



AN1800 APPLICATION NOTE

STR71x BSPI
USED AS A UART

INTRODUCTION

This document presents a standard communication interface between a STR71x microcontroller and a PC. This communication is done through the STR71x BSPI peripheral and a serial port of the PC using the RS232 protocol.

1 BSPI COMMUNICATION

The main features of the BSPI communication peripheral are summarized below. Refer to the STR71x reference manual for more details.

1.1 MAIN FEATURES

The Buffered Serial Peripheral Interface (BSPI) offers a flexible means of full-duplex data exchange with external equipment requiring an industry standard synchronous serial data format.

The BSPI allows a very wide range of baud rates with different baud rates for transmission and reception.

For BSPI, only four signals are needed, the first for transmission (MOSI), the second for reception (MISO), the third is the clock (SCLK) and the other is slave select ($\overline{SS}$).

1.2 BAUD RATES

Transmission and reception can be driven by their own baud rate generator. However be aware that to communicate correctly, the receiver must have a reception baud rate strictly equal to the transmission baud rate of the transmitter. As long as this condition is met, a wide range of baud rates is possible.

1.3 FRAMES

The length of a data word can be 8 or 16 bits, these bits are transmitted Most Significant Bit first.

2 RS232 COMMUNICATION WITH A PC

2.1 MAIN FEATURES

The electrical and protocol characteristics of RS232 are different from those of the STR71X BSPI peripheral. In RS232 communication, high level is typically +7V and low level is typically -7V, while the BSPI peripheral works with (0, +3.3V).

Furthermore, the polarities are different. A '1' bit coming from the BSPI corresponds to a '0' bit in RS232, and a '0' bit to a '1' bit. So it is necessary to implement a conversion between the PC and the BSPI peripheral. In this application ST3232 is used for this purpose.

Also the BSPI transmits Most Significant Bit first but the PC receives the Least Significant Bit first. That's why we must invert the order before transmitting the data.

2.2 PC CONFIGURATION

The PC will be used as a terminal. The description below refers to the Windows environment. This terminal application is called HyperTerminal.

Under Windows, open the "HyperTerminal" application. To configure it, go to the communication parameters menu. The options of this window must be the same as the ones defined with your STR71x.

After selecting the right serial communication port, select the same baud rate as the one configured in the microcontroller. As the PC accepts only one baud rate, transmission and reception baud rates will have the same value. Data word length will be 7 bits, and choose to use 1 stop bit. "Flow control" can be either Xon/Xoff or none. The PC is then correctly configured.

3 STR71X CONFIGURATION

This application was implemented with a STR71X. This microcontroller uses a 16 MHz external clock (quartz). A description of the baud rate selection is given later in this application note.

3.1 GENERAL INITIALIZATION

Four pins of the STR71x are used:

- the MOSI pin (Master Output Slave Input).
- the MISO pin (Master Input, Slave Output).
- the SCLK clock pin.
- the $\overline{SS}$ slave select pin.

The MOSI, MISO and SCLK pins must be initialized as Push-Pull (please refer to the Reference Manual).

3.2 BSPI CONFIGURATION

The peripheral is configured as a master by using function `BSPI_MasterEnable`, and the Baud Rate is fixed by using function `BSPI_ClockDividerConfig` (please refer to the STR71x Software Library User Manual for more information).

3.2.1 EXAMPLE

Then the baud rates must be selected. We should always have the same baud rates in the PC and in the BSPI.

Baud Rate	Clock Divider
19200	0xCF
38400	0x67
57600	0x40
115200	0x20

4 COMMUNICATION BETWEEN STR71x AND PC VIA RS232

In this application note the software modules are developed in C language, with RVDK environment, using the STR71x software library from STMicroelectronics.

It is of course only an example. It is up to you to adapt it to your specific application.

4.1 GENERAL DESCRIPTION

In this application, an STR71x is connected to a PC. The communication is performed using the “HyperTerminal” application of Windows. Characters are sent by the STR71x in ASCII code to the PC with a baudrate set to 19200 bps (ClockDivider = 0xCF) and 1 stop bit.

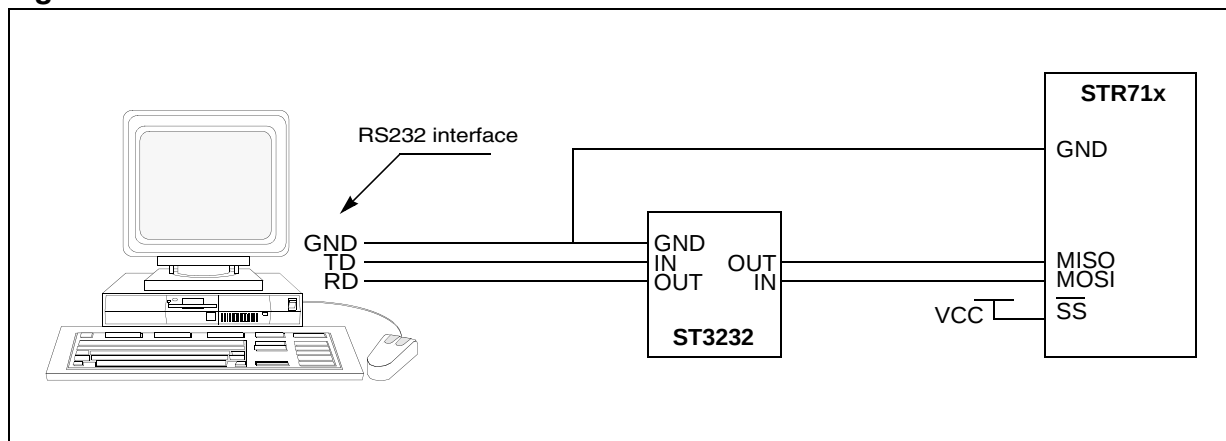
The first part of the program performs the initialization of the STR71x, core and the BSPI peripheral.

4.2 HARDWARE

The STR71x BSPI peripheral cannot be directly connected to a PC, as it uses the RS232 protocol.

The conversion between BSPI and RS232 can be done using ST3232. An overview schematic is presented in the figure below:

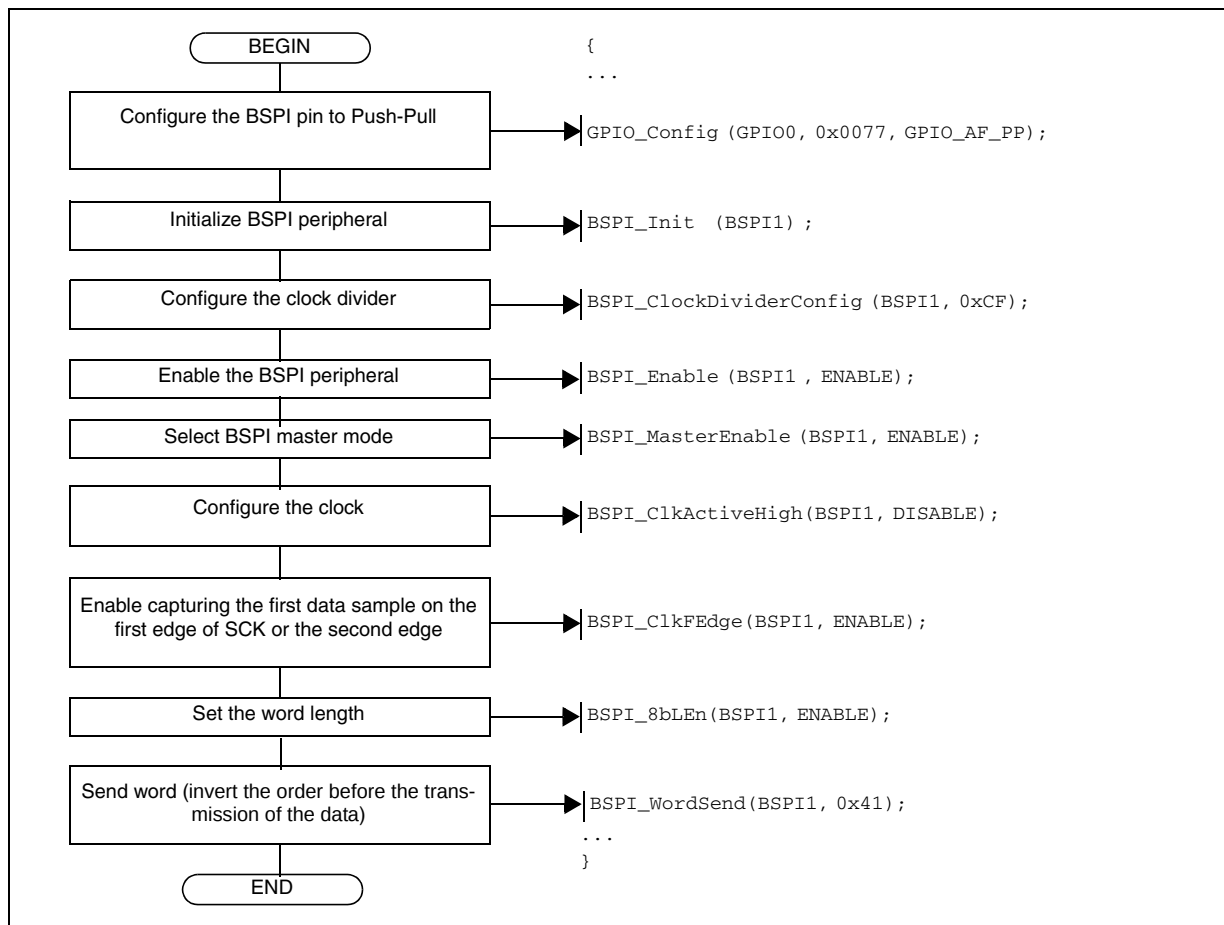
Figure 1. Hardware Overview



Be sure that the three main devices (PC, STR71x, ST3232) have the same electrical reference (GND).

4.3 SOFTWARE

Figure 2. Application flowchart



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