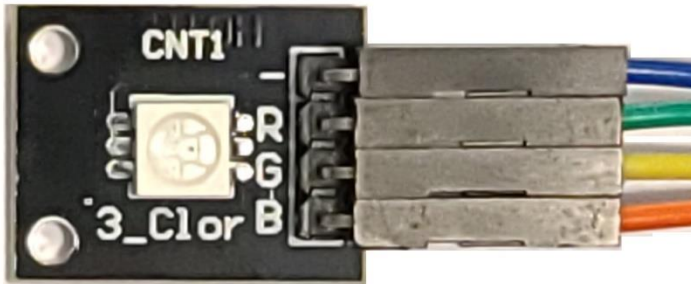


Description

This application note describes how to pulse width modulate, PWM, an RGB LED such as the below SM166-KY009-LED module on the Amp8DB2 Demonstration Board.

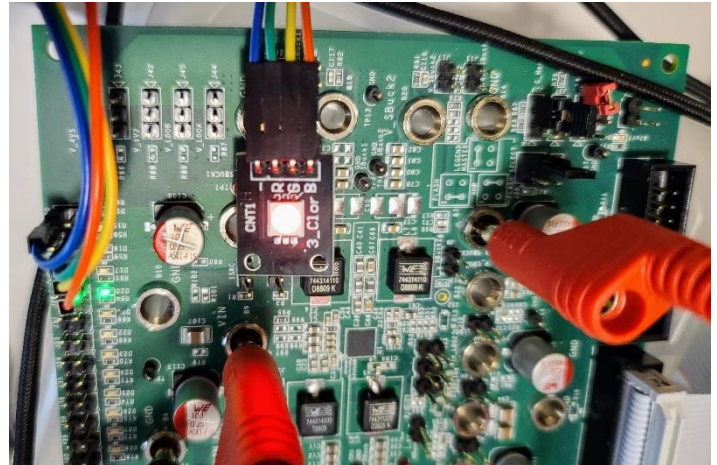
SM166-KY009-LED module



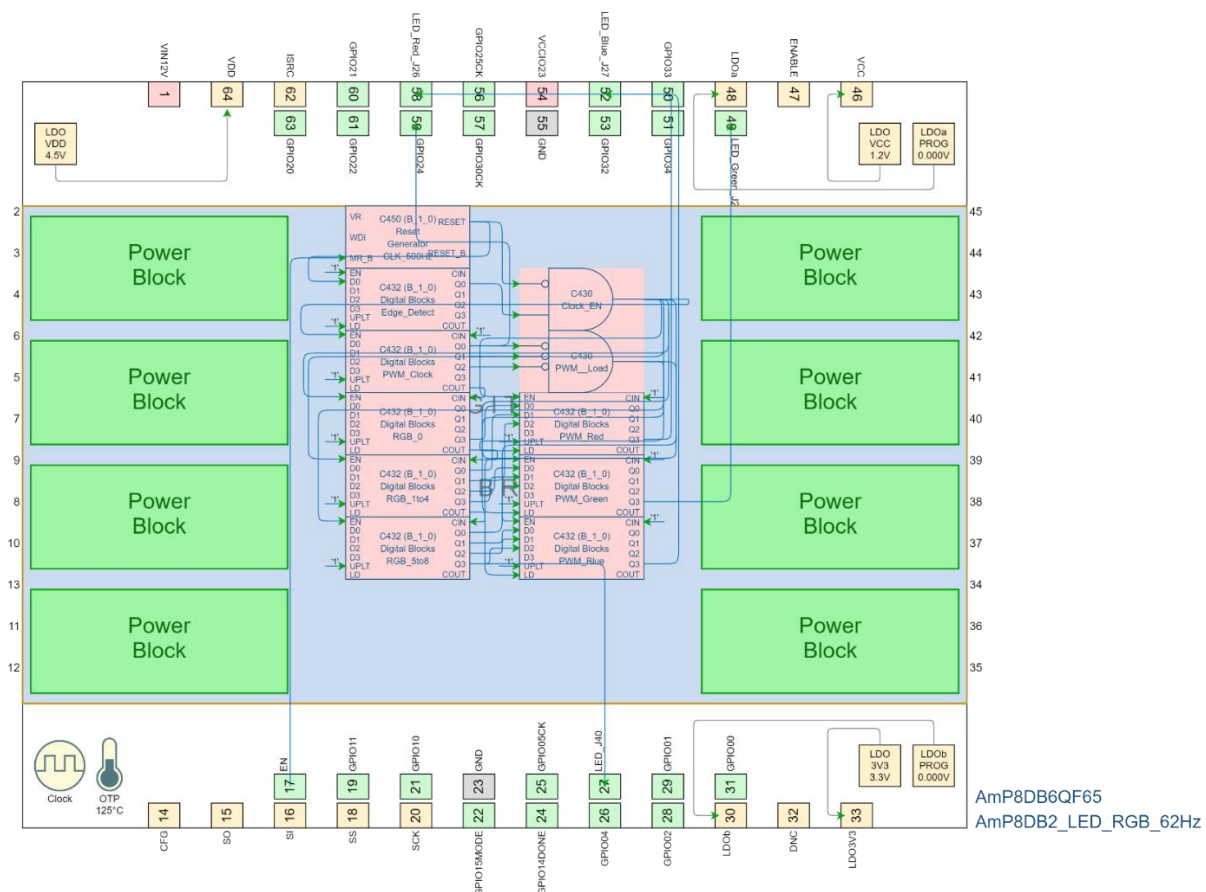
Each of the RED, GREEN and BLUE LEDs are pulse width modulated at 0%, 12.5%, 25%, 37.5%, 50%, 62.5%, 75%, and 87.5% of a 62.5 Hz refresh rate. Beginning with the RED LED incrementing through the 8 PWM values, next, the GREEN LED PWM increments once for every 8 RED LED increments and finally the BLUE LED increments once for every 8 GREEN LED increments.

This results in 8 times 8 times 8 total combinations for a total of 512 RGB colors. The duration of each combination is 0.256 seconds so that the entire 512 color sequence takes 131 seconds when implemented on the Amp8DB2 Demonstration Board below. The project file is available on page 4 Reference.

AmP8DB2 Demonstration Board



WebAmP view of RGB LED Controller state machine



Parameter Settings

The C450 Reset Timer is used to create a 2 ms period, 500 Hz clock as follows:

- Set Delay Time to 1 ms
- Set Watchdog Timeout to 1 ms
- Disable Voltage Supervision

Reset Generator

Invert MR_B ☐

Invert WDI ☐

Delay Time ms

Watchdog Time Out

Target Delay ms	Actual Delay ms
<input type="text" value="1"/>	<input type="text" value="1"/>

☐ Enable Voltage Supervision

Threshold Voltage V

RGB_PWM_62Hz Resource Usage

Resource Usage...

```

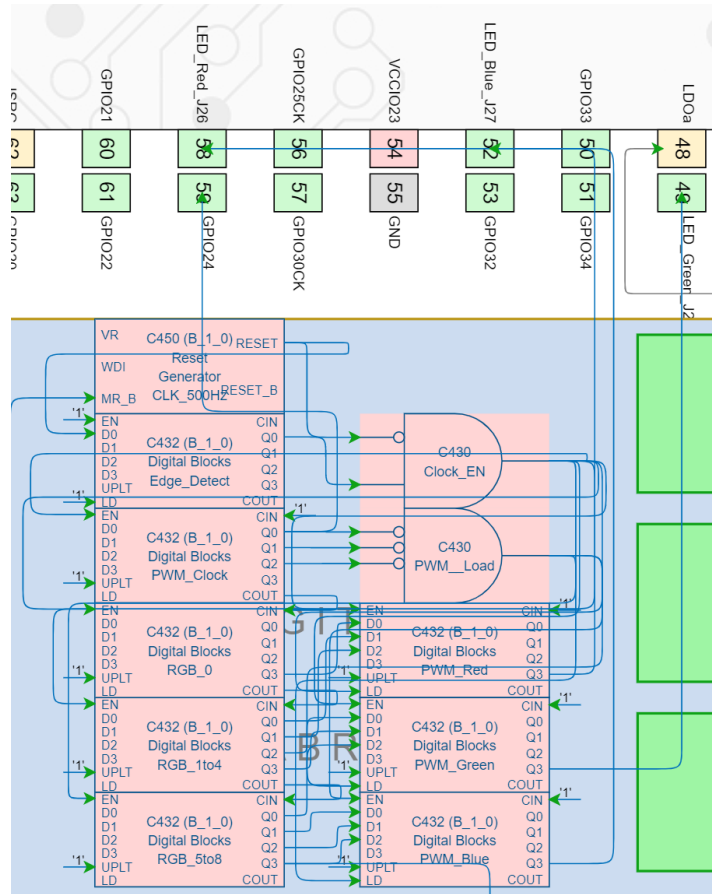
io      6 used (Capacity 24)
clb     8 used (Capacity 64)
pmt     1 used (Capacity 16)
ptg     1 used (Capacity 2)
uLogic  58 used (Capacity 512)
  
```

GPIO Current, Voltage Measurements

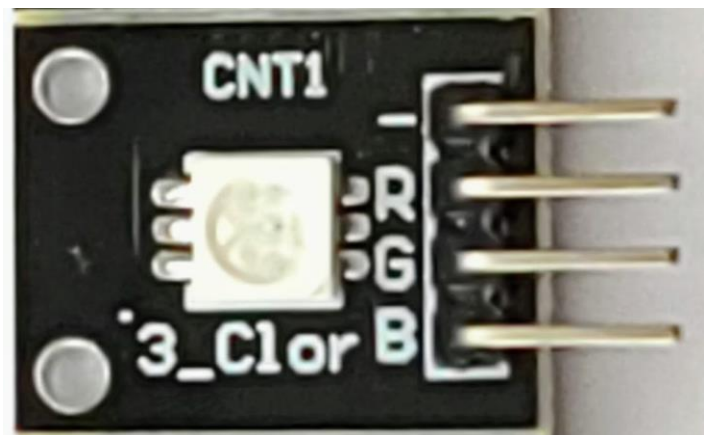
	B	R	G			mA	V	
0	0	0	0					
1	0	0	1	G	G	11	2.67	
2	0	1	0	R	R	18	2	
3	0	1	1	Y	G+R	29		
4	1	0	0	B	B	7	2.96	
5	1	0	1	C	B+G	18		
6	1	1	0	M	B+R	24		
7	1	1	1	W	B+R+G	35		

Design View

The C450 Reset Timer provides the 500 Hz clock to drive the 3-bit PWM counter, the 4-bit duration counter, the 9-bit RGB counter and the RED, GREEN and BLUE PWM 4-bit counters as follows:



SM166-KY009-LED-MD Module



5050 SMD LED Specifications

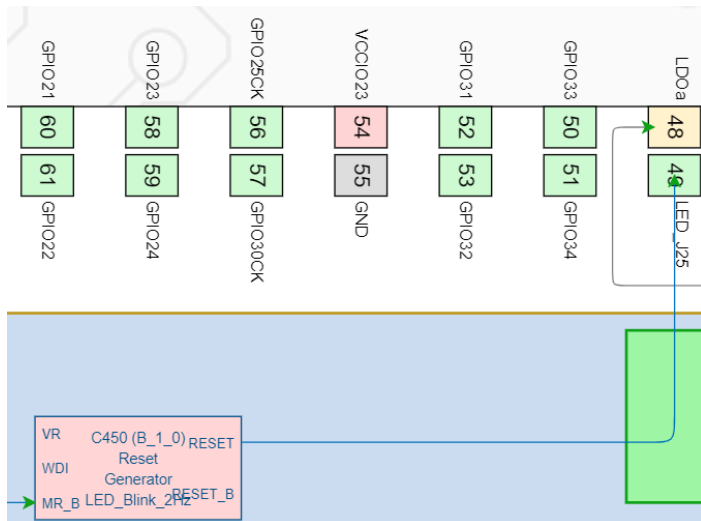
- Operating Voltage 5V max
- Red 1.8V ~2.4V
- Green 2.8V ~ 3.6V
- Blue 2.8V ~ 3.6V
- Forward Current 20mA ~ 30mA

Basic LED Examples

Basic includes Blink, Count and Shift examples to demonstrate use of the C430 AND gate, C430 NOR gate, C432 DFF4, and C450 Reset Generator. Project files are available on page 4 Reference.

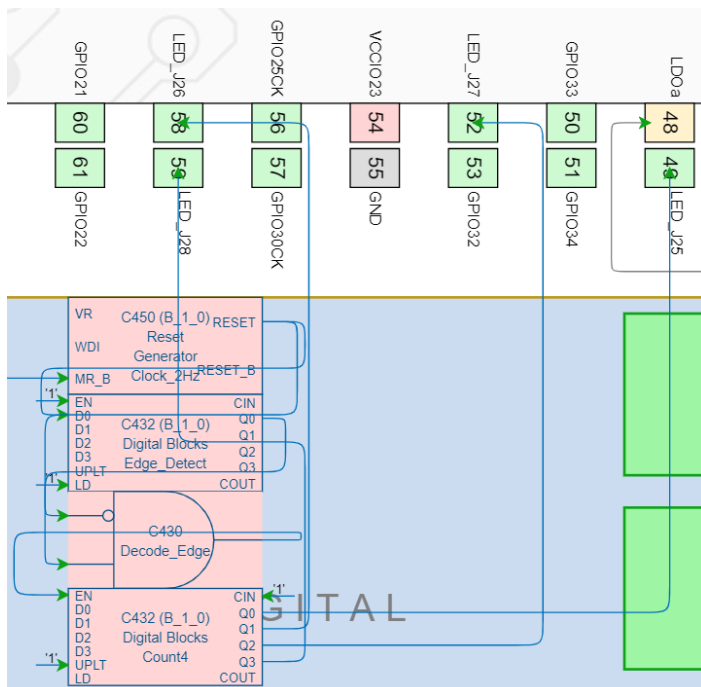
Blink

When enable EN, Pin 17, GPIO13 is asserted high (AmPLink CTRL), a single LED at J25 blinks at a 2Hz rate. Use this simplest example for “Hello World” test check.



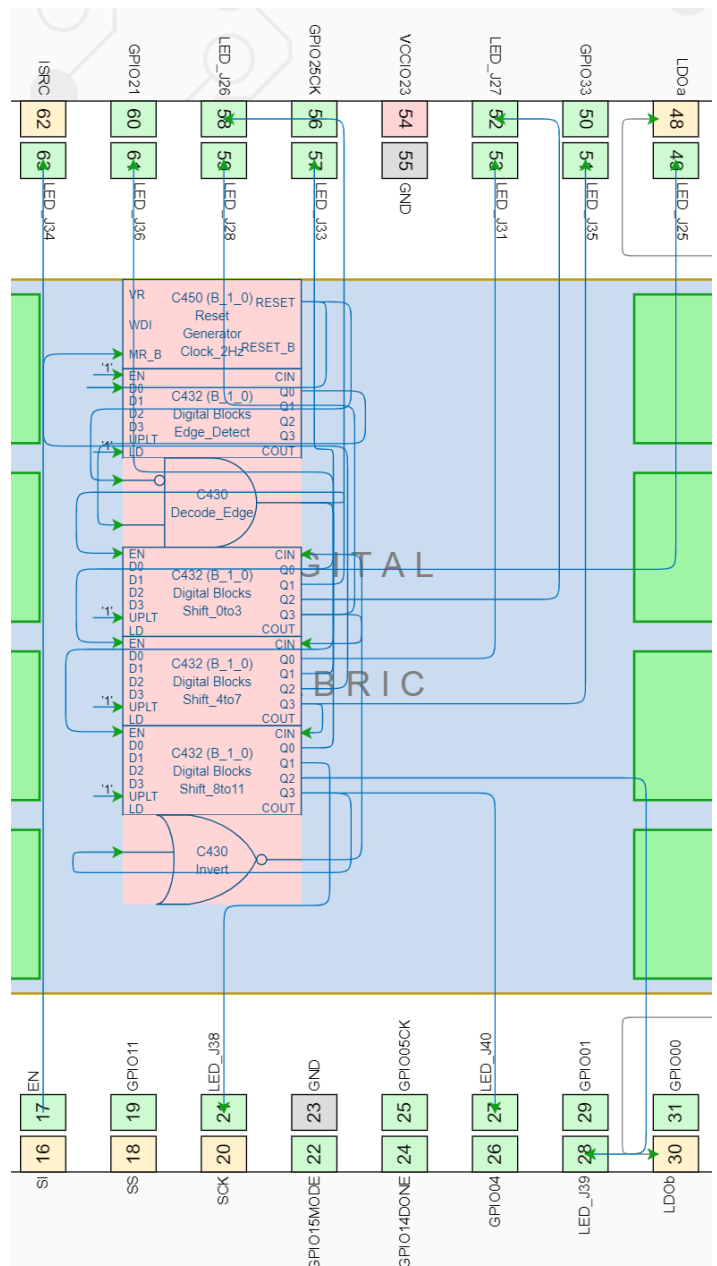
Count

When enable EN, Pin 17, GPIO13 is asserted high (AmPLink CTRL), four LEDs at J25, J26, J27 and J28 will produce a 4-bit count pattern at a 2Hz rate.



Shift

When enable EN, Pin 17, GPIO13 is asserted high (AmPLink CTRL), four LEDs at J25, J26, J27, J28, J31, J33, J34, J35, J36, J38, J39 and J40 will produce a 12-bit shift pattern at a 2Hz rate.



Reference

[AmP8DB2 DemoBoard User Guide](#)

[AmP8DB2 LED RGB 62Hz Design Project file](#)

[AmP8DB2 LED Blink 2Hz Design Project file](#)

[AmP8DB2 LED Count 2Hz Design Project file](#)

[AmP8DB2 LED Shift 2Hz Design Project file](#)

Revision History

Date	Revision
12/24/2020	Preliminary release



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