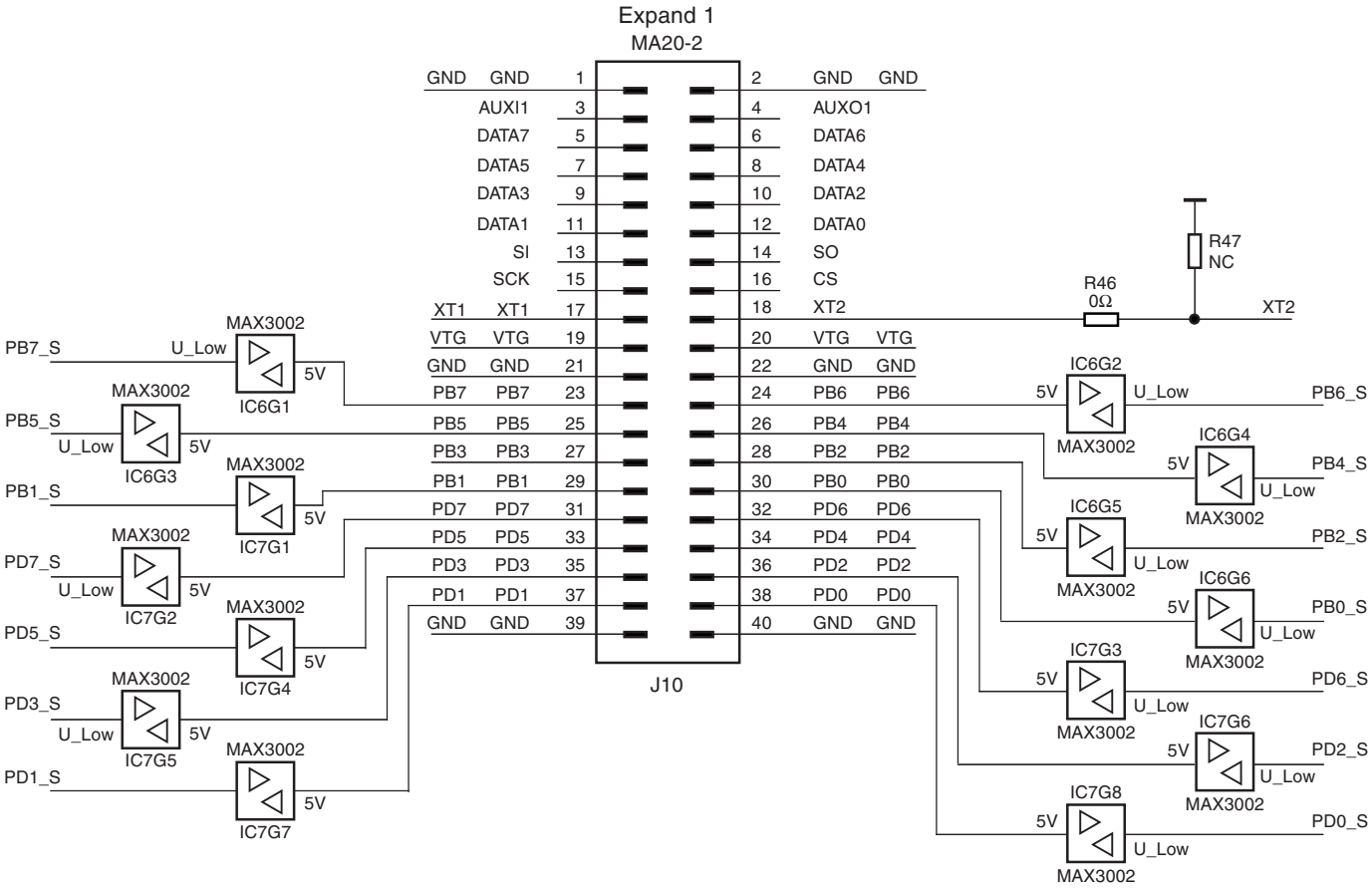


Figure 8-3. Power Supply Schematic

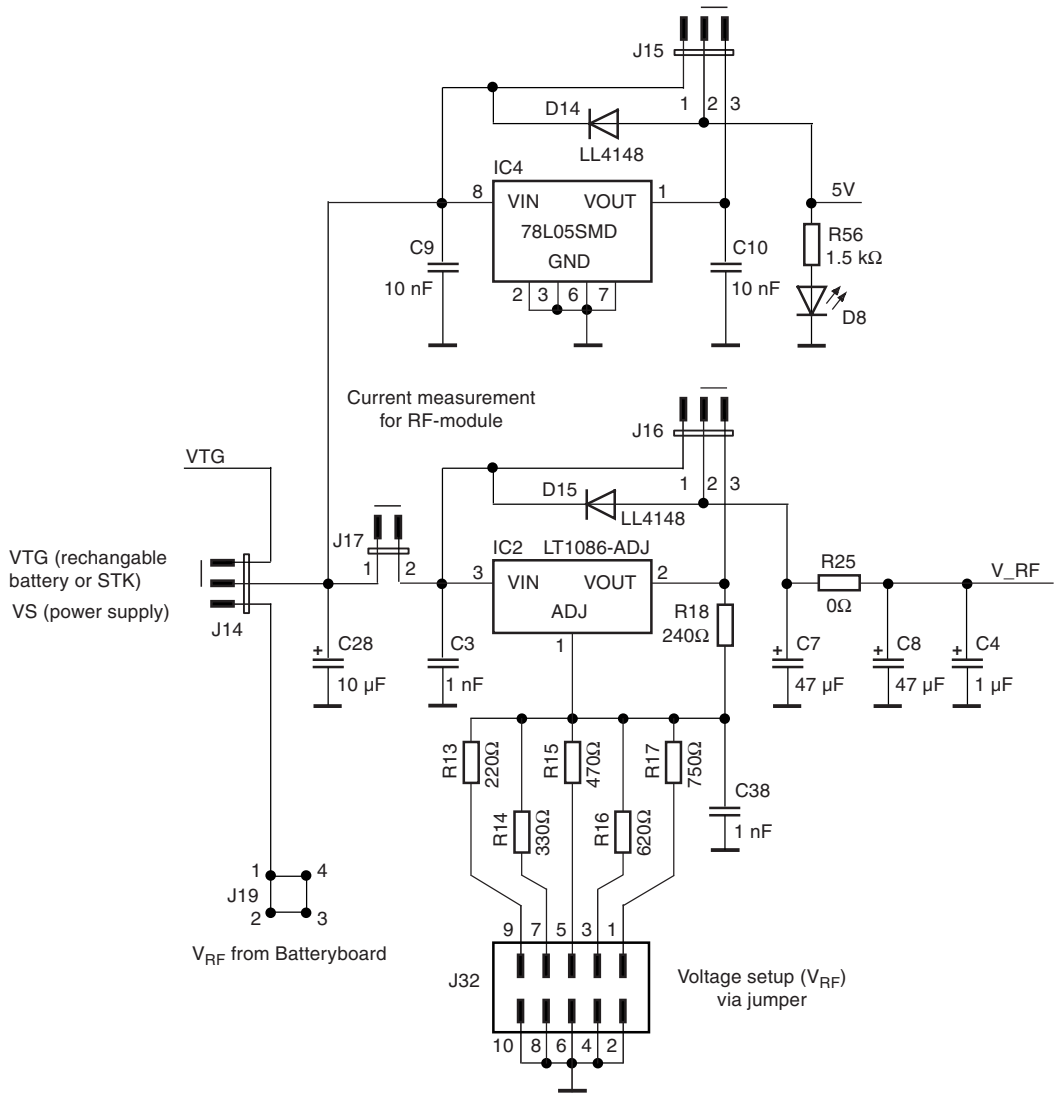


Figure 8-4. Level Shifter Schematic

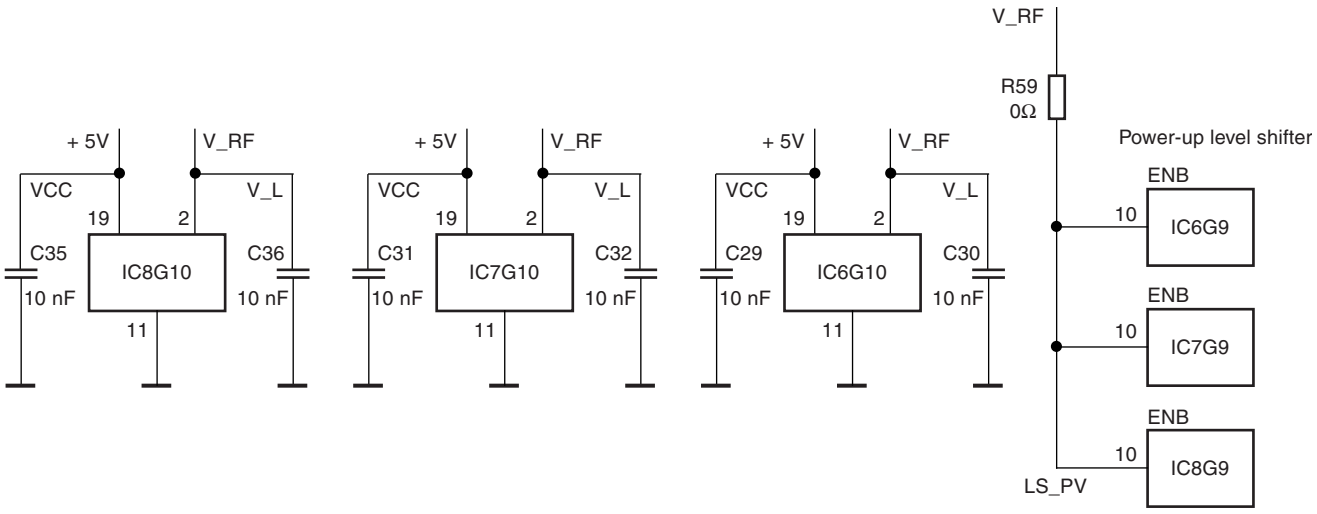


Figure 8-5. User Interface Schematic

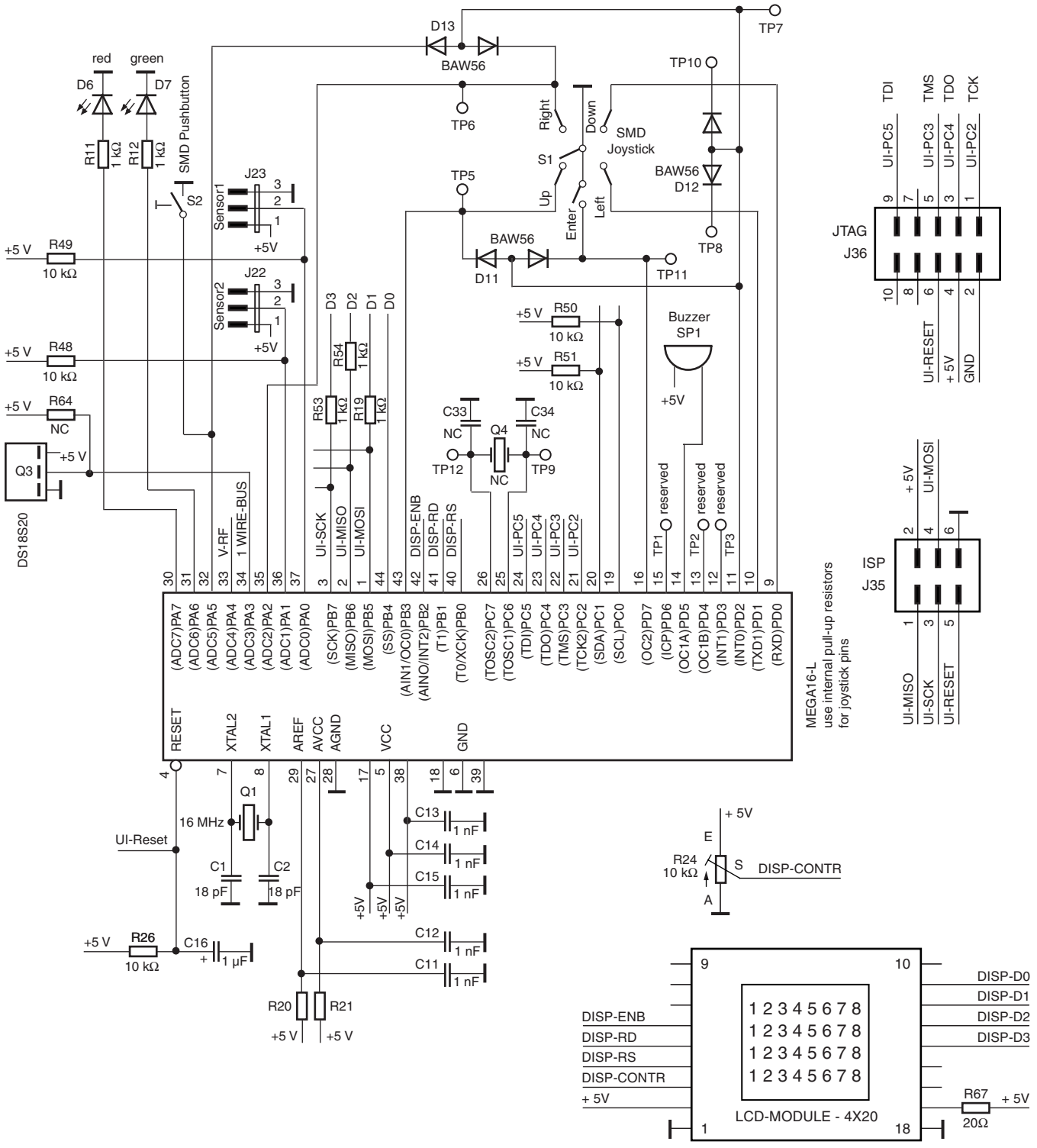
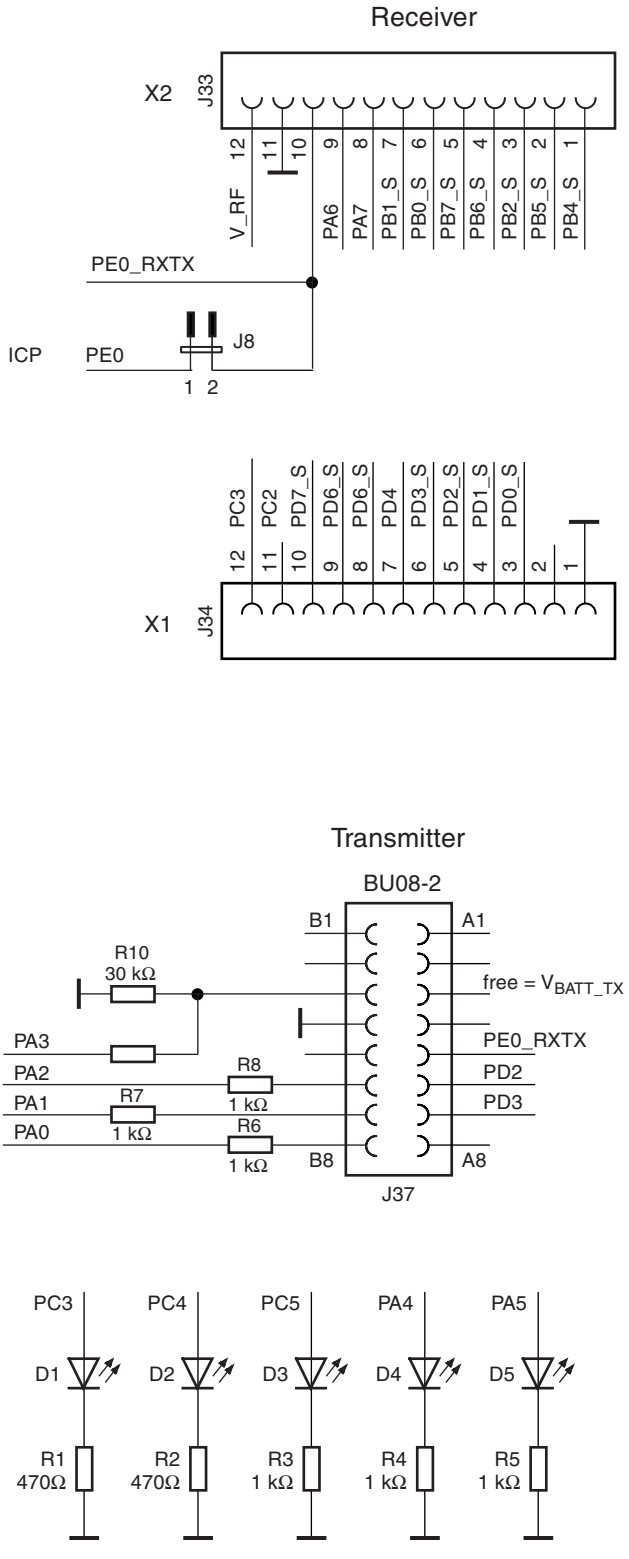


Figure 8-6. Connectors for RF Transmitter, Receiver and Transceiver Chipsets



Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
Tel: (33) 2-40-18-18-18
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ASIC/ASSP/Smart Cards
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Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

RF/Automotive
Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/
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