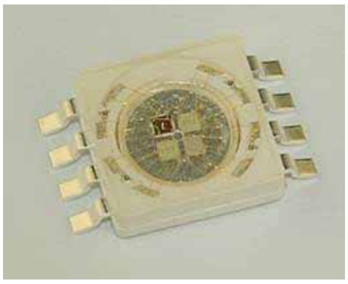
NovaBrite Products Application Note

NovaBrite

RGB Full Color

High Power LED

Application Note



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VINCENC HOME DEVELOPMENT CO., LTD

4W NovaBrite Module F Type

NovaBrite Module F Type use a FR5 PCB to connect pin1~pin8.

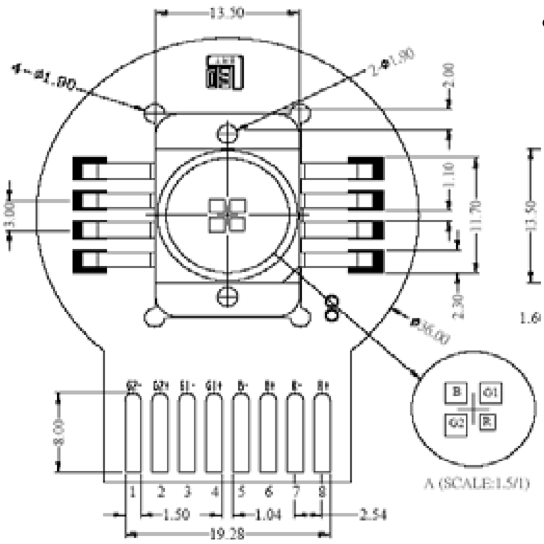
So the user could connect each LED chips with gold pad.

The NovaBrite Module F Type every chip drive Current = 350 mA, Red chip's drive Voltage=2.2V, Blue chip's drive Voltage=3.5V, Green chip's drive Voltage=3.5V.

Pin 1 control Green chip 2's negative (－) and Pin 2 control Green chip 2's positive (＋)

Pin 3 control Green chip 1's negative (－) and Pin 4 control Green chip 1's positive (＋)

Pin 5 control Blue chip 1's negative (－) and Pin 6 control Blue chip 1's positive (＋)



and Pin 8 control Red chip 1's positive (＋)

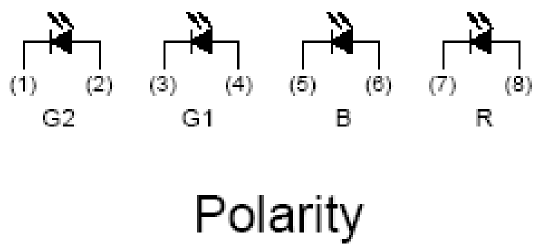


Fig. 1 NovaBrite Module F Type Electrical Characteristics

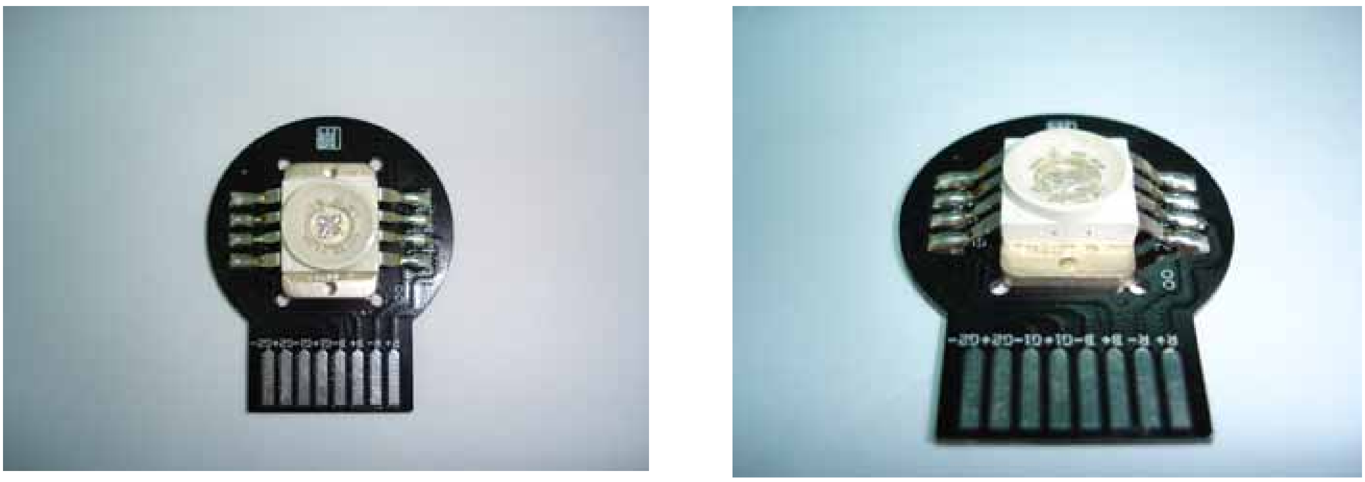


Fig. 2 NovaBrite Module F Type

4W Full Color NovaBrite 2 Electrical Characteristics

NovaBrite 2 (VHP-3B4F02)Emitter

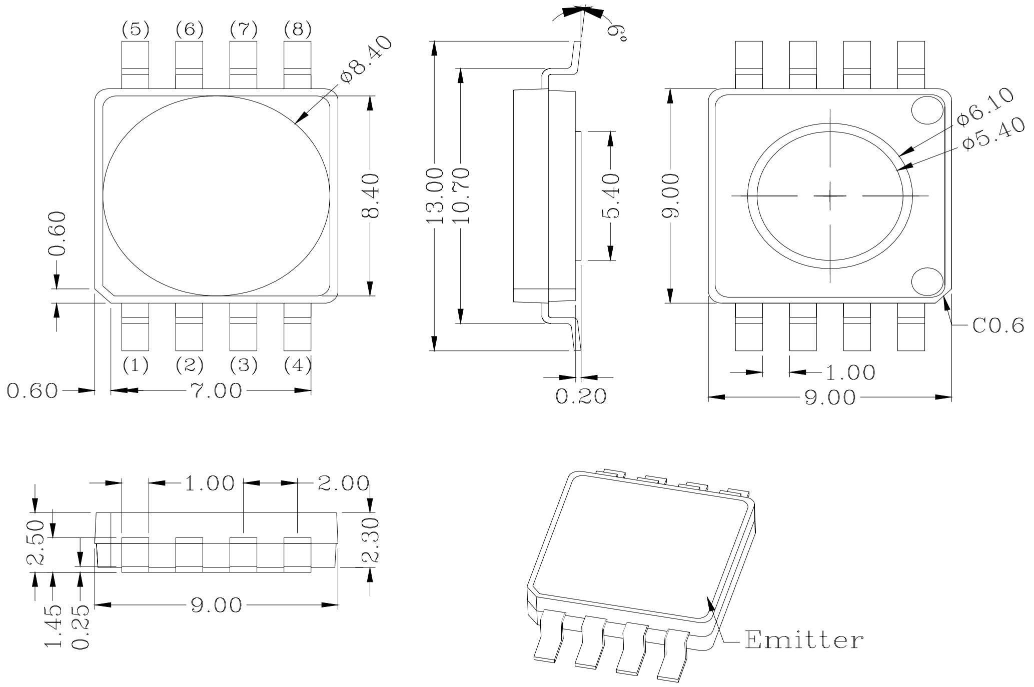


Fig. 3 NovaBrite 2 Emitter Electrical Characteristics

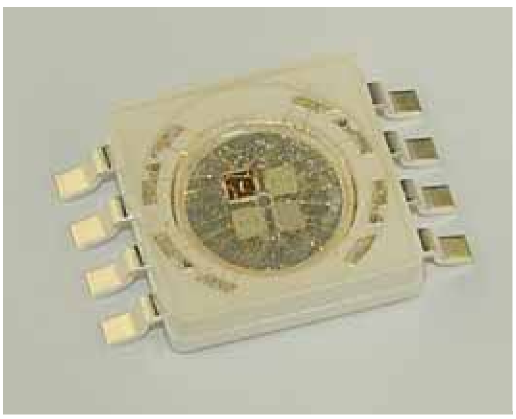
Pin 1 control Red chip’s negative (—) and Pin 2 control Red chip’s positive (+)

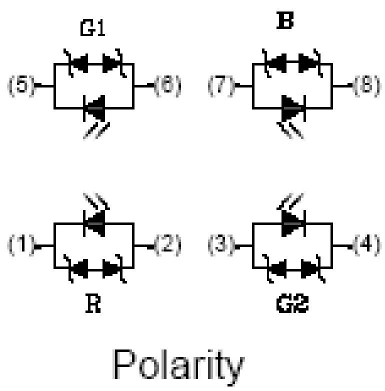
Pin 3 control Green chip 2’s negative (—) and Pin 4 control Green chip 2’s positive (+)

Pin 5 control Green chip 1’s negative (—) and Pin 6 control Green chip 1’s positive (+)

Pin 7 control Blue chip’s negative (—) and Pin 8 control Blue chip’s positive (+)

NovaBrite 2 Emitter has 3 or 4 chip package.
If NovaBrite 2 uses 3 chips package, the pin 5&6 will not be use.





Application Example

Fig. 5 Full Color Streamer Module

Fig. 6 Full Color Streamer Application Example

Fig. 7 Full Color Brick Module

Fig. 8 Full Color Brick Application Example 1

Fig. 9 Full Color Brick Application Example 2

Important Design Rules

There are four major design rules that must be considered during the design of a NovaBrite product and its assembly procedure:

1. The thermal resistance from the back of a NovaBrite Emitter to the ambient air must be kept to a minimum. Any heat barrier prevents the NovaBrite Emitter from running at optimum performance.

2. Electrical insulation between the pin 1~pin 8 and the metal is required. The slug of a NovaBrite Emitter is not electrically neutral. Do not electrically connect the slug to any trace or pad on the board.

3. Use a thermally conductive adhesive to attach the metal slug to the heatsink while minimizing the thermal resistance.

4. The soldering of NovaBrite Emitter terminals is limited to selective heating of the leads, such as hot bar soldering, fiber focused IR, or hand soldering. NovaBrite emitters cannot be soldered in infrared, vapor phase reflow or wave soldering processes.

Soldering Assembly Method

User could use hot bar soldering, fiber focuses IR, or hand soldering

Hand soldering required equipment

1.Temperature Controlled Soldering Iron

2.Set the tip temperature to 750°F

3. Use a medium-size solder tip

4. Use Lead Free Alloy

Recommended Kester Flux Core Solders:
Flux：Type245 or 285
Core Size：50
Wire Diameter：0.031''
Lead Free Alloy：Sn96.5%/Ag3%Cu0.5%

5. Add flux as necessary

Fig. 10 Hand soldering required equipment

The Soldering Step as below:

1.Clean the soldering surfaces.

2.Use a solvent like IPA to remove nonpolar compounds, and de-ionized water to remove polar compounds

3.Solder the lead to the pad. Add flux as necessary.

4.Clean any flux residue with a solvent or Kester#5768 flux cleaner.

Note: Use hand soldering you needs at least 330℃,1.5 seconds.

Application of solder flux by dispensing

Solder flux is recommended for good heat transfer during the soldering of the emitter terminals to reduce the required soldering time. A selection of commercially available solder flux pastes include:

- α_Metals 390DH4
- α_Metals LR735
- α_Metals NS4029
- ESP 6_412
- Cobar 380SR_flux gel

The amount of flux should be optimized during the adjustment of the solder process. The right amount of flux will cause the solder to melt within about 0.4s.

Soldering of electrical leads by hot bar reflow soldering

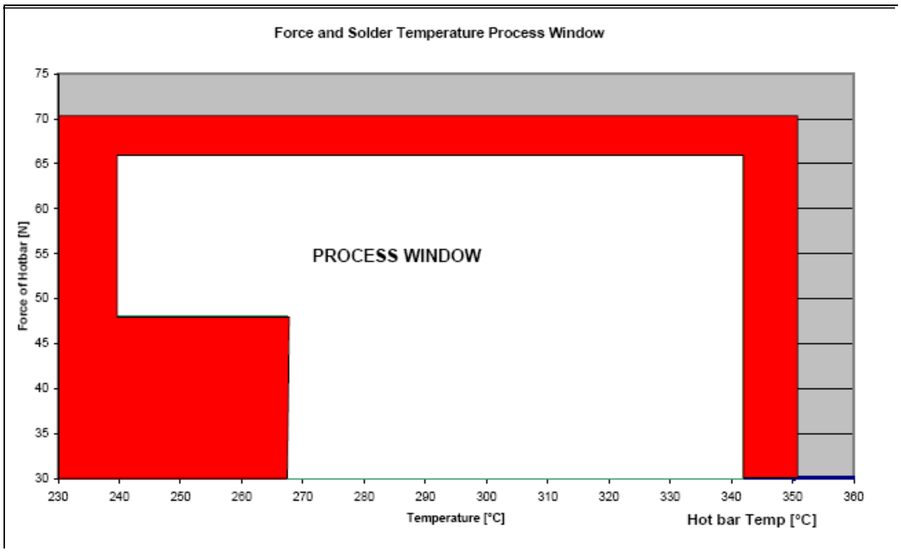
NovaBrite Emitters have a maximum storage temperature of 120°C. Therefore it is not possible to use a reflow soldering process for array assembly. A hot bar soldering process is recommended when soldering NovaBrite Emitters. This process will only transfer heat to the leads and avoids overheating the emitter that will damage the device.

In order to transfer sufficient heat from the hot bar to the device, the following process parameters must be carefully considered:

1. Amount of flux, the thickness is about 90 - 115 μm

2. Pressing force of the solder tip: 40N

3. Hot bar temperature the recommended process window for temperature and force is shown below: 330℃, 1.5 seconds.



Hot Bar Soldering Recommended Process Window.

Fig. 11 Hot bar soldering process

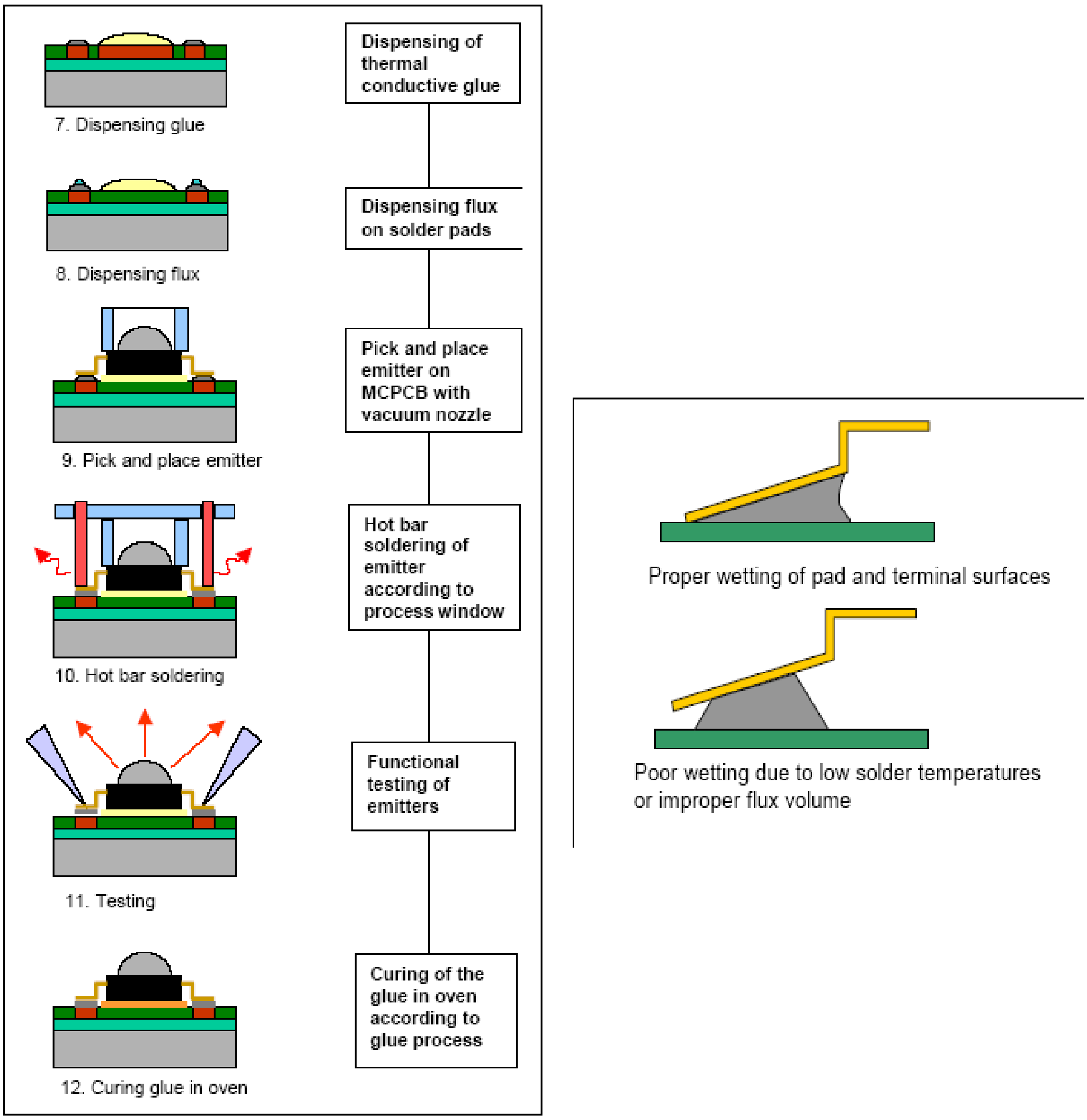


Fig. 12 Hot bar soldering process

How to placement NovaBrite Emitters

The best method of placing NovaBrite Emitters is with automated pick and place equipment. It is recommended to follow these important guidelines:

1. A 5N force for 100ms evenly spreads the glue over the entire area of the slug pad. Following these recommendations the resulting thickness of the glue layer is typically 70 µm.

2. NovaBrite Emitters should be picked and placed by the housing (white body), not by the lens or the leads.

3. The inner diameter of a vacuum pick_up nozzle should be greater than 6.1mm to avoid damage to the optical surfaces of the lens.

NOTE: Do not handle the NovaBrite Emitter by the lens or the surface at any time during the assembly process. This can cause damage to the optical surfaces or may dislocate the lens if excessive force is applied.

How to select a heat sink

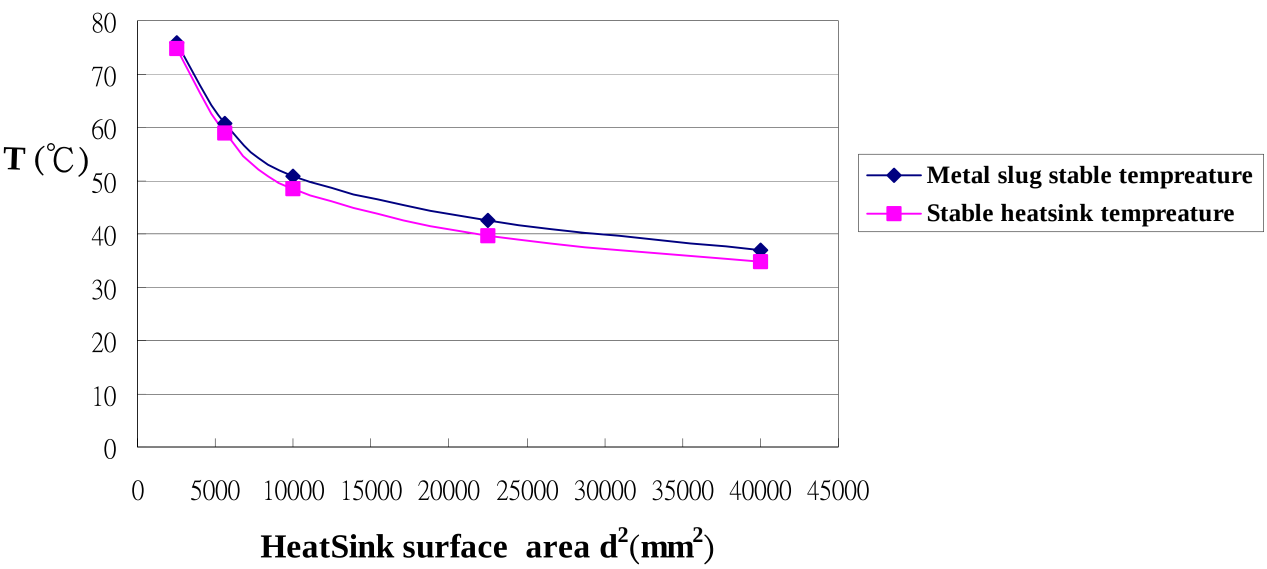


Fig. 13 Heat sink and temperature relation

Definition of Heat Sink Size

The term “ exposed surface area ” is the total area of all surfaces of the heat sink exposed to convection. The "footprint area" quantifies the projected area of the heat sink as shown in the diagram to the right. The LEDs are mounted to the heat sink face that defines the footprint area. An X Shaped finned heat sink provides more exposed surface area in a given foot print when compared to a standard finned heat sink.

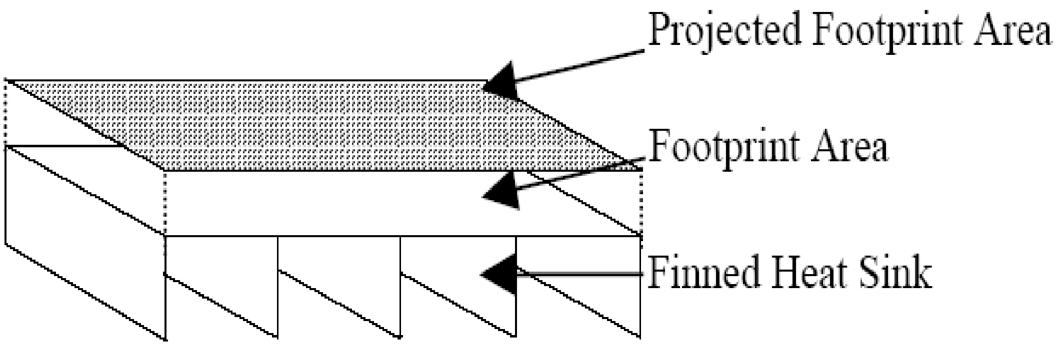


Fig. 14 Heat Sink definition

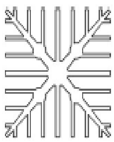
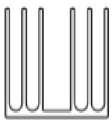
	Crossection of Heat Sink	Footprint area (inch^2)	Exposed surface area (inch^2)	R_{THETA}, J-B [°C/W]	R_{THETA}, B-A [°C/W]	R_{THETA}, J-A [°C/W]
X-Shaped, free convection		2.25	34.5	11	8.5	19.5
X-Shaped, with fan		2.25	34.5	11	3.0	14.0
Finned, free convection		3.10	36.2	11	9.0	20.0
Finned, with fan		3.10	36.2	11	4.0	15.0

Fig. 15 Heat sink Comparison Table

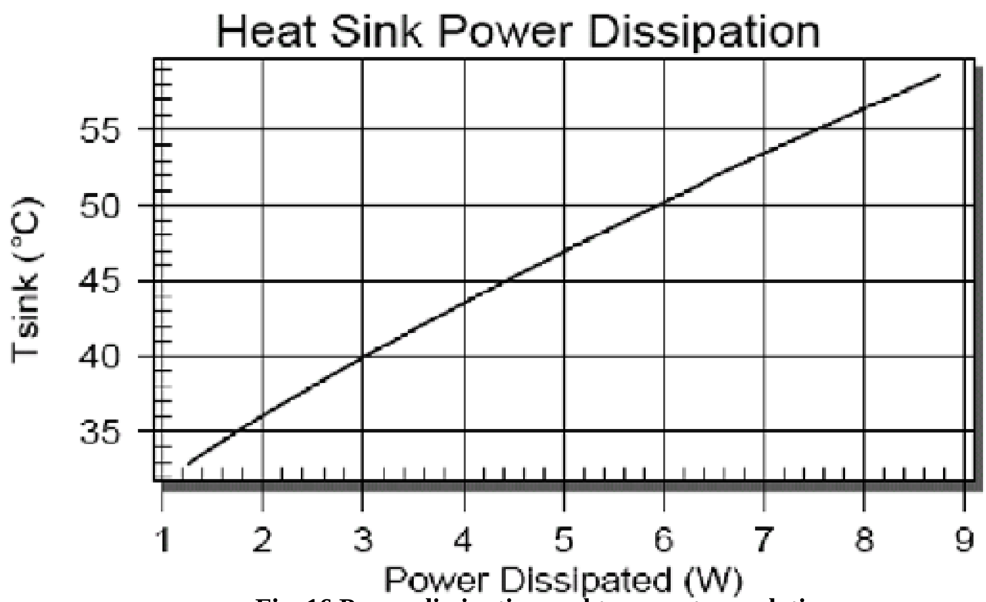


Fig. 16 Power dissipation and temperature relation

Fig. 17 Heat Sink H1

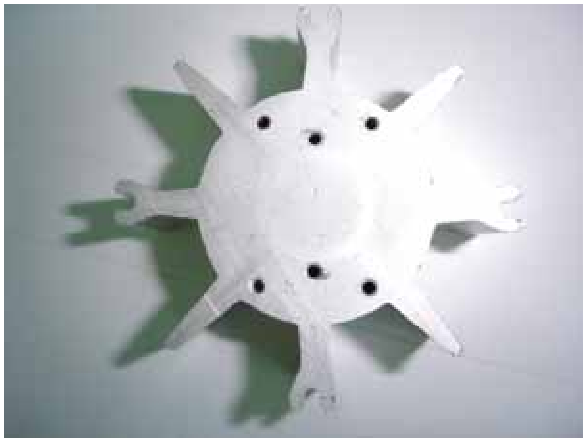


Fig. 18 Heat Sink H2

THERMAL INTERFACE MATERIAL SELECTION

Thermal interface material is critical to prevent air gaps, but is by far the most difficult parameter in thermal design to understand. Most of the Thermal Interface Material suppliers provide either a Thermal Conductivity (K) value, which is a bulk material property, and a thermal resistance measurement in cm^2 ºC/W. They may also include properties of their material under different pressures. This makes it much more difficult to select a material.

As a gross generality, unity (or 1ºC/W) can be used in "back of the envelope" thermal calculations. The purpose of a thermal interface material is to conform to every surface irregularity in the planes between the package (case) and the heatsink. Achieving a compressed metal-to-metal bond will only occur over approximately 20% of the surface area, even with highly polished surfaces. Thermal materials are used to "fill the air gaps" in this interface, hence the commonly used name "gap filler". A system that utilizes thermal greases and compression through screw down features in the Light Engine package or case, realize the lowest thermal resistance values. Even though the Thermal Conductivity (Bulk Property) of these materials are quite low (often 1 W/mK or lower) the greases are designed to conform to the microscopic gaps (or scratches) in the metal surfaces, and "squeeze" out the air.

These materials do not have significant natural adhesion, and devices must be screwed down to facilitate the lowest thermal resistance of the system. Solder is another material that can achieve low resistance values; however there is one significant drawback to the use of solders. They don't bond well to Aluminum, a common heatsink material, without significant preparation. Phase Change Materials (PCM) and Thermal interface tapes are both very prominent in designs. PCMs must be compressed to function properly. PCMs may be compressed between the LED array and the heatsink using mounting screws. PCMs are waxy materials that change from high to low viscosity after reaching a particular design temperature.

These materials then flow easily, thereby filling gaps in the same way greases do. PCMs can achieve thermal resistance values close to 1ºC/W just by applying sufficient pressure to the light source to complete the bond. Performance values approaching those of Greases can be achieved by screwing the device down to the heatsink. PCMs are very popular as they are not messy like grease, can be pre-applied to heatsinks, and do not pump-out over thermal cycling like greases. While they do not exhibit the very low resistance values of grease, they do provide an excellent and easy method of thermal management. The final category of materials commonly in use, are conductive epoxies and thermal pads. These often will have thermal resistance values greater than 1ºC/W, which, depending on your application and power level, can have significant effects on the heatsink design and selection. The following table shows a comparison of the different thermal interface materials.

How to assembly NovaBrite to the heatsink

Assembly heatsink required supplies and equipment

1. A controlable twist force screwdriver: twist force reach 0.2~20 kg
2. ϕ =1.8 (mm) screw,screw head ϕ =3.5(mm),long=6(mm)

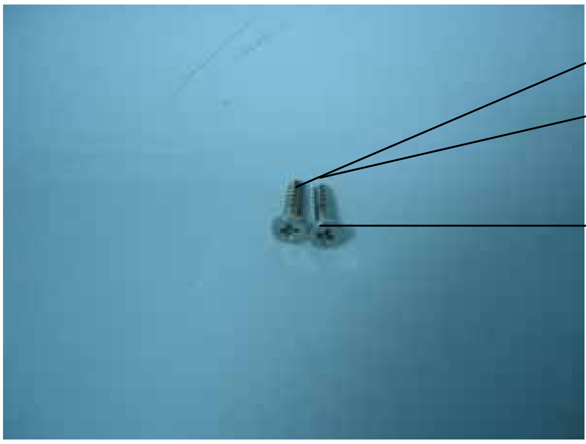


Fig. 19 Requirement Screw

3.Use thermally conductive adhesive, “TIG2000” supplier: General Electric Company

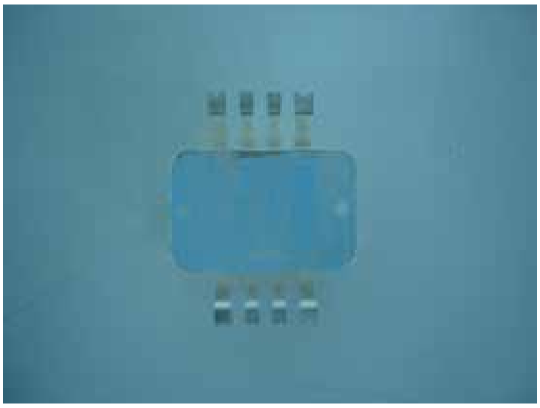


Fig. 20 Add thermally conductive adhesive, “TIG2000”

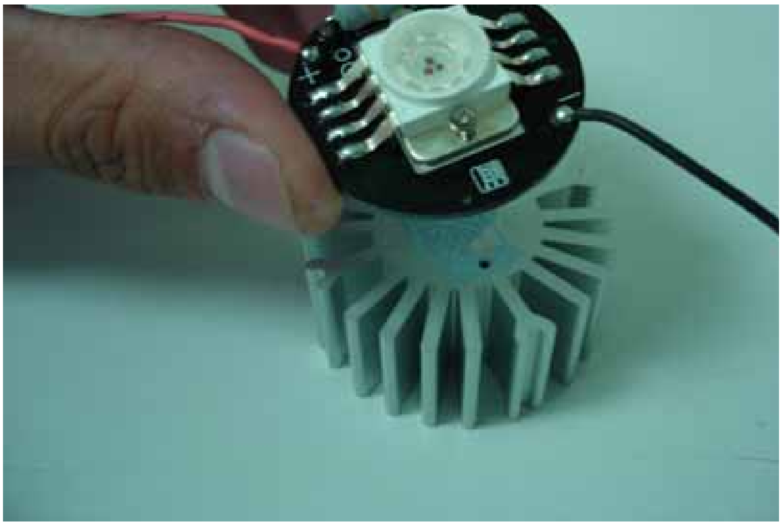


Fig. 21 Assembly NovaBrite module with heatsink H1

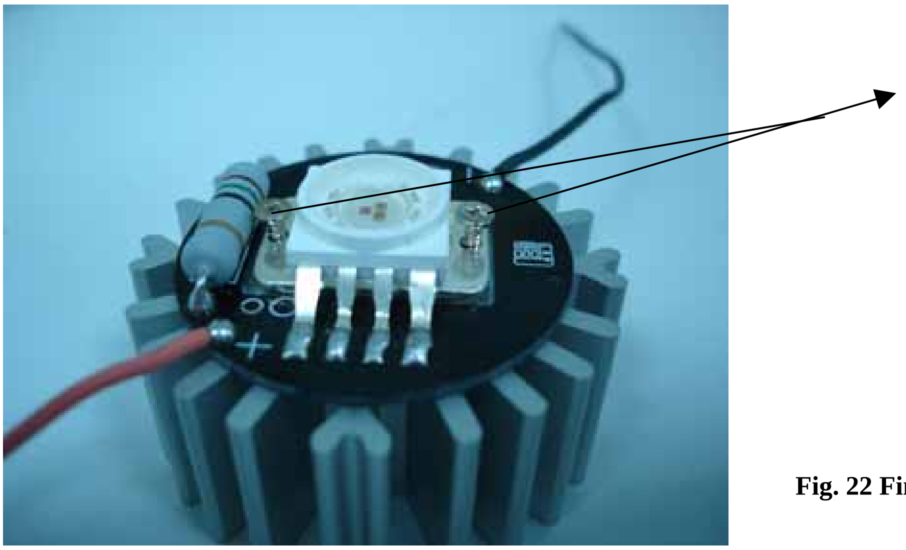


Fig. 22 Finish assembly drawing