Animated LED lighting, LLC

P4804

Daisy Chain Board

Features and Benefits

Vin Range: 5.3Vdc to 14Vdc supply

Four independent MOSFET Drivers

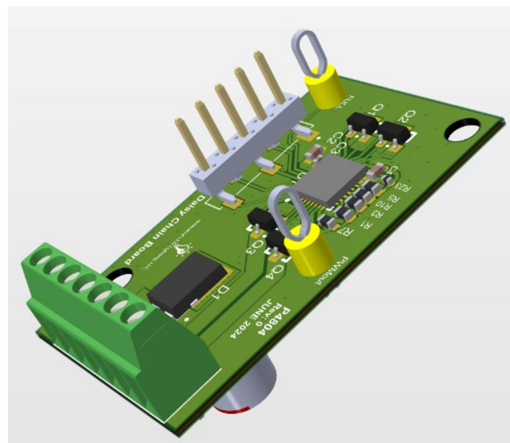
Four independent PWM dimming inputs set by microcontroller

Combine multiple daisy chain boards together in parallel to increase the number of LED strings using a 5-pin connector.

The A80804 LED driver provides extensive fault protections: Drain short-to-ground protection, Drain short-to-VIN protection, Open LED detection, Thermal protection Programmable input UVLO protection

Applications:

Drive RGBW LED strip lights for holiday lighting, patio lighting, safety lighting and general lighting applications.



Description:

The Daisy Chain board was designed to extend your LED strip lights from a microcontroller module. It is designed around the Allegro MicroSystems A80804 linear LED driver and provides a five-pin header for connecting multiple boards in a daisy chain fashion.

The Daisy Chain board provides dc power to the generic LED strip and uses Pulse Width Modulation (PWM) to regulate the current in the four independent output channels.

Dimming of the output channels can be controlled by the pulse width of each channel independently and further dimming can be achieved by using a resistor divider on the ADIM1 pin, or applying a voltage directly to the ADIM1 pin. A FULL pin on the Daisy Chain board can be pulled high to achieve maximum intensity level.

A single Daisy Chain board can drive three simple RGBW 16.4ft LED strips connected in series for a total of 49.2ft of LED strips without the use of power injection. Multiple Daisy Chain boards can be connected in parallel using the five pin connector to increase the total number of LED strips. Each Daisy Chain board will require a separate connection to a power supply.

Refer to the Allegro MicroSystems A80804 datasheet for more detailed information,

Animated LED lighting, LLC

P4804
Daisy Chain Board

Contents

Animated LED lighting, LLC

P4804
Daisy Chain Board

Selection Guide

Part Number	Vsupply	# of RGBW LED strips	Ind. Addr. LEDs	# of Outputs	# of Sensor inputs	Comm.	Conn.
P4804	+12Vdc	3	-	4	-	PWM	Screw Block

Absolute Maximum Ratings

Input Supply		**Min**	**Typ**	**Max**	**Unit**
Operating input voltage	Raw board	7.6	12	14	V
Isupply	Raw board	7.51	9.2	10.0	mA
Isupply	LEDs + board	9	208	2667	mA

Terminal Diagrams

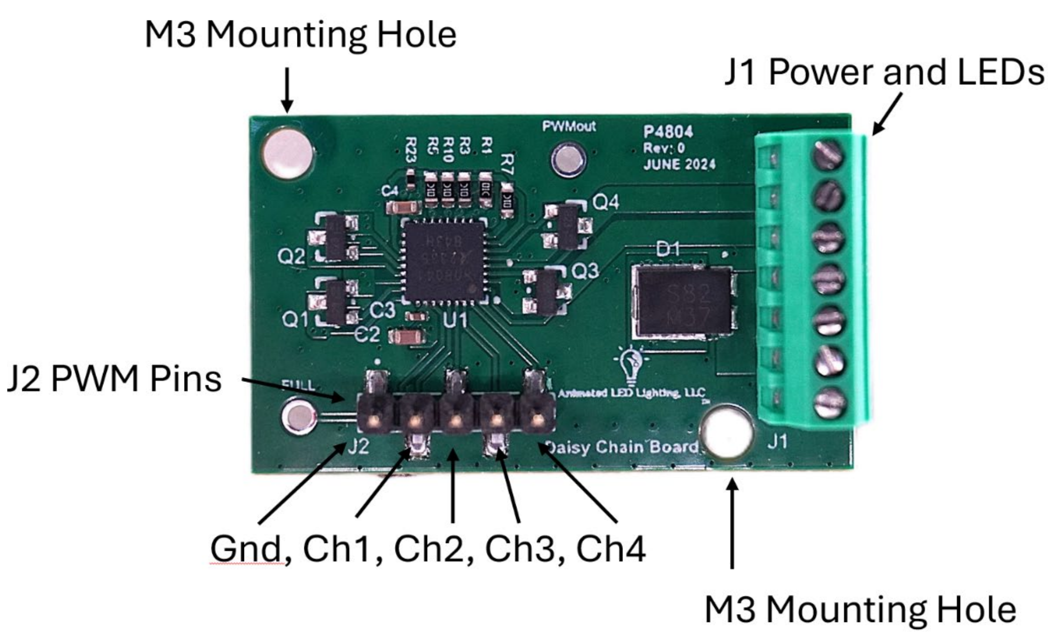


Figure 2, Connectors of the P4804 board

P4804
Daisy Chain Board

Functional Block Diagram

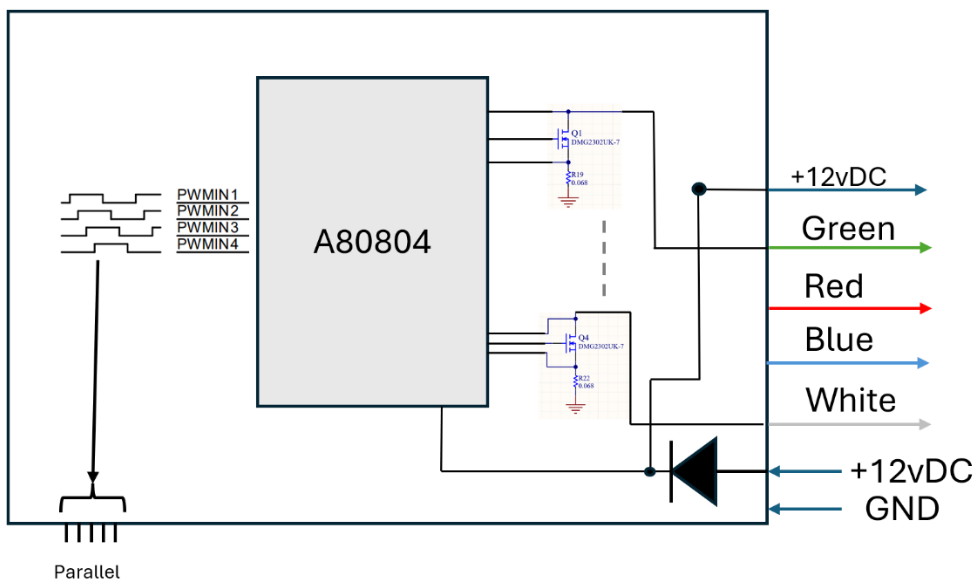


Figure 3, Functional Block Diagram

Electrical Characteristics

Input Supply		Min	Typ	Max	Unit
Operating input voltage	(Voltage applied to pins 12 and 6 of J1)	5.3	12	14	V
Supply Current	Isupply (Raw Board)	-	-	10	mA
	Isupply (PWM=0%)	7.5	8.2	11.76	mA
	Isupply (PWM=100%)	-	-	2667	mA
Startup Time		-	100	-	us
Channel Current					
Vref	Rsense voltage per channel	196	200	206	mV
Ireg	Peak current per channel	640	667	693	mA
PWMpins					
PWMrise/fall times	Between 10%-90%	-	20	-	us
PWMx	Vil	0.8	-	1.1	V
PWMx	ViH	1.5	-	2	V
Propagation delay	Tpde, delay from PWMINx to PWMout	-	2	-	Us
PWM Frequency	Freq.	200	-	1000	Hz
PWM duty cycle	Duty	5	-	100	%

Animated LED lighting, LLC

P4804

Daisy Chain Board

Functional Description

The P4804 is designed to work as an extension of a microcontroller shield board.

As an extension board, the four input channels receive PWM signals through a 5-pin header on top of the board. The duty cycle of these pins determines the amount of ON time each channel will have. A 5% duty cycle will be a minimum current or virtually OFF and a 100% duty cycle will be maximum current or maximum ON. Any variation between 5-100% will result in an average current and a varied intensity of each channel. Varying the duty cycle of multiple channels at the same time allows for the variation of colors from an RGBW LED strip and thus almost any color can be achieved. As an extension board, PWMout is non-functional and can be left floating.

A power source needs to be connected to pins 1 and 2 of the J1 connector.

For safety purposes, it is recommended to add an inline fuse between the power supply and the board equal to or slightly less than maximum expected current draw to prevent fire hazards.

The power source provides power to the RGBW LED strip through the board and needs to have a sufficient power rating to accommodate maximum power of a 100% duty cycle on all four channels simultaneously. The maximum power can be calculated by adding all the current ratings for each channel together and multiplying by the supply voltage. This will provide the total power supply needed in watts.

NOTE: DO NOT EXCEED the supply voltage rating for your particular LED strip as recommended by the manufacturer.

LED Current Sense Resistor

Sense resistors on each channel set the LED peak current and have been set to a value of 300mohms. Using the equation in the A80804 datasheet, Iledpk is equal to Vsense/Rsense.

Equation 1:

$$I_{LEDpeak} = V_{SENSE} / R_{SENSE}$$

Animated LED lighting, LLC

P4804
Daisy Chain Board

The value of Vsense is set at 200mv and therefore divided by 300mohms, the current is set at a max peak value of 667 milliamps per channel.

Do NOT exceed this limit or it may cause a fire. Observe all manufacturers' specifications for your particular model of LED strips.

The average current in each individual channel is much less than the peak current in each channel. With a PWM signal, the ON time of each channel compared to the OFF time results in an average current during each cycle of the PWM frequency (976Hz). The average current for each channel as measured through a 1 ohm resistor is shown in the graph below. Using a PWM signal results in less power needed to run LED lights, making the LED light strip more energy efficient. The A18804 can successfully run 49.4 feet of generic LED RGBW strips without the need for power injection.

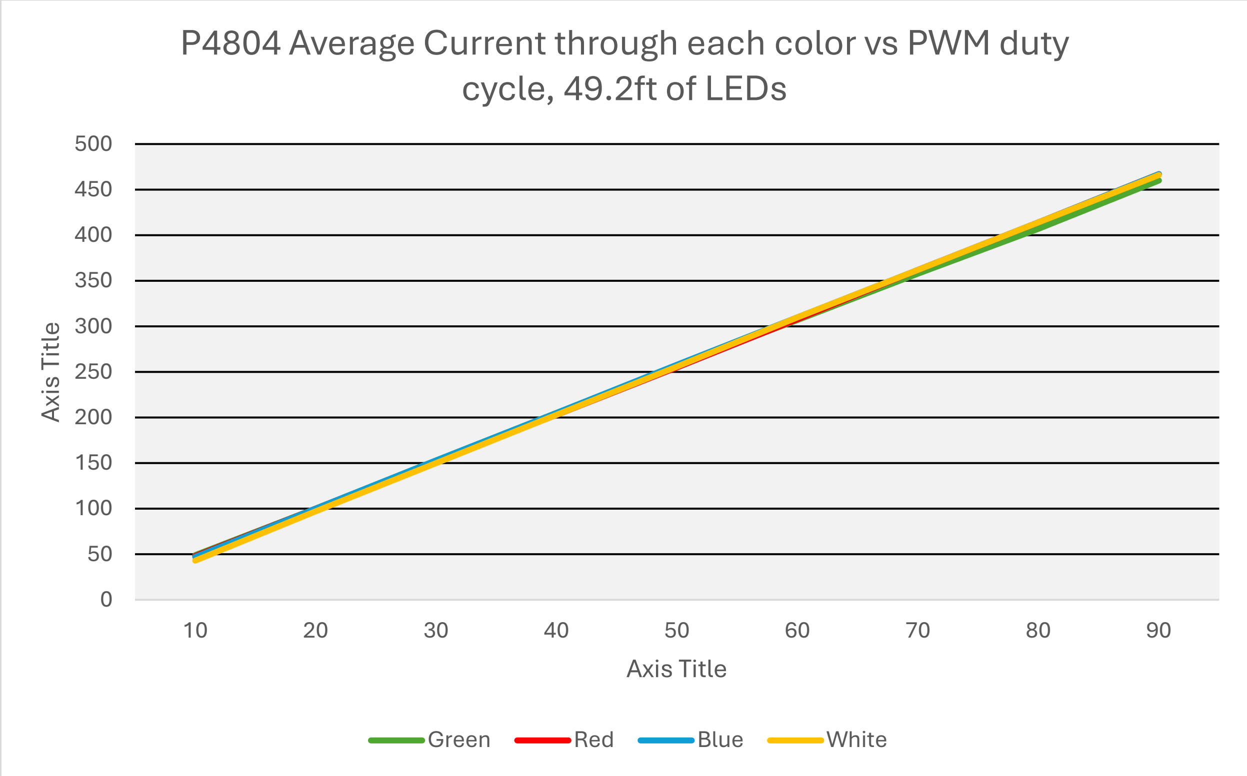


Figure 4, Current through each color of 3 RGBW LED strips in series (49.2ft)

P4804
Daisy Chain Board

The P4804 can successfully run 49.2 feet of generic LED RGBW strips without the need for power injection

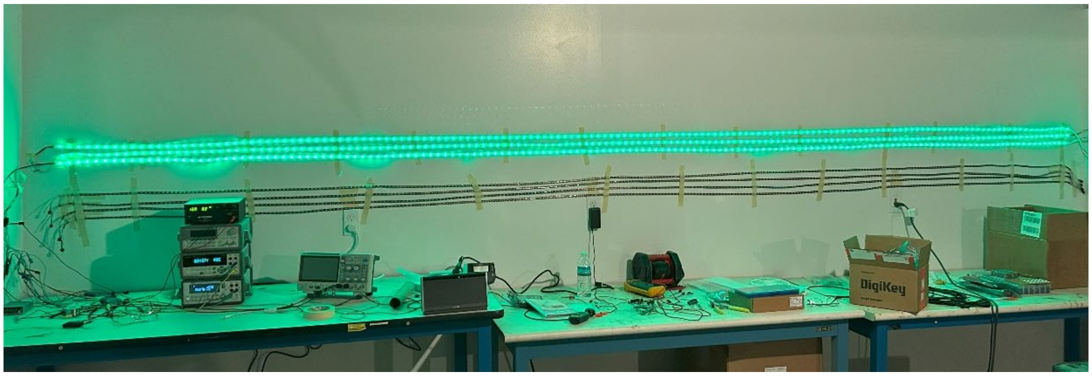


Figure 5, Lab testing of three 16.4 feet of RGBW LED strips in series (49.2ft).

PWM Pins

The PWM pins on the A80804 are logic-level pins and a logic high will turn on the output MOSFET to allow current to flow in each channel.

The PWM input pins for the P4804 Daisy Chain board are connected to J1. These pins were designed to connect the A18804 board for extending the lengths of the RGBW LED strips. Any logic signal can be connected to these pins for controlling the outputs as long as they remain within the 100 to 1000Hz frequency range and 0 to 12V input range. These PWM signals control the current passing through each string by increasing or decreasing the duty cycle. Increasing the duty cycle increases the individual strings intensity. The duty cycle range is from 0-100% and when controlled through software with a digital range setting of 0 to 255.

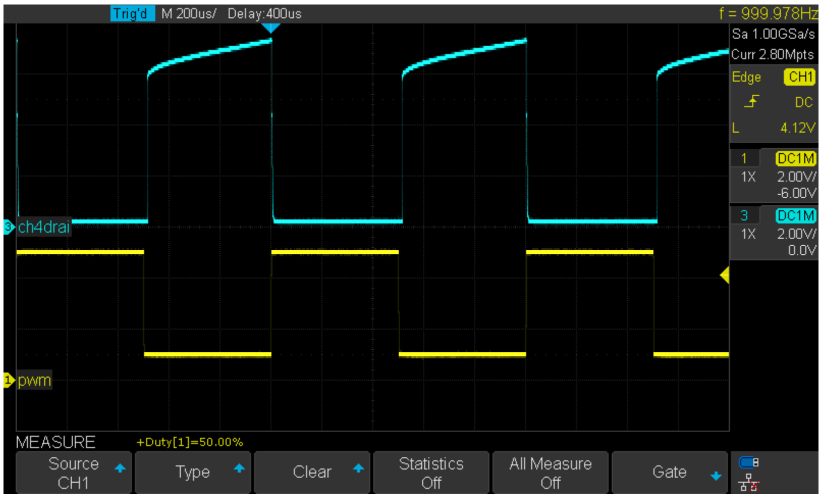


Figure 6, PWM signal at 50% Duty Cycle and Channel 4 Drain pin

The P4804 uses four external MOSFETs to handle power dissipation in each of the RGBW strings for the LED strip lights. The current in each channel is then regulated by sensing the voltage across the current sense resistors R19-R22. The maximum current per channel is set by the value of the sense resistor and can be changed for each individual channel. The sense resistor was set for the current limits of the recommended LED strips used during testing. The recommended LED strip part numbers are located at the end of this document. Other LED strips can be used but at the time of this publication, none have been tested. It is advised to read all the manufacturer's specifications for each particular LED strip and ensure safe operation by staying within the maximum limits per channel.

Analog Dimming with ADIM1

Further dimming of the LED strip can be achieved by applying a voltage on the ADIM1 pin to derate the peak LED current. This may be done for binning or other application requirements. In the P4804, a resistor divider created by R10 and R11 sets the dimming at 64%. This value can be changed by changing the resistor divider R10 & R11, see the A80804 datasheet for further information.

Protection Faults

The A80804 asserts a fault by pulling the nFAULT pin low when a fault has been detected for three consecutive PWM cycles. The device returns to normal operation immediately after the fault is removed.

Any faulted LED string will operate at a 5% duty cycle during the PWM on-time to minimize power dissipation in the MOSFETs.

When a fault occurs on one channel, the remaining channels will continue to operate normally. Only the faulted string will reduce the duty cycle to 5% until the fault has been cleared.

Typical fault conditions detected by the A80804 are Open LED, Drain short to ground and Drain short to Vin.

Stand Alone Application

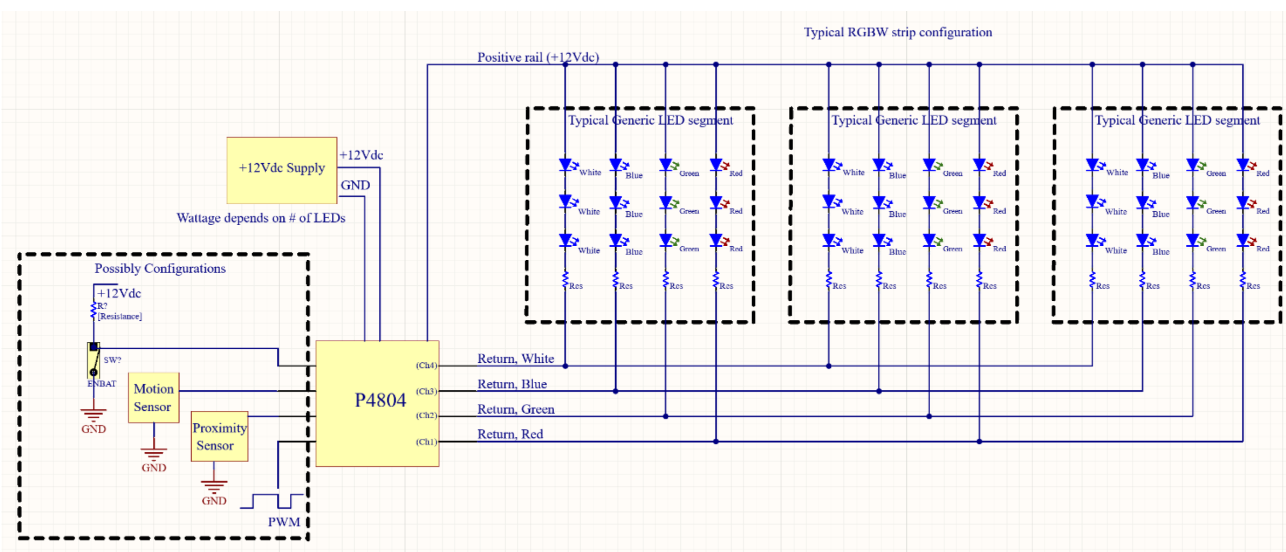


Figure 7, Stand alone application with possible input configurations

P4804
Daisy Chain Board

Daisy Chain Application

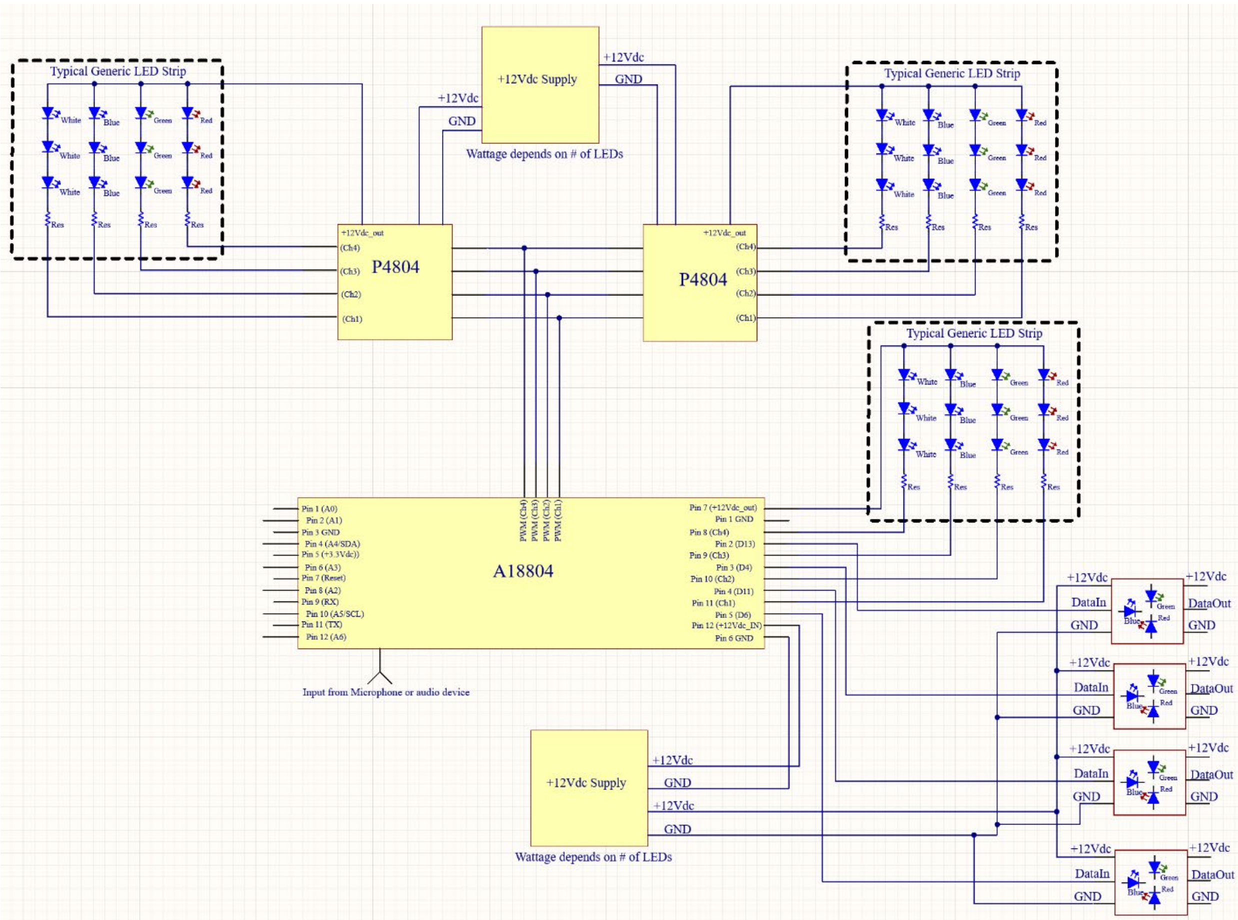


Figure 8, Daisy Chain application

LED Strip Configurations

Typical applications for generic LED strips consist of 3 LEDs in series with a current limiting resistor. The remainder of the strip is duplications of this configuration in parallel across the entire length of the strip.

Animated LED lighting, LLC

P4804
Daisy Chain Board

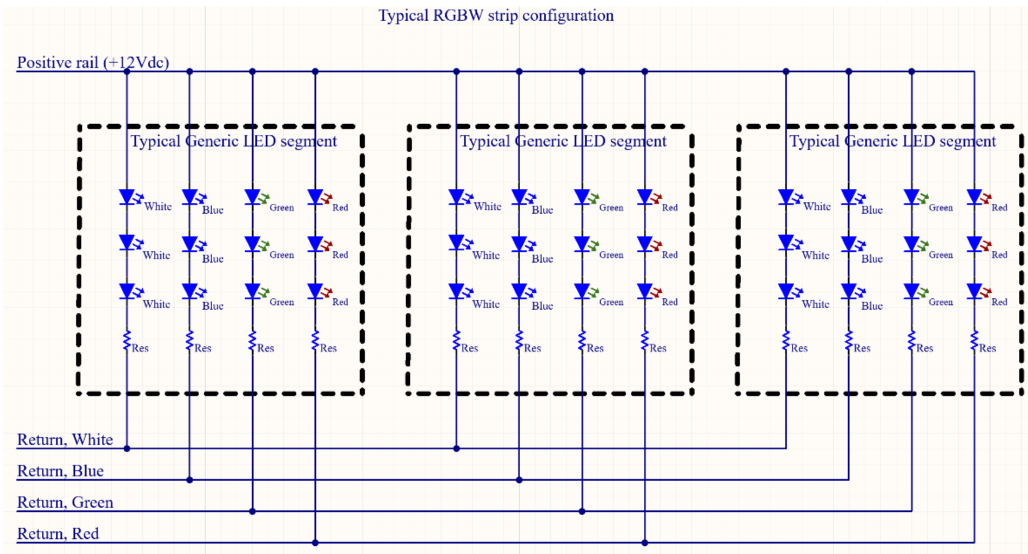


Figure 9, Typical RGBW LED Strip Manufacturing Schematic

Typical configurations of individually addressable LEDs consist of all LEDs connected in parallel to the power and ground pins, the data lines are connected in series from one LED to another across the entire length of the strip. NOTE: Data only flows in one direction, manufacturers place an identifying mark on the strip indicating which direction data will flow. Pay attention to these markings when connecting multiple strips together and when connecting to the A18804. The recommended product used for our testing is the: WS2815 DC12V LED Pixels Strip Light Dual-Signal 5M 60LEDs/M, IP65 Waterproof, White PCB

Part Number**: STW-E40K80-A6C-12B5M-12V**

These products are available from SuperbrightLEDs.com

Subscribe to our youtube channel for future videos on how to setup and use this product.

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P4804
Daisy Chain Board

Package Outline Drawing

Package dimensions are for reference only, slight variations in size may occur.

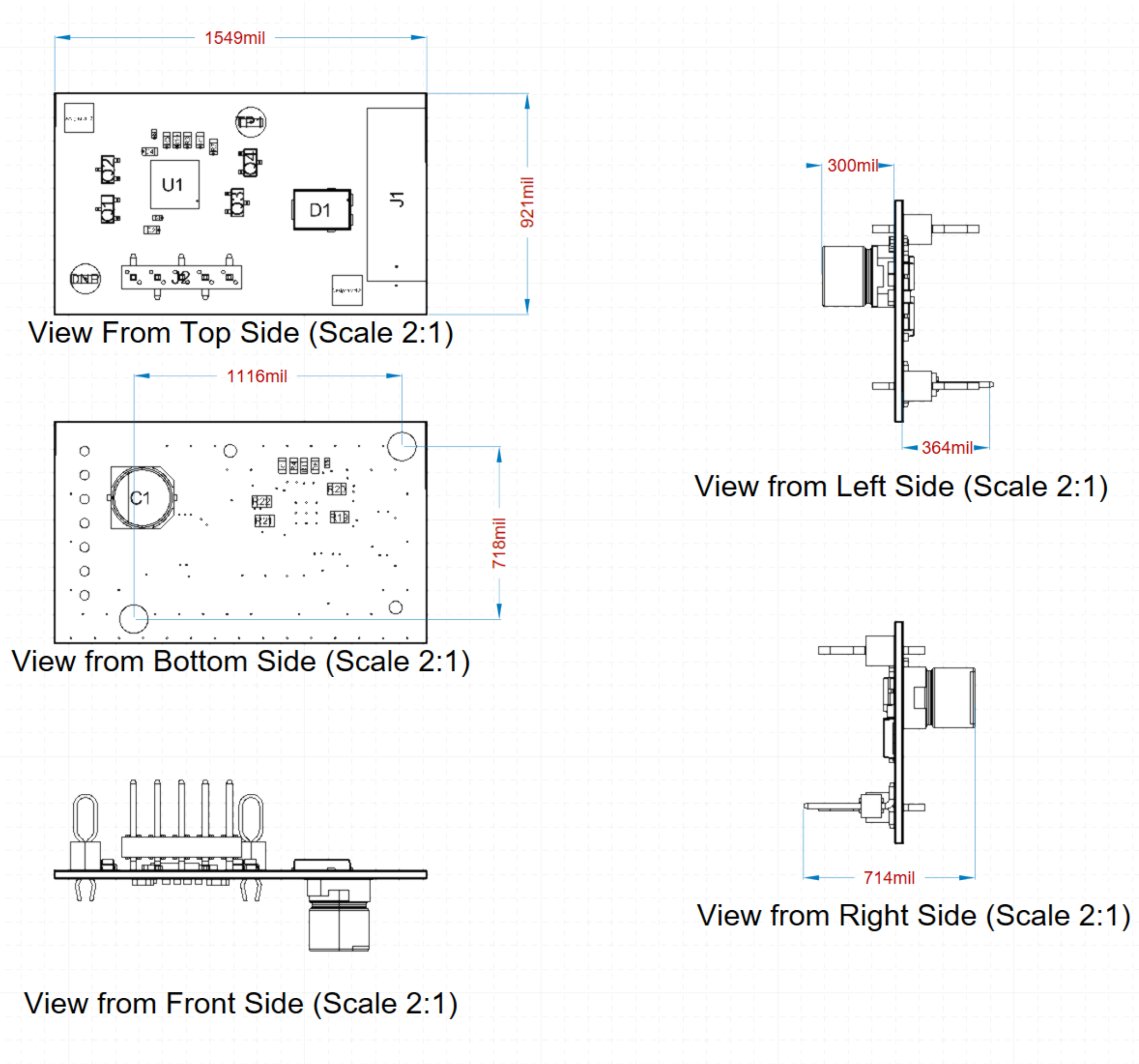

Figure 10, Package outline and Mechanical Views with Arduino installed

Animated LED lighting, LLC

P4804

Daisy Chain Board

Revision History

Number	Date	Description
0	August 1, 2024	Initial Release
1	August 4, 2024	Update maximum specifications table
2	September 5, 2024	Change the Rsense resistor to 0.3 Ohms, adjust peak currents and remove independent capabilities description.