Overview

- Cost, Price, & Cost Drivers
- Serial Processing – Drilling Example
- NRE
- Advanced Process Technology
- Profitless Prosperity
- Cost Savings
- Summary

Note: price/cost examples are approximate and from multiple vendors not necessarily those identified or shown.
Gross Profit = Price – Cost
Gross Margin = Gross Profit / Price

Vertical Probe Head

Printed Circuit Board
BGA (Solder Attach)
Space Transformer
Upper Guide Plate
Spacer
Lower Guide Plate
MicroProbe Apollo
Probes
Don’t bother…

“Ferrari”

### Cost Per Drill Hole

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Cost</td>
<td>$300,000</td>
</tr>
<tr>
<td>Annual Maintenance</td>
<td>7%</td>
</tr>
<tr>
<td>Useful Life</td>
<td>7 years</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$447,000</td>
</tr>
<tr>
<td>Facilities Annual Cost</td>
<td>$35,000</td>
</tr>
<tr>
<td>Total Annual Cost</td>
<td>$482,000</td>
</tr>
</tbody>
</table>

- **50% utilization**: $31.44/hr
- **85% utilization**: $9.25/hr
- **Tooling per hole**: $0.05

### Make vs. Buy

- **Utilization**
- **Lead Time**
- **Quality**

**Fixed vs. Variable Cost**

**Cost (Make) vs. Price (Buy)**
### Non Recurring Engineering Expense

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Design</th>
<th>Tester</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D</td>
<td>NRE</td>
<td>NRE</td>
<td>NRE</td>
</tr>
<tr>
<td>Design Input</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Probes</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Guide Plates</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Transformer</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interposer</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCB Design</td>
<td>X (External?)</td>
<td>X</td>
<td>?</td>
</tr>
<tr>
<td>PCB Fab</td>
<td>External</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mechanical H/W</td>
<td>?</td>
<td>X</td>
<td>?</td>
</tr>
<tr>
<td>Electronics</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Metrology</td>
<td>X</td>
<td>X</td>
<td>?</td>
</tr>
<tr>
<td>Packaging</td>
<td>X</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>

---

### Outgoing Metrology
Interposers

<table>
<thead>
<tr>
<th></th>
<th>Spring Pin</th>
<th>Elastomeric</th>
<th>Molded Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Area</td>
<td>NRE</td>
<td>$0.5 - 1 K</td>
<td>$2 - 3 K</td>
</tr>
<tr>
<td></td>
<td>$ / contact</td>
<td>$1 - 10</td>
<td>$0.50 - $0.60</td>
</tr>
<tr>
<td>Large Area</td>
<td>NRE</td>
<td>$10 - 15 K</td>
<td>$100 - 150 K</td>
</tr>
<tr>
<td>(1/4 wafer +)</td>
<td>$ / contact</td>
<td>$0.40 - $0.50</td>
<td>&lt; $0.10 - $0.20</td>
</tr>
</tbody>
</table>

June 12 to 15, 2011  IEEE SW Test Workshop

Space Transformers

Sequential Punch

Material & Processing

Total Via Count (K)
Advanced Process Technology

Cost Drivers
- Process Steps
- Masks
- Substrates
  - Material
  - Active Area
- Yield
- Defect Density
- Layers
- Equipment
- Rework / Repair

Whitespace

Design 1
Design 2
Design 1
Design 2

FormFactor Harmony XP
Summary

• **Understand true cost of architectures**
  – Beware of NRE
  – New architectures needed for cost reductions

• **Maintain sufficient Gross Margin**
  – Company health
  – Funding for R&D

• **Honest supplier – customer partnerships**
Acknowledgments

- Amphenol InterCon Systems
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Thank You!

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