

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.

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

Samuel Pak, A.J. Park—IWIN Co. Ltd.



This Paper

ESD Safe Materials for Test Socket and Encapsulation

Tatsuya Kawasaki—Krefine Co., Ltd.

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

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



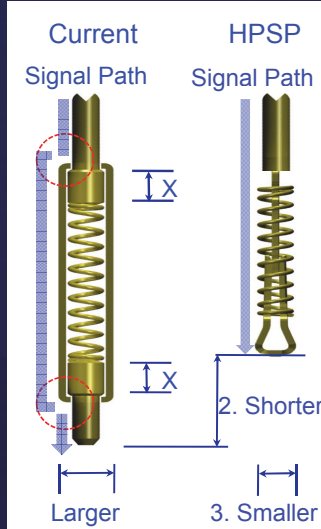
2013 BiTS Workshop
March 3 - 6, 2013



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 ?

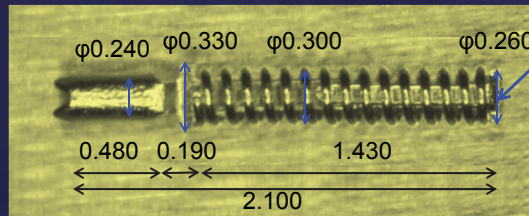


1. Stable Signal path by pinched sliding
2. Enabling Short length, 1.2mm, good for high speed application
3. Enabling Small diameter, good for finer pitch, 0.2mm pitch
4. High current carrying, 4.5 Amps in 0.4mm pitch, 3.3mm length pin
5. 0.8mm traveling in 3.3 mm length
6. Progressive stamping enabling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

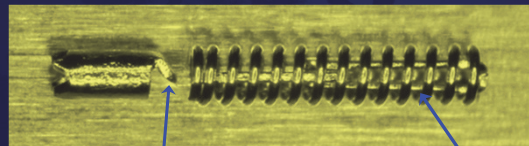
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Appearance & size measurement



Projection
 · φ0.081mm
 · Height 0.01mm



Thickness : 0.050

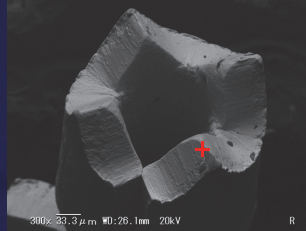
Thickness: 0.040

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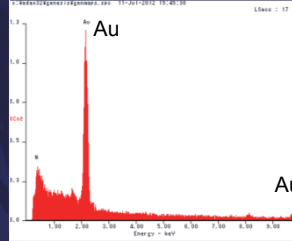
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SEM & Componential Analysis Result

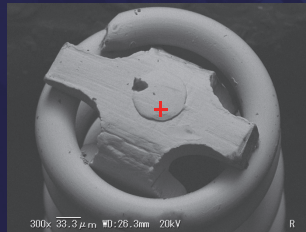
A-plunger Tip



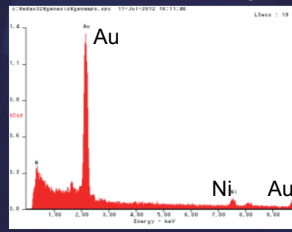
Componential analysis result



B-plunger Tip



Componential analysis result

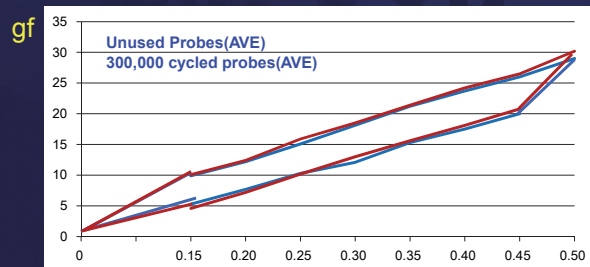
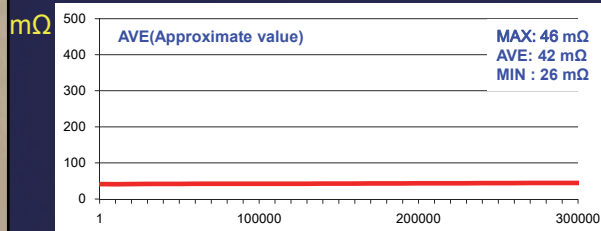


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Durability test – 300k cycles

Spring force vs Stroke (n=20)



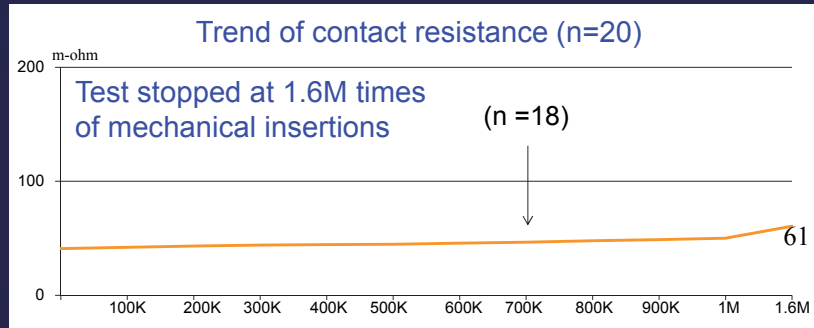
Test condition

- 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

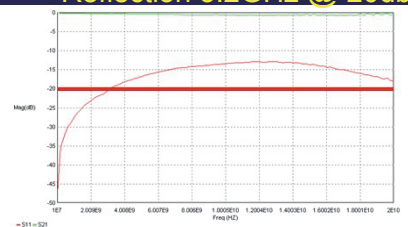
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Insertion Loss Test Data

Sample #1

Transmission 22.4GHz @-1 db

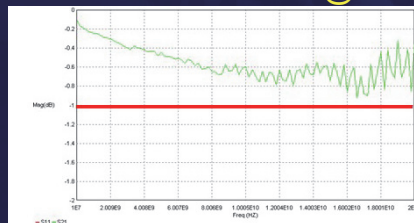
Reflection 3.2GHz @-20db



Sample #2

Transmission 21.3GHz @-1 db

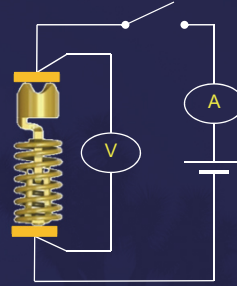
Reflection 3.0GHz @-20db



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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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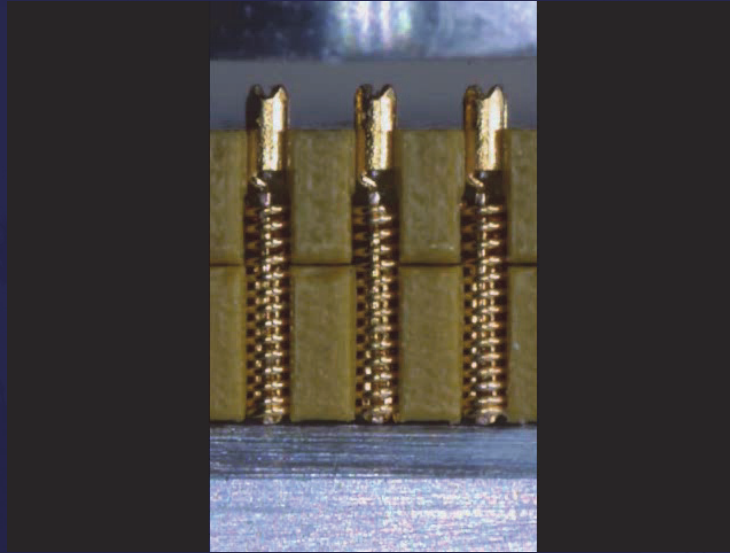
Current Carrying Capacity Measuring

- * 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

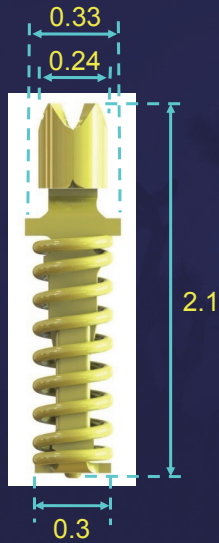
Cylindrical
Flat

Cylindrical
Sharpen

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Case study with HPSP2821



Mechanical Specifications

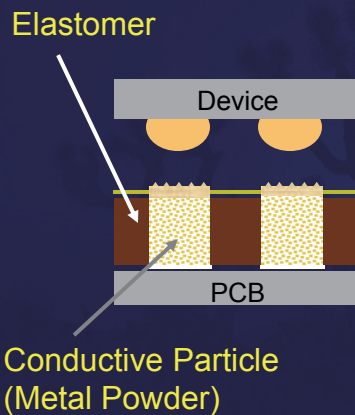
Pin height: 2.10mm
 Contact spring force: 29 gf 0.5mm
 Full stroke: 0.55mm
 Recommend stroke:
 PKG0.35mm/PCB0.15mm
 Life cycle: over 100,000

Electrical Specifications

Contact resistance: 40mili-ohm
 Insertion Loss: 22.0 GHz @ -1dB
 Current rating: 3.5A continuous

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Previous concept of elastomer socket

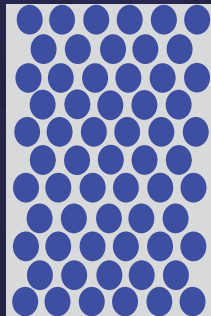


- Simple socket structure
- Good for high frequency
- Wider contact area
- Least ball damage
- Less contamination

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Electrical Conductivity vs Flexibility

High density
Conductive particle



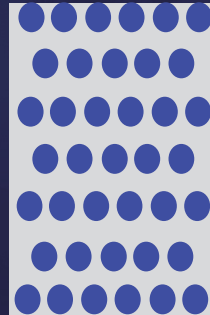
Electrical Conductivity



Flexibility



Low density
Conductive particle



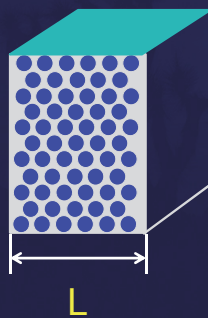
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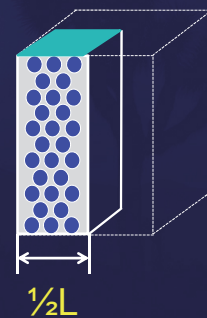
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Resistance at fine pitch

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



$L \rightarrow \frac{1}{2}L$,
 electrical conductive
 reduce to $\frac{1}{4}$



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New Idea

The diagram illustrates a two-step process for creating a high-performance spring probe pin and elastomer contact. In the first step, a metal strip with a zig-zag shape is shown. In the second step, conductive particles are added to the strip, creating a signal path. A cartoon character holding a lightbulb is shown in the top right corner, symbolizing a new idea.

Conductive particle

Metal Strip

Signal path

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How to eliminate rigidity of metal structure

The diagram illustrates a process to eliminate the rigidity of a metal structure. It shows a metal strip with a zig-zag shape being stamped progressively. The resulting metal parts are then heat treated and coated with rubber. The rigidity of the metal parts is eliminated by pressure from the top at v-notches. The resulting structure is shown in a circular inset, with a cartoon character holding a key and a padlock, symbolizing the elimination of rigidity.

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 ?

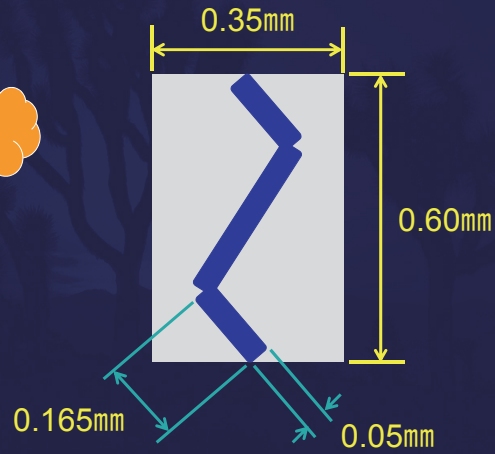
length 0.16mm x width 0.22mm

Numerous tiny metal pieces to be aligned in rubber

Possible



How



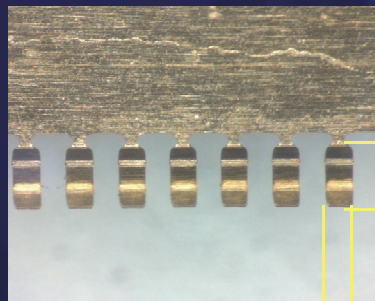
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Stamped metal strip

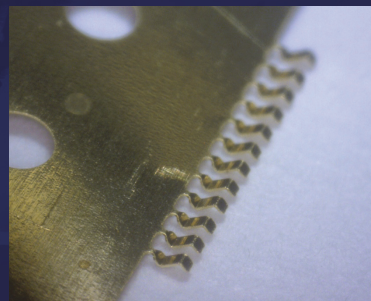
0.35mm pitch



Thickness 0.04mm

0.22mm

0.55mm

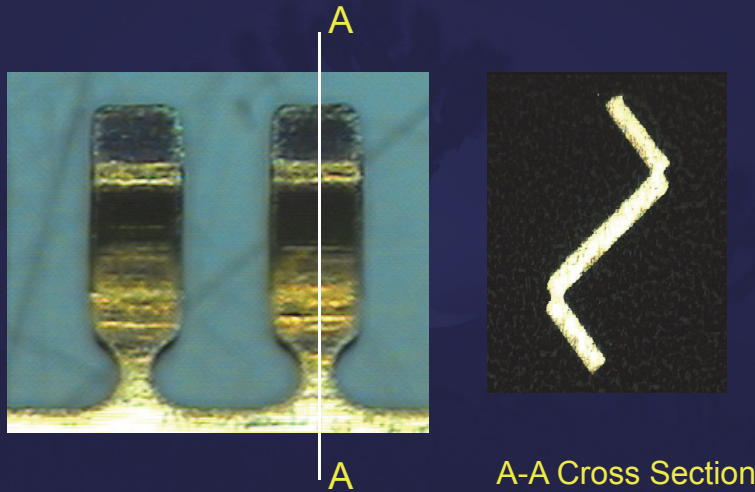


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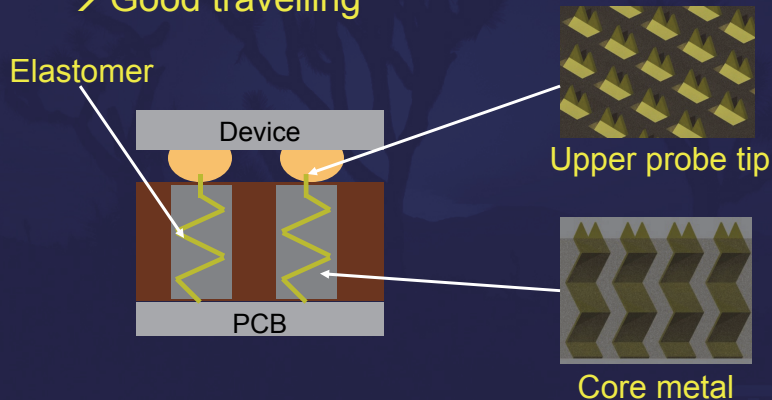
V-notches at core metal piece



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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

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