Choose the Right PCB Panelization Method, Instantly Reduce PCBA Costs

In the field of electronic manufacturing, PCBA (Printed Circuit Board Assembly) cost control has always been a core concern for enterprises. Among the many factors affecting PCBA costs, PCB panelization, as a key link connecting PCB manufacturing and component assembly, often has a "decisive" impact on the overall cost. Many manufacturers overlook the rationality of panelization methods and miss the opportunity to reduce costs. In fact, choosing a suitable panelization method can not only improve production efficiency but also directly reduce material waste, processing time, and labor costs. This Magzine will focus on the common PCB panelization methods, their impact on costs, and put forward targeted panelization suggestions for different PCB shapes, helping customer achieve cost optimization through scientific panelization.

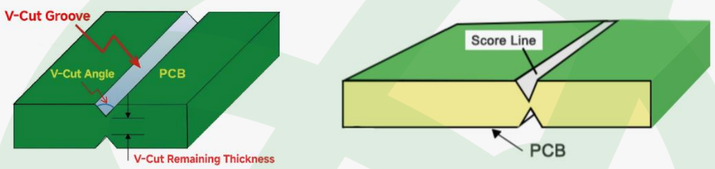
Common PCB Panelization Methods ①

PCB panelization refers to the process of combining multiple individual PCBs into a single panel of appropriate size according to certain rules before manufacturing and assembly. The choice of panelization method needs to comprehensively consider factors such as PCB design, assembly process, equipment specifications, and transportation requirements. At present, the common panelization methods in the industry mainly include the following types:

1. V-Score Panelization

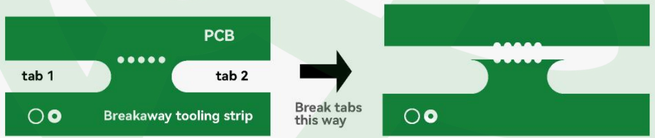
V-Score panelization is one of the most widely used panelization methods in the industry. It uses a V-shaped groove cutting machine to cut V-shaped grooves on the top and bottom surfaces of the PCB between the individual boards. The depth of the V-groove is usually 1/3 of the PCB thickness (for single-sided boards) or 1/4-1/3 of the thickness on each side (for double-sided boards), leaving a small amount of material in the middle to connect the individual boards. During the final separation, the individual boards can be separated by manual folding or mechanical force.

PCB V-Cut Schematic Diagram



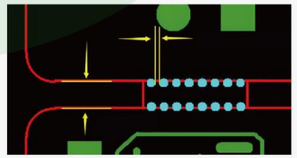
2. Tab-Rout Panelization

Tab-Rout panelization, also known as "breakaway tab" panelization, uses connecting tabs (tabs) to fix the individual boards. The tabs are usually designed with a width of 2-5mm, and the surrounding areas of the individual boards are milled away by a router, leaving only the tabs to connect them. After assembly, the individual boards can be separated by cutting off the tabs with pliers or a router. This method is suitable for PCBs with irregular shapes or those that cannot be processed by V-Score.



3. Stamp-hole Panelization

Perforated panelization is to punch a series of small holes (usually 0.8-1.2mm in diameter) between the individual boards to form a "perforated line". The individual boards are connected by the material between the small holes, and can be separated by folding or breaking along the perforated line. This method has low processing accuracy requirements and is suitable for low-cost, simple-structured PCBs, but the edge shall leave bur after separation.And POE can use Sandpaper to remove it.

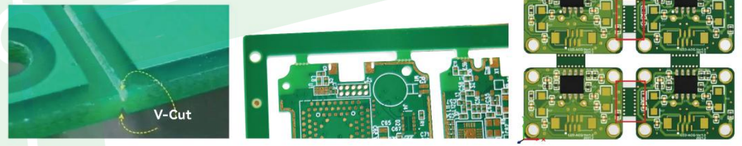


Impact of Different Panelization Methods on PCBA Costs ②

The choice of panelization method directly affects multiple links such as PCB manufacturing, component placement, reflow soldering, and post-processing, thereby affecting the overall PCBA cost. The specific impact is reflected in the following aspects:

1. Material Waste

Material waste is one of the most direct cost impacts of panelization. V-Score panelization has the least material waste because it only cuts V-grooves without removing a lot of material; Tab-Rout panelization will generate a certain amount of waste due to milling the surrounding areas, and the waste amount is related to the size and number of tabs;Stamp-hole panelization has little material waste, but the utilization rate of the panel is easily affected by the arrangement of the perforated lines.



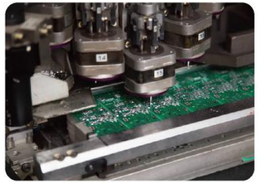
V-Cut | Tab-Rout | Stamp-Hole

2. Processing Cost

Processing cost is mainly affected by the complexity of the panelization process and the processing time. V-Score panelization has simple processing, fast speed, and low processing cost, which is suitable for mass production; Tab-Rout panelization requires milling processing, which has higher processing accuracy requirements and longer processing time, so the processing cost is higher than V-Score; Stamp hole panelization has simple processing equipment and low cost, but it is not suitable for high-precision PCBs.

3. Assembly Efficiency

Assembly efficiency directly affects labor and time costs. V-Score and Tab-Rout panelization are conducive to automated assembly equipment (such as SMT placement machines) to process multiple boards at one time, improving placement efficiency; Stamp-hole panelization may cause positional deviation during assembly due to the existence of perforated lines, affecting assembly accuracy and efficiency.

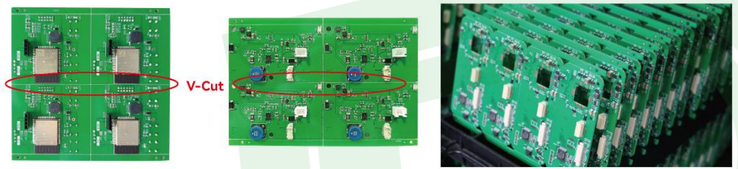


Panelization Suggestions for Different PCB Shapes ③

Different PCB shapes have different characteristics, and the suitable panelization methods are also different. Choosing the right panelization method according to the shape can maximize the utilization rate of the panel and reduce costs. The specific suggestions are as follows:

1. Rectangular/Square PCBs

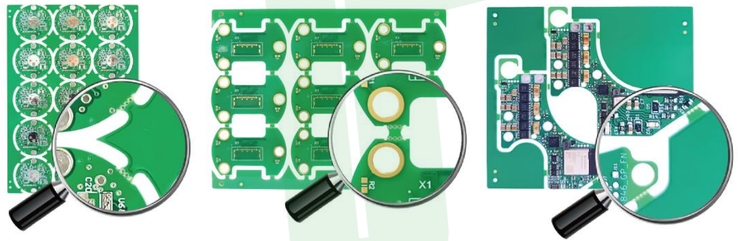
Rectangular and square PCBs are the most common shapes, with regular structures and high compatibility with various panelization methods. Suggestion: Prioritize V-Score panelization. This method has the least material waste, the lowest processing cost, and is suitable for mass production. The spacing between individual boards can be set to 0.5-1mm to further improve the utilization rate of the panel. If the PCB has components close to the edge, Tab-Rout panelization can be used, and the tabs can be designed in the areas without components to avoid damaging the components during separation.



2. Irregular Shaped PCBs (Such as Circular, Triangular, Special Shapes)

Irregular shaped PCBs have uneven edges and cannot be processed by V-Score panelization.

Suggestion: Adopt Tab-Rout or Stamp-hole panelization. The tabs can be flexibly designed according to the shape of the PCB to ensure the stability of the panel. When arranging the individual boards, they should be arranged as closely as possible to reduce the spacing between them and improve the utilization rate of the panel. For small-sized irregular PCBs, multiple boards can be combined into a regular-shaped panel first, and then processed by Tab-Rout to facilitate automated assembly.



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