PRODUCT AND MATERIAL MÉLANGE

This final session focuses on new products and materials in the test and burn-in market. The first presentation looks at high-temperature burn-in readiness, discussing a burn-in socket solution designed to address cost, design and performance challenges of high temperature burn-in. Next on the agenda is a description of new technologies developed to produce high reliability stamped parts and elastomer contacts for a finer pitch and high performance applications. The final presentation covers a new and innovative ESD control molding compound for encapsulation, developed to reduce the ESD issues in the test process.

High Temperature Burn-in (Up to 200° C): Are We Ready Yet?

Noriyuki Matsuoka, Kazumi Uratsuji —Yamaichi Electronics Co., Ltd.
Jec Sangalang—Yamaichi Electronics USA
Ryota Takeuchi—NGK Insulators, Ltd.

This Paper

Development of High Performance Spring Probe Pin and Elastomer Contact by Stamping

Samuel Pak, A.J. Park—IWIN Co. Ltd.

ESD Safe Materials for Test Socket and Encapsulation

Tatsuya Kawasaki—Krefine Co., Ltd.

Development of High Performance Spring Probe Pin and Elastomer Contact by Stamping

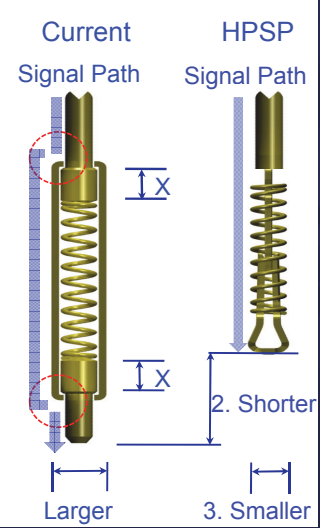
Samuel Pak, A.J. Park
IWIN Co. Ltd.

2013 BiTS Workshop
March 3 - 6, 2013

Content

- What are the differences of stamped pin
- Case studies for HPSP2821
- Summary for HPSP2821
- Challenges for elastomeric contact
- How to deal with challenges
- Summary for elastomeric contact by stamping

What are the major differences ?



1. Stable Signal path by pinched sliding
2. Enabling Short length, 1.2mm, good for high speed application
3. Enabling Small diameter, good for finer pitch, 0.2mm pitch
4. High current carrying, 4.5 Amps in 0.4mm pitch, 3.3mm length pin
5. 0.8mm traveling in 3.3 mm length
6. Progressive stamping enabling low cost

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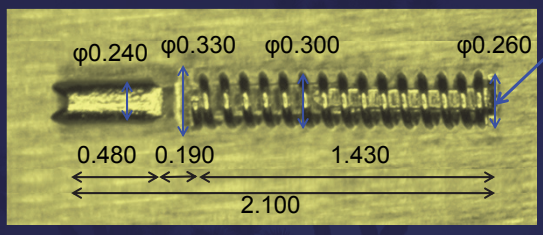
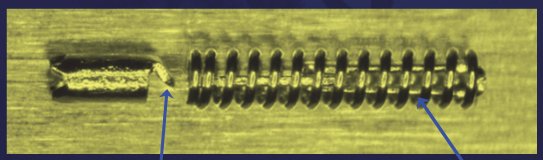
Appearance & size measurement



Projection
·φ0.081mm
·Height 0.01mm



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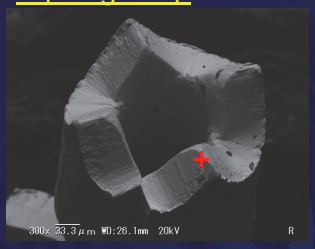
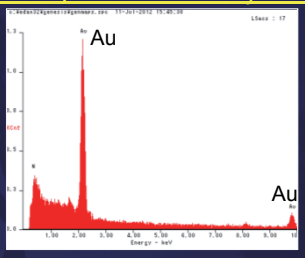
SEM & Componential Analysis Result

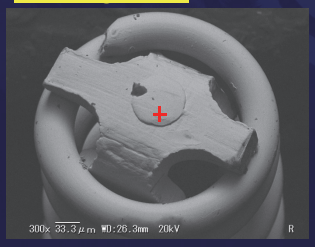
A-plunger Tip



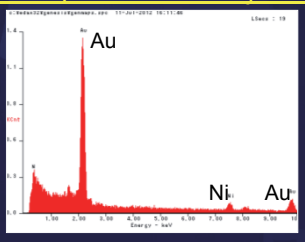
Componential analysis result



B-plunger Tip



Componential analysis result



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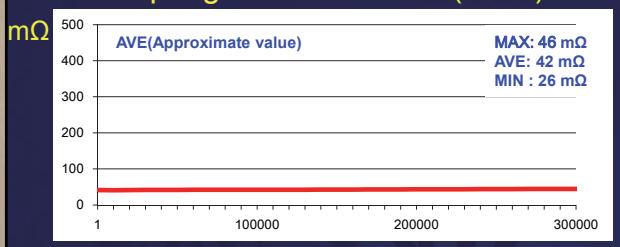
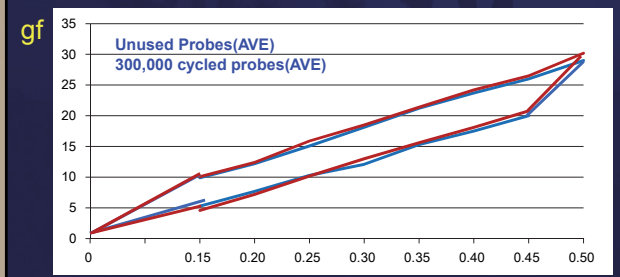
Durability test – 300k cycles

Spring force vs Stroke (n=20)





Test condition

- Cycles: 300,000 times
- Contacted electrode: Au plate
- Measure Resistance: Every 10,000 times
- Stroke: 0.50mm (Pre-stroke: 0.15mm)

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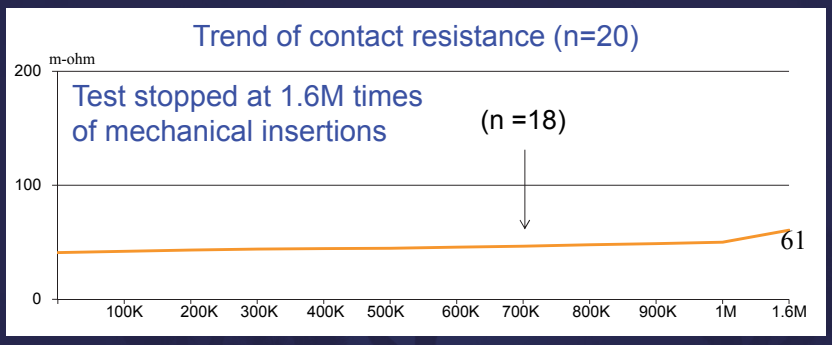
Destructive test



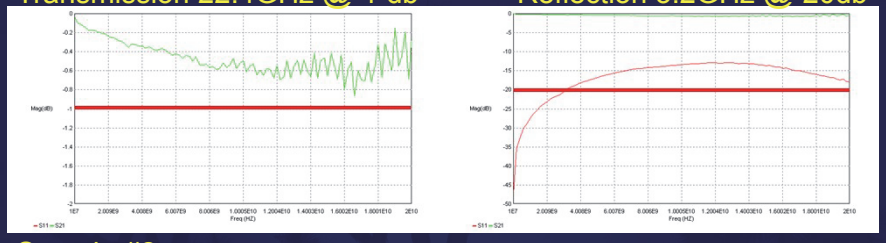
Cycles	Condition	To improve
700 k	Deflection of spring	Safety ratio shall be increased
>1 M	Erosion of gold plating	Material shall be changed to special alloy, not requiring gold plating

Insertion Loss Test Data

Sample #1

Transmission 22.4GHz @-1 db

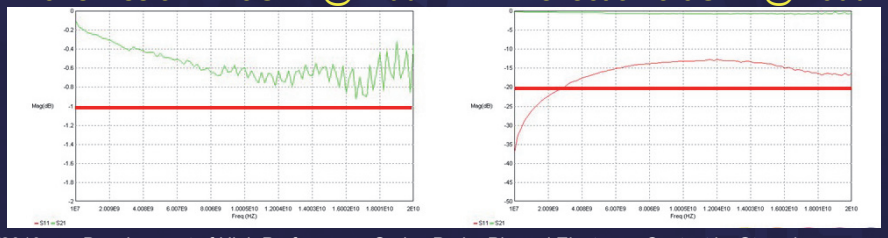
Reflection 3.2GHz @-20db



Sample #2

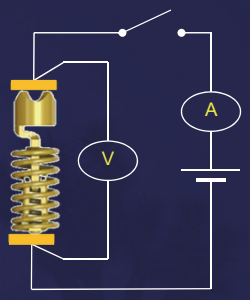
Transmission 21.3GHz @-1 db

Reflection 3.0GHz @-20db



Current Carrying Capacity Measuring

* Test condition: Ambient temp (25°C)
* Test method: Started from 1Amp and increase 1 Amp by every one minute
* Measure allowable current carrying:
  - Any change in mechanical condition, Contact force
  - Burn
  - Permanent deflection
* Result
  - at 5.0Amp, contact force was changed
* Conclusion
  - Acceptable for 3.5A of current carrying



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Current Carrying Capacity Measuring

* Result
  - in 4.5~5.0 Amp, contact force was changed

Current	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1.0A	OK	OK	OK	OK	OK
1.5A	OK	OK	OK	OK	OK
2.0A	OK	OK	OK	OK	OK
2.5A	OK	OK	OK	OK	OK
3.0A	OK	OK	OK	OK	OK
3.5A	OK	OK	OK	OK	OK
4.0A	OK	OK	OK	OK	OK
4.5A	OK	C/F Changed	OK	OK	OK
5.0A	C/F Changed		C/F Changed	C/F Changed	C/F Changed

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HPSP2821 in motion

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Tip Shape

Single Double Cylindrical Crown Cylindrical Flat Cylindrical Sharpen

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Case study with HPSP2821

Mechanical Specifications

Pin height: 2.10mm

Contact spring force: 29 gf 0.5mm

Full stroke: 0.55mm

Recommend stroke: PKG0.35mm/PCB0.15mm

Life cycle: over 100,000

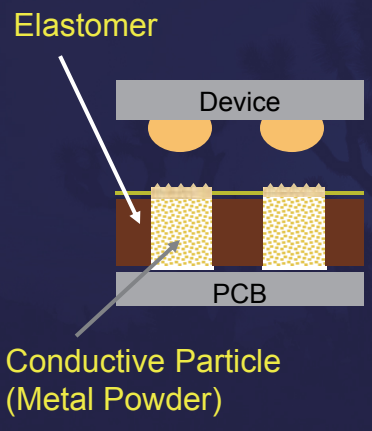
Electrical Specifications

Contact resistance: 40mili-ohm

Insertion Loss: 22.0 GHz @ -1dB

Current rating: 3.5A continuous

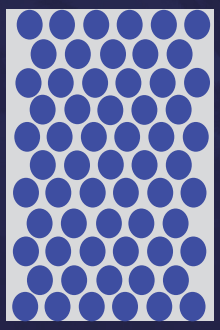
Previous concept of elastomer socket



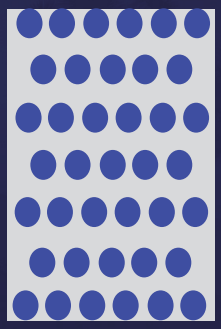
- Simple socket structure
- Good for high frequency
- Wider contact area
- Least ball damage
- Less contamination

Electrical Conductivity vs Flexibility

High density Conductive particle



Low density Conductive particle



Electrical Conductivity > Flexibility <

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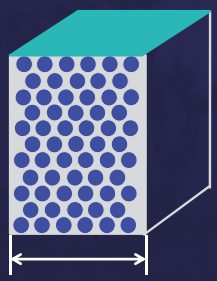
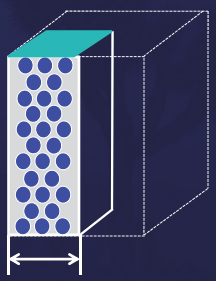
Resistance at fine pitch

Pitch 0.5㎜→0.4㎜, Pad size 0.38 mm→ 0.28 mm
Electrical resistance increased by two times



L

L→½L,
electrical conductive reduce to ¼



½L

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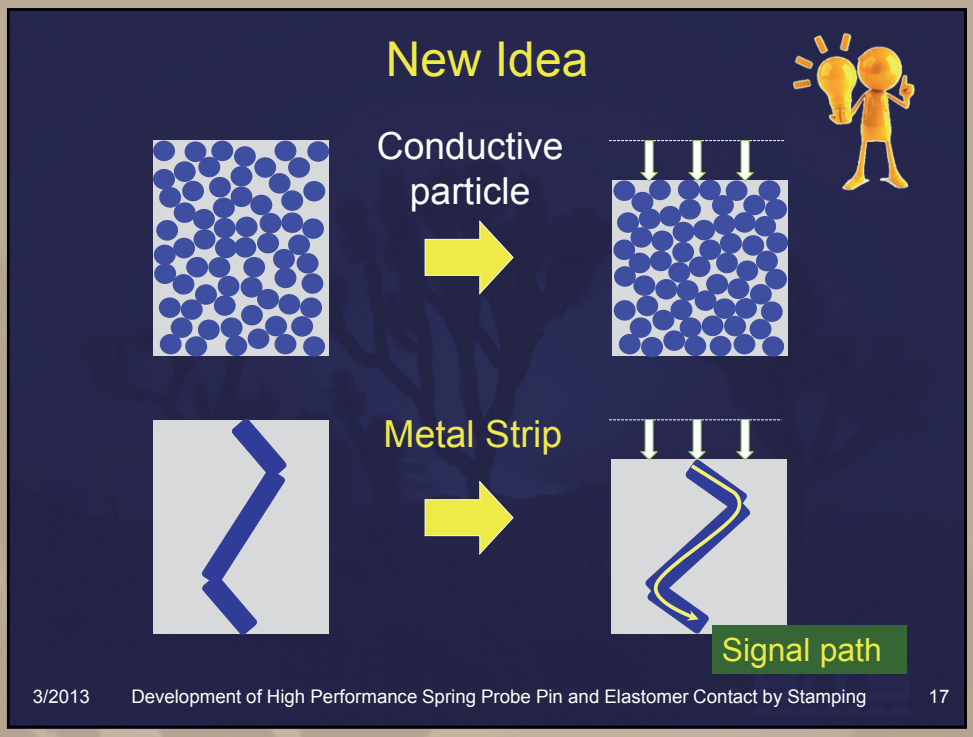
New Idea
Conductive particle
Metal Strip
Signal path
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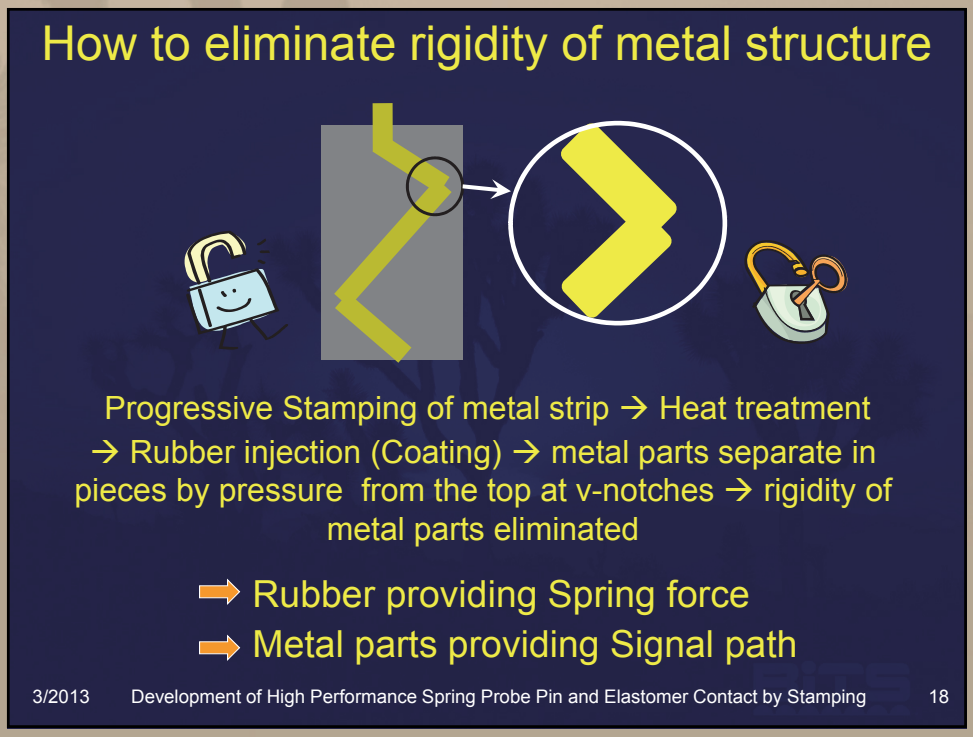
How to eliminate rigidity of metal structure
Progressive Stamping of metal strip → Heat treatment → Rubber injection (Coating) → metal parts separate in pieces by pressure from the top at v-notches → rigidity of metal parts eliminated
Rubber providing Spring force
Metal parts providing Signal path
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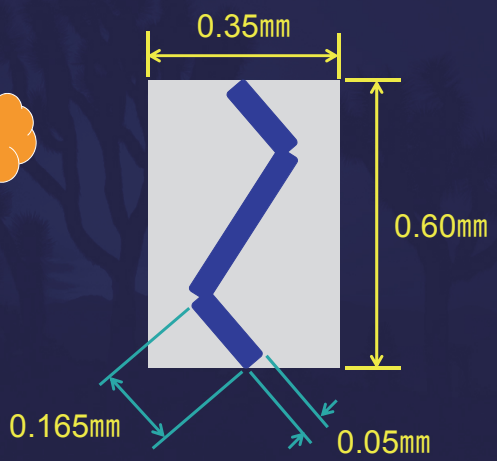
What's the challenge ?

length 0.16mm x width 0.22mm

Numerous tiny metal pieces to be aligned in rubber

Possible ?

How ?



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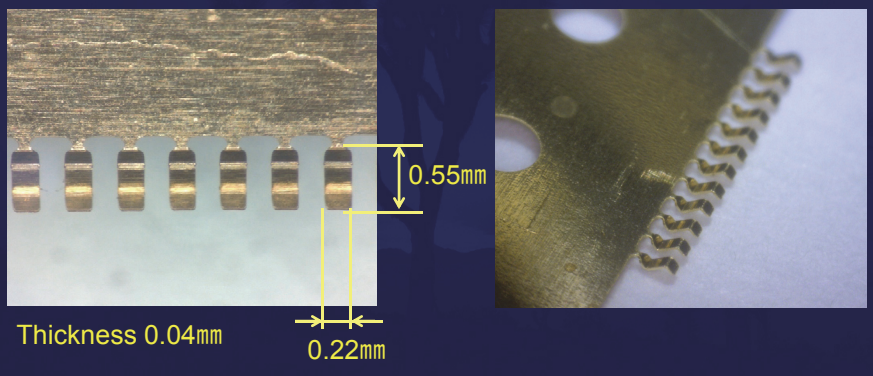
Stamped metal strip

0.35mm pitch



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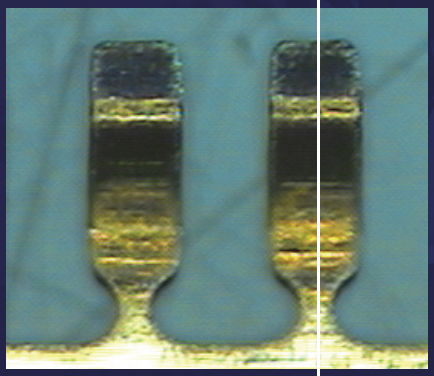
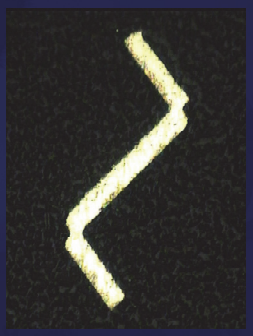
V-notches at core metal piece





A-A Cross Section

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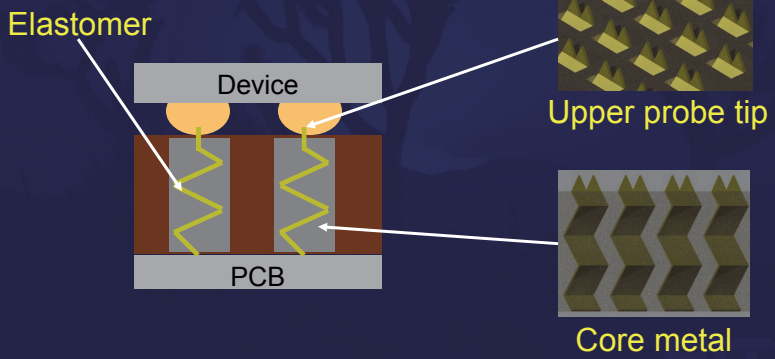
New design by core metal

- Signal path thru metal pieces
  → Better electrical performance
- Spring force by elastomeric
  → Good travelling



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Summaries for elastomeric contact by stamping

- Development expense funded by Korean Government
- Challenged 0.35 mm pitch and 0.6mm in thickness, providing 0.25mm travel
- Contact resistance 32 milliohm
- Insertion loss very low but did test only up to -1 db@40 GHz
- Need to find better rubber improving low temperature performance