

Mechanical and Electrical Performance of MicroStrip Beam Probes

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MicroConnect, Inc.

MSB Description

- Fine Pitch
- High Frequency
- High Pin Count
- Long Life

Evolution of Contact Probing

- Needles
 - Widely used
 - Limited in pitch due to minimum diameter of wires
 - Limited in bandwidth due to series L
 - Limited life
 - Pin count is first order contributor to cost

Evolution of Contact Probing

- Photolithography based
 - Membranes (planar)
 - Mechanical Crosstalk
 - MEMS structures (3 dimensional)
 - Micromachined

Technology Background

- Mechanical crosstalk in membrane probes
- Independent suspension of needle probes
- Need for solution based on photolithography

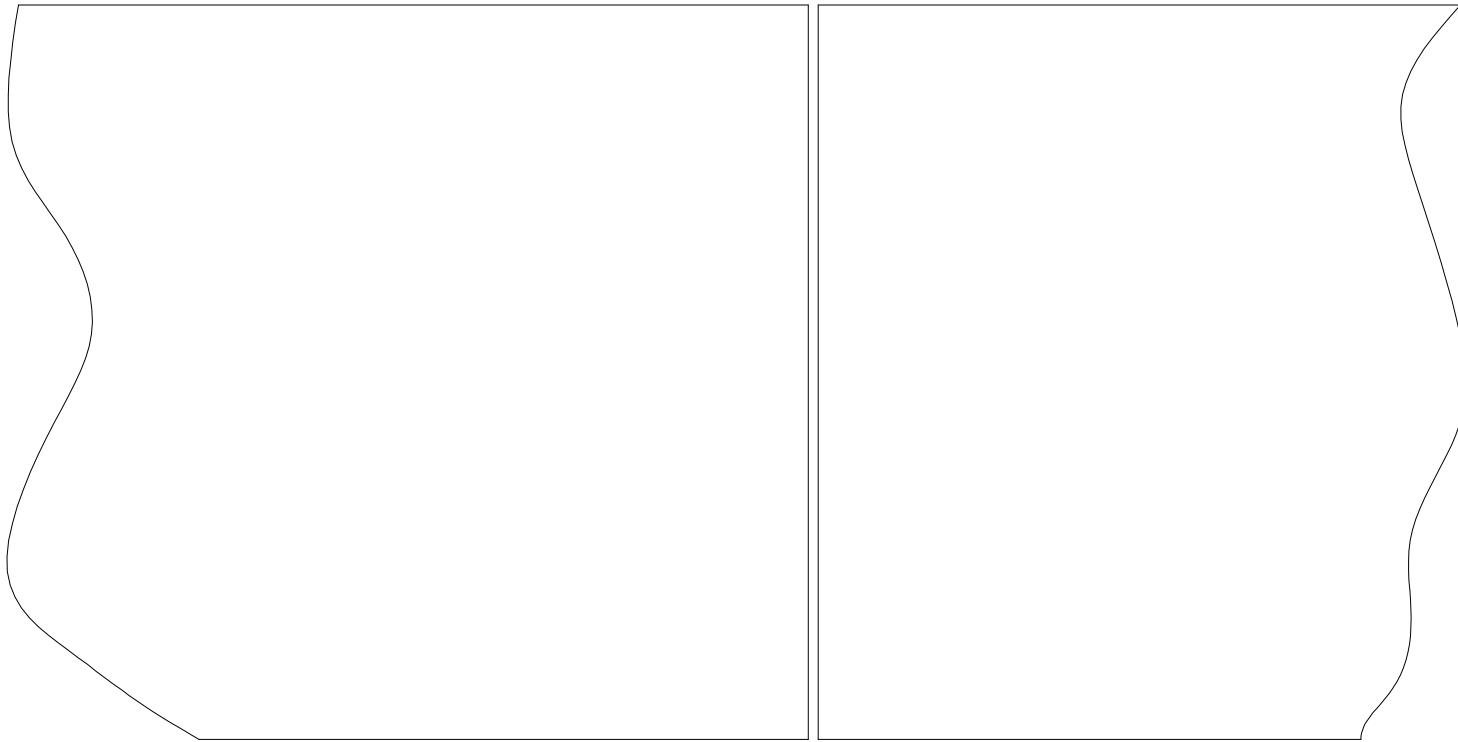
Technology Breakthrough

- Ability to produce slits with very high aspect ratio
- Initial aspect ratio 10:1

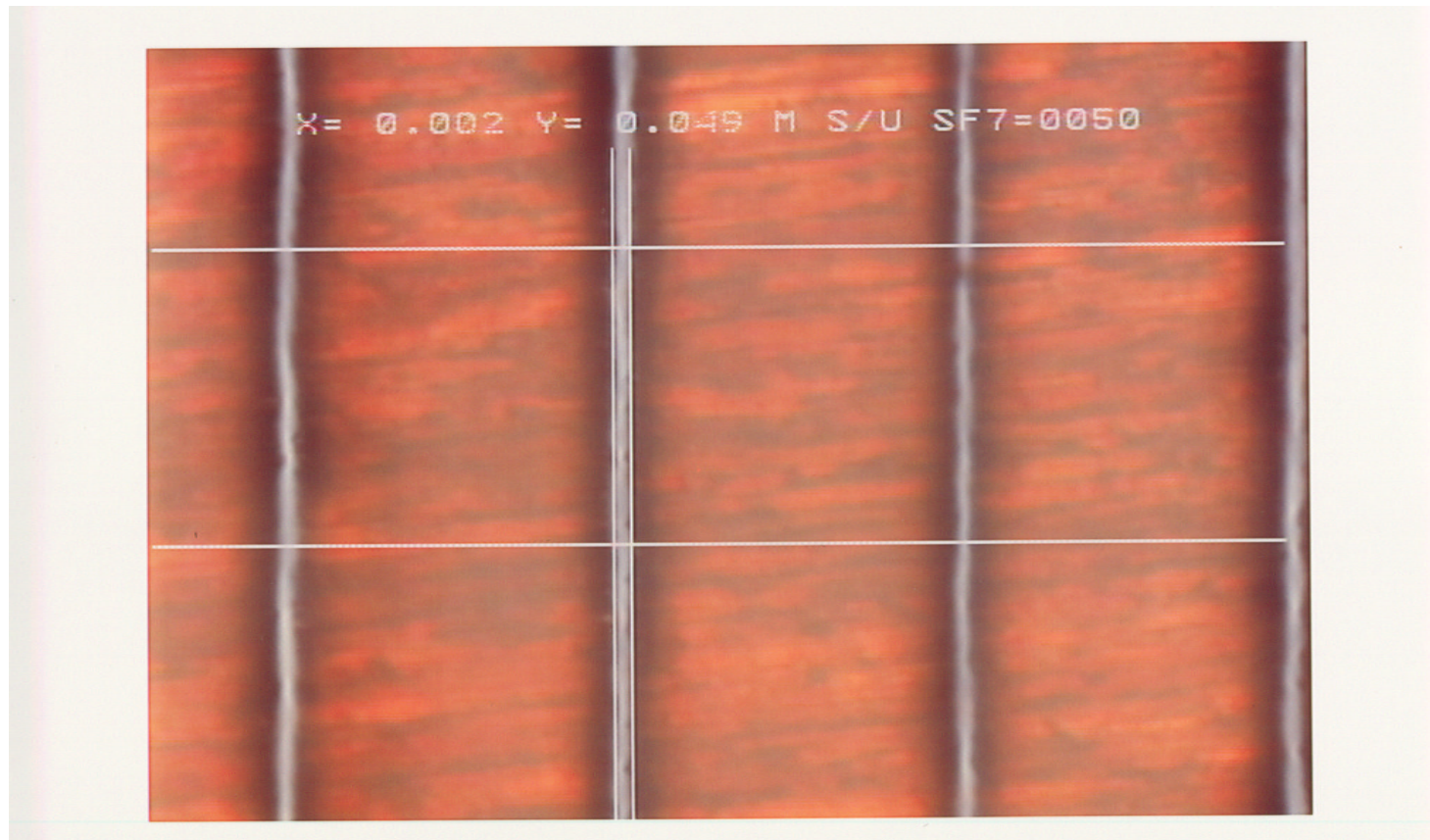
Technology Improvements

- Recent experiments resulting in 75:1
- Recent slit width of 2 μm

Scale Sketch of 75:1 Aspect Ratio Slit

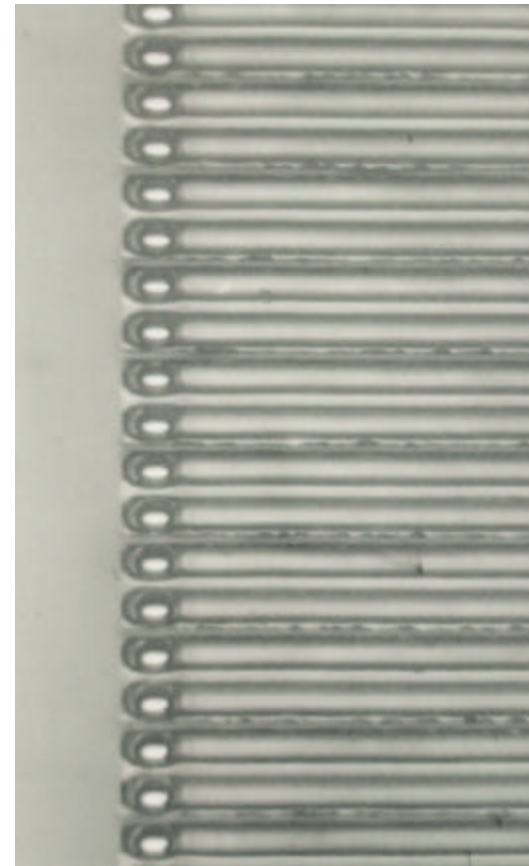


2 micron Slit in 150 micron Thick Material



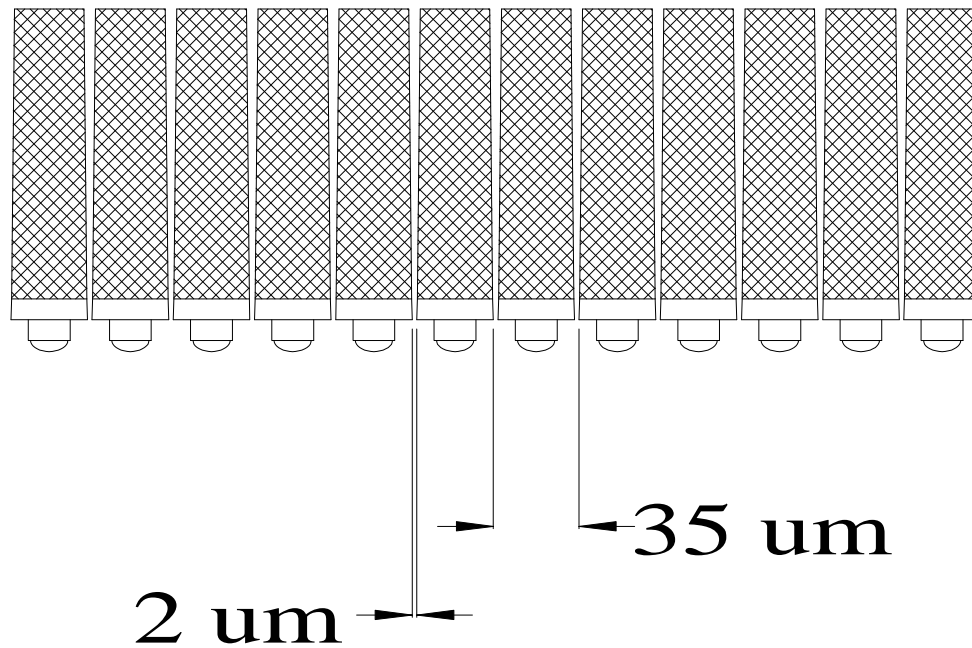
50 μm pitch probe

- Photo of actual 50 μm pitch device
- 600 pin device
- Controlled impedance to tip



- Device made by
R&D Center
Micronics Japan Co. Ltd

35 Micron Pitch Geometry



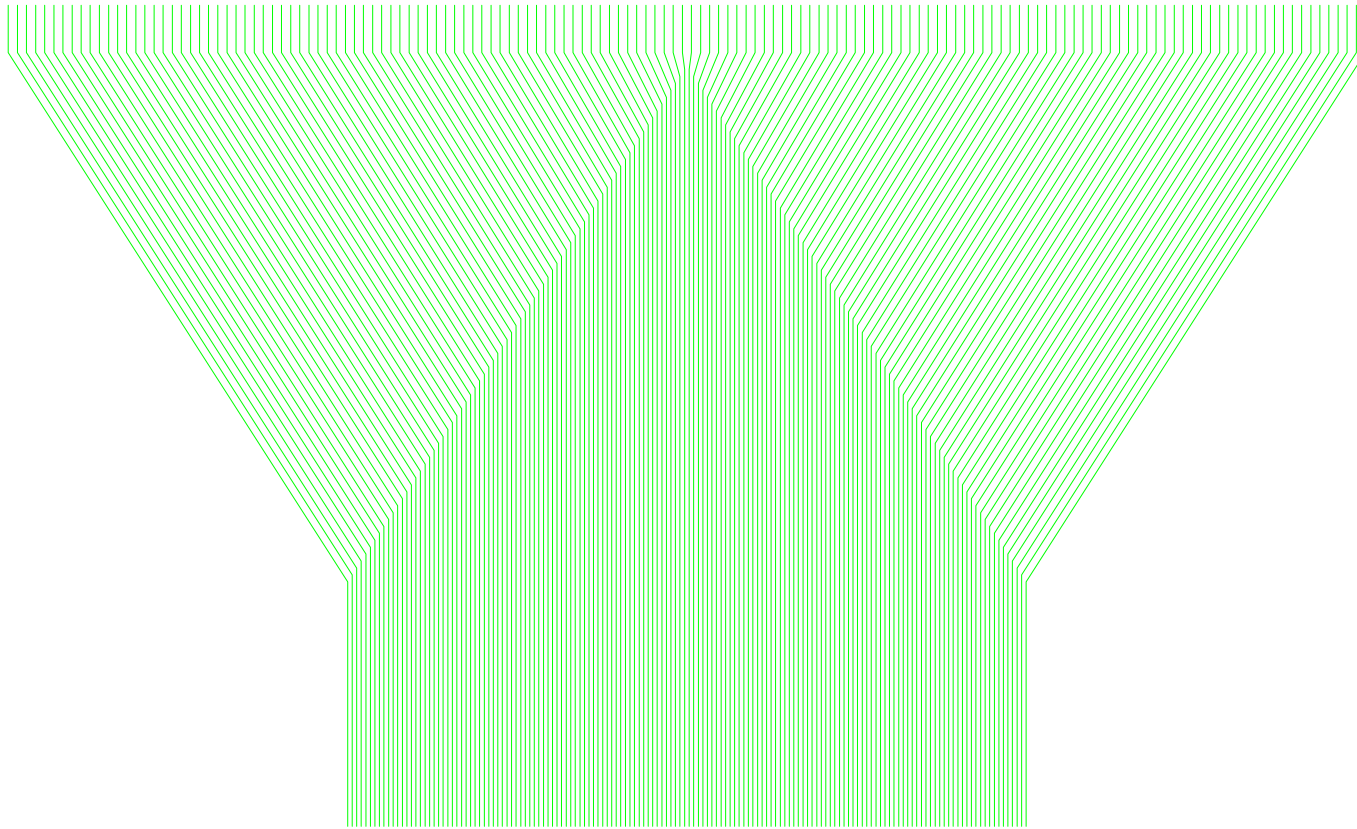
High Frequency

- Controlled impedance to contact point
- Impedance controlled by robust, mechanically stable elements

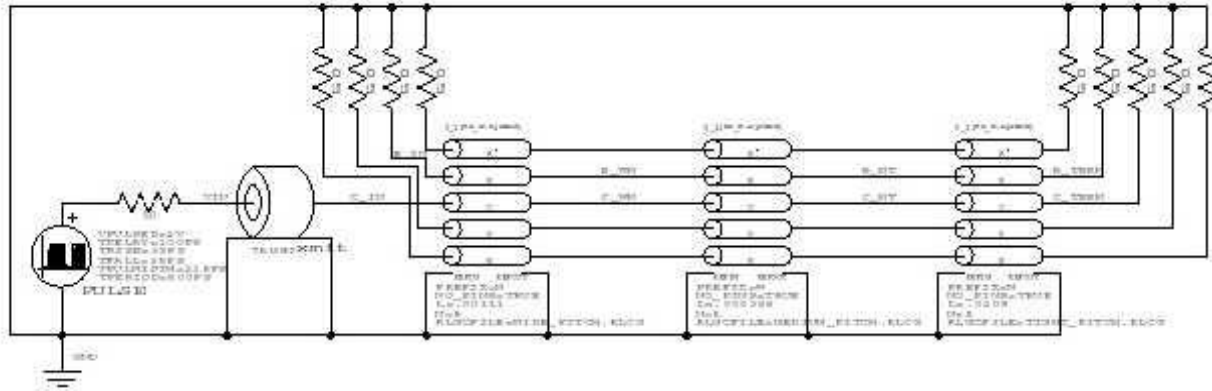
Simulated and Measured Electrical Performance

- Studies done at the Mayo Clinic
- TDR measurements tracked predictions
- Crosstalk predicted for 4 mil pitch probe

View of Signal Layer



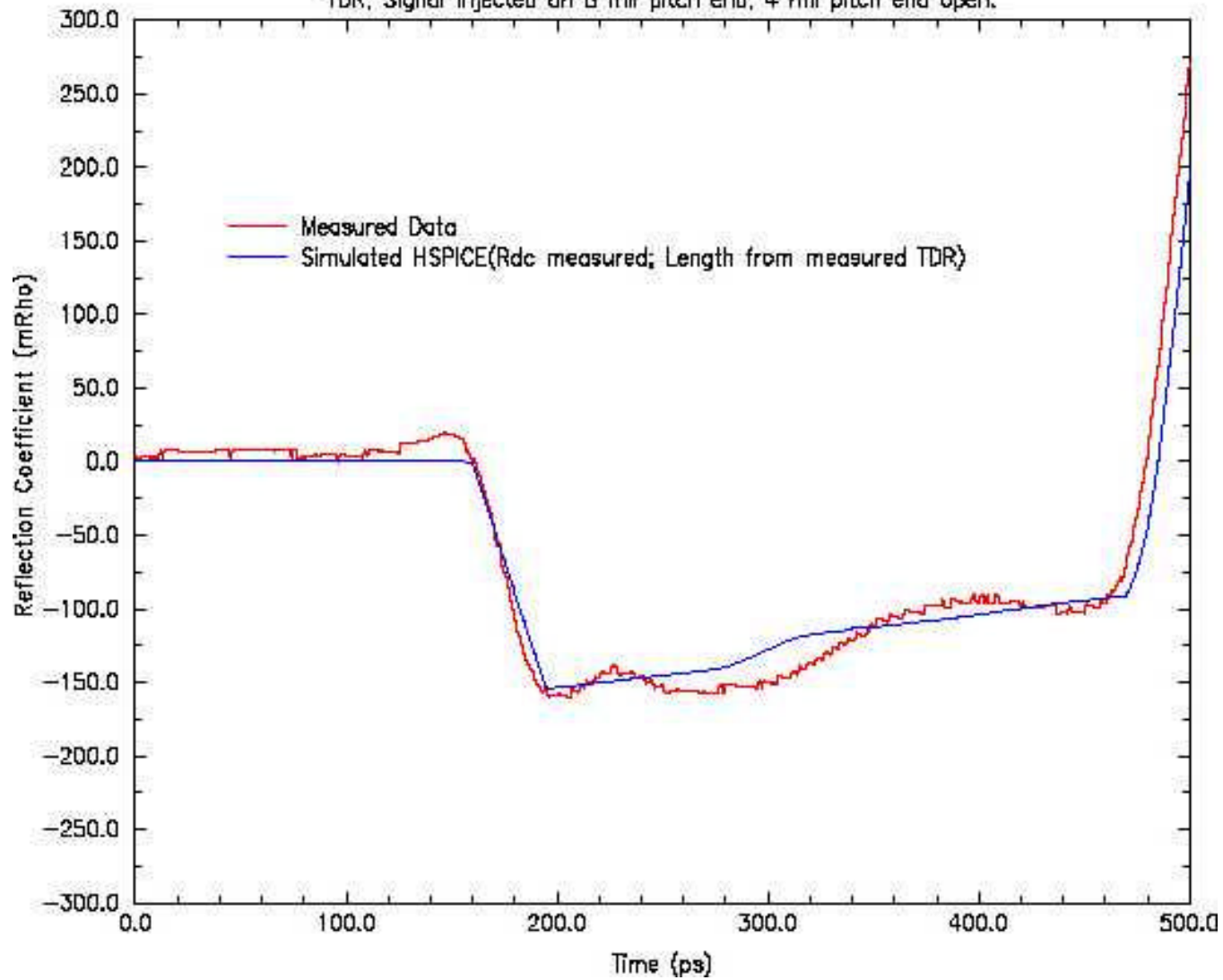
Micro Connect Inc 4 mil inner/8 mil outer Flex probe.
 ma_misc/probe_mc_Flex/sin_hspice



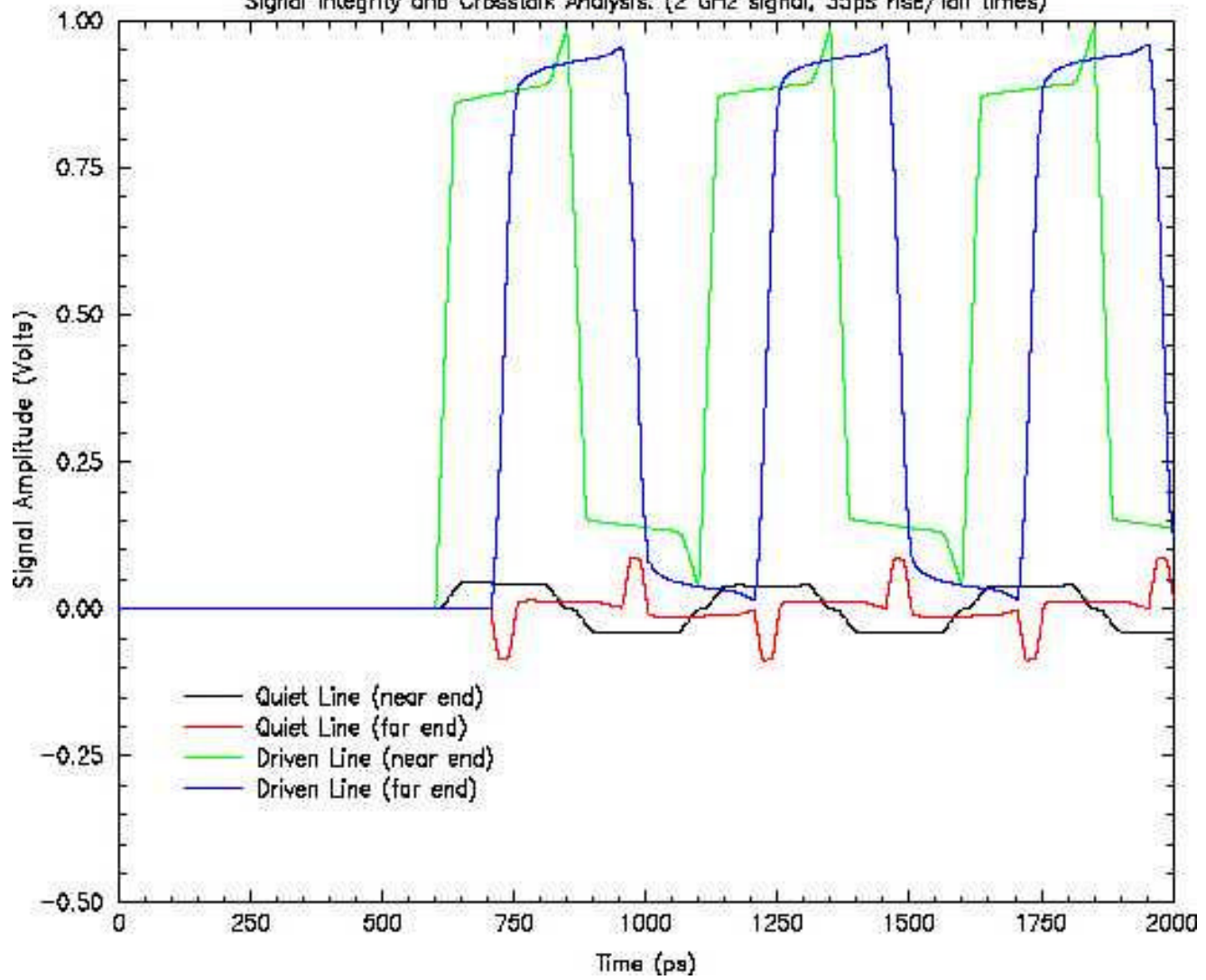
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Mayo Characterization of Micro Connects Flex Probe
TDR; Signal injected on 8 mil pitch end; 4 mil pitch end open.

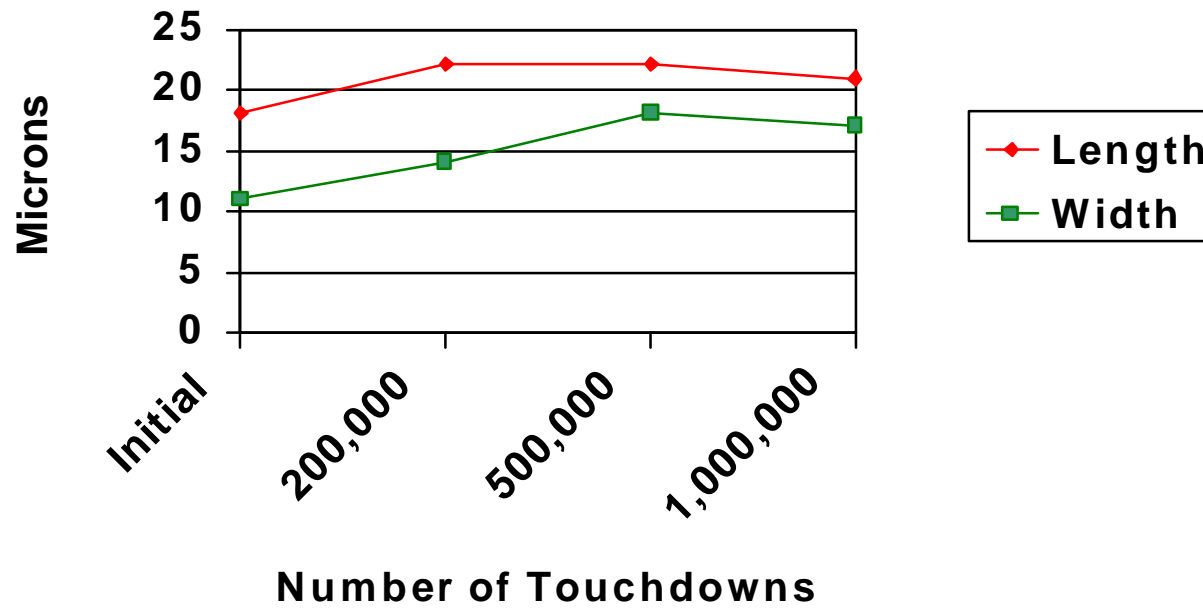


Mayo Characterization of Micro Connects Flex Probe
Signal Integrity and Crosstalk Analysis. (2 GHz signal, 35ps rise/fall times)

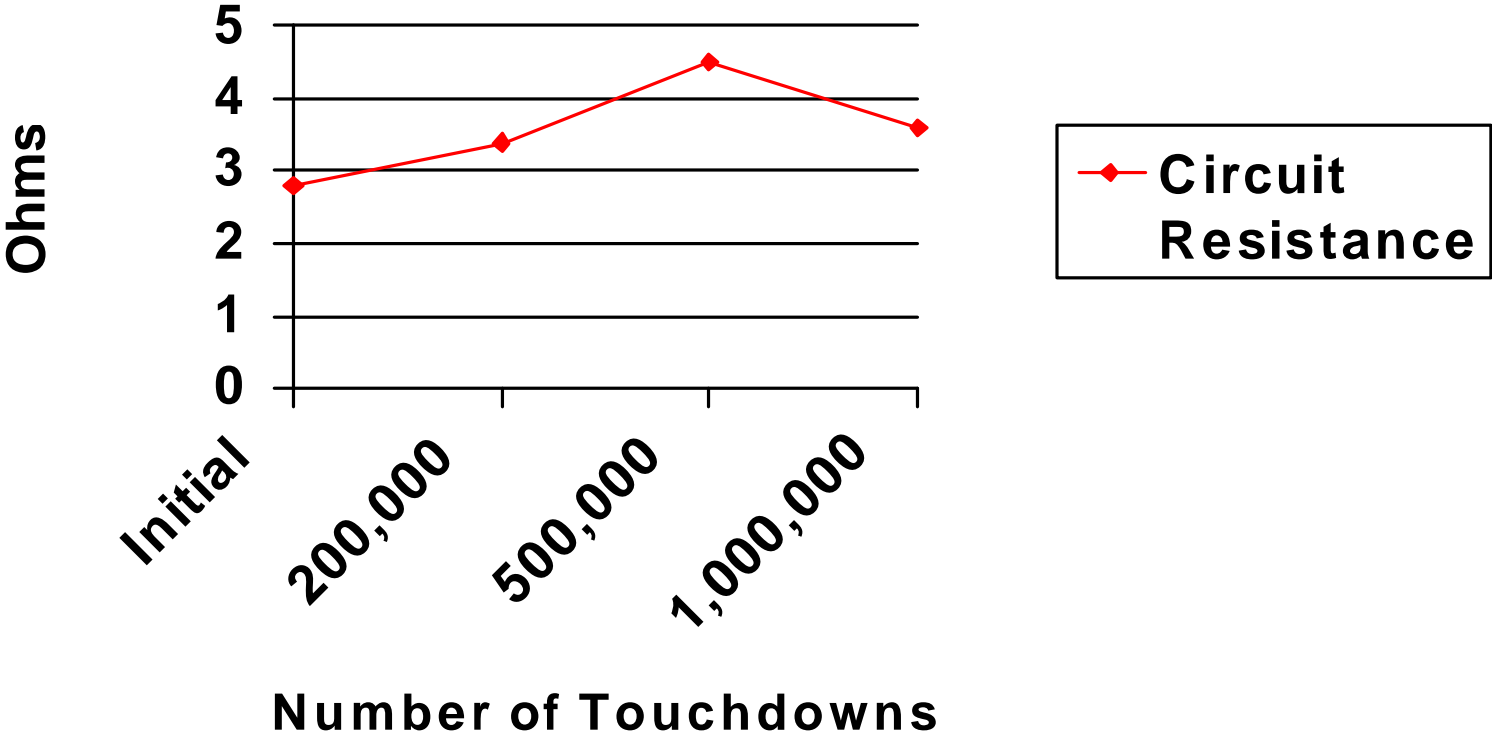


Data taken by
R&D Center
Micronics Japan Co. Ltd

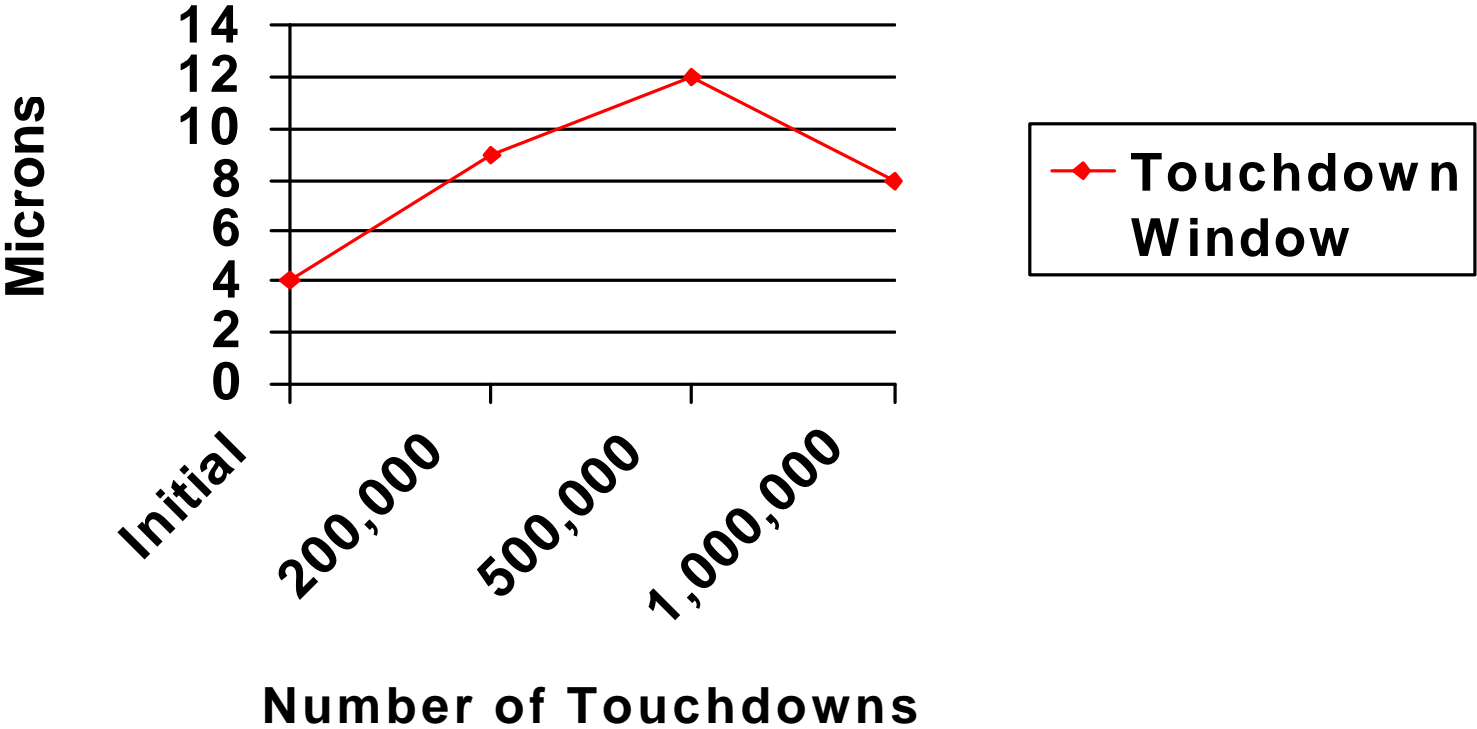
Scrub Mark Size



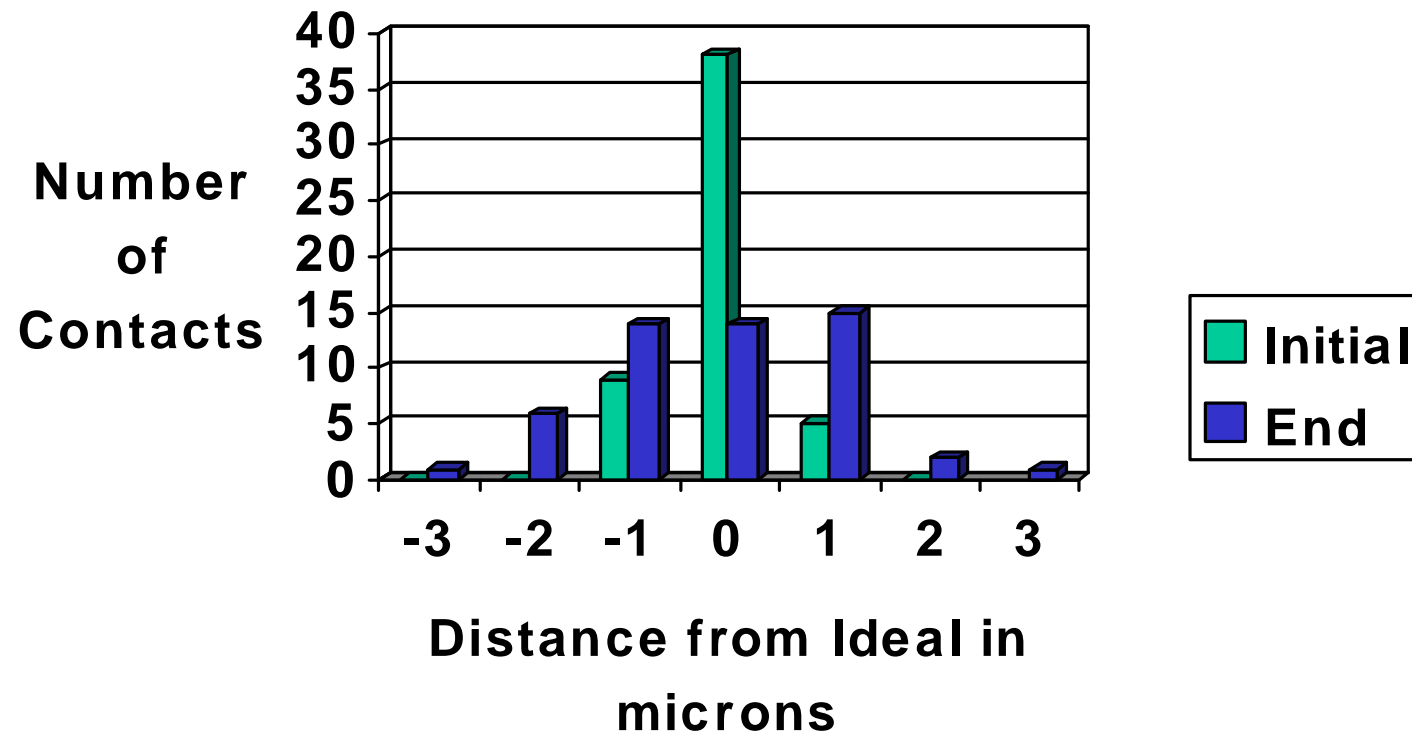
Circuit Resistance



Planarity



XY Position Distribution



Measured Electrical Performance

Data taken by
R&D Center
Micronics Japan Co. Ltd

Max Current 700ma

Impedance $50\Omega \pm 10\%$

Crosstalk $<5\%$

Contact Resistance 0.2Ω (average)

Circuit Resistance 2.5Ω (average)

Probe Design Goals

Specification by
R&D Center
Micronics Japan Co. Ltd

Chip Size 25mm X 25mm

Pin Count 2000

Pad pitch 50 μ m

Frequency Capability 10GHz

Mechanical Characteristics

Data taken by
R&D Center
Micronics Japan Co. Ltd

Contact Force	5g per bump @ 3mil overdrive
Planarization Limits	20 μ m
Bump Placement	\pm 1 μ m
Scrub Mark Size	10 μ m X 15 μ m
Life	1,000,000 TD
Temperature	25°C - 150°C at bump

Product Status

- Probe in beta test January 1998
- Probe evaluation due June 1998
- Further product shipments 3q98

Probe Test Status

- These results are a snapshot of where we are today
- Studies are ongoing to more completely characterize the probe

Credits

- Thomas C. Hill, III; Consultant
- Gregg Fokken; Mayo Clinic
- Yoshiei Hasegawa, President, Micronics Japan Co. Ltd.*

* MicroConnect and MJC have a joint development contract.