# Experiments with WS2013B RGB mini strip

You can buy RGB WS2013B strips from many vendors, load demo programs, try to understand how to modify the demos. For many, the more LEDs, the better.
Here for the few, be happy understanding a lib, and learn programming in C.
And read about the smart RGB LEDs features: see www.didel.com/RGBstrips.pdf.
The WS2813 has one more wire and this allow to bypass a defective circuit.
WS2813, WS2813B/2016 and WS2813/2017 are compatible, but have not well documented timing differences.

The WS2013 Ministrip has 2 objectives
1) Experimenting: You get one PCB with easy 4-pins 2.54mm pitch connectors, breadboard compatible, and one 2mm Grove compatible connector. The strip has 11 leds, enough to test light shows and rainbows.
2) Doing special led arrangements and wearable designs.
    The 11 LEDs are breakable as you wish. There are two options for the wiring. Since we know sewing is critical, we promote the use of flat cable. Your choice!
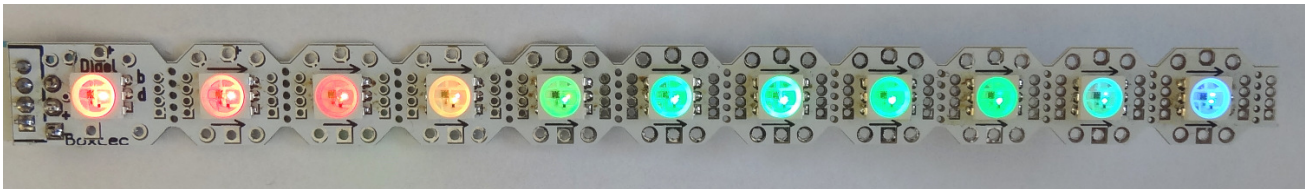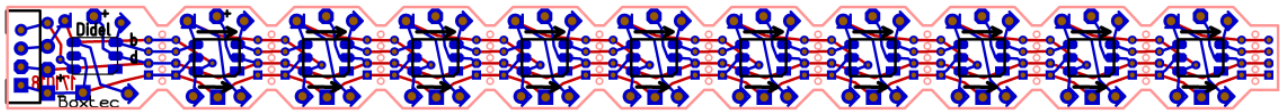
Connect the strip

You need three wires toward your microcontroller card. Gnd, +5V or +3.3V, and an ouptut, let us say pin13 (A0).
On the strip, you have choice for a Grove connector, or a 3-pin header (male on bottom for a breadboard, female on top if you plan to use jumper wires).
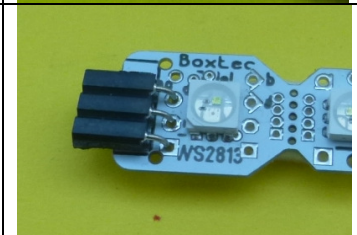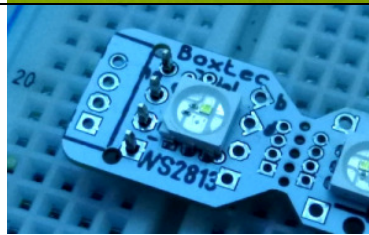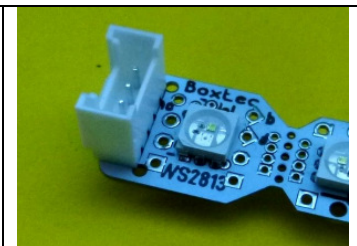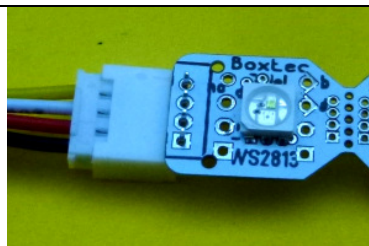
Which driver?

For the WS2813, there are several drivers on the net. The WS2813 is compatible with WS2812 and most, if not all, of the self-clocking RGB LEDs libraries (sometimes colors are swapped).
Adafruit Neopixel is widely used and documentation is well done:
https://learn.adafruit.com/neopixel-painter/test-neopixel-strip
It takes at least 2k bytes of program memory, and 3 variables for every LED.

Didel developed a set of files you will like if you are concerned about code size and download time.

With the WS28.h lib, a simple strip of less than 256 LEDs can be controlled adding the library of 200 bytes, 500 bytes with Hue. One can use small processors from the AVR Tiny family (8-10Mhz). The files are written in portable C, not using Arduino functions (GCC compiler). See https://github.com/nicoud/RGBstrips

More on the WS2813

The WS2813 solves partly the reliability problem. An additional input on every LED takes the clock of the previous circuit. If the normal signal is not active when it should, the signal is taken from the previous LED and the LED can light if good. Two consecutive bad LEDs will break the chain.

The first LED receives only one self-clocking signal. The next ones needs 2 lines, in addition to the power lines.
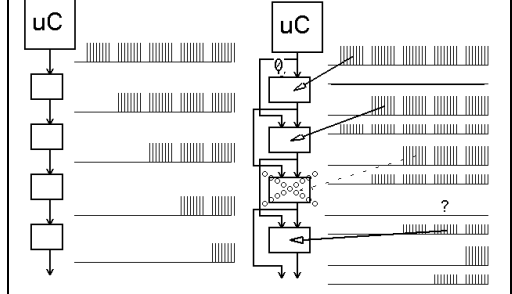
Voltage is 5V, but the strips work well at 3.7V lipo voltage and down to 2.5V (but the blue desapppear at 3V).

Current is 5 to 80mA for 10 LEDs, depending on light intensity, plus 20-40mA for an Arduino AVR328 board. Maximum intensity is only required outside. While debugging programs, 5-10% are bright enough.

Using Didel strips

The MiniStrips have 11 leds. The first LED has a choice of connectors to be controlled by your preferred card. Usually, the LED show is not very close from the microcontroller. it is not recommended to have long wires directly out of the. The first LED is on the board and communicates with the other leds with the good specifications.

Cut the first module, connect it to your board and use flat cable or a Molex connector to go the the beginning of the first 10-LEDs strip.

If you cut the strip, you have the choice as explained later to use a flat cable, or use the big holes, they are big enough for sewing.

At Didel, Gnd always have square pads.

Also, one do not need for a lot of light when you debug (and it is a must if you need to take a photo). Low current allows the wiring trick use on the UNO: pin 13 is RGB signal, pin 14 logic 1 (~5V), pin 13 logic 0 (GND),
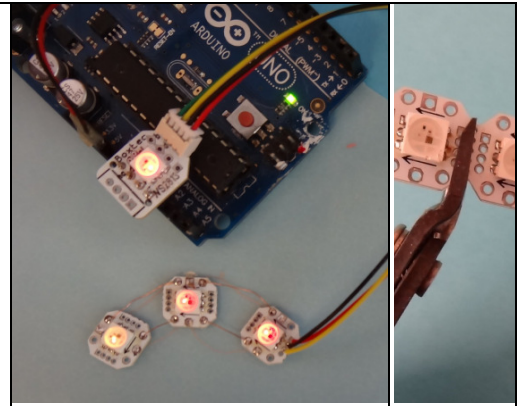

Bending and cutting

PCB is 0.6mm. Bending down to 50mm radius is possible. A break is easy to fix with 4 wires. You can bend a little the edges without breaking the strip. Copper runs on both side: it surely will break on the stretched side, but is compressed on the other side..

You can also get inspired by the Didel Minicube and solder the angles after sanding.
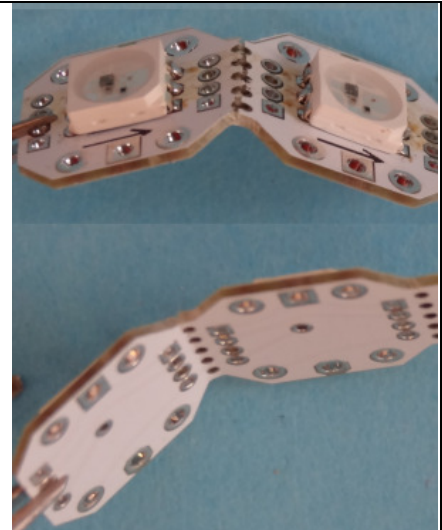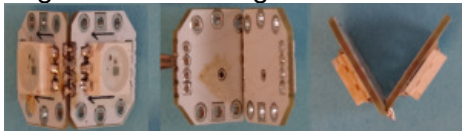
Sewing

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Leds can be connected in any order.
You find on the Web how to sew the LEDs.
Connection is as easy as with the 3-wires WS2812..
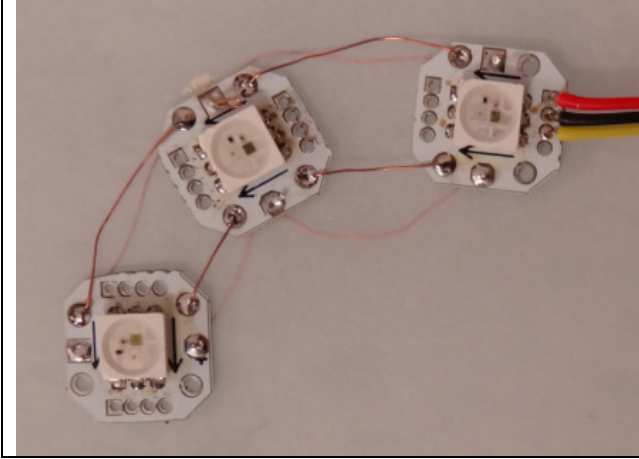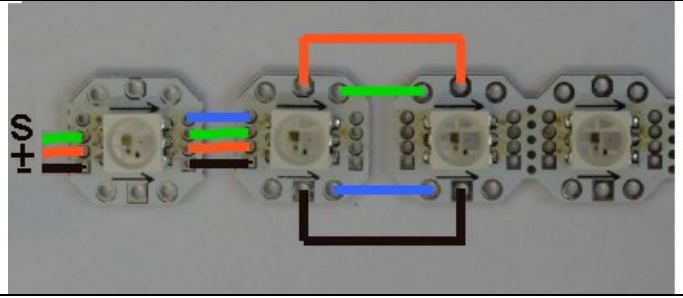
We made a test using tracing paper to have the back layer visible. We used copper wire, 0.18mm in dia, easy to take out of flexible electric wire and easy to solder. Strong enough so you do not need a cumbersome thin needle.
Power is daisy chained on the bottom. The data bridges (in green) are on top. The bypass wires (in blue) are also on top.

Using flat cable to spread the LEDs

We believe flat cable is the best for all kind of constructions: reliable and easy to solder with a jig.

Flat cable is easily available and cheap. Thickness is 1mm and the colors are great. Use only wires 1 to 4 and 5 to 8, and have the ground on wire 1 (brown) or 5 (green). Wire black – white – gray-violet is another option.
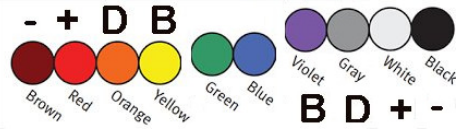
Remember, on the PCB, a square pad is always the Gnd.

The flat cable jig and its use

The jig is a simple piece of balsa wood with a slot of 0.9mm. Flat cable slides in with enough friction to stay in place. Fix it on a vice, or build a support with more than 3cm space below.
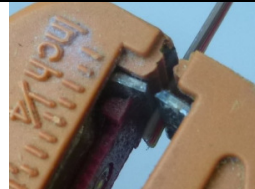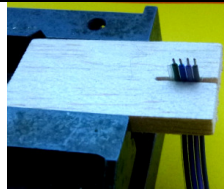
You need a good wire-stripper and strip a maximum of 2mm. What is crucial is to keep the strand of wires together, dia 0.8mm.

Now you see the trick. Position the flat cable and put the LED on top, well centered.
If one strand is folded, you have better to cut and strip again.
Solder the 4 wires, you have now a clean and reliable connection.