SP-06 SinkPAD-II™ Rebel 25mm Round LED Assembly

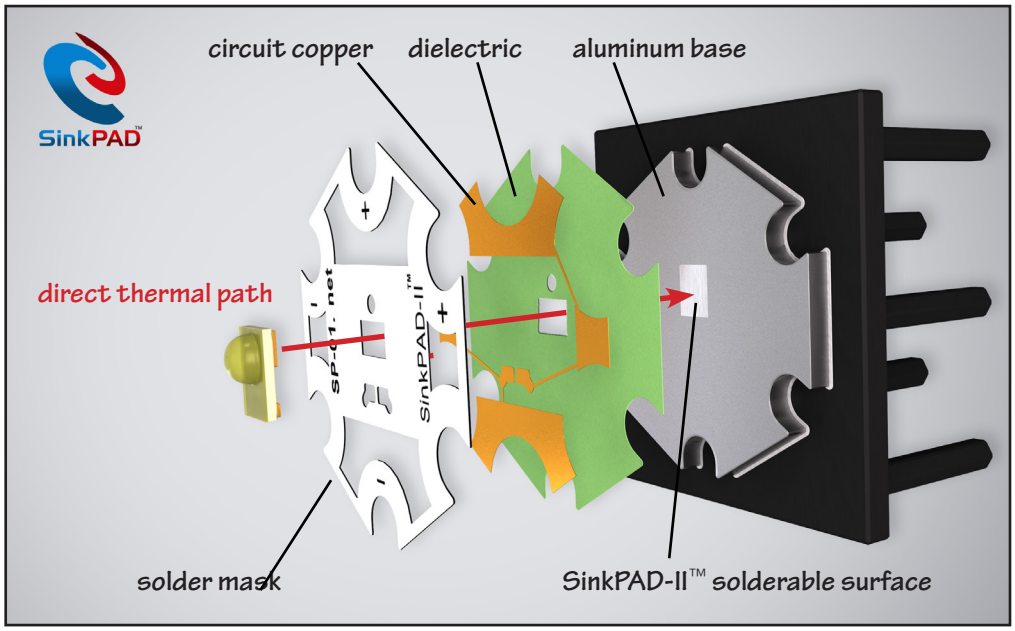
lead-free RoHS compliant

The SP-06 series of high brightness (HB) LED assemblies include a single Rebel LED soldered to a 25mm Round SinkPAD-II™ board. The SinkPAD-II™ features second-generation technology that minimizes thermal resistance by **eliminating the dielectric layer so that the LED thermal pad is soldered directly to the aluminum base**. This ensures the lowest possible LED junction temperature, resulting in increased LED life, lumens output and overall reliability.

Wire connections can be soldered to the SP-06 using standard bench top tools and hand soldering techniques, making it easy to use this LED for R&D, OEM, and MRO applications.

The SP-06 has been specifically designed to accommodate the Carclo series of hemispherical, ultra-wide angle "bubble" optics as well as the 10267 side emitting optic. It can also be used with most flush mounted lenses.

SinkPAD-II™ Technology



Features

- **Direct Thermal Path** technology for ultimate cooling efficiency.
- Extremely low thermal resistance of **0.7 °C/W** from the LED thermal pad to the bottom of the aluminum base.
- Reduced LED junction temperature
- Available with all currently produced Rebel LEDs
- Fully compatible with Carclo series 104 & 106 bubble optics
- Can be mounted with thermal tape, epoxy or mechanical fasteners
- **RoHS compliant**
- **Pb free** reflow soldered
- **UL Approved** MCPCB

Benefits

- Maximum LED life
- Maximum lumens output
- Improved color rendering and stability
- Reduced cooling requirements means a smaller heat sink
- Create more densely packed LED designs
- Same light output with fewer LEDs means reduced cost
- Wide selection of compatible optics

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Assembly Specifications

Parameter	Value
Base Type	1.6mm SinkPAD-II™ Aluminum
Thermal Performance $R\theta_{C-B}$ See the thermal model on page 8	0.7 °C/W
Pad Finish	Lead Free HASL
Solder Mask Color	White
Solder Paste	AIM NC-258 No-Clean, Lead-Free
Max Operating Temperature (Aluminum Base)[1]	120°C
Overall Dimensions (mm)	25D x 3.68H
Weight	2.6g

1. For maximum life, the aluminum board temperature must be kept below this value.
For LED specifications, please refer to the Philips Lumileds Rebel LED datasheet.

Eliminating the dielectric layer between the LED thermal pad and the aluminum base means that the SinkPAD-II™ can easily outperform even the best MCPCB boards available.

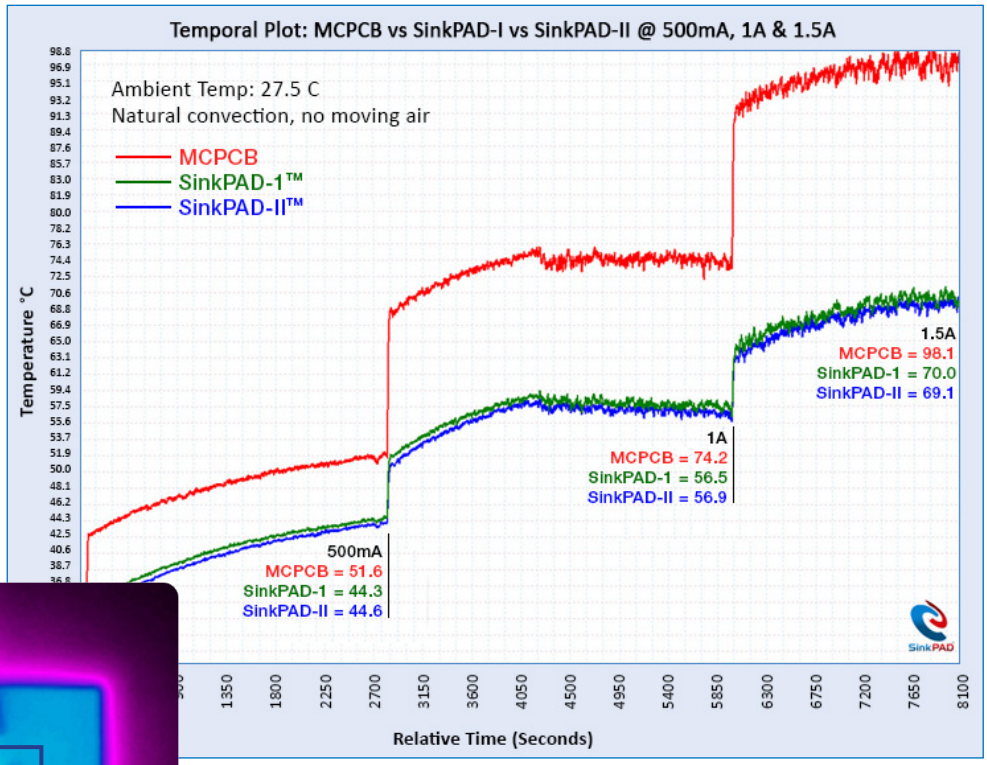


Image 1

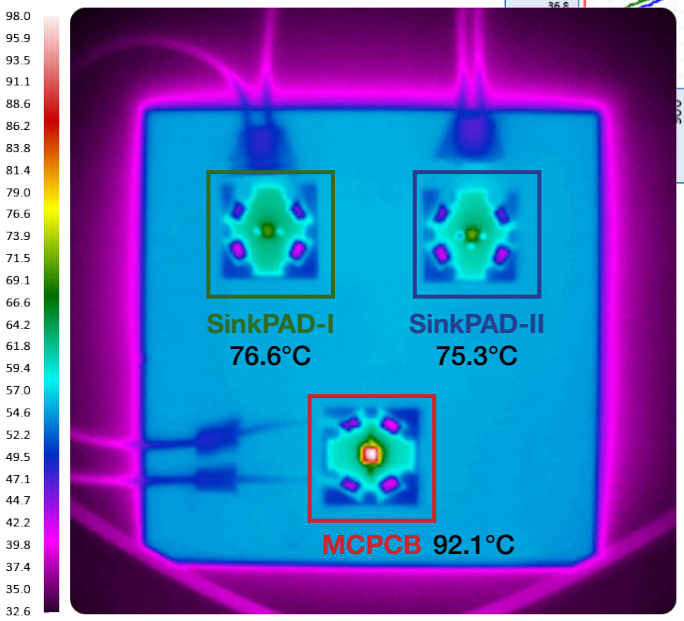


Image 2

HB LEDs radiate minimal heat around the LED. Instead, all generated heat must be conducted away from the LED through the thermal pad on the bottom. By soldering the LED thermal pad directly to the aluminum base, a **Direct Thermal Path** is established that efficiently conducts the heat to the cooling surface.

Power Drivers

The choice of power driver will depend on the Rebel LED that is mounted to the base, desired lumens output, the number of LEDs being powered, the input voltage source, and the drive current. For help with selecting and using LED power drivers, visit our online support center at www.luxeonstar.com/support.

We offer a complete selection of compatible low and high voltage current regulating drivers on our website at www.luxeonstar.com/drivers.

Secondary Optics

The SP-06 assembly has been specifically designed to accommodate a wide variety of surface mounted optics, including:

- Carclo 10403 - 120° Wide Angle Bubble Optic
- Carclo 10406 - 130° Wide Angle Bubble Optic
- Carclo 10620 - 180° Hemispherical Bubble Optic
- Carclo 10628 - 120° Downlight Bubble Optic
- Carclo 10267 - Side Emitter
- Dialite OPC1 Reflectors
- Carclo 20mm Flat Bottom Holders

More information about all of these optics is available on our website at: www.luxeonstar.com/optics.

Mounting & Cooling

Use of this assembly requires careful attention to mounting and cooling to ensure that the junction temperature of the LED is kept well below the maximum rating as specified in the LED documentation published by Philips Lumileds.

For optimal cooling, we recommend that the assembly be mounted to a suitable finned heat sink (aluminum or copper) that is exposed to open air. The assembly can be mounted to the heat sink in one of three ways:

- through pressure sensitive, thermally conductive tape
- by a thermally conductive adhesive

The bottom of the LED assembly is electrically neutral, so it is not necessary to electrically isolate the base from the cooling surface.

Once mounted, you need to confirm that the assembly is being adequately cooled by testing the temperature of the LED as described in the Measuring LED Junction Temperature section of this document.

Bottom View

LED Mounting Using Pressure Sensitive Thermal Tape

Pressure sensitive thermal tape such as our pre-cut Bond-Ply© 100 tape makes it easy to fasten the base directly to a heat sink without the need for screws, clip mounts, or fasteners. However in order to ensure a sound thermal bond, it is very important that the tape be used correctly. This includes:

- Ensuring that all mating surfaces are clean, totally flat, and free of voids
- Sizing and positioning the tape so that all mating surfaces are covered
- Applying a minimum of 10 PSI of even pressure between the LED and heat sink for at least 30 seconds

Applying even pressure to bond the LED assembly to the heat sink can be difficult due to the small size of the assembly and the need to avoid touching or applying any pressure to the LED optic. To overcome this problem, we include a thermal press with our pre-cut thermal tape. This press has been specifically designed to allow you to apply even, constant pressure to the assembly and heat sink, without touching the LED itself. A video that demonstrates how to properly apply pressure sensitive thermal tape and use a thermal press is available at www.luxeonstar.com/using-thermal-tape.

If pressure sensitive thermal tape is used correctly, there is no need to use any additional mechanical fasteners.

LED Mounting Using Thermally Conductive Adhesive

Thermally conductive adhesive such as Arctic Silver™ Thermal Adhesive requires a bit more effort to use than thermal tape, but offers a permanent bond, wider operating temperature range, and higher reliability, especially in environments where the assembly will be subjected to mechanical shock and vibration.

To create a thermally efficient and reliable bond:

- Ensure that all mating surfaces are clean and free of any grease or oil
- Use just enough epoxy to create as thin a bond line as possible
- Apply as much pressure as possible between the LED and heat sink for at least 30 seconds, and then maintain pressure using a clamp or weight until the epoxy has set

Like our thermal tape, we include a thermal press with every order of Arctic Silver Thermal Adhesive to make it easier to create a sound bond. A video that demonstrates how to properly use the Arctic Silver Thermal Adhesive and a thermal press is available at www.luxeonstar.com/using-arctic-silver.

Measuring LED Junction Temperature

The junction temperature of the LED must be tested to ensure that it is being adequately cooled.

To make testing easy, the SP-06 assembly includes a temperature test point that can be used to determine the LED junction temperature using the following procedure.

For more details, refer to the Thermal Model on page 8 of this document.

Required Tools

- Digital Multimeter
- Temperature measurement meter
- Thermocouple or thermistor with Kapton tape and/or thermal adhesive epoxy

- or -

- Hand held temperature measurement probe with a small tip

Test Procedure

1. Enter the LED Typical Thermal Resistance Junction to Thermal Pad (°C/W) $R\theta_{J\text{-}C}$ value from the Rebel LED datasheet into box **B** in the formula on page 7 of this document.
2. Ideally, the temperature should be tested with the LED assembly mounted in the location where it will be operated.

   If the assembly's location will be difficult to reach, then you will need to attach a thermocouple or thermistor to the assembly using Kapton tape or Arctic Silver™ Thermal Adhesive epoxy so that the tip of the sensor is in direct contact with the temperature measurement point as shown in Images 3 & 4. Be sure to allow the adhesive to fully cure before testing.

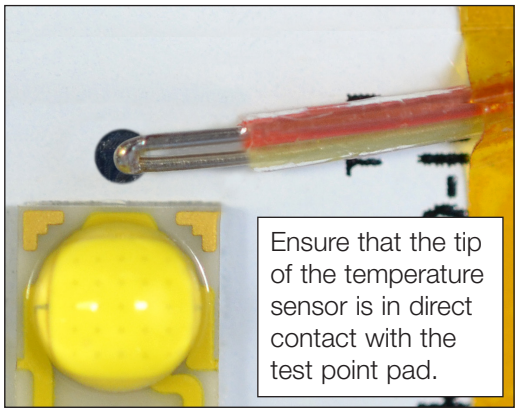


Image 3

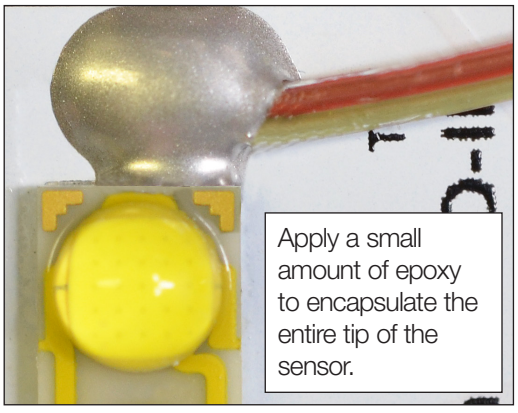


Image 4

3. If the LED assembly is easily accessible, you can use a hand held temperature probe such as our TP-01 Thermistor Tipped Probe to determine the LED junction temperature.

   To measure the test point temperature with a hand held probe, allow the temperature of the LED assembly to stabilize and then hold the tip of the probe onto the temperature test point for at least one minute. Move the tip of the probe around a bit to be sure you are measuring the point with the highest temperature reading. (Images 5 & 6)

   You will find more details about how to use the TP-01 probe (and other hand held temperature probes) at TP-01.com.

4. After the temperature measurement has stabilized, note the test point temperature and enter it in box **A** on page 7.

Firmly hold the test probe directly onto the thermal test point.

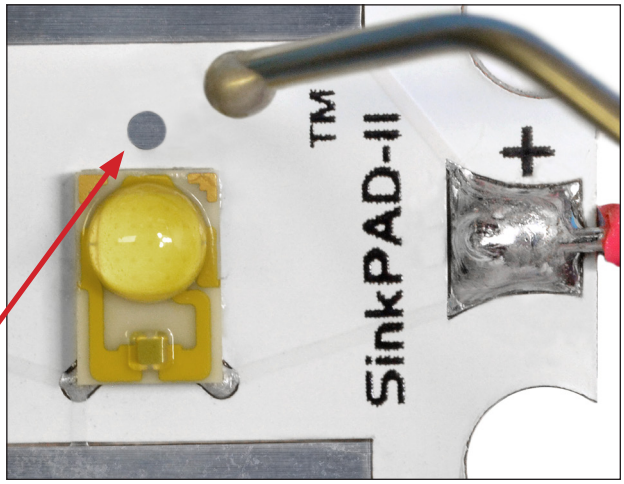


Image 5

Move the tip of the probe around to be sure that you are measuring the highest temperature you can find.

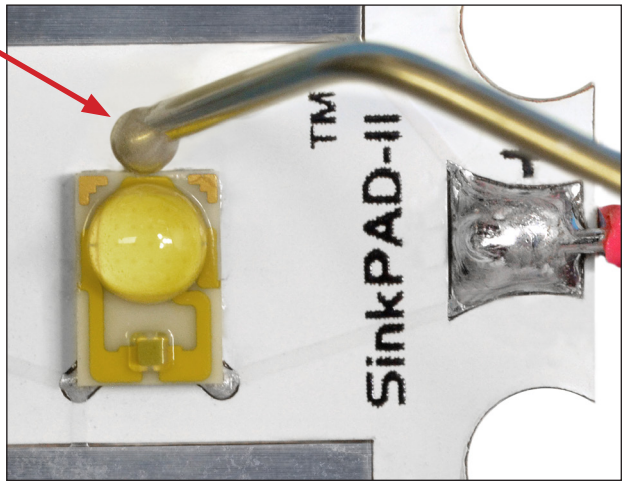


Image 6

5. Measure the forward voltage of the LED while at the stabilized temperature (Image 7) and note it in box **C**.

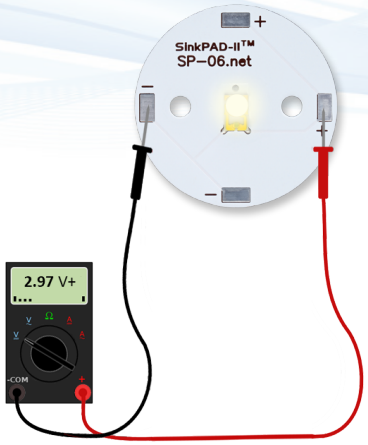


Image 7

6. Enter the current, which you are using to power the LED, in box **D**.
7. Evaluate the completed formula to determine the junction temperature of the LED.

$$\boxed{A} + (0.5 + \boxed{B}) \times (\boxed{C} \times \boxed{D}) = \boxed{}^{*}$$

A	0.5 +	B	× (C	× D) =	
Test Point T_S Temperature °C	$R\theta_{C-S}$	$R\theta_{J-C}$	LED Forward Voltage V_f	LED Forward Current I_f	LED Junction Temperature °C

* For maximum LED life, color stability and reliability, the calculated junction temperature must always be below the maximum LED junction temperature published in the Philips Lumileds datasheet for Rebel LEDs.

More information about this junction measurement technique can be found in the LUXEON LED Thermal Measurement Application Brief (AB33) published by Philips Lumileds.

Failure to ensure that the LED junction temperature is kept below it's maximum temperature rating will result in poor color rendering, early degradation of light output, and premature LED failure!

Thermal Model

Image 8 is a cross-section of a typical SinkPAD-II™ LED assembly that illustrates how the LED is attached to the SinkPAD-II™ base and shows the thermal paths between the LED junction, temperature test point and bottom of the LED assembly.

- $R\theta_{J-C}$ is the thermal resistance from the LED junction (T_j) to the LED thermal pad
- $R\theta_{C-S}$ is the thermal resistance from the LED thermal pad to the temperature test point (T_S)
- $R\theta_{C-B}$ is the thermal resistance from the LED thermal pad to the bottom of the SinkPAD-II™ assembly

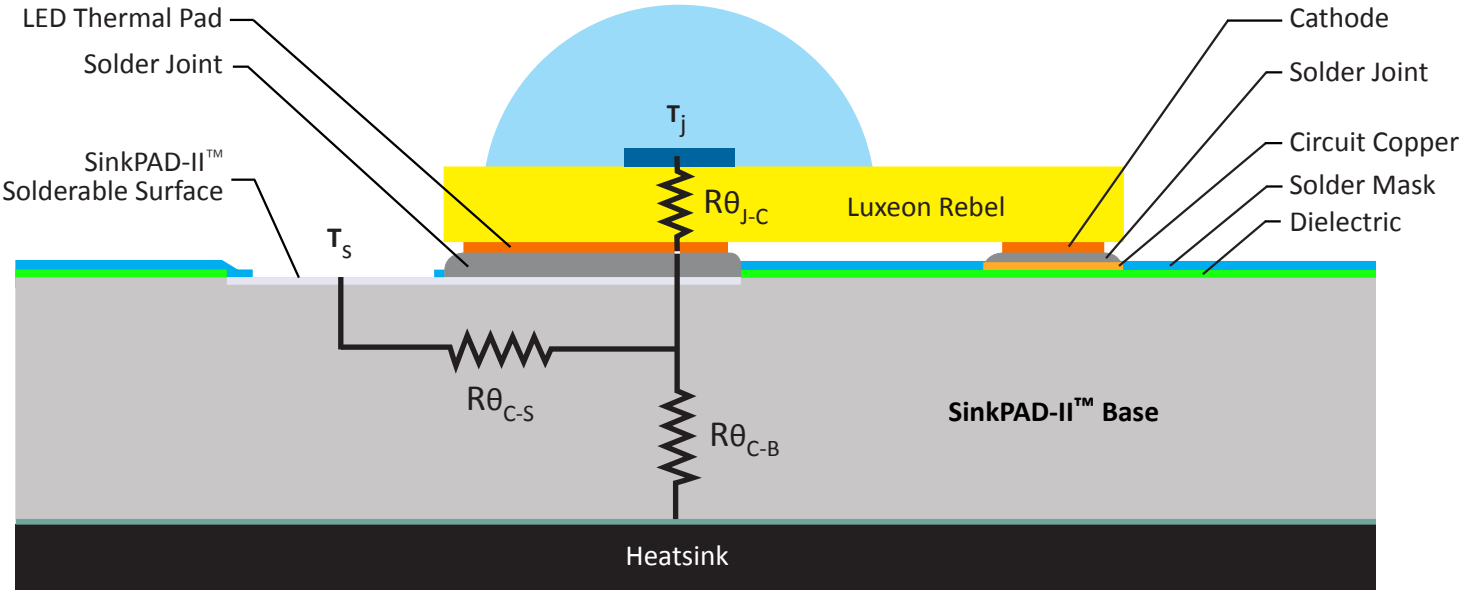
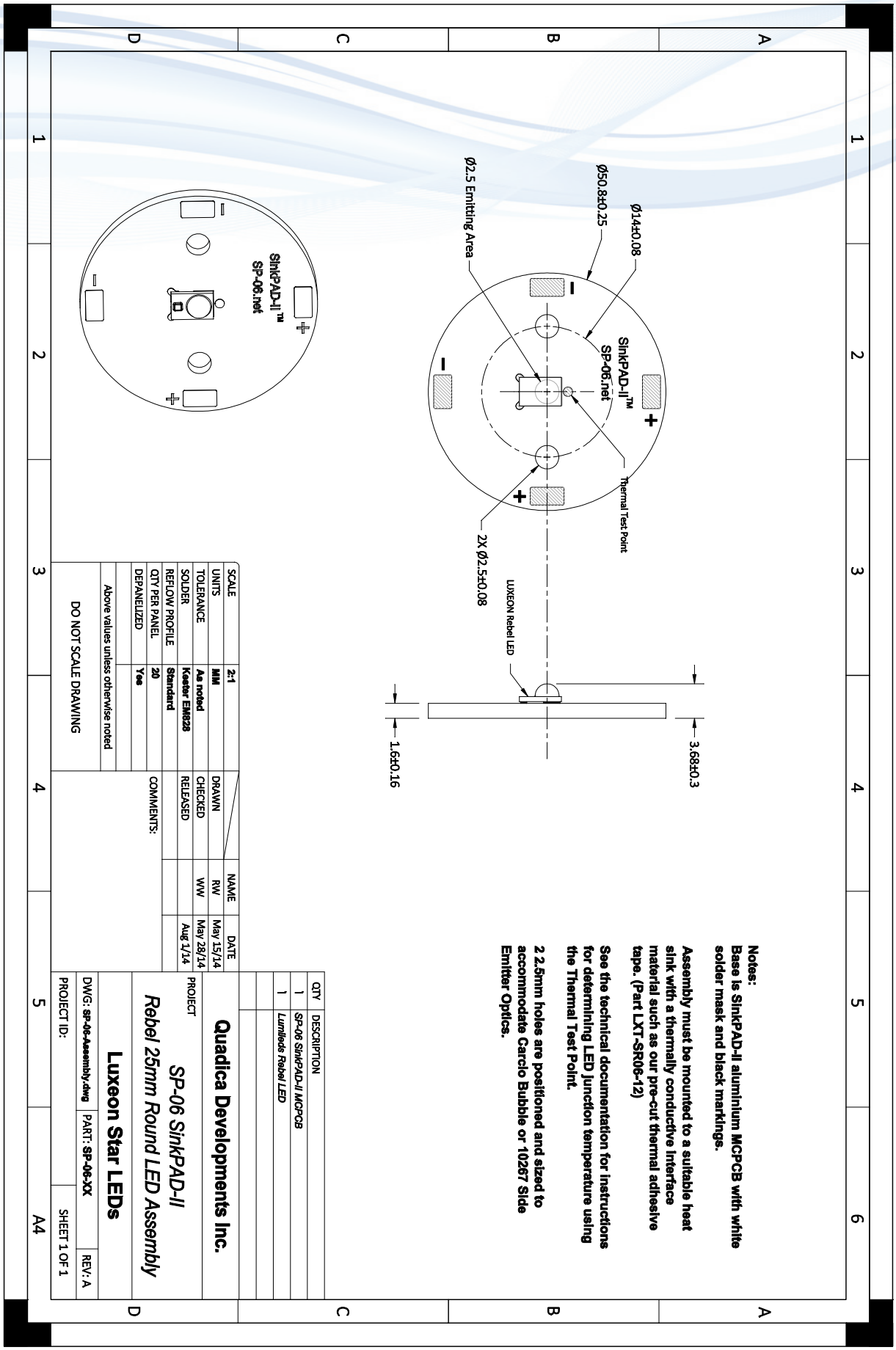


Image 8



You can download the full sized drawing from www.luxeonstar.com/sp-06-assembly.pdf

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Safety:

The LED mounted onto this assembly will produce a highly intense point of light. Do not stare directly at the LED for any length of time.

Restricted Use:

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Document ID: SP-06
Revision: Feb 10, 2015