Improved Vertical Probe Technology for Probing on Cu Pillar Bumps

Martin J. Brophy, Chin-Shun Chen, Keith Quick
Avago Technologies, 4380 Ziegler Rd., Fort Collins, CO, 80525 U.S.A. martin.brophy@avagotech.com

Joe Kuhn
Wentworth Laboratories, 2000 Wyatt Dr., Suite 1, Santa Clara, CA, 95054 U.S.A

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Abstract

We describe an improved method for die probing on the Sn bumps of Cu pillar bump flip chip die. Large area vertical Tungsten hairpin probes were replaced with smaller BeCu vertical tips. Much better probe consistency and a reduction in badly probed die were seen.

INTRODUCTION

Copper pillar bump flip chip assembly is commonly employed in modern GaAs IC's to shrink die size and lower assembly cost and overall product cost. It is desirable to diesort probe on those bumps to verify sound electrical connections but that has proven to be not easily done with normal PCM-type cantilever probe cards with BeCu tips.

Avago had developed an internal technique using "fat" (100 µm diameter) Tungsten hairpin probe tips (see Fig. 1, L) but using those in production proved to be difficult, so we turned to Wentworth's vertical probe card technology, using 75 µm square BeCu fabricated tips (Fig. 1, R), with much better probe results as documented below.

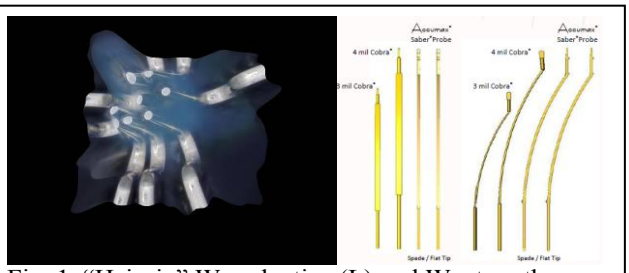

Fig. 1 "Hairpin" W probe tips (L) and Wentworth fabricated Accumax tips (R)
(Temporary pictures – we are getting better ones)

CHALLENGES OF DIESORT ON BUMPS

Cu pillar bumps are plated copper pillars in the 50 – 100 µm height range topped off by 25-50 µm bumps of an attachment material like solder paste or plated Sn. In assembly, they are flipped over and soldered to their substrates upside down much like surface mount components. This shrinks the substrate size while allowing very efficient thermal connection out of the wafer topside rather than with a backside via through a 100 µm thick wafer to plated backside Au metal.

Routine diesort test on these parts would best be done after pillar bump formation so that we can verify all went well with the pillar bump process as well as with the frontside process. But 1 mil (25 um) BeCu PCM probe tips in a cantilever probe card are not well suited for that, leaving damaged solder where the tip "skated" across the contact and potentially tearing the bump off the pillar.

As mentioned, our first solution involved 100 µm diameter W vertical flat-bottomed probes. Tests of contact resistance showed a few Ohms as typical and high variability. This translated into high false failure rates showing a probe pattern in single-site diesort test (Fig. 2)

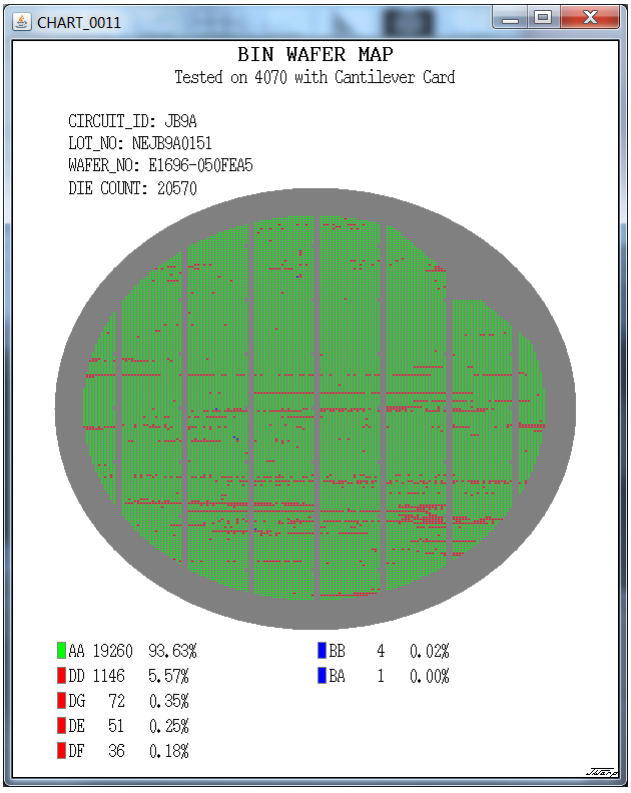

Fig. 2 Probe Pattern False Fails with Old Style Card

Wentworth vertical probe cards were seen as a possible better alternative to this probe approach. They use a hardened BeCu 75 µm tip to vertically contact the bumps. The probes are micro-fabricated rather than stamped for higher precision. The probe head is directly mounted to the Probe Card PCB allowing the probe to make direct contact to the PCB trace. This provides a very low resistance path from tester to device.

These tips do not get dirtied and cause poor contact as seen with the old probes. They yield much cleaner quad-site diesort maps as shown in Fig. 3 below on the same wafer tested the old way in Fig. 2.

CONCLUSIONS

Vertical Accumax probe technology was seen to be a superior way to test on Bumps for GaAs diesort test of Cu Pillar Bump wafers.

ACKNOWLEDGEMENTS

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ACRONYMS

PCB – Printed Circuit Board
PCM – Process Control Monitor

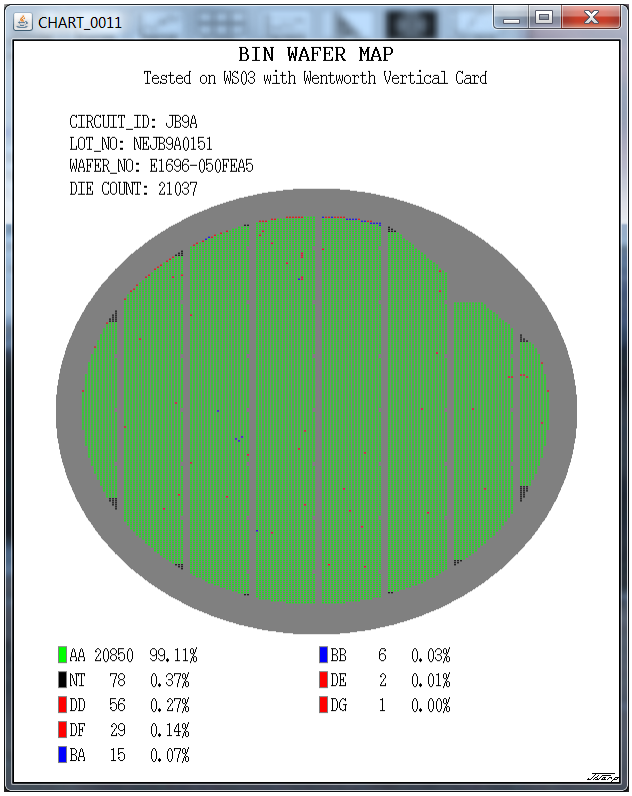

Fig. 3 Same Wafer Tested with New Style Card – no probe card pattern of false fails seen.