White Paper

Conformal Coating

Conformal coating is a well-tested method to protect DRAM modules from corrosion, wear and other damage by applying a thin, isolating layer over the module.

Introduction

With the growing trend of digitalization there is a steady increase in the use of DRAM modules and other components in hostile and remote environments. Modules are also getting ever more compact, which means smaller track spacing on the printed circuit board (PCB). This development presents a number of challenges to the system integrator.

In addition to thermal and mechanical induced stress, the modules are also susceptible to humidity, chemicals, dust and other particles. These factors can lead to corrosion, short-circuiting and general wear – ultimately decreasing the lifespan of the module. In addition the smaller track spacing also increases the risk for short-circuiting.

By applying a thin layer of acrylics and silicone on the module, conformal coating can help protect against contaminants and increase product lifespan. While the two types of coating the paper addresses have their own advantages, they both increase module ruggedness when applied.

This paper will explain what constitutes these environmental challenges, and the benefits of conformal coating and how it is properly applied.

Background

Conformal coating is so named as the applied layer conforms to the profile of the circuit assembly. It is a measure that meets the demand for better protection of components in harsh environments. This is especially true for aerospace and mission critical applications, where reliability is paramount and operations take place in every climate zone of the world.

Operations in hot and dry areas are affected by particles such as sand and dust that can severely damage sensitive electronic equipment. Vessels operate in high-salinity environments where exposed components will quickly start corroding. Aircraft are potentially even more mission-critical, as any damage to components can have drastic consequences.

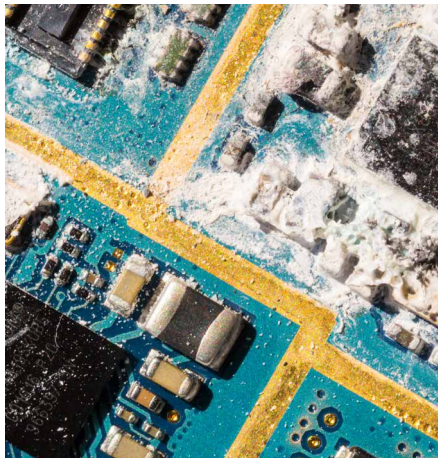
There is also a high demand in civilian applications, such as sensitive medical equipment and CNC machinery where humidity is a high-risk factor.



Challenges

Challenges from harsh environments can be split in to two main categories, namely damage from corrosion and damage from short-circuiting.

Corrosion

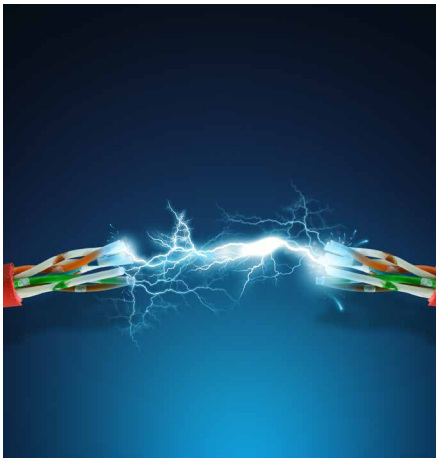


Corrosion is a natural process where metal reacts with the environment and converts to a more chemically stable form. This happens through oxidation which will produce salts of the metal (e.g. rust) and other byproducts. Corrosion will lead to degraded material strength, which in turn can cause module failure.

Corrosion will happen as long as an oxidation agent (usually oxygen, O_2) is in place. However, once the metal comes in contact with water, electrical conductivity increases and the process speeds up. Any acid will corrode the metal even faster.

While dust and other small particles will not directly affect the corrosion process, they will still absorb humidity from the air and consequently start corroding any metal it comes in contact with.

Short-circuiting



Short-circuiting happens when electricity travels an unintended path between two points with little resistance, and can cause irreparable damage to the module. In the case of DRAM modules, this happens when moisture, damage from corrosion or any other material acts as a conductor between two points on the PCB or another source of electric current.

With the track spacing on the DRAM module getting smaller, the risk for short-circuiting increases.

Solutions

Conformal Coating Options

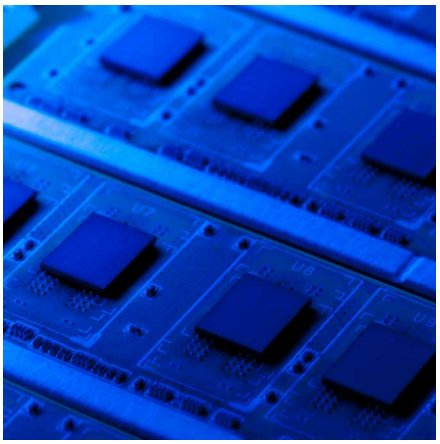
Conformal coating acts as a barrier between the harmful effects of the environment and the DRAM module. When choosing acrylics or silicones as a coating agent, it is important to first understand their respective advantages (see table 1).

Acrylics	Silicones
· Easy to remove when undergoing maintenance · Easy to re-apply · Good moisture resistance · High dielectric strength · Industrial temperature ranges (up to 85°C)	· High chemical resistance · Good moisture resistance · High dielectric strength · Very high temperature ranges (up to 200°C)

Table 1: Advantages of silicones and acrylics

As can be seen from the table above, acrylics are easy to apply and remove making it very convenient when the module undergoes maintenance. Silicones are able to withstand harsher conditions, but due to being resistant to most solvents and high heat, it is harder to remove for repair purposes. Both coatings offer high dielectric strength which means both insulation against the environment and protection against short-circuiting.

Coating Process



The coating is done in full accordance with IPCA-A-610E. The coating is then sprayed on in a thickness of between 0.03 to 0.13mm (Acrylics: 1B73) and between 0.05 to 0.21mm (Silicones: 1A33), well within the range stated in IPC-J-STD-001. The process is repeated over several sessions with an hour in-between to allow the coating to cure. The curing itself is done through an automated UV light process.

Coating Removal

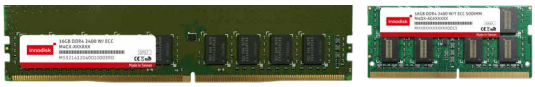
If modules need to undergo maintenance the coating first needs to be removed. This is done through ultra-sound which will cause bubbles to form in small cavities between the PCB and the coating. This in turn enables the easy removal of the coating from the module allowing further maintenance work to take place.

Conclusion

DRAM modules are becoming more prevalent in challenging environments; as such there is a growing demand for increased protection. Conformal coating is an effective measure that protects against humidity, dust, contaminants and other chemicals that can lead to corrosion, short-circuiting and other damages.

The Innodisk Solution

Conformal coating is a suitable addition to any system operating under challenging conditions. We recommend the below DRAM modules with conformal coating for an optimal, ruggedized solution:

Series	Product
Embedded Series	Unbuffered Long DIMM/ SODIMM 
	Unbuffered Long DIMM/ SODIMM with ECC 
Wide Temperature	Wide Temperature 
	Wide Temperature with ECC 
Rugged Series	Rugged DIMM 
	XR-DIMM 

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