

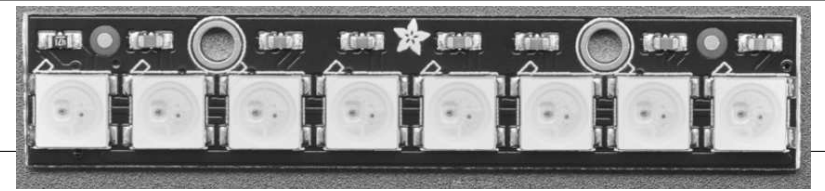
PRU Control of NeoPixel



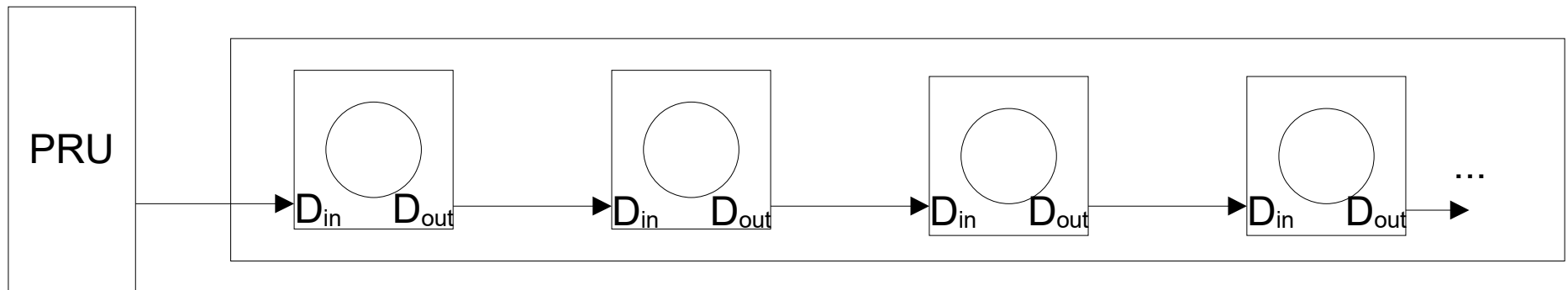
Topics

- 1) How can we drive RGBW LEDs (NeoPixel) from the BeagleBone?

About the NeoPixel



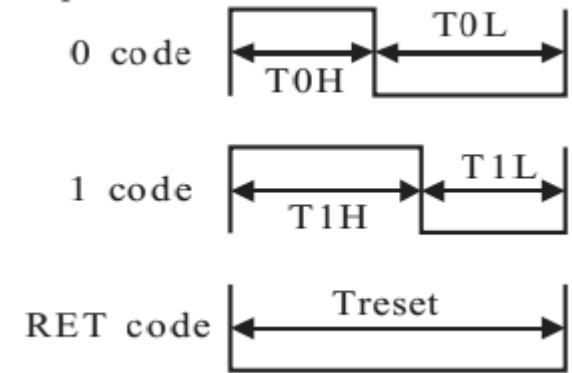
- Adafruit makes RGB LEDs called NeoPixel
 - Uses a 1-wire protocol
(Features WS2812B or SK6812 LED driver)
 - Pixels have D_{in} and D_{out} daisy chained:
As data is shifted into a pixel,
it simultaneously shifts old data.
 - Designed for 5V, but works on 3.3V!
 D_{in} signal can be $0.7V_{DD} = 0.7*5 = 3.5V$ (but it works!)



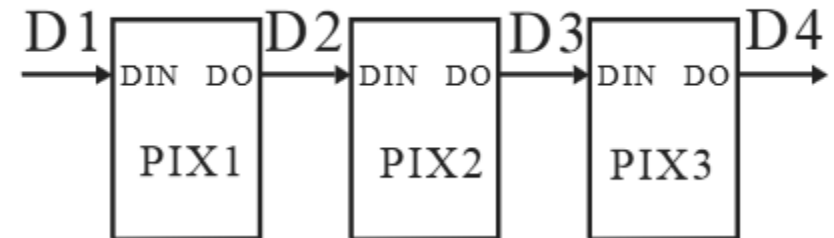
1-Wire Protocol

- The Data wire signal is a square wave
 - 0: ..
(0.35us = 350ns)
 - 1: ..
(0.7us = 700ns)
- At 200 MHz, how many clock cycles is 0.35us?
 - 1s / 200 Million Cycles/s
= 0.005 us / Cycle
= 1 cycle takes 5ns
 - Note 0.35us = 350ns
 - # cycles in 350ns
= 350 ns / 5 ns/cycle
= 70 cycles

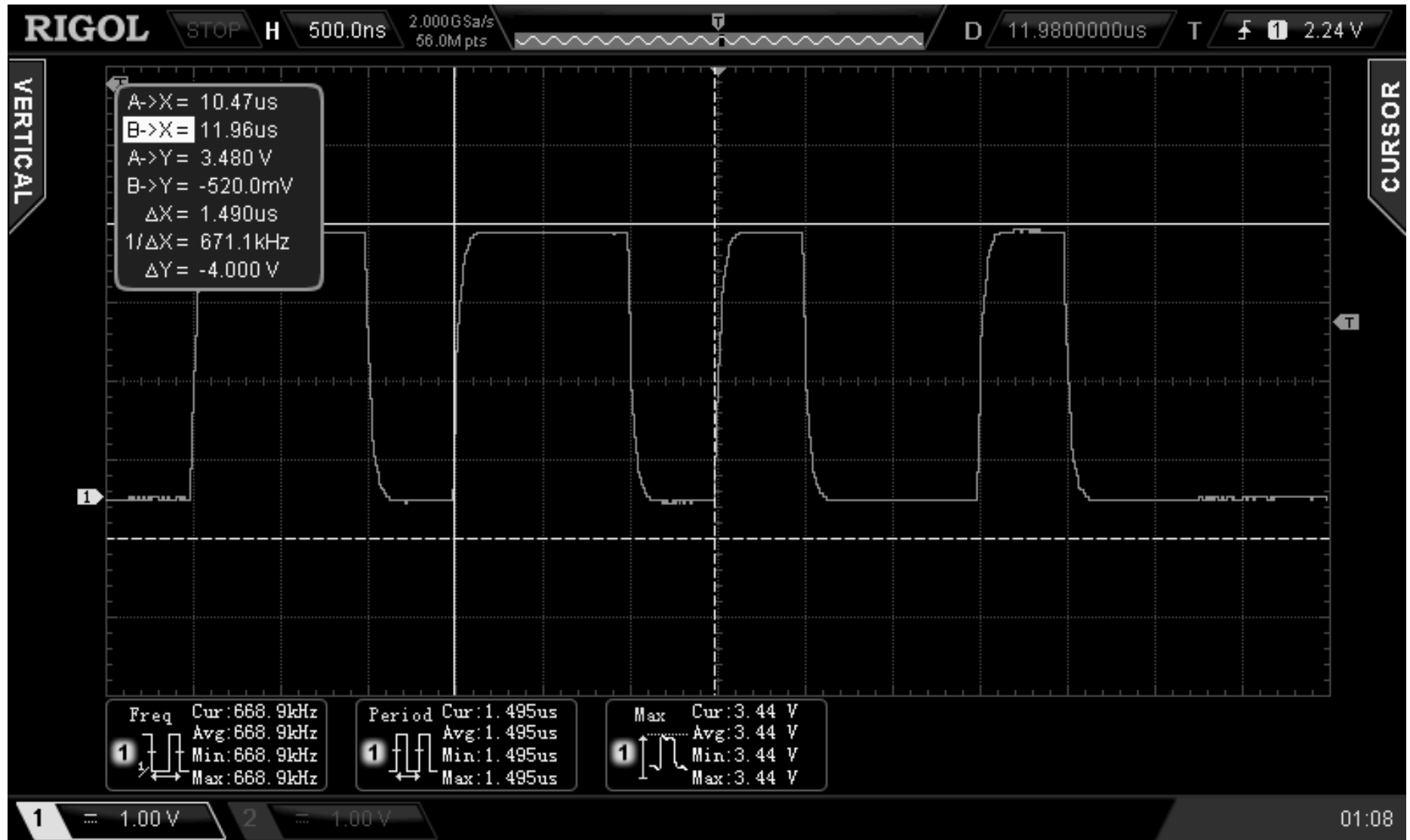
Sequence chart:



Cascade method:



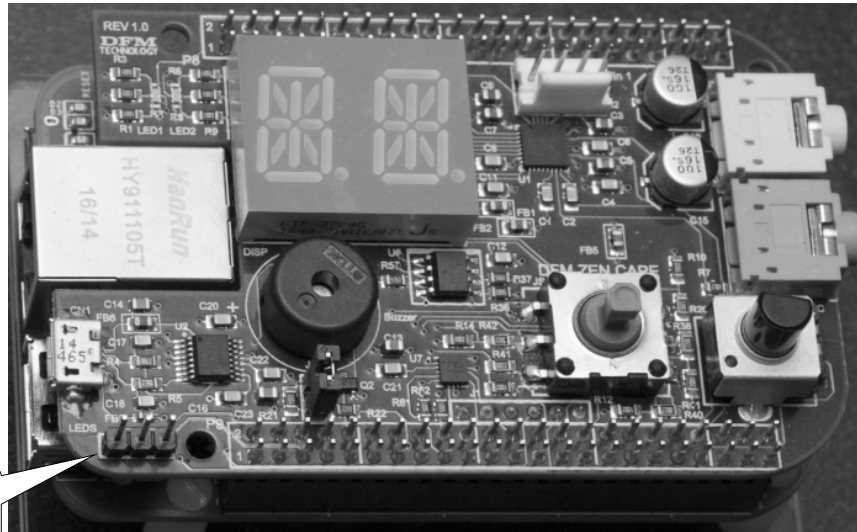
Actual Wave



Frame

- Send a single “frame” to show on the LEDs (RGBW values for all pixels)
 - Shift in all bits, for all pixels, one at a time.
 - Send the last LED’s values first (shifts through all)
 - Send data in the sequence R, G, B, W (8-bit each)
 - Send the high-bit first
- After sent whole frame, signal a RESET
 - Pull data line low for $\geq 50\mu\text{s}$
 - LEDs don’t show their new colour until they see RESET

Wiring Up



LEDS header
Pins [1, 2, 3]



LED Pin 2
or P8.1

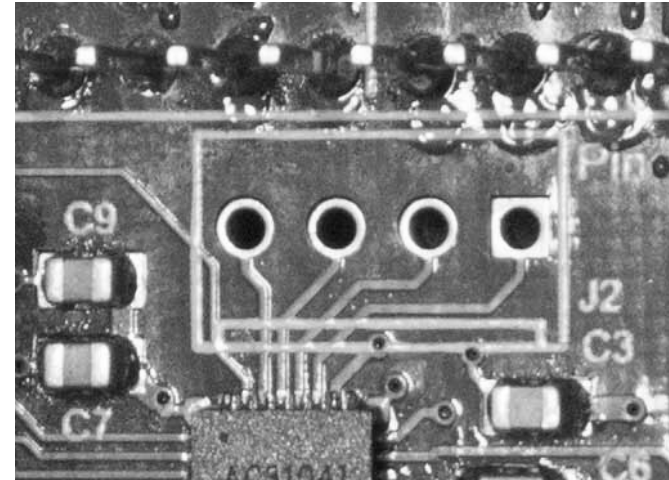
LED Pin 1
or P8.11

P9.7

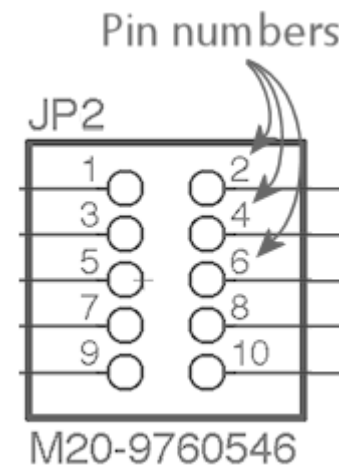
Not connected

Pin Counting Aside

- Square pin indicates pin 1 (Or circle, or triangle on board)



- On headers with 2 rows, count across first



Review Questions

- How is one wire used to send data?
- How many pulses are needed to drive 8 RGBW LEDs?
- What is the purpose of holding the data line low for $>50\mu\text{s}$?

- Links
 - NeoPixel Parts
 - Data sheet
 - Info on using NeoPixel