PC Interfacing

Fourth Level

Lecture Ten

# USB to RS232, USB to Parallel Design

Goals:
Up-on completing this lecture, the student should be able to:

1- Identify the USB to Serial and Parallel interface chips.
2- Recognize the versions and the differences between these chips.
3- Design and build interfacing circuits using these chips.

The USB to Serial RS232 adapter is very useful in many situations we need to connect a device with RS232 to a computer without RS232 port. Using FT232BM chip manufactured by Future Technology Devices International FTDI we can make a very simple USB to Serial RS232 adapter using few external components. This USB to RS232 adapter based on the FT232BM driver can support many operating systems (windows, mac, Linux).

What is FT232BM? And what is used for?
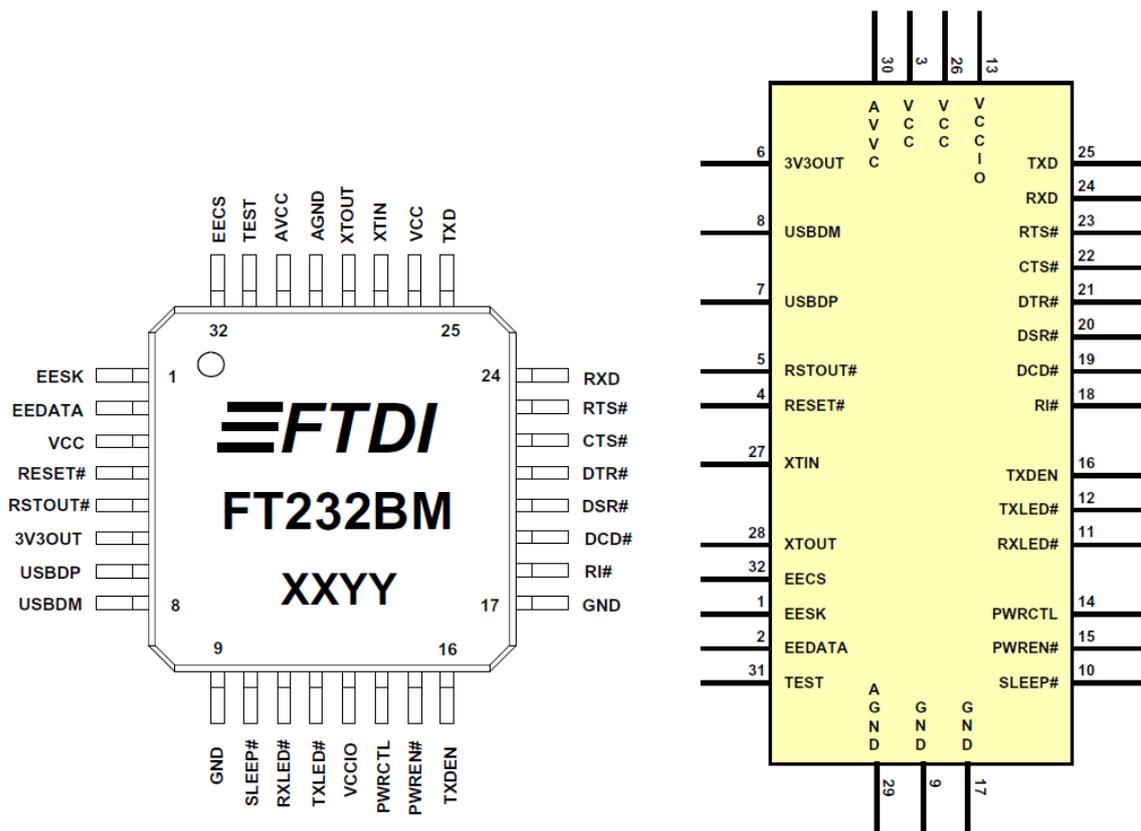
The FT232BM is a USB to serial UART interface with the following advanced features:

- Consist of 32-pin.
- Compatible with USB 1.1 and USB 2.0
- Single chip USB to asynchronous serial data transfer interface.
- Full Handshaking & Modem Interface Signals.
- UART interface support for 7 or 8 data bits.
- Data transfer rates from 300 baud to 3 M baud at TTL levels.
- 384 byte receive buffer and 128 byte transmit buffer.

Typical Applications

- USB to RS232 Converters.

- Cellular and Cordless Phone USB data transfer cables and interfaces.

- Interfacing MCU / FPGA based designs to USB.

- USB Smart Card Readers.

- USB Instrumentation.

- USB Industrial Control.

- USB MP3 Player Interface.

- USB FLASH Card Reader and Writers.

- USB Digital Camera Interface.

- USB Hardware Modems.

- USB Wireless Modems.

Before Delving into FT232BM lets understand its predecessor the FT8U232AM.

The FT8U232AM requires a small number of external components to produce a device that converts USB to TTL level RS232 signals. The FT8U232AM and supporting components is also available as a complete module - called a USBMOD1 - in a 32 pin IC, making the whole project very easy to build.

As you can see in the schematic below the circuit is very simple and the voltage needed for the circuit is obtained from the USB port.

| USB | → | FT8U232AM | → | MAX232 Driver / Receiver | → | RS232 Port |
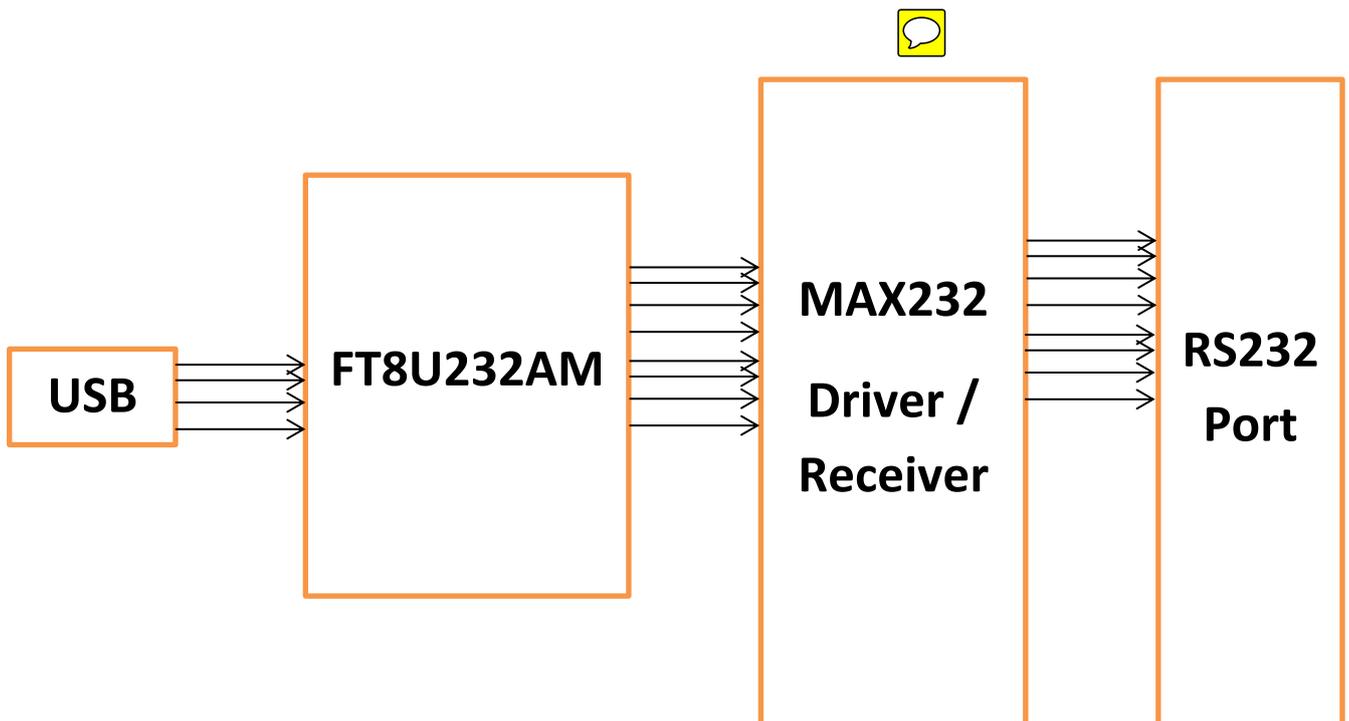
We will separate the design into two parts: the first part is the connections between USB and FT232BM and the second part is the connections between FT232BM and RS232 through MAX232.
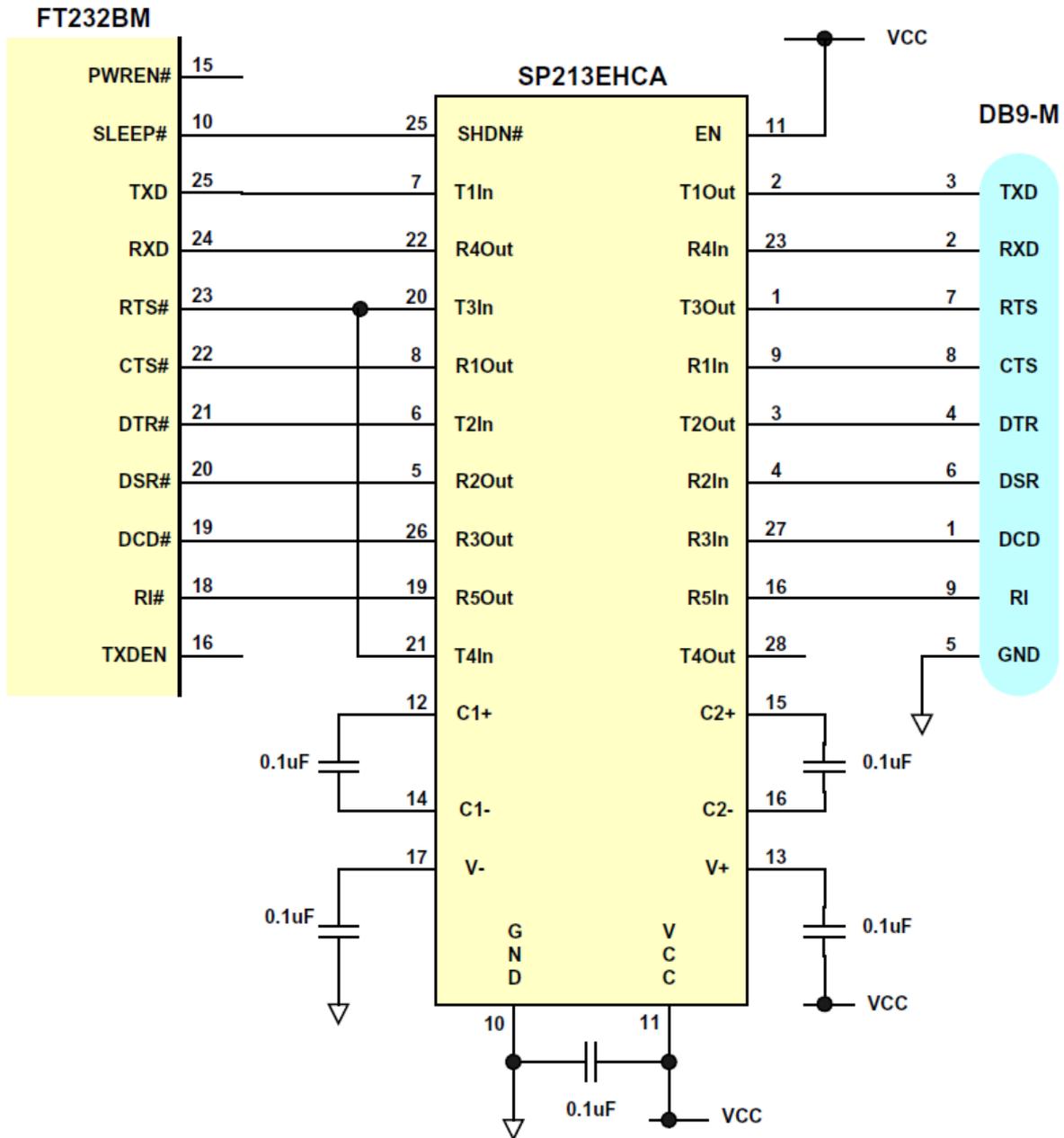
The first part:

The schematic below explain the connections between USB and FT232BM.
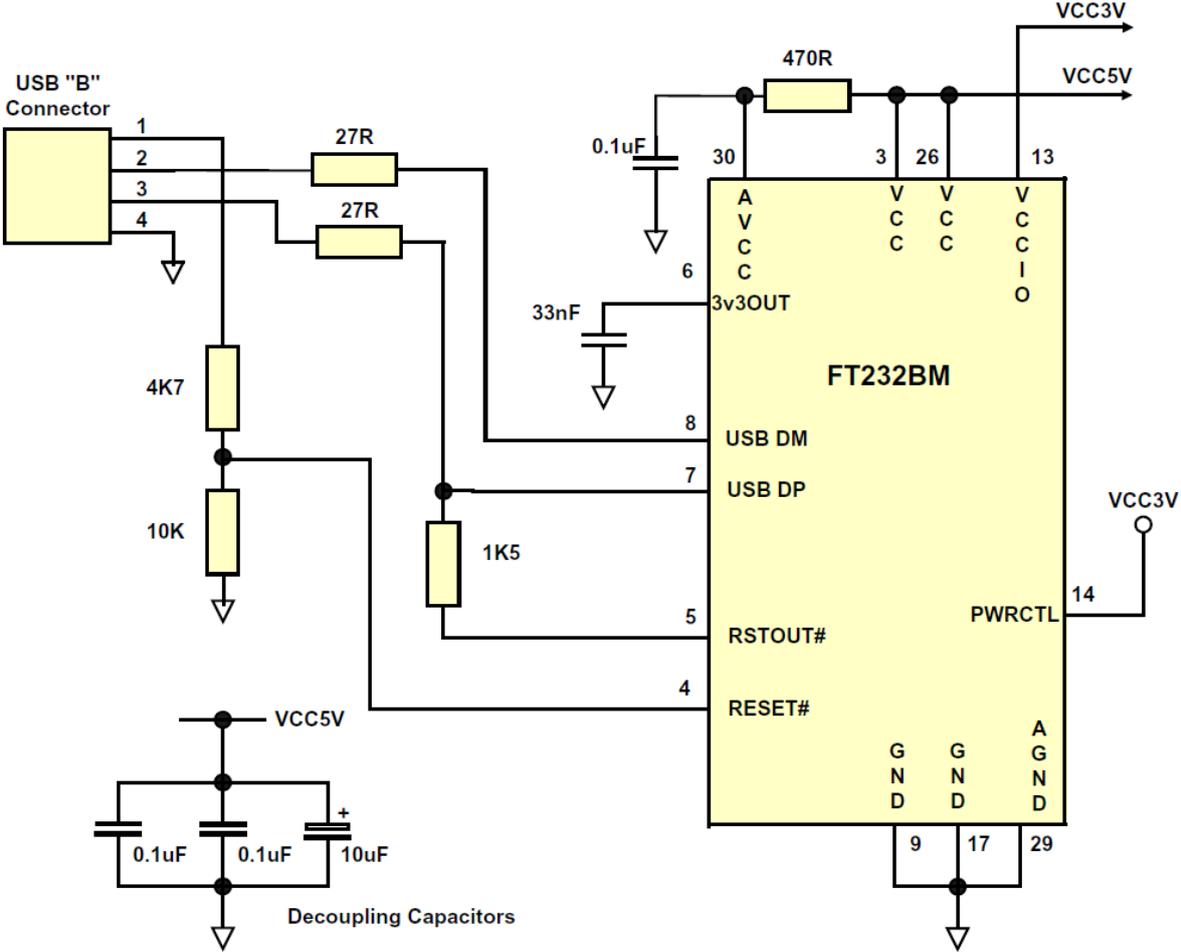
The second part:

The schematic below explain the connections between FT232BM and RS232 through MAX232.

The full design with its connections is present in the next page.

The photo of finished Adapter:

USB to Parallel circuit design:

There are several ways to convert the USB to Parallel:

1. Using Parallel to USB converter Chip (example FT245RQ):

The USB to Parallel adapter is very useful in many situations we need to connect a device with Parallel to a computer without Parallel port. Using FT245RQ chip manufactured by Future Technology Devices International FTDI we can make a very simple USB to Parallel adapter using few external components. This USB to Parallel adapter based on the FT245RQ driver can support many operating systems (windows, mac, Linux).
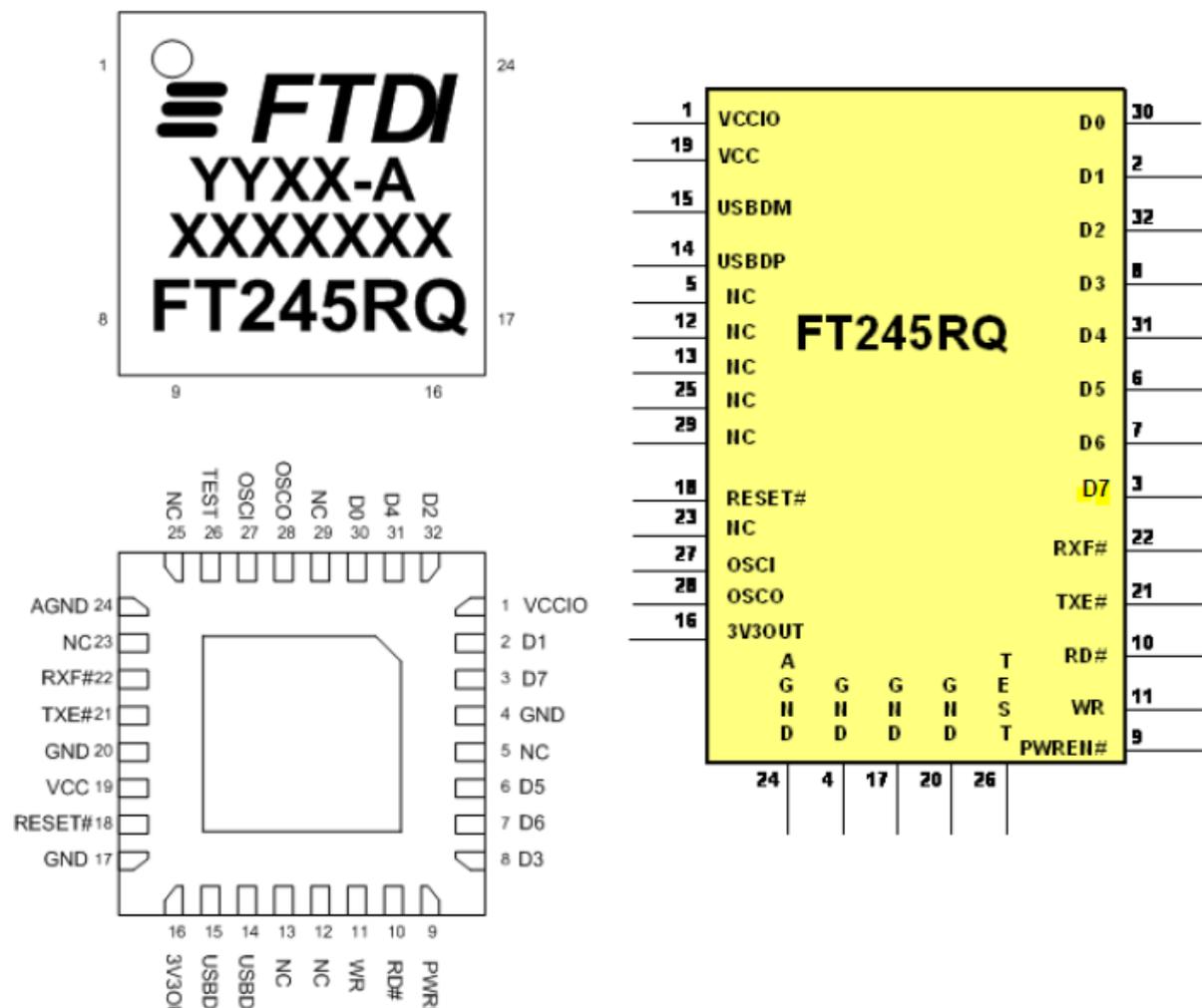
The FT245R is a USB to parallel FIFO interface with the following advanced features:

- Consist of 32-pin.
- Compatible with USB 1.1 and USB 2.0
- Single chip USB to parallel FIFO bidirectional data transfer interface.

- USB protocol handled on the chip. No USB specific firmware programming required.
- Data transfer rates up to 1Mbyte / second.
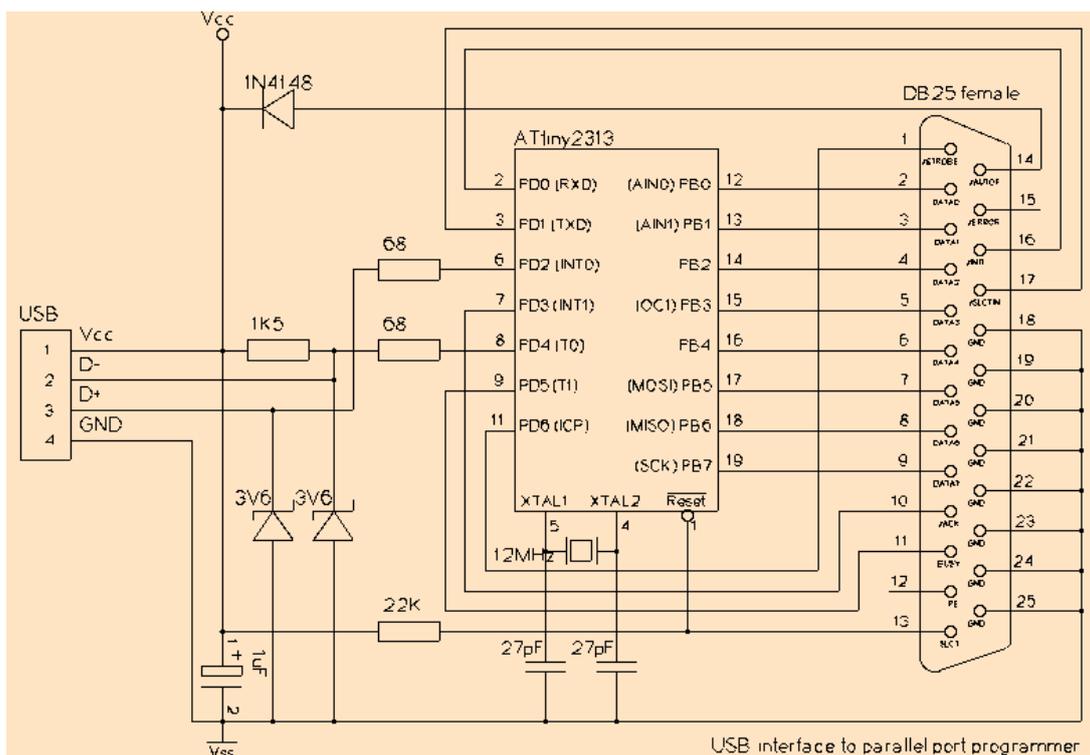
Typical Applications

Exactly same as FT232BM.

As you can see in the schematic below the circuit is very simple and the voltage needed for the circuit is obtained from the USB port.
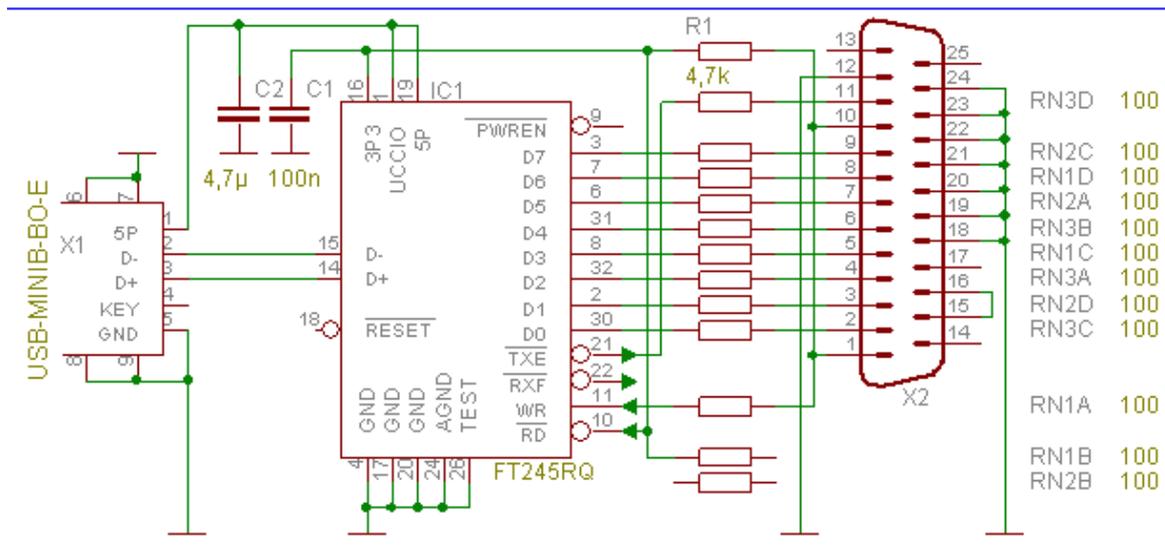
2. Using a UC with an internal USB to parallel converter module (example ATtiny2313):

The ATtiny2313 is a low-power 8-bit microcontroller.

Summary:

1- With the wide-spread of USBs, serial/parallel to serial interface converters play a major rule in today's designs.
2- There exists multiple generations of the Serial to USB converter chips.
3- Two ways can be used to convert parallel data to USB compatible format.
4- When designing, the designer should handle two protocols, one on each side with its front facing chip.

Questions:

1- How to convert Serial data to USB compatible format?
2- What is the FTDI232BM, What is FT8U232AM, are they related? are they different?3- How to convert parallel port data to USB compatible format? (mention all 2 ways), what is MODUSB1