

Development Kit Manual

DK-236



1. Introduction

Luminus Devices has developed a strong product portfolio that enables top-of-the-line illumination and projection systems. Benefiting from our continuous innovation in chip technology, packaging, and thermal management, designers can use Luminus products to achieve efficient light engine designs and deliver high-brightness solutions.

The DK-236 series development kits are designed to support the development of single- or multiple-channel systems that use low voltage, high current devices. Each kit comprises a high current driver sourced from Cuvee Systems, Inc., an efficient thermal management solution and cables, and is capable of driving Luminus products at up to 36 A. This plug-and-play solution can be easily connected to common laboratory equipment through standard connectors, allowing system designers to save weeks in their development cycle.

2. General Description

The DK-236 series development kit consist of a driver, heat sink and cables that allow easy interfacing to a wide variety of light engines or optical elements. This development kit is designed with flexible features to allow easy evaluation of the Luminus devices and to ensure that, when in use, the supplied driver will work for specific end designs. The supplied underlying circuit and thermal design can be used as a reference by system designers to create their own systems, and individual drivers may be sourced directly from Cuvee Systems, Inc.

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The driver is designed to operate in both CW (continuous wave) and pulsed modes, sourcing up to 30 A in CW mode and 36 A in pulsed mode. Test points are provided on the driver board to monitor the forward voltage, current, thermistor readout, and other circuit functions.

3. Evaluation Kit Contents

The evaluation kit contains:

1. Thermal management solution
 - a. Heat sink with fan (with $< 0.3^{\circ}\text{C/W}$ thermal resistance from heat sink to ambient)
 - b. Thermal interface material (eGraf thermal pads)
2. Electrical interface to Luminus devices
 - a. Cables to connect devices to driver circuit
 - b. Driver board for controlling operation for Luminus devices
 - c. Additional 8-pin and 10-pin connectors for PT devices

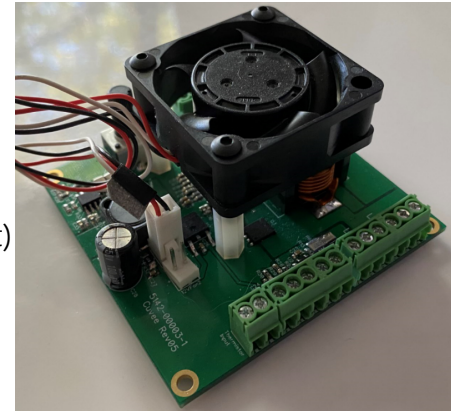


Figure 1 : Driver Board of DK-236

3.1 Heat Sink Module

The heat sink module (Figure 2) consists of an air cooled heat sink, fan, connector and mounting bracket. Connections for driving the device and readouts for a thermistor are made via the LED to driver cable (Figure 3).

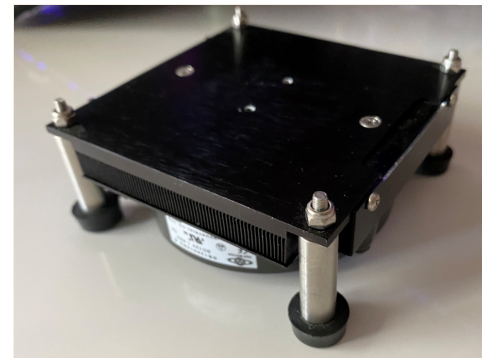


Figure 2: Heat sink module.

3.2 Cable Assembly

A 12" long cable connects Low Voltage High Current LED's to its driver board. For optimum performance increasing the length of the cable is not recommended. Figure 3 shows the LED to driver cable. The color code for the wires is as follows:

RED 14 gage wire:	LED anode (+)
BLACK 14 gage wire:	LED cathode (-)
WHITE/BLUE 24 gage wire:	Thermistor connections



Figure 3: LED to driver cable assembly.

Figure 4 and Figure 5 show how the LED is connected to the Cuvee driver board.

Note: Preliminary versions of the development kit have an adaptor terminal block to connect the LED cable (14 AWG) wires to the three 18 AWG inputs on the driver board.

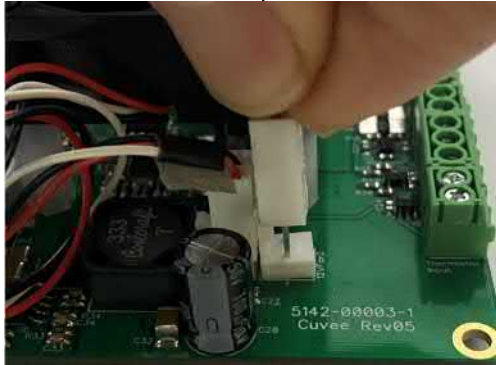


Figure 4: Connection to heat sink module



Figure 5: Connection to driver board (cable from device)

Figure 6 shows the wires which connect the user-provided power supply to the driver board.

The color code and recommended gages for the wires in the image is as follows:

- 2x RED 18 gage wire: “+” of power supply
- 2x BLACK 18 gage wire: “-” of power supply

Figure 7 shows the location and connection to the driver board. (J1) and for pulsing (J3)

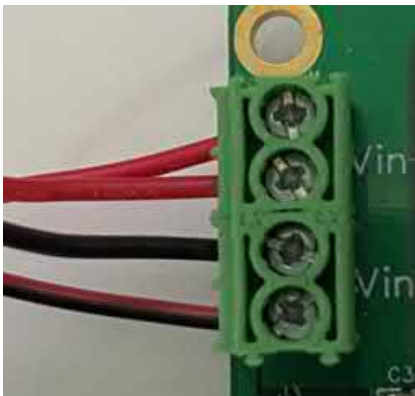


Figure 6: 18 AWG Power supply cable connectors

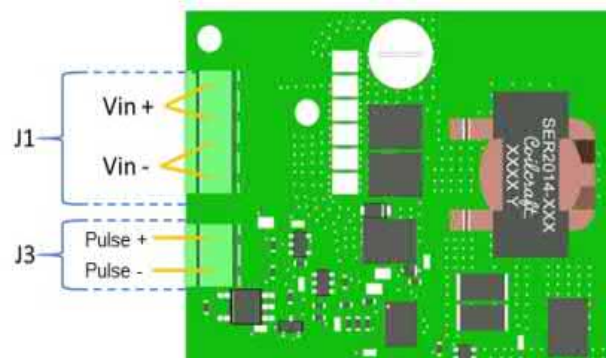


Figure 7: Vin and Signal Generator connections to driver board

3.3 Driver Board

The driver board is designed to provide power up to 36 A to any Luminus high-power LED device. Note that different LEDs have different drive current ratings and care must be taken not to exceed these limitations. Consult product data sheets for forward current and junction temperature specifications of specific LEDs. Figure 8 shows the top view of a driver board along with commonly used pins (labeled), switches and readouts.

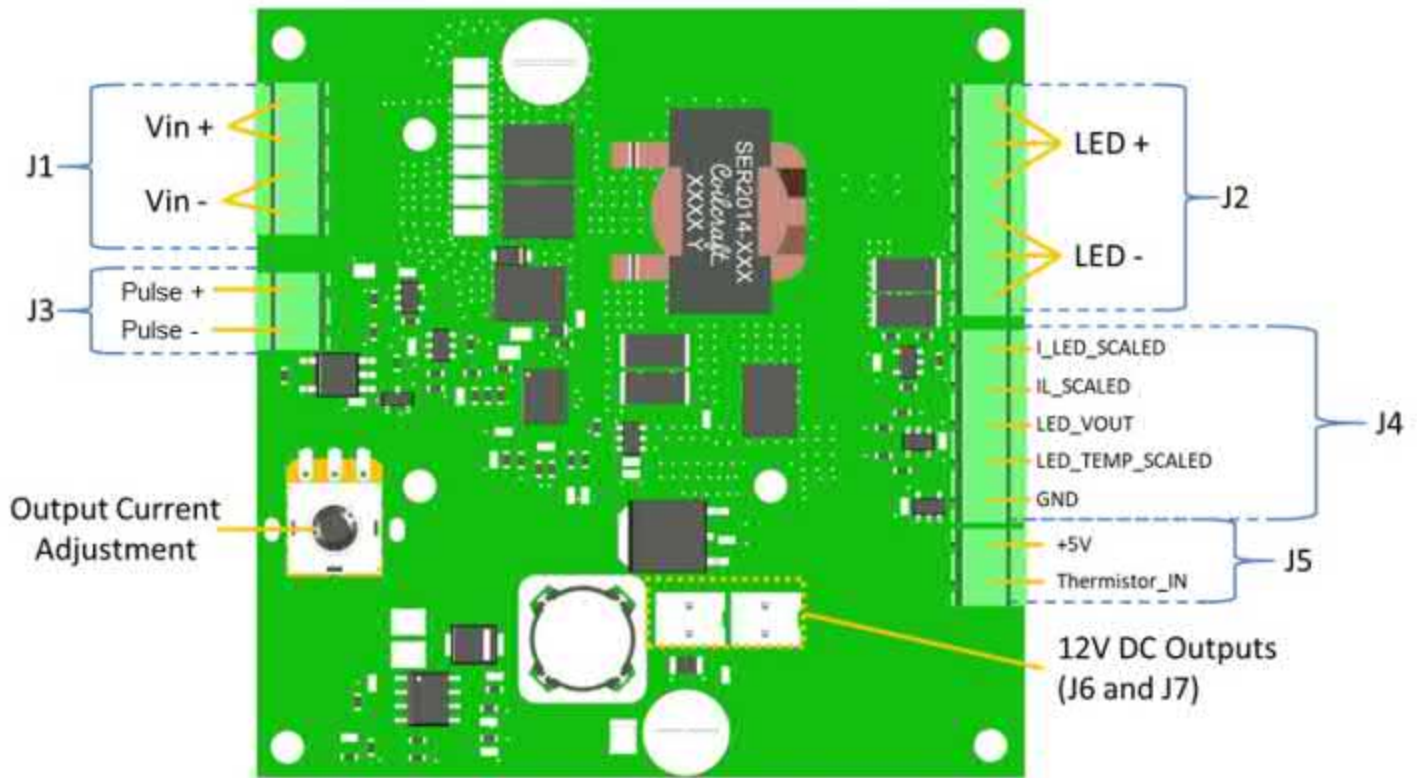


Figure 8: Complete driver board pin layout.

4. Use Instructions

4.1 Mounting the LED to the heat sink

Ineffective heat sinking may lead to premature LED degradation or failure. The following steps explain how an LED is mounted on the heat sink while ensuring good thermal contact between the copper core board and the heat sink.

1. Use a thermal pad with an area slightly larger than the area of the core board, as shown in Figure 9.
2. Place the thermal pad on the heat sink with pre-drilled holes matching the hole pattern on the heat sink.

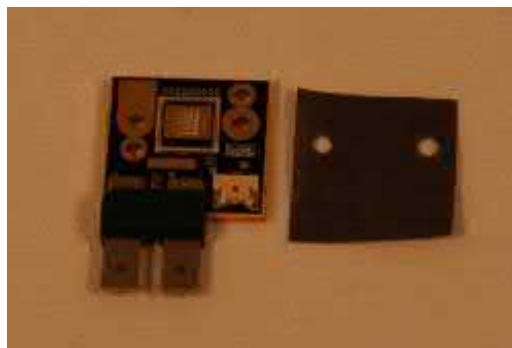


Figure 9: Luminus CBT-120 device and Thermal pad

3. Place the LED on the thermal pad such that the hole patterns match (Pre-drilled holes seen in Figure 10).
4. Insert screws in the holes of the core board and tighten. To ensure equal pressure is exerted by all screws, alternate tightening each screw until the board is securely fastened. The use of a torque wrench, with a torque setting of 40 ounce--inches (oz-in), is recommended.

Note : The heatsink described in this manual may change in later revisions, connections will be the same, and thermal properties will be qualified by similarity.



Figure 10: Pre-drilled holes

4.2 Additional Lab Equipment Needed By User

Additional lab equipment such as a 12 V or 24 V laboratory power supply, an oscilloscope, a waveform generator, a multimeter, and a photodetector are required to power and evaluate the DK-236. Table 1 lists recommended models for each of these pieces of equipment. The Lambda power supplies recommended in Table 1 assume operation of one device at a time.

Lab Equipment	Luminus Recommendation
12 V Lab Power Supply	Lambda ZUP20-20 (0-20V)
24 V Lab Power Supply	Lambda ZUP36-12/U (0-36V)
Oscilloscope	Tektronix TDS 3024B
Waveform Generator	Agilent 33220A
Multimeter	Fluke 187
Photodetector	Thorlabs PDA10A

Table 1: Additional lab equipment recommendations

4.3 Driver Board Operation

Arrange the evaluation kit, required lab power supplies, and measurement equipment (e.g., digital multimeters, oscilloscope) preferably on one table. Refer to Figure 16 for an example of the recommended equipment setup for evaluation (no wire connections shown). It is also recommended that the table has an ESD Protected Area (hereafter referred to as "EPA"). Please refer to Appendix B for ESD precautions.

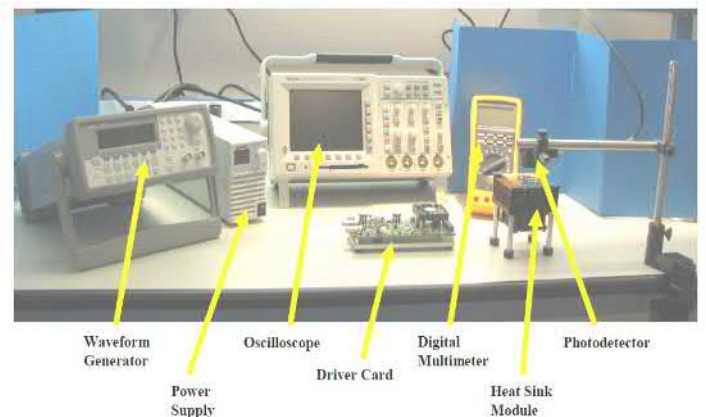


Figure 11: Equipment setup for LED evaluation (example).

Mount the device on the heat sink as discussed in section 4.1.

1. Make sure the power supply is OFF and the power switch (ON/ OFF switch in Figure 8) on the driver board is OFF.
2. Connect the driver board to the heat sink module on which the device is mounted. (J6 or J7)
3. Connect the power supply to the driver board.
4. Turn the Current Control Knob on the driver board all the way counter clockwise to set current to zero.
5. For pulsed operation, connect J3 to a signal generator for PWM operation.
6. For the power supply, set the output voltage to 12 V or 24 V, as specified for the driver board.
7. Turn the power switch on the Power supply board to "ON". The device may turn on at this point.
8. Check to make sure that the two fans, one on the driver board and one on the heat sink module, are running.
9. Using a digital voltmeter (DVM) check that the supply voltage on the driver board is correct using test point "J4", labeled "LED_VOUT" and "GND", at the right side of the board. If this voltage is zero check connections.
10. In DC voltage mode, connect DVM to "GND" and "IL_SCALED" test points to monitor current through the device.
The output is [Current of device(A) = 0.88 + Vout x 20.7] Current Accuracy \pm 5%
If utilizing PWM, use "GND" and "I_LED_SCALED" test points to monitor current through the device.
Monitoring this output ensures that the LED is always driven within its limits.
11. Connect thermistor input to J5. Wiring is interchangeable (no polarity). The driver will be limited to 1-2 A if no connection is detected. The driver has a 90 °C max LED temperature. If thermistor readings are over 90 °C, the driver will reduce current input to the LED to prevent the device from overheating.
12. Turn the knob on the driver board clockwise while monitoring the current.
This will increase the current flow through the device.

LED Output Current readout
Voltages are listed in Table 2.

Output Current (A)	R12 Reference (V)
3	0.133
5	0.234
10	0.469
15	0.704
20	0.931
25	1.166
30	1.408

Table 2: LED Output Current Setting

The device switching time responses to Vout
and Current are listed in Table 3.

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

Table 3: Vout and Current Rise & Fall Times

5. Appendix

A. Thermistor Reading

The thermistor on the core board of a Luminus device facilitates measurement of core board temperature during operation. The voltage measured at the thermistor can be read from the "LED_TEMP_SCALED" on J4.

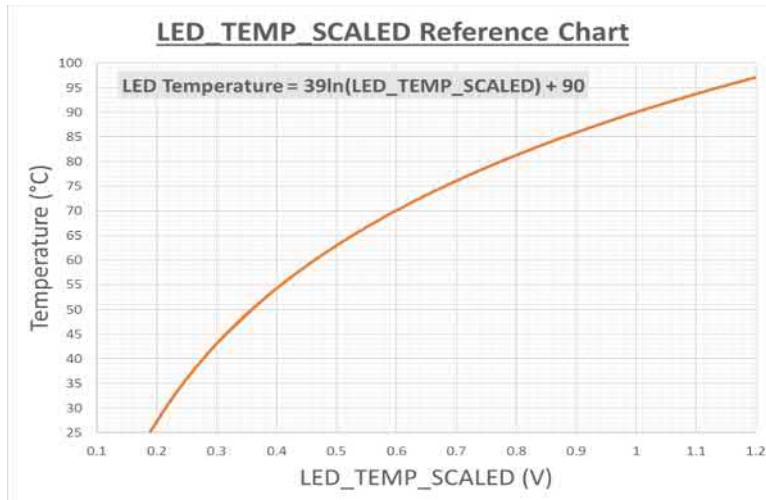


Figure 12: Thermistor temperature calculation chart

B. Precautions for ESD (Electrostatic Sensitive Discharge)

Various Luminus products are sensitive to ESD, which may cause "latent damage" to the LEDs, meaning: signs of damage may not show up until the device is used for a period of time. The use of ESD-controlled work stations and wrist straps/ground cords are recommended to minimize ESD-related damage. Further information can be found in the ESD application note (APN-002815)

C. Heat Sink Module Drawing

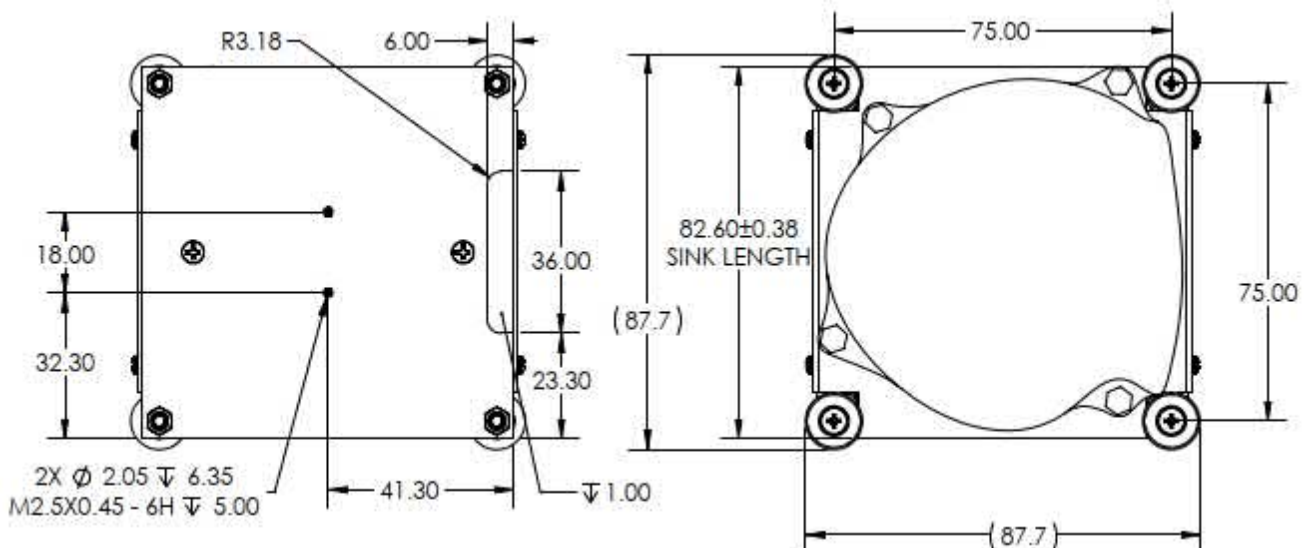


Figure 13: Heat sink module drawing

D. Wire Gauge Examples

For best performance, AWG of 16 is typically recommended for J1 and J2, where current flow is the highest.

However the J1 and J2 terminals may also be driven with 18 AWG which is found in most power cords. Since 18-gage does not carry as much current as 16 AWG, Luminus recommends loading all terminals of J1 (2x input to driver board) and J2 (3x output to LED) when using 18 AWG wire.

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



Figure 14: Solid vs Tinned Wire

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