

General Design Rules for Conformal Coating

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Why it all can go wrong in the design stage for conformal coating

Most companies have successfully adopted Design for Manufacture (DFM) principles.

They have increased the level of communication between design teams and those required to manufacture the product, to eliminate or reduce the number and variety of production challenges.

However, this is not always the case.

Conformal coating is not simply a consumable material

Unfortunately, for too many designers, conformal coating is simply a part number, to be applied to circuit boards.

For companies embracing lean philosophies and applying coatings, this failure to appreciate the subtleties of the application process can result in a board that cannot be conformal coated in the (at least as specified) process.

The design rules for conformal coating are straightforward.

Follow them and you could save money and time in your application process.

However, if the rules are not followed, the resultant circuit board design can challenge even the most sophisticated conformal coating system and its operator to achieve the finish desired.

General design rules that could save you money, time and heartache

The general rules listed below can be applied to nearly all of the conformal coating processes.

They are advice only. They have to be interpreted carefully and adapted to the circuit board.

Ultimately, they may save you time, money and a lot of heartache in the conformal coating process.

Conformal Coating Design Rules

1. Clearly defined all points of interest for the conformal coating process on a set of drawings

This includes information such as:

- Conformal coating material to be used, its viscosity and any other process details
- Application method to be used for applying the coating
- The masking details if required
- Coating thickness requirements
- The inspection criteria that the circuit board is to be inspected to including any Standards to be referenced.

2. Understand the inspection criteria

Ensure that all team members involved in the conformal coating process understand the inspection standards.

All the operators, technicians, supervisors and production staff need to understand the quality level they are trying to achieve in the process.

Any differences in understanding will clearly lead to failures and fail criteria.

3. Make sure the conformal coating, the application process and the circuit board are compatible

Ensuring that the method of application, coating material and board design chosen can actually be used together and meet the inspection criteria set is the holistic approach to the conformal coating process.

Setting inspection criteria that cannot be achieved due to a limitation in the process or the material itself makes production targets impossible.

4. Define three areas on a conformal coating diagram for material application

These areas are

- Areas that **MUST** be coated
- Areas that **MUST NOT** be coated
- Areas where it doesn't matter (coating is optional).

The areas that do not matter give process engineers options when setting up the production line.

5. Do not specify the use of conformal coating as an under fill

If a device needs to be under filled, specify a formulated under fill.

Or, consider the difference in CTE mismatch may lead to the component lifting off the PCB in the long term.

6. Specify and use tented via's on the bare board laminate

Filling via's during the board (laminate) manufacture helps to prevent the capillary flow of material from one side of the assembly to another. This can result in coating restricted areas on the other side of the board.

7. Make coating the edge of a PCB optional

Conformal coating the edge of a board can be tricky and messy, especially if there is no frame or breakout around the board. It is of questionable efficacy in improving coating or reliability performance.

8. Make coating some component packages optional

Coating the sides of a 3D device is difficult. This is especially true when the coating is subject to gravity, as well as de-wetting due to mold release agents used in the component fabrication.

The plastic or metal package moldings may be more resistant to humidity or other forms of water than any conformal coating applied.

9. Avoid using silicone RTV on the circuit board before applying the conformal coating

If you require a silicone staking materials for anti vibration purposes, then apply it after conformal coating.

If this is not possible, use a silicone conformal coating for compatibility.

If you don't want to use a silicone conformal coating, then use a urethane or epoxy staking so that is compatible with the coating.

10. Understand the masking method to be used

If masking by hand ensure the correct method of masking is understood by all of the technicians involved in the coating process.

Avoid operators interpreting the masking method and using their own methods.

11. Ensure liquid latex is dry before coating

If the masking process uses liquid latex as a masking material then ensure that enough time is allowed in the production process for the latex to be fully cured before the coating application is started.

If not then the conformal coating can interact with the latex and make it almost impossible to remove.

12. Check the quality of the latex before filling connectors

If temporary liquid latex is used to mask a connector ensure that the latex can be easily removed from under the device and not get broken off and entrapped underneath.

13. Check the process can actually achieve the conformal coating thickness

Ensure the conformal coating thickness specified can actually be achieved by the coating process and within the tolerance defined.

Some conformal coating processes such as dipping struggle to build greater than 25um coating thickness in a single coat.

Other processes apply a lot of coating and may go over the required thickness.

14. Check the coating thickness tolerance set in the inspection criteria

Do not define a tight conformal coating thickness tolerance if a wide tolerance is allowed.

Achieving $30\pm 5\mu\text{m}$ dry coating thickness across a circuit board is an order of magnitude harder (or more!) than $50\pm 25\mu\text{m}$.

Don't make conformal coating production harder than it needs to be.

15. Ensure the conformal coating specified is compatible with the circuit board

Some conformal coatings can attack components, markings and inks on the circuit board. Others will not wet the surface or solder resist well without cleaning.

Masking sure the coating works well with the circuit is a key factor for good long-term reliability and easy processing of the board.

16. Carefully define the space around connectors and other components not to be coated

The amount of space around a component that must or must not be coated can be critical.

For example defining a 1 mm boundary around a connector and demanding conformal coating must go right up this edge can create a difficult process for the production team.

Conclusions

The failure to appreciate the subtleties of the conformal coating application process can result in a board design that cannot be conformal coated effectively.

Understanding some basic design rules for conformal coating could save a lot of time and money.

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