

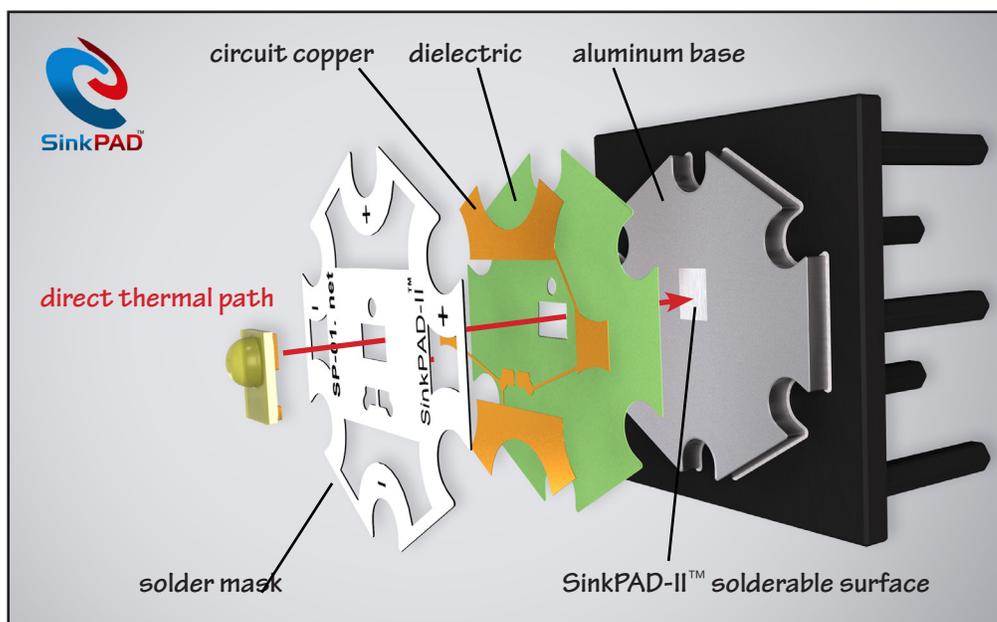
The SP-12 high brightness (HB) LED lighting module has been specifically designed to work as a drop-in replacement for Luxeon Star/O LED modules that are no longer manufactured by Philips Lumileds.

The module consists of a single Rebel LED soldered to a SinkPAD-II™ board with a [Fraen FLP-N4-RE-HRF](#) 9° optic fastened to the base. 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.

The SP-12 Rebel Star/O has a near identical form factor to the original Luxeon Star/O module and can be cooled and powered using the same heat sinking and current regulating driver used for the original Star/O.



SinkPAD-II™ Technology



Features

- Drop-in replacement for the Luxeon Star/O
- Can be powered from the same circuit as the Star/O
- Higher lumens output
- Available with all currently produced Rebel LEDs
- **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
- 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

Key Differences Between the SP-12 and the Original Star/O Modules

While the SP-12 has been designed to be used as a drop-in replacement for the original Luxeon Star/O module, there are a few key differences that the designer needs to be aware of, including:

- The attached optic produces a 9° beam angle as opposed to a 10° angle produced by the original Star/O collimator.
- The Fraen lens holder has a slightly larger diameter of 21.8mm as opposed to 21.5mm for the original Star/O.
- Depending on the Rebel LED that is mounted, the SP-12 will produce a higher lumens output at 350mA as compared to the original Star/O. If required, the lumens output can be reduced by using a lower input current.
- Depending on the Rebel LED that is mounted to the SP-12, the forward voltage may be different than the original Luxeon Star/O. This will typically have no effect for most current regulating drive circuits, however the designer will need to confirm that the input voltage to the driver is high enough to power the connected LEDs.
- While the thermal efficiency of the SP-12 is significantly better than the original Luxeon Star/O, the designer still needs to confirm that the SP-12 is being adequately cooled.

Module Specifications

Parameter	Value
Base Type	1.6mm SinkPAD-II™ Aluminum
Thermal Performance $R\theta_{C-B}$	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)	25L x 25W x 13.6H
Weight	5.9g

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.

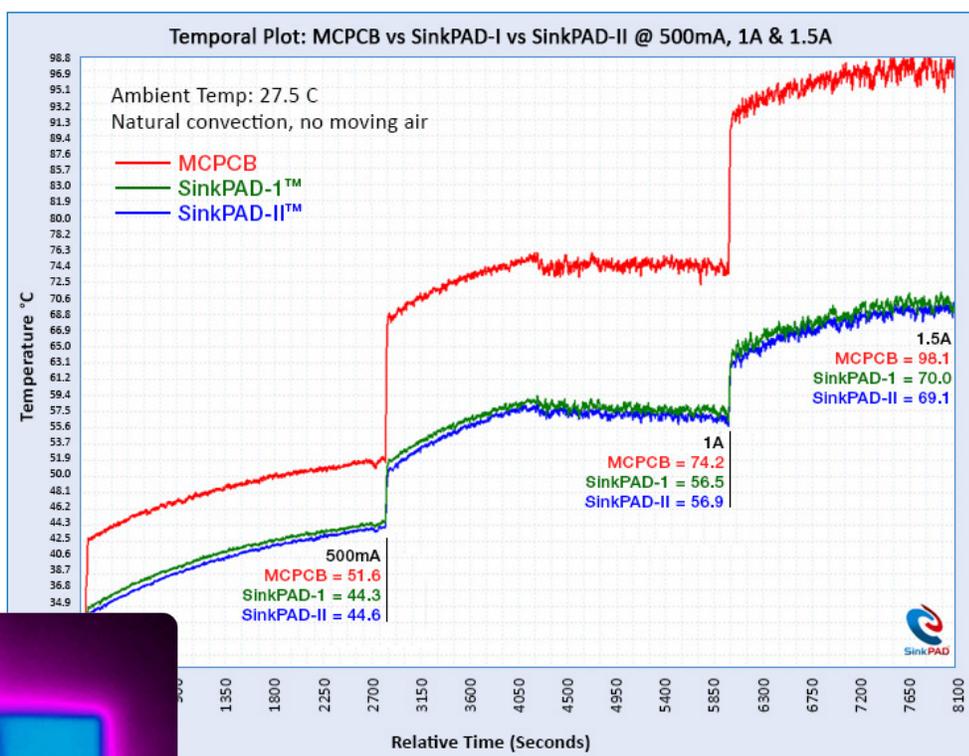


Image 1

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.

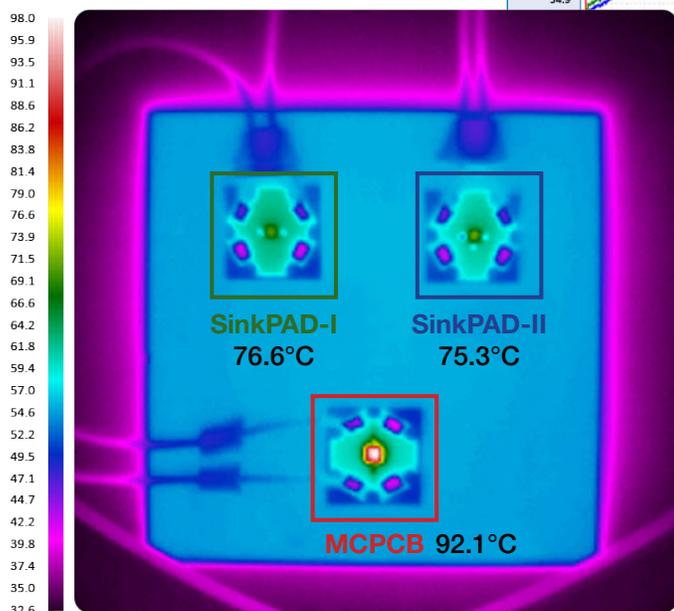


Image 2

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.

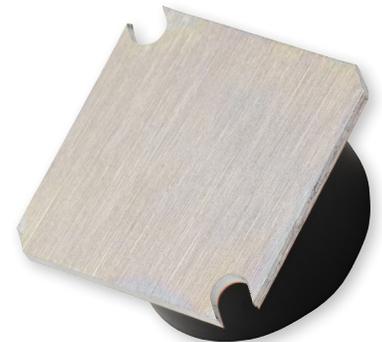
Mounting & Cooling

Use of this module 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 module be mounted to a suitable finned heat sink (aluminum or copper) that is exposed to open air. The module can be mounted to the heat sink in one of three ways:

- [through pressure sensitive, thermally conductive tape](#)
- [by a thermally conductive adhesive](#)
- with mechanical fasteners

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



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

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 module 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

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.

LED Mounting Using Mechanical Fasteners (Not Recommended)

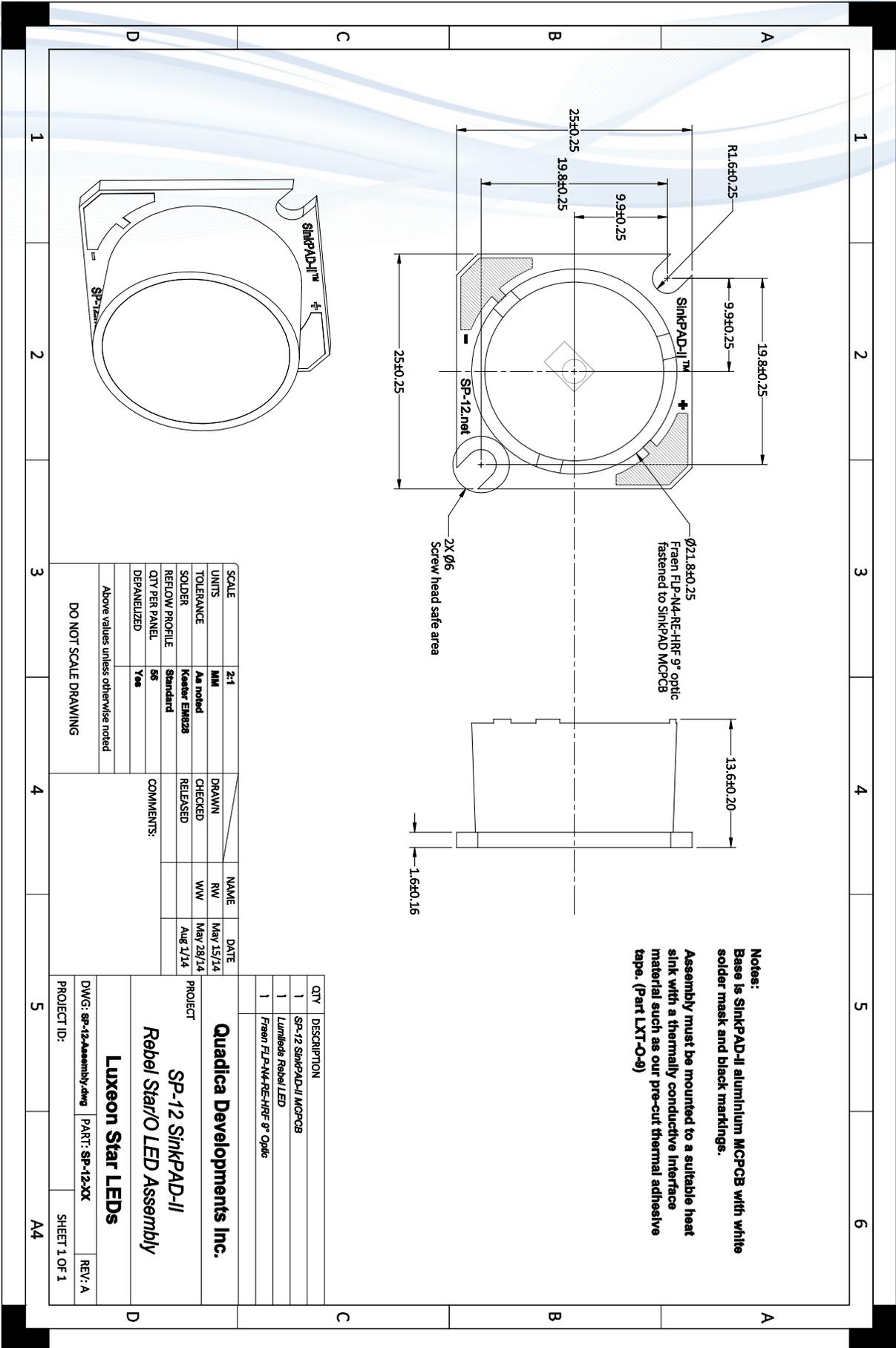
While the SP-12 includes two slots that can be used to fasten the LED module to a heat sink using screws, we generally **do not recommend** this fastening method. As the LED is directly soldered to the aluminum base, it is very easy to weaken or fracture the solder joint if the screws are unevenly or overtightened. If your specific application requires that you fasten the LED using screws, take extra care to ensure that the screws are carefully and evenly tightened, and that you only use just enough thermal grease to fill any small voids.

Measuring LED Junction Temperature

As the optic on the SP-12 module does not allow you to access the temperature test point, you will need to use a similarly sized surrogate LED module to get a close approximation of the LED junction temperature when operated under identical conditions.

A [SP-06 LED module](#) would be a good surrogate candidate as it is about the same size as the SP-12 with a single LED mounted in the center of the module. For detailed instructions on how to determine the LED junction temperature, refer to the datasheet for the selected surrogate LED.

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



You can download the full sized drawing from www.luxeonstar.com/sp-12-assembly.pdf

QTY	DESCRIPTION	DATE
1	SP-12 SinkPAD-II MCPCB	May 15/14
1	Limited Rebel LED	May 28/14
1	Fraen FLP-N4-RE-HRF 9° Optic	Aug 1/14

Quadica Developments Inc.

PROJECT: SP-12 SinkPAD-II Rebel Star/O LED Assembly

Luxeon Star LEDs

DWG: SP-12-Assembly.dwg PART: SP-12-XX REV: A

PROJECT ID: SHEET 1 OF 1

A4

Safety:

The LED mounted onto this module 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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