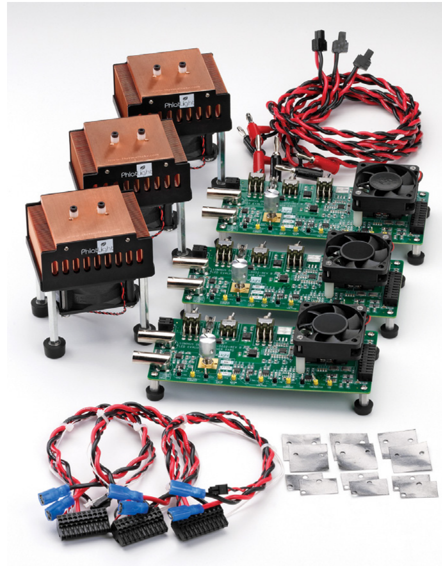

Development Kit Manual
DK-136M-1 and DK-136M-3

1. Introduction:

Big Chip LEDs from Luminus Devices have been designed from the ground up to enable a new class of illumination and projection systems. Benefiting from a suite of innovations in chip technology, packaging, and thermal management, Big Chip LEDs allow designers to achieve efficient light engine designs and deliver high brightness solutions.

The DK-136M series development kits are designed to support the development of single or three channel systems that utilize PT and CBT series Big Chip LEDs. Each channel of the kit comprises of a high current driver, an efficient thermal management solution and cables, and is capable of driving Big Chip LEDs at up to 36 A. This plug and play solution can be easily connected to common laboratory equipment through standard connectors and allows system designers to save weeks in their development cycles.

Table of Contents

2. General Description

The DK-136M series development kits consist of drivers, heat sinks and cables that allow easy interfacing to a wide variety of light engines or optical elements. The DK-136M-1 and DK-136M-3 are similar in all aspects; while the DK-136M-1 supports one channel, the DK-136M-3 supports three channels. This development kit is designed with flexible features to allow easy evaluation of the Big Chip LEDs but is not optimized for size or for direct integration into end products. However, the underlying circuit and thermal design can be used as a reference by system designers; to this effect, drawings, schematics, mechanical design files

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and bill of materials are available upon including request.

The driver is designed to operate in both CW and pulsed modes, sourcing up to 25 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 sinks with fans (with < 0.3 °C/W thermal resistance from heat sink to ambient)
   b. Thermal interface material (eGraf thermal pads)
2. Electrical interface to Big Chip LED™ devices
   a. Cables to connect tabs on devices to driver circuit
   b. Driver board for controlling operation for Big Chip LED™ devices

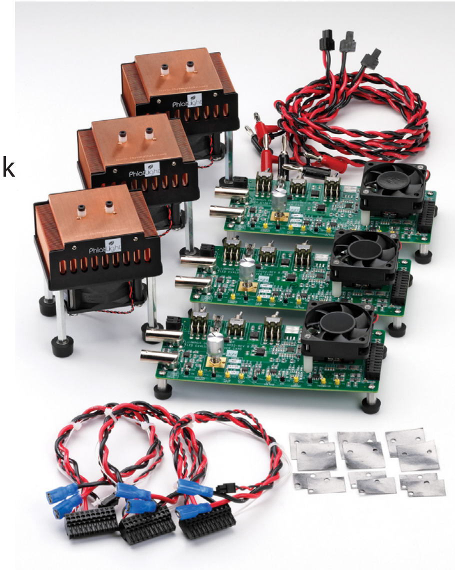

Figure 1: *Contents of DK-136M-3, three channel evaluation kit*

3.1 Heat Sink Module

The heat sink module (Figure 2) consists of an air cooled heat sink, fan, connector and mounting bracket. The module can be bolted say to a light engine using the four mounting holes on the bracket. Connections for driving the device, fan, and readouts for thermistor are made via the LED to driver cable (Figure 3).

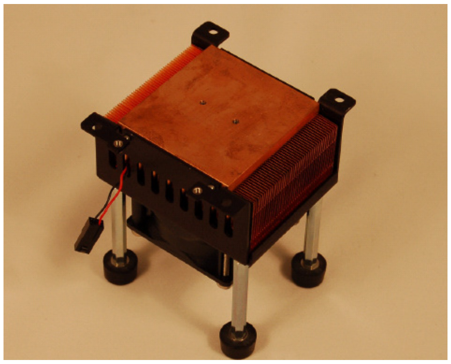

Figure 2: Heat sink module.

3.2 Cable Assembly

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

RED 18 gauge wire:	LED anode
BLACK 18 gauge wire:	LED cathode
WHITE/BLUE 24 gauge wire:	Thermistor connections
RED 24 gauge wire:	Fan +12V power
BLACK 24 gauge wire:	Fan negative return (GND)

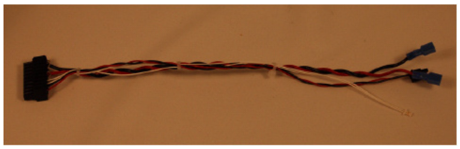

Figure 3: LED to driver cable assembly.

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Figure 4 and Figure 5 show how the LED is connected to the driver board. Note that the connector is positioned such that the screw heads are always facing the user.

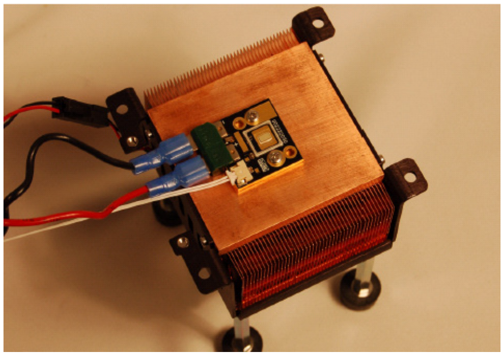

Figure 4: Connection to heat sink module

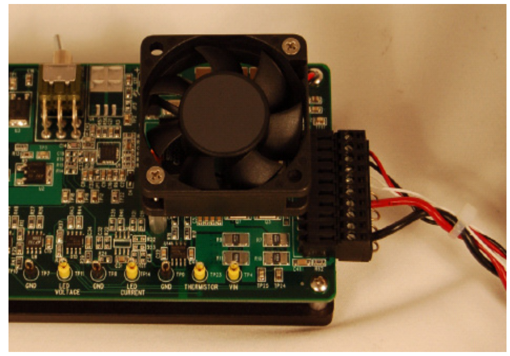

Figure 5: Connection to driver board (cable from device).

Figure 6 shows the power supply to driver board cable. One end of the cable has banana plugs to facilitate connection to a power supply and the other end has a 2 pin socket block connector. The color code for the wires is as follows:

RED 14 gauge wire: "+" of power supply

BLACK 14 gauge wire: "-" of power supply

Figure 7 shows how to the cable is connected to the driver board. Note that the cable assembly connector is positioned such that the screw heads are always facing the user.

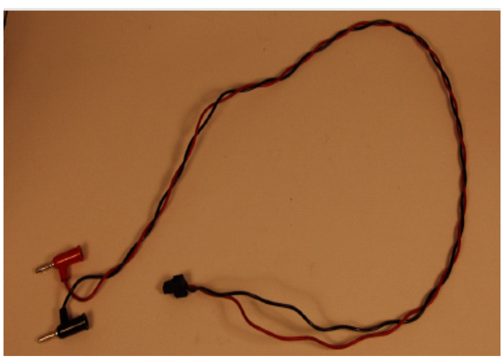

Figure 6: Power supply cable connectors

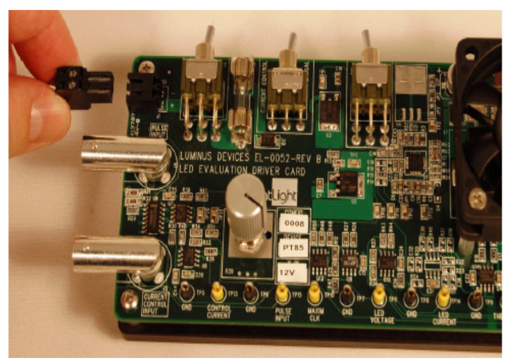

Figure 7: Power supply cable to driver board

3.3 Driver Board

The driver board is designed for to source up to 36 A to any Big Chip LED™. Note that different LEDs have different drive current limitations and care must be taken not to exceed these limitations. Consult product data sheets for current and junction temperature limitations of specific LEDs. Figure 8 shows the top view of a driver board along with commonly used pins, switches and readouts.

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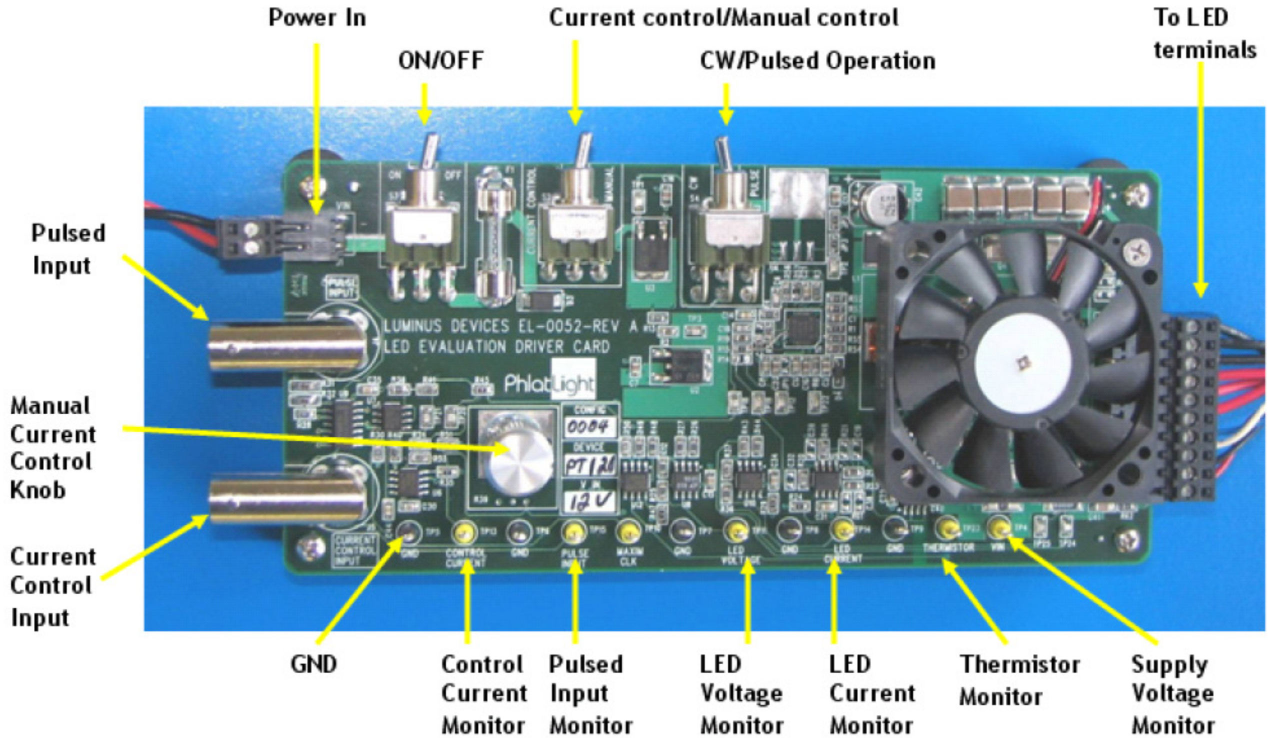

Figure 8: Driver board pin layout.

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 of an area slightly larger than the area of the core board (Figure 9).
2. Place the thermal pad on the heat sink with pre-drilled holes matching the hole pattern on the heat sink (Figures 10 and 11).

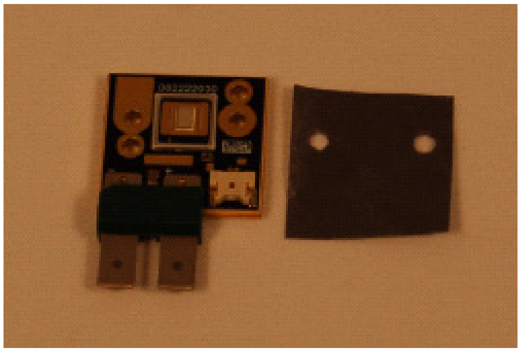

Figure 9: Thermal pad and device

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3. Place the LED on the thermal pad such that the hole patterns match (Figure 12).

4. Insert screws in the holes of the coreboard 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 Oz-Inches, is recommended.

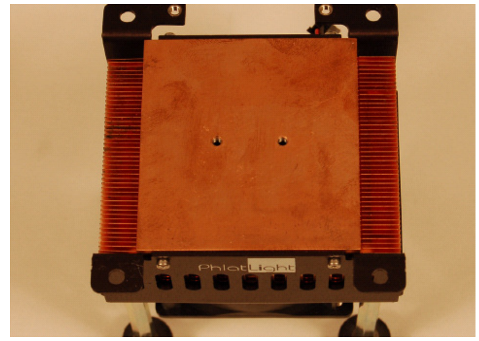

Figure 10: Pre-drilled holes

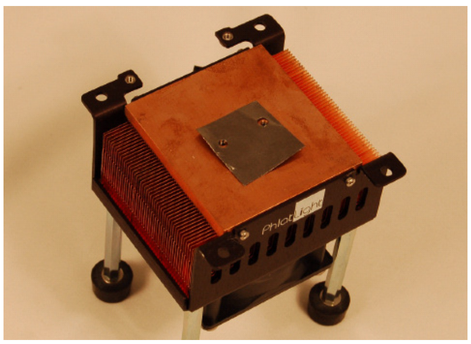

Figure 11: Thermal pad on heat sink

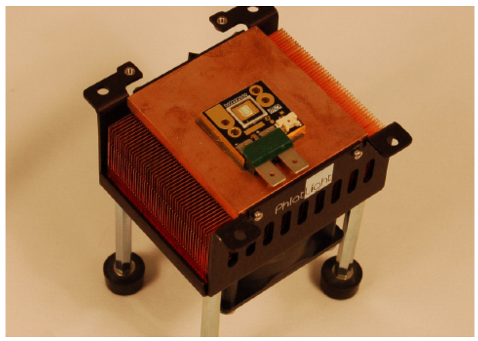

Figure 12: Device aligned on heat sink

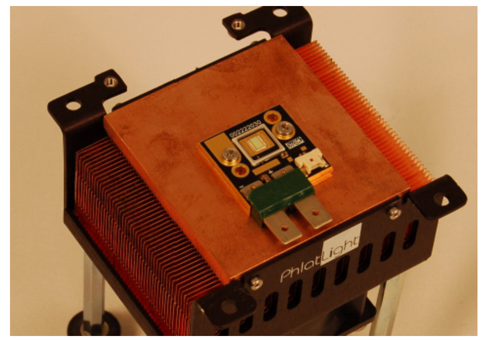

Figure 13: Device mounted on heat sink and is now ready for electrical connections

4.2 Additional Lab Equipment Needed By User

Additional lab equipment such as a 12 V laboratory power supply, an oscilloscope, a waveform generator, a multimeter and a photodetector are required to power and use the DK-136M. Table 1 lists a recommended model for the equipment. The Lambda power supply recommended in Table 1 assumes operation of one device at a time.

Lab Equipment	Luminus Recommendation
12 V Lab Power Supply	Lambda ZUP20-20
Oscilloscope	Tektronix TDS 3024B
Waveform Generator	Agilent 33220A
Multimeter	Fluke 187
Photodetector	Thorlabs PDA10A

Table 1: Additional lab equipment

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 equipment set up for evaluation (no wire connections shown). It is recommended that the table is equipped with ESD (Electrostatic Sensitive Device) safe arrangement. Please refer to Appendix B for ESD precautions.

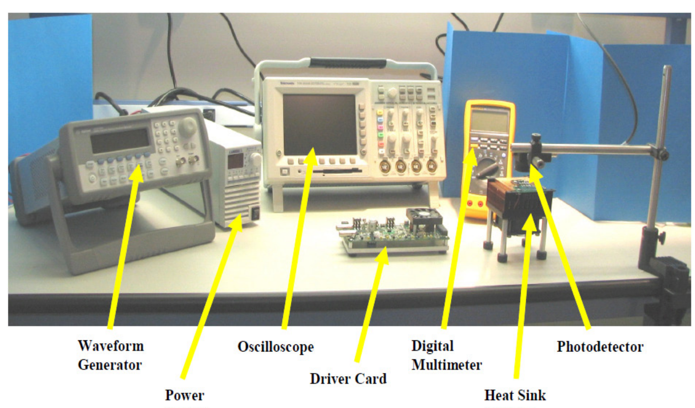

Figure 14: Equipment set up for Big Chip LED evaluation (example).

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Mount the devices on heat sinks as discussed in section 4.1.

1. Make sure power supply is OFF and the power switch (ON/ OFF switch in Figure 8) on the driver board is OFF.
2. Connect driver board to heat sink module on which device is mounted.
3. Connect power supply to driver board using the cable supplied with the kit.
4. Turn the Current Control Knob on the driver board all the way counter clockwise.
5. Set middle switch (Current Control/Manual Control switch in Figure 8) to "Manual".
6. Set right switch (CW/Pulsed switch in Figure 8) to "CW" for continuous operation.
7. Turn on power supply and set to the output voltage to 12 V, as specified for the driver board.
8. Turn power switch on driver board to "ON". The device may turn on at this point.
9. Check to make sure that the two fans, one on driver board and one on heat sink module, are running.
10. Using a digital voltmeter (DVM) check that the supply voltage on the driver board is correct using test point "TP4", labeled "VIN", at the lower right corner of board. If this voltage is zero check to see if the fuse is blown.
11. Connect DVM to "GND" and "LED CURRENT" test points to monitor current through the device. The output is 10 mV/ A. Monitoring this output to ensures that the LED is always driven within its limits.
12. Turn the knob on the driver board clockwise while monitoring the current. This will drive more current in the device.
13. To operate in pulse mode, connect a pulse generator to "Pulse Input" BNC. Pulse Generator should have an output signal set to TTL levels or 0-5 V. Using an oscilloscope, monitor the pulse generator output at the "PULSE INPUT" test point.
14. Turn the current control knob all the way counter clockwise and set the right switch to "PULSE". The driver board is now operating the device in pulse mode. The "Current Control" knob sets the amplitude of the current and the pulse generator sets the width of the pulse. Proper operation is best monitored by using a photodetector to monitor device's light output. Current amplitude can still be monitored using the "LED CURRENT" test point.

NOTE: The output voltage of the power supply should not exceed 12 V, doing so may damage the driver board. During pulsed operation, the output voltage of the power supply can overshoot the 12 V limit. To prevent voltage over shoot and consequent damage to the driver, connecting a capacitor across the output of the power supply (and thus, across the input to the driver) is recommended. Two capacitors, such as Nichicon UHE1V392MHD 3900 µF or equivalent may be used.

15. Device current amplitude can also be controlled using an external signal. Connect a signal source (0-5 V max) to the "CURRENT CONTROL INPUT" BNC. Monitor using the "CURRENT CONTROL" test point. Switch the middle switch to "CURRENT CONTROL" and the driver now uses the input signal instead of the current control knob to set the LED current amplitude. This input can be used both in CW and Pulse mode. Note that the max output current corresponds to 5V input and is the maximum level specified for the specific driver board regardless of whether operation is CW or Pulse.

Figures 15, 16 and 17 show oscilloscope traces for a GREEN Big Chip LED™ PT-120 device operated at 30A, 50% duty cycle and 2.88kHz frequency. The pink trace is the input pulse and the green trace is the photo detector output. These traces are shown for reference; actual waveforms may depend on individual driver boards, devices and settings. Figure 17 shows the input and output pulse. Figure 16 and Figure 17 show the rise time (1 µs) and fall time (1 to 2 µs) of the output pulse

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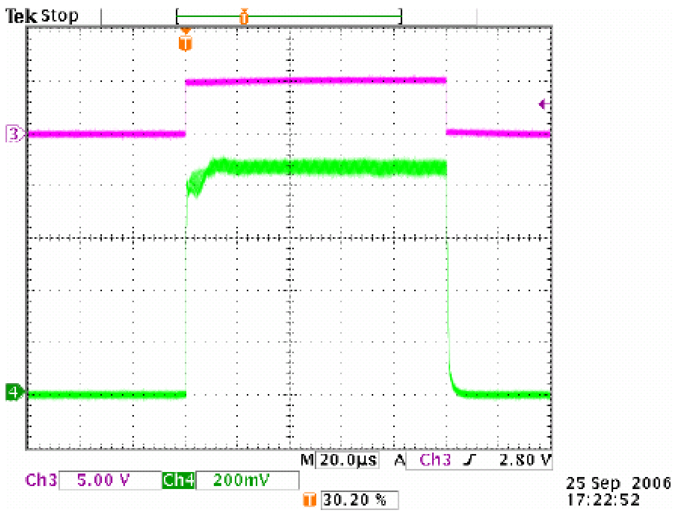

Figure 15: Input and output pulse (example).

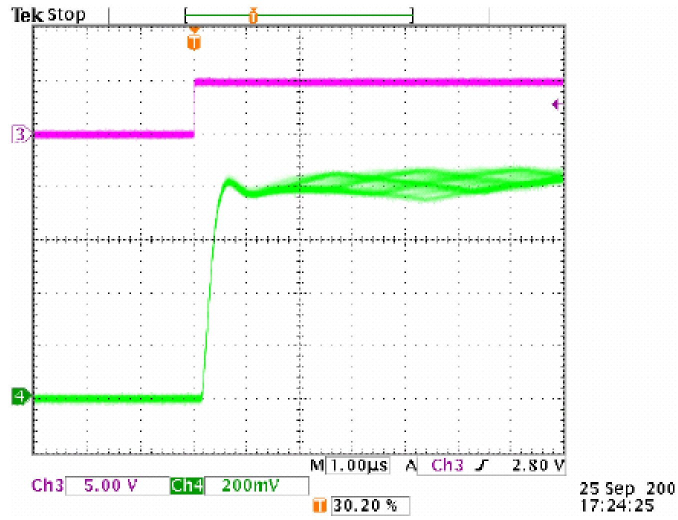

Figure 15: Rise time (example).

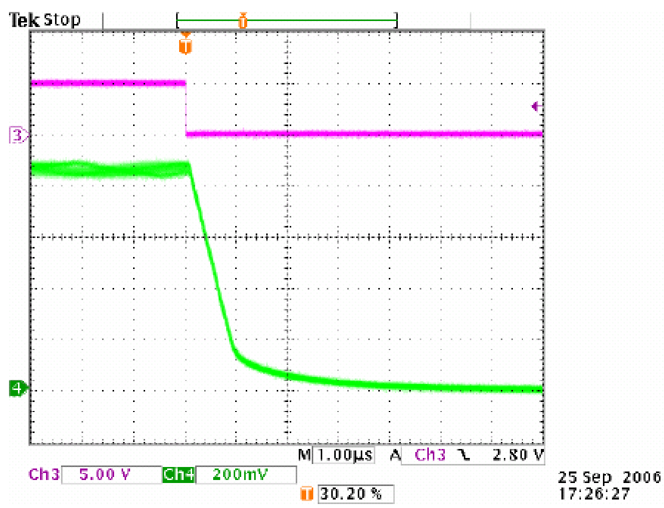

Figure 17: Fall time (example).

5. Appendix

A. Thermistor Reading

The thermistor on the core-board of a Big Chip LED™ device facilitates measurement of core-board temperature during operation. The voltage measured at the thermistor can be converted to temperature using Figure 18.

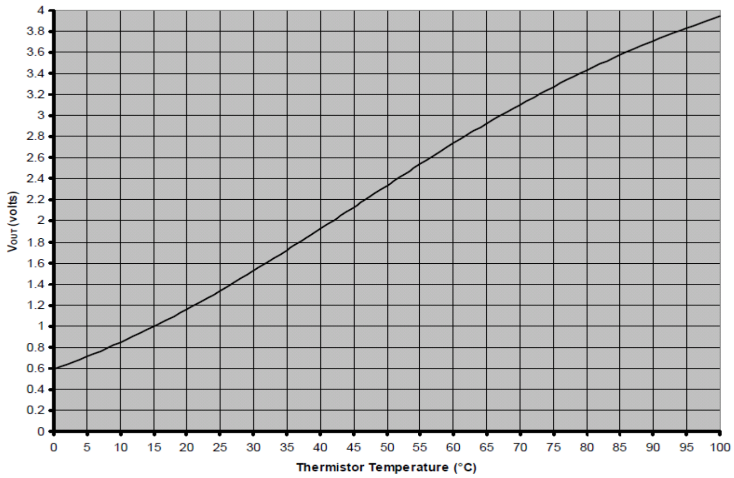

Figure 18: Thermistor temperature calculation chart

B. Precautions for ESD (Electrostatic Sensitive Discharge)

Big Chip LED™ LEDs are sensitive to ESD which may cause latent damage to the LEDs: signs of damage may not show up until the device is used for a period of time. The use of ESD controlled work stations, wrist straps/ground cords minimize ESD related damage.

C. Heat Sink Module Drawing - Top View

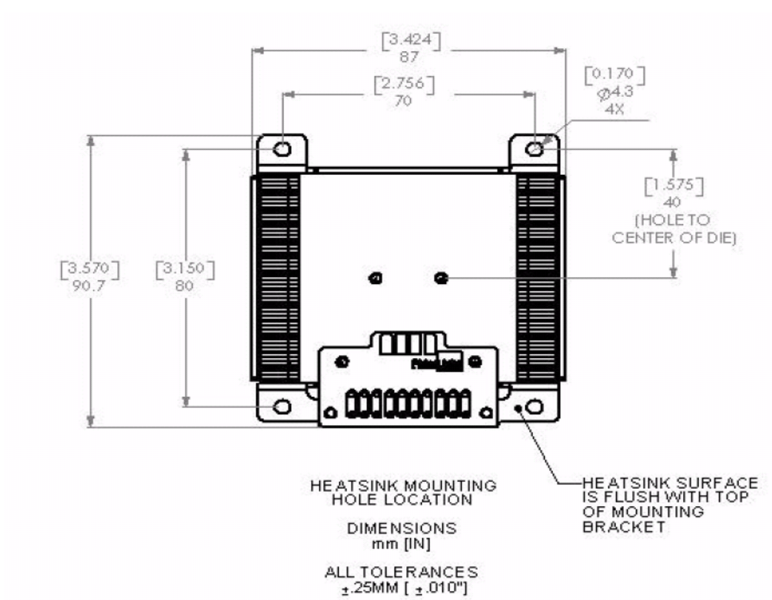

Figure 19: Heat sink module drawing, top view

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