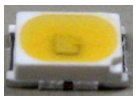
MAGIC LED PLW114050 Series
Application Note

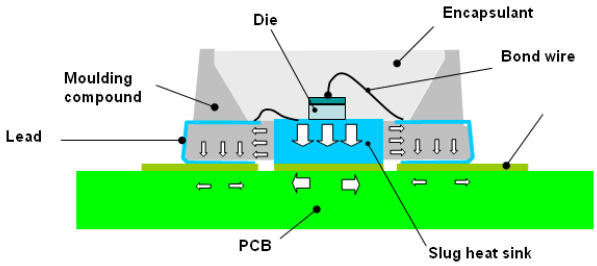


Thermal Management

Solid-state light emitting diodes (LED) are highly efficient and reliable when compared with traditional light source technologies. Their long-term reliability performance depends highly on maintaining the operating conditions within the datasheet recommendations. Although today LEDs are very efficient, a considerable amount of the electrical input power is still not converted into light but simply lost and transformed into heat. Unfortunately, the heat generated inside the LED impacts negatively on its performance and in extreme cases can even cause catastrophic failure. The LEDs are designed to dissipate heat efficiently but users need to make sure the LEDs are operating within specification. The performance of Plessey LED is characterized versus its junction temperature Tj. The junction temperature can not be measured directly and therefore it is calculated using equation (1) below;

$$T_j = T_a + (Re_{j\text{-}sp} + Re_{sp\text{-}hs} + Re_{hs\text{-}a}) * (V_f * I_f - W_{op}) \qquad (1)$$

Where,
T_j is the junction temperature in degrees Celsius (°C)
T_a is the ambient temperature (°C)
$Re_{j\text{-}sp}$ is the thermal resistance between junction and solder point (°C/W)
$Re_{sp\text{-}hs}$ is the thermal resistance of the PCB heat sink (°C/W)
$Re_{hs\text{-}a}$ is the thermal resistance between PCB heat sink and ambient (°C/W)
I_f is the forward current and V_f is forward voltage.
W_{op} is the optical radiant power (W).

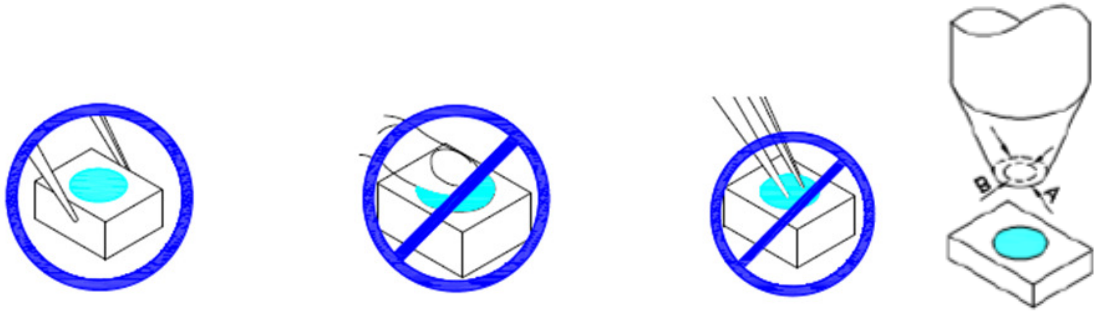


Therefore, a good thermal dissipation design consists of minimizing both thermal resistances $Re_{sp\text{-}hs}$ and $Re_{hs\text{-}a}$ achieved by optimising the heat conduction path.

Handling Precautions

Compared to epoxy encapsulate that is hard and brittle, silicone is softer and flexible. Although its characteristic significantly reduces thermal stress, it is more susceptible to damage by external mechanical force. As a result, special handling precautions need to be observed during assembly using silicon encapsulated LED products, failure to comply might lead to damage and premature failure of the LED.

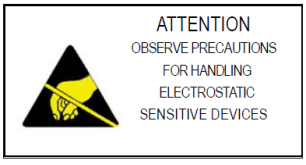
1. Handle the component along the side surface by using forceps or appropriate tools; do not directly touch or handle the silicone lens surface; it may damage the internal bond wire.



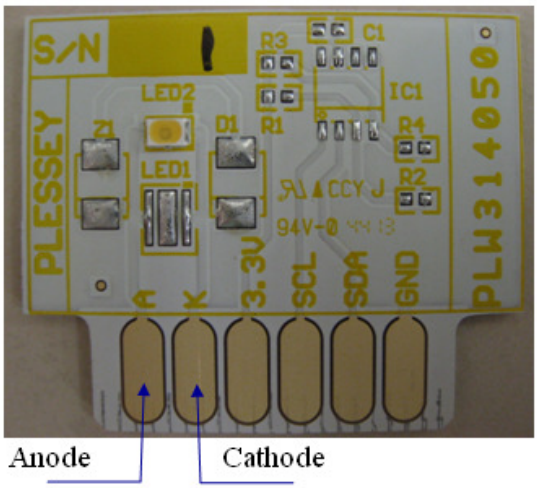
2. The outer diameter of the SMD pickup nozzle should not exceed the size of the LED to prevent air leaks. The inner diameter of the nozzle should be as large as possible. The nozzle should preferably be made of soft and elastic material to prevent scratching or damaging the LED surface during pickup. The dimensions of the component must be accurately programmed in the pick-and-place machine to insure precise pickup and avoid damage during production.

Electrostatic Discharge and Electrical Overstress

Plessey LEDs are not designed to operate with reverse bias. Precautions are required to prevent reverse bias in applications and during handling. Electrostatic discharge (ESD) or electrical overstress (EOS) may damage LEDs. Precautions such as ESD wrist straps, ESD shoe straps or antistatic gloves must be worn whenever handling the LEDs. All devices, equipment and machinery must be properly grounded. It is recommended to perform electrical tests to screen out ESD failures at final inspection. It is important to eliminate the possibility of electrical overstress during circuitry design.

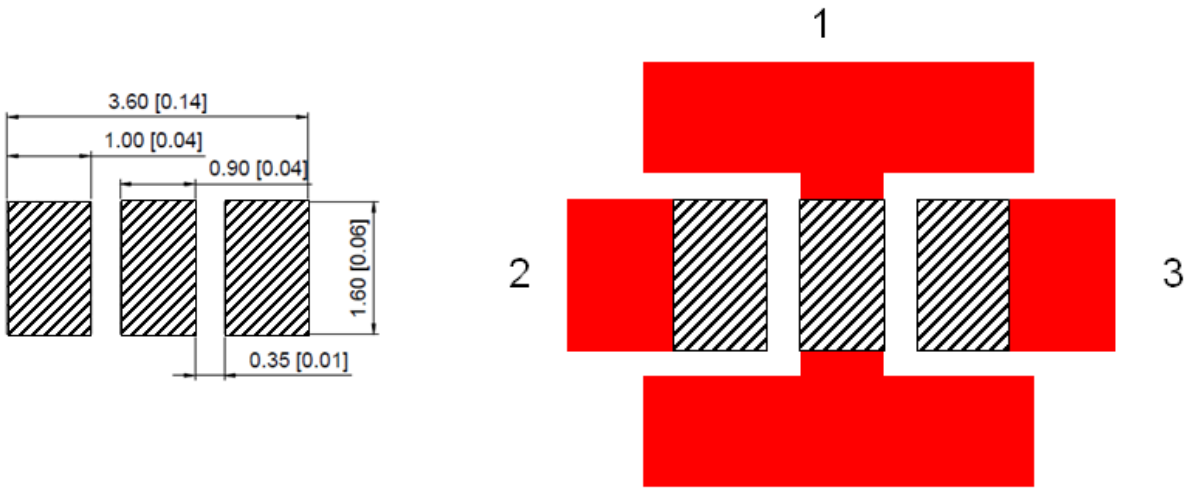


Evaluation Board



FR4 evaluation boards are available on request. Please contact Plessey sales team for further information.

Recommended solder-pad design for heat dissipation:



Note: Metal (copper) area at 1 should not be less than 50mm^2 for sufficient heat dissipation while area 2 and 3 should not be less than 5mm^2.