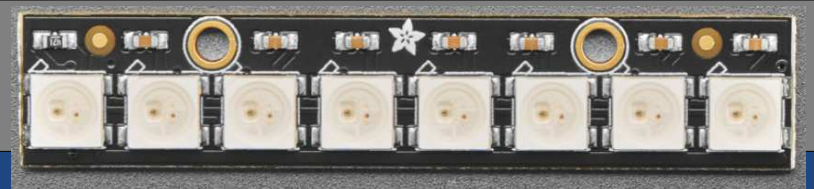


# PRU Control of NeoPixel

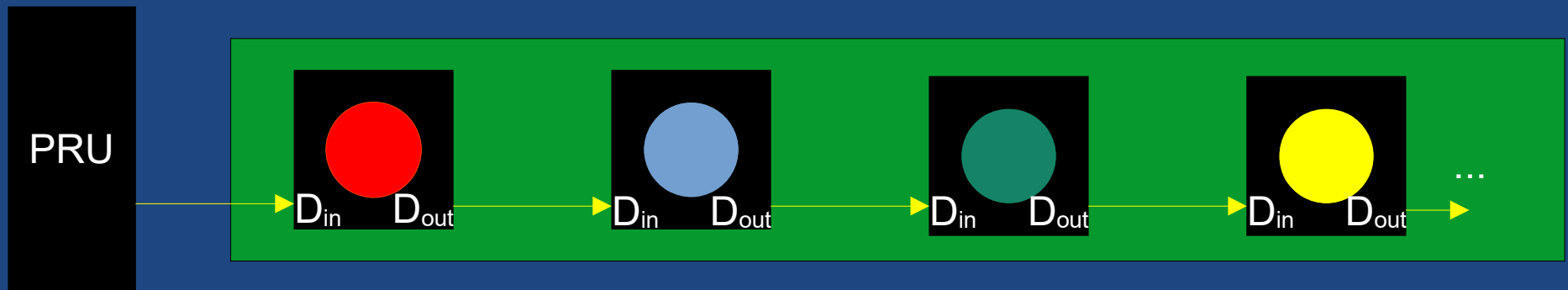


- 1) How can we drive **RGBW** LEDs (**NeoPixel**) from the BeagleBone?

# About the NeoPixel

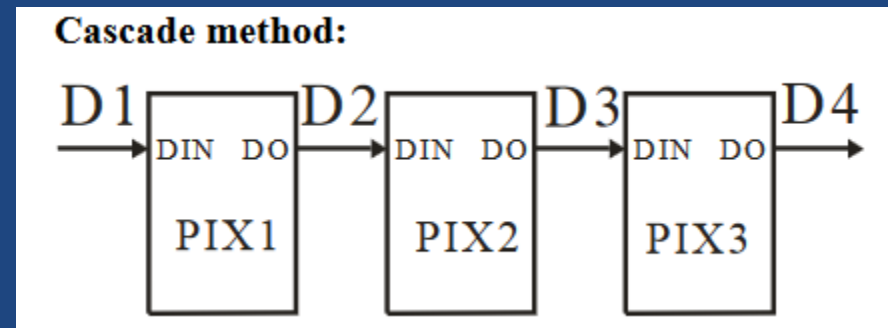
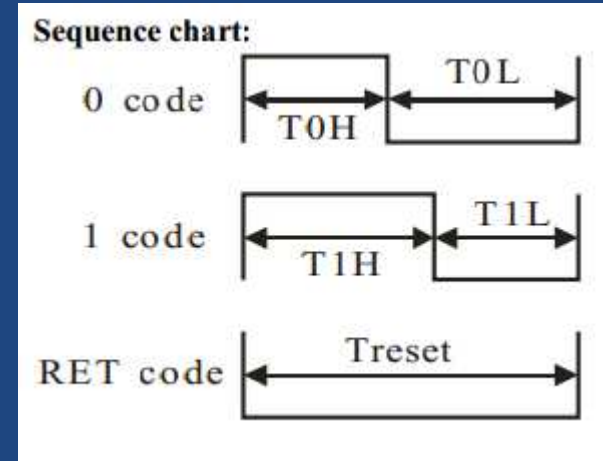


- Adafruit makes RGB LEDs called NeoPixel
  - Uses a 1-wire protocol  
(Features WS2812B or SK6812 LED driver)
  - Pixels have  $D_{in}$  and  $D_{out}$  daisy chained:  
As data is shifted into a pixel, it simultaneously shifts old data.
  - Designed for 5V, but works on 3.3V!  
 $D_{in}$  signal can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

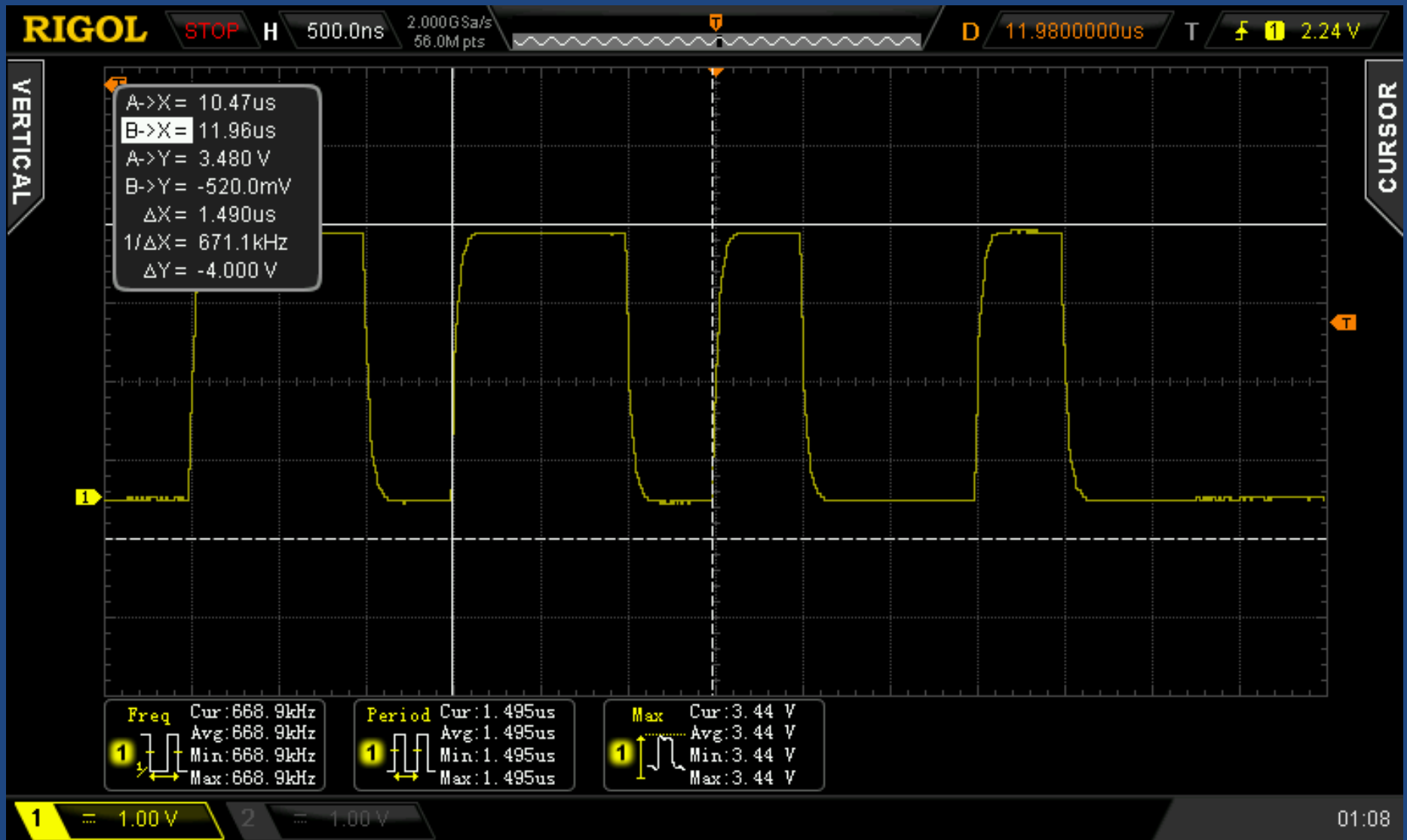


# 1-Wire Protocol

- 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



# 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

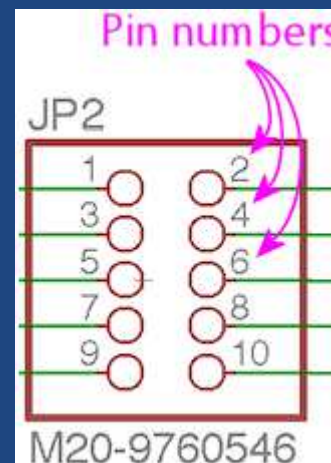
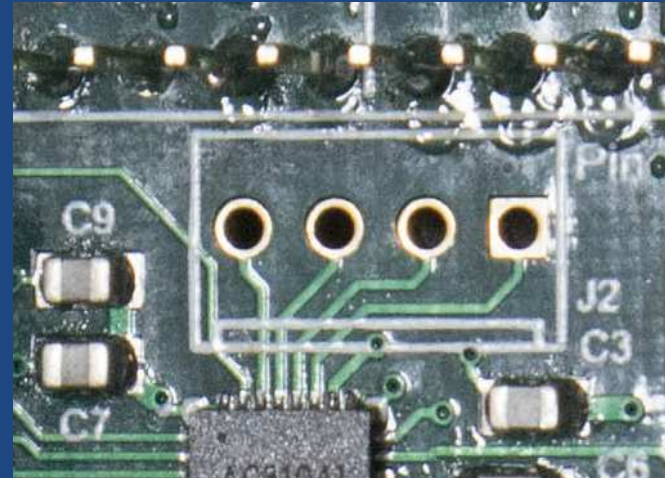
**LED Pin 1**  
or P8.11

**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 >50us**?
  
- Links
  - [NeoPixel Parts](#)
  - [Data sheet](#)
  - [Info on using NeoPixel](#)