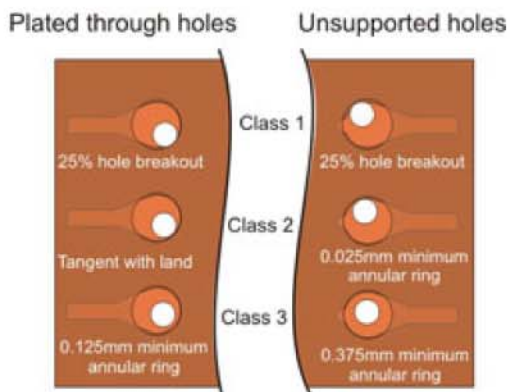


# BBG Tech Tips

## MINIMUM ANNULAR RING

The minimum annular ring is the amount of copper material measured from the edge of the hole to the outside diameter of the pad. The internal (multilayer PCBs) and external minimum annular ring on a component hole should be 2 mils (.002) to ensure product reliability.

External annular rings are measured from the inside of the plated hole in any direction (360 degrees) to the outside diameter of the pad while the internal annular rings are measured from the outside diameter of the drilled hole to the outside of the pad.



*Image courtesy of Joe Fjelstad  
Flexible Circuit Technology 3rd Edition  
www.flexiblecircuittechnology.com*

Ideally, all drilled holes should be centered on the pad. However, as packaging has continually become smaller so have the pad sizes. Drill, artwork and material shrinkage tolerances will have to be considered and therefore we can expect “drift” to happen. Holes not being centered on the pad do not necessarily mean a quality problem so long as the minimum annular ring has been satisfied.

Maintaining annular ring is an important reliability issue especially on component holes. However, depending on customer requirements, non-component or via holes may be allowed to be tangent to the pad meaning as long the inside edge of the plated hole does not go beyond outside

diameter of the plated pad. Any further, and the condition known as hole break out—the plated hole is beyond the plated pad—exists and the customer may consider the board to be scrapped.

## TEAR DROPPING

Tear dropping is used whenever there is a possibility of hole breakout. The pad size is increased or rather lengthened to help ensure that the drilled hole has the greatest possible chance of being within the pad to maintain minimum annular ring requirements. Sometimes, in the same context, the term “blowing-up the pads” is used to refer to the increasing the size of the pads when minimum annular ring will be violated because the pad-to-plated hole ratio may exceed the PCB manufacturer’s drill capabilities. CAM operators should obtain customer permission before any artwork changes are made and they must ensure there are no spacing violations between any adjacent features when tear drops are added or if the pad sizes are increased.

*Research for the above information may be from, but is not limited to, IPC reference manuals, the PCB Handbook, the Bare Board PWB Design Manual and consultation with industry professionals. Please consult a process engineer familiar with your company’s PCB assembly process before making any procedure changes.*