

# Embedded Systems Design Project

**PROJECT TITLE: - NEO PIXEL JEWEL**

**Group members:**

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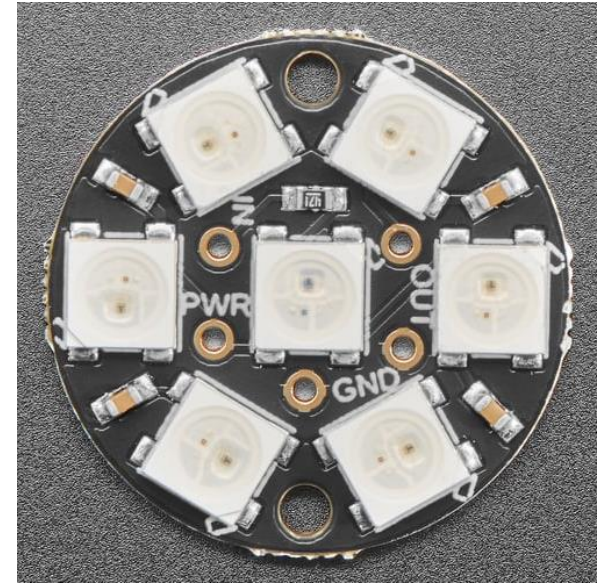
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# NeoPixel Jewel -7 x RGB LEDs

- The NeoPixel Jewel is a compact module featuring 7 individually controllable RGB LEDs.
- Each LED is a 5050-sized SMD with integrated drivers, allowing for customizable colors and patterns.
- The LEDs are 'chainable' by connecting the output of one Jewel into the input of another. There is a single data line with a very timing-specific protocol.



- Each pixel of the three primary color can achieve 256 brightness display, completed 16777216 color full color display, and scan frequency not less than 400Hz/s.
- The data transfer protocol use single NZR communication mode

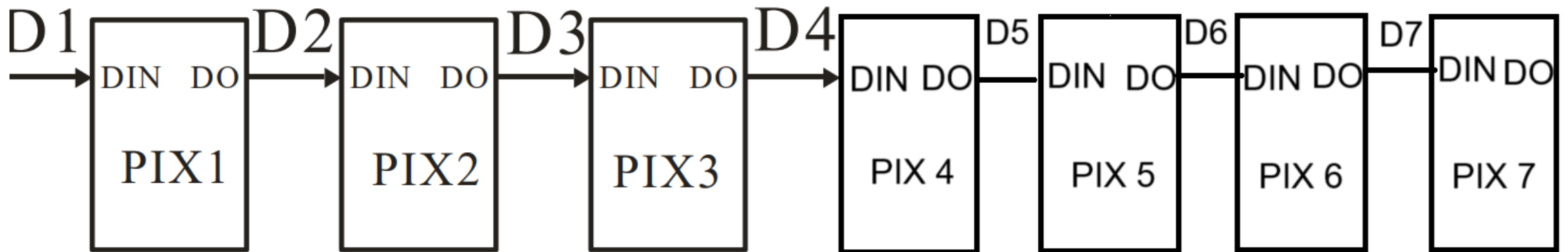
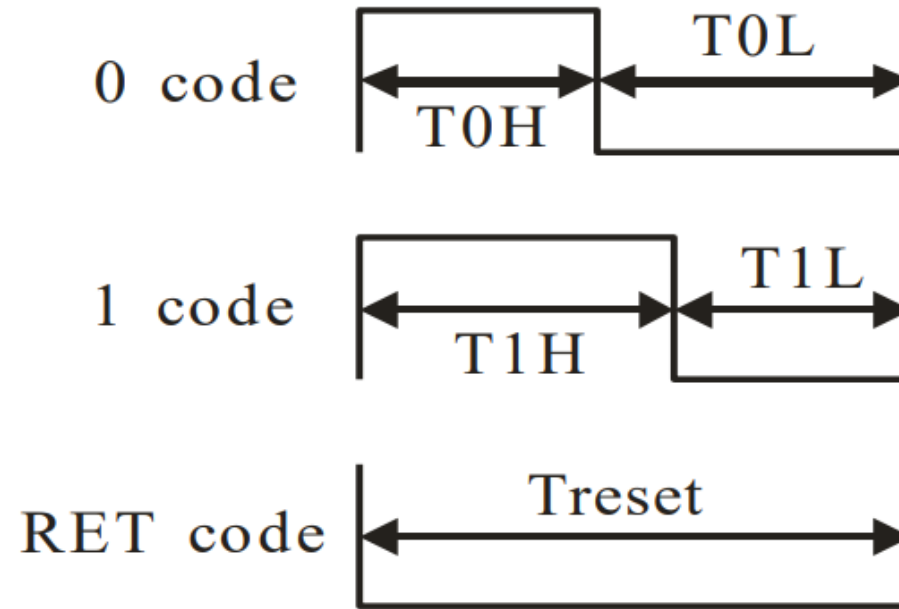


Fig:- Cascade Method

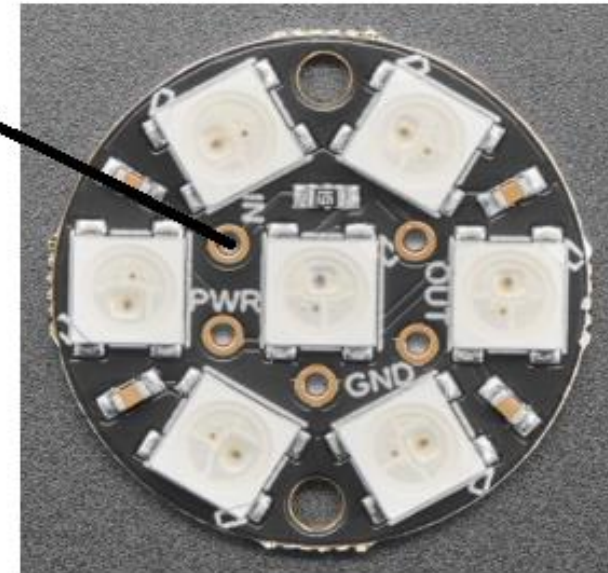
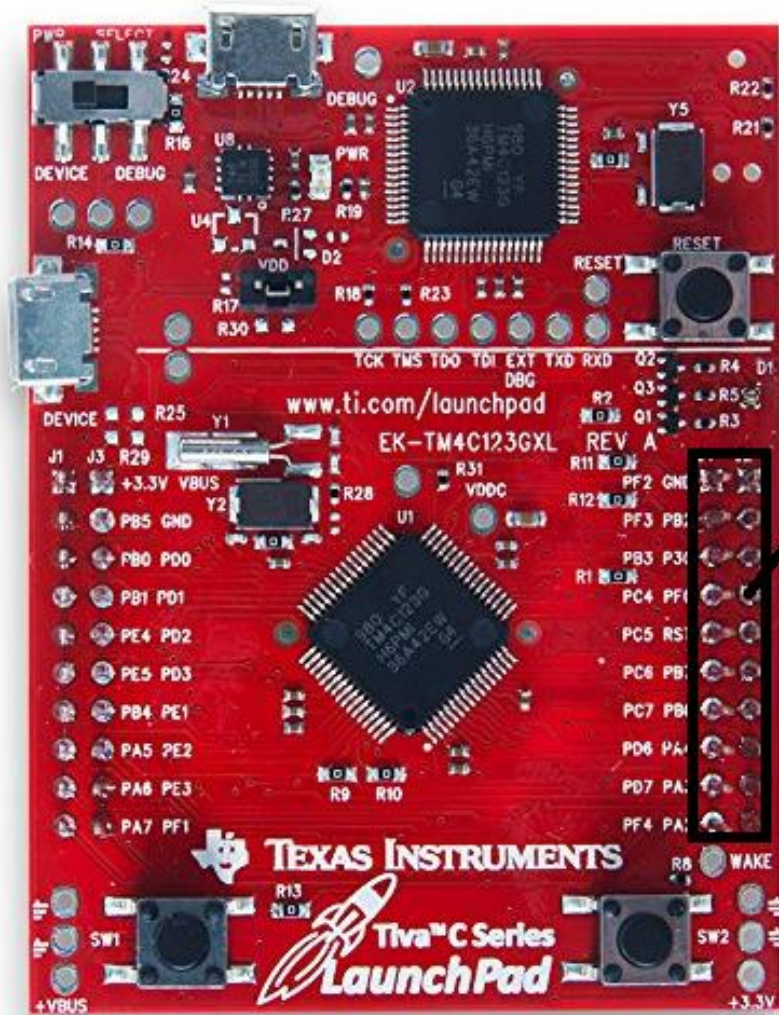
# How each bit Processed in NeoPixel



**Data transfer time(  $T_H+T_L=1.25\mu s\pm 600ns$ )**

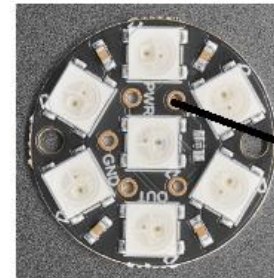
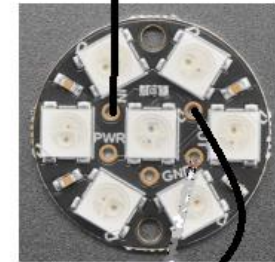
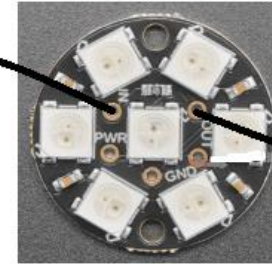
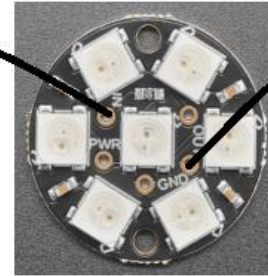
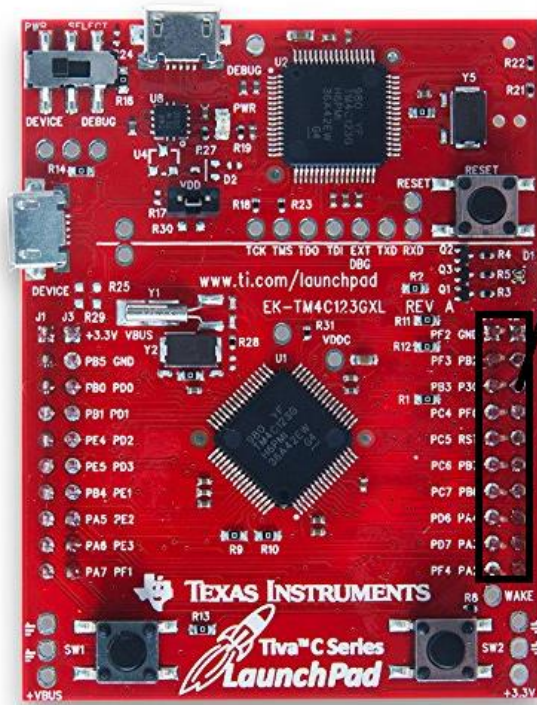
T0H	0 code ,high voltage time	0.4us	$\pm 150ns$
T1H	1 code ,high voltage time	0.8us	$\pm 150ns$
T0L	0 code , low voltage time	0.85us	$\pm 150ns$
T1L	1 code ,low voltage time	0.45us	$\pm 150ns$
RES	low voltage time	Above 50 $\mu s$	

# Microprocessor + One LED





# Microprocessor + 4 LED



# Approach

## Bit Banging:-

- Bit banging refers to manually controlling a communication protocol or interface by directly manipulating individual bits, rather than relying on hardware peripherals.
- In the context of NeoPixel project, bit banging can be a method used to control the NeoPixel LEDs without relying on specialized hardware like dedicated LED controllers.

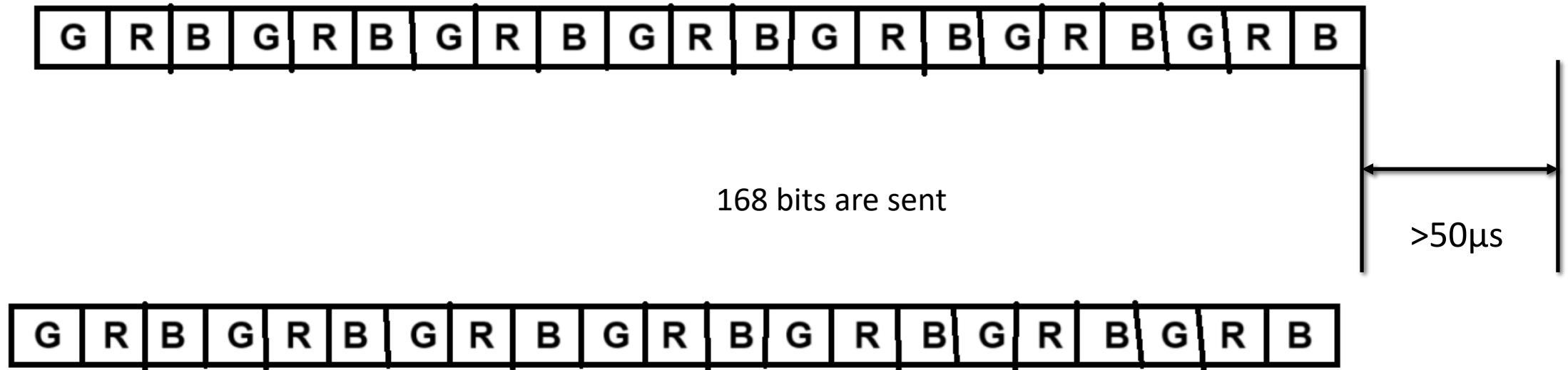
- Each LED take 24 bits of information:-

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0
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- Order is GRB.
- R-> 8bit
- G-> 8bit
- B-> 8bit



# How we Send Data



# Output Visuals

