accuprobe

Probing the World of Microelectronics

PROBE TIPS #15

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Tip Shape: Flat vs. Radius

What's behind the resurgent Flat vs. Radius debate about tip shape?

We would like to share a perspective on this topic developed over years of service to people who make their living from wafer sort. It seems that every few years somebody's experimentation makes its way through the trade press and revives interest in probe point shape: Flat vs. Radius

ORIGIN OF THE CONTROVERSY

In actuality, the shape of the point, be it Flat or Radius, is a function of the manufacturing choices made by the probe card companies. The probe suppliers choose from two options: to sand needles first etched to a sharp point to reach the desired point diameter or to etch needles to the desired point size. As with most decisions, the costs of tooling and other economic factors determined the way any given probe supplier chose to go.

Once the economic decisions have been made by a particular probe supplier, then the marketing people do their job. Years ago, probe card companies were known to take advocacy positions on one side or the other of the issue. Naturally, the sales pitch favored margin enhancement. Probe card vendors will provide what you want and anything you want, at a price.

DOES TIP SHAPE REALLY MAKE A DIFFERENCE?

The real answer is: Maybe in a few cases. There are probably as many ideal probe solutions as there are DUTs. IC test and manufacturing process engineers look for yield improvements continuously. Sometimes they strike gold, but rarely does the gold result from tip shape changes. The number of variables to be evaluated and inter-relationships between them makes the task of finding and ideal probe configuration Herculean at best. To find a probe which is ideal for all DUTs probed on a single sort line is most likely impossible.

TIP SHAPE-MORE TO IT

Some of the factors affecting tip performance that quickly come to mind:

1. Planarization, both tip to tip and prober/test system
2. Tip alloy
3. DUT pad alloy and size
4. Tip etch length
5. Tip etch shape (convex/concave)
6. Tip pressure (gram/mil overtravel)

7. Overall tip beam length (extension)
8. Tip Drop Length (small downward bend)
9. Tip angle of needle shank to wafer
10. Tip bend angle at point
11. Tip point size (diameter)
12. Tip shape: Flat or Radius

Additionally, one must consider if the test for a particular DUT is AC or DC, the power level, frequency and timing. The speed and accuracy of the prober, tester, method of interfacing the probe cards, the number of probes and pitch also come into play.

SO WHAT KNOW?

Mostly, what turn out to work for one sort floor will also work, more or less, on another sort floor. The key comes with the statement "more or less". Tip shape definitely fall into the category of "less" when thinking about the above mentioned factors.

The reason tip shape is not a factor is because probe tips wear out fairly quickly. A typical 2 mil diameter IC contact made with a radius tip will wear just 1mil before it takes the shape of " Flat" tip. Very few sort floors can afford the luxury of discarding probe cards after only 1 mil of wear on the tips.

Another look: until a radius tip wears to flat, does measurement repeatability change? This question comes to mind because as a radius tip wears, the contact area increases from a very small tangent. Actually, the point shape becomes elliptical, not round and slightly convex, not flat. This is due to the tip angles and scrubbing action across the pad.

IN CONCLUSION

We are of the opinion that tip shape determination should be based upon the individual customer…what seems to work best for your sort is the type you should choose.