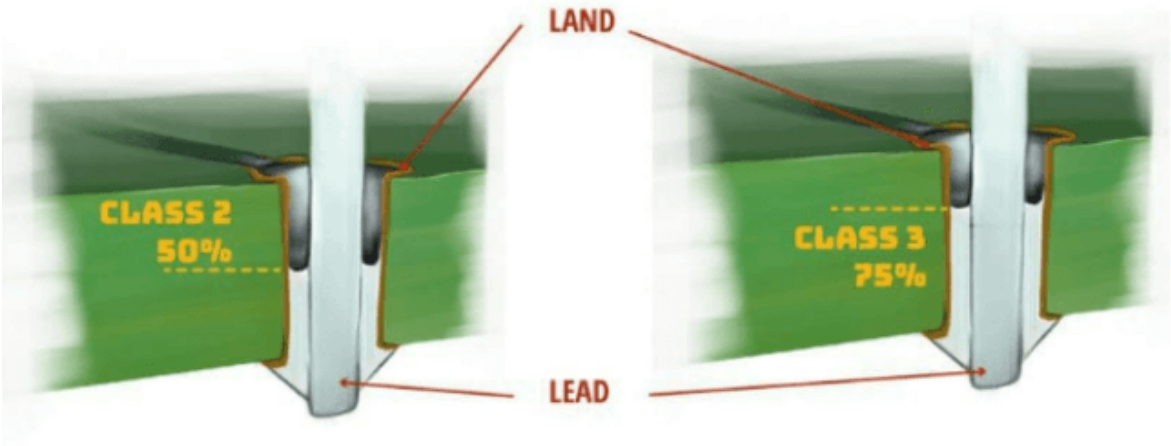
Class 2 vs Class 3 - Assembly Differences

The primary difference between Class 2 and Class 3 boards is found in plating thickness, placement of components, cleanliness, stringent standards and protocol requirements, annual ring requirements, manufacturing processes, etc.

Surface Mount

The placement of components can be slightly off the pad during the assembly process of surface-mount components. This is also a visual defect, as it usually doesn't affect the mechanical and electrical performance system. This defect is considerable in Class 2. However, this can fail the inspection testing in Class 3 boards as the Class 3 board doesn't accept any defects or imperfections.

Amount of Barrel Fill



Besides, you can also find the difference in the amount of barrel fill. For Class 2, the amount to fill the barrel for a through hole is 50%. While Class 3 requires 75% of barrel fill. This is one of the delicate processes of getting the proper amount of fill or pastes into the smaller plate of through holes, so one must be very careful during this process.

head1	head2	head3
Surface-mount components	Can be slightly placed off the pad. (doesn't affect the mechanical and electrical performance)	• Defects are not acceptable. • This kind of imperfection fails the inspection process.
Barrel Fill	Through-hole leads 50%	Through-hole leads 75%

Acceptable Solder Criteria for through-hole components

Characteristics	Class 2	Class 3
Circular wetting of solder on lead and	180	270
Circular wetting of solder on lead and	270	330
Plated Through Hole fill	50%	75%
Land Area covered with solder on the	75%	75%

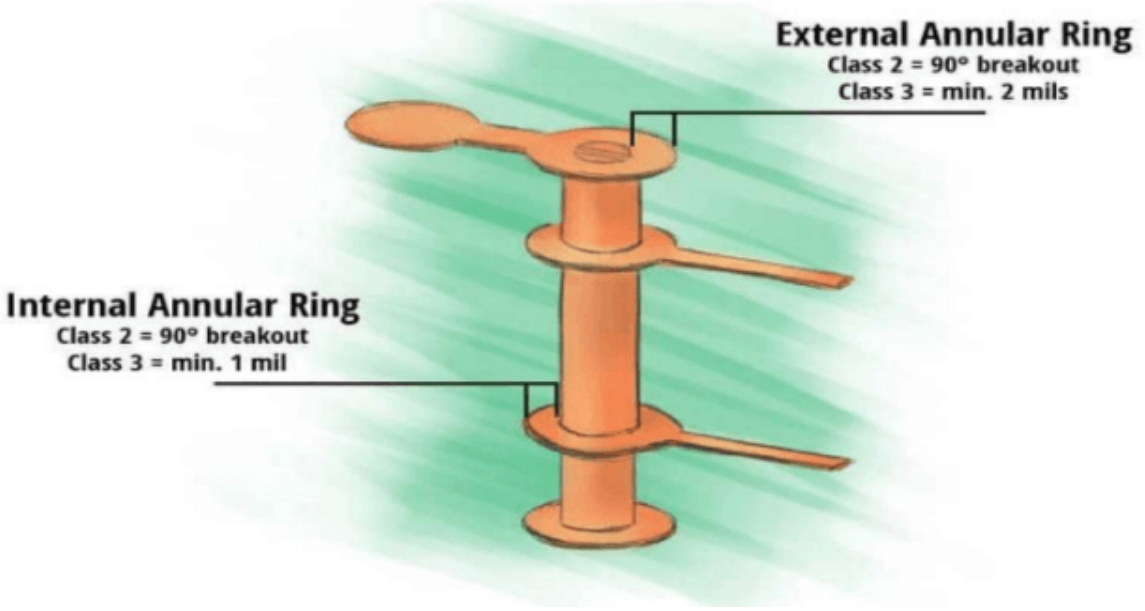
Class 2 vs Class 3 - Manufacturing Differences

Drill Breakdown

Drill breakdown is another factor that differentiates these two classes. There may be some breakdown in the annual rings. This defect is accepted in Class 2, while in Class 3, it is not acceptable.

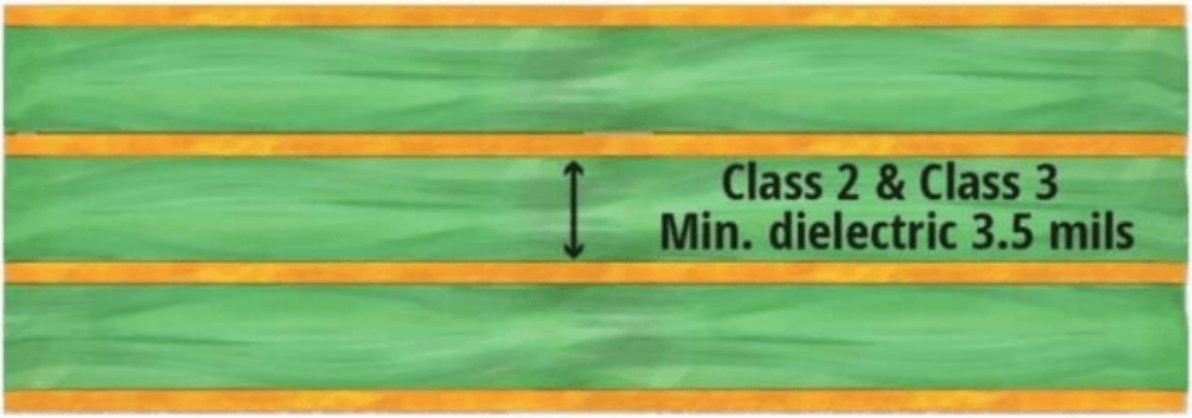
Class 3 boards need to be highly reliable, and any defects or breakouts can fail the whole testing process. At the same time, Class 2 boards can accept

the 90-degree break out of the hole, which would maintain the minimum lateral spacing.



PCB Dielectric Requirement

The minimum dielectric requirement for Class 2 and Class 3 is 3.5 mils. Also, the users and suppliers can make a deal to use dielectric.



Cost

The cost of developing a Class 3 assembly product can add up to 20% of the product cost. Thus increasing the cost of Class 3 compared to Class 2 IPC.

Besides, the higher concentration of through-hole increases the cost of the Class 3 board.

Design Rules for IPC PCB

- Ensure your land is within the recommended tolerances and accurate spacing specifications.
- Additionally, verify that all drill holes meet all the quality and size requirements. Make sure your contract manufacturer's equipment's aspect ratios align with yours.
- It is essential to ensure that the specifications for the solder masks are within the recommended tolerances. Solder mask specifications must comply with class A tolerances when designing class A products. Class 1, 2, and 3 products are the same.
- Ensure the manufacturer integrates high-quality control. For example, AOI inspections during the assembly and manufacturing process.
- Ensure cleanliness is the priority of every manufacturer, as unclean boards can affect the devices' functionality.
- Ensure the specifications and all the standards needed for Class 3 PCB.
- Finally, go through the proper rules and regulations, and requirements for each Class type of PCB.

Inspection Standard / IPC Standard Compliance

PCB-related standards are formulated by the IPC (Institute for Printed Circuits). This association was formerly known as the Institute for Printed Circuits. Despite the association's new name, Association Connecting Electronics Industries, the IPC name remains.

More than 4,000 industries are members of the IPC. They are responsible for designing PCBAs, including microelectronics, industrial equipment, medical services, computers, etc.

Therefore, IPC standards were implemented. Thus, PCB designs, manufacture, and assembly must follow standard practices in these electronics industries. Any manufacturer, defense officer, or electronics designer must comply with IPC. PCB design standards from IPC are among the most widely accepted worldwide.

IPC defects in PCB

IPC defects in PCBs include the following:

Annular ring

Copper pads surround drilled and finished holes in the annular ring. An IPC PCB defects common around the annular ring is annular ring defects. IPC annual ring is considered one of the primary concerns. However, for class 2, then there are some acceptable standards, like 90 degrees of fracture in the annual ring.

Solder joint

Solder Joint is another IPC defect in PCB. Not proper heat in the joint is the result of these solder joint defects. Sometimes, this also happens if the soldering iron is at a shallow temperature. These defects can affect the functionality of the PCB. Thus, the best soldering technique is the way of avoiding such problems. The acceptable standard separated for Class 2 and Class 3 is 180 and 270 degrees, respectively.

Component misalignment

It is one of the other IPC defects found in PCB. This takes palace when the components need to be positioned in the desired area. When components float on molten solder, this misalignment takes place. Thus, there are some guidelines for this component misalignment:

- 50% lesser pad width in Class 1 and Class 2.

- 50% lesser pad width in Class 3.

Conclusion

IPC creates the proper standards and protocols for manufacturing, designing, developing, and testing the PCB board. The proper way to integrate the IPC standards is by following the critical PCBA designs. Thus, IPC boards are widely used in electronics manufacturing. Many advanced electronics also use this IPC PCB.

Thus, Class types and the difference between them are crucial to understanding the selection of the right products. The above guidelines and tips can help you select the correct class PCB per your requirements.

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