User Guide
Low-Voltage High-Current LED Driver
V2.0

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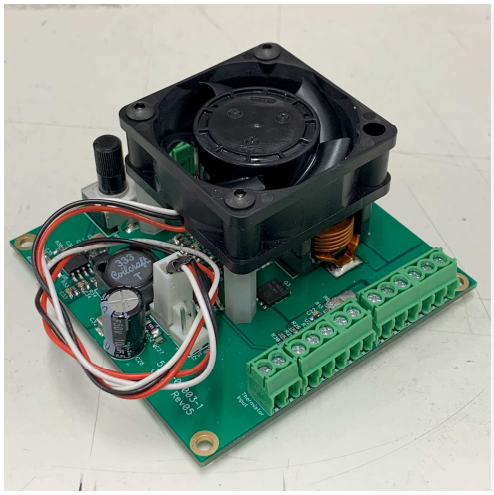
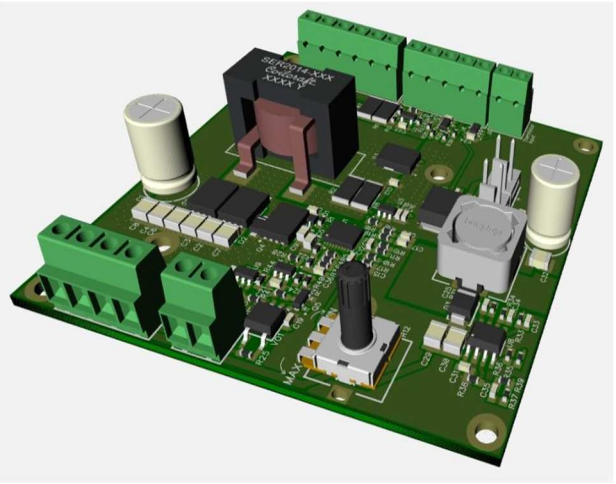
Specifications

- Input: 12VDC / 24VDC





- Dimensions: 70x70x35mm (with fan installed)
- Efficiency: 92% (typical, with 1.2W fan)
- Input: 10.5-26.4VDC @ 15A max.
- Output
  - Total Output Power = 125W
  - LED forward voltage up to 18V.
  - Total power includes power consumed by the 12VDC fan.
  - Output Current Range: 1-25A (static); 1-30A (pulsed).
  - Ripple: <5% (typical).
- Pulse Shaping Input
  - Opto-Isolated Inputs
  - Active LOW: LED output ON when input signal is LOW
  - 5-8V (Pk-Pk)
  - Minimum pulse width of 8µs recommended.
  - Refer to table in Appendix C for switching times.
- LED thermal protection based on thermistor input. Example of LED with thermistor – please see Luminus Devices LED datasheet[1]. For more information, please refer to Appendix E.

Note 1: https://www.luminus.com/products/white; Murata Manufacturing Co. NCP18XH103J03RB (http://www.murata.com/)

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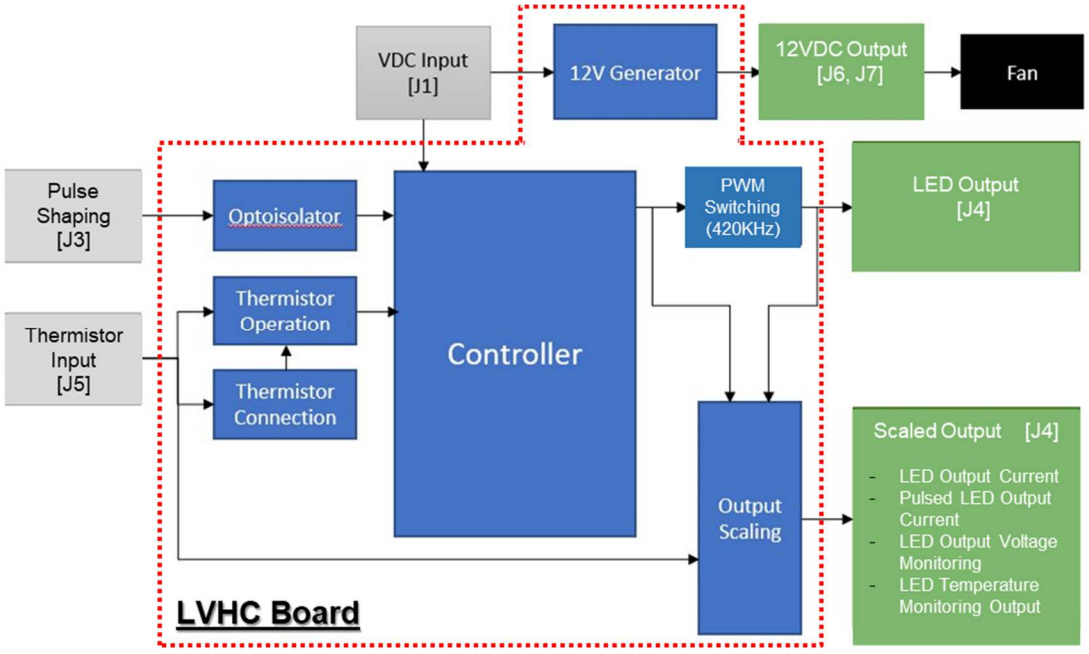
Functional Block Diagram



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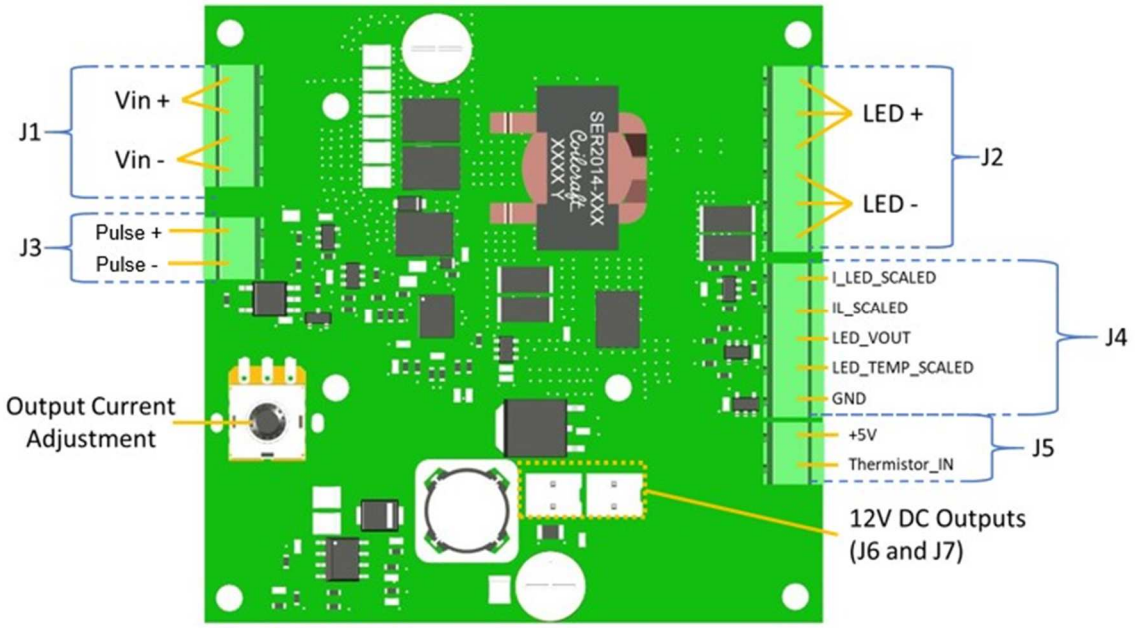
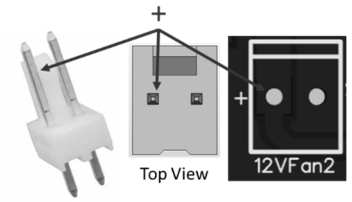
Features



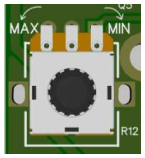
1. J1: 12VDC / 24VDC Input.
2. J2: Output to LED
3. J3: Pulse Shaping Input (**Pulse+** and **Pulse-**)
    - Isolated input to driver (optoisolator)
    - 5-8V Pk-Pk at input.
    - Minimum pulse width of 8µs recommended.
    - Active LOW input: This means a logic HIGH signal will cut off output to the LED and a logic LOW will result in full brightness (as set by R12, see #8 below).
4. J4: Reference voltages
    - **I_LED_SCALED** (LED Input Current in Amperes) and **IL_SCALED** (Board Output Current in Amperes) can be obtained via voltage measurements with respect to **GND** in J4.
        - Current (A) = 0.88 + [Voltage (V) x 20.7]
        - Accuracy: +/-5% (typical)
        - Example: 1V measured between I_LED_SCALED and GND correlates to ~21.6A LED current, +/-1A.
    - **LED_VOUT** measures the LED voltage.
    - **LED_TEMP_SCALED** translates LED temperature into a voltage (with respect to **GND** in J4).

- LED Temperature (°C) = **39*LN(LED_TEMP_SCALED) + 90**
- Accuracy: +/-2°C
- Example: 1V measured between LED_TEMP_SCALED and GND correlates to 90°C LED temperature. Refer to Appendix A.
- Formula for LED Temperature is based on a 10K thermistor input (see Note 1), and may not be valid if a different thermistor is used.

5. J5: Thermistor input.
   - 10KΩ thermistor input. See Luminus LED datasheet as example.[1]
   - Thermistor wiring is interchangeable (no polarity).
   - **90°C maximum LED temperature**: If thermistor readings are over 90°C, driver will reduce current output to LED, reducing overall power to prevent the LED from overheating. The more the temperature is exceeded, the greater the reduction of output current.
   - **Thermistor input is required for driver operation.** Driver will limit maximum current output to less than 2A if no thermistor connection is detected.
   - Refer to Appendix F for more information on thermistor operation.
6. All terminal blocks in J1-J5 can be used with wires ranging from 16-26AWG and are rated up to 10A each. Appropriate wiring must be selected based on output requirements. Refer to Appendix B below for wire size guide.
7. 12V DC output
   - Two 12V DC output connectors (J6 and J7) are provided. One is currently used to power the driver cooling fan, with an extra output for an additional fan if needed (for LED cooling, for example).
   - Connector is a 2-position header with 2.54mm pitch.



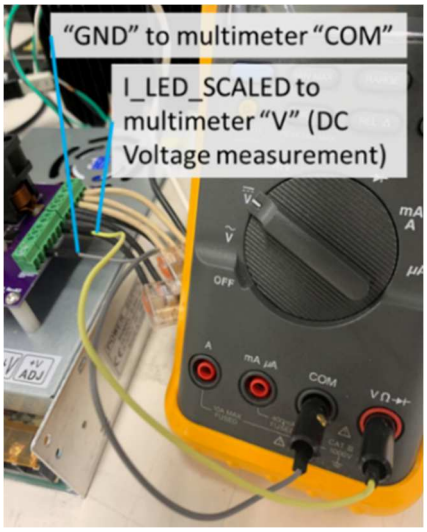
8. LED output current is set by turning R12 clockwise to increase current or counterclockwise to decrease current. See Appendix E for voltage references.



Note 1: https://www.luminus.com/products/white; Murata Manufacturing Co. NCP18XH103J03RB (http://www.murata.com/)

Start Up Procedure

1. Driver board wire connections
    - DC power supply to Vin+/- (J1). “Make sure power supply is OFF before performing this step.”
    - LED to LED+/- (J2).
    - Thermistor connection from LED to J5.
    - Reference voltages
        - Connections may be made to any of the terminal blocks in J4. Refer to # 4 in the “Features” section above.
        - Note that all voltages must be referenced to “GND”.
        - Recommend using 26AWG or thicker (up to 16AWG). Refer to Appendix B below.
        - Typical application:



    - Supplementary fan power
        - An additional 12V fan may be powered via J7 on the driver board. Refer to #7 in the “Features” section above for connector information.
        - The cooling fan for the driver board is connected to J6. **Do not disconnect the driver board fan** as it is needed for optimal product performance and longevity.
    - Custom Pulse Shaping
        - Connect the wires to the terminal blocks in J3. Note polarity (refer to #3 in the “Features” section above).
2. Powering up device

- During initial power up, it is recommended to set the output to minimum by turning R12 counterclockwise all the way to “MIN”.
- If a pulse module is installed, it is recommended to either disable it by disconnecting either wire in J3, or if using a PWM device, have it set at 0% duty cycle (full brightness) during the initial power ON.
- Turn on the DC power supply
- At this point, the LED should light up dimly, and the fan on the driver board should be running.
- Adjust R12 until the desired brightness and current is reached.

3. Troubleshooting
   A. LED does not light up.
      i. Disconnect any inputs into J3 (output signal wires from PWM or equivalent pulse shaping modules, for example).
      ii. Check connections on terminal blocks J1 and J2.
      iii. Check that the driver module is receiving power from the power supply by probing across the “Vin+” and “Vin-” terminals of J1: It should be around 12 or 24VDC, depending on power supply used.
         - If the driver board fan that is normally plugged into J6 is not ON, it is an indication that the driver board is not receiving power. Check the voltage across J6 or J7: it should be around 12VDC.

   B. LED is dim and does not respond to adjustments on R12, or is not reaching the desired current output, or flickers.
      i. Check thermistor connection (J5 on driver board). Driver board will only output minimum current without any thermistor connection.
      ii. Check LED temperature as it may be overheating. Driver board controls output to maintain a maximum LED device temperature of 90°C.
      iii. Check LED is not drawing excessive power (>125W).
         - Verify LED forward voltage and desired output current is within the power specified (125W).
         - This includes power consumed by the fans connected to J6 and J7. If the fan(s) draw too much power, output to the LED will have to be reduced.
      iv. Check LED output voltage:

- For higher voltage LEDs (>8Vout), a 24V power supply is recommended.
- Verify LED forward voltage does not exceed the maximum rated output voltage of 18V (with 24Vin).
- Note that LED voltage may increase when subjected to higher current output.

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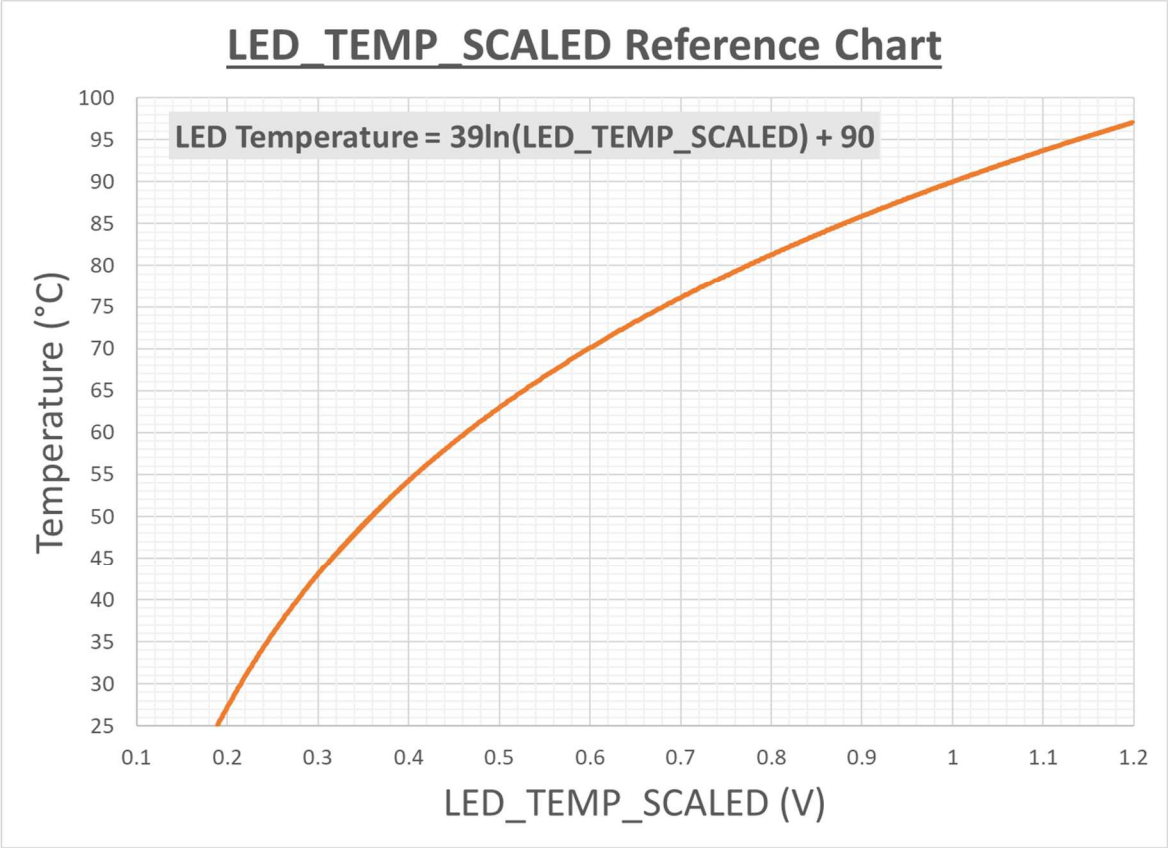
Appendix A: LED Temperature Reference Chart

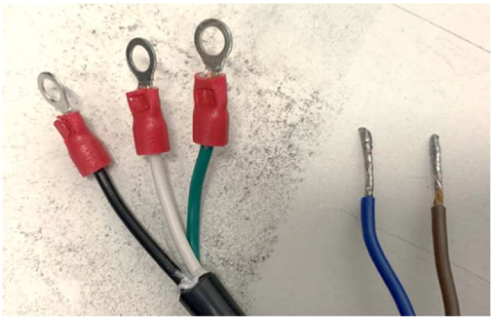


Formula for LED Temperature is based on a 10K thermistor input (see Note 1), and may not be valid if a different thermistor is used

Note 1: https://www.luminus.com/products/white; Murata Manufacturing Co. NCP18XH103J03RB (http://www.murata.com/)

Appendix B: Wire Gauge Example

- Overview:
  - For best performance, AWG of 16 is recommended for J1 and J2, where current demand is the highest.
  - 18AWG is found in most power cords. Since it does not carry as much current as 16AWG, it is recommended to load all terminals of J1 (input to driver board) and J2 (output to LED) when using 18AWG wire.
    Examples of 18AWG wires: left – with ring terminal crimps; right – tinned conductors



- For best connectivity with terminal blocks, solid (single-conductor) wires or stranded wires with tinned conductors are recommended.

Appendix C: Switching Response Time

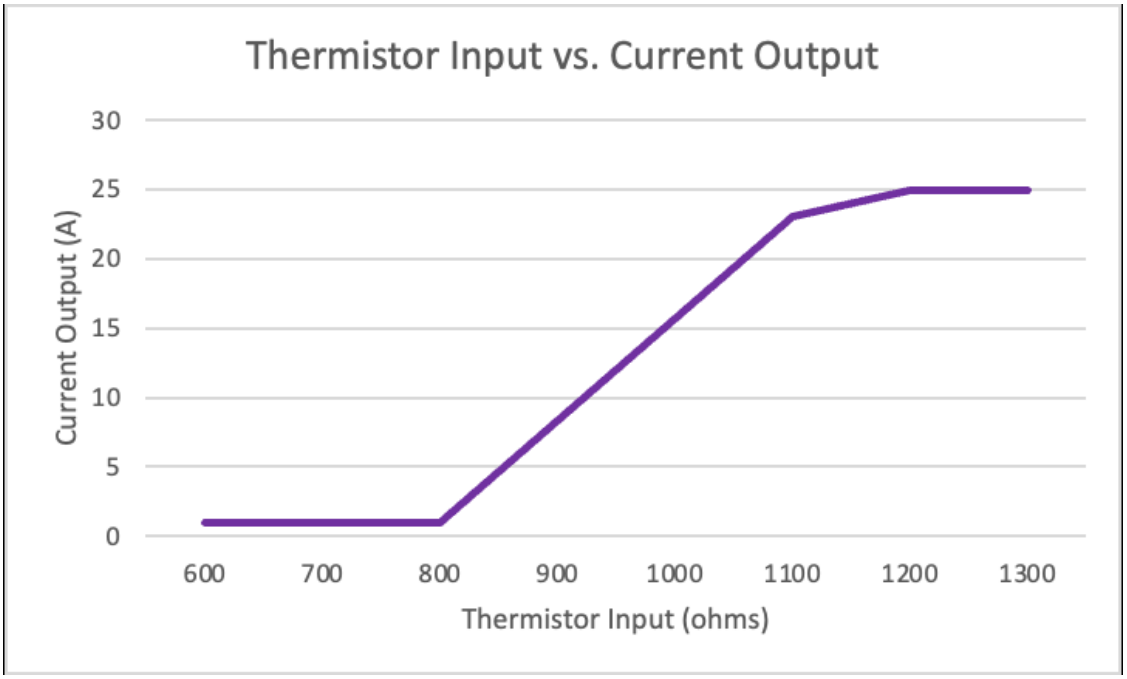
Output Voltage (V)	Output Current (A)	Rise Time (µs)	Fall Time (µs)
3	30	1.2	3.9
5	30	1.4	5.5
10	30	1.2	2.8
18	15	2	1

Minimum pulse width: 8µs recommended
Typical output current overshoot: 35%
Output conditions are for testing purposes only to obtain the worst-case rise and fall times. Please do not exceed the total rated output power for the driver.

Appendix D: R12 Current and Voltage References

Output Current (A)	R12 Reference (V)
3	0.133
5	0.234
10	0.469
15	0.704
20	0.931
25	1.166

Appendix E: Thermistor Operation



The above graph shows how the LVHC driver limits maximum current output to protect the LED. Note that using a different thermistor from the one specified in this User Guide will alter its behavior during high-temperature operation (per the above graph).

The LED thermal protection function can be bypassed by placing a 2KΩ-10KΩ resistor across J5. **Note that in doing so, the LVHC driver will not be able to detect excessive high-temperature LED operation.**