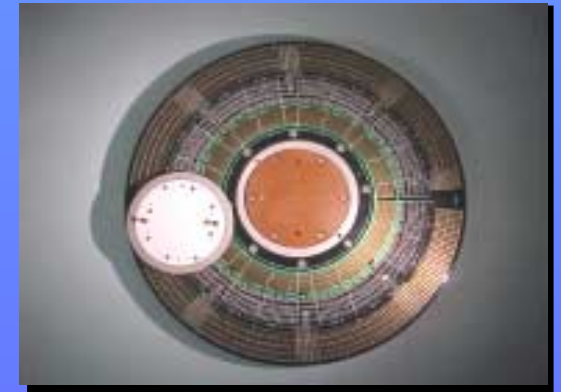
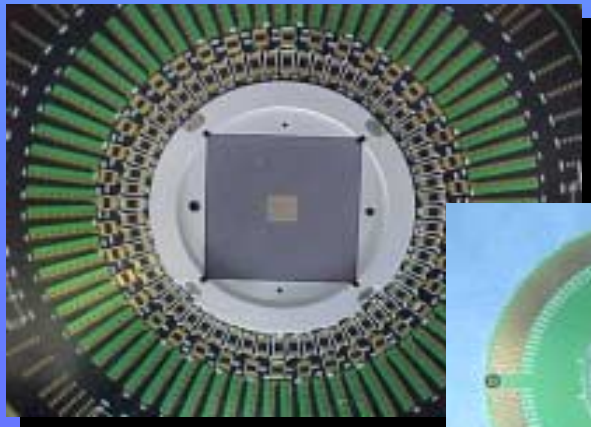
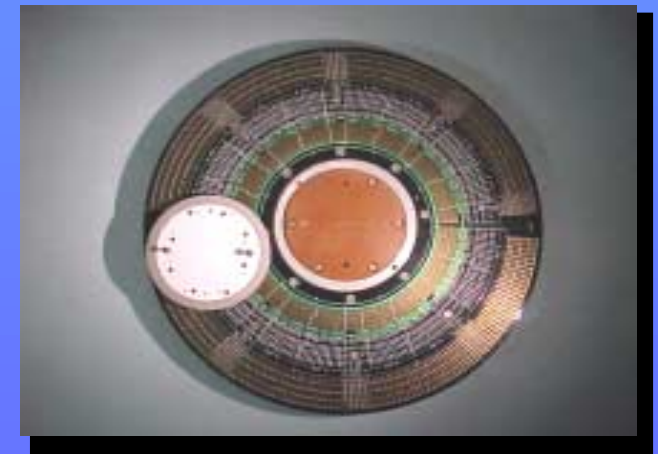
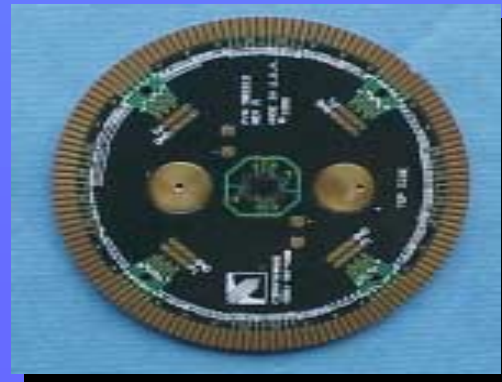


Improvements in Vertical Probing



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Outline

- ★ Objectives
- ★ Current product
- ★ New Challenges in pitch reduction
- ★ Results of temperature improvement
- ★ Conclusion

Main Parameters to be improved

 Pitch

 Temperature

 *Frequency*

Customers Needs

Requirements	1999	2000	2001	2002
Pad Pitch (μm)	100	70	50	45
Bump Pitch (μm)	225	178	150	127
Temperature ($^{\circ}\text{C}$)	25 to 150	-40 to 200	-40 to 200	-40 to 200

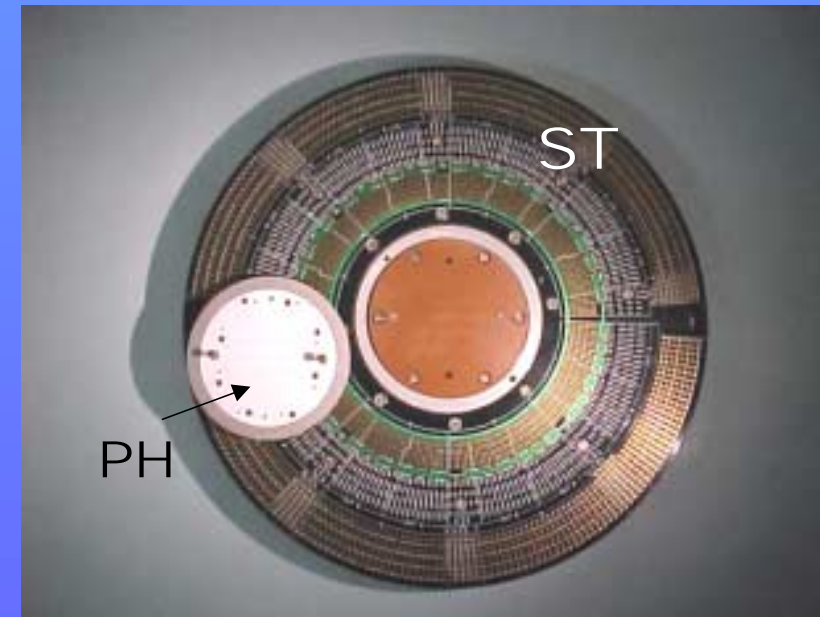
Current Product

Pitch:

5 mils probes	down to 225 μm
4 mils Probes	down to 175 μm
3 mils probes	down to 135 μm
	down to 105 μm

Temperature :

Amb and HT (up to 150°C)



Pitch Reduction



New challenges for
vertical probing

Sub-100 μm Pitch

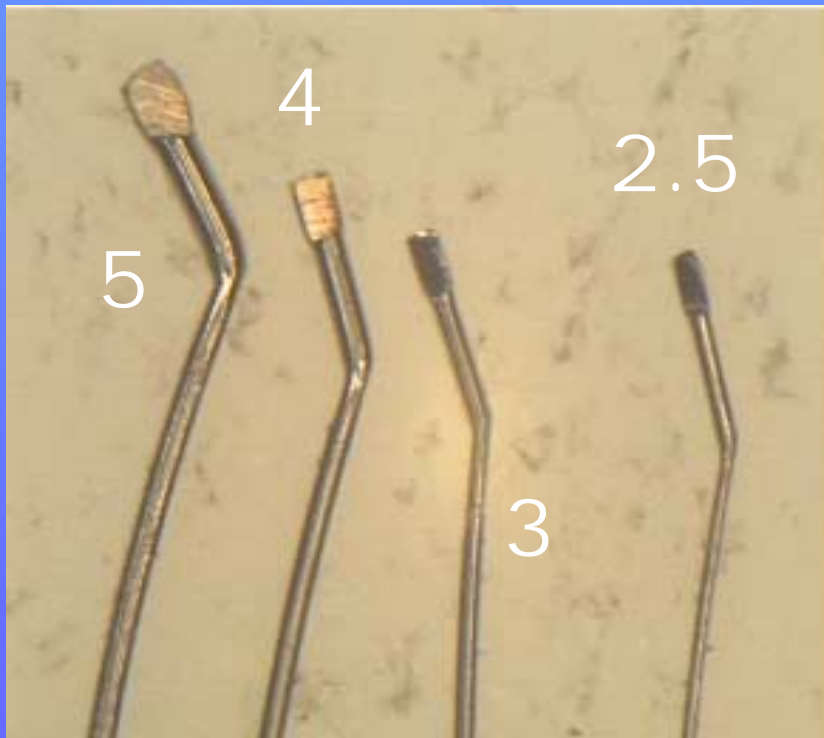
One step down to 95 μm

Enhancement of current cobra

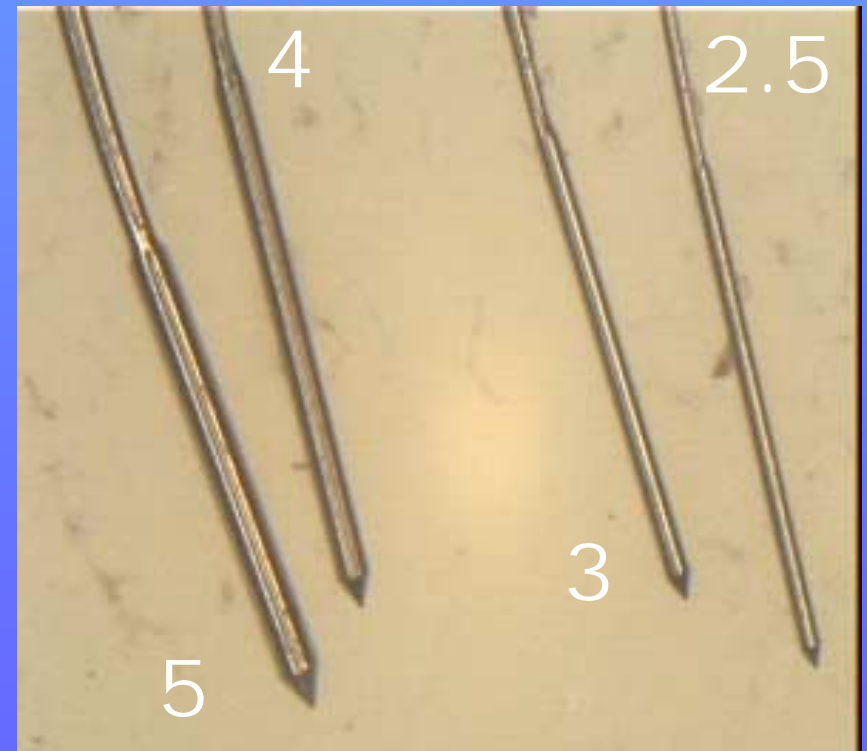
- Same grid material
- Drilling techniques:
 - laser ablation
- Space transformer:
 - hand wire ,, MLC with organic thin film,, micro PCB
- Main Change:
 - probe diameter 2.5 mills

Probe Diameters (mils)

Head



Tip



From 95 μm to 70 μm

Enhancement of current cobra

- Same grid material
- Same drilling techniques:
 - laser ablation
- Main changes:
 - space transformer based on Si interface
 - probe diameter down to 1 mills

From 70 μm to 45 μm

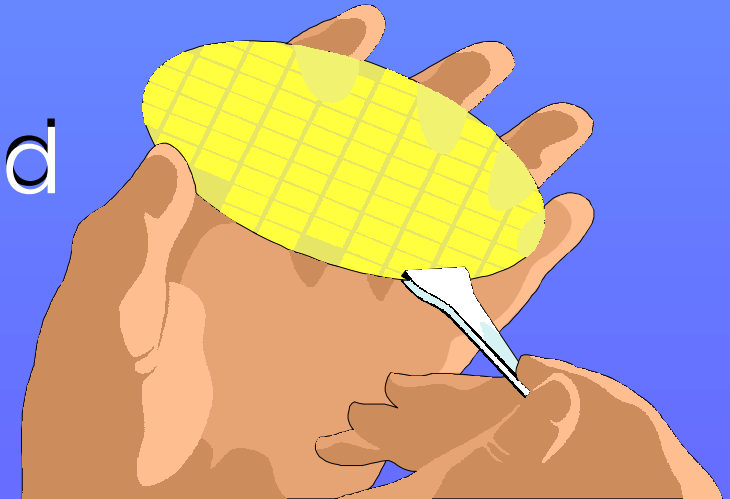
New Vertical Technology*



Medea Project
Medea Project



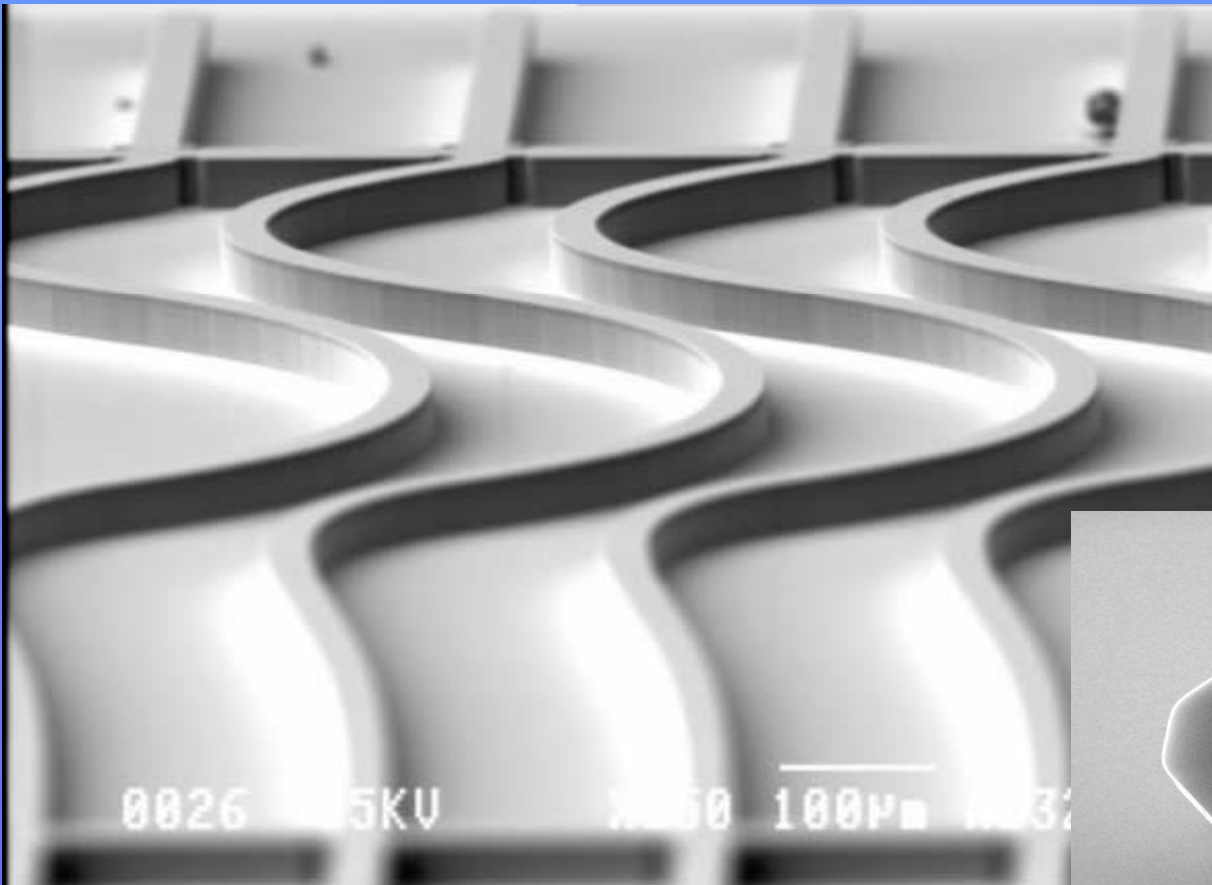
- **New material:**
 - Silicon for: probe, grid and ST interface



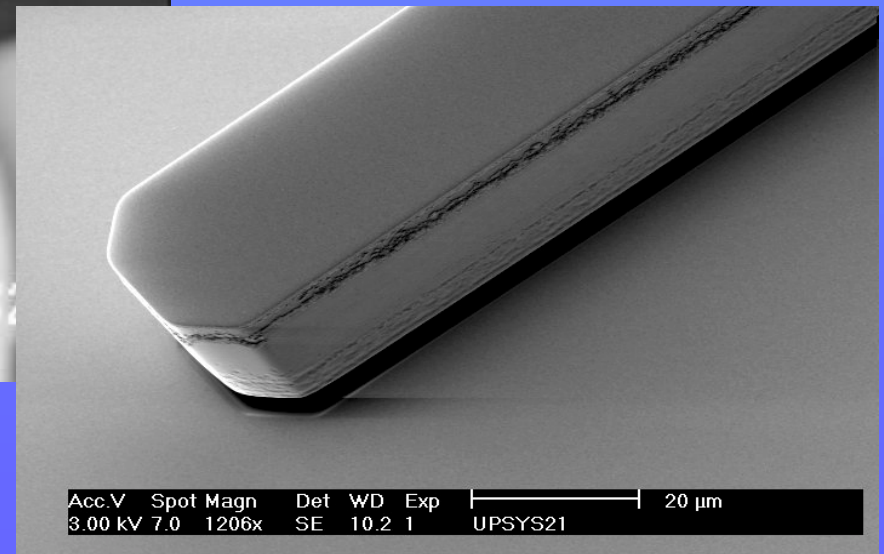
- **New technology:**
 - DRIE + metallization

From 70 μm to 45 μm

Needle Shape * (SEM)

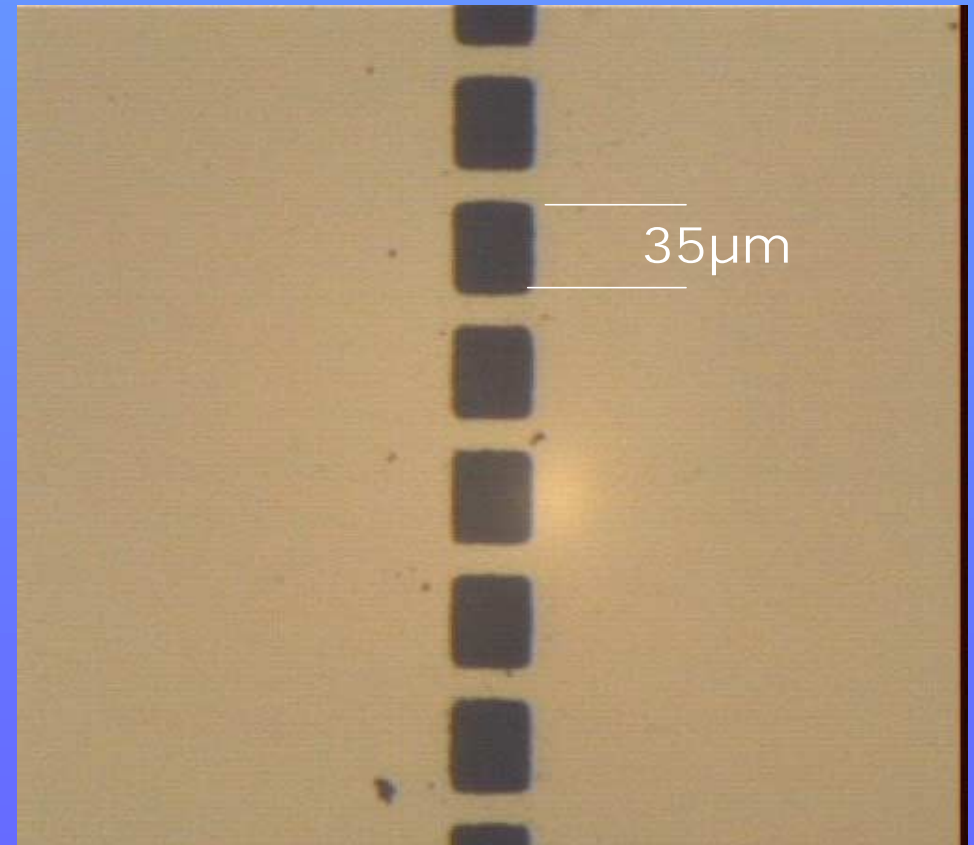
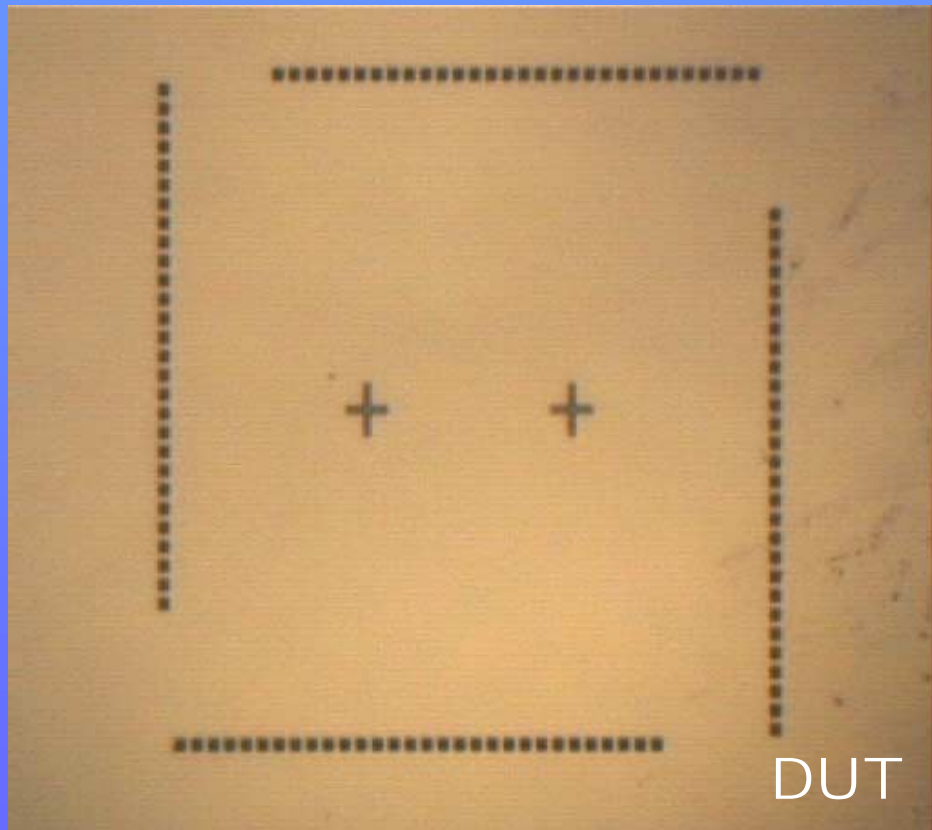


Needle Tip



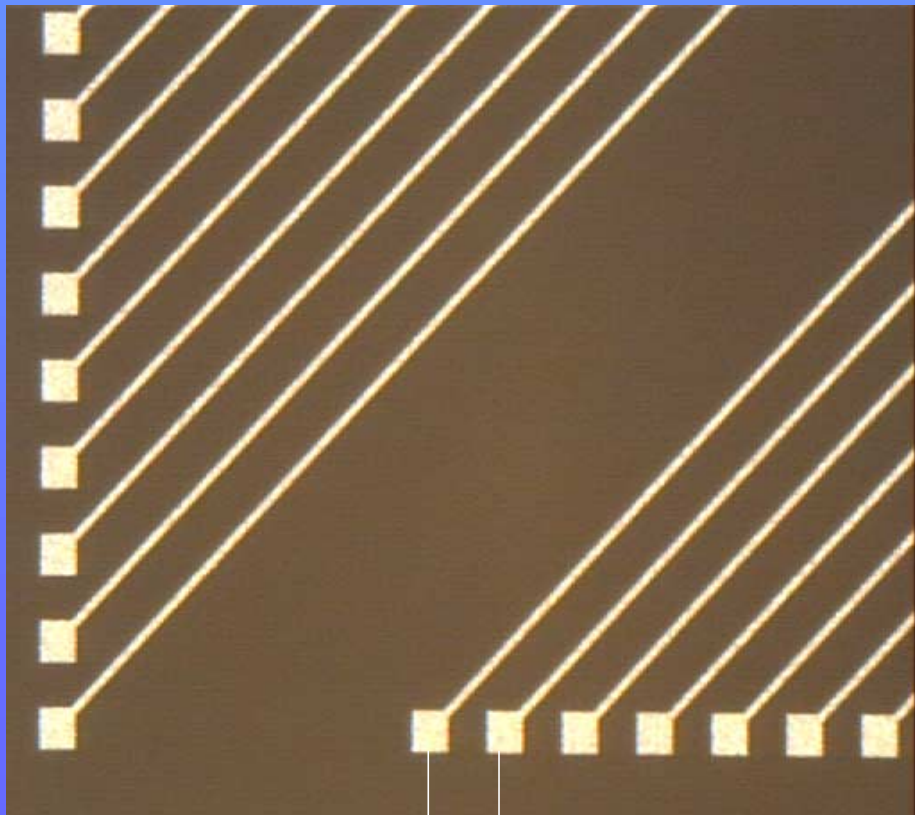
From 70 μm to 45 μm

Silicon Grid*



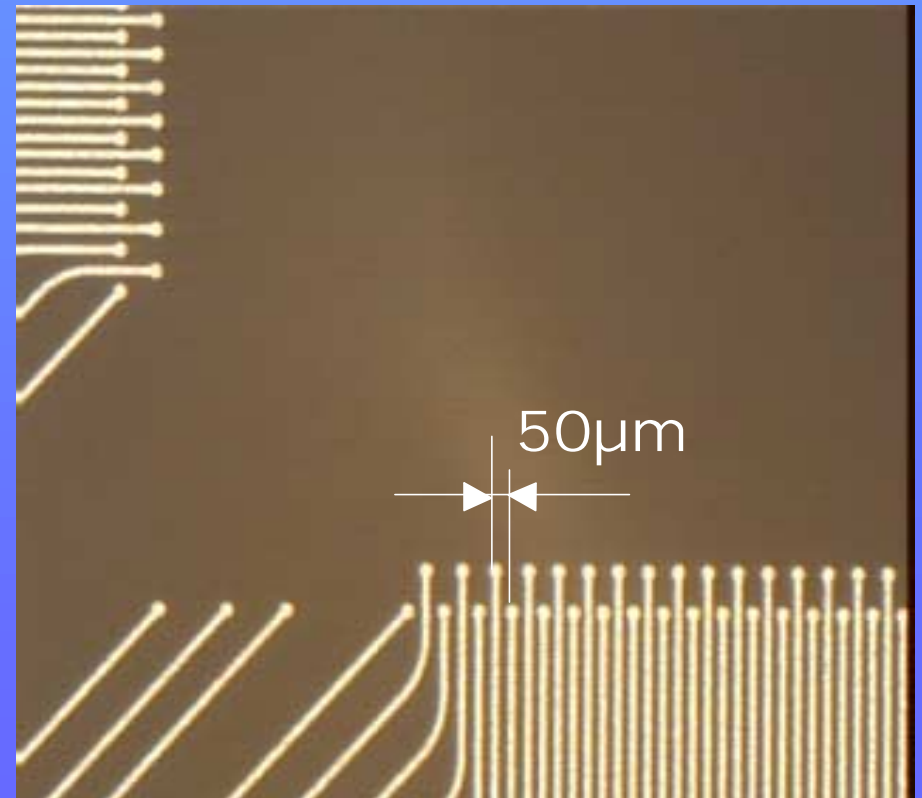
Silicon ST *

External pad



125 μm

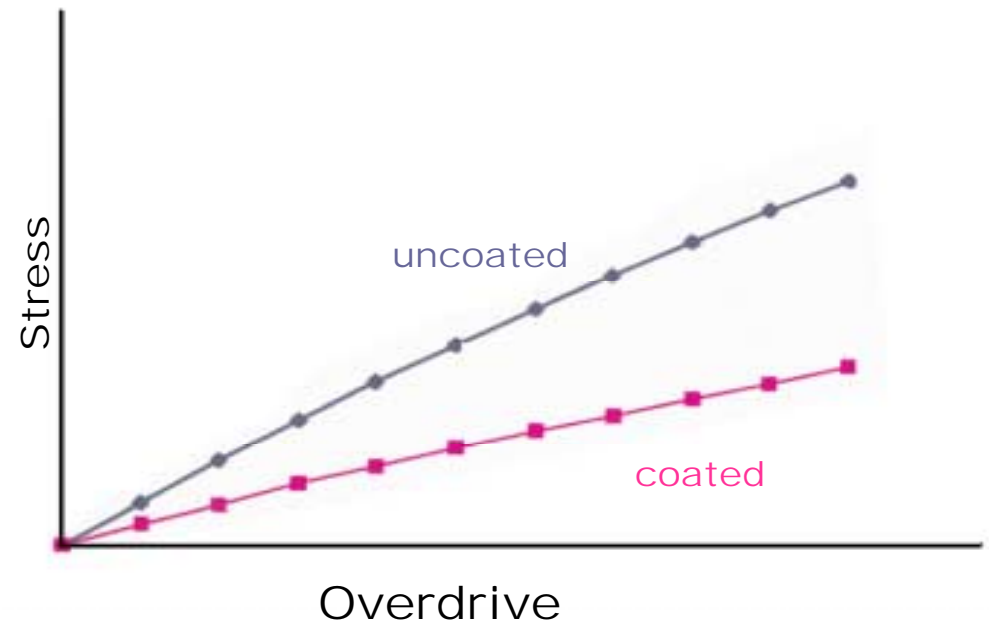
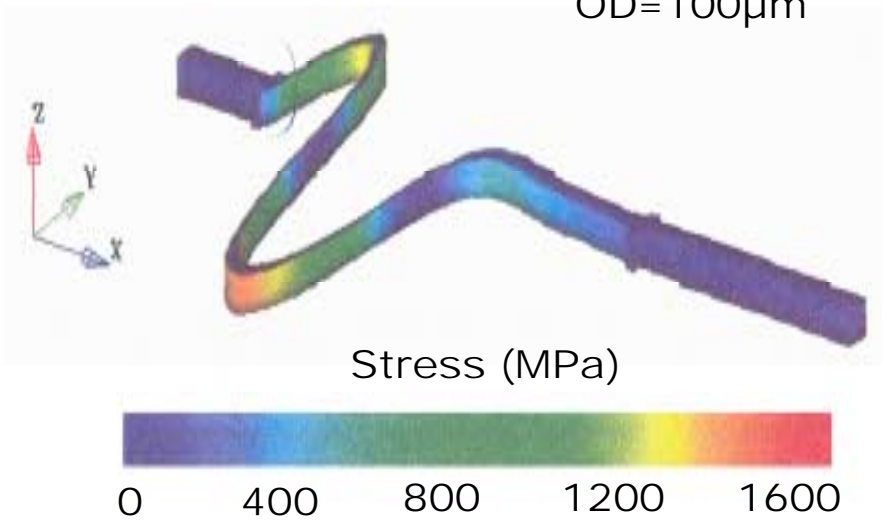
Chip layout



Stress versus overdrive

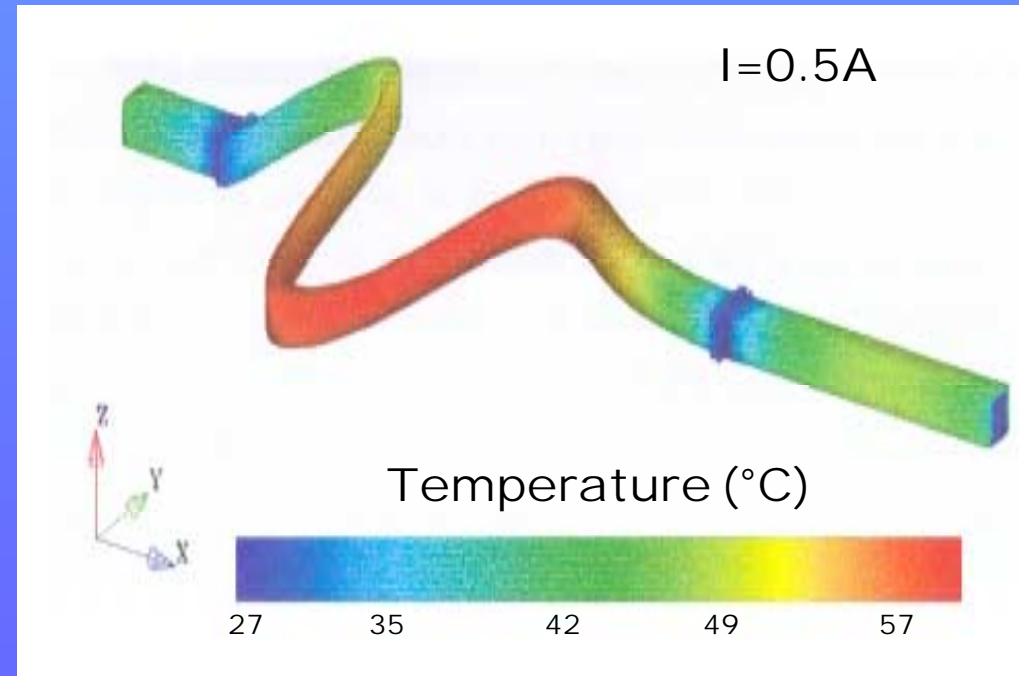
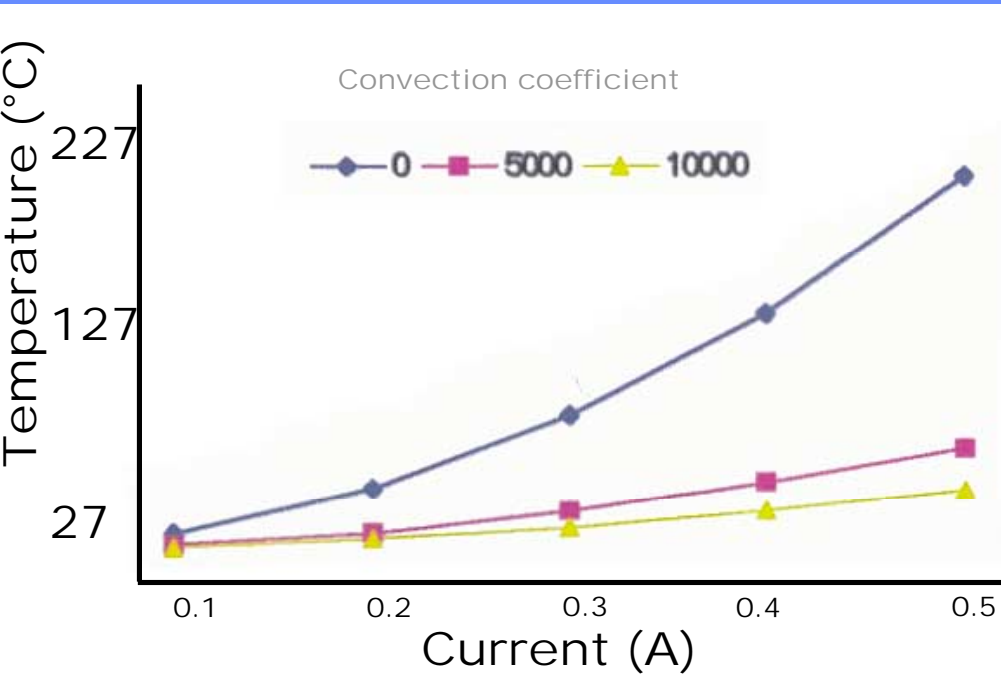
MemCad

OD=100 μm



Fracture stress of Si=7GPa

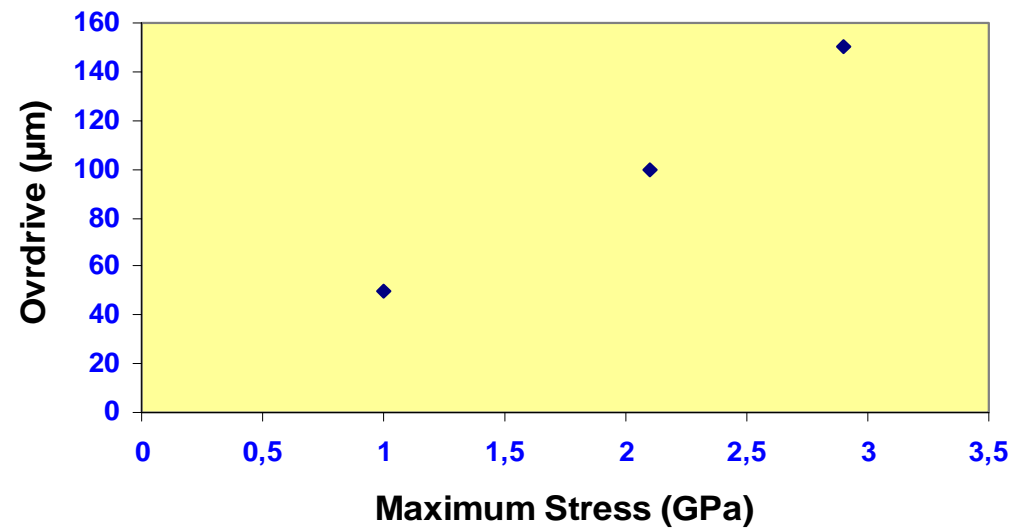
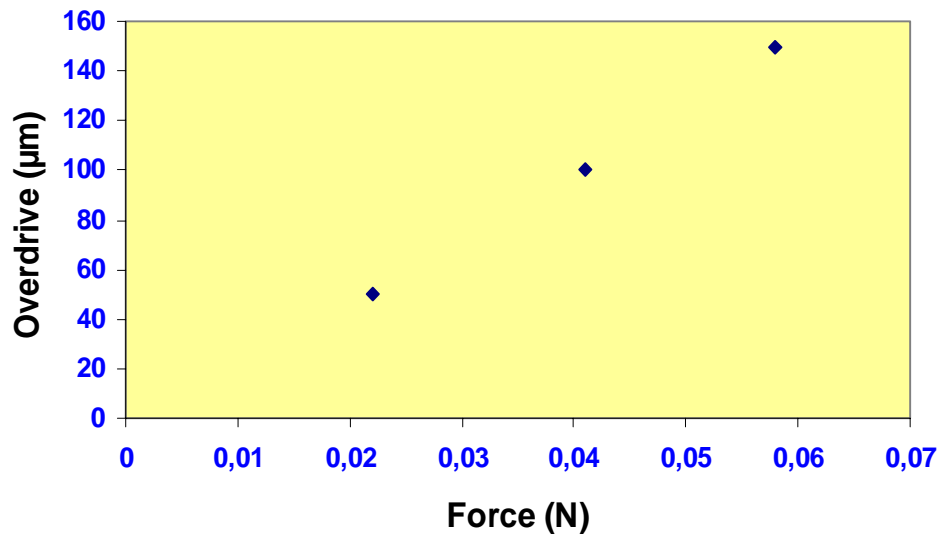
Temperature versus current



From 70 μm to 50 μm

Overdrive versus force

Non linear FEA: Nastran



From 70 μm to 50 μm

Expected Performance:

- $I = 0.4 \text{ A}$
- $R < 1 \text{ Ohm}$
- Impact size = $15 \times 30 \mu\text{m}^2$
- Force = 1 to 1.5 g/mills
- Planarity = 1 mills

Temperature improvement



New challenge
for vertical probing

-40°C up to 200°C

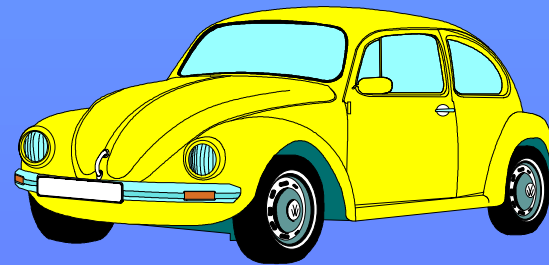
Current Technology

Elevated temperature probe card utilized since 97:

- HT material (Head and ST)
- HT curing process of ST with a specific resin
- Control of the padding position
- « Control of the planarity »

Market needs -40°C to 200°C

Automotive



Smart cards

Mobile phones



Solution



2 different probe cards to address
 -40°C and 200°C



Test hardware achieved



- 40°C : demonstrated in a static way
and need to be fully evaluated
in test environment



200°C : extrapolation of current
probe card

Conclusion

Vertical probing solutions will satisfy
pitch reduction
and temperature new requirement