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CASE STUDY

CONFORMAL COATING KEY ASPECTS: PROTECTING PCBs, PREVENTING DEFECTS AND IMPROVING PERFORMANCE

A Case Study on Advanced Conformal Coating Techniques for Enhancing PCB Reliability and Long-Term Performance in Harsh Environments

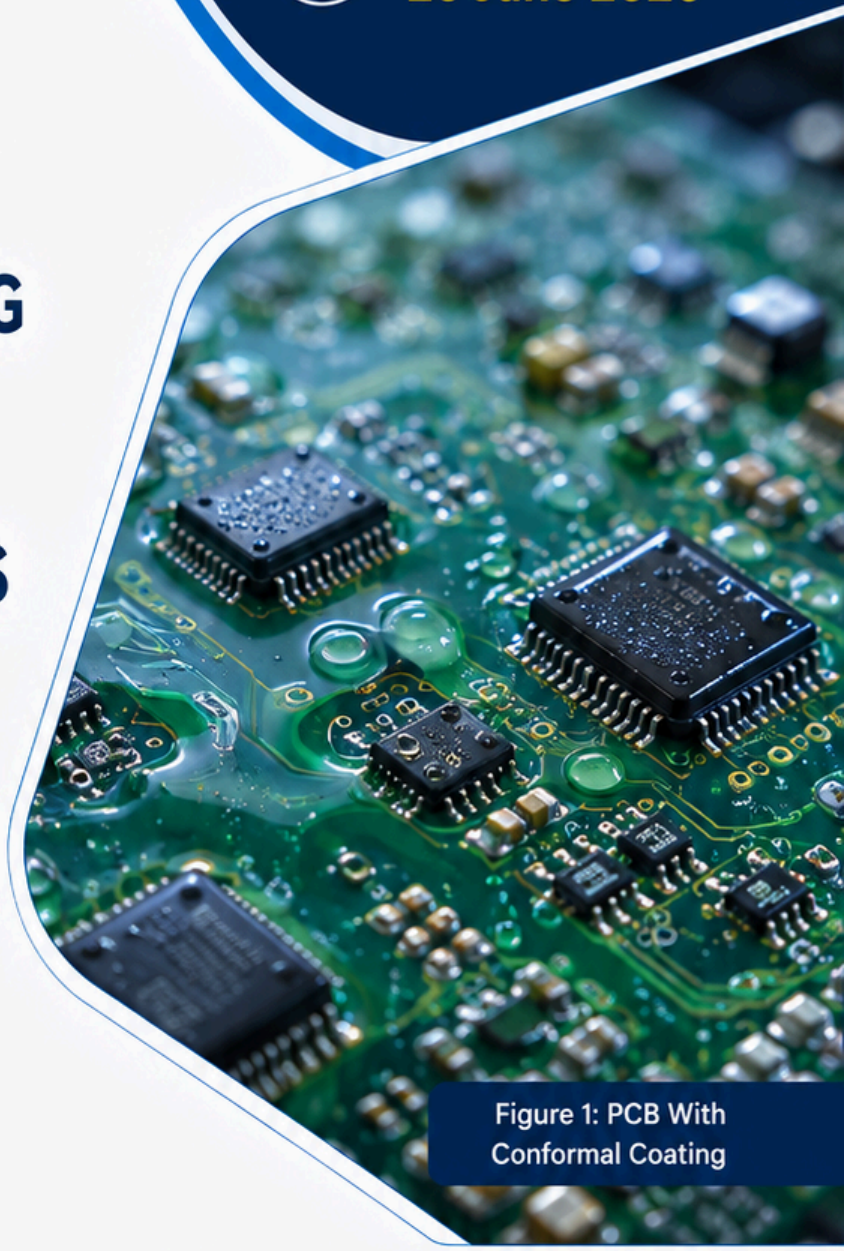

Figure 1: PCB With Conformal Coating

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Conformal Coating Key Aspects: Protecting PCBs, Preventing Defects and Improving Performance

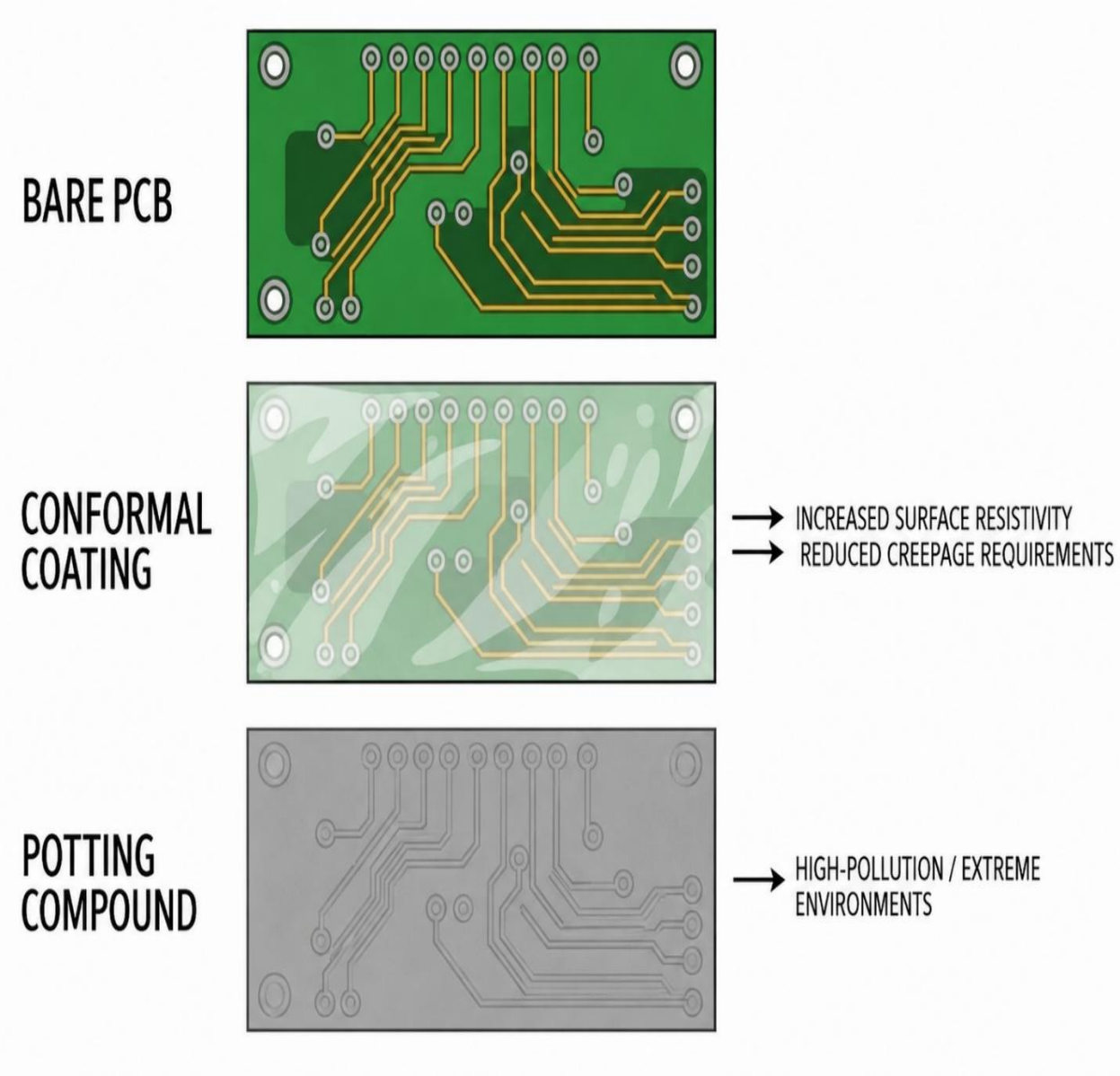

Figure 1: PCB With Conformal Coating

1. Abstract

A leading manufacturer who supplied PCBs specifically for the automatic as well as the industrial systems has identified performance issues in electronic assemblies. And this was occurred specifically in the harsh operating environment. Over the span, some of the assemblies indicated the issues which comprises of moisture-driven failures, insulation breakdown, and corrosion.

This primarily happened because the electronics systems were extensively exposed to humidity, chemicals, temperature variations, and dust. So, the company required a more dependable and stronger protection solution that could improve their PCB durability and performance in the long run.

This case study addresses these concerns and implemented the upgraded solutions for the company with the help of advanced conformal coating techniques and testing procedures, which can improve the product's reliability and quality control.

2. Problem

The leading manufacturer identified that there were several coated PCBs that were not performing as per the standards after they were deployed in the harsh, demanding environments. Several products also showcase the corrosion, moisture-related damage, and more, which might impact the performance of the electronic device.

The company also noticed that the existing conformal coating process was unable to provide the uniform protection all across the PCB section. Areas that are around the populated component edges as well as complex layouts remain impacted by the environmental exposure.

3. Key Challenges

During the evaluation of the coating process, the engineering team came to know about the several voting-related challenges that were going to impact the effectiveness of the coating along with the product quality.

The major issues or challenges incorporated

- Inconsistent or uneven coverage of the coating
- Moisture penetration issues
- Pinhole formation and trapped air bubbles
- Poor coating happened around edges and corners.
- Reduction in insulation reliability

4. Solution

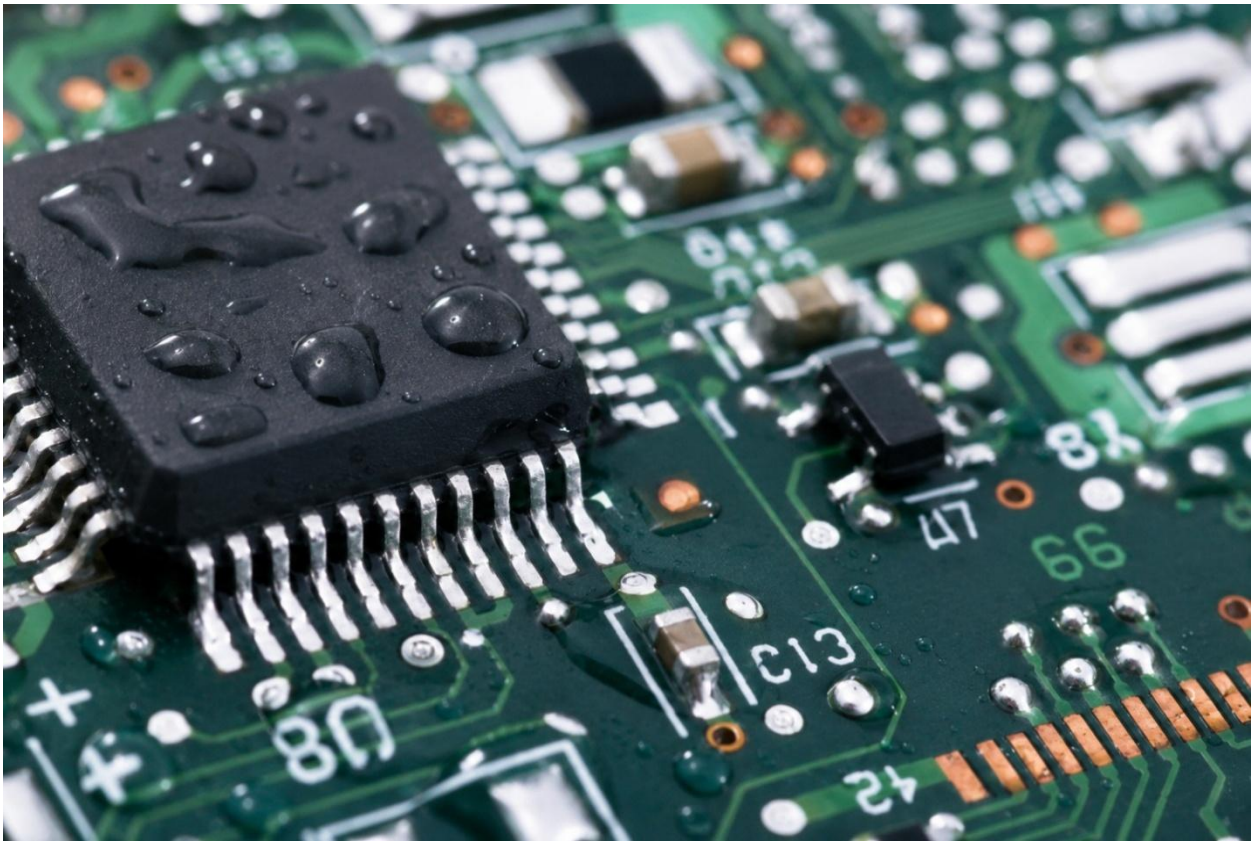

Figure 2: Close-up of a conformal-coated PCB

To improve the coating reliability as well as minimize the failures related to PCB, the manufacturer had required upgraded preparation methods, coating application processes, and quality control practices. The goal was simple: to achieve better coating consistency, long-term insulation performance, and stronger edge protection all across the electronic PCB assemblies.

4.1 Improvised PCB cleaning process

The company chose to go for the upgraded PCB cleaning process before the coating application. This makes sure that the surfaces were completely free from contamination and dust.

The cleaning procedure was incredibly focused on

- Contamination occurred due to flux.
- Dust and particles
- Ionic impurities or residues
- Contamination happened because of grease and oil.

It helps them to improve their coating adhesion and, at the same time, minimize the problems such as dewetting and insulation-based failures.

4.2 Improvised Coating Application Procedure

The engineering team optimized the coating thickness, curing conditions, and spray settings so that they could achieve more consistent or uniform protection all across the complex PCB surfaces and sharp component edges.

As for the PCB design or requirements, different coating methods were implemented, which include

- Dip coating
- Selective coating
- And spray coating

These improvements reduced the bubbles, uneven coating areas, and poor edge-related issues.

4.3 Condensation and SIR Testing

To improve the hidden coating weaknesses, the company came up with the condensation testing as well as surface insulation resistance, which is abbreviated as SIR, to evaluate the coating performance under harsh conditions.

These tests helped engineers to detect them

- Edge protection surfaces that are weak
- Corrosion-sensitive areas
- Issues related to insulation reliability
- Moisture penetration risks

By identifying the coating defects, the manufacturer minimized field failure chances before deployment.

5. Outcome

By implementing the improvised conformal coating process, the manufacturers experienced noticeable improvements in their electronic reliability and overall product performance. This enhanced coating quality helps them to get better protection from environmental damages, and also, they minimized the risk of failures that are related to premature PCBs.

The company successfully achieved reductions in

- The defects that are coating-related
- Failures that happened due to moisture
- Problems related to corrosion
- Expenses that were because of the maintenance and replacement.

This upgraded or revised coating process helps them to achieve coating consistency, uniformity, and long-term insulation stability across different types of PCB designs and product batches.

6. Key Takeaways

Conformal coating becomes an essential part when it comes to protecting PCBs as well as electronic assemblies that operate highly in the demanding environment.

Key takeaway 1: Despite achieving reliable, consistent performance, it also incorporates the proper surface preparation, optimized application methods, controlled curing, and day-to-day inspection procedures.

Key takeaway 2: By improvising the process control and utilizing the advanced testing methods, which include SIR monitoring and condensation testing. The manufacturer can be able to identify the coating weaknesses in advance so that they can improvise the product reliability and make sure that the performance of the electronics systems remains top-notch over the long run.

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