APA102-2020 Single, 2x2 mm

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This board contains an APA102-2020 RGB LED in 2x2 mm SMD package. Ideal for status signaling and prototyping. Color and brightness are controlled by 2 wires, serial data and clock signal. So you just 'set' the color data once. The boards can be chained together, the output of one leading into the input of another for near-infinitely long chains. Only two control pins are necessary independent of the number of LED's used in the system.

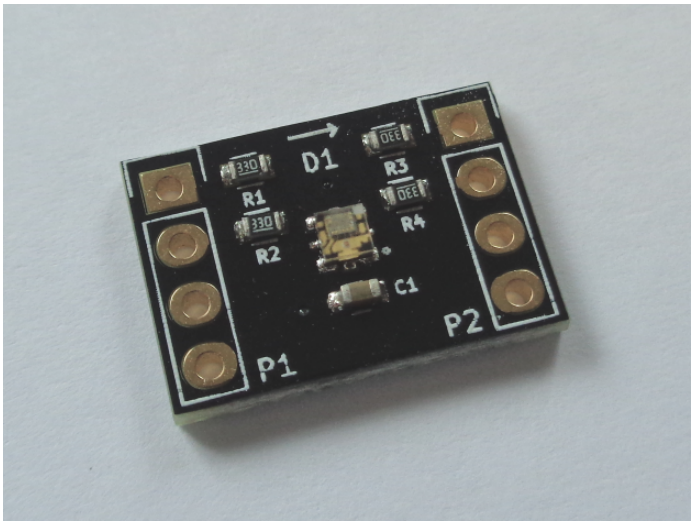

Figure 1: *Photo of the board*

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The License is attatched at the end of this document as well as a Guide to the CERN OHL v.1.2.

Please feel free to give your highly appreciated feedback, comments and suggestions. Or ask any questions about the board. We'll be glad to answer or help you.

Specification

- Dimension: 440 x 640 mil (11.176 x 16.256 mm)
- digital control RGB color and brightness
- 8 Bit color adjustment
- 5 Bit brightness adjustment
- Supply Voltage 4.5V to 7.5V
- Power consumption at full brightness(at 4.6V):
  - Red: 89 mW
  - Green: 70 mW
  - Blue: 72 mW
  - White(RGB): 205 mW
- Daisy chain able
- Clock Speed 8 MHz, possibly more

For more details and description about the LED itself, please see the data sheet.

Daisy Chain application

The LEDs can be connected in series to a chain as follow:

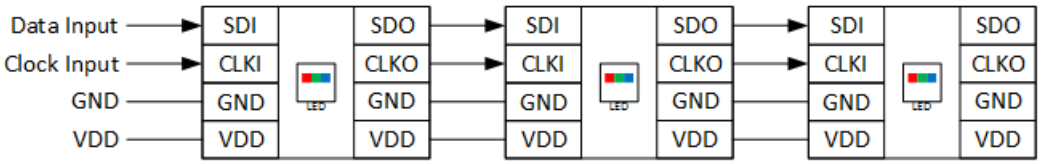


Figure 2: *Application Daisy Chain*

There are 33 Ohms series resistors on each digital signal input and output. Even they are not necessary, but maybe helpful at higher frequencies.

Control

The best way to control the LEDs is to use an SPI interface or simply use bit banging.

For Arduino users, there is even a library called "Fast LED" available.

When using SPI to conrol the LEDs, then MOSI and SCLK are the only two signals needed.

You need to sent a 32 bit long start frame, followed with the LED frames according to the number of LEDs used and an end frame.

The start frame is 32 bit long and contains only Zeros. The end frame is at least n/2 bit long, where n is the number of LEDs used and contains only Ones. So for up to 64 LEDs it can be 32 bits.

The LED frame must have 3 bits Ones at the beginning, followed with 5 bits for brightness. Then 3x 8 bits color code, blue green and red. The order is always MSB first.

The diagrams below summarize the protocol:

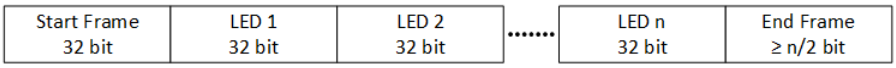


Figure 3: *Protocol Overview*

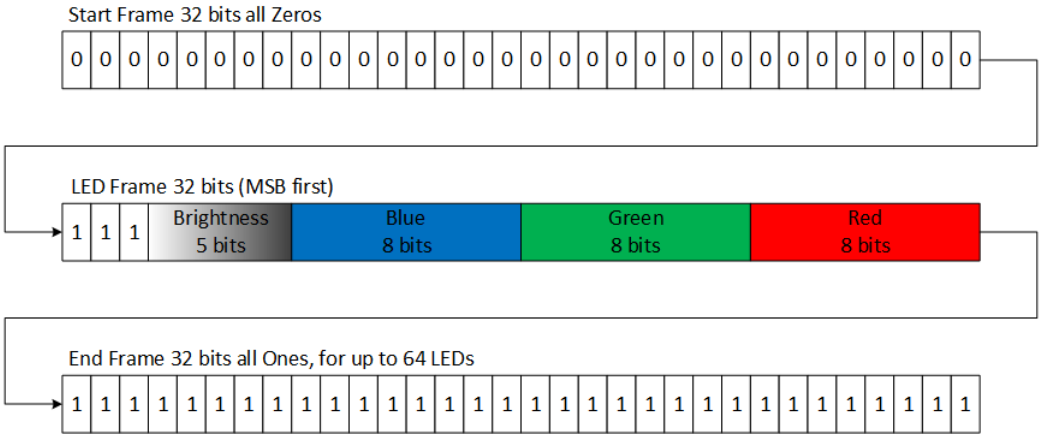
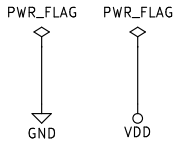
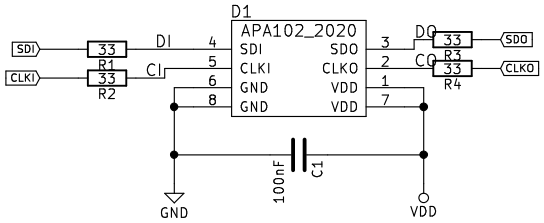


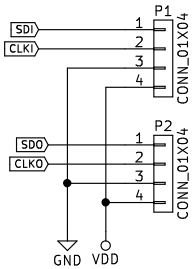
Figure 4: *Frames, LED Frame shown for one LED*

Attachments

1. Board Schematics
2. CERN OHL v1.2
3. CERN OHL v1.2 How-to-Guide







LED		
MLT **http://www.maleetronic.com**		
Sheet: / File: apa102_single.sch		
Title: APA 102 2020 digital RGB LED single		
Size: A4	Date: 2017-07-29	**Rev: 1.0**
KiCad E.D.A. kicad 4.0.6		Id: 1/1

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