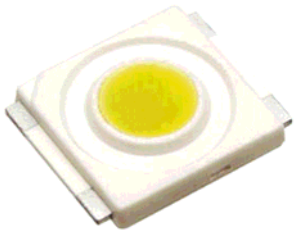
plus Opto THE OPTOELECTRONIC SPECIALISTS
T +44 (0) 1942 671122 F + (0) 1942 671133 E sales@plusopto.co.uk W www.plusopto.co.uk
B13 Derwent Court William Way Moss Industrial Estate Leigh Lancashire WN7 3PT

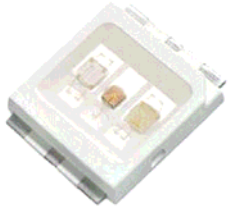
SEAM Semiconductors

APPLICATION NOTE:
Silicone Casting LED Handling Procedures

Introduction:
Seam Semiconductor uses Silicone as encapsulant material for some of their LED products, especially for high power white LED. The advantages of silicone casting over conventional epoxy casting are:



Optical clarity and lumen maintenance
Silicones have some of the highest clarity (transmission) values of any polymeric based materials. Light that is produced by the LED is transmitted efficiently with little absorbance within the silicone material. By closer matching of the refractive index of the silicone to that of the substrate, interfacial losses can be minimized. The combination of clarity and refractive index of silicones can lead to increased light output and improved lumen maintenance.



Optical Stability and Stress Relief
Another strong advantage of silicones is their thermal and photo stability in a variety of harsh environments. These features minimize the risk of yellowing or changes in physical properties during device operation. Their use also provides better thermal cycling reliability for protecting LEDs. As a result of the special materials used to fabricate these devices, many components in the package assemblies including the LED chips and their wire bonds can be sensitive to mechanical stress damage. Silicones have a soft, stress relieving nature that can cushion these devices from outside stress. Stability and the stress-relieving nature of silicones can significantly contribute to better thermal cycling reliability and long lifetimes for the packaged LEDs.

Handling Of Silicone Encapsulated LED
Compare to conventional epoxy resin encapsulant, silicone is a much softer type of material. Thus, when handling the LED, care should be taken not to apply excessive pressure on top of the silicone. Sharp object might pierce through the silicone encapsulant and damage the LED.

When handling the LED using tweezers, care should be taken to ensure the tweezers are not be in contact with the silicone surface to prevent scratches on the lens. The correct method is to pick or place the LED using tweezers from the side of the package. For SMT mounting, the pick and place nozzle must be bigger than the LED emission area. This prevents the LED from sticking to the pick and place nozzle. Parameter settings for the pick and place process should also be evaluated to ensure no damage to the LEDs.

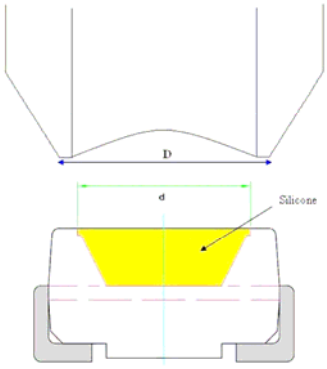


Figure 1: Pick & place nozzle diameter (D) should be larger than the opening (d)

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Caution When Apply Conformal/Insulated Coating On Top Of The LED

Many solvents are compatible (soluble) with the silicone structure. The solvent is absorbed into the cured silicone and enlarges the volume. If the solvent can later evaporate, the volume will again decrease; usually leading to little or no change in the bulkproperties of the cured silicone from its original state. The degree of swelling will vary with the solubility of the particular solvent within silicone. Most organic solvents and fuels will show an effect. However if the organic solvent is trapped in the silicone, it may become carbonized when heated up and cause IV degradation.

If customers intend to apply a layer of conformal coating on top of the LED to meet the application requirements then it is advisable to use solventless coating material. Customers should assess if there is any possibility of a chemical & physical reaction between the LED silicone and coating material by performing reliability burn in testing. Care should be taken to ensure the coating applied will not change the light property of the LED. Certain type of electronic conformal coating material may consist of UV filter as additive; this type of coating may cause the color shift of white LEDs to become more bluish.

Cleaning Of LED

If cleaning is required after soldering, we suggest customer to use IPA as cleaning agent. Maximum recommended rinsing time is 10 seconds. Ultrasonic cleaning may damage the LED and thus we do not recommend this method to perform cleaning.

Water Interaction With LED

Similar to majority of the electronic ICs, LED should not be in direct interaction with water. Water will cause lead frame corrosion and device short circuit.

Foreign Particle Acceptance Criteria

Due to the silicone is soft in nature; the tendency of foreign particulate to adhere on the silicone surface would be greater compare to epoxy resin. However a small amount of foreign particle will not affect the device performance (reliability & brightness). An example photo of acceptable foreign particle on top of the LED is shown below:

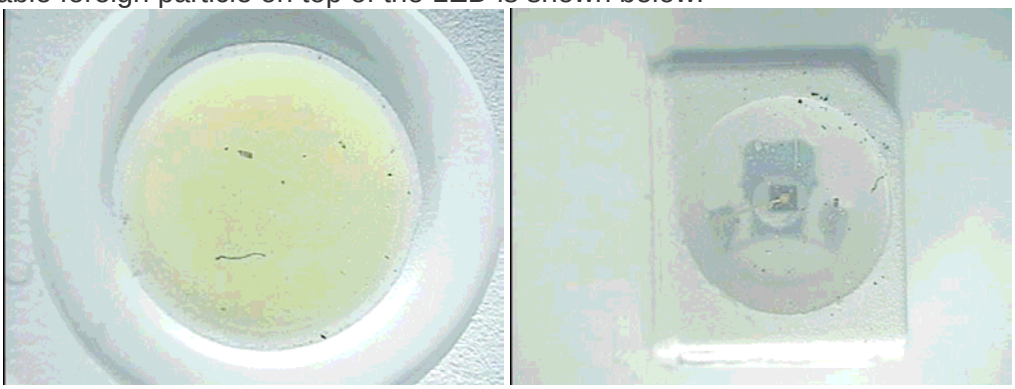

Figure 2: Acceptable foreign particle level on LED with silicone casting

Summary :

Silicone casting LEDs have better lumen maintenance and reliability performance compared to conventional epoxy type LEDs. However since silicone is soft in nature, extra precautions are should be taken to ensure that excessive force is not applied direct on top of the silicone which might damage the LED.