Electronics
LED Strings

Terry Sturtevant

Wilfrid Laurier University

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## LED Strings

- **WS2812 Strings**
- **APA102 Strings**
- **SK9822 Strings**

These are becoming common in displays. They are composed of multiple LEDs, often RGB, with individual controls. All of the LEDs in a string are connected in sequence, so that instructions cascade through.
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All of the LEDs in a string are connected in sequence, so that instructions *cascade* through.
WSB2812 LED
WSB2812 string
APA102 LED
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SK9822 LED
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WS2812 Strings
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Single wire protocol
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Single wire protocol

0-0.4\,\mu\text{s} \text{ HIGH}; 0.85\,\mu\text{s} \text{ LOW}
WS2812 Strings

Single wire protocol

0-0.4μS HIGH; 0.85μS LOW
1-0.8μS HIGH; 0.45μS LOW
WS2812 Strings

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0-0.4 $\mu$S HIGH; 0.85 $\mu$S LOW

1-0.8 $\mu$S HIGH; 0.45 $\mu$S LOW

(Above times ± 0.15 $\mu$S )
WS2812 Strings

Single wire protocol
0-0.4μS HIGH; 0.85μS LOW
1-0.8μS HIGH; 0.45μS LOW
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24 bit colour; 8 bits for each of GRB
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Data transmission is MSB first in GRB order.
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(Above times \( \pm 0.15\mu \)S)

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\textbf{RESET} \( \geq 50\mu \)S LOW between data frames
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**APA102 Strings**

Two wire protocol

Bit read on LOW to HIGH clock transition

24 bit colour; 8 bits for each of BGR

5 bit intensity

Data Frame is 111 followed by 5 bit intensity followed by 24 bit colour; 8 bits for each of BGR, MSB first

One Data Frame per LED

Data between Start Frame (0x00) and End Frame (0xFF).

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APA102 Strings

Two wire protocol
APA102 Strings

Two wire protocol

Bit read on LOW to HIGH clock transition
APA102 Strings

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APA102 Strings

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One Data Frame per LED
APA102 Strings

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SK9822 Strings
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Two wire protocol; similar to APA102
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