ASMT-Mx00

High Brightness White LED Light Source

AVAGO TECHNOLOGIES

Application Note 5284

Introduction

This High Power LED Light Source is a high performance energy efficient device which can handle high thermal and high driving current. The exposed pad design has excellent heat transfer from the package to the motherboard.

The low profile package design is suitable for a wide variety of applications especially where height is a constraint.

The package is compatible with SMT reflow soldering process and manual soldering. This will give more freedom and flexibility to the light source designer.

This application note will cover:

1) Thermal Management and Simulation
2) Handling Precaution

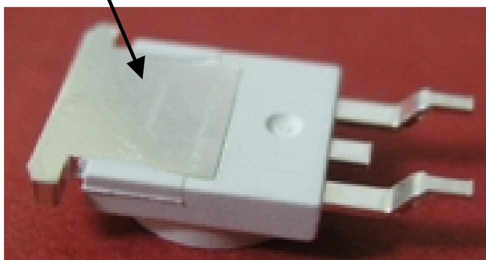
Thermal Management and Simulation

Thermal management is very critical when driving a high power LED. It is needed to control the dice junction temperature T_j as low as possible to achieve the best luminous output from the LED. For this high power LED heat sink pad (behind the LED) is the primary thermal paths for heat dissipation from the LED junction to the surrounding environment.

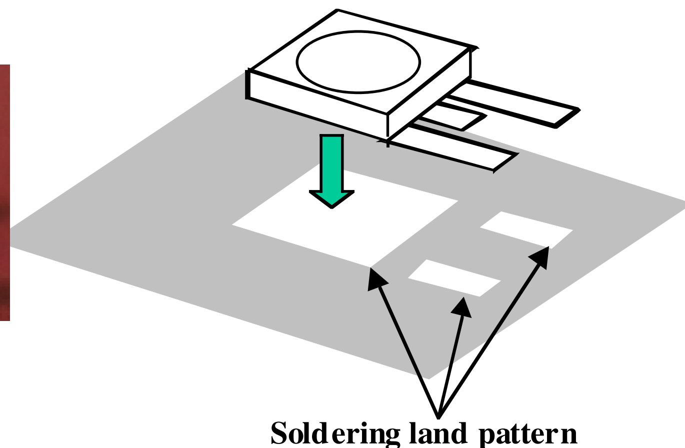
A good thermal design is able to optimize performance reliability and life expectancy of component. Below is an example on ASMT-Mx00 thermal management.

- Direct heat path design using solder as thermal interface material
- Thick heat sink
- It is recommended to use metal core PCB for better heat dissipation
- Additional finned heat sink is not required for ASMT-Mx00 to be operated at full rated current

Heat sink



Back side (Mounting)



Soldering land pattern

Thermal Simulation

The objective of this thermal simulation is to verify the thermal resistance of the package. Two types of thermal simulation were carried out.

a) Package is attached to a fixed temperature heat sink to simulate junction-to-pin thermal resistance (R_{jp}), where most of the heat is dissipated out through conduction to heat sink.

b) Package is attached to PCB during reliability to simulate the junction temperature during RTOL test.

Simulation boundary conditions:

Analysis model: Steady state, Conduction and Covection

Ambient: 25 °C and still air

Junction-to-pin Thermal resistance, $R_{jp} = (T_j - T_p)/P$

Where T_j = junction temperature

T_p = pin temperature

P = power dissipated = Forward Voltage (V) x Input Current (I) = 4.0 V 350 mA = 1.4 W

Thermal simulation models are presented in Figure 1 and Figure 2.

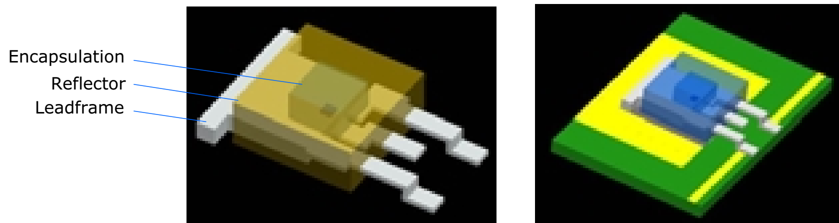


Figure 1. Thermal model of Moonstone package and its assembly on board

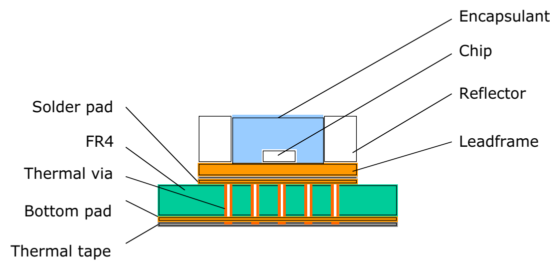


Figure 2. Schematic diagram showing the cross-sectional view of the model for package on board.

Junction-to-Pin Thermal Resistance (R_{jp})

When the package, ASMT-Mx00 is directly attached to a heat sink 25℃, the temperature profile on the package and on the lead frame is as shown in Figure 3. The lead frame design is good in heat dissipation – junction temperature increased only by 2.5℃ relative to 25℃ at the bottom of the package. The junction-to-pin thermal resistance is 1.8℃/W.

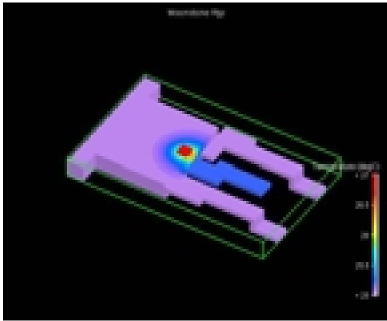


Figure3. Temperature distribution on the surface of package and leadframe

Junction Temperature in RTOL Test

The simulation is to estimate the junction temperature rise from the fixed temperature heat sink based on the PCB design defined in Section 3. The simulated junction temperature is about 33.7°C for RTOL reliability condition. Junction-to-heat sink thermal resistance is 6.2℃/W. The temperature profile of the surface on the package, leadframe and board are presented in Figure 4. The simulation data showed that the modified PCB design with reduced bottom pad size to 25 mm x 15 mm is acceptable.

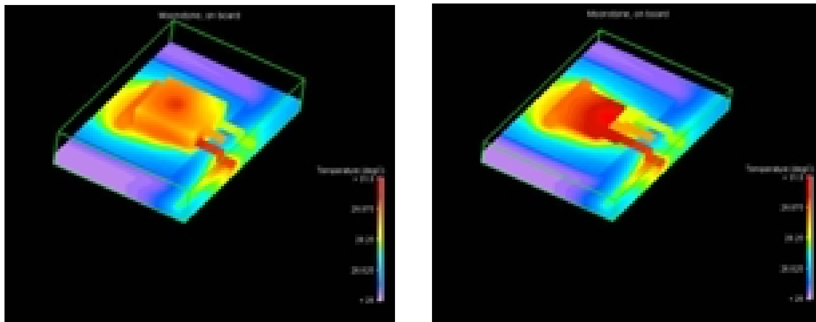


Figure 4. Temperature distribution on the surface of package and the board

The junction-to-pin thermal resistance, R_{jp}, is about 2.2℃/W for pin located at the solder pad of the PCB.

From the simulation result, the conclusions are:

Junction-to-pin thermal resistance, R_{jp} = 2.2°C/W, assuming the heat sink pad is always at 25℃. The recommended soldering land pattern is shown in Figure 5.

Figure 5. Recommended soldering land pattern

Note: Use of Heat Sink Pad is required.

Handling Precaution

This product is classified as moisture sensitive level 2A.

When the bag is opened, parts required to mount within 672 hours of factory conditions ≤ 30°C/60%, and stored at <10% RH.

Devices required bake before mounting if:

a) The humidity indicator card is >10% when read at 23 ± 5°C

b) The pack has been opened for more than 672 hours.

Baking recommended condition: 60 ± 5°C for 20 hours.

Silicone Encapsulant Handling Precaution

The encapsulation material of the product is made of silicone for better reliability of the product. As silicone is a soft material, please do not press on the silicone or poke a sharp object onto the silicone. These might damage the product and cause premature failure. During assembly or handling, the unit should be held on the body (white epoxy) as shown in the figure below.

Figure 6: Do and don't on the silicone handling

Note: Do not stack the units after reflow.

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