

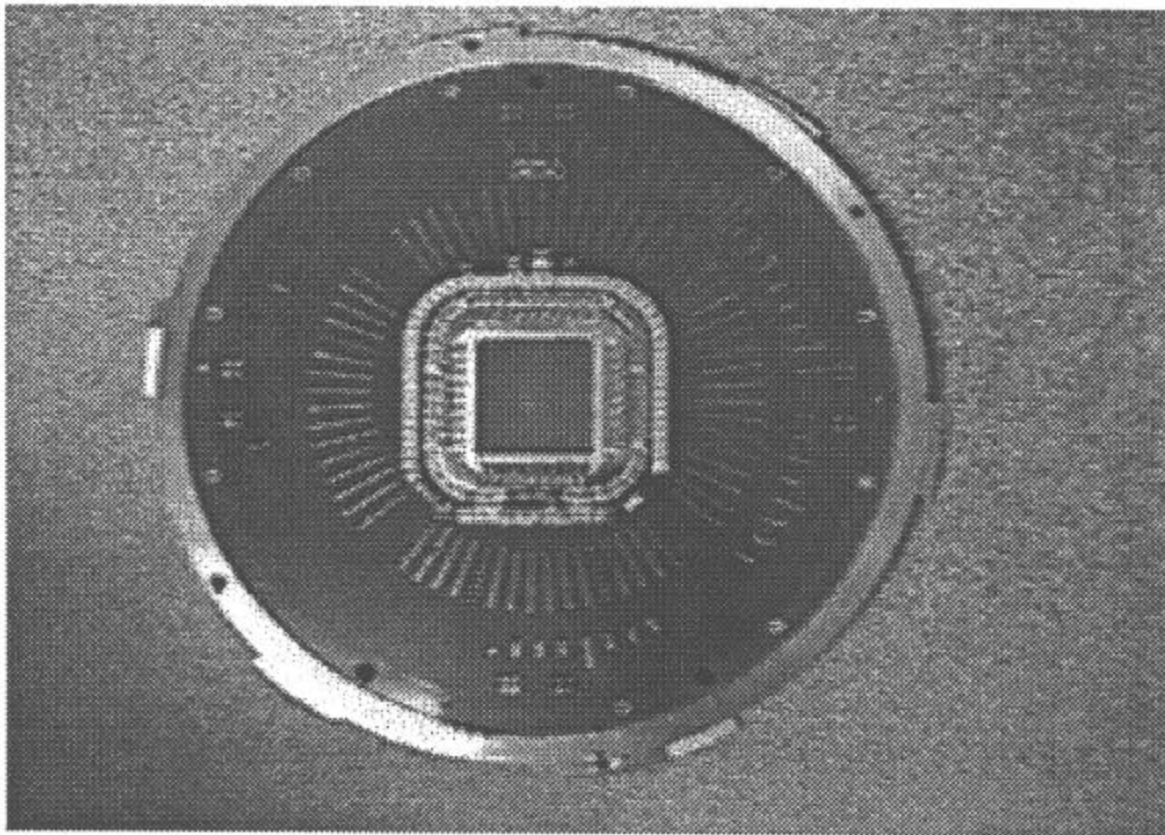


*WaferProbe*TM System

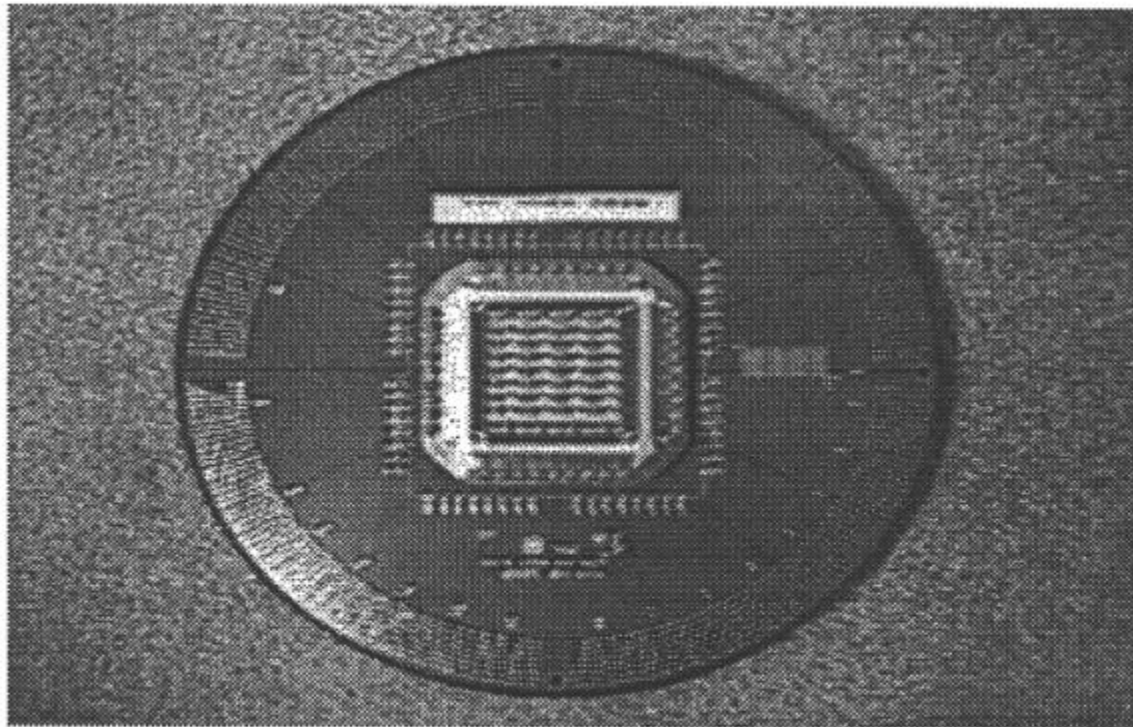
By Larry Levy



High Performance C 4 Probe Card



High Performance 4 X 8 Multiple DRAM Probe Card



WaferProbe TM System

- Microspring Technology
 - Semiconductor Processing
 - Existing Equipment (customized)
 - Patented and Patent Pending Technology

*WaferProbe*TM

- Multiple Applications
 - Al Pad Probing
 - C 4 Array Probing
 - Parallel Testing (Multiple Die)
 - At Speed Testing
 - At Temperature Testing

Typical WaferProbe Specifications

C4 Planarity (Z axis):	$\pm 7.5\mu$ (0.3 mils), 3 sigma < 13μ (0.5 mils) min to max
Aluminum Tip Planarity:	$\pm 13\mu$ (0.5 mils)
Alignment (X-Y axis)	$\pm 13\mu$ (0.5 mils), 3 sigma < 25μ (1 mil) min to max
Actual OT Required	50μ (2 mils) for C4 35μ (1.5 mils) for Al 125μ (5 mils) max for both
Temperature Range	0 - 85 °C Tested (0 - 150 °C Expected)
Probe Length	C4: 1.5 mm (60 mils), Al: 2.3 mm (90 mils)
Probe Pitch	125μ (LOC), 200μ Periph, design dependent 242μ (C4), 225μ late '97
Probe Tip Dimensions	C4 Ball: 125μ diameter Al Pad: "Pyramid" contact, 10μ sq. x 50μ tall

Typical Electrical Characteristics

- Probe Tips

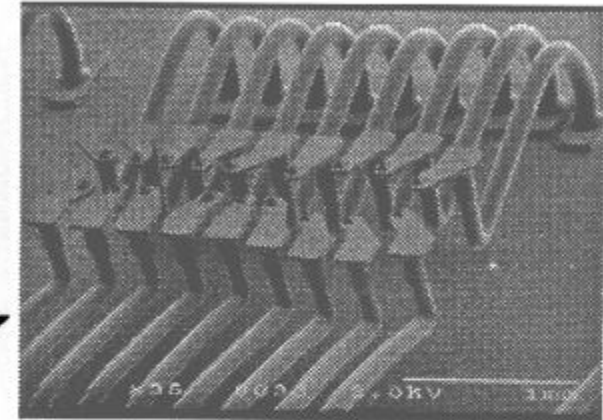
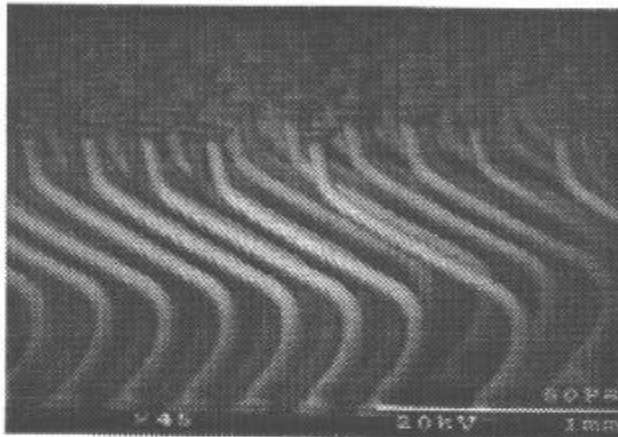
- Parasitic Inductance < 1nH
- Contact Resistance < 0.5 Ohms
- Current Load >1 amp

- Probe Cards

- Impedance 50 Ohms
- Decoupling probe < 100 mils from
- Bandwidth >1 GHz
- Rise & Fall Times < 350 ps

FormFactor's WaferProbe™ System

formfactor inc.

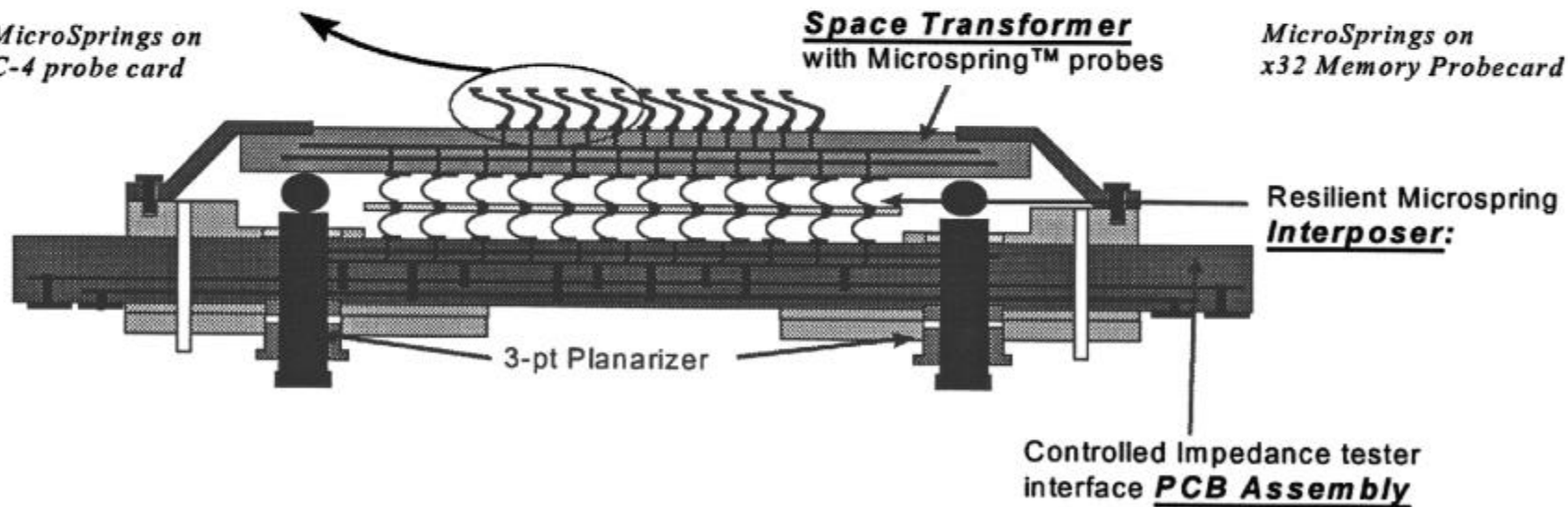


MicroSpring™
probe elements:

*MicroSprings on
C-4 probe card*

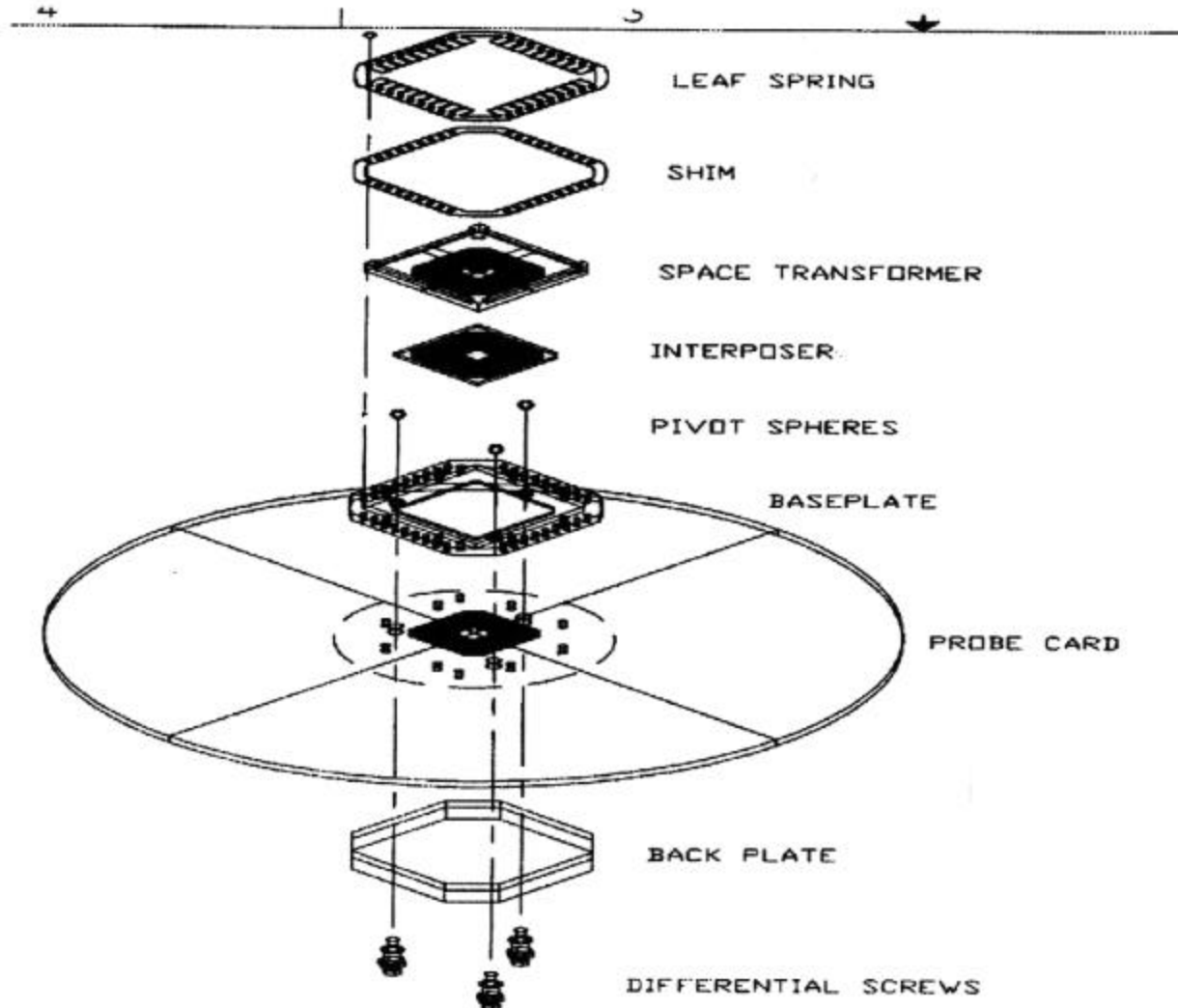
Space Transformer
with Microspring™ probes

*MicroSprings on
x32 Memory Probecard*



WaferProbe Construction

formfactor inc.





WaferProbe™ Components

- **Space Transformer** w/ MicroSprings
 - High performance, multilayer ceramic
 - 50Ω impedance, distributed ground & power planes
 - Decoupling capacitors added for high frequency bypass



WaferProbe™ Components

- **Interposer**

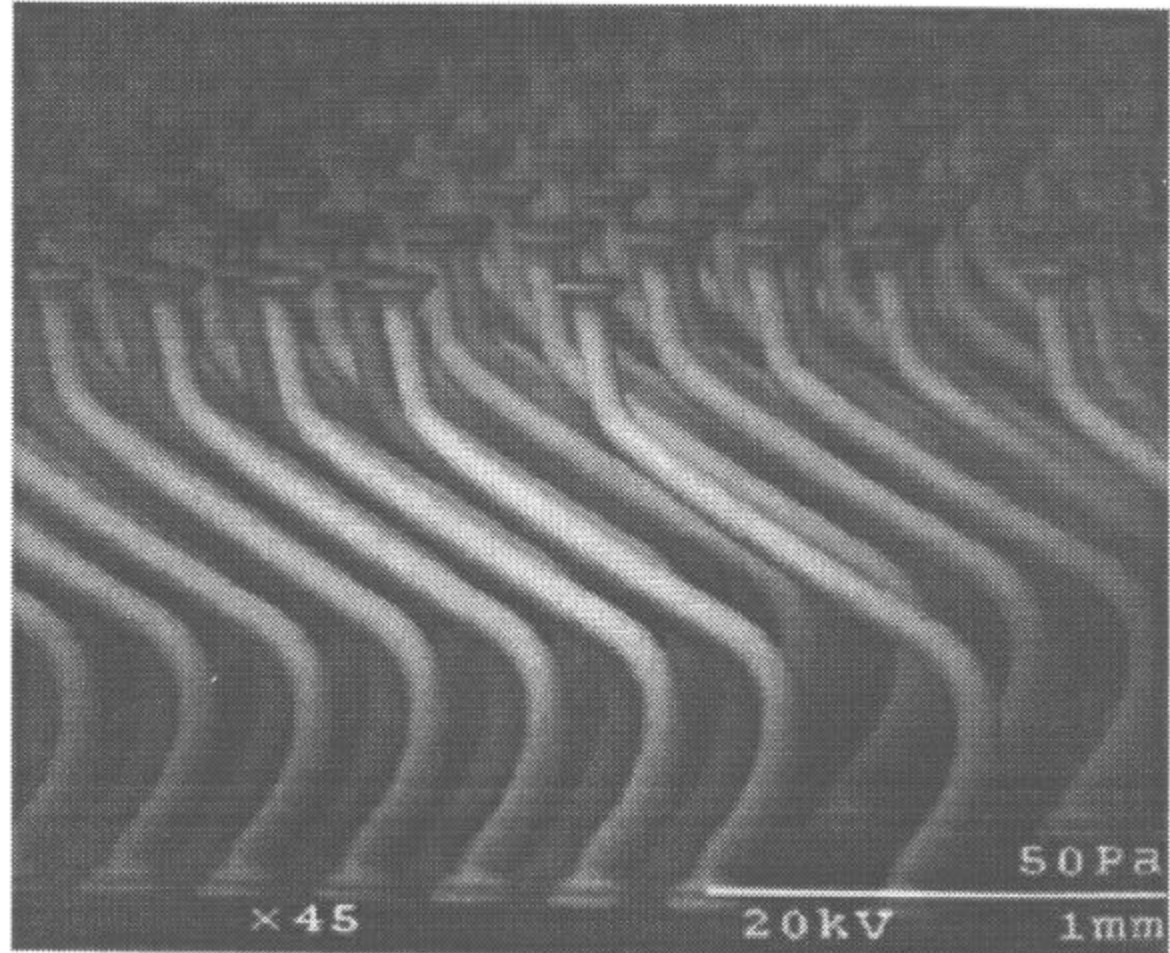
- Provides compliant z-axis, demountable connection for Space Transformer to PCB
- Double-side MicroSprings on High Temp Material
- 2000 Interconnect Lines--->4000 Future

- **PCB Assembly**

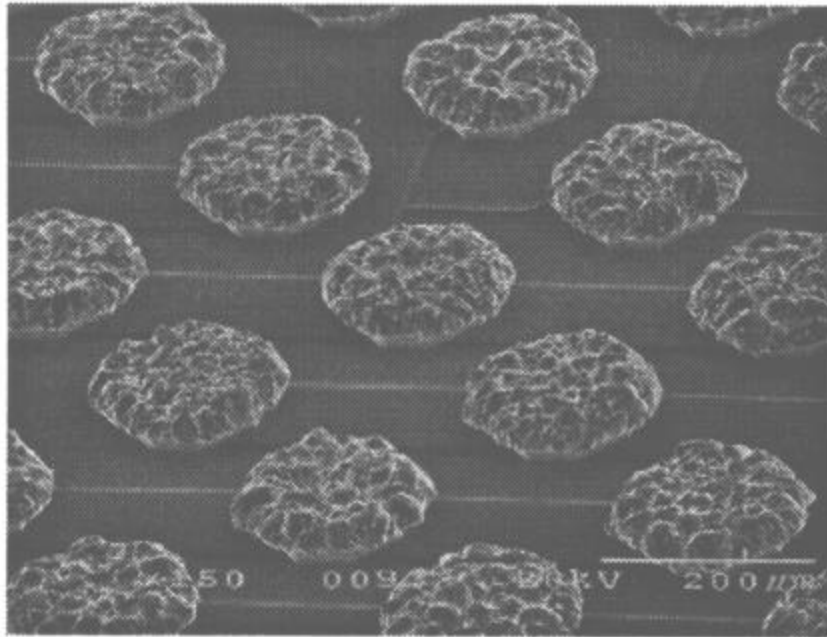
- Provides connection to tester, discrete components, Planarization Mechanism

C4 MicroSpring Array

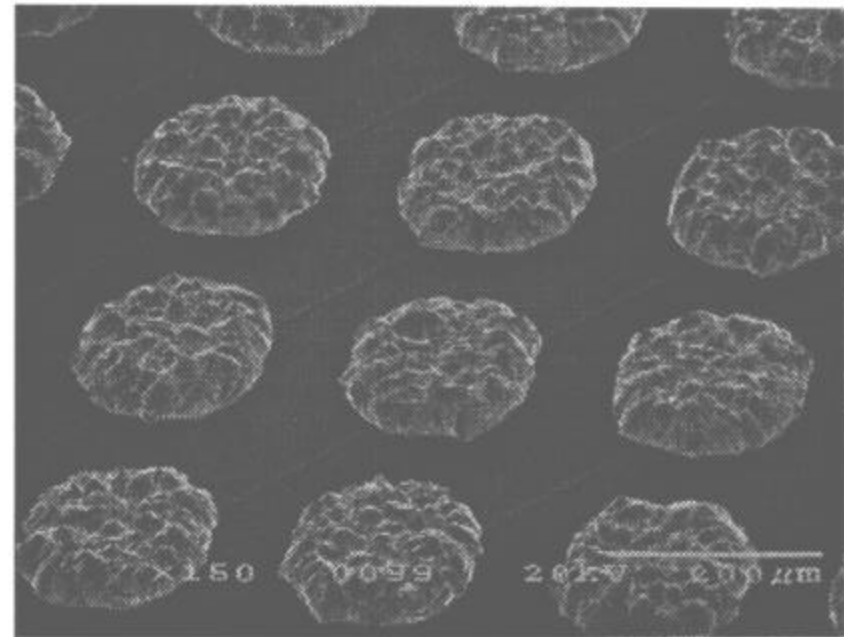
- Individually compliant springs
- Customizable Tips
- Capable of >250K touchdowns
- >1GHz bandwidth
- m X n Matrix, 2.25" max OD
- Programmable scrub characteristics
- No probe marks



C4 Pad: No Reflow Required



Unreflowed C4 Pad
Before Probe

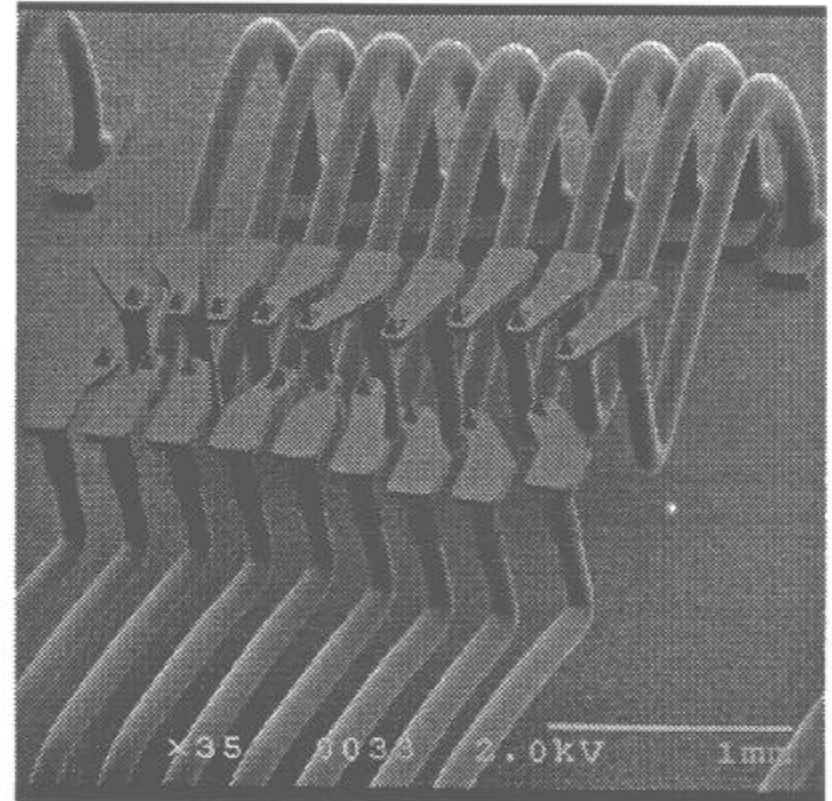


Unreflowed C4 Pad
After 10 Probes

Multi-Die Memory Probe Card

SEM photo of 1312 pin probe card
for x32 16Mbit DRAM

- Capable to simultaneous x32 probing of DRAM or Flash devices
- Capable of >250K touchdowns (>8M devices)
- >1GHz bandwidth, capable of testing SDRAMs and RAMBUS/Synclink DRAMS @ speed
- m X n Matrix, 2.25" max OD
- Programmable scrub characteristics
- Probe mark <1/5 the size of conventional technology

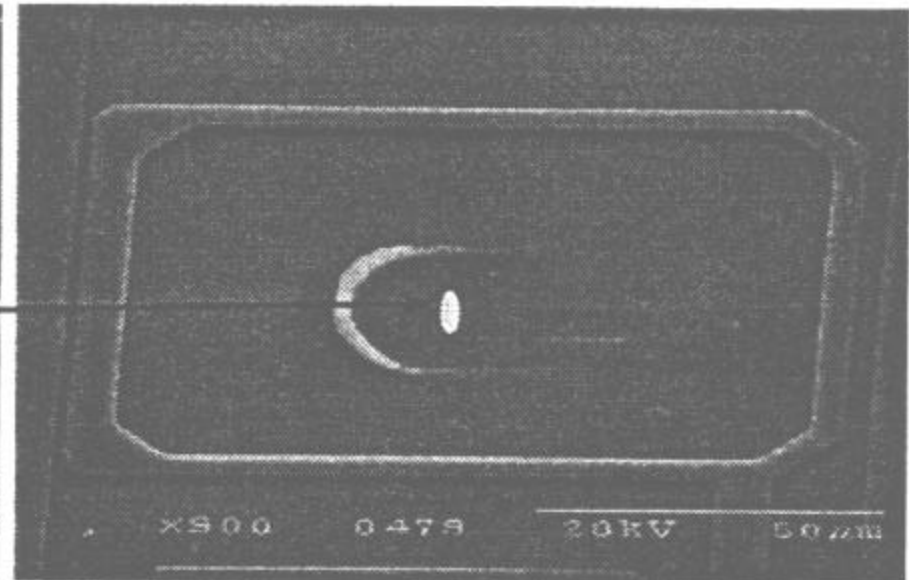
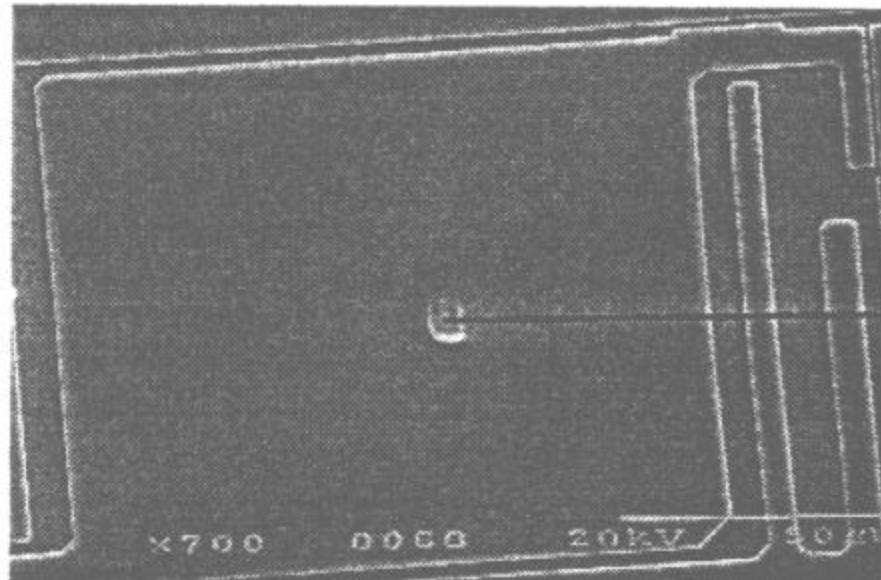




FormFactor Scrub Mark

FormFactor "Pyramid"
Probe Mark on Al

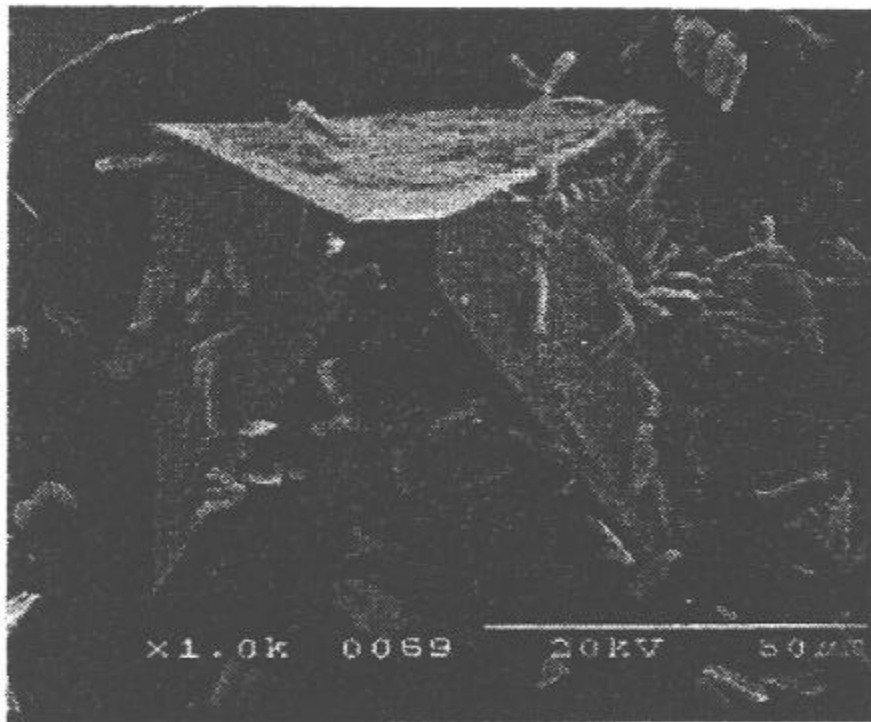
Tungsten Probe
Mark on Al



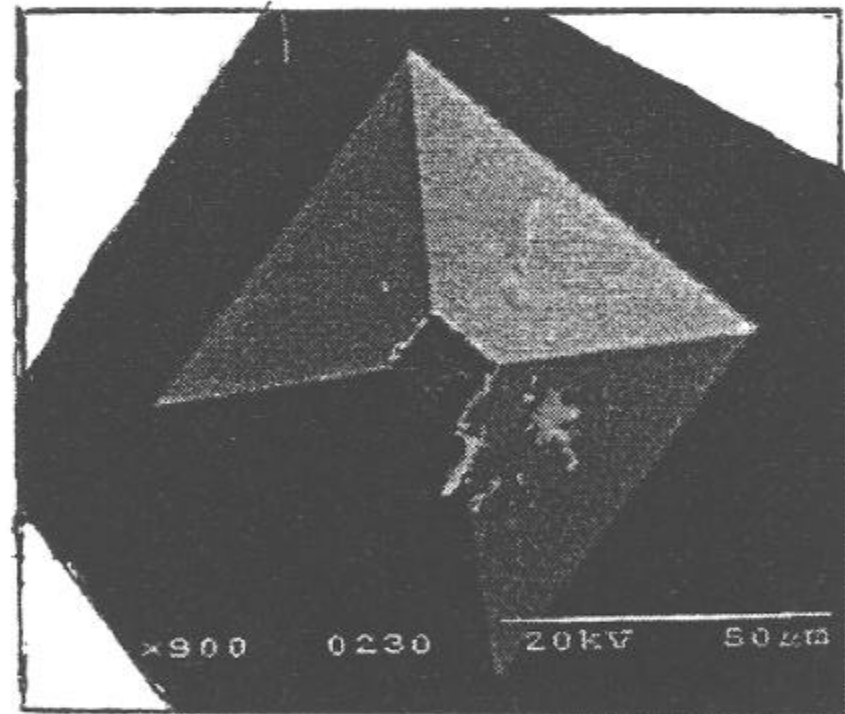
Magnification not Equivalent

Pyramid Tip Wear and Cleaning

Tip Wear after 53K Cycles



Before cleaning



After cleaning & 500 TD

WaferProbe™ Status

x32 Memory Probe Cards:

- x32 cards running on production floor
 - 1312 pin card delivered (8x4, 32 in parallel)
 - Production setup, planarization, API inspection
 - Assembly Verification
 - Probe process (overdrive, etc.)
 - Cleaning methodology



*WaferProbe*TM Status

x32 Memory Probe Cards:

- Performance

Card Type	Wafers per Unit Time	Yield
8x1	1	1.000
8x2	1.5	1.000
FFI 8x4	2.8	1.003



Available Probecard Technologies

	<u>FormFactor</u>	<u>Cobra</u>	<u>Membrane</u>	<u>Tungsten Needle</u>
Production Qualified	✓	✓	No	✓
Delivered x32 Memory Card	✓	No	No	✓
Full Array C4	✓	✓	✓	No
Low/No Maintenance	✓	✓	No	No
Eliminates C4 Reflow Step	✓	No	No	No
> 1GHz Bandwidth, 50 Ω	✓	No	✓	No
Individually Compliant Tips	✓	✓	No	✓
Photo-Defined Tip	✓	No	✓	No
Low Contact Force (< 7 gr)	✓	No	No	✓
Automatic Assembly	✓	No	✓	No
TCE Matched to Silicon	✓	✓	No	No
Z-Axis Planarity < 8 μ	✓	No	✓	No
X-Y Axis Alignment <13 μ	✓	No	✓	No