Multi-Square Probe Card
(for Multi-DUT Testing of Peripheral Pad Layout Devices)

Kouichi Eguchi, Micronics Japan Co., Ltd.
Mark Godfrey, Everett Charles Technologies
Agenda

1. Background of Multi-Square Development
2. Market Demand for Multi-Die Testing
3. Multi-Square Overview
4. Structure
5. Probe Needle Specification Review
6. Results of Reliability Test
7. Summary
Background

- Parallel test at wafer probe lowers test costs through reduced average test time per die.
- This technique is used extensively for memory test due to long test times.
- DRAM die pad patterns (i.e. LOC) and lead counts allow for highly parallel epoxy-cantilever probe cards.
- Logic, mixed-signal, and SOC device pad patterns (peripheral) and lead counts present significant challenges for efficient multi-die probing.
- The number of wafer touchdowns and ATE throughput is impacted by the die pattern of multi-DUT probe cards.
- MJC has developed Multi-Square to provide high efficiency die probe patterns for parallel test of peripheral pad ICs.
Background

Typical 4 DUT probe card design
Multi-Die Test

Diagonal 4 DUT

Ex.

Multi-Square 4 DUT

52 touchdowns → 46 touchdowns

12% efficiency improvement with 2x2 DUT probe pattern
Diagonal Probe Angle Creates a Finer Needle Pitch Requirement

For a 45° approach angle:

\[ b = \frac{a}{\sqrt{2}} \]

Example: die pitch (a) of 60 µm,
\[ b = 42 \text{ µm}. \]
Multi-Square 2x2

2x2 parallel DUT probing pattern
Multi-Square 2x2
Multi-Square 2x2
Multi-Square In-line
(1x2, 4, or 8)

Symmetric
Multi-Square 1x4
Multi-Square 1x8
Structure
1x4 Stiffener
Probe Specification Comparison

Design of Probe Needles to achieve 60 μm pitch
## Multi-Square vs Diagonal Epoxy-Ring
### 60µm pitch 585pins SoC

<table>
<thead>
<tr>
<th>Multi-Square</th>
<th>D</th>
<th>Theta</th>
<th>Ltip</th>
<th>Lb</th>
<th>Dk</th>
<th>Lt</th>
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### FEM analysis

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</table>
Reliability Test

Positional Accuracy

Planarity

Contact Resistance

Reliability is equivalent to conventional epoxy-cantilever
Improved Scrub Margin

Conventional 4DUT

Multi-Square

Bond pad

Scrub margin
Summary

- Multi-Square probe technology enables 1x2, 4, 8 and 2x2 DUT probing patterns for ICs with pads on all four sides.
- The efficient probe patterns supported reduce the number of touchdowns required per wafer, increasing ATE throughput.
- Perpendicular needle approach angles allow fine pitch probing and optimized scrub margin.
- The technology is compatible with conventional epoxy-cantilever production systems and therefore competitive for cost and schedule.
- The technology is based on proven cantilever designs and provides the same reliability and performance as conventional epoxy-cantilever technology.